# GROUP TAB LOCATOR

# INTRODUCTION

## TABLE OF CONTENTS

# FASTENER IDENTIFICATION

## DESCRIPTION

The SAE bolt strength grades range from grade 2 to grade 8. The higher the grade number, the greater the bolt strength. Identification is determined by the line marks on the top of each bolt head. The actual bolt strength grade corresponds to the number of line marks plus 2. The most commonly used metric bolt strength classes are 9.8 and 10.9. The metric strength class identification number is imprinted on the head of the bolt. The higher the class number, the greater the bolt strength. Some metric nuts are imprinted with a single-digit strength class on the nut face. Refer to the Fastener Identification and Fastener Strength Charts.

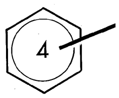
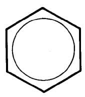
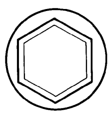
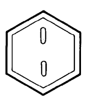
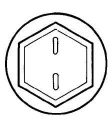
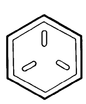
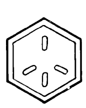
**Bolt Markings and Torques - Metric**

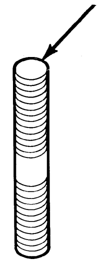
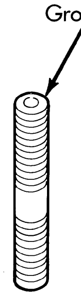
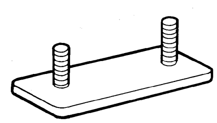
| Bolt Markings | 8.8/8.9 | | 10.9 | | 12.9 | |
|---|---|---|---|---|---|---|
| Bolt Dia. | N·m | Ft. Lbs. | N·m | Ft. Lbs. | N·m | Ft. Lbs. |
| 6 | 12 | 105* | 14 | 120* | 16 | 12 |
| 8 | 25 | 250* | 32 | 23 | 38 | 28 |
| 10 | 54 | 40 | 60 | 45 | 74 | 55 |
| 12 | 95 | 70 | 108 | 80 | 135 | 100 |
| 14 | 155 | 115 | 175 | 130 | 216 | 160 |
| 16 | 243 | 180 | 324 | 210 | 324 | 240 |
| * Inch Lbs. | | | | | | |

**Bolt Markings and Torques - U. S. Customary**

| Bolt Markings | Grade 5 | | Grade 8 | |
|---|---|---|---|---|
| Bolt Dia. | N·m | Ft. Lbs | N·m | Ft. Lbs |
| 1/4 - 20 | 10 | 95* | 14 | 125* |
| 1/4 - 28 | 10 | 95* | 17 | 150* |
| 5/16 - 18 | 22 | 200* | 30 | 270* |
| 5/16 - 24 | 26 | 240* | 33 | 300* |
| 3/8 - 16 | 40 | 30 | 55 | 40 |
| 3/8 - 24 | 47 | 35 | 60 | 45 |
| 7/16 - 14 | 68 | 50 | 88 | 65 |
| 7/16 - 20 | 74 | 55 | 95 | 70 |
| 1/2 - 13 | 101 | 75 | 135 | 100 |
| 1/2 -20 | 115 | 85 | 150 | 110 |
| 9/16 - 12 | 135 | 105 | 182 | 135 |
| 9/16 - 18 | 155 | 115 | 202 | 150 |
| 5/8 - 11 | 202 | 150 | 263 | 195 |
| 5/8 - 18 | 215 | 160 | 284 | 210 |
| 3/4 - 10 | 230 | 170 | 297 | 220 |
| 3/4 - 16 | 236 | 175 | 304 | 225 |
| 7/8 - 14 | 405 | 300 | 540 | 400 |
| * Inch Lbs. | | | | |

**HOW TO DETERMINE BOLT STRENGTH**

| | Mark | Class |
|---|---|---|
| Hexagon head bolt |  Bolt head No. 4 — 5 — 6 — 7 — 8 — 9 — 10 — 11 — | 4T 5T 6T 7T 8T 9T 10T 11T |
| |  No mark | 4T |
| Hexagon flange bolt w/washer hexagon bolt |  No mark | 4T |
| Hexagon head bolt |  Two protruding lines | 5T |
| Hexagon flange bolt w/washer hexagon bolt |  Two protruding lines | 6T |
| Hexagon head bolt |  Three protruding lines | 7T |
| Hexagon head bolt |  Four protruding lines | 8T |

| | Mark | Class |
|---|---|---|
| Stud bolt | No mark  | 4T |
| | Grooved  | 6T |
| Welded bolt |  | 4T |

95IN-4

# FASTENER USAGE

## DESCRIPTION

## FASTENER USAGE

**WARNING: Use of an incorrect fastener may result in component damage or personal injury.**

Fasteners and torque specifications references in this Service Manual are identified in metric and SAE format.

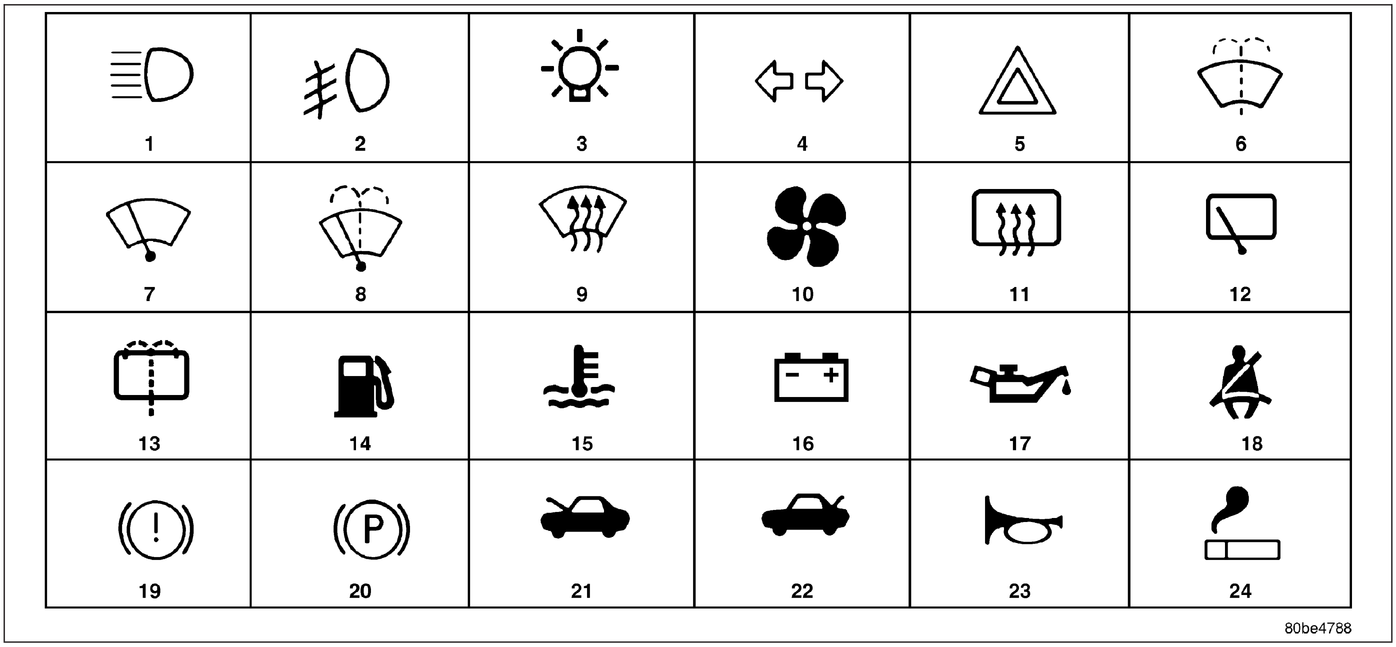
During any maintenance or repair procedures, it is important to salvage all fasteners (nuts, bolts, etc.) for reassembly. If the fastener is not salvageable, a fastener of equivalent specification must be used.

## THREADED HOLE REPAIR

Most stripped threaded holes can be repaired using a Helicoil®. Follow the vehicle or Helicoil® recommendations for application and repair procedures.

# INTERNATIONAL SYMBOLS

## DESCRIPTION




The graphic symbols illustrated in and the following International Control and Display Symbols Chart are used to identify various instrument controls. The symbols correspond to the controls and displays that are located on the instrument panel.

# METRIC SYSTEM

## DESCRIPTION

in-lbs to N•m | N•m to in-lbs

| in- lb | N•m | in-lb | N•m | in-lb | N•m | in-lb | N•m | in-lb | N•m | N•m | in-lb | N•m | in-lb | N•m | in-lb | N•m | in-lb | N•m | in-lb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | .2260 | 42 | 4.7453 | 82 | 9.2646 | 122 | 13.7839 | 162 | 18.3032 | .2 | 1.7702 | 4.2 | 37.1747 | 8.2 | 72.5792 | 12.2 | 107.9837 | 16.2 | 143.3882 |
| 4 | .4519 | 44 | 4.9713 | 84 | 9.4906 | 124 | 14.0099 | 164 | 18.5292 | .4 | 3.5404 | 4.4 | 38.9449 | 8.4 | 74.3494 | 12.4 | 109.7539 | 16.4 | 145.1584 |
| 6 | .6779 | 46 | 5.1972 | 86 | 9.7165 | 126 | 14.2359 | 166 | 18.7552 | .6 | 5.3107 | 4.6 | 40.7152 | 8.6 | 76.1197 | 12.6 | 111.5242 | 16.6 | 146.9287 |
| 8 | .9039 | 48 | 5.4232 | 88 | 9.9425 | 128 | 14.4618 | 168 | 18.9811 | .8 | 7.0809 | 4.8 | 42.4854 | 8.8 | 77.8899 | 12.8 | 113.2944 | 16.8 | 148.6989 |
| 10 | 1.1298 | 50 | 5.6492 | 90 | 10.1685 | 130 | 14.6878 | 170 | 19.2071 | 1 | 8.8511 | 5 | 44.2556 | 9 | 79.6601 | 13 | 115.0646 | 17 | 150.4691 |
| 12 | 1.3558 | 52 | 5.8751 | 92 | 10.3944 | 132 | 14.9138 | 172 | 19.4331 | 1.2 | 10.6213 | 5.2 | 46.0258 | 9.2 | 81.4303 | 13.2 | 116.8348 | 17.2 | 152.2393 |
| 14 | 1.5818 | 54 | 6.1011 | 94 | 10.6204 | 134 | 15.1397 | 174 | 19.6590 | 1.4 | 12.3916 | 5.4 | 47.7961 | 9.4 | 83.2006 | 13.4 | 118.6051 | 17.4 | 154.0096 |
| 16 | 1.8077 | 56 | 6.3270 | 96 | 10.8464 | 136 | 15.3657 | 176 | 19.8850 | 1.6 | 14.1618 | 5.6 | 49.5663 | 9.6 | 84.9708 | 13.6 | 120.3753 | 17.6 | 155.7798 |
| 18 | 2.0337 | 58 | 6.5530 | 98 | 11.0723 | 138 | 15.5917 | 178 | 20.1110 | 1.8 | 15.9320 | 5.8 | 51.3365 | 9.8 | 86.7410 | 13.8 | 122.1455 | 17.8 | 157.5500 |
| 20 | 2.2597 | 60 | 6.7790 | 100 | 11.2983 | 140 | 15.8176 | 180 | 20.3369 | 2 | 17.7022 | 6 | 53.1067 | 10 | 88.5112 | 14 | 123.9157 | 18 | 159.3202 |
| 22 | 2.4856 | 62 | 7.0049 | 102 | 11.5243 | 142 | 16.0436 | 182 | 20.5629 | 2.2 | 19.4725 | 6.2 | 54.8770 | 10.2 | 90.2815 | 14.2 | 125.6860 | 18.5 | 163.7458 |
| 24 | 2.7116 | 64 | 7.2309 | 104 | 11.7502 | 144 | 16.2696 | 184 | 20.7889 | 2.4 | 21.2427 | 6.4 | 56.6472 | 10.4 | 92.0517 | 14.4 | 127.4562 | 19 | 168.1714 |
| 26 | 2.9376 | 66 | 7.4569 | 106 | 11.9762 | 146 | 16.4955 | 186 | 21.0148 | 2.6 | 23.0129 | 6.6 | 58.4174 | 10.6 | 93.8219 | 14.6 | 129.2264 | 19.5 | 172.5970 |
| 28 | 3.1635 | 68 | 7.6828 | 108 | 12.2022 | 148 | 16.7215 | 188 | 21.2408 | 2.8 | 24.7831 | 6.8 | 60.1876 | 10.8 | 95.5921 | 14.8 | 130.9966 | 20 | 177.0225 |
| 30 | 3.3895 | 70 | 7.9088 | 110 | 12.4281 | 150 | 16.9475 | 190 | 21.4668 | 3 | 26.5534 | 7 | 61.9579 | 11 | 97.3624 | 15 | 132.7669 | 20.5 | 181.4480 |
| 32 | 3.6155 | 72 | 8.1348 | 112 | 12.6541 | 152 | 17.1734 | 192 | 21.6927 | 3.2 | 28.3236 | 7.2 | 63.7281 | 11.2 | 99.1326 | 15.2 | 134.5371 | 21 | 185.8736 |
| 34 | 3.8414 | 74 | 8.3607 | 114 | 12.8801 | 154 | 17.3994 | 194 | 21.9187 | 3.4 | 30.0938 | 7.4 | 65.4983 | 11.4 | 100.9028 | 15.4 | 136.3073 | 22 | 194.7247 |
| 36 | 4.0674 | 76 | 8.5867 | 116 | 13.1060 | 156 | 17.6253 | 196 | 22.1447 | 3.6 | 31.8640 | 7.6 | 67.2685 | 11.6 | 102.6730 | 15.6 | 138.0775 | 23 | 203.5759 |
| 38 | 4.2934 | 78 | 8.8127 | 118 | 13.3320 | 158 | 17.8513 | 198 | 22.3706 | 3.8 | 33.6342 | 7.8 | 69.0388 | 11.8 | 104.4433 | 15.8 | 139.8478 | 24 | 212.4270 |
| 40 | 4.5193 | 80 | 9.0386 | 120 | 13.5580 | 160 | 18.0773 | 200 | 22.5966 | 4 | 35.4045 | 8 | 70.8090 | 12 | 106.2135 | 16 | 141.6180 | 25 | 221.2781 |

ft-lbs to N•m | N•m to ft-lbs

| ft-lb | N•m | ft-lb | N•m | ft-lb | N•m | ft-lb | N•m | ft-lb | N•m | N•m | ft-lb | N•m | ft-lb | N•m | ft-lb | N•m | ft-lb | N•m | ft-lb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.3558 | 21 | 28.4722 | 41 | 55.5885 | 61 | 82.7049 | 81 | 109.8212 | 1 | .7376 | 21 | 15.9888 | 41 | 30.2400 | 61 | 44.9913 | 81 | 59.7425 |
| 2 | 2.7116 | 22 | 29.8280 | 42 | 56.9444 | 62 | 84.0607 | 82 | 111.1770 | 2 | 1.4751 | 22 | 16.2264 | 42 | 30.9776 | 62 | 45.7289 | 82 | 60.4801 |
| 3 | 4.0675 | 23 | 31.1838 | 43 | 58.3002 | 63 | 85.4165 | 83 | 112.5328 | 3 | 2.2127 | 23 | 16.9639 | 43 | 31.7152 | 63 | 46.4664 | 83 | 61.2177 |
| 4 | 5.4233 | 24 | 32.5396 | 44 | 59.6560 | 64 | 86.7723 | 84 | 113.8888 | 4 | 2.9502 | 24 | 17.7015 | 44 | 32.4527 | 64 | 47.2040 | 84 | 61.9552 |
| 5 | 6.7791 | 25 | 33.8954 | 45 | 61.0118 | 65 | 88.1281 | 85 | 115.2446 | 5 | 3.6878 | 25 | 18.4391 | 45 | 33.1903 | 65 | 47.9415 | 85 | 62.6928 |
| 6 | 8.1349 | 26 | 35.2513 | 46 | 62.3676 | 66 | 89.4840 | 86 | 116.6004 | 6 | 4.4254 | 26 | 19.1766 | 46 | 33.9279 | 66 | 48.6791 | 86 | 63.4303 |
| 7 | 9.4907 | 27 | 36.6071 | 47 | 63.7234 | 67 | 90.8398 | 87 | 117.9562 | 7 | 5.1629 | 27 | 19.9142 | 47 | 34.6654 | 67 | 49.4167 | 87 | 64.1679 |
| 8 | 10.8465 | 28 | 37.9629 | 48 | 65.0793 | 68 | 92.1956 | 88 | 119.3120 | 8 | 5.9005 | 28 | 20.6517 | 48 | 35.4030 | 68 | 50.1542 | 88 | 64.9545 |
| 9 | 12.2024 | 29 | 39.3187 | 49 | 66.4351 | 69 | 93.5514 | 89 | 120.6678 | 9 | 6.6381 | 29 | 21.3893 | 49 | 36.1405 | 69 | 50.8918 | 89 | 65.6430 |
| 10 | 13.5582 | 30 | 40.6745 | 50 | 67.7909 | 70 | 94.9073 | 90 | 122.0236 | 10 | 7.3756 | 30 | 22.1269 | 50 | 36.8781 | 70 | 51.6293 | 90 | 66.3806 |
| 11 | 14.9140 | 31 | 42.0304 | 51 | 69.1467 | 71 | 96.2631 | 91 | 123.3794 | 11 | 8.1132 | 31 | 22.8644 | 51 | 37.6157 | 71 | 52.3669 | 91 | 67.1181 |
| 12 | 16.2698 | 32 | 43.3862 | 52 | 70.5025 | 72 | 97.6189 | 92 | 124.7352 | 12 | 8.8507 | 32 | 23.6020 | 52 | 38.3532 | 72 | 53.1045 | 92 | 67.8557 |
| 13 | 17.6256 | 33 | 44.7420 | 53 | 71.8583 | 73 | 98.9747 | 93 | 126.0910 | 13 | 9.5883 | 33 | 24.3395 | 53 | 39.0908 | 73 | 53.8420 | 93 | 68.5933 |
| 14 | 18.9815 | 34 | 46.0978 | 54 | 73.2142 | 74 | 100.3316 | 94 | 127.4468 | 14 | 10.3259 | 34 | 25.0771 | 54 | 39.8284 | 74 | 54.5720 | 94 | 69.3308 |
| 15 | 20.3373 | 35 | 47.4536 | 55 | 74.5700 | 75 | 101.6862 | 95 | 128.8026 | 15 | 11.0634 | 35 | 25.8147 | 55 | 40.5659 | 75 | 55.3172 | 95 | 70.0684 |
| 16 | 21.6931 | 36 | 48.8094 | 56 | 75.9258 | 76 | 103.0422 | 96 | 130.1586 | 16 | 11.8010 | 36 | 26.5522 | 56 | 41.3035 | 76 | 56.0547 | 96 | 70.8060 |
| 17 | 23.0489 | 37 | 50.1653 | 57 | 77.2816 | 77 | 104.3980 | 97 | 131.5144 | 17 | 12.5386 | 37 | 27.2898 | 57 | 42.0410 | 77 | 56.7923 | 97 | 71.5435 |
| 18 | 24.4047 | 38 | 51.5211 | 58 | 78.6374 | 78 | 105.7538 | 98 | 132.8702 | 18 | 13.2761 | 38 | 28.0274 | 58 | 42.7786 | 78 | 57.5298 | 98 | 72.2811 |
| 19 | 25.7605 | 39 | 52.8769 | 59 | 79.9933 | 79 | 107.1196 | 99 | 134.2260 | 19 | 14.0137 | 39 | 28.7649 | 59 | 43.5162 | 79 | 58.2674 | 99 | 73.0187 |
| 20 | 27.1164 | 40 | 54.2327 | 60 | 81.3491 | 80 | 108.4654 | 100 | 135.5820 | 20 | 14.7512 | 40 | 29.5025 | 60 | 44.2537 | 80 | 59.0050 | 100 | 73.7562 |

in. to mm | mm to in.

| in. | mm | in. | mm | in. | mm | in. | mm | in. | mm | mm | in. | mm | in. | mm | in. | mm | in. | mm | in. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .01 | .254 | .21 | 5.334 | .41 | 10.414 | .61 | 15.494 | .81 | 20.574 | .01 | .00039 | .21 | .00827 | .41 | .01614 | .61 | .02402 | .81 | .03189 |
| .02 | .508 | .22 | 5.588 | .42 | 10.668 | .62 | 15.748 | .82 | 20.828 | .02 | .00079 | .22 | .00866 | .42 | .01654 | .62 | .02441 | .82 | .03228 |
| .03 | .762 | .23 | 5.842 | .43 | 10.922 | .63 | 16.002 | .83 | 21.082 | .03 | .00118 | .23 | .00906 | .43 | .01693 | .63 | .02480 | .83 | .03268 |
| .04 | 1.016 | .24 | 6.096 | .44 | 11.176 | .64 | 16.256 | .84 | 21.336 | .04 | .00157 | .24 | .00945 | .44 | .01732 | .64 | .02520 | .84 | .03307 |
| .05 | 1.270 | .25 | 6.350 | .45 | 11.430 | .65 | 16.510 | .85 | 21.590 | .05 | .00197 | .25 | .00984 | .45 | .01772 | .65 | .02559 | .85 | .03346 |
| .06 | 1.524 | .26 | 6.604 | .46 | 11.684 | .66 | 16.764 | .86 | 21.844 | .06 | .00236 | .26 | .01024 | .46 | .01811 | .66 | .02598 | .86 | .03386 |
| .07 | 1.778 | .27 | 6.858 | .47 | 11.938 | .67 | 17.018 | .87 | 22.098 | .07 | .00276 | .27 | .01063 | .47 | .01850 | .67 | .02638 | .87 | .03425 |
| .08 | 2.032 | .28 | 7.112 | .48 | 12.192 | .68 | 17.272 | .88 | 22.352 | .08 | .00315 | .28 | .01102 | .48 | .01890 | .68 | .02677 | .88 | .03465 |
| .09 | 2.286 | .29 | 7.366 | .49 | 12.446 | .69 | 17.526 | .89 | 22.606 | .09 | .00354 | .29 | .01142 | .49 | .01929 | .69 | .02717 | .89 | .03504 |
| .10 | 2.540 | .30 | 7.620 | .50 | 12.700 | .70 | 17.780 | .90 | 22.860 | .10 | .00394 | .30 | .01181 | .50 | .01969 | .70 | .02756 | .90 | .03543 |
| .11 | 2.794 | .31 | 7.874 | .51 | 12.954 | .71 | 18.034 | .91 | 23.114 | .11 | .00433 | .31 | .01220 | .51 | .02008 | .71 | .02795 | .91 | .03583 |
| .12 | 3.048 | .32 | 8.128 | .52 | 13.208 | .72 | 18.288 | .92 | 23.368 | .12 | .00472 | .32 | .01260 | .52 | .02047 | .72 | .02835 | .92 | .03622 |
| .13 | 3.302 | .33 | 8.382 | .53 | 13.462 | .73 | 18.542 | .93 | 23.622 | .13 | .00512 | .33 | .01299 | .53 | .02087 | .73 | .02874 | .93 | .03661 |
| .14 | 3.556 | .34 | 8.636 | .54 | 13.716 | .74 | 18.796 | .94 | 23.876 | .14 | .00551 | .34 | .01339 | .54 | .02126 | .74 | .02913 | .94 | .03701 |
| .15 | 3.810 | .35 | 8.890 | .55 | 13.970 | .75 | 19.050 | .95 | 24.130 | .15 | .00591 | .35 | .01378 | .55 | .02165 | .75 | .02953 | .95 | .03740 |
| .16 | 4.064 | .36 | 9.144 | .56 | 14.224 | .76 | 19.304 | .96 | 24.384 | .16 | .00630 | .36 | .01417 | .56 | .02205 | .76 | .02992 | .96 | .03780 |
| .17 | 3.318 | .37 | 9.398 | .57 | 14.478 | .77 | 19.558 | .97 | 24.638 | .17 | .00669 | .37 | .01457 | .57 | .02244 | .77 | .03032 | .97 | .03819 |
| .18 | 4.572 | .38 | 9.652 | .58 | 14.732 | .78 | 19.812 | .98 | 24.892 | .18 | .00709 | .38 | .01496 | .58 | .02283 | .78 | .03071 | .98 | .03858 |
| .19 | 4.826 | .39 | 9.906 | .59 | 14.986 | .79 | 20.066 | .99 | 25.146 | .19 | .00748 | .39 | .01535 | .59 | .02323 | .79 | .03110 | .99 | .03898 |
| .20 | 5.080 | .40 | 10.160 | .60 | 15.240 | .80 | 20.320 | 1.00 | 25.400 | .20 | .00787 | .40 | .01575 | .60 | .02362 | .80 | .03150 | 1.00 | .03937 |

J901N-10

The metric system is based on quantities of one, ten, one hundred, one thousand and one million.

The following chart will assist in converting metric units to equivalent English and SAE units, or vise versa.

## CONVERSION FORMULAS AND EQUIVALENT VALUES

| MULTIPLY | BY | TO GET | MULTIPLY | BY | TO GET |
|---|---|---|---|---|---|
| in-lbs | x 0.11298 | = Newton Meters (N·m) | N·m | x 8.851 | = in-lbs |
| ft-lbs | x 1.3558 | = Newton Meters (N·m) | N·m | x 0.7376 | = ft-lbs |
| Inches Hg (60° F) | x 3.377 | = Kilopascals (kPa) | kPa | x 0.2961 | = Inches Hg |
| psi | x 6.895 | = Kilopascals (kPa) | kPa | x 0.145 | = psi |
| Inches | x 25.4 | = Millimeters (mm) | mm | x 0.03937 | = Inches |
| Feet | x 0.3048 | = Meters (M) | M | x 3.281 | = Feet |
| Yards | x 0.9144 | = Meters | M | x 1.0936 | = Yards |
| mph | x 1.6093 | = Kilometers/Hr. (Km/h) | Km/h | x 0.6214 | = mph |
| Feet/Sec | x 0.3048 | = Meters/Sec (M/S) | M/S | x 3.281 | = Feet/Sec |
| mph | x 0.4470 | = Meters/Sec (M/S) | M/S | x 2.237 | = mph |
| Kilometers/Hr. (Km/h) | x 0.27778 | = Meters/Sec (M/S) | M/S | x 3.600 | Kilometers/Hr. (Km/h) |

## COMMON METRIC EQUIVALENTS

| | |
|---|---|
| 1 inch = 25 Millimeters | 1 Cubic Inch = 16 Cubic Centimeters |
| 1 Foot = 0.3 Meter | 1 Cubic Foot = 0.03 Cubic Meter |
| 1 Yard = 0.9 Meter | 1 Cubic Yard = 0.8 Cubic Meter |
| 1 Mile = 1.6 Kilometers | |

Refer to the Metric Conversion Chart to convert torque values listed in metric Newton- meters (N·m). Also, use the chart to convert between millimeters (mm) and inches (in.).

# TORQUE REFERENCES

## DESCRIPTION

SPECIFIED TORQUE FOR STANDARD BOLTS

| Class | Diameter mm | Pitch mm | Specified torque | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Hexagon head bolt | | | Hexagon flange bolt | | |
| | | | N•m | kgf-cm | ft-lbf | N•m | kgf-cm | ft-lbf |
| 4T | 6 | 1 | 5 | 55 | 48 in.-lbf | 6 | 60 | 52 in.-lbf |
| | 8 | 1.25 | 12.5 | 130 | 9 | 14 | 145 | 10 |
| | 10 | 1.25 | 26 | 260 | 19 | 29 | 290 | 21 |
| | 12 | 1.25 | 47 | 480 | 35 | 53 | 540 | 39 |
| | 14 | 1.5 | 74 | 760 | 55 | 84 | 850 | 61 |
| | 16 | 1.5 | 115 | 1,150 | 83 | — | — | — |
| 5T | 6 | 1 | 6.5 | 65 | 56 in.-lbf | 7.5 | 75 | 65 in.-lbf |
| | 8 | 1.25 | 15.5 | 160 | 12 | 17.5 | 175 | 13 |
| | 10 | 1.25 | 32 | 330 | 24 | 36 | 360 | 26 |
| | 12 | 1.25 | 59 | 600 | 43 | 65 | 670 | 48 |
| | 14 | 1.5 | 91 | 930 | 67 | 100 | 1,050 | 76 |
| | 16 | 1.5 | 140 | 1,400 | 101 | — | — | — |
| 6T | 6 | 1 | 8 | 80 | 69 in.-lbf | 9 | 90 | 78 in.-lbf |
| | 8 | 1.25 | 19 | 195 | 14 | 21 | 210 | 15 |
| | 10 | 1.25 | 39 | 400 | 29 | 44 | 440 | 32 |
| | 12 | 1.25 | 71 | 730 | 53 | 80 | 810 | 59 |
| | 14 | 1.5 | 110 | 1,100 | 80 | 125 | 1,250 | 90 |
| | 16 | 1.5 | 170 | 1,750 | 127 | — | — | — |
| 7T | 6 | 1 | 10.5 | 110 | 8 | 12 | 120 | 9 |
| | 8 | 1.25 | 25 | 260 | 19 | 28 | 290 | 21 |
| | 10 | 1.25 | 52 | 530 | 38 | 58 | 590 | 43 |
| | 12 | 1.25 | 95 | 970 | 70 | 105 | 1,050 | 76 |
| | 14 | 1.5 | 145 | 1,500 | 108 | 165 | 1,700 | 123 |
| | 16 | 1.5 | 230 | 2,300 | 166 | — | — | — |
| 8T | 8 | 1.25 | 29 | 300 | 22 | 33 | 330 | 24 |
| | 10 | 1.25 | 61 | 620 | 45 | 68 | 690 | 50 |
| | 12 | 1.25 | 110 | 1,100 | 80 | 120 | 1,250 | 90 |
| 9T | 8 | 1.25 | 34 | 340 | 25 | 37 | 380 | 27 |
| | 10 | 1.25 | 70 | 710 | 51 | 78 | 790 | 57 |
| | 12 | 1.25 | 125 | 1,300 | 94 | 140 | 1,450 | 105 |
| 10T | 8 | 1.25 | 38 | 390 | 28 | 42 | 430 | 31 |
| | 10 | 1.25 | 78 | 800 | 58 | 88 | 890 | 64 |
| | 12 | 1.25 | 140 | 1,450 | 105 | 155 | 1,600 | 116 |
| 11T | 8 | 1.25 | 42 | 430 | 31 | 47 | 480 | 35 |
| | 10 | 1.25 | 87 | 890 | 64 | 97 | 990 | 72 |
| | 12 | 1.25 | 155 | 1,600 | 116 | 175 | 1,800 | 130 |

Individual Torque Charts appear within many or the Groups. Refer to the Standard Torque Specifications Chart for torque references not listed in the individual torque charts.

# VEHICLE EMISSION CONTROL INFORMATION (VECI) LABEL

## DESCRIPTION

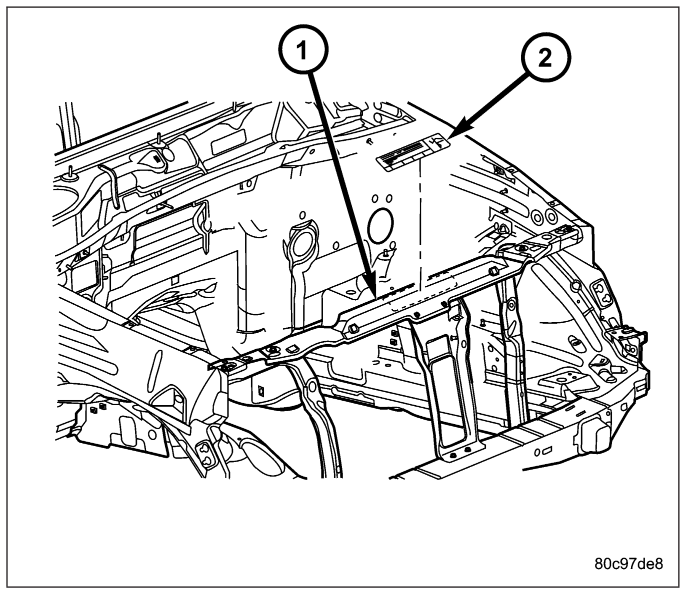
All models have a Vehicle Emission Control Information (VECI) Label. DaimlerChrysler permanently attaches the label in the engine compartment. The label cannot be removed without defacing label information and destroying label.

The label contains the vehicle's emission specifications and vacuum hose routings. All hoses must be connected and routed according to the label.

The label also contains an engine vacuum schematic. There are unique labels for vehicles built for sale in the state of California and the country of Canada. Canadian labels are written in both the English and French languages.

The VECI label contains the following:

- Engine family and displacement
- Evaporative family
- Emission control system schematic
- Certification application
- Engine timing specifications (if adjustable)
- Idle speeds (if adjustable)
- Spark plug and gap



# VEHICLE IDENTIFICATION NUMBER

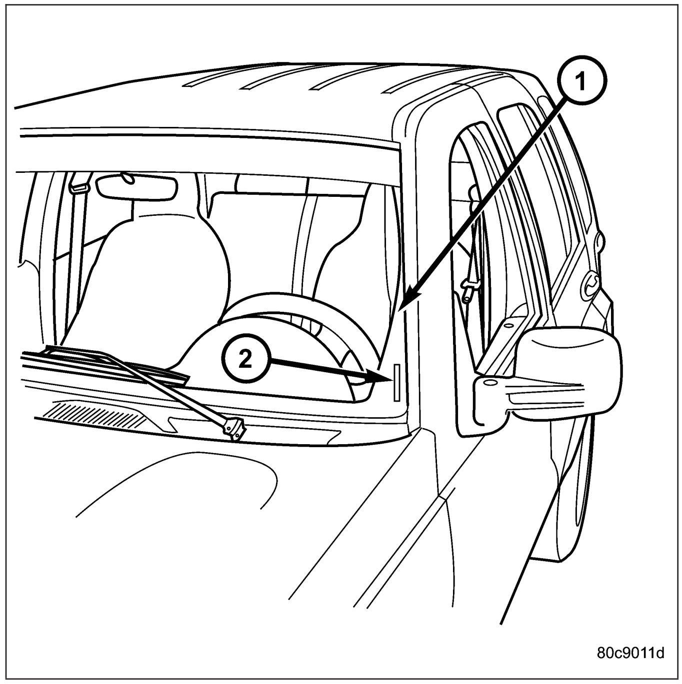
## DESCRIPTION

The Vehicle Identification Number (VIN) plate is located on the lower left A-pillar and is visible through the windshield. The VIN contains 17 characters that provide data concerning the vehicle. Refer to the VIN decoding chart to determine the identification of a vehicle.

The Vehicle Identification Number is also imprinted on the:

- Vehicle Safety Certification Label.
- Frame rail.

To protect the consumer from theft and possible fraud the manufacturer is required to include a Check Digit at the ninth position of the Vehicle Identification Number. The check digit is used by the manufacturer and government agencies to verify the authenticity of the vehicle and official documentation. The formula to use the check digit is not released to the general public.




**VEHICLE IDENTIFICATION NUMBER DECODING CHART**

| POSITION | INTERPRETATION | CODE = DESCRIPTION |
|---|---|---|
| 1 | Country of Origin | 1 = Manufactured by DaimlerChrysler Corporation |
| 2 | Make | J = Jeep |
| 3 | Vehicle Type | 4 = MPV W/O Side Airbags.<br>8 = MPV With Side Airbags. |
| 4 | Gross Vehicle Weight Rating | F = 4001 - 5000 lbs.<br>G = 5001 - 6000 lbs. |
| 5 | Vehicle Line | K = Liberty 4X2 (LHD)<br>L = Liberty 4X4 (LHD) wihtout ABB<br>M = Cherokee 4X4 (RHD)<br>6 = Cherokee (LHD) with ABB |
| 6 | Series | 3 = Liberty/Renegade<br>4 = Liberty Sport/Cherokee Sport<br>5 = Liberty Limited/Cherokee Limited |
| 7 | Body Style | 8 = Sport Utility - 4 Door |
| 8 | Engine | K = 3.7L 6 cyl MPI Gasoline<br>1 = 2.4L 4 cyl MPI Gasoline<br>5 = 2.8L 4 cyl Diesel |
| 9 | Check Digit | 0 through 9 or X |
| 10 | Model Year | 6=2006 |
| 11 | Assembly Plant | W = Toledo North Assembly Plant |
| 12 thru 17 | Vehicle Build Sequence | |

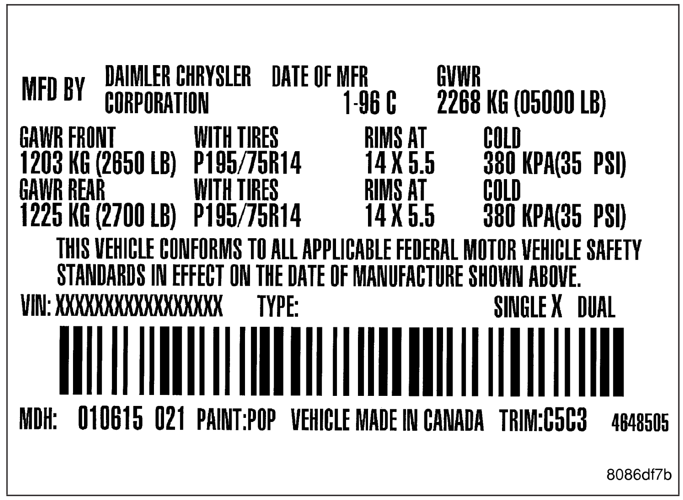
# VEHICLE CERTIFICATION LABEL

## DESCRIPTION

A vehicle certification label is attached to every DaimlerChrysler Corporation vehicle. The label certifies that the vehicle conforms to all applicable Federal Motor Vehicle Standards. The label also lists:

- Month and year of vehicle manufacture.
- Gross Vehicle Weight Rating (GVWR). The gross front and rear axle weight ratings (GAWR's) are based on a minimum rim size and maximum cold tire inflation pressure.
- Vehicle Identification Number (VIN).
- Type of vehicle.
- Type of rear wheels.
- Bar code.
- Month, Day and Hour (MDH) of final assembly.
- Paint and Trim codes.
- Country of origin.

The label is located on the driver-side door shut-face.




8086df7b

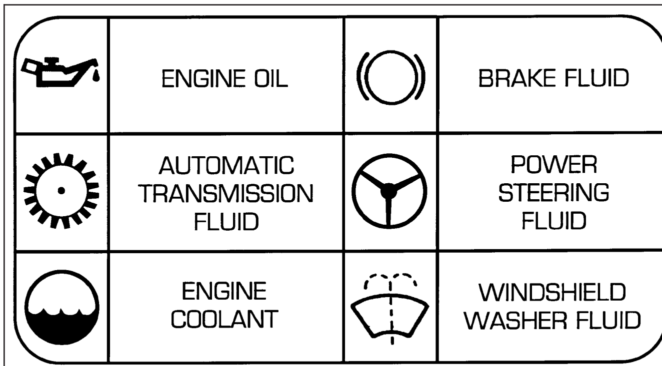
# LUBRICATION & MAINTENANCE

## TABLE OF CONTENTS

# INTERNATIONAL SYMBOLS

## DESCRIPTION

DaimlerChrysler Corporation uses international symbols to identify engine compartment lubricant and fluid inspection and fill locations.




8097ddbd

# PARTS & LUBRICANT RECOMMENDATION

## DESCRIPTION

## LUBRICANT RECOMMENDATIONS

### Chassis

| Component | Fluid, Lubricant, or Genuine Part |
|---|---|
| Steering Gear & Linkage, Ball Joints, Prop Shafts & Yokes, Wheel Bearings | Mopar® Multi-Purpose Lubricant NLGI Grade 2 EP, GC-LB |

### Body

| Component | Fluid, Lubricant, and Genuine Part |
|---|---|
| Hinges: | |
| Door & Hood | Mopar® Engine Oil |
| Swing Gate | Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB |
| Latches: Door, Hood/Safety Catch, Swing Gate | Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB |
| Seat Regulator & Track | Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB |
| Lock Cylinders | Mopar® Lock Cylinder Lube |

## FLUID TYPES

When service is required, DaimlerChrysler Corporation recommends that only Mopar® brand parts, lubricants and chemicals be used. Mopar® provides the best engineered products for servicing DaimlerChrysler Corporation vehicles.

Only lubricants bearing designations defined by the following organization should be used to service a DaimlerChrysler Corporation vehicle.

- Society of Automotive Engineers (SAE)
- American Petroleum Institute (API)
- National Lubricating Grease Institute (NLGI)

## API QUALITY CLASSIFICATION

This symbol on the front of an oil container means that the oil has been certified by the American Petroleum Institute (API) to meet all the lubrication requirements specified by DaimlerChrysler Corporation.


9400-9

## GEAR LUBRICANTS

SAE ratings also apply to multigrade gear lubricants. In addition, API classification defines the lubricants usage. Such as API GL-5 and SAE 75W-90.

# FLUID TYPES

## DESCRIPTION

## ENGINE OIL

**WARNING: New or used engine oil can be irritating to the skin. Avoid prolonged or repeated skin contact with engine oil. Contaminants in used engine oil, caused by internal combustion, can be hazardous to your health. Thoroughly wash exposed skin with soap and water. Do not wash skin with gasoline, diesel fuel, thinner, or solvents, health problems can result. Do not pollute, dispose of used engine oil properly. Contact your dealer or government agency for location of collection center in your area.**

Only lubricants bearing designations defined by the following organization should be used.
- Society of Automotive Engineers (SAE)
- American Petroleum Institute (API)
- National Lubricating Grease Institute (NLGI)
- Association des Constructeurs Européens d’ Automobiles (European Automobile Manufacturers Association) (ACEA)

## API SERVICE GRADE CERTIFIED

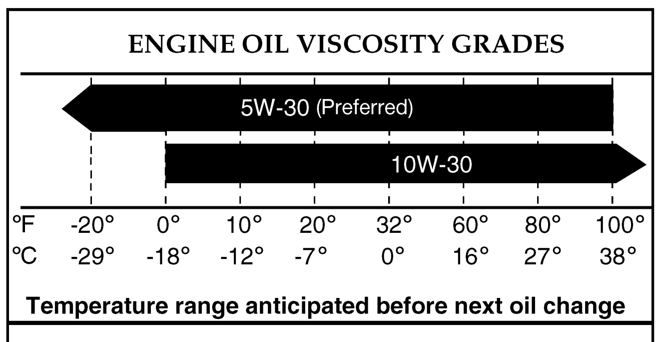
Use an engine oil that is API Certified. MOPAR® provides engine oils, that meet or exceed this requirement.

## SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. Use only engine oils with multiple viscosities such as 5W-30 or 10W-30. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range and variation.

## ACEA Categories

For countries that use the ACEA European Oil Categories for Service Fill Oils, use engine oils that meet the requirements of ACEA A1/B1, A2/B2, or A3/B3.



80b89880

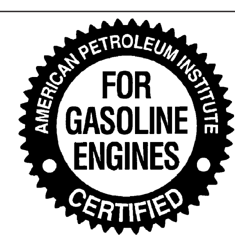
## ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

## CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the front label of engine oil plastic bottles and the top of engine oil cans.

This symbol means that the oil has been certified by the American Petroleum Institute (API). DaimlerChrysler only recommends API Certified engine oils. Use Mopar® engine oil or equivalent.



9400-9

## ENGINE OIL - DIESEL ENGINES

Only use synthetic engine oils meeting the API Categories SL/CF and Chrysler Material Standard MS-10725. Those engine oils not meeting the viscosity and API Quality and MS-10725 requirements should not be used.

### SAE VISCOSITY GRADE

The preferred engine oil is SAE 0W-40 Mobil® One Synthetic. If you can not locate SAE 0W-40 Mobil® One Synthetic, then SAE 5W-40 Mobil® One Synthetic would be acceptable.

## ENGINE OIL - DIESEL ENGINES - EXPORT

Use only Diesel Engine Oil meeting standard **MIL-2104C** or API Classification **CD or higher** or **CCML D4, D5**.

### SAE VISCOSITY GRADE

**CAUTION: Low viscosity oils must have the proper API quality or the CCMC G5 designation.**

To assure of properly formulated engine oils, it is recommended that SAE Grade 10W-40 engine oils that meet Chrysler material standard MS-6395, be used in accordance to ACEA B3, B4 specification. European Grade 10W-40 oils are also acceptable.

Oils of the SAE 5W-40 grade number are preferred when minimum temperatures consistently fall below -15° C (5° F).

## AXLE

**NOTE: DaimlerChrysler recommends using Mopar® lubricants or lubricants of equal quality.**

***FRONT AXLE***

- 186FIA (Model 30) - Mopar® Lubricant 80W-90

***REAR AXLE***

- 8 1/4 - Mopar® Gear Lubricant 75W-90 (Trailer Towing - Mopar® Synthentic Gear Lubricant 75W-140

**NOTE: Trac-lok® equipped axles require 118 ml (4 ounces) of Limited Slip Additive be added to the lubricant.**

## MANUAL TRANSMISSION

**NOTE: DaimlerChrysler recommends using Mopar® lubricants or lubricants of equal quality.**

- NSG370 - Mopar® Manual Transmission Lubricant MS-9224

## AUTOMATIC TRANSMISSION FLUID

**NOTE: Refer to Service Procedures in this group for fluid level checking procedures.**

Mopar® ATF +4, Automatic Transmission Fluid is the recommended fluid for DaimlerChrysler automatic transmissions.

**Dexron II fluid IS NOT recommended. Clutch chatter can result from the use of improper fluid.**

Mopar® ATF +4, Automatic Transmission Fluid when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.** ATF+4 also has a unique odor that may change with age. Consequently, odor and color cannot be used to indicate the fluid condition or the need for a fluid change.

### FLUID ADDITIVES

DaimlerChrysler strongly recommends against the addition of any fluids to the transmission, other than those automatic transmission fluids listed above. Exceptions to this policy are the use of special dyes to aid in detecting fluid leaks.

Various “special” additives and supplements exist that claim to improve shift feel and/or quality. These additives and others also claim to improve converter clutch operation and inhibit overheating, oxidation, varnish, and sludge. These claims have not been supported to the satisfaction of DaimlerChrysler and these additives **must not be**

**used.** The use of transmission “sealers” should also be avoided, since they may adversely affect the integrity of transmission seals.

## TRANSFER CASE - NV231

Recommended lubricant for the NV231 transfer case is Mopar® ATF +4, Automatic Transmission Fluid.

## TRANSFER CASE - NV241 GENII

Recommended lubricant for the NV2421 GENII transfer case is Mopar® ATF+4, Automatic Transmission Fluid.

## TRANSFER CASE - NV242

Recommended lubricant for the NV242 transfer case is Mopar® ATF+4, Automatic Transmission Fluid.

## ENGINE COOLANT

**WARNING: Antifreeze is an ethylene glycol base coolant and is harmful if swallowed or inhaled. If swallowed, drink two glasses of water and induce vomiting. If inhaled, move to fresh air area. Seek medical attention immediately. Do not store in open or unmarked containers. Wash skin and clothing thoroughly after coming in contact with ethylene glycol. Keep out of reach of children. Dispose of glycol base coolant properly, contact your dealer or government agency for location of collection center in your area. Do not open a cooling system when the engine is at operating temperature or hot under pressure, personal injury can result. Avoid radiator cooling fan when engine compartment related service is performed, personal injury can result.**

**CAUTION: Use of Propylene Glycol based coolants is not recommended, as they provide less freeze protection and less corrosion protection.**

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, in the cylinder head area near the exhaust valves and engine block. Then coolant carries the heat to the radiator where the tube/fin radiator can transfer the heat to the air.

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769), or the equivalent ethylene glycol base coolant with organic corrosion inhibitors (called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% Ethylene Glycol and 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

**CAUTION: Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769) may not be mixed with any other type of antifreeze. Mixing of coolants other than specified (non-HOAT or other HOAT), may result in engine damage that may not be covered under the new vehicle warranty, and decreased corrosion protection.**

## COOLANT PERFORMANCE

The required ethylene-glycol (antifreeze) and water mixture depends upon climate and vehicle operating conditions. The coolant performance of various mixtures follows:

**Pure Water-**Water can absorb more heat than a mixture of water and ethylene-glycol. This is for purpose of heat transfer only. Water also freezes at a higher temperature and allows corrosion.

**100 percent Ethylene-Glycol-**The corrosion inhibiting additives in ethylene-glycol need the presence of water to dissolve. Without water, additives form deposits in system. These act as insulation causing temperature to rise to as high as 149°C (300°F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at -22°C (-8°F).

**50/50 Ethylene-Glycol and Water-**Is the recommended mixture, it provides protection against freezing to -37°C (-34°F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. If percentage is lower, engine parts may be eroded by cavitation. Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7°C (-90°F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because specific heat of antifreeze is lower than that of water.

**CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.**

**CAUTION: Do not use coolant additives that are claimed to improve engine cooling.**

## POWER STEERING FLUID

Mopar® ATF +4, Automatic Transmission Fluid is required in the power steering system. Substitute fluids can induce power steering system failure.

Mopar® ATF +4, Automatic Transmission Fluid when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.** ATF+4 also has a unique odor that may change with age. Consequently, odor and color cannot be used to indicate the fluid condition or the need for a fluid change.

## BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use only Mopar brake fluid or an equivalent from a tightly sealed container.

**CAUTION: Never use reclaimed brake fluid or fluid from an container which has been left open. An open container of brake fluid will absorb moisture from the air and contaminate the fluid.**

**CAUTION: Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid, etc.**

## OPERATION - AUTOMATIC TRANSMISSION FLUID

The automatic transmission fluid is selected based upon several qualities. The fluid must provide a high level of protection for the internal components by providing a lubricating film between adjacent metal components. The fluid must also be thermally stable so that it can maintain a consistent viscosity through a large temperature range. If the viscosity stays constant through the temperature range of operation, transmission operation and shift feel will remain consistent. Transmission fluid must also be a good conductor of heat. The fluid must absorb heat from the internal transmission components and transfer that heat to the transmission case.

# FLUID CAPACITIES

## SPECIFICATIONS - FLUID CAPACITIES

| DESCRIPTION | SPECIFICATION |
|---|---|
| FUEL TANK – Gasoline & Diesel | 19.5 U.S. Gallons (74L)* |
| ENGINE OIL | |
| 2.4L with Filter | 4.7L (5.0 qts.) |
| 3.7L with Filter | 4.7L (5.0 qts.) |
| 2.8L Diesel with Filter | 6.0L (6.3 qts.) |
| ENGINE COOLANT | |
| Cooling System - 2.4L | 9.5L (10.0 qts.) |
| Cooling System - 3.7L | 13.2L (14.0 qts.) |
| Cooling System-2.8L Diesel | 12.5 L (11.8 qts.) |
| POWER STEERING SYSTEM | |
| Power steering fluid capacities are dependent on engine/chassis options as well as steering gear/cooler options. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these capacities may vary. Refer to 19, Steering for proper fill and bleed procedures. | |
| AUTOMATIC TRANSMISSION | |
| Service Fill - 545RFE | 4.73L (10.0 pts) |
| O-haul Fill - 545RFE | 13.33L (28.0 pts) |
| Service Fill - 42RLE | 3.8L (8.0 pts) |
| O-haul Fill - 42RLE | 8.3L (17.6 pts) |
| Dry fill capacity depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these figures may vary. (Refer to 21 - TRANSMISSION/AUTOMATIC/FLUID - STANDARD PROCEDURE) | |
| TRANSFER CASE | |
| NV231 | 1.4L (2.95 pts.) |
| NV241 GENII | 2.0L (4.2 pts.) |
| NV242 | 1.6L (3.4 pts.) |
| MANUAL TRANSMISSION | |
| NSG370 (Approximate dry fill or fill to bottom edge of the fill plug hole.) | 1.5L (3.17 pts.) |
| FRONT AXLE | |
| 186 FIA (Model 30) | 1.24L (2.6 pts.) |
| REAR AXLE | |
| 8 1/4 | 2.08L (4.4 pts.)** |
| *Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure. | |
| ** When equipped with Trac-lok, include 118 ml (4.0 ounces) of Limited Slip Additive. | |

# MAINTENANCE SCHEDULES

## DESCRIPTION

## MAINTENANCE SCHEDULES - GASOLINE ENGINES

There are two maintenance schedules that show the **required** service for your vehicle.

First is Schedule ″**B**″. It is for vehicles that are operated under the conditions that are listed below and at the beginning of the schedule.

- Day or night temperatures are below 32°F (0°C).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 10 miles (16.2 km).
- More than 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C).
- Trailer towing.
- Heavy loading.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.
- If equipped for and operated with E-85 (ethanol) fuel.

**NOTE: If ANY of these apply to you then change your engine oil every 3,000 miles (5 000 km) or 3 months, whichever comes first and follow “Schedule B” of the “Maintenance Schedules” section of this manual.**

**NOTE: If ANY of these apply to you then flush and replace your engine coolant/anti-freeze every 102,000 miles (163 000 km) or 60 months, whichever comes first, and follow “Schedule B” of the “Maintenance Schedules” section of this manual.**

**NOTE: Most vehicles are operated under the conditions listed for Schedule “B.”**

Second is Schedule **“A”.** It is for vehicles that are not operated under any of the conditions listed under Schedule “B.”

Use the schedule that best describes your driving conditions. Where time and mileage are listed, follow the interval that occurs first.

**CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.**

***At Each Stop for Fuel***

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent, add as required.

***Once a Month***

- Check the tire pressure and look for unusual wear or damage.
- Inspect the battery, and clean and tighten the terminals as required.
- Check the fluid levels of the engine coolant/anti-freeze reservoir, brake master cylinder, and transmission, and add as needed.
- Check all lights and all other electrical items for correct operation.

***At Each Oil Change***

- Change the engine oil filter.
- Inspect the exhaust system.

- Inspect brake hoses.
- Check the engine coolant/anti-freeze level, hoses, and clamps.
- Inspect manual transmission fluid level — if equipped.
- After completion of off-road operation, the underside of the vehicle should be thoroughly inspected. Examine threaded fasteners for looseness.

## Schedule "B"

Follow schedule "B" if you usually operate your vehicle under one or more of the following conditions.

- Day or night temperatures are below 32°F (0°C).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 10 miles (16.2 km).
- More than 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C).
- Trailer towing.
- Heavy loading.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.
- If equipped for and operated with E-85 (ethanol) fuel.

**NOTE: If ANY of these apply to you then change your engine oil every 3,000 miles (5 000 km) or 3 months, whichever comes first and follow "Schedule B" of the "Maintenance Schedules" section of this manual.**

**NOTE: If ANY of these apply to you then flush and replace your engine coolant/anti-freeze every 102,000 miles (163 000 km) or 60 months, whichever comes first, and follow "Schedule B" of the "Maintenance Schedules" section of this manual.**

| **Miles (Kilometers)** | **3,000 (5 000)** | **6,000 (10 000)** | **9,000 (15 000)** | **12,000 (20 000)** | **15,000 (25 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | | | X | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |

| **Miles (Kilometers)** | **18,000 (30 000)** | **21,000 (35 000)** | **24,000 (40 000)** | **27,000 (45 000)** | **30,000 (50 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ◊ | | | | | X |
| Inspect the brake linings. | | | X | | |
| Inspect the manual transmission fluid, add as necessary. | | | | | X |
| Drain and refill the front and rear axle fluid‡ | | | | | X |

| **Miles**<br>**(Kilometers)** | **18,000**<br>**(30 000)** | **21,000**<br>**(35 000)** | **24,000**<br>**(40 000)** | **27,000**<br>**(45 000)** | **30,000**<br>**(50 000)** |
|---|---|---|---|---|---|
| Inspect the transfer case fluid, add if necessary. | | | | | X |

| **Miles**<br>**(Kilometers)** | **33,000**<br>**(55 000)** | **36,000**<br>**(60 000)** | **39,000**<br>**(65 000)** | **42,000**<br>**(70 000)** | **45,000**<br>**(75 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | X | | | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. | | | | | X |

| **Miles**<br>**(Kilometers)** | **48,000**<br>**(80 000)** | **51,000**<br>**(85 000)** | **54,000**<br>**(90 000)** | **57,000**<br>**(95 000)** | **60,000**<br>**(100 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ◊ | | | | | X |
| Inspect the brake linings. | X | | | | X |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the manual transmission fluid, add as necessary. | | | | | X |
| Drain and refill the automatic transmission fluid, replace main sump filter, and spin-on cooler return filter (if equipped).† | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Drain and refill the transfer case fluid. | | | | | X |
| Flush and replace the engine coolant/anti-freeze. | | | | | X |

| **Miles**<br>**(Kilometers)** | **63,000**<br>**(105 000)** | **66,000**<br>**(110 000)** | **69,000**<br>**(115 000)** | **72,000**<br>**(120 000)** | **75,000**<br>**(125 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | | | X | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |

| **Miles** **(Kilometers)** | **63,000** **(105 000)** | **66,000** **(110 000)** | **69,000** **(115 000)** | **72,000** **(120 000)** | **75,000** **(125 000)** |
|---|---|---|---|---|---|
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |

| **Miles** **(Kilometers)** | **78,000** **(130 000)** | **81,000** **(135 000)** | **84,000** **(140 000)** | **87,000** **(145 000)** | **90,000** **(150 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ◊ | | | | | X |
| Inspect the brake linings. | | | X | | |
| Inspect the manual transmission fluid, add as necessary. | | | | | X |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Inspect the transfer case fluid, add if necessary. | | | | | X |

| **Miles** **(Kilometers)** | **93,000** **(155 000)** | **96,000** **(160 000)** | **99,000** **(165 000)** | **102,000** **(170 000)** | **105,000** **(175 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | X | | | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Flush and replace the engine coolant/anti-freeze, if not done at 60 months. | | | | X | |

| **Miles** **(Kilometers)** | **108,000** **(180 000)** | **111,000** **(185 000)** | **114,000** **(190 000)** | **117,000** **(195 000)** | **120,000** **(200 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ◊ | | | | | X |

| Miles (Kilometers) | 108,000 (180 000) | 111,000 (185 000) | 114,000 (190 000) | 117,000 (195 000) | 120,000 (200 000) |
|---|---|---|---|---|---|
| Inspect the brake linings. | X | | | | X |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the manual transmission fluid, add as necessary. | | | | | X |
| Drain and refill the automatic transmission fluid, replace main sump filter, and spin-on cooler return filter (if equipped).† | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Drain and refill the transfer case fluid. | | | | | X |
| Flush and replace the engine coolant/anti-freeze at 120 months, if not replaced at 102,000 miles (170 000 km). | | | | | X |

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

† Applies only if vehicle is used for frequent trailer towing, or fleet/commercial service.

◊ This maintenance is recommended by the manufacturer to the owner, but it is not required to maintain emissions warranty.

‡Off-highway operation, trailer towing, taxi, limousine, bus, snow plowing, or other types of commercial service or prolonged operation with heavy loading, especially in hot weather, require front and rear axle service indicated with a ‡ in Schedule "B". Perform these services if the vehicle is usually operated under these conditions.

## Schedule "A"

| Miles (Kilometers) [Months] | 6,000 (10 000) [6] | 12,000 (20 000) [12] | 18,000 (30 000) [18] | 24,000 (40 000) [24] | 30,000 (50 000) [30] |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | X | X | X | X | X |
| **Inspect the engine air filter element, and replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| Inspect the manual transmission fluid, add as necessary. | | | | | X |
| Inspect the brake linings. | | | X | | |
| Inspect the transfer case fluid. | | | | | X |

| Miles (Kilometers) [Months] | 36,000 (60 000) [36] | 42,000 (70 000) [42] | 48,000 (80 000) [48] | 54,000 (90 000) [54] |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| Rotate the tires. | X | X | X | X |
| Inspect the brake linings. | X | | | X |

| **Miles (Kilometers) [Months]** | **60,000 (100 000) [60]** | **66,000 (110 000) [66]** | **72,000 (120 000) [72]** | **78,000 (130 000) [78]** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| Rotate the tires. | X | X | X | X |
| **Inspect the engine air filter element, and replace if necessary.** | X | | | |
| **Replace the spark plugs.** | X | | | |
| **Inspect and replace the PCV valve, if necessary.** ♢ | X | | | |
| Inspect the brake linings. | | | X | |
| Inspect the drive belt and replace, if needed. | X | | | |
| Inspect the drive belt and replace as needed. Not required if previously replaced. | | | X | |
| Flush and replace the engine coolant/anti-freeze. | X | | | |
| Inspect the manual transmission fluid, add as necessary. | X | | | |
| Inspect the transfer case fluid. | X | | | |

| **Miles (Kilometers) [Months]** | **84,000 (140 000) [84]** | **90,000 (150 000) [90]** | **96,000 (160 000) [96]** | **102,000 (170 000) [102]** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| Rotate the tires. | X | X | X | X |
| **Inspect the engine air filter element, and replace if necessary.** | | X | | |
| **Replace the spark plugs.** | | X | | |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | X | | |
| Inspect the brake linings. | | X | | |
| Inspect the drive belt and replace as needed. Not required if previously replaced. | X | | X | |
| Flush and replace the engine coolant/anti-freeze if not done at 60 months. | | | | X |
| Inspect the manual transmission fluid, add as necessary. | | X | | |
| Inspect the transfer case fluid. | | X | | |

| **Miles (Kilometers) [Months]** | **108,000 (180 000) [108]** | **114,000 (190 000) [114]** | **120,000 (200 000) [120]** |
|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X |
| Rotate the tires. | X | X | X |
| **Inspect the engine air filter element, and replace if necessary.** | | | X |
| **Replace the spark plugs.** | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | X |
| Inspect the brake linings. | X | | |
| Inspect the drive belt and replace as needed. Not required if previously replaced. | X | | X |
| Flush and replace the engine coolant/anti-freeze if not done at 102,000 miles (170 000 km). | | | X |

| Miles (Kilometers) [Months] | 108,000 (180 000) [108] | 114,000 (190 000) [114] | 120,000 (200 000) [120] |
|---|---|---|---|
| Inspect the manual transmission fluid, add as necessary. | | | X |
| Drain and refill the transfer case fluid. | | | X |

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

◊ This maintenance is recommended by the manufacturer to the owner, but it is not required to maintain emissions warranty.

## MAINTENANCE SCHEDULES - DIESEL ENGINE

There are two maintenance schedules that show the **required** service for your vehicle.

First is Schedule ″**B**″. It is for vehicles that are operated under the conditions that are listed below and at the beginning of the schedule.

- Day or night temperatures are below 32°F (0°C).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 10 miles (16.2 km).
- More than 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C).
- Trailer towing.
- Heavy loading.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

**NOTE: Most vehicles are operated under the conditions listed for Schedule “B.”**

Second is Schedule **“A”**. It is for vehicles that are not operated under any of the conditions listed under Schedule “B.”

Use the schedule that best describes your driving conditions. Where time and mileage are listed, follow the interval that occurs first.

**CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.**

### *At Each Stop for Fuel*

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent, add as required.

### *Once a Month*

- Check the tire pressure and look for unusual wear or damage.
- Inspect the battery, clean and tighten the terminals as required.
- Check the fluid levels of engine coolant/anti-freeze deaeration bottle, brake master cylinder, and transmission, and add as needed.
- Check all lights and all other electrical items for correct operation.

### *At Each Oil Change*

- Change the engine oil filter.
- Inspect the exhaust system.
- Inspect brake hoses.
- Check the engine coolant/anti-freeze level, hoses, and clamps.
- Inspect engine accessory drive belts. Replace as necessary.

- Inspect for the presence of water in the fuel filter/water separator unit.

***Tire Rotation***

- Rotate the tires every 6,250 miles (10 000 km).

## Schedule “B”

Follow schedule “B” if you usually operate your vehicle under one or more of the following conditions.

- Day or night temperatures are below 32°F (0°C).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 10 miles (16.2 km).
- More than 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C).
- Trailer towing.
- Heavy loading.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

| **Miles (Kilometers)** | **6,250 (10 000)** | **12,500 (20 000)** | **18,750 (30 000)** | **25,000 (40 000)** | **31,250 (50 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | | X | | X |
| **Replace the engine air filter element.** | | X | | X | |
| Inspect the boost pressure solenoid filter. Replace as necessary. | X | X | X | X | X |
| Replace the fuel filter/water separator unit. | | | | X | |
| Inspect the brake linings. | | X | | X | |
| Drain and refill the front and rear axle fluid. | | X | | X | |

| **Miles (Kilometers)** | **37,500 (60 000)** | **43,750 (70 000)** | **50,000 (80 000)** | **56,250 (90 000)** | **62,500 (100 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | | X | | X | |
| **Replace the engine air filter element.** | X | | X | | X |
| Inspect the boost pressure solenoid filter. Replace as necessary. | X | X | X | X | X |
| Replace the boost pressure solenoid filter, if not previously replaced. | | | X | | |
| Replace the fuel filter/water separator unit. | | | X | | |
| Replace the engine accessory drive belt. | X | | | | |
| Inspect the brake linings. | X | | X | | X |
| Drain and refill the front and rear axle fluid. | X | | X | | X |
| Drain and refill the transfer case fluid. | | | | | X |
| Inspect the manual transmission fluid, add as necessary. | | | | | X |

| **Miles**<br>**(Kilometers)** | **37,500**<br>**(60 000)** | **43,750**<br>**(70 000)** | **50,000**<br>**(80 000)** | **56,250**<br>**(90 000)** | **62,500**<br>**(100 000)** |
|---|---|---|---|---|---|
| Drain and refill the automatic transmission fluid, replace sump filter, and spin-on cooler return filter (if equipped). ♢ | | | | | X |

| **Miles**<br>**(Kilometers)** | **68,750**<br>**(110 000)** | **75,000**<br>**(120 000)** | **81,250**<br>**(130 000)** | **87,500**<br>**(140 000)** | **93,750**<br>**(150 000)** | **100,000**<br>**(160 000)** |
|---|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | | X | | X | |
| **Replace the engine air filter element.** | | X | | X | | X |
| Inspect the boost pressure solenoid filter. Replace as necessary. | X | X | X | X | X | X |
| Replace the boost pressure solenoid filter, if not previously replaced. | | | | | | X |
| Replace the engine accessory drive belt.* | | X | | | | |
| Replace the engine timing belt and idler pulleys. | | | | | | X |
| Inspect the engine timing belt tensioner, replace if necessary.† | | | | | | X |
| Replace the fuel filter/water separator unit. | | X | | | | X |
| Flush and replace the engine coolant/anti-freeze. | | | | | | X |
| Inspect the brake linings. | | X | | X | | |
| Drain and refill the front and rear axle fluid. | | X | | X | | |

♢ Applies only if vehicle is used for frequent trailer towing, or fleet/commercial service.

† The replacement of such component is requested if there is superficial wear, bearing clearance, or evident grease leak.

* This maintenance is not required if the belt was previously replaced.

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

## Schedule "A"

| **Miles**<br>**(Kilometers)** | **12,500**<br>**(20 000)** | **25,000**<br>**(40 000)** | **37,500**<br>**(60 000)** | **50,000**<br>**(80 000)** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | | X | |
| **Replace the engine air filter element.** | | X | | X |
| Inspect the boost pressure solenoid filter. Replace as necessary. | X | X | X | X |
| Replace the boost pressure solenoid filter, if not previously replaced. | | | | X |
| Replace the fuel filter/water separator unit. | | X | | X |
| Inspect the brake linings. | | X | | X |
| Inspect the manual transmission fluid, add as necessary. | X | | | |

| **Miles (Kilometers)** | **12,500 (20 000)** | **25,000 (40 000)** | **37,500 (60 000)** | **50,000 (80 000)** |
|---|---|---|---|---|
| Inspect the transfer case fluid. | X | | | |

| **Miles (Kilometers)** | **62,500 (100 000)** | **75,000 (120 000)** | **87,500 (140 000)** | **100,000 (160 000)** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | | X | |
| **Replace the engine air filter element.** | | X | | X |
| Inspect the boost pressure solenoid filter. Replace as necessary. | X | X | X | X |
| Replace the boost pressure solenoid filter, if not previously replaced. | | | | X |
| Replace the fuel filter/water separator unit. | | X | | X |
| Replace the engine timing belt, and idler pulleys. | | | | X |
| Inspect the engine timing belt tensioner, replace if necessary.† | | | | X |
| Flush and replace the engine coolant/anti-freeze. | X | | | |
| Replace the engine accessory drive belt. | X | | | |
| Inspect the brake linings. | | X | | X |
| Inspect the transmission fluid, add as necessary. | X | | | |
| Inspect the transfer case fluid. | X | | | |

† The replacement of such component is requested if there is superficial wear, bearing clearance, or evident grease leak.

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

## MAINTENANCE SCHEDULES - GASOLINE ENGINES - EXPORT

There are two maintenance schedules that show the **required** service for your vehicle.

First is Schedule **“A”.** It is for vehicles that are not operated under any of the conditions listed under Schedule “B.”

Second is Schedule **″B″.** It is for vehicles that are operated under the conditions that are listed below and at the beginning of the schedule.

- Day or night temperatures are below 0°C (32°F).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 16.2 km (10 miles).
- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

Most vehicles are operated under the conditions listed for Schedule “B.”

Use the schedule that best describes your driving conditions. Where time and mileage are listed, follow the interval that occurs first.

**CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.**

### *At Each Stop for Fuel*

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent, add as required.

### *Once a Month*

- Check the tire pressure and look for unusual wear or damage.
- Inspect the battery, and clean and tighten the terminals as required.
- Check the fluid levels of the coolant reservoir, brake master cylinder, and transmission, and add as needed.
- Check all lights and all other electrical items for correct operation.

### *At Each Oil Change*

- Change the engine oil filter.
- Inspect the exhaust system.
- Inspect brake hoses.
- Check the coolant level, hoses, and clamps.
- Inspect manual transmission fluid level — if equipped.
- After completion of off-road operation, the underside of the vehicle should be thoroughly inspected. Examine threaded fasteners for looseness.

## Schedule “A”

| **Kilometers (Miles) [Months]** | **12 000 (7,500) [6]** | **24 000 (15,000) [12]** | **36 000 (22,500) [18]** | **48 000 (30,000) [24]** | **60 000 (37,500) [30]** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | X | X | X | X | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | X | |
| **Replace the spark plugs.** | | | | X | |
| Inspect the brake linings. | | | X | | |
| Inspect the transfer case fluid. | | | | X | |

| **Kilometers (Miles) [Months]** | **72 000 (45,000) [36]** | **84 000 (52,500) [42]** | **96 000 (60,000) [48]** | **108 000 (67,500) [54]** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| Rotate the tires. | X | X | X | X |
| **Inspect the engine air filter element, replace if necessary.** | | | X | |
| **Inspect and replace the PCV valve, if necessary♢.** | | | X | |
| **Replace the spark plugs.** | | | X | |
| Inspect the brake linings. | X | | | X |
| Inspect and replace the Auto Tension Drive Belt, as needed. | | | X | |
| Inspect the transfer case fluid. | | | X | |

| Kilometers<br>(Miles)<br>[Months] | 120 000<br>(75,000)<br>[60] | 132 000<br>(82,500)<br>[66] | 144 000<br>(90,000)<br>[72] | 156 000<br>(97,500)<br>[78] |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| Rotate the tires. | X | X | X | X |
| **Inspect the engine air filter element, replace if necessary.** | | | X | |
| **Replace the spark plugs.** | | | X | |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | X | |
| Inspect the brake linings. | | | X | |
| Inspect the drive belt and replace as needed. Not required if previously replaced. | X | | X | |
| Flush and replace the engine coolant at 60 months, regardless of mileage. | X | | | |
| Inspect the transfer case fluid. | | | X | |

| Kilometers<br>(Miles)<br>[Months] | 160 000<br>(100,000) | 168 000<br>(105,000)<br>[84] | 180 000<br>(112,500)<br>[90] | 192 000<br>(120,000)<br>[96] |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | | X | X | X |
| Rotate the tires. | | X | X | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | X |
| **Replace the spark plugs.** | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | | X |
| Inspect the brake linings. | | | X | |
| Inspect the drive belt and replace as needed. Not required if previously replaced. | | X | | X |
| Flush and replace the engine coolant if not done at 60 months. | X | | | |
| Drain the transfer case, and refill. | | | | X |

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

♢ This maintenance is recommended by the manufacturer to the owner, but it is not required to maintain emissions warranty.

## Schedule “B”

Follow schedule “B” if you usually operate your vehicle under one or more of the following conditions.

- Day or night temperatures are below 0°C (32°F).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 16.2 km (10 miles).
- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

| **Kilometers (Miles)** | **5 000 (3,000)** | **10 000 (6,000)** | **14 000 (9,000)** | **19 000 (12,000)** | **24 000 (15,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | | | X | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |

| **Kilometers (Miles)** | **29 000 (18,000)** | **34 000 (21,000)** | **38 000 (24,000)** | **43 000 (27,000)** | **48 000 (30,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | | | X |
| Inspect the brake linings. | | | X | | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the transfer case fluid, add if necessary. | | | | | X |

| **Kilometers (Miles)** | **53 000 (33,000)** | **58 000 (36,000)** | **62 000 (39,000)** | **67 000 (42,000)** | **72 000 (45,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | X | | | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. | | | | | X |

| **Kilometers (Miles)** | **77 000 (48,000)** | **82 000 (51,000)** | **86 000 (54,000)** | **91 000 (57,000)** | **96 000 (60,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | | | X |
| Inspect the brake linings. | X | | | | X |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Drain and refill the automatic transmission fluid, and replace main sump filter. | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Drain and refill the transfer case fluid. | | | | | X |

| **Kilometers (Miles)** | **77 000 (48,000)** | **82 000 (51,000)** | **86 000 (54,000)** | **91 000 (57,000)** | **96 000 (60,000)** |
|---|---|---|---|---|---|
| Flush and replace the engine coolant/anti-freeze at 60 months, if not done at 102,000 miles (163 000 km). | | | | | X |

| **Kilometers (Miles)** | **101 000 (63,000)** | **106 000 (66,000)** | **110 000 (69,000)** | **115 000 (72,000)** | **120 000 (75,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | | | X | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |

| **Kilometers (Miles)** | **125 000 (78,000)** | **130 000 (81,000)** | **134 000 (84,000)** | **139 000 (87,000)** | **144 000 (90,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | | | X |
| Inspect the brake linings. | | | X | | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Inspect the transfer case fluid, add if necessary. | | | | | X |

| **Kilometers (Miles)** | **149 000 (93,000)** | **154 000 (96,000)** | **158 000 (99,000)** | **163 000 (102,000)** | **168 000 (105,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | X | | | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Flush and replace the engine coolant/anti-freeze, if not done at 60 months. | | | | X | |

| **Kilometers (Miles)** | **173 000 (108,000)** | **178 000 (111,000)** | **182 000 (114,000)** | **187 000 (117,000)** | **192 000 (120,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | | | X |
| Inspect the brake linings. | X | | | | X |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Drain and refill the automatic transmission fluid, and replace main sump filter. | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Drain and refill the transfer case fluid. | | | | | X |

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

♢ This maintenance is recommended by the manufacturer to the owner, but it is not required to maintain emissions warranty.

‡Off-highway operation, trailer towing, taxi, limousine, bus, snow plowing, or other types of commercial service or prolonged operation with heavy loading, especially in hot weather, require front and rear axle service indicated with a ‡ in Schedule "B". Perform these services if the vehicle is usually operated under these conditions.

## DESCRIPTION – DIESEL ENGINES – EXPORT SCHEDULES

There are two maintenance schedules that show the **required** service for your vehicle.

First is Schedule **"A"**. It is for vehicles that are not operated under any of the conditions listed under Schedule ″B″.

Second is Schedule **"B"**. It is for vehicles that are operated under the conditions that are listed below and at the beginning of the schedule.

- Day or night temperatures are below 0°C (32°F).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 16.2 km (10 miles).
- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

Most vehicles are operated under the conditions listed for Schedule ″B″.

Use the schedule that best describes your driving conditions. Where time and mileage are listed, follow the interval that occurs first.

**CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.**

### *At Each Stop for Fuel*

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent and add if required.

*Once a Month*

- Check the tire pressure and look for unusual wear or damage.
- Inspect the battery and clean and tighten the terminals as required.
- Check the fluid levels of coolant reservoir, brake master cylinder, power steering and transmission and add as needed.
- Check all lights and all other electrical items for correct operation.

*At Each Oil Change*

- Change the engine oil filter.
- Inspect the exhaust system.
- Inspect brake hoses.
- Check the engine coolant/anti-freeze level, hoses, and clamps.
- Inspect engine accessory drive belts. Replace as necessary.
- Inspect for the presence of water in the fuel filter/water separator unit.

*Tire Rotation*

- Rotate the tires every 10 000 km (6,000 miles).

## Schedule "A"

| **Kilometers (Miles)** | **20 000 (12,500)** | **40 000 (25,000)** | **60 000 (37,500)** | **80 000 (50,000)** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | X | X | X |
| **Replace the engine air filter element.** | | X | | X |
| Replace the fuel filter/water separator unit. | | X | | X |
| Inspect the brake linings. | | X | | X |
| Inspect the transfer case fluid. | X | | | |

| **Kilometers (Miles)** | **100 000 (62,500)** | **120 000 (75,000)** | **140 000 (87,500)** | **160 000 (100,000)** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | X | X | X |
| **Replace the engine air filter element.** | | X | | X |
| Replace the fuel filter/water separator unit. | | X | | X |
| Replace the engine timing belt, and idler pulleys. | | | | X |
| Inspect the engine timing belt tensioner, replace if necessary. ◊ | | | | X |
| Flush and replace the engine coolant. | X | | | |
| Replace the engine accessory drive belt. | X | | | |
| Inspect the brake linings. | | X | | X |
| Inspect the transfer case fluid. | X | | | |

Inspection and service should also be performed anytime a malfunction is observed or suspected.

‡ Replace if there is superficial wear, bearing clearance, or evident grease leak.

**WARNING: You can be badly injured working on or around a motor vehicle. Do only that service work for which you have the knowledge and the right equipment. If you have any doubt about your ability to perform a service job, take your vehicle to a competent mechanic.**

## Schedule “B”

Follow schedule “B” if you usually operate your vehicle under one or more of the following conditions.

- Day or night temperatures are below 0°C (32°F).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 16.2 km (10 miles).
- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

| **Kilometers (Miles)** | **10 000 (6,250)** | **20 000 (12,500)** | **30 000 (18,750)** | **40 000 (25,000)** | **50 000 (31,250)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | X | X | X | X |
| **Replace the engine air filter element.** | | X | | X | |
| Replace the fuel filter/water separator unit. | | | | X | |
| Inspect the brake linings. | | X | | X | |
| Drain and refill the front and rear axle fluid. | | X | | X | |

| **Kilometers (Miles)** | **60 000 (37,500)** | **70 000 (43,750)** | **80 000 (50,000)** | **90 000 (56,250)** | **100 000 (62,500)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | X | X | X | X |
| **Replace the engine air filter element.** | X | | X | | X |
| Replace the fuel filter/water separator unit. | | | X | | |
| Replace the engine accessory drive belt. | X | | | | |
| Inspect the brake linings. | X | | X | | X |
| Drain and refill the front and rear axle fluid. | X | | X | | X |
| Drain and refill the transfer case fluid. | | | | | X |
| Drain and refill the automatic transmission fluid, and replace sump filter. ◊ | | | | | X |

| **Kilometers (Miles)** | **110 000 (68,750)** | **120 000 (75,000)** | **130 000 (81,250)** | **140 000 (87,500)** | **150 000 (93,750)** | **160 000 (100,000)** |
|---|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | X | X | X | X | X |
| **Replace the engine air filter element.** | | X | | X | | X |
| Replace the engine accessory drive belt. | | X | | | | |
| Replace the engine timing belt and idler pulleys. | | | | | | X |
| Inspect the engine timing belt tensioner, replace if necessary.† | | | | | | X |
| Replace the fuel filter/water separator unit. | | X | | | | X |

| **Kilometers**<br><br>**(Miles)** | **110 000**<br><br>**(68,750)** | **120 000**<br><br>**(75,000)** | **130 000**<br><br>**(81,250)** | **140 000**<br><br>**(87,500)** | **150 000**<br><br>**(93,750)** | **160 000**<br><br>**(100,000)** |
|---|---|---|---|---|---|---|
| Flush and replace the engine coolant/anti-freeze. | | | | | | X |
| Inspect the brake linings. | | X | | X | | |
| Drain and refill the front and rear axle fluid. | | X | | X | | |

◊ Applies only if vehicle is used for frequent trailer towing, or fleet/commercial service.

† The replacement of such component is requested when there is superficial wear, bearing clearance, or evident grease leak.

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

# FLUID FILL/CHECK LOCATIONS

## DESCRIPTION

The fluid check/fill point locations are located in each applicable service manual section.

# HOISTING

## STANDARD PROCEDURE - HOISTING RECOMMENDATIONS

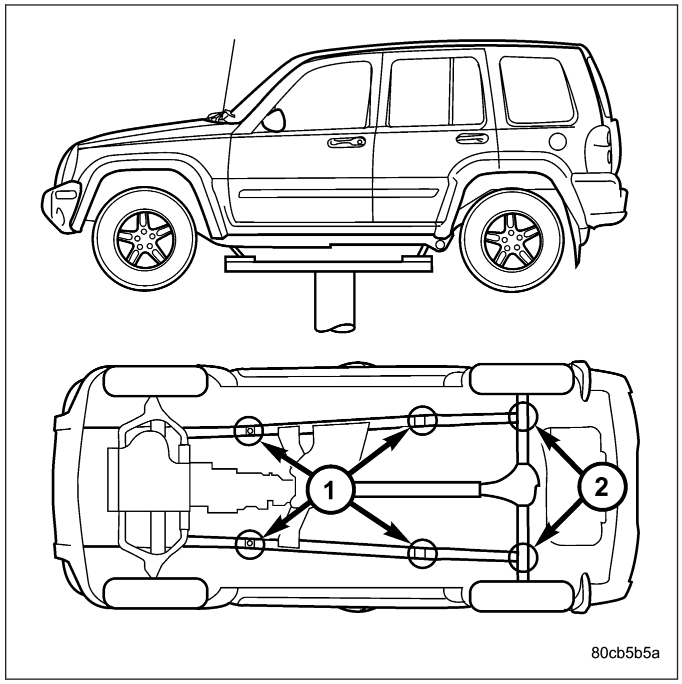
Refer to the Owner's Manual for emergency vehicle lifting procedures.

When properly positioned, a floor jack can be used to lift a Jeep vehicle. Support the vehicle in the raised position with jack stands at the front and rear ends of the frame rails.

**CAUTION: Do not attempt to lift a Jeep vehicle with a floor jack positioned under:**

- A body side sill.
- A steering linkage component.
- A drive shaft.
- The engine or transmission oil pan.
- The fuel tank.
- A front suspension arm.
- Transfer case.

**NOTE: Use the correct sub-frame rail or frame rail lifting locations only.**




## HOIST

Refer to the Owner's Manual for emergency vehicle lifting procedures.

A vehicle can be lifted with:

- A single-post, frame-contact hoist.
- A twin-post, chassis hoist.
- A ramp-type, drive-on hoist.

**NOTE: When a frame-contact type hoist is used, verify that the lifting pads are positioned properly.**

**WARNING: THE HOISTING AND JACK LIFTING POINTS PROVIDED ARE FOR A COMPLETE VEHICLE. WHEN A CHASSIS OR DRIVETRAIN COMPONENT IS REMOVED FROM A VEHICLE, THE CENTER OF GRAVITY IS ALTERED MAKING SOME HOISTING CONDITIONS UNSTABLE. PROPERLY SUPPORT OR SECURE VEHICLE TO HOISTING DEVICE WHEN THESE CONDITIONS EXIST.**

# JUMP STARTING

## STANDARD PROCEDURE - JUMP STARTING PROCEDURE

**WARNING: REVIEW ALL SAFETY PRECAUTIONS AND WARNINGS IN THE BATTERY SYSTEM SECTION OF THE SERVICE MANUAL. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE)**

- **DO NOT JUMP START A FROZEN BATTERY, PERSONAL INJURY CAN RESULT.**
- **IF EQUIPPED, DO NOT JUMP START WHEN MAINTENANCE FREE BATTERY INDICATOR DOT IS YELLOW OR BRIGHT COLOR.**
- **DO NOT JUMP START A VEHICLE WHEN THE BATTERY FLUID IS BELOW THE TOP OF LEAD PLATES.**
- **DO NOT ALLOW JUMPER CABLE CLAMPS TO TOUCH EACH OTHER WHEN CONNECTED TO A BOOSTER SOURCE.**
- **DO NOT USE OPEN FLAME NEAR BATTERY.**
- **REMOVE METALLIC JEWELRY WORN ON HANDS OR WRISTS TO AVOID INJURY BY ACCIDENTAL ARCING OF BATTERY CURRENT.**
- **WHEN USING A HIGH OUTPUT BOOSTING DEVICE, DO NOT ALLOW BATTERY VOLTAGE TO EXCEED 16 VOLTS. REFER TO INSTRUCTIONS PROVIDED WITH DEVICE BEING USED.**
  **FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

**CAUTION: When using another vehicle as a booster, do not allow vehicles to touch. Electrical systems can be damaged on either vehicle.**

### TO JUMP START A DISABLED VEHICLE:

1. Raise hood on disabled vehicle and visually inspect engine compartment for:
   - Generator drive belt condition and tension.
   - Fuel fumes or leakage, correct if necessary.
   - Frozen battery.
   - Yellow or bright color test indicator, if equipped.
   - Low battery fluid level.

**CAUTION: If the cause of starting problem on disabled vehicle is severe, damage to booster vehicle charging system can result.**

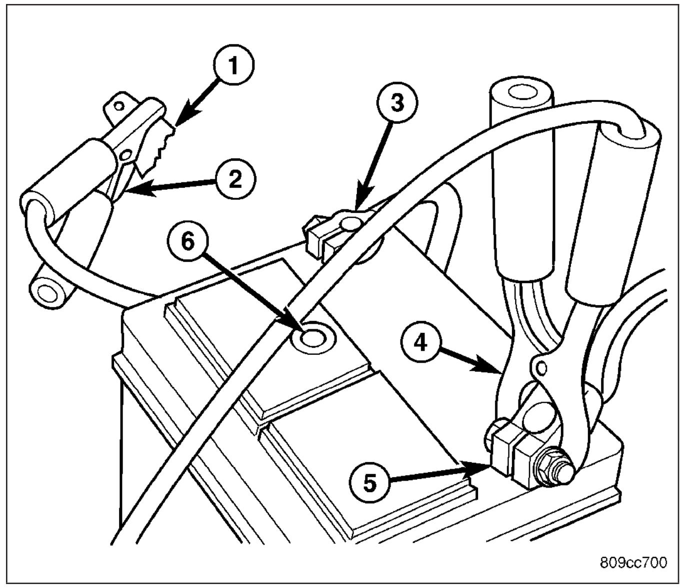
2. When using another vehicle as a booster source, turn off all accessories, place gear selector in park or neutral, set park brake or equivalent and operate engine at 1200 rpm.
3. On disabled vehicle, place gear selector in park or neutral and set park brake or equivalent. Turn OFF all accessories.
4. Connect jumper cables to booster battery. RED clamp to positive terminal (+). BLACK clamp to negative terminal (-). DO NOT allow clamps at opposite end of cables to touch, electrical arc will result . Review all warnings in this procedure.
5. On disabled vehicle, connect RED jumper cable clamp to battery positive (+) terminal. Connect BLACK jumper cable clamp to the engine as close to the ground cable connection as possible.

**CAUTION: Do not crank starter motor on disabled vehicle for more than 15 seconds, starter will overheat and could fail.**

6. Allow battery in disabled vehicle to charge to at least 12.4 volts (75% charge) before attempting to start engine. If engine does not start within 15 seconds, stop cranking engine and allow starter to cool (15 min.), before cranking again.

## DISCONNECT CABLE CLAMPS AS FOLLOWS:

- Disconnect BLACK cable clamp from engine ground on disabled vehicle.
- When using a Booster vehicle, disconnect BLACK cable clamp from battery negative terminal. Disconnect RED cable clamp from battery positive terminal.
- Disconnect RED cable clamp from battery positive terminal on disabled vehicle.

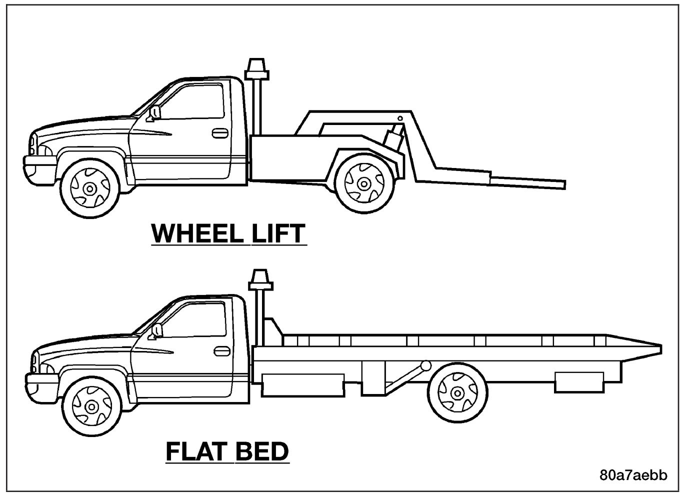


# TOWING

## STANDARD PROCEDURE - TOWING

A vehicle equipped with SAE approved wheel lift-type towing equipment can be used to tow Jeep vehicles. When towing a 4WD vehicle using a wheel-lift towing device, use tow dollies under the opposite end of the vehicle. A vehicle with flatbed device can also be used to transport a disabled vehicle.

### SAFETY PRECAUTIONS




**CAUTION: The following safety precautions must be observed when towing a vehicle:**

- Secure loose and protruding parts.
- Always use a safety chain system that is independent of the lifting and towing equipment.
- Do not allow towing equipment to contact the disabled vehicle's fuel tank.
- Do not allow anyone under the disabled vehicle while it is lifted by the towing device.
- Do not allow passengers to ride in a vehicle being towed.
- Always observe state and local laws regarding towing regulations.
- Do not tow a vehicle in a manner that could jeopardize the safety of the operator, pedestrians or other motorists.
- Do not attach tow chains, T-hooks, or J-hooks to a bumper, steering linkage, drive shafts or a non-reinforced frame hole.
- Do not tow a heavily loaded vehicle. Use a flatbed device to transport a loaded vehicle.

### TWO-WHEEL-DRIVE VEHICLE TOWING

DaimlerChrysler Corporation recommends that a vehicle be towed with the rear end lifted, whenever possible.

**WARNING: WHEN TOWING A DISABLED VEHICLE AND THE DRIVE WHEELS ARE SECURED IN A WHEEL LIFT OR TOW DOLLIES, ENSURE THE TRANSMISSION IS IN THE PARK POSITION (AUTOMATIC TRANSMISSION) OR A FORWARD DRIVE GEAR (MANUAL TRANSMISSION).**

**WARNING: ENSURE VEHICLE IS ON A LEVEL SURFACE OR THE WHEELS ARE BLOCKED TO PREVENT VEHICLE FROM ROLLING.**

### TWO WHEEL DRIVE TOWING-REAR END LIFTED

**CAUTION: Do not use steering column lock to secure steering wheel during towing operation.**

2WD vehicles can be towed with the front wheels on the surface for extended distances at speeds not exceeding 48 km/h (30 mph).

1. Attach wheel lift device to rear wheels.
2. Place the transmission in neutral.
3. Raise vehicle to towing position.
4. Attach safety chains. Route chains so not to interfere with tail pipe when vehicle is lifted.
5. Turn the ignition switch to the OFF position to unlock the steering wheel.

**CAUTION: Do not use steering column lock to secure steering wheel during towing operation.**

6. Secure steering wheel in straight ahead position with a clamp device designed for towing.
7. Place transmission in park.

## TWO WHEEL DRIVE TOWING-FRONT END LIFTED

**CAUTION: Many vehicles are equipped with air dams, spoilers, and/or ground effect panels. To avoid component damage, a wheel-lift towing vehicle or a flat-bed hauling vehicle is recommended.**

1. Attach wheel lift device to rear wheels.
2. Place the transmission in neutral.
3. Raise the rear of the vehicle off the ground and install tow dollies under rear wheels.
4. Attach wheel lift device to front wheels and raise vehicle to towing position.
5. Attach the safety chains.

**CAUTION: Do not use steering column lock to secure steering wheel during towing operation.**

6. Turn the ignition switch to the OFF position to unlock the steering wheel.
7. Secure steering wheel in straight ahead position with a clamp device designed for towing.
8. Place transmission in park.

## FOUR-WHEEL-DRIVE VEHICLE TOWING

DaimlerChrysler Corporation recommends that a 4WD vehicle be transported on a flat-bed device. A Wheel-lift device can be used provided **the trailing wheels are off the ground and positioned in tow dollies.**

**WARNING: WHEN TOWING A DISABLED VEHICLE AND THE DRIVE WHEELS ARE SECURED IN A WHEEL LIFT OR TOW DOLLIES, ENSURE THE TRANSMISSION IS IN THE PARK POSITION.**

**CAUTION: Many vehicles are equipped with air dams, spoilers, and/or ground effect panels. To avoid component damage, a wheel-lift towing vehicle or a flat-bed hauling vehicle is recommended.**

## FOUR WHEEL DRIVE TOWING—REAR END LIFTED

**WARNING: ENSURE VEHICLE IS ON A LEVEL SURFACE OR THE WHEELS ARE BLOCKED TO PREVENT VEHICLE FROM ROLLING.**

1. Attach wheel lift device to front wheels.
2. Place the transmission in neutral.
3. Raise the front of the vehicle off the ground and install tow dollies under front wheels.
4. Attach wheel lift device to rear wheels and raise vehicle to towing position.
5. Attach safety chains. Route chains so not to interfere with tail pipe when vehicle is lifted.
6. Turn the ignition switch to the OFF position to unlock the steering wheel.

**CAUTION: Do not use steering column lock to secure steering wheel during towing operation.**

7. Secure steering wheel in straight ahead position with a clamp device designed for towing.
8. Place transmission in park.

## FOUR WHEEL DRIVE TOWING—FRONT END LIFTED

**WARNING: ENSURE VEHICLE IS ON A LEVEL SURFACE OR THE WHEELS ARE BLOCKED TO PREVENT VEHICLE FROM ROLLING.**

1. Attach wheel lift device to rear wheels.
2. Place the transmission in neutral.
3. Raise the rear of the vehicle off the ground and install tow dollies under rear wheels.
4. Attach wheel lift device to front wheels and raise vehicle to towing position.
5. Attach the safety chains.

**CAUTION: Do not use steering column lock to secure steering wheel during towing operation.**

6. Turn the ignition switch to the OFF position to unlock the steering wheel.
7. Secure steering wheel in straight ahead position with a clamp device designed for towing.
8. Place transmission in park.

# SUSPENSION

## TABLE OF CONTENTS

# SUSPENSION

## DIAGNOSIS AND TESTING - SUSPENSION AND STEERING SYSTEM

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| FRONT END NOISE | 1. Loose or worn wheel bearings.<br>2. Loose or worn steering or suspension components. | 1. Replace wheel bearings.<br>2. Tighten or replace components as necessary. |
| EXCESSIVE PLAY IN STEERING | 1. Loose or worn wheel bearings.<br>2. Loose or worn steering or suspension components.<br>3. Loose or worn steering gear. | 1. Replace wheel bearings.<br>2. Tighten or replace components as necessary.<br>3. Adjust or replace steering gear. |
| FRONT WHEELS SHIMMY | 1. Loose or worn wheel bearings.<br>2. Loose or worn steering or suspension components.<br>3. Tires worn or out of balance.<br>4. Alignment. | 1. Replace wheel bearings.<br>2. Tighten or replace components as necessary.<br>3. Replace or balance tires.<br>4. Align vehicle to specifications. |
| VEHICLE INSTABILITY | 1. Loose or worn wheel bearings.<br>2. Loose or worn steering or suspension components.<br>3. Tire pressure.<br>4. Alignment. | 1. Replace wheel bearings.<br>2. Tighten or replace components as necessary.<br>3. Adjust tire pressure.<br>4. Align vehicle to specifications. |
| EXCESSIVE STEERING EFFORT | 1. Loose or worn steering gear.<br>2. Power steering fluid low.<br>3. Column coupler binding.<br>4. Tire pressure.<br>5. Alignment. | 1. Adjust or replace steering gear.<br>2. Add fluid and repair leak.<br>3. Replace coupler.<br>4. Adjust tire pressure.<br>5. Align vehicle to specifications. |
| VEHICLE PULLS TO ONE SIDE DURING BRAKING | 1. Uneven tire pressure.<br>2. Worn brake components.<br>3. Air in brake line. | 1. Adjust tire pressure.<br>2. Repair brakes as necessary.<br>3. Repair as necessary. |
| VEHICLE LEADS OR DRIFTS FROM STRAIGHT AHEAD DIRECTION ON UNCROWNED ROAD | 1. Radial tire lead.<br>2. Brakes dragging.<br>3. Weak or broken spring.<br>4. Uneven tire pressure.<br>5. Wheel Alignment.<br>6. Loose or worn steering or suspension components.<br>7. Cross caster out of spec. | 1. Cross front tires.<br>2. Repair brake as necessary.<br>3. Replace spring.<br>4. Adjust tire pressure.<br>5. Align vehicle.<br>6. Repair as necessary.<br>7. Align vehicle. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| KNOCKING, RATTLING OR SQUEAKING | 1. Worn shock bushings.<br>2. Loose, worn or bent steering/ suspension components.<br>3. Shock valve. | 1. Replace shock.<br>2. Inspect, tighten or replace components as necessary.<br>3. Replace shock. |
| IMPROPER TRACKING | Loose, worn or bent steering/ suspension components. | Inspect, tighten or replace components as necessary. |

# WHEEL ALIGNMENT

## TABLE OF CONTENTS

# WHEEL ALIGNMENT

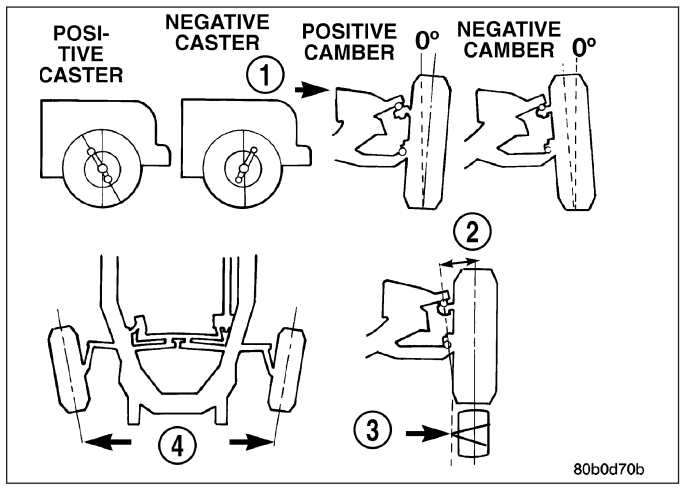
## DESCRIPTION

**NOTE: Suspension components with rubber/urethane bushings should be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur.**

Wheel alignment involves the correct positioning of the wheels in relation to the vehicle. The positioning is accomplished through suspension and steering linkage adjustments. An alignment is considered essential for efficient steering, good directional stability and to minimize tire wear. The most important measurements of an alignment are caster, camber and toe.

**CAUTION: Never attempt to modify suspension or steering components by heating or bending.**

**NOTE: Periodic lubrication of the front suspension/steering system components may be required. Rubber bushings must never be lubricated. Refer to Lubrication And Maintenance for the recommended maintenance schedule.**




## OPERATION

- **CASTER** is the forward or rearward tilt of the steering knuckle from vertical. Tilting the top of the knuckle forward provides negative caster. Tilting the top of the knuckle rearward provides positive caster. Positive caster promotes directional stability. This angle enables the front wheels to return to a straight ahead position after turns
- **CAMBER** is the inward or outward tilt of the wheel relative to the center of the vehicle. Tilting the top of the wheel inward provides negative camber. Tilting the top of the wheel outward provides positive camber. Incorrect camber will cause wear on the inside or outside edge of the tire
- **TOE** is the difference between the leading inside edges and trailing inside edges of the front tires. Wheel toe position out of specification cause's unstable steering, uneven tire wear and steering wheel off- center. The wheel toe position is the **final** front wheel alignment adjustment
- **THRUST ANGLE** is the angle of the rear axle relative to the centerline of the vehicle. Incorrect thrust angle can cause off-center steering and excessive tire wear. This angle is not adjustable, damaged component(s) must be replaced to correct the thrust angle

# STANDARD PROCEDURE

## STANDARD PROCEDURE - HEIGHT MEASUREMENT

### RIDE HEIGHT

**NOTE: The suspension is non-adjustable.**

The vehicle suspension height should be measured before performing wheel alignment procedure. Also when front suspension components have been replaced. This measure must be performed with the vehicle supporting it's own weight and taken on both sides of the vehicle.

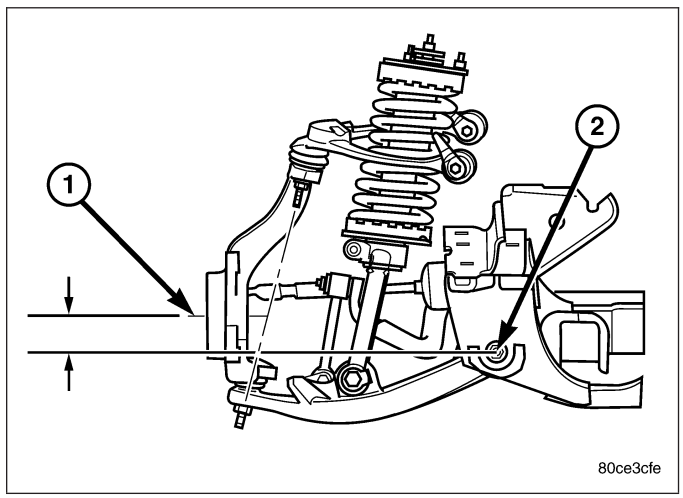
Front and rear ride heights are not adjustable. The spring selections at assembly determine ride height for acceptable appearance of the vehicle. Ride height dimensions assume full fluids (including fuel) and zero passengers. Refer to the table below for front ride height dimensions.

Vehicle ride height audits should be performed utilizing the following procedure:

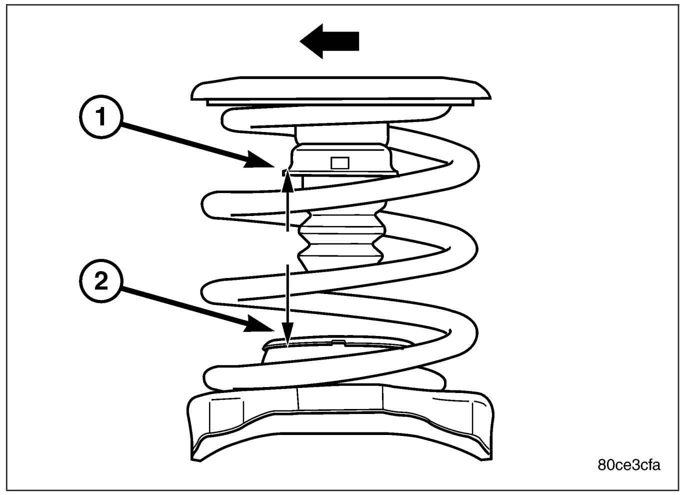
1. Drive the vehicle straight and forward on a non-tacky surface for a minimum of 20 feet to neutralize track width.
2. Bounce the front of the vehicle five times.
3. Measure and record the dimensions

FRONT RIDE HEIGHT Front ride height is defined by the relative vertical distance between the spindle center line and the rear pivot point of the front lower control arm to cradle attachment. The spindle center line is to be measured at the outer wheel face (point A). The rear pivot point is to be measured at the center of the cam/pivot bolt (point B) at its rearward most end (nut end).

REAR RIDE HEIGHT Rear ride height is defined by the relative vertical distance between the top of the lower spring seat strike surface and the bottom of the jounce cup (true metal to metal jounce travel). This is to be measured vertically inside the coil from the point intersecting the inboard edge and the for/aft center of



the jounce cup (point C) down to the strike surface (point D).




| Measurement | Target | Minimum | Maximum |
|---|---|---|---|
| Front Ride Height Distance AB | 66.5 mm Z=996.8 - 930.3 mm | 56.5 mm | 76.5 mm |
| Front Cross Ride Height Left - Right | 0.0 mm | -10.0 mm | 10.0 mm |
| Rear Ride Height Distance CD | 92.1 mm | 82.1 mm | 102.1 mm |
| Rear Cross Ride Height Left - Right | 0.0 mm | -10.0 mm | 10.0 mm |

## STANDARD PROCEDURE - CAMBER AND CASTER ADJUSTMENT

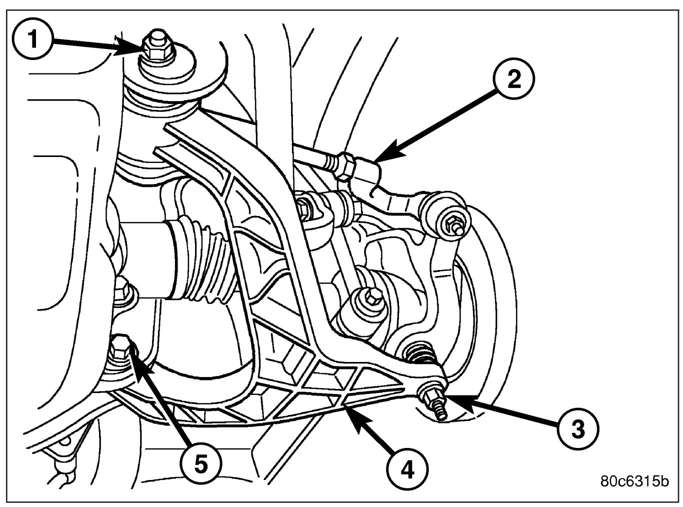
Camber and caster angle adjustments involve changing the position of the lower control arm cam bolts.

## STANDARD PROCEDURE - TOE ADJUSTMENT

4X4 SUSPENSION HEIGHT MESUREMENT MUST BE PERFORMED BEFORE AN ALIGNMENT.

The wheel toe position adjustment is the final adjustment.

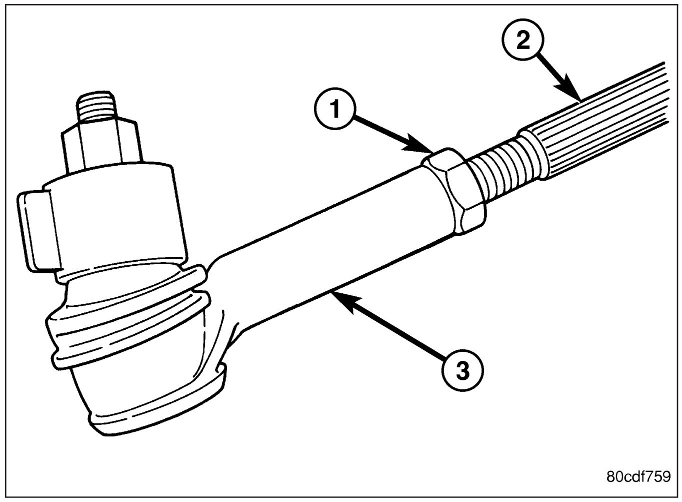
1. Start the engine and turn wheels both ways before straightening the wheels. Secure the steering wheel with the front wheels in the straight-ahead position.
2. Loosen the tie rod jam nuts.




**NOTE: Each front wheel should be adjusted for one-half of the total toe position specification. This will ensure the steering wheel will be centered when the wheels are positioned straight-ahead.**

3. Adjust the wheel toe position by turning the tie rod as necessary.

4. Tighten the tie rod jam nut to 75 N·m (55 ft. lbs.).
5. Verify the specifications
6. Turn off engine.




## STANDARD PROCEDURE - CAMBER, CASTER AND TOE ADJUSTMENT

Camber and caster angle adjustments involve changing the position of the lower suspension arm cam bolts.

### CASTER

Moving the rear position of the cam bolt in or out, will change the caster angle significantly and camber angle only slightly. To maintain the camber angle while adjusting caster, move the rear of the cam bolt in or out. Then move the front of the cam bolt slightly in the opposite direction.

To increase positive caster angle, move the rear position of the cam bolt outward (from the engine). Move the front of cam bolt inward (toward the engine) slightly until the original camber angle is obtained.

### CAMBER

Move both of the cam bolts together in or out. This will change the camber angle significantly and caster angle slightly.

After adjustment is made tighten the cam bolt nuts to proper torque specification.

### TOE ADJUSTMENT

The wheel toe position adjustment is the final adjustment.

1. Start the engine and turn wheels both ways before straightening the wheels. Secure the steering wheel with the front wheels in the straight-ahead position.
2. Loosen the tie rod jam nuts.

**NOTE: Each front wheel should be adjusted for one-half of the total toe position specification. This will ensure the steering wheel will be centered when the wheels are positioned straight-ahead.**

3. Adjust the wheel toe position by turning the tie rod as necessary .
4. Tighten the tie rod jam nut to 75 N·m (55 ft. lbs.).
5. Verify the specifications
6. Turn off engine.

# SPECIFICATIONS

## ALIGNMENT

**NOTE: Specifications are in degrees.**

### FRONT

| DESCRIPTION | SPECIFICATION | | |
|---|---|---|---|
| PREFERRED | CASTER<br>3.9° ± 0.5° | CAMBER<br>-0.375° ± 0.375° | TOTAL TOE-IN<br>.2° ± 0.125° |
| RANGE | 3.4° to + 4.4° | –0.750° to 0° | +0.075° to +0.325° |
| MAX RT/LT DIFFERENCE | 0.5° | 0.7° | 0.13° |

### REAR

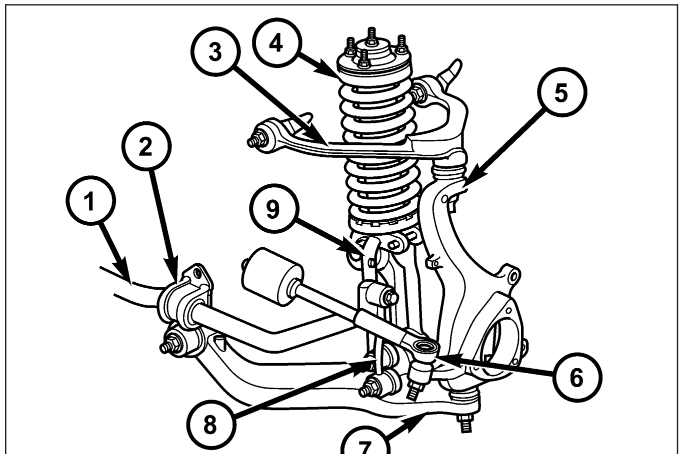
| DESCRIPTION | SPECIFICATION | | |
|---|---|---|---|
| PREFERRED | CAMBER<br>–.25°± .375° | THRUST ANGLE<br>0° to ± 0.25° | TOTAL TOE-IN<br>.25° to ± .41° |
| RANGE | –.625° to .125° | –.25° to +.25° | –.16° to .66° |

# FRONT

## TABLE OF CONTENTS

# FRONT

## DESCRIPTION



80c6753a

**NOTE: Suspension components with rubber/urethane bushings (2) should be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur.**

The front suspension is designed to allow each wheel to adapt to different road surfaces independently. The wheels are mounted to hub bearings on the steering knuckle spindles (5). The double-row hub bearings are sealed and lubricated for life. The steering knuckles turn (pivot) on ball joints integral to the outboard portion of the upper control arms and pressed into the lower steering knuckle. The ball joints are lubricated for life.

## WARNING

**WARNING: Suspension components with rubber bushings must be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort will be affected and cause premature bushing wear.**

## SPECIFICATIONS

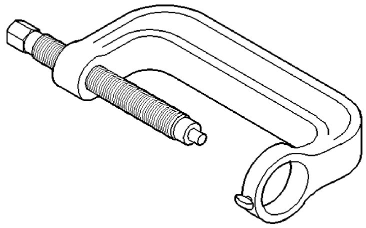
## TORQUE

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Front Shock Absorber Clevis Bracket Upper Nut | 61 | 45 | — |
| Front Shock Absorber Clevis Bracket Lower Nut | 150 | 110 | — |
| Front Shock Absorber Top (4) Mounting Nuts | 108 | 80 | — |
| Front Shock to Spring and Insulator Nut | 41 | 30 | — |
| Upper Suspension Arm Front Nut | 122 | 90 | — |
| Upper Suspension Arm Rear Nut | 122 | 90 | — |
| Lower Suspension Arm Front Nut | 170 | 125 | — |
| Lower Suspension Arm Rear Nut | 170 | 125 | — |
| Stabilizer Bar Clamp Nut | 149 | 110 | — |
| Stabilizer Bar Link Upper Nut | 136 | 100 | — |

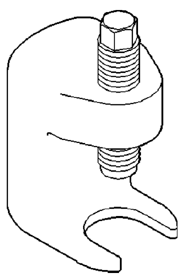
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Stabilizer Bar Link Lower Nut | 115 | 85 | — |
| Hub/Bearing Bolt | 130 | 96 | — |
| Hub/Bearing Halfshaft Nut | 135 | 100 | — |
| Upper Ball Joint Nut | 81 | 60 | — |
| Lower Ball Joint Nut | 81 | 60 | — |
| Wheel Speed Sensor | 13.5 | 10 | — |

## SPECIAL TOOLS

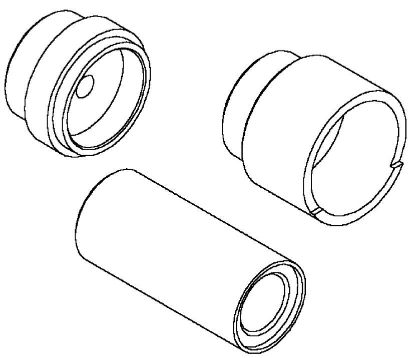
## FRONT SUSPENSION



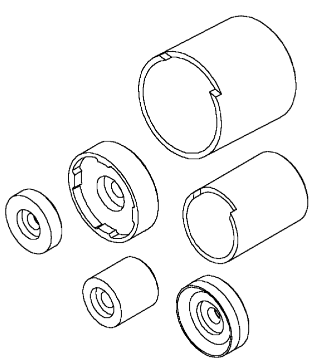

***BALL JOINT PRESS - C-4212F***



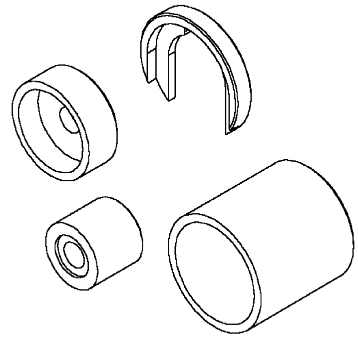
***Remover C-4150A***



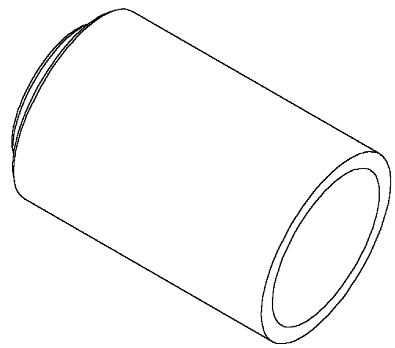
***REMOVER / INSTALLER FRONT LOWER BALL JOINT - 8859***



***FRONT LOWER CONTROL ARM & CLEVIS BUSHING REMOVER/INSTALLER - 8858***



***FRONT LOWER CONTROL BUSHING REMOVER/ INSTALLER - 8830***



***RECEIVER CUP - 6761***

# BUSHINGS

## REMOVAL

### STABILIZER BAR BUSHINGS

1. Raise vehicle on hoist.
2. Remove the stabilizer bushing clamps.
3. Remove the stabilizer bushings from the stabilizer bar.

### LOWER CONTROL ARM BUSHING

1. Remove the lower control arm (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - REMOVAL).
2. Secure the control arm in a vise.

**NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.**

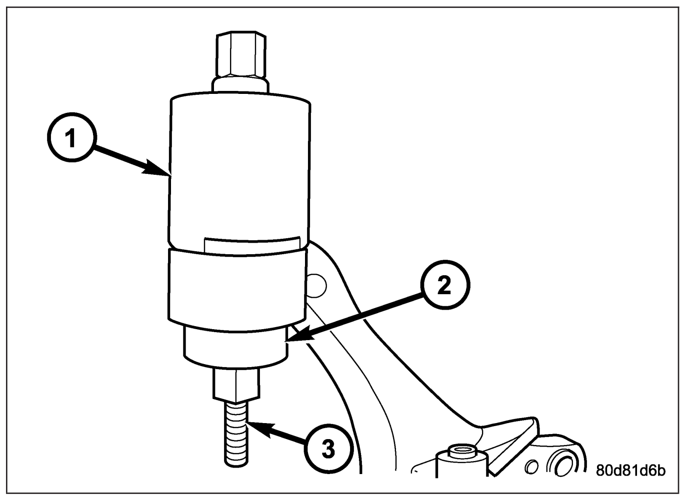
3. Press the bushing out using special tools 8858-5 (Receiver), 8858-6 (Driver) and 8839 with the threaded rod and the bearing as shown

### CLEVIS BRACKET BUSHING

1. Remove the clevis bracket from the shock (Refer to 2 - SUSPENSION/FRONT/CLEVIS BRACKET - REMOVAL).

**NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.**

2. Press the bushing out using special tools 8858-1 (receiver), 8858-3 (driver) and 8839 with the threaded rod 8839 and the bearing as shown

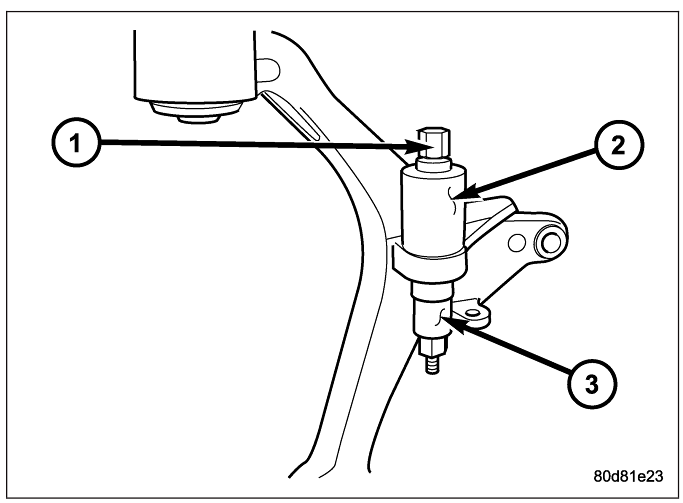



### UPPER CONTROL ARM BUSHINGS

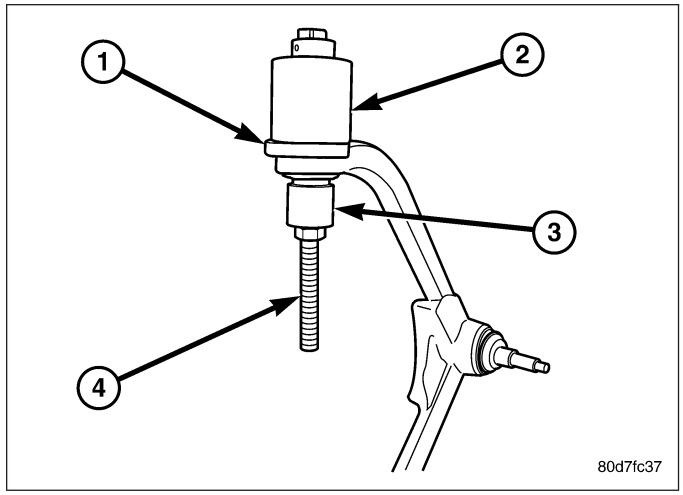
1. Remove the upper control arm (Refer to 2 - SUSPENSION/FRONT/UPPER CONTROL ARM - REMOVAL).
2. Secure the control arm in a vise.

**NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.**

3. Install bushing remover tools 8830-3 (Adapter), 8830-2 (Receiver) and 8830–4 (Driver) with the threaded rod 8838 and the bearing as shown



4. Press out the bushing.




## INSTALLATION

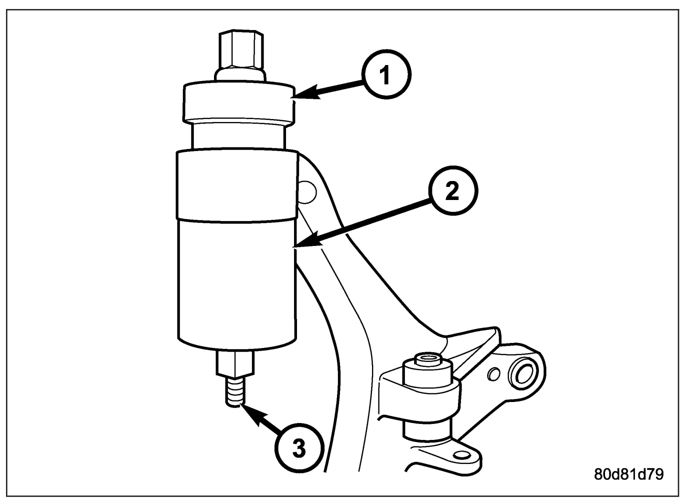
## STABILIZER BAR BUSHINGS

1. Install the stabilizer bushings to the stabilizer bar.
2. Install the stabilizer bushing clamps. Tighten the nuts to 149 N·m (110 ft.lbs.).
3. Lower the vehicle.

## LOWER CONTROL ARM BUSHING

**NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.**

1. Install the new lower control arm bushings into the lower control arm using tools 8858-5 (driver), 8858-6 (receiver) and the bearing with the threaded rod 8839 making sure to properly orient the bushing in the control.
2. Remove the control arm from the vise.
3. Install the lower control arm (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - INSTALLATION).
4. Reset the vehicle ride height (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).
5. Perform a wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

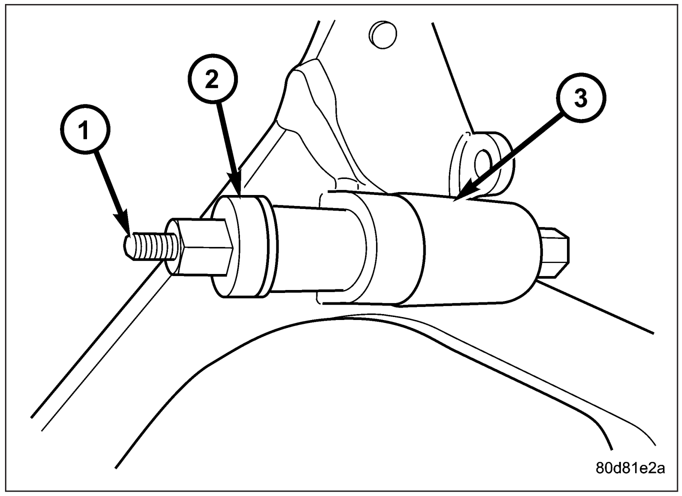



## CLEVIS BRACKET BUSHING

**NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.**

1. Install the new clevis bracket bushing into the lower control arm using tools 8858-2 (driver), 8858-1 (receiver) and the bearing with the threaded rod 8839 making sure to properly orient the bushing in the control.

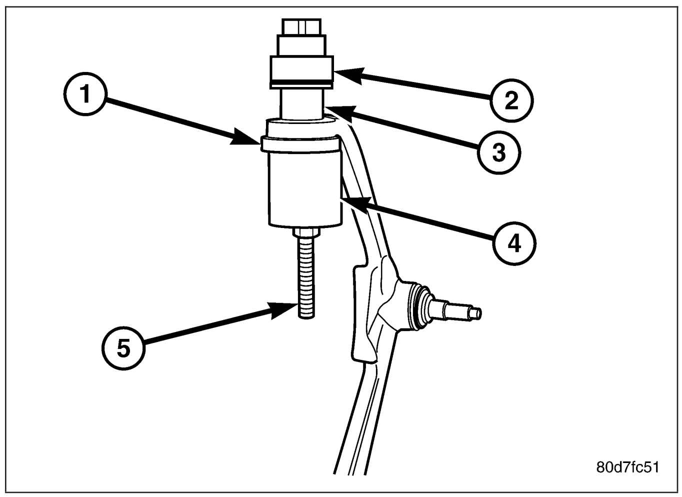
2. Install the clevis bracket (Refer to 2 - SUSPENSION/FRONT/CLEVIS BRACKET - INSTALLATION).




## UPPER CONTROL ARM BUSHINGS

**NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.**

1. Install the new upper control arm bushings into the upper control arm using tools 8830-3 (Adapter), 8830-1 (Driver) and 8830-2 (Receiver) the bearing with the threaded rod 8838 making sure to properly orient the bushing in the control arm.
2. Remove the control arm from the vise.
3. Install the upper control arm (Refer to 2 - SUSPENSION/FRONT/UPPER CONTROL ARM - INSTALLATION).
4. Perform a wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).



# HUB / BEARING

## REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Remove the caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).

**CAUTION: Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.**

4. Remove the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
5. Remove the wheel speed sensor (Refer to 5 - BRAKES/ELECTRICAL/FRONT WHEEL SPEED SENSOR - REMOVAL).
6. Remove the bracket securing the wheel speed sensor wire.
7. Remove the axle shaft nut. (if equipped with four wheel drive)
8. Remove the three mounting bolts for the hub/bearing assembly.
9. Remove the hub/bearing.

## INSTALLATION

1. Install the hub/bearing assembly to the vehicle.
2. Install the three mounting bolts for the hub/bearing. Tighten the bolt to 130 N·m (96 ft.lbs.).
3. Install the axle shaft nut. Tighten the nut to 135 N·m (100 ft.lbs.). (if equipped with four wheel drive)
4. Install the bracket to the wheel speed sensor wire.
5. Install the wheel speed sensor to the hub. Tighten the bolt to 13.5 N·m (10 ft.lbs.) (Refer to 5 - BRAKES/ELECTRICAL/FRONT WHEEL SPEED SENSOR - INSTALLATION).
6. Install the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
7. Install the disc brake caliper adapter. Tighten the nut to 135 N·m (100 ft.lbs.) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
8. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

# KNUCKLE

## REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Remove the caliper adapter. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).

**CAUTION: Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.**

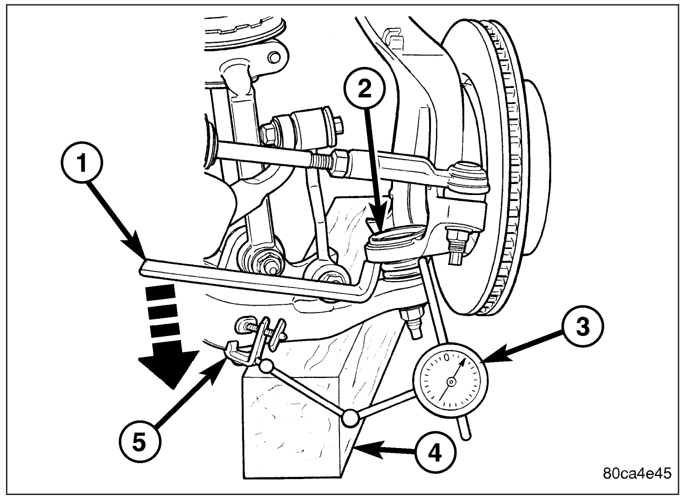
4. Remove the disc brake rotor. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
5. Remove the wheel speed sensor. (Refer to 5 - BRAKES/ELECTRICAL/FRONT WHEEL SPEED SENSOR - REMOVAL).
6. Remove the axle shaft nut. (if equipped with four wheel drive)
7. Remove the hub/bearing. (Refer to 2 - SUSPENSION/FRONT/HUB / BEARING - REMOVAL).
8. Seperate the outer tie rod end from the steering knuckle. (Refer to 19 - STEERING/LINKAGE/TIE ROD END - REMOVAL).
9. Remove the lower ball joint nut.
10. Seperate the lower ball joint from the suspension arm using tool C–4150A.
11. Remove the upper ball joint nut.
12. Seperate the upper ball joint from the knuckle using tool C–4150A.
13. Remove the knuckle from the vehicle.

## INSTALLATION

1. Install the knuckle to the vehicle.
2. Install the upper ball joint nut. Tighten the nut to 81 N·m (60 ft.lbs.).
3. Install the lower ball joint nut. Tighten the nut to 81 N·m (60 ft.lbs.).
4. Install the outer tie rod end to the steering knuckle. (Refer to 19 - STEERING/LINKAGE/TIE ROD END - INSTALLATION).
5. Install the hub/bearing. (Refer to 2 - SUSPENSION/FRONT/HUB / BEARING - INSTALLATION).
6. Install the axle shaft nut. Tighten the nut to 135 N·m (96 ft.lbs.).(if equipped with four wheel drive).
7. Install the wheel speed sensor. (Refer to 5 - BRAKES/ELECTRICAL/FRONT WHEEL SPEED SENSOR - INSTALLATION).
8. Install the disc brake rotor. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
9. Install the caliper adapter. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).
10. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
11. Perform a wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

# LOWER BALL JOINT

## DIAGNOSIS AND TESTING - LOWER BALL JOINT




1. Raise the vehicle on a drive-on hoist.

**NOTE: If a drive-on hoist is not available, use wooden blocks with jack stands to support the lower control arm in the ball joint area. Place the jack stands appropriately and lower the hoist placing weight on the lower control arm. The lower control arms should now be supporting the vehicle weight.**

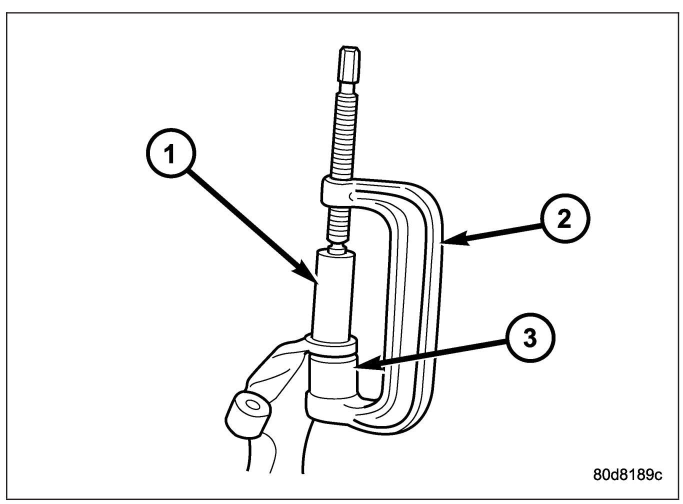
2. With the use of jack stands, lift the front end off the hoist and position wooden blocks (4) underneath both lower control arms supporting the vehicles weight.
3. Remove the tire and wheel assembly.
4. Attach a dial indicator (3) to the base of the lower control arm and align the dial indicator's contact point with the direction of the stud axis, touch the machined flat on the knuckle and zero the dial indicator.

**NOTE: Use care when applying the load to the knuckle, so the parts are not damaged using care not to tear the boot.**

5. From the front of the vehicle, insert a pry bar (1) to get it rested on the lower control arm and use lever principle to push the knuckle up until the arm of the dial indicator no longer moves.
6. Record the ball joint (2) movement on each side of the vehicle. The end play is acceptable with no more than 1.5mm of end play back to back.

## REMOVAL

1. Remove the tire and wheel assembly.
2. Remove the brake caliper and rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
3. Disconnect the tie rod from the steering knuckle (Refer to 19 - STEERING/LINKAGE/TIE ROD END - REMOVAL).
4. Remove the steering knuckle (Refer to 2 - SUSPENSION/FRONT/KNUCKLE - REMOVAL).
5. Move the halfshaft to the side and support the halfshaft out of the way (If Equipped).




**NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.**

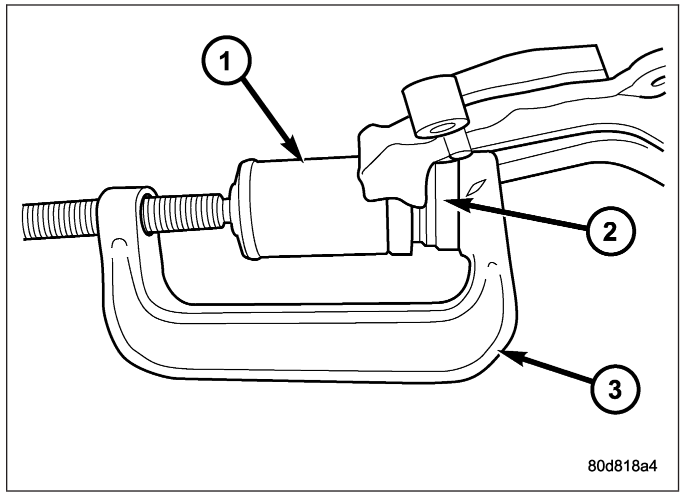
6. Secure the steering knuckle in a vise.
7. Remove the ball joint boot.
8. Press the ball joint from the steering knuckle using special tools C-4212–F (PRESS)(2), 8859-2 (RECEIVER)(3) and 8859-1 (DRIVER)(1).

## INSTALLATION

**NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.**

**NOTE: The plastic shipping cover must be in place over the ball joint boot while pressing the ball joint into the knuckle.**

1. Install the ball joint into the steering knuckle and press in using special tools C-4212–F (press)(3), 8859-3 (driver)(2) and 6761 (receiver)(1).

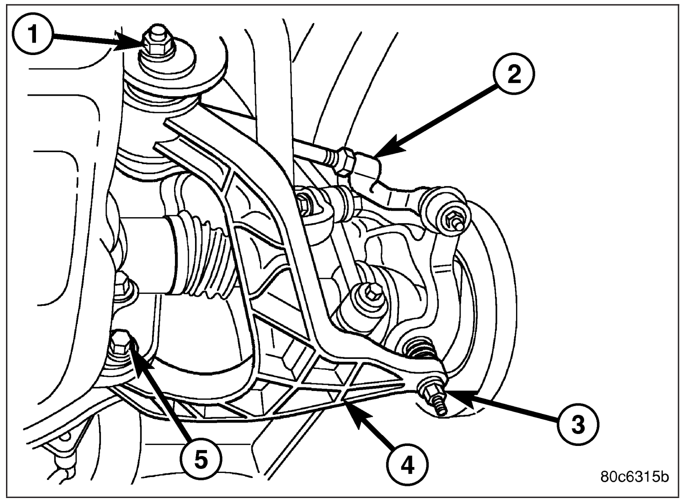



2. Remove the support for the halfshaft and install into position (If Equipped).
3. Install the steering knuckle (Refer to 2 - SUSPENSION/FRONT/KNUCKLE - INSTALLATION).
4. Install the tie rod end into the steering knuckle (Refer to 19 - STEERING/LINKAGE/TIE ROD END - INSTALLATION).
5. Install and tighten the halfshaft nut to 136 N·m (100 ft. lbs.).
6. Install the brake caliper and rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
7. Install the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
8. Check the vehicle ride height (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).
9. Perform a wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

# LOWER CONTROL ARM

## REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Remove the lower clevis bracket bolt at the lower control arm (4).
4. Remove the stabilizer link bolt at the lower control arm (4).
5. Remove the lower ball joint nut (3).
6. Separate the lower ball joint from the lower control arm using tool C-4150A.

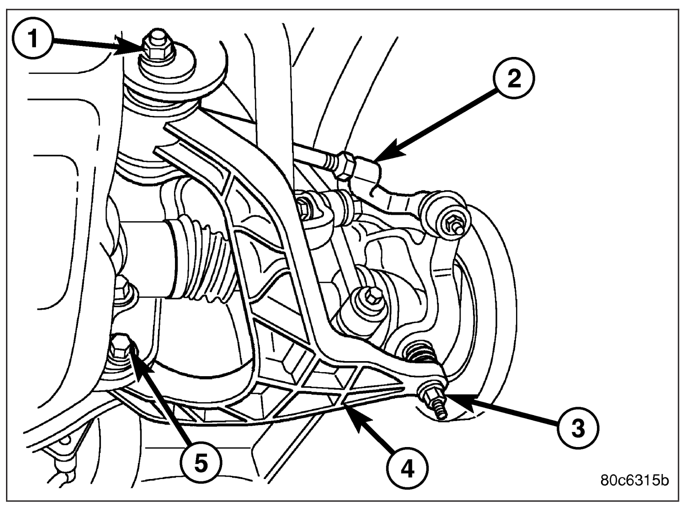



**NOTE: Marking the lower control arm pivot bolts front (1) and rear (5) will aid in the assembly procedure.**

7. Mark the lower control arm pivot bolts front (1) and rear (5).
8. Remove the front cam/pivot bolt (1).
9. Remove the rear cam/pivot bolt (5).
10. Remove the lower control arm (4) from the vehicle.

## INSTALLATION

1. Install the lower control arm (4) to the vehicle.
2. Install the rear cam/pivot bolt (5).
3. Install the front cam/pivot bolt (1).
4. Install the lower ball joint nut (3). Tighten the nut to 81 N·m (60 ft.lbs.)
5. Align the marks front and rear at the cam/pivot bolts and tighten the nuts. Tighten the nuts to 170 N·m (125 ft.lbs.)



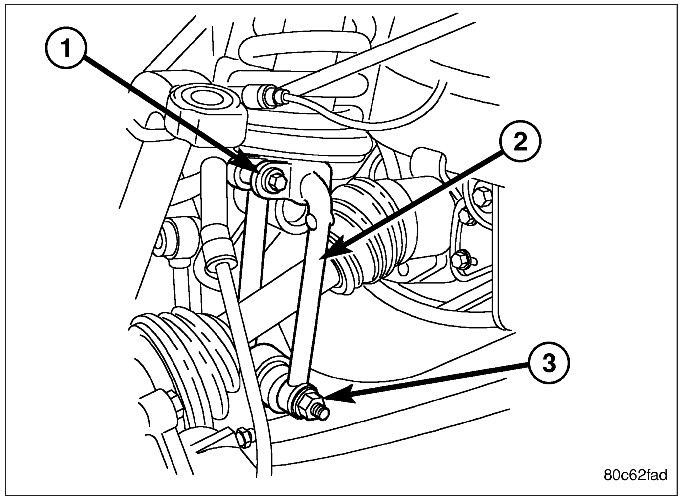

6. Install the stabilizer link bolt at the lower control arm. Tighten the nut to 136 N·m (100 ft.lbs.)
7. Install the lower clevis bracket bolt at the lower control arm. Tighten the nut to 150 N·m (110 ft.lbs.)
8. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
9. Perform a wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

# SHOCK

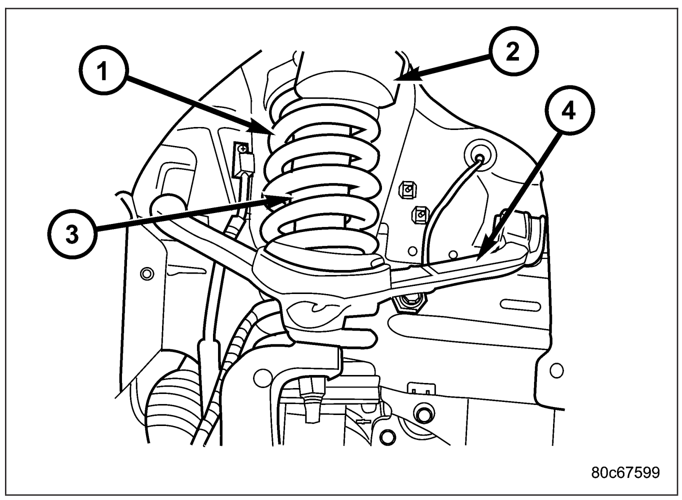
## REMOVAL

### LEFT SIDE

1. Disconnect the battery.
2. Remove the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL).
3. Unclip the power center and move it to the side out of the way.
4. Remove the battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - REMOVAL).
5. Disconnect the battery temperature sensor from the battery tray.
6. Remove the four upper shock mounting nuts.
7. Raise and support the vehicle.
8. Remove the left tire and wheel assembly.
9. Remove the lower bolt (3) at the lower control arm securing the clevis bracket (2).
10. Remove the stabilizer link (Refer to 2 - SUSPENSION/FRONT/STABILIZER LINK - REMOVAL).
11. Remove the lower ball joint nut.
12. Separate the lower ball joint from the lower control arm using remover C-4150A.
13. Rotate the lower control arm downward to allow access.
14. Remove the clevis bracket (2) at the shock.



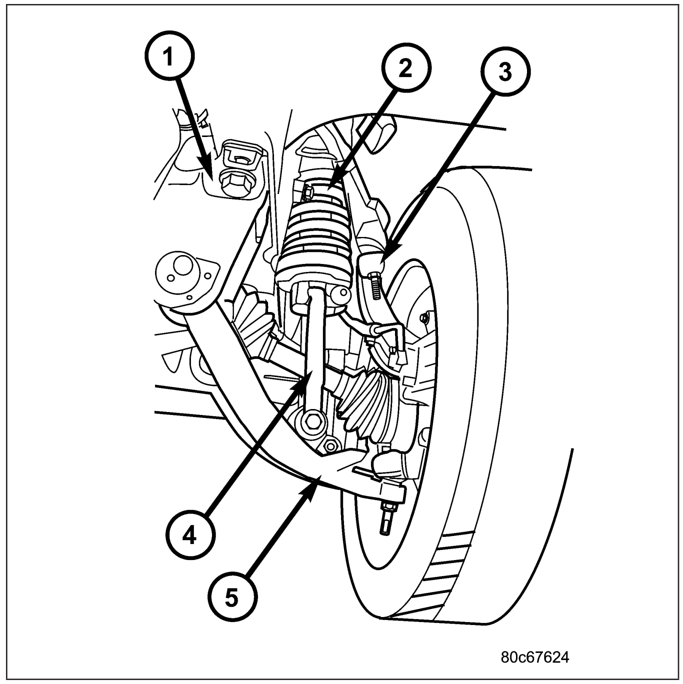

15. Remove the shock assembly (3) from the vehicle.
16. Remove the spring (1) from the shock (3) (if needed).




### RIGHT SIDE

1. Remove the air box (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - REMOVAL).
2. Remove the two cruise control servo mounting nuts.
3. Remove the upper shock mounting nuts.
4. Raise and support the vehicle.
5. Remove the right side tire assembly.

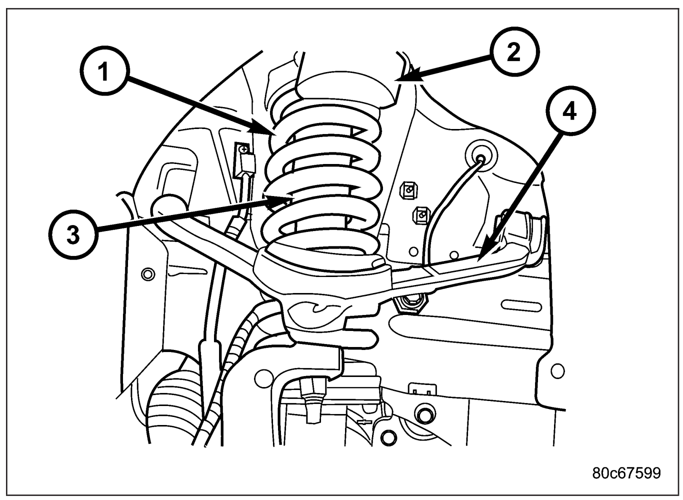
6. Remove the lower bolt at the lower control arm (5) securing the clevis bracket (4).
7. Remove the stabilizer link (Refer to 2 - SUSPENSION/FRONT/STABILIZER LINK - REMOVAL).
8. Remove the lower ball joint nut.
9. Separate the lower ball joint from the lower control arm using remover C-4150A.
10. Rotate the lower control arm downward to allow access.
11. Remove the clevis bracket (4) at the shock (2).
12. Remove the shock assembly (2) from the vehicle.
13. Remove the spring from the shock (if needed). (Refer to 2 - SUSPENSION/FRONT/SPRING - REMOVAL).



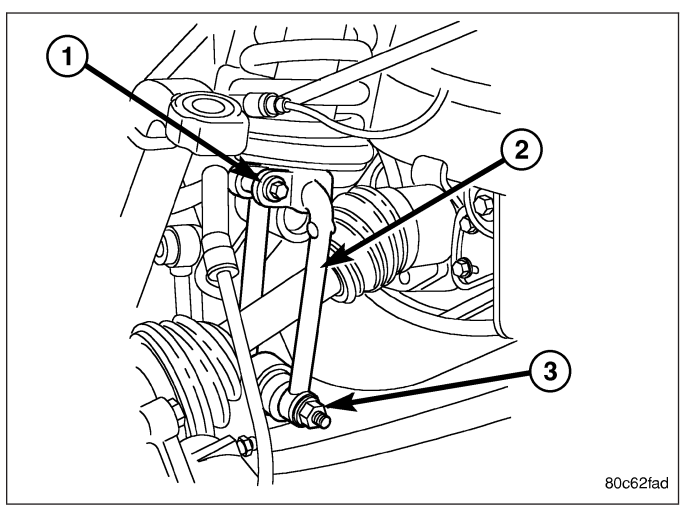

## INSTALLATION

## LEFT SIDE

1. Install the spring (1) to the shock (3) (if removed).
2. Install the shock assembly (3) to the vehicle.
3. Install the four upper shock mounting nuts. Tighten the nuts to 108 N·m (80 ft.lbs.).



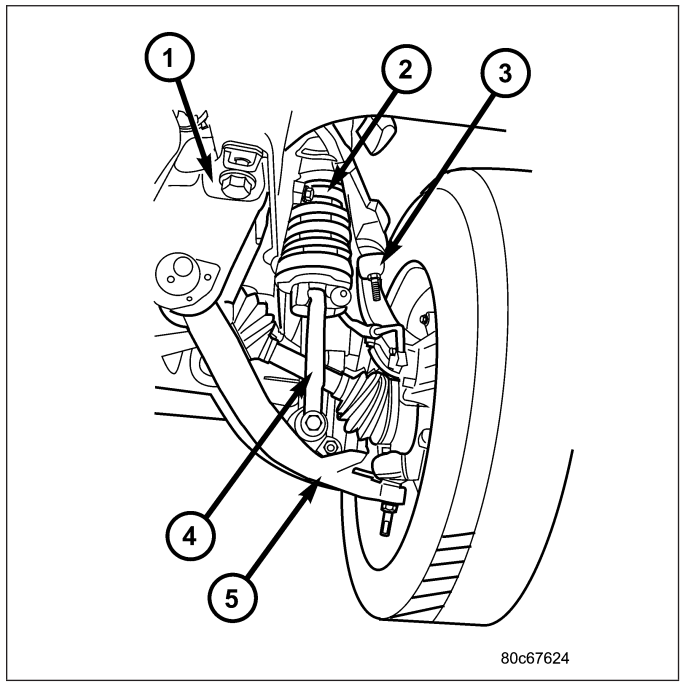

4. Install the clevis bracket (2) at the shock. (Refer to 2 - SUSPENSION/FRONT/CLEVIS BRACKET - INSTALLATION). Tighten the bolt to 61N·m (45 ft.lbs.).
5. Raise the lower control into place and reconnect the lower ball joint nut. Tighten the nut to 81 N·m (60 ft.lbs.).
6. Install the clevis bracket (2) at the lower control arm. (Refer to 2 - SUSPENSION/FRONT/CLEVIS BRACKET - INSTALLATION). Tighten the bolt to 150 N·m (110 ft.lbs.).



7. Install the lower stabilizer link at the lower control arm. Tighten the bolt to 136 N·m (100 ft.lbs.) (Refer to 2 - SUSPENSION/FRONT/STABILIZER LINK - INSTALLATION).
8. Install the left tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
9. Lower the vehicle.
10. Reconnect the battery temperature sensor.
11. Install the battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - INSTALLATION).
12. Install the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).
13. Reconnect the battery cables.

## RIGHT SIDE

1. Install the spring to the shock (if removed). (Refer to 2 - SUSPENSION/FRONT/SPRING - INSTALLATION).
2. Install the shock assembly to the vehicle.
3. Install the four upper shock mounting nuts. Tighten the nuts to 108 N·m (80 ft.lbs.).
4. Install the clevis bracket (4) at the shock (2). (Refer to 2 - SUSPENSION/FRONT/CLEVIS BRACKET - INSTALLATION). Tighten the bolt to 61 N·m (45 ft.lbs.).
5. Raise the lower control into place and reconnect the lower ball joint nut. Tighten the nut to 81 N·m (60 ft.lbs.).
6. Install the clevis bracket (4) at the lower control arm (5). (Refer to 2 - SUSPENSION/FRONT/CLEVIS BRACKET - INSTALLATION). Tighten the bolt to 150 N·m (110 ft.lbs.).
7. Install the lower stabilizer link at the lower control arm. Tighten the bolt to 136 N·m (100 ft.lbs.) (Refer to 2 - SUSPENSION/FRONT/STABILIZER LINK - INSTALLATION).
8. Install the right tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

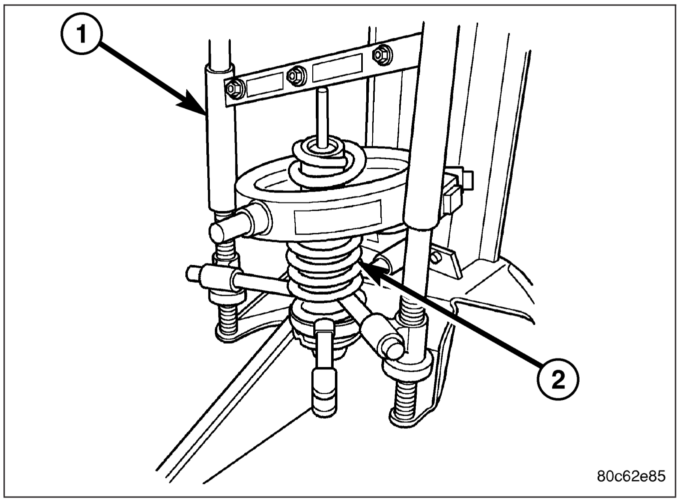



9. Lower the vehicle.
10. Install the cruise control servo mounting nuts.
11. Install the airbox (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - INSTALLATION).

# SPRING

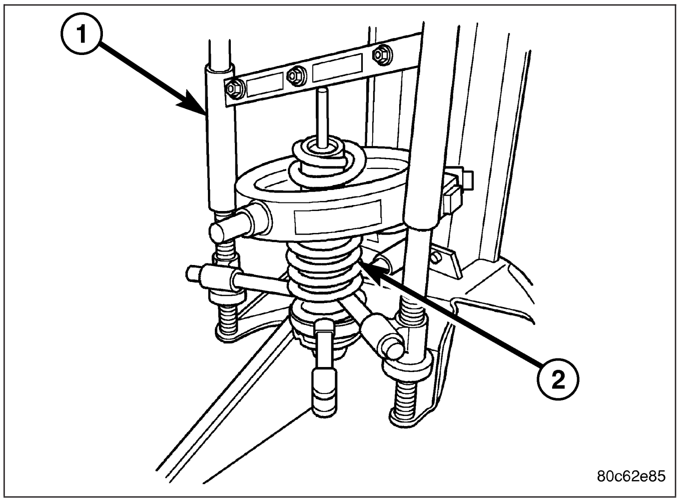
## REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Remove the shock. Refer to the proper side shock removal procedure being worked on. (Refer to 2 - SUSPENSION/FRONT/SHOCK - REMOVAL).
4. Secure the shock assembly into a Pentastar® Service Equipment W-7200 Spring compressor (1).
5. Compress the spring (2).
6. Remove the shock mount nut.
7. Remove the shock from the spring compressor.
8. Transfer the necessary parts to the type of repair being done (Insulator, Spring, shock and mount).




## INSTALLATION

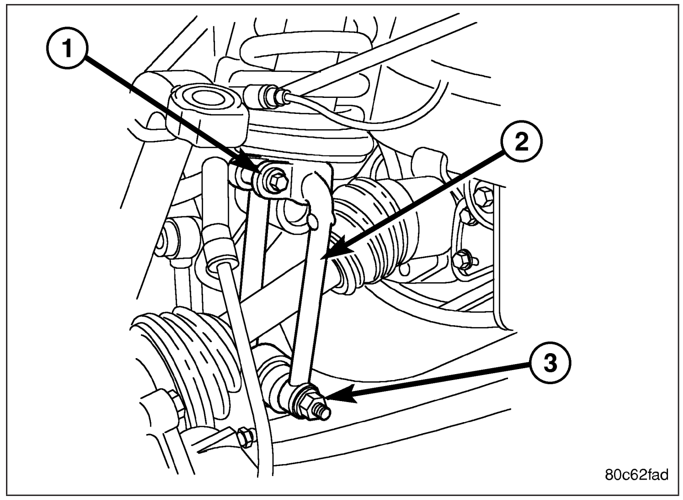
1. Install the shock to the spring (2) and spring compressor (1), After the transfer of the necessary parts to the type of repair being done (Insulator, Spring, shock and mount).
2. Install the shock mounting nut. Tighten the bolt to 41 N·m (30 ft.lbs.).
3. Loosen the compressed spring (2).
4. Remove the shock assembly from the spring compressor (1).
5. Install the shock to the vehicle. (Refer to 2 - SUSPENSION/FRONT/SHOCK - INSTALLATION).
6. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
7. Remove the support and lower the vehicle.



# CLEVIS BRACKET

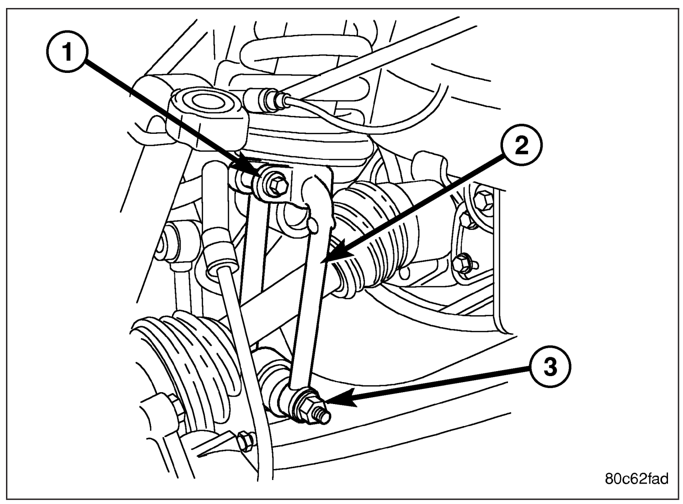
## REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Remove the lower clevis bolt (3) at the lower control arm.
4. Remove the upper clevis bolt (1) at the shock.
5. Remove the lower stabilizer link bolt at the lower control arm.
6. Remove the lower ball joint nut.
7. Separate the lower ball joint from the lower control arm using remover C-4150A.
8. Swing the lower control arm downward to allow clearance to remove the clevis bracket (2).
9. Remove the clevis bracket (2) from the vehicle.




## INSTALLATION

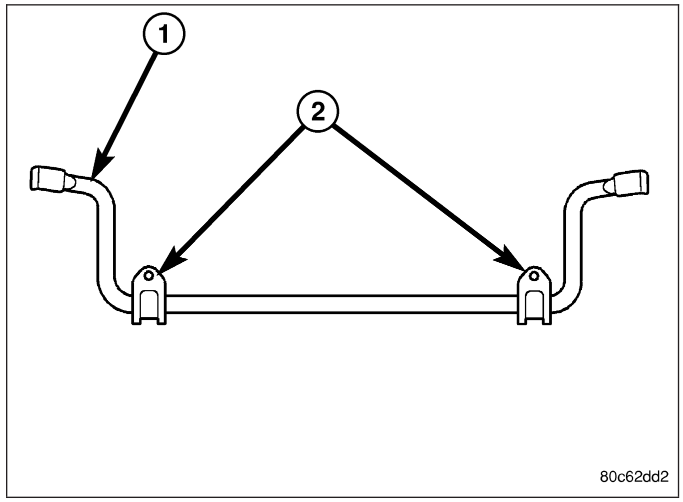
1. Install the clevis bracket (2) upper bolt (1) to the shock **Seat the clevis against the stop on the shock**. Tighten the bolt (1) to 61 N·m (45 ft.lbs.).
2. Raise the lower control arm to the lower ball joint.
3. Install the nut to the lower ball joint. Tighten the nut to 81 N·m (60 ft.lbs.).
4. Install the clevis bracket (2) lower bolt (3) to the lower control arm. Tighten the bolt (3) to 150 N·m (110 ft.lbs.).
5. Install the lower stabilizer link bolt at the lower control arm. Tighten the bolt to 115 N·m (85 ft.lbs.).
6. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
7. Lower the vehicle.



# STABILIZER BAR

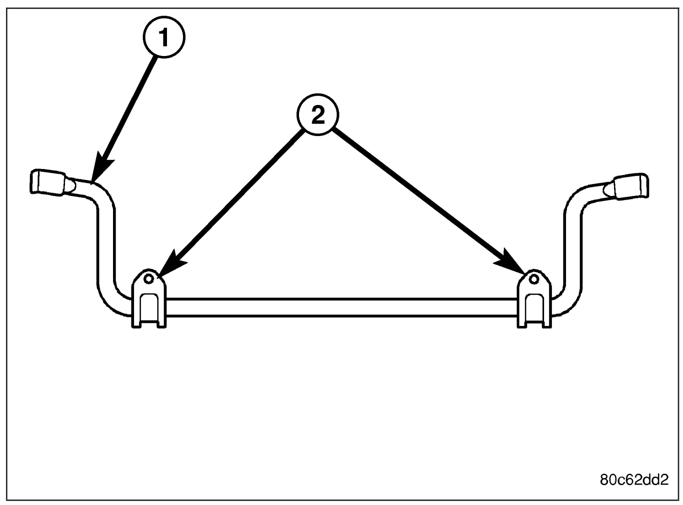
## REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Remove the upper stabilizer link bolts at the stabilizer bar (1).
4. Remove the stabilizer bar bushing clamps (2) from the frame.
5. Remove the stabilizer bar (1) from the vehicle.




## INSTALLATION

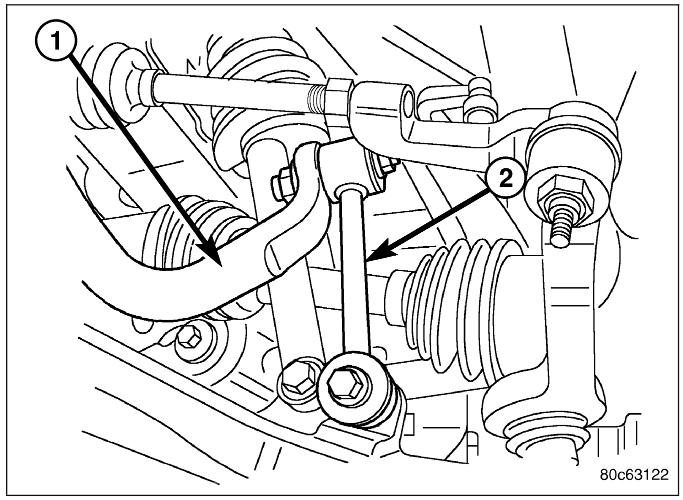
1. Install the stabilizer bar (1) to the vehicle.
2. Install the stabilizer bar bushing clamps (2). Tighten the nuts to 149 N·m (110 ft.lbs.).
3. Install the upper stabilizer link bolts and washer at the stabilizer bar (1). Tighten the bolt to 136 N·m (100 ft.lbs.).
4. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
5. Lower the vehicle.



# STABILIZER LINK

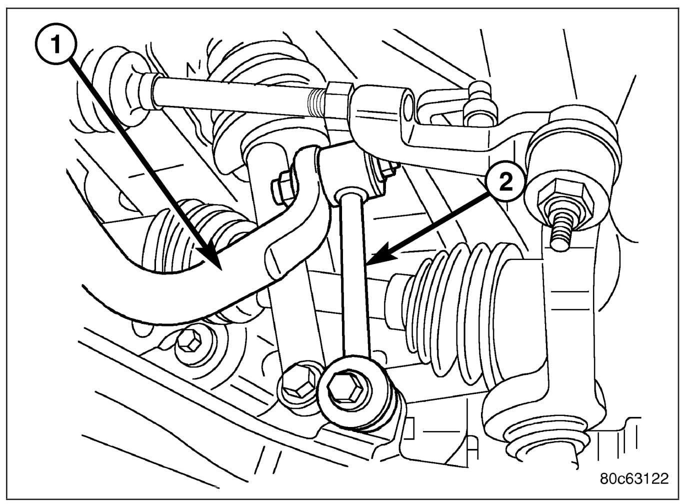
## REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Remove the lower stabilizer link bolt (2) at the lower control arm.
4. Remove the upper stabilizer link bolt (2) at the stabilizer bar (1).
5. Remove the stabilizer link (2).




## INSTALLATION

1. Install the stabilizer link (2).
2. Install the upper stabilizer link bolt (2) and washer at the stabilizer bar. Tighten the bolt to 136 N·m (100 ft.lbs.).
3. Install the lower stabilizer link bolt (2) and washer at the lower control arm. Tighten the nut to 115 N·m (85 ft.lbs.).
4. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).



# UPPER CONTROL ARM

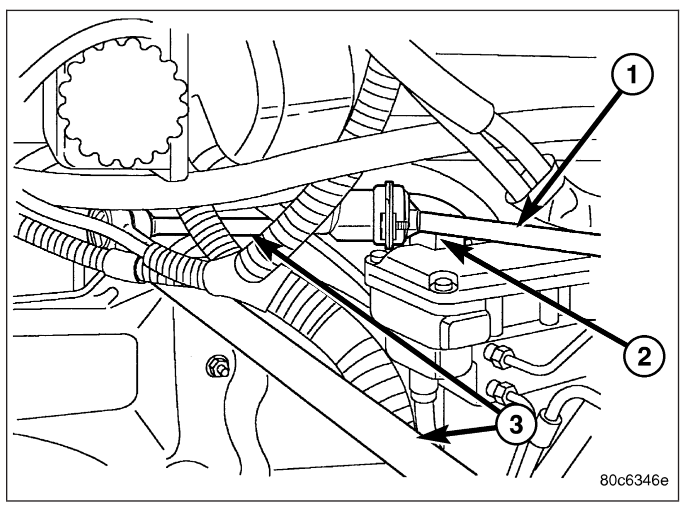
## REMOVAL

### RIGHT SIDE

1. Raise and support the vehicle.
2. Remove the right side tire and wheel assembly.
3. Remove the upper ball joint nut.
4. Separate the upper ball joint from the steering knuckle using remover C-4150A.
5. Lower the vehicle.
6. Remove the air box (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - REMOVAL).
7. Remove the cruise control servo mounting nuts.
8. Remove the upper control arm rear bolt.
9. Remove the upper control arm front bolt.
10. Remove the upper control arm from the vehicle.

### LEFT SIDE

1. Raise and support the vehicle.
2. Remove the left side tire and wheel assembly.
3. Remove the upper ball joint nut.
4. Separate the upper ball joint from the steering knuckle using remover C-4150A.
5. Lower the vehicle.
6. Remove the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL).
7. Unclip the power center and move it to the side out of the way.
8. Remove the battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - REMOVAL).
9. Disconnect the battery temperature sensor from the battery tray.
10. Remove the upper control arm rear bolt (2) by using a ratchet and extension (3) under the steering shaft (1) and positioned by the power steering reservoir.
11. Remove the upper control arm front bolt.
12. Remove the upper control arm from the vehicle.




## INSTALLATION

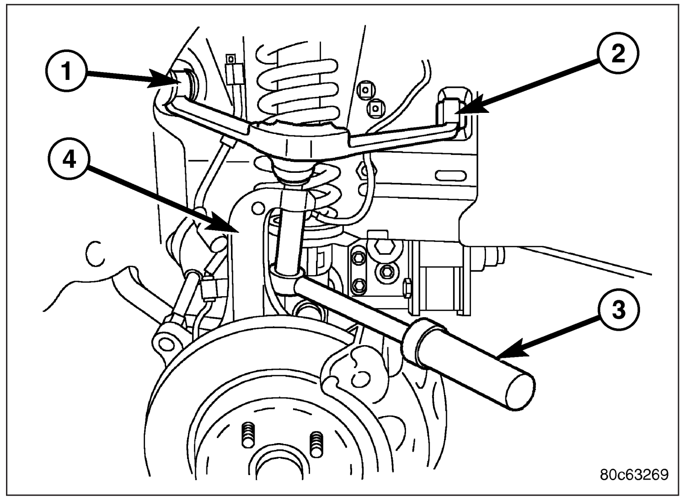
### RIGHT SIDE

1. Install the upper control arm to the vehicle.
2. Install the upper control arm front bolt. Tighten the bolt to 122 N·m (90 ft.lbs.).
3. Install the upper control arm rear bolt. Tighten the bolt to 122 N·m (90 ft.lbs.).
4. Install the cruise control servo mounting nuts.

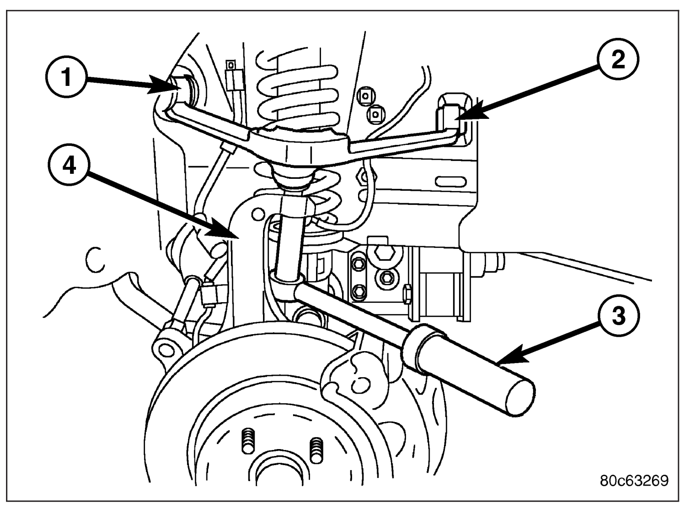
5. Install the air box (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - INSTALLATION).
6. Install the upper ball joint nut. Tighten the nut to 81 N·m (60 ft.lbs.).
7. Install the right side tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
8. Lower the vehicle.
9. Perform a wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

## LEFT SIDE

1. Install the upper control arm to the vehicle.
2. Install the upper control arm front bolt (1). Tighten the bolt to 122 N·m (90 ft.lbs.).
3. Install the upper control arm rear bolt (2). Tighten the bolt to 122 N·m (90 ft.lbs.).




4. Reconnect the battery temperature sensor to the battery tray.
5. Install the battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - INSTALLATION).
6. Install the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).
7. Reclip and mount the power center.
8. Install the upper ball joint nut. Tighten the nut to 81 N·m (60 ft.lbs.).




9. Install the left side tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
10. Lower the vehicle.
11. Perform a wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

# REAR

## TABLE OF CONTENTS

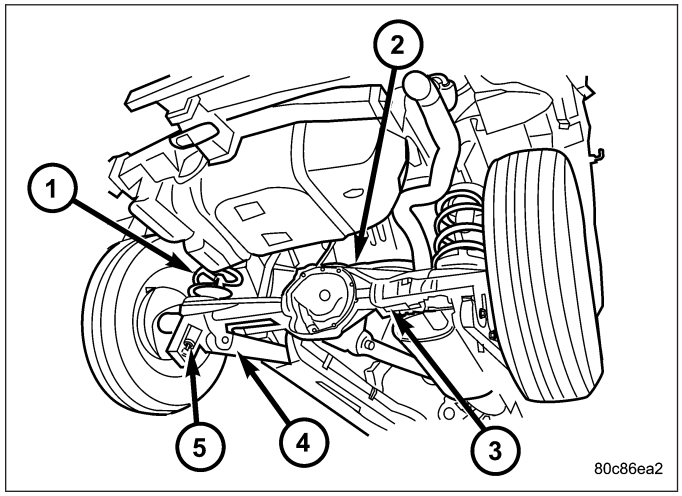
# REAR

## DESCRIPTION

**CAUTION: Suspension components with rubber/urethane bushings should be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. This will maintain vehicle ride comfort and prevent premature bushing wear.**

The rear suspension is comprised of :

- Drive axle
- Shock absorbers (5)
- Coil springs (1)
- Lower suspension arms (4)
- Upper suspension arm (2)
- Stabilizer bar (3)




## WARNING

**WARNING: Suspension components with rubber bushings must be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort will be affected and cause premature bushing wear.**

## DIAGNOSIS AND TESTING - REAR SUSPENSION

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| VEHICLE INSTABILITY | 1. Loose or worn wheel bearings. | 1. Replace wheel bearings. |
| | 2. Loose, worn or bent suspension components. | 2. Inspect, tighten or replace components as necessary. |
| | 3. Tire pressure. | 3. Adjust tire pressure. |
| VEHICLE PULLS TO ONE SIDE | 1. Weak or broken spring. | 1. Replace spring. |
| | 2. Alignment. | 2. Align vehicle to specifications. |
| | 3.Tires. | 3. Replace tires. |
| | 4. Brakes. | 4. Repair as necessary. |
| KNOCKING, RATTLING OR SQUEAKING | 1. Worn shock bushings. | 1. Replace shock. |
| | 2. Loose shock mounting. | 2. Tighten to specifications. |
| | 3. Shock valve. | 3. Replace shock. |
| | 4. Loose upper ball joint. | 4. Replace ball joint. |
| | 5. Loose, worn or bent suspension components. | 5. Inspect, tighten or replace components as necessary. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| IMPROPER TRACKING | 1. Loose, worn or bent suspension components.<br>2. Bent axle. | 1. Inspect, tighten or replace components as necessary.<br>2.Replace axle. |

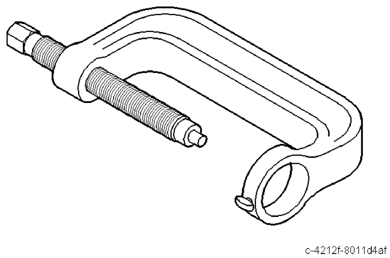
## SPECIFICATIONS

## TORQUE

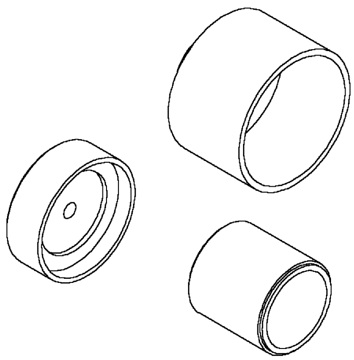
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Shock Absorber Upper Nut | 108 | 80 | — |
| Shock Absorber Lower Nut | 115 | 85 | — |
| Suspension Arm Upper Ball Joint Nut | 95 | 70 | — |
| Suspension Arm Upper Frame Bolts | 100 | 74 | — |
| Control Arm Frame Bolts | 100 | 74 | — |
| Rear Upper Ball Joint Bracket Bolts | 136 | 100 | — |
| Suspension Arms Lower Body/Axle Bracket Nut | 163 | 120 | — |
| Control Arms to Control Arm Bracket | 101 | 75 | — |
| Suspension Arms Lower Frame Bracket Nut | 163 | 120 | — |
| Control Arm Bracket to Rear Differential | 135 | 100 | — |
| Rear Differential Damper to Rear Differential | 61 | 45 | — |
| Stabilizer Bar Bolts | 99 | 73 | — |

## SPECIAL TOOLS

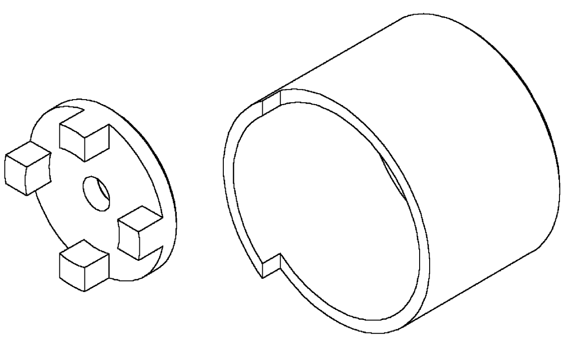
## REAR SUSPENSION



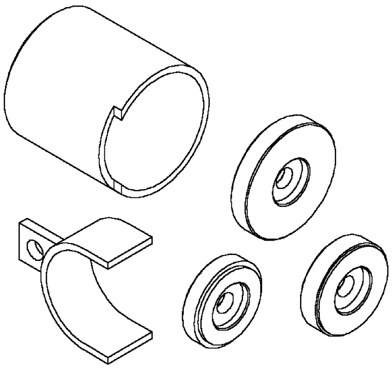

**BALL JOINT PRESS - C-4212F**



**REMOVER / INSTALLER REAR UPPER BALL JOINT - 8861**



**REMOVAL / INSTALLATION REAR UPPER CONTROL ARM BUSHINGS - 8860**



**REAR LOWER CONTROL ARM BUSHING REMOVER/INSTALLER - 8862**

# BUSHINGS

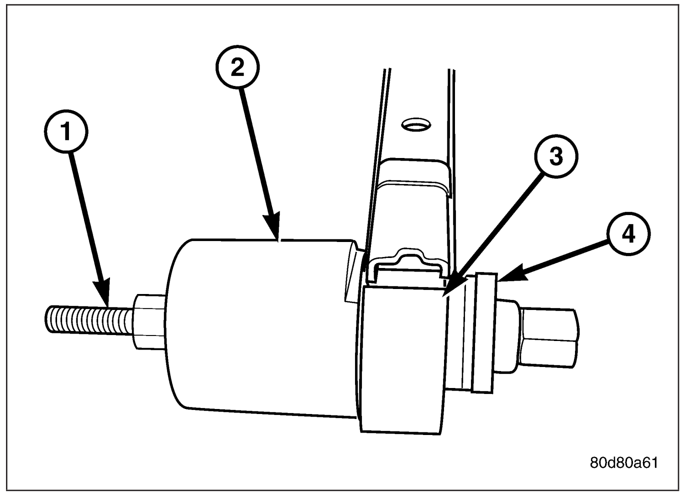
## REMOVAL

### LOWER SUSPENSION ARM BUSHING

1. Remove the lower suspension arm (Refer to 2 - SUSPENSION/REAR/LOWER CONTROL ARM - REMOVAL).
2. Secure the suspension arm in a vise.

**NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.**

3. Install special tools 8862-4 (receiver)(2), 8862-5 (spacer)(3) and 8862-1 or 8862- 2 (driver)(4) with the threaded rod 8839 (1) and the bearing as shown
4. Press out the bushing.

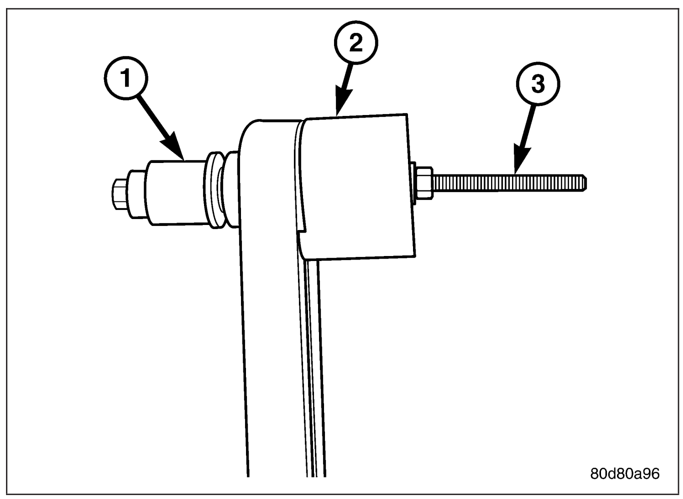



### UPPER SUSPENSION ARM BUSHING

1. Remove the upper suspension arm (Refer to 2 - SUSPENSION/REAR/UPPER CONTROL ARM - REMOVAL).
2. Secure the suspension arm in a vise.

**NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.**

3. Install special tools 8853-3 (driver)(1), 8860-1 (receiver)(2) and with the threaded rod 8838 (3) and the bearing as shown
4. Press out the bushing.

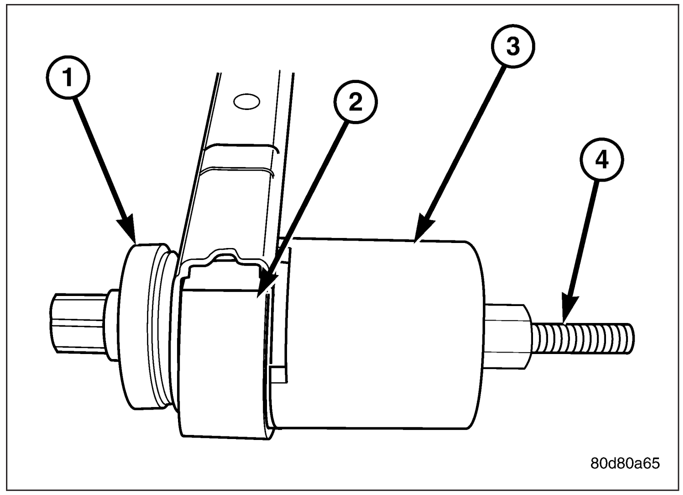



## INSTALLATION

### LOWER SUSPENSION ARM BUSHING

**NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.**

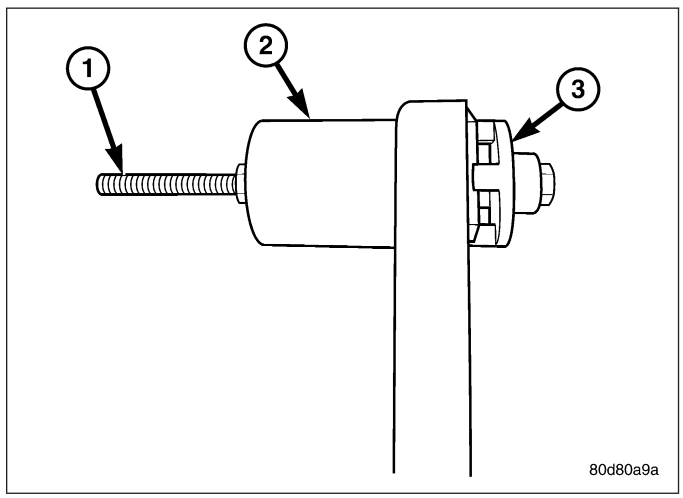
1. Install the new lower suspension arm bushings into the lower suspension arm using tools 8862-3 (driver)(1), 8862-4 (receiver)(3), 8862-5 (spacer)(2) and the bearing with the threaded rod 8839 (4) making sure to properly orient the bushing in the suspension arm.
2. Remove the suspension arm from the vise.
3. Install the lower suspension arm (Refer to 2 - SUSPENSION/REAR/LOWER CONTROL ARM - INSTALLATION).




## UPPER SUSPENSION ARM BUSHING

**NOTE: Extreme pressure lubrication must be used on the threaded portions of the tool. This will increase the longevity of the tool and insure proper operation during the removal and installation process.**

1. Install the new upper suspension arm bushings into the upper suspension arm using tools 8835-3 (receiver)(2), 8860-2 (driver)(3) and the bearing with the threaded rod 8838 (1) making sure to properly orient the bushing in the suspension arm.
2. Remove the suspension arm from the vise.
3. Install the upper suspension arm (Refer to 2 - SUSPENSION/REAR/UPPER CONTROL ARM - INSTALLATION).



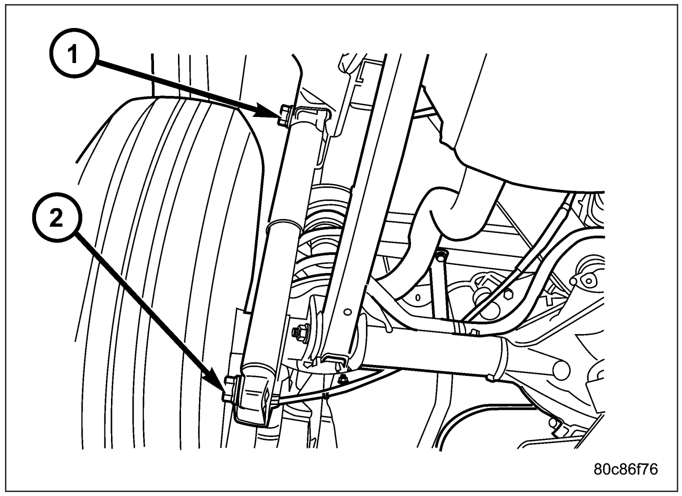
# SHOCK

## REMOVAL

1. Raise and support the vehicle. Position a hydraulic jack under the axle to support the axle.

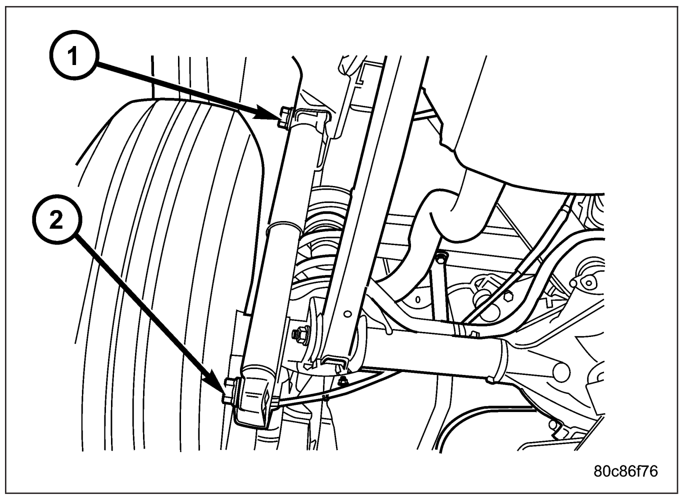
**CAUTION: Do not allow the axle to hang from the upper suspension arm ball joint.**

2. Remove the upper nut and bolt (1) from the frame bracket.
3. Remove the lower nut and bolt (2) from the axle bracket. Remove the shock absorber.




## INSTALLATION

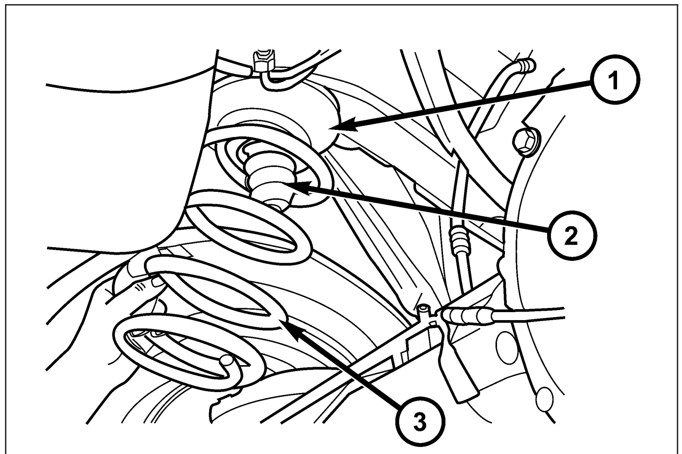
1. Install the shock absorber in the frame bracket and install the bolt and nut (1).
2. Install the shock absorber in the axle bracket and install the bolt and nut (2).
3. Remove the supports and lower the vehicle.
4. Tighten the upper mounting nuts (1) to 108 N·m (80 ft. lbs.). Tighten the lower mounting nuts (2) to 115 N·m (85 ft. lbs.).



# SPRING

## REMOVAL

1. Raise and support the vehicle. Position a hydraulic jack under the axle to support the axle.
2. Remove the shock absorber lower bolt from the axle bracket.
3. Lower the hydraulic jack and tilt the axle and remove the coil spring (3).
4. Remove and inspect the upper and lower spring isolators (1).



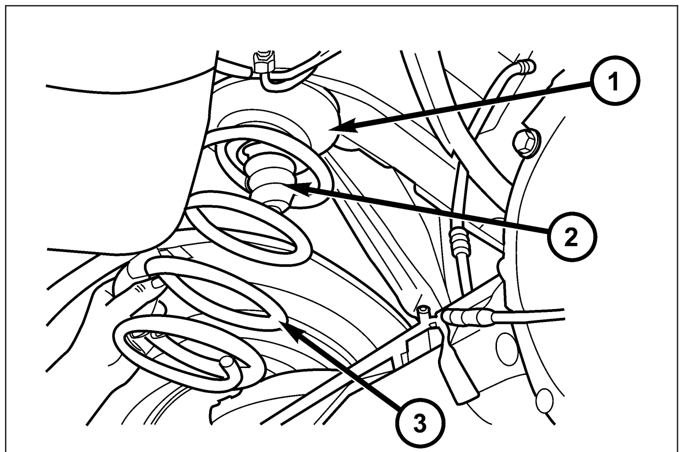

80c86f68

## INSTALLATION

1. Install the upper isolator (1).
2. Install the lower isolator.
3. Pull down on the axle and position the coil spring (3) in the lower isolator.

**CAUTION: Ensure the spring is positioned on the lower isolator.**

4. Raise the axle with the hydraulic jack.
5. Install the shock absorber to the axle bracket and tighten to 115 N·m (85 ft. lbs.).
6. Remove the supports and lower the vehicle.

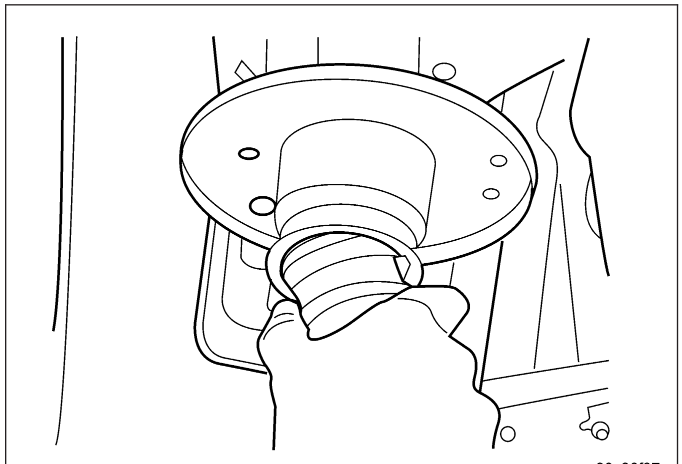



80c86f68

# JOUNCE BUMPER

## REMOVAL

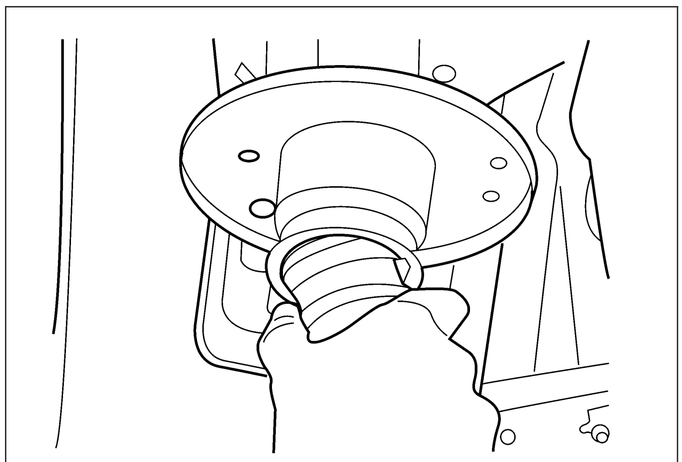
1. Remove the shock (Refer to 2 - SUSPENSION/REAR/SHOCK - REMOVAL).
2. Remove the coil spring (Refer to 2 - SUSPENSION/REAR/SPRING - REMOVAL).
3. Pull the jounce bumper downwards to remove.



80c86f37

## INSTALLATION

1. Install the jounce bumper into the mount by twisting the bumper into place.
2. Install the coil spring (Refer to 2 - SUSPENSION/REAR/SPRING - INSTALLATION).
3. Install the shock (Refer to 2 - SUSPENSION/REAR/SHOCK - INSTALLATION).

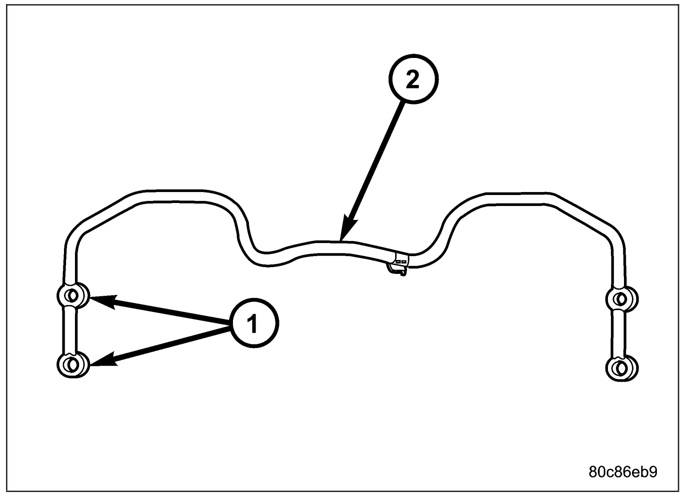


80c86f37

# STABILIZER BAR

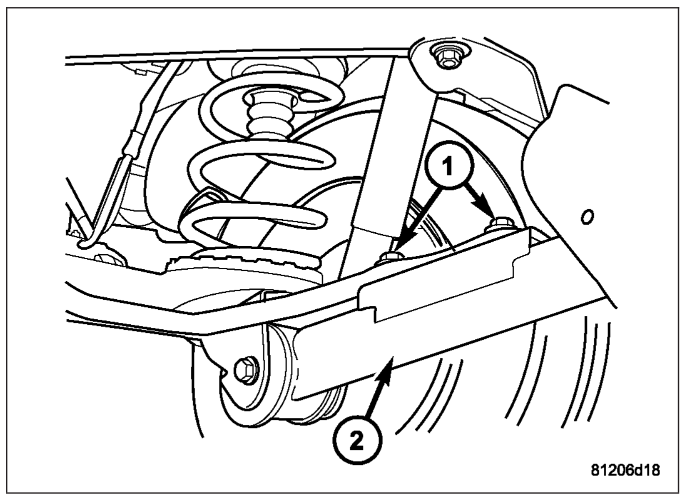
## REMOVAL

1. Raise and support the vehicle.
2. Remove the stabilizer bar bolts (1) from the lower suspension arm.
3. Remove the stabilizer bar (2).




## INSTALLATION

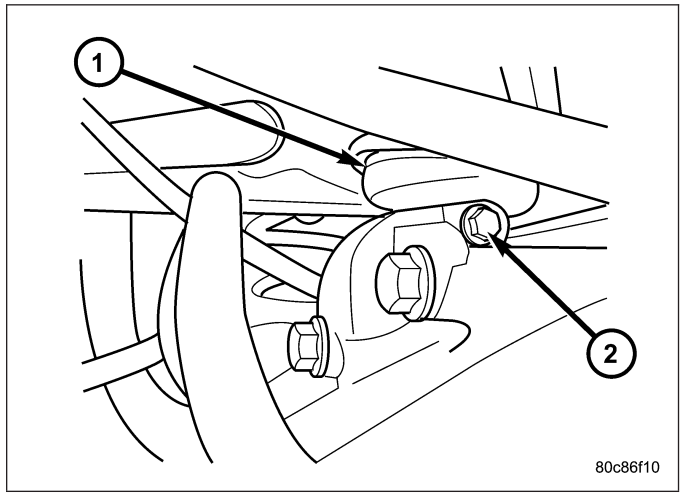
1. Position the stabilizer bar over the axle and install the bolts (1) to the lower suspension arm (2). Ensure the bar is centered with equal spacing on both sides. Tighten the bolts to 99 N·m (73 ft. lbs.).
2. Remove support and lower the vehicle.



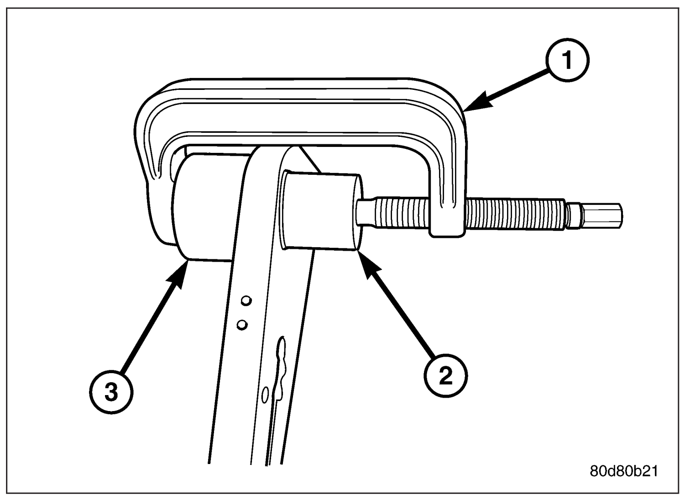
# UPPER BALL JOINT

## REMOVAL

1. Raise and support the vehicle.
2. Support the rear axle with a hydraulic jack.
3. Remove the ball joint pinch bolt (2) from the top of the axle.
4. Separate the ball joint (1) arm assembly from the differential housing by prying upwards.
5. Remove the upper suspension arm from the vehicle (Refer to 2 - SUSPENSION/REAR/UPPER CONTROL ARM - REMOVAL).
6. Secure the suspension arm in a vise.

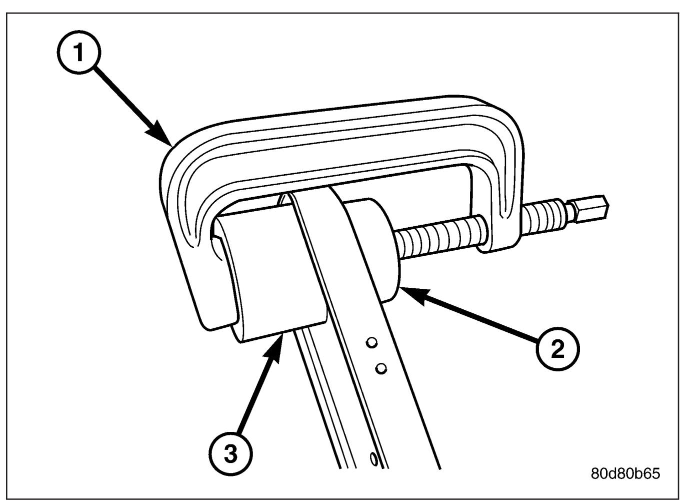



7. Install special tools C-4212F (press)(1) , 8861-3 (driver)(2) and 8861-2 (receiver)(3)
8. Press out the old ball joint.

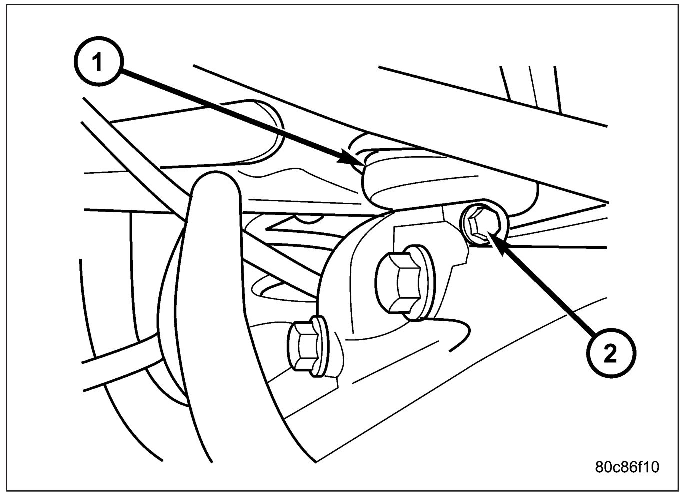



## INSTALLATION

1. Install special tools C-4212F (press)(1), 8861-1 (receiver)(2) and 8861-2 (driver)(3) with the ball joint in place.
2. Press the ball joint in the upper suspension arm.



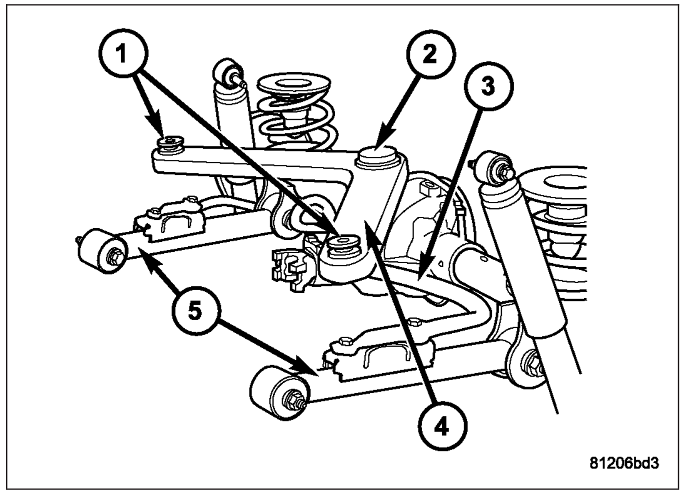
3. Remove the upper suspension arm from the vise.
4. Reinstall the upper suspension arm (Refer to 2 - SUSPENSION/REAR/UPPER CONTROL ARM - INSTALLATION).
5. Raise the rear axle with a hydraulic jack to align the ball joint (1) with the differential housing bracket.
6. Insert the ball joint (1) into the differential housing bracket.
7. Install the ball joint pinch bolt (2) and tighten to 95 N·m (70 ft. lbs.)..
8. Remove the supports and lower the vehicle.



# UPPER CONTROL ARM

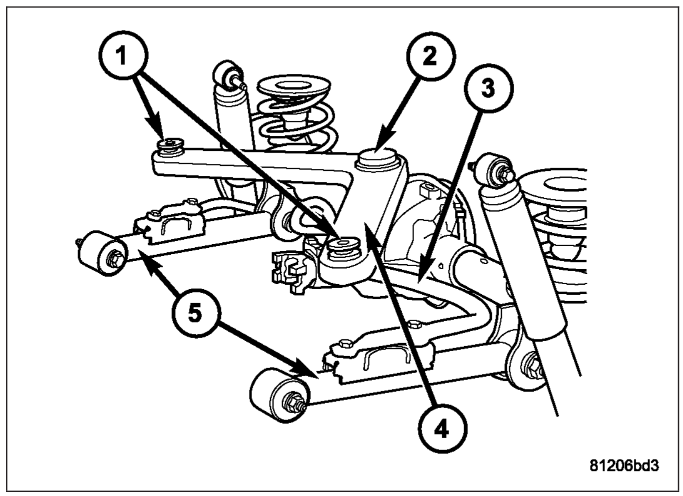
## DESCRIPTION - UPPER SUSPENSION ARM, BUSHINGS, AND BALL JOINT

The suspension arm uses vertical spool bushings to isolate road noise. The suspension arm is bolted through bushings (1) to cage nuts in the body and a ball joint (2) to the top of the differential housing.



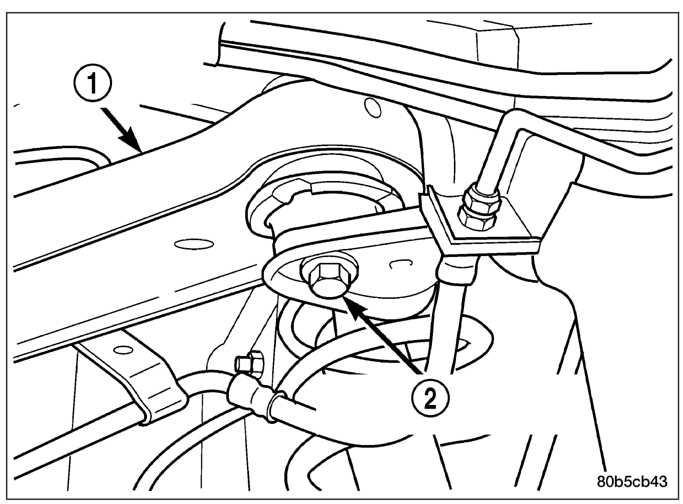

## OPERATION - UPPER SUSPENSION ARM, BUSHINGS, AND BALL JOINT

The upper suspension arm (4) provides fore/aft and lateral location of the rear axle. The suspension arm travel is limited through the use of jounce bumpers in compression and shock absorbers in rebound.

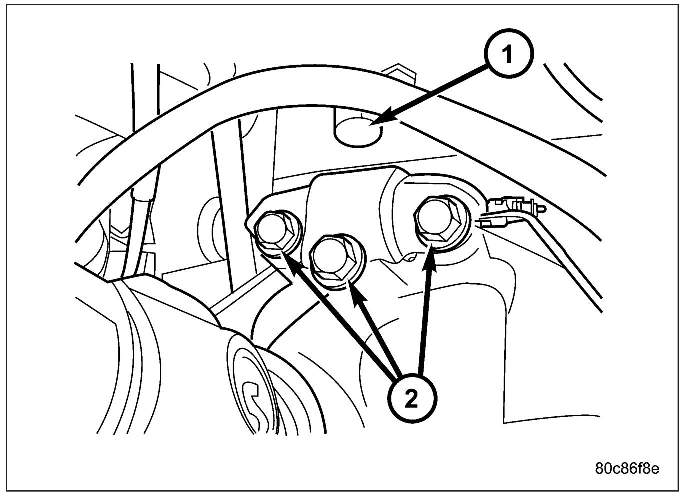



## REMOVAL

1. Raise and support the vehicle.
2. Support the rear axle with a hydraulic jack.
3. Remove the ball joint pinch bolt from the top of the differential housing bracket.
4. Remove partial nuts from the heat shield in order to lower the shield down enough to get the proper clearance to remove the right side bolt (2) from the body.
5. Remove the upper suspension arm mounting bolts (2) from the body and remove the arm (1).

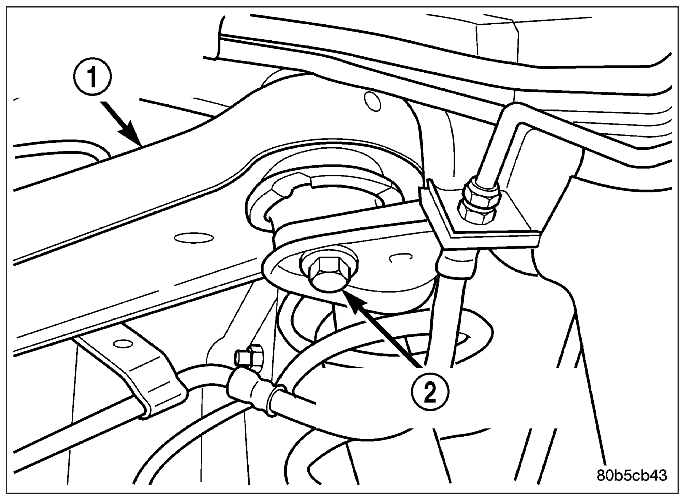


6. Remove the support bracket mounting bolts (2) if needed.

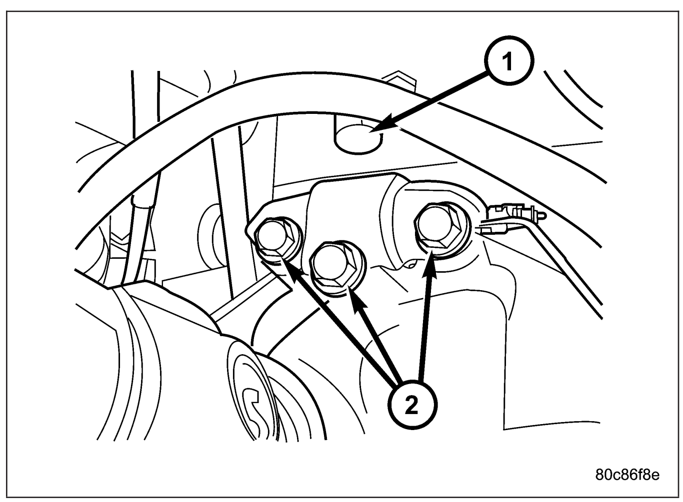



## INSTALLATION

1. Position the upper suspension arm (1) in the frame rail brackets.
2. Install the mounting bolts (2) and tighten to 100 N·m (74 ft. lbs.).



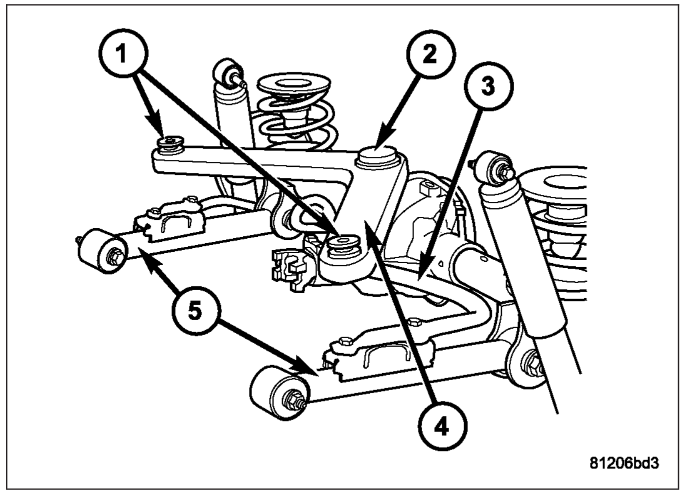

3. Retighten the heat shield back into place.
4. Install the support bracket and bolts (2) to the rear differential (if removed).
5. Pull the arm down on the differential housing bracket inserting the ball joint (1) into the support bracket (2) and install the pinch bolt and nut. Tighten the nut to 95 N·m (70 ft. lbs.).
6. Remove the supports and lower the vehicle.



# LOWER CONTROL ARM

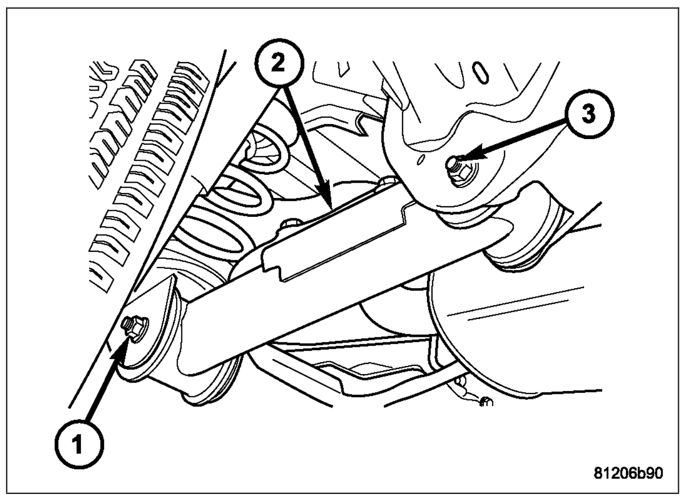
## DESCRIPTION

The lower suspension arms (5) are stamped steel and welded and use voided round bushings at the axle end and solid rubber at the body end of the arm.



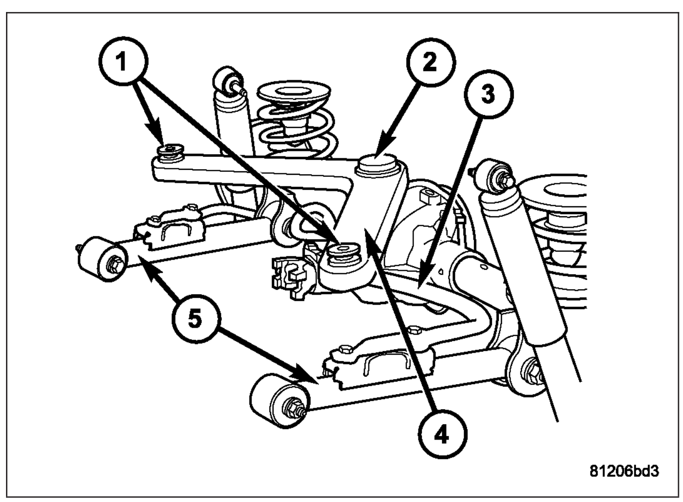

## OPERATION

The bushings provide isolation from the axle. The arms (2) mount to the unibody frame rail bracket (3) and the axle brackets (1). The arm (2) and bushings provide location and react to loads.




## REMOVAL

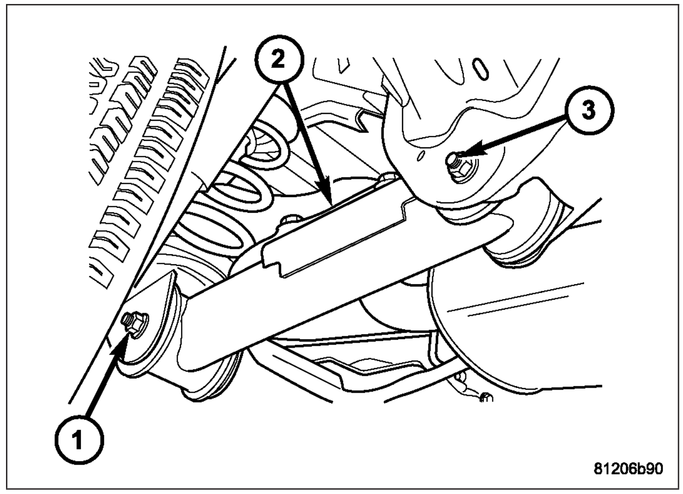
1. Raise the vehicle and support the rear axle.
2. Remove the stabilizer bar (3) retaining bolts from the suspension arm (5).



3. Remove the lower suspension arm nut and bolt (1) from the axle bracket (1).

**NOTE: When removing the right side suspension arm from the frame rail it will be necessary to pry the exhaust over slightly to allow enough clearance to remove the bolt.**

4. Remove the nut and bolt (3) from the frame rail (3) and remove the lower suspension arm (2).




## INSTALLATION

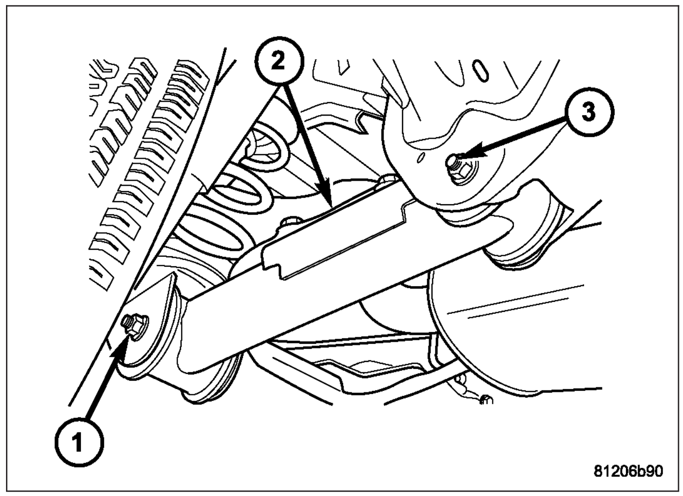
1. Position the lower suspension arm (2) in the axle bracket and frame rail bracket (3).

**NOTE: The end of the arm with the voided round bushing attaches to the axle bracket.**

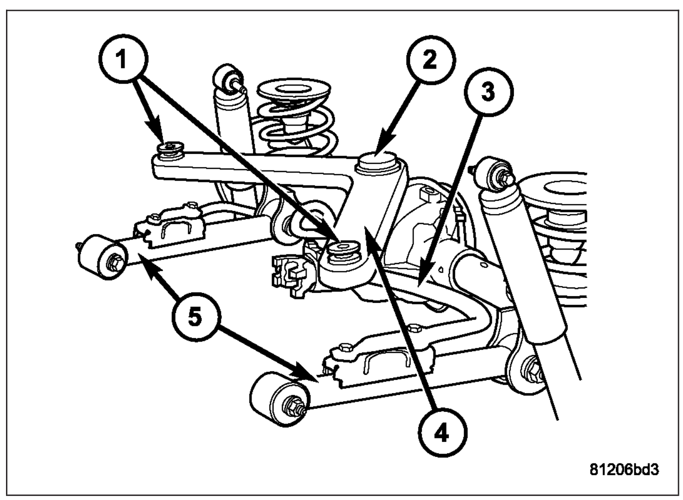
2. Install the axle bracket bolt (1) and nut finger tight.

**NOTE: When installing the right side suspension arm to the frame rail it will be necessary to pry the exhaust over slightly to allow enough clearance to install the bolt.**

3. Install the frame rail bracket bolt (3) and nut finger tight.




4. Install the stabilizer bar (3) retaining bolts to the suspension arm (5).
5. Remove the supports and lower the vehicle.
6. With the vehicle on the ground tighten the nut at the frame to 163 N·m (120 ft. lbs.). Tighten the nut at the axle bracket to 163 N·m (120 ft. lbs.).



# DIFFERENTIAL & DRIVELINE

## TABLE OF CONTENTS



# PROPELLER SHAFT

### TABLE OF CONTENTS

# PROPELLER SHAFT

## DIAGNOSIS AND TESTING

## PROPELLER SHAFT

### PROPELLER SHAFT VIBRATION

#### DRIVELINE VIBRATION

| Drive Condition | Possible Cause | Correction |
|---|---|---|
| Propeller Shaft Noise | 1. Undercoating or other foreign material on shaft. | 1. Clean exterior of shaft and wash with solvent. |
| | 2. Loose U-joint clamp screws. | 2. Install new clamps and screws and tighten to proper torque. |
| | 3. Loose or bent U-joint yoke or excessive runout. | 3. Install new yoke. |
| | 4. Incorrect driveline angularity. | 4. Measure and correct driveline angles. |
| | 5. Worn joint. | 5. Install new joint. |
| | 6. Propeller shaft damaged or out of balance. | 6. Installl new propeller shaft. |
| | 7. Broken rear spring. | 7. Install new rear spring. |
| | 8. Excessive runout or unbalanced condition. | 8. Re-index propeller shaft, test, and evaluate. |
| | 9. Excessive drive pinion gear shaft runout. | 9. Re-index propeller shaft and evaluate. |
| | 10. Excessive axle yoke deflection. | 10. Inspect and replace yoke if necessary. |
| | 11. Excessive transfer case runout. | 11. Inspect and repair as necessary. |
| U-Joint Noise | 1. Loose U-joint clamp screws. | 1. Install new clamps and screws and tighten to proper torque. |
| | 2. Lack of lubrication. | 2. Replace joints as necessary. |

Out-of-round tire or wheels that are out of balance, will cause a low frequency vibration.

Brake rotors that are unbalanced will cause a harsh, low frequency vibration.

Driveline vibration can be caused by loose or damaged engine mounts.

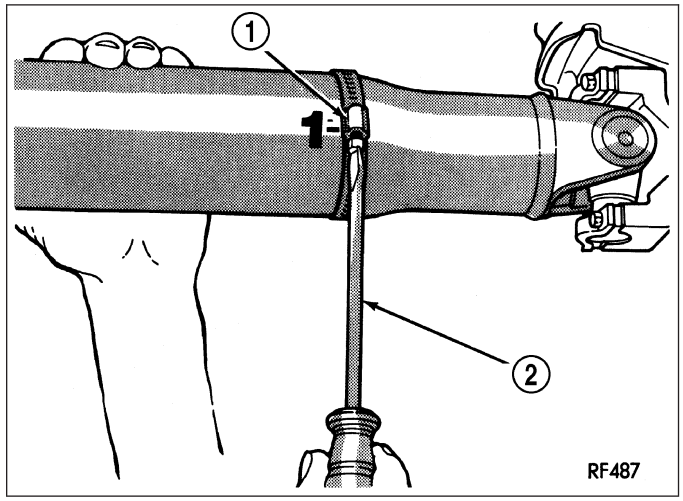
Propeller shaft vibration increases with vehicle speed. A vibration that occurs at a specific speed is not usually caused by a out of balance propeller shaft. Worn universal joints or an incorrect propeller shaft angle, can cause such a vibration.

## BALANCE

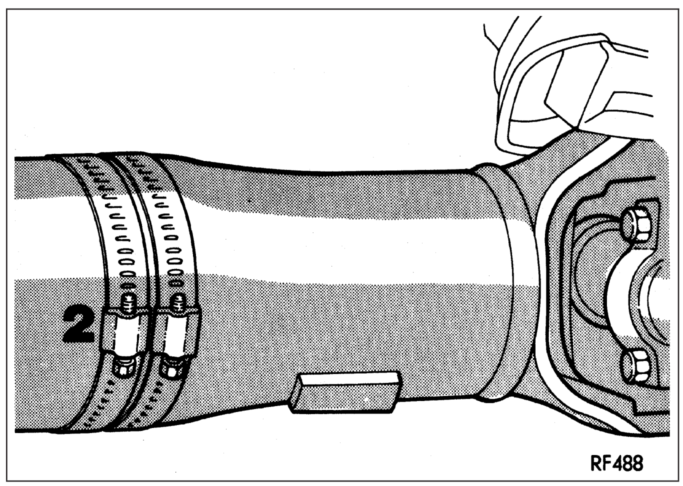
**NOTE: Indexing the propeller shaft 180° relative to the yoke may eliminate some vibrations.**

1. Raise the vehicle.
2. Clean all the foreign material from the propeller shaft and universal joints.
3. Inspect propeller shaft for missing balance weights, broken welds, and bent areas.

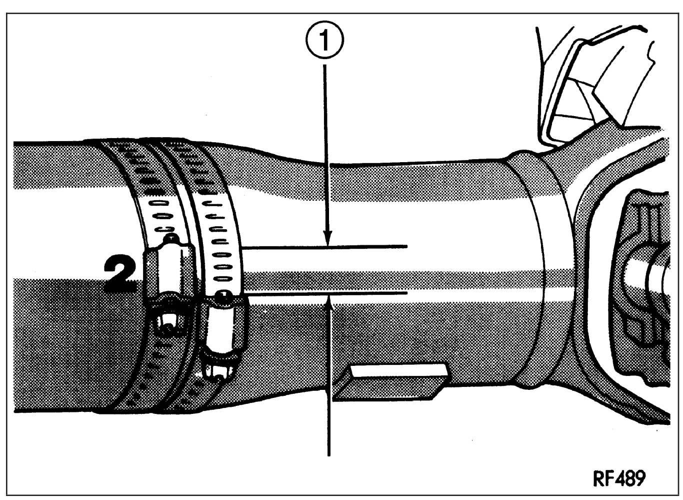
**NOTE: If the propeller shaft is bent, it must be replaced.**




4. Inspect universal joints for wear, properly installation and correct alignment with the shaft.
5. Remove wheels and tires and install wheel lug nuts to retain brake drums/rotors.
6. Mark and number the shaft six inches from the pinion yoke end at four positions 90 degrees apart.
7. Run and accelerate the vehicle until vibration occurs. Note the intensity and speed the vibration occurred. Stop the engine.
8. Position one screw clamp (1) on the propeller shaft with a screw driver (2).
9. Start the engine and check for vibration. If there is little or no change in vibration, move the clamp to the next positions. Repeat the vibration test. If there is no difference in vibration at the other positions, the source of the vibration may not be propeller shaft.
10. If vibration decreased, install a second clamp and repeat the test.




11. If the additional clamp causes an additional vibration, separate the clamps (1) (1/4 inch above and below the mark). Repeat the vibration test.
12. Increase distance between the clamps and repeat the test until the amount of vibration is at the lowest level. Bend the slack end of the clamps so the screws will not loosen.
13. If vibration remains unacceptable, repeat the procedure to the front end of the propeller shaft.
14. Install wheel and tires, and lower vehicle.



## RUNOUT

### RUNOUT SPECIFICATIONS

| | |
|---|---|
| Front of Shaft | 0.020 in. (0.50 mm) |
| Center of Shaft | 0.025 in. (0.63 mm) |
| Rear of Shaft | 0.020 in. (0.50 mm) |
| NOTE: Measure front/rear runout approximately 3 inches (76 mm) from the weld seam at each end of the shaft tube for tube lengths over 30 inches. For tube lengths under 30 inches, the maximum allowed runout is 0.020 in. (0.50 mm) for the full length of the tube. | |

1. Clean propeller shaft surface where the dial indicator will contact the shaft.
2. The dial indicator must be installed perpendicular to the shaft surface.
3. Measure runout at the center and ends of the shaft away from weld areas to ensure an accurate measurements.
4. Refer to Runout Specifications chart.
5. If propeller shaft runout is out of specification, remove propeller shaft. Index the shaft 180 degrees and measure shaft runout again.
6. If propeller shaft runout is now within specifications, mark the shaft and yokes for proper orientation.
7. If propeller shaft runout is not within specifications, check runout of the transmission/transfer case and axle. Correct as necessary and repeat propeller shaft runout measurement.
8. Replace propeller shaft if the runout still exceeds the limits.

## STANDARD PROCEDURE

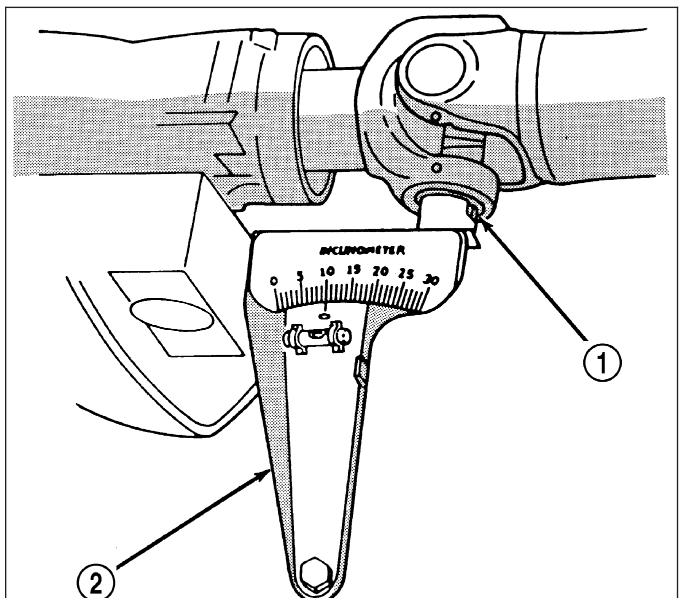
## PROPELLER SHAFT ANGLE

This procedure applies to the front and rear propeller shaft. To obtain front (output) angle on the C/V front propeller shaft, place Inclinometer 7663 on the machined ring of the pinion flange. To obtain propeller shaft angle measurement on the C/V front propeller shaft, place inclinometer on the propeller shaft tube.

1. Raise and support the vehicle at the axles as level as possible. Allow the wheels and propeller shaft to turn.
2. Remove universal joint snap rings if equipped, so inclinometer base sits flat.
3. Rotate shaft until transmission/transfer case output yoke bearing cap is facing downward.

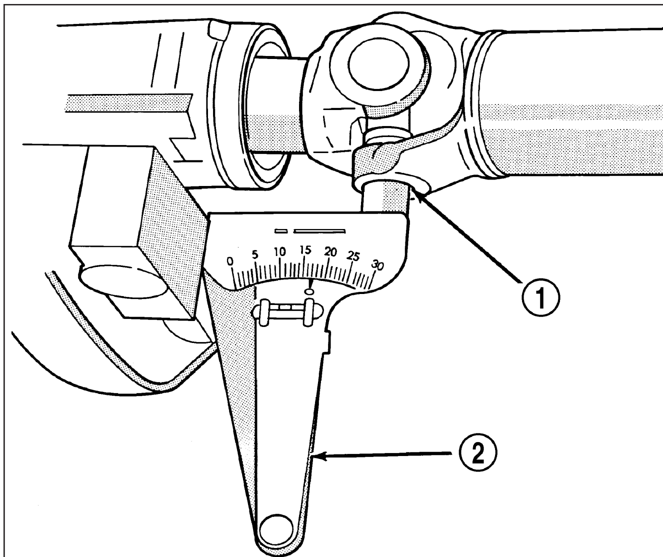
**NOTE: Always make measurements from front to rear and from the same side of the vehicle.**

4. Place inclinometer (2) on yoke bearing cap (1) or pinion flange ring parallel to the shaft. Center bubble in sight glass and record measurement. This measurement will give you the transmission or Output Yoke Angle (A).



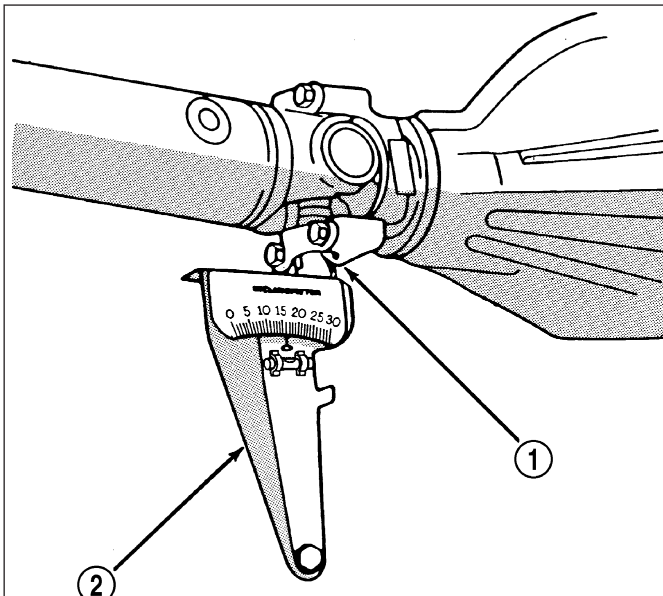
J9216-13

5. Rotate propeller shaft 90 degrees and place inclinometer (2) on yoke bearing cap (1) or propeller shaft tube on C/V propeller shaft, parallel to the shaft. Center bubble in sight glass and record measurement. This measurement can also be taken at the rear end of the shaft. This measurement will give you the propeller shaft angle (C)
6. Subtract smaller figure from larger (C minus A) to obtain transmission output operating angle.



J9216-9

7. Rotate propeller shaft 90 degrees and place inclinometer (2) on pinion yoke bearing cap (1) parallel to the shaft. Center bubble in sight glass and record measurement. This measurement will give you the pinion shaft or input yoke angle (B).
8. Subtract smaller figure from larger (C minus B) to obtain axle Input Operating Angle.



J9216-12

## RULES

Good cancellation of U-joint operating angles is within 1degree.

Operating angles less than 3 degrees.

Operating angles less than 10 degrees for double cardan U-joint.

At least 1/2 of one degree continuous operating (propeller shaft) angle.

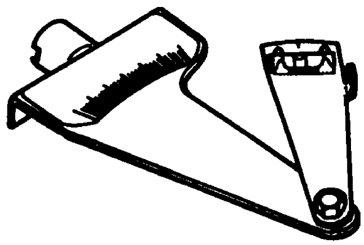
## SPECIFICATIONS

## PROPELLER SHAFT

### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Front Shaft - Companion Flange Bolts | 30 | 22 | - |
| Rear Shaft - Companion Flange Bolts | 115 | 85 | - |

## SPECIAL TOOLS



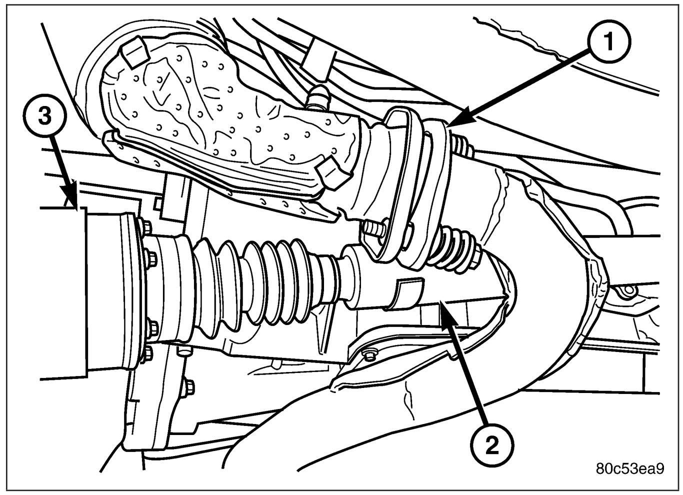
*INCLINOMETER 7663*

# SHAFT-PROPELLER FRONT

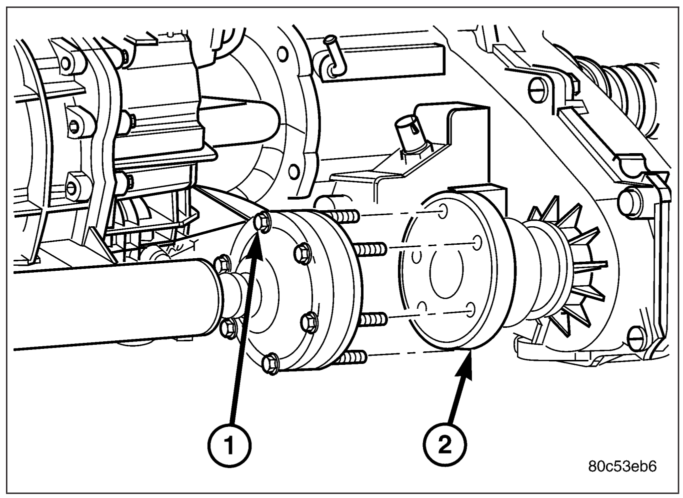
## REMOVAL

### REMOVAL – 2.8L DIESEL

1. With vehicle in neutral, position vehicle on hoist.
2. Remove left side exhaust flange (1) bolts.
3. Mark companion flanges (3) and C/V joints at the front (2) and rear of the propeller shaft for installation reference.

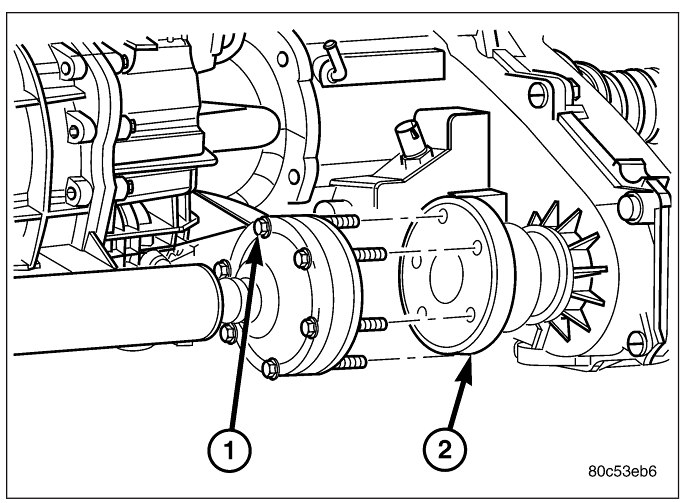



4. Remove bolts (1) from the front and rear C/V joints.
5. Push propeller shaft forward to clear transfer case companion flange (2).
6. Remove shaft from the front axle companion flange.
7. Pull down on the exhaust and tilt the front of the shaft down and pull shaft forward and remove from the vehicle.




### REMOVAL - 3.7L GAS ENGINE

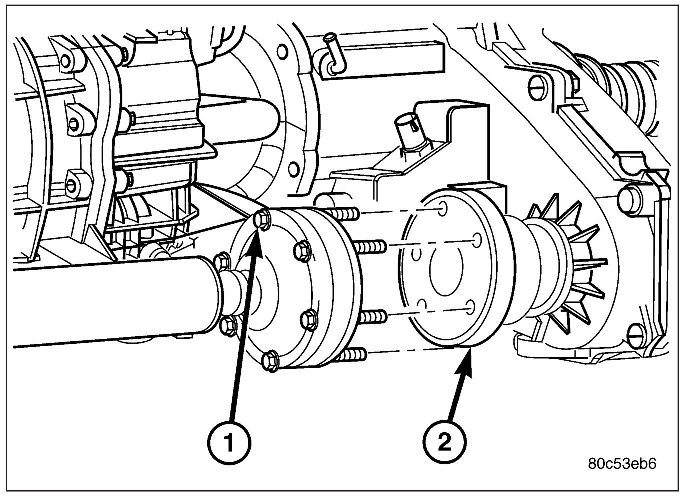
1. With vehicle in neutral, position vehicle on hoist.
2. Mark companion flanges and C/V joints at the front and rear of the propeller shaft for installation reference.
3. Remove bolts (1) from the front and rear C/V joints (2).
4. Push propeller shaft forward to clear transfer case companion flange.
5. Remove shaft from the front axle companion flange.
6. Tilt the front of the shaft down and pull shaft forward and remove from the vehicle.



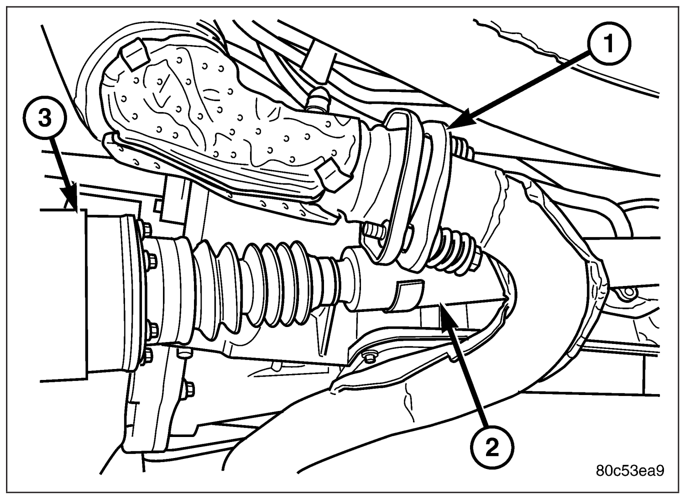
## INSTALLATION

## INSTALLATION – 2.8L DIESEL

1. Install propeller shaft between companion flanges.
2. Align marks on the companion flanges with the marks on the C/V joints.
3. Install front C/V joint bolts and tighten to 30 N·m (22 ft. lbs.).
4. Install rear C/V joint bolts (1) and tighten to 30 N·m (22 ft. lbs.).

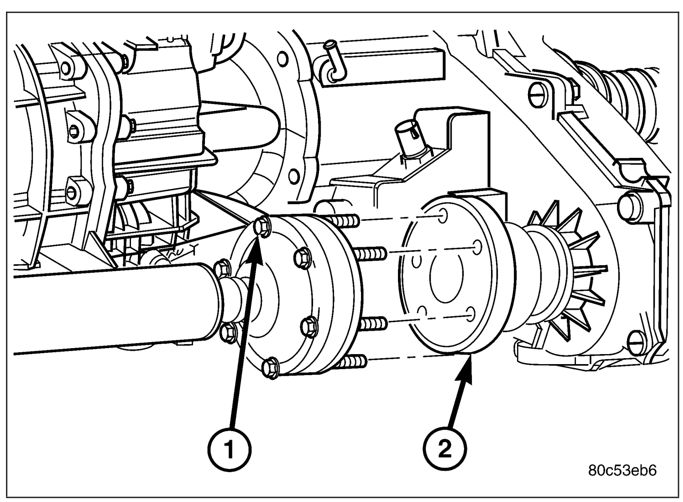



5. Install exhaust flange (1) and bolts.




## INSTALLATION - 3.7L GAS ENGINE

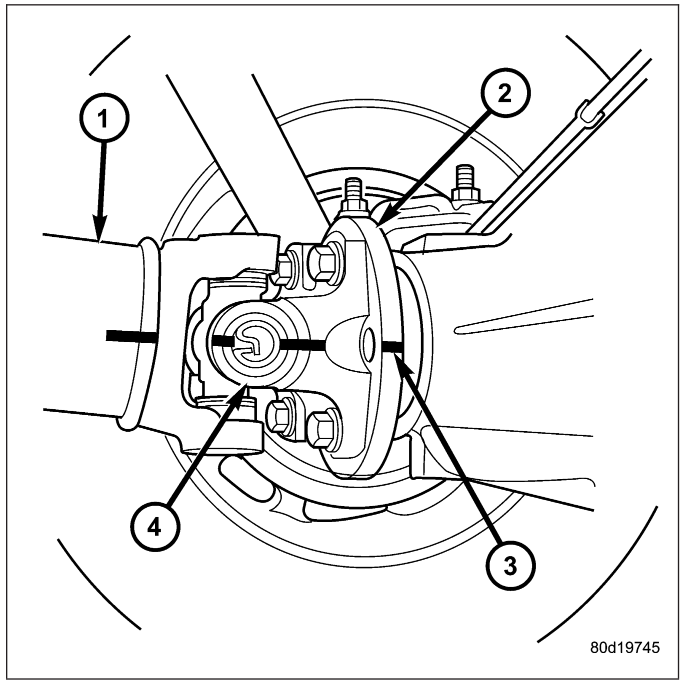
1. Install propeller shaft between companion flanges.
2. Align marks on the companion flanges with the marks on the C/V joints.
3. Install front C/V joint bolts and tighten to 30 N·m (22 ft. lbs.).
4. Install rear C/V joint bolts (1) and tighten to 30 N·m (22 ft. lbs.).



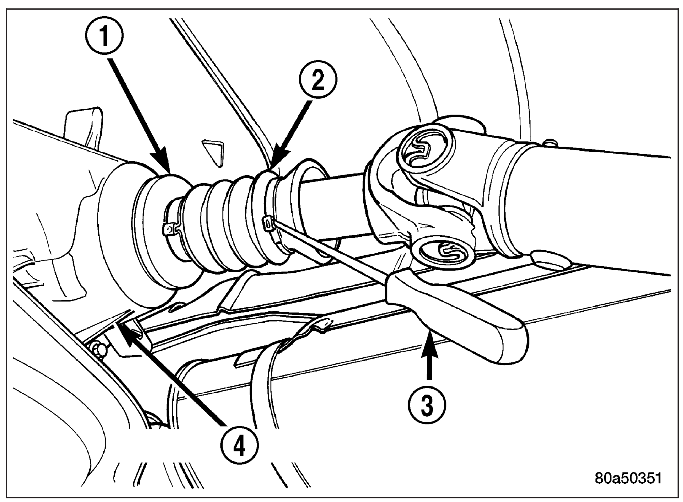
# SHAFT-PROPELLER REAR

## REMOVAL

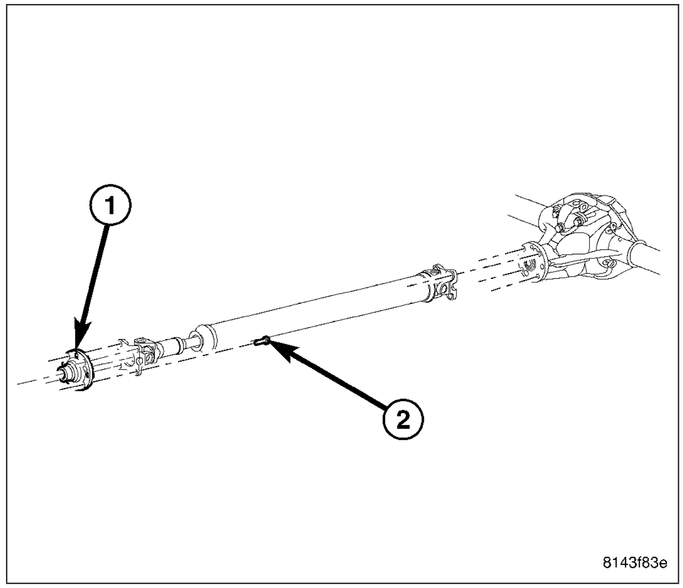
1. With vehicle in neutral, position vehicle on hoist.
2. Mark a reference line (3) across companion flanges (2) (4) and propeller shaft (1) for installation.




3. Pry open clamp holding the dust boot (2) to propeller shaft yoke, if equipped.

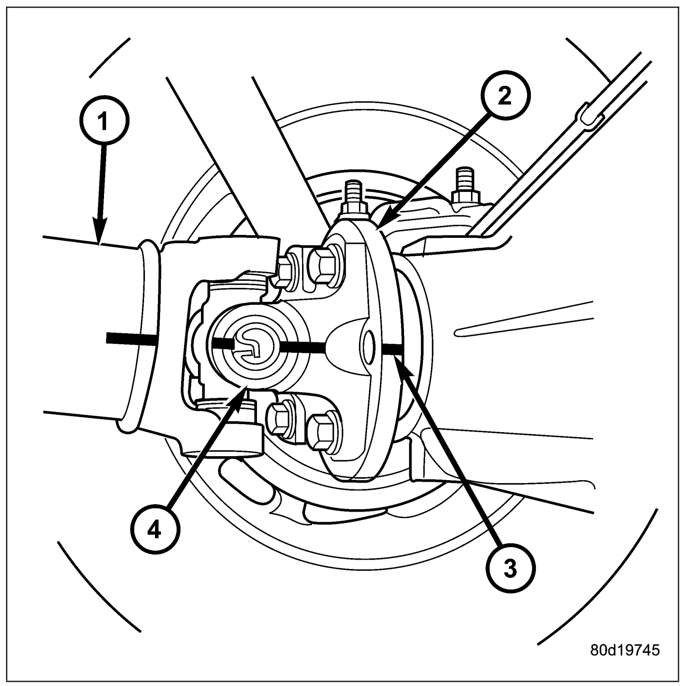


4. On 4x2 vehicles with manual transmission remover transmission companion flange (1) bolts (2).
5. Remove pinion companion flange bolts.
6. Remove propeller shaft.

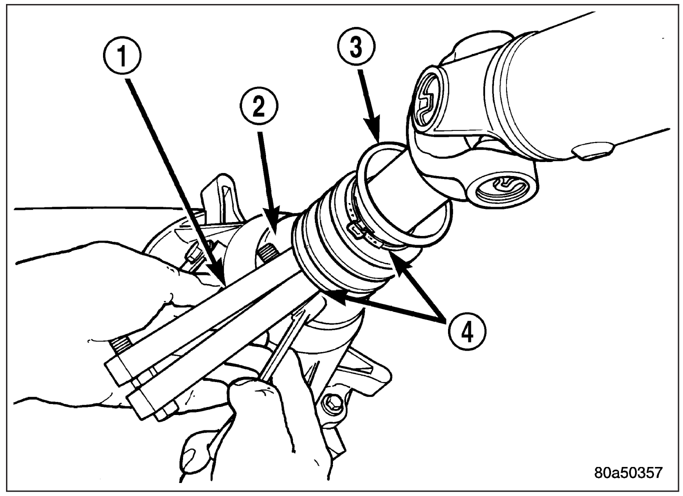



## INSTALLATION

1. Slide slip yoke on the transmission/transfer case output shaft. On 4x2 vehicles with a manual transmission install transmission flange bolts and tighten to 115 N·m (85 ft. lbs.).
2. Align reference marks (3) on companion flanges (2) (4) and propeller shaft (1).



3. Install companion flange bolts and tighten to 115 N·m (85 ft. lbs.).
4. Tighten dust boot (3) clamps (4) if equipped with clamp installer (1).

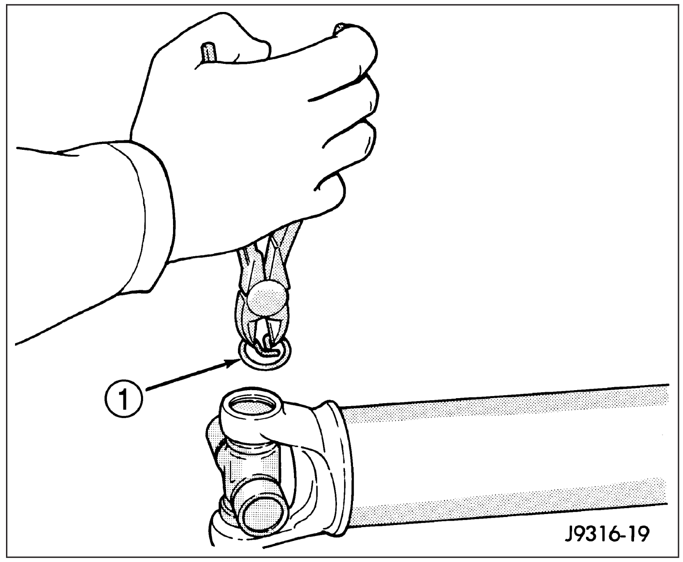


# UNIVERSAL JOINT-SINGLE CARDAN

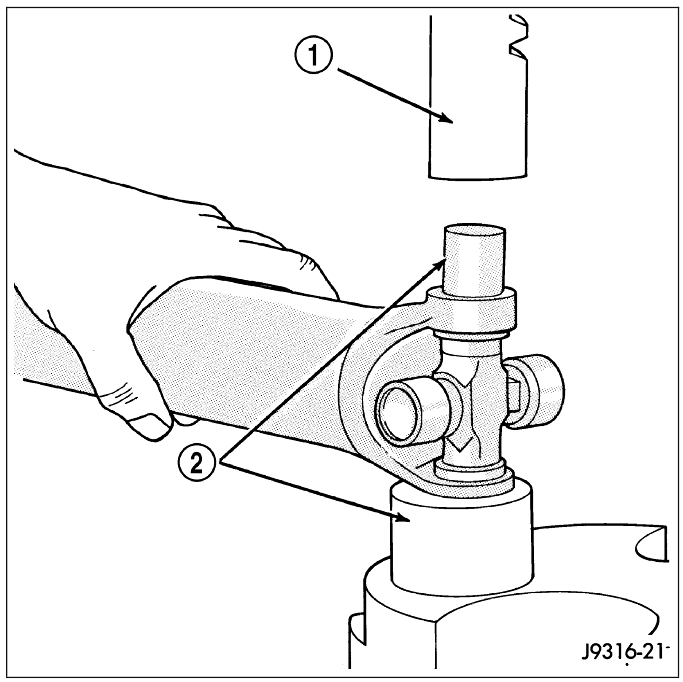
## DISASSEMBLY - WITH SNAP RINGS

**NOTE: This procedure describes a propeller shaft equipped with a cardan joint in the tube yoke. For propeller shafts equipped with a companion/slip yoke, repeat the steps to remove the remaining cardan joint.**

1. Tap outside of bearing cap with a drift to loosen snap ring.
2. Remove snap rings (1) from both sides of yoke.



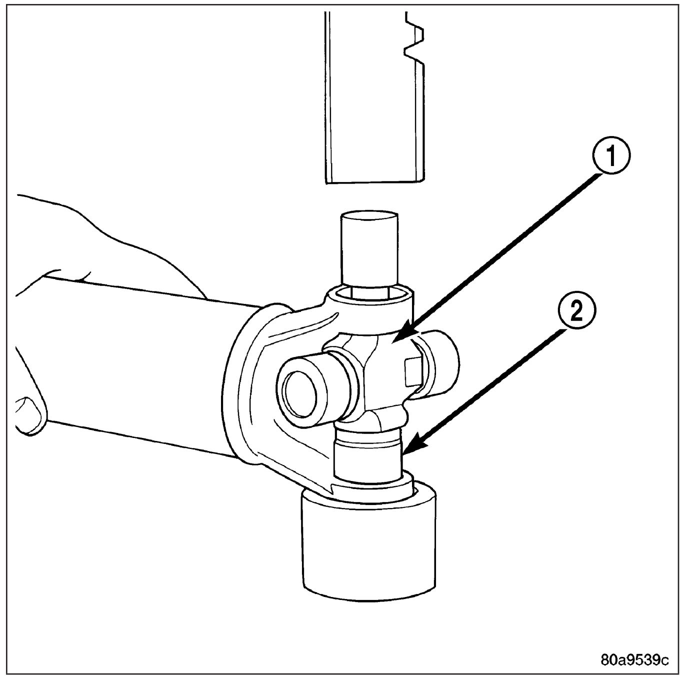

3. Position yoke with the grease fitting if equipped, pointing up.
4. Position a socket (2) with a inside diameter large enough to receive the bearing cap, beneath the yoke on a press.
5. Place another socket (2) with an outside diameter smaller than bearing cap on the upper bearing cap and press (1) the lower cap through the yoke.



**NOTE: If the bearing cap will not pull out of the yoke by hand after pressing, tap the yoke ear near the bearing cap to dislodge the cap.**

6. Pull bearing cap of the yoke.
7. Turn yoke over in the press and straighten the cross (1). Press the cross until the remaining bearing cap (2) can be removed.

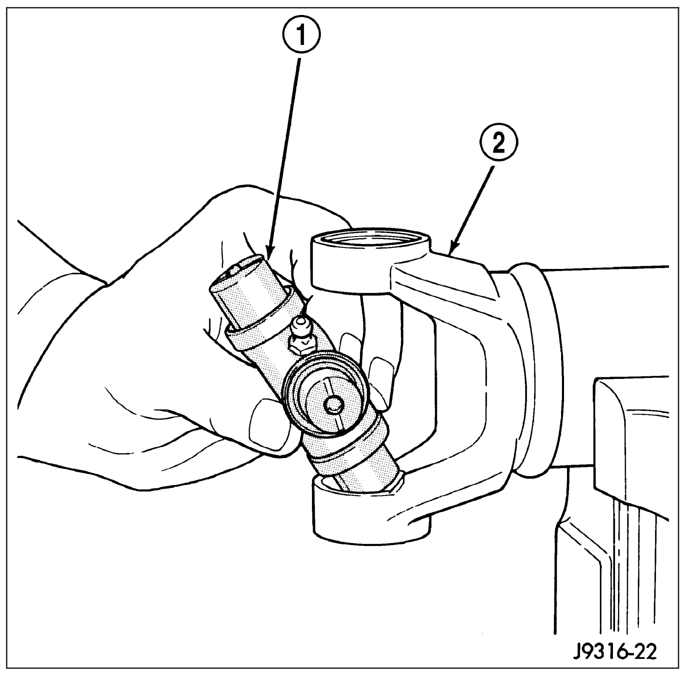
**CAUTION: If cross or bearing cap are not straight during removal, the bearing cap will score the walls of the yoke bore and damage can occur.**




## ASSEMBLY - WITH SNAP RINGS

**NOTE: This procedure describes a propeller shaft equipped a cardan joint in the tube yoke. For propeller shafts equipped with a companion/slip yoke, repeat the steps to remove the remaining cardan joint.**

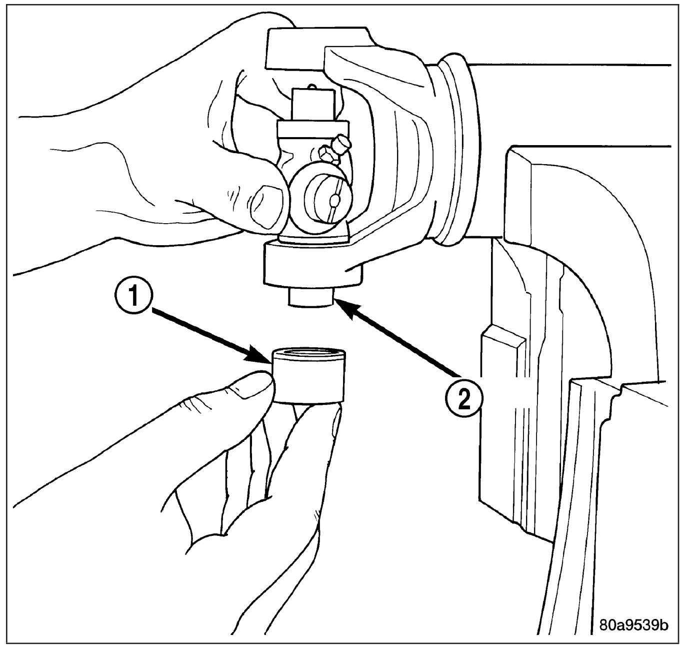
1. Apply (EP) N.L.G.I. Grade 1 or 2 grease to inside of yoke bores.
2. Position cross (1) in yoke (2) with lube fitting pointing up, if equipped.



3. Place a bearing cap (1) over the cross end (2) and align cap with yoke bore.
4. Press bearing cap into the yoke bore enough to clear snap ring groove.
5. Repeat Step 3 and Step 4 to install the opposite bearing cap.

**NOTE: If joint is stiff or binding, strike the yoke with a soft hammer to seat the needle bearings.**

6. Add grease to lube fitting, if equipped.



# HALF SHAFT

## TABLE OF CONTENTS

# HALF SHAFT

## CAUTION

**CAUTION:: Never grasp half shaft assembly by the boots. This may cause the boot to pucker or crease and reduce the service life of the boot.**
**Avoid over angulating or stroking the C/V joints when handling the half shaft.**
**Half shafts exposed to battery acid, transmission fluid, brake fluid, differential fluid or gasoline may cause the boots to deteriorate. Failure to follow these instruction will result in damage.**

## DIAGNOSIS AND TESTING

## HALF SHAFT

Check inboard and outboard C/V joint for leaking grease. This is a sign of boot or boot clamp damage.

### NOISE/VIBRATION IN TURNS

A clicking noise or vibration in turns could be caused by a damaged outer C/V or inner tripod joint seal boot or seal boot clamps. This will result in the loss/contamination of the joint grease, resulting in inadequate lubrication of the joint. Noise could also be caused by another component of the vehicle coming in contact with the half shafts.

### CLUNKING NOISE DURING ACCELERATION

This noise may be a damaged or worn C/V joint. A torn boot or loose/missing clamp on the inner/outer joint which has allowed the grease to be lost will damage the C/V joint.

### SHUDDER/VIBRATION DURING ACCELERATION

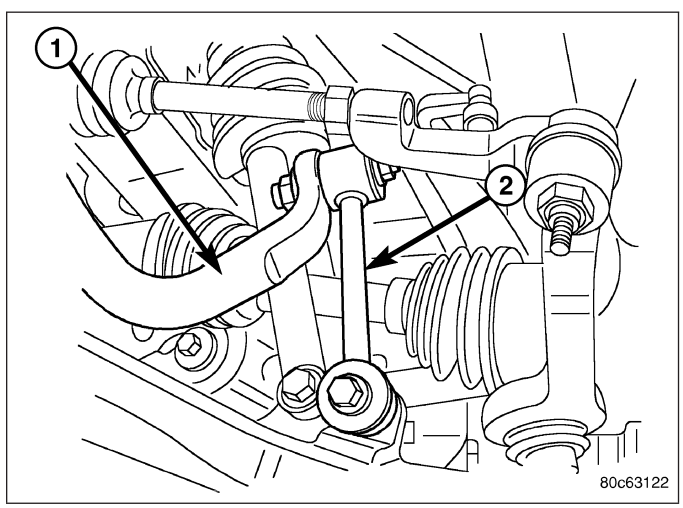
This could be a worn/damaged inner tripod joint or a sticking tripod joint. Improper wheel alignment may also cause a shudder or vibration.

### VIBRATION AT HIGHWAY SPEEDS

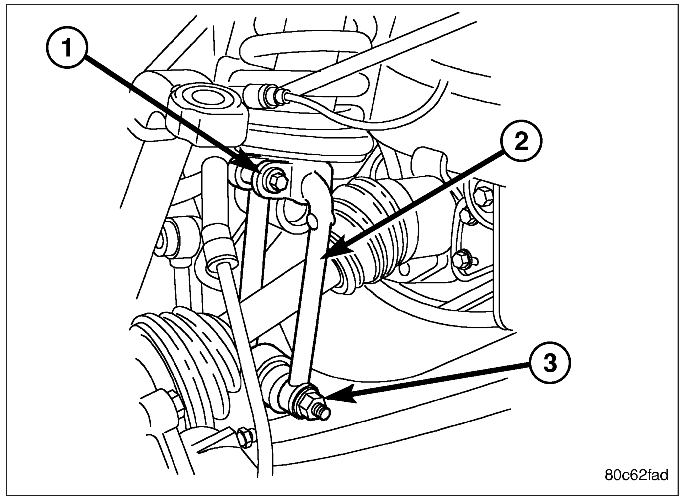
This problem could be a result of out of balance front tires or tire/wheel runout. Foreign material (mud, etc.) packed on the backside of the wheel(s) will also cause a vibration.

## REMOVAL

1. With vehicle in neutral, position vehicle on hoist.
2. Remove half shaft hub nut.
3. Remove stabilizer link (2) from stabilizer bar (1).

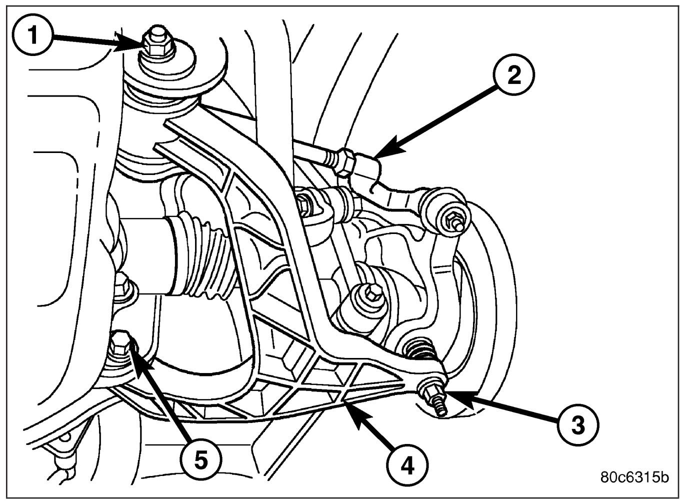


4. Remove clevis bracket (2) lower bolt (3).




5. Remover lower ball joint nut (3) and separate lower ball joint from the lower control arm (4).
6. Pull out on the steering knuckle and push the half shaft out of the knuckle.
7. With a pry bar remove the half shaft from the axle.

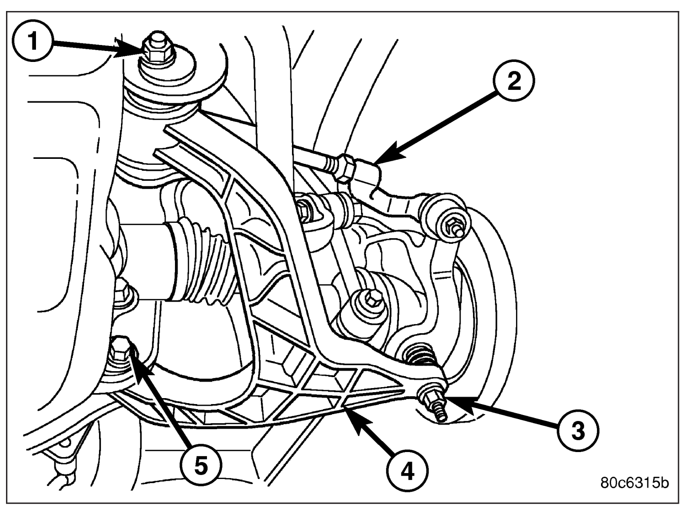
**NOTE: Right side half shaft has an axle shaft that may come out of the axle.**



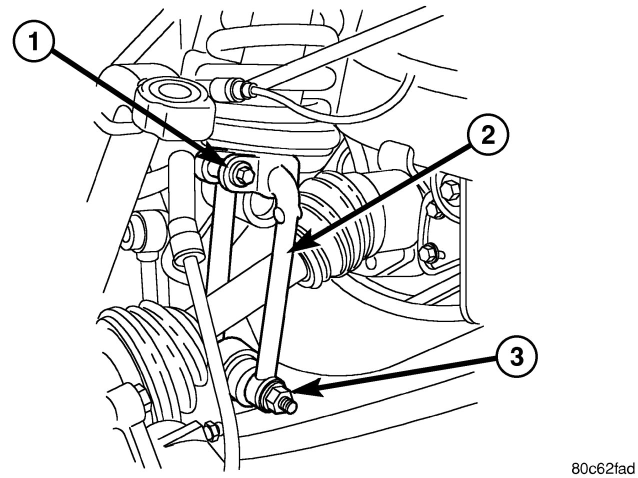

## INSTALLATION

**NOTE: Separate right half shaft from axle shaft in a vise if necessary and install axle shaft in the axle.**

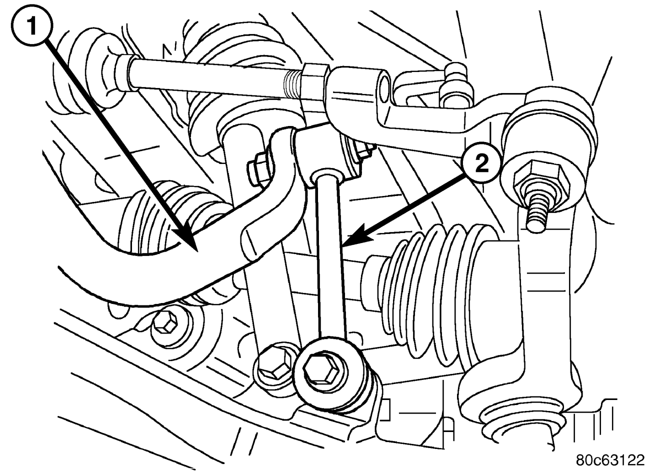
1. Apply a light coat of wheel bearing grease on the female splines of the inner C/V joint.
2. Install half shaft on the axle shaft spline and push firmly to engage the snap ring. Pull on the half shaft to verify snap has engaged.
3. Clean hub bearing bore and apply a light coat of wheel bearing grease.
4. Pull out on the steering knuckle and push the half shaft through the knuckle.
5. Install lower ball joint (3) into the lower control arm (4) and tighten pinch bolt.



6. Align clevis (2) with knuckle. Install and tighten lower clevis bolt (3) to specifications.




7. Install stabilizer bar link (2) on stabilizer bar (1).
8. Install half shaft hub nut and tighten to specifications.



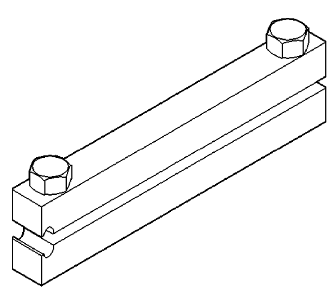

## SPECIFICATIONS

## HALF SHAFT

### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Half Shaft Nut | 136 | 100 | - |

## SPECIAL TOOLS



***INSTALLER C-4975A***

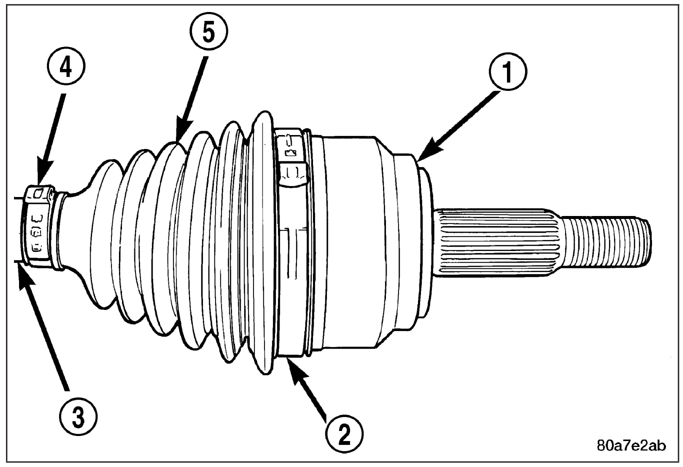
# JOINT/BOOT-C/V OUTER

## REMOVAL

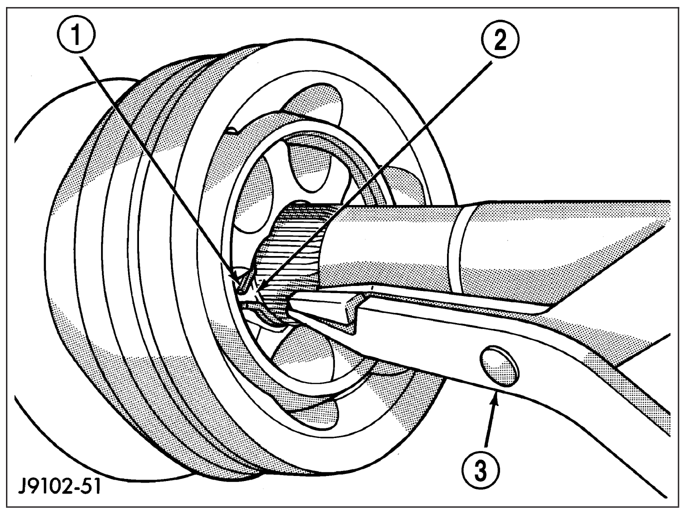
1. Place shaft in vise with soft jaws and support C/V joint.

**CAUTION: Do not damage C/V housing or half shaft.**

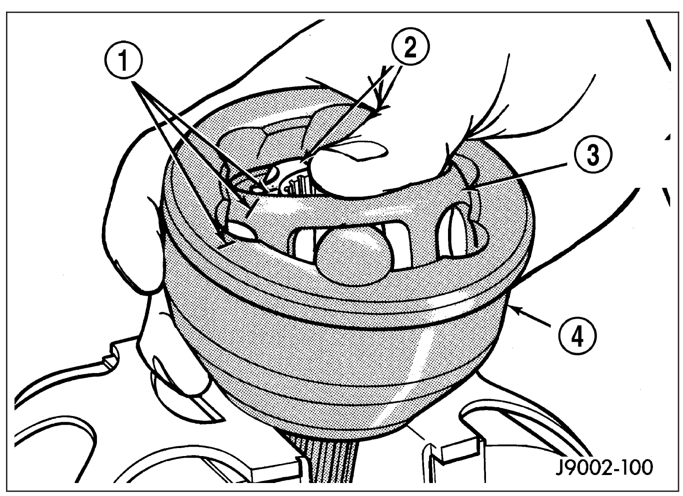
2. Remove clamps (2) (4) with a cut-off wheel or grinder.




3. Slide the boot down the shaft.
4. Remove lubricant to expose the C/V joint snap ring.
5. Spread snap ring (1) and slide the joint off the shaft.



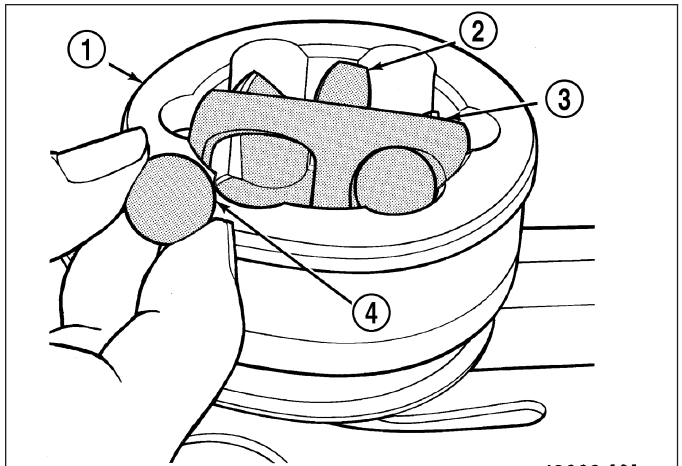

6. Slide boot off the shaft and discard old boot.
7. Mark alignment marks (1) on the inner race/hub (2), bearing cage (3) and housing with dabs of paint.



8. Clamp C/V joint in a vertical position in a soft jawed vise.
9. Press down one side of the bearing cage (3) to gain access to the ball at the opposite side.

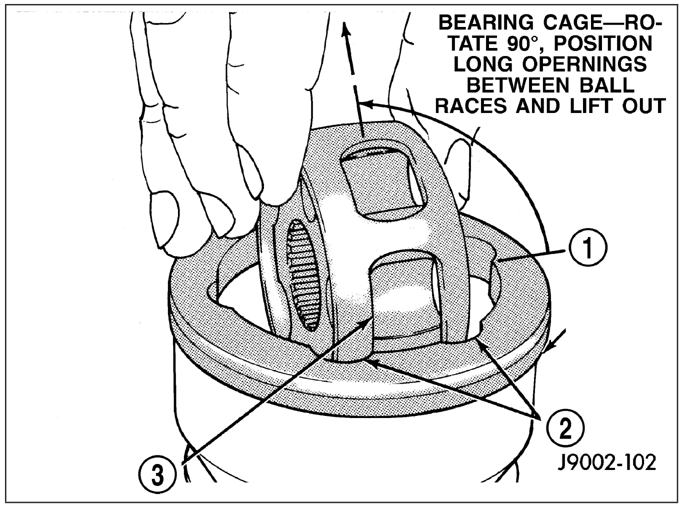
**NOTE: If joint is tight, use a hammer and brass drift to loosen the bearing hub. Do not contact the bearing cage with the drift.**

10. Remove ball (4) from the bearing cage (3).



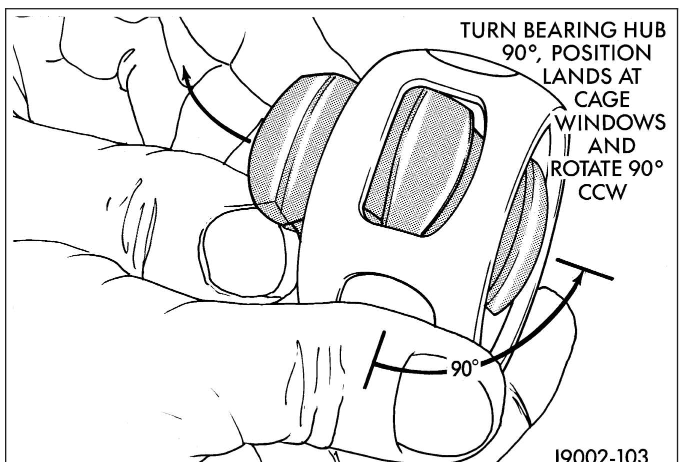
J9002-101

11. Repeat step above until all six balls are removed from the bearing cage.
12. Lift cage and inner race (2) upward and out from the housing (1).



J9002-102

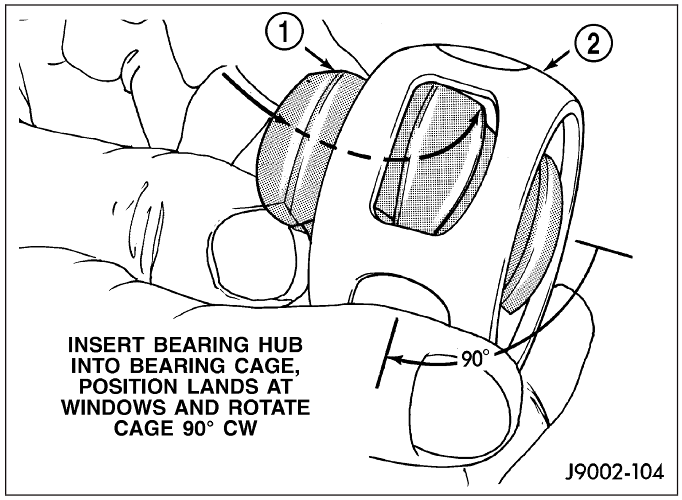
13. Turn inner race 90° in the cage and rotate the inner race/hub out of the cage.



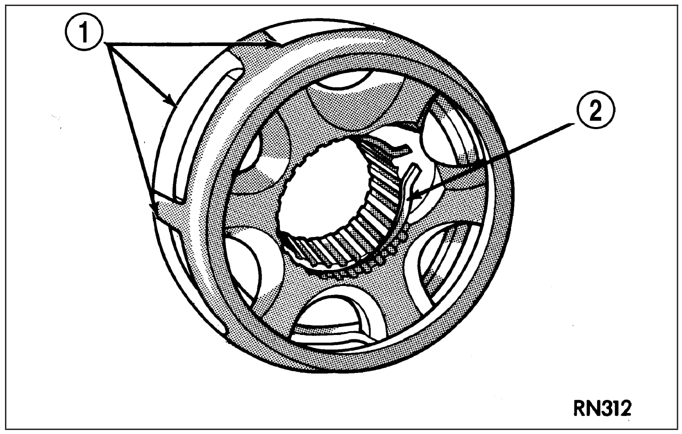
J9002-103

## INSTALLATION

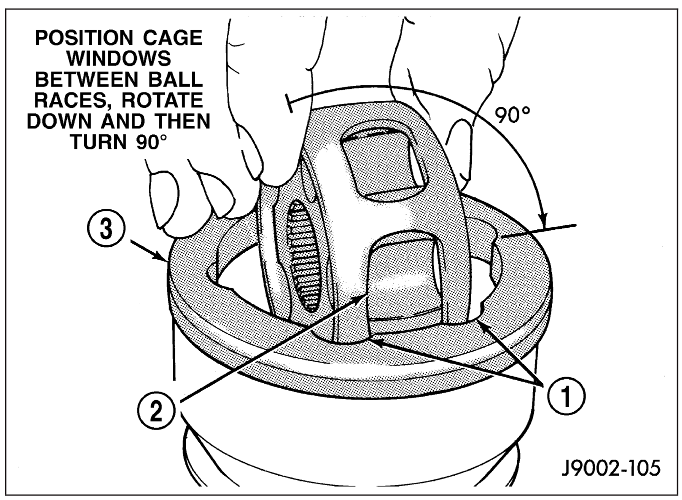
1. Apply a light coat of grease to the C/V joint components before assembling them.
2. Align inner race, cage and housing according to the alignment reference marks.
3. Insert inner race (1) into the cage (2) and rotate race into the cage.



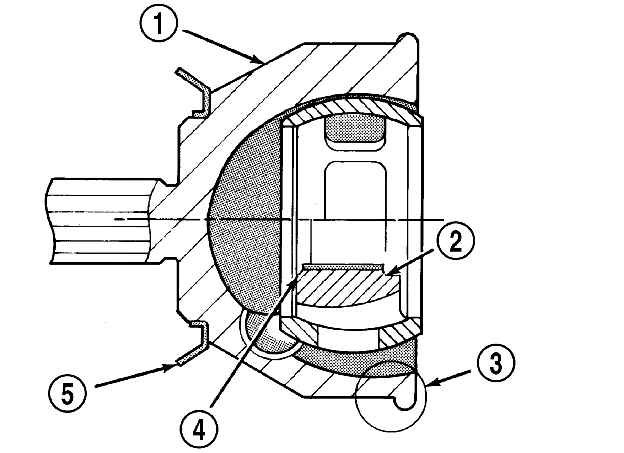

4. Rotate inner race/hub in the cage (1).




5. Insert cage into the housing (3).

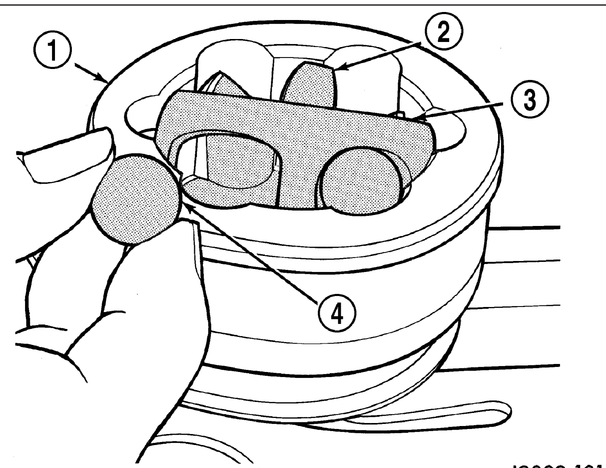


6. Rotate cage 90° into the housing (1).



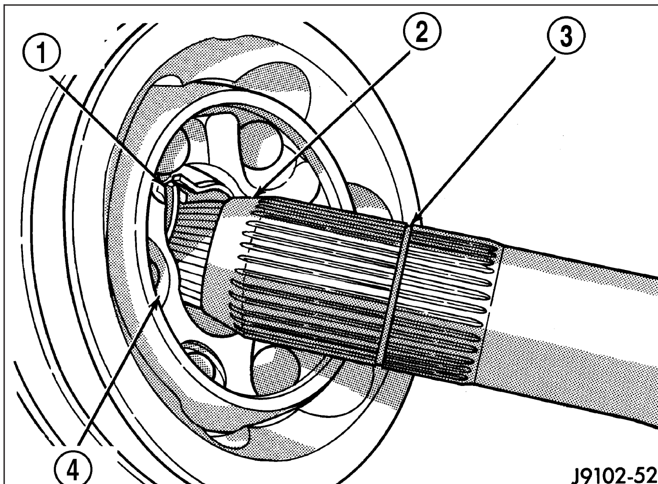
J9102-43

7. Apply lubricant included with replacement boot/joint to the ball races. Spread lubricant equally between all the races.
8. Tilt inner race/hub (2) and cage (3) and install the balls (4).



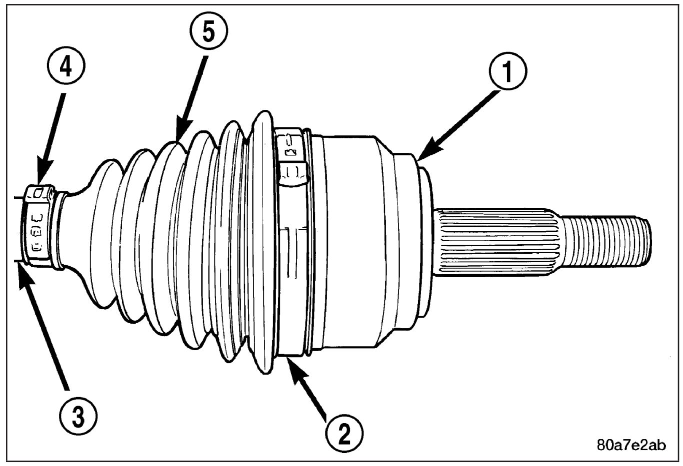
J9002-101

9. Place new clamps onto new boot and slide boot onto the shaft to it's original position.
10. Apply the rest of lubricant to the C/V joint and boot.
11. Push the joint onto the shaft until the snap ring (1) seats in the groove (3). Pull on the joint to verify the span ring has engaged.



J9102-52

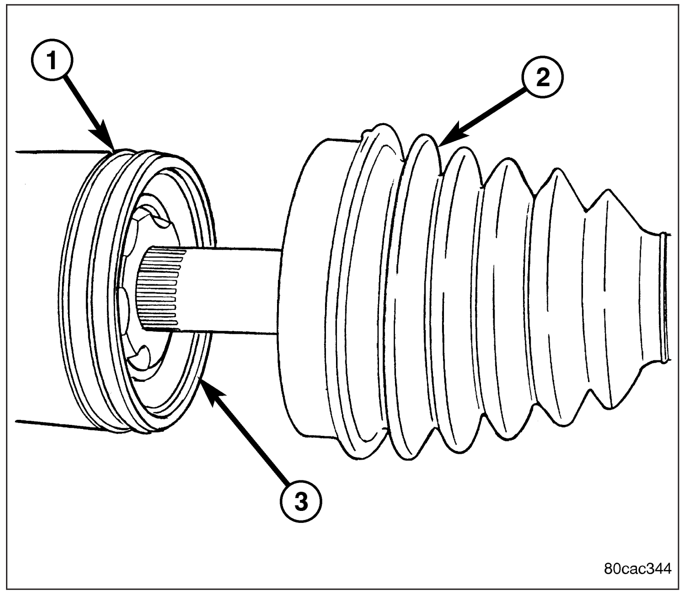
12. Position boot on the joint in it's original position. Ensure boot is not twisted and remove any excess air.
13. Secure both boot clamps (2) (4) with Clamp Installer C-4975A. Place tool on clamp bridge and tighten tool until the jaws of the tool are closed.



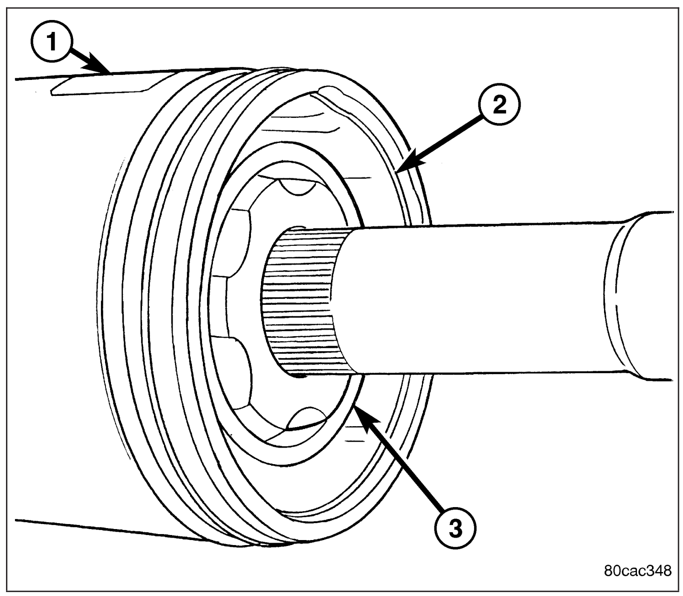
# JOINT/BOOT-C/V INNER

## REMOVAL

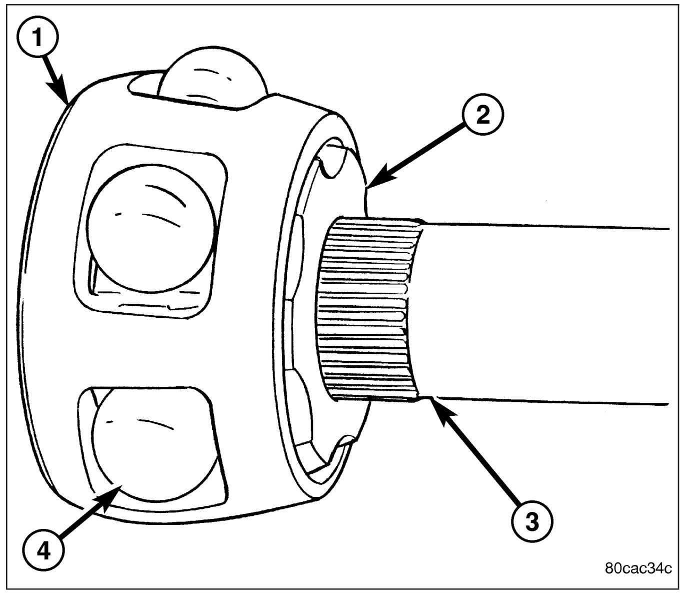
1. Clamp shaft in a vise (with soft jaws) and support C/V joint (1).
2. Remove clamps with a cut-off wheel or grinder.
3. Slide boot down (2) the shaft.



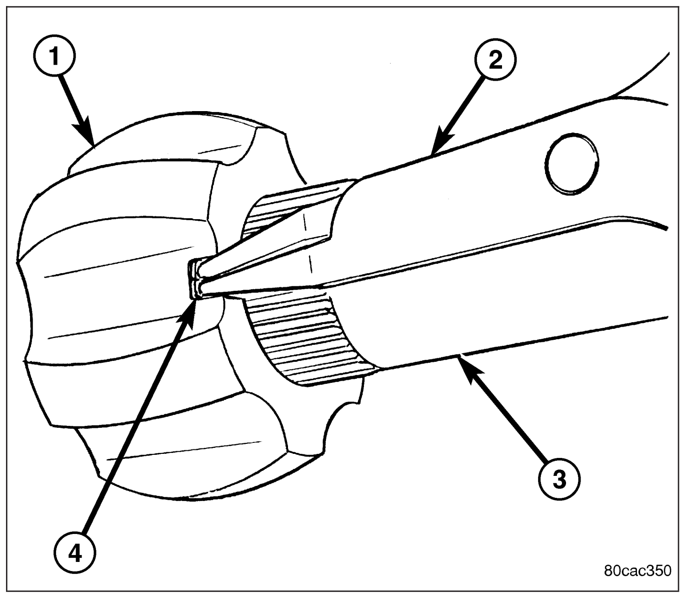

4. Remove lubricant from housing (1) to expose the C/V snap ring (2) and remove snap ring.



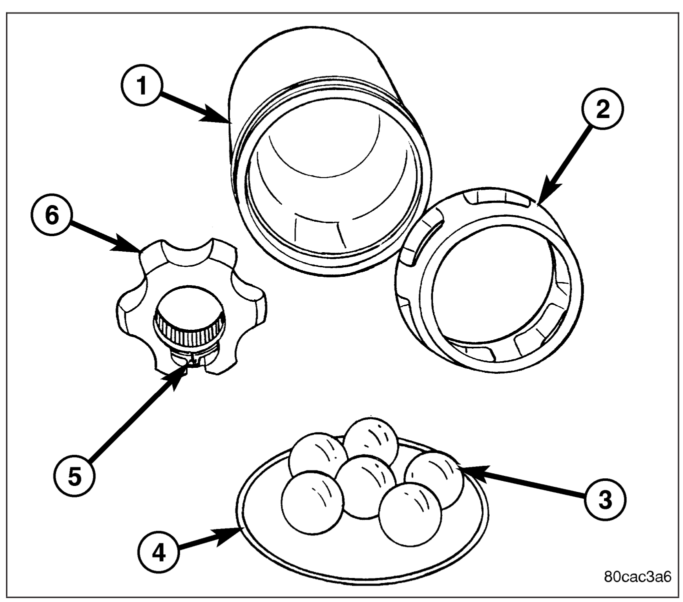
5. Remove bearings (4) from the cage (1).
6. Rotate cage (1) 30° and slide cage off the inner race (2) and down the shaft (3).




7. Remove spread inner race (1) snap ring (4) and remove race (1) from the shaft (3).
8. Remove boot from the shaft and discard.

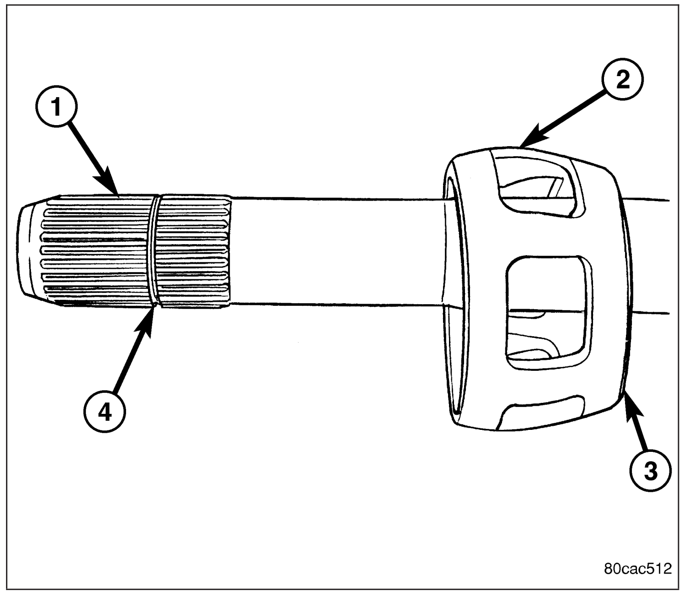



9. Clean and inspect housing (1), cage (2), bearings (3), housing snap-ring (4), inner race snap-ring (5) and inner race (6) for wear or damage.

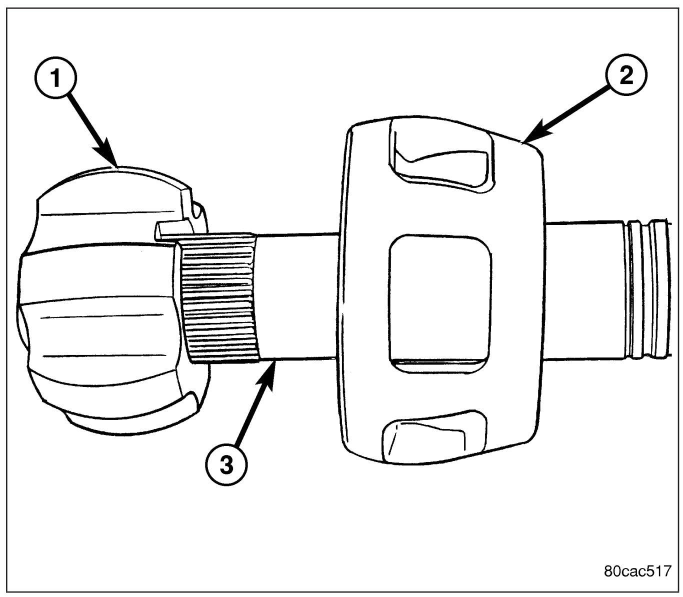


## INSTALLATION

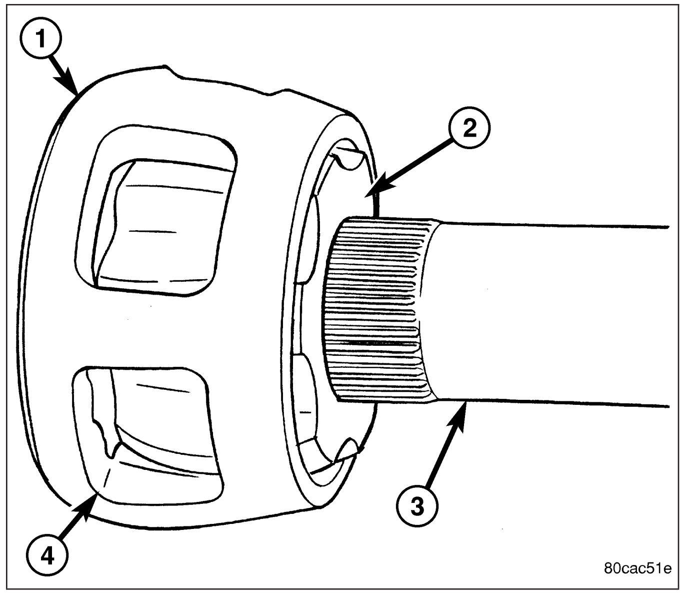
1. Apply a coat of grease supplied with the joint/boot to the C/V joint components before assembling them.
2. Place new clamps on the new boot and slide boot down the shaft.
3. Slide cage (2) onto the shaft (1) with the small diameter (3) end towards the boot.



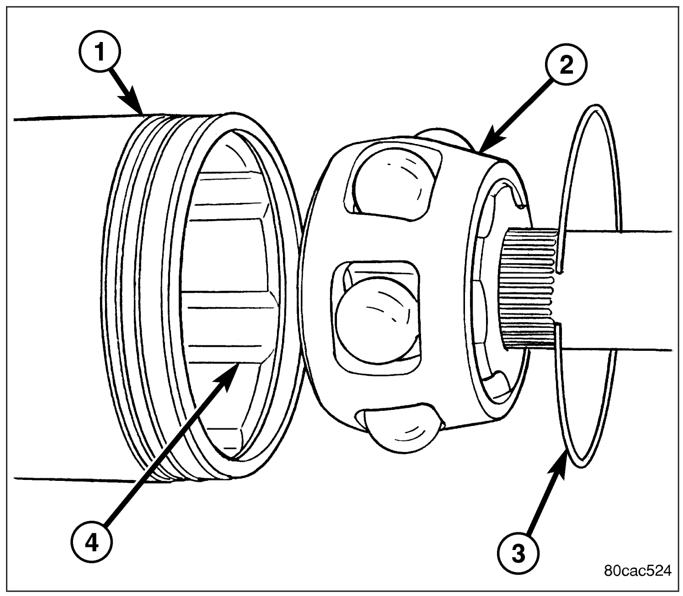

4. Install the inner race (1) onto the shaft (3). Pull on the race to verify snap ring has engaged.



5. Align cage (1) with the inner race (2) and slide over the race.
6. Turn the cage 30° to align the cage windows (4) with the race (2).




7. Apply grease to the inner race and bearings and install the bearings.
8. Apply grease to the housing bore (4) then install the bearing assembly (2) into the housing (1).
9. Install the housing snap ring (3) and verify it is seated in the groove.
10. Fill the housing and boot with the remaining grease.
11. Slide the boot onto the C/V housing into it's original position. Ensure boot is not twisted and remove any excess air.
12. Secure both boot clamps with Clamp Installer C-4975A. Place tool on clamp bridge and tighten tool until the jaws of the tool are closed.



# FRONT AXLE - 186FIA

## TABLE OF CONTENTS

# FRONT AXLE - 186FIA

## DIAGNOSIS AND TESTING

## FRONT AXLE - 186FIA

### GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, worn/damaged gears or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak-noise range. If the noise stops or changes greatly check for:

- Insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side and pinions gears, usually do not cause noise during straight-ahead driving, when the gears are unloaded. The side gears are loaded during turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

### BEARING NOISE

Bearing noise can be either a whining or a growling sound.

**Pinion bearings** have a constant high pitch noise, because it rotates at a faster rate. This noise changes with vehicle speed. If noise is heard under a load, the rear pinion bearing is the source. If noise is heard during a coast, the front pinion bearing is the source.

**Differential bearings** usually produce a low pitch noise. The differential bearing noise is constant and varies only with vehicle speed.

**Axle shaft bearing** noise generally changes when the bearings are loaded. Turn vehicle sharply to the left and the right during a road test. This will load and unload the bearings and change the noise level. If axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 m.p.h.

### LOW SPEED KNOCK

Low speed knock is generally caused by:

- Worn U-joints/CV joint.
- Worn side-gear thrust washers.
- Worn pinion shaft bore.

### VIBRATION

Vibration at the rear of the vehicle is usually caused by:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out-of-balance wheels.
- Loose wheel lug nuts.
- Worn U-joints/CV joint.
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

Check for loose or damaged front-end components or engine/transmission mounts. These components can contribute to what appears to be an axle vibration. Also look at engine accessories, brackets and drive belts.

**NOTE: All driveline components should be examined before starting any repair.**

## DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear or the clutch engaged, can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U-joints/CV joint.
- Loose spring mounts.
- Loose pinion gear nut and yoke.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

To determined the source of a snap/clunk noise, raise vehicle on a hoist with the wheels free to rotate. Have a helper shift the transmission into gear and listen for the noise.

**DIAGNOSTIC CHART**

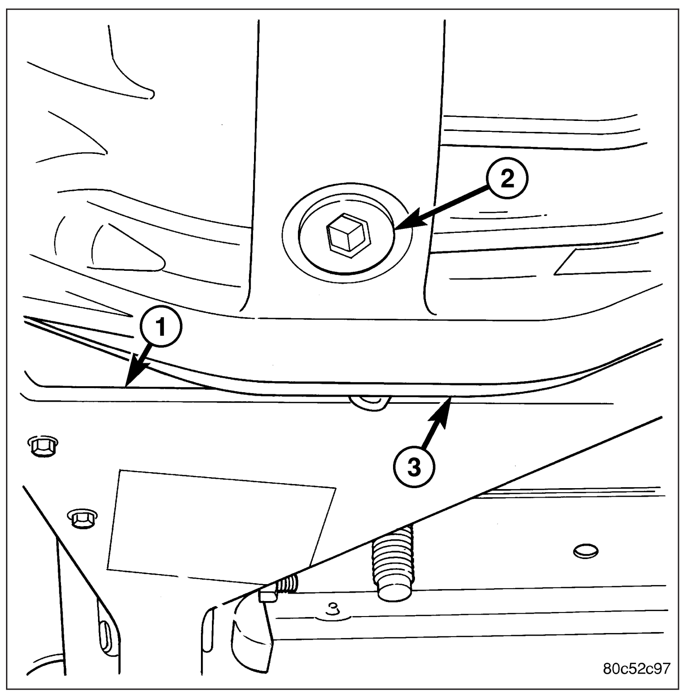
| Condition | Possible Causes | Correction |
|---|---|---|
| Wheel Noise | 1. Wheel loose. | 1. Tighten loose nuts. |
| | 2. Worn wheel bearing. | 2. Replace bearing. |
| Axle Shaft Noise | 1. Misaligned axle tube. | 1. Inspect axle tube alignment. Correct as necessary. |
| | 2. Bent or sprung axle shaft. | 2. Inspect and correct as necessary. |
| | 3. End-play in pinion bearings. | 3. Refer to pinion pre-load information and correct as necessary. |
| | 4. Excessive gear backlash between the ring gear and pinion. | 4. Check adjustment of the ring gear and pinion backlash. Correct as necessary. |
| | 5. Improper adjustment of pinion gear bearings. | 5. Adjust the pinion bearings pre-load. |
| | 6. Loose pinion yoke nut. | 6. Tighten the pinion yoke nut. |
| | 7. Scuffed gear tooth contact surfaces. | 7. Inspect and replace as necessary. |
| Axle Shaft Broke | 1. Misaligned axle tube. | 1. Replace the broken shaft after correcting tube mis-alignment. |
| | 2 Vehicle overloaded. | 2. Replace broken shaft and avoid excessive weight on vehicle. |
| | 3. Erratic clutch operation. | 3. Replace broken shaft and avoid or correct erratic clutch operation. |
| | 4. Grabbing clutch. | 4. Replace broken shaft and inspect and repair clutch as necessary. |

| Condition | Possible Causes | Correction |
|---|---|---|
| Differential Cracked | 1. Improper adjustment of the differential bearings. | 1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly. |
| | 2. Excessive ring gear backlash. | 2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly. |
| | 3. Vehicle overloaded. | 3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight. |
| | 4. Erratic clutch operation. | 4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch. |
| Differential Gears Scored | 1. Insufficient lubrication. | 1. Replace scored gears. Fill differential with the correct fluid type and quantity. |
| | 2. Improper grade of lubricant. | 2. Replace scored gears. Fill differential with the correct fluid type and quantity. |
| | 3. Excessive spinning of one wheel/tire. | 3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary. |
| Loss Of Lubricant | 1. Lubricant level too high. | 1. Drain lubricant to the correct level. |
| | 2. Worn axle shaft seals. | 2. Replace seals. |
| | 3. Cracked differential housing. | 3. Repair as necessary. |
| | 4. Worn pinion seal. | 4. Replace seal. |
| | 5. Worn/scored yoke. | 5. Replace yoke and seal. |
| | 6. Axle cover not properly sealed. | 6. Remove, clean and seal cover. |
| Axle Overheating | 1. Lubricant level low. | 1. Fill differential to correct level. |
| | 2. Improper grade of lubricant. | 2. Fill differential with the correct fluid type and quantity. |
| | 3. Bearing pre-loads too high. | 3. Adjust bearing pre-loads. |
| | 4. Insufficient ring gear backlash. | 4. Adjust ring gear backlash. |
| Gear Teeth Broke | 1. Overloading. | 1. Replace gears. Examine other gears and bearings for possible damage. |
| | 2. Erratic clutch operation. | 2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation. |
| | 3. Ice-spotted pavement. | 3. Replace gears and examine remaining parts for damage. |
| | 4. Improper adjustments. | 4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct. |

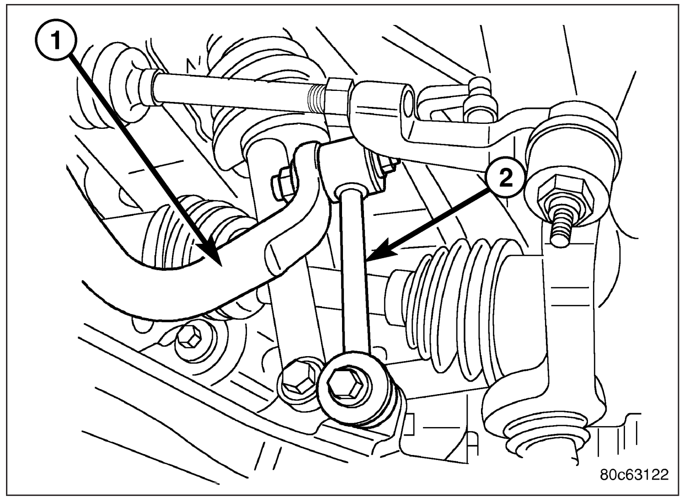
| Condition | Possible Causes | Correction |
|---|---|---|
| Axle Noise | 1. Insufficient lubricant. | 1. Fill differential with the correct fluid type and quantity. |
| | 2. Improper ring gear and pinion adjustment. | 2. Check ring gear and pinion contact pattern. |
| | 3. Unmatched ring gear and pinion. | 3. Replace gears with a matched ring gear and pinion. |
| | 4. Worn teeth on ring gear or pinion. | 4. Replace ring gear and pinion. |
| | 5. Loose pinion bearings. | 5. Adjust pinion bearing pre-load. |
| | 6. Loose differential bearings. | 6. Adjust differential bearing pre-load. |
| | 7. Ring gear run-out. | 7. Measure ring gear run-out. Replace components as necessary. |
| | 8. Loose differential bearing cap bolts. | 8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued to the proper specification. |
| | 9. Housing not machined properly. | 9. Replace housing. |

## REMOVAL

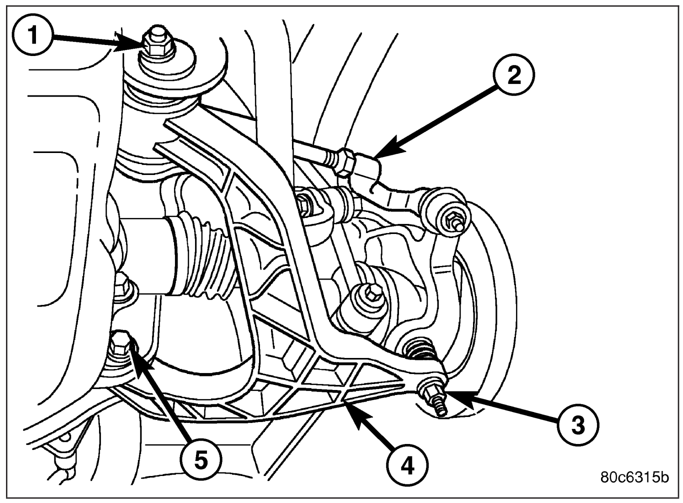
1. With vehicle in neutral, position vehicle on hoist.
2. Remove skid plate.
3. Remove differential housing (3) drain plug (2) and drain fluid.



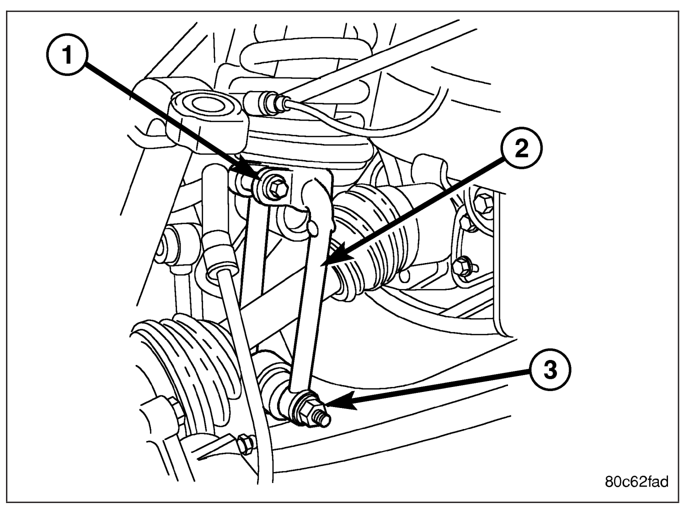
4. Mark front propeller shaft and pinion flange. Remove propeller shaft from pinion flange.
5. Remove half shaft hub nuts.
6. Remove stabilizer bar (1) links (2) from the lower control arms.




7. Remove tie rod end (2) nuts and separate ends from the knuckles.
8. Remove lower ball joint nuts (3) and separate ball joints from the lower control arms (4).



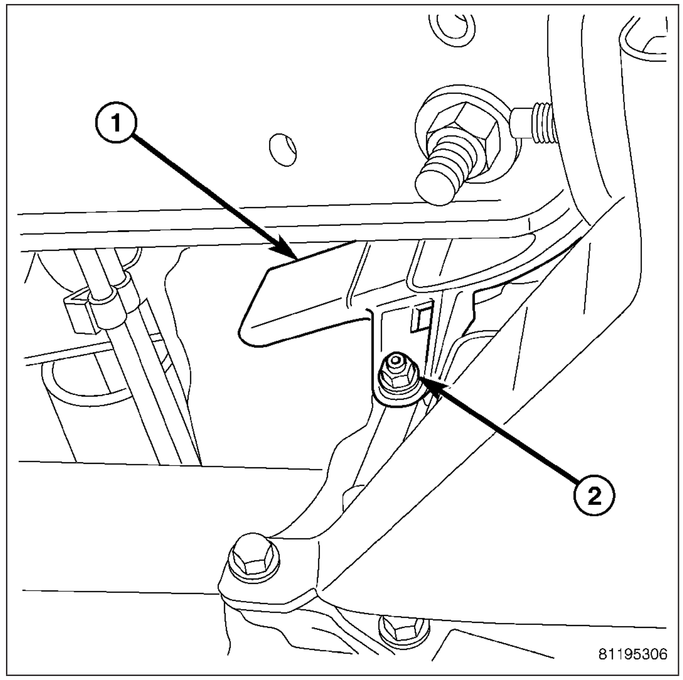

9. Remove shock clevis (2) lower bolts (3).
10. Pull out on the steering knuckles and push the half shaft out of the knuckles.



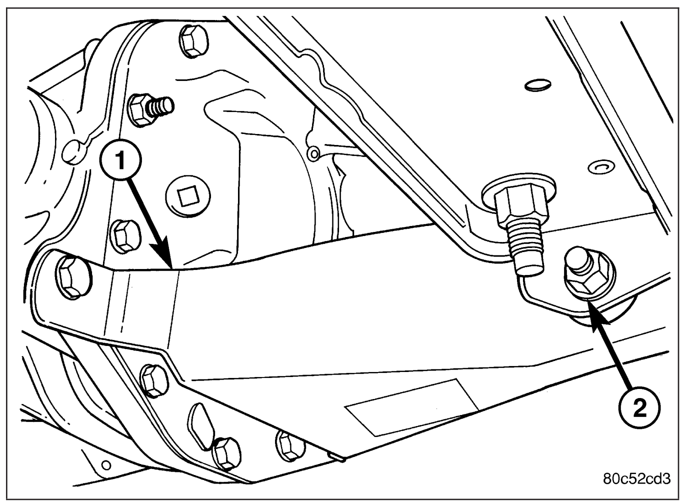
11. With a pry bar remove the half shafts from the axle.

**NOTE: Right half shaft has a splined axle that may come out with the half shaft.**

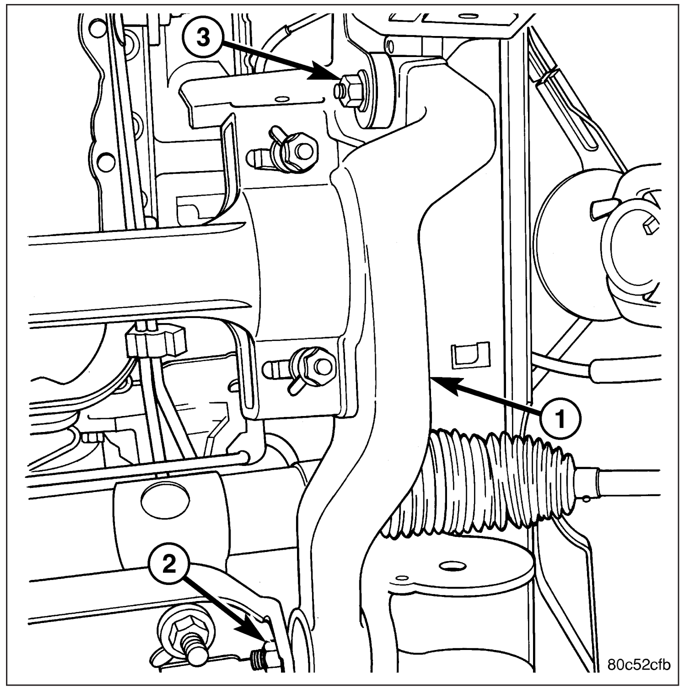
12. Remove differential vent hose from cover and remove drain trough (1) nut (2).



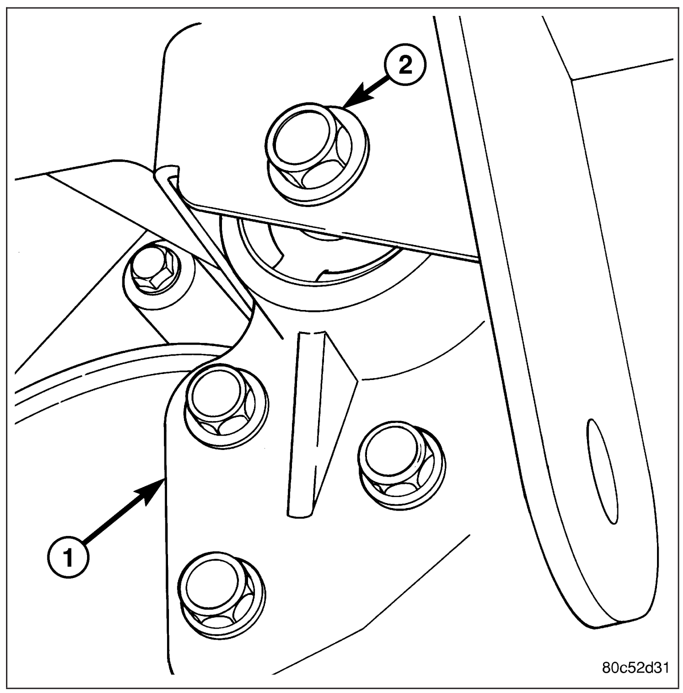

13. Support axle with a lift/jack.
14. Remove bolts from left front axle bracket (1) and cradle bracket bolt.
15. Remove oil filter drip tray.



16. Mark and remove right control arm cam bolt.
17. Remove front bolt (2) and rear bolt (3) from right axle bracket (1) frame mounts.



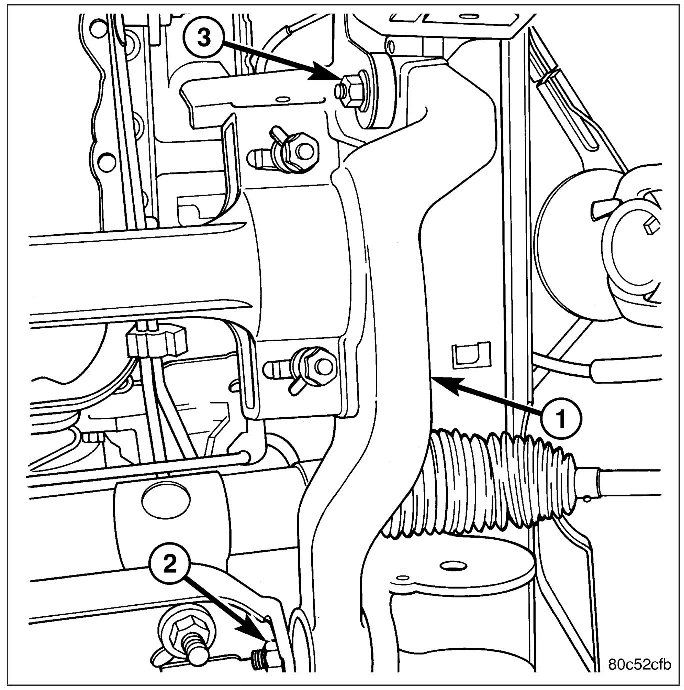

18. Remove bolt (2) from left rear axle bracket (1) frame mount.
19. Lower axle and from vehicle.



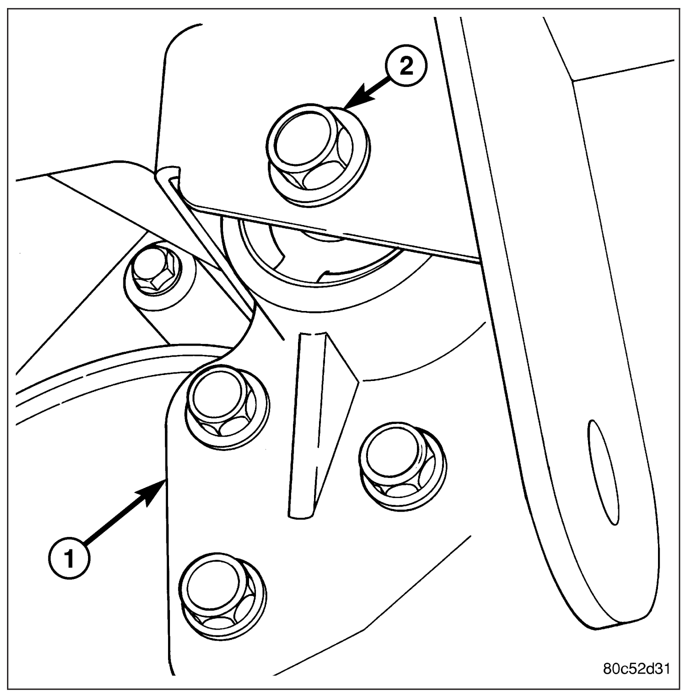
## INSTALLATION

**NOTE: Separate right axle shaft from the half shaft if necessary and install axle shaft in the axle.**

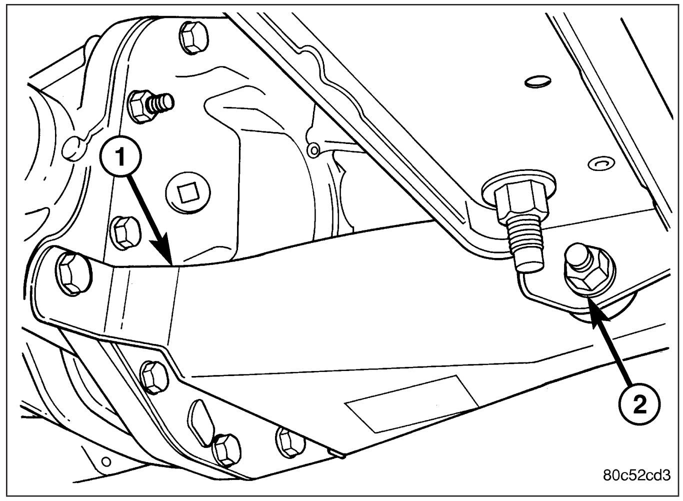
1. Install right bracket (1) to axle and tighten to 88 N·m (65 ft. lbs.).



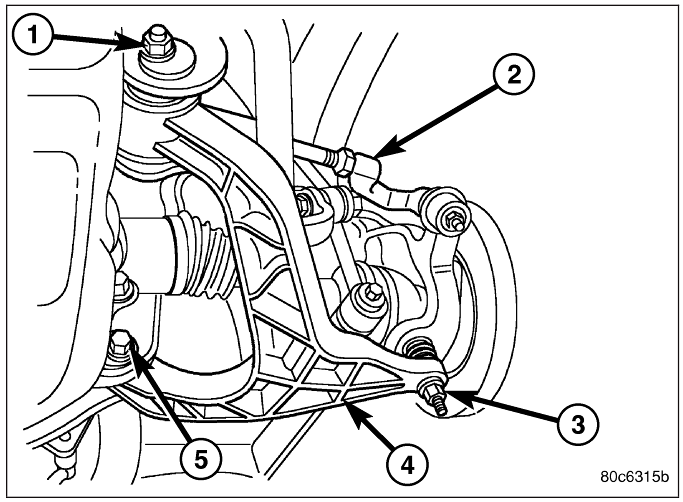

2. Install left rear bracket (1) to axle and tighten to 61 N·m (45 ft. lbs.).



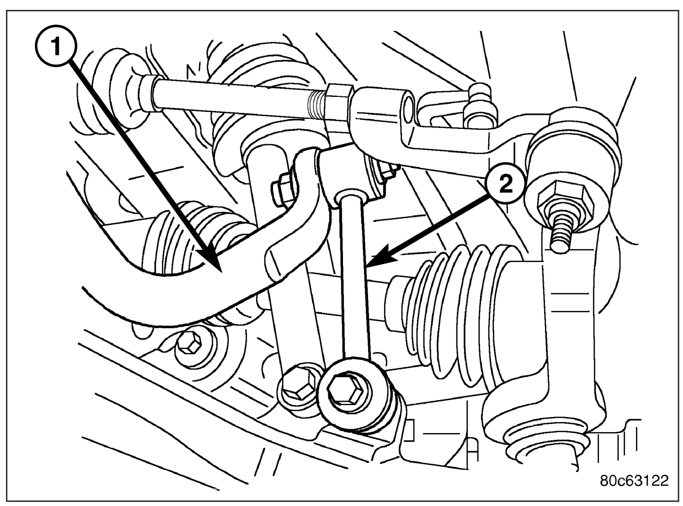
3. Install left front bracket (1) to axle and tighten to 61 N·m (45 ft. lbs.).
4. Raise axle up and align brackets with frame mounts.
5. Install frame mount bolts and tighten to 88 N·m (65 ft. lbs.).




6. Install half shafts.
7. Install right front control arm cam bolt (1) with marks aligned.
8. Install lower ball joint into lower control arms (4) and tighten nuts (3).
9. Align clevis with knuckles and install clevis bolts.



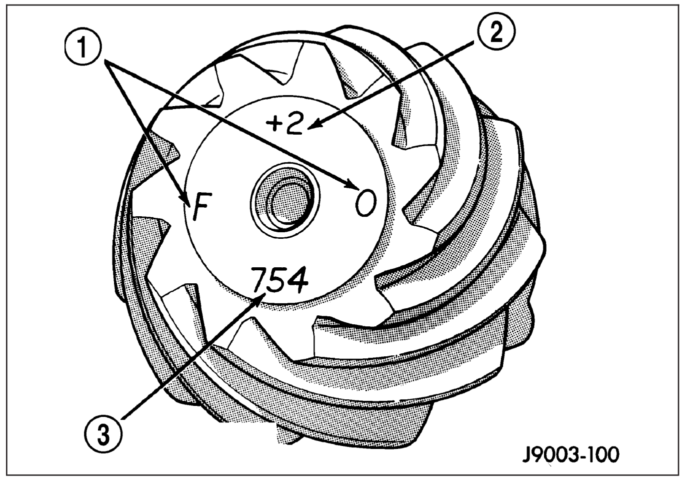

10. Install stabilizer bar (1) links (2) to lower control arms and install bolts.
11. Install oil filter trough.
12. Install new half shaft hub nuts and tighten to 136 N·m (100 ft. lbs.).
13. Install propeller shaft.
14. Install axle vent hose.
15. Fill differential with gear lubricant.
16. Install skid plate.
17. Tighten clevis and stabilizer links bolts to specifications.
18. Check vehicle alignment.



## ADJUSTMENTS

## PINION DEPTH-BEARING PRELOAD-GEAR BACKLASH

Ring and pinion gears are supplied as matched sets. Gear match numbers (3) for the ring and pinion gear are etched onto each gear. A plus (+) number, minus (–) number or zero (0) is etched into the face of the pinion gear (2). This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0).




Compensation for pinion depth variance is achieved with a select shim/oil slinger. The shims are placed between the rear pinion bearing and the pinion gear head.

If installing a new gear, note the depth variance number of the original and replacement pinion. Add or subtract this number from the original depth shim/oil slinger to compensate for the difference in the depth variances. The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim.

**Pinion Gear Depth Variance Chart**: Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

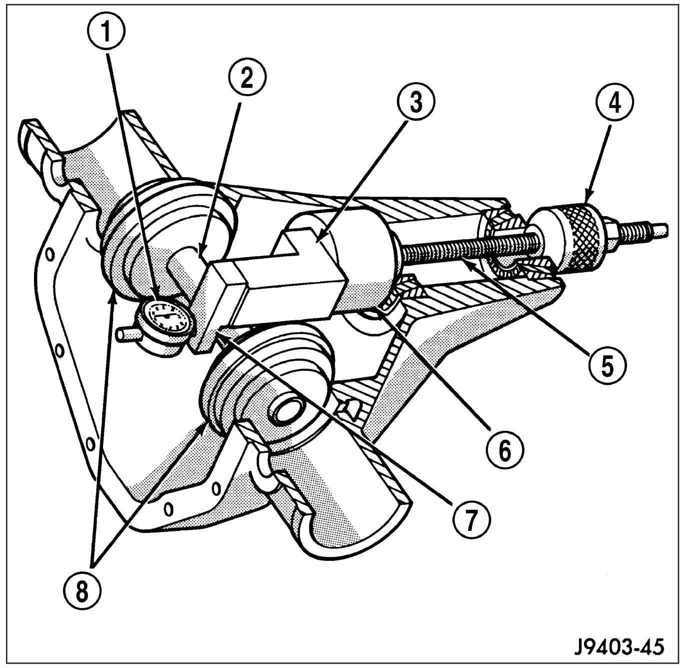
**PINION GEAR DEPTH VARIANCE**

| Original Pinion Gear Depth Variance | Replacement Pinion Gear Depth Variance | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | −4 | −3 | −2 | −1 | 0 | +1 | +2 | +3 | +4 |
| **+4** | +0.008 | +0.007 | +0.006 | +0.005 | +0.004 | +0.003 | +0.002 | +0.001 | 0 |
| **+3** | +0.007 | +0.006 | +0.005 | +0.004 | +0.003 | +0.002 | +0.001 | 0 | −0.001 |
| **+2** | +0.006 | +0.005 | +0.004 | +0.003 | +0.002 | +0.001 | 0 | −0.001 | −0.002 |
| **+1** | +0.005 | +0.004 | +0.003 | +0.002 | +0.001 | 0 | −0.001 | −0.002 | −0.003 |
| **0** | +0.004 | +0.003 | +0.002 | +0.001 | 0 | −0.001 | −0.002 | −0.003 | −0.004 |
| **−1** | +0.003 | +0.002 | +0.001 | 0 | −0.001 | −0.002 | −0.003 | −0.004 | −0.005 |
| **−2** | +0.002 | +0.001 | 0 | −0.001 | −0.002 | −0.003 | −0.004 | −0.005 | −0.006 |
| **−3** | +0.001 | 0 | −0.001 | −0.002 | −0.003 | −0.004 | −0.005 | −0.006 | −0.007 |
| **−4** | 0 | −0.001 | −0.002 | −0.003 | −0.004 | −0.005 | −0.006 | −0.007 | −0.008 |

## PINION DEPTH MEASUREMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the housing. Take measurements with Pinion Gauge Set and Dial Indicator C-3339 (1).

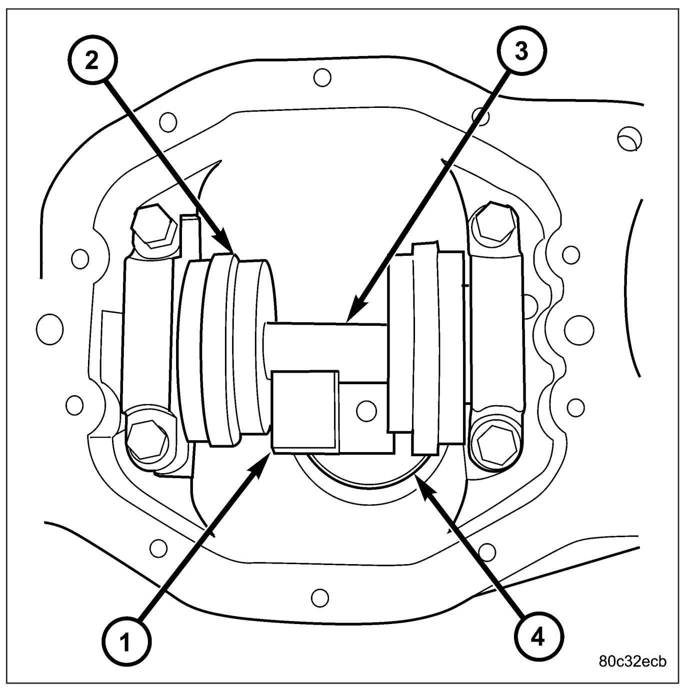
1. Assemble Pinion Height Block 6739 (3), Pinion Block 8804 (6) and rear pinion bearing onto Screw 6741(5).
2. Insert height gauge components into the housing through pinion bearing cups.
3. Install front pinion bearing and Cone-nut 6740 (4) onto the screw. Tighten Cone-Nut until Torque To Rotate screw is 1.7 N·m (15 in. lbs.).



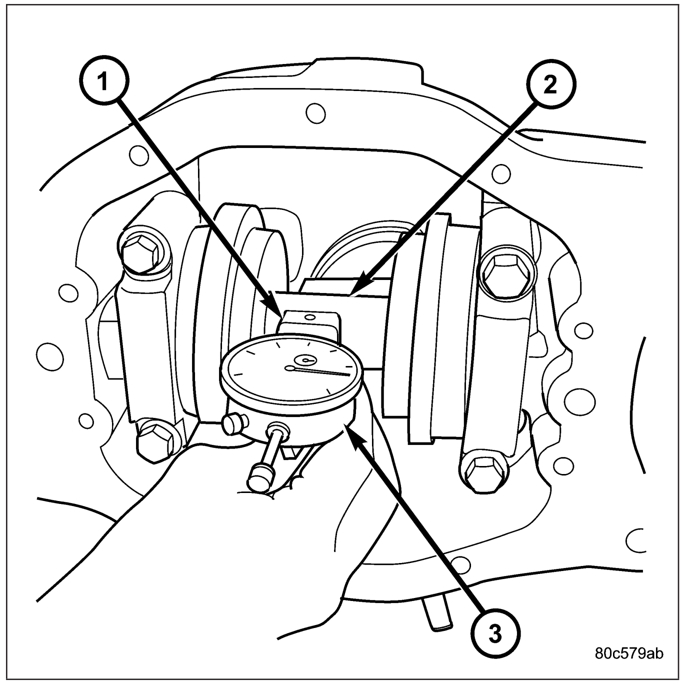

4. Position Arbor Disc 6732 (2) and Arbor D-115-3 (3) into the housing bearing cradles. Install differential bearing caps on Arbor Discs and tighten bolts to 41 N·m (30 ft. lbs.).

**NOTE: Arbor Discs 6732 has different step diameters to fit other axles. Choose proper step for axle being serviced.**

5. Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.

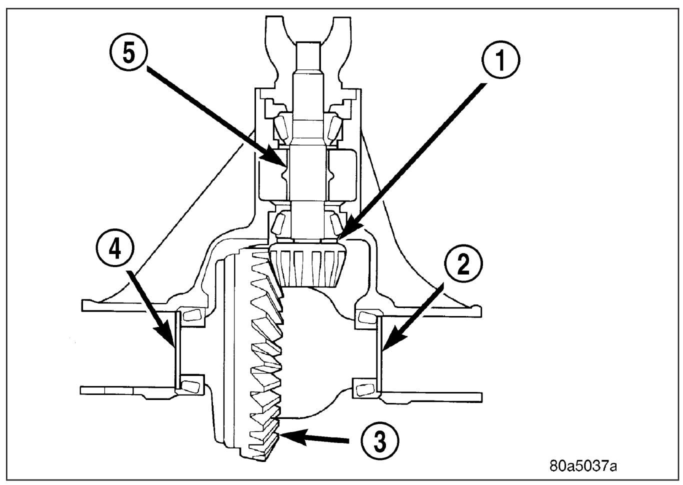


6. Position Scooter Block (1) with Dial Indicator (3) flush on the pinion height block. Hold the scooter block and zero the dial indicator.
7. Slowly slide the scooter block across the pinion height block over to the arbor (2). Move the scooter block till the dial indicator probe crests the arbor (2) and record the highest reading.
8. Select a shim/oil slinger equal to the dial indicator reading plus the pinion depth variance number etched in the face of the pinion. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.




## DIFFERENTIAL SIDE BEARING PRELOAD AND GEAR BACKLASH

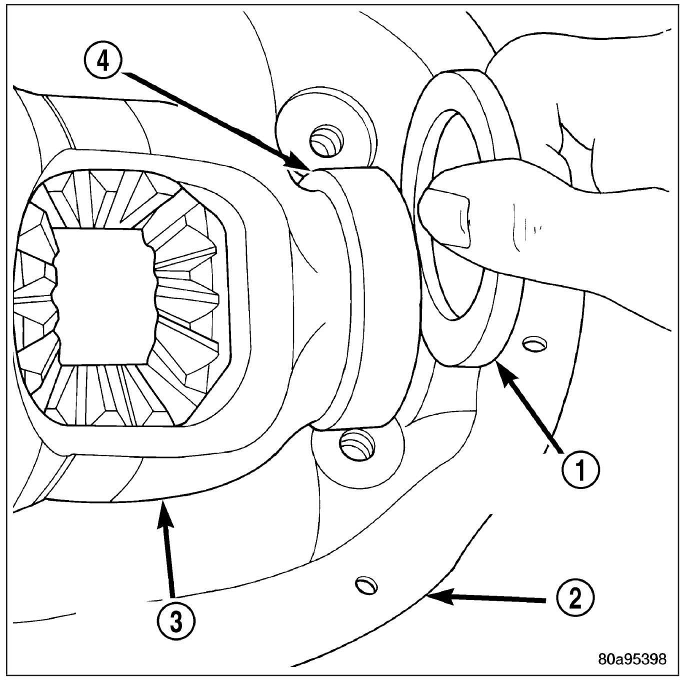
Differential bearing preload and gear backlash is achieved with selective shims (2) (4) located between the differential bearing cups and differential housing. The proper shim thickness can be determined using slip-fit Dummy Bearings D-348 in place of the differential side bearings and a Dial Indicator C-3339. Before measuring differential bearing preload and gear backlash, measure pinion gear depth and prepare pinion for installation. Pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After measuring shim thickness to take up differential side play, install pinion and measure gear backlash shim thickness. Overall shim thickness is the dial indicator reading and preload specification added together. The gear backlash measurement determines the shim thickness used on the ring gear side of the differential case. Subtract gear backlash shim thickness from overall shim thickness to determine shim thickness for pinion gear side of the differential. Differential shim measurements are performed with spreader W-129-B removed.



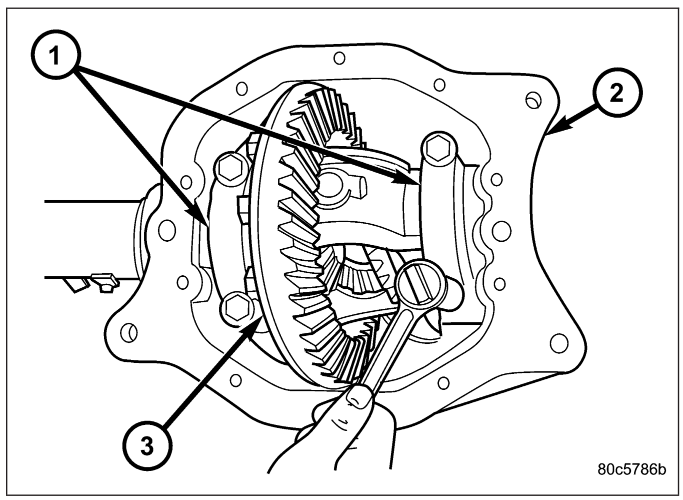
## PRELOAD SHIM SELECTION

**NOTE: It is difficult to salvage the differential side bearings during the removal procedure. Install replacement bearings if necessary.**

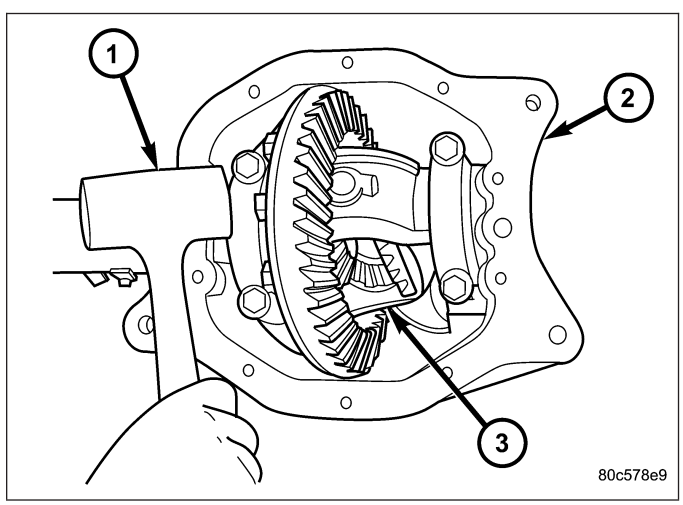
1. Remove differential side bearings from differential case.
2. Install ring gear on differential case and tighten bolts to specification.
3. Install Dummy Bearings D-348 (4) on differential case (3).
4. Install differential case in the housing.
5. Record the thickness of Dummy Shims 8107 (1). Insert the shims between the dummy bearings and the differential housing (2).



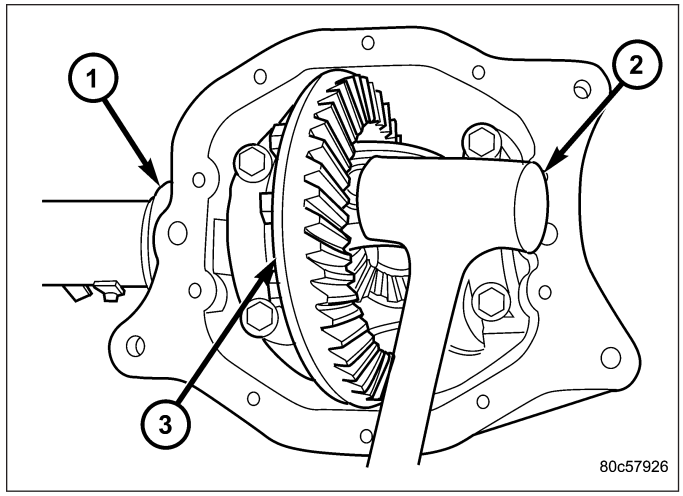

6. Install the bearing caps (1) in their correct positions and snug the bolts (3).



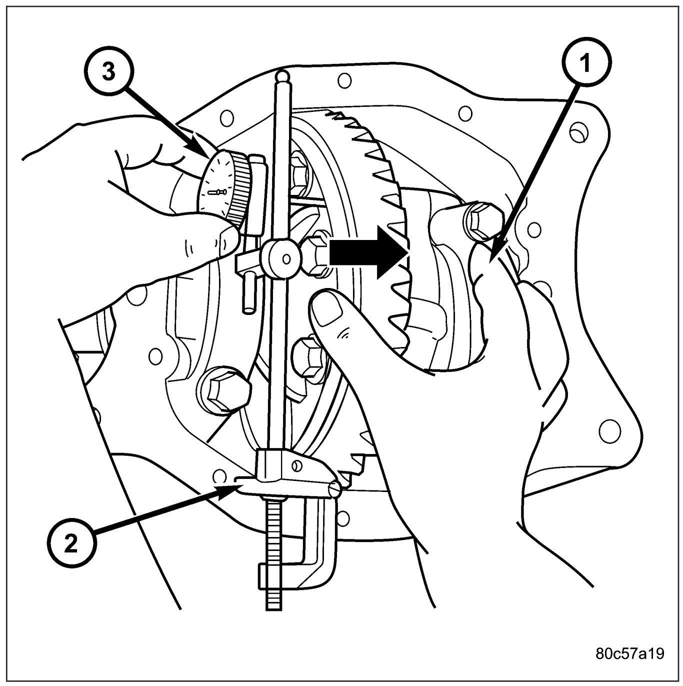

7. With a dead-blow hammer (1), seat differential dummy bearing to pinion side of the housing (2).



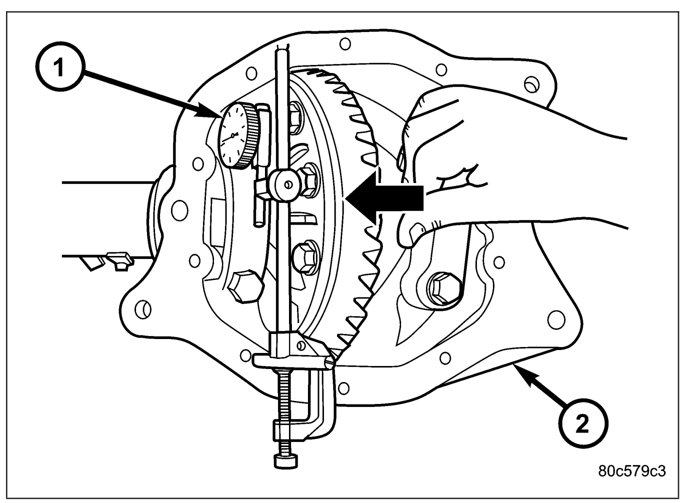
8. With a dead-blow hammer (2), seat differential dummy bearing to the ring gear (3) side of the housing (1).



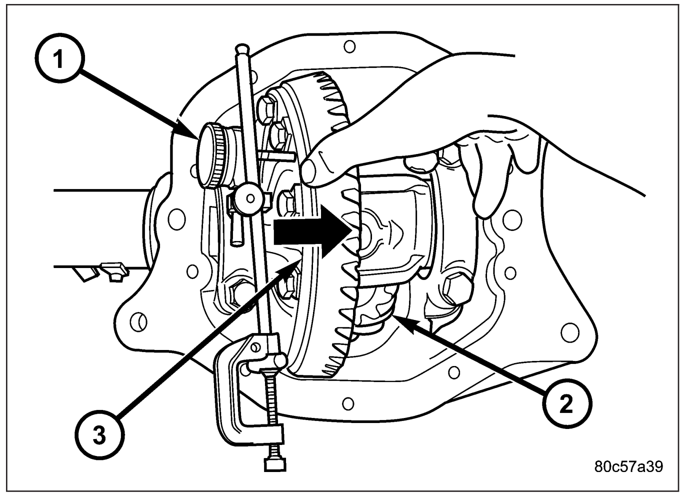

9. Thread Pilot Stud C-3288-B (2) into rear cover bolt hole below ring gear.
10. Attach a Dial Indicator C-3339 (3) to the Pilot Stud. Position the dial indicator plunger on flat surface between the ring gear bolts.
11. Push and hold differential case to pinion gear side (1) of the housing and zero dial indicator.



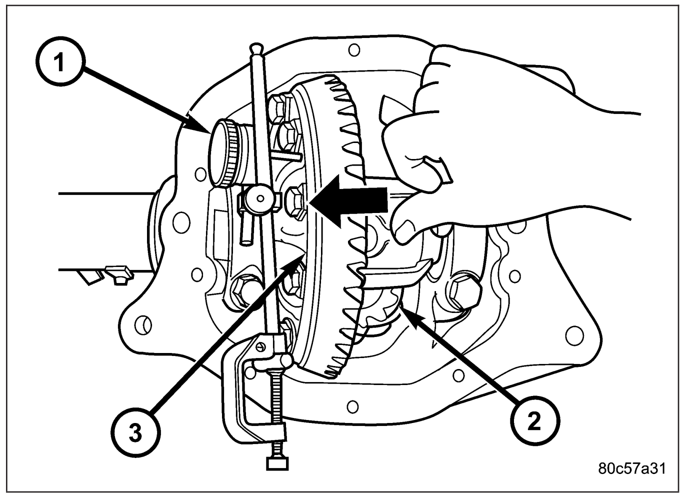

12. Push and hold differential case to ring gear side of the housing (2) and record dial indicator (1) reading.
13. Add 0.152 mm (0.006 in.) to the zero end play total. This new total represents the thickness of shims to compress or preload the new bearings when the differential is installed.
14. Rotate dial indicator out of the way on the pilot stud.
15. Remove differential case and dummy bearings from the housing.
16. Install the pinion gear in the housing. Install the pinion yoke and establish the correct pinion rotating torque.
17. Install differential case and Dummy Bearings D-348 in the housing.
18. Install a single dummy shim in the ring gear side. Install bearing caps and tighten bolts snug.



19. Seat ring gear side dummy bearing.
20. Position the dial indicator (1) plunger on a flat surface between the ring gear (3) bolt heads.
21. Push and hold differential case toward pinion gear (2) and zero dial indicator.




22. Push and hold differential case to ring gear side (3) of the housing and record dial indicator (1) reading. Add dummy shim thickness to this reading. This will be the total shim thickness to achieve zero backlash.
23. Subtract 0.076 mm (0.003 in.) from the dial indicator reading to compensate for backlash between ring and pinion gears. This total is the thickness shim required to achieve proper backlash.
24. Subtract the backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the axle housing.
25. Rotate dial indicator out of the way on pilot stud.
26. Remove differential case and dummy bearings from the housing.



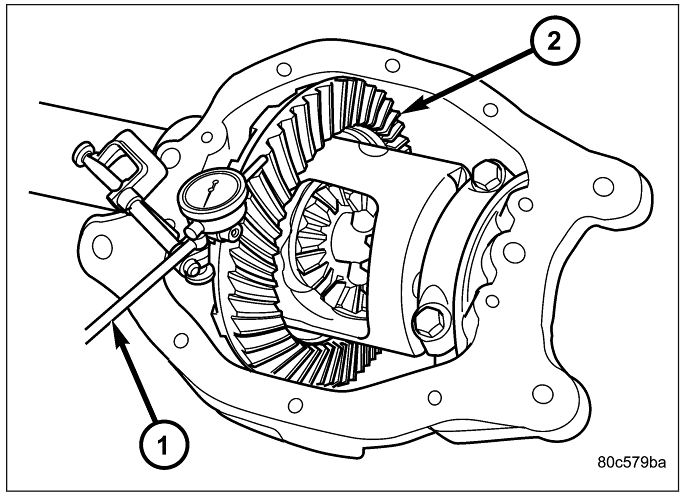

27. Install side bearings and cups on differential case.
28. Install spreader W-129-B with Adapter Set 6987 on the housing and spread axle opening enough to receive differential case.

**CAUTION: Never spread the differential housing over 0.34 mm (0.013 in.). If the housing is over-spread, it could be distorted or damaged.**

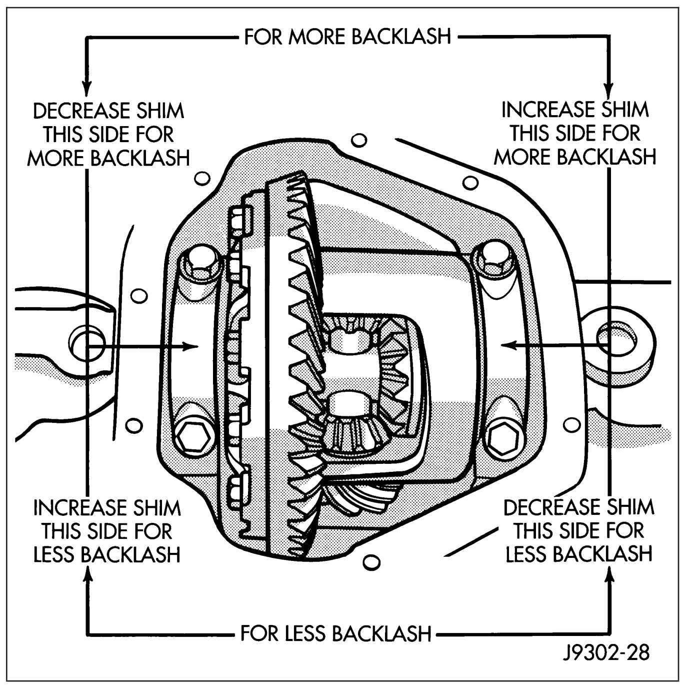
29. Place the bearing preload shims in the axle housing, against the axle tubes.
30. Install differential case into the housing.
31. Remove spreader from the housing.

## GEAR BACKLASH

1. Rotate the differential case several times to seat the side bearings.
2. Position the indicator plunger (1) against a ring gear tooth (2).
3. Push and hold ring gear upward while not allowing the pinion gear to rotate.
4. Zero dial indicator face to pointer.
5. Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm (0.005 in.) and 0.20 mm (0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the housing to the other.
6. Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.



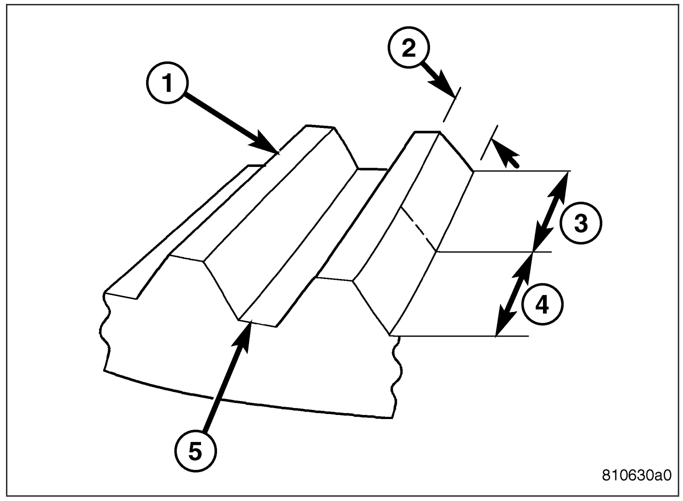

After the proper backlash is achieved, perform Gear Contact Pattern Analysis procedure.

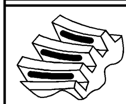
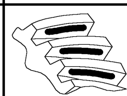
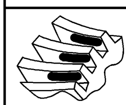
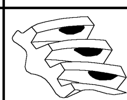
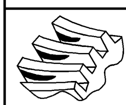
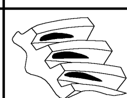
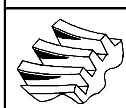
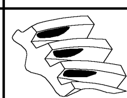
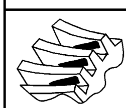
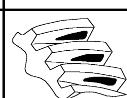


## GEAR CONTACT PATTERN

The ring gear and pinion teeth contact patterns will show if the pinion depth is correct in the housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

The TOP LAND (1) of the gear tooth is the top surface of the tooth. The PROFILE (2) of the gear tooth is the depth of the tooth. The TOE (3) of the gear is the portion of the tooth surface at the end towards the center. The HEEL (4) of the gear is the portion of the tooth at the outer-end. The ROOT (5) of the gear tooth is the lowest portion of the tooth.




| DRIVE SIDE HEEL TOE | CONDITION | COAST SIDE TOE HEEL | CONDITION | ACTION REQUIRED |
|---|---|---|---|---|
|  | **Desirable pattern.** The drive pattern should be centered on the tooth. There should be some clearance between the pattern and the top of the tooth. |  | **Desirable pattern.** The coast pattern should be centered on the tooth, but may be slightly toward the toe. There should be some clearance between the pattern and the top of the tooth. | None |
|  | **Top heel contact** |  | **Top toe contact** | Backlash correct. Thicker pinion position shim required. |
|  | **Root toe contact** |  | **Root heel contact** | Backlash correct. Thinner pinion position shim required. |
|  | **Top heel contact** |  | **Top heel contact** | Pinion position shim correct. Decrease backlash. |
|  | **Root toe contact** |  | **Root toe contact** | Pinion position shim correct. Increase backlash. |

8106312d

**NOTE: If the PROFILE across the tooth is the same it is a 3 Axis cut gear. If the PROFILE across the tooth is tapered it is a 2 Axis cut gear.**

1. Apply a thin coat of hydrated ferric oxide or equivalent to the drive and coast side of the ring gear teeth.
2. Wrap, twist and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.
3. With a boxed end wrench on a ring gear bolt, rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

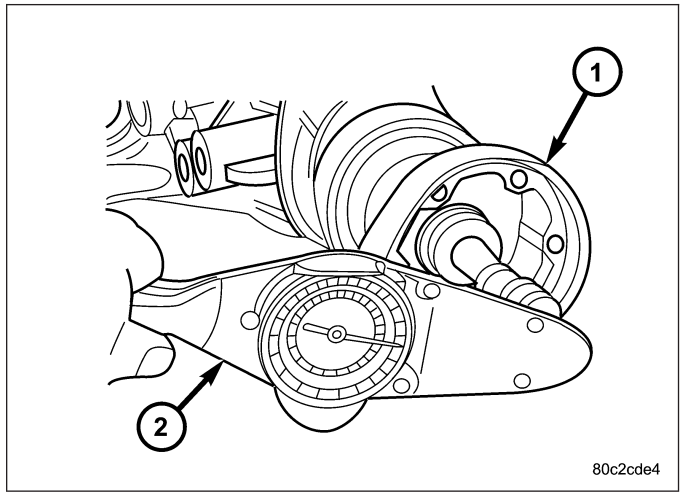
The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart and adjust pinion depth and gear backlash as necessary.

## DIFFERENTIAL BEARING PRELOAD CHECK

The final check on the differential assembly before installing the axles, is torque to rotate pinion (1) and differential combined with an inch pound torque wrench (2). This will verify the correct differential bearing preload.

Torque to rotate the differential and pinion is the torque to rotate the pinion plus:

- Gear Ratio 3.55 - 0.48-0.78 N·m (4.2-6.9 in. lbs.)
- Gear Ratio 3.73 - 0.45-0.75 N·m (3.9-6.6 in. lbs.)



# SPECIFICATIONS

## FRONT AXLE - 186FIA

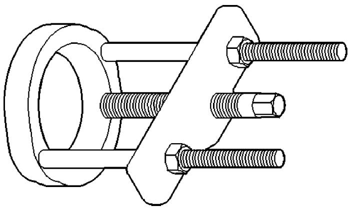
### AXLE SPECIFICATIONS

| DESCRIPTION | SPECIFICATION |
|---|---|
| Axle Ratio | 3.55, 3.73 |
| Ring Gear Diameter | 186 mm (7.33 in.) |
| Ring Gear Backlash | 0.12-0.20 mm (0.005-0.008 in.) |
| Pinion Bearing Preload | 1.69-2.82 N·m (15-25 in. lbs.) |
| Differential Bearing Preload Added To Pinion Torque To Rotate | |
| | |
| Gear Ratio 3.55 | 0.48-0.78 N·m (4.2-6.9 in. lbs.) |
| Gear Ratio 3.73 | 0.45-0.75 N·m (3.9-6.6 in. lbs.) |
| Gear Ratio 4.10 | 0.41-0.69 N·m (3.6-6.0 in. lbs.) |

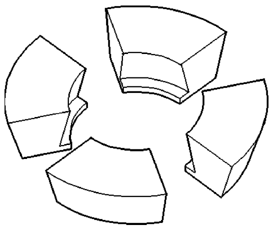
### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Ring Gear Bolts | 108 | 80 | - |
| Differential Bearing Cap Bolts | 54-68 | 39-50 | - |
| Drain Trough bolt | 12 | - | 110 |
| Differential Cover Bolts | 19-26 | 14-19 | - |
| Pinion Nut | 217-352 | 160-260 | - |
| Left Axle Bracket Bolts | 61 | 45 | - |
| Front Axle Bracket Bolts | 61 | 45 | - |
| Right Axle Bracket Bolts | 88 | 65 | - |
| Axle Brackets To Frame Bolts | 88 | 65 | - |

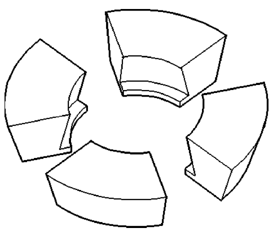
## SPECIAL TOOLS



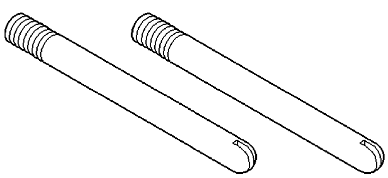
*PULLER C-293-PA*



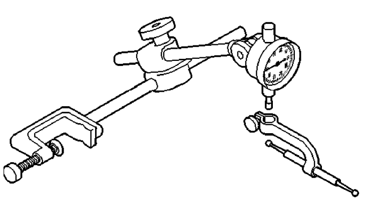
*ADAPTER C-293-39*



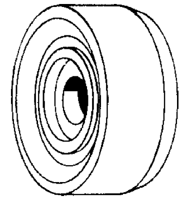
*ADAPTER C-293-42*



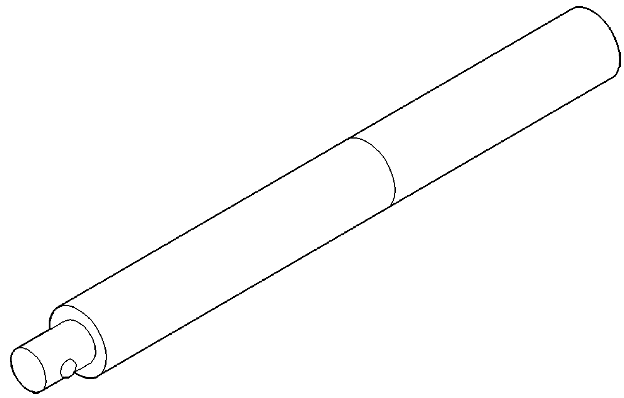
*PILOT STUD C-3288-B*



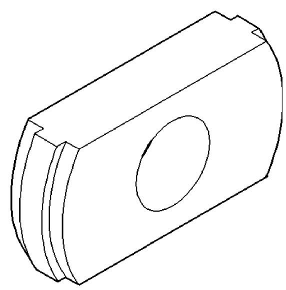

*DIAL INDICATOR C-3339*



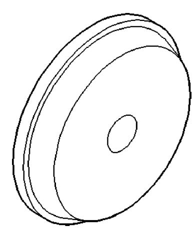
*INSTALLER C-3716-A*



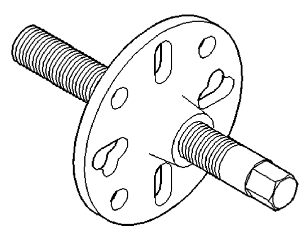
*HANDLE C-4171*



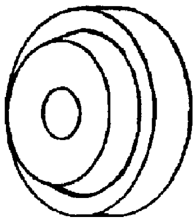
*REMOVER C-4307*



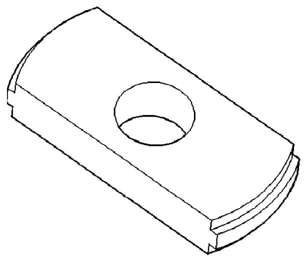
*INSTALLER C-4308*



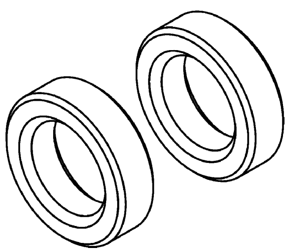
*PULLER C-452*



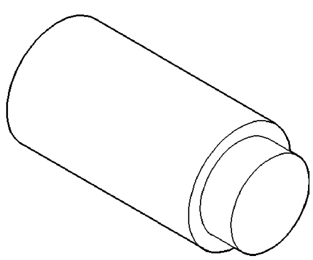
INSTALLER D-146



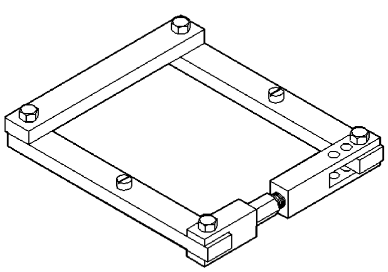
REMOVER D-149



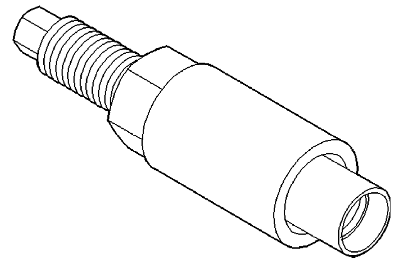
DUMMY BEARINGS D-348



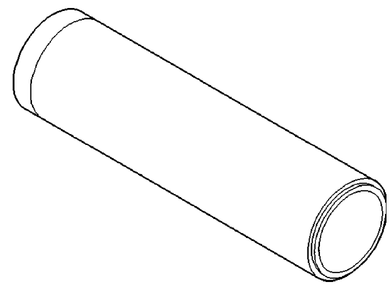
PLUG SP-3289



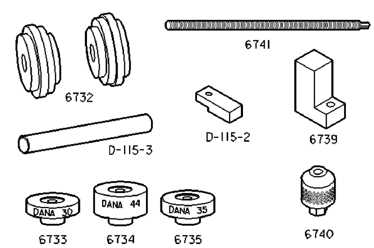
SPREADER W-129-B



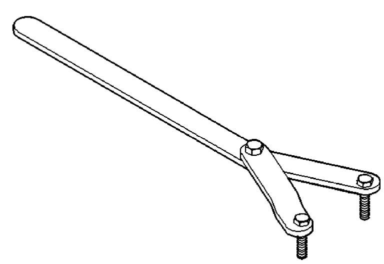
INSTALLER W-162-D



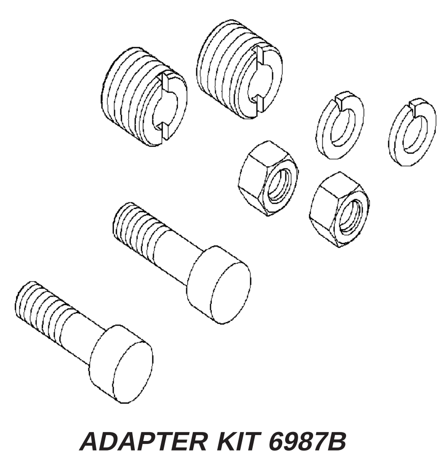
INSTALLER 6448A



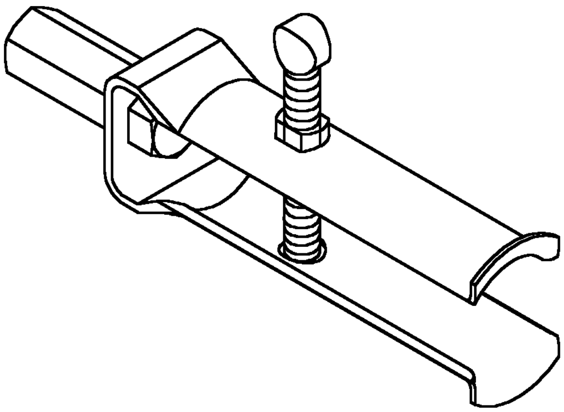

PINION DEPTH SET 6774



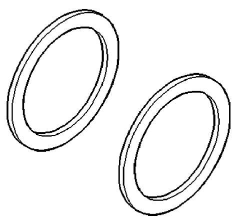
SPANNER WRENCH 6958



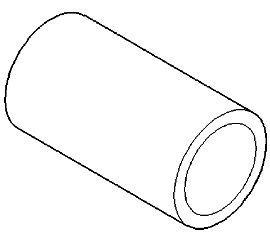
ADAPTER KIT 6987B



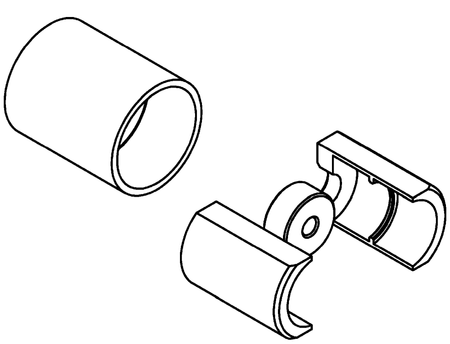
REMOVER 7794-A



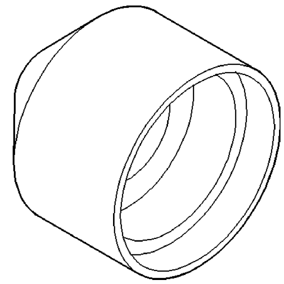
DUMMY SHIMS 8107



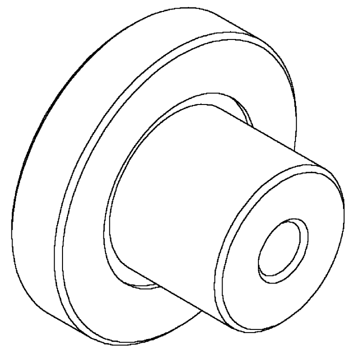
CUP 8109



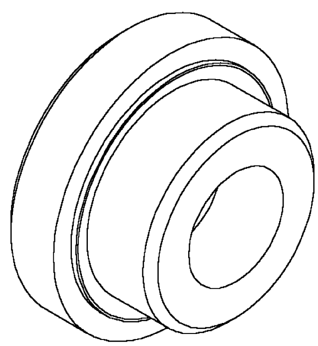
REMOVER 8420A



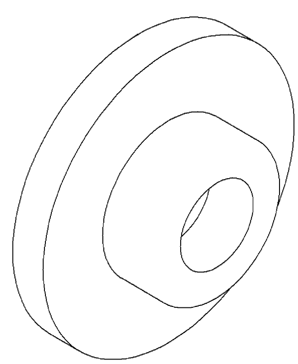
INSTALLER 8681



PINION BLOCK 8804



INSTALLER 8805

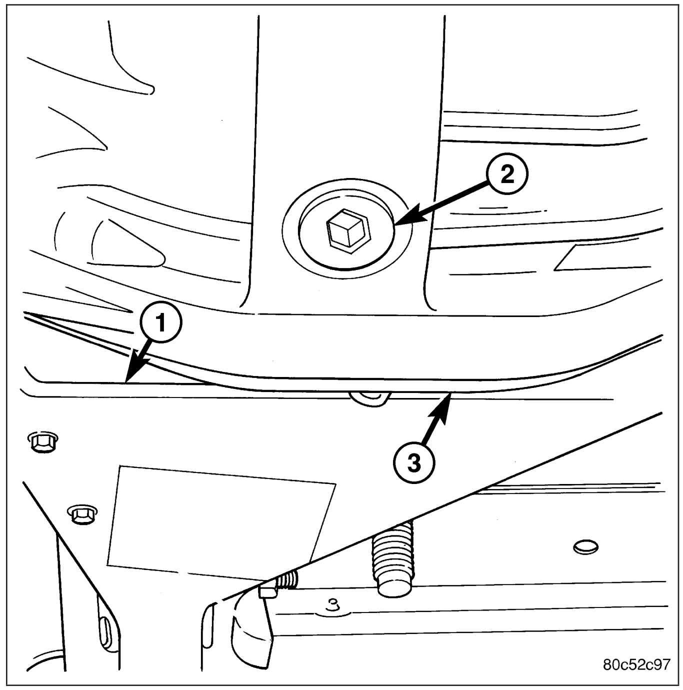


INSTALLER 8806

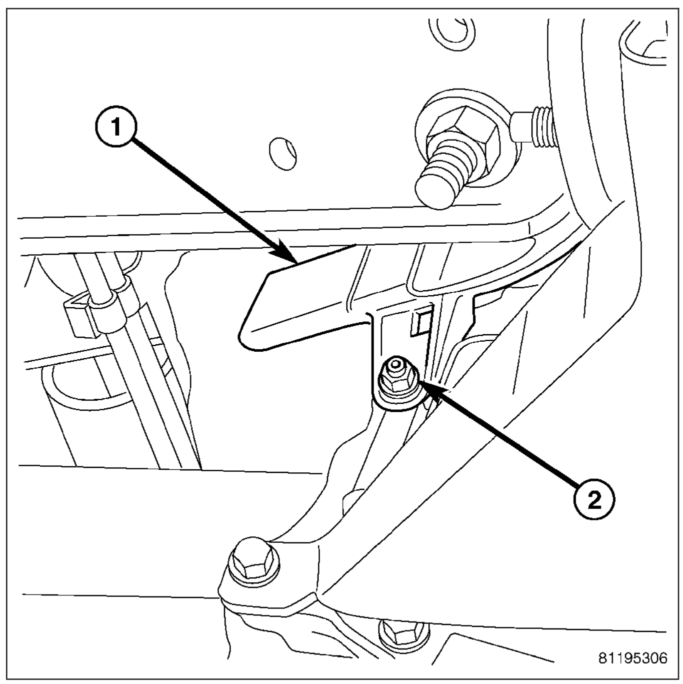
# COVER-DIFFERENTIAL

## REMOVAL

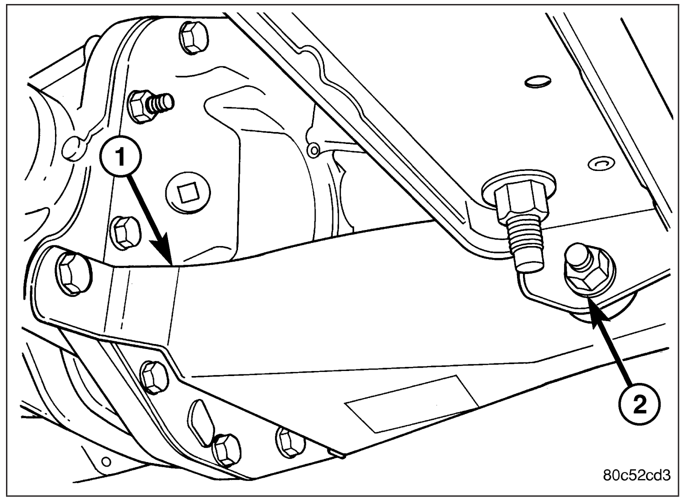
1. With vehicle in neutral, position vehicle on hoist.
2. Remove skid plate.
3. Remove drain plug (2) from housing (3) and drain fluid.




4. Remove oil trough (1) bolt from axle bracket.
5. Remove oil trough nut (2) from differential cover.

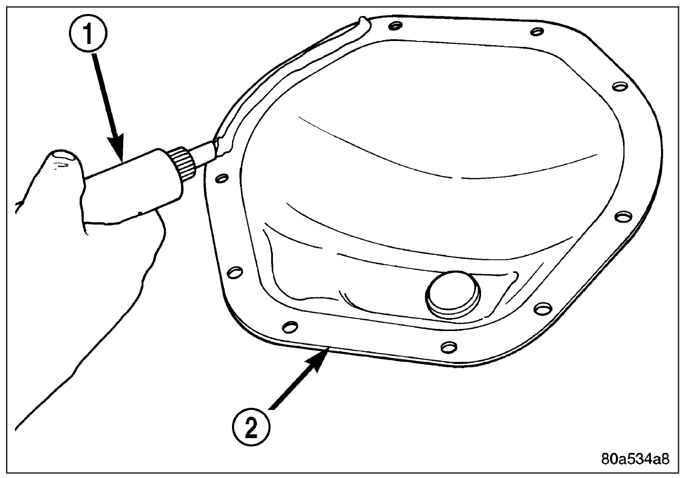


6. Loosen left front axle bracket bolt (2) at cradle.
7. Remove left front axle bracket (1) bolts from the axle and let bracket hang forward of the axle.
8. Remove vent hose from cover and remove oil trough.
9. Remove differential cover bolts and remove cover.



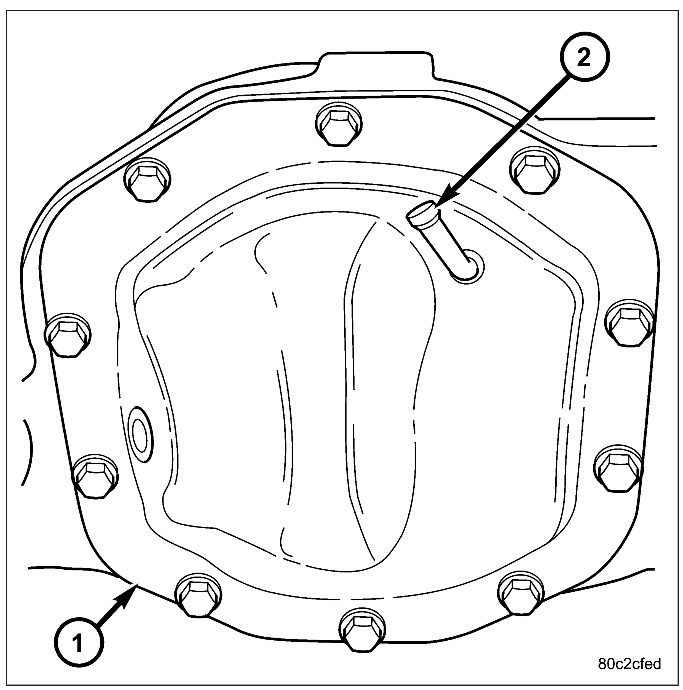

## INSTALLATION

1. Clean cover and mating surface.
2. Apply a bead of Mopar Axle RTV sealant (1) or equivalent to the differential cover (2).




**CAUTION: If cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied. Failure to follow these instructions will result in a leak.**

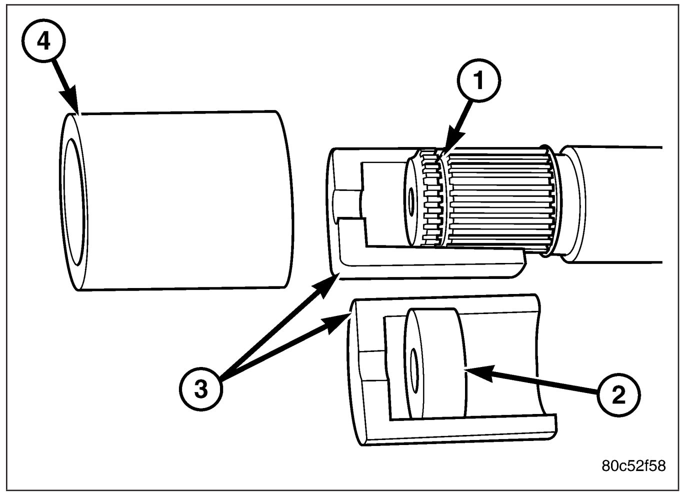
3. Install differential housing cover (1) and tighten bolts in a criss-cross pattern to 19-26 N·m (14-19 ft. lbs.).
4. Install drain trough and tighten nut to 23 N·m (200 in. lbs.).
5. Install vent hose (2) on differential cover with new clamp.
6. Install axle bracket to axle and tighten to 61 N·m (45 ft. lbs.).
7. Install drain trough bolt to axle bracket and tighten to 12 N·m (110 in. lbs.).
8. Tighten left front axle bracket cradle nut to 61 N·m (45 ft. lbs.).
9. Install skid plate.



# SHAFT-AXLE

## REMOVAL

1. With vehicle in neutral, position vehicle on hoist.
2. Remove right half shaft from vehicle.
3. Remove snap ring and o-ring from axle shaft.
4. Assemble Remover 8420A blocks (3) with hammer threads (2) on snap ring groove (1) on the shaft. Slide collar (4) over blocks and thread slid hammer into remover and remove shaft.
5. Slide axle shaft out of the axle tube.

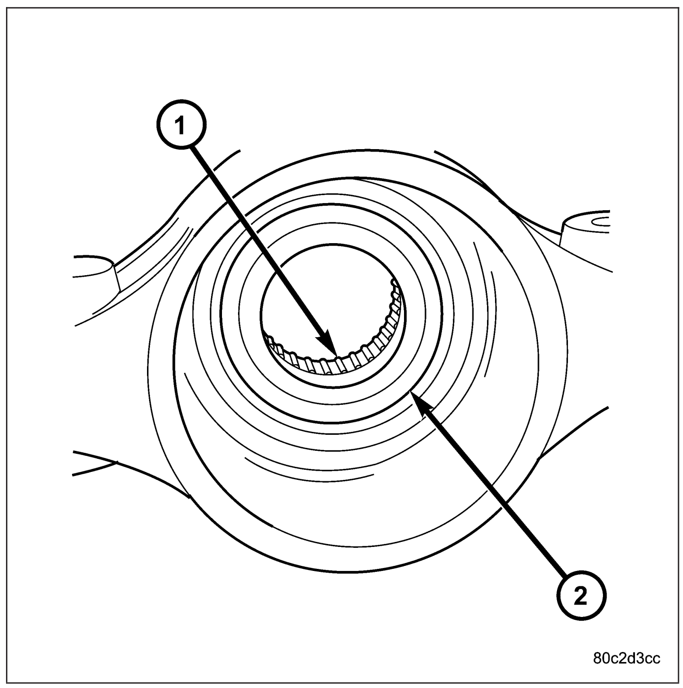



## INSTALLATION

1. Lubricate bearing (1) bore and seal (2) lip with gear lubricant. Insert axle shaft through seal, bearing and engage it into side gear splines.

**NOTE: Use care to prevent shaft splines from damaging axle shaft seal.**

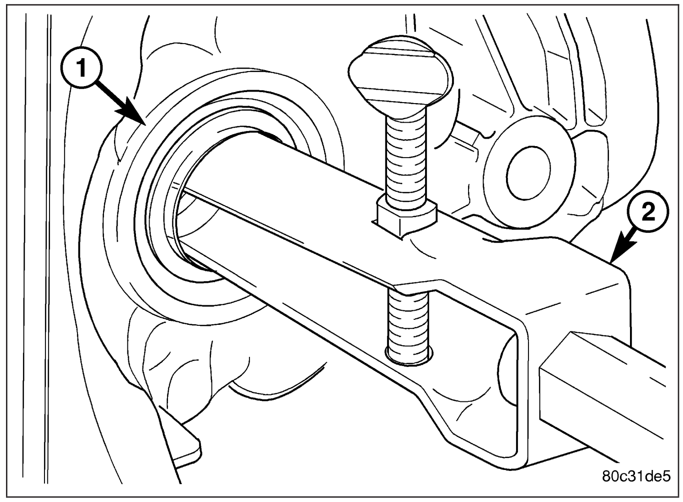
2. Install half shaft snap-ring and o-ring.
3. Push the axle shaft until the axle shaft snap-ring passes through the side gear.
4. Install right half shaft.
5. Check differential fluid level.



# SEAL-AXLE SHAFT

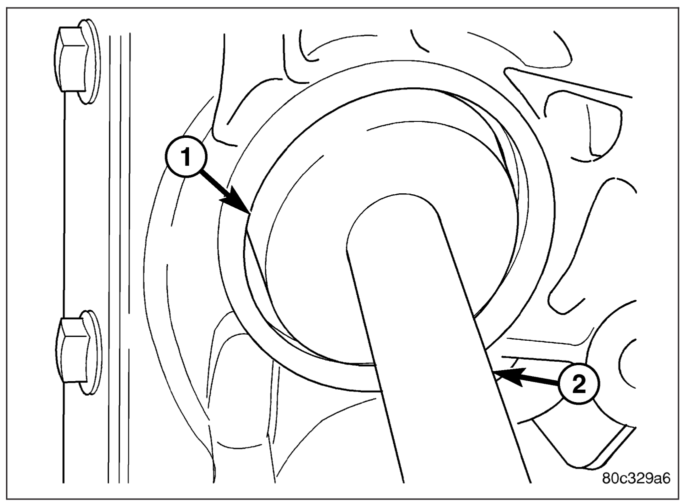
## REMOVAL

1. Remove half shaft.
2. Remove axle shaft for right side seal removal.
3. Remove shaft seal (1) with Remover 7794-A (2) and a slide hammer.




## INSTALLATION

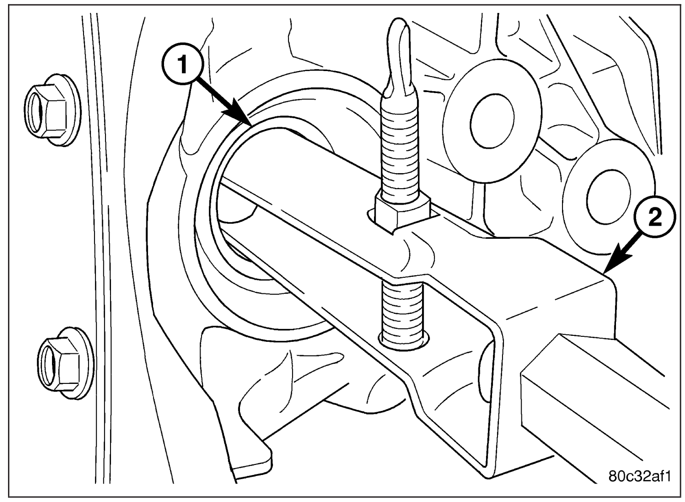
1. Apply a light coat of lubricant on the lip of the shaft seal.
2. Install **new** shaft seal with Installer 8806 (2) and Handle C-4171(1).
3. Install right axle shaft if removed.
4. Install half shaft.



# BEARING-AXLE

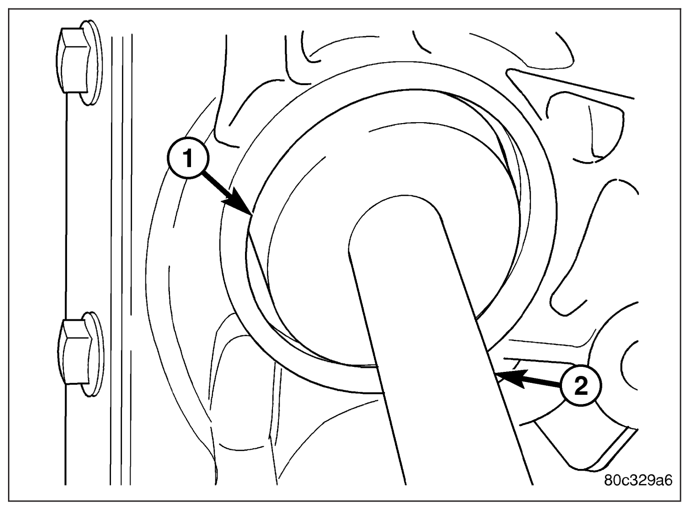
## REMOVAL

1. Remove half shaft.
2. Remove axle shaft for right side seal removal.
3. Remove shaft seal with Remover 7794-A and a slide hammer.
4. Remove shaft bearing (1) with Remover 7794-A (2) and a slide hammer.




## INSTALLATION

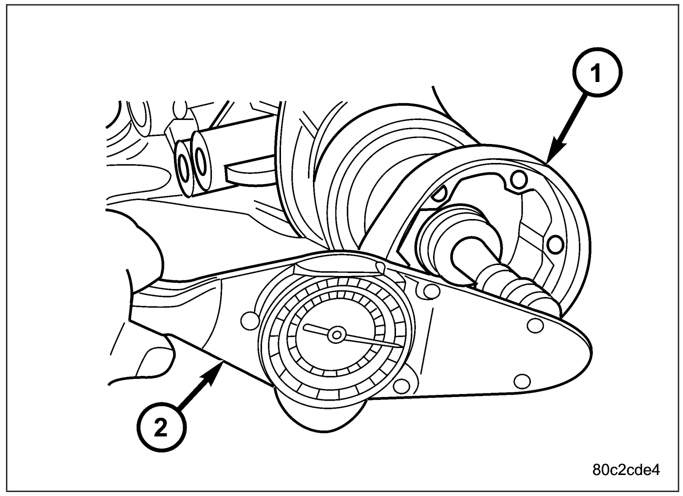
1. Install **new** shaft bearing with Installer 8805 and Handle C-4171.
2. Apply a light coat of lubricant on the lip of the shaft seal.
3. Install **new** shaft seal with Installer 8806 (1) and Handle C-4171 (2).
4. Install right axle shaft if removed.
5. Install half shaft.



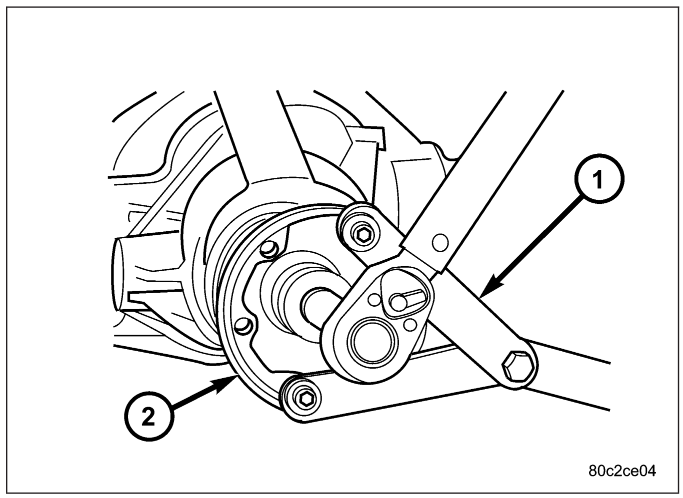
# SEAL-PINION

## REMOVAL

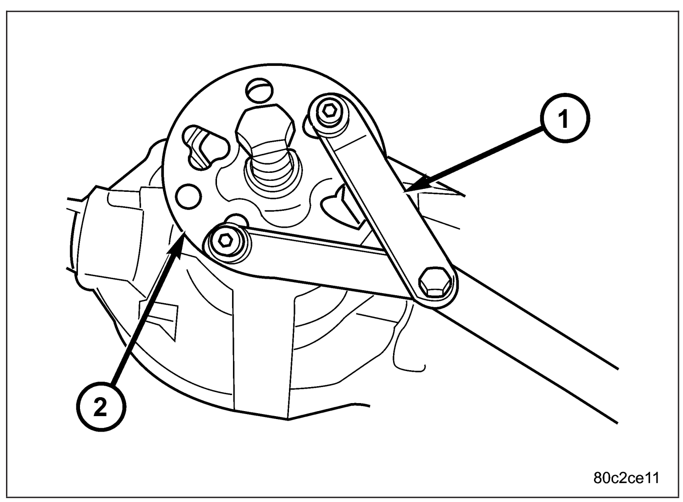
1. With vehicle in neutral, position vehicle on hoist.
2. Remove brake calipers and rotors.
3. Remove propeller shaft.
4. Rotate pinion gear a minimum of ten times and verify the pinion rotates smoothly.
5. Record torque to rotate the pinion gear (1) with a inch pound torque wrench (2).




6. Using a short piece of pipe and Spanner Wrench 6958 (1) to hold the pinion companion flange (2) and remove the pinion nut.

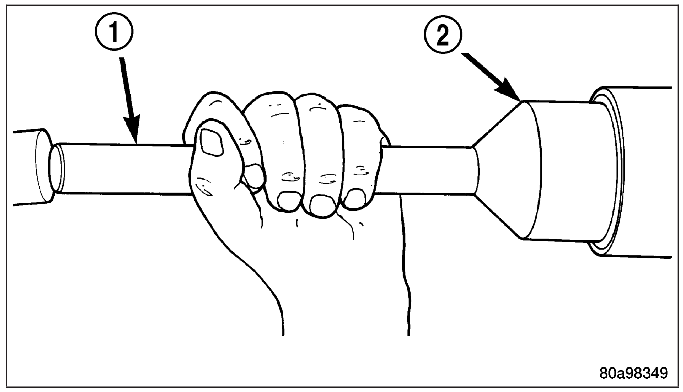



7. Remove pinion companion flange with Puller C-452 (2) and Spanner Wrench 6958 (1).
8. Pry pinion seal out with a seal pick.



## INSTALLATION

1. Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer 8681(2).

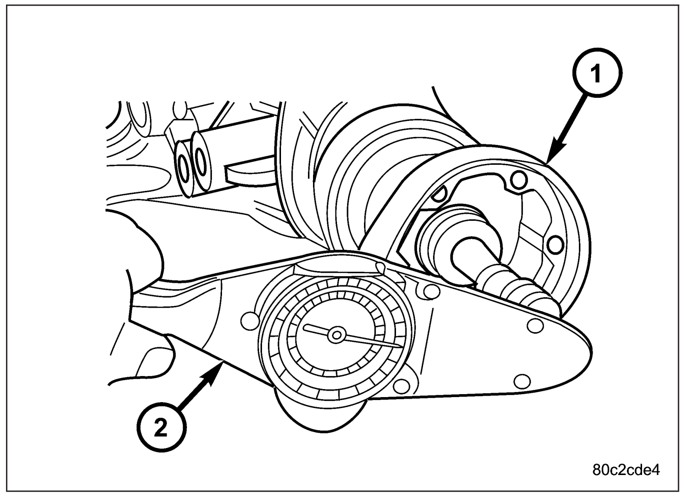



2. Install pinion companion flange on the pinion gear with Installer W-162-D, Cup 8109 and Wrench 6958.

**CAUTION: Do not exceed the minimum tightening torque 217 N·m (160 ft. lbs.) while installing pinion nut at this point. Failure to follow these instructions will result in damage.**

3. Install a **new** nut on the pinion gear. **Tighten the nut only enough to remove the shaft end play.**

**CAUTION: Never loosen pinion nut to decrease pinion rotating torque and never exceed specified preload torque. Failure to follow these instructions will result in damage.**




4. Rotate pinion a minimum of ten time and verify pinion rotates smoothly. Rotate the pinion shaft (1) with an inch pound torque wrench (2). Rotating torque should be equal to the reading recorded during removal plus 0.56 N·m (5 in. lbs.).
5. If rotating torque is low, use Spanner Wrench 6958 to hold the pinion companion flange and tighten the pinion nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.

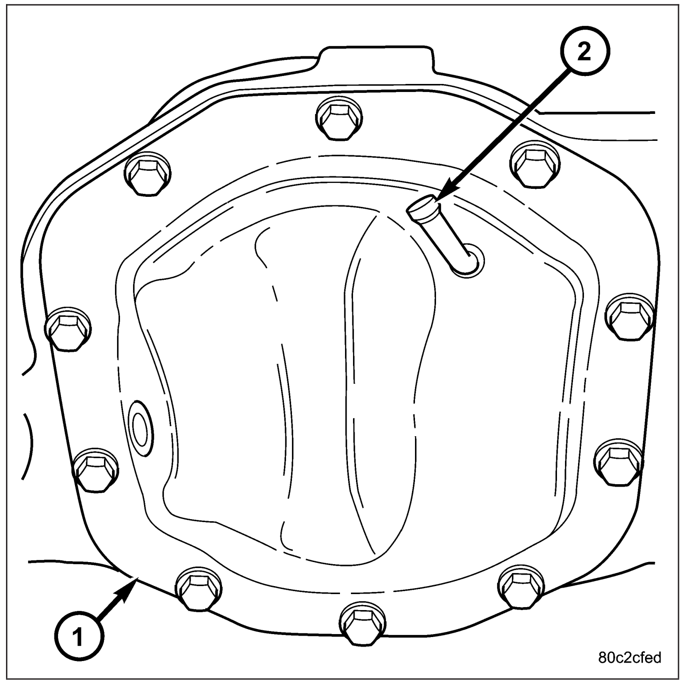
**CAUTION: If maximum tightening torque is reached prior to reaching the required rotating torque, the collapsible spacer may have been damaged. Failure to follow these instructions will result in damage.**

6. Install propeller shaft.
7. Fill differential with gear lubricant.

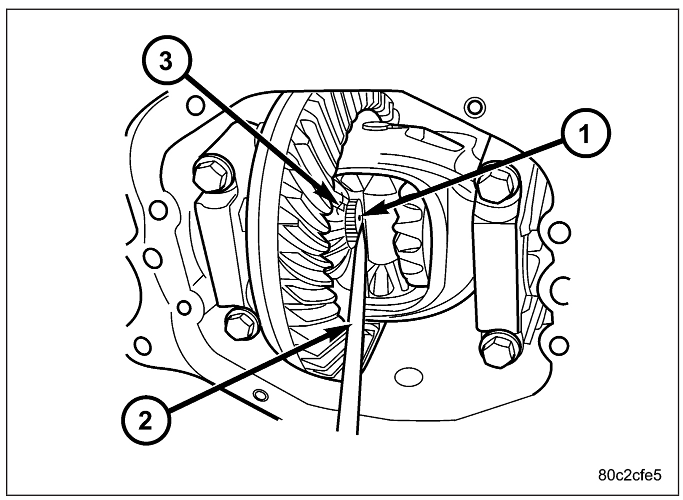
# DIFFERENTIAL

## REMOVAL

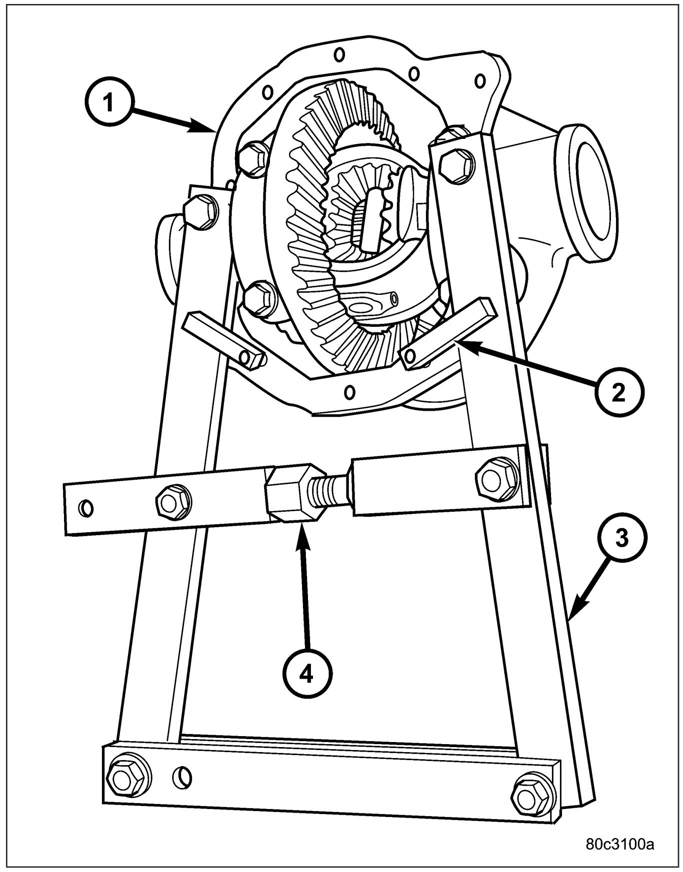
1. Remove differential housing cover (1).




2. Push right axle shaft (1) out of side gear (3) with a screw driver (2) and remove shaft.



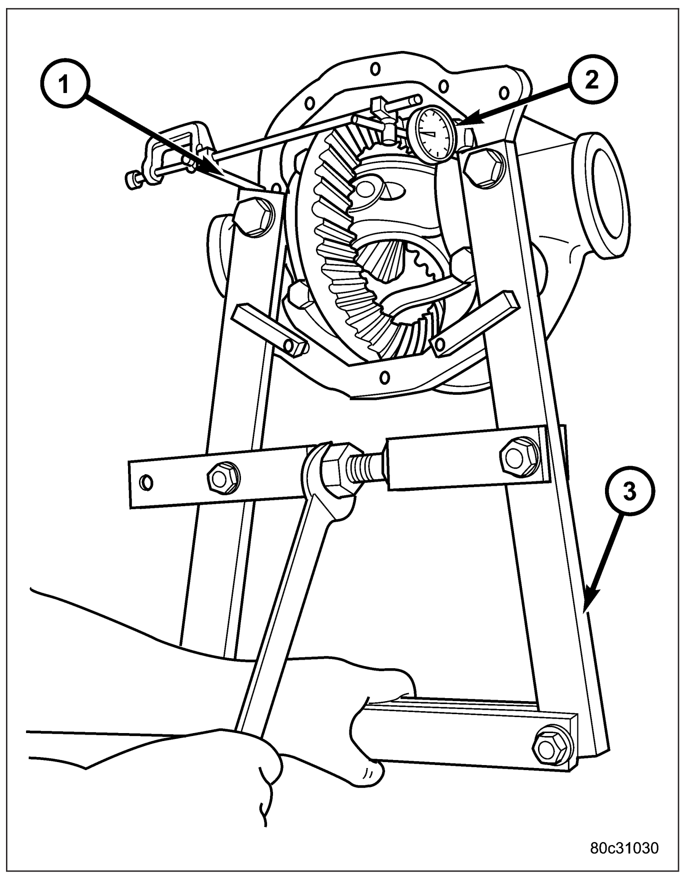
3. Mark differential bearing caps for installation reference.
4. Loosen bearing cap bolts.
5. Position Spreader W-129-B (3) onto differential locating holes and install the safety hold-down clamps (2). Tighten spreader turnbuckle (4) finger-tight.



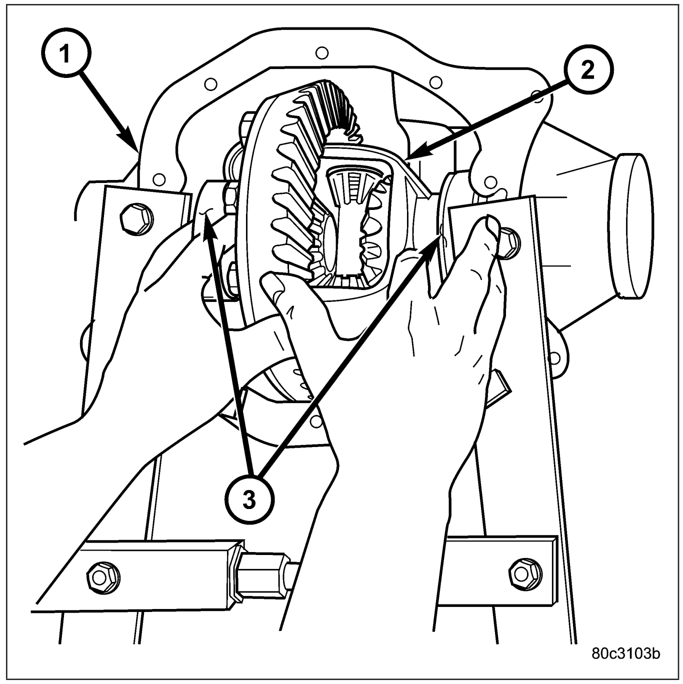

6. Install a Pilot Stud C-3288-B (1) at the left side of the differential housing. Attach Dial Indicator C-3339 (2) to pilot stud. Load indicator plunger against the opposite side of the housing and zero the indicator.
7. Spread differential case while measuring the distance with the dial indicator.

**CAUTION: Never spread the differential housing over 0.34 mm (0.013 in). Failure to heed caution may result in damage.**

8. Remove dial indicator.

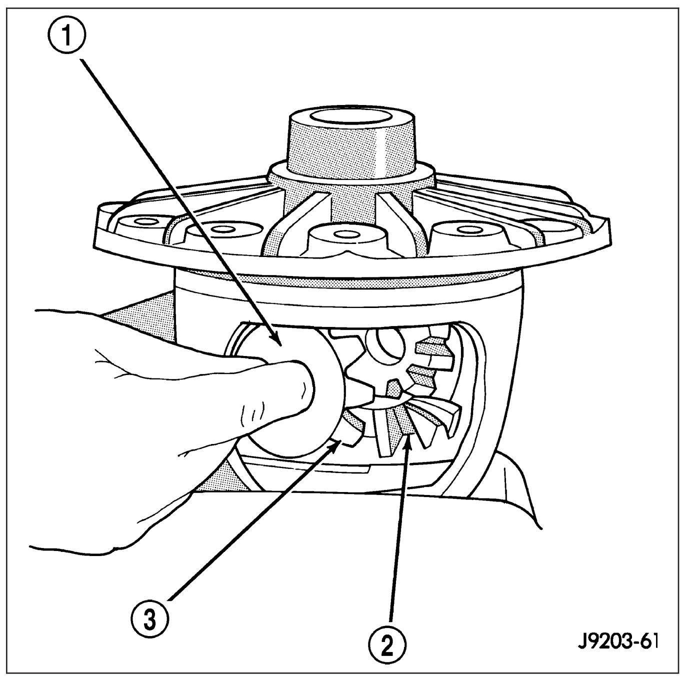


9. Hold differential case (2) and remove bearing caps.
10. Remove differential from the housing (1).
11. Tag differential bearing (3) cups and shims to indicate location.
12. Remove spreader from housing.



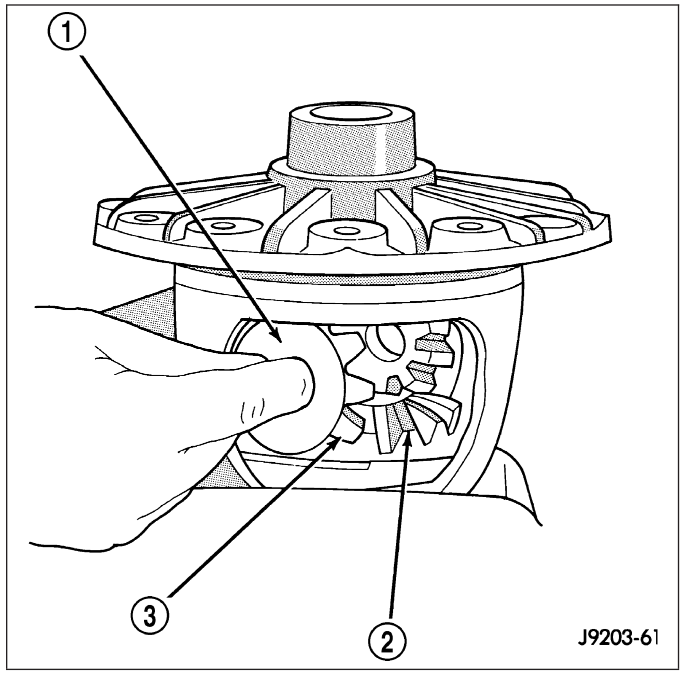

## DISASSEMBLY

1. Remove ring gear.
2. Remove roll-pin holding mate shaft in housing.
3. Remove pinion gear mate shaft.
4. Rotate differential side gears (2) and remove pinion gears (3) and thrust washers (1).
5. Remove differential side gears and thrust washers.

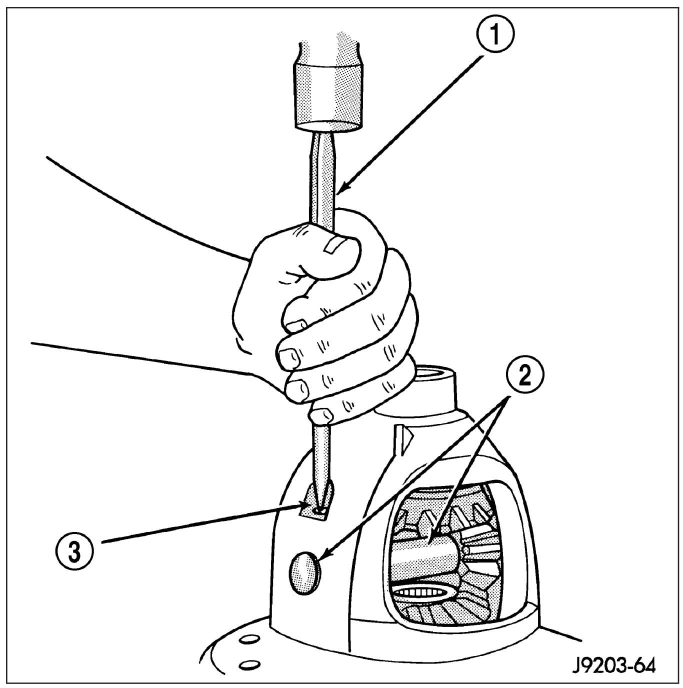


## ASSEMBLY

1. Install differential side gears (2) and thrust washers.
2. Install pinion mate gears (3) and thrust washers (1).
3. Install pinion gear mate shaft.




4. Align hole in the pinion gear mate shaft (2) with the hole in the differential case.
5. Install the roll-pin (3) in the differential case with a hammer and punch (1). Peen the edge of the roll-pin hole in the differential case in two places 180° apart.
6. Lubricate all differential components with hypoid gear lubricant.
7. Install ring gear.



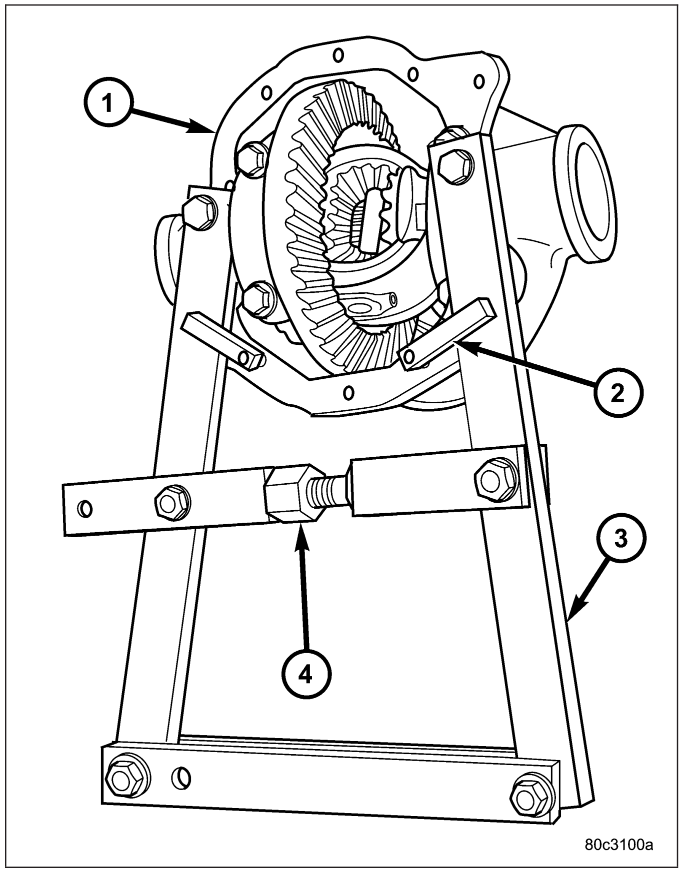
## INSTALLATION

**NOTE: If differential bearings or differential case are replaced, Refer to adjustments fore Differential Bearing Preload and Gear Backlash procedures.**

1. Position Spreader W-129-B on differential location holes and install safety hold-down clamps. Tighten spreader turnbuckle finger-tight.
2. Install Pilot Stud C-3288-B to the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load indicator plunger against the opposite side of the housing and zero the indicator.
3. Spread housing while measuring the distance with the dial indicator.

**CAUTION: Never spread the differential housing over 0.34 mm (0.013 in). Failure to follow these instructions will damage the housing.**

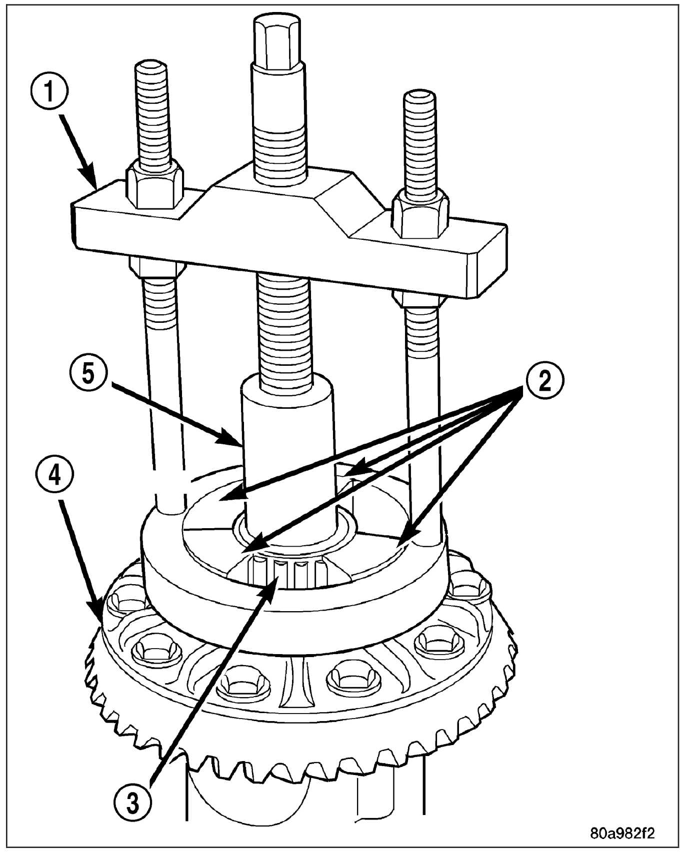
4. Remove dial indicator.
5. Install differential case in the housing. Tap differential case to seat bearings cups and preload shims in housing.
6. Install bearing caps and loosely install bolts.
7. Loosen turnbuckle (4) remove safety clamp (2) and remove spreader (3).
8. Tighten bearing cap bolts in a criss-cross pattern to 54-68 N·m (39-50 ft. lbs.).
9. Install right axle shaft.
10. Install differential housing cover.



# BEARING-DIFFERENTIAL CASE

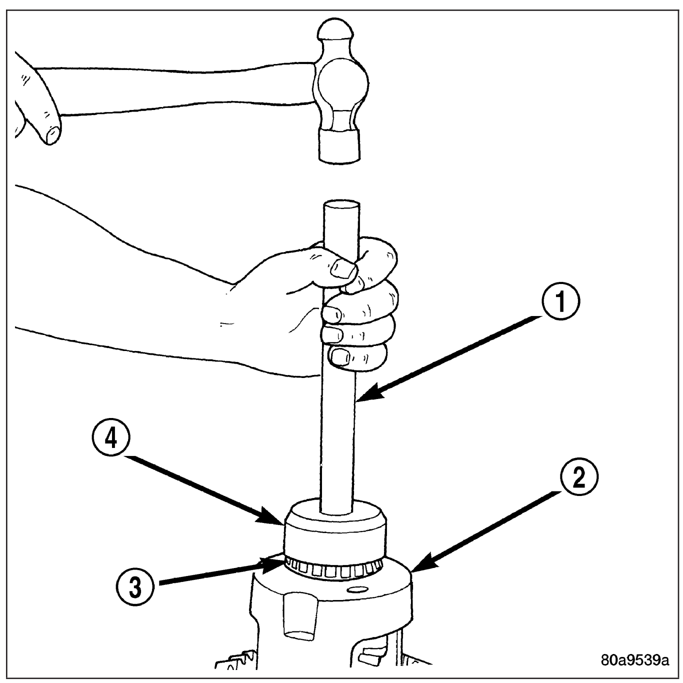
## REMOVAL

1. Remove differential from the housing.
2. Remove bearings (3) from the differential case (4) with Puller/Press C-293-PA (1), Adapters C-293-39 (2) and Plug SP-3289 (5).




## INSTALLATION

1. Install differential case (2) bearings (3) with Installer C-3716-A (4) and Handle C-4171(1).
2. Install differential into the housing.

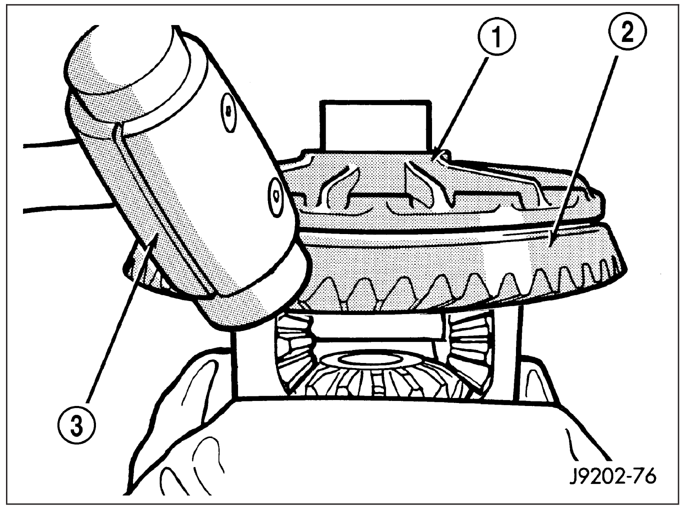


# GEAR-PINION/RING

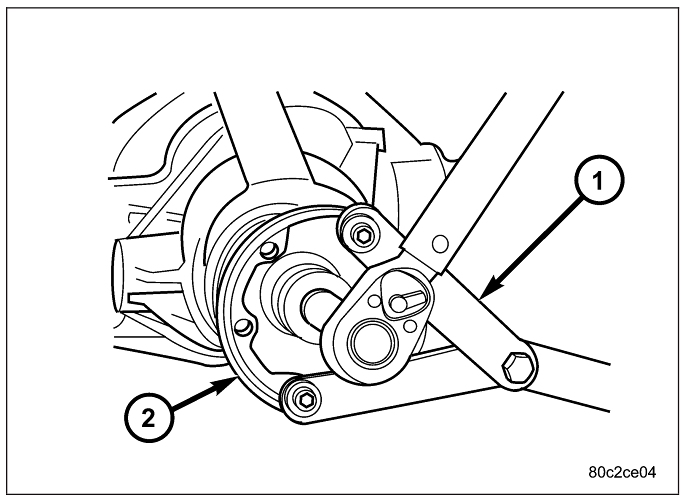
## REMOVAL

**NOTE: The ring gear and pinion are serviced as a matched set. Never replace ring gear without replacing the matched pinion gear.**

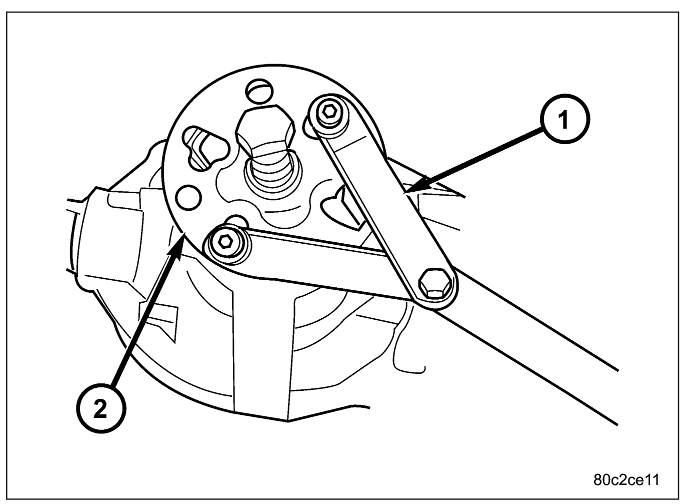
1. Remove differential from axle housing.
2. Place differential case (1) in a vise with soft jaws.
3. Remove bolts holding ring gear to differential case.
4. Driver ring gear (2) off the differential case (1) with a dead-blow hammer (3).



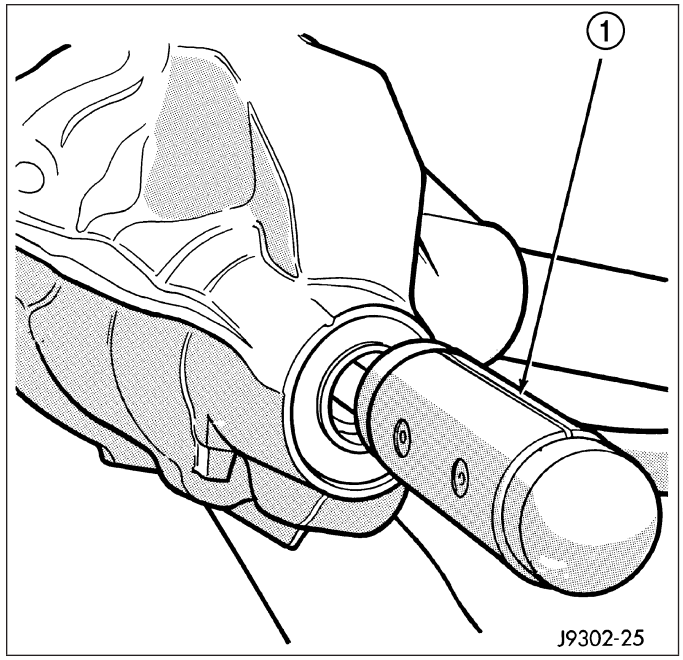

5. With Spanner Wrench 6958 (1) and a short length of 1 in. pipe, hold pinion companion flange (2) and remove pinion nut.




6. Remove pinion companion flange from pinion shaft with Spanner Wrench 6958 (1) and Puller C-452 (2).

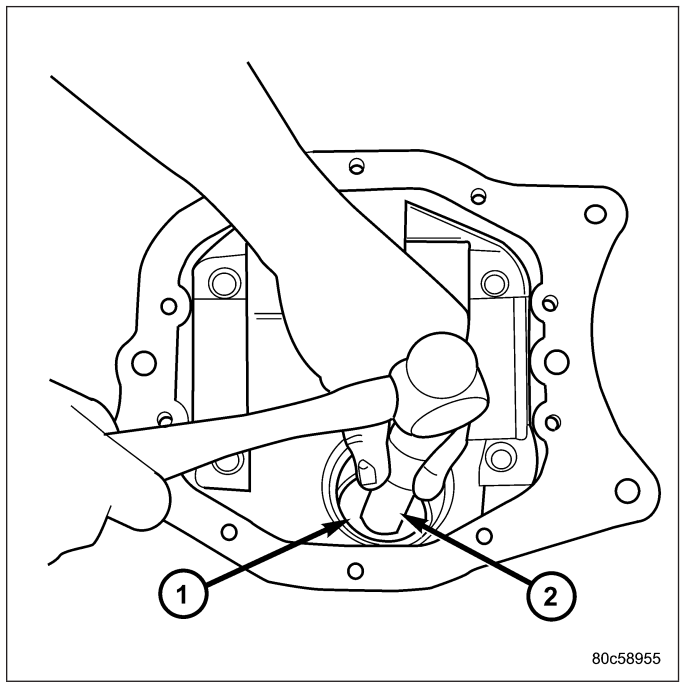


7. Remove pinion gear from housing with dead-blow hammer (1).

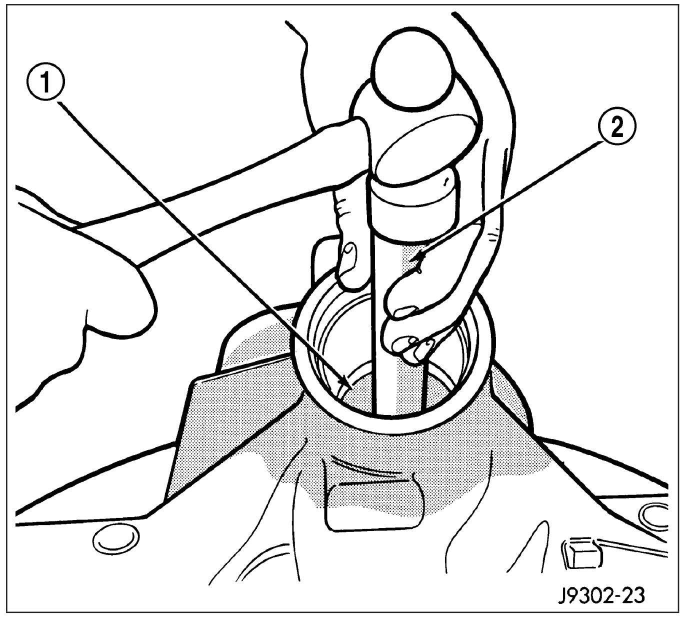



.

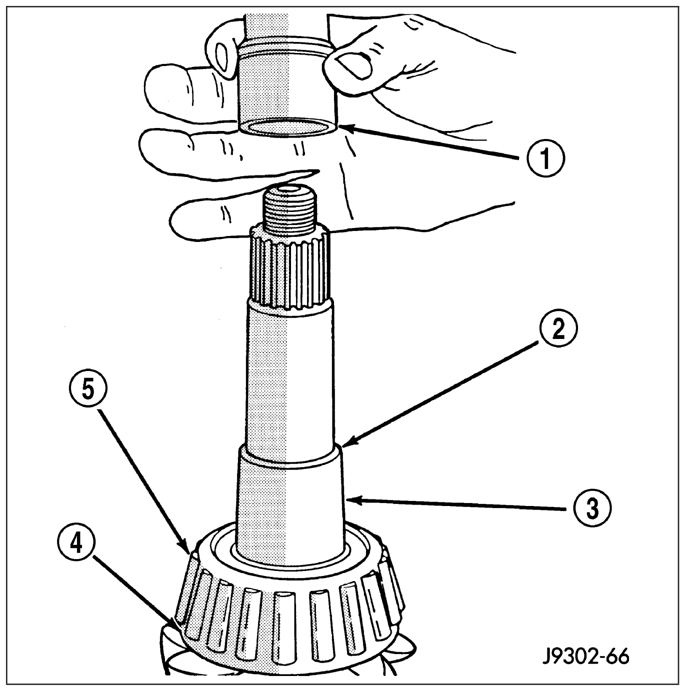
8. Remove front pinion bearing cup, bearing, oil slinger and pinion seal with Remover D-149 (1) and Handle C-4171 (2).



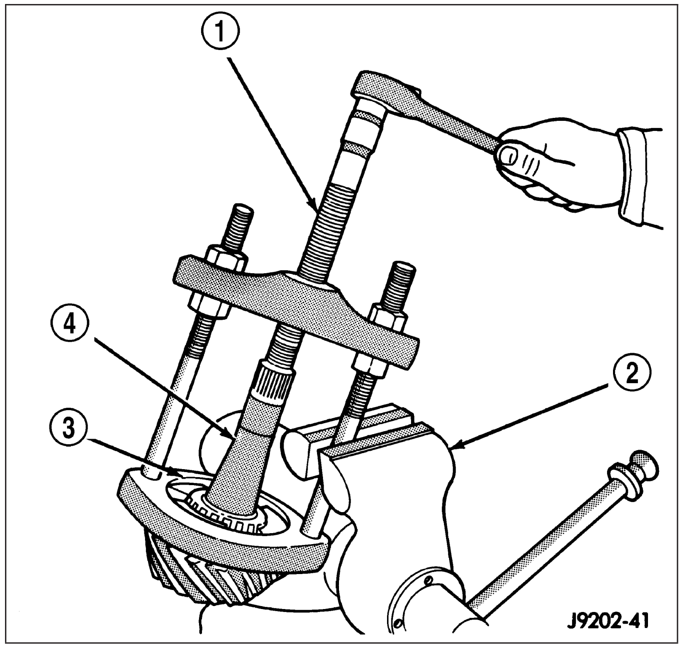
9. Remove rear pinion bearing cup with Remover C-4307 (1) and Handle C-4171 (2).




10. Remove collapsible spacer (1) from pinion gear (3).



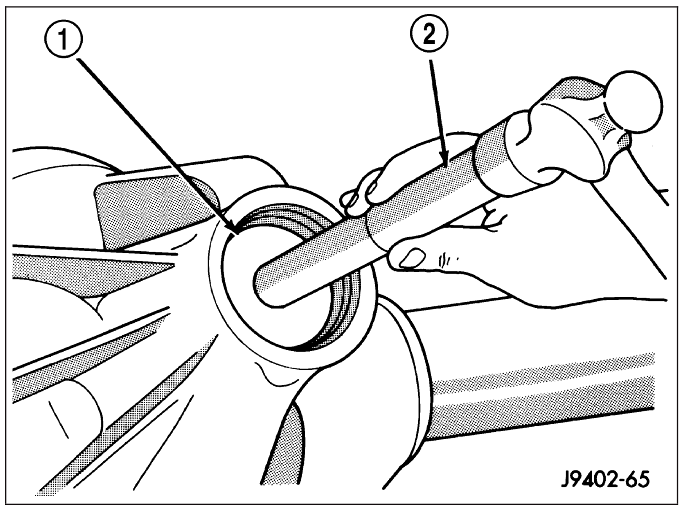
11. Remove rear pinion bearing from the pinion (4) with Puller/Press C-293-PA (1) and Adapters C-293-42 (3). Remove oil slinger/pinion depth shim from the pinion shaft and record thickness.



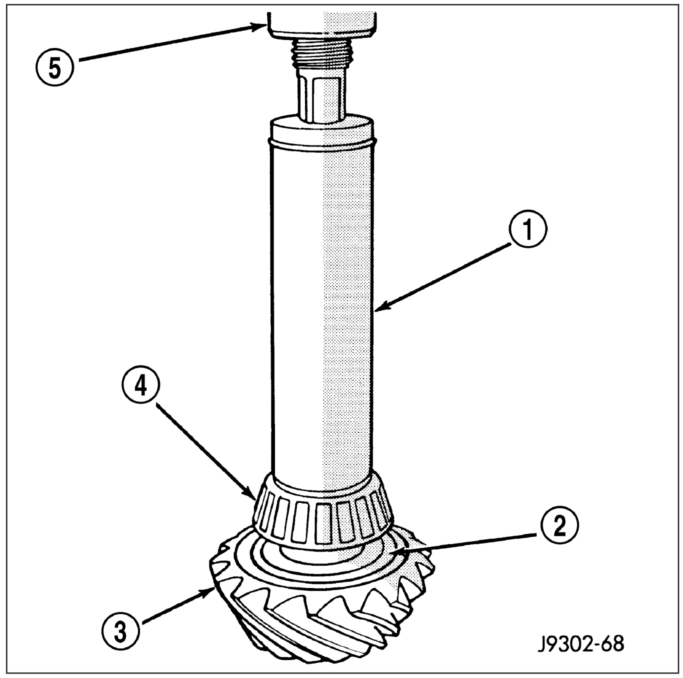

## INSTALLATION

**NOTE: Pinion depth shims are located under the rear pinion bearing. If ring and pinion gears are reused, the pinion oil slinger/depth shim should not require replacement. Refer to Adjustments (Pinion Gear Depth) to select the proper thickness shim before installing pinion gear.**

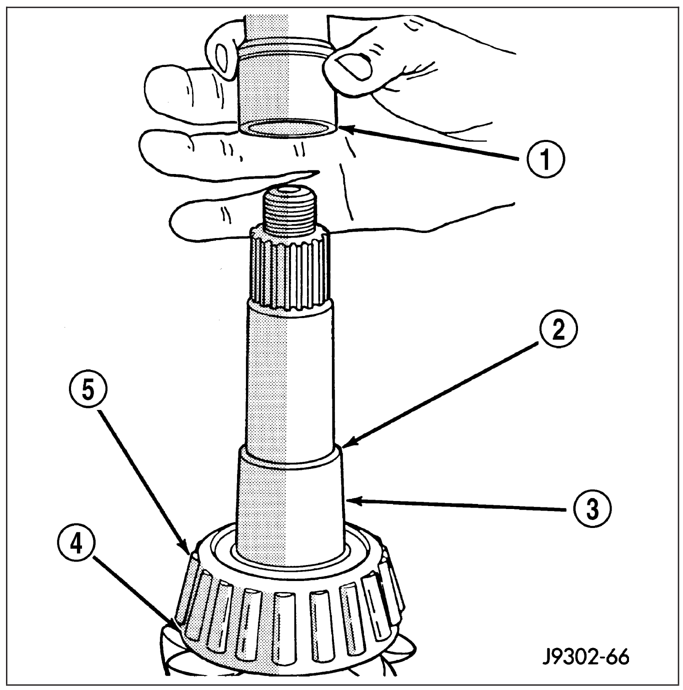
1. Install front pinion bearing, and oil slinger if equipped.
2. Apply a light coating of gear lubricant on the lip of pinion seal and install seal with Installer 8681.
3. Apply Mopar Door Ease or equivalent lubricant to outside surface of pinion bearing cups.
4. Install rear bearing cup with Installer C-4308 and Handle C-4171.
5. Install front bearing cup with Installer D-146 (1) and Handle C-4171 (1).



6. Install oil slinger/depth shim (2) and rear pinion bearing (4) on pinion shaft (3) with Installer 6448A (1) and a press (1).



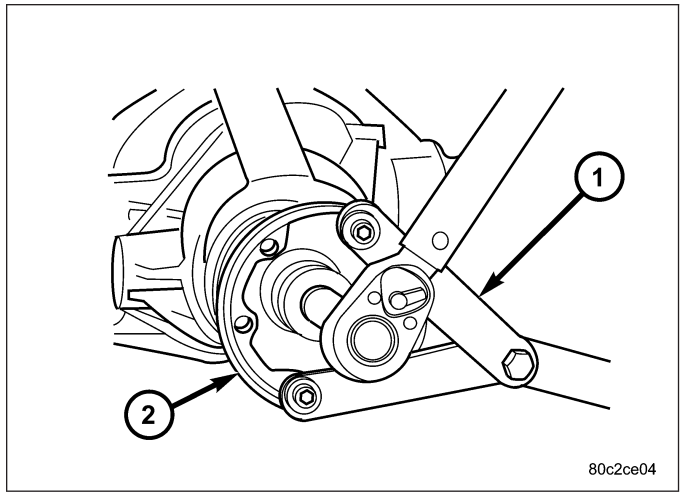

7. Install a **new** collapsible spacer (1) on pinion shaft (3) and install pinion into the housing.
8. Install pinion companion flange, with Installer W-162-D, Cup 8109 and Spanner Wrench 6958.



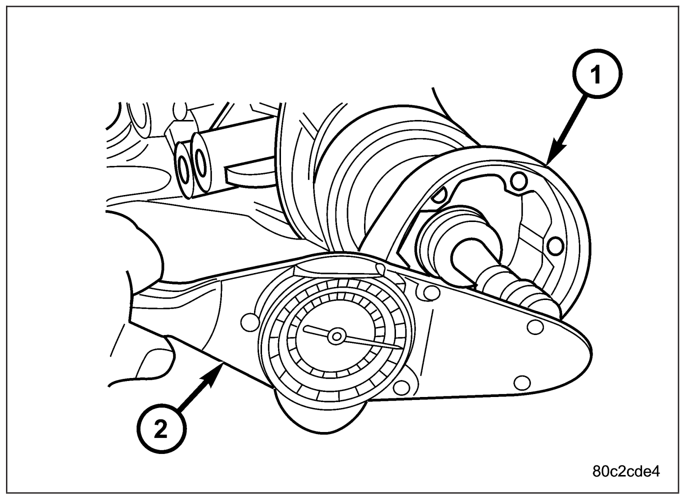
9. Install pinion a **new** nut onto the pinion gear and tighten the nut to 217 N·m (160 ft. lbs.). **Do not over-tighten.**

**CAUTION: Never loosen pinion gear nut to decrease pinion rotating torque and never exceed specified preload torque. Failure to follow these instructions will result in damage.**

10. Use Spanner Wrench 6958 (1), a length of 1 in. pipe and a torque wrench set at 678 N·m (500 ft. lbs.) and crush collapsible spacer until bearing end play is taken up.



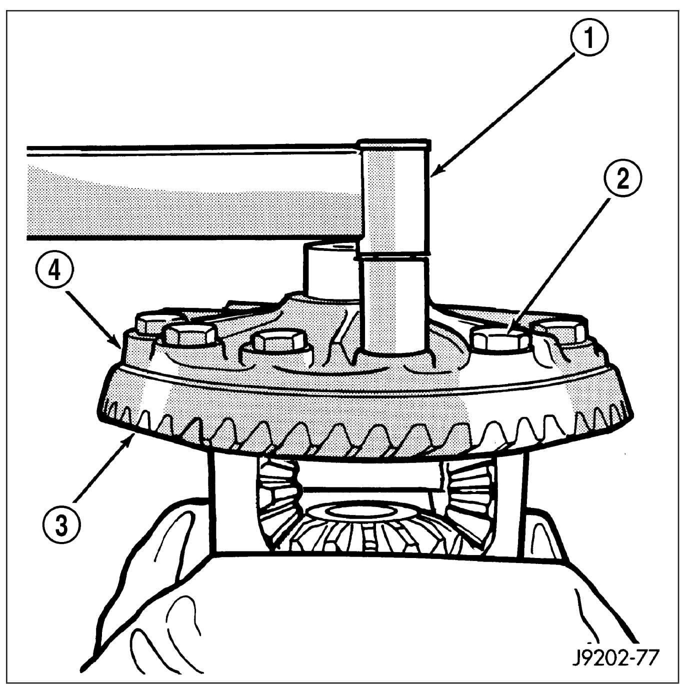

11. Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the required rotating torque is achieved. Measure rotating torque frequently to avoid over crushing the collapsible spacer.
12. Rotate the pinion a minimum of ten times. Verify pinion (1) rotates smoothly and check rotating torque with an inch pound torque wrench (2). Pinion gear rotating torque is:
    - Original Bearings: 1 to 2.25 N·m (10 to 20 in. lbs.).
    - New Bearings: 1.69 to 2.82 N·m (15 to 25 in. lbs.).




13. Invert differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.
14. Invert differential case (4) in the vise. Install **new** ring gear (3) bolts (2) and alternately tighten to 108 N·m (80 ft. lbs.).

**CAUTION: Never reuse the ring gear bolts. Failure to follow these instructions will result in damage.**

15. Install differential in housing and verify differential bearing preload, gear mesh and contact pattern.



# REAR AXLE - 8 1/4

## TABLE OF CONTENTS

# REAR AXLE - 8 1/4

## DIAGNOSIS AND TESTING

## REAR AXLE - 8 1/4

### GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, incorrect pinion depth, tooth contact, worn/damaged gears, or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak-noise range. If the noise stops or changes greatly check for:

- Insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side and pinions gears, usually do not cause noise during straight-ahead driving, when the gears are unloaded. The side gears are loaded during turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

### BEARING NOISE

Bearing noise can be either a whining or a growling sound.

**Pinion bearings** have a constant high pitch noise, because it rotates at a faster rate. This noise changes with vehicle speed. If noise is heard under a load, the rear pinion bearing is the source. If noise is heard during a coast, the front pinion bearing is the source.

**Differential bearings** usually produce a low pitch noise. The differential bearing noise is constant and varies only with vehicle speed.

**Axle shaft bearing** noise generally changes when the bearings are loaded. Turn vehicle sharply to the left and the right during a road test. This will load and unload the bearings and change the noise level. If axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 m.p.h.

### LOW SPEED KNOCK

Low speed knock is generally caused by:

- Worn U-joints/CV joint.
- Worn side-gear thrust washers.
- Worn pinion shaft bore.

### VIBRATION

Vibration at the rear of the vehicle is usually caused by:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out-of-balance wheels.
- Loose wheel lug nuts.
- Worn U-joints/CV joint.
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

Check for loose or damaged front-end components or engine/transmission mounts. These components can contribute to what appears to be an axle vibration. Also look at engine accessories, brackets and drive belts.

**NOTE: All driveline components should be examined before starting any repair.**

## DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear or the clutch engaged, can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U-joints/CV joint.
- Loose spring mounts.
- Loose pinion gear nut and yoke.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

To determined the source of a snap/clunk noise, raise vehicle on a hoist with the wheels free to rotate. Have a helper shift the transmission into gear and listen for the noise.

### DIAGNOSTIC CHART

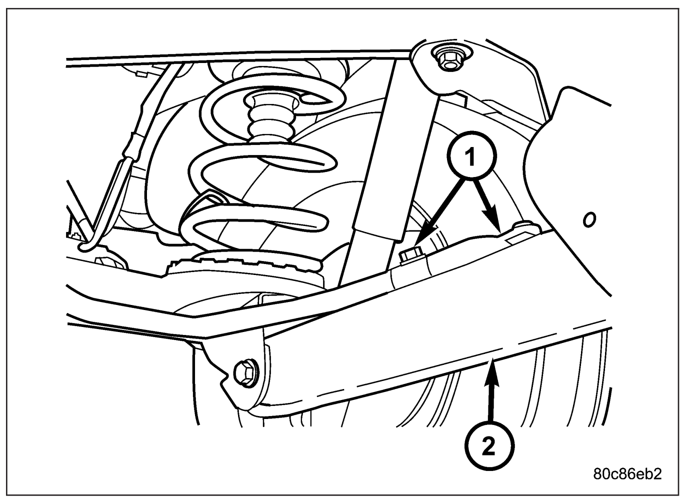
| Condition | Possible Causes | Correction |
|---|---|---|
| Wheel Noise | 1. Wheel loose. | 1. Tighten loose nuts. |
| | 2. Worn wheel bearing. | 2. Replace bearing. |
| Axle Shaft Noise | 1. Misaligned axle tube. | 1. Inspect axle tube alignment. Correct as necessary. |
| | 2. Bent or sprung axle shaft. | 2. Inspect and correct as necessary. |
| Axle Shaft Broke | 1. Misaligned axle tube. | 1. Replace the broken shaft after correcting tube mis-alignment. |
| | 2 Vehicle overloaded. | 2. Replace broken shaft and avoid excessive weight on vehicle. |
| | 3. Erratic clutch operation. | 3. Replace broken shaft and avoid or correct erratic clutch operation. |
| | 4. Grabbing clutch. | 4. Replace broken shaft and inspect and repair clutch as necessary. |
| Differential Cracked | 1. Improper adjustment of the differential bearings. | 1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly. |
| | 2. Excessive ring gear backlash. | 2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly. |
| | 3. Vehicle overloaded. | 3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight. |
| | 4. Erratic clutch operation. | 4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch. |

| Condition | Possible Causes | Correction |
|---|---|---|
| Differential Gears Scored | 1. Insufficient lubrication. | 1. Replace scored gears. Fill differential with the correct fluid type and quantity. |
| | 2. Improper grade of lubricant. | 2. Replace scored gears. Fill differential with the correct fluid type and quantity. |
| | 3. Excessive spinning of one wheel/tire. | 3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary. |
| Loss Of Lubricant | 1. Lubricant level too high. | 1. Drain lubricant to the correct level. |
| | 2. Worn axle shaft seals. | 2. Replace seals. |
| | 3. Cracked differential housing. | 3. Repair as necessary. |
| | 4. Worn pinion seal. | 4. Replace seal. |
| | 5. Worn/scored yoke. | 5. Replace yoke and seal. |
| | 6. Axle cover not properly sealed. | 6. Remove, clean and seal cover. |
| Axle Overheating | 1. Lubricant level low. | 1. Fill differential to correct level. |
| | 2. Improper grade of lubricant. | 2. Fill differential with the correct fluid type and quantity. |
| | 3. Bearing pre-loads too high. | 3. Adjust bearing pre-loads. |
| | 4. Insufficient ring gear backlash. | 4. Adjust ring gear backlash. |
| Gear Teeth Broke | 1. Overloading. | 1. Replace gears. Examine other gears and bearings for possible damage. |
| | 2. Erratic clutch operation. | 2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation. |
| | 3. Ice-spotted pavement. | 3. Replace gears and examine remaining parts for damage. |
| | 4. Improper adjustments. | 4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct. |

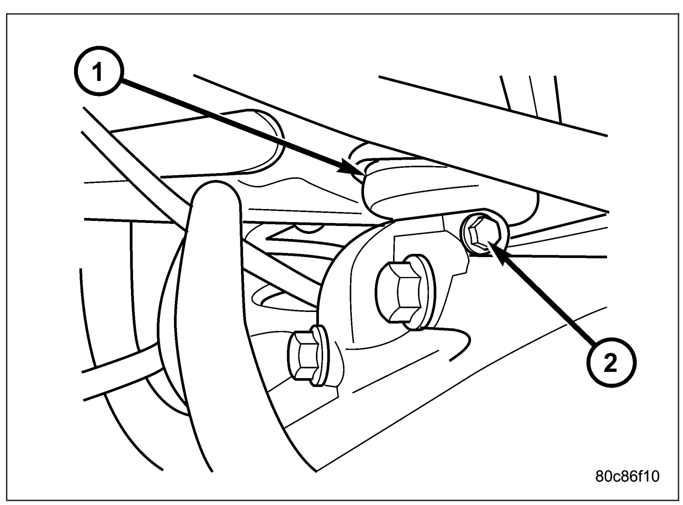
| Condition | Possible Causes | Correction |
|---|---|---|
| Axle Noise | 1. Insufficient lubricant. | 1. Fill differential with the correct fluid type and quantity. |
| | 2. Improper ring gear and pinion adjustment. | 2. Check ring gear and pinion contact pattern. Adjust backlash or pinion depth. |
| | 3. Unmatched ring gear and pinion. | 3. Replace gears with a matched ring gear and pinion. |
| | 4. Worn teeth on ring gear or pinion. | 4. Replace ring gear and pinion. |
| | 5. Loose pinion bearings. | 5. Adjust pinion bearing pre-load. |
| | 6. Loose differential bearings. | 6. Adjust differential bearing pre-load. |
| | 7. Ring gear run-out. | 7. Measure ring gear run-out. Replace components as necessary. |
| | 8. Loose differential bearing cap bolts. | 8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued to the proper specification. |
| | 9. Housing not machined properly. | 9. Replace housing. |

## REMOVAL

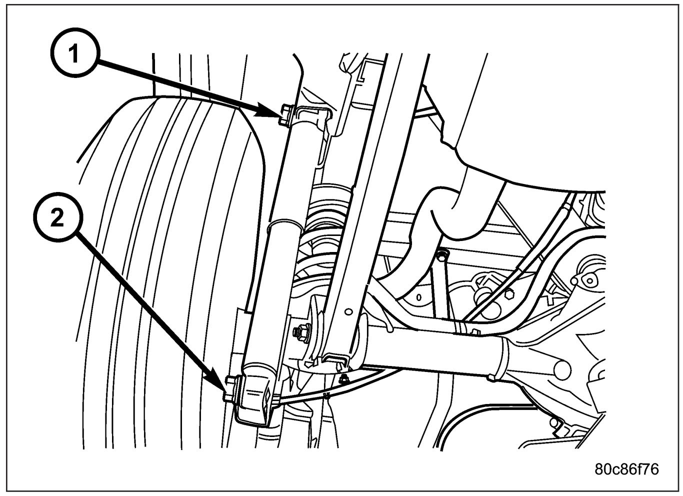
1. With vehicle in neutral, position vehicle on hoist.
2. Position a lift/jack under the axle and secure axle to device.
3. Mark propeller shaft and pinion yoke for installation reference.
4. Remove propeller shaft and suspend under the vehicle.
5. Remove brake components.
6. Remove vent hose from the axle shaft tube.
7. Remove the stabilizer bar bolts (1) from lower control arm (2).



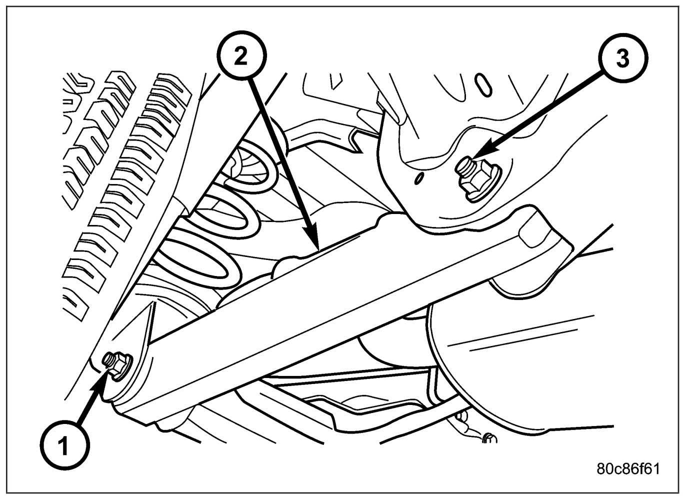

8. Remove upper control arm ball joint (1) pinch bolt (2) from bracket.



9. Remove shock absorbers from axle brackets (2).



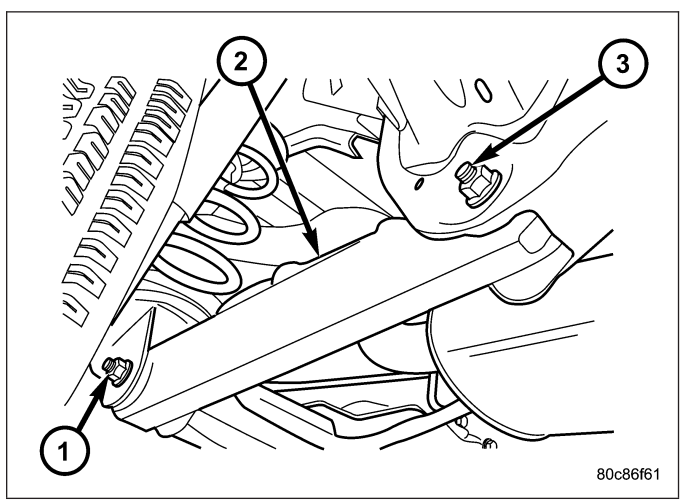

10. Loosen all lower control arms (2) mounting bolts.
11. Lower axle enough to remove coil springs and spring insulators.
12. Remove lower control arm bolts from the axle brackets (1).
13. Lower and remove the axle.



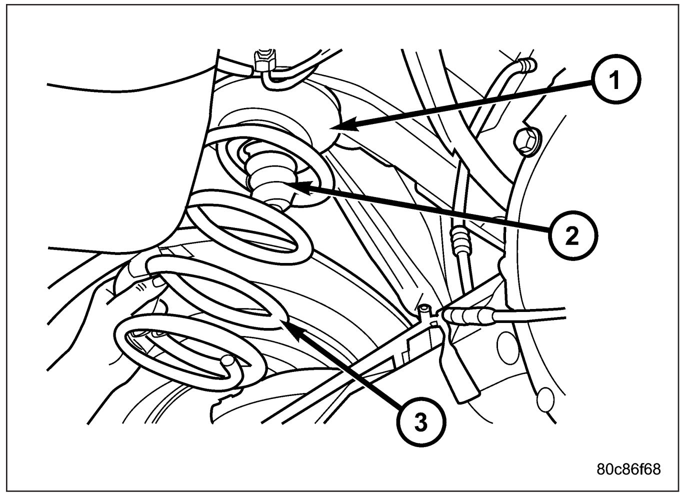

## INSTALLATION

**CAUTION: The weight of the vehicle must be supported by the springs before the lower control arms are tightened. This must be done to maintain vehicle ride height and prevent premature bushing failure.**

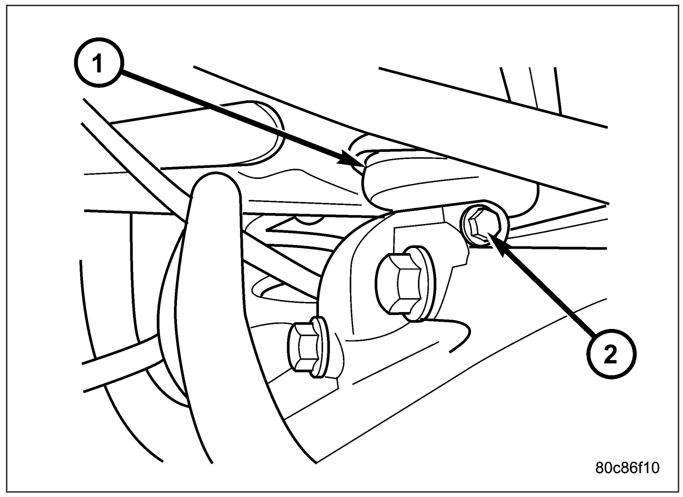
1. Raise the axle under the vehicle.
2. Install lower control arms (2) onto the axle brackets (1) and loosely install the mounting bolts.



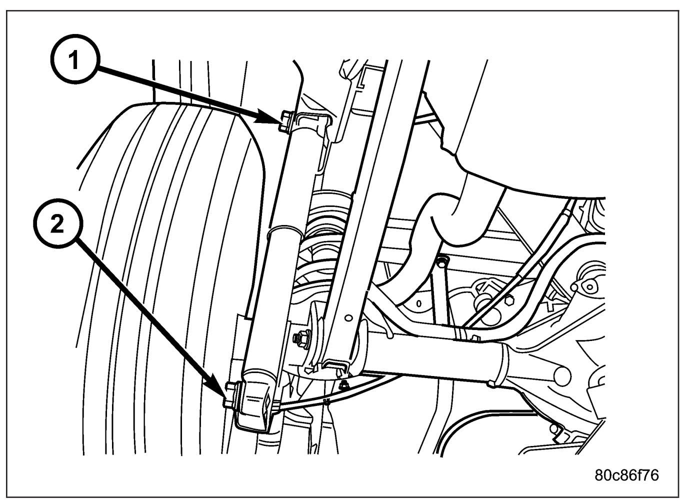
3. Install coil spring isolators (1) and springs (3).
4. Raise axle up until springs are seated.




5. Install upper control arm ball joint (1) into axle bracket and tighten pinch bolt (2) to torque specification.



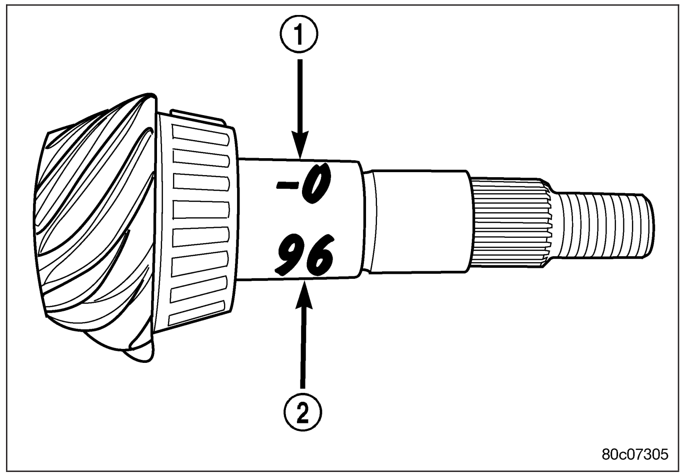

6. Install shock absorbers and tighten bolts (2) to torque specification.
7. Install stabilizer bar and tighten nuts to torque specification.
8. Install brake components.
9. Install axle vent hose.
10. Install propeller shaft with reference marks.
11. Install the wheels and tires.
12. Remove lifting device from axle and lower the vehicle.
13. Tighten the lower control arm bolts to torque specification.



# ADJUSTMENTS

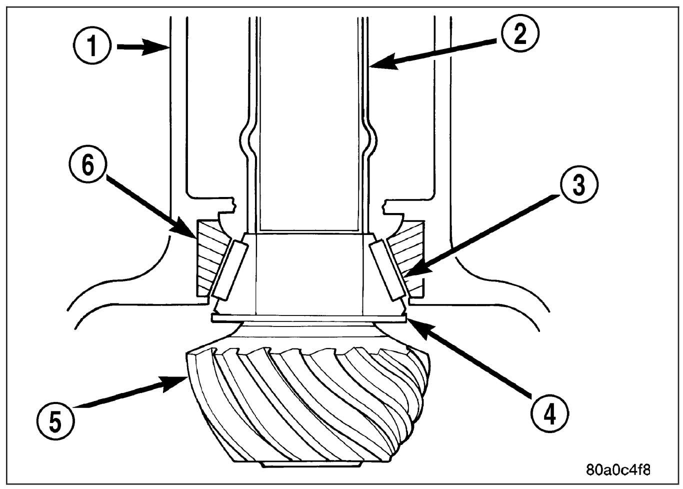
## PINION DEPTH-BEARING PRELOAD-GEAR BACKLASH

Ring gear and pinion are supplied as matched sets. Identifying numbers for the ring gear and pinion are painted onto the pinion gear shaft and the side of the ring gear. A plus (+) number, minus (–) number or zero (0) along with the gear set sequence number (2) (01 to 99) is on each gear. This first number (1) the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion marked with a (0). The next two numbers are the sequence number of the gear set. The standard depth provides the best teeth contact pattern.




Compensation for pinion depth variance is achieved with select shims (4). The shims are placed behind the rear pinion bearing.

If installing a new gear, note the depth variance number of the original and replacement pinion. Add or subtract this number from the original depth shim/oil slinger to compensate for the difference in the depth variances. The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim.



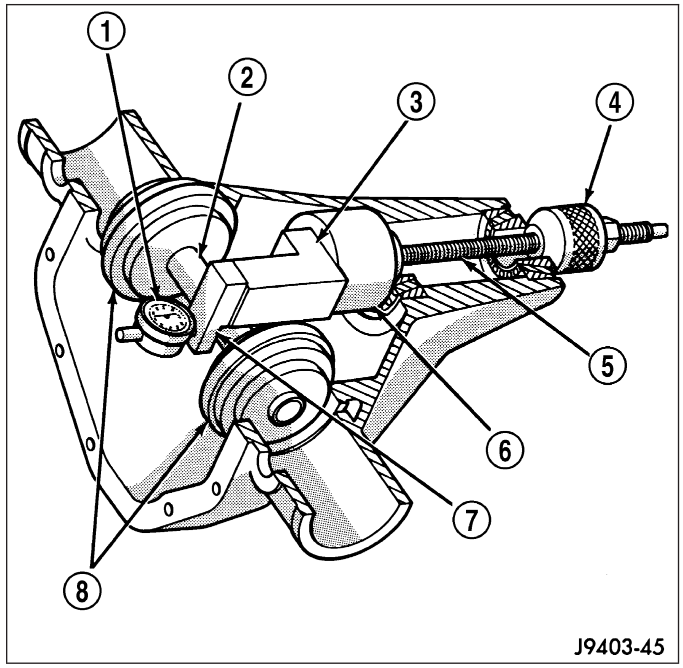

**Pinion Gear Depth Variance Chart**: Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

**PINION GEAR DEPTH VARIANCE**

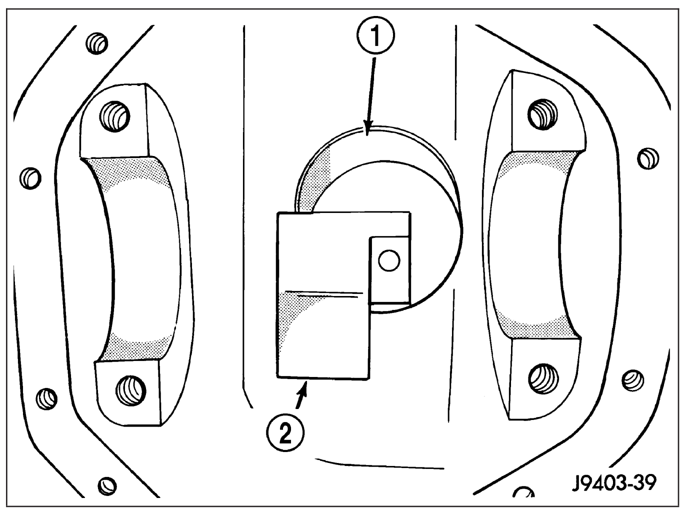
| Original Pinion Gear Depth Variance | Replacement Pinion Gear Depth Variance | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | −4 | −3 | −2 | −1 | 0 | +1 | +2 | +3 | +4 |
| **+4** | +0.008 | +0.007 | +0.006 | +0.005 | +0.004 | +0.003 | +0.002 | +0.001 | 0 |
| **+3** | +0.007 | +0.006 | +0.005 | +0.004 | +0.003 | +0.002 | +0.001 | 0 | −0.001 |
| **+2** | +0.006 | +0.005 | +0.004 | +0.003 | +0.002 | +0.001 | 0 | −0.001 | −0.002 |
| **+1** | +0.005 | +0.004 | +0.003 | +0.002 | +0.001 | 0 | −0.001 | −0.002 | −0.003 |
| **0** | +0.004 | +0.003 | +0.002 | +0.001 | 0 | −0.001 | −0.002 | −0.003 | −0.004 |
| **−1** | +0.003 | +0.002 | +0.001 | 0 | −0.001 | −0.002 | −0.003 | −0.004 | −0.005 |
| **−2** | +0.002 | +0.001 | 0 | −0.001 | −0.002 | −0.003 | −0.004 | −0.005 | −0.006 |
| **−3** | +0.001 | 0 | −0.001 | −0.002 | −0.003 | −0.004 | −0.005 | −0.006 | −0.007 |
| **−4** | 0 | −0.001 | −0.002 | −0.003 | −0.004 | −0.005 | −0.006 | −0.007 | −0.008 |

## PINION DEPTH MEASUREMENT

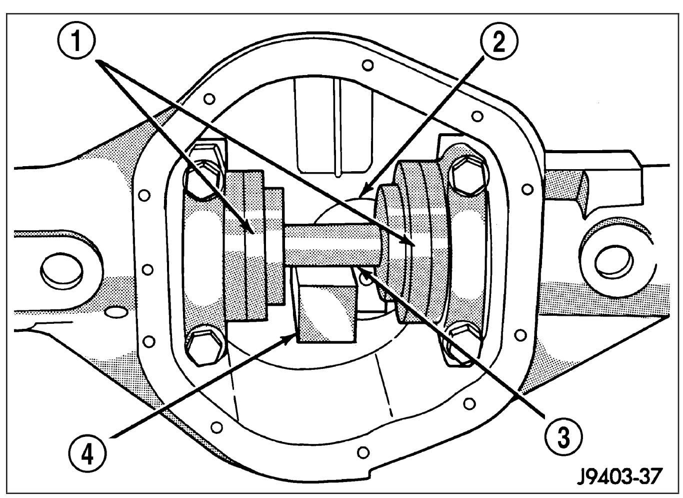
Measurements are taken with pinion bearing cups and pinion bearings installed in the housing. Take measurements with Pinion Gauge Set and Dial Indicator C-3339 (1).



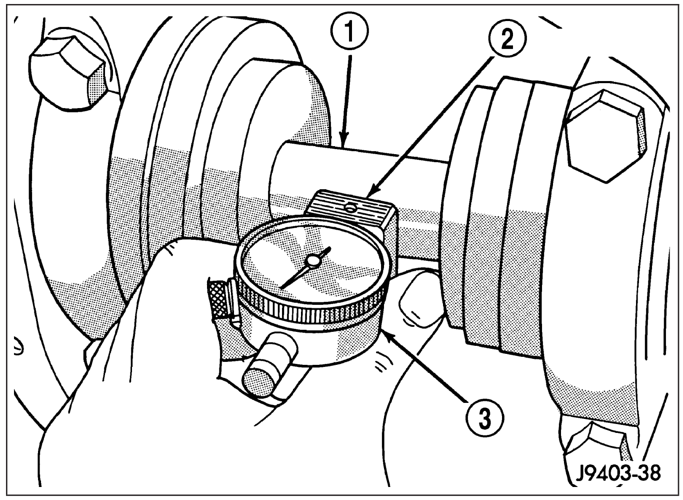

1. Assemble Pinion Height Block 6739 (2), Pinion Block 8540 (1) and rear pinion bearing onto Screw 6741.
2. Insert assembled height gauge components, rear bearing and screw into housing through pinion bearing cups.




3. Install front pinion bearing and Cone-Nut 6740 on the screw. Tighten Cone-Nut until Torque To Rotate screw is 1.7 N·m (15 in. lbs.).
4. Place Arbor Disc 8541 (1) on Arbor D-115-3 (3) in position in the housing side bearing cradles. Install differential bearing caps on arbor discs and tighten cap bolts to 41 N·m (30 ft. lbs.).



5. Assemble Dial Indicator C-3339 (3) into Scooter Block D-115-2 (2) and secure set screw.
6. Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the rearward surface of the pinion height block. Hold scooter block in place and zero the dial indicator. Tighten dial indicator face lock screw.
7. Slowly slide the dial indicator probe over the edge of the pinion height block.
8. Slide the dial indicator probe across the gap between the pinion height block and the arbor bar (1) with the scooter block against the pinion height block. When dial probe contacts the arbor bar, the dial pointer will turn clockwise. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve a zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

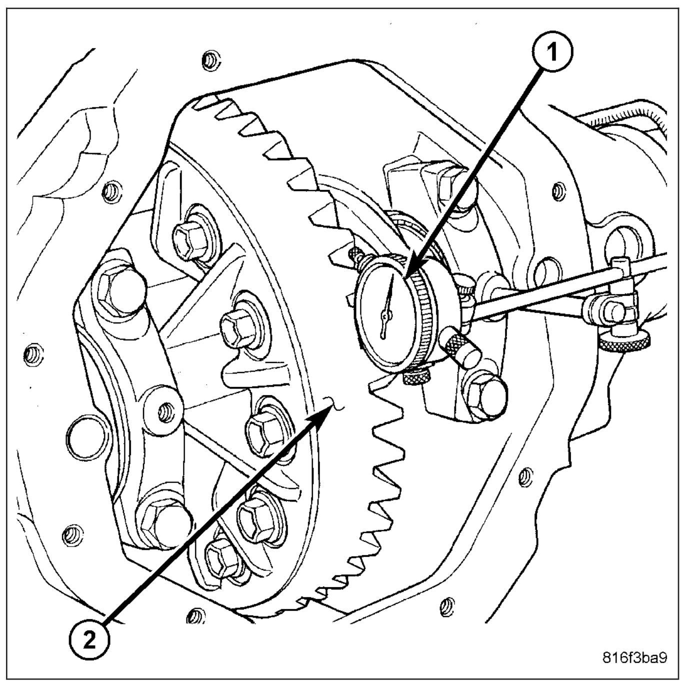



9. Select a shim equal to the dial indicator reading, plus the drive pinion gear depth variance number marked on the shaft of the pinion. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading. Then subtract 0.041 mm (0.0016 in.) from the total measurement. This will be the correct shim selection for the pinion height.

## DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

The following must be considered when adjusting bearing preload and gear backlash :

- The maximum ring gear (2) backlash variation is 0.076 mm (0.003 in.).
- Mark the gears so the same teeth are meshed during all backlash measurements.
- Maintain the torque while adjusting the bearing preload and ring gear backlash.
- Excessive adjuster torque will introduce a high bearing load and cause premature bearing failure. Insufficient adjuster torque can result in excessive differential case free-play and ring gear noise.
- Insufficient adjuster torque will not support the ring gear correctly and can cause excessive differential case free-play and ring gear noise.




**NOTE: The differential bearing cups will not always immediately follow the threaded adjusters as they are moved during adjustment. To ensure accurate bearing cup responses to the adjustments:**

- **Maintain the gear teeth engaged (meshed) as marked.**
- **The bearings must be seated by rapidly rotating the pinion gear a half turn back and forth.**
- **Do this five to ten times each time the threaded adjusters are adjusted.**

1. Use Adjuster C-4164 to adjust each threaded adjuster inward until the differential bearing free-play is eliminated. Allow some ring gear backlash, approximately 0.25 mm (0.01 in.) between the ring and pinion gear. Seat the bearing cups with the procedure described above.
2. Install dial indicator (1) and position the plunger against the drive side of a ring gear tooth (2). Measure the backlash at 4 positions (90 degrees apart) around the ring gear. Locate and mark the area of minimum backlash.

3. Rotate the ring gear to the position of the least backlash. Mark the gear so that all future backlash measurements will be taken with the same gear teeth meshed.
4. Loosen the right-side, tighten the left-side threaded adjuster. Obtain backlash of 0.076 to 0.102 mm (0.003 to 0.004 in.) with each adjuster tightened to 14 N·m (10 ft. lbs.). Seat the bearing cups with the procedure described above.
5. Tighten the differential bearing cap bolts to 95 N·m (70 ft. lbs.).
6. Tighten the right-side threaded adjuster to 102 N·m (75 ft. lbs.). Seat the bearing cups with the procedure described above. Continue to tighten the right-side adjuster and seat bearing cups until the torque remains constant at 102 N·m (75 ft. lbs.)
7. Measure the ring gear backlash. The range of backlash is 0.12 to 0.20 mm (0.005 to 0.008 in.).
8. Continue increasing the torque at the right-side threaded adjuster until the specified backlash is obtained.

**NOTE: The left-side threaded adjuster torque should have approximately 102 N·m (75 ft. lbs.). If the torque is considerably less, the complete adjustment procedure must be repeated.**

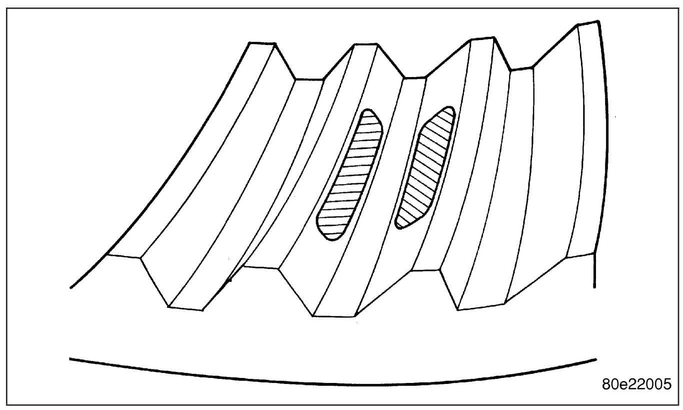
9. Tighten the left-side threaded adjuster until 102 N·m (75 ft. lbs.) torque is indicated. Seat the bearing rollers with the procedure described above. Do this until the torque remains constant.
10. Install the threaded adjuster locks and tighten the lock screws to 10 N·m (90 in. lbs.).

After the proper backlash is achieved, perform the Gear Contact procedure.

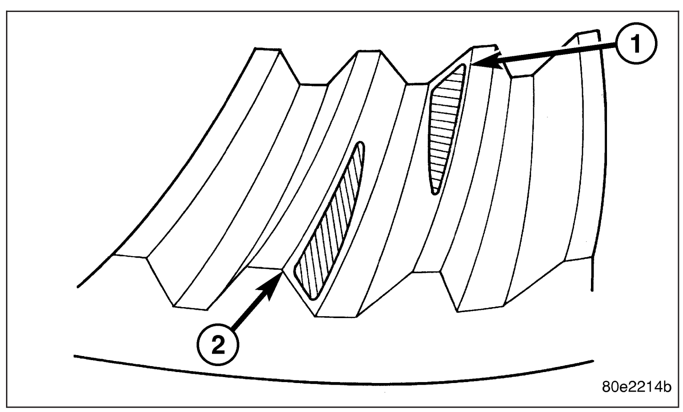
## GEAR CONTACT PATTERN

1. Wipe clean each tooth of the ring gear.
2. Apply gear marking compound to all of the ring gear teeth.
3. Verify bearing cap bolts are torque specification.
4. Apply parking brakes lightly to create at 14 N·m (10 ft. lbs.) pinion rotating torque.
5. Rotate the pinion/pinion yoke 4 full revolutions in each directions.
6. Read gear tooth contact pattern.

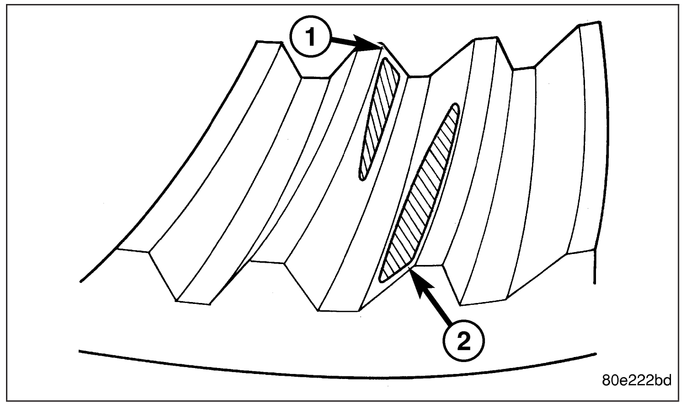
Gear contact pattern is correct. Backlash and pinion depth is correct.



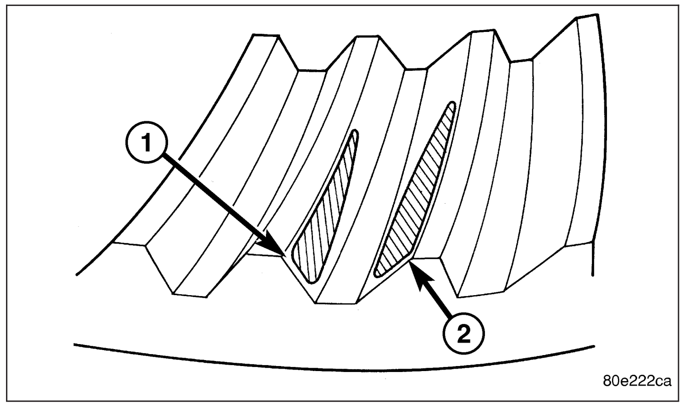

Ring gear is too far away from the pinion gear, coast side toe (1) drive side heel (2). Decrease backlash by moving ring closer to the pinion gear using the adjusters.



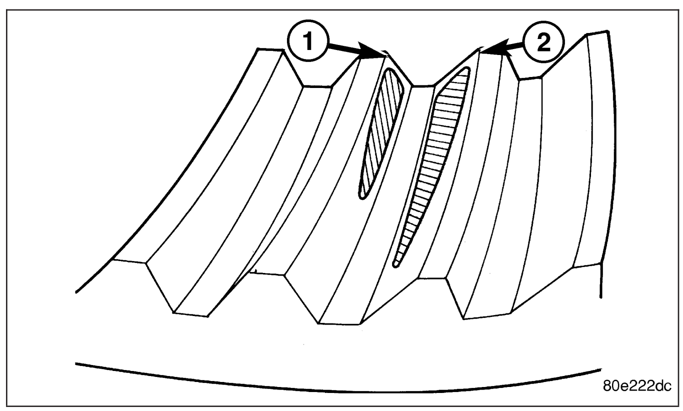
Ring gear is too close to the pinion gear, drive side toe (1) coast side heel (2). Increase backlash by moving ring away from the pinion gear using the adjusters.



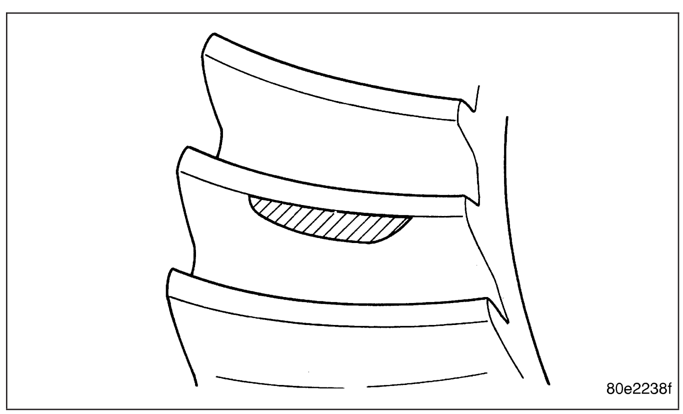

Ring gear is too far away from the pinion gear, drive side heel (1) coast side heel (2). Decrease backlash by moving ring gear closer to the pinion gear using the adjusters.



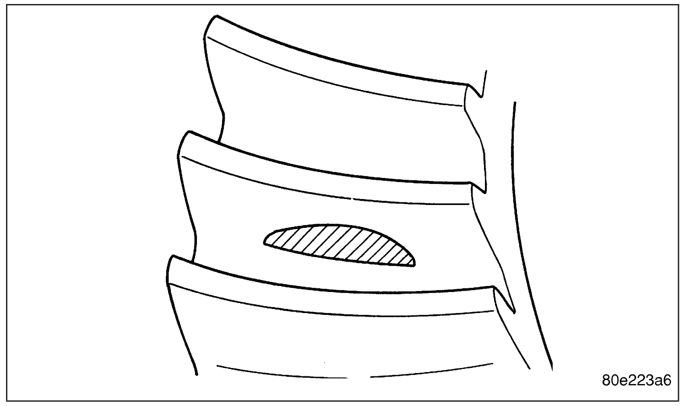

Ring gear is too close to the pinion gear, drive side toe (1) coast side toe (2). Increase backlash by moving ring gear away from the pinion gear using the adjusters.




Pinion gear is set too low. Increase pinion gear height, by increasing pinion depth shim thickness.



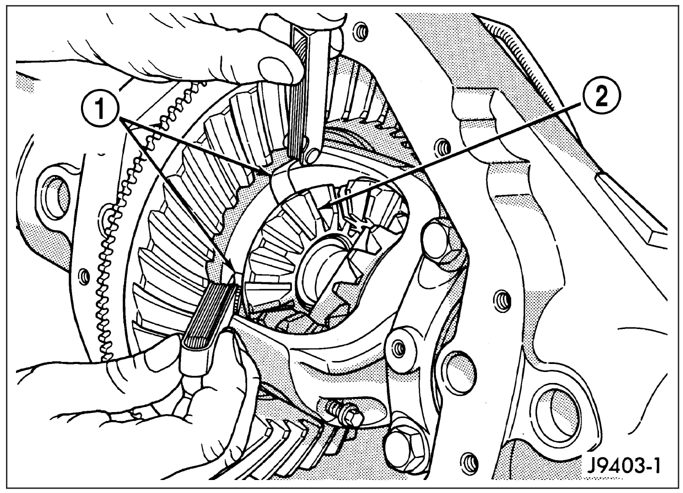
Pinion gear is set too high. Decrease pinion height by decreasing the pinion depth shim thickness.




## SIDE GEAR CLEARANCE

When measuring side gear clearance, check each gear independently. If it necessary to replace a side gear, replace both gears as a matched set.

1. Install axle shafts and C-locks and pinion mate shaft.
2. Measure each side gear clearance. Insert a matched pair of feeler gauge (1) blades between the side gear (2) and differential housing on opposite sides of the hub.




| | |
|---|---|
| SIDE GEAR CLEARANCE | 0.007 |
| THRUST WASHER THICKNESS | + 0.033 |
| TOTAL | 0.040 |
| | 0.040 |
| REPLACEMENT WASHER THICKNESS | − 0.037 |
| NEW SIDE GEAR CLEARANCE | 0.003 |

J9203-31

3. If side gear clearances is no more than 0.005 inch. Determine if the axle shaft is contacting the pinion mate shaft. **Do not remove the feeler gauges, inspect the axle shaft with the feeler gauge inserted behind the side gear.** If the end of the axle shaft is not contacting the pinion mate shaft, the side gear clearance is acceptable.
4. If clearance is more than 0.005 inch (axle shaft not contacting mate shaft), record the side gear clearance. Remove the thrust washer and measure its thickness with a micrometer. Add the washer thickness to the recorded side gear clearance. The sum of gear clearance and washer thickness will determine required thickness of replacement thrust washer.

In some cases, the end of the axle shaft will move and contact the mate shaft when the feeler gauge is inserted. The C-lock is preventing the side gear from sliding on the axle shaft.

5. If there is no side gear clearance, remove the C-lock from the axle shaft. Use a micrometer to measure the thrust washer thickness. Record the thickness and re-install the thrust washer. Assemble the differential case without the C-lock installed and re-measure the side gear clearance.
6. Compare both clearance measurements. If the difference is less than 0.3 mm (0.012 in.) add clearance recorded when the C-lock was installed to thrust washer thickness measured. The sum will determine the required thickness of the replacement thrust washer.
7. If clearance is 0.3 mm (0.012 in.) or greater, both side gears must be replaced (matched set) and the clearance measurements repeated.
8. If clearance (above) continues to be 0.3 mm (0.012 in.) or greater, the case must be replaced.

# SPECIFICATIONS - 8 1/4

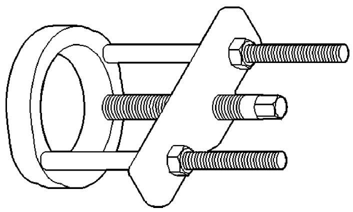
## AXLE SPECIFICATIONS

| DESCRIPTION | SPECIFICATION |
|---|---|
| Axle Ratio | 3.55, 3.73 |
| Differential Case Flange Runout | 0.076 mm (0.003 in.) |
| Differential Case Clearance | 0.12 mm (0.005 in.) |
| Ring Gear Diameter | 213 mm (8.25 in.) |
| Ring Gear Backlash | 0.12-0.20 mm (0.005-0.008 in.) |
| Ring Gear Runout | 0.12 mm (0.005 in.) |
| Pinion Bearing Preload - Original Bearings | 1-2 N·m (10-20 in. lbs.) |
| Pinion Bearing Preload - New Bearings | 1-3.4 N·m (10-30 in. lbs.) |

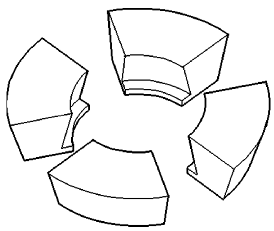
## TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Differential Cover Bolts | 41 | 30 | - |
| Bearing Cap Bolts | 95 | 70 | - |
| Ring Gear Bolts | 102 | 75 | - |
| Pinion Nut Minimum | 285 | 210 | - |
| Pinion Mate Shaft Screw | 16 | 12 | - |
| Axle Damper | 61 | 45 | - |
| Adjuster Lock Screw | 10 | - | 90 |

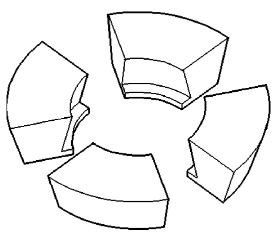
## SPECIAL TOOLS



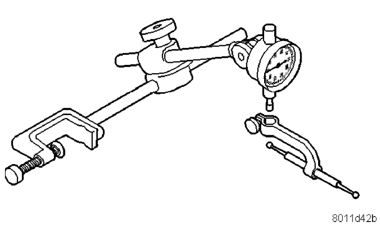
***PULLER/PRESS C-293-PA***



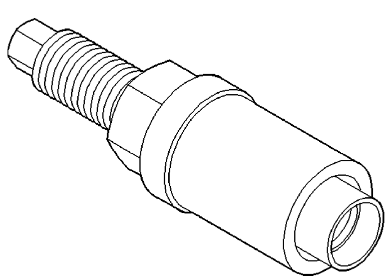
***ADAPTERS C-293-47***



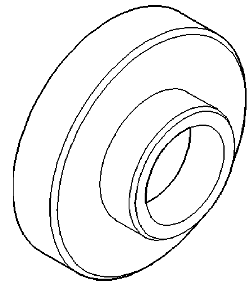
***ADAPTERS C-293-48***



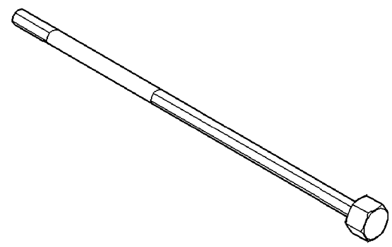

***DIAL INDICATOR C-3339***



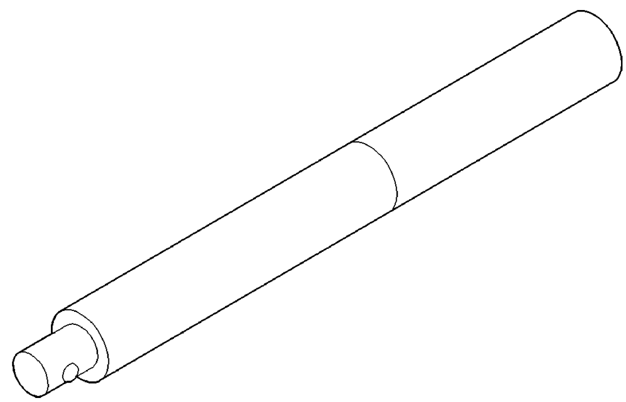
***INSTALLER C-3718***



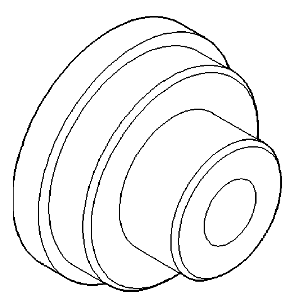
***INSTALLER C-4076-B***



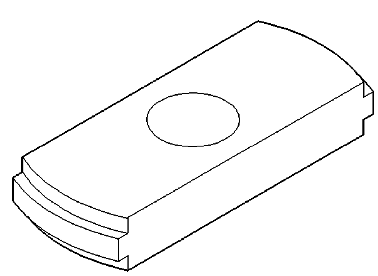
***ADJUSTMENT C-4164***



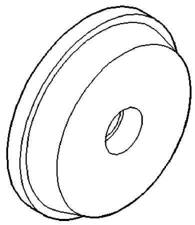
***HANDLE C-4171***



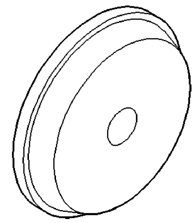
***INSTALLER C-4198***



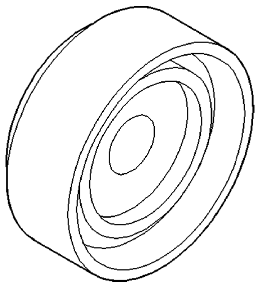
***REMOVER C-4307***



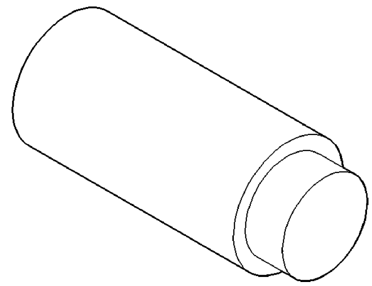
INSTALLER C-4308



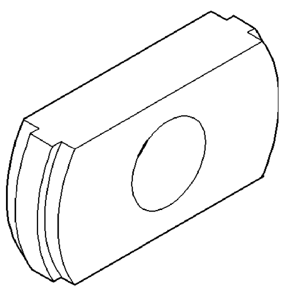
INSTALLER D-130



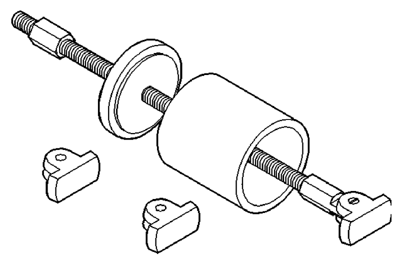
INSTALLER C-4340



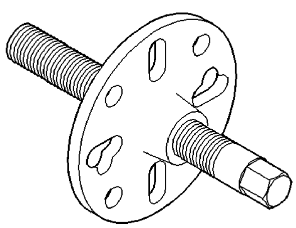
PLUG SP-3289



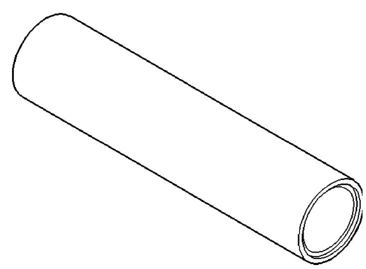
REMOVER C-4345



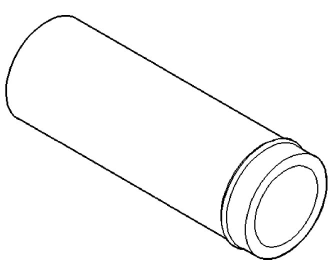
REMOVER 6310



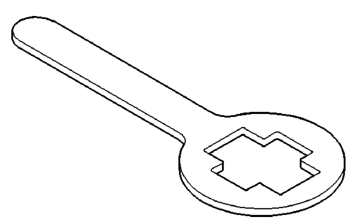
PULLER C-452



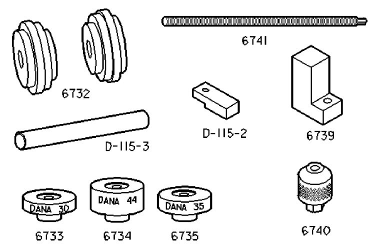
INSTALLER 6448A



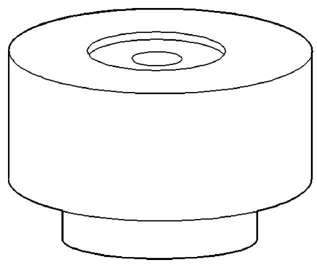
HANDLE C-4735



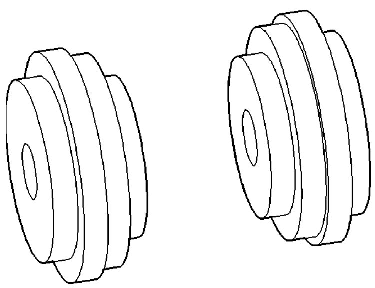
HOLDER 6719A




PINION GAUGE SET 6774



PINION BLOCK 8540



ARBOR DISCS 8541

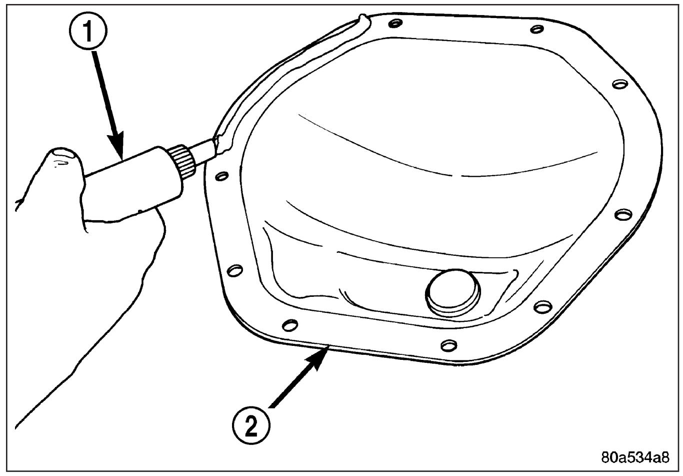
# COVER-DIFFERENTIAL

## REMOVAL

1. With vehicle in neutral, position vehicle on hoist.
2. Remove drain plug.
3. Remove cover bolts.
4. Remove cover and drain lubricant.

## INSTALLATION

1. Apply a bead of orange Mopar™ Axle RTV sealant (1) or equivalent to the housing cover (2).



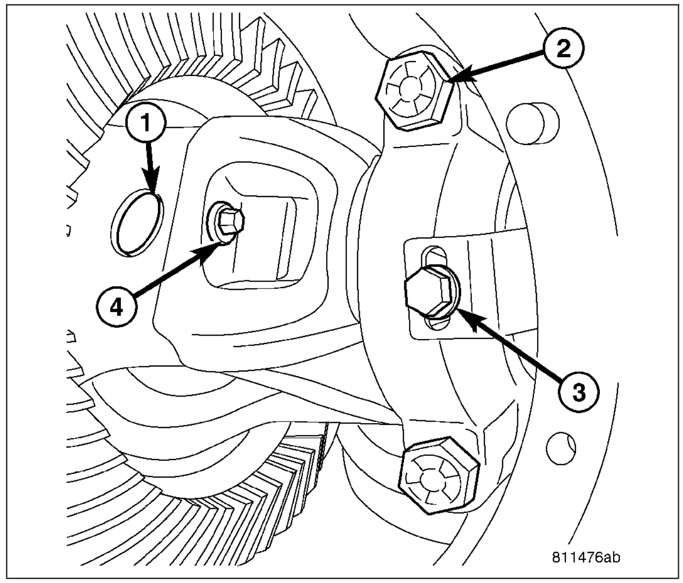

**CAUTION: If cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied. Failure to follow these instructions will cause a leak.**

2. Install cover and identification tag. Tighten cover bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.).
3. Fill differential to specifications.
4. Install fill plug.

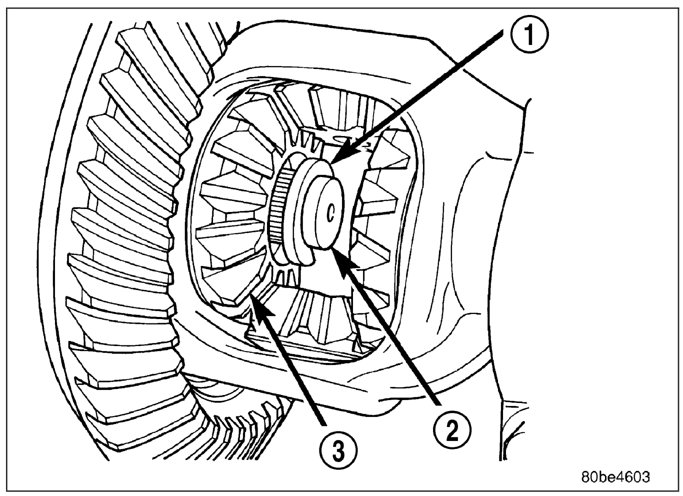
# SHAFT-AXLE

## REMOVAL

1. With vehicle in neutral, position vehicle on hoist.
2. Remove rear brake components.
3. Remove wheel speed sensor.
4. Remove differential housing cover and drain lubricant.
5. Rotate differential case so pinion mate shaft (1) lock screw (4) is accessible. Remove lock screw and pinion mate shaft from differential case.

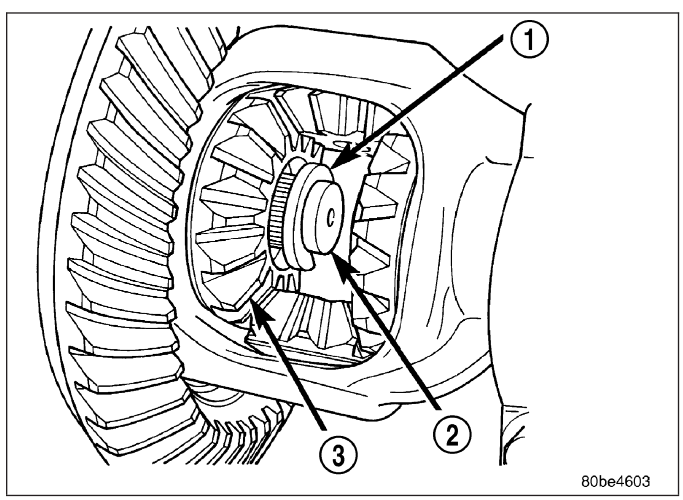



6. Push axle shaft inward and remove axle shaft C-lock (1) from the axle shaft (2).
7. Remove axle shaft from side gear (3) and axle tube.

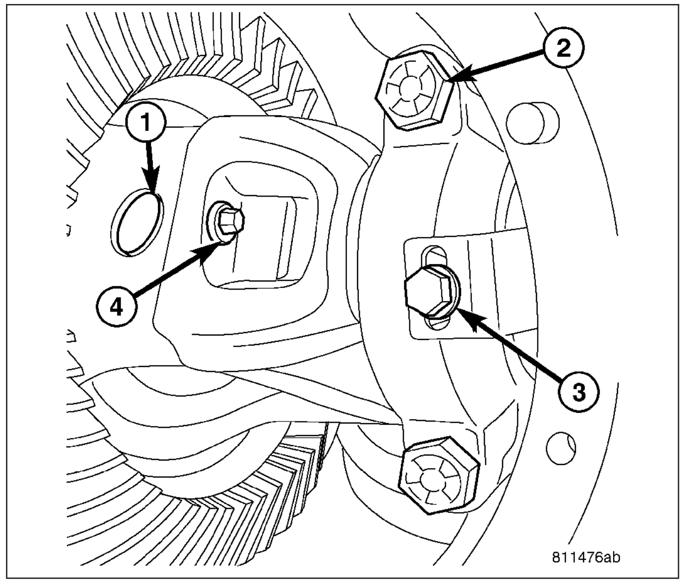



## INSTALLATION

1. Lubricate bearing bore and seal lip with gear lubricant.
2. Install axle shaft (2) through seal, bearing and engage into side gear (3) splines.
3. Install C-lock (1) in axle shaft end, then push axle shaft outward to seat C-lock in side gear.



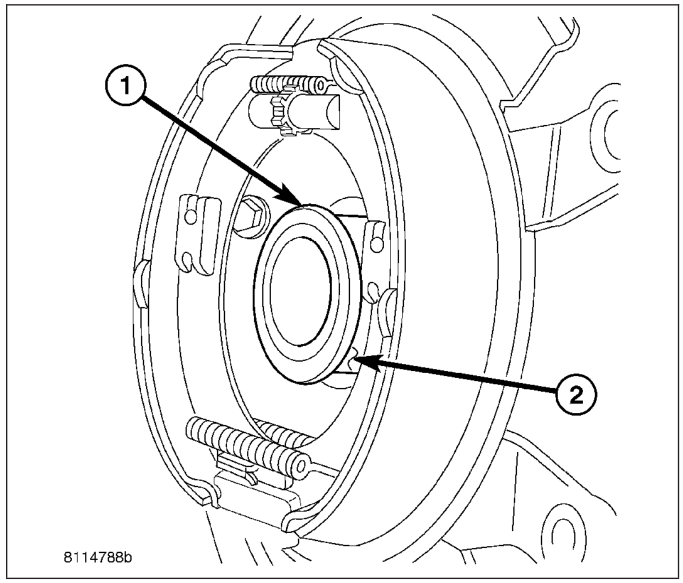
4. Install pinion mate shaft (1) into differential case and through thrust washers and differential pinions.
5. Align hole in shaft with hole in the differential case and install lock screw (4) with Loctite® on the threads. Tighten lock screw to 11 N·m (8 ft. lbs.).
6. Install differential cover.
7. Install wheel speed sensor.
8. Install rear brake components.



# SEAL-AXLE SHAFT

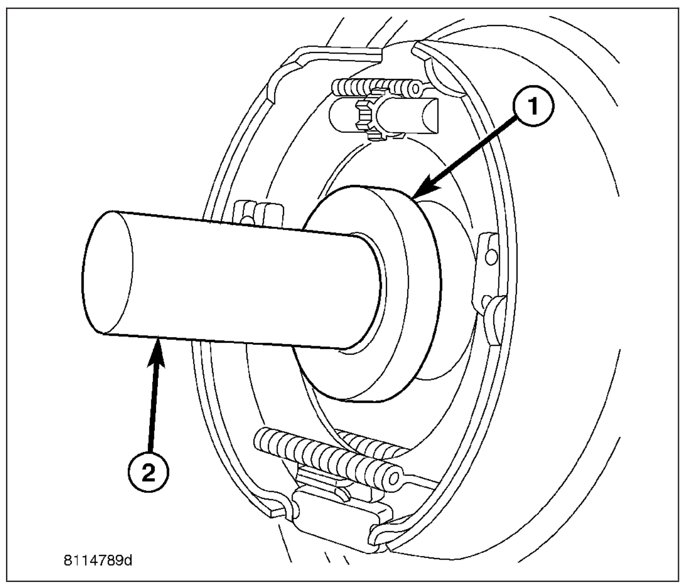
## REMOVAL

1. Remove axle shaft.
2. Remove axle shaft seal (1) from axle tube (2) with a seal pick.




## INSTALLATION

1. Remove any old sealer/burrs from axle tube.
2. Coat **new** seal lip with axle lubricant and install seal with Installer C-4198 (1) and Handle C-4171 (1).
3. Install axle shaft.

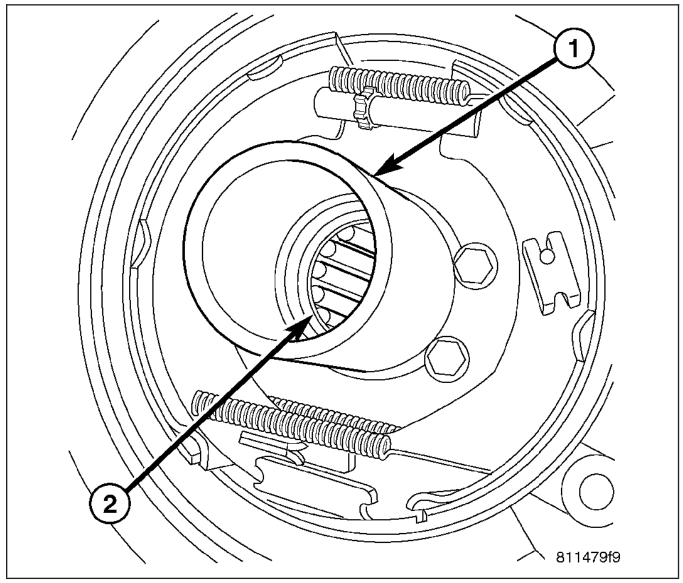


# BEARING-AXLE

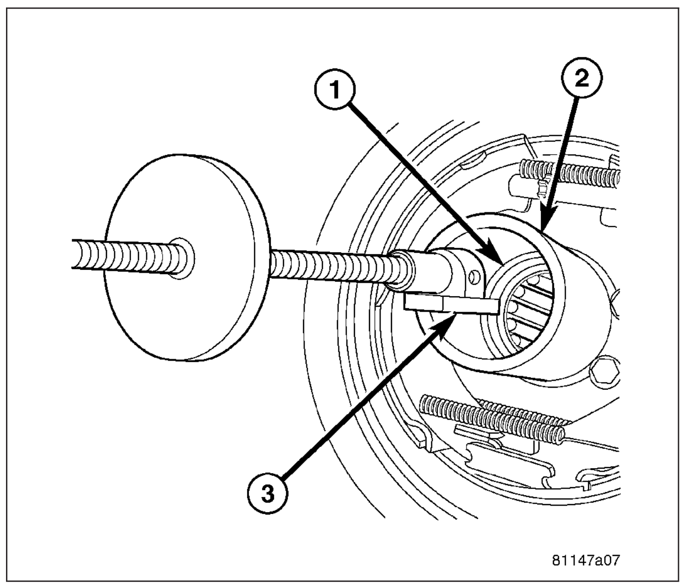
## REMOVAL

**NOTE: Remove bearing with Bearing Remover 6310 and Foot 6310-9.**

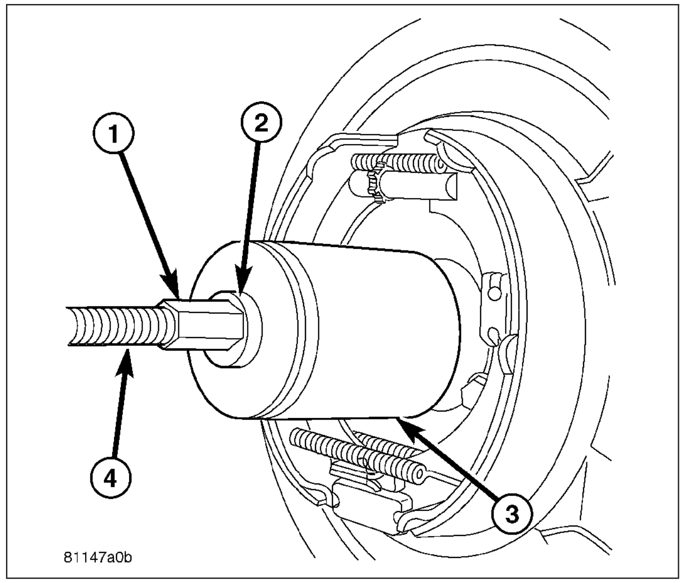
1. Remove axle shaft.
2. Remove axle seal with seal pick.
3. Position bearing (2) receiver (1) on axle tube.




4. Insert bearing remover Foot 6310-9 (3) through receiver (2) and bearing (1).



5. Tighten remove nut (1) on the shaft (4) to pull bearing into the receiver (3).

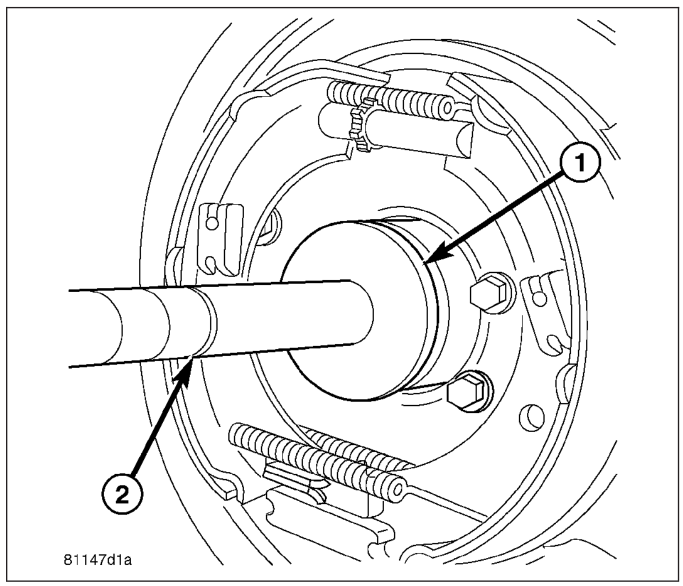



## INSTALLATION

1. Remove any old sealer/burrs from axle tube.
2. Install axle shaft bearing with Installer C-4198 (1) and Handle C-4171 (2). Drive bearing in until tool contacts the axle tube.

**NOTE: Bearing is installed with the bearing part number against installer.**

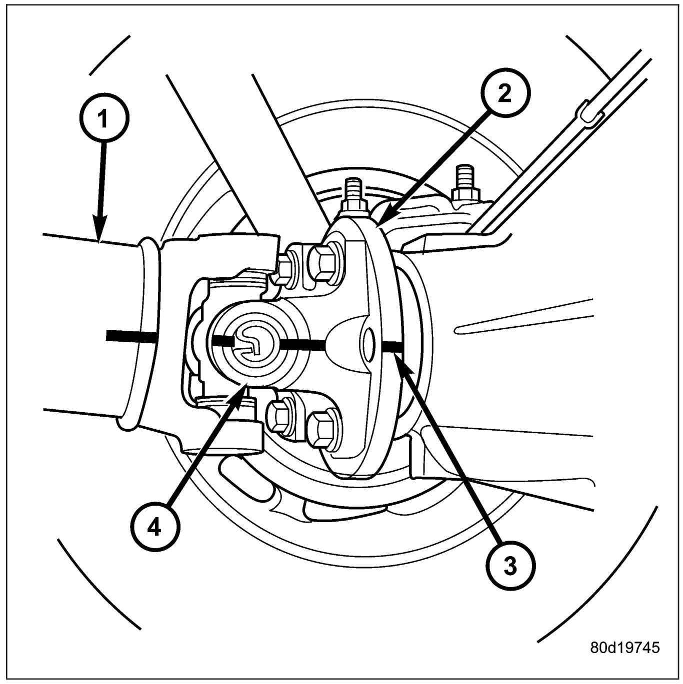
3. Coat **new** axle seal lip with axle lubricant. Install seal with Installer C-4198 and Handle C-4171.
4. Install axle shaft.



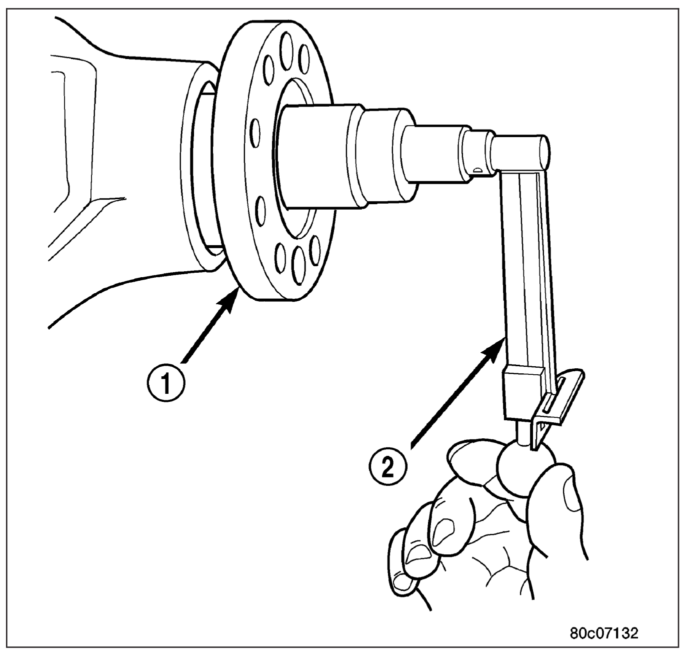
# SEAL-PINION

## REMOVAL

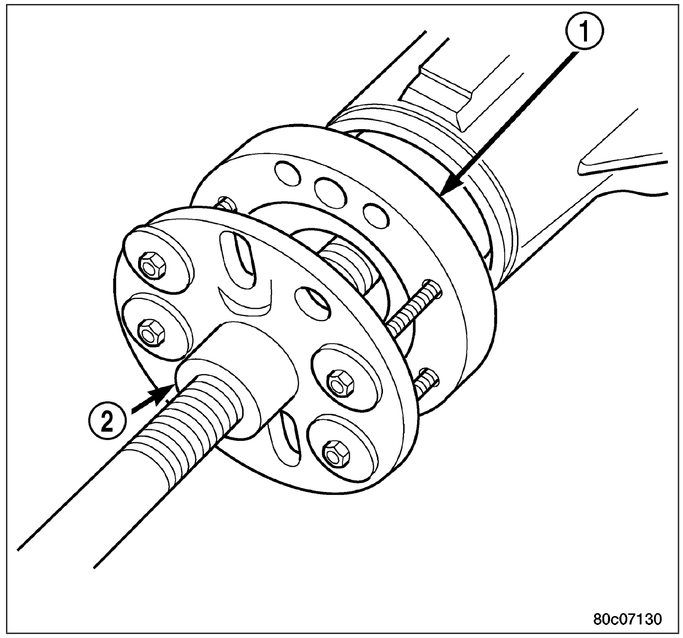
1. With vehicle in neutral, position vehicle on hoist.
2. Mark a reference line (3) across the axle companion flange (2) and propeller shaft flange yoke (4).
3. Remove companion flange bolts and remove propeller shaft
4. Remove wheel and tire assemblies.
5. Remove brake calipers and rotors to prevent any drag.




6. Rotate companion flange three or four times and verify flange rotates smoothly.
7. Measure rotating torque of the pinion (1) with a inch pound torque wrench (2) and record reading for installation reference.
8. Install bolts into two of the threaded holes in the companion flange 180 degrees apart.
9. Position Holder 6719A against the companion flange and install a bolt and washer into one of the remaining threaded holes. Tighten the bolts so the Holder 6719A is held to the flange.
10. Remove the pinion nut and washer.

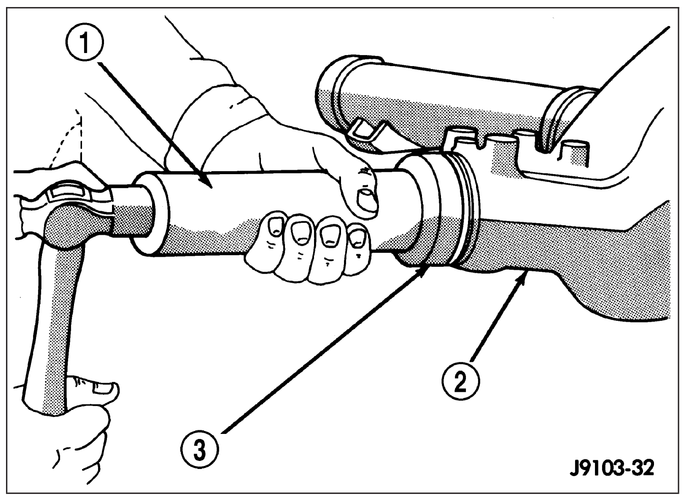


11. Remove companion flange (1) with Puller C-452 (2).
12. Remove pinion seal with a seal puller.



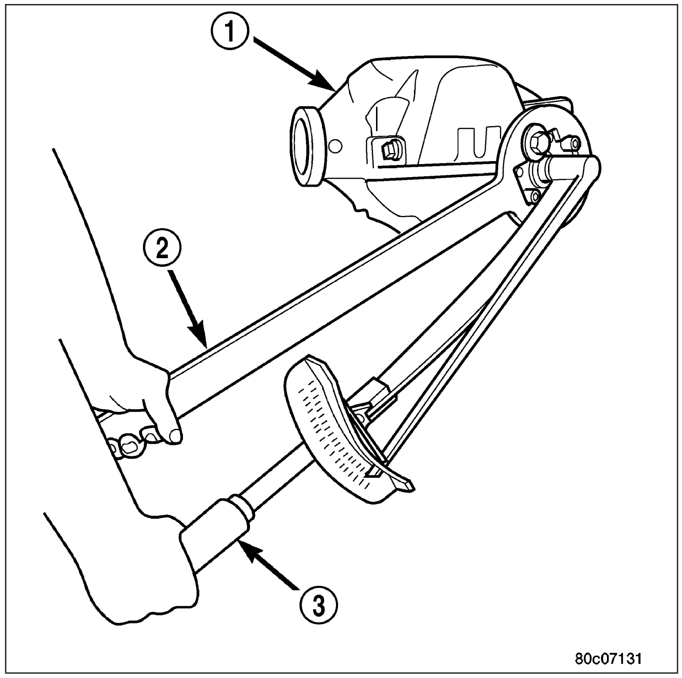

## INSTALLATION

1. Apply a light coating of gear lubricant on the lip of pinion seal.
2. Install **new** pinion seal with Installer C-4076-B (3) and Handle C-4735 (1).

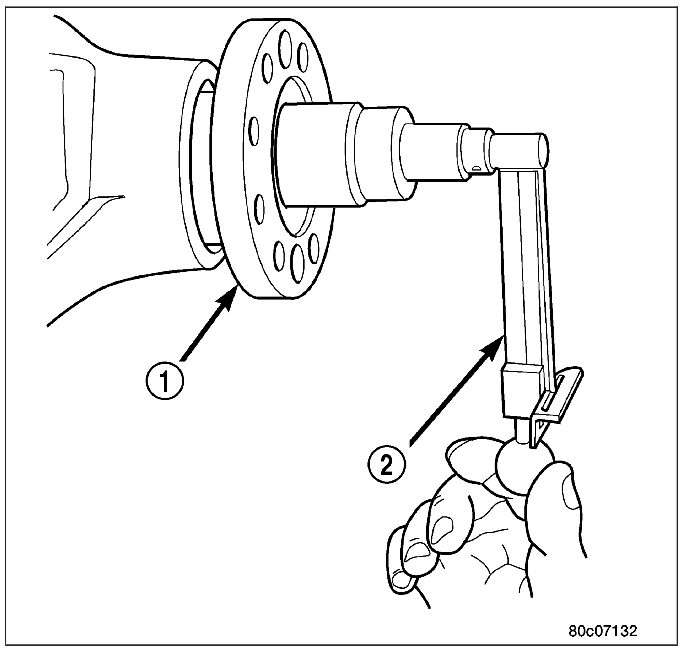


3. Install companion flange on the end of the shaft with the reference marks aligned.
4. Install bolts into two of the threaded holes in the companion flange 180 degrees apart.
5. Position Holder 6719A (2) against the companion flange and install a bolt and washer into one of the remaining threaded holes. Tighten the bolts so Holder 6719A is held to the flange.
6. Install companion flange on pinion shaft with Installer C-3718 and Holder 6719A.
7. Install the pinion washer and a **new** pinion nut. The convex side of the washer must face outward.

**CAUTION: Do not exceed the minimum tightening torque when installing the companion flange retaining nut at this point. Failure to heed caution may result in damage.**




8. Hold companion flange with Holder 6719A (2) and with a torque wrench (3) tighten pinion nut to 285 N·m (210 ft. lbs.). Rotate pinion several revolutions to ensure the bearing rollers are seated.
9. Rotate pinion (1) with an inch pound torque wrench (2). Rotating torque should be equal to the reading recorded during removal plus an additional 0.56 N·m (5 in. lbs.).



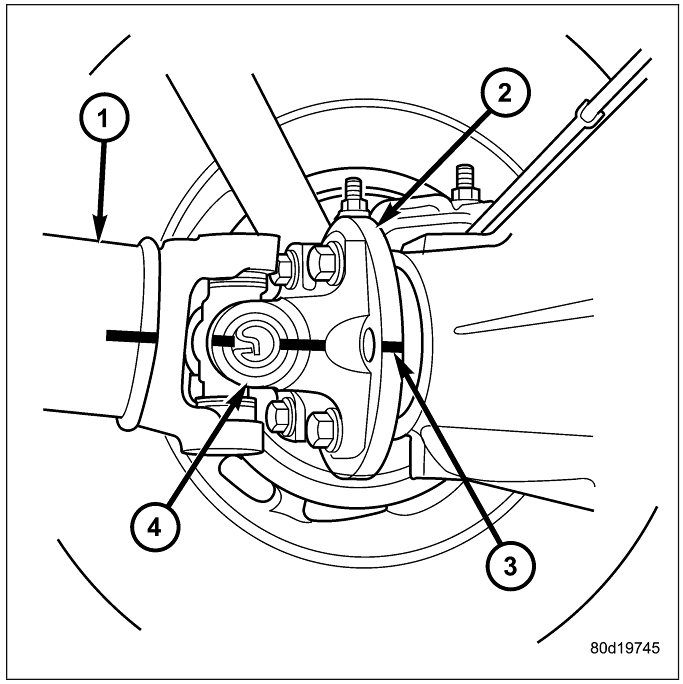

**CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. Failure to follow these instructions will result in damage.**

10. If rotating torque is low use Holder 6719A to hold the companion flange and tighten pinion nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.

**NOTE: The seal replacement is unacceptable if final pinion nut torque is less than 285 N·m (210 ft. lbs.).**

**NOTE: The bearing rotating torque should be constant during a complete revolution of the pinion. If the rotating torque varies, this indicates a binding condition.**

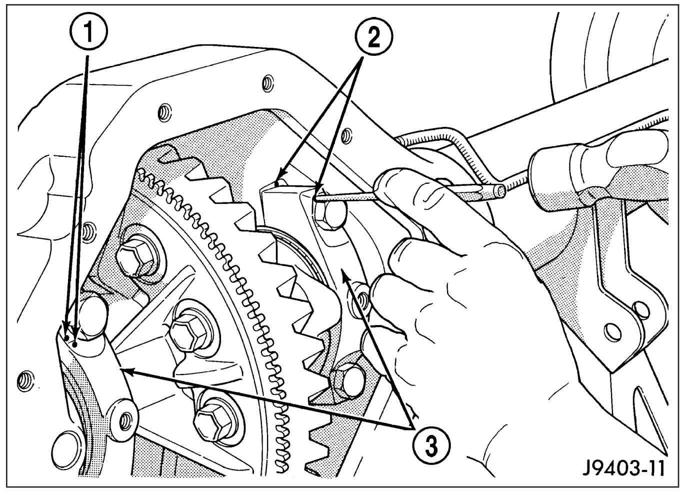
11. Install propeller shaft (1) with installation reference marks (3) aligned.
12. Install rear brake components.



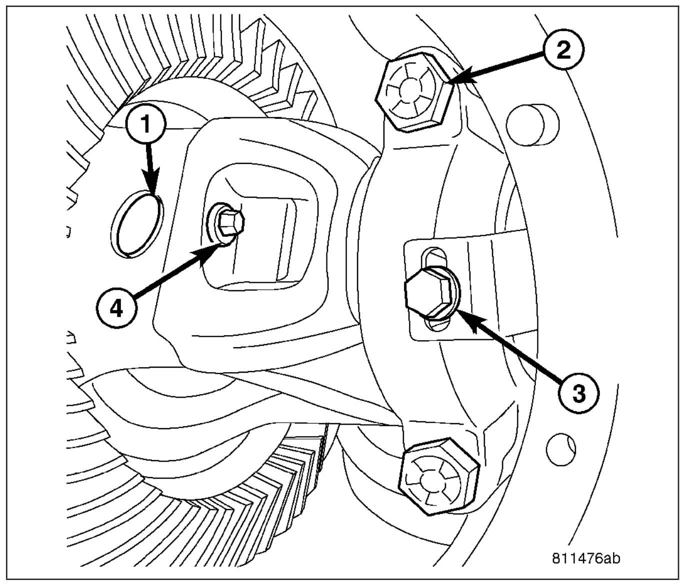
# DIFFERENTIAL

## REMOVAL

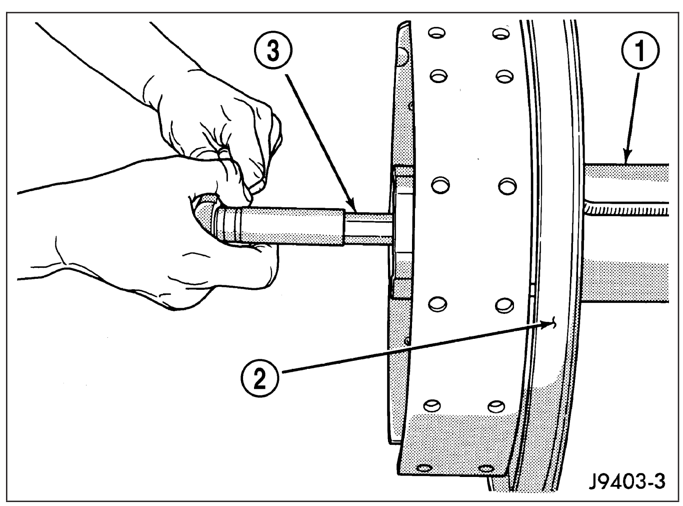
1. Remove differential fill plug.
2. Remove differential cover and drain lubricant.
3. Remove axle shaft C-locks and axle shafts.
4. Remove ABS sensor from housing.
5. Mark (1) (2) differential housing and bearing caps (3) for installation reference.




6. Remove bearing adjuster lock bolt (3) from bearing caps.
7. Loosen differential bearing cap bolts (2).

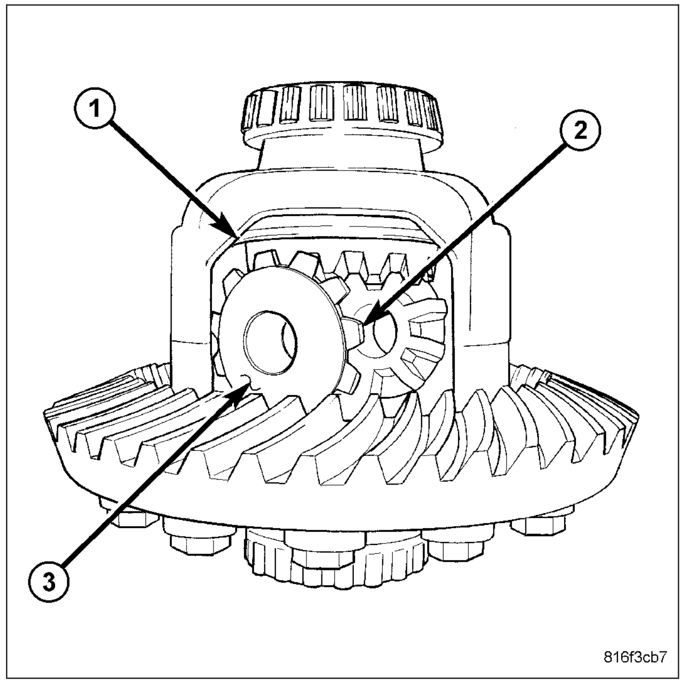



8. Loosen differential bearing adjusters through the axle tubes (1) with Adjuster C-4164 (3).
9. Hold differential case while removing bearing caps and adjusters.
10. Remove differential case and tag differential bearing cups and adjusters to indicate location.
11. Clean housing cavity with flushing oil, light engine oil or a lint free cloth.

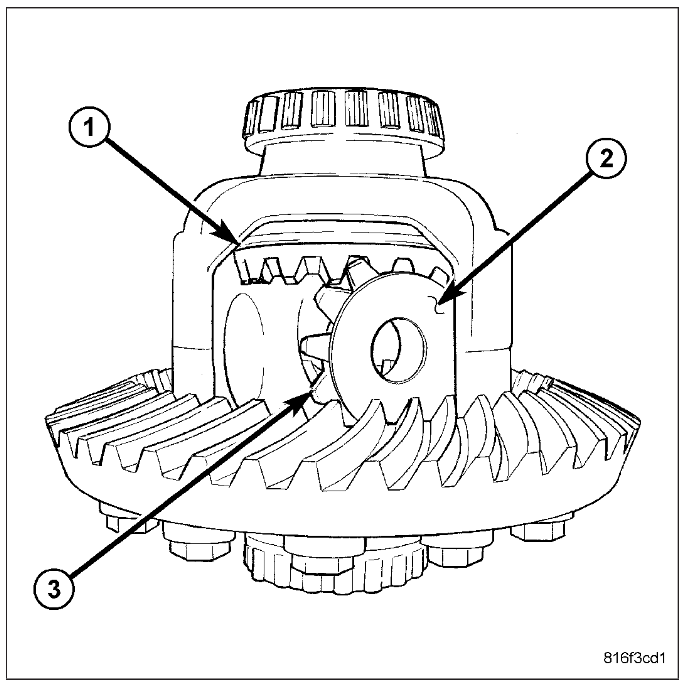


## DISASSEMBLY

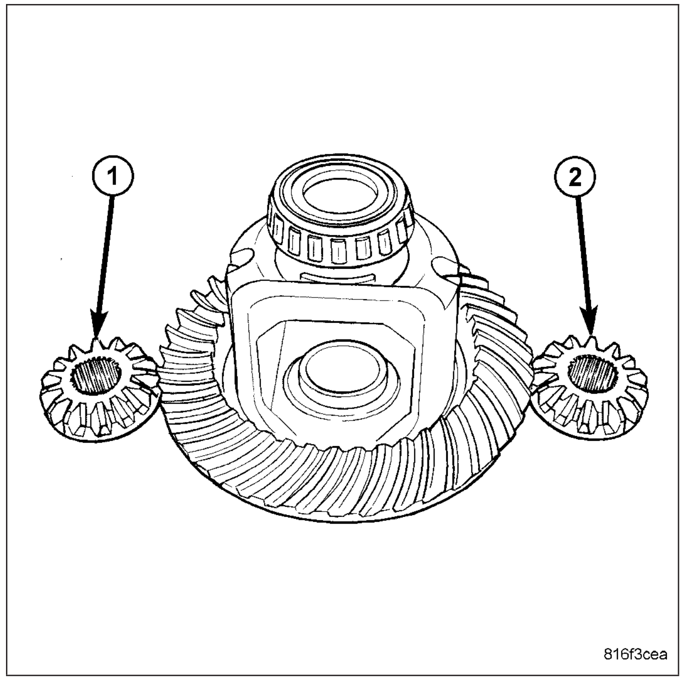
1. Rotate one pinion gear (2) with thrust washer (3) to the differential window (1) and remove gear and thrust washer.




2. Rotate remaining pinion gear (3) with thrust washer (2) to the differential window (1) and remove gear and washer.



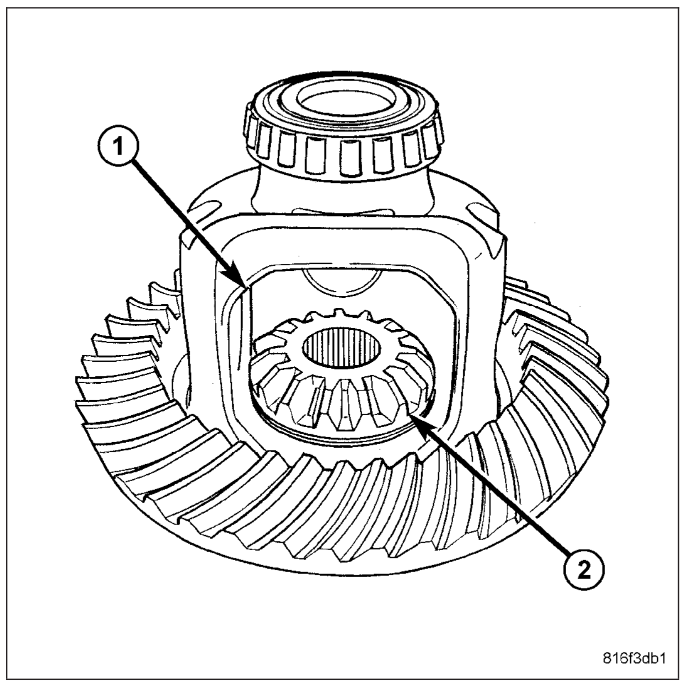
3. Remove differential side gears (1) (2) and thrust washers.



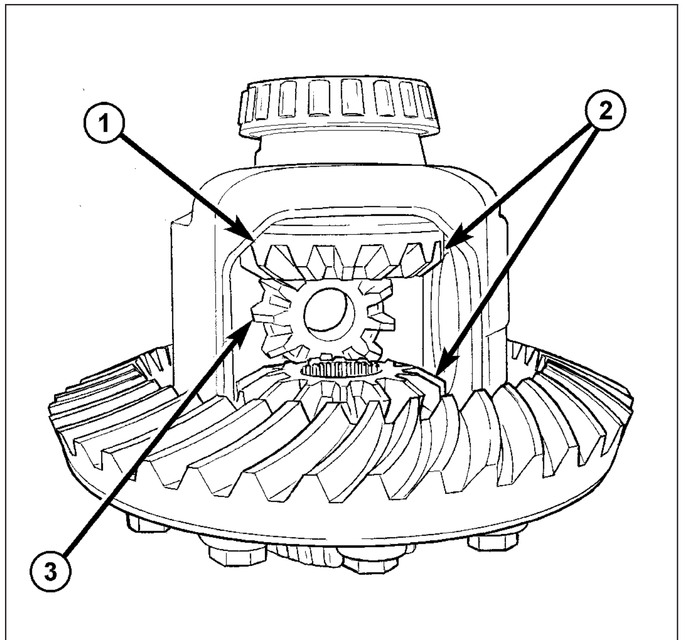

## ASSEMBLY

**NOTE: If same gears and thrust washers are being used, install them into their original locations.**

1. Lubricate all differential components with axle lubricant.
2. Install differential side gears (2) and thrust washers through differential window (1).

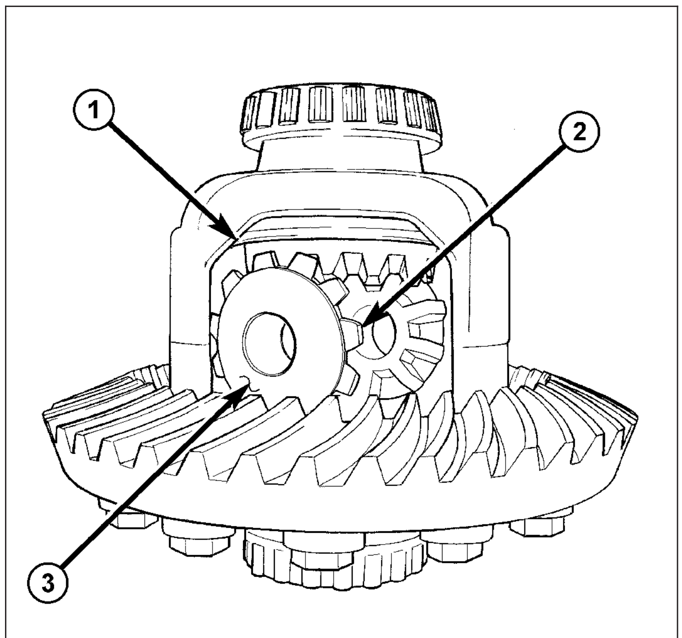


3. Install first pinion gear (3) with thrust washer into differential window (1) and side gears (2). Rotate pinion gear into the case.



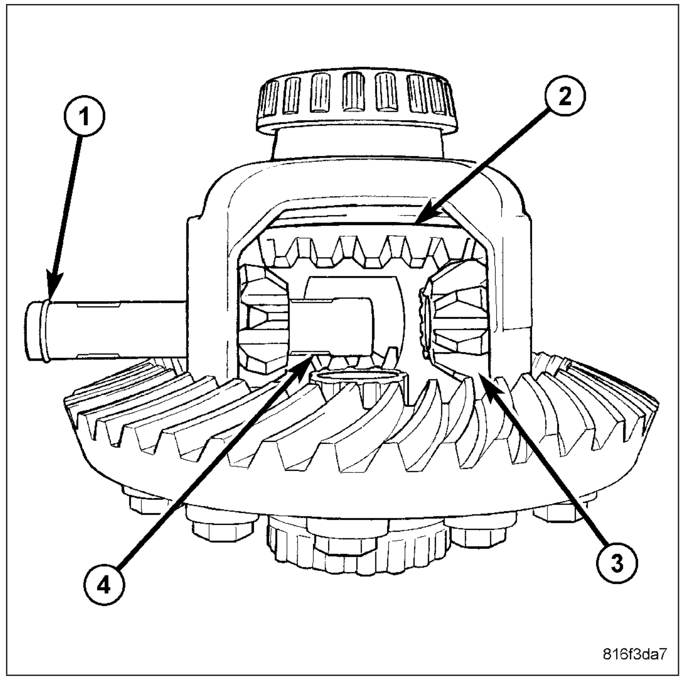
816f3e23

4. Install remaining pinion gear (2) and thrust washer (3). Rotate gears to align hole in the pinion gears with hole in the differential case.



816f3cb7

5. Slide pinion shaft (1) into the case and through the pinion gears (3) to align the gears.

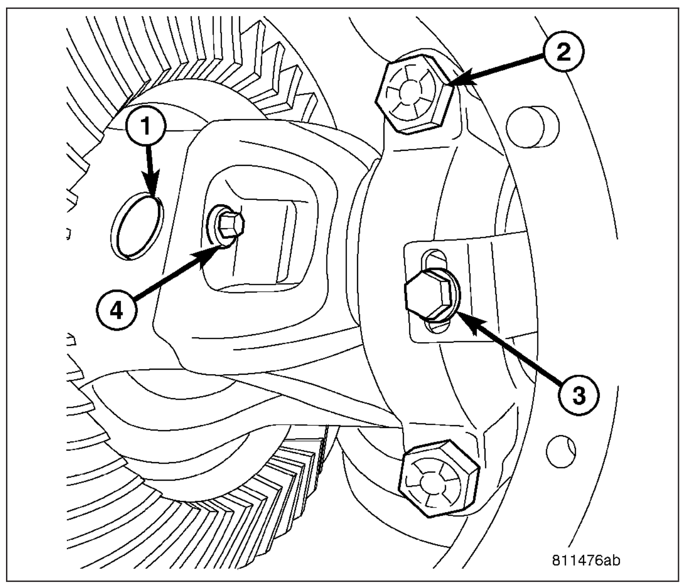



## INSTALLATION

1. Apply a coat of hypoid gear lubricant to differential bearings, bearing cups and threaded adjusters.

**NOTE: Grease can be used to keep the adjusters in position.**

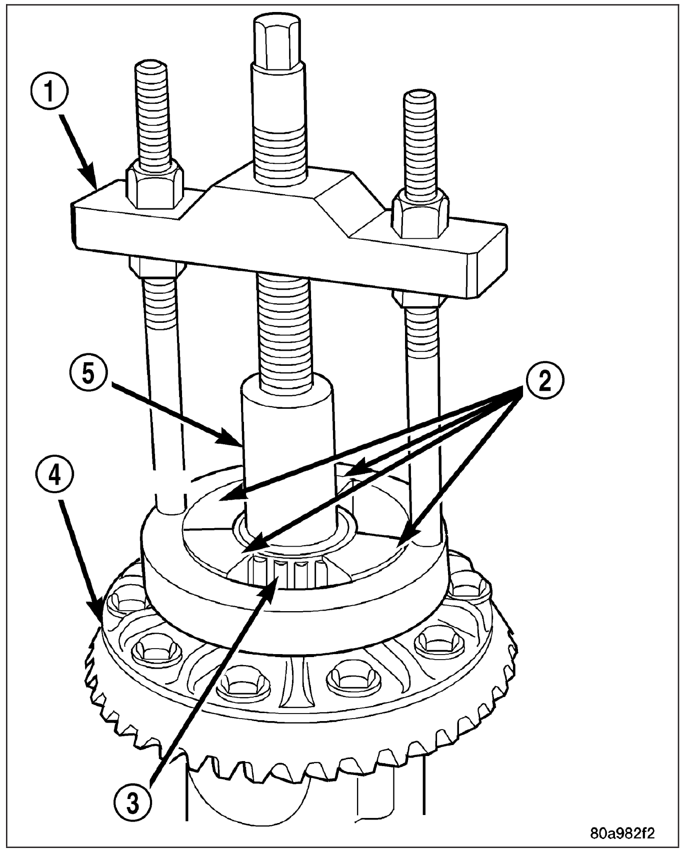
2. Install differential assembly into the housing.
3. Install differential bearing caps in their original locations.
4. Install bearing cap bolts (2) and tighten upper bolts to 14 N·m (10 ft. lbs.). Tighten lower bolts finger-tight until bolt head is seated.
5. Perform differential bearing preload and adjustment procedure.
6. Tighten bearing cap bolts in a criss-cross pattern to 95 N·m (70 ft. lbs.).
7. Install adjuster locks (3) on bearing caps and tighten to 10 N·m (90 in. lbs.).
8. Install axle shafts.
9. Install differential cover.



# BEARING-DIFFERENTIAL CASE

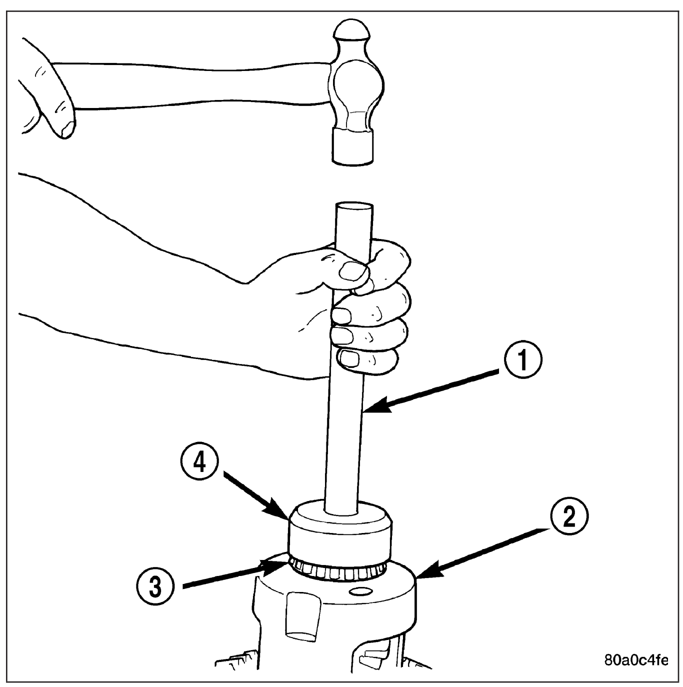
## REMOVAL

1. Remove differential case from axle.
2. Remove differential bearings (3) from the case with Puller/Press C-293-PA (1) and Adapters C-293-48 (2) and Plug SP-3289 (5).




## INSTALLATION

1. Install differential (2) bearings (3) with Installer C-4340 (4) and Handle C-4171(1).
2. Install differential case in axle.

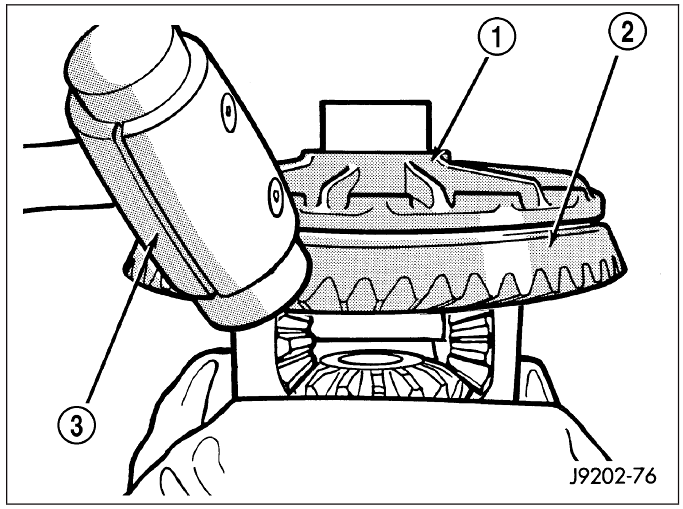


# GEAR-PINION/RING

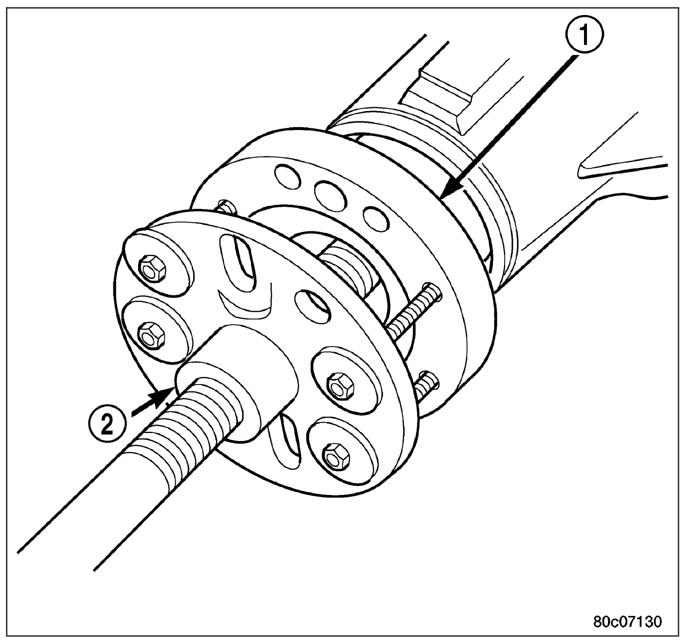
## REMOVAL

**NOTE: The ring and pinion gears are serviced in a matched set. Never replace one gear without replacing the other matched gear.**

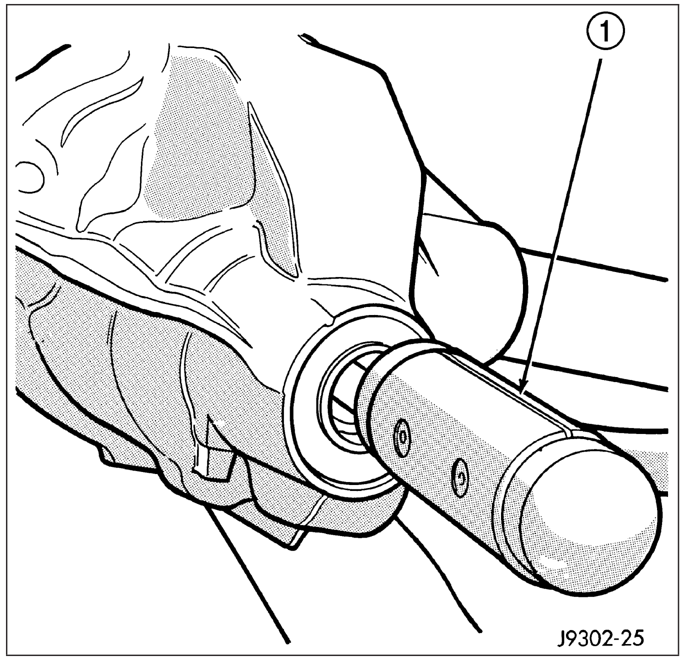
1. Remove differential from axle housing.
2. Place differential case (1) in a vise with soft metal jaw.
3. Remove bolts holding ring gear (2) to differential case.
4. Drive ring gear from differential case with a dead-blow hammer (3).



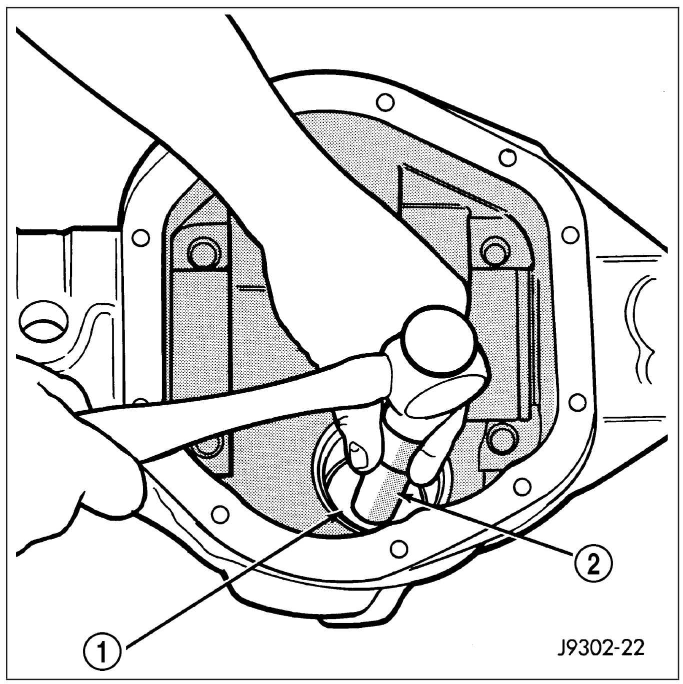

5. Hold flange (1) with Holder 6719A and remove flange nut and washer.
6. Remove flange (1) from pinion shaft with Puller C-452 (2).



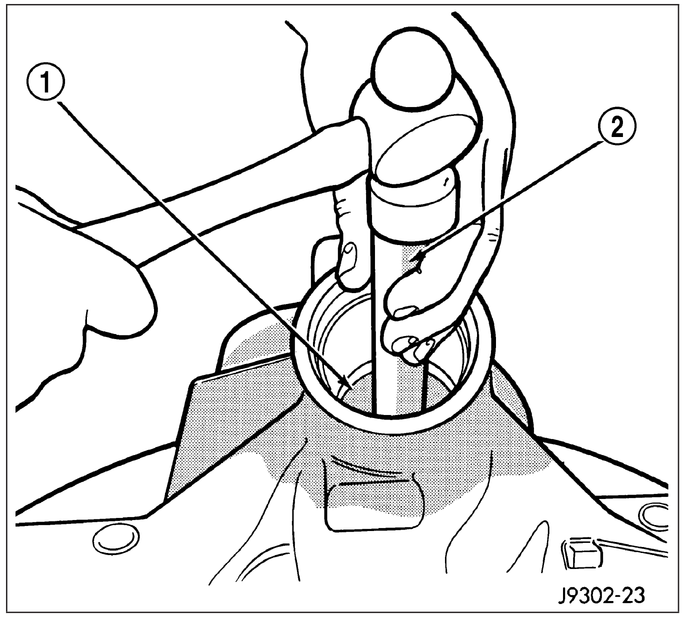
7. Remove pinion from the housing with dead-blow hammer (1).
8. Remove pinion shaft seal with a seal pick.
9. Remove oil slinger, if equipped, and front pinion bearing.



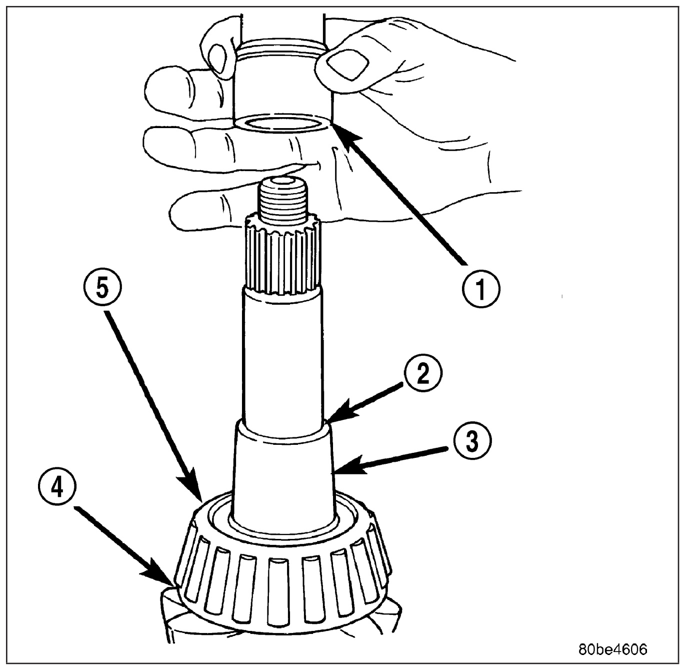

10. Remove front pinion bearing cup with Remover C-4345 (1) and Handle C-4171 (2).



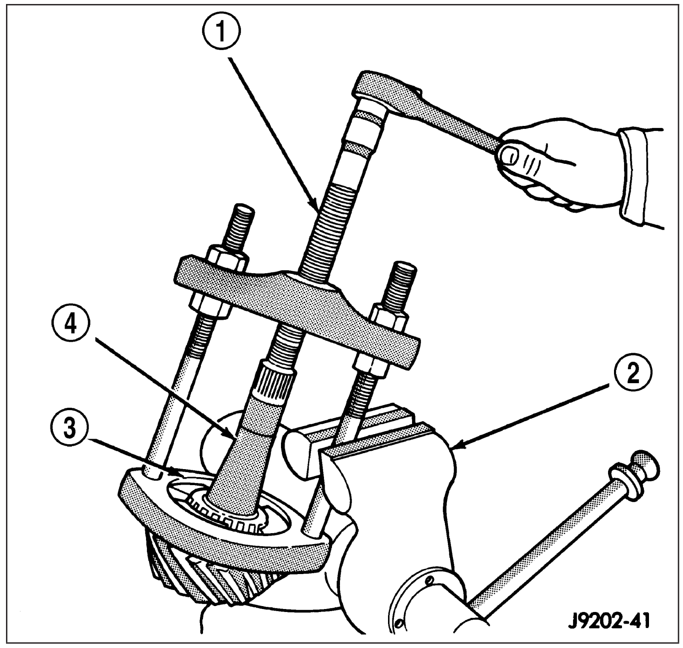
11. Remove rear bearing cup with Remover C-4307 (1) and Handle C-4171 (2).




12. Remove collapsible spacer (1) from pinion (3).



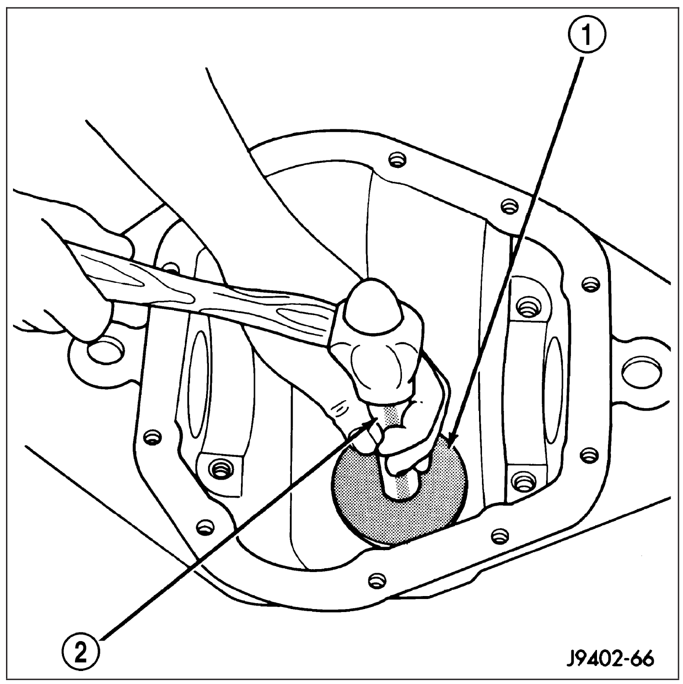
13. Remove rear pinion bearing with Puller/Press C-293-PA (1) and Adapters C-293-47 (3).
14. Remove depth shims from the pinion shaft and record the shims thickness.



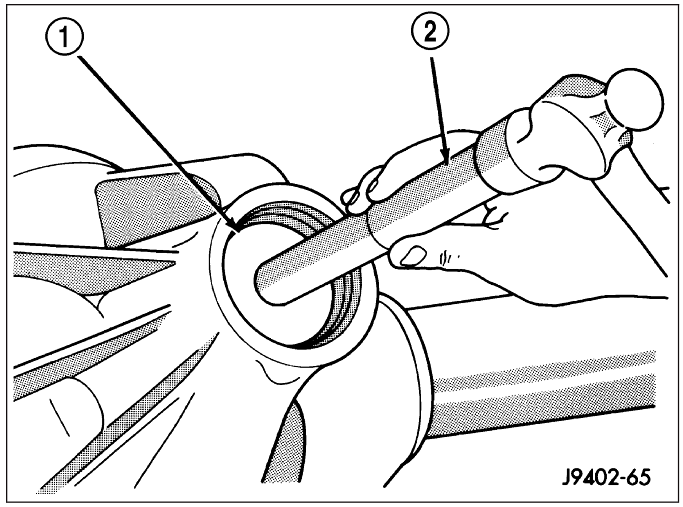

## INSTALLATION

**NOTE: A pinion depth shim/oil baffle is located under the rear pinion bearing. If ring and pinion gears are reused, the original pinion depth shim/oil baffle can be used. Refer to Adjustments (Pinion Gear Depth) to select the proper shim thickness if ring and pinion gear are replaced.**

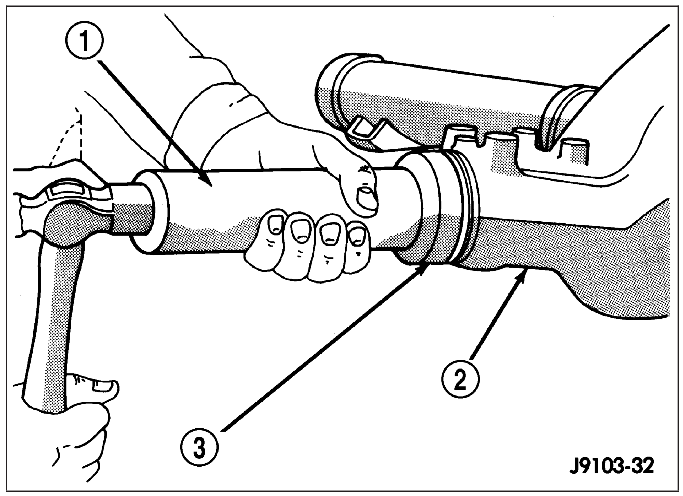
1. Install rear pinion bearing cup with Installer C-4308 (1) and Handle C-4171 (2).



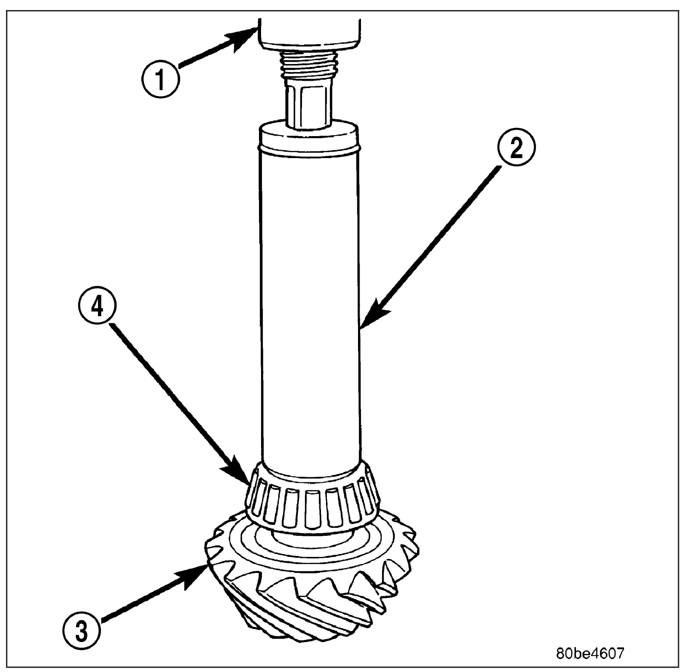
2. Install front pinion bearing cup with Installer D-130 (1) and Handle C-4171 (2).



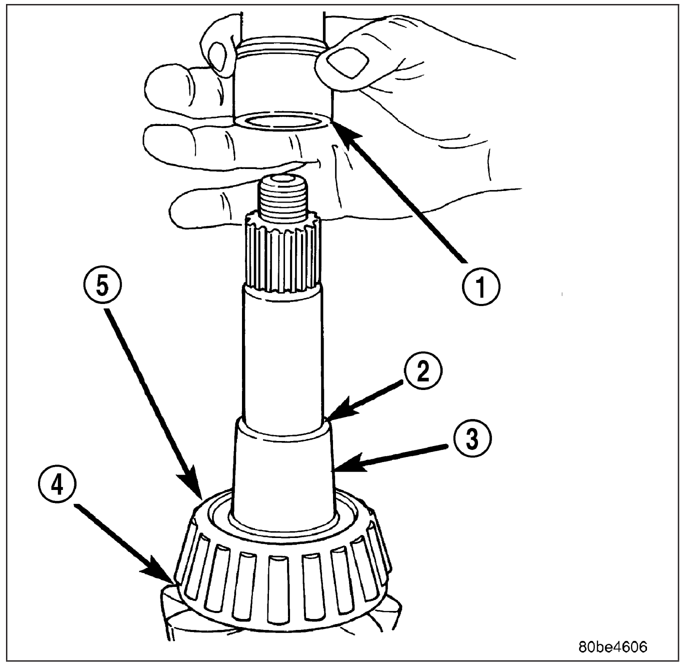

3. Install pinion front bearing and oil slinger, if equipped.
4. Apply a light coating of gear lubricant on the lip of pinion seal and install seal with Installer C-4076-B (3) and Handle C-4735 (1).



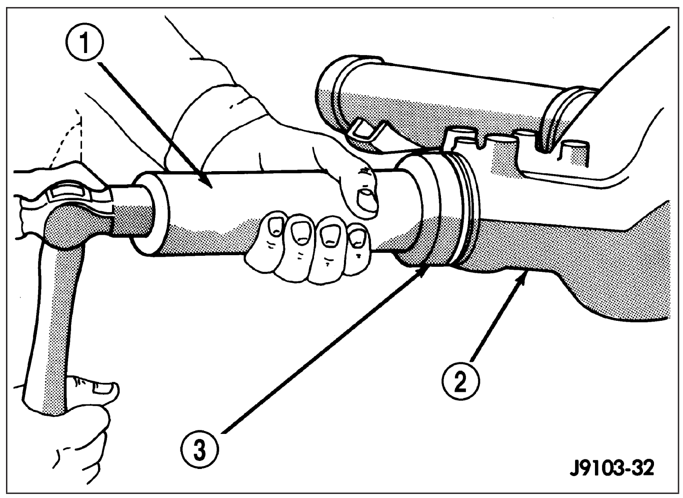

5. Place pinion depth shim on the pinion.
6. Install rear bearing (4) on pinion gear (3) and slinger if equipped, with Installer 6448A (2) and a press (1).



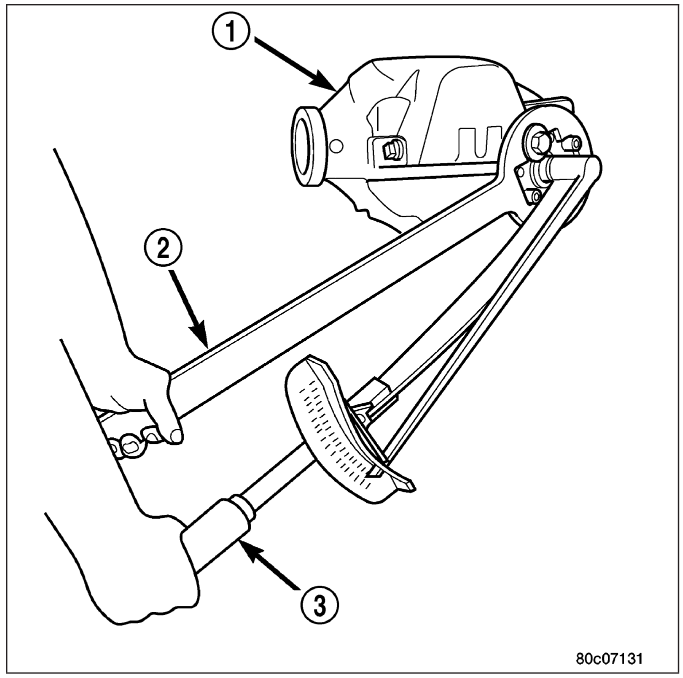
7. Install a **new** collapsible spacer (1) on pinion shaft (3) and install pinion in housing.




8. Install new pinion seal with Installer C-4076-B (3) and Handle C-4735 (1).

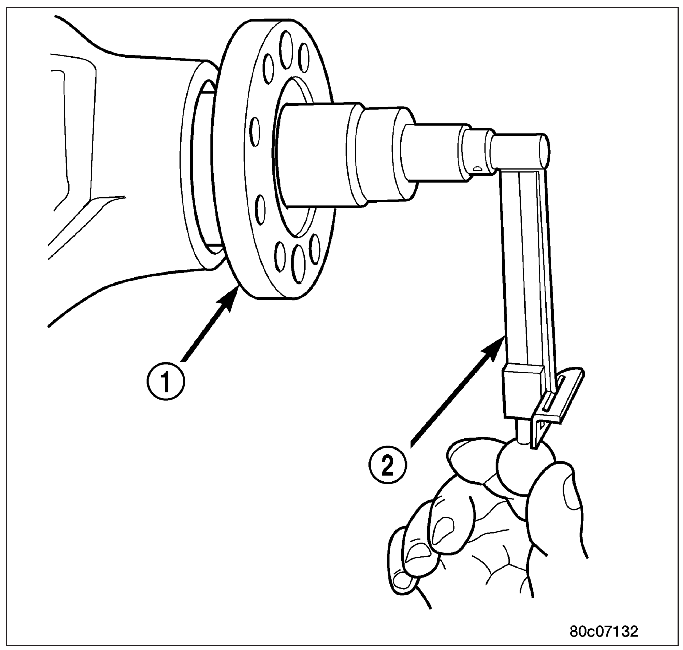


9. Install companion flange with Installer C-3718 and Holder 6719A.
10. Install flange washer and a new nut on the pinion. The convex side of the washer must face outward.
11. Holding flange with Holder 6719A (2) and tighten nut with torque wrench (3) to 285 N·m (210 ft. lbs.).




**CAUTION: Never loosen pinion nut to decrease pinion rotating torque and never exceed specified preload torque. Failure to heed caution may result in damage.**

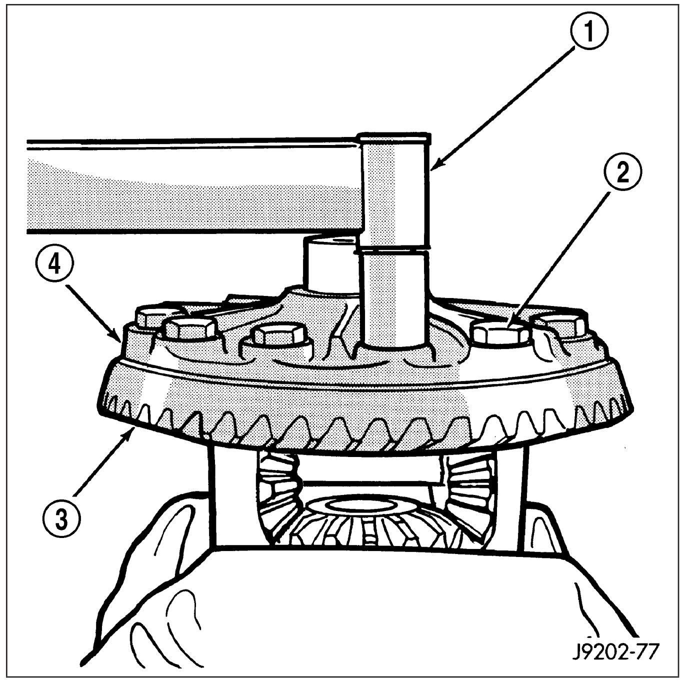
12. Hold flange with Holder 6719A and slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the desired Torque To Rotating is achieved. Measure rotating torque frequently to avoid over crushing the spacer.
13. Check pinion (1) Torque To Rotating with an inch pound torque wrench (2). The pinion Torque To Rotating is:
   - Original Bearings: 1 to 2 N·m (10 to 20 in. lbs.).
   - New Bearings: 1 to 5 N·m (10 to 30 in. lbs.).



14. Install ring gear (3) on differential case (4) and start two ring gear bolts (2).
15. Invert differential case in the vise.
16. Install **new** ring gear bolts and alternately tighten to 102 N·m (75 ft. lbs.).

**CAUTION: Never reuse the ring gear bolts. Failure to follow these instructions will result in damage.**

17. Install differential in axle housing and verify gear mesh refer to Adjustments (Gear Contact Pattern).



# VEHICLE QUICK REFERENCE

## TABLE OF CONTENTS

# FLUID - CAPACITIES & RECOMMENDED

## SPECIFICATIONS

## FLUIDS, LUBRICANTS, AND GENUINE PARTS

### ENGINE

| Component | Fluid, Lubricant, or Genuine Part |
|---|---|
| Engine Coolant | Mopar® Antifreeze/Coolant 5 Year/100,000 Mile Formula HOAT (Hybrid Organic Additive Technology) |
| Engine Oil (3.7L Engines) | Use API Certified SAE 5W-30 Engine Oil, meeting the requirements of DaimlerChrysler Material Standard MS-6395. |
| Engine Oil (2.8L Diesel Engines) | Use SAE 0W-40 Synthetic Engine Oil that meets API Categories SL/CF, and the requirements of DaimlerChrysler Material Standard MS-10725. If SAE 0W-40 is not available, SAE 5W-40 Synthetic Engine Oil is acceptable. |
| Oil Filter (3.7L Engine) | Mopar® Oil Filter (P/N 4781452AA or 4781452BB) |
| Oil Filter (2.8L Diesel Engine) | Mopar® Oil Filter (P/N 05072720AA) |
| Spark Plugs | Refer to the Vehicle Emission Control Information label in the engine compartment. |
| Fuel Selection (Gasoline Engines Only) | 87 Octane (89 Octane should be used for trailer towing purposes - 3.7L Only). |

### ENGINE - EXPORT

| Component | Fluid, Lubricant, or Genuine Part |
|---|---|
| Engine Coolant | Mopar® Antifreeze/Coolant 5 Year/100,000 Mile Formula HOAT (Hybrid Organic Additive Technology) |
| Engine Oil - Gasoline (Non ACEA Categories) | For best performance and maximum protection under all types of operating conditions, the manufacture only recommends engine oils that are API certified and meet the requirements of DaimlerChrysler Material Standard MS-6395. Use Mopar or an equivalent oil meeting the specification MS-6395. These Certified Oils exhibit the American Petroleum Institute (API) Engine Oil Certification Symbol on the front of the oil container. This symbol means that the oil has been tested, certified, and licensed by the American Petroleum Institute (API) to meet the oil standards required by the manufacturers. The manufacturer only recommends API Certified engine oils that meet the requirements of DaimlerChrysler Material Standard MS-6395. |
| Engine Oil - Gasoline (ACEA Categories) | For countries that use the ACEA European Oil Categories for Service Fill Oils, use engine oils that meet the requirements of ACEA A3/B3, A3/B4 or A5/B5. |
| Engine Oil - Diesel | Use only Diesel Engine Oils confirming to API (American Petroleum Institute) Quality CH-3 or CH-4. For countries that use the ACEA European Oil Categories for Service Fill Oils, use engine oils that meet the requirements of ACEA A3/B3 or A3/B4. |
| Oil Filter (3.7L Engine) | Mopar® Oil Filter (P/N 04781452AA or 04781452BB) |
| Oil Filter (2.8L Diesel Engine) | Mopar® Oil Filter (P/N 05072720AA) |
| Spark Plugs | Refer to the Vehicle Emission Control Information label in the engine compartment. |
| Fuel Selection (Gasoline Engines) | 91 Octane |

## Chassis

| Component | Fluid, Lubricant, or Genuine Part |
|---|---|
| Automatic Transmission | Mopar® ATF+4 Automatic Transmission Fluid |
| Manual Transmission | Mopar® Manual Transmission Lubricant or equivalent (meeting the requirements of DaimlerChrysler Material Standard MS-9224) |
| Transfer Case | Mopar® ATF+4 Automatic Transmission Fluid |
| Axle Differential (Front) | Mopar® Gear & Axle Lubricant (SAE 80W-90) or equivalent. |
| Axle Differential (Rear) | Mopar® Synthetic Gear Lubricant (SAE 75W-90) or equivalent. For trailer towing, the lubricant should be replaced with Mopar® Synthetic Gear & Axle Lubricant (SAE 75W-140) or equivalent.<br>Models equipped with Trac-Lok™ require a limited-slip additive. |
| Brake Master Cylinder | Mopar® DOT 3 Brake Fluid, SAE J1703 should be used. If DOT 3, SAE J1703 brake fluid is not available, then DOT 4 is acceptable. Use only recommended brake fluids. |
| Power Steering Reservoir | Mopar® ATF+4 Automatic Transmission Fluid |

## CHASSIS - EXPORT

| Component | Fluid, Lubricant, or Genuine Part |
|---|---|
| Automatic Transmission | Mopar® ATF+4 Automatic Transmission Fluid |
| Manual Transmission | Mopar® Manual Transmission Lubricant (P/N 04874464). |
| Transfer Case | Mopar® ATF+4 Automatic Transmission Fluid. |
| Axle Differential (front-rear) | Mopar® SAE 75W-140 (API GL5) Synthetic Gear Lubricant or equivalent. The 8.25 Corporate Rear Axle should use a SAE 75W-90 Gear Lubricant. For trailer towing, the lubricant should be replaced with SAE 75W-140 Synthetic Gear Lubricant.<br>Models equipped with Trac-Lok™ require a friction modifier additive. |
| Brake Master Cylinder | Mopar® Brake Fluid DOT 3 Motor Vehicle. If Mopar® brake fluid conforming to SAE J1703 standards is not available, then DOT 4 or DOT 4+ brake fluid is acceptable. |
| Power Steering Reservoir | Mopar® ATF+4 Automatic Transmission Fluid |
| Ball Joints, Prop Shafts, U-Joints, Yokes, & Wheel Bearings | Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB |

## CAPACITIES

| DESCRIPTION | U.S. | Metric |
|---|---|---|
| **Fuel (Approximate)** | 20.5 Gallons | 78 Liters |
| **Engine Oil with Filter** | | |
| 3.7 Liter Engines (SAE 5W-30, API Certified Engine Oil) | 5 Qts | 4.7 Liters |
| 2.8 Liter Diesel Engine (SAE 0W-40 Synthetic Engine Oil) | 6.4 Qts | 6.1 Liters |
| **Cooling System *** | | |
| 3.7 Liter Engine (Mopar® Antifreeze/Coolant 5 Year/100,000 Mile Formula) | 14 Qts | 13.2 Liters |
| 2.8 Liter Diesel Engine (Mopar® Antifreeze/Coolant 5 Year/ 100,000 Mile Formula) | 13 Qts | 12.5 Liters |
| * Includes heater and coolant recovery bottle filled to MAX level. | | |

# FUSE LOCATIONS & TYPES

## SPECIFICATIONS

## FUSE PANEL

### Interior Fuses

The fuse panel is on the left side of the instrument panel. A label is attached to the fuse panel cover to identify each fuse for ease of replacement.

| Cavity | Fuse | Description |
|---|---|---|
| 1 | 15 Amp<br>Blue | Horn Relay, Power Sunroof Relay, Power Window Relay |
| 2 | 10 Amp<br>Red | Rear Fog Lights (Export Only) |
| 3 | 20 Amp<br>Yellow | Cigar Lighter |
| 4 | 10 Amp<br>Red | Headlight Low Beam Right |
| 5 | 10 Amp<br>Red | Headlight Low Beam Left |
| 6 | 20 Amp<br>Yellow | Body Control Module/Power Door Locks |
| 7 | 10 Amp<br>Red | Left Park Light/Left Tail Lamp/License Plate Lamp |
| 8 | Spare | |
| 9 | 10 Amp<br>Red | Right Park Light/RightTail Lamp/License Plate Lamp/Cluster |
| 10 | Spare | |
| 11 | 15 Amp<br>Blue | Flasher |
| 12 | 15 Amp<br>Blue | Stop Lights |
| 13 | 10 Amp<br>Red | Body Control Module/CMTC/Cluster/Pass. Airbag On,Off Indicator, Auto Daylight Mirror/Light Bar Switch (Renegade Only) |
| 14 | 10 Amp<br>Red | PDC Fuel Pump/AC Clutch, Starter Relay/Engine Controller/ Transmission Controller (Diesel Only) |
| 15 | Spare | |
| 16 | 20 Amp<br>Yellow | Power Outlet (Rear) |
| 17 | 15 Amp<br>Blue | Rear Wiper |
| 18 | 20 Amp<br>Yellow | Radio Choke & Relay |
| 19 | 20 Amp<br>Yellow | Frt Fog Lights/Trailer Tow Stop and Turn Lights |
| 20 | Spare | |
| 21 | 10 Amp<br>Red | Radio |

| Cavity | Fuse | Description |
|---|---|---|
| 22 | 20 Amp<br>Yellow | Power Sunroof Relay/Antenna Module (Export Only) |
| 23 | Spare | |
| 24 | 10 Amp<br>Red | PDC Blower Motor |
| 25 | 10 Amp<br>Red | Heated Seat Switches/HVAC Control Head/Trailer Tow Battery Charge |
| 26 | 10 Amp<br>Red | Headlight High Beam Right |
| 27 | 10 Amp<br>Red | Headlight High Beam Left |
| 28 | Spare | |
| 29 | 10 Amp<br>Red | Heated Mirrors/Rear Window Defroster Indicator |
| 30 | 15 Amp<br>Blue | Heated Seat Module |
| 31 | Spare | |
| 32 | 10 Amp<br>Red | Wiper Switch/Front and Rear Wipers |
| 33 | 10 Amp<br>Red | SKIM Module/Data Link Connector |
| 34 | 15 Amp<br>Blue | Body Control Module/Cluster/Interior Lights, Hands Free Module/Radio/CMTC/ITM Module & Siren (Export Only) |
| 35 | Spare | |
| 36 | 10 Amp<br>Red | Airbag Control Module/Occupation Classification Module (Right Front Seat) |
| 37 | 10 Amp<br>Red | Airbag Control Module |
| 38 | 10 Amp<br>Red | ABS Controller/Shifter Assembly |
| 39 | 10 Amp<br>Red | Hazard Flasher (Turn Signals)/Backup Lamp Switch (Manual Transmission Only)/Transmission Range Switch (Automatic Transmission Only) |

## Underhood Fuses (Power Distribution Center)

Your vehicle is equipped with an electrical power distribution center located in the engine compartment near the battery. This power center houses plug-in “Cartridge” fuses which replace in-line fusible links. The power center also contains “Mini” fuses and plug-in full and micro ISO relays. A label inside the latching cover of the center identifies each component for ease of replacement, if necessary. “Cartridge” fuses and relays can be obtained from your authorized dealer.

**Power Distribution Center (Gasoline Engines)**

| Cavity | Fuse | Description |
|---|---|---|
| F1 | 40 Amp<br>Green | Blower Motor |
| F2 | 40 Amp<br>Green | Radiator Fan |
| F3 | 50 Amp<br>Red | JB Power |

| Cavity | Fuse | Description |
|---|---|---|
| F4 | 40 Amp<br>Green | ABS Pump |
| F5 | 20 Amp<br>Yellow | NGC Trans |
| F6 | 30 Amp<br>Pink | ASD |
| F7 | 50 Amp<br>Red | JB Power |
| F8 | 40 Amp<br>Green | Ign/Start |
| F9 | 50 Amp<br>Red | JB Power |
| F10 | 30 Amp<br>Pink | Trailer Tow |
| F11 | | Open |
| F12 | 30 Amp<br>Pink | Light Bar |
| F13 | 40 Amp<br>Green | Windows |
| F14 | 40 Amp<br>Green | Ignition Switch |
| F15 | 50 Amp<br>Red | JB Power |
| F16 | | Open |
| F17 | | Open |
| F18 | | Open |
| F19 | 30 Amp<br>Pink | Rear Window Defogger (HBL) |
| F20 | | Open |
| F21 | 20 Amp<br>Yellow | A/C Clutch |
| F22 | | Open |
| F23 | | Open |
| F24 | 20 Amp<br>Yellow | Fuel Pump |
| F25 | 20 Amp<br>Yellow | ABS Valves |
| F26 | 25 Amp<br>Natural | Injectors |
| F27 | | Open |
| F28 | 15 Amp<br>Blue | Starter |
| R29 | Half ISO Relay | Fuel Pump |
| R30 | Half ISO Relay | Starter |
| R31 | Half ISO Relay | Wiper On/Off |
| R32 | Half ISO Relay | Wiper Hi/Lo |
| R33 | Full ISO Relay | H. Blower |
| R34 | Full ISO Relay | Rad. Fan Hi |

| Cavity | Fuse | Description |
|---|---|---|
| R35 | Half ISO Relay | A/C Clutch |
| R36 | | Open |
| R37 | Half ISO Relay | NGC Trans |
| R38 | | Open |
| R39 | Full ISO Relay | ASD |
| R40 | Full ISO Relay | Rad. Fan Lo |

**Power Distribution Center (Diesel Engines)**

| Cavity | Fuse | Description |
|---|---|---|
| F1 | 40 Amp<br>Green | Blower Motor |
| F2 | 40 Amp<br>Green | Radiator Fan |
| F3 | 50 Amp<br>Red | JB Power |
| F4 | 40 Amp<br>Green | ABS Pump |
| F5 | | Open |
| F6 | 30 Amp<br>Pink | ASD |
| F7 | 50 Amp<br>Red | JB Power |
| F8 | 40 Amp<br>Green | Ign/Start |
| F9 | 50 Amp<br>Red | JB Power |
| F10 | 30 Amp<br>Pink | Trailer Tow |
| F11 | 20 Amp<br>Yellow | Fuel Heater |
| F12 | 30 Amp<br>Pink | Light Bar |
| F13 | 40 Amp<br>Green | Windows |
| F14 | 40 Amp<br>Green | Ignition Switch |
| F15 | 50 Amp<br>Red | JB Power |
| F16 | 15 Amp<br>Blue | ASD Feed |
| F17 | | Open |
| F18 | | Open |
| F19 | 30 Amp<br>Pink | Rear Window Defogger (HBL) |
| F20 | | Open |
| F21 | 20 Amp<br>Yellow | A/C Clutch |
| F22 | | Open |

| Cavity | Fuse | Description |
|---|---|---|
| F23 | | Open |
| F24 | | Open |
| F25 | 20 Amp<br>Yellow | ABS Valves |
| F26 | 25 Amp<br>Natural | Injectors |
| F27 | | Open |
| F28 | 15 Amp<br>Blue | Starter |
| R29 | Half ISO Relay | Fuel Heater |
| R30 | Half ISO Relay | Starter |
| R31 | Half ISO Relay | Wiper On/Off |
| R32 | Half ISO Relay | Wiper Hi/Lo |
| R33 | Full ISO Relay | H. Blower |
| R34 | Full ISO Relay | Rad. Fan Hi |
| R35 | Half ISO Relay | A/C Clutch |
| R36 | Half ISO Relay | Viscous Heat |
| R37 | | Open |
| R38 | | Open |
| R39 | Full ISO Relay | ASD |
| R40 | Full ISO Relay | Rad. Fan Lo |

# MAINTENANCE SCHEDULES

## DESCRIPTION

## MAINTENANCE SCHEDULES - GASOLINE ENGINES

There are two maintenance schedules that show the **required** service for your vehicle.

First is Schedule ″**B**″. It is for vehicles that are operated under the conditions that are listed below and at the beginning of the schedule.

- Day or night temperatures are below 32°F (0°C).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 10 miles (16.2 km).
- More than 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C).
- Trailer towing.
- Heavy loading.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.
- If equipped for and operated with E-85 (ethanol) fuel.

**NOTE: If ANY of these apply to you then change your engine oil every 3,000 miles (5 000 km) or 3 months, whichever comes first and follow "Schedule B" of the "Maintenance Schedules" section of this manual.**

**NOTE: If ANY of these apply to you then flush and replace your engine coolant/anti-freeze every 102,000 miles (163 000 km) or 60 months, whichever comes first, and follow "Schedule B" of the "Maintenance Schedules" section of this manual.**

**NOTE: Most vehicles are operated under the conditions listed for Schedule "B."**

Second is Schedule **"A".** It is for vehicles that are not operated under any of the conditions listed under Schedule "B."

Use the schedule that best describes your driving conditions. Where time and mileage are listed, follow the interval that occurs first.

**CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.**

***At Each Stop for Fuel***

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent, add as required.

***Once a Month***

- Check the tire pressure and look for unusual wear or damage.
- Inspect the battery, and clean and tighten the terminals as required.
- Check the fluid levels of the engine coolant/anti-freeze reservoir, brake master cylinder, and transmission, and add as needed.
- Check all lights and all other electrical items for correct operation.

***At Each Oil Change***

- Change the engine oil filter.
- Inspect the exhaust system.

- Inspect brake hoses.
- Check the engine coolant/anti-freeze level, hoses, and clamps.
- Inspect manual transmission fluid level — if equipped.
- After completion of off-road operation, the underside of the vehicle should be thoroughly inspected. Examine threaded fasteners for looseness.

## Schedule “B”

Follow schedule “B” if you usually operate your vehicle under one or more of the following conditions.

- Day or night temperatures are below 32°F (0°C).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 10 miles (16.2 km).
- More than 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C).
- Trailer towing.
- Heavy loading.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.
- If equipped for and operated with E-85 (ethanol) fuel.

**NOTE: If ANY of these apply to you then change your engine oil every 3,000 miles (5 000 km) or 3 months, whichever comes first and follow “Schedule B” of the “Maintenance Schedules” section of this manual.**

**NOTE: If ANY of these apply to you then flush and replace your engine coolant/anti-freeze every 102,000 miles (163 000 km) or 60 months, whichever comes first, and follow “Schedule B” of the “Maintenance Schedules” section of this manual.**

| **Miles (Kilometers)** | **3,000 (5 000)** | **6,000 (10 000)** | **9,000 (15 000)** | **12,000 (20 000)** | **15,000 (25 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | | | X | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |

| **Miles (Kilometers)** | **18,000 (30 000)** | **21,000 (35 000)** | **24,000 (40 000)** | **27,000 (45 000)** | **30,000 (50 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | | | X |
| Inspect the brake linings. | | | X | | |
| Inspect the manual transmission fluid, add as necessary. | | | | | X |
| Drain and refill the front and rear axle fluid‡ | | | | | X |

| Miles (Kilometers) | 18,000 (30 000) | 21,000 (35 000) | 24,000 (40 000) | 27,000 (45 000) | 30,000 (50 000) |
|---|---|---|---|---|---|
| Inspect the transfer case fluid, add if necessary. | | | | | X |

| Miles (Kilometers) | 33,000 (55 000) | 36,000 (60 000) | 39,000 (65 000) | 42,000 (70 000) | 45,000 (75 000) |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | X | | | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. | | | | | X |

| Miles (Kilometers) | 48,000 (80 000) | 51,000 (85 000) | 54,000 (90 000) | 57,000 (95 000) | 60,000 (100 000) |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ◊ | | | | | X |
| Inspect the brake linings. | X | | | | X |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the manual transmission fluid, add as necessary. | | | | | X |
| Drain and refill the automatic transmission fluid, replace main sump filter, and spin-on cooler return filter (if equipped).† | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Drain and refill the transfer case fluid. | | | | | X |
| Flush and replace the engine coolant/anti-freeze. | | | | | X |

| Miles (Kilometers) | 63,000 (105 000) | 66,000 (110 000) | 69,000 (115 000) | 72,000 (120 000) | 75,000 (125 000) |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | | | X | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |

| **Miles**<br>**(Kilometers)** | **63,000**<br>**(105 000)** | **66,000**<br>**(110 000)** | **69,000**<br>**(115 000)** | **72,000**<br>**(120 000)** | **75,000**<br>**(125 000)** |
|---|---|---|---|---|---|
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |

| **Miles**<br>**(Kilometers)** | **78,000**<br>**(130 000)** | **81,000**<br>**(135 000)** | **84,000**<br>**(140 000)** | **87,000**<br>**(145 000)** | **90,000**<br>**(150 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | | | X |
| Inspect the brake linings. | | | X | | |
| Inspect the manual transmission fluid, add as necessary. | | | | | X |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Inspect the transfer case fluid, add if necessary. | | | | | X |

| **Miles**<br>**(Kilometers)** | **93,000**<br>**(155 000)** | **96,000**<br>**(160 000)** | **99,000**<br>**(165 000)** | **102,000**<br>**(170 000)** | **105,000**<br>**(175 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | X | | | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Flush and replace the engine coolant/anti-freeze, if not done at 60 months. | | | | X | |

| **Miles**<br>**(Kilometers)** | **108,000**<br>**(180 000)** | **111,000**<br>**(185 000)** | **114,000**<br>**(190 000)** | **117,000**<br>**(195 000)** | **120,000**<br>**(200 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter, if not replaced at 3 months. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | | | X |

| Miles (Kilometers) | 108,000 (180 000) | 111,000 (185 000) | 114,000 (190 000) | 117,000 (195 000) | 120,000 (200 000) |
|---|---|---|---|---|---|
| Inspect the brake linings. | X | | | | X |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the manual transmission fluid, add as necessary. | | | | | X |
| Drain and refill the automatic transmission fluid, replace main sump filter, and spin-on cooler return filter (if equipped).† | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Drain and refill the transfer case fluid. | | | | | X |
| Flush and replace the engine coolant/anti-freeze at 120 months, if not replaced at 102,000 miles (170 000 km). | | | | | X |

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

† Applies only if vehicle is used for frequent trailer towing, or fleet/commercial service.

◊ This maintenance is recommended by the manufacturer to the owner, but it is not required to maintain emissions warranty.

‡Off-highway operation, trailer towing, taxi, limousine, bus, snow plowing, or other types of commercial service or prolonged operation with heavy loading, especially in hot weather, require front and rear axle service indicated with a ‡ in Schedule "B". Perform these services if the vehicle is usually operated under these conditions.

## Schedule "A"

| Miles (Kilometers) [Months] | 6,000 (10 000) [6] | 12,000 (20 000) [12] | 18,000 (30 000) [18] | 24,000 (40 000) [24] | 30,000 (50 000) [30] |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | X | X | X | X | X |
| **Inspect the engine air filter element, and replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| Inspect the manual transmission fluid, add as necessary. | | | | | X |
| Inspect the brake linings. | | | X | | |
| Inspect the transfer case fluid. | | | | | X |

| Miles (Kilometers) [Months] | 36,000 (60 000) [36] | 42,000 (70 000) [42] | 48,000 (80 000) [48] | 54,000 (90 000) [54] |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| Rotate the tires. | X | X | X | X |
| Inspect the brake linings. | X | | | X |

| **Miles**<br>**(Kilometers)**<br>**[Months]** | **60,000**<br>**(100 000)**<br>**[60]** | **66,000**<br>**(110 000)**<br>**[66]** | **72,000**<br>**(120 000)**<br>**[72]** | **78,000**<br>**(130 000)**<br>**[78]** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| Rotate the tires. | X | X | X | X |
| **Inspect the engine air filter element, and replace if necessary.** | X | | | |
| **Replace the spark plugs.** | X | | | |
| **Inspect and replace the PCV valve, if necessary.** ♢ | X | | | |
| Inspect the brake linings. | | | X | |
| Inspect the drive belt and replace, if needed. | X | | | |
| Inspect the drive belt and replace as needed. Not required if previously replaced. | | | X | |
| Flush and replace the engine coolant/anti-freeze. | X | | | |
| Inspect the manual transmission fluid, add as necessary. | X | | | |
| Inspect the transfer case fluid. | X | | | |

| **Miles**<br>**(Kilometers)**<br>**[Months]** | **84,000**<br>**(140 000)**<br>**[84]** | **90,000**<br>**(150 000)**<br>**[90]** | **96,000**<br>**(160 000)**<br>**[96]** | **102,000**<br>**(170 000)**<br>**[102]** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| Rotate the tires. | X | X | X | X |
| **Inspect the engine air filter element, and replace if necessary.** | | X | | |
| **Replace the spark plugs.** | | X | | |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | X | | |
| Inspect the brake linings. | | X | | |
| Inspect the drive belt and replace as needed. Not required if previously replaced. | X | | X | |
| Flush and replace the engine coolant/anti-freeze if not done at 60 months. | | | | X |
| Inspect the manual transmission fluid, add as necessary. | | X | | |
| Inspect the transfer case fluid. | | X | | |

| **Miles**<br>**(Kilometers)**<br>**[Months]** | **108,000**<br>**(180 000)**<br>**[108]** | **114,000**<br>**(190 000)**<br>**[114]** | **120,000**<br>**(200 000)**<br>**[120]** |
|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X |
| Rotate the tires. | X | X | X |
| **Inspect the engine air filter element, and replace if necessary.** | | | X |
| **Replace the spark plugs.** | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | X |
| Inspect the brake linings. | X | | |
| Inspect the drive belt and replace as needed. Not required if previously replaced. | X | | X |
| Flush and replace the engine coolant/anti-freeze if not done at 102,000 miles (170 000 km). | | | X |

| Miles (Kilometers) [Months] | 108,000 (180 000) [108] | 114,000 (190 000) [114] | 120,000 (200 000) [120] |
|---|---|---|---|
| Inspect the manual transmission fluid, add as necessary. | | | X |
| Drain and refill the transfer case fluid. | | | X |

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

◊ This maintenance is recommended by the manufacturer to the owner, but it is not required to maintain emissions warranty.

## MAINTENANCE SCHEDULES - DIESEL ENGINE

There are two maintenance schedules that show the **required** service for your vehicle.

First is Schedule ″**B**″. It is for vehicles that are operated under the conditions that are listed below and at the beginning of the schedule.

- Day or night temperatures are below 32°F (0°C).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 10 miles (16.2 km).
- More than 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C).
- Trailer towing.
- Heavy loading.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

**NOTE: Most vehicles are operated under the conditions listed for Schedule "B."**

Second is Schedule **"A"**. It is for vehicles that are not operated under any of the conditions listed under Schedule "B."

Use the schedule that best describes your driving conditions. Where time and mileage are listed, follow the interval that occurs first.

**CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.**

### *At Each Stop for Fuel*

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent, add as required.

### *Once a Month*

- Check the tire pressure and look for unusual wear or damage.
- Inspect the battery, clean and tighten the terminals as required.
- Check the fluid levels of engine coolant/anti-freeze deaeration bottle, brake master cylinder, and transmission, and add as needed.
- Check all lights and all other electrical items for correct operation.

### *At Each Oil Change*

- Change the engine oil filter.
- Inspect the exhaust system.
- Inspect brake hoses.
- Check the engine coolant/anti-freeze level, hoses, and clamps.
- Inspect engine accessory drive belts. Replace as necessary.

- Inspect for the presence of water in the fuel filter/water separator unit.

***Tire Rotation***

- Rotate the tires every 6,250 miles (10 000 km).

## Schedule “B”

Follow schedule “B” if you usually operate your vehicle under one or more of the following conditions.

- Day or night temperatures are below 32°F (0°C).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 10 miles (16.2 km).
- More than 50% of your driving is at sustained high speeds during hot weather, above 90°F (32°C).
- Trailer towing.
- Heavy loading.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

| **Miles (Kilometers)** | **6,250 (10 000)** | **12,500 (20 000)** | **18,750 (30 000)** | **25,000 (40 000)** | **31,250 (50 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | | X | | X |
| **Replace the engine air filter element.** | | X | | X | |
| Inspect the boost pressure solenoid filter. Replace as necessary. | X | X | X | X | X |
| Replace the fuel filter/water separator unit. | | | | X | |
| Inspect the brake linings. | | X | | X | |
| Drain and refill the front and rear axle fluid. | | X | | X | |

| **Miles (Kilometers)** | **37,500 (60 000)** | **43,750 (70 000)** | **50,000 (80 000)** | **56,250 (90 000)** | **62,500 (100 000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | | X | | X | |
| **Replace the engine air filter element.** | X | | X | | X |
| Inspect the boost pressure solenoid filter. Replace as necessary. | X | X | X | X | X |
| Replace the boost pressure solenoid filter, if not previously replaced. | | | X | | |
| Replace the fuel filter/water separator unit. | | | X | | |
| Replace the engine accessory drive belt. | X | | | | |
| Inspect the brake linings. | X | | X | | X |
| Drain and refill the front and rear axle fluid. | X | | X | | X |
| Drain and refill the transfer case fluid. | | | | | X |
| Inspect the manual transmission fluid, add as necessary. | | | | | X |

| **Miles** **(Kilometers)** | **37,500 (60 000)** | **43,750 (70 000)** | **50,000 (80 000)** | **56,250 (90 000)** | **62,500 (100 000)** |
|---|---|---|---|---|---|
| Drain and refill the automatic transmission fluid, replace sump filter, and spin-on cooler return filter (if equipped). ♢ | | | | | X |

| **Miles** **(Kilometers)** | **68,750 (110 000)** | **75,000 (120 000)** | **81,250 (130 000)** | **87,500 (140 000)** | **93,750 (150 000)** | **100,000 (160 000)** |
|---|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | | X | | X | |
| **Replace the engine air filter element.** | | X | | X | | X |
| Inspect the boost pressure solenoid filter. Replace as necessary. | X | X | X | X | X | X |
| Replace the boost pressure solenoid filter, if not previously replaced. | | | | | | X |
| Replace the engine accessory drive belt.* | | X | | | | |
| Replace the engine timing belt and idler pulleys. | | | | | | X |
| Inspect the engine timing belt tensioner, replace if necessary.† | | | | | | X |
| Replace the fuel filter/water separator unit. | | X | | | | X |
| Flush and replace the engine coolant/anti-freeze. | | | | | | X |
| Inspect the brake linings. | | X | | X | | |
| Drain and refill the front and rear axle fluid. | | X | | X | | |

♢ Applies only if vehicle is used for frequent trailer towing, or fleet/commercial service.

† The replacement of such component is requested if there is superficial wear, bearing clearance, or evident grease leak.

* This maintenance is not required if the belt was previously replaced.

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

## Schedule "A"

| **Miles** **(Kilometers)** | **12,500 (20 000)** | **25,000 (40 000)** | **37,500 (60 000)** | **50,000 (80 000)** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | | X | |
| **Replace the engine air filter element.** | | X | | X |
| Inspect the boost pressure solenoid filter. Replace as necessary. | X | X | X | X |
| Replace the boost pressure solenoid filter, if not previously replaced. | | | | X |
| Replace the fuel filter/water separator unit. | | X | | X |
| Inspect the brake linings. | | X | | X |
| Inspect the manual transmission fluid, add as necessary. | X | | | |

| Miles (Kilometers) | 12,500 (20 000) | 25,000 (40 000) | 37,500 (60 000) | 50,000 (80 000) |
|---|---|---|---|---|
| Inspect the transfer case fluid. | X | | | |

| Miles (Kilometers) | 62,500 (100 000) | 75,000 (120 000) | 87,500 (140 000) | 100,000 (160 000) |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | | X | |
| **Replace the engine air filter element.** | | X | | X |
| Inspect the boost pressure solenoid filter. Replace as necessary. | X | X | X | X |
| Replace the boost pressure solenoid filter, if not previously replaced. | | | | X |
| Replace the fuel filter/water separator unit. | | X | | X |
| Replace the engine timing belt, and idler pulleys. | | | | X |
| Inspect the engine timing belt tensioner, replace if necessary.† | | | | X |
| Flush and replace the engine coolant/anti-freeze. | X | | | |
| Replace the engine accessory drive belt. | X | | | |
| Inspect the brake linings. | | X | | X |
| Inspect the transmission fluid, add as necessary. | X | | | |
| Inspect the transfer case fluid. | X | | | |

† The replacement of such component is requested if there is superficial wear, bearing clearance, or evident grease leak.

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

## MAINTENANCE SCHEDULES - GASOLINE ENGINES - EXPORT

There are two maintenance schedules that show the **required** service for your vehicle.

First is Schedule **"A".** It is for vehicles that are not operated under any of the conditions listed under Schedule "B."

Second is Schedule **″B″.** It is for vehicles that are operated under the conditions that are listed below and at the beginning of the schedule.

- Day or night temperatures are below 0°C (32°F).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 16.2 km (10 miles).
- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

Most vehicles are operated under the conditions listed for Schedule "B."

Use the schedule that best describes your driving conditions. Where time and mileage are listed, follow the interval that occurs first.

**CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.**

***At Each Stop for Fuel***

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent, add as required.

***Once a Month***

- Check the tire pressure and look for unusual wear or damage.
- Inspect the battery, and clean and tighten the terminals as required.
- Check the fluid levels of the coolant reservoir, brake master cylinder, and transmission, and add as needed.
- Check all lights and all other electrical items for correct operation.

***At Each Oil Change***

- Change the engine oil filter.
- Inspect the exhaust system.
- Inspect brake hoses.
- Check the coolant level, hoses, and clamps.
- Inspect manual transmission fluid level — if equipped.
- After completion of off-road operation, the underside of the vehicle should be thoroughly inspected. Examine threaded fasteners for looseness.

## Schedule “A”

| **Kilometers (Miles) [Months]** | **12 000 (7,500) [6]** | **24 000 (15,000) [12]** | **36 000 (22,500) [18]** | **48 000 (30,000) [24]** | **60 000 (37,500) [30]** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | X | X | X | X | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | X | |
| **Replace the spark plugs.** | | | | X | |
| Inspect the brake linings. | | | X | | |
| Inspect the transfer case fluid. | | | | X | |

| **Kilometers (Miles) [Months]** | **72 000 (45,000) [36]** | **84 000 (52,500) [42]** | **96 000 (60,000) [48]** | **108 000 (67,500) [54]** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| Rotate the tires. | X | X | X | X |
| **Inspect the engine air filter element, replace if necessary.** | | | X | |
| **Inspect and replace the PCV valve, if necessary♢.** | | | X | |
| **Replace the spark plugs.** | | | X | |
| Inspect the brake linings. | X | | | X |
| Inspect and replace the Auto Tension Drive Belt, as needed. | | | X | |
| Inspect the transfer case fluid. | | | X | |

| **Kilometers**<br>**(Miles)**<br>**[Months]** | **120 000**<br>**(75,000)**<br>**[60]** | **132 000**<br>**(82,500)**<br>**[66]** | **144 000**<br>**(90,000)**<br>**[72]** | **156 000**<br>**(97,500)**<br>**[78]** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| Rotate the tires. | X | X | X | X |
| **Inspect the engine air filter element, replace if necessary.** | | | X | |
| **Replace the spark plugs.** | | | X | |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | X | |
| Inspect the brake linings. | | | X | |
| Inspect the drive belt and replace as needed. Not required if previously replaced. | X | | X | |
| Flush and replace the engine coolant at 60 months, regardless of mileage. | X | | | |
| Inspect the transfer case fluid. | | | X | |

| **Kilometers**<br>**(Miles)**<br>**[Months]** | **160 000**<br>**(100,000)** | **168 000**<br>**(105,000)**<br>**[84]** | **180 000**<br>**(112,500)**<br>**[90]** | **192 000**<br>**(120,000)**<br>**[96]** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | | X | X | X |
| Rotate the tires. | | X | X | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | X |
| **Replace the spark plugs.** | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | | X |
| Inspect the brake linings. | | | X | |
| Inspect the drive belt and replace as needed. Not required if previously replaced. | | X | | X |
| Flush and replace the engine coolant if not done at 60 months. | X | | | |
| Drain the transfer case, and refill. | | | | X |

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

♢ This maintenance is recommended by the manufacturer to the owner, but it is not required to maintain emissions warranty.

## Schedule “B”

Follow schedule “B” if you usually operate your vehicle under one or more of the following conditions.

- Day or night temperatures are below 0°C (32°F).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 16.2 km (10 miles).
- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

| **Kilometers**<br>**(Miles)** | **5 000**<br>**(3,000)** | **10 000**<br>**(6,000)** | **14 000**<br>**(9,000)** | **19 000**<br>**(12,000)** | **24 000**<br>**(15,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | | | X | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |

| **Kilometers**<br>**(Miles)** | **29 000**<br>**(18,000)** | **34 000**<br>**(21,000)** | **38 000**<br>**(24,000)** | **43 000**<br>**(27,000)** | **48 000**<br>**(30,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | | | X |
| Inspect the brake linings. | | | X | | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the transfer case fluid, add if necessary. | | | | | X |

| **Kilometers**<br>**(Miles)** | **53 000**<br>**(33,000)** | **58 000**<br>**(36,000)** | **62 000**<br>**(39,000)** | **67 000**<br>**(42,000)** | **72 000**<br>**(45,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | X | | | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. | | | | | X |

| **Kilometers**<br>**(Miles)** | **77 000**<br>**(48,000)** | **82 000**<br>**(51,000)** | **86 000**<br>**(54,000)** | **91 000**<br>**(57,000)** | **96 000**<br>**(60,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | | | X |
| Inspect the brake linings. | X | | | | X |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Drain and refill the automatic transmission fluid, and replace main sump filter. | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Drain and refill the transfer case fluid. | | | | | X |

| **Kilometers**<br>**(Miles)** | **77 000**<br>**(48,000)** | **82 000**<br>**(51,000)** | **86 000**<br>**(54,000)** | **91 000**<br>**(57,000)** | **96 000**<br>**(60,000)** |
|---|---|---|---|---|---|
| Flush and replace the engine coolant/anti-freeze at 60 months, if not done at 102,000 miles (163 000 km). | | | | | X |

| **Kilometers**<br>**(Miles)** | **101 000**<br>**(63,000)** | **106 000**<br>**(66,000)** | **110 000**<br>**(69,000)** | **115 000**<br>**(72,000)** | **120 000**<br>**(75,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | | | X | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |

| **Kilometers**<br>**(Miles)** | **125 000**<br>**(78,000)** | **130 000**<br>**(81,000)** | **134 000**<br>**(84,000)** | **139 000**<br>**(87,000)** | **144 000**<br>**(90,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ♢ | | | | | X |
| Inspect the brake linings. | | | X | | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Inspect the transfer case fluid, add if necessary. | | | | | X |

| **Kilometers**<br>**(Miles)** | **149 000**<br>**(93,000)** | **154 000**<br>**(96,000)** | **158 000**<br>**(99,000)** | **163 000**<br>**(102,000)** | **168 000**<br>**(105,000)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | | X | | X | |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| Inspect the brake linings. | | X | | | |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Flush and replace the engine coolant/anti-freeze, if not done at 60 months. | | | | X | |

| Kilometers (Miles) | 173 000 (108,000) | 178 000 (111,000) | 182 000 (114,000) | 187 000 (117,000) | 192 000 (120,000) |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| Rotate the tires. | X | | X | | X |
| **Inspect the engine air filter element, replace if necessary.** | | | | | X |
| **Replace the spark plugs.** | | | | | X |
| **Inspect and replace the PCV valve, if necessary.** ◊ | | | | | X |
| Inspect the brake linings. | X | | | | X |
| Drain and refill the front and rear axle fluid‡ | | | | | X |
| Drain and refill the automatic transmission fluid, and replace main sump filter. | | | | | X |
| Inspect the drive belt and replace as needed. Not required if belt was previously replaced. | | | | | X |
| Drain and refill the transfer case fluid. | | | | | X |

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

◊ This maintenance is recommended by the manufacturer to the owner, but it is not required to maintain emissions warranty.

‡Off-highway operation, trailer towing, taxi, limousine, bus, snow plowing, or other types of commercial service or prolonged operation with heavy loading, especially in hot weather, require front and rear axle service indicated with a ‡ in Schedule “B”. Perform these services if the vehicle is usually operated under these conditions.

## DESCRIPTION – DIESEL ENGINES – EXPORT SCHEDULES

There are two maintenance schedules that show the **required** service for your vehicle.

First is Schedule **“A”**. It is for vehicles that are not operated under any of the conditions listed under Schedule ″B″.

Second is Schedule **“B”**. It is for vehicles that are operated under the conditions that are listed below and at the beginning of the schedule.

- Day or night temperatures are below 0°C (32°F).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 16.2 km (10 miles).
- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

Most vehicles are operated under the conditions listed for Schedule ″B″.

Use the schedule that best describes your driving conditions. Where time and mileage are listed, follow the interval that occurs first.

**CAUTION: Failure to perform the required maintenance items may result in damage to the vehicle.**

### *At Each Stop for Fuel*

- Check the engine oil level about 5 minutes after a fully warmed engine is shut off. Checking the oil level while the vehicle is on level ground will improve the accuracy of the oil level reading. Add oil only when the level is at or below the ADD or MIN mark.
- Check the windshield washer solvent and add if required.

***Once a Month***

- Check the tire pressure and look for unusual wear or damage.
- Inspect the battery and clean and tighten the terminals as required.
- Check the fluid levels of coolant reservoir, brake master cylinder, power steering and transmission and add as needed.
- Check all lights and all other electrical items for correct operation.

***At Each Oil Change***

- Change the engine oil filter.
- Inspect the exhaust system.
- Inspect brake hoses.
- Check the engine coolant/anti-freeze level, hoses, and clamps.
- Inspect engine accessory drive belts. Replace as necessary.
- Inspect for the presence of water in the fuel filter/water separator unit.

***Tire Rotation***

- Rotate the tires every 10 000 km (6,000 miles).

## Schedule "A"

| **Kilometers**<br>**(Miles)** | **20 000**<br>**(12,500)** | **40 000**<br>**(25,000)** | **60 000**<br>**(37,500)** | **80 000**<br>**(50,000)** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | X | X | X |
| **Replace the engine air filter element.** | | X | | X |
| Replace the fuel filter/water separator unit. | | X | | X |
| Inspect the brake linings. | | X | | X |
| Inspect the transfer case fluid. | X | | | |

| **Kilometers**<br>**(Miles)** | **100 000**<br>**(62,500)** | **120 000**<br>**(75,000)** | **140 000**<br>**(87,500)** | **160 000**<br>**(100,000)** |
|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | X | X | X |
| **Replace the engine air filter element.** | | X | | X |
| Replace the fuel filter/water separator unit. | | X | | X |
| Replace the engine timing belt, and idler pulleys. | | | | X |
| Inspect the engine timing belt tensioner, replace if necessary. ◊ | | | | X |
| Flush and replace the engine coolant. | X | | | |
| Replace the engine accessory drive belt. | X | | | |
| Inspect the brake linings. | | X | | X |
| Inspect the transfer case fluid. | X | | | |

Inspection and service should also be performed anytime a malfunction is observed or suspected.

‡ Replace if there is superficial wear, bearing clearance, or evident grease leak.

**WARNING: You can be badly injured working on or around a motor vehicle. Do only that service work for which you have the knowledge and the right equipment. If you have any doubt about your ability to perform a service job, take your vehicle to a competent mechanic.**

## Schedule "B"

Follow schedule "B" if you usually operate your vehicle under one or more of the following conditions.

- Day or night temperatures are below 0°C (32°F).
- Stop and go driving.
- Extensive engine idling.
- Driving in dusty conditions.
- Short trips of less than 16.2 km (10 miles).
- More than 50% of your driving is at sustained high speeds during hot weather, above 32°C (90°F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).
- Off-road or desert driving.

| **Kilometers (Miles)** | **10 000 (6,250)** | **20 000 (12,500)** | **30 000 (18,750)** | **40 000 (25,000)** | **50 000 (31,250)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | X | X | X | X |
| **Replace the engine air filter element.** | | X | | X | |
| Replace the fuel filter/water separator unit. | | | | X | |
| Inspect the brake linings. | | X | | X | |
| Drain and refill the front and rear axle fluid. | | X | | X | |

| **Kilometers (Miles)** | **60 000 (37,500)** | **70 000 (43,750)** | **80 000 (50,000)** | **90 000 (56,250)** | **100 000 (62,500)** |
|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | X | X | X | X |
| **Replace the engine air filter element.** | X | | X | | X |
| Replace the fuel filter/water separator unit. | | | X | | |
| Replace the engine accessory drive belt. | X | | | | |
| Inspect the brake linings. | X | | X | | X |
| Drain and refill the front and rear axle fluid. | X | | X | | X |
| Drain and refill the transfer case fluid. | | | | | X |
| Drain and refill the automatic transmission fluid, and replace sump filter. ◊ | | | | | X |

| **Kilometers (Miles)** | **110 000 (68,750)** | **120 000 (75,000)** | **130 000 (81,250)** | **140 000 (87,500)** | **150 000 (93,750)** | **160 000 (100,000)** |
|---|---|---|---|---|---|---|
| Change the engine oil and engine oil filter. | X | X | X | X | X | X |
| **Inspect the engine air filter element. Replace as necessary.** | X | X | X | X | X | X |
| **Replace the engine air filter element.** | | X | | X | | X |
| Replace the engine accessory drive belt. | | X | | | | |
| Replace the engine timing belt and idler pulleys. | | | | | | X |
| Inspect the engine timing belt tensioner, replace if necessary.† | | | | | | X |
| Replace the fuel filter/water separator unit. | | X | | | | X |

| **Kilometers** <br> **(Miles)** | **110 000** <br> **(68,750)** | **120 000** <br> **(75,000)** | **130 000** <br> **(81,250)** | **140 000** <br> **(87,500)** | **150 000** <br> **(93,750)** | **160 000** <br> **(100,000)** |
|---|---|---|---|---|---|---|
| Flush and replace the engine coolant/anti-freeze. | | | | | | X |
| Inspect the brake linings. | | X | | X | | |
| Drain and refill the front and rear axle fluid. | | X | | X | | |

◊ Applies only if vehicle is used for frequent trailer towing, or fleet/commercial service.

† The replacement of such component is requested when there is superficial wear, bearing clearance, or evident grease leak.

Inspection and service should be performed anytime a malfunction is observed or suspected. Retain all receipts.

# REPLACEMENT BULBS

## SPECIFICATIONS

## REPLACEMENT LIGHT BULBS - INTERIOR

### SPECIFICATIONS

| LIGHT BULBS — Interior | Bulb Number |
|---|---|
| A/C Heater | Not Serviceable |
| Ashtray Receiver Light | 161 |
| Climate Control (Manual A/C) | 74 |
| Front Reading | 192 |
| Rear Cargo Light | 214–2 |
| Lighted Vanity Mirror * | P/N 6501966 |
| Underpanel Courtesy Lights | 906 |
| Instrument Cluster (General Illumination) | 103 |
| Telltale/Hazard Light | 74 |

* Available only from authorized dealers.

## REPLACEMENT LIGHT BULBS - EXTERIOR

### SPECIFICATIONS

| LIGHT BULBS — Exterior | Bulb Number |
|---|---|
| Backup Lights | 3157 P27/7W |
| Center High-Mounted Stoplight | 921/W16W |
| Fog Lights (Sport/Limited Only) | 9145 |
| Fog Lights (Renegade) | H3 |
| Front Park/Turn Lights | 3157 P27/7W |
| Front Side Marker | 168 |
| Headlights | 9007QL |
| Headlights - EXPORT | H4 |
| Rear License Plate Light | 168 |
| Rear Stop/Tail Lights | 3157 P27/7W |
| Rear Stop/Tail/Fog Lights - EXPORT | 3157 P27/7W |
| Rear Turn Signal Lights (2) | 3757 APY27/7W |

**NOTE: Numbers refer to commercial bulb types that can be purchased from your authorized dealer.**

If a bulb needs to be replaced, visit your authorized dealer.

# TRAILER TOWING

## SPECIFICATIONS

## TRAILER TOWING

In this section you will find safety tips and information on limits to the type of towing you can reasonably do with your vehicle. Before towing a trailer carefully review this information to tow your load as efficiently and safely as possible.

### Common Towing Definitions

The following trailer towing related definitions will assist you in understanding the following information:

**Gross Vehicle Weight Rating (GVWR)**

The GVWR is the total allowable weight of your vehicle. This includes driver, passengers, cargo and tongue weight. The total load must be limited so that you do not exceed the GVWR.

**Gross Trailer Weight (GTW)**

The gross trailer weight (GTW) is the weight of the trailer plus the weight of all cargo, consumables and equipment (permanent or temporary) loaded in or on the trailer in its ″loaded and ready for operation″ condition. The recommended way to measure GTW is to put your fully loaded trailer on a vehicle scale. The entire weight of the trailer must be supported by the scale.

**Gross Axle Weight Rating (GAWR)**

The GAWR is the maximum capacity of the front and rear axles. Distribute the load over the front and rear axles evenly. Make sure that you do not exceed either front or rear GAWR.

**WARNING:**
**It is important that you do not exceed the maximum front or rear GAWR. A dangerous driving condition can result if either rating is exceeded. You could lose control of the vehicle and have an accident.**

**Tongue Weight (TW)**

The downward force exerted on the hitch ball by the trailer. In most cases it should not be less than 10% or more than 15% of the trailer load. You must consider this as part of the load on your vehicle.

**Frontal Area**

The maximum height and maximum width of the front of a trailer.

**Trailer Sway Control**

The trailer sway control is a telescoping link that can be installed between the hitch receiver and the trailer tongue that typically provides adjustable friction associated with the telescoping motion to dampen any unwanted trailer swaying motions while traveling.

**Weight-Carrying Hitch**

A weight-carrying hitch supports the trailer tongue weight, just as if it were luggage located at a hitch ball or some other connecting point of the vehicle. These kind of hitches are the most popular on the market today and they're commonly used to tow small- and medium-sized trailers.

**Weight-Distributing Hitch**

A weight-distributing hitch includes a receiver attached to the tow vehicle, plus a removable hitch head and spring bar assembly that fits into the receiver opening and hook up brackets that connect the spring bars to the trailer frame.

## Trailer Hitch Classification

Your vehicle may be factory equipped for safe towing of trailers weighing over 2,000 lbs (907 kg) with the optional Trailer Tow Prep Package. See your dealer for package content.

The following chart provides the industry standard for the maximum trailer weight a given trailer hitch class can tow and should be used to assist you in selecting the correct trailer hitch for your intended towing condition. Refer to the Trailer Towing Weights (Maximum Trailer Weight Ratings) chart for the Max. GTW towable for your given drivetrain.

| Trailer Hitch Classification | |
|---|---|
| **Class** | **Max. GTW (Gross Trailer Wt.)** |
| Class I - Light Duty | 2,000 lbs (907 kg) |
| Class II - Medium Duty | 3,500 lbs (1587 kg) |
| Class III - Heavy Duty | 5,000 lbs (2268 kg) |
| Class IV - Extra Heavy Duty | 10,000 lbs (4540 kg) |

All trailer hitches should be professionally installed on your vehicle.

## Trailer Towing Weights (Maximum Trailer Weight Ratings)

The following chart provides the maximum trailer weight ratings towable for your given drivetrain.

| Engine/ Transmission | Model | GVWR (Gross Vehicle Wt. Rating) | GCWR (Gross Combined Wt. Rating) | Frontal Area | Max. GTW (Gross Trailer Wt.) | Max. Tongue Wt. (See Note 1) |
|---|---|---|---|---|---|---|
| 3.7L/6-Speed Manual | 4x2 | 5,350 lbs (2 427 kg) | 8,500 lbs (3 855 kg) | 40 ft2 | 3,500 lbs (1 587 kg) | 350 lbs (159 kg) |
| 3.7L/6-Speed Manual | 4x4 | 5,600 lbs (2 540 kg) | 8,750 lbs (3 969 kg) | 40 ft2 | 3,500 lbs (1 587 kg) | 350 lbs (159 kg) |
| 3.7L/ Automatic | 4x2 | 5,350 lbs (2 427 kg) | 7,150 lbs (3 243 kg) | 32 ft2 | 2,000 lbs (907 kg) | 200 lbs (91 kg) |
| 3.7L/ Automatic | 4x4 | 5,600 lbs (2 540 kg) | 7,400 lbs ( 3 356 kg) | 32 ft2 | 2,000 lbs (907 kg) | 200 lbs (91 kg) |
| 3.7L/ Automatic w/ Cooler | 4x2 | 5,350 lbs (2 427 kg) | 9,850 lbs (4 468 kg) | 60 ft2 | 5,000 lbs (2 268 kg) | 500 lbs (227 kg) |
| 3.7L/ Automatic w/Cooler | 4x4 | 5,600 lbs (2 540 kg) | 10,100 lbs (4 581 kg) | 60 ft2 | 5,000 lbs (2 268 kg) | 500 lbs (227 kg) |
| 2.8L Diesel/ Automatic | 4x4 | 5,650 lbs (2 563 kg) | 10,150 lbs (4 604 kg) | 60 ft2 | 5,000 lbs (2 268 kg) | 500 lbs (227 kg) |
| Refer to local laws for maximum trailer towing speeds. | | | | | | |

**NOTE: The trailer tongue weight must be considered as part of the combined weight of occupants and cargo, and should never exceed the weight referenced on the Tire and Loading Information placard.**

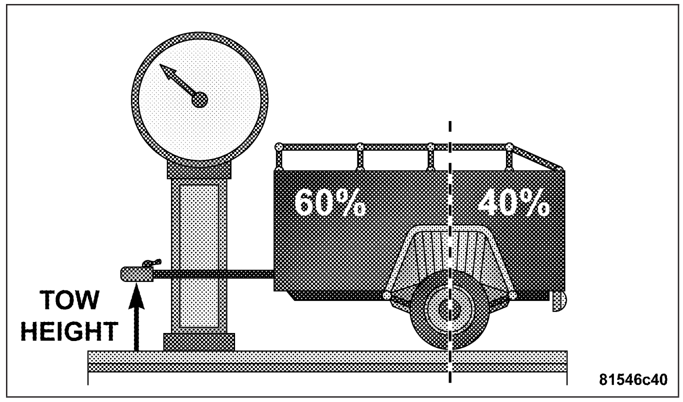
## Trailer and Tongue Weight

Always load a trailer with 60% to 65% of the weight in the front of the trailer. This places 10% to 15% of the Gross Trailer Weight (GTW) on the tow hitch of your vehicle. Loads balanced over the wheels or heavier in the rear can cause the trailer to sway **severely** side to side which will cause loss of control of the vehicle and trailer. Failure to load trailers heavier in front is the cause of many trailer accidents.

Never exceed the maximum tongue weight stamped on your bumper or trailer hitch.

Consider the following items when computing the weight on the rear axle of the vehicle:

- The tongue weight of the trailer.
- The weight of any other type of cargo or equipment put in or on your vehicle.
- The weight of the driver and all passengers.




**NOTE: Remember that everything put into or on the trailer adds to the load on your vehicle. Also, additional factory-installed options, or dealer-installed options, must be considered as part of the total load on your vehicle. Refer to the Tire and Loading Information placard in the Tire Safety Information Section of this manual for the maximum combined weight of occupants and cargo for your vehicle.**

**Trailer sway control and a weight distributing (load equalizing) hitch are recommended for Tongue Weights (TW) above 150 lbs (68 kg) and required for Tongue Weights above 300 lbs (136 kg).**

## Towing Requirements

To promote proper break-in of your new vehicle drivetrain components the following guidelines are recommended:

**CAUTION:**
- **Avoid towing a trailer for the first 500 miles (805 km) of vehicle operation. Doing so may damage your vehicle.**
- **During the first 500 miles (805 km) of trailer towing, limit your speed to 50 mph (80 km/h).**

When towing a trailer, never exceed the GAWR, or GCWR, ratings.

**WARNING:**
**Improper towing can lead to an injury accident. Follow these guidelines to make your trailer towing as safe as possible:**
**Make certain that the load is secured in the trailer and will not shift during travel. When trailering cargo that is not fully secured, dynamic load shifts can occur that may be difficult for the driver to control. You could lose control of your vehicle and have an accident.**

- When hauling cargo or towing a trailer, do not overload your vehicle or trailer. Overloading can cause a loss of control, poor performance or damage to brakes, axle, engine, transmission, steering, suspension, chassis structure or tires.
- Safety chains must always be used between your vehicle and trailer. Always connect the chains to the frame or hook retainers of the vehicle hitch. Cross the chains under the trailer tongue and allow enough slack for turning corners.
- Vehicles with trailers should not be parked on a grade. When parking, apply the parking brake on the tow vehicle. Put the tow vehicle automatic transmission in P for Park. Always, block or ″chock″ the trailer wheels.
- GCWR must not be exceeded.
- **Total weight must be distributed between the tow vehicle and the trailer such that the following four ratings are not exceeded:**
  - GVWR
  - GTW
  - GAWR
  - Tongue weight rating for the trailer hitch utilized (This requirement may limit the ability to always achieve the 10% to 15% range of tongue weight as a percentage of total trailer weight).

**Towing Requirements — Tires**

− Do not attempt to tow a trailer while using a compact spare tire.
− Proper tire inflation pressures are essential to the safe and satisfactory operation of your vehicle.
− Also, check the trailer tires for proper tire inflation pressures before trailer usage.

− Check for signs of tire wear or visible tire damage before towing a trailer. Refer to the (Refer to 22 - TIRES/WHEELS/TIRES - DESCRIPTION) section of this manual on Tread Wear Indicators for the proper inspection procedure.

− When replacing tires refer to (Refer to 22 - TIRES/WHEELS/TIRES - DESCRIPTION) section of this manual on Replacement Tires for proper tire replacement procedures. Replacing tires with a higher load carrying capacity will not increase the vehicle's GVWR and GAWR limits.

**Towing Requirements — Trailer Brakes**

− Do **not** interconnect the hydraulic brake system or vacuum system of your vehicle with that of the trailer. This could cause inadequate braking and possible personal injury.

− An electronically actuated trailer brake controller is required when towing a trailer with electronically actuated brakes. When towing a trailer equipped with a hydraulic surge actuated brake system, an electronic brake controller is not required.

− Trailer brakes are recommended for trailers over 1,000 lbs (454 kg) and required for trailers in excess of 2,000 lbs (907 kg).

**CAUTION:**
**If the trailer weighs more than 1,000 lbs (454 kg) loaded, it should have its own brakes and they should be of adequate capacity. Failure to do this could lead to accelerated brake lining wear, higher brake pedal effort, and longer stopping distances.**

**WARNING:**
**Do not connect trailer brakes to your vehicle's hydraulic brake lines. It can overload your brake system and cause it to fail. You might not have brakes when you need them and could have an accident.**
**Towing any trailer will increase your stopping distance. When towing you should allow for additional space between your vehicle and the vehicle in front of you. Failure to do so could result in an accident.**

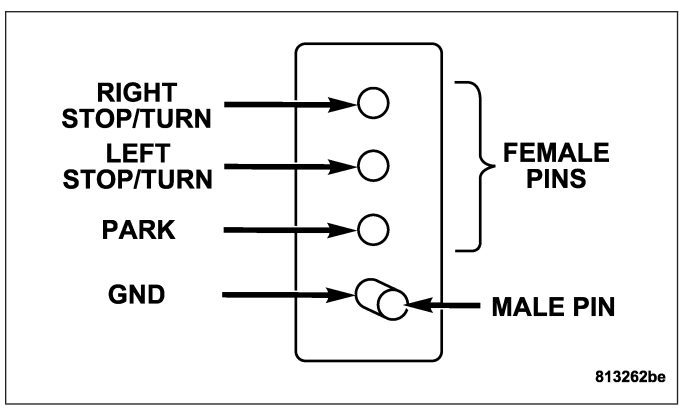
## Towing Requirements — Trailer Lights & Wiring

Whenever you pull a trailer, regardless of the trailer size, stop lights and turn signals on the trailer are required for motoring safety.

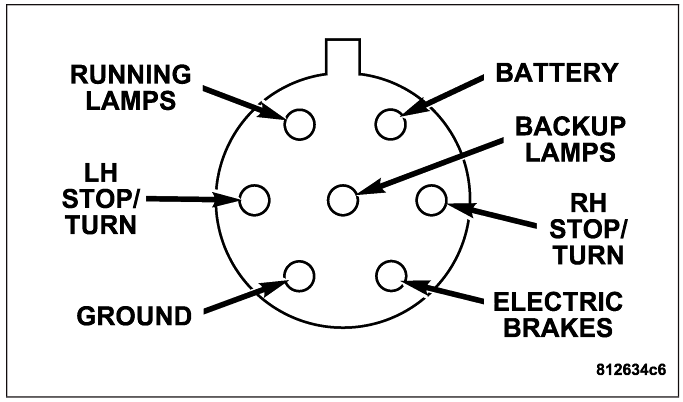
The Trailer Tow Package may include a 4 and 7 pin wiring harness. Use a factory approved trailer harness and connector.

**NOTE: Do not cut or splice wiring into the vehicles wiring harness.**

The electrical connections are all complete to the vehicle but you must mate the harness to a trailer connector. Refer to the following illustrations.



## Towing Tips




Before setting out on a trip, practice turning, stopping and backing the trailer in an area away from heavy traffic.

### Towing Tips — Automatic Transmission

The “D” range can be selected when towing. However, if frequent shifting occurs while in this range, the “3” range should be selected.Using the “3” range while operating the vehicle under heavy operating conditions will improve performance and extend transmission life by reducing excessive shifting and heat build up. This action will also provide better engine braking.

The automatic transmission fluid and filter should be changed if you REGULARLY tow a trailer for more than 45 minutes of continuous operation. See Schedule “B” in section 8 of this manual for transmission fluid change intervals.

**NOTE: Check the automatic transmission fluid level before towing.**

### Towing Tips — Electronic Speed Control (If Equipped)

− Don’t use in hilly terrain or with heavy loads.

− When using the speed control, if you experience speed drops greater than 10 mph (16 km/h), disengage until you can get back to cruising speed.

− Use speed control in flat terrain and with light loads to maximize fuel efficiency.

### Towing Tips — Autostick (If Equipped)

− For vehicles equipped with Autostick. By using the Autostick modes, and selecting a specific gear range, frequent shifting can be avoided. The highest gear range should be selected that allows for adequate performance. For example, choose “4” if the desired speed can be maintained. Choose “3” or “2” if needed to maintain the desired speed.

− Extended driving at high RPM should be avoided to prevent excess heat generation. A reduction in vehicle speed may be required to avoid extended driving at high RPM. Return to a higher gear range or vehicle speed when road conditions and RPM level allows.

### Towing Tips — Cooling System

To reduce potential for engine and transmission overheating, take the following actions:

- City Driving - When stopped for short periods of time, put transmission in neutral and increase engine idle speed.
- Highway Driving - Reduce speed.
- Air Conditioning - Turn off temporarily.
- refer to Cooling System Operating information in the Maintenance section of this manual for more information.

# BRAKES

## TABLE OF CONTENTS



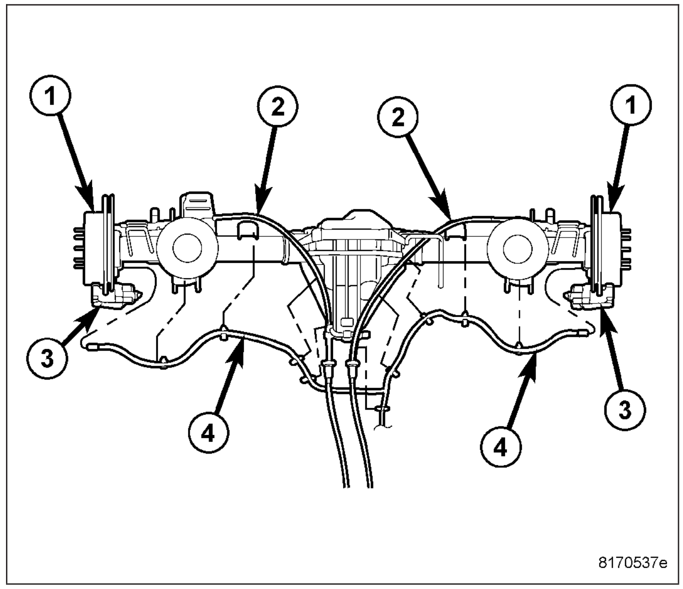
## BRAKES - BASE - SERVICE INFORMATION

### TABLE OF CONTENTS

# BRAKES - BASE - SERVICE INFORMATION

## DESCRIPTION

ESP and Power assist four wheel disc brakes are standard equipment. Disc brake components consist of single piston calipers and ventilated rotors. Rear disc brakes use a drum in hat design for the parking brake which is activated by brake shoes pressing against the inside of the drum in hat rotor (1).




The parking brake mechanism is lever and cable operated. The cables (2) are attached to equalizers on the rear disc brake support plate which moves the park brake shoes firmly against the drum in hat rotor. The parking brakes are operated by a hand lever.

The vehicle is equipped with ESP (Electronic Stability Program). There are four wheel speed sensors, one sensor at each wheel to monitor input.

A dual diaphragm vacuum power brake booster is used for all applications. All models have an aluminum master cylinder with plastic reservoir.

Factory brake lining on all models consists of an organic base material combined with metallic particles. The original equipment linings do not contain asbestos.

## WARNING

**WARNING: Dust and dirt accumulating on brake parts during normal use may contain asbestos fibers from aftermarket linings. Breathing excessive concentrations of asbestos fibers can cause serious bodily harm. Exercise care when servicing brake parts. Do not clean brake parts with compressed air or by dry brushing. Use a vacuum cleaner specifically designed for the removal of asbestos fibers from brake components. If a suitable vacuum cleaner is not available, cleaning should be done with a water dampened cloth. Do not sand, or grind brake lining unless equipment used is designed to contain the dust residue. Dispose of all residue containing asbestos fibers in sealed bags or containers to minimize exposure to yourself and others. Follow practices prescribed by the occupational safety and health administration and the environmental protection agency for the handling, processing, and disposition of dust or debris that may contain asbestos fibers.**

**CAUTION: Never use gasoline, kerosene, alcohol, motor oil, transmission fluid, or any fluid containing mineral oil to clean the system components. These fluids damage rubber cups and seals. Use only fresh brake fluid or Mopar brake cleaner to clean or flush brake system components. These are the only cleaning materials recommended. If system contamination is suspected, check the fluid for dirt, discoloration, or separation into distinct layers. Also check the reservoir cap seal for distortion. Drain and flush the system with new brake fluid if contamination is suspected.**

**CAUTION: Use Mopar brake fluid, or an equivalent quality fluid meeting SAE/DOT standards J1703 and DOT 3. Brake fluid must be clean and free of contaminants. Use fresh fluid from sealed containers only to ensure proper antilock component operation.**

**CAUTION: Use Mopar multi-mileage or high temperature grease to lubricate caliper slide surfaces, drum brake pivot pins, and shoe contact points on the backing plates. Use multi-mileage grease or GE 661 or Dow 111 silicone grease on caliper slide pins to ensure proper operation.**

## DIAGNOSIS AND TESTING - BASE BRAKE SYSTEM

Base brake components consist of the brake shoes, calipers, rotors, brake lines, master cylinder, booster, and parking brake components.

Brake diagnosis involves determining if the problem is related to a mechanical, hydraulic, or vacuum operated component.

The first diagnosis step is the preliminary check.

## PRELIMINARY BRAKE CHECK

1. Check condition of tires and wheels. Damaged wheels and worn, damaged, or underinflated tires can cause pull, shudder, vibration, and a condition similar to grab.
2. If complaint was based on noise when braking, check suspension components. Jounce front and rear of vehicle and listen for noise that might be caused by loose, worn or damaged suspension or steering components.
3. Inspect brake fluid level and condition. Note that the brake reservoir fluid level will decrease in proportion to normal lining wear. **Also note that brake fluid tends to darken over time. This is normal and should not be mistaken for contamination.**
    a. If fluid level is abnormally low, look for evidence of leaks at calipers, brake lines, and master cylinder.
    b. If fluid appears contaminated, drain out a sample to examine. System will have to be flushed if fluid is separated into layers, or contains a substance other than brake fluid. The system seals and cups will also have to be replaced after flushing. Use clean brake fluid to flush the system.
4. Check parking brake operation. Verify free movement and full release of cables and hand lever. Also note if vehicle was being operated with parking brake partially applied.
5. Check brake pedal operation. Verify that pedal does not bind and has adequate free play. If pedal lacks free play, check pedal and power booster for being loose or for bind condition. Do not road test until condition is corrected.
6. Check booster vacuum check valve and hose.
7. If components checked appear OK, road test the vehicle.

## ROAD TESTING

1. If complaint involved low brake pedal, pump pedal and note if it comes back up to normal height.
2. Check brake pedal response with transmission in Neutral and engine running. Pedal should remain firm under constant foot pressure.
3. During road test, make normal and firm brake stops in 25-40 mph range. Note faulty brake operation such as low pedal, hard pedal, fade, pedal pulsation, pull, grab, drag, noise, etc.
4. Attempt to stop the vehicle with the parking brake only and note grab, drag, noise, etc.

### PEDAL FALLS AWAY

A brake pedal that falls away under steady foot pressure is generally the result of a system leak. The leak point could be at a brake line, fitting, hose, or caliper. If leakage is severe, fluid will be evident at or around the leaking component.

Internal leakage (seal by-pass) in the master cylinder caused by worn or damaged piston cups, may also be the problem cause.

An internal leak in the ABS or junction block may also be the problem with no physical evidence.

### LOW PEDAL

If a low pedal is experienced, pump the pedal several times. If the pedal comes back up worn linings or rotors are the most likely causes. The proper course of action is to inspect and replace all worn components.

### SPONGY PEDAL

A spongy pedal is most often caused by air in the system. However, substandard brake lines and hoses can also cause a spongy pedal. The proper course of action is to bleed the system, and replace substandard quality brake hoses if suspected.

### HARD PEDAL OR HIGH PEDAL EFFORT

A hard pedal or high pedal effort may be due to lining that is water soaked, contaminated, glazed, or badly worn. The power booster or check valve could also be faulty.

### PEDAL PULSATION

Pedal pulsation is caused by components that are loose, or beyond tolerance limits.

The primary cause of pulsation are disc brake rotors with excessive lateral runout or thickness variation. Other causes are loose wheel bearings or calipers and worn, damaged tires.

**NOTE: Some pedal pulsation may be felt during ABS activation.**

### BRAKE DRAG

Brake drag occurs when the lining is in constant contact with the rotor or drum. Drag can occur at one wheel, all wheels, fronts only, or rears only.

Drag is a product of incomplete brake shoe release. Drag can be minor or severe enough to overheat the linings, rotors and drums.

Minor drag will usually cause slight surface charring of the lining. It can also generate hard spots in rotors and drums from the overheat-cool down process. In most cases, the rotors, drums, wheels and tires are quite warm to the touch after the vehicle is stopped.

Severe drag can char the brake lining all the way through. It can also distort and score rotors and drums to the point of replacement. The wheels, tires and brake components will be extremely hot. In severe cases, the lining may generate smoke as it chars from overheating.

Common causes of brake drag are:

- Seized or improperly adjusted parking brake cables.
- Loose/worn wheel bearing.
- Seized caliper piston.
- Caliper binding on corroded bushings or rusted slide surfaces.
- Loose caliper mounting.
- Drum parking brake shoes binding on worn/damaged support plates.
- Mis-assembled components.
- Long booster output rod.

If brake drag occurs at all wheels, the problem may be related to a blocked master cylinder return port, or faulty power booster (binds-does not release).

### BRAKE FADE

Brake fade is usually a product of overheating caused by brake drag. However, brake overheating and resulting fade can also be caused by riding the brake pedal, making repeated high deceleration stops in a short time span, or constant braking on steep mountain roads. Refer to the Brake Drag information in this section for causes.

### BRAKE PULL

Front brake pull condition could result from:

- Contaminated lining in one caliper
- Seized caliper piston
- Binding caliper
- Loose caliper
- Rusty caliper slide surfaces
- Improper brake shoes
- Damaged rotor

A worn, damaged wheel bearing or suspension component are further causes of pull. A damaged front tire (bruised, ply separation) can also cause pull.

A common and frequently misdiagnosed pull condition is where direction of pull changes after a few stops. The cause is a combination of brake drag followed by fade at one of the brake units.

As the dragging brake overheats, efficiency is so reduced that fade occurs. Since the opposite brake unit is still functioning normally, its braking effect is magnified. This causes pull to switch direction in favor of the normally functioning brake unit.

An additional point when diagnosing a change in pull condition concerns brake cool down. Remember that pull will return to the original direction, if the dragging brake unit is allowed to cool down (and is not seriously damaged).

### REAR BRAKE GRAB OR PULL

Rear grab or pull is usually caused by improperly adjusted or seized parking brake cables, contaminated lining, bent or binding shoes and support plates, or improperly assembled components. This is particularly true when only one rear wheel is involved. However, when both rear wheels are affected, the master cylinder or proportioning valve could be at fault.

### BRAKES DO NOT HOLD AFTER DRIVING THROUGH DEEP WATER PUDDLES

This condition is generally caused by water soaked lining. If the lining is only wet, it can be dried by driving with the brakes very lightly applied for a mile or two. However, if the lining is both soaked and dirt contaminated, cleaning and/or replacement will be necessary.

### BRAKE LINING CONTAMINATION

Brake lining contamination is mostly a product of leaking calipers, worn seals, driving through deep water puddles, or lining that has become covered with grease and grit during repair. Contaminated lining should be replaced to avoid further brake problems.

### WHEEL AND TIRE PROBLEMS

Some conditions attributed to brake components may actually be caused by a wheel or tire problem.

A damaged wheel can cause shudder, vibration and pull. A worn or damaged tire can also cause pull.

Severely worn tires with very little tread left can produce a grab-like condition as the tire loses and recovers traction. Flat-spotted tires can cause vibration and generate shudder during brake operation. A tire with internal damage such as a severe bruise, cut, or ply separation can cause pull and vibration.

## BRAKE NOISES

Some brake noise is common with some disc brakes during the first few stops after a vehicle has been parked overnight or stored. This is primarily due to the formation of trace corrosion (light rust) on metal surfaces. This light corrosion is typically cleared from the metal surfaces after a few brake applications causing the noise to subside.

### BRAKE SQUEAK/SQUEAL

Brake squeak or squeal may be due to linings that are wet or contaminated with brake fluid, grease, or oil. Glazed linings and rotors with hard spots can also contribute to squeak. Dirt and foreign material embedded in the brake lining will also cause squeak/squeal.

A very loud squeak or squeal is frequently a sign of severely worn brake lining. If the lining has worn through to the brake shoes in spots, metal-to-metal contact occurs. If the condition is allowed to continue, rotors and drums can become so scored that replacement is necessary.

### BRAKE CHATTER

Brake chatter is usually caused by loose or worn components, or glazed/burnt lining. Rotors with hard spots can also contribute to chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.

### THUMP/CLUNK NOISE

Thumping or clunk noises during braking are frequently **not** caused by brake components. In many cases, such noises are caused by loose or damaged steering, suspension, or engine components. However, calipers that bind on the slide surfaces can generate a thump or clunk noise.

## STANDARD PROCEDURE

### PRESSURE BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

Do not pump the brake pedal at any time while bleeding. Air in the system will be compressed into small bubbles that are distributed throughout the hydraulic system. This will make additional bleeding operations necessary.

Do not allow the master cylinder to run out of fluid during bleed operations. An empty cylinder will allow additional air to be drawn into the system. Check the cylinder fluid level frequently and add fluid as needed.

Bleed only one brake component at a time in the following sequence:

- Master Cylinder
- Junction Block
- Right Rear Wheel
- Left Rear Wheel
- Right Front Wheel
- Left Front Wheel

Follow the manufacturers instructions carefully when using pressure equipment. Do not exceed the tank manufacturers pressure recommendations. Generally, a tank pressure of 15-20 psi is sufficient for bleeding.

Fill the bleeder tank with recommended fluid and purge air from the tank lines before bleeding.

Do not pressure bleed without a proper master cylinder adapter. The wrong adapter can lead to leakage, or drawing air back into the system. Use adapter provided with the equipment or Adapter 6921.

### MANUAL BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

Do not pump the brake pedal at any time while bleeding. Air in the system will be compressed into small bubbles that are distributed throughout the hydraulic system. This will make additional bleeding operations necessary.

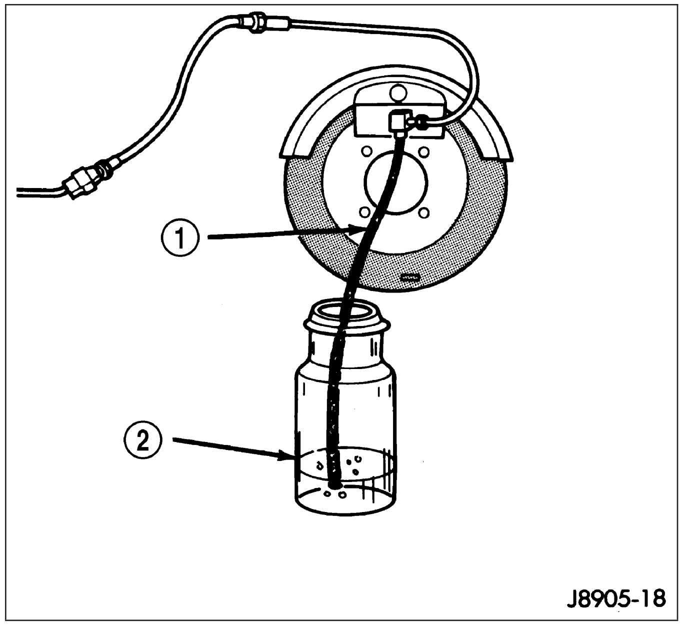
Do not allow the master cylinder to run out of fluid during bleed operations. An empty cylinder will allow additional air to be drawn into the system. Check the cylinder fluid level frequently and add fluid as needed.

Bleed only one brake component at a time in the following sequence:

- Master Cylinder
- Junction Block
- Right Rear Wheel
- Left Rear Wheel
- Right Front Wheel
- Left Front Wheel

1. Remove reservoir filler caps and fill reservoir.
2. If calipers were overhauled, open all caliper bleed screws. Then close each bleed screw as fluid starts to drip from it. Top off master cylinder reservoir once more before proceeding.

3. Attach one end of bleed hose to bleed screw and insert opposite end in glass container partially filled with brake fluid. Be sure end of bleed hose is immersed in fluid.
4. Open up bleeder, then have a helper press down the brake pedal. Once the pedal is down close the bleeder. Repeat bleeding until fluid stream is clear and free of bubbles. Then move to the next wheel.




## SPECIFICATIONS

## BASE BRAKES

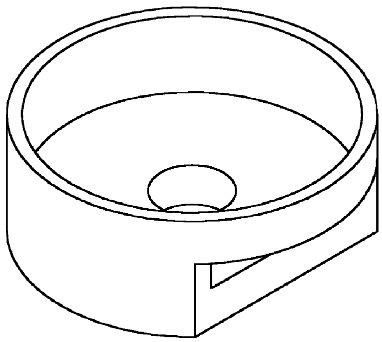
| DESCRIPTION | SPECIFICATION |
|---|---|
| Disc Brake Rotor Diameter Front | 288 x 28 mm (11.3 x 1.102 in) |
| Disc Brake Rotor Diameter Rear | 285 x 12 mm (11 x 0.472 in) |
| Disc Brake Rotor Ventilated Front | Max. Runout 0.102 mm (0.004 in.) |
| Disc Brake Rotor Solid Rear | Max. Runout 0.102 mm (0.004 in.) |
| Disc Brake Rotor Ventilated Front | Max. Thickness Variation 0.015 mm (0.0006 in.) |
| Disc Brake Rotor Solid Rear | Max. Thickness Variation 0.018 mm (0.0007 in.) |
| Disc Brake Rotor Ventilated Front | Min. Thickness 26.0 mm (1.0236 in.) |
| Disc Brake Rotor Solid Rear | Min. Thickness 11.0 mm (0.4331 in.) |
| Disc Brake Caliper | Sliding |
| Brake Booster | Dual Diaphragm |

## TORQUE

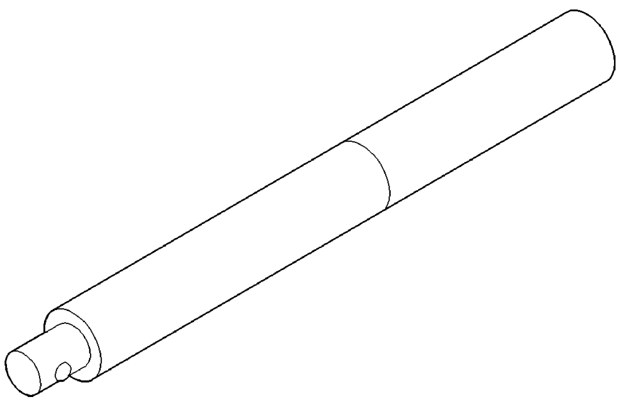
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Brake Booster Mounting Nuts | 25 | — | 220 |
| Brake Pedal Shaft to Steering Column Support Bracket Nut & Washer Assembly | 22.6 | — | 200 |
| Master Cylinder Mounting Nuts | 25 | — | 220 |
| Master Cylinder Brake Lines | 20 | 15 | 180 |
| Junction Block Mounting Nuts | 14.1 | — | 125 |
| Junction Block Brake Lines | 20 | 15 | 180 |
| Caliper Mounting Bolts Front | 15 | 11 | — |
| Caliper Mounting Bolts Rear | 25 | — | 220 |
| Caliper Brake Hose Banjo Bolt Front | 31 | 23 | — |
| Caliper Brake Hose Banjo Bolt Rear | 31 | 23 | — |
| Parking Brake Lever Screws | 10-14 | 7-10 | — |
| Parking Brake Lever Bracket Screws | 10-14 | 7-10 | — |

## SPECIAL TOOLS

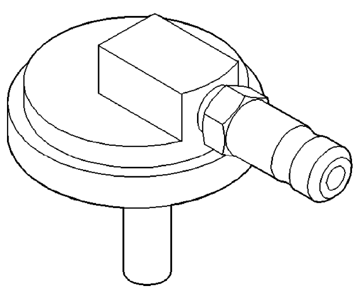
## BASE BRAKES



*Installer Caliper Dust Boot 8280*



*Handle C-4171*



*Adapter Pressure Bleeder 6921*

# BRAKE LINES

## DESCRIPTION

Flexible rubber hose is used at both front and rear brakes and at the rear axle junction block. Double walled steel tubing is used to connect the master cylinder to the major hydraulic braking components and then to the flexible rubber hoses. Double inverted style and ISO style flares are used on the brake lines.

## DIAGNOSIS AND TESTING - BRAKE LINE AND HOSES

Flexible rubber hose is used at both front and rear brakes and at the rear axle junction block. Inspect the hoses whenever the brake system is serviced, at every engine oil change, or whenever the vehicle is in for service.

Inspect the hoses for surface cracking, scuffing, or worn spots. Replace any brake hose immediately if the fabric casing of the hose is exposed due to cracks or abrasions.

Also check brake hose installation. Faulty installation can result in kinked, twisted hoses, or contact with the wheels and tires or other chassis components. All of these conditions can lead to scuffing, cracking and eventual failure.

The steel brake lines should be inspected periodically for evidence of corrosion, twists, kinks, leaks, or other damage. Heavily corroded lines will eventually rust through causing leaks. In any case, corroded or damaged brake lines should be replaced.

Factory replacement brake lines and hoses are recommended to ensure quality, correct length and superior fatigue life. Care should be taken to make sure that brake line and hose mating surfaces are clean and free from nicks and burrs. Also remember that right and left brake hoses are not interchangeable.

Use new copper seal washers at all caliper connections. Be sure brake line connections are properly made (not cross threaded) and tightened to recommended torque.

## STANDARD PROCEDURE

## DOUBLE INVERTED FLARING

A pre-formed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

Special bending tools are needed to avoid kinking or twisting of metal brake tubes. Special flaring tools are needed to make a double inverted flare or ISO flare.

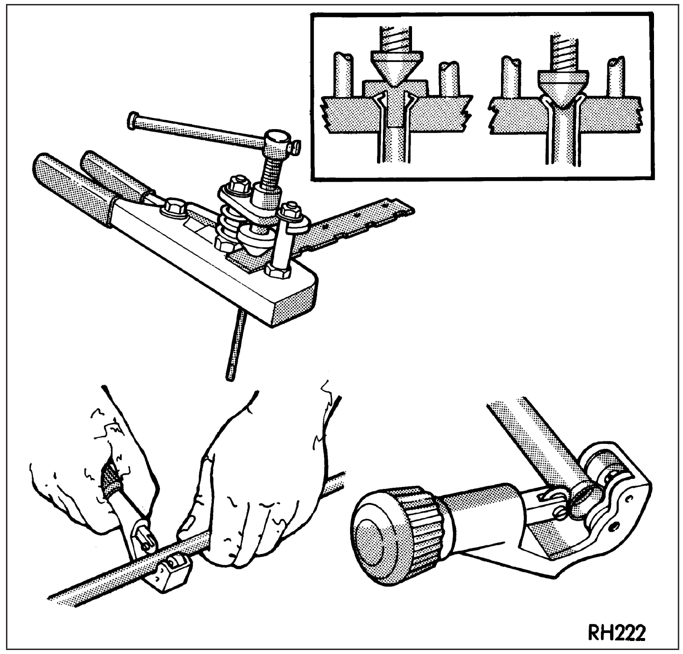
1. Cut off damaged tube with Tubing Cutter.
2. Ream cut edges of tubing to ensure proper flare.
3. Install replacement tube nut on the tube.
4. Insert tube in flaring tool.
5. Place gauge form over the end of the tube.
6. Push tubing through flaring tool jaws until tube contacts recessed notch in gauge that matches tube diameter.
7. Tighten the tool bar on the tube
8. Insert plug on gauge in the tube. Then swing compression disc over gauge and center tapered flaring screw in recess of compression disc.
9. Tighten tool handle until plug gauge is squarely seated on jaws of flaring tool. This will start the inverted flare.
10. Remove the plug gauge and complete the inverted flare.

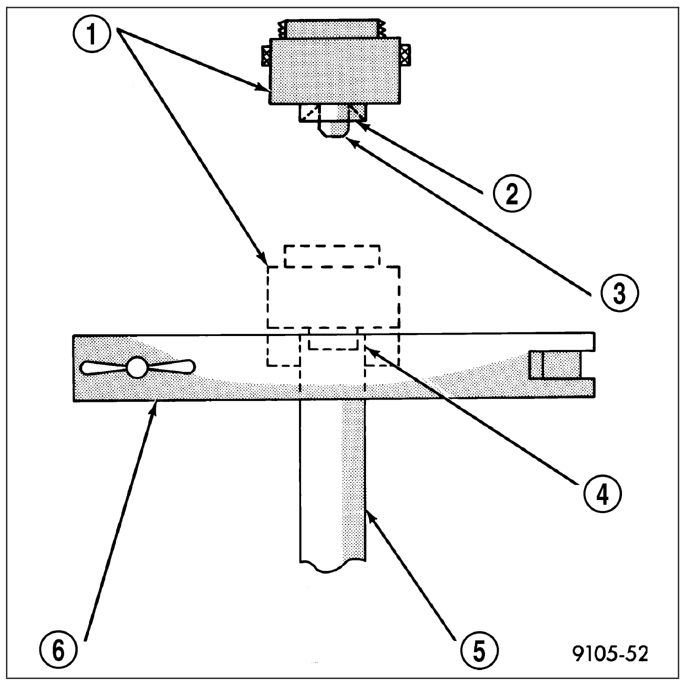
## ISO FLARING

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

To make a ISO flare use a Flaring Tool kit.

1. Cut off damaged tube with Tubing Cutter.
2. Remove any burrs from the inside of the tube.
3. Install tube nut on the tube.
4. Position the tube in the flaring tool flush with the top of the tool bar. Then tighten the tool bar on the tube.
5. Install the correct size adaptor on the flaring tool yoke screw.
6. Lubricate the adaptor.
7. Align the adaptor and yoke screw over the tube.
8. Turn the yoke screw in until the adaptor is squarely seated on the tool bar.

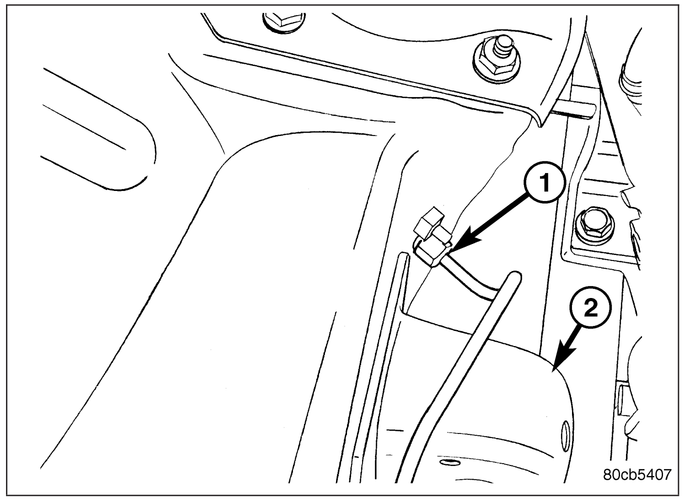


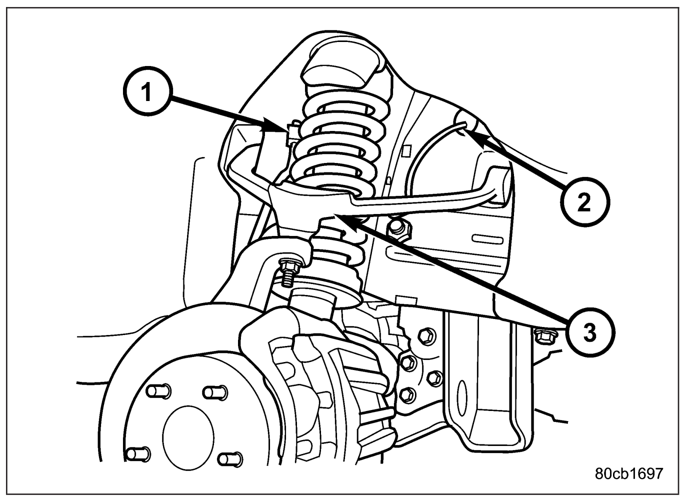
# REMOVAL

## FRONT BRAKE CALIPER HOSE

1. Install prop rod on the brake pedal to keep pressure on the brake system.
2. Remove the brake line (1) from the brake hose inside the engine compartment by the front control arm bolt (2).
3. Raise and support vehicle.

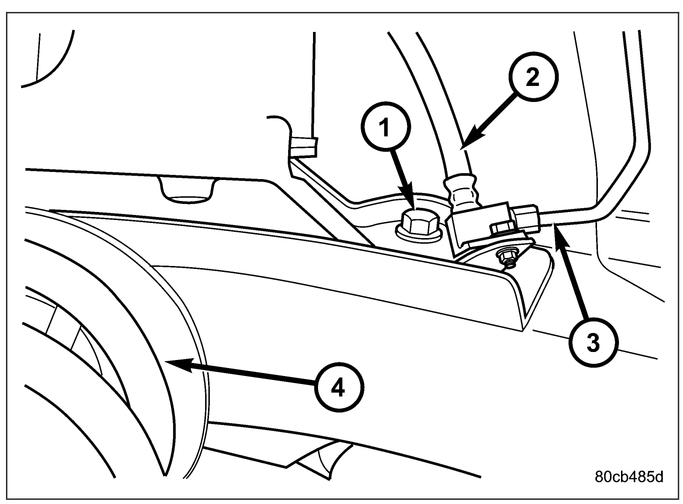



4. Remove the brake hose banjo bolt at the caliper.
5. Remove the mounting bolt for the top of the brake hose (1) at the vehicle.
6. Remove the hose.

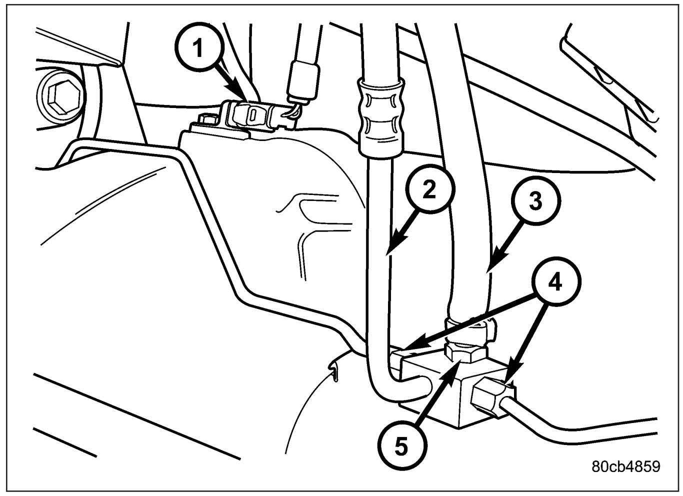



## REAR BRAKE HOSE

1. Install prop rod on the brake pedal to keep pressure on the brake system.
2. Raise and support the vehicle.
3. Remove the brake line (3) from the hose (2) at the body.
4. Remove the brake hose mounting bolt (1) at the top of the hose located at the body.



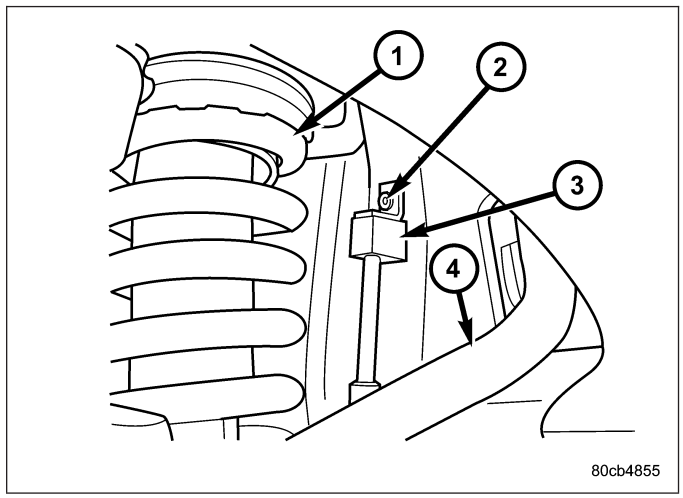
5. Remove the vent tube (3).
6. Remove the two brake lines (4) at the bottom of the hose located at the axle.
7. Remove the mounting bolt (5) for the brake hose (2) at the axle.
8. Remove the hose (2).




## INSTALLATION

## FRONT BRAKE CALIPER HOSE

1. Install the hose (3).
2. Install the mounting bolt (2) for the top of the brake hose (3) at the vehicle.
3. Install the brake hose banjo bolt at the caliper.
4. Lower the vehicle and remove the support.
5. Install the brake line to the brake hose inside the engine compartment by the front control arm bolt (4).
6. Remove the prop rod from the brake pedal.
7. Bleed the brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).




## REAR BRAKE HOSE

1. Install the hose.
2. Install the mounting bolt for the brake hose at the axle.
3. Install the two brake lines at the bottom of the hose located at the axle.
4. Install the vent tube.
5. Install the brake hose mounting bolt at the top of the hose located at the body.
6. Install the brake line to the hose at the body.
7. Lower the vehicle and remove the support.
8. Remove the prop rod.
9. Bleed the brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).

# BRAKE PADS / SHOES

## REMOVAL

### FRONT

1. Raise and support the vehicle.
2. Remove the front wheel and tire assembly.
3. Drain a small amount of fluid from the master cylinder brake reservoir with a **clean** suction gun.
4. Bottom the caliper pistons into the caliper by prying the caliper over.
5. Remove the caliper mounting bolts.
6. Remove the disc brake caliper from the mount.

**CAUTION: Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.**

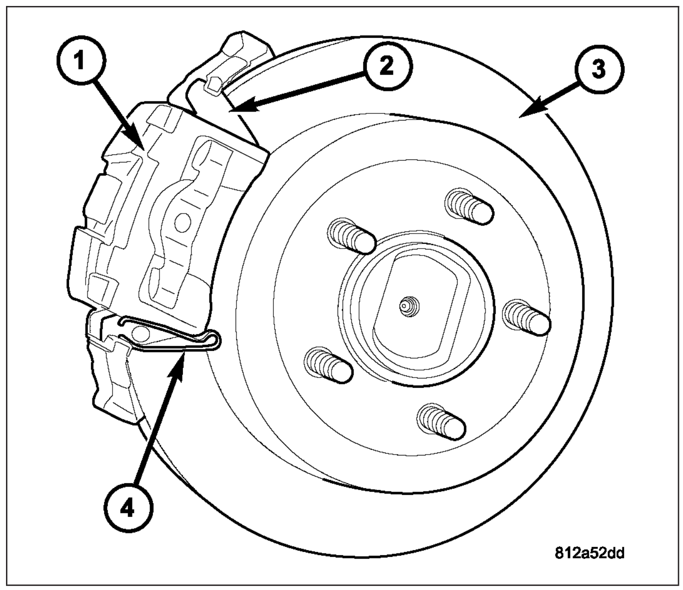
7. Remove the inboard and outboard pads.

### REAR

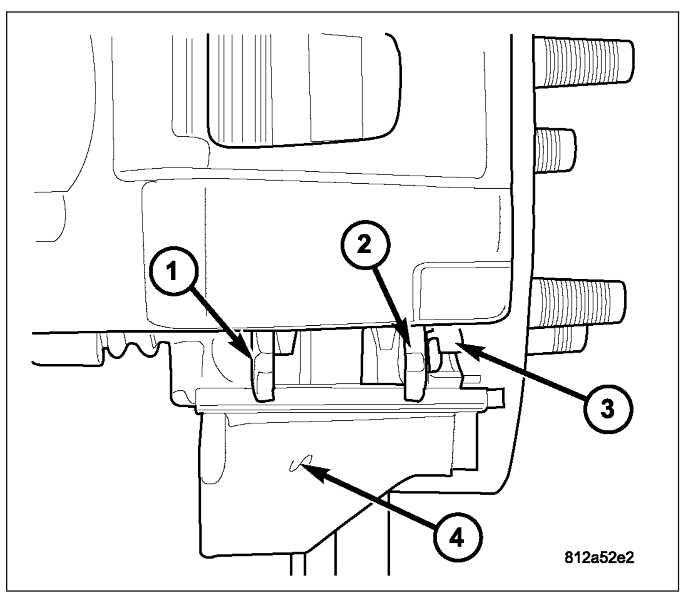
1. Raise and support vehicle.
2. Remove the wheel and tire assemblies.
3. Compress the caliper (1).
4. Remove the caliper slide pin bolts, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).

**NOTE: Do not allow brake hose to support caliper assembly.**

5. Remove the caliper by tilting the top up and off the caliper adapter.




6. Support and hang the caliper.
7. Remove the inboard brake pad (1) from the caliper.
8. Remove the outboard brake pad (2) from the caliper.



## INSTALLATION

### FRONT

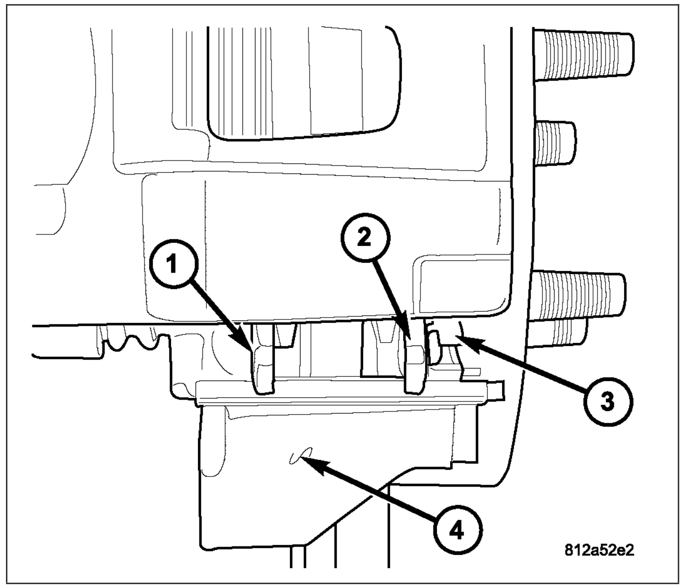
1. Install the inboard and outboard pads.
2. Install the caliper (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
3. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

### REAR

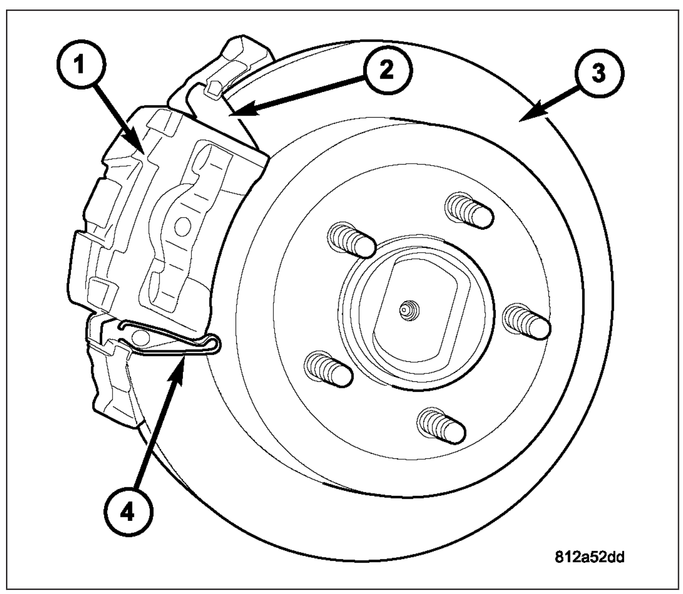
1. Place an old brake shoe between a C-clamp and caliper piston. Bottom piston in the caliper bore with C-clamp.
2. Clean caliper mounting adapter (4) and anti-rattle spring guide (3).
3. Lubricate anti-rattle spring guides (3) with Mopar brake grease.
4. Install anti-rattle spring guides (3).

**NOTE: Anti-rattle spring guides (3) are not interchangeable.**

5. Install inboard brake pad (1) to the caliper.
6. Install outboard brake pad (2) to the caliper.
7. Tilt the top of the caliper over rotor and under adapter. Then push the bottom of the caliper down onto the adapter (4).




8. Install caliper (1) to the rotor and then install the caliper slide pin bolts, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
9. Install wheel and tire assemblies and lower vehicle, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
10. Apply brakes several times to seat caliper pistons and brake shoes and obtain firm pedal.
11. Top off master cylinder fluid level.



# DISC BRAKE CALIPERS

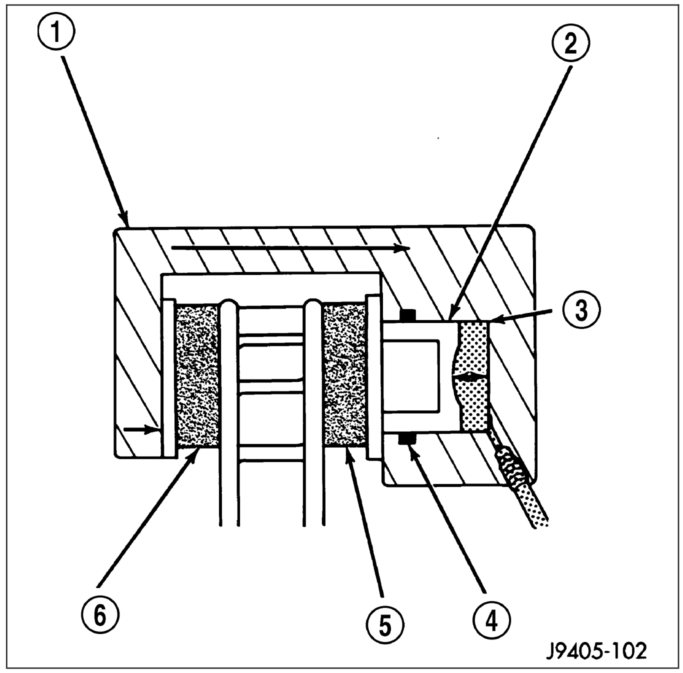
## DESCRIPTION

The calipers are a single piston type. The calipers are free to slide laterally, this allows continuous compensation for lining wear.

## OPERATION

When the brakes are applied fluid pressure is exerted against the caliper piston. The fluid pressure is exerted equally and in all directions. This means pressure exerted against the caliper piston and within the caliper bore will be equal.

Fluid pressure applied to the piston is transmitted directly to the inboard brake shoe. This forces the shoe lining against the inner surface of the disc brake rotor. At the same time, fluid pressure within the piston bore forces the caliper to slide inward on the mounting bolts. This action brings the outboard brake shoe lining into contact with the outer surface of the disc brake rotor.



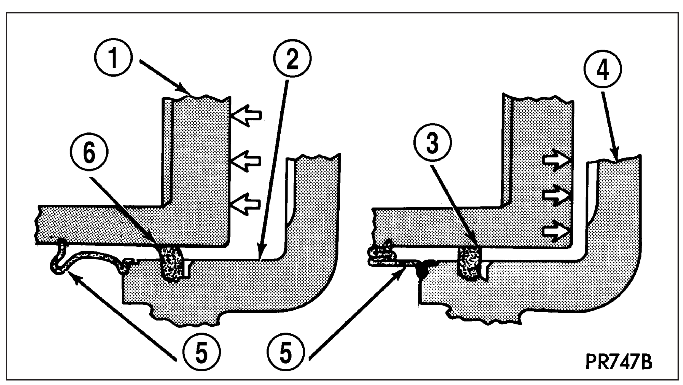

In summary, fluid pressure acting simultaneously on both piston and caliper, produces a strong clamping action. When sufficient force is applied, friction will attempt to stop the rotors from turning and bring the vehicle to a stop.

Application and release of the brake pedal generates only a very slight movement of the caliper and piston. Upon release of the pedal, the caliper and piston return to a rest position. The brake shoes do not retract an appreciable distance from the rotor. In fact, clearance is usually at, or close to zero. The reasons for this are to keep road debris from getting between the rotor and lining and in wiping the rotor surface clear each revolution.

The caliper piston seal controls the amount of piston extension needed to compensate for normal lining wear.

During brake application, the seal is deflected outward by fluid pressure and piston movement. When the brakes (and fluid pressure) are released, the seal relaxes and retracts the piston.

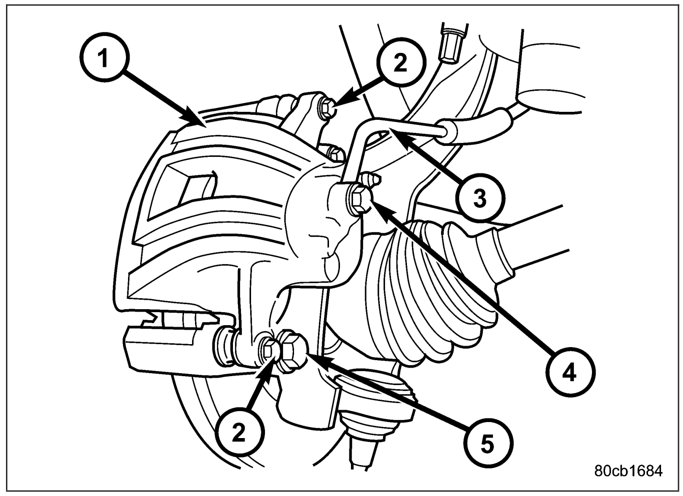
The amount of piston retraction is determined by the amount of seal deflection. Generally the amount is just enough to maintain contact between the piston and inboard brake shoe.



## REMOVAL

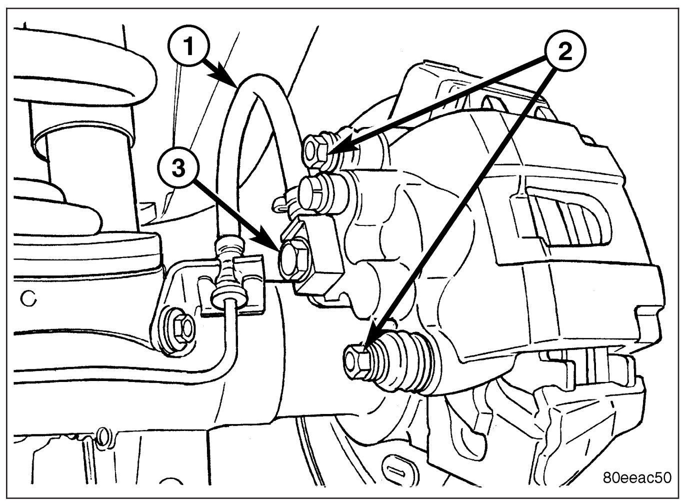
### FRONT

1. Install prop rod on the brake pedal to keep pressure on the brake system.
2. Raise and support vehicle.
3. Remove front wheel and tire assembly.
4. Remove the brake hose banjo bolt (4) if replacing caliper.
5. Remove the caliper mounting slide pin bolts (2).
6. Remove the caliper (1) from vehicle.



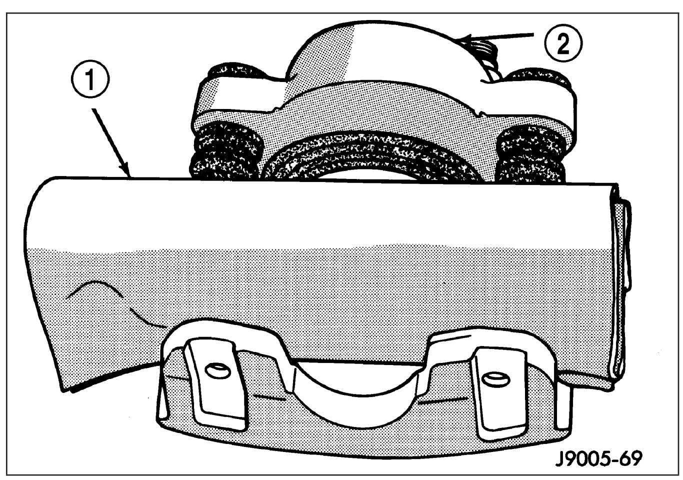

### REAR

1. Install prop rod on the brake pedal to keep pressure on the brake system.
2. Raise and support vehicle.
3. Remove the wheel and tire assembly.
4. Remove the brake hose banjo bolt (3) if replacing caliper.
5. Remove the caliper mounting slide pin bolts (2).
6. Remove the caliper from vehicle.




## DISASSEMBLY

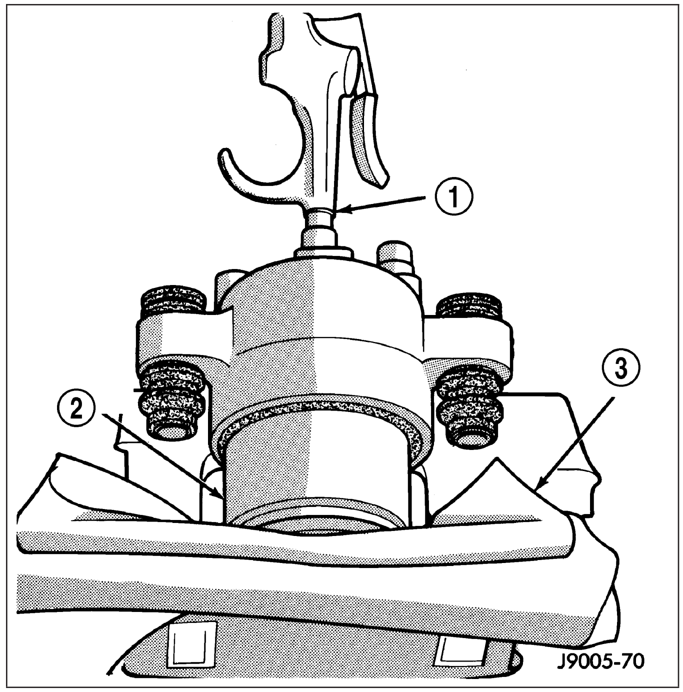
1. Remove brake shoes from caliper.
2. Drain brake fluid out of caliper.
3. Take a piece of wood and pad it with one-inch thickness of shop towels (1). Place this piece in the outboard shoe side of the caliper in front of the piston. This will cushion and protect caliper piston during removal.



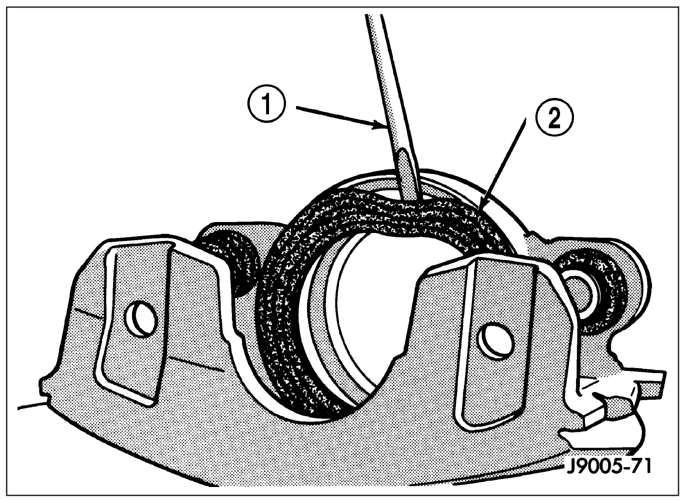
4. Remove caliper piston (2) with **short bursts** of low pressure compressed air. Direct air through fluid inlet port and ease piston out of bore.

**CAUTION: Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston. Use only enough air pressure to ease the piston out.**

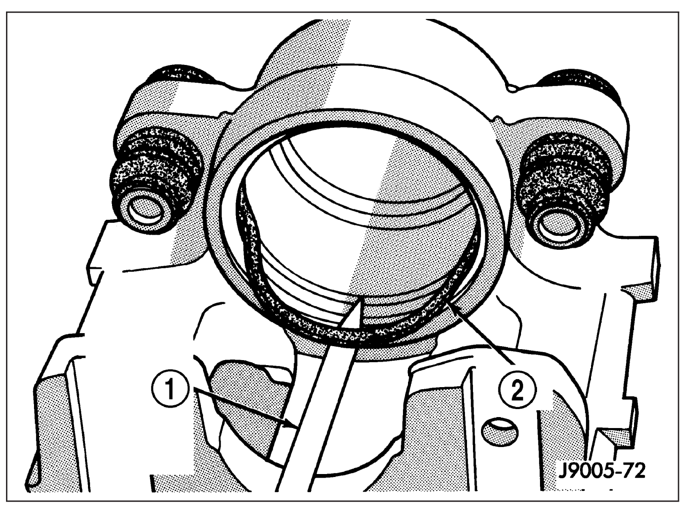
**WARNING: Never attempt to catch the piston as it leaves the bore. This may result in personal injury.**



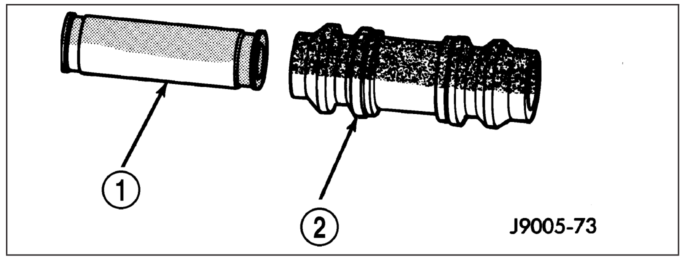

5. Remove caliper piston dust boot with suitable pry tool (1).




6. Remove caliper piston seal with wood or plastic tool (1). Do not use metal tools as they will scratch piston bore.



7. Remove caliper mounting bolt bushings (1) and boots (2).




## CLEANING

Clean the caliper components with clean brake fluid or brake clean only. Wipe the caliper and piston dry with lint free towels or use low pressure compressed air.

**CAUTION: Do not use gasoline, kerosene, thinner, or similar solvents. These products may leave a residue that could damage the piston and seal.**

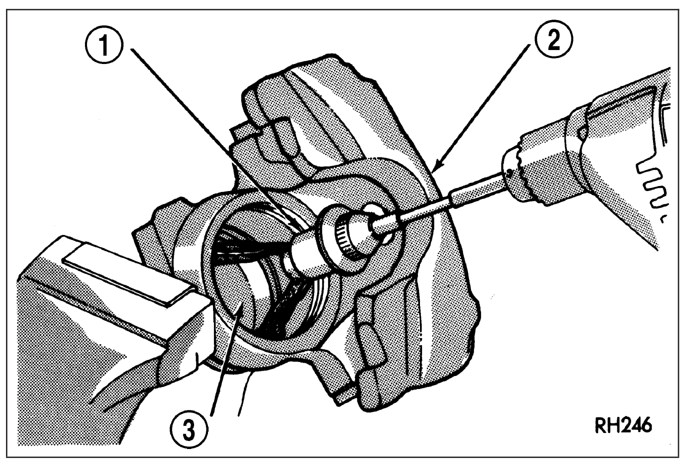
## INSPECTION

The piston is made from a phenolic resin (plastic material) and should be smooth and clean.

The piston must be replaced if cracked or scored. Do not attempt to restore a scored piston surface by sanding or polishing.

**CAUTION: If the caliper piston is replaced, install the same type of piston in the caliper. Never interchange phenolic resin and steel caliper pistons. The pistons, seals, seal grooves, caliper bore and piston tolerances are different.**

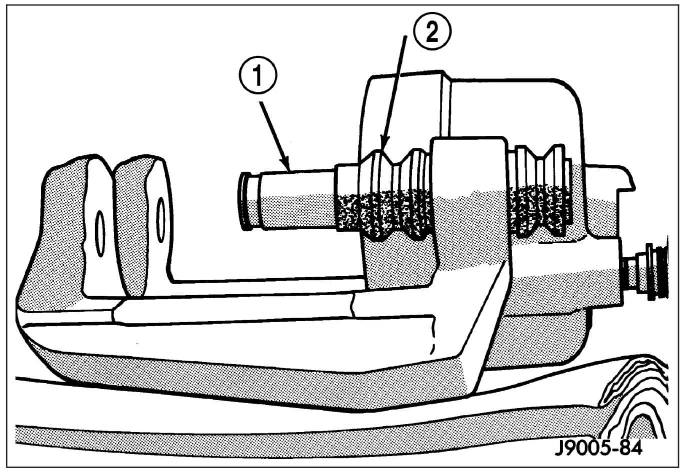
The bore can be **lightly** polished with a brake hone to remove very minor surface imperfections. The caliper should be replaced if the bore is severely corroded, rusted, scored, or if polishing would increase bore diameter more than 0.025 mm (0.001 inch).



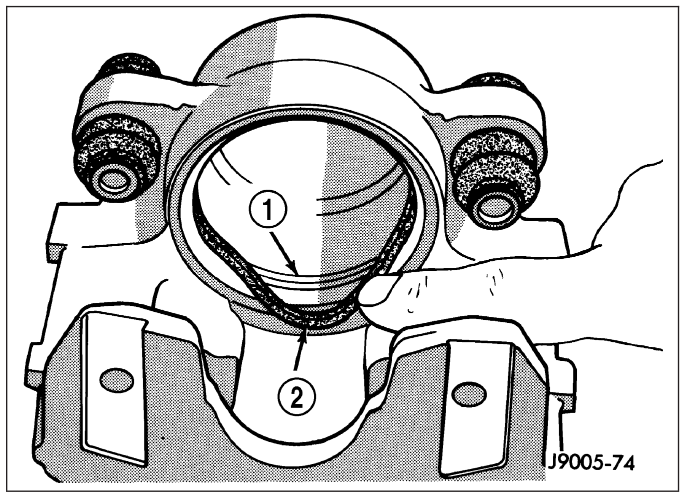
## ASSEMBLY

**CAUTION: Dirt, oil, and solvents can damage caliper seals. Insure assembly area is clean and dry.**

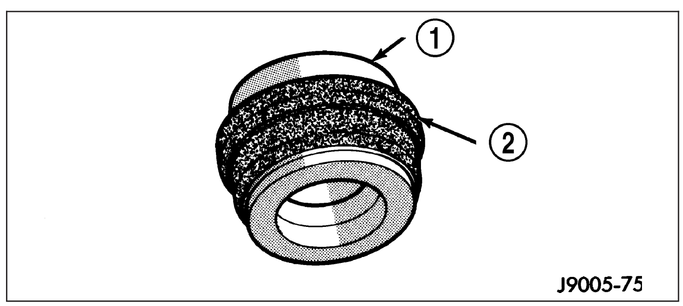
1. Lubricate caliper piston bore, new piston seal and piston with clean brake fluid.
2. Lubricate caliper bushings and interior of bushing boots with silicone grease.
3. Install bushing boots (2) in caliper, then insert bushing into boot and push bushing (1) into place.



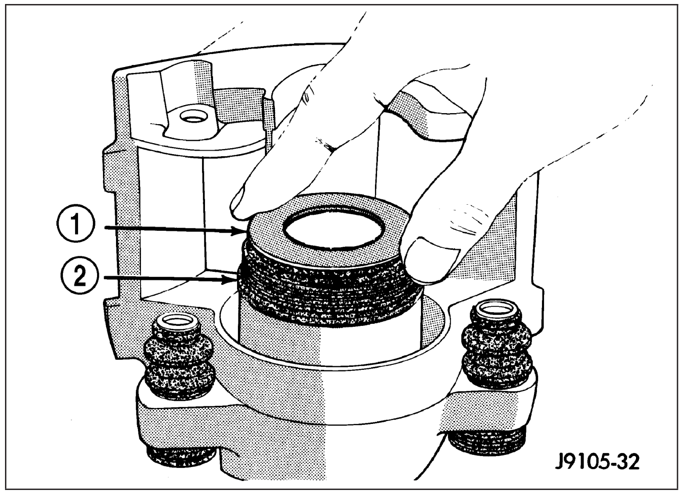

4. Install new piston seal into seal groove (1) with finger.



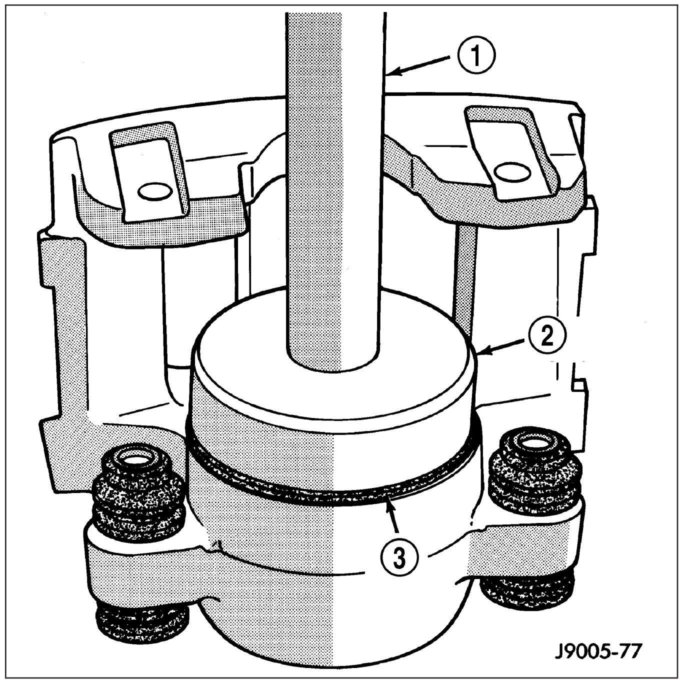

5. Install new dust boot on caliper piston and seat boot in piston groove (1).



6. Press piston (1) into caliper bore by hand, use a turn and push motion to work piston into seal.
7. Press caliper piston to bottom of bore.




8. Seat dust boot (3) in caliper with Installer Tool C-4842 (2) and Tool Handle C-4171 (1).
9. Replace caliper bleed screw if removed.



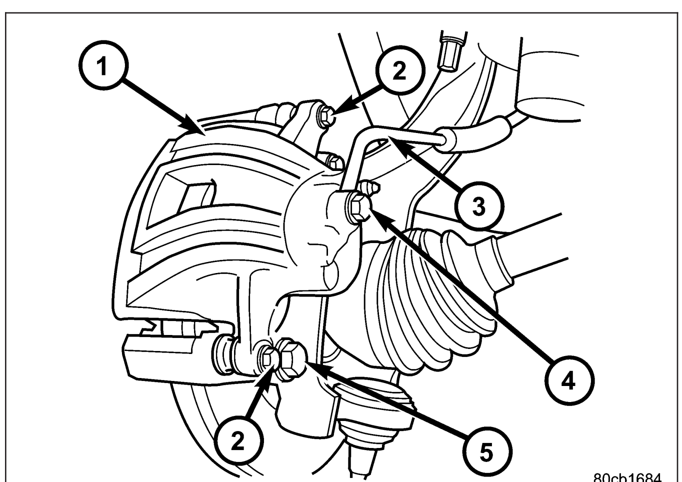

## INSTALLATION

## FRONT

1. Install caliper (1) to the caliper adapter.
2. Coat the caliper mounting slide pin bolts (2) with silicone grease. Begin with the bolt closet to the bleeder screws (top), Then install and tighten the bolts to 15 N·m (11 ft. lbs.).
3. Install the brake hose banjo bolt (4) if removed.

**CAUTION: Verify brake hose is not twisted or kinked before tightening fitting bolt.**

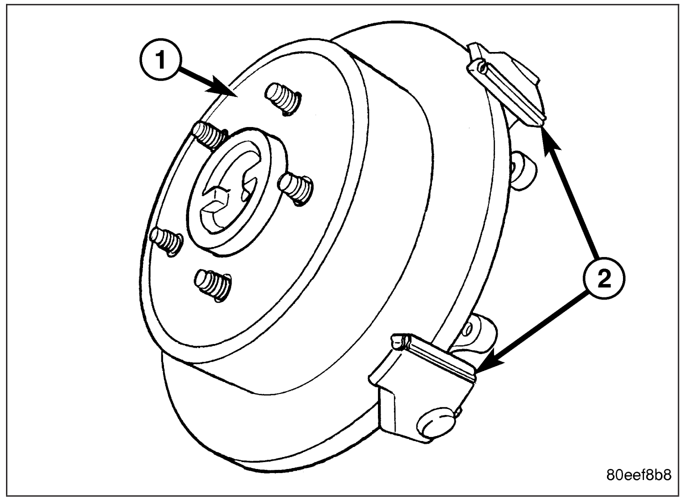
4. Install the brake hose (3) to the caliper (1) with **new seal washers** and tighten fitting bolt to 31 N·m (23 ft. lbs.).



5. Remove the prop rod from the vehicle.
6. Bleed the base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).
7. Install the wheel and tire assemblies (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
8. Remove the supports and lower the vehicle.
9. Verify a firm pedal before moving the vehicle.

## REAR

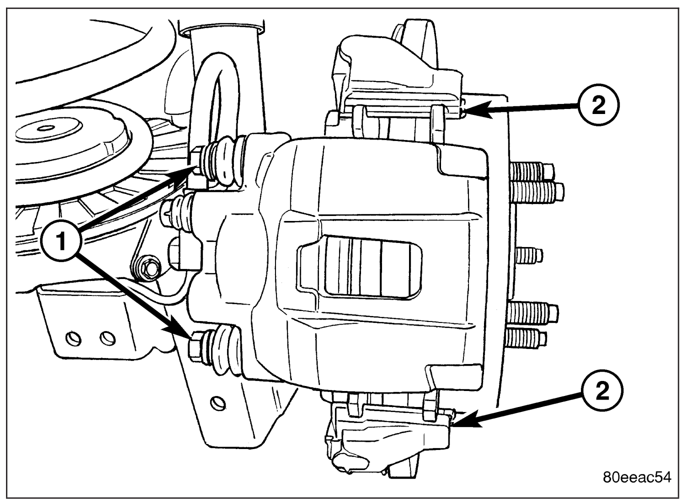
1. Install the brake pads if removed.
2. Lubricate ant-rattle clips (2) for the disc brake pads.




3. Install caliper to the caliper adapter.
4. Coat the caliper mounting slide pin bolts (1) with silicone grease. Then install and tighten the bolts to 15 N·m (11 ft. lbs.).
5. Install the brake hose banjo bolt if removed.

**CAUTION: Verify brake hose is not twisted or kinked before tightening fitting bolt.**

6. Install the brake hose to the caliper with **new seal washers** and tighten fitting bolt to 31 N·m (23 ft. lbs.).




7. Remove the prop rod from the vehicle.
8. Bleed the base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).
9. Install the wheel and tire assemblies (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
10. Remove the supports and lower the vehicle.
11. Verify a firm pedal before moving the vehicle.

# DISC BRAKE CALIPER ADAPTER

## REMOVAL

1. Raise and support the vehicle.
2. Remove the front wheel and tire assembly.
3. Drain a small amount of fluid from master cylinder brake reservoir with a **clean** suction gun.
4. Bottom the caliper pistons into the caliper by prying the caliper over.
5. Remove the caliper mounting bolts.
6. Remove the disc brake caliper from the mount.

**CAUTION: Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.**

7. Remove the inboard and outboard brake pads. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - REMOVAL).
8. Remove the caliper adapter mounting bolts .

## INSTALLATION

1. Install the caliper adapter mounting bolts. Tighten the mounting bolts to 135 N·m (100 ft.lbs).
2. Install the inboard and outboard pads. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - INSTALLATION).
3. Install the caliper mounting bolts.
4. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

# ROTORS

## DIAGNOSIS AND TESTING

## DISC BRAKE ROTOR

The rotor braking surfaces should not be refinished unless necessary.

Light surface rust and scale can be removed with a lathe equipped with dual sanding discs. The rotor surfaces can be restored by machining in a disc brake lathe if surface scoring and wear are light.

Replace the rotor under the following conditions:

- severely scored
- tapered
- hard spots
- cracked
- below minimum thickness

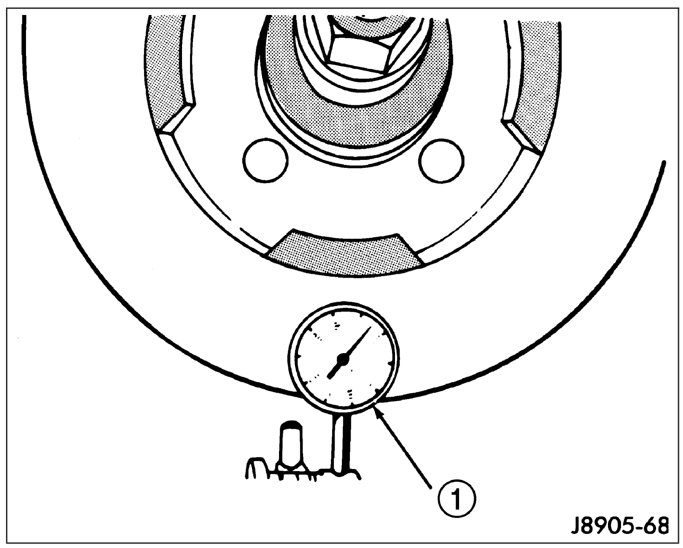
### ROTOR MINIMUM THICKNESS

Measure rotor thickness at the center of the brake shoe contact surface. Replace the rotor if worn below minimum thickness, or if machining would reduce thickness below the allowable minimum.

Rotor minimum thickness is usually specified on the rotor hub. The specification is either stamped or cast into the hub surface.

### ROTOR RUNOUT

Check rotor lateral runout with dial indicator C-3339 (1). Excessive lateral runout will cause brake pedal pulsation and rapid, uneven wear of the brake shoes. Position the dial indicator plunger approximately 25.4 mm (1 in.) inward from the rotor edge. The dial indicator should be positioned in the center of the rotor surface. Maximum allowable rotor runout is 0.102 mm (0.004 in.).



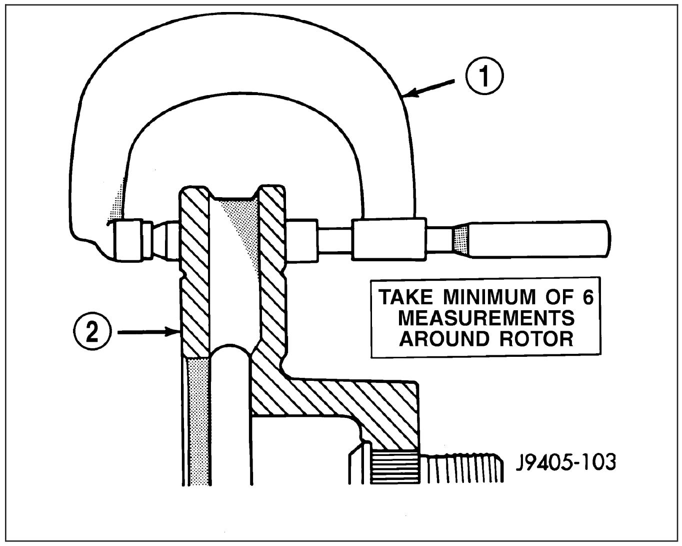
## ROTOR THICKNESS VARIATION

Variations in rotor thickness will cause pedal pulsation, noise and shudder.

Measure rotor thickness at 6 to 12 points around the rotor face.

Position the micrometer (1) approximately 25.4 mm (1 in.) from the rotor (2) outer circumference for each measurement.

Thickness should not **vary** by more than 0.013 mm (0.0005 in.) from point-to-point on the rotor. Machine or replace the rotor if necessary.




## BRAKE DRUM IN HAT ROTOR

The maximum allowable diameter of the drum braking surface is indicated on the drum outer edge. Always replace the drum if machining would cause drum diameter to exceed the size limit indicated on the drum in hat.

### BRAKE DRUM RUNOUT

Measure drum diameter and runout with an accurate gauge. The most accurate method of measurement involves mounting the drum in a brake lathe and checking variation and runout with a dial indicator.

Machine the drum if runout or variation exceed values. Replace the drum in hat rotor if machining causes the drum in hat rotor to exceed the maximum allowable diameter.

## STANDARD PROCEDURE

## DISC BRAKE ROTOR

The disc brake rotor can be machined if scored or worn. The lathe must machine both sides of the rotor simultaneously with dual cutter heads. The rotor mounting surface must be clean before placing on the lathe. Equipment capable of machining only one side at a time may produce a tapered rotor. A hub mounted on-vehicle lathe is recommended. This type of lathe trues the rotor to the vehicles hub/bearing.

**CAUTION: Brake rotors that do not meet minimum thickness specifications before or after machining must be replaced.**

## BRAKE DRUM IN HAT ROTOR MACHINING

The brake drum in hat rotor can be machined on a drum lathe when necessary. Initial machining cuts should be limited to 0.12 - 0.20 mm (0.005 - 0.008 in.) at a time as heavier feed rates can produce taper and surface variation. Final finish cuts of 0.025 to 0.038 mm (0.001 to 0.0015 in.) are recommended and will generally provide the best surface finish.

Be sure the drum in hat rotor is securely mounted in the lathe before machining operations. A damper strap should always be used around the drum to reduce vibration and avoid chatter marks.

The maximum allowable diameter of the drum braking surface is stamped or cast into the drum in hat rotor.

**CAUTION: Replace the drum in hat rotor if machining will cause the drum to exceed the maximum allowable diameter.**

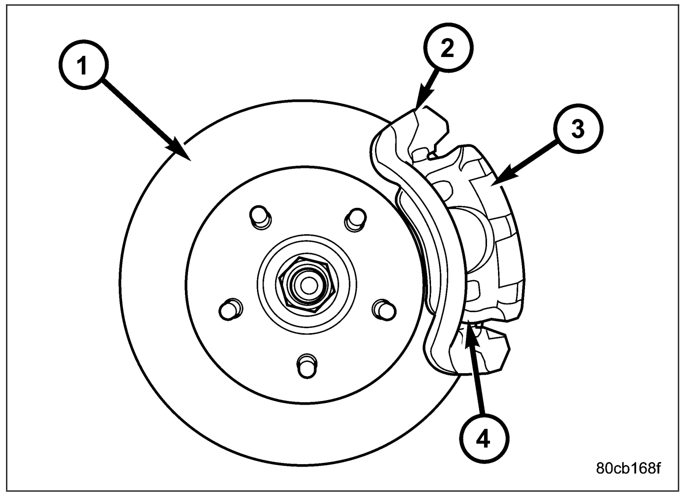
## REMOVAL

### FRONT

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.

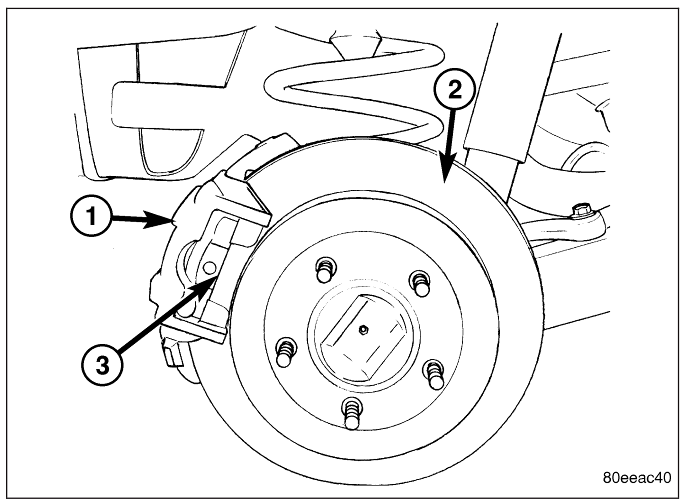
**CAUTION: Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose will result. Provide a suitable support to hang the caliper securely.**

3. Remove the caliper adapter (2). (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).
4. Remove the disc brake rotor (1).




### REAR

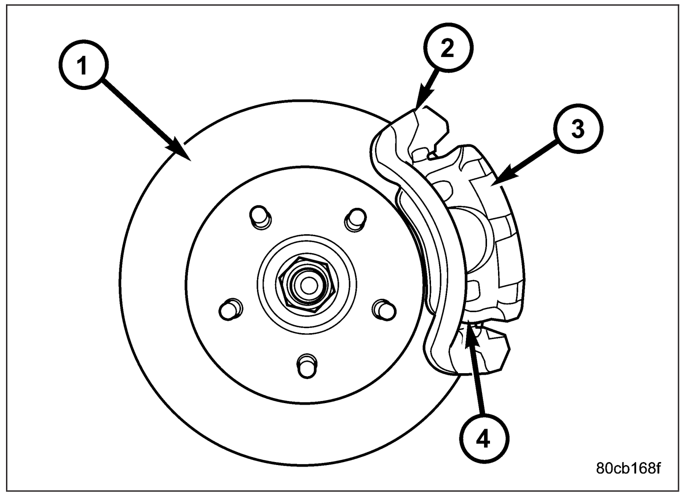
1. Raise and support the vehicle
2. Remove the tire and wheel assembly.
3. Remove the disc brake caliper (1) and pads (3), (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
4. Remove the retianing clips and rotor assembly.



## INSTALLATION

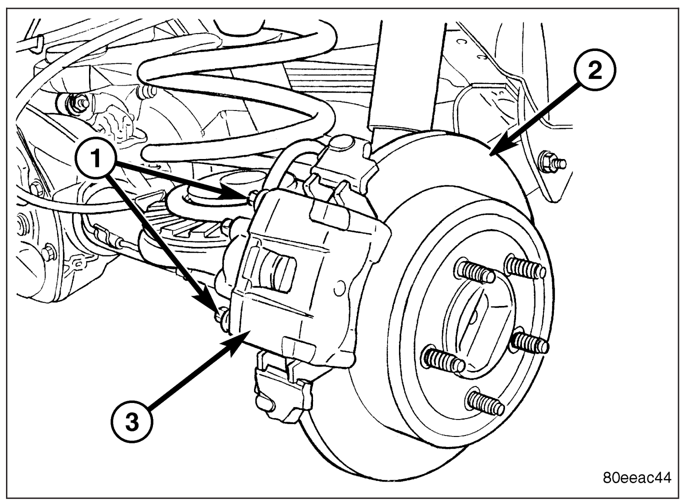
### FRONT

1. Install the disc brake rotor (1) to the hub.
2. Install the caliper mounting adapter (2). (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).
3. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).




### REAR

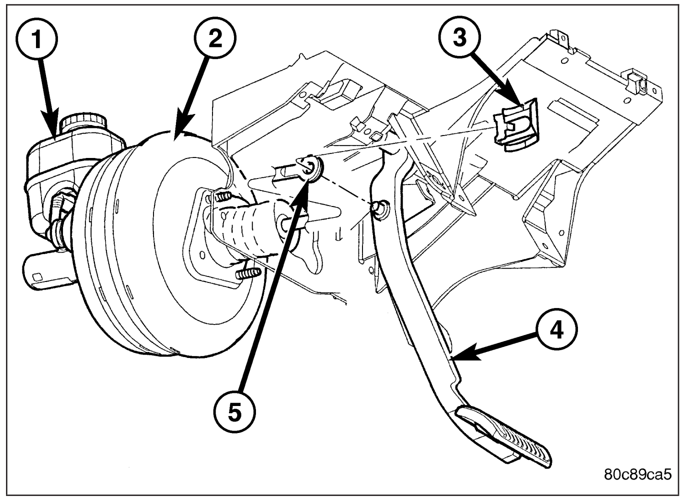
1. Install the rotor (2) to the axleshaft.
2. Install the disc brake caliper (3) and pads , (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
3. Install the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
4. Lower the vehicle.



# PEDAL

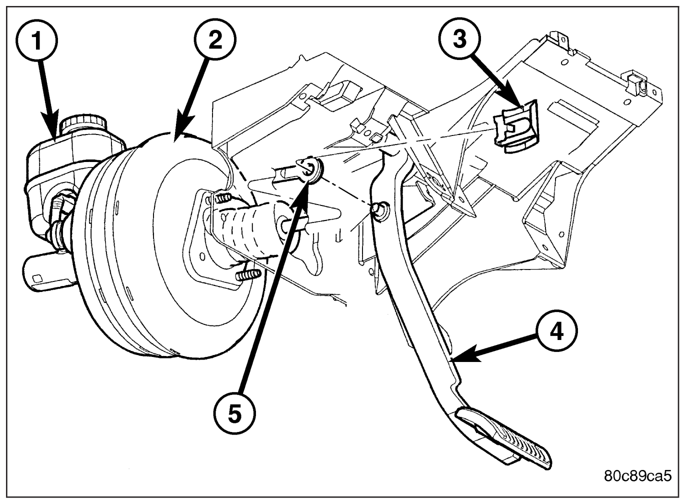
## DESCRIPTION

A suspended-type brake pedal (4) is used, the pedal pivots on a shaft mounted in the steering column support bracket. The bracket is attached to the dash panel. The unit is serviced as an assembly, except for the pedal pad.



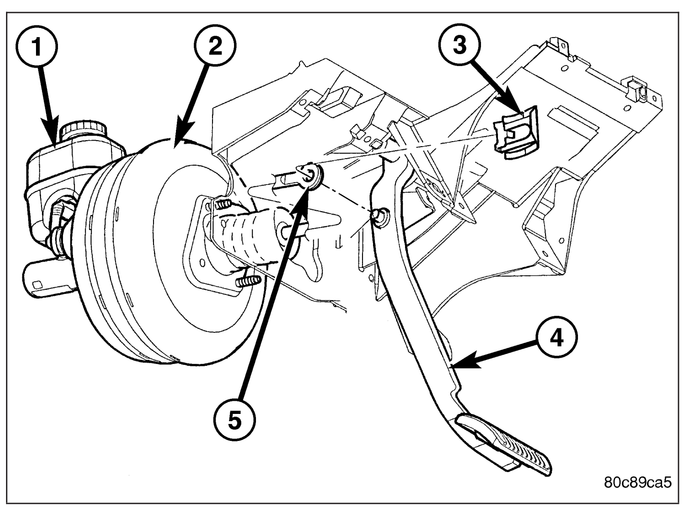

## OPERATION

The brake pedal (4) is attached to the booster push rod (5). When the pedal is depressed, the primary booster push rod (5) is depressed which move the booster secondary rod. The booster secondary rod depress the master cylinder piston (1).



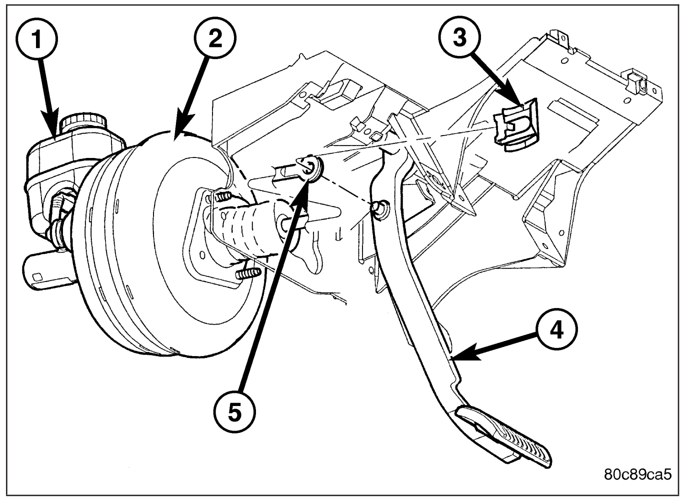

## REMOVAL

1. Remove the knee blocker under the steering column, (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - REMOVAL).
2. Remove the retainer clip securing the booster push rod (5) to pedal (4).
3. Remove the brake lamp switch, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL).
4. Remove the nuts securing the pedal to the column bracket.
5. Remove the pedal from the vehicle.



## INSTALLATION

1. Install the pedal (4) into the vehicle.
2. Install the nuts securing the pedal to the column bracket.
3. Tighten the nuts to 22.6 N·m (200 in. lbs.).
4. Lubricate the brake pedal pin and bushings with Mopar multi-mileage grease.
5. Install the booster push rod (5) on the pedal pin and install a new retainer clip.
6. Install the brake lamp switch, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - INSTALLATION).
7. Install the knee blocker, (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - INSTALLATION).



# POWER BRAKE BOOSTER

## DESCRIPTION

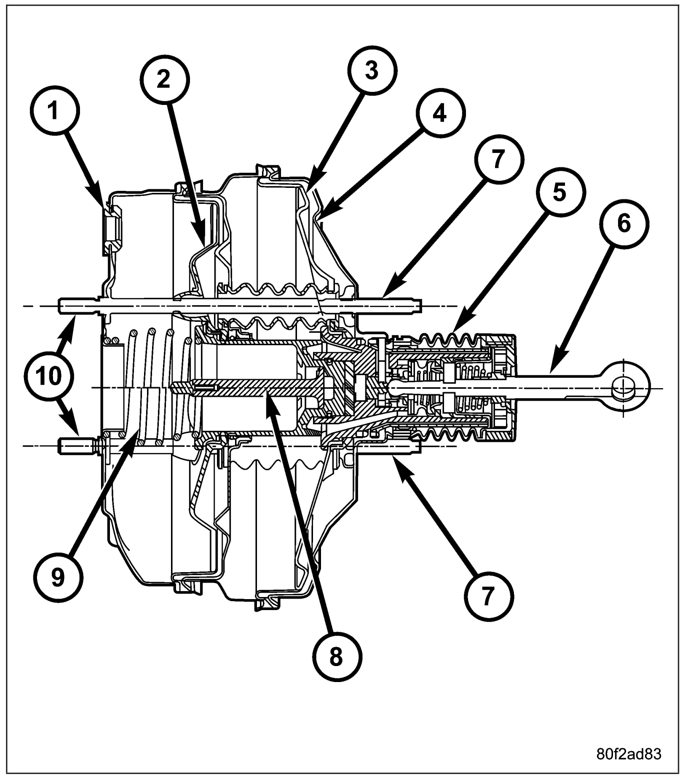
The booster assembly consists of a housing divided into separate chambers by two internal diaphragms. The outer edge of each diaphragm is attached to the booster housing. The diaphragms are connected to the booster primary push rod.

Two push rods are used in the booster. The primary push rod connects the booster to the brake pedal. The secondary push rod connects the booster to the master cylinder to stroke the cylinder pistons.

The booster assembly is of the tie-bar design. This means the structural support of the assembly is through the tie-bars, whose ends protrude through the booster shell. One end is the master cylinder mounting stud and the other end is the booster mounting stud. The booster assembly (with properly functioning check valve installed) may not have a good vacuum seal unless the booster is installed on the dash panel mounting bracket with master cylinder and booster mounting nuts properly torqued.

## OPERATION

The atmospheric inlet valve is opened and closed by the primary push rod (6). Booster vacuum supply is through a hose attached to an intake manifold fitting at one end and to the booster check valve (1) at the other. The vacuum check valve (1) in the booster housing (4) is a one-way device that prevents vacuum leak back.




Power assist is generated by utilizing the pressure differential between normal atmospheric pressure and a vacuum. The vacuum needed for booster operation is taken directly from the engine intake manifold. The entry point for atmospheric pressure is through a filter and inlet valve at the rear of the housing.

The chamber areas forward of the booster diaphragms are exposed to vacuum from the intake manifold. The chamber areas to the rear of the diaphragms, are exposed to normal atmospheric pressure of 101.3 kilopascals (14.7 pounds/square in.).

Brake pedal application causes the primary push rod to open the atmospheric inlet valve. This exposes the area behind the diaphragms to atmospheric pressure. The resulting pressure differential provides the extra apply force for power assist.

The booster check valve, check valve grommet and booster seals are serviceable.

## DIAGNOSIS AND TESTING - MASTER CYLINDER/POWER BOOSTER

1. Start engine and check booster vacuum hose connections. A hissing noise indicates vacuum leak. Correct any vacuum leak before proceeding, also ensure booster mounting nuts are torqued correctly.
2. Stop engine and shift transmission into Neutral.
3. Pump brake pedal until all vacuum reserve in booster is depleted.
4. Press and hold brake pedal under light foot pressure. The pedal should hold firm, if the pedal falls away master cylinder is faulty (internal leakage).
5. Start engine and note pedal action. It should fall away slightly under light foot pressure then hold firm. If no pedal action is discernible, power booster, vacuum supply, or vacuum check valve is faulty. Proceed to the POWER BOOSTER VACUUM TEST.
6. If the POWER BOOSTER VACUUM TEST passes, rebuild booster vacuum reserve as follows: Release brake pedal. Increase engine speed to 1500 rpm, close the throttle and immediately turn off ignition to stop engine.

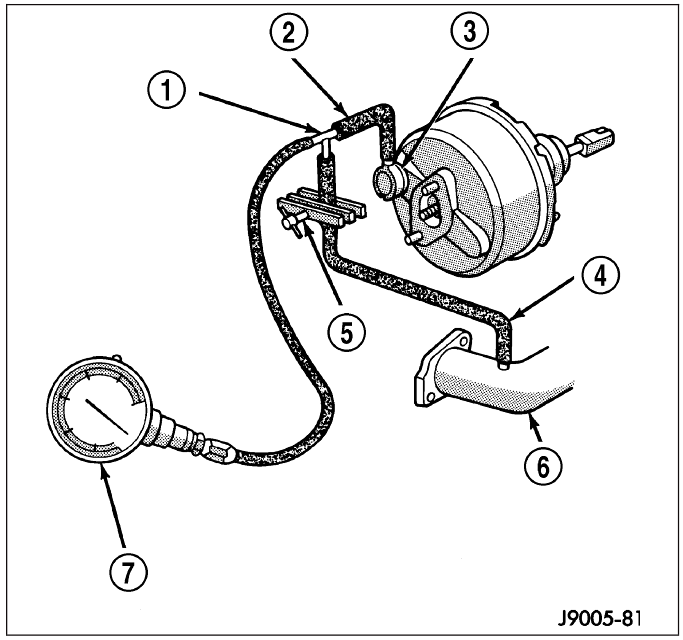
7. Wait a minimum of 90 seconds and try brake action again. Booster should provide two or more vacuum assisted pedal applications. If vacuum assist is not provided, booster is faulty.

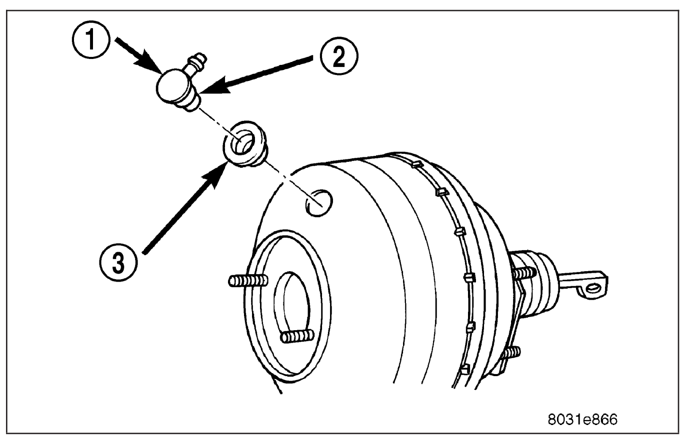
## POWER BOOSTER VACUUM TEST

1. Connect vacuum gauge to booster check valve with short length of hose and T-fitting.
2. Start and run engine at curb idle speed for one minute.
3. Observe the vacuum supply. If vacuum supply is not adequate, repair vacuum supply.
4. Clamp hose shut between vacuum source and check valve.
5. Stop engine and observe vacuum gauge.
6. If vacuum drops more than one inch Hg (33 millibars) within 15 seconds, booster diaphragm or check valve is faulty.

## POWER BOOSTER CHECK VALVE TEST

1. Disconnect vacuum hose from check valve.
2. Remove check valve and valve seal from booster.
3. Use a hand operated vacuum pump for test.
4. Apply 15-20 inches vacuum at large end of check valve.
5. Vacuum should hold steady. If gauge on pump indicates vacuum loss, check valve is faulty and should be replaced.



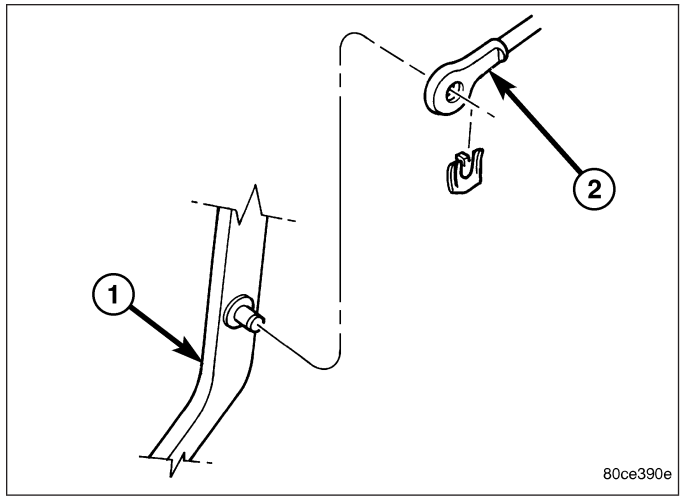




## REMOVAL

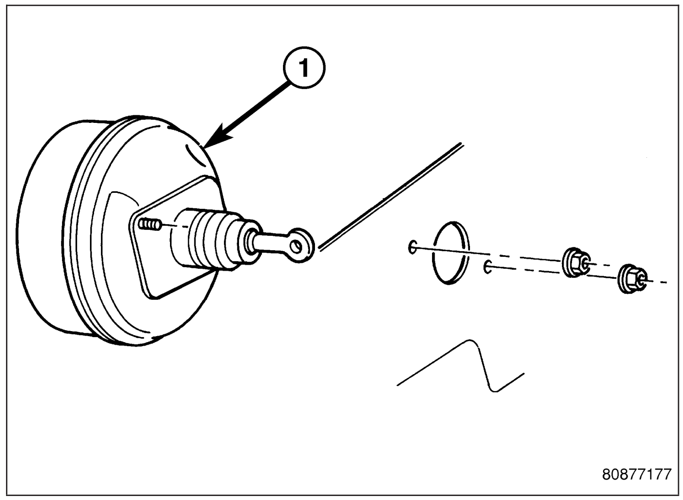
## LEFT HAND DRIVE (LHD)

1. Disconnect the wire to the fluid level switch at the bottom of the reservoir.
2. Remove the master cylinder (Refer to 5 - BRAKES/ HYDRAULIC/MECHANICAL/MASTER CYLINDER - REMOVAL).
3. Disconnect vacuum hoses from booster check valve.
4. Remove the brake lines from the master cylinder and the HCU (abs vehicles only) or the junction block for clearance.
5. Disconnect the HCU from the mounts and move to the side for clearance of the booster.
6. Remove knee blocker under the steering column, (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - REMOVAL).

7. Remove the brake light switch and discard, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL)
8. Remove retaining clip that secures booster push rod (2) to brake pedal (1).



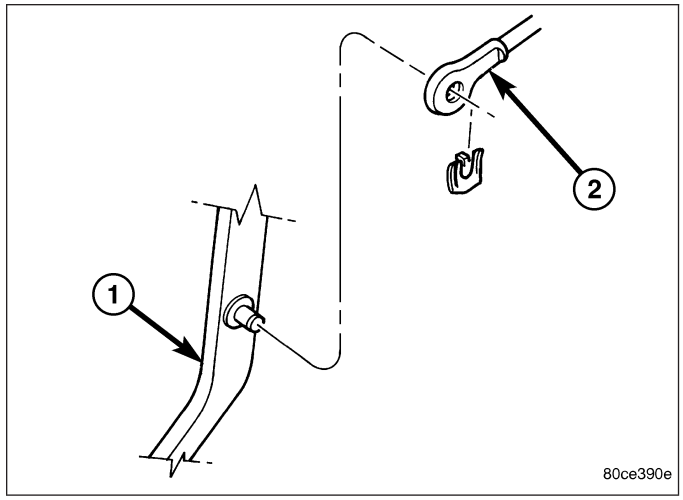

9. Remove nuts attaching booster (1) to the dash panel.
10. In engine compartment, slide booster studs out of dash panel, tilt booster upward, and remove booster from engine compartment.



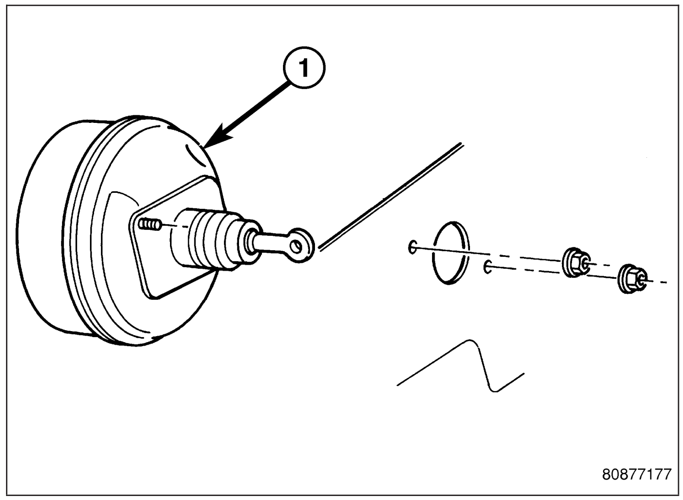

## RIGHT HAND DRIVE (RHD)

1. Remove the air box (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - REMOVAL).
2. Relocate the cruise control servo to gain access to the booster for removal.
3. Remove the brake lines from the master cylinder.
4. Remove the master cylinder (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - REMOVAL).
5. Disconnect vacuum hose from booster check valve.
6. Remove knee blocker under the steering column, (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - REMOVAL).

7. Remove the brake light switch and discard, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - REMOVAL)
8. Remove retaining clip that secures booster push rod (2) to brake pedal (1).



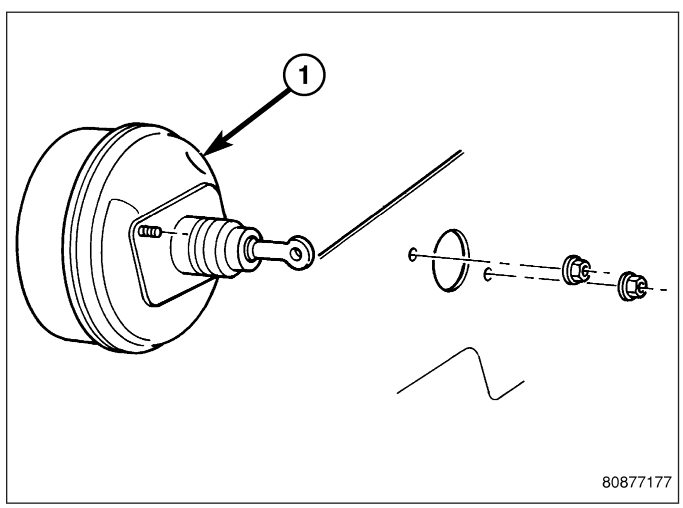

9. Remove nuts attaching booster (1) to the dash panel.
10. In engine compartment, slide booster studs out of dash panel, tilt booster upward, and remove booster from engine compartment.




## INSTALLATION

## LEFT HAND DRIVE (LHD)

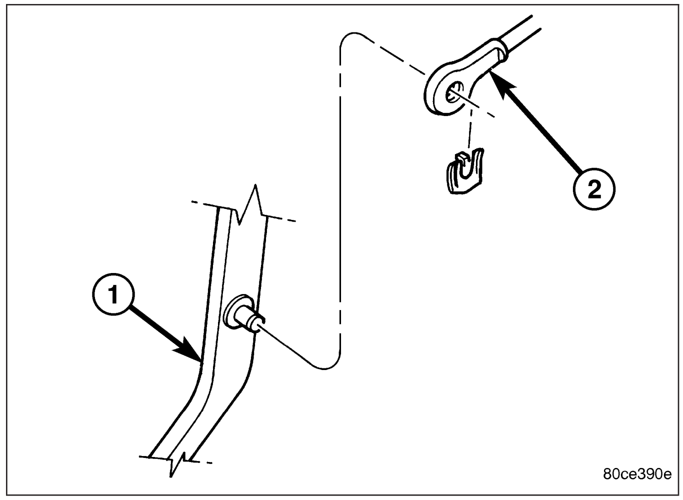
1. Align and position booster (1) on the dash panel.
2. Install booster mounting nuts. Tighten nuts just enough to hold booster in place.



3. Slide booster push rod (2) onto the brake pedal (1). Then secure push rod to pedal pin with retaining clip.

**NOTE: Lubricate the pedal pin with Mopar multi-mileage grease before installation.**

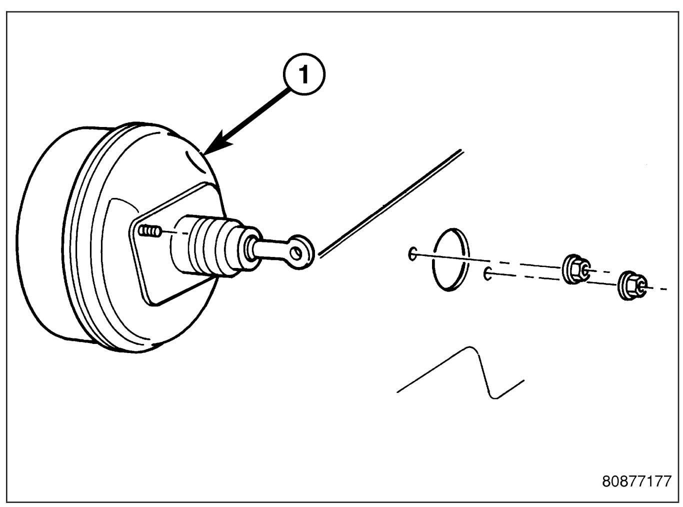
4. Tighten booster mounting nuts to 25 N·m (220 in. lbs.).




5. Install a new brake lamp switch and reconnect the electrical connector.
6. Install the knee blocker, (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - INSTALLATION).
7. If original master cylinder is being installed, check condition of seal at rear of master cylinder. Replace seal if cut, or torn.
8. Clean cylinder mounting surface of brake booster. Use shop towel wetted with brake cleaner for this purpose. Dirt, grease, or similar materials will prevent proper cylinder seating and could result in vacuum leak.
9. Align and install master cylinder on the booster studs. Install mounting nuts and tighten to 25 N·m (220 in. lbs.).
10. Connect vacuum hose to booster check valve.
11. Remount the HCU. Tighten bracket mounting nuts to 14 N·m (125 in. lbs.).
12. Connect and secure the brake lines to HCU or junction block and master cylinder. Start all brake line fittings by hand to avoid cross threading.
13. Connect the wire to fluid level switch at the bottom of the reservoir.
14. Fill and bleed base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE).
15. Verify proper brake operation before moving vehicle.

## RIGHT HAND DRIVE (RHD)

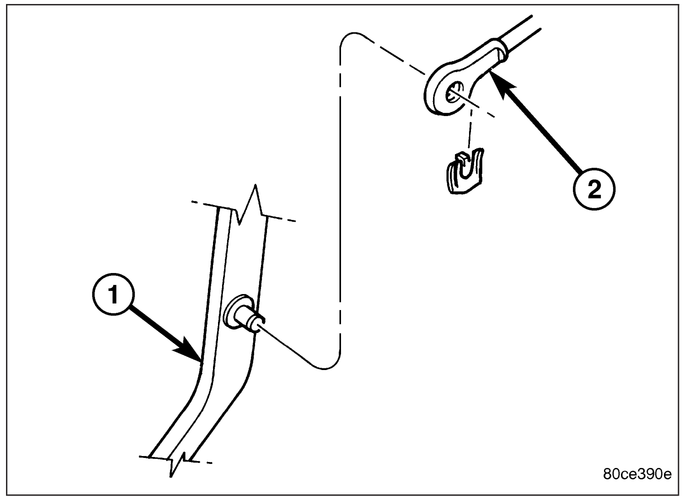
1. Align and position booster (1) on the dash panel.
2. Install booster mounting nuts. Tighten nuts just enough to hold booster in place.



3. Slide booster push rod (2) onto the brake pedal (1). Then secure push rod (2) to pedal pin with retaining clip.

**NOTE: Lubricate the pedal pin with Mopar multi-mileage grease before installation.**

4. Tighten booster mounting nuts to 39 N·m (29 ft. lbs.).
5. Install a new brake lamp switch and reconnect the electrical connector.




6. Install the knee blocker, (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - INSTALLATION).
7. If original master cylinder is being installed, check condition of seal at rear of master cylinder. Replace seal if cut, or torn.
8. Clean cylinder mounting surface of brake booster. Use shop towel wetted with brake cleaner for this purpose. Dirt, grease, or similar materials will prevent proper cylinder seating and could result in vacuum leak.
9. Align and install master cylinder on the booster studs. Install mounting nuts and tighten to 17.5 N·m (155 in. lbs.).
10. Connect vacuum hose to booster check valve.
11. Remount the cruise control servo to the original location. Tighten bracket mounting nuts to 17.5 N·m (155 in. lbs.).
12. Connect and secure the brake lines to HCU and master cylinder. Start all brake line fittings by hand to avoid cross threading.
13. Connect the wire to fluid reservoir.
14. Install the air box.
15. Fill and bleed base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE).
16. Verify proper brake operation before moving vehicle.

# MASTER CYLINDER

## DESCRIPTION

The master cylinder has a removable nylon reservoir. The cylinder body is made of aluminum and contains a primary and secondary piston assembly. The cylinder body including the piston assemblies are not serviceable. If diagnosis indicates an internal problem with the cylinder body, it must be replaced as an assembly. The reservoir and grommets are the only replaceable parts on the master cylinder.

## OPERATION

The master cylinder bore contains a primary and secondary piston. The primary piston supplies hydraulic pressure to the front brakes. The secondary piston supplies hydraulic pressure to the rear brakes. The master cylinder reservoir stores reserve brake fluid for the hydraulic brake circuits.

## DIAGNOSIS AND TESTING - MASTER CYLINDER/POWER BOOSTER

1. Start engine and check booster vacuum hose connections. A hissing noise indicates vacuum leak. Correct any vacuum leak before proceeding, also ensure booster mounting nuts are torqued correctly.
2. Stop engine and shift transmission into Neutral.
3. Pump brake pedal until all vacuum reserve in booster is depleted.
4. Press and hold brake pedal under light foot pressure. The pedal should hold firm, if the pedal falls away master cylinder is faulty (internal leakage).
5. Start engine and note pedal action. It should fall away slightly under light foot pressure then hold firm. If no pedal action is discernible, power booster, vacuum supply, or vacuum check valve is faulty. Proceed to the POWER BOOSTER VACUUM TEST.
6. If the POWER BOOSTER VACUUM TEST passes, rebuild booster vacuum reserve as follows: Release brake pedal. Increase engine speed to 1500 rpm, close the throttle and immediately turn off ignition to stop engine.
7. Wait a minimum of 90 seconds and try brake action again. Booster should provide two or more vacuum assisted pedal applications. If vacuum assist is not provided, booster is faulty.

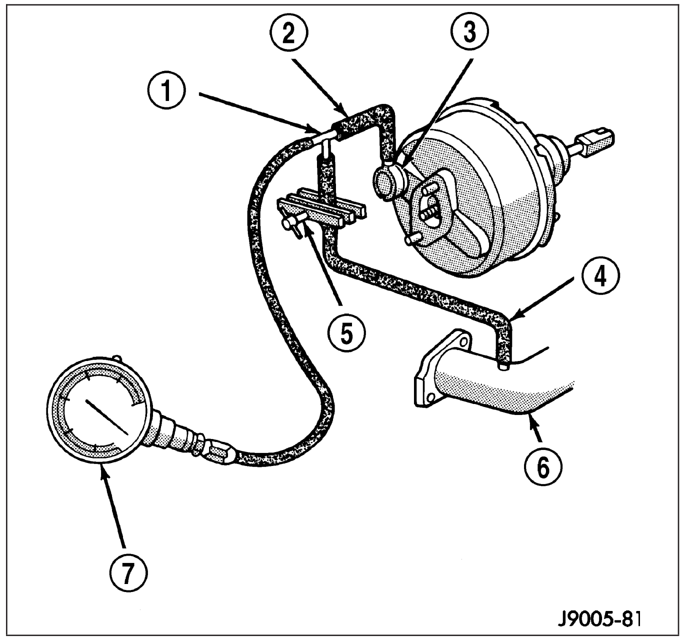
### POWER BOOSTER VACUUM TEST

1. Connect vacuum gauge to booster check valve with short length of hose and T-fitting.
2. Start and run engine at curb idle speed for one minute.
3. Observe the vacuum supply. If vacuum supply is not adequate, repair vacuum supply.
4. Clamp hose shut between vacuum source and check valve.
5. Stop engine and observe vacuum gauge.

6. If vacuum drops more than one inch Hg (33 millibars) within 15 seconds, booster diaphragm or check valve is faulty.

## POWER BOOSTER CHECK VALVE TEST

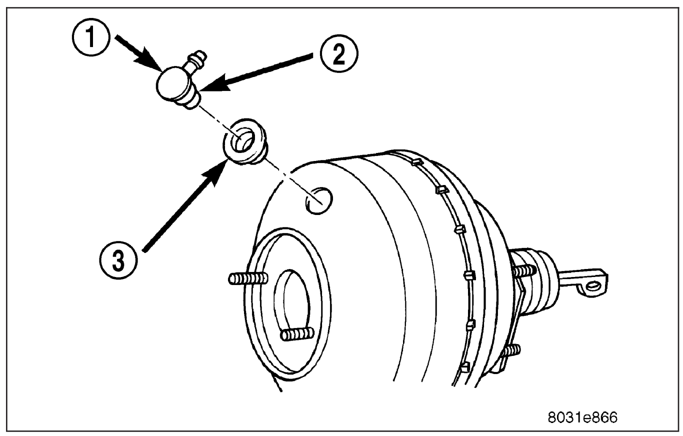
1. Disconnect vacuum hose from check valve.
2. Remove check valve and valve seal from booster.
3. Use a hand operated vacuum pump for test.
4. Apply 15-20 inches vacuum at large end of check valve.
5. Vacuum should hold steady. If gauge on pump indicates vacuum loss, check valve is faulty and should be replaced.

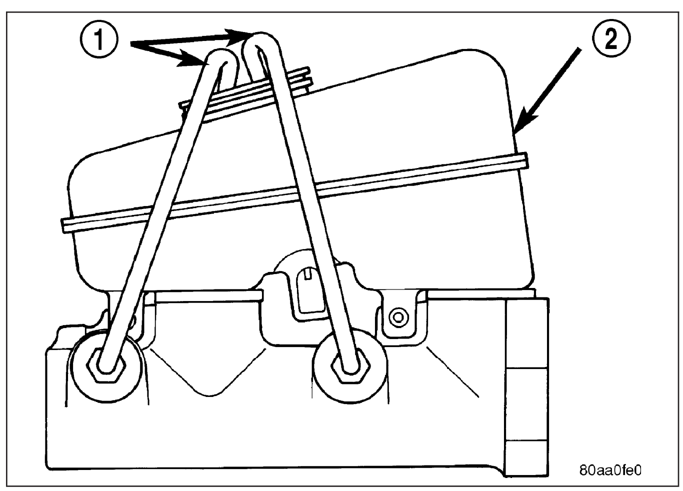



## STANDARD PROCEDURE - MASTER CYLINDER BLEEDING

A new master cylinder should be bled before installation on the vehicle. Required bleeding tools include bleed tubes and a wood dowel to stroke the pistons. Bleed tubes can be fabricated from brake line.

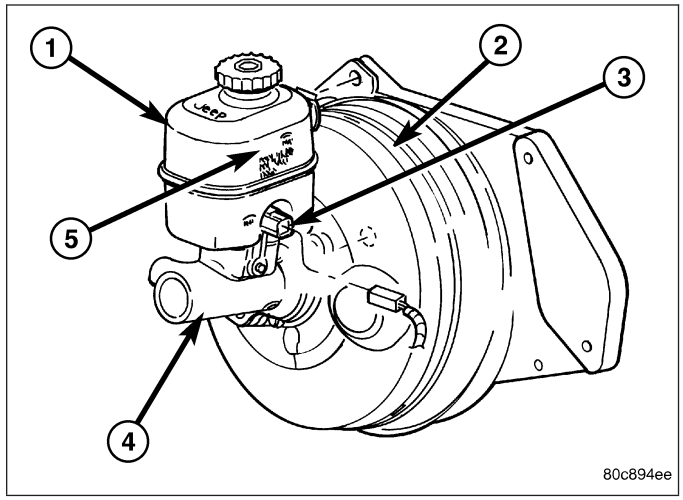
1. Mount master cylinder in vise.
2. Attach bleed tubes to cylinder outlet ports. Then position each tube end into reservoir.
3. Fill reservoir with fresh brake fluid.
4. Press cylinder pistons inward with wood dowel. Then release pistons and allow them to return under spring pressure. Continue bleeding operations until air bubbles are no longer visible in fluid.



## REMOVAL

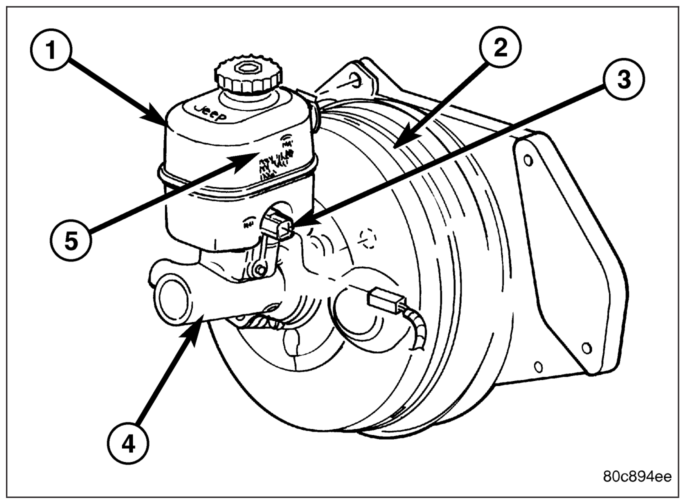
1. Siphon and drain the fluid from the reservoir (1).
2. Remove the brake lines at the master cylinder (4).
3. Disconnect the fluid level electrical connector (3) from the reservoir (1).
4. Remove mounting nuts from the master cylinder (4).
5. Remove master cylinder (4).
6. Remove cylinder cover and drain the rest of the fluid.
7. If master cylinder reservoir requires service, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/FLUID RESERVOIR - REMOVAL).




## INSTALLATION

**NOTE: If master cylinder is replaced, bleed cylinder before installation.**

1. Clean cylinder mounting surface of brake booster (2).
2. Install master cylinder (4) onto brake booster studs.
3. Install mounting nuts and tighten to 25 N·m (220 in. lbs.).
4. Connect the brake lines to the master cylinder and tighten to 20 N·m (180 in. lbs.).
5. Connect fluid level electrical connector (3) to the reservoir (1).
6. Fill and bleed base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE).



# FLUID

## DESCRIPTION

## BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use only Mopar brake fluid or an equivalent from a tightly sealed container.

**CAUTION: Never use reclaimed brake fluid or fluid from an container which has been left open. An open container of brake fluid will absorb moisture from the air and contaminate the fluid.**

**CAUTION: Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid, etc.**

## DIAGNOSIS AND TESTING

## BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

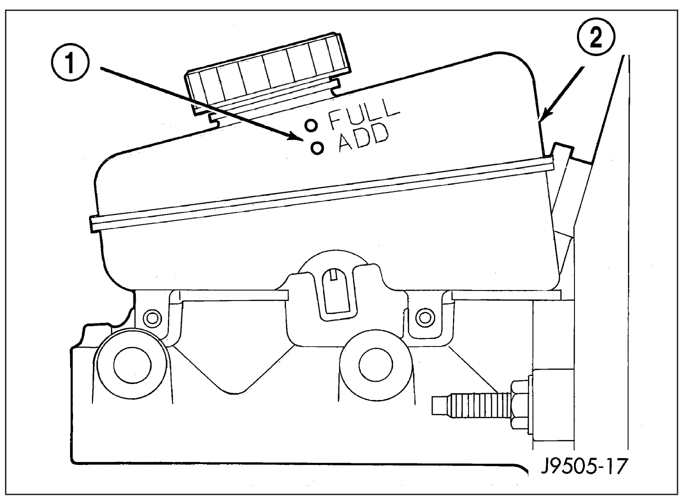
To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

## STANDARD PROCEDURE - MASTER CYLINDER FLUID LEVEL

Always clean the master cylinder reservoir and cap before adding fluid. This will prevent dirt from falling in the reservoir and contaminating the brake fluid.

The reservoir has a ADD and a FULL mark on the side fill to the FULL mark.



# FLUID RESERVOIR

## REMOVAL

1. Install prop rod on brake pedal to keep pressure on the brake system.
2. Remove reservoir cap and siphon fluid into drain container.
3. Remove the electrical connector from the fluid level switch in the reservoir.
4. Remove the reservoir mounting bolt.
5. Remove the reservoir from the master cylinder by pulling upwards.
6. Remove old grommets from cylinder body.

## INSTALLATION

1. Fill and bleed master cylinder on bench before installation in vehicle.

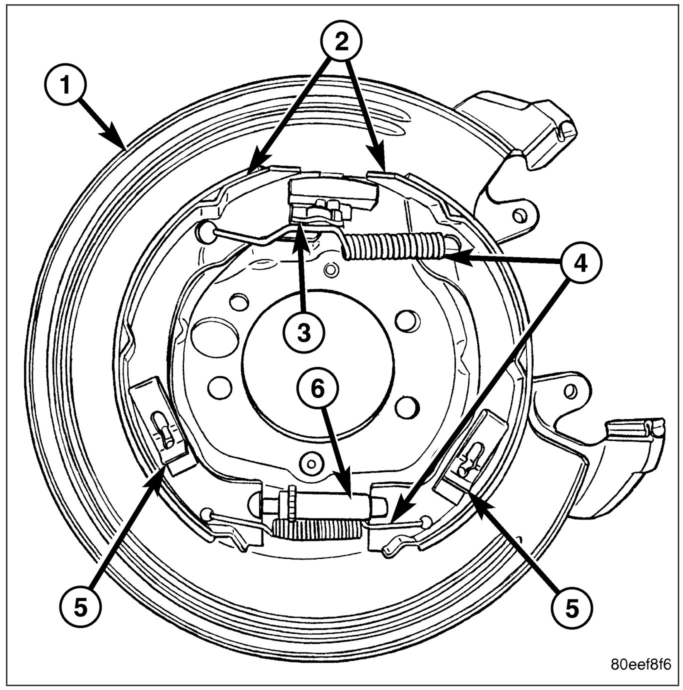
**CAUTION: Do not use any type of tool to install the grommets. Tools may cut, or tear the grommets creating a leak problem after installation. Install the grommets using finger pressure only.**

2. Lubricate new grommets with clean brake fluid and Install new grommets in cylinder body. Use finger pressure to install and seat grommets.
3. Start reservoir in grommets. Then rock reservoir back and forth while pressing downward to seat it in grommets.
4. Install the mounting bolt for the reservoir to the master cylinder.
5. Reconnect the electrical connector to the fluid reservoir level switch.
6. Remove the prop rod from the vehicle.
7. Fill and bleed base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE).

# SUPPORT PLATE

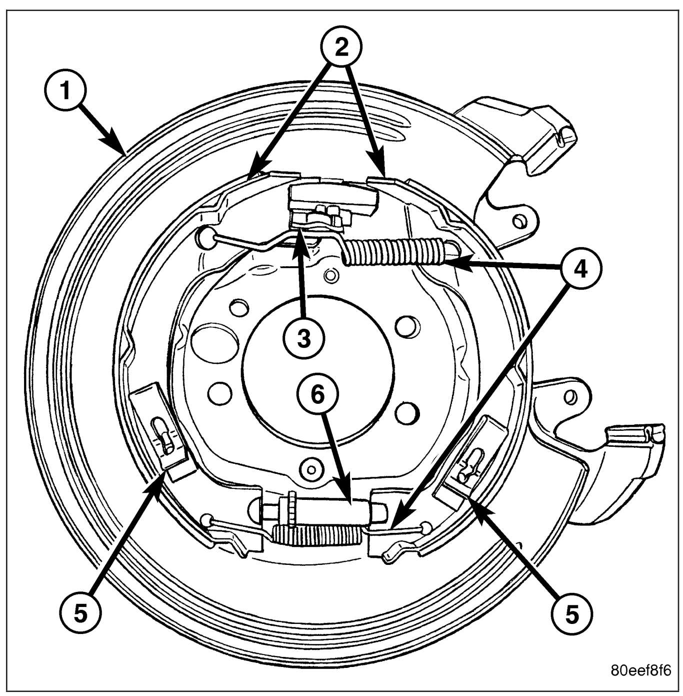
## REMOVAL

1. Remove wheel and tire assembly.
2. Remove the disc brake caliper (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
3. Remove the rotor, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
4. Remove the axle shaft , (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - AXLE SHAFTS - REMOVAL).
5. Remove the park brake shoes (2) , (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - REMOVAL).
6. Remove the parking brake cable from the brake lever.
7. Remove the bolts attaching the support plate (1) to the axle and remove the support plate (1).

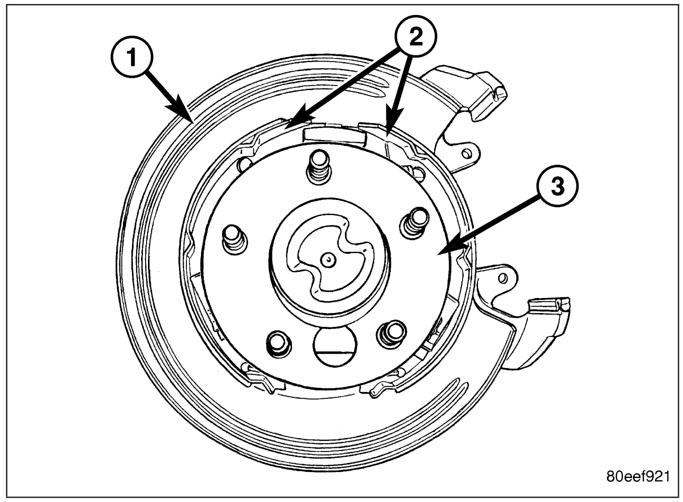



## INSTALLATION

1. Install support plate on axle flange. Tighten attaching bolts to 115 N·m (85 ft. lbs.).
2. Install the park brake shoes (2) , (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - INSTALLATION).
3. Install parking brake cable in the brake lever.



4. Install axle shaft (3), (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - AXLE SHAFTS - INSTALLATION).




5. Adjust brake shoes to drum with brake gauge (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).
6. Install the rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
7. Install the caliper (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
8. Install the wheel and tire assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

# PARKING BRAKE

## DESCRIPTION

The parking brake is a hand lever and cable operated system used to apply the rear brakes.

## OPERATION

A hand operated lever in the passenger compartment is the main application device. The front cable is connected between the hand lever and the rear cables with an equalizer.

The rear cables are connected to the actuating lever on each primary brake shoe. The levers are attached to the brake shoes by a pin either pressed into, or welded to the lever. A clip is used to secure the pin in the brake shoe. The pin allows each lever to pivot independently of the brake shoe.

To apply the parking brakes, the hand lever is pulled upward. This pulls the rear brake shoe actuating levers forward, by means of a tensioner and cables. As the actuating lever is pulled forward, the parking brake strut (which is connected to both shoes), exerts a linear force against the secondary brake shoe. This action presses the secondary shoe into contact with the drum. Once the secondary shoe contacts the drum, force is exerted through the strut. This force is transferred through the strut to the primary brake shoe causing it to pivot into the drum as well.

A gear type ratcheting mechanism is used to hold the lever in an applied position. Parking brake release is accomplished by the hand lever release button.

A parking brake switch is mounted on the parking brake lever and is actuated by movement of the lever. The switch, which is in circuit with the red warning light in the dash, will illuminate the warning light whenever the parking brakes are applied.

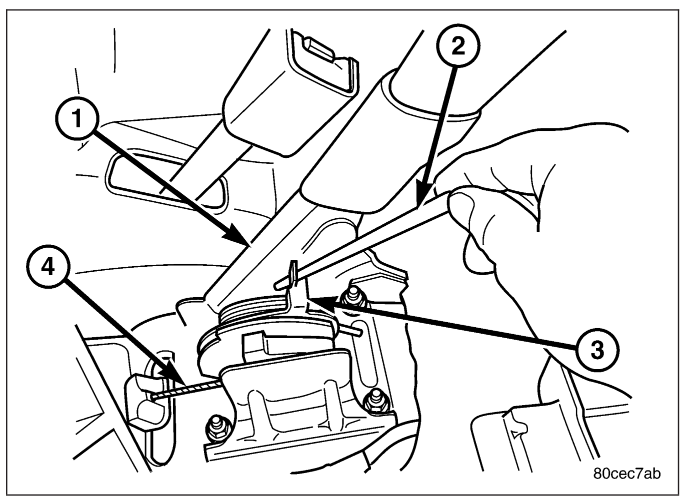
Parking brake is self-adjusting when the lever is pulled. The cable tensioner, once adjusted at the factory, should not need further adjustment under normal circumstances.

## ADJUSTMENTS

## LOCK OUT

**NOTE: The parking brake is self-adjusting, it can not be adjusted.**

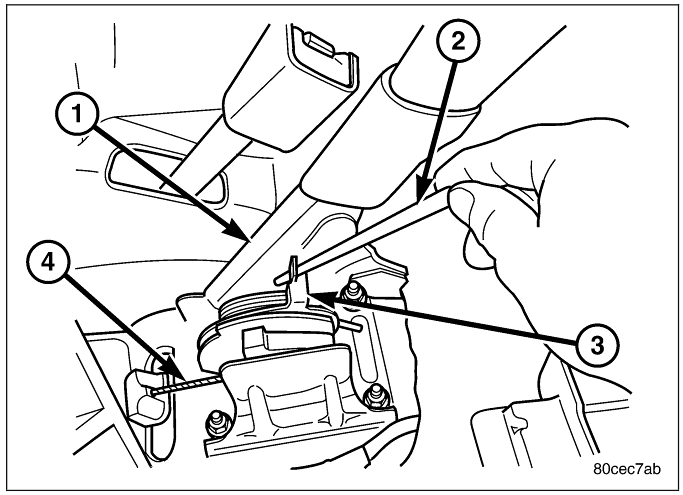
1. Remove the center floor console (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).
2. Pull up on the spring until the tab on the lever passes the tab on the cable guide (3) and install a punch (2) in the hole on the side then release.
3. The park brake system is now locked out to perform necessary repairs.



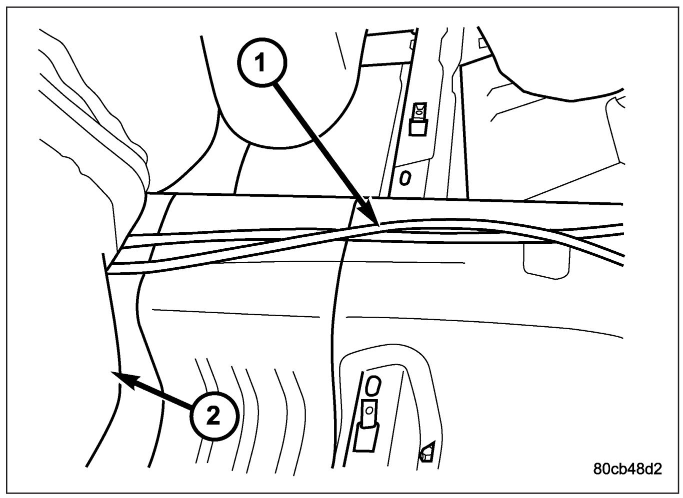
# CABLES

## REMOVAL

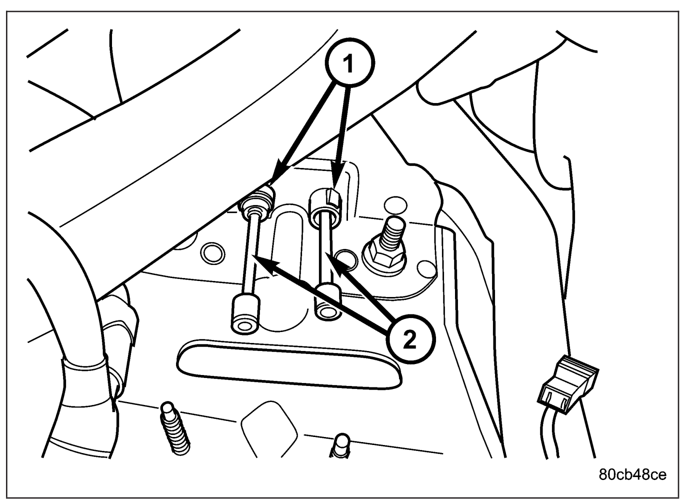
1. Lock out the parking brake cables (Refer to 5 - BRAKES/PARKING BRAKE - ADJUSTMENTS).



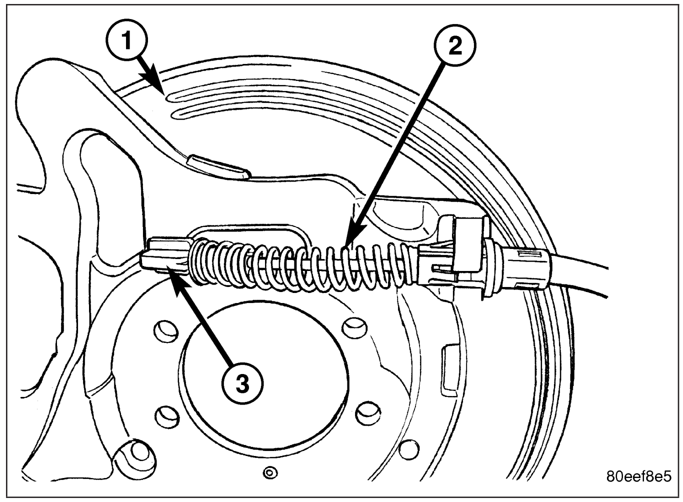

2. Remove the rear seat (Refer to 23 - BODY/SEATS/ SEAT - REMOVAL).
3. Pull the carpet forward far enough in the rear to gain access to the two parking brake cables thru the floor.
4. Disconnect the two cables (1) from the front mount.




5. Push the cables (2) thru the floor with the grommets.
6. Remove the cable from the axle bracket with a proper sized box end wrench over the tangs (1).

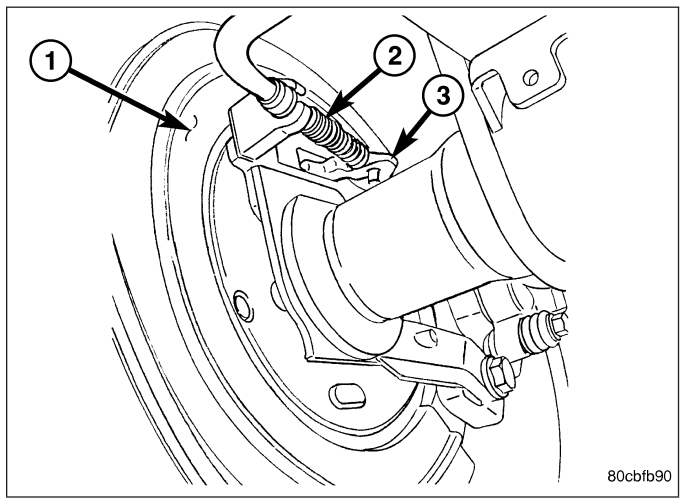


7. Remove the brake cable (2) from the brake lever (3).

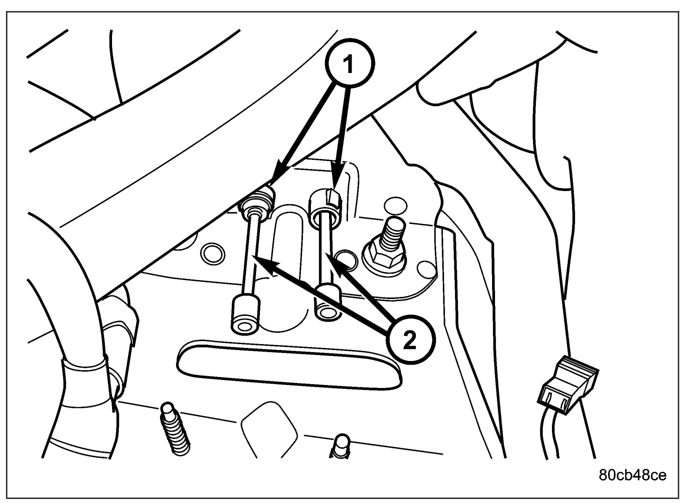



## INSTALLATION

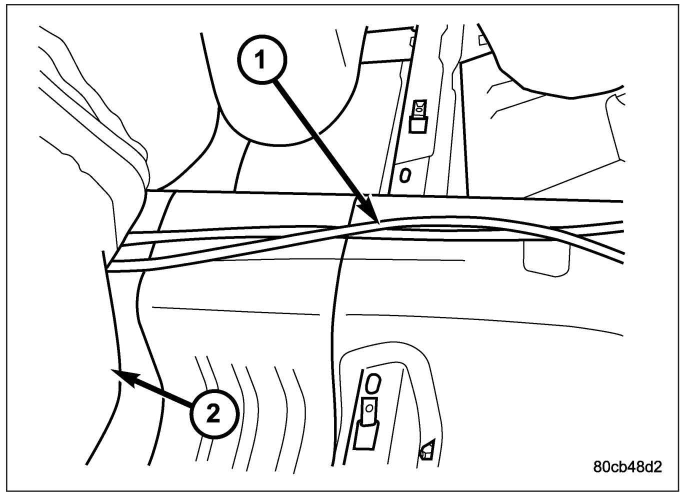
1. Install the cables (2) into the axle bracket.
2. Reconnect the cable to the park brake lever (3).



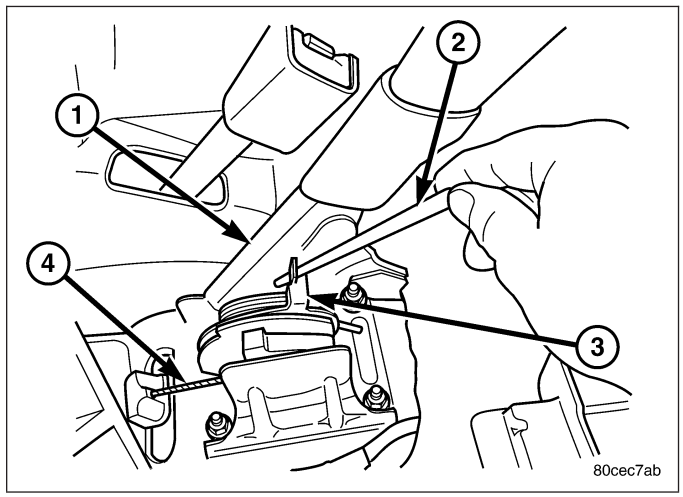

3. Push the cables (2) thru the floor and seat the tangs (1).



4. Reconnect the two cables (1) to the front mount.
5. Lay the carpet (2) back down in the rear.
6. Install the rear seat (Refer to 23 - BODY/SEATS/ SEAT - INSTALLATION).



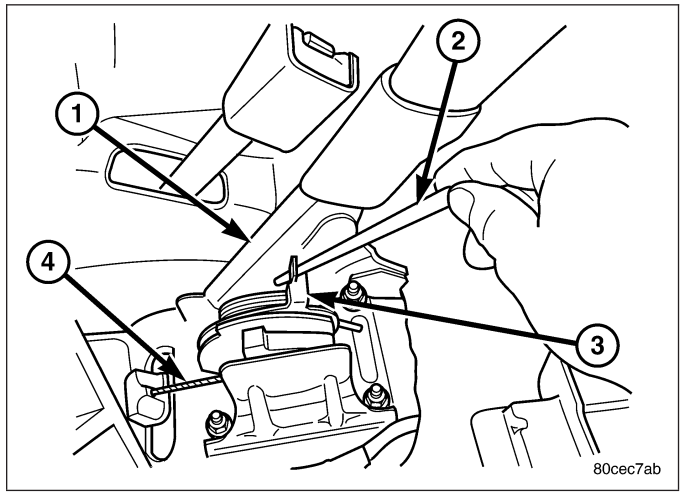

7. Remove the lock out device (2) on the lever (1).
8. Adjust the park brake shoes (Refer to 5 - BRAKES/ PARKING BRAKE/SHOES - ADJUSTMENTS).
9. Test the parking brake.



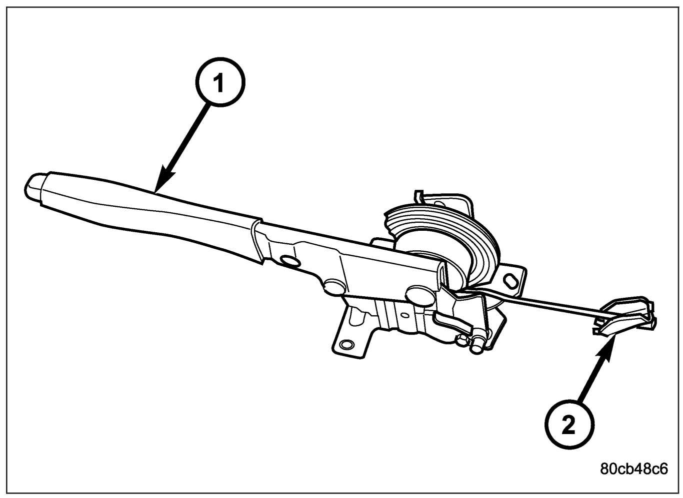
# LEVER

## REMOVAL

1. Remove the center floor console, (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).
2. Lock out the parking brakes (Refer to 5 - BRAKES/ PARKING BRAKE - ADJUSTMENTS).

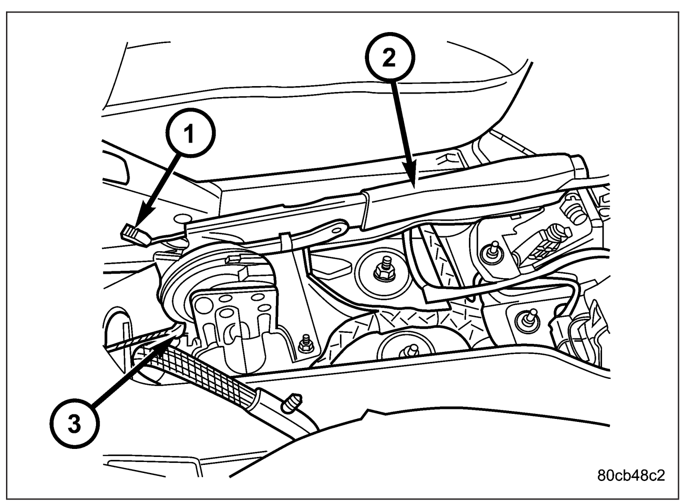



3. Disengage the front cables from the equalizer (2).
4. Disconnect the parking brake lamp switch wire.
5. Remove the parking brake lever assembly (1) mounting bolts.
6. Remove the lever assembly (1).




## INSTALLATION

1. Install the parking brake lever assembly (2).
2. Install the parking brake lever assembly (2) to the mounting bolts and tighten.
3. Engage the front cables (3) to the equalizer.
4. Reconnect the parking brake lamp switch wire.
5. If installing a new parking brake lever remove the pin that comes on the lever when shipped.
6. If you are reinstalling the original park brake lever remove the lock out device at this time.
7. Test the parking brake lever.

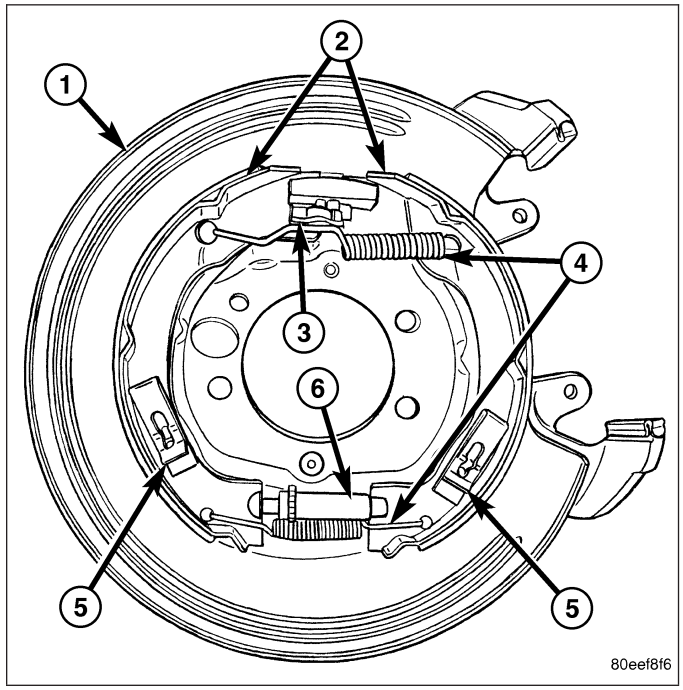



8. Install the center floor console, (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION).

# SHOES

## DESCRIPTION

Drum in hat park brakes are dual shoe, internal expanding units with an automatic self adjusting mechanism.

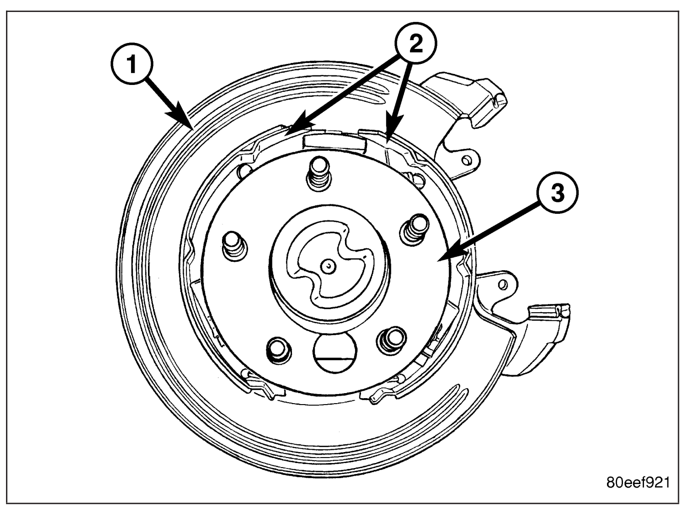



## OPERATION

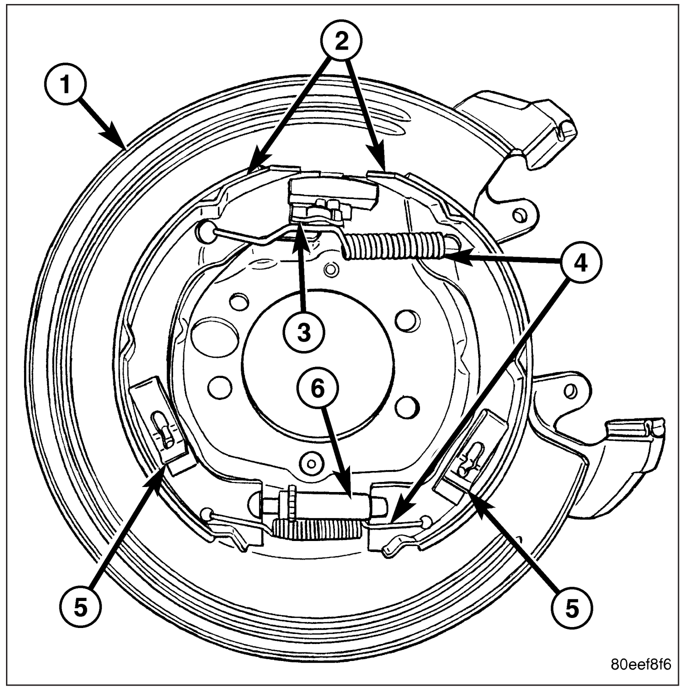
When the parking brake pedal is depressed the brake cable pulls the brake shoes outward against the brake drum. When the brake pedal is released the return springs attached to the brake shoes pull the shoes back to there original position.

## REMOVAL

1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.
3. Remove the disc brake caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
4. Remove the disc brake rotor, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).



5. Disassemble the rear park brake shoes (2).




## CLEANING - REAR DRUM IN HAT BRAKE

Clean the individual brake components, including the support plate exterior, with a water dampened cloth or with brake cleaner. Do not use any other cleaning agents. Remove light rust and scale from the brake shoe contact pads on the support plate with fine sandpaper.

## INSPECTION - REAR DRUM IN HAT BRAKE

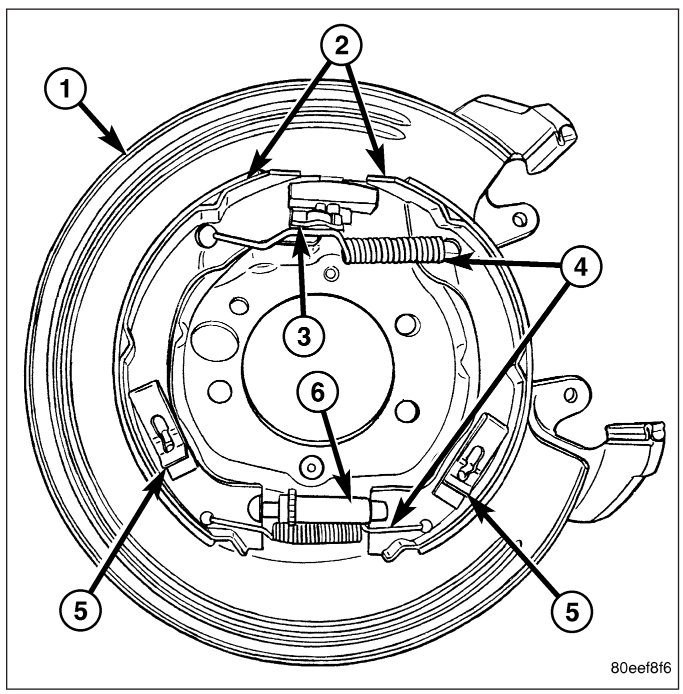
As a general rule, riveted brake shoes should be replaced when worn to within 0.78 mm (1/32 in.) of the rivet heads. Bonded lining should be replaced when worn to a thickness of 1.6 mm (1/16 in.).

Examine the lining contact pattern to determine if the shoes are bent or the drum is tapered. The lining should exhibit contact across its entire width. Shoes exhibiting contact only on one side should be replaced and the drum checked for runout or taper.

Inspect the adjuster screw assembly (6). Replace the assembly if the star wheel or threads are damaged, or the components are severely rusted or corroded.

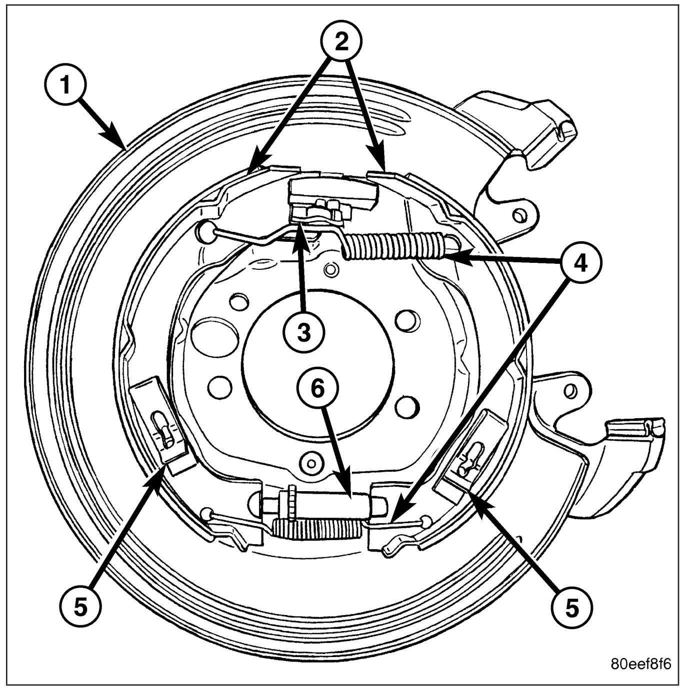
Discard the brake springs (4) and retainer components if worn, distorted or collapsed. Also replace the springs if a brake drag condition had occurred. Overheating will distort and weaken the springs.

Inspect the brake shoe contact pads on the support plate (1), replace the support plate (1) if any of the pads are worn or rusted through. Also replace the plate if it is bent or distorted.

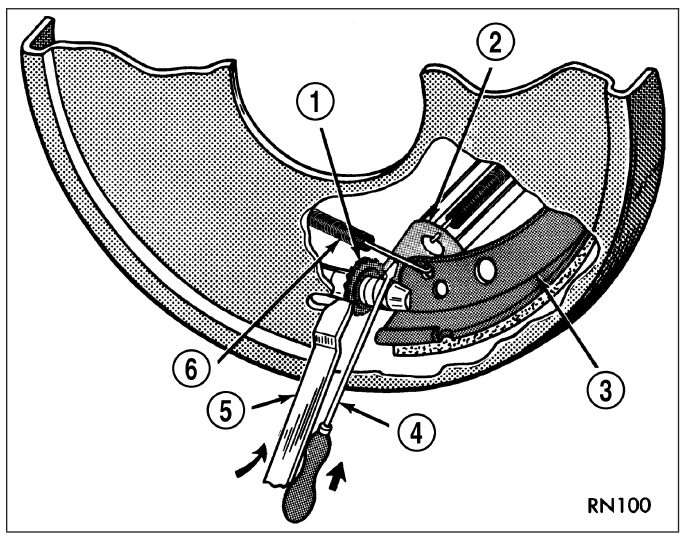


## INSTALLATION

**NOTE: On a new vehicle or after parking brake lining replacement, it is recommended that the parking brake system be conditioned prior to use. This is done by making one stop from 25 mph on dry pavement or concrete using light to moderate force on the parking brake lever.**




1. Reassemble the rear park brake shoes (2).
2. Adjust the rear brake shoes (1) (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).
3. Install the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
4. Install the disc brake caliper (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).




5. Install the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
6. Lower the vehicle.

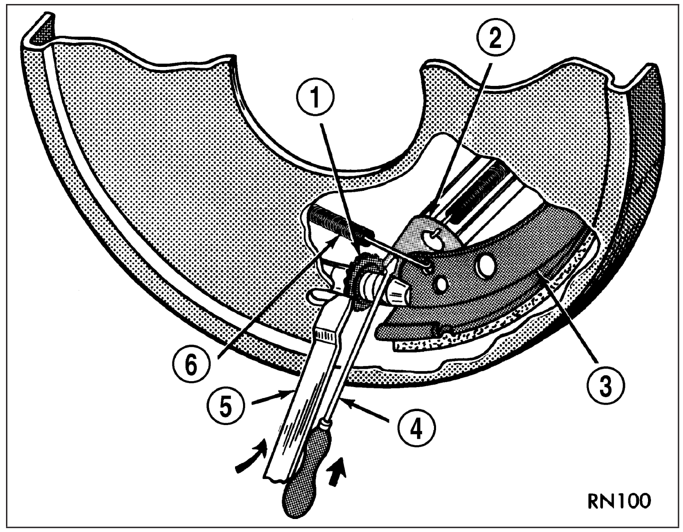
## ADJUSTMENTS

## REAR DRUM IN HAT PARK BRAKE (ROTOR INSTALLED) USING ADJUSTING TOOL

Adjustment can be made with a standard brake gauge or with adjusting tool. Adjustment is performed with the complete brake assembly installed on the backing plate.

1. Be sure parking brake lever is fully released.
2. Raise vehicle so rear wheels can be rotated freely.
3. Remove plug from each access hole in brake support plates.
4. Loosen parking brake cable adjustment nut until there is slack in front cable.
5. Insert adjusting tool through support plate access hole and engage tool in teeth of adjusting screw star wheel.

6. Rotate adjuster screw star wheel (move tool handle upward) until slight drag can be felt when wheel is rotated.
7. Push and hold adjuster lever away from star wheel with thin screwdriver.
8. Back off adjuster screw star wheel until brake drag is eliminated.
9. Repeat adjustment at opposite wheel. Be sure adjustment is equal at both wheels.
10. Install support plate access hole plugs.
11. Adjust parking brake cable and lower vehicle.
12. Apply park brake hand lever and make sure park brakes hold the vehicle staionary.
13. Release park brake hand lever.




## REAR DRUM IN HAT PARK BRAKE (ROTOR REMOVED)

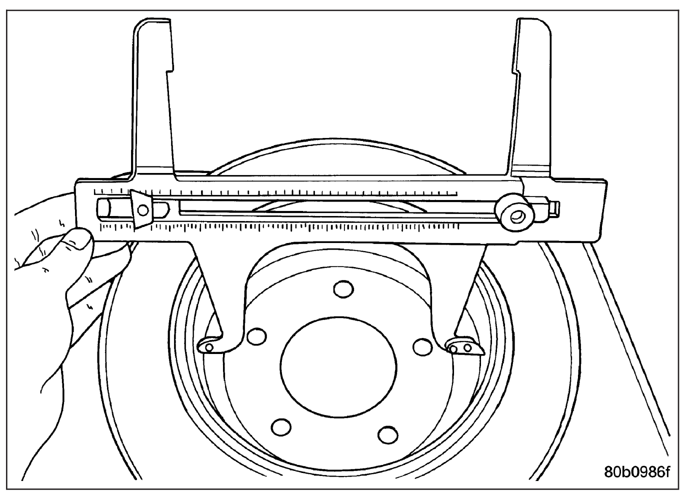
Under normal circumstances, the only time adjustment is required is when the shoes are replaced, removed for access to other parts, or when one or both rotors are replaced.

Adjustment can be made with a standard brake gauge or with adjusting tool. Adjustment is performed with the complete brake assembly installed on the backing plate.

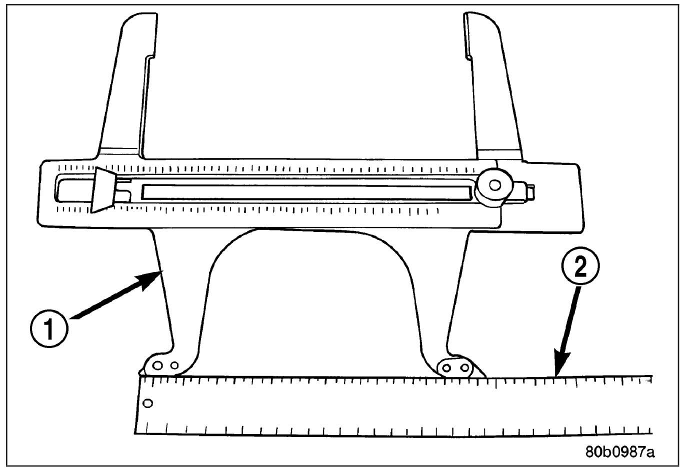
**CAUTION: Before adjusting the park brake shoes be sure that the park brake pedal is in the fully released position. If park brake pedal is not in the fully released position, the park brake shoes can not be accurately adjusted.**

1. Raise vehicle.
2. Remove tire and wheel.
3. Remove disc brake caliper from caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
4. Remove rotor from the axleshaft (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).

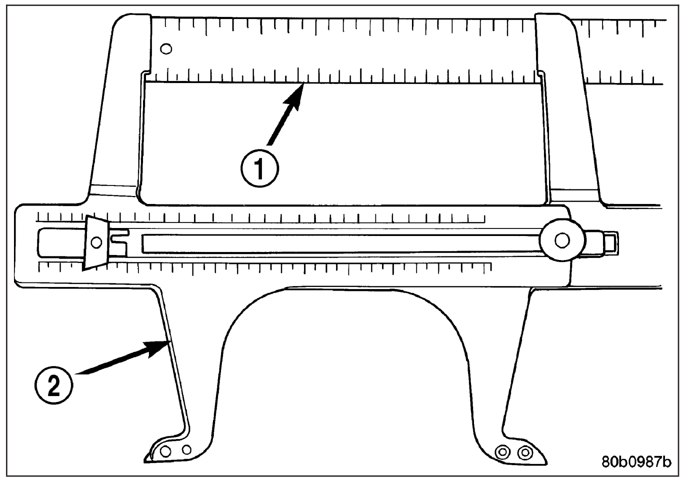
**NOTE: When measuring the brake drum diameter, the diameter should be measured in the center of the area in which the park brake shoes contact the surface of the brake drum.**



5. Using Brake Shoe Gauge, Special Tool C-3919 (1), or equivalent, **accurately** measure the inside diameter of the park brake drum portion of the rotor.
6. Using a ruler (2) that reads in 64th of an inch, accurately read the measurement of the inside diameter of the park brake drum from the special tool.




7. Reduce the inside diameter measurement of the brake drum that was taken using Special Tool C-3919 (2) by 1/64 of an inch. Reset Gauge, Brake Shoe, Special Tool C-3919 (2) or the equivalent used, so that the outside measurement jaws are set to the reduced measurement.
8. Place Gauge, Brake Shoe, Special Tool C-3919 (2) , or equivalent over the park brake shoes. The special tool must be located diagonally across at the top of one shoe and bottom of opposite shoe (widest point) of the park brake shoes.
9. Using the star wheel adjuster, adjust the park brake shoes until the lining on the park brake shoes just touches the jaws on the special tool.
10. Repeat step 8 above and measure shoes in both directions.




11. Install brake rotor on the axleshaft (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
12. Rotate rotor to verify that the park brake shoes are not dragging on the brake drum. If park brake shoes are dragging, remove rotor and back off star wheel adjuster one notch and recheck for brake shoe drag against drum. Continue with the previous step until brake shoes are not dragging on brake drum.
13. Install disc brake caliper on caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).
14. Install wheel and tire.
15. Tighten the wheel mounting nuts in the proper sequence until all nuts are torqued to half the specified torque. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).
16. Lower vehicle.

**CAUTION: Before moving vehicle, pump brake pedal several times to ensure the vehicle has a firm enough pedal to stop the vehicle.**

**NOTE: After parking brake lining replacement, it is recommended that the parking brake system be conditioned prior to use. This is done by making one stop from 25 mph on dry pavement or concrete using light to moderate force on the parking brake hand lever.**

17. Road test the vehicle to ensure proper function of the vehicle's brake system.

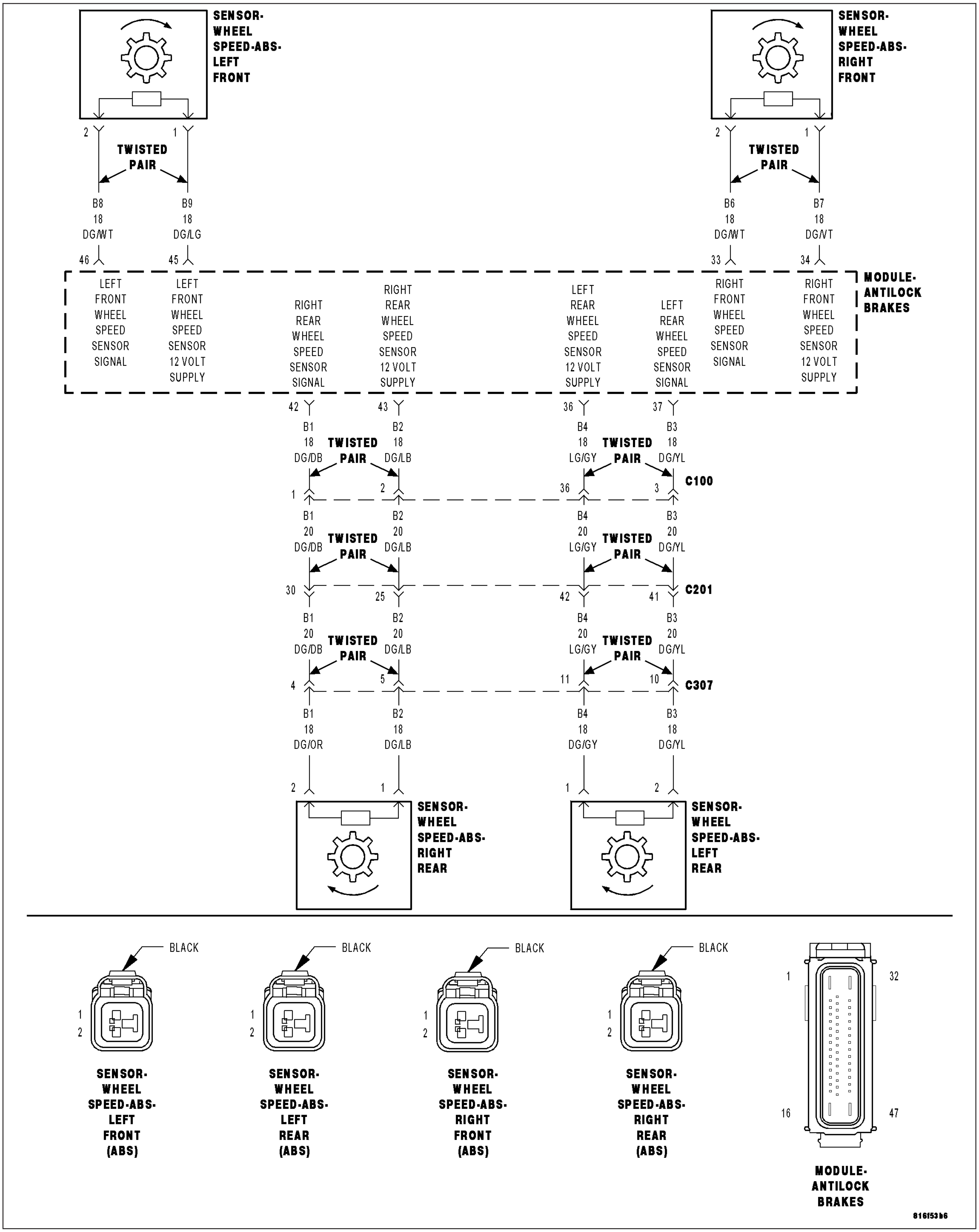
# BRAKES - ABS ELECTRICAL DIAGNOSTICS

## TABLE OF CONTENTS

# BRAKES - ABS ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## C100A–LEFT FRONT WHEEL SPEED SENSOR CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Left Front Wheel Speed Sensor circuit fails the diagnostic test.

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| (B9) LEFT FRONT WSS 12 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN |
| (B8) LEFT FRONT WSS SIGNAL CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN |
| (B8) LEFT FRONT WSS SIGNAL CIRCUIT SHORTED TO (B9) LEFT FRONT WSS 12 VOLT SUPPLY CIRCUIT |
| LEFT FRONT WSS |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. CHECK FOR DTC C100A–LEFT FRONT WHEEL SPEED SENSOR CIRCUIT

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

With the scan tool, read DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C100A–LEFT FRONT WHEEL SPEED SENSOR CIRCUIT?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK CONNECTOR/TERMINAL FOR DAMAGE

**NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.**

Turn the ignition off.

Inspect the Anti-Lock Brake Module harness connector, Left Front WSS, and Left Front WSS harness connector.

**Is the Left Front WSS or any of the connectors/terminals damaged?**

**Yes** >> Repair as necessary.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. CHECK (B9) LEFT FRONT WSS 12 VOLT SUPPLY CIRCUIT VOLTAGE

Disconnect the Left Front WSS harness connector.

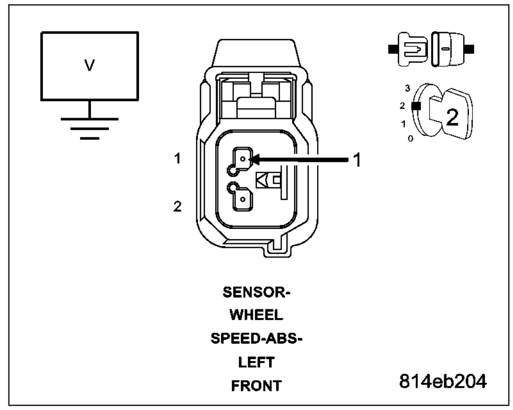
Turn the ignition on.

Measure the voltage of the (B9) Left Front WSS 12 Volt Supply circuit.

**Is the voltage above 10.0 volts?**

**Yes** >> Go To 6

**No** >> Go To 4




## 4. CHECK (B9) LEFT FRONT WSS SUPPLY CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Anti-Lock Brake Module harness connector.

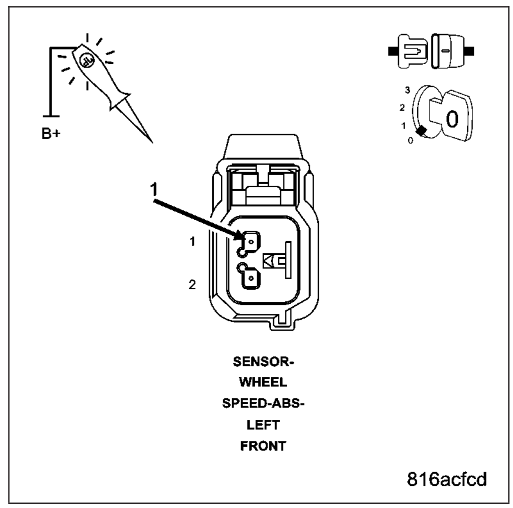
Using a 12-volt test light connected to 12-volts, probe the (B9) Left Front WSS Supply circuit.

**Does the test light illuminate brightly?**

**Yes** >> Repair the (B9) Left Front WSS Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5




## 5. CHECK (B9) LEFT FRONT WSS SUPPLY CIRCUIT OPEN

Connect a jumper wire between ground and the (B9) Left Front WSS Supply circuit in the Anti-Lock Brakes Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (B9) Left Front WSS Supply circuit.

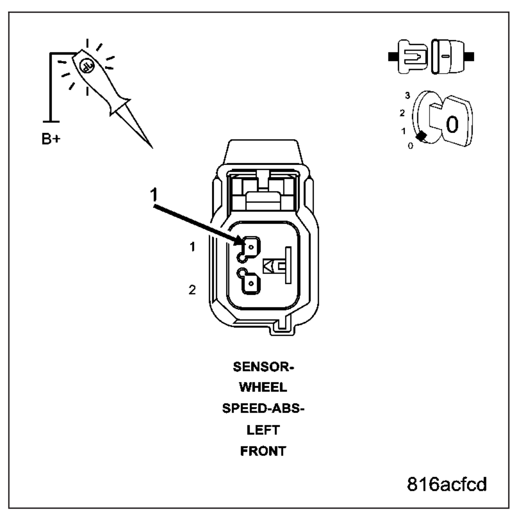
**Does the test light illuminate brightly?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

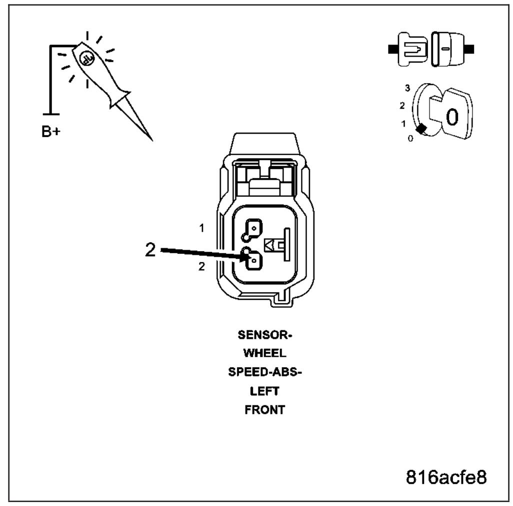
**No** >> Repair the (B9) Left Front WSS Supply circuit for an open.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



## 6. CHECK (B8) LEFT FRONT WSS SIGNAL CIRCUIT SHORT TO GROUND

Using a 12-volt test light connected to 12-volts, probe the (B8) Left Front WSS Signal circuit.




**Does the test light illuminate brightly?**

**Yes** >> Repair the (B8) Left Front WSS Signal circuit for a short to ground.

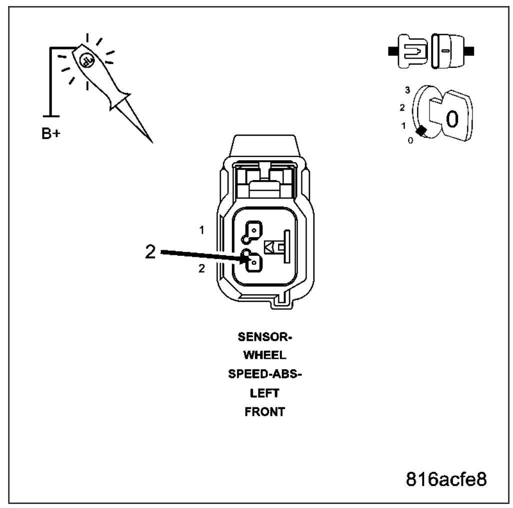
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 7

## 7. CHECK (B8) LEFT FRONT WSS SIGNAL CIRCUIT OPEN

Connect a jumper wire between ground and the (B8) Left Front WSS Signal circuit in the Anti-Lock Brakes Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (B8) Left Front WSS Signal circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 8

**No** >> Repair the (B8) Left Front WSS Signal circuit for an open.

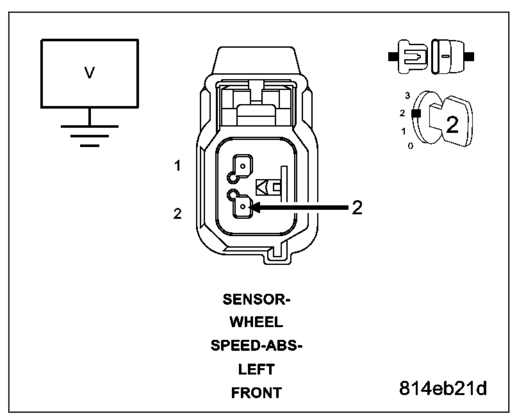
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 8. CHECK (B8) LEFT FRONT WSS SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Remove all jumper wires.

Measure the voltage between the (B8) Left Front WSS Signal circuit and ground.




**Is the voltage above one volt?**

**Yes** >> Repair the (B8) Left Front WSS Signal circuit for a short to voltage.

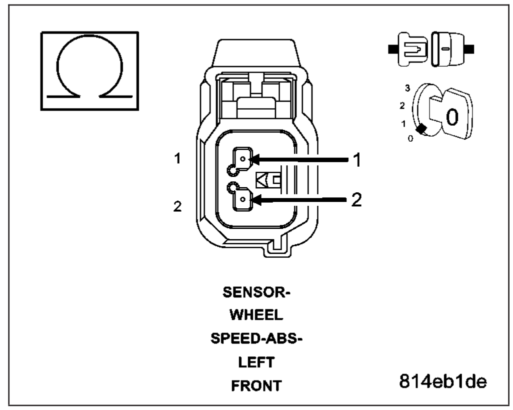
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 9

## 9. CHECK (B8) LEFT FRONT WSS SIGNAL CIRCUIT AND (B9) LEFT FRONT WSS SUPPLY CIRCUIT SHORT TOGETHER

Turn the ignition off.

Measure the resistance between the (B8) Left Front WSS Signal circuit and the (B9) Left Front WSS Supply circuit.




**Is the resistance above 5.0 ohms?**

**Yes** >> Go To 10

**No** >> Repair the (B8) Left Front WSS Signal circuit and the (B9) Left Front WSS Supply circuit for a short together.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 10. LEFT FRONT WHEEL SPEED SENSOR

Replace the Left Front Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**CAUTION: Ensure brake capability is available before road testing.**

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read ABS DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C100A–LEFT FRONT WHEEL SPEED SENSOR CIRCUIT reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Left Front WSS Signal is intermittently missing a vehicle speed above 40 kph (25 mph) or erratic wheel speed signal during acceleration or sensed wheel speed is different from other wheels.

| Possible Causes |
|---|
| LEFT FRONT WSS LOOSE — B8, B9 CIRCUITS/CONNECTOR/TERMINAL DAMAGE |
| LEFT FRONT TONE WHEEL DAMAGE |
| LEFT FRONT WHEEL BEARING DAMAGE |
| IMPROPER LEFT FRONT TIRE PRESSURE/MISMATCHED TIRES |
| LEFT FRONT WSS |
| ANTI-LOCK BRAKE MODULE |

### Diagnostic Test

#### 1. CHECK FOR DTC C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**

**NOTE: If DTC C100A Left Front Wheel Speed Sensor Circuit is present it must be repaired before continuing.**

Turn the ignition on.

With the scan tool, record and erase DTCs.

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

#### 2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

**NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.**

Slowly accelerate as straight as possible from a stop to 40 km/h (25 m.p.h.).

**Is the Left Front WSS speed showing 0 km/h (0 m.p.h.) or not matching other wheel speeds?**

**Yes** >> Go To 3

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 3. CHECK FOR IMPROPER LEFT FRONT TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Left Front Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

**Is the Left Front Tire improperly inflated or mismatched tires on vehicle?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK LEFT FRONT WSS LOOSENESS, INSPECT B8, B9 CIRCUITS/TERMINALS FOR DAMAGE

**NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals**

Inspect the Anti-Lock Brake Module harness connector, Left Front WSS, and Left Front WSS harness connector

Inspect the Left Front WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B8) Left Front WSS Signal and (B9) Left Front WSS Supply circuits between the Left Front WSS and Anti-Lock Brake Module for damage.

**Is the Left Front WSS loose or any of the wiring/connectors/terminals damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK LEFT FRONT TONE WHEEL FOR DAMAGE

Inspect the Left Front Tone Wheel for damage, missing teeth, cracks, or looseness.

**NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.**

**Is the Left Front Tone Wheel damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 6

## 6. CHECK LEFT FRONT WHEEL BEARING FOR DAMAGE

Inspect the Left Front wheel bearing for excessive runout or clearance.

**NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.**

**Is the Left Front Wheel Bearing Damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 7

## 7. LEFT FRONT WHEEL SPEED SENSOR

Replace the Left Front Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read ABS DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Left Front WSS reading is different from the readings received from the other WSS's at a vehicle speed above 40 kph (25 mph). The Anti-Lock Brake Module compares WSS readings from side-to-side on an axle and front-to-rear.

| Possible Causes |
|---|
| LEFT FRONT WSS LOOSE — B8, B9 CIRCUITS/CONNECTOR/TERMINAL DAMAGE |
| IMPROPER LEFT FRONT TIRE PRESSURE/MISMATCHED TIRES |
| LEFT FRONT TONE WHEEL/BEARING DAMAGE |
| LEFT FRONT WSS |
| ANTI-LOCK BRAKE MODULE |

## Diagnostic Test

### 1. CHECK FOR DTC C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, record and erase DTCs.

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C1014-LEFT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE?**

**Yes** >> Go To 3

**No** >> Go To 2

### 2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

**NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.**

Slowly accelerate as straight as possible from a stop to 40 km/h (25 m.p.h.).

**Is the Left Front WSS speed showing 0 km/h (0 m.p.h.) or not matching other wheel speeds?**

**Yes** >> Go To 3

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## 3. CHECK FOR IMPROPER LEFT FRONT TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Left Front Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

**Is the Left Front Tire improperly inflated or mismatched tires on vehicle?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK LEFT FRONT WSS LOOSENESS, INSPECT B8, B9 CIRCUITS/TERMINALS FOR DAMAGE

**NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals**

Inspect the Anti-Lock Brake Module harness connector, Left Front WSS, and Left Front WSS harness connector

Inspect the Left Front WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B8) Left Front WSS Signal and (B9) Left Front WSS Supply circuits between the Left Front WSS and Anti-Lock Brake Module for damage.

**Is the Left Front WSS loose or any of the wiring/connectors/terminals damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK LEFT FRONT TONE WHEEL FOR DAMAGE

Inspect the Left Front Tone Wheel for damage, missing teeth, cracks, or looseness.

**NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.**

**Is the Left Front Tone Wheel damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 6

## 6. LEFT FRONT WHEEL SPEED SENSOR

Replace the Left Front Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST - VER 1. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read ABS DTCs.

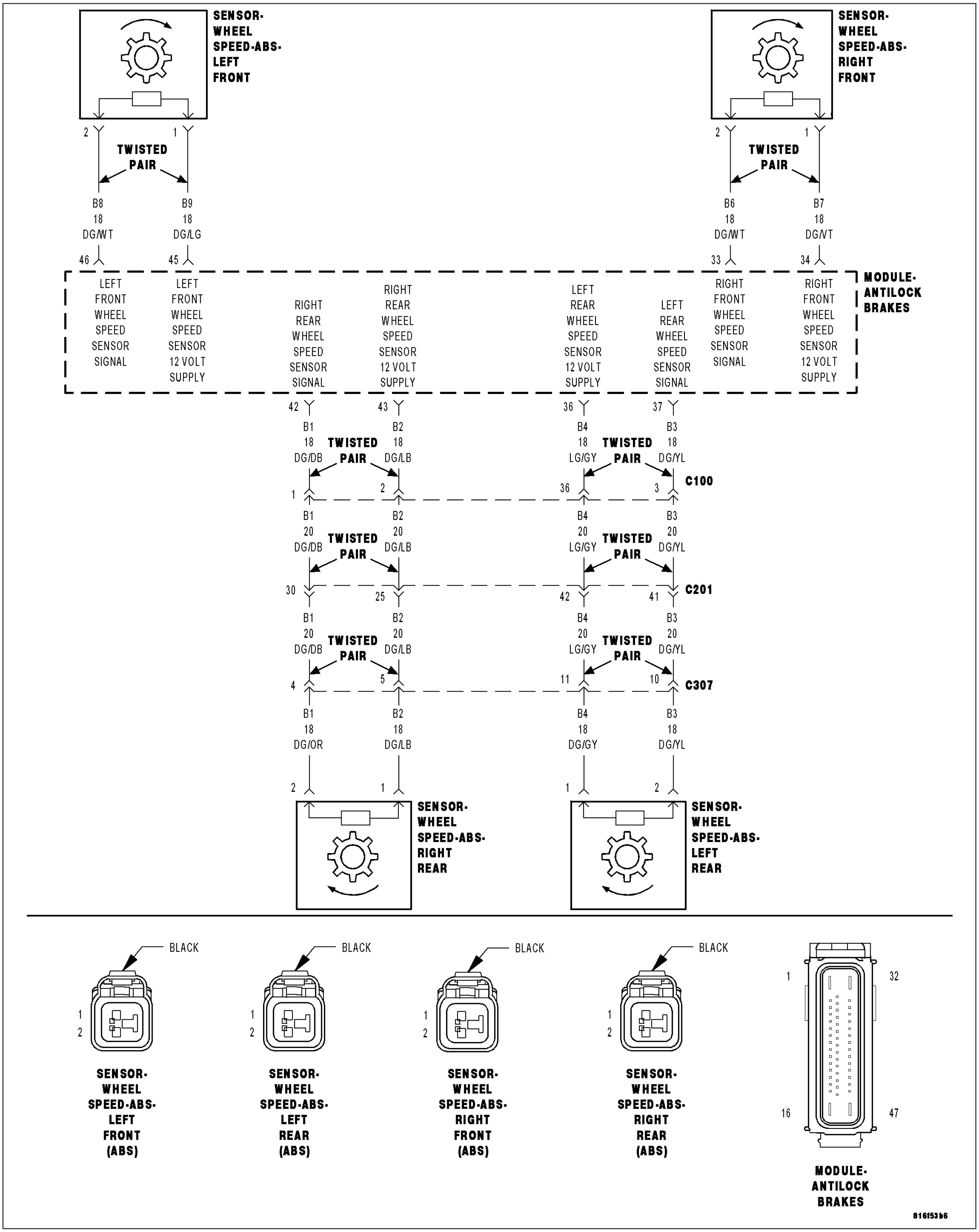
**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C1011-LEFT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C1015–RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Right Front Wheel Speed Sensor circuit fails the diagnostic test.

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| (B7) RIGHT FRONT WSS 12 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN |
| (B6) RIGHT FRONT WSS SIGNAL CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN |
| (B6) RIGHT FRONT WSS SIGNAL CIRCUIT SHORTED TO (B7) RIGHT FRONT WSS 12 VOLT SUPPLY CIRCUIT |
| RIGHT FRONT WSS |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. CHECK FOR DTC C1015–RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT

**NOTE: This DTC must be active for the results of this test to be valid.**
Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

With the scan tool, read DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C1015–RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK CONNECTOR/TERMINAL FOR DAMAGE

**NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.**
Turn the ignition off.

Inspect the Anti-Lock Brake Module harness connector, Right Front WSS, and Right Front WSS harness connector.

**Is the Right Front WSS or any of the connectors/terminals damaged?**

**Yes** >> Repair as necessary.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. CHECK (B7) RIGHT FRONT WSS 12 VOLT SUPPLY CIRCUIT VOLTAGE

Disconnect the Right Front WSS harness connector.

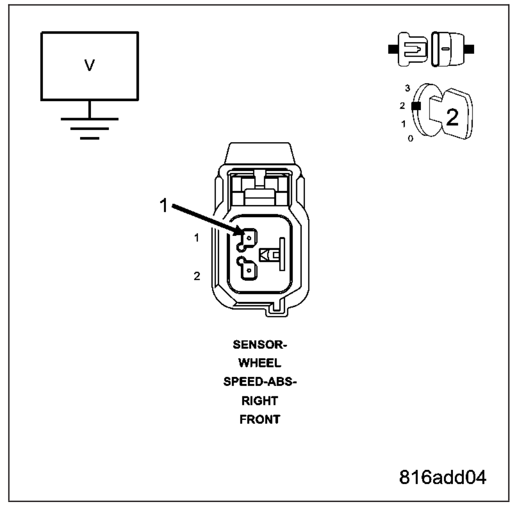
Turn the ignition on.

Measure the voltage of the (B7) Right Front WSS 12 Volt Supply circuit.

**Is the voltage above 10.0 volts?**

**Yes** >> Go To 6

**No** >> Go To 4




## 4. CHECK (B7) RIGHT FRONT WSS 12 VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the Right Front WSS harness connector.

Disconnect the Anti-Lock Brake Module harness connector.

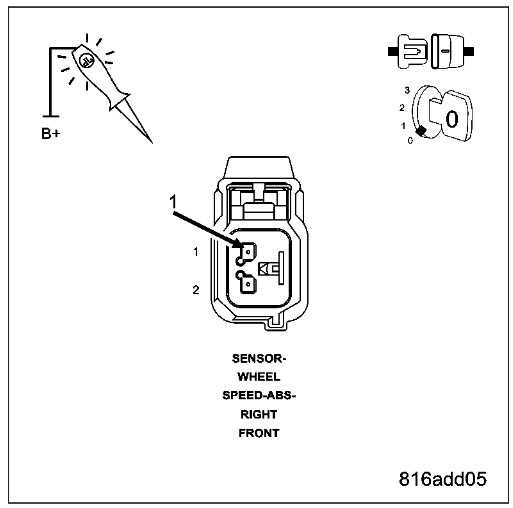
Using a 12-volt test light connected to 12-volts, probe the (B7) Right Front WSS Supply circuit.

**Does the test light illuminate brightly?**

**Yes** >> Repair the (B7) Right Front WSS Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5




## 5. CHECK (B7) RIGHT FRONT WSS 12 VOLT SUPPLY CIRCUIT FOR AN OPEN

Connect a jumper wire between ground and the (B7) Right Front WSS Supply circuit in the Anti-Lock Brakes Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (B7) Right Front WSS Supply circuit.

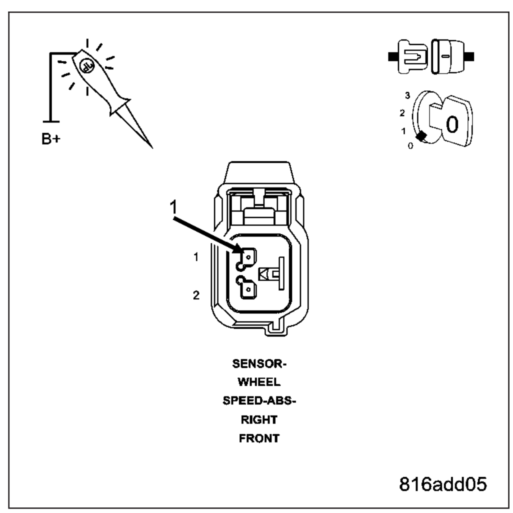
**Does the test light illuminate brightly?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

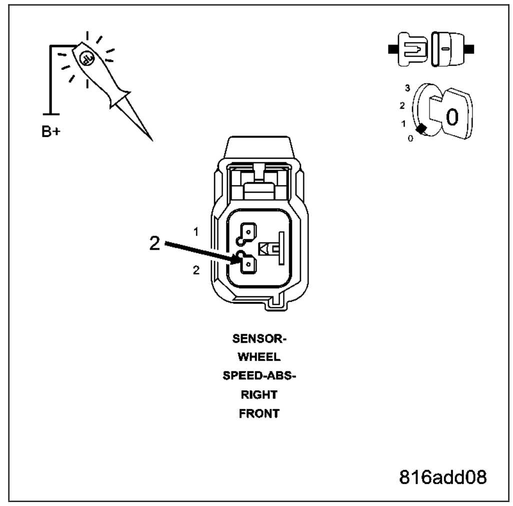
**No** >> Repair the (B7) Right Front WSS Supply circuit for an open.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



## 6. CHECK (B6) RIGHT FRONT WSS SIGNAL CIRCUIT SHORT TO GROUND

Using a 12-volt test light connected to 12-volts, probe the (B6) Right Front WSS Signal circuit.




**Does the test light illuminate brightly?**

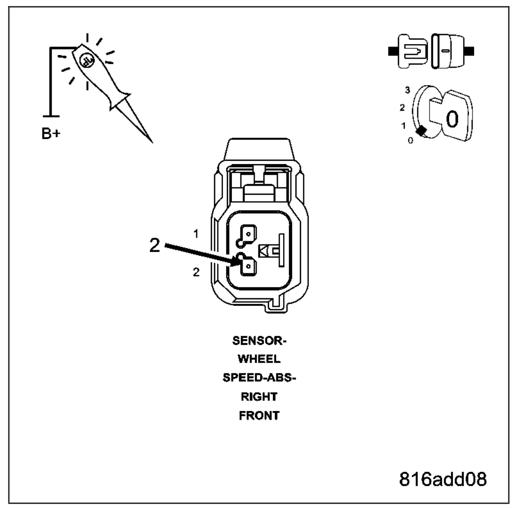
**Yes** >> Repair the (B6) Right Front WSS Signal circuit for a short to ground.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 7

## 7. CHECK (B6) RIGHT FRONT WSS SIGNAL CIRCUIT OPEN

Connect a jumper wire between ground and the (B6) Right Front WSS Signal circuit in the Anti-Lock Brakes Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (B6) Right Front WSS Signal circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 8

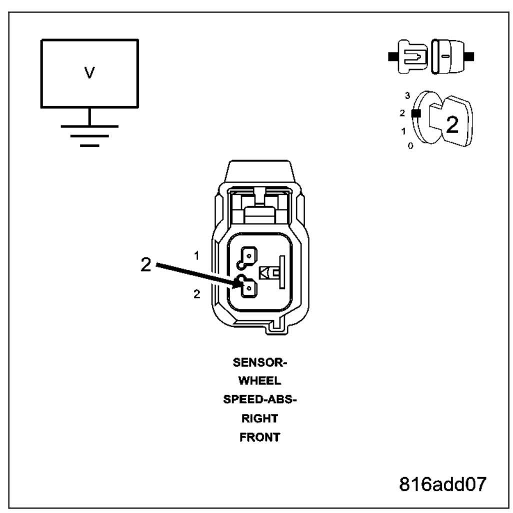
**No** >> Repair the (B6) Right Front WSS Signal circuit for an open.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 8. CHECK (B6) RIGHT FRONT WSS SIGNAL CIRCUIT FOR AN SHORT TO VOLTAGE

Turn the ignition on.

Remove all jumper wires.

Measure the voltage between the (B6) Right Front WSS Signal circuit and ground.




**Is the voltage above one volt?**

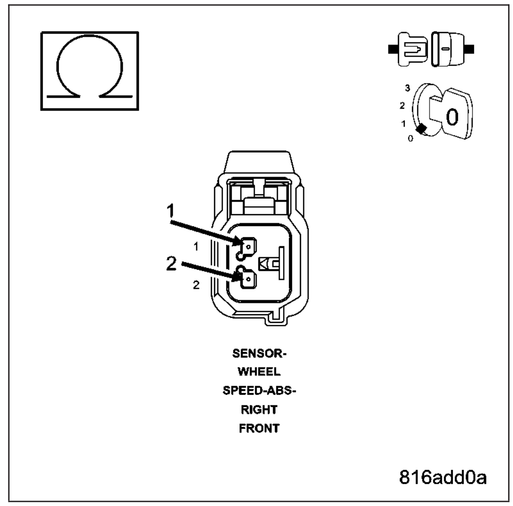
**Yes** >> Repair the (B6) Right Front WSS Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 9

## 9. CHECK (B6) RIGHT FRONT WSS SIGNAL CIRCUIT AND (B7) RIGHT FRONT WSS 12 VOLT SUPPLY CIRCUIT SHORTED TOGETHER

Turn the ignition off.

Measure the resistance between the (B6) Right Front WSS Signal circuit and the (B7) Right Front WSS Supply circuit.




**Is the resistance above 5.0 ohms?**

**Yes** >> Go To 10

**No** >> Repair the (B6) Right Front WSS Signal circuit and the (B7) Right Front WSS Supply circuit for a short together.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 10. RIGHT FRONT WHEEL SPEED SENSOR

Replace the Right Front Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**CAUTION: Ensure brake capability is available before road testing.**

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read ABS DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C1015–RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Right Front WSS Signal is intermittently missing a vehicle speed above 25mph (40 kph) or erratic wheel speed signal during acceleration or sensed wheel speed is different from other wheels.

| Possible Causes |
|---|
| RIGHT FRONT WSS LOOSE — B6, B7 CIRCUITS/CONNECTOR/TERMINAL DAMAGE |
| RIGHT FRONT TONE WHEEL DAMAGE |
| RIGHT FRONT WHEEL BEARING DAMAGE |
| IMPROPER RIGHT FRONT TIRE PRESSURE/MISMATCHED TIRES |
| RIGHT FRONT WSS |
| ANTI-LOCK BRAKE MODULE |

## Diagnostic Test

### 1. CHECK FOR DTC C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**

**NOTE: If DTC C1015–Right Front Wheel Speed Sensor Circuit is present it must be repaired before continuing.**

Turn the ignition on.

With the scan tool, record and erase DTCs.

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

**NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.**

Slowly accelerate as straight as possible from a stop to 40 km/h (25 m.p.h.).

**Is the Right Front WSS speed showing 0 km/h (0 m.p.h.) or not matching other wheel speeds?**

**Yes** >> Go To 3

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 3. CHECK FOR IMPROPER RIGHT FRONT TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Right Front Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

**Is the Right Front Tire improperly inflated or mismatched tires on vehicle?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK RIGHT FRONT WSS LOOSENESS, INSPECT B6, B7 CIRCUITS/TERMINALS FOR DAMAGE

**NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals**

Inspect the Anti-Lock Brake Module harness connector, Right Front WSS, and Right Front WSS harness connector

Inspect the Right Front WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B6) Right Front WSS Signal and (B7) Right Front WSS Supply circuits between the Right Front WSS and Anti-Lock Brake Module for damage.

**Is the Right Front WSS loose or any of the wiring/connectors/terminals damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK RIGHT FRONT TONE WHEEL FOR DAMAGE

Inspect the Right Front Tone Wheel for damage, missing teeth, cracks, or looseness.

**NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.**

**Is the Right Front Tone Wheel damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 6

## 6. CHECK RIGHT FRONT WHEEL BEARING FOR DAMAGE

Inspect the Right Front wheel bearing for excessive runout or clearance.

**NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.**

**Is the Right Front Wheel Bearing Damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 7

## 7. RIGHT FRONT WHEEL SPEED SENSOR

Replace the Right Front Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read ABS DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C101C-RIGHT FRONT WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Right Front WSS reading is different from the readings received from the other WSS's at a vehicle speed above 40 kph (25 mph). The Anti-Lock Brake Module compares WSS readings from side-to-side on an axle and front-to-rear.

| Possible Causes |
|---|
| RIGHT FRONT WSS LOOSE — B6, B7 CIRCUITS/CONNECTOR/TERMINAL DAMAGE |
| IMPROPER RIGHT FRONT TIRE PRESSURE/MISMATCHED TIRES |
| RIGHT FRONT TONE WHEEL/BEARING DAMAGE |
| RIGHT FRONT WSS |
| ANTI-LOCK BRAKE MODULE |

## Diagnostic Test

### 1. CHECK FOR DTC C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**
Turn the ignition on.

With the scan tool, record and erase DTCs.

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE?**

**Yes** >> Go To 3

**No** >> Go To 2

### 2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

**NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.**
Slowly accelerate as straight as possible from a stop to 40 km/h (25 m.p.h.).

**Is the Right Front WSS speed showing 0 km/h (0 m.p.h.) or not matching other wheel speeds?**

**Yes** >> Go To 3

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## 3. CHECK FOR IMPROPER RIGHT FRONT TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Right Front Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

**Is the Right Front Tire improperly inflated or mismatched tires on vehicle?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK RIGHT FRONT WSS LOOSENESS, INSPECT B6, B7 CIRCUITS/TERMINALS FOR DAMAGE

**NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals**

Inspect the Anti-Lock Brake Module harness connector, Right Front WSS, and Right Front WSS harness connector

Inspect the Right Front WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B6) Right Front WSS Signal and (B7) Right Front WSS Supply circuits between the Right Front WSS and Anti-Lock Brake Module for damage.

**Is the Right Front WSS loose or any of the wiring/connectors/terminals damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK RIGHT FRONT TONE WHEEL FOR DAMAGE

Inspect the Right Front Tone Wheel for damage, missing teeth, cracks, or looseness.

**NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.**

**Is the Right Front Tone Wheel damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 6

## 6. RIGHT FRONT WHEEL SPEED SENSOR

Replace the Right Front Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read ABS DTCs.

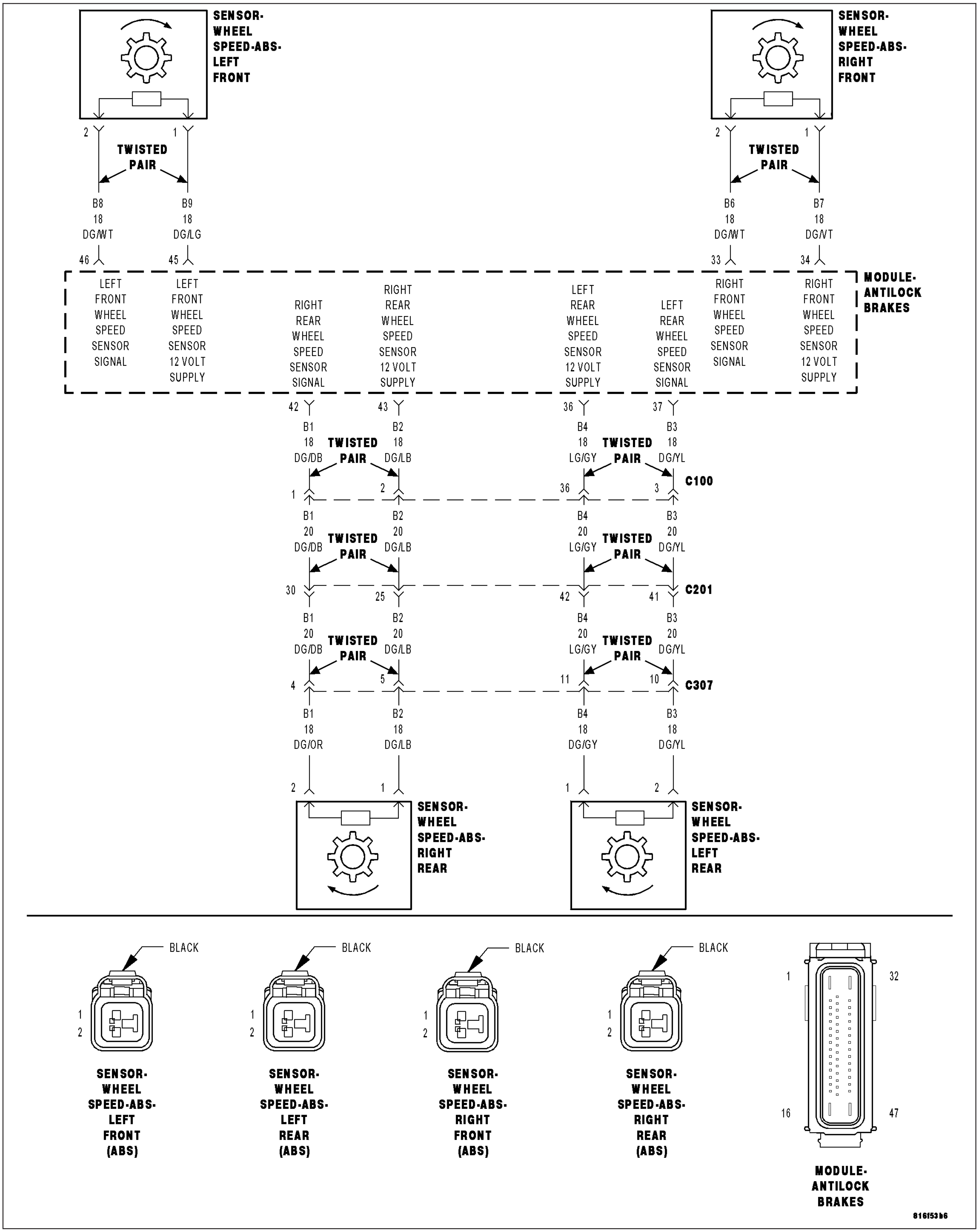
**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C101F-RIGHT FRONT WHEEL SPEED COMPARATIVE PERFORMANCE reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C1020–LEFT REAR WHEEL SPEED SENSOR CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Left Rear Wheel Speed Sensor circuit fails the diagnostic test.

| Possible Causes |
| --- |
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| (B4) LEFT REAR WSS 12 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN |
| (B3) LEFT REAR WSS SIGNAL CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN |
| (B3) LEFT REAR WSS SIGNAL CIRCUIT SHORTED TO (B4) LEFT REAR WSS 12 VOLT SUPPLY CIRCUIT |
| LEFT REAR WSS |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. CHECK FOR DTC C1020–LEFT REAR WHEEL SPEED SENSOR CIRCUIT

**NOTE: This DTC must be active for the results of this test to be valid.**
Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

With the scan tool, read DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C1020–LEFT REAR WHEEL SPEED SENSOR CIRCUIT?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK CONNECTOR/TERMINAL FOR DAMAGE

**NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.**
Turn the ignition off.

Inspect the Anti-Lock Brake Module harness connector, Left Rear WSS, and Left Rear WSS harness connector.

**Is the Left Rear WSS or any of the connectors/terminals damaged?**

**Yes** >> Repair as necessary.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. CHECK (B4) LEFT REAR WSS 12 VOLT SUPPLY CIRCUIT VOLTAGE

Disconnect the Left Rear WSS harness connector.

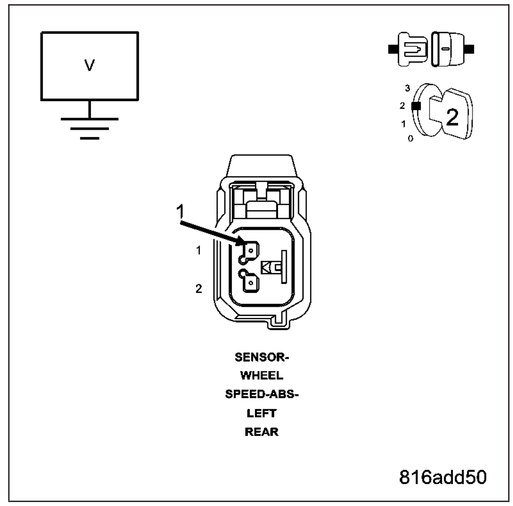
Turn the ignition on.

Measure the voltage of the (B4) Left Rear WSS 12 Volt Supply circuit.

**Is the voltage above 10.0 volts?**

**Yes** >> Go To 6

**No** >> Go To 4




## 4. CHECK (B4) LEFT REAR WSS 12 VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the Left Rear WSS harness connector.

Disconnect the Anti-Lock Brake Module harness connector.

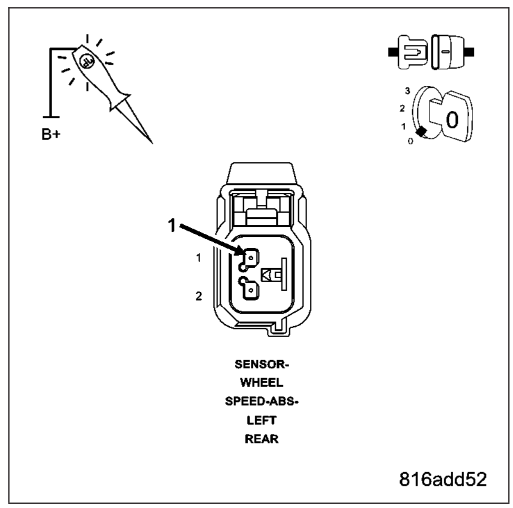
Using a 12-volt test light connected to 12-volts, probe the (B4) Left Rear WSS Supply circuit.

**Does the test light illuminate brightly?**

**Yes** >> Repair the (B4) Left Rear WSS Supply circuit for a short to ground.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5




## 5. CHECK (B4) LEFT REAR WSS 12 VOLT SUPPLY CIRCUIT FOR AN OPEN

Connect a jumper wire between ground and the (B4) Left Rear WSS Supply circuit in the Anti-Lock Brakes Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (B4) Left Rear WSS Supply circuit.

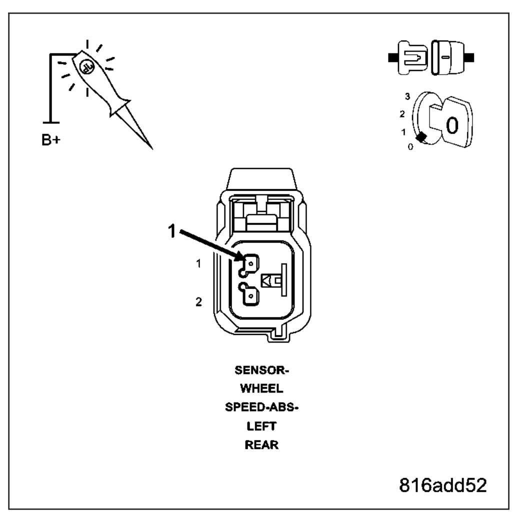
**Does the test light illuminate brightly?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

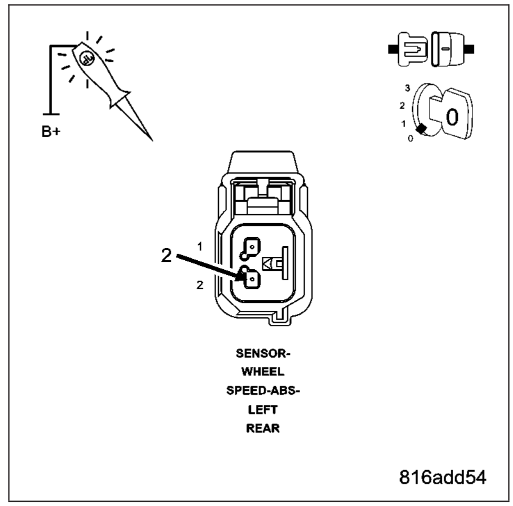
**No** >> Repair the (B4) Left Rear WSS Supply circuit for an open.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



## 6. CHECK (B3) LEFT REAR WSS SIGNAL CIRCUIT FOR A SHORT TO GROUND

Using a 12-volt test light connected to 12-volts, probe the (B3) Left Rear WSS Signal circuit.




**Does the test light illuminate brightly?**

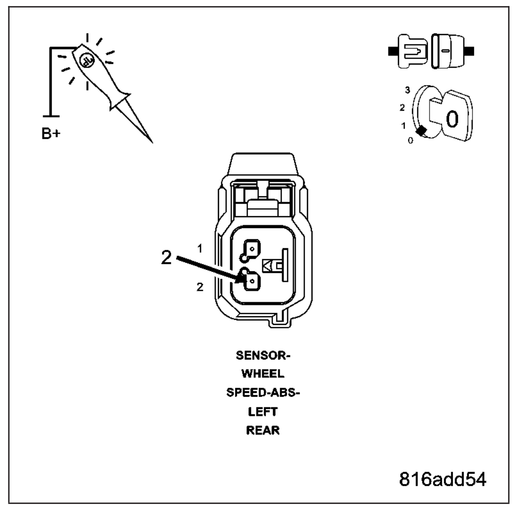
**Yes** >> Repair the (B3) Left Rear WSS Signal circuit for a short to ground.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 7

## 7. CHECK (B3) LEFT REAR WSS SIGNAL CIRCUIT FOR AN OPEN

Connect a jumper wire between ground and the (B3) Left Rear WSS Signal circuit in the Anti-Lock Brakes Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (B3) Left Rear WSS Signal circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 8

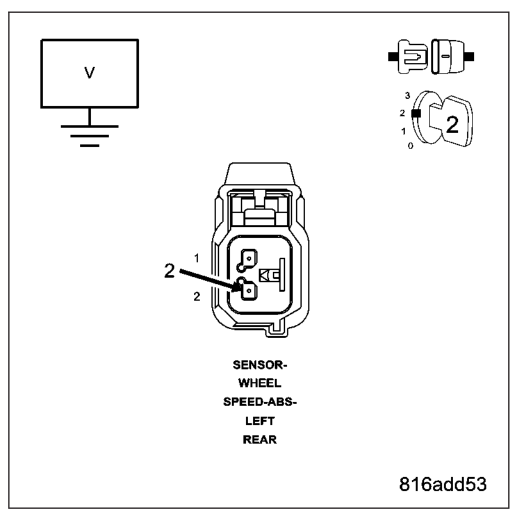
**No** >> Repair the (B3) Left Rear WSS Signal circuit for an open.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 8. CHECK (B3) LEFT REAR WSS SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Remove all jumper wires.

Measure the voltage between the (B3) Left Rear WSS Signal circuit and ground.




**Is the voltage above one volt?**

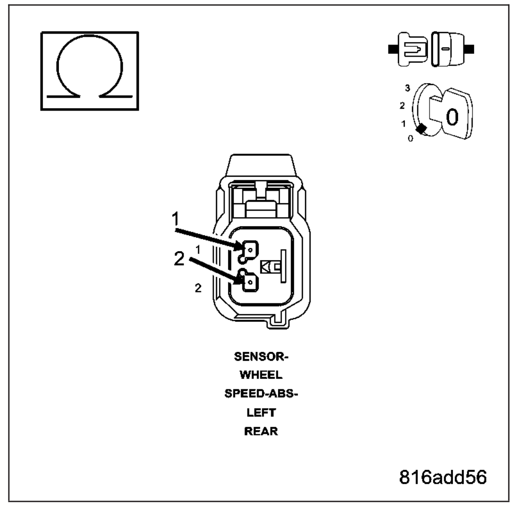
**Yes** >> Repair the (B3) Left Rear WSS Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 9

## 9. CHECK (B3) LEFT REAR WSS SIGNAL CIRCUIT AND (B4) LEFT REAR WSS 12 VOLT SUPPLY CIRCUIT SHORTED TOGETHER

Turn the ignition off.

Measure the resistance between the (B3) Left Rear WSS Signal circuit and the (B4) Left Rear WSS Supply circuit.




**Is the resistance above 5.0 ohms?**

**Yes** >> Go To 10

**No** >> Repair the (B3) Left Rear WSS Signal circuit and the (B4) Left Rear WSS Supply circuit for a short together.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 10. LEFT REAR WHEEL SPEED SENSOR

Replace the Left Rear Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**CAUTION: Ensure brake capability is available before road testing.**
Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read ABS DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C1020–LEFT REAR WHEEL SPEED SENSOR CIRCUIT reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C1027-LEFT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Left Rear WSS Signal is intermittently missing a vehicle speed above 25mph (40 kph) or erratic wheel speed signal during acceleration or sensed wheel speed is different from other wheels.

| Possible Causes |
|---|
| LEFT REAR WSS AIR GAP |
| LEFT REAR WSS LOOSE — B3, B4 CIRCUITS/CONNECTOR/TERMINAL DAMAGE |
| LEFT REAR TONE WHEEL DAMAGE |
| LEFT REAR WHEEL BEARING DAMAGE |
| IMPROPER LEFT REAR TIRE PRESSURE/MISMATCHED TIRES |
| LEFT REAR WSS |
| ANTI-LOCK BRAKE MODULE |

### Diagnostic Test

#### 1. CHECK FOR DTC C1027-LEFT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**
Turn the ignition on.

With the scan tool, record and erase DTCs.

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C1027-LEFT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

#### 2. CHECK LEFT REAR WSS AIR GAP

Turn the ignition off.

Using a feeler gauge, measure the Left Rear WSS air gap.

**NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.**

**Is the Left Rear WSS air gap within specifications?**

**Yes** >> Go To 3

**No** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 3. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

**NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.**
Slowly accelerate as straight as possible from a stop to 40 km/h (25 m.p.h.).

**Is the Left Rear WSS speed showing 0 km/h (0 m.p.h.) or not matching other wheel speeds?**

**Yes** >> Go To 4

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 4. CHECK FOR IMPROPER LEFT REAR TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Left Rear Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

**Is the Left Rear Tire improperly inflated or mismatched tires on vehicle?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK LEFT REAR WSS LOOSENESS, INSPECT B4, B5 CIRCUITS/TERMINALS FOR DAMAGE

**NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals**
Inspect the Anti-Lock Brake Module harness connector, Left Rear WSS, and Left Rear WSS harness connector

Inspect the Left Rear WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B3) Left Rear WSS Signal and (B4) Left Rear WSS Supply circuits between the Left Rear WSS and Anti-Lock Brake Module for damage.

**Is the Left Rear WSS loose or any of the wiring/connectors/terminals damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 6

## 6. CHECK LEFT REAR TONE WHEEL FOR DAMAGE

Inspect the Left Rear Tone Wheel for damage, missing teeth, cracks, or looseness.

**NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.**

**Is the Left Rear Tone Wheel damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 7

## 7. CHECK LEFT REAR WHEEL BEARING FOR DAMAGE

Inspect the Left Rear wheel bearing for excessive runout or clearance.

**NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.**

**Is the Left Rear Wheel Bearing Damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 8

## 8. LEFT REAR WHEEL SPEED SENSOR

Replace the Left Rear Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read ABS DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C1027-LEFT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C102A-LEFT REAR WHEEL SPEED COMPARATIVE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Left Rear WSS reading is different from the readings received from the other WSS's at a vehicle speed above 40 kph (25 mph). The Anti-Lock Brake Module compares WSS readings from side-to-side on an axle and front-to-rear.

| Possible Causes |
| --- |
| LEFT REAR WSS LOOSE — B3, B4 CIRCUITS/CONNECTOR/TERMINAL DAMAGE |
| IMPROPER LEFT REAR TIRE PRESSURE/MISMATCHED TIRES |
| LEFT REAR WSS AIR GAP |
| LEFT REAR TONE WHEEL DAMAGE |
| LEFT REAR WSS |
| ANTI-LOCK BRAKE MODULE |

### Diagnostic Test

#### 1. CHECK FOR DTC C102A-LEFT REAR WHEEL SPEED COMPARATIVE PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**
Turn the ignition on.

With the scan tool, record and erase DTCs.

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C102A-LEFT REAR WHEEL SPEED COMPARATIVE PERFORMANCE?**

**Yes** >> Go To 3

**No** >> Go To 2

#### 2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

**NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.**
Slowly accelerate as straight as possible from a stop to 40 km/h (25 m.p.h.).

**Is the Left Rear WSS speed showing 0 km/h (0 m.p.h.) or not matching other wheel speeds?**

**Yes** >> Go To 3

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## 3. CHECK FOR IMPROPER LEFT REAR TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Left Rear Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

**Is the Left Rear Tire improperly inflated or mismatched tires on vehicle?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK LEFT REAR WSS LOOSENESS, INSPECT B3, B4 CIRCUITS/TERMINALS FOR DAMAGE

**NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals**

Inspect the Anti-Lock Brake Module harness connector, Left Rear WSS, and Left Rear WSS harness connector

Inspect the Left Rear WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B3) Left Rear WSS Signal and (B4) Left Rear WSS Supply circuits between the Left Rear WSS and Anti-Lock Brake Module for damage.

**Is the Left Rear WSS loose or any of the wiring/connectors/terminals damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK LEFT REAR WSS AIR GAP

Turn the ignition off.

Using a feeler gauge, measure the Left Rear WSS air gap.

**NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.**

**Is the Left Rear WSS air gap within specifications?**

**Yes** >> Go To 6

**No** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 6. CHECK LEFT REAR TONE WHEEL FOR DAMAGE

Inspect the Left Rear Tone Wheel for damage, missing teeth, cracks, or looseness.

**NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.**

**Is the Left Rear Tone Wheel damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 7

## 7. LEFT REAR WHEEL SPEED SENSOR

Replace the Left Rear Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read ABS DTCs.

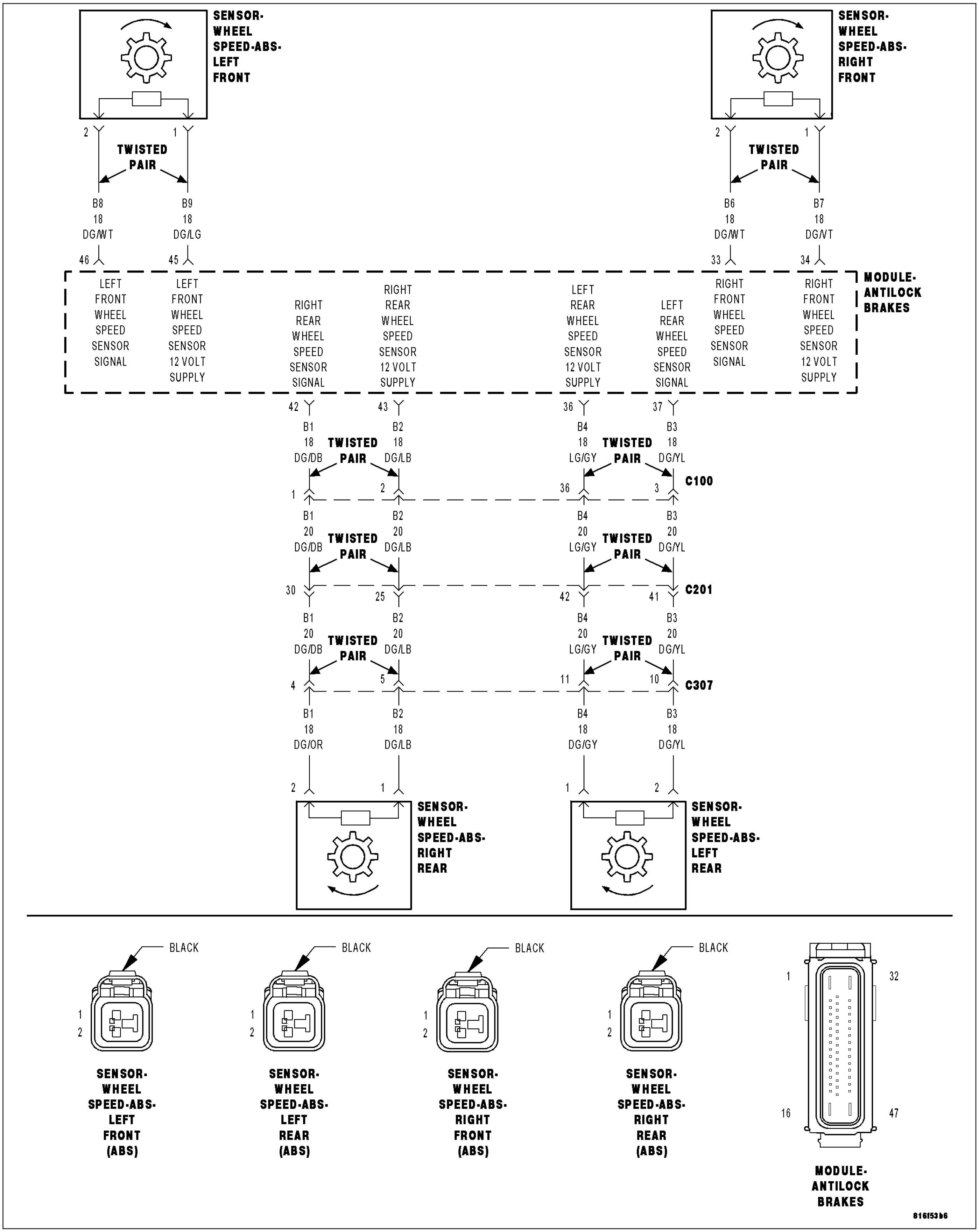
**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C102A-LEFT REAR WHEEL SPEED COMPARATIVE PERFORMANCE reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C102B–RIGHT REAR WHEEL SPEED SENSOR CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Right Rear Wheel Speed Sensor circuit fails the diagnostic test.

| Possible Causes |
| --- |
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| (B2) RIGHT REAR WSS 12 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN |
| (B1) RIGHT REAR WSS SIGNAL CIRCUIT SHORTED TO VOLTAGE, GROUND, OR OPEN |
| (B1) RIGHT REAR WSS SIGNAL CIRCUIT SHORTED TO (B2) RIGHT REAR WSS 12 VOLT SUPPLY CIRCUIT |
| RIGHT REAR WSS |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. CHECK FOR DTC C102B–RIGHT REAR WHEEL SPEED SENSOR CIRCUIT

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

With the scan tool, read DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C102B–RIGHT REAR WHEEL SPEED SENSOR CIRCUIT?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK CONNECTOR/TERMINAL FOR DAMAGE

**NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals.**

Turn the ignition off.

Inspect the Anti-Lock Brake Module harness connector, Right Rear WSS, and Right Rear WSS harness connector.

**Is the Right Rear WSS or any of the connectors/terminals damaged?**

**Yes** >> Repair as necessary.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

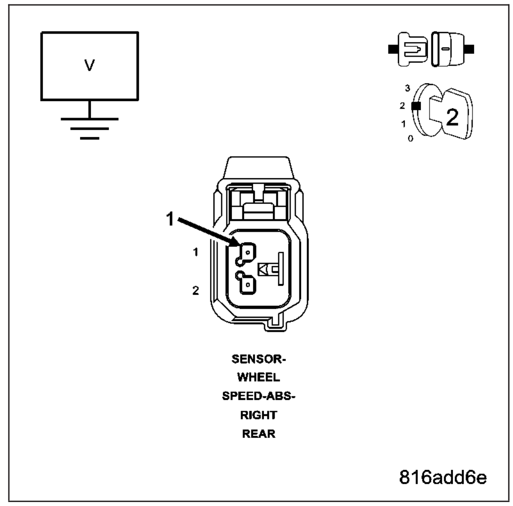
**No** >> Go To 3

## 3. CHECK (B2) RIGHT REAR WSS 12 VOLT SUPPLY CIRCUIT VOLTAGE

Disconnect the Right Rear WSS harness connector.

Turn the ignition on.

Measure the voltage of the (B2) Right Rear WSS 12 Volt Supply circuit.




**Is the voltage above 10.0 volts?**

**Yes** >> Go To 6

**No** >> Go To 4

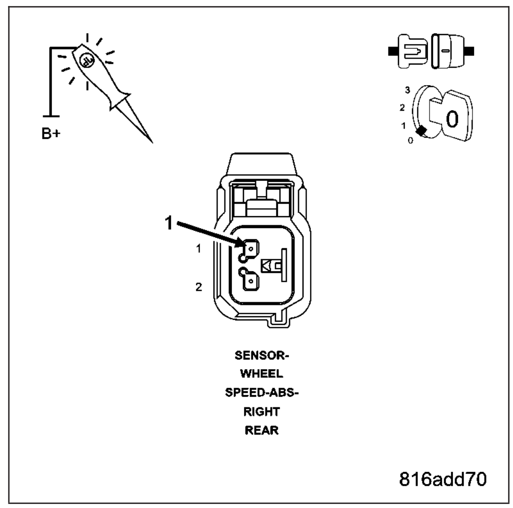
## 4. CHECK (B2) RIGHT REAR WSS 12 VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the Right Rear WSS harness connector.

Disconnect the Anti-Lock Brake Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (B2) Right Rear WSS Supply circuit.




**Does the test light illuminate brightly?**

**Yes** >> Repair the (B2) Right Rear WSS Supply circuit for a short to ground.

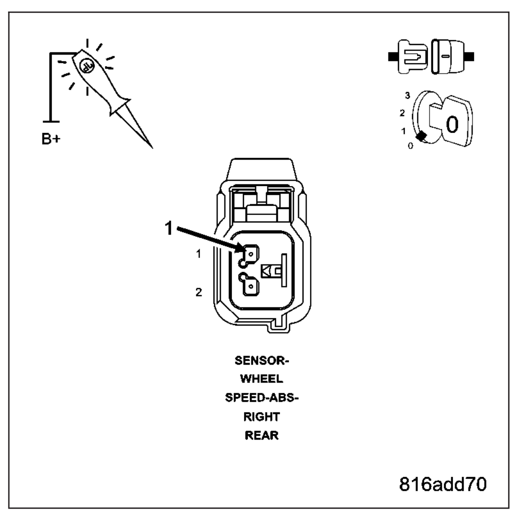
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK (B2) RIGHT REAR WSS 12 VOLT SUPPLY CIRCUIT FOR AN OPEN

Connect a jumper wire between ground and the (B2) Right Rear WSS Supply circuit in the Anti-Lock Brakes Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (B2) Right Rear WSS Supply circuit.




**Does the test light illuminate brightly?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.

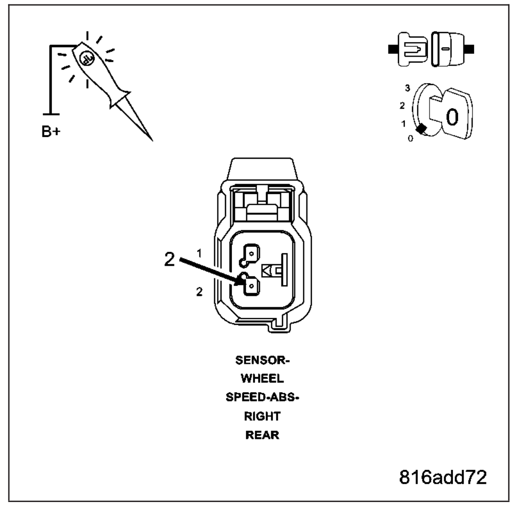
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Repair the (B2) Right Rear WSS Supply circuit for an open.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 6. CHECK (B1) RIGHT REAR WSS SIGNAL CIRCUIT FOR A SHORT TO GROUND

Using a 12-volt test light connected to 12-volts, probe the (B1) Right Rear WSS Signal circuit.




**Does the test light illuminate brightly?**

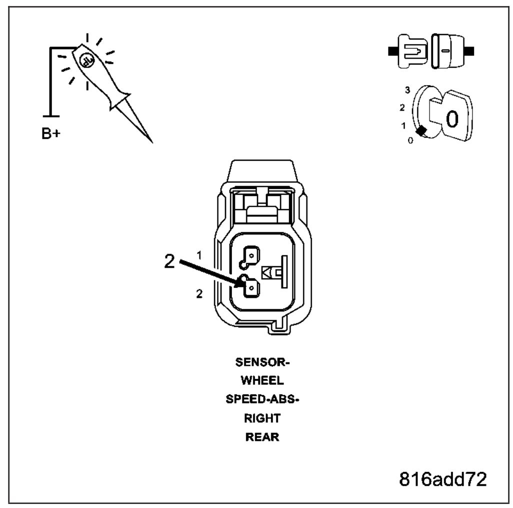
**Yes** >> Repair the (B1) Right Rear WSS Signal circuit for a short to ground.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 7

## 7. CHECK (B1) RIGHT REAR WSS SIGNAL CIRCUIT FOR AN OPEN

Connect a jumper wire between ground and the (B1) Right Rear WSS Signal circuit in the Anti-Lock Brakes Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (B1) Right Rear WSS Signal circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 8

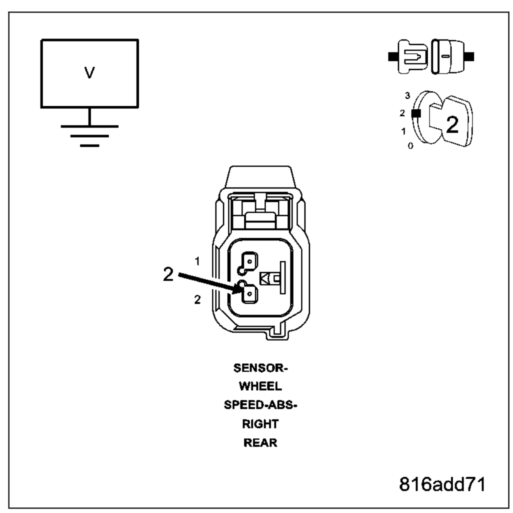
**No** >> Repair the (B1) Right Rear WSS Signal circuit for an open.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 8. CHECK (B1) RIGHT REAR WSS SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Remove all jumper wires.

Measure the voltage between the (B1) Right Rear WSS Signal circuit and ground.




**Is the voltage above one volt?**

**Yes** >> Repair the (B1) Right Rear WSS Signal circuit for a short to voltage.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 9

## 9. CHECK (B1) RIGHT REAR WSS SIGNAL CIRCUIT FOR A SHORT TO (B2) RIGHT REAR WSS 12 VOLT SUPPLY CIRCUIT

Turn the ignition off.

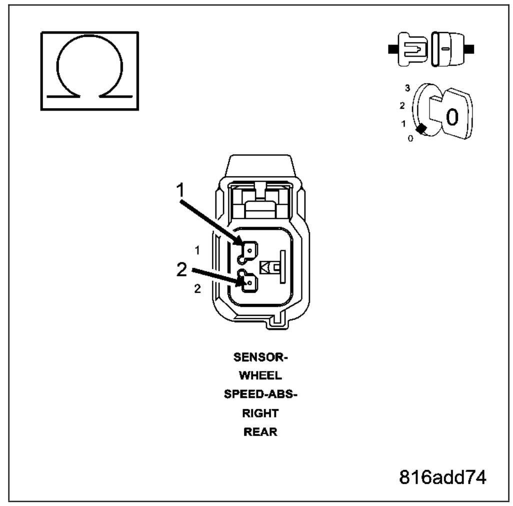
Measure the resistance between the (B1) Right Rear WSS Signal circuit and the (B2) Right Rear WSS Supply circuit.

**Is the resistance above 5.0 ohms?**

**Yes** >> Go To 10

**No** >> Repair the (B1) Right Rear WSS Signal circuit and the (B2) Right Rear WSS Supply circuit for a short together.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).




## 10. RIGHT REAR WHEEL SPEED SENSOR

Replace the Right Rear Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**CAUTION: Ensure brake capability is available before road testing.**

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read ABS DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C102B–RIGHT REAR WHEEL SPEED SENSOR CIRCUIT reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C1032-RIGHT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Right Rear WSS Signal is intermittently missing a vehicle speed above 25mph (40 kph) or erratic wheel speed signal during acceleration or sensed wheel speed is different from other wheels.

| Possible Causes |
|---|
| RIGHT REAR WSS AIR GAP |
| RIGHT REAR WSS LOOSE — B1, B2 CIRCUITS/CONNECTOR/TERMINAL DAMAGE |
| RIGHT REAR TONE WHEEL DAMAGE |
| RIGHT REAR WHEEL BEARING DAMAGE |
| IMPROPER RIGHT REAR TIRE PRESSURE/MISMATCHED TIRES |
| RIGHT REAR WSS |
| ANTI-LOCK BRAKE MODULE |

### Diagnostic Test

#### 1. CHECK FOR DTC C1032-RIGHT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**
Turn the ignition on.

With the scan tool, record and erase DTCs.

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C1032-RIGHT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

#### 2. CHECK RIGHT REAR WSS AIR GAP

Turn the ignition off.

Using a feeler gauge, measure the Right Rear WSS air gap.

**NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.**

**Is the Right Rear WSS air gap within specifications?**

**Yes** >> Go To 3

**No** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 3. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

**NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.**

Slowly accelerate as straight as possible from a stop to 40 km/h (25 m.p.h.).

**Is the Right Rear WSS speed showing 0 km/h (0 m.p.h.) or not matching other wheel speeds?**

**Yes** >> Go To 4

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 4. CHECK FOR IMPROPER RIGHT REAR TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Right Rear Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

**Is the Right Rear Tire improperly inflated or mismatched tires on vehicle?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK RIGHT REAR WSS LOOSENESS, INSPECT B1, B2 CIRCUITS/TERMINALS FOR DAMAGE

**NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals**

Inspect the Anti-Lock Brake Module harness connector, Right Rear WSS, and Right Rear WSS harness connector

Inspect the Right Rear WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B1) Right Rear WSS Signal and (B2) Right Rear WSS Supply circuits between the Right Rear WSS and Anti-Lock Brake Module for damage.

**Is the Right Rear WSS loose or any of the wiring/connectors/terminals damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 6

## 6. CHECK RIGHT REAR TONE WHEEL FOR DAMAGE

Inspect the Right Rear Tone Wheel for damage, missing teeth, cracks, or looseness.

**NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.**

**Is the Right Rear Tone Wheel damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 7

## 7. CHECK RIGHT REAR WHEEL BEARING FOR DAMAGE

Inspect the Right Rear wheel bearing for excessive runout or clearance.

**NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.**

**Is the Right Rear Wheel Bearing Damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 8

## 8. RIGHT REAR WHEEL SPEED SENSOR

Replace the Right Rear Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read ABS DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C1032-RIGHT REAR WHEEL SPEED SENSOR SIGNAL ERRATIC PERFORMANCE reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C1035-RIGHT REAR WHEEL SPEED COMPARATIVE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Right Rear WSS reading is different from the readings received from the other WSS's at a vehicle speed above 40 kph (25 mph). The Anti-Lock Brake Module compares WSS readings from side-to-side on an axle and front-to-rear.

| Possible Causes |
| --- |
| RIGHT REAR WSS LOOSE — B1, B2 CIRCUITS/CONNECTOR/TERMINAL DAMAGE |
| IMPROPER RIGHT REAR TIRE PRESSURE/MISMATCHED TIRES |
| RIGHT REAR WSS AIR GAP |
| RIGHT REAR TONE WHEEL DAMAGE |
| RIGHT REAR WSS |
| ANTI-LOCK BRAKE MODULE |

### Diagnostic Test

#### 1. CHECK FOR DTC C1035-RIGHT REAR WHEEL SPEED COMPARATIVE PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**
Turn the ignition on.

With the scan tool, record and erase DTCs.

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C1035-RIGHT REAR WHEEL SPEED COMPARATIVE PERFORMANCE?**

**Yes** >> Go To 3

**No** >> Go To 2

#### 2. CHECK WHEEL SPEED SENSOR SIGNALS

Turn the ignition on.

With the scan tool, monitor and graph ALL the WSS speeds and compare graph while an assistant drives the vehicle.

**NOTE: If graph shows periodic dropouts pay close attention to the tone wheel.**
Slowly accelerate as straight as possible from a stop to 40 km/h (25 m.p.h.).

**Is the Right Rear WSS speed showing 0 km/h (0 m.p.h.) or not matching other wheel speeds?**

**Yes** >> Go To 3

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## 3. CHECK FOR IMPROPER RIGHT REAR TIRE PRESSURE/MISMATCHED TIRES

Turn the ignition off.

Check and adjust the Right Rear Tire pressure.

Check and adjust all other tire pressures.

Inspect for mismatched tires on vehicle.

**Is the Right Rear Tire improperly inflated or mismatched tires on vehicle?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK RIGHT REAR WSS LOOSENESS, INSPECT B1, B2 CIRCUITS/TERMINALS FOR DAMAGE

**NOTE: Check all terminals for broken, bent, pushed out, or corroded terminals**

Inspect the Anti-Lock Brake Module harness connector, Right Rear WSS, and Right Rear WSS harness connector

Inspect the Right Rear WSS for looseness, excessive corrosion and not properly fastened.

Inspect the (B1) Right Rear WSS Signal and (B2) Right Rear WSS Supply circuits between the Right Rear WSS and Anti-Lock Brake Module for damage.

**Is the Right Rear WSS loose or any of the wiring/connectors/terminals damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK RIGHT REAR WSS AIR GAP

Turn the ignition off.

Using a feeler gauge, measure the Right Rear WSS air gap.

**NOTE: Refer to the appropriate service information, if necessary, for procedures or specifications.**

**Is the Right Rear WSS air gap within specifications?**

**Yes** >> Go To 6

**No** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 6. CHECK RIGHT REAR TONE WHEEL FOR DAMAGE

Inspect the Right Rear Tone Wheel for damage, missing teeth, cracks, or looseness.

**NOTE: The Tone Wheel teeth should be perfectly square, not bent, or nicked.**

**Is the Right Rear Tone Wheel damaged?**

**Yes** >> Repair as necessary
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 7

## 7. RIGHT REAR WHEEL SPEED SENSOR

Replace the Right Rear Wheel Speed Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read ABS DTCs.

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C1035-RIGHT REAR WHEEL SPEED COMPARATIVE PERFORMANCE reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C1041-LEFT FRONT TONE WHEEL PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module detects periodic drops of a WSS signal.

| Possible Causes |
|---|
| LEFT FRONT TONE WHEEL/BEARING DAMAGE |
| DIRTY TONE WHEEL/SENSOR |

### Diagnostic Test

#### 1. CHECK FOR A DTC C1041-LEFT FRONT TONE WHEEL PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**
Turn the ignition on.

With the scan tool, read DTCs.

Record DTC and Freeze Frame information.

With the scan tool, erase DTCs.

Cycle the ignition switch off then on.

**WARNING: To avoid personal injury or death, check brake capability is available before road testing.**
Test drive the vehicle in a straight line to 40 Km/h (25 mph).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read DTCs.

**Does the scan tool display: C1041-LEFT FRONT TONE WHEEL PERFORMANCE?**

**Yes** >> Replace the Left Front Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## C1042-RIGHT FRONT TONE WHEEL PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module detects periodic drops of a WSS signal.

| Possible Causes |
|---|
| RIGHT FRONT TONE WHEEL/BEARING DAMAGE |
| DIRTY TONE WHEEL/SENSOR |

### Diagnostic Test

#### 1. CHECK FOR A DTC C1042-RIGHT FRONT TONE WHEEL PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**
Turn the ignition on.

With the scan tool, read DTCs.

Record DTC and Freeze Frame information.

With the scan tool, erase DTCs.

Cycle the ignition switch off then on.

**CAUTION: Ensure brake capability is available before road testing.**
Test drive the vehicle in a straight line to 40 km/h (25 mph).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read DTCs.

**Does the scan tool display: C1042-RIGHT FRONT TONE WHEEL PERFORMANCE?**

**Yes** >> Replace the Right Front Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## C1043-LEFT REAR TONE WHEEL PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module detects periodic drops of a WSS signal.

| Possible Causes |
|---|
| LEFT REAR TONE WHEEL/BEARING DAMAGE |
| DIRTY TONE WHEEL/SENSOR |

## Diagnostic Test

### 1. CHECK FOR A DTC C1043-LEFT REAR TONE WHEEL PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**
Turn the ignition on.

With the scan tool, read DTCs.

Record DTC and Freeze Frame information.

With the scan tool, erase DTCs.

Cycle the ignition switch off then on.

**CAUTION: Ensure brake capability is available before road testing.**
Test drive the vehicle in a straight line to 40 km/h (25 mph).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read DTCs.

**Does the scan tool display: C1043-LEFT REAR TONE WHEEL PERFORMANCE?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK THE LEFT REAR TONE WHEEL FOR DAMAGE

**NOTE: Check the tone wheel teeth for missing teeth, cracks, or looseness. Teeth should be perfectly square, not bent, or nicked.**
Check the Left Rear Tone Wheel for damage.

Check the Left Rear Tone Wheel for dirt.

**Was the tone wheel dirty?**

**Yes** >> Clean tone wheel and sensor. Clear codes and retest.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Left Rear Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C1044-RIGHT REAR TONE WHEEL PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module detects periodic drops of a WSS signal.

| Possible Causes |
| --- |
| RIGHT REAR TONE WHEEL/BEARING DAMAGE |
| DIRTY TONE WHEEL/SENSOR |

## Diagnostic Test

### 1. CHECK FOR A DTC C1044-RIGHT REAR TONE WHEEL PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, read DTCs.

Record DTC and Freeze Frame information.

With the scan tool, erase DTCs.

Cycle the ignition switch off then on.

**CAUTION: Ensure brake capability is available before road testing.**

Test drive the vehicle in a straight line to 40 Km/h (25 mph).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read DTCs.

**Does the scan tool display: C1044-RIGHT REAR TONE WHEEL PERFORMANCE?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK THE RIGHT REAR TONE WHEEL FOR DAMAGE

**NOTE: Check the tone wheel teeth for missing teeth, cracks, or looseness. Teeth should be perfectly square, not bent, or nicked.**

Check the Right Rear Tone Wheel for damage.

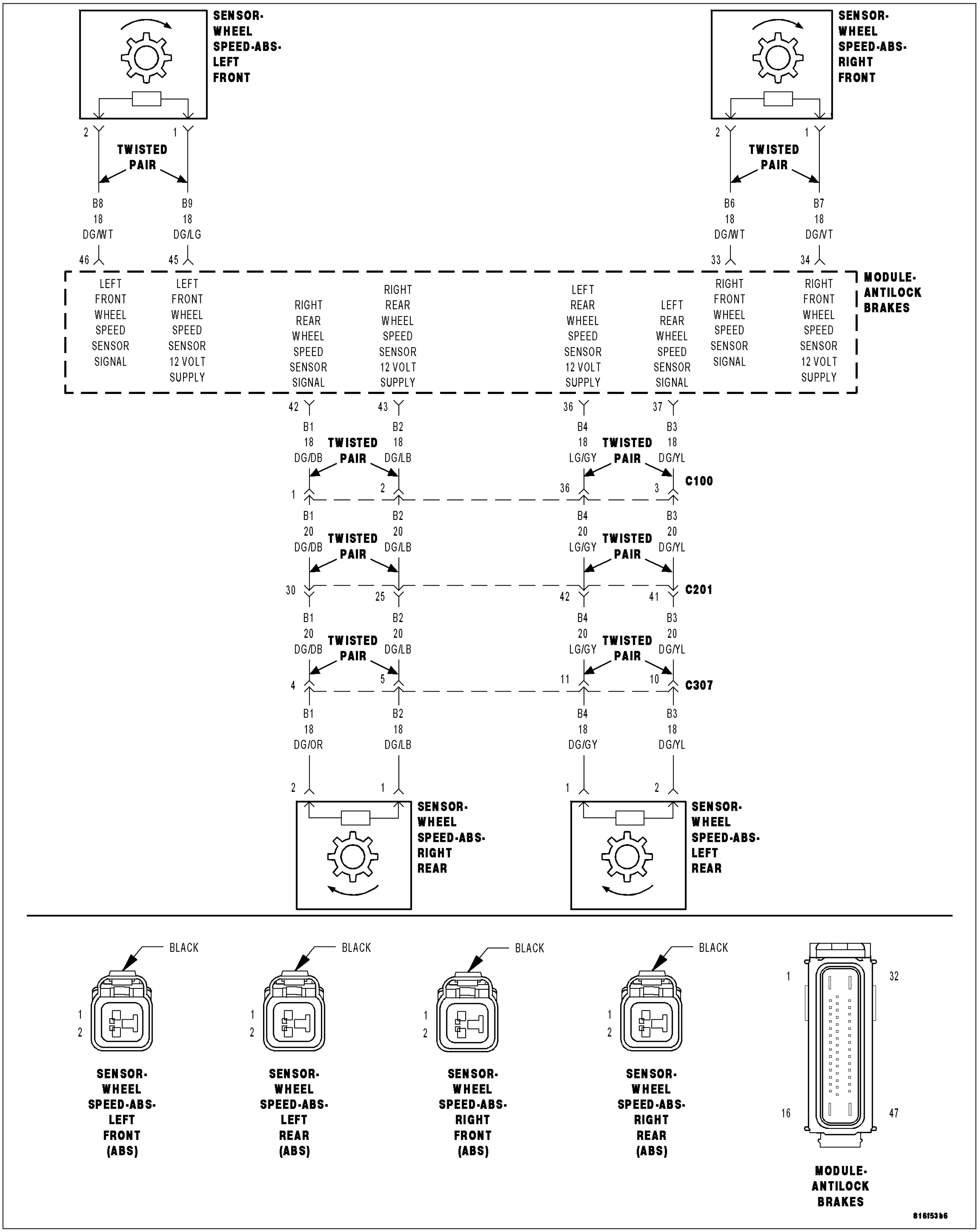
Check the Right Rear Tone Wheel for dirt.

**Was the tone wheel dirty?**

**Yes** >> Clean tone wheel and sensor. Clear codes and retest.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Right Rear Tone Wheel in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C1046–LEFT FRONT WHEEL PRESSURE PHASE MONITORING




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During active ABS control.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects a pressure reduction phase and the following pressure hold phase is too long.

| Possible Causes |
| --- |
| LEFT FRONT TONE WHEEL/BEARING DAMAGED |
| WHEEL SPEED SIGNALS SWAPPED |
| LEFT FRONT WSS |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. COMPARE WHEEL SPEED SENSOR SIGNALS

**WARNING: Ensure brake capability is available before road testing.**

With the scan tool, monitor ALL the WSS speeds while an assistant drives the vehicle.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 m.p.h.).

**Does the Left Front WSS speed differ from the other WSS speeds by 8 Km/h (5 m.p.h.) or show NO speed?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. INSPECT TONE WHEEL/BEARING

Turn the ignition off.

Visually inspect the tone wheel and bearing for damage.

- Check the tone wheel teeth for missing teeth, cracks, and looseness. The teeth must be perfectly square, not bent, or nicked. Check the wheel bearing for worn/looseness.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

### 3. CHECK WHEEL SPEED SENSOR WIRING

Check the Anti-Lock Brakes Module and Wheel Speed Sensors harness connectors for incorrectly wired connectors.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. LEFT FRONT WHEEL SPEED SENSOR

Replace the Left Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**CAUTION: Ensure brake capability is available before road testing.**
Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read ABS DTCs.

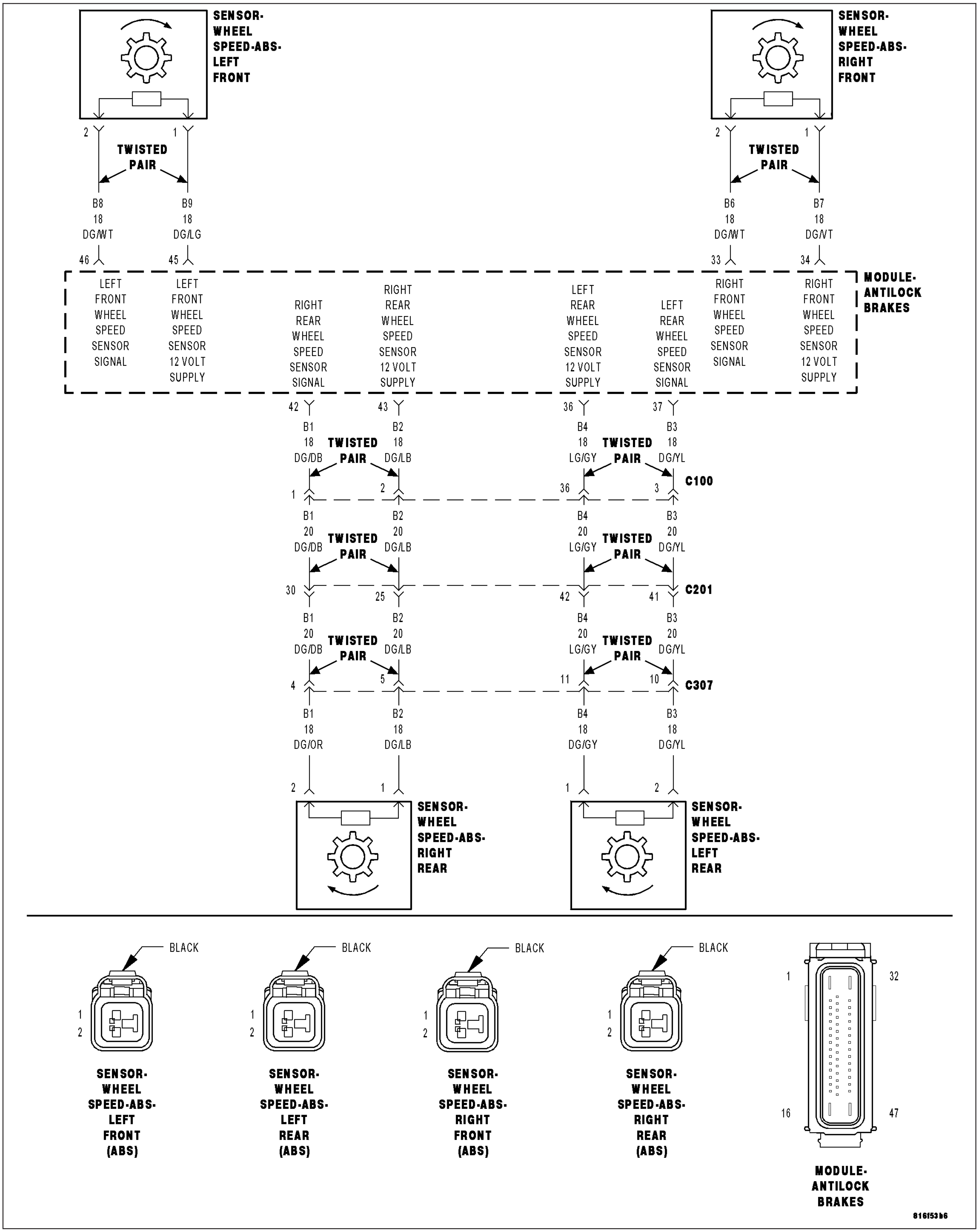
**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C1046–LEFT FRONT WHEEL PRESSURE PHASE MONITORING reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C1047–RIGHT FRONT WHEEL PRESSURE PHASE MONITORING




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During active ABS control.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects a pressure reduction phase and the following pressure hold phase is too long.

| Possible Causes |
| --- |
| RIGHT FRONT TONE WHEEL DAMAGED |
| WHEEL SPEED SIGNALS SWAPPED |
| RIGHT FRONT WSS |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. COMPARE WHEEL SPEED SENSOR SIGNALS

**WARNING: Ensure brake capability is available before road testing.**

With the scan tool, monitor ALL the WSS speeds while an assistant drives the vehicle.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 m.p.h.).

**Does the Right Front WSS speed differ from the other WSS speeds by 8 Km/h (5 m.p.h.) or show NO speed?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. INSPECT TONE WHEEL/BEARING

Turn the ignition off.

Visually inspect the tone wheel and bearing for damage.

- Check the tone wheel teeth for missing teeth, cracks, and looseness. The teeth must be perfectly square, not bent, or nicked. Check the wheel bearing for worn/looseness.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

### 3. CHECK WHEEL SPEED SENSOR WIRING

Check the Anti-Lock Brakes Module and Wheel Speed Sensors harness connectors for incorrectly wired connectors.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. RIGHT FRONT WHEEL SPEED SENSOR

Replace the Right Front Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**CAUTION: Ensure brake capability is available before road testing.**
Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read ABS DTCs.

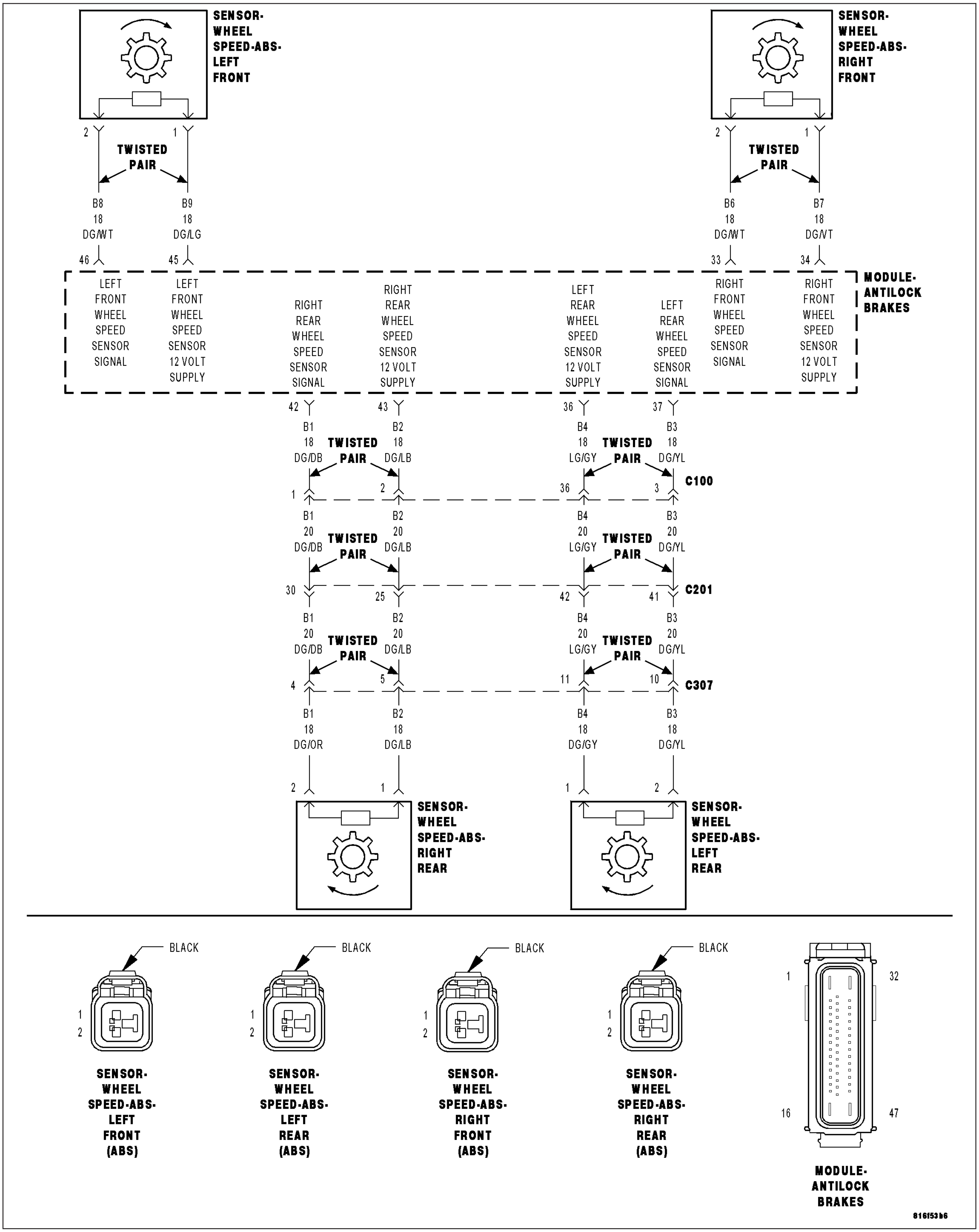
**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C1047–RIGHT FRONT WHEEL PRESSURE PHASE MONITORING reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C1048–LEFT REAR WHEEL PRESSURE PHASE MONITORING




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During active ABS control.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects a pressure reduction phase and the following pressure hold phase is too long.

| Possible Causes |
| --- |
| LEFT REAR TONE WHEEL/WHEEL BEARING |
| WHEEL SPEED SIGNALS SWAPPED |
| LEFT REAR WSS |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. COMPARE WHEEL SPEED SENSOR SIGNALS

**WARNING: Ensure brake capability is available before road testing.**

With the scan tool, monitor ALL the WSS speeds while an assistant drives the vehicle.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 m.p.h.).

**Does the Left Rear WSS speed differ from the other WSS speeds by 8 Km/h (5 m.p.h.) or show NO speed?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. INSPECT TONE WHEEL/BEARING

Turn the ignition off.

Visually inspect the tone wheel and bearing for damage.

- Check the tone wheel teeth for missing teeth, cracks, and looseness. The teeth must be perfectly square, not bent, or nicked. Check the wheel bearing for worn/looseness.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

### 3. CHECK WHEEL SPEED SENSOR WIRING

Check the Anti-Lock Brakes Module and Wheel Speed Sensors harness connectors for incorrectly wired connectors.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. LEFT REAR WHEEL SPEED SENSOR

Replace the Left Rear Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**CAUTION: Ensure brake capability is available before road testing.**
Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read ABS DTCs.

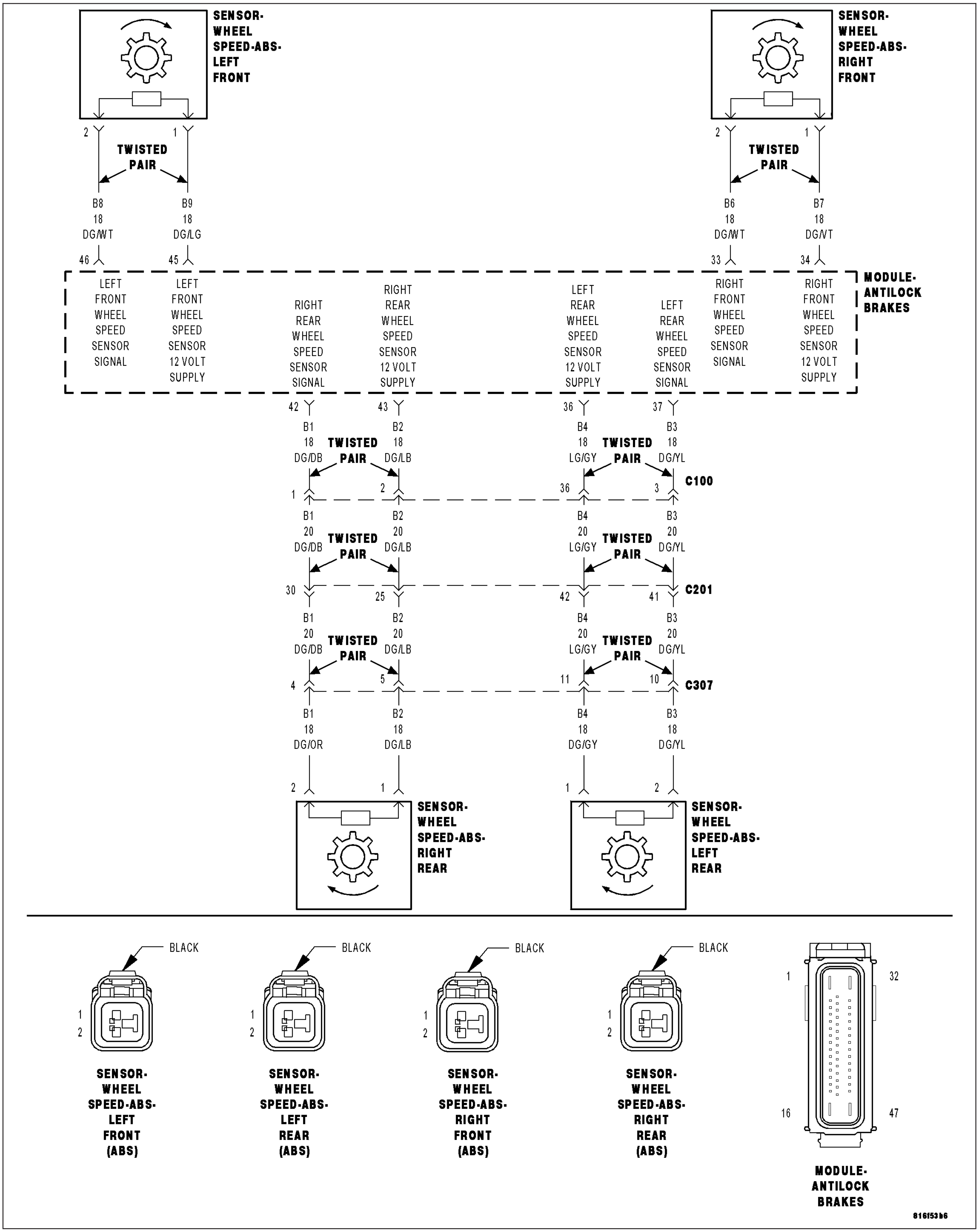
**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C1048–LEFT REAR WHEEL PRESSURE PHASE MONITORING reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C1049–RIGHT REAR WHEEL PRESSURE PHASE MONITORING




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During active ABS control.
- **Set Condition:**
  When the Anti-Lock Brakes Module detects a pressure reduction phase and the following pressure hold phase is too long.

| Possible Causes |
|---|
| RIGHT REAR TONE WHEEL DAMAGED |
| WHEEL SPEED SIGNALS SWAPPED |
| RIGHT REAR WSS |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. COMPARE WHEEL SPEED SENSOR SIGNALS

**WARNING: Ensure brake capability is available before road testing.**

With the scan tool, monitor ALL the WSS speeds while an assistant drives the vehicle.

Slowly accelerate as straight as possible from a stop to 40 km/h (25 m.p.h.).

**Does the Right Rear WSS speed from the other WSS speeds by 8 Km/h (5 m.p.h.) or show NO speed?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. INSPECT TONE WHEEL/BEARING

Turn the ignition off.

Visually inspect the tone wheel and bearing for damage.

- Check the tone wheel teeth for missing teeth, cracks, and looseness. The teeth must be perfectly square, not bent, or nicked. Check the wheel bearing for worn/looseness.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

### 3. CHECK WHEEL SPEED SENSOR WIRING

Check the Anti-Lock Brakes Module and Wheel Speed Sensors harness connectors for incorrectly wired connectors.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. RIGHT REAR WHEEL SPEED SENSOR

Replace the Right Rear Wheel Speed Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**CAUTION: Ensure brake capability is available before road testing.**
Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read ABS DTCs.

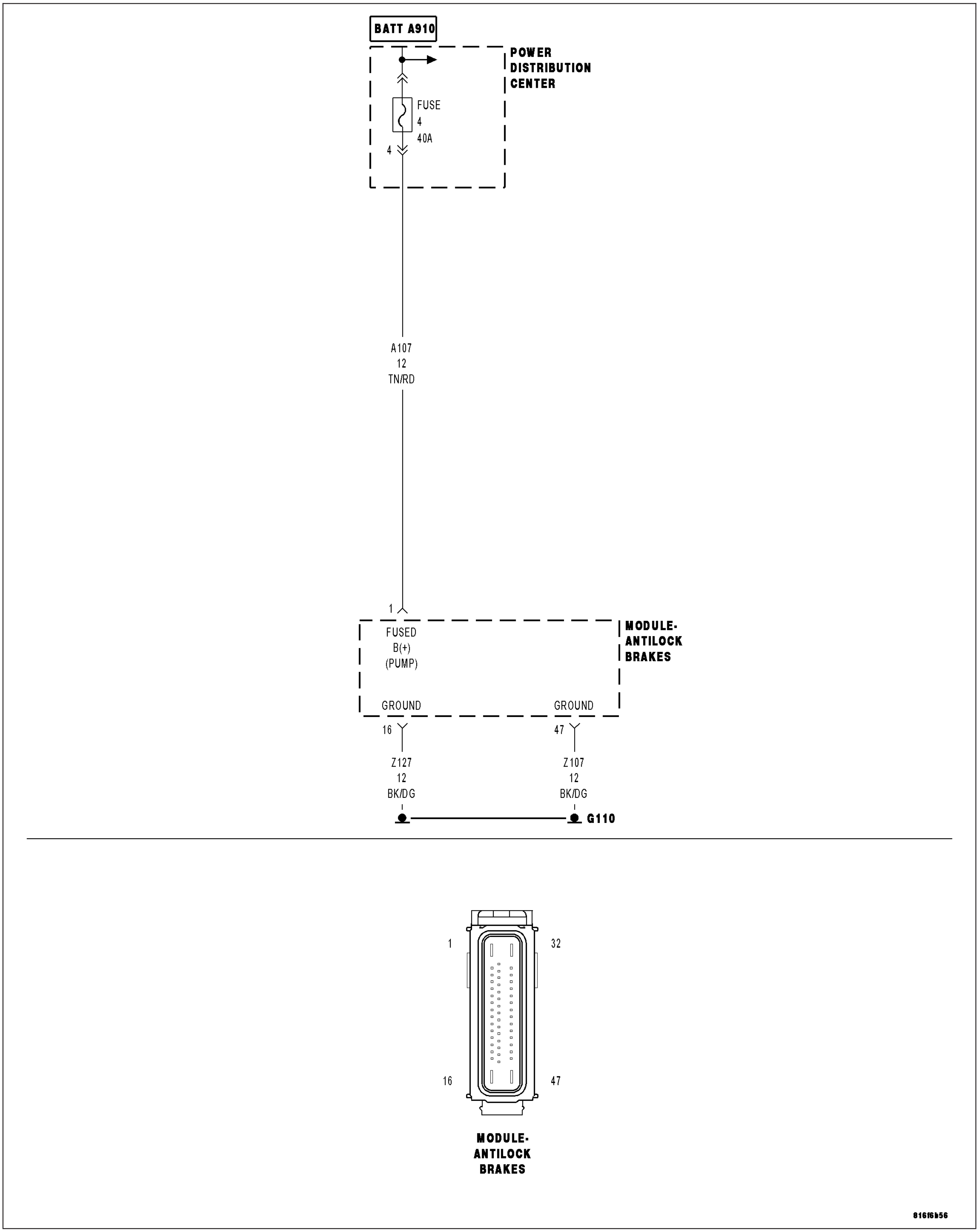
**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Did DTC C1049–RIGHT REAR WHEEL PRESSURE PHASE MONITORING reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C1073–ABS PUMP MOTOR CONTROL CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ABS Pump Motor is activated.
- **Set Condition:**
  The Anti-Lock Brake Module detects low pump motor feedback voltage with actuation of the pump motor relay.

| Possible Causes |
|---|
| BLOWN PUMP FUSE |
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| HIGH RESISTANCE IN B+ CIRCUITS |
| HIGH RESISTANCE IN GROUND CIRCUITS |
| INTEGRATED CONTROL UNIT |

## Diagnostic Test

### 1. CHECK FOR A DTC C1073-ABS PUMP MOTOR CONTROL CIRCUIT

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**

With the scan tool, read DTCs

**NOTE: The Anti-Lock Brake Module must sense ALL 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicators.**

**Does the scan tool display: C1073-ABS PUMP MOTOR CONTROL CIRCUIT?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Turn the ignition off.

Visually inspect the related wiring harness. Look for any pinched, chafed, pierced, and partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, and corroded terminals.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. CHECK THE ABS PUMP MOTOR FUSED B+ FOR AN OPEN

Turn the ignition off.

Remove and visually inspect the ABS Pump Motor B+ fuse.

**Is the ABS Pump Motor B+ fuse open?**

**Yes** >> Go To 4

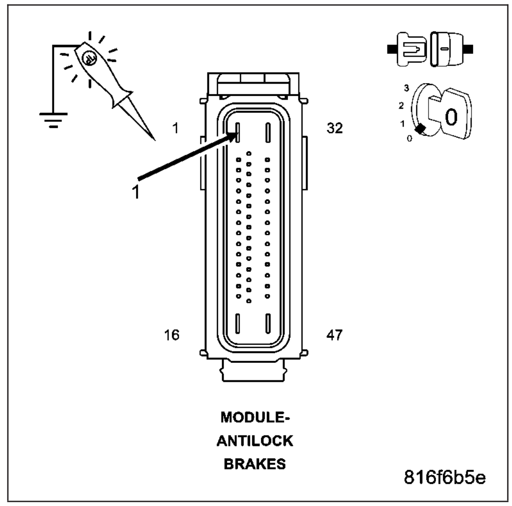
**No** >> Go To 6

## 4. CHECK THE (A107) FUSED B(+) FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the Anti-Lock Brake Module harness connector.

Using a 12–volt test light connected to 12–volts, probe the (A107) Fused B+ circuit.




**Does the test light illuminate brightly?**

**Yes** >> Repair the (A107) Fused B(+) circuit for a short to ground. Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK THE (A107) FUSED B(+) CIRCUIT

Turn the ignition off.

Visually inspect the (A107) Fused B(+) circuit in the wiring harness.

Look for any signs of intermittent short to ground.

**Is the wiring harness OK?**

**Yes** >> Go To 6

**No** >> Repair the (A107) Fused B(+) circuit for a short to ground. Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 6. CHECK THE VOLTAGE ON THE (A107) FUSED B(+) CIRCUIT

Turn the ignition off.

Disconnect the Anti-Lock Brake Module harness connector.

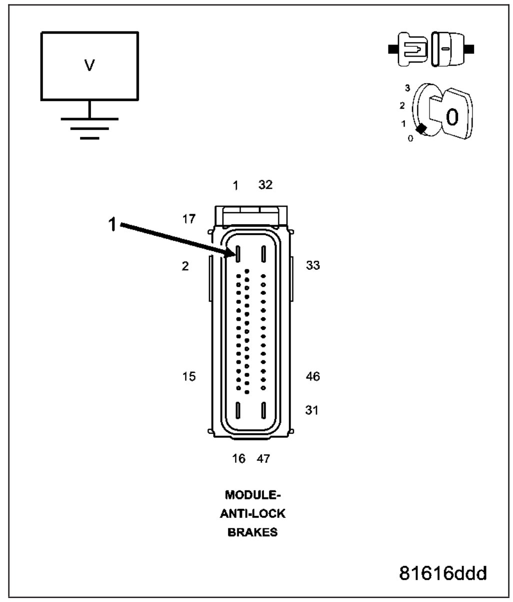
Measure the voltage of the (A107) Fused B(+) circuit in the Anti-Lock Brake Module harness connector.

**Is the voltage above 10 volts?**

**Yes** >> Go To 7

**No** >> Repair the (A107) Fused B(+) circuit for an open.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).




## 7. CHECK THE (Z107) GROUND CIRCUITS FOR AN OPEN

Measure the resistance of the (Z107) Ground circuits between the Anti-Lock Brake Module harness connector and ground

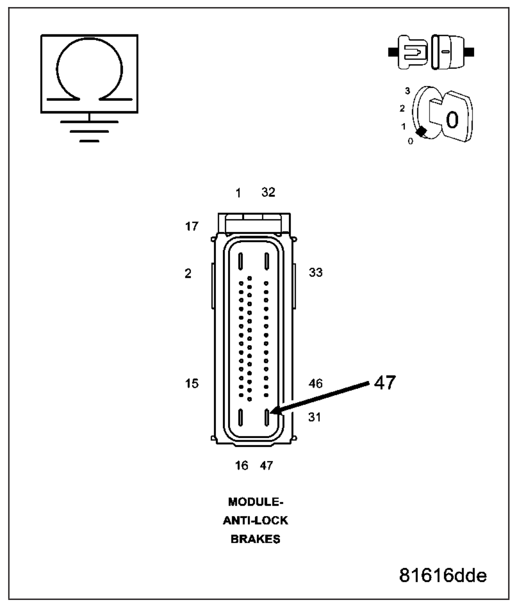
**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the ICU per service information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Repair the high resistance in the affected circuit.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



## C1078–TIRE REVOLUTIONS RANGE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  A comparison between the tire circumference value contained in the EEPROM and the tire circumference value received on the CAN bus. Programmed value for tire size is not within acceptable range.

| Possible Causes |
|---|
| INCORRECT VALUE PROGRAMMED INTO ECM |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. INCORRECT VALUE PROGRAMMED INTO FCM

| TIRE SIZE | BODY STYLE | ENGINE SIZE | SALES CODE | TIRE CIRCUMFERENCE (DEC) |
|---|---|---|---|---|
| P225/75R 16 WRANGLER ST | KJ | ALL | TR7 | |
| P235/70R 16 WRANGLER SR-A | KJ | ALL | TSN | |
| P235/70R 16 WRANGLER SR-A | KJ | ALL | TSZ | |
| P235/65R 17 EAGLE RSA | KJ | ALL | TX7 | |
| P235/65R 17 WRANGLER HP | KJ | ALL | TUP | |

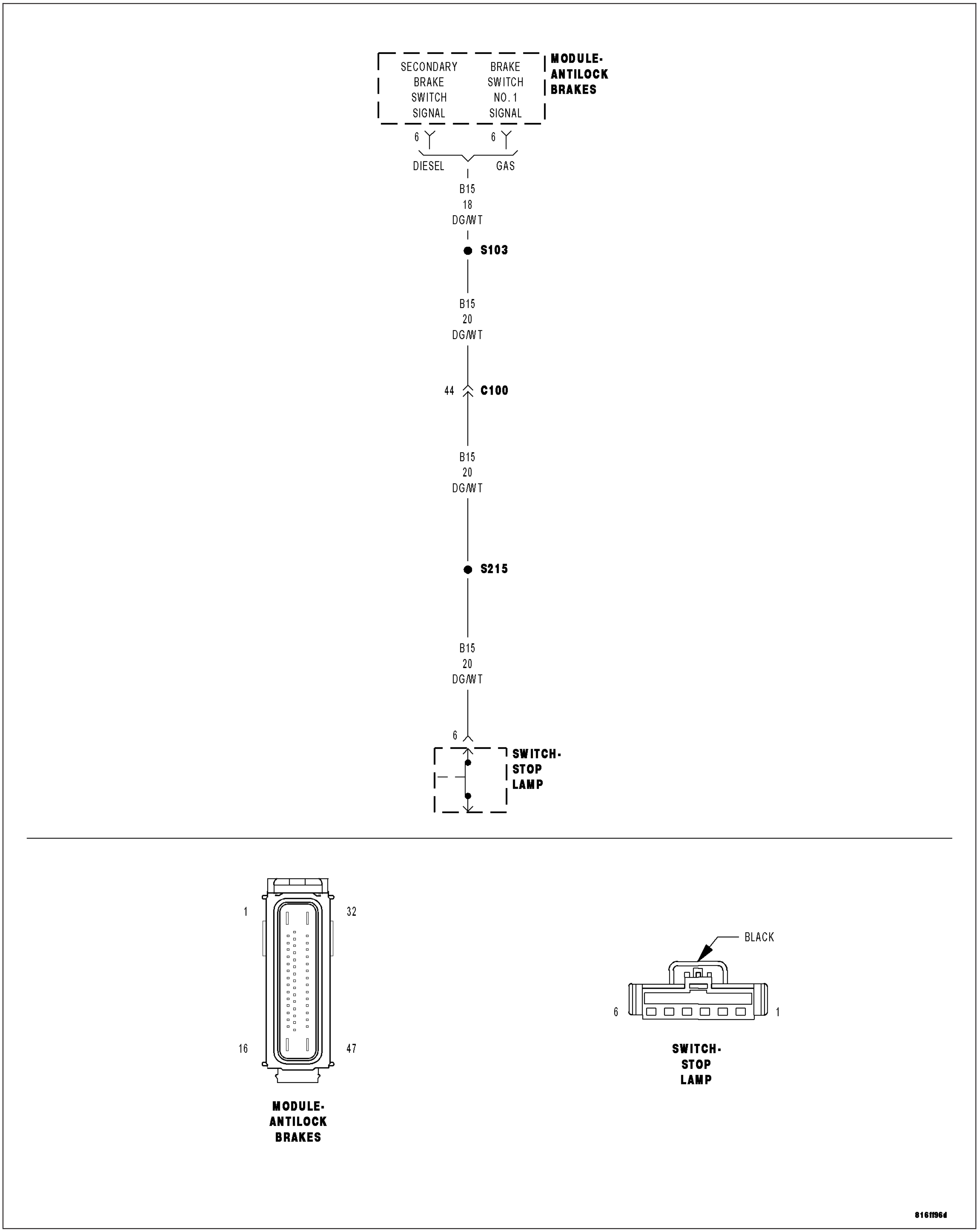
Verify the correct Tire/wheel information is programmed in the FCM.

**Is the correct value programmed in the FCM according to the chart?**

**Yes** >> Test complete.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Program the correct Tire/Wheel information in the FCM.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C107C–BRAKE PEDAL SWITCH 1/2 STUCK




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, but not during first run.
  Or, with low supply voltage.
  Or, if a Pressure Sensor fault is active.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects a mismatch between the Brake Test Signal (BTS) from the Pressure Sensor and the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas).

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| STOP LAMP RELATED DTCs OR SYMPTOMS PRESENT |
| MISADJUSTED PEDAL SWITCH |
| PRESSURE SENSOR OR VOLTAGE RELATED DTCs PRESENT |
| (B15) SECONDARY BRAKE SWITCH SIGNAL CIRCUIT (DIESEL) OR (B15) BRAKE SWITCH NO. 1 SIGNAL CIRCUIT (GAS) OPEN |
| (B15) SECONDARY BRAKE SWITCH SIGNAL CIRCUIT (DIESEL) OR (B15) BRAKE SWITCH NO. 1 SIGNAL CIRCUIT (GAS) SHORT TO GROUND |
| STOP LAMP SWITCH |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Diagnose and repair all Pressure Sensor and Voltage related DTCs and all Stop Lamp related DTCs and symptoms before diagnosing this DTC.**

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

Press and release the brake pedal several times.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Turn the ignition off.

Visually inspect the related wiring harness. Look for any pinched, chafed, pierced, and partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, and corroded terminals.

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. CHECK (B15) SECONDARY BRAKE SWITCH SIGNAL CIRCUIT (DIESEL) OR (B15) BRAKE SWITCH NO. 1 SIGNAL CIRCUIT (GAS) FUNCTION WHILE DEPRESSING & RELEASING THE BRAKE PEDAL

Disconnect the Anti-Lock Brakes Module harness connector.

Turn the ignition on.

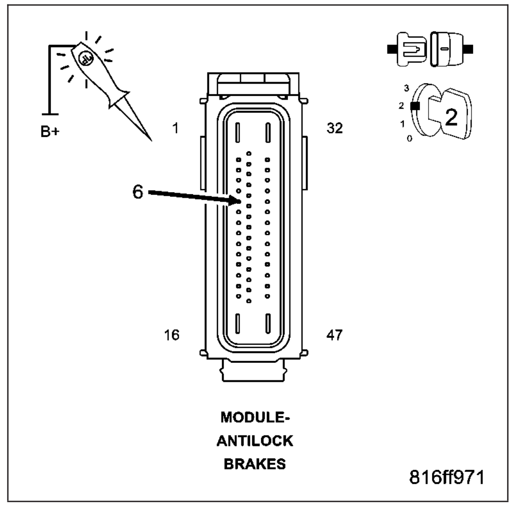
Using a 12-volt test light connected to 12 volts, probe the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas) in the Anti-Lock Brakes Module harness connector.

Depress and release the brake pedal.

**Does the test light illumination toggle from off to on?**

**Yes** >> Go To 7

**No** >> Go To 4




816ff971

## 4. CHECK (B15) SECONDARY BRAKE SWITCH SIGNAL CIRCUIT (DIESEL) OR (B15) BRAKE SWITCH NO. 1 SIGNAL CIRCUIT (GAS) FOR AN OPEN

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

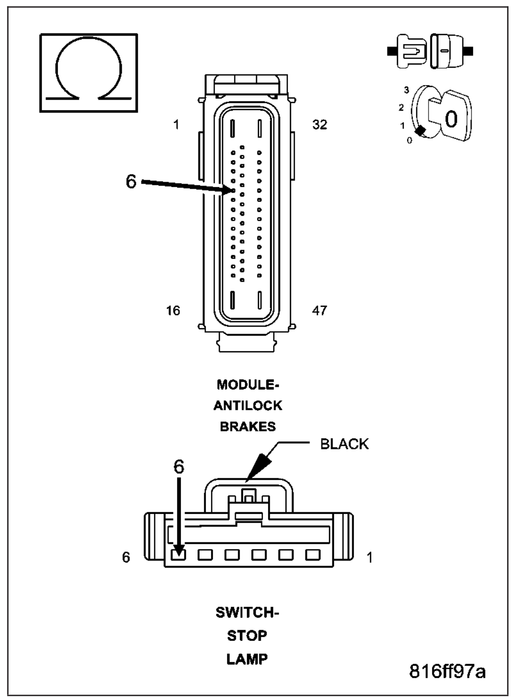
Measure the resistance of the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas) between the Anti-Lock Brakes Module harness connector and the Stop Lamp Switch harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas) for an open.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



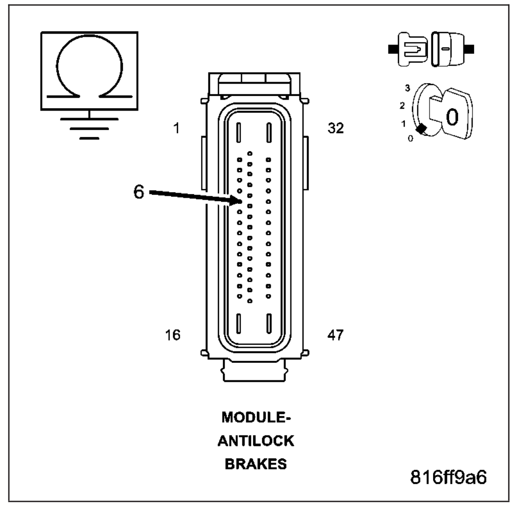

816ff97a

## 5. CHECK (B15) SECONDARY BRAKE SWITCH SIGNAL CIRCUIT (DIESEL) OR (B15) BRAKE SWITCH NO. 1 SIGNAL CIRCUIT (GAS) FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

Measure the resistance of the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas) between ground and the Anti-Lock Brakes Module harness connector.




**Is the resistance below 10k ohms?**

**Yes** >> Repair the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas) for a short to ground.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 6

## 6. CHECK (B15) SECONDARY BRAKE SWITCH SIGNAL CIRCUIT (DIESEL) OR (B15) BRAKE SWITCH NO. 1 SIGNAL CIRCUIT (GAS) FOR A OPEN GROUND Measure the resistance on the (Z940) Ground circuit and ground in the Stop Lamp Switch harness connector.

**Is the resistance below 5 ohms?**

**Yes** >> Replace the Stop Lamp Switch in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Repair the open in the (Z940) Ground circuit.

## 7. CHECK BRAKE PEDAL ADJUSTMENT

- Reconnect the Stop Lamp Switch harness connector.

Using a 12-volt test light connected to 12 volts, backprobe the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas) in the Stop Lamp Switch harness connector.

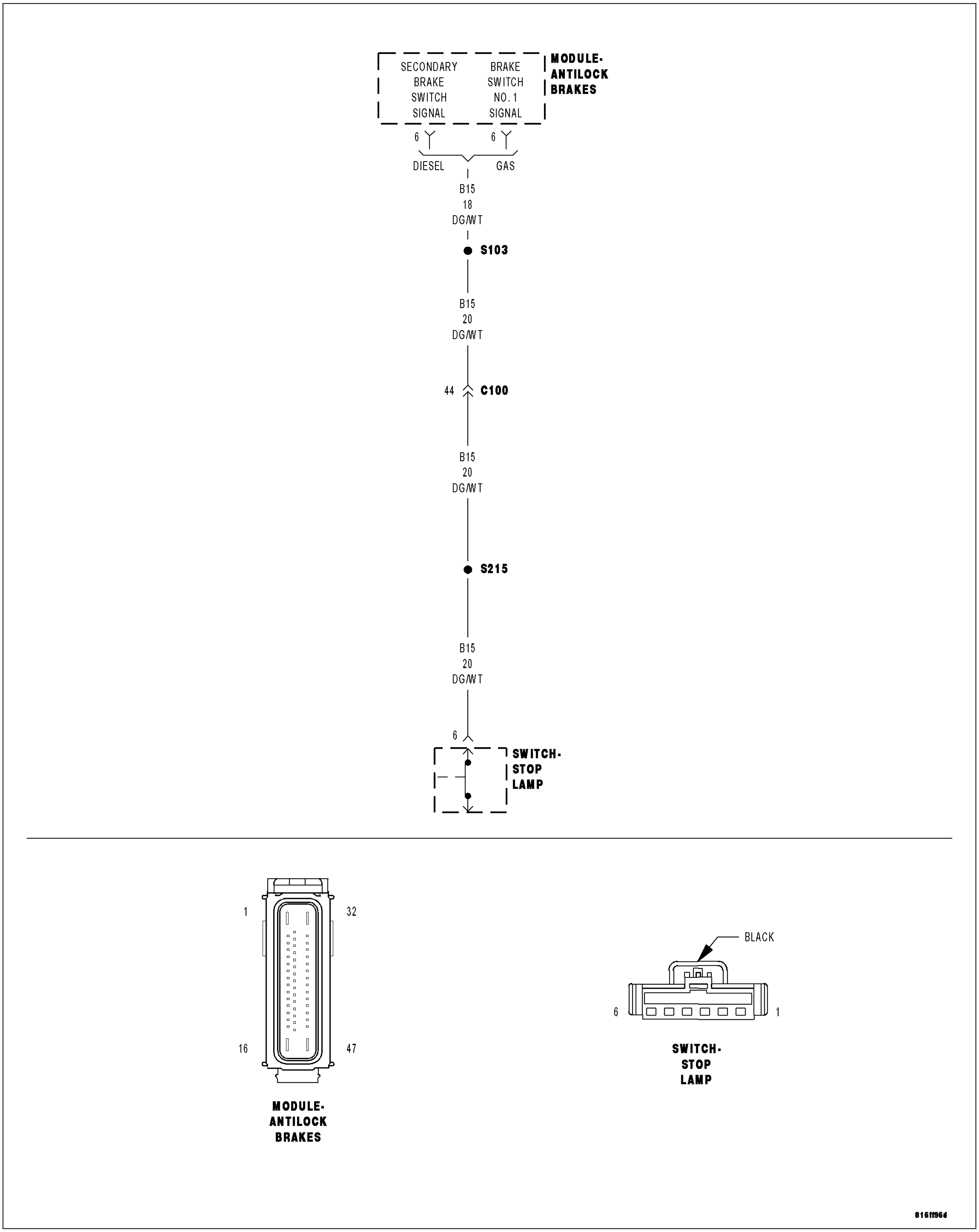
Depress and release the brake pedal.

**Does the test light illumination toggle from off to on within 4–5 mm of brake pedal travel?**

**Yes** >> Replace the Anti-Lock Bakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Stop Lamp Switch in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C107D–BRAKE PEDAL SWITCH 1/2 CORRELATION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the vehicle is driven.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects an implausible signal from the Stop Lamp Switch.

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| STOP LAMP RELATED DTCs OR SYMPTOMS PRESENT (F942 CIRCUIT/FUSE OPEN) |
| MISADJUSTED PEDAL SWITCH |
| (B15) SECONDARY BRAKE SWITCH SIGNAL CIRCUIT (DIESEL) OR (B15) BRAKE SWITCH NO. 1 SIGNAL CIRCUIT (GAS) SHORTED TO GROUND |
| (B15) SECONDARY BRAKE SWITCH SIGNAL CIRCUIT (DIESEL) OR (B15) BRAKE SWITCH NO. 1 SIGNAL CIRCUIT (GAS) OPEN |
| STOP LAMP SWITCH |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Diagnose and repair all Pressure Sensor and Voltage related DTCs and all Stop Lamp related DTCs and symptoms before diagnosing this DTC.**

Turn the ignition on.

With the scan tool, read ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase DTCs.

Cycle the ignition switch.

**WARNING: Ensure brake capability is available before road testing.**

Test drive the vehicle as follows: Drive for more than 6 minutes at a speed greater than 40 km/h (25 m.p.h.) and accelerate to a speed greater than 40 km/h (25 m.p.h.) and then decelerate to a speed lower than 3 km/h (2 m.p.h.) five consecutive times.

Park the vehicle.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Turn the ignition off.

Visually inspect the related wiring harness. Look for any pinched, chafed, pierced, and partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, and corroded terminals.

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. CHECK (B15) SECONDARY BRAKE SWITCH SIGNAL CIRCUIT (DIESEL) OR (B15) BRAKE SWITCH NO. 1 SIGNAL CIRCUIT (GAS) FUNCTION WHILE DEPRESSING & RELEASING THE BRAKE PEDAL

Disconnect the Anti-Lock Brakes Module harness connector.

Turn the ignition on.

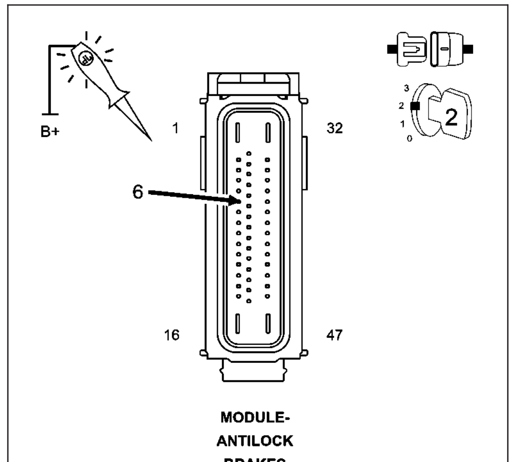
Using a 12-volt test light connected to 12 volts, backprobe the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas) in the Anti-Lock Brakes Module harness connector.

Depress and release the brake pedal.

**Does the test light illumination toggle from off to on?**

**Yes** >> Go To 7

**No** >> Go To 4



816ff971

## 4. CHECK (B15) SECONDARY BRAKE SWITCH SIGNAL CIRCUIT (DIESEL) OR (B15) BRAKE SWITCH NO. 1 SIGNAL CIRCUIT (GAS) FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

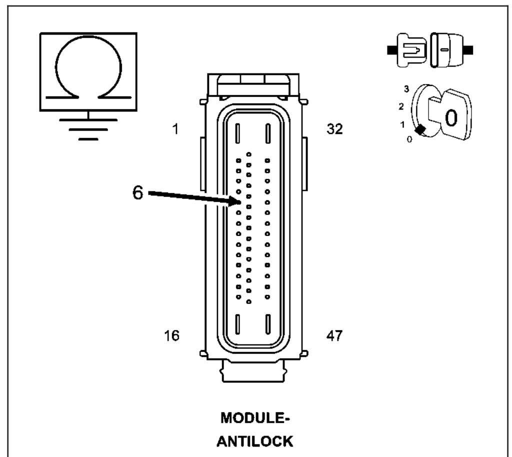
Measure the resistance of the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas) between ground and the Anti-Lock Brakes Module harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas) for a short to ground.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

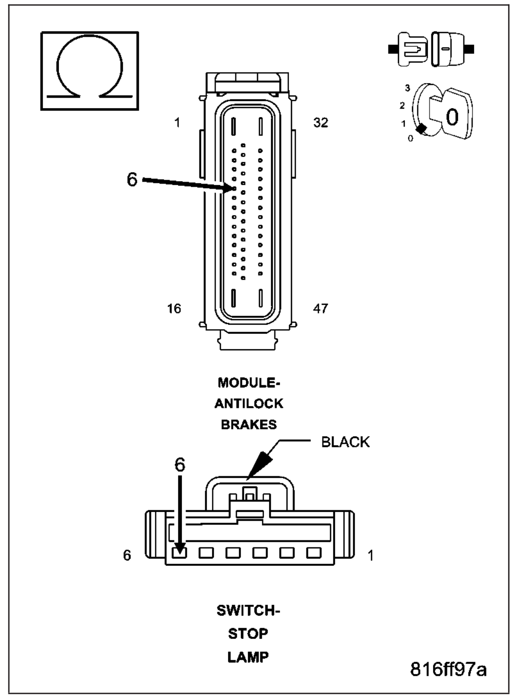
**No** >> Go To 5



816ff9a6

## 5. CHECK (B15) SECONDARY BRAKE SWITCH SIGNAL CIRCUIT (DIESEL) OR (B15) BRAKE SWITCH NO. 1 SIGNAL CIRCUIT (GAS) FOR AN OPEN

Measure the resistance of the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas) between the Anti-Lock Brakes Module harness connector and the Stop Lamp Switch harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas) for an open.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 6. CHECK (B15) SECONDARY BRAKE SWITCH SIGNAL CIRCUIT (DIESEL) OR (B15) BRAKE SWITCH NO. 1 SIGNAL CIRCUIT (GAS) FOR A OPEN GROUND Measure the resistance on the (Z904) Ground circuit and ground in the Stop Lamp Switch harness connector.

**Is the resistance below 5 ohms?**

**Yes** >> Replace the Stop Lamp Switch in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Repair the open in the (Z904) Ground circuit.

## 7. CHECK BRAKE PEDAL ADJUSTMENT

- Reconnect the Stop Lamp Switch harness connector.

Using a 12-volt test light connected to 12 volts, backprobe the (B15) Secondary Brake Switch Signal circuit (Diesel) or the (B15) Brake Switch No. 1 Signal circuit (Gas) in the Stop Lamp Switch harness connector.

Depress and release the brake pedal.

**Does the test light illumination toggle from off to on within 4–5 mm of brake pedal travel?**

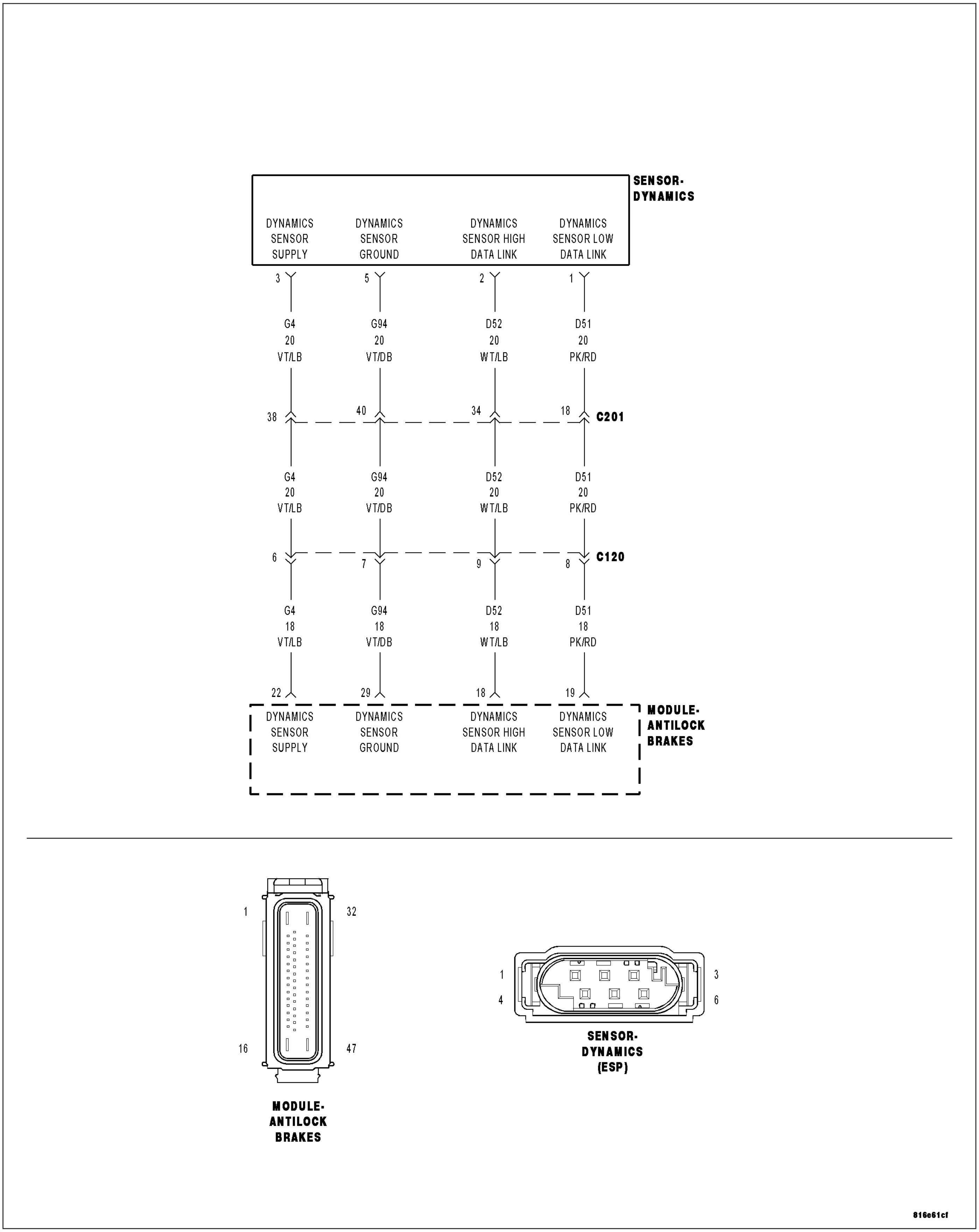
**Yes** >> Replace the Anti-Lock Bakes Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Stop Lamp Switch in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C1210–G SENSOR INPUT CIRCUIT PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Once per loop, but not during active test function of acceleration sensor if the sensor voltage is out of range.
- **Set Condition:**
  Longitudinal acceleration sensor signal is out of range.

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| (G4) DYNAMICS SENSOR SUPPLY HIGH RESISTANCE |
| (G94) GROUND CIRCUIT HIGH RESISTANCE |
| DYNAMICS SENSOR INSTALLATION |
| DYNAMICS SENSOR |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. CHECK FOR A DTC C1210–G SENSOR INPUT CIRCUIT PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Cycle the ignition switch from off to on.

With the scan tool, read and record DTCs.

**Does the scan tool display: C1210–G SENSOR INPUT CIRCUIT PERFORMANCE?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK THE TERMINALS/CONNECTORS/WIRING HARNESS FOR DAMAGE

Check the Steering Angle Sensor installation.

Check all related wiring for bruised, chafed, pierced, or partially broken wires.

Check all related connectors for broken, bent, pushed out, or corroded terminals.

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. (G4) DYNAMICS SENSOR SUPPLY HIGH RESISTANCE

Turn the ignition off.
Disconnect the Dynamics Sensor harness connector.
Turn the ignition on.
Measure the voltage of the (G4) Dynamics Sensor Supply circuit at the Dynamics Sensor harness connector.

**Is the voltage above 10 volts?**

**Yes** >> Go To 4

**No** >> Repair the (G4) Dynamics Sensor Supply circuit for high resistance.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 4. (G94) GROUND CIRCUIT HIGH RESISTANCE

Turn the ignition off.
Measure the resistance between the (G94) Ground circuit and ground.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (G94) Ground circuit for high resistance.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 5. CHECK THE DYNAMICS SENSOR INSTALLATION

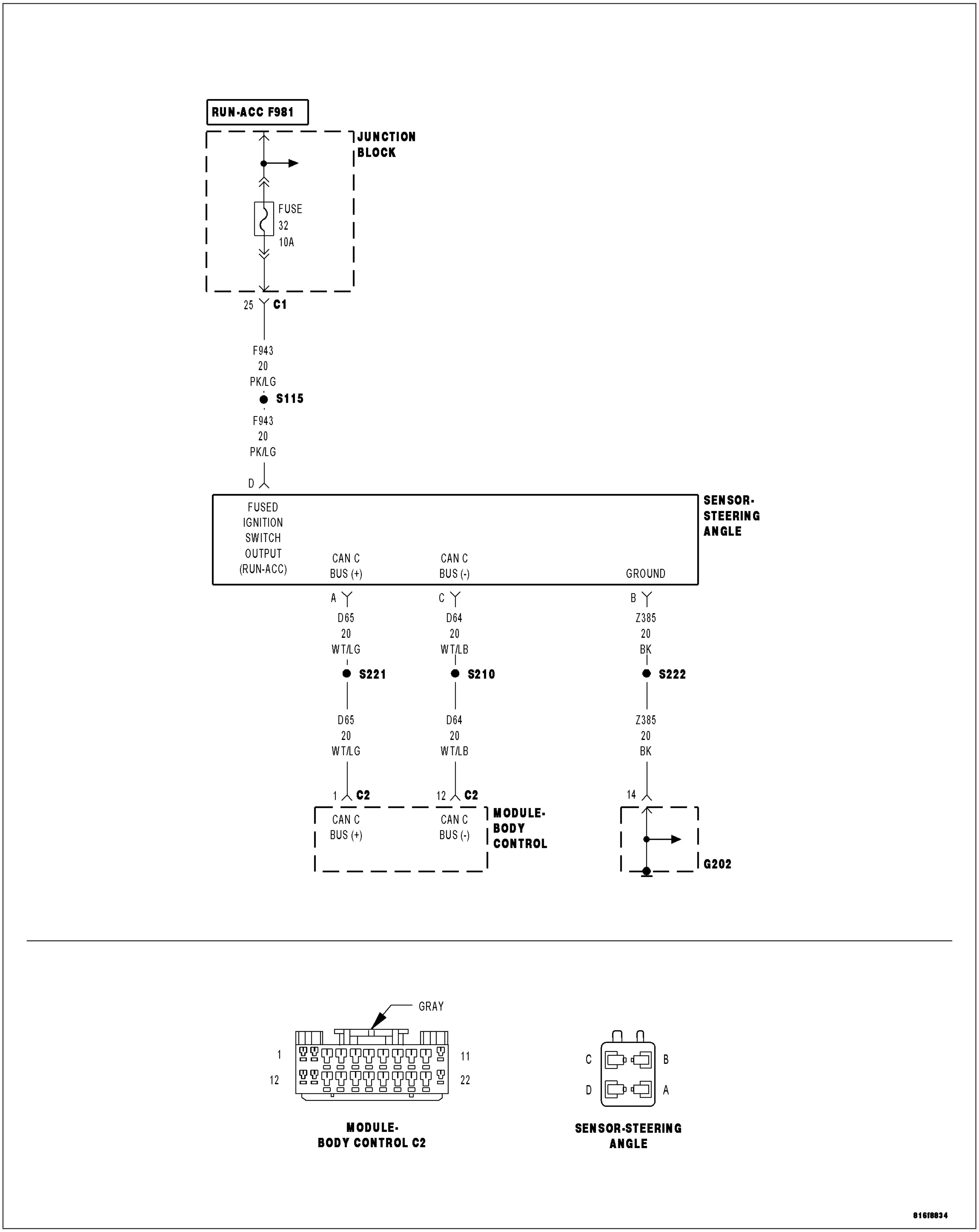
**NOTE: Dynamics Sensor installation and mounting bolt torque is crucial for proper operation.**
Turn the ignition off.
Check the Dynamics Sensor for damaged, modified, and bent mounting brackets.
Check the Dynamics Sensor mounting bolts for a loose or over tightened condition.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Dynamics Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C1219–STEERING ANGLE SENSOR ERRATIC PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Anti-Lock Brake Module detects that the calculated steering wheel angle exceeds what is physically possible.

| Possible Causes |
| --- |
| VEHICLE DAMAGE |
| STEERING COLUMN / INTERMEDIATE SHAFT DAMAGE |
| STEERING ANGLE SENSOR LOOSE |
| STEERING ANGLE SENSOR IMPROPERLY INSTALLED (WRONG MOUNTING POSITION) |
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| (F943) FUSED IGNITION SWITCH OUTPUT (RUN-ACC) CIRCUIT HIGH RESISTANCE |
| (Z385) GROUND CIRCUIT HIGH RESISTANCE |
| STEERING ANGLE SENSOR |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. PERFORM TEST DRIVE & VERIFY DTC IS STILL ACTIVE

Turn the ignition on.

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

**WARNING: Ensure brake capability is available before road testing.**
Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/hr (6 and 15 m.p.h.).

Park the vehicle.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK STEERING ANGLE SENSOR OUTPUT

Start the engine.

Center the steering wheel.

With the scan tool, read the Steering Angle Sensor Position.

**Is the Steering Angle Sensor Position within ±15°?**

**Yes** >> Go To 3

**No** >> Go To 8

## 3. INSPECT VEHICLE, STEERING COLUMN, & INTERMEDIATE SHAFT FOR DAMAGE

**NOTE: If possible, check vehicle repair history for collision damage.**

Turn the ignition off.

Inspect the vehicle for damage causing tracking problems.

Inspect the steering column and intermediate shaft for damage.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK STEERING ANGLE SENSOR INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: Proper Steering Angle Sensor installation is crucial for proper operation.**

Verify that the Steering Angle Sensor are properly installed.

**Is the Steering Angle Sensor properly installed?**

**Yes** >> Go To 5

**No** >> Repair as necessary and clear offsets by initializing ECU with wheels pointing straight ahead.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 5. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: A low voltage condition at the Steering Angle Sensor will cause this DTC to set.**

Check all related wiring for pinched, chafed, pierced, and partially broken wires.

Check all related connectors for broken, bent, pushed out, and corroded terminals.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

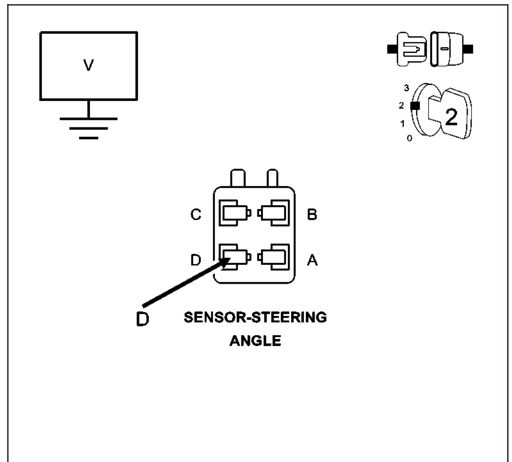
**No** >> Go To 6

## 6. CHECK (F943) FUSED IGNITION SWITCH OUTPUT (RUN-ACC) CIRCUIT FOR HIGH RESISTANCE

Disconnect the Steering Angle Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (F943) Fused Ignition Switch Output (Run-ACC) circuit.



816f8838

**Is the voltage above 11.0 volts?**

**Yes** >> Go To 7

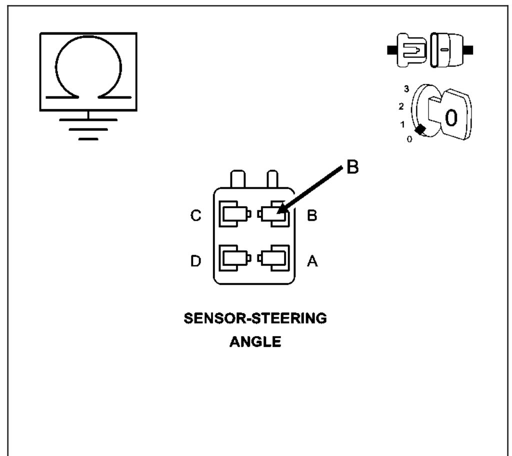
**No** >> Repair the (F943) Fused Ignition Switch Output (Run-ACC) circuit for high resistance.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 7. CHECK (Z385) GROUND CIRCUIT FOR HIGH RESISTANCE

Turn the ignition off.

Measure the resistance of the (Z385) Ground circuit between ground and the Steering Angle Sensor harness connector.



816f8840

**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Steering Angle Sensor in accordance with the Service Information and clear offsets by initializing ECU with wheels pointing straight ahead. Refer to ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Repair the (Z385) Ground circuit for high resistance.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 8. CHECK STEERING ANGLE SENSOR OUTPUT WHILE ROTATING THE STEERING WHEEL

With the scan tool, read the Steering Angle Sensor Position while rotating the steering wheel to the right and then to the left. The Steering Angle Sensor Position should decrease when rotating the steering wheel to the right and increase when rotating the steering wheel to the left.

**Did the steering angle change accordingly?**

**Yes** >> Replace the Anti-Lock Brake Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Steering Angle Sensor in accordance with the Service Information and clear offsets by initializing ECU with wheels pointing straight ahead.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C121A–STEERING ANGLE SENSOR NOT INITIALIZED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During the Drive Test.
- **Set Condition:**
  This DTC may set with DTC C1231–DRIVE TEST: STEERING ANGLE SENSOR due to cycling of ignition several times or entering and exiting diagnostics several times.

Refer to **C1231–DRIVE TEST: STEERING ANGLE SENSOR** in this Section for the diagnostic test procedure.

## C121C-TORQUE REQUEST SIGNAL DENIED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Powertrain Control Module indicates, for an extended period of time, that engine management relevant for Automatic Yaw Control/Traction Control System control can not be accomplished.

| Possible Causes |
| --- |
| ANTI-LOCK BRAKE MODULE |
| POWERTRAIN CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR A DTC C121C-TORQUE REQUEST SIGNAL DENIED

**NOTE: This DTC must be active for the results of this test to be valid and this DTC may set while driving under severe load conditions.**

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Cycle the ignition switch from off to on.

Start Engine.

With the scan tool, read and record DTCs.

**Does the scan tool display: C121C-TORQUE REQUEST SIGNAL DENIED?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK THE POWERTRAIN DTCS

With the scan tool, read and record Powertrain DTCs.

**Were any Powertrain related DTCs found?**

**Yes** >> Repair the Powertrain System in accordance with the Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

### 3. ESP TORQUE REQUEST SIGNAL

Engine started.

With the scan tool, read the Allow ESP Torque Request status bit.

**Was the Allow ESP Torque Request showing NOT set?**

**Yes** >> Replace the Powertrain Module in accordance with the Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace the Anti-Lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C121D–BRAKE PRESSURE SENSOR CIRCUIT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module indicates that the Brake Pressure Sensor Signal is out of range.

| Possible Causes |
|---|
| ANTI-LOCK BRAKE MODULE |
| INTEGRATED CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR A DTC C121D-BRAKE PRESSURE SENSOR CIRCUIT

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Start the engine.

Depress and release the brake pedal.

With the scan tool, read and record DTCs.

**Does the scan tool display: C121D-BRAKE PRESSURE SENSOR CIRCUIT?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. RECHECK FOR A DTC C121D-BRAKE PRESSURE SENSOR CIRCUIT

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Start the engine.

Depress and release the brake pedal.

With the scan tool, read and record DTCs.

**Does the scan tool display: C121D-BRAKE PRESSURE SENSOR CIRCUIT?**

**Yes** >> Replace the ICU in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test complete

## C121E-BRAKE PRESSURE SENSOR COMPARATIVE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module indicates that the Brake Pressure Sensor Signal is out of range.

| Possible Causes |
| --- |
| ANTI-LOCK BRAKE MODULE |
| INTEGRATED CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR A DTC C121E-BRAKE PRESSURE SENSOR COMPARATIVE PERFORMANCE

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Start the engine.

Depress and release the brake pedal.

With the scan tool, read and record DTCs.

**Does the scan tool display: C121E-BRAKE PRESSURE SENSOR COMPARATIVE PERFORMANCE?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. RECHECK FOR A DTC C121E-BRAKE PRESSURE SENSOR COMPARATIVE PERFORMANCE

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Start the engine.

Depress and release the brake pedal.

With the scan tool, read and record DTCs.

**Does the scan tool display: C121E-BRAKE PRESSURE SENSOR COMPARATIVE PERFORMANCE?**

**Yes** >> Replace the ICU in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test complete

## C1221-BRAKE PRESSURE SENSOR/ACCEL PEDAL POSITION SENSOR CORRELATION

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module indicates that the Brake Pressure Sensor output signal is not plausible.

| Possible Causes |
|---|
| AIR IN BRAKE SYSTEM / WORN MECHANICAL COMPONENTS |
| BRAKE SWITCH SIGNAL OPEN |
| BRAKE PRESSURE SENSOR |
| INTEGRATED CONTROL MODULE |

### Diagnostic Test

#### 1. CHECK FOR A DTC C1221-BRAKE PRESSURE SENSOR/ACCEL PEDAL POSITION SENSOR CORRELATION

Turn the ignition on.
With the scan tool, read and record DTCs.
With the scan tool, read and record Freeze Frame information.
With the scan tool, erase DTCs.
Start the engine.
Depress and release the brake pedal.
With the scan tool, read and record DTCs.

**Does the scan tool display: C1221-BRAKE PRESSURE SENSOR/ACCEL PEDAL POSITION SENSOR CORRELATION?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

#### 2. CHECK BRAKE SWITCH

With the scan tool look at the Brake Switch Signal.
Apply the brakes on and off while checking for a Brake Switch Signal change.

**Did the Brake Switch Signal change?**

**Yes** >> Go To 3

**No** >> Repair as needed.

#### 3. CHECK BRAKE PRESSURE SENSOR

With the scan tool look at Pressure Sensor Signal and the Brake Switch Signal.
With the brakes not applied the Pressure Sensor should read ± 15 bar.
Apply the brakes the Pressure Sensor should read above 15 bar.

**Did Brake Pressure Sensor increase above 15 bar?**

**Yes** >> Replace the Integrated Control Unit in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK FOR AIR IN BRAKE SYSTEM

**NOTE: Before continuing the brake system must be bled to verify there is no air in the brake system.**

Turn ignition off.

Bleed brake system.

Check worn mechanical components.

**Was there any air in the brake system or worn mechanical components?**

**Yes** >> Repair as needed.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Integrated Control Unit in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C1231-DRIVE TEST: STEERING ANGLE SENSOR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During the Drive Test.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects implausible Steering Angle Sensor data.

| Possible Causes |
|---|
| STEERING ANGLE SENSOR INSTALLATION |
| STEERING ANGLE SENSOR |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. CHECK FOR A DTC C1231–DRIVE TEST: STEERING ANGLE SENSOR

**NOTE: This DTC must be active for the results of this test to be valid.**

**NOTE: If any of the following DTCs are present they must be repaired before continuing.**

DTC C1219-STEERING ANGLE SENSOR ERRATIC PERFORMANCE

DTC C121A-STEERING ANGLE SENSOR NOT INITIALIZED

DTC C123F-STEERING ANGLE SENSOR COMPARATIVE PERFORMANCE

DTC C1240-STEERING ANGLE SENSOR ANGLE OVERTRAVEL PERFORMANCE

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

Perform ECU initialization with drive test. Refer to Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Start the engine.

With the scan tool, read and record DTCs.

**Does the scan tool display: C1231–DRIVE TEST: STEERING ANGLE SENSOR?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. VERIFY THAT THE STEERING ANGLE SENSOR IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the Steering Angle Sensor is active on the bus.

**Is the Steering Angle Sensor active on the bus?**

**Yes** >> Go To 3

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

## 3. CHECK STEERING ANGLE

Turn steering wheel so wheels point in a straight ahead position.

With scan tool check steering angle.

**Is the Steering Angle reading within ±15 degrees?**

**Yes** >> Go To 4

**No** >> Go To 5

## 4. CHECK STEERING ANGLE CHANGE

Turn steering wheel so wheels point in a straight ahead position.

With scan tool check steering angle.

Rotate steering wheel to the right and the degrees will decrease and rotating steering wheel to the left the degrees will increase.

**Did the steering angle change accordingly?**

**Yes** >> Replace the Anti-Lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Steering Angle Sensor in accordance with the Service Information and clear offsets by initializing ECU with wheels pointing straight ahead.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 5. CHECK STEERING ANGLE SENSOR INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: Proper Steering Angle Sensor installation is crucial for proper operation.**

Turn the ignition off.

Verify that the Steering Angle Sensor is properly installed. Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION.

**Is the Steering Angle Sensor properly installed?**

**Yes** >> Replace the Anti-Lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Repair as necessary and clear offsets by initializing ECU with wheels pointing straight ahead.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C1232–DRIVE TEST: PRESSURE SENSOR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During the Drive Test.
- **Set Condition:**
  If the Pressure Sensor fails to activate.

| Possible Causes |
|---|
| HYDRAULIC / BRAKE SYSTEM COMPONENT INSTALLATION |
| INTEGRATED CONTROL UNIT |
| PRESSURE SENSOR (HYDRAULIC CONTROL UNIT) |

## Diagnostic Test

### 1. CHECK FOR A DTC C1232–DRIVE TEST: PRESSURE SENSOR

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

Perform ECU initialization with drive test. Refer to ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Start the engine.

With the scan tool, read and record DTCs.

**Does the scan tool display: C1232–DRIVE TEST: PRESSURE SENSOR?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK HYDRAULIC SYSTEM & BRAKE SYSTEM COMPONENT INSTALLATION & FUNCTION

Verify that the Anti-Lock Brakes Module and Hydraulic Control Unit are properly installed.

Verify that the hydraulic system is properly filled and bled.

Verify that the brake system components are installed and functioning properly.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Clean contacts in HCU first if problem reoccurs replace the Integrated Control Unit in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C1234–DRIVE TEST: SENSOR CLUSTER INSTALLATION

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During the Drive Test.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects implausible Dynamics Sensor data.

| Possible Causes |
| --- |
| DYNAMICS SENSOR INSTALLATION |
| DYNAMICS SENSOR |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. CHECK FOR A DTC C1234–DRIVE TEST: SENSOR CLUSTER INSTALLATION

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

Perform ECU initialization with drive test. Refer to ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Start the engine.

With the scan tool, read and record DTCs.

**Does the scan tool display: C1234–DRIVE TEST: SENSOR CLUSTER INSTALLATION?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION diagnostic procedure.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK THE DYNAMICS SENSOR INSTALLATION

**NOTE: Dynamics Sensor installation and mounting bolt torque is crucial for proper operation.**

Turn the ignition off.

Check the Dynamics Sensor for damaged, modified, and bent mounting brackets.

Check the Dynamics Sensor mounting bolts for a loose or over tightened condition.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Dynamics Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C1238-DRIVE TEST: UNSUCCESSFUL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During the Drive Test.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects a fault with the Steering Angle Sensor, the Pressure Sensor, or the Dynamics Sensor.

| Possible Causes |
|---|
| STEERING ANGLE SENSOR |
| PRESSURE SENSOR |
| DYNAMICS SENSOR |
| ANTI-LOCK BRAKES MODULE |

### Diagnostic Test

1. **DIAGNOSE & REPAIR ALL DTCs**

**Repair**

Diagnose and repair all DTCs.

## C1239–EMISSIONS ROLLS TEST ACTIVE

For a complete wiring diagram **Refer to Section 8W**.

### Theory of Operation

The functional effects are that the output signal for all wheel speeds mimic the wheel with the highest wheel speed.

This DTC sets when the Emissions Rolls Test is active.

Close out the Emissions Rolls Test though the FCM.

## C123A–ESP SYSTEM SENSORS CALIBRATION

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Once per ignition cycle.
- **Set Condition:**
  If the calculated checksum does not match the stored checksum.

| Possible Causes |
|---|
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. INITIALIZE ANTI-LOCK BRAKES MODULE

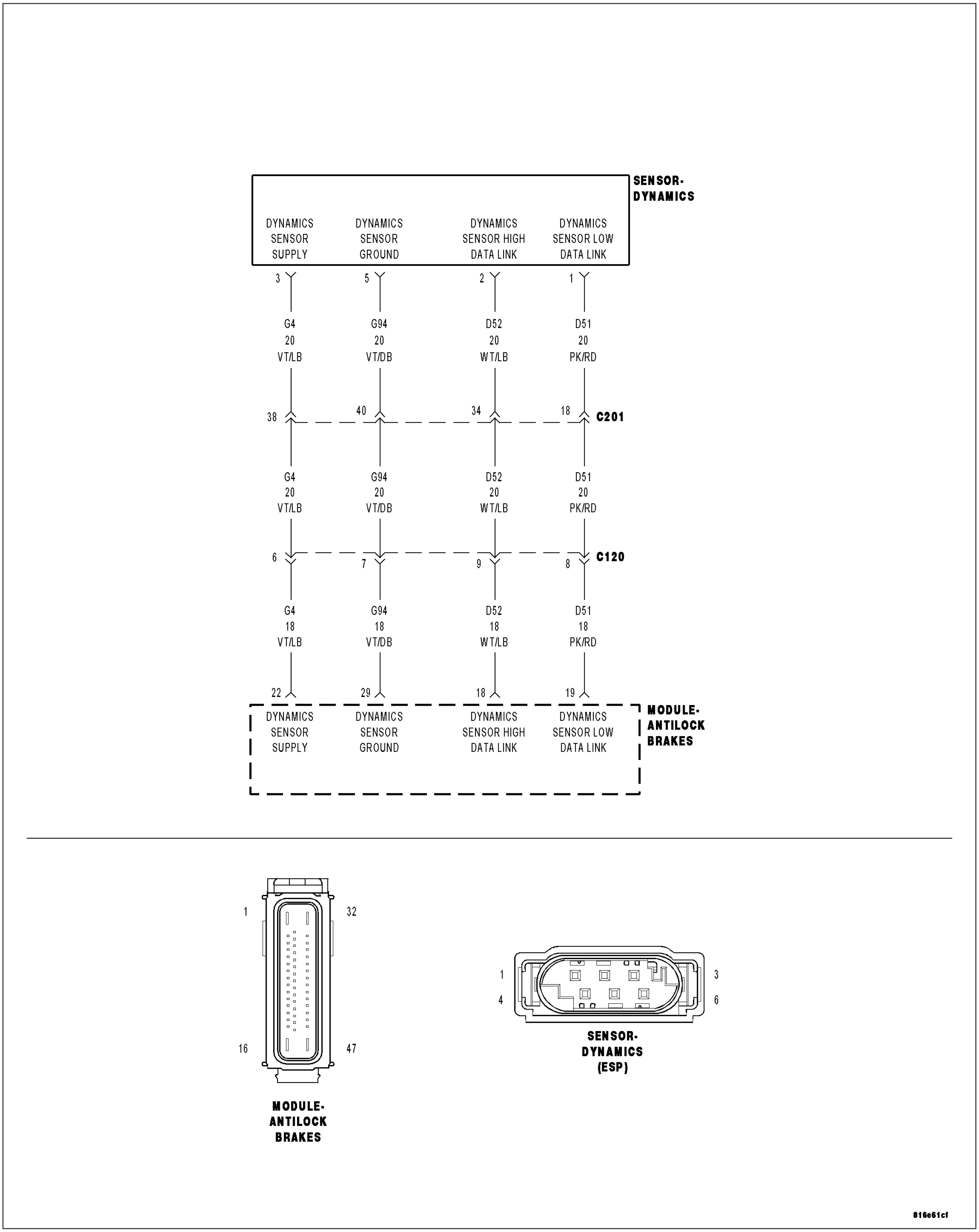
Initialize ECU refer to ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**Does this DTC reset?**

**Yes** >> Replace the Anti-Lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test complete.

## C123B–ESP SYSTEM CONTROL TOO LONG




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module indicates ESP control lasting longer the 15 seconds.

| Possible Causes |
|---|
| HYDRAULIC/BRAKE ISSUE |
| DYNAMICS SENSOR |
| INTEGRATED CONTROL MODULE |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: If other DTC's are set they must be repaired before continuing. This DTC must be active for the results of this test to be valid and this DTC may set while driving under excessive driving conditions.**

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

**WARNING: Ensure brake capability is available before road testing.**

Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 20 km/hr (6 and 12 m.p.h.).

Park the vehicle.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK HYDRAULIC SYSTEM & BRAKE SYSTEM COMPONENT INSTALLATION & FUNCTION

Verify that the Anti-Lock Brakes Module and Hydraulic Control Unit are properly installed.

Verify that the hydraulic system is properly filled and bled.

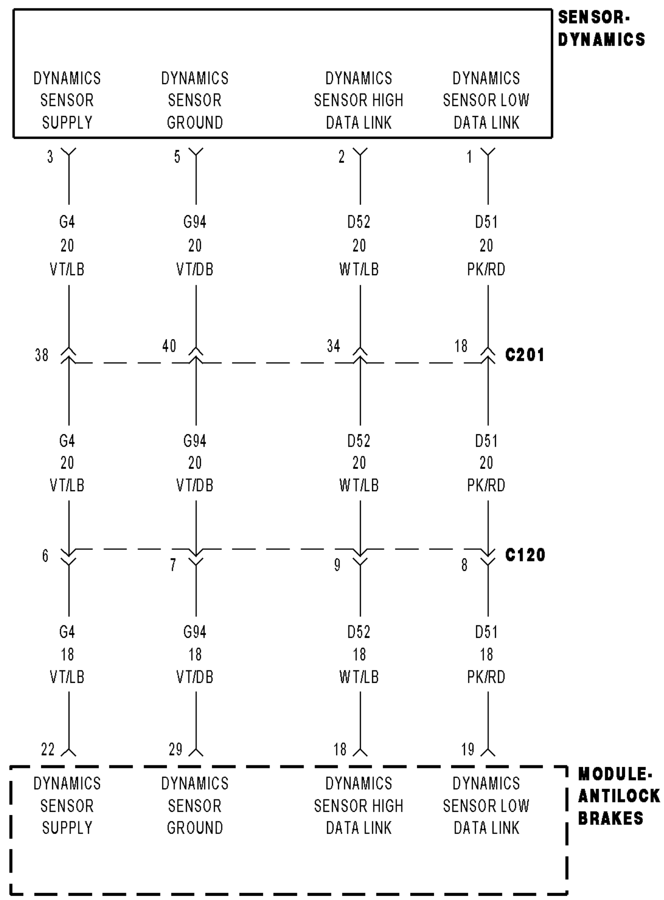
Verify that the brake system components are installed and functioning properly.

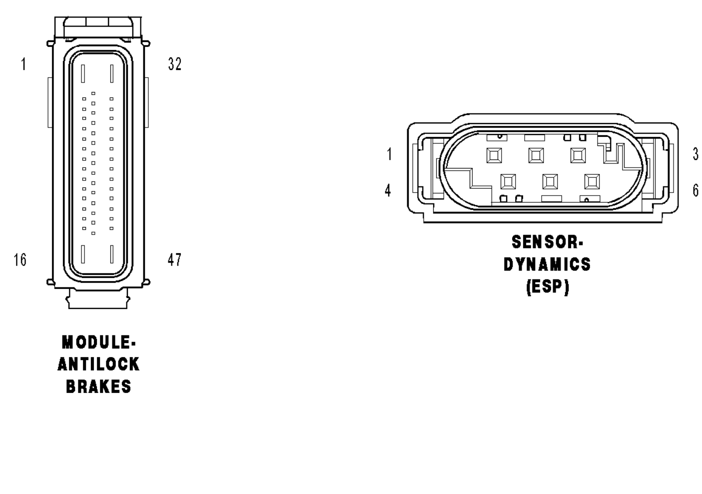
**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Dynamics Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C123C–DYNAMICS SENSOR MOUNTING/INSTALLATION PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With vehicle speed above 11 km/h (7 m.p.h.), but not if the sensor signal is invalid.
  Or, during skidding.
  Or, when driving in reverse.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects implausible Dynamics Sensor values.

| Possible Causes |
| --- |
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| DYNAMICS SENSOR INSTALLATION |
| DYNAMICS SENSOR |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: If present, diagnose and repair DTC C2114–DYNAMICS SENSOR SUPPLY VOLTAGE LOW or DTC C2115–DYNAMICS SENSOR SUPPLY VOLTAGE HIGH before diagnosing this DTC.**

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

**WARNING: Ensure brake capability is available before road testing.**

Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 20 km/hr (6 and 12 m.p.h.).

Park the vehicle.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK THE DYNAMICS SENSOR INSTALLATION

**NOTE: Dynamics Sensor installation and mounting bolt torque is crucial for proper operation.**

Turn the ignition off.

Check the Dynamics Sensor for damaged, modified, and bent mounting brackets.

Check the Dynamics Sensor mounting bolts for a loose or over tightened condition.

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Visually inspect the related wiring harness. Look for any pinched, chafed, pierced, and partially broken wires.
Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, and corroded terminals.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Dynamics Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C123F–STEERING ANGLE SENSOR COMPARATIVE PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on, but not if a checksum failure of the stored offset values is detected.
  Or, a CAN time-out failure is detected.
  Or, a failure is detected by the Steering Angle Sensor.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects that either the calculated steering wheel angle offset or the steering wheel angle signal measured output is out of range.

| Possible Causes |
|---|
| VEHICLE DAMAGE |
| STEERING COLUMN / INTERMEDIATE SHAFT DAMAGE |
| STEERING WHEEL ALIGNMENT |
| STEERING ANGLE SENSOR LOOSE |
| STEERING ANGLE SENSOR IMPROPERLY INSTALLED (WRONG MOUNTING POSITION) |
| STEERING ANGLE SENSOR |
| ANTI-LOCK BRAKE MODULE |

## Diagnostic Test

### 1. PERFORM TEST DRIVE & VERIFY DTC IS STILL ACTIVE

**NOTE: If present, diagnose and repair DTC C1219-STEERING ANGLE SENSOR ERRATIC PERFORMANCE, C121A-STEERING ANGLE SENSOR NOT INITIALIZED, or C1240-STEERING ANGLE SENSOR OVERTRAVEL PERFORMANCE before diagnosing this DTC.**

Turn the ignition on.

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

**WARNING: To avoid personal injury or death, check brake capability is available before road testing.**

Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/hr (6 and 15 m.p.h.).

Park the vehicle.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. INSPECT VEHICLE, STEERING COLUMN, & INTERMEDIATE SHAFT FOR DAMAGE

**NOTE: If possible, check vehicle repair history for collision damage.**

Turn the ignition off.

Inspect the vehicle for damage causing tracking problems or steering wheel misalignment.

Inspect the steering column and intermediate shaft for damage.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. CHECK STEERING ANGLE SENSOR OUTPUT

Start the engine.

Turn the steering wheel so wheels point in a straight ahead position.

With the scan tool, read the Steering Angle Sensor position.

**Is the Steering Angle Sensor Position within ± 15° degrees?**

**Yes** >> Go To 5

**No** >> Go To 4

## 4. CHECK STEERING ANGLE SENSOR INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: Proper Steering Angle Sensor installation is crucial for proper operation.**

Verify that the Steering Angle Sensor are properly installed.

**Is the Steering Angle Sensor properly installed?**

**Yes** >> Go To 5

**No** >> Repair as necessary and clear offsets by initializing ECU with wheels pointing straight ahead.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 5. RE-INITIALIZE THE ESP MODULE

Perform ECU initialization with drive test to clear offsets. Refer to Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**Is DTC C123F–STEERING ANGLE SENSOR COMPARATIVE PERFORMANCE still active?**

**Yes** >> Go To 6

**No** >> Sensor was probably loose or calibrated with wheels not centered to vehicle. Test complete.
Perform the ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 6. CHECK STEERING ANGLE SENSOR OUTPUT WHILE ROTATING THE STEERING WHEEL

With the scan tool, read the Steering Angle Sensor position while rotating the steering wheel to the right and then to the left. The Steering Angle Sensor position should decrease when rotating the steering wheel to the right and increase when rotating the steering wheel to the left.

**Did the steering angle change accordingly?**

**Yes** >> Replace the Anti-Lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Steering Angle Sensor in accordance with the Service Information and clear offsets by initializing ECU with wheels pointing straight ahead.
Perform the ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C1240–STEERING ANGLE SENSOR OVERTRAVEL PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on, but not if a CAN time out failure is detected.
  Or, if a fault is detected by the Steering Angle Sensor.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects that the absolute value of the measured steering wheel angle is greater than 720 degrees.

| Possible Causes |
|---|
| VEHICLE DAMAGE |
| STEERING COLUMN / INTERMEDIATE SHAFT DAMAGE |
| STEERING WHEEL ALIGNMENT |
| STEERING ANGLE SENSOR LOOSE |
| STEERING ANGLE SENSOR IMPROPERLY INSTALLED (WRONG MOUNTING POSITION) |
| STEERING ANGLE SENSOR |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. PERFORM TEST DRIVE & VERIFY DTC IS STILL ACTIVE

Turn the ignition on.

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

**WARNING: To avoid personal injury or death, check brake capability is available before road testing.**
Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/hr (6 and 15 m.p.h.).

Park the vehicle.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. INSPECT VEHICLE, STEERING COLUMN, & INTERMEDIATE SHAFT FOR DAMAGE

**NOTE: If possible, check vehicle repair history for collision damage.**
Turn the ignition off.

Inspect the vehicle for damage causing tracking problems or steering wheel misalignment.

Inspect the steering column and intermediate shaft for damage.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. CHECK STEERING ANGLE CHANGE

Turn steering wheel so wheels point in a straight ahead position.

With scan tool check steering angle if reading travels to 720 degrees whiling rotating wheel from lock to lock.

**NOTE: Sensor damage can occur if wheel is turned over 720 degrees.**

Rotate steering wheel to the right and the degrees will decrease and rotating steering wheel to the left the degrees will increase.

**Did the steering angle change accordingly and display less the 720 degrees from lock to lock?**

**Yes** >> Go To 4

**No** >> Replace the Steering Angle Sensor in accordance with the Service Information and clear offsets by initializing ECU with wheels pointing straight ahead.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 4. CHECK STEERING ANGLE SENSOR INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: Proper Steering Angle Sensor installation is crucial for proper operation.**

Verify that the Steering Angle Sensor are properly installed. Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION.

**Is the Steering Angle Sensor properly installed?**

**Yes** >> Replace the Steering Angle Sensor and clear offsets by initializing ECU with wheels pointing straight ahead, in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Repair as necessary and clear offsets by initializing ECU with wheels pointing straight ahead.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C1242–G SENSOR INPUT SIGNAL PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously, with ignition on, until vehicle speed exceeds 20 km/h (12.4 m.p.h.) for the first time, but not if the sensor voltage is out of range,
  Or, during diagnostic mode.
  Or, if the monitoring was inhibited by a corresponding diagnostics command.
  Or, if the vehicle speed has exceeded 20 km/h (12.4 m.p.h.) during the actual ignition cycle.
  Or, if at least one over spinning wheel is detected.
  Or, if one of the control functions is active.
- **Set Condition:**
  If the measured acceleration signal is higher than 0.8 g and longer than the specified detection time.

| Possible Causes |
|---|
| DYNAMICS SENSOR INSTALLATION |
| DYNAMICS SENSOR OR ANTI-LOCK BRAKE MODULE |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

**WARNING: To avoid personal injury or death, check brake capability is available before road testing.**
Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 20 km/hr (6 and 12 m.p.h.).

Park the vehicle.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK THE DYNAMICS SENSOR INSTALLATION

**NOTE: Dynamics Sensor installation and mounting bolt torque is crucial for proper operation.**
Turn the ignition off.

Check the Dynamics Sensor for damaged, modified, and bent mounting brackets.

Check the Dynamics Sensor mounting bolts for a loose or over tightened condition.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >>

**NOTE: Vehicles without a Dynamics Sensor replace Anti-Lock Brake Module.**
**Replace the Dynamics Sensor or Anti-Lock Brake Module in accordance with the Service Information.**
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C1243–G SENSOR NOT INITIALIZED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Once after ignition on.
- **Set Condition:**
  If the stored zero point calibration value of the longitudinal acceleration sensor is invalid.

| Possible Causes |
| --- |
| DYNAMICS SENSOR NOT CALIBRATED |
| DYNAMICS SENSOR |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. PERFORM ECU INITIALIZATION

Turn the ignition on.

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

**WARNING: To avoid personal injury or death, check brake capability is available before road testing.**
Perform ECU initialization with drive test refer to ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**NOTE: The ECU Initialization process must include driving the vehicle into a 90° turn.**
Park the vehicle.

>> Go To 2

### 2. VERIFY IF DTC IS STILL ACTIVE

Cycle the ignition switch.

**WARNING: To avoid personal injury or death, check brake capability is available before road testing.**
Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/hr (6 and 15 m.p.h.).

Park the vehicle.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >>

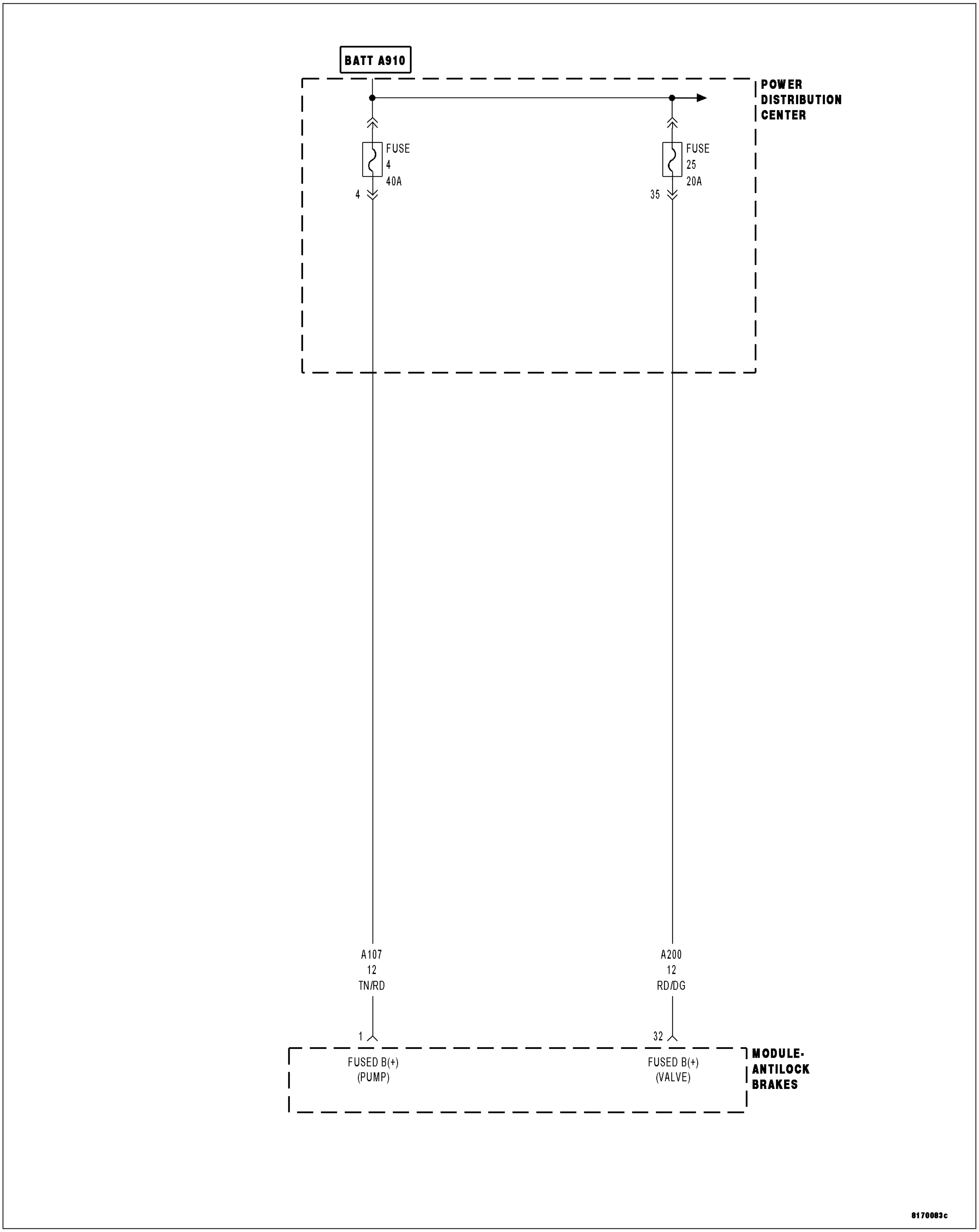
**NOTE: Vehicles without a Dynamics Sensor replace Anti-Lock Brake Module.**
**Replace the Dynamics Sensor or Anti-Lock Brake Module in accordance with the Service Information.**

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## C2100–BATTERY VOLTAGE LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects system voltage is below 9.5 volts.

| Possible Causes |
| --- |
| ECM OR PCM DTCs PRESENT |
| VEHICLE BATTERY / CHARGING SYSTEM |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. DTC'S IN THE PCM

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, read and record DTCs from the PCM.

With the scan tool, read and record Freeze Fame information.

With the scan tool, erase DTCs.

Start the engine.

With the scan tool, read and record DTCs.

With the scan tool read DTCs from the PCM.

**Are any charging system codes present?**

**Yes** >> Repair the charging system DTC in the PCM.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 2

### 2. CHARGING SYSTEM FAILURE

Start the engine.

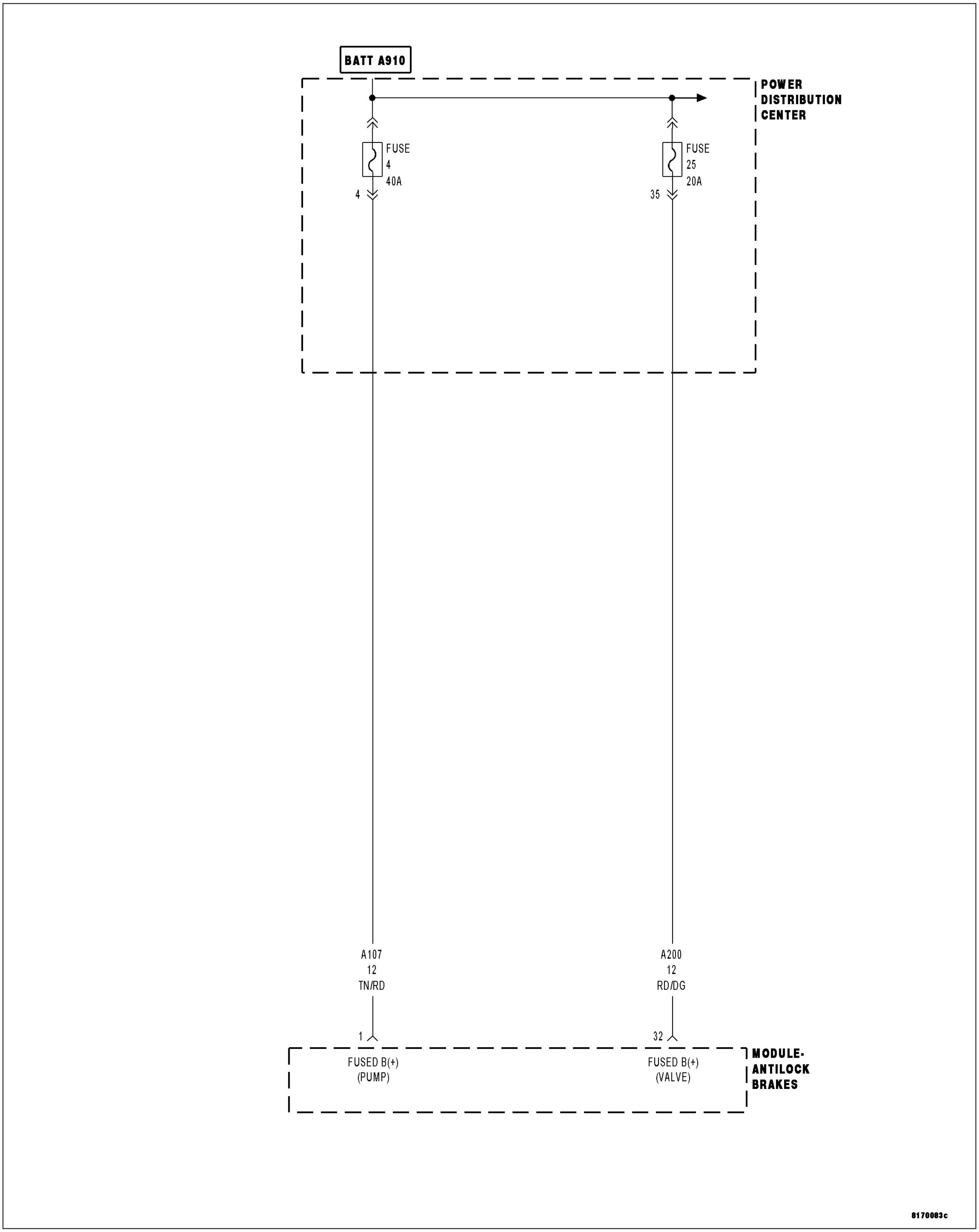
Connect voltmeter to vehicle battery.

**Is the vehicle battery voltage under 10 volts?**

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

**Yes** >> Repair the charging system per service information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C2101–BATTERY VOLTAGE HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects system voltage is above 17 volts.

| Possible Causes |
|---|
| ECM/PCM DTCs PRESENT |
| VEHICLE BATTERY / CHARGING SYSTEM |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1.

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, read and record DTCs from the ECM/PCM.

With the scan tool, read and record Freeze Fame information.

With the scan tool, erase DTC's.

Start the engine.

With the scan tool, read and record DTCs.

With the scan tool read DTCs from the PCM.

**Are any charging system codes present?**

**Yes** >> Repair the charging system DTC in the ECM/PCM.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

**No** >> Go To 2

### 2. CHARGING SYSTEM FAILURE

Start the engine.

Connect voltmeter to vehicle battery.

**Is the vehicle battery voltage over 16.8 volts?**

**No** >> Go To 3

**Yes** >> Repair the charging system per service information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

### 3. CHARGING POWER SUPPLY VOLTAGE

With a scan tool read Power Supply Voltage.

**Is Power Supply Voltage over 16.8 volts?**

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C2111–SENSOR SUPPLY 1 VOLTAGE CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects that the supply voltage for external analog sensors is out of range.

| Possible Causes |
|---|
| ANTI-LOCK BRAKES MODULE |
| PRESSURE SENSOR (HYDRAULIC CONTROL UNIT) |

## Diagnostic Test

### 1. REPLACE ANTI-LOCK BRAKES MODULE & VERIFY IF DTC IS STILL ACTIVE

Turn the ignition off.

Replace the Anti-Lock Brakes Module in accordance with the Service Information.

Turn the ignition on.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Replace the Hydraulic Control Unit in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## C2112–SENSOR SUPPLY 1 VOLTAGE CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects that the supply voltage for external analog sensors is out of range.

| Possible Causes |
|---|
| ANTI-LOCK BRAKES MODULE |
| PRESSURE SENSOR (HYDRAULIC CONTROL UNIT) |

## Diagnostic Test

### 1. REPLACE ANTI-LOCK BRAKES MODULE & VERIFY IF DTC IS STILL ACTIVE

Turn the ignition off.

Replace the Anti-Lock Brakes Module in accordance with the Service Information. Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Turn the ignition on.

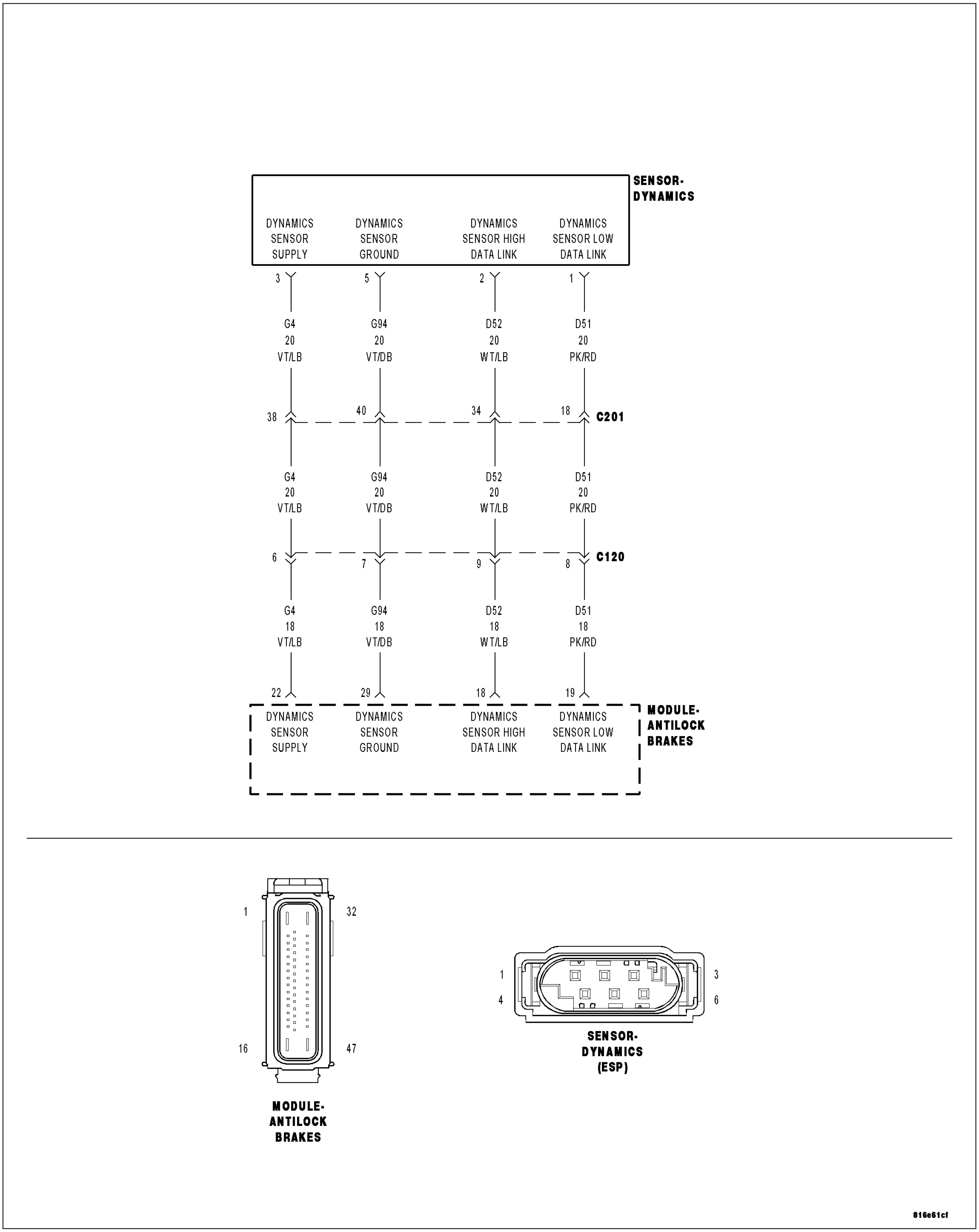
With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Replace the Hydraulic Control Unit in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## C2114–DYNAMICS SENSOR SUPPLY VOLTAGE LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Dynamics Sensor status changes from initialized to not initialized due to low voltage on the (G4) Dynamics Sensor Supply circuit.

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| (G4) DYNAMICS SENSOR SUPPLY CIRCUIT HIGH RESISTANCE |
| (G94) DYNAMICS SENSOR GROUND CIRCUIT HIGH RESISTANCE |
| (G4) DYNAMICS SENSOR SUPPLY CIRCUIT SHORTED TO OTHER ABS CIRCUITS |
| DYNAMICS SENSOR |
| ANTI-LOCK BRAKES MODULE |

## 1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## 2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Turn the ignition off.

Check all related wiring for pinched, chafed, pierced, and partially broken wires.

Check all related connectors for broken, bent, pushed out, and corroded terminals.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

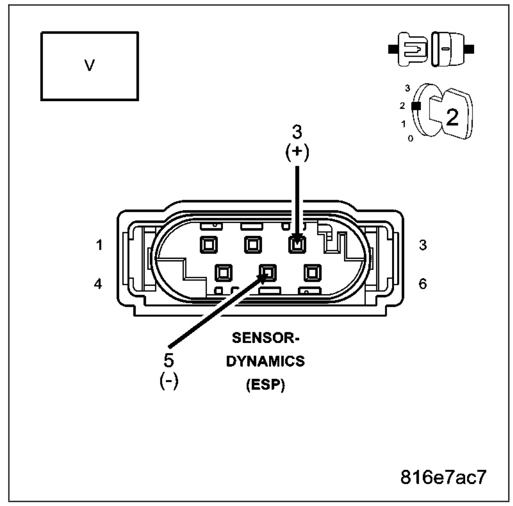
**No** >> Go To 3

## 3. CHECK (G4) DYNAMICS SENSOR SUPPLY CIRCUIT & (G94) DYNAMICS SENSOR GROUND CIRCUIT FUNCTION

Disconnect the Dynamics Sensor harness connector.

Turn the ignition on.

Measure the voltage between the (G4) Dynamics Sensor Supply Circuit and the (G94) Dynamics Sensor Ground Circuit.




**Is the voltage above 4.5 volts?**

**Yes** >> Replace the Dynamics Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

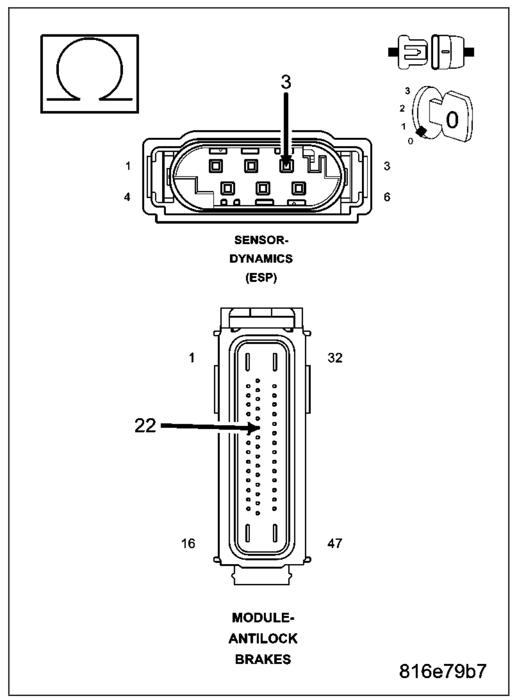
**No** >> Go To 4

## 4. CHECK (G4) DYNAMICS SENSOR SUPPLY CIRCUIT FOR HIGH RESISTANCE

Turn the ignition off.

Disconnect the Anti-Lock Brakes Module harness connector.

Measure the resistance of the (G4) Dynamics Sensor Supply circuit between the Dynamics Sensor harness connector and the Anti-Lock Brakes Module harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (G4) Dynamics Sensor Supply circuit for high resistance.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 5. CHECK (G94) DYNAMICS SENSOR GROUND CIRCUIT FOR HIGH RESISTANCE

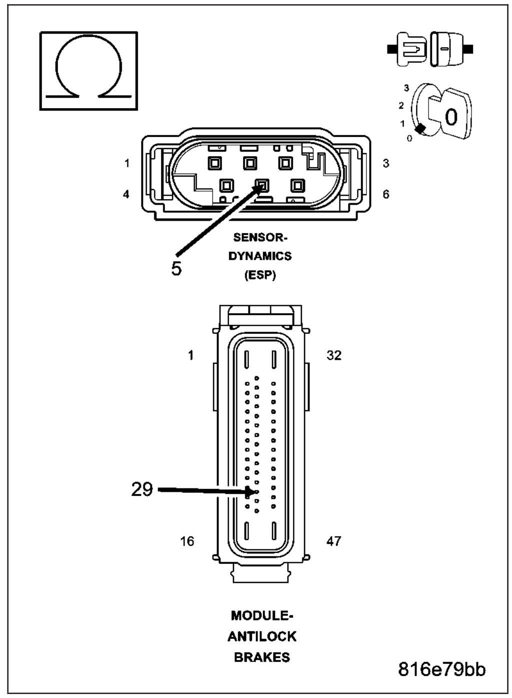
Measure the resistance of the (G94) Dynamics Sensor Ground circuit between the Dynamics Sensor harness connector and the Anti-Lock Brakes Module harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the (G94) Dynamics Sensor Ground circuit for high resistance.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).




## 6. CHECK (G4) DYNAMICS SENSOR SUPPLY CIRCUIT FOR A SHORT TO OTHER ABS CIRCUITS

Measure the resistance between the (G4) Dynamics Sensor Supply circuit and the B46, B15, D21, D65, D64, Z127, D52, D51, G94, B6, B7, B4. B3, B1, B2, B9, B8, and Z107 circuit in the Anti-Lock Brakes Module harness connector.

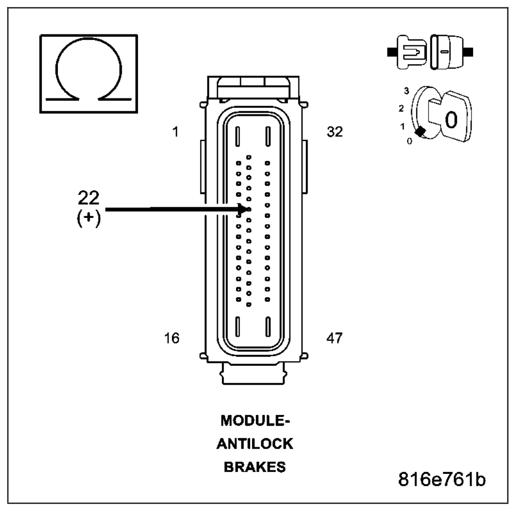
**Is the resistance below 10k ohms on any of the circuits?**

**Yes** >> Repair all circuits with a resistance below 10k ohms for a short to the (G4) Dynamics Sensor Supply circuit.

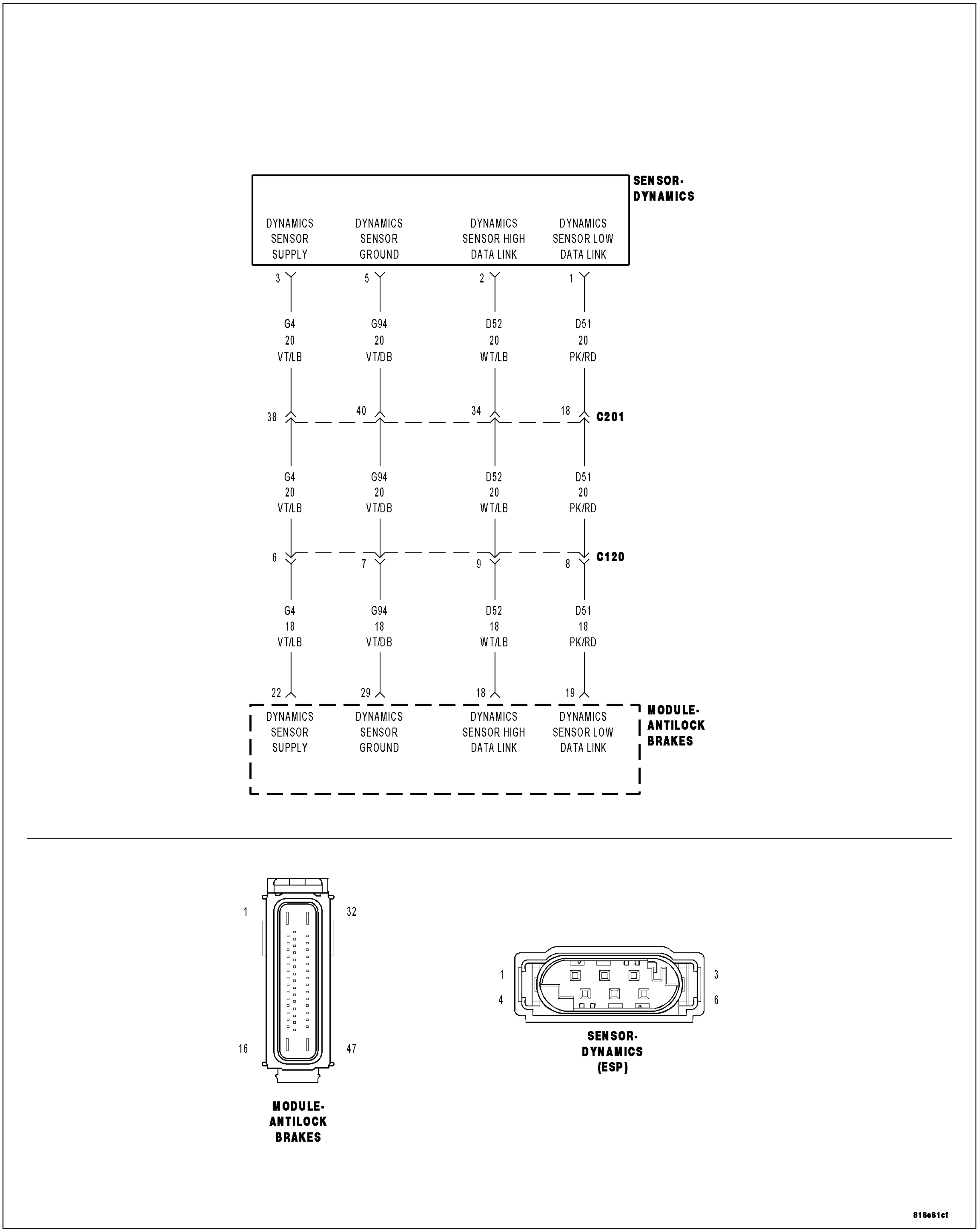
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).



## C2115–DYNAMICS SENSOR SUPPLY VOLTAGE HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Upon ignition on, prior to switching the (G4) Dynamics Sensor Supply circuit power on.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects voltage on the (G4) Dynamics Sensor Supply circuit when the circuit's power is turned off.

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| (G4) DYNAMICS SENSOR SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| ANTI-LOCK BRAKES MODULE |

## 1. VERIFY DTC IS ACTIVE

Turn the ignition on.
With the scan tool, read and record ABS DTCs.
With the scan tool, read and record Environmental Data (EV Data).
With the scan tool, erase ABS DTCs.
Cycle the ignition switch.
With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## 2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Turn the ignition off.
Check all related wiring for pinched, chafed, pierced, and partially broken wires.
Check all related connectors for broken, bent, pushed out, and corroded terminals.

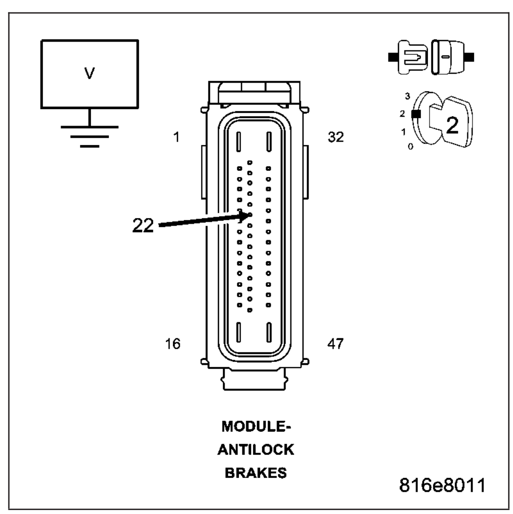
**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. CHECK (G4) DYNAMICS SENSOR SUPPLY CIRCUIT SHORT FOR A SHORT TO VOLTAGE

Disconnect the Anti-Lock Brakes Module harness connector.
Turn the ignition on.
Measure the voltage of the (G4) Dynamics Sensor Supply Circuit.

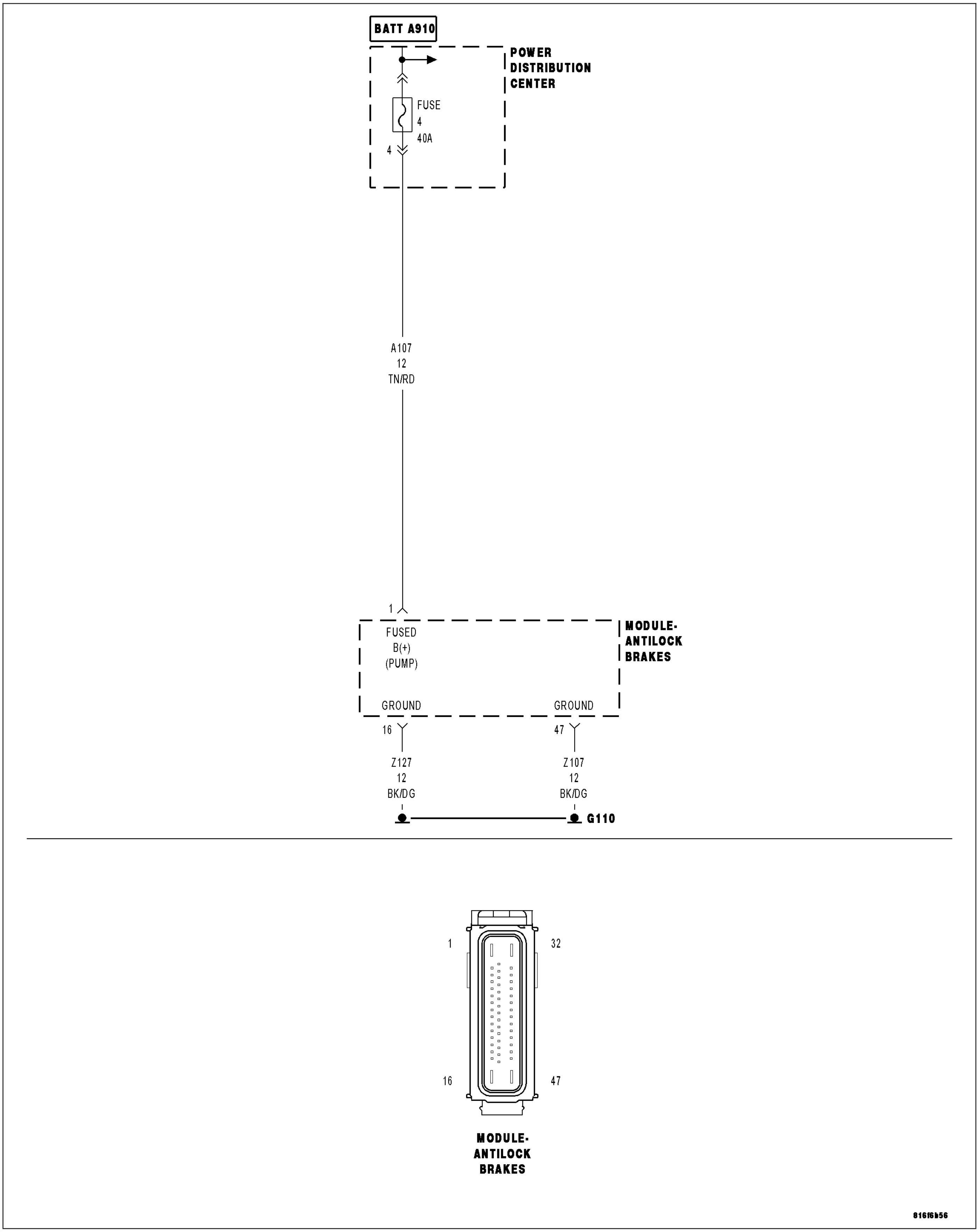



**Is the voltage above 0.2 volts?**

**Yes** >> Repair the (G4) Dynamics Sensor Supply Circuit for a short to voltage.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C2116–ABS PUMP MOTOR SUPPLY LOW VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and the ABS Pump Motor deactivated, but not if supply voltage faults are detected. Or, if the control is switched off.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects either a low voltage condition when the ABS Pump Motor is activated or deactivated or a high voltage condition when the ABS Pump Motor is deactivated.

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| ABS PUMP MOTOR FUSE OPEN |
| (A107) FUSED B(+) CIRCUIT SHORTED TO GROUND, OPEN, OR HIGH RESISTANCE |
| (Z127) GROUND CIRCUIT OPEN, OR HIGH RESISTANCE |
| ANTI-LOCK BRAKES MODULE |
| PUMP MOTOR (HYDRAULIC CONTROL UNIT) |

## Diagnostic Test

### 1. CHECK FOR A DTC C2116–ABS PUMP MOTOR SUPPLY LOW VOLTAGE

**NOTE: This DTC must be active for the results of this test to be valid.**
Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

Road test the vehicle over 40 km/h (25 m.p.h.).

**NOTE: Vehicle must be driven above 40 km/h (25 m.p.h.) for set conditions to be meet.**
With the scan tool, read DTCs.

**Does the scan tool display: C2116–ABS PUMP MOTOR SUPPLY LOW VOLTAGE?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING) Diagnostic Test

### 2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Turn the ignition off.

Visually inspect the Anti-Lock Brakes Module harness connector and wiring harness for damage.

Check all related wiring for pinched, chafed, pierced, and partially broken wires.

Check all related connectors for broken, bent, pushed out, and corroded terminals.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. CHECK ABS PUMP MOTOR FUSE

Remove and visually inspect the ABS Pump Motor fuse.

**Is the fuse open?**

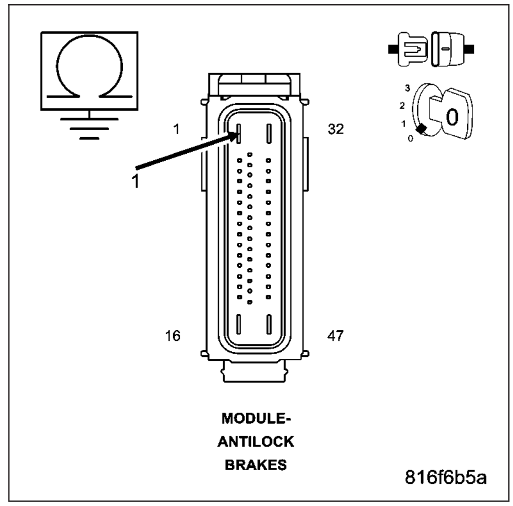
**Yes** >> Go To 4

**No** >> Go To 5

## 4. CHECK (A107) FUSED B(+) CIRCUIT FOR A SHORT TO GROUND

Disconnect the Anti-Lock Brakes Module harness connector.

Measure the resistance of the (A107) Fused B(+) circuit between ground and the Anti-Lock Brakes Module harness connector.




**Is the resistance below 10k ohms?**

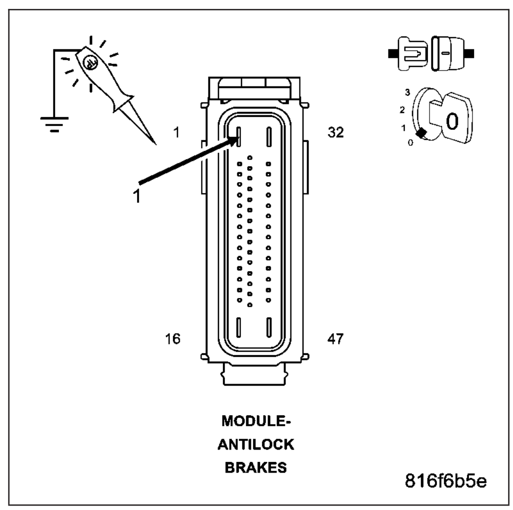
**Yes** >> Repair the (A107) Fused B(+) circuit for a short to ground.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK (A107) FUSED B(+) CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Replace the ABS Pump Motor fuse.

Using a 12-volt test light connected to ground, probe the (A107) Fused B(+) circuit.




**NOTE: The test light should illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

**Does the test light illuminate brightly?**

**Yes** >> Go To 6

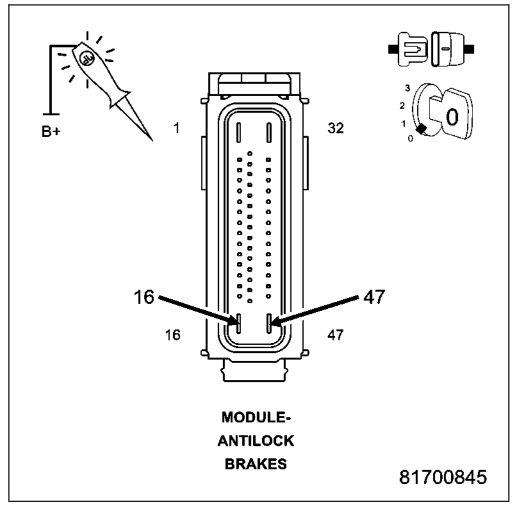
**No** >> Repair the (A107) Fused B(+) circuit for an open or high resistance.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 6. CHECK (Z127) GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Using a 12-volt test light connected to 12 volts, probe the (Z127) Ground circuit.

**NOTE: The test light should illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

**Does the test light illuminate brightly on both circuits?**




**Yes** >> Go To 7

**No** >> Repair (Z127) circuit for an open or high resistance.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 7. REPLACE ANTI-LOCK BRAKES MODULE & VERIFY IF DTC IS STILL ACTIVE

Replace the Anti-Lock Brakes Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Turn the ignition on.

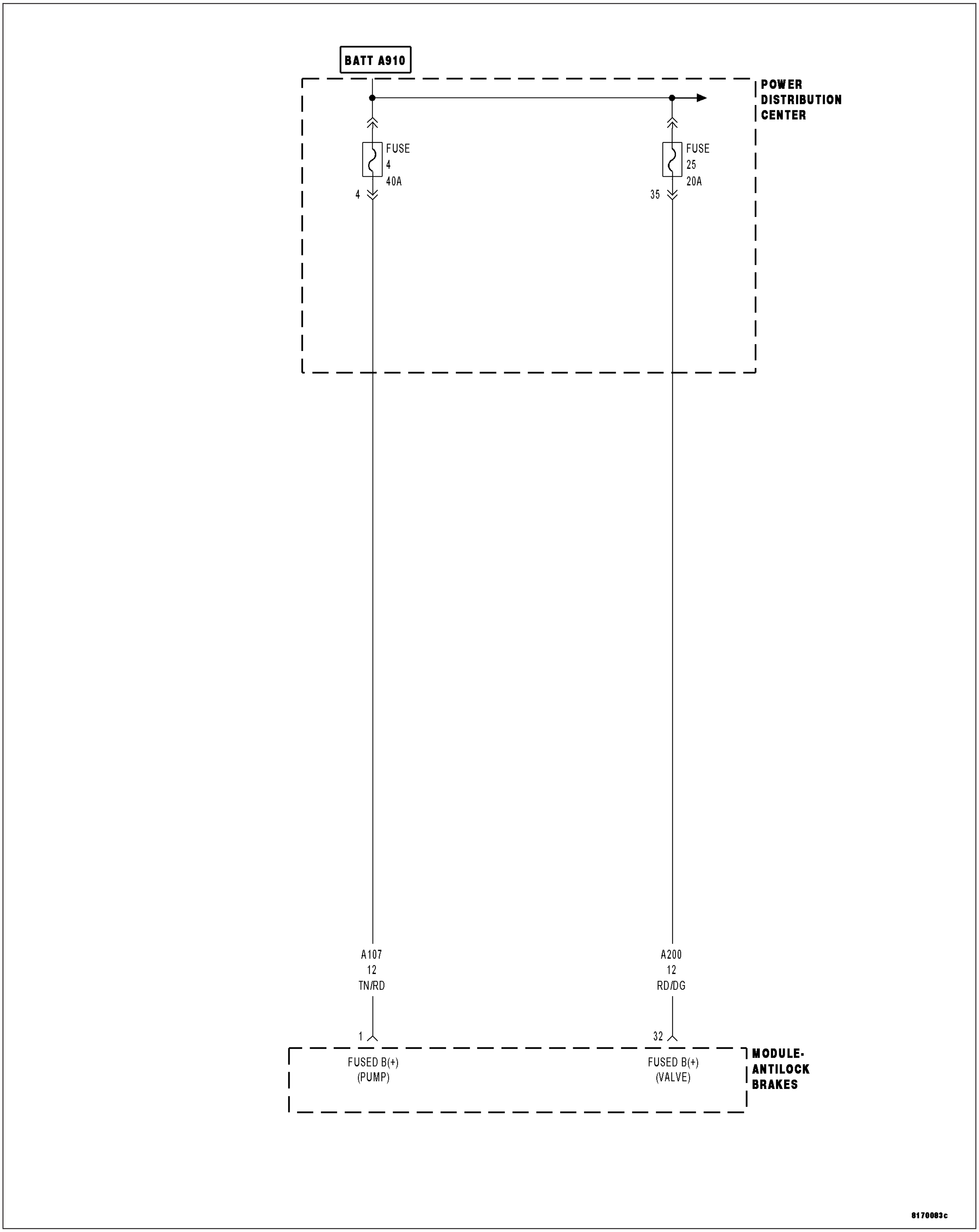
With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Replace the Hydraulic Control Unit in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## C2200–ANTI-LOCK BRAKE MODULE INTERNAL




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on. The Anti-Lock Brake Module monitors its internal microprocessors for correct operation.
- **Set Condition:**
  If the Anti-lock brake module detects an internal fault, the DTC is set.

| Possible Causes |
|---|
| ABM - INTERNAL FAULT |

## Diagnostic Test

### 1. ABM INTERNAL FAILURE DTC PRESENT

Turn the ignition on.
With the scan tool, read DTCs.
With the scan tool, erase DTCs.
Turn the ignition off.
Turn the ignition on.
With the scan tool, read DTCs.

**Does the scan tool display ANTI-LOCK BRAKE MODULE INTERNAL FAILURE?**

**Yes** >> Replace the Anti-Lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

## C2202-ORIGINAL VIN MISMATCH/MISSING

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module fails the diagnostic test.

| Possible Causes |
|---|
| ANTI-LOCK BRAKE MODULE |

### 1. ANTI-LOCK BRAKE MODULE CONFIGURATION

The Anti-lock Brake Module hardware check has determined that module configuration does not match vehicle configuration. Verify that the correct module part number is installed in the vehicle.

Turn the ignition on.

With the Scan Tool, verify that the VIN stored in the controller matches the vehicle VIN.

With the Scan Tool, select Clear Stored DTCs.

Cycle the ignition off, then on.

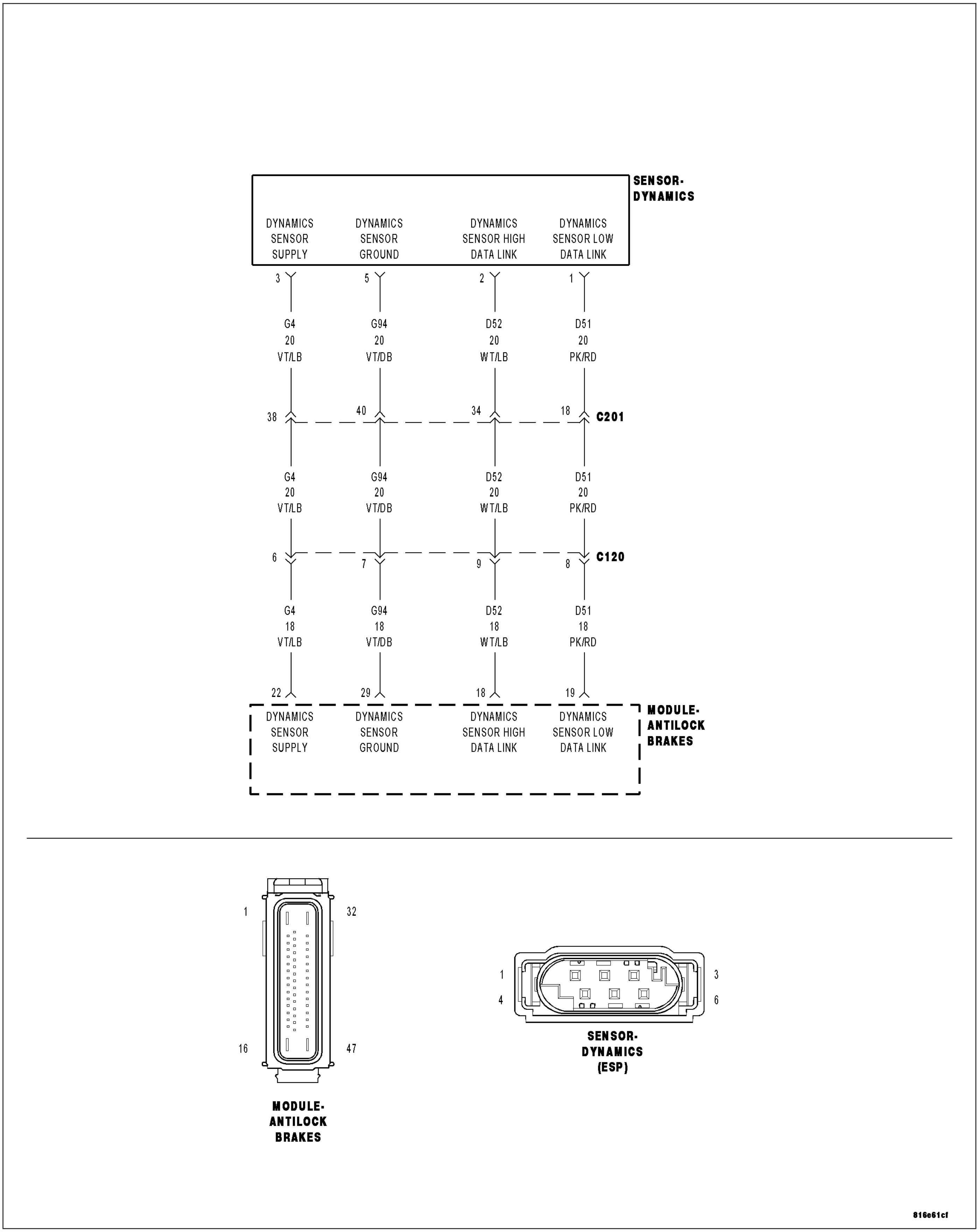
With the Scan Tool, select View DTCs.

**Does this DTC reset?**

**Yes** >> Replace the Anti-lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test complete.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C2204–DYNAMICS SENSOR INTERNAL




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously, with ignition on, until vehicle speed exceeds 20 km/h (12.4 m.p.h.) for the first time, but not if the sensor voltage is out of range.
  Or, during diagnostic mode.
  Or, if the monitoring was inhibited by a corresponding diagnostics command.
  Or, if the vehicle speed has exceeded 20 km/h (12.4 m.p.h.) during the actual ignition cycle.
  Or, if at least one over spinning wheel is detected.
  Or, if one of the control functions is active.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects that the Lateral Sensor signal is out of range.

| Possible Causes |
|---|
| DYNAMICS SENSOR INSTALLATION |
| DYNAMICS SENSOR |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

**WARNING: Ensure brake capability is available before road testing.**
Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 20 km/hr (6 and 12 m.p.h.).

Park the vehicle.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK THE DYNAMICS SENSOR INSTALLATION

**NOTE: Dynamics Sensor installation and mounting bolt torque is crucial for proper operation.**
Turn the ignition off.

Check the Dynamics Sensor for damaged, modified, and bent mounting brackets.

Check the Dynamics Sensor mounting bolts for a loose or over tightened condition.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

### 3. CHECK DYNAMICS SENSOR OUTPUT

**CAUTION: All previously removed connectors must be connected before test driving the vehicle.**
Connect all previously disconnected components and connectors.

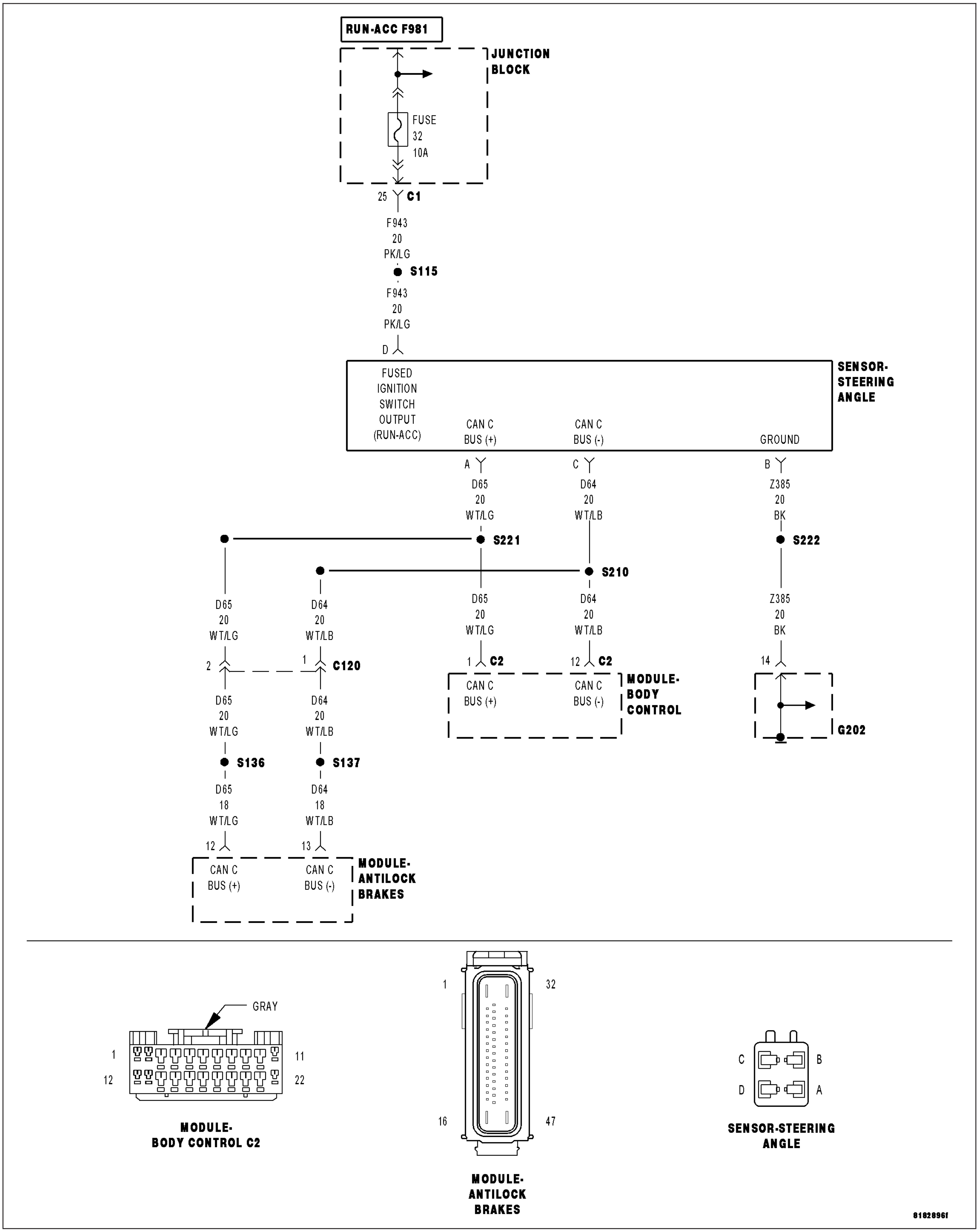
**WARNING: Ensure brake capability is available before road testing.**
Monitor Dynamics Sensor operation while an assistant drives the vehicle.

**Is Lateral Sensor output between 0.02 G to 0.16 G and Yaw Sensor output between 1.30° to 5.70°**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Dynamics Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## C2205–STEERING ANGLE SENSOR INTERNAL




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on, but not if supply voltage faults are detected.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects that the Steering Angle Sensor is either not calibrated, or not initialized, or its status changes from initialized to not initialized, or if the sensor sends an internal failure message.

| Possible Causes |
|---|
| STEERING ANGLE SENSOR NOT INITIALIZED |
| STEERING ANGLE SENSOR |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. CHECK FOR A DTC C2205-STEERING ANGLE SENSOR INTERNAL

**NOTE: This DTC must be active for the results of this test to be valid.**
Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

**WARNING: Ensure brake capability is available before road testing.**
Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/hr (6 and 15 m.p.h.).

Park the vehicle.

With the scan tool, read and record DTCs.

**Does the scan tool display: C2205-STEERING ANGLE SENSOR INTERNAL?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. STEERING ANGLE SENSOR

Replace the Steering Angle Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**CAUTION: Ensure brake capability is available before road testing.**
Road test the vehicle over 25 km/h (6 and 15 m.p.h).

**NOTE: Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/hr (6 and 15 m.p.h.). for set conditions to be meet.**
With the scan tool, read ABS DTCs.

**Did DTC C2205-STEERING ANGLE SENSOR INTERNAL reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## C2206–VEHICLE CONFIGURATION MISMATCH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module detects the signal from the gateway module relevant for vehicle characteristic is missing or does not match for a period greater than the specified fault duration.

| Possible Causes |
|---|
| TIPM / PCM NOT CONFIGURED CORRECTLY |
| ANTI-LOCK BRAKE MODULE |

## Diagnostic Test

### 1. CHECK FOR A DTC C2206-VEHICLE CONFIGURATION MISMATCH

**NOTE: This DTC must be active for the results of this test to be valid.**

**NOTE: This DTC will be active when a new module is installed until initialization is performed.**

Turn the ignition on.

With the scan tool, read and record DTCs.

With the scan tool, read and record Freeze Frame information.

With the scan tool, erase DTCs.

Perform ECU initialization with drive test on ABM. Refer to ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Cycle the ignition switch from off to on.

With the scan tool, read and record DTCs.

**Does the scan tool display: C2206-VEHICLE CONFIGURATION MISMATCH?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. VERIFY THAT THE TIPM/PCM IS CONFIGURED CORRECTLY

Turn the ignition on.

Check the following data to verify the TIPM/PCM is configured correctly. Engine Displacement (PCM), XWD 4x2, 4x4, all Wheel Drive, (TIPM), Axle ratio (TIPM), Vehicle Line (TIPM), Brake type 0= ABS 1=ESP (TIPM).

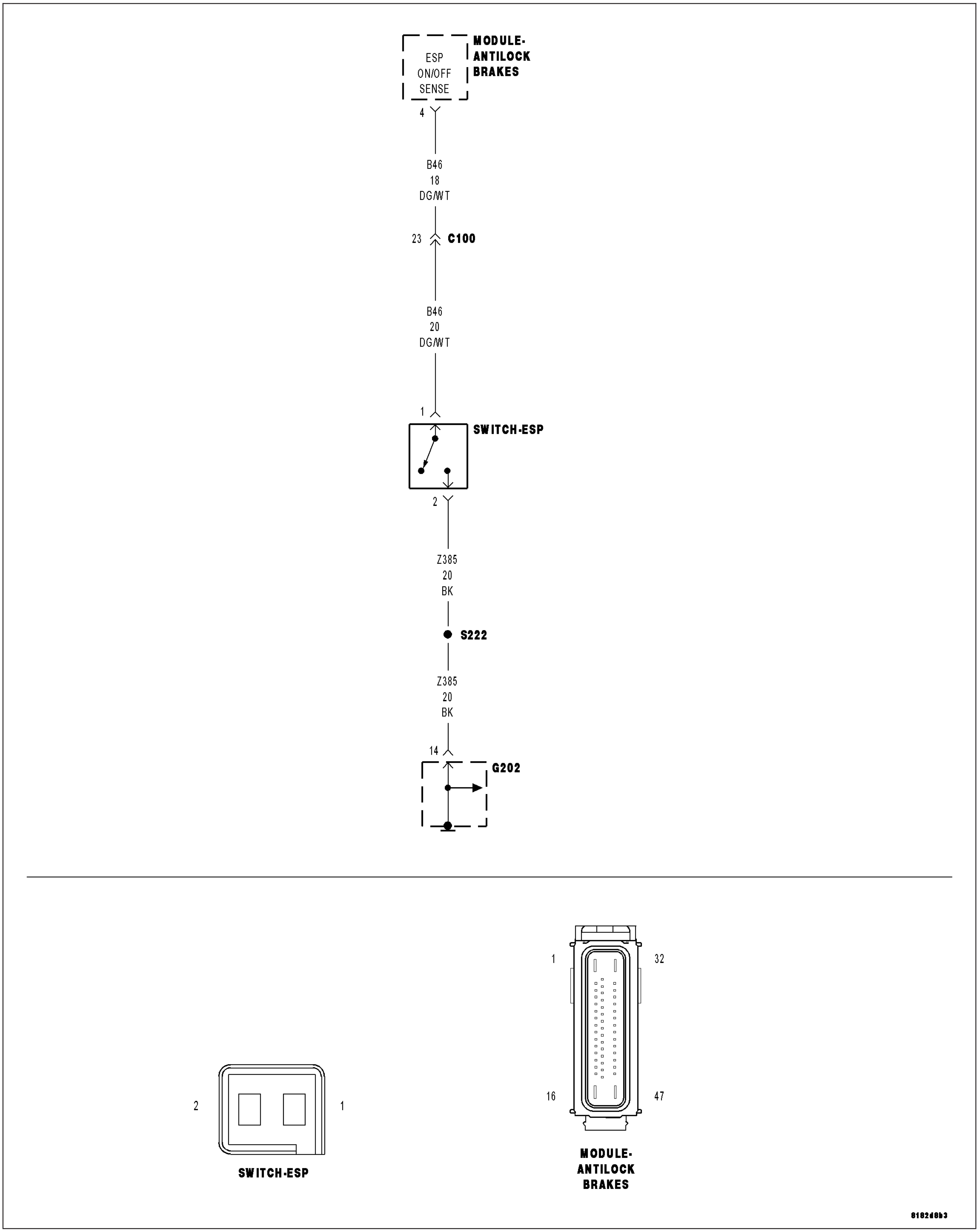
**NOTE: The DTC will be active when a new controller is installed until initialization is performed.**

**Was the TIPM/PCM configured correctly?**

**Yes** >> Replace the Anti-Lock Brake Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Reprogram the appropriate module.
Perform ABS or PCM VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## ESP/TCS SWITCH CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module indicates that the ESP/TCS Switch is low for 30 seconds.

| Possible Causes |
|---|
| STUCK CLOSED ESP/TCS SWITCH |
| (Z385) GROUND CIRCUIT OPEN |
| (B46) ESP/TCS CONTROL SWITCH SENSE CIRCUIT SHORTED TO GROUND |
| ANTI-LOCK BRAKE MODULE |

## Diagnostic Test

### 1. ESP/TCS SWITCH CIRCUIT

**NOTE: If any other DTCs are present they must be repaired before continuing.**

Turn the ignition on.

Turn the ESP/TCS switch on then off.

Check for car icon on solid in cluster and pressing ESP/TCS switch does not change state.

With the scan tool, read the switch state for the ESP/TCS switch with NO pressure on the brake, read and record DTCs.

**Does the scan tool display switch state indicating pressed?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

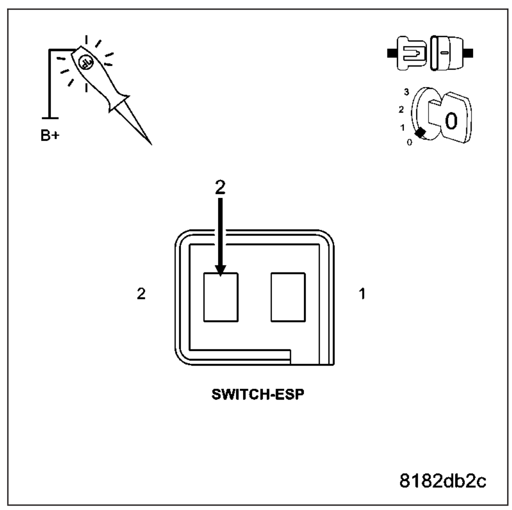
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING).

### 2. (Z385) OPEN CIRCUIT

Turn the ignition off.

Disconnect the ESP/TCS switch.

Using a 12–volt test light connected to 12–volts, check the (Z385) ground circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

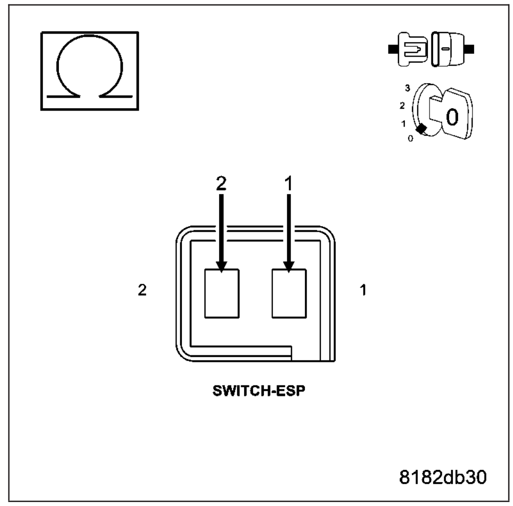
**No** >> Repair (Z385) ground circuit for an open circuit or high resistance.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 3. CHECK FOR A STUCK ESP/TCS SWITCH

Turn the ignition off.

Measure the internal resistance of the ESP/TCS Switch between the (B46) ESP/TCS control circuit and (Z385) Ground circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the ESP/TCS Switch in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

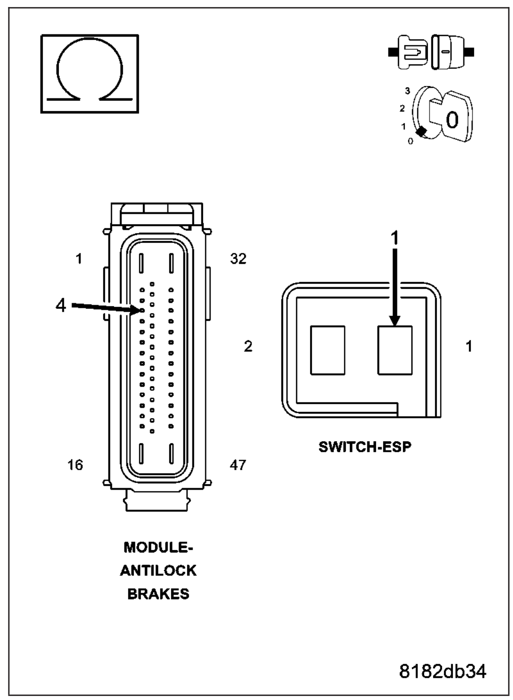
## 4. ESP/TCS CONTROL CIRCUIT

Turn the ignition off.

Disconnect the ESP/TCS Switch.

Disconnect the Anti-Lock Brake Module harness connector.

Measure the resistance of the (B46) ESP/TCS control circuit to ground.




**Is the resistance below 5.0 ohms?**

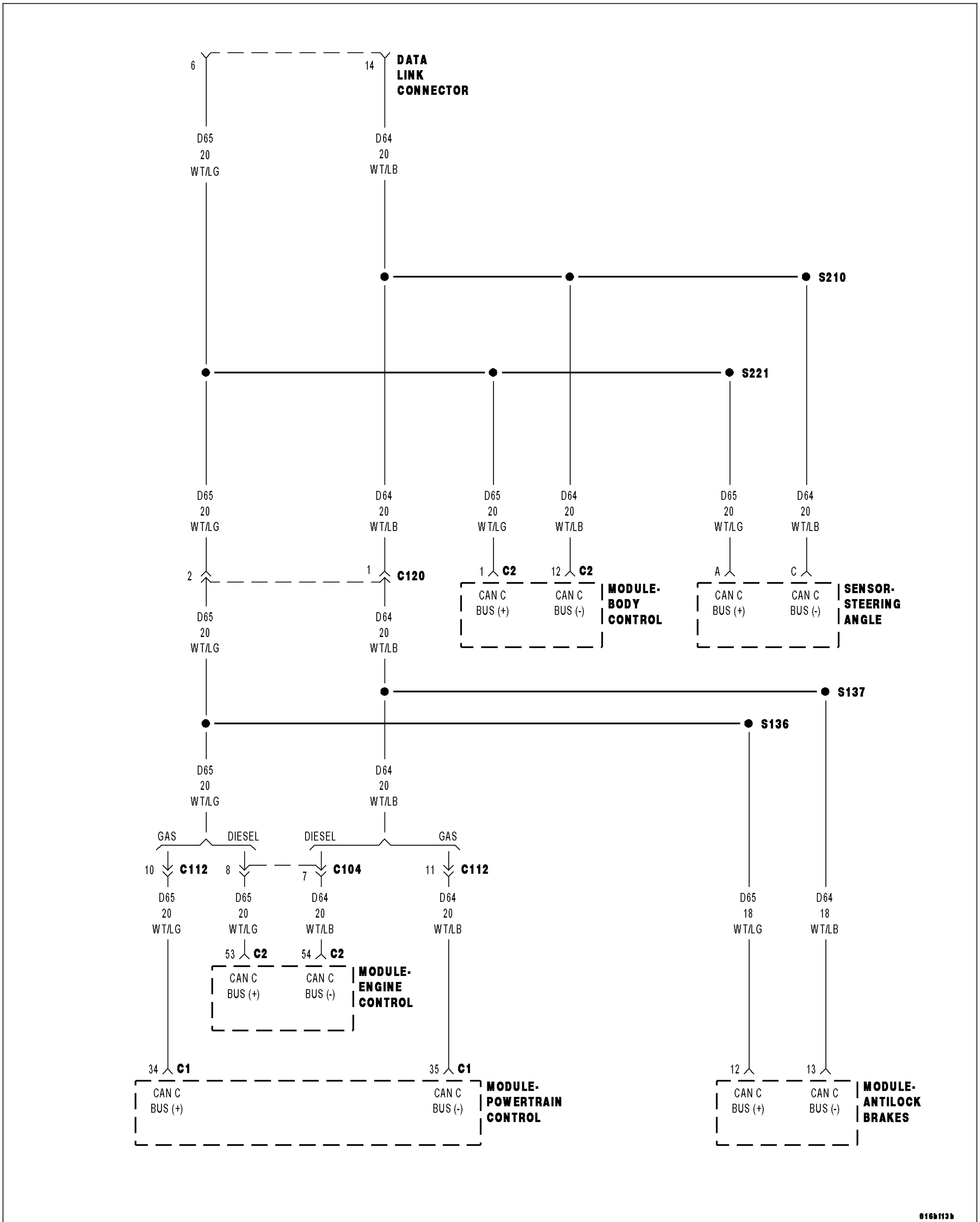
**Yes** >> Repair the (B46) ESP/TCS control circuit for a short to ground.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Anti-Lock Brake Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## U0002–CAN C BUS OFF PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  A module detects a short in either CAN C Bus circuit.

Perform the CAN C Bus Communication Failure diagnostic test procedure. **(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)**.

## U0100–LOST COMMUNICATION WITH ECM/PCM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
- **Set Condition:**
  If the Anti-Lock Brakes Module fails to receive bus messages from the ECM or PCM for approximately 500 ms.

| Possible Causes |
| --- |
| DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| ECM OR PCM POWER AND GROUND |
| ECM OR PCM |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Verify the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**
Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs related to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

**No** >> Go To 3

## 3. VERIFY THAT THE ECM OR PCM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the ECM or PCM is active on the bus.

**Is the ECM or PCM active on the bus?**

**Yes** >> Go To 4

**No** >> Perform the Stored Lost Communication test procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs “Logged Against” the ECM or PCM?**

**Yes** >> Replace/update the ECM or PCM in accordance with the service information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)..
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Anti-Lock Brakes Module in accordance with the service information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## U0101–LOST COMMUNICATION WITH TCM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
- **Set Condition:**
  If the Anti-Lock Brakes Module fails to receive bus messages from the TCM for approximately 500 ms.

| Possible Causes |
| --- |
| DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| TCM POWER AND GROUND |
| PCM DTCs PRESENT |
| TCM |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Verify the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**

**NOTE: If present, diagnose and repair DTC U0002–CAN C BUS OFF PERFORMANCE, DTC U0146–LOST COMMUNICATION WITH CENTRAL GATEWAY, or DTC U1502–IMPLAUSIBLE MESSAGE DATA LENGTH RECEIVED FROM FCM / BCM before diagnosing this DTC.**

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> Perform the Stored Lost Communication test procedure. Refer to the table of contents in this section. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs related to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

**No** >> Go To 3

## 3. VERIFY THAT THE TCM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the TCM is active on the bus.

**Is the TCM active on the bus?**

**Yes** >> Go To 4

**No** >> Refer to the Table of Contents located in this section for a no response test procedure.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs “Logged Against” the TCM?**

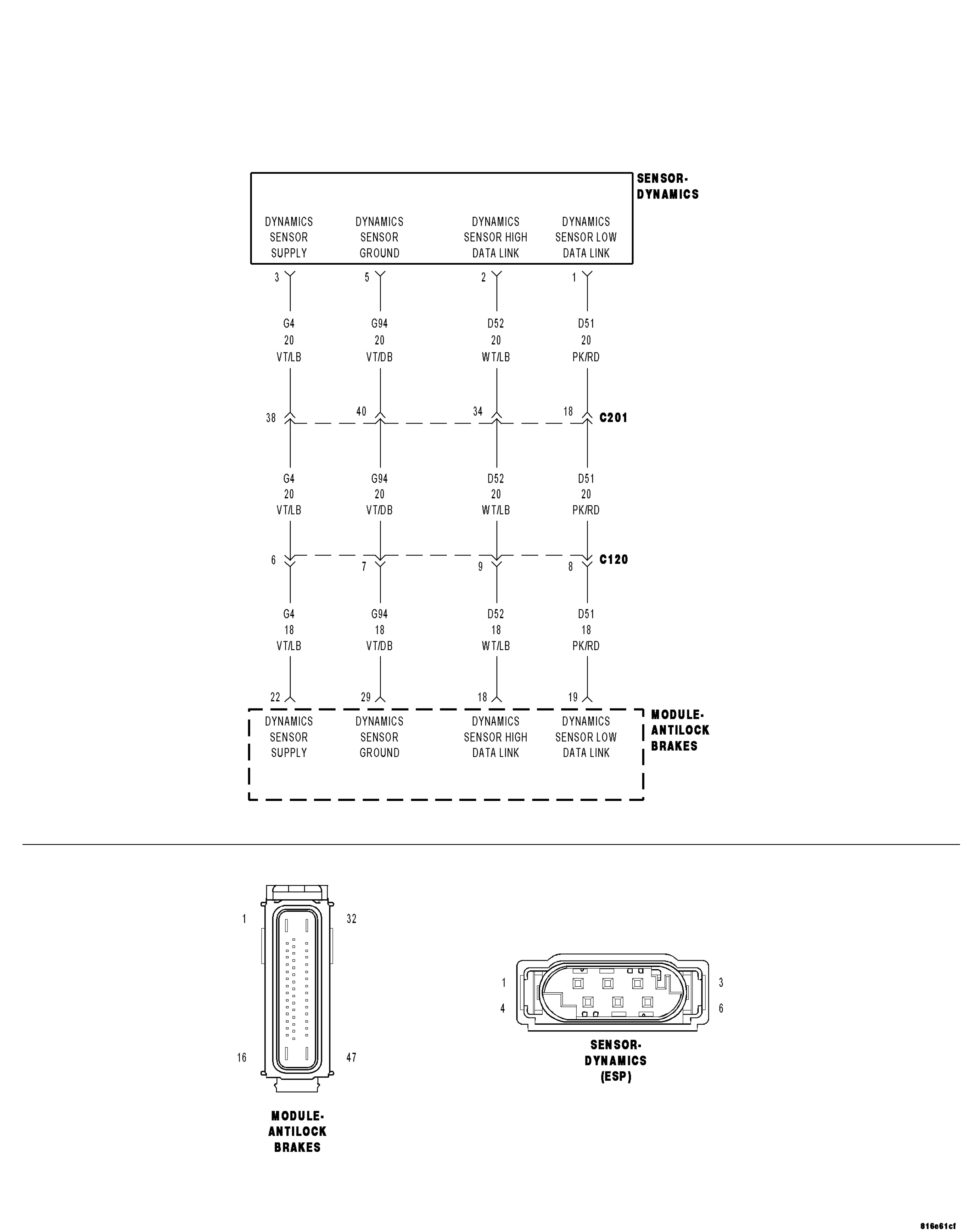
**Yes** >> Replace/update the TCM in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace the Anti-Lock Brakes Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## U0125–LOST COMMUNICATION WITH DYNAMICS SENSOR




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Anti-Lock Brakes Module fails to receive bus messages from the Dynamics Sensor.

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT SHORTED TO GROUND, SHORTED TO VOLTAGE, OR OPEN |
| (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT SHORTED TO GROUND, SHORTED TO VOLTAGE, OR OPEN |
| DYNAMICS SENSOR |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: If present, diagnose and repair DTC C2114–DYNAMICS SENSOR SUPPLY VOLTAGE LOW or DTC C2115–DYNAMICS SENSOR SUPPLY VOLTAGE HIGH before proceeding.**

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Visually inspect the related wiring harness. Look for any pinched, chafed, pierced, and partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, and corroded terminals.

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

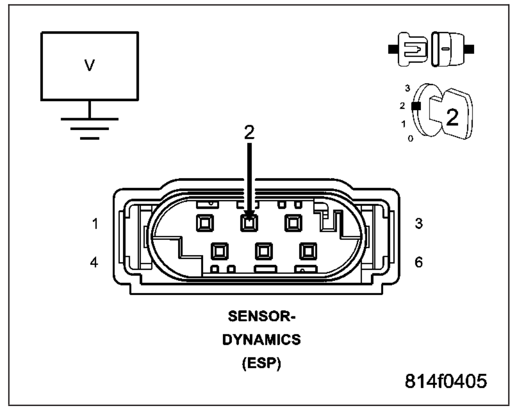
## 3. CHECK THE (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR A SHORT TO VOLTAGE

Disconnect the Anti-Lock Brakes Module harness connector.

Disconnect the Dynamics Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (D52) Dynamics Sensor High Data Link circuit.




**Is there any voltage present?**

**Yes** >> Repair the (D52) Dynamics Sensor High Data Link circuit for a short to voltage.

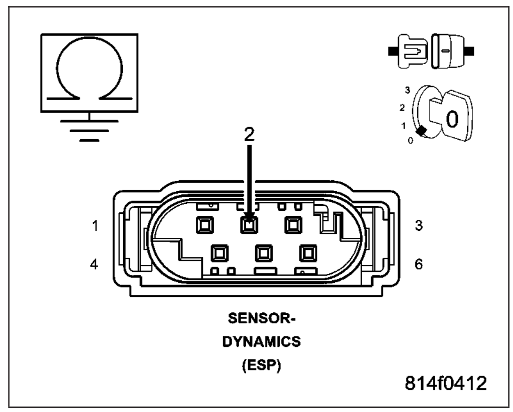
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK THE (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Measure the resistance of the (D52) Dynamics Sensor High Data Link circuit between ground and the Dynamics Sensor harness connector.




**Is the resistance below 5.0 ohms?**

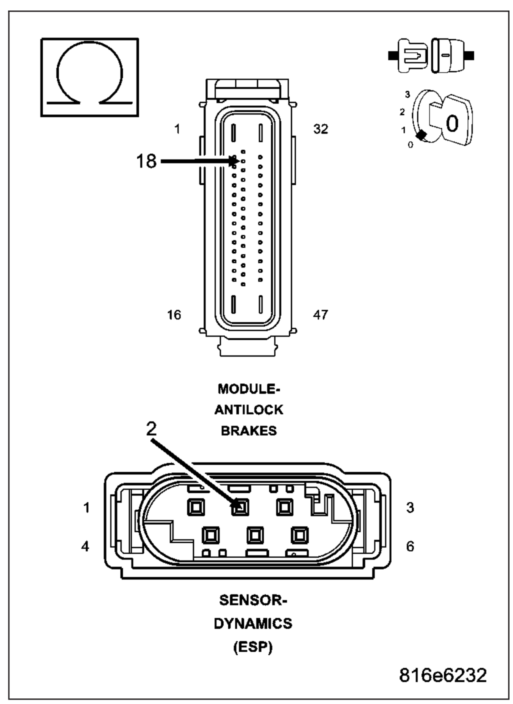
**Yes** >> Repair the (D52) Dynamics Sensor High Data Link circuit for a short to ground.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK THE (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR AN OPEN

Measure the resistance of the (D52) Dynamics Sensor High Data Link circuit between the Dynamics Sensor harness connector and the Anti-Lock Brakes Module harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

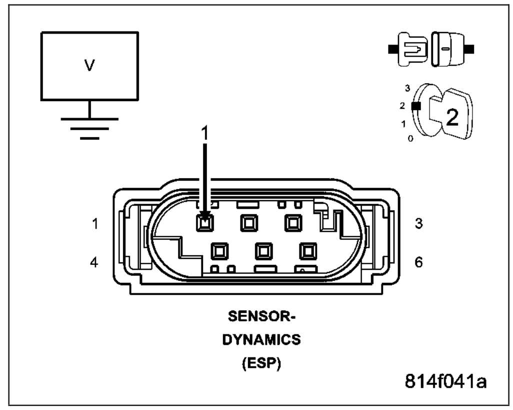
**No** >> Repair the (D52) Dynamics Sensor High Data Link circuit for an open.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 6. CHECK THE (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (D51) Dynamics Sensor Low Data Link circuit.




**Is there any voltage present?**

**Yes** >> Repair the (D51) Dynamics Sensor Low Data Link circuit for a short to voltage.

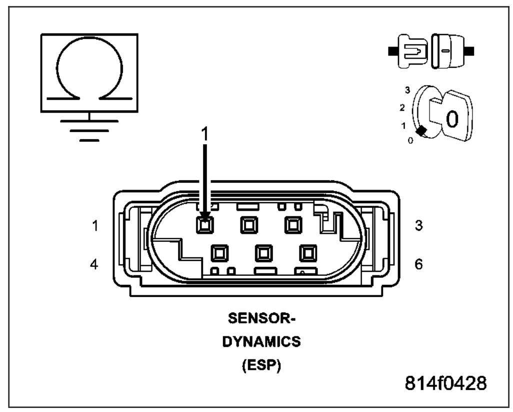
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 7

## 7. CHECK THE (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Measure the resistance of the (D51) Dynamics Sensor Low Data Link circuit between ground and the Dynamics Sensor harness connector.




**Is the resistance below 5.0 ohms?**

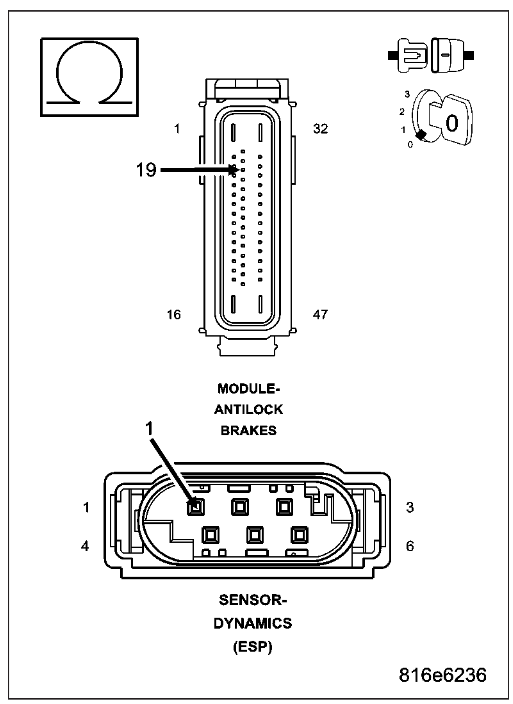
**Yes** >> Repair the (D51) Dynamics Sensor Low Data Link circuit for a short to ground.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 8

## 8. CHECK THE (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR AN OPEN

Measure the resistance of the (D51) Dynamics Sensor Low Data Link circuit between the Dynamics Sensor harness connector and the Anti-Lock Brakes Module harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Dynamics Sensor in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Repair the (D51) Dynamics Sensor Low Data Link circuit for an open.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## U0126–LOST COMMUNICATION WITH STEERING ANGLE SENSOR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
- **Set Condition:**
  If the Anti-Lock Brakes Module fails to receive bus messages from the Steering Angle Sensor for approximately 500 ms.

| Possible Causes |
| --- |
| DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| STEERING ANGLE SENSOR POWER AND GROUND |
| STEERING ANGLE SENSOR |
| ANTI-LOCK BRAKES MODULE |

### Diagnostic Test

#### 1. VERIFY DTC IS ACTIVE

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**
Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

#### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs related to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. VERIFY THAT THE STEERING ANGLE SENSOR IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the Steering Angle Sensor is active on the bus.

**Is the Steering Angle Sensor active on the bus?**

**Yes** >> Go To 4

**No** >> Refer to the Stored Lost Communication test procedure. Refer to the table of contents in this section.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs "Logged Against" the STEERING ANGLE SENSOR?**

**Yes** >> Replace/update the Steering Angle Sensor in accordance with the service information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Anti-Lock Brakes Module in accordance with the service information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## U0146–LOST COMMUNICATION WITH CENTRAL GATEWAY

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
- **Set Condition:**
  If the Anti-Lock Brakes Module either fails to receive bus messages from the Engine Control Module (ECM) for approximately 500 ms, or it receives invalid messages from the ECM, or it detects messages from the ECM are of improper data length.

| Possible Causes |
|---|
| DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| ECM POWER AND GROUND |
| ECM |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING).

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs related to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. VERIFY THAT THE ECM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the ECM is active on the bus.

**Is the ECM active on the bus?**

**Yes** >> Go To 4

**No** >> .Perform the Stored Lost Communication test procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs "Logged Against" the ECM?**

**Yes** >> Replace/update the ECM in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to BODY VERIFICATION TEST – VER 1).

**No** >> Replace the Anti-Lock Brakes Module in accordance with the service information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## U0401–IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, one valid CAN message received at least once, and no U0002-CAN C Bus Off Performance DTC present.
- **Set Condition:**
  When the Anti-Lock Brake Module detects an incorrect CAN message from the Engine Control Module (ECM).

| Possible Causes |
|---|
| ABM CAN BUS DTCS |
| ENGINE DTCS |
| ANTI-LOCK BRAKE MODULE |

## Diagnostic Test

### 1. CHECK FOR DTC U0401-IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, record and erase DTCs.

Cycle the ignition switch from off to on.

With the scan tool, read DTCs.

**Does the scan tool display: U0401-IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM?**

**Yes** >> Go To 2

**No** >> Perform the ABS Intermittent Condition diagnostic procedure in this Section.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING). Diagnostic Test

### 2. CHECK IF FCM CAN BUS DTCs ARE PRESENT

With the scan tool, read FCM DTCs.

**Are there any FCM CAN BUS DTCs present?**

**Yes** >> Refer to the appropriate diagnostic. (Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

### 3. CHECK IF ENGINE DTCs ARE PRESENT

With the scan tool, read Engine DTCs.

**Are there any Engine DTCs present?**

**Yes** >> Refer to the 9 - ENGINE ELECTRICAL DIAGNOSTICS and diagnose the appropriate symptom.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Using the schematics as a guide, check the Anti-Lock Brake Module pins, terminals, and connectors for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the Anti-Lock Brake Module per the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## U0429–IMPLAUSIBLE DATA RECEIVED FROM SCM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With ignition on, but not if low voltage is detected.
  Or, if a CAN Bus off event is detected.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects either the sequence or integrity of the Steering Angle Sensor messages is invalid.

| Possible Causes |
|---|
| CAN C BUS CIRCUIT(S) SHORTED |
| LOAD TOO HIGH ON CAN C BUS |
| STEERING ANGLE SENSOR DTCs PRESENT |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. CHECK IF COMMUNICATION RELATED DTCs ARE PRESENT

Turn the ignition on.

With the scan tool, read ABS DTCs.

**Are any Communication related DTCs present?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of symptoms.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 2

### 2. CHECK IF OTHER STEERING ANGLE SENSOR RELATED DTCs ARE PRESENT

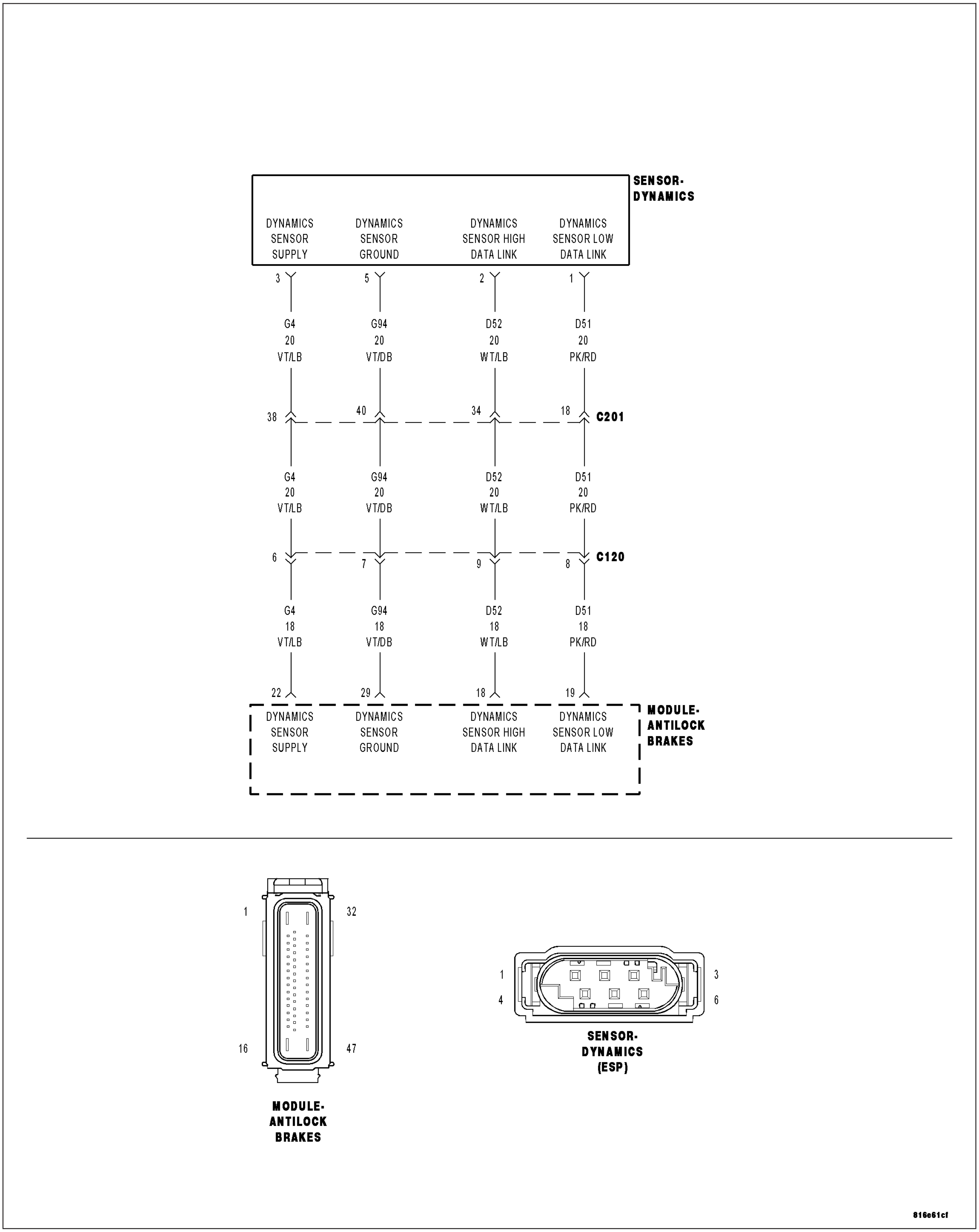
With the scan tool, read ABS DTCs.

**Are any other STEERING ANGLE SENSOR DTCs present?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this Section for a complete list of symptoms.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Steering Angle Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## U1003–ESP CAN C BUS PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects too many CAN Bus off events on the Dynamics Sensor Data Link circuits.

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT SHORTED TO GROUND, VOLTAGE, OR OPEN |
| (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT SHORTED TO GROUND, VOLTAGE, OR OPEN |
| DYNAMICS SENSOR |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

Turn the ignition on.
With the scan tool, read and record ABS DTCs.
With the scan tool, read and record Environmental Data (EV Data).
With the scan tool, erase ABS DTCs.
Cycle the ignition switch.
With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.
Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING).

### 2. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Visually inspect the related wiring harness. Look for any pinched, chafed, pierced, and partially broken wires.
Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, and corroded terminals.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

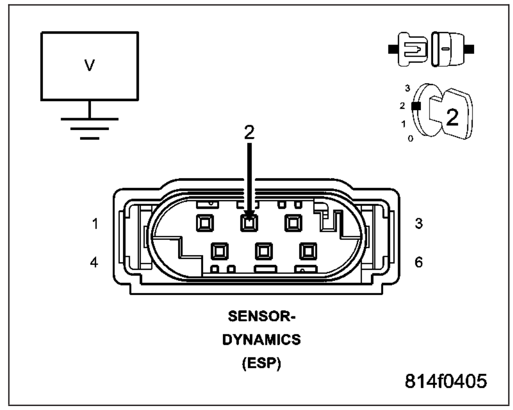
## 3. CHECK THE (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR A SHORT TO VOLTAGE

Disconnect the Anti-Lock Brakes Module harness connector.

Disconnect the Dynamics Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (D52) Dynamics Sensor High Data Link circuit.




**Is there any voltage present?**

**Yes** >> Repair the (D52) Dynamics Sensor High Data Link circuit for a short to voltage.

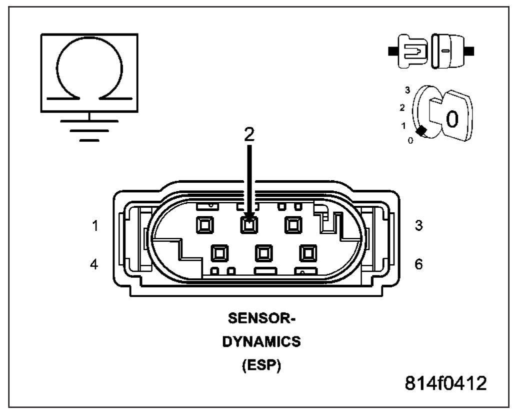
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK THE (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Measure the resistance of the (D52) Dynamics Sensor High Data Link circuit between ground and the Dynamics Sensor harness connector.




**Is the resistance below 5.0 ohms?**

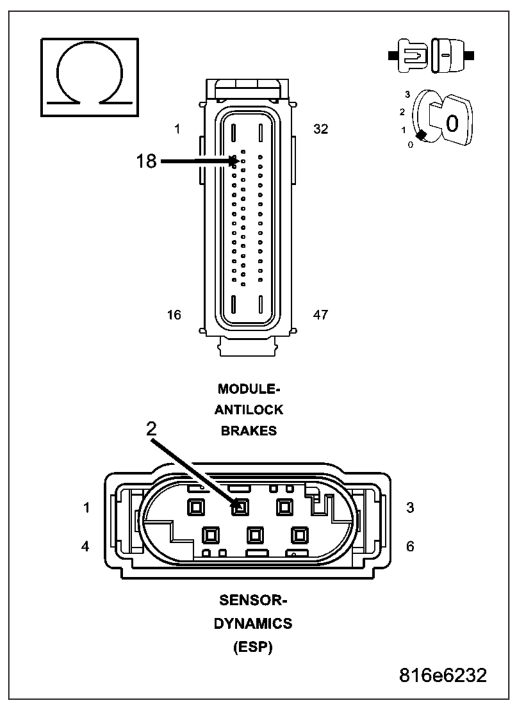
**Yes** >> Repair the (D52) Dynamics Sensor High Data Link circuit for a short to ground.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK THE (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR AN OPEN

Measure the resistance of the (D52) Dynamics Sensor High Data Link circuit between the Dynamics Sensor harness connector and the Anti-Lock Brakes Module harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

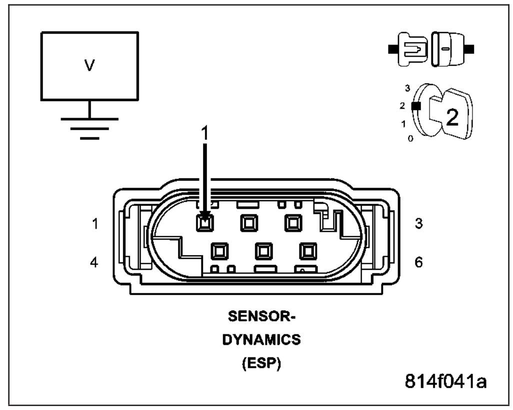
**No** >> Repair the (D52) Dynamics Sensor High Data Link circuit for an open.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 6. CHECK THE (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (D51) Dynamics Sensor Low Data Link circuit.




**Is there any voltage present?**

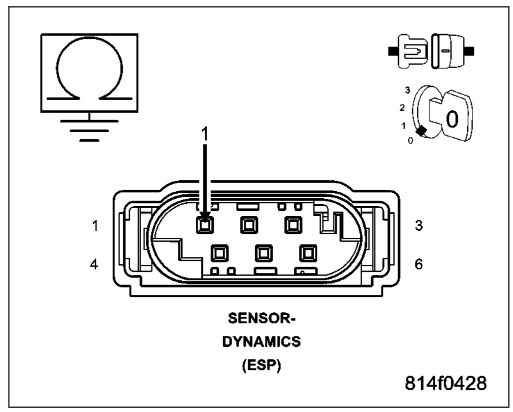
**Yes** >> Repair the (D51) Dynamics Sensor Low Data Link circuit for a short to voltage.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 7

## 7. CHECK THE (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Measure the resistance of the (D51) Dynamics Sensor Low Data Link circuit between ground and the Dynamics Sensor harness connector.



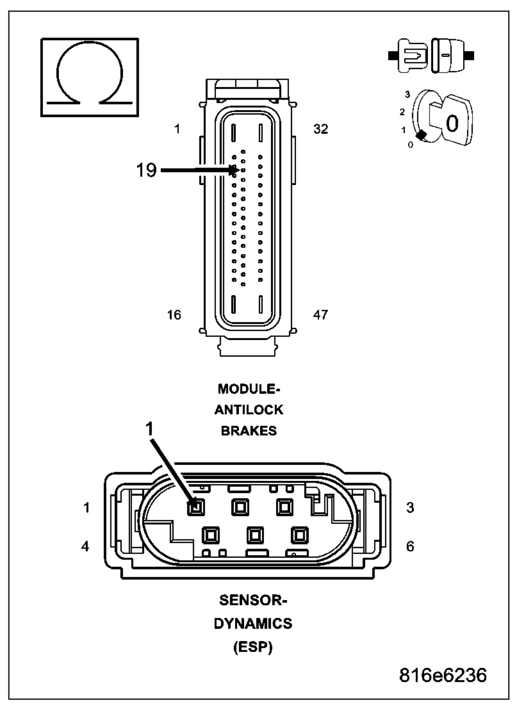

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (D51) Dynamics Sensor Low Data Link circuit for a short to ground.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 8

## 8. CHECK THE (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR AN OPEN

Measure the resistance of the (D51) Dynamics Sensor Low Data Link circuit between the Dynamics Sensor harness connector and the Anti-Lock Brakes Module harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 9

**No** >> Repair the (D51) Dynamics Sensor Low Data Link circuit for an open.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 9. REPLACE DYNAMICS SENSOR & VERIFY IF DTC IS STILL ACTIVE

Replace the Dynamics Sensor in accordance with the Service Information. Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

Turn the ignition on.

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

**WARNING: Ensure brake capability is available before road testing.**

Test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/hr (6 and 15 m.p.h.).

Park the vehicle.

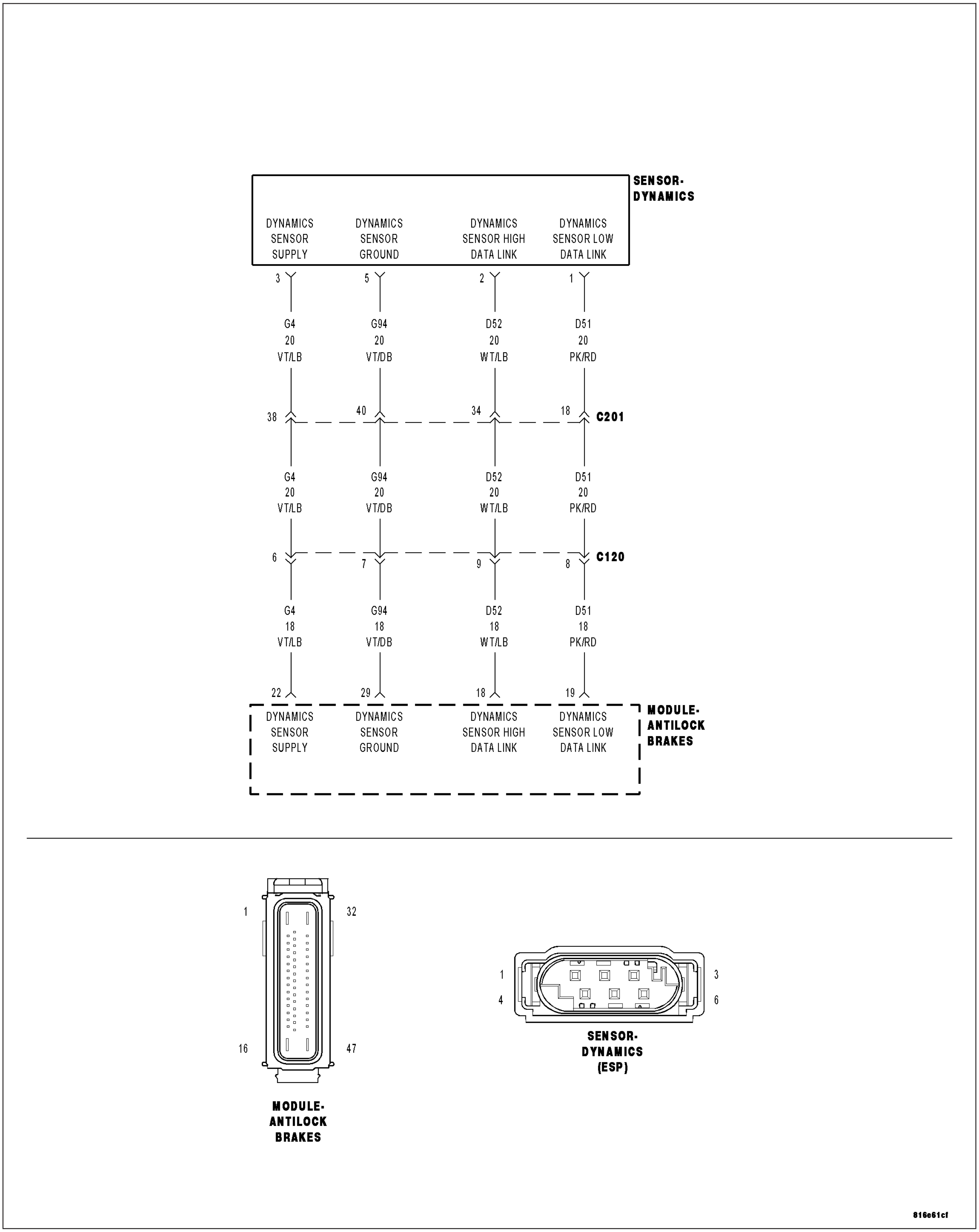
With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## U1104–CAN C BUS CRC PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects an invalid CAN message from the Dynamics Sensor.

| Possible Causes |
| --- |
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT SHORTED TO GROUND, VOLTAGE, OR OPEN |
| (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT SHORTED TO GROUND, VOLTAGE, OR OPEN |
| DYNAMICS SENSOR INSTALLATION |
| DYNAMICS SENSOR |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING).

### 2. CHECK THE DYNAMICS SENSOR INSTALLATION

**NOTE: Dynamics Sensor installation and mounting bolt torque is crucial for proper operation.**

Turn the ignition off.

Check the Dynamics Sensor for damaged, modified, and bent mounting brackets.

Check the Dynamics Sensor mounting bolts for a loose or over tightened condition.

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

### 3. INSPECT RELATED WIRING HARNESS, TERMINALS, & CONNECTORS

Visually inspect the related wiring harness. Look for any pinched, chafed, pierced, and partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, and corroded terminals.

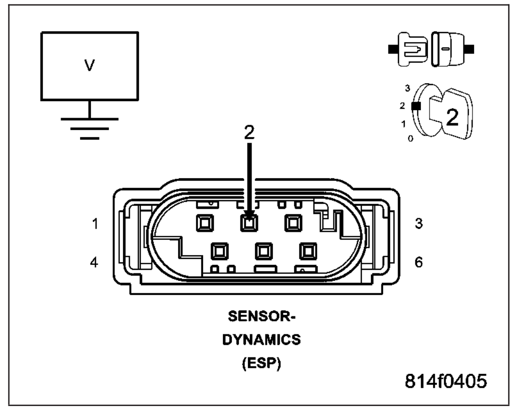
**Were any problems found?**

**Yes** >> Repair as necessary.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK THE (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR A SHORT TO VOLTAGE




Disconnect the Anti-Lock Brakes Module harness connector.

Disconnect the Dynamics Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (D52) Dynamics Sensor High Data Link circuit.

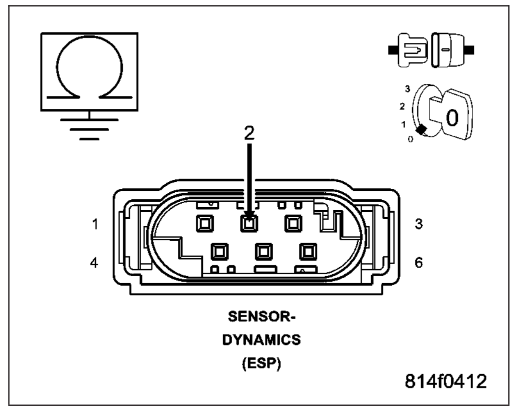
**Is there any voltage present?**

**Yes** >> Repair the (D52) Dynamics Sensor High Data Link circuit for a short to voltage.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK THE (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR A SHORT TO GROUND




Turn the ignition off.

Measure the resistance of the (D52) Dynamics Sensor High Data Link circuit between ground and the Dynamics Sensor harness connector.

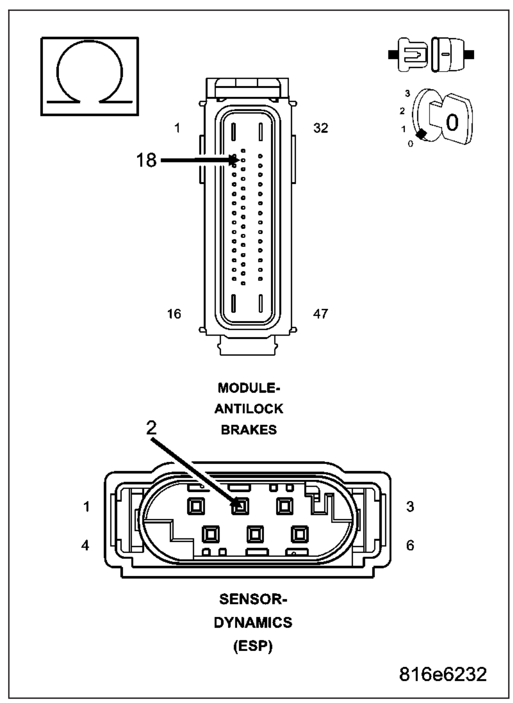
**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (D52) Dynamics Sensor High Data Link circuit for a short to ground.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 6

## 6. CHECK THE (D52) DYNAMICS SENSOR HIGH DATA LINK CIRCUIT FOR AN OPEN




Measure the resistance of the (D52) Dynamics Sensor High Data Link circuit between the Dynamics Sensor harness connector and the Anti-Lock Brakes Module harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

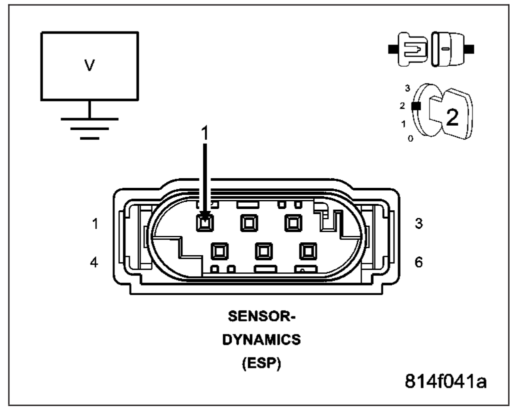
**No** >> Repair the (D52) Dynamics Sensor High Data Link circuit for an open.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## 7. CHECK THE (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (D51) Dynamics Sensor Low Data Link circuit.




**Is there any voltage present?**

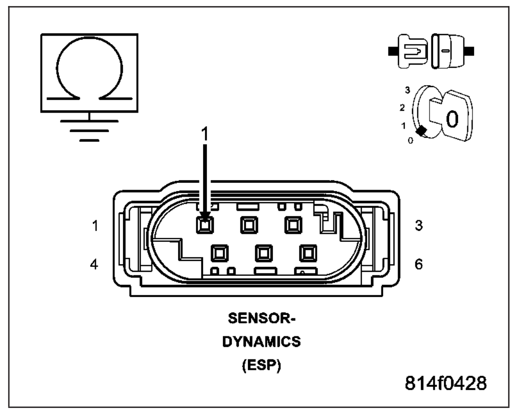
**Yes** >> Repair the (D51) Dynamics Sensor Low Data Link circuit for a short to voltage.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 8

## 8. CHECK THE (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Measure the resistance of the (D51) Dynamics Sensor Low Data Link circuit between ground and the Dynamics Sensor harness connector.



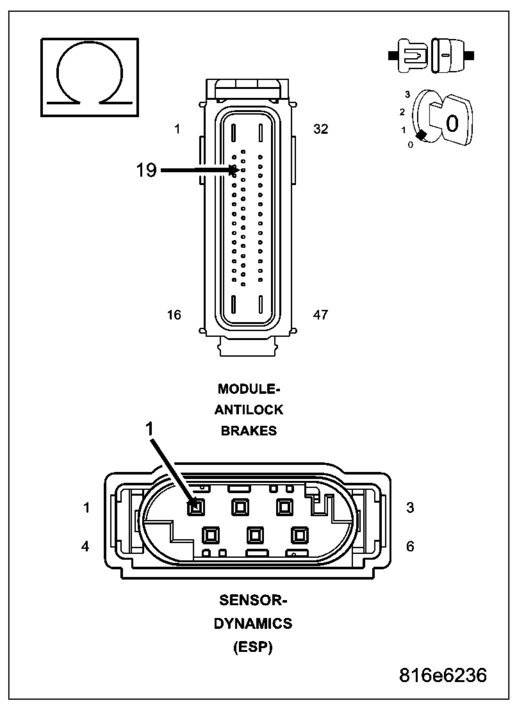

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (D51) Dynamics Sensor Low Data Link circuit for a short to ground.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 9

## 9. CHECK THE (D51) DYNAMICS SENSOR LOW DATA LINK CIRCUIT FOR AN OPEN

Measure the resistance of the (D51) Dynamics Sensor Low Data Link circuit between the Dynamics Sensor harness connector and the Anti-Lock Brakes Module harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Dynamics Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Repair the (D51) Dynamics Sensor Low Data Link circuit for an open.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## U140E–IMPLAUSIBLE VEHICLE CONFIGURATION DATA RECEIVED

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Once per ignition cycle, but not during cranking.
  Or, if low supply voltage faults are detected.
- **Set Condition:**
  If the Anti-Lock Brakes Module either fails to receive vehicle configuration data from the Engine Control Module (ECM) or Powertrain Control Module (PCM) or Body Control Module (BCM) or the configuration data it receives from the ECM or PCM or BCM is invalid

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| ECM OR PCM DTCs PRESENT |
| ECM OR PCM NOT PROGRAMMED OR PROGRAMMED WITH INCORRECT VIN |
| BCM NOT PROGRAMMED OR PROGRAMMED WITH INCORRECT INFORMATION |
| ECM, PCM OR BCM |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: This DTC must be active for the results of this test to be valid. If DTC C2206-VEHICLE CONFIGURATION MISMATCH is present it must be repaired before continuing.**

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs related to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

**No** >> Go To 3

## 3. CHECK IF BCM DTCs ARE PRESENT

With the scan tool, read BCM DTCs.

**Are any DTCs present?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. VERIFY BCM IS CONFIGURED CORRECTLY

With the scan tool, verify that the BCM part number and configuration is correct for the vehicle.

**Is the correct BCM installed in the vehicle?**

**No** >> Replace and program the BCM in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**Yes** >> Go To 5

## 5. CHECK IF ECM OR PCM DTCs ARE PRESENT

With the scan tool, read ECM or PCM DTCs.

**Are any DTCs present?**

**Yes** >> Diagnose and repair the DTC(s). Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 6

## 6. VERIFY CORRECT ECM OR PCM IS INSTALLED IN THE VEHICLE

With the scan tool, verify that the ECM or PCM part number is correct for the vehicle.

**Is the correct ECM or PCM installed in the vehicle?**

**No** >> Replace and program the ECM or PCM in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**Yes** >> Go To 7

## 7. VERIFY ECM OR PCM IS PROGRAMMED WITH CORRECT VIN

With the scan tool, verify that the ECM or PCM is programmed with the correct VIN.

**Is the ECM or PCM programmed with the correct VIN?**

**No** >> Using the scan tool, perform PCM Replaced to update the VIN in the PCM.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**Yes** >> Go To 8

## 8. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs “Logged Against” the ECM or PCM?**

**Yes** >> Replace/update the ECM or PCM in accordance with the service information.
Perform POWERTRAIN VERIFICATION TEST. Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Using the schematics as a guide, check the Anti-Lock Brakes Module pins, terminals, and connectors for corrosion, damage, and terminal push out. Pay particular attention to all Communication circuits. If no problems are found, replace the Anti-Lock Brakes Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## U1501–IMPLAUSIBLE MESSAGE DATA LENGTH RECEIVED FROM ECM/PCM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously, with ignition on.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects bus messages from the Engine Control Module (ECM) or Powertrain Control Module (PCM) are of improper data length.

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| ECM OR PCM DTCs PRESENT |
| ECM OR PCM |
| ANTI-LOCK BRAKES MODULE |

### Diagnostic Test

#### 1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

#### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs related to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

**No** >> Go To 3

## 3. CHECK IF ECM OR PCM DTCs ARE PRESENT

With the scan tool, read ECM or PCM DTCs.

**Are any DTCs present?**

**Yes** >> Diagnose and repair the DTC(s). Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs "Logged Against" the ECM or PCM?**

**Yes** >> Replace/update the ECM or PCM in accordance with the service information.
Perform POWERTRAIN VERIFICATION TEST. Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Using the schematics as a guide, check the Anti-Lock Brakes Module pins, terminals, and connectors for corrosion, damage, and terminal push out. Pay particular attention to all Communication circuits. If no problems are found, replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## U1502–IMPLAUSIBLE MESSAGE DATA LENGTH RECEIVED FROM TCM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously, with ignition on.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects bus messages from the Transmission Control Module (TCM) are of improper data length.

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| TCM DTCs PRESENT |
| TCM |
| ANTI-LOCK BRAKES MODULE |

### Diagnostic Test

#### 1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, read and record ABS DTCs.

With the scan tool, read and record Environmental Data (EV Data).

With the scan tool, erase ABS DTCs.

Cycle the ignition switch.

With the scan tool, read ABS DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING)

#### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs related to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

**No** >> Go To 3

## 3. CHECK IF TCM DTCs ARE PRESENT

With the scan tool, read TCM DTCs.

**Are any TCM DTCs present?**

**Yes** >> Diagnose and repair the DTC(s).

Perform TRANSMISSION VERIFICATION TEST - VER 1.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Using the schematics as a guide, check the Anti-Lock Brakes Module pins, terminals, and connectors for corrosion, damage, and terminal push out. Pay particular attention to all Communication circuits. If no problems are found, replace the Anti-Lock Brakes Module in accordance with the Service Information.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

## U1503–IMPLAUSIBLE MESSAGE DATA LENGTH RECEIVED FROM FCM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module detects an incorrect CAN message from the Front Control Module (FCM).

| Possible Causes |
| --- |
| FCM CAN BUS DTCS |
| ANTI-LOCK BRAKE MODULE |

## Diagnostic Test

### 1. CHECK IF FCM CAN BUS DTCs ARE PRESENT

With the scan tool, read FCM DTCs.

**Are there any FCM CAN BUS DTCs present?**

**Yes** >> Refer to 8-ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING and diagnose the appropriate symptom.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

# U1504-IMPLAUSIBLE MESSAGE DATA LENGTH RECEIVED FROM STEERING ANGLE SENSOR

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on.
- **Set Condition:**
  When the Anti-Lock Brake Module detects an incorrect CAN message from the Steering Angle Sensor.

| Possible Causes |
| --- |
| FCM CAN BUS DTCS |
| STEERING ANGLE SENSOR |
| ANTI-LOCK BRAKE MODULE |

## Diagnostic Test

### 1. CHECK FOR A DTC U1504-IMPLAUSIBLE MESSAGE DATA LENGTH RECEIVED FROM STEERING ANGLE SENSOR

**NOTE: Diagnose and repair any Steering Angle Sensor DTCs in the Steering Column Module, any communication DTCs in the SCM, FCM or PCM and any system under voltage or over voltage DTCs before continuing with this test.**

**NOTE: This DTC must be active for the results of this test to be valid.**

Turn the ignition on.

With the scan tool, read DTCs.

Record DTC and Freeze Frame information.

With the scan tool, erase DTCs.

Cycle the ignition switch off then on.

With the scan tool, read DTCs.

**Does the scan tool display: U1504-IMPLAUSIBLE MESSAGE DATA LENGTH RECEIVED FROM STEERING ANGLE SENSOR?**

**Yes** >> Go To 2

**No** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires.

Refer to the ABS-INTERMITTENT CONDITION TEST. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING).

### 2. CHECK THE WIRING HARNESS, TERMINALS, AND CONNECTORS

Visually inspect the related wiring harness. Look for any bruised, chafed, pierced, or partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Monitor the scan tool data relative to this circuit while performing a wiggle test on the wiring. Look for the data to change other than as expected or for the DTC to reset.

Refer to any Technical Service Bulletins that apply.

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. STEERING ANGLE SENSOR

Replace the Steering Angle Sensor in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**Did DTC U1504-IMPLAUSIBLE MESSAGE DATA LENGTH RECEIVED FROM STEERING ANGLE SENSOR reset?**

**Yes** >> Replace the Anti-Lock Brakes Module in accordance with the Service Information.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## ABS INTERMITTENT CONDITION

For a complete wiring diagram **Refer to Section 8W**.

### Diagnostic Test

#### 1. PERFORM ABS INTERMITTENT CONDITION TEST

**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.**

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Refer to any Technical Service Bulletins (TSBs) that may apply.

Review the scan tool Environmental Data (EV Data). If possible, try to duplicate the conditions under which the DTC set.

Turn the ignition off.

Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

Wiggle the wires while checking for shorts and open circuits.

Perform a voltage drop test on the related circuits between the suspected faulty component and the Anti-Lock Brake Module.

Inspect and clean all PCM, ABS, engine, and chassis grounds that are related to the most current DTC.

If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits

For any Relay DTCs, actuate the Relay with the scan tool and wiggle the related wire harness to try to interrupt the actuation.

Use the scan tool to perform a System Test if one applies to failing component.

A co-pilot, data recorder, and/or lab scope should be used to help diagnose intermittent conditions.

**Were any problems found during the above inspections?**

**Yes** >> Perform the necessary repairs.
Perform ABS VERIFICATION TEST. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

**No** >> Test Complete.

## STANDARD PROCEDURE

## ABS VERIFICATION TEST

### 1. ABS VERIFICATION TEST

**WARNING: To avoid personal injury or death, check brake capability is available before road testing.**

**NOTE: If the ABM (Anti-Lock Brake Module), SAS (Steering Angle Sensor), Dynamics Sensor was replaced, it must be initialized using the scan tool. If not initialized, the ABS indicator will flash continuously with no DTCs. To initialize the ABM and clear offsets have wheels pointing straight ahead and follow the directions on the scan tool. The drive test requires a 90° turn. If the Dynamics Sensor was replaced, test drive the vehicle by turning the vehicle left or right in a curving manner at a velocity between 10 and 25 km/hr (6 and 15 m.p.h.).**

1. Turn the ignition off.
2. Connect all previously disconnected components and connectors.
3. Verify all accessories are turned off and the battery is fully charged.
4. Verify that the ignition is on, with the scan tool, erase all Diagnostic Trouble Codes from All modules. Start the engine and allow it to run for 2 minutes and fully operate the system that was indicating the failure.
5. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the scan tool, read DTCs from all modules.
6. If any Diagnostic Trouble Codes are present, return to symptom list and trouble shoot new or recurring symptom.

**NOTE: For Sensor Signal and Pump Motor faults, the ABM must sense all 4 wheels at 12 km/h (7.5 mph) before it will extinguish the ABS indicator.**

7. If there are no DTCs present after turning ignition on, road test the vehicle for at least 5 minutes. Perform several anti-lock braking stops.
8. Again, with the scan tool read DTCs. If any DTCs are present, refer to the Table of Contents in the applicable Section for the diagnostic test procedure and troubleshoot the new or recurring symptom.
9. If there are no Diagnostic Trouble Codes (DTCs) present, and the customer's concern can no longer be duplicated, the repair is complete.

**Are any DTCs present or is the original concern still present?**

**Yes** >> Repair is not complete, refer to appropriate symptom.

**No** >> Repair is complete.

# BRAKES - ABS SERVICE INFORMATION

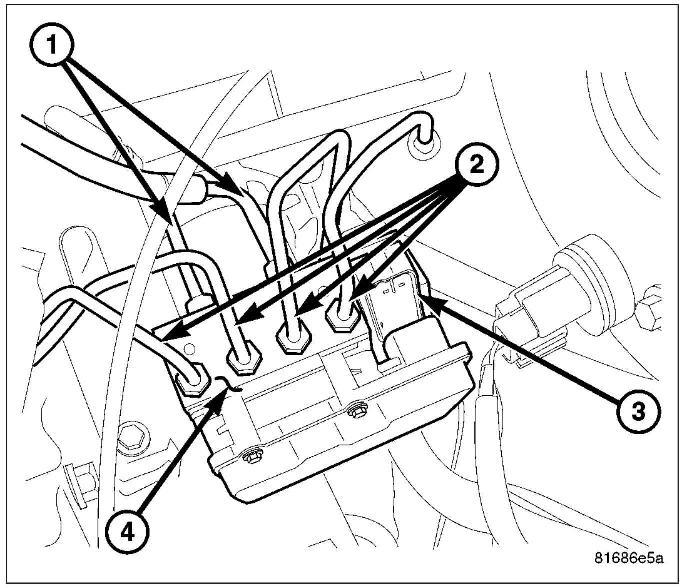
## TABLE OF CONTENTS

# BRAKES - ABS SERVICE INFORMATION

## DESCRIPTION

## ANTILOCK BRAKE SYSTEM WITH TRACTION CONTROL

This vehicle uses the Continental Teves MK25e electronic brake control system. The system includes ABS (Anti-lock Brake System), EVBP (Electronic Variable Brake Proportioning), TCS (Traction Control System), BAS (Brake Assist System), ERM (Electronic Roll Mitigation) and ESP (Electronic Stability Program). All six systems work together to enhance vehicle stability and control in various driving conditions and are commonly referred to as ESP. ESP is standard




The electronic brake control system uses the following components to operate:

- Integrated Control Unit (ICU) – The ICU is a combination of the Electronic Brake Controller (EBC) and the Hydraulic Control Unit (HCU) (4)
- Wheel Speed Sensors (WSS) - Four sensors (one at each wheel)
- Dynamics Sensor – The Dynamics Sensor includes a yaw rate sensor, (The Dynamics Sensor is located under the center console near the center of the vehicle).
- lateral accelerometer and, on 4x4 vehicles with a low range transfer case (245 T-Case), a longitudinal accelerometer.
- Steering Angle Sensor (SAS) – The SAS is part of the clock spring assembly in the steering column.
- Brake Pressure Sensor – The brake pressure sensor is located in the HCU and is not serviceable separate from the HCU.

## ALL-SPEED TRACTION CONTROL

The TCS is an all-speed traction control system that functions up to the maximum allowed vehicle speed. TCS enhances vehicle stability and mobility by reducing wheel spin when accelerating on slippery surfaces. TCS controls wheel spin by applying the brakes and/or reducing engine power.

## ANTILOCK BRAKE SYSTEM (ABS)

The purpose of the antilock brake system (ABS) is to prevent wheel lockup under braking conditions on virtually any type of road surface. Antilock braking is desirable because a vehicle that is stopped without locking the wheels retains directional stability and some steering capability. This allows the driver to retain greater control of the vehicle during braking

## ELECTRONIC VARIABLE BRAKE PROPORTIONING

Vehicles equipped with ABS use EVBP to balance front-to-rear braking. The EVBP is used in place of a rear brake proportioning valve. The EVBP system controls the slip of the rear wheels during braking at low to moderate deceleration, up until the point where ABS control is necessary. The brake pressure at the rear wheels is controlled by using the inlet and outlet valves located in the hydraulic control unit (HCU).

EVBP activation should not be perceptible by the customer because there is no pump motor noise and almost no brake pedal feedback.

## ELECTRONIC STABILITY PROGRAM

The ESP system enhances directional control and stability of the vehicle under various driving conditions. ESP corrects for over/under steering of the vehicle by applying the brake of the appropriate wheel to assist in counteracting the over/under steer condition. Engine power may also be reduced to help the vehicle maintain the desired path. ESP uses sensors in the vehicle to determine the vehicle path intended by the driver and compares it to the actual path of the vehicle. When the actual path does not match the intended path, ESP applies the brake of the appropriate wheel to assist in counteracting the oversteer or understeer condition

- Oversteer – when the vehicle is turning more than appropriate for the steering wheel position.
- Understeer – when the vehicle is turning less than appropriate for the steering wheel position.

The “ESP/TCS Indicator Light” located in the instrument cluster, starts to flash as soon as the tires lose traction and the ESP system becomes active. The “ESP/TCS Indicator Light” also flashes when TCS is active.

## BRAKE ASSIST SYSTEM (BAS)

The BAS is designed to optimize the vehicle’s braking capability during emergency braking maneuvers. The system detects an emergency braking situation by sensing the rate and amount of brake application and then applies optimum pressure to the brakes. This can help reduce braking distances. The BAS complements the antilock brake system (ABS). Applying the brakes very quickly results in the best BAS assistance.

## ELECTRONIC ROLL MITIGATION (ERM)

This system anticipates the potential for wheel lift by monitoring the driver’s steering wheel input and the speed of the vehicle. When ERM determines that the rate of change of the steering wheel angle and vehicles speed are sufficient to potentially cause wheel lift, it applies the appropriate brake and may reduce engine power to lessen the chance that wheel lift will occur. ERM will only intervene during very severe or evasive driving maneuvers.

ERM can only reduce the chance of wheel lift occurring during severe or evasive driving maneuvers. It can not prevent wheel lift due to other factors such as road conditions, leaving the roadway or striking objects or other vehicles.

## OPERATION

## ANTILOCK BRAKE SYSTEM WITH TRACTION CONTROL

### ABS

There are a few performance characteristics of the MK25E Antilock Brake System that may at first seem abnormal, but in fact are normal. These characteristics are described below.

#### NORMAL BRAKING

Under normal braking conditions, the ABS functions the same as a standard base brake system with a diagonally split master cylinder and conventional vacuum assist.

#### ABS BRAKING

ABS operation is available at all vehicle speeds above 3–5 mph. If a wheel locking tendency is detected during a brake application, the brake system enters the ABS mode. During ABS braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel circuit is designed with a set of electric solenoids to allow modulation, although for vehicle stability, both rear wheel solenoids receive the same electrical signal. Wheel lockup may be perceived at the very end of an ABS stop and is considered normal.

During an ABS event, the integrated control unit (ICU) regulates hydraulic pressure at all 4 of the vehicle’s wheels.

The hydraulic pressure at each front wheel is controlled independently (relative to the amount of slip at each wheel) in order to maximize the braking force generated by the front brakes. The rear wheels are controlled such that the hydraulic pressure at either rear wheel does not exceed that of the highest slip rear wheel in order to maintain vehicle stability.

The system can build and release pressure at each wheel, depending on signals generated by the wheel speed sensors (WSS) at each wheel and received at the Antilock Brake Module (ABM).

### NOISE AN BRAKE PEDAL FEEL

During ABS braking, some brake pedal movement may be felt. In addition, ABS braking will create ticking, popping, or groaning noises heard by the driver. This is normal and is due to pressurized fluid being transferred between the master cylinder and the brakes. If ABS operation occurs during hard braking, some pulsation may be felt in the vehicle body due to fore and aft movement of the suspension as brake pressures are modulated.

At the end of an ABS stop, ABS is turned off when the vehicle is slowed to a speed of 3–4 mph. There may be a slight brake pedal drop anytime that the ABS is deactivated, such as at the end of the stop when the vehicle speed is less than 3 mph or during an ABS stop where ABS is no longer required. These conditions exist when a vehicle is being stopped on a road surface with patches of ice, loose gravel, or sand on it. Also, stopping a vehicle on a bumpy road surface activates ABS because of the wheel hop caused by the bumps.

### TIRE NOISE AND MARKS

Although the ABS system prevents complete wheel lockup, some wheel slip is desired in order to achieve optimum braking performance. Wheel slip is defined as follows: 0 percent slip means the wheel is rolling freely and 100 percent slip means the wheel is fully locked. During brake pressure modulation, wheel slip is allowed to reach up to 25–30 percent. This means that the wheel rolling velocity is 25–30 percent less than that of a free rolling wheel at a given vehicle speed. This slip may result in some tire chirping, depending on the road surface. This sound should not be interpreted as total wheel lockup.

Complete wheel lockup normally leaves black tire marks on dry pavement. The ABS will not leave dark black tire marks since the wheel never reaches a fully locked condition. However, tire marks may be noticeable as light patched marks.

### START-UP AND DRIVE-OFF CYCLES

When the ignition is turned on, a popping sound and a slight brake pedal movement may be noticed. The ABS warning lamp will also be on for up to 5 seconds after the ignition is turned on.

When the vehicle is first driven off, a humming may be heard or felt by the driver at approximately 12–25 mph (20–40 km/h). All of these conditions are a normal function of ABS as the system is performing a diagnosis check.

### PREMATURE ABS CYCLING

Symptoms of premature ABS cycling include: clicking sounds from the solenoid valves; pump/motor running; and pulsations in the brake pedal. Premature ABS cycling can occur at any braking rate of the vehicle and on any type of road surface. Neither the red BRAKE indicator lamp, nor the amber ABS indicator lamp, illuminate and no fault codes are stored in the ABM.

Premature ABS cycling is a condition that needs to be correctly assessed when diagnosing problems with the antilock brake system. It may be necessary to use a scan tool to detect and verify premature ABS cycling.

Check the following common causes when diagnosing premature ABS cycling: damaged wheel bearings (causing tone wheel issues); damaged wheel bearing housings where wheel speed sensors mount; and loose wheel speed sensor mounting bolts.

After diagnosing the defective component, repair or replace it as required. When the component repair or replacement is completed, test drive the vehicle to verify that premature ABS cycling has been corrected.

## ALL-SPEED TRACTION CONTROL

Traction control systems sense impending wheel spin based on a model of the rate of change of wheel speed under normal traction conditions. The All-Speed Traction Control uses signals from the same wheel speed sensors as ABS to determine when to apply the brakes to one or more wheels and when to reduce engine torque output using the electronic throttle control (ETC) to prevent wheel slip during acceleration. Throttle control makes the vehicle less reliant on brake application alone to maintain traction, increasing the operating speed range and more closely modulates speed, resulting in smoother operation. With All-Speed Traction Control reducing engine torque as well as applying the brakes, it is possible to achieve almost seamless torque application at the wheels.

If the wheel slip is severe enough to require throttle intervention, All-Speed Traction Control will reduce engine torque and sometimes upshift the transmission to avoid the condition. In milliseconds, All-Speed Traction Control interrogates the engine control system to determine the current torque output, determines how much the torque output the current conditions will allow, and signals this requirement to the engine control system, which reduces the torque by partially closing the throttle. With execution of the torque reduction, the brake system reduces brake pressure to make the transition smooth, while maintaining forward progress. By reducing engine power, braking effectiveness is maintained and the system can operate throughout the normal vehicle speed range. That is why the system is identified as providing “all-speed” traction control.

With AWD, where front-wheel slip can occur, the degree of throttle intervention is relatively less than with rear-wheel drive. The difference in speed capability and the degree of throttle intervention between rear-wheel drive and all-wheel drive is due to the fact that non-driven front wheels on a rear-wheel drive vehicle give the system an accurate vehicle speed reference on which to base responses. With AWD, the possibility that the front wheels may also be slipping makes appropriate corrective action more difficult to determine, thus limiting the effective speed range. Offsetting this is the fact that loss of traction is less likely with AWD because torque is transmitted through all four wheels to begin with. In actual driving situations on snow or ice, the rear-wheel drive and AWD systems respond in essentially the same way up to the 45 mph (72 km/h) limit of the AWD system.

When severe wheel slippage is detected (as on snow-covered roads), the Winter Mode feature of All-Speed Traction Control causes the transmission to up-shift to higher gears at lower speeds than normal. Once a slippery launch condition is detected, the transmission will remain in Winter Mode for a minimum of three minutes. After that, if the road is providing normal traction, the system returns to providing normal up-shifts.

## ANTILOCK BRAKE SYSTEM (ABS)

There are a few performance characteristics of the MK25e anti-lock brake system that may, at first, seem abnormal but in fact are normal. These characteristics are described below.

### NORMAL BRAKING

Under normal braking conditions, the ABS functions the same as a standard base brake system with a front/rear split master cylinder and conventional vacuum assist.

### ABS BRAKING

ABS operation is available at all vehicle speeds above 3-5 mph. If a wheel locking tendency is detected during brake application, the brake system enters ABS mode. During ABS braking, hydraulic pressure in the four wheel circuit is modulated to prevent any wheel from locking. Each wheel circuit is designed with a set of electronic solenoids to allow brake pressure to be modulated at each wheel individually. For vehicle stability reasons, both rear wheel solenoids receive the same electrical signal input during ABS. Wheel lock-up may be perceived at the very end of an ABS stop and is considered normal.

During an ABS event, the integrated control unit (ICU) regulates hydraulic brake pressure at all four of the vehicle’s wheels.

The hydraulic pressure at each front wheel is controlled independently (relative to the amount of slip at each wheel) in order to maximize the braking force generated by the front brakes. The rear wheels are controlled such that the hydraulic pressure at each wheel is the same and does not exceed the pressure appropriate for the wheel with the highest slip in order to maintain vehicle stability.

## ELECTRONIC VARIABLE BRAKE PROPORTIONING

Upon entry into EVBP the inlet valve for the rear brake circuit is switched ON so that the fluid supply from the master cylinder is shut off. In order to decrease the rear brake pressure, the outlet valve for the rear brake circuit is pulsed. This allows fluid to enter the low pressure accumulator (LPA) in the Hydraulic Control Unit (HCU) resulting in a drop in fluid pressure to the rear brakes. In order to increase the rear brake pressure, the outlet valve is switched off and the inlet valve is pulsed. This increases the pressure to the rear brakes. This back-and-forth process will continue until the required slip difference is obtained. At the end of EVBP braking (brakes released) the fluid in the LPA drains back to the master cylinder by switching on the outlet valve and draining through the inlet valve check valve. At the same time the inlet valve is switched on in case of another brake application.

The EVBP will remain functional during many ABS fault modes. If both the red BRAKE and amber ABS warning indicators are illuminated, the EVBP may not be functioning.

## ELECTRONIC STABILITY PROGRAM

To determine whether the car is responding properly to cornering commands, ESP uses steering wheel angle, yaw (turning) rate and lateral acceleration sensors (combined into Dynamics Sensor). Using signals from these sensors, in addition to individual wheel speed sensor signals, the system determines appropriate brake and throttle actions. Once initiated, ESP operates much like All-Speed Traction Control, except that the goal is directional stability. If the vehicle yaw response, or rate of turning, is inconsistent with the steering angle and vehicle speed indications, the ESP system applies the brakes and, if necessary closes the throttle, to restore control. This occurs whether the vehicle is turning too rapidly (oversteering) or not rapidly enough (understeering).

## DIAGNOSIS AND TESTING - ANTILOCK BRAKING SYSTEM

The ABS brake system performs several self-tests every time the ignition switch is turned on and the vehicle is driven. The ABM monitors the systems input and output circuits to verify the system is operating correctly. If the on board diagnostic system senses that a circuit is malfunctioning the system will set a trouble code in its memory.

**NOTE: An audible noise may be heard during the self-test. This noise should be considered normal.**

**NOTE: The scan tool is used to diagnose the ABS system. For additional information refer to the Electrical, Electronic Control Modules section.**

## STANDARD PROCEDURE - ABS BRAKE BLEEDING

ABS system bleeding requires conventional bleeding methods plus use of the DRB scan tool. The procedure involves performing a base brake bleeding, followed by use of the scan tool to cycle and bleed the HCU pump and solenoids. A second base brake bleeding procedure is then required to remove any air remaining in the system.

1. Perform base brake bleeding, (Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).
2. Connect scan tool to the Data Link Connector.
3. Select ANTILOCK BRAKES, followed by MISCELLANEOUS, then ABS BRAKES. Follow the instructions displayed. When scan tool displays TEST COMPLETE, disconnect scan tool and proceed.
4. Perform base brake bleeding a second time, (Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).
5. Top off master cylinder fluid level and verify proper brake operation before moving vehicle.

## SPECIFICATIONS

### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Hydraulic Control Unit Mounting Nuts (HCU) | 14.1 | — | 125 |
| Hydraulic Control Unit Brake Lines (HCU) | 20.3 | — | 180 |
| Antilock Brake Module Mounting Screws (ABM) | 1.8 | — | 16 |
| Wheel Speed Sensors Front Mounting Bolt | 13.5 | — | 120 |
| Wheel Speed Sensor Rear Mounting Bolt | 9 | — | 80 |
| Dynamics Sensor Nuts | 9 | — | 80 |

# ELECTRICAL

## DESCRIPTION

A wheel speed sensor is used at each wheel. The front sensors are mounted to the steering knuckles. The rear sensors are mounted at the outboard end of the axle. Tone wheels are mounted to the outboard ends of the front and rear axle shafts. The gear type tone wheel serves as the trigger mechanism for each sensor.

## OPERATION

The sensors convert wheel speed into a small digital signal. The ABM sends 12 volts to the sensors. The sensor has an internal magneto resistance bridge that alters the voltage and amperage of the signal circuit. This voltage and amperage is changed by magnetic induction when the toothed tone wheel passes the wheel speed sensor. This digital signal is sent to the ABM. The ABM measures the voltage and amperage of the digital signal for each wheel.

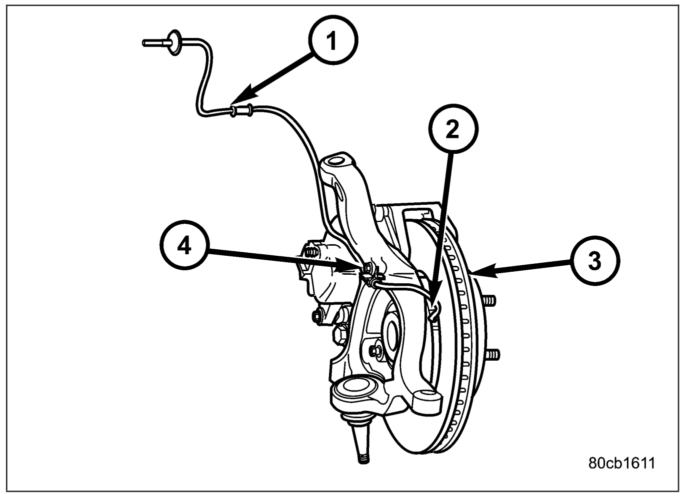
# SENSOR-WHEEL SPEED-FRONT

## REMOVAL

1. Disconnect the front wheel speed sensor wire connector that is located on the inboard side of the respective wheel house.
2. Raise and support the vehicle.
3. Remove the tire and wheel assembly.
4. Remove the caliper adapter. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).

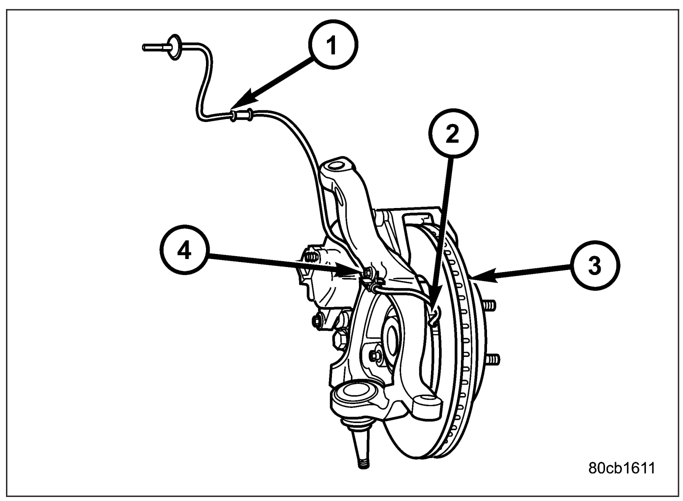
**CAUTION: Never allow the disc brake caliper to hang from the brake hose. Damage to the brake hose with result. Provide a suitable support to hang the caliper securely.**

5. Remove the disc brake rotor (3). (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
6. Remove the wheel speed sensor mounting bolt to the hub.
7. Remove the wheel speed sensor wire from the hub/bearing.
8. Remove the wheel speed sensor wire hold down (4) from the knuckle.
9. Remove the wheel speed sensor wire (1) thru the wheel well.
10. Remove the wheel speed sensor (2) from the vehicle.




## INSTALLATION

1. Install the wheel speed sensor (2) to the vehicle.
2. Install the wheel speed sensor wire (1) thru the wheel well.
3. Install the wheel speed sensor wire (1) to the hub/bearing.
4. Install the wheel speed sensor wire hold down (4) to the knuckle.
5. Install the wheel speed sensor mounting bolt to the hub. Tighten the mounting bolt to 13.5 N·m (120 in. lbs.).
6. Install the disc brake rotor (3) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

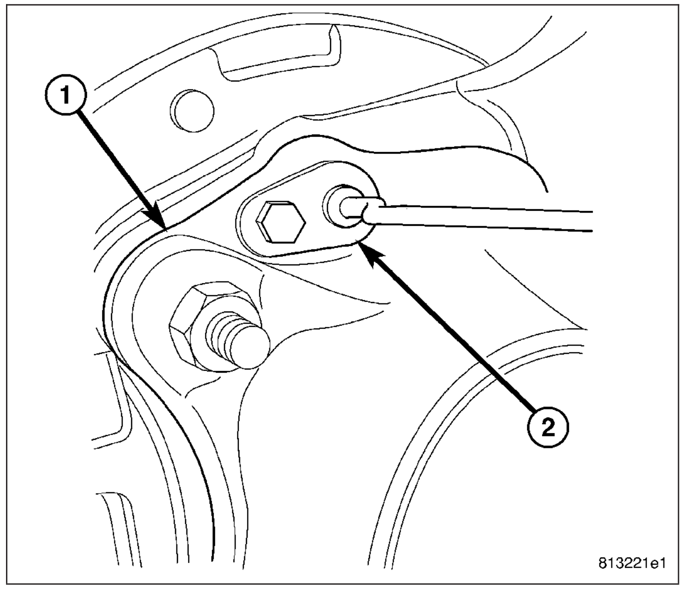



7. Install the disc brake caliper adapter. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).
8. Install the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
9. Reconnect the front wheel speed sensor wire connector to the inboard side of the wheel house being worked on.

# SENSOR- WHEEL SPEED-REAR

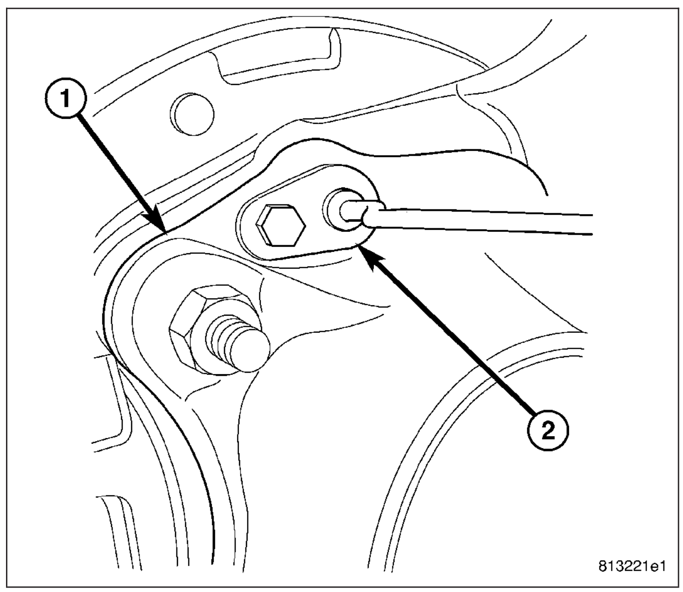
## REMOVAL

1. Raise and support the vehicle.
2. Remove the wheel speed sensor mounting bolt (2) from the rear support plate (1).
3. Remove the wheel speed sensor from the support plate (1).
4. Disconnect the wheel speed sensor electrical connector.




## INSTALLATION

1. Insert the wheel speed sensor (2) through the support plate (1).
2. Tighten the wheel speed sensor bolt (2) to 12-14 N·m (106-124 in. lbs.).
3. Secure the wheel speed sensor wire to the routing clips. Verify that the sensor wire is secure and clear of the rotating components.
4. Reconnect the wheel speed sensor electrical connector.
5. Lower the vehicle.

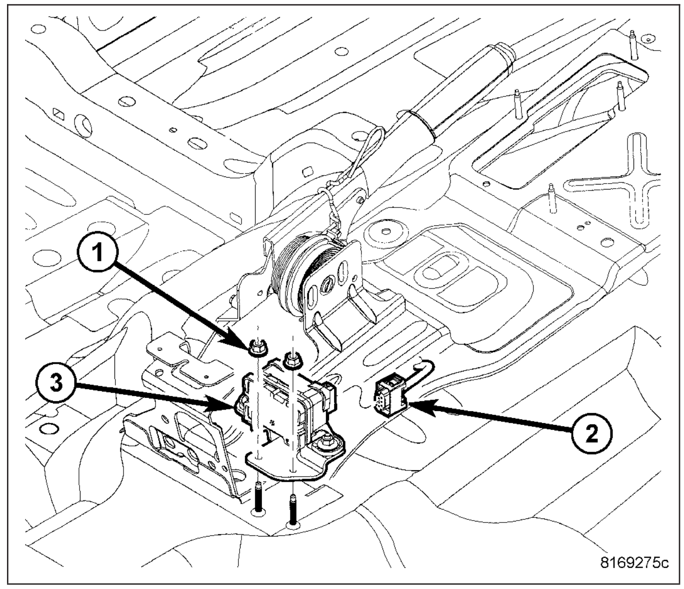


# SENSOR-DYNAMICS

## DESCRIPTION

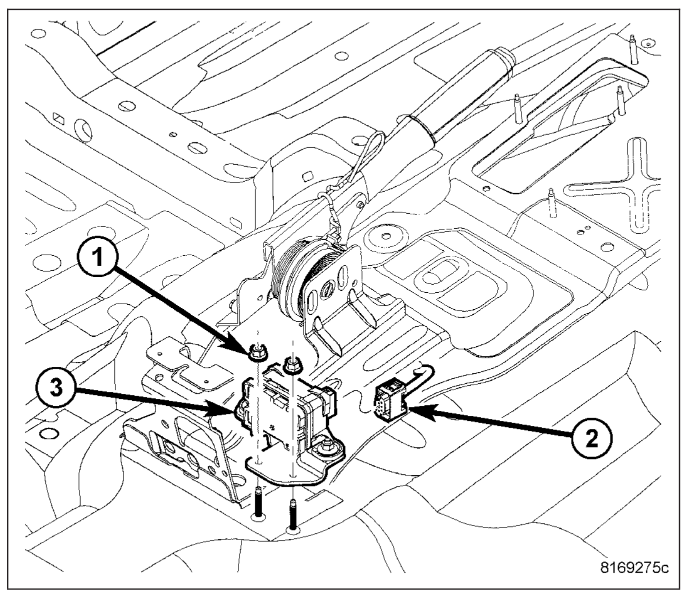
The Yaw Rate and Lateral Acceleration Sensors are housed into one unit known as the Dynamics Sensor (3). The sensor is used to measure side-to-side (Lateral) motion and vehicle rotational sensing (how fast the vehicle is turning - Yaw).

Yaw and Lateral Acceleration Sensors cannot be serviced separately. The entire Dynamics Sensor (3) must be replaced when necessary.



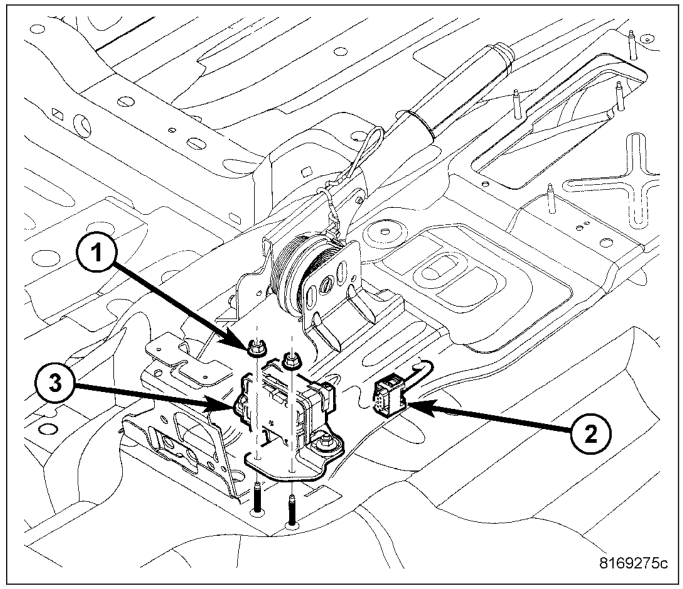

## REMOVAL

1. Remove the center console (Refer to 23 - BODY/ INTERIOR/FLOOR CONSOLE - REMOVAL).
2. Disconnect electrical connector (2) from the dynamics sensor (3).
3. Remove the two nuts (1) securing the sensor to the floor.
4. Remove the sensor (3).



## INSTALLATION

1. Install the dynamics sensor (3) to the vehicle.
2. Install the electrical connector (2) making sure that the connector is fully seated into the sensor (3)
3. Install the two retaining nuts (1) and tighten to 9 N·m (80 in. lbs.).
4. Install the floor console.



# SENSOR-STEERING ANGLE

## DESCRIPTION

**NOTE: Steering angle sensor is part of the airbag clockspring and is not serviced separately from the clock-spring.**

Under transient cornering conditions the lateral acceleration sensor does not measure the true sway force on the car. In order to compensate for this the system uses the driver's steering command (Steering angle sensor) and vehicle speed to estimate the true sway force. This signal is matched with the lateral acceleration sensor signal to ensure a significantly-reduced transient sway of the vehicle body.

## REMOVAL

**NOTE: Steering angle sensor is part of the airbag clockspring and is not serviced separately from the clock-spring.**

1. For removal of the steering angle sensor (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

## INSTALLATION

**NOTE: Steering angle sensor is part of the airbag clockspring and is not serviced separately from the clock-spring.**

1. For installation of the steering angle sensor (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

# HCU (HYDRAULIC CONTROL UNIT)

## DESCRIPTION

The HCU consists of a valve body, pump motor, and wire harness.

## OPERATION

Accumulators in the valve body store extra fluid released to the system for ABS mode operation. The pump provides the fluid volume needed and is operated by a DC type motor. The motor is controlled by the ABM.

The valves modulate brake pressure during antilock braking and are controlled by the ABM.

The HCU provides three channel pressure control to the front and rear brakes. One channel controls the rear wheel brakes in tandem. The two remaining channels control the front wheel brakes individually.

During antilock braking, the solenoid valves are opened and closed as needed. The valves are not static. They are cycled rapidly and continuously to modulate pressure and control wheel slip and deceleration.

During normal braking, the HCU solenoid valves and pump are not activated. The master cylinder and power booster operate the same as a vehicle without an ABS brake system.

During antilock braking, solenoid valve pressure modulation occurs in three stages, pressure increase, pressure hold, and pressure decrease. The valves are all contained in the valve body portion of the HCU.

### PRESSURE DECREASE

The outlet valve is opened and the inlet valve is closed during the pressure decrease cycle.

A pressure decrease cycle is initiated when speed sensor signals indicate high wheel slip at one or more wheels. At this point, the ABM closes the inlet then opens the outlet valve, which also opens the return circuit to the accumulators. Fluid pressure is allowed to bleed off (decrease) as needed to prevent wheel lock.

Once the period of high wheel slip has ended, the ABM closes the outlet valve and begins a pressure increase or hold cycle as needed.

### PRESSURE HOLD

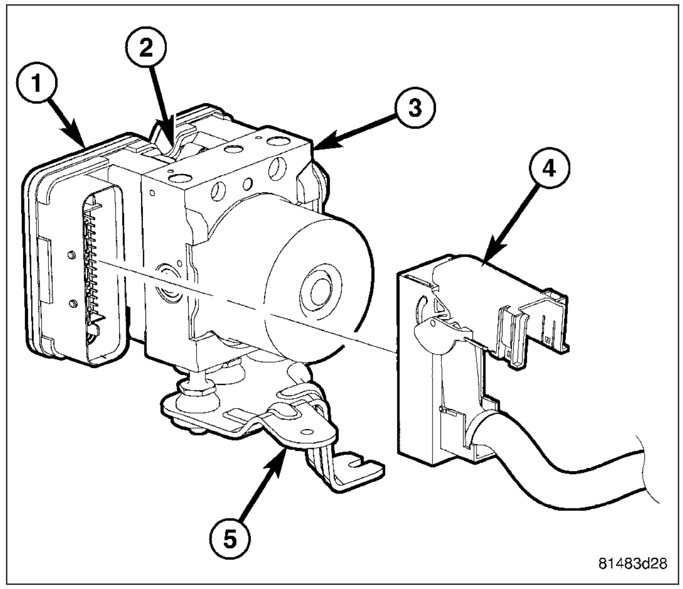
Both solenoid valves are closed in the pressure hold cycle. Fluid apply pressure in the control channel is maintained at a constant rate. The ABM maintains the hold cycle until sensor inputs indicate a pressure change is necessary.

### PRESSURE INCREASE

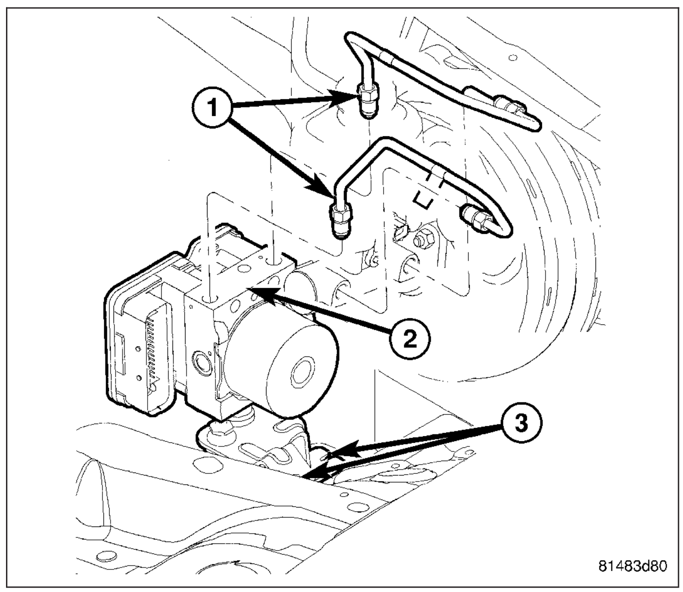
The inlet valve is open and the outlet valve is closed during the pressure increase cycle. The pressure increase cycle is used to counteract unequal wheel speeds. This cycle controls re-application of fluid apply pressure due to changing road surfaces or wheel speed.

## REMOVAL

1. Install prop rod on the brake pedal to keep pressure on the brake system.
2. Remove negative battery cable from the battery.
3. Pull up on the ABM harness connector release (4) and remove connector.

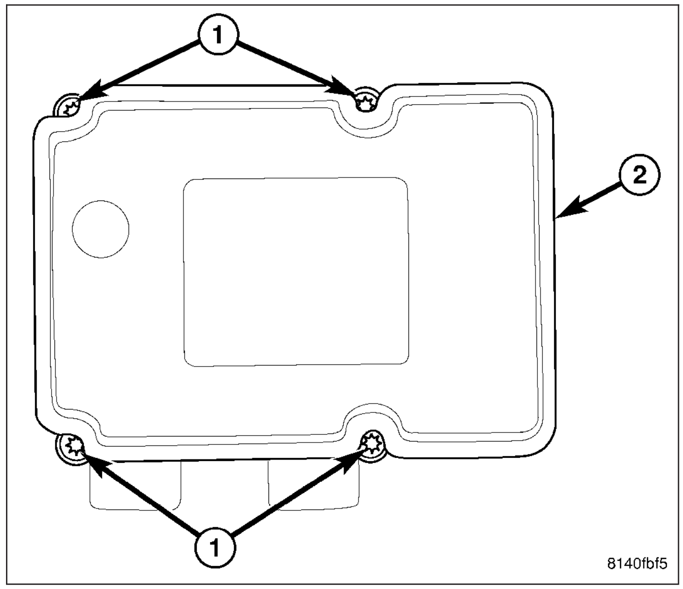



4. Remove brake lines (1) from the ABM (2).
5. Remove ABM (2) mounting nuts (3) and remove ABM(2).

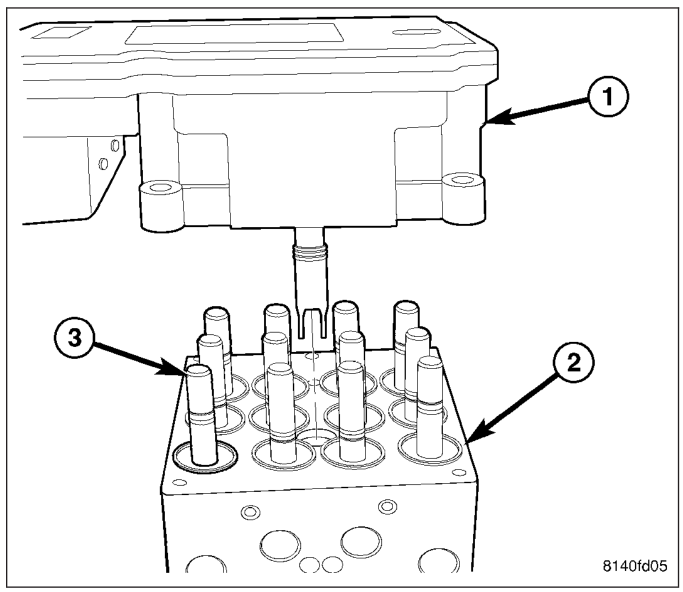


## DISASSEMBLY

1. Remove the four screws (1) attaching the ABM module to the HCU (2).




2. Separate the ABM module (1) from the HCU (2).

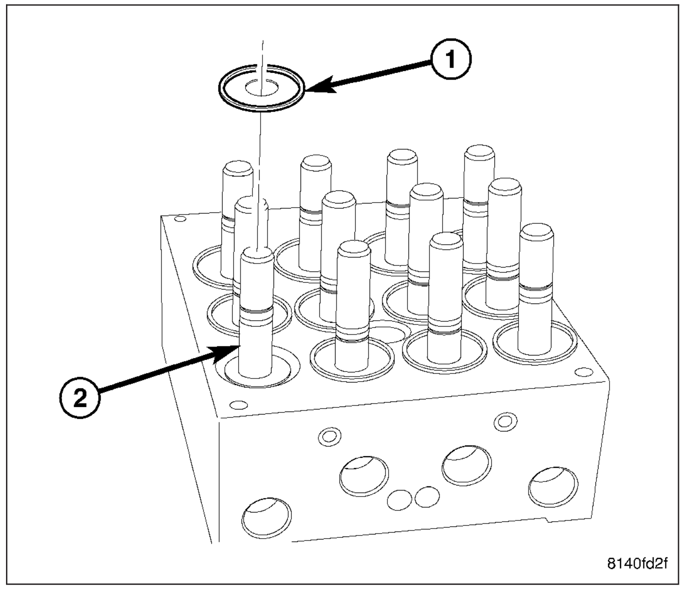


## ASSEMBLY

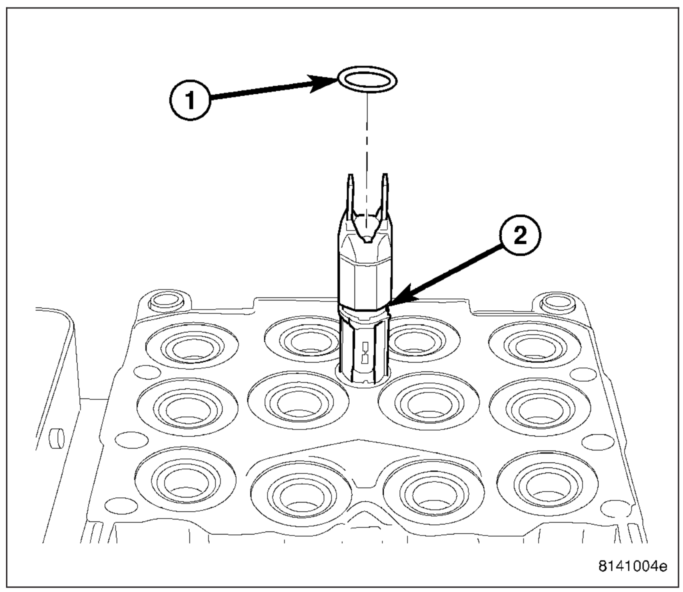
1. Clean any debris off the mating surfaces of the HCU and ABM module.

**CAUTION: When installing new O-rings or solenoid valve stem seals, do not use any type of lubricant.**

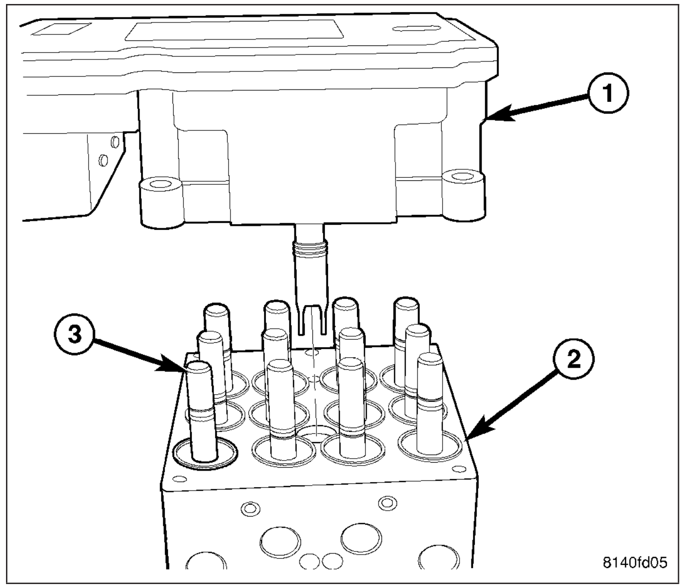
2. If the seals on the components are not new, they must be replaced. Each of the solenoid valve stem seals (1) must be replaced **do not reuse solenoid valve stem seals**.




3. The pump/motor connector O-ring (1) should also be replaced if not new



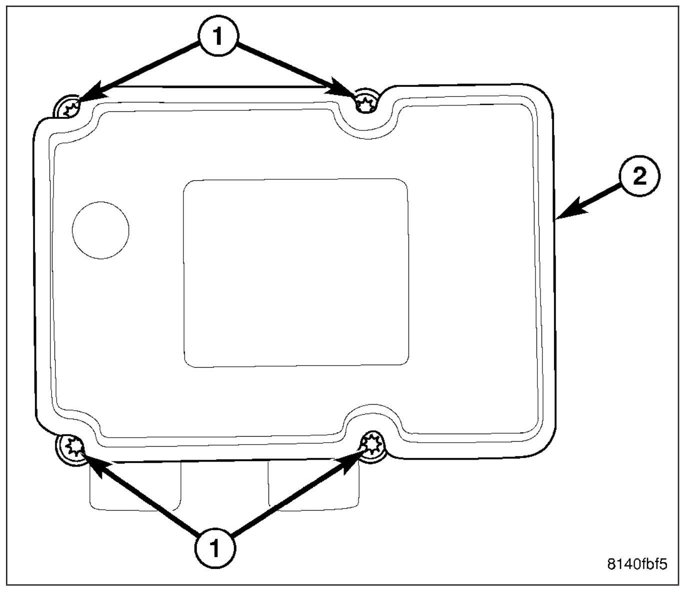
4. Align components and install the ABM module on the HCU.
5. Install the four screws attaching the ABM module to the HCU. Tighten the mounting screws to 2 N·m (17 in. lbs.) torque.
6. If the mounting bracket needs to be installed, install the mounting pins in the HCU as necessary and tighten to 11 N·m (97 in. lbs.) torque. Insert the mounting pins into the grommets mounted in the bracket, then install the single mounting bolt. Tighten the mounting bolt to 11 N·m (97 in. lbs.) torque.
7. Install the HCU in the vehicle (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/HCU (HYDRAULIC CONTROL UNIT) - INSTALLATION).

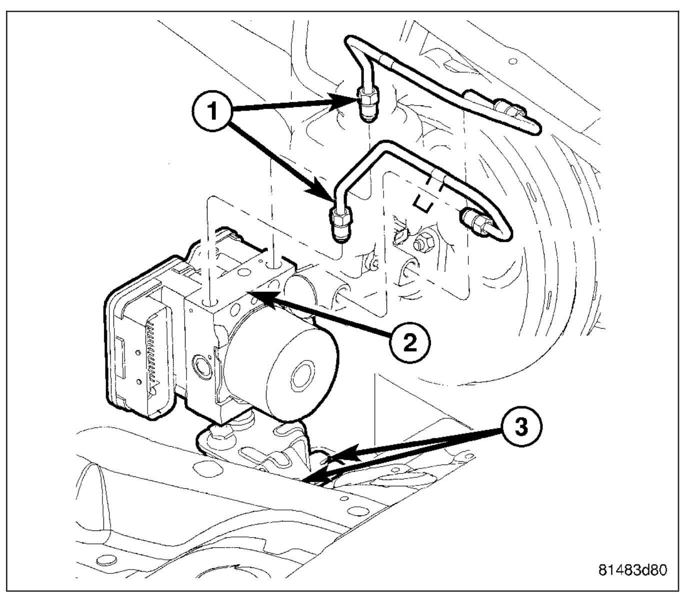



## INSTALLATION

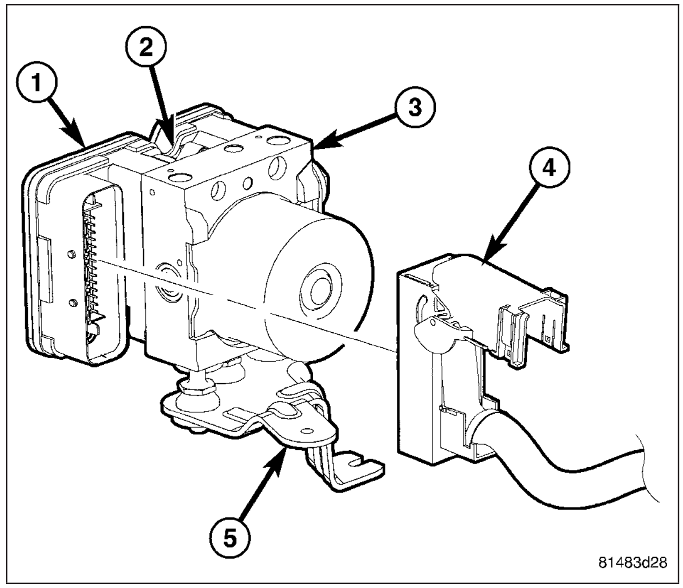
**NOTE: If the ABM module is being replaced with a new ABM module it must be reprogrammed with the use of a scan tool.**

1. Install ABM (2) on the mounting studs (3).
2. Install mounting nuts. Tighten to 14.1 N·m (125 in. lbs.).
3. Install brake lines (1) to the ABM (2) and tighten to 20 N·m (180 in. lbs.) .



4. Install wiring harness connector (4) to the ABM (3) and push down on the release to secure the connector.
5. Install negative battery cable to the battery.
6. Bleed ABS brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).



# CLUTCH

## TABLE OF CONTENTS

# CLUTCH

## WARNING

**WARNING: Exercise care when servicing clutch components. Factory installed clutch discs do not contain asbestos fibers. Dust and dirt on clutch parts may contain asbestos fibers from aftermarket components. Breathing excessive concentrations of these fibers can cause serious bodily harm. Wear a respirator during service and never clean clutch components with compressed air or with a dry brush. Either clean the components with water dampened rags or use a vacuum cleaner specifically designed to remove asbestos fibers and dust. Do not create dust by sanding a clutch discs. Replace the disc if the friction material is damaged. Dispose of all dust and dirt containing asbestos fibers in sealed bags or containers. This will minimize exposure to yourself and to others. Follow all recommended safety practices prescribed by the occupational safety and health administration (OSHA) and the environmental safety agency (EPA), for the handling and disposal of products containing asbestos. Failure to follow these instructions may result in personal injury or death.**

## DIAGNOSIS AND TESTING

## CLUTCH

Drive the vehicle at normal speeds. Shift the transmission through all gear ranges and observe clutch action. If the clutch chatters, grabs, slips or does not release properly, remove and inspect the clutch components. If the problem is noise or hard shifting, further diagnosis may be needed as the transmission or another driveline component may be at fault.

**NOTE: Vehicles equipped with a Dual Mass Flywheel may produce a rattle when the engine is shut off. This noise is considered normal.**

### CLUTCH CONTAMINATION

Fluid contamination is a frequent cause of clutch malfunctions. Oil, water or clutch fluid on the clutch disc and pressure plate surfaces will cause chatter, slip and grab. Inspect components for oil, hydraulic fluid or water/road splash contamination.

Oil contamination indicates a leak at either the rear main seal or transmission input shaft. Clutch fluid leaks are usually from damaged slave cylinder push rod seals. Heat buildup caused by slippage between the pressure plate, disc and flywheel can bake the oil residue onto the components. The glaze-like residue ranges in color from amber to black.

Road splash contamination is dirt/water entering the clutch housing due to loose bolts, housing cracks. Driving through deep water puddles can force water/road splash into the housing through such openings.

### IMPROPER RELEASE OR CLUTCH ENGAGEMENT

Clutch release or engagement problems are caused by wear or damage clutch components. A visual inspection of the release components will usually reveal the problem part.

Release problems can result in hard shifting and noise. Look for leaks at the clutch cylinders and interconnecting line and loose slave cylinder bolts. Also worn/loose release fork, pivot stud, clutch disc, pressure plate or release bearing.

Engagement problems can result in slip, chatter/shudder and noisy operation. The causes may be clutch disc contamination, wear, distortion or flywheel damage. Visually inspect to determine the actual cause of the problem.

### CLUTCH MISALIGNMENT

Clutch components must be in proper alignment with the crankshaft and transmission input shaft. Misalignment caused by excessive runout or warpage of any clutch component will cause grab, chatter and improper clutch release.

## PRESSURE PLATE AND DISC RUNOUT

Check the clutch disc before installation. Axial (face) runout of a **new** disc should not exceed 0.50 mm (0.020 in.). Measure runout about 6 mm (1/4 in.) from the outer edge of the disc facing. Obtain another disc if runout is excessive.

Check condition of the clutch before installation. A warped cover or diaphragm spring will cause grab and incomplete release or engagement. Be careful when handling the cover and disc. Impact can distort the cover, diaphragm spring, release fingers and the hub of the clutch disc.

Use an alignment tool when positioning the disc on the flywheel. The tool prevents accidental misalignment which could result in cover distortion and disc damage.

A frequent cause of clutch cover distortion (and consequent misalignment) is improper bolt tightening.

## FLYWHEEL RUNOUT

Check flywheel runout whenever misalignment is suspected. Flywheel runout should not exceed 0.08 mm (0.003 in.). Measure runout at the outer edge of the flywheel face with a dial indicator. Mount the indicator on a stud installed in place of one of the flywheel bolts.

Common causes of runout are:

- heat warpage
- improper machining
- incorrect bolt tightening
- improper seating on crankshaft flange shoulder
- foreign material on crankshaft flange

Flywheel machining is not recommended. The flywheel clutch surface is machined to a unique contour and machining will negate this feature. Minor flywheel scoring can be cleaned up by hand with 180 grit emery or with surface grinding equipment. Remove only enough material to reduce scoring (approximately 0.001 - 0.003 in.). Heavy stock removal is **not recommended.** Replace the flywheel if scoring is severe and deeper than 0.076 mm (0.003 in.). Excessive stock removal can result in flywheel cracking or warpage after installation; it can also weaken the flywheel and interfere with proper clutch release.

Clean the crankshaft flange before mounting the flywheel. Dirt and grease on the flange surface may cock the flywheel causing excessive runout. Use new bolts when remounting a flywheel and secure the bolts with Mopar Lock And Seal or equivalent. Tighten flywheel bolts to specified torque only. Overtightening can distort the flywheel hub causing runout.

## DIAGNOSIS CHART

The diagnosis charts Diagnosis Chart describe common clutch problems, causes and correction. Conditions, causes and corrective action are outlined in the indicated columns.

**Diagnosis Chart**

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| Disc facing worn out | 1. Normal wear. | 1. Replace cover and disc. |
| | 2. Driver frequently rides (slips) the clutch. Results in rapid overheating and wear. | 2. Replace cover and disc. |
| | 3. Insufficient clutch cover diaphragm spring tension. | 3. Replace cover and disc. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| Clutch disc facing contaminated with oil, grease, or clutch fluid. | 1. Leak at rear main engine seal or transmission input shaft seal. | 1. Replace appropriate seal. |
| | 2. Excessive amount of grease applied to the input shaft splines. | 2. Remove grease and apply the correct amount of grease. |
| | 3. Road splash, water entering housing. | 3. Replace clutch disc. Clean clutch cover and reuse if in good condition. |
| | 4. Slave cylinder leaking. | 4. Replace hydraulic clutch linkage. |
| Clutch is running partially disengaged. | 1. Release bearing sticking or binding and does not return to the normal running position. | 1. Verify failure. Replace the release bearing and transmission front bearing retainer as necessary. |
| Flywheel below minimum thickness specification. | 1. Improper flywheel machining. Flywheel has excessive taper or excessive material removal. | 1. Replace flywheel. |
| Clutch disc, cover and/or diaphragm spring warped or distorted. | 1. Rough handling. Impact bent cover, spring, or disc. | 1. Replace disc or cover as necessary. |
| | 2. Improper bolt tightening procedure. | 2. Tighten clutch cover using proper procedure. |
| Facing on flywheel side of disc torn, gouged, or worn. | 1. Flywheel surface scored or nicked. | 1. Correct surface condition if possible. Replace flywheel and disc as necessary. |
| | 2. Clutch disc sticking or binding on transmission input shaft. | 2. Lubricate splines with high temperature grease. |
| Clutch disc facing burnt. Flywheel and cover pressure plate surfaces heavily glazed. | 1. Frequent operation under high loads or hard acceleration conditions. | 1. Correct condition of flywheel and pressure plate surface. Replace clutch cover and disc. Alert driver to problem cause. |
| | 2. Driver frequently rides (slips) clutch. Results in rapid wear and overheating of disc and cover. | 2. Correct condition of flywheel and pressure plate surface. Replace clutch cover and disc. Alert driver to problem cause. |
| Clutch disc binds on input shaft splines. | 1. Clutch disc hub splines damaged during installation. | 1. Clean, smooth, and lubricate hub splines if possible. Replace disc if necessary. |
| | 2. Input shaft splines rough, damaged, or corroded. | 2. Clean, smooth, and lubricate shaft splines if possible. Replace input shaft if necessary. |
| Clutch disc rusted to flywheel and/or pressure plate. | 1. Clutch not used for and extended period of time (e.g. long term vehicle storage). | 1. Sand rusted surfaces with 180 grit sanding paper. Replace clutch cover and flywheel if necessary. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| Pilot bearing seized, loose, or rollers are worn. | 1. Bearing cocked during installation. | 1. Install and lubricate a new bearing. |
| | 2. Bearing defective. | 2. Install and lubricate a new bearing. |
| | 3. Bearing not lubricated. | 3. Install and lubricate a new bearing. |
| | 4. Clutch misalignment. | 4. Inspect clutch and correct as necessary. Install and lubricate a new bearing. |
| Clutch will not disengage properly. | 1. Low clutch fluid level. | 1. Replace hydraulic linkage assembly. |
| | 2. Clutch cover loose. | 2. Follow proper bolt tightening procedure. |
| | 3. Clutch disc bent or distorted. | 3. Replace clutch disc. |
| | 4. Clutch cover diaphragm spring bent or warped. | 4. Replace clutch cover. |
| | 5. Clutch disc installed backwards. | 5. Remove and install clutch disc correctly. |
| | 6. Release fork bent or fork pivot loose or damaged. | 6. Replace fork or pivot as necessary. |
| | 7. Clutch master or slave cylinder failure. | 7. Replace hydraulic linkage assembly. |
| Clutch pedal squeak. | 1. Pivot pin loose. | 1. Tighten pivot pin if possible. Replace clutch pedal if necessary. |
| | 2. Master cylinder bushing not lubricated. | 2. Lubricate master cylinder bushing. |
| | 3. Pedal bushings worn out or cracked. | 3. Replace and lubricate bushings. |
| Clutch master or slave cylinder plunger dragging or binding | 1. Master or slave cylinder components worn or corroded. | 1. Replace clutch hydraulic linkage assembly. |
| Release bearing is noisy. | 1. Release bearing defective or damaged. | 1. Replace release bearing. |
| Contact surface of release bearing damaged. | 1. Clutch cover incorrect or release fingers bent or distorted. | 1. Replace clutch cover and release bearing. |
| | 2. Release bearing defective or damaged. | 2. Replace the release bearing. |
| | 3. Release bearing misaligned. | 3. Check and correct runout of clutch components. Check front bearing sleeve for damage/ alignment. Repair as necessary. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
| --- | --- | --- |
| Partial engagement of clutch disc. One side of disc is worn and the other side is glazed and lightly worn. | 1. Clutch pressure plate position incorrect. | 1. Replace clutch disc and cover. |
| | 2. Clutch cover, spring, or release fingers bent or distorted. | 2. Replace clutch disc and cover. |
| | 3. Clutch disc damaged or distorted. | 3. Replace clutch disc. |
| | 4. Clutch misalignment. | 4. Check alignment and runout of flywheel, disc, pressure plate, and clutch housing. Correct as necessary. |

# SPECIFICATIONS

## CLUTCH

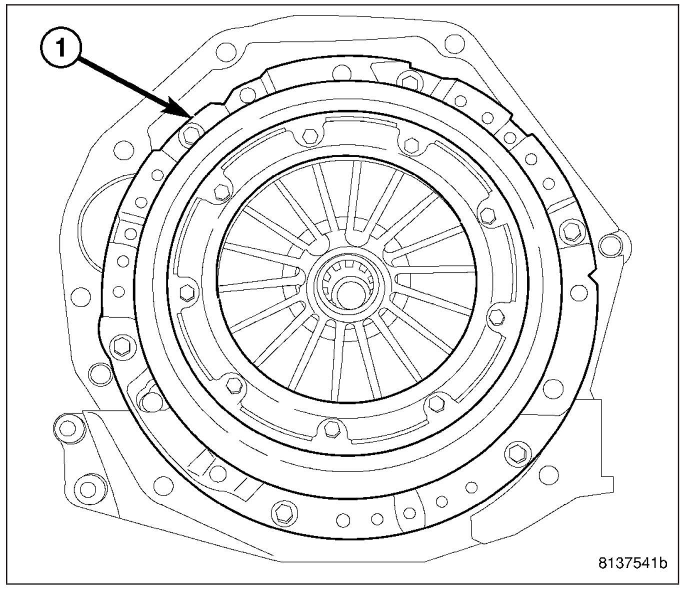
### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
| --- | --- | --- | --- |
| Pressure Plate Bolts - 3.7L | 50 | 37 | - |
| Pressure Plate Bolts - 2.5L Diesel | 54 | 40 | - |
| Clutch Cylinder Bolts | 23 | - | 200 |
| Flywheel Bolts - 3.7L | 81 | 60 | - |
| Flywheel Bolts - 2.5L Diesel | 45 | 33 | - |
| Master Cylinder Nuts | 38 | 28 | - |
| Slave Cylinder Nuts | 23 | 17 | - |
| Pedal Bracket Nuts | 39 | 29 | - |

# DISC-CLUTCH

## REMOVAL

1. Remove transmission.
2. Mark position of pressure plate (1) on flywheel with paint or a scriber for assembly reference, if clutch is not being replaced.
3. Loosen pressure plate bolts evenly and in rotation to relieve spring tension and avoid warping the plate.
4. Remove pressure plate bolts and pressure plate and disc.



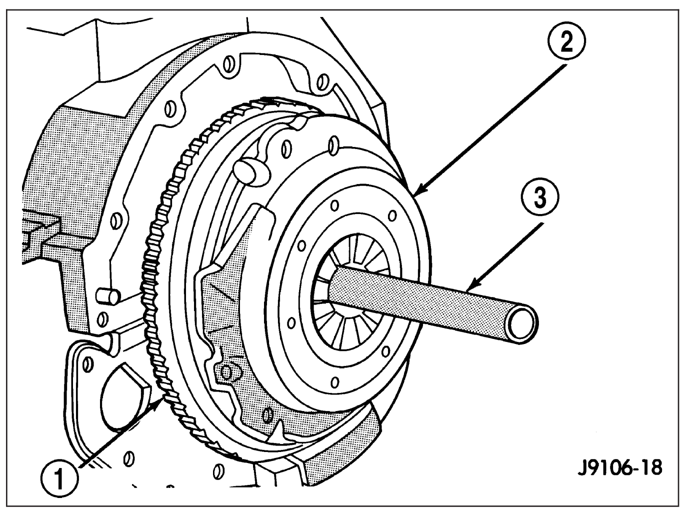

## INSTALLATION

## GAS ENGINES

1. Lightly scuff sand flywheel face with 180 grit emery cloth, then clean with a wax and grease remover.
2. Lubricate pilot bearing with Mopar high temperature bearing grease or equivalent.
3. Check runout and operation of **new** clutch disc.

**NOTE: Disc must slide freely on transmission input shaft splines.**

4. With the disc on the input shaft, check face runout with dial indicator. Check runout at disc hub 6 mm (1/4 in.) from outer edge of facing. Obtain another clutch disc if runout exceed 0.5 mm (0.020 in.).
5. Position clutch disc on flywheel with side marked flywheel against the flywheel.




**NOTE: If not marked, the flat side of disc hub goes towards the flywheel.**

6. Insert clutch alignment tool (3) through the clutch disc and into the pilot bearing.
7. Position clutch pressure plate (2) over disc and on the flywheel (1).
8. Install pressure plate bolts finger tight.

**CAUTION: Use only the factory bolts to mount the pressure plate. The bolts must be the correct size. If bolts are too short, there isn't enough thread engagement, if too long bolts interfere with the Dual Mass Flywheel.**

9. Tighten pressure plate bolts evenly and in rotation a few threads at a time.

**CAUTION: The bolts must be tightened evenly and to specified torque. Failure to follow these instructions will distort the pressure plate.**

10. Tighten pressure plate bolts 50 N·m (37 ft. lbs.).
11. Apply light coat of Mopar high temperature bearing grease or equivalent to clutch disc hub and splines of transmission input shaft.

**CAUTION: Do not over lubricate shaft splines. This will result in grease contamination of disc.**

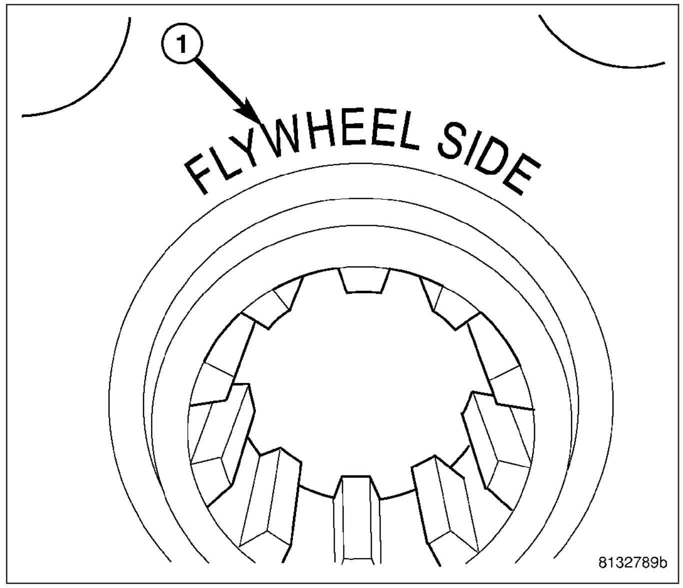
12. Install transmission.

## DIESEL ENGINE

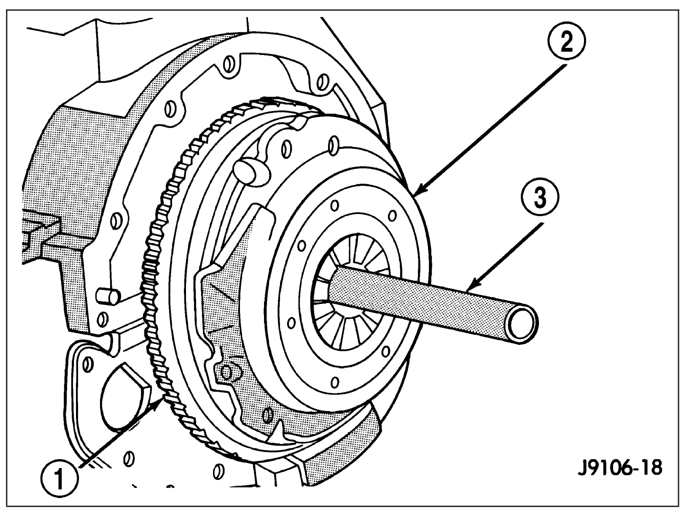
1. Lightly scuff sand flywheel face with 180 grit emery cloth, then clean with a wax and grease remover.
2. Lubricate pilot bearing with Mopar high temperature bearing grease or equivalent.
3. Check runout and operation of **new** clutch disc.

**NOTE: Disc must slide freely on transmission input shaft splines.**

4. With the disc on the input shaft, check face runout with dial indicator. Check runout at disc hub 6 mm (1/4 in.) from outer edge of facing. Obtain another clutch disc if runout exceed 0.5 mm (0.020 in.).
5. Position clutch disc on flywheel with side marked flywheel side (1) against the flywheel. If not marked, the flat side of disc hub goes towards the flywheel.




6. Insert clutch alignment tool (3) through the clutch disc and into the pilot bearing.
7. Position clutch pressure plate (2) over disc and on the flywheel (1).



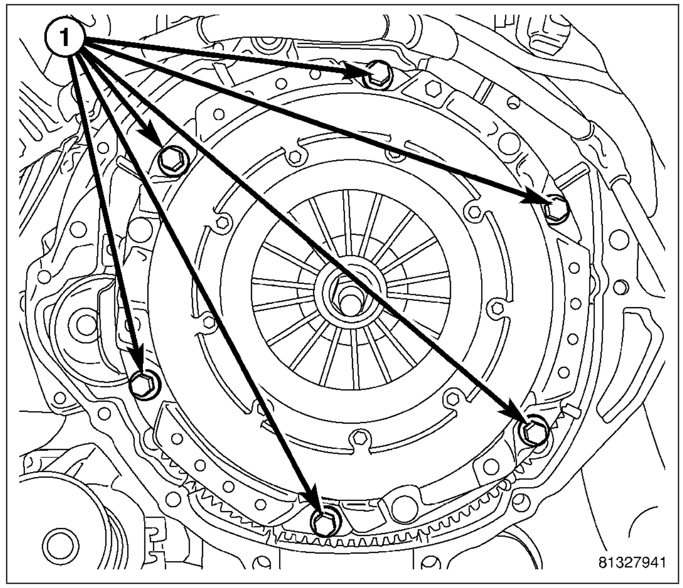
8. Install pressure plate bolts (1) finger tight.
9. Tighten pressure plate bolts evenly and in rotation a few threads at a time.

**CAUTION: The bolts must be tightened evenly and to specified torque. Failure to follow these instruction will distort the pressure plate.**

10. Tighten pressure plate bolts to 54 N·m (40 ft. lbs.).
11. Apply light coat of Mopar® high temperature bearing grease or equivalent to clutch disc hub and splines of transmission input shaft.

**CAUTION: Do not over lubricate shaft splines. Failure to follow these instruction will contamination of disc.**

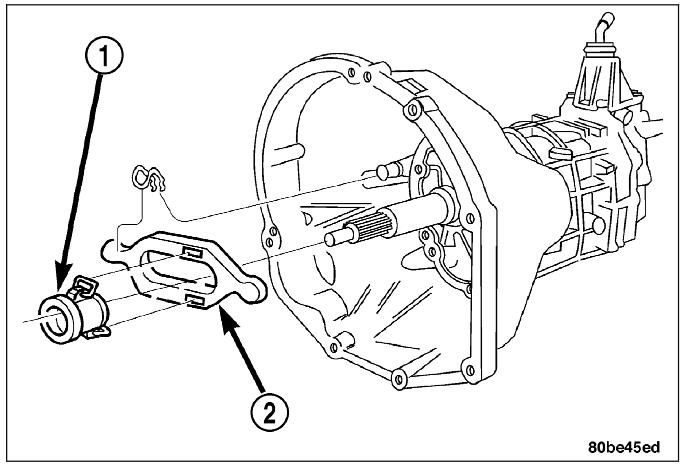
12. Install transmission.



# BEARING-CLUTCH RELEASE

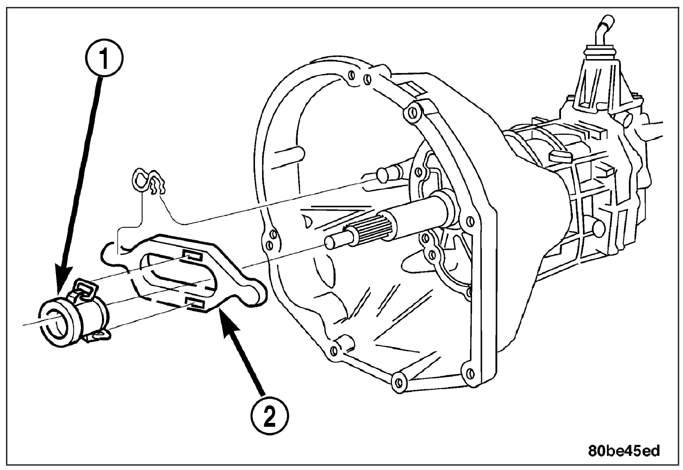
## REMOVAL

1. Remove transmission.
2. Disconnect release bearing (1) from release fork (2) and remove the bearing.
3. Inspect bearing slide surface of transmission front bearing retainer. Replace retainer if slide surface is scored, worn, or cracked.
4. Inspect release fork and fork pivot. Be sure pivot is secure and in good condition. Be sure fork is not distorted or worn. Replace release fork retainer spring if bent or damaged.




## INSTALLATION

1. Lubricate crankshaft pilot bearing with Mopar™ high temperature bearing grease or equivalent. Apply grease to end of long shank, small diameter flat blade screwdriver. Then insert tool through clutch disc hub to reach bearing.
2. Lubricate input shaft splines, bearing retainer slide surface, fork pivot and release fork pivot surface.
3. Install new release bearing (1) and secured to release fork (2).
4. Install transmission.

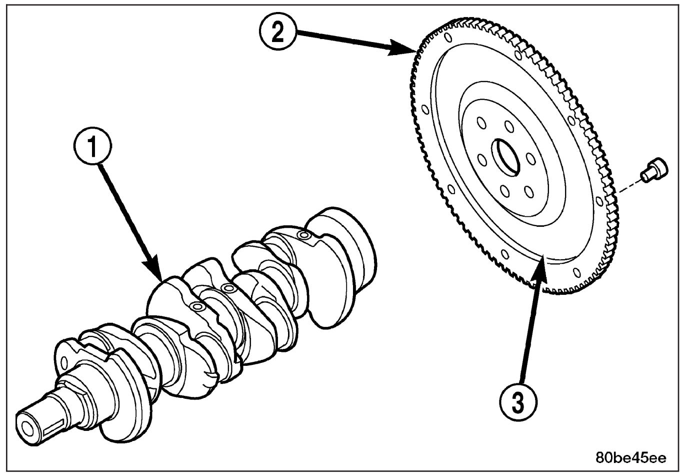


# FLYWHEEL

## DESCRIPTION

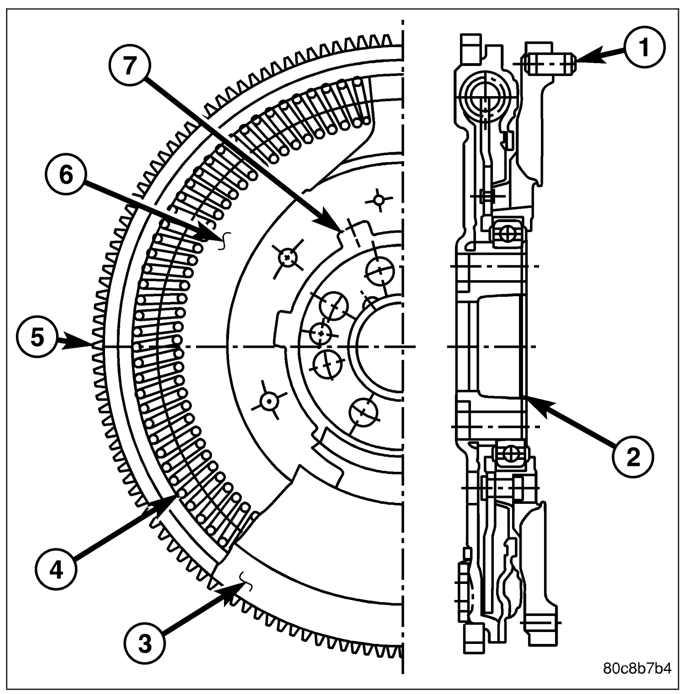
### STANDARD FLYWHEEL

The standard flywheel is used on the 3.7L engine. The flywheel (3) is a heavy plate bolted to the rear of the crankshaft (1). The flywheel incorporates the ring gear (2) around the outer circumference to mesh with the starter to permit engine cranking. The rear face of the flywheel serves as the driving member to the clutch disc.




### DUAL MASS FLYWHEEL

The Dual Mass Flywheel is used on the 2.8L Diesel. The flywheel incorporates the ring gear (5) around the outer circumference to mesh with the starter to permit engine cranking. The primary flywheel (6) side is bolted to the crankshaft. The secondary flywheel (3) side serves as the driving member to the clutch disc. Internal springs (4) between the flywheels are use to dampen energy. The Dual Mass Flywheel is serviced as an assembly only and should never be taken apart.




## DIAGNOSIS AND TESTING

## FLYWHEEL

Check flywheel runout whenever misalignment is suspected. Flywheel runout should not exceed 0.08 mm (0.003 in.). Measure runout at the outer edge of the flywheel face with a dial indicator. Mount the indicator on a stud installed in place of one of the flywheel bolts.

Common causes of runout are:

- heat warpage
- improper machining
- incorrect bolt tightening

- improper seating on crankshaft flange shoulder
- foreign material on crankshaft flange

Flywheel machining is not recommended. The flywheel clutch surface is machined to a unique contour and machining will negate this feature. Minor flywheel scoring can be cleaned up by hand with 180 grit emery or with surface grinding equipment. Remove only enough material to reduce scoring (approximately 0.001 - 0.003 in.). Heavy stock removal is **not recommended.** Replace the flywheel if scoring is severe and deeper than 0.076 mm (0.003 in.). Excessive stock removal can result in flywheel cracking or warpage after installation; it can also weaken the flywheel and interfere with proper clutch release.

Clean the crankshaft flange before mounting the flywheel. Dirt and grease on the flange surface may cock the flywheel causing excessive runout. Use new bolts when remounting a flywheel and secure the bolts with Mopar Lock And Seal or equivalent. Tighten flywheel bolts to specified torque only. Overtightening can distort the flywheel hub causing runout.

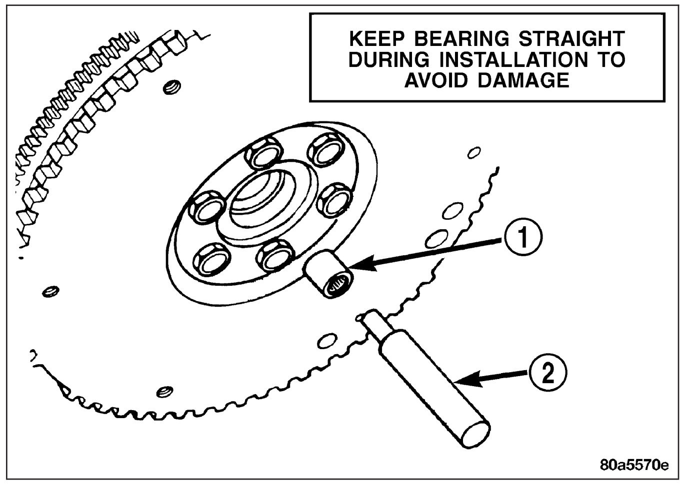
# BEARING-PILOT

## REMOVAL

1. Remove transmission.
2. Remove pressure plate and clutch disc.
3. Remove pilot bearing with an internal (blind hole) puller.

## INSTALLATION

1. Lubricate new bearing with Mopar high temperature bearing grease or equivalent.
2. Start new pilot bearing (1) into crankshaft by hand. Then seat bearing with clutch alignment tool (2).
3. Install clutch disc and pressure plate.
4. Install transmission.

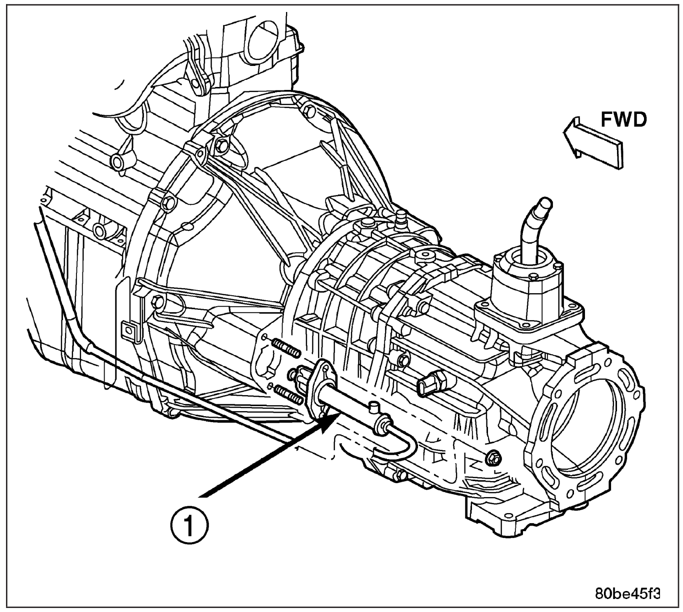


# LINKAGE

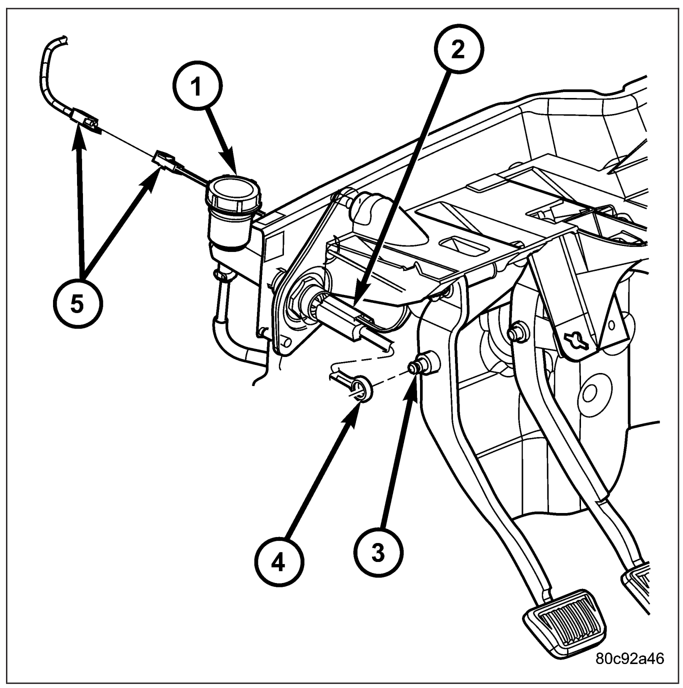
## REMOVAL

**NOTE: The clutch master cylinder, slave cylinder and connecting line are serviced as an assembly only. The linkage components cannot be overhauled or serviced separately. The cylinders and connecting line are sealed units.**

1. With vehicle in neutral, position vehicle on hoist.
2. Remove slave cylinder (1) from clutch housing.
3. Disengage clutch fluid line from body clips, if applicable.
4. Lower vehicle.

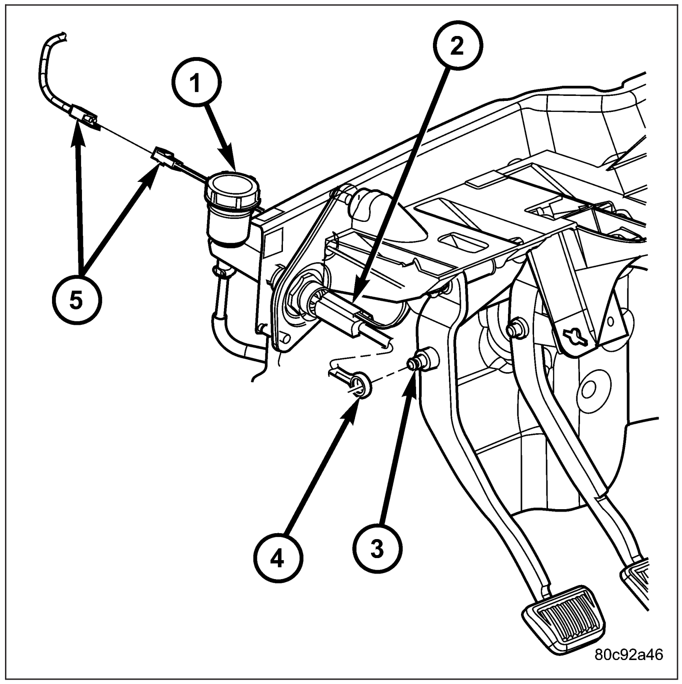



5. Tighten clutch master cylinder (1) reservoir cap to avoid spilling fluid.
6. Remove clutch master cylinder attaching nuts.
7. Disengage clutch master cylinder actuator (4) from pivot pin (3) on pedal arm.
8. Disconnect clutch interlock safety switch wires (5).
9. Remove clutch hydraulic linkage through engine compartment.



## INSTALLATION

**NOTE: The clutch master cylinder, slave cylinder and connecting line are serviced as an assembly only. The linkage components cannot be overhauled or serviced separately. The cylinders and connecting line are sealed units.**




1. Tighten master cylinder reservoir cap to avoid spills.
2. Position clutch linkage components in vehicle. Work connecting line and slave cylinder downward past engine and adjacent to clutch housing.
3. Position clutch master cylinder (1) on dash panel.
4. Attach clutch master cylinder actuator (4) to pivot pin (3) on clutch pedal.
5. Install clutch master cylinder nuts and tighten to 38 N·m (28 ft. lbs.).
6. Raise vehicle.
7. Insert slave cylinder push rod through clutch housing opening and securely engaged into release lever.
8. Install slave cylinder nuts and tighten to 23 N·m (17 ft. lbs.).
9. Secure clutch fluid line in body and transmission clips.
10. Connect clutch interlock safety switch wires (5).

# CYLINDER-MASTER

## INSPECTION

The clutch fluid reservoir, master cylinder, slave cylinder and fluid lines are pre-filled with fluid at the factory during assembly operations.

The hydraulic system should not require additional fluid under normal circumstances. **The reservoir fluid level will actually increase as normal clutch wear occurs. Avoid overfilling or removing fluid from the reservoir.**

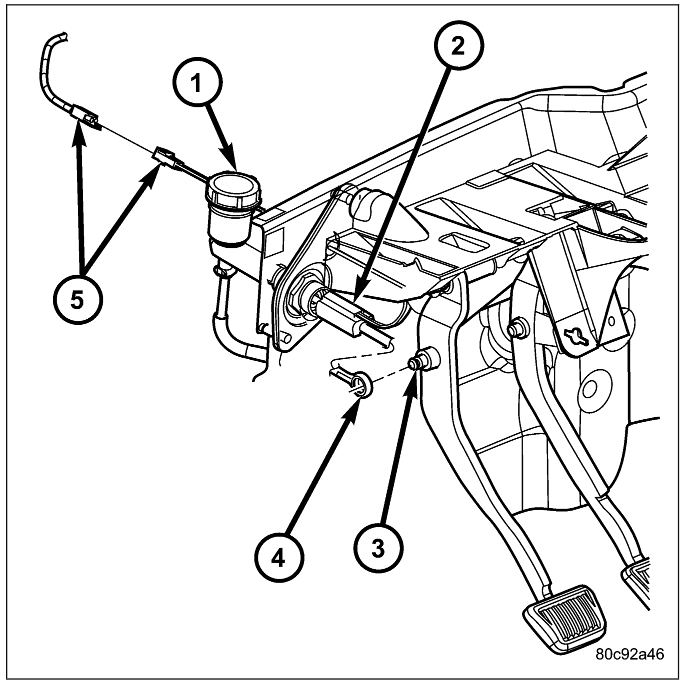
Clutch fluid level is checked at the master cylinder reservoir. An indicator ring is provided on the outside of the reservoir. With the cap and diaphragm removed, fluid level should not be above indicator ring.

To avoid contaminating the hydraulic fluid during inspection, wipe reservoir and cover clean before removing the cap.

# PEDAL-CLUTCH

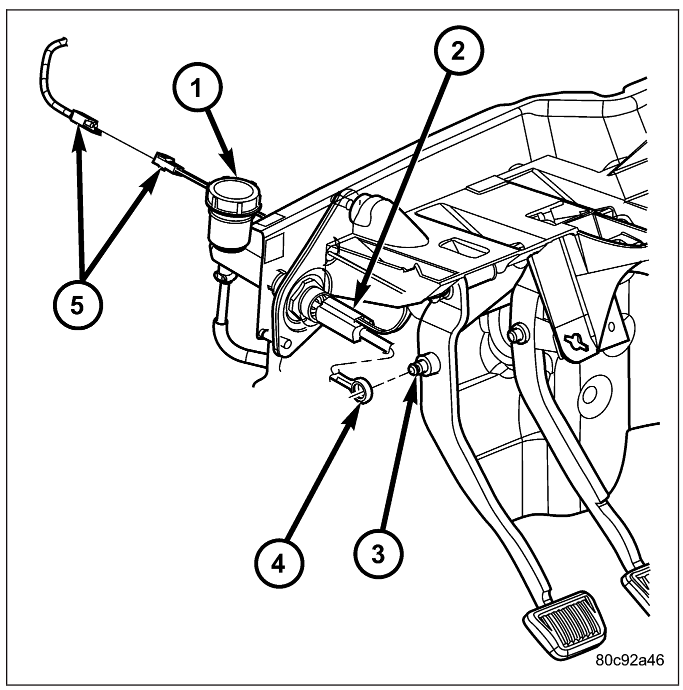
## REMOVAL

1. Remove steering column lower cover and knee blocker for access.
2. Disconnect clutch pedal position switch wires.
3. Disengage bushing lock tabs attaching clutch master cylinder actuator (4) to pedal pivot (3).
4. Remove nuts attaching pedal and bracket to dash panel and upper cowl support.
5. Separate pedal assemble from vehicle.




## INSTALLATION

1. Place clutch pedal and bracket over studs on dash panel and cowl support.
2. Install pedal and bracket to dash panel nuts and tighten to 39 N·m (29 ft. lbs.).
3. Install actuator (4) on brake pedal pivot (3).
4. Connect clutch pedal position switch wires (5).



# RELAY-CLUTCH SWITCH OVERRIDE

## DESCRIPTION

The clutch pedal position switch override relay is located in the Power Distribution Center (PDC). Refer to PDC cover label for location within PDC.

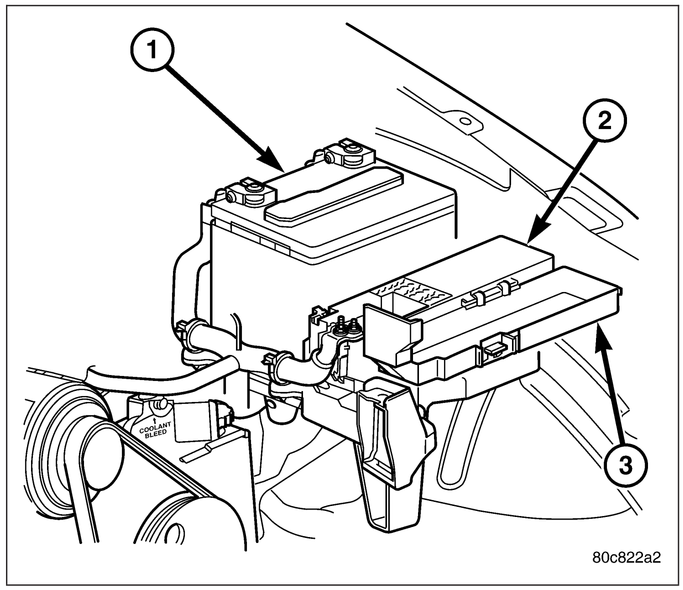
## OPERATION

The clutch pedal position switch override relay, inhibits operation of the clutch pedal position switch when the vehicle transfer case is in the four wheel drive low-range position. This enables the starter motor to operate without depressing the clutch pedal, for off-road applications. If Diagnostic Trouble Codes (DTC's) for the override relay or transfer case switch are stored, override relay will be inhibited.

## REMOVAL

**NOTE: Refer to label on PDC cover for relay location.**

1. Remove PDC (2) cover (3).
2. Remove relay from PDC.
3. Check relay and PDC terminals for:
   - Damage or corrosion
   - Pin height (all terminals should be same height)




## INSTALLATION

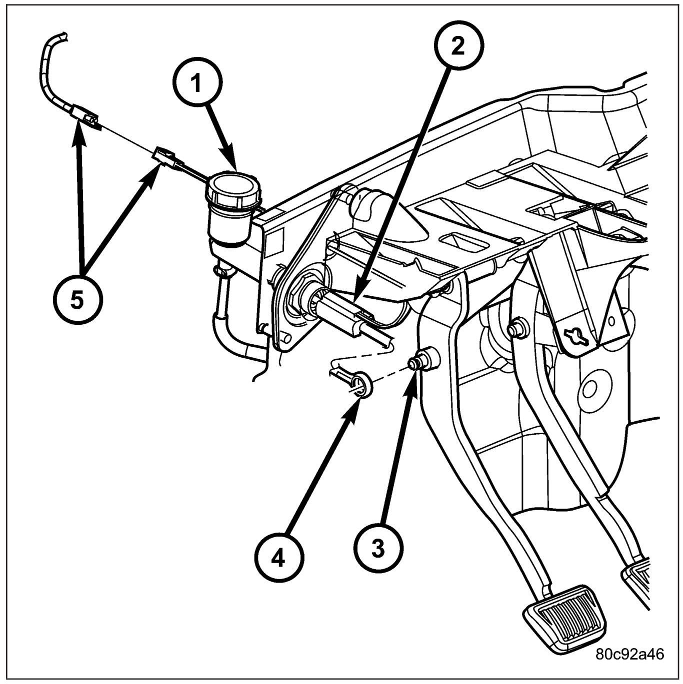
1. Install relay in PDC.
2. Install PDV cover.
3. Verify operation of relay.

# SWITCH-CLUTCH PEDAL POSITION

## DESCRIPTION

The clutch pedal position switch (2) is located under the instrument panel, attached to the clutch master cylinder (1) push rod. The wiring harness connection for the switch is in the engine compartment.

The clutch pedal position switch override relay is located in the Power Distribution Center (PDC). Refer to PDC cover label for location within PDC.




## OPERATION

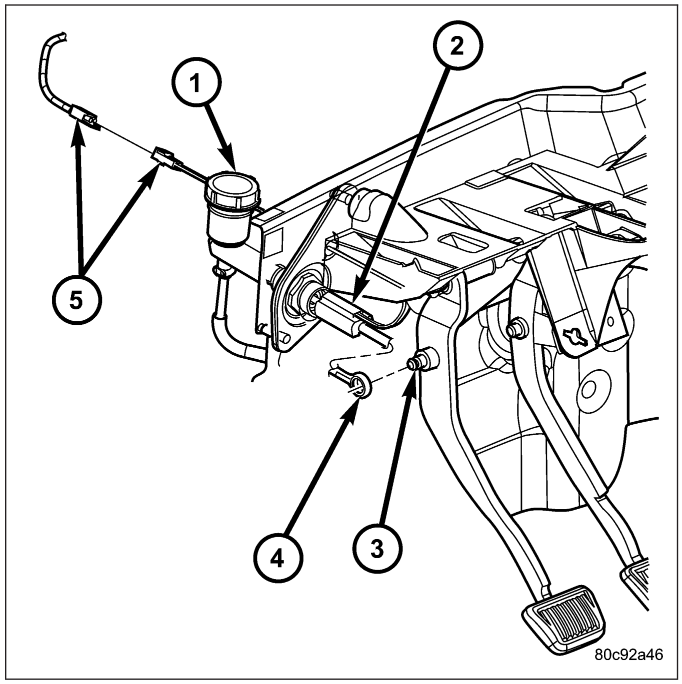
The clutch pedal position switch is used to prevent starter motor engagement unless the clutch pedal is depressed. An input from this switch is also used to either shut down/prevent operation of the speed control system when the clutch pedal is depressed.

**Four Wheel Drive Feature:** The clutch pedal position switch override relay, inhibits operation of the position switch when the vehicle transfer case is in the four wheel drive low-range position. This enables the starter motor to operate without depressing the clutch pedal, for off-road applications. If Diagnostic Trouble Codes (DTC's) for the override relay or transfer case switch are stored, override relay will be inhibited.

## DIAGNOSIS AND TESTING

## CLUTCH PEDAL POSITION SWITCH

1. Disconnect switch 2-wire connector (5) in engine compartment.
2. Check switch continuity with an ohmmeter while operating clutch pedal.
   - Pedal Depressed - Continuity
   - Pedal Released - No Continuity
3. If continuity is not present or always present, replace clutch master cylinder. Switch is not serviced separately.



# COOLING

## TABLE OF CONTENTS

# COOLING

## DESCRIPTION

### 3.7L ENGINE

The cooling system consists of the following items:

- 2 Speed electric cooling fan - Standard.
- 2 Speed electric cooling fan and mechanical engine fan with viscous clutch - Heavy duty cooling only
- Radiator
- Thermostat
- Combined coolant pressure bottle/overflow system with pressure cap
- Combination A/C/transmission oil cooler (if equipped with an automatic transmission)
- Coolant
- Water pump
- Hoses and hose clamps

### 2.8L DIESEL ENGINE

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible, maintains normal operating temperature and prevents overheating.

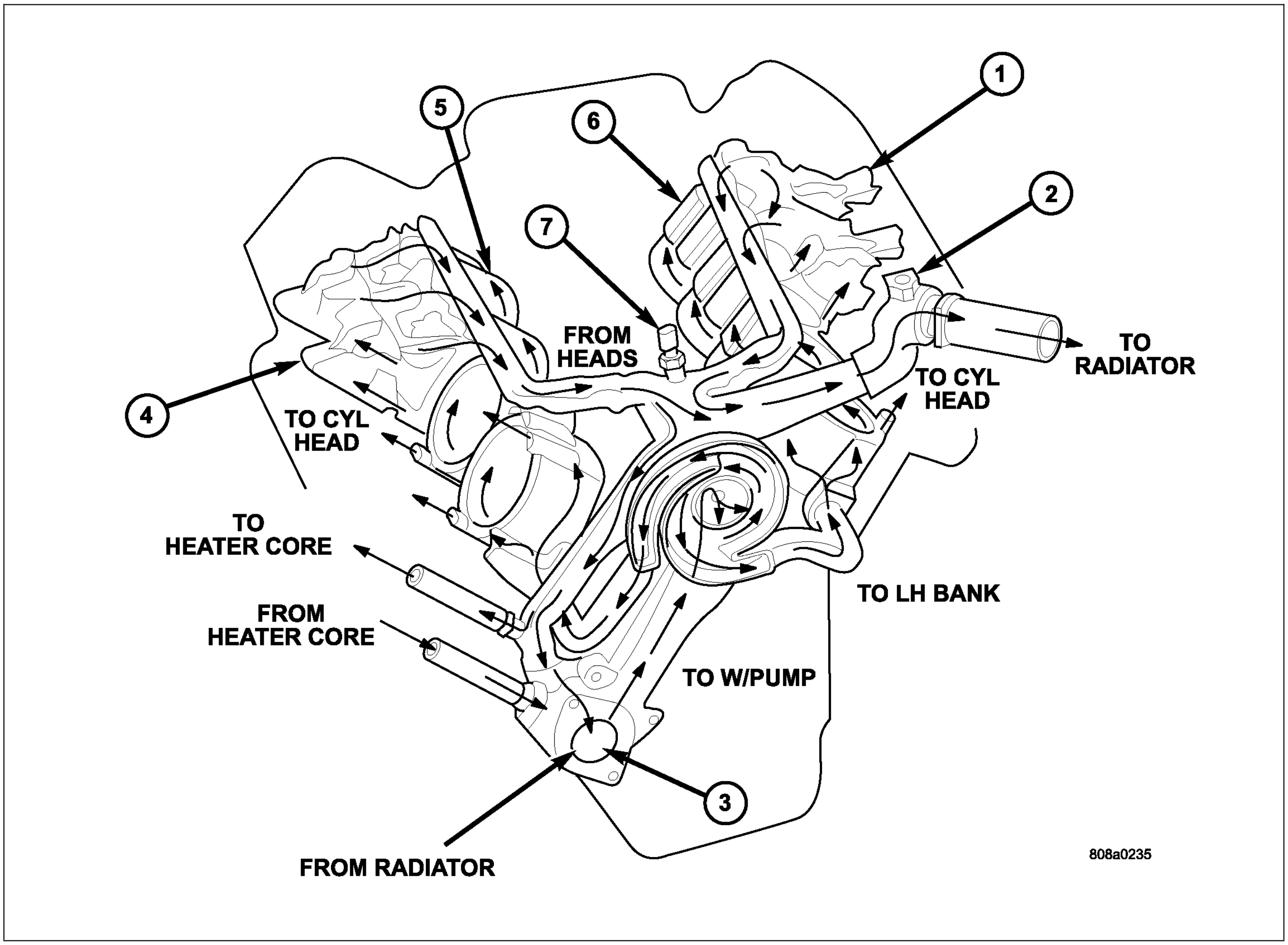
The cooling system also provides a means of heating the passenger compartment. The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system. A separate and remotely mounted, pressurized coolant tank using a pressure/vent cap is used.

#### COOLING SYSTEM COMPONENTS

The cooling system consists of:

- Charge Air Cooler
- 2 Speed Electric Cooling Fan with an engine driven fan with viscous clutch
- A aluminum-core radiator with plastic side tanks
- A separate pressurized coolant tank
- Combined coolant pressure bottle with pressure cap plus an overflow system
- Fan shroud
- Thermostat
- Coolant
- Low coolant warning lamp
- Coolant temperature gauge
- Water pump
- Hoses and hose clamps

## COOLING SYSTEM ROUTING - 3.7L ENGINE



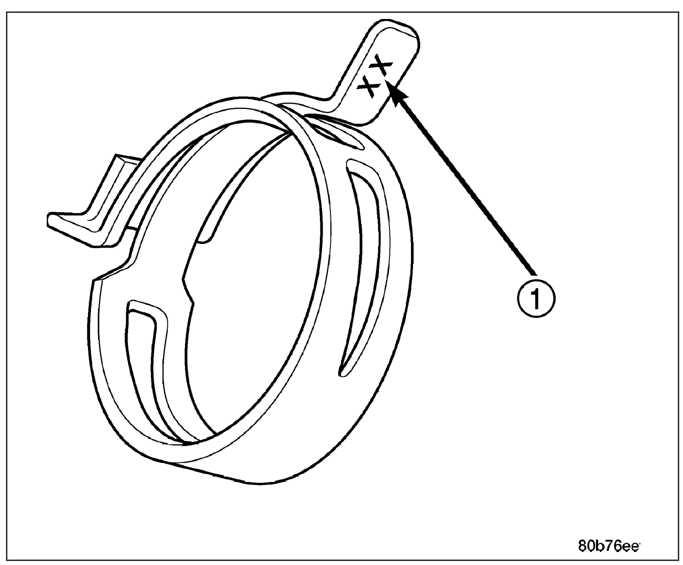

For cooling system routing refer to.

## HOSE CLAMPS

The cooling system utilizes spring type hose clamps. If a spring type clamp replacement is necessary, replace with the original Mopar® equipment spring type clamp.

**WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL NUMBER 6094. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.**

**CAUTION: A number or letter is stamped into the tongue (1) of constant tension clamps. If replacement is necessary, use only a original equipment clamp with matching number or letter.**



# OPERATION

## COOLING SYSTEM

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible. It also maintains normal operating temperature and prevents overheating.

The cooling system also provides a means of heating the passenger compartment. The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system.

## HOSE CLAMPS

The spring type hose clamp applies constant tension on a hose connection. To remove a spring type hose clamp, only use constant tension clamp pliers designed to compress the hose clamp.

# DIAGNOSIS AND TESTING

## ON-BOARD DIAGNOSTICS (OBD)

### COOLING SYSTEM RELATED DIAGNOSTICS

The powertrain control module (PCM) has been programmed to monitor certain cooling system components:

- If the engine has remained cool for too long a period, such as with a stuck open thermostat, a Diagnostic Trouble Code (DTC) can be set.
- If an open or shorted condition has developed in the relay circuit controlling the electric radiator fan, a Diagnostic Trouble Code (DTC) can be set.

If the problem is sensed in a monitored circuit often enough to indicate an actual problem, a DTC is stored. The DTC will be stored in the PCM memory for eventual display to the service technician. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

### ACCESSING DIAGNOSTIC TROUBLE CODES

To read DTC's and to obtain cooling system data (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

### ERASING TROUBLE CODES

After the problem has been repaired, use the DRB scan tool to erase a DTC. Refer to the appropriate Powertrain Diagnostic Procedures service information for operation of the DRB scan tool.

## PRELIMINARY CHECKS

### ENGINE COOLING SYSTEM OVERHEATING

Establish what driving conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause:

- PROLONGED IDLE
- VERY HIGH AMBIENT TEMPERATURE
- SLIGHT TAIL WIND AT IDLE
- SLOW TRAFFIC
- TRAFFIC JAMS
- HIGH SPEED
- STEEP GRADES

Driving techniques that avoid overheating are:

- Idle with A/C off when temperature gauge is at end of normal range.

1. TRAILER TOWING:

Consult Trailer Towing section of owner's manual. Do not exceed limits.

2. RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may affect cooling system. This may be:

- Engine adjustments (incorrect timing)

- Slipping engine accessory drive belt(s)
- Brakes (possibly dragging)
- Changed parts. Incorrect water pump, or pump rotating in wrong direction due to belt not correctly routed
- Reconditioned radiator or cooling system refilling (possibly under filled or air trapped in system).

**NOTE: If investigation reveals none of the previous items as a cause for an engine overheating complaint, refer to following Cooling System Diagnosis charts.**

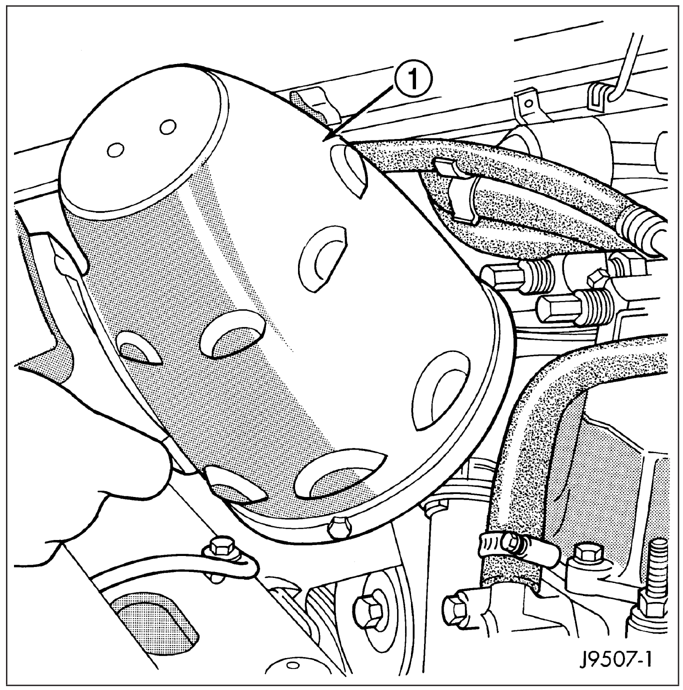
These charts are to be used as a quick-reference only. Refer to the group text for information.

## COOLING SYSTEM LEAKS

### ULTRAVIOLET LIGHT METHOD

A leak detection additive is available through the parts department that can be added to cooling system. The additive is highly visible under ultraviolet light (black light). Pour one ounce of additive into cooling system. Place heater control unit in HEAT position. Start and operate engine until radiator upper hose is warm to touch. Aim the commercially available black light tool at components to be checked. If leaks are present, black light will cause additive to glow a bright green color.

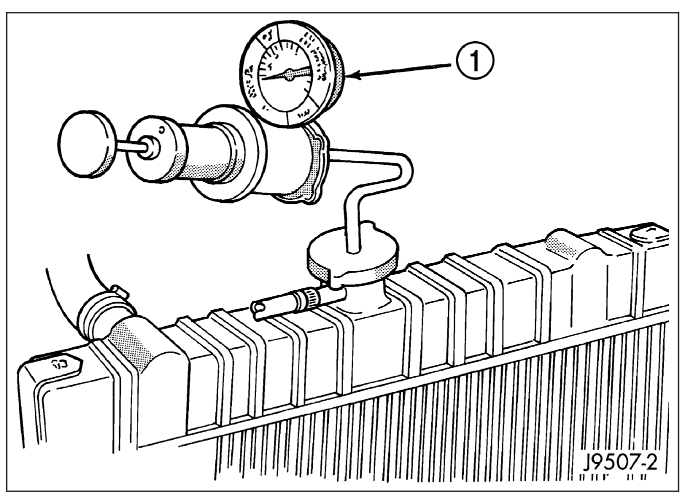
The black light (1) can be used in conjunction with a pressure tester to determine if any external leaks exist.




### PRESSURE TESTER METHOD

The engine should be at normal operating temperature. Recheck the system cold if cause of coolant loss is not located during the warm engine examination.

**WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING.**




Carefully remove radiator pressure cap from pressure bottle and check coolant level. Push down on cap to disengage it from stop tabs. Wipe inside of filler neck and examine lower inside sealing seat for nicks, cracks, paint, and dirt. Inspect radiator-to- reserve/ overflow tank hose for internal obstructions. Insert a wire through the hose to be sure it is not obstructed.

Inspect cams on outside of filler neck. If cams are damaged, seating of pressure cap valve and tester seal will be affected.

Attach pressure tester (7700 or an equivalent) to radiator filler neck.

Operate tester pump (1) to apply 110 kPa (16 psi) pressure to system. If hoses enlarge excessively or bulges while testing, replace as necessary. Observe gauge pointer and determine condition of cooling system according to following criteria:

**Holds Steady:** If pointer remains steady for two minutes, serious coolant leaks are not present in system. However, there could be an internal leak that does not appear with normal system test pressure. If it is certain that coolant is being lost and leaks cannot be detected, inspect for interior leakage or perform Internal Leakage Test.

**Drops Slowly:** Indicates a small leak or seepage is occurring. Examine all connections for seepage or slight leakage with a flashlight. Inspect radiator, hoses, gasket edges and heater. Seal small leak holes with a Sealer Lubricant (or equivalent). Repair leak holes and inspect system again with pressure applied.

**Drops Quickly:** Indicates that serious leakage is occurring. Examine system for external leakage. If leaks are not visible, inspect for internal leakage. Large radiator leak holes should be repaired by a reputable radiator repair shop.

## INTERNAL LEAKAGE INSPECTION

Remove engine oil pan drain plug and drain a small amount of engine oil. If coolant is present in the pan, it will drain first because it is heavier than oil. An alternative method is to operate engine for a short period to churn the oil. After this is done, remove engine dipstick and inspect for water globules. Also inspect transmission dipstick for water globules and transmission fluid cooler for leakage.

**WARNING: WITH RADIATOR PRESSURE TESTER TOOL INSTALLED ON RADIATOR, DO NOT ALLOW PRESSURE TO EXCEED 124 KPA (18 PSI). PRESSURE WILL BUILD UP QUICKLY IF A COMBUSTION LEAK IS PRESENT. TO RELEASE PRESSURE, ROCK TESTER FROM SIDE TO SIDE. WHEN REMOVING TESTER, DO NOT TURN TESTER MORE THAN 1/2 TURN IF SYSTEM IS UNDER PRESSURE.**

Operate engine without pressure cap on radiator until thermostat opens. Attach a Pressure Tester to filler neck. If pressure builds up quickly it indicates a combustion leak exists. This is usually the result of a cylinder head gasket leak or crack in engine. Repair as necessary.

If there is not an immediate pressure increase, pump the Pressure Tester. Do this until indicated pressure is within system range of 110 kPa (16 psi). Fluctuation of gauge pointer indicates compression or combustion leakage into cooling system.

Because the vehicle is equipped with a catalytic converter, **do not** remove spark plug cables or short out cylinders to isolate compression leak.

If the needle on dial of pressure tester does not fluctuate, race engine a few times to check for an abnormal amount of coolant or steam. This would be emitting from exhaust pipe. Coolant or steam from exhaust pipe may indicate a faulty cylinder head gasket, cracked engine cylinder block or cylinder head.

A convenient check for exhaust gas leakage into cooling system is provided by a commercially available Block Leak Check tool. Follow manufacturers instructions when using this product.

## COMBUSTION LEAKAGE TEST - WITHOUT PRESSURE TESTER

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

**WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.**

Drain sufficient coolant to allow thermostat removal. (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL). Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

Add coolant to radiator to bring level to within 6.3 mm (1/4 in) of top of thermostat housing.

**CAUTION: Avoid overheating. Do not operate engine for an excessive period of time. Open draincock immediately after test to eliminate boil over.**

Start engine and accelerate rapidly three times, to approximately 3000 rpm while observing coolant. If internal engine combustion gases are leaking into cooling system, bubbles will appear in coolant. If bubbles do not appear, internal combustion gas leakage is not present.

## COOLING SYSTEM DIAGNOSIS CHART - GAS ENGINE

### COOLING SYSTEM DIAGNOSIS CHART

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| TEMPERATURE GAUGE READS LOW | 1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open thermostat? | 1. Refer to for On-Board Diagnostics and DTC information. Replace thermostat if necessary. |
| | 2. Is the temperature sending unit connected? | 2. Check the temperature sensor connector. (Refer to 7 - COOLING/ ENGINE/ENGINE COOLANT TEMP SENSOR - DESCRIPTION). Repair connector if necessary. |
| | 3. Is the temperature gauge operating OK? | 3. Check gauge operation. Repair as necessary. |
| | 4. Coolant level low in cold ambient temperatures accompanied with poor heater performance. | 4. Check coolant level in the coolant pressure bottle and the radiator. Inspect system for leaks. Repair leaks as necessary. |
| | 5. Improper operation of internal heater doors or heater controls. | 5. Inspect heater and repair as necessary. (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING) |
| | 6. Electric fan functioning when not required. | 6. Inspect electric fan for proper operation. Refer to Electric Cooling Fan in this section. Refer to group 8W for electric cooling fan and relay circuit schematic data. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| TEMPERATURE GAUGE READS HIGH OR THE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM THE COOLING SYSTEM. | 1. Trailer is being towed, a steep hill is being climbed, vehicle is operated in slow moving traffic, or engine is being idled with very high ambient (outside) temperatures and the air conditioning is on. Higher altitudes could aggravate these conditions. | 1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and attempt to drive the vehicle without any of the previous conditions. Observe the temperature gauge. The gauge should return to the normal range. If the gauge does not return to the normal range, determine the cause for overheating and repair. |
| | 2. Is the temperature gauge reading correctly? | 2. Check gauge. (Refer to Group 8J - INSTRUMENT CLUSTER). Repair as necessary. |
| | 3. Is the temperature warning illuminating unnecessarily? | 3. Check warning lamp operation. (Refer to Group 8J - INSTRUMENT CLUSTER). Repair as necessary. |
| | 4. Coolant low in coolant pressure bottle and radiator? | 4. Check for coolant leaks and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). |
| | 5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following Step 6. | 5. Tighten cap. |
| | 6. Poor seals at the radiator cap. | 6. (a) Check condition of cap and cap seals. (Refer to 7 - COOLING/ ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING).<br>(b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator. |
| | 7. Coolant not flowing through system. | 7. (a) Check condition of pressure bottle cap and cap seals. (Refer to 7 - COOLING/ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING).<br>(b) Check condition of radiator vent nipple. If neck is damaged, replace radiator.<br>(c) Check condition of the hose from the radiator to the coolant tank. It should fit tight at both ends without any kinks or tears. Replace hose if necessary.<br>(d) Check pressure bottle/overflow tank and tanks hoses for blockage. Repair as necessary. |
| | 8. Incorrect coolant concentration | 8. Check coolant. (Refer to 7 - COOLING/ENGINE/COOLANT - DESCRIPTION) for correct coolant/water mixture ratio. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| | 9. Fan installed backwards on viscous drive. | 9. Mount fan on drive correctly. |
| | 10. Radiator or A/C condenser fins are dirty or clogged. | 10. Remove insects and debris. (Refer to 7 - COOLING/ENGINE/ RADIATOR - CLEANING). |
| | 11. Radiator core is corroded or plugged. | 11. Have radiator re-cored or replaced. |
| | 12. Fuel or ignition system problems. | 12. Refer to FUEL and /or IGNITION CONTROL for diagnosis. |
| | 13. Dragging brakes. | 13. Check and correct as necessary. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING) for correct procedures. |
| | 14. Bug screen or cardboard is being used, reducing airflow. | 14. Remove bug screen or cardboard. |
| | 15. Thermostat partially or completely shut. | 15. Check thermostat operation and replace as necessary. (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - DIAGNOSIS AND TESTING). |
| | 16. Viscous fan drive not operating properly. | 16. Check fan drive operation and replace as necessary. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING). |
| | 17. Cylinder head gasket leaking. | 17. Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). For repair, (Refer to 9 - ENGINE/ CYLINDER HEAD - REMOVAL). |
| | 18. Heater core leaking. | 18. Check heater core for leaks. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ HEATER CORE - REMOVAL). Repair as necessary. |
| | 19. Electric fan not functioning. | 19. Inspect electric fan for proper operation (Refer to 7 - COOLING/ ENGINE/RADIATOR FAN - DESCRIPTION). |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC) | 1. During cold weather operation, with the heater blower in the high position, the gauge reading may drop slightly. | 1. A normal condition. No correction is necessary. |
| | 2. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in this circuit. | 2. Check operation of gauge and repair if necessary (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). |
| | 3. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running) | 3. A normal condition. No correction is necessary. Gauge should return to normal range after vehicle is driven. |
| | 4. Gauge reading high after re-starting a warmed up (hot) engine. | 4. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation. |
| | 5. Coolant level low in cooling system (air will build up in the cooling system causing the thermostat to open late). | 5. Check and correct coolant leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). |
| | 6. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing a thermostat to open late. | 6. (a) Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). (b) Check for coolant in the engine oil. Inspect for white steam emitting from the exhaust system. Repair as necessary. |
| | 7. Water pump impeller loose on shaft. | 7. Check water pump and replace as necessary. (Refer to 7 - COOLING/ENGINE/WATER PUMP - DIAGNOSIS AND TESTING). |
| | 8. Loose accessory drive belt. (water pump slipping) | 8. (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - DIAGNOSIS AND TESTING). Check and correct as necessary. |
| | 9. Air leak on the suction side of the water pump allows air to build up in cooling system causing thermostat to open late. | 9. Locate leak and repair as necessary. |
| PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT TO COOLANT TANK. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT RESERVE/ OVERFLOW TANK | 1. Pressure relief valve in pressure bottle cap is defective. | 1. Check condition of radiator cap and cap seals. (Refer to 7 - COOLING/ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). Replace cap as necessary. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE READING HIGH OR HOT | 1. Coolant leaks in radiator, cooling system hoses, water pump or engine. | 1. Pressure test and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). |
| DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH | 1. Engine overheating. | 1. Check reason for overheating and repair as necessary. |
| | 2. Freeze point of coolant not correct. Mixture is too rich or too lean. | 2. Check coolant concentration. (Refer to 7 - COOLING/ENGINE/ COOLANT - DESCRIPTION) and adjust ratio as required. |
| HOSE OR HOSES COLLAPSE WHILE ENGINE IS RUNNING | 1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant reserve/overflow system. | 1. (a) Radiator cap relief valve stuck. (Refer to 7 - COOLING/ ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). Replace if necessary. |
| | | (b) Hose between coolant reserve/overflow tank and radiator is kinked. Repair as necessary. |
| | | (c) Vent at coolant reserve/overflow tank is plugged. Clean vent and repair as necessary. |
| | | (d) Reserve/overflow tank is internally blocked or plugged. Check for blockage and repair as necessary. |
| NOISY VISCOUS FAN/DRIVE | 1. Fan blades loose. | 1. Replace fan blade assembly. (Refer to 7 - COOLING/ENGINE/ RADIATOR FAN - REMOVAL) |
| | 2. Fan blades striking a surrounding object. | 2. Locate point of fan blade contact and repair as necessary. |
| | 3. Air obstructions at radiator or air conditioning condenser. | 3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser. |
| | 4. Thermal viscous fan drive has defective bearing. | 4. Replace fan drive. Bearing is not serviceable. (Refer to 7 - COOLING/ ENGINE/RADIATOR FAN - REMOVAL). |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| INADEQUATE HEATER PERFORMANCE. THERMOSTAT FAILED IN OPEN POSITION | 1. Has a Diagnostic trouble Code (DTC) been set? | 1. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION) for correct procedures and replace thermostat if necessary. |
| | 2. Coolant level low | 2. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING). |
| | 3. Obstructions in heater hose/ fittings | 3. Remove heater hoses at both ends and check for obstructions. |
| | 4. Heater hose kinked | 4. Locate kinked area and repair as necessary. |
| | 5. Water pump is not pumping water to/through the heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. If only one of the hoses is hot, the water pump may not be operating correctly or the heater core may be plugged. Accessory drive belt may be slipping causing poor water pump operation. | 5. (Refer to 7 - COOLING/ENGINE/ WATER PUMP - DIAGNOSIS AND TESTING). If a slipping belt is detected, (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - REMOVAL). If heater core obstruction is detected, (Refer to 7 - COOLING - STANDARD PROCEDURE) for cooling system reverse flushing. |
| STEAM IS COMING FROM THE FRONT OF VEHICLE NEAR THE GRILLE AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP AND RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE | 1. During wet weather, moisture (snow, ice or rain condensation) on the radiator or condenser will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contacts the hot radiator or condenser, steam may be emitted. This usually occurs in cold weather with no fan or airflow to blow it away. | 1. Occasional steam emitting from this area is normal. No repair is necessary. |
| COOLANT COLOR | 1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant. | 1. (Refer to 7 - COOLING/ENGINE/ COOLANT - DESCRIPTION) for coolant concentration information. Adjust coolant mixture as necessary. |
| COOLANT LEVEL CHANGES IN COOLANT RESERVE/OVERFLOW TANK. TEMPERATURE GAUGE IS IN NORMAL RANGE | 1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the tank was between the FULL and ADD marks at normal operating temperature, the level should return to within that range after operation at elevated temperatures. | 1. A normal condition. No repair is necessary. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| FAN RUNS ALL THE TIME | 1. Fan control sensors inoperative. | 1. Check for DTC s. Verify sensor readings. |
| | 2. Fan control solenoid stuck ″on″. | 2. Check fan operation speeds. Refer to fan speed operation table. |
| | 3. Fan control solenoid harness damaged. | 3. Check for DTC 1499. Repair as required. |
| | 4. Transmission temperature too high. | 4. Check for transmission over temp. DTC. |
| | 5. Engine coolant temperature too high. | 5. (a) Check coolant level. Correct level as required. |
| | | (b) Thermostat stuck. Replace thermostat. |
| | | (c) Water pump failed. Replace water pump. |
| | | (d) Coolant flow restricted. Clean radiator. |
| | | (e) Air flow over radiator obstructed. Remove obstruction. |

## COOLING SYSTEM DIAGNOSIS CHART - DIESEL ENGINE

Establish what driving conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause:

1. PROLONGED IDLE, VERY HIGH AMBIENT TEMPERATURE, SLIGHT TAIL WIND AT IDLE, SLOW TRAFFIC, TRAFFIC JAMS, HIGH SPEED OR STEEP GRADES.
   - Idle with A/C off when temperature gauge is at end of normal range.
2. TRAILER TOWING:

Consult Trailer Towing section of owners manual. Do not exceed limits.

3. RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may effect cooling system. This may be:

- Engine adjustments (incorrect timing)
- Slipping engine accessory drive belt
- Brakes (possibly dragging)
- Changed parts (incorrect water pump)
- Reconditioned radiator or cooling system refilling (possibly under filled or air trapped in system).

**NOTE: If investigation reveals none of the previous items as a cause for an engine overheating complaint, refer to following Cooling System Diagnosis charts.**

These charts are to be used as a quick-reference only.

**COOLING SYSTEM DIAGNOSIS-DIESEL ENGINE**

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| TEMPERATURE GAUGE READS LOW | 1. Diesel engines, due to their inherent efficiency are slower to warm up than gasoline powered engines, and will operate at lower temperatures when the vehicle is unloaded. | 1. The low gauge reading may be normal. Refer to thermostats in the manual text for information. See Thermostat Diagnosis-Diesel Engine. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| | 2. Is the temperature gauge connected to the temperature gauge coolant sensor on the engine? | 2. Check the engine temperature sensor connector in the engine compartment. |
| | 3. Is the temperature gauge operating OK? | 3. Check gauge operation. Repair as necessary. |
| | 4. Coolant level low in cold ambient temperatures accompanied with poor heater performance. | 4. Check coolant level in the coolant tank. Inspect system for leaks. Repair leaks as necessary. Refer to the Coolant section for WARNINGS and precautions before removing the pressure cap. |
| | 5. Improper operation of internal heater doors or heater controls. | 5. Inspect heater and repair as necessary. Refer to Heating and Air Conditioning for procedures. |
| TEMPERATURE GAUGE READS HIGH. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM COOLING SYSTEM | 1. Trailer is being towed, a steep hill is being climbed, vehicle is operated in slow moving traffic, or engine is being idled with very high ambient (outside) temperature and the air conditioning is on. Higher altitudes could aggravate these conditions. | 1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and attempt to drive the vehicle without any of the previous conditions. Observe the temperature gauge. The gauge should return to the normal range. If the gauge does not return to normal range, determine the cause for the overheating and repair. |
| | 2. Temperature gauge reading incorrectly. | 2. Check gauge. Refer to I/P group. |
| | 3. Coolant low in coolant tank and radiator. | 3. Check for coolant leaks and repair as necessary. |
| | 4. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. | 4. Tighten cap. |
| | 5. Poor seals at pressure/vent cap. | 5. (a) Check condition of cap and cap seals. (b) Check condition of coolant tank filler neck. Make sure it does not leak pressure. |
| | 6. Freeze point of antifreeze not correct. Mixture may be too rich. | 6. Check antifreeze. Adjust antifreeze-to-water ratio as required. |
| | 7. Coolant not flowing through system. | 7. Check for coolant flow in coolant tank with engine warm and thermostat open. Coolant should be observed flowing through the tank. If flow is not observed, determine reason for lack of flow and repair as necessary. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| | 8. Radiator or A/C condenser fins are dirty or clogged. | 8. Clean debris from radiator or A/C condenser |
| | 9. Radiator core is corroded or plugged. | 9. Have radiator re-cored or replaced. |
| | 10. Aftermarket A/C installed without proper A/C condenser. | 10. Install proper A/C condenser. |
| | 11. Dragging Brakes. | 11. Check and correct as necessary. |
| | 12. Non-factory bug screen is being used reducing air flow. | 12. Only a factory screen should be used. |
| | 13. Thermostat partially or completely shut. This is more prevalent on high mileage vehicles. | 13. Check thermostat and replace if necessary. |
| | 14. Cylinder head gasket leaking. | 14. Check cylinder head gasket for leaks. |
| | 15. Heater core leaking. | 15. Check heater core for leaks. Repair as necessary. |
| TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC) | 1. During cold weather operation, with the heater blower in the high position, the gauge reading may drop slightly. Fluctuation is also influenced by loads, outside temperature and extended idle time with diesel engines. | 1. A normal condition. No correction is necessary. |
| | 2. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in this circuit. | 2. Check operation of gauge and repair as necessary. |
| | 3. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running). | 3. A normal condition. No correction needed. Gauge should return to normal range after vehicle is driven. |
| | 4. Gauge reading high after starting a warm-up (hot) engine. | 4. A normal condition. No correction needed. Gauge should return to normal after a few minutes of engine operation. |
| | 5. Coolant level low in the coolant tank (air will build up in the cooling system causing the thermostat to open late). | 5. Check and correct coolant leaks. |
| | 6. Cylinder head gasket leaking allowing exhaust gases to enter the cooling system causing the thermostat to open late. | 6. (a) Check for cylinder head gasket leaks with a commercially available leak tester. (b) Check for coolant in engine oil. Inspect for white steam emitting from exhaust system. Repair as necessary. |
| | 7. Water pump impeller loose on shaft. | 7. Check water pump and replace as necessary. |
| | 8. Loose accessory drive belt (water pump slipping). | 8. Check and correct as necessary. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
| --- | --- | --- |
| | 9. Air leak on the suction side of the water pump allowing air to build up in the cooling system causing the thermostat to open late. | 9. Locate leak and repair as necessary. |
| PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT TANK | 1. Pressure relief valve in pressure/vent cap is defective. | 1. Check condition of pressure/vent cap and cap seals. |
| | 2. Head gasket leak or cracked cylinder head. | 2. Repair as necessary. |
| COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE IS READING HIGH OR HOT | 1. Coolant leaks in radiator, cooling system hoses, water pump, or engine. | 1. Pressure test cooling system and repair as necessary. |
| HOSE OR HOSES COLLAPSE WHEN ENGINE IS COOLING | 1. Vacuum created in cooling system on engine cool-down is not being relieved through pressure/vent cap. | 1. Cap relief valve stuck. Replace if necessary. |
| NOISY FAN | 1. Cooling fan blades loose. | 1. Replace cooling fan assembly. |
| | 2. Cooling fan blades striking a surrounding object. | 2. Locate point of fan blade contact and repair as necessary. |
| | 3. Air obstructions at radiator or A/C condenser. | 3. Remove obstructions or clean debris from radiator or A/C condenser. |
| INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED) | 1. Radiator and/or A/C condenser is restricted, obstructed or dirty (insects, leaves, etc.) | 1. Remove restriction or clean debris from radiator or A/C condenser. |
| | 2. Engine is overheating (heat may be transferred from radiator to A/C condenser. High underhood temperatures due to engine overheating may also transfer heat to A/C condenser). | 2. Correct overheating condition. |
| | 3. The cooling system is equipped with air seals at the radiator and/or A/C condenser. If these seals are missing or damaged, not enough air flow will be pulled through the radiator and A/C condenser. | 3. Check for missing or damaged air seals. Repair as necessary. |
| | 4. Is the cooling fan operating correctly? | 4. Refer to Cooling Fan in this group for diagnosis. Repair as necessary. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| INADEQUATE HEATER PERFORMANCE. MAY BE ACCOMPANIED BY LOW GAUGE READING | 1. Diesel engines, due to their inherent efficiency are slower to warm up than gasoline powered engines, and will operate at lower temperatures when the vehicle is unloaded. | 1. The lower gauge reading may be normal. |
| | 2. Coolant level low. | 2. Pressure test cooling system. Repair leaks as necessary. |
| | 3. Obstruction in heater hose fitting at engine. | 3. Remove heater hoses and check for obstructions. Repair as necessary. |
| | 4. Heater hose kinked. | 4. Locate kinked area. Repair as necessary. |
| | 5. Water pump is not pumping water to heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. If only one of the hoses is hot the water pump may not be operating correctly. The accessory drive belt may also be slipping causing poor water pump operation. | 5. Refer to water pumps in this group. Repair as necessary. If a slipping belt is detected, refer to Engine Accessory Drive Belts in this group. Repair as necessary. |
| HEAT ODOR | 1. Various heat shields are used at certain drive line components. One or more of these shields may be missing. | 1. Locate missing shields. Repair or replace as necessary. |
| | 2. Is temperature gauge reading above the normal range? | 2. Refer to the previous Temperature Gauge Reads High in these Diagnostic Charts. Repair as necessary. |
| | 3. Has undercoating been applied to any unnecessary components? | 3. Clean undercoating as necessary. |
| STEAM IS COMING FROM FRONT OF VEHICLE NEAR GRILLE AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP AND RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE | 1. During wet weather, moisture (snow, ice, or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contacts the hot radiator, steam may be emitted. This usually occurs in cold weather with no fan or air flow to blow it away. | 1. Occasional steam emitting from this area is normal. No repair is necessary. |
| COOLANT ODOR | 1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant. | 1. Refer to Coolant in this group for antifreeze tests. Adjust antifreeze-to-water ratio as necessary. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
| --- | --- | --- |
| COOLANT LEVEL CHANGES IN COOLANT TANK. TEMPERATURE GAUGE IS IN NORMAL RANGE | 1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the tank was between the HOT and COLD marks at normal engine operating temperature, the level should return to within that range after operation at elevated temperatures. | 1. This a normal condition. No repair necessary. |

## COOLING SYSTEM FLOW CHECK - DIESEL ENGINE

To determine whether coolant is flowing through the cooling system, use the following procedures:

1. If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If it is hot, coolant is circulating.

**WARNING: DO NOT REMOVE THE COOLING SYSTEM PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.**

2. Remove pressure/vent cap when engine is cold, idle engine until thermostat opens, you should observe coolant flow while looking down in the coolant recovery pressure container. Once flow is detected install the pressure/vent cap.

## COOLING SYSTEM AERATION

Low coolant level in a cross flow radiator will equalize in both tanks with engine off. With engine running and at operating temperature, the high pressure inlet tank runs full and the low pressure outlet tank drops, resulting in cooling system aeration. Aeration will draw air into the water pump resulting in the following:

- High reading shown on the temperature gauge.
- Loss of coolant flow through the heater core.
- Corrosion in the cooling system.
- Water pump seal may run dry, increasing the risk of premature seal failure.
- Combustion gas leaks into the coolant can also cause aeration.

## STANDARD PROCEDURE

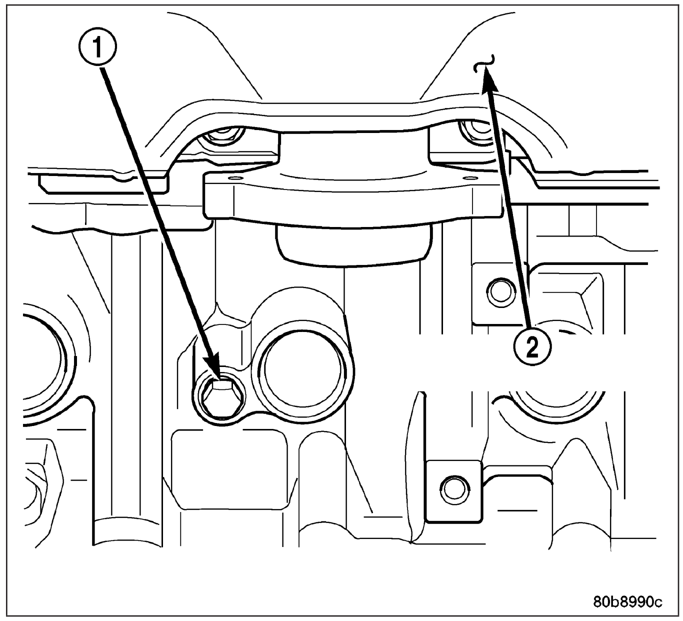
## DRAINING COOLING SYSTEM

**WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS (1) OR LOOSEN THE RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.**

1. DO NOT remove radiator cap first. With engine cold, raise vehicle on a hoist and locate radiator draincock.

**NOTE: Radiator draincock is located on the left/ lower side of radiator facing to rear of vehicle.**

2. Attach one end of a hose to the draincock. Put the other end into a clean container. Open draincock and drain coolant from radiator. This will empty the coolant reserve/overflow tank. The coolant does not have to be removed from the tank unless the system is being refilled with a fresh mixture. When tank is empty, remove radiator cap and continue draining cooling system.




## REFILLING COOLING SYSTEM

1. Tighten the radiator draincock and the cylinder block drain plug(s) (if removed).

**CAUTION: Failure to purge air from the cooling system can result in an overheating condition and severe engine damage.**

2. Fill cooling system with the antifreeze mixture (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION). Fill pressure bottle to service line and install cap.

**NOTE: The engine cooling system will push any remaining air into the coolant bottle within about an hour of normal driving. As a result, a drop in coolant level in the pressure bottle may occur. If the engine cooling system overheats and pushes coolant into the overflow side of the coolant bottle, this coolant will be sucked back into the cooling system ONLY IF THE PRESSURE CAP IS LEFT ON THE BOTTLE. Removing the pressure cap breaks the vacuum path between the two bottle sections and the coolant will not return to cooling system.**

3. With heater control unit in the HEAT position, operate engine with pressure bottle cap in place.
4. Add coolant to pressure bottle as necessary. **Only add coolant to the pressure bottle when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.**

**NOTE: The coolant bottle has two chambers. Coolant will normally only be in the outboard (larger) of the two. The inboard chamber is only to recover coolant in the event of an overheat or after a recent service fill. The inboard chamber should normally be empty. If there is coolant in the overflow side of the coolant bottle (after several warm/cold cycles of the engine) and coolant level is above cold full when cold, disconnect the end of the overflow hose at the fill neck and lower it into a clean container. Allow coolant to drain into the container until emptied. Reconnect overflow hose to fill neck.**

## COOLING SYSTEM - REVERSE FLUSHING

**CAUTION: The cooling system normally operates at 97-110 kPa (14-16 psi) pressure. Exceeding this pressure may damage the radiator or hoses.**

Reverse flushing of the cooling system is the forcing of water through the cooling system. This is done using air pressure in the opposite direction of normal coolant flow. It is usually only necessary with very dirty systems with evidence of partial plugging.

## CHEMICAL CLEANING

If visual inspection indicates the formation of sludge or scaly deposits, use a radiator cleaner (Mopar ® Radiator Kleen or equivalent) before flushing. This will soften scale and other deposits and aid the flushing operation.

**CAUTION: Be sure instructions on the container are followed.**

## REVERSE FLUSHING RADIATOR

Disconnect the radiator hoses from the radiator fittings. Attach a section of radiator hose to the radiator bottom outlet fitting and insert the flushing gun. Connect a water supply hose and air supply hose to the flushing gun.

**CAUTION: The cooling system normally operates at 97-110 kPa (14 -16 psi) pressure. Exceeding this pressure may damage the radiator or hoses.**

Allow the radiator to fill with water. When radiator is filled, apply air in short blasts allowing radiator to refill between blasts. Continue this reverse flushing until clean water flows out through rear of radiator cooling tube passages. For more information, refer to operating instructions supplied with flushing equipment. Have radiator cleaned more extensively by a radiator repair shop.

## REVERSE FLUSHING ENGINE

Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE). Remove the thermostat housing and thermostat. Install the thermostat housing. Disconnect the radiator upper hose from the radiator and attach the flushing gun to the hose. Disconnect the radiator lower hose from the water pump. Attach a lead away hose to the water pump inlet fitting.

**CAUTION: Be sure that the heater control valve is closed (heat off). This is done to prevent coolant flow with scale and other deposits from entering the heater core.**

Connect the water supply hose and air supply hose to the flushing gun. Allow the engine to fill with water. When the engine is filled, apply air in short blasts, allowing the system to fill between air blasts. Continue until clean water flows through the lead away hose. For more information, refer to operating instructions supplied with flushing equipment.

Remove the lead away hose, flushing gun, water supply hose and air supply hose. Remove the thermostat housing (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL). Install the thermostat and housing with a replacement gasket (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - INSTALLATION). Connect the radiator hoses. Refill the cooling system with the correct antifreeze/water mixture (Refer to 7 - COOLING - STANDARD PROCEDURE).

# INSPECTION

After performing a cleaning/flush procedure, inspect all hoses, clamps and connections for deterioration and leaks. Inspect radiator and heater core for leaks.

# SPECIFICATIONS

## FILL VOLUMES

### SPECIFICATIONS

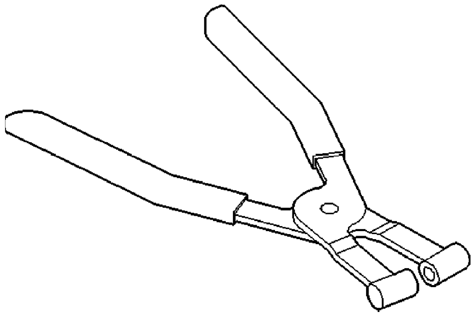
| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| 2.4L | 9.7 L | 9.2 qts. |
| 3.7L | 12.8 L | 11.8 qts. |
| 2.8L DIESEL | 12.5 L | 11.8 qts |

## TORQUE

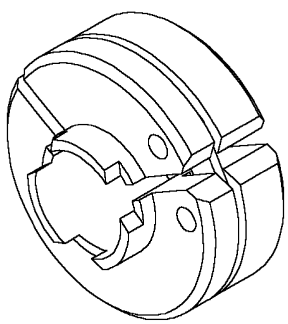
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Engine Air Tubes | | | |
| Turbocharger to Intercooler | 4.7 | - | 42 |
| Intercooler to Intake Manifold | 4.7 | - | 42 |
| Automatic Belt Tensioner to Mounting Bracket | | | |
| 2.4L | 41 | 30 | - |
| 3.7L | 41 | 30 | - |
| Automatic Belt Tensioner Pulley Bolt | | | |
| 2.4L | 61 | 45 | - |
| 3.7L | 61 | 45 | - |
| Accessory Drive Belt Idler Pulley Bolt - 2.8L Diesel | 53 | 39 | - |
| Accessory Drive Belt Tensioner Bolt - 2.8L Diesel | 47.1 | 35 | - |
| Viscous Fan Drive to Engine - 3.7L | 95 | 70 | - |
| Viscous Fan Drive to Engine - 2.8L Diesel | 149 | 110 | - |
| Cooling Fan Support Bolts | 47.1 | 35 | - |
| Block Heater Bolt | | | |
| 2.4L | 2 | - | 17 |
| 3.7L | 2 | - | 17 |
| Transmission Oil/Condenser to Radiator Bolts | 11.9 | - | 105 |
| Coolant Overflow Bottle to Plenum mounting Bolts - 2.4L only | 8.5 | - | 75 |
| Coolant Pressure Bottle to Plenum mounting Bolts -3.7L only | 8.5 | - | 75 |
| Electric Fan to Fan Shroud Bolts | 9 | - | 80 |
| Fan Blade Assy. to Viscous Drive Bolts - 3.7L/2.8L HD Cooling | 23.7 | - | 210 |
| Fan Shroud to Radiator Mounting Bolts | 9 | - | 80 |
| Radiator Upper Isolator to Crossmember - Bolts | 10.7 | - | 95 |
| Thermostat Housing Bolts | | | |
| 2.8L Diesel | 27.5 | 21 | - |
| 2.4L | 28 | - | 250 |
| 3.7L | 13 | - | 115 |
| Water Pump Bolts | | | |
| 2.4L | 12 | - | 105 |
| 3.7L | 54 | 40 | - |
| Water Pump Housing Nuts - 2.8L Diesel | 24.4 | 18 | - |

## SPECIAL TOOLS

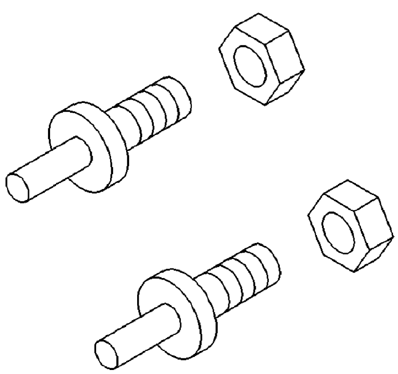
## COOLING



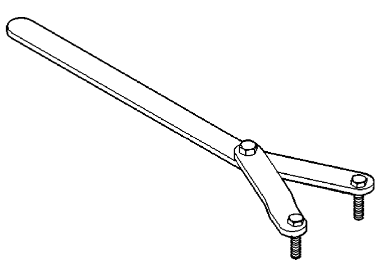
PLIERS 6094



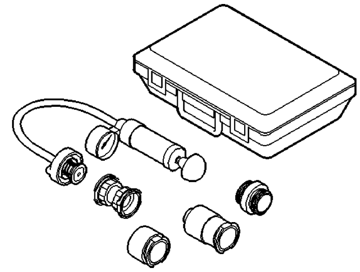
RELEASE TOOL 8875A



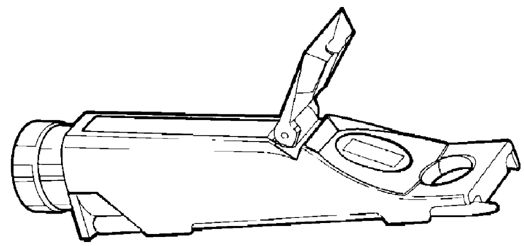
ADAPTER PINS 8346



SPANNER WRENCH 6958 WITH 8346 ADAPTOR PINS



PRESSURE TESTER 7700A



COOLANT REFRACTOMETER 8286

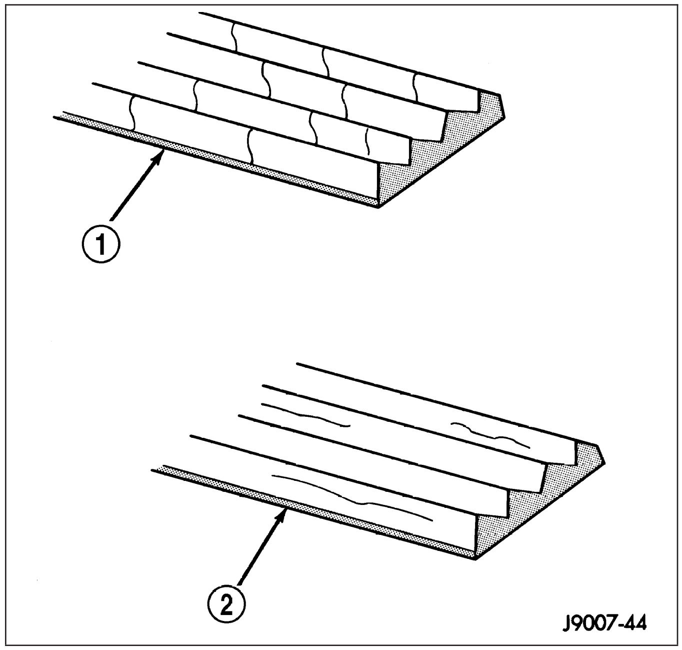
# ACCESSORY DRIVE

## TABLE OF CONTENTS

# ACCESSORY DRIVE

## DIAGNOSIS AND TESTING - SERPENTINE DRIVE BELT DIAGNOSIS

When diagnosing serpentine drive belts, small cracks (1) that run across ribbed surface of belt from rib to rib, are considered normal. These are not a reason to replace belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced. Also replace belt if it has excessive wear, frayed cords or severe glazing.




**SERPENTINE DRIVE BELT DIAGNOSIS CHART**

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| RIB CHUNKING (ONE OR MORE RIBS HAS SEPARATED FROM BELT BODY) | 1. Foreign objects imbedded in pulley grooves. | 1. Remove foreign objects from pulley grooves. Replace belt. |
| | 2. Installation damage. | 2. Replace belt. |
| RIB OR BELT WEAR | 1. Pulley(s) misaligned. | 1. Align pulley(s). |
| | 2. Abrasive environment. | 2. Clean pulley(s). Replace belt if necessary. |
| | 3. Rusted pulley(s). | 3. Clean rust from pulley(s). |
| | 4. Sharp or jagged pulley groove tips. | 4. Replace pulley. |
| | 5. Rubber deteriorated. | 5. Replace belt. |
| LONGITUDINAL BELT CRACKING (CRACKS BETWEEN TWO RIBS) | 1. Belt has mistracked from pulley groove. | 1. Replace belt. |
| | 2. Pulley groove tip has worn away rubber to tensile member. | 2. Replace belt. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
| --- | --- | --- |
| BELT SLIPS | 1. Belt slipping because of insufficient tension. | 1. Replace automatic belt tensioner. |
| | 2. Belt routed incorrectly. | 2. Verify belt routing. |
| | 3. Incorrect belt. | 3. Replace belt. |
| | 4. Belt or pulley subjected to substance (belt dressing, oil ethylene glycol) that has reduced friction. | 4. Replace belt and clean pulleys. |
| | 5. Driven component bearing failure. | 5. Replace faulty component bearing. |
| | 6. Belt glazed and hardened from heat and excessive slippage. | 6. Replace belt. |
| "GROOVE JUMPING" (BELT DOES NOT MAINTAIN CORRECT POSITION ON PULLEY) | 1. Belt tension either too high or too low. | 1. Replace automatic belt tensioner. |
| | 2. Belt routed incorrectly. | 2. Verify belt routing. |
| | 3. Incorrect belt. | 3. Replace belt. |
| | 4. Pulley(s) not within design tolerance. | 4. Replace pulley(s). |
| | 5. Foreign object(s) in grooves. | 5. Remove foreign objects from grooves. |
| | 6. Pulley misalignment. | 6. Check and replace. |
| | 7. Belt cord line is broken. | 7. Replace belt. |
| BELT BROKEN (NOTE: IDENTIFY AND CORRECT PROBLEM BEFORE NEW BELT IS INSTALLED) | 1. Excessive tension. | 1. Replace belt and automatic belt tensioner. |
| | 2. Incorrect belt. | 2. Replace belt. |
| | 3. Tensile member damaged during belt installation. | 3. Replace belt. |
| | 4. Severe misalignment. | 4. Check and replace. |
| | 5. Bracket, pulley, or bearing failure. | 5. Replace defective component and belt. |
| NOISE (OBJECTIONABLE SQUEAL, SQUEAK, OR RUMBLE IS HEARD OR FELT WHILE DRIVE BELT IS IN OPERATION) | 1. Belt slippage. | 1. Replace belt or automatic belt tensioner. |
| | 2. Bearing noise. | 2. Locate and repair. |
| | 3. Belt misalignment. | 3. Replace belt. |
| | 4. Belt-to-pulley mismatch. | 4. Install correct belt. |

Refer to SERPENTINE DRIVE BELT DIAGNOSIS CHART for further belt diagnosis.

# BELT TENSIONERS

## DESCRIPTION

The automatic belt tensioner is a spring loaded arm and pulley assembly. The tensioner assembly is designed to apply constant pressure on the accessory drive belt to maintain proper belt tension.

## OPERATION

**WARNING: THE AUTOMATIC BELT TENSIONER ASSEMBLY IS SPRING LOADED. DO NOT ATTEMPT TO DISASSEMBLE THE TENSIONER ASSEMBLY.**

The automatic belt tensioner maintains correct belt tension using a coiled spring within the tensioner housing. The spring applies pressure to the tensioner arm pressing the arm into the belt, tensioning the belt.

If a new belt is being installed, the arrow must be within approximately 3 mm (1/8 in.) of indexing mark. Belt is considered new if it has been used 15 minutes or less. If this specification cannot be met, check for:

- The wrong belt being installed (incorrect length/width)
- Worn bearings on an engine accessory (A/C compressor, power steering pump, water pump, idler pulley or generator)
- A pulley on an engine accessory being loose
- Misalignment of an engine accessory
- Belt incorrectly routed.

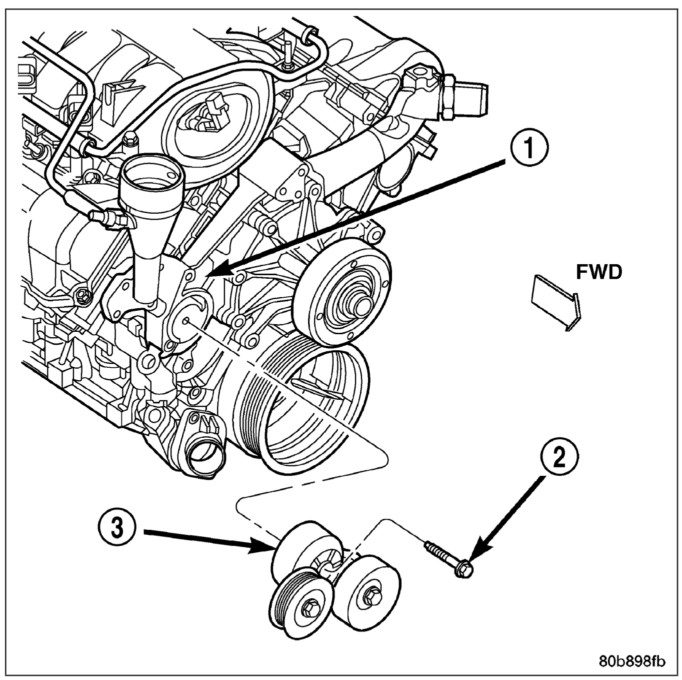
## REMOVAL

## 3.7L ENGINE

1. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
2. Remove tensioner assembly (3) from engine front cover.

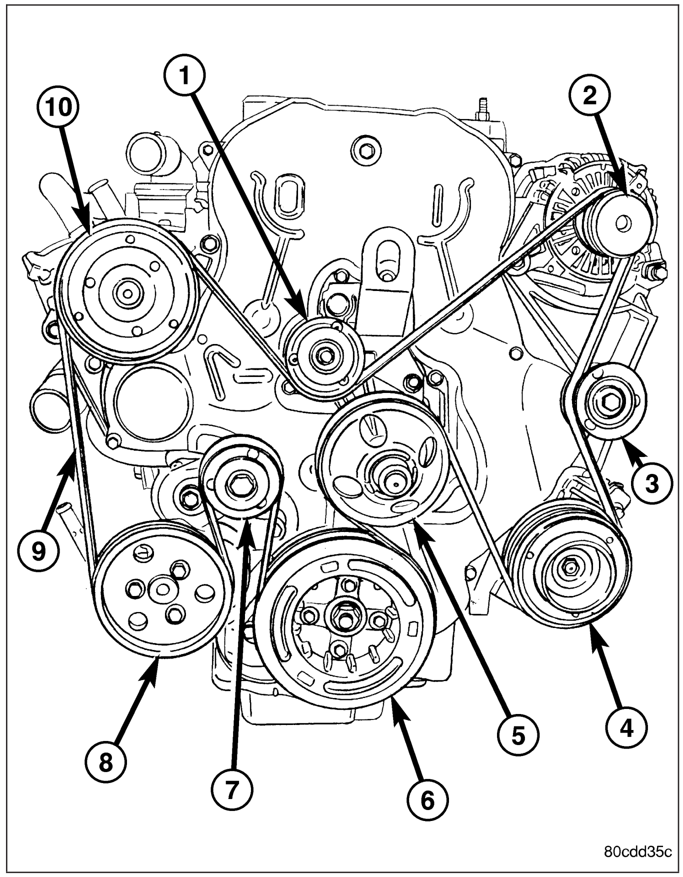
**WARNING: BECAUSE OF HIGH SPRING TENSION, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY (EXCEPT FOR PULLEY ON TENSIONER).**

3. Remove pulley bolt. Remove pulley from tensioner.

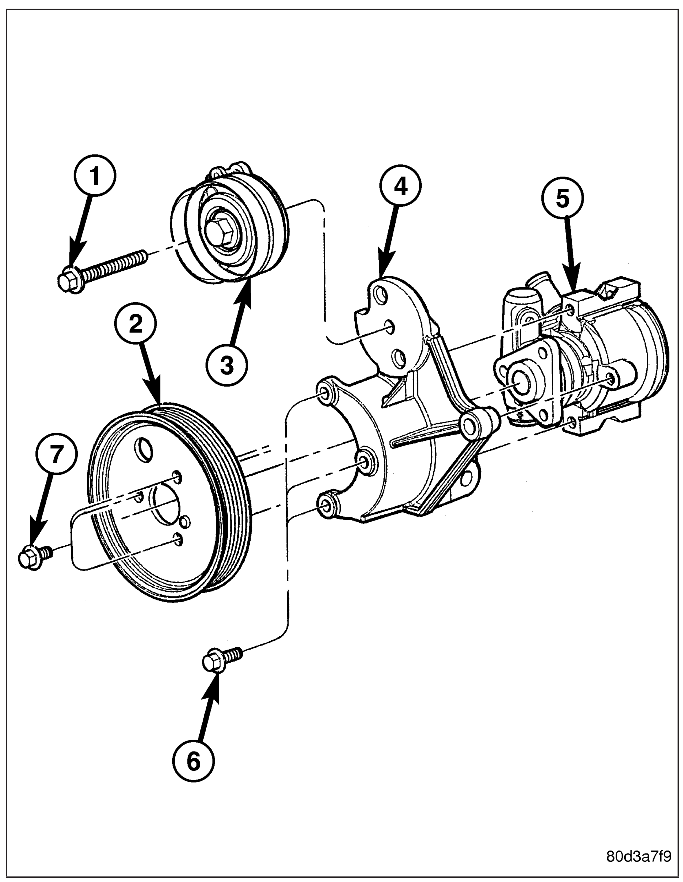


## 2.8L DIESEL

1. Disconnect negative battery cable.
2. Remove accessory drive belt (9) (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).




3. Remove belt tensioner retaining bolt and remove tensioner (3) from bracket (4).



## INSTALLATION

### 3.7L ENGINE

1. Install pulley and pulley bolt to tensioner. Tighten bolt to 61 N·m (45 ft. lbs.) torque.
2. An indexing slot is located on back of tensioner. Align this slot to the head of the bolt on the front cover. Install the mounting bolt. Tighten bolt to 41 N·m (30 ft. lbs.).
3. Install drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
4. Check belt indexing marks (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

### 2.8L DIESEL

1. Install belt tensioner on bracket. Torque retaining bolt to 47 N·m.
2. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
3. Connect negative battery cable.

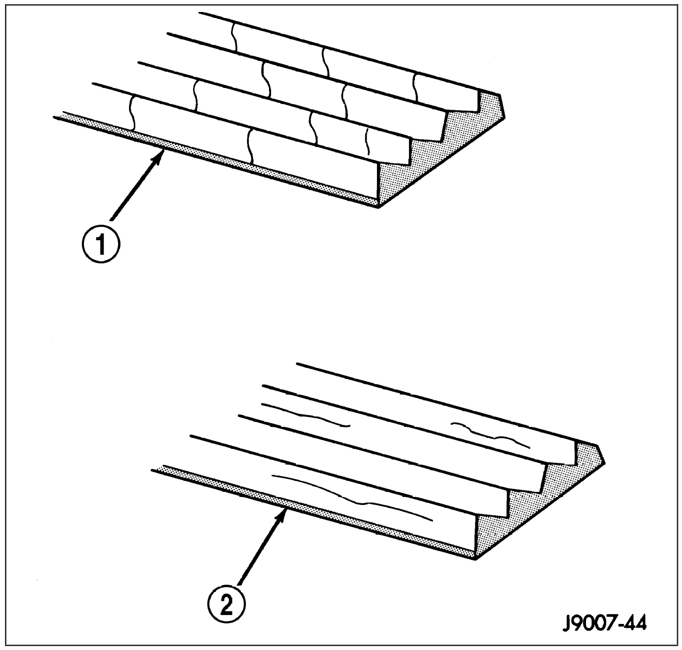
# DRIVE BELTS

## DIAGNOSIS AND TESTING - ACCESSORY DRIVE BELT

### VISUAL DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks (1) that run across the ribbed surface of the belt from rib to rib , are considered normal. These are not a reason to replace the belt. However, cracks running along a rib (2) (not across) are **not** normal. Any belt with cracks running along a rib must be replaced. Also replace the belt if it has excessive wear, frayed cords or severe glazing.

Refer to ACCESSORY DRIVE BELT DIAGNOSIS CHART for further belt diagnosis.




### NOISE DIAGNOSIS

#### ACCESSORY DRIVE BELT DIAGNOSIS CHART

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| RIB CHUNKING (One or more ribs has separated from belt body). | 1. Foreign objects imbedded in pulley grooves..<br>2. Installation damage. | 1. Remove foreign objects from pulley grooves. Replace belt.<br>2. Replace belt. |
| RIB OR BELT WEAR. | 1. Pulley misaligned.<br>2. Abrasive environment.<br>3. Rusted pulley(s).<br>4. Sharp or jagged pulley groove tips.<br>5. Belt rubber deteriorated. | 1. Align pulley(s).<br>2. Clean pulley(s). Replace belt if necessary.<br>3. Clean rust from pulley(s).<br>4. Replace pulley. Inspect belt.<br>5. Replace belt. |
| BELT SLIPS. | 1. Belt slipping because of insufficient tension.<br>2. Belt or pulley exposed to substance that has reduced friction (belt dressing, oil, ethylene glycol).<br>3. Driven component bearing failure (seizure).<br>4. Belt glazed or hardened from heat and excessive slippage. | 1. Inspect/Replace tensioner if necessary.<br>2. Replace belt and clean pulleys.<br>3. Replace faulty component or bearing.<br>4. Replace belt. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
| --- | --- | --- |
| LONGITUDAL BELT CRACKING. | 1. Belt has mistracked from pulley groove. | 1. Replace belt. |
| | 2. Pulley groove tip has worn away rubber to tensile member. | 2. Replace belt. |
| ″GROOVE JUMPING″ (Belt does not maintain correct position on pulley). | 1. Incorrect belt tension. | 1. Inspect/Replace tensioner if necessary. |
| | 2. Pulley(s) not within design tolerance. | 2. Replace pulley(s). |
| | 3. Foreign object(s) in grooves. | 3. Remove foreign objects from grooves. |
| | 4. Pulley misalignment. | 4. Align component. |
| | 5. Belt cordline is broken. | 5. Replace belt. |
| BELT BROKEN (Note: Identify and correct problem before new belt is installed). | 1. Incorrect belt tension. | 1. Replace Inspect/Replace tensioner if necessary. |
| | 2. Tensile member damaged during belt installation. | 2. Replace belt. |
| | 3. Severe misalignment. | 3. Align pulley(s). |
| | 4. Bracket, pulley, or bearing failure. | 4. Replace defective component and belt. |
| NOISE (Objectionable squeal, squeak, or rumble is heard or felt while drive belt is in operation). | 1. Incorrect belt tension. | 1. Inspect/Replace tensioner if necessary. |
| | 2. Bearing noise. | 2. Locate and repair. |
| | 3. Belt misalignment. | 3. Align belt/pulley(s). |
| | 4. Belt to pulley mismatch. | 4. Install correct belt. |
| | 5. Driven component induced vibration. | 5. Locate defective driven component and repair. |
| TENSION SHEETING FABRIC FAILURE (Woven fabric on outside circumference of belt has cracked or separated from body of belt). | 1. Tension sheeting contacting stationary object. | 1. Correct rubbing condition. |
| | 2. Excessive heat causing woven fabric to age. | 2. Replace belt. |
| | 3. Tension sheeting splice has fractured. | 3. Replace belt. |
| CORD EDGE FAILURE (Tensile member exposed at edges of belt or separated from belt body). | 1. Incorrect belt tension. | 1. Inspect/Replace tensioner if necessary. |
| | 2. Belt contacting stationary object. | 2. Replace belt. |
| | 3. Pulley(s) out of tolerance. | 3. Replace pulley. |
| | 4. Insufficient adhesion between tensile member and rubber matrix. | 4. Replace belt. |

Noises generated by the accessory drive belt are most noticeable at idle. Before replacing a belt to resolve a noise condition, inspect all of the accessory drive pulleys for alignment, glazing, or excessive end play.

## REMOVAL

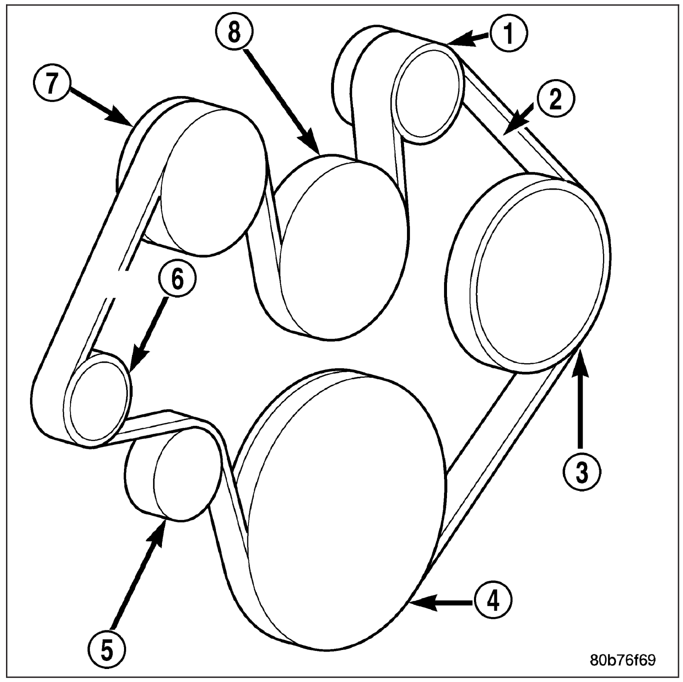
### 3.7L ENGINE

**NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.**

**CAUTION: DO NOT LET TENSIONER ARM SNAP BACK TO THE FREEARM POSITION, SEVERE DAMAGE MAY OCCUR TO THE TENSIONER.**

Belt tension is not adjustable. Belt adjustment is maintained by an automatic spring loaded belt tensioner.

1. Disconnect negative battery cable from battery.
2. Rotate belt tensioner (6) until it contacts its stop. Remove belt, then slowly rotate the tensioner into the freearm position.



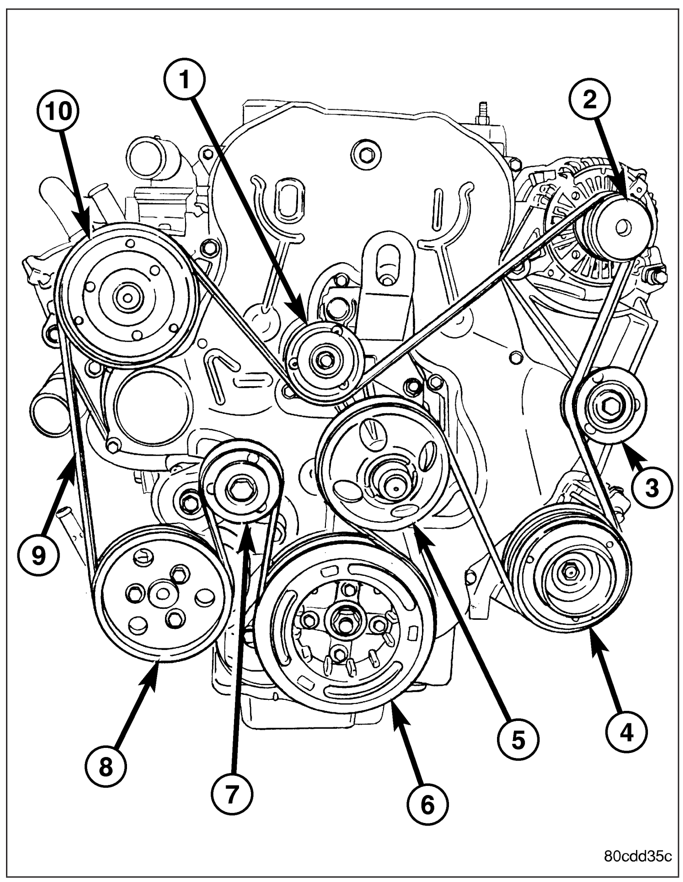

### 2.8L DIESEL

**NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.**

**CAUTION: DO NOT LET TENSIONER ARM SNAP BACK TO THE FREEARM POSITION, SEVERE DAMAGE MAY OCCUR TO THE TENSIONER.**

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring loaded) belt tensioner.

1. Disconnect negative battery cable.
2. Rotate belt tensioner until it contacts its stop. Remove belt (9), then slowly rotate the tensioner into the freearm position.



## INSTALLATION

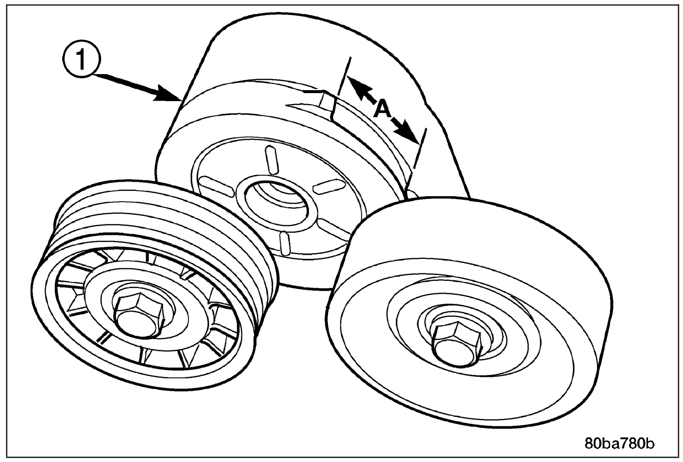
## 3.7L ENGINE

**NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.**

Belt tension is not adjustable. Belt adjustment is maintained by an automatic spring loaded belt tensioner.

1. Check condition of all pulleys.

**CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction.**




2. Install new belt. Route the belt around all pulleys except the idler pulley. Rotate the tensioner arm (1) until it contacts its stop position. Route the belt around the idler and slowly let the tensioner rotate into the belt. Make sure the belt is seated onto all pulleys.
3. With the drive belt installed, inspect the belt wear indicator. On 3.7L Engines the gap between the tang and the housing stop (measurement A) must not exceed 24 mm (0.94 inches).

## 2.8L DIESEL

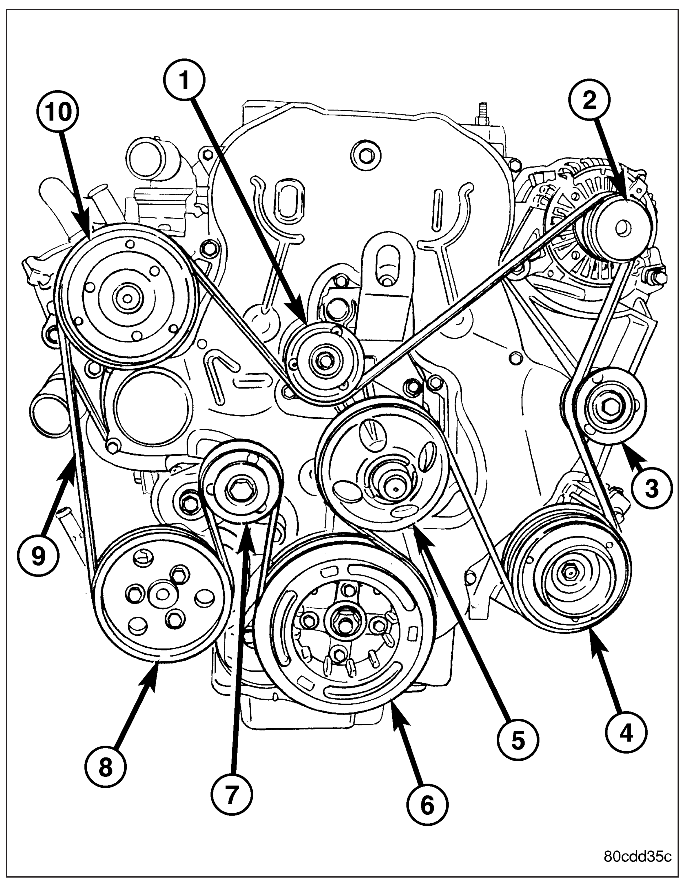
**NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.**

Belt tension is not adjustable. Belt adjustment is maintained by an automatic spring loaded belt tensioner.

1. Check condition of all pulleys.

**CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction.**

2. Install new belt (9). Route the belt around all pulleys except the idler pulley. Rotate the tensioner arm until it contacts its stop position. Route the belt around the idler and slowly let the tensioner rotate into the belt. Make sure the belt is seated onto all pulleys.

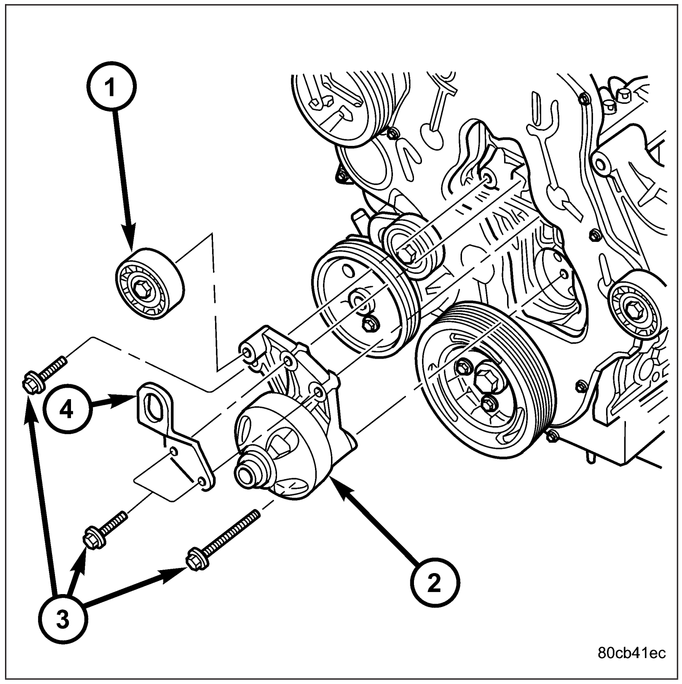


# IDLER PULLEY

## REMOVAL

**CAUTION: The retaining bolts on the idler pulleys are left hand thread.**

1. Disconnect negative battery cable.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Remove idler pulley (1) retaining bolts and pulleys.




## INSTALLATION

## 2.8L DIESEL

1. Install idler pulleys and retaining bolts. Torque bolts to 53 N·m.
2. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
3. Connect negative battery cable.

# ENGINE

## TABLE OF CONTENTS

# COOLANT

## DESCRIPTION

## HOAT COOLANT

**WARNING: Antifreeze is an ethylene-glycol base coolant and is harmful if swallowed or inhaled. If swallowed, drink two glasses of water and induce vomiting. If inhaled, move to fresh air area. seek medical attention immediately. Do not store in open or unmarked containers. Wash skin and clothing thoroughly after coming in contact with ethylene-glycol. Keep out of reach of children. Dispose of glycol base coolant properly, contact your dealer or government agency for location of collection center in your area. Do not open a cooling system when the engine is at operating temperature or hot under pressure, personal injury can result. Avoid radiator cooling fan when engine compartment related service is performed, personal injury can result.**

**CAUTION: Use of Propylene-Glycol based coolants is not recommended, as they provide less freeze protection and less corrosion protection.**

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, in the cylinder head area near the exhaust valves and engine block. Then coolant carries the heat to the radiator where the tube/ fin radiator can transfer the heat to the air.

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769), or the equivalent ethylene-glycol base coolant with organic corrosion inhibitors (called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% ethylene-glycol and 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

**CAUTION: Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769) may not be mixed with any other type of antifreeze. Mixing of coolants other than specified (non-HOAT or other HOAT), may result in engine damage that may not be covered under the new vehicle warranty, and decreased corrosion protection.**

## COOLANT PERFORMANCE

The required ethylene-glycol (antifreeze) and water mixture depends upon climate and vehicle operating conditions. The coolant performance of various mixtures follows:

**Pure Water-** Water can absorb more heat than a mixture of water and ethylene-glycol. This is for purpose of heat transfer only. Water also freezes at a higher temperature and allows corrosion.

**100 percent Ethylene-Glycol -** The corrosion inhibiting additives in ethylene-glycol need the presence of water to dissolve. Without water, additives form deposits in system. These act as insulation causing temperature to rise to as high as 149°C (300°F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at -22°C (-8°F).

**50/50 Ethylene-Glycol and Water -** Is the recommended mixture, it provides protection against freezing to -37°C (-34°F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. If percentage is lower, engine parts may be eroded by cavitation. Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7°C (-90°F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because specific heat of antifreeze is lower than that of water.

**CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.**

### COOLANT SELECTION AND ADDITIVES

The use of aluminum cylinder blocks, cylinder heads and water pumps requires special corrosion protection. Only Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (glycol base coolant with corrosion inhibitors called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

**CAUTION: Do not use coolant additives that are claimed to improve engine cooling.**

## ENGINE COOLANT

### ETHYLENE-GLYCOL MIXTURES

**CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.**

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37° C (-35° F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7° C (-90° F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149° C (300° F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at 22° C (-8° F ).

### PROPYLENE-GLYCOL MIXTURES

It's overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32° C (-26° F). 5° C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125° C (257° F ) at 96.5 kPa (14 psi), compared to 128° C (263° F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up on a cooling system designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/ethylene-glycol Mixtures can cause the destabilization of various corrosion inhibitors, causing damage to the various cooling system components. Also, once ethylene-glycol and propylene-glycol based coolants are mixed in the vehicle, conventional methods of determining freeze point will not be accurate. Both the refractive index and specific gravity differ between ethylene glycol and propylene glycol.

## OPERATION

Coolant flows through the engine block absorbing the heat from the engine, then flows to the radiator where the cooling fins in the radiator transfers the heat from the coolant to the atmosphere. During cold weather the ethylene-glycol or propylene-glycol coolant prevents water present in the cooling system from freezing within temperatures indicated by mixture ratio of coolant to water.

# COOLANT RECOVERY CONTAINER

## DESCRIPTION

### COOLANT RECOVERY PRESSURE SYSTEM - 3.7L/2.8L DIESEL

This system works on the principal of a closed and deaerated system using thermally generated pressure. The expansion and contraction of the coolant in the pressurized closed system keeps it free of trapped air. It provides:

- A pressurized surge tank volume for expansion and contraction.
- A non-pressurized overflow volume to capture excess coolant expansion and allow for it's return to the pressurized system.
- A pressurized cap on the pressure bottle rather than the radiator. This facilitates deaeration of the system.
- Reserve coolant is included in the pressurized volume to account for minor leaks and evaporation or boiling losses.
- Provides a warning light for low coolant level.

### COOLANT RECOVERY NON-PRESSURE SYSTEM - 2.4L

This system works on the principal of a closed and completely deaerated system using thermally generated pressure. The bottle acts as a reserve coolant source to keep air out of the system but must have a specified minimum amount of coolant in the bottle at all times. The expansion and contraction of the coolant in the pressurized closed coolant loop allows the reserve bottle to accept and give up excess fluid via a hose from the radiator neck. It provides:

- A non-pressurized reserve coolant tank volume for expansion and contraction of coolant.
- A pressurized cap on the radiator. This keeps the main loop of the cooling system at an elevated operating pressure and prevents coolant boiling at lower temperatures. It is the highest point in the 2.4L.
- Reserve coolant is included in the non-pressurized tank in enough quantity to account for minor leaks and evaporation or boiling losses, and to keep the return line back to the radiator full at all times. Failure to do so could allow air to be sucked back into the radiator as the engine and engine coolant cool down and the coolant volume contracts.

# COOLANT RECOVERY PRESSURE CONTAINER

## DESCRIPTION

This system works along with the radiator pressure cap. This is done by using thermal expansion and contraction of the coolant to keep the coolant free of trapped air. It provides:

- A volume for coolant expansion and contraction.
- A convenient and safe method for checking/adjusting coolant level at atmospheric pressure. This is done without removing the radiator pressure cap.
- Some reserve coolant to the radiator to cover minor leaks and evaporation or boiling losses.

As the engine cools, a vacuum is formed in the cooling system of both the radiator and engine. Coolant will then be drawn from the coolant tank and returned to a proper level in the radiator.

The coolant reservoir/overflow system has a radiator mounted pressurized cap, an overflow tube, and a plastic coolant reservoir/overflow tank, mounted to the right side of the cowl. It is mounted to the cowl with two nuts on top, and a slide bracket on the bottom.

## OPERATION

## COOLANT RECOVERY PRESSURE SYSTEM - 3.7L/2.8L DIESEL

As the engine warms, the coolant in the closed system expands. The pressurized bottle accepts the expanding fluid. Then, when the thermostat opens and a high demand for coolant is placed on the system, the pressurized surge tank side of the bottle can supply the temporary additional volume of coolant demanded by the system. Once the water pump catches up with the flow demand, the tank returns to equilibrium. A separate compartment in the bottle accepts the overflow coolant which is then drawn back into the primary side of the bottle when the engine and coolant cool down

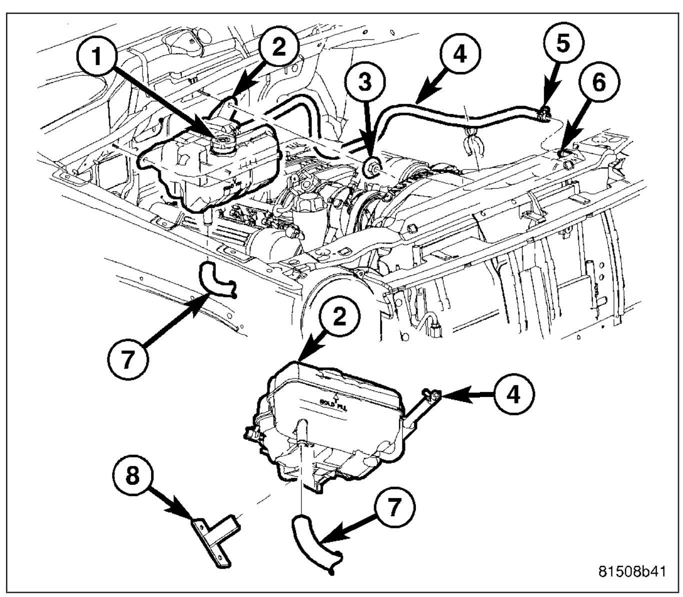
The advantage of the pressurized system is that any excess air in the cooling system is routed to the top of the bottle via a vent hose at the thermostat housing to the bottle. This air accumulates at the top of the pressurized volume in the bottle (the highest point in the system) and is forced out of the system through the pressure cap. This keeps the system properly deaerated and maintains pressure in the cooling system to prevent water pump cavitation

The diesel bottle has an additional vent line back to the radiator that is immersed in the coolant bath at the bottle. This also ensures air at the radiator is routed back to bottle for expulsion and that a constant head of liquid is present at the radiator.

## REMOVAL

## PRESSURE SYSTEM - 3.7L/2.8L DIESEL

1. Remove pressure cap from bottle.
2. Siphon coolant from pressure bottle (2) into a contaminant free container.
3. Disconnect coolant bottle to radiator hose at coolant bottle.
4. Disconnect lower hose at coolant bottle.
5. Remove mounting nuts.
6. Remove coolant bottle from bracket.



# INSTALLATION

## PRESSURE SYSTEM - 3.7L/2.8L DIESEL

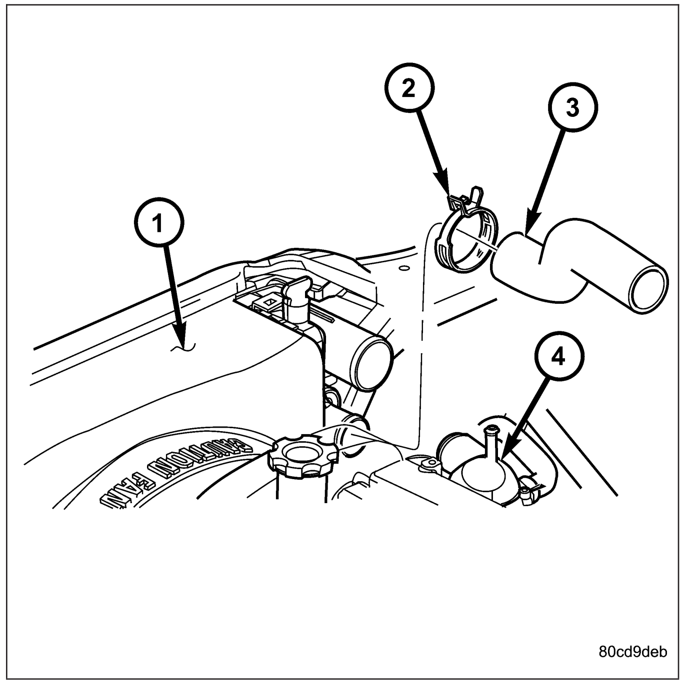
1. Position pressure bottle on mounting bracket.
2. Install mounting nuts. Tighten nuts to 8.5 N·m (75 in. lbs.).
3. Install lower hose at coolant bottle.
4. Install radiator to coolant bottle hose at coolant bottle.
5. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

# COOLANT SYSTEM HOSES-2.8L DIESEL

## REMOVAL

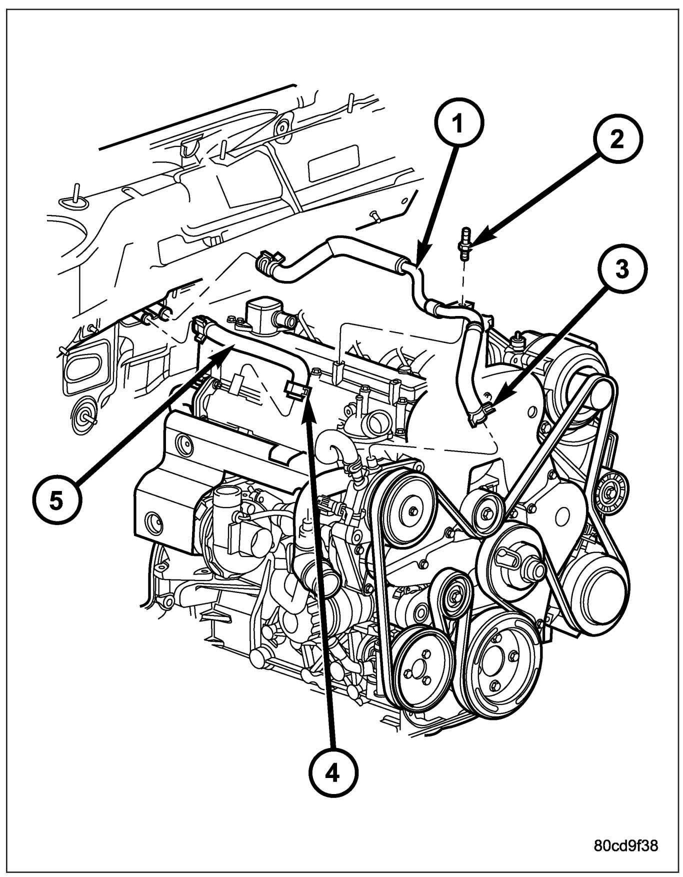
### UPPER RADIATOR HOSE - 2.8L DIESEL

1. Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
2. Disconnect upper radiator hose (3) from thermostat housing.
3. Disconnect upper radiator hose from radiator and remove from vehicle.




### HEATER CORE HOSES - 2.8L DIESEL

1. Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
2. Remove engine cover from engine (Refer to 9 - ENGINE COVER - REMOVAL).
3. Disconnect heater core supply line at heater core and viscous heater. Remove hose from vehicle.
4. Disconnect heater core return line (5) from heater core and EGR cooler. Remove hose from vehicle.



## INSTALLATION

### UPPER RADIATOR HOSE - 2.8L DIESEL

1. Install upper radiator hose on radiator and thermostat housing.
2. Reposition hose clamps in proper position.
3. Refill cooling system to proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

### HEATER CORE HOSES - 2.8L DIESEL

1. Connect heater core supply hose to heater core and viscous heater. Position hose clamps into proper position.
2. Connect heater core return hose to heater core and EGR cooler. Position hose clamps into proper position.
3. Install engine cover to engine (Refer to 9 - ENGINE COVER - INSTALLATION).
4. Refill cooling system to proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

# ENGINE BLOCK HEATER

## DESCRIPTION

The block heater is operated by ordinary house current (110 Volt A.C.) through a power cord and connector located in the engine compartment. The heater is mounted in a core hole (in place of a core hole plug) in the engine block, with the heating element immersed in coolant.

**CAUTION: The power cord must be secured in its retainer clips, and not positioned so it could contact linkages or exhaust manifolds and become damaged.**

## OPERATION

The block heater element is submerged in the cooling system's coolant. When electrical power (110 volt A.C.) is applied to the element, it creates heat. This heat is transferred to the engine coolant. This provides easier engine starting and faster warm-up when vehicle is operated in areas having extremely low temperatures.

## REMOVAL - 3.7L

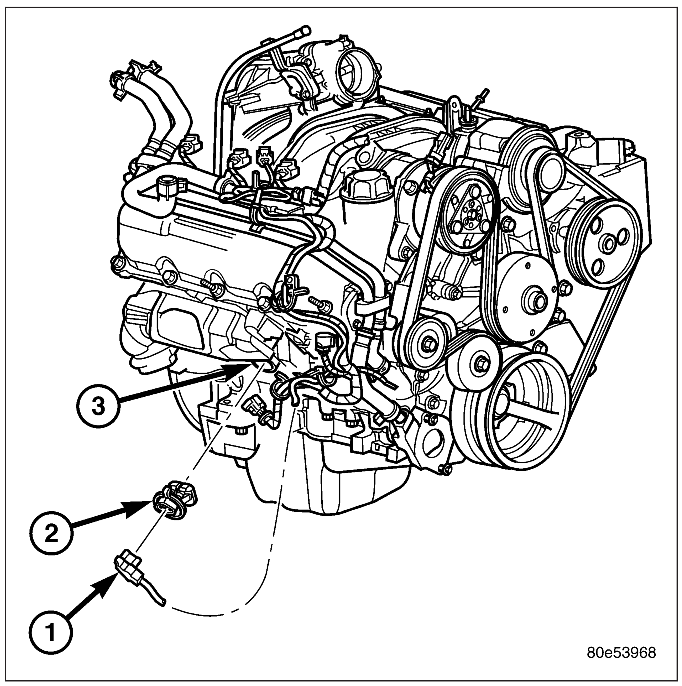
1. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
2. Raise vehicle on hoist.
3. Detach power cord plug from heater.
4. Loosen screw in center of heater. Remove heater assembly.

## INSTALLATION - 3.7L

1. Thoroughly clean core hole and heater seat.
2. Insert heater assembly (2) with element loop positioned **upward** .
3. With heater seated, tighten center screw securely to assure a positive seal.

**CAUTION: To prevent damage, the power cord must be secured in it's retaining clips, and not positioned so it could contact linkages or exhaust manifold.**

4. Connect power cord to heater.
5. Lower vehicle.
6. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).



# ENGINE COOLANT TEMPERATURE SENSOR

## DESCRIPTION

The Engine Coolant Temperature (ECT) sensor is used to sense engine coolant temperature. The sensor protrudes into an engine water jacket.

The ECT sensor is a two-wire Negative Thermal Coefficient (NTC) sensor. Meaning, as engine coolant temperature increases, resistance (voltage) in the sensor decreases. As temperature decreases, resistance (voltage) in the sensor increases.

## OPERATION

At key-on, the Powertrain Control Module (PCM) sends out a regulated 5 volt signal to the ECT sensor. The PCM then monitors the signal as it passes through the ECT sensor to the sensor ground (sensor return).

When the engine is cold, the PCM will operate in Open Loop cycle. It will demand slightly richer air-fuel mixtures and higher idle speeds. This is done until normal operating temperatures are reached.

The PCM uses inputs from the ECT sensor for the following calculations:

- for engine coolant temperature gauge operation through CCD or PCI (J1850) communications
- Injector pulse-width
- Spark-advance curves
- ASD relay shut-down times
- Idle Air Control (IAC) motor key-on steps
- Pulse-width prime-shot during cranking
- O2 sensor closed loop times
- Purge solenoid on/off times
- EGR solenoid on/off times (if equipped)
- Leak Detection Pump operation (if equipped)
- Radiator fan relay on/off times (if equipped)
- Target idle speed

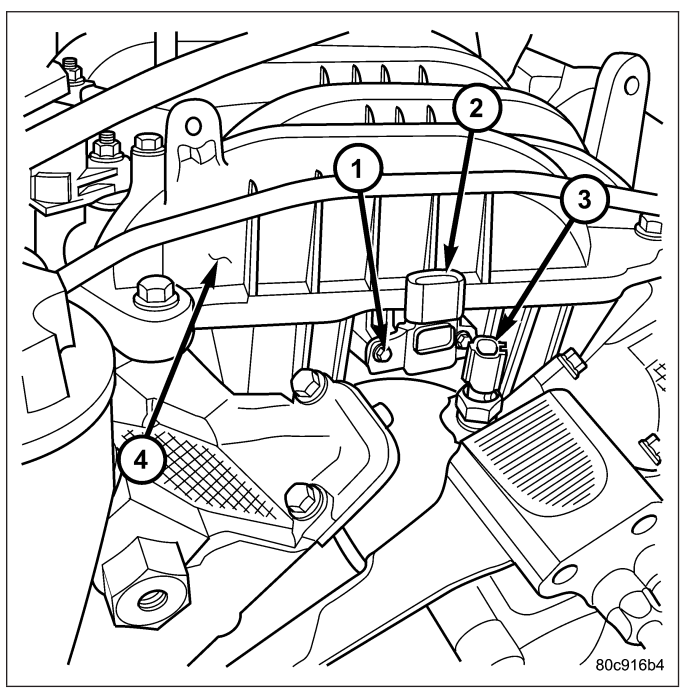
## REMOVAL

## 3.7L ENGINE

The Engine Coolant Temperature (ECT) sensor (3) is installed into a water jacket at front of intake manifold near rear of generator.

**WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR.**

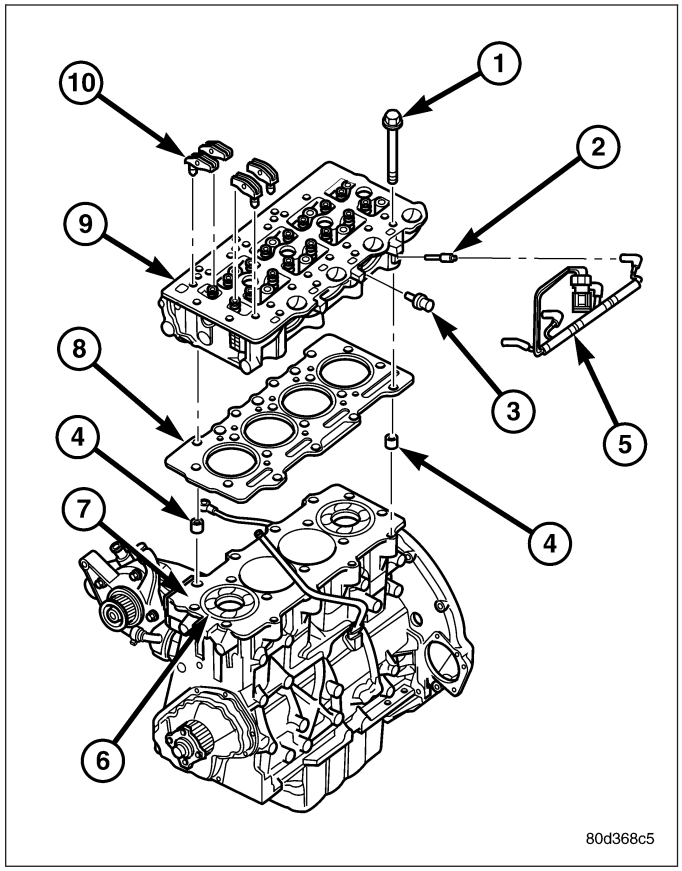
1. Partially drain cooling system.
2. Disconnect electrical connector from sensor.
3. Remove sensor from intake manifold.



## 2.8L DIESEL ENGINE

**WARNING: DO NOT REMOVE OR LOOSEN THE COOLANT PRESSURE/VENT CAP, CYLINDER BLOCK DRAIN PLUGS, OR THE DRAINCOCK WHEN THE SYSTEM IS HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM THE COOLANT CAN OCCUR.**

1. Disconnect negative battery cable.
2. Drain the cooling system. (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE)
3. Disconnect coolant temperature sensor electrical connector.
4. Remove coolant temperature sensor (3) from cylinder head.




## INSTALLATION

## 3.7L ENGINE

1. Apply thread sealant to sensor threads.
2. Install sensor to engine.
3. Tighten coolant temperature sensor to 11 N·m (8 ft. lbs.) torque.
4. Replace any lost engine coolant.

## 2.8L DIESEL ENGINE

1. Install coolant temperature sensor in thermostat housing.
2. Connect coolant temperature sensor electrical connector.
3. Refill cooling system. (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE)
4. Connect negative battery cable.

# ENGINE COOLANT THERMOSTAT

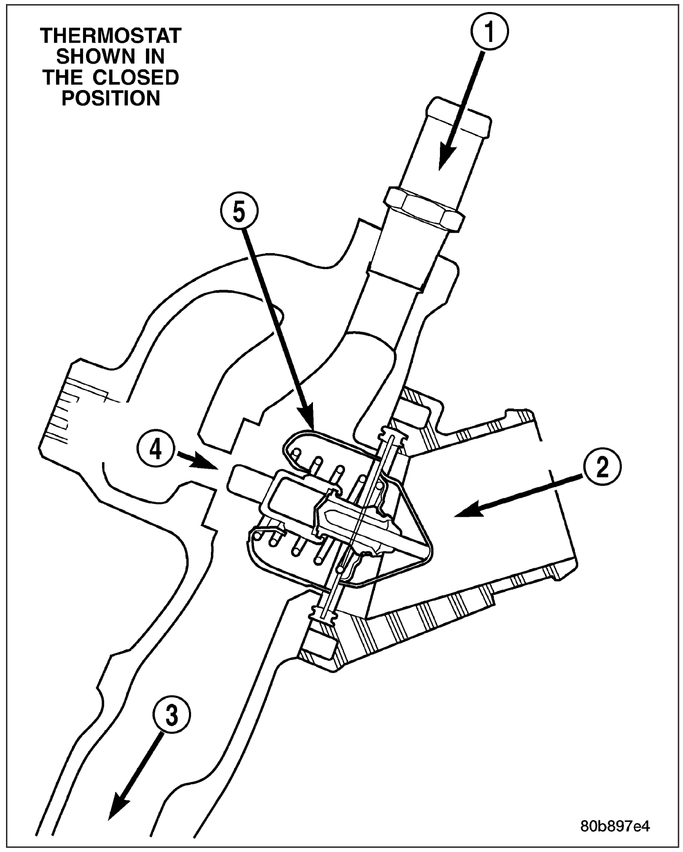
## DESCRIPTION

## DESCRIPTION - 3.7L ENGINE

**CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.**

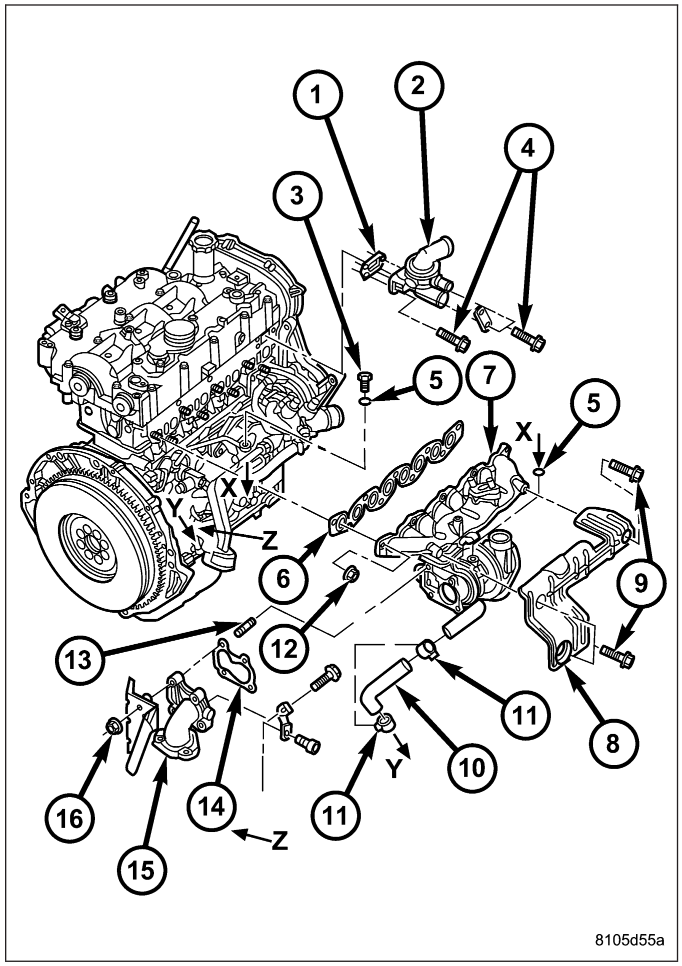
A pellet-type thermostat (5) controls the operating temperature of the engine by controlling the amount of coolant flow to the radiator. On all engines the thermostat is closed below 195°F (90°C). Above this temperature, coolant is allowed to flow to the radiator. This provides quick engine warm up and overall temperature control. On the 3.7L engine the thermostat is designed to block the flow of the coolant bypass journal by 50% instead of completely blocking the flow. This design controls coolant temperature more accurately.

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes other problems. These are: longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation. This condensation can result in sludge formation.



## DESCRIPTION

A pellet-type thermostat (2) controls the operating temperature of the engine by controlling the amount of coolant flow to the radiator.




## OPERATION

The thermostat starts to open at 80°C (176°F). Above this temperature, coolant is allowed to flow to the radiator. This provides quicker engine warmup and overall temperature control.

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes other problems. These are: longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation. This condensation can result in sludge formation.

## DIAGNOSIS AND TESTING - THERMOSTAT

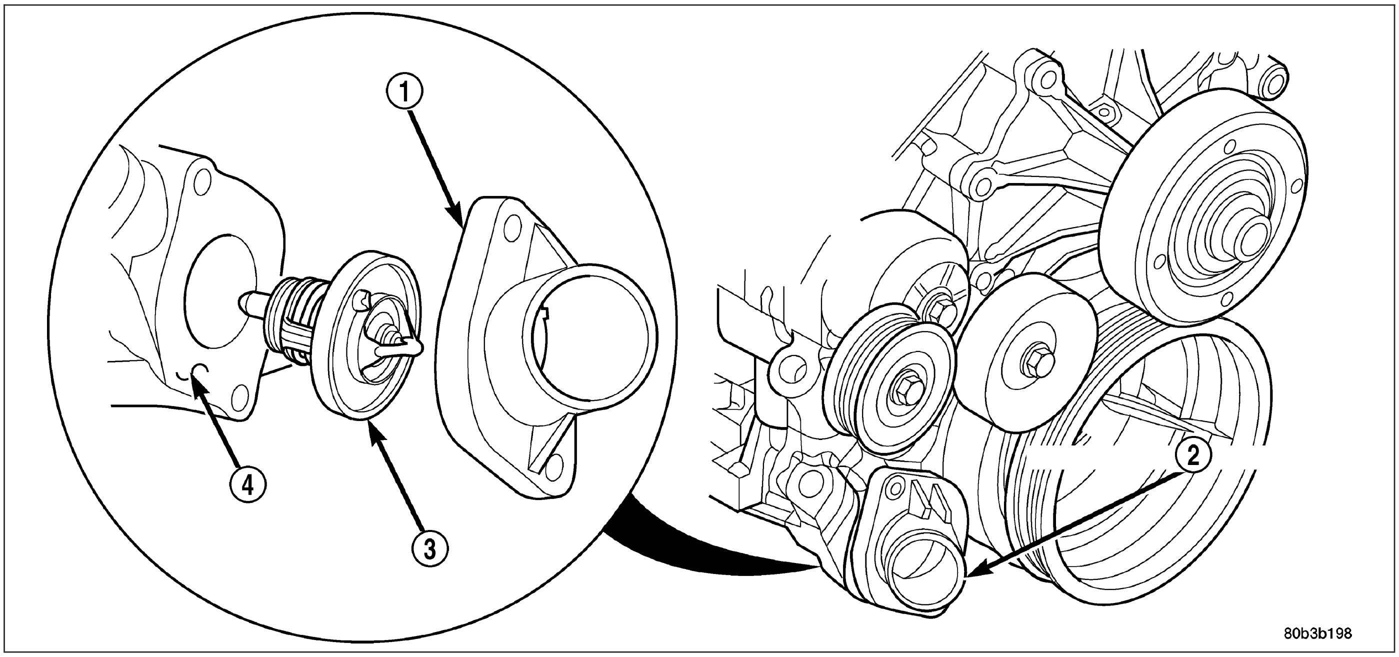
### ON-BOARD DIAGNOSTICS

All models are equipped with On-Board Diagnostics for certain cooling system components. If the powertrain control module (PCM) detects low engine coolant temperature, it will record a Diagnostic Trouble Code (DTC). For other DTC numbers, (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

The DTC can also be accessed through the DRB scan tool.

## REMOVAL

## 3.7L ENGINE




**WARNING: DO NOT LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR.**

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

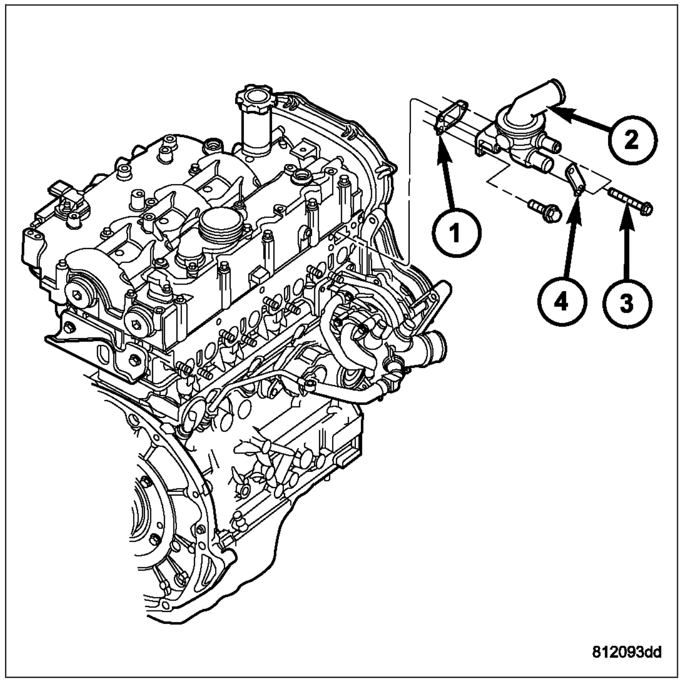
If thermostat (3) is being replaced, be sure that replacement is specified thermostat for vehicle model and engine type.

1. Disconnect negative battery cable at battery.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Raise vehicle on hoist.
4. Remove splash shield.
5. Remove lower radiator hose clamp and lower radiator hose at thermostat housing.
6. Remove thermostat housing mounting bolts, thermostat housing and thermostat.

## 2.8L DIESEL ENGINE

**NOTE: The thermostat is not serviced separately. The thermostat and housing must be replaced as an assembly.**

1. Disconnect negative battery cable.
2. Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).
3. Partially drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
4. Disconnect upper radiator hose and bypass hoses at thermostat housing (2).
5. Remove thermostat housing retaining bolts, support bracket (2.8L) and housing from cylinder head, discard gasket.




## INSTALLATION

## 3.7L ENGINE

1. Clean mating areas of timing chain cover and thermostat housing.
2. Install thermostat (spring side down) into recessed machined groove on housing assembly. Make sure rubber seal locating tab is positioned in the corresponding notch in the housing.
3. Position thermostat housing on timing chain cover.
4. Install two housing-to-timing chain cover bolts. Tighten bolts to 12 N·m (105 in. lbs.) torque.
5. Install lower radiator hose on thermostat housing.
6. Install splash shield.
7. Lower vehicle.
8. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
9. Connect negative battery cable to battery.
10. Start and warm the engine. Check for leaks.

## 2.8L DIESEL ENGINE

1. Clean old gasket material from cylinder head and thermostat housing.
2. Install thermostat housing with gasket and support bracket (2.8 L) to cylinder head. Torque bolts to 27 N·m.
3. Connect coolant bypass hose and upper radiator hose to thermostat housing.
4. Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
5. Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).
6. Connect negative battery cable.

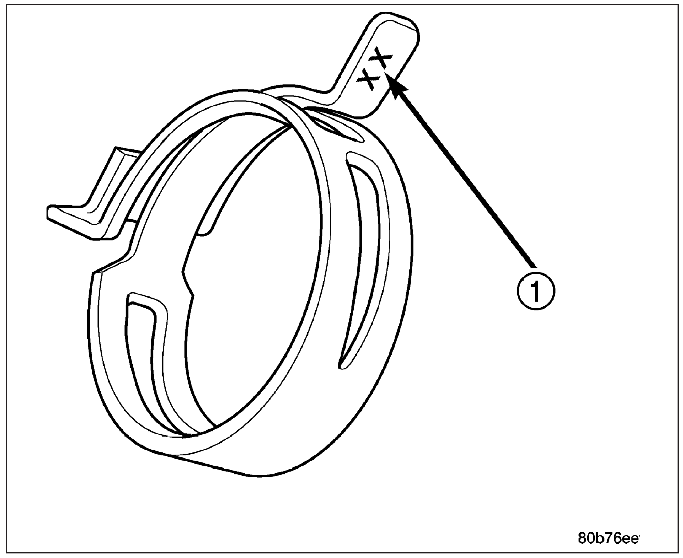
# HOSE CLAMPS

## DESCRIPTION - HOSE CLAMPS

The cooling system utilizes spring type hose clamps. If a spring type clamp replacement is necessary, replace with the original Mopar® equipment spring type clamp.

**WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL NUMBER 6094.. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.**

**CAUTION: A number or letter is stamped into the tongue (1) of constant tension clamps. If replacement is necessary, use only a original equipment clamp with matching number or letter.**




## OPERATION - HOSE CLAMPS

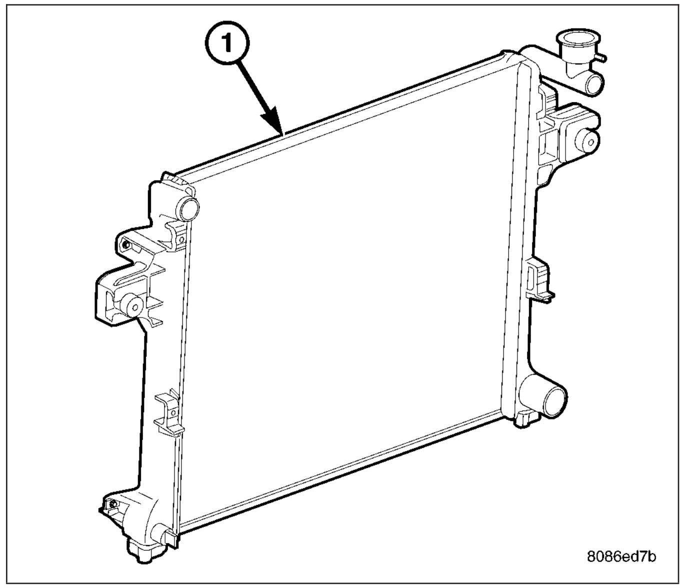
The spring type hose clamp applies constant tension on a hose connection. To remove a spring type hose clamp, only use constant tension clamp pliers designed to compress the hose clamp.

# RADIATOR

## DESCRIPTION

All vehicles are equipped with a cross flow type radiator (1) with plastic side tanks.

Plastic tanks, while stronger than brass, are subject to damage by impact, such as from tools or wrenches. Handle radiator with care.

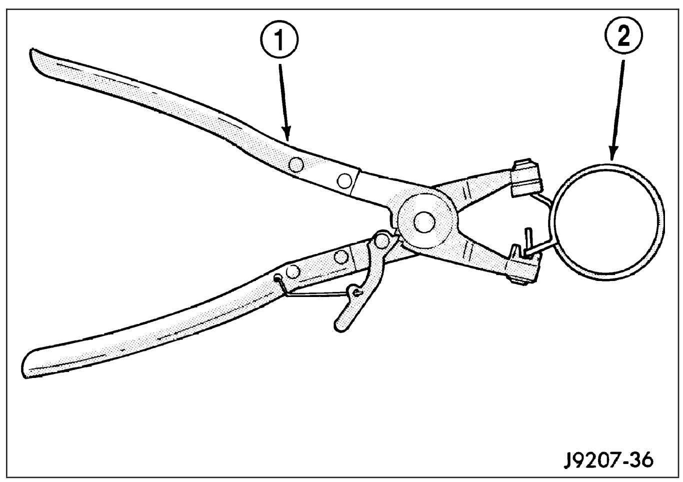



## REMOVAL

## 3.7L/2.8L DIESEL ENGINES

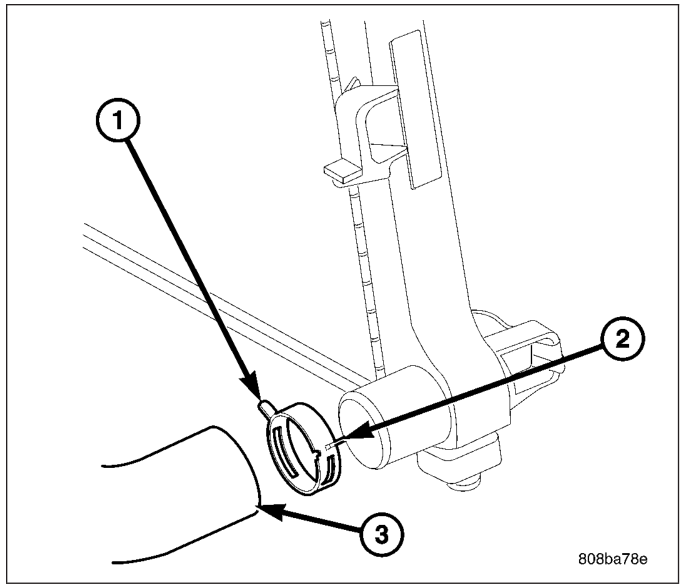
**WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR. REFER TO COOLING SYSTEM DRAINING.**

Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

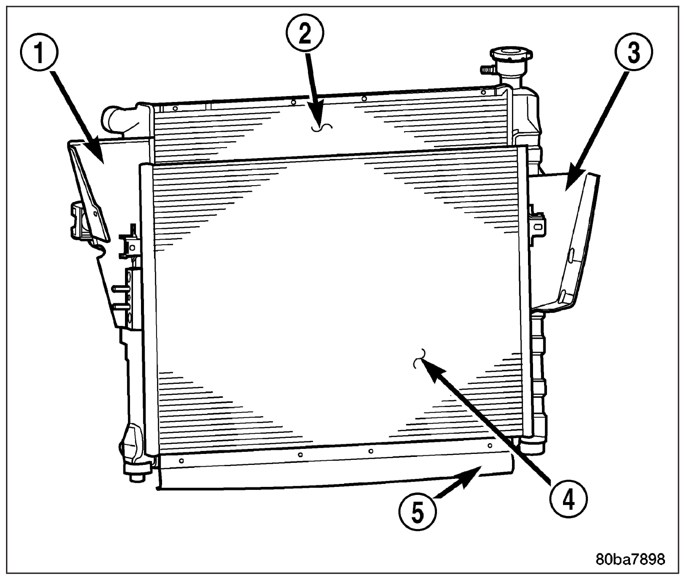



**WARNING: CONSTANT TENSION HOSE CLAMPS (2) ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL NUMBER 6094. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.**

**CAUTION: A number or letter is stamped (2) into the tongue of constant tension clamps. If replacement is necessary, use only an original equipment clamp with matching number or letter.**




**CAUTION: When removing the radiator or A/C condenser for any reason, note the location of all radiator-to-body and radiator-to-A/C condenser rubber air seals. These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.**



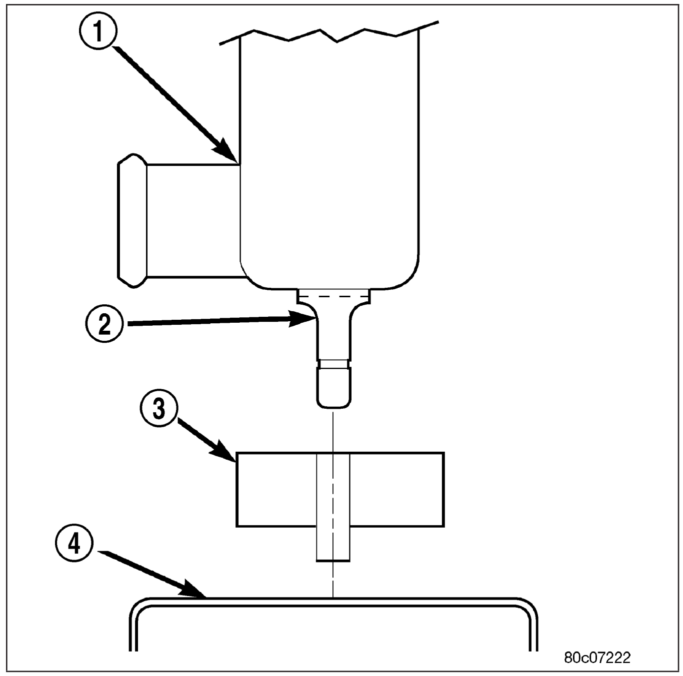

1. Disconnect the negative battery cable at battery.
2. Drain coolant from radiator (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove the front grille (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
4. Remove the cooling fan from the engine, if equipped.
5. Remove the two radiator mounting bolts.
6. Disconnect the connector for the electric fan.
7. Disconnect the power steering cooler line from cooler.
8. Disconnect the radiator upper and lower hoses.
9. Disconnect the overflow hose from radiator (2).

10. The lower part of radiator is equipped with two alignment dowel pins (2) . They are located on the bottom of radiator tank and fit into rubber grommets. These rubber grommets are pressed into the radiator lower crossmember.

**WARNING: THE AIR CONDITIONING SYSTEM (IF EQUIPPED) IS UNDER A CONSTANT PRESSURE EVEN WITH THE ENGINE OFF. REFER TO REFRIGERANT WARNINGS IN, HEATING AND AIR CONDITIONING BEFORE HANDLING ANY AIR CONDITIONING COMPONENT.**

**NOTE: The radiator and radiator cooling fan can be removed as an assembly. It is not necessary to remove the cooling fan before removing or installing the radiator.**

11. Gently lift up and remove radiator from vehicle. Be careful not to scrape the radiator fins against any other component. Also be careful not to disturb the air conditioning condenser (if equipped).




## CLEANING

Clean radiator fins With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

## INSPECTION

The radiator cooling fins should be checked for damage or deterioration. Inspect cooling fins to make sure they are not bent or crushed, these areas result in reduced heat exchange causing the cooling system to operate at higher temperatures. Inspect the plastic end tanks for cracks, damage or leaks.

Inspect the radiator neck for damage or distortion.

## INSTALLATION

## 3.7L/2.8L DIESEL ENGINES

**CAUTION: Before installing the radiator or A/C condenser, be sure the radiator-to-body and radiator-to-A/C condenser rubber air seals are properly fastened to their original positions. These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.**

1. Gently lower the radiator and fan shroud into the vehicle. Guide the two radiator alignment dowels into the rubber grommets located in lower radiator crossmember.
2. Connect the radiator upper and lower hoses and hose clamps to radiator.

**CAUTION: The tangs on the hose clamps must be positioned straight down.**

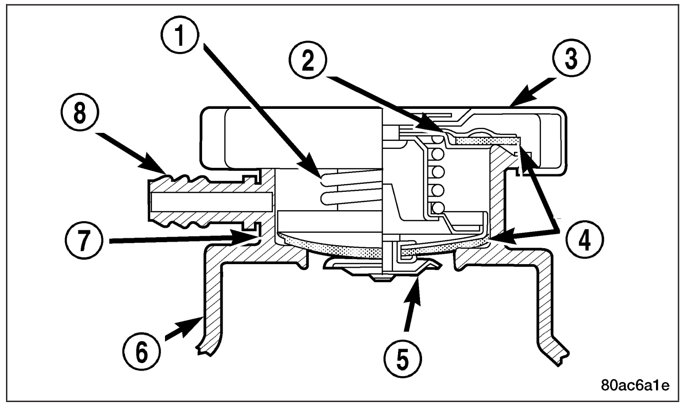
3. Install coolant reserve/overflow tank hose at radiator.
4. Install both radiator mounting bolts.
5. Reconnect the electric cooling fan.
6. Install the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).
7. Reinstall the cooling fan to the engine.
8. Rotate the fan blades (by hand) and check for interference at fan shroud.
9. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

10. Connect battery cable at battery.
11. Start and warm engine. Check for leaks.

# RADIATOR PRESSURE CAP

## DESCRIPTION

The cooling system cap is located on the coolant pressure bottle for 3.7L/2.8L Diesel engine and the radiator for the 2.4L engine. The cap construction includes; stainless steel swivel top, rubber seals and retainer, main spring (1), and a spring loaded valve.




## OPERATION

The pressure cap allows the cooling system to operate at higher than atmospheric pressure which raises the coolant boiling point, thus allowing increased radiator cooling capacity. The pressure cap releases pressure at some point within a range of 110 kPa ± 14 kPa (16 psi ± 2 psi).

A spring-loaded vent valve in the center of the cap allows the system to pressurize and depressurize without creating a vacuum. If the valve is stuck open, coolant will escape to the overflow hose. There is also a gasket in the cap to seal to the top of the filler neck.

**CAUTION: Use only the pressure cap specified for this vehicle. Use of other pressure caps can lead to coolant loss and overheating.**

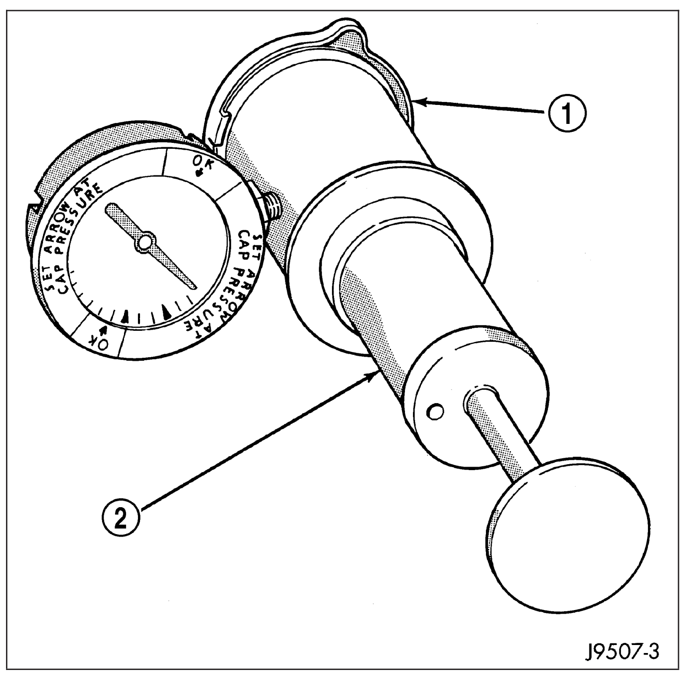
## DIAGNOSIS AND TESTING

## RADIATOR PRESSURE CAP - GAS ENGINES

Remove cap (1) from pressure bottle or radiator as appropriate. Be sure that sealing surfaces are clean. Moisten rubber gasket with water and install the cap on pressure tester (tool 7700 or an equivalent).

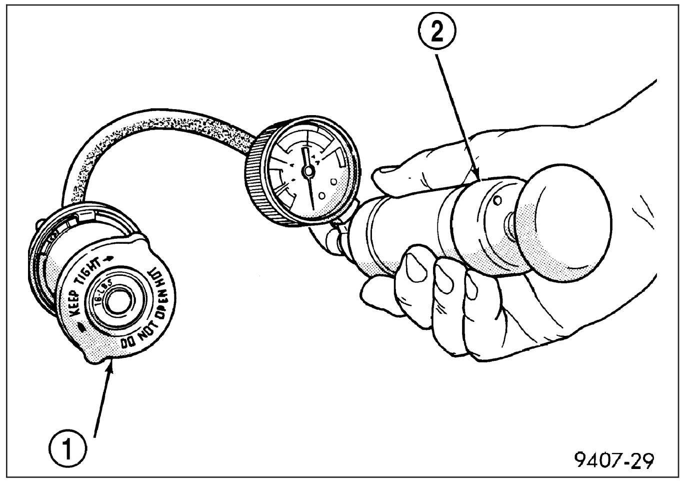
Operate the tester pump (2) and observe the gauge pointer at its highest point. The cap release pressure should be 124 to 145 kPa (18 to 21 psi). The cap is satisfactory when the pressure holds steady. It is also good if it holds pressure within the 124 to 145 kPa (18 to 21 psi) range for 30 seconds or more. If the pointer drops quickly, replace the cap.

**CAUTION: Radiator pressure testing tools are very sensitive to small air leaks, which will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to tool. Turn tool upside down and recheck pressure cap to confirm that cap needs replacement.**



## RADIATOR PRESSURE CAP - 3.7L/2.8L DIESEL

Dip the pressure cap (1) in water. Clean any deposits off the vent valve or its seat and apply cap to end of the Pressure Cap Test Adaptor that is included with the Cooling System Tester 7700. Working the plunger, bring the pressure to 104 kPa (15 psi) on the gauge. If the pressure cap fails to hold pressure of at least 97 kPa (14 psi), replace the pressure cap.

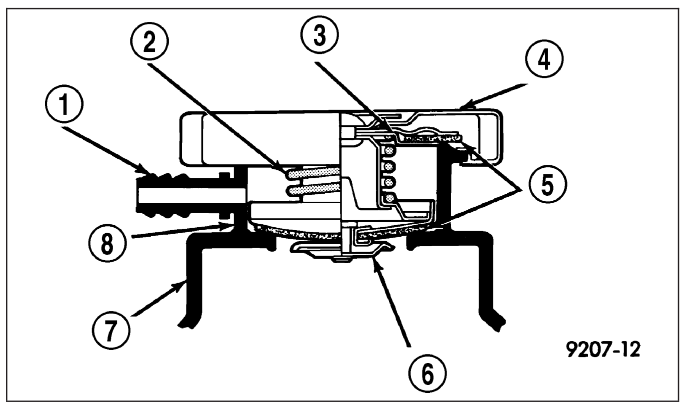



**CAUTION: The Cooling System Tester Tool is very sensitive to small air leaks that will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to the tool. Turn tool upside down and recheck pressure cap to confirm that cap is bad.**

If the pressure cap tests properly while positioned on Cooling System Tester (2) , but will not hold pressure or vacuum when positioned on the filler neck. Inspect the filler neck and cap top gasket for irregularities that may prevent the cap from sealing properly.

## PRESSURE RELIEF TEST - 3.7L/2.8L DIESEL

The pressure cap upper gasket (seal) pressure relief can be checked by removing the overflow hose at the radiator filler neck nipple. Attach the Radiator Pressure Tool to the filler neck nipple (1) and pump air into the radiator. Pressure cap upper gasket should relieve at 69-124 kPa (10-18 psi) and hold pressure at 55 kPa (8 psi) minimum.




**WARNING: THE WARNING WORDS "DO NOT OPEN HOT" ON THE RADIATOR PRESSURE CAP IS A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, THE RADIATOR CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT OR UNDER PRESSURE.**

There is no need to remove the radiator cap at any time **except** for the following purposes:

1. Check and adjust coolant freeze point.
2. Refill system with new coolant.
3. Conducting service procedures.
4. Checking for vacuum leaks.

**WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT 15 MINUTES BEFORE REMOVING CAP. THEN PLACE A SHOP TOWEL OVER THE CAP AND WITHOUT PUSHING DOWN ROTATE COUNTERCLOCKWISE TO THE FIRST STOP. ALLOW FLUIDS TO ESCAPE THROUGH THE OVERFLOW TUBE AND WHEN THE SYSTEM STOPS PUSHING COOLANT AND STEAM INTO THE CRS TANK AND PRESSURE DROPS PUSH DOWN AND REMOVE THE CAP COMPLETELY. SQUEEZING THE RADIATOR INLET HOSE WITH A SHOP TOWEL (TO CHECK PRESSURE) BEFORE AND AFTER TURNING TO THE FIRST STOP IS RECOMMENDED.**

## CLEANING

Clean the radiator pressure cap using a mild soap and water only.

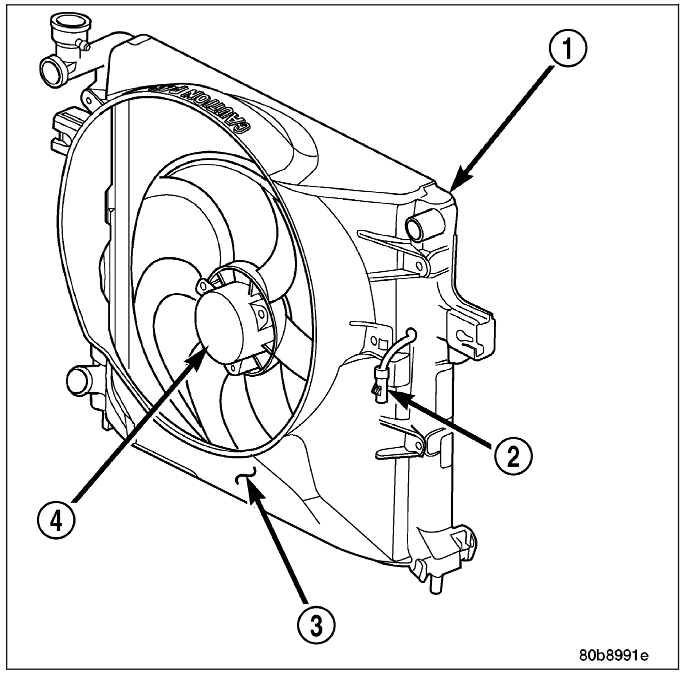
## INSPECTION

Visually inspect the pressure valve gasket on the cap. Replace cap if the gasket is swollen, torn or worn. Inspect the area around radiator filler neck for white deposits that indicate a leaking cap.

# RADIATOR FAN - ELECTRIC

## DESCRIPTION

The fan (4) is electrically controlled by the powertrain control module (PCM) through the fan control relays. The relays are located in the power distribution center (PDC) in the engine compartment.




## OPERATION

The electric radiator cooling fan is controlled by the Powertrain Control Module (PCM) through the radiator cooling fan relays. The PCM regulates fan operation based on input from the engine coolant temperature sensor, battery temperature sensor,air conditioning select switch and vehicle speed.

The fan is not energized during engine cranking regardless of the electrical input from the temperature sensors and air conditioning switch. However, if engine operation conditions warrant fan engagement, the fan will run once engine starts.

**On vehicles NOT equipped with AC:** The relay is energized when the coolant temperature is above 80° C (176° F), or battery temperature sensor above –12° C (10° F). It will then de-energize when coolant temperature drops below 82° C (180° F), or battery temperature sensor below –9° C (16° F).

**Vehicles Equipped with AC:** In addition to using coolant temperature and battery temperature sensor to control cooling fan operation, the cooling fan will also be engaged when the ,air conditioning system is activated. The relay is also energized when air conditioning is selected and coolant temperature is above 95° C (203° F), or , air conditioning is selected and battery temperature sensor is above 41° C (106° F). It will then de-energize when air conditioning is selected and coolant temperature is below 92° C (198° F), or air conditioning is selected and battery temperature is below 38° C (100° F).

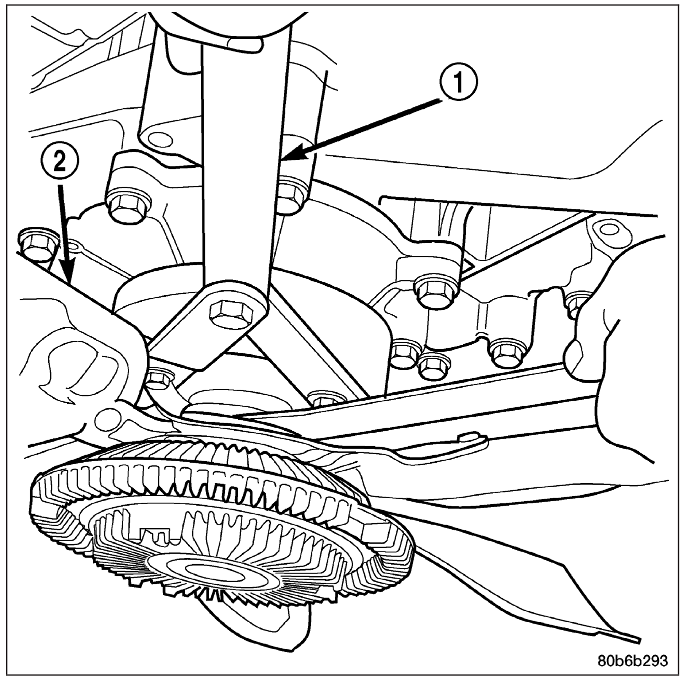
## REMOVAL

## 3.7L ENGINE

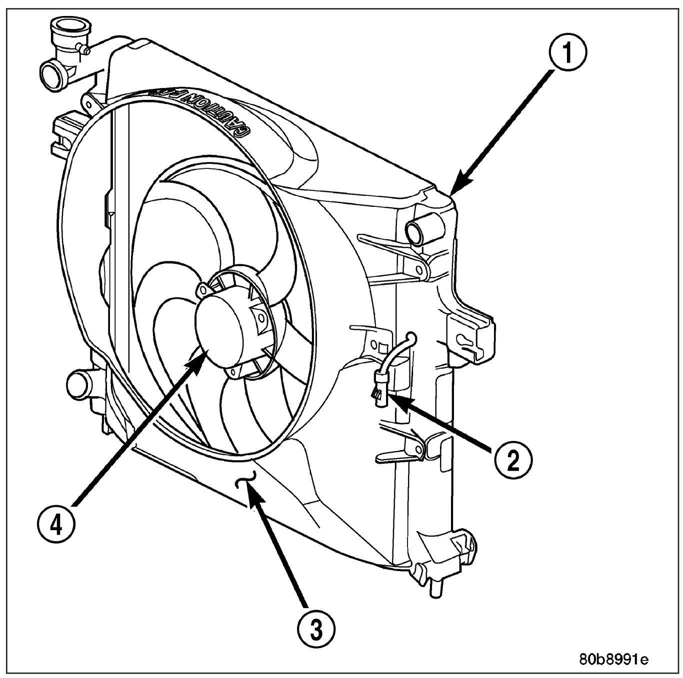
If the fan blade is bent, warped, cracked or damaged in any way, it must be replaced **only** with a replacement fan blade. **Do not attempt to repair a damaged fan blade.**

**NOTE: For 3.7L Heavy Duty/Max Cool/Trailer Tow cooling package, the viscous fan cannot be removed separate from the shroud. Both fan and shroud must be removed together.**

1. Disconnect battery negative cable.
2. Using special tool 6958 spanner wrench and 8346 adapters, remove the viscous fan from the water pump.




3. Gently lay fan into shroud.
4. Disconnect the electrical connector (2) for the electric fan, then disconnect connector from shroud.
5. Remove the two fan shroud mounting bolts connecting the fan shroud to the radiator.
6. Remove the shroud and fan from the vehicle.




## INSTALLATION

## 3.7L ENGINE

**NOTE: For 3.7L Heavy Duty/Max Cool/Trailer Tow cooling package, the viscous fan cannot be installed separate from the shroud. Both fan and shroud must be installed together.**

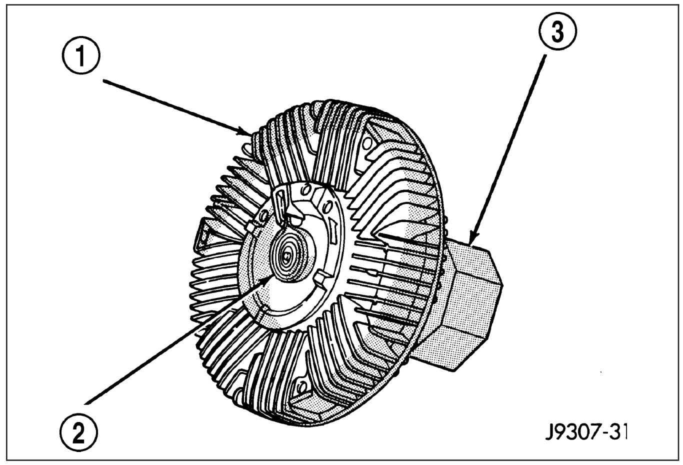
1. Gently lay viscous fan into shroud.
2. Install fan shroud assembly into the vehicle. Tighten fan shroud to radiator bolts to (5.5 N·m (50 in. lbs.).

3. Using special tool 6958 spanner wrench and 8346 adapters, install the viscous fan on the water pump.
4. Connect fan motor wire connector to harness connector, and attach connector to shroud.
5. Connect battery negative cable.
6. Start engine and check fan operation.

# RADIATOR - FAN - VISCOUS

## DESCRIPTION

**CAUTION: If the viscous fan drive is replaced because of mechanical damage, the cooling fan blades should also be inspected. Inspect for fatigue cracks, loose blades, or loose rivets that could have resulted from excessive vibration. Replace fan blade assembly if any of these conditions are found. Also inspect water pump bearing and shaft assembly for any related damage due to a viscous fan drive malfunction.**




The thermal viscous fan drive (1) is a silicone-fluid-filled coupling used to connect the fan blades to the water pump shaft. The coupling allows the fan to be driven in a normal manner. This is done at low engine speeds while limiting the top speed of the fan to a predetermined maximum level at higher engine speeds.

On the 3.7L engine, an electric fan is standard and the viscous fan is added on for trailer tow packages only.

On the 2.8L diesel engine, the viscous is standard.

## OPERATION

A thermostatic bimetallic spring coil is located on the front face of the viscous fan drive unit. This spring coil reacts to the temperature of the radiator discharge air. It engages the viscous fan drive for higher fan speed if the air temperature from the radiator rises above a certain point. Until additional engine cooling is necessary, **the fan will remain at a reduced rpm regardless of engine speed. Normally less than 800 rpm.**

Only when sufficient heat is present, will the viscous fan drive engage. This is when the air flowing through the radiator core causes a reaction to the bimetallic coil. It then increases fan speed to provide the necessary additional engine cooling.

Once the engine has cooled, the radiator discharge temperature will drop. The bimetallic coil again reacts and the fan speed is reduced to the previous disengaged speed.

## DIAGNOSIS AND TESTING

## VISCOUS FAN DRIVE

If the fan assembly free-wheels without drag (the fan blades will revolve more than five turns when spun by hand), replace the fan drive. This spin test must be performed when the engine is cool.

For the following test, the cooling system must be in good condition. It also will ensure against excessively high coolant temperature.

**WARNING: BE SURE THAT THERE IS ADEQUATE FAN BLADE CLEARANCE BEFORE DRILLING.**

1. Drill a 3.18-mm (1/8-in) diameter hole in the top center of the fan shroud.
2. Obtain a dial thermometer with an 8 inch stem (or equivalent). It should have a range of -18° to 105°C (0° to 220° F). Insert thermometer through the hole in the shroud. Be sure that there is adequate clearance from the fan blades.
3. Connect a tachometer and an engine ignition timing light (timing light is to be used as a strobe light).
4. Block the air flow through the radiator. Secure a sheet of plastic in front of the radiator (or air conditioner condenser). Use tape at the top to secure the plastic and be sure that the air flow is blocked.
5. Be sure that the air conditioner (if equipped) is turned off.

**WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.**

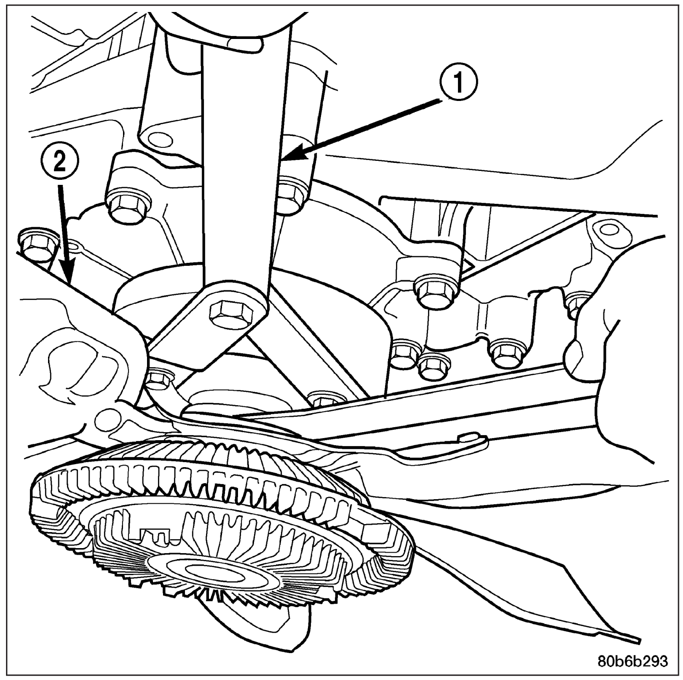
6. Start the engine and operate at 2400 rpm. Within ten minutes the air temperature (indicated on the dial thermometer) should be up to 93° C (200° F). Fan drive **engagement** should have started to occur at between 91° to 96° C (195° to 205° F). Engagement is distinguishable by a definite **increase** in fan flow noise (roaring). The timing light also will indicate an increase in the speed of the fan.
7. When the air temperature reaches 93° C (200° F), remove the plastic sheet. Fan drive **disengagement** should have started to occur at between 62° to 85° C (145° to 185° F). A definite **decrease** of fan flow noise (roaring) should be noticed. If not, replace the defective viscous fan drive unit.

## REMOVAL

## 3.7L ENGINE

1. Disconnect negative battery cable from battery.

**NOTE: The thermal viscous fan drive/fan blade assembly is attached (threaded) to water pump hub shaft.**




2. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Remove fan blade/viscous fan drive assembly from water pump using special tool 6958 spanner wrench and 8346 adapters(1) , by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive (2) are **RIGHT HAND.**
4. Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.
5. Do not unbolt fan blade assembly from viscous fan drive at this time.
6. Remove fan shroud to radiator bolts.
7. Remove fan shroud and fan blade/viscous fan drive assembly as a complete unit from vehicle.
8. After removing fan blade/viscous fan drive assembly, **do not** place viscous fan drive in horizontal position. If stored horizontally, silicone fluid in the viscous fan drive could drain into its bearing assembly and contaminate lubricant.

**CAUTION: Do not remove water pump pulley-to-water pump bolts. This pulley is under belt tension.**

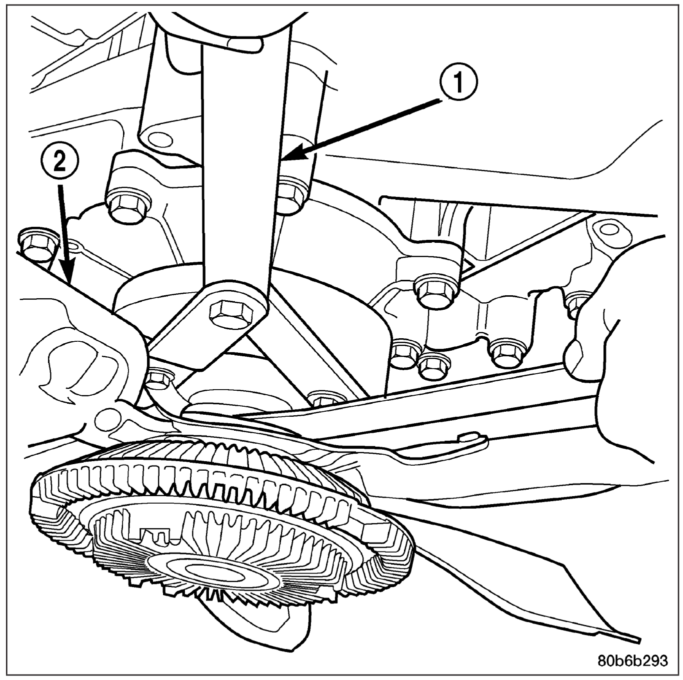
9. Remove four bolts securing fan blade assembly to viscous fan drive.

## 2.8L DIESEL

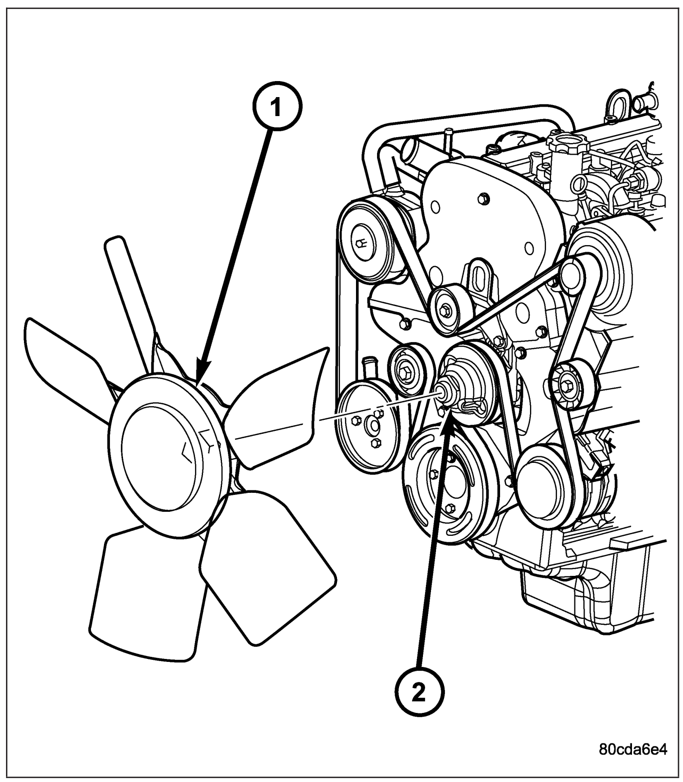
1. Disconnect negative battery cable.

**NOTE: The thermal viscous fan drive/fan blade assembly is attached (threaded) to fan support.**

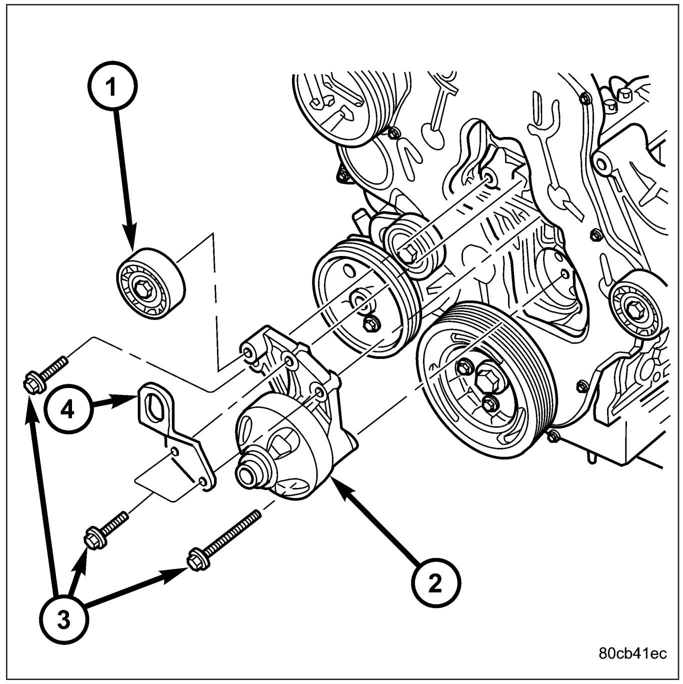
2. Remove fan blade/viscous fan drive assembly from water pump using special tool 6958 spanner wrench, by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.**




3. Do not attempt to remove fan/fan drive viscous clutch assembly (1) from vehicle at this time.
4. Do not unbolt fan blade assembly from fan drive viscous clutch at this time.



5. Remove fan shroud to radiator bolts.
6. Remove fan shroud and fan blade/fan drive viscous clutch assembly as a complete unit from vehicle.
7. After removing fan blade/fan drive viscous clutch assembly, **do not** place viscous clutch in horizontal position. If stored horizontally, silicone fluid in the fan drive viscous clutch could drain into its bearing assembly and contaminate lubricant.
8. Remove four bolts securing fan blade assembly to fan drive viscous clutch.
9. Remove cooling fan support (2) from engine block.




## CLEANING

Clean the fan blades using a mild soap and water. Do not use an abrasive to clean the blades.

## INSPECTION

**WARNING: DO NOT ATTEMPT TO BEND OR STRAIGHTEN FAN BLADES IF FAN IS NOT WITHIN SPECIFICATIONS.**

**CAUTION: If fan blade assembly is replaced because of mechanical damage, water pump and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.**

1. Remove fan blade assembly from viscous fan drive unit (four bolts).
2. Lay fan on a flat surface with leading edge facing down. With tip of blade touching flat surface, replace fan if clearance between opposite blade and surface is greater than 2.0 mm (.090 inch). Rocking motion of opposite blades should not exceed 2.0 mm (.090 inch). Test all blades in this manner.
3. Inspect fan assembly for cracks, bends, loose rivets or broken welds. Replace fan if any damage is found.

## INSTALLATION

## 3.7L ENGINE

1. Assemble fan blade to viscous fan drive. Tighten mounting bolts to 23.7 N·m (210 in. lbs.) torque.

**NOTE: The viscous fan and fan shroud must be installed as an assembly.**

2. Gently lay viscous fan into fan shroud.
3. Install the fan shroud to radiator mounting bolts. Tighten bolts to 9 N·m (80 in·lbs).
4. Thread the fan and fan drive onto the water pump pulley, and tighten nut using special tool 6958 spanner wrench and 8346 adapters.
5. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

**CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL) for correct belt routing.**

## 2.8L DIESEL

1. Assemble fan blade to viscous fan drive. Tighten mounting bolts to 23.7 N·m (210 in. lbs.) torque.

**NOTE: The viscous fan and fan shroud must be installed as an assembly.**

2. Gently lay fan and viscous drive into fan shroud.
3. Install the fan shroud to radiator mounting bolt. Tighten bolts to 9 N·m (80 in. lbs.) torque..
4. Thread the fan and viscous drive onto the fan support and tighten nut using special tool 6958 spanner wrench.
5. Install cooling fan support to engine block. Torque bolts to 149 N·m.(110 ft. lbs.).
6. Install fan drive viscous clutch and fan assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
7. Connect negative battery cable.

# WATER PUMP

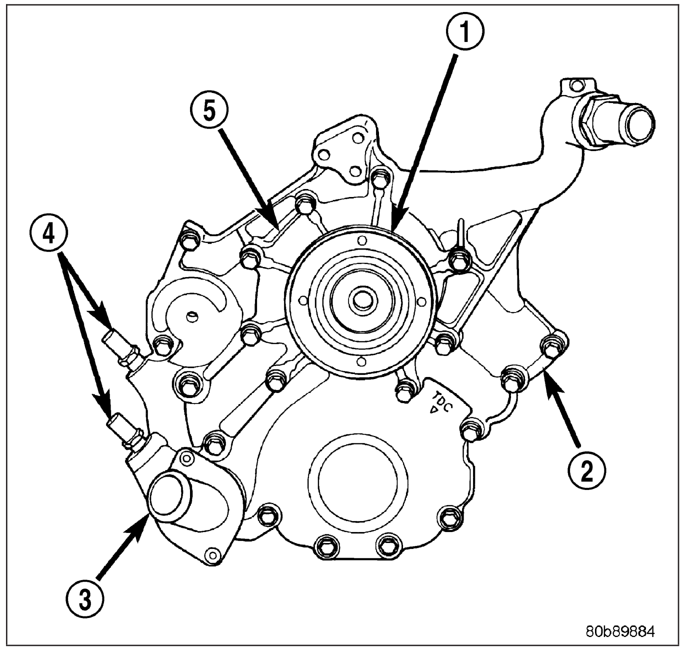
## DESCRIPTION

### 3.7L ENGINE

A centrifugal water pump (5) circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core. The pump is driven from the engine crankshaft by a single serpentine drive belt.

The water pump impeller is pressed onto the rear of a shaft that rotates in bearings pressed into the housing. The housing has two small holes to allow seepage to escape. The water pump seals are lubricated by the antifreeze in the coolant mixture. No additional lubrication is necessary.

Both heater hoses are connected to fittings on the timing chain front cover. The water pump is also mounted directly to the timing chain cover and is equipped with a non serviceable integral pulley.




### 2.8L DIESEL ENGINE

The water pump on the 2.8L CRD diesel has a die cast aluminum housing. It bolts to a aluminum housing which attaches to the engine block.

## DESCRIPTION - WATER PUMP BYPASS - 3.7L

The 3.7L engine uses an internal water/coolant bypass system. The design uses galleries in the timing chain cover to circulate coolant during engine warm-up preventing the coolant from flowing through the radiator. The thermostat uses a stub shaft located at the rear of the thermostat to control flow through the bypass gallery.

## OPERATION

### 2.8L DIESEL ENGINE

The water pump is used to circulate coolant through the cooling system. The coolant is pumped through the engine block, cylinder head, heater core, EGR cooler, viscous heater, and radiator.

### 3.7L ENGINES

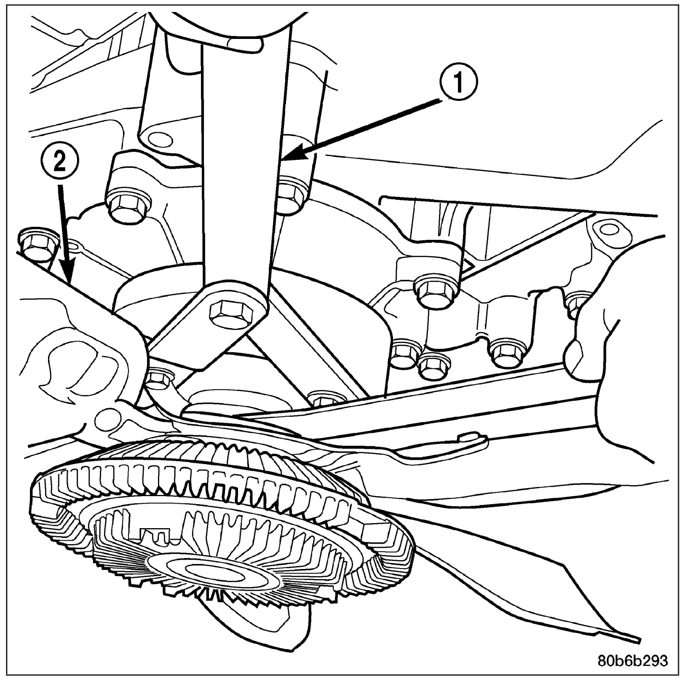
A centrifugal water pump circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core, this coolant absorbs the heat generated when the engine is running. The pump is driven by the engine crankshaft via a drive belt.

## REMOVAL

## 3.7L

The water pump on 3.7L engines is bolted directly to the engine timing chain case cover.

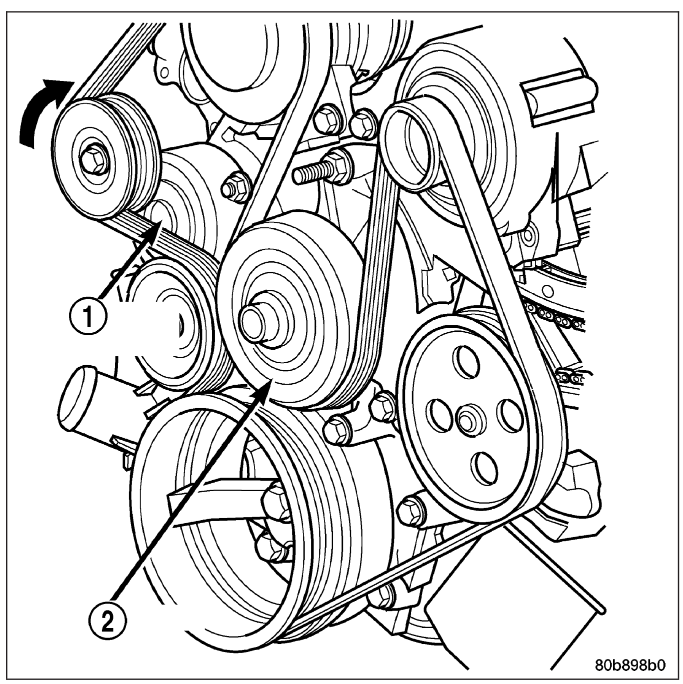
1. Disconnect negative battery cable from battery.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove fan/viscous fan drive assembly from water pump (2) (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL). Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.




**WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL NUMBER 6094. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.**

**CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only an original equipment clamp with matching number or letter.**

4. If water pump is being replaced, do not unbolt fan blade assembly from thermal viscous fan drive.
5. Remove two fan shroud-to-radiator screws. Disconnect the coolant overflow hose.
6. Remove upper fan shroud and fan blade/viscous fan drive assembly from vehicle.
7. After removing fan blade/viscous fan drive assembly, **do not** place thermal viscous fan drive in horizontal position. If stored horizontally, silicone fluid in viscous fan drive could drain into its bearing assembly and contaminate lubricant.
8. Remove accessory drive belt (1) (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
9. Remove lower radiator hose clamp and remove lower hose at water pump.
10. Remove seven water pump mounting bolts and one stud bolt.

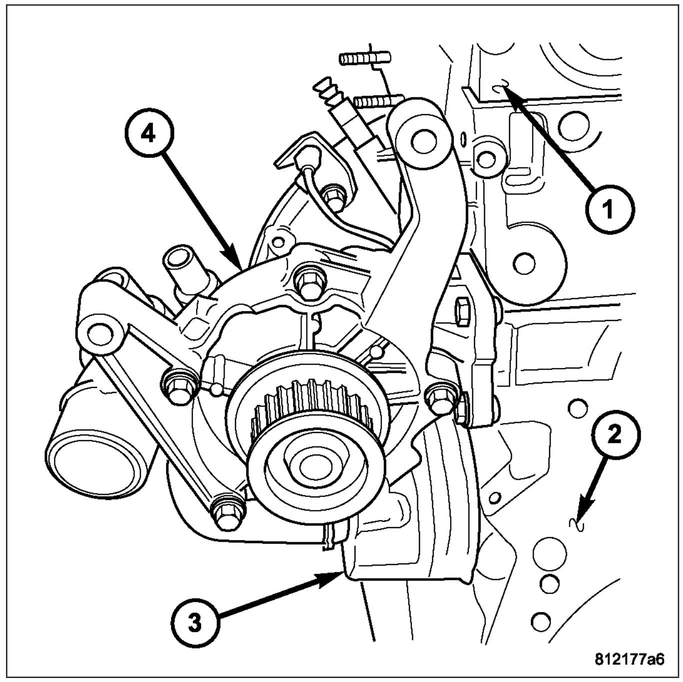



**CAUTION: Do not pry water pump at timing chain case/cover. The machined surfaces may be damaged resulting in leaks.**

11. Remove water pump and gasket. Discard gasket.

## 2.8L DIESEL ENGINE

1. Disconnect negative battery cable.
2. Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
3. Remove timing belt inner and outer covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
4. Remove water pump retaining bolts and pump (4) .




## CLEANING

Clean the gasket mating surface. Use caution not to damage the gasket sealing surface.

## INSPECTION

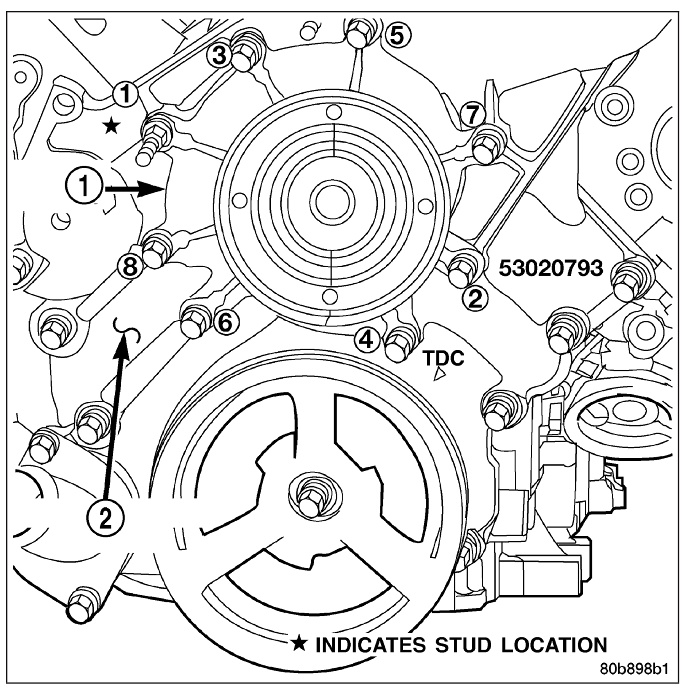
Inspect the water pump assembly for cracks in the housing, Water leaks from shaft seal, Loose or rough turning bearing or Impeller rubbing either the pump body or timing chain case/cover.

## INSTALLATION

## 3.7L ENGINE

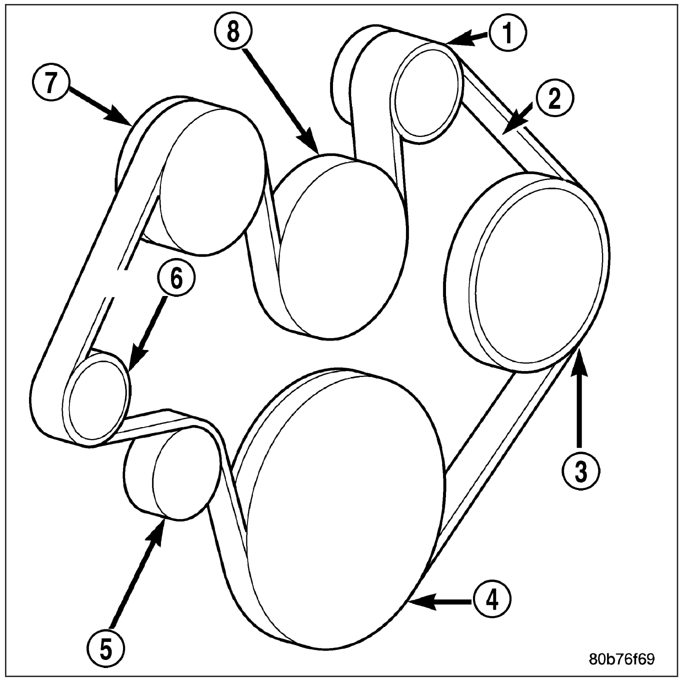
The water pump (1) on 3.7L engines is bolted directly to the engine timing chain case cover (2).

1. Clean gasket mating surfaces.
2. Using a new gasket, position water pump and install mounting bolts as shown.. Tighten water pump mounting bolts to 54 N·m (40 ft. lbs.) torque.
3. Spin water pump to be sure that pump impeller does not rub against timing chain case/cover.
4. Connect radiator lower hose to water pump.



5. Relax tension from belt tensioner (6). Install drive belt (2) (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

**CAUTION: When installing the serpentine accessory drive belt, belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to for correct belt routing. Or, refer to the Belt Routing Label located in the engine compartment. The correct belt with correct length must be used.**




6. Position upper fan shroud and fan blade/viscous fan drive assembly.
7. Be sure the upper and lower portions of the fan shroud are firmly connected. All air must flow through the radiator.
8. Install two fan shroud-to-radiator screws.
9. Be sure of at least 25 mm (1.0 inches) between tips of fan blades and fan shroud.
10. Install fan blade/viscous fan drive assembly to water pump shaft (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
11. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
12. Connect negative battery cable.
13. Start and warm the engine. Check for leaks.

## 2.8L DIESEL ENGINE

1. Clean mating surfaces of water pump housing and engine block as necessary.
2. Place new o-ring in groove in water pump housing. Install water pump and retaining bolts. Torque bolts to 24 N·m.
3. Install both inner and outer timing belt covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
4. Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
5. Connect negative battery cable.

# TRANSMISSION

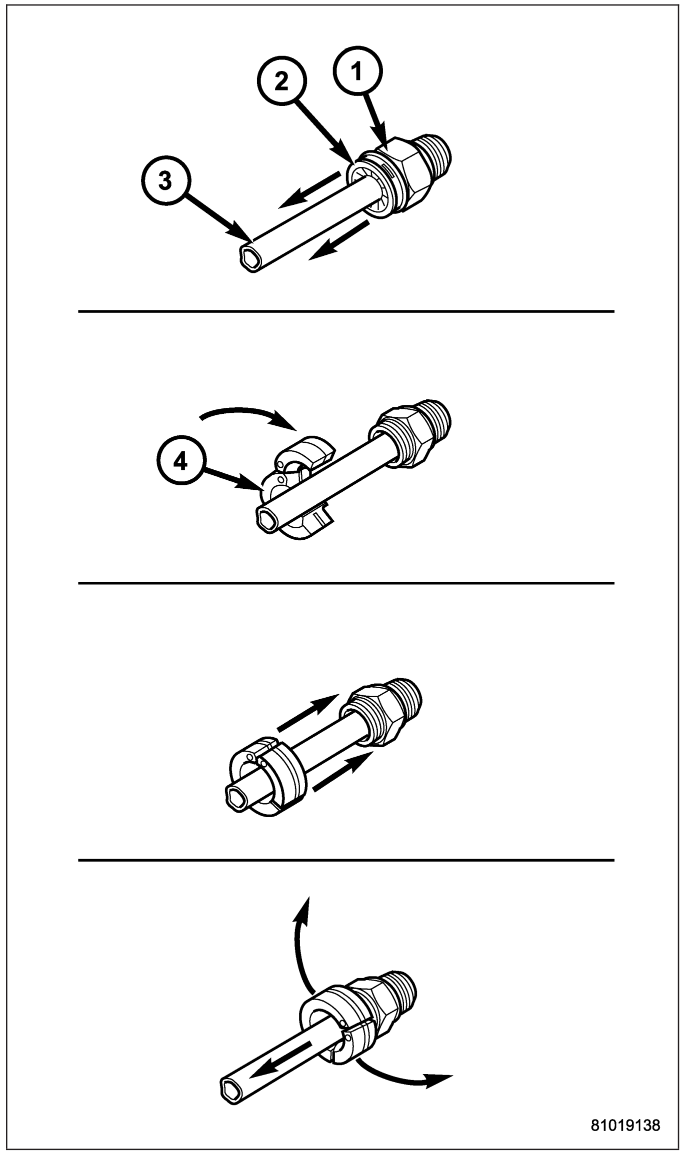
## TABLE OF CONTENTS

# TRANSMISSION

## STANDARD PROCEDURE - TRANSMISSION COOLER LINE QUICK CONNECT FITTING DISASSEMBLY/ASSEMBLY

### DISCONNECT

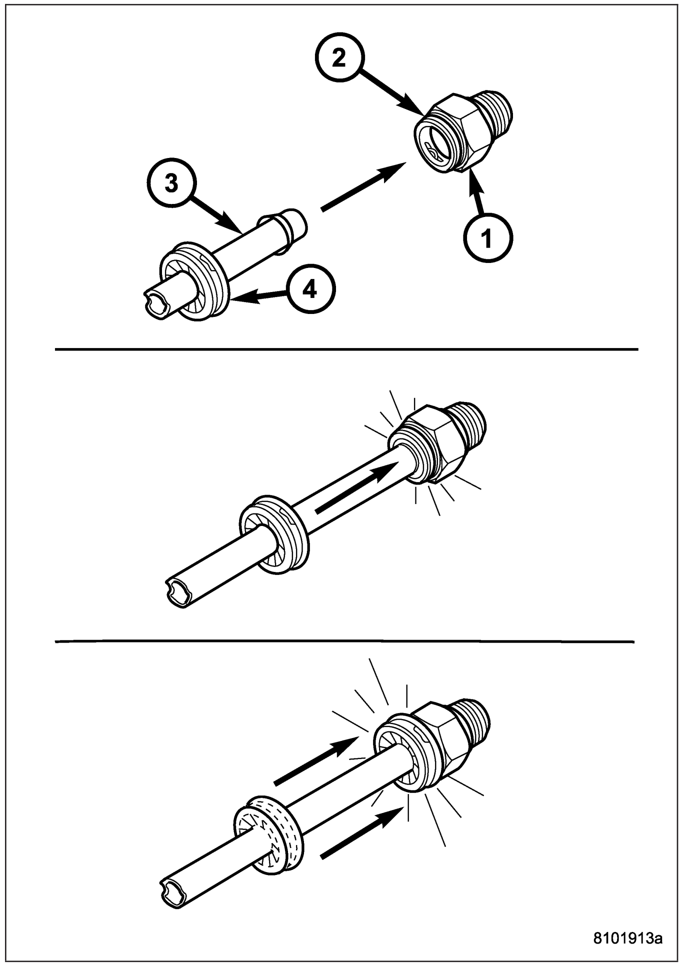
1. Remove dust cap by pulling it straight back off of quick connect fitting (1).
2. Place disconnect tool Release Tool 8875A (4) onto transmission cooler line with the fingers of the tool facing the quick connect fitting.
3. Slide disconnect tool down the transmission line and engage the fingers of the tool into the retaining clip. When properly engaged in the clip, the tool will fit flush against the quick connect fitting.
4. Rotate the disconnect tool 60° to expand the retaining clip.
5. While holding the disconnect tool against the quick connect fitting, pull back on the transmission cooler line to remove.



## CONNECT

1. Align transmission cooler line (3) with quick connect fitting while pushing straight into the fitting.
2. Push in on transmission cooler line until a “click” is heard or felt.
3. Slide dust cap (4) down the transmission cooler line and snap it over the quick connect fitting until it is fully seated and rotates freely. Dust cap will only snap over quick connect fitting when the transmission cooler line is properly installed.

**NOTE: If dust cap will not snap into place, repeat assembly step #2.**



# TRANS COOLER

## DESCRIPTION

The automatic transmission cooler is located in the front of the condenser and behind the front fascia. The transmission cooler is a heat exchanger that allows heat in the transmission fluid to be transferred to the air passing over the cooler fins.

The transmission oil cooler for the 2.8L Diesel with automatic transmission integrated into the A/C condenser.

The Transmission oil cooler assembly is equipped with quick connect fitting for the transmission oil cooler lines.

## REMOVAL

1. Remove electric cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
2. Position cooling fan out of the way.
3. Using Tool 8875A, disconnect transmission cooler tube from the transmission cooler (Refer to 7 - COOLING/TRANSMISSION - STANDARD PROCEDURE).
4. Remove the transmission cooler mounting bolts.
5. Remove transmission cooler from vehicle.

## INSTALLATION

1. Position transmission cooler in vehicle.
2. Install transmission mounting bolts. Tighten to 14 N·m (123 in. lbs.)
3. Install transmission cooler lines into cooler (Refer to 7 - COOLING/TRANSMISSION - STANDARD PROCEDURE).
4. Install electric cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

# AUDIO/VIDEO

## TABLE OF CONTENTS



# AUDIO/VIDEO - ELECTRICAL DIAGNOSTICS

## TABLE OF CONTENTS

# AUDIO/VIDEO - ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## ALL OUTPUTS SHORT - BASE AUDIO SYSTEM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition in RUN and IOD fuse installed.
- **Set Condition:**
  The radio has sensed a short on the output for more than 10 seconds.

| Possible Causes |
| --- |
| LEFT I/P SPEAKER |
| LEFT FRONT DOOR SPEAKER |
| RIGHT I/P SPEAKER |
| RIGHT FRONT DOOR SPEAKER |
| LEFT REAR SPEAKER |
| RIGHT REAR SPEAKER |
| (+) CIRCUIT SHORTED TO GROUND |
| SPEAKER SECTION OF RADIO |
| (-) CIRCUIT SHORTED TO GROUND |
| SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER |

### Diagnostic Test

#### 1. DETERMINE FAULT

Turn the ignition on.
Turn the Radio on.
With the Scan Tool, erase the audio DTC's.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool , read the audio DTC's.

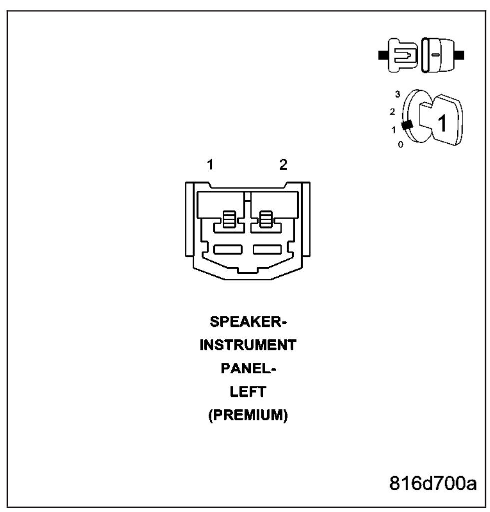
**Does the Scan Tool display ALL OUTPUTS SHORT?**

**Yes** >> Go To 2

**No** >> Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short.
Perform BODY VERIFICATION TEST - VER 1.

#### 2. LEFT I/P SPEAKER

Turn the ignition off.
Disconnect the Left I/P Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool , erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.



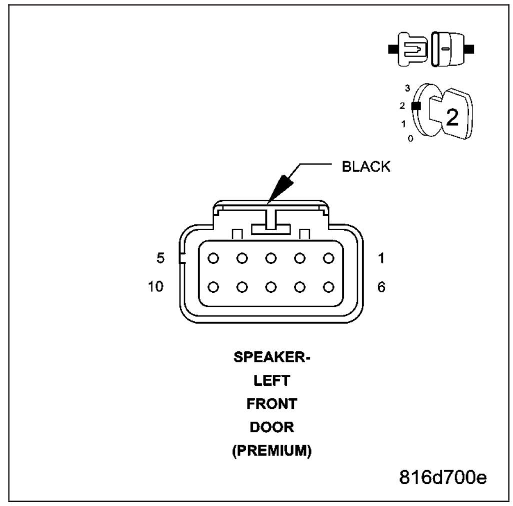

**Does the Scan Tool display ALL OUTPUTS SHORT?**

**Yes** >> Go To 3

**No** >> Replace the Left I/P Speaker.
Perform BODY VERIFICATION TEST - VER 1.

## 3. LEFT FRONT DOOR SPEAKER

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool , erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool , read DTC's.



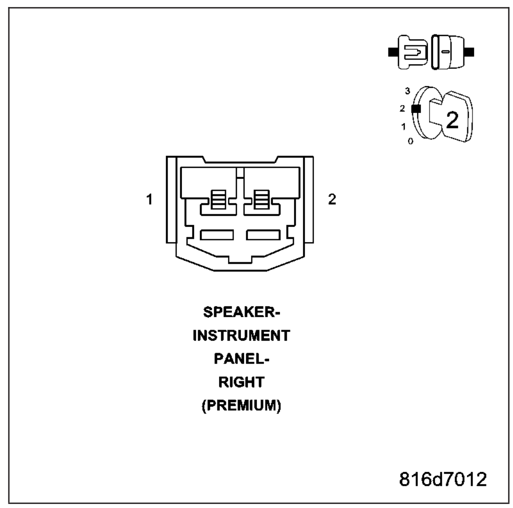

**Does the Scan Tool display ALL OUTPUTS SHORT?**

**Yes** >> Go To 4

**No** >> Replace the Left Front Door Speaker.
Perform BODY VERIFICATION TEST - VER 1.

## 4. RIGHT I/P SPEAKER

Turn the ignition off.
Disconnect the Right I/P Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool , erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.



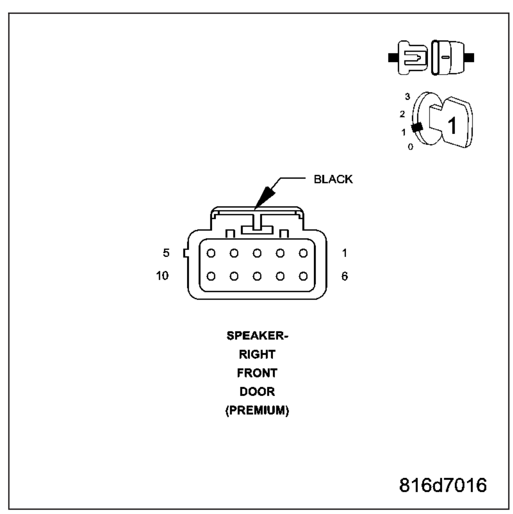

**Does the Scan Tool display ALL OUTPUTS SHORT?**

**Yes** >> Go To 5

**No** >> Replace the Right I/P Speaker.
Perform BODY VERIFICATION TEST - VER 1.

## 5. RIGHT FRONT DOOR SPEAKER

Turn the ignition off.
Disconnect the Right Front Door Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool , erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.

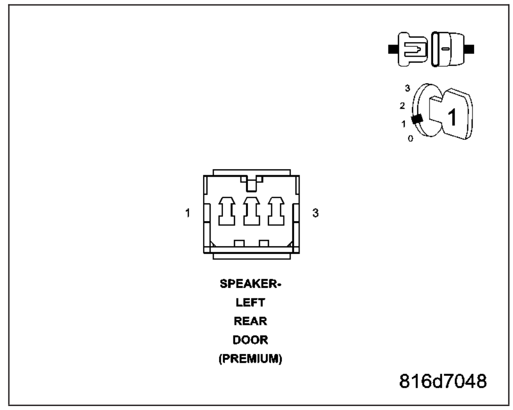



**Does the Scan Tool display ALL OUTPUTS SHORT?**

**Yes** >> Go To 6

**No** >> Replace the Right Front Door Speaker.
Perform BODY VERIFICATION TEST - VER 1.

## 6. LEFT REAR SPEAKER



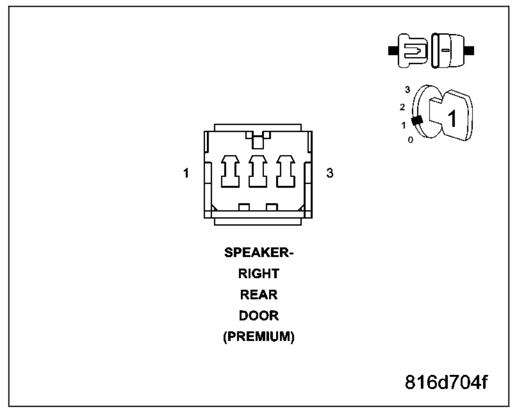

Turn the ignition off.
Disconnect the Left Rear Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool , erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.

**Does the Scan Tool display ALL OUTPUTS SHORT?**

**Yes** >> Go To 7

**No** >> Replace the Left Rear Speaker.
Perform BODY VERIFICATION TEST - VER 1.

## 7. RIGHT REAR SPEAKER




Turn the ignition off.
Disconnect the Right Rear Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool, erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.

**Does the Scan Tool display ALL OUTPUTS SHORT?**

**Yes** >> Go To 8

**No** >> Replace the Right Rear Speaker.
Perform BODY VERIFICATION TEST - VER 1.

## 8. (+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Disconnect the Left I/P Speaker harness connector.
Disconnect the Right Front Door Speaker harness connector.
Disconnect the Right I/P Speaker harness connector.
Disconnect the Left Rear Speaker harness connector.
Disconnect the Right Rear Speaker harness connector.
Disconnect the Radio C1 harness connector.
Measure the resistance between ground and each speaker (+) circuit.

**Is the resistance below 1000.0 (1K) ohms?**

**Yes** >> Repair the speaker (+) circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 9

## 9. (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Disconnect the Left I/P Speaker harness connector.
Disconnect the Right Front Door Speaker harness connector.
Disconnect the Right I/P Speaker harness connector.
Disconnect the Left Rear Speaker harness connector.
Disconnect the Right Rear Speaker harness connector.
Disconnect the Radio C1 harness connector.
Measure the resistance between ground and each speaker (-) circuit.

**Is the resistance below 1000.0 (1K) ohms?**

**Yes** >> Repair the speaker (-) circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 10

## 10. SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Disconnect the Left I/P Speaker harness connector.
Disconnect the Right Front Door Speaker harness connector.
Disconnect the Right I/P Speaker harness connector.
Disconnect the Left Rear Speaker harness connector.
Disconnect the Right Rear Speaker harness connector.
Disconnect the Radio C1 harness connector.
Measure the resistance between each speaker (+) circuit and each speaker (-) circuit.

**Is the resistance below 1000.0 (1K) ohms for any of the measurements?**

**Yes** >> Repair the shorted together speaker circuits.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 11

## 11. SPEAKER SECTION OF RADIO

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Radio.
Perform BODY VERIFICATION TEST - VER 1.

## ALL OUTPUTS SHORT - PREMIUM AUDIO SYSTEM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition in RUN and IOD fuse installed.
- **Set Condition:**
  The radio has sensed a short on the output for more than 10 seconds.

| Possible Causes |
|---|
| LEFT FRONT DOOR SPEAKER |
| RIGHT FRONT DOOR SPEAKER |
| (+) CIRCUIT SHORTED TO GROUND |
| (-) CIRCUIT SHORTED TO GROUND |
| SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER |
| SPEAKER SECTION OF RADIO |

## Diagnostic Test

### 1. DETERMINE FAULT

Turn the ignition on.
Turn the Radio on.
With the Scan Tool , erase the audio DTC's.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool , read the audio DTC's.

**Does the Scan Tool display ALL OUTPUTS SHORT?**

**Yes** >> Go To 2

**No** >> Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short.
Perform BODY VERIFICATION TEST - VER 1.

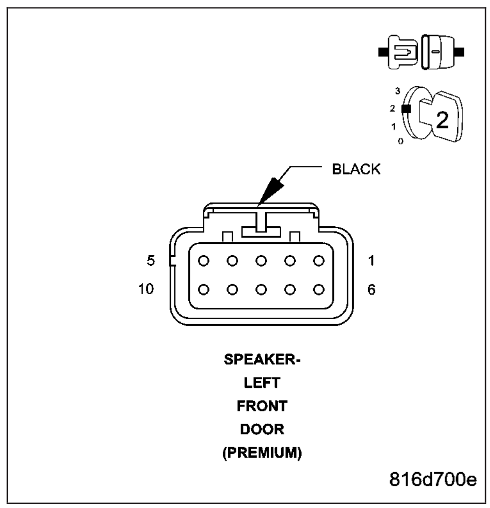
### 2. LEFT FRONT DOOR SPEAKER

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool , erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool , read DTC's.

**Does the Scan Tool display ALL OUTPUTS SHORT?**

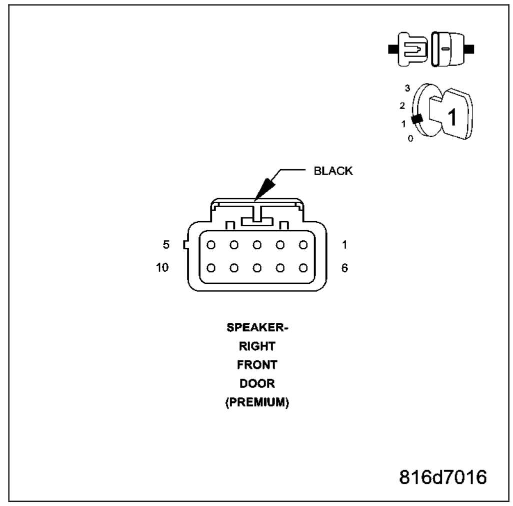
**Yes** >> Go To 3

**No** >> Replace the Left Front Door Speaker.
Perform BODY VERIFICATION TEST - VER 1.



## 3. RIGHT FRONT DOOR SPEAKER

Turn the ignition off.
Disconnect the Right Front Door Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool , erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool , read DTC's.




**Does the Scan Tool display ALL OUTPUTS SHORT?**

**Yes** >> Go To 4

**No** >> Replace the Right Front Door Speaker.
Perform BODY VERIFICATION TEST - VER 1.

## 4. (+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Disconnect the Right Front Door Speaker harness connector.
Disconnect the Radio C1 harness connector.
Measure the resistance between ground and each speaker (+) circuit.

**Is the resistance below 1000.0 (1K) ohms?**

**Yes** >> Repair the speaker (+) circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Disconnect the Right Front Door Speaker harness connector.
Disconnect the Radio C1 harness connector.
Measure the resistance between ground and each speaker (-) circuit.

**Is the resistance below 1000.0 (1K) ohms?**

**Yes** >> Repair the speaker (-) circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 6

## 6. SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Disconnect the Right Front Door Speaker harness connector.
Disconnect the Radio C1 harness connector.
Measure the resistance between each speaker (+) circuit and each speaker (-) circuit.

**Is the resistance below 1000.0 (1K) ohms for any of the measurements?**

**Yes** >> Repair the shorted together speaker circuits.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 7

## 7. SPEAKER SECTION OF RADIO

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Radio.
Perform BODY VERIFICATION TEST - VER 1.

## CASSETTE PLAYER INOP

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition and radio turned on.
- **Set Condition:**
  The code will set if the radio detects a internal cassette failure.

| Possible Causes |
|---|
| INTERNAL FAILURE |

## Diagnostic Test

### 1. INTERNAL FAILURE

**NOTE: If a DTC is set, erase the DTC and attempt to reset the DTC. If DTC resets, follow this test.**
This is an internal radio failure.

**View repair**

**Repair**

Replace the Radio.
Perform BODY VERIFICATION TEST - VER 1.

## CD CHANGER MECHANICAL FAILURE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition and CD Changer turned on.
- **Set Condition:**
  The code will set if the CD Changer detects a mechanical failure.

| Possible Causes |
|---|
| INTERNAL FAILURE |

## Diagnostic Test

### 1. INTERNAL FAILURE

**NOTE: Erase DTC and attempt to reset. If DTC resets, follow this test.**
This is an internal CD Changer failure.

**View repair**

**Repair**

Replace the CD Changer.
Perform BODY VERIFICATION TEST - VER 1.

## CD CHANGER READ FAILURE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition and CD Changer turned on.
- **Set Condition:**
  The code will set if a CD that is not formatted as a music CD is installed in the CD Changer.

| Possible Causes |
|---|
| CD CHANGER READ FAILURE |

## Diagnostic Test

### 1. CD CHANGER READ FAILURE

Replace the problem CD with a good, clean, unscratched, music CD.

Turn the radio on and select the good CD.

With the Scan Tool , read DTC's.

**Does the Scan Tool display CD CHANGER READ FAILURE?**

**Yes** >> Replace the CD Changer.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Test Complete.

## CD CHANGER TEMPERATURE HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition and CD Changer turned on.
- **Set Condition:**
  The code will set if the temperature inside the CD Changer is above +65° C (+145° F).

| Possible Causes |
|---|
| HIGH TEMPERATURE FAILURE |

## Diagnostic Test

### 1. HIGH TEMPERATURE

With the Scan Tool, erase the audio DTC's.

Start the engine and allow the engine to reach normal operating temperature.

If the vehicle has been in the hot sunlight or extreme cold move the vehicle indoors and open the doors to allow the inside temperature to stabilize.

The CD Changer will operate between -23° C and 65° C (-10° F and +145° F).

With the Scan Tool, read DTC's.

**Does the Scan Tool display CD CHANGER TEMPERATURE HIGH?**

**Yes** >> Replace the CD Changer.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Test Complete.

## CD PLAY FAILURE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition and the radio CD player turned on.
- **Set Condition:**
  The code will set if a CD that is not formatted as a music CD or is scratched, dirty so the radio can not play the CD.

| Possible Causes |
|---|
| CD PLAY FAILURE |

## Diagnostic Test

### 1. CD PLAY FAILURE

Replace the problem CD with a good, clean, unscratched, music CD.

Turn the radio CD player on.

With the Scan Tool, read DTC's.

**Does the Scan Tool display CD PLAY FAILURE?**

**Yes** >> Replace the Radio.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Test Complete.

## CD READ FAILURE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition and the radio CD player turned on.
- **Set Condition:**
  The code will set if a CD that is not formatted as a music CD is installed in the radio CD player.

| Possible Causes |
|---|
| CD READ FAILURE |

## Diagnostic Test

### 1. CD READ FAILURE

Replace the problem CD with a good, clean, unscratched, music CD.

Turn the radio CD player on.

With the Scan Tool, read DTC's.

**Does the Scan Tool display CD READ FAILURE?**

**Yes** >> Replace the Radio.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Test Complete.

## CD TEMPERATURE HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition and the radio CD player turned on.
- **Set Condition:**
  The code will set if the temperature inside the radio CD player is above +70° C (+156° F).

| Possible Causes |
|---|
| HIGH TEMPERATURE FAILURE |

## Diagnostic Test

### 1. HIGH TEMPERATURE

With the ScanTool, erase the audio DTC's.

Start the engine and allow the engine to reach normal operating temperature.

If the vehicle has been in the hot sunlight or extreme cold move the vehicle indoors and open the doors to allow the inside temperature to stabilize.

The radio CD player will operate between -23° C and 70° C (-10° F and +156° F).

With the Scan Tool, read DTC's.

**Does the Scan Tool display CD TEMPERATURE HIGH?**

**Yes** >> Replace the Radio.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Test Complete.

## LOW VOLTAGE LEVEL

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the radio on.
- **Set Condition:**
  The radio detects lower than normal voltage.

| Possible Causes |
| --- |
| CHECK CHARGING SYSTEM |
| CHECK VOLTAGE LEVEL AT RADIO |
| RADIO |

### Diagnostic Test

#### 1. CHECK CHARGING SYSTEM

Check the charging system in accordance with the service information.

**Is the charging system operating properly?**

**Yes** >> Go To 2

**No** >> Refer to the appropriate service information and repair as necessary.
Perform BODY VERIFICATION TEST - VER 1.

#### 2. CHECK VOLTAGE LEVEL AT RADIO

Turn the ignition off.
Disconnect the Radio harness connector.
Start the engine.
Measure the voltage of each Fused B+ circuit and the Fused Ignition Switch Output circuit.

**Is the voltage above or approximately 14 volts for each measurement?**

**Yes** >> Go To 3

**No** >> Repair the circuit for high resistance.
Perform BODY VERIFICATION TEST - VER 1.

#### 3. RADIO

**NOTE: Reconnect all previously disconnected components.**
Turn the ignition and Radio on.
With the Scan Tool, erase the audio DTC’s.
Start the engine.
With the Scan Tool, read the audio DTC’s.

**Did this DTC reset?**

**Yes** >> Replace the Radio.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Test Complete.

## NO ANTENNA CONNECTION

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the radio in seek up/down mode.
- **Set Condition:**
  With the radio in seek mode for two minutes and the radio does not detect an antenna connection or does not receive a radio station signal.

| Possible Causes |
|---|
| BAD ANTENNA CONNECTION |
| TEST ANTENNA |
| RADIO |

## Diagnostic Test

### 1. BAD ANTENNA CONNECTION

Turn the ignition off.

Disconnect the Radio Antenna connector.

Inspect the Radio Antenna connection.

**Was the Antenna connection clean and tight?**

**Yes** >> Go To 2

**No** >> Repair Antenna connection as needed.
Perform BODY VERIFICATION TEST - VER 1.

### 2. TEST ANTENNA

Refer to the Audio System in the service information and test the Antenna in accordance with the service procedure.

**Is the Antenna ok?**

**Yes** >> Go To 3

**No** >> Repair or replace the Antenna assembly as necessary.
Perform BODY VERIFICATION TEST - VER 1.

### 3. RADIO

**NOTE: Reconnect all previously disconnected components.**
Turn the ignition and Radio on.

**NOTE: Move vehicle outside approximately 30ft from any structure.**
With the Scan Tool, erase the audio DTC's, put the radio in seek up and seek down mode for approximately 2 minutes before proceeding.

With the Scan Tool, read the audio DTC's.

**Did this DTC reset?**

**Yes** >> Replace the Radio.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Test Complete.

# *POOR SOUND QUALITY

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| CHECK AUDIO DTCS |
| CHECK SELECTED RADIO EQ CURVE |
| SET THE RADIO EQ CURVE |
| VERIFY SOUND PERFORMANCE |

## Diagnostic Test

### 1. CHECK AUDIO DTCS

Turn the ignition on.

With the Scan Tool, check for any audio related DTC's.

**Are any Audio related DTCs set?**

**Yes** >> Refer to the Audio category for the related symptom(s).
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 2

### 2. CHECK SELECTED RADIO EQ CURVE

Turn the ignition on.

With the Scan Tool, enter body, body computer then miscellaneous.

Check the radio EQ curve setting and follow the instructions on the Scan Tool.

**Is the radio EQ curve correct for the audio combination the vehicle is equipped with?**

**Yes** >> Refer to the service information for problems related to poor sound quality and perform the appropriate checks.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. SET THE RADIO EQ CURVE

Turn the ignition on.

With the Scan Tool, enter body, body computer then miscellaneous.

Set the radio EQ curve. Follow the instructions on the Scan Tool.

Cycle the ignition switch from off to on.

Check the radio EQ curve setting.

**Is the radio EQ curve correct for the audio combination the vehicle is equipped with?**

**Yes** >> Refer to the service information for problems related to poor sound quality and perform the appropriate checks.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1.

## POWER AMP SHUTDOWN - BASE AUDIO SYSTEM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition in RUN and IOD fuse installed.
- **Set Condition:**
  The radio has sensed a short on the output for more than 10 seconds.

| Possible Causes |
|---|
| LEFT I/P SPEAKER |
| LEFT FRONT DOOR SPEAKER |
| RIGHT I/P SPEAKER |
| RIGHT FRONT DOOR SPEAKER |
| LEFT REAR SPEAKER |
| RIGHT REAR SPEAKER |
| (+) CIRCUIT SHORTED TO GROUND |
| SPEAKER SECTION OF RADIO |
| (-) CIRCUIT SHORTED TO GROUND |
| SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER |

### Diagnostic Test

#### 1. DETERMINE FAULT

Turn the ignition on.
Turn the Radio on.
With the Scan Tool, erase the audio DTC's.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read the audio DTC's.

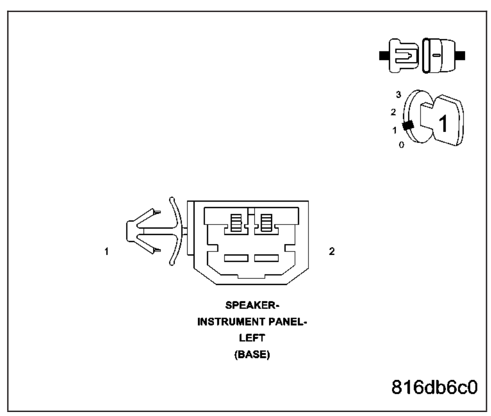
**Does the Scan Tool display POWER AMP SHUTDOWN?**

**Yes** >> Go To 2

**No** >> Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short.
Perform BODY VERIFICATION TEST - VER 1.

#### 2. LEFT I/P SPEAKER

Turn the ignition off.
Disconnect the Left I/P Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool, erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.




**Does the Scan Tool display POWER AMP SHUTDOWN?**

**Yes** >> Go To 3

**No** >> Replace the Left I/P Speaker.
Perform BODY VERIFICATION TEST - VER 1.

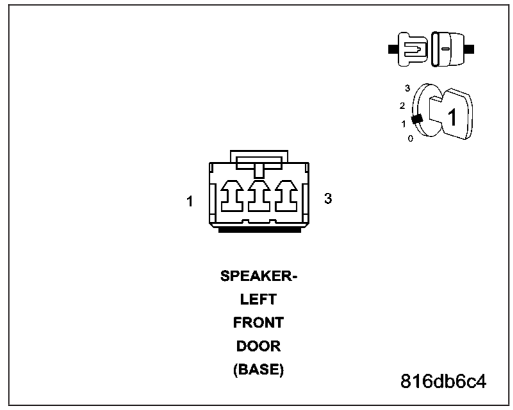
## 3. LEFT FRONT DOOR SPEAKER

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool, erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.

**Does the Scan Tool display POWER AMP SHUTDOWN?**

**Yes** >> Go To 4

**No** >> Replace the Left Front Door Speaker.
Perform BODY VERIFICATION TEST - VER 1.



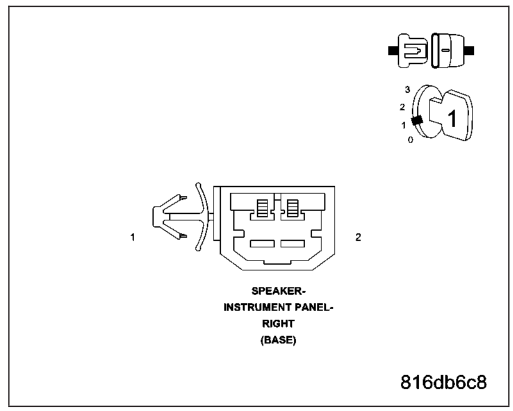

## 4. RIGHT I/P SPEAKER

Turn the ignition off.
Disconnect the Right I/P Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool, erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.

**Does the Scan Tool display POWER AMP SHUTDOWN?**

**Yes** >> Go To 5

**No** >> Replace the Right I/P Speaker.
Perform BODY VERIFICATION TEST - VER 1.



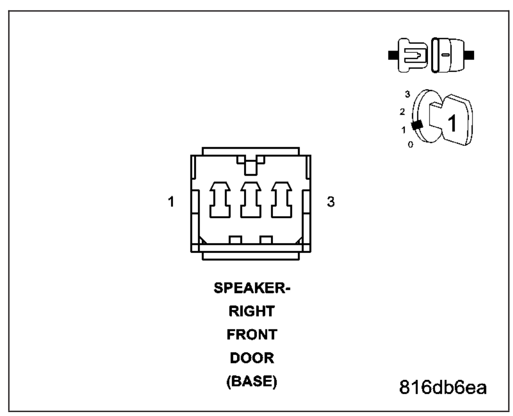

## 5. RIGHT FRONT DOOR SPEAKER

Turn the ignition off.
Disconnect the Right Front Door Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool, erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.

**Does the Scan Tool display POWER AMP SHUTDOWN?**

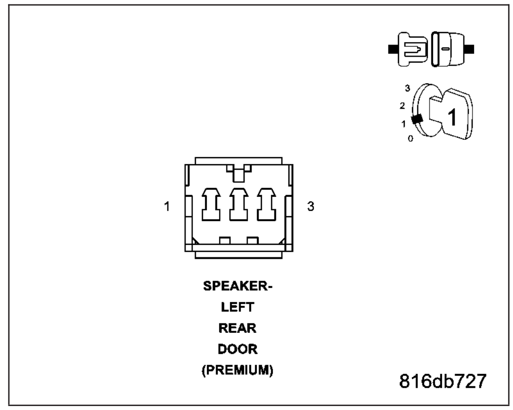
**Yes** >> Go To 6

**No** >> Replace the Right Front Door Speaker.
Perform BODY VERIFICATION TEST - VER 1.



## 6. LEFT REAR SPEAKER

Turn the ignition off.
Disconnect the Left Rear Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool, erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.



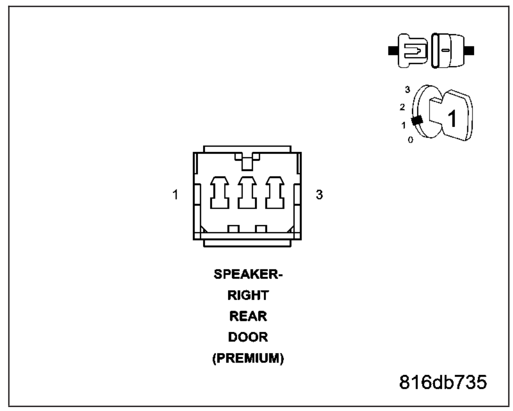

**Does the Scan Tool display POWER AMP SHUTDOWN?**

**Yes** >> Go To 7

**No** >> Replace the Left Rear Speaker.
Perform BODY VERIFICATION TEST - VER 1.

## 7. RIGHT REAR SPEAKER

Turn the ignition off.
Disconnect the Right Rear Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool, erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.




**Does the Scan Tool display POWER AMP SHUTDOWN?**

**Yes** >> Go To 8

**No** >> Replace the Right Rear Speaker.
Perform BODY VERIFICATION TEST - VER 1.

## 8. (+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Disconnect the Left I/P Speaker harness connector.
Disconnect the Right Front Door Speaker harness connector.
Disconnect the Right I/P Speaker harness connector.
Disconnect the Left Rear Speaker harness connector.
Disconnect the Right Rear Speaker harness connector.
Disconnect the Radio C1 harness connector.
Measure the resistance between ground and each speaker (+) circuit.

**Is the resistance below 1000.0 (1K) ohms?**

**Yes** >> Repair the speaker (+) circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 9

## 9. (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Disconnect the Left I/P Speaker harness connector.
Disconnect the Right Front Door Speaker harness connector.
Disconnect the Right I/P Speaker harness connector.
Disconnect the Left Rear Speaker harness connector.
Disconnect the Right Rear Speaker harness connector.
Disconnect the Radio C1 harness connector.
Measure the resistance between ground and each speaker (-) circuit.

**Is the resistance below 1000.0 (1K) ohms?**

**Yes** >> Repair the speaker (-) circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 10

## 10. SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Disconnect the Left I/P Speaker harness connector.
Disconnect the Right Front Door Speaker harness connector.
Disconnect the Right I/P Speaker harness connector.
Disconnect the Left Rear Speaker harness connector.
Disconnect the Right Rear Speaker harness connector.
Disconnect the Radio C1 harness connector.
Measure the resistance between each speaker (+) circuit and each speaker (-) circuit.

**Is the resistance below 1000.0 (1K) ohms for any of the measurements?**

**Yes** >> Repair the shorted together speaker circuits.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 11

## 11. SPEAKER SECTION OF RADIO

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Radio.
Perform BODY VERIFICATION TEST - VER 1.

## POWER AMP SHUTDOWN - PREMIUM AUDIO SYSTEM

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition in RUN and IOD fuse installed.
- **Set Condition:**
  The radio has sensed a short on the output for more than 10 seconds.

| Possible Causes |
| --- |
| LEFT FRONT DOOR SPEAKER |
| RIGHT FRONT DOOR SPEAKER |
| (+) CIRCUIT SHORTED TO GROUND |
| (-) CIRCUIT SHORTED TO GROUND |
| (+) & (-) CIRCUITS SHORTED TOGETHER |
| RADIO |

## Diagnostic Test

### 1. DETERMINE FAULT

Turn the ignition on.
Turn the Radio on.
With the Scan Tool, erase the audio DTC's.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read the audio DTC's.

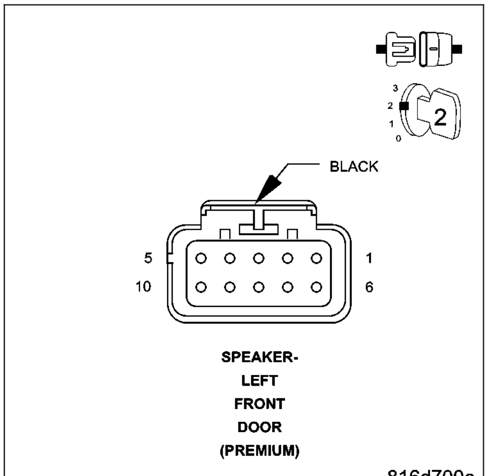
**Does the Scan Tool display POWER AMP SHUTDOWN?**

**Yes** >> Go To 2

**No** >> Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short.
Perform BODY VERIFICATION TEST - VER 1.

### 2. LEFT FRONT DOOR SPEAKER

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool, erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.



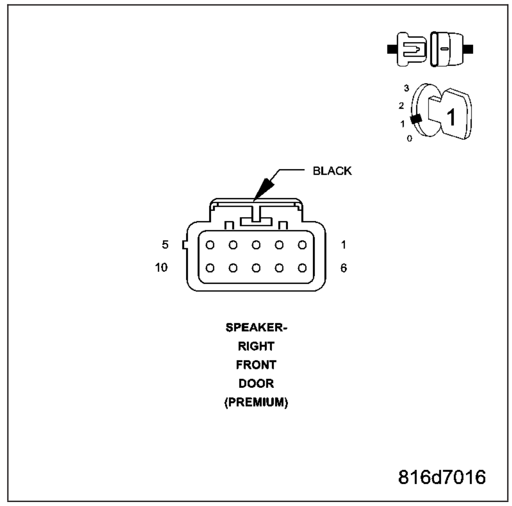

816d700e

**Does the Scan Tool display POWER AMP SHUTDOWN?**

**Yes** >> Go To 3

**No** >> Replace the Left Front Door Speaker.
Perform BODY VERIFICATION TEST - VER 1.

## 3. RIGHT FRONT DOOR SPEAKER




Turn the ignition off.
Disconnect the Right Front Door Speaker harness connector.
Turn the ignition on.
Turn the radio on.
With the Scan Tool, erase the audio DTCs.
Cycle the ignition switch from off to on and wait 10 seconds.
With the Scan Tool, read DTC's.

**Does the Scan Tool display POWER AMP SHUTDOWN?**

**Yes** >> Go To 4

**No** >> Replace the Right Front Door Speaker.
Perform BODY VERIFICATION TEST - VER 1.

## 4. (+) CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Disconnect the Right Front Door Speaker harness connector.
Disconnect the Radio C1 harness connector.
Measure the resistance between ground and each speaker (+) circuit.

**Is the resistance below 1000.0 (1K) ohms?**

**Yes** >> Repair the speaker (+) circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Disconnect the Right Front Door Speaker harness connector.
Disconnect the Radio C1 harness connector.
Measure the resistance between ground and each speaker (-) circuit.

**Is the resistance below 1000.0 (1K) ohms?**

**Yes** >> Repair the speaker (-) circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 6

## 6. SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER

Turn the ignition off.
Disconnect the Left Front Door Speaker harness connector.
Disconnect the Right Front Door Speaker harness connector.
Disconnect the Radio C1 harness connector.
Measure the resistance between each speaker (+) circuit and each speaker (-) circuit.

**Is the resistance below 1000.0 (1K) ohms for any of the measurements?**

**Yes** >> Repair the shorted together speaker circuits.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 7

## 7. SPEAKER SECTION OF RADIO

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Radio.
Perform BODY VERIFICATION TEST - VER 1.

## *REMOTE RADIO SWITCHES INOPERATIVE (IF EQUIPPED)

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ATTEMPT TO COMMUNICATE WITH THE RADIO |
| CHECK OPERATION OF SWITCHES |
| LEFT REMOTE RADIO SWITCH SHORTED TO GROUND |
| RIGHT REMOTE RADIO SWITCH SHORTED TO GROUND |
| RADIO CONTROL MUX CIRCUIT SHORTED TO GROUND AT THE SWITCH |
| RADIO CONTROL MUX CKT SHORTED TO THE RADIO CONTROL MUX RETURN CKT AT THE SWITCH |
| CLOCKSPRING SHORTED TO GROUND |
| RADIO CONTROL MUX CIRCUIT SHORTED TO GROUND |
| RADIO CONTROL MUX CKT SHORTED TO THE RADIO CONTROL MUX RETURN CKT |
| BODY CONTROL MODULE - INTERNAL SHORT |
| CLOCKSPRING OPEN |
| OPEN RADIO CONTROL MUX RETURN CIRCUIT |
| OPEN RADIO CONTROL MUX CIRCUIT |
| BODY CONTROL MODULE - OPEN INTERNALLY |

## Diagnostic Test

### 1. ATTEMPT TO COMMUNICATE WITH THE RADIO

Turn the ignition on.

With the Scan Tool, attempt to communicate with the Radio.

**Was the Scan Tool able to communicate with the Radio?**

**Yes** >> Go To 2

**No** >> Refer to the communication category and perform the appropriate symptom.
Perform BODY VERIFICATION TEST - VER 1.

### 2. CHECK OPERATION OF SWITCHES

Turn the ignition on.

Turn the Radio on.

Operate all the remote radio switch functions.

**Is only one function or one switch not operating properly?**

**Yes** >> Repair the Radio Control MUX circuit or the Radio Control MUX Return circuit for an open between the inoperative switch and the clockspring. If OK, replace the remote radio switch.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. CHECK THE REMOTE RADIO CONTROL SWITCH VOLTAGE

Turn the ignition on.

With the Scan Tool, enter Body Computer then Sensors and monitor the Radio Control SW voltage.

**Is the voltage above 3.8 volts?**

**Yes** >> Go To 4

**No** >> Go To 8

## 4. CLOCKSPRING OPEN

Turn the ignition on.

Turn the Radio on.

Disconnect the Clockspring C1 harness connector.

Connect a jumper wire between the Radio Control MUX circuit and the Radio Control MUX Return circuit.

**Did the radio change stations?**

**Yes** >> Repair the Radio Control MUX circuit or the Radio Control MUX Return circuit for an open between the clockspring and the splice to the switches. If OK, replace the Clockspring.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. OPEN RADIO CONTROL MUX RETURN CIRCUIT

Turn the ignition off.

Disconnect the Clockspring C1 harness connector.

Disconnect the BCM C2 harness connector.

Measure the resistance of the Radio Control MUX Return circuit between the BCM C2 connector and the Clockspring C1 connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Radio Control MUX Return circuit for an open between the clockspring and the BCM.
Perform BODY VERIFICATION TEST - VER 1.

## 6. OPEN RADIO CONTROL MUX CIRCUIT

Turn the ignition off.

Disconnect the Clockspring C1 harness connector.

Disconnect the BCM C2 harness connector.

Measure the resistance of the Radio Control MUX circuit between the BCM C2 connector and the Clockspring C1 connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the Radio Control MUX circuit for an open between the clockspring and the BCM.
Perform BODY VERIFICATION TEST - VER 1.

## 7. BODY CONTROL MODULE - OPEN INTERNALLY

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Body Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1.

## 8. LEFT REMOTE RADIO SWITCH SHORTED TO GROUND

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait 2 minutes before proceeding.**

**CAUTION: Do not place an intact undeployed airbag module face down on a hard surface, the airbag module will propel into the air if accidently deployed.**

Remove the Driver Airbag Module.

Disconnect the Left Remote Radio Switch harness connector.

Turn the ignition on, reconnect the battery.

With the Scan Tool, enter Body Computer then Sensors and monitor the Radio Control SW voltage.

**Is the voltage above 3.8 volts?**

**Yes** >> Replace the Left Remote Radio Switch.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 9

## 9. RIGHT REMOTE RADIO SWITCH SHORTED TO GROUND

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait 2 minutes before proceeding.**

**CAUTION: Do not place an intact undeployed airbag module face down on a hard surface, the airbag module will propel into the air if accidently deployed.**

Remove the Driver Airbag Module.

Disconnect the Right Remote Radio Switch harness connector.

Turn the ignition on, reconnect the battery.

With the Scan Tool, enter Body Computer then Sensors and monitor the Radio Control SW voltage.

**Is the voltage above 3.8 volts?**

**Yes** >> Replace the Right Remote Radio Switch.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 10

## 10. CHECK THE CLOCKSPRING

Turn the ignition off.

Disconnect the Clockspring C3 harness connector.

Turn the ignition on.

With the Scan Tool, enter Body Computer then Sensors and monitor the Radio Control SW voltage.

**Is the voltage above 3.8 volts?**

**Yes** >> Go To 11

**No** >> Go To 12

## 11. RADIO CONTROL MUX CIRCUIT SHORTED TO GROUND AT THE SWITCH

Turn the ignition off.

Disconnect the Clockspring C3 harness connector.

**NOTE: Ensure both remote radio switches are disconnected.**

Measure the resistance between ground and the Radio Control MUX circuit at the clockspring C3 harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the Radio Control MUX circuit for a short to ground between the clockspring and the remote radio switches.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the Radio Control MUX circuit for a short to the Radio Control MUX Return circuit between the clockspring and the remote radio switches.
Perform BODY VERIFICATION TEST - VER 1.

## 12. CLOCKSPRING SHORTED TO GROUND

Turn the ignition off.

Disconnect the Clockspring C1 harness connector.

Turn the ignition on.

With the Scan Tool, enter Body Computer then Sensors and monitor the Radio Control SW voltage.

**Is the voltage above 3.8 volts?**

**Yes** >> Replace the Clockspring in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 13

## 13. RADIO CONTROL MUX CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Clockspring C1 harness connector.

Disconnect the BCM C2 harness connector.

Measure the resistance between ground and the Radio Control MUX circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the Radio Control MUX circuit for a short to ground between the clockspring and the BCM.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 14

## 14. RADIO CONTROL MUX CKT SHORTED TO THE RADIO CONTROL MUX RETURN CKT

Turn the ignition off.

Disconnect the Clockspring C1 harness connector.

Disconnect the BCM C2 harness connector.

Measure the resistance between the Radio Control MUX circuit and the Radio Control MUX Return circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the Radio Control MUX circuit for a short to the Radio Control MUX Return circuit between the clockspring and the BCM.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST - VER 1.

# AUDIO/VIDEO

## TABLE OF CONTENTS

# AUDIO/VIDEO

## DESCRIPTION

Several combinations of radio receivers and speaker systems are offered on this model. The audio system uses an ignition switched source of battery current so that the system will only operate when the ignition switch is in the RUN or ACCESSORY positions.

The audio system includes the following components:

- Amplifier choke and relay (with premium speaker system only)
- Antenna
- Compact disc changer (if equipped)
- Power amplifier mounted to each front door speaker (with premium speaker system only)
- Radio noise suppression components
- Radio receiver
- Remote radio switches (if equipped)
- Speakers

Certain functions and features of the audio system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communication Interface (PCI) bus network. The data bus network allows the sharing of sensor information. For diagnosis of these electronic modules or of the data bus network, the use of a scan tool and the proper Diagnostic Procedures information is recommended.

## OPERATION

The audio system components are designed to provide audio entertainment and information through the reception, tuning and amplification of locally broadcast radio signals in both the Amplitude Modulating (AM) and Frequency Modulating (FM) commercial frequency ranges.

The audio system components operate on battery current received through a fuse in the Junction Block (JB) on a fused ignition switch output (run-acc) circuit so that the system will only operate when the ignition switch is in the Run or Accessory positions.

On vehicles that are equipped with the optional remote radio switches, the Body Control Module (BCM) receives hard wired resistor multiplexed inputs from the remote radio switches. The programming in the BCM allows it to process those inputs and send the proper messages to the radio receiver over the Programmable Communication Interface (PCI) bus network to control the radio volume up or down, station seek up or down, preset station advance, and mode advance functions.

Refer to the owner's manual for more information on the features, use and operation of each of the available audio systems.

## DIAGNOSIS AND TESTING - AUDIO

**Any diagnosis of the Audio system should begin with the use of scan tool. For information on the use of the scan tool, refer to the appropriate Diagnostic information.**

**Refer to the appropriate wiring information.**

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

**AUDIO SYSTEM DIAGNOSIS TABLE**

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| NO AUDIO | 1. Fuse faulty. | 1. Check radio fuse and Ignition-Off Draw (IOD) fuse in Junction Block (JB). Replace fuses, if required. |
| | 2. Radio connector faulty. | 2. Check for loose or corroded radio connector. Repair, if required. |
| | 3. Wiring faulty. | 3. Check for shorted or open wires. Repair wiring, if required. |
| | 4. Radio ground faulty. | 4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required. |
| | 5. Radio faulty. | 5. Refer to appropriate Diagnostic Service Manual. |
| | 6. Speakers faulty. | 6. Replace speaker as necessary. |
| | 7. Choke and relay faulty | 7. Replace choke and relay as necessary. |
| NO RADIO DISPLAY | 1. Fuse faulty. | 1. Check radio fuse and Ignition-Off Draw (IOD) fuse in Junction Block (JB). Replace fuses, if required. |
| | 2. Radio connector faulty. | 2. Check for loose or corroded radio connector. Repair, if required. |
| | 3. Wiring faulty. | 3. Check for battery voltage at radio connector. Repair wiring, if required. |
| | 4. Radio ground faulty. | 4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required. |
| | 5. Radio faulty. | 5. Refer to appropriate Diagnostic Service Manual. |
| CLOCK WILL NOT KEEP SET TIME | 1. Fuse faulty. | 1. Check Ignition-Off Draw (IOD) fuse in the Junction Block (JB). Replace fuse, if required. |
| | 2. Radio connector faulty. | 2. Check for loose or corroded radio connector. Repair, if required. |
| | 3. Wiring faulty. | 3. Check for battery voltage at radio connector. Repair wiring, if required. |
| | 4. Radio ground faulty. | 4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required. |
| | 5. Radio faulty. | 5. Refer to appropriate Diagnostic Service Manual. |
| POOR RADIO RECEPTION | 1. Antenna faulty. | 1. (Refer to 8 - ELECTRICAL/AUDIO/ANTENNA BODY & CABLE - DIAGNOSIS AND TESTING). |
| | 2. Radio ground faulty. | 2. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required. |
| | 3. Radio noise suppression faulty. | 3. Repair or replace ground strap as necessary. |
| | 4. Radio faulty. | 4. Refer to appropriate Diagnostic Service Manual. |
| SOUND DISTORTION ( VIBRATION FROM SPEAKER AREA, BUZZING - HUMMING) | 1. Door trim panel loose or missing fasteners. | 1. Inspect door trim panel and correct as necessary. Replace any missing fasteners. |

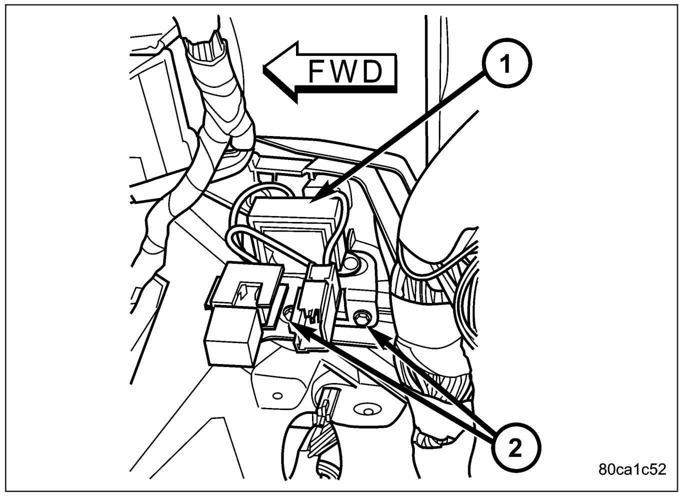
| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| | 2. Water shield loose or misaligned. | 2. Inspect water shield and adjust as required. |
| | 3. Items placed in door trim panel map pockets vibrating or moving from side to side. | 3. Remove items from door trim panel. Ensure that vibration is no longer present. |
| NO/POOR TAPE OPERATION | 1. Faulty tape. | 1. Insert known good tape and test operation. |
| | 2. Foreign objects behind tape door. | 2. Remove foreign objects and test operation. |
| | 3. Dirty cassette tape head. | 3. Clean head with Mopar Cassette Head Cleaner. |
| | 4. Faulty tape deck. | 4. Exchange or replace radio, if required. |
| NO COMPACT DISC OPERATION | 1. Faulty CD. | 1. Insert known good CD and test operation. |
| | 2. Foreign material on CD. | 2. Clean CD and test operation. |
| | 3. Condensation on CD or optics. | 3. Allow temperature of vehicle interior to stabilize and test operation. |
| | 4. Faulty CD player. | 4. Refer to appropriate Diagnostic Service Manual. |

# AMPLIFIER CHOKE AND RELAY

## DESCRIPTION

Vehicles equipped with the premium speaker package have a amplifier choke and relay (1). The amplifier choke and relay is mounted to the lower instrument panel above the pedals and towards the instrument panel center stack.

The amplifier choke and relay should be checked if there is no sound output from the speakers. The amplifier choke and relay can not be repaired or adjusted and, if faulty or damaged, the unit must be replaced.




## OPERATION

The amplifier choke and relay is used to control the supply of fused battery current to the front door speaker-mounted dual amplifiers. The speaker relay is energized by a fused 12 volt output from the radio receiver whenever the radio is turned on. For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

## DIAGNOSIS AND TESTING - AMPLIFIER CHOKE AND RELAY

**Any diagnosis of the Audio system should begin with the use of scan tool. For information on the use of the scan tool, refer to the appropriate Diagnostic information.**

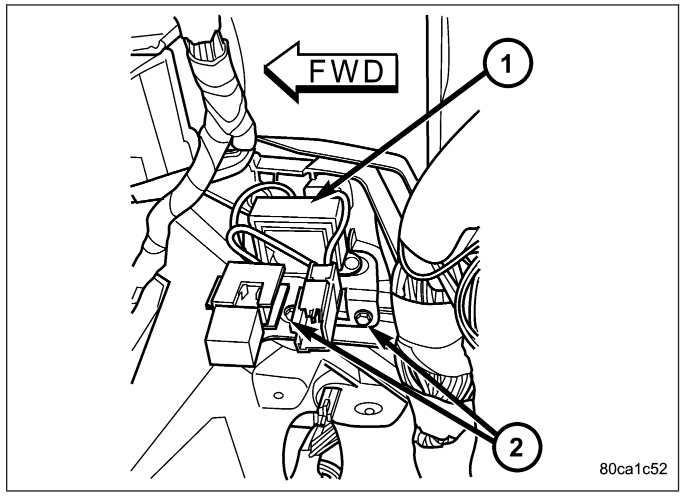
The amplifier choke and relay is used to switch power to the individual speaker amplifiers used with the premium speaker package. The amplifier choke and relay is serviced only as a unit. If all of the speakers are inoperative the amplifier choke and relay should be inspected. Before replacement, make the following inspections of the amplifier choke and relay circuits. For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

1. Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, replace the faulty fuse.
2. Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the battery as required.
3. Disconnect the instrument panel wire harness connector from the amplifier choke and relay. Check for battery voltage at the fused B(+) circuit cavity of the instrument panel wire harness connector for the amplifier choke and relay. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.
4. Probe the ground circuit cavity of the instrument panel wire harness connector for the amplifier choke and relay. Check for continuity to a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open ground circuit to ground as required.
5. Turn the ignition switch to the RUN position and turn the radio ON. Check for battery voltage at the radio 12-volt output circuit cavity of the instrument panel wire harness connector for the amplifier choke and relay. If OK, go to Step 6. If not OK, repair the open radio 12-volt output circuit to the radio as required.
6. Turn the radio and ignition switches to the OFF position. Reconnect the instrument panel wire harness connector to the amplifier choke and relay. Check for battery voltage at the amplified speaker (+) circuit cavity of the instrument panel wire harness connector for the amplifier choke and relay. There should be zero volts. Turn the ignition and radio switches to the ON position. There should now be battery voltage. If OK, repair the open amplified

speaker (+) circuits to the speaker-mounted amplifiers as required. If not OK, replace the faulty amplifier choke and relay.

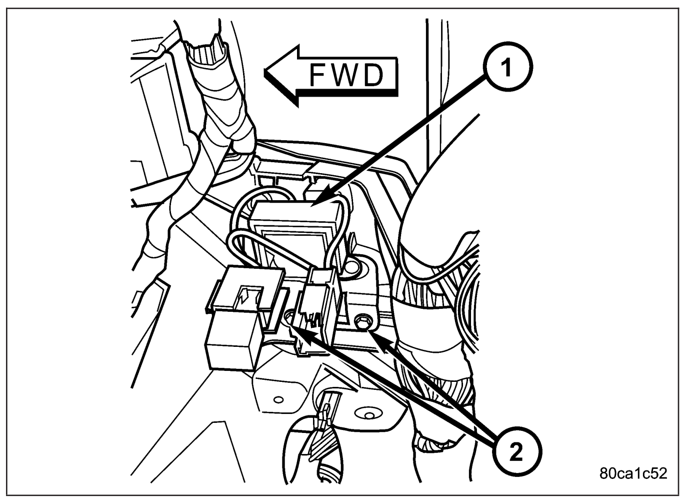
## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove knee blocker cover and knee blocker.
3. Disconnect the electrical harness connector from the amplifier choke and relay (1).
4. Remove mounting fasteners and amplifier choke and relay.




## INSTALLATION

1. Install the amplifier choke and relay (1).
2. Install and tighten the mounting fasteners.
3. Connect the electrical harness connector.
4. Install knee blocker cover and knee blocker.
5. Connect the battery negative cable.



# ANTENNA BODY & CABLE

## DESCRIPTION

### DOMESTIC

The antenna body and cable is secured below the fender panel by the antenna cap nut through a mounting hole in the side of the right front fender. The primary coaxial antenna cable is then routed beneath the fender sheet metal and through a entry hole in the right cowl side panel into the interior of the vehicle. Inside the vehicle, the primary coaxial cable is connected to a secondary instrument panel antenna coaxial cable with an in-line connector that is located behind the right kick panel. The instrument panel antenna cable is then routed behind the instrument panel to the back of the radio.

### EXPORT

The primary coaxial antenna cable is routed behind the A-pillar trim, up the right side of the roof panel above the headliner. Inside the vehicle, the primary coaxial cable is connected to a secondary instrument panel antenna coaxial cable with an in-line connector that is located behind the A-pillar trim at one end. At the other end, the cable is connected to the antenna module. The instrument panel antenna cable is then routed behind the instrument panel to the back of the radio.

## OPERATION

The antenna body and cable connects the antenna mast (domestic) or quarter glass integral antenna (export) to the radio. The radio antenna is an electromagnetic circuit component used to capture radio frequency signals that are broadcast by local commercial radio stations in both the Amplitude Modulating (AM) and Frequency Modulating (FM) frequency ranges. These electromagnetic radio frequency signals induce small electrical modulations into the antenna as they move past the mast. The antenna body transfers the weak electromagnetic radio waves induced into the antenna into the center conductor of the flexible primary antenna coaxial cable. The braided outer shield of the antenna coaxial cable is grounded through both the antenna body and the radio chassis, effectively shielding the radio waves as they are conducted to the radio. The radio then tunes and amplifies the weak radio signals into stronger electrical signals in order to operate the audio system speakers.

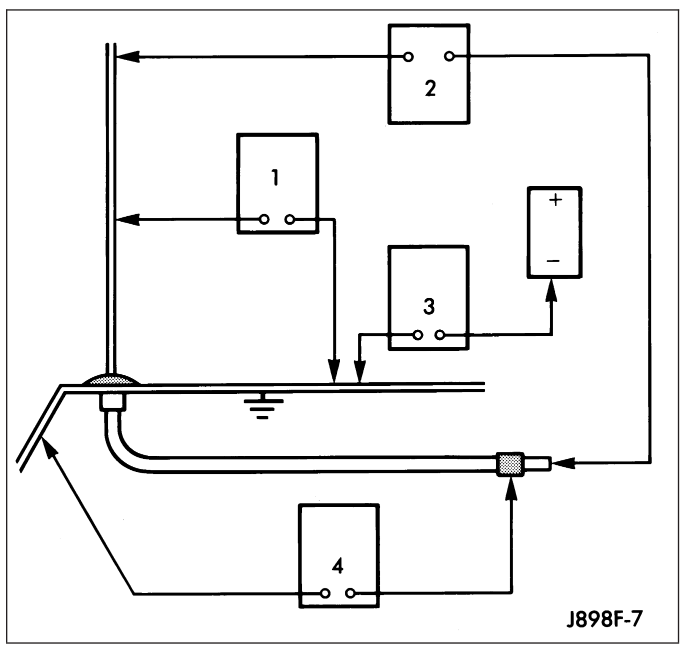
## DIAGNOSIS AND TESTING - ANTENNA BODY AND CABLE

The following four tests are used to diagnose the antenna with an ohmmeter:

- **Test 1** - Mast to ground test
- **Test 2** - Tip-of-mast to tip-of-conductor test
- **Test 3** - Body ground to battery ground test
- **Test 4** - Body ground to antenna coaxial cable shield test.

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

The ohmmeter test lead connections for each test are shown in the illustration.



**NOTE: This model has a two-piece antenna coaxial cable. Tests 2 and 4 must be conducted in two steps to isolate an antenna cable problem. First, test the primary antenna cable (integral to the antenna body and cable) from the coaxial cable connector behind the right side kick panel to the antenna body. Then, test the secondary antenna cable (instrument panel antenna cable) from the coaxial cable connector behind the right side kick panel to the coaxial cable connector at the radio.**

## TEST 1

Test 1 determines if the antenna mast is insulated from ground. Proceed as follows:

1. Disconnect and isolate the antenna coaxial cable connector behind the right side kick panel.
2. Touch one ohmmeter test lead to the tip of the antenna mast. Touch the other test lead to known ground. Check the ohmmeter reading for continuity.
3. There should be no continuity. If OK, go to Test 2. If not OK, replace the faulty antenna body and cable.

## TEST 2

Test 2 checks the antenna conductor components for an open circuit. This test should be performed first on the entire antenna circuit, from the antenna mast to the center conductor of the coaxial cable connector at the radio. If an open circuit is detected, each of the three antenna conductor components (antenna mast, antenna body and cable, instrument panel antenna cable) should be isolated and tested individually to locate the exact component that is the source of the open circuit. To begin this test, proceed as follows:

1. Disconnect the instrument panel antenna cable coaxial connector from the back of the radio.
2. Touch one ohmmeter test lead to the tip of the antenna mast. Touch the other test lead to the center conductor pin of the instrument panel antenna cable coaxial connector for the radio. Check the ohmmeter reading for continuity.
3. There should be continuity. The ohmmeter should register only a fraction of an ohm resistance. High or infinite resistance indicates a damaged or open antenna conductor. If OK, go to Test 3. If not OK, isolate and test each of the individual antenna conductor components. Replace only the faulty antenna conductor component.

## TEST 3

Test 3 checks the condition of the vehicle body ground connection. To begin this test, proceed as follows:

1. This test must be performed with the battery positive cable disconnected from the battery. Disconnect and isolate both battery cables, negative cable first.
2. Reconnect the battery negative cable.
3. Touch one ohmmeter test lead to a good clean ground point on the vehicle fender. Touch the other test lead to the battery negative terminal post. Check the ohmmeter reading for continuity.
4. There should be continuity. The ohmmeter should register less than one ohm resistance. High or infinite resistance indicates a loose, corroded, or damaged connection between the battery negative terminal and the vehicle body. If OK, go to Test 4. If not OK, check the battery negative cable connection to the vehicle body and the radio noise suppression ground strap connections to the engine and the vehicle body for being loose or corroded. Clean or tighten these connections as required.

## TEST 4

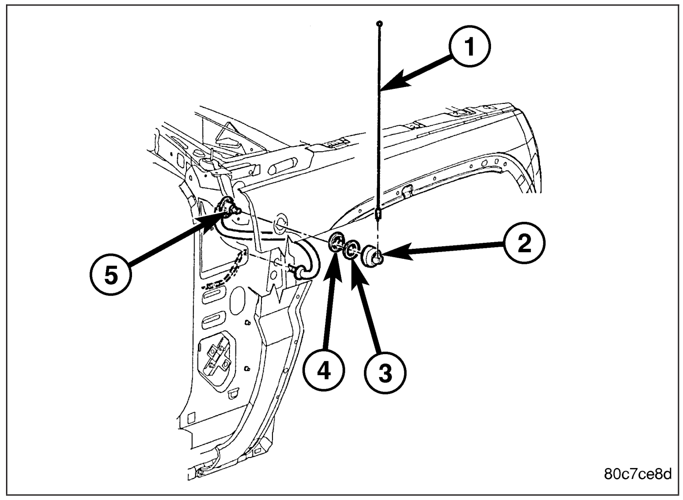
Test 4 checks the condition of the connection between the antenna coaxial cable shield and the vehicle body ground as follows:

1. Disconnect and isolate the antenna coaxial cable connector behind the right side kick panel.
2. Touch one ohmmeter test lead to a good clean ground point on the vehicle fender. Touch the other test lead to the outer crimp on the antenna coaxial cable connector. Check the ohmmeter reading for continuity.
3. There should be continuity. The ohmmeter should register less than one ohm resistance. High or infinite resistance indicates a loose, corroded, or damaged connection between the antenna body and the vehicle body or between the antenna body and the antenna coaxial cable shield. If not OK, clean the antenna body to fender mating surfaces and tighten the antenna cap nut to specifications.
4. Check the resistance again with an ohmmeter. If the resistance is still more then one ohm, replace the faulty antenna body and cable.

## REMOVAL

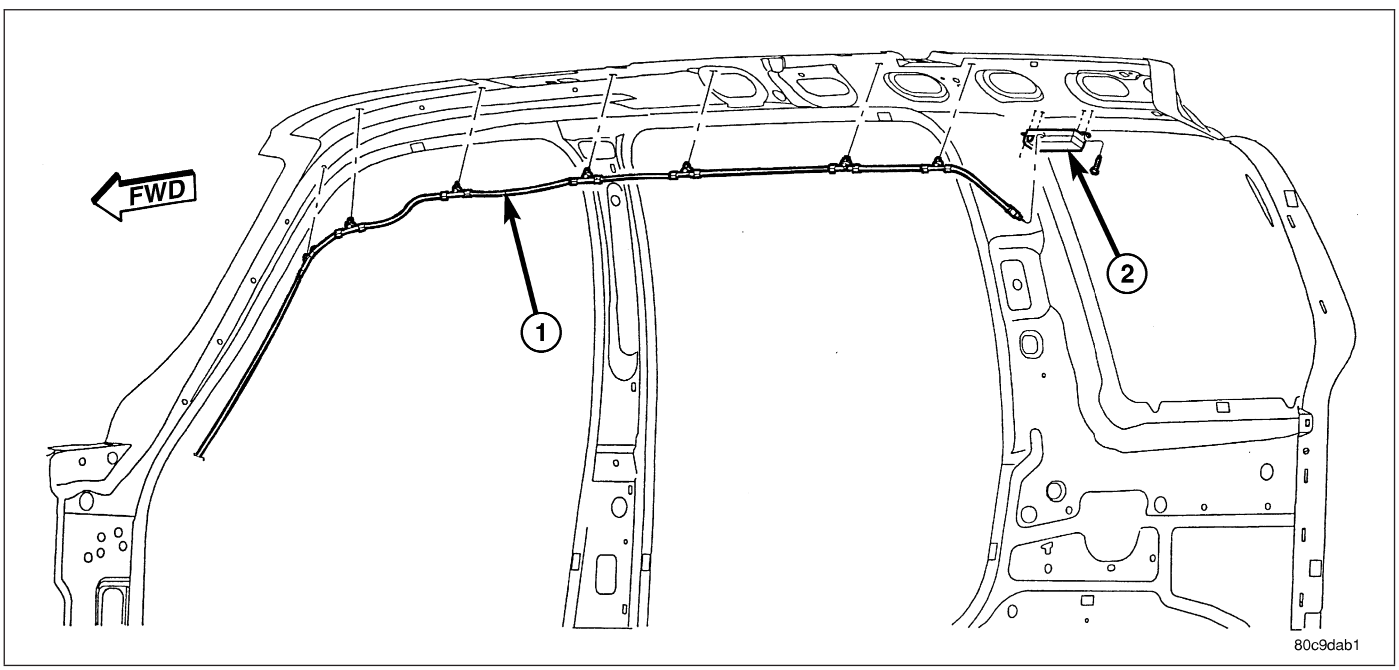
### DOMESTIC

1. Disconnect and isolate the battery negative cable.
2. Remove the antenna mast (1).
3. Remove cover (2).
4. Remove mounting nut (3).
5. Remove bezel adapter.
6. Remove right kick panel trim.
7. Disconnect antenna body and cable from the instrument panel cable. Attach a wire or string (approximately 2 feet in length) to the cable to aid in installation of the new cable.
8. Remove the upper fender mounting bolts. Loosen the two fender mounting bolts located near the upper door hinge (Refer to 23 - BODY/EXTERIOR/FRONT FENDER - REMOVAL).
9. Carefully pull fender out to access the antenna body and cable. Pull cable up through the opening with wire attached.




### EXPORT

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**



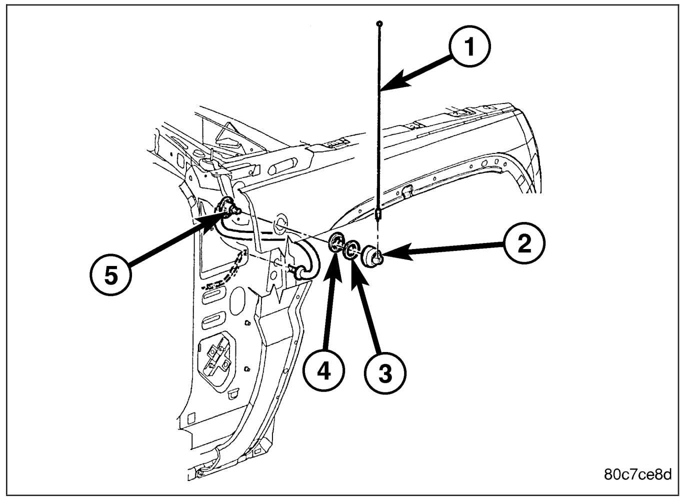

1. Disconnect and isolate the battery negative cable.
2. Remove the assist handles on the right side of the headliner (Refer to 23 - BODY/INTERIOR/ASSIST HANDLE - REMOVAL).
3. Remove the right side visor (Refer to 23 - BODY/INTERIOR/SUN VISOR - REMOVAL).
4. Remove the A-pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL).
5. Lower headliner as necessary to access antenna cable (1).

6. Disconnect antenna cable from antenna module (2).
7. Remove antenna cable from roof panel by pulling on retaining clips.
8. Disconnect antenna cable from instrument panel antenna cable by disconnecting the antenna connector.

## INSTALLATION

### DOMESTIC

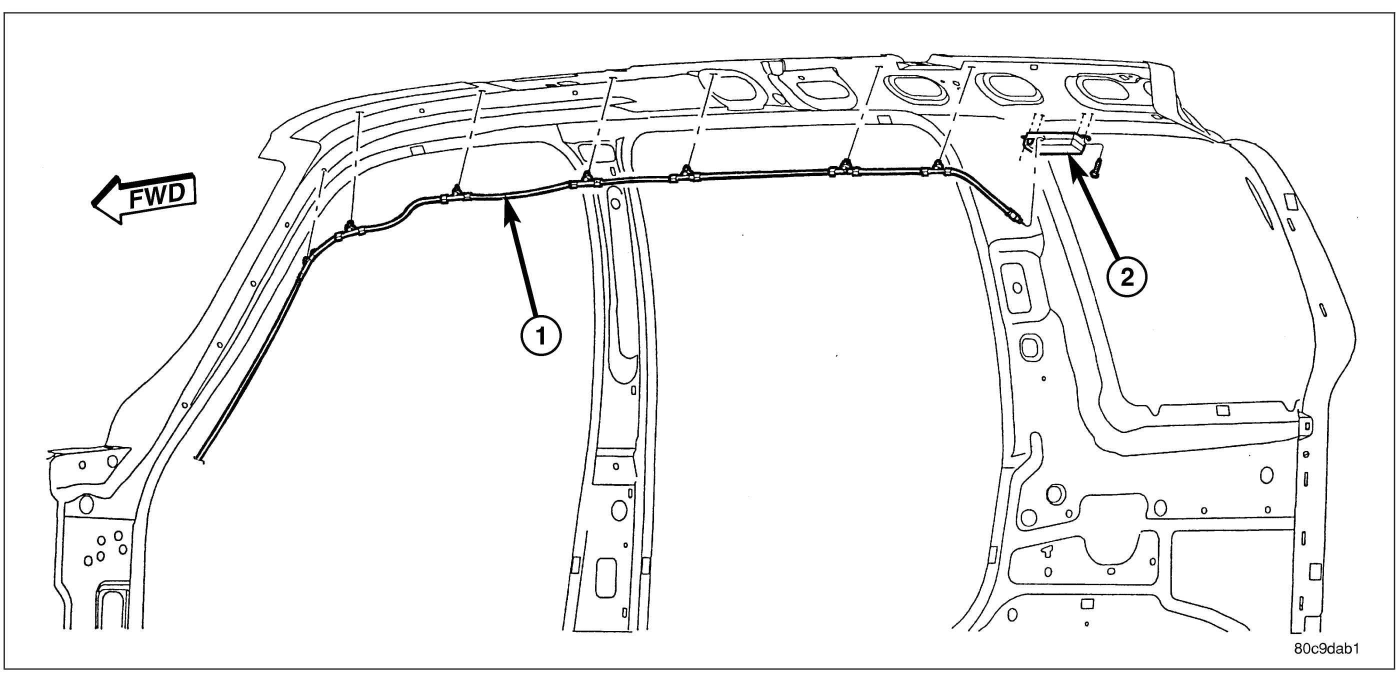
1. Attached wire to new cable. Pull fender out and insert cable into opening.
2. Pull cable through hole in kick panel area using the attached wire.
3. Connect antenna body cable to the instrument panel cable (5).
4. Install right kick panel trim.
5. Install bezel adapter.
6. Install mounting nut.
7. Install cover.
8. Install antenna mast. Tighten to 50 N·m (37 ft. lbs.). **Ensure that the antenna mast is fully seated on antenna base and that there is no gap between the mast and base.**
9. Tighten fender mounting bolts near door hinge area.




10. Install and tighten the upper fender mounting bolts (Refer to 23 - BODY/EXTERIOR/FRONT FENDER - INSTALLATION).
11. Connect the battery negative cable.

### EXPORT

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

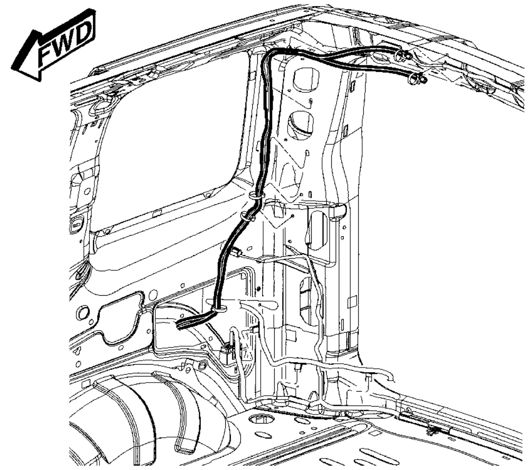


1. Connect antenna cable (1) to the instrument panel antenna cable.
2. Install antenna cable to the roof panel by pressing retaining clips into position.
3. Connect antenna cable to the antenna module (2).
4. Raise headliner into position.
5. Install A-pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION).
6. Install the right side sunvisor (Refer to 23 - BODY/INTERIOR/SUN VISOR - INSTALLATION).
7. Install the assist handles (Refer to 23 - BODY/INTERIOR/ASSIST HANDLE - INSTALLATION).
8. Connect the battery negative cable.

# ANTENNA CABLE - SATELLITE RADIO

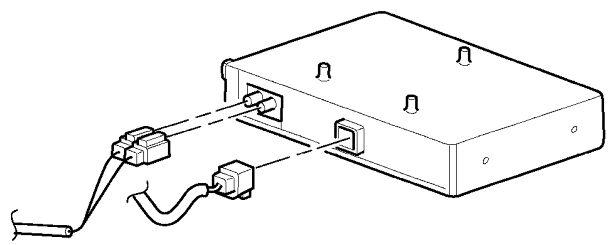
## REMOVAL

1. Disconnect and isolate the battery cable.
2. Remove headliner (Refer to 23 - BODY/INTERIOR/ HEADLINER - REMOVAL).
3. Disconnect antenna cable from antenna.
4. Remove antenna cable retainers from C-pillar and roof panel.




8147d222

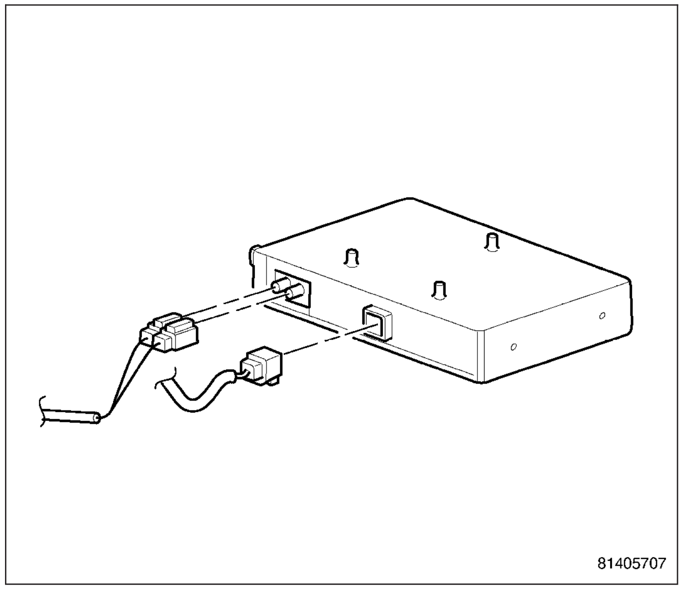
5. Disconnect antenna cable from satellite receiver.



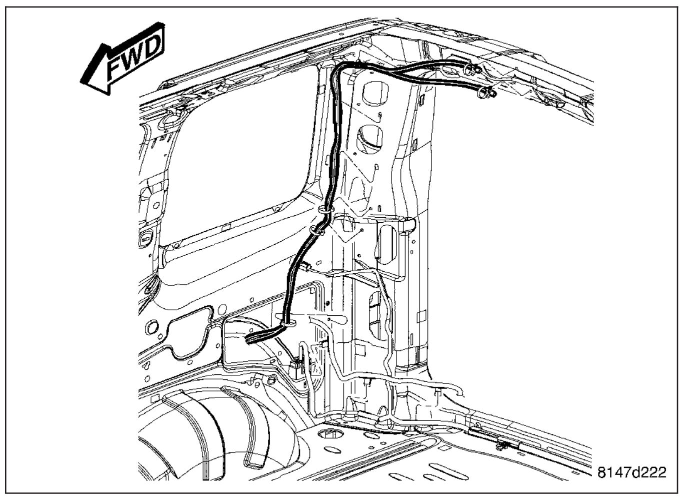
81405707

## INSTALLATION

1. Connect antenna cable to satellite receiver.



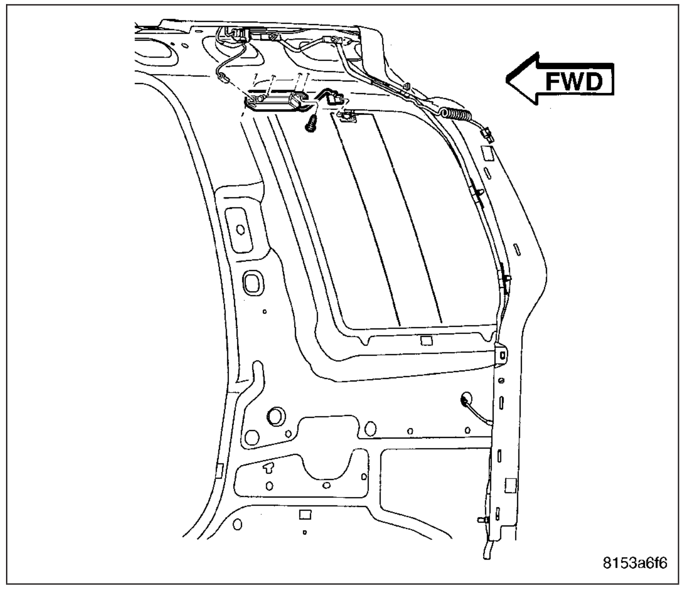

2. Install antenna cable retainers to C-pillar and roof panel.
3. Connect antenna cable to satellite antenna.
4. Install headliner (Refer to 23 - BODY/INTERIOR/ HEADLINER - INSTALLATION).
5. Connect battery negative cable.



# ANTENNA MODULE

## DESCRIPTION

The antenna module is an electromagnetic circuit component designed to capture and enhance radio frequency signals in both the AM and FM broadcast bands. The antenna module is mounted to the right rear roof rail under the headliner. The modules mounting brackets also double as the ground circuit. The module has an electrical connector that connects to the integral radio antenna, located on the right rear quarter glass. There is also an electrical connector for battery voltage and a coax cable connector.




## OPERATION

The antenna module receives both AM and FM radio signals supplied by the side window integral radio antenna system and selectively amplifies them. The amplified signal is then sent through the body length coax cable to the radio input.

## DIAGNOSIS AND TESTING

## ANTENNA MODULE

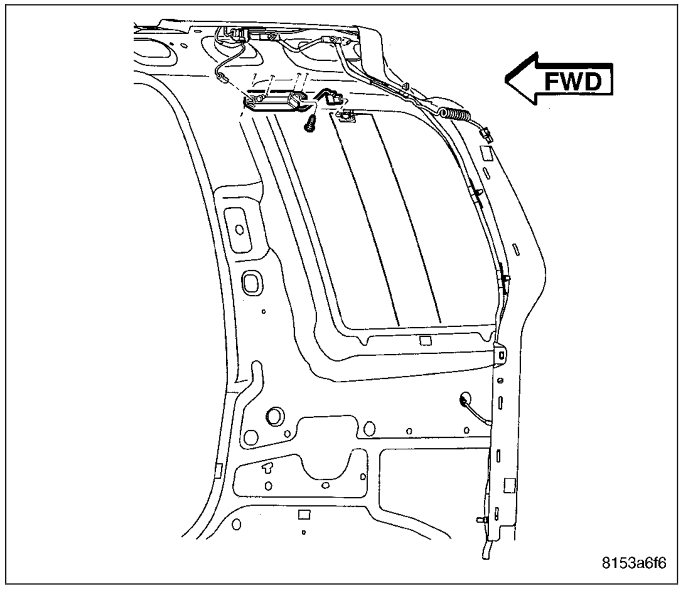
### ANTENNA MODULE DIAGNOSIS TABLE

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| NO AM RECEPTION, WEAK FM RECEPTION | 1. Antenna module to antenna connector open or disconnected. | 1. Repair open, reconnect antenna module connector to glass mounted antenna. |
| | 2. Coax open or disconnected. | 2. Repair open, reconnect coax. |
| | 3. No battery power at antenna module. | 3. Check fuse, if okay, repair open in battery voltage circuit. |
| NO AM OR FM RECEPTION | 1. Coax disconnected at radio. | 1. Reconnect coax. |
| | 2. Coax shorted to ground. | 2. Repair or Replace coax |
| WEAK OR NO AM/FM RECEPTION | 1. Antenna Module faulty. | 1. Substitute known good module. If reception improves, Antenna Module was faulty. |

## REMOVAL

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

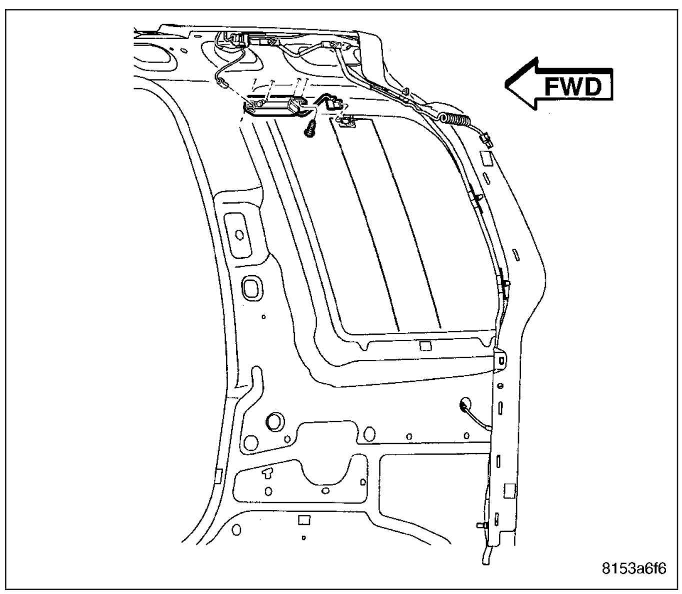
1. Disconnect and isolate the battery negative cable.
2. Remove the headliner as necessary to access antenna module.
3. Disconnect the electrical harness connector from the antenna module.
4. Disconnect the antenna module connector from the integral antenna.
5. Remove the mounting fasteners from the antenna module.
6. Disconnect the coax lead from the antenna module.




## INSTALLATION

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

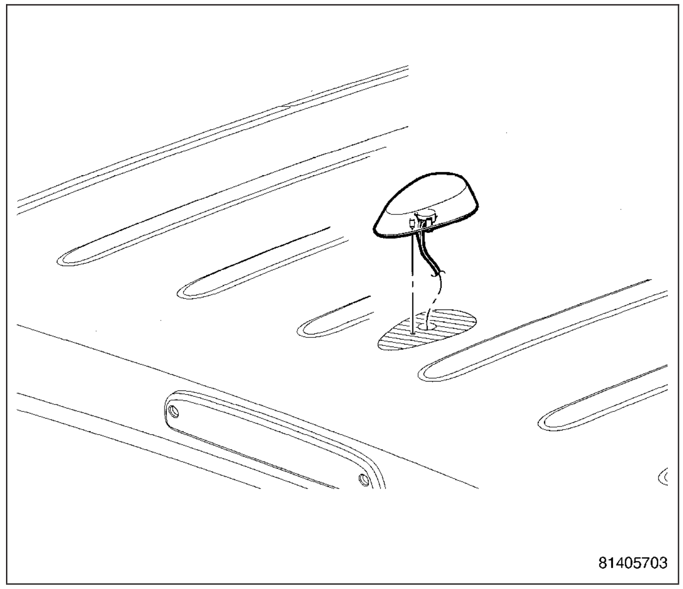
1. Plug coax into antenna module.
2. Position antenna module. Install and tighten mounting fasteners.
3. Connect antenna module lead to the integral antenna.
4. Connect battery power supply lead to antenna module.
5. Install headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION)
6. Connect battery negative cable.



# ANTENNA-SATELLITE RADIO

## DESCRIPTION

The satellite radio antenna is secured by a threaded fastener and two retainers which protrude through a hole in the roof panel. Two antenna cables from the antenna are connected to the satellite receiver.

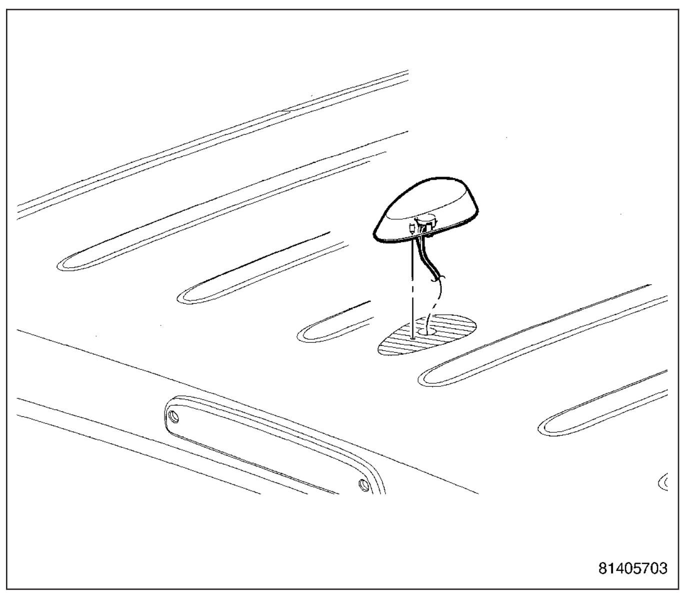



## OPERATION

The satellite radio antenna receives signals from orbiting satellites and sends these signals to the satellite receiver module. The satellite radio antenna must have open space in which to operate. Items carried on the roof, parking inside etc. can have an effect on the antenna's ability to receive signals.

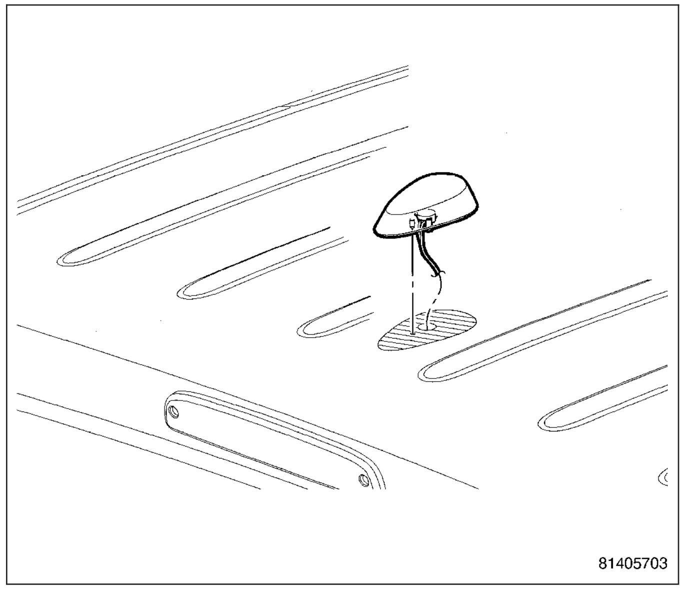
## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the headliner (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL).
3. Disconnect the antenna cables from the antenna.
4. Remove the retaining fastener.
5. From inside the vehicle, and using a flat bladed tool, depress one of the retaining tabs on the antenna. Push up the one side of the antenna connector through the roof panel. Depress the other side of the connector and remove the antenna.



## INSTALLATION

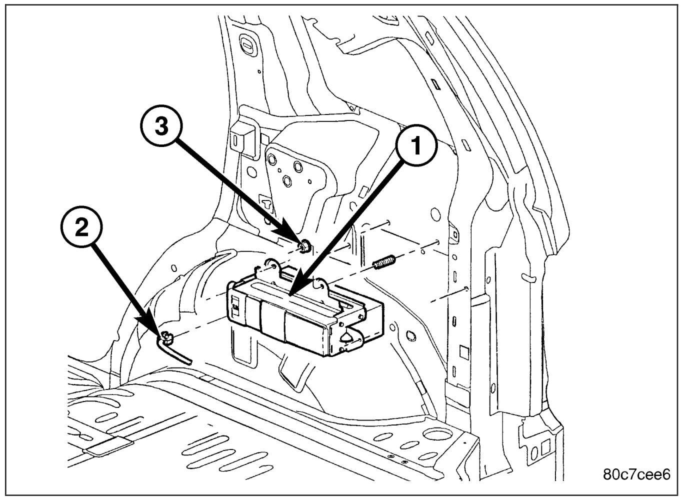
1. Insert wire harness through hole in roof panel. Press antenna into position until both retainers snap into place.
2. Install and tighten the retaining fasteners.
3. Connect antenna cable connectors to antenna.
4. Install headliner (Refer to 23 - BODY/INTERIOR/ HEADLINER - INSTALLATION).
5. Connect battery negative cable.



# CD CHANGER

## DESCRIPTION

The CD changer (if equipped) is mounted in the cargo area of the passenger compartment on the right rear quarter panel.

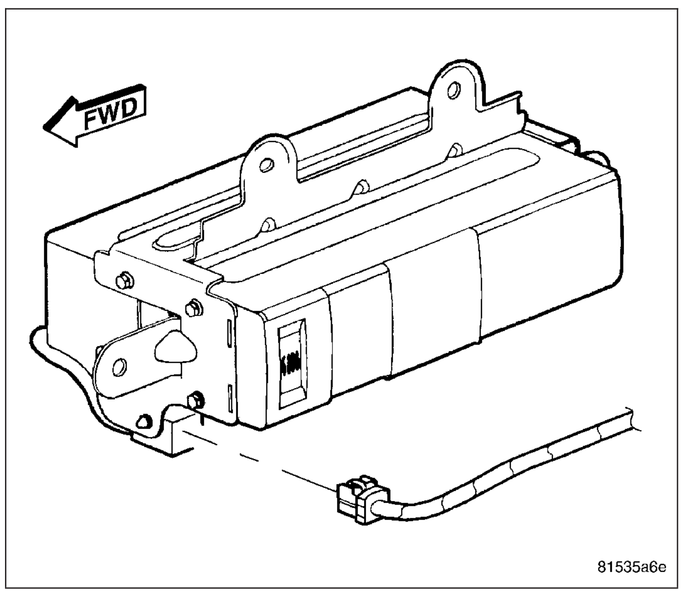



## OPERATION

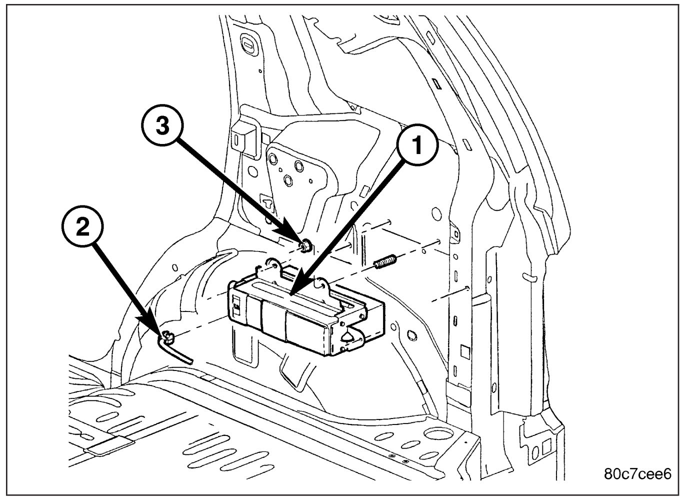
The CD changer will only operate when the ignition switch is in the On or Accessory positions, and the radio is turned on. The six-CD magazine may be ejected with the ignition in the Off position.

## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the right rear quarter trim panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL).
3. Disconnect the electrical wire harness connector.

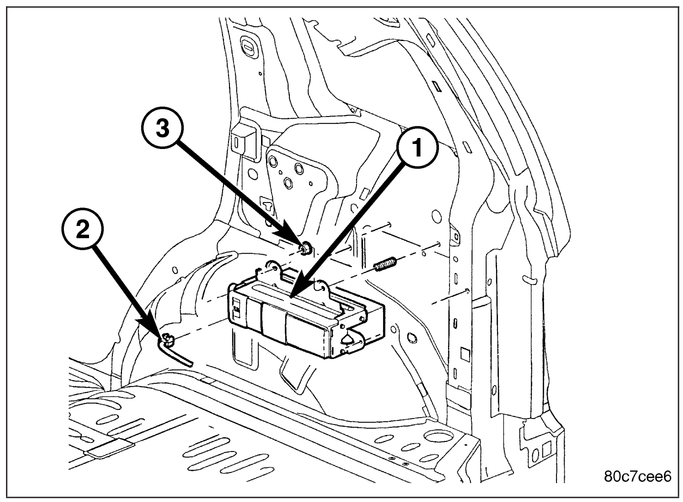


4. Remove the mounting fasteners.
5. Remove the CD Changer (1) from the vehicle.

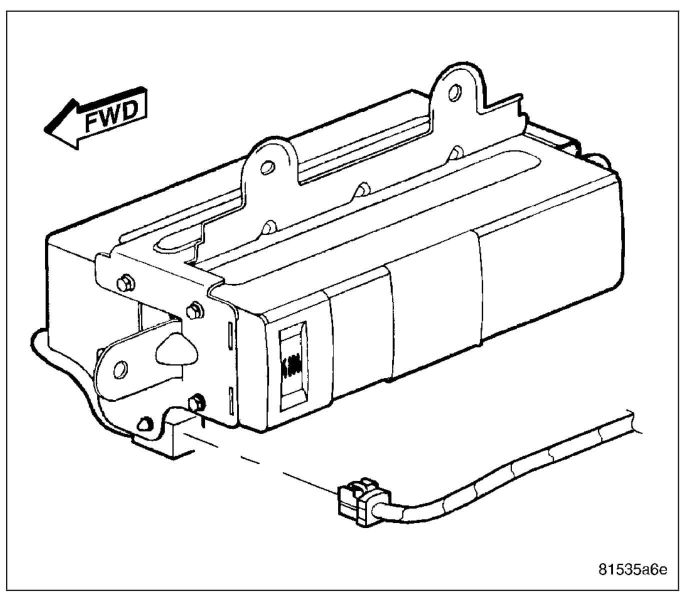



## INSTALLATION

1. Install the CD Changer to the vehicle.
2. Install and tighten the mounting fasteners.




3. Connect the wire harness connector.
4. Install the right rear quarter trim panel (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - INSTALLATION).
5. Connect the battery negative cable.



# INSTRUMENT PANEL ANTENNA CABLE

## REMOVAL

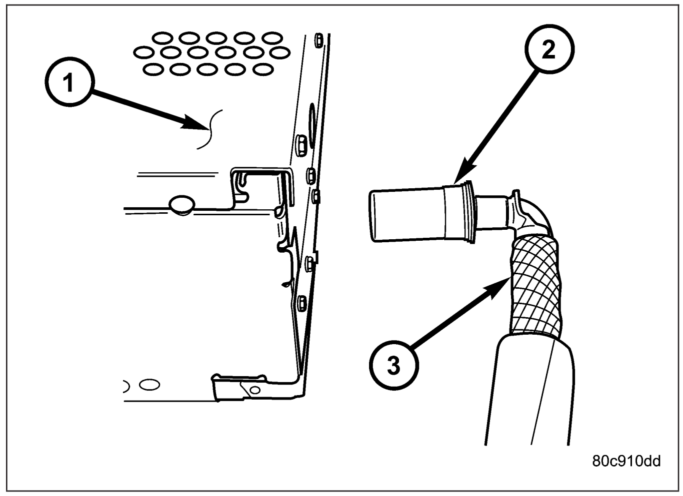
### DOMESTIC

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

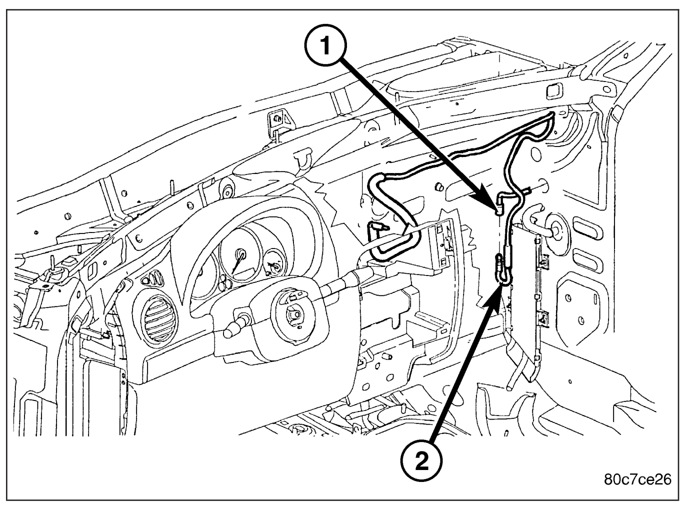
1. Disconnect and isolate the battery negative cable.
2. Remove the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).

**CAUTION: Pulling the antenna cable straight out of the radio without pulling on the locking antenna connector could damage the cable or radio.**

3. Disconnect the antenna cable from radio by pulling the locking antenna connector (2) away from radio.




4. Disengage each of the retainers that secure the cable to the instrument panel.
5. Remove the cable (1) from the instrument panel.



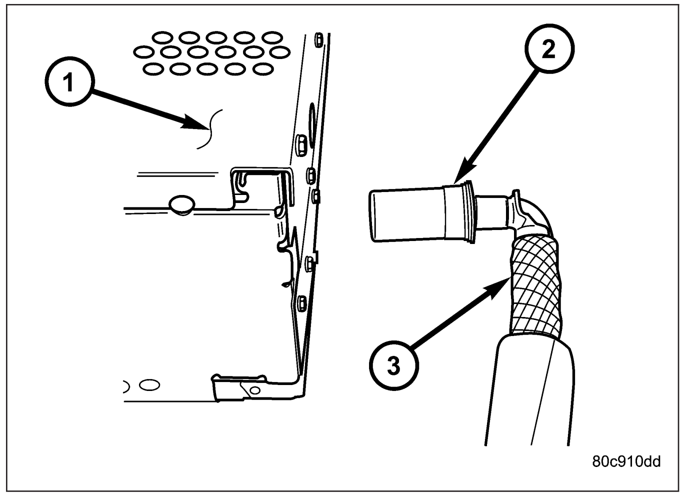

### EXPORT

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

1. Disconnect and isolate the battery negative cable.
2. Remove the instrument panel (Refer to 23 - BODY/ INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).

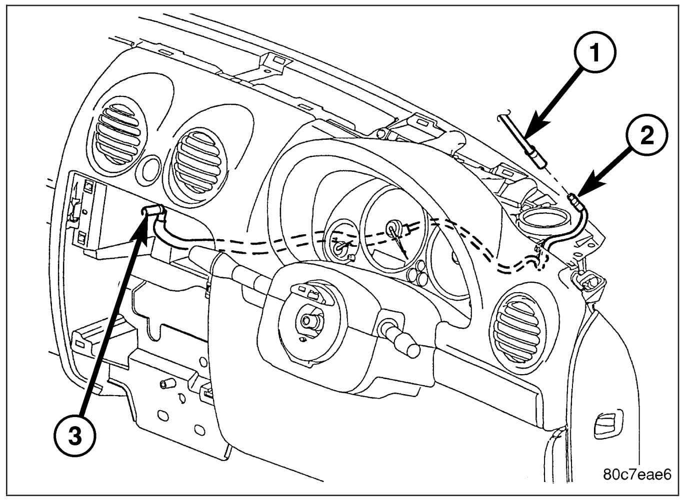
**CAUTION: Pulling the antenna cable straight out of the radio without pulling on the locking antenna connector could damage the cable or radio.**

3. Disconnect antenna cable from radio by pulling on the locking antenna connector (2)




.

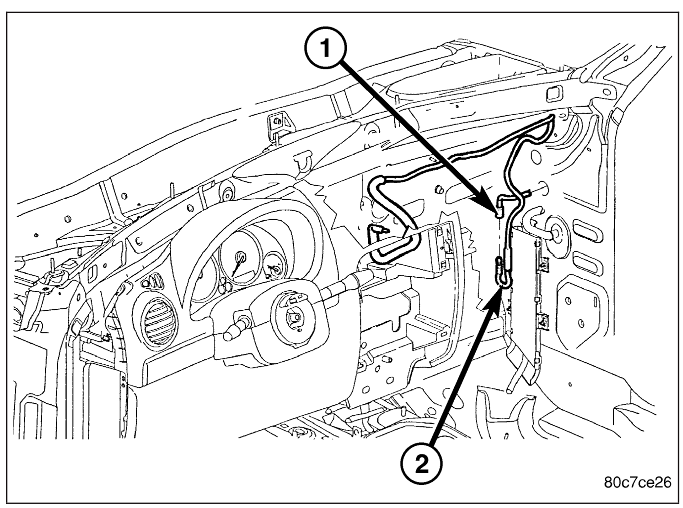
4. Disengage each of the retainers that secure the cable (2) to the instrument panel.




## INSTALLATION

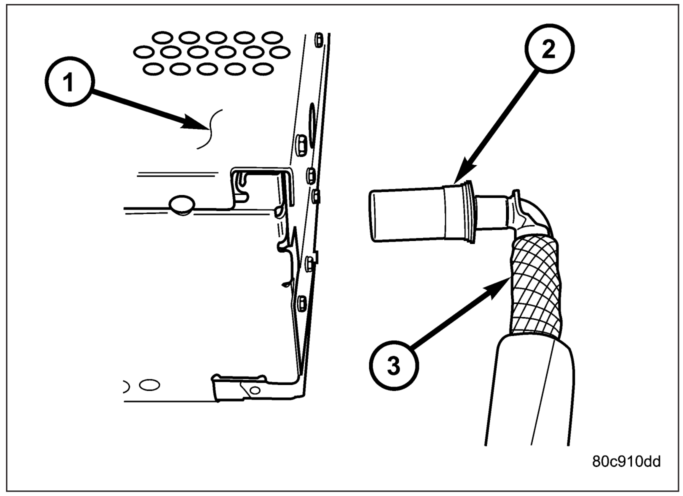
### DOMESTIC

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental air-bag deployment and possible personal injury.**




1. Position the instrument panel antenna cable onto the instrument panel.
2. Engage each of the retainers that secure the cable to the back side of the instrument panel.

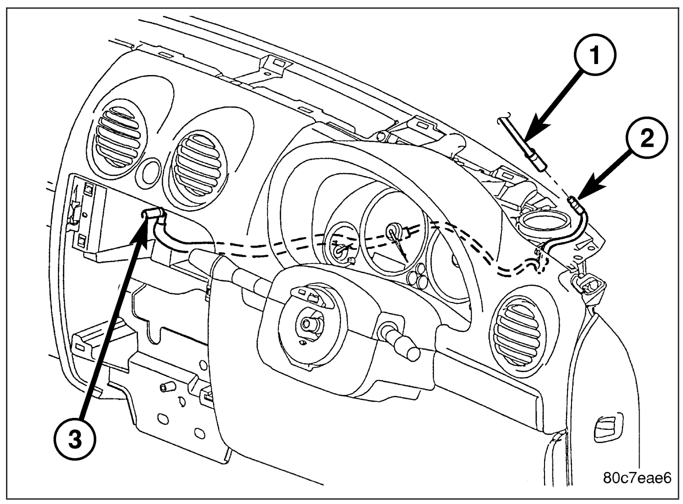
3. Connect cable to radio.
4. Install instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).
5. Connect the battery negative cable.



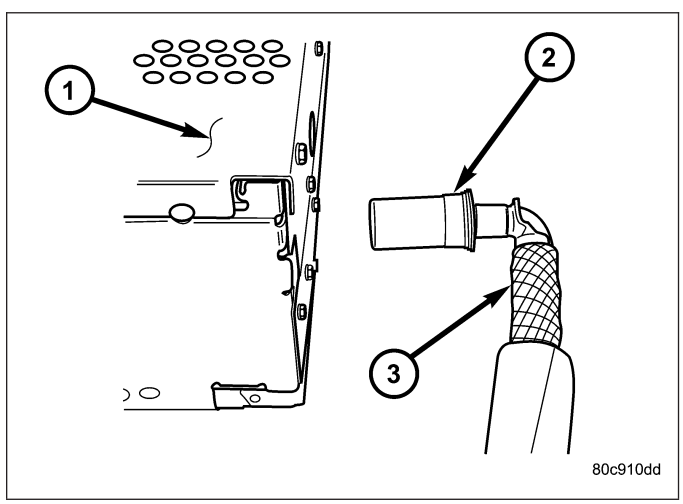

## EXPORT

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

1. Position the instrument panel antenna cable onto the instrument panel.
2. Engage each of the retainers that secure the cable (2) to the back side of the instrument panel.



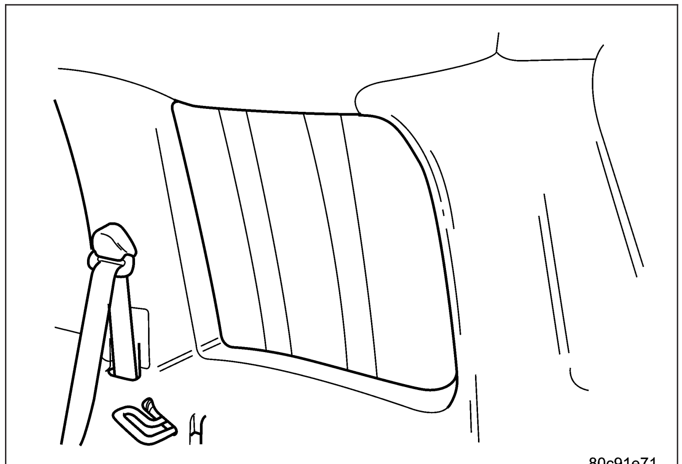

3. Connect cable to radio.
4. Install instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).
5. Connect the battery negative cable.



# QUARTER GLASS INTEGRAL ANTENNA

## DESCRIPTION

The integral radio antenna element is bonded to the right rear quarter glass and is replaced with the glass assembly only.


80c91e71

## OPERATION

The integral antenna receives radio frequencies and sends them to the antenna module for amplification.

## DIAGNOSIS AND TESTING - QUARTER GLASS INTEGRAL ANTENNA

The antenna grid pattern connects to the terminal tab for both AM and FM.

For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds. To detect breaks in the integral antenna elements, the following procedure is required:

1. Disconnect the antenna module connector from the antenna terminals on the glass.
2. Using an ohmmeter, place a lead on one of the terminals and check each end of the grid pattern connected to this terminal for continuity. If continuity is not present, move one lead through the grid in progression starting at the terminal with the other lead on the terminal until continuity is lost. A break in the antenna grid can be repaired using a Mopar Rear Window Defogger Repair Kit (Part Number 4267922) or equivalent (Refer to 8 - ELECTRICAL/HEATED GLASS - STANDARD PROCEDURE).

# RADIO

## DESCRIPTION

### RADIO

Available radios include:

- AM/FM/cassette with CD changer control feature (RBB sales code)
- AM/FM/cassette/CD/ with CD changer control feature (RAZ sales code)
- AM/FM/CD with CD changer control feature (RBK sales code)
- AM/FM/ 6 CD in-dash changer (RBQ sales code)
- AM/FM/cassette/CD with CD changer control feature (RAD, RBT or RBY sales code) - export only
- AM/FM/CD (REK sales code) - export only
- AM/FM/DVD with GPS navigation (RB1 sales code)
- AM/FM/DVD with GPS navigation (RB3 sales code) - export only

All radio receivers can communicate on the Programmable Communications Interface (PCI) data bus network.

### COUNTRY CODE AND CABIN EQ SETTING - REK RADIO ONLY

The REK radio may require the country code and cabin EQ setting to be set if not programmed correctly.

**If battery power is lost to radio, the anti-theft code must be entered before radio will operate.**

If the region the vehicle will be driven in uses 10 kHz spacing on the AM band (i.e. 950, 960 etc.), set the Country Code to "USA". If the region uses 9 kHz spacing, has LW and MW Bands, and uses RDS (i.e. AF, PTY, TA, etc.), set the radio for "EUR". If neither of the previous settings apply, and the vehicle is not being driven in Japan, set the radio to "ROW". Vehicles driven in Japan should have the radio set to "JPN". The following chart list selected country codes and radio broadcast standards.

To enter the country code and EQ setting, use a scan tool.

**COUNTRY CODE SELECTION CHART**

| INTERNATIONAL COUNTRY CODE | RADIO BROADCAST STD. |
|---|---|
| AFGHANISTAN (8AA) | ROW |
| ALBANIA (8BA) | ROW |
| ALGERIA (8AC) | EUR |
| AMERICAN SAMOA (8AD) | ROW |
| ANDORRA (8AE) | ROW |
| ANGOLA (8AF) | ROW |
| ANGUILLA (8HA) | USA |
| ANTARCTICA (8HB) | ROW |
| ANTIGUA (8AG) | USA |
| ARGENTINA (8AJ) | USA |
| ARMENIA (8HC) | EUR |
| ARUBA (8AK) | USA |
| AUSTRALIA (8AL) | ROW |
| AUSTRIA (8AM) | EUR |
| AZERBAIJAN (8HD) | ROW |
| AZORES (8AN) | USA |
| BAHAMAS (8AP) | USA |
| BAHRAIN (8AR) | ROW |

| INTERNATIONAL COUNTRY CODE | RADIO BROADCAST STD. |
|---|---|
| BANGLADESH (8AS) | ROW |
| BARBADOS & ISLANDS (8AT) | ROW |
| BELARUS (8G5) | EUR |
| BELGIUM & LUXEMBOURG (8AU) | EUR |
| BELIZE (8AV) | USA |
| BENIN (8WA) | ROW |
| BERMUDA (8AX) | USA |
| BOLIVIA (8AY) | USA |
| BOSNIA-HERZEGOVINA (8HE) | ROW |
| BOTSWANA (8AZ) | ROW |
| BRAZIL (8A1) | USA |
| BRITISH INDIA OCEAN (8A2) | ROW |
| BRITISH VIRGIN ISLANDS (8A3) | USA |
| BRUNEI (8A4) | ROW |
| BULGARIA (8A5) | EUR |
| BURKINA FASO (8GM) | ROW |
| CAMBODIA/ KAMPUCHEA (8DG) | ROW |
| CAMEROON (8A9) | ROW |
| CANARY ISLANDS (8BB) | ROW |
| CAPE VERDE (8BD) | ROW |
| CAYMAN ISLANDS (8BF) | USA |
| CENTRAL AFRICAN REPUBLIC (8BG) | ROW |
| CHAD (8BJ) | ROW |
| CHILE (8BK) | USA |
| CHINA MAINLAND (8BL) | ROW |
| COLOMBIA (8BM) | USA |
| COMOROS (8BN) | ROW |
| CONGO (8BP) | ROW |
| COSTA RICA (8BS) | USA |
| CROATIA (8G7) | EUR |
| CUBA (8BT) | USA |
| CYPRUS (8BB) | EUR |
| CZECH. REPUBLIC (8BW) | EUR |
| DENMARK (8BX) | EUR |
| DJIBOUTI (8BU) | ROW |
| DOMINICA (8BZ) | USA |

| INTERNATIONAL COUNTRY CODE | RADIO BROADCAST STD. |
|---|---|
| DOMINICAN REPUBLIC (8B1) | USA |
| ECUADOR (8B2) | USA |
| EGYPT (8B3) | ROW |
| EL SALVADOR (8B4) | USA |
| EQUATORIAL GUINEA (8B5) | ROW |
| ERITREA (8BU) | ROW |
| ESTONIA (8B6) | EUR |
| ETHIOPIA (8B7) | ROW |
| FAEROE ISLANDS (8HG) | ROW |
| FAUKLAND ISLANDS (8B8) | ROW |
| FIJI (8B9) | EUR |
| FINLAND (8CA) | EUR |
| FRANCE (8CD) | EUR |
| FRENCH GUIANA ( 8CC) | ROW |
| FRENCH POLYNESIA / TAHITI (8F9) | ROW |
| GABON (8CF) | ROW |
| GAMBIA (8CG) | ROW |
| GEORGIA (8HH) | EUR |
| GERMANY (8CJ) | EUR |
| GHANA (8CK) | ROW |
| GIBRALTAR (8CL) | ROW |
| GREECE (8CP) | EUR |
| GREENLAND (8CR) | EUR |
| GRENADA (8CS) | USA |
| GUADELOUPE (8CT) | ROW |
| GUAM (8CU) | ROW |
| GUATEMALA (8CV) | USA |
| GUINEA (8CW) | ROW |
| GUINEA - BISSAU (8CX) | ROW |
| GUYANA (8CY) | USA |
| HAITI (8CZ) | USA |
| HONDURAS (8C1) | USA |
| HONG KONG (8C2) | ROW |
| HUNGARY (8C3) | EUR |
| ICELAND (8C4) | EUR |
| INDIA (8C5) | ROW |
| INDONESIA (8C6) | ROW |
| IRAN (8C7) | ROW |
| IRAQ (8C8) | ROW |
| IRELAND (8C9) | EUR |

| INTERNATIONAL COUNTRY CODE | RADIO BROADCAST STD. |
|---|---|
| ISRAEL (8DA) | ROW |
| ITALY (8DB) | EUR |
| IVORY COAST (8DC) | ROW |
| JAMAICA (8DD) | USA |
| JAPAN (8DE) | JAN |
| JORDAN (8DF) | ROW |
| KAZAKSTAN (8G6) | EUR |
| KENYA (8DH) | ROW |
| KIRIBATI/GILBERT (8HJ) | ROW |
| KUWAIT (8DK) | ROW |
| KYRGYZSTAN (8HK) | EUROPEAN |
| LAOS (8DM) | ROW |
| LATVIA (8G2) | EUR |
| LEBANON (8DN) | ROW |
| LESOTHO (8DP) | ROW |
| LIBERIA (8DR) | ROW |
| LITHUANIA (8G3) | EUR |
| LIBYA (8DT) | ROW |
| MACAO (8DU) | ROW |
| MALAGASY/ MADAGASCAR (8DW) | ROW |
| MALAWI (8DX) | ROW |
| MALAYSIA (8DY) | ROW |
| MALDIVES (8DZ) | ROW |
| MALI (8D1) | ROW |
| MALTA & GOZO (8D2) | ROW |
| MARSHALL ISLANDS (8D4) | ROW |
| MARTINIQUE (8D5) | ROW |
| MAURITANIA (8D6) | ROW |
| MAURITIUS (8D7) | ROW |
| MAYOTTE (8HL) | ROW |
| MEXICO (8D9) | USA |
| MICRONESIA (8BE) | ROW |
| MOLDOVA (8HM) | EUR |
| MONACO (8EF) | EUR |
| MONGOLIA (8EE) | ROW |
| MOROCCO (8EG) | EUR |
| MOZAMBIQUE (8PH) | ROW |
| NAMIBIA (8EJ) | ROW |
| NEPAL (8EL) | ROW |
| NETHERLANDS (8EM) | EUR |

| INTERNATIONAL COUNTRY CODE | RADIO BROADCAST STD. |
|---|---|
| NETHERLANDS ANTILLES/CURACAO (8HN) | USA |
| NEW CALEDONIA (8EN) | ROW |
| NEW ZEALAND (8EP) | ROW |
| NICARAGUA (8ER) | USA |
| NIGER (8ES) | ROW |
| NIGERIA (8ET) | ROW |
| NORTH KOREA (8EV) | ROW |
| NORWAY (8EW) | EUR |
| OMAN (8EX) | ROW |
| PAKISTAN (8EY) | ROW |
| PANAMA (8EZ) | USA |
| PAPUA NEW GUINEA (8E1) | ROW |
| PARAGUAY (8E2) | USA |
| PERU (8E4) | USA |
| PHILIPPINES (8E5) | ROW |
| POLAND (8E7) | EUR |
| PORTUGAL (8E8) | EUR |
| PUERTO RICO (8E9) | USA |
| QATAR (8FA) | ROW |
| ROMANIA (8FB) | EUR |
| RUSSIA (8FE) | EUR |
| RWANDA (8FD) | ROW |
| SAO TOME (8FG) | ROW |
| SAUDI ARABIA (8FH) | ROW |
| SENEGAL (8FJ) | ROW |
| SERBIA (8HS) | EUR |
| SEYCHELLES (8FK) | ROW |
| SIERRA LEONE (8FL) | ROW |
| SINGAPORE (8FM) | ROW |
| SLOVAKIA (8CE) | EUR |
| SLOVENIA (8GX) | EUR |
| SOLOMON ISLANDS (8FN) | ROW |
| SOMALIA (8FP) | ROW |
| SOUTH AFRICA (8FR) | ROW |
| SOUTH KOREA (8DJ) | ROW |
| SPAIN (8FS) | EUR |
| SRI LANKA (8FT) | EUR |
| ST. KITTS AND NEVIS (8FU) | USA |
| ST. LUCIA (8FX) | USA |

| INTERNATIONAL COUNTRY CODE | RADIO BROADCAST STD. |
|---|---|
| ST. PIERRE & MIQUELON (8FZ) | USA |
| ST. THOMAS & U.S. VIRGIN ISLANDS (8F1) | USA |
| ST. VINCENT (8F2) | USA |
| SUDAN (8F3) | ROW |
| SURINAME (8F4) | ROW |
| SWAZILAND (8F5) | EUR |
| SWEDEN (8F6) | EUR |
| SWITZERLAND (8F7) | EUR |
| SYRIA (8F8) | ROW |
| TAIWAN (8GA) | ROW |
| TAJIKISTAN (8HT) | EUR |
| TANZANIA (8GB) | ROW |
| THAILAND (8GC) | ROW |
| TOGO (8GD) | ROW |
| TONGA (8GE) | ROW |
| TRINIDAD & TOBAGO (8GF) | USA |
| TUNISIA (8GG) | EUR |
| TURKEY (8GH) | ROW |
| TURKMENISTAN (8HV) | EUR |
| TURKS & CAICOS ISLAND (8GJ) | USA |
| TUVALU (8CM) | ROW |
| UGANDA (8GK) | ROW |
| UKRAINE (8FC) | EUR |
| UNITED ARAB EMIRATES (8GL) | ROW |
| UNITED KINGDOM (8CN) | EUR |
| URUGUAY (8GN) | USA |
| UZBEKISTAN (8HW) | EUR |
| VANUATU (8GP) | ROW |
| VATICAN CITY (8GR) | EUR |
| VENEZUELA (8GS) | USA |
| VIETNAM (8GT) | ROW |
| WALLIS & FUTUNA (8GV) | ROW |
| WESTERN SAMOA (8GW) | ROW |
| YEMEN (8AH) | ROW |
| YUGOSLAVIA (8HR) | EUR |
| ZAIRE (8GY) | ROW |
| ZAMBIA (8GZ) | ROW |

| INTERNATIONAL COUNTRY CODE | RADIO BROADCAST STD. |
|---|---|
| ZIMBABWE (8G1) | ROW |

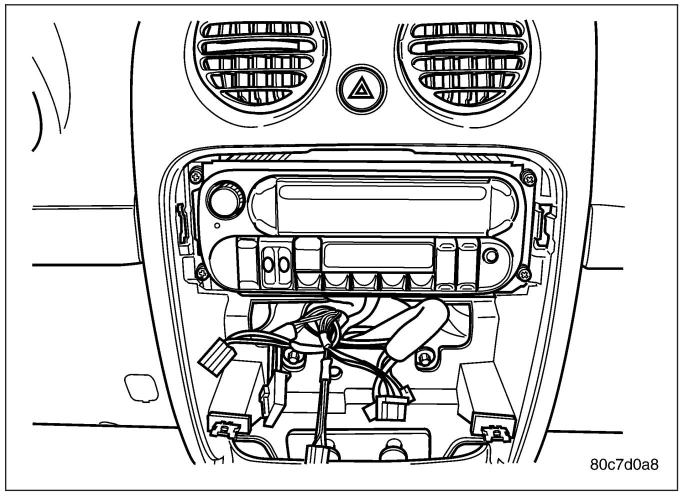
## OPERATION

The radio receiver operates on ignition switched battery current that is available only when the ignition switch is in the On or Accessory positions. The electronic digital clock function of the radio operates on fused battery current supplied through the IOD fuse, regardless of the ignition switch position.

For complete circuit diagrams, refer to the appropriate wiring information.

## REMOVAL

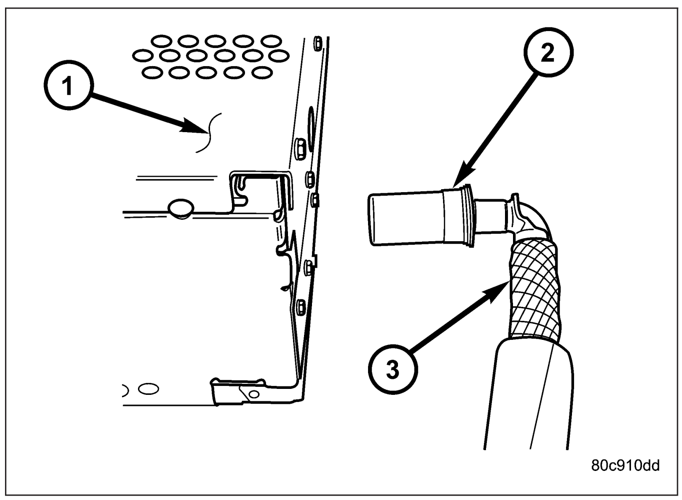
1. Disconnect and isolate the battery negative cable.
2. Remove the instrument panel center trim panel.
3. Remove the radio mounting fasteners.



80c7d0a8

**CAUTION: Pulling the antenna cable straight out of the radio without pulling on the locking antenna connector could damage the cable or radio.**

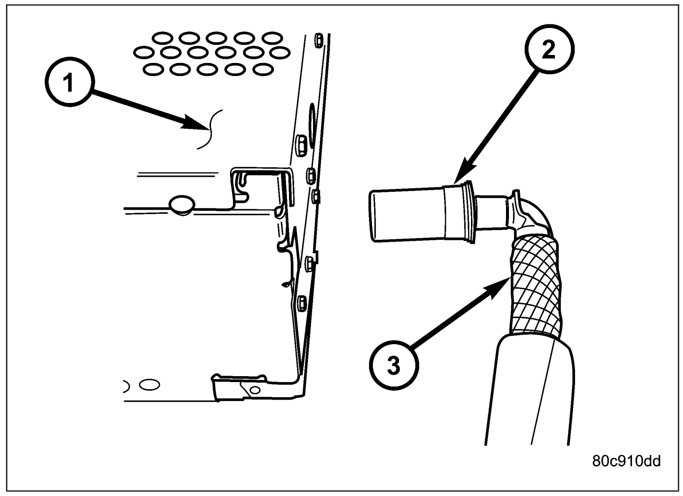
4. Disconnect the antenna cable by pulling the locking antenna connector (2) away from the radio.
5. Disconnect the electrical harness connector(s).
6. Remove radio from instrument panel.



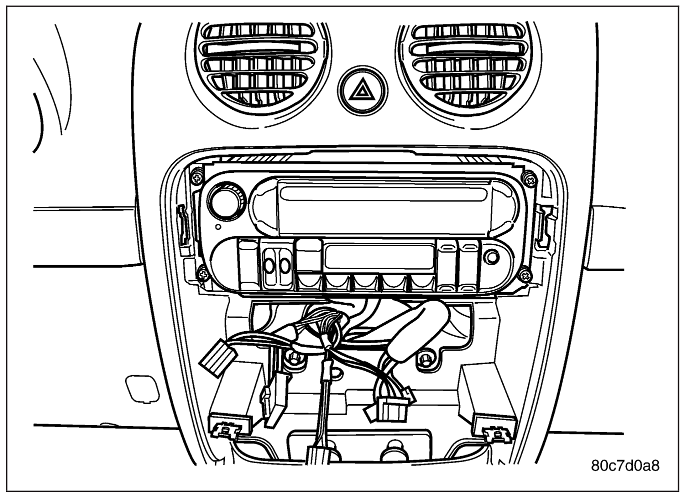

80c910dd

## INSTALLATION

1. Connect the wire harness connector(s).
2. Connect the antenna cable.




3. Install the radio to the instrument panel.
4. Install and tighten the radio mounting fasteners.
5. Install the instrument panel center trim panel.
6. Connect the battery negative cable.



# RADIO NOISE SUPPRESSION COMPONENTS

## DESCRIPTION

Radio Frequency Interference (RFI) and ElectroMagnetic Interference (EMI) can be produced by any on-board or external source of electromagnetic energy. These electromagnetic energy sources can radiate electromagnetic signals through the air, or conduct them through the vehicle electrical system.

When the audio system converts RFI or EMI to an audible acoustic wave form, it is referred to as radio noise. This undesirable radio noise is generally manifested in the form of “buzzing,” “hissing,” “popping,” “clicking,” “crackling,” and/or “whirring” sounds. In most cases, RFI and EMI radio noise can be suppressed using a combination of vehicle and component grounding, filtering and shielding techniques. This vehicle is equipped with factory-installed radio noise suppression devices that were designed to minimize exposure to typical sources of RFI and EMI; thereby, minimizing radio noise complaints.

Radio noise suppression is accomplished primarily through circuitry or devices that are integral to the factory-installed radios, audio power amplifiers and other on-board electrical components such as generators, wiper motors, blower motors, and fuel pumps that have been found to be potential sources of RFI or EMI. External radio noise suppression devices that are used on this vehicle to control RFI or EMI, and can be serviced, include the following:

- **Engine-to-body ground strap -** This length of braided ground strap has an eyelet terminal connector crimped to each end. One end is secured to the engine cylinder head(s). The other is secured to the plenum.
- **Resistor-type spark plugs -** This type of spark plug has an internal resistor connected in series between the spark plug terminal and the center electrode to help reduce the production of electromagnetic radiation that can result in radio noise.

## OPERATION

There are two common strategies that can be used to suppress Radio Frequency Interference (RFI) and ElectroMagnetic Interference (EMI) radio noise. The first suppression strategy involves preventing the production of RFI and EMI electromagnetic signals at their sources. The second suppression strategy involves preventing the reception of RFI and EMI electromagnetic signals by the audio system components.

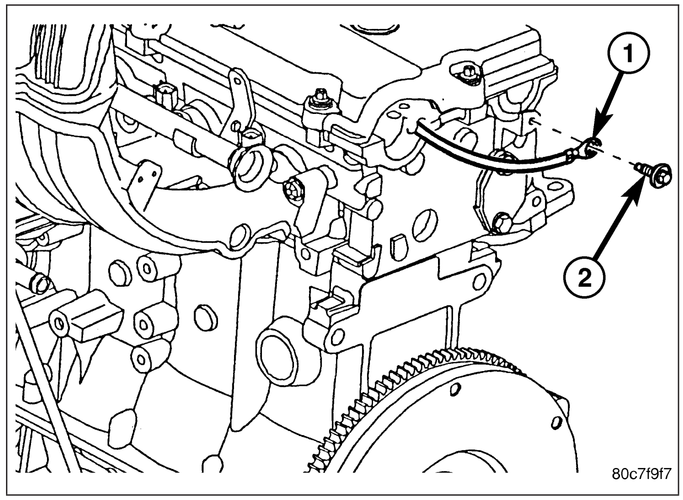
The use of braided ground straps in key locations is part of the RFI and EMI prevention strategy. These ground straps ensure adequate ground paths, particularly for high current components such as many of those found in the starting, charging, ignition, engine control and transmission control systems. An insufficient ground path for any of these high current components may result in radio noise caused by induced voltages created as the high current seeks alternative ground paths through components or circuits intended for use by, or in close proximity to the audio system components or circuits.

Preventing the reception of RFI and EMI is accomplished by ensuring that the audio system components are correctly installed in the vehicle. Loose, corroded or improperly soldered wire harness connections, improperly routed wiring and inadequate audio system component grounding can all contribute to the reception of RFI and EMI. A properly grounded antenna body and radio chassis, as well as a shielded antenna coaxial cable with clean and tight connections will each help reduce the potential for reception of RFI and EMI.

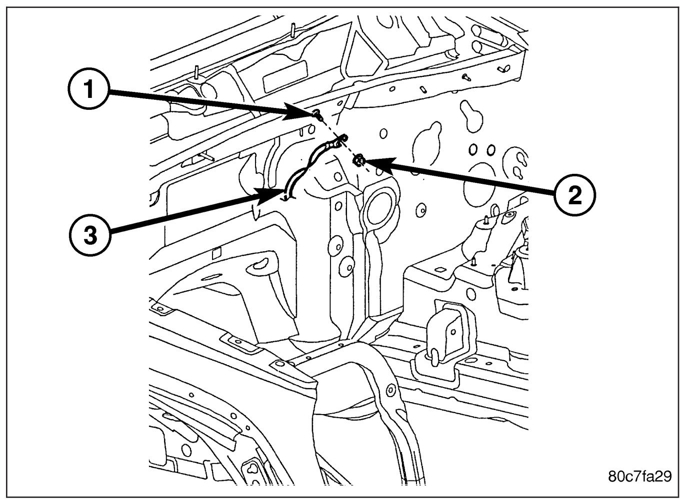
## REMOVAL

### 2.4L ENGINE

1. Disconnect and isolate the battery negative cable.
2. Remove the retaining bolt (2) from the engine cylinder head.

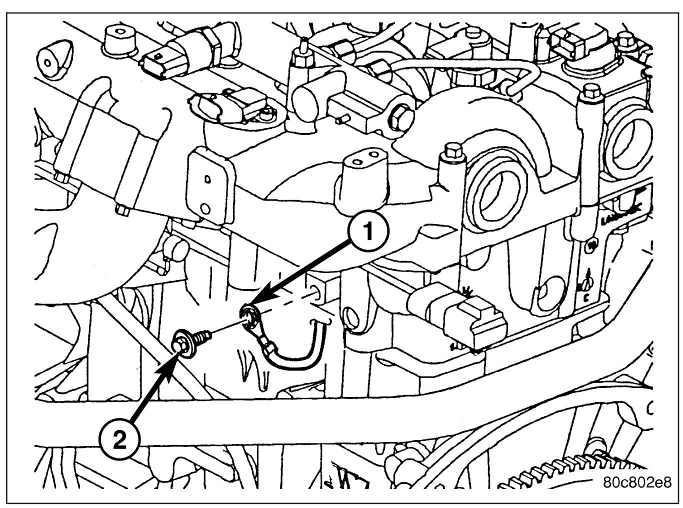



3. Remove the retaining nut (2) from the plenum.

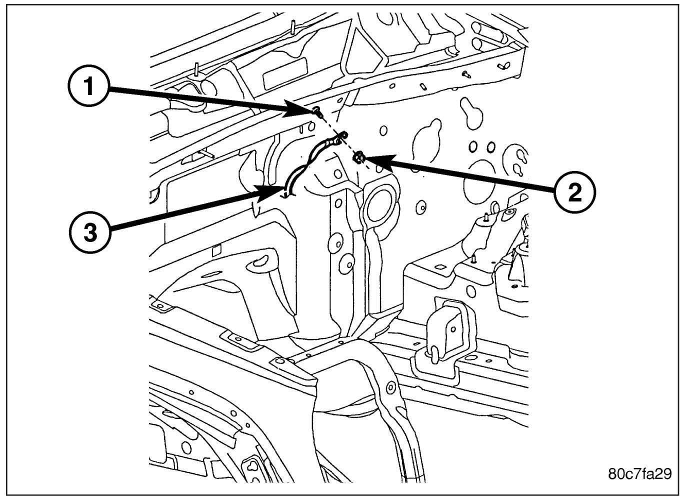



### 2.5L ENGINE

1. Disconnect and isolate the battery negative cable.
2. Remove the retaining bolt (2) from the engine cylinder head.

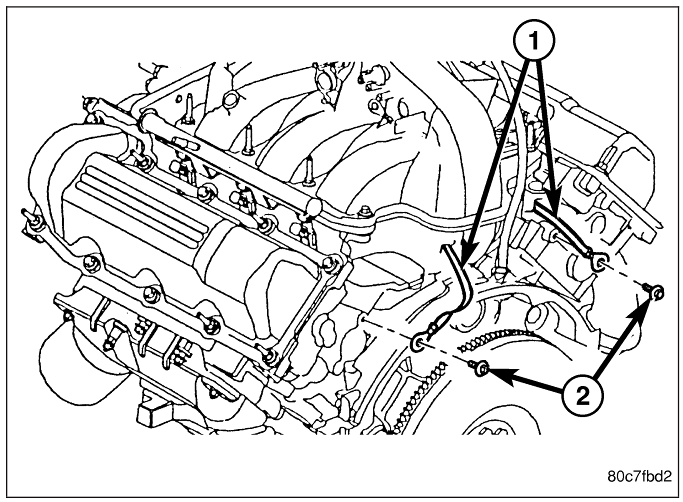


3. Remove the retaining nut (2) from the plenum.

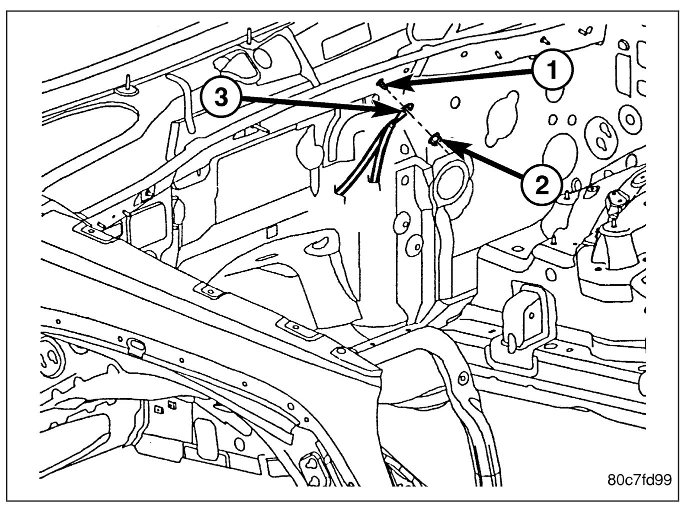



## 3.7L ENGINE

1. Disconnect and isolate the battery negative cable.
2. Remove the retaining bolts (2) from the engine cylinder heads.



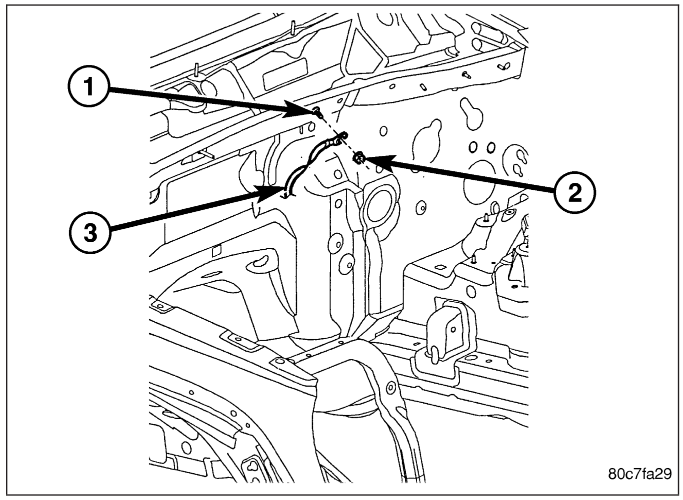

3. Remove the retaining nut (2) from the plenum.



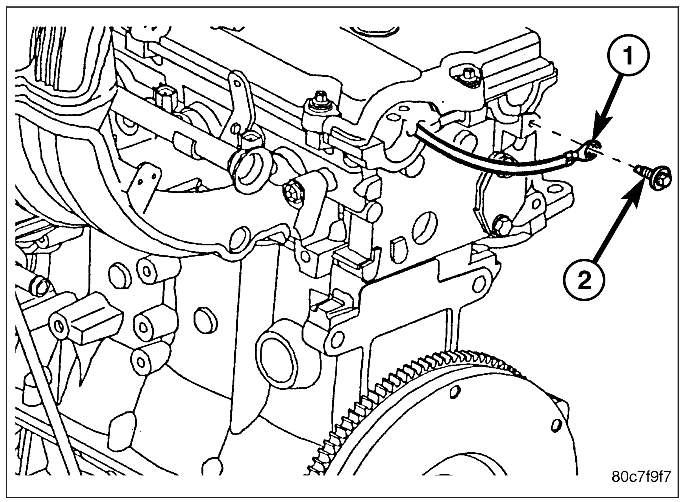
## INSTALLATION

### 2.4L ENGINE

1. Install the retaining nut and ground strap to the plenum.

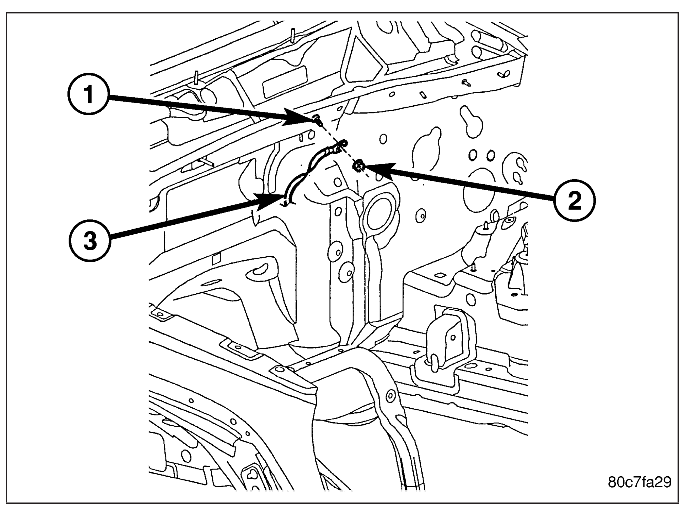



2. Install the retaining bolt and ground strap to the engine cylinder head.
3. Connect the battery negative cable.

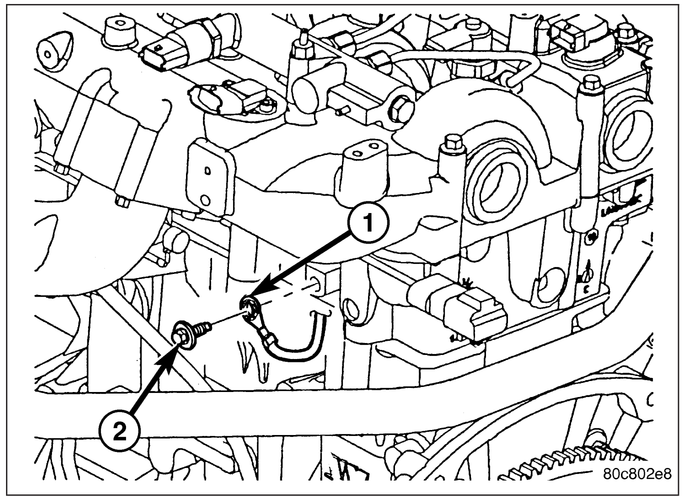



### 2.5L ENGINE

1. Install the retaining nut and ground strap to the plenum.

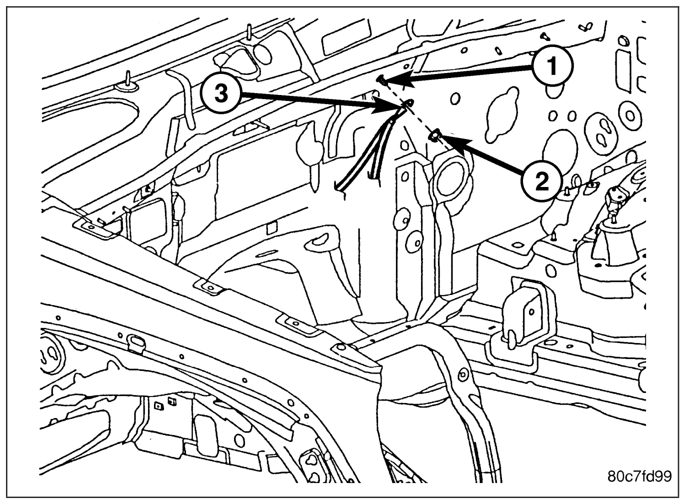


2. Install the retaining bolt and ground strap to the engine cylinder head.
3. Connect the battery negative cable.

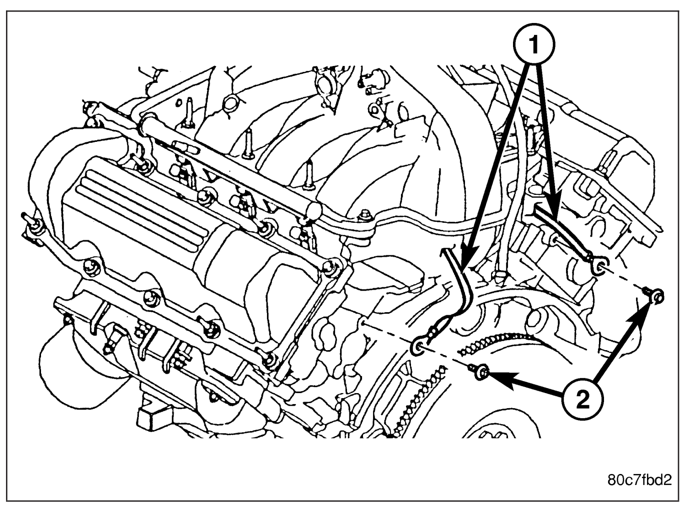



### 3.7L ENGINE

1. Install the retaining nut and ground strap to the plenum.



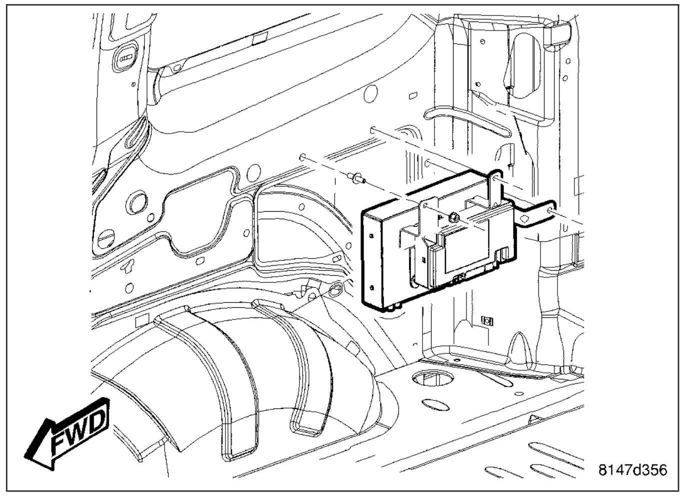

2. Install the retaining bolts and ground strap to the engine cylinder heads.
3. Connect the battery negative cable.



# RECEIVER-SATELLITE

## DESCRIPTION

The satellite receiver is located behind the right rear quarter trim.

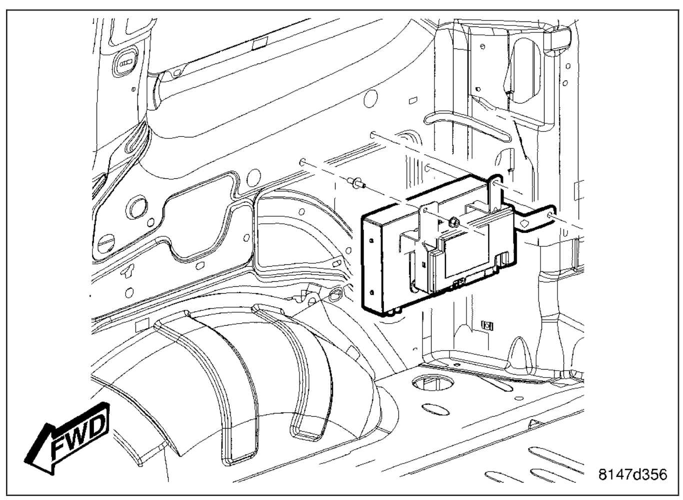



## OPERATION

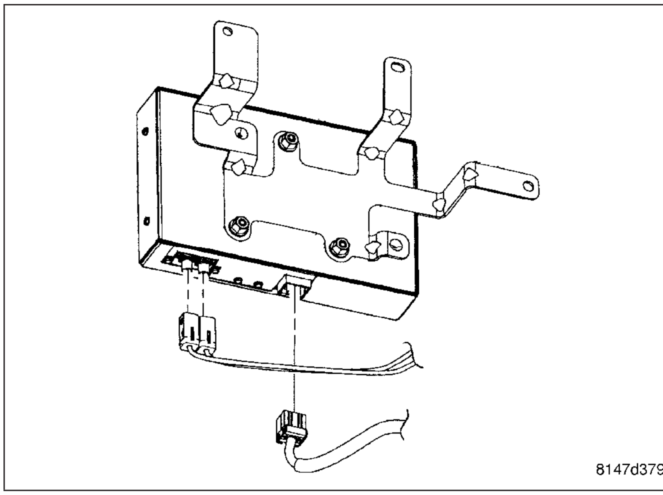
The satellite receiver module receives signals from the roof mounted antenna and processes this information before it is sent to the radio. The module operates on both battery feed circuits and CAN bus messages. It will operate with the ignition key in the run or accessory position only.

## REMOVAL

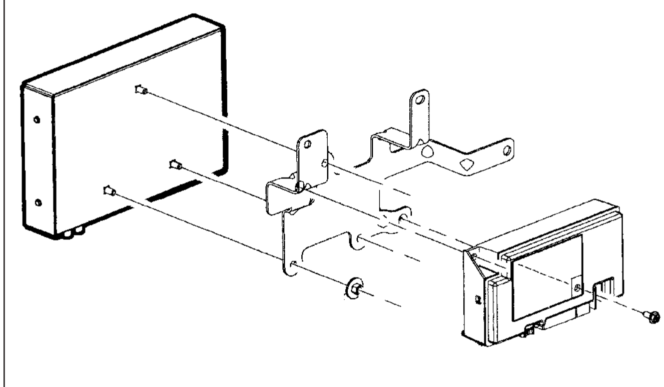
1. Disconnect and isolate the battery negative cable.
2. Remove the right quarter trim panel (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL).
3. Remove mounting fasteners.



4. Disconnect electrical harness connector.

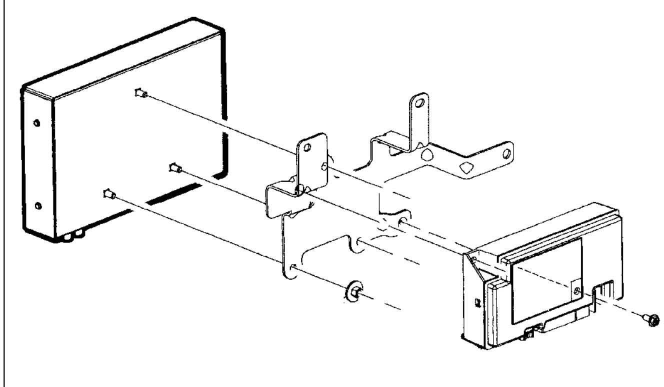

8147d379

5. Remove the hands free module from the mounting bracket.
6. Remove the satellite module mounting fasteners.

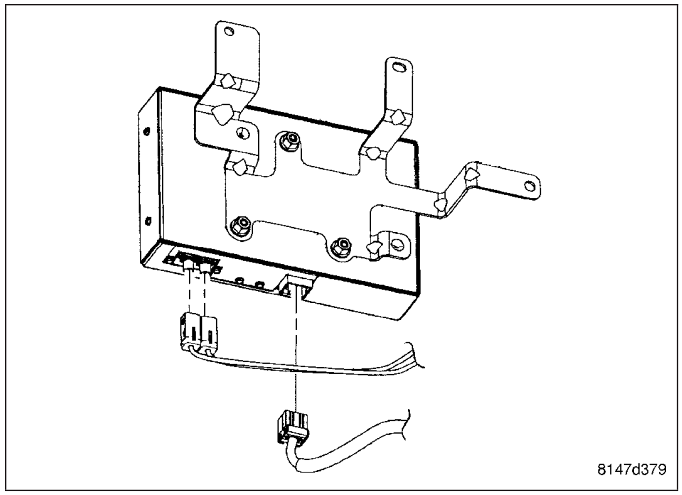

8147d394

## INSTALLATION

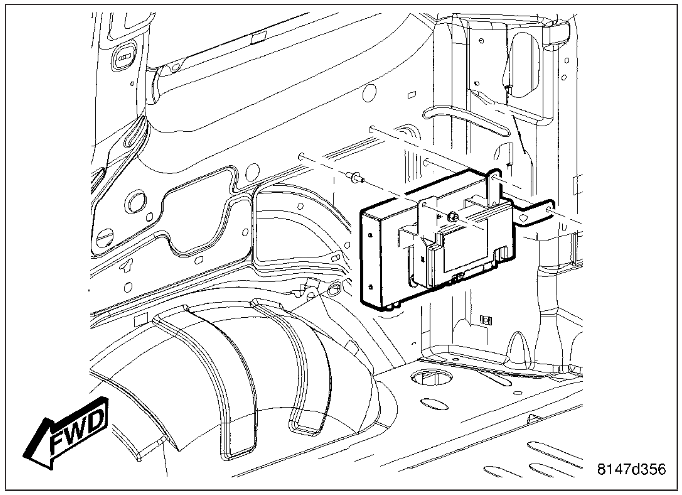
1. Position satellite module to bracket.
2. Install and tighten mounting fasteners.
3. Position hands free module to bracket.
4. Install and tighten mounting fasteners.


8147d394

5. Connect electrical harness connectors and antenna cables.


8147d379

6. Position bracket assembly to quarter panel.
7. Install and tighten mounting fasteners.
8. Install quarter trim panel.
9. Connect battery negative cable.

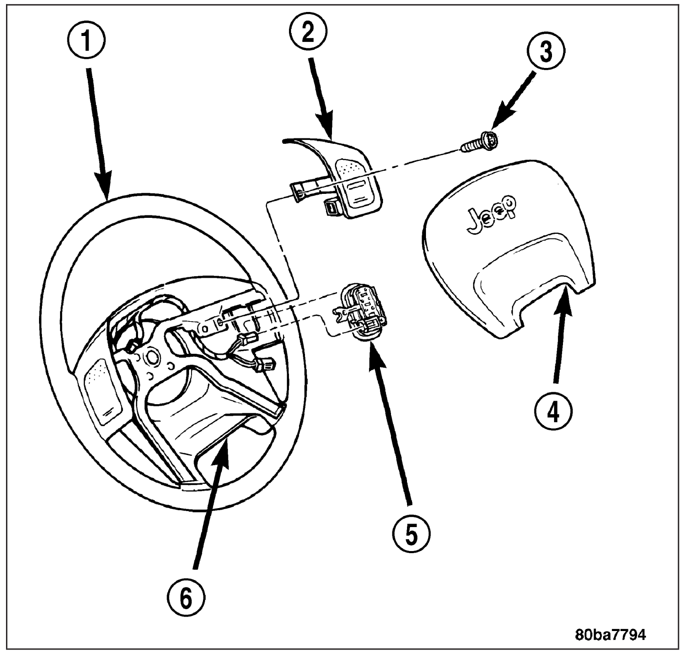


8147d356

# REMOTE SWITCHES

## DESCRIPTION

Two rocker-type switches (2) (if equipped) are mounted on the back (instrument panel side) of the steering wheel spokes. The switch on the left spoke is the seek switch and has seek up, seek down, and preset station advance functions. The switch on the right spoke is the volume control switch and has volume up, and volume down functions. The switch on the right spoke also includes a “mode” control that allows the driver to sequentially select AM radio, FM radio, cassette player, CD player or CD changer (if equipped).




## OPERATION

The six switches in the two remote radio switch units are normally open, resistor multiplexed momentary switches that are hard wired to the Body Control Module (BCM) through the clockspring. The BCM sends a five volt reference signal to both switch units on one circuit, and senses the status of all of the switches by reading the voltage drop on a second circuit.

When the BCM senses an input (voltage drop) from any one of the remote radio switches, it sends the proper switch status messages on the Programmable Communication Interface (PCI) data bus network to the radio receiver. The electronic circuitry within the radio receiver is programmed to respond to these remote radio switch status messages by adjusting the radio settings as requested. For diagnosis of the BCM or the PCI data bus, the use of a scan tool and the proper Diagnostic Procedures manual are recommended.

## DIAGNOSIS AND TESTING - REMOTE SWITCHES

**Any diagnosis of the Audio system should begin with the use of scan tool. For information on the use of the scan tool, refer to the appropriate Diagnostic information.**

For complete circuit diagrams, refer to the appropriate wiring information.

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

1. Disconnect and isolate the battery negative cable. Remove the remote radio switch(es) from the steering wheel (Refer to 8 - ELECTRICAL/AUDIO/REMOTE SWITCHES - REMOVAL).
2. Use an ohmmeter to check the switch resistances as shown in the Remote Radio Switch Test chart. If the remote radio switch resistances check OK, go to Step 3. If not OK, replace the faulty switch.

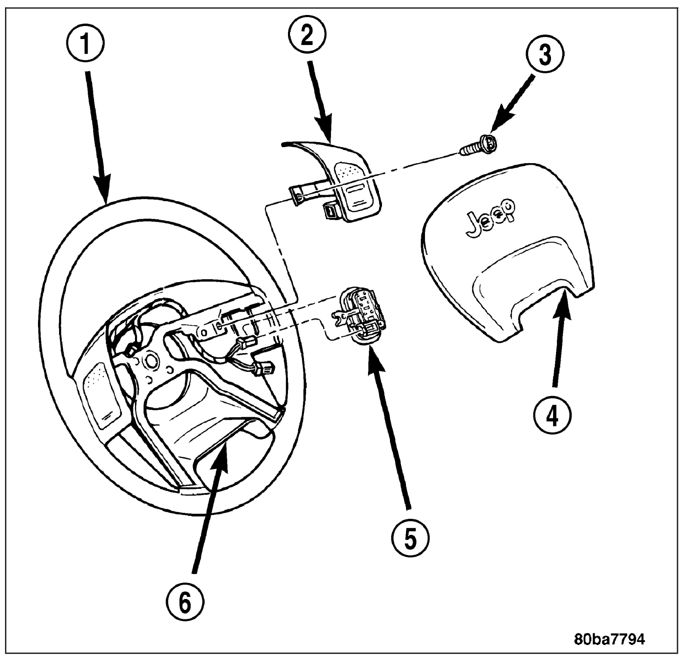
**REMOTE RADIO SWITCH TEST TABLE**

| Switch | Switch Position | Resistance |
|---|---|---|
| Right (White) | Volume Up | 1.210 Kilohms ± 1% |
| Right (White) | Volume Down | 3.010 Kilohms ± 1% |
| Right (White) | Mode Advance | 0.0511 Kilohms ± 1% |
| Left (Black) | Seek Up | 0.261 Kilohms ± 1% |
| Left (Black) | Seek Down | 0.681 Kilohms ± 1% |
| Left (Black) | Pre-Set Station Advance | 0.162 Kilohms ± 1% |

3. Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for 5 volts at the radio control mux circuit cavities of the steering wheel wire harness connectors for both remote radio switches. If OK, go to Step 4. If not OK, repair the open or shorted radio control mux circuit to the Body Control Module (BCM) as required.
4. Disconnect and isolate the battery negative cable. Disconnect the 22-way instrument panel wire harness connector from the BCM. Check for continuity between the remote radio switch ground circuit cavities of the steering wheel wire harness connectors for both remote radio switches and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted remote radio switch ground circuit to the BCM as required.
5. Check for continuity between the remote radio switch ground circuit cavities of the steering wheel wire harness connectors for both remote radio switches and the 22-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, refer to the proper Diagnostic Procedures manual to test the BCM and the PCI data bus. If not OK, repair the open remote radio switch ground circuit as required.

## REMOVAL

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

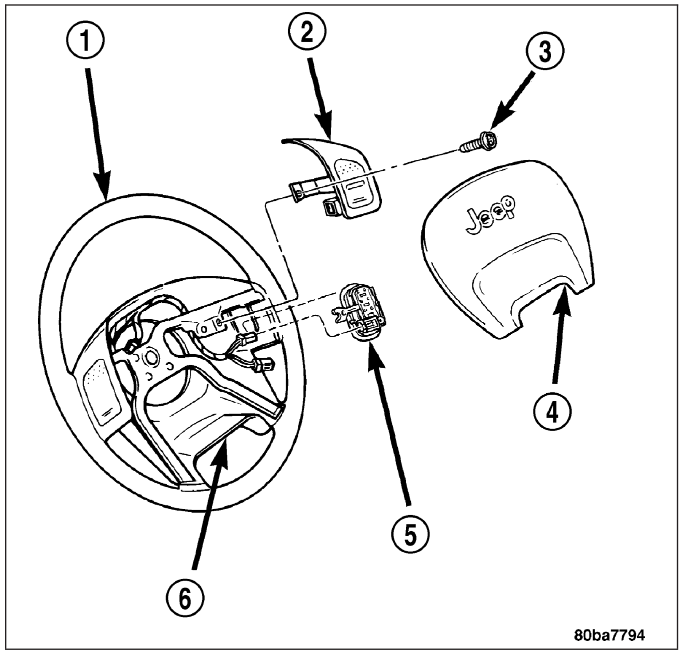



1. Disconnect and isolate the battery negative cable.
2. Remove the driver side airbag from the vehicle (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).
3. Remove the speed control switches.
4. Unplug the wire harness connector from the remote radio switch (5).
5. Depress the tabs on each side of each switch and push the switch through the rear steering wheel cover.

## INSTALLATION

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

1. Install remote radio switch to the steering wheel.
2. Connect the wire harness to the remote radio switch.
3. Install the speed control switches.
4. Install the driver side airbag (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).
5. Connect the battery negative cable.



# SPEAKER

## DESCRIPTION

### STANDARD

The standard equipment speaker system includes speakers in six locations. One 6.4 centimeter (2.50 inch) diameter speaker is installed on each end of the instrument panel top pad. One 16.5 centimeter (6.5 inch) full-range speaker is located in each front door. There is also one full-range 16.5 centimeter (6.5 inch) diameter full-range speaker located in each rear door.

### PREMIUM

The optional premium speaker system features six Premium model speakers in six locations. Each of the standard speakers is replaced with Premium model speakers. One 6.4 centimeter (2.50 inch) diameter speaker is installed on each end of the instrument panel top pad. One 16.5 centimeter (6.5 inch) Premium woofer is located in each front door. There is also one full-range 16.5 centimeter (6.5 inch) diameter Premium full-range speaker located in each rear door. The premium speaker system also includes a power amplifier mounted to each front door speaker. The total available power of the premium speaker system is about 160 watts.

## OPERATION

Two wires connected to each speaker, one feed circuit (+) and one return circuit (–), allow the audio output signal electrical current to flow through the voice coil. For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

## DIAGNOSIS AND TESTING - SPEAKER

**Any diagnosis of the Audio system should begin with the use of scan tool. For information on the use of the scan tool, refer to the appropriate Diagnostic information.**

Refer to the appropriate wiring information.

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

**CAUTION: The speaker output of the radio is a “floating ground” system. Do not allow any speaker lead to short to ground, as damage to the radio may result.**

**NOTE: If poor sound quality is noted in the audio system, check the Cabin Equalization curve programmed in the BCM. Make sure a base speaker system has the Base Cabin Equalization Curve programmed to the vehicle. If the vehicle has a premium speaker system, make sure the Premium Cabin Equalization Curve is programmed to the vehicle**

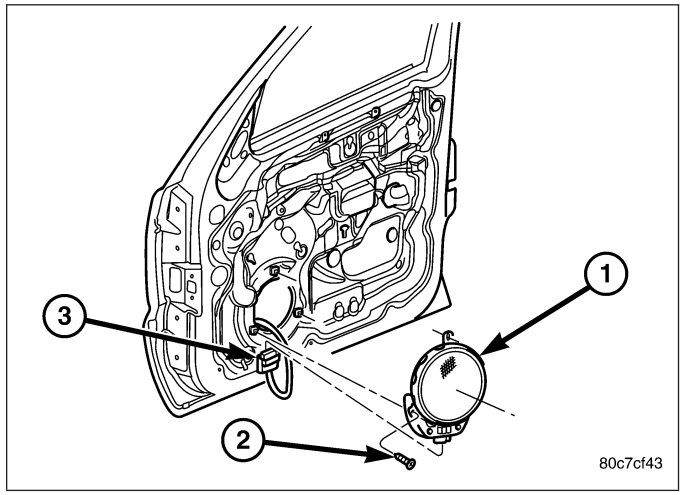
1. If all speakers are inoperative, check the fuses in the Junction Block (JB). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
2. Turn the ignition switch to the ON position. Turn the radio receiver ON. Adjust the balance and fader control controls to check the performance of each individual speaker. Note the speaker locations that are not performing correctly. Go to Step 3.
3. Turn the radio receiver OFF. Turn the ignition OFF. Disconnect and isolate the battery negative cable. If vehicle is **not** equipped with an amplifier, remove the radio receiver. If vehicle is equipped with an amplifier. disconnect wire harness connector at output side of amplifier. Go to Step 4.
4. Check both the speaker feed (+) circuit and return (-) circuit cavities for the inoperative speaker at the radio receiver wire harness connector for continuity to ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted speaker feed (+) and/or return (-) circuits(s) to the speaker as required.

5. Disconnect wire harness connector at the inoperative speaker. Check for continuity between the speaker feed (+) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. Repeat the check between the speaker return (-) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. In each case, there should be continuity. If OK, replace the faulty speaker. If not OK, repair the open speaker feed (+) and/or return (-) circuits(s) as required.

## REMOVAL

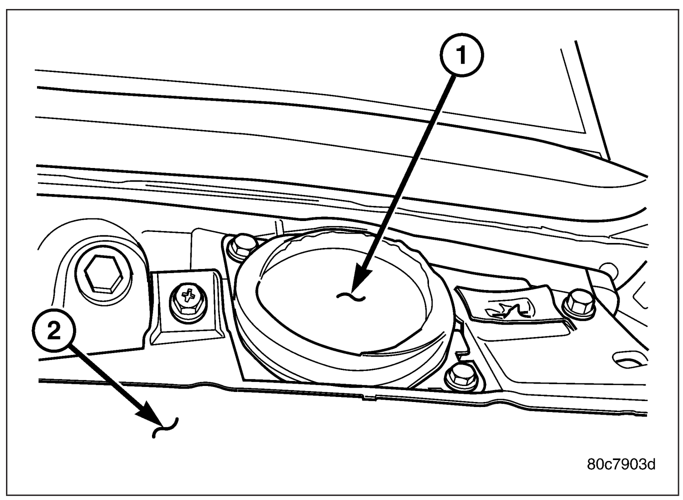
### FRONT DOOR

1. Disconnect and isolate the battery negative cable.
2. Remove the front door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
3. Remove the speaker mounting fasteners.
4. Remove the speaker (1) from the door and disconnect the wire harness connector.



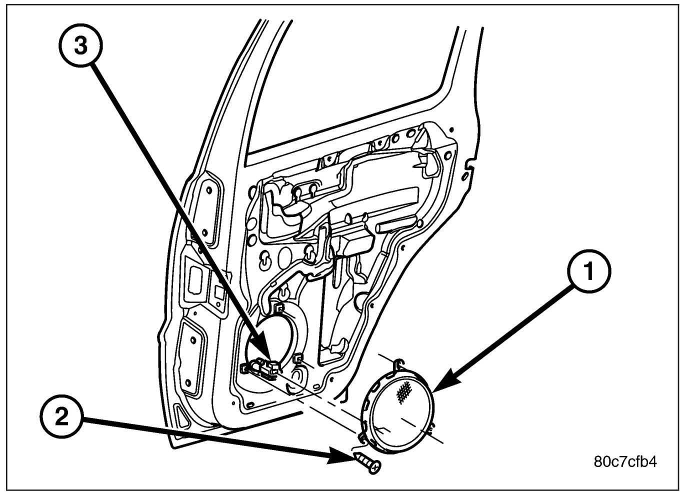

### INSTRUMENT PANEL

1. Disconnect and isolate the battery negative cable.
2. Remove the A-pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL).
3. Remove instrument panel top cover (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - REMOVAL).
4. Remove speaker mounting fasteners.
5. Remove speaker (1) and disconnect the wire harness connector.



## REAR DOOR

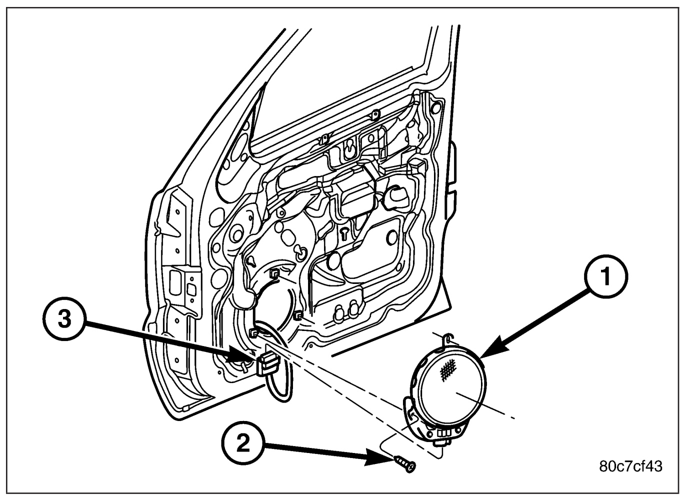
1. Disconnect and isolate the battery negative cable.
2. Remove the rear door trim panel (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL).
3. Remove the speaker mounting fasteners.
4. Remove the speaker (1) from the door and disconnect the wire harness connector (3).




## INSTALLATION

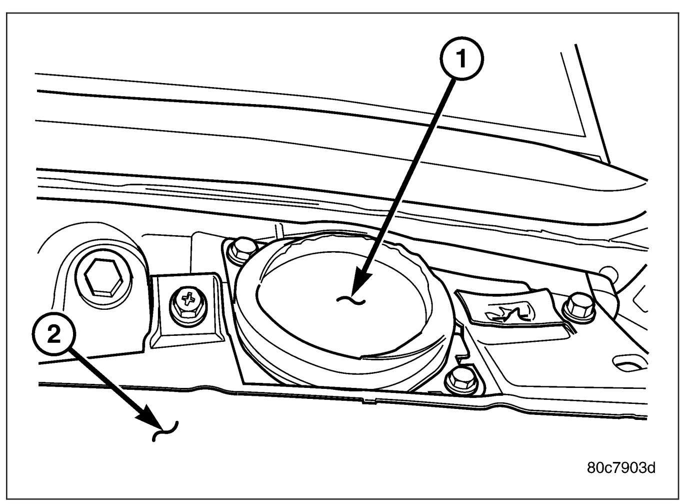
### FRONT DOOR

1. Connect the wire harness connector and install the speaker to the door.
2. Install the speaker mounting screws. Tighten to 2 N·m (20 in. lbs.).
3. Install the front door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION).
4. Connect the battery negative cable.



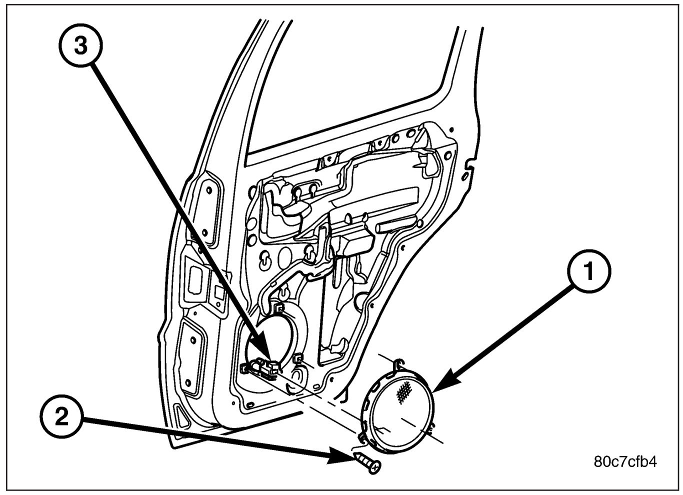

### INSTRUMENT PANEL

1. Connect wire harness connector and install speaker.
2. Install speaker mounting screws. Tighten to 2 N·m (20 in. lbs.).
3. Install instrument panel top cover (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - INSTALLATION).
4. Install the A-pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION).
5. Connect the battery negative cable.



## REAR DOOR

1. Connect the wire harness connector and install the speaker to the door.
2. Install the speaker mounting screws. Tighten to 2 N·m (20 in. lbs.).
3. Install the rear door trim panel (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION).
4. Connect the battery negative cable.



# CHIME/BUZZER

## TABLE OF CONTENTS



## CHIME/BUZZER - ELECTRICAL DIAGNOSTICS

### TABLE OF CONTENTS

# CHIME/BUZZER - ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## *CHIME INOPERATIVE

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. TEST CHIME OPERATION WITH THE SCAN TOOL

Turn the ignition on.

With the scan tool, actuate the Chime.

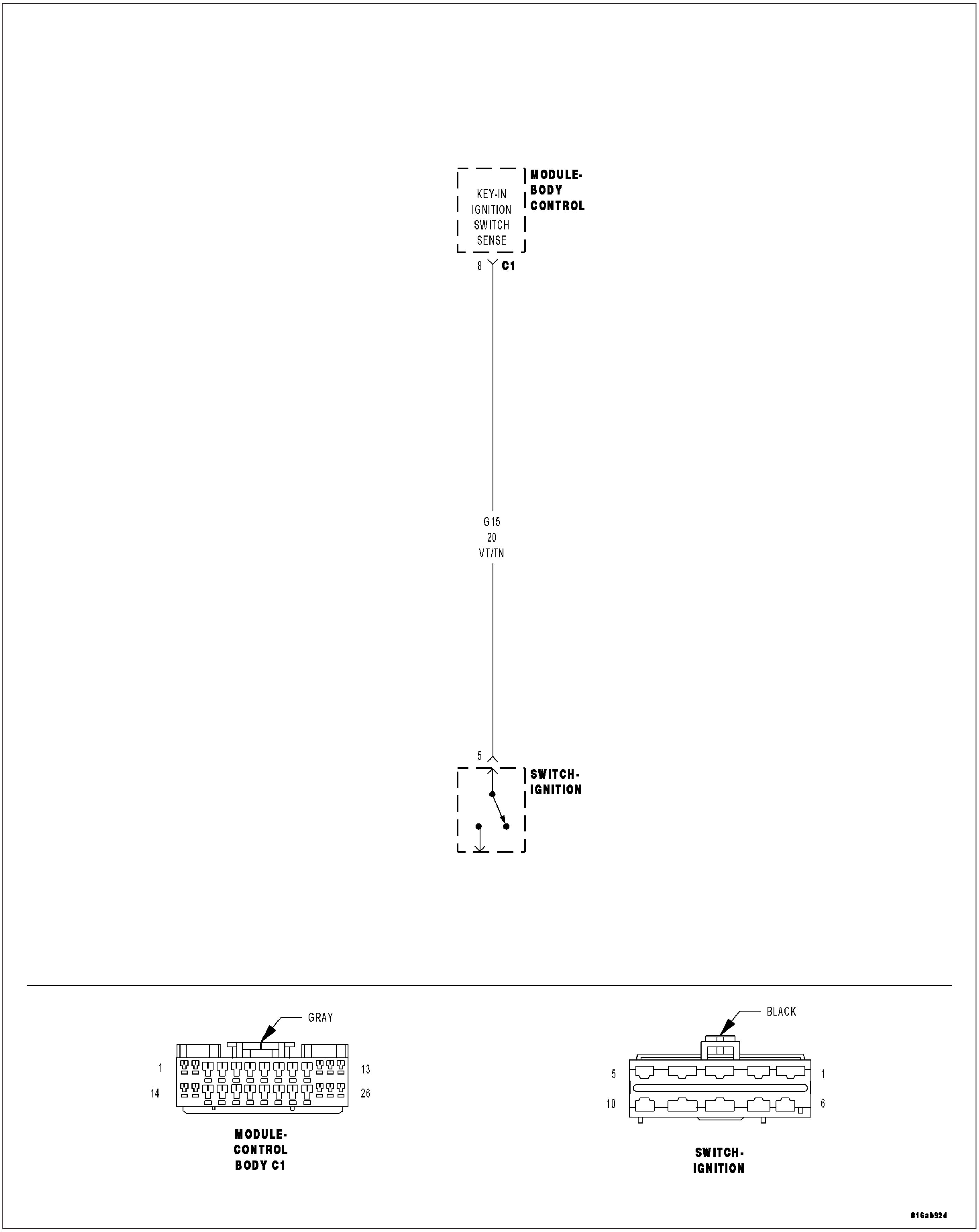
**Does the Chime sound?**

**Yes** >> Refer to the Table of Contents in this Section for related symptoms.

**No** >> Replace the Instrument Cluster in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

# *CHIME SOUNDS WITH DRIVER DOOR OPEN & KEY REMOVED




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| (G15) KEY-IN IGNITION SWITCH SENSE CIRCUIT SHORTED TO GROUND |
| IGNITION LOCK CYLINDER |
| IGNITION SWITCH |
| BODY CONTROL MODULE (BCM) |

## Diagnostic Test

### 1. CHECK THE KEY IN IGNITION STATUS WITH THE KEY REMOVED

**NOTE: Ensure the exterior lamps turn on and off properly and are off before continuing this test.**

Turn the ignition on.

With the scan tool in BCM, select Input Output.

Remove the key from the ignition switch.

With the scan tool, read the Key In Ignition status.

**Does the scan tool display: Key Not In Ignition?**

**Yes** >> Refer to the Service Information for other possible causes.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 2

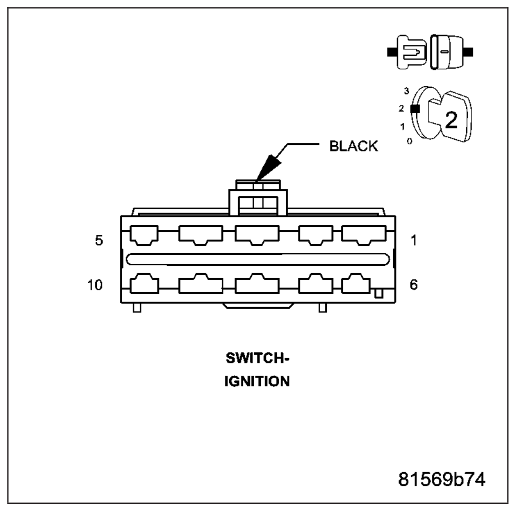
### 2. CHECK FOR A SHORTED IGNITION LOCK CYLINDER / IGNITION SWITCH

Disconnect the Ignition Switch harness connector.

**Does the chime turn off?**

**Yes** >> Inspect the Ignition Lock Cylinder for damage and repair as necessary. If OK, replace the Ignition Switch in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

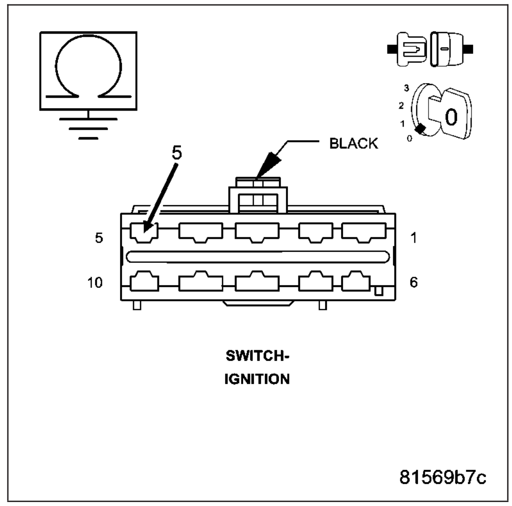
**No** >> Go To 3



## 3. CHECK THE (G15) KEY-IN IGNITION SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Disconnect the BCM C1 harness connector.

Measure the resistance of the (G15) Key-In Ignition Switch Sense circuit between ground and the Ignition Switch harness connector.




**Is the resistance below 100.0 ohms?**

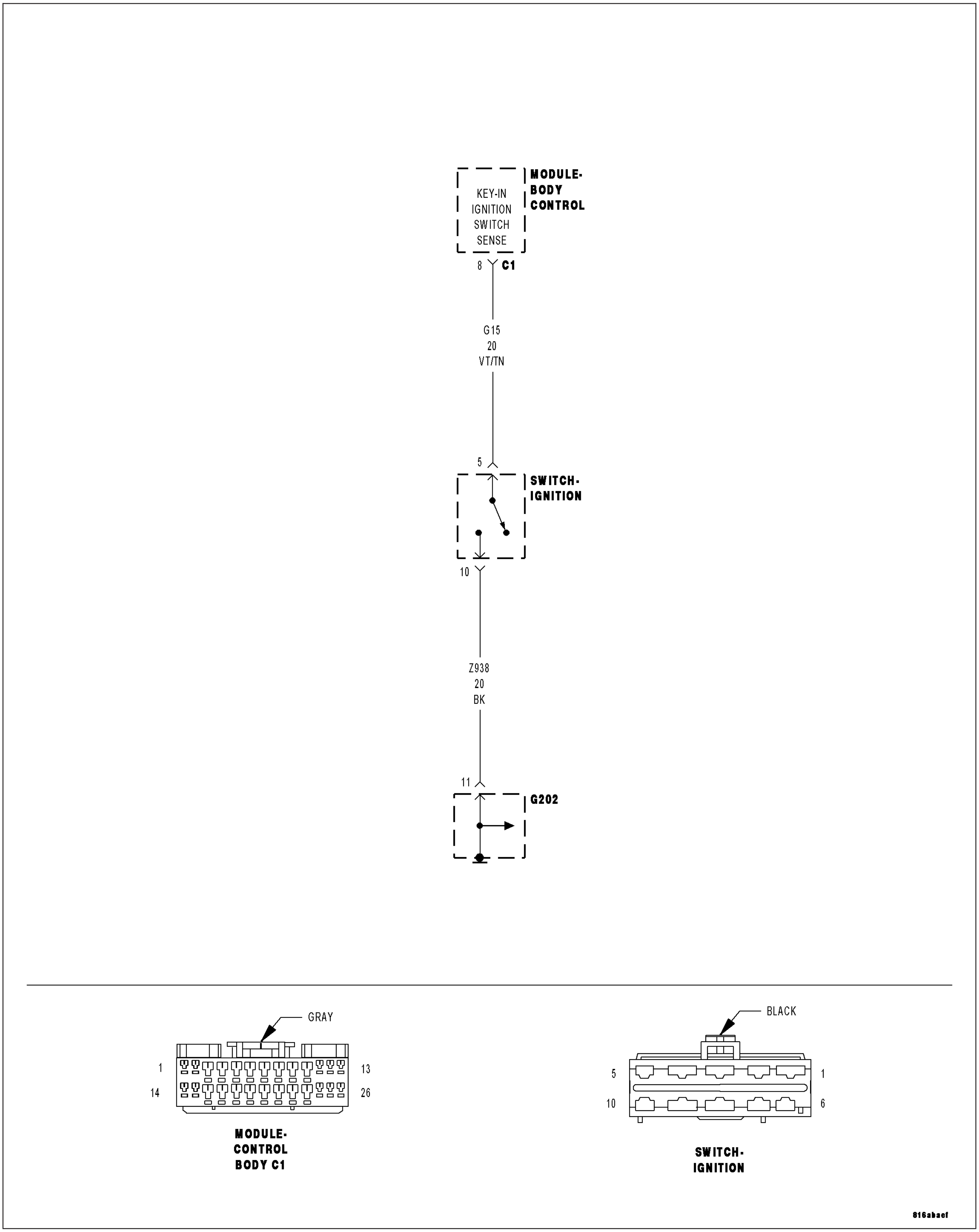
**Yes** >> Repair the (G15) Key-In Ignition Switch Sense circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## *CHIME INOPERATIVE WITH KEY IN IGNITION & DRIVER DOOR OPEN




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| BODY CONTROL MODULE (BCM) DTC(S) PRESENT |
| (Z938) GROUND CIRCUIT OPEN |
| (G15) KEY-IN IGNITION SWITCH SENSE CIRCUIT OPEN |
| IGNITION SWITCH OPEN |
| BODY CONTROL MODULE (BCM) |

## Diagnostic Test

### 1. CHECK FOR DTCs IN THE BODY CONTROL MODULE (BCM)

**NOTE: The driver door ajar switch must be operational for the result of this test to be valid.**

Turn the ignition on.

With the scan tool, read BCM DTCs.

**Does the scan tool display any Cluster Wake Up Output or Communication DTCs?**

**Yes** >> Refer to the Table of Contents in (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING) or in (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the applicable diagnostic procedures.

**No** >> Go To 2

### 2. CHECK THE KEY IN IGNITION STATUS WITH THE SCAN TOOL

With the scan tool in BCM, select Input Output.

With the scan tool, read the Key In Ignition Status.

**Does the scan tool display: Key In Ignition?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 3

### 3. CHECK FOR AN OPEN IGNITION SWITCH

Back probe the Ignition Switch harness connector with a jumper wire between the (G15) Key-In Ignition Switch Sense circuit and the (Z938) Ground circuit.

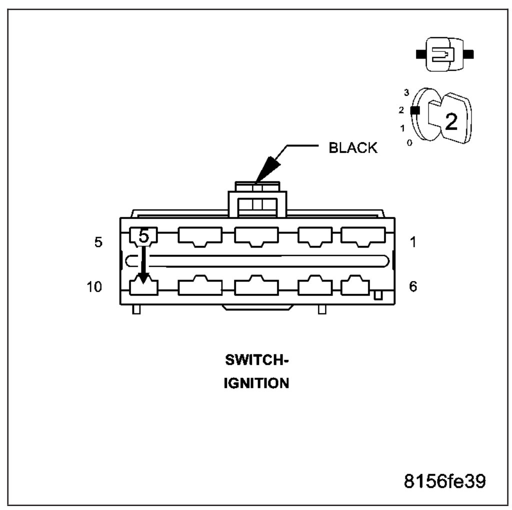
With the scan tool, read the Key In Ignition Status.

**Does the scan tool display: Key In Ignition?**

**Yes** >> Replace the Ignition Switch in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4



## 4. CHECK THE (Z938) GROUND CIRCUIT FOR AN OPEN

Turn the ignition off.

Remove the jumper wire.

Disconnect the Ignition Switch harness connector.

Turn all lights off.

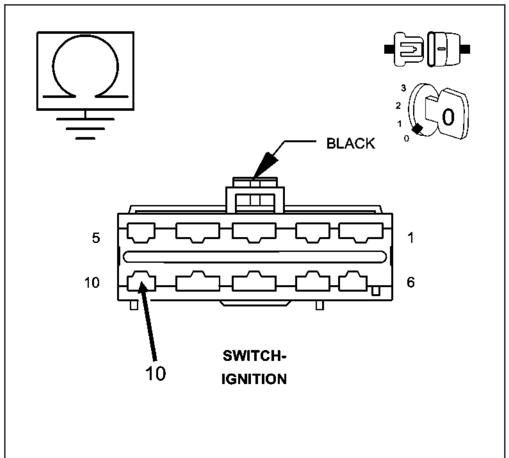
Measure the resistance of the (Z938) Ground circuit between ground and the Ignition Switch harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (Z938) Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



8156fe52

## 5. CHECK THE (G15) KEY-IN IGNITION SWITCH SENSE CIRCUIT FOR AN OPEN

Disconnect the BCM C1 harness connector.

Measure the resistance of the (G15) Key-In Ignition Switch Sense circuit between the Ignition Switch harness connector and the BCM C1 harness connector.

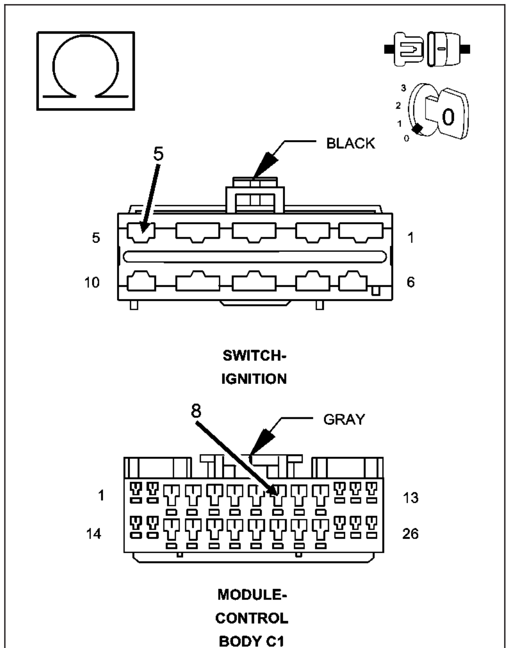
**Is the resistance below 5.0 ohms?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (G15) Key-In Ignition Switch Sense circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



8156fea1

## *VEHICLE SPEED WARNING CHIME PROBLEM

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| INCORRECT COUNTRY CODE PROGRAMMED IN BODY CONTROL MODULE (BCM) |
| BODY CONTROL MODULE (BCM) |

### 1. VERIFY THE BCM IS PROGRAMMED WITH THE CORRECT COUNTRY CODE

**NOTE: The high speed warning chime is for Gulf Coast Countries only.**

Turn the ignition on.

With the scan tool in BCM, select Miscellaneous.

With the scan tool, read the country code setting.

**Is the country code incorrect?**

**Yes** >> Reprogram with the correct country code.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace and program the BCM in accordance with the Service Information.

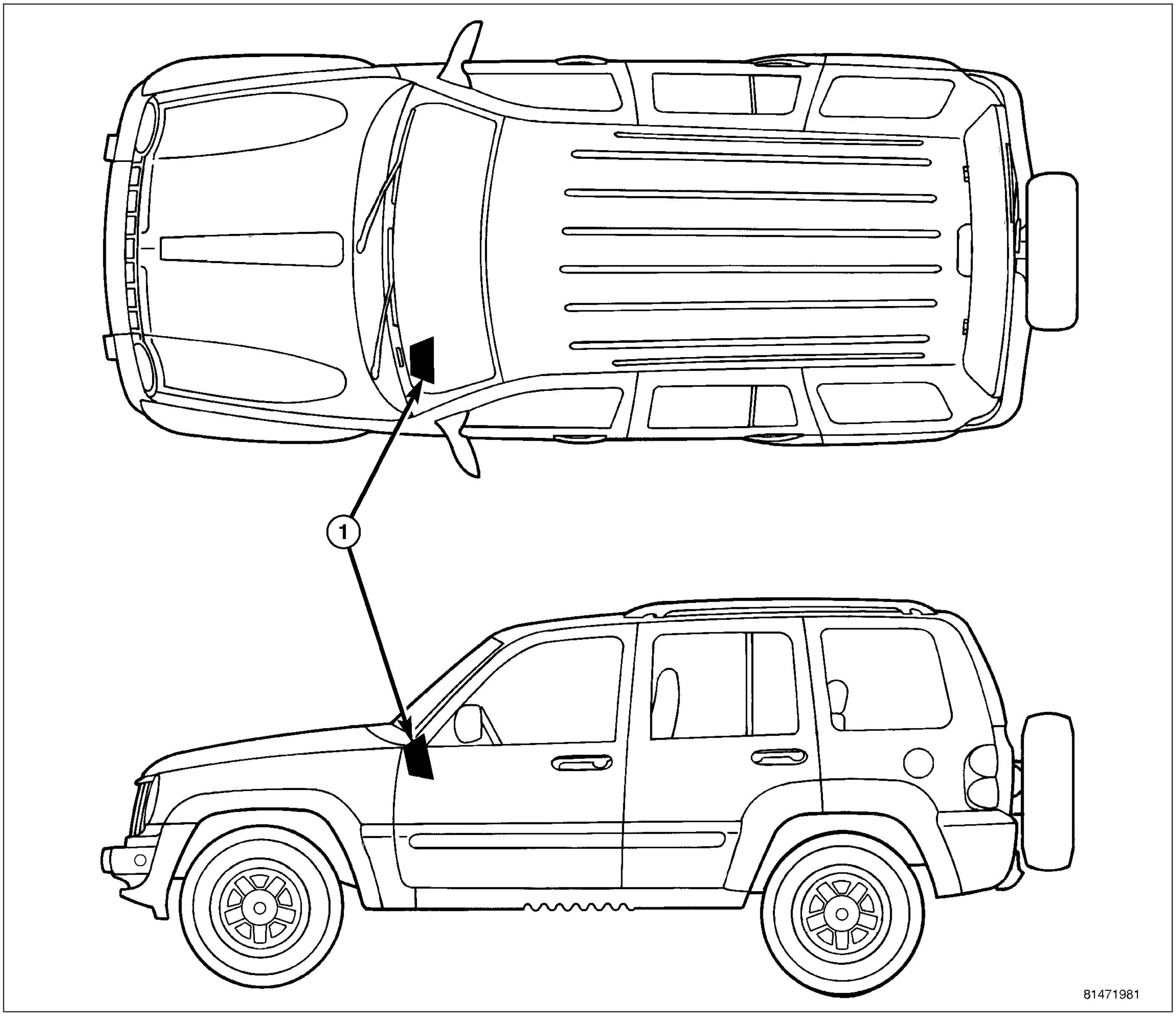
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

# CHIME WARNING SYSTEM

## TABLE OF CONTENTS

# CHIME WARNING SYSTEM

## DESCRIPTION




A chime warning system is standard factory-installed equipment. The chime warning system uses an electromechanical transducer that is soldered onto the electronic circuit board inside of the ElectroMechanical Instrument Cluster (EMIC) (1) to provide audible indications of various vehicle conditions that may require the attention of the vehicle operator or occupants.

The EMIC electromechanical transducer generates both beep tones and chime tones. The microprocessor-based EMIC utilizes electronic chime request messages received from other modules in the vehicle over the Programmable Communications Interface (PCI) data bus along with hard wired inputs to monitor many sensors and switches throughout the vehicle. In response to those inputs, the circuitry and programming of the EMIC allow it to control the audible outputs that are produced through its on-board transducer.

The EMIC is capable of producing the following audible outputs:

- **Fixed Duration Beep** - A short, sharp, single tactile “beep” tone that is about 150 milliseconds in duration.
- **EVIC Warning Chime** - Two sets of three “beep” tones indicate a warning is being displayed by the Electronic Vehicle Information Center (EVIC) in the overhead console.
- **Single Chime Tone** - A single “bong-like” chime tone.

- **Slow Rate Repetitive Chime** - Repeated chime tones that are issued at a slow rate of about 50 chimes per minute.
- **Fast Rate Repetitive Chime** - Repeated chime tones that are issued at a fast rate of about 180 chimes per minute.

Hard wired circuitry connects the EMIC and the various chime warning system switch and sensor inputs to their modules and to each other through the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the EMIC through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

The EMIC chime warning system circuits and components cannot be adjusted or repaired. If the EMIC circuitry or the on-board transducer are damaged or faulty, the EMIC unit must be replaced.

## OPERATION

The chime warning system operates on battery voltage received through a fuse in the Junction Block (JB) on a non-switched fused B(+) circuit so that the system may operate regardless of the ignition switch position. The chime warning system also monitors the ignition switch position so that some chime features are functional only with the ignition switch in the On position, while others are functional regardless of the ignition switch position.

The chime warning system provides an audible indication to the vehicle operator or occupants under the following conditions:

- **ABS Indicator Warning** - On vehicles equipped with an optional Antilock Brake System (ABS), the Electro-Mechanical Instrument Cluster (EMIC) transducer will generate one short chime when the ignition switch is in the On position, and an electronic message is received over the Programmable Communications Interface (PCI) data bus from the Controller Antilock Brake (CAB) requesting “Antilock Brake System (ABS)” indicator illumination. This warning will only occur following completion of the “ABS” indicator bulb test, and will only occur once during any ignition cycle.
- **Airbag Indicator Warning** - The EMIC transducer will generate one short chime when the ignition switch is in the On position, and an electronic message is received over the PCI data bus from the Airbag Control Module (ACM) requesting “Airbag” indicator illumination. This warning will only occur following completion of the “Airbag” indicator bulb test, and will only occur once during any ignition cycle.
- **Charging System Indicator Warning** - Each time the ignition switch is turned to the On position, the EMIC transducer will generate a single chime the first time an electronic message is received over the PCI data bus from the Powertrain Control Module (PCM) requesting charging system indicator illumination. This warning indicates that a failure condition has been monitored affecting the operation of the charging system related components or circuits.
- **Compass Mini-Trip Computer Global Reset** - The EMIC transducer will generate one short chime when the ignition switch is in the On position, and an electronic message is received over the PCI data bus from the optional Compass Mini-Trip Computer (CMTC) requesting that the CMTC elapsed time, average fuel economy, and/or trip odometer data has been reset. The CMTC monitors hard wired inputs from the U.S./Metric and Reset button switches, and electronic messages received from the Body Control Module (BCM) to determine the proper reset messages to send to the EMIC.
- **Door Ajar Warning** - On vehicles without an optional Electronic Vehicle Information Center (EVIC), the EMIC transducer will generate one short chime for each of three display sequences when the ignition switch is in the On position and electronic messages are received over the PCI data bus from the Body Control Module (BCM) indicating that the status of any door ajar input has changed and indicating that the vehicle is moving.
- **Electronic Throttle Control Indicator Warning** - On vehicles equipped with an optional diesel engine, the EMIC transducer will generate a single chime the first time an electronic message is received over the PCI data bus from the PCM requesting Electronic Throttle Control (ETC) indicator illumination, either solid or flashing. This chime will only occur once during any ignition cycle.
- **Engine Coolant Temperature High Warning** - Each time the ignition switch is turned to the On position, the EMIC transducer will generate chime tones the first time an electronic message is received over the PCI data bus from the PCM indicating that the engine coolant temperature is too high. This chime will sound for five consecutive tones unless an electronic message is received from the PCM indicating that the engine coolant

temperature is not too high, or the ignition switch is turned to the Off position before the five tones have completed.

- **Electronic Stability Program/Brake Assist System Fault Warning** - The EMIC transducer will generate one short chime each time the Electronic Stability Program (ESP)/Brake Assist System (BAS) indicator is illuminated in the instrument cluster. This warning indicates a failure condition has been monitored affecting the operation of the ESP/BAS related components or circuits. This warning will only occur following completion of the “ESP/BAS” indicator bulb test, and will only occur once during any ignition cycle.
- **Electronic Vehicle Information Center Warning** - On vehicles equipped with an optional EVIC, the EMIC transducer will generate chimes when an electronic message is received over the PCI data bus from the EVIC indicating that the EVIC is displaying certain warnings.
- **Fasten Seat Belt Indicator Warning** - The EMIC transducer will generate repetitive chimes at a slow rate each time a hard wired input is received from a seat belt switch indicating that the driver side or passenger side front seat belt is not fastened with the ignition switch in the On position. The chime warning system also supports the enhanced seat belt reminder (beltminder) when this feature is enabled, and will sound five chimes at a slow rate (one each time the lamp turns on during flashing). (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/SEAT BELT INDICATOR - OPERATION).
- **Gas Cap Warning** - On domestic vehicles equipped with a gasoline engine, the EMIC transducer will generate one short chime each time an electronic message is received over the PCI data bus from the PCM indicating that there is a gross leak in the vapor recovery system. This chime will only occur once during any ignition cycle.
- **Gate Ajar Warning** - On vehicles without an optional EVIC, the EMIC transducer will generate one short chime for each of three display sequences when the ignition switch is in the On position, and electronic messages are received over the PCI data bus from the BCM indicating that the status of the tailgate ajar input has changed from closed to not closed and indicating that the vehicle is moving.
- **Glass Ajar Warning** - On vehicles without an optional EVIC, the EMIC transducer will generate one short chime for each of two display sequences when the ignition switch is in the On position, and electronic messages are received over the PCI data bus from the BCM indicating that the status of the rear flip-up glass ajar input has changed from closed to not closed and indicating that the vehicle is moving.
- **Head/Park/Fog Lamps-On Warning** - The EMIC transducer will generate repetitive chimes at a fast rate when the ignition switch is in any position except On, and electronic messages are received over the PCI data bus from the BCM indicating that the exterior lamps are On and that the driver side front door is open. The chimes will continue to sound until the exterior lamps are turned Off, the driver side front door is closed, or the ignition switch is turned to the On position, whichever occurs first.
- **Key-In-Ignition Warning** - The EMIC transducer will generate repetitive chimes at a fast rate when the ignition switch is in any position except On, and electronic messages are received over the PCI data bus from the BCM indicating that the key is in the ignition lock cylinder and that the driver side front door open. These chimes will continue to sound until the key is removed from the ignition lock cylinder, the driver side front door is closed, or the ignition switch is turned to the On position, whichever occurs first.
- **Low Coolant Warning** - On vehicles equipped with an optional diesel engine, the EMIC transducer will generate a single chime when the ignition switch is first turned to the On position and a hard wired input from the engine coolant level sensor to the EMIC indicates that the coolant level is low for more than about one-quarter second. Any time after the ignition switch is first turned to the On position, the EMIC uses internal programming to check the status of the engine coolant level sensor inputs about once every second, then adjusts an internal counter up or down based upon the status of this input. When the counter accumulates thirty inputs indicating that the coolant level is low, a single chime is sounded. This strategy is intended to reduce the effect that coolant sloshing within the coolant reservoir can have on reliable chime warning operation. This chime will only occur once during any ignition cycle.
- **Low Fuel Warning** - Each time the ignition switch is turned to the On position, the EMIC transducer will generate a single chime the first time an electronic message is received over the PCI data bus from the PCM requesting “Low Fuel” indicator illumination. The chime will only occur a second time during the same ignition cycle if another electronic message has been received from the PCM indicating that there is an increase in the fuel level equal to about 3 liters (0.8 gallon), then a subsequent electronic message from the PCM requests “Low Fuel” indicator illumination. This strategy combined with filtering performed by the internal programming of the PCM on the fuel tank sending unit input is intended to reduce the possibility of fuel sloshing within the fuel tank causing multiple low fuel warning chimes during a given ignition cycle. The EMIC will also respond with the low fuel warning chime when electronic fuel level messages are received from the PCM indicating that

the hard wired input to the PCM from the fuel tank sending unit is an open circuit (greater than full), or a short circuit (less than empty).

- **Low Oil Pressure Indicator Warning** - Each time the ignition switch is turned to the On position, the EMIC transducer will generate a single chime the first time three sequential sets of electronic messages are received over the PCI data bus from the PCM indicating that the engine oil pressure is too low with the engine running.
- **Low Wash Warning** - On vehicles without an optional EVIC, the EMIC transducer will generate one short chime for each of two display sequences when the ignition switch is turned to the On position and a hard wired input from the washer fluid level switch to the EMIC indicates the washer fluid is low for more than about one-quarter second. Any time after the ignition switch is first turned to the On position, the EMIC uses internal programming to check the status of the washer fluid level switch inputs about once every second, then adjusts an internal counter up or down based upon the status of this input. When the counter accumulates thirty inputs indicating that the washer fluid level is low, a single chime is sounded. This strategy is intended to reduce the effect that fluid sloshing within the washer reservoir can have on reliable chime warning operation. This warning will only occur once during any ignition cycle.
- **Overspeed Warning** - The EMIC transducer will generate repetitive chimes at a slow rate when the ignition switch is in the On position, and an electronic message is received over the PCI data bus from the PCM indicating that the vehicle speed is over a pre-programmed speed value. These chimes will continue to sound until the vehicle speed messages are below the pre-programmed speed value, or until the ignition switch is turned to the Off position, whichever occurs first. This feature is only enabled on vehicles that have a BCM that has been configured for sale in a Middle East Gulf Coast Country (GCC).
- **No Airbag Indicator Message Warning** - The EMIC transducer will generate one short chime and turn on the “Airbag” indicator when the ignition switch is in the On position, and a PCI data bus “Airbag” indicator on or off message is not received from the ACM for six consecutive seconds.
- **No Antilock Brake Indicator Message Warning** - The EMIC transducer will generate one short chime and turn on the “ABS” indicator when the ignition switch is in the On position, and a PCI data bus “ABS” indicator on or off message is not received from the CAB for six consecutive seconds.
- **No Fuel Level Message Warning** - The EMIC transducer will generate one short chime and turn on the “Low Fuel” indicator when the ignition switch is in the On position, and a PCI data bus fuel level message is not received from the PCM for twelve consecutive seconds.
- **Remote Keyless Entry Transmitter Programming** - On vehicles so equipped, the EMIC transducer will generate a single short chime when an electronic message is received over the PCI data bus from the BCM indicating that a Remote Keyless Entry (RKE) transmitter has been successfully programmed by the customer into the RKE module memory.
- **Sentry Key “Customer Learn” Mode Announcement** - On vehicles so equipped, the EMIC transducer will generate one short chime to confirm that an electronic “Customer Learn” message has been received over PCI data bus to indicate that the Sentry Key REmote Entry Module (SKREEM) is prepared for programming additional sentry key transponders. This chime feature is only active on vehicles equipped with the optional Sentry Key system, and sold in a market where “Customer Learn” programming is an allowed feature.
- **Service Traction Control System Warning** - On vehicles so equipped, the EMIC transducer will generate one short chime to confirm that an electronic “Service Traction Control System” message has been received over PCI data bus from the Controller Antilock Brake (CAB) to indicate that the traction control system requires service. This warning will only occur once during any ignition cycle.
- **Tire Pressure Monitor Warning** - The EMIC transducer will generate one short chime when the ignition switch is in the On position, and an electronic message is received over the PCI data bus from the Sentry Key REmote Entry Module (SKREEM) requesting the TPM indicator be turned on for a monitored low tire pressure condition. This warning will only occur once per monitored low tire during any ignition cycle.
- **Tire Pressure Monitor Fault Warning** - The EMIC transducer will generate one short chime when the ignition switch is in the On position, and an electronic message is received over the PCI data bus from the Sentry Key REmote Entry Module (SKREEM) requesting the TPM indicator be flashed on and off for a detected TPM sensor or system fault. This warning will only occur once during any ignition cycle.
- **Turn Signal On Warning** - The EMIC transducer will generate repetitive chimes at a slow rate to indicate that a turn signal has been active continuously for a distance of about 3.2 kilometers (about two miles). The chime will continue until the turn signal input becomes inactive, until the hazard warning system is turned On, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Water-In-Fuel Indicator Warning** - On vehicles equipped with a diesel engine, each time the ignition switch is turned to the On position, the EMIC transducer will generate a single chime the first time an electronic mes-

sage is received over the PCI data bus from the PCM requesting “Water-in-Fuel” indicator illumination. This warning will only occur once during any ignition cycle.

The EMIC provides chime service for all available features in the chime warning system. The EMIC relies upon its internal programming, numerous hard wired inputs, and electronic message inputs received from other modules over the PCI data bus to provide the chime warning system features. The internal programming of the EMIC determines the priority of each chime request input that is received, as well as the rate and duration of each chime that is to be generated.

The hard wired chime warning system inputs to the EMIC, as well as other hard wired circuits for this system may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the EMIC, the PCI data bus, or the electronic messages received by the EMIC from other modules. The most reliable, efficient, and accurate means to diagnose the EMIC, the PCI data bus, or the electronic message inputs used for the chime warning system requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## DIAGNOSIS AND TESTING

## CHIME WARNING SYSTEM

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

The hard wired chime warning system inputs to the ElectroMechanical Instrument Cluster (EMIC), as well as other hard wired circuits for this system may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the EMIC, the Programmable Communications Interface (PCI) data bus, or the electronic message inputs used by the EMIC to provide chime warning system service. The most reliable, efficient, and accurate means to diagnose the EMIC, the PCI data bus, and the electronic message inputs for the chime warning system requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

# ELECTRONIC CONTROL MODULES

## TABLE OF CONTENTS



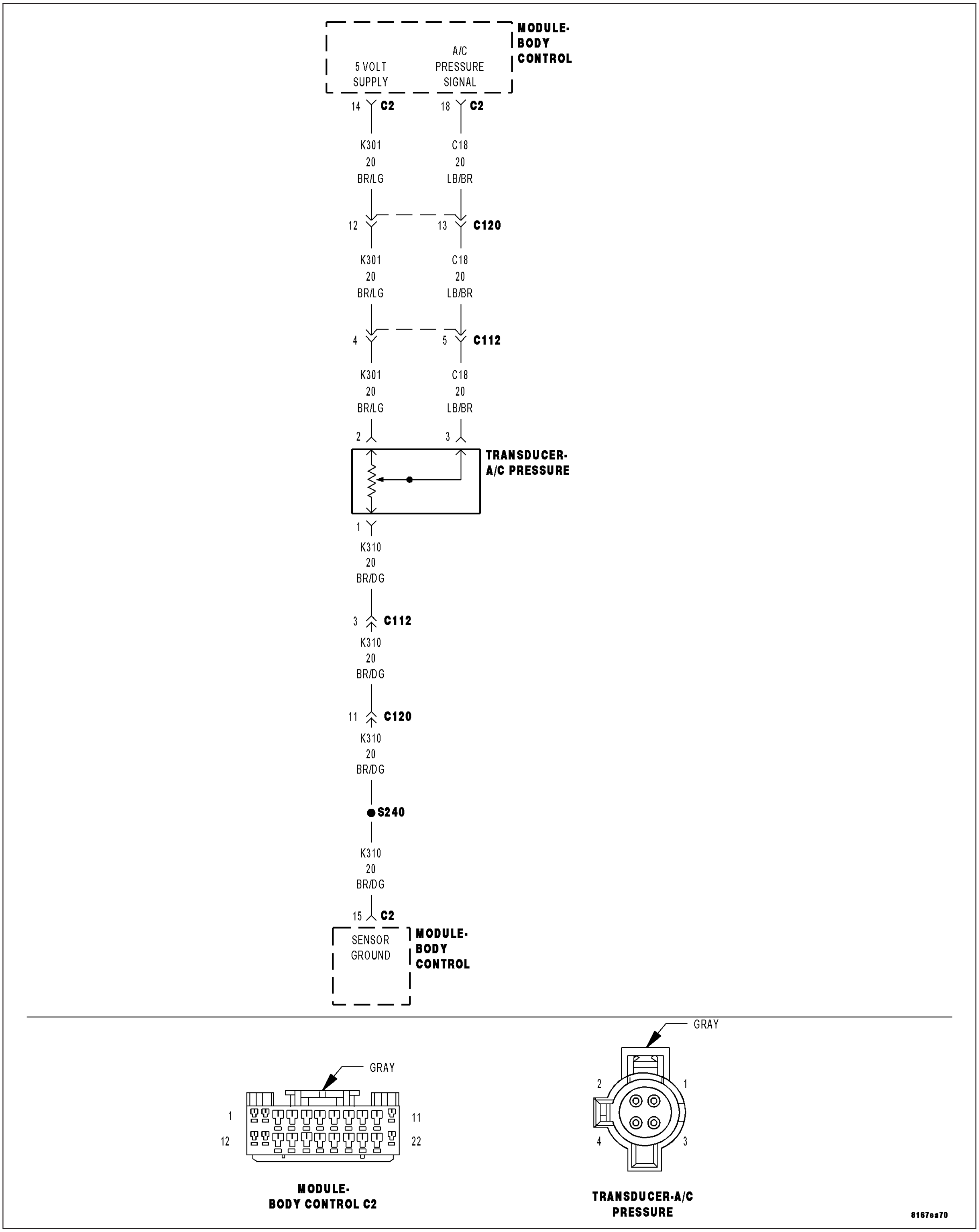
## ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTIC

### TABLE OF CONTENTS

# ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTIC

## DIAGNOSIS AND TESTING

## A/C PRESSURE SENSOR HIGH (BCM)




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Body Control Module (BCM) will set this DTC if voltage goes above 4.92 volts for more than 5 seconds on the (C18) A/C Pressure Sensor Signal circuit.

| Possible Causes |
|---|
| (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (K301) 5-VOLT SUPPLY CIRCUIT |
| (C18) A/C PRESSURE SIGNAL CIRCUIT OPEN |
| (K310) SENSOR GROUND CIRCUIT OPEN |
| A/C PRESSURE TRANSDUCER |
| BCM |

## Diagnostic Test

### 1. CHECK THE A/C PRESSURE TRANSDUCER VOLTAGE

**NOTE: Verify that the A/C Refrigerant System is properly charged before proceeding.**
Start the engine.
With the scan tool, read the A/C Pressure Transducer voltage.

**Is the voltage above 4.6 volts?**

**Yes** >> Go To 2

**No** >> Go To 7

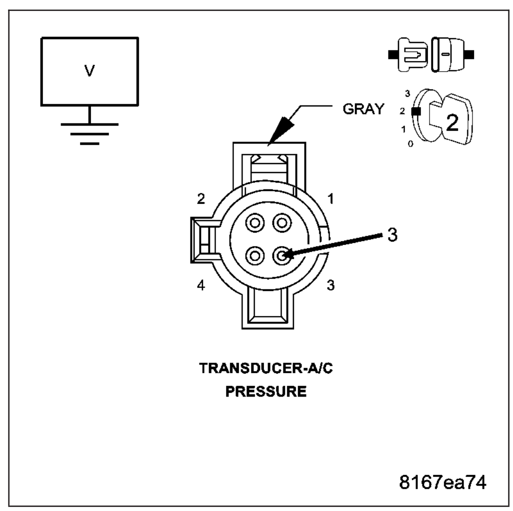
### 2. CHECK THE (C18) A/C PRESSURE SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off.
Disconnect the A/C Pressure Transducer harness connector.
Turn the ignition on.
Measure the voltage of the (C18) A/C Pressure Signal circuit.

**Is the voltage above 5.2 volts?**

**Yes** >> Repair the (C18) A/C Pressure Signal circuit for a short to voltage.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 3

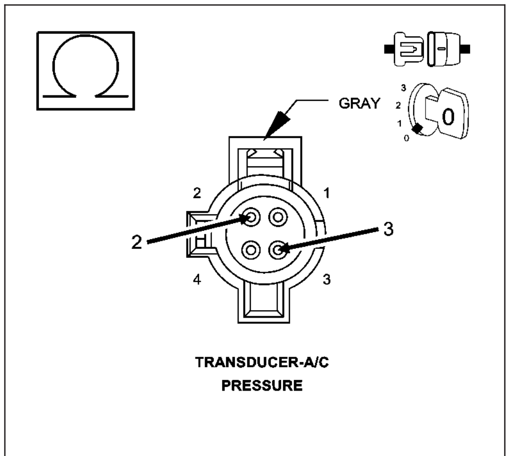


## 3. CHECK THE (C18) A/C PRESSURE SIGNAL CIRCUIT FOR A SHORT TO THE (K301) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the BCM C2 harness connector.

Measure the resistance between the (C18) A/C Pressure Signal circuit and the (K301) 5-Volt Supply circuit in the A/C Pressure Transducer harness connector.



8167ea78

**Is the resistance below 10k ohms?**

**Yes** >> Repair the (C18) A/C Pressure Signal circuit for a short to the (K301) 5-Volt Supply circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4

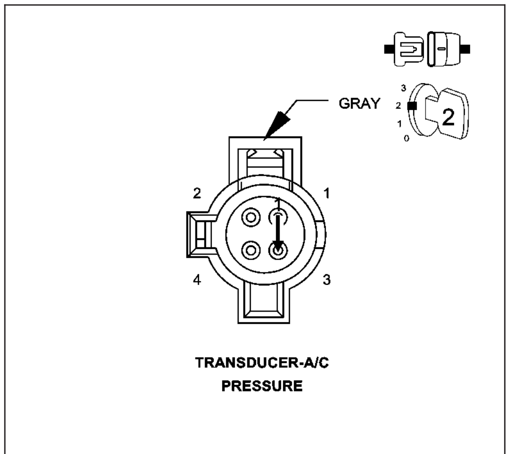
## 4. CHECK THE (C18) A/C PRESSURE SIGNAL CIRCUIT & THE (K310) SENSOR GROUND CIRCUIT FUNCTION

Reconnect the BCM C2 harness connector.

Connect a jumper wire between the (C18) A/C Pressure Signal circuit and the (K310) Sensor Ground circuit.

Turn the ignition on.

With the scan tool, read the A/C Pressure Transducer voltage.



8167ea7c

**Is the voltage below 1.0 volt?**

**Yes** >> Replace the A/C Pressure Transducer in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 5

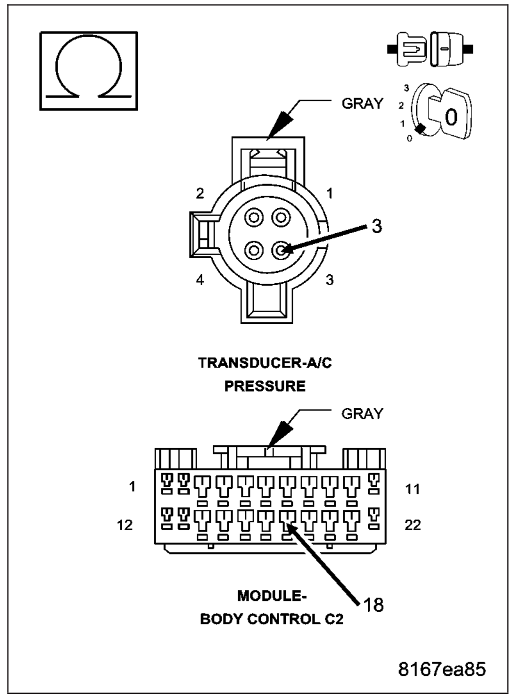
## 5. CHECK THE (C18) A/C PRESSURE SIGNAL CIRCUIT FOR AN OPEN

Turn the ignition off.

Remove the jumper wire from the A/C Pressure Transducer harness connector.

Disconnect the BCM C2 harness connector.

Measure the resistance of the (C18) A/C Pressure Signal circuit between the A/C Pressure Transducer harness connector and the BCM C2 harness connector.




**Is the resistance below 5.0 ohms?**

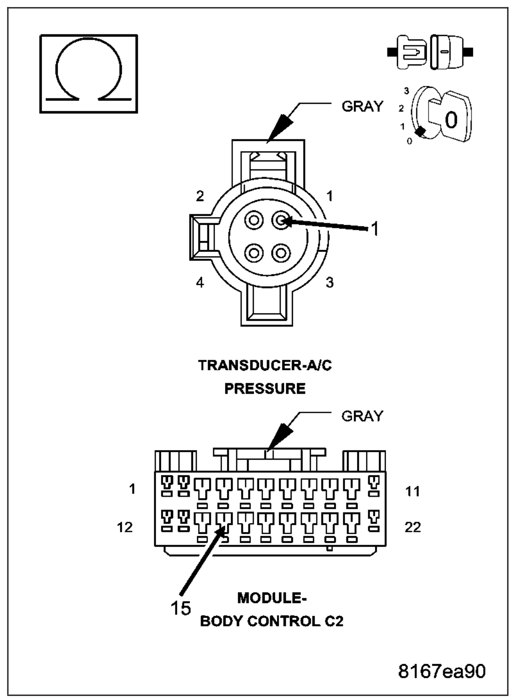
**Yes** >> Go To 6

**No** >> Repair the (C18) A/C Pressure Signal circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 6. CHECK THE (K310) SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the (K310) Sensor Ground circuit between the A/C Pressure Transducer harness connector and the BCM C2 harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (K310) Sensor Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 7. TEST FOR INTERMITTENT CONDITION

**NOTE: The condition that set this DTC is not present at this time. The following may help in identifying the cause of the intermittent condition.**

Check the Technical Service Bulletins (TSBs) for related concerns.

Turn the ignition on.

Using the scan tool, erase the BCM DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

Monitor the scan tool for DTCs while wiggling the related wiring harness.

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chaffed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Perform a voltage drop test on the related circuits between the component and the BCM.

If numerous DTCs were set, use the wiring diagram/schematic to check for common ground and supply circuits.

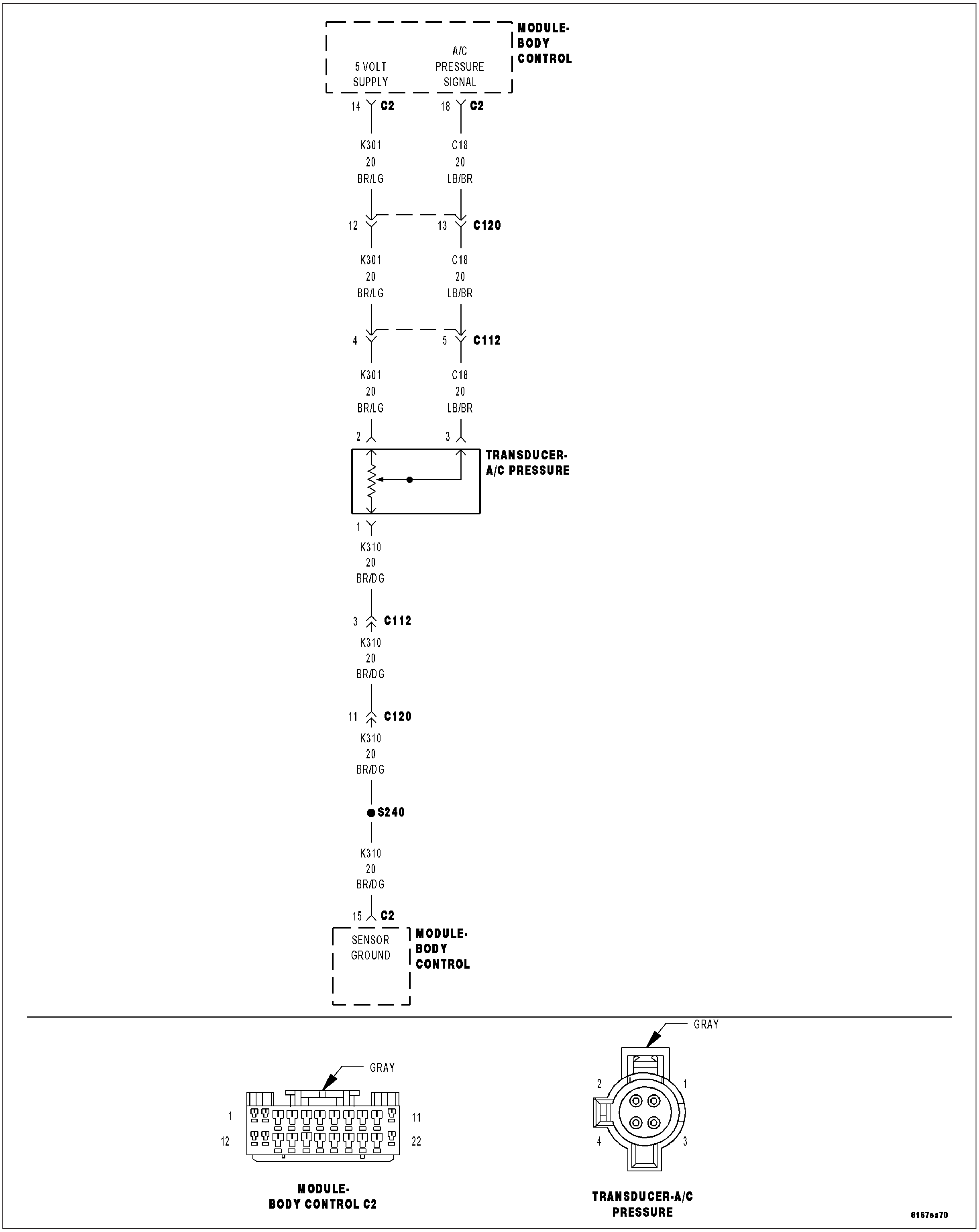
**Were any problems found?**

**Yes** >> Repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Test Complete.

## A/C PRESSURE SENSOR LOW (BCM)




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Body Control Module (BCM) will set this DTC if voltage drops below 0.137 volts for more than 5 seconds on the (C18) A/C Pressure Sensor Signal circuit.

| Possible Causes |
| --- |
| (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND |
| (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (K310) SENSOR GROUND CIRCUIT |
| (K301) 5-VOLT SUPPLY CIRCUIT OPEN |
| (K301) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| (K301) 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K310) SENSOR GROUND CIRCUIT |
| A/C PRESSURE TRANSDUCER |
| BCM |

## Diagnostic Test

### 1. CHECK THE A/C PRESSURE TRANSDUCER VOLTAGE

**NOTE: Verify that the A/C Refrigerant System is properly charged before proceeding.**
Start the engine.
With the scan tool, read the A/C Pressure Transducer voltage.

**Is the voltage below 0.5 volts?**

**Yes** >> Go To 2

**No** >> Go To 9

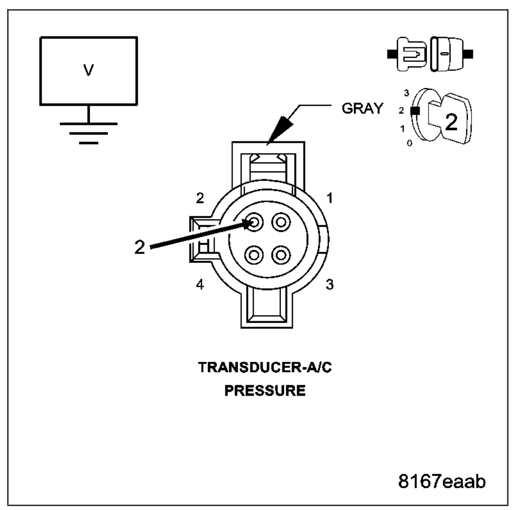
### 2. CHECK THE (K301) 5-VOLT SUPPLY CIRCUIT VOLTAGE

Turn the ignition off.
Disconnect the A/C Pressure Transducer harness connector.
Turn the ignition on.
Measure the voltage of the (K301) 5-Volt Supply circuit.

**Is the voltage above 4.5 volts?**

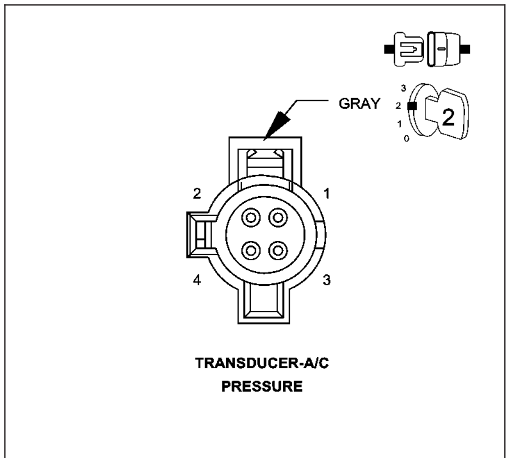
**Yes** >> Go To 3

**No** >> Go To 6



## 3. CHECK THE A/C PRESSURE TRANSDUCER VOLTAGE WITH THE TRANSDUCER DISCONNECTED

With the scan tool, read the A/C Pressure Transducer voltage.



8167eaaf

**Is the voltage above 0.5 of a volt?**

**Yes** >> Replace the A/C Pressure Transducer in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

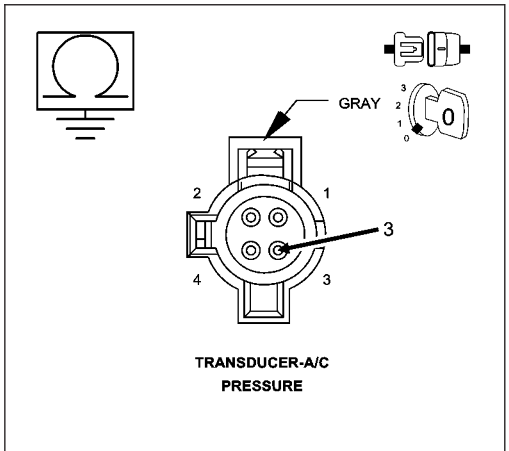
**No** >> Go To 4

## 4. CHECK THE (C18) A/C PRESSURE SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the BCM C2 harness connector.

Measure the resistance between ground and the (C18) A/C Pressure Signal circuit at the A/C Pressure Transducer harness connector.



8167eab3

**Is the resistance below 10k ohms?**

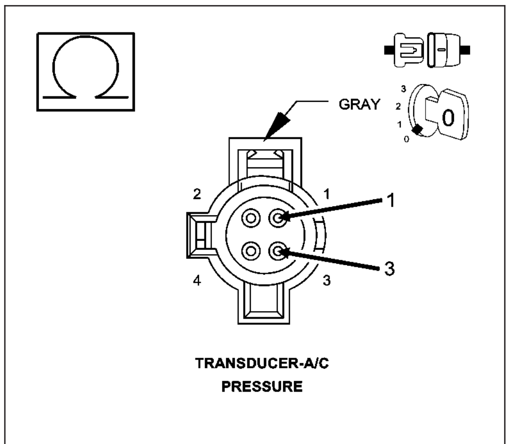
**Yes** >> Repair the (C18) A/C Pressure Signal circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK THE (C18) A/C PRESSURE SIGNAL CIRCUIT FOR A SHORT TO THE (K310) SENSOR GROUND CIRCUIT

Measure the resistance between the (C18) A/C Pressure Signal circuit and the (K310) Sensor Ground circuit at the A/C Pressure Transducer harness connector.



8167eab7

**Is the resistance below 10k ohms?**

**Yes** >> Repair the (C18) A/C Pressure Signal circuit for a short to the (K310) Sensor Ground circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 6. CHECK THE (K301) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Turn the ignition off.

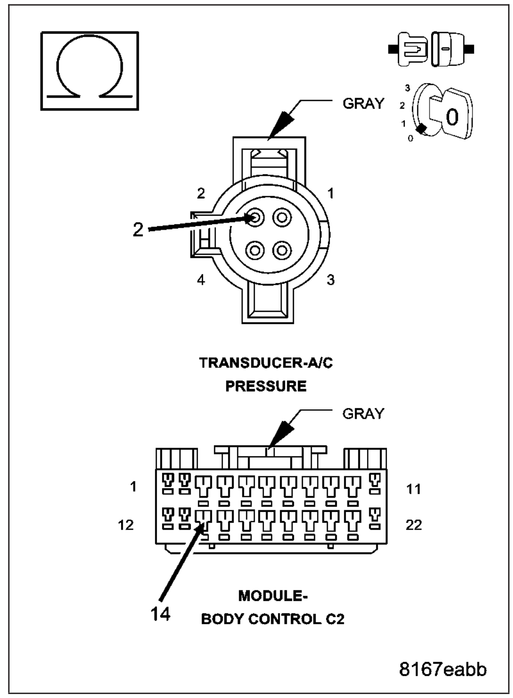
Disconnect the BCM C2 harness connector.

Measure the resistance of the (K301) 5-Volt Supply circuit between the A/C Pressure Transducer harness connector and the BCM C2 harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the (K301) 5-Volt Supply circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



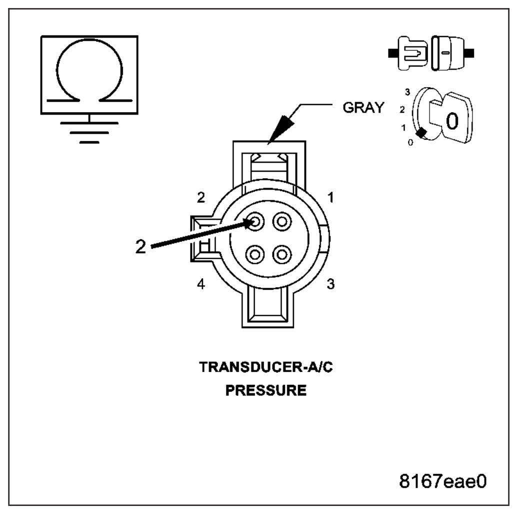

## 7. CHECK THE (K301) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (K301) 5-Volt Supply circuit at the A/C Pressure Transducer harness connector.

**Is the resistance below 10k ohms?**

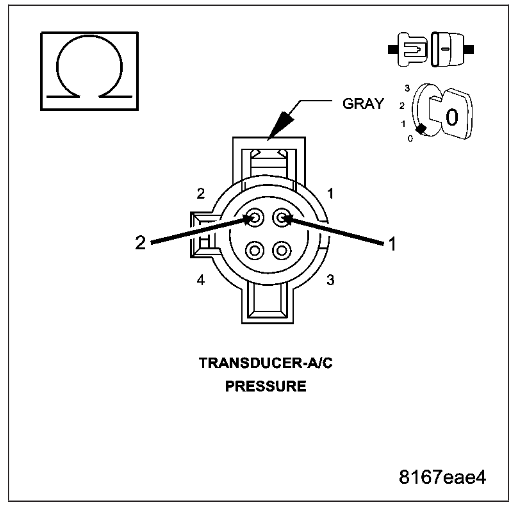
**Yes** >> Repair the (K301) 5-Volt Supply circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 8



## 8. CHECK THE (K301) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO FOR A SHORT TO THE (K310) SENSOR GROUND CIRCUIT

Measure the resistance between the (K301) 5-Volt Supply circuit and the (K310) Sensor Ground circuit at the A/C Pressure Transducer harness connector.




**Is the resistance below 10k ohms?**

**Yes** >> Repair the (K301) 5-Volt Supply circuit for a short to the (K310) Sensor Ground circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 9. TEST FOR INTERMITTENT CONDITION

**NOTE: The condition that set this DTC is not present at this time. The following may help in identifying the cause of the intermittent condition.**

Check the Technical Service Bulletins (TSBs) for related concerns.

Turn the ignition on.

Using the scan tool, erase the BCM DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

Monitor the scan tool for DTCs while wiggling the related wiring harness.

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chaffed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Perform a voltage drop test on the related circuits between the component and the BCM.

If numerous DTCs were set, use the wiring diagram/schematic to check for common ground and supply circuits.

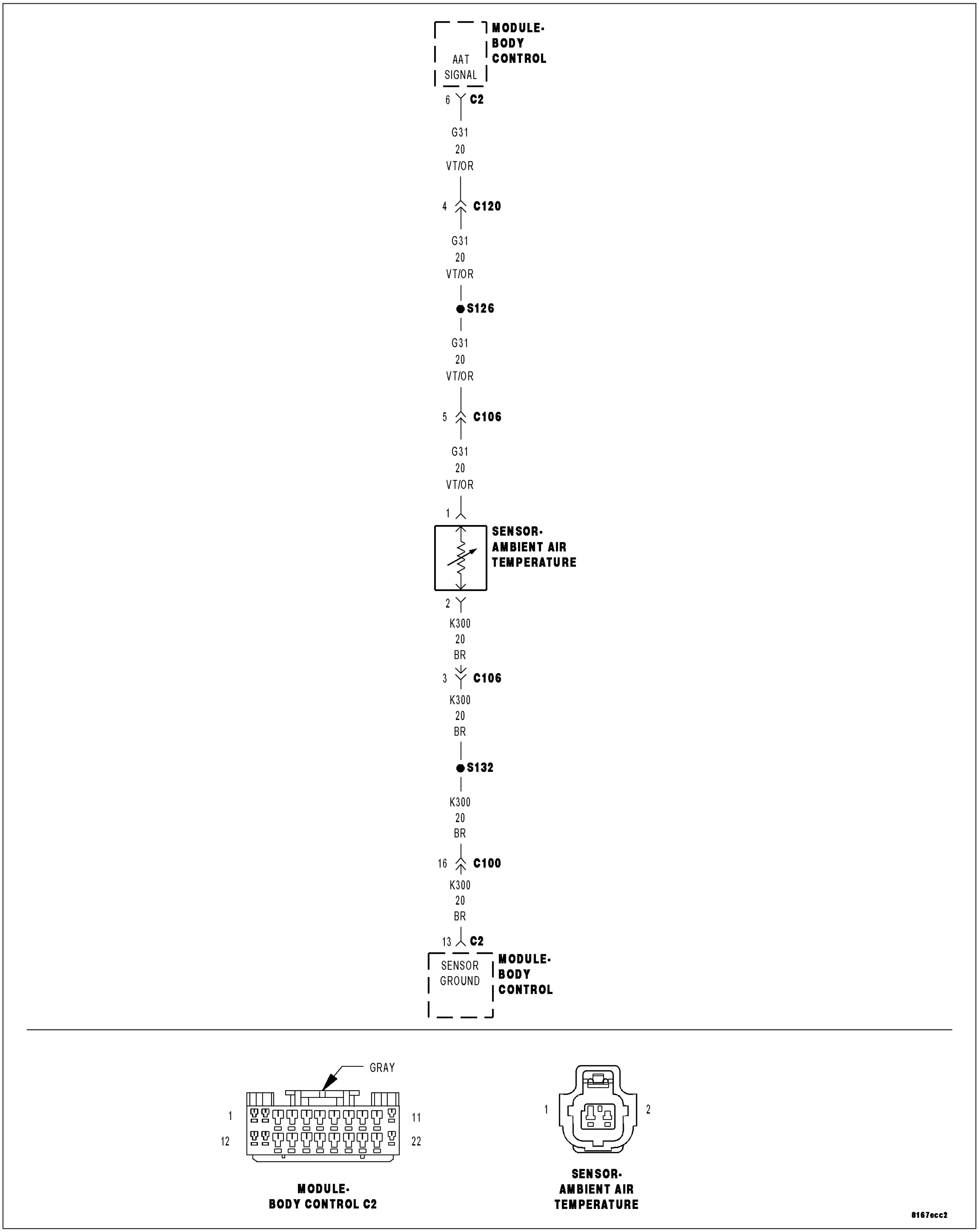
**Were any problems found?**

**Yes** >> Repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Test Complete.

## AMBIENT TEMPERATURE HIGH (BCM)




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Body Control Module (BCM) will set this DTC if voltage goes above 4.7 volts for more than 5 seconds on the (G31) Ambient Temperature Sensor Signal circuit.

| Possible Causes |
|---|
| (G31) AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| (G31) AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN |
| (K300) SENSOR GROUND CIRCUIT OPEN |
| AMBIENT TEMPERATURE SENSOR |
| BCM |

## Diagnostic Test

### 1. CHECK THE AMBIENT TEMPERATURE SENSOR VOLTAGE

Turn the ignition on.

With the scan tool, read the Ambient Temperature Sensor voltage.

**Is the voltage above 4.5 volts?**

**Yes** >> Go To 2

**No** >> Go To 7

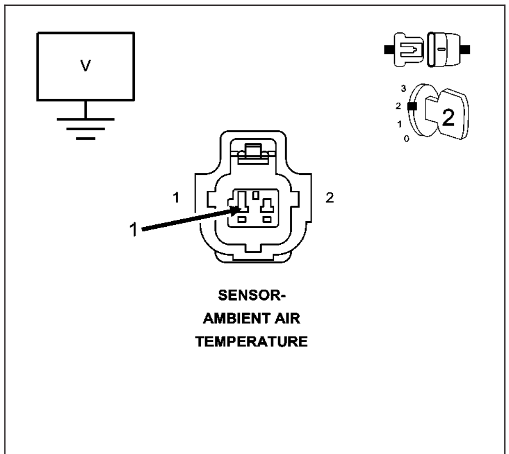
### 2. CHECK THE (G31) AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT VOLTAGE

Turn the ignition off.

Disconnect the Ambient Temperature Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (G31) Ambient Temperature Sensor Signal circuit.



8167eccc

**Is the voltage above 5.2 volts?**

**Yes** >> Go To 3

**No** >> Go To 4

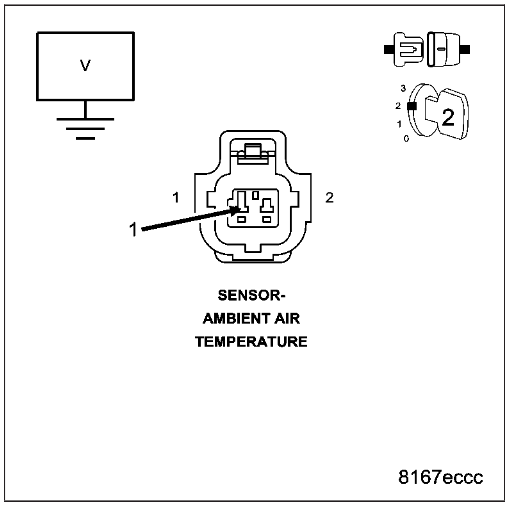
## 3. CHECK THE (G31) AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the BCM C2 harness connector.

Turn the ignition on.

Measure the voltage of the (G31) Ambient Temperature Sensor Signal circuit.




**Is the voltage above 0.2 volts?**

**Yes** >> Repair the (G31) Ambient Temperature Sensor Signal circuit for a short to voltage.

**No** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

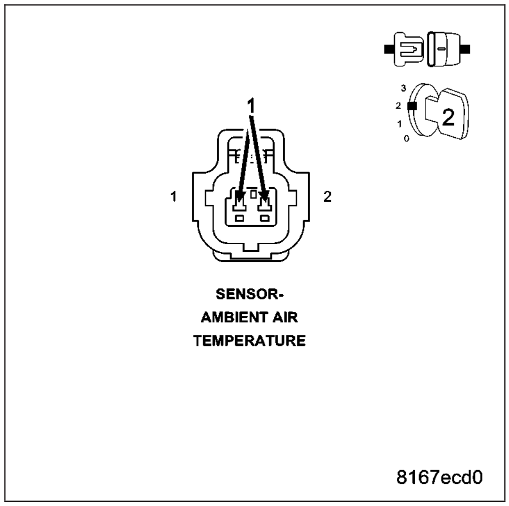
## 4. CHECK THE (G31) AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT & THE (K300) SENSOR GROUND CIRCUIT FUNCTION

Turn the ignition off.

Connect a jumper wire between the (G31) Ambient Temperature Sensor Signal circuit and the (K300) Sensor Ground circuit.

Turn the ignition on.

With the scan tool, read the Ambient Temperature Sensor voltage.



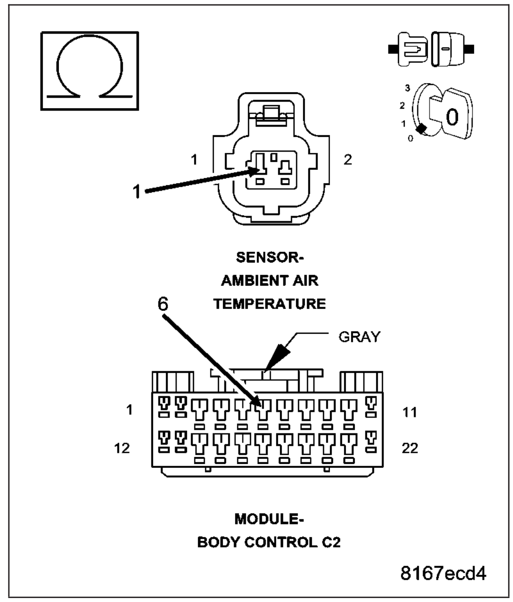

**Is the voltage below 1.0 volt?**

**Yes** >> Replace the Ambient Temperature Sensor in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK THE (G31) AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT FOR AN OPEN




Turn the ignition off.

Remove the jumper wire from the Ambient Temperature Sensor harness connector.

Disconnect the BCM C2 harness connector.

Measure the resistance of the (G31) Ambient Temperature Sensor Signal circuit between the Ambient Temperature Sensor harness connector and the BCM C2 harness connector.

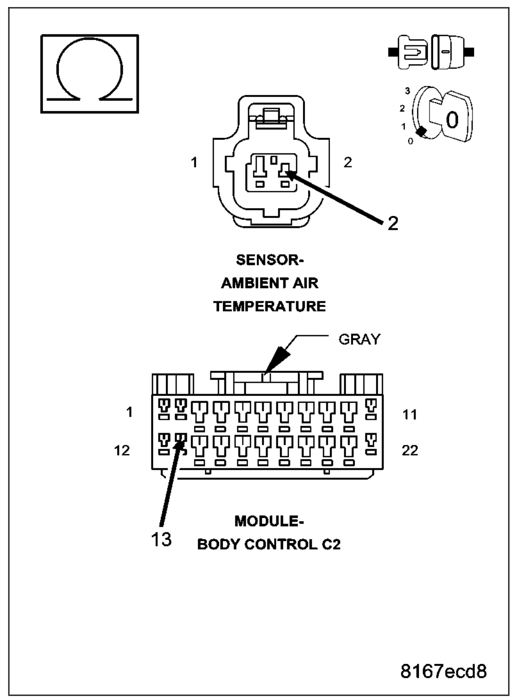
**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the (G31) Ambient Temperature Sensor Signal circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 6. CHECK THE (K300) SENSOR GROUND CIRCUIT FOR AN OPEN




Measure the resistance of the (K300) Sensor Ground circuit between the Ambient Temperature Sensor harness connector and the BCM C2 harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (K300) Sensor Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 7. TEST FOR INTERMITTENT CONDITION

**NOTE: The condition that set this DTC is not present at this time. The following may help in identifying the cause of the intermittent condition.**

Check the Technical Service Bulletins (TSBs) for related concerns.

Turn the ignition on.

Using the scan tool, erase BCM DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

Monitor the scan tool for DTCs while wiggling the related wiring harness.

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chaffed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Perform a voltage drop test on the related circuits between the component and the BCM.

If numerous DTCs were set, use the wiring diagram/schematic to check for common ground and supply circuits.

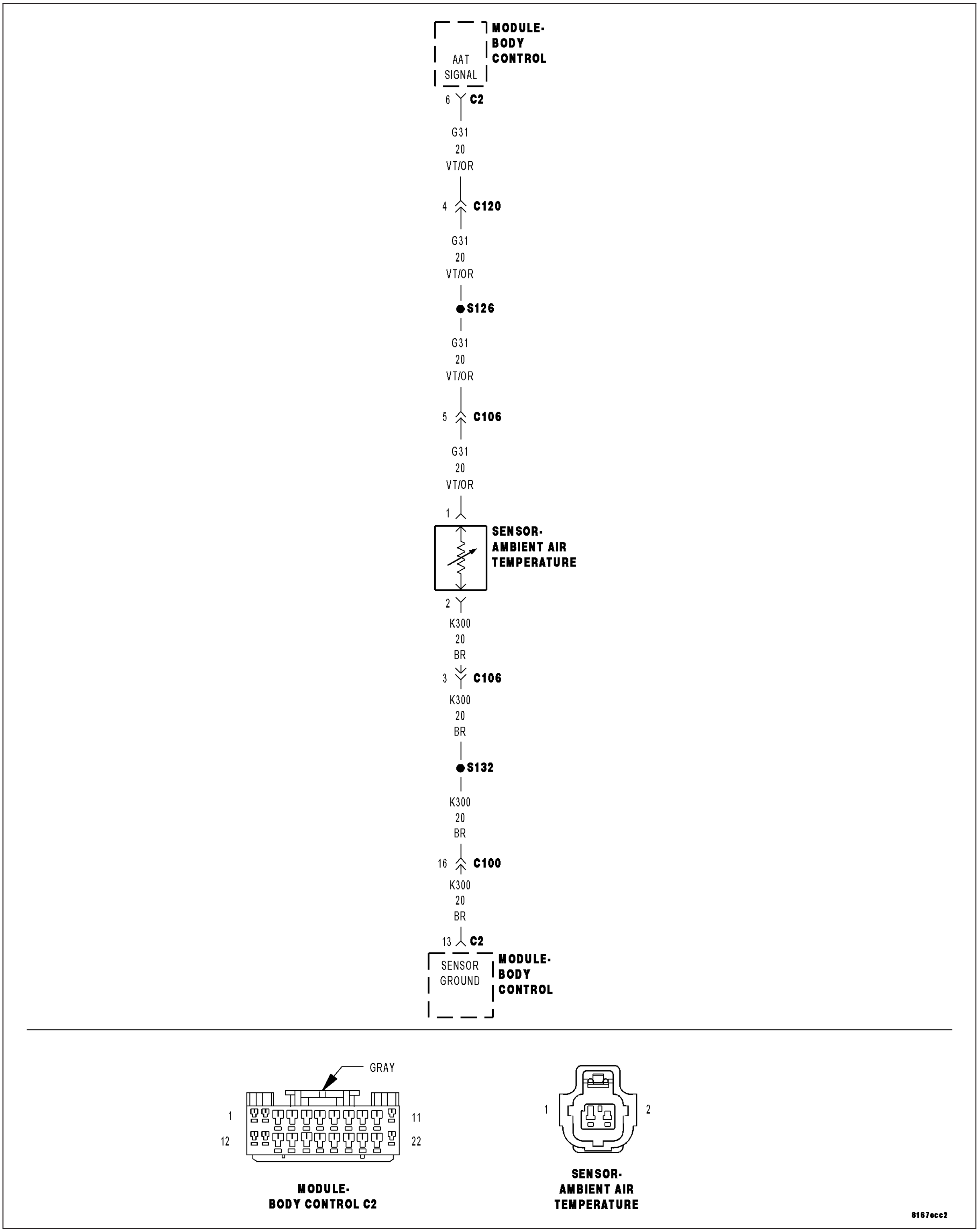
**Were any problems found?**

**Yes** >> Repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Test Complete.

## AMBIENT TEMPERATURE LOW (BCM)




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Body Control Module (BCM) will set this DTC if voltage drops below 0.195 volts for more than 5 seconds on the (G31) Ambient Temperature Sensor Signal circuit.

| **Possible Causes** |
|---|
| (G31) AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| (G31) AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO THE (K300) SENSOR GROUND CIRCUIT |
| AMBIENT TEMPERATURE SENSOR |
| BCM |

## Diagnostic Test

### 1. CHECK THE AMBIENT TEMPERATURE SENSOR VOLTAGE

Turn the ignition on.

With the scan tool, read the Ambient Temperature Sensor voltage.

**Is the voltage below 0.5 volts?**

**Yes** >> Go To 2

**No** >> Go To 5

### 2. CHECK THE AMBIENT TEMPERATURE SENSOR VOLTAGE WITH THE SENSOR DISCONNECTED

Turn the ignition off.

Disconnect the Ambient Temperature Sensor harness connector.

Turn the ignition on.

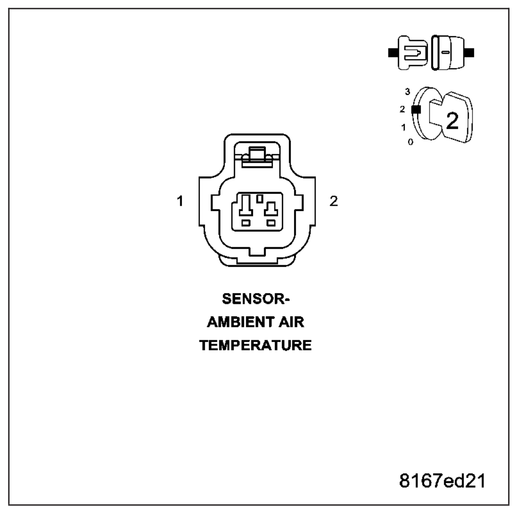
With the scan tool, read the Ambient Temperature Sensor voltage.

**Is the voltage above 4.6 volts?**

**Yes** >> Replace the Ambient Temperature Sensor in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 3

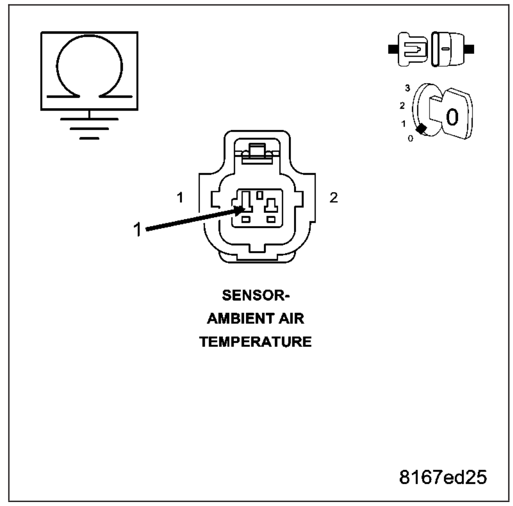


## 3. CHECK THE (G31) AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the BCM C2 harness connector.

Measure the resistance between ground and the (G31) Ambient Temperature Sensor Signal circuit at the Ambient Temperature Sensor harness connector.




**Is the resistance below 10k ohms?**

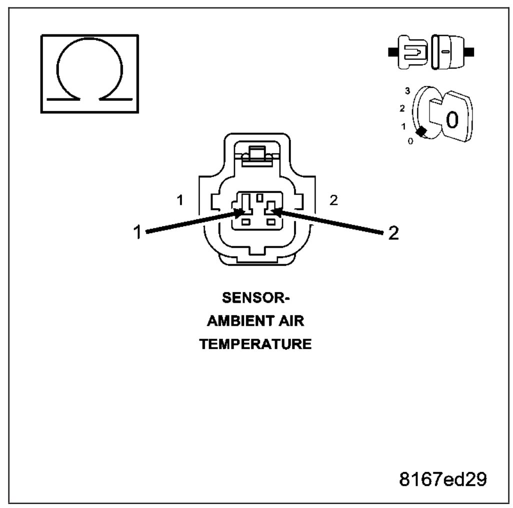
**Yes** >> Repair the (G31) Ambient Temperature Sensor Signal circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK THE (G31) AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO THE (K300) SENSOR GROUND CIRCUIT

Measure the resistance between the (G31) Ambient Temperature Sensor Signal circuit and the (K300) Sensor Ground circuit at the Ambient Temperature Sensor harness connector.




**Is the resistance below 10k ohms?**

**Yes** >> Repair the (G31) Ambient Temperature Sensor Signal circuit for a short to the (K300) Sensor Ground circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 5. TEST FOR INTERMITTENT CONDITION

**NOTE: The condition that set this DTC is not present at this time. The following may help in identifying the cause of the intermittent condition.**

Check the Technical Service Bulletins (TSBs) for related concerns.

Turn the ignition on.

Using the scan tool, erase BCM DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

Monitor the scan tool for DTCs while wiggling the related wiring harness.

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chaffed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Perform a voltage drop test on the related circuits between the component and the BCM.

If numerous DTCs were set, use the wiring diagram/schematic to check for common ground and supply circuits.

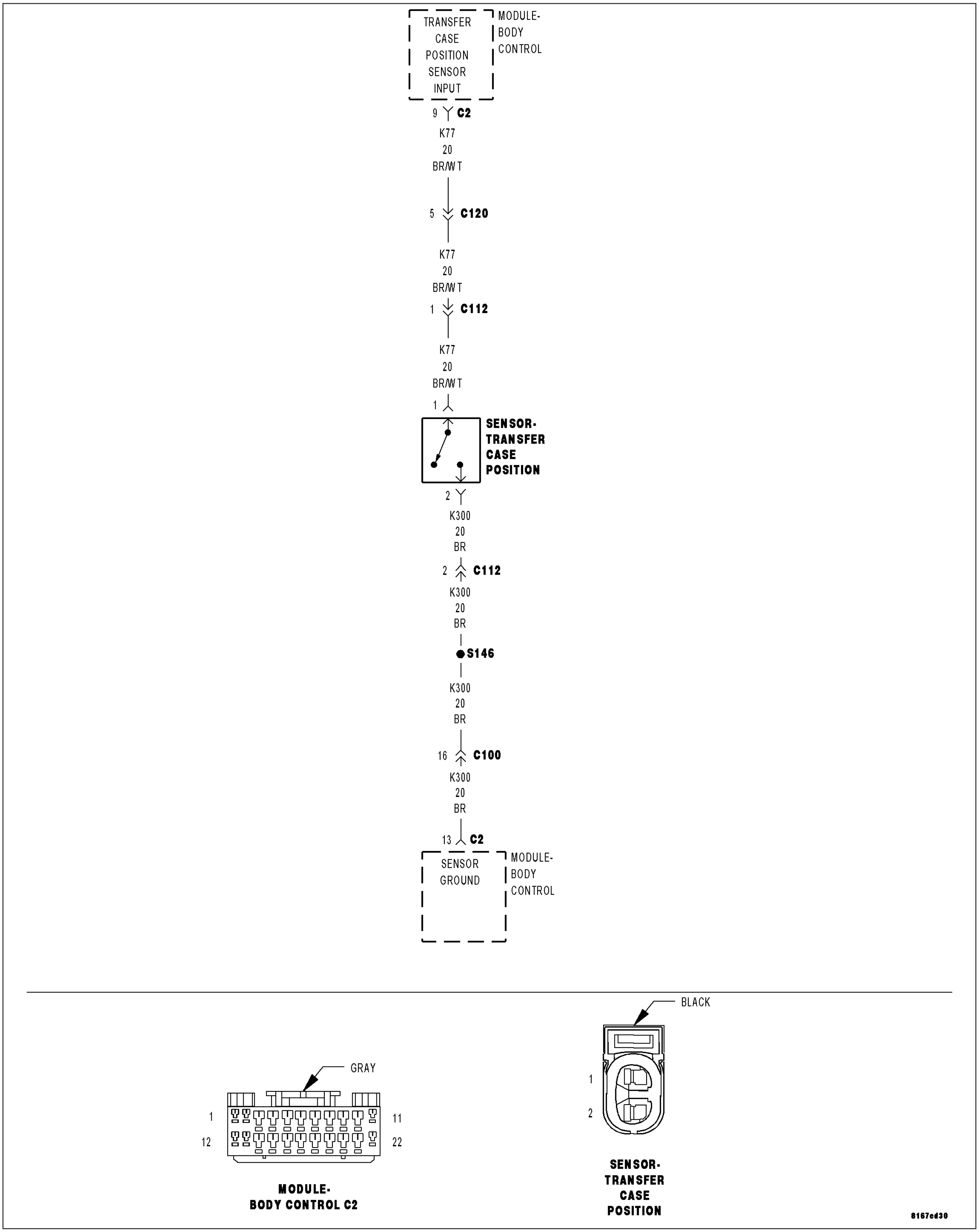
**Were any problems found?**

**Yes** >> Repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Test Complete.

## T-CASE SWITCH HIGH (BCM)




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Body Control Module (BCM) will set this DTC if voltage goes above 4.8 volts for more than 5 seconds on the (K77) Transfer Case Position Sensor Input circuit.

| Possible Causes |
|---|
| (K77) TRANSFER CASE POSITION SENSOR INPUT CIRCUIT SHORTED TO VOLTAGE |
| (K77) TRANSFER CASE POSITION SENSOR INPUT CIRCUIT OPEN |
| (K300) SENSOR GROUND CIRCUIT OPEN |
| TRANSFER CASE POSITION SENSOR |
| BCM |

## Diagnostic Test

### 1. CHECK THE TRANSFER CASE POSITION SENSOR INPUT VOLTAGE

Turn the ignition on.

With the scan tool, read the Transfer Case Position Sensor Input voltage.

**Is the voltage above 4.5 volts?**

**Yes** >> Go To 2

**No** >> Go To 7

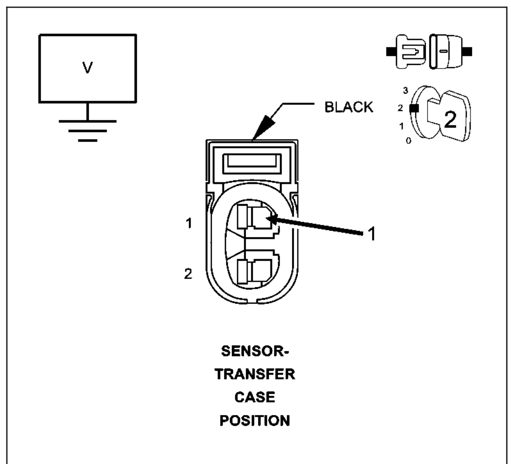
### 2. CHECK THE (K77) TRANSFER CASE POSITION SENSOR INPUT CIRCUIT VOLTAGE

Turn the ignition off.

Disconnect the Transfer Case Position Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K77) Transfer Case Position Sensor Input circuit.



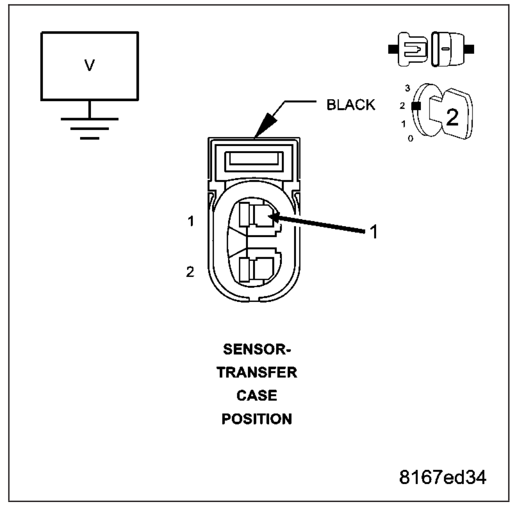
8167ed34

**Is the voltage above 5.2 volts?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK THE (K77) TRANSFER CASE POSITION SENSOR INPUT CIRCUIT FOR A SHORT TO VOLTAGE




Turn the ignition off.

Disconnect the BCM C2 harness connector.

Turn the ignition on.

Measure the voltage of the (K77) Transfer Case Position Sensor Input circuit at the Transfer Position Sensor harness connector.

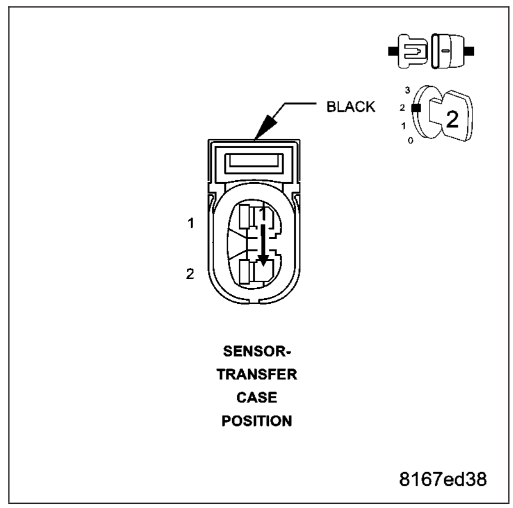
**Is the voltage above 0.2 volts?**

**Yes** >> Repair the (K77) Transfer Case Position Sensor Input circuit for a short to voltage.

**No** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 4. CHECK THE (K77) TRANSFER CASE POSITION SENSOR INPUT CIRCUIT & THE (K300) SENSOR GROUND CIRCUIT FUNCTION




Turn the ignition off.

Connect a jumper wire between the (K77) Transfer Case Position Sensor Input circuit and the (K300) Sensor Ground circuit.

Turn the ignition on.

With the scan tool, read the Transfer Case Position Sensor Input voltage.

**Is the voltage below 1.0 volt?**

**Yes** >> Replace the Transfer Case Position Sensor in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 5

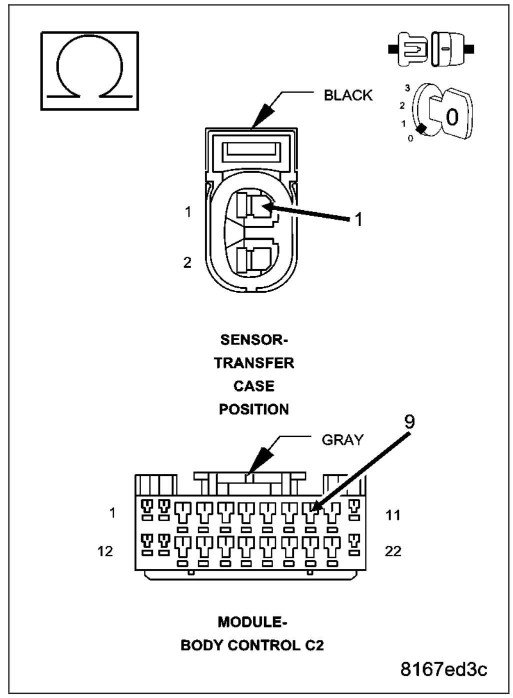
## 5. CHECK THE (K77) TRANSFER CASE POSITION SENSOR INPUT CIRCUIT FOR AN OPEN

Turn the ignition off.

Remove the jumper wire from the Transfer Case Position Sensor harness connector.

Disconnect the BCM C2 harness connector.

Measure the resistance of the (K77) Transfer Case Position Sensor Input circuit between the Transfer Case Position Sensor harness connector and the BCM C2 harness connector.




**Is the resistance below 5.0 ohms?**

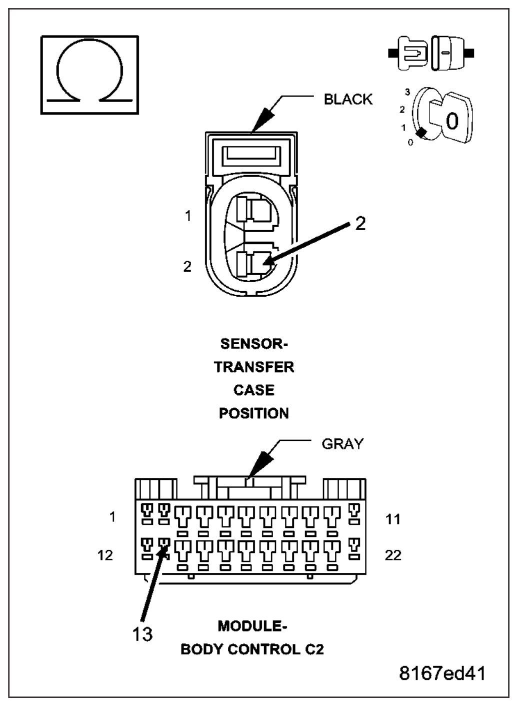
**Yes** >> Go To 6

**No** >> Repair the (K77) Transfer Case Position Sensor Input circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 6. CHECK THE (K300) SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the (K300) Sensor Ground circuit between the Transfer Case Position Sensor harness connector and the BCM C2 harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (K300) Sensor Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 7. TEST FOR INTERMITTENT CONDITION

**NOTE: The condition that set this DTC is not present at this time. The following may help in identifying the cause of the intermittent condition.**

Check the Technical Service Bulletins (TSBs) for related concerns.

Turn the ignition on.

Using the scan tool, erase BCM DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

Monitor the scan tool for DTCs while wiggling the related wiring harness.

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chaffed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Perform a voltage drop test on the related circuits between the component and the BCM.

If numerous DTCs were set, use the wiring diagram/schematic to check for common ground and supply circuits.

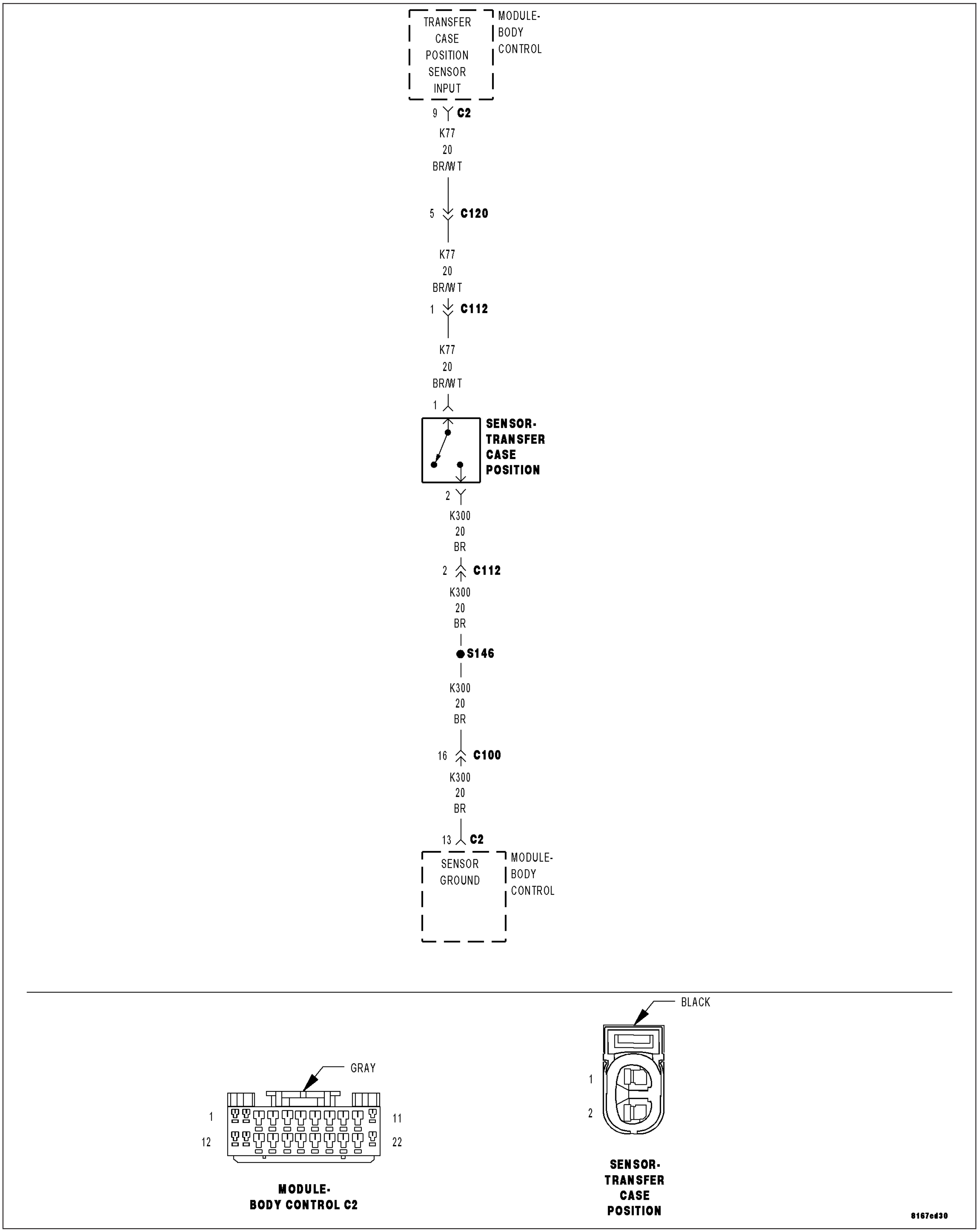
**Were any problems found?**

**Yes** >> Repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Test Complete.

## T-CASE SWITCH LOW (BCM)




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Body Control Module (BCM) will set this DTC if voltage drops below 0.155 volts for more than 5 seconds on the (K77) Transfer Case Position Sensor Input circuit.

| Possible Causes |
|---|
| (K77) TRANSFER CASE POSITION SENSOR INPUT CIRCUIT SHORTED TO GROUND |
| (K77) TRANSFER CASE POSITION SENSOR INPUT CIRCUIT SHORTED TO THE (K300) SENSOR GROUND CIRCUIT |
| TRANSFER CASE POSITION SENSOR |
| BCM |

## Diagnostic Test

### 1. CHECK THE TRANSFER CASE POSITION SENSOR INPUT VOLTAGE

Turn the ignition on.

With the scan tool, read the Transfer Case Position Sensor Input voltage.

**Is the voltage below 0.5 volts?**

**Yes** >> Go To 2

**No** >> Go To 5

### 2. CHECK THE TRANSFER CASE POSITION SENSOR INPUT VOLTAGE WITH THE SENSOR DISCONNECTED

Turn the ignition off.

Disconnect the Transfer Case Position Sensor harness connector.

Turn the ignition on.

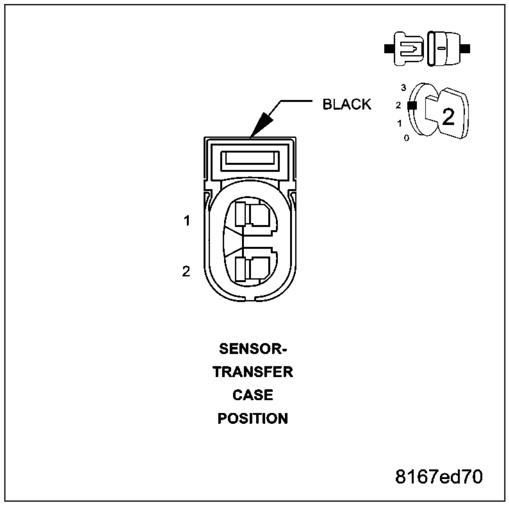
With the scan tool, read the Transfer Case Position Sensor voltage.

**Is the voltage above 4.6 volts?**

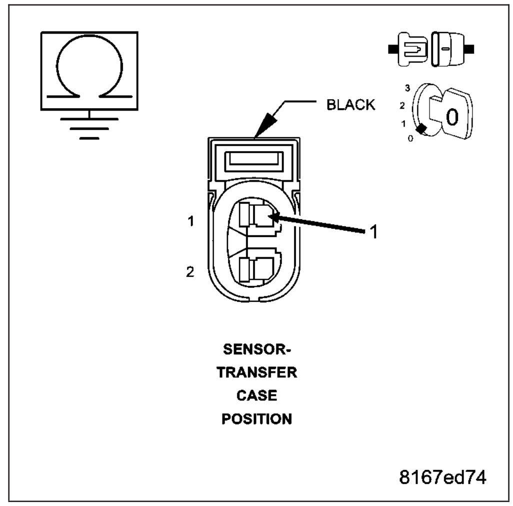
**Yes** >> Replace the Transfer Case Position Sensor in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 3



## 3. CHECK THE (K77) TRANSFER CASE POSITION SENSOR INPUT CIRCUIT FOR A SHORT TO GROUND




Turn the ignition off.

Disconnect the BCM C2 harness connector.

Measure the resistance between ground and the (K77) Transfer Case Position Sensor Input circuit at the Transfer Case Position Sensor harness connector.

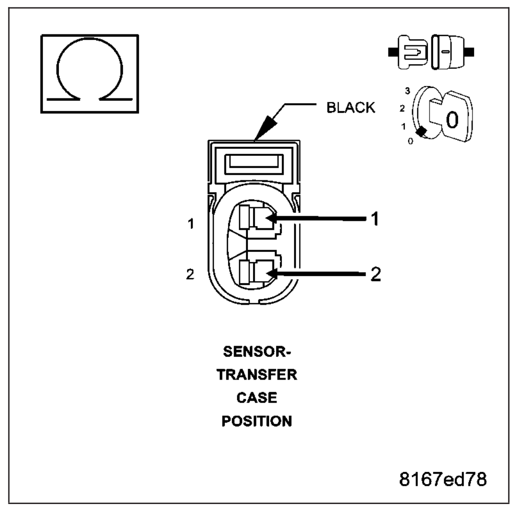
**Is the resistance below 10k ohms?**

**Yes** >> Repair the (K77) Transfer Case Position Sensor Input circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK THE (K77) TRANSFER CASE POSITION SENSOR INPUT CIRCUIT FOR A SHORT TO THE (K300) SENSOR GROUND CIRCUIT




Measure the resistance between the (K77) Transfer Case Position Sensor Input circuit and the (K300) Sensor Ground circuit at the Transfer Case Position Sensor harness connector.

**Is the resistance below 10k ohms?**

**Yes** >> Repair the (K77) Transfer Case Position Sensor Input circuit for a short to the (K300) Sensor Ground circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 5. TEST FOR INTERMITTENT CONDITION

**NOTE: The condition that set this DTC is not present at this time. The following may help in identifying the cause of the intermittent condition.**

Check the Technical Service Bulletins (TSBs) for related concerns.

Turn the ignition on.

Using the scan tool, erase BCM DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

Monitor the scan tool for DTCs while wiggling the related wiring harness.

Turn the ignition off.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chaffed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Perform a voltage drop test on the related circuits between the component and the BCM.

If numerous DTCs were set, use the wiring diagram/schematic to check for common ground and supply circuits.

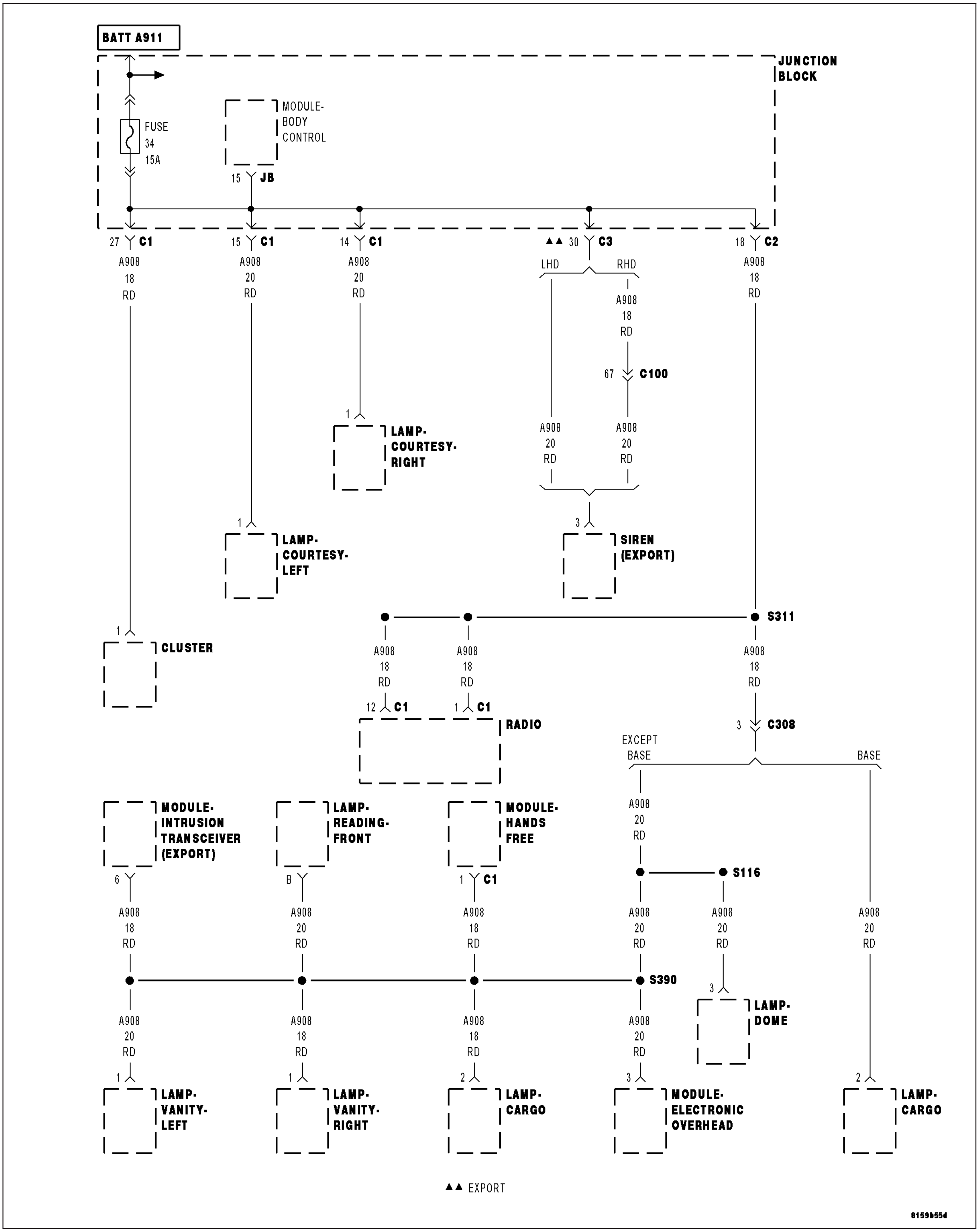
**Were any problems found?**

**Yes** >> Repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Test Complete.

## BATTERY IOD DISCONNECT AT BCM




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The BCM detects a no or low voltage condition on the IOD circuit.

| Possible Causes |
|---|
| OPEN FUSES |
| JUNCTION BLOCK |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR AN ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the BCM DTC's.

Turn the ignition off then turn the ignition on and wait approximately 1 minute.

With the scan tool, read the BCM DTC's.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. CHECK FUSES

Turn the ignition off.

Inspect the Junction Block and the PDC fuses.

**Are any fuses open?**

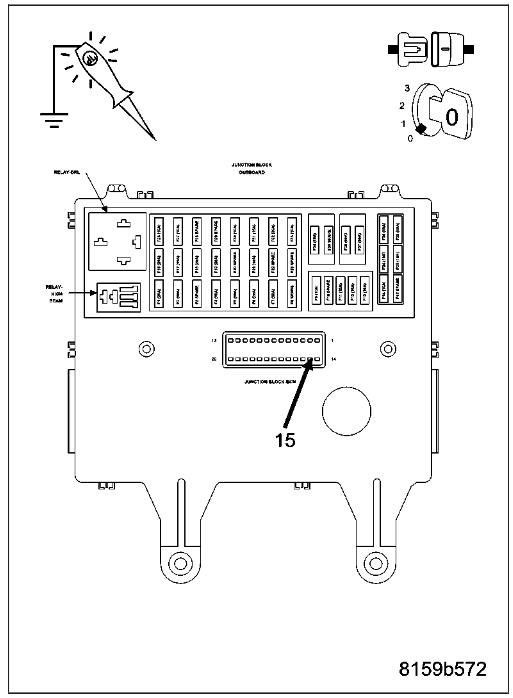
**Yes** >> Replace Fuse(s) as necessary. Use the wiring diagrams to help isolate a possible short circuit condition.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. CHECK THE (A908) FUSED B+ CIRCUIT FOR AN OPEN

Remove the BCM from the Junction Block.

Using a 12-volt test light connected to ground, probe the (A908) Fused B+ circuit (cavity 15).




**Is the test light illuminated?**

**Yes** >> Replace the Body Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (A908) Fused B+ circuit for an open. If ok, replace the Junction Block in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## EEPROM CHECKSUM FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  When the EEPROM memory checksum is determined to be incorrect.

| Possible Causes |
| --- |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the BCM DTC's.

Turn the ignition off then turn the ignition on and wait approximately 1 minute.

With the scan tool, read the BCM DTC's.

**Did this DTC reset?**

**Yes** >> Replace the Body Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Test Complete.

## FLASH CHECKSUM FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  When the flash checksum is determined to be incorrect.

| Possible Causes |
| --- |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the BCM DTC's.

Turn the ignition off then turn the ignition on and wait approximately 1 minute.

With the scan tool, read the BCM DTC's.

**Did this DTC reset?**

**Yes** >> Replace the Body Control Module in accordance with the service information.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Test Complete.

## ITM MESSAGES NOT RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The BCM does not receive any messages from the Intrusion Transceiver Module (ITM) for at least 30 seconds.

| Possible Causes |
|---|
| (D25) PCI BUS CIRCUIT OPEN |
| INTRUSION TRANSCEIVER MODULE POWER AND GROUND |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. ATTEMPT TO COMMUNICATE WITH THE INTRUSION TRANSCEIVER MODULE (ITM)

Turn the ignition on.

With the scan tool attempt to communicate with the ITM.

**Was the scan tool able to I/D or communicate with the ITM?**

**Yes** >> Go To 2

**No** >> Refer to the table of contents and perform the related symptom.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

### 2. BODY CONTROL MODULE

With the scan tool, erase the BCM DTC's.

Turn the ignition on and wait approximately 1 minute.

With the scan tool, read the BCM DTC's.

**Did this DTC reset?**

**Yes** >> Replace the Body Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## LOST COMMUNICATION WITH ITM, NO IFR RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The BCM does not receive any messages from the Intrusion Transceiver Module (ITM) for at least 30 seconds.

| Possible Causes |
|---|
| (D25) PCI BUS CIRCUIT OPEN |
| INTRUSION TRANSCEIVER MODULE POWER AND GROUND |
| BODY CONTROL MODULE |

### Diagnostic Test

#### 1. ATTEMPT TO COMMUNICATE WITH THE INTRUSION TRANSCEIVER MODULE (ITM)

Turn the ignition on.

With the scan tool attempt to communicate with the ITM.

**Was the scan tool able to I/D or communicate with the ITM?**

**Yes** >> Go To 2

**No** >> Refer to the table of contents and perform the related symptom.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

#### 2. BODY CONTROL MODULE

With the scan tool, erase the BCM DTC’s.

Turn the ignition on and wait approximately 1 minute.

With the scan tool, read the BCM DTC’s.

**Did this DTC reset?**

**Yes** >> Replace the Body Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## PCM/ECM MESSAGES NOT RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The BCM does not receive any messages from the PCM/ECM for at least 30 seconds.

| Possible Causes |
|---|
| PCM/ECM POWER AND GROUND |
| CAN C BUS CIRCUIT FAULT |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. ATTEMPT TO COMMUNICATE WITH THE PCM/ECM

Turn the ignition on.

With the scan tool attempt to communicate with the PCM/ECM.

**Was the scan tool able to I/D or communicate with the PCM/ECM?**

**Yes** >> Go To 2

**No** >> Refer to the table of contents and perform the related symptom.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

### 2. BODY CONTROL MODULE

With the scan tool, erase the BCM DTC's.

Turn the ignition on and wait approximately 1 minute.

With the scan tool, read the BCM DTC's.

**Did this DTC reset?**

**Yes** >> Ensure the CAN C Bus circuits are not open at the BCM, if ok then replace the Body Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## VIN MSG NOT RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Body Control Module (BCM) either fails to receive a VIN message within 1 second or the VIN message contains signal not available (SNA) information.

| Possible Causes |
|---|
| WIRING HARNESS, TERMINAL, CONNECTOR DAMAGE |
| DTCs RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| ECM OR PCM DTCs PRESENT |
| ECM OR PCM |
| BCM |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

Turn the ignition on.

With the scan tool, record an erase BCM DTCs.

Cycle the ignition switch.

With the scan tool, read BCM DTCs.

**Does this DTC reset?**

**Yes** >> Go To 2

**No** >> Using the schematics as a guide, check the BCM and the ECM or PCM pins, terminals, and connectors for corrosion, damage, and terminal push out. Pay particular attention to all Communication circuits.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCs

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs related to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

**No** >> Go To 3

### 3. CHECK IF ECM OR PCM DTCs ARE PRESENT

With the scan tool, read ECM or PCM DTCs.

**Are any DTCs present?**

**Yes** >> Diagnose and repair the DTC(s). Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCs

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs “Logged Against” the ECM or PCM?**

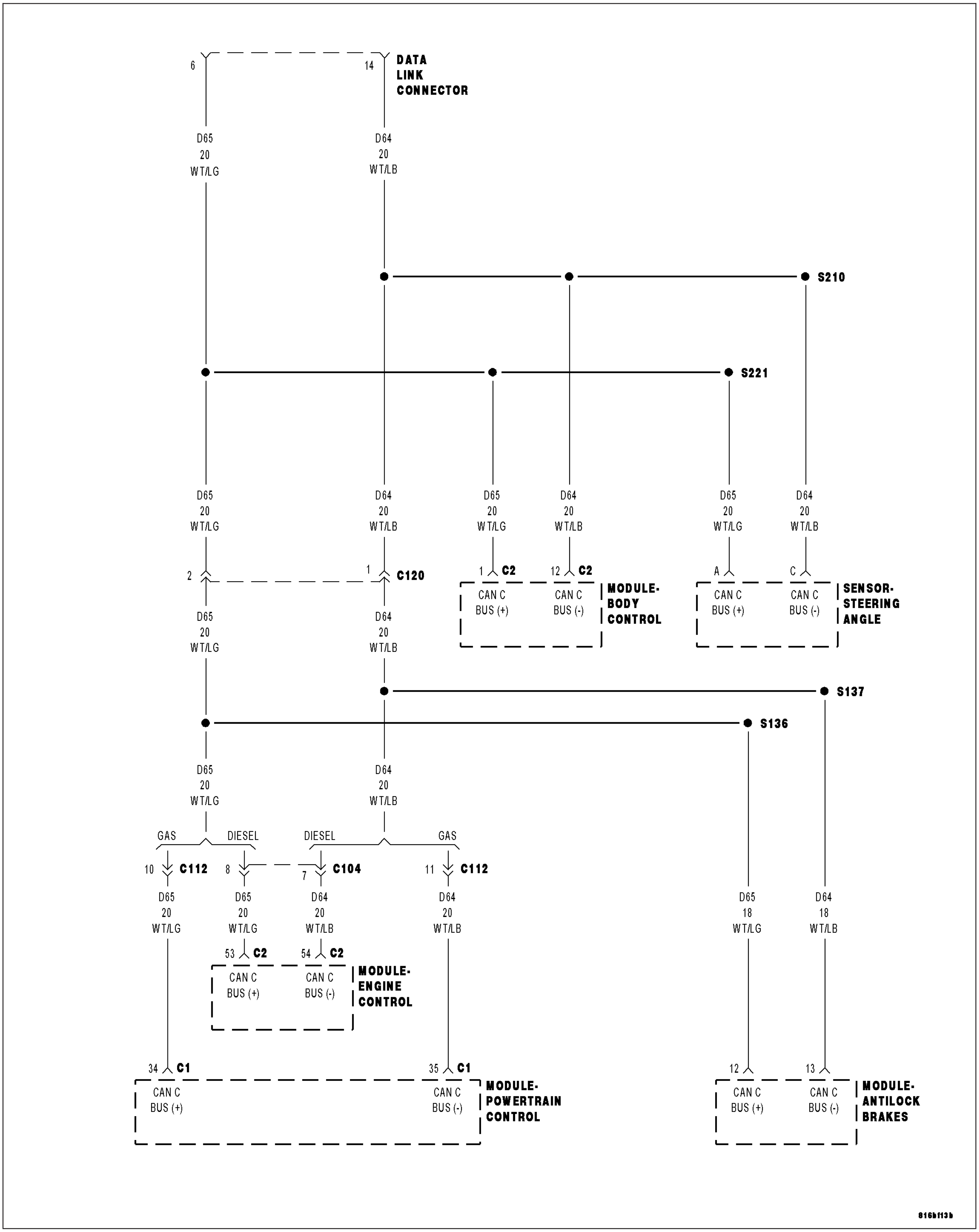
**Yes** >> Replace/update the ECM or PCM in accordance with the service information.

Perform POWERTRAIN VERIFICATION TEST. Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.

**No** >> Using the schematics as a guide, check the BCM pins, terminals, and connectors for corrosion, damage, and terminal push out. Pay particular attention to all Communication circuits. If no problems are found, replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## U0001-CAN C BUS CIRCUIT

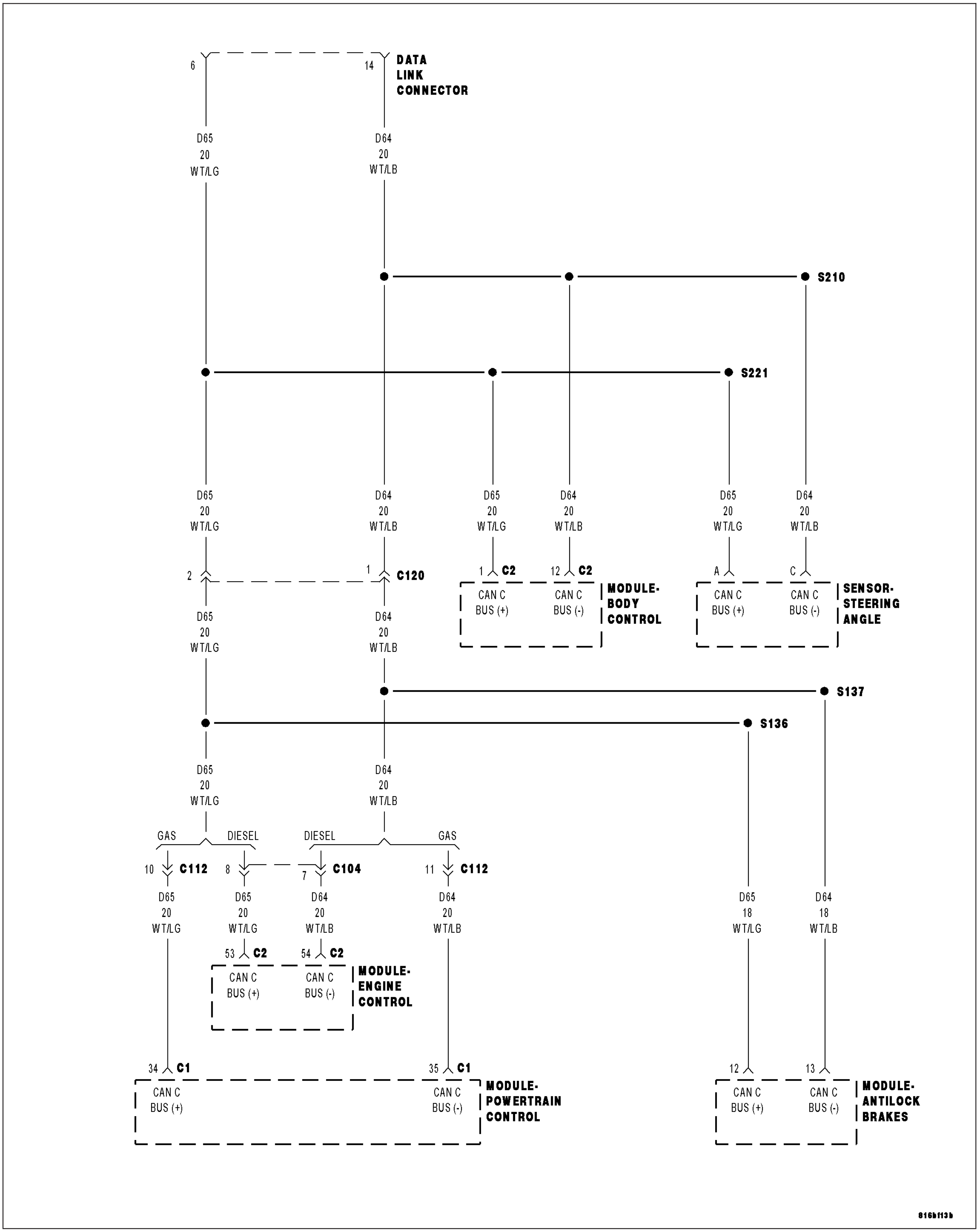



For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  A module detects a short in either CAN C Bus circuit.

Perform the CAN C Bus Communication Failure diagnostic test procedure. **(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)**.

## U0002–CAN C BUS OFF PERFORMANCE

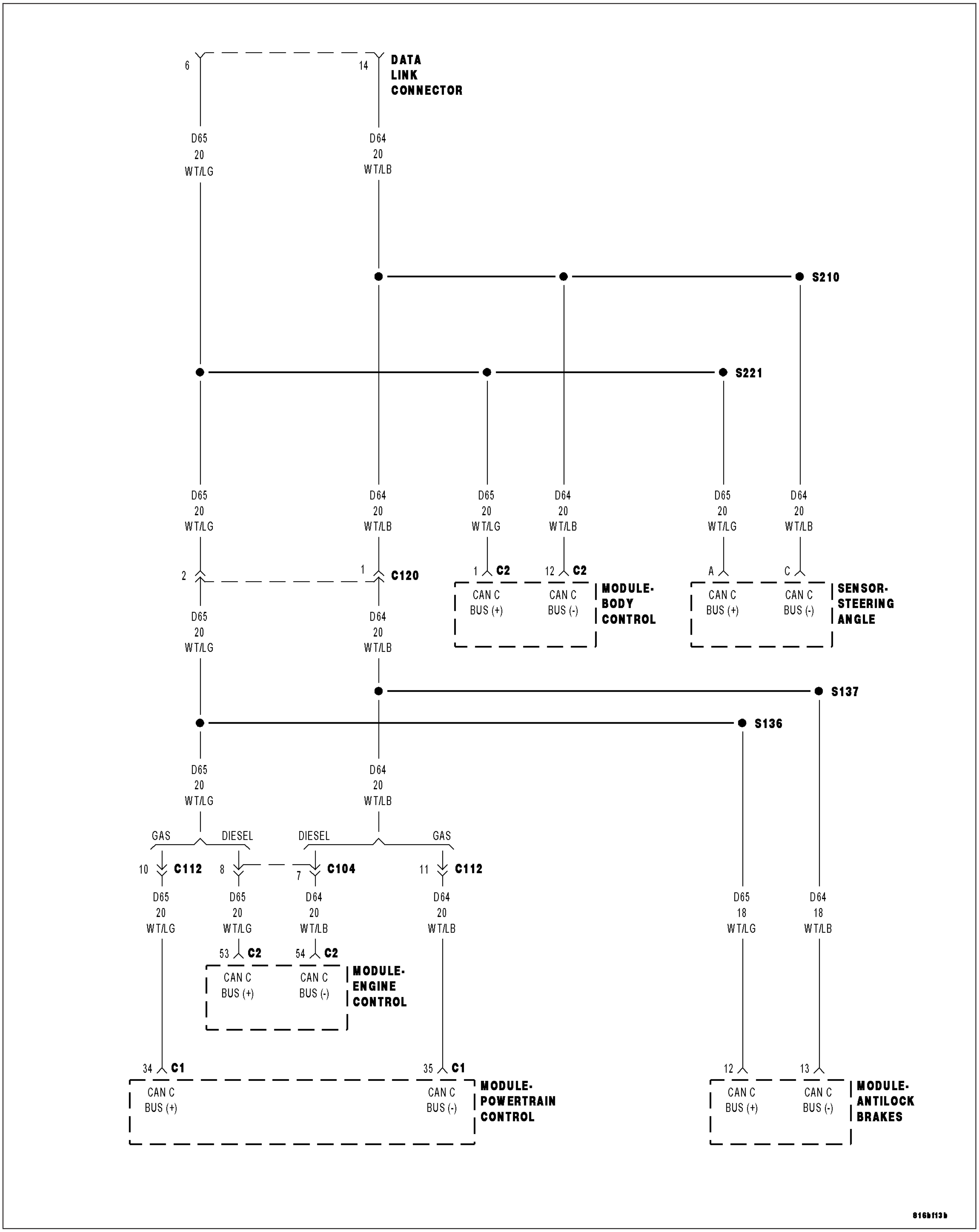



For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  A module detects a short in either CAN C Bus circuit.

Perform the CAN C Bus Communication Failure diagnostic test procedure. **(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)**.

## U0100-LOST COMMUNICATION WITH ECM/PCM




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
- **Set Condition:**
  Bus messages not received from the ECM/PCM for approximately 500ms.

| Possible Causes |
|---|
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| ECM/PCM |
| ECM/PCM POWER AND GROUND |
| MODULE THAT SET THIS DTC |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**
Turn the ignition on.

With the scan tool, read active DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Perform the Stored Lost Communication test procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC. Refer to the Table of Contents for a complete list of the symptoms.

**No** >> Go To 3

### 3. VERIFY THAT THE ECM/PCM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the ECM/PCM is active on the bus.

**Is the ECM/PCM active on the bus?**

**Yes** >> Go To 4

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

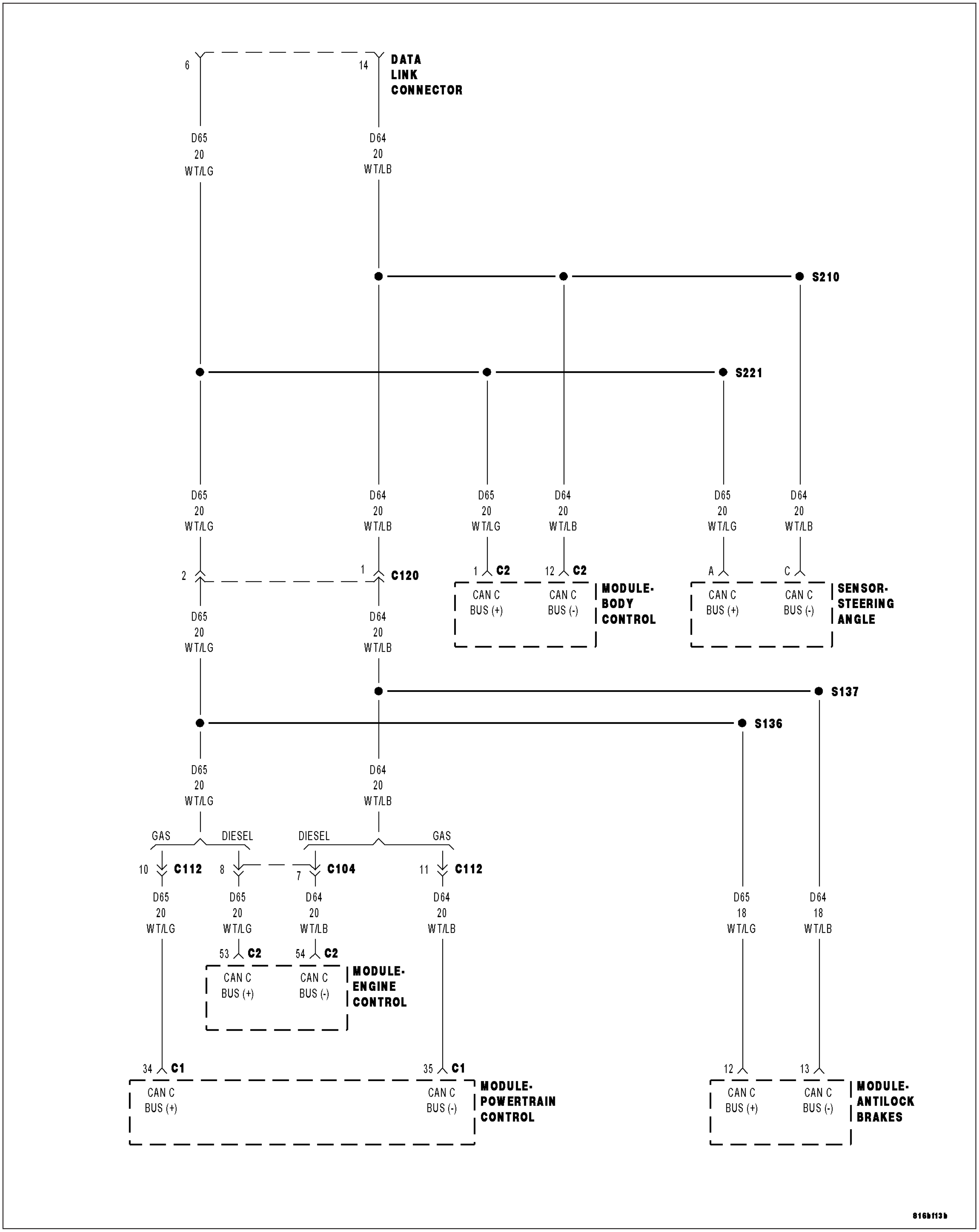
With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs “Logged Against” the ECM/PCM?**

**Yes** >> Replace/update the ECM/PCM in accordance with the service information.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace/update the module that set this DTC in accordance with the service information.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE SYSTEM (ABS) CONTROL MODULE



For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
- **Set Condition:**
  Bus messages not received from the Antilock Brake Module for approximately 500ms.

| Possible Causes |
|---|
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| ANTILOCK BRAKE MODULE |
| ANTILOCK BRAKE MODULE POWER AND GROUND |
| MODULE THAT SET THIS DTC |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**
Turn the ignition on.

With the scan tool, read active DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Perform the Stored Lost Communication test procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC. Refer to the Table of Contents for a complete list of the symptoms.

**No** >> Go To 3

### 3. VERIFY THAT THE ABS MODULE IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the ABS is active on the bus.

**Is the ABS active on the bus?**

**Yes** >> Go To 4

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic procedures.

### 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs “Logged Against” the ABS?**

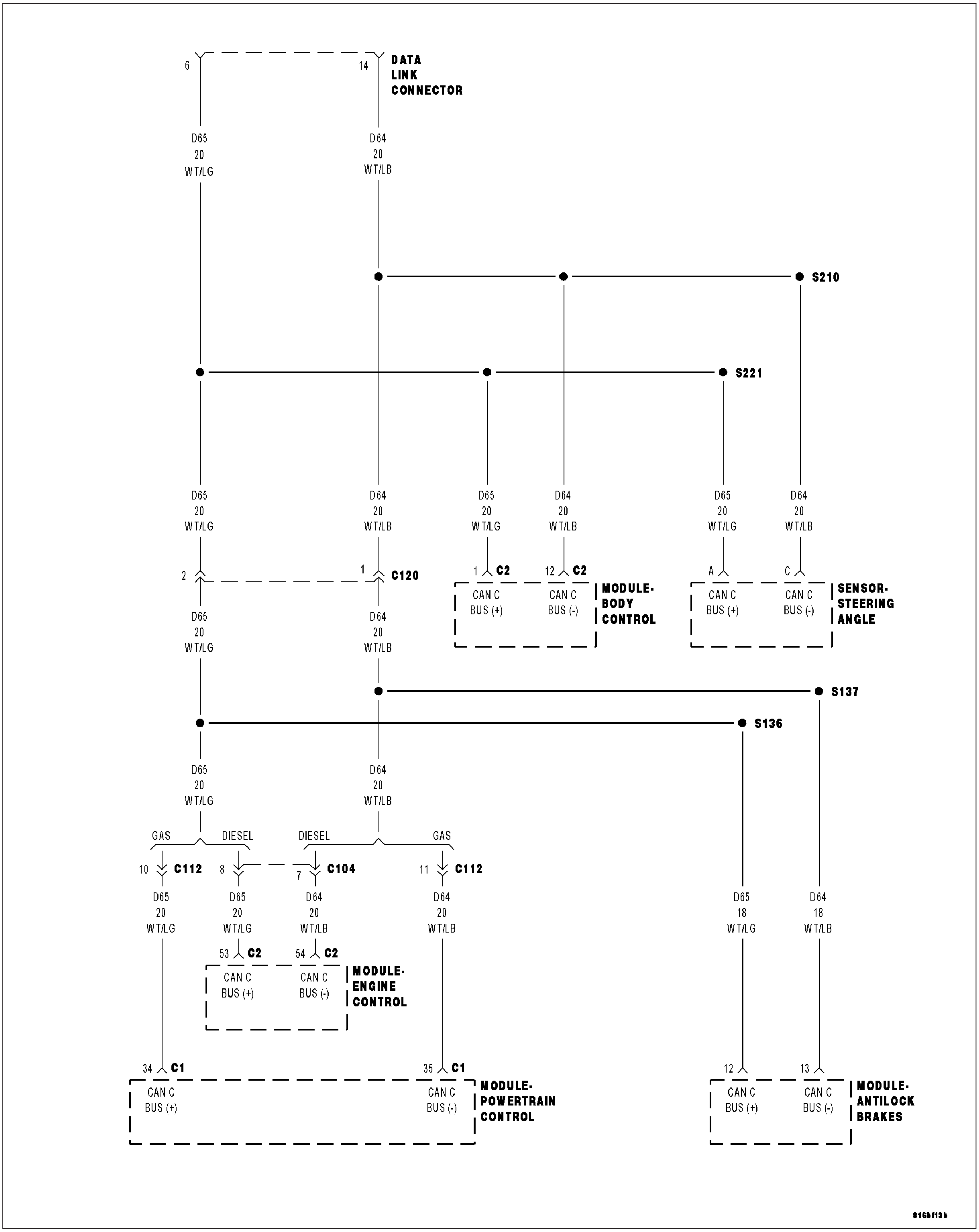
**Yes** >> Replace/update the Antilock Brake Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace/update the module that set this DTC in accordance with the service information

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## U0126-LOST COMMUNICATION WITH STEERING ANGLE SENSOR (SAS)




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
- **Set Condition:**
  Bus messages not received from the SAS (steering angle sensor) for approximately 500ms.

| Possible Causes |
|---|
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| STEERING ANGLE SENSOR |
| STEERING ANGLE SENSOR POWER AND GROUND |
| MODULE THAT SET THIS DTC |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**
Turn the ignition on.

With the scan tool, read active DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Perform the Stored Lost Communication test procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC. Refer to the Table of Contents for a complete list of the symptoms.

**No** >> Go To 3

### 3. VERIFY THAT THE SAS IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the SAS is active on the bus.

**Is the SAS active on the bus?**

**Yes** >> Go To 4

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic procedures.

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs "Logged Against" the SAS?**

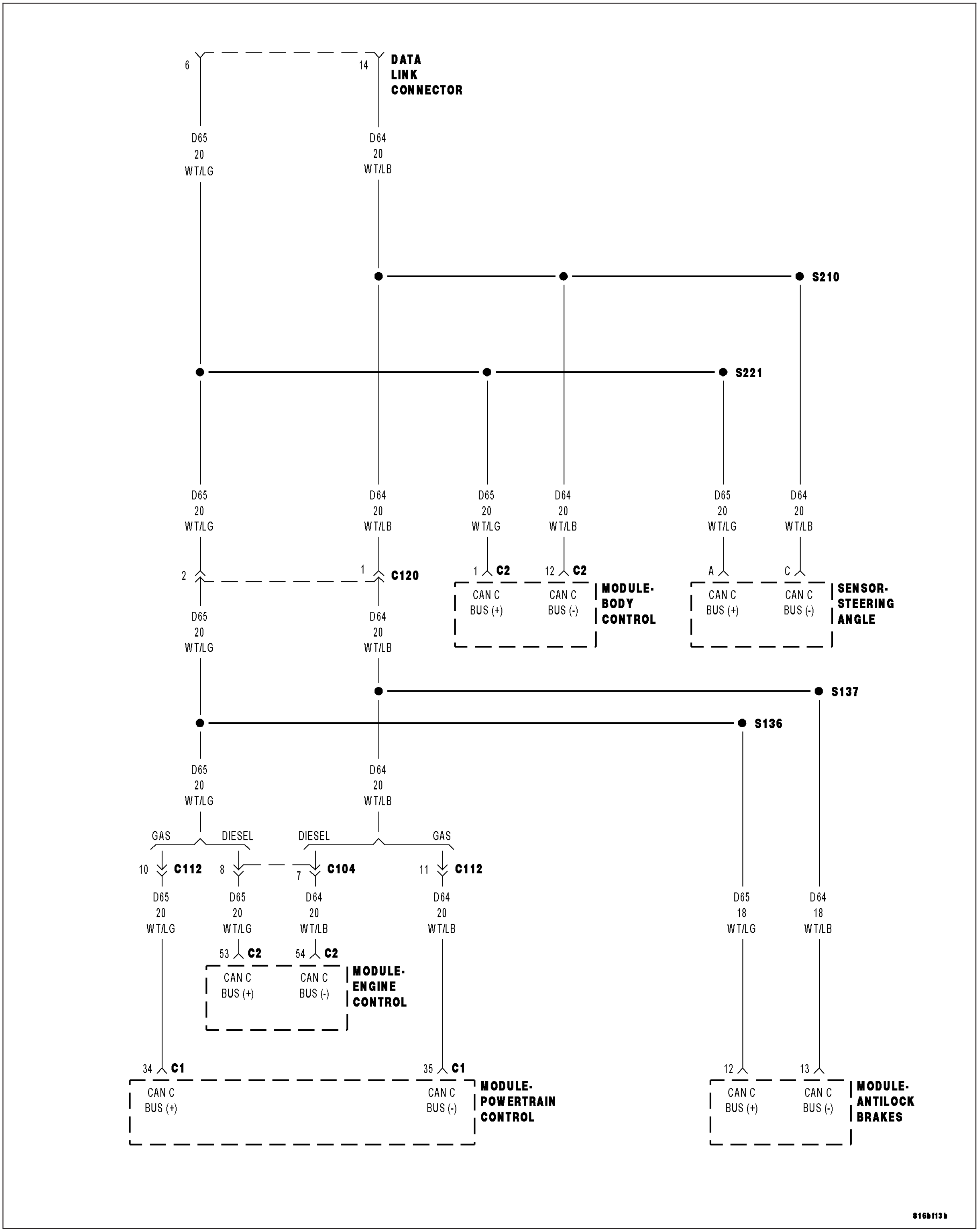
**Yes** >> Replace/update the Steering Angle Sensor (internal to the clockspring) in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace/update the module that set this DTC in accordance with the service information

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## U110A-LOST COMMUNICATION WITH SCCM - CAN C (STEERING ANGLE SENSOR)



For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
    - With the ignition on
    - Battery voltage between 10 and 16 volts
    - IOD fuse installed
- **Set Condition:**
  Bus messages not received from the SAS (steering angle sensor) for approximately 500ms.

| Possible Causes |
| --- |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| STEERING ANGLE SENSOR |
| STEERING ANGLE SENSOR POWER AND GROUND |
| MODULE THAT SET THIS DTC |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**
Turn the ignition on.

With the scan tool, read active DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Perform the Stored Lost Communication test procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC. Refer to the Table of Contents for a complete list of the symptoms.

**No** >> Go To 3

### 3. VERIFY THAT THE SAS IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the SAS is active on the bus.

**Is the SAS active on the bus?**

**Yes** >> Go To 4

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

### 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs “Logged Against” the SAS?**

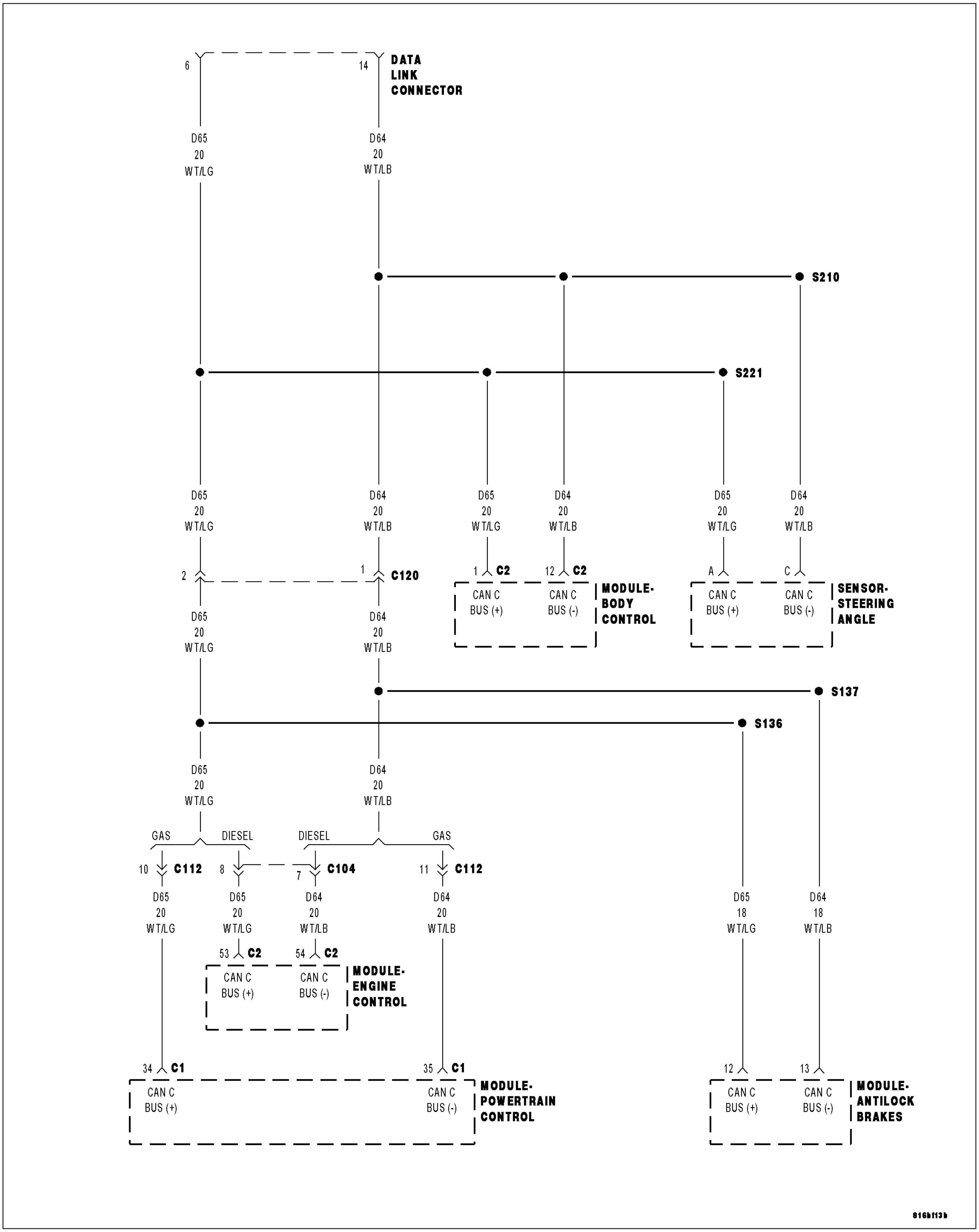
**Yes** >> Replace/update the Steering Angle Sensor (internal to the clockspring) in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace/update the module that set this DTC in accordance with the service information

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *STORED LOST COMMUNICATION DTCS




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
    - With the ignition on
    - Battery voltage between 10 and 16 volts
    - IOD fuse installed
- **Set Condition:**
  Bus messages not received from for approximately 500ms.

| Possible Causes |
|---|
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| POWER OR GROUND FROM THE REPORTING MODULE |
| MODULE THAT SET THIS DTC |
| PREVIOUS SERVICE PERFORMED WITHIN THE LAST 100 KEY CYCLES (FUSE/RELAYS REMOVED, WIRING SERVICE, BATTERY DISCONNECT) |
| LOW BATTERY/JUMP START CONDITION |
| IOD FUSE WAS REMOVED DURING SHIPPING |
| CHECK FOR RELATED TSBS |

## Diagnostic Test

### 1. VERIFY DTC IS STORED

**NOTE: Stored faults may indicate a customer perceived intermittent condition.**

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**

Turn the ignition on.

With the scan tool, read stored DTCs.

**Is this DTC stored?**

**Yes** >> Go To 2

**No** >> Diagnose the active DTC. Refer to the table of contents for a list of the symptoms.

### 2. CHECK THE ENVIRONMENTAL DATA

With the scan tool, read the loss of communication environmental data.

**Does the loss of communication environmental odometer data match up to any of the previous service procedures listed in the possible causes or are their any stored CAN C hardware electrical, battery, ignition voltage, VIN missing/mismatch DTCs present which match environmental data?**

**Yes** >> These DTCs may have been the result of other service procedures performed. Clear DTCs.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. VERIFY INTERMITTENT LOST COMMUNICATION DTC-WIRING CONCERNS

With the scan tool, select Network View and select Advanced.

**Is there more than one ECU with stored DTCs “Logged Against” the module and one or more lost communication DTCs stored in the offending module?**

**Yes** >> Verify if the vehicle was recently in for this type of service. Otherwise, visually inspect the related wiring harness for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals. Repair as necessary.

**No** >> Go To 4

## 4. VERIFY INTERMITTENT LOST COMMUNICATION DTC-OFFENDING MODULE

With the scan tool, select Network View and select Advanced.

**Is there more than one ECU with stored DTCs “Logged Against” the module and NO lost communication DTCs stored in the offending module?**

**Yes** >> Check for a TSB related to this offending module.

**No** >> Go To 5

## 5. VERIFY INTERMITTENT LOST COMMUNICATION DTC-REPORTING MODULE

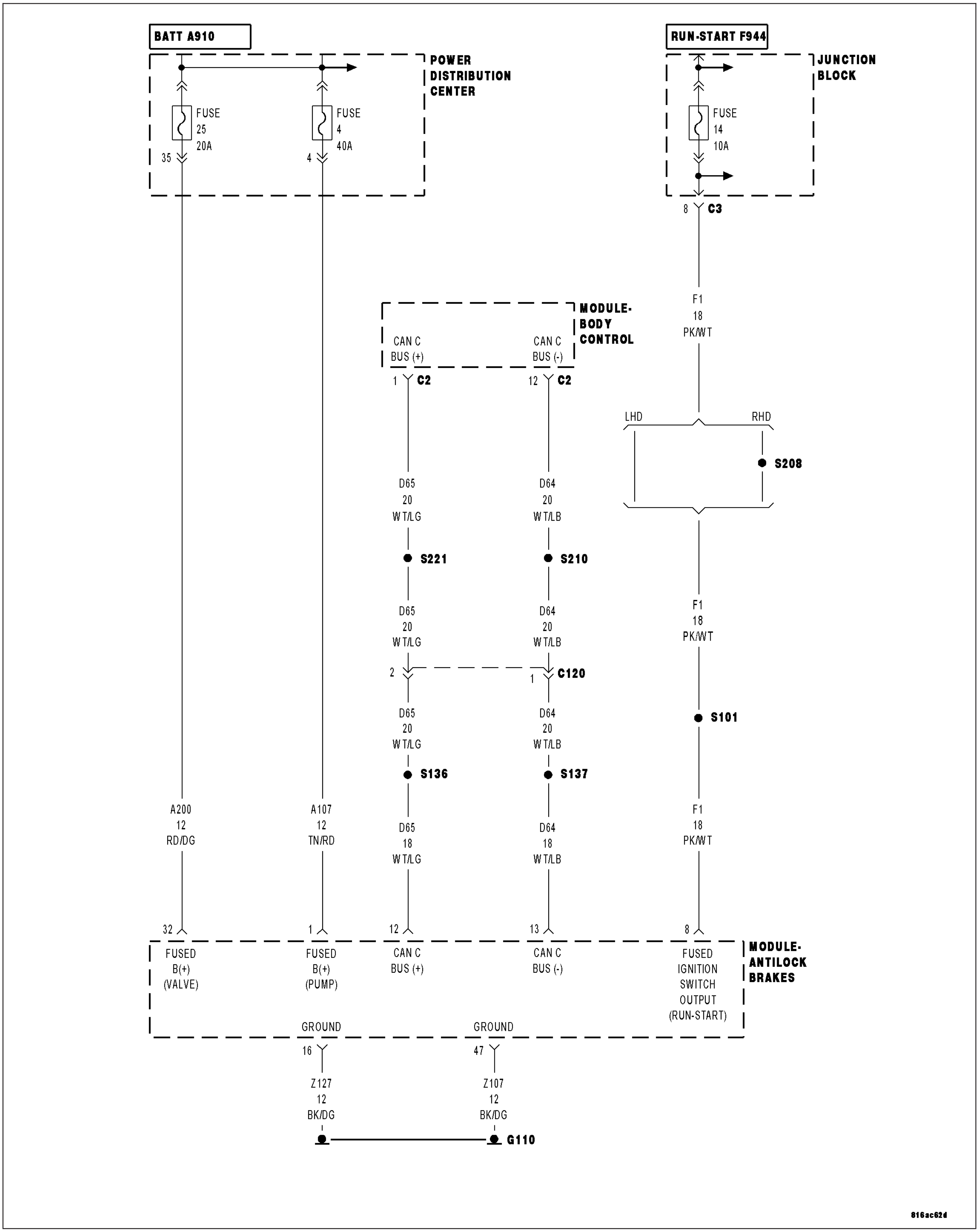
With the scan tool, select Network View and select Advanced.

**Is there ONLY ONE ECU with stored DTCs “Logged Against” the module?**

**Yes** >> Check for a TSB related to the module that set this DTC.

**No** >> Verify if the vehicle was recently in for this type of service. Otherwise, visually inspect the related wiring harness for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals. Repair as necessary.

## *NO RESPONSE FROM ABS (ANTILOCK BRAKE MODULE)




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (A107) (A200) FUSED B(+) CIRCUIT OPEN OR SHORTED |
| (Z107) (Z127) GROUND CIRCUIT OPEN |
| (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED |
| (D65) CAN C BUS (+) CIRCUIT OPEN |
| (D64) CAN C BUS (-) CIRCUIT OPEN |
| ANTILOCK BRAKE MODULE |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**

With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

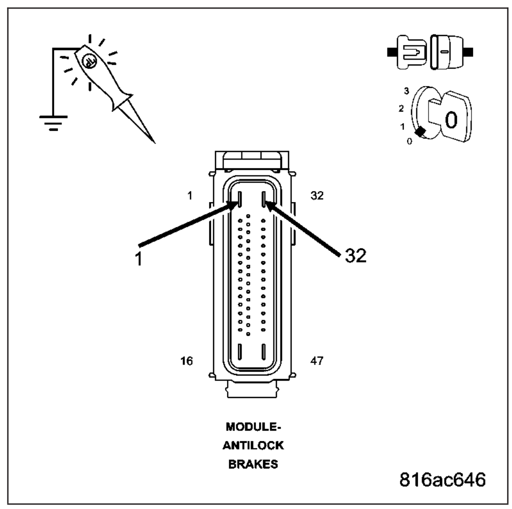
**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (A107) (A200) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the Antilock Brake Module harness connector.

Using a 12-volt test light connected to ground, check each (A107) and (A200) Fused B(+) circuit.




**Does the test light illuminate brightly for each circuit?**

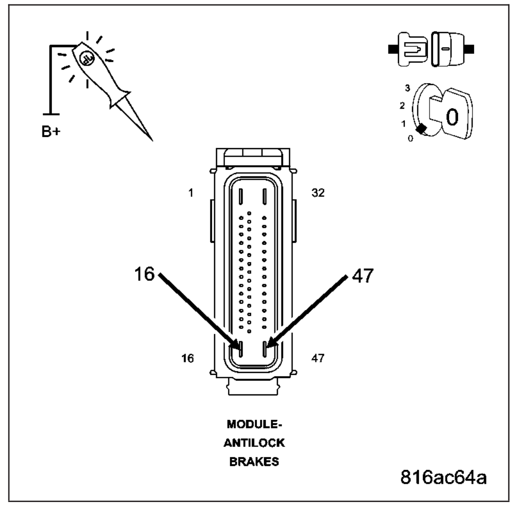
**Yes** >> Go To 3

**No** >> Repair the (A107) or (A200) Fused B(+) circuit for an open or short.

Perform ABS VERIFICATION TEST - VER 1.

## 3. (Z107) (Z127) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check each (Z107) and (Z127) ground circuit.




**Does the test light illuminate brightly for each circuit?**

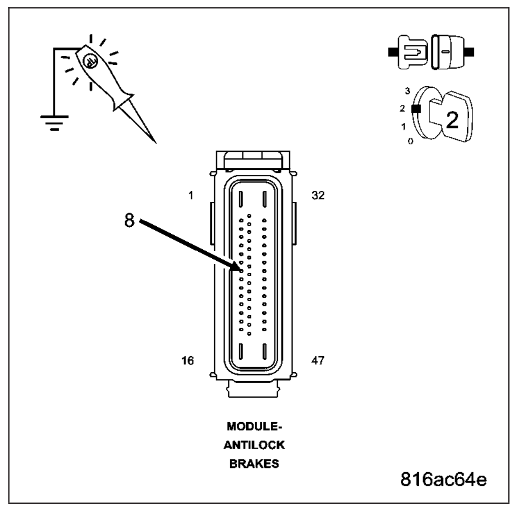
**Yes** >> Go To 4

**No** >> Repair the (Z107) or (Z127) ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.

## 4. (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F1) Fused Ignition Switch Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 5

**No** >> Repair the (F1) Fused Ignition Switch Output circuit for an open or short.
Perform ABS VERIFICATION TEST - VER 1.

## 5. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

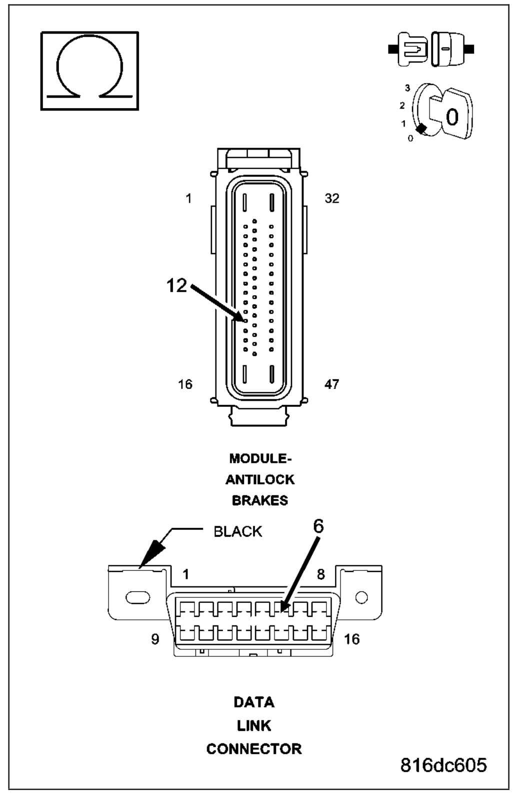
Disconnect the scan tool from the DLC connector.

Measure the resistance of the (D65) CAN C Bus (+) circuit between the DLC connector and the Antilock Brake Module connector.

**Is resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the (D65) CAN C Bus (+) circuit for an open.
Perform ABS VERIFICATION TEST - VER 1.



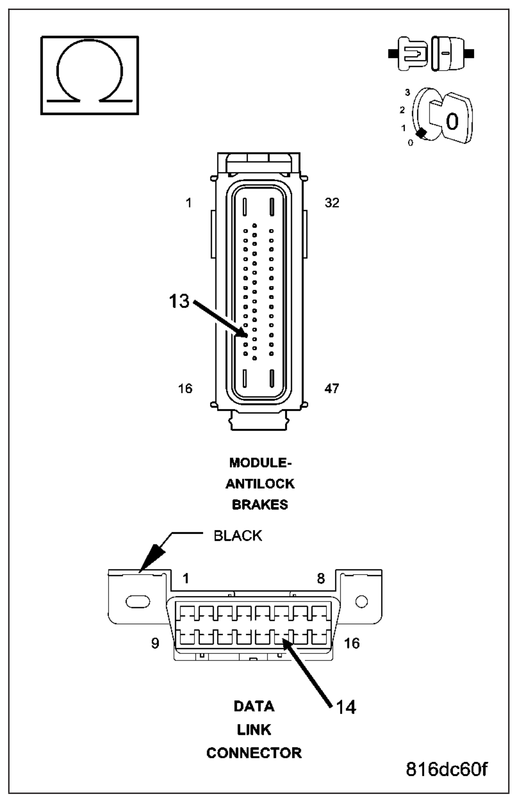

## 6. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the DLC connector and the Antilock Brake Module connector.

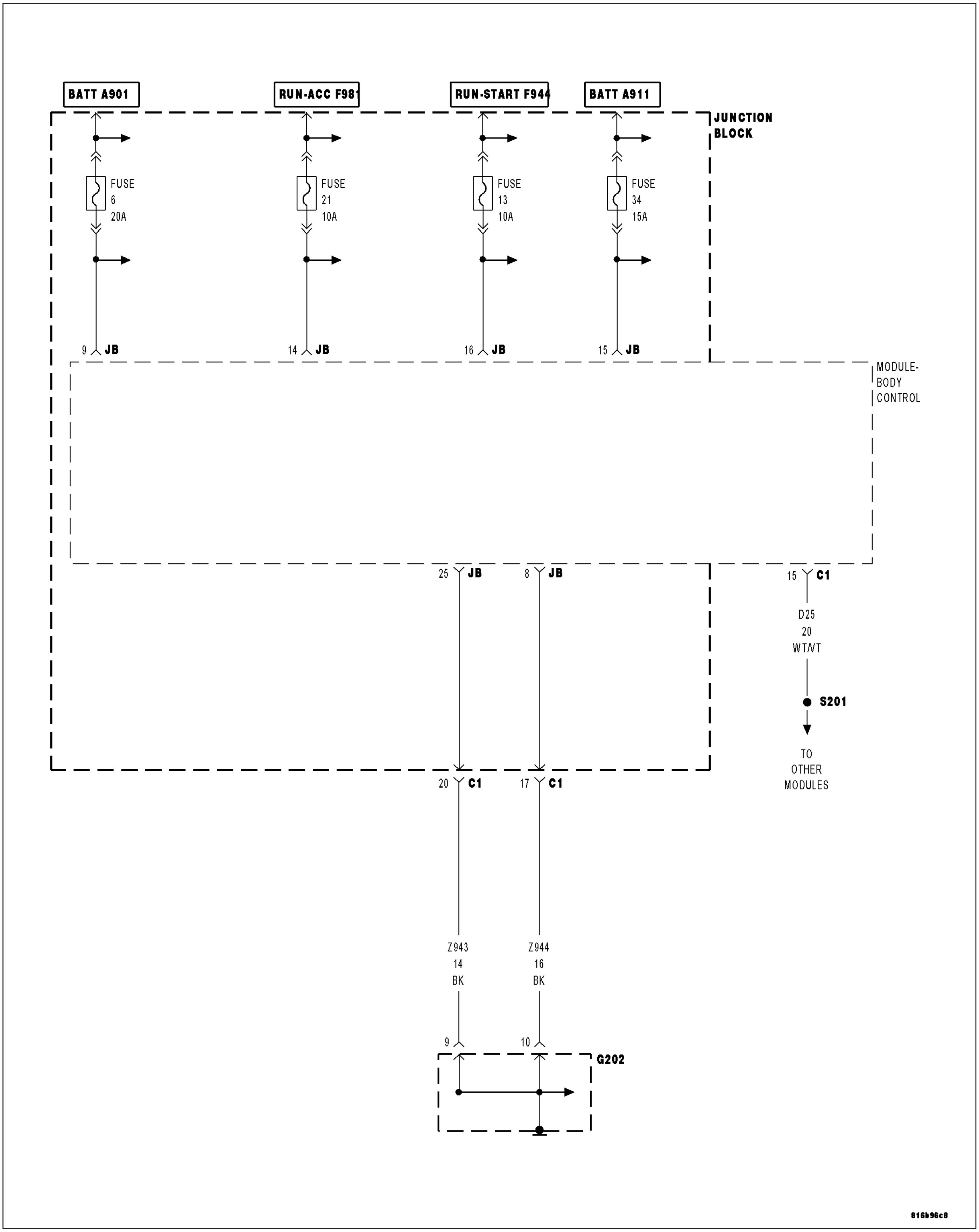
**Is resistance below 5.0 ohms?**

**Yes** >> Replace the Antilock Brake Module in accordance with the service information.
Perform ABS VERIFICATION TEST - VER 1.

**No** >> Repair the (D64) CAN C Bus (-) circuit for an open.
Perform ABS VERIFICATION TEST - VER 1.



## *NO RESPONSE FROM BODY CONTROL MODULE




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (Z943) (Z944) GROUND CIRCUIT OPEN |
| (A213) (A908) FUSED B(+) CIRCUIT OPEN |
| (F98) (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN |
| (D25) PCI BUS CIRCUIT OPEN |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. PCI BUS COMMUNICATION AND TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**
With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (Z943) (Z944) GROUND CIRCUIT OPEN

Turn the ignition off.

Remove the Body Control Module from the Junction Block.

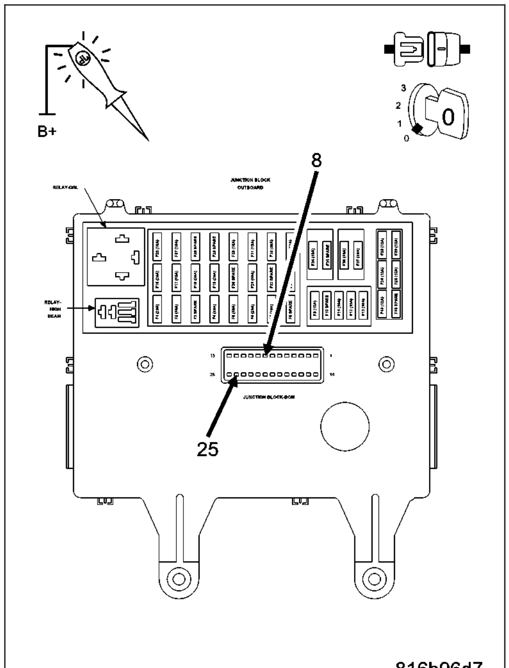
Using a 12-volt test light connected to 12-volts, probe each (Z943) and (Z944) ground circuit.

**Does the test light illuminate brightly for each circuit?**

**Yes** >> Go To 3

**No** >> Repair the appropriate ground circuit for an open between the Junction Block and the common grounding point. If OK, replace the Junction Block in accordance with the service information.

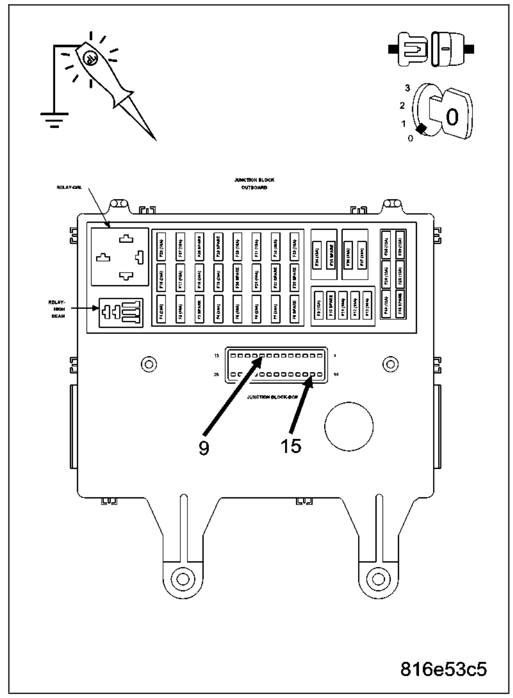
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).




816b96d7

## 3. (A213) (A908) FUSED B(+) CIRCUIT OPEN

Using a 12-volt test light connected to ground, probe the (A213) and (A908) Fused B(+) circuit.




**Does the test light illuminate brightly for each circuit?**

**Yes** >> Go To 4

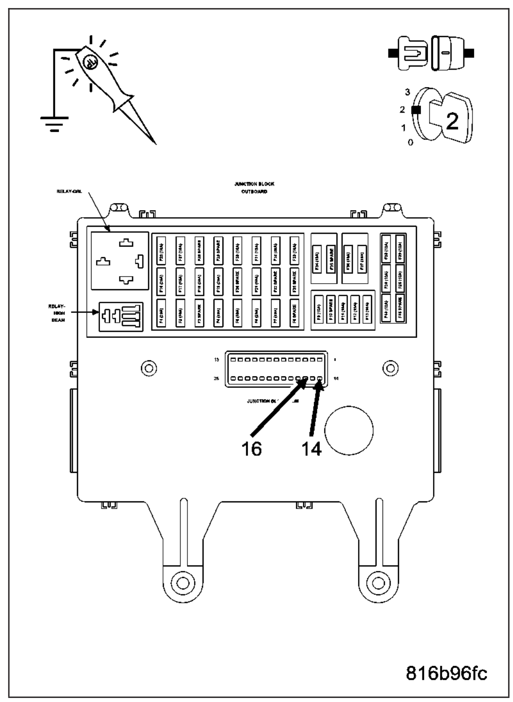
**No** >> Check all Junction Block and PDC fuses. If OK, replace the Junction Block in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 4. (F98) (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (F98) and (F942) Fused Ignition Switch Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 5

**No** >> Check all Junction Block and PDC fuses. If OK, replace the Junction Block in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

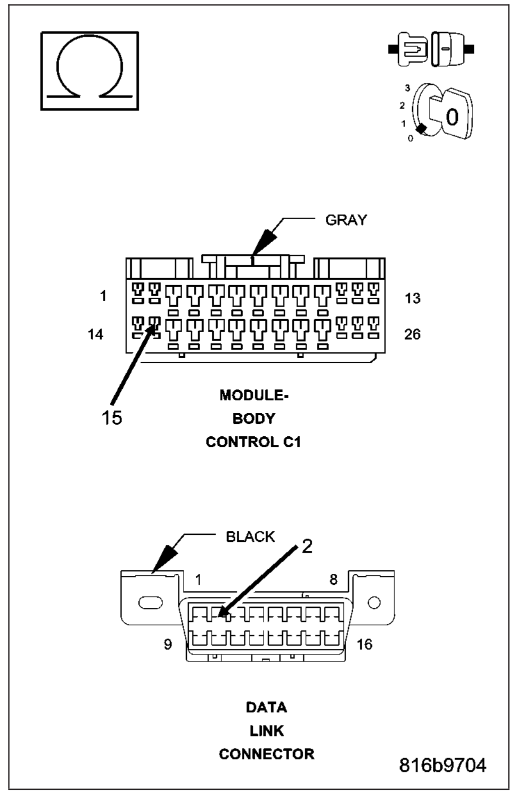
## 5. (D25) PCI BUS CIRCUIT OPEN

Turn the ignition off.

Disconnect the scan tool from the DLC connector.

Disconnect the Body Control Module C1 harness connector.

Measure the resistance of the (D25) PCI Bus circuit between the DLC and the Body Control Module connector.




**Is the resistance below 5.0 ohms?**

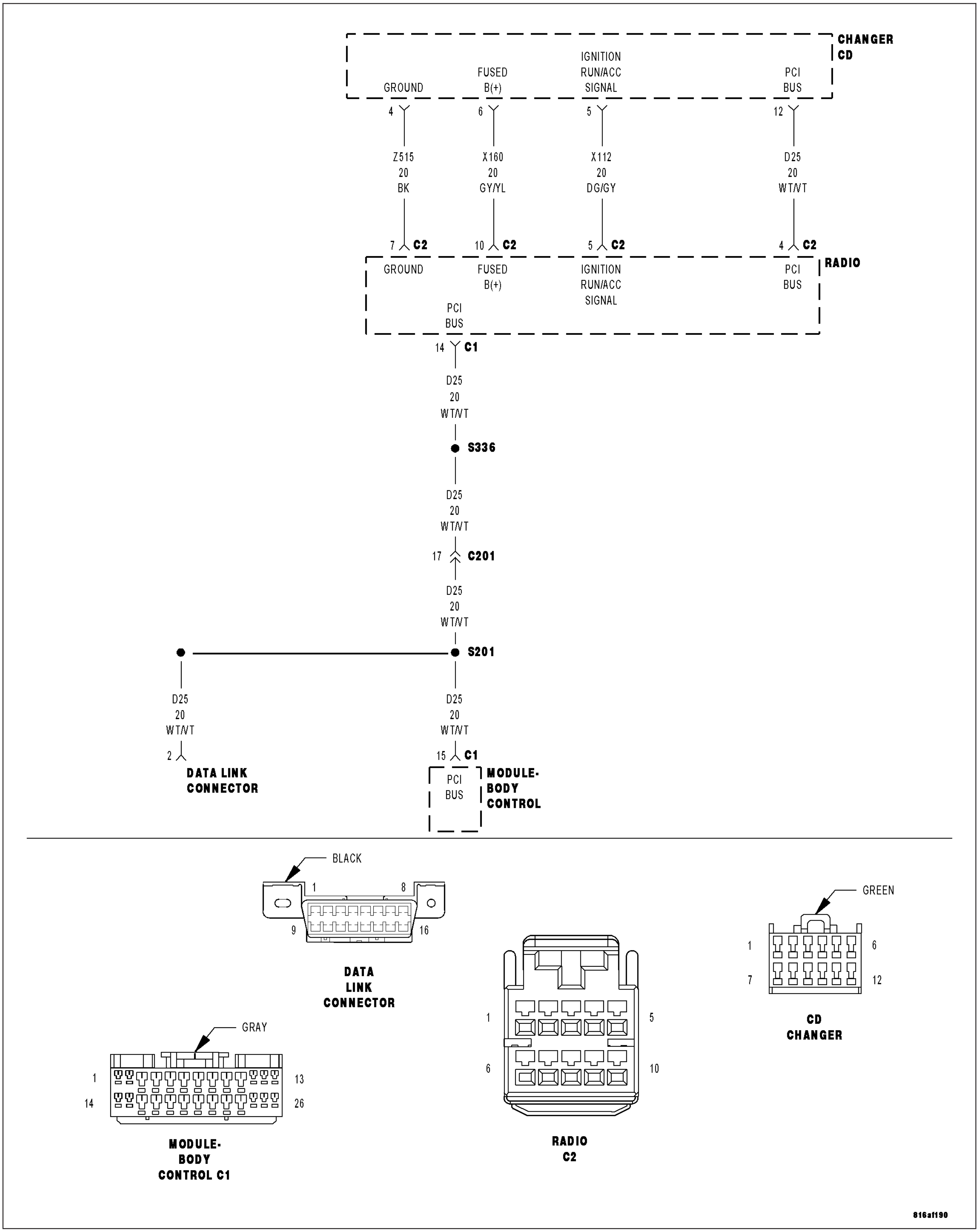
**Yes** >> Replace the Body Control Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (D25) PCI Bus circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## *NO RESPONSE FROM CD CHANGER




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (Z515) GROUND CIRCUIT OPEN |
| (X160) FUSED B(+) CIRCUIT OPEN |
| (X112) IGNITION RUN/ACC SIGNAL CIRCUIT OPEN |
| (D25) PCI BUS CIRCUIT OPEN |
| RADIO |
| CD CHANGER |

## Diagnostic Test

### 1. ESTABLISH COMMUNICATION WITH RADIO ON PCI BUS

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**

With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool communicate with the radio?**

**Yes** >> Go To 2

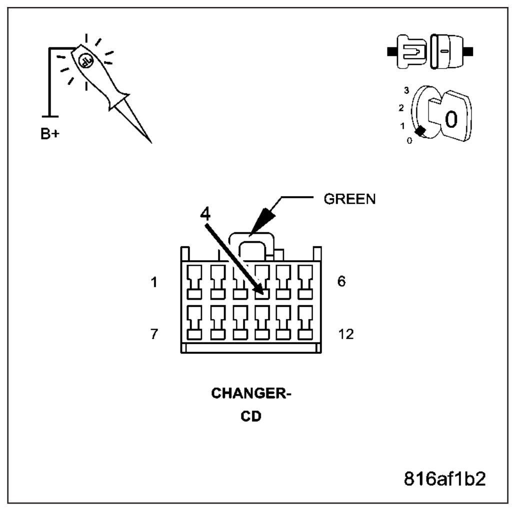
**No** >> Perform the appropriate no response test. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

### 2. (Z515) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the CD Changer harness connector.

Using a 12-volt test light connected to 12-volts, probe the (Z515) ground circuit.




**Does the test light illuminate brightly?**

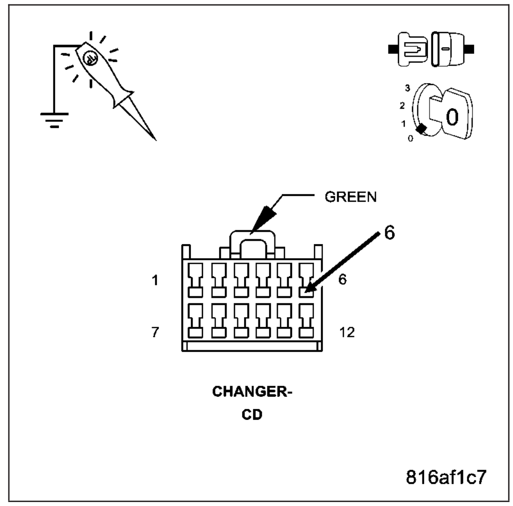
**Yes** >> Go To 3

**No** >> Repair the (Z515) Ground circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. (X160) FUSED B(+) CIRCUIT OPEN

Using a 12-volt test light connected to ground, probe the (X160) Fused B(+) circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

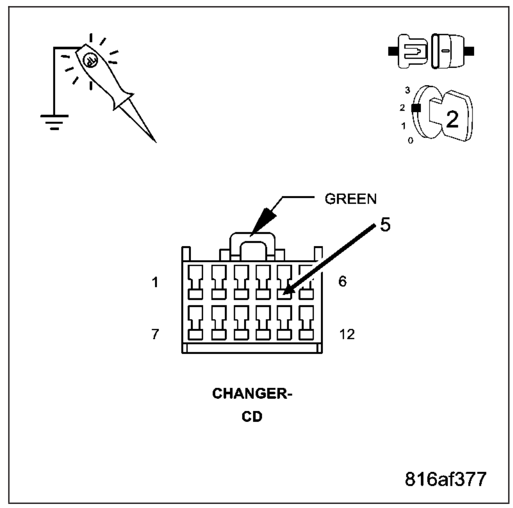
**No** >> Repair the (X160) Fused B(+) circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 4. (X112) IGNITION RUN/ACC SIGNAL CIRCUIT OPEN

Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (X112) Ignition Run/Acc Signal circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 5

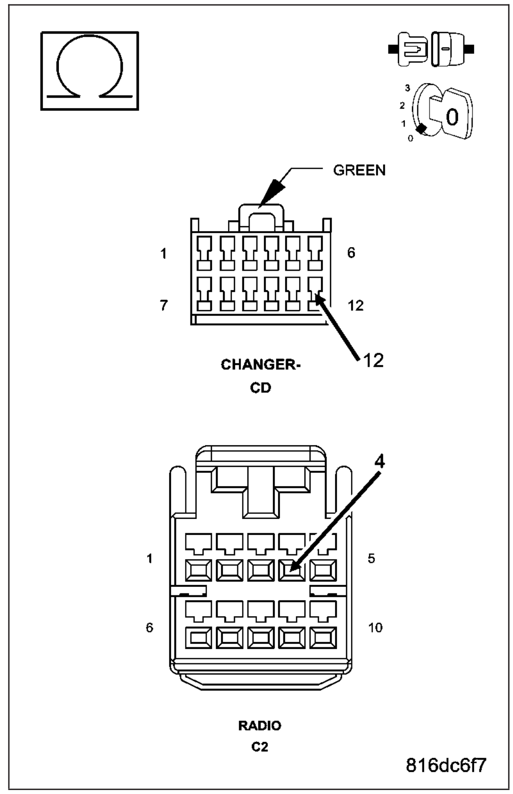
**No** >> Repair the (X112) Ignition Run/Acc Signal circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 5. (D25) PCI BUS CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (D25) PCI Bus circuit between the Radio C2 harness connector and the CD Changer connector.




**Is the resistance below 5.0 ohms?**

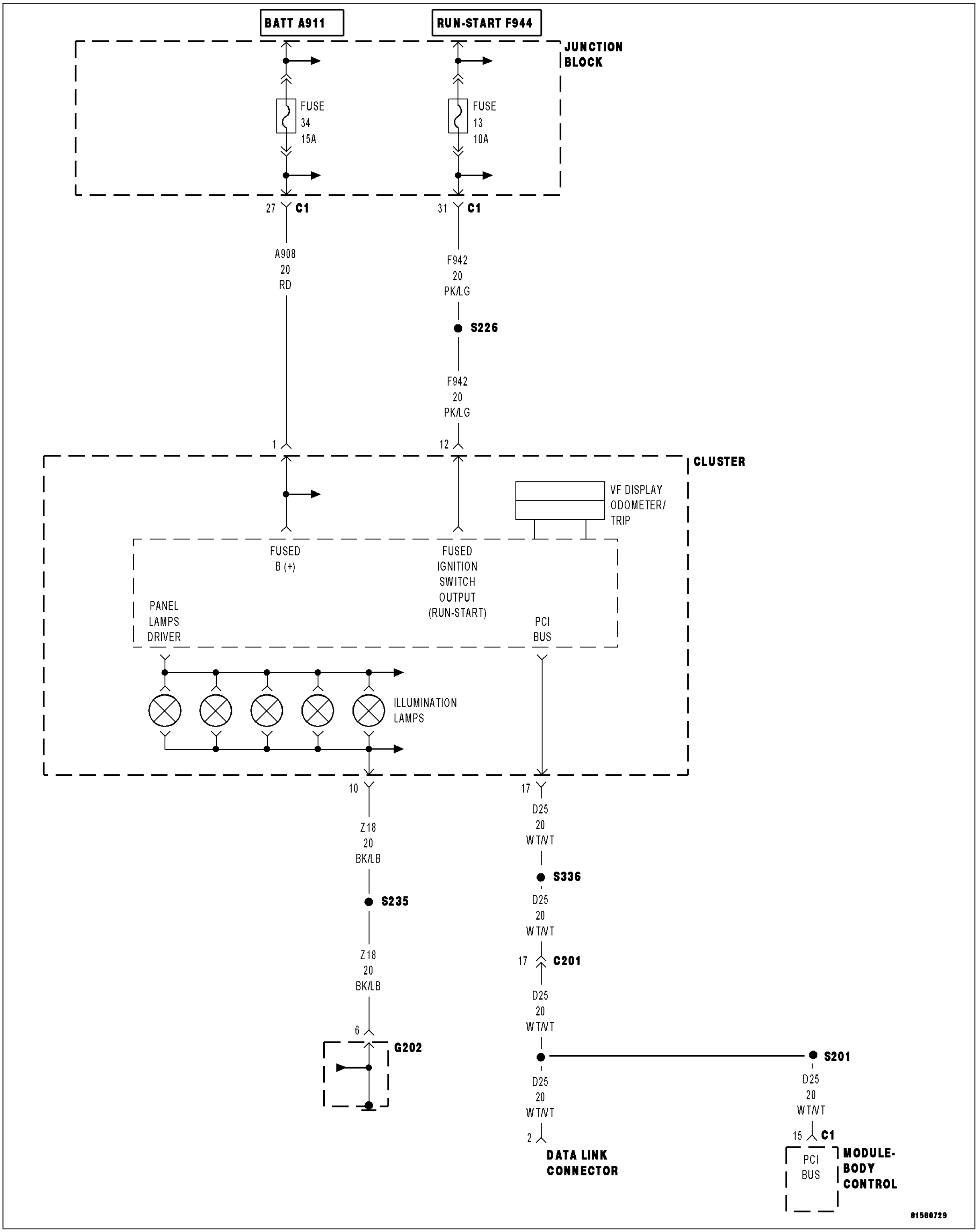
**Yes** >> Replace the CD Changer in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (D25) PCI Bus circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

# *NO RESPONSE FROM CLUSTER




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| (Z18) GROUND CIRCUIT OPEN |
| (A908) FUSED B(+) CIRCUIT OPEN |
| (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN |
| (D25) PCI BUS CIRCUIT OPEN |
| CLUSTER |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**

With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

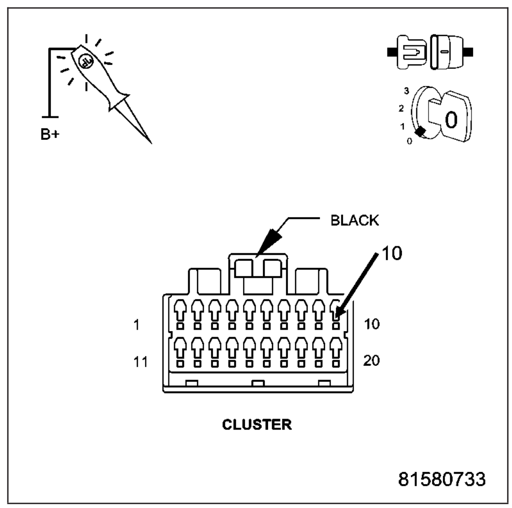
**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (Z18) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Cluster harness connector.

Using a 12-volt test light connected to 12-volts, probe the (Z18) ground circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the (Z18) Ground circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. (A908) FUSED B(+) CIRCUIT OPEN

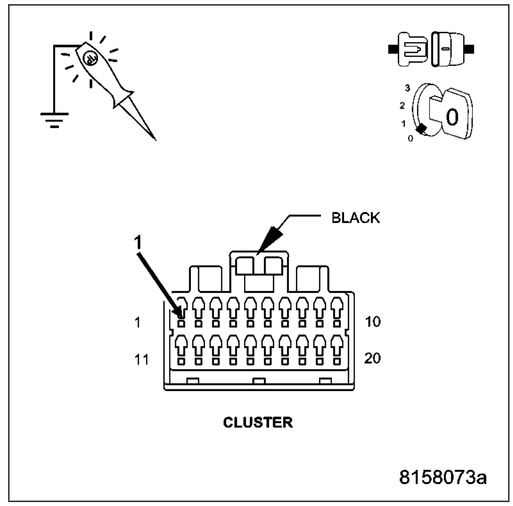
Using a 12-volt test light connected to ground, probe the (A908) Fused B(+) circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the (A908) Fused B(+) circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).




## 4. (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition on.

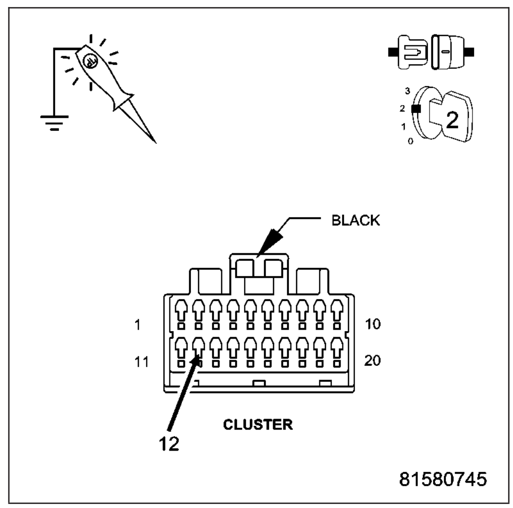
Using a 12-volt test light connected to ground, probe the (F942) Fused Ignition Switch Output circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 5

**No** >> Repair the (F942) Fused Ignition Switch Output circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

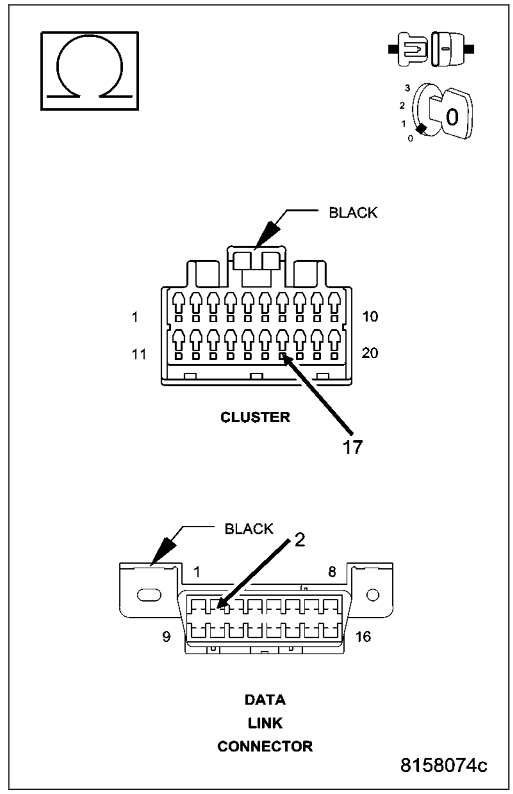


## 5. (D25) PCI BUS CIRCUIT OPEN

Turn the ignition off.

Disconnect the scan tool from the DLC connector.

Measure the resistance of the (D25) PCI Bus circuit between the DLC and the cluster connector.




**Is the resistance below 5.0 ohms?**

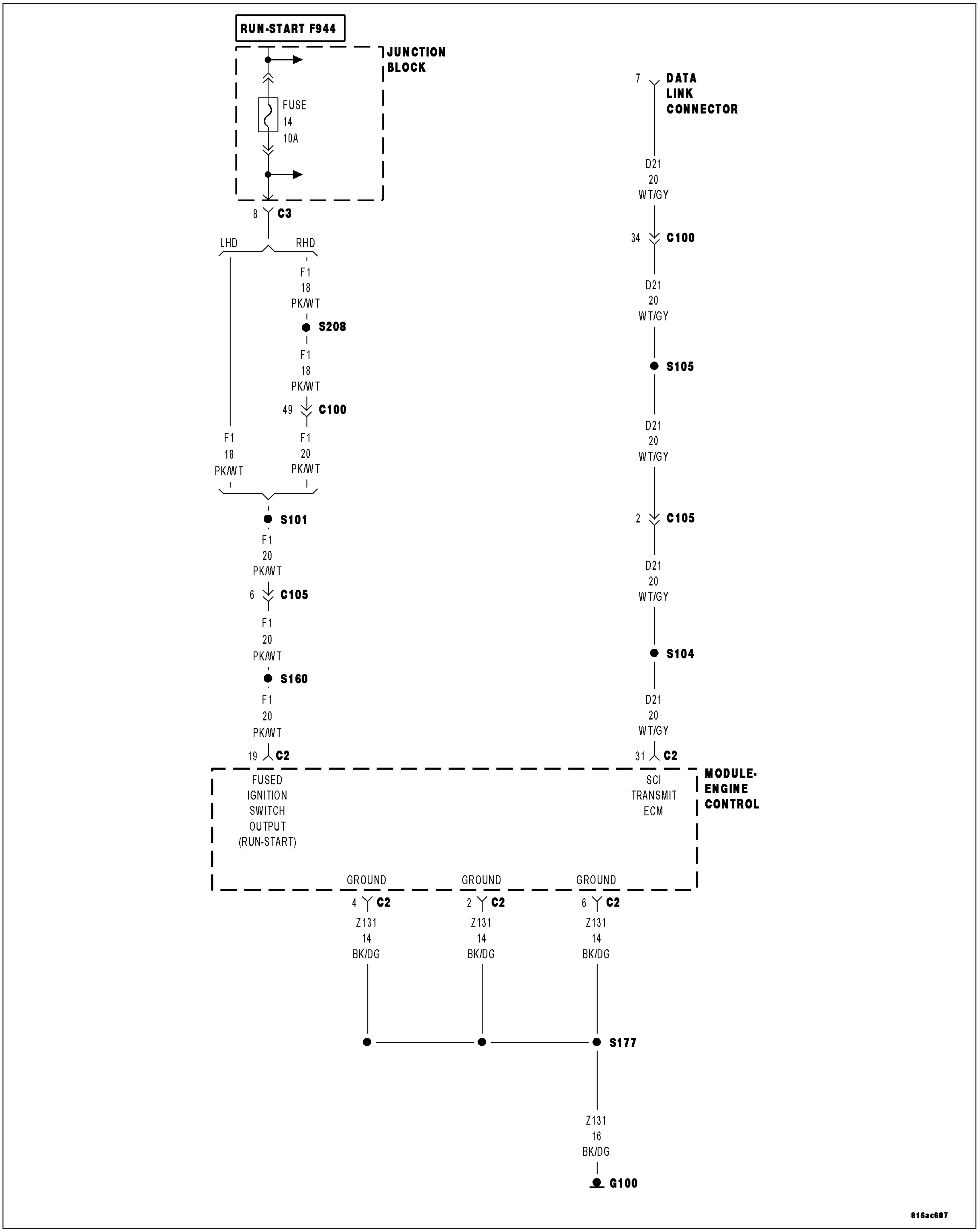
**Yes** >> Replace the Cluster in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (D25) PCI Bus circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## *NO RESPONSE FROM ECM (ENGINE CONTROL MODULE) - DIESEL




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| ENGINE CONTROL MODULE POWER AND GROUND |
| (D21) SCI TRANSMIT CIRCUIT SHORTED TO VOLTAGE |
| (D21) SCI TRANSMIT CIRCUIT SHORTED TO GROUND |
| (D21) SCI TRANSMIT CIRCUIT OPEN |
| TRANSMISSION CONTROL MODULE |
| ANTILOCK BRAKE MODULE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**
With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. CHECK ECM POWER AND GROUND

Check the ECM power and ground circuits. Refer to 9 - ENGINE ELECTRICAL DIAGNOSTICS - DIESEL for the diagnostic test procedure.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform the ECM VERIFICATION TEST.

**No** >> Go To 3

## 3. (D21) SCI CIRCUIT SHORTED TO GROUND AT ECM

Turn the ignition off.

Disconnect the scan tool from the DLC connector.

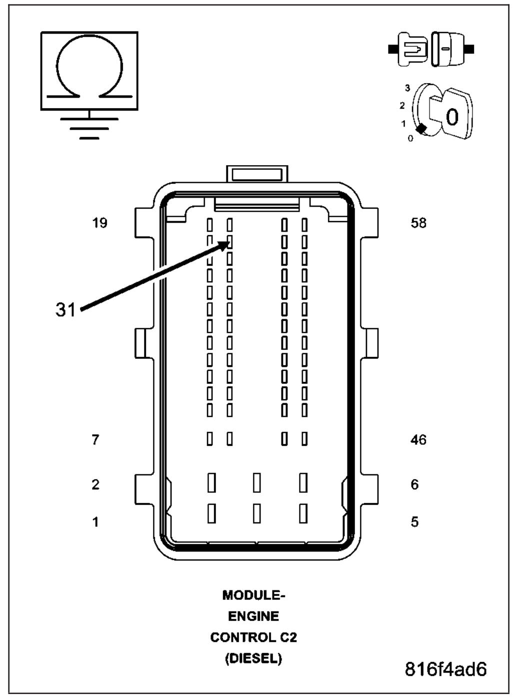
Disconnect the ECM C2 harness connector.

Measure the resistance between ground and the (D21) SCI Transmit circuit at the ECM harness connector.

**Is resistance below 5.0 ohms?**

**Yes** >> Go To 4

**No** >> Go To 6




## 4. (D21) SCI CIRCUIT SHORTED TO GROUND AT TCM

Disconnect the TCM harness connector.

Measure the resistance between ground and the (D21) SCI Transmit circuit at the TCM harness connector.

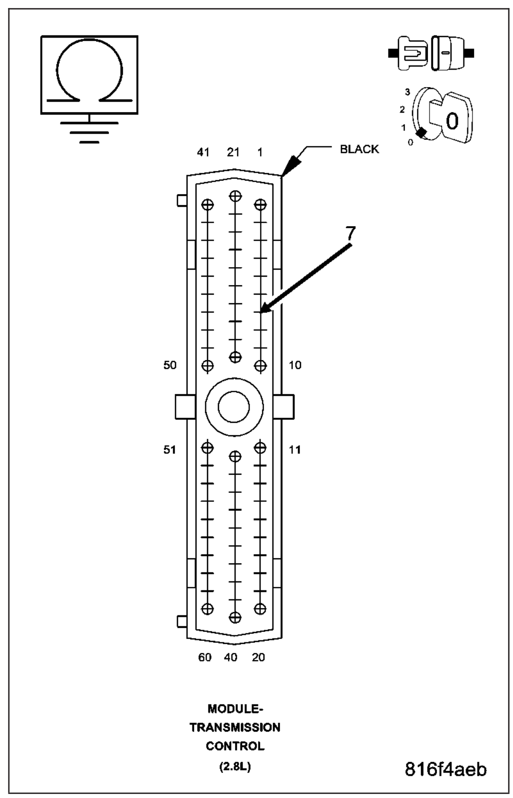
**NOTE: If the vehicle is not equipped with a TCM, answer yes to the question.**

**Is resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Replace the Transmission Control Module in accordance with the service information.

Perform the BODY VERIFICATION TEST–VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## 5. (D21) SCI CIRCUIT SHORTED TO GROUND AT ABS MODULE

Disconnect the ABS module harness connector.

Measure the resistance between ground and the (D21) SCI Transmit circuit at the ABS module harness connector.

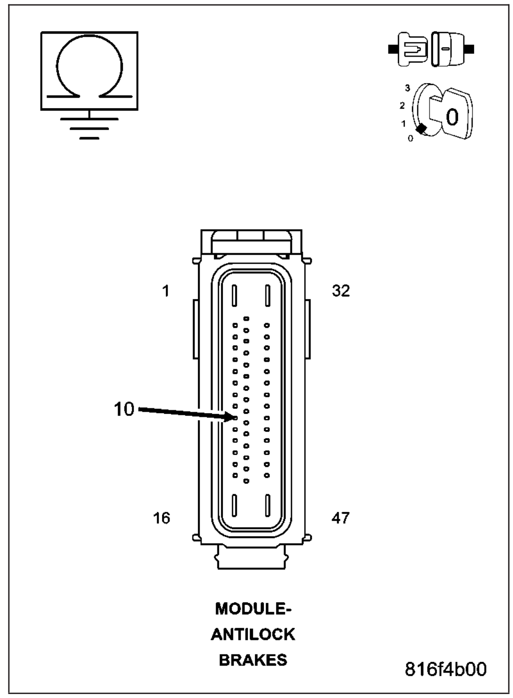
**Is resistance below 5.0 ohms?**

**Yes** >> Repair the (D21) SCI Transmit circuit for a short to ground.

Perform the BODY VERIFICATION TEST–VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Antilock Brake System Module in accordance with the service information.

Perform the BODY VERIFICATION TEST–VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)




## 6. (D21) SCI CIRCUIT SHORTED TO VOLTAGE AT THE DLC

Turn the ignition on.

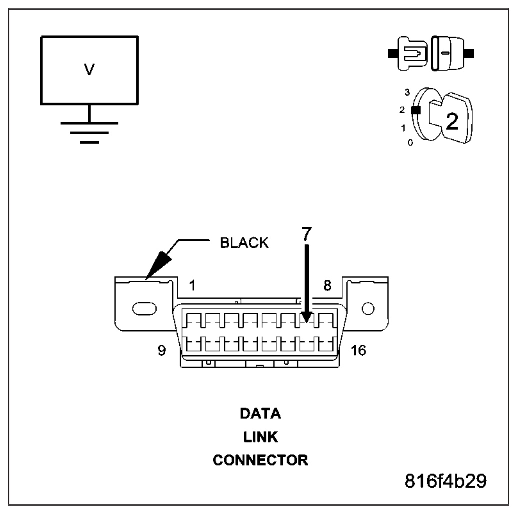
Measure the voltage of the (D21) SCI Transmit circuit at the DLC connector.

**Is the voltage above 10.0 volts?**

**Yes** >> Repair the (D21) SCI Transmit circuit for a short to voltage.

Perform the BODY VERIFICATION TEST–VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 7



## 7. (D21) SCI CIRCUIT OPEN AT THE DLC

Turn the ignition off.

Measure the resistance of the (D21) SCI Transmit circuit between the ECM connector and the DLC connector.

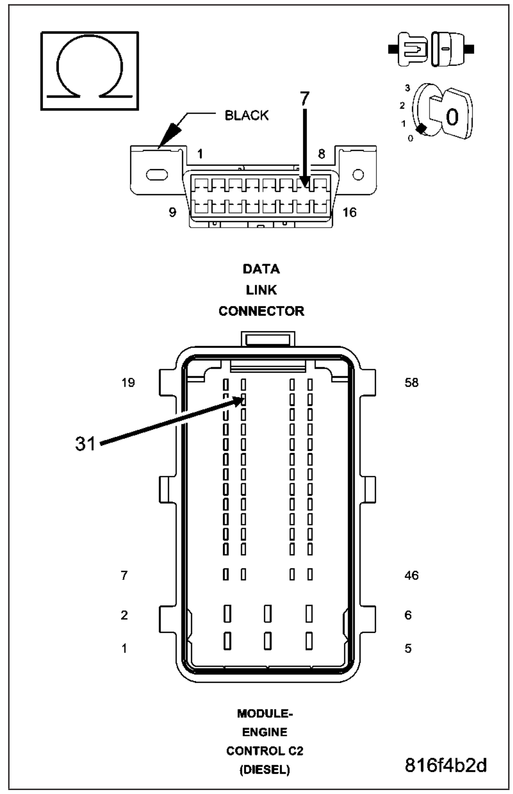
**Is resistance below 5.0 ohms?**

**Yes** >> Replace the Engine Control Module in accordance with the service information.

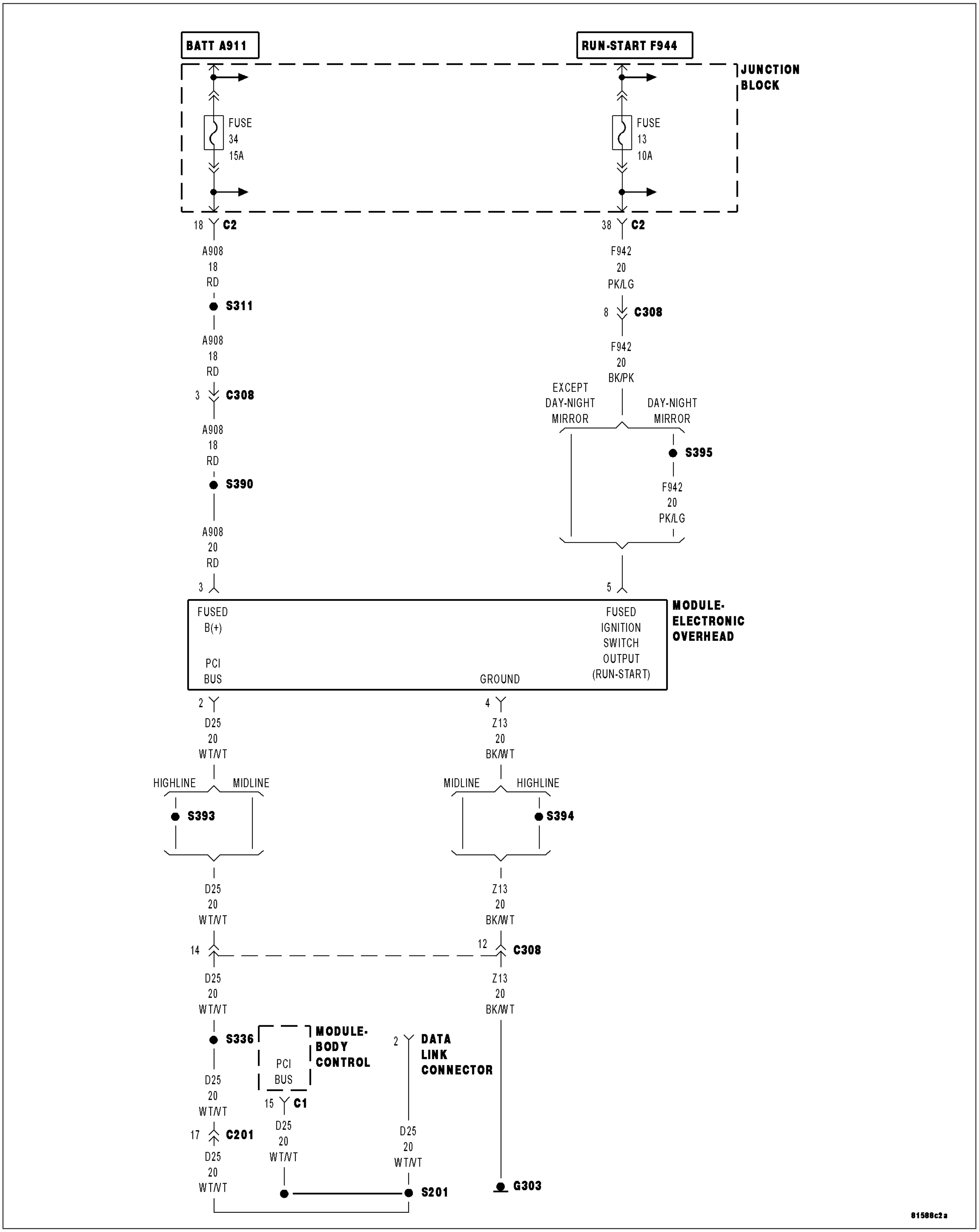
Perform the ECM VERIFICATION TEST.

**No** >> Repair the (D21) SCI Transmit circuit for an open.

Perform the BODY VERIFICATION TEST–VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## *NO RESPONSE FROM EOM (ELECTRONIC OVERHEAD MODULE)




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| (Z13) GROUND CIRCUIT OPEN |
| (A908) FUSED B(+) CIRCUIT OPEN |
| (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN |
| (D25) PCI BUS CIRCUIT OPEN |
| ELECTRONIC OVERHEAD MODULE |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**

With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

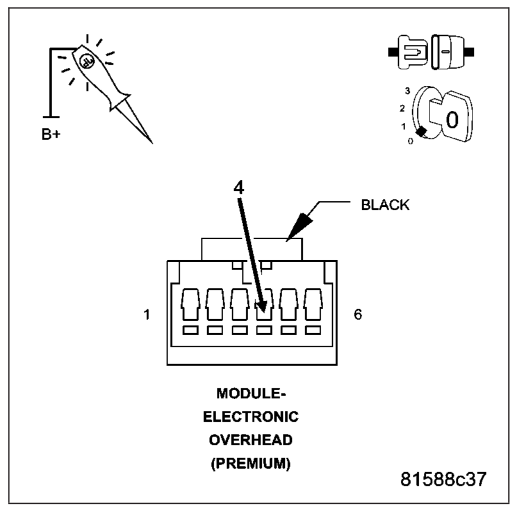
**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (Z13) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Electronic Overhead Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (Z13) ground circuit.




**Does the test light illuminate brightly?**

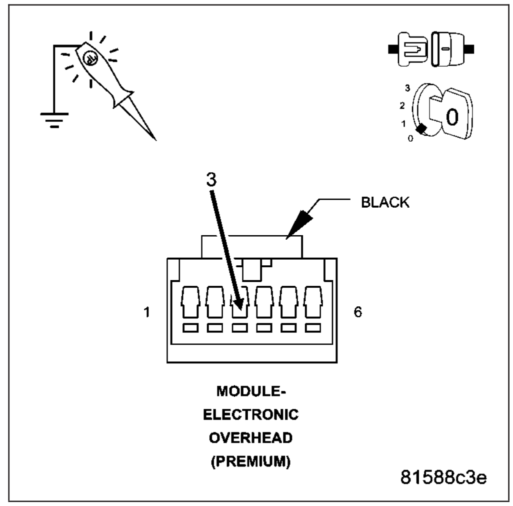
**Yes** >> Go To 3

**No** >> Repair the (Z13) Ground circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. (A908) FUSED B(+) CIRCUIT OPEN

Using a 12-volt test light connected to ground, probe the (A908) Fused B(+) circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

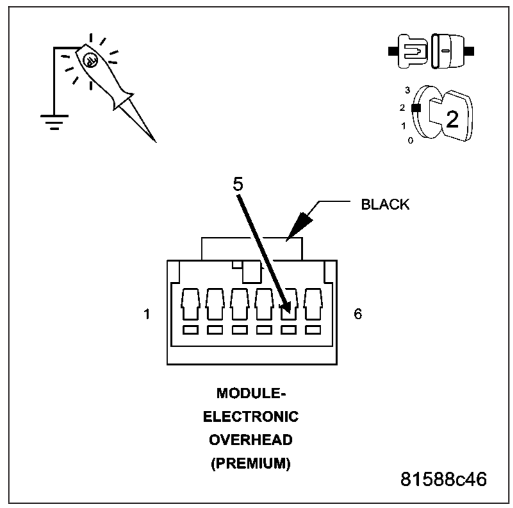
**No** >> Repair the (A908) Fused B(+) circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 4. (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (F942) Fused Ignition Switch Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 5

**No** >> Repair the (F942) Fused Ignition Switch Output circuit for an open.

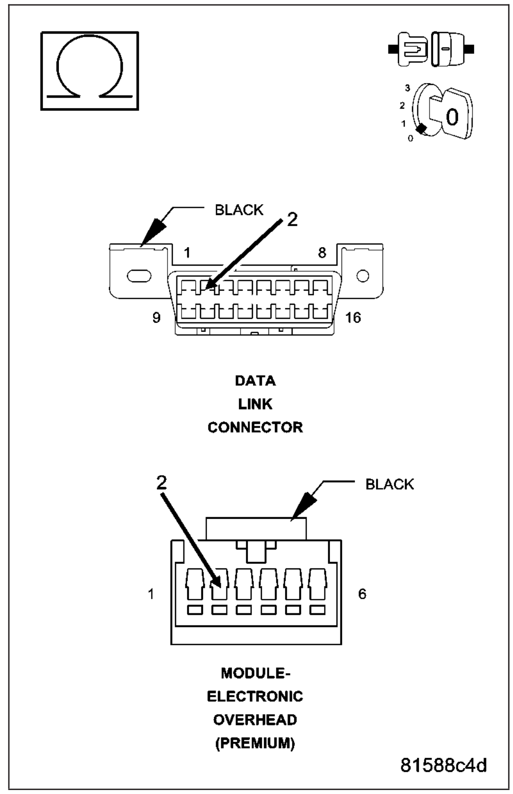
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 5. (D25) PCI BUS CIRCUIT OPEN

Turn the ignition off.

Disconnect the scan tool from the DLC connector.

Measure the resistance of the (D25) PCI Bus circuit between the DLC and the Electronic Overhead Module connector.




**Is the resistance below 5.0 ohms?**

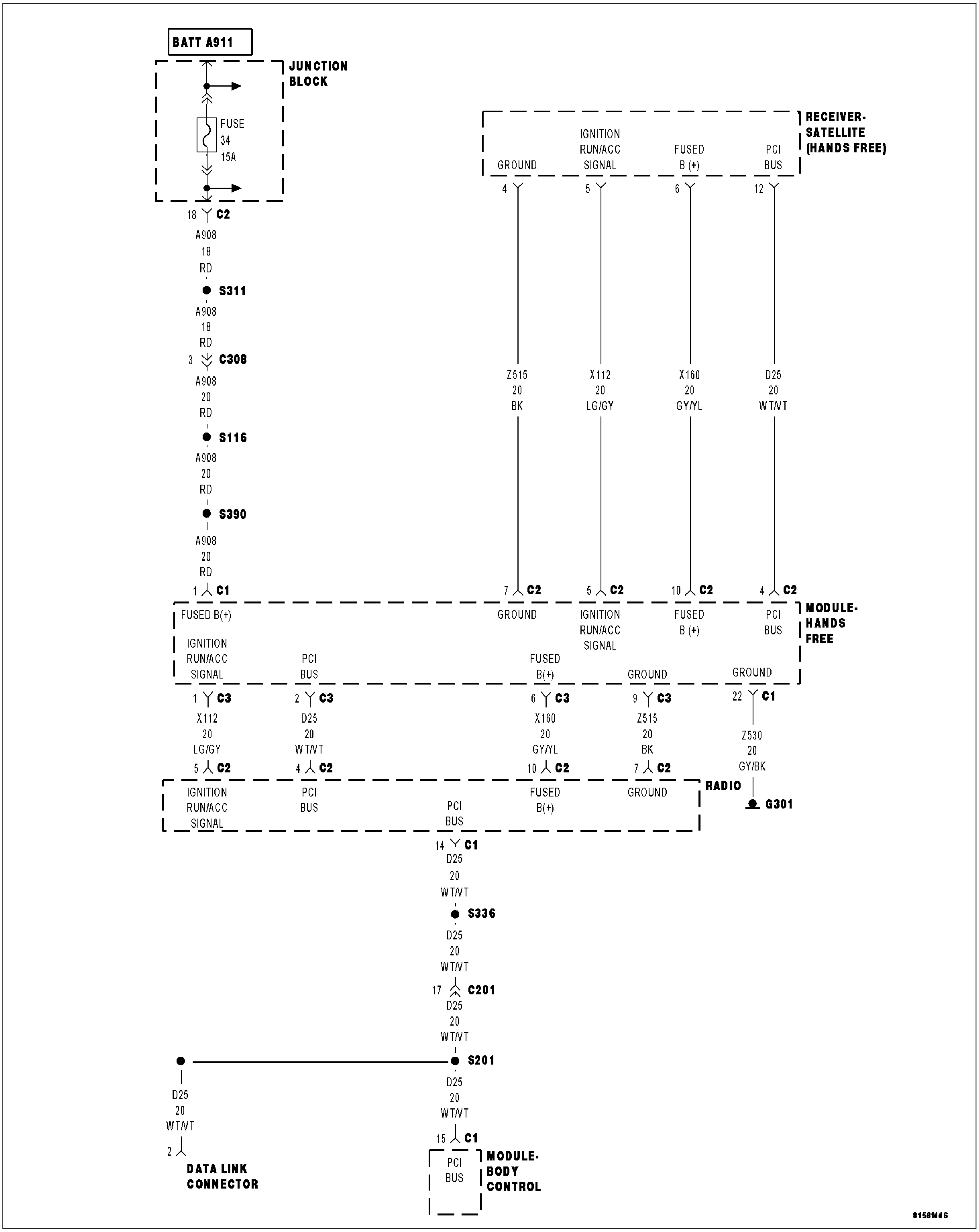
**Yes** >> Replace the Electronic Overhead Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (D25) PCI Bus circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## *NO RESPONSE FROM HANDS FREE MODULE




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| (Z530) GROUND CIRCUIT OPEN |
| (A908) FUSED B(+) CIRCUIT OPEN |
| (D25) PCI BUS CIRCUIT OPEN |
| RADIO |
| HANDS FREE MODULE (HFM) |

## Diagnostic Test

### 1. ESTABLISH COMMUNICATION WITH RADIO ON PCI BUS

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**
With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool communicate with the radio?**

**Yes** >> Go To 2

**No** >> Perform the appropriate no response test. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

### 2. (Z530) GROUND CIRCUIT OPEN

Turn the ignition off.

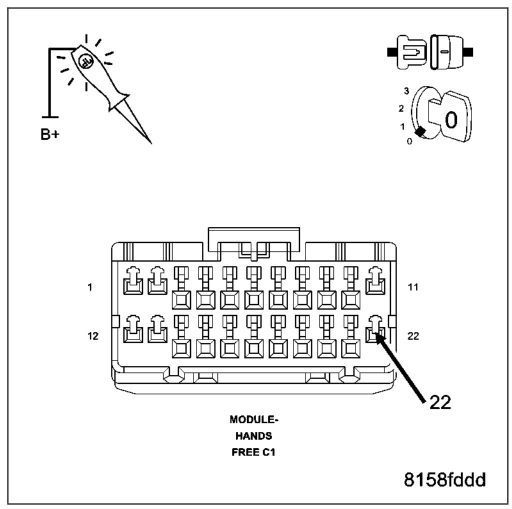
Disconnect the Hands Free Module C1 harness connector.

Using a 12-volt test light connected to 12-volts, probe the (Z530) ground circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the (Z530) Ground circuit for an open.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



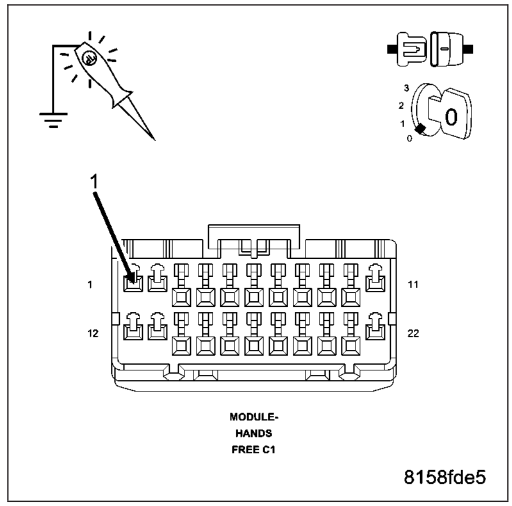
## 3. (A908) FUSED B(+) CIRCUIT OPEN

Using a 12-volt test light connected to ground, probe the (A908) Fused B(+) circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the (A908) Fused B(+) circuit for an open.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).




## 4. (D25) PCI BUS CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module C3 harness connector.

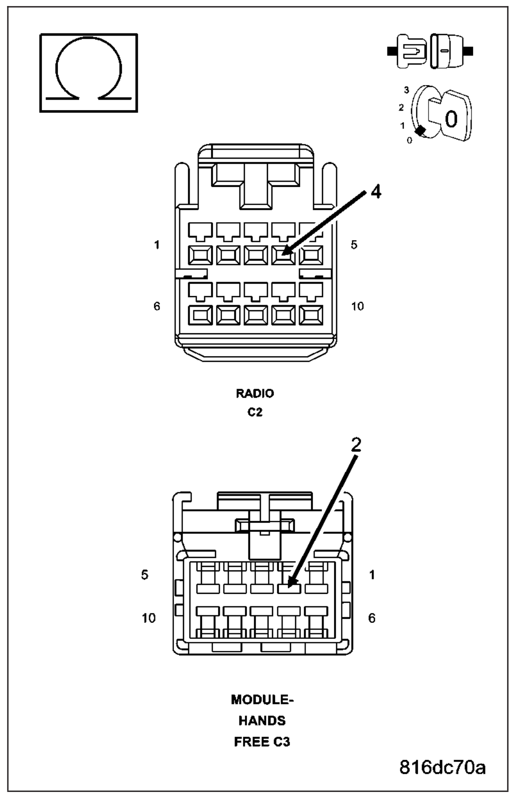
Disconnect the Radio C2 harness connector.

Measure the resistance of the (D25) PCI Bus circuit between the Radio C2 harness connector and the Hands Free Module connector.

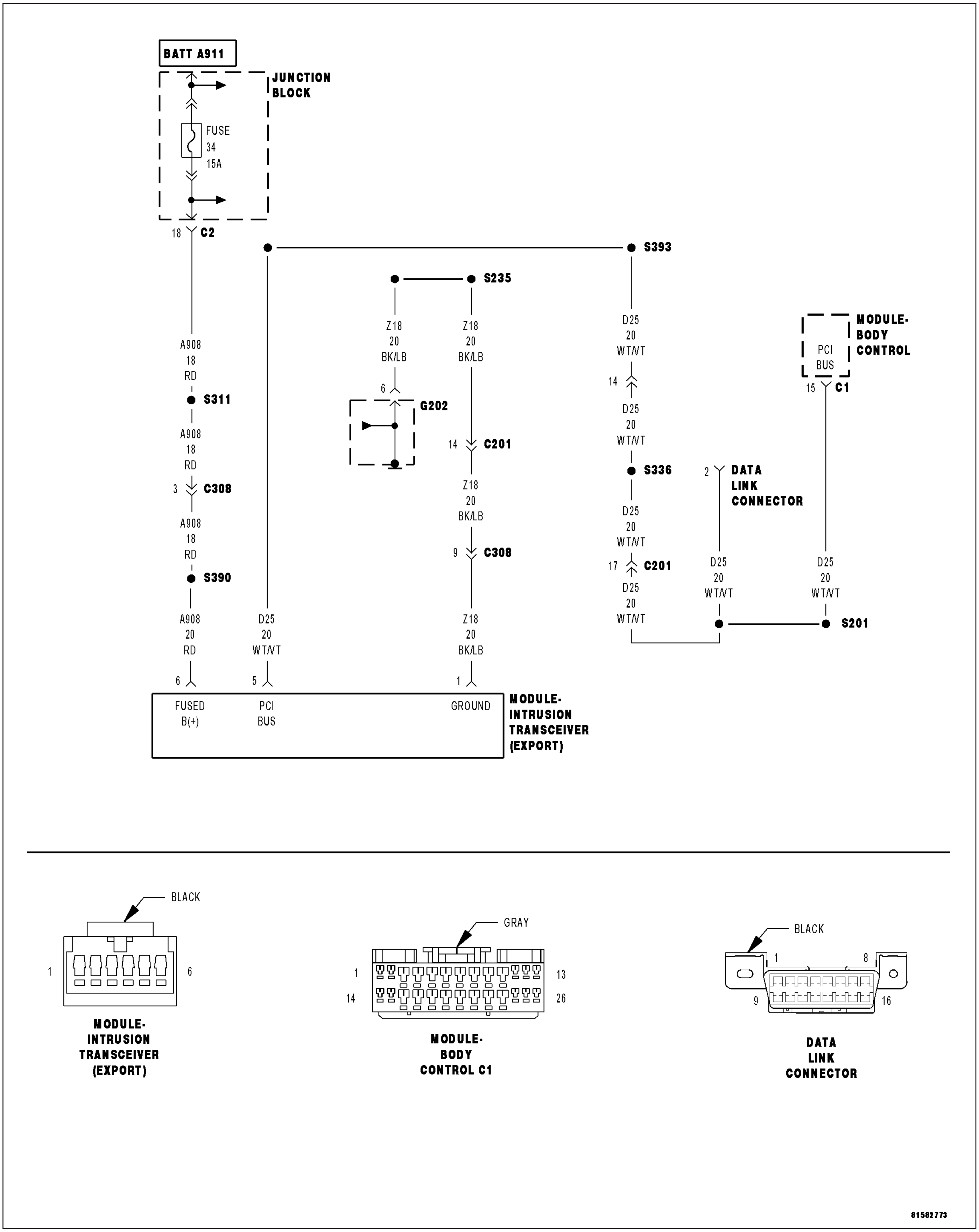
**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Hands Free Module in accordance with the service information.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (D25) PCI Bus circuit for an open.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



# *NO RESPONSE FROM INTRUSION TRANSCEIVER MODULE




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| (Z18) GROUND CIRCUIT OPEN |
| (A908) FUSED B(+) CIRCUIT OPEN |
| (D25) PCI BUS CIRCUIT OPEN |
| INTRUSION TRANSCEIVER MODULE |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**

With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

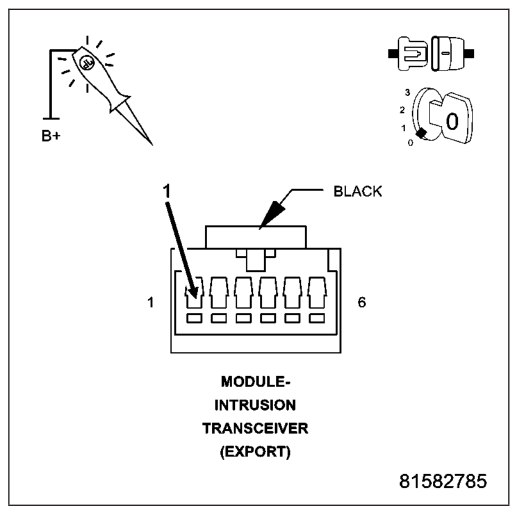
**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (Z18) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Intrusion Transceiver Module harness connector.

Using a 12-volt test light connected to 12-volts, probe the (Z18) ground circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the (Z18) Ground circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. (A908) FUSED B(+) CIRCUIT OPEN

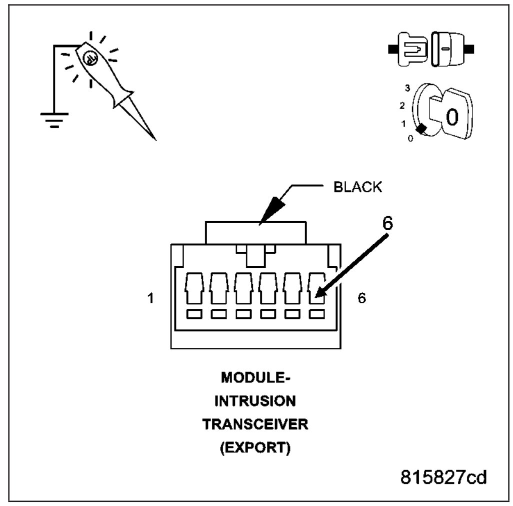
Using a 12-volt test light connected to ground, probe the (A908) Fused B(+) circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the (A908) Fused B(+) circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).




## 4. (D25) PCI BUS CIRCUIT OPEN

Turn the ignition off.

Disconnect the scan tool from the DLC connector.

Measure the resistance of the (D25) PCI Bus circuit between the DLC and the Intrusion Transceiver Module connector.

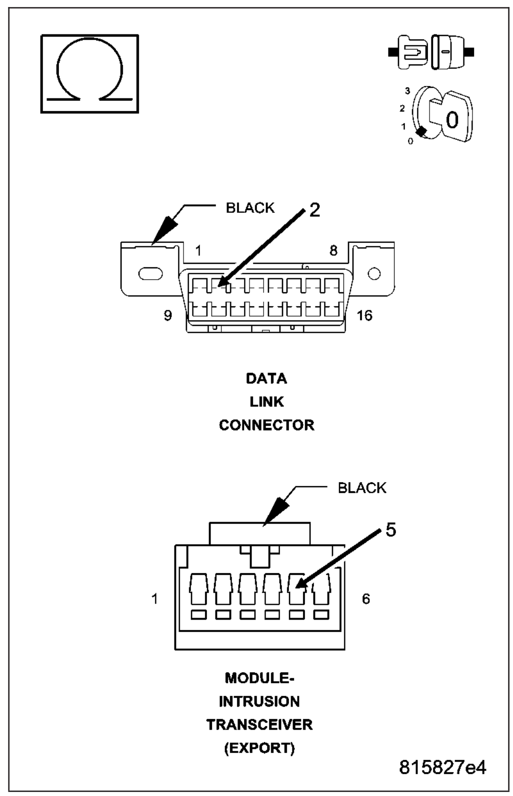
**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Intrusion Transceiver Module in accordance with the service information.

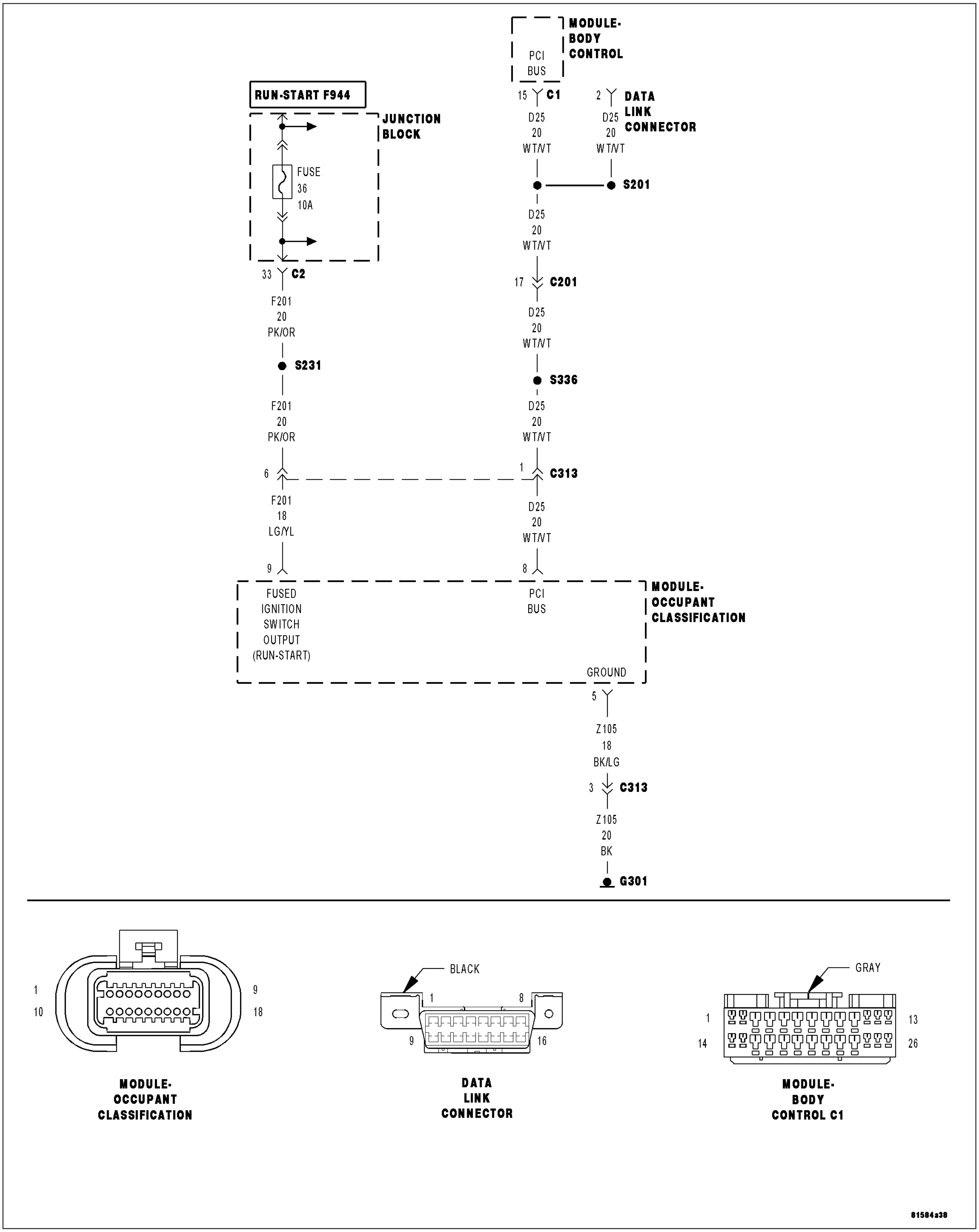
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (D25) PCI Bus circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



## *NO RESPONSE FROM OCCUPANT CLASSIFICATION MODULE




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (F201) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN |
| (Z105) GROUND CIRCUIT OPEN |
| (D25) PCI BUS CIRCUIT OPEN |
| OCCUPANT CLASSIFICATION MODULE |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**

With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

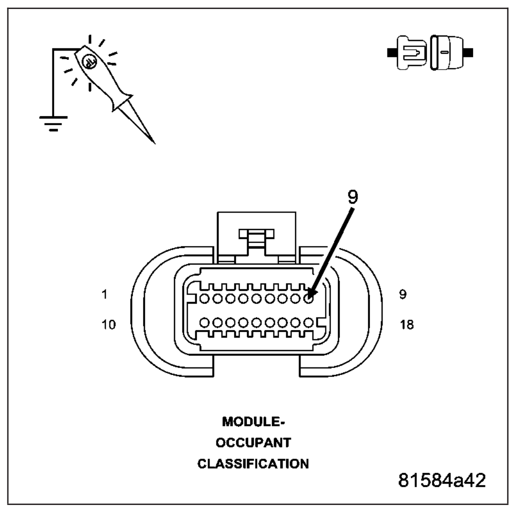
### 2. (F201) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Occupant Classification Module harness connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

Using a 12-volt test light connected to ground, probe the (F201) Fused Ignition Switch Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the (F201) Fused Ignition Switch Output circuit for an open.

Perform the AIRBAG VERIFICATION TEST – VER 1.

## 3. (Z105) GROUND CIRCUIT OPEN

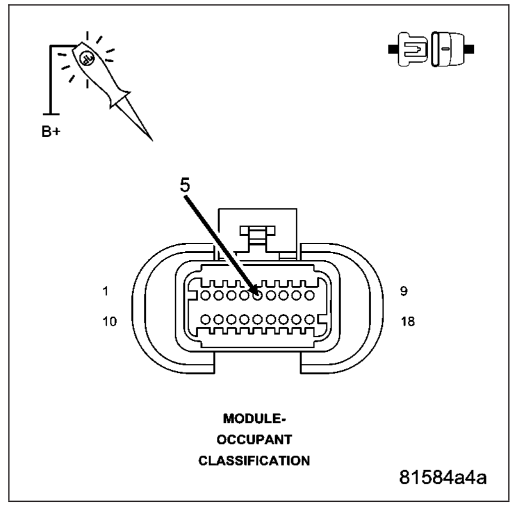
Turn the ignition off.

Using a 12-volt test light connected to 12-volts, probe the (Z105) ground circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the (Z105) Ground circuit for an open.
Perform the AIRBAG VERIFICATION TEST – VER 1.




## 4. (D25) PCI BUS CIRCUIT OPEN

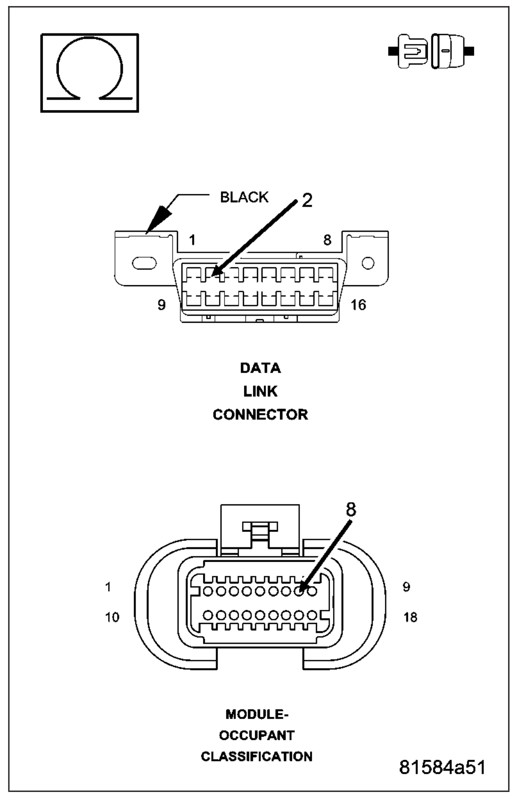
Disconnect the scan tool from the DLC connector.

Measure the resistance of the (D25) PCI Bus circuit between the DLC and the Occupant Classification Module connector.

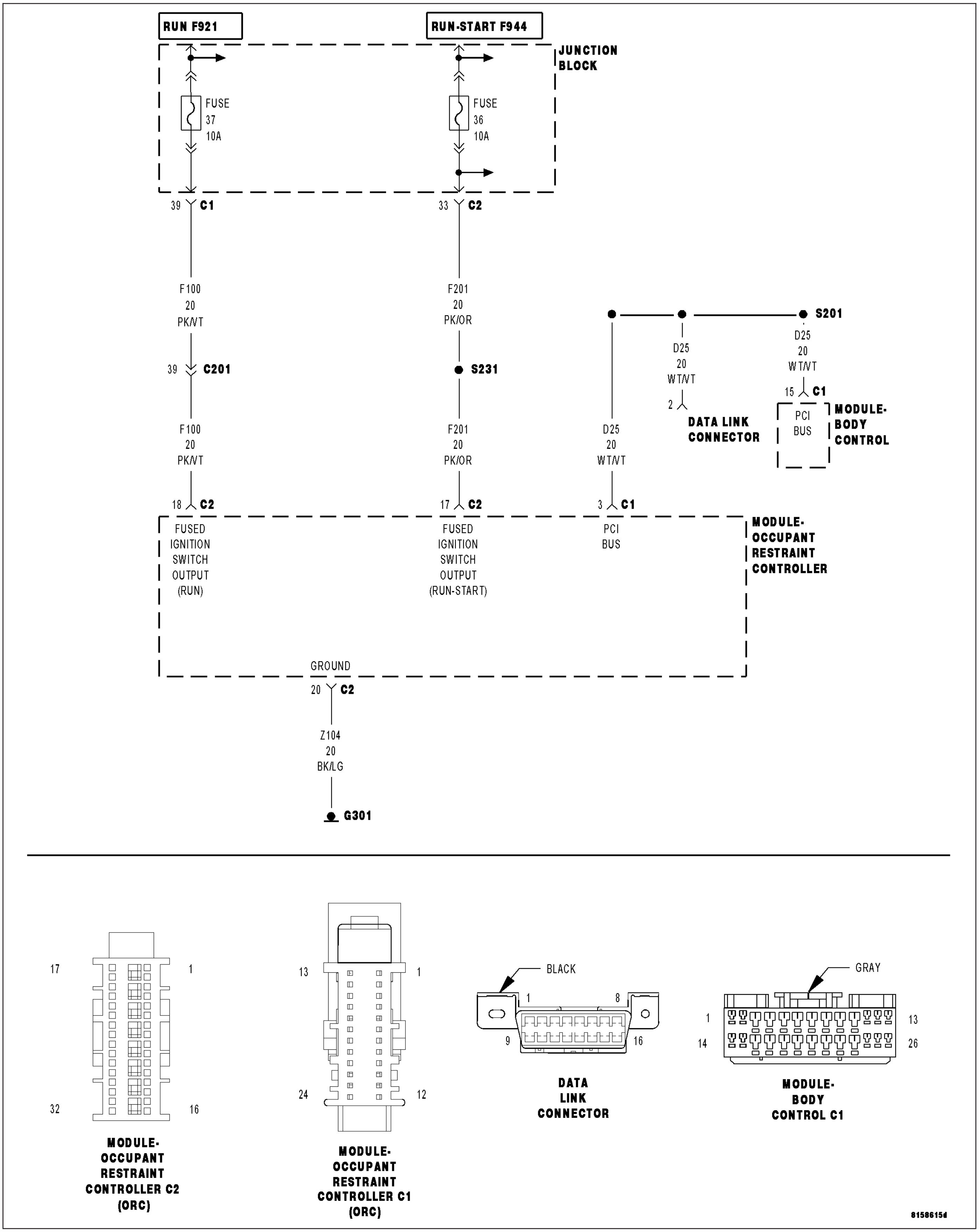
**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Occupant Classification Module in accordance with the service information.
Perform the AIRBAG VERIFICATION TEST – VER 1.

**No** >> Repair the (D25) PCI Bus circuit for an open.
Perform the AIRBAG VERIFICATION TEST – VER 1.



## *NO RESPONSE FROM OCCUPANT RESTRAINT CONTROLLER




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN |
| (F100) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN |
| (Z104) GROUND CIRCUIT OPEN |
| (D25) PCI BUS CIRCUIT OPEN |
| OCCUPANT RESTRAINT CONTROLLER |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**

With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. CHECKING FOR VOLTAGE AT THE ORC

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Occupant Restraint Controller C1 and C2 harness connectors.

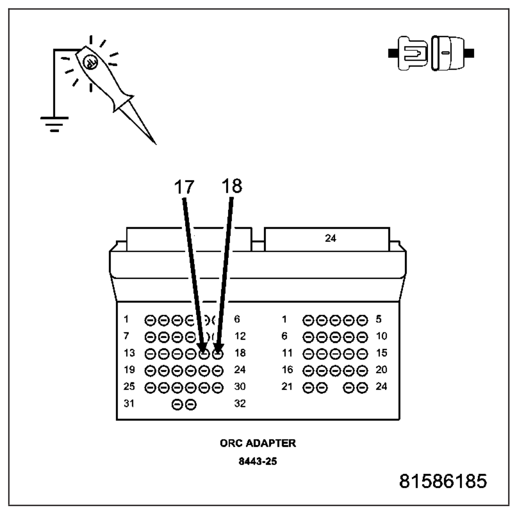
Connect the appropriate Load Tool ORC Adapter to the ORC connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

Using a 12-volt test light connected to ground, probe the (F100) Fused Ignition Switch Output (run) circuit and the (F201) Fused Ignition Switch Output (run-start) circuit.

**NOTE: One open circuit will not cause a NO RESPONSE condition.**

**Did the test light illuminate brightly on both circuits?**




**Yes** >> Go To 3

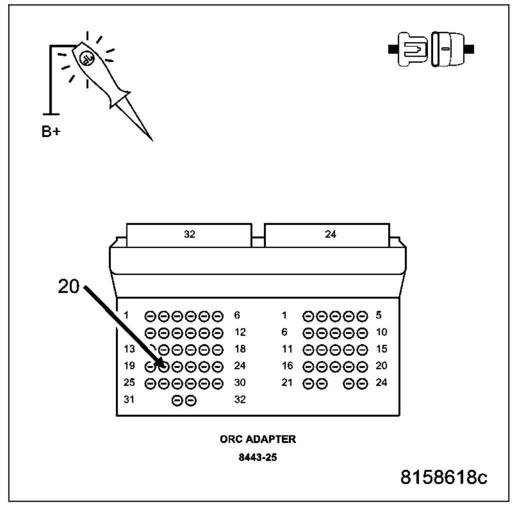
**No** >> Repair the (F100) Fused Ignition Switch Output (run) or the (F201) Fused Ignition Switch Output (run-start) circuit for an open.

Perform the AIRBAG VERIFICATION TEST – VER 1.

## 3. (Z104) GROUND CIRCUIT OPEN

Turn the ignition off.

Using a 12-volt test light connected to 12-volts, probe the (Z104) ground circuit.




**Did the test light illuminate brightly?**

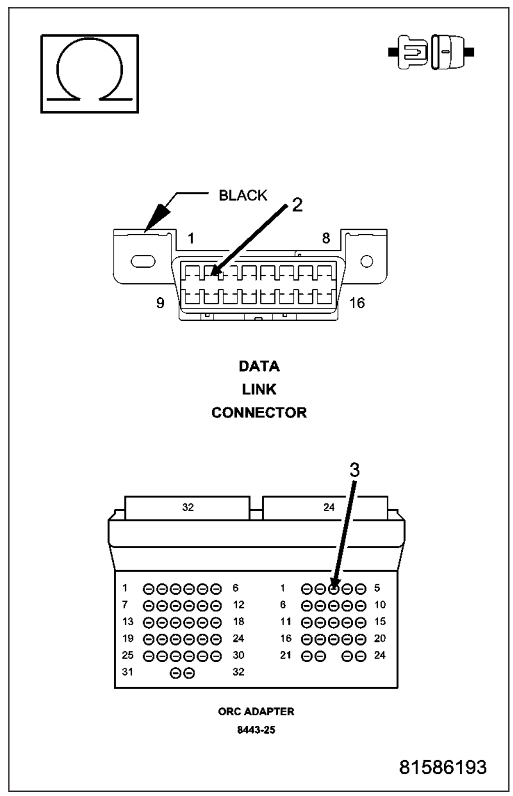
**Yes** >> Go To 4

**No** >> Repair the (Z104) Ground circuit for an open.
Perform the AIRBAG VERIFICATION TEST – VER 1.

## 4. (D25) PCI BUS CIRCUIT OPEN

Disconnect the scan tool from the DLC connector.

Measure the resistance of the (D25) PCI Bus circuit between the DLC and the Occupant Restraint Controller C1 harness connector.

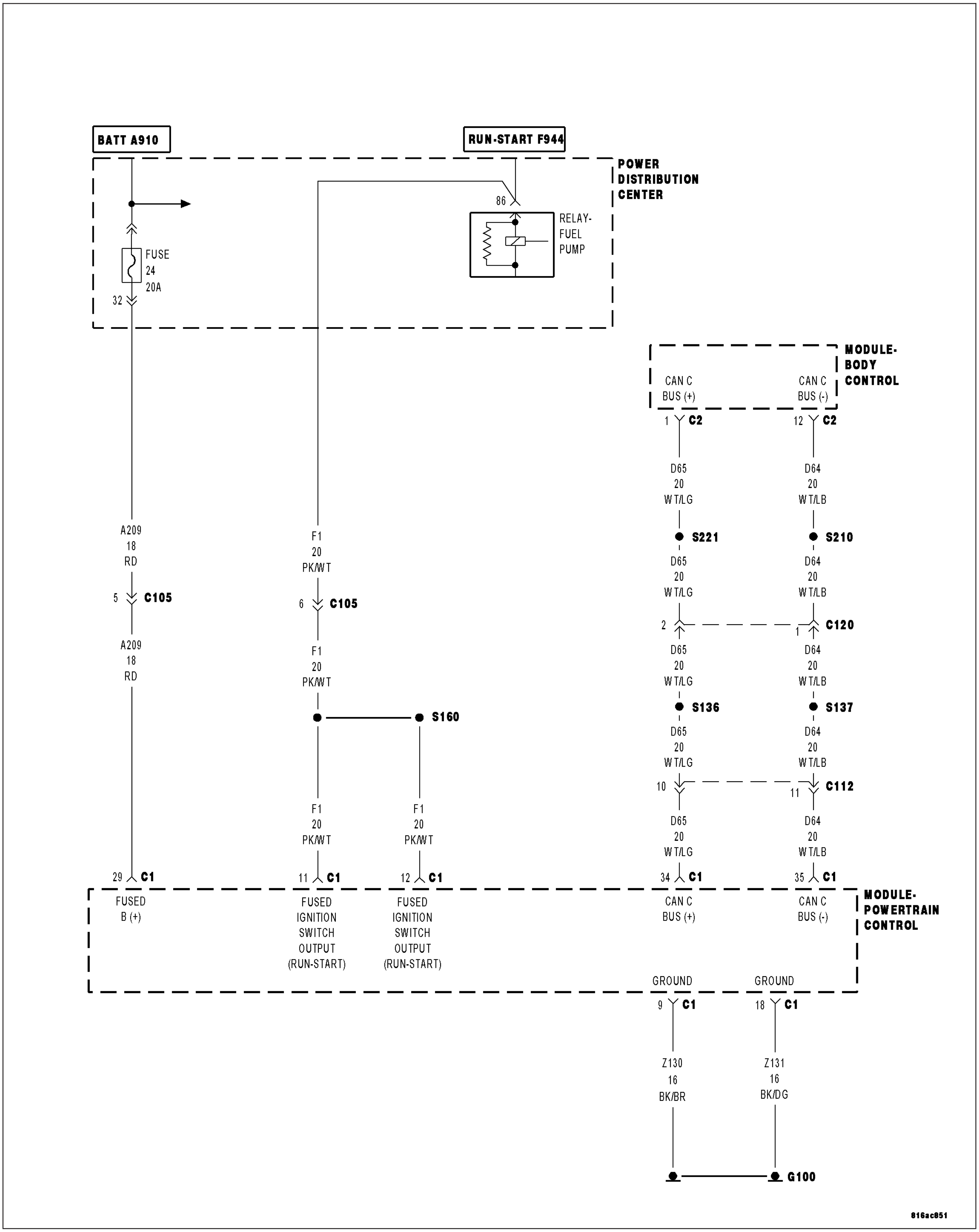



**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Occupant Restraint Controller Module in accordance with the service information.
Perform the AIRBAG VERIFICATION TEST – VER 1.

**No** >> Repair the (D25) PCI Bus circuit for an open.
Perform the AIRBAG VERIFICATION TEST – VER 1.

## *NO RESPONSE FROM PCM (POWERTRAIN CONTROL MODULE) (NGC)




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (A209) FUSED B(+) CIRCUIT OPEN OR SHORTED |
| (Z130) (Z131) GROUND CIRCUIT OPEN |
| (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED |
| (D65) CAN C BUS (+) CIRCUIT OPEN |
| (D64) CAN C BUS (-) CIRCUIT OPEN |
| POWERTRAIN CONTROL MODULE |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**
With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (A209) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

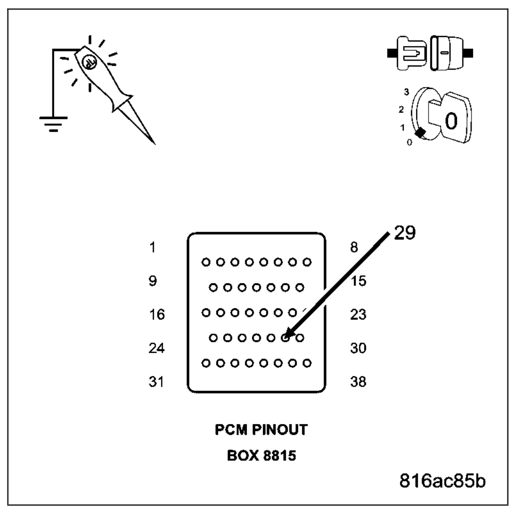
Disconnect the PCM C1 harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**
Using a 12-volt test light connected to ground, check the (A209) Fused B(+) circuit.

**Does the test light illuminate brightly?**

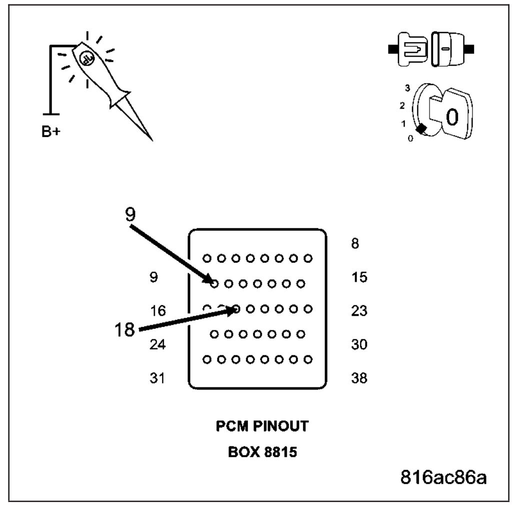
**Yes** >> Go To 3

**No** >> Repair the (A209) Fused B(+) circuit for an open or short.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.



## 3. (Z130) (Z131) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check each (Z130) and (Z131) ground circuit.




**Does the test light illuminate brightly for each circuit?**

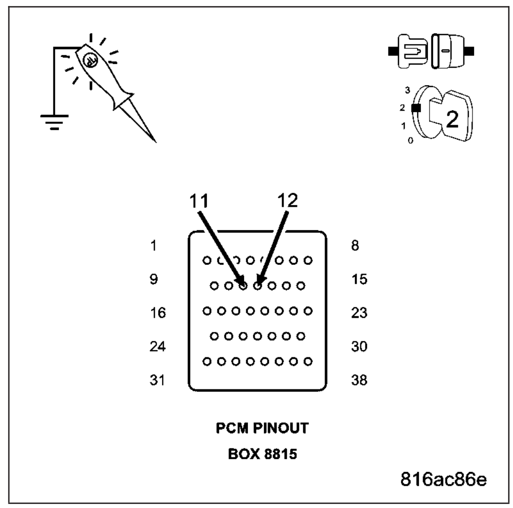
**Yes** >> Go To 4

**No** >> Repair the ground circuit for an open.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.

## 4. (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F1) Fused Ignition Switch Output circuit.




**Does the test light illuminate brightly for each circuit?**

**Yes** >> Go To 5

**No** >> Repair the (F1) Fused Ignition Switch Output circuit for an open or short.
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.

## 5. (D65) CAN C BUS (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the scan tool from the DLC.

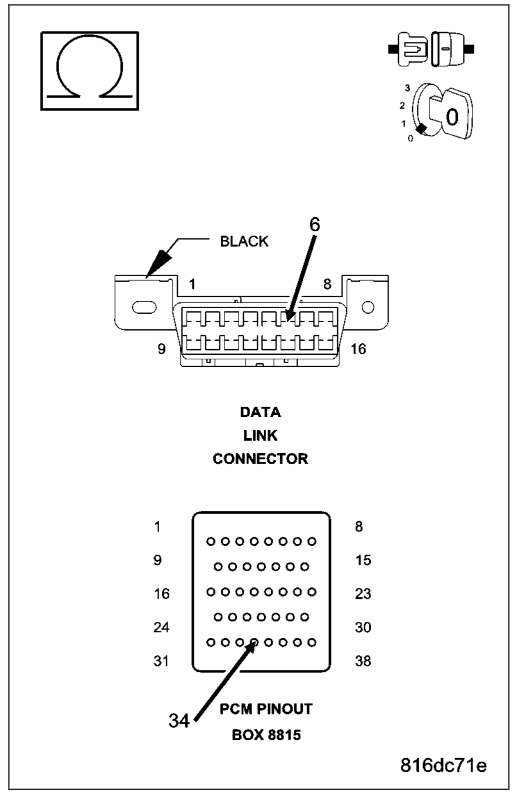
Measure the resistance of the (D65) CAN C Bus (+) circuit between the DLC connector and the appropriate terminal of the special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the (D65) CAN C Bus (+) circuit for an open.

Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.




## 6. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the DLC connector and the appropriate terminal of the special tool #8815.

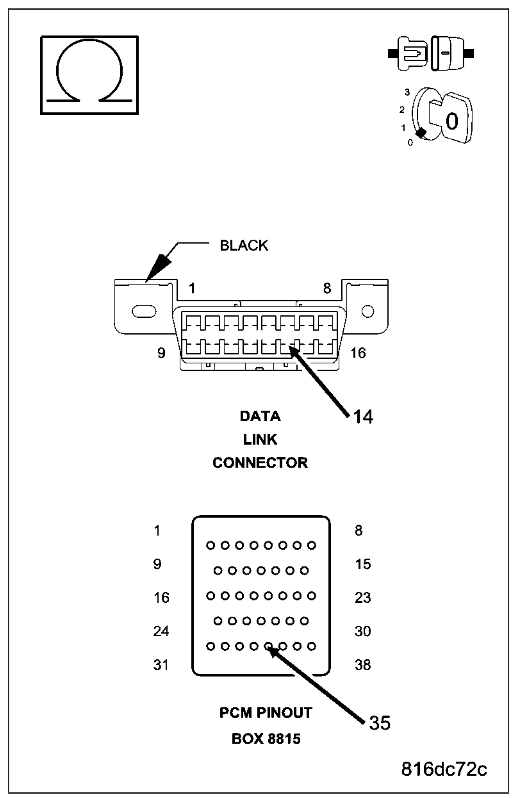
**Is the resistance below 5.0 ohms?**

**Yes** >> Replace and program the Powertrain Control Module in accordance with the service information.

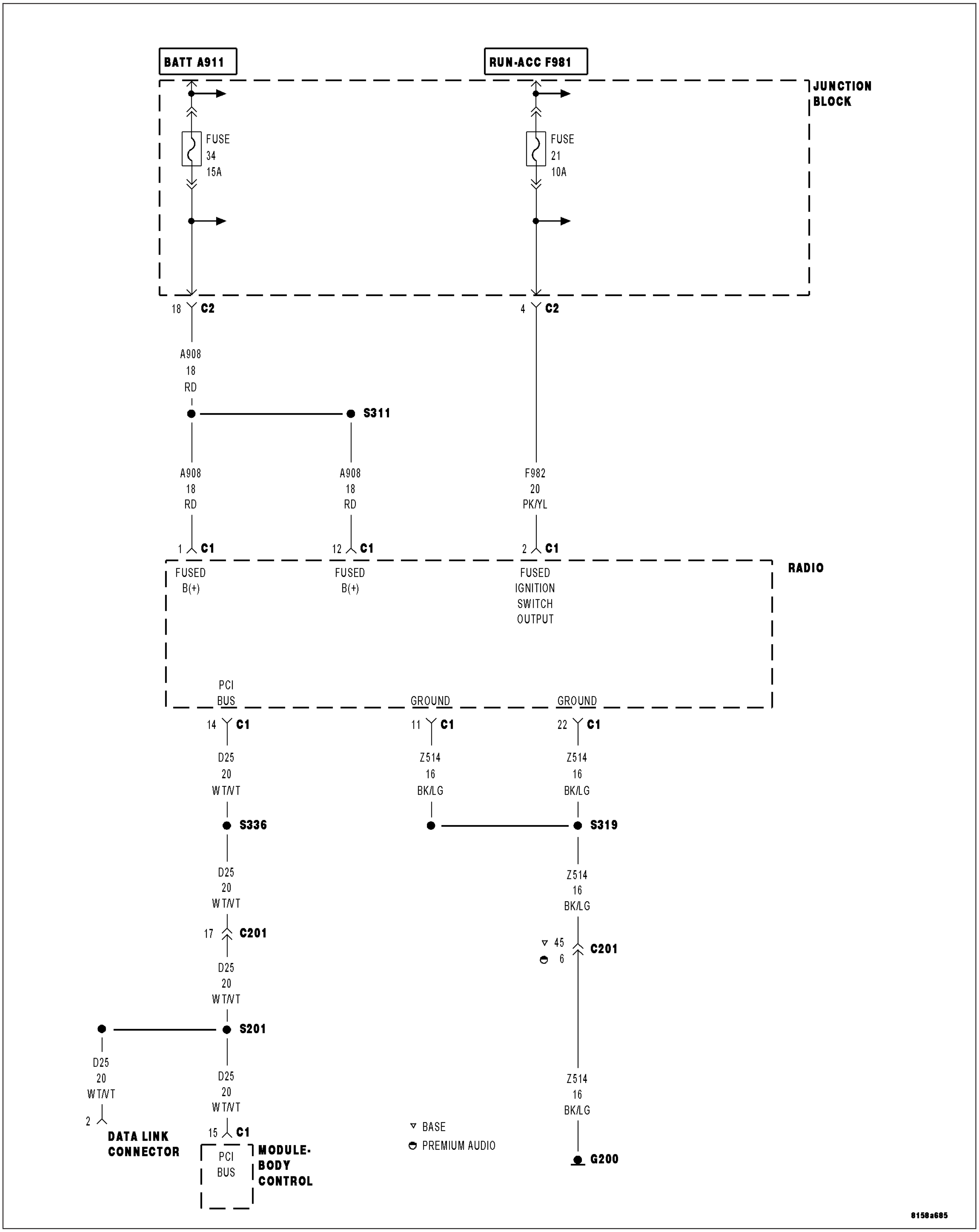
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.

**No** >> Repair the (D64) CAN C Bus (-) circuit for an open.

Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5.



## *NO RESPONSE FROM RADIO




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (Z514) GROUND CIRCUIT OPEN |
| (A908) FUSED B(+) CIRCUIT OPEN |
| (F982) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN |
| (D25) PCI BUS CIRCUIT OPEN |
| RADIO |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**

With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

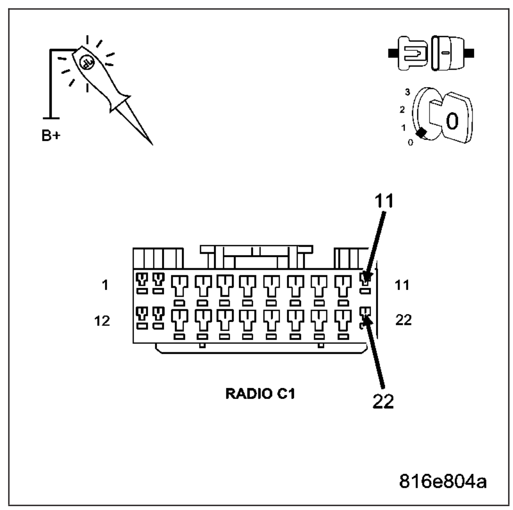
**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (Z514) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Radio C1 harness connector.

Using a 12-volt test light connected to 12-volts, probe each (Z514) ground circuit.




**Does the test light illuminate brightly for each circuit?**

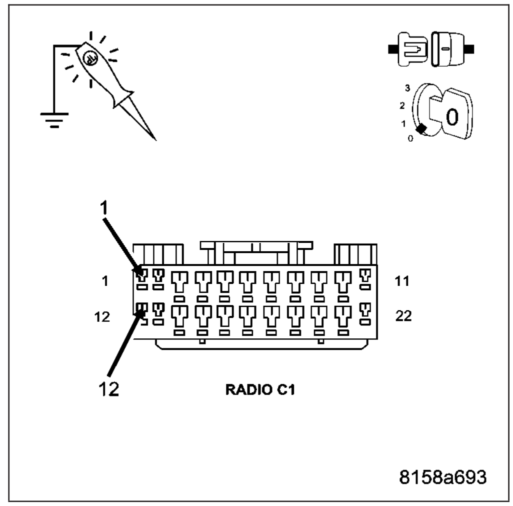
**Yes** >> Go To 3

**No** >> Repair the (Z514) Ground circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. (A908) FUSED B(+) CIRCUIT OPEN

Using a 12-volt test light connected to ground, probe each (A908) Fused B(+) circuit.




**Does the test light illuminate brightly for each circuit?**

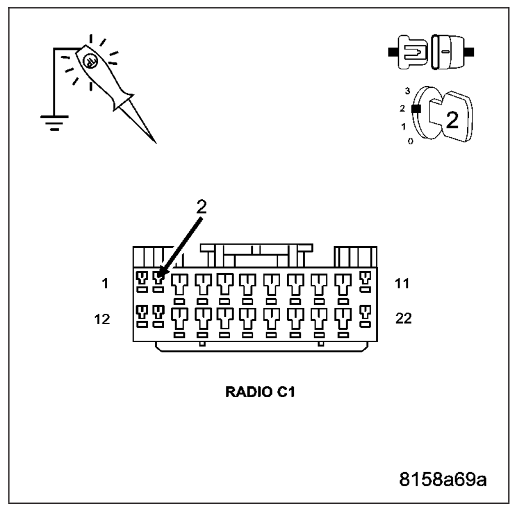
**Yes** >> Go To 4

**No** >> Repair the (A908) Fused B(+) circuit for an open.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 4. (F982) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (F982) Fused Ignition Switch Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 5

**No** >> Repair the (F982) Fused Ignition Switch Output circuit for an open.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

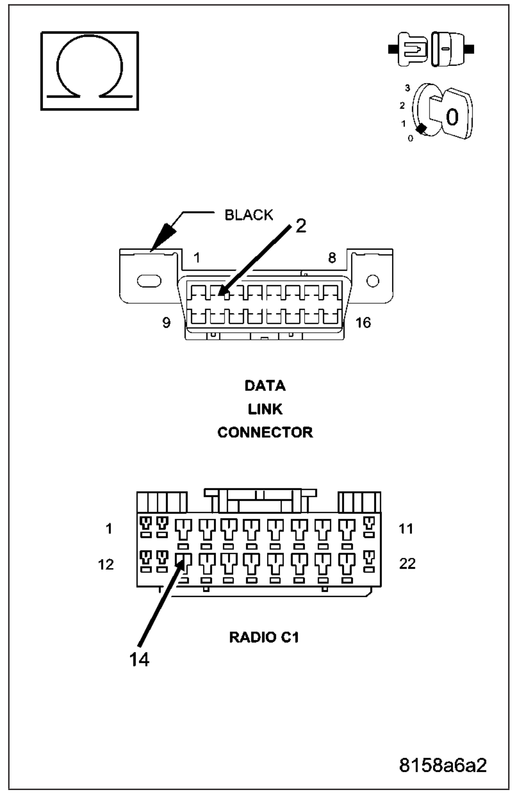
## 5. (D25) PCI BUS CIRCUIT OPEN

Turn the ignition off.

Disconnect the scan tool from the DLC connector.

Measure the resistance of the (D25) PCI Bus circuit between the DLC and the Radio C1 connector.

**Is the resistance below 5.0 ohms?**



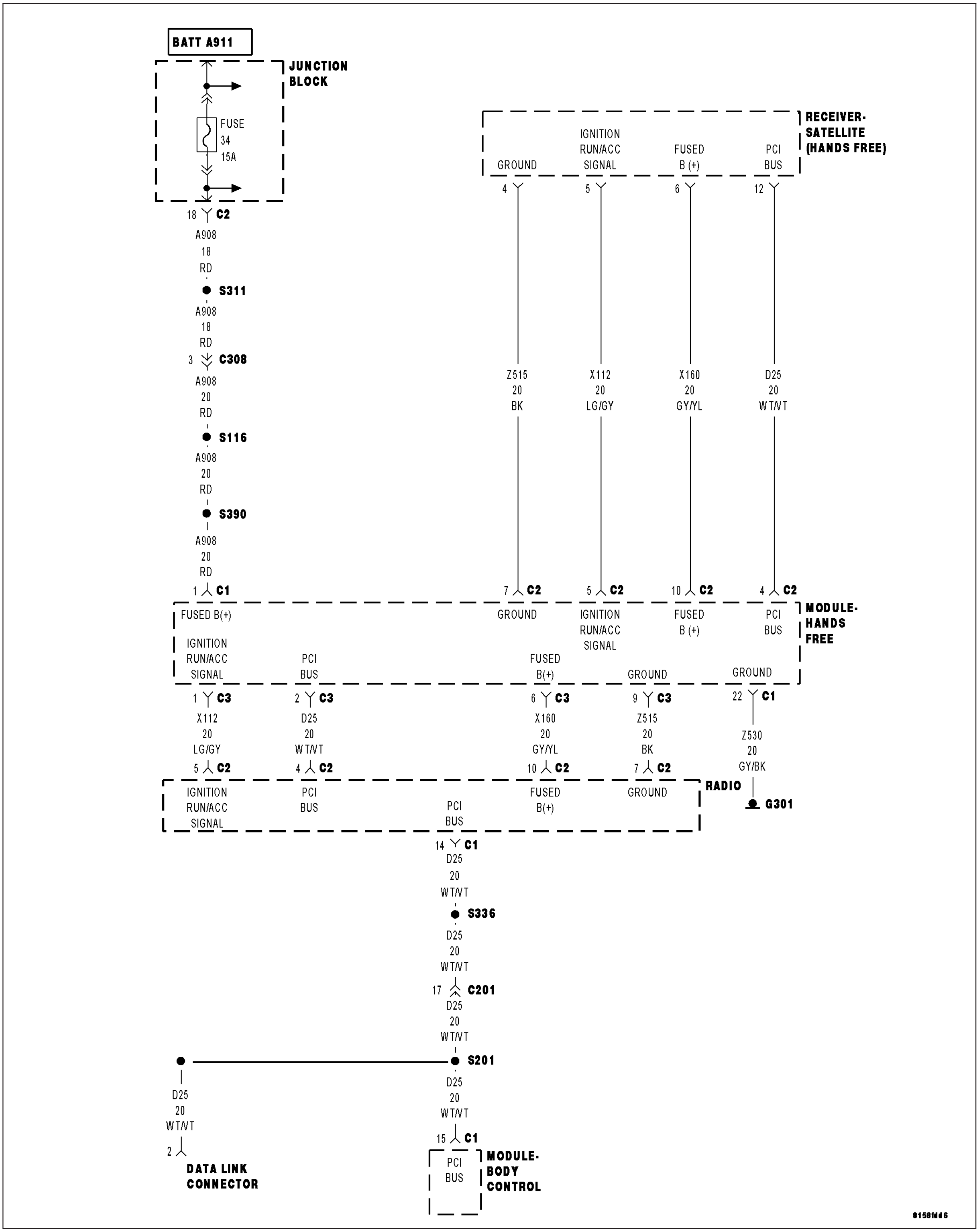

**Yes** >> Replace the Radio in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (D25) PCI Bus circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

# *NO RESPONSE FROM SATELLITE RECEIVER (SDAR)




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (Z515) GROUND CIRCUIT OPEN |
| (X160) FUSED B(+) CIRCUIT OPEN |
| (X112) IGNITION RUN/ACC SIGNAL CIRCUIT OPEN |
| (D25) PCI BUS CIRCUIT OPEN |
| RADIO |
| HANDS FREE MODULE |
| SATELLITE RECEIVER |

## Diagnostic Test

### 1. ESTABLISH COMMUNICATION WITH RADIO AND HANDS FREE MODULE (IF EQUIPPED) ON PCI BUS

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**
With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool communicate with the Radio and Hands Free Module?**

**Yes** >> Go To 2

**No** >> Perform the appropriate no response test. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

### 2. VISUALLY INSPECT THE RADIO AND SATELLITE RECEIVER CONNECTORS

Turn the ignition off.

Disconnect the Radio C2 harness connector.

Disconnect the Satellite Receiver harness connector.

Visually inspect the connectors for damage and pushed out pins.

**NOTE: If the vehicle is equipped with a Hands Free Phone module, check the connectors. This device is a pass through for the satellite receiver circuits.**

**Was any damage found?**

**Yes** >> Repair as necessary.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

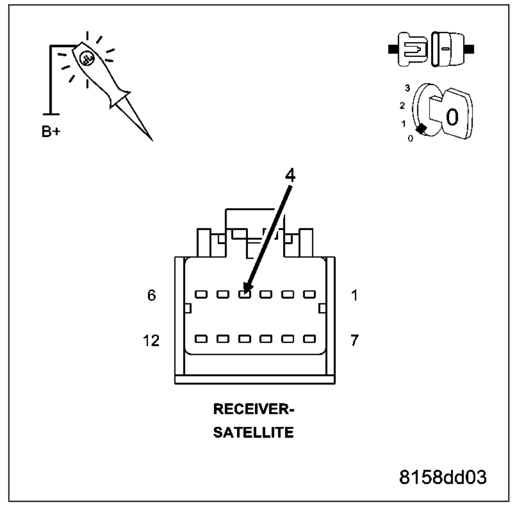
**No** >> Go To 3

## 3. (Z515) GROUND CIRCUIT OPEN

Reconnect the Radio C2 harness connector.

**NOTE: If the vehicle is equipped with a Hands Free Phone module, check the connectors. This device is a pass through for the satellite receiver circuits.**

Using a 12-volt test light connected to 12-volts, probe the (Z515) ground circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the (Z515) Ground circuit for an open.

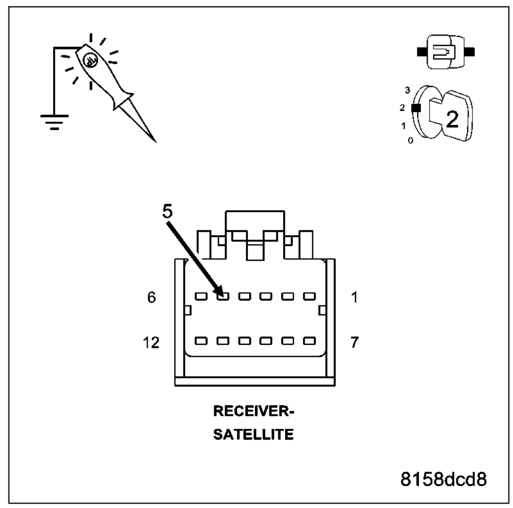
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 4. (X112) IGNITION RUN/ACC SIGNAL CIRCUIT OPEN

**NOTE: If the vehicle is equipped with a Hands Free Phone module, check the connectors. This device is a pass through for the satellite receiver circuits.**

Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (X112) Ignition Run/Acc Signal circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 5

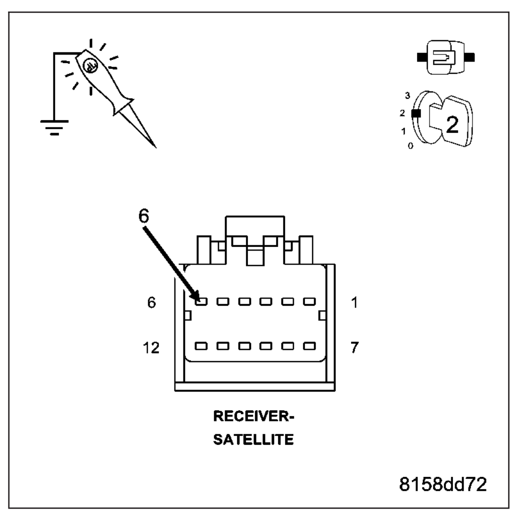
**No** >> Repair the (X112) Ignition Run/Acc Signal circuit for an open. If ok, replace the Radio.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 5. (X160) FUSED B(+) CIRCUIT OPEN

**NOTE: If the vehicle is equipped with a Hands Free Phone module, check the connectors. This device is a pass through for the satellite receiver circuits.**

Using a 12-volt test light connected to ground, probe the (X160) Fused B(+) circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 6

**No** >> Repair the (X160) Fused B(+) circuit for an open. If ok, replace the Radio.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

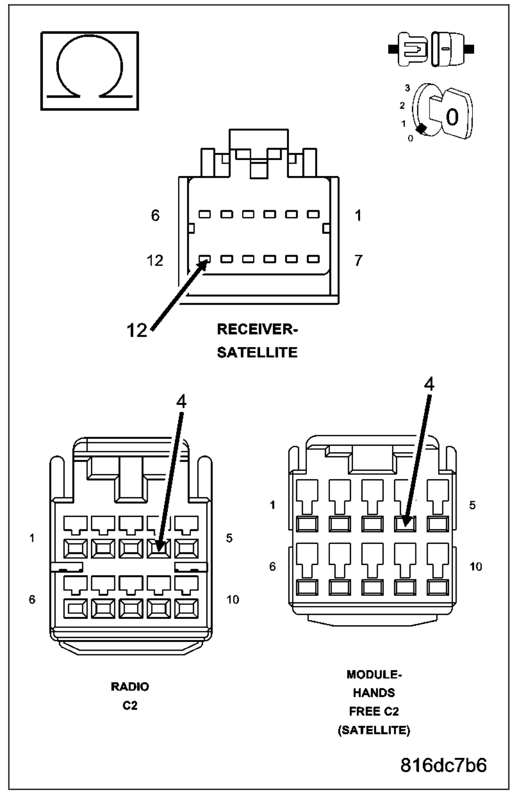
## 6. (D25) PCI BUS CIRCUIT OPEN

Turn the ignition off.

Disconnect the Radio C2 harness connector.

**NOTE: If equipped disconnect the HFM C2 harness connector.**

Measure the resistance of the (D25) PCI Bus circuit between either the Radio C2 harness connector (or if equipped the HFM C2 harness connector) and the Satellite Receiver harness connector.




**Is the resistance below 5.0 ohms?**

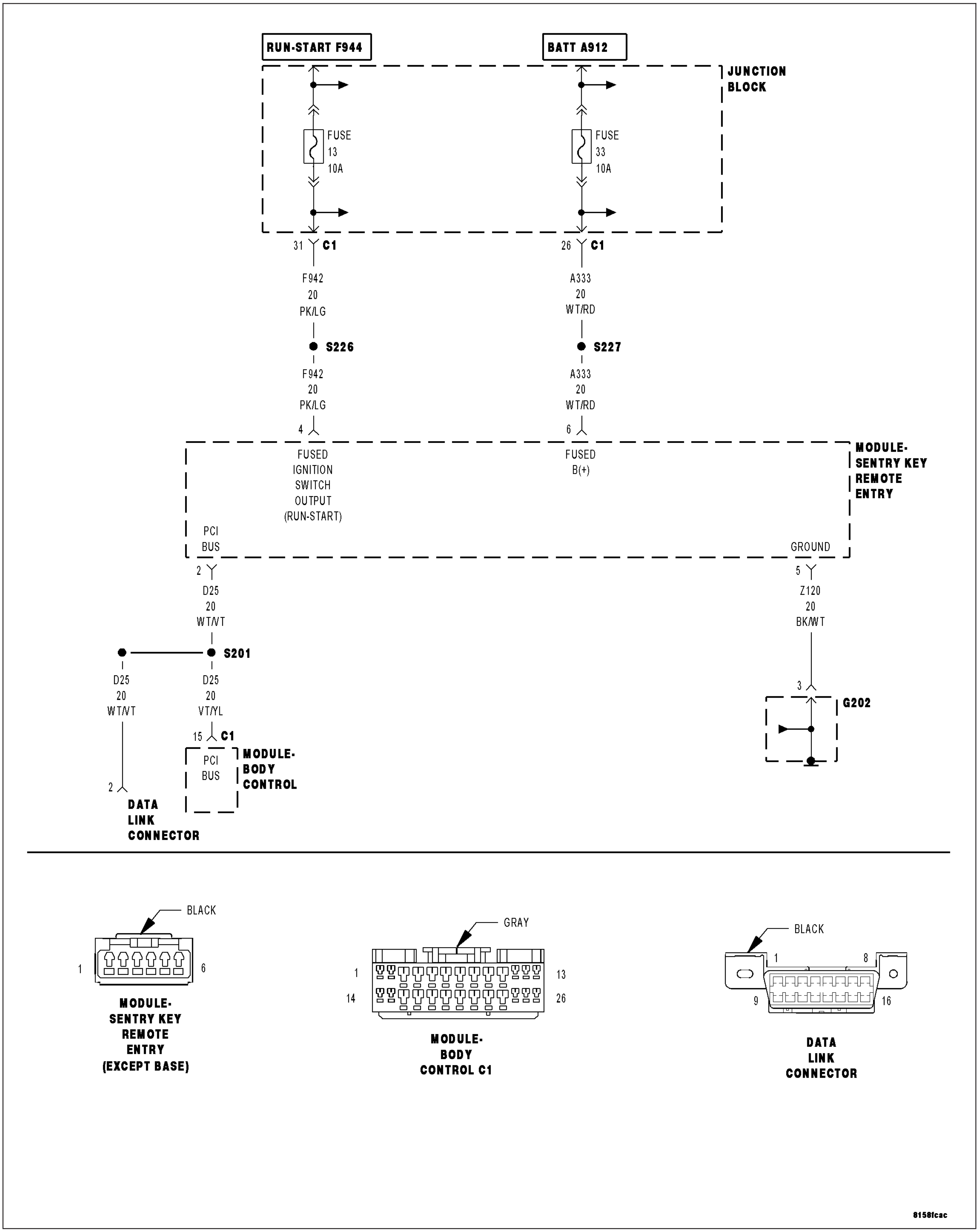
**Yes** >> Replace the Satellite Receiver in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (D25) PCI Bus circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## *NO RESPONSE FROM SENTRY KEY REMOTE ENTRY MODULE




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (Z120) GROUND CIRCUIT OPEN |
| (A333) FUSED B(+) CIRCUIT OPEN |
| (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN |
| (D25) PCI BUS CIRCUIT OPEN |
| SENTRY KEY REMOTE ENTRY MODULE (SKREEM) |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**
With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

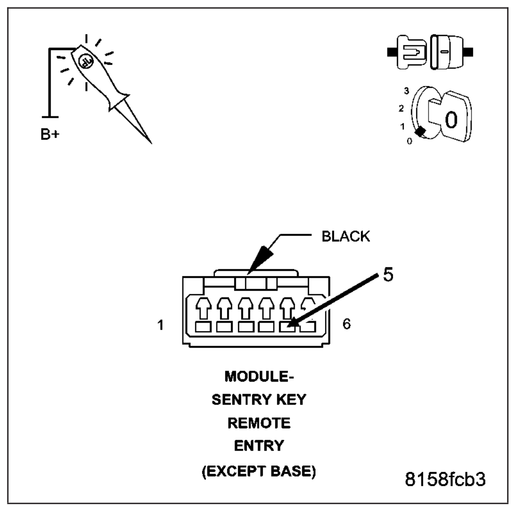
**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (Z120) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Sentry Key Remote Entry Module (SKREEM) harness connector.

Using a 12-volt test light connected to 12-volts, probe the (Z120) ground circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the (Z120) Ground circuit for an open.
Perform SKIS VERIFICATION TEST.

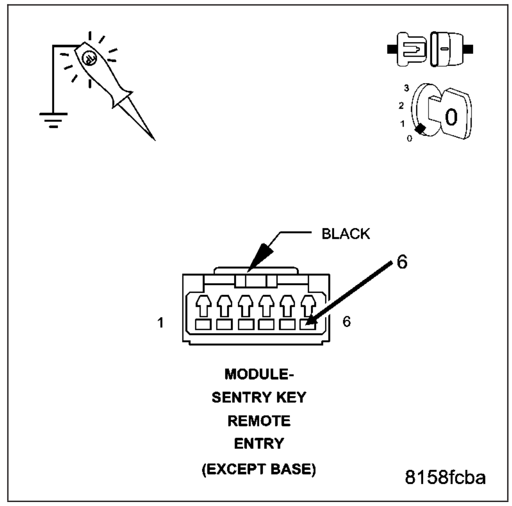
## 3. (A333) FUSED B(+) CIRCUIT OPEN

Using a 12-volt test light connected to ground, probe the (A333) Fused B(+) circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the (A333) Fused B(+) circuit for an open.
Perform SKIS VERIFICATION TEST.




## 4. (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

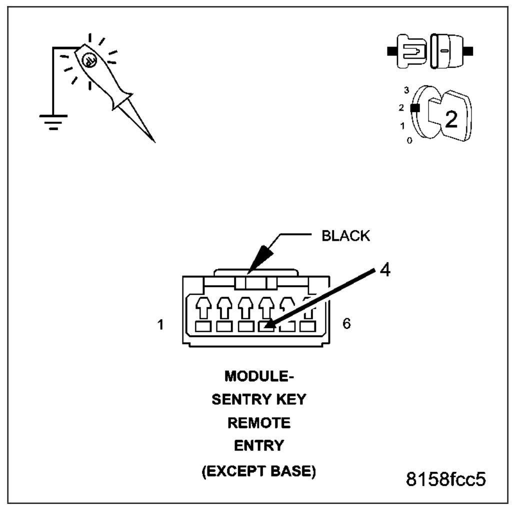
Turn the ignition on.

Using a 12-volt test light connected to ground, probe the (F942) Fused Ignition Switch Output circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 5

**No** >> Repair the (F942) Fused Ignition Switch Output circuit for an open.
Perform SKIS VERIFICATION TEST.

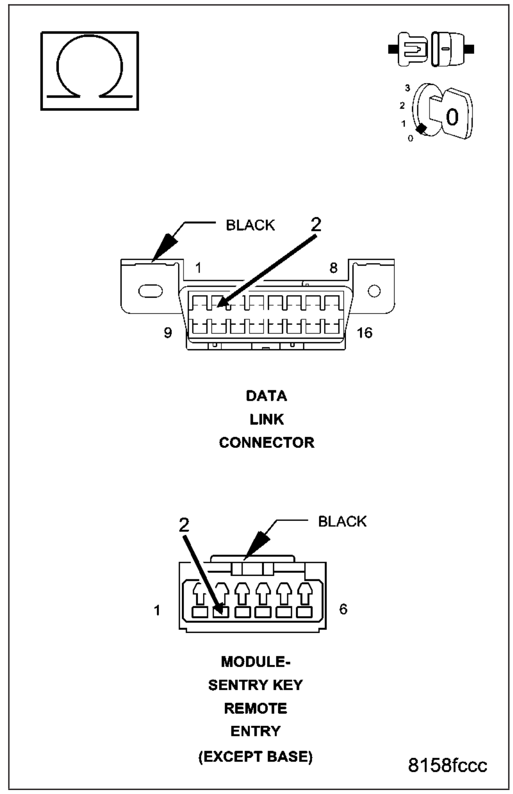


## 5. (D25) PCI BUS CIRCUIT OPEN

Turn the ignition off.

Disconnect the scan tool from the DLC connector.

Measure the resistance of the (D25) PCI Bus circuit between the DLC and the Sentry Key Remote Entry Module (SKREEM) harness connector.

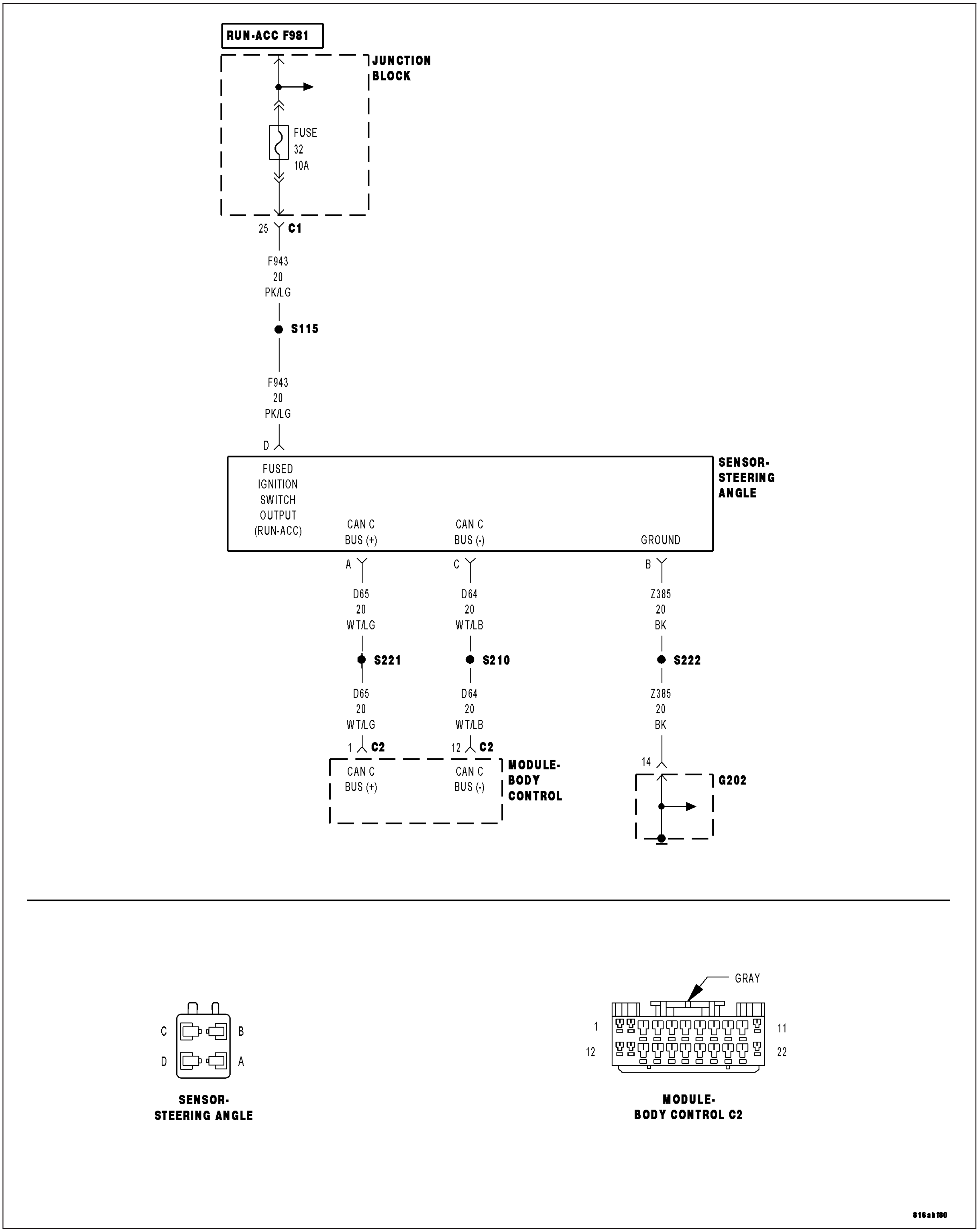



**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Sentry Key Remote Entry Module (SKREEM) in accordance with the service information.
Perform SKIS VERIFICATION TEST.

**No** >> Repair the (D25) PCI Bus circuit for an open.
Perform SKIS VERIFICATION TEST.

## *NO RESPONSE FROM THE STEERING ANGLE SENSOR (SAS)




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (F943) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED |
| (Z385) GROUND CIRCUIT OPEN |
| (D65) CAN C BUS (+) CIRCUIT OPEN |
| (D64) CAN C BUS (-) CIRCUIT OPEN |
| STEERING ANGLE SENSOR |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**

With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the sensor?**

**Yes** >> Go To 2

**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

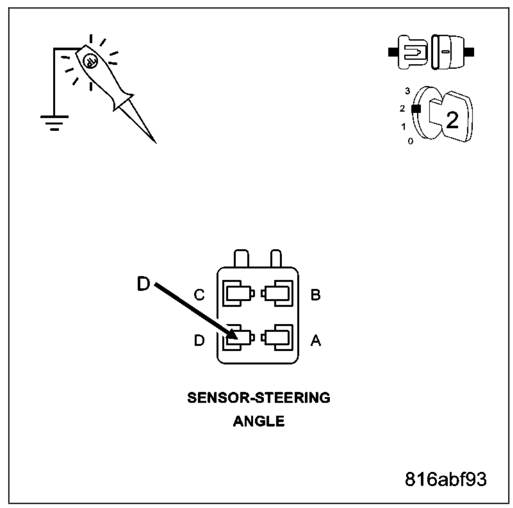
### 2. (F943) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the Steering Angle Sensor harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F943) Fused Ignition Switch Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the (F943) Fused Ignition Switch Output circuit for an open or short.

Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 3. (Z385) GROUND CIRCUIT OPEN

Turn the ignition off.

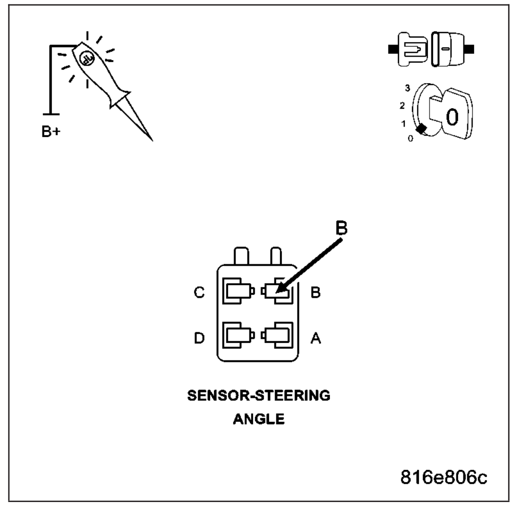
Using a 12-volt test light connected to 12-volts, check the (Z385) ground circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the (Z385) ground circuit for an open.

Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)




## 4. (D65) CAN C BUS (+) CIRCUIT OPEN

Disconnect the scan tool from the DLC connector.

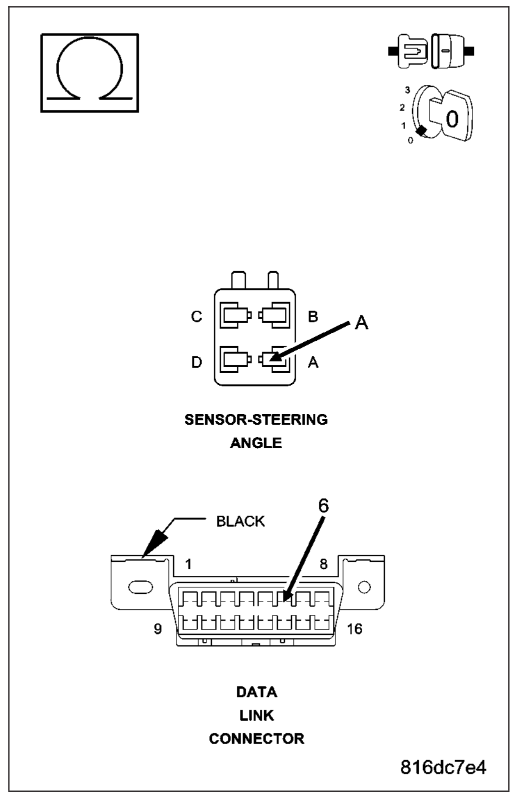
Measure the resistance of the (D65) CAN C Bus (+) circuit between the DLC connector and the Steering Angle Sensor connector.

**Is resistance below 5.0 ohms?**

**Yes** >> Go To 5

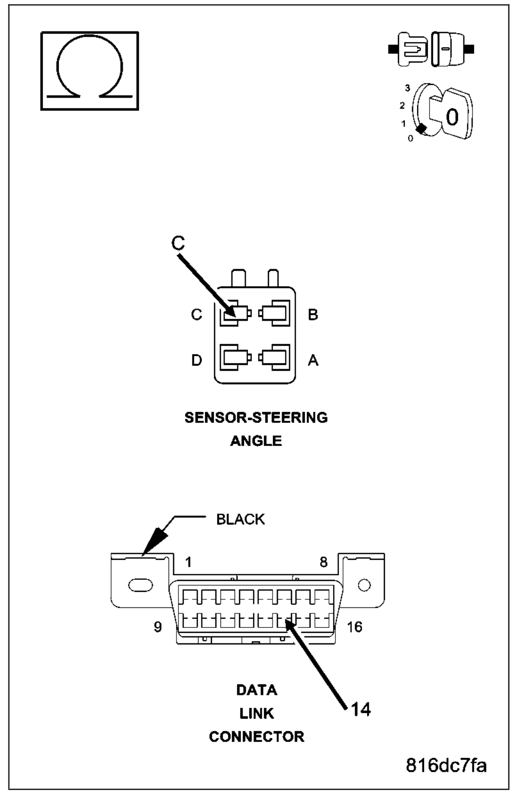
**No** >> Repair the (D65) CAN C Bus (+) circuit for an open.

Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## 5. (D64) CAN C BUS (-) CIRCUIT OPEN

Measure the resistance of the (D64) CAN C Bus (-) circuit between the DLC connector and the Steering Angle Sensor connector.




**Is resistance below 5.0 ohms?**

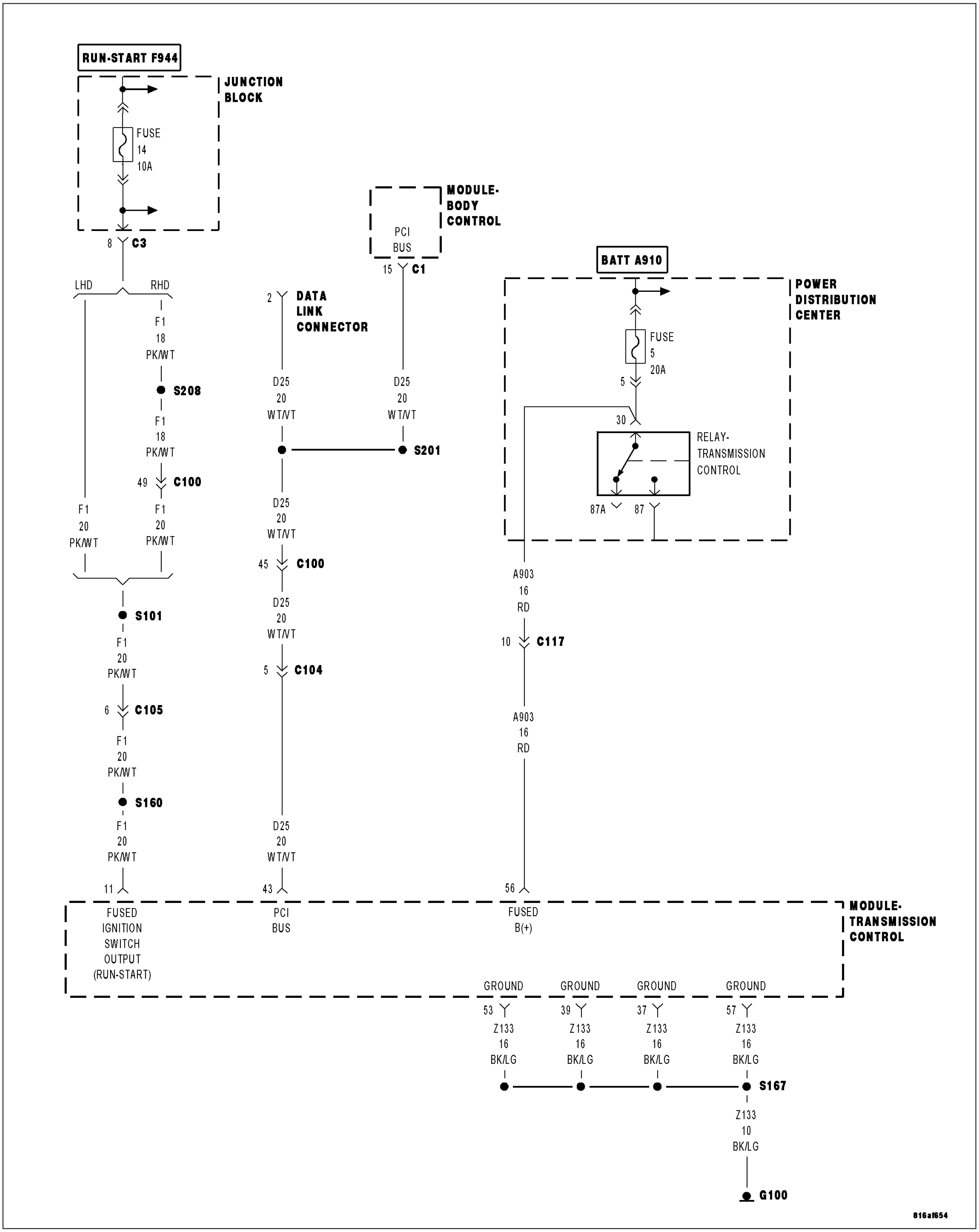
**Yes** >> Replace the Steering Angle Sensor in accordance with the service information.

Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (D64) CAN C Bus (-) circuit for an open.

Perform the BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *NO RESPONSE FROM TCM (TRANSMISSION CONTROL MODULE) (2.8L)




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (A903) FUSED B(+) CIRCUIT OPEN OR SHORTED |
| (Z133) GROUND CIRCUIT OPEN |
| (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED |
| (D25) PCI BUS CIRCUIT OPEN |
| TRANSMISSION CONTROL MODULE |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**

With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

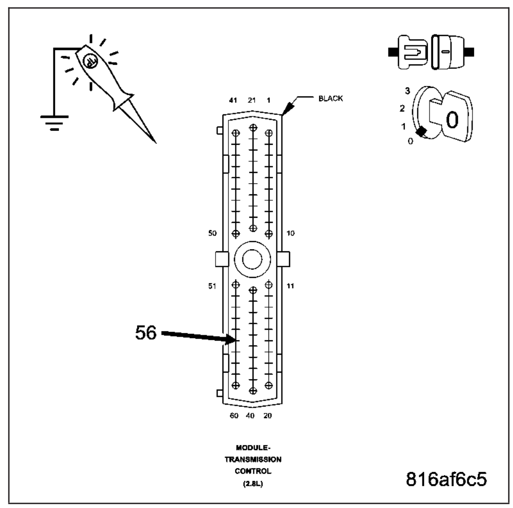
**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (A903) FUSED B(+) CIRCUIT OPEN OR SHORTED

Turn the ignition off.

Disconnect the TCM harness connector.

Using a 12-volt test light connected to ground, check the (A903) Fused B(+) circuit.




**Does the test light illuminate brightly?**

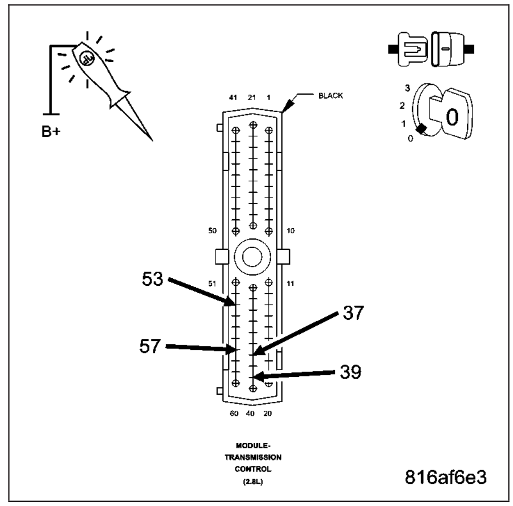
**Yes** >> Go To 3

**No** >> Repair the (A903) Fused B(+) circuit for an open or short.

Perform the appropriate POWERTRAIN VERIFICATION TEST.

## 3. (Z133) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check each (Z133) ground circuit.




**Does the test light illuminate brightly for each circuit?**

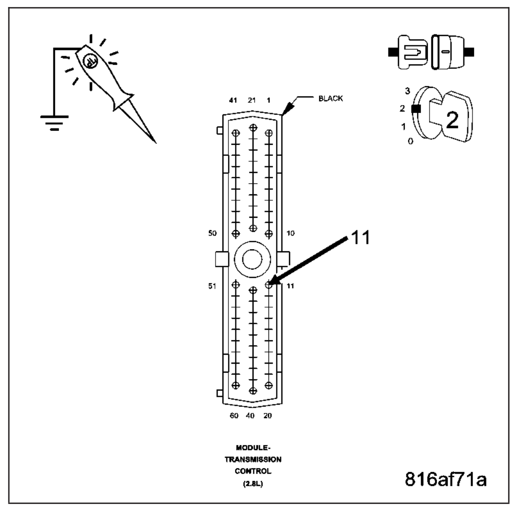
**Yes** >> Go To 4

**No** >> Repair the (Z133) ground circuit for an open.
Perform the appropriate POWERTRAIN VERIFICATION TEST.

## 4. (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORTED

Turn the ignition on.

Using a 12-volt test light connected to ground, check the (F1) Fused Ignition Switch Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 5

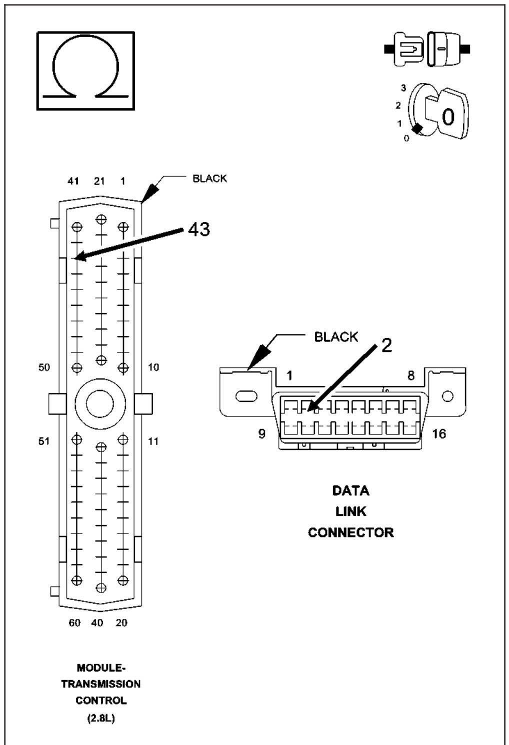
**No** >> Repair the (F1) Fused Ignition Switch Output circuit for an open or short.
Perform the appropriate POWERTRAIN VERIFICATION TEST.

## 5. (D25) PCI BUS CIRCUIT OPEN

Turn the ignition off.

Disconnect the scan tool from the DLC connector.

Measure the resistance of the (D25) PCI Bus circuit between the DLC and the TCM connector.



816af738

**Is the resistance below 5.0 ohms?**

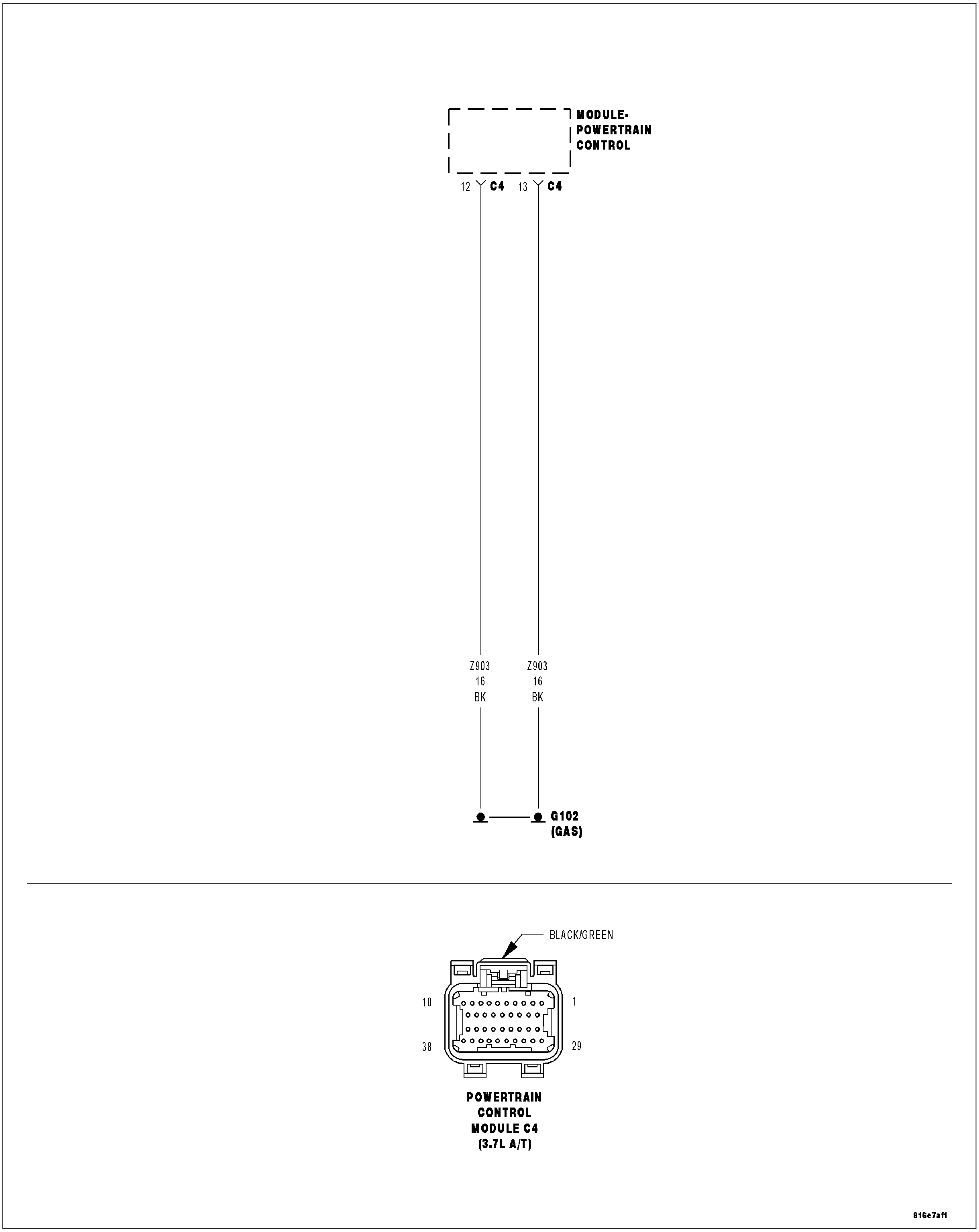
**Yes** >> Replace the Transmission Control Module in accordance with the service information.

Perform the appropriate POWERTRAIN VERIFICATION TEST.

**No** >> Repair the (D25) PCI Bus circuit for an open.

Perform the appropriate POWERTRAIN VERIFICATION TEST.

## *NO RESPONSE FROM TCM (POWERTRAIN CONTROL MODULE) - NGC




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (A209) B(+) CIRCUIT OPEN OR SHORTED |
| (Z903) GROUND CIRCUIT OPEN |
| (F1) FUSED IGNITION SW OUTPUT CIRCUIT OPEN OR SHORTED |
| (D65) CAN C BUS (+) CIRCUIT OPEN |
| (D64) CAN C BUS (-) CIRCUIT OPEN |
| POWERTRAIN CONTROL MODULE |

## Diagnostic Test

### 1. TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**

With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool display a red X next to the module?**

**Yes** >> Go To 2

**No** >> The no response condition is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent , pushed out, and corroded terminals.

### 2. ATTEMPT TO COMMUNICATE WITH THE PCM

With the scan tool in ECU view, observe the status of the PCM.

**Does the scan tool display a red X next to the PCM?**

**Yes** >> Refer to the No Response From PCM test procedure. Refer to the table of contents in this section.

**No** >> Go To 3

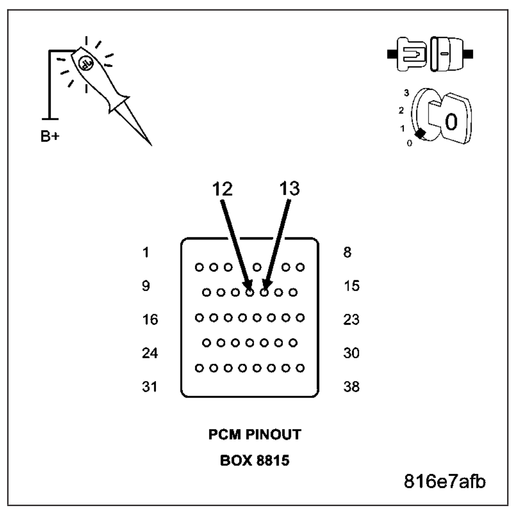
### 3. (Z903) GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM C4 harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Using a 12-volt test light connected to 12-volts, check the (Z903) ground circuit.

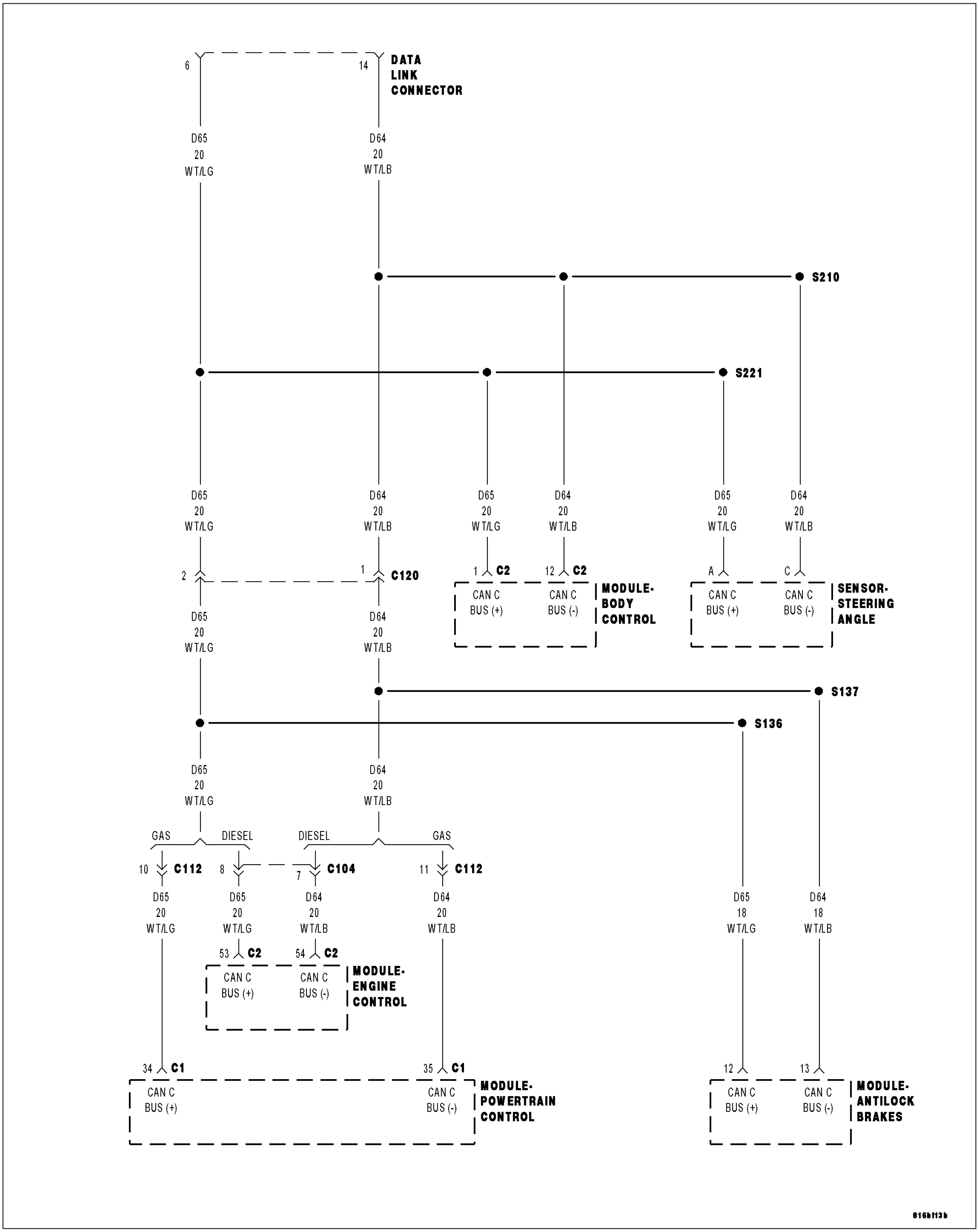



**Does the test light illuminate brightly?**

**Yes** >> Replace and program the Powertrain Control Module in accordance with the service information.
Perform the appropriate VERIFICATION TEST.

**No** >> Repair the (Z903) ground circuit for an open.
Perform the appropriate VERIFICATION TEST.

## *CAN C BUS COMMUNICATION FAILURE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The scan tool cannot communicate with ANY module on the CAN C Bus circuit.

| Possible Causes |
|---|
| (D65) CAN C BUS (+) CIRCUIT SHORTED TO VOLTAGE |
| (D64) CAN C BUS (-) CIRCUIT SHORTED TO VOLTAGE |
| (D65) CAN C BUS (+) CIRCUIT SHORTED TO GROUND |
| (D64) CAN C BUS (-) CIRCUIT SHORTED TO GROUND |
| (D65) CAN C BUS (+) CIRCUIT SHORTED TO (D64) CAN C BUS (-) CIRCUIT |
| ANTILOCK BRAKE MODULE |
| POWERTRAIN CONTROL MODULE (PCM or ECM) |
| STEERING ANGLE SENSOR |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. VERIFY CAN C BUS COMMUNICATION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**
With the scan tool select ECU View.

**NOTE: A red X will be next to the module that is not communicating or not installed on the vehicle, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool communicate with any module on the CAN C Bus circuit?**

**Yes** >> The conditions that caused this symptom are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

**No** >> Go To 2

### 2. CHECK THE D65 CAN C (+) AND (D64) CAN C (-) CIRCUITS FOR A SHORT TO VOLTAGE

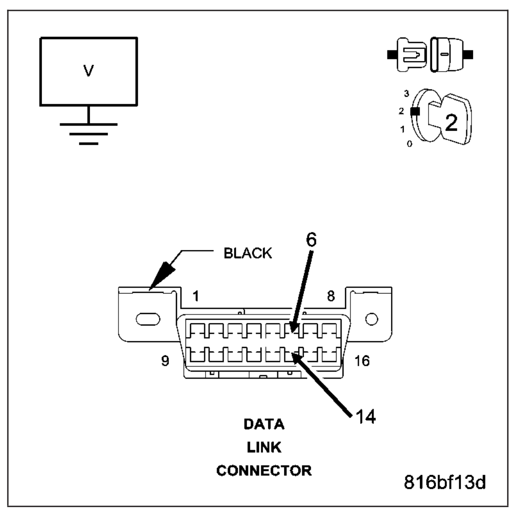
Turn the ignition on.

Measure the voltage of the (D65) CAN C Bus (+) circuit and the (D64) CAN C Bus (-) circuit at the DLC.

**Is the voltage steadily above 4.0 volts?**

**Yes** >> Go To 3

**No** >> Go To 4



## 3. (D65) CAN C BUS (+) CIRCUIT OR (D64) CAN C BUS (-) CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

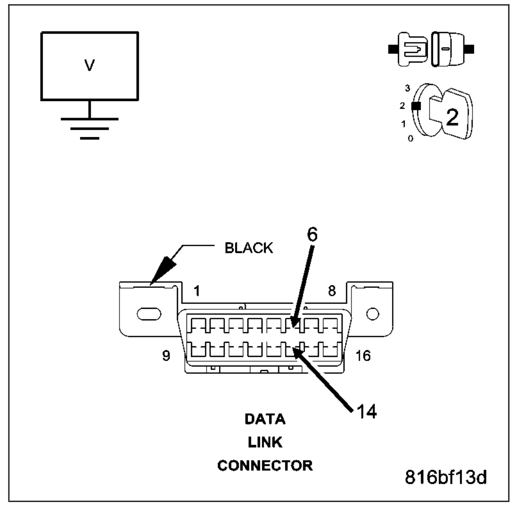
Disconnect the scan tool from the DLC.

**NOTE: Perform the following steps for each module on the CAN C Bus Circuit.**

Measure the voltage between the (D65) CAN C Bus (+) circuit and the (D64) CAN C Bus (-) circuit and ground at the DLC.

Disconnect a module, turn the ignition on and check if the module that was disconnected was causing the short to voltage internally.

While monitoring the voltmeter, disconnect each module on the CAN C Bus Circuit one at a time.




**Is there any voltage present with all modules disconnected?**

**Yes** >> Repair the (D65) CAN C Bus (+) circuit or (D64) CAN C Bus (-) circuit for a short to voltage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

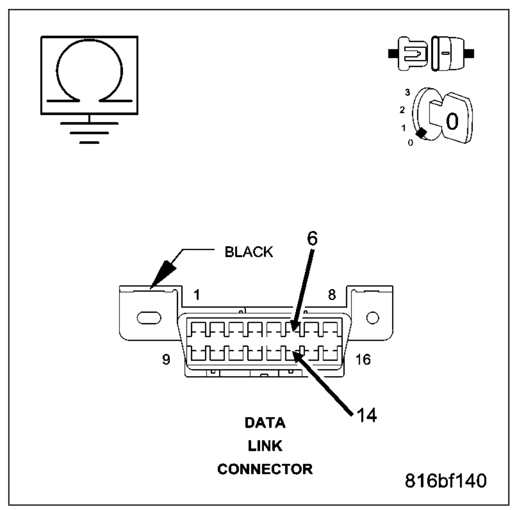
**No** >> Replace the module in accordance with the service information that when disconnected eliminated the short to voltage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 4. CHECK THE (D65) CAN C BUS (+) CIRCUIT AND THE (D64) CAN C BUS (-) CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Measure the resistance between the (D65) CAN C Bus (+) circuit and ground and the (D64) CAN C Bus (-) circuit and ground at the DLC.



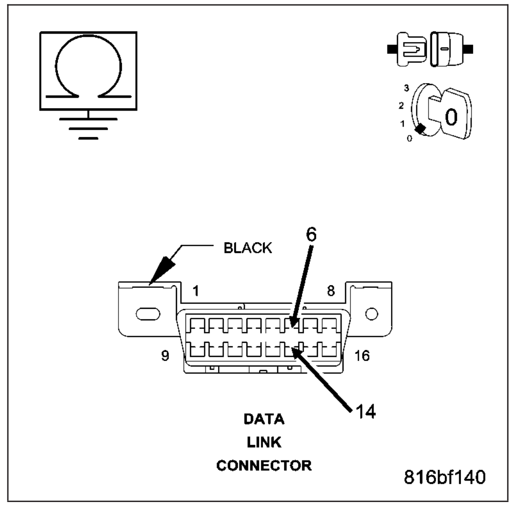

**Is the resistance below 5.0 ohms on either circuit?**

**Yes** >> Go To 5

**No** >> Go To 6

## 5. (D65) CAN C BUS (+) CIRCUIT OR (D64) CAN C (-) CIRCUIT SHORTED TO GROUND

Turn the ignition off.




**NOTE: Perform the following steps for each module on the CAN C Bus Circuit.**

Measure the resistance between the (D65) CAN C Bus (+) circuit and the (D64) CAN C Bus (-) circuit and ground at the DLC.

Disconnect a module, check if the module that was disconnected was causing the short to ground internally.

While monitoring the ohmmeter, disconnect each module on the CAN C Bus Circuit one at a time.

**Is the resistance below 5.0 ohms with all modules disconnected?**

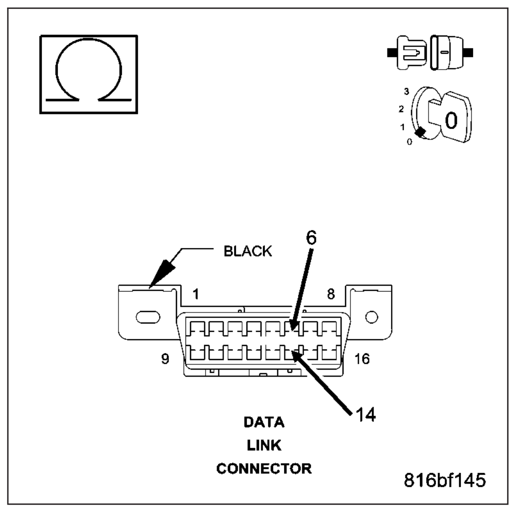
**Yes** >> Repair the (D65) CAN C Bus (+) circuit or (D64) CAN C Bus (-) circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the module in accordance with the service information that when disconnected eliminated the short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 6. (D65) CAN C BUS (+) CIRCUIT SHORTED TO (D64) CAN C BUS (-) CIRCUIT




**NOTE: Perform the following steps for each module on the CAN C Bus Circuit.**

Measure the resistance between the (D65) CAN C Bus (+) circuit and the (D64) CAN C Bus (-) circuit at the DLC.

Disconnect a module, check if the module that was disconnected was causing the short internally.

While monitoring the ohmmeter, disconnect each module on the CAN C Bus Circuit one at a time.

**Is the resistance below 5.0 ohms with all modules disconnected?**

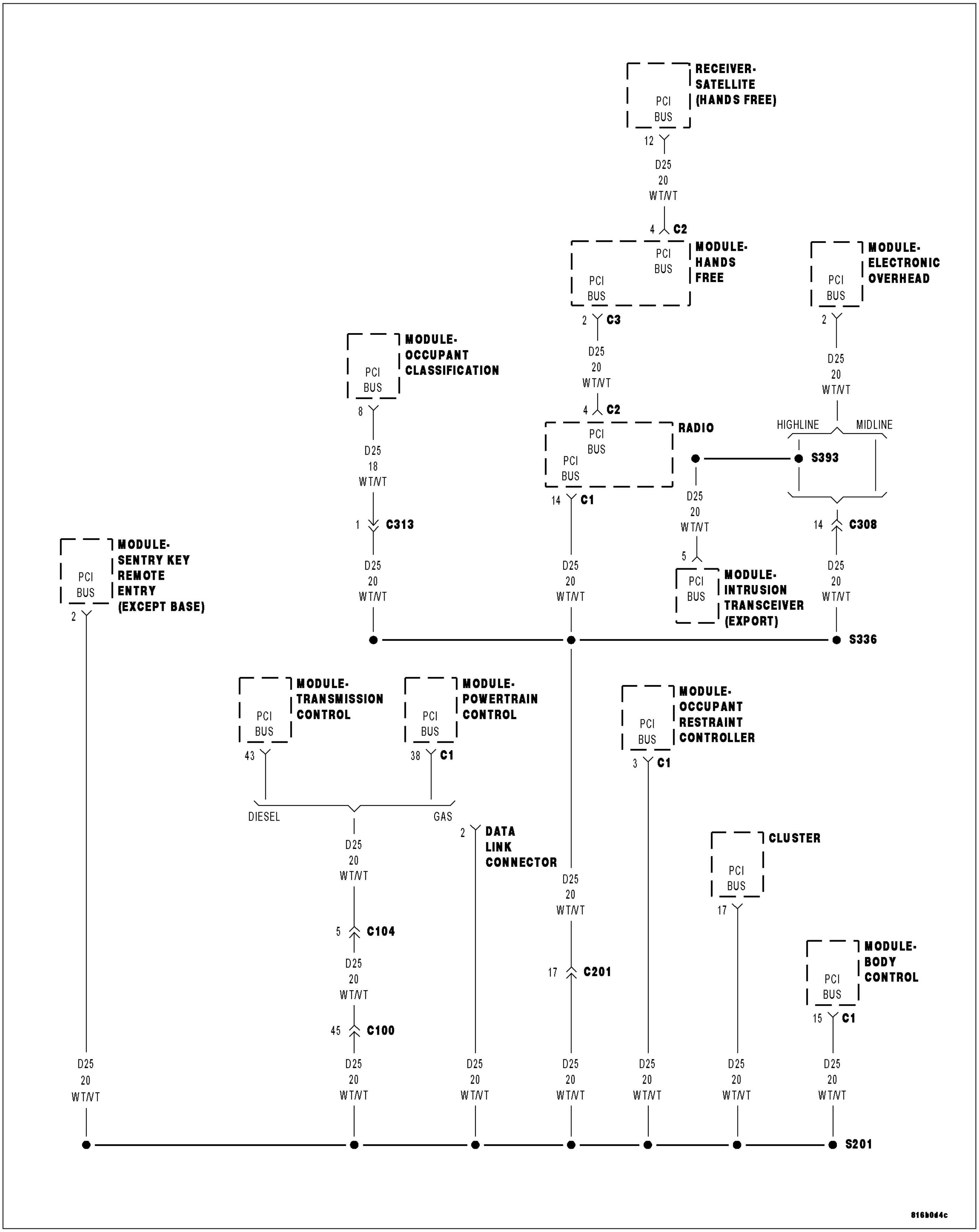
**Yes** >> Repair the (D65) CAN C Bus (+) circuit for a short to the (D64) CAN C Bus (-) circuit.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the module in accordance with the service information that when disconnected eliminated the short.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *PCI BUS COMMUNICATION FAILURE




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (D25) PCI BUS CIRCUIT OPEN AT DATA LINK CONNECTOR (DLC) |
| (D25) PCI BUS CIRCUIT SHORTED TO GROUND |
| (D25) PCI BUS CIRCUIT SHORTED TO VOLTAGE |
| ANY PCI BUS MODULE INTERNALLY SHORTED TO GROUND |
| ANY PCI BUS MODULE INTERNALLY SHORTED TO VOLTAGE |

## Diagnostic Test

### 1. PCI BUS COMMUNICATION AND TEST FOR INTERMITTENT CONDITION

Turn the ignition on.

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10.0 and 16.0 volts.**
With the scan tool, select ECU view.

**NOTE: A red X will be next to the module that is not communicating or not installed on the vehicle, indicating that the module is not active on the Bus network. A green check indicates that the module is active on the Bus network.**

**Does the scan tool communicate with any module on the PCI Bus network?**

**Yes** >> The conditions that caused this symptom are not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

**No** >> Go To 2

### 2. (D25) PCI BUS CIRCUIT OPEN AT THE DLC

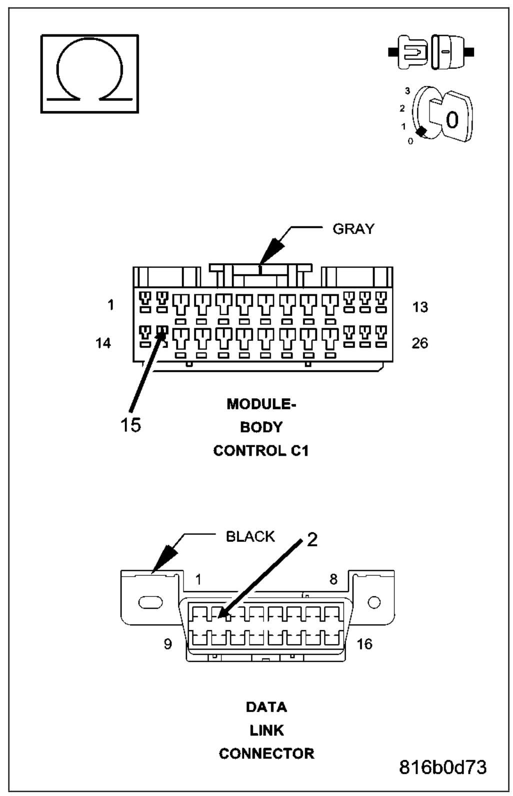
**NOTE: If the PCI Bus circuit is open between the BCM and the DLC the scan tool will be unable to identify the vehicle. Perform the test below to determine if the open condition exists causing the scan tool error.**
Turn the ignition off.

Disconnect the negative battery cable.

Disconnect the scan tool from the DLC.

Disconnect the BCM C1 harness connector.

Measure the resistance of the (D25) PCI Bus circuit between the DLC and the BCM harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 3

**No** >> Repair the (D25) PCI Bus circuit for an open.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. CHECK THE (D25) PCI BUS CIRCUIT FOR A SHORT TO VOLTAGE

**NOTE: Reconnect the BCM harness connector and the negative battery cable.**

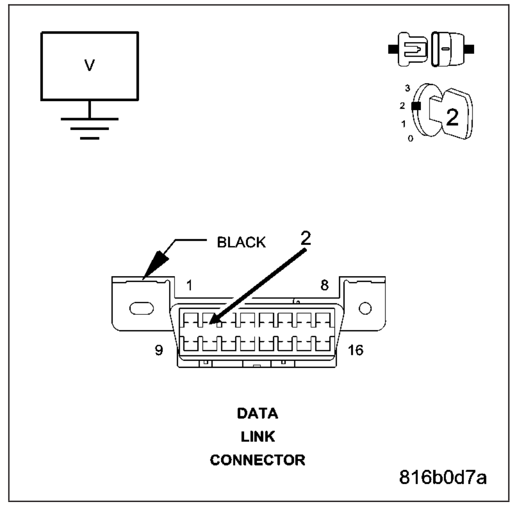
Turn the ignition on.

Measure the voltage of the (D25) PCI Bus circuit at the DLC.

**Is the voltage steadily above 7.0 volts?**

**Yes** >> Go To 4

**No** >> Go To 5




## 4. (D25) PCI BUS CIRCUIT SHORTED TO VOLTAGE

**NOTE: If the PCI Bus circuit is shorted to voltage the scan tool will be unable to identify the vehicle. Perform the test below, make the repairs as indicated. Re-attempt communication with the scan tool.**

Turn the ignition off.

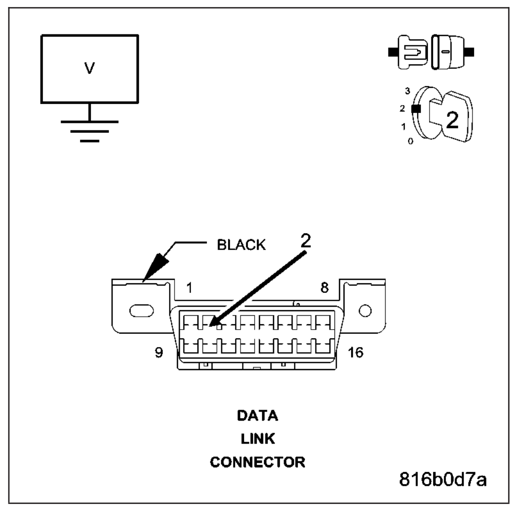
Using a voltmeter, connect one end to the (D25) PCI Bus circuit at the DLC and the other end to ground.

**NOTE: For each module on the PCI Bus perform the following steps.**

Turn the ignition off, wait one minute before disconnecting a module, turn the ignition on and check if the module disconnected was causing the short to voltage internally.

While monitoring the voltmeter, disconnect each module the vehicle is equipped with one at a time.

**Is the voltage steadily above 7.0 volts with all the modules disconnected?**



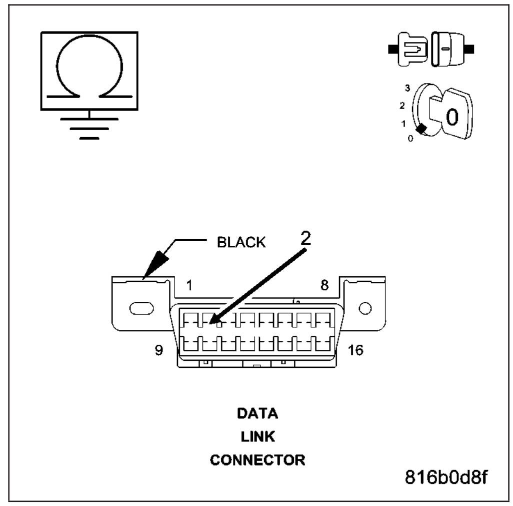

**Yes** >> Repair the (D25) PCI Bus circuit for a short to voltage.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace the module that when disconnected eliminated the short to voltage.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 5. (D25) PCI BUS CIRCUIT SHORTED TO GROUND




**NOTE: If the PCI Bus circuit is shorted to ground the scan tool will be unable to identify the vehicle. Perform the test below, make the repairs as indicated. When the repair is complete unplug the IOD fuse, wait 30 seconds, and plug the fuse back in. This will re-initialize the BCM. Re-attempt communication with the scan tool.**

Turn the ignition off.

Using a ohmmeter, connect one end to the (D25) PCI Bus circuit at the DLC and the other end to ground.

While monitoring the ohmmeter, disconnect each module the vehicle is equipped with one at a time.

**NOTE: Total bus resistance to ground thru all of the modules is typically between 350 to 1000 ohms. The more modules on the PCI Bus, the lower the total resistance will be.**

**Is the resistance below 150.0 ohms with all the modules disconnected?**

**Yes** >> Repair the (D25) PCI Bus circuit for a short to ground.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace the module that when disconnected the short to ground was eliminated.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## STANDARD PROCEDURE

# BODY VERIFICATION TEST – VER 1

## Diagnostic Test

### 1. Perform Body Verification Test

**NOTE: If the SKREEM, PCM or ECM was replaced, refer to the Service Information for proper programming procedures.**

1. Disconnect all jumper wires and reconnect all previously disconnected components and connectors.
2. If the Instrument Cluster was replaced, use the scan tool to insure the proper warning indicators are configured.
3. If the Body Control Module was replaced, turn the ignition on for 15 seconds (to learn the VIN). If the vehicle is equipped with VTSS, use the scan tool and enable VTSS.
4. Program tire size, country code, radio EQ setting and RKE transmitters (if the SKREEM was replaced) and all options as necessary.
5. (Export only) If the Intrusion Transceiver Module (ITM) was replaced, use the scan tool to enable ITM and program Interior Type.
6. (Export only) If the Siren was replaced, perform the scan tool Siren Replacement procedure.
7. Ensure that all accessories are turned off.
8. Ensure that the battery is fully charged.
9. Turn the ignition on.
10. With the scan tool, record and erase DTCs from all modules.
11. If any other electronic control module was replaced, select the applicable module from the scan tool menu and press “Misc. Functions”. If the module has programmable features, program as necessary.
12. Turn the ignition off, wait 10 seconds, and then turn the ignition on.
13. Operate all functions of the system that caused the original concern.
14. With the scan tool, check for DTCs in all modules.

**Are DTCs present in any of the modules or is the original condition still present?**

**Yes** >> The repair is not complete. Refer to the related category for the DTC or symptom that is still present.

**No** >> The repair is complete.

# ELECTRONIC CONTROL MODULES

## TABLE OF CONTENTS

# ELECTRONIC CONTROL MODULES

## STANDARD PROCEDURE

## PCM/SKREEM PROGRAMMING

**NOTE: Before replacing the Powertrain Control Module (PCM), be certain to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most PCM driver/control circuit failures are caused by internal component failures (i.e. relays and solenoids) and shorted circuits (i.e. pull-ups, drivers, and switched circuits). These failures are difficult to detect when a double fault has occurred and only one Diagnostic Trouble Code (DTC) has been set.**

When a Powertrain Control Module (PCM) and the Sentry Key REmote Entry Module (SKREEM) on vehicles equipped with the Sentry Key Immobilizer System (SKIS) are replaced at the same time, perform the following steps in order:

1. Program the new PCM.
2. Program the new SKREEM (also sometimes referred to as the Wireless Control Module or WCM).
3. Replace all ignition keys and program them into the new SKREEM/WCM.

### PROGRAMMING THE PCM/SKREEM

The SKIS Secret Key is an ID code that is unique to each SKREEM/WCM. This code is programmed and stored in the SKREEM/WCM, the PCM, and each ignition key transponder chip. When the PCM or SKREEM/WCM is replaced, it is necessary to program the Secret Key into the new module using a diagnostic scan tool. Follow the programming steps outlined in the diagnostic scan tool for “PCM Replaced” or “WCM Replaced” under “Miscellaneous Functions” for the “WCM/Wireless Control Module” menu item as appropriate.

**NOTE: Be certain to enter the correct country code for the SKREEM/WCM. If the incorrect country code is programmed into the SKREEM, it cannot be changed and the SKREEM must be replaced.**

**NOTE: If the PCM and the SKREEM/WCM are replaced at the same time, all vehicle ignition keys will need to be replaced and new keys programmed into the new SKREEM/WCM.**

**NOTE: Programming the PCM or SKREEM is done using a diagnostic scan tool and a PIN to enter secure access mode. If three attempts are made to enter secure access mode using an incorrect PIN, secure access mode will be locked out for one hour. To exit this lockout mode, turn the ignition to the RUN position for one hour then enter the correct PIN. (Ensure all accessories are turned OFF. Also monitor the battery state and connect a battery charger if necessary).**

### PROGRAMMING IGNITION KEYS TO THE SKREEM

Each ignition key transponder also has a unique ID code that is assigned at the time the key is manufactured. When a key is programmed into the SKREEM/WCM, the transponder ID code is learned by the module and the transponder acquires the unique Secret Key ID code from the SKREEM/WCM. To program ignition keys into the SKREEM/WCM, follow the programming steps outlined in the diagnostic scan tool for “Program Ignition Keys or Key FOBs” under “Miscellaneous Functions” for the “WCM/Wireless Control Module” menu item.

**NOTE: A maximum of eight keys can be learned to each SKREEM. Once a key is learned to a SKREEM, that key has acquired the Secret Key for that SKREEM and cannot be transferred to any other SKREEM or vehicle.**

If ignition key programming is unsuccessful, the scan tool will display one of the following error messages:

- **Programming Not Attempted** - The scan tool attempts to read the programmed key status and there are no keys programmed into SKREEM memory.
- **Programming Key Failed (Possible Used Key From Wrong Vehicle)** - SKREEM is unable to program an ignition key transponder due to one of the following:
  - The ignition key transponder is faulty.

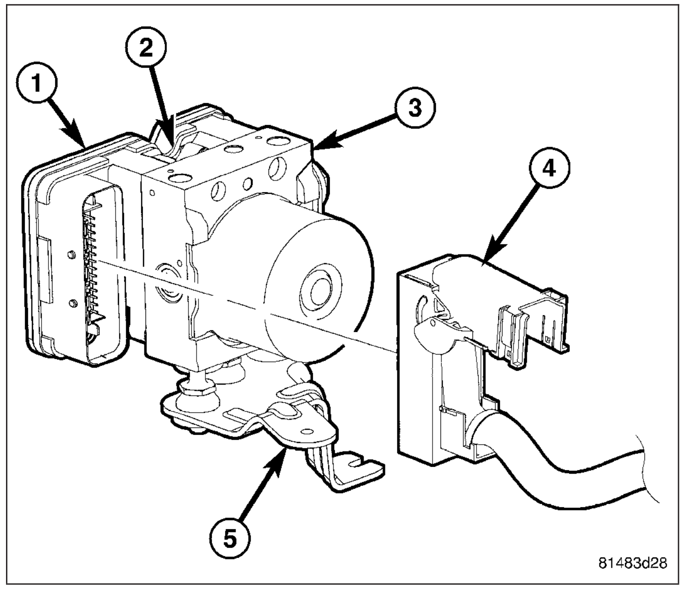
- The ignition key transponder is or has been already programmed to another vehicle.

- **8 Keys Already Learned, Programming Not Done** - The SKREEM transponder ID memory is full.
- **Learned Key In Ignition** - The ID for the ignition key transponder currently in the ignition lock cylinder is already programmed into SKREEM memory.

# MODULE-ANTILOCK BRAKE

## DESCRIPTION

The Antilock Brake Module (ABM) (1) is mounted to the Hydraulic Control Unit (HCU) (3) and operates the ABS system.

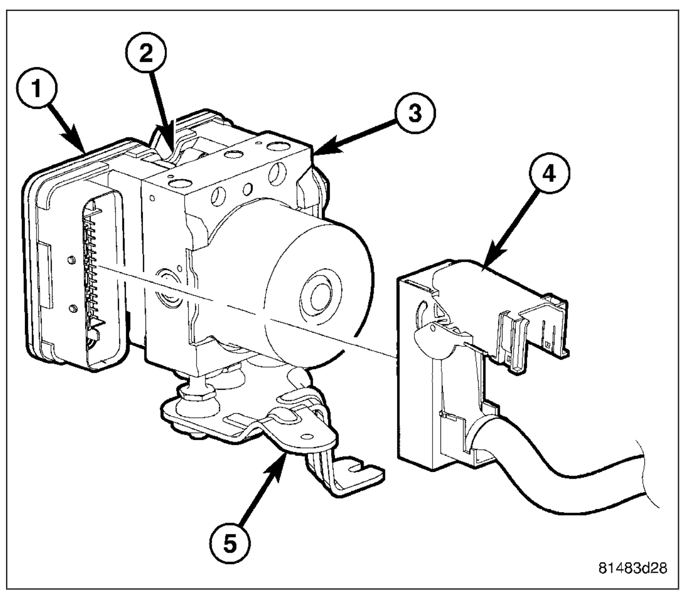



## OPERATION

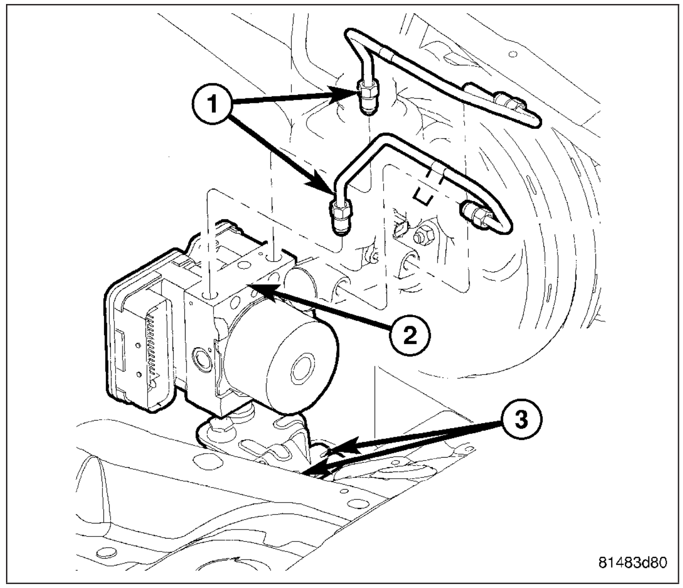
The ABM voltage source is through the ignition switch in the RUN position. The ABM contains dual microprocessors. A logic block in each microprocessor receives identical sensor signals. These signals are processed and compared simultaneously. The ABM contains a self check program that illuminates the ABS warning light when a system fault is detected. Faults are stored in a diagnostic program memory and are accessible with the scan tool. ABS faults remain in memory until cleared, or until after the vehicle is started approximately 50 times. Stored faults are **not** erased if the battery is disconnected.

## REMOVAL

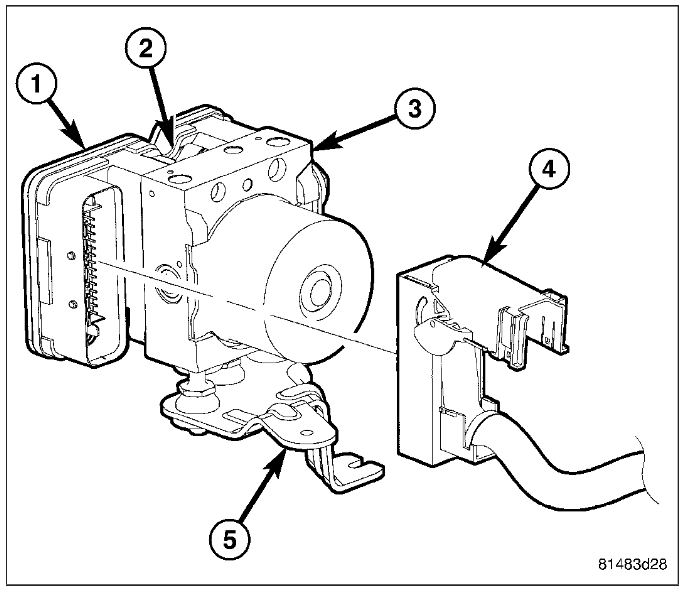
1. Remove the negative battery cable from the battery.
2. Pull up on the ABM harness connector (4) release and remove connector.
3. Remove the pump connector from the ABM.



4. Remove the brake lines (1) from the ABM (2).
5. Remove the ABM (2) mounting nuts (3).
6. Remove the ABM unit from the vehicle.



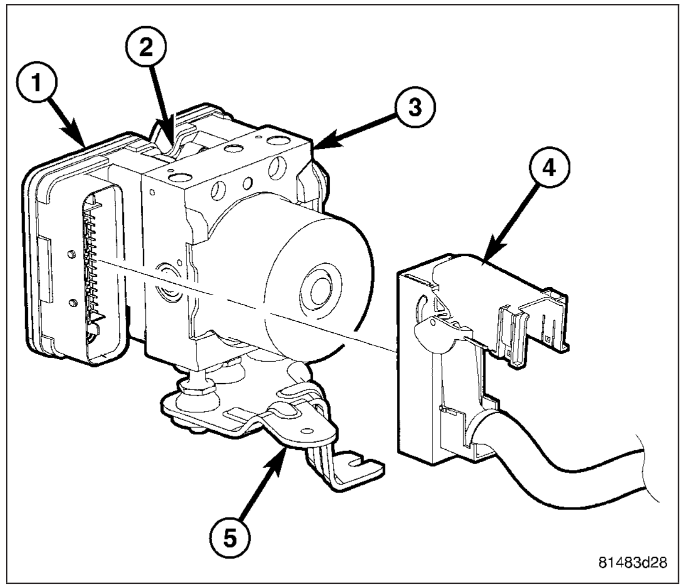

7. Remove the ABM module (1) mounting screws (2) from the ABM unit (3) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/HCU (HYDRAULIC CONTROL UNIT) - DISASSEMBLY).



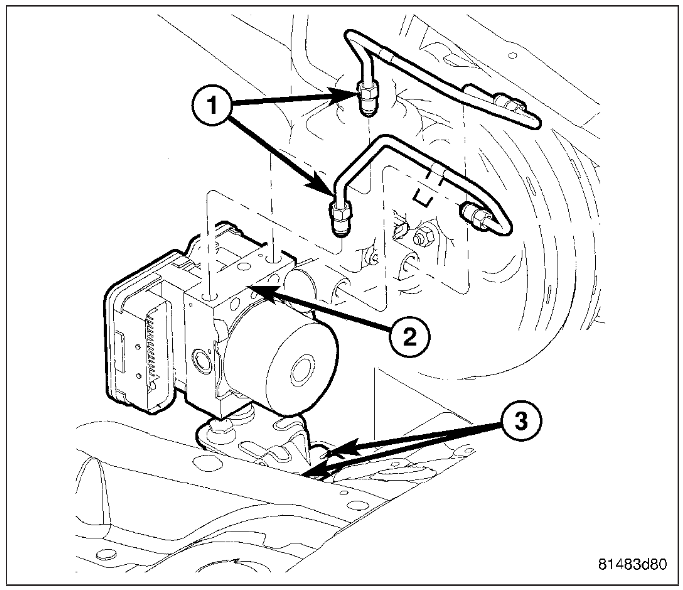

## INSTALLATION

**NOTE: If the ABM module (1) is being replaced with a new ABM module it must be reprogrammed with the use of a scan tool.**

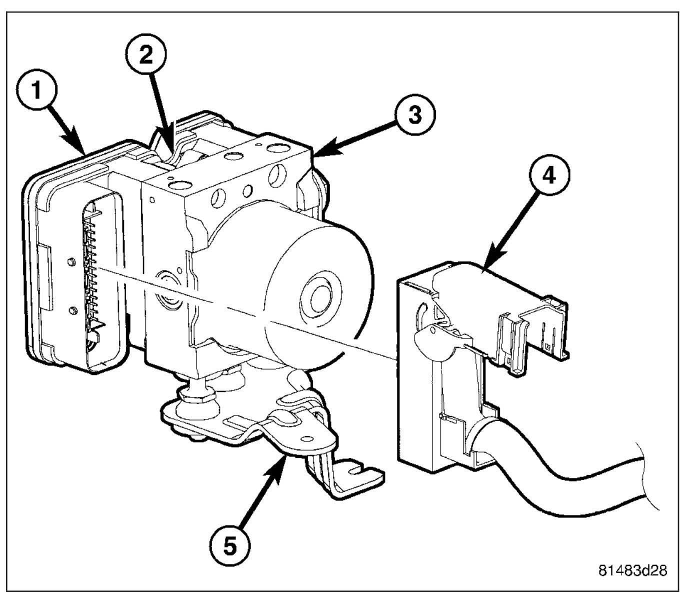
1. Install ABM module (1) to the ABM unit (3) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/HCU (HYDRAULIC CONTROL UNIT) - ASSEMBLY).
2. Install mounting screws (2). Tighten to 2 N·m (16 in. lbs.).




3. Install the ABM unit (2) to the vehicle.
4. Install the ABM mounting bracket nuts (3) and tighten to 14 N·m (125 in. lbs.).
5. Install brake lines (1) to the ABM unit (2) and tighten to 20 N·m (180 in. lbs.).



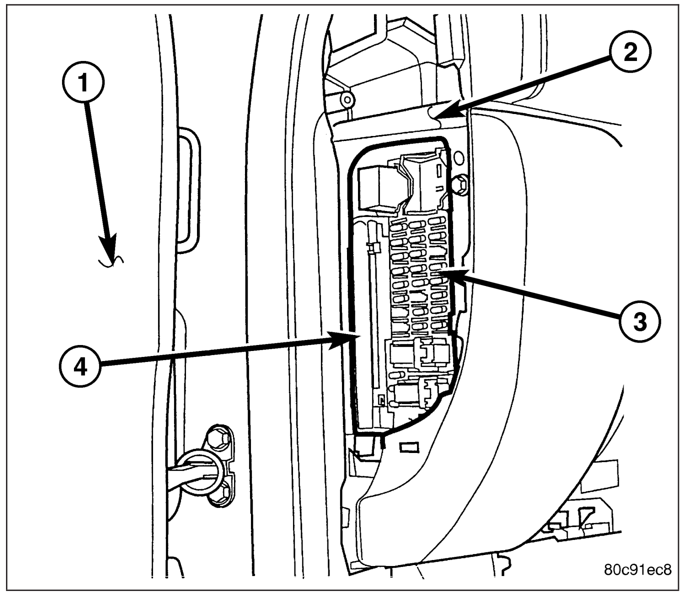

6. Install the wiring harness connector (4) to the ABM unit and push down on the release to secure the connector.
7. Install negative battery cable to the battery.
8. Bleed ABS brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).



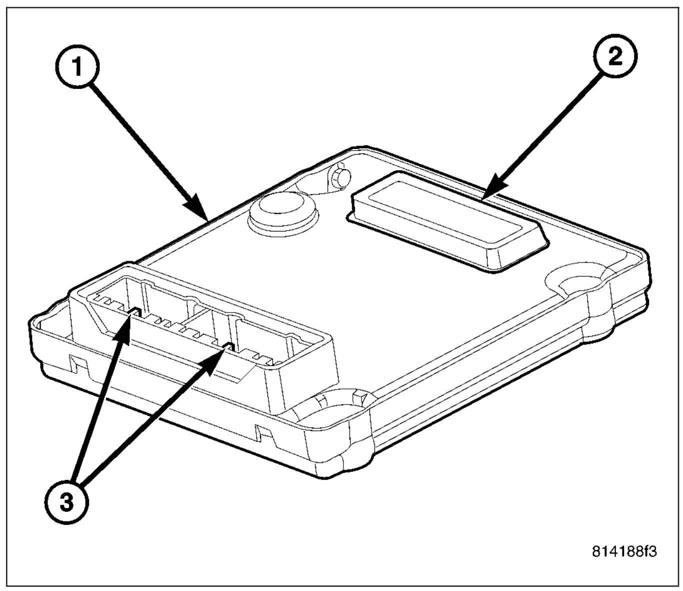
# BODY CONTROL MODULE

## DESCRIPTION

A Body Control Module (BCM) (4) is concealed behind the driver side end of the instrument panel (2) in the passenger compartment, where it is secured to the fuse panel side of the Junction Block (JB) (3) with four screws. The JB is the interface between the body, the instrument panel, and the headlamp and dash wire harnesses. The JB also contains the fuses and relays used for the interior electrical system of the vehicle.




The BCM (1) is enclosed in a molded plastic housing with two integral external connectors (3) that connect it to the vehicle electrical system through two take outs with connectors from the instrument panel wire harness. The BCM also has an integral interface connector (2) that joins it through a connector receptacle that is integral to the JB housing to the circuitry within the JB. This connector is referred to as the JB-BCM connector. The combined BCM and JB are sometimes referred to as the Junction Block Module (JBM).




The BCM utilizes integrated circuitry and information carried on the Programmable Communications Interface (PCI) data bus along with many hard wired inputs to monitor numerous sensor and switch inputs throughout the vehicle. In response to those inputs, the internal circuitry and programming of the BCM allow it to control and integrate many electronic functions and features of the vehicle through both hard wired outputs and the transmission of electronic message outputs to other electronic modules in the vehicle over the PCI data bus.

Vehicles equipped with the optional Electronic Stability Program (ESP) have a hybrid bus network. The hybrid network includes some electronic nodes that communicate using a Controller Area Network (CAN-C) protocol, in addition to nodes communicating on the PCI data bus. The BCM in vehicles with a hybrid bus is also equipped to serve as the Central GateWay and may be referred to as the BCMCGW. The central gateway allows communication between nodes on the two bus networks by translating messages between them.

The electronic functions and features that the BCM supports or controls include the following:

- **A/C Select Switch Status** - The BCM monitors an input from, and transmits the status of the A/C switch in the heater-A/C control.

- **Audio System Cabin Equalization** - The BCM stores the cabin equalization curves for numerous optional speaker architectures for use by the radio. The equalization curve information allows the radio to optimize sound output for the unique combination of cabin and speaker architecture found within the vehicle. The BCM provides this information when requested by the radio over the PCI data bus.
- **Cargo Lamp Disable** - The BCM monitors an input from the cargo lamp switch to provide an interior lighting disable feature.
- **Chimes** - The chime tone transducer is located on the ElectroMechanical Instrument Cluster (EMIC) circuit board, but the EMIC goes to sleep with the ignition switch in the Off position. The BCM provides a wake-up output to the EMIC based upon inputs from the key-in ignition switch or the exterior lighting switch, then sends electronic chime request messages to the EMIC for the headlamps-on warning and key-in ignition warning.
- **Door Lock Inhibit** - The BCM monitors the key-in ignition switch and the driver side front door ajar switch to provide a door lock inhibit feature.
- **Electronic Pinion Factor** - On vehicles without the optional Antilock Brake System (ABS) the BCM provides a source voltage to the rear wheel speed sensor and monitors a returned vehicle speed signal input. The BCM is able to use the vehicle speed signal input to accurately calculate vehicle speed and distance information by applying an electronic pinion factor. This factor is based upon either a pre-programmed tire size or a Tire Revolutions per Mile (TIRE REV/MILE) value that compensates for multiple optional axle ratios and tire diameters. The correct electronic pinion factor **must** be programmed into the BCM using a diagnostic scan tool in order for the vehicle speed and distance information to be accurate. The BCM then transmits the correct vehicle speed information over the PCI data bus for use by the EMIC for control of the speedometer and odometer.
- **Enhanced Accident Response Support** - The BCM monitors an input from the Airbag Control Module (ACM) and, five seconds after a front or side airbag deployment will unlock all doors by activating the power unlock output if the power lock switch input remains inactive for two seconds. The BCM also turns on the interior lighting after an airbag deployment event, five seconds after the vehicle speed is zero. The interior lighting remains illuminated until the ignition switch is turned to the Off position, at which time the interior lighting returns to normal operation and control. These Enhanced Accident Response System (EARS) features are each dependent upon a functional vehicle electrical system following the vehicle impact event.
- **Exterior Lamp Load Shedding** - The BCM provides a battery saver feature which will automatically turn off exterior lamps that remain on after a timed interval.
- **Exterior Lamp Status** - The BCM monitors the status of the park lamp, low beam, high beam or Daytime Running Lamp (DRL - Canada only), front fog lamp (optional), and rear fog lamp (in required markets only) relays.
- **Exterior Lighting Control** - The BCM provides exterior lamp control for standard head and park lamps, as well as Daytime Running Lamps (DRL - Canada only), front fog lamps (optional), and rear fog lamps (in required markets only). This includes support for features including optical horn (also known as flash-to-pass) and headlamp time delay.
- **Flip-Up Glass Control** - The BCM monitors inputs from the tailgate cylinder lock switch, the tailgate handle switch, the Remote Keyless Entry (RKE) system and the rear wiper switch to provide control for the rear flip-up glass actuator.
- **Fog Lamp Control** - The BCM provides fog lamp control for front fog lamps (optional), and rear fog lamps (in required markets only).
- **Front Wiper System Status** - The BCM monitors the status of the front wiper motor park switch.
- **Fuel Economy and Distance to Empty Calculations** - The BCM calculates and transmits the fuel ECOnomy (ECO) and Distance To Empty (DTE) data.
- **Headlamp Time Delay** - The BCM provides a headlamp time delay feature with the ignition switch in the Off position.
- **Heated Rear Glass Control** - The BCM provides control and timer functions for the heated rear glass feature and transmits the system status.
- **Ignition On/Off Timer** - The BCM monitors and transmits the elapsed ignition On timer data and monitors the ignition Off time.
- **Ignition Switch Position Status** - The BCM monitors and transmits the status of the ignition switch.
- **Instrument Panel Dimming** - The BCM monitors and transmits the selected illumination intensity level of the panel lamps dimmer switch.
- **Interior Lamp Load Shedding** - The BCM provides a battery saver feature which will automatically turn off all interior lamps that remain on after a timed interval.

- **Interior Lighting Control** - The BCM monitors inputs from the interior lighting switch, the door ajar switches, the flip-up glass ajar switch, the tailgate ajar switch, the cargo lamp switch, the reading lamp switches, and the RKE system to provide courtesy lamp control. This includes support for timed illuminated entry with theater-style fade-to-off and courtesy illumination defeat features.
- **Intermittent Wipe and Front Wiper System Control** - The BCM monitors inputs from the front wiper and washer switch and the front wiper motor park switch to provide front wiper system control through the wiper on/off and high/low relays. This includes support for adjustable intermittent wipe, mist wipe (also known as pulse wipe), and wipe-after-wash features.
- **Key-In-Ignition Switch Status** - The BCM monitors and transmits the status of the key-in-ignition switch.
- **Panic Mode** - The BCM provides support for the RKE system panic mode feature.
- **Parade Mode** - The BCM provides a parade mode (also known as funeral mode) that allows the interior Vacuum Fluorescent Displays (VFD) to be illuminated at full intensity while driving in daylight with the exterior lamps On.
- **Power Locks -** The BCM monitors inputs from the power lock switches and the RKE system to provide control of the power lock motors through outputs to the lock, unlock, and driver unlock relays. This includes support for rolling door locks (also known as automatic door locks) and a door lock inhibit mode.
- **Programmable Features** - The BCM provides support for several standard and optional programmable features, including: rolling door locks, headlamp time delay interval, RKE driver-door-only or unlock-all-doors, RKE optical chirp, and RKE audible chirp.
- **Remote Keyless Entry** - The BCM provides support for the RKE system features, including support for the RKE Lock, Unlock (with optional driver-door-only unlock, and unlock-all-doors), rear flip-up glass control, Panic, audible chirp, optical chirp, and illuminated entry modes.
- **Rolling Door Locks** - The BCM provides support for the power lock system rolling door locks feature (also known as automatic door locks).
- **Tailgate and Flip-Up Glass Ajar Status -** The BCM monitors and transmits the status of the tailgate and rear flip-up glass ajar switches.
- **Remote Radio Switch Interface** - The BCM monitors and transmits the status of the optional remote radio switches.
- **Self-Diagnostics** - The BCM provides support for diagnostics through communication with a diagnostic scan tool over the PCI data bus network. Each analog and digital input can be verified, and each output can be actuated through the use of this diagnostic protocol. The BCM also stores Diagnostic Trouble Codes (DTCs) to assist in the troubleshooting of this unit.
- **Vacuum Fluorescent Display Synchronization** - The BCM transmits panel lamp intensity data which allows modules with Vacuum Fluorescent Displays (VFD) to coordinate their illumination intensity.
- **Vehicle Theft Security System** - The BCM monitors inputs from the door ajar switches, the tailgate ajar switch, the flip-up glass ajar switch, the hood ajar switch (in required markets only), and the RKE system to control the features of the optional Vehicle Theft Security System (VTSS).

Hard wired circuitry connects the BCM to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the BCM through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

Many of the electronic features in the vehicle controlled or supported by the BCM are programmable using a customer programming procedure or a diagnostic scan tool. In addition, the BCM software is Flash compatible, which means it can be reprogrammed using Flash reprogramming procedures. However, if any of the BCM hardware is damaged or faulty, the entire BCM unit must be replaced.

## OPERATION

The microprocessor-based Body Control Module (BCM) monitors many hard wired switch and sensor inputs as well as those resources it shares with other electronic modules in the vehicle through its communication over the Programmable Communications Interface (PCI) data bus or the hybrid bus network. The internal programming and all of these inputs allow the BCM microprocessor to determine the tasks it needs to perform and their priorities, as well as both the standard and optional features that it should provide. The BCM programming then performs those tasks and provides those features through both PCI data bus or hybrid bus communication with other electronic modules and through hard wired outputs through a number of driver circuits, relays, and actuators. These outputs allow the BCM the ability to control numerous accessory systems in the vehicle.

The BCM operates on battery and ignition voltage inputs received through several fuses in the Junction Block (JB) on a non-switched fused B(+) circuit, through another fuse in the JB on a fused ignition switch output (run-start) circuit, and through a third fuse in the JB on a fused ignition switch output (run-acc) circuit. This arrangement allows the BCM to provide some features regardless of the ignition switch position, while other features will operate only with the ignition switch in the On, Start, and/or Accessory positions. All of the battery voltage circuits are connected to the BCM through the JB/BCM connector.

The BCM receives ground through five separate circuits. Three of these circuits are connected to the BCM through a connector of the instrument panel wire harness on three separate ground circuits, while the other two circuits are connected to the BCM through the JB/BCM connector. Each of these circuits receives a path to ground through the instrument panel wire harness with an eyelet terminal connector that is secured by a nut to a ground stud on the driver side instrument panel end bracket near the JB.

The BCM monitors its own internal circuitry as well as many of its input and output circuits, and will store a Diagnostic Trouble Code (DTC) in electronic memory for any failure it detects. These DTCs can be retrieved and diagnosed using a diagnostic scan tool. Refer to the appropriate diagnostic information.

## INPUT AND OUTPUT CIRCUITS

### HARD WIRED INPUTS

The hard wired inputs to the BCM include the following:

- **A/C on/off control**
- **BCM flash enable**
- **Door lock switch mux**
- **Driver door ajar switch sense**
- **Flip-up glass ajar switch sense**
- **Flip-up glass release switch sense**
- **Front fog lamp switch sense**
- **Front wiper park switch sense**
- **Front wiper switch mux**
- **Fused B(+)**
- **Fused ignition switch output (run-acc)**
- **Fused ignition switch output (run-start)**
- **Headlamp switch mux**
- **High beam switch sense**
- **Hood ajar switch sense - with VTSS - in markets where required only**
- **Key-in ignition switch sense**
- **Left rear door ajar switch sense**
- **Lightbar switch sense - Renegade with light bar only**
- **Panel lamps dimmer switch mux**
- **Passenger front door ajar switch sense**
- **Radio control mux - with remote radio switches only**
- **Rear courtesy lamp control**
- **Rear window defogger control**
- **Rear wiper intermittent driver**
- **Rear wiper on driver**

- **RHD input - connected to ground on right-hand drive models only**
- **Right rear door ajar switch sense**
- **Tailgate ajar switch sense**
- **Washer pump driver**
- **Vehicle speed signal**

Refer to the appropriate wiring information for additional details.

### HARD WIRED OUTPUTS

The hard wired outputs of the BCM include the following:

- **Accessory delay relay control - power sunroof only**
- **Courtesy lamp driver**
- **Courtesy lamp load shed**
- **Door lock relay control**
- **Door unlock relay control**
- **Driver door unlock relay control**
- **Flip-up glass release motor driver**
- **Front fog lamp relay control**
- **Front wiper high/low relay control**
- **Front wiper on/off relay control**
- **Fused B(+) - lock, unlock and driver unlock relay feed**
- **Hazard lamp control**
- **High beam relay control**
- **Horn relay control**
- **Instrument cluster wake up signal**
- **Low beam relay control**
- **Park lamp relay control**
- **Rear fog lamp relay control - with rear fog lamps in markets where required only**
- **Rear window defogger relay control**
- **Tailgate lock driver**
- **Tailgate unlock driver**
- **Vehicle speed output**
- **Vehicle speed sensor supply - except with Antilock Brake System (ABS)**
- **VTSS indicator driver - with VTSS only**

Refer to the appropriate wiring information for additional details.

### GROUNDS

The BCM receives ground through five separate circuits, and also supplies a clean ground path to several switches through the following hard wired circuits:

- **Door lock switch ground**
- **Multi-function switch ground**
- **Radio control mux return**
- **Tailgate switch ground**

Refer to the appropriate wiring information for additional details.

### COMMUNICATION

The BCM has the following communication circuits:

- **PCI bus**
- **CAN-C High bus - with ESP only**
- **CAN-C Low bus - with ESP only**

Refer to the appropriate wiring information for additional details.

## DIAGNOSIS AND TESTING

## BODY CONTROL MODULE

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

The hard wired inputs to and outputs from the Body Control Module (BCM), as well as other hard wired circuits for this module may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

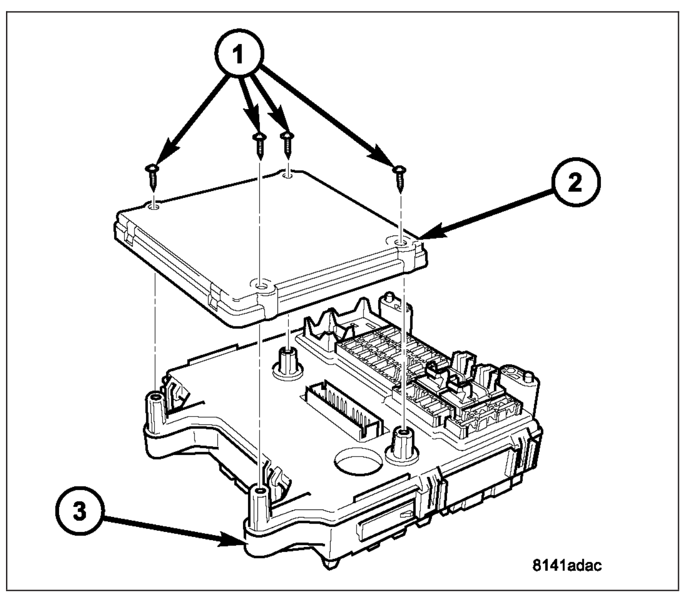
However, conventional diagnostic methods may not prove conclusive in the diagnosis of the BCM, the Programmable Communications Interface (PCI) data bus, or the electronic messages received and transmitted by the BCM over the PCI data bus. The most reliable, efficient, and accurate means to diagnose the BCM, the PCI data bus and the electronic message inputs to and outputs from this module requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: Before replacing a Body Control Module (BCM), use a diagnostic scan tool to retrieve the current settings for the many BCM programmable features including electronic pinion factor (tire size), cabin equalization curve (audio system architecture), country code and Remote Keyless Entry (RKE) system preferences. These settings MUST be programmed into the replacement BCM using the diagnostic scan tool before returning the vehicle to service. A new BCM is shipped in default mode that may prevent proper speedometer indications and the availability of numerous electronic features until it has been properly programmed. Refer to the appropriate diagnostic information.**

1. Disconnect and isolate the battery negative cable.
2. Remove the Junction Block Module (JBM) (3) from the instrument panel end bracket on the driver side of the vehicle. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/JUNCTION BLOCK - REMOVAL).
3. Remove the four screws (1) that secure the Body Control Module (BCM) (2) to the Junction Block (JB).
4. Remove the BCM from the JB.

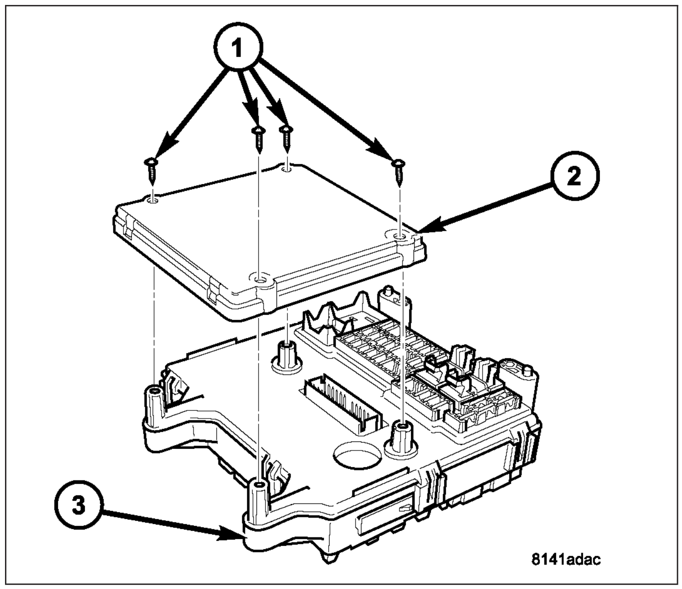


## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: Before replacing a Body Control Module (BCM), use a diagnostic scan tool to retrieve the current settings for the many BCM programmable features including electronic pinion factor (tire size), cabin equalization curve (audio system architecture), country code and Remote Keyless Entry (RKE) system preferences. These settings MUST be programmed into the replacement BCM using the diagnostic scan tool before returning the vehicle to service. A new BCM is shipped in default mode that may prevent proper speedometer indications and the availability of numerous electronic features until it has been properly programmed. Refer to the appropriate diagnostic information.**

1. Position the Body Control Module (BCM) (2) to the Junction Block (JB) (3) and reconnect them at the JB/BCM interface connector.
2. Install and tighten the four screws (1) that secure the BCM to the JB. Tighten the screws to 2 N·m (20 in. lbs.).
3. Reinstall the Junction Block Module (JBM) onto the instrument panel end bracket. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/JUNCTION BLOCK - INSTALLATION).
4. Reconnect the battery negative cable.




## SPECIFICATIONS

## BODY CONTROL MODULE

### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Body Control Module Mounting Screws | 2 | - | 20 |

# COMMUNICATION

## DESCRIPTION

The primary on-board communication network between microprocessor-based electronic control modules in this model is the DaimlerChrysler Programmable Communication Interface (PCI) data bus system. However, some modules in the vehicle use the Controller Area Network (CAN-C) data bus system in combination with the PCI bus to form a hybrid bus system. A data bus network minimizes redundant wiring connections; and, at the same time, reduces wire harness complexity, sensor current loads and controller hardware by allowing each sensing device to be connected to only one module (also referred to as a node). Each node reads, then broadcasts its sensor data over the bus for use by all other nodes requiring that data. Each node ignores the messages on the bus that it cannot use.

The hybrid bus system has a central gateway or hub integral to a Body Control Module/Central GateWay (BCM-CGW) that is connected to both buses. The gateway physically and electrically isolates the buses from each other and coordinates the bi-directional transfer of messages between them. The BCM is located on the Junction Block (JB), which is located on the driver side instrument panel end bracket in the passenger compartment of the vehicle.

The PCI bus is a single-wire multiplex system, while the CAN-C bus is a two-wire multiplex system. Multiplexing is any system that enables the transmission of multiple messages over a single channel or circuit. Depending upon the optional equipment in the vehicle, the PCI bus is used for communication between most all body interior nodes, while the CAN-C bus is used exclusively by certain powertrain and chassis nodes in vehicles equipped with the hybrid bus.

In addition, certain vehicles may also be equipped with a Serial Controller Interface (SCI) or a K-Line serial link bus to provide direct diagnostic access between a diagnostic scan tool connected to the industry-standard 16-way Data Link Connector (DLC) located below the driver side instrument panel and certain powertrain nodes. The Bus Connections table identifies those nodes in this vehicle with more than one possible bus connection configuration. Those nodes that are not listed in the table are all connected to and accessed through the PCI bus.

| BUS CONNECTIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **NODE** | | **BCM** | **CAB** | **ECM** | **PCM** | **SAS** | **TCM** | **YAW** |
| **ALSO KNOWN AS** | | **BCMCGW, Body Controller** | **ABM, ABS, ESP Controller** | **Diesel Engine Controller** | **NGC, Gas Engine Controller** | **Steering Angle Sensor** | **EATX, Transmission Controller** | **Yaw, Lateral G Sensor** |
| **OPTIONS** | | **w/ Central Gateway** | **w/ABS & ESP Only** | **w/Diesel Only** | **w/Gas Only** | | **w/ATX Only** | |
| **Gas Engine** | ***COMM** | PCI & CAN | CAN | | CAN | CAN | PCI | **CAN |
| | ***DIAG** | PCI | CAN | | CAN | CAN | PCI/SCI | **CAN |
| | ***FLASH** | PCI | CAN | | CAN | CAN | SCI | **CAN |
| **Diesel Engine w/MTX** | ***COMM** | PCI & CAN | CAN | CAN | | CAN | | **CAN |
| | ***DIAG** | PCI | CAN | ***K-LINE | | CAN | | **CAN |
| | ***FLASH** | PCI | CAN | ***K-LINE | | CAN | | **CAN |
| **Diesel Engine w/ATX** | ***COMM** | PCI & CAN | CAN | CAN | | CAN | | **CAN |
| | ***DIAG** | PCI | CAN | ***K-LINE | | CAN | | **CAN |
| | ***FLASH** | PCI | CAN | ***K-LINE | | CAN | | **CAN |
| **Notes** | | | | | | | | |

| BUS CONNECTIONS | | | | | | | |
|---|---|---|---|---|---|---|---|
| NODE | BCM | CAB | ECM | PCM | SAS | TCM | YAW |
| ALSO KNOWN AS | BCMCGW, Body Controller | ABM, ABS, ESP Controller | Diesel Engine Controller | NGC, Gas Engine Controller | Steering Angle Sensor | EATX, Transmission Controller | Yaw, Lateral G Sensor |
| OPTIONS | w/ Central Gateway | w/ABS & ESP Only | w/Diesel Only | w/Gas Only | | w/ATX Only | |
| *FUNCTIONS | COMM = Intravehicle Communication | | | | | | |
| | DIAG = Scan Tool Diagnostic Communication | | | | | | |
| | FLASH = Flash Reprogramming Access | | | | | | |
| **CAN | This is a dedicated CAN-C bus line between the Yaw Sensor and the CAB. | | | | | | |
| ***K-LINE | The K-Line bus may also referred to as the Serial Controller Interface (SCI) bus in some diagnostic information. | | | | | | |

## OPERATION

The hybrid bus network allows all electronic modules connected to the bus to share information with each other. Regardless of whether a message originates from a module on the low speed Programmable Communications Interface (PCI) bus or on the high speed Controller Area Network (CAN-C) bus, the message structure and layout is similar, which allows the Body Control Module Central GateWay (sometimes referred to as the BCMCGW) to process and transfer messages between the buses. The BCMCGW also stores a Diagnostic Trouble Code (DTC) for certain bus network faults.

All modules (also referred to as nodes) transmit and receive messages over one of these two buses, either the single-wire PCI bus or the two-wire CAN-C bus. Data exchange between nodes is achieved by serial transmission of encoded data messages. Each node can both send and receive serial data simultaneously. Bus messages are carried over the data bus in the form of Variable Pulse Width Modulated (VPWM) signals which, when the high and low voltage pulses are strung together, form a message. Each node uses arbitration to sort the message priority if two competing messages are attempting to be broadcast at the same time.

The voltage network used to transmit messages requires biasing and termination. Each module on the bus network provides its own biasing and termination. Each node terminates the bus through a terminating resistor and a terminating capacitor. There are two types of nodes on the bus. The dominant node terminates the bus through a 1 KW resistor and a 3300 pF capacitor, typically resulting in about a 3300 ohm termination resistance. However, this resistance value may vary somewhat by application. The BCM (or BCMCGW) is the only dominant node in this network. A non-dominant (or recessive) node terminates the bus through an 11 KW resistor and a 330 pF capacitor, typically resulting in about a 10800 ohm termination resistance.

## PROGRAMMABLE COMMUNICATIONS INTERFACE DATA BUS

The PCI (or J1850) data bus communication protocol exceeds the Society of Automotive Engineers (SAE) J1850 Standard for Class B Multiplexing. The PCI data bus speed is an average 10.4 Kilobits per second (Kbps).

## CONTROLLER AREA NETWORK DATA BUS

The communication protocol being used for the CAN-C data bus is a non-proprietary, open standard adopted from the Bosch CAN Specification 2.0b. The CAN-C is the faster of the two primary buses in the hybrid bus system providing near real-time communication (500 Kbps).

The CAN-C bus nodes are connected in parallel to the two-wire bus using a twisted pair, where the wires are wrapped around each other to provide shielding from unwanted electromagnetic induction, thus preventing interference with the relatively low voltage signals being carried through them. The twisted pairs have between 33 and 50 twists per meter. While the CAN bus is operating (active), one of the bus wires will carry a higher voltage and is referred to as the CAN High or CAN bus (+) wire, while the other bus wire will carry a lower voltage and is referred to as the CAN Low or CAN bus (–) wire. Refer to the CAN-C bus voltage table.

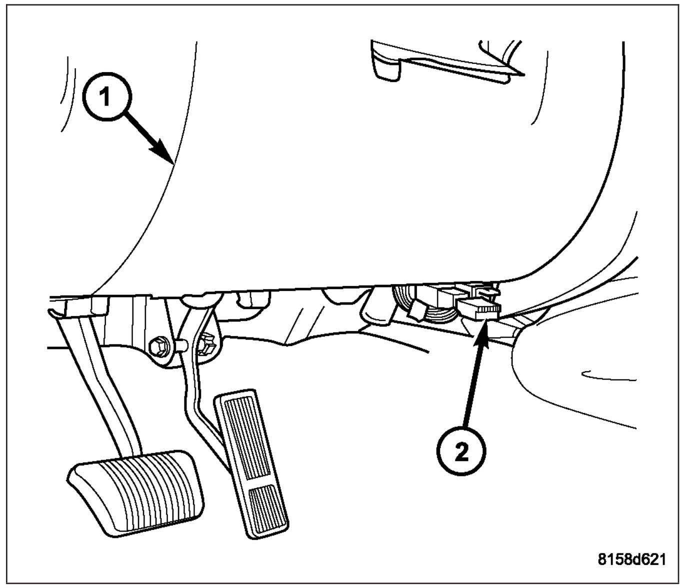
| CAN-C Bus Voltages (Normal Operation) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Bus Circuit** | **Sleep** | **Recessive (Bus Idle)** | **Dominant (Bus Active)** | **CAN-L Short to Ground** | **CAN-H Short to Ground** | **CAN-L Short to Battery** | **CAN-H Short to Battery** | **CAN-H Short to CAN-L** |
| **CAN-L (–)** | 0 V | 2.4 - 2.5 V | 1.3 - 2.3 V | 0 V | 0.3 - 0.5V | Battery Voltage | Battery Voltage Less 0.75 V | 2.45 V |
| **CAN-H (+)** | 0 V | 2.4 - 2.5 V | 2.6 - 3.5 V | 0.02 V | 0 V | Battery Voltage Less 0.75 V | Battery Voltage | 2.45 V |
| **Notes** | | | | | | | | |
| All measurements taken between node ground and CAN terminal with a standard DVOM. | | | | | | | | |
| DVOM will display average network voltage. | | | | | | | | |
| Total resistance of CAN-C network can also be measured (60 ohms). | | | | | | | | |

The CAN-C bus network is awake only when the ignition switch is in the On or Start positions. However, an individual node on the CAN bus may still be awake with the ignition switch in the Accessory or Unlock positions. This is because the integrated circuitry of an individual node may be capable of processing certain sensor inputs and outputs without the need to utilize network resources.

# DATA LINK CONNECTOR

## DESCRIPTION

The Data Link Connector (DLC) (2) is a 16-way molded plastic connector insulator on a dedicated take out of the instrument panel wire harness. This connector is located at the lower edge of the instrument panel, inboard of the steering column. The connector insulator is retained by two screws through two integral mounting tabs to the lower instrument panel reinforcement, just below the lower edge of the instrument panel steering column opening cover (1).



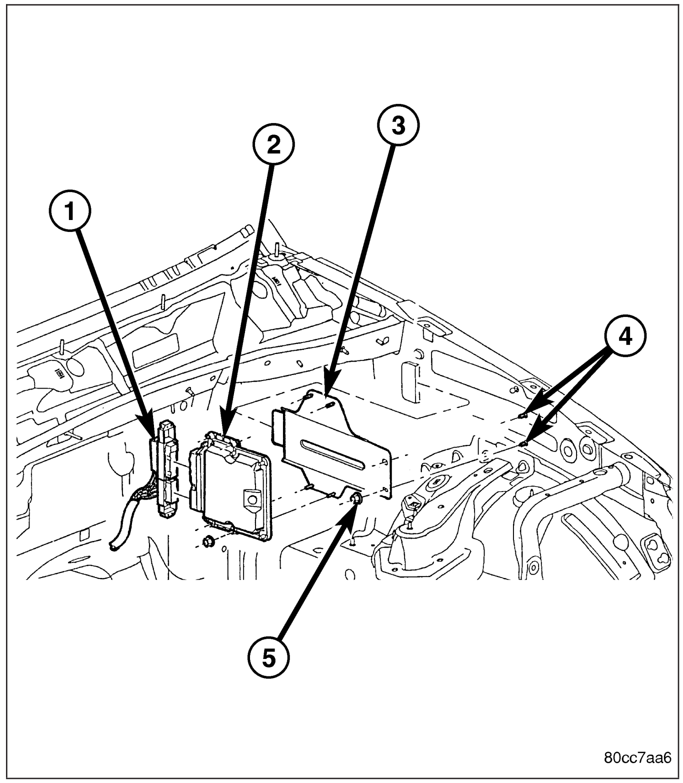

## OPERATION

The Data Link Connector (DLC) is an industry-standard 16-way connector that permits the connection of a diagnostic scan tool to the hybrid data bus network for interfacing with, configuring, and retrieving Diagnostic Trouble Code (DTC) data from the electronic modules that reside on the network within the vehicle.

# MODULE-DIESEL ENGINE CONTROL

## DESCRIPTION

The Engine Control Module (ECM) (2) is located in the left side of engine compartment attached to the left inner fender behind the battery. The ECM also incorporates the barometric pressure sensor in it's housing.




## OPERATION

The ECM has been programmed to monitor different circuits of the diesel fuel injection system. This monitoring is called on-board diagnostics. Certain criteria must be met for a diagnostic trouble code to be entered into the ECM memory. The criteria may be a range of engine rpm, engine temperature, time or other input signals to the ECM. If all of the criteria for monitoring a system or circuit are met, and a problem is sensed, then a DTC will be stored in the ECM memory. It is possible that a DTC for a monitored circuit may not be entered into the ECM memory, even though a malfunction has occurred. This may happen when the monitoring criteria have not been met. The ECM compares input signal voltages from each input device with specifications (the established high and low limits of the input range) that are programmed into it for that device. If the input voltage is not within the specifications and other trouble code criteria are met, a DTC will be stored in the ECM memory.

## ECM OPERATING MODES

As input signals to the ECM change, the ECM adjusts its response to the output devices. For example, the ECM must calculate a different fuel quantity and fuel timing for engine idle condition than it would for a wide open throttle condition. There are several different modes of operation that determine how the ECM responds to the various input signals.

**Ignition Switch On (Engine Off)**

When the ignition is turned on, the ECM activates the glow plug relay for a time period that is determined by engine coolant temperature, atmospheric temperature and battery voltage.

**Engine Start-Up Mode**

The ECM uses the engine temperature sensor and the crankshaft position sensor (engine speed) inputs to determine fuel injection quantity.

### Normal Driving Modes

Engine idle, warm-up, acceleration, deceleration and wide open throttle modes are controlled based on all of the sensor inputs to the ECM. The ECM uses these sensor inputs to adjust fuel quantity and fuel injector timing.

### Limp-In Mode

If there is a fault detected with the accelerator pedal position sensor, the ECM will set the engine speed at 1100 rpm.

### Overspeed Detection Mode

If the ECM detects engine rpm that exceeds 5200 rpm, the ECM will set a DTC in memory and illuminate the MIL until the DTC is cleared.

### After-Run Mode

The ECM transfers RAM information to ROM and performs an Input/Output state check.

## MONITORED CIRCUITS

The ECM is able to monitor and identify most driveability related trouble conditions. Some circuits are directly monitored through ECM feedback circuitry. In addition, the ECM monitors the voltage state of some circuits and compares those states with expected values. Other systems are monitored indirectly when the ECM conducts a rationality test to identify problems. Although most subsytems of the engine control module are either directly or indirectly monitored, there may be occasions when diagnostic trouble codes are not immediately identified. For a trouble code to set, a specific set of conditions must occur and unless these conditions occur, a DTC will not set.

## DIAGNOSTIC TROUBLE CODES

Each Diagnostic Trouble Code (DTC) is diagnosed by following a specific procedure. The diagnostic test procedure contains step-by-step instruction for determining the cause of the DTC as well as no trouble code problems. Refer to the appropriate Diesel Powertrain Diagnostic Manual for more information.

### HARD CODE

A DTC that comes back within one cycle of the ignition key is a hard code. This means that the problem is current every time the ECM/SKIM checks that circuit or function. Procedures in this manual verify if the DTC is a hard code at the beginning of each test. When the fault is not a hard code, an intermittent test must be performed. NOTE: If the scan tool displays faults for multiple components (i.e. ECT, VSS, IAT sensors) identify and check the shared circuits for possible problems before continuing (i.e. sensor grounds or 5-volt supply circuits). Refer to the appropriate schematic to identify shared circuits. Refer to the appropriate Diesel Powertrain Diagnostic Manual for more information.

### INTERMITTENT CODE

A DTC that is not current every time the ECM/SKIM checks the circuit or function is an intermittent code. Most intermittent DTCs are caused by wiring or connector problems. Problems that come and go like this are the most difficult to diagnose; they must be looked for under specific conditions that cause them. **NOTE: Electromagnetic (radio) interference can cause an intermittent system malfunction.** This interference can interrupt communication between the ignition key transponder and the SKIM. The following checks may assist you in identifying a possible intermittent problem:

- Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, loose fitting or corroded terminals.
- Visually inspect the related wire harness. Look for chafed, pierced or partially broken wire.
- Refer to hotlines or technical service bulletins that may apply.

Refer to the appropriate Diesel Powertrain Diagnostic Manual for more information.

**ECM DIAGNOSTIC TROUBLE CODES**

**IMPORTANT NOTE:** Before replacing the ECM for a failed driver, control circuit or ground circuit, be sure to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most ECM driver/control circuit failures are caused by internal failures to components (i.e. relays and solenoids) and shorted circuits (i.e. sensor pull-ups, drivers and ground circuits). These faults are difficult to detect when a double fault has occurred and only one DTC has set. If the scan tool displays faults for multiple components (i.e. VSS, ECT, Batt Temp, etc.) identify and check the shared circuits for possible problems before continuing (i.e. sensor grounds or 5-volt supply circuits). Refer to the appropriate wiring diagrams to identify shared circuits. Refer to the appropriate Diesel Powertrain Diagnostic Manual for more information.

## STANDARD PROCEDURE - PCM/ECM/SKIM PROGRAMMING - DIESEL

**NOTE: Before replacing the PCM/ECM for a failed driver, control circuit or ground circuit, be sure to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most PCM/ECM driver/control circuit failures are caused by internal component failures (i.e. relay and solenoids) and shorted circuits (i.e. pull-ups, drivers and switched circuits). These failures are difficult to detect when a double fault has occurred and only one DTC has set.**

### PCM/SKIM PROGRAMMING

When a PCM (JTEC) and the SKIM are replaced at the same time perform the following steps in order:

1. Program the new PCM (JTEC).
2. Program the new SKIM.
3. Replace all ignition keys and program them to the new SKIM.

### ECM/SKIM PROGRAMMING

When an ECM (Bosch) and the SKIM are replaced at the same time perform the following steps in order:

1. Program the new SKIM.
2. Program the new ECM (Bosch).

### PROGRAMMING THE ECM (Bosch)

1. To program the VIN, connect the scan tool and turn the ignition on.
2. Select Engine from the main menu. The scan tool will require the VIN to be entered before continuing.
3. Select ENTER to update the VIN. The scan tool will display the updated VIN.
4. If the engine is equipped with air conditioning, the ECM A/C function must be enabled. Enable the ECM A/C function as follows:
   - Using the scan tool, select ENGINE, MISCELLANEOUS, then ENABLE/DISABLE A/C
   - Push 1 to enable A/C. The scan tool screen should display A/C Activated.

### PROGRAMMING THE PCM (JTEC)

The SKIS Secret Key is an ID code that is unique to each SKIM. This code is programmed and stored in the SKIM, PCM and transponder chip (ignition keys). When replacing the PCM it is necessary to program the secret key into the new PCM using the scan tool. Perform the following steps to program the secret key into the PCM.

1. Turn the ignition switch on (transmission in park/neutral).
2. Use the scan tool and select THEFT ALARM, SKIM then MISCELLANEOUS.
3. Select PCM REPLACED (GAS ENGINE).
4. Enter secured access mode by entering the vehicle four-digit PIN.
5. Select ENTER to update PCM VIN.

**NOTE: If three attempts are made to enter secure access mode using an incorrect PIN, secured access mode will be locked out for one hour. To exit this lockout mode, turn the ignition to the RUN position for one hour then enter the correct PIN. (Ensure all accessories are turned off. Also monitor the battery state and connect a battery charger if necessary).**

6. Press ENTER to transfer the secret key (the SKIM will send the secret key to the PCM).
7. Press Page Back to get to the Select System menu and select ENGINE, JTEC (diesel only), MISCELLANEOUS, and SRI MEMORY CHECK.
8. The scan tool will ask, Is odometer reading between XX and XX? Select the YES or NO button on the scan tool. If NO is selected, the scan tool will read, Enter Odometer Reading<From I.P. odometer>. Enter the odometer reading from the Instrument Panel and press ENTER.

## PROGRAMMING THE SKIM

1. Turn the ignition switch on (transmission in park/neutral).
2. Use the scan tool and select THEFT ALARM, SKIM then MISCELLANEOUS.
3. Select PCM REPLACED (GAS ENGINE).
4. Program the vehicle four-digit PIN into SKIM.
5. Select COUNTRY CODE and enter the correct country.

**NOTE: Be sure to enter the correct country code. If the incorrect country code is programmed into SKIM, the SKIM must be replaced.**

6. Select YES to update VIN (the SKIM will learn the VIN from the PCM).
7. Press ENTER to transfer the secret key (the PCM will send the secret key to the SKIM).
8. Program ignition keys to SKIM.

**NOTE: If the PCM and the SKIM are replaced at the same time, all vehicle keys will need to be replaced and programmed to the new SKIM.**

## PROGRAMMING IGNITION KEYS TO THE SKIM

1. Turn the ignition switch on (transmission in park/neutral).
2. Use the scan tool and select THEFT ALARM, SKIM then MISCELLANEOUS.
3. Select PROGRAM IGNITION KEY'S.
4. Enter secured access mode by entering the vehicle four-digit PIN.

**NOTE: A maximum of eight keys can be learned to each SKIM. Once a key is learned to a SKIM it (the key) cannot be transferred to another vehicle.**

If ignition key programming is unsuccessful, the scan tool will display one of the following messages:

Programming Not Attempted - The scan tool attempts to read the programmed key status and there are no keys programmed into SKIM memory.

Programming Key Failed (Possible Used Key From Wrong Vehicle) - SKIM is unable to program key due to one of the following:

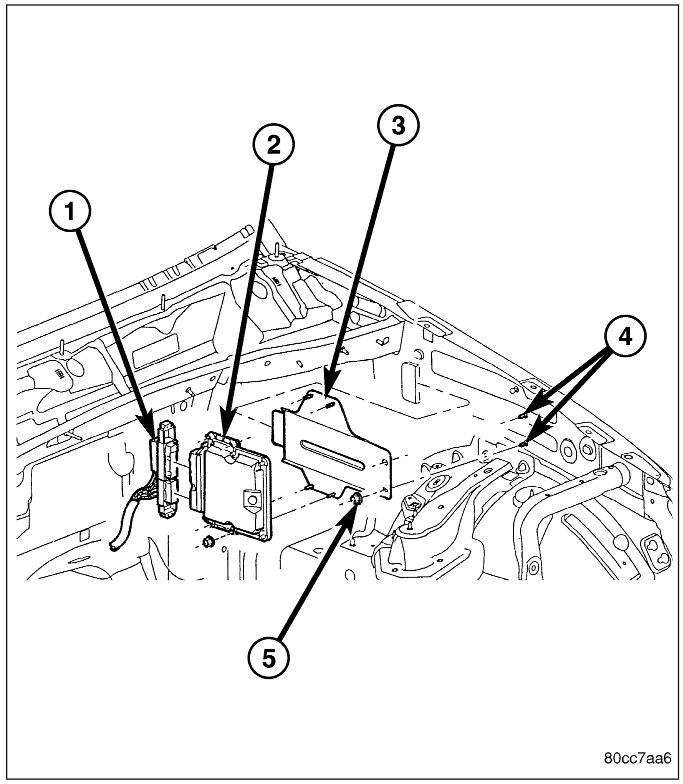
- faulty ignition key transponder
- ignition key is programmed to another vehicle.
- 8 Keys Already Learned, Programming Not Done - SKIM transponder ID memory is full.

5. Obtain ignition keys to be programmed from customer (8 keys maximum).
6. Using the scan tool, erase all ignition keys by selecting MISCELLANEOUS and ERASE ALL CURRENT IGN. KEYS.
7. Program all ignition keys.

Learned Key In Ignition - Ignition key transponder ID is currently programmed in SKIM memory.

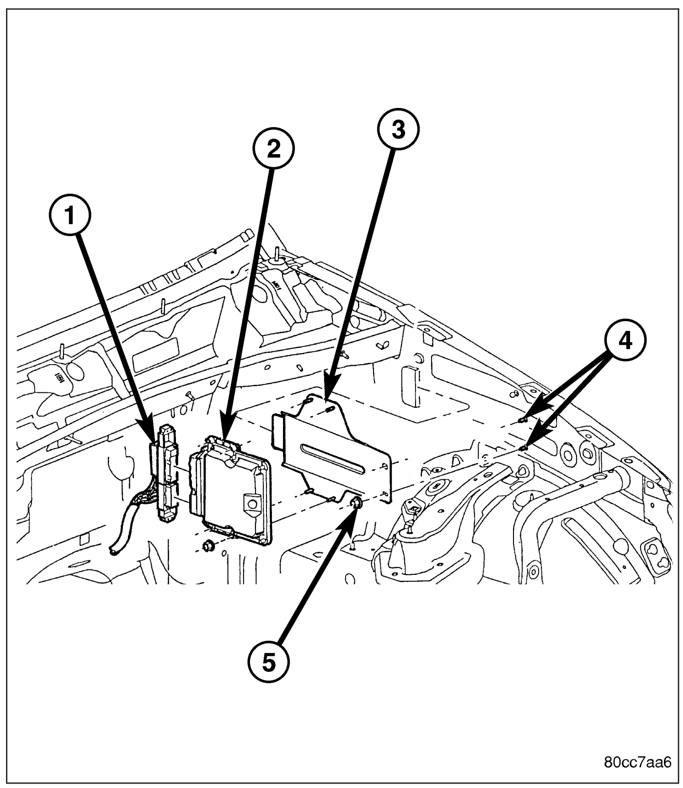
## REMOVAL

1. Disconnect negative battery cable.
2. Disconnect ECM electrical connectors (1).
3. Remove ECM bracket (3) to inner fender retaining nuts (5).
4. Remove ECM (2) and bracket assembly from vehicle.
5. Separate ECM from bracket.




## INSTALLATION

1. Install ECM (2) on bracket (3).
2. Position ECM and bracket assembly in vehicle.
3. Install ECM bracket to inner fender retaining nuts (5).
4. Connect ECM electrical connectors (1).
5. Connect negative battery cable.

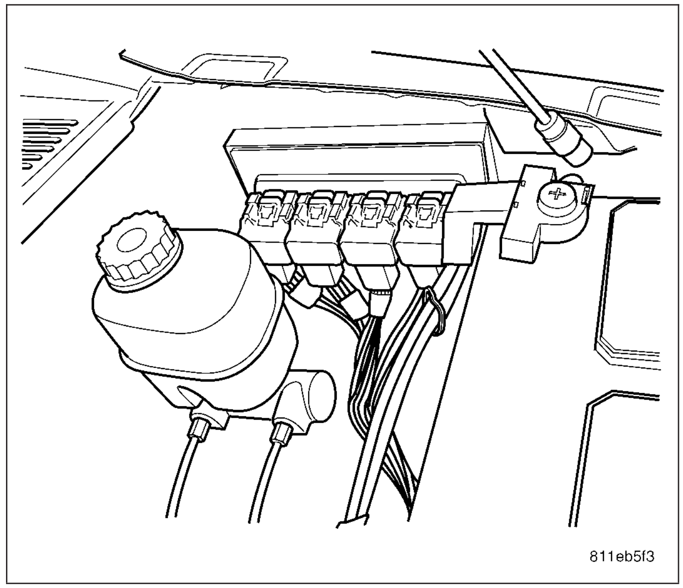


# MODULE-POWERTRAIN CONTROL

## DESCRIPTION

### PCM

The Powertrain Control Module (PCM) is located in the engine compartment.




## MODES OF OPERATION

As input signals to the Powertrain Control Module (PCM) change, the PCM adjusts its response to the output devices. For example, the PCM must calculate different injector pulse width and ignition timing for idle than it does for Wide Open Throttle (WOT).

The PCM will operate in two different modes: **Open Loop and Closed Loop**.

During Open Loop modes, the PCM receives input signals and responds only according to preset PCM programming. Input from the oxygen (O2S) sensors is not monitored during Open Loop modes.

During Closed Loop modes, the PCM will monitor the oxygen (O2S) sensors input. This input indicates to the PCM whether or not the calculated injector pulse width results in the ideal air-fuel ratio. This ratio is 14.7 parts air-to-1 part fuel. By monitoring the exhaust oxygen content through the O2S sensor, the PCM can fine tune the injector pulse width. This is done to achieve optimum fuel economy combined with low emission engine performance.

The fuel injection system has the following modes of operation:

- Ignition switch ON
- Engine start-up (crank)
- Engine warm-up
- Idle
- Cruise
- Acceleration
- Deceleration
- Wide Open Throttle (WOT)
- Ignition switch OFF

The ignition switch On, engine start-up (crank), engine warm-up, acceleration, deceleration and wide open throttle modes are Open Loop modes. The idle and cruise modes, (with the engine at operating temperature) are Closed Loop modes.

## IGNITION SWITCH (KEY-ON) MODE

This is an Open Loop mode. When the fuel system is activated by the ignition switch, the following actions occur:

- The PCM pre-positions the Idle Air Control (IAC) motor.
- The PCM determines atmospheric air pressure from the MAP sensor input to determine basic fuel strategy.
- The PCM monitors the engine coolant temperature sensor input. The PCM modifies fuel strategy based on this input.
- Intake manifold air temperature sensor input is monitored.
- Throttle Position Sensor (TPS) is monitored.
- The Auto ShutDown (ASD) relay is energized by the PCM for approximately three seconds.
- The fuel pump is energized through the fuel pump relay by the PCM. The fuel pump will operate for approximately three seconds unless the engine is operating or the starter motor is engaged.
- The O2S sensor heater element is energized via the ASD or O2S heater relay. The O2S sensor input is not used by the PCM to calibrate air-fuel ratio during this mode of operation.

## ENGINE START-UP MODE

This is an Open Loop mode. The following actions occur when the starter motor is engaged.

The PCM receives inputs from:

- Battery voltage
- Engine Coolant Temperature (ECT) sensor
- CranKshaft Position (CKP) sensor
- Intake manifold Air Temperature (IAT) sensor
- Manifold Absolute Pressure (MAP) sensor
- Throttle Position Sensor (TPS)
- Camshaft position sensor signal

The PCM monitors the crankshaft position sensor. If the PCM does not receive a crankshaft position sensor signal within three seconds of cranking the engine, it will shut down the fuel injection system.

The fuel pump is activated by the PCM through the fuel pump relay.

Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.

The PCM determines the proper ignition timing according to input received from the crankshaft position sensor.

## ENGINE WARM-UP MODE

This is an Open Loop mode. During engine warm-up, the PCM receives inputs from:

- Battery voltage
- Engine Coolant Temperature (ECT) sensor
- CranKshaft Position (CKP) sensor
- Intake manifold Air Temperature (IAT) sensor
- Manifold Absolute Pressure (MAP) sensor
- Throttle Position Sensor (TPS)
- Camshaft position sensor signal
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)

Based on these inputs the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM adjusts engine idle speed through the IAC motor and adjusts ignition timing.
- The PCM operates the A/C compressor clutch through the A/C compressor clutch relay. This is done if A/C has been selected by the vehicle operator and specified pressures are met at the high and low–pressure A/C switches. Refer to Heating and Air Conditioning for additional information.

- When engine has reached operating temperature, the PCM will begin monitoring O2S sensor input. The system will then leave the warm-up mode and go into closed loop operation.

## IDLE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At idle speed, the PCM receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine Coolant Temperature (ECT) sensor
- CranKshaft Position (CKP) sensor
- Intake manifold Air Temperature (IAT) sensor
- Manifold Absolute Pressure (MAP) sensor
- Throttle Position Sensor (TPS)
- Camshaft position sensor signal
- Battery voltage
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen sensors

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio by varying injector pulse width. It also adjusts engine idle speed through the IAC motor.
- The PCM adjusts ignition timing by increasing and decreasing spark advance.
- The PCM operates the A/C compressor clutch through the A/C compressor clutch relay. This is done if A/C has been selected by the vehicle operator and specified pressures are met at the high and low–pressure A/C switches. Refer to Heating and Air Conditioning for additional information.

## CRUISE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At cruising speed, the PCM receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine Coolant Temperature (ECT) sensor
- CranKshaft Position (CKP) sensor
- Intake manifold Air Temperature (IAT) sensor
- Manifold Absolute Pressure (MAP) sensor
- Throttle Position Sensor (TPS)
- Camshaft position sensor signal
- Park/neutral switch (gear indicator signal -auto. trans. only)
- Oxygen (O2S) sensors

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then adjust the injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio. It also adjusts engine idle speed through the IAC motor.
- The PCM adjusts ignition timing by turning the ground path to the coil(s) on and off.
- The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

## ACCELERATION MODE

This is an Open Loop mode. The PCM recognizes an abrupt increase in throttle position or MAP pressure as a demand for increased engine output and vehicle acceleration. The PCM increases injector pulse width in response to increased throttle opening.

## DECELERATION MODE

When the engine is at operating temperature, this is an Open Loop mode. During hard deceleration, the PCM receives the following inputs.

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine Coolant Temperature (ECT) sensor
- CranKshaft Position (CKP) sensor
- Intake manifold Air Temperature (IAT) sensor
- Manifold Absolute Pressure (MAP) sensor
- Throttle Position Sensor (TPS)
- Camshaft position sensor signal
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Vehicle speed

If the vehicle is under hard deceleration with the proper rpm and closed throttle conditions, the PCM will ignore the oxygen sensor input signal. The PCM will enter a fuel cut-off strategy in which it will not supply a ground to the injectors. If a hard deceleration does not exist, the PCM will determine the proper injector pulse width and continue injection.

Based on the above inputs, the PCM will adjust engine idle speed through the IAC motor.

The PCM adjusts ignition timing by turning the ground path to the coil on and off.

## WIDE OPEN THROTTLE MODE

This is an Open Loop mode. During wide open throttle operation, the PCM receives the following inputs.

- Battery voltage
- Engine Coolant Temperature (ECT) sensor
- CranKshaft Position (CKP) sensor
- Intake manifold Air Temperature (IAT) sensor
- Manifold Absolute Pressure (MAP) sensor
- Throttle Position Sensor (TPS)
- Camshaft position sensor signal

During wide open throttle conditions, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off. The PCM ignores the oxygen sensor input signal and provides a predetermined amount of additional fuel. This is done by adjusting injector pulse width.
- The PCM adjusts ignition timing by turning the ground path to the coil(s) on and off.

## IGNITION SWITCH OFF MODE

When ignition switch is turned to OFF position, the PCM stops operating the injectors, ignition coil, ASD relay and fuel pump relay.

# 5 VOLT SUPPLIES

Two different Powertrain Control Module (PCM) five volt supply circuits are used; primary and secondary.

# IGNITION CIRCUIT SENSE

This circuit ties the ignition switch to the Powertrain Control Module (PCM).

## POWER GROUNDS

The Powertrain Control Module (PCM) has two main grounds. Both of these grounds are referred to as power grounds. All of the high-current, noisy, electrical devices are connected to these grounds as well as all of the sensor returns. The sensor return comes into the sensor return circuit, passes through noise suppression, and is then connected to the power ground.

The power ground is used to control ground circuits for the following PCM loads:

- Generator field winding
- Fuel injectors
- Ignition coil(s)
- Certain relays/solenoids
- Certain sensors

## SENSOR RETURN

The Sensor Return circuits are internal to the Powertrain Control Module (PCM).

Sensor Return provides a low–noise ground reference for all engine control system sensors. Refer to Power Grounds for more information.

## OPERATION

## PCM

The PCM operates the fuel system. The PCM is a pre-programmed, triple microprocessor digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions.

The PCM receives input signals from various switches and sensors. Based on these inputs, the PCM regulates various engine and vehicle operations through different system components. These components are referred to as Powertrain Control Module (PCM) Outputs. The sensors and switches that provide inputs to the PCM are considered Powertrain Control Module (PCM) Inputs.

The PCM adjusts ignition timing based upon inputs it receives from sensors that react to: engine rpm, manifold absolute pressure, engine coolant temperature, throttle position, transmission gear selection (automatic transmission), vehicle speed, power steering pump pressure, and the brake switch.

The PCM adjusts idle speed based on inputs it receives from sensors that react to: throttle position, vehicle speed, transmission gear selection, engine coolant temperature and from inputs it receives from the air conditioning clutch switch and brake switch.

Based on inputs that it receives, the PCM adjusts ignition coil dwell. The PCM also adjusts the generator charge rate through control of the generator field and provides speed control operation.

**NOTE: PCM Inputs:**

- A/C request (if equipped with factory A/C)
- A/C select (if equipped with factory A/C)
- A/C pressure transducer
- Auto shutdown (ASD) sense
- Battery temperature
- Battery voltage
- Brake switch
- J1850 bus (+) circuits
- J1850 bus (-) circuits
- Camshaft position sensor signal
- Crankshaft position sensor
- Data link connection for scan tool
- Engine coolant temperature sensor

- Fuel level (through J1850 circuitry)
- Generator (battery voltage) output
- Ignition circuit sense (ignition switch in on/off/crank/run position)
- Intake manifold air temperature sensor
- Knock sensors (2 on 3.7L engine)
- Leak detection pump (switch) sense (if equipped)
- Manifold absolute pressure (MAP) sensor
- Oil pressure
- Oxygen sensors
- Park/neutral switch (automatic transmission only)
- Power ground
- Power steering pressure switch
- Sensor return
- Signal ground
- Speed control multiplexed single wire input
- Throttle position sensor
- Transfer case switch (4WD range position)
- Vehicle speed sensor

**NOTE: PCM Outputs:**

- A/C clutch relay
- Auto shutdown (ASD) relay
- J1850 bus (+/-) circuits for: speedometer, voltmeter, fuel gauge, oil pressure gauge/lamp, engine temp. gauge and speed control warn. lamp
- Clutch pedal position switch override relay
- Data link connection for scan tool
- EGR valve control solenoid (if equipped)
- EVAP canister purge solenoid
- Five volt sensor supply (primary)
- Five volt sensor supply (secondary)
- Fuel injectors
- Fuel pump relay
- Generator field driver (-)
- Generator field driver (+)
- Idle air control (IAC) motor
- Ignition coil(s)
- Leak detection pump (if equipped)
- Malfunction indicator lamp (Check engine lamp). Driven through J1850 circuits.
- Oxygen sensor heater relays
- Oxygen sensors (pulse width modulated)
- Radiator cooling fan relay (pulse width modulated)
- Speed control vacuum solenoid
- Speed control vent solenoid
- Tachometer (if equipped). Driven through J1850 circuits.
- Transmission convertor clutch circuit. Driven through J1850 circuits.

## 5 VOLT SUPPLIES

Primary 5 volt supply:

- supplies the required 5 volt power source to the Crankshaft Position (CKP) sensor.
- supplies the required 5 volt power source to the Camshaft Position (CMP) sensor.
- supplies a reference voltage for the Manifold Absolute Pressure (MAP) sensor.

- supplies a reference voltage for the Throttle Position Sensor (TPS).

Secondary 5 volt supply:

- supplies the required 5 volt power source to the oil pressure sensor.
- supplies the required 5 volt power source for the Vehicle Speed Sensor (VSS) (if equipped).
- supplies the 5 volt power source to the transmission pressure sensor (certain automatic transmissions).

## IGNITION CIRCUIT SENSE

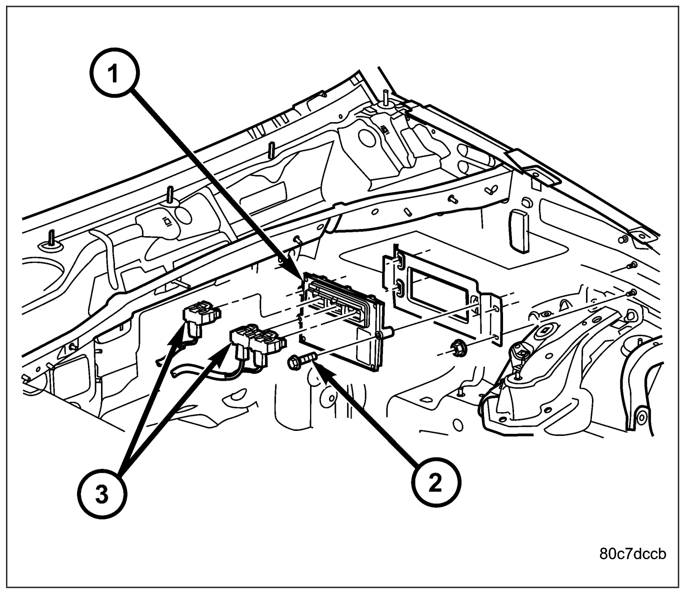
The ignition circuit sense input tells the PCM the ignition switch has energized the ignition circuit.

Battery voltage is also supplied to the PCM through the ignition switch when the ignition is in the RUN or START position. This is referred to as the ″ignition sense″ circuit and is used to ″wake up″ the PCM. Voltage on the ignition input can be as low as 6 volts and the PCM will still function. Voltage is supplied to this circuit to power the PCM's 8-volt regulator and to allow the PCM to perform fuel, ignition and emissions control functions.

## REMOVAL

**Use the scan tool to reprogram the new powertrain control module (PCM) with the vehicles original identification number (VIN) and the vehicles original mileage. If this step is not done, a diagnostic trouble code (DTC) may be set.**

The PCM (1) is located in the engine compartment near the battery.



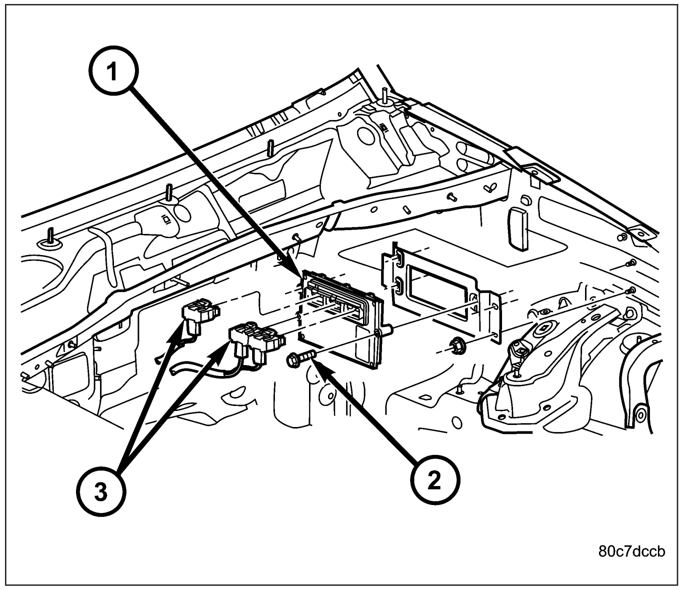

To avoid possible voltage spike damage to the PCM, ignition key must be off, and negative battery cable must be disconnected before unplugging PCM connectors.

1. Disconnect negative battery cable at battery.
2. Remove cover over electrical connectors. Cover snaps onto PCM.
3. **NGC Modules :** Carefully unplug the four 38-way connectors from PCM. **JTEC Modules :** Carefully unplug the three 32–way connectors from PCM.
4. Remove three PCM mounting bolts (2) and remove PCM from vehicle.

## INSTALLATION

**Use the scan tool to reprogram the new powertrain control module (PCM) with the vehicles original identification number (VIN) and the vehicles original mileage. If this step is not done, a diagnostic trouble code (DTC) may be set.**

1. Install PCM (1) and three mounting bolts (2) to vehicle.
2. Tighten bolts. Refer to torque specifications.
3. Check pin connectors in the PCM and its connectors for corrosion or damage. Also, the pin heights in connectors should all be same. Repair as necessary before installing connectors.
4. **NGC Modules :** Carefully install the four 38-way connectors into PCM. **JTEC Modules :** Carefully install the three 32–way connectors into PCM.
5. Install cover over electrical connectors. Cover snaps onto PCM.
6. Install battery cable.
7. Use the scan tool to reprogram new PCM with vehicles original Identification Number (VIN) and original vehicle mileage.

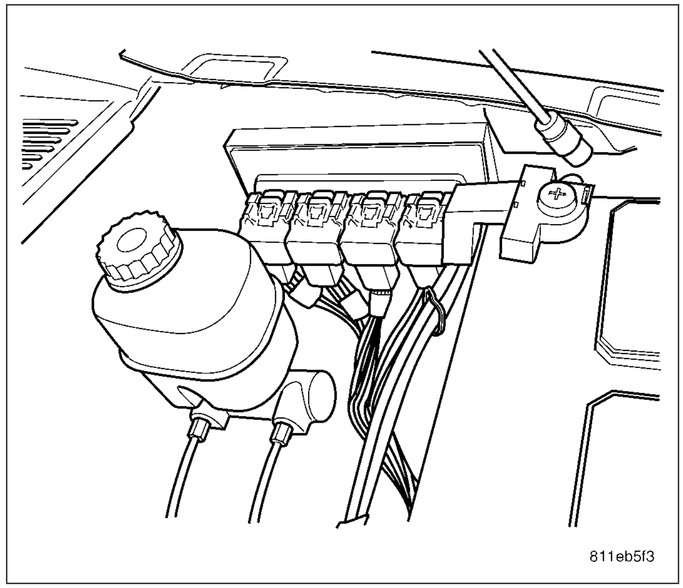


# MODULE-TRANSMISSION CONTRO

## DESCRIPTION

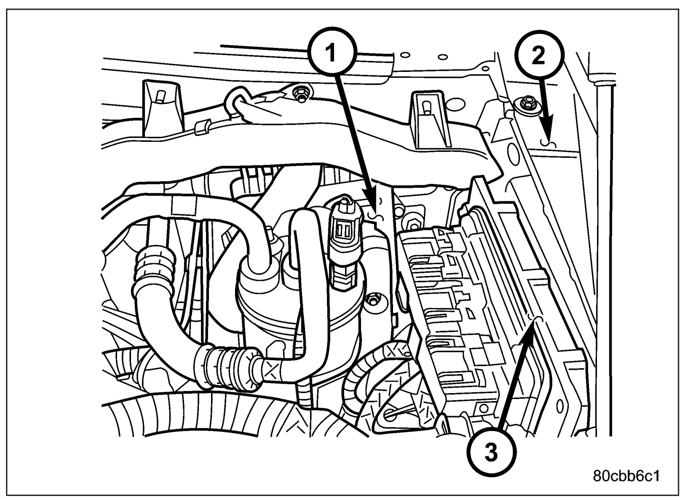
### TRANSMISSION CONTROL MODULE - GASOLINE ENGINES

The Transmission Control Module (TCM) is a sub-module within the Powertrain Control Module (PCM). The PCM is located on the left inner fender.




### TRANSMISSION CONTROL MODULE - DIESEL ENGINE

The Transmission Control Module (TCM) (3) is located in the engine compartment on the left (driver) side and is mounted to the dash panel.




## OPERATION

### TRANSMISSION CONTROL MODULE - GASOLINE ENGINES

The TCM is the controlling unit for all electronic operations of the transmission. The TCM receives information regarding vehicle operation from both direct and indirect inputs, and selects the operational mode of the transmission. Direct inputs are hard-wired to, and used specifically by the TCM. Indirect inputs originate from other components/modules, and are shared with the TCM via the PCI bus.

Some examples of **direct inputs** to the TCM are:

- Battery (B+) voltage
- Ignition "ON" voltage
- Transmission Control Relay (Switched B+)
- Throttle Position Sensor

- CranKshaft Position sensor (CKP)
- Transmission Range Sensor (TRS)
- Pressure Switches (L/R, 2/4, OD)
- Transmission Temperature Sensor (TTS) (Integral to TRS)
- Input Shaft Speed Sensor
- Output Shaft Speed Sensor

Some examples of **indirect inputs** to the TCM are:

- Engine/Body Identification
- Manifold Pressure
- Target Idle
- Torque Reduction Confirmation
- Speed Control ON/OFF Switch
- Engine Coolant Temperature
- Ambient/Battery Temperature
- Brake Switch Status
- Scan Tool Communication

Based on the information received from these various inputs, the TCM determines the appropriate shift schedule and shift points, depending on the present operating conditions and driver demand. This is possible through the control of various direct and indirect outputs.

Some examples of TCM **direct outputs** are:

- Transmission Control Relay
- Solenoids (L/R, 2/4, OD and UD)
- Vehicle Speed (to PCM)
- Torque Reduction Request (to PCM)

Some examples of TCM **indirect outputs** are:

- Transmission Temperature (to PCM)
- PRNDL Position (to BCM)

In addition to monitoring inputs and controlling outputs, the TCM has other important responsibilities and functions:

- Storing and maintaining Clutch Volume Indices (CVI)
- Storing and selecting appropriate Shift Schedules
- System self-diagnostics
- Diagnostic capabilities (with scan tool)

**NOTE: If the TCM has been replaced, the “Quick Learn Procedure” must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)**

## CLUTCH VOLUME INDEX (CVI)

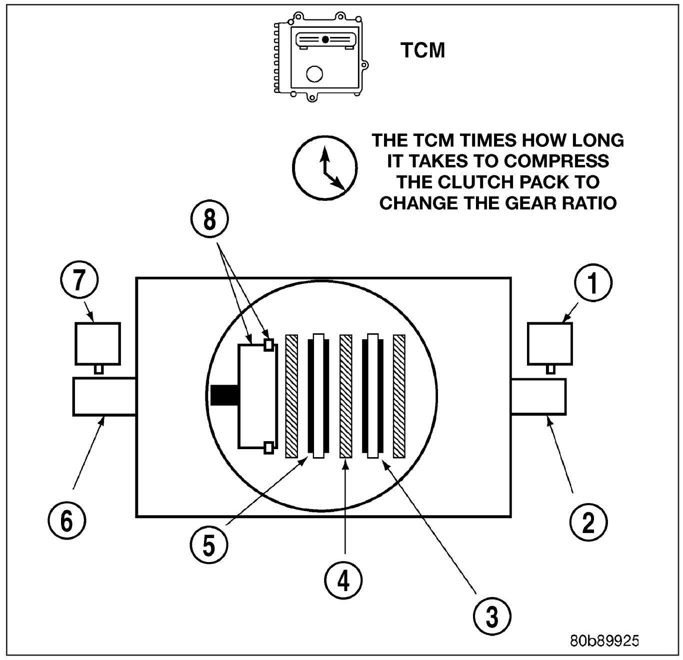
An important function of the TCM is to monitor Clutch Volume Index (CVI). CVIs represent the volume of fluid needed to compress a clutch pack.

The TCM monitors gear ratio changes by monitoring the Input and Output Speed Sensors. The Input, or Turbine Speed Sensor sends an electrical signal to the TCM that represents input shaft rpm. The Output Speed Sensor provides the TCM with output shaft speed information.

By comparing the two inputs, the TCM can determine transmission gear position. This is important to the CVI calculation because the TCM determines CVIs by monitoring how long it takes for a gear change to occur.

Gear ratios can be determined by using the scan tool and reading the Input/Output Speed Sensor values in the “Monitors” display. Gear ratio can be obtained by dividing the Input Speed Sensor value by the Output Speed Sensor value.

For example, if the input shaft is rotating at 1000 rpm and the output shaft is rotating at 500 rpm, then the TCM can determine that the gear ratio is 2:1. In direct drive (3rd gear), the gear ratio changes to 1:1. The gear ratio changes as clutches are applied and released. By monitoring the length of time it takes for the gear ratio to change following a shift request, the TCM can determine the volume of fluid used to apply or release a friction element.




The volume of transmission fluid needed to apply the friction elements are continuously updated for adaptive controls. As friction material wears, the volume of fluid need to apply the element increases.

Certain mechanical problems within the input clutch assembly (broken return springs, out of position snap rings, excessive clutch pack clearance, improper assembly, etc.) can cause inadequate or out-of-range element volumes. Also, defective Input/Output Speed Sensors and wiring can cause these conditions. The following chart identifies the appropriate clutch volumes and when they are monitored/updated:

| CLUTCH VOLUMES | | | | |
|---|---|---|---|---|
| Clutch | When Updated | | | Proper Clutch Volume |
| | Shift Sequence | Oil Temperature | Throttle Angle | |
| L/R | 2-1 or 3-1 coast downshift | > 21° C (70° F) | < 5° | 35 to 83 |
| 2/4 | 1-2 shift | > 43° C (110° F) | 5 - 54° | 20 to 77 |
| OD | 2-3 shift | | | 48 to 150 |
| UD | 4-3 or 4-2 shift | | > 5° | 24 to 70 |

## SHIFT SCHEDULES

As mentioned earlier, the TCM has programming that allows it to select a variety of shift schedules. Shift schedule selection is dependent on the following:

- Shift lever position
- Throttle position
- Engine load
- Fluid temperature
- Software level

As driving conditions change, the TCM appropriately adjusts the shift schedule. Refer to the following table 42RLE Shift Schedule to determine the appropriate operation expected, depending on driving conditions.

**42RLE Shift Schedule**

| Schedule | Condition | Expected Operation |
|---|---|---|
| **Extreme Cold** | Oil temperature at start-up below -27° C (-16° F) | Park, Reverse, Neutral and 2nd gear only (prevents shifting which may fail a clutch with frequent shifts) |

| Schedule | Condition | Expected Operation |
|---|---|---|
| **Cold** | Oil temperature at start-up above -25° C (-12° F) and below 2° C (36° F) | - Delayed 2-3 upshift (approximately 22-31 mph)<br>- Delayed 3-4 upshift (45-53 mph)<br>- Early 4-3 coastdown shift (approximately 30 mph)<br>- Early 3-2 coastdown shift (approximately 17 mph)<br>- High speed 4-2, 3-2, 2-1 kickdown shifts are prevented<br>- No EMCC |
| **Warm** | Oil temperature at start-up above 2° C (36° F) and below 27° C (80° F) | - Normal operation (upshift, kickdowns, and coastdowns)<br>- No EMCC |
| **Hot** | Oil temperature at start-up above 27° C (80° F) | - Normal operation (upshift, kickdowns, and coastdowns)<br>- Full EMCC, no PEMCC except to engage FEMCC (except at closed throttle at speeds above 70-83 mph) |
| **Overheat** | Oil temperature above 115° C (240° F) or engine coolant temperature above 118° C (244° F) | - Delayed 2-3 upshift (25-32 mph)<br>- Delayed 3-4 upshift (41-48 mph)<br>- 3rd gear FEMCC from 30-48 mph<br>- 3rd gear PEMCC from 27-31 mph |
| **Super Overheat** | Oil temperature above 127° C (260° F) | - All ″Overheat″ shift schedule features apply<br>- 2nd gear PEMCC above 22 mph<br>- Above 22 mph the torque converter will not unlock unless the throttle is closed or if a wide open throttle 2nd PEMCC to 1 kickdown is made |

## TRANSMISSION CONTROL MODULE - DIESEL ENGINE

The Transmission Control Module (TCM) controls all electronic operations of the transmission. The TCM receives information regarding vehicle operation from both direct and indirect inputs, and selects the operational mode of the transmission. Direct inputs are hard wired to, and used specifically by the TCM. Indirect inputs are shared with the TCM via the vehicle communication bus.

Some examples of **direct inputs** to the TCM are:

- Battery (B+) voltage
- Ignition “ON” voltage
- Transmission Control Relay (Switched B+)
- Throttle Position Sensor
- Crankshaft Position Sensor
- Transmission Range Sensor
- Pressure Switches
- Transmission Temperature Sensor
- Input Shaft Speed Sensor
- Output Shaft Speed Sensor
- Line Pressure Sensor

Some examples of **indirect inputs** to the TCM are:

- Engine/Body Identification
- Manifold Pressure
- Target Idle
- Torque Reduction Confirmation
- Engine Coolant Temperature
- Ambient/Battery Temperature
- Scan Tool Communication

Based on the information received from these various inputs, the TCM determines the appropriate shift schedule and shift points, depending on the present operating conditions and driver demand. This is possible through the control of various direct and indirect outputs.

Some examples of TCM **direct outputs** are:

- Transmission Control Relay
- Solenoids
- Torque Reduction Request

Some examples of TCM **indirect outputs** are:

- Transmission Temperature (to PCM)
- PRNDL Position (to cluster/CCN)

In addition to monitoring inputs and controlling outputs, the TCM has other important responsibilities and functions:

- Storing and maintaining Clutch Volume Indexes (CVI)
- Storing and selecting appropriate Shift Schedules
- System self-diagnostics
- Diagnostic capabilities (with scan tool)

**NOTE: If the TCM has been replaced, the "Quick Learn Procedure" must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)**

## BATTERY FEED

A fused, direct battery feed to the TCM is used for continuous power. This battery voltage is necessary to retain memory in the TCM. When the battery (B+) is disconnected, this memory is lost. When the battery (B+) is restored, this memory loss is detected by the TCM and a Diagnostic Trouble Code (DTC) is set.

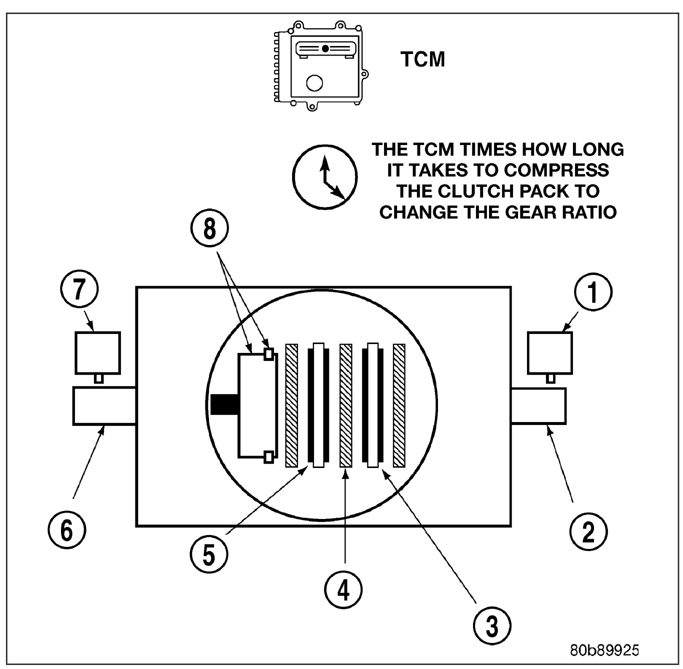
## CLUTCH VOLUME INDEXES (CVI)

An important function of the TCM is to monitor Clutch Volume Indexes (CVI). CVIs represent the volume of fluid needed to compress a clutch pack.

The TCM monitors gear ratio changes by monitoring the Input and Output Speed Sensors. The Input, or Turbine Speed Sensor sends an electrical signal to the TCM that represents input shaft rpm. The Output Speed Sensor provides the TCM with output shaft speed information.

By comparing the two inputs, the TCM can determine transmission gear position. This is important to the CVI calculation because the TCM determines CVIs by monitoring how long it takes for a gear change to occur.

Gear ratios can be determined by using the Scan Tool and reading the Input/Output Speed Sensor values in the "Monitors" display. Gear ratio can be obtained by dividing the Input Speed Sensor value by the Output Speed Sensor value.



For example, if the input shaft is rotating at 1000 rpm and the output shaft is rotating at 500 rpm, then the TCM can determine that the gear ratio is 2:1. In direct drive (3rd gear), the gear ratio changes to 1:1. The gear ratio changes as clutches are applied and released. By monitoring the length of time it takes for the gear ratio to change following a shift request, the TCM can determine the volume of fluid used to apply or release a friction element.

The volume of transmission fluid needed to apply the friction elements are continuously updated for adaptive controls. As friction material wears, the volume of fluid need to apply the element increases.

Certain mechanical problems within the input clutch assembly can cause inadequate or out-of-range element volumes. Also, defective Input/Output Speed Sensors and wiring can cause these conditions. The following chart identifies the appropriate clutch volumes and when they are monitored/updated:

| CLUTCH VOLUMES | | |
|---|---|---|
| **Clutch** | **When Updated** | **Proper Clutch Volume** |
| L/R | 2-1 or 3-1 downshift | 45 to 134 |
| 2C | 3-2 kickdown shift | 25 to 85 |
| OD | 2-3 upshift | 30 to 100 |
| 4C | 3-4 upshift | 30 to 85 |
| UD | 4-3 kickdown shift | 30 to 100 |

## SHIFT SCHEDULES

As mentioned earlier, the TCM has programming that allows it to select a variety of shift schedules. Shift schedule selection is dependent on the following:

- Shift lever position
- Throttle position
- Engine load
- Fluid temperature
- Software level

As driving conditions change, the TCM appropriately adjusts the shift schedule. Refer to the following chart to determine the appropriate operation expected, depending on driving conditions.

| Schedule | Condition | Expected Operation |
|---|---|---|
| **Extreme Cold** | Oil temperature below -27° C (16° F) | -Park, Reverse, Neutral and 1st and 3rd gear only in D position, 2nd gear only in Manual 2 or L<br>-No EMCC |
| **Super Cold** | Oil temperature between -24° C (-12° F) and -12° C (10° F) | - Delayed 2-3 upshift<br>- Delayed 3-4 upshift<br>- Early 4-3 coastdown shift<br>- High speed 4-2, 3-2, 2-1 kickdown shifts are prevented<br>-Shifts at high throttle openings willl be early.<br>- No EMCC |
| **Cold** | Oil temperature between -12° C (10° F) and 2° C (36° F) | -Shift schedule is the same as Super Cold except that the 2-3 upshifts are not delayed. |
| **Warm** | Oil temperature between 4° C (40° F) and 27° C (80° F) | - Normal operation (upshift, kickdowns, and coastdowns)<br>- No EMCC |

| Schedule | Condition | Expected Operation |
|---|---|---|
| **Hot** | Oil temperature between 27° C (80° F) and 115° C (240° F) | - Normal operation (upshift, kickdowns, and coastdowns)<br><br>- Normal EMCC operation |
| **Overheat** | Oil temperature above 115° C (240° F) or engine coolant temperature above 118° C (244° F) | - Delayed 2-3 upshift<br>- Delayed 3-4 upshift<br>- 3rd gear FEMCC from 30-48 mph<br>- 3rd gear PEMCC above 35 mph<br>- Above 25 mph the torque converter will not unlock unless the throttle is closed or if a wide open throttle 2nd PEMCC to 1 kickdown is made |

## STANDARD PROCEDURE

## TCM QUICK LEARN

The quick learn procedure requires the use of the scan tool.

This program allows the electronic transmission system to recalibrate itself. This will provide the proper transmission operation. The quick learn procedure should be performed if any of the following procedures are performed:

- Transmission Assembly Replacement
- Transmission Control Module Replacement
- Solenoid Pack Replacement
- Clutch Plate and/or Seal Replacement
- Valve Body Replacement or Recondition

To perform the Quick Learn Procedure, the following conditions must be met:

- The brakes must be applied
- The engine speed must be above 500 rpm
- The throttle angle (TPS) must be less than three degrees
- The shift lever position must stay in PARK until prompted to shift to overdrive
- The shift lever position must stay in overdrive after the Shift to Overdrive prompt until the scan tool indicates the procedure is complete.
- The calculated oil temperature must be above 16° C (60° F) and below 93° C (200° F).

## DRIVE LEARN

When a transmission is repaired and a Quick Learn procedure has been performed on the Transmission Control Module (TCM), the following Drive Learn procedure can be performed to fine tune any shifts which are particularly objectionable.

**NOTE: It is not necessary to perform the complete Drive Learn procedure every time the TCM is Quick Learned. Perform only the portions which target the objectionable shift.**

### LEARN A SMOOTH 1ST NEUTRAL TO DRIVE SHIFT

Perform this procedure only if the complaint is for a delayed or harsh shift the first time the transmission is put into gear after the vehicle is allowed to set with the engine not running for at least 10 minutes. Use the following steps to have the TCM learn the 1st N-D UD CVI.

**NOTE: The transmission oil temperature must be between 27-43° C (80-110° F).**

1. Start the engine only when the engine and ignition have been off for at least ten (10) minutes.

2. With the vehicle at a stop and the service brake applied, record the 1st N-D UD CVI while performing a Neutral to Drive shift. The 1st N-D UD CVI accounts for air entrapment in the UD clutch that may occur after the engine has been off for a period of time.
3. Repeat Step 1 and Step 2 until the recorded 1st N-D UD CVI value stabilizes.

**NOTE: It is important that this procedure be performed when the transmission temperature is between 27-43° C (80-110° F). If this procedure takes too long to complete fully for the allowed transmission oil temperature, the vehicle may be returned to the customer with an explanation that the shift will improve daily during normal vehicle usage. The TCM also learns at higher oil temperatures, but these values (line pressure correction values) are not available for viewing on the scan tool.**

## LEARN A SMOOTH NEUTRAL TO DRIVE GARAGE SHIFT

Perform this procedure if the complaint is for a delayed or harsh shift when the transmission is put into gear after the vehicle has had its first shift. Use the following steps to have the TCM learn the Norm N-D UD CVI.

**NOTE: The transmission oil temperature must be between 27-43° C (80-110° F) to learn the UD CVI. Additional learning occurs at temperatures as low as -18° C (0° F) and as high as 93° C (200° F). This procedure may be performed at any temperature that experiences poor shift quality. Although the UD CVI may not change, shift quality should improve.**

1. Start the vehicle engine and shift to drive.
2. Move the vehicle forward to a speed of at least 16 km/h (10 MPH) and come to a stop. This ensures no air is present in the UD hydraulic circuit.
3. Perform repeated N-D shifts at a stop while pausing in Neutral for at least 2-3 seconds and monitor Norm N-D UD CVI volume until the value stabilizes. The value will change during the N-D shift. This is normal since the UD value is different for the N-D shift then the normal value shown which is used for 4-3 coastdown and kickdowns. Perform repeated shifts in this temperature range until the Norm N-D UD CVI value stabilizes and the N-D shifts become smooth.

## LEARN THE 1ST 2-3 SHIFT AFTER A RESTART OR SHIFT TO REVERSE

Use the following steps to have the TCM learn the 1st 2-3 shift OD CVI.

**NOTE: The transmission oil temperature must be above 27° C (80° F).**

1. With the vehicle engine running, select reverse gear for over 2 seconds.
2. Shift the transmission to Drive and accelerate the vehicle from a stop at a steady 15 degree throttle opening and perform a 2-3 shift while noting the 1st 2-3 OD CVI.
3. Repeat Step 1 and Step 2 until the 1st 2-3 upshift becomes smooth and the 1st 2-3 OD CVI stabilizes.

## LEARN A SMOOTH 2-3 AND 3-4 UPSHIFT

**NOTE: The transmission oil temperature must be above 43° C (110° F).**

Use the following steps to have the TCM learn the OD and 4C CVI's.

1. Accelerate the vehicle from a stop at a steady 15 degree throttle opening and perform multiple 1-2, 2-3, and 3-4 upshifts. The 2nd 2-3 shift following a restart or shift to reverse will be shown during the shift as a value between the 1st 2-3 OD CVI and the normal OD CVI. Updates to the normal OD CVI will occur after the 2nd shift into 3rd gear, following a restart or shift to reverse.
2. Repeat Step 1 until the 2-3 and 3-4 shifts become smooth and the OD and 4C CVI become stable.

## LEARN A SMOOTH 4-3 COASTDOWN AND PART THROTTLE 4-3 KICKDOWN

**NOTE: The transmission oil temperature must be above 43° C (110° F).**

Use the following steps to have the TCM learn the UD shift volume.

1. At a vehicle speed between 64-97 km/h (40-60 mph), perform repeated 4-3 kickdown shifts.

2. Repeat Step 1 until the UD volume becomes somewhat stable and the shift becomes smooth.

## LEARN A SMOOTH 1-2 UPSHIFT AND 3-2 KICKDOWN

Use the following steps to have the TCM learn the 2C shift volume.

**NOTE: The transmission oil temperature must be above 43° C (110° F).**

1. With a vehicle speed below 48 km/h (30 mph) and the transmission in 3rd gear, perform multiple 3-2 kickdowns.
2. Repeat Step 1 until the 3-2 kickdowns become smooth and the 2C CVI becomes stable.

## LEARN A SMOOTH MANUAL 2-1 PULLDOWN SHIFT AS WELL AS A NEUTRAL TO REVERSE SHIFT

**NOTE: The transmission oil temperature must be above 43° C (110° F).**

Use the following steps to have the TCM learn the LR volume.

1. With the vehicle speed around 40-48 km/h (25-30 mph) in Manual 2nd, perform manual pulldowns to Low or 1st gear at closed throttle.
2. Repeat Step 1 until the LR CVI becomes stable and the manual 2-1 becomes smooth.

## LEARN A SMOOTH NEUTRAL TO REVERSE SHIFT

**NOTE: The transmission oil temperature must be above 43° C (110° F).**

1. With the vehicle at a stop, perform Neutral to Reverse shifts until the shift is smooth. An unlearned Neutral to Reverse shift may be harsh or exhibit a double bump.
2. If any of the shifts are still not smooth after the clutch volume stabilizes, an internal transmission problem may be present.

## LEARN A SMOOTH 4-5 UPSHIFT

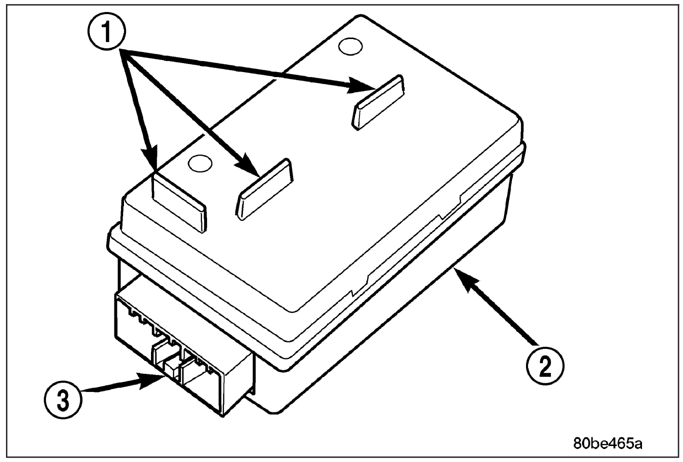
**NOTE: The transmission oil temperature must be above 43° C (110° F).**

Use the following steps to have the TCM learn the Alt 2C CVI.

1. Accelerate the vehicle through 88 km/h (55 mph) at a steady 10-15 degree throttle opening and perform multiple 4-5 upshifts.
2. Repeat Step 1 until the 4-5 shift become smooth and the Alt 2C CVI become stable. There is a separate 2C volume used and learned for 4-5 shifts, 2CA. It is independent of the 2C CVI learned on 3-2 kickdowns.

# HEATED SEAT MODULE

## DESCRIPTION




The heated seat module (2) is also known as the Seat Heat Interface Module. The heated seat module (2) is located under the left front seat cushion, where it is secured to a mounting bracket via two push-pin retainers. The heated seat module has a single connector receptacle (3) that allows the module to be connected to all of the required inputs and outputs through the seat wire harness.

The heated seat module (2) is an electronic microprocessor controlled device designed and programmed to use inputs from the heated seat relay, the two heated seat switches and the two heated seat sensors to operate and control the heated seat elements in both front seats and the two heated seat indicator lamp Light-Emitting Diodes (LEDs) in each heated seat switch. The heated seat module is also programmed to perform self-diagnosis of certain heated seat system functions and provide feedback of that diagnosis through the heated seat switch indicator lamps.

The heated seat module (2) cannot be repaired. If the heated seat module is damaged or faulty, the entire module must be replaced.

## OPERATION

The heated seat module operates on fused battery current received from a fuse in the junction block. The module is grounded at all times. Inputs to the module include a resistor multiplexed heated seat switch request circuit for each of the two heated seat switches and the heated seat sensor inputs from the seat cushions of each front seat. In response to those inputs, the heated seat module controls battery current to the heated seat elements and sensors, and controls the ground for the heated seat switch indicator lamps (LED's).

When a heated seat switch (Driver or Passenger) is depressed a signal is received by the heated seat module, the module energizes the proper indicator LED (Low or High) in the switch by grounding the indicator lamp circuit to indicate that the heated seat system is operating. At the same time, the heated seat module energizes the selected heated seat sensor circuit and the sensor provides the module with an input indicating the surface temperature of the selected seat cushion.

The Low heat set point is about 36° C (96.8° F), and the High heat set point is about 42° C (107.6° F). If the seat cushion surface temperature input is below the temperature set point for the selected temperature setting, the heated seat module energizes an N-channel Field Effect Transistor (N-FET) within the module which energizes the heated seat elements in the selected seat cushion and back. When the sensor input to the module indicates the correct temperature set point has been achieved, the module de-energizes the N-FET which de-energizes the heated seat elements. The heated seat module will continue to cycle the N-FET as needed to maintain the selected temperature set point.

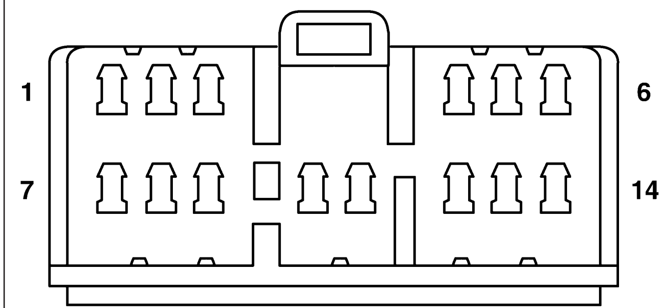
If the heated seat module detects a heated seat sensor value input that is out of range or a shorted or open heated seat element circuit, it will notify the vehicle operator or the repair technician of this condition by flashing the High and/or Low indicator lamps in the affected heated seat switch. Refer to **Diagnosis and Testing Heated Seat System** in Heated Systems for flashing LED diagnosis and testing procedures. Refer to **Diagnosis and Testing Heated Seat Module** in this section for heated seat module diagnosis and testing procedures. Also refer to the Body Diagnostic Manual for additional diagnosis and testing procedures.

## DIAGNOSIS AND TESTING - HEATED SEAT MODULE

If a heated seat fails to heat and one or both of the indicator lamps on a heated seat switch flash, refer to **Heated Seat System Diagnosis and Testing** in Heated Systems for flashing LED failure identification. Refer to **Wiring Diagrams** in for complete heated seat system wiring diagrams.

1. Remove the heated seat module from its mounting location (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/MEMORY HEATED SEAT/ MIRROR MODULE - REMOVAL).

**NOTE: Any resistance values (ohms Ω) given in the following text are supplied using the automatic range generated by a fluke® automotive meter. If another type of measuring device is used the values generated may not be the same as the results shown here, or may have to be converted to the range used here.**



80cb4c88

## RIGHT SEAT HEATER INOPERATIVE

1. If a heated seat heats but one or both indicator lamps (LED's) on the heated seat switch fail to illuminate, check the driver circuit with the inoperative LED for a short to ground. If OK, replace the heated seat switch. If NOT OK repair the short to ground as required and than replace the heated seat switch.

**NOTE: If the right seat cushion is already warm the following step will not prove conclusive.**

2. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #3 for battery voltage when the right heated seat switch is turned "ON", voltage should be present, If OK go to Step 3 If NOT OK, test the right heated seat switch (Refer to 8 - ELECTRICAL/HEATED SEATS/PASSENGER HEATED SEAT SWITCH - DIAGNOSIS AND TESTING). If the switch tests OK, check for continuity between the switch and control module on the MUX circuit, If OK replace the heated seat control module. If NOT OK, repair the open or shorted MUX circuit as required.

**NOTE: Be certain the battery is fully charged before testing. Failure to do so can result in incorrect readings.**

3. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #10 for battery voltage, while observing the voltmeter depress the right heated seat switch **low** setting twice, voltage should toggle between approx.12v and 8v, If OK go to Step 4. If NOT OK check for continuity between the switch and control module on the low heat driver circuit, If OK replace the heated seat control module.
4. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #11 for battery voltage, while observing the voltmeter depress the right heated seat switch **high** setting twice, voltage should toggle between approx.12v and 8v, If OK go to Step 5. If NOT OK check for continuity between the switch and control module on the high heat driver circuit, If OK replace the heated seat control module.
5. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #2 for approx. 5v, voltage should be present, If OK go to Step 6. If NOT OK replace the heated seat control module.
6. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #7 for a range in voltage from 1.72v (warm seat) – 3.0v (cold seat). It should be within this range, If OK replace the heated seat module. If NOT OK test the Heated Seat Sensor. If NOT OK, replace the right heated seat element and sensor assembly. If the heated seat sensor tests OK, check for continuity between the right heated seat cushion connector and control module connector on the 5v supply circuit, If NOT OK, repair the open or shorted 5v supply

circuit as required. If OK check for continuity between the right heated seat cushion connector and control module connector on the temperature sensor input circuit. If NOT OK, repair the open or shorted temperature sensor input circuit as required. If OK replace the heated seat control module.

## LEFT SEAT HEATER INOPERATIVE

1. If a heated seat heats but one or both indicator lamps (LED's) on the heated seat switch fail to illuminate, check the driver circuit with the inoperative LED for a short to ground. If OK, replace the heated seat switch. If NOT OK repair the short to ground as required and than replace the heated seat switch.

**NOTE: If the left seat cushion is already warm the following step will not prove conclusive.**

2. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #5 for battery voltage when the left heated seat switch is turned "ON", voltage should be present, If OK go to Step 3 If NOT OK, test the left heated seat switch (Refer to 8 - ELECTRICAL/HEATED SEATS/DRIVER HEATED SEAT SWITCH - DIAGNOSIS AND TESTING). If the switch tests OK, check for continuity between the switch and control module on the MUX circuit, If OK replace the heated seat control module. If NOT OK, repair the open or shorted MUX circuit as required.
3. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #12 for battery voltage, while observing the voltmeter depress the left heated seat switch **low** setting twice, voltage should toggle between approx.12v and 8v, If OK go to Step 4. If NOT OK check for continuity between the switch and control module on the low heat driver circuit, If OK replace the heated seat control module.
4. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #14 for battery voltage, while observing the voltmeter depress the left heated seat switch **high** setting twice, voltage should toggle between approx.12v and 8v, If OK go to Step 5. If NOT OK check for continuity between the switch and control module on the high heat driver circuit, If OK replace the heated seat control module.
5. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #2 for approx. 5v, 5 voltage should be present, If OK go to Step 6. If NOT OK replace the heated seat control module.
6. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #8 for a range in voltage from 1.72v (warm seat) – 3.0v (cold seat). It should be within this range, If OK replace the heated seat control module. If NOT OK, test the Heated Seat Sensor. If NOT OK, replace the left heated seat element and sensor assembly. If the heated seat sensor tests OK, check for continuity between the left heated seat cushion connector and control module connector on the 5v supply circuit, If NOT OK, repair the open or shorted 5v supply circuit as required. If OK check for continuity between the left heated seat cushion connector and control module connector on the temperature sensor input circuit. If NOT OK, repair the open or shorted temperature sensor input circuit as required. If OK replace the heated seat control module.

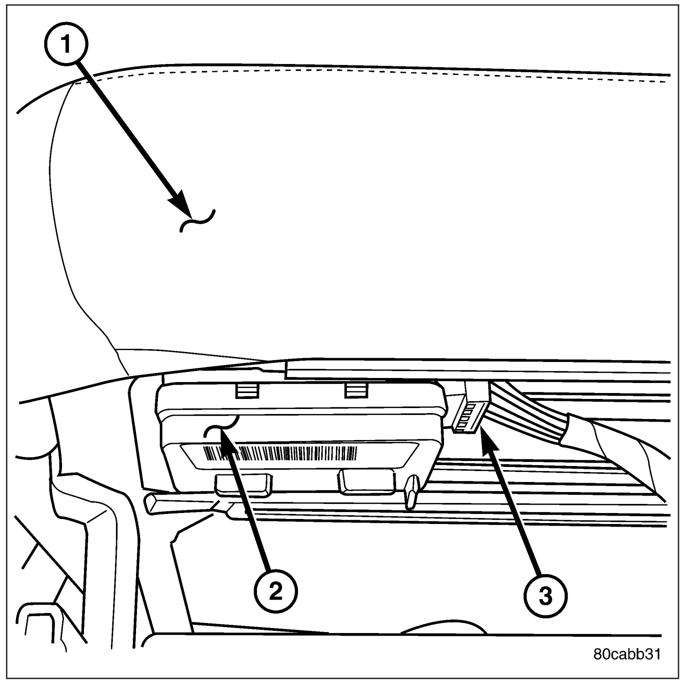
## BOTH SEATS INOPERATIVE

If both seats (driver and passenger) fail to heat and the indicator lamps on the heated seat switches for both seats fail to operate, test the heated seat fuses in the junction block. If the heated seat fuses check OK, go to Step 1.

1. Back-probe the heated seat module wire harness connector, do not disconnect. Check for continuity between the ground circuit cavity #13 of the heated seat module connector and a good ground. If OK go to Step 2. If NOT OK, repair the open or shorted ground circuit as required.
2. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #4 and #6 for battery voltage, voltage should be present, If OK go to Step 3. If NOT OK repair the open or shorted fused B(+) circuit as required.
3. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #2 for approx. 5v, voltage should be present, replace the heated seat control module with a known good module and verify system operation.

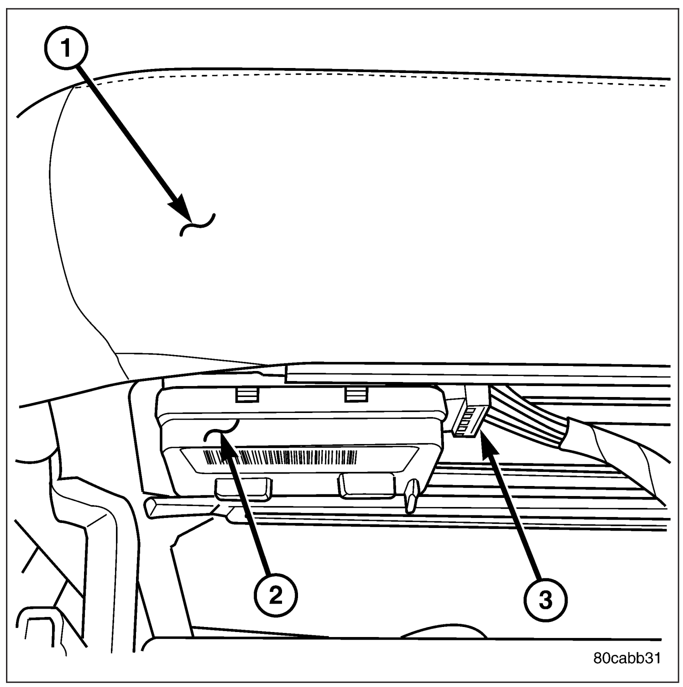
## REMOVAL

1. Working under the front seat cushion (1), remove the heated seat module (2) from its mounting bracket by gently prying the module off of the two mounting pushpins.
2. Disconnect the seat wire harness connector (3) from the connector receptacle on the side of the heated seat module (2).
3. Remove the heated seat module from the vehicle.




## INSTALLATION

1. Connect the seat wire harness connector (3) to the connector receptacle on the side of the heated seat module (2).
2. Install the heated seat module (2) on its mounting bracket under the front seat (1).
3. Verify heated seat system operation.



# ENGINE SYSTEMS

## TABLE OF CONTENTS



# BATTERY SYSTEM

## TABLE OF CONTENTS

# BATTERY SYSTEM

## DESCRIPTION

A single 12-volt battery is standard factory-installed equipment on this model. All of the components of the battery system are located within the engine compartment of the vehicle. The battery system for this vehicle covers the following related components, which are covered in further detail later in this section of the service manual:

- **Battery** - The storage battery provides a reliable means of storing a renewable source of electrical energy within the vehicle.
- **Battery Cables** - The battery cables connect the battery terminal posts to the vehicle electrical system.
- **Battery Holddown** - The battery holddown hardware secures the battery in the battery tray in the engine compartment.
- **Battery Tray** - The battery tray provides a secure mounting location in the vehicle for the battery and an anchor point for the battery holddown hardware.

For battery system maintenance schedules and jump starting procedure, see the owner's manual in the vehicle glove box. Optionally, refer to the Lubrication and Maintenance section of this manual for the recommended battery maintenance schedules and for the proper battery jump starting procedure. While battery charging can be considered a maintenance procedure, the battery charging procedure and related information are located later in this section of the service manual. This was done because the battery must be fully-charged before any battery system diagnosis or testing procedures can be performed.

## OPERATION

The battery system is designed to provide a safe, efficient, reliable and mobile means of delivering and storing electrical energy. This electrical energy is required to operate the engine starting system, as well as to operate many of the other vehicle accessory systems for limited durations while the engine and/or the charging system are not operating. The battery system is also designed to provide a reserve of electrical energy to supplement the charging system for short durations while the engine is running and the electrical current demands of the vehicle exceed the output of the charging system. In addition to delivering, and storing electrical energy for the vehicle, the battery system serves as a capacitor and voltage stabilizer for the vehicle electrical system. It absorbs most abnormal or transient voltages caused by the switching of any of the electrical components or circuits in the vehicle.

## DIAGNOSIS AND TESTING

## BATTERY SYSTEM

The battery, starting, and charging systems in the vehicle operate with one another and must be tested as a complete system. In order for the engine to start and the battery to maintain its charge properly, all of the components that are used in these systems must perform within specifications. It is important that the battery, starting, and charging systems be thoroughly tested and inspected any time a battery needs to be charged or replaced. The cause of abnormal battery discharge, overcharging or early battery failure must be diagnosed and corrected before a battery is replaced and before a vehicle is returned to service. The service information for these systems has been separated within this service manual to make it easier to locate the specific information you are seeking. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used for the battery, starting, and charging systems include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, a volt/ohmmeter, a battery charger, a carbon pile rheostat (load tester) and a 12-volt test lamp may be required. All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. Refer to Charging System for the proper charging system on-board diagnostic test procedures.

### MICRO 420 BATTERY TESTER

The Micro 420 automotive battery tester is designed to help the dealership technicians diagnose the cause of a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle. If the instruction manual is not available refer to the standard procedure in this section, which includes the directions for using the Micro 420 battery tester.

| BATTERY SYSTEM DIAGNOSIS | | |
|---|---|---|
| CONDITION | POSSIBLE CAUSES | CORRECTION |
| THE BATTERY SEEMS WEAK OR DEAD WHEN ATTEMPTING TO START THE ENGINE. | 1. The electrical system ignition-off draw is excessive. | 1. Refer to the IGNITION-OFF DRAW TEST Standard Procedure for the proper test procedures. Repair the excessive ignition-off draw, as required. |
| | 2. The charging system is faulty. | 2. Determine if the charging system is performing to specifications. Refer to Charging System for additional charging system diagnosis and testing procedures. Repair the faulty charging system, as required. |
| | 3. The battery is discharged. | 3. Determine the battery state-of-charge using the Micro 420 battery tester. Refer to the Standard Procedures in this section for additional test procedures. Charge the faulty battery, as required. |
| | 4. The battery terminal connections are loose or corroded. | 4. Refer to Battery Cables for the proper battery cable diagnosis and testing procedures. Clean and tighten the battery terminal connections, as required. |
| | 5. The battery has an incorrect size or rating for this vehicle. | 5. Refer to Battery System Specifications for the proper size and rating. Replace an incorrect battery, as required. |
| | 6. The battery is faulty. | 6. Determine the battery cranking capacity using the Micro 420 battery tester. Refer to the Standard Procedures in this section for additional test procedures. Replace the faulty battery, as required. |
| | 7. The starting system is faulty. | 7. Determine if the starting system is performing to specifications. Refer to Starting System for the proper starting system diagnosis and testing procedures. Repair the faulty starting system, as required. |
| | 8. The battery is physically damaged. | 8. Inspect the battery for loose terminal posts or a cracked and leaking case. Replace the damaged battery, as required. |

| BATTERY SYSTEM DIAGNOSIS | | |
|---|---|---|
| CONDITION | POSSIBLE CAUSES | CORRECTION |
| THE BATTERY STATE OF CHARGE CANNOT BE MAINTAINED. | 1. The battery has an incorrect size or rating for this vehicle. | 1. Refer to Battery System Specifications for the proper specifications. Replace an incorrect battery, as required. |
| | 2. The battery terminal connections are loose or corroded. | 2. Refer to Battery Cable for the proper cable diagnosis and testing procedures. Clean and tighten the battery terminal connections, as required. |
| | 3. The electrical system ignition-off draw is excessive. | 3. Refer to the IGNITION-OFF DRAW TEST Standard Procedure for the proper test procedures. Repair the faulty electrical system, as required. |
| | 4. The battery is faulty. | 4. Test the battery using the Micro 420 battery tester. Refer to Standard Procedures for additional test procedures. Replace the faulty battery, as required. |
| | 5. The starting system is faulty. | 5. Determine if the starting system is performing to specifications. Refer to Starting System for the proper starting system diagnosis and testing procedures. Repair the faulty starting system, as required. |
| | 6. The charging system is faulty. | 6. Determine if the charging system is performing to specifications. Refer to Charging System for additional charging system diagnosis and testing procedures. Repair the faulty charging system, as required. |
| | 7. Electrical loads exceed the output of the charging system. | 7. Inspect the vehicle for aftermarket electrical equipment which might cause excessive electrical loads. |
| | 8. Slow driving or prolonged idling with high-amperage draw systems in use. | 8. Advise the vehicle operator, as required. |
| THE BATTERY WILL NOT ACCEPT A CHARGE. | 1. The battery is faulty. | 1. Test the battery using the Micro 420 battery tester. Charge or replace the faulty battery, as required. |

## ABNORMAL BATTERY DISCHARGING

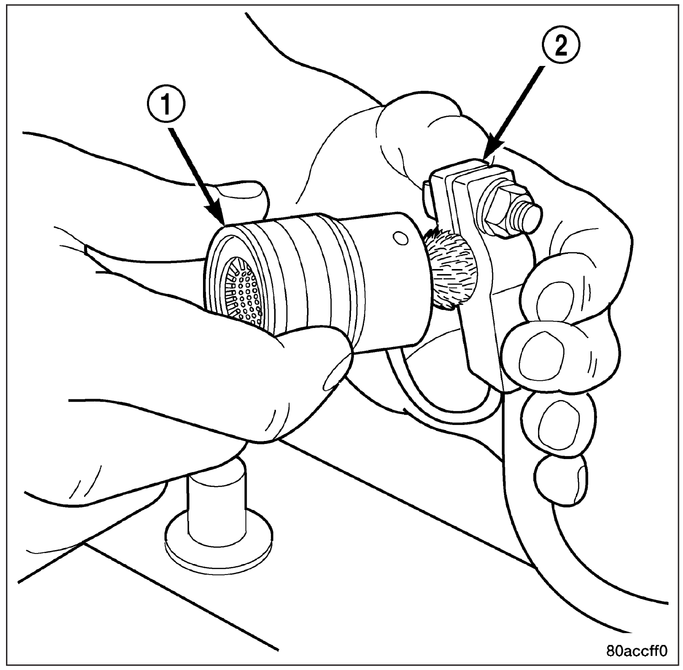
Any of the following conditions can result in abnormal battery discharging:

1. A faulty or incorrect charging system component. Refer to Charging System for additional charging system diagnosis and testing procedures.
2. A faulty or incorrect battery. Use Micro 420 battery tester and refer to Battery System for additional battery diagnosis and testing procedures.
3. A faulty circuit or component causing excessive ignition-off draw.
4. Electrical loads that exceed the output of the charging system. This can be due to equipment installed after manufacture, or repeated short trip use.
5. A faulty or incorrect starting system component. Refer to Starting System for the proper starting system diagnosis and testing procedures.
6. Corroded or loose battery posts and/or terminal clamps.
7. Slow driving speeds (heavy traffic conditions) or prolonged idling, with high-amperage draw systems in use.

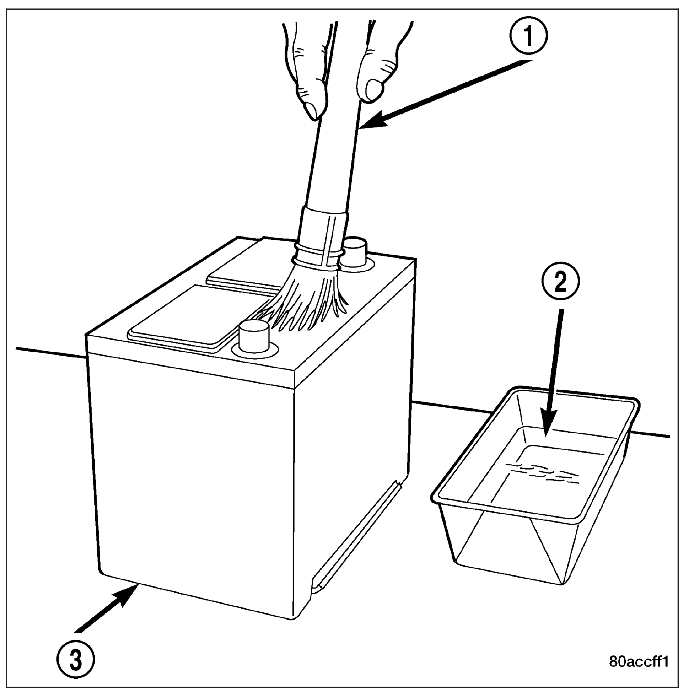
## CLEANING

The following information details the recommended cleaning procedures for the battery and related components. In addition to the maintenance schedules found in this service manual and the owner's manual, it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

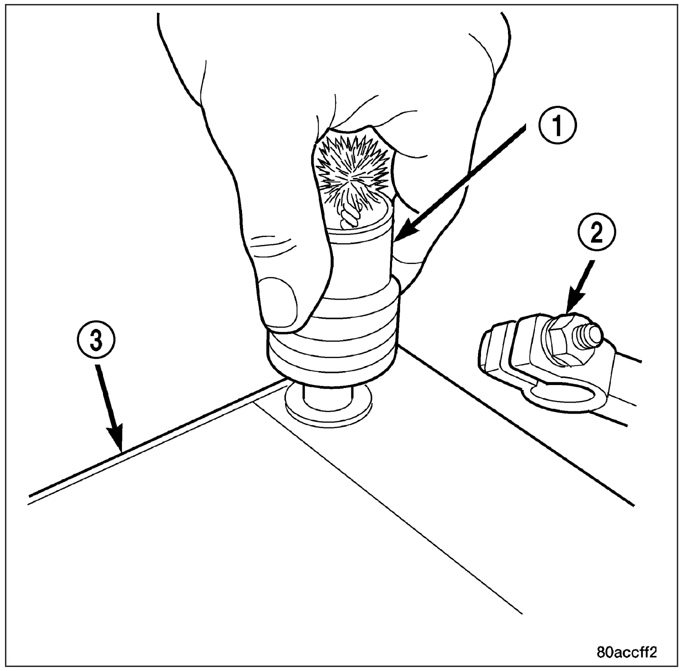
1. Clean the battery cable terminal clamps (2) of all corrosion. Remove any corrosion using a wire brush or a post and terminal cleaning tool (1), and a sodium bicarbonate (baking soda) and warm water cleaning solution.
2. Clean the battery tray and battery hold down hardware of all corrosion. Remove any corrosion using a wire brush and a sodium bicarbonate (baking soda) and warm water cleaning solution. Paint any exposed bare metal.




3. If the removed battery is to be reinstalled, clean the outside of the battery (3) case and the top cover with a sodium bicarbonate (baking soda) and warm water cleaning solution (2) using a stiff bristle parts cleaning brush (1) to remove any acid film. Rinse the battery with clean water. Ensure that the cleaning solution does not enter the battery cells through the vent holes. If the battery is being replaced, refer to Battery System Specifications for the factory-installed battery specifications. Confirm that the replacement battery is the correct size and has the correct ratings for the vehicle.
4. If the vehicle is so equipped, clean the battery thermal guard with a sodium bicarbonate (baking soda) and warm water cleaning solution using a stiff bristle parts cleaning brush to remove any acid film.



5. Clean any corrosion from the battery terminal posts with a wire brush or a post and terminal cleaner (1) , and a sodium bicarbonate (baking soda) and warm water cleaning solution.




## INSPECTION

The following information details the recommended inspection procedures for the battery and related components. In addition to the maintenance schedules found in this service manual and the Owner's Manual, it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

1. Inspect the battery cable terminal clamps for damage. Replace any battery cable that has a damaged or deformed terminal clamp.
2. Inspect the battery tray and battery holddown hardware for damage. Replace any damaged parts.
3. Slide the thermal guard off of the battery case. Inspect the battery case for cracks or other damage that could result in electrolyte leaks. Also, check the battery terminal posts for looseness. Batteries with damaged cases or loose terminal posts must be replaced.
4. Inspect the battery thermal guard for tears, cracks, deformation or other damage. Replace any battery thermal guard that has been damaged.
5. Inspect the battery built-in test indicator sight glass for an indication of the battery condition. If the battery is discharged, charge as required. Refer to Standard Procedures for the proper battery built-in indicator test procedures. Also refer to Standard Procedures for the proper battery charging procedures.

## SPECIFICATIONS

## BATTERY

The battery Group Size number, the Cold Cranking Amperage (CCA) rating, and the Reserve Capacity (RC) rating or Ampere-Hours (AH) rating can be found on the original equipment battery label. Be certain that a replacement battery has the correct Group Size number, as well as CCA, and RC or AH ratings that equal or exceed the original equipment specification for the vehicle being serviced. Battery sizes and ratings are discussed in more detail below.

- **Group Size** - The outside dimensions and terminal placement of the battery conform to standards established by the Battery Council International (BCI). Each battery is assigned a BCI Group Size number to help identify a correctly-sized replacement.
- **Cold Cranking Amperage** - The Cold Cranking Amperage (CCA) rating specifies how much current (in amperes) the battery can deliver for thirty seconds at -18° C (0° F). Terminal voltage must not fall below 7.2 volts during or after the thirty second discharge period. The CCA required is generally higher as engine displacement increases, depending also upon the starter current draw requirements.
- **Reserve Capacity** - The Reserve Capacity (RC) rating specifies the time (in minutes) it takes for battery terminal voltage to fall below 10.5 volts, at a discharge rate of 25 amperes. RC is determined with the battery

fully-charged at 26.7° C (80° F). This rating estimates how long the battery might last after a charging system failure, under minimum electrical load.

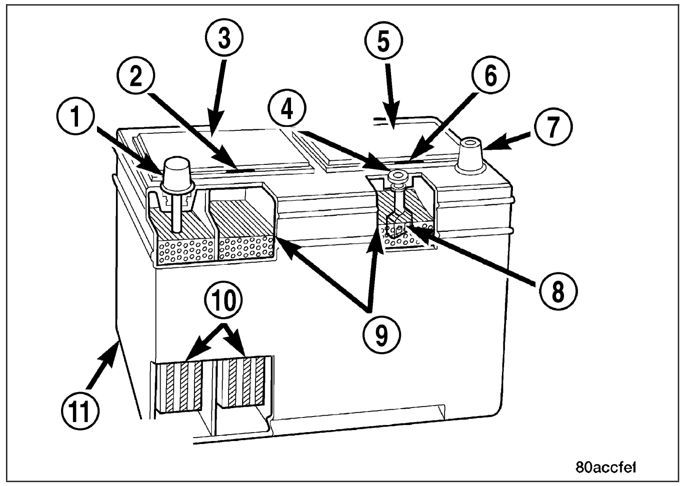
- **Ampere-Hours** - The Ampere-Hours (AH) rating specifies the current (in amperes) that a battery can deliver steadily for twenty hours, with the voltage in the battery not falling below 10.5 volts. This rating is also sometimes identified as the twenty-hour discharge rating.
- **Load Test Amperage** - The Load Test Amperage rating specifies the current (in amperes) that a battery should be tested at with the battery load test equipment. This value should always be 50 percent of the CCA. For example: the CCA for this battery is 600amps, the Load Test Amperage is 50 percent of that or 300 amps.

| BATTERY CLASSIFICATIONS & RATINGS | | | | | |
|---|---|---|---|---|---|
| Part Number | BCI Group Size Classification | Cold Cranking Amperage | Reserve Capacity | Ampere - Hours | Load Test Amperage |
| 04609365AD | 34 | 600 | 120 | 66 | 300 |

# BATTERY

## DESCRIPTION

### CONVENTIONAL BATTERY - GASOLINE ENGINES




A conventional large capacity, low-maintenance storage battery (11) is standard factory-installed equipment on models equipped with a gasoline engine. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - SPECIFICATIONS) for the proper specifications of the factory-installed batteries available on this model. Male post type terminals (1) and (7) made of a soft lead material protrude from the top of the molded plastic battery case to provide the means for connecting the battery to the vehicle electrical system. The battery positive terminal post (1) is physically larger in diameter than the negative terminal post (7) to ensure proper battery connection. The letters **POS** and **NEG** are also molded into the top of the battery case adjacent to their respective positive and negative terminal posts for identification confirmation. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - DESCRIPTION) for more information on the battery cables that connect the battery to the vehicle electrical system.

The battery is made up of six individual cells that are connected in series. Each cell contains positively charged plate groups (10) that are connected with lead straps to the positive terminal post, and negatively charged plate groups (10) that are connected with lead straps to the negative terminal post. Each plate consists of a stiff mesh framework or grid coated with lead dioxide (positive plate) or sponge lead (negative plate). Insulators or plate separators made of a non-conductive material are inserted between the positive and negative plates to prevent them from contacting or shorting against one another. These dissimilar metal plates are submerged in a sulfuric acid and water solution called an electrolyte.

### SPIRAL PLATE BATTERY - DIESEL ENGINE

**WARNING: Never exceed 14.4 volts when charging a spiral plate battery. Personal injury and/or battery damage may result.**

Vehicles equipped with a diesel engine utilize a spiral wound plate designed battery with recombination technology. This is a maintenance-free battery that is capable of delivering more power than a conventional battery. This additional power is required by a diesel engine during cold cranking.

Spiral plate technology takes the elements of traditional batteries - lead and sulfuric acid - to the next level. By tightly winding layers of spiral grids and acid-permeated vitreous separators into cells, the manufacturer has developed a battery with more power and service life than conventional batteries the same size. The spiral plate battery is completely, permanently sealed. Through gas recombination, hydrogen and oxygen within the battery are captured during normal charging and reunited to form the water within the electrolyte, eliminating the need to add distilled water. Therefore, these batteries have non-removable battery vent caps. Water **cannot** be added to this battery.

The acid inside an spiral plate battery is bound within the vitreous separators, ending the threat of acid leaks. This feature allows the battery to be installed in any position anywhere in the vehicle.

Spiral plate technology is the process by which the plates holding the active material in the battery are wound tightly in coils instead of hanging flat, like conventional batteries. This design has a lower internal resistance and also increases the active material surface area.

Due to the maintenance-free design, distilled water cannot be added to this battery. Therefore, if more than 14.4 volts are used during the spiral plate battery charging process, water vapor can be exhausted through the pressure-sensitive battery vents and lost for good. This can permanently damage the spiral plate battery. Never exceed 14.4 volts when charging a spiral plate battery. Personal injury and/or battery damage may result.

Batteries are used to store electrical energy potential in a chemical form. When an electrical load is applied to the battery terminals, an electrochemical reaction occurs within the battery. This reaction causes the battery to discharge electrical current.

## OPERATION

The battery is designed to store electrical energy in a chemical form. When an electrical load is applied to the terminals of the battery, an electrochemical reaction occurs. This reaction causes the battery to discharge electrical current from its terminals. As the battery discharges, a gradual chemical change takes place within each cell. The sulfuric acid in the electrolyte combines with the plate materials, causing both plates to slowly change to lead sulfate. At the same time, oxygen from the positive plate material combines with hydrogen from the sulfuric acid, causing the electrolyte to become mainly water. The chemical changes within the battery are caused by the movement of excess or free electrons between the positive and negative plate groups. This movement of electrons produces a flow of electrical current through the load device attached to the battery terminals.

As the plate materials become more similar chemically, and the electrolyte becomes less acid, the voltage potential of each cell is reduced. However, by charging the battery with a voltage higher than that of the battery itself, the battery discharging process is reversed. Charging the battery gradually changes the sulfated lead plates back into sponge lead and lead dioxide, and the water back into sulfuric acid. This action restores the difference in the electron charges deposited on the plates, and the voltage potential of the battery cells. For a battery to remain useful, it must be able to produce high-amperage current over an extended period. A battery must also be able to accept a charge, so that its voltage potential may be restored.

The battery is vented to release excess hydrogen gas that is created when the battery is being charged or discharged. However, even with these vents, hydrogen gas can collect in or around the battery. If hydrogen gas is exposed to flame or sparks, it may ignite. If the electrolyte level is low, the battery may arc internally and explode. If the battery is equipped with removable cell caps, add distilled water whenever the electrolyte level is below the top of the plates. If the battery cell caps cannot be removed, the battery must be replaced if the electrolyte level becomes low.

## DIAGNOSIS AND TESTING

## BATTERY

The battery must be completely charged and the top, posts and terminal clamps should be properly cleaned and inspected before diagnostic procedures are performed. Refer to Battery System Cleaning for the proper cleaning procedures, and Battery System Inspection for the proper battery inspection procedures. Refer to Standard Procedures for the proper battery charging procedures.

**WARNING: If the battery shows signs of freezing, leaking or loose posts, do not test, assist-boost, or charge. The battery may arc internally and explode. Personal injury and/or vehicle damage may result.**

**WARNING: Explosive hydrogen gas forms in and around the battery. Do not smoke, use flame, or create sparks near the battery. Personal injury and/or vehicle damage may result.**

**WARNING: The battery contains sulfuric acid, which is poisonous and caustic. Avoid contact with the skin, eyes, or clothing. In the event of contact, flush with water and call a physician immediately. Keep out of the reach of children.**

**WARNING: If the battery is equipped with removable cell caps, be certain that each of the cell caps are in place and tight before the battery is returned to service. Personal injury and/or vehicle damage may result from loose or missing cell caps.**

The condition of a battery is determined by two criteria:

1. **State-Of-Charge** - This can be determined by checking the battery voltage (open-circuit voltage test).
2. **Cranking Capacity** - This can be determined by performing a battery load test, which measures the ability of the battery to supply high-amperage current.

First, determine the battery state-of-charge using the Micro 420 battery tester. Perform the open-circuit voltage test to determine the state-of-charge. Refer to open-circuit voltage test in the Standard Procedures section of this group.

Second, determine the battery cranking capacity by performing a load test. The battery must be charged before proceeding with a load test if:

- Micro 420 tester indicates battery charging is required.
- The battery open-circuit voltage is less than 12.4 volts.

A battery that will not accept a charge is faulty, and must be replaced. Further testing is not required. A fully-charged battery must be load tested to determine its cranking capacity. A battery that is fully-charged, but does not pass the load test, is faulty and must be replaced.

**NOTE: Completely discharged batteries may take several hours to accept a charge. Refer to Standard Procedures for the proper battery charging procedures.**

A battery is fully-charged when:

- Micro 420 tester indicates battery is OK.
- Open-circuit voltage of the battery is 12.4 volts or greater.

## STANDARD PROCEDURE

## CONVENTIONAL BATTERY CHARGING

**CAUTION: Vehicles equipped with a diesel engine utilize a unique spiral plate battery. This battery has a maximum charging voltage that must be used in order to restore the battery to its full potential, failure to use the spiral plate battery charging procedure could result in damage to the battery or personal injury. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE - SPIRAL PLATE BATTERY CHARGING) for the appropriate procedure.**

Battery charging can be performed fast or slow, it terms of time. **Slow** battery charging is the best means of restoring a battery to full potential. Fast battery charging should only be performed when absolutely necessary due to time restraints. A battery is fully-charged when:

- Micro 420 tester indicates the battery is OK.
- Open-circuit voltage of the battery is 12.65 volts or above.

**WARNING: Never exceed twenty amperes when charging a cold (-1° c [30° f] or lower) battery. The battery may arc internally and explode. Personal injury and/or vehicle damage may result.**

**CAUTION: Always disconnect and isolate the battery negative cable before charging a battery. Do not exceed sixteen volts while charging a battery. Damage to the vehicle electrical system components may result.**

**CAUTION: Battery electrolyte will bubble inside the battery case during normal battery charging. Electrolyte boiling or being discharged from the battery vents indicates a battery overcharging condition. Immediately reduce the charging rate or turn off the charger to evaluate the battery condition. Damage to the battery may result from overcharging.**

**CAUTION: The battery should not be hot to the touch. If the battery feels hot to the touch, turn off the charger and let the battery cool before continuing the charging operation. Damage to the battery may result.**

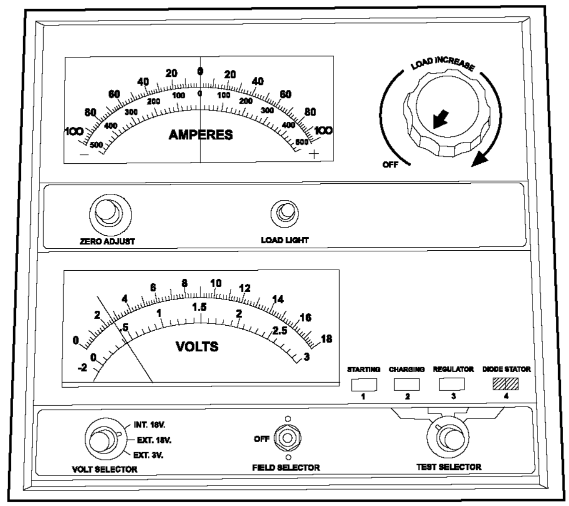
Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the battery charger and the battery from being damaged if they are improperly connected. If the battery state-of-charge is too low for the polarity-sensing circuitry to detect, the battery charger will not operate. This makes it appear that the battery will not accept charging current. See the instructions provided by the manufacturer of the battery charger for details on how to bypass the polarity-sensing circuitry.

After the battery has been charged to 12.4 volts or greater, perform a load test to determine the battery cranking capacity. Refer to Standard Procedures for the proper battery load test procedures. If the battery will endure a load test, return the battery to service. If the battery will not endure a load test, it is faulty and must be replaced.

Clean and inspect the battery hold downs, tray, terminals, posts, and top before completing battery service. Refer to Battery System Cleaning for the proper battery system cleaning procedures, and Battery System Inspection for the proper battery system inspection procedures.

## CHARGING A COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless this procedure is properly followed, a good battery may be needlessly replaced.



80863de9

1. Measure the voltage at the battery posts with a voltmeter, accurate to 1/10 (0.10) volt. If the reading is below ten volts, the battery charging current will be low. It could take some time before the battery accepts a current greater than a few milliamperes. Such low current may not be detectable on the ammeters built into many battery chargers.
2. Disconnect and isolate the battery negative cable. Connect the battery charger leads. Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the battery charger and the battery from being damaged if they are improperly connected. If the battery state-of-charge is too low for the polarity-sensing circuitry to detect, the battery charger will not operate. This makes it appear that the battery will not accept charging current. See the instructions provided by the manufacturer of the battery charger for details on how to bypass the polarity-sensing circuitry.
3. Battery chargers vary in the amount of voltage and current they provide. The amount of time required for a battery to accept measurable charging current at various voltages is shown in the Charge Rate Table. If the charging current is still not measurable at the end of the charging time, the battery is faulty and must be replaced. If the charging current is measurable during the charging time, the battery may be good and the charging should be completed in the normal manner.

**CHARGE RATE TABLE**

| Voltage | Hours |
|---|---|
| 16.0 volts maximum | up to 4 hours |
| 14.0 to 15.9 volts | up to 8 hours |
| 13.9 volts or less | up to 16 hours |

## CHARGING TIME REQUIRED

The time required to charge a battery will vary, depending upon the following factors:

- **Battery Capacity** - A completely discharged heavy-duty battery requires twice the charging time of a small capacity battery.
- **Temperature** - A longer time will be needed to charge a battery at -18° C (0° F) than at 27° C (80° F). When a fast battery charger is connected to a cold battery, the current accepted by the battery will be very low at first. As the battery warms, it will accept a higher charging current rate (amperage).
- **Charger Capacity** - A battery charger that supplies only five amperes will require a longer charging time. A battery charger that supplies twenty amperes or more will require a shorter charging time.
- **State-Of-Charge** - A completely discharged battery requires more charging time than a partially discharged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current (amperage) will be low. As the battery charges, the specific gravity of the electrolyte will gradually rise.

The Battery Charging Time Table gives an indication of the time required to charge a typical battery at room temperature based upon the battery state-of-charge and the charger capacity.

**BATTERY CHARGING TIME TABLE**

| Charging Amperage | 5 Amps | 10 Amps | 20 Amps |
|---|---|---|---|
| Open Circuit Voltage | Hours Charging @ 21° C (70° F) | | |
| 12.25 to 12.49 | 6 hours | 3 hours | 1.5 hours |
| 12.00 to 12.24 | 10 hours | 5 hours | 2.5 hours |
| 10.00 to 11.99 | 14 hours | 7 hours | 3.5 hours |
| Below 10.00 | 18 hours | 9 hours | 4.5 hours |

## SPIRAL PLATE BATTERY CHARGING

Vehicles equipped with a diesel engine utilize a unique spiral plate battery. This battery has a maximum charging voltage that must not be exceeded in order to restore the battery to its full potential, failure to use the following spiral plate battery charging procedure could result in damage to the battery or personal injury.

Battery charging is the means by which the battery can be restored to its full voltage potential. A battery is fully-charged when:

- Micro 420 battery tester indicates battery is OK.
- Open-circuit voltage of the battery is 12.65 volts or above.
- Battery passes Load Test multiple times.

**WARNING: If the battery shows signs of freezing, leaking, loose posts or low electrolyte level, do not test, assist-boost, or charge. The battery may arc internally and explode. Personal injury and/or vehicle damage may result.**

**WARNING: Explosive hydrogen gas forms in and around the battery. Do not smoke, use flame, or create sparks near the battery. Personal injury and/or vehicle damage may result.**

**WARNING: The battery contains sulfuric acid, which is poisonous and caustic. Avoid contact with the skin, eyes, or clothing. In the event of contact, flush with water and call a physician immediately. Keep out of the reach of children.**

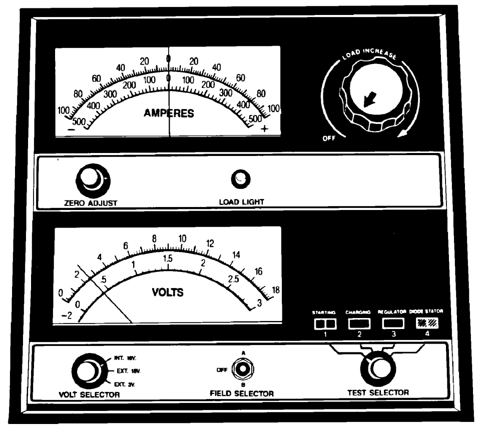
**CAUTION: Always disconnect and isolate the battery negative cable before charging a battery. Charge the battery directly at the battery terminals. Do not exceed 14.4 volts while charging a battery.**

**CAUTION: The battery should not be hot to the touch. If the battery feels hot to the touch, turn off the charger and let the battery cool before continuing the charging operation. Damage to the battery may result.**

After the battery has been charged to 12.6 volts or greater, perform a load test to determine the battery cranking capacity. Refer to Battery Diagnosis and Testing for the proper battery test procedures. If the battery will endure a load test, return the battery to service. If the battery will not pass a load test, it is faulty and must be replaced.

Clean and inspect the battery hold downs, tray, terminals, posts, and top before completing battery service. Refer to Battery System Cleaning for the proper battery system cleaning procedures, and Battery System Inspection for the proper battery system inspection procedures.

## CHARGING A COMPLETELY DISCHARGED BATTERY – SPIRAL PLATE BATTERY



898A-12

The following procedure should be used to recharge a completely discharged battery. Unless this procedure is properly followed, a good battery may be needlessly replaced.

1. Measure the voltage at the battery posts with a voltmeter, accurate to 1/10 (0.10) volt. Refer to Battery Removal and Installation for access instructions. If the reading is below ten volts, the battery charging current will be low. It could take several hours before the battery accepts a current greater than a few milliamperes. Such low current may not be detectable on the ammeters built into many battery chargers.
2. Disconnect and isolate the battery negative cable. Connect the battery charger leads. Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the battery charger and the battery from being damaged if they are improperly connected. If the battery state-of-charge is too low for the polarity-sensing circuitry to detect, the battery charger will not operate. This makes it appear that the battery will not accept charging current. See the instructions provided by the manufacturer of the battery charger for details on how to bypass the polarity-sensing circuitry.
3. Battery chargers vary in the amount of voltage and current they provide. The amount of time required for a battery to accept measurable charging current at various voltages is shown in the Charge Rate Table. If the charging current is still not measurable at the end of the charging time, the battery is faulty and must be replaced. If the charging current is measurable during the charging time, the battery may be good and the charging should be completed in the normal manner.

**SPIRAL-PLATE BATTERY CHARGE RATE TABLE**

| Voltage | Minutes |
|---|---|
| 14.4 volts maximum | up to 10 minutes |
| 13.0 to 14 volts | up to 20 minutes |
| 12.9 volts or less | up to 30 minutes |

## CHARGING TIME REQUIRED

The time required to charge a battery will vary, depending upon the following factors:

- **Battery Capacity** - A completely discharged heavy-duty battery requires twice the charging time of a small capacity battery.
- **Temperature -** A longer time will be needed to charge a battery at -18° C (0° F) than at 27° C (80° F). When a fast battery charger is connected to a cold battery, the current accepted by the battery will be very low at first. As the battery warms, it will accept a higher charging current rate (amperage).
- **Charger Capacity** - A battery charger that supplies only five amperes will require a longer charging time. A battery charger that supplies eight amperes will require a shorter charging time.
- **State-Of-Charge** - A completely discharged battery requires more charging time than a partially discharged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current (amperage) will be low. As the battery charges, the specific gravity of the electrolyte will gradually rise.

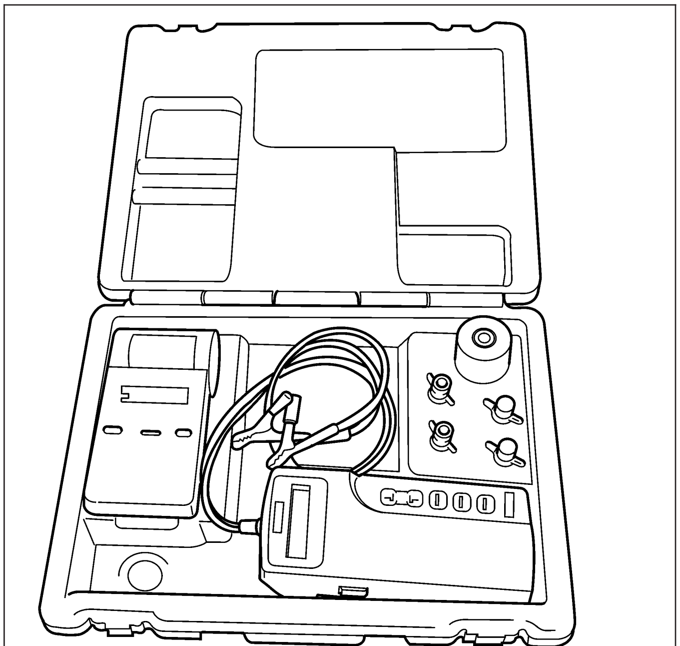
The Battery Charging Time Table gives an indication of the time required to charge a typical battery at room temperature based upon the battery state-of-charge and the charger capacity.

**SPIRAL-PLATE BATTERY CHARGING TIME TABLE**

| Charging Amperage | 5 Amps | 8 Amps |
|---|---|---|
| Open Circuit Voltage | Hours Charging @ 21° C (70° F) | |
| 12.25 to 12.49 | 6 hours | 3 hours |
| 12.00 to 12.24 | 10 hours | 5 hours |
| 10.00 to 11.99 | 14 hours | 7 hours |
| Below 10.00 | 18 hours | 9 hours |

## USING MICRO 420 BATTERY TESTER

Always use the Micro 420 instruction manual that was supplied with the tester as a reference. If the Instruction Manual is not available the following procedure can be used:


80c91c8d

**WARNING: Always wear appropriate eye protection and use extreme caution when working with batteries.**

## BATTERY TESTING

1. If testing the battery OUT-OF-VEHICLE, clean the battery terminals with a wire brush before testing. If the battery is equipped with side post terminals, install and tighten the supplied lead terminal stud adapters. Do not use steel bolts. Failure to properly install the stud adapters, or using stud adapters that are dirty or worn-out may result in false test readings.
2. If testing the battery IN-THE-VEHICLE, make certain all of the vehicle accessory loads are OFF, including the ignition. **The preferred test position is at the battery terminal**. If the battery is not accessible, you may test using both the positive and negative jumper posts. Select TESTING AT JUMPER POST when connecting to that location.
3. Connect the tester to the battery or jumper posts, the red clamp to positive (+) and the black clamp to negative (–).
4. Using the ARROW key select **in** or **out** of vehicle testing and press ENTER to make a selection.
5. If not selected, choose the Cold Cranking Amp (CCA) battery rating. Or select the appropriate battery rating for your area (see menu). The tester will then run its self programmed test of the battery and display the results. Refer to the test result table noted below.

**CAUTION: If REPLACE BATTERY is the result of the test, this may mean a poor connection between the vehicle's cables and battery exists. After disconnecting the vehicle's battery cables from the battery, retest the battery using the OUT-OF-VEHICLE test before replacing.**

6. While viewing the battery test result, press the CODE button and the tester will prompt you for the last 4 digits of the VIN. Use the UP/DOWN arrow buttons to scroll to the correct character; then press ENTER to select and move to the next digit. Then press the ENTER button to view the SERVICE CODE. Pressing the CODE button a second time will return you to the test results.

| BATTERY TEST RESULTS | |
|---|---|
| GOOD BATTERY | Return to service |
| GOOD - RECHARGE | Fully charge battery and return to service |
| CHARGE & RETEST | Fully charge battery and retest battery |
| REPLACE BATTERY | Replace the battery and retest complete system |
| BAD-CELL REPLACE | Replace the battery and retest complete system |

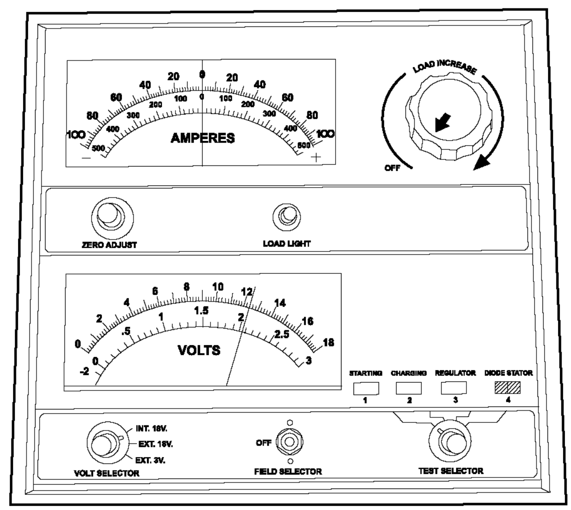
**NOTE: The SERVICE CODE is required on every warranty claim submitted for battery replacement.**

## OPEN-CIRCUIT VOLTAGE TEST

A battery open-circuit voltage (no load) test will show the approximate state-of-charge of a battery.

Before proceeding with this test, completely charge the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE).

1. Before measuring the open-circuit voltage, the surface charge must be removed from the battery. Turn on the headlamps for fifteen seconds, then allow up to five minutes for the battery voltage to stabilize.
2. Disconnect and isolate both battery cables, negative cable first.
3. Using a voltmeter connected to the battery posts (see the instructions provided by the manufacturer of the voltmeter), measure the open-circuit voltage.



80863dd0

See the Open-Circuit Voltage Table. This voltage reading will indicate the battery state-of-charge, but will not reveal its cranking capacity. If a battery has an open-circuit voltage reading of 12.4 volts or greater, it may be tested to reveal its cranking capacity (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE).

| OPEN CIRCUIT VOLTAGE TABLE | |
|---|---|
| Open Circuit Voltage | Charge Percentage |
| 11.7 volts or less | 0% |
| 12.0 volts | 25% |
| 12.2 volts | 50% |
| 12.4 volts | 75% |
| 12.6 volts or more | 100% |

## IGNITION-OFF DRAW TEST

The term Ignition-Off Draw (IOD) identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. A normal vehicle electrical system will draw from five to thirty-five milliamperes (0.005 to 0.035 ampere) with the ignition switch in the Off position, and all non-ignition controlled circuits in proper working order. Up to thirty-five milliamperes are needed to enable the memory functions for the Powertrain Control Module (PCM), digital clock, electronically tuned radio, and other modules which may vary with the vehicle equipment.

A vehicle that has not been operated for approximately twenty days, may discharge the battery to an inadequate level. When a vehicle will not be used for twenty days or more (stored), remove the IOD fuse from the Power Distribution Center (PDC). This will reduce battery discharging.

Excessive IOD can be caused by:

- Electrical items left on.
- Faulty or improperly adjusted switches.
- Faulty or shorted electronic modules and components.
- An internally shorted generator.
- Intermittent shorts in the wiring.

If the IOD is over thirty-five milliamperes, the problem must be found and corrected before replacing a battery. In most cases, the battery can be charged and returned to service after the excessive IOD condition has been corrected.

1. Verify that all electrical accessories are off. Turn off all lamps, remove the ignition key, and close all doors. If the vehicle is equipped with an illuminated entry system or an electronically tuned radio, allow the electronic timer function of these systems to automatically shut off (time out). This may take up to three minutes. See the Electronic Module Ignition-Off Draw Table for more information.

| ELECTRONIC MODULE IGNITION-OFF DRAW (IOD) TABLE | | | |
|---|---|---|---|
| Module | Time Out? (If Yes, Interval And Wake-Up Input) | IOD | IOD After Time Out |
| Radio | No | 1 to 3 milliamperes | N/A |
| Audio Power Amplifier | No | up to 1 milliampere | N/A |
| Body Control Module (BCM) | No | 4.75 milliamperes (max.) | N/A |
| Powertrain Control Module (PCM) | No | 0.95 milliampere | N/A |
| ElectroMechanical Instrument Cluster (EMIC) | No | 0.44 milliampere | N/A |
| Combination Flasher | No | 0.08 milliampere | N/A |
| Automatic Transmission Controller (EATX) | Yes, 20 minutes | 120 milliampere | 0.70 ma |

2. Determine that the underhood lamp is operating properly, then disconnect the lamp wire harness connector or remove the lamp bulb.
3. Disconnect the battery negative cable.
4. Set an electronic digital multi-meter to its highest amperage scale. Connect the multi-meter between the disconnected battery negative cable terminal clamp and the battery negative terminal post. Make sure that the doors remain closed so that the illuminated entry system is not activated. The multi-meter amperage reading may remain high for up to three minutes, or may not give any reading at all while set in the highest amperage scale, depending upon the electrical equipment in the vehicle. The multi-meter leads must be securely clamped to the battery negative cable terminal clamp and the battery negative terminal post. If continuity between the battery negative terminal post and the negative cable terminal clamp is lost during any part of the IOD test, the electronic timer function will be activated and all of the tests will have to be repeated.
5. After about three minutes, the high-amperage IOD reading on the multi-meter should become very low or nonexistent, depending upon the electrical equipment in the vehicle. If the amperage reading remains high, remove and replace each fuse or circuit breaker in the Power Distribution Center (PDC) and then in the Junction Block (JB), one at a time until the amperage reading becomes very low, or nonexistent. Refer to the appropriate wiring information in this service manual for complete PDC and JB fuse, circuit breaker, and circuit identification. This will isolate each circuit and identify the circuit that is the source of the high-amperage IOD. If the amperage

reading remains high after removing and replacing each fuse and circuit breaker, disconnect the wire harness from the generator. If the amperage reading now becomes very low or nonexistent, refer to Charging System for the proper charging system diagnosis and testing procedures. After the high-amperage IOD has been corrected, switch the multi-meter to progressively lower amperage scales and, if necessary, repeat the fuse and circuit breaker remove-and-replace process to identify and correct all sources of excessive IOD. It is now safe to select the lowest milliampere scale of the multi-meter to check the low-amperage IOD.

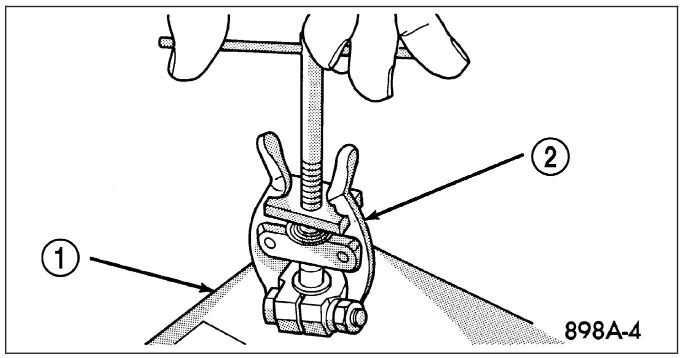
**CAUTION: Do not open any doors, or turn on any electrical accessories with the lowest milliampere scale selected, or the multi-meter may be damaged.**

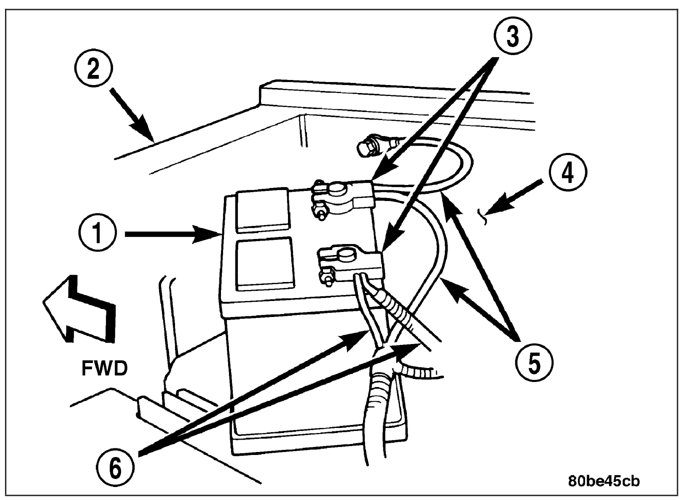
6. Observe the multi-meter reading. The low-amperage IOD should not exceed thirty-five milliamperes (0.035 ampere). If the current draw exceeds thirty-five milliamperes, isolate each circuit using the fuse and circuit breaker remove-and-replace process in Step 5. The multi-meter reading will drop to within the acceptable limit when the source of the excessive current draw is disconnected. Repair this circuit as required; whether a wiring short, incorrect switch adjustment, or a component failure is at fault.

## REMOVAL

**WARNING: Wear a suitable pair of rubber gloves (not the household type) when removing a battery by hand. Safety glasses should also be worn. If the battery is cracked or leaking, the electrolyte can burn the skin and eyes.**

**NOTE: The use of a battery terminal puller (2) may be necessary if the cable clamps will not separate from the battery posts.**

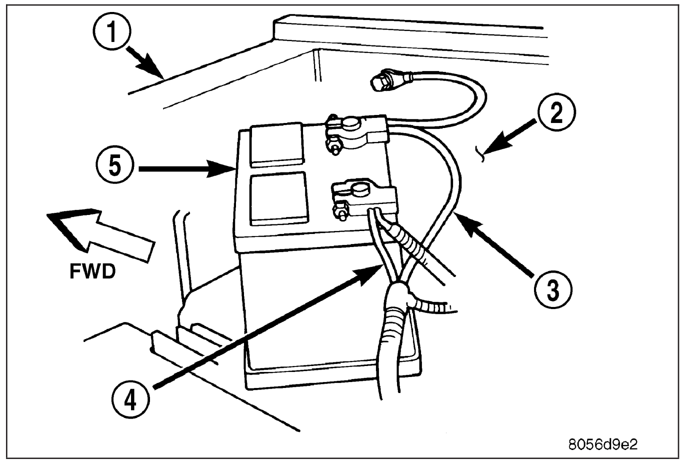



1. Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.
2. Loosen the battery negative cable (5) terminal clamp pinch-bolt hex nut.
3. Disconnect the battery negative cable (5) terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.
4. Loosen the battery positive cable (6) terminal clamp pinch-bolt hex nut.
5. Disconnect the battery positive cable (6) terminal clamp from the battery positive terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.
6. Remove the battery holddowns from the battery, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY HOLDDOWN - REMOVAL) for the proper battery holddown removal procedures.
7. Remove the battery and the battery thermal guard (if equipped) from the battery tray as a unit.
8. If equipped, remove the battery thermal guard from the battery case.

## INSTALLATION

1. Clean and inspect all of the battery system components. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING) and (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - INSPECTION) for the proper procedures.
2. If equipped, install the battery thermal guard onto the battery case (5).
3. Position the battery (5) onto the battery trayt. Ensure that the battery positive and negative terminal posts are correctly positioned. The battery cable terminal clamps must reach the correct battery terminal post without stretching the cables.
4. Reinstall the battery holddowns onto the battery, (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY HOLDDOWN - INSTALLATION) for the proper installation procedure.




**CAUTION: Be certain that the battery cable terminal clamps are connected to the correct battery terminal posts. Reversed battery polarity may damage electrical components of the vehicle.**

5. Clean the battery cable terminal clamps and the battery terminal posts. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING) for cleaning procedure.
6. Reconnect the battery positive cable (4) terminal clamp to the battery positive terminal post. Tighten the terminal clamp pinch-bolt hex nut to 8.5 N·m (75 in. lbs.).
7. Reconnect the battery negative cable (3) terminal clamp to the battery negative terminal post. Tighten the terminal clamp pinch-bolt hex nut to 8.5 N·m (75 in. lbs.).
8. Apply a thin coating of petroleum jelly or chassis grease to the exposed surfaces of the battery cable terminal clamps and the battery terminal posts.
9. Obtain an appropriate scan tool and check the PCM for any stored battery disconnect trouble codes. Clear codes if required.

# BATTERY HOLDDOWN

## DESCRIPTION

The battery holddown hardware includes a plastic holddown bracket and retaining bolt. The battery holddown bracket meshes with the battery tray to secure the battery to the battery tray.

When installing a battery into the battery tray, it is important that the holddown hardware is properly installed and that the fastener is tightened to the proper specifications. Improper holddown fastener tightness, whether too loose or too tight, can result in damage to the battery, the vehicle, or both. Refer to Battery Holddown for the proper installation procedure, including the proper holddown fastener torque specifications.

## OPERATION

The battery holddown secures the battery in the battery tray. This holddown is designed to prevent battery movement during the most extreme vehicle operation conditions. Periodic removal and lubrication of the battery holddown hardware is recommended to prevent hardware seizure at a later date.

**CAUTION: Never operate a vehicle without a battery holddown device properly installed. Damage to the vehicle, components and battery could result.**

## REMOVAL

1. Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.
2. Loosen the battery negative cable terminal clamp pinch-bolt hex nut.
3. Disconnect the battery negative cable terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.
4. Remove the battery hold down bracket retaining bolt from the threaded insert in the battery tray assembly.

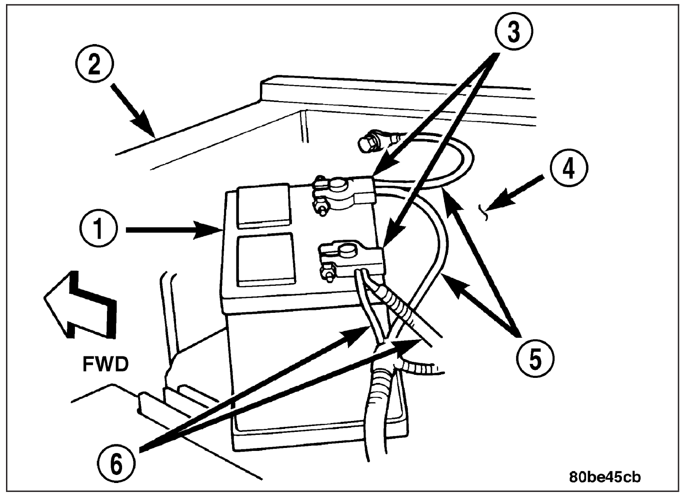
## INSTALLATION

1. Clean and inspect the battery hold down hardware. Refer to Battery Cleaning for the proper battery system component cleaning procedures, and Battery Inspection for the proper battery system component inspection procedures.
2. Position the battery hold down bracket onto the battery tray.
3. Install and tighten the battery hold down bracket retaining bolt. Tighten the bolt to 4 N·m (35 in. lbs.).
4. Reconnect the battery negative cable terminal clamp to the battery negative terminal post. Tighten the terminal clamp pinch-bolt hex nut to 8.4 N·m (75 in. lbs.).

# BATTERY CABLES

## DESCRIPTION

The battery cables (5) and (6) are large gauge, stranded copper wires sheathed within a heavy plastic or synthetic rubber insulating jacket. The wire used in the battery cables combines excellent flexibility and reliability with high electrical current carrying capacity. The battery cables feature a clamping type female battery terminal (3) made of soft lead that is die cast onto one end of the battery cable wire. A square headed pinch-bolt and hex nut are installed at the open end of the female battery terminal clamp. Large eyelet type terminals are crimped onto the opposite end of the battery cable wire and then solder-dipped. The battery positive cable wires have a red insulating jacket to provide visual identification and feature a larger female battery terminal clamp to allow connection to the larger battery positive terminal post. The battery negative cable wires have a black insulating jacket and a smaller female battery terminal clamp.




The battery cables cannot be repaired and, if damaged or faulty they must be replaced. Both the battery positive and negative cables are available for service replacement only as a unit with the battery wire harness, which may include portions of the wiring circuits for the generator and other components on some models. Refer to the appropriate wiring information in this service manual for the location of the proper battery cable wire harness diagrams. The wiring information also includes proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

## OPERATION

The battery cables connect the battery terminal posts to the vehicle electrical system. These cables also provide a path back to the battery for electrical current generated by the charging system for restoring the voltage potential of the battery. The female battery terminal clamps on the ends of the battery cable wires provide a strong and reliable connection of the battery cable to the battery terminal posts. The terminal pinch bolts allow the female terminal clamps to be tightened around the male terminal posts on the top of the battery. The eyelet terminals secured to the opposite ends of the battery cable wires from the female battery terminal clamps provide secure and reliable connection of the battery cables to the vehicle electrical system.

The battery positive cable terminal clamp is die cast onto the ends of two wires. One wire has an eyelet terminal that connects the battery positive cable to the B(+) terminal studs of the Power Distribution Center (PDC), and the other wire has an eyelet terminal that connects the battery positive cable to the B(+) terminal stud of the engine starter motor solenoid. The battery negative cable terminal clamp is also die cast onto the ends of two wires. One wire has an eyelet terminal that connects the battery negative cable to the vehicle powertrain through a stud on the left side of the engine cylinder block. The other wire has an eyelet terminal that connects the battery negative cable to the vehicle body through a ground stud on the left wheel house, near the battery.

## DIAGNOSIS AND TESTING

## BATTERY CABLES

A voltage drop test will determine if there is excessive resistance in the battery cable terminal connections or the battery cable. If excessive resistance is found in the battery cable connections, the connection point should be disassembled, cleaned of all corrosion or foreign material, then reassembled. Following reassembly, check the voltage drop for the battery cable connection and the battery cable again to confirm repair.

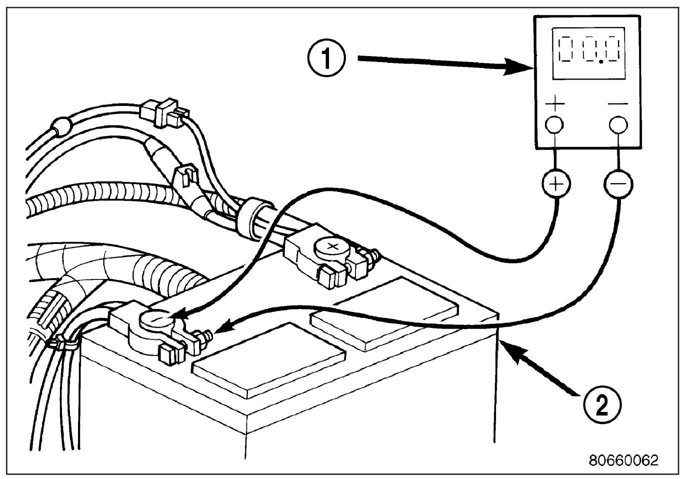
When performing the voltage drop test, it is important to remember that the voltage drop is giving an indication of the resistance between the two points at which the voltmeter probes are attached. **EXAMPLE:** When testing the resistance of the battery positive cable, touch the voltmeter leads to the battery positive cable terminal clamp and to the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud. If you probe the battery positive terminal post and the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud, you are reading the combined voltage drop in the battery positive cable terminal clamp-to-terminal post connection and the battery positive cable.

## VOLTAGE DROP TEST

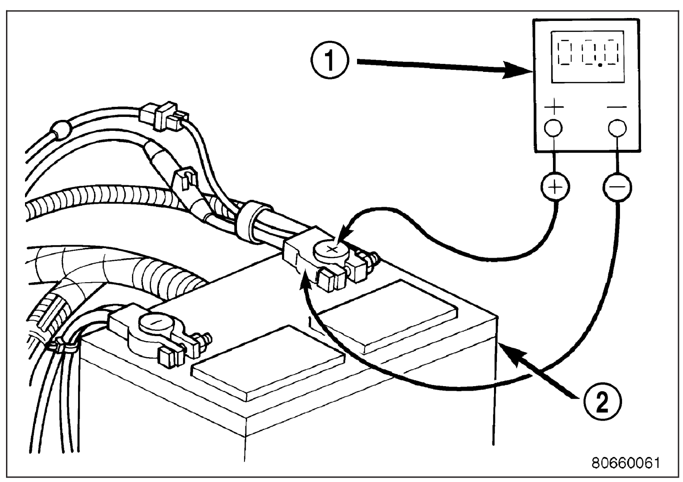
The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing this test, be certain that the following procedures are accomplished:

- The battery is fully-charged and load tested. Refer to Standard Procedures for the proper battery charging and load test procedures.
- Fully engage the parking brake.
- If the vehicle is equipped with an automatic transmission, place the gearshift selector lever in the Park position. If the vehicle is equipped with a manual transmission, place the gearshift selector lever in the Neutral position and block the clutch pedal in the fully depressed position.
- Verify that all lamps and accessories are turned off.
- To prevent the engine from starting, remove the Automatic Shut Down (ASD) relay. The ASD relay is located in the Power Distribution Center (PDC), in the engine compartment. See the fuse and relay layout label affixed to the underside of the PDC cover for ASD relay identification and location.

1. Connect the positive lead of the voltmeter (1) to the battery (2) negative terminal post. Connect the negative lead of the voltmeter (1) to the battery (2) negative cable terminal clamp. Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery negative cable terminal clamp and the battery negative terminal post.

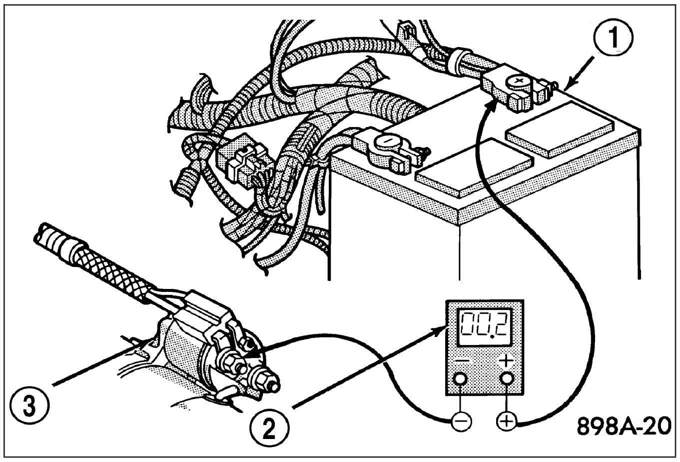



2. Connect the positive lead of the voltmeter (1) to the battery (2) positive terminal post. Connect the negative lead of the voltmeter (1) to the battery (2) positive cable terminal clamp. Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor

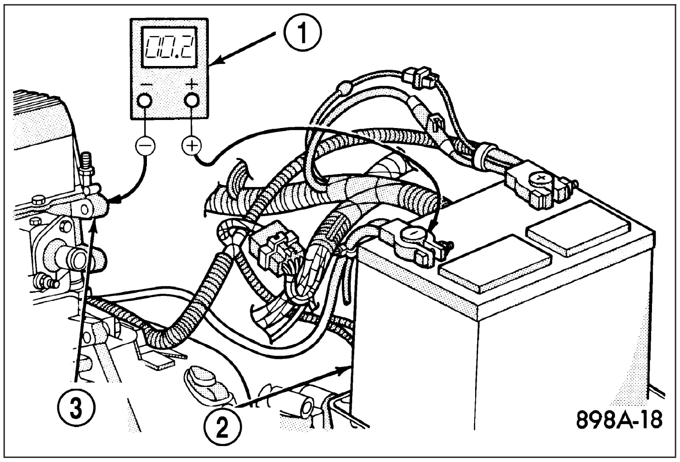


connection between the battery positive cable terminal clamp and the battery positive terminal post.

3. Connect the voltmeter (2) to measure between the battery positive cable terminal clamp (1) and the starter solenoid B(+) terminal stud (3). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery positive cable eyelet terminal connection at the starter solenoid B(+) terminal stud. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.




4. Connect the voltmeter (1) to measure between the battery (2) negative cable terminal clamp and a good clean ground on the engine block (3). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery negative cable eyelet terminal connection to the engine block. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery negative cable.




## REMOVAL

The battery cables on this model may include portions of wiring circuits for the generator and other components on the vehicle. If battery cable replacement is required, it will be necessary to extract the cables out of the engine wire harness assembly. Use care not to damage the other wires and circuits which are also packaged into the engine wire harness assembly.

1. Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.
2. Disconnect and isolate the negative battery cable terminal.
3. Remove the tape from the engine wire harness assembly, to access the desired battery cable.
4. One at a time, trace and disconnect the battery cable retaining fasteners and routing clips until the desired cable is free from the vehicle.
5. Feed the battery cable out of the vehicle.

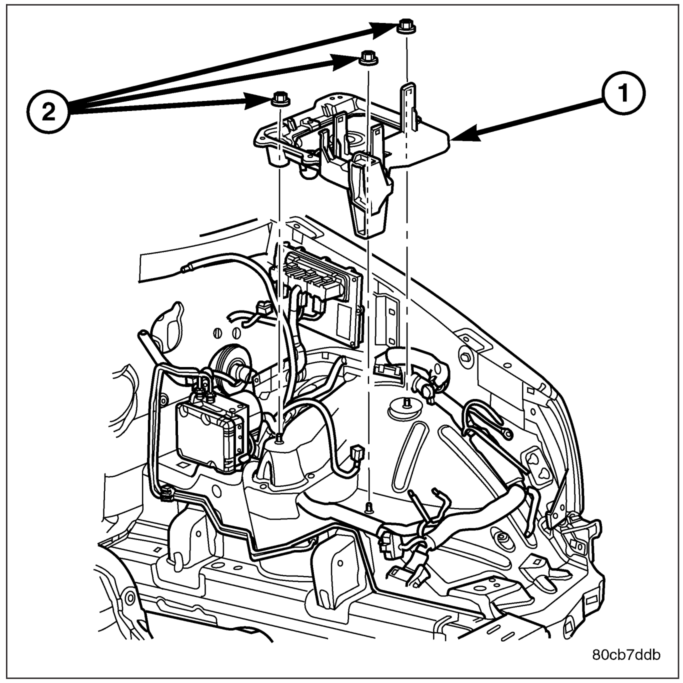
## INSTALLATION

1. Position the battery cable in the vehicle.
2. One at a time, trace and install the battery cable retaining fasteners and routing clips until the desired cable is properly installed in the engine wire harness assembly.
3. Install the tape on the engine wire harness assembly.
4. Connect the negative battery cable terminal.

# BATTERY TRAY

## DESCRIPTION

The battery is placed in a molded plastic tray (1) located in the left front corner of the engine compartment. The battery hold down hardware is contained within the battery tray. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY HOLDDOWN - DESCRIPTION) for more information on hold down hardware.

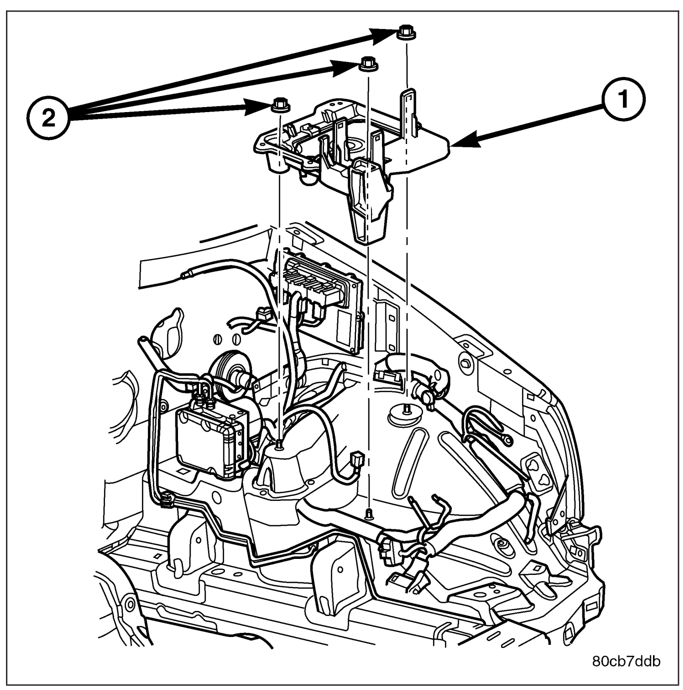



## OPERATION

The battery tray provides a secure mounting location and supports the battery. On some vehicles, the battery tray also provides the anchor point/s for the battery holddown hardware. The battery tray and the battery holddown hardware combine to secure and stabilize the battery in the engine compartment, which prevents battery movement during vehicle operation. Unrestrained battery movement during vehicle operation could result in damage to the vehicle, the battery, or both.

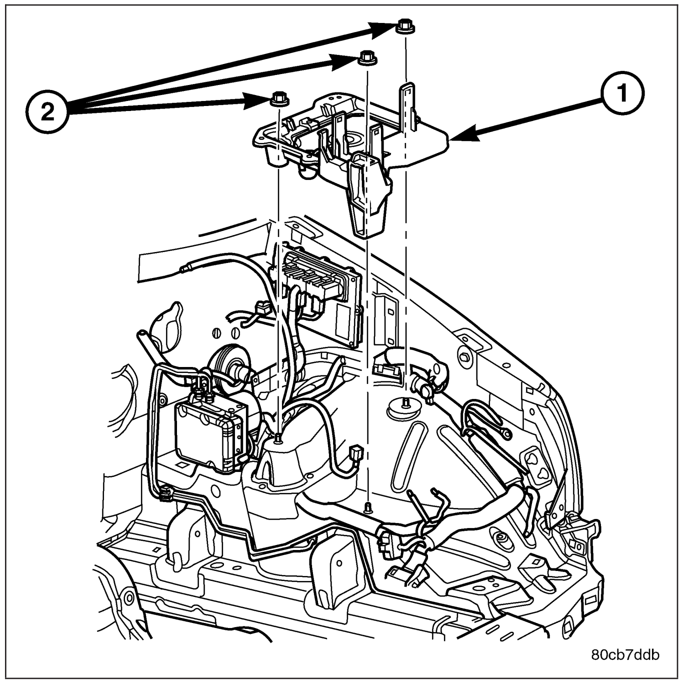
## REMOVAL

1. Remove the battery from the battery tray (1) (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL).
2. Unlatch and remove the PDC from the battery tray (1).
3. Remove the three nuts (2) that secure the battery tray (1) to the weld studs on the front extension of the left front wheelhouse inner panel.
4. Remove the battery tray (1) from the vehicle.



## INSTALLATION

1. Clean and inspect the battery tray (1). (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING).
2. Position the battery tray (1) onto the weld studs on the front extension of the left front wheelhouse inner panel.
3. Install the three nuts (2) that secure the battery tray (1) to the weld studs on the front extension of the left front wheelhouse inner panel. Tighten the nuts to 7 N·m (65 in. lbs.).
4. Install the PDC on the battery tray.
5. Install the battery onto the battery tray. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).



# CHARGING SYSTEM

## TABLE OF CONTENTS

# CHARGING SYSTEM

## DESCRIPTION

The charging system consists of:

- Generator
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch
- Battery (refer to 8, Battery for information)
- Battery temperature sensor
- Generator Lamp (if equipped)
- Check Gauges Lamp (if equipped)
- Wiring harness and connections (refer to 8, Wiring for information)

## OPERATION

The charging system is turned on and off with the ignition switch. The system is on when the engine is running and the ASD relay is energized. When the ASD relay is on, voltage is supplied to the ASD relay sense circuit at the PCM. This voltage is connected through the PCM and supplied to one of the generator field terminals (Gen. Source +) at the back of the generator.

The amount of DC current produced by the generator is controlled by the EVR (field control) circuitry contained within the PCM. This circuitry is connected in series with the second rotor field terminal and ground.

A battery temperature sensor, located in the battery tray housing, is used to sense battery temperature. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. This is done by cycling the ground path to control the strength of the rotor magnetic field. The PCM then compensates and regulates generator current output accordingly.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including EVR (field control) circuitry, are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for certain failures it detects. Refer to Diagnostic Trouble Codes in; Powertrain Control Module; Electronic Control Modules for more DTC information.

The Check Gauges Lamp (if equipped) monitors: **charging system voltage,** engine coolant temperature and engine oil pressure. If an extreme condition is indicated, the lamp will be illuminated. This is done as reminder to check the three gauges. The signal to activate the lamp is sent via the CCD bus circuits. The lamp is located on the instrument panel. Refer to 8, Instrument Cluster for additional information.

## DIAGNOSIS AND TESTING - CHARGING SYSTEM

The following procedures may be used to diagnose the charging system if:

- the check gauges lamp (if equipped) is illuminated with the engine running
- the voltmeter (if equipped) does not register properly
- an undercharged or overcharged battery condition occurs.

Remember that an undercharged battery is often caused by:

- accessories being left on with the engine not running
- a faulty or improperly adjusted switch that allows a lamp to stay on. Refer to Ignition-Off Draw Test in 8, Battery for more information.

### INSPECTION

The Powertrain Control Module (PCM) monitors critical input and output circuits of the charging system, making sure they are operational. A Diagnostic Trouble Code (DTC) is assigned to each input and output circuit monitored by the On-Board Diagnostic (OBD) system. Some charging system circuits are checked continuously, and some are checked only under certain conditions.

Refer to Diagnostic Trouble Codes in; Powertrain Control Module; Electronic Control Modules for more DTC information. This will include a complete list of DTC's including DTC's for the charging system.

To perform a complete test of the charging system, refer to the appropriate Powertrain Diagnostic Procedures service manual and the DRB® scan tool. Perform the following inspections before attaching the scan tool.

1. Inspect the battery condition. Refer to 8, Battery for procedures.
2. Inspect condition of battery cable terminals, battery posts, connections at engine block, starter solenoid and relay. They should be clean and tight. Repair as required.
3. Inspect all fuses in both the fuseblock and Power Distribution Center (PDC) for tightness in receptacles. They should be properly installed and tight. Repair or replace as required.
4. Inspect generator mounting bolts for tightness. Replace or tighten bolts if required. Refer to the Generator Removal/Installation section of this group for torque specifications.
5. Inspect generator drive belt condition and tension. Tighten or replace belt as required. Refer to Belt Tension Specifications in 7, Cooling System.
6. Inspect automatic belt tensioner (if equipped). Refer to 7, Cooling System for information.
7. Inspect generator electrical connections at generator field, battery output, and ground terminal (if equipped). Also check generator ground wire connection at engine (if equipped). They should all be clean and tight. Repair as required.

## SPECIFICATIONS

### TORQUE - EXCEPT DIESEL

| DESCRIPTION | N-m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Generator Horizontal Mounting Bolts - 3.7L | 57 | 42 | - |
| Generator Vertical Mounting Bolt - 3.7L | 40 | 29 | - |
| Generator Mounting Bolts - 2.4L | 57 | 42 | - |
| B+ Terminal Nut at Top of Generator | 13 | - | 115 |
| Generator Decoupler | 110 | 81 | - |

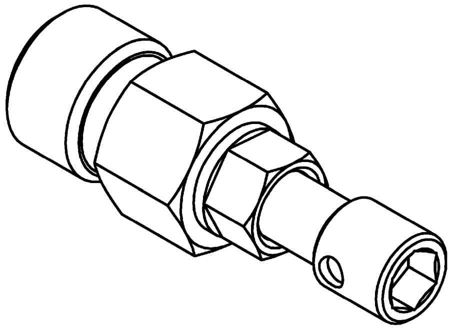
### TORQUE – DIESEL

| DESCRIPTION | N-m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| B+ Terminal Nut at Top of Generator | 13 | - | 115 |
| Generator Mounting Bolts/Nut | 54 | 40 | - |
| Rear Generator Support Bracket Bolts (to engine) | 28 | - | 250 |
| Generator Decoupler | 110 | 81 | - |

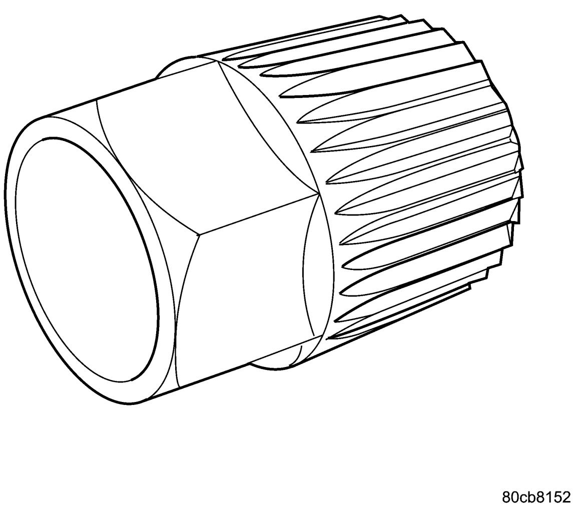
## GENERATOR RATINGS - GAS ENGINES

| TYPE | RATED SAE AMPS | ENGINES | MINIMUM TEST AMPS |
|---|---|---|---|
| DENSO | 124 | 2.4L | 88 |
| DENSO | 136 | 2.4L | 96 |
| DENSO | 136 | 3.7L | 96 |
| DENSO | 160 | 3.7L | 112 |

## SPECIAL TOOLS



GENERATOR DECOUPLER TOOL #8433




GENERATOR DECOUPLER TOOL #8823

# SENSOR - BATTERY TEMPERATURE

## DESCRIPTION

The Battery Temperature Sensor (BTS) is attached to the battery tray located under the battery.

## OPERATION

The BTS is used to determine the battery temperature and control battery charging rate. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. System voltage will be higher at colder temperatures and is gradually reduced at warmer temperatures.

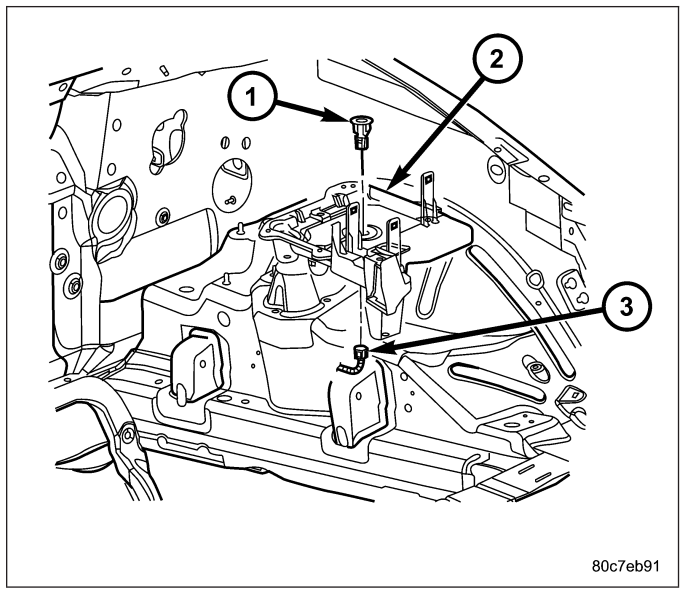
The PCM sends 5 volts to the sensor and is grounded through the sensor return line. As temperature increases, resistance in the sensor decreases and the detection voltage at the PCM increases.

The BTS is also used for OBD II diagnostics. Certain faults and OBD II monitors are either enabled or disabled, depending upon BTS input (for example, disable purge and enable Leak Detection Pump (LDP) and O2 sensor heater tests). Most OBD II monitors are disabled below 20° F (-7° C).

## REMOVAL

The battery temperature sensor (1) is located under the vehicle battery and is attached to a mounting hole on battery tray.

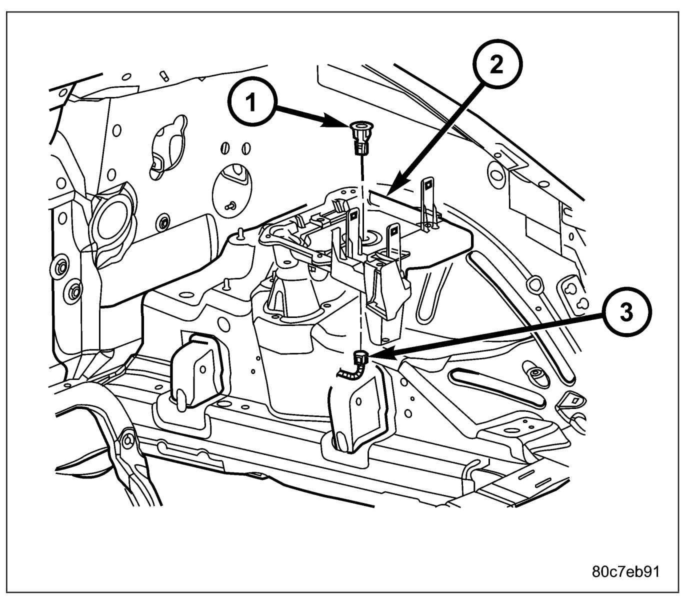
1. Remove battery. Refer to 8, Battery for procedures.
2. Disconnect sensor pigtail harness from engine wire harness electrical connector.
3. Pry sensor straight up from battery tray mounting hole.




## INSTALLATION

The battery temperature sensor (1) is located under vehicle battery and is attached to a mounting hole on battery tray.

1. Feed pigtail harness through hole in top of battery tray and press sensor into top of battery tray.
2. Connect pigtail harness.
3. Install battery. Refer to 8, Battery for procedures.



# GENERATOR

## DESCRIPTION

The generator is belt-driven by the engine using a serpentine type drive belt. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

## OPERATION

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

The stator winding connections deliver the induced AC current to 3 positive and 3 negative diodes for rectification. From the diodes, rectified DC current is delivered to the vehicle electrical system through the generator battery terminal.

Although the generators appear the same externally, different generators with different output ratings are used on this vehicle. Be certain that the replacement generator has the same output rating and part number as the original unit. Refer to Specifications and see Generator Ratings for amperage ratings and part numbers.

Noise emitting from the generator may be caused by: worn, loose or defective bearings; a loose or defective drive pulley; incorrect, worn, damaged or misadjusted fan drive belt; loose mounting bolts; a misaligned drive pulley or a defective stator or diode.

## REMOVAL

## REMOVAL - GAS

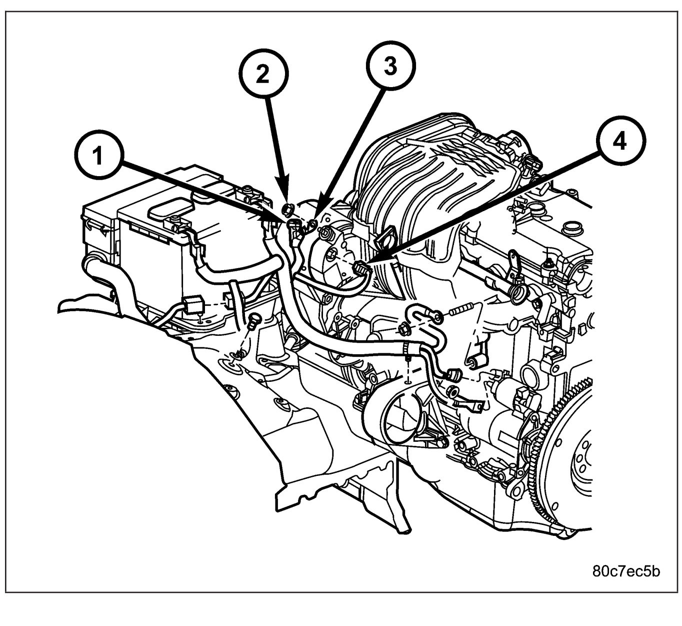
**CAUTION: Disconnect negative cable from battery before removing battery output wire from generator. Failure to do so can result in injury.**

1. Disconnect and isolate negative battery cable at battery.

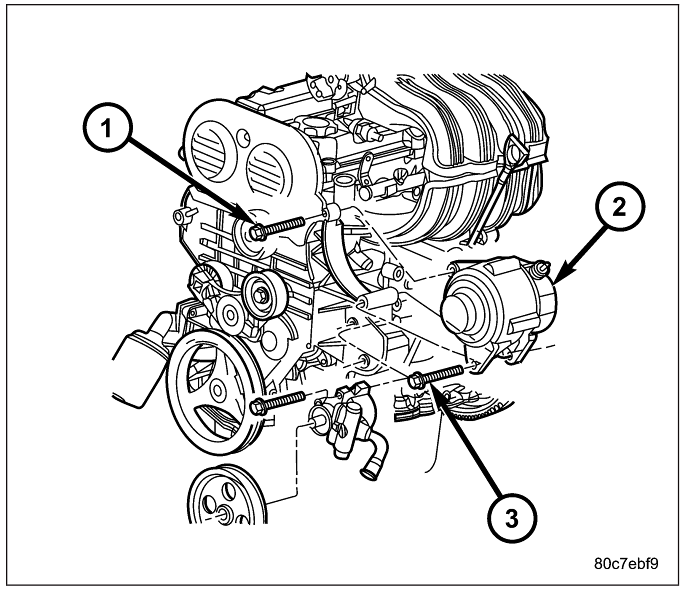
**CAUTION: Never force a belt over a pulley rim using a screwdriver. The synthetic fiber of the belt can be damaged.**

**CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. The water pump will be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to overheat. Refer to belt routing label in engine compartment, or refer to Belt Schematics in Cooling System.**

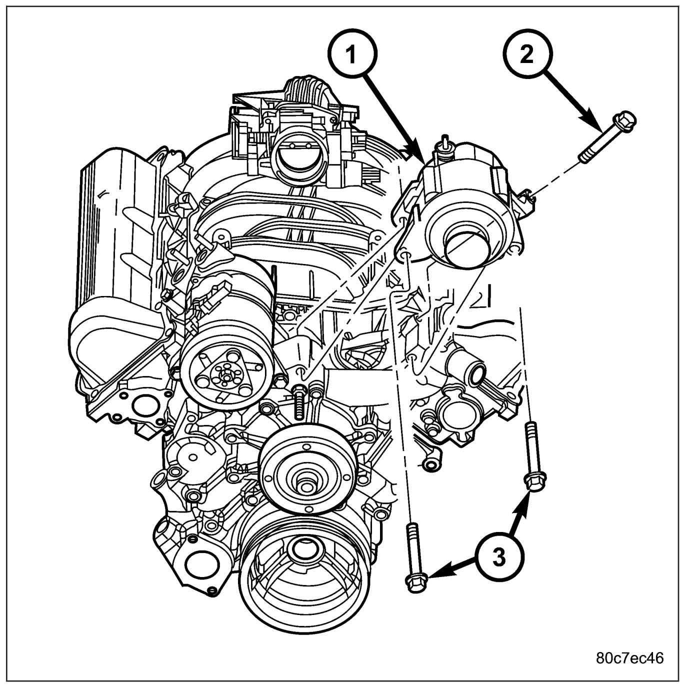
2. Remove generator drive belt. Refer to 7, Cooling System for procedures.
3. Unsnap plastic protective cover (1) from B+ mounting stud.
4. Remove B+ terminal mounting nut (2) at top of generator.
5. Disconnect field wire electrical connector (4) at rear of generator by pushing on connector tab.



6. 2.4L Engine: Remove 2 generator mounting bolts (1) and (2).




7. 3.7L Engine: Remove 1 vertical generator mounting bolt (2) and two horizontal mounting bolts (3).
8. Remove generator from vehicle.




## REMOVAL- DIESEL

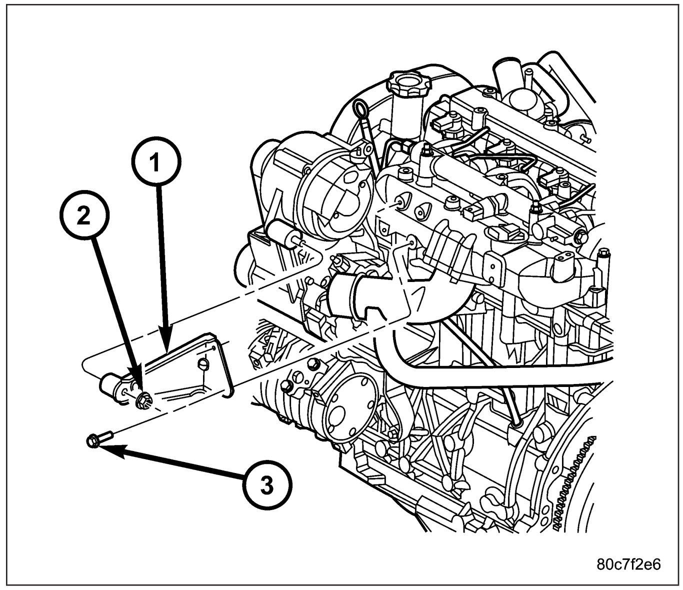
**CAUTION: Disconnect negative cable from battery before removing battery output wire from generator. Failure to do so can result in injury.**

**CAUTION: Never force a belt over a pulley rim using a screwdriver. The synthetic fiber of the belt can be damaged.**

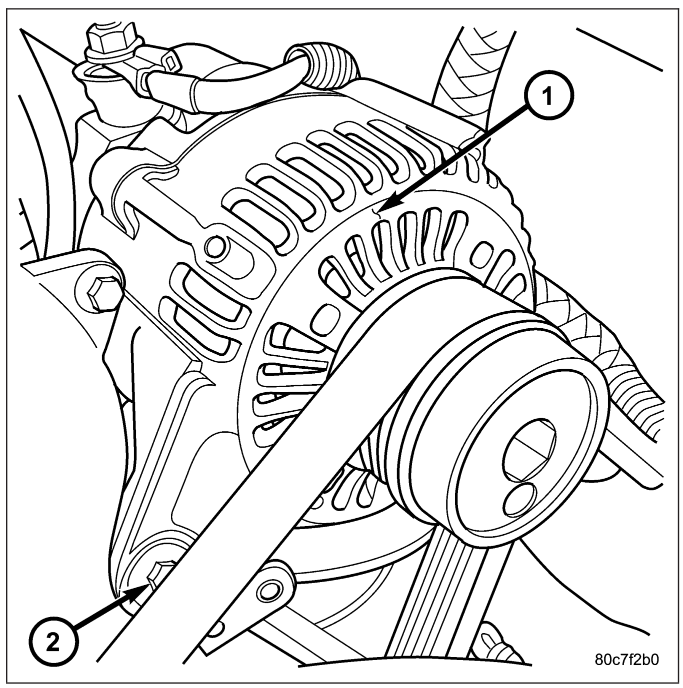
**CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. The water pump will be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to overheat. Refer to belt routing label in engine compartment, or refer to Belt Schematics in Cooling System.**

1. Disconnect and isolate negative battery cable.
2. Remove engine oil fill cap and engine oil dipstick.
3. Remove plastic decorative engine cover. Cover snaps onto engine.

4. Remove generator drive belt. Refer to Cooling System for procedure.
5. Remove protective plastic cover from B+ stud at top of generator.
6. Remove nut securing battery output cable to B+ terminal at top of generator.
7. Unplug field terminal connector at rear of generator.
8. Loosen support bracket bolts (3) and nut (2).



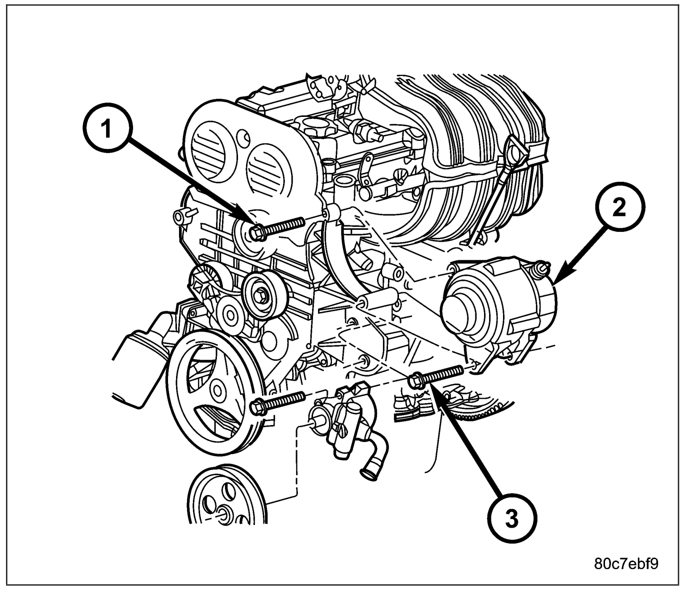

9. Remove two generator mounting bolts (2).
10. Remove generator from vehicle.



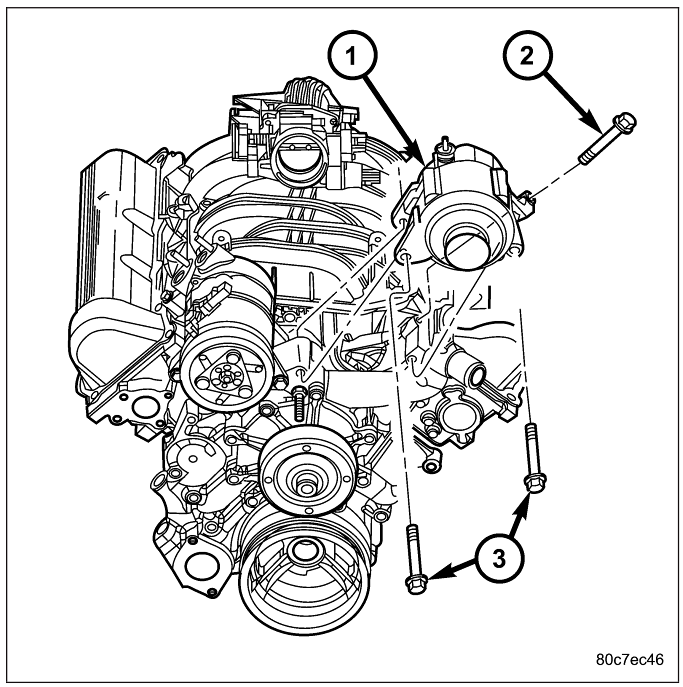
# INSTALLATION

## INSTALLATION - GAS

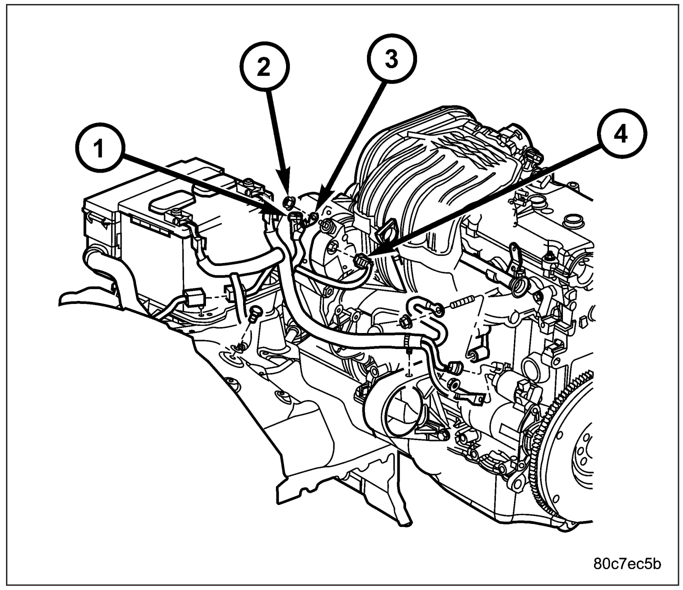
1. 2.4L Engine: Position generator to engine and install two mounting bolts (1) and (2) and tighten to 57 N·m (42 ft. lbs.)




2. 3.7L Engine: Position generator to engine and install three mounting bolts (2) and (3). Tighten 2 horizontal mounting bolts to specified torque. Tighten 1 vertical mounting bolt and tighten to 40 N·m (29 ft. lbs.)



3. Snap field wire connector (4) into rear of generator.
4. Install B+ terminal (3) and nut (2) to generator mounting stud and tighten to 13 N·m (115 in. lbs.)
5. Snap plastic protective cover (1) to B+ terminal.



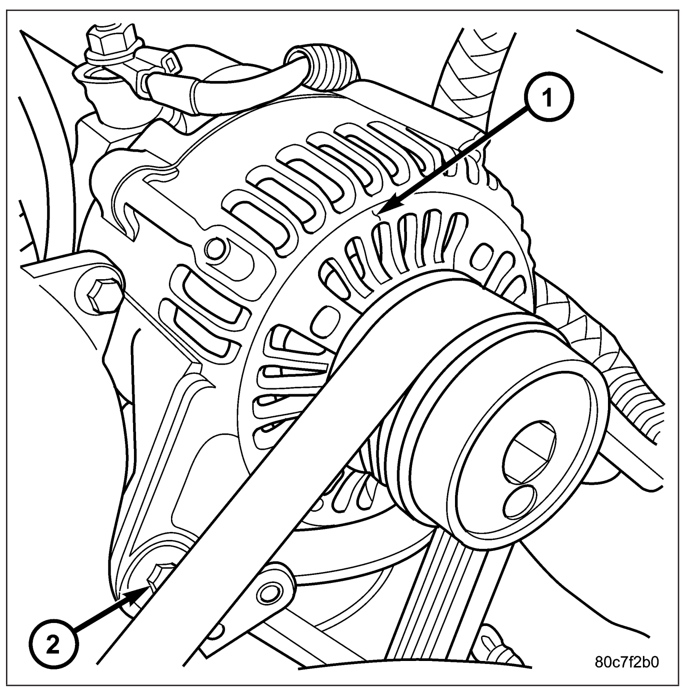

**CAUTION: Never force a belt over a pulley rim using a screwdriver. The synthetic fiber of the belt can be damaged.**

**CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. The water pump will be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to over-heat. Refer to belt routing label in engine compartment, or refer to Belt Schematics in 7, Cooling System.**

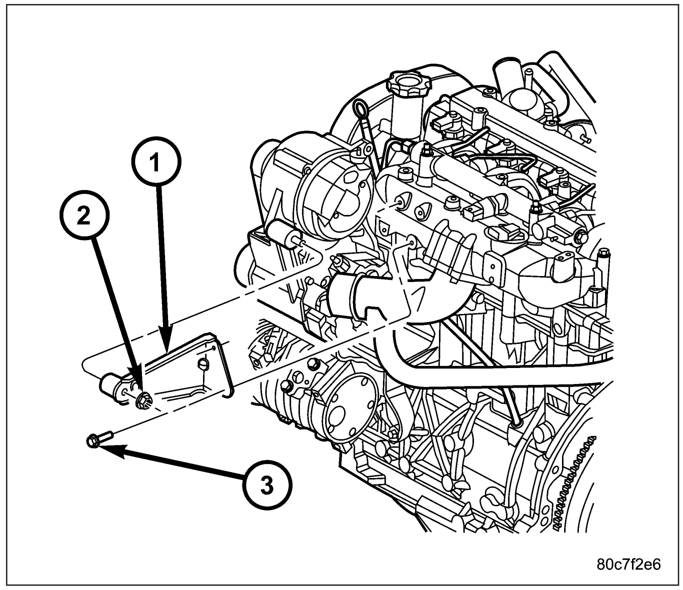
6. Install drive belt Refer to 7, Cooling System for belt routing, belt adjustment and bolt tightening procedures.
7. Install negative battery cable to battery.

## INSTALLATION - DIESEL

1. Position generator (1) to engine.
2. Install generator mounting bolts/nuts (2) and tighten to 54 N·m (42 ft. lbs.).



3. Tighten support bracket bolts (3) and nut (2).
4. Connect field terminal connector at rear of generator.
5. Install battery output cable and nut to B+ terminal at top of generator and tighten to 13 N·m (115 in. lbs.)
6. Install protective plastic cover to B+ stud at top of generator.




**CAUTION: Never force a belt over a pulley rim using a screwdriver. The synthetic fiber of the belt can be damaged.**

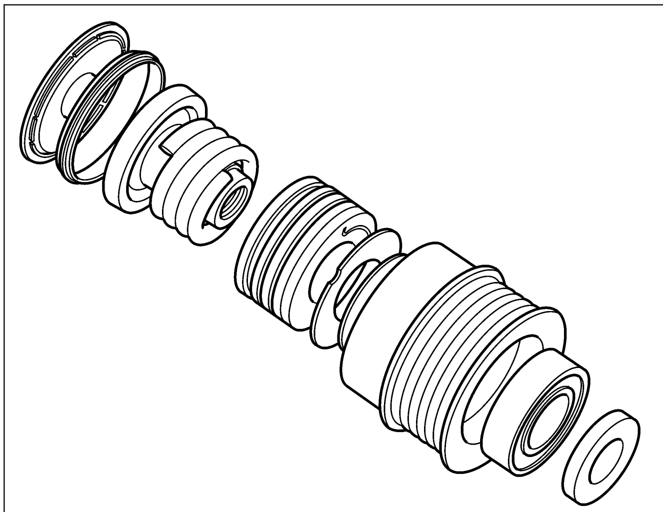
**CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. The water pump will be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to overheat. Refer to belt routing label in engine compartment, or refer to Belt Schematics in Cooling System.**

7. Install generator drive belt. Refer to Cooling System for procedure.
8. Install engine oil fill cap and engine oil dipstick.
9. Install plastic decorative engine cover. Cover snaps onto engine.
10. Connect negative battery cable.
11. Check charging system for proper operation.

# PULLEY - GENERATOR DECOUPLER

## DESCRIPTION

**The generator decoupler is used only with certain engines.** The decoupler is used in place of the standard generator drive pulley.



80a9349e

## OPERATION

**The generator decoupler is used only with certain engines.** The decoupler is a one-way clutch designed to help reduce belt tension fluctuation, vibration, reduce fatigue loads, improve belt life, reduce hubloads on components, and reduce noise. Dry operation is used (no grease or lubricants). The decoupler is not temperature sensitive and also has a low sensitivity to electrical load. The decoupler is a non-serviceable item and is to be replaced as an assembly.

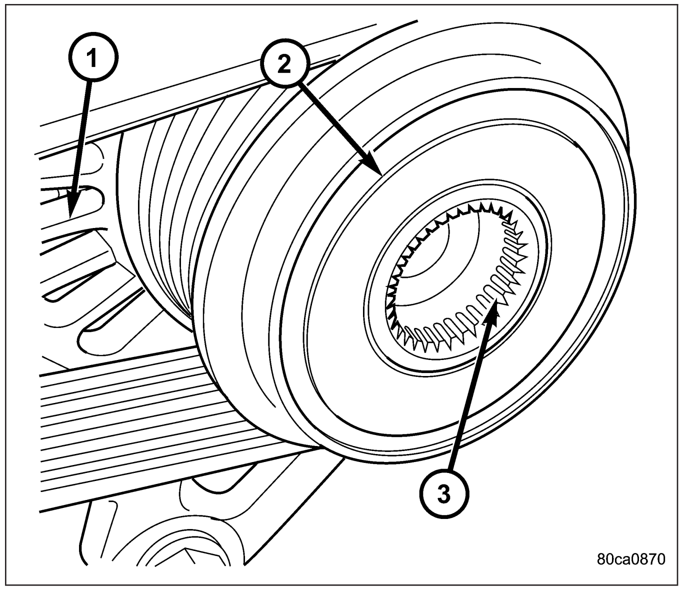
## DIAGNOSIS AND TESTING - GENERATOR DECOUPLER

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| Does not drive generator (generator not charging) | Internal failure | Replace decoupler |
| Noise coming from decoupler | Internal failure | Replace decoupler |

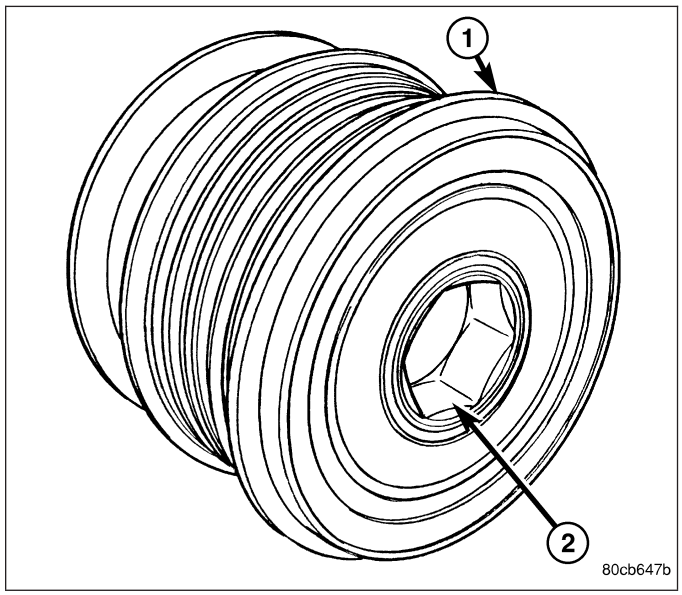
## REMOVAL

**The generator decoupler is used only with certain engines.**

Two different type generator decoupler pulleys are used. One can be identified by the use of machined splines (3).




The other decoupler is equipped with a hex opening (2) and will not use splines.

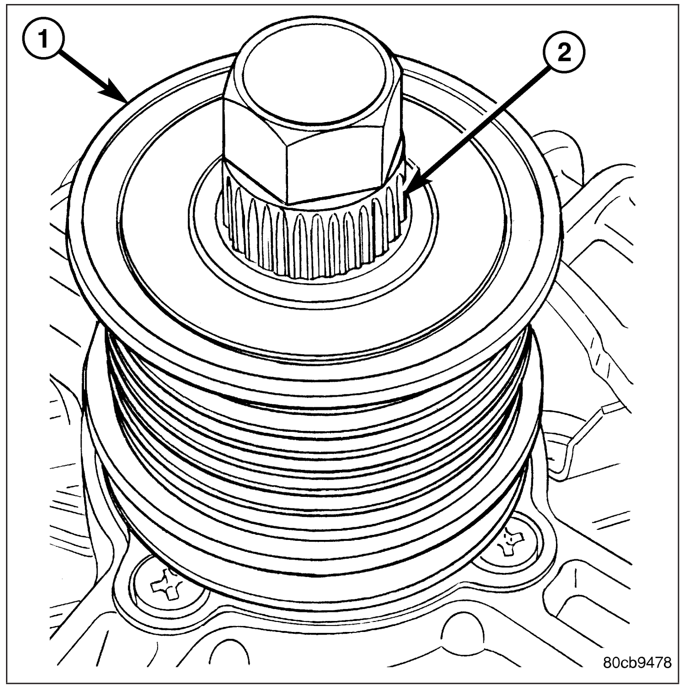



Different special tools are required to service each different decoupler. Refer to following procedure.

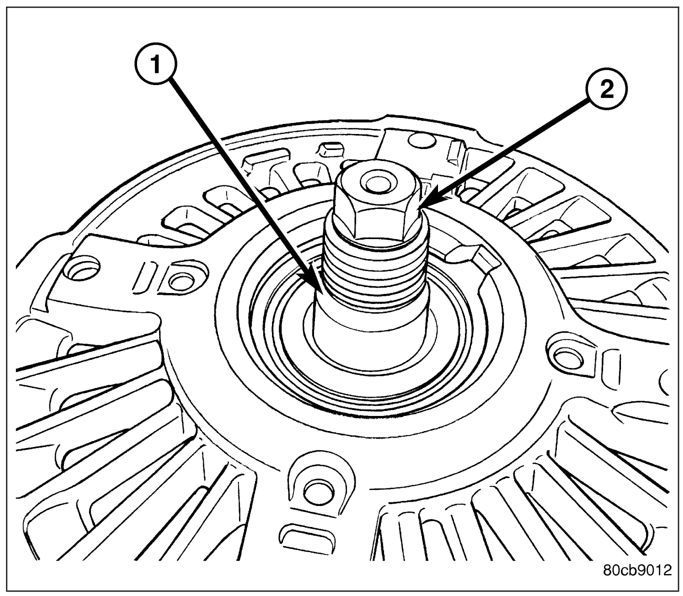
**INA Decoupler**

1. Disconnect negative battery cable.
2. Remove generator and accessory drive belt. Refer to Generator Removal.

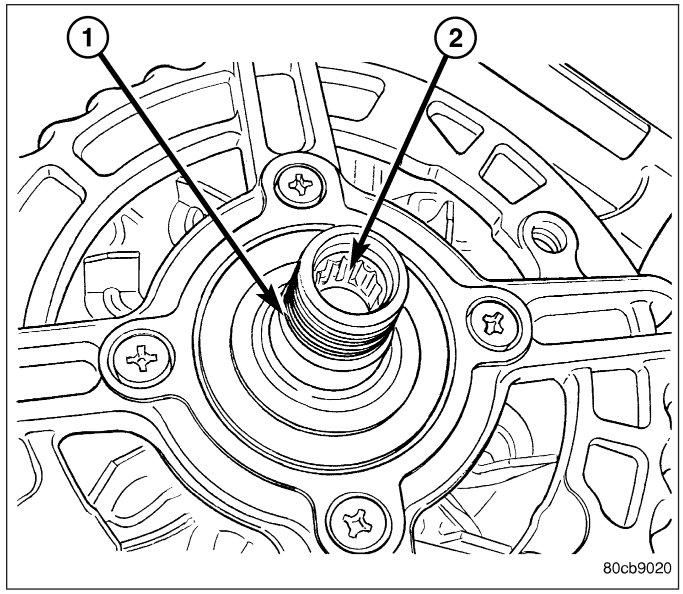
3. Position Special Tool #8823 (VM.1048) (2) into decoupler (1).



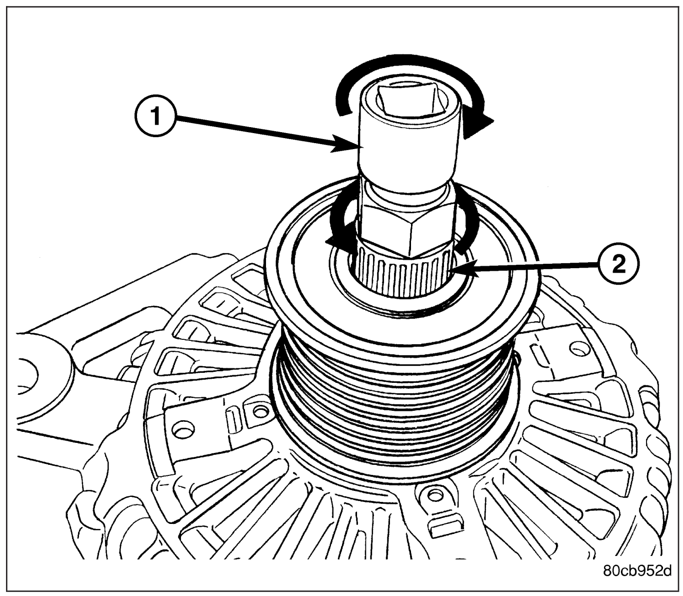

4. Determine if end of generator shaft is hex shaped (2).......................



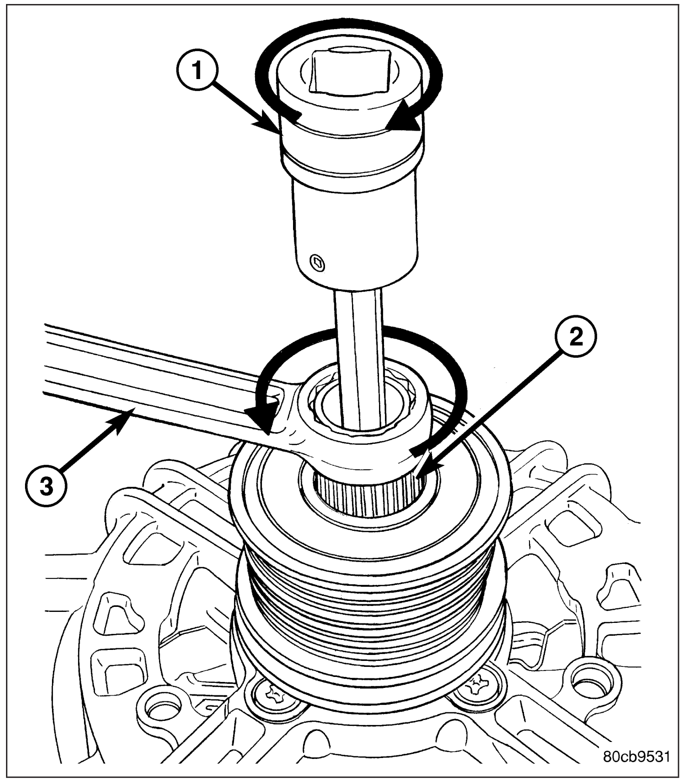
5. ............ or is splined (2).



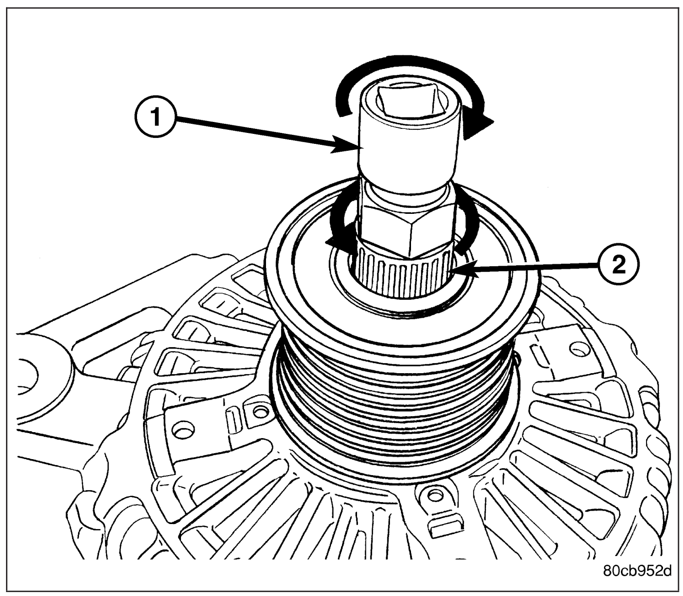

6. If hex is used, insert a 10MM deep socket (1) into tool #8823 (VM.1048).



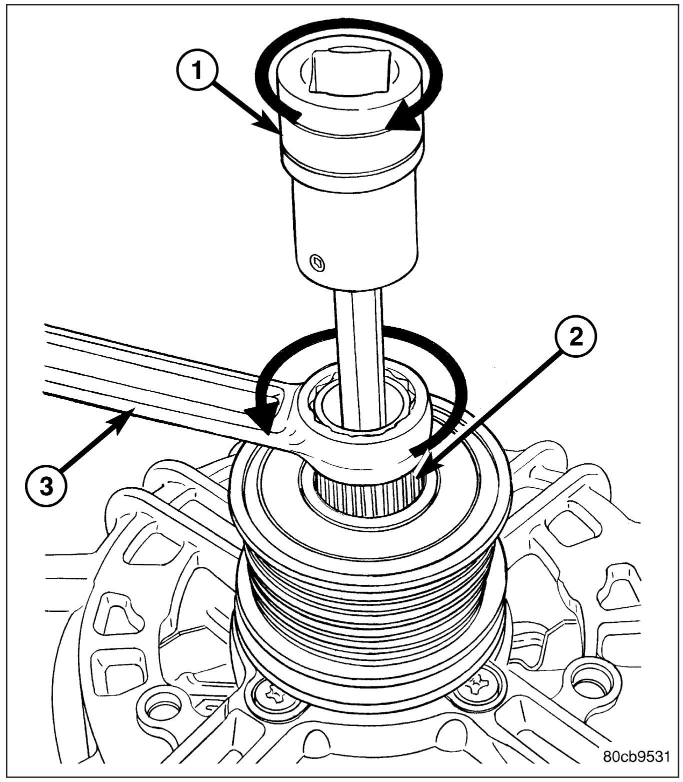
7. If splined, insert a 5/16” 6-point hex driver (1), or a 10MM 12-point triple square driver into tool #8823 (VM.1048).




8. The generator shaft uses conventional right-hand threads to attach decoupler. To break decoupler loose from generator threads, rotate end of tool (1) clockwise or...........,

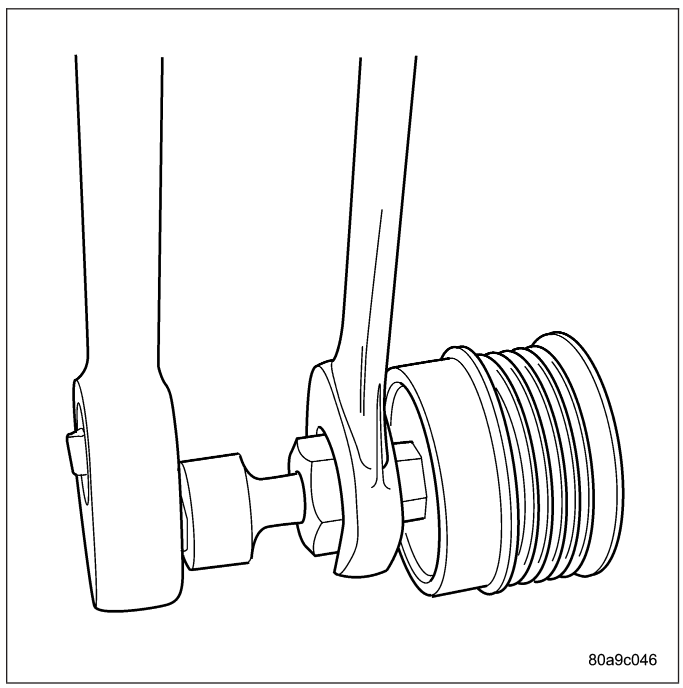


9. rotate end of tool (1) clockwise.
10. After breaking loose with tool, unthread decoupler by hand from generator.

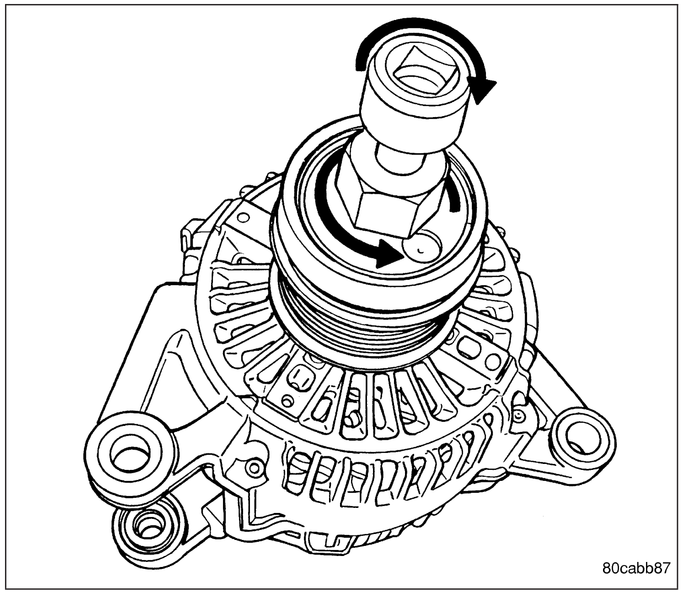



**Litens Decoupler**

1. Disconnect negative battery cable.
2. Remove generator and accessory drive belt. Refer to Generator Removal.
3. Position Special Tool #8433 into decoupler. Align to hex end of generator shaft.



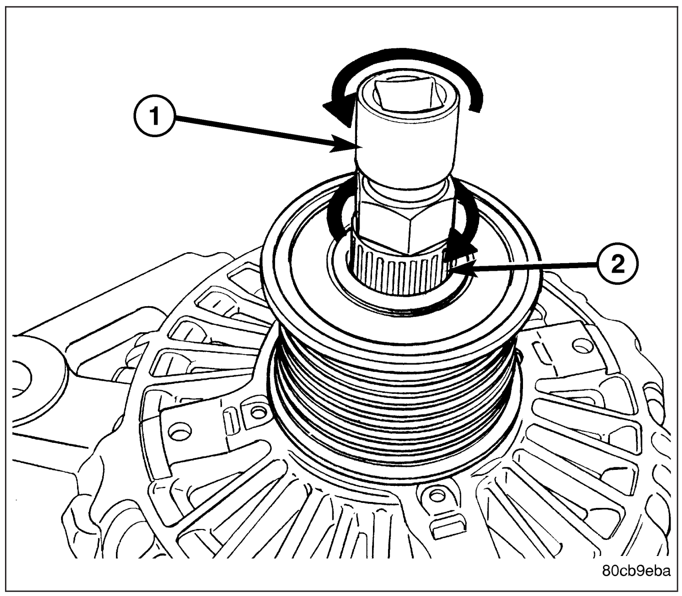
4. The generator shaft uses conventional right-hand threads to attach decoupler. To break decoupler loose from generator threads, rotate end of tool clockwise.
5. After breaking loose with tool, unthread decoupler by hand from generator.



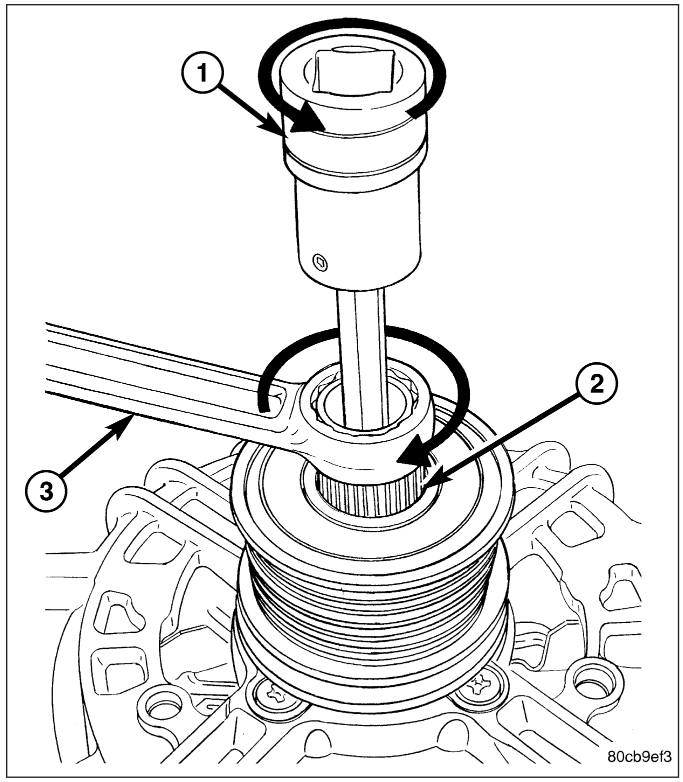

## INSTALLATION

### INA Decoupler

1. Thread decoupler pulley onto generator shaft by hand (right-hand threads).
2. Position Special Tool #8823 (VM.1048) into decoupler.
3. Determine if end of generator shaft is hex shaped or is splined. If hex is used, insert a 10MM deep socket (1) into tool #8823 (VM.1048) or..............



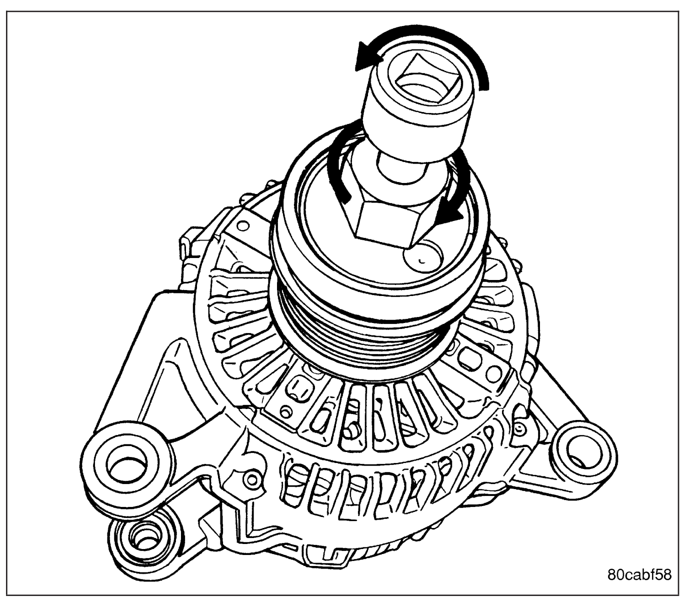
4. ............if splined, insert a 5/16” 6-point hex driver (1), or a 10MM 12-point triple square driver into tool #8823 (VM.1048).




5. **Do not use an adjustable, ratcheting “click type” torque wrench. Most “click type” wrenches will only allow torque to be applied in a clockwise rotation. Use a dial-type or beam-type wrench.** Tighten in counterclockwise rotation and tighten to 110 N·m (81 ft. lbs.).
6. Install accessory drive belt, and generator. Refer to Generator Installation.
7. Connect negative battery cable.

**Litens Decoupler**

1. Thread decoupler pulley onto generator shaft by hand (right-hand threads).
2. Position Special Tool 8433 into decoupler. Align tool to hex end of generator shaft.
3. **Do not use an adjustable, ratcheting “click type” torque wrench. Most “click type” wrenches will only allow torque to be applied in a clockwise rotation. Use a dial-type or beam-type wrench.** Tighten in counterclockwise rotation and tighten to 110 N·m (81 ft. lbs.).




4. Install accessory drive belt, and generator. Refer to Generator Installation.
5. Connect negative battery cable.

# REGULATOR - VOLTAGE

## DESCRIPTION

The Electronic Voltage Regulator (EVR) is not a separate component. It is actually a voltage regulating circuit located within the Powertrain Control Module (PCM). The EVR is not serviced separately. If replacement is necessary, the PCM must be replaced.

## OPERATION

The amount of DC current produced by the generator is controlled by EVR circuitry contained within the Powertrain Control Module (PCM). This circuitry is connected in series with the generators second rotor field terminal and its ground.

Voltage is regulated by cycling the ground path to control the strength of the rotor magnetic field. The EVR circuitry monitors system line voltage (B+) and battery temperature (refer to Battery Temperature Sensor for more information). It then determines a target charging voltage. If sensed battery voltage is 0.5 volts or lower than the target voltage, the PCM grounds the field winding until sensed battery voltage is 0.5 volts above target voltage. A circuit in the PCM cycles the ground side of the generator field up to 100 times per second (100Hz), but has the capability to ground the field control wire 100% of the time (full field) to achieve the target voltage. If the charging rate cannot be monitored (limp-in), a duty cycle of 25% is used by the PCM in order to have some generator output. Also refer to Charging Operation for additional information.

# STARTING SYSTEM

## TABLE OF CONTENTS

# STARTING SYSTEM

## DESCRIPTION

The starting system consists of:

- Starter relay
- Starter motor (including an integral starter solenoid)

Other components to be considered as part of starting system are:

- Battery
- Battery cables
- Ignition switch and key lock cylinder
- Clutch pedal position switch (manual transmission)
- Park/neutral position switch (automatic transmission)
- Wire harnesses and connections.

The Battery, Starting, and Charging systems operate in conjunction with one another, and must be tested as a complete system. For correct operation of starting/charging systems, all components used in these 3 systems must perform within specifications. When attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used in each of these groups include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

Certain starting system components are monitored by the PCM and may produce a Diagnostic Trouble Code (DTC).

## OPERATION

The starting system components form two separate circuits. A high-amperage feed circuit that feeds the starter motor between 150 and 350 amperes (700 amperes - diesel engine), and a low-amperage control circuit that operates on less than 20 amperes. The high-amperage feed circuit components include the battery, the battery cables, the contact disc portion of the starter solenoid, and the starter motor. The low-amperage control circuit components include the ignition switch, the clutch pedal position switch (manual transmission), the park/neutral position switch (automatic transmission), the starter relay, the electromagnetic windings of the starter solenoid, and the connecting wire harness components.

If the vehicle is equipped with a manual transmission, it has a clutch pedal position switch installed in series between the ignition switch and the coil battery terminal of the starter relay. This normally open switch prevents the starter relay from being energized when the ignition switch is turned to the momentary Start position, unless the clutch pedal is depressed. This feature prevents starter motor operation while the clutch disc and the flywheel are engaged. The starter relay coil ground terminal is always grounded on vehicles with a manual transmission.

If the vehicle is equipped with an automatic transmission, battery voltage is supplied through the low-amperage control circuit to the coil battery terminal of the starter relay when the ignition switch is turned to the momentary Start position. The park/neutral position switch is installed in series between the starter relay coil ground terminal and ground. This normally open switch prevents the starter relay from being energized and the starter motor from operating unless the automatic transmission gear selector is in the Neutral or Park positions.

When the starter relay coil is energized, the normally open relay contacts close. The relay contacts connect the relay common feed terminal to the relay normally open terminal. The closed relay contacts energize the starter solenoid coil windings.

The energized solenoid pull-in coil pulls in the solenoid plunger. The solenoid plunger pulls the shift lever in the starter motor. This engages the starter overrunning clutch and pinion gear with the starter ring gear on the manual transmission flywheel or on the automatic transmission torque converter or torque converter drive plate.

As the solenoid plunger reaches the end of its travel, the solenoid contact disc completes the high-amperage starter feed circuit and energizes the solenoid plunger hold-in coil. Current now flows between the solenoid battery terminal and the starter motor, energizing the starter.

Once the engine starts, the overrunning clutch protects the starter motor from damage by allowing the starter pinion gear to spin faster than the pinion shaft. When the driver releases the ignition switch to the On position, the starter relay coil is de-energized. This causes the relay contacts to open. When the relay contacts open, the starter solenoid plunger hold-in coil is de-energized.

When the solenoid plunger hold-in coil is de-energized, the solenoid plunger return spring returns the plunger to its relaxed position. This causes the contact disc to open the starter feed circuit, and the shift lever to disengage the overrunning clutch and pinion gear from the starter ring gear.

## DIAGNOSIS AND TESTING - STARTING SYSTEM

The battery, starting, and charging systems operate in conjunction with one another, and must be tested as a complete system. For correct starting/charging system operation, all of the components involved in these 3 systems must perform within specifications.

| Starting System Diagnosis | | |
|---|---|---|
| CONDITION | POSSIBLE CAUSE | CORRECTION |
| STARTER FAILS TO OPERATE. | 1. Battery discharged or faulty. | 1. Refer to Battery. Charge or replace battery, if required. |
| | 2. Starting circuit wiring faulty. | 2. Refer to 8, Wiring Diagrams. Test and repair starter feed and/or control circuits, if required. |
| | 3. Starter relay faulty. | 3. Refer to Starter Relay in Diagnosis and Testing. Replace starter relay if required. |
| | 4. Ignition switch faulty. | 4. Refer to Ignition Switch and Key Lock Cylinder. Replace ignition switch if required. |
| | 5. Clutch pedal position switch faulty. | 5. Refer to Clutch Pedal Position Switch. |
| | 6. Park/Neutral position switch faulty or misadjusted. | 6. Refer to Park/Neutral Position Switch. Replace park/neutral position switch if required. |
| | 7. Starter solenoid faulty. | 7. Refer to Starter Motor. Replace starter motor assembly if required. |
| | 8. Starter motor faulty. | 8. If all other starting system components and circuits test OK, replace starter motor. |
| STARTER ENGAGES, FAILS TO TURN ENGINE. | 1. Battery discharged or faulty. | 1. Refer to Battery. Charge or replace battery if required. |
| | 2. Starting circuit wiring faulty. | 2. Refer to 8, Wiring Diagrams. Test and repair starter feed and/or control circuits if required. |
| | 3. Starter motor faulty. | 3. If all other starting system components and circuits test OK, replace starter motor assembly. |
| | 4. Engine seized. | 4. Refer to Engine Diagnosis in the Diagnosis and Testing section of 9, Engine. |
| STARTER ENGAGES, SPINS OUT BEFORE ENGINE STARTS. | 1. Starter ring gear faulty. | 1. Refer to Starter Motor Removal and Installation. Remove starter motor to inspect starter ring gear. Replace starter ring gear if required. |
| | 2. Starter motor faulty. | 2. If all other starting system components and circuits test OK, replace starter motor assembly. |
| STARTER DOES NOT DISENGAGE. | 1. Starter motor improperly installed. | 1. Refer to Starter Motor Removal and Installation. Tighten starter mounting hardware to correct torque specifications. |
| | 2. Starter relay faulty. | 2. Refer to Starter Relay Diagnosis and Testing. Replace starter relay if required. |
| | 3. Ignition switch faulty. | 3. Refer to Ignition Switch and Key Lock Cylinder. Replace ignition switch if required. |
| | 4. Starter motor faulty. | 4. If all other starting system components and circuits test OK, replace starter motor. |

### INSPECTION

For complete starter wiring circuit diagrams, refer to 8, Wiring Diagrams. Before removing any unit from starting system for repair or diagnosis, perform the following inspections:

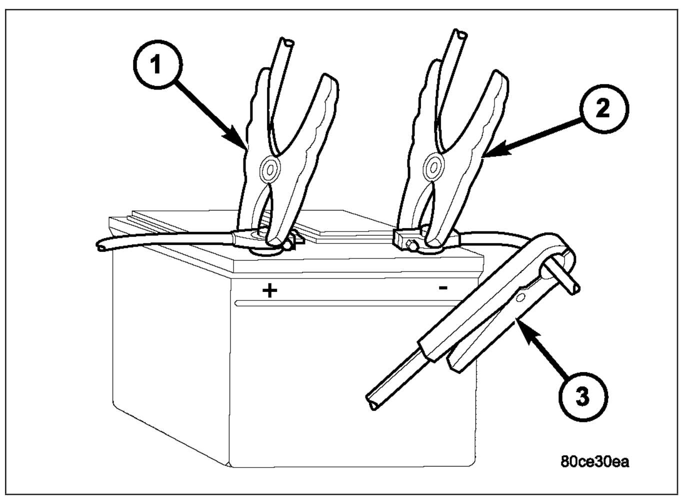
**WARNING: On vehicles equipped with airbags, refer to 8, passive restraint systems, before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

- **Battery** - Visually inspect battery for indications of physical damage and loose or corroded cable connections. Determine state-of-charge and cranking capacity of battery. Charge or replace battery if required. Refer to **Battery** in 8, Battery. **Note: If equipped with diesel engine, a dual battery system may be used, and both batteries must be inspected.**
- **Ignition Switch** - Visually inspect ignition switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Ignition Switch and Key Lock Cylinder.**
- **Clutch Pedal Position Switch** - If equipped with manual transmission, visually inspect clutch pedal position switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Clutch Pedal Position Switch** in 6, Clutch.
- **Park/Neutral Position Switch** - If equipped with automatic transmission, visually inspect park/neutral position switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Park/Neutral Position Switch** in 21, Transmission.
- **Starter Relay** - Visually inspect starter relay for indications of physical damage and loose or corroded wire harness connections.
- **Starter Motor** - Visually inspect starter motor for indications of physical damage and loose or corroded wire harness connections.
- **Starter Solenoid** - Visually inspect starter solenoid for indications of physical damage and loose or corroded wire harness connections.
- **Wiring** - Visually inspect wire harnesses for damage. Repair or replace any faulty wiring, as required. Refer to 8, Wiring Diagrams.

## TESTING

### COLD CRANKING TEST

For complete starter wiring circuit diagrams, refer to 8, Wiring Diagrams. The battery must be fully-charged and load-tested before proceeding. Refer to **Battery** in Battery.




1. Connect volt-ampere tester to battery terminals (1), (2) and (3). See instructions provided by manufacturer of volt-ampere tester being used. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, tester should be connected to battery on left side of vehicle only. Also, tester current reading must be taken from positive battery cable lead that connects to starter motor.**
2. Fully engage parking brake.
3. If equipped with manual transmission, place gearshift selector lever in Neutral position and block clutch pedal in fully depressed position. If equipped with automatic transmission, place gearshift selector lever in Park position.
4. Verify that all lamps and accessories are turned off.
5. To prevent a gasoline engine from starting, remove Automatic ShutDown (ASD) relay. To prevent a diesel engine from starting, remove Fuel Pump Relay. These relays are located in Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

**WARNING: If equipped with diesel engine, attempt to start engine a few times before proceeding with following step.**

6. Rotate and hold ignition switch in Start position. Note cranking voltage and current (amperage) draw readings shown on volt-ampere tester.
   a. If voltage reads below 9.6 volts, refer to **Starter Motor** in Diagnosis and Testing. If starter motor is OK, refer to **Engine Diagnosis** in 9, Engine for further testing of engine. If starter motor is not OK, replace faulty starter motor.
   b. If voltage reads above 9.6 volts and current (amperage) draw reads below specifications, refer to **Feed Circuit Test** in this section.
   c. If voltage reads 12.5 volts or greater and starter motor does not turn, refer to **Control Circuit Testing** in this section.
   d. If voltage reads 12.5 volts or greater and starter motor turns very slowly, refer to **Feed Circuit Test** in this section.

**NOTE: A cold engine will increase starter current (amperage) draw reading, and reduce battery voltage reading.**

### FEED CIRCUIT TEST

The starter feed circuit test (voltage drop method) will determine if there is excessive resistance in high-amperage feed circuit. For complete starter wiring circuit diagrams, refer 8, Wiring Diagrams.

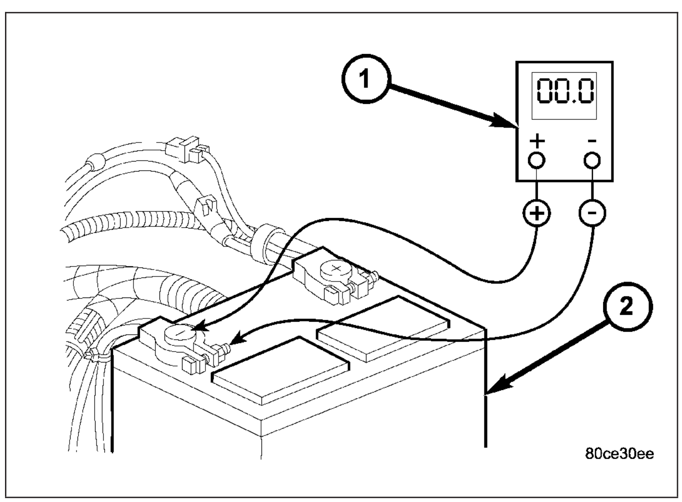
When performing these tests, it is important to remember that voltage drop is giving an indication of resistance between two points at which voltmeter probes are attached.

**Example:** When testing resistance of positive battery cable, touch voltmeter leads to positive battery cable clamp and cable connector at starter solenoid. If you probe positive battery terminal post and cable connector at starter solenoid, you are reading combined voltage drop in positive battery cable clamp-to-terminal post connection and positive battery cable.

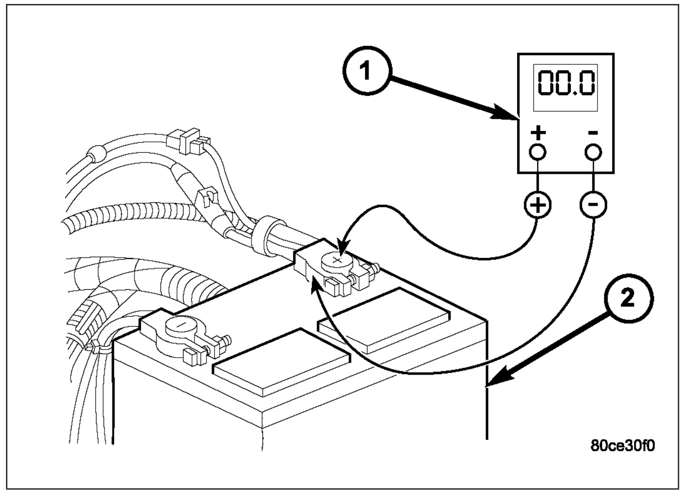
The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing tests, be certain that following procedures are accomplished:

- Battery is fully-charged and load-tested. Refer to **Battery** in 8, Battery.
- Fully engage parking brake.
- If equipped with manual transmission, place gearshift selector lever in Neutral position and block clutch pedal in fully depressed position. If equipped with automatic transmission, place gearshift selector lever in Park position.
- Verify that all lamps and accessories are turned off.
- To prevent a gasoline engine from starting, remove Automatic ShutDown (ASD) relay. To prevent a diesel engine from starting, remove Fuel Pump Relay. These relays are located in Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

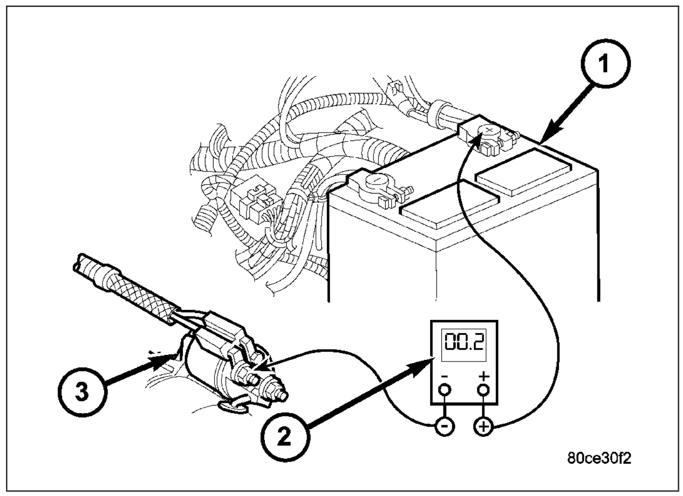
1. Connect positive lead of voltmeter (1) to negative battery cable terminal post. Connect negative lead of voltmeter to negative battery cable clamp. Rotate and hold ignition switch in Start position. Observe voltmeter (1). If voltage is detected, correct poor contact between cable clamp and terminal post. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, procedure must be performed twice, once for each battery.**



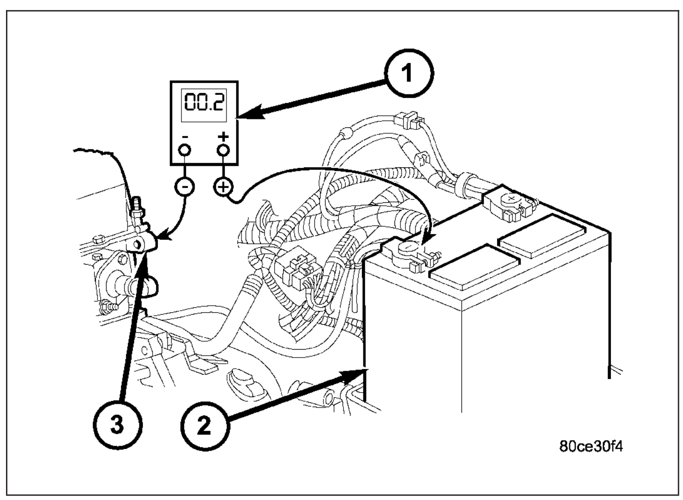
2. Connect positive lead of voltmeter (1) to positive battery terminal post. Connect negative lead of voltmeter to battery positive cable clamp. Rotate and hold ignition switch in Start position. Observe voltmeter (1). If voltage is detected, correct poor contact between cable clamp and terminal post. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, this procedure must be performed twice, once for each battery.**



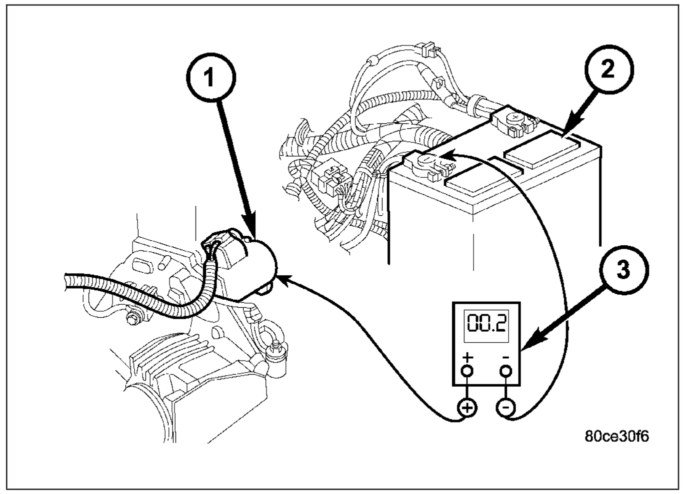

3. Connect voltmeter (2) to measure between battery positive terminal post and starter solenoid battery terminal stud (3). Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, clean and tighten battery cable connection at solenoid. Repeat test. If reading is still above 0.2 volt, replace faulty positive battery cable. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, this procedure must be performed on driver side battery only.**




4. Connect voltmeter (1) to measure between negative battery terminal post and a good clean ground on engine block (3). Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, clean and tighten negative battery cable attachment on engine block. Repeat test. If reading is still above 0.2 volt, replace faulty negative battery cable. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, this procedure must be performed twice, once for each battery.**



5. Connect positive lead of voltmeter (3) to starter housing (1). Connect negative lead of voltmeter to negative battery terminal post. Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, correct poor starter to engine block ground contact. **Note: Certain diesel equipped models use dual batteries. If equipped with dual battery system, this procedure must be performed on driver side battery only.**




6. If equipped with dual battery system (certain diesel equipped models), connect positive lead of voltmeter to positive battery cable clamp on battery located on left side of vehicle. Connect negative lead of voltmeter to positive battery terminal post on battery located on right side of vehicle. Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, clean and tighten battery cables at both batteries. Repeat test. If reading is still above 0.2 volt, replace faulty positive battery cable.

If resistance tests detect no feed circuit problems, refer to **Starter Motor** in the Diagnosis and Testing.

### CONTROL CIRCUIT TESTING

The starter control circuit components should be tested in the order in which they are listed, as follows:

- **Starter Relay** - Refer to **Starter Relay** Diagnosis and Testing.
- **Starter Solenoid** - Refer to **Starter Motor** Diagnosis and Testing.
- **Ignition Switch** - Refer to **Ignition Switch and Key Lock Cylinder**
- **Clutch Pedal Position Switch** - If equipped with manual transmission, refer to **Clutch Pedal Position Switch** in 6, Clutch.
- **Park/Neutral Position Switch** - If equipped with automatic transmission, refer to **Park/Neutral Position Switch** in 21, Transmission.
- **Wire harnesses and connections** - Refer to 8, Wiring Diagrams.

## INSPECTION - STARTING SYSTEM

The following starting system components should be carefully inspected whenever any starting system problem is encountered.

**WARNING: On vehicles equipped with airbags, disable airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate battery negative (ground) cable, then wait two minutes for airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable airbag system. Failure to take proper precautions could result in accidental airbag deployment and possible personal injury.**

### *Battery*

- Visually inspect battery for indications of physical damage and loose or corroded cable connections. Determine state-of-charge and cranking capacity of battery. Charge or replace battery, if required. Refer to **Battery** for battery cleaning and inspection procedures.

### *Ignition Switch*

- Visually inspect ignition switch for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Wiring Diagrams**. Refer to **Ignition Switch and Key Lock Cylinder** for ignition switch service procedures.

***Clutch Pedal Position Switch***

- If vehicle is equipped with a manual transmission, visually inspect clutch pedal position switch for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Clutch Hydraulic Linkage** for clutch pedal position switch service procedures.

***Park/Neutral Position Switch***

- If vehicle is equipped with an automatic transmission, visually inspect park/neutral position switch for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Park/Neutral Position Switch** for park/neutral position switch service procedures.

***Starter Relay***

- Visually inspect starter relay for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Starter Relay** for starter relay service procedures.

***Starter Motor***

- Visually inspect starter motor for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. If problem being diagnosed involves improper starter engagement, disengagement or noise complaints, starter motor should be removed. With starter motor removed, inspect starter pinion and ring gears for damaged or missing teeth. Replace faulty components as required. Refer to **Starter Motor** for removal/installation procedures.

***Starter Solenoid***

- Visually inspect starter solenoid for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Starter Motor** for starter solenoid service procedures.

***Wiring***

- Visually inspect starting system wire harnesses for indications of physical damage. Repair or replace any faulty wiring, as required. Refer to **Wiring Diagrams** for repair or connector and terminal service procedures.

## SPECIFICATIONS

### TORQUE - GAS

| DESCRIPTION | N-m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Starter Solenoid Battery Cable Nut | 11 | - | 100 |
| Starter Mounting Bolts - 2.4L | 54 | 40 | - |
| Starter Mounting Bolts -3.7L | 54 | 40 | - |
| Starter Heat Shield Mounting Bolts | 6 | - | 55 |

### TORQUE - DIESEL

| DESCRIPTION | N-m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Starter Solenoid Battery Cable Nut | 11 | - | 100 |
| Starter Mounting Bolts | 27 | 20 | - |

## STARTER MOTOR - GAS POWERED

| Starter Motor and Solenoid | |
|---|---|
| Engine Application | 2.4L / 3.7L |
| Power Rating | 1.4 Kilowatt (1.9 Horsepower) |
| Voltage | 12 Volts |
| ** Number of Permanent Magnets | 6 |
| Number of Brushes | 4 |
| Drive Type | Planetary Gear Reduction |
| Free Running Test Voltage | 11.2 Volts |
| Free Running Test Maximum Amperage Draw | 90 Amperes |
| Free Running Test Minimum Speed | 2400 rpm |
| Solenoid Closing Maximum Voltage Required | 7.8 Volts |
| * Cranking Amperage Draw Test | 160 Amperes |
| | |
| *Test at operating temperature. Cold engine, tight (new) engine, or heavy oil will increase starter amperage draw. | |
| **The starter is equipped with permanent magnets. Never strike the starter case to attempt to loosen a sticking/ stuck armature as permanent magnets may crack or break. | |

## TORQUE - DIESEL

| ITEM | SPECIFICATION |
|---|---|
| ENGINE | TURBO DIESEL |
| RATED VOLTAGE | 12 VOLTS |
| NUMBER OF FIELDS | 4 |
| NUMBER OF POLES | 4 |
| NUMBER OF BRUSHES | 4 |
| DRIVE TYPE | GEAR REDUCTION |
| FREE RUNNING TEST VOLTAGE | 11.5 VOLTS |
| FREE RUNNING TEST MAXIMUM AMPERAGE DRAW | 160 AMPS |
| FREE RUNNING TEST MINIMUM SPEED | 5500 RPM |
| SOLENOID CLOSING MAXIMUM VOLTAGE | 7.8 VOLTS |
| MAXIMUM CRANKING AMPERAGE DRAW | * 500 AMPS |

* A COLD OR NEW ENGINE WILL INCREASE STARTER AMPERAGE DRAW. THE USE OF HEAVY WEIGHT ENGINE OIL WILL ALSO INCREASE STARTER AMPERAGE DRAW.

# STARTER MOTOR

## DIAGNOSIS AND TESTING - STARTER MOTOR

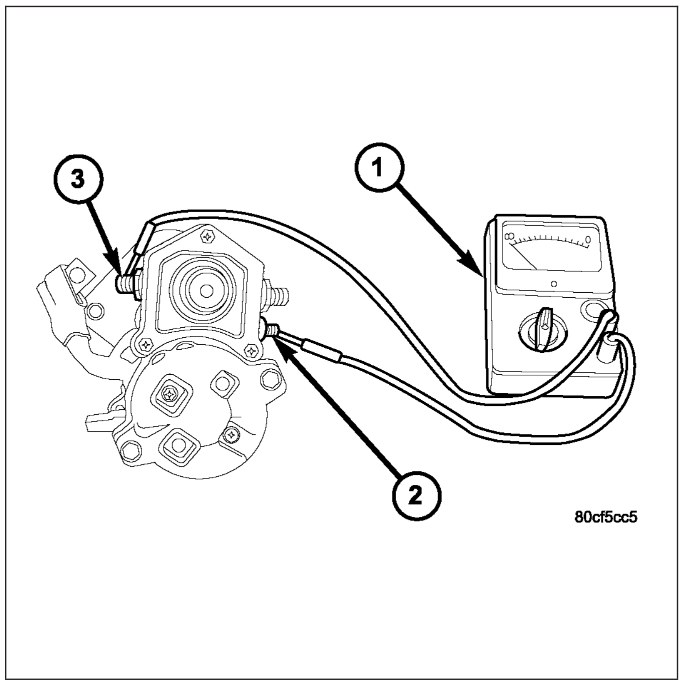
Correct starter motor operation can be confirmed by performing the following free running bench test. This test can only be performed with starter motor removed from vehicle. Refer to Specifications for starter motor specifications.

1. Remove starter motor from vehicle. Refer to Starter Motor Removal and Installation.
2. Mount starter motor securely in a soft-jawed bench vise. The vise jaws should be clamped on the mounting flange of starter motor. Never clamp on starter motor by field frame.
3. Connect a suitable volt-ampere tester and a 12-volt battery to starter motor in series, and set ammeter to 100 ampere scale. See instructions provided by manufacturer of volt-ampere tester being used.
4. Install jumper wire from solenoid terminal to solenoid battery terminal. The starter motor should operate. If starter motor fails to operate, replace faulty starter motor assembly.
5. Adjust carbon pile load of tester to obtain free running test voltage. Refer to Specifications for starter motor free running test voltage specifications.
6. Note reading on ammeter and compare reading to free running test maximum amperage draw. Refer to Specifications for starter motor free running test maximum amperage draw specifications.
7. If ammeter reading exceeds maximum amperage draw specification, replace faulty starter motor assembly.

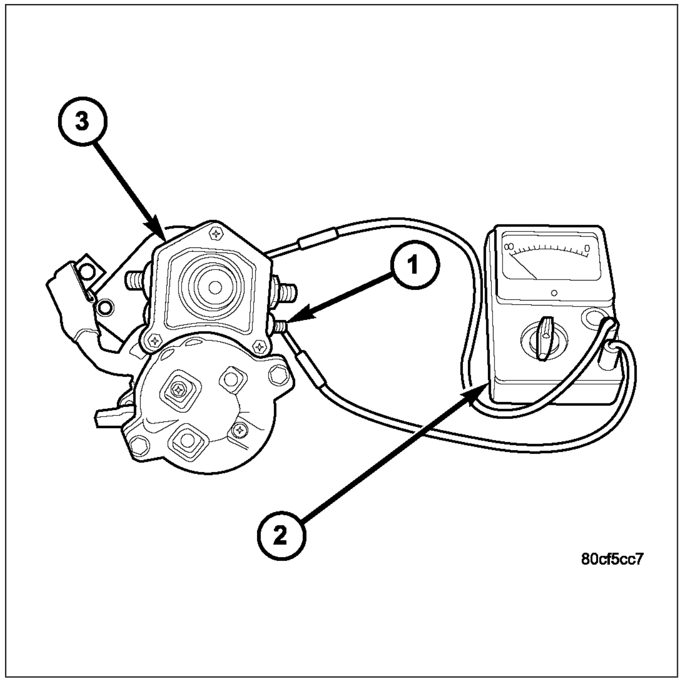
### STARTER SOLENOID

This test can only be performed with starter motor removed from vehicle.

1. Remove starter motor from vehicle. Refer to Starter Motor Removal and Installation.
2. Disconnect wire from solenoid field coil terminal.
3. Check for continuity between solenoid terminal (3) and solenoid field coil terminal (2) with a continuity tester (1). There should be continuity. If OK, go to Step 4. If not OK, replace faulty starter motor assembly.



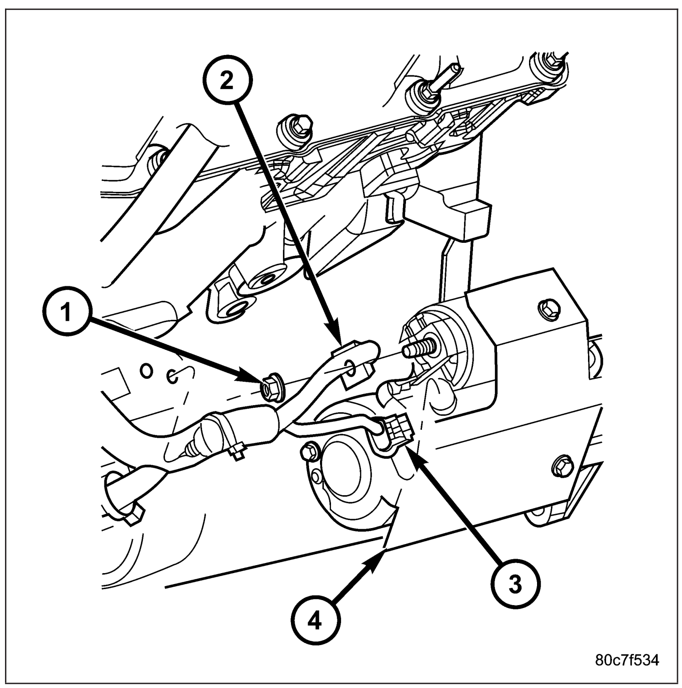
4. Check for continuity between solenoid terminal (1) and solenoid case. There should be continuity. If not OK, replace faulty starter motor assembly.



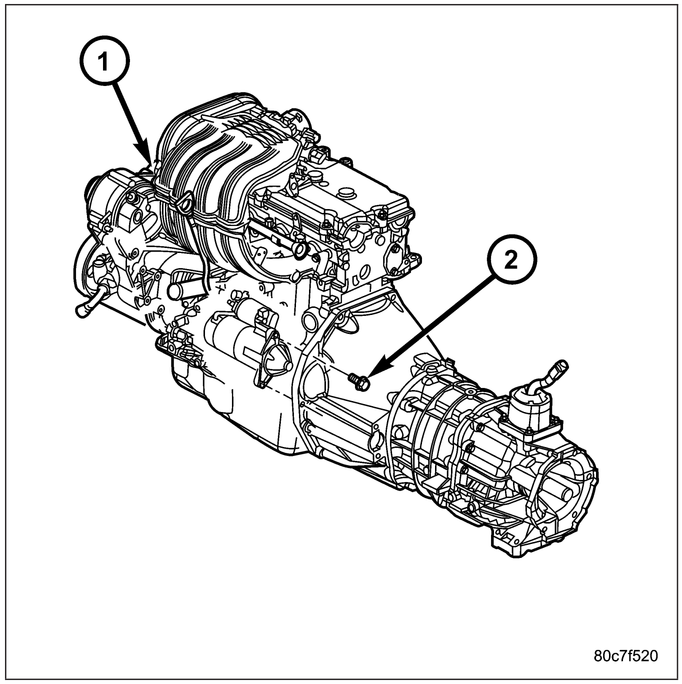

## REMOVAL

### 2.4L

1. Disconnect and isolate negative battery cable.
2. Raise and support vehicle.
3. Remove solenoid wire connector (3) from solenoid terminal.
4. Remove battery cable eyelet (2) from stud on starter solenoid.

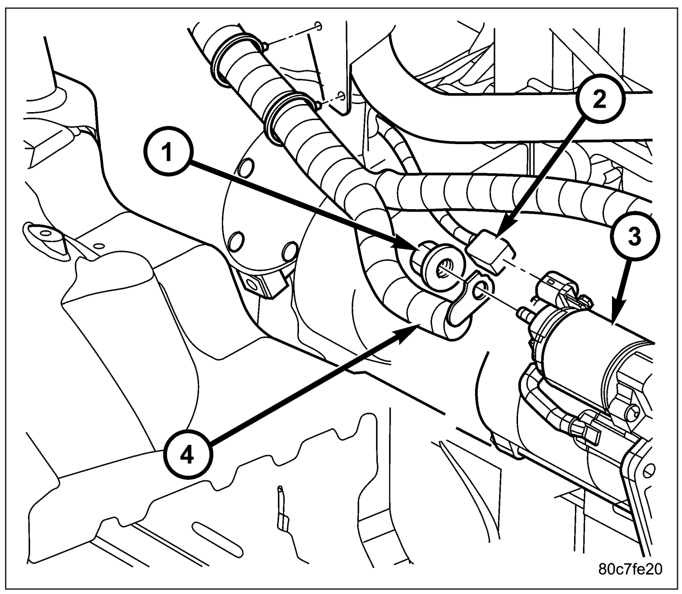


5. Remove two starter mounting bolts (2) and remove starter from vehicle.

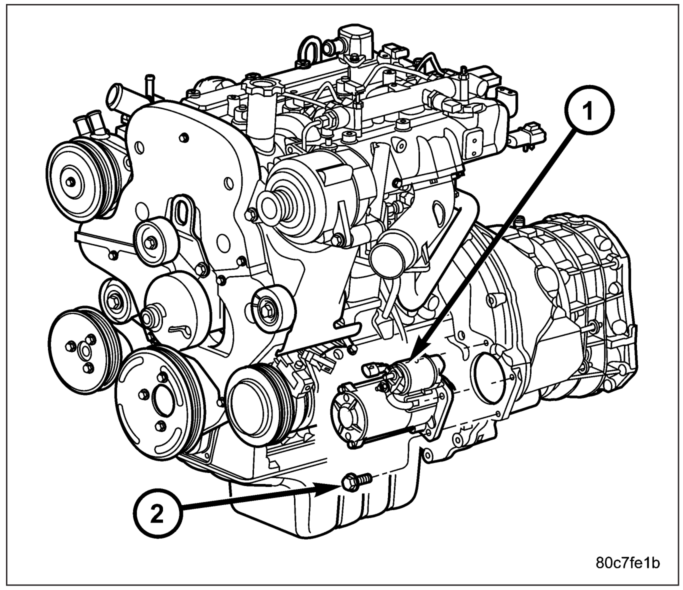



## 2.8L - DIESEL

1. Disconnect and isolate negative battery cable.
2. Raise and support vehicle.
3. Disconnect solenoid wire connector (2) from solenoid terminal.
4. Remove battery cable eyelet (4) from stud on starter solenoid.

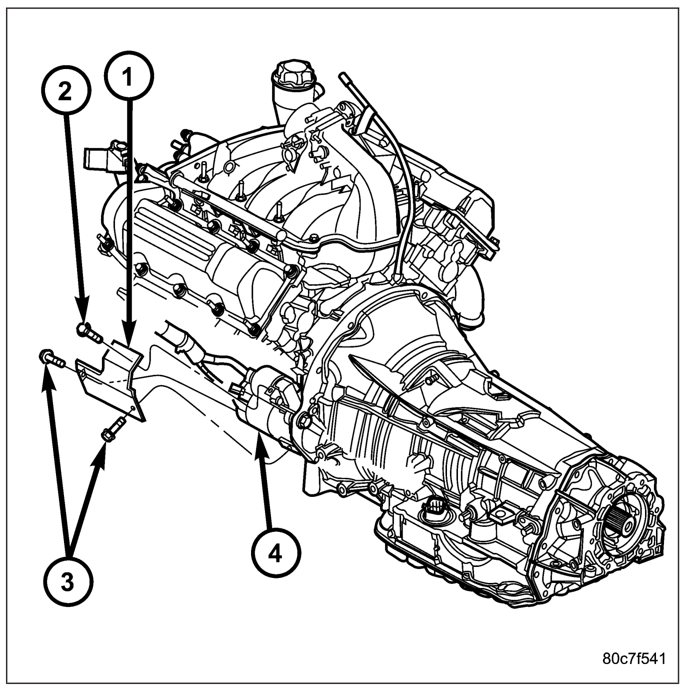


5. Remove three starter mounting bolts (2).
6. Remove starter (1) from transmission bellhousing.

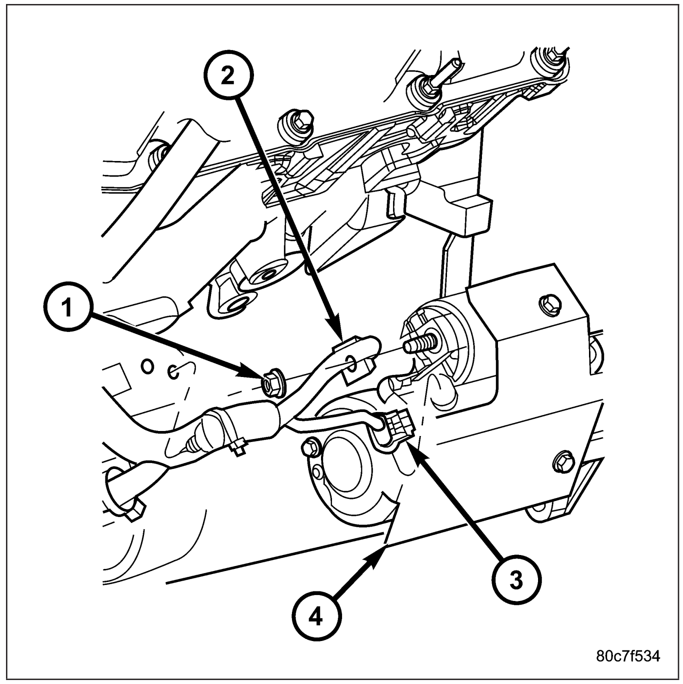



### 3.7L

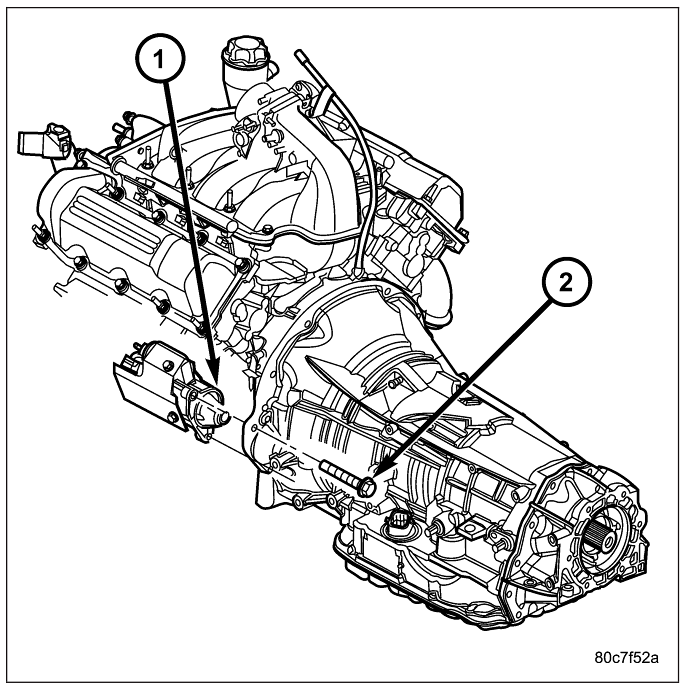
1. Disconnect and isolate negative battery cable.
2. Raise and support vehicle.
3. Remove 2 flange bolts securing left exhaust downpipe to crossover pipe. Lower pipe slightly to allow front propeller shaft removal.
4. Remove front propeller shaft.
5. Remove two starter heat shield bolts (3) at side of starter.
6. Remove starter heat shield nut at front of starter.
7. Remove starter heat shield.



8. Remove solenoid wire connector (3) from solenoid terminal.
9. Remove battery cable eyelet (2) from stud on starter solenoid.



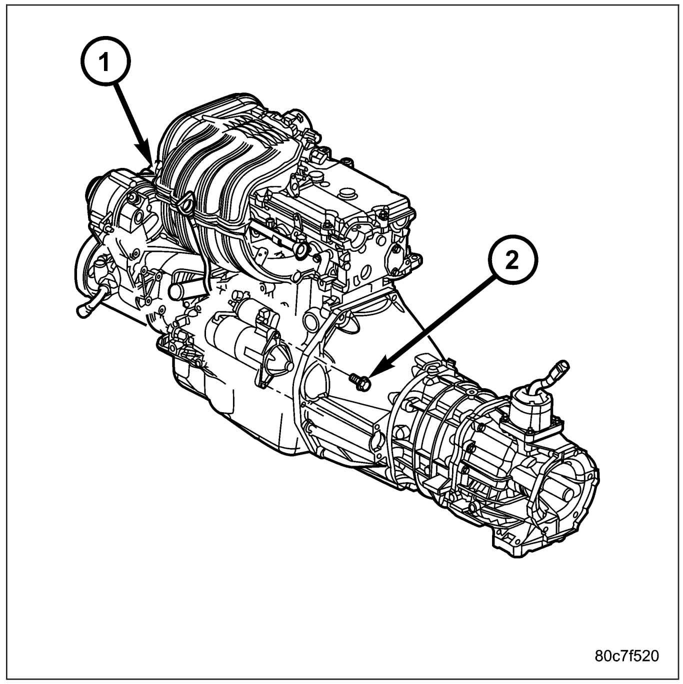

10. Remove two starter mounting bolts (2).
11. Position front of starter to face rear of vehicle. Rotate starter until solenoid position is located below starter.
12. Remove starter from vehicle by passing it between exhaust pipe and transmission bellhousing.



## INSTALLATION

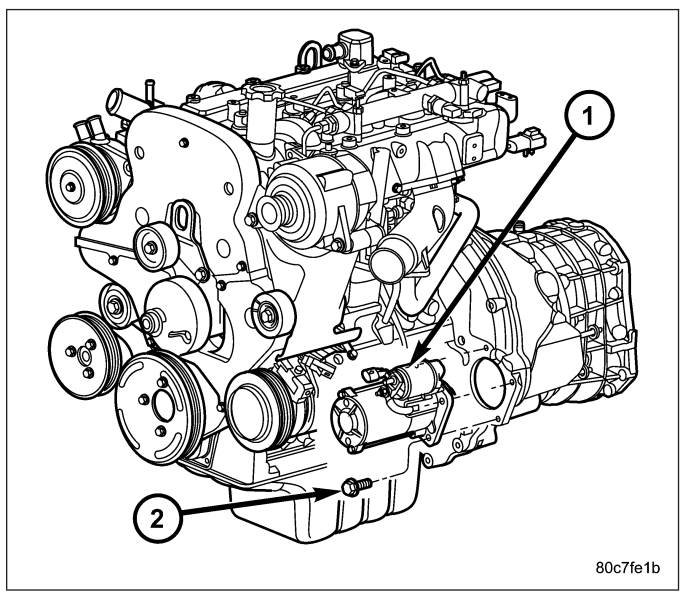
### 2.4L

1. Position starter into bellhousing and install two bolts (2) and tighten to 54 N·m (40 ft. lbs.).
2. Install battery cable and nut to stud on starter solenoid and tighten to 11 N·m (100 in. lbs.).
3. Install solenoid wire connector to solenoid terminal.
4. Lower vehicle.
5. Connect negative battery cable.

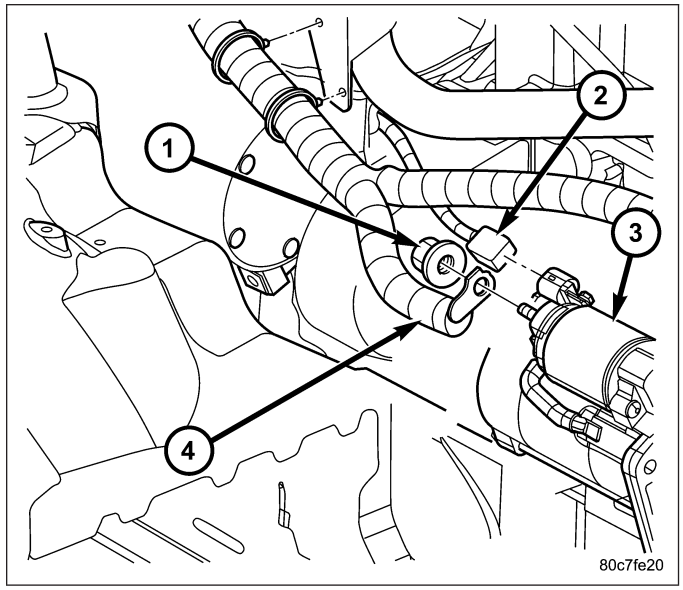



### 2.8L - DIESEL

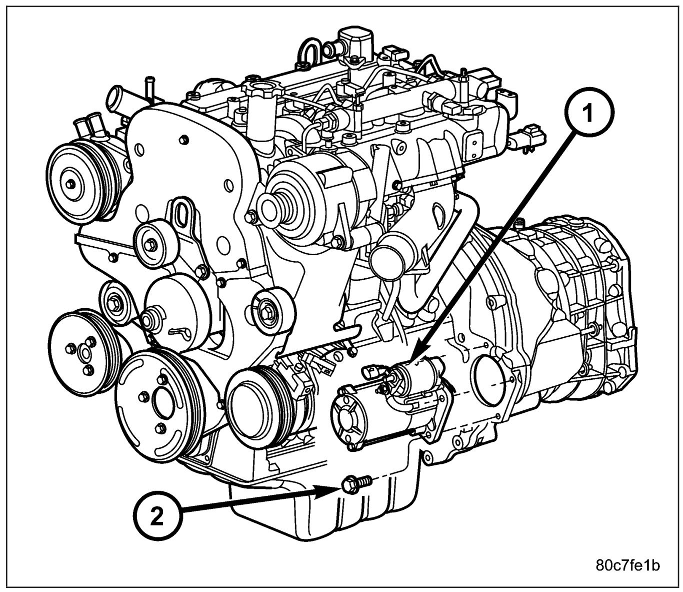
1. Position starter motor (1) to transmission housing.



2. Connect battery cable solenoid terminal wire harness connector (2) to connector receptacle on starter solenoid. Always support starter motor during this process. Do not let starter motor hang from wire harness.
3. Install battery cable eyelet terminal (4) onto solenoid B (+) terminal stud.
4. Install nut (1) securing battery cable eyelet terminal to starter solenoid B (+) terminal stud and tighten to 11 N·m (100 in. lbs.).



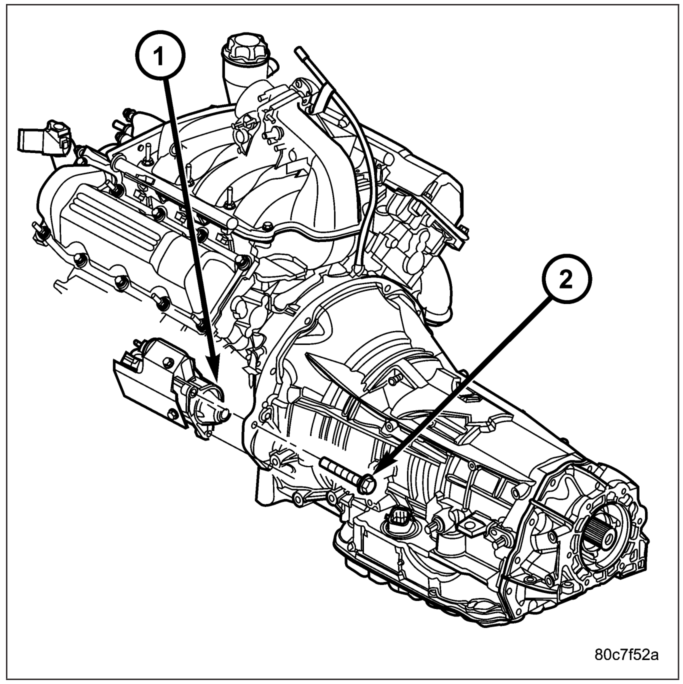

5. Position starter motor and install three bolts (2). Tighten 3 bolts in this sequence: top bolt, bottom bolt, middle bolt to 27 N·m (20 ft. lbs.).
6. Lower vehicle.
7. Connect negative battery cable.




## 3.7L

1. Position front of starter towards rear of vehicle with solenoid position rotated until it is located below starter. Install starter by passing it between exhaust pipe and transmission bellhousing.

2. Position starter into bellhousing and install two bolts (2) and tighten to 54 N·m (40 ft. lbs.).
3. Install battery cable and nut to stud on starter solenoid and tighten to 11 N·m (100 in. lbs.).
4. Install solenoid wire connector to solenoid terminal.
5. Position starter heat shield and install nut at front of starter.
6. Install 2 starter heat shield bolts at side of starter.
7. Install front propeller shaft.
8. Install 2 flange bolts securing left exhaust downpipe to crossover pipe.
9. Lower vehicle.
10. Connect negative battery cable.



# RELAY - STARTER MOTOR

## DESCRIPTION

The starter relay is an electromechanical device that switches battery current to the pull-in coil of the starter solenoid when ignition switch is turned to Start position. The starter relay is located in the Power Distribution Center (PDC) in the engine compartment. See PDC cover for relay identification and location.

The starter relay is a International Standards Organization (ISO) relay. Relays conforming to ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions.

The starter relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

## OPERATION

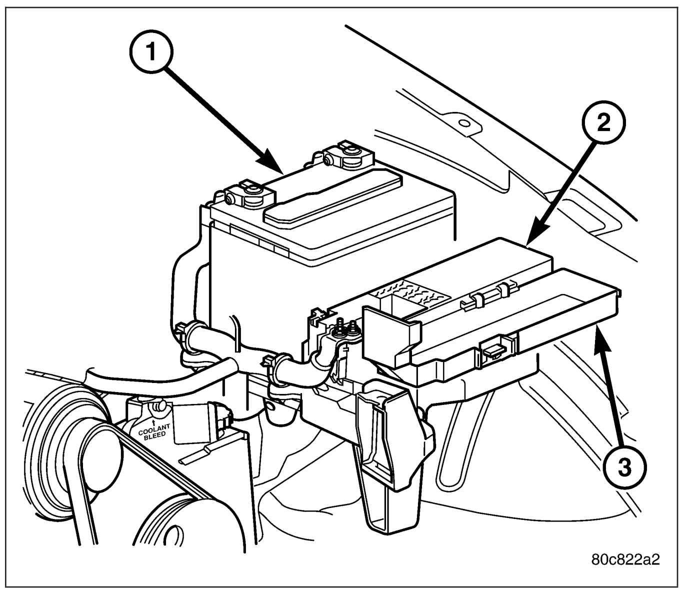
The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When electromagnetic coil is energized, it draws the movable contact away from normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When electromagnetic coil is de-energized, spring pressure returns movable contact to normally closed position. The resistor or diode is connected in parallel with electromagnetic coil within relay, and helps to dissipate voltage spikes produced when coil is de-energized.

## REMOVAL

The starter relay is located in the Power Distribution Center (PDC) (2). Refer to label on PDC cover for relay location.

1. Remove PDC cover (3).
2. Remove relay from PDC.
3. Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.
4. Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.




## INSTALLATION

1. Refer to Power Distribution Center (PDC) cover for starter relay location.
2. Install relay to PDC.
3. Install cover to PDC.

# HEATED SYSTEMS

## TABLE OF CONTENTS



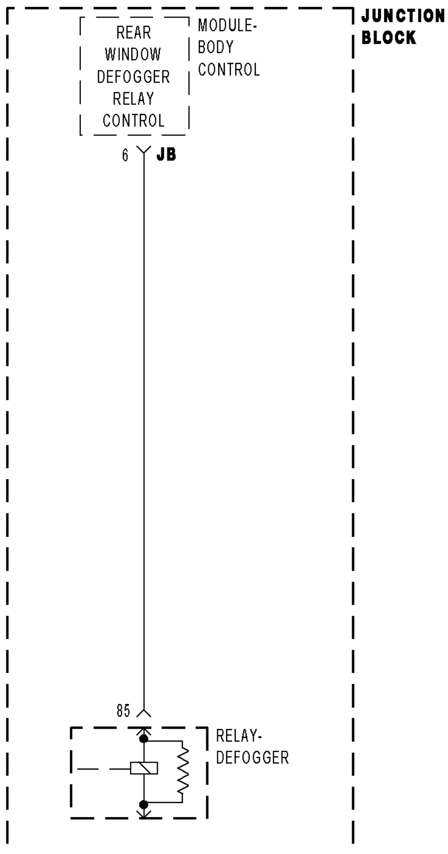
# HEATED GLASS - ELECTRICAL DIAG

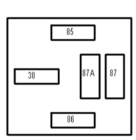
## TABLE OF CONTENTS

# HEATED GLASS - ELECTRICAL DIAG

## DIAGNOSIS AND TESTING

## REAR DEFOGGER RELAY CONTROL CIRCUIT SHORT TO VOLTAGE




RELAY-
REAR WINDOW
DEFOGGER
(IN JUNCTION BLOCK)

8170b607

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the BCM detects unwanted voltage on the rear window defogger control circuit.

| Possible Causes |
|---|
| CODE ACTIVE |
| REAR DEFOGGER RELAY SHORTED |
| JUNCTION BLOCK - REAR DEFOGGER RELAY CONTROL CIRCUIT SHORT TO VOLTAGE |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. CHECK TROUBLE CODE

Turn the ignition on.

With the scan tool, erase DTCs.

Attempt to operate the Rear Window Defogger.

With the scan tool, read DTCs.

**Does the scan tool display REAR WINDOW DEFOGGER RELAY CONTROL CIRCUIT SHORT TO VOLTAGE?**

**Yes** >> Go To 2

**No** >> Problem is intermittent and not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors and repair as necessary.
Perform BODY VERIFICATION TEST - VER 1.

### 2. RELAY SHORTED

Remove the Rear Window Defogger Relay from the Junction Block.

Install a substitute relay in place of the Rear Window Defogger Relay.

With the scan tool, erase DTCs.

Attempt to operate the Rear Window Defogger.

With the scan tool, read DTCs.

**Does the scan tool display REAR WINDOW DEFOGGER RELAY CONTROL CIRCUIT SHORT TO VOLTAGE?**

**Yes** >> Go To 3

**No** >> Replace the original relay.
Perform BODY VERIFICATION TEST - VER 1.

## 3. JUNCTION BLOCK - REAR WINDOW DEFOGGER RELAY CONTROL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

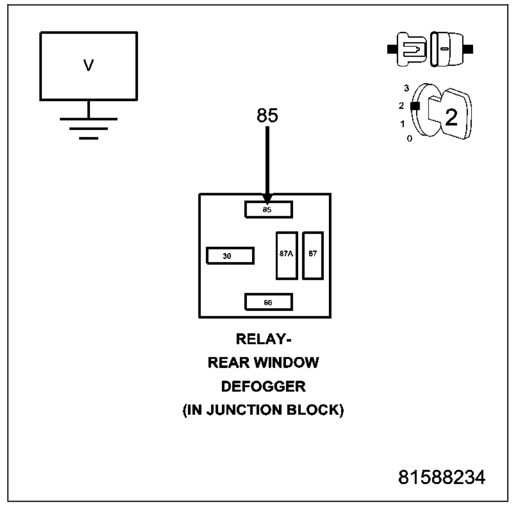
Remove the Rear Window Defogger Relay from the Junction Block.

Remove the Body Control Module from the Junction Block.

**NOTE: Ensure the Junction Block connectors are reconnected at this time.**

Turn the ignition on.

Measure the voltage of the Rear Window Defogger Relay Control circuit in the relay connector of the Junction Block.

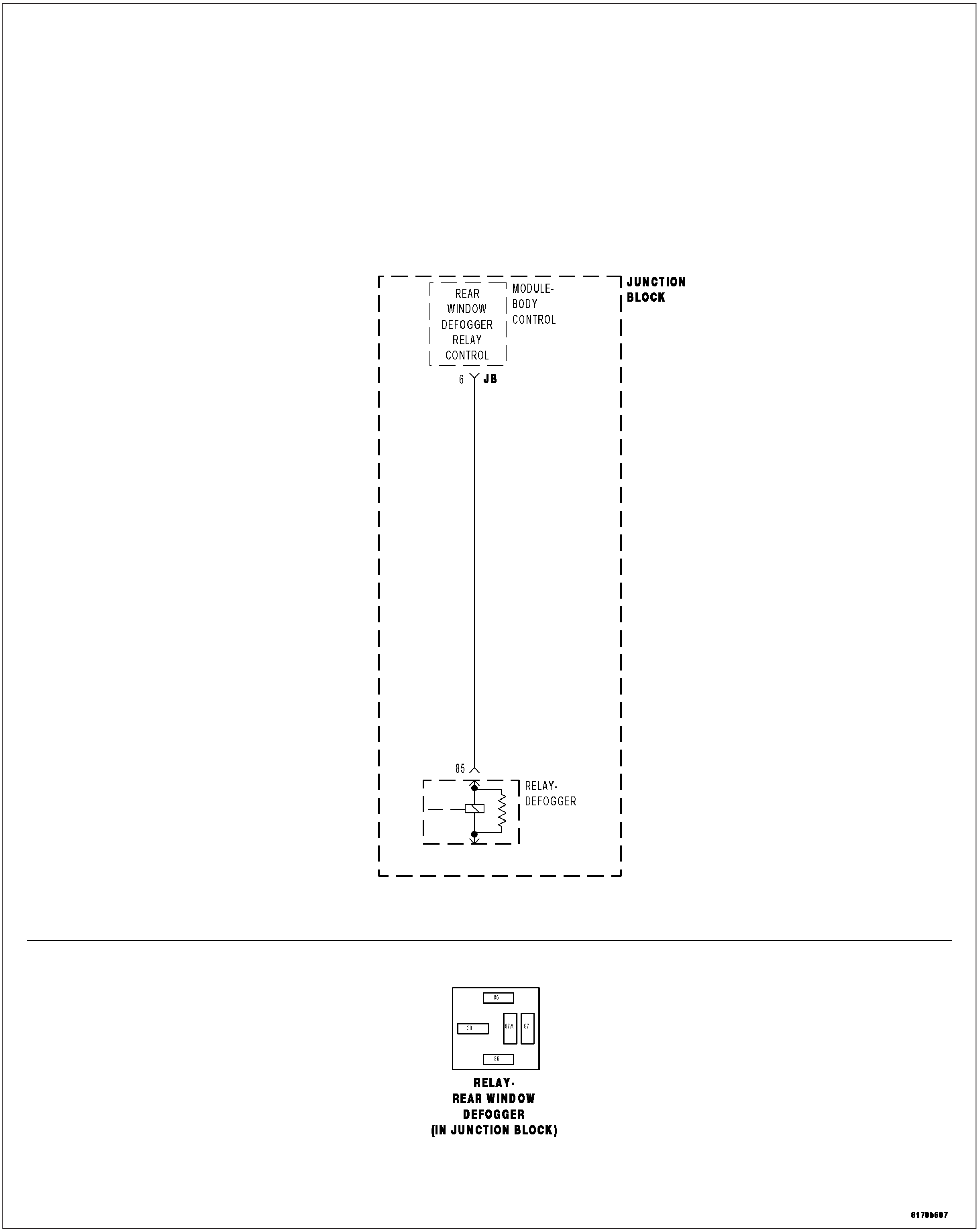



**Is there any voltage present?**

**Yes** >> Replace the Junction Block.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

## REAR DEFOGGER RELAY CONTROL CIRCUIT OPEN/SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

## Diagnostic Test

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the BCM detects no voltage on the Rear Window Defogger Control circuit due to an open or short to ground.

| Possible Causes |
|---|
| JUNCTION BLOCK FUSE 39 |
| CODE ACTIVE |
| RELAY OPEN OR SHORTED |
| JUNCTION BLOCK - REAR WINDOW DEFOGGER RELAY CONTROL SHORT TO GROUND |
| FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN |
| JUNCTION BLOCK - REAR WINDOW DEFOGGER RELAY CONTROL OPEN |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. CHECK TROUBLE CODE

Turn the ignition on.

With the scan tool, erase DTCs.

Attempt to operate the Rear Window Defogger.

With the scan tool, read DTCs.

**Does the scan tool display REAR WINDOW DEFOGGER RELAY CONTROL CIRCUIT OPEN/SHORT TO GROUND?**

**Yes** >> Go To 2

**No** >> Problem is intermittent and not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors and repair as necessary. Ensure the relay is completely plugged in.
Perform BODY VERIFICATION TEST - VER 1.

### 2. JUNCTION BLOCK FUSE 39

Check Junction Block fuse 39.

**Is the fuse open.**

**Yes** >> Check for a short to ground and replace the Junction Block fuse.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition on.

Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output circuit at Fuse 39.

The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.

**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the open Fused Ignition Switch Output circuit as necessary.
Perform BODY VERIFICATION TEST - VER 1.

## 4. RELAY OPEN OR SHORTED

Remove the Rear Window Defogger Relay from the Junction Block.

Install fuse if previously removed.

Install a substitute relay in place of the Rear Window Defogger Relay.

With the scan tool, erase DTCs.

Attempt to operate the Rear Window Defogger.

With the scan tool, read DTCs.

**Does the scan tool display REAR WINDOW DEFOGGER RELAY CONTROL CIRCUIT OPEN/SHORT TO GROUND?**

**Yes** >> Go To 5

**No** >> Replace the original relay.
Perform BODY VERIFICATION TEST - VER 1.

## 5. JUNCTION BLOCK - REAR WINDOW DEFOGGER RELAY CONTROL SHORT TO GROUND

Turn the ignition off.

Remove the Rear Window Defogger Relay from the Junction Block.

Remove the Body Control Module from the Junction Block.

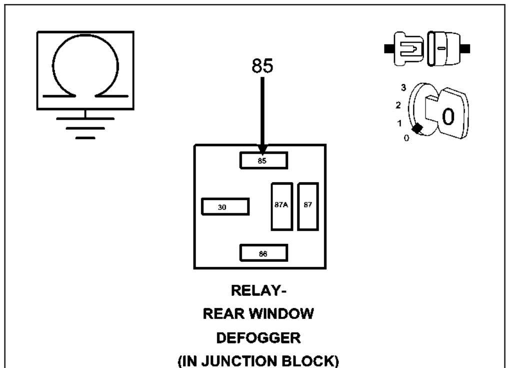
**NOTE: Ensure the Junction Block connectors are reconnected at this time.**

Measure the resistance between ground and the Rear Window Defogger Relay Control circuit in the relay connector of the Junction Block.

**Is the resistance below 100.0 ohms?**

**Yes** >> Replace the Junction Block.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 6




8170b668

## 6. JUNCTION BLOCK - REAR WINDOW DEFOGGER RELAY CONTROL OPEN

Turn the ignition off.

Remove the Rear Window Defogger Relay from the Junction Block.

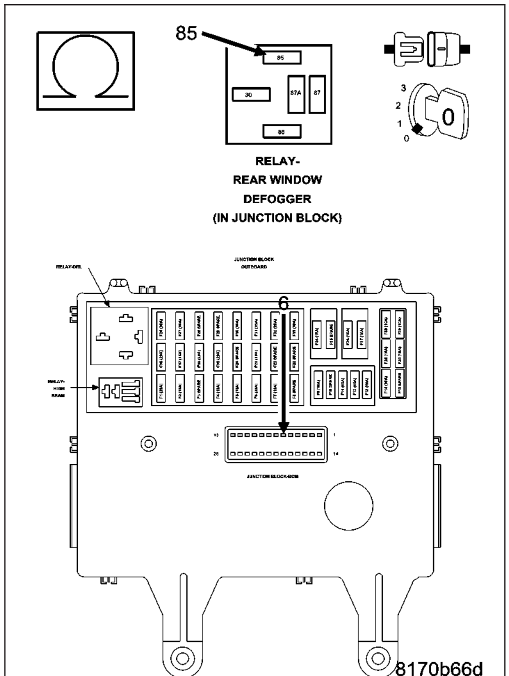
Remove the Body Control Module from the Junction Block.

Measure the resistance of the Rear Window Defogger Relay Control circuit between the Relay connector and the Junction Block - BCM connector.

**Is the resistance below 2.0 ohms?**

**Yes** >> Go To 7

**No** >> Replace the Junction Block.
Perform BODY VERIFICATION TEST - VER 1.




8170b66d

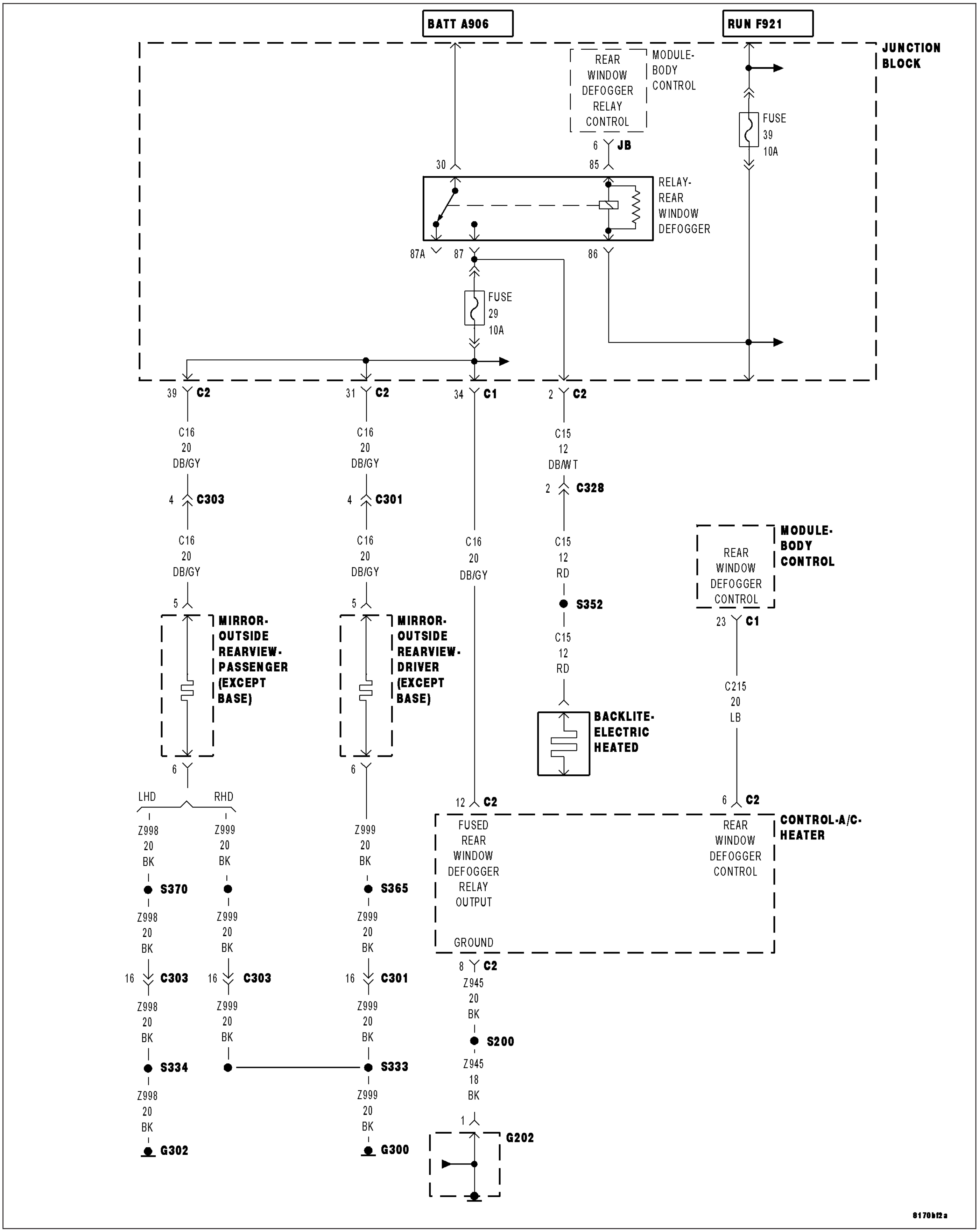
## 7. BODY CONTROL MODULE

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

## *REAR WINDOW DEFOGGER INOPERATIVE




For the Instrument Cluster circuit diagram (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| JUNCTION BLOCK FUSE 29 |
| PDC FUSE 19 |
| REAR DEFOGGER RELAY DTC'S |
| REAR WINDOW DEFOGGER RELAY OUTPUT CIRCUIT OPEN |
| REAR WINDOW DEFOGGER RELAY |
| REAR WINDOW DEFOGGER GRID OPEN |
| FUSED B(+) CKT OPEN AT RELAY |
| A/C-HEATER CONTROL |
| OPEN GROUND CIRCUIT |
| FUSED REAR WINDOW DEFOGGER RELAY OUTPUT CIRCUIT OPEN |
| REAR WINDOW DEFOGGER CONTROL OPEN |
| BODY CONTROL MODULE |
| A/C-HEATER CONTROL LED |

## Diagnostic Test

### 1. REAR DEFOGGER RELAY DTC'S

With the scan tool, read the Body Control Module DTC's.

**Are there any Rear Defogger Relay DTC's present?**

**Yes** >> Refer to the symptom list for problems related to Rear Defogger Relay DTC's.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 2

### 2. REAR DEFOGGER SWITCH OPERATION

Toggle the Rear Defogger switch and observe the indicator.

**Does the indicator toggle on and off when the switch is pressed?**

**Yes** >> Go To 3

**No** >> Go To 4

### 3. REAR DEFOGGER GRID OPEN

Turn the ignition on.

Turn the Rear Window Defogger on.

Measure the voltage between the Rear Window Defogger Relay Output circuit at the defogger grid on the rear window to ground.

**Is the voltage above 12.0 volts?**

**Yes** >> Repair the open in the Rear Window Defogger Grid or the Grid Ground circuit.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the Rear Window Defogger Relay Output circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.

## 4. SCAN TOOL ON/OFF STATE

With the scan tool, Rear Defogger Switch state.

Cycle the Rear Defogger On/Off button and observe the scan tool.

**Did the scan tool display change?**

**Yes** >> Go To 5

**No** >> Go To 10

## 5. PDC FUSE 19

Check the Power Distribution Center fuse 19.

**Is the fuse open?**

**Yes** >> Check for a short to ground and replace the PDC fuse.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 6

## 6. JUNCTION BLOCK FUSE 29

Check Junction Block fuse 29.

**Is the fuse open?**

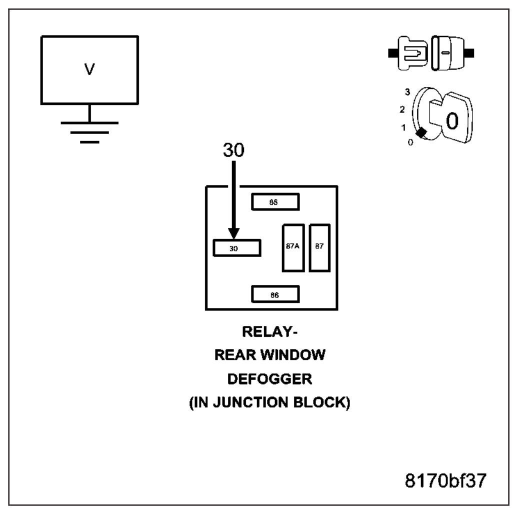
**Yes** >> Check for a short to ground and replace the Junction Block fuse.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 7

## 7. FUSED B(+) CKT OPEN

Remove the Rear Window Defogger Relay from the Junction Block.

Measure the voltage of the Fused B(+) circuit in the Rear Window Defogger Relay connector.




**Is the voltage above 10.0 volts?**

**Yes** >> Go To 8

**No** >> Repair the open Fused B(+) circuit from PDC fuse 19.
Perform BODY VERIFICATION TEST - VER 1.

## 8. SUBSTITUTE RELAY

Remove the Rear Window Defogger Relay from the Junction Block.

Install a known good relay in the Rear Window Defogger Relay connector.

Turn the ignition on.

Toggle the Rear Window Defogger switch and observe the indicator.

**Does the Rear Window Defogger indicator illuminate?**

**Yes** >> Replace the original Rear Window Defogger Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 9

## 9. A/C HEATER CONTROL LED

Gain access to the A/C Heater Control C2 connector.

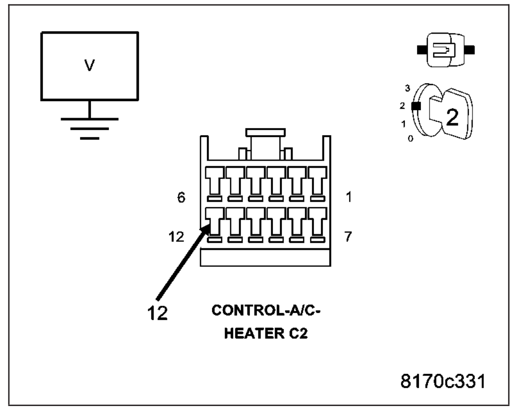
Toggle the Rear Window Defogger switch in the next step.

While back probing, measure the voltage of the Fused Rear Window Defogger Relay Output circuit.

**Is there any voltage present?**

**Yes** >> Replace the A/C-Heater Control.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the Fused Rear Window Defogger Relay Output circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.




## 10. GROUND WIRE

Turn the ignition off.

Disconnect the A/C-Heater Control C2 connector.

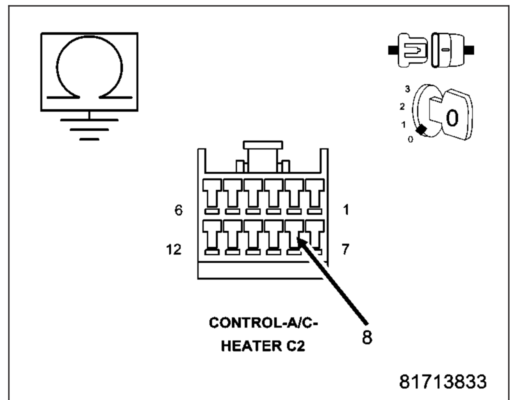
Turn of all interior lights.

Measure the resistance of the Ground circuit in the C2 connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 11

**No** >> Repair the ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.




## 11. A/C HEATER CONTROL

Turn the ignition off.

Disconnect the A/C-Heater Control C2 connector.

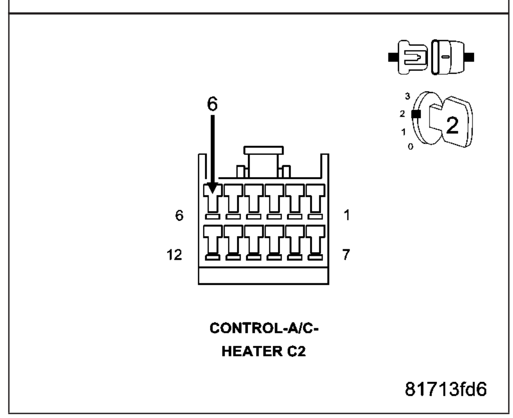
With the scan tool, read the Rear Defogger Switch state.

Connect a jumper wire between Rear Window Defogger Control and ground.

**Did the scan tool display change?**

**Yes** >> Replace the A/C-Heater Control.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 12



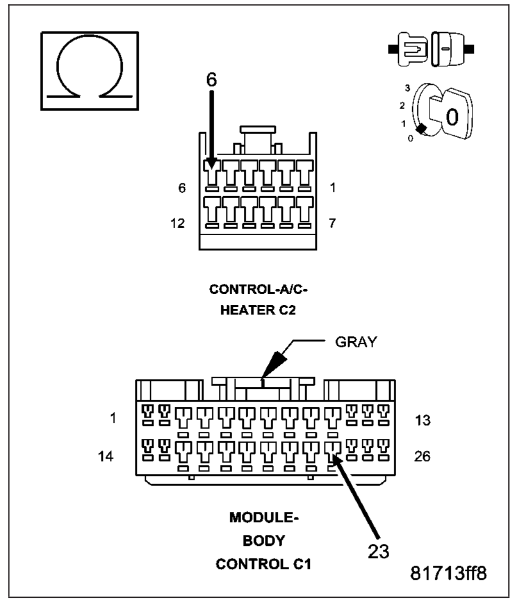
## 12. REAR WINDOW DEFOGGER CONTROL OPEN

Turn the ignition off.

Disconnect the A/C-Heater Control C2 connector.

Disconnect the Body Control Module C1 connector.

Measure the resistance of the Rear Window Defogger Control circuit between the A/C- Heater Control C2 connector and the Body Control Module C1 connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the Rear Window Defogger Control circuit for an open.

Perform BODY VERIFICATION TEST - VER 1.

# HEATED GLASS - SERVICE INFORMATION

## TABLE OF CONTENTS

# HEATED GLASS - SERVICE INFORMATION

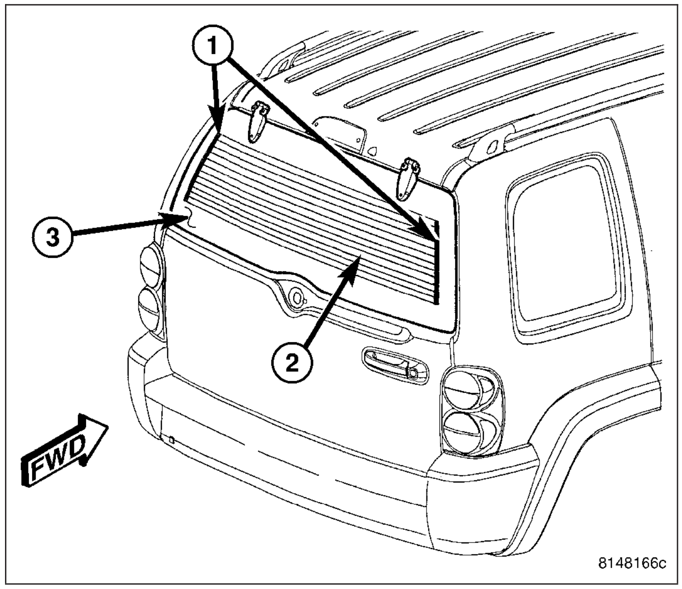
## DESCRIPTION

**CAUTION: Grid lines can be damaged or scraped off with sharp instruments. Care should be taken in cleaning glass or removing foreign materials, decals or stickers. Normal glass cleaning solvents or hot water used with rags or toweling is recommended.**

The rear window defogger system, also known as electric backlight (EBL), consists of two vertical bus bars (1) linked by a series of grid lines (2) fired onto the inside surface of the rear window (3).

The EBL system is turned On or Off by a switch in the A/C-heater control located at the center of the instrument panel and by a timing circuit integral to the body control module (BCM).

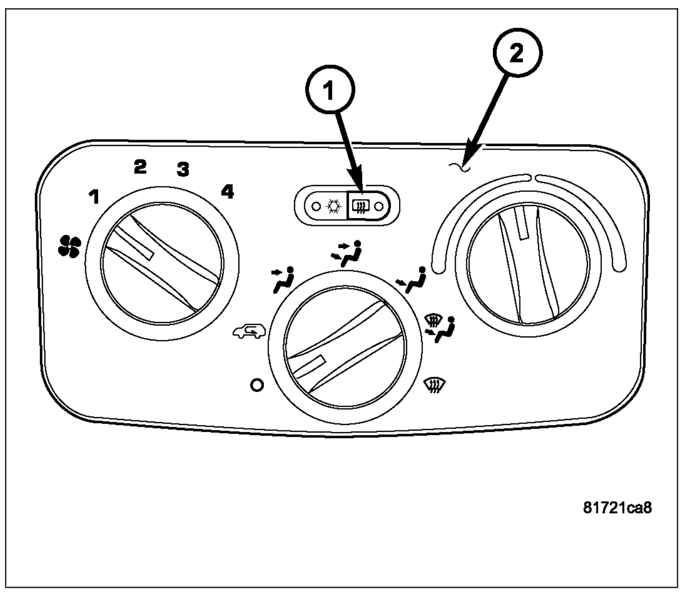
Circuit protection is provided by two cartridge fuses. The fuse located in the junction block (JB) is for the control circuit and the fuse located in the power distribution center (PDC) is for the heated grid circuit.




## OPERATION

The electric backlight (EBL) system is controlled by a momentary switch (1) located in the A/C-heater control (2) In the instrument panel. When the rear window defogger switch is pressed to the On position, the body control module (BCM) energizes the rear window defogger (EBL) relay, which then directs fused battery current through the relay and to the rear defogger grid lines and the heated side view mirrors, when equipped. The grid lines heat the glass to help clear the rear window and side mirror surfaces of fog or frost.

An amber indicator in the rear window defogger switch will illuminate to indicate when the EBL system is turned on. The BCM contains the EBL system control circuitry including the timer logic.




**NOTE: The EBL system turns off automatically after 10 minutes of initial operation. Each following activation cycle of the EBL system will last 5 minutes.**

The EBL system will automatically turn off after a programmed time interval of about 10 minutes as long as the ignition switch is the Run position. After the initial time interval has expired, if the rear window defogger switch is turned on again during the same ignition cycle, the EBL system will automatically turn off after about 5 minutes. The EBL system will also turn off if the ignition switch is turned to any position other than Run or by manually pressing the rear window defogger switch a second time.

Repair of the rear window defogger grid lines, bus bars, terminals or pigtail wires can be accomplished using the Mopar Rear Window Defogger Repair Kit (Part Number 04549275) or equivalent (Refer to 8 - ELECTRICAL/

HEATED GLASS/REAR WINDOW DEFOGGER GRID - STANDARD PROCEDURE - GRID LINE AND TERMINAL REPAIR).

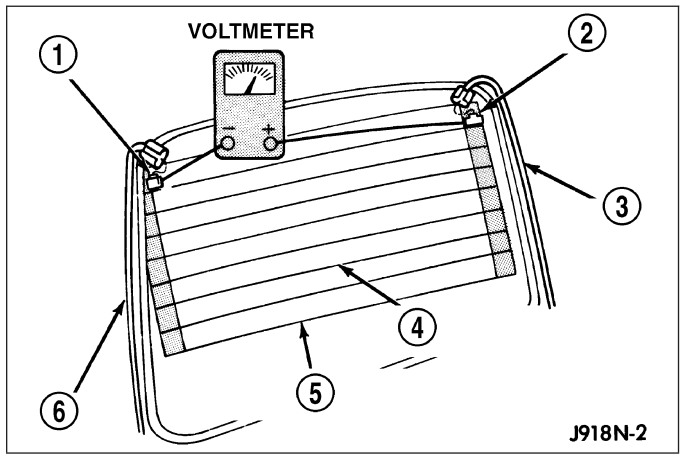
## DIAGNOSIS AND TESTING

## ELECTRIC BACKLIGHT (EBL) SYSTEM

**NOTE: Illumination of the defogger switch indicator lamp does not necessarily mean that electrical current is reaching the rear glass heating grid lines.**

**NOTE: For circuit descriptions and diagrams of the rear window defogger (EBL) system, refer to 8W - WIRING DIAGRAM INFORMATION.**

Operation of the electric backlight (EBL) system can be confirmed by the following:




1. Use a DRBIII® scan tool and check for diagnostic trouble codes (DTCs) related to the body control module (BCM). If no DTCs are found, go to Step 2. If any DTCs are found, repair as required, then proceed to Step 2
2. Turn the ignition switch to the Run position. Set the rear window defogger switch in the On position. The rear window defogger operation can be checked by feeling the surfaces of the rear window glass or outside rear view mirror glass. A distinct difference in temperature between the grid lines (5) and the adjacent clear glass or the mirror glass should be detected within three to four minutes of operation.
3. If a temperature difference is not detected, use a 12-volt DC voltmeter and contact the rear glass heating grid terminal A (1) with the negative lead, and terminal B (2) with the positive lead. The voltmeter should read battery voltage. If the voltmeter does not read battery voltage, check the following:
   - Confirm the ignition switch is in the Run position.
   - Confirm the rear window defogger switch is in the On position.
   - Confirm the EBL feed wire (3) is connected to the heating grid positive terminal and that there is continuity between the EBL relay and the heating grid.
   - Confirm the EBL ground wire (6) is connected to the heating grid negative terminal and that there is continuity to ground.
   - Check the EBL relay and fuse located in the junction block (JB) in the passenger compartment. The relay and fuse must be tight in the receptacles and all electrical connections must be secure.
   - Check the fuse in the power distribution center (PDC) located in the engine compartment. The fuse must be tight in the receptacle and all electrical connections must be secure.
4. If broken defogger grid lines or bus bars are suspected, use a 12-volt DC voltmeter and contact terminal A with the negative lead and each rear glass heating grid line at its mid-point C (4) with the positive lead. The voltmeter should read approximately 6 volts at each grid line mid-point. If the voltmeter does not read approximately 6 volts, repair the open grid line(s) or bus bar(s) (Refer to 8 - ELECTRICAL/HEATED GLASS/GRID-REAR WINDOW DEFOGGER - STANDARD PROCEDURE).
5. If the EBL system still does not operate, replace the A/C-heater control (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CONTROL-A/C HEATER - REMOVAL).
6. If the EBL system operation has been verified but the rear window defogger indicator does not illuminate, replace the A/C-heater control (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CONTROL-A/C HEATER - REMOVAL).

# GRID-REAR WINDOW DEFOGGER

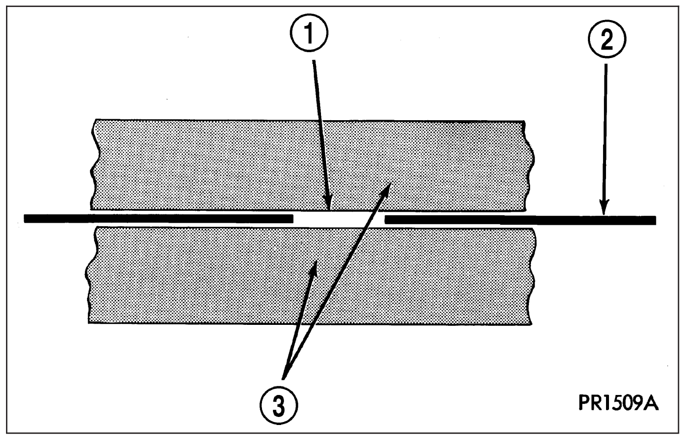
## STANDARD PROCEDURE

## GRID LINE AND TERMINAL REPAIR

**WARNING: Materials contained in the Repair Kit (Part Number 04549275) may cause skin or eye irritation. The kit contains epoxy resin and amine type hardener, which are harmful if swallowed. Avoid contact with the skin and eyes. For skin contact, wash the affected areas with soap and water. For contact with the eyes, flush with plenty of water. Do not take internally. If taken internally, induce vomiting and call a physician immediately. Use with adequate ventilation. Do not use near fire or flame. Contains flammable solvents. Keep out of the reach of children. Failure to follow the warnings could result in possible personal injury or death.**

Repair of the rear glass heating grid lines, bus bars, terminals or pigtail wires can be accomplished using the Mopar Rear Window Defogger Repair Kit (Part Number 04549275) or equivalent.

1. Mask the repair area with masking tape (3) so that the conductive epoxy can be applied neatly. Extend the epoxy application onto the grid line (2) or the bus bar on each side of the break (1).
2. Follow the instructions in the repair kit for preparing the damaged area.
3. Remove the package separator clamp and mix the two conductive epoxy components thoroughly within the packaging. Fold the package in half and cut the center corner to dispense the epoxy.
4. For grid line repairs, mask the area to be repaired with masking tape or use a template.
5. Apply the epoxy through the slit in the masking tape or template. Overlap both ends of the break by at least 19 millimeters (0.75 inch).




6. For a terminal or pigtail wire replacement, mask the adjacent areas so the epoxy can be extended onto the adjacent grid line as well as the bus bar. Apply a thin layer of epoxy to the area where the terminal or pigtail wire was fastened and onto the adjacent grid line.
7. Apply a thin layer of conductive epoxy to the terminal or bare wire end of the pigtail and place it in the proper location on the bus bar. To prevent the terminal or pigtail wire from moving while the epoxy is curing, it must be wedged or clamped.
8. Carefully remove the masking tape or template.

**CAUTION: Do not allow the glass surface to exceed 204° C (400° F) when using a heat gun, or the glass may fracture.**

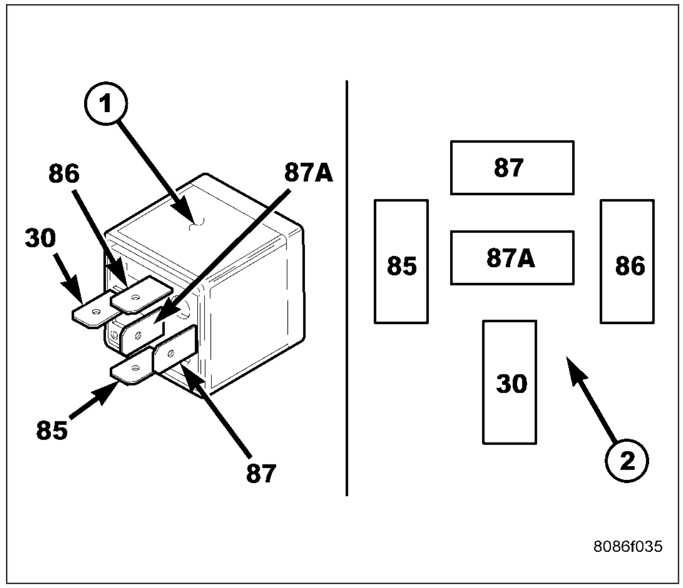
9. Allow the epoxy to cure 24 hours at room temperature, or carefully use a heat gun for 15 minutes. When using a heat gun, hold it approximately 25.4 centimeters (10 inches) from the repair and do not allow the glass surface to exceed 204° C (400° F).
10. After the conductive epoxy is properly cured, remove the wedge or clamp from the terminal or pigtail wire.
11. Connect the wire harness leads to the grid terminals or pigtail wires and verify EBL operation.

# RELAY-REAR WINDOW DEFOGGER

## DESCRIPTION

The rear window defogger (EBL) relay (1) is an International Standards Organization (ISO)-type relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal functions and patterns (2). The EBL relay is a electromechanical device that switches battery current through a fuse in the power distribution center (PDC) to the rear window defogger grid and to the outside mirror heating grids, when equipped. The EBL relay is energized when the relay coil is provided a ground path by the control circuitry within the body control module (BCM).

The EBL relay is located in the junction block (JB) in the passenger compartment.




## OPERATION

The ISO-standard rear window defogger (EBL) relay is an electromechanical switch that uses a low current input controlled by the body control module (BCM) to control the high current output to the rear window defogger grid lines The movable, common feed relay contact is held against the fixed, normally closed relay contact by spring pressure. When the electromagnetic relay coil is energized, it draws the movable common feed relay contact away from the fixed, normally closed relay contact and, holds it against the fixed, normally open relay contact. This action allows high current to flow to the rear window defogger grid lines.

When the relay coil is de-energized, spring pressure returns the movable relay contact back against the fixed, normally closed contact point. The resistor or diode is connected in parallel with the relay coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The EBL relay cannot be repaired and, if faulty or damaged, it must be replaced. Refer to the appropriate wiring information for diagnosis and testing of the ISO-standard relay and for complete rear window defogger (EBL) wiring diagrams.

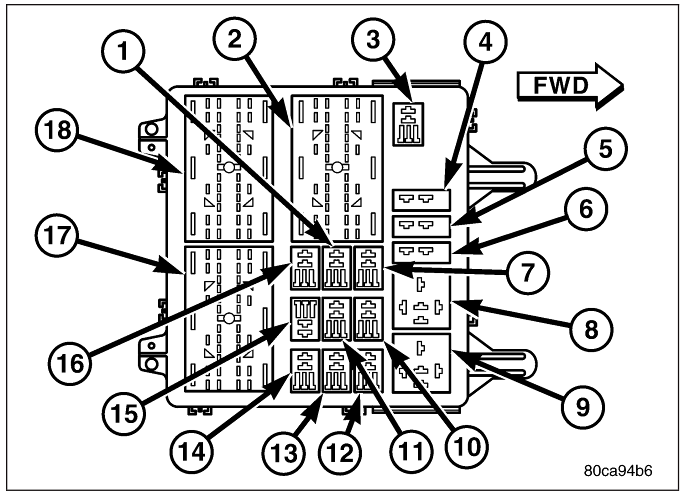
## REMOVAL

**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in an accidental airbag deployment and possible personal injury or death.**

1. Disconnect and isolate the negative battery cable.
2. Remove the cover from the junction block (JB) located in the passenger compartment.

**NOTE: Refer to the fuse and relay layout map on the inside of the JB cover for EBL relay location.**

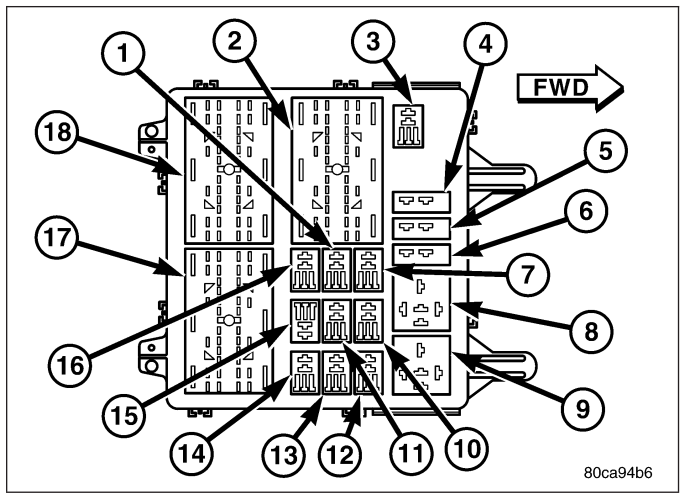
3. Remove the EBL relay (8) from the JB.




## INSTALLATION

**NOTE: Refer to the fuse and relay layout map on the inside of the junction block (JB) cover for EBL relay location.**

1. Position the EBL relay (8) into the proper receptacle of the JB.
2. Align the EBL relay terminals with the terminal cavities in the JB receptacle and push down firmly on the relay until the terminals are fully seated.
3. Install the cover onto the JB.
4. Reconnect the negative battery cable.

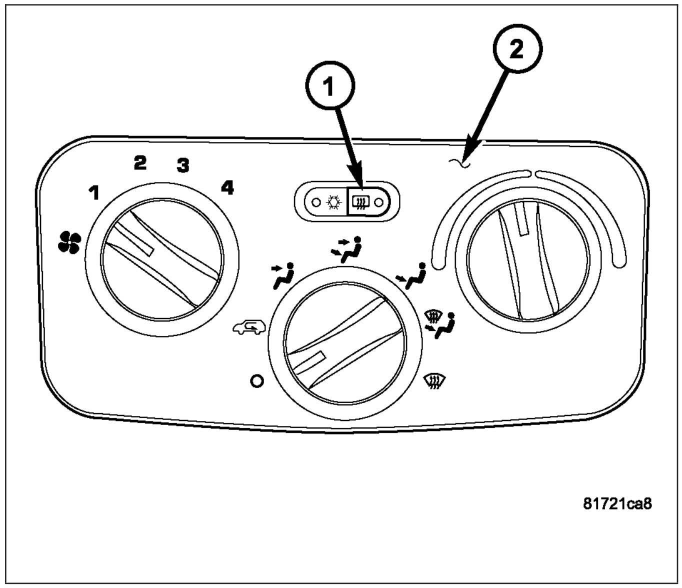


# SWITCH-REAR WINDOW DEFOGGER

## DESCRIPTION

The rear window defogger switch (1) is integrated into the A/C-heater control (2) located in the instrument panel. When the rear window defogger switch is activated, the A/C-heater control requests the body control module (BCM) to operate the rear window defogger (EBL) relay.

When the EBL relay is activated, current is directed to the rear defogger grid lines and the heated side view mirrors (if equipped). The grid lines heat the glass to help clear the surface of fog or frost.




## OPERATION

An LED indicator will illuminate when the rear window defogger switch is activated. When the switch is activated, it energizes the timing circuit integral to the body control module (BCM), which then activates the rear window defogger (EBL) relay. The EBL relay controls the current flow to the grids of the rear window defogger and when equipped, the heated side view mirrors.

**NOTE: The EBL system turns off automatically after 10 minutes of initial operation. Each following activation cycle of the EBL system will last 5 minutes.**

The EBL system will automatically turn off after a programmed time interval of about 10 minutes as long as the ignition switch is the Run position. After the initial time interval has expired, if the rear window defogger switch is turned on again during the same ignition cycle, the EBL system will automatically turn off after about 5 minutes. The EBL system will also turn off if the ignition switch is turned to any position other than Run or by manually pressing the rear window defogger switch a second time.

The rear window defogger switch and the rear window defogger LED indicator cannot be repaired and, if faulty or damaged, the A/C-heater control must be replaced (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CONTROL-A/C HEATER - REMOVAL).

## DIAGNOSIS AND TESTING

## REAR WINDOW DEFOGGER SWITCH

The rear window defogger switch and timer circuit may be tested in the vehicle with or without the DRB III® scan tool.

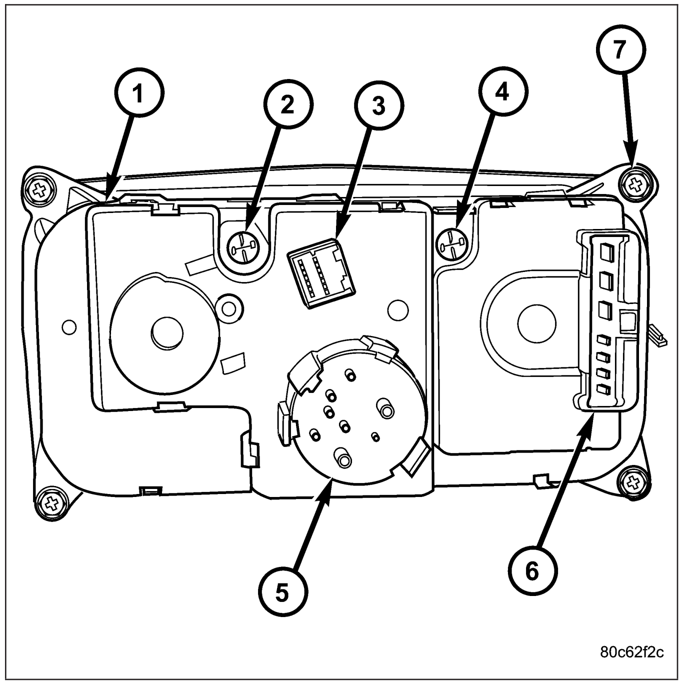
### TESTING WITH SCAN TOOL

Using a DRB III® scan tool, refer to the proper Body Diagnostic Procedures Manual.

**TESTING WITHOUT SCAN TOOL**

**NOTE: For circuit descriptions and diagrams of the rear window defogger (EBL) system, refer to 8W - WIRING DIAGRAM INFORMATION.**

1. Remove the A/C-heater control from the instrument panel (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CONTROL-A/C HEATER - REMOVAL).
2. Using a ohmmeter, check for continuity between the ground circuit cavity of the defogger switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open circuit as required.
3. Check for continuity between the ground circuit terminal and the rear window defogger relay output terminal (3) on the back of the A/C-heater control. There should be momentary continuity as the defogger switch is pressed, and then no continuity. If OK, (Refer to 8 - ELECTRICAL/HEATED GLASS - DIAGNOSIS AND TESTING). If not OK, replace the faulty A/C-heater control.



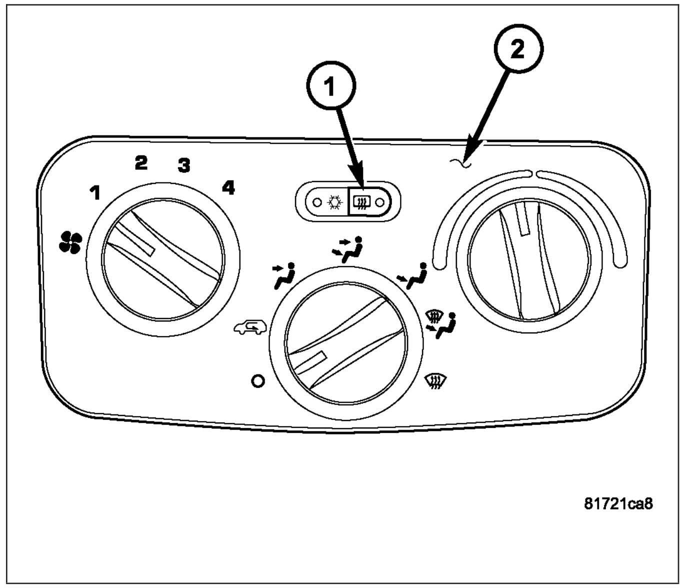
# HEATED MIRRORS - SERVICE INFORMATION

## TABLE OF CONTENTS

# HEATED MIRRORS - SERVICE INFORMATION

## DESCRIPTION

The optional heated mirror system is controlled by the momentary rear window defogger switch (1) which is integral to the A/C-heater control (2). An amber indicator lamp in the switch will illuminate to indicate when the rear window defogger (EBL) system is turned on.




The heated mirror system only operates in concert with the EBL system, and will automatically turn off after a programmed time interval of about 10 minutes as long as the ignition switch is the Run position. After the initial time interval has expired, if the rear window defogger switch is turned on again during the same ignition cycle, the heated mirror system will automatically turn off after about 5 minutes. The heated mirror system will also turn off if the ignition switch is turned to any position other than Run or by manually pressing the rear window defogger switch a second time.

## OPERATION

When the rear window defogger switch is pressed, the rear window defogger (EBL) system becomes activated and an electric heater grid located behind the glass of each of the outside rear view mirrors is energized. When energized, each of these heater grids produce heat to help clear the outside rear view mirrors of ice, snow, or fog.

If the outside mirror heating grids are both inoperative, (refer to 8 - ELECTRICAL/HEATED GLASS - DIAGNOSIS AND TESTING) in this group. If only one of the outside mirror heating grids is inoperative, (refer to 8 - ELECTRICAL/POWER MIRRORS - DIAGNOSIS AND TESTING).

The heating grid behind each outside mirror glass cannot be repaired and, if faulty or damaged, the mirror glass must be replaced (refer to 23 - BODY/EXTERIOR/GLASS-OUTSIDE REARVIEW MIRROR - REMOVAL).

# HEATED SEAT SYSTEM-SERVICE INFO

## TABLE OF CONTENTS

# HEATED SEAT SYSTEM-SERVICE INFO

## DESCRIPTION

Individually controlled electrically heated front seats are available on models that are also equipped with the optional leather trim package. Vehicles with this option can be visually identified by the two separate heated seat switches mounted on the outboard seat cushion side shields. The heated seat system allows the front seat driver and passenger to select from two different levels of supplemental electrical seat heating, or no seat heating to suit their individual comfort requirements. The heated seat system for this vehicle includes the following major components:

- **Heated Seat Switches** - Two heated seat switches are used per vehicle, including two Light-Emitting Diode (LED) indicator lamps and an incandescent back lighting bulb for each switch. One switch for the driver and one for the passenger front seats. The switches are mounted on the outboard seat cushion side shields.
- **Heated Seat Module** - also referred to as the Seat Heat Interface Module (SHIM), this module contains the solid state electronic control and diagnostic logic circuitry for the heated seat system. One heated seat module is used per vehicle and is mounted under the left front seat cushion. Refer to the Electronic Control Modules section of the service manual for heated seat module information.
- **Heated Seat Elements** - Four heated seat elements are used per vehicle, one for each front seat back and one for each front seat cushion. The elements are integral to the individual front seat and seat back cushions and cannot be removed from the cushions, once installed at the factory.
- **Heated Seat Sensors** - Two heated seat sensors are used per vehicle, one for each front seat. The sensors are integral to the individual front seat heating elements.

Following are general descriptions of the major components in the heated seat system. See the owner's manual in the vehicle glove box for more information on the features, use and operation of the heated seat system. Refer to **Wiring Diagrams** for the location of complete heated seat system wiring diagrams.

## OPERATION

The heated seat module receives fused battery current through fuse No.29 in the Junction Block (JB) when the ignition switch is in the "ON" position. The heated seat switches receive battery current through fuse No.25 in the Junction Block also, when the ignition switch is in the "ON" position. The heated seat module shares a common ground circuit with each of the heated seat elements. The heated seat elements will only operate when the surface temperature of the seat cushion is below the designed temperature set points of the system.

The heated seat system will also be turned off automatically whenever the ignition switch is turned to any position except On. If the ignition switch is turned to the Off position while a heated seat is turned ON, the heated seat will remain Off after the ignition switch is turned back "ON" until a heated seat switch is depressed again.

The heated seat module monitors inputs from the heated seat sensors and the heated seat switches. In response to these inputs the heated seat module uses its internal programming to control outputs to the heated seat elements in both front seats and to control the heated seat LED indicator lamps located in both of the heated seat switches. The heated seat module is also programmed to provide self-diagnostic capability. When the module detects certain failures within the heated seat system, it will provide a visual indication of the failure by flashing the indicator lamps in the affected heated seat switch. The heated seat module will automatically turn off the heated seat elements if it detects a short or open in the heated seat element circuit or a heated seat sensor value that is out of range.

## DIAGNOSIS AND TESTING - HEATED SEAT SYSTEM

### HEATED SEAT SYSTEM SELF-DIAGNOSIS

The heated seat system is capable of performing some self-diagnostics. The following table depicts the various monitored failures which will be reported to the vehicle operator or technician by flashing the individual heated seat switch Light Emitting Diode (LED) indicator lamps. Refer to the Heated Seat System Self-Diagnosis table for failure identification. The driver side heated seat switch indicator lamps will flash if a failure occurs in the driver side heated seat, and the passenger side heated seat switch indicator lamps will flash for a passenger side heated seat failure. If a monitored heated seat system failure occurs, the switch indicator lamps will flash at a pulse rate of about one-half second on, followed by about one-half second off for a duration of about one minute after the switch for the faulty heated seat is depressed in either the Low or High direction. This process will repeat every time the faulty heated seat switch is actuated until the problem has been corrected.

| Heated Seat System Self-Diagnosis | | |
|---|---|---|
| Monitored Failure | Switch High Indicator Lamp | Switch Low Indicator Lamp |
| Heated Seat Element Shorted | Flashing | Flashing |
| Heated Seat Element Open | Flashing | Off |
| Heated Seat Sensor Value Out of Range | Off | Flashing |

If the heated seat system failure is identified by flashing heated seat switch indicator lamps, go to the appropriate diagnosis and testing procedure in this section and confirm the condition, using the step by step procedure. If the monitored failure is confirmed, replace the component. If the monitored failure is not confirmed, replace the heated seat module with a known good unit and retest the system.

## HEATED SEAT SYSTEM TESTING

Refer to **Wiring Diagrams** for the location of complete heated seat system wiring diagrams. Before testing the individual components in the heated seat system, perform the following preliminary checks:

- If a single indicator lamp for one heated seat switch does not operate and the heated seat elements do heat, refer to **Diagnosis and Testing the Heated Seat Switch** in this section for the location of heated seat switch diagnosis and testing procedures.
- If both indicator lamps for a heated seat switch operate, but the heated seat elements do not heat, refer to **Diagnosis and Testing the Heated Seat Module** in Electronic Control Modules for the location of heated seat module diagnosis and testing procedures.
- If an indicator lamp on either heated seat switch remains illuminated after the heated seat has been turned Off, refer to **Diagnosis and Testing the Heated Seat Module** in Electronic Control Modules for the location of heated seat module diagnosis and testing procedures. Also refer to the Body Diagnostic Manual for additional diagnosis and testing procedures.

# HEATED SEAT SWITCH

## DESCRIPTION

The heated seat switches are located on the outboard cushion side shield of the driver and passenger front seats. The two, three-position rocker type switches provide a resistor multiplexed signal to the Heated Seat Module through separate hard wired circuits. Each switch has an Off, Low and High setting. Each switch contains two light emitting diodes (LED), one for each High and Low setting to let the occupant know that the seat heater system is on.

The heated seat switches and their LED's cannot be repaired. If either switch is faulty or damaged the entire switch must be replaced.

## OPERATION

There are three positions that can be selected with each of the heated seat switches: Off, Low, and High. When the front of the switch rocker is fully depressed, the High position is selected and the high position LED indicator illuminates. When the rear of the switch rocker is fully depressed, the Low position is selected and the low position LED indicator illuminates. When the switch rocker is depressed a second time in either direction, Off is selected and both LED indicators are extinguished.

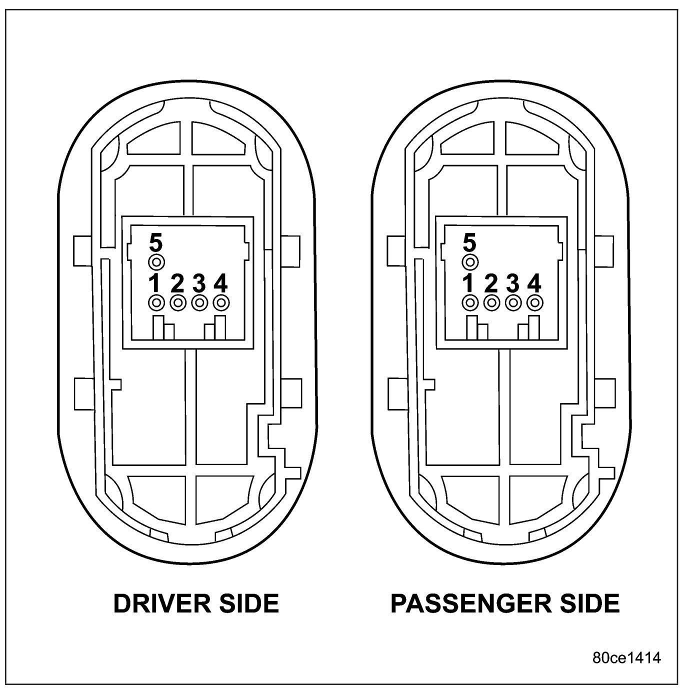
Both switches provide separate resistor multiplexed hard wire inputs to the Heated Seat Module to indicate the selected switch position. The heated seat module monitors the switch inputs and responds to the heated seat switch status messages by controlling the output to the seat heater elements of the selected seat. The Low heat position set point is about 36° C (97° F), and the High heat position set point is about 41° C (105° F).

## DIAGNOSIS AND TESTING

## HEATED SEAT SWITCH

If a heated seat fails to heat and one or both of the indicator lamps on a heated seat switch flash, refer to **Heated Seat System Diagnosis and Testing** in this section for flashing LED failure identification. Refer to **Wiring Diagrams** for complete heated seat system wiring diagrams.

1. If the problem being diagnosed involves a heated seat switch indicator lamp that remains illuminated after the heated seat has been turned Off, (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/MEMORY HEATED SEAT/MIRROR MODULE - DIAGNOSIS AND TESTING) for heated seat module diagnosis and testing procedures. If not, go to Step 2
2. Remove the heated seat switch (Refer to 8 - ELECTRICAL/HEATED SEATS/DRIVER HEATED SEAT SWITCH - REMOVAL). Check for continuity between the ground circuit cavity No.5 of the heated seat switch connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit as required.
3. Turn the ignition switch to the ON position. Check for battery voltage at the fused ignition switch output circuit cavity No.1 of the heated seat switch connector. If OK, go to Step 4. If not OK, repair the open fused ignition switch output circuit as required.




4. Check the continuity between pin No.1 and pin No.3 of the heated seat switch. If the readings do not correspond to those in the Heated Seat Switch Continuity table, replace the heated seat switch. If OK, and the heated seat system is still not operating properly (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/MEMORY HEATED SEAT/MIRROR MODULE - DIAGNOSIS AND TESTING) for heated seat module diagnosis and testing procedures.

**NOTE: Any resistance values (ohms Ω) given in the following text are supplied using the automatic range generated by a fluke® automotive meter. If another type of measuring device is used, the values generated may not be the same as the results shown here, or may have to be converted to the range used here.**

**TESTING HEATED SEAT SWITCH CONTINUITY**

| CONTINUITY BETWEEN | SWITCH POSITION | OHMS READING +/– 10% |
|---|---|---|
| PIN 1 AND 3 | OFF | 2.2 K (2200) OHMS |
| PIN 1 AND 3 | LO | .415 K (415) OHMS |
| PIN 1 AND 3 | HI | 33 OHMS |

## REMOVAL

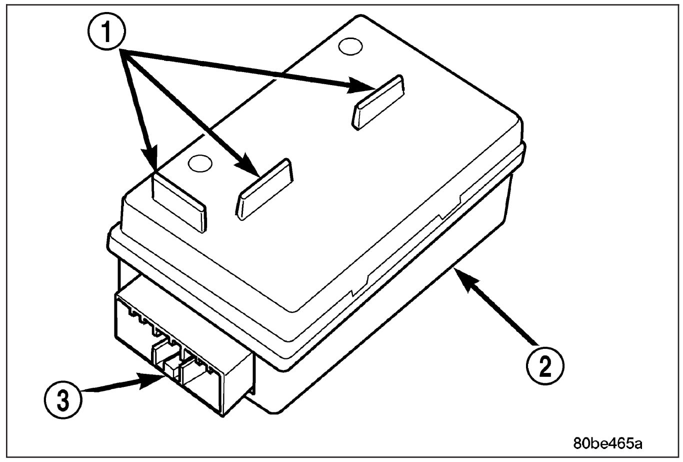
1. Disconnect and isolate the negative battery cable.
2. Remove the appropriate seat cushion side shield (Refer to 23 - BODY/SEATS/SEAT CUSHION SIDE COVERS - REMOVAL).
3. Disconnect the heated seat switch electrical connector. Depress the locking tab and pull straight apart.
4. Working from the underside of the switch, gently rock the switch back and forth out of its mounting location.

## INSTALLATION

1. Gently rock the switch back and forth in to its mounting location.
2. Connect the heated seat switch electrical connector.
3. Install the appropriate seat cushion side shield. Refer to the Body section of the service manual for the procedure.
4. Connect the negative battery cable.

# HEATED SEAT MODULE

## DESCRIPTION




The heated seat module (2) is also known as the Seat Heat Interface Module. The heated seat module (2) is located under the left front seat cushion, where it is secured to a mounting bracket via two push-pin retainers. The heated seat module has a single connector receptacle (3) that allows the module to be connected to all of the required inputs and outputs through the seat wire harness.

The heated seat module (2) is an electronic microprocessor controlled device designed and programmed to use inputs from the heated seat relay, the two heated seat switches and the two heated seat sensors to operate and control the heated seat elements in both front seats and the two heated seat indicator lamp Light-Emitting Diodes (LEDs) in each heated seat switch. The heated seat module is also programmed to perform self-diagnosis of certain heated seat system functions and provide feedback of that diagnosis through the heated seat switch indicator lamps.

The heated seat module (2) cannot be repaired. If the heated seat module is damaged or faulty, the entire module must be replaced.

## OPERATION

The heated seat module operates on fused battery current received from a fuse in the junction block. The module is grounded at all times. Inputs to the module include a resistor multiplexed heated seat switch request circuit for each of the two heated seat switches and the heated seat sensor inputs from the seat cushions of each front seat. In response to those inputs, the heated seat module controls battery current to the heated seat elements and sensors, and controls the ground for the heated seat switch indicator lamps (LED's).

When a heated seat switch (Driver or Passenger) is depressed a signal is received by the heated seat module, the module energizes the proper indicator LED (Low or High) in the switch by grounding the indicator lamp circuit to indicate that the heated seat system is operating. At the same time, the heated seat module energizes the selected heated seat sensor circuit and the sensor provides the module with an input indicating the surface temperature of the selected seat cushion.

The Low heat set point is about 36° C (96.8° F), and the High heat set point is about 42° C (107.6° F). If the seat cushion surface temperature input is below the temperature set point for the selected temperature setting, the heated seat module energizes an N-channel Field Effect Transistor (N-FET) within the module which energizes the heated seat elements in the selected seat cushion and back. When the sensor input to the module indicates the correct temperature set point has been achieved, the module de-energizes the N-FET which de-energizes the heated seat elements. The heated seat module will continue to cycle the N-FET as needed to maintain the selected temperature set point.

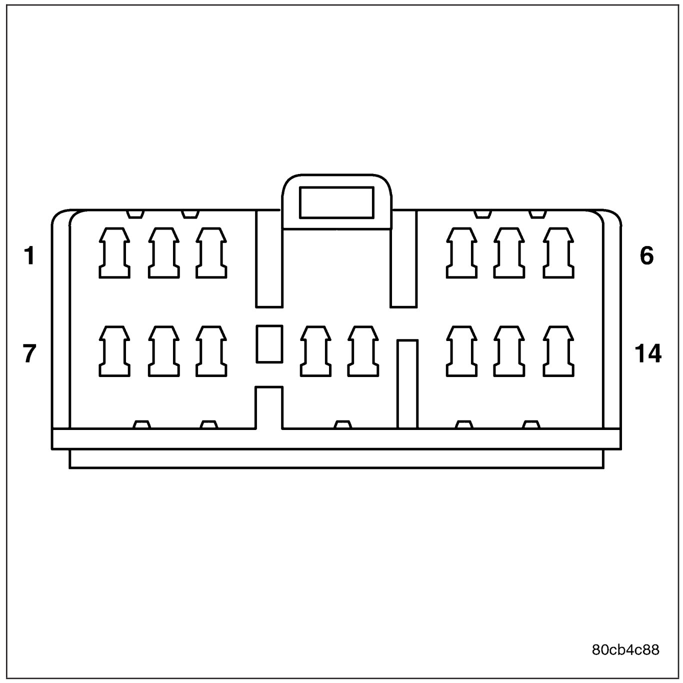
If the heated seat module detects a heated seat sensor value input that is out of range or a shorted or open heated seat element circuit, it will notify the vehicle operator or the repair technician of this condition by flashing the High and/or Low indicator lamps in the affected heated seat switch. Refer to **Diagnosis and Testing Heated Seat System** in Heated Systems for flashing LED diagnosis and testing procedures. Refer to **Diagnosis and Testing Heated Seat Module** in this section for heated seat module diagnosis and testing procedures. Also refer to the Body Diagnostic Manual for additional diagnosis and testing procedures.

## DIAGNOSIS AND TESTING - HEATED SEAT MODULE

If a heated seat fails to heat and one or both of the indicator lamps on a heated seat switch flash, refer to **Heated Seat System Diagnosis and Testing** in Heated Systems for flashing LED failure identification. Refer to **Wiring Diagrams** in for complete heated seat system wiring diagrams.

1. Remove the heated seat module from its mounting location (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/MEMORY HEATED SEAT/ MIRROR MODULE - REMOVAL).

**NOTE: Any resistance values (ohms Ω) given in the following text are supplied using the automatic range generated by a fluke® automotive meter. If another type of measuring device is used the values generated may not be the same as the results shown here, or may have to be converted to the range used here.**




## RIGHT SEAT HEATER INOPERATIVE

1. If a heated seat heats but one or both indicator lamps (LED's) on the heated seat switch fail to illuminate, check the driver circuit with the inoperative LED for a short to ground. If OK, replace the heated seat switch. If NOT OK repair the short to ground as required and than replace the heated seat switch.

**NOTE: If the right seat cushion is already warm the following step will not prove conclusive.**

2. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #3 for battery voltage when the right heated seat switch is turned "ON", voltage should be present, If OK go to Step 3 If NOT OK, test the right heated seat switch (Refer to 8 - ELECTRICAL/HEATED SEATS/PASSENGER HEATED SEAT SWITCH - DIAGNOSIS AND TESTING). If the switch tests OK, check for continuity between the switch and control module on the MUX circuit, If OK replace the heated seat control module. If NOT OK, repair the open or shorted MUX circuit as required.

**NOTE: Be certain the battery is fully charged before testing. Failure to do so can result in incorrect readings.**

3. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #10 for battery voltage, while observing the voltmeter depress the right heated seat switch **low** setting twice, voltage should toggle between approx.12v and 8v, If OK go to Step 4. If NOT OK check for continuity between the switch and control module on the low heat driver circuit, If OK replace the heated seat control module.
4. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #11 for battery voltage, while observing the voltmeter depress the right heated seat switch **high** setting twice, voltage should toggle between approx.12v and 8v, If OK go to Step 5. If NOT OK check for continuity between the switch and control module on the high heat driver circuit, If OK replace the heated seat control module.
5. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #2 for approx. 5v, voltage should be present, If OK go to Step 6. If NOT OK replace the heated seat control module.
6. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #7 for a range in voltage from 1.72v (warm seat) – 3.0v (cold seat). It should be within this range, If OK replace the heated seat module. If NOT OK test the Heated Seat Sensor. If NOT OK, replace the right heated seat element and sensor assembly. If the heated seat sensor tests OK, check for continuity between the right heated seat cushion connector and control module connector on the 5v supply circuit, If NOT OK, repair the open or shorted 5v supply

circuit as required. If OK check for continuity between the right heated seat cushion connector and control module connector on the temperature sensor input circuit. If NOT OK, repair the open or shorted temperature sensor input circuit as required. If OK replace the heated seat control module.

## LEFT SEAT HEATER INOPERATIVE

1. If a heated seat heats but one or both indicator lamps (LED's) on the heated seat switch fail to illuminate, check the driver circuit with the inoperative LED for a short to ground. If OK, replace the heated seat switch. If NOT OK repair the short to ground as required and than replace the heated seat switch.

**NOTE: If the left seat cushion is already warm the following step will not prove conclusive.**

2. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #5 for battery voltage when the left heated seat switch is turned "ON", voltage should be present, If OK go to Step 3 If NOT OK, test the left heated seat switch (Refer to 8 - ELECTRICAL/HEATED SEATS/DRIVER HEATED SEAT SWITCH - DIAGNOSIS AND TESTING). If the switch tests OK, check for continuity between the switch and control module on the MUX circuit, If OK replace the heated seat control module. If NOT OK, repair the open or shorted MUX circuit as required.
3. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #12 for battery voltage, while observing the voltmeter depress the left heated seat switch **low** setting twice, voltage should toggle between approx.12v and 8v, If OK go to Step 4. If NOT OK check for continuity between the switch and control module on the low heat driver circuit, If OK replace the heated seat control module.
4. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #14 for battery voltage, while observing the voltmeter depress the left heated seat switch **high** setting twice, voltage should toggle between approx.12v and 8v, If OK go to Step 5. If NOT OK check for continuity between the switch and control module on the high heat driver circuit, If OK replace the heated seat control module.
5. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #2 for approx. 5v, 5 voltage should be present, If OK go to Step 6. If NOT OK replace the heated seat control module.
6. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #8 for a range in voltage from 1.72v (warm seat) – 3.0v (cold seat). It should be within this range, If OK replace the heated seat control module. If NOT OK, test the Heated Seat Sensor. If NOT OK, replace the left heated seat element and sensor assembly. If the heated seat sensor tests OK, check for continuity between the left heated seat cushion connector and control module connector on the 5v supply circuit, If NOT OK, repair the open or shorted 5v supply circuit as required. If OK check for continuity between the left heated seat cushion connector and control module connector on the temperature sensor input circuit. If NOT OK, repair the open or shorted temperature sensor input circuit as required. If OK replace the heated seat control module.

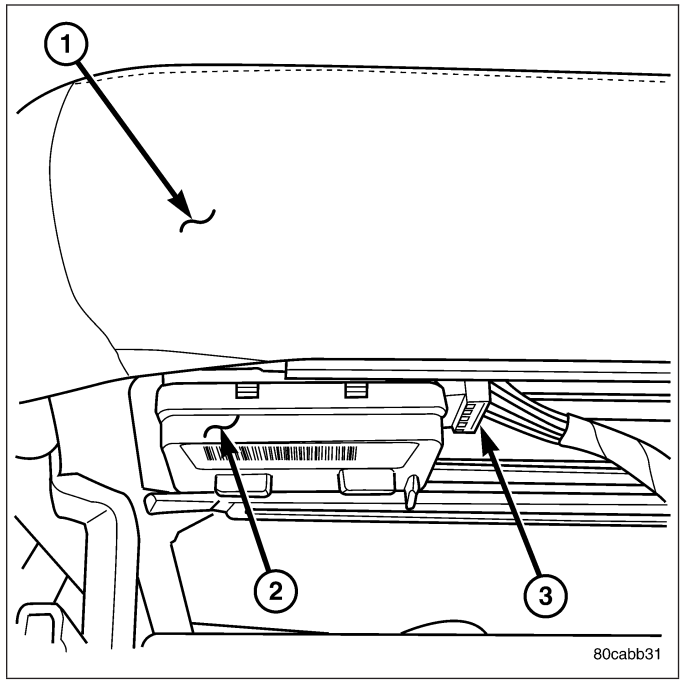
## BOTH SEATS INOPERATIVE

If both seats (driver and passenger) fail to heat and the indicator lamps on the heated seat switches for both seats fail to operate, test the heated seat fuses in the junction block. If the heated seat fuses check OK, go to Step 1.

1. Back-probe the heated seat module wire harness connector, do not disconnect. Check for continuity between the ground circuit cavity #13 of the heated seat module connector and a good ground. If OK go to Step 2. If NOT OK, repair the open or shorted ground circuit as required.
2. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #4 and #6 for battery voltage, voltage should be present, If OK go to Step 3. If NOT OK repair the open or shorted fused B(+) circuit as required.
3. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity #2 for approx. 5v, voltage should be present, replace the heated seat control module with a known good module and verify system operation.

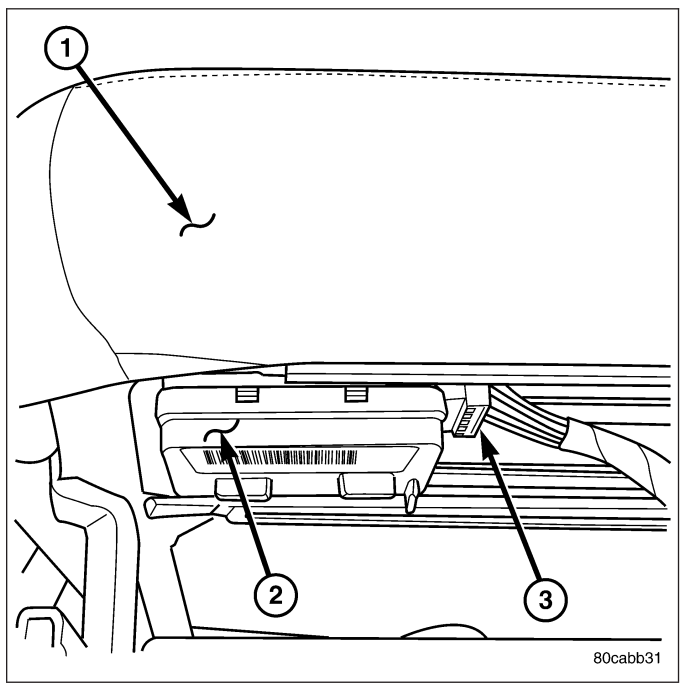
## REMOVAL

1. Working under the front seat cushion (1), remove the heated seat module (2) from its mounting bracket by gently prying the module off of the two mounting pushpins.
2. Disconnect the seat wire harness connector (3) from the connector receptacle on the side of the heated seat module (2).
3. Remove the heated seat module from the vehicle.




## INSTALLATION

1. Connect the seat wire harness connector (3) to the connector receptacle on the side of the heated seat module (2).
2. Install the heated seat module (2) on its mounting bracket under the front seat (1).
3. Verify heated seat system operation.



# HEATED SEAT ELEMENT

## DESCRIPTION

The heated seat system includes four seat heating elements. Two are located in each front seat, one for the seat cushion and the other for the seat back. All models use two resistor wire heating elements for each seat that are connected in series with the Heated Seat Module (HSM). The temperature sensor is a Negative Temperature Coefficient (NTC) thermistor. One temperature sensor is used for each seat, and it is located on the seat cushion heating element for all models.

The seat heating elements are permanently attached to the seat cushions. The heated seat elements and the temperature sensor cannot be adjusted or repaired and, if faulty or damaged, the seat cushions must be replaced. Refer to the Body section for the seat cushion service procedures.

## OPERATION

The heated seat elements resist the flow of electrical current. When battery current is passed through the elements, the energy lost by the resistance of the elements to the current flow is released in the form of heat. When the temperature of the seat cushion cover rises, the resistance of the sensor decreases. The Heated Seat Module supplies a five-volt current to one side of each sensor, and monitors the voltage drop through the sensor on a return circuit. The Heated Seat Module uses this temperature sensor input to monitor the temperature of the seat, and regulates the current flow to the seat heating elements accordingly.

## DIAGNOSIS AND TESTING - HEATED SEAT ELEMENT

### SEAT CUSHION ELEMENT

**NOTE: When checking heated seat elements for continuity, be certain to move the heating element being checked. Moving the element, such as siting in the seat will eliminate the possibility of an intermittent open in the element which would only be evident if the element was in a certain position. Failure to check the element in various positions could result in an incomplete test.**

1. Disconnect and isolate the battery negative cable. Disconnect the green heated seat cushion element wire harness connector from the power seat wire harness. The power seat wire harness connectors for the seat cushion heating elements are secured to a bracket located under the seat cushion frame. Refer to **Wiring** for connector pin information.
2. Check for continuity between the two heated seat element circuit cavities. There should be continuity. If OK, the elements within the seat assembly test OK, go to Step 3. If not OK, replace the faulty seat heating element and cushion assembly.
3. Test the seat wire harness between the heated seat module connector and the heated seat wire harness element connector for a shorted or open circuit. If OK, element is OK, proceed with testing the heated seat sensor and module. If not OK, repair the shorted or open seat wire harness as required.

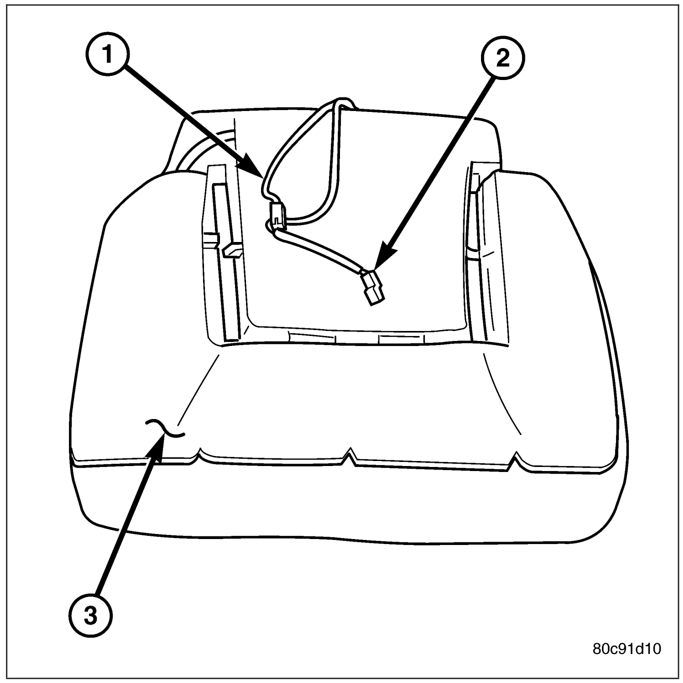
### SEAT BACK ELEMENT

1. Disconnect and isolate the battery negative cable. Disconnect the green heated seat back element wire harness connector from the power seat wire harness. The power seat wire harness connectors for the seat cushion heating elements are secured to a bracket located under the seat cushion frame. Refer to **Wiring** for connector pin information.
2. Check for continuity between the two heated seat element circuit cavities. There should be continuity. If OK, the elements within the seat assembly test OK, go to Step 3. If not OK, replace the faulty seat heating element and cushion assembly.
3. Test the seat wire harness between the heated seat module connector and the heated seat wire harness element connector for a shorted or open circuit. If OK, element is OK, proceed with testing the heated seat sensor and module. If not OK, repair the shorted or open seat wire harness as required.

## REMOVAL

**NOTE: Do not remove the factory installed heating elements (3) from the seat or seat back cushions. The original element is permanently attached and cannot be removed without permanent damage. The replacement heating element is designed to be applied directly on top of the inoperative factory installed heating element.**

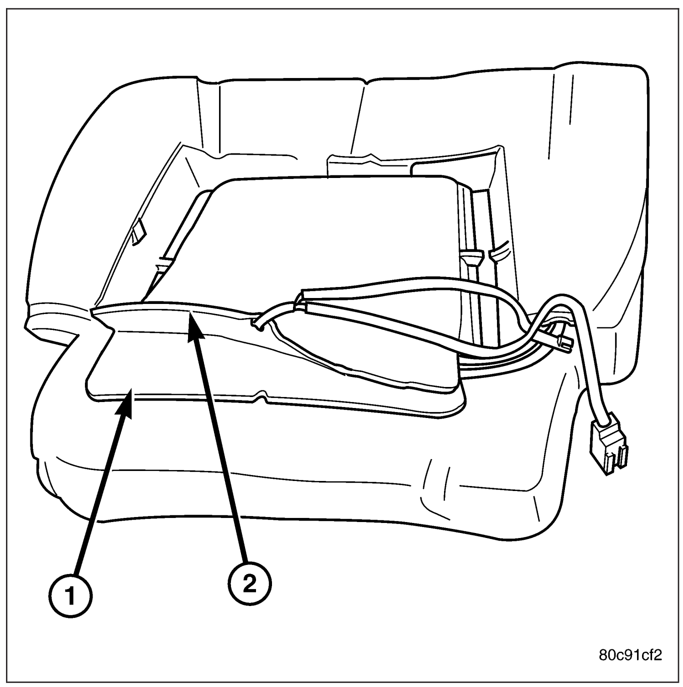
1. Disconnect and isolate the negative battery cable.
2. Remove the appropriate seat cushion, (Refer to 23 - BODY/SEATS/SEAT CUSHION COVER - REMOVAL) or seat back trim cover, (Refer to 23 - BODY/SEATS/SEAT BACK CUSHION / COVER - REMOVAL).
3. Disconnect the inoperative heated seat cushion or seat back element electrical connectors (2).
4. Locate the wires leading from the inoperative heating element and cut them off flush with the edge of the original heating element.




## INSTALLATION

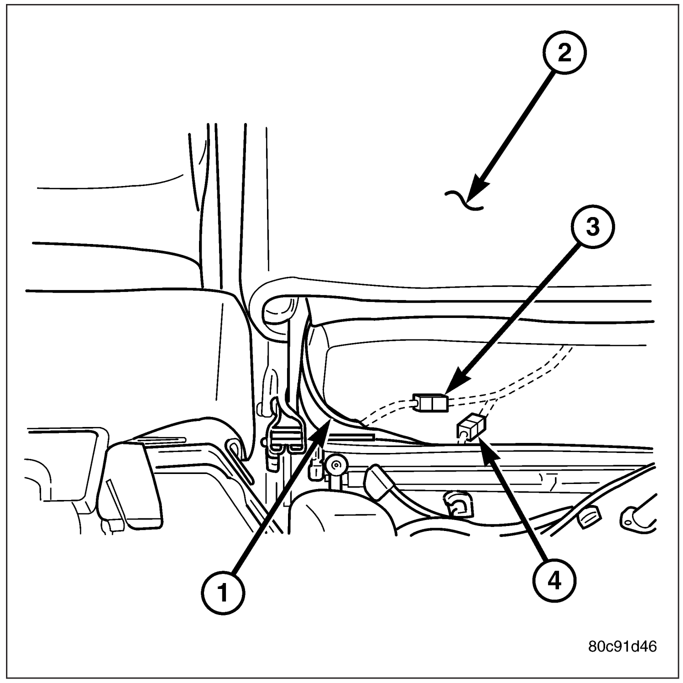
1. Peel off the adhesive backing on the back of the replacement heating element (2) and stick directly on top of the factory installed heating element (1).

**CAUTION: During the installation of the replacement heating element, be careful not to fold or crease the element assembly. Folds or creases will cause premature failure.**



2. Connect the new heating element electrical connectors (3&4).
3. Connect the battery negative cable.
4. Verify heated seat system operation.
5. Install the appropriate seat cushion, (Refer to 23 - BODY/SEATS/SEAT CUSHION COVER - INSTALLATION) or seat back trim cover, (Refer to 23 - BODY/SEATS/SEAT BACK CUSHION / COVER - INSTALLATION).

**NOTE: Make certain the seat wire harness is correctly routed through the seat and seat back. The excess wire between the cushion and back elements should be securely tucked between the rear of the cushion foam and the rear carpet flap of the trim cover.**



# HEATED SEAT SENSOR

## DESCRIPTION

The heated seat temperature sensor is a Negative Temperature Coefficient (NTC) thermistor. One temperature sensor is used for each seat. This temperature sensor is located in the seat cushion heating element on all models.

The heated seat temperature sensor cannot be repaired or adjusted and must be replaced if defective. The heated seat cushion element must be replaced if the temperature sensor is defective. Refer to the procedure in this section of the service manual.

## OPERATION

When the temperature of the seat cushion cover rises, the resistance of the sensor decreases. The heated seat module supplies five-volts to one side of each sensor, and monitors the voltage drop through the sensor on a return circuit. The heated seat module uses this temperature sensor input to monitor the temperature of the seat, and regulates the current flow to the seat heating elements accordingly.

## DIAGNOSIS AND TESTING - HEATED SEAT SENSOR

For complete circuit diagrams, refer to **WIRING**.

**NOTE: Any resistance values (ohms Ω) given in the following text are supplied using the automatic range generated by a fluke® automotive meter. If another type of measuring device is used the values generated may not be the same as the results shown here, or may have to be converted to the range used here.**

1. Position the driver seat in the full rearward position.
2. Unclip the heated seat module from the bottom of the drivers seat cushion pan.
3. Back-probe the heated seat module wire harness connector, do not disconnect. Check cavity (No.7 for passenger, No.8 for driver seat) for a range in voltage from approx. 1.72 – 3.0 volts. It should be within this range, If OK check the heated seat element. If NOT OK, check for the proper 5 volt supply to the heated seat sensor, from the module. Refer to Wiring for specific information. If 5 volts is not being supplied to the sensor from the module, replace the heated seat module.
4. Test the seat wire harness between the heated seat module connector and the heated seat wire harness connector for shorted or open circuits. If OK, refer to **Diagnosis and Testing the Heated Seat Module** in Electronic Control Modules, for the proper heated seat module diagnosis and testing procedures. If not OK, repair the shorted or open heated seat wire harness as required.

## REMOVAL

1. For heated seat sensor replacement procedure (Refer to 8 - ELECTRICAL/HEATED SEATS/HEATED SEAT ELEMENT - REMOVAL).

# HORN

## TABLE OF CONTENTS

# HORN SYSTEM

## DESCRIPTION

The dual-note horn system features dual electromagnetic horn units. The horn system includes the following major components:

- **Horn** - The two horns are located below the Power Distribution Center (PDC).
- **Horn Relay** - The horn relay is located in the Junction Block (JB).
- **Horn Switch** - The horn switch is molded into the driver airbag assembly.

## OPERATION

The horn system operates on battery current received through fuse 3 in the Junction Block (JB). The horn system circuit is designed so that the system will remain operational, regardless of the ignition switch position.

## DIAGNOSIS AND TESTING - HORN SYSTEM

In most cases, any problem involving continually sounding horns can be quickly alleviated by removing the horn relay from the Junction Block (JB).

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

**HORN SYSTEM DIAGNOSIS TABLE**

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| BOTH HORNS INOPERATIVE | 1. Faulty fuse. | 1. Check the fuse in the Junction Block (JB). Replace the fuse and repair the shorted circuit or component, if required. |
| | 2. Faulty horn relay. | 2. Refer to horn relay for the proper diagnosis and testing procedures. Replace the horn relay or repair the open horn relay circuit, if required. |
| | 3. Faulty horn switch. | 3. Refer to horn switch for the proper diagnosis and testing procedure. Replace the horn switch or repair the open horn switch circuit, if required. |
| | 4. Faulty horns. | 4. Refer to horn for the proper diagnosis and testing procedure. Replace the horns or repair the open horn circuit, if required. |
| ONE HORN INOPERATIVE | 1. Faulty horn. | 1. Refer to horn for the proper diagnosis and testing procedures. Replace the horn or repair the open horn circuit, if required. |
| HORN SOUNDS CONTINUOUSLY | 1. Faulty horn relay. | 1. Refer to horn relay for the proper diagnosis and testing procedure. Replace the horn relay or repair the shorted horn relay control circuit, if required. |
| | 2. Faulty horn switch. | 2. Refer to horn switch for the proper diagnosis and testing procedure. Replace the horn switch or repair the shorted horn switch circuit, if required. |

# HORN

## DIAGNOSIS AND TESTING - HORN

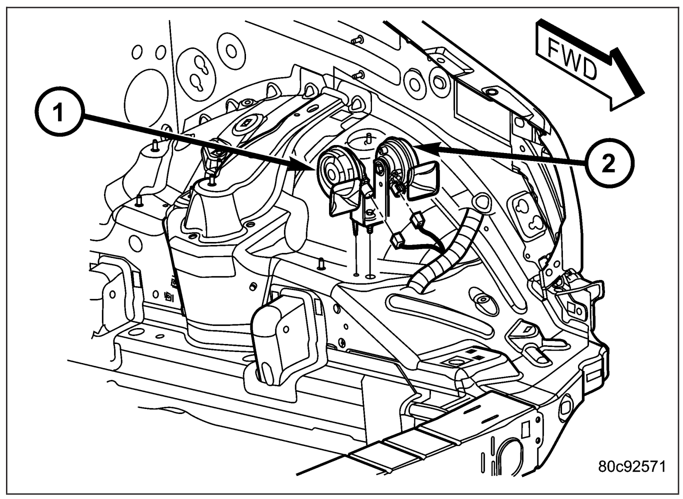
**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

Refer to the appropriate wiring information.

1. Disconnect the wire harness connector from the horn. Measure the resistance between the horn ground circuit cavity of the wire harness connector and a good ground. There should be no measurable resistance. If OK, go to Step 2. If not OK, replace wiring as necessary.
2. Check for battery voltage at the horn relay output circuit cavity of the wire harness connector for the horn. There should be zero volts. If OK, go to Step 3. If not OK, check horn relay.
3. Depress the horn switch. There should now be battery voltage at the horn relay output circuit cavity of the wire harness connector for the horn. If OK, but the horn does not sound, replace the faulty horn. If not OK, check horn relay and horn relay circuit.

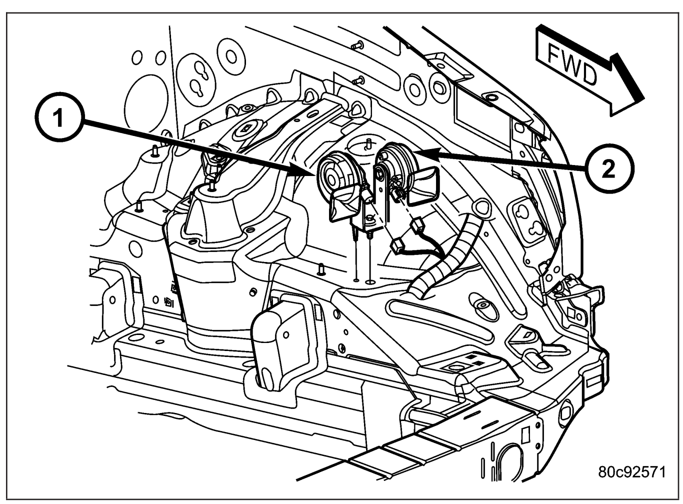
## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Disconnect the electrical harness connector from the horns.
3. Remove the mounting bolt.
4. Remove the horns (1) and (2).




## INSTALLATION

1. Install the horns (1) and (2).
2. Install the mounting bolt. Tighten bolt to 25 N·m (19 lb. ft.).
3. Connect the electrical harness connector to the horns
4. Connect the battery negative cable.



# HORN SWITCH

## DESCRIPTION

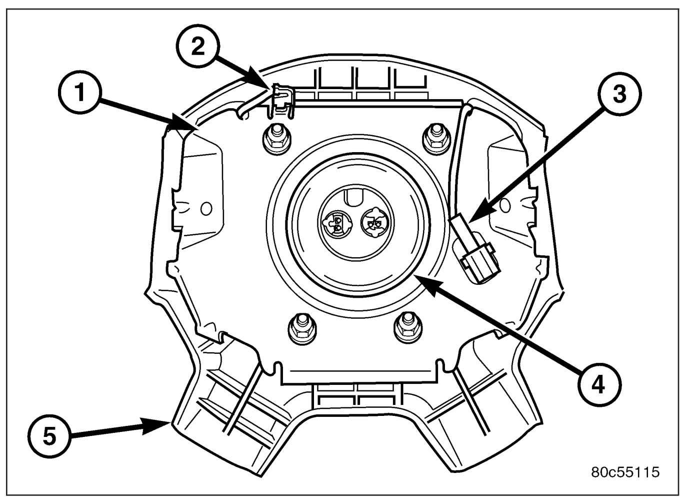
The horn switch is molded into the driver airbag. The horn switch can not be serviced separately. For service procedures, (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

## DIAGNOSIS AND TESTING - HORN SWITCH

For complete circuit diagrams, refer to the appropriate wiring information.

**WARNING: Disable the airbag system before attempting any steering wheel, steering column, seat belt tensioner, side airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

1. Disconnect and isolate the battery negative cable.
2. Remove the steering column opening cover.
3. Check for continuity between the metal steering column jacket and a good ground. There should be continuity. If OK, go to Step 4. If not OK, (Refer to 19 - STEERING/COLUMN - INSTALLATION) for proper installation of the steering column.
4. Remove the driver side airbag module from the steering wheel (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL). Disconnect the horn switch wire harness connectors from the driver side airbag module.
5. Remove the horn relay from the Junction Block (JB). Check for continuity between the steering column half of the horn switch feed wire (3) harness connector and a good ground. There should be no continuity. If OK, go to Step 6. If not OK, repair the shorted horn relay control circuit to the horn relay in the Junction Block as required.




6. Check for continuity between the steering column half of the horn switch feed wire harness connector and the horn relay control circuit cavity for the horn relay in the Junction Block. There should be continuity. If OK, go to Step 7. If not OK, repair the open horn relay control circuit to the horn relay in the Junction Block as required.
7. Check for continuity between the horn switch feed wire and the horn switch ground wire (2) on the driver side airbag module. There should be no continuity. If OK, go to Step 8. If not OK, replace the faulty horn switch.
8. Depress the center of the driver side airbag module trim cover (5) and check for continuity between the horn switch feed wire and the horn switch ground wire on the driver side airbag module. There should now be continuity. If not OK, replace the faulty horn switch (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

# IGNITION CONTROL

## TABLE OF CONTENTS

# IGNITION SYSTEMS

## DESCRIPTION

The ignition system consists of:

- Spark Plugs
- Ignition Coil(s)
- Powertrain Control Module (PCM)
- Crankshaft Position Sensor
- 2 Knock Sensors (3.7L only)
- Camshaft Position Sensor
- The MAP, TPS, IAC and ECT also have an effect on the control of the ignition system.

## OPERATION

The 3.7L engine uses a separate ignition coil for each cylinder. The one-piece coil bolts directly to the cylinder head. Rubber boots seal the secondary terminal ends of the coils to the top of all 6 spark plugs. A separate electrical connector is used for each coil.

Because of coil design, spark plug cables (secondary cables) are not used. A distributor is not used.

Two knock sensors (one for each cylinder bank) are used to help control spark knock.

The Auto Shutdown (ASD) relay provides battery voltage to each ignition coil. The Powertrain Control Module (PCM) provides a ground contact (circuit) for energizing each coil. When the PCM breaks the contact, the energy in the coil primary transfers to the secondary causing a spark. The PCM will de-energize the ASD relay if it does not receive inputs from either the crankshaft or camshaft position sensors.

## SPECIFICATIONS

## IGNITION TIMING

Ignition timing is not adjustable on any engine.

## ENGINE FIRING ORDER - 3.7L V-6

The engine firing order is: 1 - 6 - 5 - 4 - 3 - 2

## IGNITION COIL RESISTANCE - 3.7L V-6

| PRIMARY RESISTANCE 21-27°C (70-80°F) | SECONDARY RESISTANCE 21-27°C (70-80°F) |
|---|---|
| 0.6 - 0.9 Ohms | 6,000 - 9,000 Ohms |

## SPARK PLUGS

| ENGINE | PLUG TYPE | ELECTRODE GAP |
|---|---|---|
| 3.7L | ZFR6F - 11G (NGK #) | 1.1 mm (0.042 in.) |

## TORQUE

| DESCRIPTION | N-m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Camshaft Position Sensor - 3.7L | 12 | - | 106 |
| Crankshaft Position Sensor Nut/Bolt - 3.7L | 23 | 21 | 205 |
| * Knock Sensor Bolt - 3.7L | * 20 | * 15 | |
| Ignition Coil Mounting Nuts - 3.7L | 8 | - | 70 |
| Ignition Coil Capacitor Nuts - 3.7L | 8 | - | 70 |
| Spark Plugs - 3.7L | 27 | 20 | - |
| Do not apply any sealant, thread-locker or adhesive to bolts. Poor sensor performance may result. | | | |
| * Torque critical tapered design. Do not exceed 15 ft. lbs. | | | |

# RELAY-AUTO SHUT DOWN

## DESCRIPTION - PCM OUTPUT

The 5-pin, 12-volt, Automatic Shutdown (ASD) relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

## OPERATION

## ASD SENSE - PCM INPUT

A 12-volt signal at this input indicates to the PCM that the ASD has been activated. The relay is used to connect the oxygen sensor heater elements, oxygen sensor heater relay, ignition coil and fuel injectors to the positive side of the 12-volt power supply.

This input is used only to sense that the ASD relay is energized. If the Powertrain Control Module (PCM) does not see 12-volts at this input when the ASD should be activated, it will set a Diagnostic Trouble Code (DTC).

## ASD SENSE- PCM OUTPUT

The ASD relay supplies battery voltage (12+ volts) to the fuel injectors and ignition coil(s). With certain emissions packages it also supplies 12-volts to the oxygen sensor heating elements and the oxygen sensor heater relay.

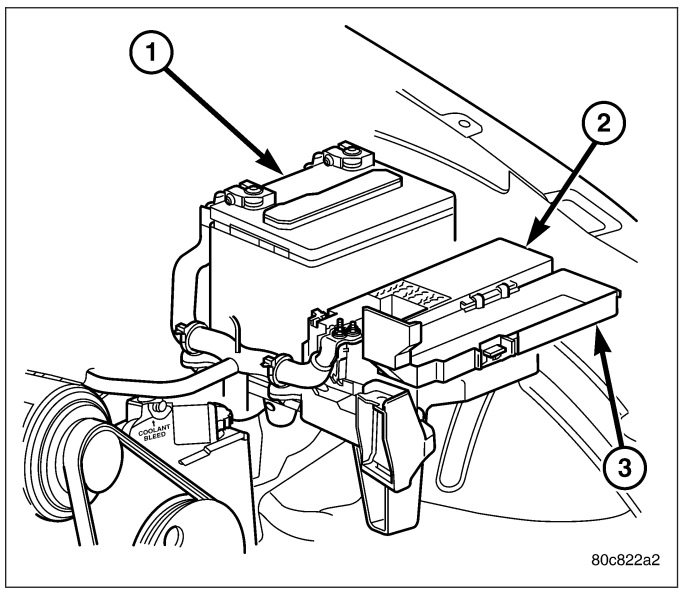
The ground circuit for the coil within the ASD relay is controlled by the Powertrain Control Module (PCM). The PCM operates the ASD relay by switching its ground circuit on and off.

The ASD relay will be shut-down, meaning the 12-volt power supply to the ASD relay will be de-activated by the PCM if the ignition key is left in the ON position. This is if the engine has not been running for approximately 1.8 seconds.

## REMOVAL

The ASD relay is located in the Power Distribution Center (PDC) (2). Refer to label on PDC cover for relay location.

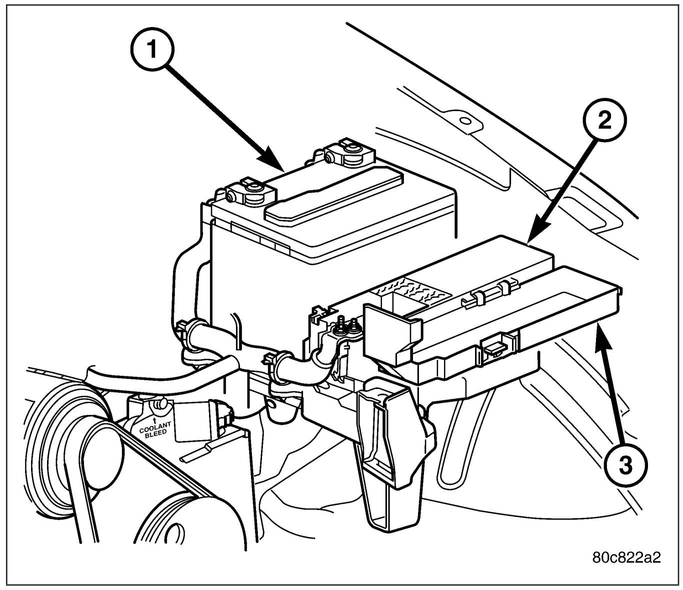
1. Remove PDC cover.
2. Remove relay from PDC.
3. Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.
4. Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.



## INSTALLATION

The ASD relay is located in the Power Distribution Center (PDC) (2). Refer to label on PDC cover for relay location.

1. Install relay to PDC.
2. Install cover (3) to PDC.

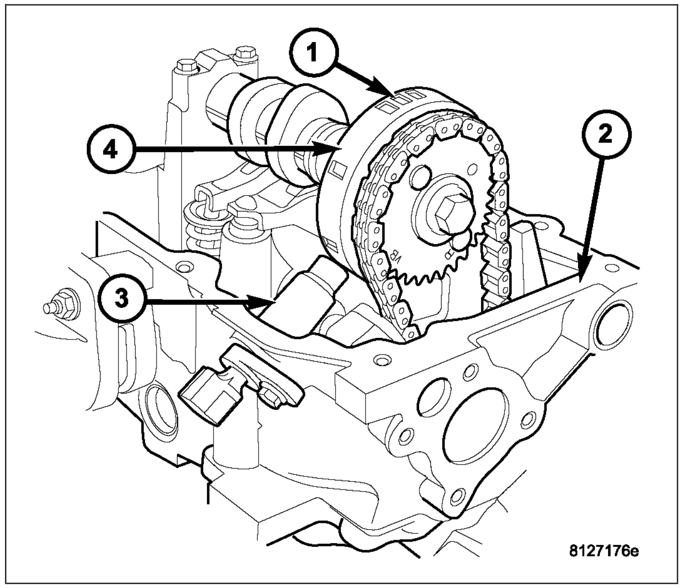


# SENSOR-CAMSHAFT POSITION

## DESCRIPTION

### 3.7L

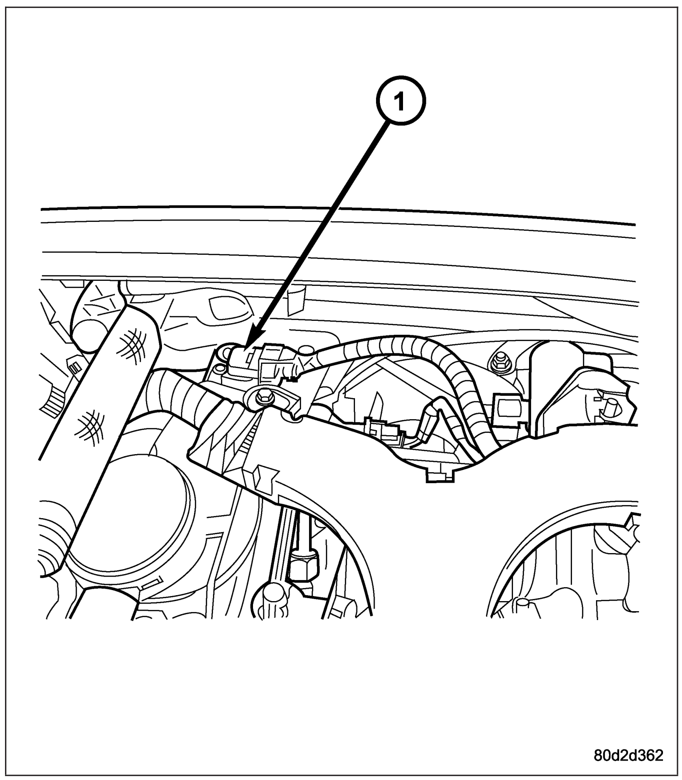
The Camshaft Position Sensor (CMP) (3) is bolted to the right-front side of the right cylinder head (2).




### 2.8L TURBODIESEL

The camshaft position (CMP) (1) sensor is mounted in the top of cylinder head cover/intake manifold at the rear of the engine.

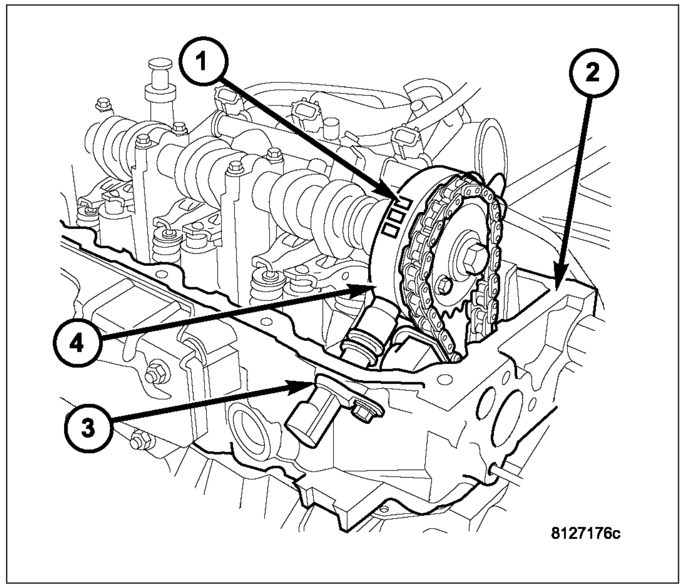
The CMP sensor (1) is a hall effect device that detects a notch on the rear of the exhaust camshaft that allows the ECM to determine the position of cylinder number one. The engine will continue to run if the signal is lost, but will not restart after the vehicle is shut off.



## OPERATION

### 3.7L

The Camshaft Position Sensor (CMP) sensor on the 3.7L (3) contains a hall effect device referred to as a sync signal generator. A rotating target wheel (tonewheel) (4) for the CMP is located at the front of the camshaft for the right cylinder head (2). This sync signal generator detects notches (1) located on a tonewheel. As the tonewheel rotates, the notches pass through the sync signal generator. The signal from the CMP sensor is used in conjunction with the Crankshaft Position Sensor (CKP) to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

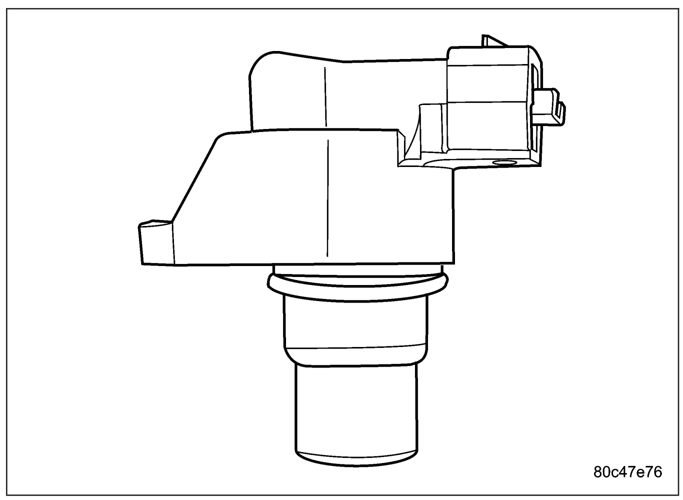



When the leading edge of the tonewheel notch enters the tip of the CMP, the interruption of magnetic field causes the voltage to switch high, resulting in a sync signal of approximately 5 volts.

When the trailing edge of the tonewheel notch leaves the tip of the CMP, the change of the magnetic field causes the sync signal voltage to switch low to 0 volts.

### 2.8L TURBODIESEL

The camshaft position (CMP) sensor is a hall effect switch. A tooth made of a ferromagnetic material is attached to the camshaft. When this tooth passes the CMP sensor an electronic signal is created. This signal is then sent to the engine control module (ECM). This signal is used by the ECM to determine TDC and which cylinder has just entered its compression phase.

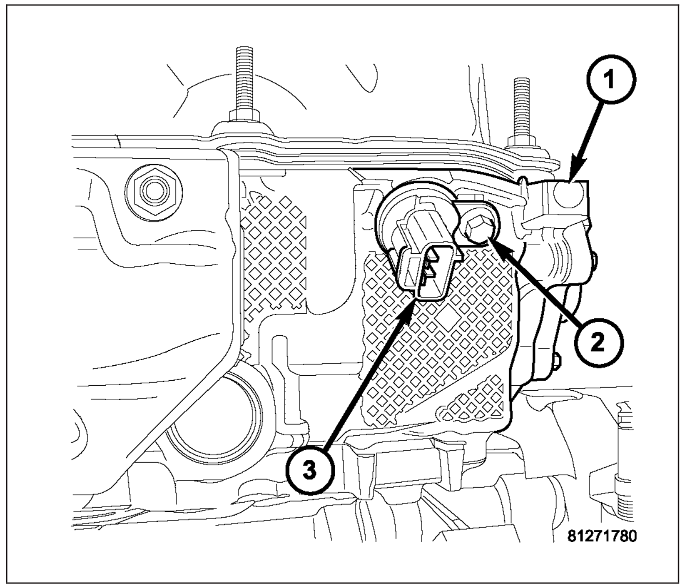


## REMOVAL

### 3.7L

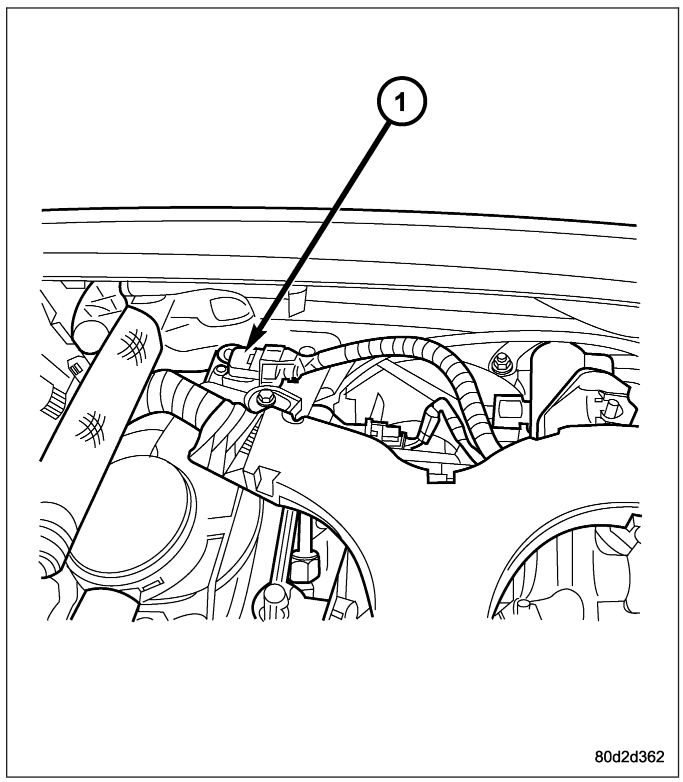
The Camshaft Position Sensor (CMP) (3) is bolted to the front/top of the right cylinder head (1).

1. Disconnect electrical connector at CMP sensor.
2. Remove sensor mounting bolt (2).
3. Carefully twist sensor from cylinder head.
4. Check condition of sensor O-ring.




### 2.8L TURBODIESEL

1. Disconnect negative battery cable.
2. Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).
3. Disconnect CMP sensor electrical connector.
4. Remove CMP sensor (1) retaining bolt and remove sensor from cylinder head cover/intake manifold.



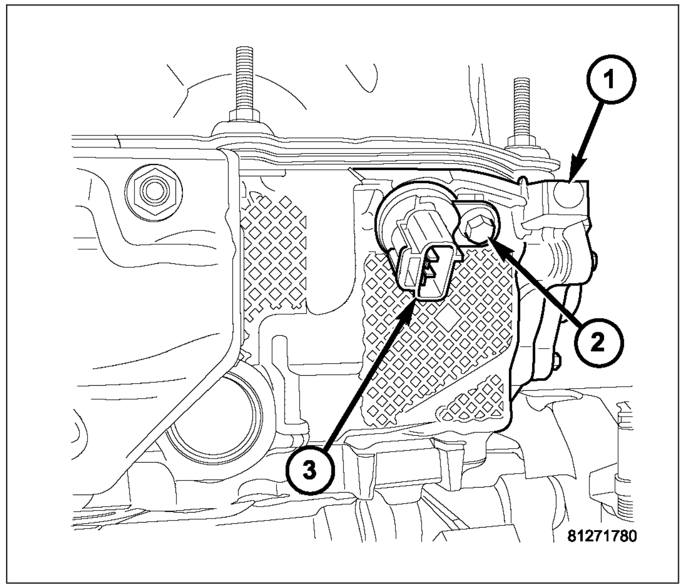
## INSTALLATION

### 3.7L

1. Clean out machined hole in cylinder head.
2. Apply a small amount of engine oil to sensor O-ring.
3. Install sensor (3) into cylinder head (1) with a slight rocking and twisting action.

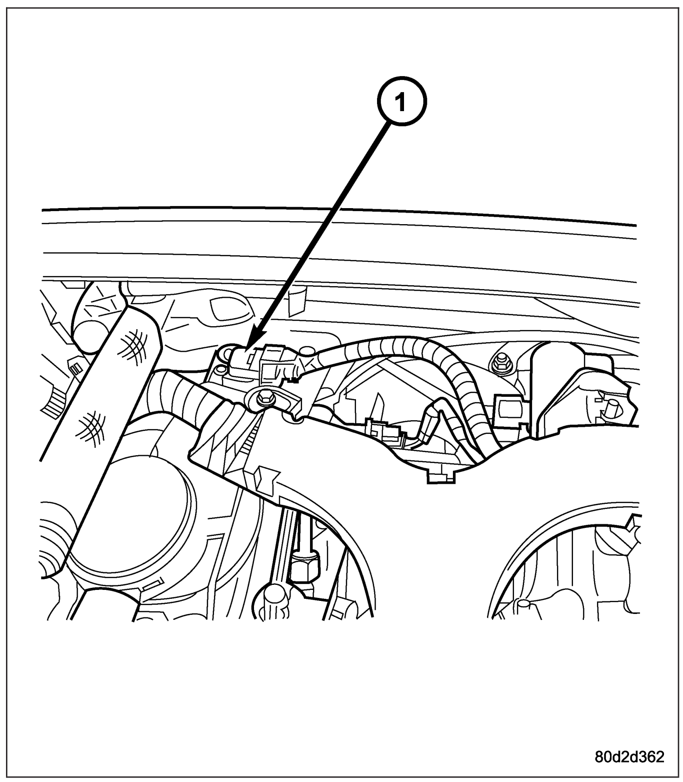
**CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder head. If sensor is not flush, damage to sensor mounting tang may result.**

4. Install mounting bolt (2) and tighten to 12 N·m (106 in. lbs.).
5. Connect electrical connector to sensor.




### 2.8L TURBODIESEL

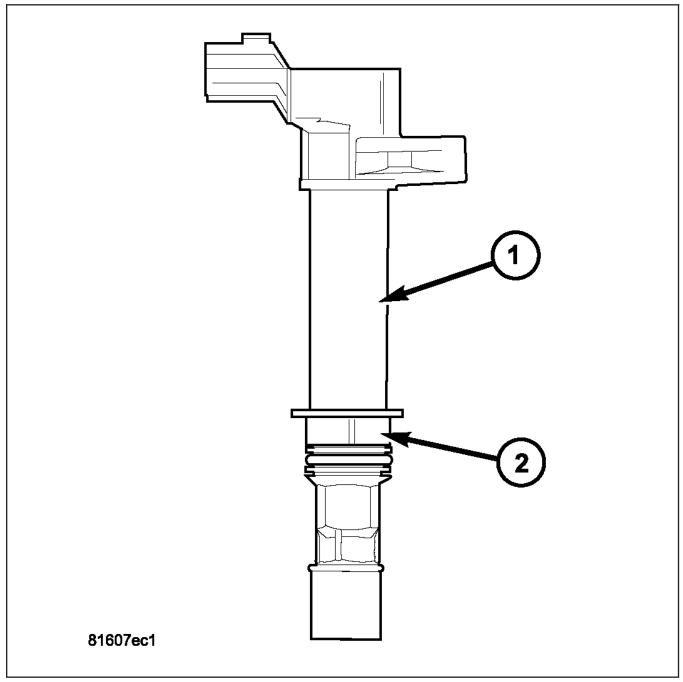
1. Lubricate O-ring on new CMP sensor (1) and install in cylinder head cover/intake manifold.
2. Install retaining bolts. Torque to 11 N·m (105 in. lbs.).
3. Connect sensor electrical connector.
4. Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).
5. Connect negative battery cable.



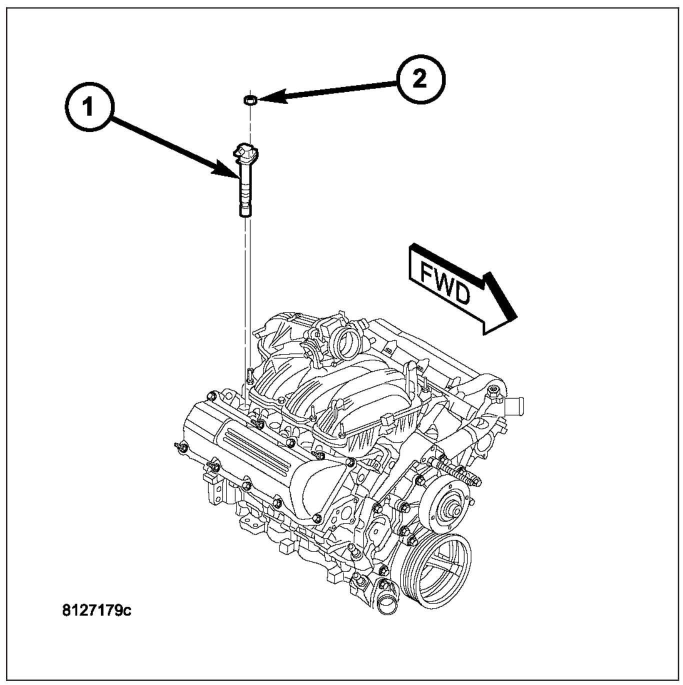
# COIL-IGNITION

## DESCRIPTION

The 3.7L uses 6 dedicated, and individually fired coil (1) for each spark plug.




Each coil (1) is mounted directly into the cylinder head and onto the top of each spark plug.




## OPERATION

Battery voltage is supplied to the 6 individual ignition coils from the ASD relay. The Powertrain Control Module (PCM) opens and closes each ignition coil ground circuit at a determined time for ignition coil operation.

**Base ignition timing is not adjustable.** By controlling the coil ground circuit, the PCM is able to set the base timing and adjust the ignition timing advance. This is done to meet changing engine operating conditions.

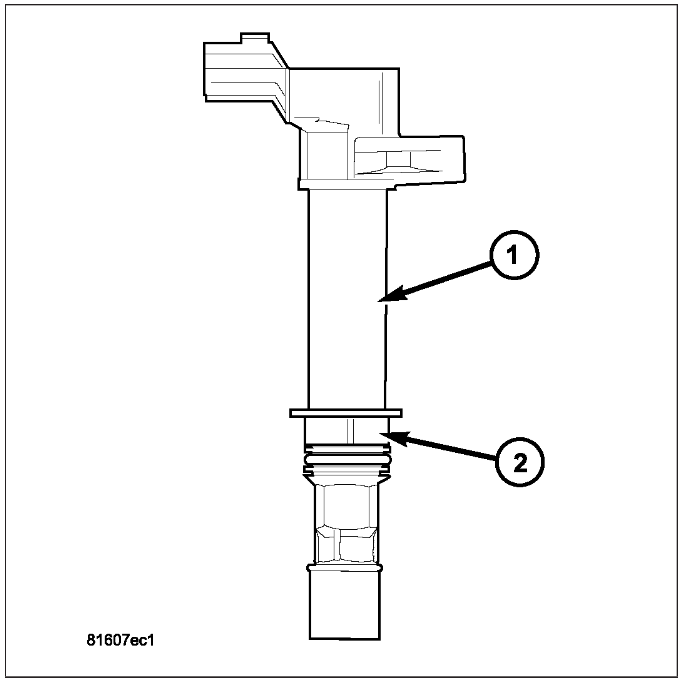
The ignition coil is not oil filled. The windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the ignition coil to be mounted on the engine.

Because of coil design, spark plug cables (secondary cables) are not used.

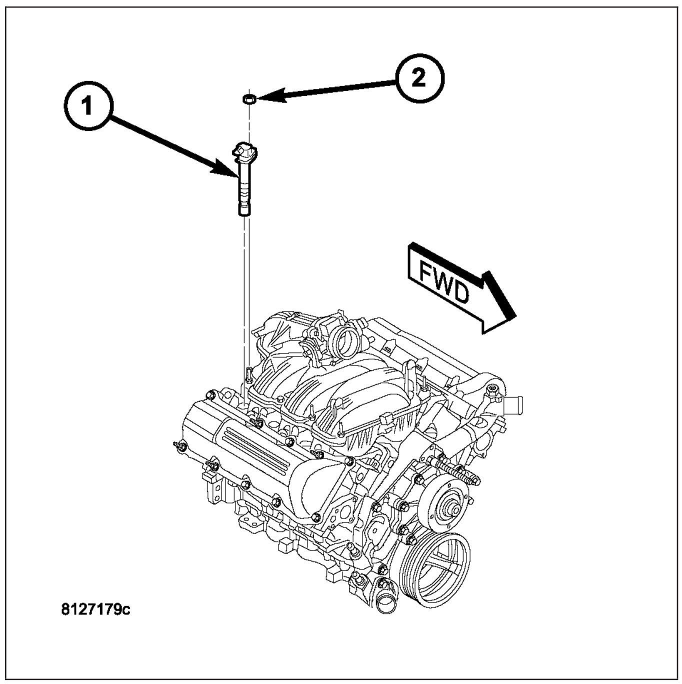
## REMOVAL

An individual ignition coil (1) is used for each spark plug. The coil fits into machined holes in the cylinder head. A mounting stud/nut secures each coil to the top of the intake manifold. The bottom of the coil is equipped with a rubber boot to seal the spark plug to the coil. Inside each rubber boot is a spring. The spring is used for a mechanical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately. An o-ring (2) is used to seal the coil at the opening into the cylinder head.

1. Depending on which coil is being removed, the throttle body air intake tube or intake box may need to be removed to gain access to coil.
2. Disconnect electrical connector from coil by pushing downward on release lock on top of connector and pull connector from coil.
3. Clean area at base of coil with compressed air before removal.

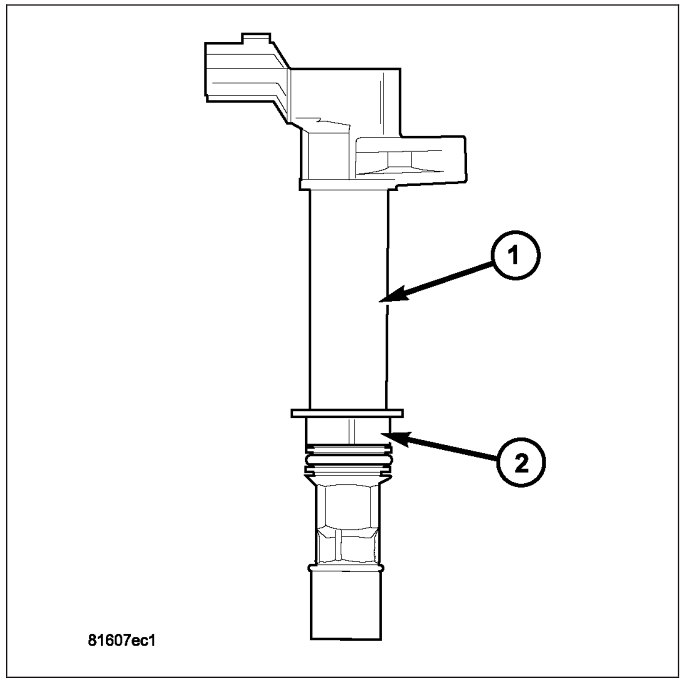



4. Remove coil mounting nut (2) from mounting stud.
5. Carefully pull up coil from cylinder head opening with a slight twisting action.
6. Remove coil from vehicle.

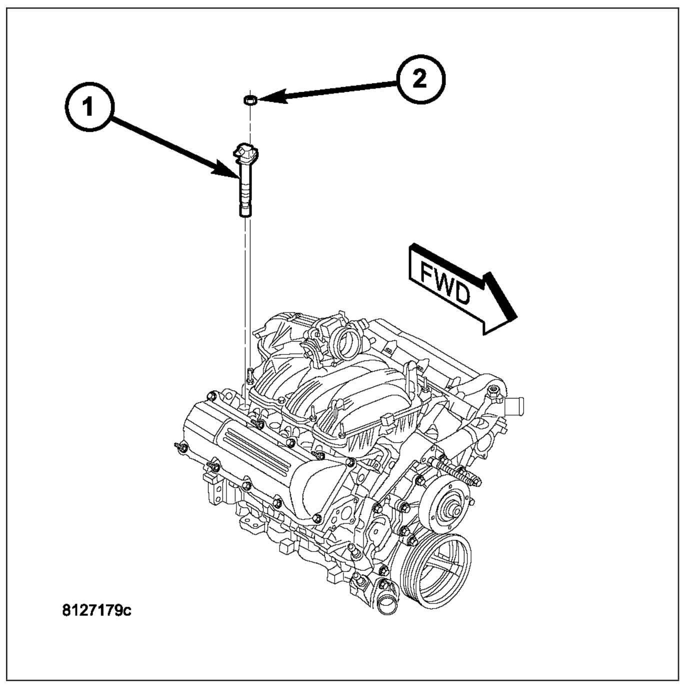


## INSTALLATION

1. Using compressed air, blow out any dirt or contaminants from around top of spark plug.
2. Check condition of coil O-ring (2) and replace as necessary. To aid in coil installation, apply silicone to coil O-ring (2).



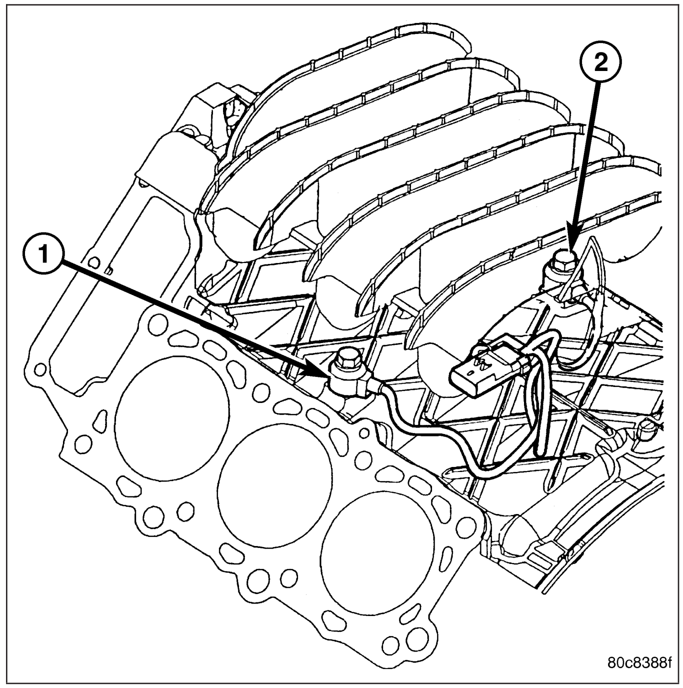

3. Position ignition coil (1) into cylinder head opening and push onto spark plug. Do this while guiding coil base over mounting stud.
4. Install coil mounting stud nut (2). Tighten to 8 N·m (70 in. lbs).
5. Connect electrical connector to coil by snapping into position.
6. If necessary, install throttle body air tube.



# SENSOR-KNOCK

## DESCRIPTION

The two knock sensors (1) and (2) are bolted into the cylinder block under the intake manifold.




## OPERATION

Two knock sensors are used on the 3.7L V-6 engine; one for each cylinder bank. When the knock sensor detects a knock in one of the cylinders on the corresponding bank, it sends an input signal to the Powertrain Control Module (PCM). In response, the PCM retards ignition timing for all cylinders by a scheduled amount.

Knock sensors contain a piezoelectric material which constantly vibrates and sends an input voltage (signal) to the PCM while the engine operates. As the intensity of the crystal's vibration increases, the knock sensor output voltage also increases.

The voltage signal produced by the knock sensor increases with the amplitude of vibration. The PCM receives the knock sensor voltage signal as an input. If the signal rises above a predetermined level, the PCM will store that value in memory and retard ignition timing to reduce engine knock. If the knock sensor voltage exceeds a preset value, the PCM retards ignition timing for all cylinders. It is not a selective cylinder retard.

The PCM ignores knock sensor input during engine idle conditions. Once the engine speed exceeds a specified value, knock retard is allowed.

Knock retard uses its own short term and long term memory program.

Long term memory stores previous detonation information in its battery-backed RAM. The maximum authority that long term memory has over timing retard can be calibrated.

Short term memory is allowed to retard timing up to a preset amount under all operating conditions (as long as rpm is above the minimum rpm) except at Wide Open Throttle (WOT). The PCM, using short term memory, can respond quickly to retard timing when engine knock is detected. Short term memory is lost any time the ignition key is turned off.

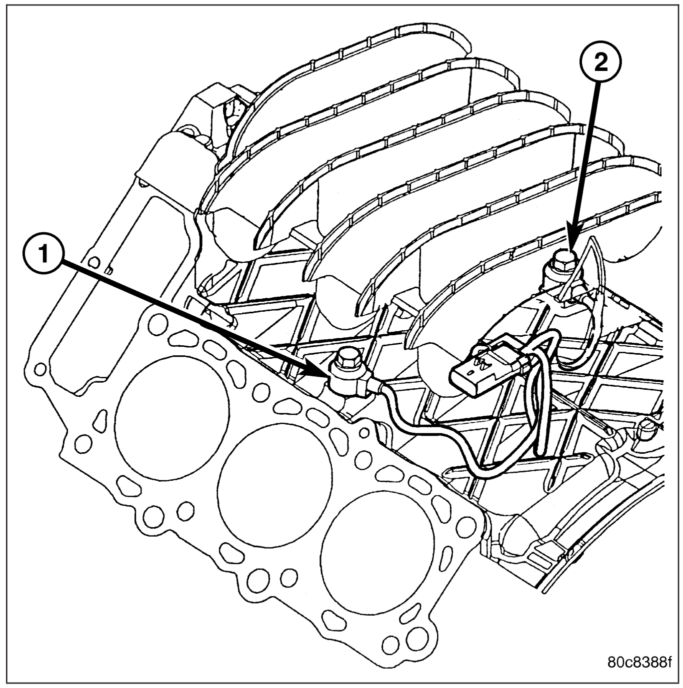
**NOTE: Over or under tightening the sensor mounting bolts will affect knock sensor performance, possibly causing improper spark control. Always use the specified torque when installing the knock sensors.**

## REMOVAL

The two knock sensors (1) are bolted into the cylinder block under the intake manifold.

**NOTE: The left sensor is identified by an identification tag (LEFT). It is also identified by a larger bolt head. The Powertrain Control Module (PCM) must have and know the correct sensor left/right positions. Do not mix the sensor locations.**

1. Disconnect knock sensor dual pigtail harness from engine wiring harness. This connection is made near rear of engine.
2. Remove intake manifold (Refer to 9 - ENGINE/ MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
3. Remove sensor mounting bolts (2). Note foam strip on bolt threads. This foam is used only to retain the bolts to sensors for plant assembly. It is not used as a sealant. Do not apply any adhesive, sealant or thread locking compound to these bolts.
4. Remove sensors (1) from engine.



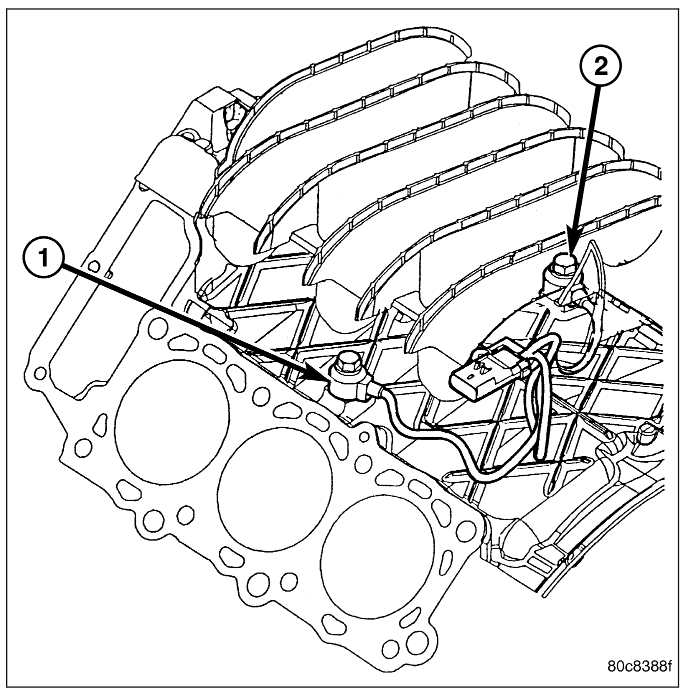

## INSTALLATION

**NOTE: The left sensor is identified by an identification tag (LEFT). It is also identified by a larger bolt head. The Powertrain Control Module (PCM) must have and know the correct sensor left/right positions. Do not mix the sensor locations.**

1. Thoroughly clean knock sensor mounting holes.
2. Install sensors (1) into cylinder block.

**NOTE: Over or under tightening the sensor mounting bolts will affect knock sensor performance, possibly causing improper spark control. Always use the specified torque when installing the knock sensors. The torque for the knock senor bolt is relatively light for an 8 mm bolt.**

**NOTE: Note foam strip on bolt threads. This foam is used only to retain the bolts to sensors for plant assembly. It is not used as a sealant. Do not apply any adhesive, sealant or thread locking compound to these bolts.**




3. Install and tighten mounting bolts (2). Tighten to 20 N·m (176 in. lbs.).
4. Install intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
5. Connect knock sensor wiring harness to engine harness (4) at rear of intake manifold.

# PLUG-SPARK

## DESCRIPTION

Resistor type spark plugs are used.

Spark plug resistance values range from 6,000 to 20,000 ohms (when checked with at least a 1000 volt spark plug tester). **Do not use an ohmmeter to check the resistance values of the spark plugs. Inaccurate readings will result.**

## OPERATION

To prevent possible pre-ignition and/or mechanical engine damage, the correct type/heat range/number spark plug must be used.

Always use the recommended torque when tightening spark plugs. This is especially true when plugs are equipped with tapered seats. Incorrect torque can distort the spark plug and change plug gap. It can also pull the plug threads and do possible damage to both the spark plug and the cylinder head.

Remove the spark plugs and examine them for burned electrodes and fouled, cracked or broken porcelain insulators. Keep plugs arranged in the order in which they were removed from the engine. A single plug displaying an abnormal condition indicates that a problem exists in the corresponding cylinder. Replace spark plugs at the intervals recommended in the Lubrication and Maintenance section.

Spark plugs that have low mileage may be cleaned and reused if not otherwise defective, carbon or oil fouled. Also refer to Spark Plug Conditions.

**CAUTION: Never use a motorized wire wheel brush to clean the spark plugs. Metallic deposits will remain on the spark plug insulator and will cause plug misfire.**

## REMOVAL

Each individual spark plug is located under each ignition coil. Each individual ignition coil must be removed to gain access to each spark plug (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - REMOVAL).

1. Remove necessary air filter tubing at throttle body.
2. Prior to removing ignition coil, spray compressed air around coil base at cylinder head.
3. Prior to removing spark plug, spray compressed air into cylinder head opening. This will help prevent foreign material from entering combustion chamber.
4. Remove spark plug from cylinder head using a quality socket with a rubber or foam insert. Also check condition of ignition coil o-ring and replace as necessary.
5. Inspect spark plug condition.

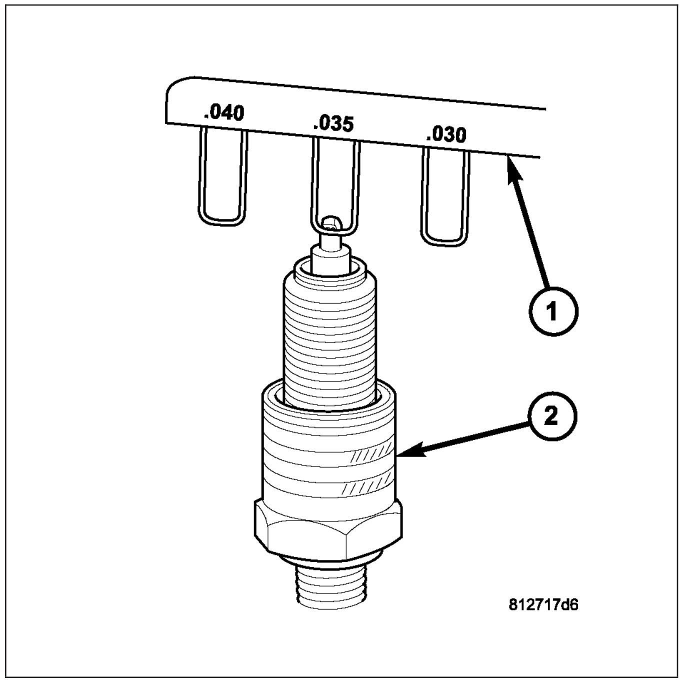
## CLEANING

## CLEANING AND ADJUSTMENT

The plugs may be cleaned using commercially available spark plug cleaning equipment. After cleaning, file center electrode flat with a small point file or jewelers file before adjusting gap.

**CAUTION: Never use a motorized wire wheel brush to clean spark plugs. Metallic deposits will remain on spark plug insulator and will cause plug misfire.**

Adjust spark plug gap with a gap gauging tool (1).




## INSTALLATION

Special care should be taken when installing spark plugs into the cylinder head spark plug wells. Be sure the plugs do not drop into the plug wells as electrodes can be damaged.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap or a cracked porcelain insulator.

1. Start the spark plug into the cylinder head by hand to avoid cross threading.
2. Tighten spark plugs to 27 N·m (20 ft. lbs.).
3. Before installing ignition coil(s), check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil O-ring.
4. Install ignition coil(s) (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - INSTALLATION).

# SWITCH-IGNITION

## DESCRIPTION

The electrical ignition switch is located on the steering column. It is used as the main on/off switching device for most electrical components. The mechanical key cylinder is used to engage/disengage the electrical ignition switch.

## DIAGNOSIS AND TESTING - IGNITION SWITCH

### ELECTRICAL DIAGNOSIS

For ignition switch electrical schematics, Refer to the appropriate section for the component.

### MECHANICAL DIAGNOSIS (KEY DIFFICULT TO ROTATE)

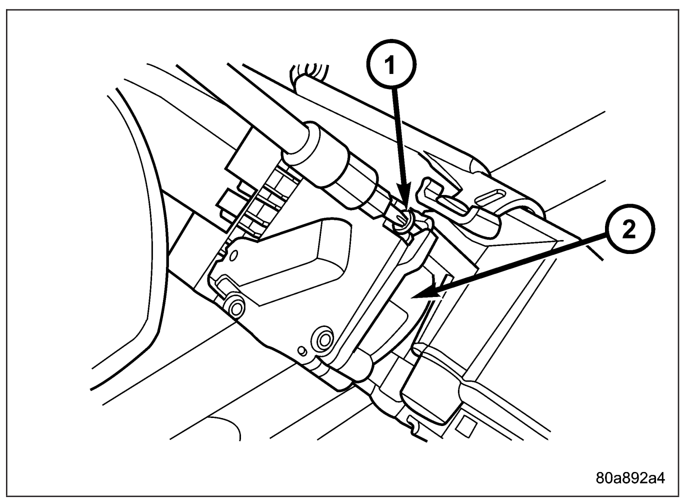
**Vehicles equipped with an automatic transmission and a floor mounted shifter:** a cable is used to connect the interlock device in the steering column assembly, to the transmission floor shift lever. This interlock system is used to lock the transmission shifter in the PARK position when the key cylinder is rotated to any position. If the ignition key is difficult to rotate to or from any position, it may not be the fault of the key cylinder or the steering column components. The brake transmission shift interlock cable may be out of adjustment. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 30RH/GEAR SHIFT CABLE - ADJUSTMENTS). The interlock system within the steering column is not serviceable. If repair is necessary, the steering column assembly must be replaced. (Refer to 19 - STEERING/COLUMN - REMOVAL).

**Vehicles equipped with a manual transmission and a floor mounted shifter:** on certain models, a button is located on the steering column behind the ignition key cylinder. The button must be manually depressed to allow rotation of the ignition key cylinder to any position. If it is difficult to rotate the key to any position, the lever mechanism may be defective. This mechanism is not serviceable. If repair is necessary, the steering column assembly must be replaced. (Refer to 19 - STEERING/COLUMN - REMOVAL).

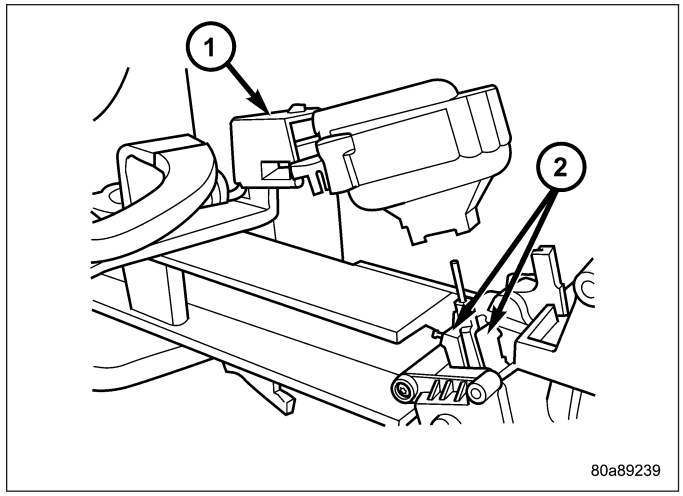
## REMOVAL

The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before removing ignition switch.

1. Remove lower steering column cover screws and remove cover.
2. Remove lock cylinder. (Refer to 19 - STEERING/COLUMN/KEY/LOCK CYLINDER - REMOVAL).
3. Remove the multi-function switch.
4. Disconnect the electrical connector at the rear of the ignition switch.
5. Remove the ignition switch mounting screw (1). Use tamper proof torx bit to remove the screw (1).



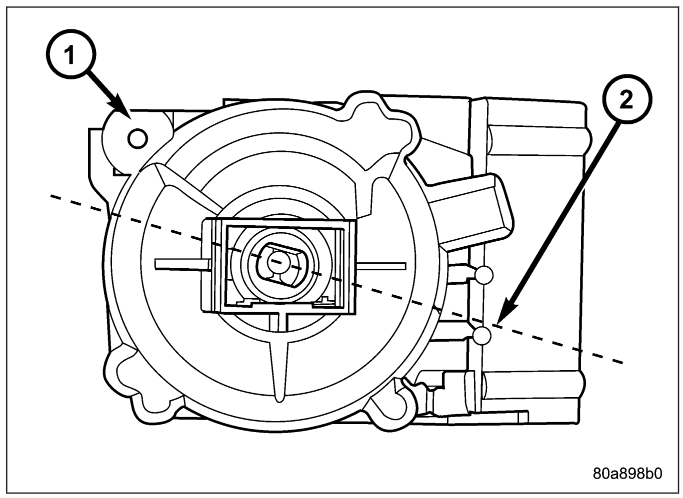
6. Pull the ignition switch (1) straight out to remove from the locking tabs (2).




## INSTALLATION

The ignition key must be in the key cylinder for cylinder installation. The key cylinder must be aligned with the ignition switch for installation.

1. Before installing ignition switch (1), rotate the slot in the switch to the ON position (2).
2. Connect the electrical connector to rear of ignition switch (1). Make sure that locking tab is fully seated into wiring connector.
3. Position the switch to the column and install tamper proof screw. Tighten screw to 2 N·m (17 in. lbs.).
4. Install the lock cylinder (Refer to 19 - STEERING/COLUMN/KEY/LOCK CYLINDER - INSTALLATION).
5. Test the operation of the lock cylinder for smooth rotating.




6. Install the multi-function switch.
7. Install steering column lower cover.

# SWITCH-KEY-IN IGNITION

## DESCRIPTION

The key-in ignition switch is integral to the ignition switch, which is mounted on the left side of the steering column, opposite the ignition cylinder. It closes a path to ground for the instrument cluster chime warning circuitry when the ignition key is inserted in the ignition lock cylinder and the driver door jamb switch is closed (driver door is open). The key-in ignition switch opens the ground path when the key is removed from the ignition cylinder.

The key-in ignition switch cannot be repaired and, if faulty or damaged, the entire ignition switch must be replaced. (Refer to 19 - STEERING/COLUMN/IGNITION SWITCH - REMOVAL).

## DIAGNOSIS AND TESTING - KEY-IN IGNITION SWITCH

For circuit descriptions and diagrams, Refer to the appropriate sections on the individual components.

**WARNING: On vehicles equipped with airbags, refer to electrical - passive restraint systems before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

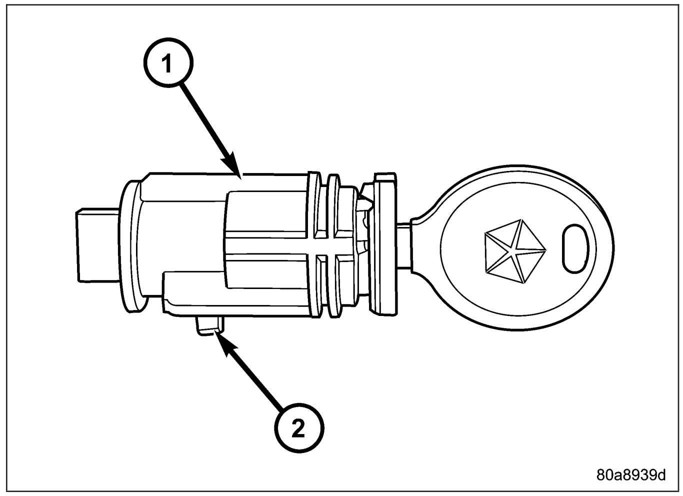
1. Disconnect and isolate the battery negative cable. Remove the steering column shrouds. Unplug the key-in ignition switch wire harness connector from the ignition switch.
2. Check for continuity between the key-in switch sense circuit and the left front door jamb switch sense circuit terminals of the key-in ignition switch. There should be continuity with the key in the ignition cylinder, and no continuity with the key removed from the ignition cylinder. If OK, go to Step 3. If not OK, replace the faulty ignition switch assembly.
3. Check for continuity between the left front door jamb switch sense circuit cavity of the key-in ignition switch wire harness connector and a good ground. There should be continuity with the driver door open, and no continuity with the driver door closed. If OK, see the diagnosis for Instrument Cluster in this group. If not OK, repair the circuit to the driver door jamb switch as required.

# CYLINDER-KEY/LOCK

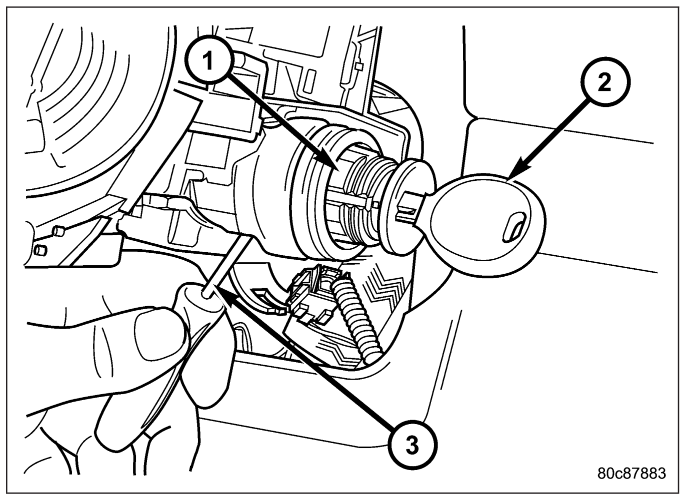
## REMOVAL

The ignition key must be in the key cylinder (1) for cylinder removal. The key cylinder must be removed first before removing ignition switch.

1. If equipped with an automatic transmission, place shifter in PARK position.
2. Remove the lower shroud cover.
3. Remove the remote keyless entry (R.K.E.) module.
4. Remove the halo ring around the cylinder.
5. Rotate key to ON position.
6. A release tang (2) is located on bottom of key cylinder (1).



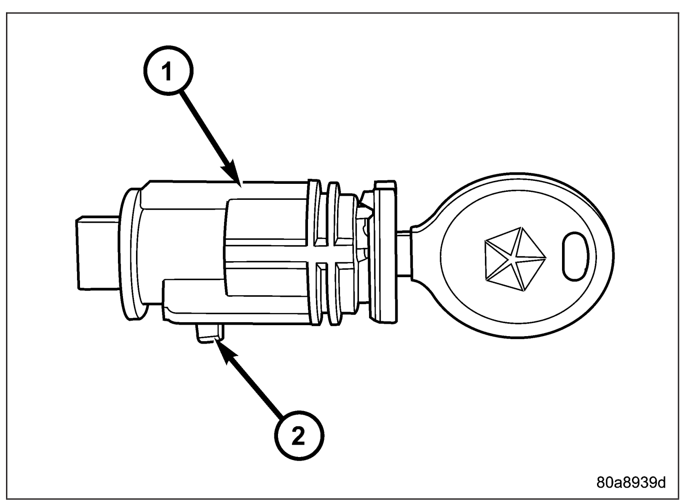

7. Position a small screwdriver or pin punch (3) into tang access hole on bottom of steering column.
8. Push the pin punch (3) up while pulling key cylinder (1) from steering column.




## INSTALLATION

The ignition key must be in the key cylinder (1) for cylinder installation.

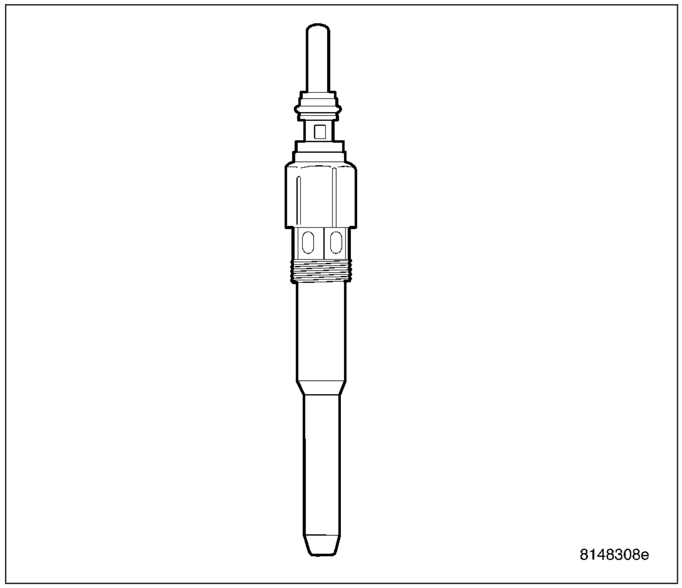
1. Install the key cylinder (1) into the housing using care to align the end of the key cylinder with the ignition switch.
2. Push the key cylinder (1) in until it clicks .
3. Rotate the key to the insert position.
4. install the halo ring around the key cylinder housing.
5. Install the R.K.E. module.
6. Install the lower shroud cover.



# PLUG-GLOW

## DESCRIPTION

**CAUTION: The glow plug system is a 7 volt system. The glow plugs DO NOT tolerate any over voltage. Full battery voltage will destroy the glow plug immediately. DO NOT test the glow plugs with a 12V source as damage will occur to the glow plug.**




**CAUTION:**

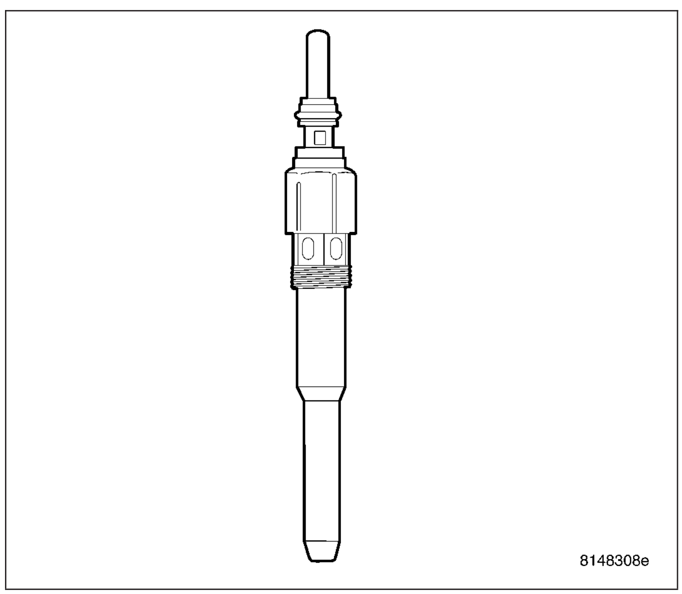
- **Never bend, bump or knock the ceramic glow plugs.**
- **Ceramic glow plugs must not be handled loose in a container. Store, handle, and transport them only in original boxes.**
- **If there is any doubt about the proper condition of a glow plug, do not use it anymore.**
- **Do not clean the glow plugs with abrasive or aggressive media.**
- **Avoid dipping the glow plug into fluids.**
- **Read Diagnostic Trouble Codes (DTCs). If a glow plug problem is indicated, do not start the engine.**

**CAUTION: Disregarding these instructions may cause severe engine damage.**

Glow plugs are used to help start a cold or cool engine. The glow plugs will heat up and glow to heat the combustion chamber of each cylinder. An individual glow plug is used for each cylinder. Each glow plug is threaded into the left side of the cylinder head below the cylinder head cover/intake manifold.

## OPERATION

**CAUTION: The glow plug system is a 7 volt system. DO NOT test the glow plugs with a 12 V source as damage will occur to the glow plug(s).**




The Engine Control Module (ECM) monitors various engine sensors. When the ignition key is turned to the ON position, the ECM sends a signal to the glow plug module to turn on, and cycle, the glow plugs for a predetermined amount of time, plus illuminate the glow plug light in the instrument panel. Once activated, the element inside of the ceramic core of the glow plug begins to glow. Each glow plug draws approximately 5 amps, for a total system amperage of 20 amps at 22° C (72° F) ambient temperature. If there is a fault with the glow plug system, the ECM will store a fault code.

## DIAGNOSIS AND TESTING - GLOW PLUGS

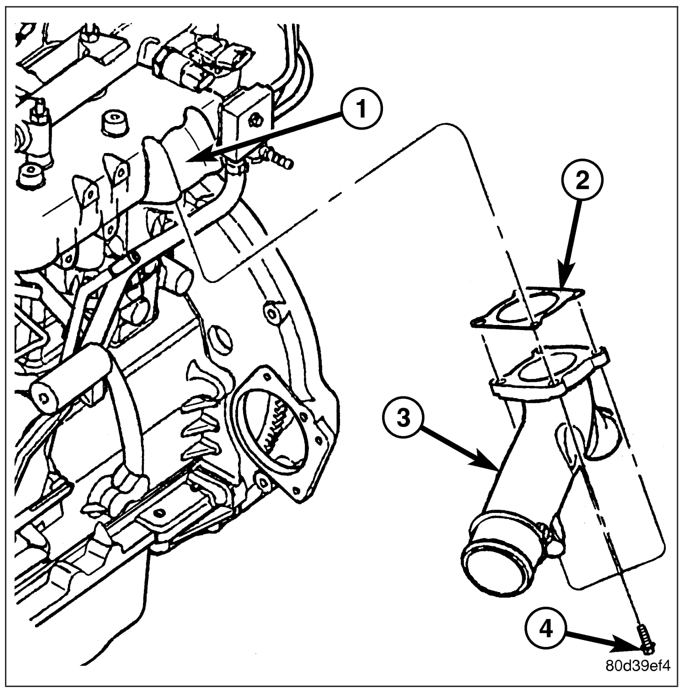
**CAUTION: DO NOT start the engine before the glow system test correctly.**

1. Measure the electrical resistance of the glow plug in the installed condition, resistance should be less than 0.8Ω. The ground contact must be as close as possible to the glow plug contact to avoid introducing errors in the measurement.
2. If the resistance is out of tolerance, remove the glow plug and check it again separately.
3. Use the actuator test function for the glow plug module and glow plug lamp. The design and function of the glow plug module tests each glow plug to check the complete glow system.
4. If MIL is OFF and OBD has not recognized a malfunction of the glow system, testing is finished and the engine can be started.
5. If MIL is still ON, check the electrical connectors of glow plugs and power up the glow plugs again.

## REMOVAL

**CAUTION:**
- **If necessary, remove hindering components to ease access.**
- **Do not bend, knock, or drop the glow plugs while handling (any mechanical impact may damage the glow plug).**
- **First loosen the glow plug with a wrench then screw it out by hand or with assistance of a flexible tool (e.g. with a rubber hose).**
- **Compare the removed glow plug with a new one. If there are missing parts of the ceramic heating element, remove all fragments from the combustion chamber before you start the engine. CYLINDER HEAD WILL NEED TO BE REMOVED**

1. Disconnect negative battery cable.
2. To access the glow plug for cylinder number one, no additional components need to be removed.
3. To remove the glow plug for cylinder number two, remove the rear generator bracket.
4. To remove the glow plug for cylinder number three, remove the EGR pipe from the intake elbow and remove the intake elbow.
5. To remove the glow plug for cylinder number four, relocate the fuel filter assembly.
6. Disconnect glow plug electrical connectors.
7. Remove glow plugs from cylinder head.



## INSTALLATION

**CAUTION:**

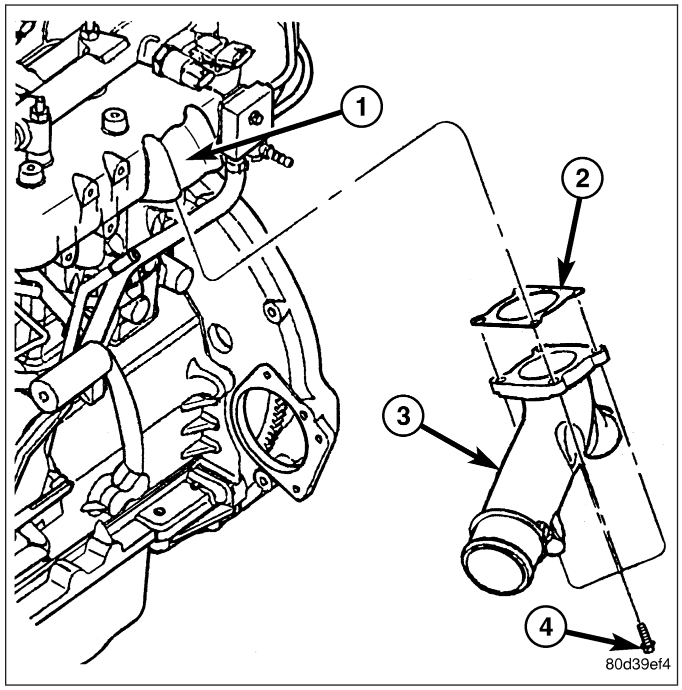
- **Before a new glow plug is installed, make sure that the thread of glow plug and glow plug bore in the cylinder head is dry, clean, and oil/grease-free**
- **Check the resistance of the glow plug with an appropriate multi-meter, resistance should be less than 0.8Ω.**
- **Tighten the glow plug by hand or means of a flexible tool (e.g. rubber hose) as far as possible and finish tightening with a correctly set torque wrench.**
- **Strictly observe the required tightening torque.**
- **Do not bend, knock, or drop the glow plug while installing.**

**CAUTION: If a fragment of the ceramic heater of the glow plug has fallen into the combustion chamber, the cylinder head MUST be removed.**

1. Install glow plugs all the way into cylinder head, hand tight, until the thread stops.

**CAUTION: Strictly observe the required tightening torque. If tightening torque was to high, remove and replace the glow plug.**

2. Tighten glow plugs to 12.5 N·m (110 in. lbs.).
3. Connect glow plug electrical connectors.
4. Install any components that were removed for access.
5. Connect negative battery cable.
6. Test the glow plug system for proper operation before starting the engine. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/GLOW PLUG - DIAGNOSIS AND TESTING)

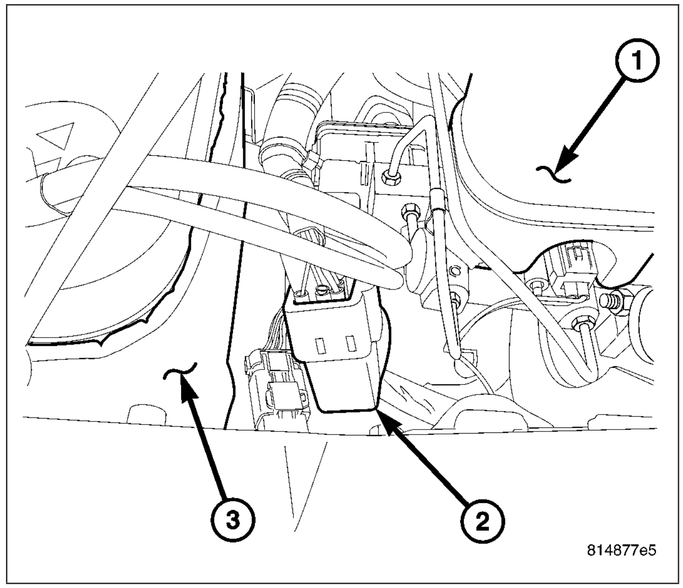


# MODULE-GLOW PLUG

## DESCRIPTION

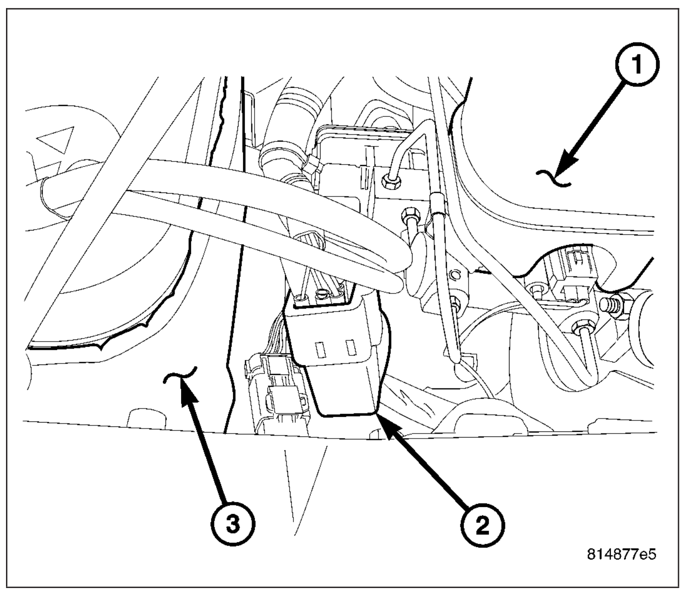
**CAUTION: The glow plug system is a 7 volt system. DO NOT ATTEMPT to test the glow plug system with a 12V power source or damage will occur.**

The glow plug module (2) is mounted to the inner fender between the battery and the master cylinder (1) in the engine compartment. For an explanation of the glow plug system operation (Refer to 8 - ELECTRICAL/IGNITION CONTROL/GLOW PLUG RELAY - OPERATION).




## OPERATION

**CAUTION: The glow plug system is a 7 volt system. DO NOT ATTEMPT to test the glow plug system with a 12V power source or damage will occur.**




When the ignition (key) switch is placed in the ON position, a signal is sent from the sensors to the ECM relaying current engine coolant temperature and ambient air temperature.

After receiving this signal, the ECM will determine if, when and for how long of a period the glow plugs should be activated. This is done before, during and after the engine is started. Whenever the glow plug module (2) is activated, it will control the 7 volt high amperage circuit for the operation of the four glow plugs.

The Glow Plug lamp is tied to this circuit. Lamp operation is also controlled by the ECM.

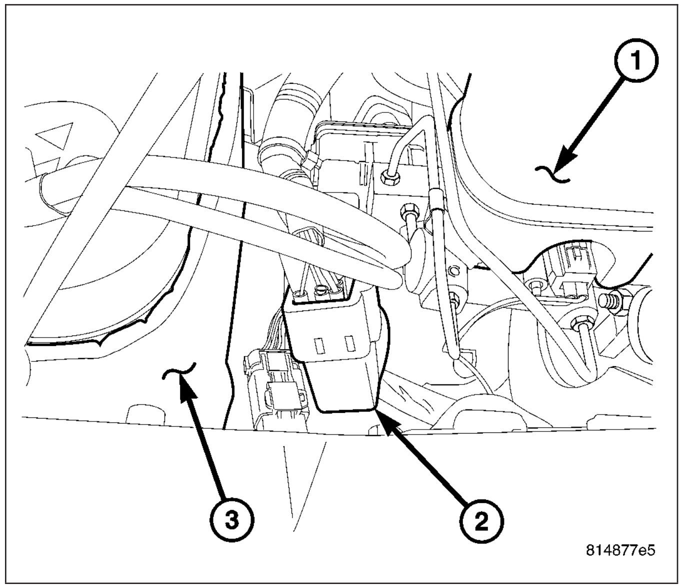
With a cold engine, the glow plug module and glow plugs may be activated for a maximum time of 200 seconds. Refer to the following Glow Plug Control chart for a temperature/time comparison of the glow plug relay operation.

In this chart, Pre-Heat and Post-Heat times are mentioned. Pre-Heat is the amount of time the glow plug control circuit is activated when the ignition (key) is switched ON, without the engine running. Post-Heat is the amount of time the glow plug control circuit is activated after the engine is operated. The Glow Plug lamp will not be activated during the post-heat cycle.

| Engine Coolant Temperature ″Key ON″ | Wait-To Start Lamp ″ON″ (Seconds) | Pre-Heat Cycle (Glow Plugs On Seconds) | Post-Heat Cycle (Seconds) |
|---|---|---|---|
| -30C | 10 SEC. | 35 SEC. | 200 SEC. |
| -10C | 10 SEC. | 23 SEC. | 180 SEC. |
| +10C | 1 SEC. | 21 SEC. | 160 SEC. |
| +30C | 1 SEC. | 20 SEC. | 140 SEC. |
| +40C | 1 SEC. | 19 SEC. | 70 SEC. |
| +70C | 1 SEC. | 16 SEC. | 20 SEC. |

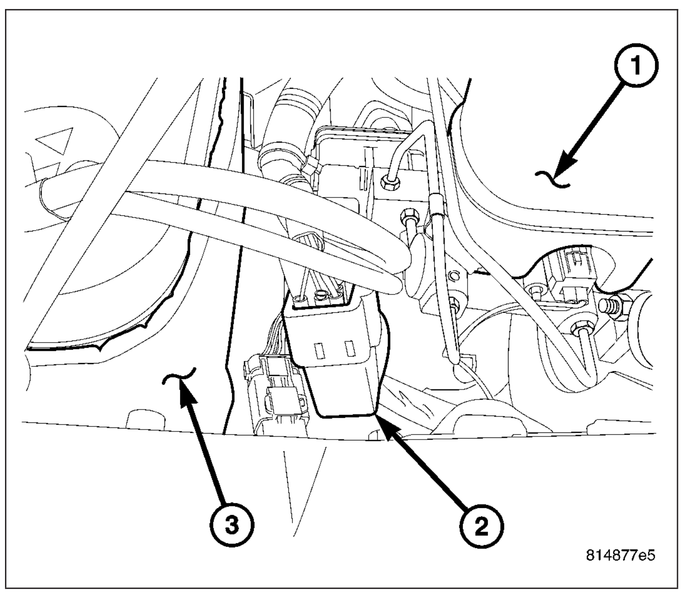
## REMOVAL

1. Disconnect the negative battery cable.
2. Disconnect the glow plug wiring harness connector.
3. Remove the module (2) from the inner wheel well.




## INSTALLATION

1. Connect the glow plug wiring harness connector.
2. Secure the relay onto the inner fender well.
3. Connect the negative battery cable.



# CAPACITOR-IGNITION COIL

## DESCRIPTION

One coil capacitor is used. It is located in the engine compartment and attached (clipped) to a wiring trough near the brake power booster.

## OPERATION

The coil capacitor(s) help dampen the amount of conducted electrical noise to the camshaft position sensor, crankshaft position sensor, and throttle position sensor. This noise is generated on the 12V supply wire to the ignition coils and fuel injectors.

## REMOVAL

The coil capacitor is located in the engine compartment and is attached (clipped) to a wiring harness trough near the brake power booster (graphic not available).

1. Unclip capacitor from wiring harness trough.
2. Disconnect electrical connector at capacitor.

## INSTALLATION

1. Connect electrical connector to coil capacitor.
2. Position capacitor into v-clip on wiring harness trough.

# INSTRUMENT CLUSTER

## TABLE OF CONTENTS



## INSTRUMENT CLUSTER - ELECTRICAL DIAGNOSTICS

### TABLE OF CONTENTS

# INSTRUMENT CLUSTER - ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## ABS LAMP CIRCUIT SHORT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects Indicator short/open fault during internal self test.

| Possible Causes |
| --- |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read DTCs.

**When this code is set, the Instrument Cluster must be replaced.**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## ABS LAMP OPEN

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects Indicator short/open fault during internal self test.

| Possible Causes |
|---|
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read DTCs.

**When this code is set, the Instrument Cluster must be replaced.**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## AIRBAG LAMP CIRCUIT SHORT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects Indicator short/open fault during internal self test.

| Possible Causes |
|---|
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read DTCs.

**When this code is set, the Instrument Cluster must be replaced.**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## AIRBAG LAMP OPEN

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects Indicator short/open fault during internal self test.

| Possible Causes |
|---|
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read DTCs.

**When this code is set, the Instrument Cluster must be replaced.**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## BRAKE LAMP CIRCUIT SHORT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects Indicator short/open fault during internal self test.

| Possible Causes |
|---|
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read DTCs.

**When this code is set, the Instrument Cluster must be replaced.**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## BRAKE LAMP OPEN

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects Indicator short/open fault during internal self test.

| Possible Causes |
|---|
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read DTCs.

**When this code is set, the Instrument Cluster must be replaced.**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## MIL LAMP CIRCUIT SHORT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects Indicator short/open fault during internal self test.

| Possible Causes |
| --- |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read DTCs.

**When this code is set, the Instrument Cluster must be replaced.**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## MIL LAMP OPEN

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects Indicator short/open fault during internal self test.

| Possible Causes |
|---|
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read DTCs.

**When this code is set, the Instrument Cluster must be replaced.**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## SEATBELT LAMP CIRCUIT SHORT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects Indicator short/open fault during internal self test.

| Possible Causes |
|---|
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read DTCs.

**When this code is set, the Instrument Cluster must be replaced.**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## SEATBELT LAMP OPEN

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects Indicator short/open fault during internal self test.

| Possible Causes |
|---|
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

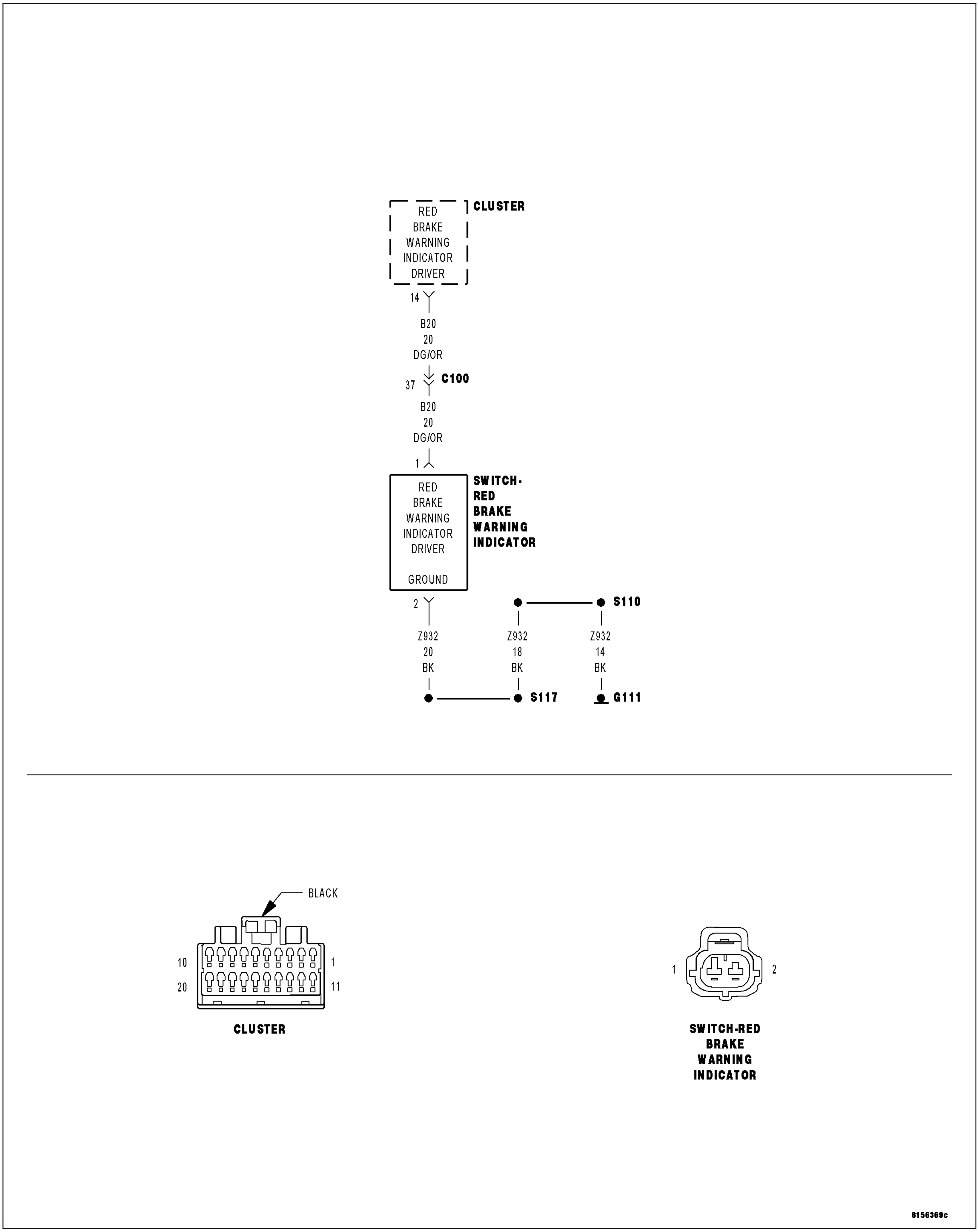
With the scan tool, read DTCs.

**When this code is set, the Instrument Cluster must be replaced.**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## BRAKE FLUID SWITCH CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The cluster performs open circuit detection on the Brake Fluid Level (Red Brake Warning Indicator Driver) switch and the sense circuit. Fault sets if an open circuit is detected. When this fault is detected the cluster will illuminate the Brake warning indicator.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| BRAKE FLUID LEVEL SWITCH |
| (Z932) BRAKE FLUID LEVEL SWITCH GROUND CIRCUIT |
| (B20) RED BRAKE WARNING INDICATOR DRIVER CIRCUIT |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

**NOTE: Ensure that the Brake Fluid Level Switch harness connector is properly connected.**

With the scan tool, erase DTCs.

Cycle the ignition and wait approximately 15 seconds.

With the scan tool, read DTCs.

**Does the scan tool display: BRAKE FLUID SWITCH CIRCUIT OPEN?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connectors.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. BRAKE FLUID LEVEL SWITCH

Turn the ignition off.

Disconnect the Brake Fluid Level Switch harness connector.

Check connectors - Clean/repair as necessary.

Measure the internal resistance of the Brake Fluid Level (Red Brake Warning Indicator Driver) Switch.

**Is the resistance above 1.1k (1,100) ohms?**

**Yes** >> Replace the Brake Fluid Level (Red Brake Warning Indicator Driver) Switch in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3

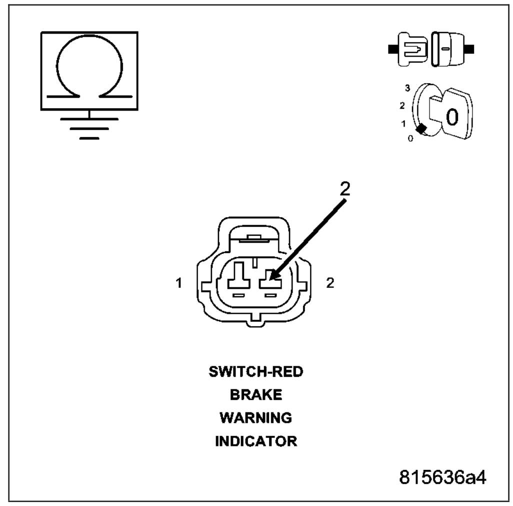
## 3. (Z932) BRAKE FLUID LEVEL SWITCH GROUND CIRCUIT

Turn the ignition off.

Disconnect the Brake Fluid Level Switch harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance between ground and the (Z932) Brake Fluid Level Switch Ground circuit.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (Z932) Brake Fluid Level (Red Brake Warning Indicator Driver) Switch Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 4

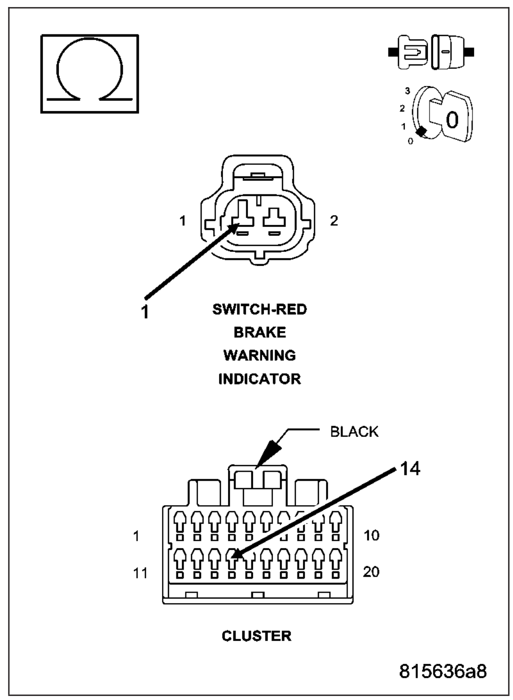
## 4. (B20) RED BRAKE WARNING INDICATOR DRIVER CIRCUIT OPEN

Turn the ignition off.

Disconnect the Brake Fluid Level Switch harness connector.

Disconnect the Instrument Cluster harness connector.

Measure the resistance of the (B20) Red Brake Warning Indicator Driver circuit.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (B20) Red Brake Warning Indicator Driver circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and configure the Instrument Cluster in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## CLUSTER BUS TRANSMIT SHUTDOWN

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects loss of internal bus transmission for 4 seconds.

| Possible Causes |
| --- |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Cycle the ignition and wait approximately 1 minute.

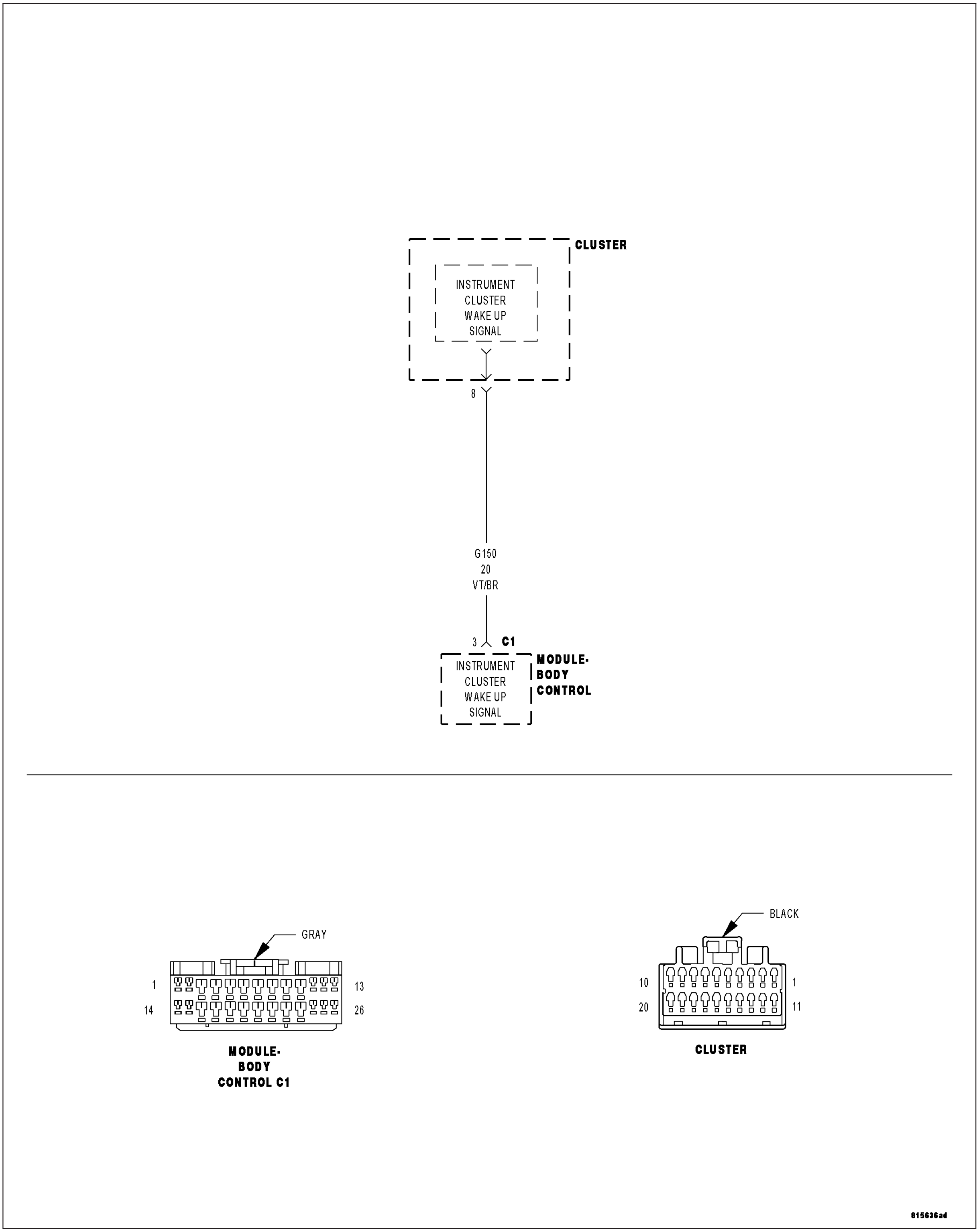
With the scan tool, read DTCs.

**Did this DTC reset?**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## CLUSTER WAKE UP OUTPUT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the OFF position.
- **Set Condition:**
  When the BCM receives an input from the driver door switch or an input from exterior lamp control switch. Symptoms will include: No fast chime with key in ignition or Park Lamps on and driver door open. No VF odometer display when door open. No cluster, high beam indicator, front or rear fog lamp indicator illumination.

| Possible Causes |
| --- |
| (G150) INSTRUMENT CLUSTER WAKE UP SIGNAL CIRCUIT SHORT TO VOLTAGE |
| INTERMITTENT CONDITION |
| BODY CONTROL MODULE |
| INSTRUMENT CLUSTER |

## Diagnostic Test

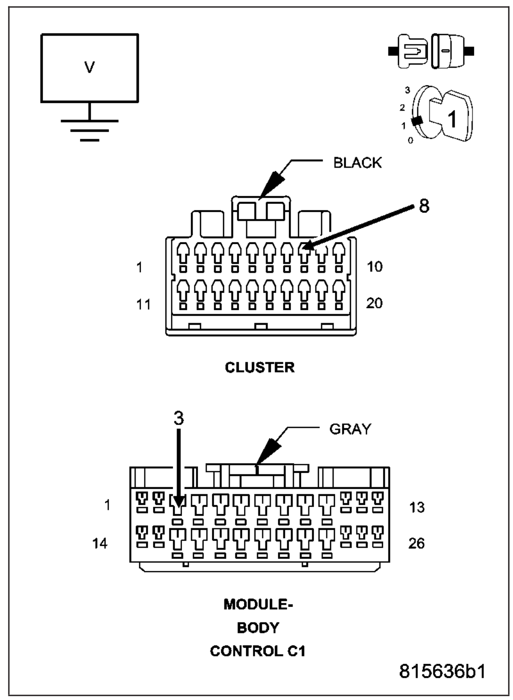
### 1. (G150) INSTRUMENT CLUSTER WAKE UP SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the BCM C1 harness connector.

Disconnect the Instrument Cluster harness connector.

Measure the voltage between the (G150) Instrument Cluster Wake Up Signal circuit and ground.




**Is there any voltage present?**

**Yes** >> Repair the (G150) Instrument Cluster Wake Up Signal circuit for a short to voltage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2

## 2. BODY CONTROL MODULE

Turn the ignition off.

Disconnect the Instrument Cluster harness connector.

Ensure that the BCM C1 harness connector is connected.

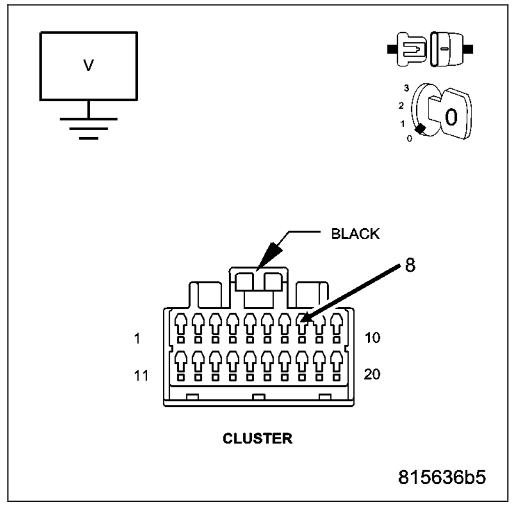
Measure the voltage between the (G150) Cluster Wake Up circuit and ground.

**Is there any voltage present?**

**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3




## 3. INSTRUMENT CLUSTER

Turn the ignition off.

Ensure that the Instrument Cluster and BCM C1 harness connectors are connected.

Turn the ignition on.

With the scan tool, read DTCs.

**Did this DTC reset?**

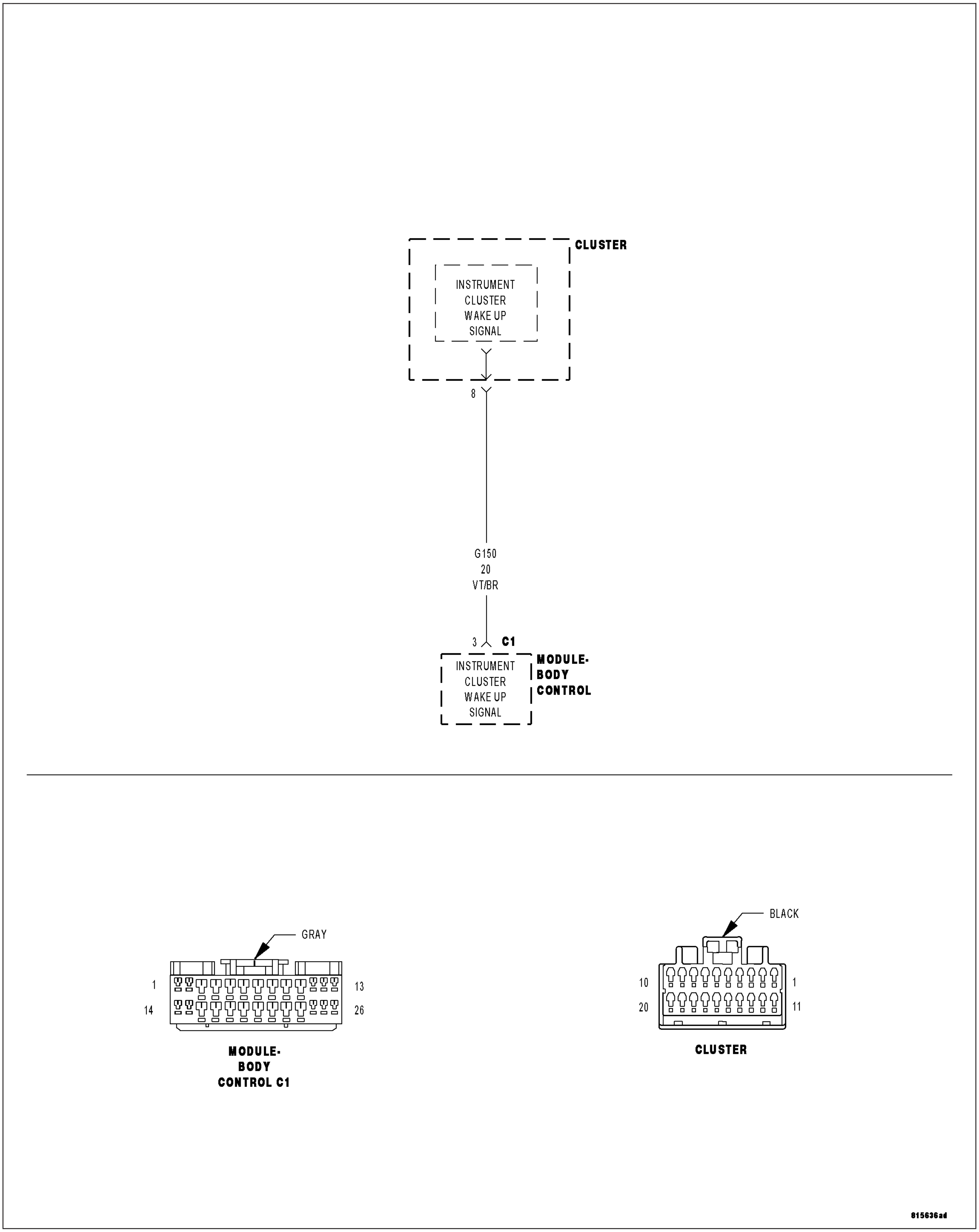
**Yes** >> Replace and configure the Instrument Cluster in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> The condition is not present at this time. Monitor scan tool DTCs while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## CLUSTER WAKE UP OUTPUT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the OFF position.
- **Set Condition:**
  When the BCM receives an input from the driver door switch or an input from exterior lamp control switch. Symptoms will include: No fast chime with key in ignition or Park Lamps on and driver door open. No VF odometer display when door open. No cluster, high beam indicator, front or rear fog lamp indicator illumination.

| Possible Causes |
|---|
| (A908) FUSED B(+) CIRCUIT OPEN |
| (G150) INSTRUMENT CLUSTER WAKE UP SIGNAL CIRCUIT OPEN |
| INTERMITTENT CONDITION |
| (G150) INSTRUMENT CLUSTER WAKE UP SIGNAL CIRCUIT SHORT TO GROUND |
| BODY CONTROL MODULE |
| INSTRUMENT CLUSTER |

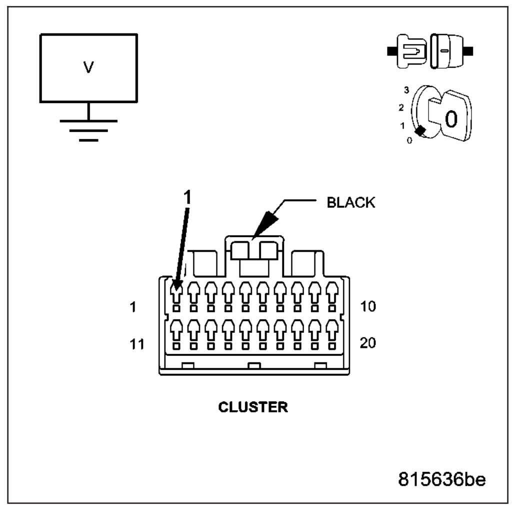
## Diagnostic Test

### 1. (A908) FUSED B(+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Instrument Cluster harness connector.

Measure the voltage between the (A908) Fused B(+) circuit and ground.

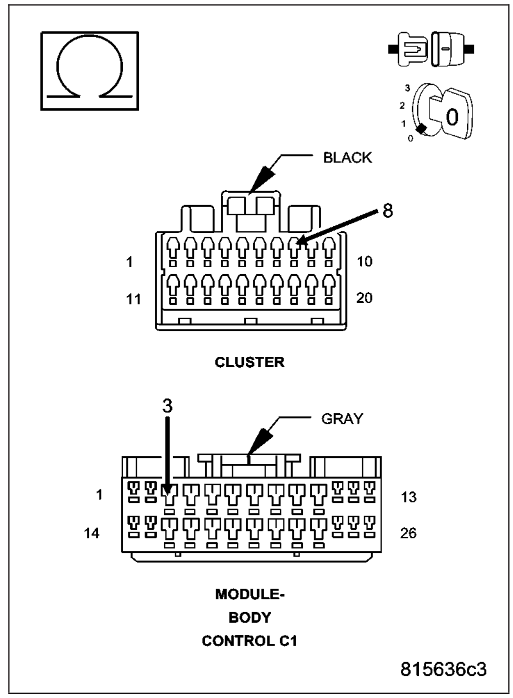



**Is the voltage above 10.5 volts?**

**Yes** >> Go To 2

**No** >> Repair the (A908) Fused B(+) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 2. (G150) INSTRUMENT CLUSTER WAKE UP SIGNAL CIRCUIT OPEN




Turn the ignition off.

Disconnect the Instrument Cluster harness connector.

Disconnect the BCM C1 harness connector.

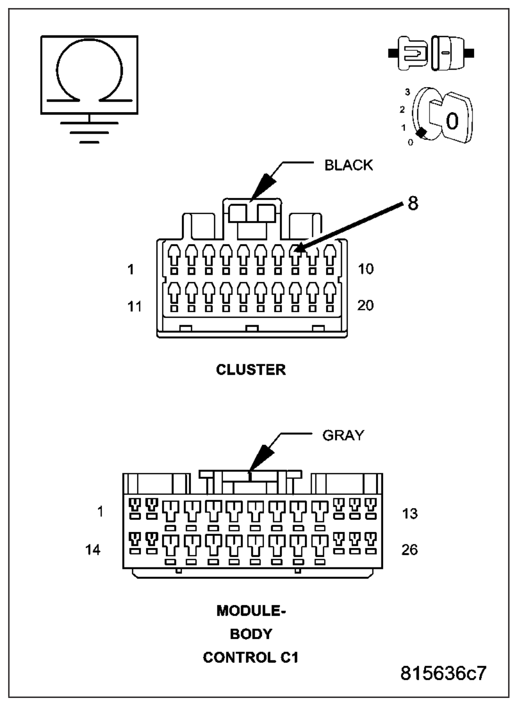
Measure the resistance of the (G150) Instrument Cluster Wake Up Signal circuit.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (G150) Instrument Cluster Wake Up Signal circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (G150) CLUSTER WAKE UP CIRCUIT SHORT TO GROUND




Turn the ignition off.

Disconnect the Instrument Cluster harness connector.

Disconnect the BCM C1 harness connector.

Measure the resistance between ground and the (G150) Cluster Wake Up circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (G150) Instrument Cluster Wake Up Signal circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. BODY CONTROL MODULE

Turn the ignition off.

Disconnect the Instrument Cluster harness connector.

Ensure that the BCM C1 harness connector is connected.

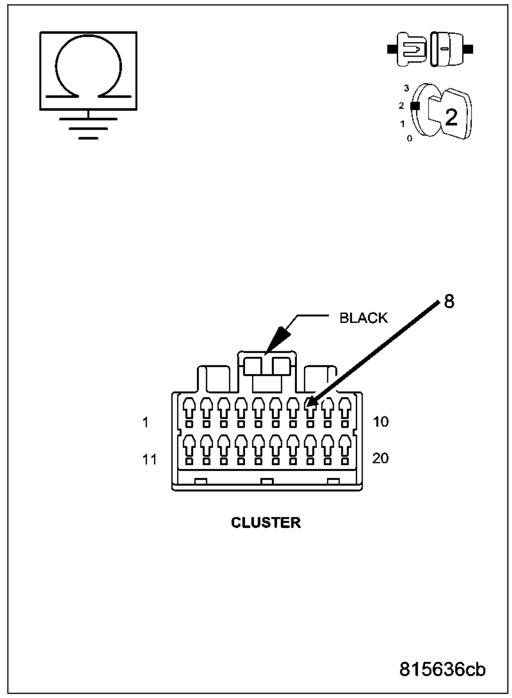
Install a DVOM between the Cluster Wake Up circuit of the Instrument Cluster harness connector and ground.

Set the DVOM to read resistance.

Turn the ignition on.

With the scan tool, select Body Control Module, then Actuators.

Observe the DVOM while using the scan tool to actuate the Cluster Wake Up ″on.″




**Did the DVOM indicate a brief (2 second) continuity to ground?**

**Yes** >> Go To 5

**No** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 5. INSTRUMENT CLUSTER

Turn the ignition off.

Ensure that the Instrument Cluster and BCM C1 harness connectors are connected.

Open the driver door or actuate the High Beam Headlamps with the key off.

With the scan tool, read DTCs.

**Did this DTC reset?**

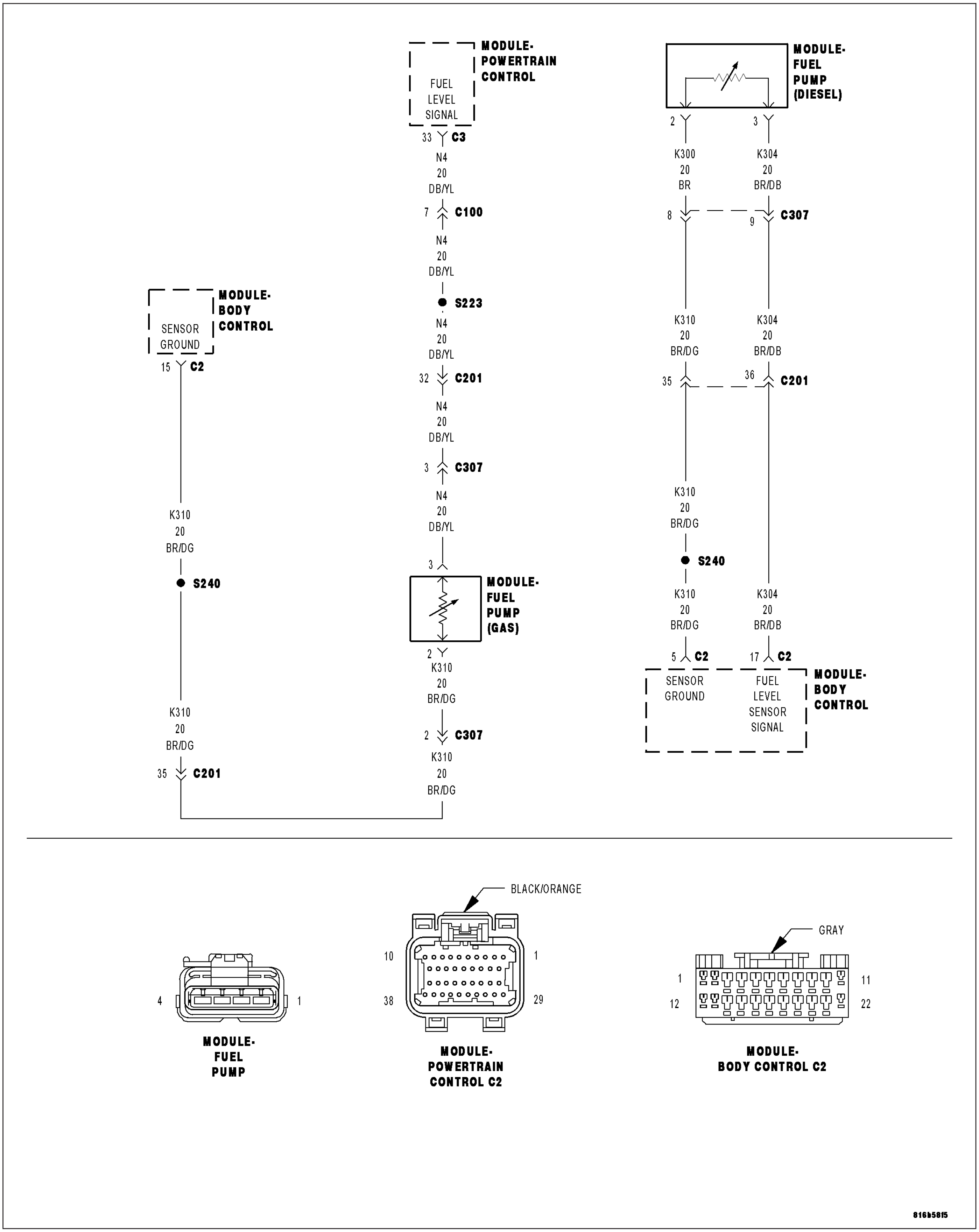
**Yes** >> Replace and configure the Instrument Cluster in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> The condition is not present at this time. Monitor scan tool DTCs while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## FUEL SENSOR FAULTED LOW (BCM)




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The fuel level sensor signal voltage goes below 0.0196 of a volt for more than 90 seconds.

| Possible Causes |
| --- |
| FUEL LEVEL SENSOR VOLTAGE BELOW 0.0196 OF A VOLT |
| FUEL LEVEL SENSOR |
| (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND |
| (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT |
| PCM |

## Diagnostic Test

### 1. FUEL LEVEL SENSOR VOLTS BELOW 0.0196 VOLT

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
With the scan tool, read the Fuel Level Sensor voltage.

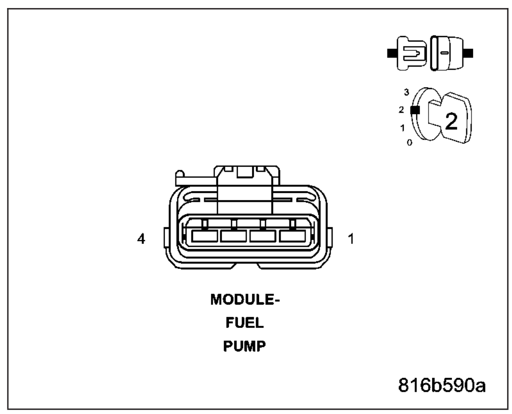
**Is the Fuel Level Sensor voltage below 0.0196 of a volt?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. FUEL LEVEL SENSOR

Turn the ignition off.
Disconnect the Fuel Pump Module harness connector.
Ignition on, engine not running.
With the scan tool, read the Fuel Level Sensor voltage.




**Did the Fuel Level Sensor voltage change from below 0.4 of a volt to above 4.0 volts?**

**Yes** >> Replace the Fuel Level Sensor in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

### 3. DETERMINE VEHICLE ENGINE TYPE

**What type of engine is the vehicle equipped with?**

**Gas** >> Go To 4

**Gas (ESP)**
Go To 7

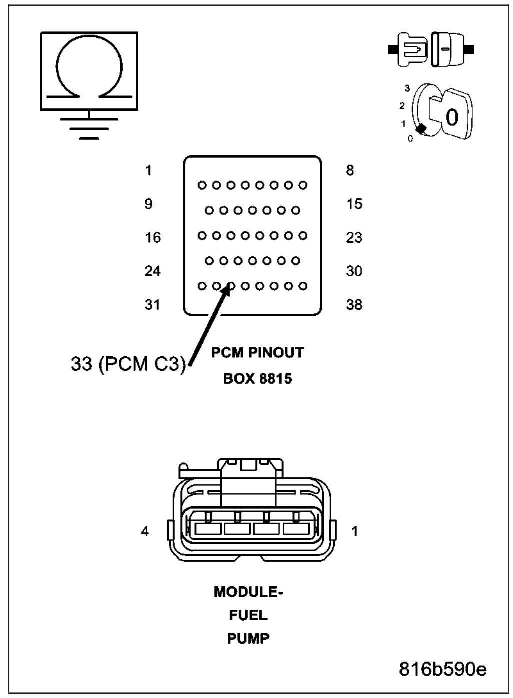
**Diesel**
Go To 10

## 4. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 and C3 PCM harness connectors.

Measure the resistance between ground and the (N4) Fuel Level Signal circuit at the Fuel Level Sensor harness connector.



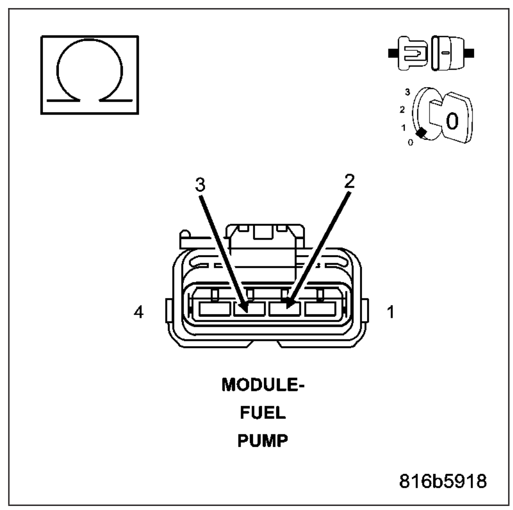

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (N4) Fuel Level Signal circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND

Measure the resistance between the (N4) Fuel Level Signal circuit and the (K900) Sensor ground circuit at the Fuel Pump Module harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K900) Sensor ground and the (N4) Fuel Level Signal circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the BCM C2 harness connectors.

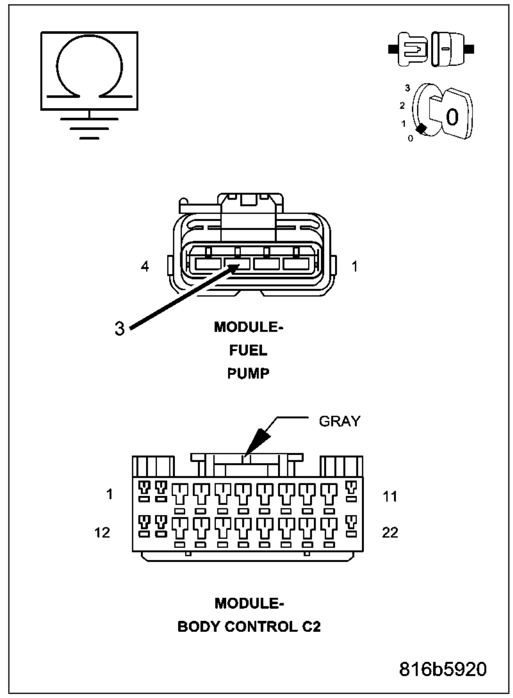
Measure the resistance between ground and the (N4) Fuel Level Signal circuit at the Fuel Level Sensor harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (N4) Fuel Level Signal circuit.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 8




## 8. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K310) SENSOR GROUND

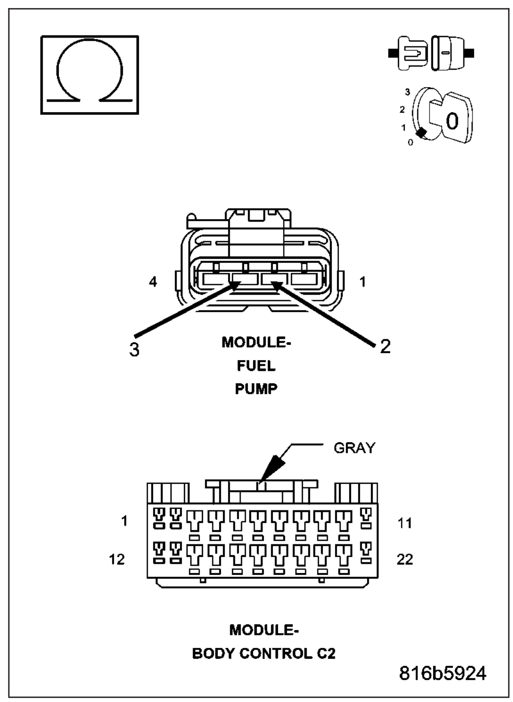
Measure the resistance between the (N4) Fuel Level Signal circuit and the (K310) Sensor ground circuit at the Fuel Pump Module harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K310) Sensor ground and the (N4) Fuel Level Signal circuit.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 9



## 9. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Body Control Module per Service Information.

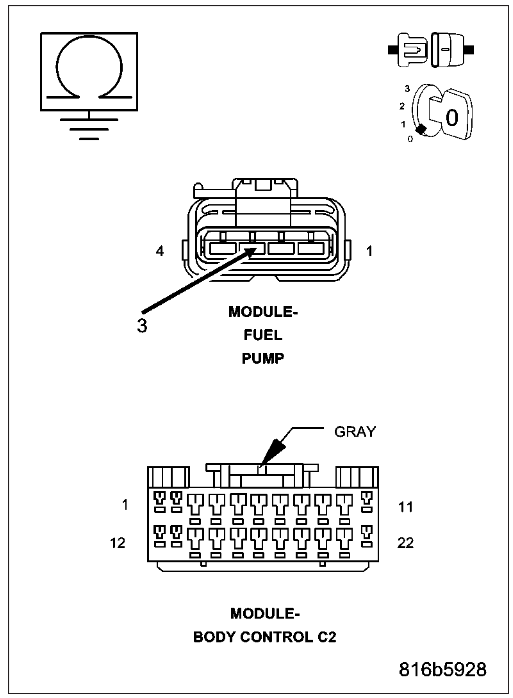
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 10. (K304) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the BCM C2 harness connectors.

Measure the resistance between ground and the (K304) Fuel Level Signal circuit at the Fuel Level Sensor harness connector.




**Is the resistance below 100 ohms?**

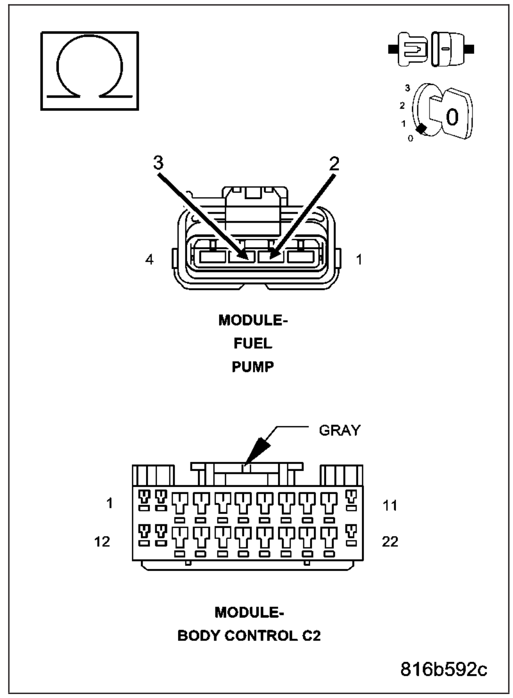
**Yes** >> Repair the short to ground in the (K304) Fuel Level Signal circuit.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 11

## 11. (K304) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K300) SENSOR GROUND

Measure the resistance between the (K304) Fuel Level Signal circuit and the (K300) Sensor ground circuit at the Fuel Pump Module harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K300) Sensor ground and the (N304) Fuel Level Signal circuit.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 12

## 12. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

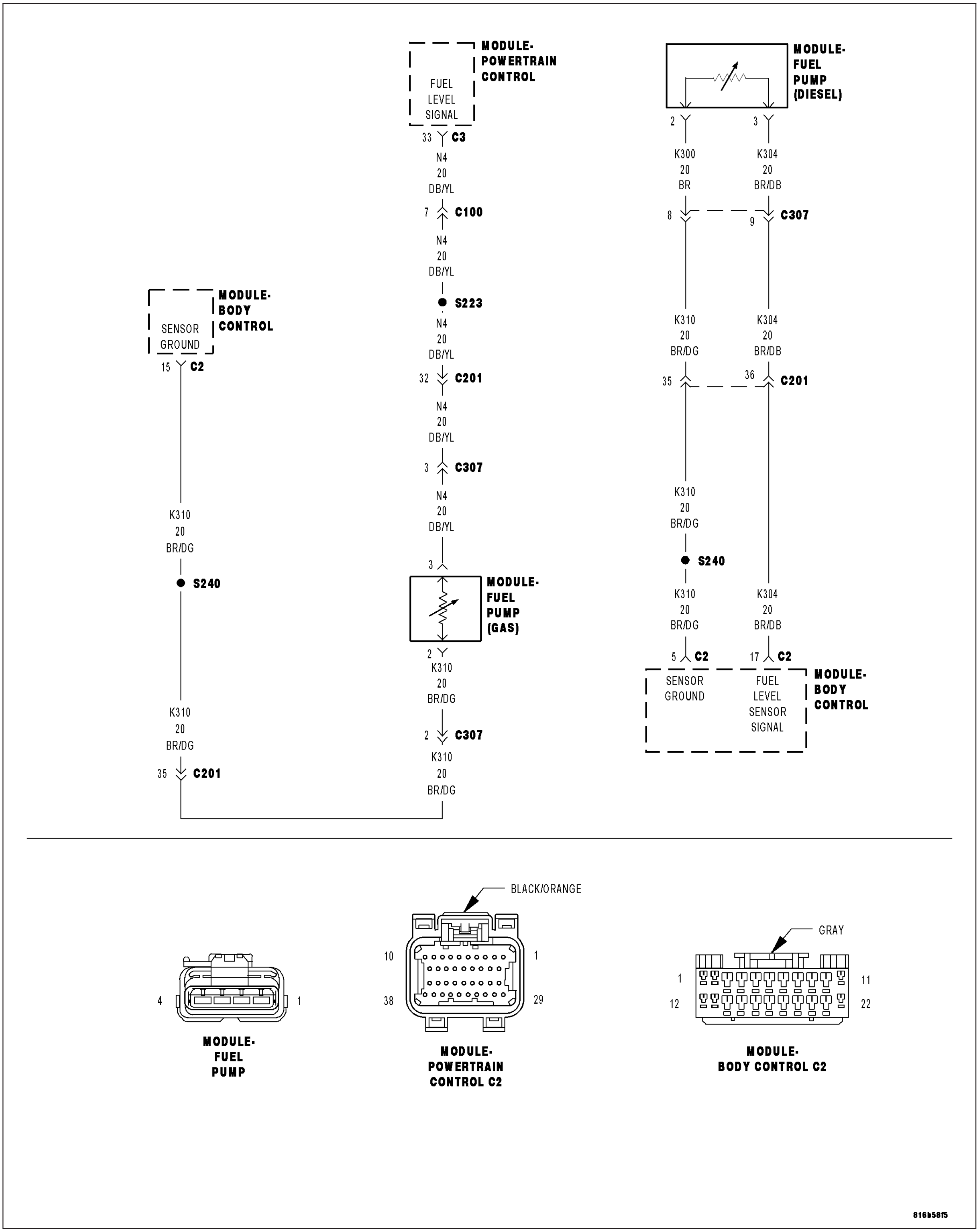
**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Powertrain Control Module per Service Information.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## FUEL SENSOR FAULTED HIGH (BCM)




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The fuel level sensor signal voltage at the PCM goes above 4.9 volts for more than 90 seconds.

| Possible Causes |
|---|
| FUEL LEVEL SENSOR VOLTAGE ABOVE 4.9 VOLTS |
| FUEL LEVEL SENSOR |
| (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN |
| (K900) SENSOR GROUND CIRCUIT OPEN |
| PCM |

## Diagnostic Test

### 1. FUEL LEVEL SENSOR VOLTAGE ABOVE 4.9 VOLTS

Ignition on, engine not running.

With the scan tool, read the Fuel Level Sensor voltage.

**Is the Fuel Level Sensor voltage above 4.9 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. FUEL LEVEL SENSOR

Turn the ignition off.

Disconnect the Fuel Pump Module electrical harness connector.

Connect a jumper wire between the (N4) Fuel Level Signal circuit and the (K900) Sensor ground circuit at the Fuel Pump Module harness connector.

Ignition on, engine not running.

With the scan tool, read the Fuel Level Sensor voltage.

**NOTE: Remove the jumper wire before continuing.**

**Did the Fuel Level Sensor voltage change from above 4.8 volts to below 0.4 of a volt?**

**Yes** >> Replace the Fuel Level Sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

### 3. DETERMINE VEHICLE ENGINE TYPE

**What type of engine is the vehicle equipped with?**

**Gas** >> Go To 4

**Gas (ESP)**
Go To 8

**Diesel**
Go To 12

## 4. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO VOLTAGE

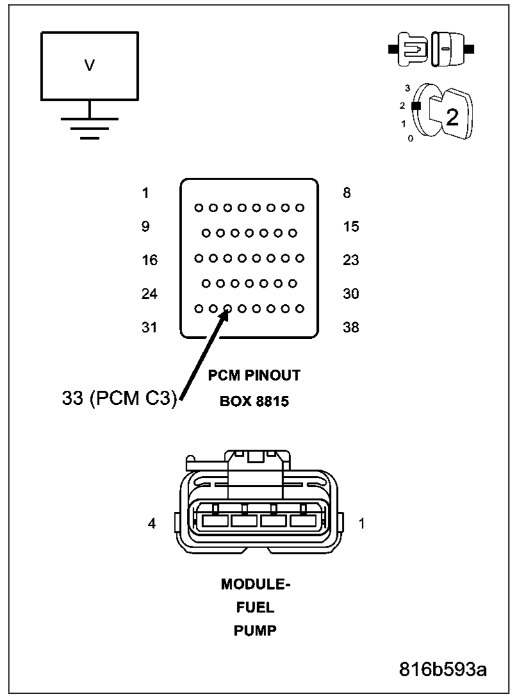
Turn the ignition off.

Disconnect the C2 and C3 PCM harness connectors.

**WARNING: When the engine is operating, do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.**

Ignition on, engine not running.

Measure the voltage on the (N4) Fuel Level Signal circuit at the Fuel Pump Module harness connector.




**Is the voltage above 5.3 volts?**

**Yes** >> Repair the short to voltage in the (N4) Fuel Level Signal circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

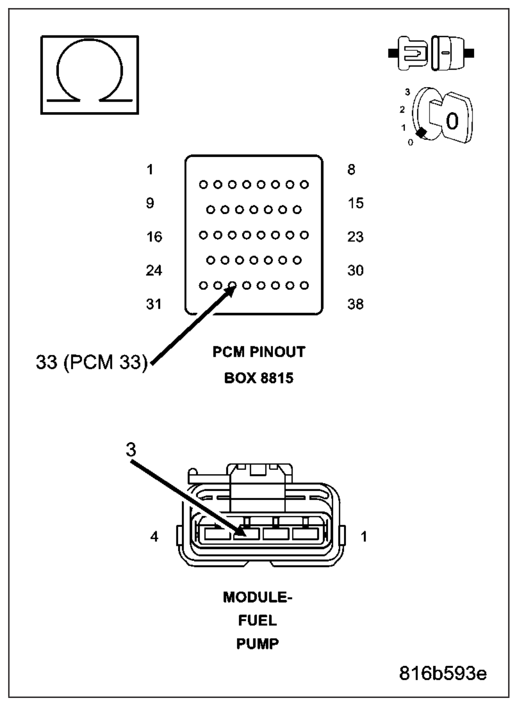
**No** >> Go To 5

## 5. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the pcm harness connectors. Probing the pcm harness connectors will damage the pcm terminals resulting in poor terminal to pin connection. Install miller special tool #8815 to perform diagnosis.**

Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the appropriate terminal in Miller Special Tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

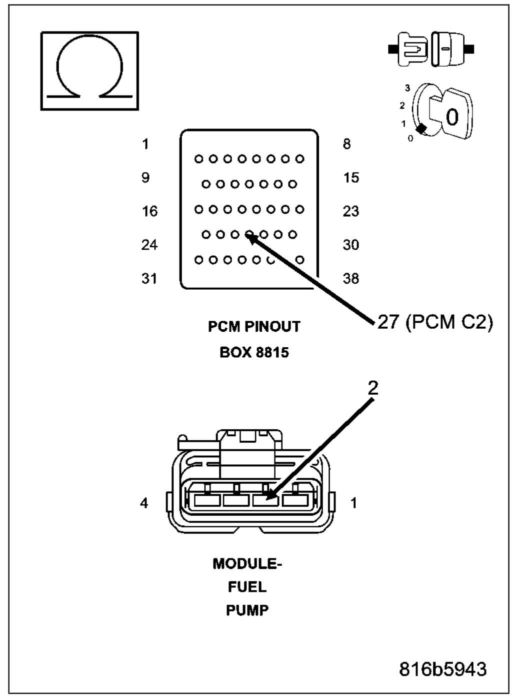
**No** >> Repair the open in the (N4) Fuel Level Signal circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (K900) SENSOR GROUND CIRCUIT OPEN

**CAUTION: Do not probe the pcm harness connectors. Probing the pcm harness connectors will damage the pcm terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K900) Sensor ground circuit from the Fuel Pump Module harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 8. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED BATTERY TO VOLTAGE

Turn the ignition off.

Disconnect the BCM C2 harness connectors.

Ignition on, engine not running.

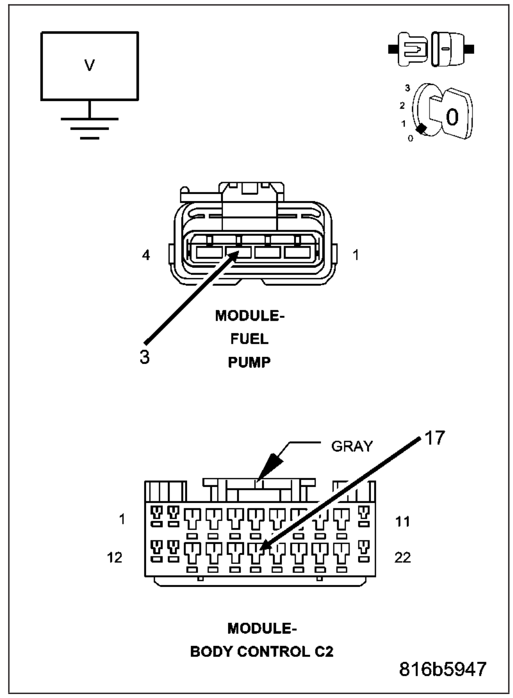
Measure the voltage on the (N4) Fuel Level Signal circuit at the Fuel Pump Module harness connector.

**Is the voltage above 5.3 volts?**

**Yes** >> Repair the short to voltage in the (N4) Fuel Level Signal circuit.

Perform BODY VERIFICATION TEST VER -1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 9




## 9. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

Turn the ignition off.

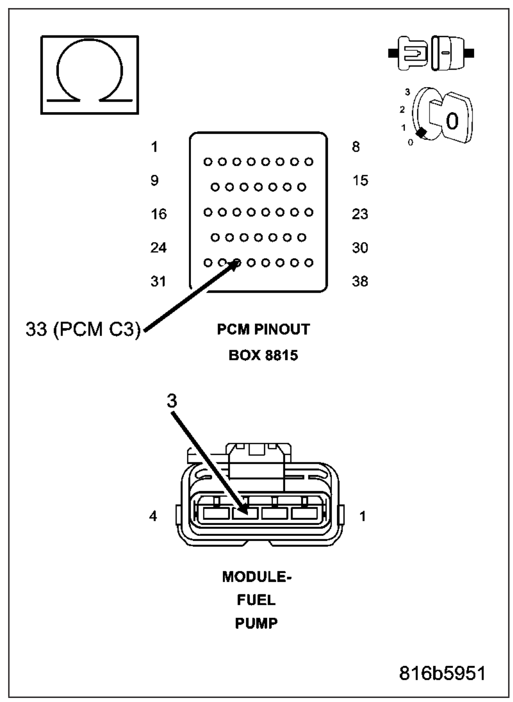
Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the appropriate terminal in Miller Special Tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 10

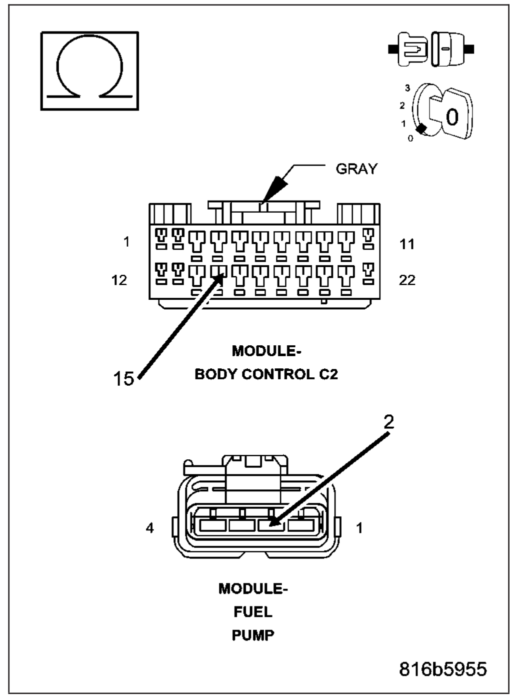
**No** >> Repair the open in the (N4) Fuel Level Signal circuit.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## 10. (K310) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K310) Sensor ground circuit from the Fuel Pump Module harness connector to the appropriate terminal of Miller Special Tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 11

**No** >> Repair the open in the (K310) Sensor ground circuit.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 11. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

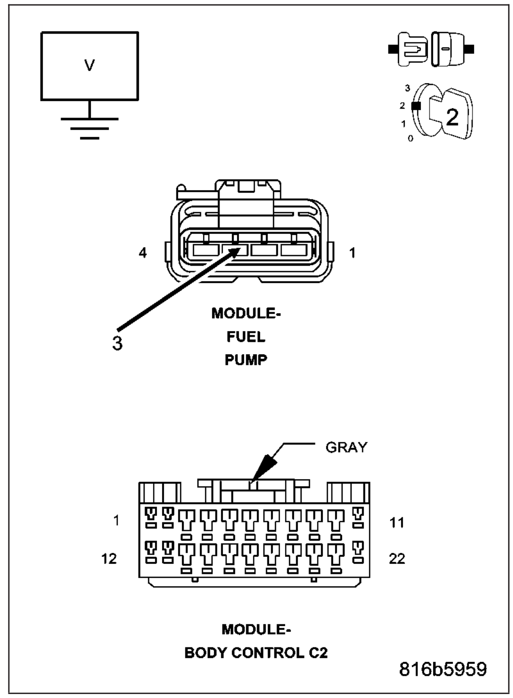
**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Body Control Module per Service Information.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 12. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the BCM C2 harness connectors.

Ignition on, engine not running.

Measure the voltage on the (N4) Fuel Level Signal circuit at the Fuel Pump Module harness connector.

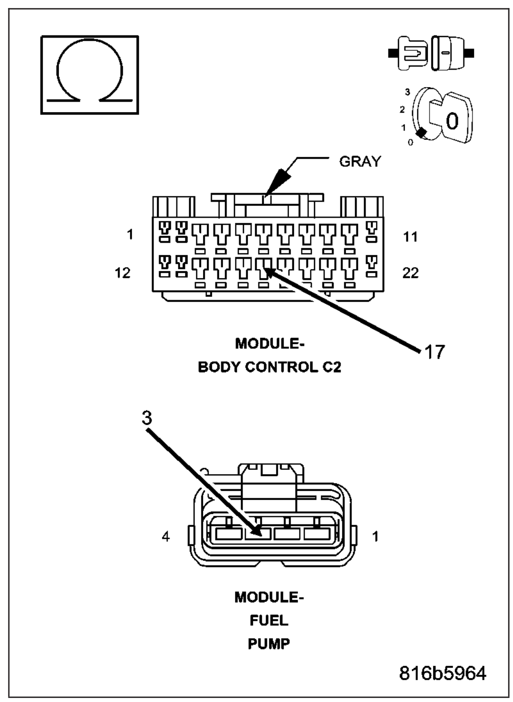
**Is the voltage above 5.3 volts?**

**Yes** >> Repair the short to voltage in the (N4) Fuel Level Signal circuit.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. (K304) FUEL LEVEL SIGNAL CIRCUIT OPEN




Turn the ignition off.

Measure the resistance of the (K304) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the appropriate terminal in Miller Special Tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 14

**No** >> Repair the open in the (K304) Fuel Level Signal circuit.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 14. (K300) SENSOR GROUND CIRCUIT OPEN

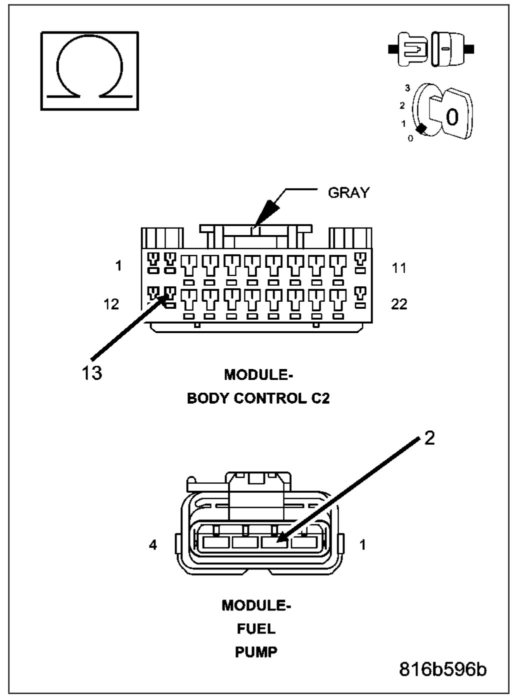
Measure the resistance of the (K300) Sensor ground circuit from the Fuel Pump Module harness connector to the appropriate terminal of Miller Special Tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 15

**No** >> Repair the open in the (K300) Sensor ground circuit.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)




## 15. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Body Control Module per Service Information.

Perform BODY VERIFICATION TEST VER - 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## INTERNAL MODULE FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  The instrument cluster detects an internal failure.

| Possible Causes |
|---|
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read DTCs.

**When this code is set, the Instrument Cluster must be replaced.**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## NO ABS BUS MESSAGES RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects no ABS bus messages for 6 continuous seconds. The cluster will illuminate the ABS warning indicator.

| Possible Causes |
|---|
| NO RESPONSE - PCI BUS - CAB MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. NO RESPONSE - PCI BUS - CAB MODULE

Turn the ignition on.

With the scan tool, attempt to communicate with the CAB module.

**Was the scan tool able to I/D or communicate with the CAB module?**

**Yes** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Refer to the COMMUNICATION category for the related symptom(s). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## NO BCM BUS MESSAGES RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects no BCM bus message for 6 seconds.

| Possible Causes |
|---|
| NO RESPONSE - PCI BUS - BCM |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. NO RESPONSE - PCI BUS - BCM

Turn the ignition on.

With the scan tool, attempt to communicate with the BCM.

**Was the scan tool able to I/D or communicate with the BCM?**

**Yes** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Refer to the COMMUNICATION category for the related symptom(s).

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## NO EVIC/TPM BUS MESSAGES RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects no EVIC/TPM bus messages for 6 seconds.

| Possible Causes |
|---|
| NO RESPONSE - EVIC/TPM |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. NO RESPONSE - EVIC/TPM

Turn the ignition on.

With the scan tool, attempt to communicate with the EVIC/TPM.

**Was the scan tool able to I/D or communicate with the EVIC/TPM?**

**Yes** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Refer to the COMMUNICATION category for the related symptom(s).

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## NO ORC BUS MESSAGES RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects no ORC bus message for 6 seconds. The cluster will illuminate the Airbag warning indicator.

| Possible Causes |
|---|
| NO RESPONSE - PCI BUS - ORC |
| INTERMITTENT CONDITION |

### Diagnostic Test

#### 1. NO RESPONSE - PCI BUS - ORC

Turn the ignition on.

With the scan tool, attempt to communicate with the ACM.

**Was the scan tool able to I/D or communicate with the ACM?**

**Yes** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Refer to the COMMUNICATION category for the related symptom(s).

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## NO PCI BUS MESSAGES RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects no PCI Bus messages for 4 continuous seconds. The VF will display ″no bus.″ The cluster will illuminate the ABS, Fuel, Airbag, and MIL warning indicators. All gauge needles will default to the lowest indication.

| Possible Causes |
|---|
| NO RESPONSE - PCI BUS |
| INTERMITTENT CONDITION |
| NO RESPONSE - PCI BUS - INSTRUMENT CLUSTER |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. NO RESPONSE - PCI BUS

Turn the ignition on.

**NOTE: When the Instrument Cluster detects no PCI Bus, the VF will display ″no bus″.**
With the scan tool, attempt to communicate with other modules on the PCI Bus.

**Was the scan tool able to communicate with other modules?**

**Yes** >> Go To 2

**No** >> Refer to the COMMUNICATION category for the related symptom(s).
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. NO RESPONSE - PCI BUS - INSTRUMENT CLUSTER

Turn the ignition on.

With the scan tool, select System Monitors, then J1850 Module Scan.

**Does the scan tool display MIC PRESENT on the BUS?**

**Yes** >> Go To 3

**No** >> Refer to symptom ″No Response from Instrument Cluster in the Communication″ category.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 3. INSTRUMENT CLUSTER

With the scan tool, erase DTCs.

Cycle the ignition and wait approximately 1 minute.

With the scan tool, read DTCs.

**Did this DTC reset?**

**Yes** >> Replace the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## NO PCM BUS MESSAGES RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects no PCM bus message for 20 seconds. The cluster will illuminate the MIL indicator.

| Possible Causes |
|---|
| NO RESPONSE - PCI BUS - PCM |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. NO RESPONSE - PCI BUS - PCM

Turn the ignition on.

With the scan tool, attempt to communicate with the PCM.

**Was the scan tool able to I/D or communicate with the PCM?**

**Yes** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Refer to the COMMUNICATION category for the related symptom(s).

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## NO SKIM BUS MESSAGES RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run/Start position.
- **Set Condition:**
  The Instrument Cluster detects no SKIM bus message for 20 seconds.

| Possible Causes |
|---|
| NO RESPONSE - PCI BUS - SKIM |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. NO RESPONSE - PCI BUS - SKIM

Turn the ignition on.

**NOTE: Ensure that the vehicle is equipped with the SKIM feature before proceeding with this test.**
With the scan tool, attempt to communicate with the SKIM module.

**Was the scan tool able to I/D or communicate with the SKIM module?**

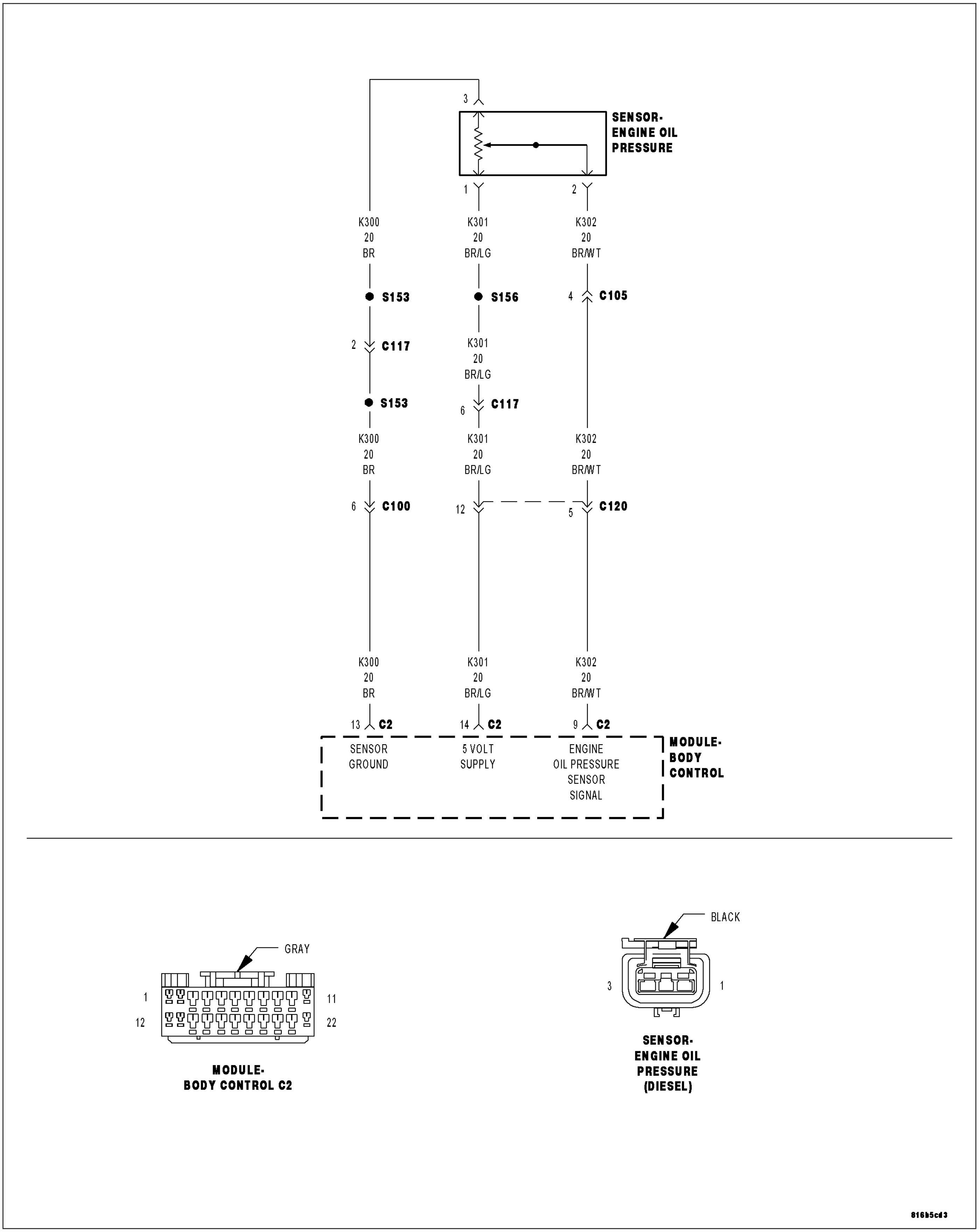
**Yes** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Refer to the COMMUNICATION category for the related symptom(s).

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## OIL PRESSURE SENSOR FAULTED HIGH




For a complete wiring diagram **Refer to Section 8W**.

## Diagnostic Test

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Oil Pressure Sensor voltage high.

| Possible Causes |
|---|
| (K302) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K302) OIL PRESSURE SENSOR SIGNAL CIRCUIT OPEN |
| (K302) OIL PRESSURE SENSOR SIGNAL CIRCUIT OPEN |
| (K300) SENSOR GROUND CIRCUIT OPEN |
| OIL PRESSURE SENSOR |
| POWERTRAIN CONTROL MODULE (PCM) |

## Diagnostic Test

### 1. OIL PRESSURE SENSOR VOLTAGE ABOVE 4.92 VOLTS

Start the engine.

With a scan tool, read the Oil Pressure Sensor voltage.

**Is the voltage above 4.92 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. OIL PRESSURE SENSOR

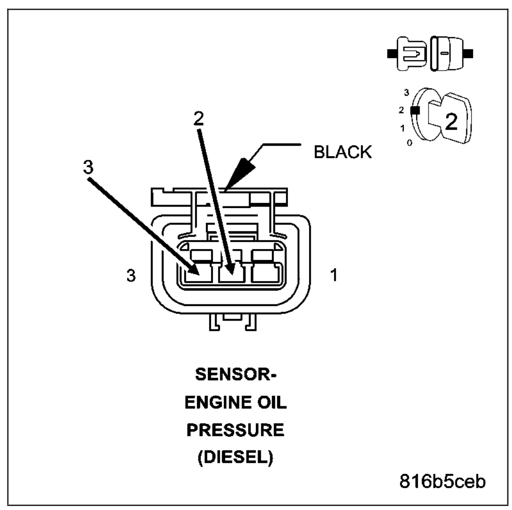
Turn the ignition off.

Disconnect the Oil Pressure Sensor harness connector.

Connect a jumper wire between the (K302) Oil Pressure Sensor Signal circuit and the (K300) Sensor ground circuit in the Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the Oil Pressure Sensor voltage.



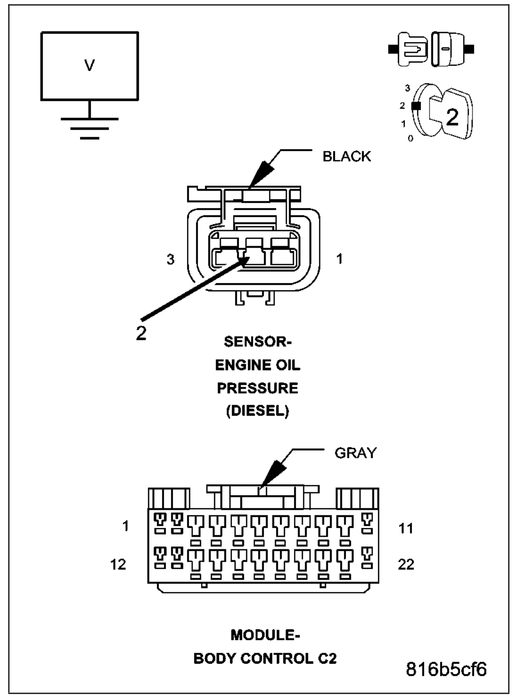

**Is the voltage below 1.0 volt with the jumper wire installed?**

**Yes** >> Replace the Oil Pressure Sensor.
Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3

**NOTE: Remove the jumper wire before continuing.**

## 3. (K302) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE




Turn the ignition off.

Disconnect the BCM C2 harness connector.

Ignition on, engine not running.

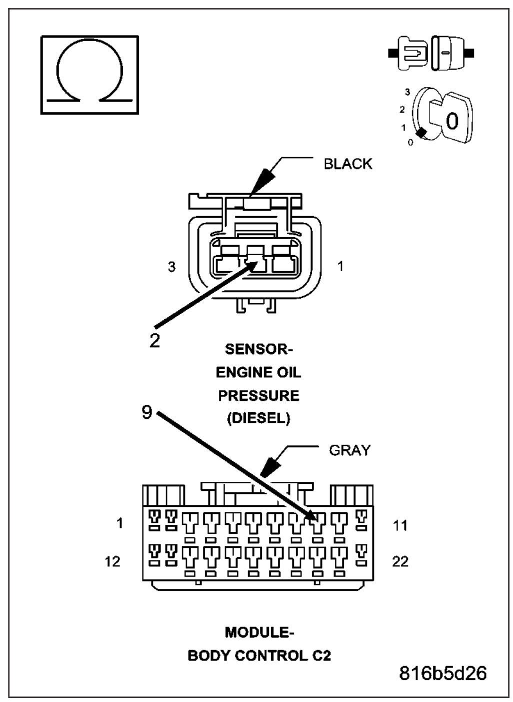
Measure the voltage on the (K302) Oil Pressure Sensor Signal circuit in the Oil Pressure Sensor harness connector.

**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K302) Oil Pressure Sensor Signal circuit.
Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (K302) OIL PRESSURE SENSOR SIGNAL CIRCUIT OPEN




Turn the ignition off.

Measure the resistance of the (K302) Oil Pressure Sensor Signal circuit.

**Is the resistance below 5.0 ohms?**

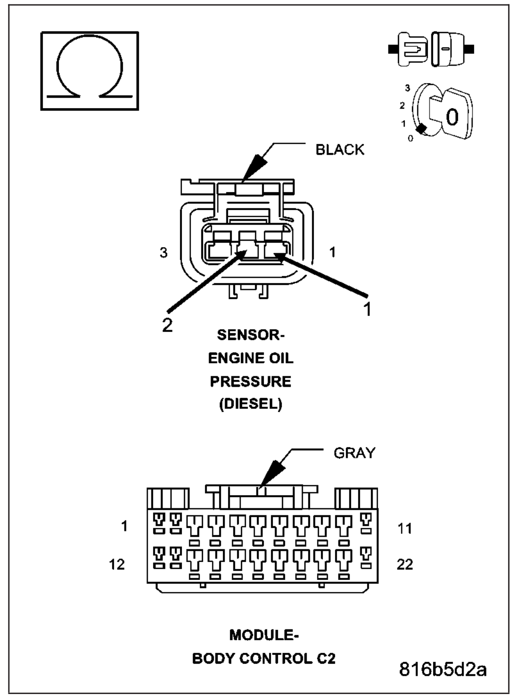
**Yes** >> Go To 5

**No** >> Repair the open in the (K302) Oil Pressure Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (K302) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO THE (K301) 5–VOLT SUPPLY CIRCUIT

Disconnect the BCM C2 harness connector.

Measure the resistance between the (K302) Oil Pressure Sensor Signal circuit and the (K301) 5-volt Supply circuit in the Oil Pressure Sensor harness connector.




**Is the resistance below 100 ohms?**

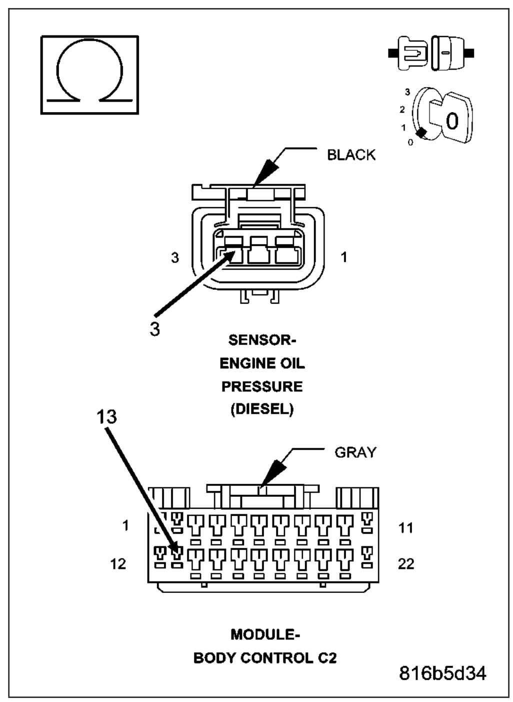
**Yes** >> Repair the short between the (K301) 5-volt Supply circuit and the (K302) Oil Pressure Sensor Signal circuit.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (K300) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K300) Sensor ground circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K300) Sensor ground circuit.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 7. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

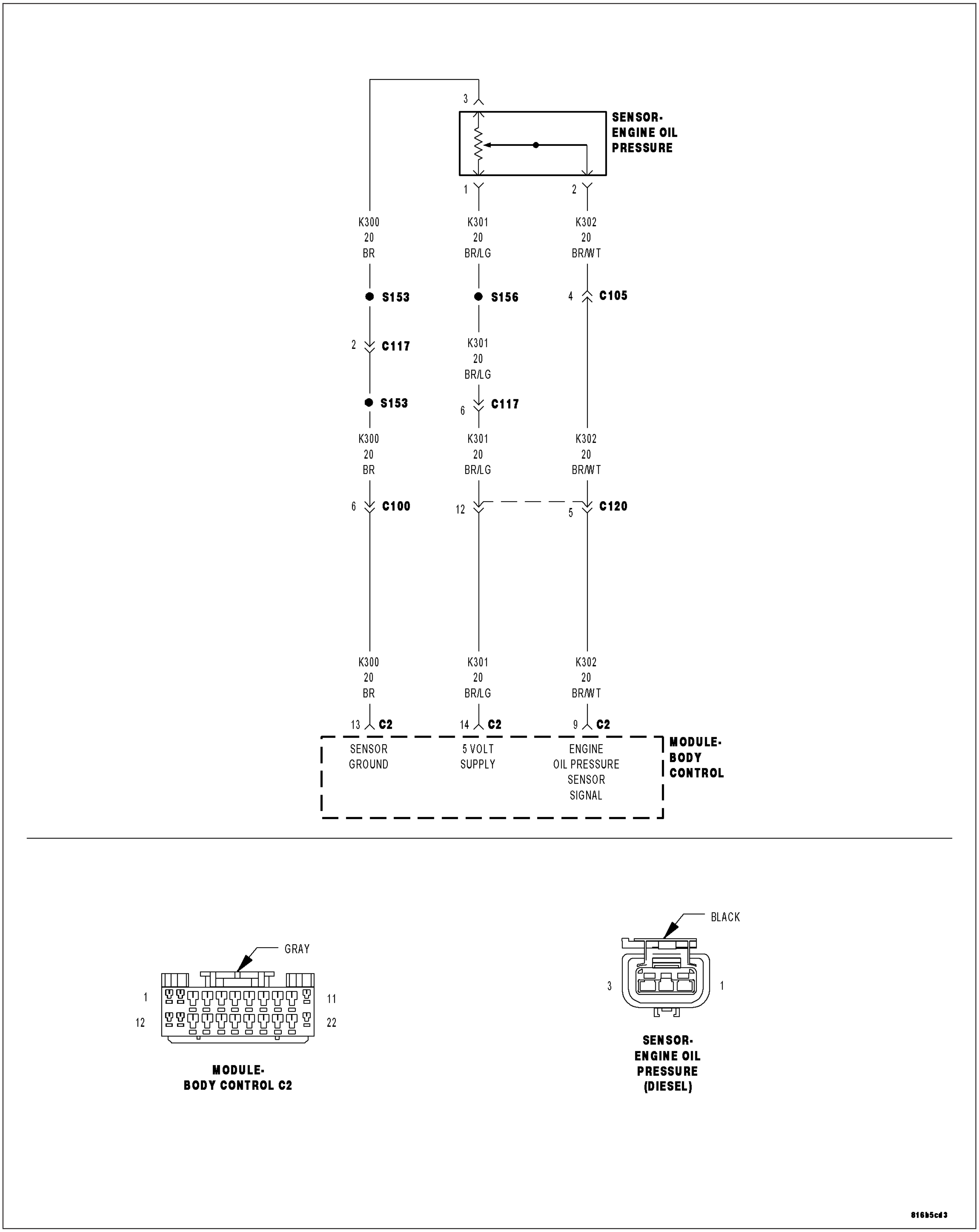
**Yes** >> Repair as necessary.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## OIL PRESSURE SENSOR FAULTED LOW (BCM)




For a complete wiring diagram **Refer to Section 8W**.

## Diagnostic Test

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Oil Pressure Sensor voltage low.

| Possible Causes |
|---|
| (K301) 5-VOLT SUPPLY CIRCUIT |
| (K302) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| (K302) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO THE (K300) SENSOR GROUND CIRCUIT |
| (K301) 5-VOLT SUPPLY CIRCUIT OPEN |
| (K301) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| OIL PRESSURE SENSOR |
| BCM |

## Diagnostic Test

### 1. OIL SENSOR VOLTAGE BELOW 0.08 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the MAP Sensor voltage.

**Is the voltage below 0.08 of a volt?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

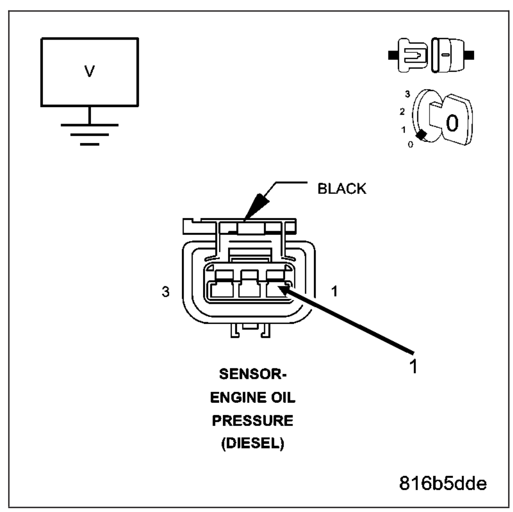
### 2. (K301) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Oil Pressure Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K301) 5-volt Supply circuit in the Oil Pressure Sensor harness connector.




**Is the voltage between 4.5 to 5.2 volts?**

**Yes** >> Go To 3

**No** >> Go To 6

## 3. OIL PRESSURE SENSOR

With a scan tool, monitor the Oil Pressure Sensor voltage with the Sensor harness connector disconnected.

**Is the voltage above 4.5 volts?**

**Yes** >> Replace the Oil Pressure Sensor.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

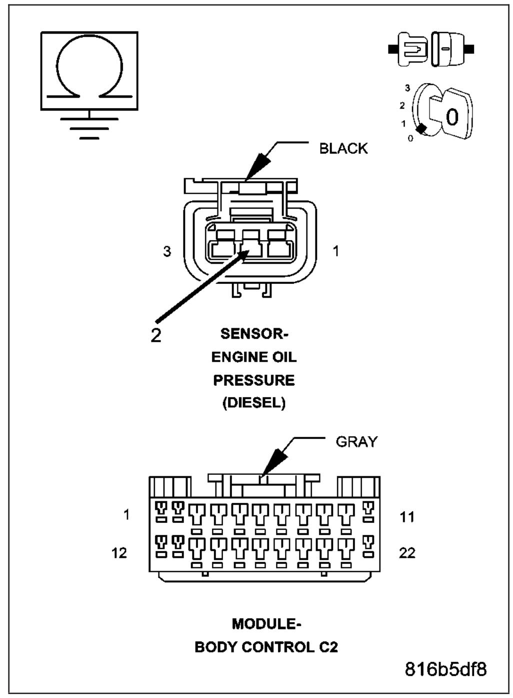
**No** >> Go To 4

## 4. (K302) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the BCM C2 harness connector.

Measure the resistance between ground and the (K302) Oil Pressure Sensor Signal circuit in the Oil Pressure Sensor harness connector.




**Is the resistance below 100 ohms?**

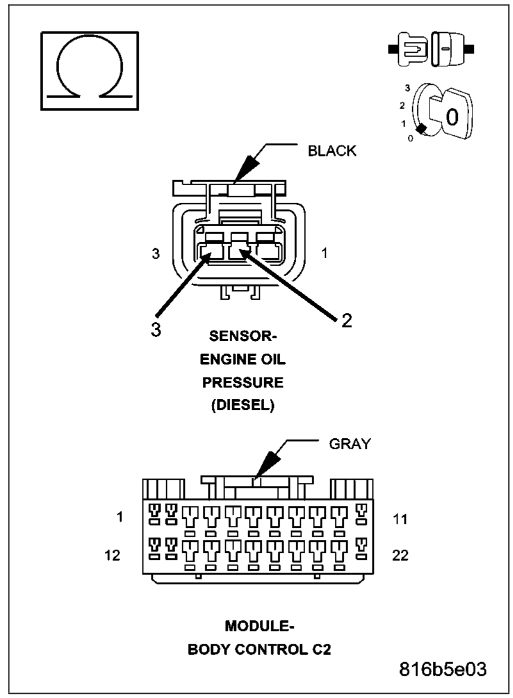
**Yes** >> Repair the short to ground in the (K302) Oil Pressure Sensor Signal circuit.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (K302) OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO THE (K300) SENSOR GROUND CIRCUIT

Measure the resistance between the (K302) Oil Pressure Sensor Signal circuit and the (K300) Sensor ground circuit in the Oil Pressure Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (K302) Oil Pressure Sensor Signal circuit and the (K300) Sensor ground circuit.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

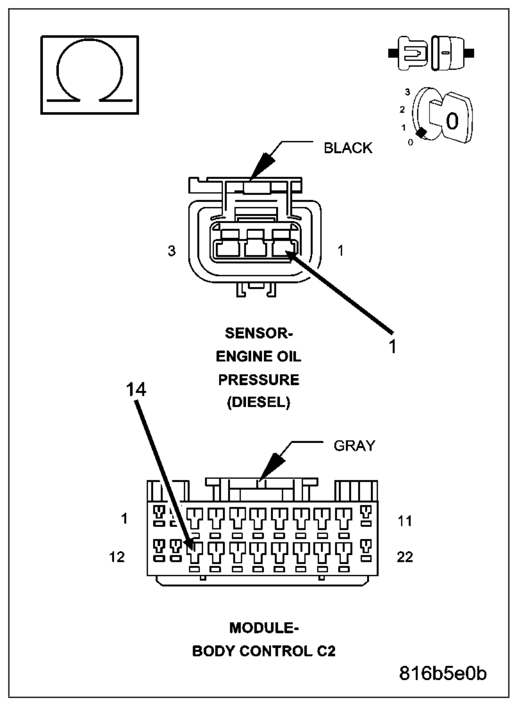
**No** >> Go To 6

## 6. (K301) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the BCM C2 harness connector.

Measure the resistance of the (K301) 5-volt Supply circuit.



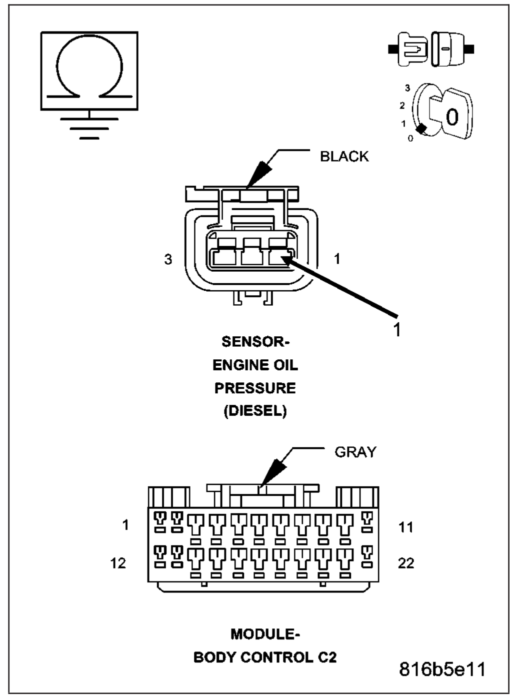

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K301) 5-volt Supply circuit.

Perform the BODY VERIFICATION TEST VER. 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 7. (K301) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND




Measure the resistance between ground and the (K301) 5-volt Supply circuit in the Oil Pressure Sensor harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K301) 5-volt Supply circuit.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and program the BODY Control Module per Service Information.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## TIRE SIZE NOT PROGRAMMED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the battery is connected.
- **Set Condition:**
  Tire size is not programmed to a valid size. The default condition for a new BCM is un-programmed. The BCM must be programmed with a valid tire size or the speedometer will default to Zero and this code will set.

| Possible Causes |
|---|
| PROGRAM TIRE SIZE |

## Diagnostic Test

### 1. PROGRAM TIRE SIZE

With the scan toolin Body Computer, select Miscellaneous, then select Program Tire Size.

Program the appropriate tire size.

With the scan tool, erase DTCs.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

With the scan tool, read DTCs.

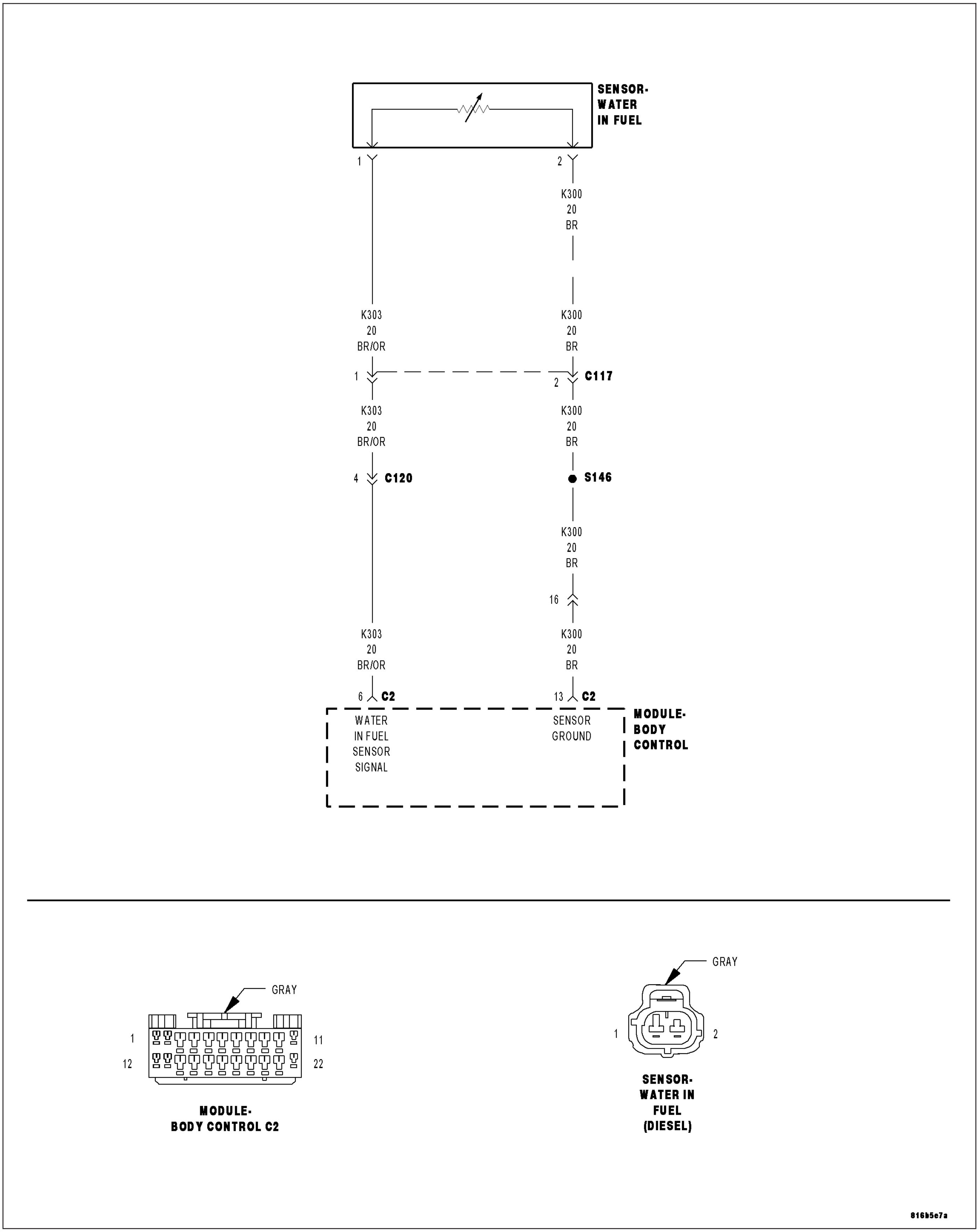
**Did this DTC reset?**

**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## WATER IN FUEL SENSOR FAULTED HIGH (BCM)




For a complete wiring diagram **Refer to Section 8W**.

## Diagnostic Test

- **When Monitored:**
  With the Ignition on.
- **Set Condition:**
  The BCM detects a High condition on the Water In Fuel Sensor Signal Circuit.

| **Possible Causes** |
|---|
| (K303) WATER IN FUEL SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| (K303) WATER IN FUEL SENSOR SIGNAL CIRCUIT OPEN |
| (K300) SENSOR GROUND CIRCUIT OPEN |
| BCM |
| WATER IN FUEL SENSOR |

## Diagnostic Test

### 1. WATER IN FUEL SENSOR

Turn the ignition off.

Disconnect the Water In Fuel Sensor harness connector.

Connect a jumper wire between the (K303) and (K300) circuits at the Water In Fuel Sensor harness connector.

Turn the ignition on.

**NOTE: Check connectors - Clean/repair as necessary.**

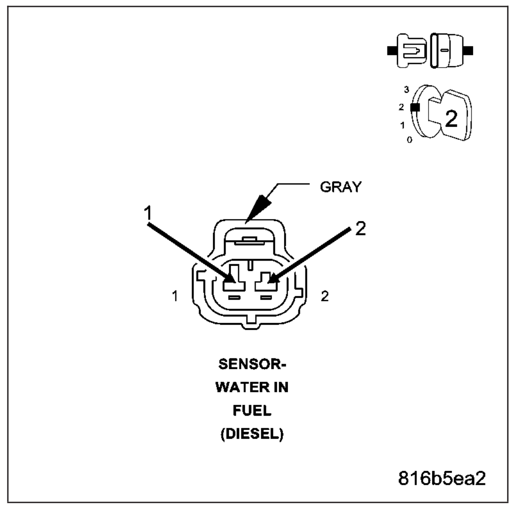
With the scan tool, check DTCs.

**Does the scan tool display: WATER IN FUEL SENSOR FAULTED HIGH?**

**Yes** >> Replace the Water In Fuel Sensor.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2



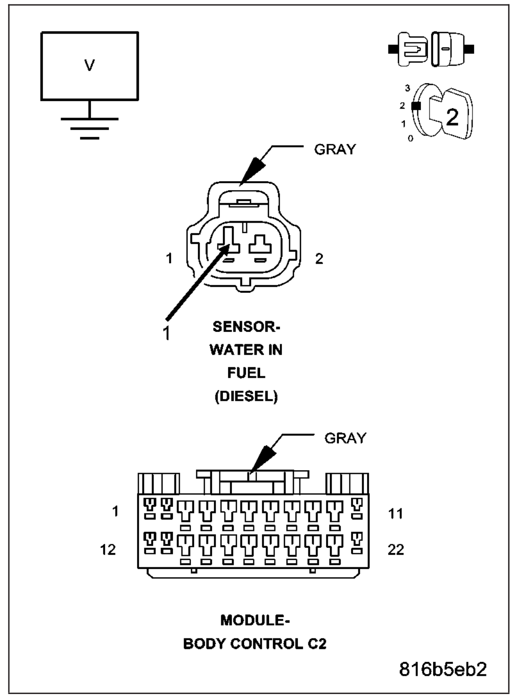
## 2. (K303) WATER IN FUEL SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the BCM C2 harness connectors.

Ignition on, engine not running.

Measure the voltage on the (K303) Water In Fuel Sensor Signal circuit.




**Is the voltage above 5.3 volts?**

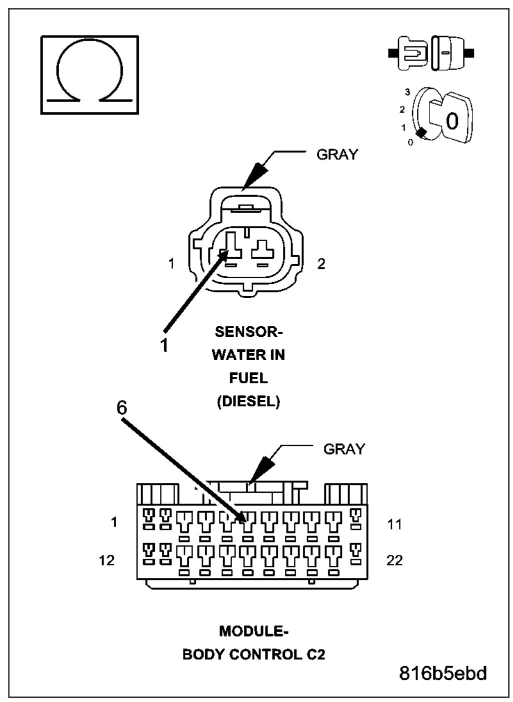
**Yes** >> Repair the short to voltage in the (K303) Water In Fuel Sensor Signal circuit.
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (K303) WATER IN FUEL SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (K303) Water In Fuel Sensor Signal circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the open in the (K303) Water In Fuel Sensor Signal circuit.
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 4. (K300) SENSOR GROUND CIRCUIT OPEN

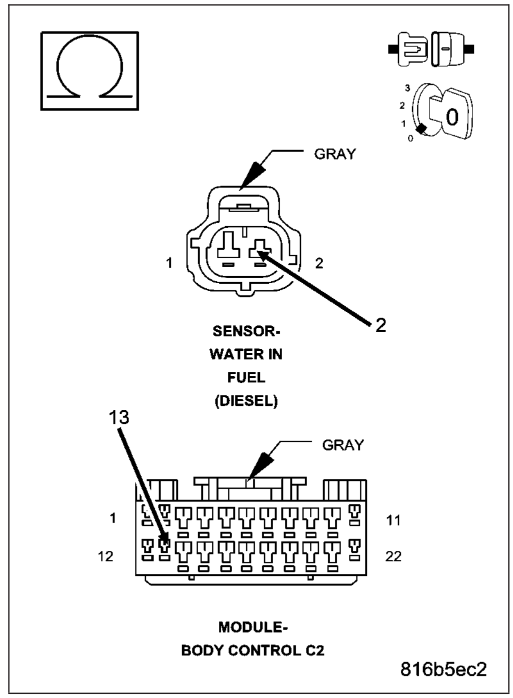
Measure the resistance of the (K300) Sensor ground circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the open in the (K300) Sensor ground circuit.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)




## 5. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

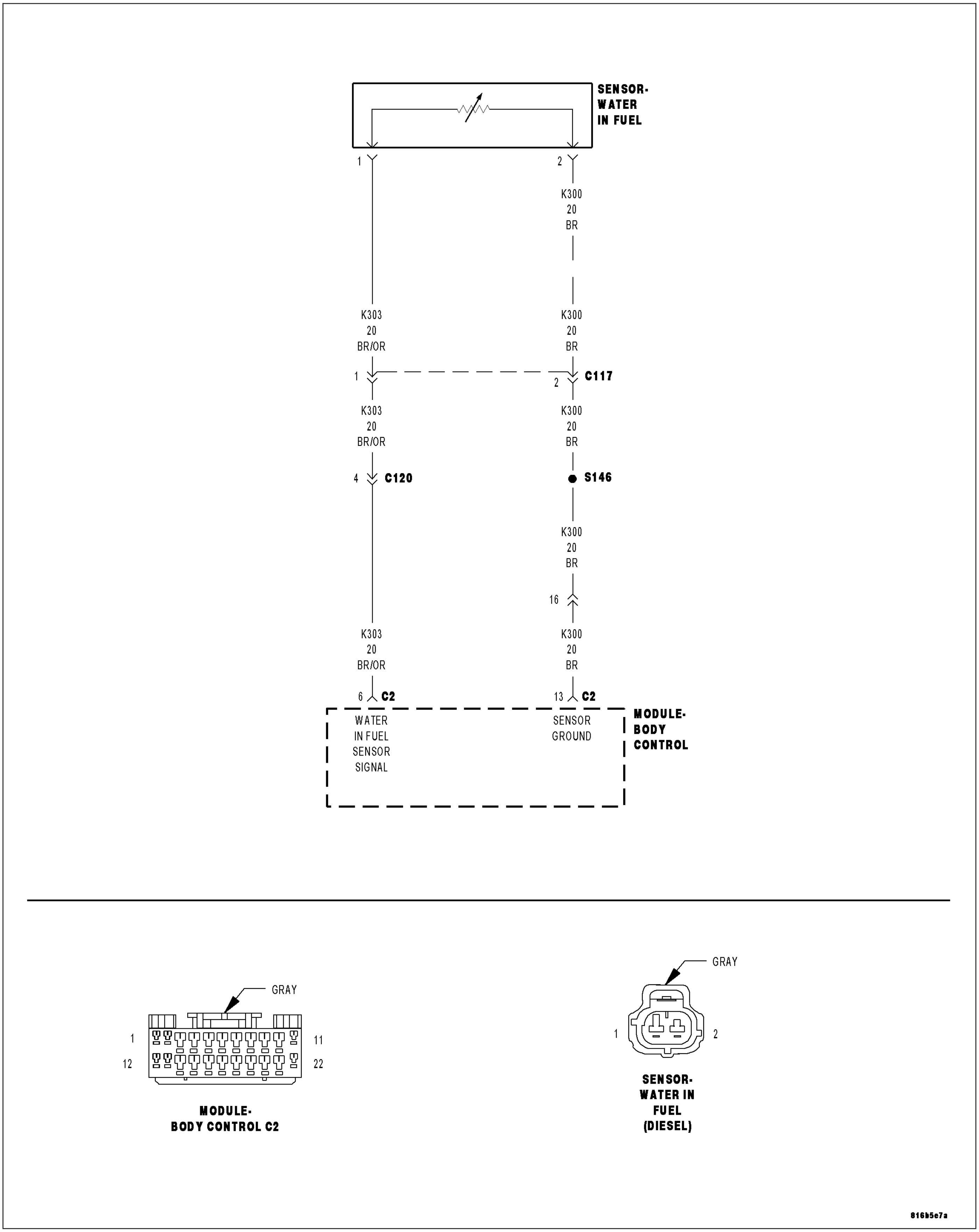
**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Powertrain Control Module per Service Information.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## WATER IN FUEL SENSOR FAULTED LOW (BCM)




For a complete wiring diagram **Refer to Section 8W**.

## Diagnostic Test

- **When Monitored:**
  With the Ignition on.
- **Set Condition:**
  The BCM detects a Low condition on the Water In Fuel Sensor Signal Circuit.

| Possible Causes |
| --- |
| (K303) WATER IN FUEL SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| (K303) WATER IN FUEL SENSOR SIGNAL CIRCUIT SHORTED TO THE (K300) SENSOR GROUND CIRCUIT |
| WATER IN FUEL SENSOR |
| BCM |

## Diagnostic Test

### 1. WATER IN FUEL SENSOR

Turn the ignition off.

Disconnect the Water in fuel sensor harness connector.

Turn the ignition on.

**NOTE: Check connectors - Clean/repair as necessary.**

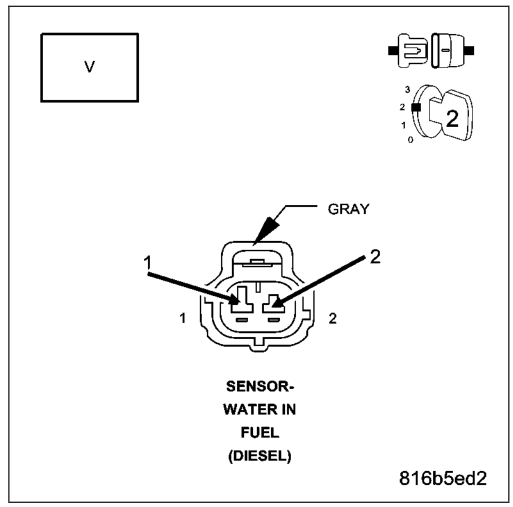
Measure the voltage between the signal circuit and return circuit of the WIF sensor harness connector.

**Is the voltage between 4.5 and 5.5 volts?**

**Yes** >> Replace the Water in fuel sensor.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2

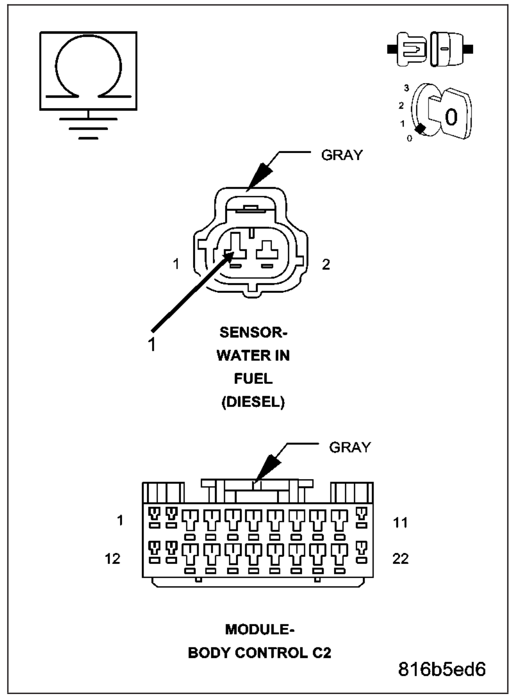


## 2. (K303) WATER IN FUEL SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Disconnect the BCM C2 connector.

**NOTE: Check connectors - Clean/repair as necessary.**

Measure the resistance between ground and the (K303) Water In Fuel Sensor Signal circuit.




**Is the resistance less than 10 ohms?**

**Yes** >> Repair the (K303) Water In Fuel Sensor Signal circuit for a short ground.
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

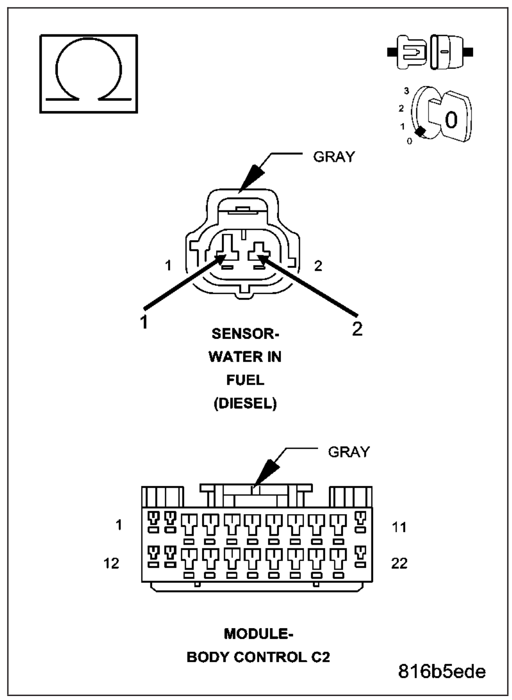
**No** >> Go To 3

## 3. (K303) WATER IN FUEL SENSOR SIGNAL CIRCUIT SHORTED TO THE (K300) SENSOR GROUND CIRCUIT

Disconnect the BCM C2 connector.

**NOTE: Check connectors - Clean/repair as necessary.**

Measure the resistance between the (K303) Water In Fuel Sensor Signal circuit and the (K300) Sensor Ground circuit.




**Is the resistance less than 10 ohms?**

**Yes** >> Repair the (K303) Water In Fuel Sensor Signal circuit for a short to the (K300) Sensor Ground circuit.
Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Body Control Module per Service Information.

Perform BODY VERIFICATION TEST VER - 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

# *4WD INDICATOR INACCURATE

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| 4WD MODE SENSOR DTC PRESENT |
| INTERMITTENT CONDITION |
| TRANSFER CASE POSITION SENSOR |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. 4WD MODE SENSOR DTC PRESENT

**NOTE: With the scan tool, ensure that the Instrument Cluster is configured for the correct transfer case before proceeding with this test.**
With the scan tool, read DTCs.

**Does the scan tool display any 4WD Mode Sensor DTCs?**

**Yes** >> Refer to the DRIVEABILITY category and perform the appropriate symptom.

**No** >> Go To 2

### 2. INSTRUMENT CLUSTER

Perform the Instrument Cluster Self Test.

Depress and hold the Trip Odometer reset button while turning the ignition from the off to the on position.

**Did the 4WD indicator in question illuminate?**

**Yes** >> Go To 3

**No** >> Replace and configure the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 3. TRANSFER CASE POSITION SENSOR

Turn the ignition on.

With the scan tool in Sensors, read the T-Case Position while moving the transfer case shift lever through all of the positions.

The scan tool should display the following values:

4WD Lo: 0.96 - 1.35 volts

Neutral: 2.39 - 2.76 volts

Full Time: 3.2 - 3.5 volts

Part Time: 3.7 - 4.0 volts

2WD: 4.17 - 4.45 volts

**Is the Transfer Case Position voltage within the specified ranges?**

**Yes** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

**No** >> Replace the Transfer Case Position Sensor in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 2. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## *4WD INDICATOR INACCURATE - DIESEL ONLY

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| 4WD MODE SENSOR DTC PRESENT |
| INTERMITTENT CONDITION |
| TRANSFER CASE POSITION SENSOR |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. 4WD MODE SENSOR DTC PRESENT

**NOTE: With the scan tool, ensure that the Instrument Cluster is configured for the correct transfer case before proceeding with this test.**
With the scan tool, read DTCs.

**Does the scan tool display any 4WD Mode Sensor DTCs?**

**Yes** >> Refer to the DRIVEABILITY category and perform the appropriate symptom.

**No** >> Go To 2

### 2. INSTRUMENT CLUSTER

Perform the Instrument Cluster Self Test.

Depress and hold the Trip Odometer reset button while turning the ignition from the off to the on position.

**Did the 4WD indicator in question illuminate?**

**Yes** >> Go To 3

**No** >> Replace and configure the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 3. TRANSFER CASE POSITION SENSOR

Turn the ignition on.

With the scan tool in Sensors, read the T-Case Position while moving the transfer case shift lever through all of the positions.

The scan tool should display the following values:

4WD Lo: 0.15 - 0.40 volts

Neutral: 0.68 - 0.98 volts

Full Time: 1.23 - 1.56 volts

Part Time: 1.78 - 2.12 volts

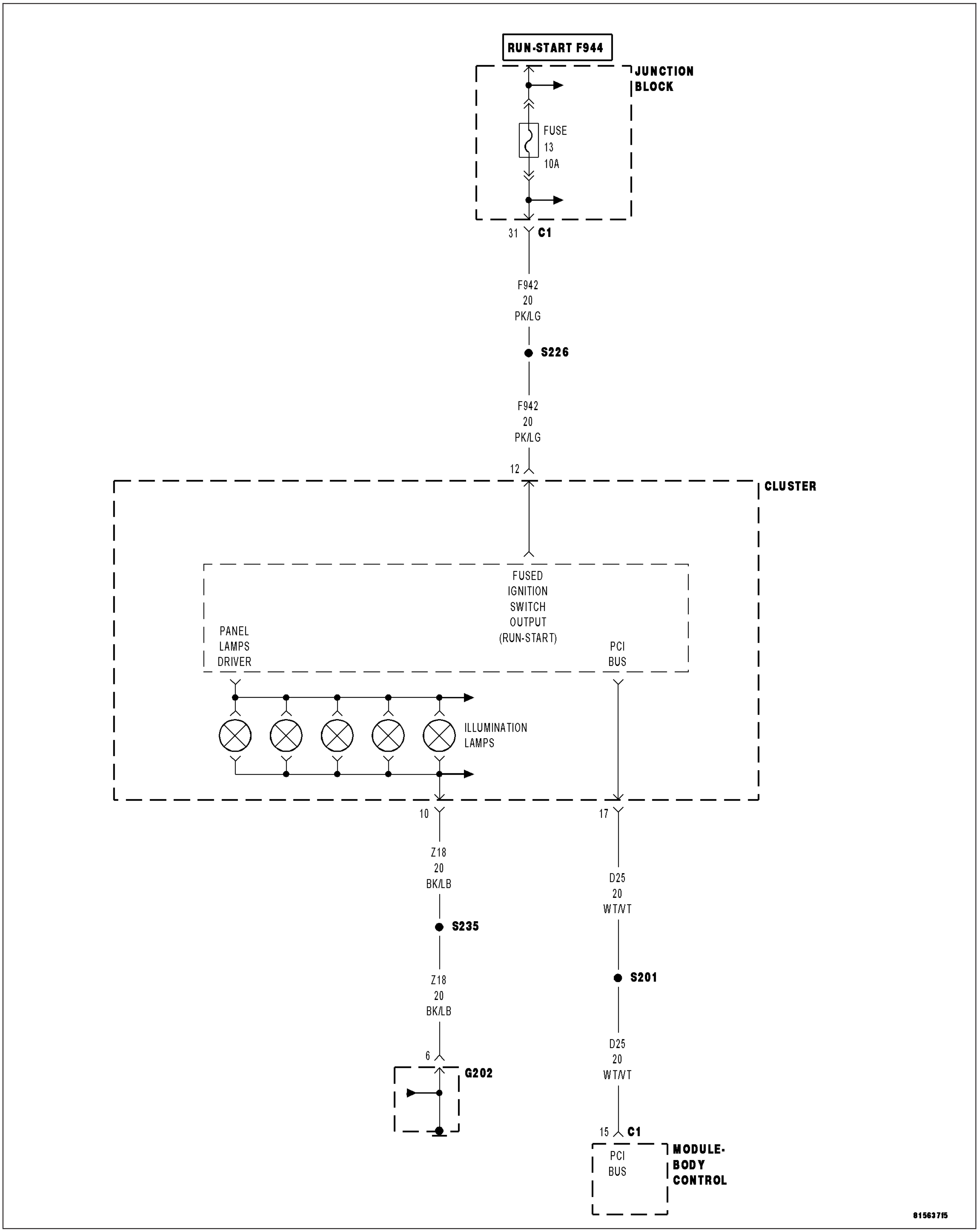
2WD: 2.43 - 2.77 volts

**Is the Transfer Case Position voltage within the specified ranges?**

**Yes** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

**No** >> Replace the Transfer Case Position Sensor in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 2. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## *ALL GAUGES INOPERATIVE




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| NO RESPONSE - PCI BUS |
| NO RESPONSE - PCI BUS - POWERTRAIN CONTROL MODULE |
| NO RESPONSE - PCI BUS - INSTRUMENT CLUSTER |
| (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT SHORT TO GROUND |
| (Z18) INSTRUMENT CLUSTER GROUND CIRCUIT OPEN |
| (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. NO RESPONSE - PCI BUS

Turn the ignition on.

With the scan tool, select System Monitors, then J1850 Module Scan.

**Does the scan tool display: MIC PRESENT on the BUS?**

**Yes** >> Go To 2

**No** >> Refer to the COMMUNICATION category and perform the appropriate symptom.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. NO RESPONSE - PCI BUS - POWERTRAIN CONTROL MODULE

Turn the ignition on.

With the scan tool, select Body, MIC, SYSTEM TESTS, PCM Monitor.

**Does the scan tool display: PCM INACTIVE on the BUS?**

**Yes** >> Refer to the symptom list for problems related to *NO RESPONSE FROM THE POWERTRAIN CONTROL MODULE.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3

### 3. NO RESPONSE - PCI BUS - INSTRUMENT CLUSTER

Turn the ignition on.

With the scan tool, select Body, MIC, MODULE DISPLAY.

**Does the scan tool display: NO RESPONSE from MIC?**

**Yes** >> Refer to the symptom list for problems related to *NO RESPONSE FROM THE INSTRUMENT CLUSTER.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT SHORT TO GROUND

Turn the ignition off.

Inspect the #13 Fuse in the Junction Block.

If the fuse is open, replace with proper rated fuse.

Turn the ignition on for one minute.

Turn the ignition off.

Inspect the #13 Fuse in the Junction Block.

**Is the fuse open?**

**Yes** >> Repair the (F942) Fused Ignition Switch Output circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Instrument Cluster harness connector.

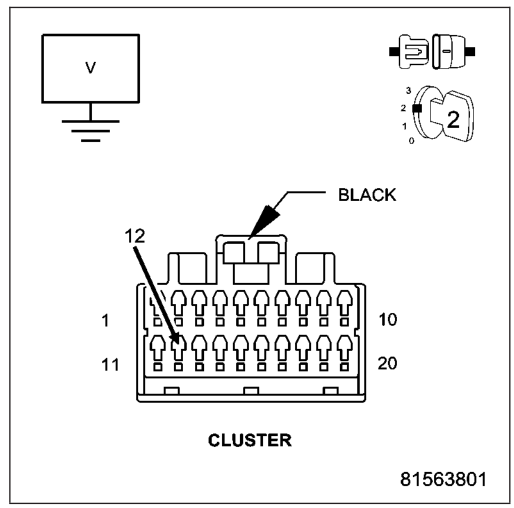
Turn the ignition on.

Measure the voltage between the (F942) Fused Ignition Switch Output circuit and ground.

**Is the voltage above 10.5 volts?**

**Yes** >> Go To 6

**No** >> Repair the (F942) Fused Ignition Switch Output circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)




## 6. (Z18) INSTRUMENT CLUSTER GROUND CIRCUIT OPEN

Turn the ignition off.

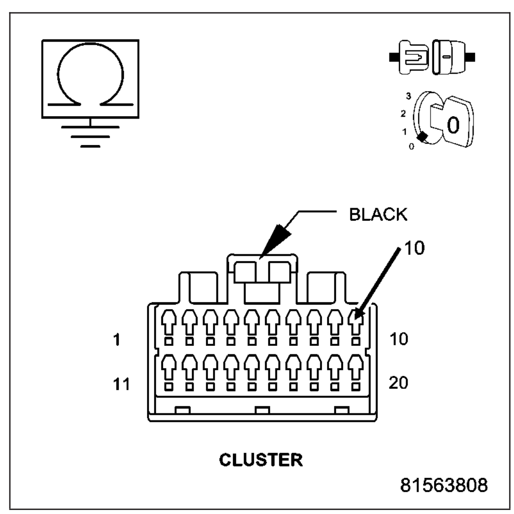
Disconnect the Instrument Cluster harness connector.

Measure the resistance between ground and the (Z18) Instrument Cluster Ground circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Replace and configure the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair (Z18) the Instrument Cluster Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## *ANY PCI BUS INDICATOR INOPERATIVE

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| INDICATOR MESSAGE NOT RECEIVED |
| NO RESPONSE - INSTRUMENT CLUSTER |
| NO RESPONSE - PCI BUS |
| NO RESPONSE - PCI BUS - POWERTRAIN CONTROL MODULE |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. NO RESPONSE - INSTRUMENT CLUSTER

Turn the ignition on.

With the scan tool, select System Monitors, then J1850 Module Scan.

**Does the scan tool display: MIC PRESENT on the BUS?**

**Yes** >> Go To 2

**No** >> Refer to the COMMUNICATION category and perform the appropriate symptom.

### 2. NO RESPONSE - INSTRUMENT CLUSTER

Turn the ignition on.

With the scan tool, select MIC, then MODULE DISPLAY.

**Does the scan tool display: NO RESPONSE from MIC?**

**Yes** >> Refer to the symptom list for problems related to *NO RESPONSE FROM THE INSTRUMENT CLUSTER.

**No** >> Go To 3

### 3. NO RESPONSE - PCI BUS

Turn the ignition on.

With the scan tool, select Body, MIC, MONITORS, PCI BUS MONITORS.

**Does the scan tool display: PCM INACTIVE on the BUS?**

**Yes** >> Refer to the symptom list for problems related to *NO RESPONSE FROM THE POWERTRAIN CONTROL MODULE.

**No** >> Go To 4

### 4. INDICATOR MESSAGE NOT RECEIVED

**NOTE: Diagnose and repair any PCM or BCM DTCs before proceeding with this test.**

Perform the Instrument Cluster Self Test.

Depress and hold the Trip Odometer button while turning the ignition from the off to the on position.

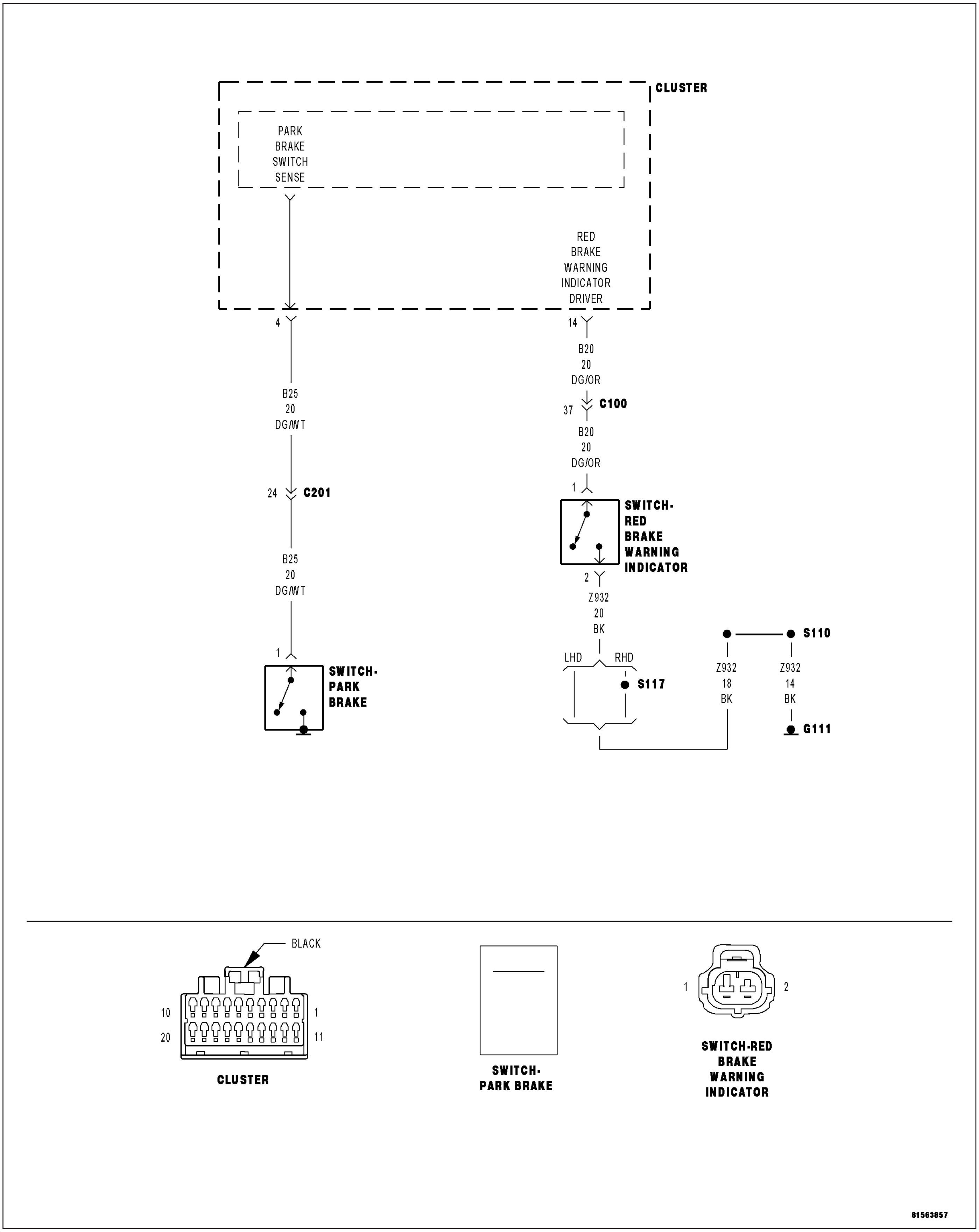
Observe the indicator in question.

**Did the indicator illuminate?**

**Yes** >> Refer to the appropriate Service Information category to diagnose the related system.

**No** >> Replace and configure the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *BRAKE INDICATOR ALWAYS ON




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| BRAKE FLUID LEVEL SWITCH CIRCUIT DTC PRESENT |
| BRAKE FLUID LEVEL SWITCH |
| (B20) RED BRAKE WARNING INDICATOR DRIVER CIRCUIT SHORT TO GROUND |
| PARK BRAKE SWITCH |
| (B25) PARK BRAKE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. BRAKE FLUID SWITCH CIRCUIT DTC PRESENT

**NOTE: Ensure that the Brake Fluid Level is properly filled and the Brake Fluid Level Switch harness connector is properly connected.**

With the scan tool, erase DTCs.

Cycle the ignition and wait approximately 15 seconds.

With the scan tool, read DTCs.

**Does the scan tool display: BRAKE FLUID LEVEL SWITCH CIRCUIT OPEN?**

**Yes** >> Refer to symptom list for problems related to ″BRAKE FLUID LEVEL SWITCH CIRCUIT OPEN″.

**No** >> Go To 2

### 2. BRAKE FLUID LEVEL SWITCH

Turn the ignition off.

Disconnect the Brake Fluid Level Switch harness connector.

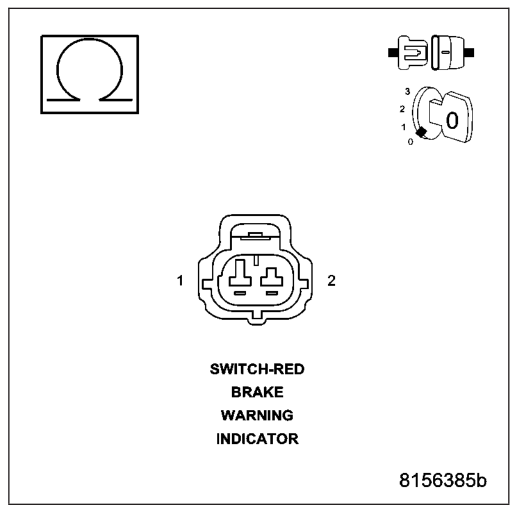
Measure the resistance of the Brake Fluid Level Switch.

**Is the resistance below 900 ohms?**

**Yes** >> Replace the Brake Fluid Level Switch in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3



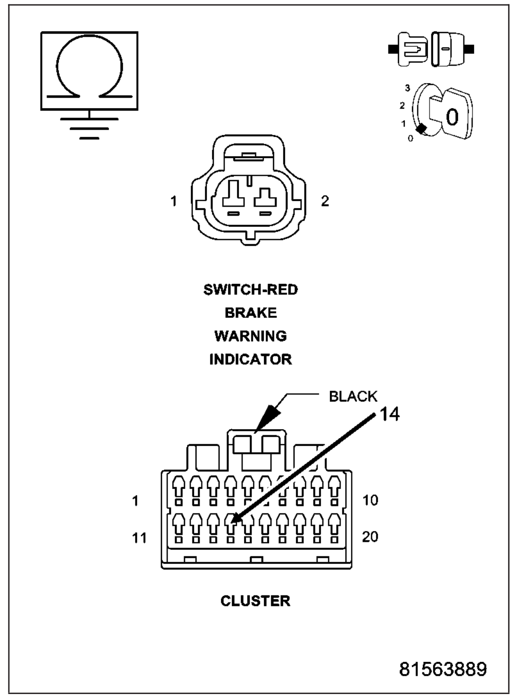
## 3. (B20) RED BRAKE WARNING INDICATOR DRIVER CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Brake Fluid Level Switch harness connector.

Disconnect the Instrument Cluster harness connector.

Measure the resistance between ground and the (B20) Red Brake Warning Indicator Driver circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (B20) Red Brake Warning Indicator Driver circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. PARK BRAKE SWITCH

**NOTE: Ensure that the Brake Fluid Level Switch and Instrument Cluster harness connectors are properly connected.**

Disconnect the Park Brake Switch harness connector.

With the scan tool in Inputs/Outputs, read the Park Brake Switch state.

**Does the scan tool display: Open?**

**Yes** >> Replace the Park Brake Switch in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 5

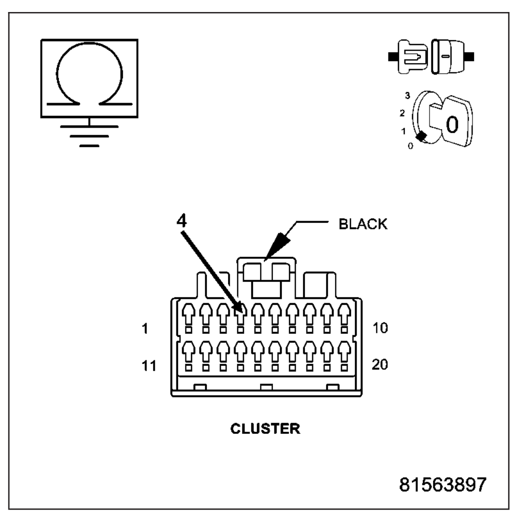
## 5. (B25) PARK BRAKE SWITCH SENSE CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Park Brake Switch harness connector.

Disconnect the Instrument Cluster harness connector.

Measure the resistance between ground and the (B25) Park Brake Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

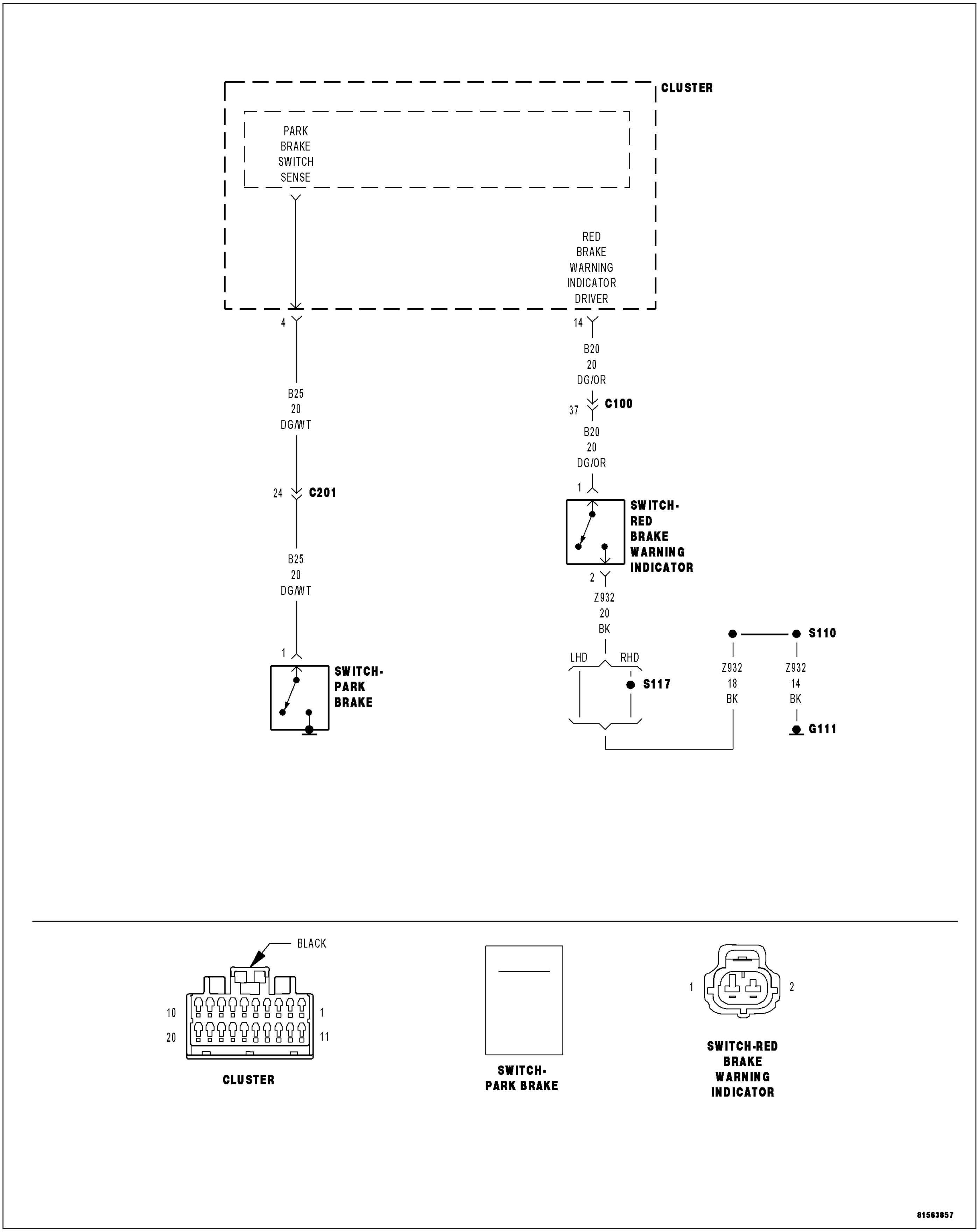
**Yes** >> Repair the (B25) Park Brake Switch Sense circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and configure the Instrument Cluster in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *BRAKE INDICATOR INOPERATIVE



For a complete wiring diagram **Refer to Section 8W**.

## Diagnostic Test

| Possible Causes |
|---|
| BRAKE FLUID LEVEL SWITCH |
| PARK BRAKE SWITCH |
| (B25) PARK BRAKE SWITCH SENSE CIRCUIT OPEN |
| INSTRUMENT CLUSTER |

### 1. BRAKE FLUID LEVEL SWITCH

**Is the BRAKE indicator only inoperative with the Park Brake engaged?**

**Yes** >> Go To 2

**No** >> Replace the Brake Fluid Level Switch in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. PARK BRAKE SWITCH

Disconnect the Park Brake Switch harness connector.
Connect a jumper wire between the Park Brake Switch Sense circuit and ground.
Turn the ignition on.
Observe the BRAKE indicator.

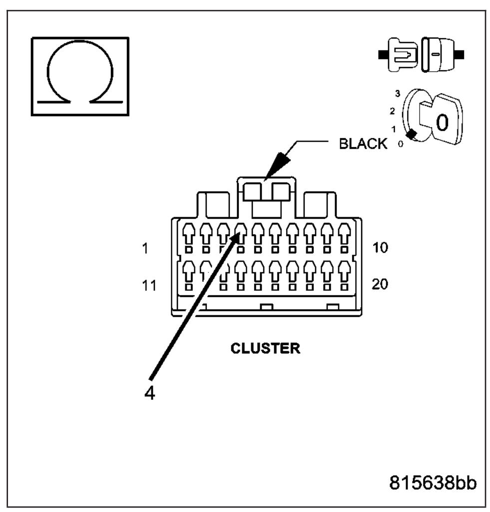
**Did the BRAKE indicator illuminate?**

**Yes** >> Replace the Park Brake Switch in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3

### 3. (B25) PARK BRAKE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off.
Disconnect the Park Brake Switch harness connector.
Disconnect the Instrument Cluster harness connector.
Measure the resistance of the (B25) Park Brake Switch Sense circuit.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (B25) Park Brake Switch Sense circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and configure the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *FUEL GAUGE INACCURATE

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| FUEL LEVEL SENSOR DTC PRESENT |
| INTERMITTENT CONDITION |
| FUEL LEVEL SENSOR |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. FUEL LEVEL SENSOR DTC PRESENT

**NOTE: Diagnose and repair any PCM Fuel Level DTCs before proceeding with this test.**
With the scan tool, read DTCs.

**Does the scan tool display any Fuel Level Sensor DTCs?**

**Yes** >> Refer to symptom list for problems related to Fuel Level Sensor DTCs.

**No** >> Go To 2

### 2. INSTRUMENT CLUSTER

Perform the Instrument Cluster Self Test.

Depress and hold the Trip Odometer reset button while turning the ignition on.

**NOTE: The Instrument Cluster Self Test can also be performed using the scan tool.**
Observe the Fuel Gauge calibration points during the Self Test.

The Fuel Gauge indicator needle should pause at the following positions:

Off: Empty Stop below ″E″

Calibration Point 1: ″1/4″

Calibration Point 2: ″1/2″

Calibration Point 3: ″F″

Calibration Point 4: ″3/4″

Calibration Point 5: ″1/2″

Calibration Point 6: ″1/4″

Calibration Point 7: ″E″

**Did the Fuel Gauge needle pause at the correct calibration points?**

**Yes** >> Go To 3

**No** >> Replace and configure the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 3. FUEL LEVEL SENSOR

With the scan tool, select Body, MIC, then Monitors.

Read the Fuel Tank Level Volts.

Compare the Fuel Tank Level Volts displayed by the scan tool to the Fuel Gauge using the following values:

4.3 - 3.19 Volts (Approximately 220 - 200 Ohms of Fuel Sensor Resistance) = ″E″

2.56 Volts (Approximately 160 Ohms of Fuel Sensor Resistance) = ″1/4″

1.91 Volts (Approximately 120 Ohms of Fuel Sensor Resistance) = ″1/2″

1.27 Volts (Approximately 80 Ohms of Fuel Sensor Resistance) = ″3/4″

0.319 - .646 Volts (Approximately 20 - 40 Ohms of Fuel Sensor Resistance) = ″F″

**NOTE: Fuel Tank Level Voltage should be within +/- 0.2 volts.**

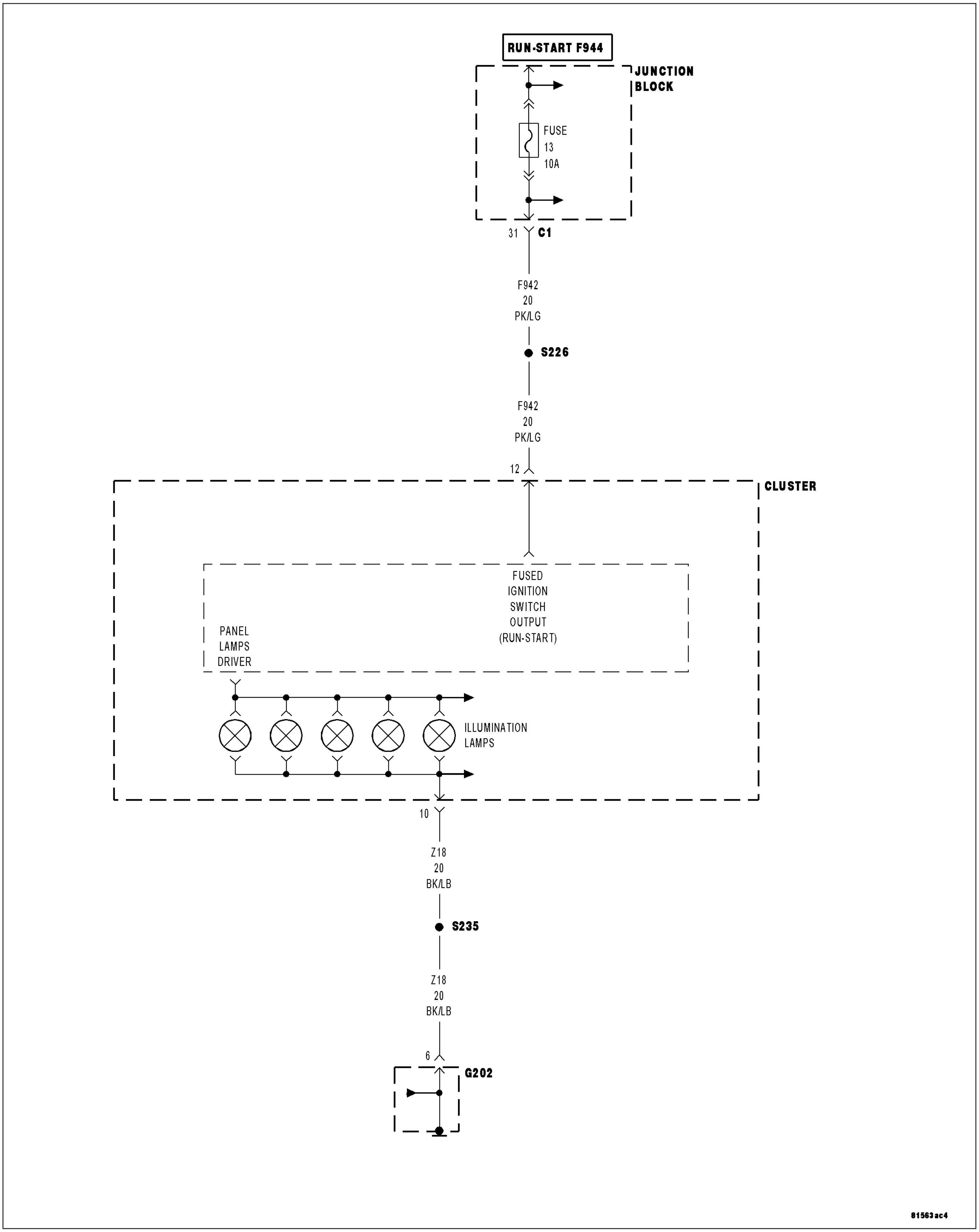
**Is the displayed Fuel Tank Level voltage correct?**

**Yes** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector termianls.

**No** >> Replace the Fuel Level Sensor in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *INSTRUMENT CLUSTER INOPERATIVE




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT SHORT TO GROUND |
| (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN |
| (Z18) INSTRUMENT CLUSTER GROUND CIRCUIT OPEN |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT SHORT TO GROUND

Turn the ignition off.
Remove and inspect the #13 Fuse in the Junction Block.
If the fuse is open, replace with proper rated fuse.
Turn the ignition on for 1 minute.
Turn the ignition off.
Remove and inspect the #13 Fuse in the Junction Block.

**Is the fuse open?**

**Yes** >> Repair the (F942) Fused Ignition Switch Output circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 2

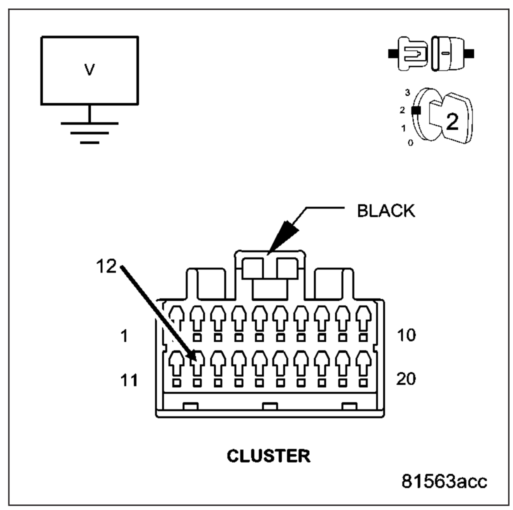
### 2. (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition off.
Disconnect the Instrument Cluster harness connector.
Turn the ignition on.
Measure the voltage between (F942) Fused Ignition Switch Output circuit and ground.

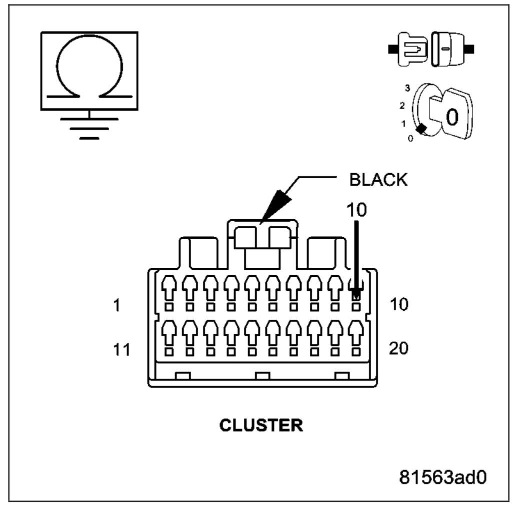
**Is the voltage above 10.5 volts?**

**Yes** >> Go To 3

**No** >> Repair the (F942) Fused Ignition Switch Output circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.



## 3. (Z18) INSTRUMENT CLUSTER GROUND CIRCUIT OPEN




Turn the ignition off.

Disconnect the Instrument Cluster harness connector.

Measure the resistance between ground and the (Z18) Instrument Cluster Ground circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Replace and configure the Instrument Cluster in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the (Z18) Instrument Cluster Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1.

## *LOW COOLANT INDICATOR ALWAYS ON - DIESEL ONLY

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| LOW COOLANT LEVEL SWITCH |
| (G18) LOW COOLANT FLUID LEVEL SENSE CIRCUIT SHORT TO GROUND |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. LOW COOLANT LEVEL SWITCH

**NOTE: Ensure that the coolant is filled to the proper level before proceeding with this test.**

Disconnect the Low Coolant Level Switch harness connector.

With the scan tool in Inputs/Outputs, read the Low Coolant Switch state.

**Does the scan tool display: Closed?**

**Yes** >> Go To 2

**No** >> Replace the Low Coolant Switch in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. (G18) LOW COOLANT FLUID LEVEL SENSE CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Low Coolant Level Switch harness connector.

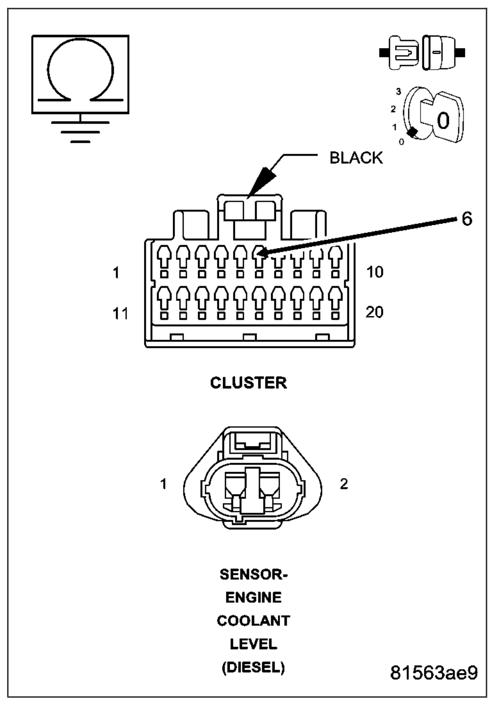
Disconnect the Instrument Cluster harness connector.

Measure the resistance between ground and the (G18) Low Coolant Fluid Level Sense circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (G18) Low Coolant Fluid Level Sense circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and configure the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## *LOW COOLANT INDICATOR INOPERATIVE - DIESEL ONLY

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| LOW COOLANT SWITCH |
| (G18) LOW COOLANT FLUID LEVEL SENSE CIRCUIT OPEN |
| (Z939 )LOW COOLANT SWITCH GROUND CIRCUIT OPEN |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. LOW COOLANT SWITCH

**NOTE: Perform the Instrument Cluster Self Test before proceeding with this test. If the Indicator does not illuminate, replace the Cluster.**

Turn the ignition off.

Disconnect the Low Coolant Switch harness connector.

Connect a jumper wire between cavity 1 and cavity 2.

Turn the ignition on and wait approximately 1 minute.

With the scan tool in Inputs/Outputs, read the Low Coolant Switch state.

**Does the scan tool display: Closed?**

**Yes** >> Replace the Low Coolant Switch in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. (Z939) LOW COOLANT SWITCH GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Low Coolant Switch harness connector.

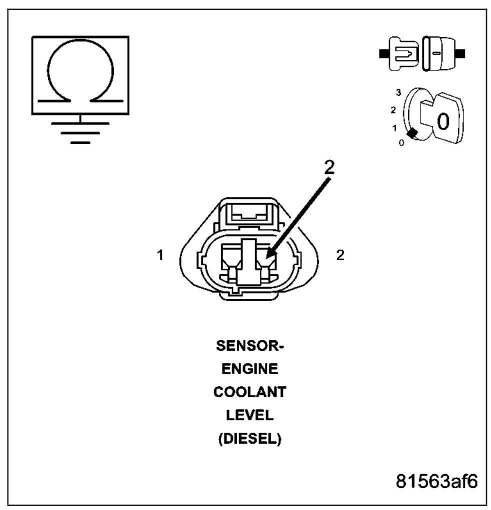
Measure the resistance between ground and the (Z939) Low Coolant Switch Ground circuit.

**Is the resistance above 5.0 ohms?**

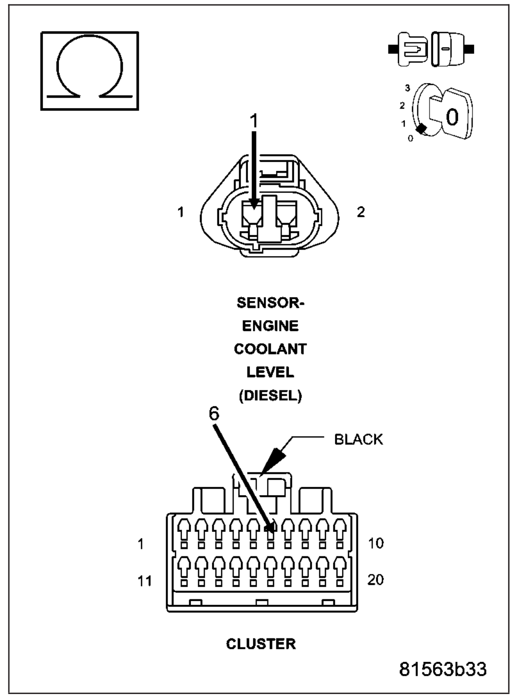
**Yes** >> Repair the (Z939) Low Coolant Switch Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3



## 3. (G18) LOW COOLANT FLUID LEVEL SENSE CIRCUIT OPEN




Turn the ignition off.

Disconnect the Low Coolant Switch harness connector.

Disconnect the Instrument Cluster harness connector.

Measure the resistance of the (G18) Low Coolant Fluid Level Sense circuit.

**Is the resistance above 5.0 ohms?**

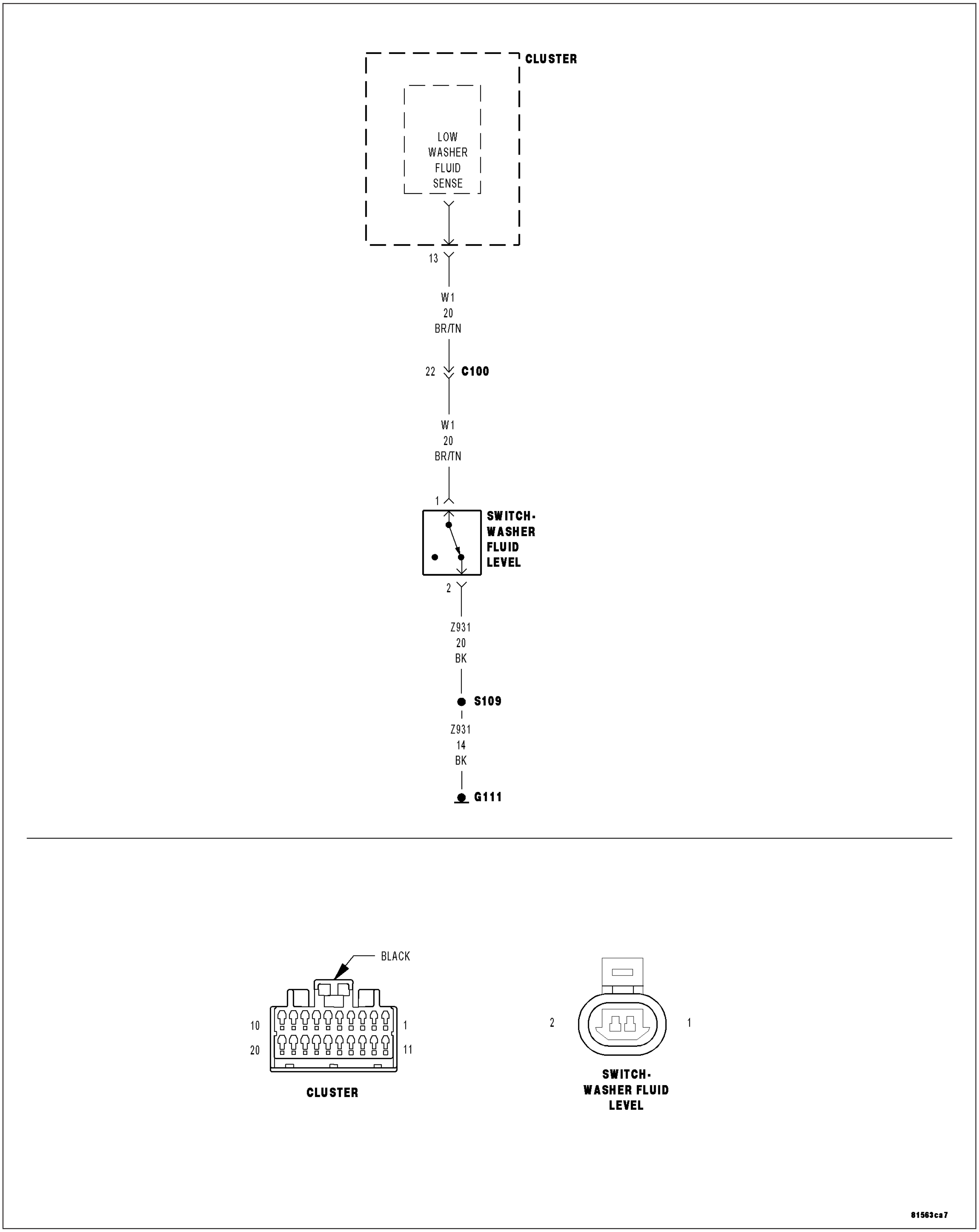
**Yes** >> Repair the (G18) Low Coolant Fluid Level Sense circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and configure the Instrument Cluster in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *LOW WASH MESSAGE NOT OPERATING PROPERLY




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| WASHER FLUID LEVEL SWITCH ALWAYS CLOSED |
| (W1) LOW WASHER FLUID SENSE CIRCUIT OPEN |
| (W1) LOW WASHER FLUID SENSE CIRCUIT SHORT TO GROUND |
| WASHER FLUID LEVEL SWITCH ALWAYS OPEN |
| (Z931) WASHER FLUID LEVEL SWITCH GROUND CIRCUIT OPEN |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. FAULT DESCRIPTION

**NOTE: Ensure that the Washer Fluid reservoir is filled and the Fluid Level Switch connector is properly connected before proceeding with this test.**

Turn the ignition on and wait approximately 1 minute.

**Is the LOWASH message always displayed?**

**Yes** >> Go To 2

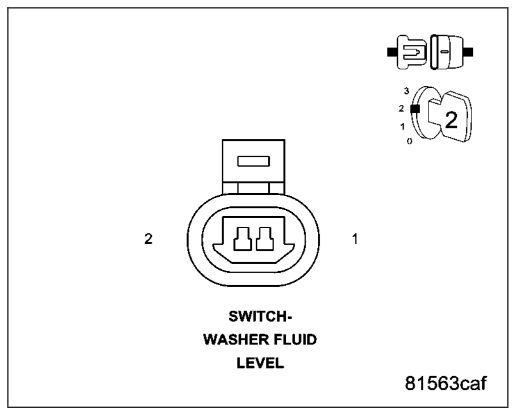
**No** >> Go To 3

### 2. WASHER FLUID LEVEL SWITCH ALWAYS CLOSED

Turn the ignition off.

Disconnect the Washer Fluid Level Switch harness connector.

Turn the ignition on and wait approximately 1 minute.




**Does the VF display: LOWASH?**

**Yes** >> Repair the Low Washer Fluid Sense circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Washer Fluid Level Switch in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

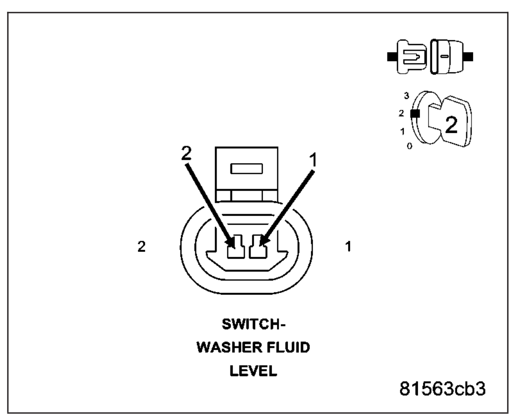
### 3. WASHER FLUID LEVEL SWITCH ALWAYS OPEN

Turn the ignition off.

Disconnect the Washer Fluid Level Switch harness connector.

Connect a jumper wire between cavity 1 and cavity 2.

Turn the ignition on and wait approximately 1 minute.




**Does the VF display: LOWASH?**

**Yes** >> Replace the Washer Fluid Level Switch in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

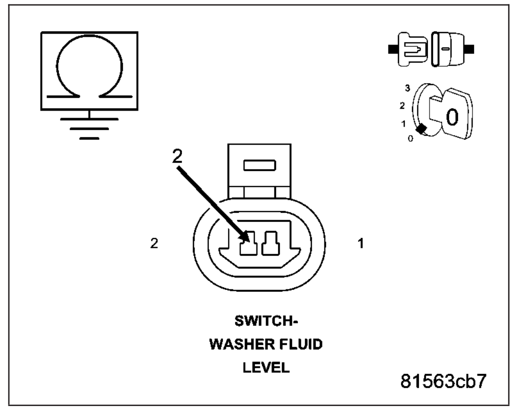
**No** >> Go To 4

## 4. WASHER FLUID LEVEL SWITCH

Turn the ignition off.

Disconnect the Washer Fluid Level Switch harness connector.

Measure the resistance between ground and the (Z931) Washer Fluid Level Switch Ground circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Washer Fluid Level Switch Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

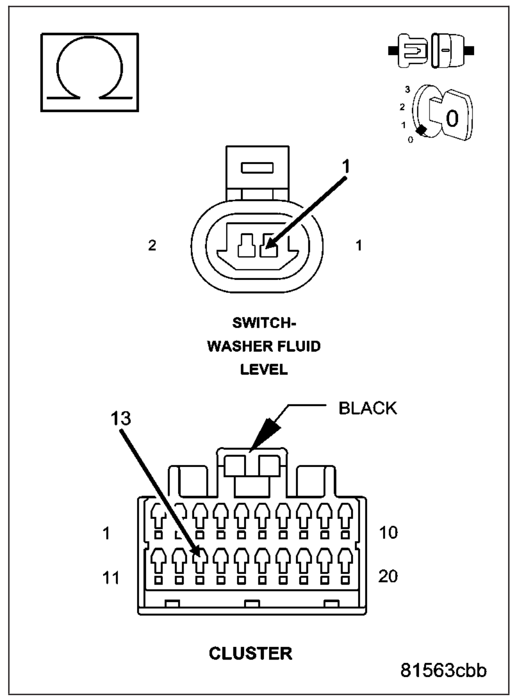
## 5. (W1) LOW WASHER FLUID SENSE CIRCUIT OPEN

Turn the ignition off.

Disconnect the Washer Fluid Level Switch harness connector.

Disconnect the Instrument Cluster harness connector.

Measure the resistance of the (W1) Low Washer Fluid Sense circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace and configure the Instrument Cluster in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (W1) Low Washer Fluid Sense circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *ONE GAUGE INOPERATIVE

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| POWERTRAIN CONTROL MODULE DTCS |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. POWERTRAIN CONTROL MODULE

Turn the ignition on.

With the scan tool, read DTCs.

**Does the scan tool display any PCM DTCs?**

**Yes** >> Refer to the DRIVEABILITY category and perform the appropriate symptom.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. INSTRUMENT CLUSTER

Turn the ignition off.

Perform the Instrument Cluster Self Test.

**NOTE: The Self Test can be initiated manually by depressing and holding the Trip Reset button while turning the ignition on, or by using the scan tool.**

Observe the gauge in question while the Instrument Cluster performs the Self Test.

The gauges should position at the following calibrations points:

Speedometer MPH: 0, 30, 60, 90, 120, 90, 60, 30, 0

Speedometer kPH: 0, 60, 120, 180, 240, 180, 120, 60, 0

Tachometer Gas: 0, 1000, 3000, 5000, 7000, 5000, 3000, 1000, 0

Tachometer Diesel: 0, 1000, 3000, 5000, 3000, 1000, 0

Fuel: 1/4, 1/2, 3/4, F, 3/4, 1/2, 1/4, E

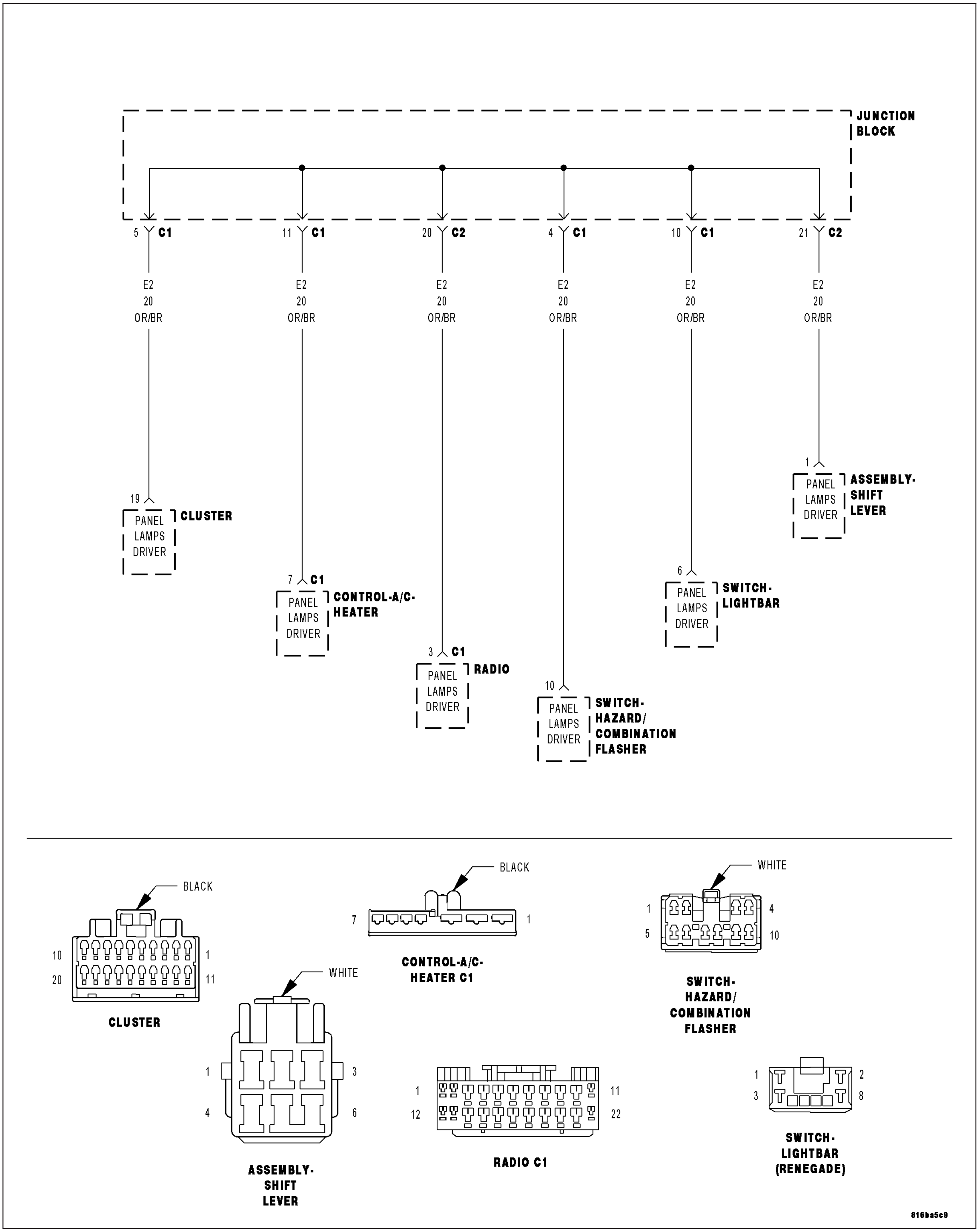
Coolant: Lo, 1/4, 1/2, 3/4, HI, 3/4, 1/2, 1/4, Lo

**Did the gauge in question operate properly?**

**Yes** >> Test Complete.

**No** >> Replace and configure the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *PANEL DIMMING INOPERATIVE




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| PANEL ILLUMINATION DTC PRESENT |
| ILLUMINATION BULB(S) |
| (L78) FUSED PARK LAMP RELAY OUTPUT CIRCUIT SHORT TO GROUND |
| (L78) FUSED PARK LAMP RELAY OUTPUT CIRCUIT OPEN |
| (E2) PANEL LAMPS DRIVER CIRCUIT SHORT TO VOLTAGE |
| ILLUMINATED COMPONENT INTERNALLY SHORTED |
| (E2) PANEL LAMPS DRIVER CIRCUIT SHORT TO GROUND |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. PANEL ILLUMINATION DTC PRESENT

Turn the ignition on.

With the scan tool, read DTCs.

**Does the scan tool display any MIC or BCM DTCs?**

**Yes** >> Refer to symptom list for problems related to BCM or Instrument Cluster DTCs

**No** >> Go To 2

### 2. ILLUMINATION BULB(S)

Turn the ignition on.

Turn the Park Lamps on and adjust the dimming switch to maximum brightness.

**Are all of the Instrument Cluster illumination bulbs inoperative?**

**Yes** >> Go To 3

**No** >> Replace the Illumination Bulb(s) as necessary in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 3. FUSED PARK LAMP RELAY OUTPUT CIRCUIT SHORT TO GROUND

Turn the ignition off.

Remove and inspect the #9 Fuse in the Junction Block.

If the fuse is open, replace with proper rated fuse.

Turn the Park Lamps on for 1 minute.

Turn the ignition off.

Remove and inspect the #9 Fuse in the Junction Block.

**Is the #9 Fuse in the Junction Block open?**

**Yes** >> Using the wiring diagram/schematic as a guide, repair the Fused Park Lamp Relay Output circuit for a short to ground (between the Junction Block and the Instrument Cluster).

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

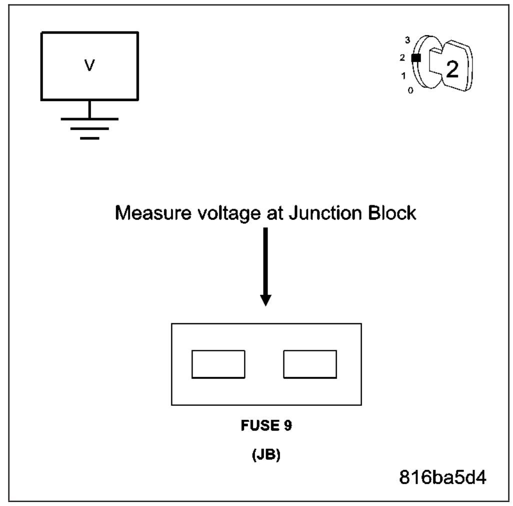
**No** >> Go To 4

## 4. PARK LAMP RELAY OUTPUT CIRCUIT OPEN

Turn the ignition on.

Turn the Park Lamps on.

Measure the voltage between the #9 Fuse in the Junction Block and ground.




**Is the voltage above 10.5 volts?**

**Yes** >> Go To 5

**No** >> Repair the Junction Block in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 5. (L78) FUSED PARK LAMP RELAY OUTPUT CIRCUIT OPEN

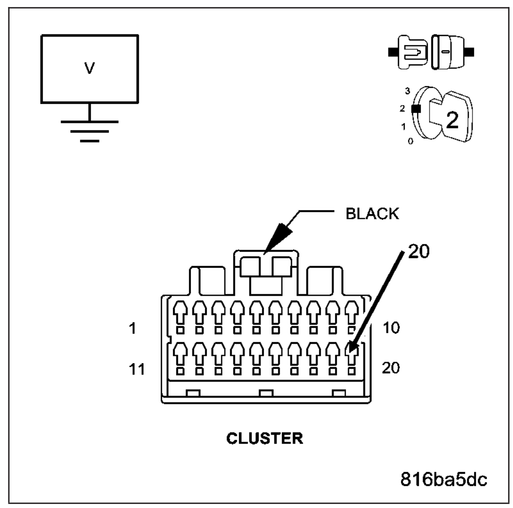
Turn the ignition off.

Disconnect the Instrument Cluster harness connector.

Turn the ignition on.

Turn the Park Lamps on.

Measure the voltage between the (L78) Fused Park Lamp Relay Output circuit and ground.




**Is the voltage above 10.5 volts?**

**Yes** >> Go To 6

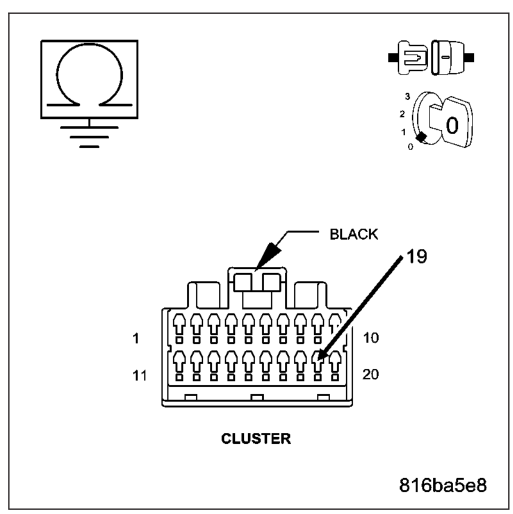
**No** >> Repair the (L78) Fused Park Lamp Relay Output circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 6. (E2) PANEL LAMPS DRIVER CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

Measure the voltage between the (E2) Panel Lamps Driver circuit and ground.




**Is there any voltage present?**

**Yes** >> Repair the (E2) Panel Lamps Driver circuit for a short to voltage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. ILLUMINATED COMPONENT INTERNALLY SHORTED

Turn the ignition off.

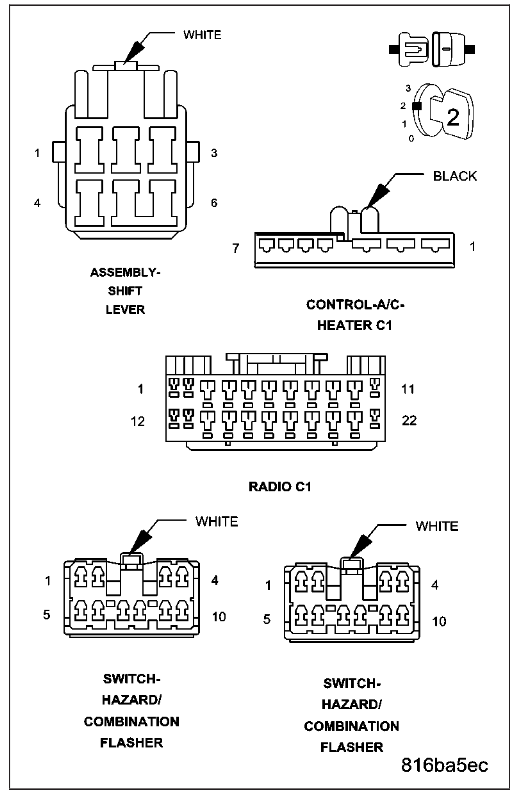
Ensure that the Instrument Cluster harness connector is connected.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors to all of the illuminated components.

Turn the ignition on.

Turn the Park Lamps on.

While disconnecting components, inspect for Instrument Cluster illumination.




**Does the Instrument Cluster illumination operate after disconnecting any component?**

**Yes** >> Replace the illuminated component as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 8

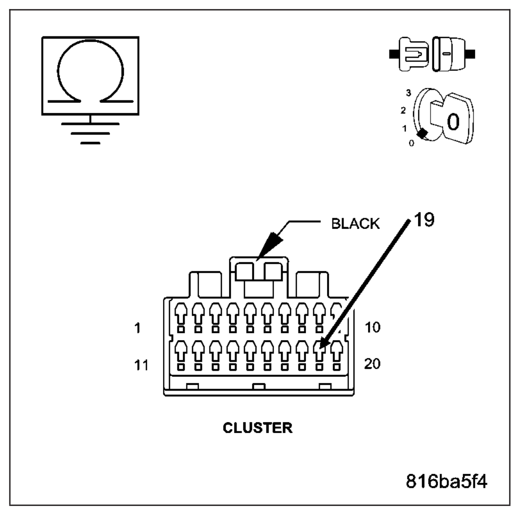
## 8. (E2) PANEL LAMPS DRIVER CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Instrument Cluster harness connector.

Using the wiring diagram/schematic as a guide, ensure that all illuminated components are disconnected.

Measure the resistance between ground and the (E2) Panel Lamps Driver circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (E2) Panel Lamps Driver circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and configure the Instrument Cluster in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *SEAT BELT INDICATOR ALWAYS ON

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| ACM DTC PRESENT |
| INSTRUMENT CLUSTER |

## Diagnostic Test

### 1. ACM DTC PRESENT

Turn the ignition on.

Ensure that the seat belt buckles are not damaged and are buckled.

With the scan tool select MIC, in Inputs/Outputs, read the Seatbelt Lamp state.

**Does the scan tool display: ON?**

**Yes** >> Refer to Seat Belt symptom(s) in the Airbag category.

**No** >> Replace and configure the Instrument Cluster in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

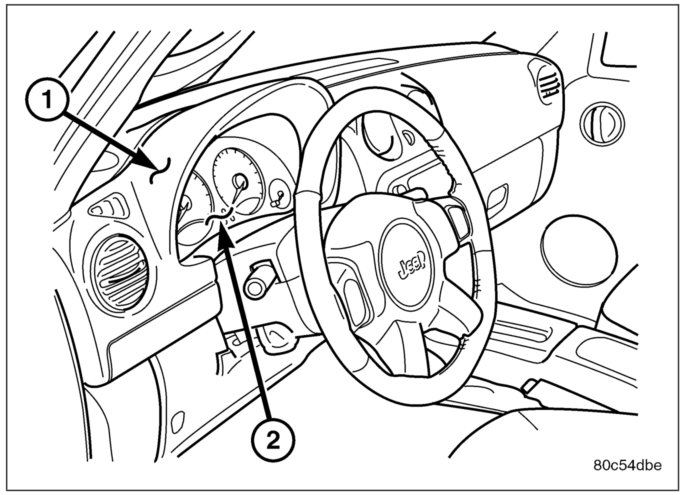
# INSTRUMENT CLUSTER

## TABLE OF CONTENTS

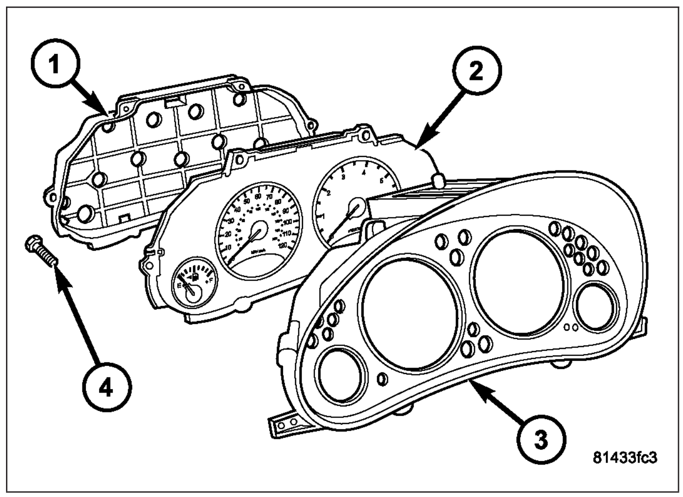
# INSTRUMENT CLUSTER

## DESCRIPTION

The instrument cluster (2) for this vehicle is an ElectroMechanical Instrument Cluster (EMIC) that is located in the instrument panel (1) above the steering column opening, directly in front of the driver. The remainder of the EMIC, including the mounts and the electrical connections, are concealed within the instrument panel behind the cluster bezel. Besides analog gauges and indicators, the EMIC module incorporates a blue-green digital Vacuum Fluorescent Display (VFD) unit for displaying odometer/trip odometer information, some warning or reminder indications and certain diagnostic information.




The EMIC gauges and indicators are visible through a dedicated opening in the cluster bezel on the instrument panel and are protected by a clear plastic cluster lens that is integral to a cluster lens, hood and mask unit (3). Just behind the cluster lens is the cluster hood and an integral cluster mask, which are constructed of molded black plastic. Two cluster masks are used; a base black version is used on base vehicles, while a premium black version features a chrome trim ring around the perimeter of each gauge opening and is used on premium vehicles.




The cluster hood serves as a visor and shields the face of the cluster from ambient light and reflections to reduce glare, while the cluster mask serves to separate and define the individual gauges and indicators of the EMIC. A black plastic odometer/trip odometer switch button protrudes through dedicated holes in the cluster mask and the cluster lens near the lower edge of the cluster just to the right of the tachometer. The molded plastic EMIC lens, hood and mask unit has three integral mounting tabs, one on each of the lower outboard corners of the unit and one on the upper surface of the hood near the center. These mounting tabs are used to secure the EMIC to the molded plastic instrument panel cluster carrier with two screws at the top, and one screw at each outboard tab.

The rear of the cluster housing (2) and the EMIC electronic circuitry are protected by a molded plastic rear cover (1), which is secured to the cluster lens, hood and mask unit with six screws (4). The rear cover includes clearance holes for service access to each of the nine incandescent bulb and bulb holder units installed on the cluster circuit board for general illumination lighting and for the cluster connector receptacle. The single connector receptacle on the back of the cluster electronic circuit board connects the EMIC to the vehicle electrical system through a single dedicated take out and connector of the instrument panel wire harness.

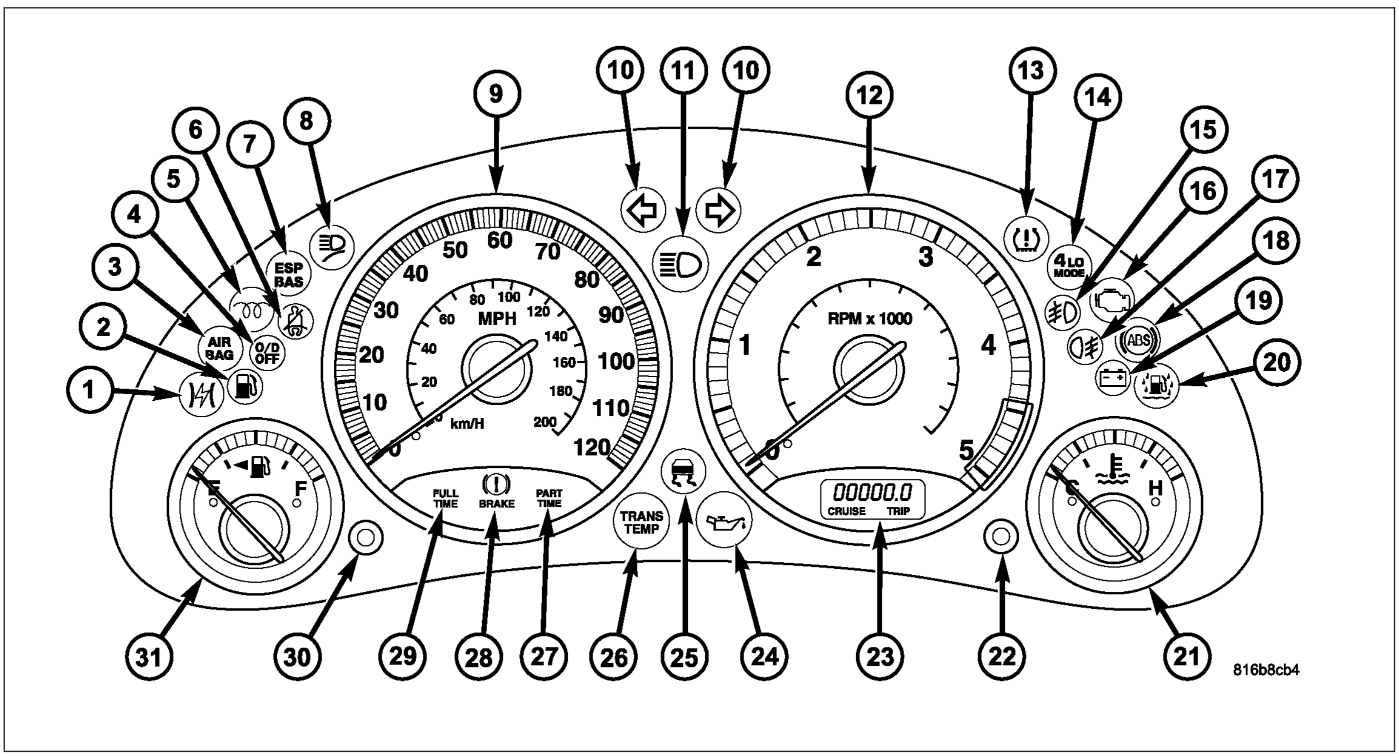
Sandwiched between the rear cover and the lens, hood and mask unit is the cluster housing. The molded plastic cluster housing serves as the carrier for the cluster circuit board and circuitry, the cluster connector receptacle, the gauges, a Light Emitting Diode (LED) for each cluster indicator, the VFD unit, an audible tone transducer, the cluster overlay, the gauge pointers, the odometer/trip odometer switch and the switch button.

Behind the cluster lens, hood, and mask unit on the face of the cluster housing is the cluster overlay. The cluster overlay is a laminated plastic unit. The dark, visible, outer surface of the overlay is marked with all of the gauge dial faces and graduations, but this layer is also translucent. The darkness of this outer layer prevents the cluster from appearing cluttered or busy by concealing the cluster indicators that are not illuminated, while the translucence of this layer allows those indicators and icons that are illuminated to be readily visible. The underlying layer of the overlay is opaque and allows light from the various indicators and the incandescent illumination lamps behind it to be visible through the outer layer of the overlay only through predetermined stencil-like cutouts. A rectangular opening in the overlay at the base of the tachometer dial face has a smoked clear lens through which the illuminated VFD unit can be viewed.

Numerous versions of the EMIC module are offered on this vehicle, in both base and premium trim. These versions accommodate all of the variations of optional equipment and regulatory requirements for the various markets in which the vehicle will be offered. The microprocessor-based EMIC utilizes integrated circuitry and information carried on the Programmable Communication Interface (PCI) data bus along with several hard wired analog and multiplexed inputs to monitor sensors and switches throughout the vehicle. In response to those inputs, the internal circuitry and programming of the EMIC allow it to control and integrate many electronic functions and features of the vehicle through both hard wired outputs and the transmission of electronic message outputs to other electronic modules in the vehicle over the PCI data bus. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - DESCRIPTION - PCI BUS).

Besides typical instrument cluster gauge and indicator support, the electronic functions and features that the EMIC supports or controls include the following:

- **Audible Warnings** - The EMIC electronic circuit board is equipped with an audible tone transducer and programming that allows it to provide various audible alerts to the vehicle operator, including chime tones and beep tones. (Refer to 8 - ELECTRICAL/CHIME WARNING SYSTEM - DESCRIPTION).
- **Panel Lamps Dimming Control** - The EMIC provides a hard wired 12-volt Pulse-Width Modulated (PWM) output that synchronizes the dimming level of all panel lamps dimmer controlled lamps with that of the cluster illumination lighting.




The EMIC houses four analog gauges, one odometer/trip odometer VFD unit and has provisions for up to twenty-five indicators. Some of the EMIC indicators are automatically configured when the EMIC is connected to the vehicle electrical system for compatibility with certain optional equipment or equipment required for regulatory purposes in certain markets. While each EMIC may have provisions for indicators to support every available option, the configurable indicators will not be functional in a vehicle that does not have the equipment that an indicator supports.

The EMIC includes the following analog gauges:

- **Engine Temperature Gauge (21)**
- **Fuel Gauge (31)**
- **Speedometer (9)**

- **Tachometer (12)**

The EMIC includes the following VFD display units:

- **Odometer Display (23)** - Includes ajar indicators (without Electronic Vehicle Information Center (EVIC) only), cruise indicator, gas cap indicator (with gasoline engines only), low coolant indicator (with diesel engine only), odometer, trip odometer, washer fluid indicator (without EVIC only).
- **Odometer/Trip Odometer Switch Button (22)**

The EMIC includes provisions for the following indicators:

- **Airbag Indicator (3)**
- **Ajar Indicators** - textual messages in odometer VFD (23) for doors, tailgate and rear flip-up glass.
- **Antilock Brake System (ABS) Indicator (18)**
- **Brake Indicator (28)**
- **Charging Indicator (19)**
- **Coolant Low Indicator (w/Diesel Engine only)** - textual message in odometer VFD (23).
- **Cruise Indicator** - in odometer VFD (23).
- **Electronic Stability Program (ESP)/Brake Assist System (BAS) Indicator (7)**
- **Electronic Throttle Control (ETC) Indicator (1)** - with diesel engine only.
- **Four-Wheel Drive Full Time Indicator (29)** - with Selec-Trac transfer case only.
- **Four-Wheel Drive Low Mode Indicator (14)** - with four-wheel drive only.
- **Four-Wheel Drive Part Time Indicator (27)** - with four-wheel drive only.
- **Front Fog Lamp Indicator (15)** - with front fog lamps only.
- **Gas Cap Indicator** - with gasoline engine only in odometer VFD (23).
- **High Beam Indicator (11)**
- **Light Bar Lamp Indicator (8)** - with light bar lamps only.
- **Low Fuel Indicator (2)**
- **Low Oil Pressure Indicator (24)**
- **Malfunction Indicator Lamp (MIL) (16)**
- **Overdrive Off Indicator (4)** - with automatic transmission only.
- **Rear Fog Lamp Indicator (17)** - with rear fog lamps only.
- **Seatbelt Indicator (6)**
- **Security Indicator (30)**
- **Tire Pressure Monitor Indicator (13)**
- **Traction Control/Electronic Stability Program (ESP) Indicator (25)**
- **Transmission Overtemp Indicator (26)** - with automatic transmission only.
- **Turn Signal (Right and Left) Indicators (10)**
- **Wait-To-Start Indicator (5)** - with diesel engine only.
- **Washer Fluid Indicator** - textual message in odometer VFD (23).
- **Water-In-Fuel Indicator (20)** - with diesel engine only.

Each indicator in the EMIC, except the Cruise indicator located within the odometer/trip odometer VFD unit, is illuminated by a dedicated Light Emitting Diode (LED) that is soldered onto the EMIC electronic circuit board. The LED units are not available for service replacement and, if damaged or ineffective, the entire EMIC must be replaced. Cluster illumination is accomplished by dimmable incandescent back lighting, which illuminates the gauges for visibility when the exterior lighting is turned on. Each of the incandescent bulbs is secured by an integral bulb holder to the electronic circuit board from the back of the cluster housing.

Hard wired circuitry connects the EMIC to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the EMIC through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

The EMIC module for this vehicle is serviced only as a complete unit. The EMIC module cannot be adjusted or repaired. If a gauge, an LED indicator, the VFD unit, the electronic circuit board, the circuit board hardware, the cluster overlay, or the EMIC housing are damaged or ineffective, the entire EMIC module must be replaced. The cluster lens, hood and mask unit and the incandescent general illumination lamp bulbs with holders are available for individual service replacement.

## OPERATION

The ElectroMechanical Instrument Cluster (EMIC) is designed to allow the vehicle operator to monitor the conditions of many of the vehicle components and operating systems. The gauges and indicators in the EMIC provide valuable information about the various standard and optional powertrains, fuel and emissions systems, cooling systems, lighting systems, safety systems and many other convenience items. The EMIC is installed in the instrument panel so that all of these monitors can be easily viewed by the vehicle operator when driving, while still allowing relative ease of access for service.

The microprocessor-based EMIC hardware and software uses various inputs to control the gauges and indicators visible on the face of the cluster. Some of these inputs are hard wired, but most are in the form of electronic messages that are transmitted by other electronic modules over the Programmable Communication Interface (PCI) data bus. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - OPERATION).

The EMIC microprocessor smooths the input data using algorithms to provide gauge readings that are accurate, stable and responsive to operating conditions. These algorithms are designed to provide gauge readings during normal operation that are consistent with customer expectations. However, when abnormal conditions exist such as high coolant temperature, the algorithm can drive the gauge pointer to an extreme position and the microprocessor can sound a chime through the on-board audible tone transducer to provide distinct visual and audible indications of a problem to the vehicle operator. The EMIC may also produce audible warnings for other electronic modules in the vehicle based upon electronic tone request messages received over the PCI data bus. Each audible warning is intended to provide the vehicle operator with an audible alert to supplement a visual indication.

The EMIC circuitry operates on battery current received through a fused B(+) fuse on a non-switched fused B(+) circuit, and on battery current received through a fused ignition switch output (run-start) fuse on a fused ignition switch output (run-start) circuit. This arrangement allows the EMIC to provide some features regardless of the ignition switch position, while other features will operate only with the ignition switch in the On or Start positions. The EMIC receives a ground input from the Body Control Module (BCM) as a wake-up signal in order to provide the ignition-off features. The EMIC circuitry is grounded through a ground circuit and take out of the instrument panel wire harness with an eyelet terminal connector that is secured by a nut to a ground stud located on the left instrument panel end bracket.

The EMIC also has a self-diagnostic actuator test capability, which will test each of the PCI bus message-controlled functions of the cluster by lighting the appropriate indicators (except the airbag indicator), positioning the gauge needles at several predetermined calibration points across the gauge faces, and stepping the display of the odometer Vacuum-Fluorescent Display (VFD) unit sequentially from all ones through all nines. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

### GAUGES

All gauges receive battery current through the EMIC circuitry when the ignition switch is in the On or Start positions. With the ignition switch in the Off position battery current is not supplied to any gauges, and the EMIC circuitry is programmed to move all of the gauge needles back to the low end of their respective scales. Therefore, the gauges do not accurately indicate any vehicle condition unless the ignition switch is in the On or Start positions.

All of the EMIC gauges are air core magnetic units. Two fixed electromagnetic coils are located within each gauge. These coils are wrapped at right angles to each other around a movable permanent magnet. The movable magnet is suspended within the coils on one end of a pivot shaft, while the gauge needle is attached to the other end of the shaft. One of the coils has a fixed current flowing through it to maintain a constant magnetic field strength. Current flow through the second coil changes, which causes changes in its magnetic field strength. The current flowing through the second coil is changed by the EMIC circuitry in response to messages received over the PCI data bus. The gauge needle moves as the movable permanent magnet aligns itself to the changing magnetic fields created around it by the electromagnets.

The gauges are diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the PCI data bus and the electronic data bus message inputs to the EMIC that control each gauge require the use of a diagnostic scan tool. Refer to the appropriate diagnostic information. Specific operation details for each gauge may be found elsewhere in this service information.

### VACUUM-FLUORESCENT DISPLAY

The Vacuum-Fluorescent Display (VFD) unit is soldered to the EMIC electronic circuit board. With the ignition switch in the Off or Accessory positions, the odometer display is activated when the driver door is opened (Rental Car mode) and is deactivated when the driver door is closed. Otherwise, the display unit is active when the ignition switch is in the On or Start positions, and inactive when the ignition switch is in the Off or Accessory positions.

The illumination intensity of the VFD unit is controlled by the EMIC circuitry based upon electronic dimming level messages received from the BCM over the PCI data bus, and is synchronized with the illumination intensity of other VFD units in the vehicle. The BCM provides dimming level messages based upon internal programming and inputs it receives from the circuitry of the multi-function switch on the steering column based upon the settings of the control knob and control ring on the left (lighting) control stalk that have been selected by the vehicle operator.

The EMIC VFD unit has several display capabilities including odometer, trip odometer, some warning or reminder indications, and various diagnostic information when certain fault conditions exist. On models equipped with the optional Electronic Vehicle Information Center (EVIC), most of the odometer VFD unit warning and reminder indications are suppressed so as not to duplicate indications that are provided by the EVIC. The odometer VFD warning and reminder messages include:

- **“door”** - indicating a door is ajar (on vehicles without the optional EVIC only).
- **“gascap”** - indicating that the fuel tank filler cap is loose or that there is a gross leak in the fuel vapor recovery system (on vehicles with a gasoline engine only).
- **“gate”** - indicating the tailgate is ajar (on vehicles without the optional EVIC only).
- **“glass”** - indicating the tailgate glass is ajar (on vehicles without the optional EVIC only).
- **“locool”** - indicating the engine coolant level is low (on vehicles with an optional diesel engine only).
- **“lowash”** - indicating that the washer fluid level is low (on vehicles without the optional EVIC only).
- **“no bus”** - indicating there is no PCI data bus communication detected.

An odometer/trip odometer switch on the EMIC circuit board is used to control some of the display modes. This switch is actuated manually by depressing the odometer/trip odometer switch button that extends through the lower edge of the cluster lens, just right of the tachometer. Actuating this switch momentarily with the ignition switch in the On position will toggle the VFD between the odometer and trip odometer modes. Depressing the switch button for about two seconds while the VFD is in the trip odometer mode will reset the trip odometer value to zero. The VFD can be reverted to the odometer display and any currently displayed textual messages suspended by momentarily depressing and releasing the odometer/trip odometer reset switch button.

Holding this switch depressed while turning the ignition switch from the Off position to the On position will initiate the EMIC self-diagnostic actuator test. The VFD will also display the cluster software version level near the completion of the EMIC self-diagnostic actuator test. Refer to the instrument cluster diagnosis and testing service information for additional details on this cluster function. The EMIC microprocessor remembers which display mode is active when the ignition switch is turned to the Off position, and returns the VFD display to that mode when the ignition switch is turned On again.

The VFD unit is diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the PCI data bus and the electronic data bus message inputs to the EMIC that control some of the VFD functions requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information. Specific operation details for the odometer, the trip odometer, and the various warning and reminder indicator functions of the VFD unit may be found elsewhere in this service information.

### INDICATORS

Indicators are located in various positions within the EMIC and are all connected to the EMIC electronic circuit board. Some indicators operate based upon hard wired inputs to the EMIC, but most are controlled by PCI data bus messages from other electronic modules in the vehicle. Some are controlled by a combination of hard wired inputs, electronic messaging and EMIC programming. If the EMIC loses PCI data bus communication, the EMIC circuitry will automatically turn on the Malfunction Indicator Lamp (MIL) until PCI data bus communication is restored.

The various EMIC indicators are controlled by different strategies; some receive fused ignition switch output from the EMIC circuitry and have a switched ground, others are grounded through the EMIC circuitry and have a switched battery feed, while still others are completely controlled by the EMIC microprocessor based upon various hard wired and electronic message inputs. Some indicators are illuminated at a fixed intensity, while the illumination intensity of others is synchronized with that of the EMIC general illumination lighting.

In addition, certain indicators in this instrument cluster are automatically configured or self-configured. This feature allows the configurable indicators to be enabled by the EMIC circuitry for compatibility with certain optional equipment. The ABS indicator, airbag indicator, and Tire Pressure Monitor (TPM) indicator are automatically configured by PCI data bus messages received by the EMIC from the CAB, ACM or EVIC after the EMIC is installed in the vehicle. Once these configuration settings are learned by the EMIC, a diagnostic scan tool must be used to remove these settings from the EMIC non-volatile memory. The automatically configured or self-configured indicators remain latent in each EMIC at all times and will be active only when the EMIC receives the appropriate PCI message inputs for the optional system or equipment.

The hard wired indicator inputs are diagnosed using conventional diagnostic methods. However, the EMIC circuitry and PCI bus message controlled indicators are diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the PCI data bus and the electronic message inputs to the EMIC that control an indicator requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information. Specific details of the operation for each indicator may be found elsewhere in this service information.

### CLUSTER ILLUMINATION

The EMIC has several illumination lamps that provide cluster back lighting whenever the exterior lighting is turned On. The illumination intensity of these lamps is adjusted when the interior lighting control ring on the left control stalk of the multi-function switch is rotated (down to dim, up to brighten) to one of six available minor detent positions. The Body Control Module (BCM) monitors a resistor multiplexed input from the multi-function switch on a panel lamps dimmer switch mux circuit. In response to that input, the BCM provides a control output to energize the park lamp relay and transmits an electronic dimming level message to the EMIC over the Programmable Communications Interface (PCI) data bus based upon internal programming.

The EMIC receives the electronic dimming level message from the BCM, and a battery current input from the energized park lamp relay on the hard wired fused park lamp relay output. Based upon the dimming level message, the EMIC then converts the battery current input to the appropriate 12-volt Pulse Width Modulated (PWM) output. This PWM output is used to illuminate the cluster illumination lamps and the VFD unit on the EMIC circuit board, and provides a PWM output on the hard wired fused panel lamps dimmer switch signal circuit to control and synchronize the illumination intensity of other incandescent illumination lamps in the vehicle. The cluster illumination lamps are grounded at all times.

The BCM also transmits electronic dimming level messages over the PCI data bus to other electronic modules in the vehicle to control and synchronize the illumination intensity of their VFD units to that of the EMIC VFD unit. In addition, the control ring on the left (lighting) control stalk of the multi-function switch has a Parade Mode position to provide a parade or funeral mode. The BCM monitors the request for this mode from the multi-function switch, then transmits an electronic dimming level message to illuminate all VFD units in the vehicle at full (daytime) intensity for easier visibility when driving in daylight with the exterior lighting turned On.

The hard wired multi-function switch and panel lamps dimmer inputs to and outputs from the EMIC may be diagnosed using conventional diagnostic methods. However, proper testing of the PWM output of the EMIC and the electronic dimming level messages sent by the BCM over the PCI data bus requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## INPUT AND OUTPUT CIRCUITS

### HARD WIRED INPUTS

The hard wired inputs to the EMIC include the following:

- **BCM Wake Up Input**
- **Driver Side Front Seat Belt Switch Sense**
- **Fused B(+) - Ignition-Off Draw**
- **Fused Ignition Switch Output (Run-Start)**
- **Fused Park Lamp Relay Output**
- **Left Turn Signal**
- **Low Coolant Fluid Level Sense - with Diesel Engine**
- **Low Washer Fluid Sense**
- **Park Brake Switch Sense**
- **Passenger Side Front Seat Belt Switch Sense**

- **Red Brake Warning Indicator Driver**
- **Right Turn Signal**
- **VTSS Indicator Driver**

Refer to the appropriate wiring information for additional details.

#### HARD WIRED OUTPUTS

The hard wired outputs of the EMIC include the following:

- **Fused Panel Lamps Dimmer Switch Signal**

Refer to the appropriate wiring information for additional details.

#### GROUNDS

The EMIC receives a ground path through the following hard wired circuits:

- **Power Ground**

Refer to the appropriate wiring information for additional details.

#### COMMUNICATION

The EMIC has provisions for the following communication circuits:

- **PCI Data Bus**

Refer to the appropriate wiring information for additional details.

## DIAGNOSIS AND TESTING

## INSTRUMENT CLUSTER

If the instrument cluster general illumination lighting is inoperative, refer to CLUSTER ILLUMINATION DIAGNOSIS .

If all of the instrument cluster gauges and indicators are inoperative, be certain to check the instrument cluster fused B(+) fuse and the instrument cluster fused B(+) and ground circuits for shorts or opens. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

If an individual hard wired gauge or indicator is inoperative, refer to the diagnosis and testing service information for that specific gauge or indicator. If an individual Programmable Communications Interface (PCI) data bus message-controlled gauge or indicator is inoperative, perform the Actuator Test as follows:

### ACTUATOR TEST

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: The practice of exchanging (swapping) instrument clusters and other electronic modules in this vehicle with those removed from another vehicle must always be avoided. If the instrument cluster has been replaced, certain indicators in this instrument cluster will be automatically configured when the cluster is connected to the electrical system of the vehicle. This feature allows those indicators to be activated for compatibility with certain optional equipment. Some other indicators may require manual intervention to obtain proper configuration for the equipment in the specific vehicle. If the problem being diagnosed involves erroneous illumination of the ABS indicator, the airbag indicator, the Electronic Throttle Control (ETC) indicator, the Part Time indicator, the Full Time indicator or the Tire Pressure Monitor indicator when the vehicle does not have the appropriate equipment, a diagnostic scan tool must be used to manually enable or disable the correct indicator(s). Refer to the appropriate diagnostic information.**

The instrument cluster actuator test will put the instrument cluster into its self-diagnostic mode. In this mode the instrument cluster can perform a self-diagnostic test that will confirm that the instrument cluster circuitry, the gauges, the PCI data bus message controlled indicators, and the chime tone transducer are capable of operating as designed. During the actuator test the instrument cluster circuitry will sound the audible tone transducer, position each of the gauge needles at various calibration points, illuminate each of the segments in the Vacuum-Fluorescent Display (VFD) unit, and turn all of the PCI data bus message-controlled indicators on and off again.

Successful completion of the actuator test will confirm that the instrument cluster is operational. However, there may still be a problem with the PCI data bus, the Powertrain Control Module (PCM), the Airbag Control Module (ACM), the Body Control Module (BCM), the Electronic Vehicle Information Center (EVIC), the Sentry Key REmote Entry Module (SKREEM), or the inputs to one of these electronic control modules. Use a diagnostic scan tool to diagnose these components. Refer to the appropriate diagnostic information.

1. Begin the test with the ignition switch in the Off position.
2. Depress the odometer/trip odometer switch button.
3. While still holding the odometer/trip odometer switch button depressed, turn the ignition switch to the On position, but do not start the engine.
4. Release the odometer/trip odometer switch button.
5. The instrument cluster will automatically begin the actuator test sequence, as follows:
    a. The cluster will turn on, then off again each of the PCI data bus message controlled indicators to confirm the functionality of the indicator and the cluster control circuitry:
    b. The cluster will sweep the needles for each of the gauges to several calibration points in sequence to confirm the functionality of the gauge and the cluster control circuitry:
    c. The cluster will sequentially step the odometer/trip odometer VFD unit display from all ones (111111) through all nines (999999) to confirm the functionality of all VFD unit segments and their control circuitry, then display the software version number.
    d. The cluster will generate five (5) chime tones to confirm the functionality of the audible tone transducer and the control circuitry.
6. The actuator test is now completed. The instrument cluster will automatically exit the self-diagnostic mode and return to normal operation at the completion of the test, if the ignition switch is turned to the Off position during the test, or if an engine rpm message indicating that the engine is running is received from the PCM over the PCI data bus during the test.
7. Go back to Step 1 to repeat the test, if required.

## CLUSTER ILLUMINATION DIAGNOSIS

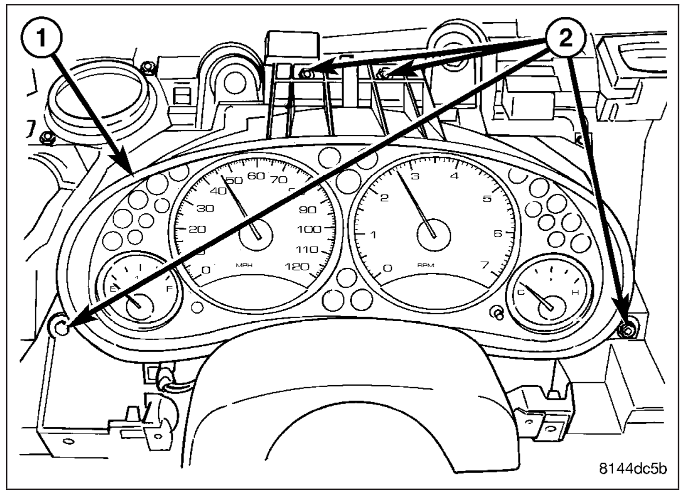
**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

If the problem being diagnosed is a single inoperative illumination lamp, be certain that the bulb and bulb holder unit are properly installed in the instrument cluster electronic circuit board. If no installation problems are found, replace the faulty bulb and bulb holder unit. If all of the cluster illumination lamps are inoperative, the most reliable, efficient, and accurate means to diagnose the cluster illumination function of the instrument cluster requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Disconnect and isolate the battery negative cable.
2. Remove the cluster bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).
3. Remove the four screws (2) that secure the instrument cluster (1) to the instrument panel structural support.
4. Pull the instrument cluster rearward far enough to access and disconnect the instrument panel wire harness connector from the connector receptacle on the back of the cluster housing.
5. Remove the instrument cluster from the instrument panel.




## DISASSEMBLY

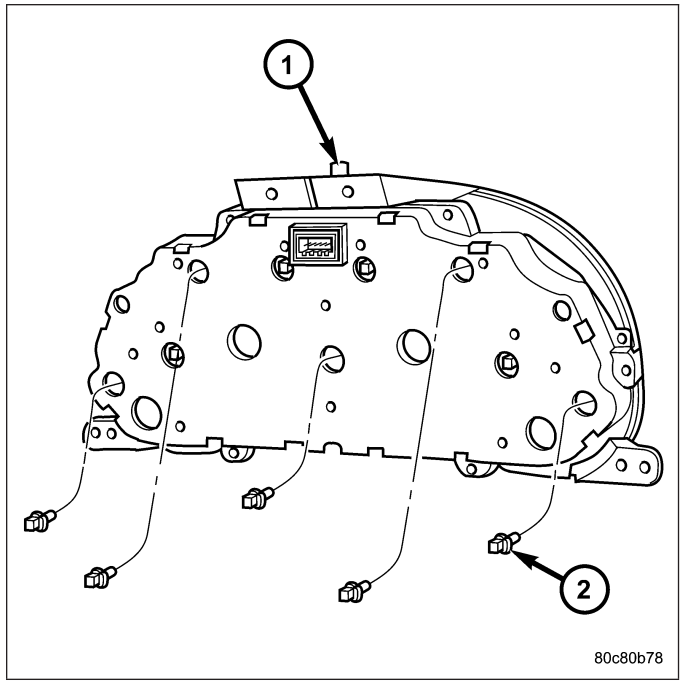
**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: The incandescent instrument cluster illumination lamp bulbs (including the integral bulb holders), and the cluster lens, hood and mask unit are the only components of the instrument cluster used in this vehicle that are serviced separately. Following are the procedures for disassembling these components from the instrument cluster.**

## CLUSTER BULB

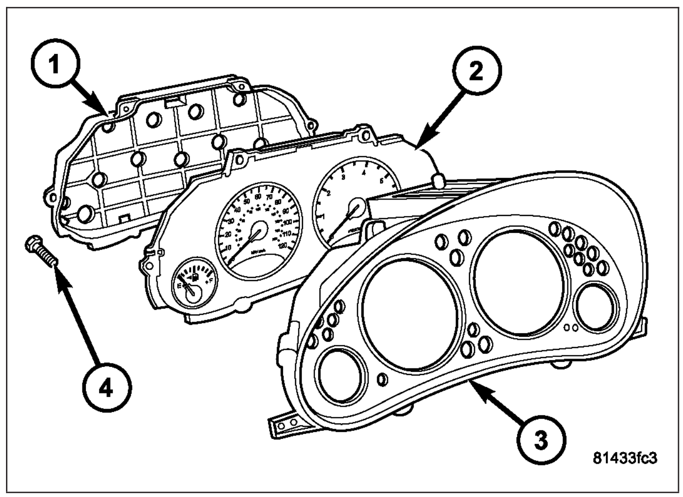
**NOTE: This procedure applies to each of the incandescent cluster illumination lamp and bulb holder units.**

1. Disconnect and isolate the battery negative cable.
2. Remove the instrument cluster (1) from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).
3. Rotate the bulb holder (2) counterclockwise about sixty degrees on the instrument cluster circuit board.
4. Pull the bulb and bulb holder straight out of the circuit board.




## CLUSTER LENS, HOOD, AND MASK

1. Disconnect and isolate the battery negative cable.
2. Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).
3. From the back of the instrument cluster, remove the six screws (4) that secure the rear cover (1) and the lens, hood, and mask unit (3) to the cluster housing (2).
4. Remove the lens, hood, and mask unit from the face of the instrument cluster.




## ASSEMBLY

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

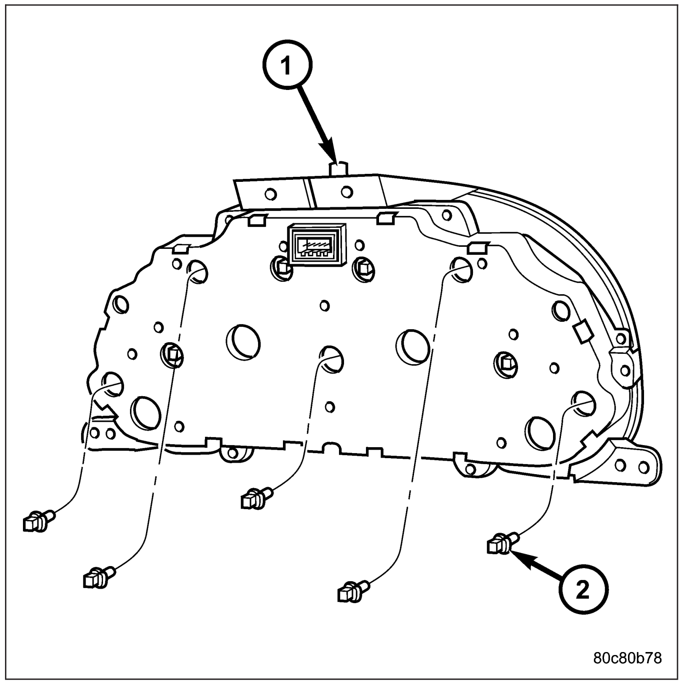
**NOTE: The incandescent instrument cluster illumination lamp bulbs (including the integral bulb holders), and the cluster lens, hood and mask unit are the only components of the instrument cluster used in this vehicle that are serviced separately. Following are the procedures for disassembling these components from the instrument cluster.**

## CLUSTER BULB

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the instrument cluster, the electronic circuit board and/or the gauges.**

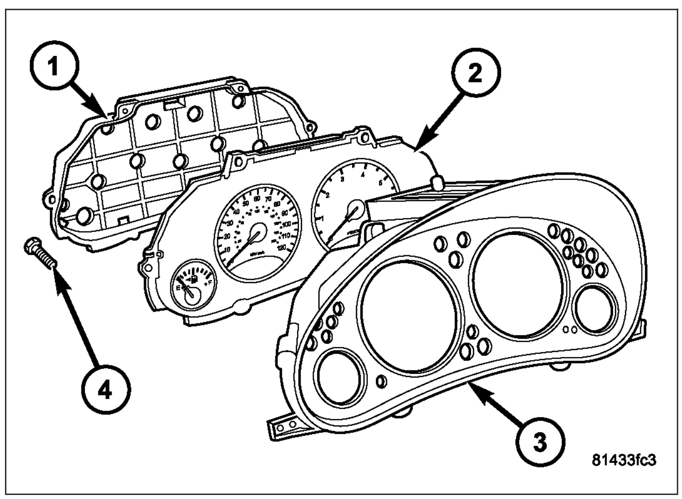
**NOTE: This procedure applies to each of the incandescent cluster illumination lamp and bulb holder units.**

1. Align the bulb holder and bulb (2) with the keyed opening in the circuit board of the instrument cluster (1).
2. Insert the bulb holder and bulb straight into the circuit board until the bulb holder is firmly seated.
3. Rotate the bulb holder clockwise about thirty degrees on the circuit board to lock it into place.
4. Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).
5. Reconnect the battery negative cable.




## CLUSTER LENS, HOOD, AND MASK

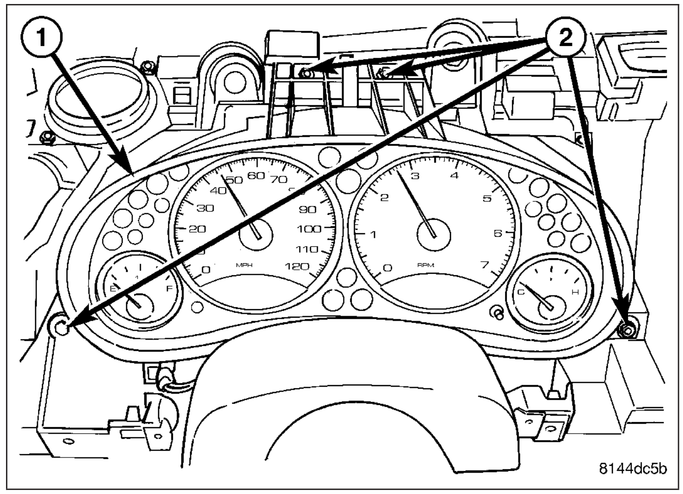
1. Position the cluster lens, hood, and mask unit (3) over the face of the instrument cluster (2). Be certain that the odometer/trip odometer switch button is inserted through the proper clearance holes in the mask and the lens.
2. From the back of the instrument cluster, install and tighten the six screws (4) that secure the rear cover (1) and the lens, hood, and mask unit to the cluster housing. Tighten the screws to 1 N·m (10 in. lbs.).
3. Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).
4. Reconnect the battery negative cable.




## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Position the instrument cluster (1) close enough to the instrument panel to reconnect the instrument panel wire harness connector to the connector receptacle on the back of the cluster housing.
2. Position the instrument cluster into the instrument panel.
3. Install and tighten the four screws (2) that secure the instrument cluster to the instrument panel. Tighten the screws to 2 N·m (17 in. lbs.).
4. Reinstall the cluster bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ CLUSTER BEZEL - INSTALLATION).
5. Reconnect the battery negative cable.




**NOTE: If the instrument cluster has been replaced, certain indicators in this instrument cluster will be automatically configured when the cluster is connected to the electrical system of the vehicle. This feature allows those indicators to be activated for compatibility with certain optional equipment. Some other indicators may require manual intervention to obtain proper configuration for the equipment in the specific vehicle. If a problem is noted involving erroneous illumination of the ABS indicator, the airbag indicator, the electronic throttle control indicator, the Part Time indicator or the Full Time indicator when the vehicle does not have the appropriate equipment, a diagnostic scan tool must be used to manually enable or disable the correct indicator(s). Refer to the appropriate diagnostic information.**

## SPECIFICATIONS

## INSTRUMENT CLUSTER

### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Instrument Cluster Lens, Hood and Mask Mounting Screws | 1 | - | 10 |
| Instrument Cluster Mounting Screws | 2 | - | 17 |

# ABS INDICATOR

## DESCRIPTION


An Antilock Brake System (ABS) indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional ABS, this indicator is electronically disabled. This indicator is located above the engine temperature gauge and to the right of the tachometer in the cluster overlay.

The ABS indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Failure of Anti-lock Braking System” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The ABS indicator is serviced as a unit with the instrument cluster.

## OPERATION

The ABS indicator gives an indication to the vehicle operator when the ABS system is faulty or inoperative. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Controller Antilock Brake (CAB) over the Programmable Communications Interface (PCI) data bus.

The ABS indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the ABS indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the ABS indicator is illuminated by the instrument cluster for about three seconds as a bulb test.
- **ABS Lamp-On Message** - Each time the cluster receives a lamp-on message from the CAB, the ABS indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the cluster receives no lamp-on or lamp-off messages from the CAB for six consecutive seconds, the ABS indicator is illuminated. The indicator remains illuminated until the cluster receives a valid message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the instrument cluster is put through the actuator test, the ABS indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.
- **ABS Diagnostic Test** - The ABS indicator is blinked on and off by lamp-on and lamp-off messages from the CAB during the performance of the ABS diagnostic tests.

The CAB continually monitors the ABS circuits and sensors to decide whether the system is in good operating condition. The CAB then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the CAB sends a lamp-on message after the bulb test, it indicates that the CAB has detected a system malfunction and/or that the ABS system has become inoperative. The CAB will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. Each time the ABS indicator fails to light due to an open or short in the cluster ABS indicator circuit, the cluster sends a message notifying the CAB of the condition, then the instrument cluster and the CAB will each store a DTC.

For proper diagnosis of the antilock brake system, the CAB, the PCI data bus, or the electronic message inputs to the instrument cluster that control the ABS indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# AIRBAG INDICATOR

## DESCRIPTION


An airbag indicator is standard equipment on all instrument clusters. However, the instrument cluster is programmed to automatically enable this indicator only on vehicles equipped with the airbag system, which is not available in some markets. The indicator is located above the fuel gauge and to the left of the speedometer in the instrument cluster overlay.

The airbag indicator consists of a stencil-like cutout of the text “AIR BAG” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “AIR BAG” text to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The airbag indicator is serviced as a unit with the instrument cluster.

## OPERATION

The airbag indicator gives an indication to the vehicle operator when the airbag system is faulty or inoperative. The airbag indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Airbag Control Module (ACM) over the Programmable Communications Interface (PCI) data bus.

The airbag indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the airbag indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the airbag indicator is illuminated for about six seconds. The entire bulb test is a function of the ACM.
- **ACM Lamp-On Message** - Each time the cluster receives a lamp-on message from the ACM, the airbag indicator will be illuminated. The indicator remains illuminated for about 12 seconds or until the cluster receives a lamp-off message from the ACM, whichever is longer.
- **Communication Error** - If the cluster receives no airbag messages for six consecutive seconds, the airbag indicator is illuminated. The indicator remains illuminated until the cluster receives a single lamp-off message from the ACM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the airbag indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry. The actuator test illumination of the airbag indicator is a function of the instrument cluster.

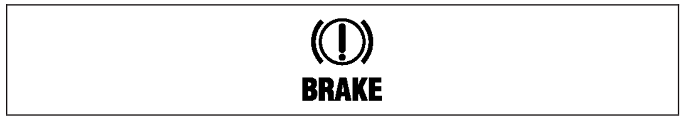
The ACM continually monitors the airbag system circuits and sensors to decide whether the system is in good operating condition. The ACM then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the ACM sends a lamp-on message after the bulb test, it indicates that the ACM has detected a system malfunction and/or that the airbags and seat belt tensioners may not deploy when required, or may deploy when not required. The ACM will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. Each time the airbag indicator fails to illuminate due to an open or short in the cluster airbag indicator circuit, the cluster sends a message notifying the ACM of the condition, then the instrument cluster and the ACM will each store a DTC.

For proper diagnosis of the airbag system, the ACM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the airbag indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# BRAKE/PARK BRAKE INDICATOR

## DESCRIPTION

A brake indicator is standard equipment on all instrument clusters. This indicator is located near the lower edge of the speedometer gauge dial face in the instrument cluster overlay.




The brake indicator consists of stencil-like cutout of the text “BRAKE” and the International Control and Display Symbol icon for “Brake Failure” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the text and icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The brake indicator is serviced as a unit with the instrument cluster.

## OPERATION

The brake indicator gives an indication to the vehicle operator when the parking brake is applied, when there are certain brake hydraulic system malfunctions as indicated by a low brake hydraulic fluid level condition, or when the brake fluid level switch is disconnected. On models equipped with an optional Antilock Brake System (ABS), the brake indicator can also give an indication when certain faults are detected in the ABS. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming, electronic messages received by the cluster from the Controller Antilock Brake (CAB) over the Programmable Communications Interface (PCI) data bus (ABS only), and hard wired inputs from the park brake switch and the brake fluid level switch.

The brake indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the brake indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the brake indicator is illuminated by the instrument cluster for about three seconds as a bulb test.
- **Brake Lamp-On Message** - Each time the cluster receives a lamp-on message from the CAB, the brake indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Park Brake Switch Input** - Each time the cluster detects ground on the park brake switch sense circuit (park brake switch closed = park brake applied or not fully released) while the ignition switch is in the On position, the brake indicator is illuminated. The indicator remains illuminated until the park brake switch sense input to the cluster is an open circuit (park brake switch open = park brake fully released), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Brake Fluid Level Switch Input** - Each time the cluster detects ground on the red brake warning indicator driver circuit (brake fluid level switch closed = brake hydraulic system fluid level low) while the ignition switch is in the On position, the brake indicator is illuminated. The indicator remains illuminated until the status of the red brake warning indicator driver input to the cluster is off (brake fluid level switch off = brake hydraulic system fluid level is not low), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Brake Fluid Level Switch Input Fault** - The brake fluid level switch also features a 1 kilohm diagnostic resistor connected in parallel between the switch input and output to provide the cluster with verification that the red brake warning indicator driver circuit is not open. If the cluster does not see a proper input on the red brake warning indicator driver circuit while the ignition switch is in the On position, it will turn on the brake indicator. The indicator remains illuminated until the red brake warning indicator driver circuit fault is resolved, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the instrument cluster is put through the actuator test, the brake indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The park brake switch on the park brake lever mechanism provides a hard wired ground input to the instrument cluster circuitry through the park brake switch sense circuit whenever the park brake is applied or not fully released.

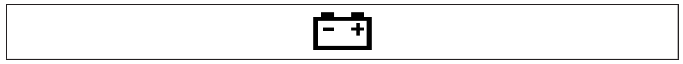
The brake fluid level switch on the brake master cylinder reservoir provides a hard wired ground input to the instrument cluster circuitry through the red brake warning indicator driver circuit whenever the fluid level in the reservoir becomes low. On models equipped with the optional ABS system, the CAB continually monitors the ABS system circuits and sensors to decide whether the system is in good operating condition. The CAB then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the CAB sends a lamp-on message after the bulb test, it indicates that the CAB has detected a system malfunction and/or that the ABS system has become inoperative. The CAB will store a Diagnostic Trouble Code (DTC) for any malfunction it detects.

For further diagnosis of the brake indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). The park brake switch input to the instrument cluster may be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information. For proper diagnosis of the brake fluid level switch, the ABS, the CAB, the PCI data bus, or the electronic message inputs to the instrument cluster that control the brake indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# CHARGING INDICATOR

## DESCRIPTION

A charging indicator is standard equipment on all instrument clusters. This indicator is located above the engine temperature gauge and to the right of the tachometer on the instrument cluster overlay.



The charging indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for "Battery Charging Condition" in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The charging indicator is serviced as a unit with the instrument cluster.

## OPERATION

The charging indicator gives an indication to the vehicle operator when the electrical system voltage is too low or too high. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The charging indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the charging indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the charging indicator is illuminated by the instrument cluster for about three seconds as a bulb test.
- **Voltage Low Message** - Each time the cluster receives a message from the PCM indicating the electrical system voltage is low (less than about nine volts is a charge fail condition), the charging indicator will be illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating the electrical system voltage is normal (greater than about 12.0 volts, but less than 16.0 volts), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Voltage High Message** - Each time the cluster receives a message from the PCM indicating a electrical system voltage is high (greater than about 16.0 volts), the charging indicator will be illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating the electrical system voltage is normal (less than about 15.5 volts, but greater than 9.0 volts), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the charging indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the electrical system voltage to control the generator output. The PCM then sends the proper system voltage messages to the instrument cluster. If the instrument cluster turns on the charging indicator after the bulb test, it may indicate that the charging system requires service. For further diagnosis of the charging indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the charging system, the PCI data bus, or the electronic message inputs to the instrument cluster that control the charging indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# COOLANT LOW INDICATOR

## DESCRIPTION

A coolant low indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with an optional diesel engine this indicator is electronically disabled. The coolant low indication appears within the cluster Vacuum Fluorescent Display (VFD) unit.

The coolant low indicator consists of a textual “LoCooL” message which appears in place of the odometer information in the VFD. The VFD is soldered onto the cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents the indicator from being clearly visible when it is not illuminated. The textual message appears in the same blue-green color and at the same lighting level as the odometer information when it is illuminated by the instrument cluster electronic circuit board.

The coolant low indicator is serviced as a unit with the VFD in the instrument cluster.

## OPERATION

The coolant low indicator gives an indication to the vehicle operator when the diesel engine coolant level is low. This indicator is controlled by the instrument cluster logic circuit based upon cluster programming and a hard wired input received by the cluster from the engine coolant level switch.

The coolant low indicator function of the cluster Vacuum Fluorescent Display (VFD) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the VFD coolant low indication will always be off when the ignition switch is in any position except On or Start. The instrument cluster will turn on the coolant low indicator for the following reasons:

- **Engine Coolant Level Switch Input** - Each time the cluster detects a low resistance or ground on the low coolant fluid level sense circuit (engine coolant level switch closed = engine coolant level low) while the ignition switch is in the On position, the cluster applies an algorithm to ensure that the input is correct and not the result of coolant sloshing in the coolant reservoir. The cluster tests the status of the circuit about seven milliseconds after ignition On, and about once every second thereafter, then uses an internal counter to count up or down. When the counter accumulates 30 ground inputs on the circuit, the coolant low indicator will be illuminated. If the ignition switch is in the On position and the vehicle is not moving when the coolant level switch input is received, the VFD will repeatedly and sequentially cycle the coolant low indication in two second intervals with the odometer/trip odometer information and any other active warnings including: door ajar, gate ajar, glass ajar, and low washer fluid. If the vehicle is moving, or once the cluster of a non-moving vehicle receives an electronic vehicle speed message from the Powertrain Control Module (PCM) indicating a speed greater than zero, the warning sequence will consist of three complete display cycles with an audible single chime tone accompanying each cycle, then revert to only the visual coolant low indication and odometer/trip odometer display cycling until the low coolant fluid level sense input to the cluster is not closed or low resistance (engine coolant level switch not closed or low resistance = engine coolant level full), or until the ignition switch is turned to the Off position, whichever occurs first. The VFD can be reverted to the odometer display and any currently displayed textual messages suspended by momentarily depressing and releasing the odometer/trip odometer reset switch button on the front of the cluster.
- **Engine Coolant Level Switch Input Fault** - The engine coolant level switch also features a 3.3 kilohm diagnostic resistor connected in parallel between the switch input and output to provide the cluster with verification that the low coolant fluid level sense circuit is not open or shorted. If the cluster does not see a proper input on the low coolant fluid level sense circuit, it will suspend coolant low indicator operation. The indicator operation remains suspended until the low coolant fluid level sense circuit fault is resolved.

The engine coolant level switch on the coolant bottle provides a hard wired ground input to the instrument cluster circuitry through the low coolant fluid level sense circuit whenever the level of the coolant in the bottle is low. For further diagnosis of the coolant low indicator or the instrument cluster circuitry that controls the VFD, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the engine coolant level switch input to the instrument cluster that controls the coolant low indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# CRUISE INDICATOR

## DESCRIPTION

**CRUISE**

A cruise indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional speed control system, this indicator is electronically disabled. This indicator is located within the odometer/trip odometer Vacuum Fluorescent Display (VFD) unit.

The cruise indicator consists of the text “CRUISE” in the lower portion of the odometer VFD unit. The odometer VFD is soldered onto the instrument cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents the indicator from being clearly visible when it is not illuminated. The “CRUISE” text appears in a blue-green color and at the same lighting level as the odometer/trip odometer information when it is illuminated by the instrument cluster electronic circuit board.

The cruise indicator is serviced as a unit with the VFD unit in the instrument cluster.

## OPERATION

The cruise indicator gives an indication to the vehicle operator when the speed control system is turned On, regardless of whether the speed control is engaged. This indicator is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The cruise indicator is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The indicator only illuminates when it is switched to ground by the instrument cluster logic circuit. The instrument cluster will turn on the cruise indicator for the following reasons:

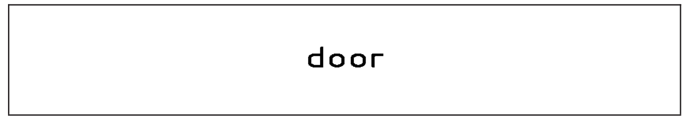
- **Cruise Lamp-On Message** - Each time the cluster receives a cruise lamp-on message from the PCM indicating the speed control system has been turned On, the cruise indicator is illuminated. The indicator remains illuminated until the cluster receives a cruise lamp-off message from the PCM or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the cruise indicator will be turned on, then off again during the VFD portion of the test in order to confirm the functionality of the VFD and the cluster control circuitry.

The PCM continually monitors the speed control switches to determine the appropriate outputs to the speed control servo. The PCM then sends the proper cruise indicator lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the cruise indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the speed control system, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the cruise indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# DOOR AJAR INDICATOR

## DESCRIPTION




A door ajar indicator is standard equipment on all instrument clusters. This indicator is located within the odometer/trip odometer Vacuum Fluorescent Display (VFD) unit. However, on models equipped with the optional Electronic Vehicle Information Center (EVIC) the door ajar indicator in the odometer VFD is electronically suppressed so as not to duplicate indications that are provided by the EVIC.

The door ajar indicator consists of the text “door”, which appears in place of the odometer/trip odometer information in the odometer VFD unit. The odometer VFD is soldered onto the cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents the indicator from being clearly visible when it is not illuminated. The “door” text appears in the same blue-green color and at the same lighting level as the odometer/trip odometer information when it is illuminated by the instrument cluster electronic circuit board.

The door ajar indicator is serviced as a unit with the VFD unit in the instrument cluster.

## OPERATION

The door ajar indicator gives an indication to the vehicle operator that one or more of the passenger compartment doors may be open or not completely latched. This indicator is controlled by the instrument cluster logic circuit based upon cluster programming and electronic messages received by the cluster from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus.

The door ajar indicator function of the Vacuum Fluorescent Display (VFD) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the VFD door ajar indication will always be off when the ignition switch is in any position except On or Start. The instrument cluster will turn on the door ajar indicator for the following reasons:

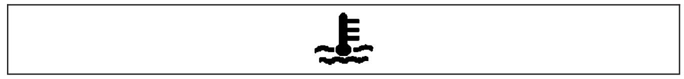
- **Door Ajar Lamp-On Message** - Each time the cluster receives a door ajar lamp-on message from the BCM indicating that a door is open or not completely latched, the door ajar indicator will be illuminated. If the ignition switch is in the On position and the vehicle is not moving when the door ajar lamp-on message is received, the VFD will repeatedly and sequentially cycle the door ajar indication in two second intervals with the odometer/trip odometer information and any other active warnings including: gate ajar, glass ajar, and low washer fluid. If the vehicle is moving, or once the cluster of a non-moving vehicle receives an electronic vehicle speed message from the Powertrain Control Module (PCM) indicating a speed greater than zero, the warning sequence will consist of three complete display cycles with an audible single chime tone accompanying each cycle, then revert to only the visual door ajar indication and odometer/trip odometer display cycling until the door ajar switch is cycled. The door ajar indicator will also be extinguished when the cluster receives a door ajar lamp-off message from the BCM, if the ignition switch is turned to the Off position, whichever occurs first. The VFD can be reverted to the odometer display and any currently displayed textual messages suspended by momentarily depressing and releasing the odometer/trip odometer reset switch button on the front of the cluster.

The BCM continually monitors the door ajar switches to determine the status of the doors. The BCM then sends the proper door ajar lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the door ajar indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the door ajar switches and circuits, the BCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the door ajar indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# ENGINE TEMPERATURE GAUGE

## DESCRIPTION



An engine coolant temperature gauge is standard equipment on all instrument clusters. This gauge is located in the lower right corner of the instrument cluster, to the right of the tachometer. The gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree scale on the cluster overlay that reads left-to-right from “C” (or Cold) to “H” (or Hot) for all engines. An International Control and Display Symbol icon for “Engine Coolant Temperature” is located on the cluster overlay, in the center of the gauge directly above the hub of the gauge needle.

The engine coolant temperature gauge text and graphics are white against a black field, while the major and minor scale increments are black against a silver field, except for a pair of red zone increments at the far right (Hot) end of the gauge scale. All text, graphics and increments are clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white text and graphics and the major black increments appear blue-green, while the major red increments still appear red. The minor increments are not illuminated. The red gauge needle is internally illuminated.

Gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. The engine coolant temperature gauge is serviced as a unit with the instrument cluster.

## OPERATION

The engine coolant temperature gauge gives an indication to the vehicle operator of the engine coolant temperature. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The engine coolant temperature gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Engine Temperature Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is within the normal operating range [up to about 124° C (255° F) for gasoline engines, or about 110° C (230° F) for diesel engines], the gauge needle is moved to the actual relative temperature position on the gauge scale.
- **Engine Temperature High Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is high [above about 127° C (260° F) for gasoline engines, or 112° C (233° F) for diesel engines], the gauge needle is moved into the center of the red warning zone on the gauge scale.
- **Engine Temperature Critical Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is critical [above about 132° C (269° F) for gasoline engines, or 115° C (239° F) for diesel engines], the gauge needle is moved to the high end of the red warning zone on the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the engine coolant temperature gauge needle will be swept to several gauge calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the engine coolant temperature sensor to determine the engine operating temperature. The PCM then sends the proper engine coolant temperature messages to the instrument cluster. For further diagnosis of the engine coolant temperature gauge or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster moves the engine coolant temperature gauge needle to indicate a high or critical engine temperature, it may indicate that the engine or the engine cooling system requires service.

For proper diagnosis of the engine coolant temperature sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the engine coolant temperature gauge, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# ELECTRONIC STABILITY PROGRAM/BRAKE ASSIST SYSTEM INDICATOR

## DESCRIPTION

An ESP/BAS indicator is standard equipment on all instrument clusters. This indicator is located above the fuel gauge and to the left of the speedometer on the cluster overlay.


The ESP/BAS indicator consists of a stencil-like cutout of the text “ESP BAS” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “ESP BAS” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The ESP/BAS indicator is serviced as a unit with the instrument cluster.

## OPERATION

The ESP/BAS indicator gives an indication to the vehicle operator when a fault has been detected in the Electronic Stability Program (ESP)/Brake Assist System (BAS). This indicator is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Controller Antilock Brake (CAB) over the Programmable Communications Interface (PCI) data bus.

The ESP/BAS indicator is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The indicator only illuminates when it is switched to ground by the instrument cluster circuitry. The instrument cluster will turn on the ESP/BAS indicator for the following reasons:

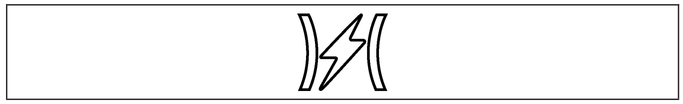
- **Bulb Test** - Each time the ignition switch is turned to the On position the ESP/BAS indicator is illuminated for about four seconds as a bulb test.
- **ESP/BAS Lamp-On Message** - Each time the cluster receives an ESP/BAS lamp-on message from the CAB indicating that a fault has been detected in an ESP/BAS system circuit or component, the ESP/BAS indicator will be illuminated. The indicator remains illuminated until the fault is corrected and the cluster receives an ESP/BAS lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the ESP/BAS indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The CAB continually monitors the ESP/BAS system components and circuits to determine the condition of the system. The CAB then sends the proper ESP/BAS lamp-on and lamp-off messages to the instrument cluster. For proper diagnosis of the ESP/BAS system, the CAB, the PCI data bus, or the electronic message inputs to the instrument cluster that control the ESP/BAS indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# ETC INDICATOR

## DESCRIPTION

An Electronic Throttle Control (ETC) indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional diesel engine, this indicator is electronically disabled. This indicator is located above the fuel gauge and to the left of the speedometer on the cluster overlay.



The ETC indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for "Electronic Throttle Control" in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The ETC indicator is serviced as a unit with the instrument cluster.

## OPERATION

The Electronic Throttle Control (ETC) indicator gives an indication to the vehicle operator when the ETC system is faulty or inoperative. The ETC indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The ETC indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the ETC indicator for the following reasons:

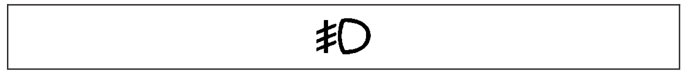
- **Bulb Test** - Each time the ignition switch is turned to the On position the ETC indicator is illuminated for about 15 seconds. The entire bulb test is a function of the PCM.
- **ETC Lamp-On Message** - Each time the cluster receives a lamp-on message from the PCM, the ETC indicator will be illuminated. The indicator can be flashed on and off, or illuminated solid, as dictated by the PCM message. The indicator remains illuminated solid or continues to flash for about 12 seconds or until the cluster receives a lamp-off message from the PCM, whichever is longer. If the indicator is illuminated solid with the engine running the vehicle will usually remain drivable. If the indicator is flashing with the engine running the vehicle may require towing. A flashing indicator means the ETC system requires immediate service.
- **Communication Error** - If the cluster receives no lamp-on or lamp-off message from the PCM for 20 consecutive seconds, the Malfunction Indicator Lamp (MIL) is illuminated by the instrument cluster. The MIL remains controlled and illuminated by the cluster until a valid ETC indicator lamp-on or lamp-off message is received from the PCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the ETC indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry. The actuator test illumination of the ETC indicator is a function of the PCM.

The PCM continually monitors the ETC system circuits and sensors to decide whether the system is in good operating condition. The PCM then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the PCM sends a lamp-on message after the bulb test, it indicates that the PCM has detected an ETC system malfunction and/or that the ETC system is inoperative. The PCM will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. Each time the ETC indicator fails to illuminate due to an open or short in the cluster ETC indicator circuit, the cluster sends a message notifying the PCM of the condition, then the instrument cluster and the PCM will each store a DTC.

For proper diagnosis of the ETC system, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the ETC indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# FRONT FOG LAMP INDICATOR

## DESCRIPTION



A front fog lamp indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional front fog lamps, this indicator is electronically disabled. This indicator is located above the engine temperature gauge and to the right of the tachometer on the cluster overlay.

The front fog lamp indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Front Fog Light” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A green Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in green through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

When the exterior lighting is turned On, the illumination intensity of the front fog lamp indicator is dimmable, which is adjusted along with the cluster illumination lighting using the panel lamps dimmer control ring on the left control stalk of the multi-function switch.

The front fog lamp indicator is serviced as a unit with the instrument cluster.

## OPERATION

The front fog lamp indicator gives an indication to the vehicle operator whenever the front fog lamps are illuminated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus.

The front fog lamp indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the front fog lamp indicator for the following reasons:

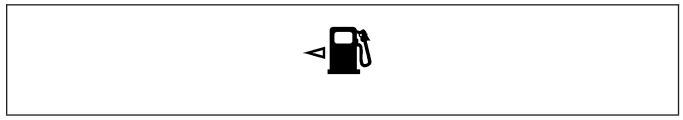
- **Front Fog Lamp-On Message** - Each time the cluster receives a front fog lamp-on message from the BCM indicating the front fog lamps are turned On, the front fog lamp indicator will be illuminated. The indicator remains illuminated until the cluster receives a front fog lamp-off message from the BCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the front fog lamp indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The BCM continually monitors the exterior lighting (multi-function) switch to determine the appropriate outputs to the front fog lamp relay. The BCM then sends the proper front fog lamp indicator lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the front fog lamp indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the front fog lamp system, the BCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the front fog lamp indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# FUEL GAUGE

## DESCRIPTION



A fuel gauge is standard equipment on all instrument clusters. This gauge is located in the lower left corner of the instrument cluster, to the left of the speedometer. This gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree scale on the cluster overlay that reads left-to-right from “E” (or Empty) to “F” (or Full). An International Control and Display Symbol icon for “Fuel” is located on the cluster overlay, directly above the hub of the gauge needle. An arrowhead pointed to the left side of the vehicle is imprinted on the cluster overlay next to the “Fuel” icon in the fuel gauge to provide the driver with a reminder as to the location of the fuel filler access.

The fuel gauge text and graphics are white against a black field, while the major and minor scale increments are black against a silver field, except for a pair of red zone increments at the far left (Empty) end of the gauge scale. All text, graphics and increments are clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white text and graphics and the major black increments appear blue-green, while the major red increments still appear red. The minor increments are not illuminated. The red gauge needle is internally illuminated. Gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board.

The fuel gauge is serviced as a unit with the instrument cluster.

## OPERATION

The fuel gauge gives an indication to the vehicle operator of the level of fuel in the fuel tank. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The fuel gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Percent Tank Full Message -** Each time the cluster receives a message from the PCM indicating the percent tank full, the cluster moves the gauge needle to the proper relative position on the gauge scale. The PCM applies an algorithm to the input from the fuel tank sending unit to dampen gauge needle movement against the negative effect that fuel sloshing within the fuel tank can have on accurate inputs to the PCM.
- **Less Than 15 Percent Tank Full Message -** Each time the cluster receives messages from the PCM indicating the percent tank full is less than 15, the gauge needle is moved to below the one-eighth position (red zone) on the gauge scale and the low fuel indicator is illuminated. The low fuel indicator remains illuminated until the cluster receives messages from the PCM indicating that the percent tank full is greater than 15 (one-eighth), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Less Than Empty Percent Tank Full Message -** Each time the cluster receives a message from the PCM indicating the percent tank full is less than empty, the gauge needle is moved to the far left (low) end of the gauge scale and the low fuel indicator is illuminated immediately. This message would indicate that the fuel tank sending unit input to the PCM is a short circuit.
- **More Than Full Percent Tank Full Message -** Each time the cluster receives a message from the PCM indicating the percent tank full is more than full, the gauge needle is moved to the far left (low) end of the gauge scale and the low fuel indicator is illuminated immediately. This message would indicate that the fuel tank sending unit input to the PCM is an open circuit.
- **Actuator Test -** Each time the cluster is put through the actuator test, the fuel gauge needle will be swept to several calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the fuel tank sending unit input to determine the level of fuel in the fuel tank. The PCM then applies an algorithm to the input and sends the proper percent tank full messages to the instrument cluster. For further diagnosis of the fuel gauge or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the fuel tank sending unit, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the fuel gauge, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# GAS CAP INDICATOR

## DESCRIPTION

A gas cap indicator is standard equipment on all instrument clusters. However, on vehicles equipped with the optional diesel engine, this indicator is electronically disabled. The gas cap indication appears within the odometer Vacuum Fluorescent Display (VFD) unit.

The gas cap indicator consists of a textual **GASCAP** message which appears in place of the odometer information in the display. The odometer VFD is soldered onto the cluster electronic circuit board, and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents the indicator from being clearly visible when it is not illuminated. The gas cap textual message appears in the same blue-green color and at the same lighting level as the odometer information when it is illuminated by the instrument cluster electronic circuit board.

The gas cap indicator is serviced as a unit with the VFD in the instrument cluster.

## OPERATION

The gas cap indicator gives an indication to the vehicle operator when there is a gross leak detected in the on-board fuel vapor recovery system. This indicator is controlled by the instrument cluster logic circuit based upon cluster programming and electronic messages received over the Programmable Communications Interface (PCI) data bus from the Powertrain Control Module (PCM).

The gas cap indicator function of the odometer Vacuum Fluorescent Display (VFD) unit is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the VFD gas cap indication will always be off when the ignition switch is in any position except On or Start. The instrument cluster will turn on the gas cap indicator for the following reasons:

- **Gas Cap Indicator Request Message** - Each time the cluster receives a gas cap indicator request message from the PCM indicating there is a gross leak in the vapor recovery system, the gas cap indicator will be illuminated. If the ignition switch is in the On position and the vehicle is not moving when the gas cap indicator request message is received, the VFD will repeatedly and sequentially cycle the gas cap indication in two second intervals with the odometer/trip odometer information and any other active warnings including: door ajar, gate ajar, glass ajar, and low washer fluid. If the vehicle is moving, or once the cluster of a non-moving vehicle receives an electronic vehicle speed message from the Powertrain Control Module (PCM) indicating a speed greater than zero, the warning sequence will consist of three complete display cycles with an audible single chime tone accompanying each cycle, then revert to only the visual gas cap indication and odometer/trip odometer display cycling until the cluster receives a message indicating there is no gross leak in the vapor recovery system, or until the ignition switch is turned to the Off position, whichever occurs first. The VFD can be reverted to the odometer display and any currently displayed textual messages suspended by momentarily depressing and releasing the odometer/trip odometer reset switch button on the front of the cluster.

The PCM continually monitors the on board vapor recovery system to determine whether there are air leaks in the system. The PCM then sends the proper gas cap indicator messages to the instrument cluster. For proper diagnosis of the on board vapor recovery system, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the gas cap indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# GATE AJAR INDICATOR

## DESCRIPTION


A gate ajar indicator is standard equipment on all instrument clusters. This indicator is located within the odometer/trip odometer Vacuum Fluorescent Display (VFD) unit. However, on models equipped with the optional Electronic Vehicle Information Center (EVIC) the gate ajar indicator in the odometer VFD is electronically suppressed so as not to duplicate indications that are provided by the EVIC.

The gate ajar indicator consists of the text “GATE”, which appears in place of the odometer/trip odometer information in the odometer VFD unit. The odometer VFD is soldered onto the cluster electronic circuit board and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents the indicator from being clearly visible when it is not illuminated. The “GATE” text appears in the same blue-green color and at the same lighting level as the odometer/trip odometer information when it is illuminated by the instrument cluster electronic circuit board.

The gate ajar indicator is serviced as a unit with the VFD unit in the instrument cluster.

## OPERATION

The gate ajar indicator gives an indication to the vehicle operator that the rear tailgate may be open or not completely latched. This indicator is controlled by the instrument cluster logic circuit based upon cluster programming and electronic messages received by the cluster from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus.

The gate ajar indicator function of the Vacuum Fluorescent Display (VFD) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the VFD gate ajar indication will always be off when the ignition switch is in any position except On or Start. The instrument cluster will turn on the gate ajar indicator for the following reasons:

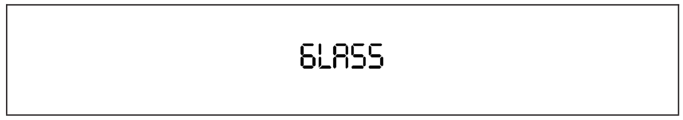
- **Gate Ajar Lamp-On Message** - Each time the cluster receives a gate ajar lamp-on message from the BCM indicating that the rear tailgate is open or not completely latched, the gate ajar indicator will be illuminated. If the ignition switch is in the On position and the vehicle is not moving when the gate ajar lamp-on message is received, the VFD will repeatedly and sequentially cycle the gate ajar indication in two second intervals with the odometer/trip odometer information and any other active warnings including: door ajar, glass ajar, and low washer fluid. If the vehicle is moving, or once the cluster of a non-moving vehicle receives an electronic vehicle speed message from the Powertrain Control Module (PCM) indicating a speed greater than zero, the warning sequence will consist of three complete display cycles with an audible single chime tone accompanying each cycle, then revert to only the visual gate ajar indication and odometer/trip odometer display cycling until the tailgate ajar switch is cycled. The gate ajar indicator will also be extinguished when the cluster receives a gate ajar lamp-off message from the BCM, or if the ignition switch is turned to the Off position, whichever occurs first. The VFD can be reverted to the odometer display and any currently displayed textual messages suspended by momentarily depressing and releasing the odometer/trip odometer reset switch button on the front of the cluster.

The BCM continually monitors the tailgate ajar switch to determine the status of the rear tailgate. The BCM then sends the proper gate ajar lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the gate ajar indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the tailgate ajar switch and circuit, the BCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the gate ajar indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# GLASS AJAR INDICATOR

## DESCRIPTION




A glass ajar indicator is standard equipment on all instrument clusters. This indicator is located within the odometer/trip odometer Vacuum Fluorescent Display (VFD) unit. However, on models equipped with the optional Electronic Vehicle Information Center (EVIC) the glass ajar indicator in the odometer VFD is electronically suppressed so as not to duplicate indications that are provided by the EVIC.

The glass ajar indicator consists of the text "GLASS", which appears in place of the odometer/trip odometer information in the odometer VFD unit. The odometer VFD is soldered onto the cluster electronic circuit board and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents the indicator from being clearly visible when it is not illuminated. The "GLASS" text appears in the same blue-green color and at the same lighting level as the odometer/trip odometer information when it is illuminated by the instrument cluster electronic circuit board.

The glass ajar indicator is serviced as a unit with the VFD unit in the instrument cluster.

## OPERATION

The glass ajar indicator gives an indication to the vehicle operator that the rear flip-up glass may be open or not completely latched. This indicator is controlled by the instrument cluster logic circuit based upon cluster programming and electronic messages received by the cluster from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus.

The glass ajar indicator function of the Vacuum Fluorescent Display (VFD) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the VFD glass ajar indication will always be off when the ignition switch is in any position except On or Start. The instrument cluster will turn on the glass ajar indicator for the following reasons:

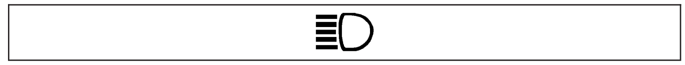
- **Glass Ajar Lamp-On Message** - Each time the cluster receives a glass ajar lamp-on message from the BCM indicating that the rear flip-up glass is open or not completely latched, the glass ajar indicator will be illuminated. If the ignition switch is in the On position and the vehicle is not moving when the glass ajar lamp-on message is received, the VFD will repeatedly and sequentially cycle its glass ajar indication in two second intervals with the odometer/trip odometer information and any other active warnings including: door ajar, gate ajar, and low washer fluid. If the vehicle is moving, or once the cluster of a non-moving vehicle receives an electronic vehicle speed message from the Powertrain Control Module (PCM) indicating a speed greater than zero, the warning sequence will consist of three complete display cycles with an audible single chime tone accompanying each of the first two cycles, then revert to only the visual glass ajar indication and odometer/trip odometer display cycling until the glass ajar switch is cycled. The glass ajar indicator will also be extinguished when the cluster receives a glass ajar lamp-off message from the BCM, or if the ignition switch is turned to the Off position, whichever occurs first. The VFD can be reverted to the odometer display and any currently displayed textual messages suspended by momentarily depressing and releasing the odometer/trip odometer reset switch button on the front of the cluster.

The BCM continually monitors the flip-up glass ajar switch to determine the status of the rear flip-up glass. The BCM then sends the proper glass ajar lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the glass ajar indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the glass ajar switch and circuit, the BCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the glass ajar indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# HIGH BEAM INDICATOR

## DESCRIPTION



A high beam indicator is standard equipment on all instrument clusters. This indicator is located near the upper edge of the cluster overlay, between the tachometer and the speedometer.

The high beam indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for "High Beam" in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A blue Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in blue through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The high beam indicator is serviced as a unit with the instrument cluster.

## OPERATION

The high beam indicator gives an indication to the vehicle operator whenever the headlamp high beams are illuminated. In certain markets where required, the high beam indicator also gives an indication when the optional light bar lamps are illuminated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus.

The high beam indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the high beam indicator for the following reasons:

- **High Beam Headlamps-On Message** - Each time the cluster receives a high beam headlamps-on electronic message from the BCM the high beam indicator will be illuminated. The high beam indicator remains illuminated until the cluster receives a high beam headlamps-off message from the BCM.
- **Light Bar Lamps-On Message** - This function of the high beam indicator applies only to vehicles equipped with the optional light bar lamps and manufactured for certain markets where it is required. Each time the cluster receives a light bar lamps-on message from the BCM the high beam indicator will be illuminated. The high beam indicator remains illuminated until the cluster receives a light bar lamps-off message from the BCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the high beam indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The BCM continually monitors the exterior lighting (multi-function) switch and the optional light bar lamp switch to determine the appropriate outputs to the headlamp low beam, headlamp high beam, and light bar lamp relays. The BCM then sends the proper high beam indicator and light bar lamp indicator messages to the instrument cluster. For further diagnosis of the high beam indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the headlamp system, the light bar lamp system, the BCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the high beam indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# LIGHT BAR LAMP INDICATOR

## DESCRIPTION

A light bar lamp indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional roof-mounted light bar, this indicator is electronically disabled. The light bar lamp indicator is located above the fuel gauge and to the left of the speedometer in the cluster overlay.

The light bar lamp indicator consists of a stencil-like cutout of an icon in the opaque layer of the instrument cluster overlay. This icon is similar in appearance to the International Control and Display Symbol icon for “High Beam”, but has an additional curved line beneath it to represent the forward roofline of the vehicle. The dark outer layer of the overlay prevents the indicator from being clearly visible when the it is not illuminated. An amber or blue Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber or blue through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The color of the LED used is determined by the requirements of the market for which the vehicle is manufactured.

When the exterior lighting is turned On, the illumination intensity of the light bar lamp indicator is dimmable, which is adjusted along with the cluster illumination lighting using the panel lamps dimmer control ring on the left control stalk of the multi-function switch.

The light bar lamp indicator is serviced as a unit with the instrument cluster.

## OPERATION

The light bar lamp indicator gives an indication to the vehicle operator whenever the light bar lamps are illuminated. In certain markets where required, the high beam indicator also gives an indication when the optional light bar lamps are illuminated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus.

The light bar lamp indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the light bar lamp indicator for the following reasons:

- **Light Bar Lamps-On Message** - Each time the cluster receives a light bar lamps-on message from the BCM, the light bar lamp indicator will be illuminated. The light bar lamp indicator remains illuminated until the cluster receives a light bar lamps-off message from the BCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the light bar lamp indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The BCM continually monitors the light bar lamp switch to determine the appropriate outputs to the light bar lamp relay. The BCM then sends the proper light bar lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the light bar lamp indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the light bar lamp system, the BCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the light bar lamp indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# LOW FUEL INDICATOR

## DESCRIPTION

A low fuel indicator is standard equipment on all instrument clusters. The low fuel indicator is located above the fuel gauge and to the left of the speedometer in the cluster overlay.

The low fuel indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Fuel” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The low fuel indicator is serviced as a unit with the instrument cluster.

## OPERATION

The low fuel indicator gives an indication to the vehicle operator when the level of fuel in the fuel tank becomes low. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The low fuel indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the low fuel indicator for the following reasons:

- **Bulb Test -** Each time the ignition switch is turned to the On position the low fuel indicator is illuminated for about three seconds as a bulb test.
- **Less Than 15 Percent Tank Full Message** - Each time the cluster receives messages from the PCM indicating that the percent tank full is less than 15, the low fuel indicator is illuminated. The indicator remains illuminated until the cluster receives messages from the PCM indicating that the percent tank full has increased to greater than 15. The PCM applies an algorithm to the input from the fuel tank sending unit to dampen the illumination of the low fuel indicator against the negative effect that fuel sloshing within the fuel tank can have on accurate inputs to the PCM.
- **Less Than Empty Percent Tank Full Message -** Each time the cluster receives a message from the PCM indicating the percent tank full is less than empty, the low fuel indicator is illuminated immediately. This message would indicate that the fuel tank sending unit input to the PCM is a short circuit.
- **More Than Full Percent Tank Full Message** - Each time the cluster receives a message from the PCM indicating the percent tank full is more than full, the low fuel indicator is illuminated immediately. This message would indicate that the fuel tank sending unit input to the PCM is an open circuit.
- **Communication Error** - If the cluster fails to receive a percent tank full message for more than about 12 seconds, the cluster control circuitry will illuminate the low fuel indicator until a new percent tank full message is received, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test -** Each time the cluster is put through the actuator test, the low fuel indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the fuel tank sending unit input to determine the level of fuel in the fuel tank. The PCM then applies an algorithm to the input and sends the proper percent tank full messages to the instrument cluster. For further diagnosis of the low fuel indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the fuel tank sending unit, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the low fuel indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# LOW OIL PRESSURE INDICATOR

## DESCRIPTION

A low oil pressure indicator is standard equipment on all instrument clusters. This indicator is located near the lower edge of the cluster overlay, between the tachometer and the speedometer.

The low oil pressure indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Engine Oil” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The low oil pressure indicator is serviced as a unit with the instrument cluster.

## OPERATION

The low oil pressure indicator gives an indication to the vehicle operator when the engine oil pressure reading reflects a condition requiring immediate attention. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The low oil pressure indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the low oil pressure indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the low oil pressure indicator is illuminated as a bulb test. The indicator will remain illuminated until the engine is started (engine speed is greater than 450 rpm), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Engine Oil Pressure Low Message** - Once the engine has been started (engine speed is greater than 450 rpm), each time the cluster receives three consecutive messages from the PCM indicating that the engine oil pressure is about 4 kPa or lower (about 0.6 psi or lower), the low oil pressure indicator is illuminated. The indicator remains illuminated until the cluster receives a single message from the PCM indicating that the engine oil pressure is about 76 kPa or higher (about 11 psi or higher), or until the ignition switch is turned to the Off position, whichever occurs first. Once the cluster monitors an engine speed of greater than 450 rpm, the cluster logic will ignore engine speed in determining low oil pressure indicator operation for the remainder of the current ignition cycle.
- **Actuator Test** - Each time the cluster is put through the actuator test, the low oil pressure indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

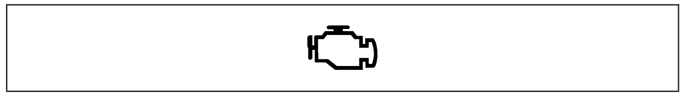
The PCM continually monitors the engine oil pressure sensor to determine the engine oil pressure. The PCM then sends the proper engine oil pressure messages to the instrument cluster. If the instrument cluster turns on the indicator after the bulb test, it may indicate that the engine or the engine oiling system requires service. For further diagnosis of the low oil pressure indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the engine oil pressure sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the low oil pressure indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# MALFUNCTION INDICATOR LAMP (MIL)

## DESCRIPTION

A Malfunction Indicator Lamp (MIL) is standard equipment on all instrument clusters. This indicator is located above the coolant temperature gauge and to the right of the tachometer in the cluster overlay.



The MIL consists of a stencil-like cutout of the International Control and Display Symbol icon for “Engine” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The MIL is serviced as a unit with the instrument cluster.

## OPERATION

The Malfunction Indicator Lamp (MIL) gives an indication to the vehicle operator when the Powertrain Control Module (PCM) has recorded a Diagnostic Trouble Code (DTC) for an On-Board Diagnostics II (OBDII) emissions-related circuit or component malfunction. The MIL is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the PCM over the Programmable Communications Interface (PCI) data bus.

The MIL Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the MIL for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the indicator is illuminated for about seven seconds as a bulb test.
- **MIL Lamp-On Message** - Each time the cluster receives a MIL lamp-on message from the PCM, the indicator will be illuminated. The indicator can be flashed on and off, or illuminated solid, as dictated by the PCM message. For some DTC’s, if a problem does not recur, the PCM will send a lamp-off message automatically. Other DTC’s may require that a fault be repaired and the PCM be reset before a lamp-off message will be sent. For more information on the PCM and the DTC set and reset parameters, (Refer to 25 - EMISSIONS CONTROL - OPERATION).
- **Communication Error** - If the cluster receives no messages from the PCM for twenty consecutive seconds, the MIL is illuminated by the instrument cluster to indicate a loss of bus communication. The indicator remains controlled and illuminated by the cluster until a valid message is received from the PCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the MIL will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the fuel and emissions system circuits and sensors to decide whether the system is in good operating condition. The PCM then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the instrument cluster turns on the MIL after the bulb test, it may indicate that a malfunction has occurred or that the fuel and emissions systems require service. For further diagnosis of the MIL or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the fuel and emissions systems, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the MIL, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# ODOMETER

## DESCRIPTION


An odometer and trip odometer are standard equipment in all instrument clusters. The odometer and trip odometer information are displayed in a common electronic, blue-green Vacuum Fluorescent Display (VFD) unit. The VFD unit is soldered onto the cluster electronic circuit board and is visible through a window with a smoked clear lens located in the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents it from being clearly visible when it is not illuminated.

The odometer and trip odometer information are not displayed simultaneously. The trip odometer reset switch on the instrument cluster circuit board toggles the display between odometer and trip odometer modes by depressing the odometer/trip odometer switch button that extends through the lower edge of the cluster lens, just right of the odometer VFD. When the trip odometer information is displayed, the word “TRIP” is also illuminated near the bottom of the VFD in a blue-green color and at the same lighting level as the trip odometer information.

The odometer and trip odometer distance information is stored in the instrument cluster memory. This information can be increased when the proper inputs are provided to the instrument cluster, but the information cannot be decreased. The odometer can display values up to 864,004 kilometers (536,870 miles). The odometer latches at these values, and will not roll over to zero. The trip odometer can display values up to 9,999.9 kilometers (9,999.9 miles) before it rolls over to zero.

The odometer display does not have a decimal point and will not show values less than a full unit (kilometer or mile), while the trip odometer display does have a decimal point and will show tenths of a unit (kilometer or mile). The unit of measure for the odometer and trip odometer is selected at the time that it is manufactured, and cannot be changed. If the instrument cluster has a kilometers-per-hour primary speedometer scale, the odometer/trip odometer registers kilometers; and if the cluster features a miles-per-hour primary speedometer scale, the odometer/trip odometer registers miles.

The odometer/trip odometer has a “Rental Car” mode, which will illuminate the odometer information in the VFD whenever the driver side front door is opened with the ignition switch in the Off or Accessory positions. During daylight hours (exterior lamps are Off) the VFD is illuminated at full brightness for clear visibility. At night (exterior lamps are On) the VFD lighting level is adjusted with the other cluster illumination lamps using the panel lamps dimmer control ring on the left control stalk of the multi-function switch. However, a “Parade” mode position of the panel lamps dimmer control ring allows the VFD to be illuminated at full brightness if the exterior lamps are turned On during daylight hours.

The odometer/trip odometer VFD unit, the trip odometer switch, and the trip odometer switch button are serviced as a unit with the instrument cluster.

## OPERATION

The odometer and trip odometer give an indication to the vehicle operator of the distance the vehicle has traveled. This indicator is controlled by the instrument cluster circuitry based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The odometer and trip odometer information is displayed by the instrument cluster Vacuum Fluorescent Display (VFD) unit. The VFD will display the odometer information whenever the driver side front door is opened with the ignition switch in the Off or Accessory positions, and will display the last previously selected odometer or trip odometer information when the ignition switch is turned to the On or Start positions. The instrument cluster circuitry controls the VFD and provides the following features:

- **Odometer/Trip Odometer Display Toggling** - Actuating the trip odometer reset switch button momentarily with the VFD illuminated will toggle the display between the odometer and trip odometer information. Each time the VFD is illuminated with the ignition switch in the On or Start positions, the display will automatically return to the last mode previously selected (odometer or trip odometer). The VFD can be reverted to the odometer display and any currently displayed textual messages suspended by momentarily depressing and releasing the odometer/trip odometer reset switch button.
- **Trip Odometer Reset** - When the trip odometer reset switch button is pressed and held for longer than about two seconds with the ignition switch in the On or Start positions, the trip odometer will be reset to 0.0 kilome-

ters (miles). The VFD unit must be displaying the trip odometer information in order for the trip odometer information to be reset.

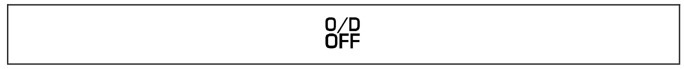
- **Communication Error** - If the cluster fails to receive a distance message during normal operation, it will hold and display the last data received until the ignition switch is turned to the Off position. If the cluster does not receive a distance message within one second after the ignition switch is turned to the On position, it will display the last distance message stored in the cluster memory. If the cluster is unable to display distance information due to an error internal to the cluster, the VFD will display "error".
- **Actuator Test** - Each time the cluster is put through the actuator test, the VFD will step sequentially through a display of "111111" through "999999", then display the cluster software version number to confirm the functionality of each of the VFD unit segments and the cluster control circuitry.

The PCM continually monitors the vehicle speed pulse information received from the Body Control Module (BCM), then sends the proper distance messages to the instrument cluster. For further diagnosis of the odometer/trip odometer or the instrument cluster circuitry that controls these functions, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the vehicle speed sensor, the BCM, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the odometer/trip odometer, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# OVERDRIVE OFF INDICATOR

## DESCRIPTION




An overdrive off indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional overdrive automatic transmission, this indicator is electronically disabled. This indicator is located above the fuel gauge and to the left of the speedometer in the cluster overlay.

The overdrive off indicator consists of a stencil-like cutout of the text “O/D OFF” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the text from being clearly visible when the indicator is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “O/D OFF” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

When the exterior lighting is turned On, the illumination intensity of the overdrive off indicator is dimmable, which is adjusted along with the cluster illumination lighting using the panel lamps dimmer control ring on the left control stalk of the multi-function switch.

The overdrive off indicator is serviced as a unit with the instrument cluster.

## OPERATION

The overdrive off indicator gives an indication to the vehicle operator when the Off position of the overdrive off switch has been selected, disabling the electronically controlled overdrive feature of the automatic transmission. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The overdrive off indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the overdrive off indicator for the following reasons:

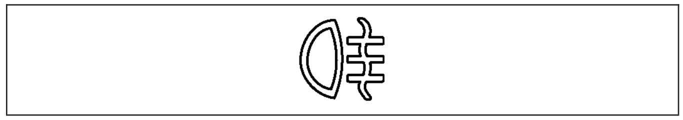
- **Overdrive Off Lamp-On Message** - Each time the cluster receives an overdrive off lamp-on message from the PCM the overdrive off indicator will be illuminated. The indicator remains illuminated until the cluster receives an overdrive off lamp-off message from the PCM, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the overdrive off indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the overdrive off switch to determine the appropriate outputs to the automatic transmission. The PCM then sends the proper overdrive off lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the overdrive off indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the overdrive control system, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the overdrive off indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# REAR FOG LAMP INDICATOR

## DESCRIPTION



A rear fog lamp indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional rear fog lamps, which are available only in certain markets where they are required, this indicator is electronically disabled. This indicator is located above the coolant temperature gauge and to the right of the tachometer in the cluster overlay.

The rear fog lamp indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Rear Fog Light” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

When the exterior lighting is turned On, the illumination intensity of the rear fog lamp indicator is dimmable, which is adjusted along with the cluster illumination lighting using the panel lamps dimmer control ring on the left control stalk of the multi-function switch.

The rear fog lamp indicator is serviced as a unit with the instrument cluster.

## OPERATION

The rear fog lamp indicator gives an indication to the vehicle operator whenever the rear fog lamps are illuminated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus.

The rear fog lamp indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the rear fog lamp indicator for the following reasons:

- **Rear Fog Lamp-On Message** - Each time the cluster receives a rear fog lamp-on message from the BCM the rear fog lamp indicator will be illuminated. The indicator remains illuminated until the cluster receives a rear fog lamp-off message from the BCM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the rear fog lamp indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The BCM continually monitors the exterior lighting (multi-function) switch to determine the appropriate outputs to the rear fog lamp relay. The BCM then sends the proper rear fog lamp indicator lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the rear fog lamp indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the rear fog lamp system, the BCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the rear fog lamp indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# SEATBELT INDICATOR

## DESCRIPTION

A seatbelt indicator is standard equipment on all instrument clusters. This indicator is located above the fuel gauge and to the left of the speedometer in the cluster overlay.

The seatbelt indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for "Seat Belt" in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The seatbelt indicator is serviced as a unit with the instrument cluster.

## OPERATION

The seatbelt indicator gives an indication to the vehicle operator of the status of the driver and passenger side front seat belts. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming. On models equipped with airbags the indicator is also controlled by electronic messages received by the cluster from the Airbag Control Module (ACM) over the Programmable Communications Interface (PCI) data bus.

The seatbelt indicator also includes a programmable enhanced seatbelt reminder or "beltminder" feature that is enabled when the vehicle is shipped from the factory. This beltminder feature can be disabled and enabled by the customer using a specific programming event sequence, or by the dealer using a diagnostic scan tool.

The seatbelt indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the seatbelt indicator for the following reasons:

- **Seatbelt Reminder Function** - Each time the cluster receives a battery current input on the fused ignition switch output (run-start) circuit, the indicator will be illuminated as a seatbelt reminder for about seven seconds, or until the ignition switch is turned to the Off position, whichever occurs first. This reminder function will occur regardless of the status of the seat belt switch inputs received by the cluster from the driver and passenger side front seat belts.
- **Seat Belt Switch Input - Beltminder Active** - Following the seatbelt reminder function on models equipped with the Occupant Classification System (OCS), each time the cluster receives an input from the driver or passenger side front seat belt switch indicating that a front seat belt is not fastened with the ignition switch in the Start or On positions, the indicator will be illuminated. The passenger side front seat belt switch input must be accompanied by electronic messages received from the Airbag Control Module (ACM) over the Programmable Communications Interface (PCI) data bus indicating that the passenger side front seat is occupied. On models not equipped with the OCS, the cluster responds only to the driver side seat belt switch input. In addition, if the front seat belt remains unbuckled about sixty seconds after the conclusion of the seatbelt reminder function with the vehicle speed greater than about 13 kilometers-per-hour (8 miles-per-hour), the seatbelt indicator will begin to cycle between flashing on and off for five seconds, then lighting solid for three seconds. The seatbelt indicator will continue to cycle between flashing and solid illumination for 12 complete cycles, until the cluster receives no front seat belt switch input, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Seat Belt Switch Input - Beltminder Inactive** - Following the seatbelt reminder function on models equipped with the OCS, each time the cluster receives an input from the driver or passenger side front seat belt switch indicating that a front seat belt is not fastened with the ignition switch in the Start or On positions, the indicator will be illuminated. The passenger side front seat belt switch input must be accompanied by electronic messages received from the ACM over the PCI data bus indicating that the passenger side front seat is occupied. On models not equipped with the OCS, the cluster responds only to the driver side seat belt switch input. The seatbelt indicator remains illuminated until the cluster receives no seat belt switch input, or until the ignition switch is turned to the Off position, whichever occurs first.

- **Actuator Test** - Each time the cluster is put through the actuator test, the seatbelt indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The cluster continually monitors the status of the front seat belt switch inputs and electronic messages from the ACM to determine the appropriate seatbelt indicator operation. For further diagnosis of the seatbelt indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the seatbelt switches, the ACM, the OCS, the PCI data bus, or the electronic message inputs to the instrument cluster that control the seatbelt indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

## STANDARD PROCEDURE

## ENHANCED SEATBELT REMINDER PROGRAMMING

The seatbelt indicator also includes a programmable enhanced seatbelt reminder or “beltminder” feature that is enabled when the vehicle is shipped from the factory. This beltminder feature provides extended and modified visual seatbelt indicator and audible chime warning responses to an unbuckled driver side front seat belt. The beltminder feature may be disabled or enabled by the customer using the programming sequence that follows, or by the dealer using a diagnostic scan tool.

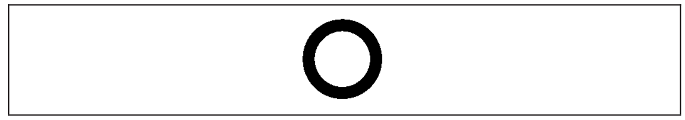
### CUSTOMER PROGRAMMING SEQUENCE

**NOTE: The following sequence of events must occur within sixty (60) seconds of the ignition switch being placed in the On position in order for the programming to be completed successfully.**

1. With all doors closed and the ignition switch in any position except On or Start, buckle the driver side front seat belt.
2. Turn the ignition switch to the On position and wait for the seatbelt indicator reminder function to conclude (about seven seconds).
3. Unbuckle and buckle the driver side front seat belt three or more times, ending with the belt buckled.
4. Turn the ignition switch to any position except On or Start to toggle the beltminder feature from its current setting (from active to inactive, or from inactive to active). A single chime tone will provide an audible confirmation that the programming sequence has been successfully completed.

# SECURITY INDICATOR

## DESCRIPTION



A security indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional Vehicle Theft Alarm (VTA) or the optional Sentry Key Immobilizer System (SKIS), this indicator is electronically disabled. This indicator is located near the lower edge of the cluster overlay below the speedometer and to the right of the fuel gauge.

The security indicator consists of a small round cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in red through the translucent outer layer of the overlay when it is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The security indicator is serviced as a unit with the instrument cluster.

## OPERATION

The security indicator gives an indication to the vehicle operator when the Vehicle Theft Alarm (VTA) is arming or is armed. This indicator is controlled on the instrument cluster circuit board by a hard wired input to the cluster from the Body Control Module (BCM) on the VTSS indicator driver circuit.

On models equipped with the Sentry Key Immobilizer System (SKIS), the security indicator also gives an indication to the vehicle operator of the status of the SKIS. The SKIS function of this indicator is controlled by the BCM based upon BCM programming and electronic messages received by the BCM from the Sentry Key REmote Entry Module (SKREEM) over the Programmable Communications Interface (PCI) data bus.

The security indicator Light Emitting Diode (LED) receives battery current on the instrument cluster electronic circuit board through a fused B(+) circuit at all times. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the BCM. The BCM will turn on the security indicator for the following reasons:

- **Bulb Test** - Only on vehicles equipped with the SKIS, each time the ignition switch is turned to the On position the SKREEM sends an electronic message to the BCM to illuminate the security indicator for about three seconds as a bulb test. The entire bulb test is a function of the SKREEM.
- **VTA Indication** - During the sixteen second VTA pre-arming function, the BCM will flash the security indicator on and off repeatedly at a steady, fast rate to indicate that the VTA is in the process of arming. Following successful VTA arming, the BCM flashes the security indicator on and off continuously at a slower rate to indicate that the VTA is armed. The security indicator continues flashing at the slower rate until the VTA is disarmed.
- **SKIS Lamp-On Message** - Each time the BCM receives a SKIS lamp-on message from the SKREEM, the security indicator will be illuminated. The indicator can be flashed on and off, or illuminated solid, as dictated by the SKREEM message. The indicator remains illuminated solid or continues to flash until the BCM receives a SKIS lamp-off message from the SKREEM, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - Only on vehicles equipped with the SKIS, if the BCM receives no SKIS lamp-on or lamp-off messages from the SKREEM for twenty consecutive seconds, the security indicator is illuminated by the BCM. The indicator remains controlled and illuminated by the BCM until a valid SKIS lamp-on or lamp-off message is received from the SKREEM.
- **Actuator Test** - Only on vehicles equipped with the SKIS, each time the instrument cluster is put through the actuator test, the security indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the indicator control circuitry.

The BCM circuitry controls the security indicator through the VTSS indicator driver circuit whenever the ignition switch is in the Off position and the VTA is arming, armed, or triggered. On vehicles equipped with the SKIS, the SKREEM performs a self-test each time the ignition switch is turned to the On position to decide whether the SKIS is in good operating condition and whether a valid key is present in the ignition lock cylinder. The SKREEM then sends the proper lamp-on or lamp-off messages to the BCM. If the BCM flashes the security indicator upon ignition On, or turns on the security indicator solid after the bulb test, it indicates that a SKIS malfunction has occurred or that the SKIS is inoperative.

The VTSS indicator driver circuit between the BCM and the instrument cluster can be diagnosed using conventional diagnostic tools and methods. However, for proper diagnosis of the VTA, the SKIS, the SKREEM, the BCM, the PCI data bus, or the electronic message and hard wired inputs to the BCM that control the security indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# SHIFT INDICATOR (TRANSFER CASE)

## DESCRIPTION

### PART TIME INDICATOR


A part time indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with an optional four-wheel drive system, this indicator is electronically disabled. This indicator is located near the lower edge of the speedometer gauge dial face on the cluster overlay.

The part time indicator consists of a stencil-like cutout of the text “PART TIME” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “PART TIME” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

When the exterior lighting is turned On, the illumination intensity of the part time indicator is dimmable, which is adjusted along with the cluster illumination lighting using the panel lamps dimmer control ring on the left control stalk of the multi-function switch.

The part time indicator is serviced as a unit with the instrument cluster.

### FULL TIME INDICATOR

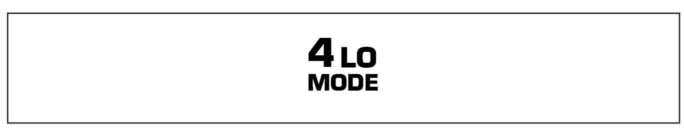

A full time indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional Selec-Trac four-wheel drive system, this indicator is electronically disabled. This indicator is located near the lower edge of the speedometer gauge dial face in the cluster overlay.

The full time indicator consists of a stencil-like cutout of the text “FULL TIME” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A green Light Emitting Diode (LED) behind the cutout in the opaque layer of the cluster overlay causes the “FULL TIME” text to appear in green through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

When the exterior lighting is turned On, the illumination intensity of the full time indicator is dimmable, which is adjusted along with the cluster illumination lighting using the panel lamps dimmer control ring on the left control stalk of the multi-function switch.

The full time indicator is serviced as a unit with the instrument cluster.

### FOUR LOW MODE INDICATOR




A four low mode indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional four-wheel drive system, this indicator is electronically disabled. This indicator is located above the coolant temperature gauge and to the right of the tachometer in the cluster overlay.

The four low mode indicator consists of a stencil-like cutout of the words “4 LO MODE” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “4 LO MODE” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

When the exterior lighting is turned On, the illumination intensity of the four low mode indicator is dimmable, which is adjusted along with the cluster illumination lighting using the panel lamps dimmer control ring on the left control stalk of the multi-function switch.

The four low mode indicator is serviced as a unit with the instrument cluster.

## OPERATION

## PART TIME INDICATOR

The part time indicator gives an indication to the vehicle operator whenever a part time operating mode of the four-wheel drive transfer case is selected. On vehicles equipped with the Command-Trac four-wheel drive system, the part time indicator lights when the transfer case is engaged in the “4H” or “4L” positions. On vehicles equipped with the Selec-Trac four-wheel drive system, the part time indicator lights when the transfer case is engaged in the “4 X 4 Part Time” position. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The instrument cluster must be electronically configured for the type of transfer case in the vehicle using a diagnostic scan tool in order to provide proper operation of the part time indicator. The part time indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the part time indicator for the following reasons:

- **Part Time Lamp-On Message** - Each time the cluster receives a part time lamp-on message from the PCM indicating that a part time position of the four-wheel drive transfer case has been selected, the part time indicator will be illuminated. The indicator remains illuminated until the cluster receives a part time lamp-off message from the PCM or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the part time indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the transfer case switch to determine the driveline operating mode. The PCM then sends the proper part time lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the part time indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the transfer case switch, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the part time indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

## FULL TIME INDICATOR

The full time indicator gives an indication to the vehicle operator whenever a full time operating mode of the four-wheel drive transfer case is selected. On vehicles equipped with the Selec-Trac four-wheel drive system, the full time indicator lights when the transfer case is engaged in the “4 X 4 Full Time” position. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The instrument cluster must be electronically configured for the type of transfer case in the vehicle using a diagnostic scan tool in order to provide proper operation of the full time indicator. The full time indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the full time indicator for the following reasons:

- **Full Time Lamp-On Message** - Each time the cluster receives a full time lamp-on message from the PCM indicating that a full time position of the four-wheel drive transfer case has been selected, the full time indicator will be illuminated. The indicator remains illuminated until the cluster receives a full time lamp-off message from the PCM or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the full time indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the transfer case switch to determine the driveline operating mode. The PCM then sends the proper full time lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the full time indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the transfer case switch, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the full time indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

## FOUR LOW MODE INDICATOR

The four low mode indicator gives an indication to the vehicle operator that a “Low” operating mode of the four-wheel drive transfer case is selected. On vehicles equipped with the Command-Trac four-wheel drive system, the four low mode indicator lights when the transfer case is engaged in the “4L” position. On vehicles equipped with the Selec-Trac four-wheel drive system, the four low mode indicator lights when the transfer case is engaged in the “4 Lo” position.

This indicator is controlled by a transistor on the instrument cluster circuit board based upon the cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The instrument cluster must be electronically configured for the type of transfer case in the vehicle using a diagnostic scan tool in order to provide proper operation of the four low mode indicator.

The four low mode indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the four low mode indicator for the following reasons:

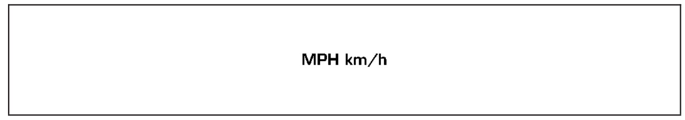
- **Four Low Mode Lamp-On Message** - Each time the cluster receives a four low mode lamp-on message from the PCM indicating that a low range position of the four-wheel drive transfer case has been selected, the four low mode indicator will be illuminated. The indicator remains illuminated until the cluster receives a four low mode lamp-off message from the PCM or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the four low mode indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the transfer case switch to determine the driveline operating mode. The PCM then sends the proper four low mode lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the four low mode indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the transfer case switch, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the four low mode indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# SPEEDOMETER

## DESCRIPTION




A speedometer is standard equipment on all instrument clusters. The speedometer is located next to the tachometer, just to the left of center in the instrument cluster. The speedometer consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry, and a fixed 255 degree primary scale on the gauge dial face that reads left-to-right either from “0” to “120” mph, or from “0” to “240” km/h, depending upon the market for which the vehicle is manufactured.

Most versions also have a secondary inner scale on the gauge dial face that provides the equivalent opposite measurement units from the primary scale. Text appearing on the cluster overlay just above the hub of the speedometer needle abbreviates the unit of measure for the primary scale (i.e.: MPH or km/h), while the text for the unit of measure for the secondary scale (i.e.: MPH or km/h) is located adjacent to the low end of that scale.

The speedometer primary scale text is white against a black field, while the major and minor primary scale increments are black against a silver field. If equipped, the secondary scale text and increments are light gray against a black field. All text and increments are clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, all primary scale text and major increments appear blue-green. The primary scale minor increments and the secondary scale are not illuminated. The red gauge needle is internally illuminated. Gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board.

The speedometer is serviced as a unit with the instrument cluster.

## OPERATION

The speedometer gives an indication to the vehicle operator of the vehicle road speed. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The speedometer is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

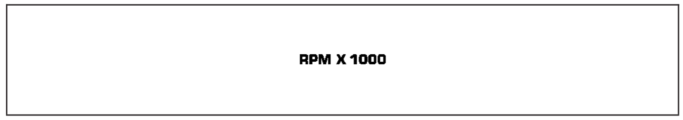
- **Vehicle Speed Message** - Each time the cluster receives a vehicle speed message from the PCM it will calculate the correct vehicle speed reading and position the gauge needle at that relative speed position on the gauge scale. The cluster will receive a new vehicle speed message and reposition the gauge pointer accordingly about every 86 milliseconds. The gauge needle will continually be repositioned at the relative vehicle speed position on the gauge scale until the until the vehicle stops moving, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the cluster fails to receive a speedometer message, it will hold the gauge needle at the last indication for about six seconds, or until the ignition switch is turned to the Off position, whichever occurs first. After six seconds, the gauge needle will return to the left end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the speedometer needle will be swept to several calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the vehicle speed information received from the Body Control Module (BCM) to determine the vehicle road speed. The PCM then sends the proper vehicle speed messages to the instrument cluster. For further diagnosis of the speedometer or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the BCM, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the speedometer, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# TACHOMETER

## DESCRIPTION




A tachometer is standard equipment on all instrument clusters. The tachometer is located next to the speedometer, just to the right of center in the instrument cluster. The tachometer consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 255 degree scale on the gauge dial face that reads left-to-right from “0” to “7” for gasoline engines. On vehicles with a diesel engine, the scale reads from “0” to “5”. The text “RPM X 1000” imprinted on the cluster overlay directly above the hub of the tachometer needle identifies that each number on the tachometer scale is to be multiplied by 1000 rpm.

The tachometer text is white against a black field, while the major and minor scale increments are black against a silver field. A light gray inner secondary scale provides a balanced appearance between the tachometer and speedometer, but is purely cosmetic. All text and increments are clearly visible within the instrument cluster in daylight. The gasoline engine tachometer has red increments designating the engine red line beginning at 5800 rpm, while the red increments for the diesel engine tachometer begin at 4000 rpm. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, all text and major increments appear blue-green, while the red major increments still appear red. The minor increments and the secondary scale are not illuminated. The red gauge needle is internally illuminated. Gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board.

The tachometer is serviced as a unit with the instrument cluster.

## OPERATION

The tachometer gives an indication to the vehicle operator of the engine speed. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The tachometer is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Engine Speed Message -** Each time the cluster receives an engine speed message from the PCM it will calculate the correct engine speed reading and position the gauge needle at that relative speed position on the gauge scale. The cluster will receive a new engine speed message and reposition the gauge pointer accordingly about every 86 milliseconds. The gauge needle will continually be repositioned at the relative engine speed position on the gauge scale until the engine stops running, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error -** If the cluster fails to receive an engine speed message, it will hold the gauge needle at the last indication for about six seconds, or until the ignition switch is turned to the Off position, whichever occurs first. After six seconds, the gauge needle will return to the left end of the gauge scale.
- **Actuator Test -** Each time the cluster is put through the actuator test, the tachometer needle will be swept to several calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

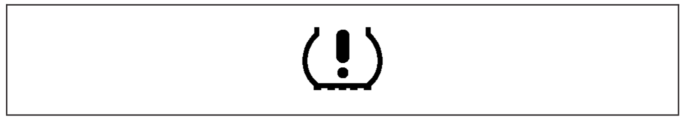
The PCM continually monitors the crankshaft position sensor to determine the engine speed. The PCM then sends the proper engine speed messages to the instrument cluster. For further diagnosis of the tachometer or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the crankshaft position sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the tachometer, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# TIRE PRESSURE MONITOR INDICATOR

## DESCRIPTION

A Tire Pressure Monitor (TPM) indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with the optional TPM, this indicator is electronically disabled. This indicator is located above the coolant temperature gauge and to the right of the tachometer in the cluster overlay.



The TPM indicator consists of a stencil-like cutout of an icon that represents a cross-section of a tire with a centered exclamation point in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The TPM indicator is serviced as a unit with the instrument cluster.

## OPERATION

The Tire Pressure Monitor (TPM) indicator gives an indication to the vehicle operator of the status of the TPM system. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Sentry Key REmote Entry Module (SKREEM) over the Programmable Communications Interface (PCI) data bus.

The TPM indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provide a path to ground by the instrument cluster transistor. The instrument cluster will turn on the TPM indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position, the SKREEM sends a TPM lamp-on message to the cluster to illuminate the TPM indicator for about three seconds as a bulb test.
- **TPM Lamp-On Message** - Each time the cluster receives a TPM lamp-on message from the SKREEM, the TPM indicator will be illuminated. The indicator remains illuminated until the cluster receives a TPM lamp-off message from the SKREEM or until the ignition switch is turned to the Off position, whichever occurs first.
- **TPM Fault Message** - Each time the cluster receives a TPM fault message from the SKREEM, the TPM indicator will be flashed on and off for 60 seconds indicating a sensor or system fault. The cluster then waits for 10 minutes and begins to flash the indicator again. This behavior repeats until the cluster receives a valid message from the SKREEM indicating there is no sensor or system fault or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the cluster receives no TPM lamp-on or lamp-off messages from the SKREEM for six consecutive seconds, the TPM indicator is illuminated by the instrument cluster. The indicator remains controlled and illuminated by the cluster until a valid TPM lamp-on or lamp-off message is received from the SKREEM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the TPM indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

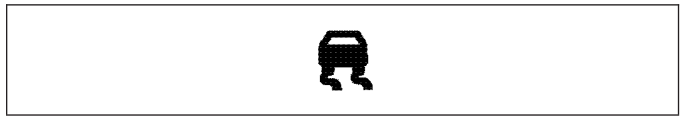
The SKREEM performs a self-test each time the ignition switch is turned to the On position to decide whether the TPM system is in good operating condition and whether the tire inflation pressures are too high or too low. The SKREEM then sends the proper TPM lamp-on or lamp-off messages to the instrument cluster. For further diagnosis of the TPM indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the TPM indicator after the bulb test, it indicates that the inflation pressure of a tire is too low or that a malfunction has occurred and the TPM system is inoperative.

For proper diagnosis of the SKREEM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the TPM indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# TRACTION CONTROL INDICATOR

## DESCRIPTION

A traction control indicator is standard equipment on all instrument clusters. This indicator is located near the lower edge of the cluster overlay, between the tachometer and the speedometer.



The traction control indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for "Stability - Anti-Spin" in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The traction control indicator is serviced as a unit with the instrument cluster.

## OPERATION

The traction control indicator gives an indication to the vehicle operator when the Electronic Stability Program (ESP)/Traction Control System (TCS) has been activated or deactivated. This indicator is controlled by the instrument cluster logic circuit based upon cluster programming and electronic messages received by the cluster from the Controller Antilock Brake (CAB) over the Programmable Communications Interface (PCI) data bus.

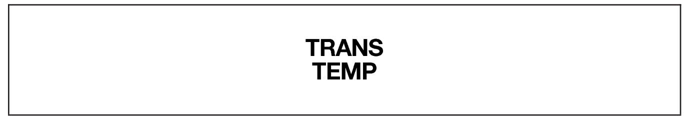
The traction control indicator is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The indicator only illuminates when it is switched to ground by the instrument cluster circuitry. The instrument cluster will turn on the traction control indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the traction control indicator is illuminated for about four seconds as a bulb test. The entire bulb test is a function of the CAB.
- **Traction Control Lamp-On Message** - Each time the cluster receives a traction control lamp-on message from the CAB indicating that the ESP/TCS has been activated or deactivated, the traction control indicator will be illuminated. The indicator can be flashed on and off (activated), or illuminated solid (deactivated), as dictated by the CAB message. The indicator remains illuminated solid or continues to flash until the cluster receives a traction control lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Service Traction Control System Message** - Each time the cluster receives a service traction control system message from the CAB indicating that a ESP/TCS fault has been detected, the traction control indicator will be illuminated solid and a single chime tone is sounded. The indicator remains illuminated solid until the fault is corrected and the cluster receives a traction control lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the traction control indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The CAB continually monitors the traction control switch to determine the proper outputs to the components of the Antilock Brake System (ABS). The CAB then sends the proper traction control lamp-on and lamp-off messages to the instrument cluster. For proper diagnosis of the traction control switch, the ABS, the CAB, the PCI data bus, or the electronic message inputs to the instrument cluster that control the traction control indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# TRANS TEMP INDICATOR

## DESCRIPTION




A transmission over-temperature indicator is standard equipment on all instrument clusters. However, on vehicles not equipped with an optional automatic transmission, this indicator is electronically disabled. This indicator is located near the lower edge of the cluster overlay, between the tachometer and the speedometer.

The transmission over-temperature indicator consists of a stencil-like cutout of the text “TRANS TEMP” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “TRANS TEMP” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The transmission over-temperature indicator is serviced as a unit with the instrument cluster.

## OPERATION

The transmission over-temperature indicator gives an indication to the vehicle operator when the transmission fluid temperature is excessive, which may lead to accelerated transmission component wear or failure. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The transmission over-temperature indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the transmission over-temperature indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the transmission over-temperature indicator is illuminated for about three seconds as a bulb test.
- **Trans Over-Temp Lamp-On Message** - Each time the cluster receives a trans over-temp lamp-on message from the PCM indicating that the transmission fluid temperature is 135° C (275° F) or higher, the indicator will be illuminated. The indicator remains illuminated until the cluster receives a trans over-temp lamp-off message from the PCM, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the transmission over-temperature indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

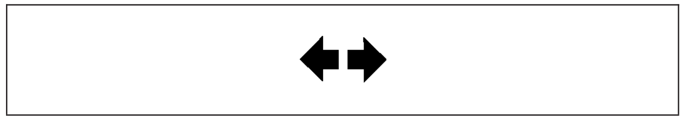
The PCM continually monitors the transmission temperature sensor to determine the transmission operating condition. The PCM then sends the proper transmission temperature messages to the instrument cluster. If the instrument cluster turns on the transmission over-temperature indicator due to a high transmission oil temperature condition, it may indicate that the transmission and/or the transmission cooling system are being overloaded or that they require service. For further diagnosis of the transmission over-temperature indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the transmission temperature sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the transmission over-temperature indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# TURN SIGNAL INDICATOR

## DESCRIPTION

Two turn signal indicators, one right and one left, are standard equipment on all instrument clusters. These indicators are located near the upper edge of the cluster overlay, between the speedometer and the tachometer.



Each turn signal indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Turn Warning” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents these icons from being clearly visible when they are not illuminated. A green Light-Emitting Diode (LED) behind each cutout in the opaque layer of the cluster overlay causes the icon to appear in green through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The turn signal indicators are serviced as a unit with the instrument cluster.

## OPERATION

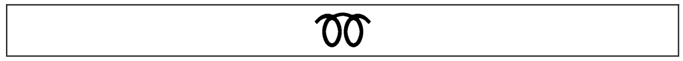
The turn signal indicators give an indication to the vehicle operator that the turn signals (left or right indicator flashing) or hazard warning signals (both left and right indicators flashing) have been selected and are operating. These indicators are controlled by two individual hard wired inputs from the combination flasher circuitry within the hazard switch to the instrument cluster electronic circuit board.

Each turn signal indicator Light Emitting Diode (LED) is grounded on the instrument cluster electronic circuit board at all times. Therefore, these indicators can be illuminated regardless of the ignition switch position. Each LED will only illuminate when it is provided battery current by the combination flasher circuitry of the hazard switch. The turn signal indicators are connected in parallel with the other turn signal circuits. This arrangement allows the turn signal indicators to remain functional, regardless of the condition of the other circuits in the turn signal and hazard warning systems.

The combination flasher outputs of the hazard switch to the instrument cluster turn signal indicator inputs can be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information. For further diagnosis or more information on the combination flasher and hazard switch operation, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HAZARD SWITCH - DESCRIPTION).

# WAIT-TO-START INDICATOR

## DESCRIPTION



A wait-to-start indicator is only found in the instrument clusters of vehicles equipped with an optional diesel engine. This indicator is located above the fuel gauge and to the left of the speedometer in the cluster overlay.

The wait-to-start indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Diesel Preheat” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The wait-to-start indicator is serviced as a unit with the instrument cluster.

## OPERATION

The wait-to-start indicator gives an indication to the vehicle operator when the diesel engine glow plugs are energized in their pre-heat operating mode. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The wait-to-start indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the wait-to-start indicator for the following reasons:

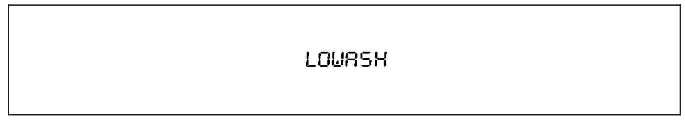
- **Wait-To-Start Lamp-On Message** - Each time the cluster receives a wait-to-start lamp-on message from the PCM indicating that the glow plugs are heating and are too cool for efficient and reliable engine starting, the wait-to-start indicator will be illuminated. The indicator remains illuminated until the cluster receives a wait-to-start lamp-off message or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the wait-to-start indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the ambient air temperature and the glow plug pre-heater circuits to determine how long the glow plugs should be energized in their pre-heat operating mode. The PCM then sends the proper wait-to-start lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the wait-to-start indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the glow plug pre-heater control circuits, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the wait-to-start indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# WASHER FLUID INDICATOR

## DESCRIPTION




A washer fluid indicator is standard equipment on all instrument clusters. This indicator is located within the odometer/trip odometer Vacuum Fluorescent Display (VFD) unit. However, on models equipped with the optional Electronic Vehicle Information Center (EVIC) the washer fluid indicator in the odometer VFD is electronically suppressed so as not to duplicate indications that are provided by the EVIC.

The washer fluid indicator consists of the text "LOWASH", which appears in place of the odometer/trip odometer information in the odometer VFD unit. The odometer VFD is soldered onto the cluster electronic circuit board and is visible through a window with a smoked clear lens located on the lower edge of the tachometer gauge dial face of the cluster overlay. The dark lens over the VFD prevents the indicator from being clearly visible when it is not illuminated. The "LOWASH" text appears in the same blue-green color and at the same lighting level as the odometer/trip odometer information when it is illuminated by the instrument cluster electronic circuit board.

The washer fluid indicator is serviced as a unit with the instrument cluster.

## OPERATION

The washer fluid indicator gives an indication to the vehicle operator that the fluid level in the washer reservoir is low. This indicator is controlled by the instrument cluster logic circuit based upon cluster programming and a hard wired input received by the cluster from the washer fluid level switch mounted on the washer reservoir.

The washer fluid indicator function of the Vacuum Fluorescent Display (VFD) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the VFD washer fluid indication will always be off when the ignition switch is in any position except On or Start. The instrument cluster will turn on the washer fluid indicator for the following reasons:

- **Washer Fluid Level Switch Input -** Each time the cluster detects ground on the low washer fluid sense circuit (washer fluid level switch closed = washer fluid level low) the cluster applies an algorithm to ensure that the input is correct and not the result of fluid sloshing in the washer reservoir. The cluster tests the status of the circuit about seven milliseconds after the ignition switch is turned to the On position, and about once every second thereafter, then uses an internal counter to count up or down. When the counter accumulates 30 ground inputs on the circuit, the washer fluid indicator will be illuminated. If the vehicle is not moving when the washer fluid level switch input counter reaches 30, the VFD will repeatedly and sequentially cycle its low washer fluid indication in two second intervals with the odometer/trip odometer information and any other active warnings including: door ajar, gate ajar, and glass ajar. If the vehicle is moving, or once the cluster of a non-moving vehicle receives an electronic vehicle speed message from the Powertrain Control Module (PCM) indicating a speed greater than zero, the warning sequence will consist of 15 complete display cycles with an audible single chime tone accompanying each of the first two cycles, then revert to only the odometer/trip odometer display. Once the washer fluid indicator warning has completed, the washer fluid indicator is extinguished and will not repeat until the ignition switch is cycled. The VFD can be reverted to the odometer display and any currently displayed textual messages suspended by momentarily depressing and releasing the odometer/trip odometer reset switch button on the front of the cluster.

The instrument cluster continually monitors the washer fluid level switch in the washer reservoir to determine the status of the washer fluid level. For further diagnosis of the washer fluid indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

The washer fluid level switch and circuits can be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information. The washer fluid level switch also features a 3.3 kilohm diagnostic resistor connected in parallel between the switch input and output to provide the cluster with verification that the low washer fluid sense circuit is not open or shorted. This input can be monitored using a diagnostic scan tool. Refer to the appropriate diagnostic information.

# WATER-IN-FUEL INDICATOR

## DESCRIPTION

A water-in-fuel indicator is only found in the instrument clusters of vehicles equipped with an optional diesel engine. This indicator is located above the coolant temperature gauge and to the right of the tachometer in the cluster overlay.

The water-in-fuel indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Water In Fuel” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board.

The water-in-fuel indicator is serviced as a unit with the instrument cluster.

## OPERATION

The water-in-fuel indicator gives an indication to the vehicle operator when there is excessive water in the fuel system. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus.

The water-in-fuel indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the water-in-fuel indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the water-in-fuel indicator is illuminated for about three seconds as a bulb test.
- **Water-In-Fuel Lamp-On Message** - Each time the cluster receives a water-in-fuel lamp-on message from the PCM indicating there is excessive water in the diesel fuel system, the water-in-fuel indicator will be illuminated. The indicator remains illuminated until the cluster receives a water-in-fuel lamp-off message, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the water-in-fuel indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the water-in-fuel sensor to determine whether there is excessive water in the diesel fuel. The PCM then sends the proper water-in-fuel lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the water-in-fuel indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

For proper diagnosis of the water-in-fuel-sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the water-in-fuel indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# LAMPS

## TABLE OF CONTENTS



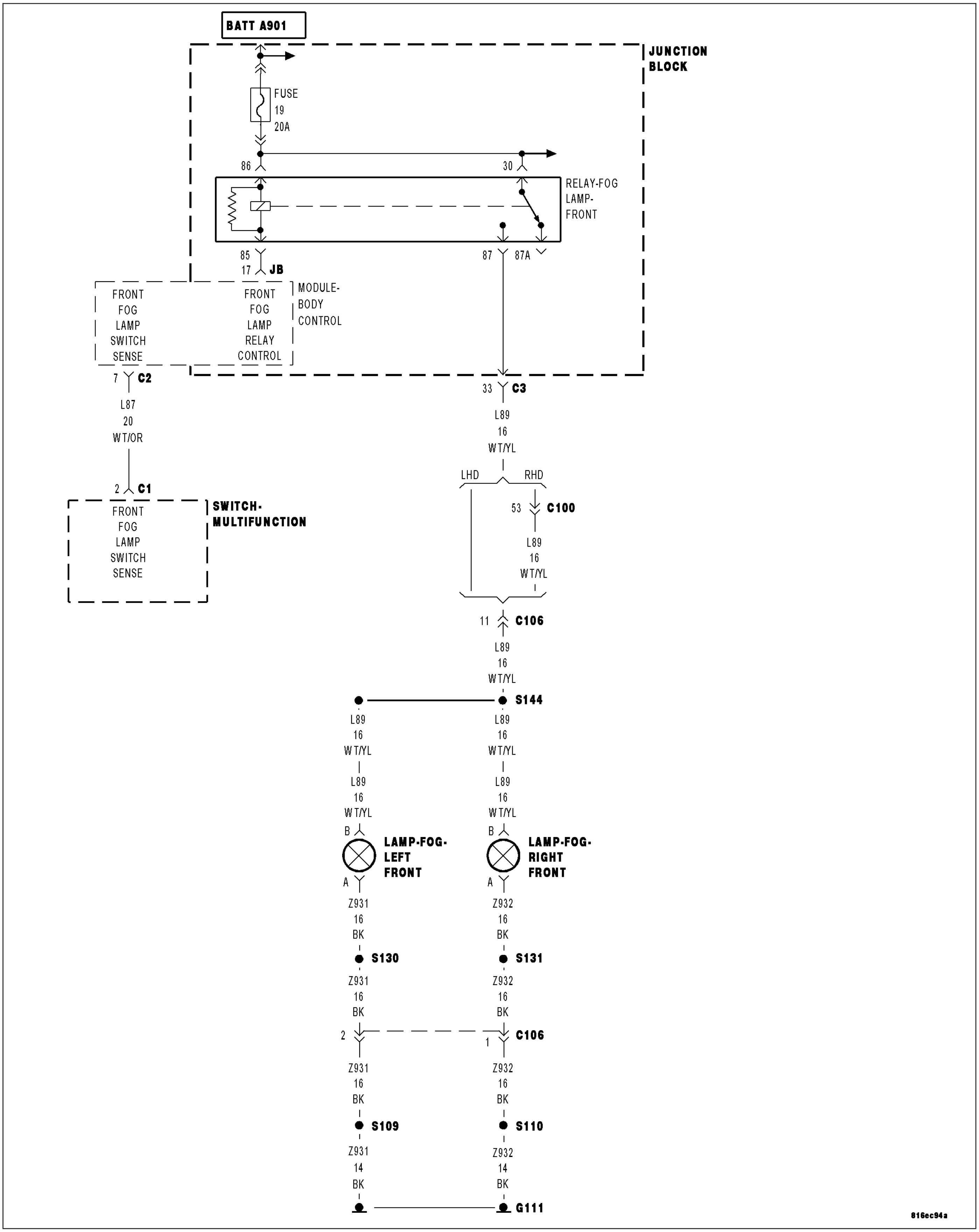
## LAMPS/LIGHTING - EXTERIOR - ELECTRICAL DIAGNOSTICS

### TABLE OF CONTENTS

# LAMPS/LIGHTING - EXTERIOR - ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## FRONT FOG RELAY CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  BCM detects battery on the Front Fog Relay when it is attempting to turn on the Front Fog Lamps for more than 5 seconds. The BCM learns that the Front Fog Options exists on a vehicle when it detects a ground on the Front Fog Switch Input circuit.

| Possible Causes |
|---|
| MISSING RELAY |
| OPEN FUSE |
| FOG LAMP RELAY |
| BODY CONTROL MODULE |
| FOG LAMP RELAY CONTROL CIRCUIT OPEN |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all BCM DTC's.

Turn the Fog Lamps on.

With the Scan Tool, read the DTC information.

**Does the Scan Tool read: FRONT FOG RELAY CKT HIGH?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. MISSING RELAY

Turn the ignition off.

Check the Junction Block to make certain the Fog Lamp Relay is present.

**Is the Fog Lamp Relay present?**

**Yes** >> Go To 3

**No** >> Replace the missing Fog Lamp Relay.
Perform BODY VERIFICATION TEST - VER 1.

### 3. OPEN FUSE

Turn the ignition off.

Check Junction Block fuse 19.

**Is the fuse open?**

**Yes** >> Replace the open fuse.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. FOG LAMP RELAY

Turn the ignition off.
Install a known good relay in place of the fog lamp relay.
Turn the Fog Lamps On.

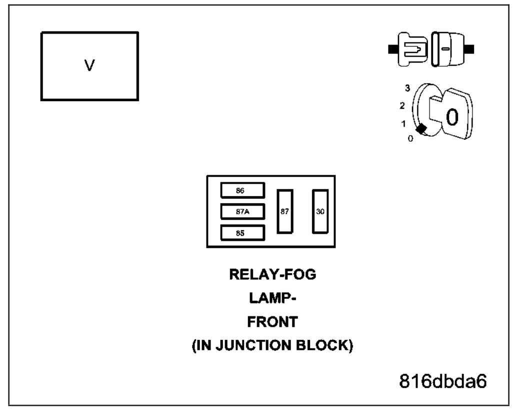
**Do the Fog Lamps operate normally?**

**Yes** >> Replace the Fog Lamp Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. BODY CONTROL MODULE

Turn the ignition off.
Remove the Fog Lamp Relay.
Measure the voltage of the Fused B+ circuit of the fog lamp relay.

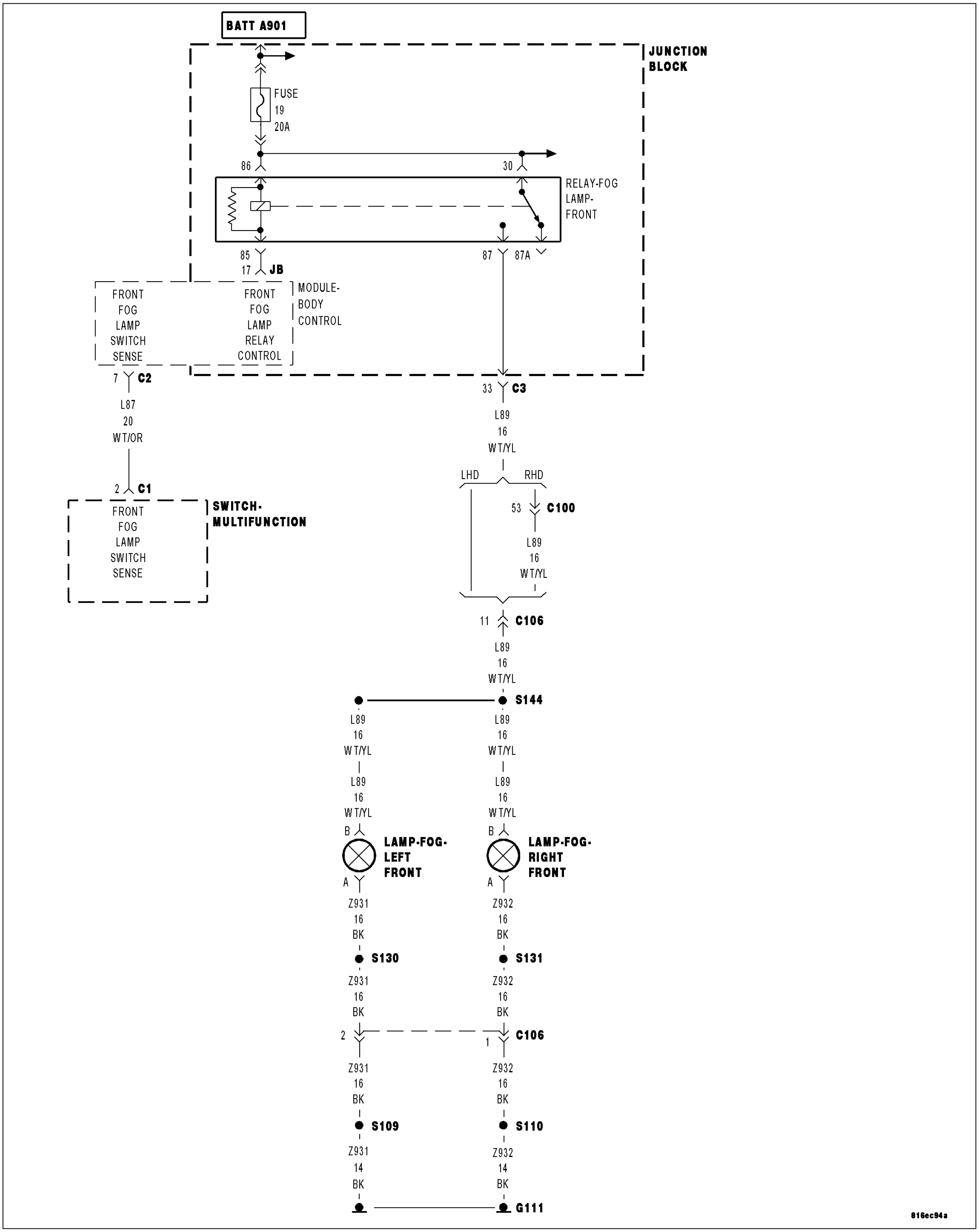



**Is the voltage above 10 volts?**

**Yes** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the Fog Lamp Relay Control Circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

## FRONT FOG RELAY CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  BCM detects a low (ground) on the Front Fog Relay even though it is not attempting to turn on the Front Fog Lamps for more than 5 seconds.

| Possible Causes |
| --- |
| FRONT FOG RELAY SHORT TO GROUND |
| FRONT FOG RELAY |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all BCM DTC's.

Turn the Fog Lamps on.

With the Scan Tool, read the DTC information.

**Does the Scan Tool read: FRONT FOG RELAY CKT LOW?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor Scan Tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.

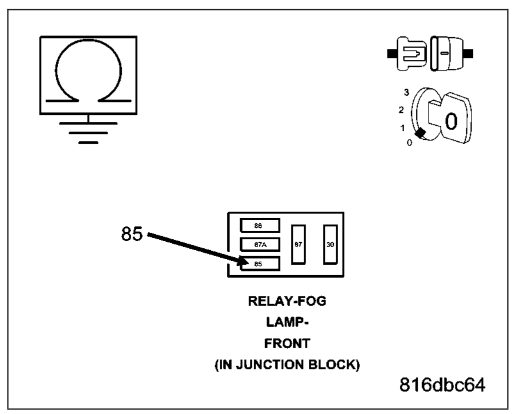
Perform BODY VERIFICATION TEST - VER 1.

### 2. FRONT FOG RELAY SHORT TO GROUND

Turn the ignition off.

Disconnect the Front Fog Relay.

Measure the resistance between ground and the Front Fog Relay Control circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the Front Fog Relay Control circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1.

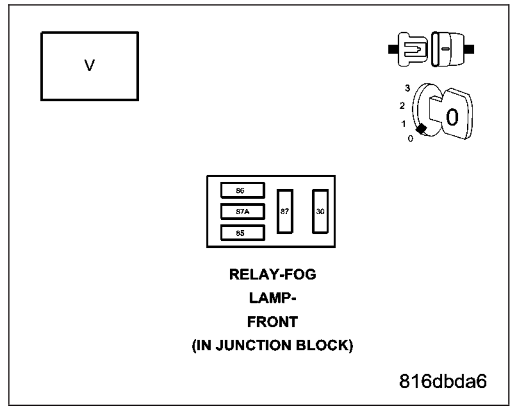
**No** >> Go To 3

## 3. FRONT FOG RELAY

Turn the ignition off.

Disconnect the Front Fog Relay harness connector.

Measure the voltage of the Front Fog Relay harness connector coil side feed circuit to ground.




**Is the voltage above 10.0 volts?**

**Yes** >> Replace the Fog Lamp Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

## HEADLAMP SWITCH INPUT CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The BCM detects a voltage greater than 4.75 V on the Headlamp Switch Input for more than 5 seconds.

| Possible Causes |
| --- |
| HEADLAMP SWITCH OPEN |
| HEADLAMP SWITCH MUX CIRCUIT OPEN |
| HEADLAMP SWITCH RETURN CIRCUIT OPEN |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, erase all BCM DTC's.

Turn the headlamps to the ON position.

With the Scan Tool, read DTCs.

**Does the Scan Tool display: HEADLAMP SWITCH INPUT CKT HIGH?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor Scan Tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. HEADLAMP SWITCH OPEN

Turn the ignition off.

Disconnect the Multifunction Switch harness connector.

Connect a jumper wire between the Headlamp Switch MUX circuit and the Headlamp Switch Return circuit in the Multifunction Switch harness connector.

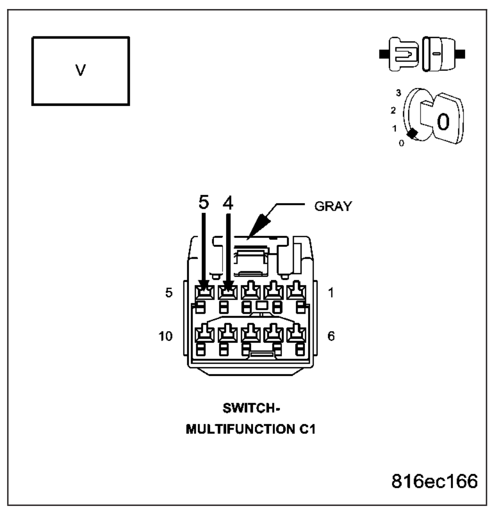
Turn the ignition on.

With the Scan Tool, select Body, Body Controller and read: Headlamp Switch volts.

**Does the Scan Tool display Headlamp Switch voltage below 0.5 volts?**

**Yes** >> Replace the Headlamp Switch.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3



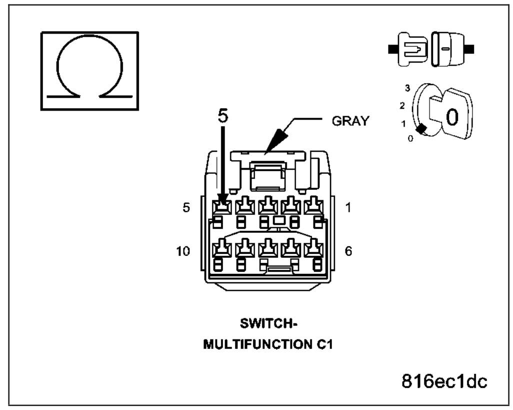
## 3. HEADLAMP SWITCH MUX CIRCUIT OPEN

Turn the ignition off.

Disconnect the Body Control Module harness connector.

Disconnect the Multifunction Switch harness connector.

Measure resistance of the Headlamp Switch MUX circuit from the Body Control Module connector to the Multifunction Switch harness connector.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the Headlamp Switch MUX circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

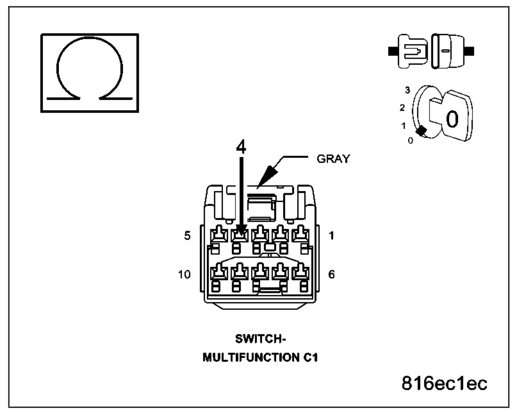
## 4. HEADLAMP SWITCH RETURN CIRCUIT OPEN

Turn the ignition off.

Disconnect the Body Control Module harness connector.

Disconnect the Multifunction Switch C1 harness connector.

Measure resistance of the Headlamp Switch Return circuit from the Body Control Module connector to the Multifunction Switch harness connector.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the Headlamp Switch Return circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

# HEADLAMP SWITCH INPUT CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  BCM detects a voltage less than 0.25 volts on the Headlamp Switch Input for more than 5 seconds.

| Possible Causes |
|---|
| HEADLAMP SWITCH SHORTED |
| HEADLAMP SWITCH MUX CIRCUIT SHORT TO RETURN CIRCUIT |
| HEADLAMP SWITCH MUX CIRCUIT SHORT TO GROUND |
| HEADLAMP SWITCH RETURN CIRCUIT SHORT TO GROUND |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all BCM DTC's.

Turn the headlamps to the ON position.

With the Scan Tool, read DTCs.

**Does the Scan Tool display: HEADLAMP SWITCH INPUT CKT LOW?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor Scan Tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.

Perform BODY VERIFICATION TEST - VER 1.

### 2. HEADLAMP SWITCH SHORTED

Turn the ignition off.

Disconnect the Multifunction Switch harness connector.

Turn the ignition on.

With the Scan Tool, select Body, Body Control Module and read: Headlamp Switch voltage.

**Does the Scan Tool display Headlamp Switch voltage above 4.8 volts?**

**Yes** >> Replace the Multifunction Switch.

Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. HEADLAMP SWITCH MUX CIRCUIT SHORT TO MUX RETURN CIRCUIT

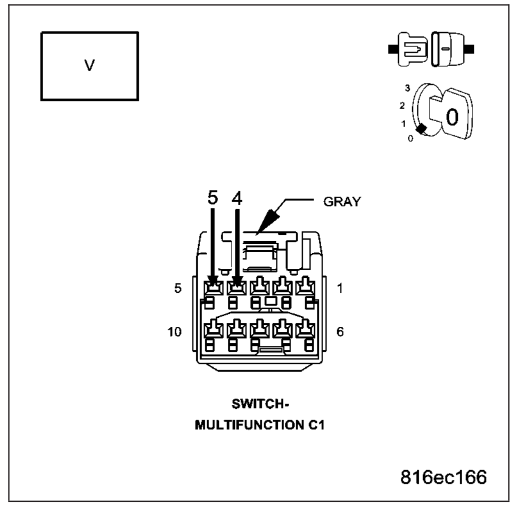
Turn the ignition off.

Disconnect the Body Control Module harness connector.

Disconnect the Multifunction Switch harness connector.

Measure resistance between the Headlamp Switch Return circuit and the Headlamp Switch MUX circuit.

**Is the resistance below 5.0 ohms?**




**Yes** >> Repair the Headlamp Switch MUX circuit for a short to the Headlamp Switch Return circuit.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. HEADLAMP SWITCH MUX CIRCUIT SHORT TO GROUND

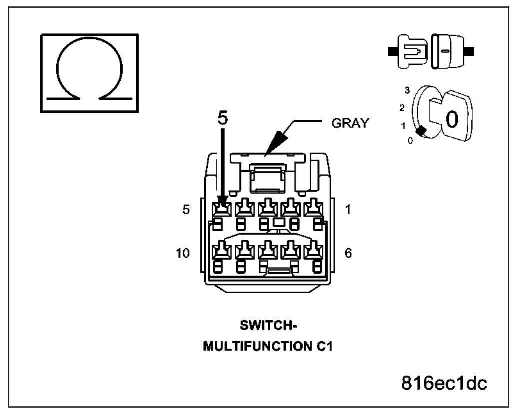
Turn the ignition off.

Disconnect the Body Control Module harness connector.

Disconnect the Multifunction Switch harness connector.

Measure resistance between ground and the Headlamp Switch MUX circuit.

**Is the resistance above 5.0 ohms?**




**Yes** >> Repair the Headlamp Switch MUX Circuit for a short to ground condition.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. HEADLAMP SWITCH RETURN CIRCUIT SHORT TO GROUND

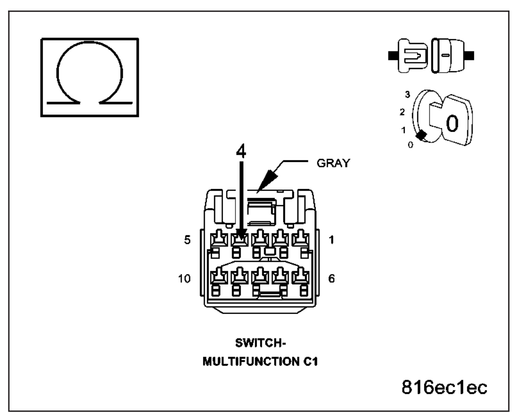
Turn the ignition off.

Disconnect the Body Control Module harness connector.

Disconnect the Multifunction Switch harness connector.

Measure resistance between ground and the Headlamp Switch Return circuit.

**Is the resistance below 5.0 ohms?**




**Yes** >> Repair the Headlamp Switch Return Circuit for a short to ground condition.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

## HIGH BEAM RELAY CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  BCM detects battery on the High Beam Relay when it is attempting to turn on the High Beams for more than 5 seconds.

| Possible Causes |
|---|
| MISSING RELAY |
| OPEN FUSE |
| HIGH BEAM RELAY |
| MULTIFUNCTION SWITCH |
| HIGH BEAM SWITCH SENSE CIRCUIT OPEN |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the Scan Tool, clear all BCM DTC's.

Turn the High Beams on.

With the Scan Tool, read the DTC information.

**Does the Scan Tool read: HIGH BEAM RELAY CIRCUIT HIGH?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. MISSING RELAY

Turn the ignition off.

Check the Junction Block to make certain the High Beam Relay is present.

**Is the High Beam Relay present?**

**Yes** >> Go To 3

**No** >> Replace the missing High Beam Relay.
Perform BODY VERIFICATION TEST - VER 1.

### 3. OPEN FUSE

Turn the ignition off.

Check the Junction Block High Beam fuses 26 and 27.

**Are any of the fuses open?**

**Yes** >> Replace the open fuse.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. HIGH BEAM RELAY

Turn the ignition off.

Install a known good relay in place of the High Beam Relay.

Turn the High Beams On.

**Do the High Beams operate normally?**

**Yes** >> Replace the High Beam Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 5

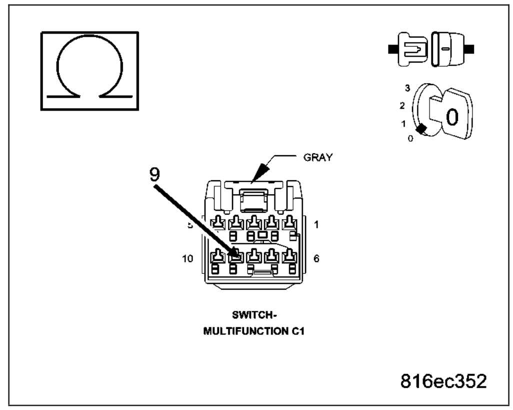
## 5. MULTIFUNCTION SWITCH

Turn the ignition off.

Disconnect the Multifunction Switch harness connector C1.

Disconnect the BCM C2 connector.

Measure the resistance of the High Beam Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Multifunction Switch.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the High Beam Switch Sense circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

## *LOW BEAM HEADLAMPS INOPERATIVE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Possible Causes
- **Set Condition:**
  Possible Causes

| Possible Causes |
|---|
| LOW BEAM RELAY |
| OPEN FUSED B+ CIRCUIT |
| LOW BEAM RELAY CONTROL CIRCUIT |
| LOW BEAM RELAY |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the Low Beams on.

**Do the Low Beam Headlamps operate properly?**

**Yes** >> The condition is not present at this time. Monitor Scan Tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 2

### 2. LOW BEAM RELAY

Remove the Low Beam Relay from the Junction Block.

Install a known good relay in place of the Low Beam Relay.

With the Scan Tool, actuate the Low Beam Relay.

**Do the Headlamps flash while actuating the Low Beam Relay?**

**Yes** >> Replace the Low Beam Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. OPEN FUSED B(+) CIRCUIT

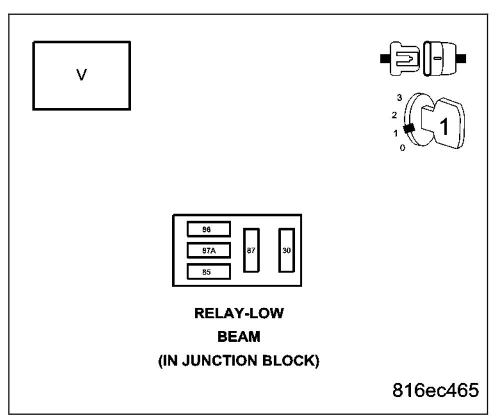
Remove the Low Beam Relay from the Junction Block.

Measure the voltage of the Fused B(+) circuit at the Low Beam Relay connector.

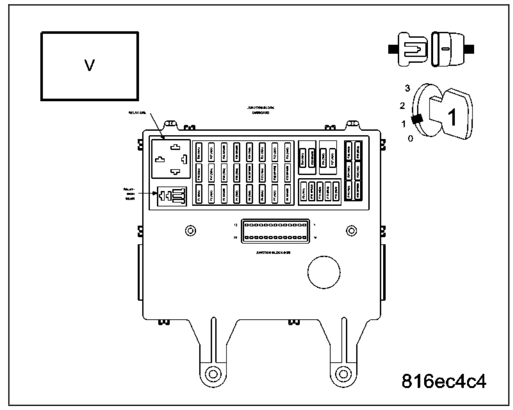
**Is the voltage above 10.0 volts?**

**Yes** >> Go To 4

**No** >> Repair the open fused B+ circuit.
Perform BODY VERIFICATION TEST - VER 1.



## 4. LOW BEAM RELAY CONTROL CIRCUIT




Remove the BCM from the junction block.

Connect a jumper wire between the Fused B(+) circuit and the Low Beam Relay Control circuit at the Low Beam Relay connector.

Measure the voltage of the Low Beam Relay Control circuit to the BCM Junction Block connector.

**Is the voltage above 10.0 volts?**

**Yes** >> Go To 5

**No** >> Repair the Low Beam Relay Control circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

## 5. LOW BEAM HEADLAMP RELAY

Disconnect the jumper wire.

Reinstall the Low Beam Relay in the Junction Block.

Remove the BCM from the junction block.

Measure the voltage of the Low Beam Relay Control circuit to the BCM internal connector.

**Is the voltage above 10.0 volts?**

**Yes** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Low Beam Relay.
Perform BODY VERIFICATION TEST - VER 1.

## LOW BEAM RELAY CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With ignition on
- **Set Condition:**
  BCM detects battery on the Low Beam Relay when it is attempting to turn on the Low Beams for more than 5 seconds.

| Possible Causes |
|---|
| MISSING RELAY |
| OPEN FUSE |
| LOW BEAM RELAY |
| BODY CONTROL MODULE |
| FUSED LOW BEAM RELAY OUTPUT CIRCUIT OPEN |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC's.

Turn the Low Beams on.

With the scan tool, read the DTC information.

**Does the scan tool read: LOW BEAM RELAY CIRCUIT HIGH?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. MISSING RELAY

Turn the ignition off.

Check the Junction Block to make certain the Low Beam Relay is present.

**Is the Low Beam Relay present?**

**Yes** >> Go To 3

**No** >> Replace the missing Low Beam Relay.
Perform BODY VERIFICATION TEST - VER 1.

### 3. OPEN FUSE

Turn the ignition off.

Check the Junction Block Low Beam fuses 4 and 5.

**Are any of the fuses open?**

**Yes** >> Replace the open fuse.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. LOW BEAM RELAY

Turn the ignition off.
Install a known good relay in place of the Low Beam Relay.
Turn the Low Beams On.

**Do the Low Beams operate normally?**

**Yes** >> Replace the Low Beam Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. BODY CONTROL MODULE

Turn the ignition off
Remove the Low Beam Relay.
Measure the voltage of the Fused B+ circuit of the Low Beam Relay.

**Is the voltage above 10 volts?**

**Yes** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the Fused Low Beam Relay Output circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

## LOW BEAM RELAY CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  BCM detects a low (ground) on the Low Beam Relay even though it is not attempting to turn on the Low Beams for more than 5 seconds.

| Possible Causes |
|---|
| LOW BEAM RELAY SHORT TO GROUND |
| LOW BEAM RELAY |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC's.

Turn the Low Beams on.

With the scan tool, read the DTC information.

**Does the scan tool read: LOW BEAM RELAY CKT LOW?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor DRBIII parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. LOW BEAM RELAY SHORT TO GROUND

Turn the ignition off.

Disconnect the Low Beam Relay.

Measure the resistance between ground and the Low Beam Relay Control circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the Low Beam Relay Control circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. LOW BEAM RELAY

Turn the ignition off.

Disconnect the Low Beam Relay harness connector.

Measure the voltage of the Low Beam Relay harness connector coil side feed circuit to ground.

**Is the voltage above 10.0 volts?**

**Yes** >> Replace the Low Beam Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

## PARK LAMP RELAY CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  BCM detects battery on the Park Lamp Relay when it is attempting to turn on the Park Lamps for more than 5 seconds.

| Possible Causes |
|---|
| MISSING RELAY |
| OPEN FUSE |
| PARK LAMP RELAY |
| BODY CONTROL MODULE |
| FUSED PARK LAMP RELAY OUTPUT CIRCUIT OPEN |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC's.

Turn the Park Lamps on.

With the scan tool, read the DTC information.

**Does the scan tool read: PARK LAMP RELAY CKT HIGH?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. MISSING RELAY

Turn the ignition off.

Check the Junction Block to make certain the Park Lamp Relay is present.

**Is the Park Lamp Relay present?**

**Yes** >> Go To 3

**No** >> Replace the missing Park Lamp Relay.
Perform BODY VERIFICATION TEST - VER 1.

### 3. OPEN FUSE

Turn the ignition off.

Check the Junction Block Park Lamp fuses 23 and 9.

**Are any of the fuses open?**

**Yes** >> Replace the open fuse.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. PARK LAMP RELAY

Turn the ignition off.
Install a known good relay in place of the Park Lamp Relay.
Turn the Park Lamps On.

**Do the Park Lamps operate normally?**

**Yes** >> Replace the Park Lamp Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. BODY CONTROL MODULE

Turn the ignition off.
Remove the Park Lamp Relay.
Measure the voltage of the Fused B+ circuit of the Park Lamp Relay.

**Is the voltage above 10 volts?**

**Yes** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the Fused Park Lamp Relay Output circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

## PARK LAMP RELAY CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  BCM detects a low (ground) on the Park Lamp Relay even though it is not attempting to turn on the Park Lamps for more than 5 seconds.

| Possible Causes |
| --- |
| PARK LAMP RELAY SHORT TO GROUND |
| PARK LAMP RELAY |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC’s.

Turn the Park Lamps on.

With the scan tool, read the DTC information.

**Does the scan tool read: PARK LAMP RELAY CKT LOW?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. PARK LAMP RELAY SHORT TO GROUND

Turn the ignition off.

Disconnect the Park Lamp Relay.

Measure the resistance between ground and the Park Lamp Relay Control circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the Park lamp Relay Control circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. PARK LAMP RELAY

Turn the ignition off.

Disconnect the Park Lamp Relay harness connector.

Measure the voltage of the Park Lamp Relay harness connector coil side feed circuit to ground.

**Is the voltage above 10.0 volts?**

**Yes** >> Replace the Park Lamp Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

## REAR FOG RELAY CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  BCM detects battery on the Rear Fog Relay when it is attempting to turn on the Front Fog Lamps for more than 5 seconds. The BCM is programmed per Country Code whether or not a vehicle is equipped with a Rear Fog Relay.

| Possible Causes |
|---|
| MISSING RELAY |
| OPEN FUSE |
| FOG LAMP RELAY |
| BODY CONTROL MODULE |
| FOG LAMP RELAY CONTROL CIRCUIT OPEN |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC's.

Turn the Fog Lamps on.

With the scan tool, read the DTC information.

**Does the scan tool read: REAR FOG RELAY CIRCUIT HIGH?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. MISSING RELAY

Turn the ignition off.

Check the Junction Block to make certain the Rear Fog Lamp Relay is present.

**Is the Rear Fog Lamp Relay present?**

**Yes** >> Go To 3

**No** >> Replace the missing Fog Lamp Relay.
Perform BODY VERIFICATION TEST - VER 1.

### 3. OPEN FUSE

Turn the ignition off.

Check Junction Block fuse 2.

**Is the fuse open?**

**Yes** >> Replace the open fuse.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. FOG LAMP RELAY

Turn the ignition off.

Install a known good relay in place of the Rear Fog Lamp Relay.

Turn the Fog Lamps On.

**Do the Rear Fog Lamps operate normally?**

**Yes** >> Replace the Fog Lamp Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. BODY CONTROL MODULE

Turn the ignition off.

Remove the Fog Lamp Relay.

Measure the voltage of the Fused B+ circuit of the Fog Lamp Relay.

**Is the voltage above 10 volts?**

**Yes** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the Fog Lamp Relay Control Circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

## REAR FOG RELAY CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  BCM detects a low (ground) on the Fog Relay even though it is not attempting to turn on the Rear Fog Lamps for more than 5 seconds.

| Possible Causes |
|---|
| LOW BEAM RELAY |
| OPEN FUSED B+ CIRCUIT |
| LOW BEAM RELAY CONTROL CIRCUIT |
| LOW BEAM RELAY |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC's.

Turn the Fog Lamps on.

With the scan tool, read the DTC information.

**Does the scan tool read: Rear Fog Relay Circuit Low?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. REAR FOG RELAY SHORT TO GROUND

Turn the ignition off.

Disconnect the Rear Fog Relay.

Measure the resistance between ground and the Rear Fog Relay Control circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the Rear Fog Relay Control circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. REAR FOG RELAY

Turn the ignition off.

Disconnect the Rear Fog Relay harness connector from the Junction Block.

Measure the voltage of the Rear Fog Relay harness connector coil side feed circuit to ground.

**Is the voltage above 10.0 volts?**

**Yes** >> Replace the Rear Fog Lamp Relay.
Perform BODY VERIFICATION TEST - VER 1.

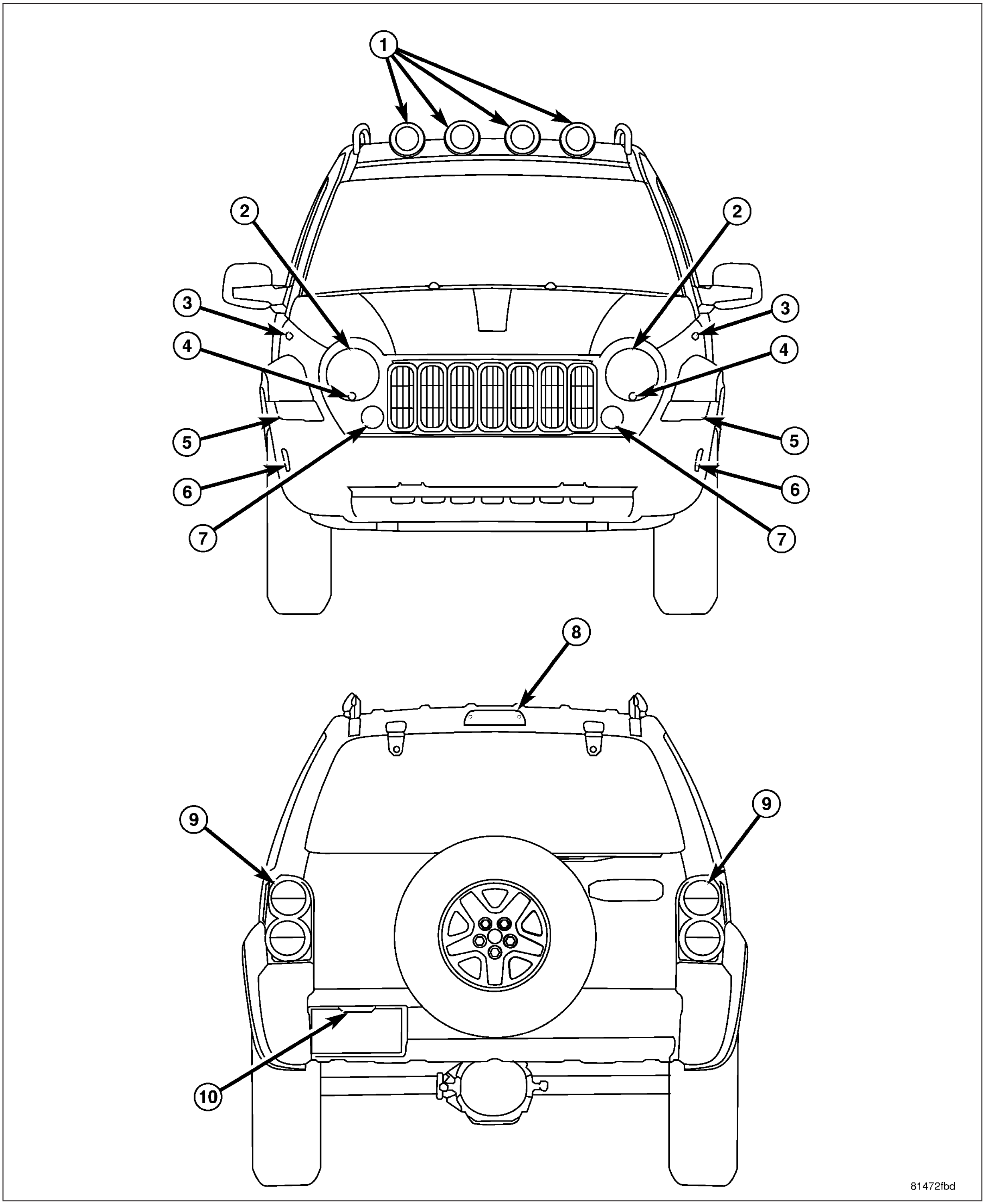
**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

# LAMPS/LIGHTING - EXTERIOR

## TABLE OF CONTENTS

# LAMPS/LIGHTING - EXTERIOR

## DESCRIPTION



The exterior lighting system for this vehicle includes the following exterior lamp units:

- **Center High Mounted Stop Lamp (8)** - A standard equipment Center High Mounted Stop Lamp (CHMSL) is centered on the rear edge of the roof panel above the flip-up glass opening at the rear of the vehicle.
- **Front Fog Lamps (7)** - Two optional front fog lamps are available on this vehicle, grille opening panel mounted fog lamp units with an adjustable reflector that are secured behind a dedicated opening on each side of the grille panel below and inboard of the headlamps; or, free standing fascia mounted lamps with an adjustable mounting bracket that are secured to the upper horizontal surface of the front fascia below and inboard of the headlamps.
- **Front Park Lamps (5)** - A standard equipment front park lamp unit is mounted high at each outboard end of the front fascia.
- **Front Position Lamps (4)** - A front position lamp is integral to each headlamp unit in certain markets where they are required.
- **Front Side Marker Lamps/Reflectors (6)** - A front side marker lamp unit is mounted low on each outward facing outboard end of the front fascia. In certain markets where the side repeater lamp is required, the bulb and socket is deleted from the front side marker lamp and only the lamp housing with its reflective lens is used.
- **Headlamps (2)** - Standard equipment round headlamp units with a fixed lens and an adjustable reflector are secured to the grille opening panel at each side of the front grille. In certain markets where required, a headlamp leveling actuator motor and/or a front position lamp is/are integral to each headlamp.
- **License Plate Lamps (10)** - Vehicles with a license plate tub integral to the left side of the rear fascia have a single rear license plate lamp unit mounted to the underside of the upper horizontal wall of the fascia tub formation. Vehicles with a license plate bracket secured to the spare tire carrier have two rear license plate lamps mounted to the underside of the upper horizontal wall of the tub formation in the bracket.
- **Light Bar Lamps (1)** - Vehicles equipped with this option have a light bar mounted to the roof panel just rearward of the upper windshield opening header. Depending upon the market the vehicle is manufactured for, the light bar incorporates either two or four individually adjustable, forward-facing, auxiliary lamp units.
- **Rear Lamp Units (9)** - A standard equipment rear lamp unit is mounted to the rear of each quarter panel on either side of the tailgate opening.
- **Side Repeater Lamps (3)** - A side repeater lamp is mounted to each front fender just behind the front wheel in certain markets where they are required.
- **Rear Reflectors** - In certain markets where they are required, two rectangular, red reflectors are located on the rear bumper fascia, one just inboard and below each rear lamp unit.

These exterior lighting lamp units and their controls are combined to provide the following exterior lighting features:

- **Auxiliary (Off-Road) Lamps** - On vehicles equipped with the light bar lamp option, the auxiliary (off-road) light bar lamps include the clear bulbs, reflectors and clear lenses of each of the two or four adjustable lamps integral to the light bar.
- **Backup Lamps** - The backup (or reverse) lamps include a clear bulb, reflector and clear lens that are integral to each rear lamp unit.
- **Brake Lamps** - The brake (or stop) lamps include the clear bulbs, reflectors and red lenses that are integral to each rear lamp unit and the CHMSL.
- **Daytime Running Lamps** - Vehicles manufactured for sale in Canada illuminate the high beam filament of each headlamp bulb at a reduced intensity to serve as the Daytime Running Lamps (DRL).
- **Front Fog Lamps** - Both optional front fog lamps include the bulb, reflector and lens of each adjustable front fog lamp unit.
- **Hazard Warning Lamps** - The hazard warning lamps include the bulbs, reflectors and lenses of each lamp in the right and left, front and rear turn signal circuits.
- **Headlamps** - The headlamps include a single, dual filament halogen bulb, an adjustable reflector and a clear lens integral to each headlamp unit.
- **Headlamp Leveling** - Headlamp leveling is available only in certain markets where it is required equipment. A headlamp leveling actuator motor on each headlamp unit and a headlamp leveling switch mounted on the instrument panel allow the vertical axis of the headlamp beam pattern to be adjusted by the vehicle operator from the interior of the vehicle to compensate for passenger or cargo load.
- **Optical Horn** - Also known as flash-to-pass, the beam selection function of the multi-function switch left (lighting) control stalk has a momentary intermediate position that allows the headlamp high beams to be flashed momentarily, without changing the headlamp beam selection.

- **Park Lamps** - The front park lamps include either the clear bulbs, the reflectors and the amber lenses of the front park lamp units or the clear position lamp bulb integral to each headlamp unit. Vehicles not equipped with repeater lamp units have front side marker lamps. The bulbs are removed from the front side marker lamps on vehicles with repeater lamps so that they serve only as reflectors. The rear park lamps include a clear bulb, a reflector and a red lens integral to each rear lamp unit as well as the clear bulb and lens of the license plate lamp unit or units.
- **Rear Fog Lamps** - Rear fog lamps are available only in certain markets where they are required equipment. The rear fog lamps include a clear bulb, a reflector and a red lens that are integral to each rear lamp unit.
- **Turn Signal Lamps** - The front turn signal lamps include a clear bulb, a reflector, and an amber lens that are integral to each front park lamp unit and the front side marker lamps. In certain markets where required, the repeater lamps on each front fender replace the front side marker lamps in the front turn signal circuits. The rear turn signal lamps include an amber bulb, a reflector and a clear lens that are integral to each rear lamp unit.

Other components of the exterior lighting system for this vehicle include:

- **Backup Lamp Switch** - Vehicles equipped with a manual transmission have a plunger-type backup lamp switch located on the transmission housing. A Transmission Range Sensor (TRS) integral to the solenoid pack on the valve body of the optional electronic automatic transmission performs the backup lamp switch function on vehicles that are so equipped.
- **Body Control Module** - The Body Control Module (BCM) is located on the Junction Block (JB) under the driver side outboard end of the instrument panel. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/BODY CONTROL MODULE - DESCRIPTION).
- **Brake Lamp Switch** - A plunger-type brake lamp switch is located on the steering column support bracket under the instrument panel and is actuated by the brake pedal arm when the brake pedal is depressed.
- **Combination Flasher** - An electronic combination turn signal and hazard warning flasher is integral to the hazard warning switch in the center of the instrument panel.
- **Daytime Running Lamp Relay** - Vehicles manufactured for sale in Canada use a solid state Daytime Running Lamps (DRL) relay installed in the Junction Block (JB) instead of the conventional high beam relay.
- **Front Fog Lamp Relay** - Vehicles equipped with the optional front fog lamps have a front fog lamp relay located in the Junction Block (JB).
- **Hazard Switch** - The hazard switch is located near the center of the instrument panel and includes the electronic combination flasher circuitry for the hazard warning system and the turn signal system.
- **Headlamp Leveling Motor** - A headlamp leveling actuator motor is located on the back of each headlamp housing of vehicles manufactured for certain markets where the headlamp leveling feature is required.
- **Headlamp Leveling Switch** - A thumbwheel actuated four-position headlamp leveling switch is mounted in the driver side instrument panel bezel of vehicles manufactured for certain markets where the headlamp leveling feature is required.
- **High Beam Relay** - A high beam relay is located in the Junction Block (JB) of all vehicles except those that are manufactured for sale in Canada. Canadian vehicles have a solid state Daytime Running Lamps (DRL) relay in the JB instead of the high beam relay.
- **Light Bar Lamp Switch** - A rocker actuated light bar lamp switch is mounted in the driver side instrument panel bezel of vehicles equipped with the optional light bar lamps.
- **Low Beam Relay** - A low beam relay is located in the Junction Block (JB) of all vehicles.
- **Multi-Function Switch** - The multi-function switch is located on the steering column, just below the steering wheel. The multi-function switch includes a left (lighting) control stalk and a right (wiper) control stalk. The left control stalk is dedicated to providing almost all of the driver controls for both the exterior and interior lighting systems.
- **Park Brake Switch** - A park brake switch is located on the park brake lever mechanism on the floor panel transmission tunnel between the two front seats.
- **Park Lamp Relay** - A park lamp relay is located in the Junction Block (JB) of all vehicles.
- **Rear Fog Lamp Relay** - Vehicles manufactured for certain markets where rear fog lamps are required equipment have a rear fog lamp relay located in the Junction Block (JB).
- **Trailer Tow Connector** - Vehicles equipped with a factory-installed trailer towing package have a heavy duty 7-way trailer tow connector installed in a bracket on the trailer hitch receiver.
- **Trailer Tow Relays** - Vehicles equipped with a factory-installed trailer towing package have a connector bank containing four relays located behind the right quarter trim panel. The four relays are used to supply fused

ignition switch output (run), brake lamps, right turn signal, and left turn signal outputs to a trailer through the trailer tow wiring and connectors. Refer to the appropriate wiring information.

- **Trailer Tow Wiring Adapter** - Vehicles equipped with a factory-installed trailer towing package have a wiring adapter provided that adapts the factory-installed heavy duty 7-way trailer tow connector to a conventional 4-way light duty connector.
- **Turn Signal Cancel Cam** - A turn signal cancel cam is integral to the clockspring of all vehicles.

Hard wired circuitry connects the exterior lighting system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the exterior lighting components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

## OPERATION

Following are paragraphs that briefly describe the operation of each of the major exterior lighting systems. The hard wired circuits and components of the exterior lighting systems may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the Body Control Module (BCM), the ElectroMechanical Instrument Cluster (EMIC), the Powertrain Control Module (PCM) or the Programmable Communications Interface (PCI) data bus. The most reliable, efficient, and accurate means to diagnose the BCM, the EMIC, the PCM, the PCI data bus or the electronic bus message inputs and outputs related to the various exterior lighting systems requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

### BACKUP LAMPS

The backup (or reverse) lamps have a path to ground at all times through a takeout and eyelet terminal of the rear lighting wire harness that is secured by a ground screw to the base of the right D-pillar behind the quarter trim panel. The backup lamps receive battery voltage from a fused ignition switch output (run) fuse on the back-up lamp feed circuit only when the backup lamp switch (manual transmission) or the Transmission Range Sensor (TRS - electronic automatic transmission) is closed by the gearshift mechanism within the transmission.

### BRAKE LAMPS

The brake (or stop) lamps have a path to ground at all times through the rear lighting harness and a takeout and eyelet terminal of the rear body wire harness that is secured by a ground screw at the base of the right D-pillar behind the quarter trim panel. The Center High Mounted Stop Lamp (CHMSL) has a path to ground at all times through a takeout and eyelet terminal of the rear body wire harness that is secured by a ground screw at the base of the driver side (left or right) D-pillar behind the quarter trim panel. The brake lamps and CHMSL receive battery voltage from a fuse in the Junction Block (JB) on the brake lamp switch output circuit when the brake lamp switch is closed by the brake pedal arm.

### DAYTIME RUNNING LAMPS

Vehicles manufactured for sale in Canada illuminate the high beam filament of both headlamp bulbs at a reduced intensity when the engine is running and the exterior lamps are turned off. This feature is enabled by the Body Control Module (BCM) and a solid state Daytime Running Lamps (DRL) relay, which is installed in the Junction Block (JB). The high beam relay is omitted from the JB on vehicles equipped with DRL.

When the BCM monitors an engine speed signal of greater than 450 rpm and the status of the exterior lighting switch input is Off, the BCM duty cycles the DRL relay to produce illumination of the headlamp high beam filaments at a reduced intensity. The BCM also provides normal headlamp high beam operation through the DRL relay on vehicles so equipped. When the DRL relay is energized, it provides battery voltage from a fused B(+) fuse in the JB to the headlamp high beam filament through the DRL relay output circuit.

### FRONT FOG LAMPS

Vehicles equipped with optional front fog lamps have a premium Body Control Module (BCM), a front fog lamp relay installed in the Junction Block (JB), and a front fog lamp switch integral to the left control stalk of the multi-function switch. The front fog lamps have a path to ground at all times through their connection to the front fascia wire harness from two take outs with eyelet terminals that are secured by ground screws to the left inner fender shield in the engine compartment.

The BCM controls front fog lamp operation by monitoring the exterior lighting switch input from the multi-function switch, then energizing or de-energizing the front fog lamp relay control coil. The BCM also sends the appropriate electronic message to the ElectroMechanical Instrument Cluster (EMIC) over the Programmable Communications Interface (PCI) data bus to control operation of the front fog lamp indicator.

When the front fog lamp relay is energized, it provides battery voltage from a fused B(+) fuse in the JB to the front fog lamps through the front fog lamp relay output circuit. The BCM provides a battery saver (load shedding) feature for the front fog lamps, which will turn these lamps off if they are left on for more than about eight minutes with the ignition switch in the Off position. In certain markets where required, the front fog lamps are also turned off by the BCM whenever the headlamp high beams are selected. Each front fog lamp includes an integral adjustment screw to be used for static aiming of the fog lamp beams.

## HAZARD WARNING LAMPS

With the hazard switch in the On position, the hazard warning system is activated causing the hazard switch button, the right and left turn signal indicators, and the right and left turn signal lamps to begin flashing on and off. When the hazard warning system is activated, the circuitry within the hazard switch and electronic combination flasher unit will repeatedly energize and de-energize two internal relays that switch battery voltage from a fused B(+) fuse in the Junction Block (JB) to the turn signal indicators and the turn signal lamps through the right and left turn signal circuits.

The flashing of the hazard switch button illumination lamp is performed internally by the hazard switch and combination flasher unit circuit board. The hazard warning lamps can also be energized by the Body Control Module (BCM) through a hazard lamp control circuit input to the hazard switch and combination flasher unit.

## HEADLAMPS

The headlamp system includes the Body Control Module (BCM), a low beam relay installed in the Junction Block (JB), a high beam relay installed in the JB (except Canada), a solid state Daytime Running Lamps (DRL) relay installed in the JB (Canada only), the exterior lighting switches integral to the left (lighting) control stalk of the multi-function switch, and the ElectroMechanical Instrument Cluster (EMIC). The headlamps have a path to ground at all times through the grille opening reinforcement wire harness and two take outs with eyelet terminals of the headlamp and dash wire harness that are secured by ground screws to the left inner fender shield in the engine compartment.

The BCM controls headlamp operation by monitoring the exterior lighting switch inputs from the multi-function switch, then energizing or de-energizing the low beam relay, the high beam relay or the solid state circuitry of the DRL relay. It also sends electronic messages to the EMIC over the Programmable Communications Interface (PCI) data bus to control operation of the high beam indicator. When each respective relay is energized, it provides battery voltage from a fuse in the Power Distribution Center (PDC) through a relay (low beam, high beam, or DRL) output circuit.

The BCM also provides a battery saver (load shedding) feature for the headlamps, which will turn these lamps off if they are left on for more than about eight minutes with the ignition switch in the Off position; and, a headlamp delay feature with optional delay intervals that can be programmed using a diagnostic scan tool. Each headlamp includes an integral reflector adjustment screw to be used for static aiming of the headlamp beams.

## HEADLAMP LEVELING

In certain markets where required, a headlamp leveling system is provided on the vehicle. The headlamp leveling system includes unique headlamp units equipped with a headlamp leveling actuator motor, and a rotary thumbwheel actuated headlamp leveling switch on the instrument panel. The headlamp leveling system allows the headlamp beams to be adjusted to one of four vertical positions to compensate for changes in inclination caused by the loading of the vehicle suspension.

The leveling motors are mechanically connected through an integral pushrod to the adjustable headlamp reflector. The headlamp leveling switch is a resistor multiplexed unit that provides one of four voltage outputs to the headlamp leveling motors. The headlamp leveling motors will move the headlamps to the selected position based upon the voltage input received from the switch. The headlamp leveling motors and switch have a path to ground at all times. The headlamp leveling components operate on battery voltage received through the fused park lamp relay output circuit so that the system will only operate when the exterior lighting is turned on.

## LIGHT BAR LAMPS

The optional light bar (auxiliary off-road) lamps system the Body Control Module (BCM), the light bar switch on the instrument panel, and the ElectroMechanical Instrument Cluster. For all North American markets, the light bar switch receives battery voltage on a fused ignition switch output (run-start) circuit, which enables the switch to energize the lamps whenever the ignition switch is in the On or Start positions. For markets outside of North America, the light bar switch receives battery voltage from the park lamp relay in the Junction Block (JB) on the park lamp relay output circuit, and monitors an input from the low beam driver output circuit of the low beam relay in the JB, which enables the switch to energize the light bar lamps only with the park lamps On and the low beam headlamps Off.

The light bar lamps have a path to ground at all times through a take out and eyelet terminal of the instrument panel wire harness that is secured by a nut to a ground stud on the left instrument panel end bracket (left-hand drive) or the center of the instrument panel support structure (right-hand drive). The light bar switch controls light bar lamp operation by providing battery voltage from a fused B(+) fuse in the Power Distribution Center (PDC) to the lamps on the lightbar switch output circuit. When the lightbar switch output circuit is energized, the light bar switch also provides an input to the BCM on the lightbar switch sense circuit. The BCM then provides the appropriate electronic messages to the EMIC over the Programmable Communications Interface (PCI) data bus to control operation of the light bar indicator, the high beam indicator, or both indicators as required by the market for which the vehicle was manufactured.

## PARK LAMPS

The park lamps system includes the Body Control Module (BCM), a park lamp relay installed in the Junction Block (JB), and the exterior lighting switch integral to the left (lighting) control stalk of the multi-function switch. The front park lamp and side marker lamp or, if equipped, the front position lamp bulbs each have a path to ground at all times through two take outs with eyelet terminals of the headlamp and dash wire harness that are secured by ground screws to the left inner fender shield in the engine compartment. The rear park and license plate lamps have a path to ground at all times through a take out and eyelet terminal of the rear body harness that is secured by a ground screw to the base of the right D-pillar behind the quarter trim panel.

The BCM controls park lamp operation by monitoring the exterior lighting switch input from the multi-function switch, then energizing or de-energizing the park lamp relay. When the park lamp relay is energized, it provides battery voltage from a fuse in the Power Distribution Center (PDC) through a park lamp relay output circuit to the appropriate lamp bulbs. On vehicles manufactured for North American markets only, the BCM also provides a battery saver (load shedding) feature for the park lamps, which will turn these lamps off if they are left on for more than about eight minutes with the ignition switch in the Off position.

## REAR FOG LAMPS

Rear fog lamps are installed on vehicles manufactured for certain markets where they are required. The rear fog lamp system includes a premium Body Control Module (BCM), a rear fog lamp relay installed in the Junction Block (JB), and a rear fog lamp switch integral to the left (lighting) control stalk of the multi-function switch. The rear fog lamps operate in concert with the front fog lamps. The rear fog lamps have a path to ground at all times through a take out and eyelet terminal of the rear body wire harness that is secured by a ground screw to the base of the right D-pillar behind the quarter trim panel.

The BCM controls rear fog lamp operation by monitoring the exterior lighting switch input from the multi-function switch, then energizing or de-energizing the rear fog lamp relay control coil and sending the appropriate electronic messages to the instrument cluster over the Programmable Communications Interface (PCI) data bus to control rear fog lamp indicator operation. When the rear fog lamp relay is energized, it provides battery voltage from a fused B(+) fuse in the JB to the rear fog lamps through the rear fog lamp relay output circuit. The BCM also provides a battery saver (load shedding) feature for the rear fog lamps, which will turn these lamps off if they are left on for more than about eight minutes with the ignition switch in the Off position.

## TRAILER TOW WIRING

In addition to the trailer tow wiring provisions, vehicles equipped with an optional trailer tow package include trailer tow relays installed in a bank of connectors concealed behind the quarter trim panel above the right rear wheel house. These relays isolate the trailer lighting from the vehicle lighting and are controlled by the normal outputs of the brake lamp switch, hazard warning switch/combination flasher unit, and the park lamp relay. When a trailer tow relay is energized, it provides battery voltage from a fused B(+) fuse to the trailer lamps through the trailer tow wiring to synchronize the illumination and flash rate of the trailer brake, park and turn signal lamps with those of the tow vehicle.

### TURN SIGNAL LAMPS

When the left control stalk of the multi-function switch is moved up (right turn) or down (left turn), the turn signal system is activated causing the selected right or left turn signal indicators and turn signal lamps to flash on and off. When the turn signal system is activated, the circuitry within the turn signal switch and the hazard switch/electronic combination flasher unit will repeatedly energize and de-energize one of two internal relays that switch battery voltage from a fused ignition switch output (run) fuse in the Junction Block (JB) to the appropriate turn signal indicator and turn signal lamps.

The ElectroMechanical Instrument Cluster (EMIC) chime tone transducer will generate an audible turn signal cancel warning each time the vehicle is driven for a distance of about 3.2 kilometers (about two miles) with a turn signal indicator flashing. The EMIC uses Programmable Communications Interface (PCI) data bus distance messages from the Powertrain Control Module (PCM) and a hard wired input from the turn signal switch circuitry or the multi-function switch to determine when to sound the turn signal cancel warning.

## WARNING

## WARNINGS - LAMPS/LIGHTING - EXTERIOR

**WARNING:: To avoid personal injury or death, eye protection should be used when servicing any glass components.**

**CAUTION: Do not contaminate the glass of halogen bulbs with fingerprints or allow contact with other possibly oily surfaces. Reduced bulb life will result.**

**CAUTION: Do not use bulbs with higher candle power than indicated in the Bulb Application table (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - SPECIFICATIONS). In addition, do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owner's Manual. Damage to lamps, lenses, wiring and other related electrical components can result.**

## DIAGNOSIS AND TESTING

## LAMPS/LIGHTING - EXTERIOR

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: When diagnosing the exterior lighting circuits, remember that high generator output can burn out bulbs rapidly and repeatedly; and, that dim or flickering bulbs can be caused by low generator output or poor battery condition. If one of these symptoms is a problem on the vehicle, be certain to diagnose the battery and charging system, then repair as necessary.**

**NOTE: A good ground is necessary for proper lighting operation. If a lighting problem is being diagnosed that involves multiple symptoms, systems, or components, the problem can often be traced to a loose, corroded, or open ground.**

The hard wired exterior lamp and lighting circuits may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the Body Control Module (BCM), the ElectroMechanical Instrument Cluster (EMIC), the Powertrain Control Module (PCM), the Programmable

Communications Interface (PCI) data bus, or the electronic message inputs used to provide exterior lamp and lighting service or many of the electronic features of the exterior lamp and lighting systems. The most reliable, efficient, and accurate means to diagnose the BCM, the EMIC, the PCM, the PCI data bus, and the electronic message inputs used for control of the exterior lamps and lighting system requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## BACKUP LAMPS

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| BACKUP LAMP DOES NOT ILLUMINATE | 1. Inoperative or missing fuse. | 1. Test and replace backup lamp fuse as required. |
| | 2. Inoperative or missing bulb. | 2. Test and replace backup lamp bulb as required. |
| | 3. Inoperative ground circuit. | 3. Test and repair backup lamp ground circuit as required. |
| | 4. Inoperative supply circuit. | 4. Test and repair open back-up lamp supply circuit as required. |
| | 5. Inoperative switch. | 5. Test and replace backup lamp switch (manual transmission) or transmission range sensor (automatic transmission) as required. |
| BACKUP LAMP DOES NOT EXTINGUISH | 1. Inoperative supply circuit. | 1. Test and repair shorted back-up lamp supply circuit as required. |
| | 2. Inoperative switch. | 2. Test and replace backup lamp switch (manual transmission) or transmission range sensor (automatic transmission) as required. |

## BRAKE LAMPS

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| BRAKE LAMP DOES NOT ILLUMINATE | 1. Inoperative or missing fuse. | 1. Test and replace brake lamp fuse as required. |
| | 2. Inoperative or missing bulb. | 2. Test and replace brake lamp bulb as required. |
| | 3. Inoperative ground circuit. | 3. Test and repair brake lamp ground circuit as required. |
| | 4. Inoperative supply circuit. | 4. Test and repair open brake lamp switch output circuit as required. |
| | 5. Inoperative switch. | 5. Test and replace brake lamp switch as required. |
| BRAKE LAMP DOES NOT EXTINGUISH | 1. Inoperative supply circuit. | 1. Test and repair shorted brake lamp switch output circuit as required. |
| | 2. Inoperative switch. | 2. Test and replace brake lamp switch as required. |

## DAYTIME RUNNING LAMPS

**NOTE: Before performing the following tests, determine whether the headlamp low and high beams operate. If the headlamp high and low beams are also inoperative, diagnose and repair that problem before attempting to repair the Daytime Running Lamps.**

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| DAYTIME RUNNING LAMPS WILL NOT ILLUMINATE | 1. High beam relay installed. | 1. Vehicles with DRL should have a solid state DRL relay, but no high beam relay. If vehicle has DRL relay installed, remove the high beam relay as required. |
| | 2. Inoperative or missing DRL relay. | 2. Replace DRL relay with a known good unit and check operation. Replace DRL relay as required. |
| | 3. Incorrect BCM programming. | 3. Use a diagnostic scan tool to check and program correct country code into BCM as required. |
| | 4. Inoperative BCM inputs or outputs. | 4. Use a diagnostic scan tool to test the BCM inputs or outputs. Refer to the appropriate diagnostic information. |

## FRONT FOG LAMPS

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| ONE FRONT FOG LAMP DOES NOT ILLUMINATE | 1. Inoperative or missing bulb. | 1. Test and replace front fog lamp bulb as required. |
| | 2. Inoperative ground circuit. | 2. Test and repair front fog lamp ground circuit as required. |
| | 3. Inoperative supply circuit. | 3. Test and repair open front fog lamp relay output circuit as required. |
| BOTH FRONT FOG LAMPS DO NOT ILLUMINATE | 1. Inoperative or missing fuse. | 1. Test and replace front fog lamp fuse as required. |
| | 2. Inoperative control circuit. | 2. Test and repair open front fog lamp relay control circuit as required. |
| | 3. Inoperative or missing relay. | 3. Test and replace front fog lamp relay as required. |
| | 4. Inoperative ground circuit. | 4. Test and repair front fog lamp ground circuit as required. |
| | 5. Inoperative supply circuit. | 5. Test and repair open front fog lamp relay output circuit as required. |
| | 6. Inoperative switch. | 6. Test and replace multi-function switch as required. |
| | 7. Inoperative BCM inputs or outputs. | 7. Use a diagnostic scan tool to test the BCM inputs and outputs. Refer to the appropriate diagnostic information. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| FRONT FOG LAMPS DO NOT EXTINGUISH | 1. Inoperative supply circuit. | 1. Test and repair shorted front fog lamp relay output circuit as required. |
| | 2. Inoperative control circuit. | 2. Test and repair shorted front fog lamp relay control circuit as required. |
| | 3. Inoperative relay. | 3. Test and replace front fog lamp relay as required. |
| | 4. Inoperative switch. | 4. Test and replace multi-function switch as required. |
| | 5. Inoperative BCM inputs or outputs. | 5. Use a diagnostic scan tool to test the BCM inputs and outputs. Refer to the appropriate diagnostic information. |

## HAZARD WARNING LAMPS

**NOTE: Before performing the following tests, confirm whether the left and right turn signals operate satisfactorily. If the turn signals are inoperative or operate improperly, diagnose and repair that problem before attempting to repair the Hazard Warning Lamps.**

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| HAZARD WARNING LAMPS DO NOT FLASH | 1. Inoperative or missing fuse. | 1. Test and replace hazard warning fuse as required. |
| | 2. Inoperative ground circuit. | 2. Test and repair hazard switch ground circuit as required. |
| | 3. Inoperative supply circuit. | 3. Test and repair open hazard switch fused B(+) circuit as required. |
| | 4. Inoperative switch/flasher. | 4. Test and replace hazard switch/ combination flasher unit as required. |
| HAZARD WARNING LAMPS DO NOT STOP FLASHING | 1. Inoperative switch/flasher. | 1. Test and replace hazard switch/ combination flasher unit as required. |

## HEADLAMPS

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| ONE HEADLAMP DOES NOT ILLUMINATE | 1. Inoperative or missing fuse. | 1. Test and replace headlamp fuse as required. |
| | 2. Inoperative or missing bulb. | 2. Test and replace headlamp bulb as required. |
| | 3. Inoperative ground circuit. | 3. Test and repair open headlamp ground circuit as required. |
| | 4. Inoperative supply circuit. | 4. Test and repair open headlamp low beam, high beam, or DRL relay output circuit as required. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| BOTH LOW OR HIGH BEAM HEADLAMPS DO NOT ILLUMINATE | 1. Inoperative or missing relay. | 1. Test and replace low beam, high beam, or DRL relay as required. (Note: Vehicles with a DRL relay do not use a high beam relay. The DRL relay cannot be tested. Replace DRL relay with a known good unit and check operation. Replace DRL relay as required.) |
| | 2. Inoperative control circuit. | 2. Test and repair open low beam or high beam relay control circuit as required. |
| | 3. Inoperative switch. | 3. Test and replace multi-function switch as required. |
| | 4. Inoperative BCM inputs or outputs. | 4. Use a diagnostic scan tool to test the BCM inputs and outputs. Refer to the appropriate diagnostic information. |
| HEADLAMPS DO NOT EXTINGUISH | 1. Inoperative supply circuit. | 1. Test and repair shorted headlamp low beam, high beam, or DRL relay output circuit as required. |
| | 2. Inoperative control circuit. | 2. Test and repair shorted low beam or high beam relay control circuit as required. |
| | 3. Inoperative relay. | 3. Test and replace low beam, high beam, or DRL relay as required. (Note: Vehicles with a DRL relay do not use a high beam relay. The DRL relay cannot be tested. Replace DRL relay with a known good unit and check operation. Replace DRL relay as required.) |
| | 4. Inoperative switch. | 4. Test and replace multi-function switch as required. |
| | 5. Inoperative BCM inputs or outputs. | 5. Use a diagnostic scan tool to test the BCM inputs and outputs. Refer to the appropriate diagnostic information. |
| HEADLAMPS WILL NOT SWITCH FROM HIGH TO LOW BEAMS, OR FROM LOW TO HIGH BEAMS | 1. Inoperative relay. | 1. Test and replace low beam, high beam, or DRL relay as required. (Note: Vehicles with a DRL relay do not use a high beam relay. The DRL relay cannot be tested. Replace DRL relay with a known good unit and check operation. Replace DRL relay as required.) |
| | 2. Inoperative switch. | 2. Test and replace multi-function switch as required. |
| | 3. Inoperative BCM inputs or outputs. | 3. Use a diagnostic scan tool to test the BCM inputs and outputs. Refer to the appropriate diagnostic information. |

## HEADLAMP LEVELING

**NOTE: Before performing the following tests, confirm whether the park lamps operate properly. If the park lamps are inoperative, diagnose and repair that problem before attempting to repair the Headlamp Leveling System.**

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| ONE LEVELING MOTOR IS INOPERATIVE | 1. Inoperative ground circuit. | 1. Test and repair open leveling motor ground circuit as required. |
| | 2. Inoperative supply circuit. | 2. Test and repair open leveling motor feed circuit as required. |
| | 3. Inoperative signal circuit. | 3. Test and repair open headlamp adjust signal circuit as required. |
| | 4. Inoperative motor. | 4. Test and replace headlamp leveling motor as required. |
| BOTH LEVELING MOTORS ARE INOPERATIVE | 1. Inoperative switch ground circuit. | 1. Test and repair open leveling switch ground circuit as required. |
| | 2. Inoperative motor ground circuit. | 2. Test and repair open leveling motor ground circuit as required. |
| | 3. Inoperative switch supply circuit. | 3. Test and repair open leveling switch feed circuit as required. |
| | 4. Inoperative motor feed circuit. | 4. Test and repair open leveling motor feed circuit as required. |
| | 5. Inoperative signal circuit. | 5. Test and repair open or shorted leveling motor signal circuit as required. |
| | 6. Inoperative switch. | 6. Test and replace leveling switch as required. |
| | 7. Inoperative motors. | 7. Test and replace leveling motors as required. |

## LIGHT BAR LAMPS

**NOTE: Before performing the following tests on vehicles manufactured for markets outside of North America, confirm whether both the park lamps and the low beam headlamps operate satisfactorily. If the park lamps or low beam headlamps are inoperative or operate improperly, diagnose and repair that problem before attempting to repair the light bar lamps.**

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| ONE LIGHT BAR LAMP DOES NOT ILLUMINATE | 1. Inoperative or missing bulb. | 1. Test and replace off road lamp bulb as required. |
| | 2. Inoperative ground circuit | 2. Test and repair open off road lamp ground circuit as required. |
| | 3. Inoperative supply circuit. | Test and repair open lightbar switch output circuit as required. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| NO LIGHT BAR LAMPS ILLUMINATE | 1. Inoperative or missing fuse. | 1. Test and replace light bar lamp fuse as required. |
| | 2. Inoperative switch feed circuit. | 2. Test and repair open fused B(+) circuit to light bar switch as required. |
| | 3. Inoperative ground circuit. | 3. Test and repair open off road lamp ground circuit as required. |
| | 4. Inoperative supply circuit. | 4. Test and repair open lightbar switch output circuit as required. |
| | 5. Inoperative switch ground circuit. | 5. Test and repair open light bar switch ground circuit as required. |
| | 6. Inoperative switch supply circuit. | 6. Test and repair open fused ignition switch output (run-start) circuit (North America) or park lamp relay output circuit (except North America) as required. |
| | 7 Inoperative switch. | 7. Test and replace light bar lamp switch as required. |
| LIGHT BAR LAMPS DO NOT EXTINGUISH | 1. Inoperative supply circuit. | 1. Test and repair shorted lightbar switch output circuit as required. |
| | 2. Inoperative switch. | 2. Test and replace light bar lamp switch as required. |
| INOPERATIVE OR INCORRECT LIGHT BAR INDICATIONS IN INSTRUMENT CLUSTER | 1. Inoperative switch sense circuit. | 1. Test and repair open/shorted lightbar switch sense circuit as required. |
| | 2. Incorrect BCM programming. | 2. Use a diagnostic scan tool to check and program correct country code into BCM as required. |
| | 3. Inoperative BCM inputs or outputs. | 3. Use a diagnostic scan tool to test the BCM inputs or outputs. Refer to the appropriate diagnostic information. |

## PARK LAMPS

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| ONE OR SEVERAL, BUT NOT ALL LAMPS IN PARK LAMP CIRCUIT DO NOT ILLUMINATE | 1. Inoperative or missing fuse. | 1. Test and replace park lamp fuse as required. |
| | 2. Inoperative or missing bulb. | 2. Test and replace park lamp bulb as required. |
| | 3. Inoperative ground circuit. | 3. Test and repair open park lamp ground circuit as required. |
| | 4. Inoperative supply circuit. | 4. Test and repair open park lamp relay output circuit as required. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| NO PARK LAMPS ILLUMINATE | 1. Inoperative or missing relay. | 1. Test and replace park lamp relay as required. |
| | 2. Inoperative control circuit. | 2. Test and repair open park lamp relay control circuit as required. |
| | 3. Inoperative switch. | 3. Test and replace multi-function switch as required. |
| | 4. Inoperative BCM inputs or outputs. | 4. Use a diagnostic scan tool to test the BCM inputs and outputs. Refer to the appropriate diagnostic information. |
| PARK LAMPS DO NOT EXTINGUISH | 1. Inoperative supply circuit. | 1. Test and repair shorted park lamp relay output circuit as required. |
| | 2. Inoperative control circuit. | 2. Test and repair shorted park lamp relay control circuit as required. |
| | 3. Inoperative relay. | 3. Test and replace park lamp relay as required. |
| | 4. Inoperative switch. | 4. Test and replace multi-function switch as required. |
| | 5. Inoperative BCM inputs or outputs. | 5. Use a diagnostic scan tool to test the BCM inputs and outputs. Refer to the appropriate diagnostic information. |

## REAR FOG LAMPS

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| ONE REAR FOG LAMP DOES NOT ILLUMINATE | 1. Inoperative or missing bulb. | 1. Test and replace rear fog lamp bulb as required. |
| | 2. Inoperative ground circuit. | 2. Test and repair open rear fog lamp ground circuit as required. |
| | 3. Inoperative supply circuit. | 3. Test and repair open rear fog lamp relay output circuit as required. |
| BOTH REAR FOG LAMPS DO NOT ILLUMINATE | 1. Inoperative or missing fuse. | 1. Test and replace rear fog lamp fuse as required. |
| | 2. Inoperative ground circuit. | 2. Test and repair open rear fog lamp ground circuit as required. |
| | 3. Inoperative supply circuit. | 3. Test and repair open rear fog lamp relay output circuit as required. |
| | 4. Inoperative control circuit. | 4. Test and repair open rear fog lamp relay control circuit as required. |
| | 5. Inoperative or missing relay. | 5. Test and replace rear fog lamp relay as required. |
| | 6. Inoperative switch. | 6. Test and replace multi-function switch as required. |
| | 7. Incorrect BCM programming. | 7. Use a diagnostic scan tool to check and program correct country code into BCM as required. |
| | 8. Inoperative BCM inputs or outputs. | 8. Use a diagnostic scan tool to test the BCM inputs or outputs. Refer to the appropriate diagnostic information. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| REAR FOG LAMPS DO NOT EXTINGUISH | 1. Inoperative supply circuit. | 1. Test and repair shorted rear fog lamp relay output circuit as required. |
| | 2. Inoperative control circuit. | 2. Test and repair shorted rear fog lamp relay control circuit as required. |
| | 3. Inoperative relay. | 3. Test and replace rear fog lamp relay as required. |
| | 4. Inoperative switch. | 4. Test and replace multi-function switch as required. |
| | 5. Inoperative BCM inputs or outputs. | 5. Use a diagnostic scan tool to test the BCM inputs or outputs. Refer to the appropriate diagnostic information. |

## TURN SIGNAL LAMPS

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| ONE TURN SIGNAL LAMP DOES NOT ILLUMINATE | 1. Inoperative or missing bulb. | 1. Test and replace turn signal bulb as required. |
| | 2. Inoperative ground circuit. | 2. Test and repair open ground circuit as required. |
| | 3. Inoperative supply circuit. | 3. Test and repair open right or left turn signal circuit as required. |
| ALL RIGHT SIDE AND/OR ALL LEFT SIDE TURN SIGNAL LAMPS DO NOT FLASH | 1. Inoperative sense circuit. | 1. Test and repair open right or left turn switch sense circuit as required. |
| | 2. Inoperative signal circuit. | 2. Test and repair open right or left turn signal circuit as required. |
| | 3. Inoperative switch. | 3. Test and replace multi-function switch as required. |
| | 4. Inoperative flasher. | 4. Replace hazard switch/combination flasher with a known good unit and check operation. Replace hazard switch/ combination flasher unit as required. |
| ALL RIGHT SIDE OR ALL LEFT SIDE TURN SIGNALS FLASH TOO RAPIDLY (MORE THAN 100 FLASHES PER MINUTE) | 1. Inoperative or missing bulb. | 1. Test and replace turn signal bulb as required. |
| | 2. Inoperative ground circuit. | 2. Test and repair open ground circuit as required. |
| | 3. Inoperative signal circuit | 3. Test and repair open right or left turn signal circuit as required. |
| | 4. Inoperative flasher. | 4. Replace hazard switch/combination flasher with a known good unit and check operation. Replace hazard switch/ combination flasher unit as required. |

# SPECIFICATIONS

## LAMPS/LIGHTING - EXTERIOR

### BULB APPLICATION TABLE

| LAMP | BULB |
|---|---|
| BACKUP | 3157 P27/7W |
| BRAKE | 3157 P27/7W |
| CENTER HIGH MOUNTED STOP | 921/W16W |
| FRONT FOG (FASCIA MOUNTED) | H3/55W |
| FRONT FOG (GRILLE MOUNTED) | 9145/H10 |
| FRONT PARK/TURN | 3157 P27/7W |
| FRONT POSITION | W5W |
| FRONT SIDE MARKER | 168 |
| HEADLAMP (NORTH AMERICA) | 9007QL |
| HEADLAMP (EXCEPT NORTH AMERICA) | H-4 W0W6 |
| LICENSE (NORTH AMERICA) | 168 |
| LICENSE (EXCEPT NORTH AMERICA) | W5W |
| LIGHT BAR (OFF ROAD) | 9006LL |
| REAR FOG | 3157 P27/7W |
| REAR PARK/TAIL | 3157 P27/7W |
| REAR TURN | 3757A PY27/7W |
| SIDE REPEATER | W5W |

### TORQUE SPECIFICATIONS

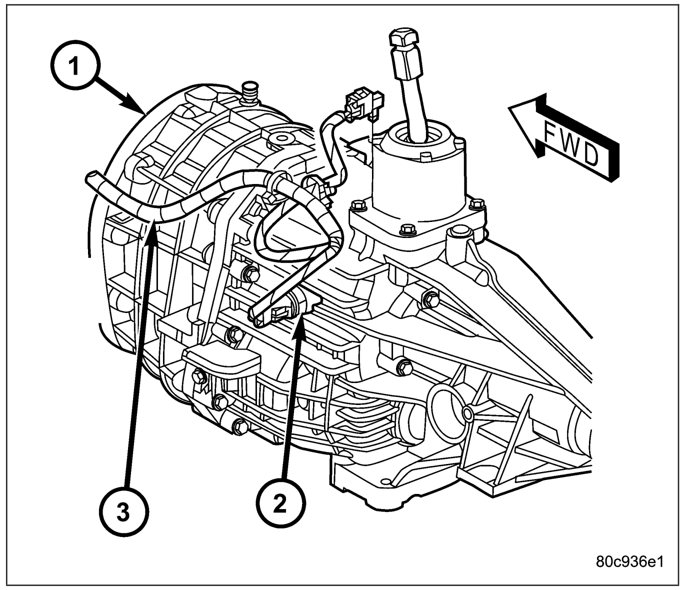
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| CHMSL Mounting Screws | 2 | - | 21 |
| Front Fog Lamp Bezel and Lens Mounting Screws (Fascia Mounted) | 2 | - | 17 |
| Front Fog Lamp Adjuster Mounting Screw (Grille Mounted) | 3 | - | 30 |
| Front Fog Lamp Bracket Mounting Screw (Fascia Mounted) | 20 | 15 | - |
| Hazard Switch Mounting Screw | 2 | - | 17 |
| Headlamp Unit Mounting Screws | 3 | - | 30 |
| License Plate Bracket Mounting Screws (Export) | 28 | 21 | - |
| License Plate Lamp Mounting Screws | 2 | - | 20 |
| Light Bar Lamp Bracket Mounting Screws | 2 | - | 17 |
| Light Bar Lamp Cover Mounting Screws | 2 | - | 17 |

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Light Bar Reinforcement Mounting Nuts | 6 | - | 50 |
| Steering Column Shroud Mounting Screws | 2 | - | 20 |
| Park Brake Switch Mounting Screw | 3 | - | 24 |
| Park/Turn Signal Lamp Mounting Screw | 2 | - | 20 |
| Rear Lamp Unit Mounting Screws | 2 | - | 20 |
| 7-Way Trailer Tow Connector Mounting Screws | 4 | - | 35 |

# BACKUP LAMP SWITCH

## DESCRIPTION

Vehicles equipped with a manual transmission (1) have a normally open, spring-loaded plunger type backup lamp switch (2). Vehicles with an optional electronic automatic transmission have a Transmission Range Sensor (TRS) that is used to perform several functions, including that of the backup lamp switch. The TRS is described in further detail elsewhere in this service information.




The backup lamp switch is located in a threaded hole on the side of the manual transmission housing. The switch has a threaded body and a hex formation near the plunger end of the switch. An integral connector receptacle at the end of the switch opposite the plunger connects the switch to the vehicle electrical system through a take out and connector of the engine wire harness (3). When installed, only the switch connector and the hex formation are visible on the outside of the transmission housing. The backup lamp switch cannot be adjusted or repaired and, if inoperative or damaged, the entire switch unit must be replaced.

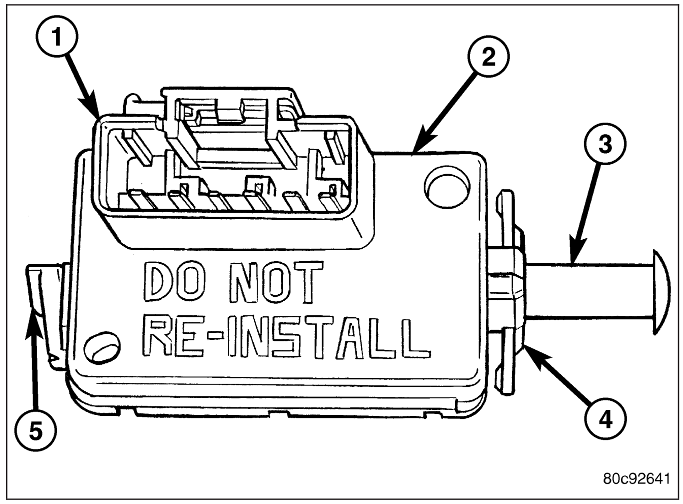
## OPERATION

The backup lamp switch controls the flow of battery voltage to the backup lamp bulbs through an output on the back-up lamp feed circuit. The switch plunger is mechanically actuated by the gearshift mechanism within the transmission, which will depress the switch plunger and close the switch contacts whenever the reverse gear has been selected. The switch receives battery voltage through a fuse in the Junction Block (JB) whenever the ignition switch is in the On position. The backup lamp switch and circuits can be tested using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

# BRAKE LAMP SWITCH

## DESCRIPTION

The brake lamp switch (2) is a three circuit, spring-loaded plunger actuated switch that is secured to the steering column support bracket under the instrument panel on the driver side of the vehicle. The molded plastic switch housing has an integral connector receptacle (1) containing six terminal pins and featuring a Connector Position Assurance (CPA) lock. The switch is connected to the vehicle electrical system through a dedicated take out of the instrument panel wire harness.




The switch plunger (3) extends through a mounting collar (4) on one end of the switch housing. The plunger has a one time telescoping self-adjustment feature that is activated after the switch is installed by moving an adjustment release lever (5) on the opposite end of the switch housing clockwise, until it locks into a position that is parallel to the connector receptacle.

An installed brake lamp switch cannot be readjusted or repaired. If the switch is damaged, inoperative, or removed from its mounting position for any reason, it must be replaced with a new unit.

## OPERATION

The brake lamp switch controls three independent circuits. These circuits are described as follows:

- **Brake Lamp Switch Circuit** - A normally open brake lamp switch circuit receives a battery voltage input, and supplies this battery voltage to the brake lamps and the Controller Antilock Brake (CAB) on a brake lamp switch output circuit only when the brake pedal is depressed (brake lamp switch plunger released).
- **Brake Lamp Switch Signal Circuit** - A normally closed brake lamp switch signal circuit receives a direct path to ground, and supplies this ground input to the Powertrain Control Module (PCM) on a brake lamp switch sense circuit only when the brake pedal is released (brake lamp switch plunger is depressed).
- **Speed Control Circuit** - A normally closed speed control circuit receives a battery voltage input from the Powertrain Control Module on a speed control supply circuit, and supplies this battery voltage to the speed control servo solenoids (dump, vacuum, and vent) on a speed control brake switch output circuit only when the speed control system is turned On and the brake pedal is released (brake lamp switch plunger is depressed).

The components of the self-adjusting brake switch plunger consist of a two-piece telescoping plunger, a split plunger locking collar, and a release wedge. The release lever has a shaft with a wedge that spreads the plunger locking collar to an open or released position. After the switch is installed and the brake pedal is released, the plunger telescopes to the correct adjustment position. When the release lever is moved to the release position, the wedge is disengaged from the locking collar causing the collar to apply a clamping pressure to the two plunger halves, fixing the plunger length.

The brake lamp switch can be diagnosed using conventional diagnostic tools and methods.

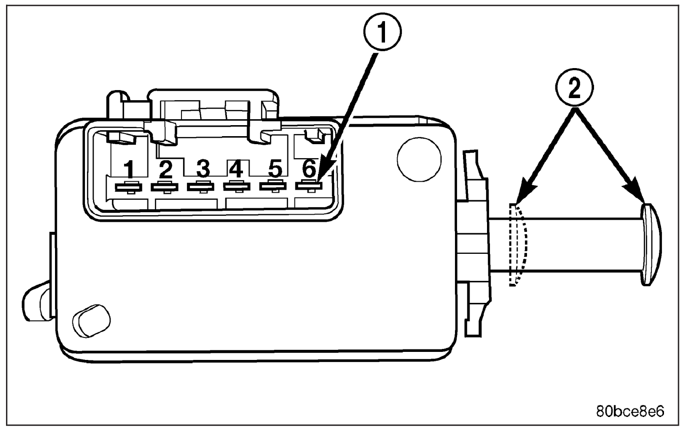
## DIAGNOSIS AND TESTING

## BRAKE LAMP SWITCH

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: Do not remove the brake lamp switch from the mounting bracket. The self-adjusting switch plunger is a one time only feature. If the switch is removed from the mounting bracket, it MUST be replaced with a new switch.**

1. Disconnect and isolate the battery negative cable.
2. Disconnect the wire harness connector from the brake lamp switch.
3. Using an ohmmeter, perform the continuity tests at the terminal pins (1) in the brake lamp switch connector receptacle as shown in the Brake Lamp Switch Tests table.




| BRAKE LAMP SWITCH TESTS | |
|---|---|
| PLUNGER POSITION (2) | CONTINUITY BETWEEN (1) |
| Released (Extended) | Pins 1 and 2 |
| Compressed (Depressed) | Pins 3 and 4, 5 and 6 |

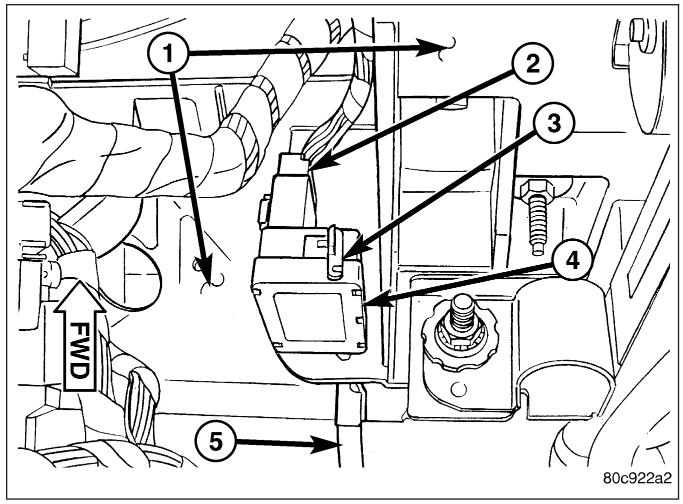
4. If the switch fails any of the continuity tests, replace the inoperative brake lamp switch as required.

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: The brake lamp switch self-adjusting switch plunger is a one time only feature. If the switch is removed from the mounting bracket, it MUST be replaced with a new switch.**

1. Disconnect and isolate the battery negative cable.
2. Locate the brake lamp switch (4) near the support bracket (1) on the lower steering column.
3. Disconnect the wire harness connector (2) from the brake lamp switch.
4. Rotate the brake lamp switch housing counter-clockwise about 30 degrees to align the tabs on the switch locking collar with the keyed mounting hole in the switch mounting bracket.
5. Pull the switch straight back from the keyed hole to remove it from the bracket.
6. Discard the removed brake lamp switch.

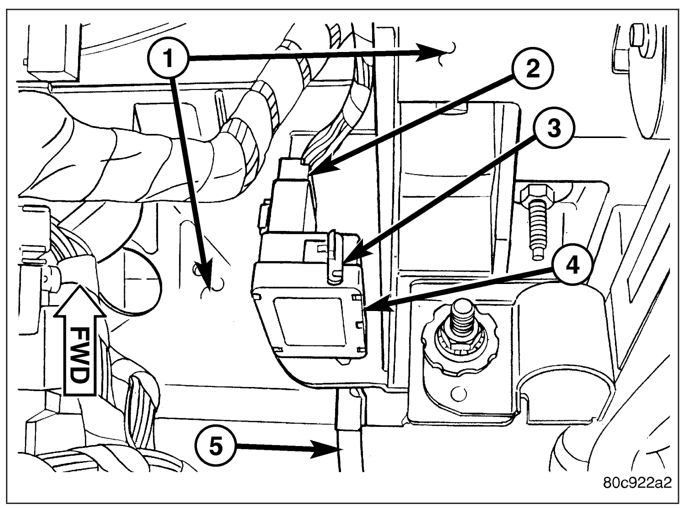



## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: The brake lamp switch self-adjusting switch plunger is a one time only feature. If the switch is removed from the mounting bracket, it MUST be replaced with a new switch.**

1. Depress and hold the brake pedal (5) in the depressed position.
2. Align the tabs on the brake lamp switch (4) locking collar with the keyed hole in the switch mounting bracket.
3. Insert the tabs on the brake lamp switch locking collar through the keyed hole in the switch mounting bracket until the switch housing is firmly seated against the bracket.
4. Rotate the switch clockwise about 30 degrees to engage the tabs on the locking collar with the switch mounting bracket.
5. Release the brake pedal.




**CAUTION: Do not release or pull up on the brake pedal before the switch plunger adjustment has been completed.**

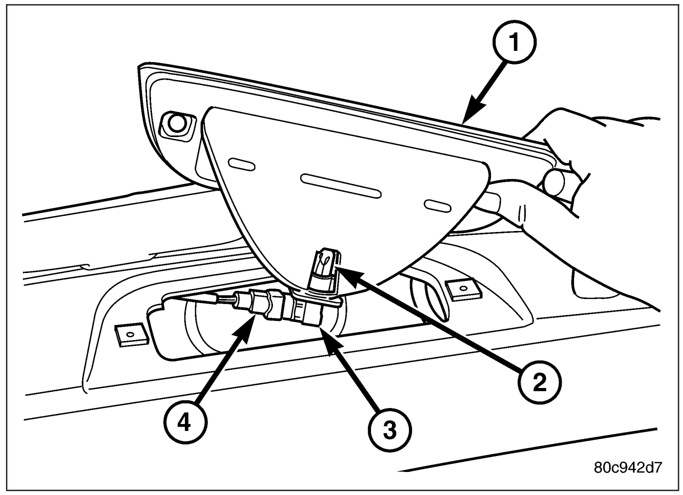
6. Release the brake pedal, but do not pull it upward.
7. Rotate the plunger adjustment release lever (3) clockwise until it locks into place. The lever should be parallel to the brake lamp switch connector receptacle. This action will set the switch plunger length to a final adjustment position and cannot be undone. If not performed properly the first time, a new brake lamp switch **must** be installed.
8. Reconnect the wire harness connector (2) to the brake lamp switch.
9. Reconnect the battery negative cable.

# LAMP-HIGH MOUNTED STOP

## REMOVAL

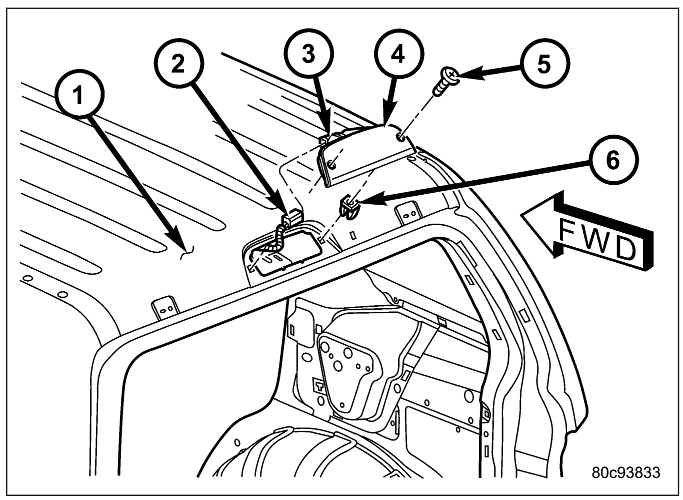
### BULB

1. Disconnect and isolate the battery negative cable.
2. Remove the two screws that secure the Center High Mounted Stop Lamp (CHMSL) (1) to the roof panel.
3. Pull the CHMSL lens and housing away from the header panel far enough to access the lamp wiring (4) and bulb socket (3) on the back of the lamp.
4. Firmly grasp the socket on the back of the lamp housing and rotate it counterclockwise about 30 degrees to unlock it.
5. Pull the socket and bulb (2) straight out from the keyed opening in the housing.
6. Pull the base of the bulb straight out of the socket.




### LAMP

1. Disconnect and isolate the battery negative cable.
2. Remove the two screws (5) that secure the Center High Mounted Stop Lamp (CHMSL) (4) to the rear of the roof panel (1).
3. Pull the CHMSL away from the roof panel far enough to access and disconnect the wire harness connector (4) from the lamp socket (3).
4. Remove the CHMSL from the roof panel.

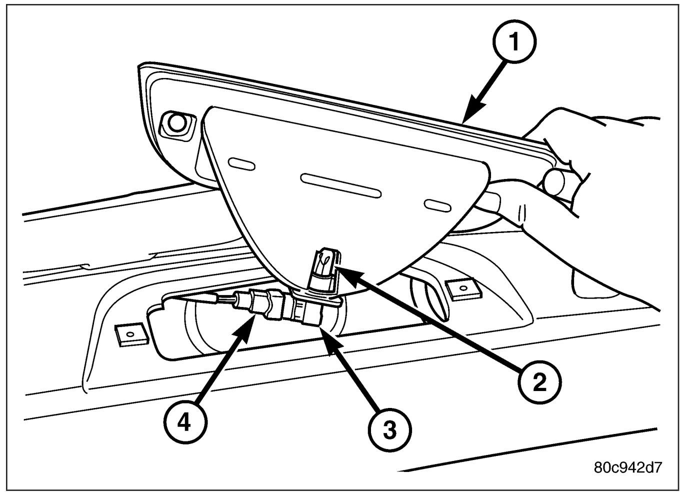



## INSTALLATION

### BULB

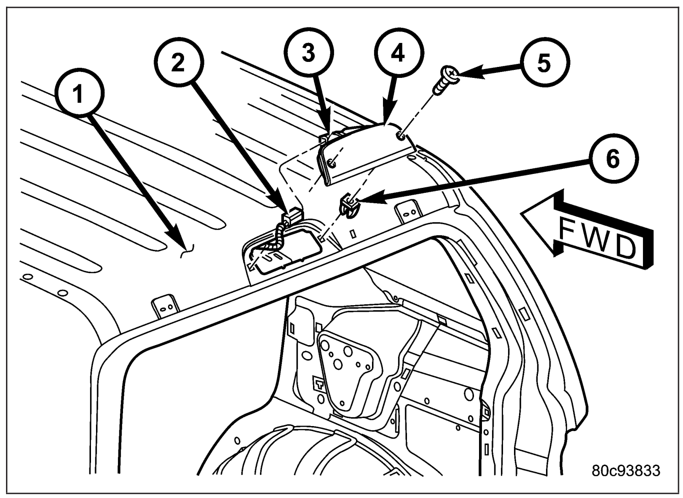
**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

1. Align the base of the bulb (2) with the socket (3).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of CHMSL housing (1).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Position the CHMSL into the opening in the rear roof panel.
7. Install and tighten the two screws that secure the CHMSL to the roof panel. Tighten the screws to 2 N·m (21 in. lbs.).
8. Reconnect the battery negative cable.




## LAMP

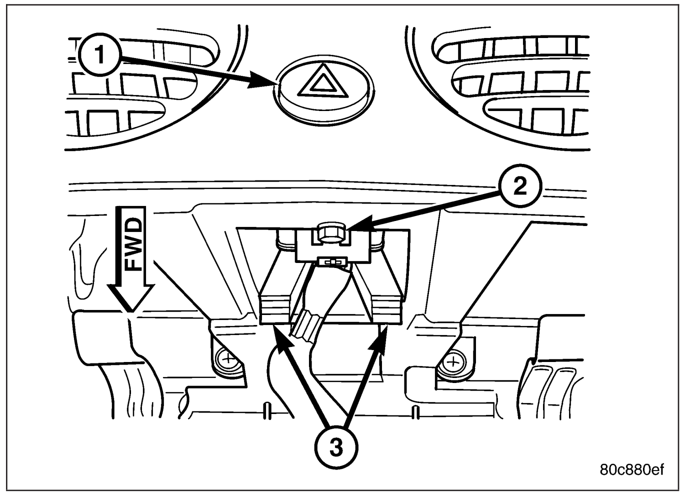
1. Check to be certain that the two plastic nuts (6) are properly positioned and in good condition on each side of the roof panel (1) opening for the Center High Mounted Stop Lamp (CHMSL) (4).
2. Position the CHMSL near the roof panel opening.
3. Reconnect the wire harness connector (2) to the CHMSL socket (3).
4. Install and tighten the two screws (5) that secure the CHMSL to the roof panel. Tighten the screws to 2 N·m (21 in. lbs.).
5. Reconnect the battery negative cable.



# COMBINATION FLASHER

## DESCRIPTION

The combination flasher is integral to the hazard switch unit located behind the hazard switch button (1) near the center of the instrument panel. The combination flasher is a smart relay that functions as both the turn signal system and the hazard warning system flasher. The combination flasher contains active electronic Integrated Circuitry (IC) elements.




This flasher is designed to handle the current flow requirements of the factory-installed lighting. If supplemental lighting is added to the turn signal lamp circuits, such as when towing a trailer with lights, the combination flasher will automatically try to compensate to keep the flash rate the same.

The combination flasher cannot be repaired or adjusted and, if inoperative or damaged, the hazard switch unit must be replaced.

## OPERATION

The combination flasher has the following inputs and outputs: fused B(+), fused ignition switch output, right turn signal sense, left turn signal sense, and one output each for the right and left turn signal circuits. The combination flasher also receives an internal input through the hazard switch and, on vehicles equipped with the optional Vehicle Theft Security System (VTSS), receives an input from the Body Control Module (BCM) in order to flash the turn signal lamps as an optical alert feature of that system.

Battery voltage is supplied to the flasher on a fused B(+) circuit so that the flasher can perform the hazard warning flasher function, regardless of the ignition switch position. The flasher also receives battery voltage on a separate fused ignition switch output (run-start) circuit to perform the turn signal flasher function.

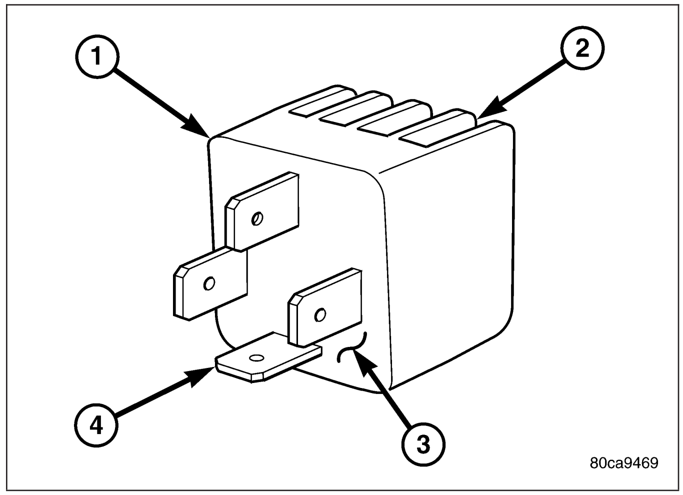
The Integrated Circuit (IC) within the combination flasher contains the logic that controls the flasher operation and the flash rate. The IC receives separate sense ground inputs from the multi-function switch for the right and left turn signals, and from the hazard switch contacts or the BCM for the hazard warning signals. A special design feature of the combination flasher allows it to ″sense″ that a turn signal circuit or bulb is not operating, and provide the driver an indication of the condition by flashing the remaining bulbs in the affected circuit at a higher rate (120 flashes-per-minute or higher).

Because of the active electronic elements within the combination flasher, it cannot be tested with conventional automotive electrical test equipment. If the combination flasher is believed to be faulty, test the turn signal and hazard warning systems before replacing the flasher. If no problems are found, replace the hazard warning switch with a known good unit to confirm system operation.

# DAYTIME RUNNING LAMP RELAY

## DESCRIPTION

The Daytime Running Lamp (DRL) relay (1) is a solid state relay that is used only on vehicles manufactured for sale in Canada. The DRL relay is installed in the Junction Block (JB) on the driver side outboard end of the instrument panel. Vehicles equipped with this relay **do not** have a headlamp high beam relay installed in the JB.




The DRL relay features a die cast aluminum housing that serves to contain the solid state circuitry of the relay as well as to perform as a heat sink (2). Potting material (3) fills the base of the housing to enclose and protect the circuitry.

Four male spade terminals (4) exit the base of the relay housing through the potting material to connect the relay to the vehicle electrical system. These terminals are laid out in a footprint that is similar to that of a conventional International Standards Organization (ISO) relay; however, a standard ISO relay must never be installed in place of the DRL relay.

The DRL relay cannot be adjusted or repaired and, if inoperative or damaged, it must be replaced with a new unit.

## OPERATION

The Daytime Running Lamps (DRL) relay is a solid state relay that controls the flow of battery current to the high beam filaments of both headlamp bulbs based upon a duty cycle control input received from the Body Control Module (BCM) of vehicles equipped with the DRL feature. By cycling the DRL relay output, the BCM controls the illumination intensity of the high beam filaments. The DRL relay is connected to the vehicle electrical system through a receptacle in the Junction Block (JB). The inputs and outputs of the DRL relay include:

- **Battery Voltage Input** - The DRL relay receives battery voltage on a fused B(+) circuit from a fused B(+) fuse in the Power Distribution Center (PDC).
- **Ground Input** - The DRL relay receives a path to ground through a splice block with an eyelet terminal that is secured by a nut to a ground stud on the driver side instrument panel end bracket near the JB.
- **Control Input** - The DRL relay control input is received from the BCM and/or the momentary optical horn (flash-to-pass) output of the multi-function switch through a high beam relay control circuit.
- **Control Output** - The DRL relay supplies Pulse Width Modulated (PWM) battery voltage to the headlamp high beam filaments through the high beam relay output circuit.

Because of active electronic elements within the DRL relay, it cannot be diagnosed or tested using conventional diagnostic tools and procedures. If the DRL relay is believed to be inoperative, test and repair the headlamp system as necessary. If no problem is found in the headlamp system, replace the DRL relay with a known good unit to confirm system operation.

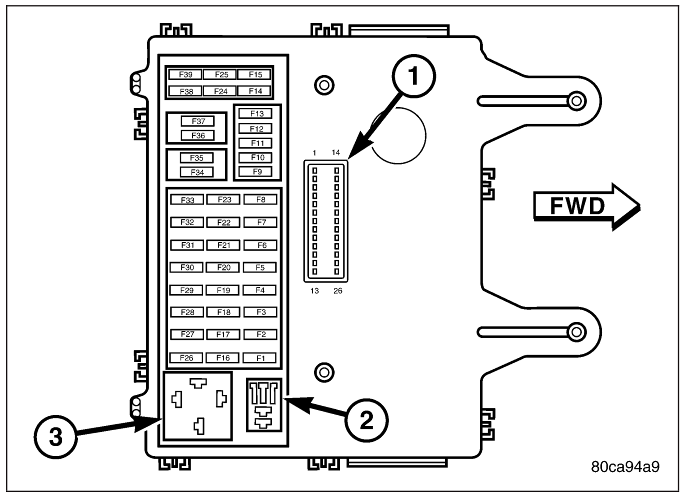
The DRL relay cannot be repaired and, if inoperative or damaged, it must be replaced. Refer to the appropriate wiring information for diagnosis and testing of the DRL relay and for complete exterior lighting wiring diagrams.

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: The DRL relay is installed in the Junction Block (JB) on the driver side outboard end of the instrument panel. Vehicles equipped with this relay MUST NOT have a headlamp high beam relay installed in the JB. Also, although the terminals of the DRL relay are laid out in a footprint that is similar to that of a conventional International Standards Organization (ISO) relay, a standard ISO relay MUST NEVER be installed in the place of the DRL relay.**

1. Disconnect and isolate the battery negative cable.
2. Remove the trim from the driver side end of the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL END CAP - REMOVAL).
3. Remove the Daytime Running Lamp (DRL) relay (3) by grasping it firmly and pulling it straight out from the receptacle in the JB.

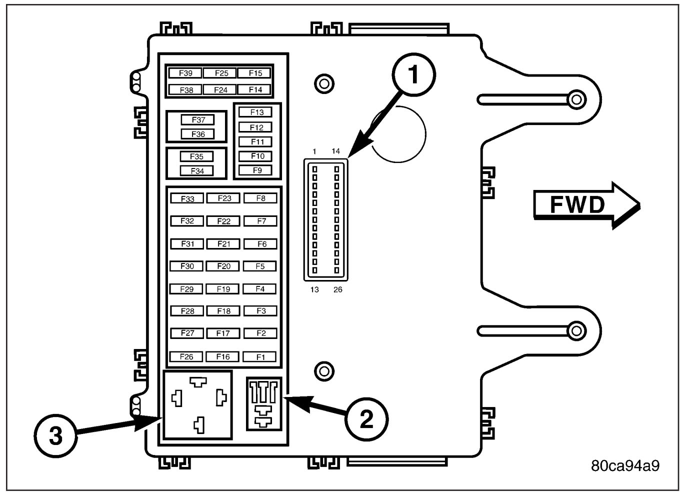



## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: The DRL relay is installed in the Junction Block (JB) on the driver side outboard end of the instrument panel. Vehicles equipped with this relay MUST NOT have a headlamp high beam relay installed in the JB. Also, although the terminals of the DRL relay are laid out in a footprint that is similar to that of a conventional International Standards Organization (ISO) relay, a standard ISO relay MUST NEVER be installed in the place of the DRL relay.**

1. Position the Daytime Running Lamp (DRL) relay to the proper receptacle (3) in the JB. The adjacent receptacle (2) must NOT be populated by a headlamp high beam relay on a vehicle that is equipped with a DRL relay.
2. Align the DRL relay terminals with the cavities in the JB receptacle.
3. Push firmly and evenly on the top of the DRL relay until the relay base is fully seated in the JB receptacle.
4. Reinstall the trim onto the driver side outboard end of the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL END CAP - INSTALLATION).
5. Reconnect the battery negative cable.

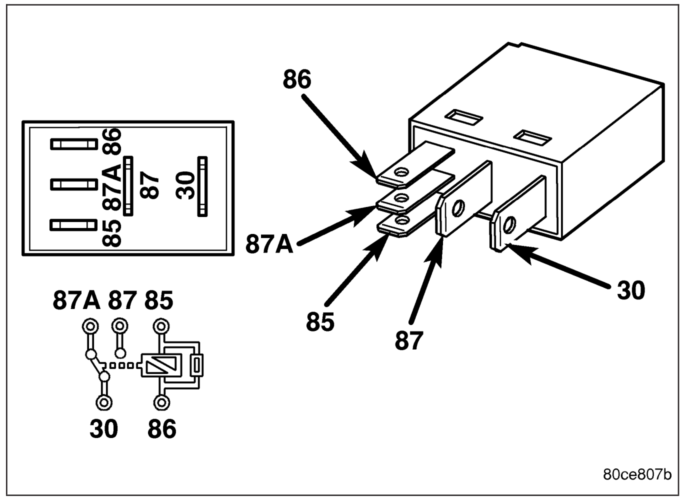


# FOG LAMP RELAY

## DESCRIPTION

### FRONT

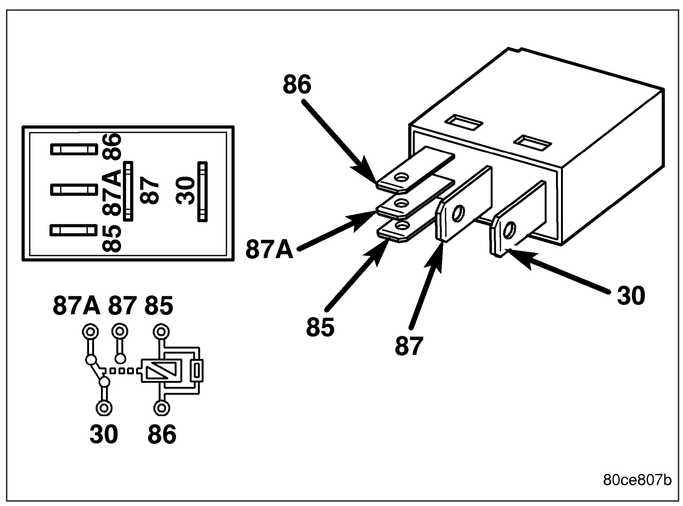
The front fog lamp relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. This relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs through five integral male spade-type terminals that extend from the relay base plate.




The front fog lamp relay is located in the Junction Block (JB) on the driver side outboard end bracket of the instrument panel. Refer to Junction Block in the wiring section of this service information for specific relay cavity assignment information. The front fog lamp relay cannot be adjusted or repaired and, if inoperative or damaged, the unit must be replaced.

### REAR

The rear fog lamp relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. This relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs through five integral male spade-type terminals that extend from the relay base plate.




The rear fog lamp relay is located in the Junction Block (JB) on the driver side outboard end bracket of the instrument panel. Refer to Junction Block in the wiring section of this service information for specific relay cavity assignment information. The rear fog lamp relay cannot be adjusted or repaired and, if inoperative or damaged, the unit must be replaced.

## OPERATION

### FRONT

The front fog lamp relay is an electromechanical switch that uses a low current input from the Body Control Module (BCM) to control a high current output to the front fog lamps. Within the relay are an electromagnetic coil, a movable contact and two fixed contact points. A resistor is connected in parallel with the coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the field of the relay coil collapses.

The movable common supply contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This field draws the movable contact point away from the normally closed contact, and holds it against the normally open contact. When the relay coil is de-energized, spring pressure returns the movable contact back against the normally closed contact.

The inputs and outputs of the front fog lamp relay include:

- **Common Supply Terminal (30)** - The common feed terminal is connected to a fused B(+) circuit at all times.
- **Coil Ground Terminal (85)** - The coil ground terminal is connected to a control output of the premium Body Control Module (BCM) through a front fog lamp relay control circuit. The BCM controls front fog lamp operation by controlling a ground path through this circuit.
- **Coil Battery Terminal (86)** - The coil battery terminal is connected to a fused B(+) circuit at all times.
- **Normally Open Terminal (87)** - The normally open terminal is connected to the front fog lamps through a front fog lamp relay output circuit and provides battery voltage to the front fog lamps whenever the relay is energized.
- **Normally Closed Terminal (87A)** - The normally closed terminal is not connected in this application, but will have battery voltage present whenever the relay is de-energized.

The front fog lamp relay can be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

### REAR

The rear fog lamp relay is an electromechanical switch that uses a low current input from the Body Control Module (BCM) to control a high current output to the rear fog lamps. Within the relay are an electromagnetic coil, a movable contact and two fixed contact points. A resistor is connected in parallel with the coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the field of the relay coil collapses.

The movable common supply contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This field draws the movable contact point away from the normally closed contact, and holds it against the normally open contact. When the relay coil is de-energized, spring pressure returns the movable contact back against the normally closed contact.

The inputs and outputs of the rear fog lamp relay include:

- **Common Supply Terminal (30)** - The common feed terminal is connected to a fused B(+) circuit at all times.
- **Coil Ground Terminal (85)** - The coil ground terminal is connected to a control output of the premium BCM through a rear fog lamp relay control circuit. The BCM controls rear fog lamp operation by controlling a ground path through this circuit.
- **Coil Battery Terminal (86)** - The coil battery terminal is connected to a fused B(+) circuit at all times.
- **Normally Open Terminal (87)** - The normally open terminal is connected to the rear fog lamps through a rear fog lamp relay output circuit and provides battery voltage to the rear fog lamps whenever the relay is energized.
- **Normally Closed Terminal (87A)** - The normally closed terminal is not connected in this application, but will have battery voltage present whenever the relay is de-energized.

The rear fog lamp relay can be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

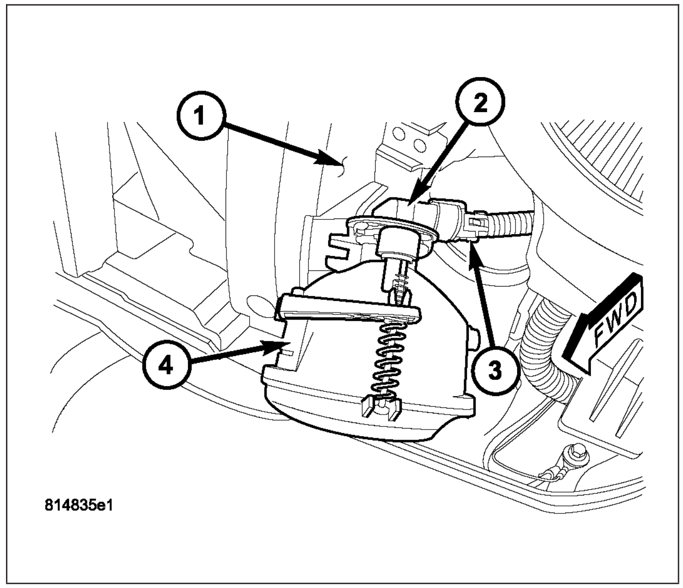
# FRONT FOG LAMP

## REMOVAL

## BULB - GRILLE MOUNTED

**CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.**

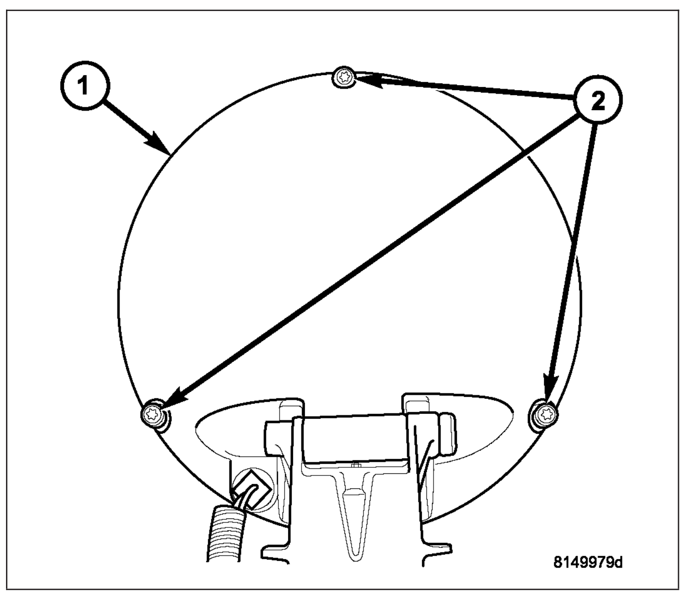
1. Disconnect and isolate the battery negative cable.
2. Remove the front fog lamp from the grille opening reinforcement (1), but do not disconnect the wire harness connector (3) from the socket (2) on the back of the lamp housing (4). (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/FRONT FOG LAMP - REMOVAL).
3. Firmly grasp the socket on the back of the housing and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb straight out from the keyed opening in the housing.
5. Pull the base of the bulb straight out of the socket.



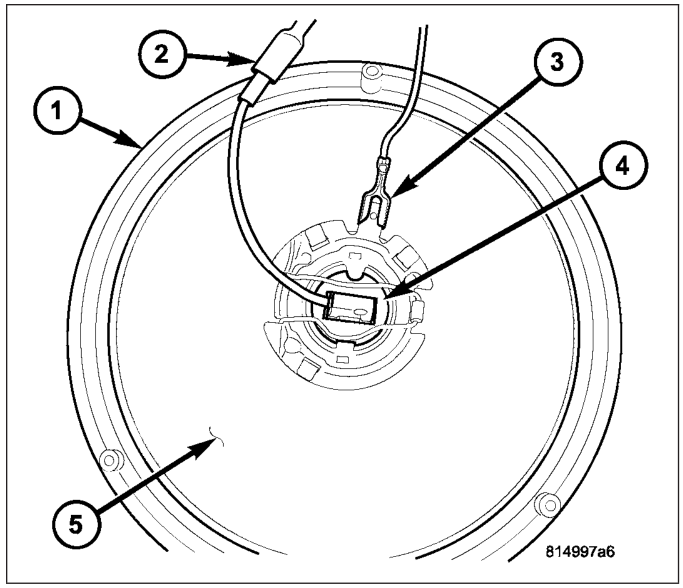

## BULB - FASCIA MOUNTED

**CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.**

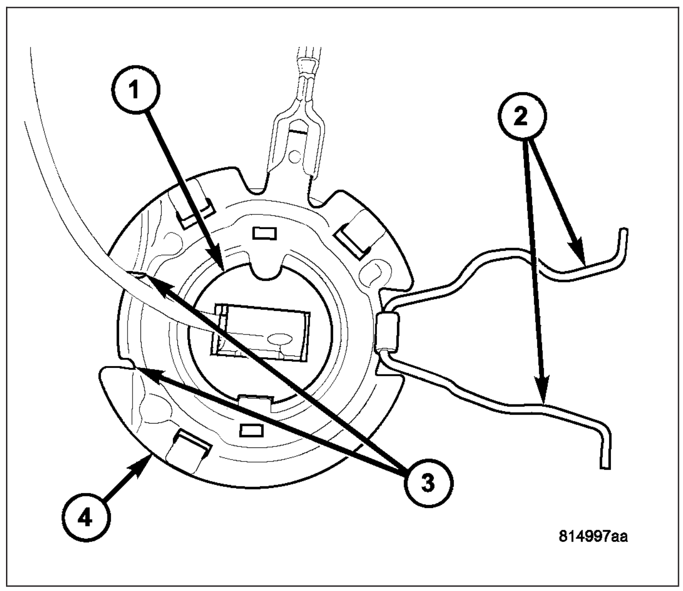
1. Disconnect and isolate the battery negative cable.
2. Remove the three screws (2) that secure the front fog lamp bezel and lens to the back of the lamp housing (1).



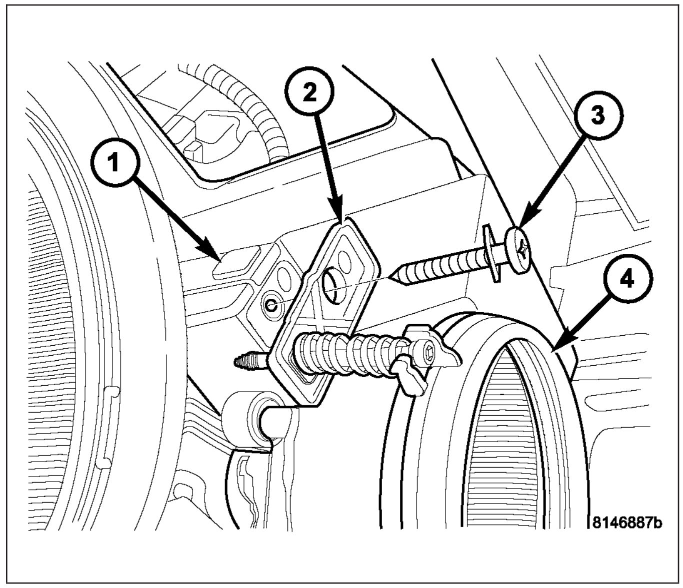
3. Pull the bezel (1) and lens away from the front of the lamp housing far enough to access and disconnect the fog lamp wiring connector from the bulb pigtail wire (2).




4. Pinch together the two hooked ends of the bulb retainer clip (2) and disengage them from the slots (3) in the mounting flange (4) on the back of the lens reflector.
5. Pivot the retainer clip up off of the bulb flange and out of the way.
6. Pull the bulb straight out of the mounting flange on the back of the lens reflector.

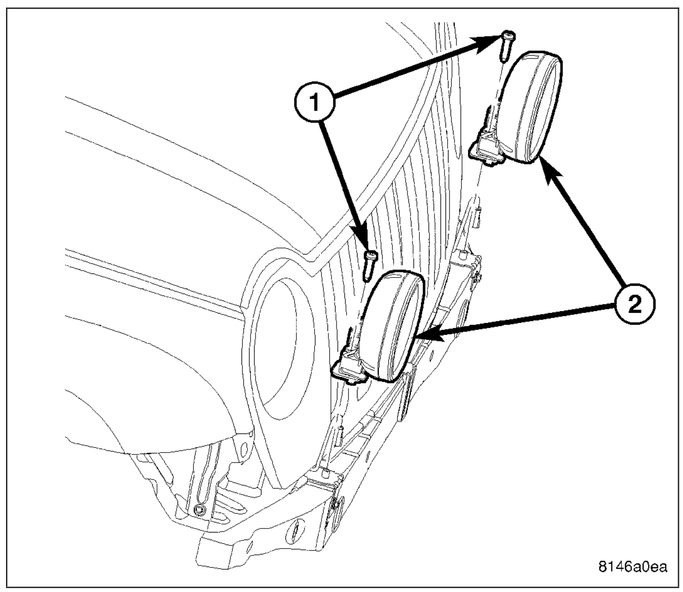


## LAMP - GRILLE MOUNTED




1. Disconnect and isolate the battery negative cable.
2. Remove the grille panel from the front of the grille opening reinforcement. (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
3. Remove the screw (3) that secures the fog lamp adjuster bracket (2) to the grille opening reinforcement (1).
4. Insert a trim stick or another suitable wide flat-bladed tool, between either side of the lamp (4) and the side of the lamp seat in the grille opening reinforcement.
5. Carefully pry the pivot pin on either side of the lamp out of its receptacle in the stanchion within the seat of the reinforcement.
6. Pull the lamp out from the seat far enough to access and disconnect the wire harness connector from the bulb socket on the back of the lamp housing.
7. Remove the lamp from the vehicle.

## LAMP - FASCIA MOUNTED




1. Disconnect and isolate the battery negative cable.
2. Remove the grille panel from the front of the grille opening reinforcement. (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
3. Disconnect the front fog lamp pigtail wire from the connector on the grille opening reinforcement.
4. Remove the screw (1) from the mounting bracket that secures the fog lamp (2) to the bracket on the top of the front bumper fascia.
5. Remove the lamp from the top of the fascia.

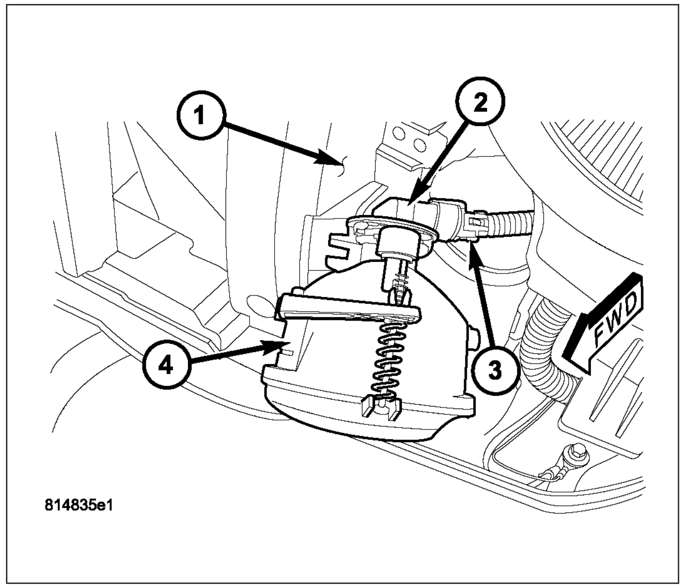
## INSTALLATION

## BULB - GRILLE MOUNTED

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

**CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.**

1. Align the base of the bulb with the front fog lamp socket (2).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of the front fog lamp housing (4).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place. The socket connector receptacle (3) should be pointed horizontally.
6. Reinstall the fog lamp into the grille opening reinforcement (1). (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/FRONT FOG LAMP - INSTALLATION).
7. Reconnect the battery negative cable.

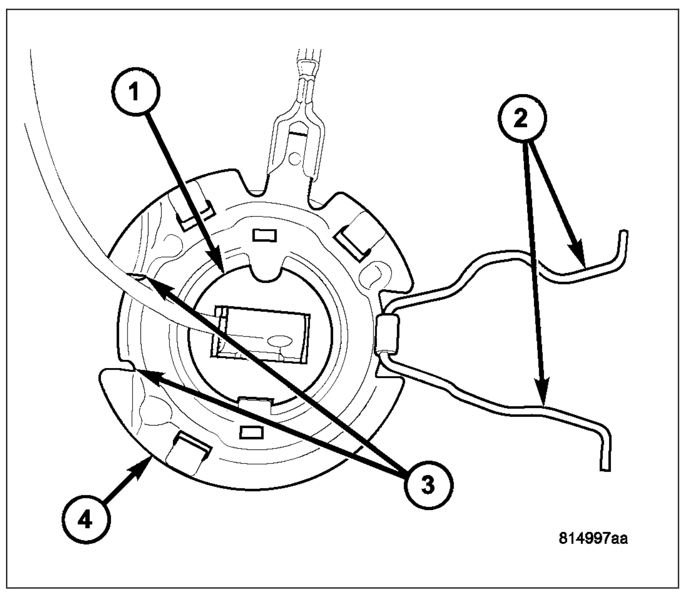



## BULB - FASCIA MOUNTED

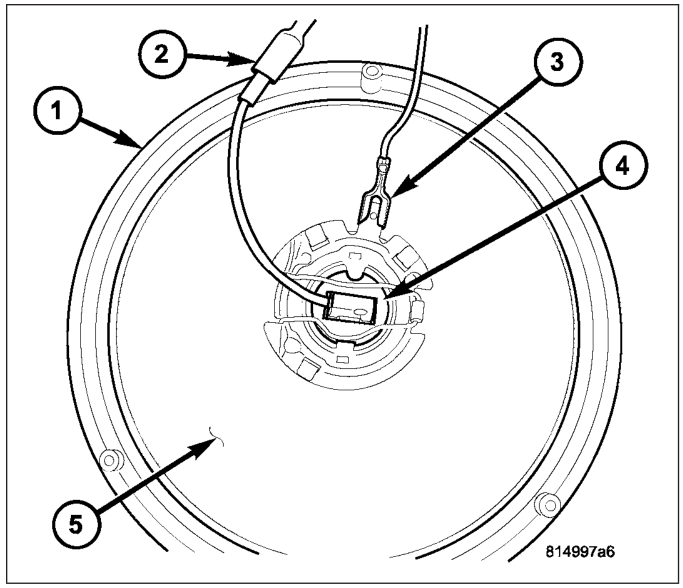
**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

**CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.**

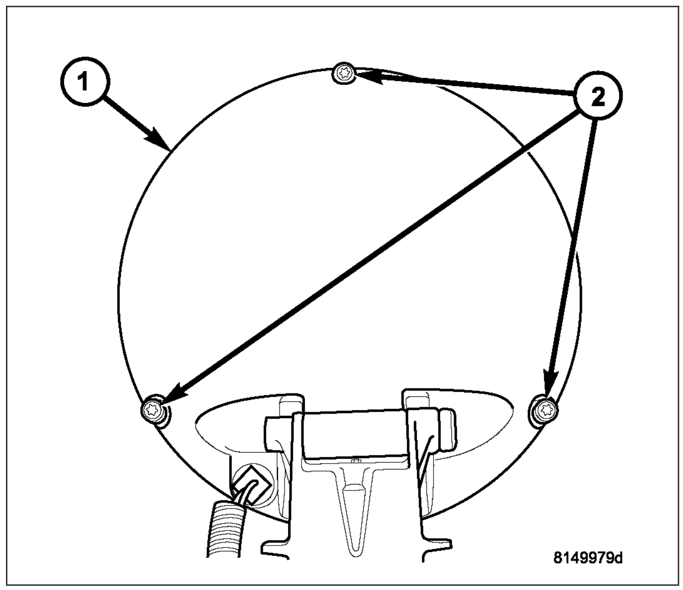
1. Align the fog lamp bulb flange (1) with the mounting flange (4) on the back of the lens reflector.
2. Insert the bulb straight into the opening in the mounting flange until the bulb flange is firmly seated.
3. Pivot the bulb retainer clip (2) up and over the bulb flange.
4. Pinch together the two hooked ends of the retainer clip and engage them into the slots (3) in the mounting flange to lock the bulb into place.



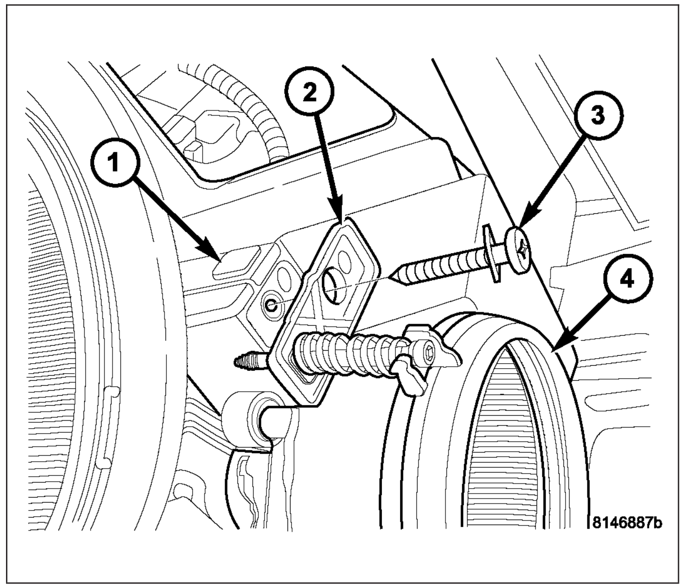
5. Reconnect the bulb pigtail wire to the fog lamp wiring connector (2).
6. Align and install the lens and bezel (1) into the front fog lamp housing. Be certain not to pinch the lamp wiring between the housing and the bezel.




7. Install and tighten the three screws (2) that secure the bezel and lens to the back of the lamp housing (1). Tighten the screws to 2 N·m (17 in. lbs.).
8. Reconnect the battery negative cable.

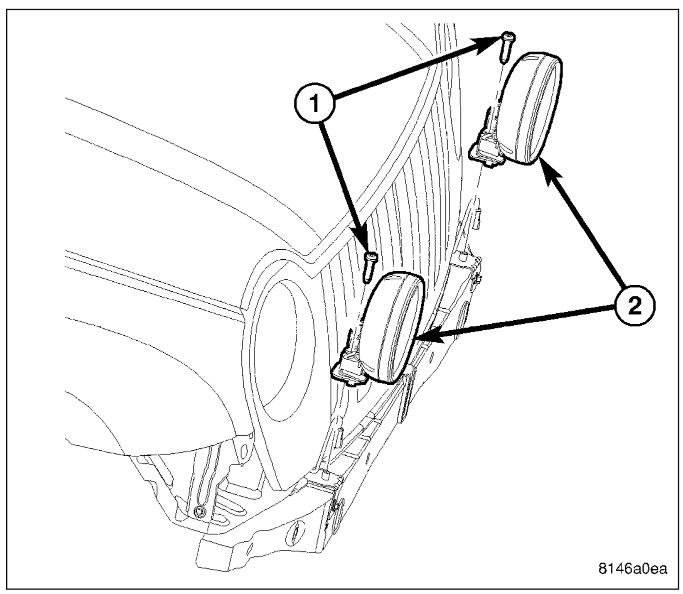


## LAMP - GRILLE MOUNTED




1. Position the front fog lamp (4) to the seat in the grille opening reinforcement (1).
2. Reconnect the wire harness connector to the bulb socket on the back of the lamp housing.
3. Engage the pivot pin on either side of the lamp into its receptacle in the stanchion within the lamp seat of the grille opening reinforcement.
4. Insert a trim stick or another suitable wide flat-bladed tool, between the opposite side of the lamp and the side of the lamp seat.
5. Carefully pry between the side of the lamp and the seat far enough for the loose pivot pin to be snapped into place within its stanchion.
6. Install and tighten the screw (3) that secures the fog lamp adjuster bracket (2) to the grille opening reinforcement. Tighten the screw to 3 N·m (30 in. lbs.).
7. Reinstall the grille panel onto the front of the grille opening reinforcement. (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).
8. Reconnect the battery negative cable.
9. Confirm proper front fog lamp alignment. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/FRONT FOG LAMP UNIT - ADJUSTMENTS).

## LAMP - FASCIA MOUNTED




1. Position the front fog lamp (2) to the bracket on the top of the front bumper fascia.
2. Install and tighten the screw (1) into the mounting bracket that secures the lamp to the fascia. Tighten the screw to 20 N·m (15 ft. lbs.).
3. Reconnect the lamp pigtail wire to the connector on the grille opening reinforcement.
4. Reinstall the grille panel onto the front of the grille opening reinforcement. (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).
5. Reconnect the battery negative cable.
6. Confirm proper front fog lamp alignment. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/FRONT FOG LAMP UNIT - ADJUSTMENTS).

## ADJUSTMENTS

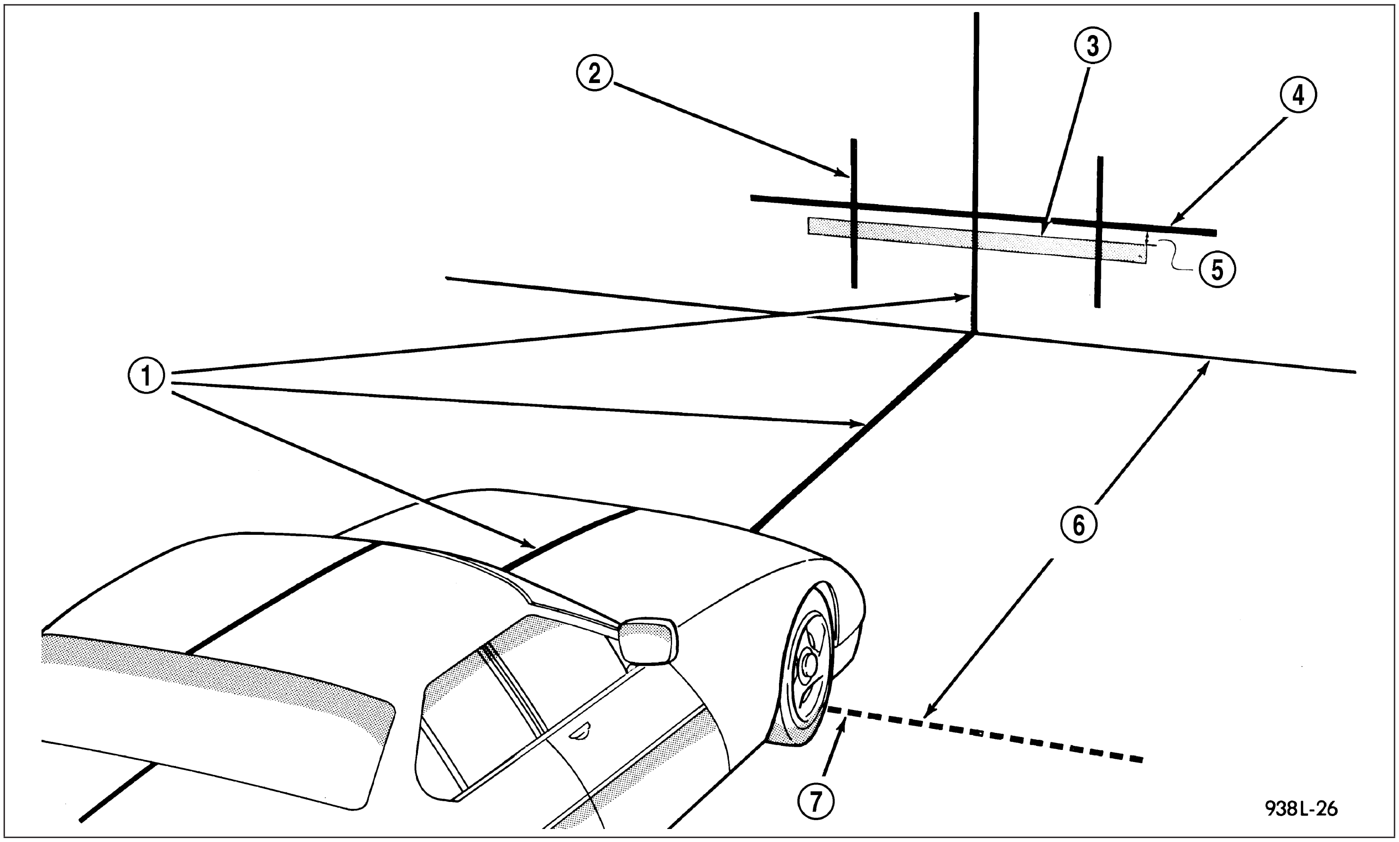
## FRONT FOG LAMP UNIT

### VEHICLE PREPARATION FOR FOG LAMP ALIGNMENT

1. Repair or replace any inoperative or damaged components that could hinder proper lamp alignment.
2. Verify proper tire inflation.
3. Clean the front fog lamp lenses.
4. Verify that the cargo area is not heavily loaded.

5. The fuel tank should be Full. Add 2.94 kilograms (6.5 pounds) of weight over the fuel tank for each estimated gallon of missing fuel.

## FOG LAMP ALIGNMENT SCREEN PREPARATION




Prepare an alignment screen as illustrated.

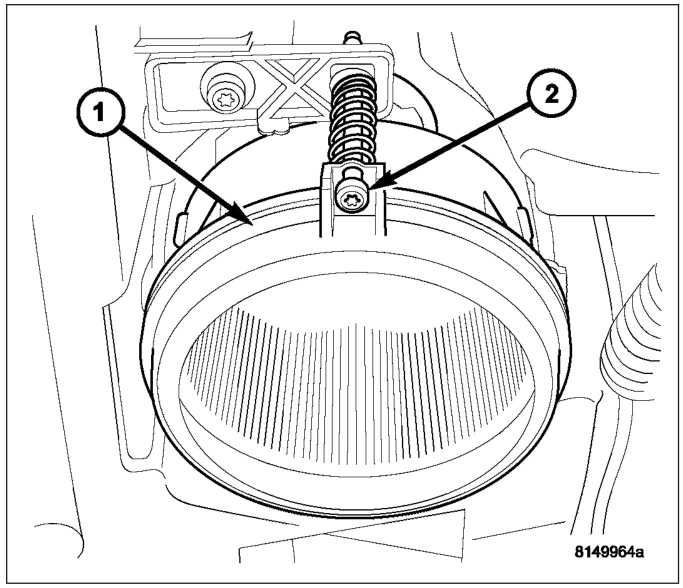
1. Position the vehicle on a level surface perpendicular to a flat wall 7.62 meters (25 feet) (6) away from the front of the front fog lamp lens (7). If necessary, tape a line on the floor 7.62 meters (25 feet) away from and parallel to the wall.
2. Measure up on the wall 1.27 meters (5 feet) from the floor and tape a vertical line on the alignment screen at the centerline of the vehicle (1). Sight along the centerline of the vehicle (from the rear of the vehicle forward) to verify the accuracy of the centerline placement.
3. Rock the vehicle from side-to-side three times to allow the suspension to stabilize, then jounce the front suspension three times by pushing downward on the front bumper and releasing. Measure the distance from the center of the front fog lamp lens to the floor. Transfer this measurement to the alignment screen and tape a horizontal line on the wall at this mark (4). This line will be used for up-and-down adjustment reference.
4. Measure the distance from the centerline of the vehicle to the center of each front fog lamp being aligned. Transfer these measurements to the alignment screen and tape a vertical line this distance to each side of the vehicle centerline (2). These lines will be used for left/right reference.

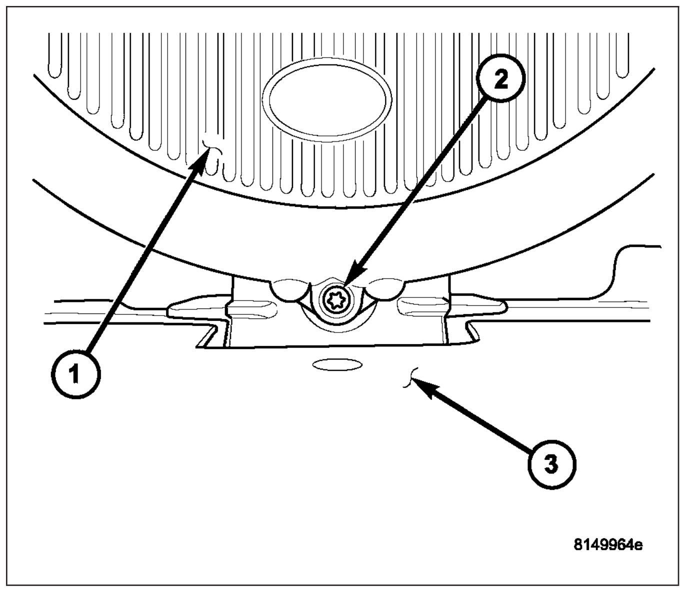
## FOG LAMP ADJUSTMENT

A properly aligned front fog lamp will project a pattern on the alignment screen 100 millimeters (4 inches) below the fog lamp centerline and straight ahead of the lamp.

**NOTE: On vehicles with grille-mounted fog lamps the grille must be removed to access the front fog lamp adjusting screws. (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).**

1. Turn the front fog lamp (1) adjusting screws (2) to adjust the beam height as required.



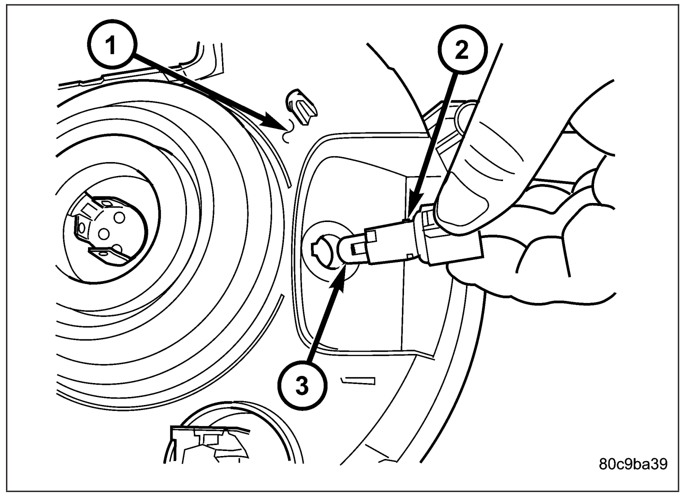



# FRONT POSITION LAMP

## REMOVAL - BULB

**NOTE: The front position lamps are integral to the headlamps on vehicles manufactured for certain markets where these lamps are required.**

1. Disconnect and isolate the battery negative cable.
2. Remove the headlamp from the front grille opening reinforcement. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - REMOVAL).
3. Firmly grasp the front position lamp socket (2) near the bottom of the headlamp unit housing (1) and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb straight out from the keyed opening in the housing.
5. Pull the base of the bulb (3) straight out of the socket.

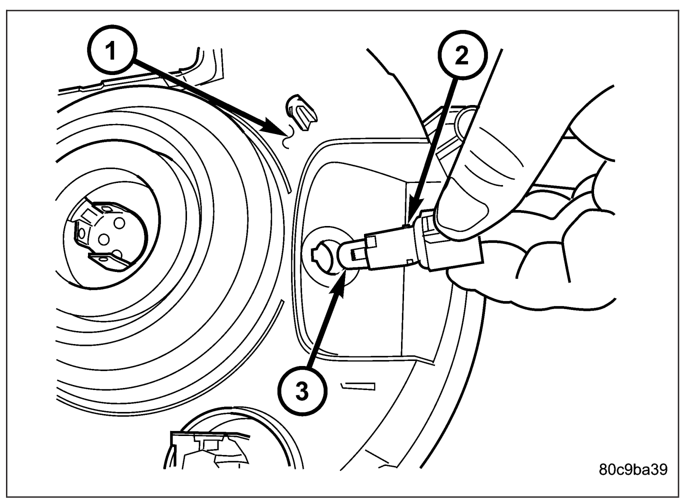



## INSTALLATION - BULB

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

**NOTE: The front position lamps are integral to the headlamp units on vehicles manufactured for certain markets where these lamps are required.**

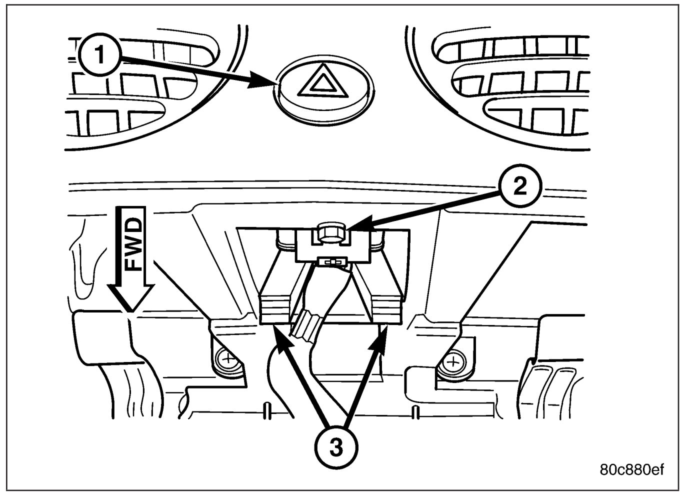
1. Align the base of the bulb (3) with the position lamp bulb socket (2).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the bottom of the headlamp housing (1).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Reinstall the headlamp unit onto the grille opening reinforcement. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - INSTALLATION).
7. Reconnect the battery negative cable.
8. Confirm proper headlamp unit alignment. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - ADJUSTMENTS).



# HAZARD SWITCH

## DESCRIPTION

The hazard switch is integral to the hazard switch module, which is secured near the center of instrument panel just above the radio. Only the hazard switch button (1) is visible through a dedicated, beveled, circular opening in the instrument panel between the two center panel outlets of the heat and air conditioning system. A red, stencil-like International Control and Display Symbol icon for "Hazard Warning" identifies the hazard switch button. The remainder of the hazard switch module is concealed behind the instrument panel.




All of the circuitry and components of the hazard switch module are contained within a molded black plastic housing. On the opposite end of the housing from the switch button is an integral connector receptacle and a stamped steel mounting bracket. The mounting bracket includes two latch feature tabs (3) that extend downward to support the back of the housing. These tabs engage the edge of the mounting hole provided for the switch in the instrument panel above the radio opening. The switch module housing also has an integral short, dowel-like alignment pin on each side just behind the switch button that is engaged in integral ramp formations in the instrument panel two align and support the face of the module. Finally, a single screw (2) through the top of the radio opening securely fastens the switch module to the instrument panel.

The switch module is connected to the vehicle electrical system through a single dedicated take out and connector of the instrument panel wire harness. Within the hazard switch module is the hazard switch circuitry, which includes a circuit board with both the hazard switch and the electronic combination flasher circuitry. The circuitry of the combination flasher performs both the hazard flasher and the turn signal flasher functions.

The hazard switch module cannot be adjusted or repaired and, if inoperative or damaged, it must be replaced as a unit.

## OPERATION

The hazard switch button is slightly recessed in the instrument panel when the switch is in the Off position, and latches at a position that is flush with the outer surface of the instrument panel when in the On position. The hazard switch module circuit board includes miniature relays that produce audible clicking to emulate the sound of a conventional flasher whenever the turn signals or the hazard warning system are activated.

The hazard switch module receives battery voltage on a fused B(+) circuit from a fuse in the Junction Block (JB) at all times for operation of the hazard warning, and on a fused ignition switch output (run) circuit from another fuse in the JB whenever the ignition switch is in the On position for operation of the turn signals. The module receives a path to ground through a splice block secured by a nut to a ground stud on the driver side instrument panel end bracket near the JB.

Inputs to and outputs from the hazard switch module include:

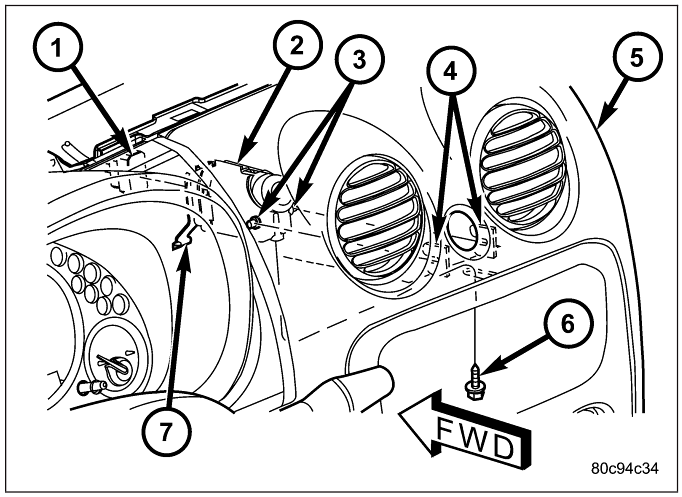
- **Panel Lamps Dimmer Input** - A non-serviceable incandescent bulb soldered onto the hazard switch module provides illumination of the switch button when the exterior lighting is turned On through the fused panel lamps dimmer switch signal circuit. This bulb flashes on and off at full intensity whenever the hazard switch button is activated, regardless of the status of the exterior lighting.
- **Hazard Switch Input** - The combination flasher receives an internal ground input from the hazard switch to request hazard flasher operation.
- **Multi-Function Switch Input** - The combination flasher receives separate ground inputs from the multi-function switch on right and left turn switch sense circuits to request turn signal flasher operation.
- **Body Control Module Input** - The Body Control Module (BCM) can request hazard flasher operation by providing a ground path to the combination flasher through a hazard lamp control circuit.

- **Turn Signal Output** - The combination flasher responds to the flasher inputs by energizing and de-energizing two miniature relays on the module circuit board. These relays control the switch output through the right and left turn signal circuits. One relay controls the right lamps, while the other controls the left.

Because of active electronic elements within the hazard switch module, it cannot be tested using conventional diagnostic tools or procedures. If a problem is noted with turn signal or hazard warning system operation, test and confirm the turn signal and hazard warning lighting circuits are in good condition before replacing the hazard switch module.

## REMOVAL

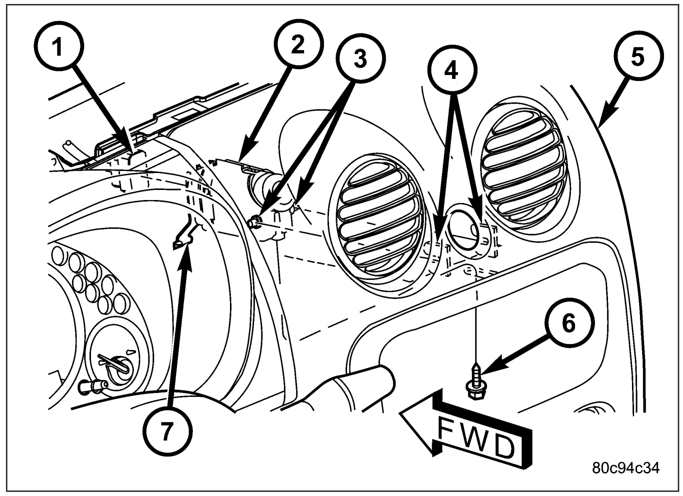
**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**




1. Disconnect and isolate the battery negative cable.
2. Remove the radio from the instrument panel. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - REMOVAL).
3. Remove the screw (6) at the top of the instrument panel radio opening that secures the hazard switch (2) to the instrument panel (5).
4. Reach through the radio opening to access the two latch tabs (7) of the stamped metal hazard switch mounting bracket.
5. Pull rearward and downward on the latch tabs of the switch mounting bracket far enough to disengage them from the instrument panel trim.
6. Push the hazard switch button through the button opening far enough to disengage the alignment pins (3) on each side of the switch housing from the saddle-like ramp formations (4) on the back of the instrument panel trim.
7. Pull the switch down into the radio opening far enough to access and disconnect the instrument panel wire harness connector (1) from the back of the switch.
8. Remove the hazard switch through the instrument panel radio opening.

## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

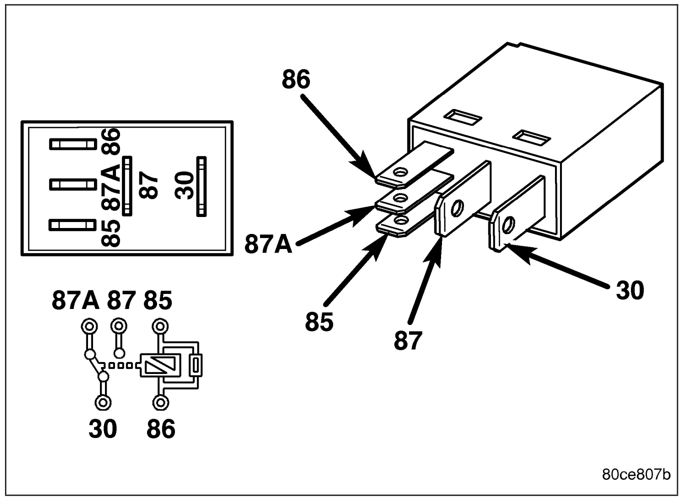



1. Position the hazard switch module (2) into the instrument panel (5) radio opening.
2. Reconnect the instrument panel wire harness connector (1) to the back of the switch housing.
3. Reach through the instrument panel radio opening to position the hazard switch for installation.
4. Guide the hazard switch button through the button opening of the instrument panel, which will engage the alignment pins (3) on each side of the switch housing into the saddle-like ramp formations (4) on the back of the instrument panel trim.
5. Press upward on the back of the hazard switch until the latch tabs (7) of the mounting bracket are both engaged with the instrument panel trim.
6. Install and tighten the screw (6) that secures the switch to the top of the instrument panel radio opening. Tighten the screw to 2 N·m (17 in. lbs.).
7. Reinstall the radio into the instrument panel. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - INSTALLATION).
8. Reconnect the battery negative cable.

# HEADLAMP HIGH BEAM RELAY

## DESCRIPTION

The headlamp high beam relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. This relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs through five integral male spade-type terminals that extend from the relay base plate.




The headlamp high beam relay is located in the Junction Block (JB). This relay is omitted from vehicles manufactured for sale in Canada, which have a Daytime Running Lamp (DRL) solid state relay installed in the JB that also performs the high beam relay function.

The headlamp high beam relay cannot be adjusted or repaired and, if inoperative or damaged, it must be replaced with a new unit.

## OPERATION

The headlamp high beam relay is an electromechanical switch that uses a low current input from the Body Control Module (BCM) to control a high current output to the headlamp high beam filaments. Within the relay are an electromagnetic coil, a movable contact and two fixed contact points. A resistor is connected in parallel with the coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the field of the relay coil collapses.

The movable common supply contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This field draws the movable contact point away from the normally closed contact, and holds it against the normally open contact. When the relay coil is de-energized, spring pressure returns the movable contact back against the normally closed contact.

The inputs and outputs of the headlamp high beam relay include:

- **Common Supply Terminal (30)** - The common feed terminal is connected to a fused B(+) circuit at all times.
- **Coil Ground Terminal (85)** - The common feed terminal is connected to a fused B(+) circuit at all times.
- **Coil Battery Terminal (86)** - The coil battery terminal is connected to a control output of the Body Control Module (BCM) and to the momentary optical horn (flash-to-pass) output of the multi-function switch through a high beam relay control circuit. The BCM and/or the multi-function switch controls headlamp high beam operation by controlling a ground path through this circuit.
- **Normally Open Terminal (87)** - The normally open terminal is connected to the headlamp high beam filaments through the high beam relay output circuit and provides battery voltage to the headlamp high beams whenever the relay is energized.
- **Normally Closed Terminal (87A)** - The normally closed terminal is not connected in this application, but will have battery voltage present whenever the relay is de-energized.

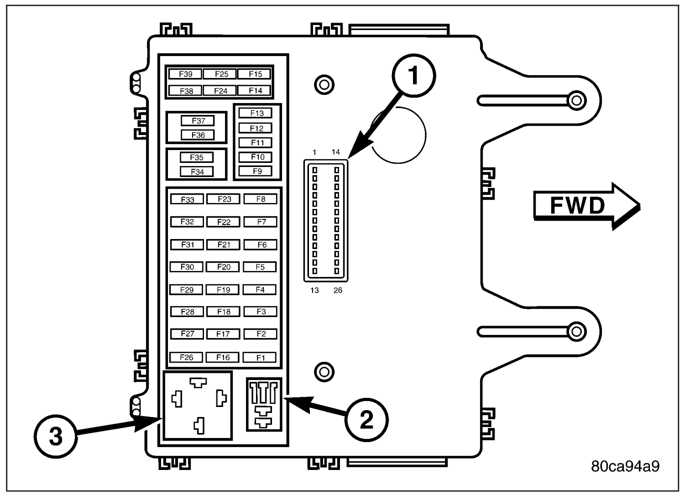
The headlamp high beam relay can be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: The headlamp high beam relay is installed in the Junction Block (JB) on the driver side outboard end of the instrument panel. Vehicles equipped with a Daytime Running Lamps (DRL) relay MUST NOT have a headlamp high beam relay installed in the JB.**

1. Disconnect and isolate the battery negative cable.
2. Remove the trim from the driver side end of the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL END CAP - REMOVAL).
3. Remove the high beam relay by grasping it firmly and pulling it straight out from the receptacle (2) in the Junction Block (JB).

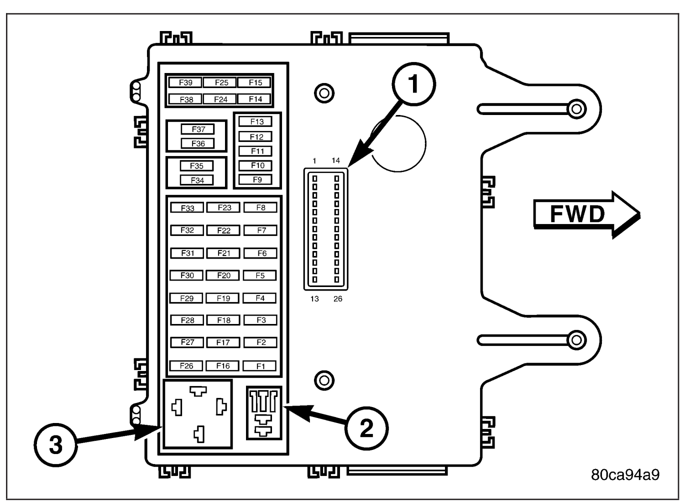



## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

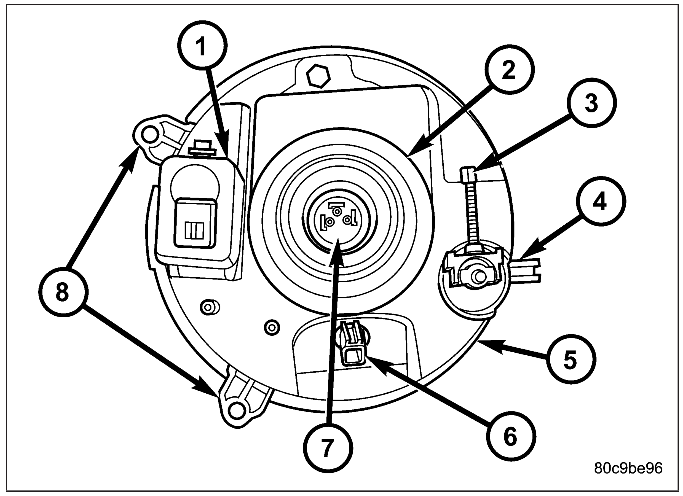
**NOTE: The headlamp high beam relay is installed in the Junction Block (JB) on the driver side outboard end of the instrument panel. Vehicles equipped with a Daytime Running Lamps (DRL) relay MUST NOT have a headlamp high beam relay installed in the JB.**

1. Position the headlamp high beam relay to the proper receptacle (2) in the Junction Block (JB).
2. Align the high beam relay terminals with the cavities in the JB receptacle.
3. Push firmly and evenly on the top of the high beam relay until the relay base is fully seated in the JB receptacle.
4. Reinstall the trim onto the driver side outboard end of the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL END CAP - INSTALLATION).
5. Reconnect the battery negative cable.



# HEADLAMP LEVELING MOTOR

## DESCRIPTION




The headlamp leveling motor (1) is located on the rear inboard side of each headlamp unit (5) on vehicles equipped with the headlamp leveling system, which is available only in certain markets where required. The motor is encased within a molded plastic housing and is secured by an integral wedge-type mounting boss to a keyed flange on the back of the headlamp unit housing. A rubber seal around the circumference of the mounting boss seals the motor to the headlamp.

The outside of the motor housing features an integral molded connector on its rearward surface, a hex-headed adjusting screw extends from the top of the housing, and a plastic pushrod with a ball formation on its free end extends from the motor mounting boss. Within the motor housing is a 12-volt Direct Current (DC) servo motor, an electronic controller board that includes the motor logic circuits, and an integral screw-drive transmission. The headlamp leveling motor is connected to the vehicle electrical system through a dedicated take out and connector of the front fascia wire harness.

The headlamp leveling motor is serviced as a unit with the headlamp unit. The motor cannot be repaired and, if inoperative or damaged, the entire headlamp unit must be replaced.

## OPERATION

The controller board and logic circuitry of the headlamp leveling motor control motor operation based upon a voltage signal input received from the resistor multiplexed headlamp leveling switch on the instrument panel. When the motor is energized it will extend or retract the motor pushrod through the integral screw-drive transmission. The ball on the end of the pushrod is snapped into a socket on the back of the reflector within the headlamp unit housing, which will cause the reflector to move as the pushrod is extended or retracted, changing the angle at which the light is projected from the headlamps.

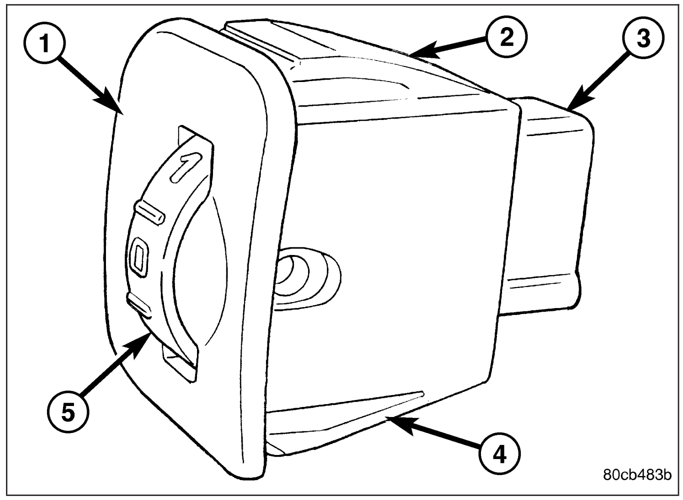
The headlamp leveling motors and switch have a path to ground at all times. The headlamp leveling components operate on battery voltage received through the fused park lamp relay output circuit so that the system will only operate when the exterior lighting is turned On.

Because of active electronic elements within the headlamp leveling motor, it cannot be tested using conventional diagnostic tools and procedures. If the headlamp leveling system is believed to be inoperative, the headlamp leveling circuits and the leveling switch must be tested before considering motor replacement.

# HEADLAMP LEVELING SWITCH

## DESCRIPTION

The headlamp leveling switch (1) is used only on vehicles manufactured for certain markets where the headlamp leveling system is required. The headlamp leveling switch is mounted in the driver side inboard trim bezel on the instrument panel. Only the switch bezel and thumbwheel (5) are visible on the outer surface of the instrument panel trim bezel. The black plastic switch thumbwheel is marked with white numbers “0,” “1,” “2,” and “3,” each of which indicates one of the four switch detent positions. Each higher number represents a lower aiming position of the headlamp beam relative to the road surface.




The black, molded plastic switch housing encloses the switch thumbwheel mechanism and the leveling switch circuitry including the switch contacts and a series resistor configuration. A connector receptacle (3) is integral to the back of the switch housing, while a single integral latch feature (2) on the top of the housing and two latch features (4) on the bottom of the housing secure the switch in the instrument panel trim bezel. The switch is connected to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness.

The headlamp leveling switch cannot be adjusted or repaired and, if inoperative or damaged, the unit must be replaced.

## OPERATION

The headlamp leveling switch receives battery voltage on a fused park lamp relay output circuit from a fuse in the Junction Block (JB) whenever the park lamps relay is energized (the park lamps are turned On). The switch receives a path to ground through a splice block in the instrument panel wire harness secured by a nut to a ground stud on the driver side instrument panel end bracket near the JB.

The only output from the switch is a voltage signal that it provides to the headlamp leveling motors on a headlamp adjust signal circuit. Each switch position selects a different tap on a series resistor within the switch to provide a different voltage signal to the leveling motors. The higher the switch position number, the higher the output voltage level.

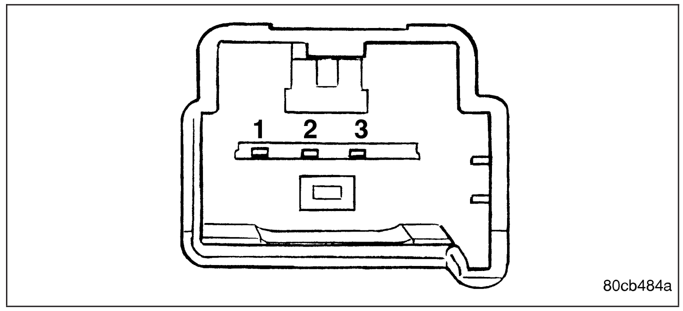
The headlamp leveling switch can be tested using conventional diagnostic tools and methods.

## DIAGNOSIS AND TESTING

## HEADLAMP LEVELING SWITCH

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Disconnect and isolate the battery negative cable.
2. Disconnect the instrument panel wire harness connector from the headlamp leveling switch.
3. Using an ohmmeter, perform the resistance tests at the terminal pins in the headlamp leveling switch connector receptacle as shown in the Headlamp Leveling Switch Tests table.




| HEADLAMP LEVELING SWITCH TESTS | |
|---|---|
| SWITCH POSITION | RESISTANCE (OHMS) BETWEEN PINS 1 AND 3 |
| 0 | 0.5 ± 0.5 |
| 1 | 301 ± 1 |
| 2 | 595 ± 1 |
| 3 | 739 ± 1 |

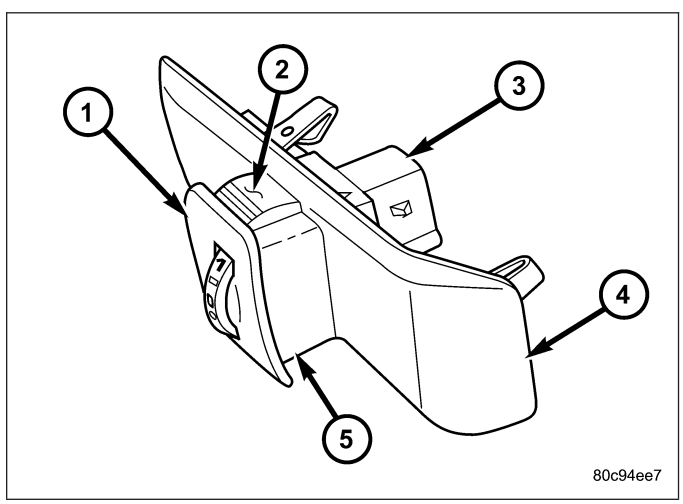
4. If the switch fails any of the resistance tests, replace the inoperative headlamp leveling switch as required.

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: A headlamp leveling switch is used only on vehicles manufactured for certain markets where headlamp leveling is required.**

1. Disconnect and isolate the battery negative cable.
2. Remove the driver side inboard bezel (4) from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL DRIVER SIDE BEZEL - REMOVAL).
3. Disconnect the instrument panel wire harness connector from the headlamp leveling switch connector receptacle (3).
4. From the back of the trim bezel, depress the two lower latch features (5) on the switch housing and rock the bottom of the switch out through the face of the bezel.



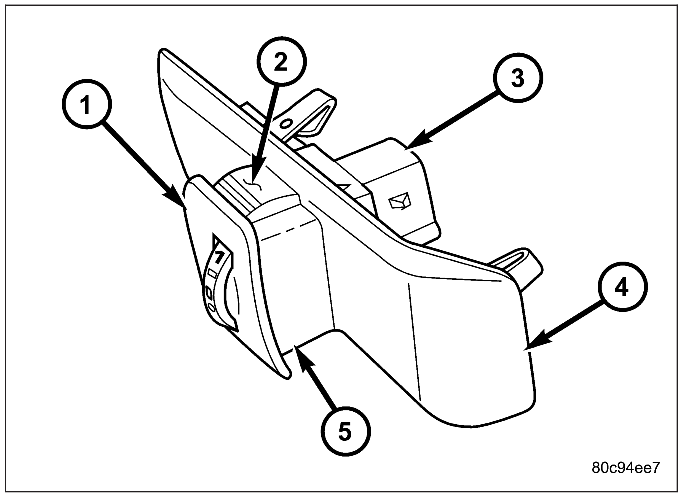
5. From the back of the trim bezel, depress the upper latch feature (2) on the switch housing and push the switch (1) out through the face of the bezel.

## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: A headlamp leveling switch is used only on vehicles manufactured for certain markets where headlamp leveling is required.**

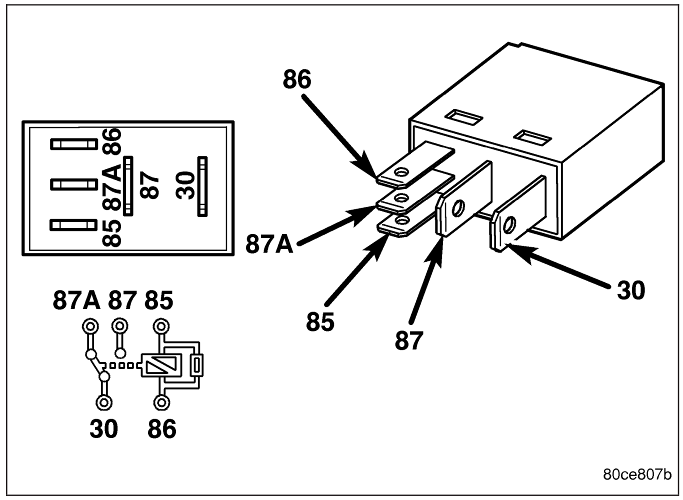
1. From the face of the driver side inboard bezel (4), align the headlamp leveling switch housing (1) to the mounting hole in the bezel.
2. Push the switch into the mounting hole until it is fully seated and each of the latch features (2 and 5) is fully engaged.
3. Position the switch and bezel unit to the instrument panel.
4. Reconnect the instrument panel wire harness connector to the switch connector receptacle (3).
5. Reinstall the trim bezel and switch unit onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL DRIVER SIDE BEZEL - INSTALLATION).
6. Reconnect the battery negative cable.



# HEADLAMP LOW BEAM RELAY

## DESCRIPTION

The headlamp low beam relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. This relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs through five integral male spade-type terminals that extend from the relay base plate.




The headlamp low beam relay is located in the Junction Block (JB) on the driver side instrument panel end bracket. The headlamp low beam relay cannot be adjusted or repaired and, if inoperative or damaged, it must be replaced with a new unit.

## OPERATION

The headlamp low beam relay is an electromechanical switch that uses a low current input from the Body Control Module (BCM) to control a high current output to the headlamp low beam filaments. Within the relay are an electromagnetic coil, a movable contact and two fixed contact points. A resistor is connected in parallel with the coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the field of the relay coil collapses.

The movable common supply contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This field draws the movable contact point away from the normally closed contact, and holds it against the normally open contact. When the relay coil is de-energized, spring pressure returns the movable contact back against the normally closed contact.

The inputs and outputs of the headlamp low beam relay include:

- **Common Supply Terminal (30)** - The common feed terminal is connected to a fused B(+) circuit at all times.
- **Coil Ground Terminal (85)** - The common feed terminal is connected to a fused B(+) circuit at all times.
- **Coil Battery Terminal (86)** - The coil battery terminal is connected to a control output of the Body Control Module (BCM) through a low beam relay control circuit. The BCM controls headlamp low beam operation by controlling a ground path through this circuit.
- **Normally Open Terminal (87)** - The normally open terminal is connected to the headlamp low beam filaments through the low beam relay output circuit and provides battery voltage to the headlamp low beams whenever the relay is energized.
- **Normally Closed Terminal (87A)** - The normally closed terminal is not connected in this application, but will have battery voltage present whenever the relay is de-energized.

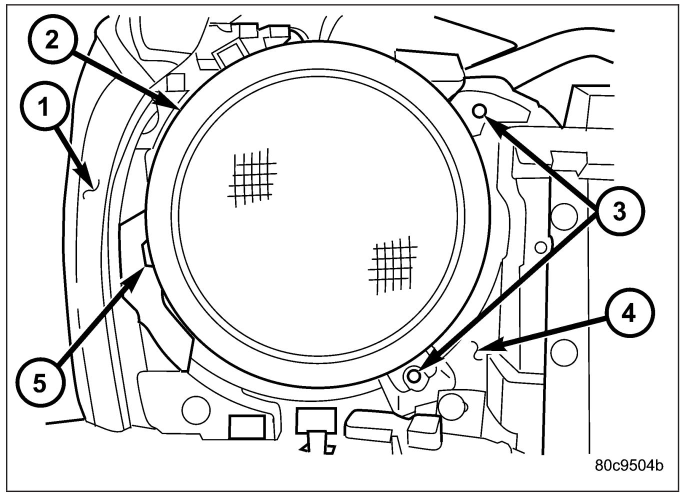
The headlamp low beam relay can be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

# HEADLAMP UNIT

## REMOVAL

## LAMP

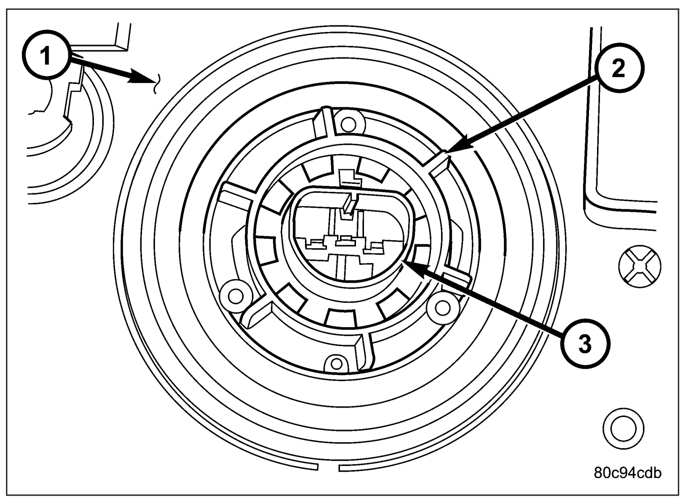
1. Disconnect and isolate the battery negative cable.
2. Remove the grille panel from the grille opening reinforcement. (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
3. Remove the two screws that secure the mounting tabs (3) on the inboard side of the headlamp unit housing (2) to the grille opening reinforcement (4).
4. Pull the inboard side of the headlamp unit away from the grille opening reinforcement far enough to disengage the locator tab (5) on the outboard side of the unit from the engagement slot in the outboard edge of the reinforcement.
5. Pull the headlamp unit away from the grille opening reinforcement far enough to disconnect the wire harness connectors from the headlamp bulb socket (North America), the headlamp bulb base (Export), the front position lamp socket (if equipped), and the headlamp leveling motor (if equipped).
6. Remove the headlamp from the grille opening reinforcement.




## BULB - NORTH AMERICA

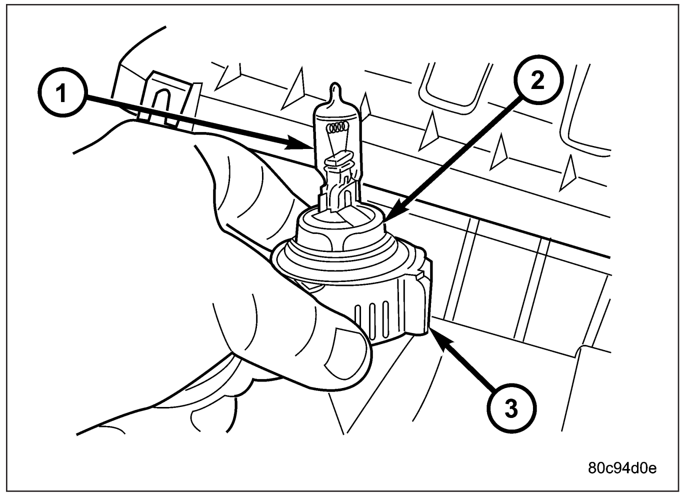
1. Disconnect and isolate the battery negative cable.
2. Reach behind the headlamp unit (1) from the engine compartment side of the upper radiator crossmember to access the headlamp bulb lock ring (2).
3. Firmly grasp the lock ring on the back of the headlamp unit housing.
4. Rotate the lock ring on the back of the headlamp housing counterclockwise about 30 degrees to unlock it.

**CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.**



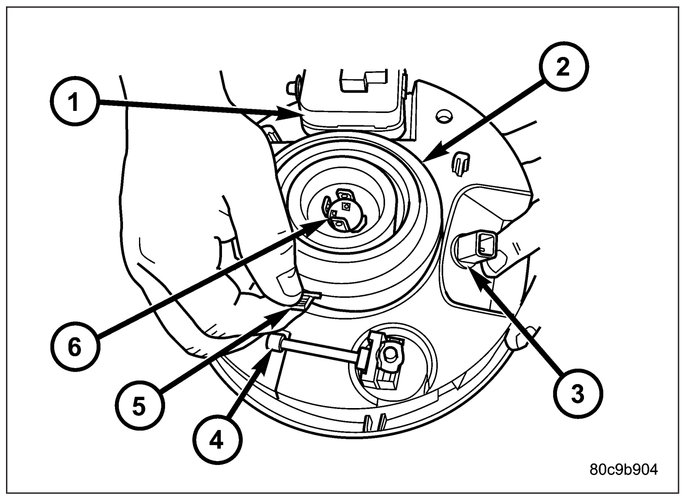

5. Pull the lock ring, socket, and bulb (3) straight out of the keyed opening in the headlamp housing and up from behind the upper radiator crossmember.

6. Disconnect the grille opening reinforcement wire harness connector from the headlamp bulb (1) socket connector (2) receptacle.
7. Remove the bulb and socket unit from the lock ring (3).

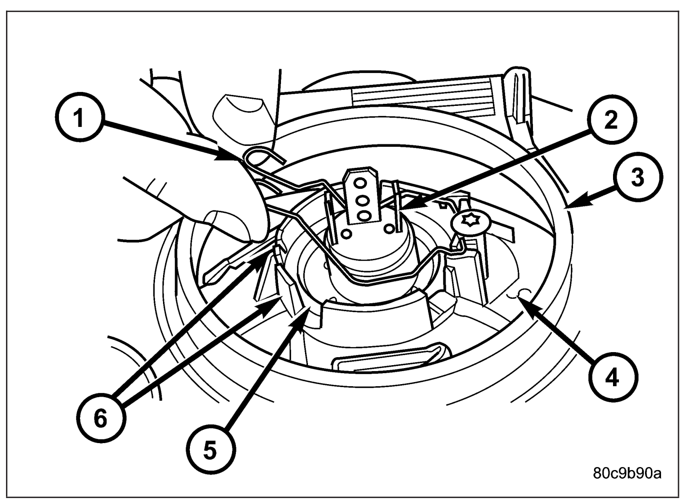



## BULB - EXPORT

1. Disconnect and isolate the battery negative cable.
2. Remove the headlamp unit from the grille opening reinforcement. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - REMOVAL).
3. Firmly grasp the tab of the headlamp boot seal (2) on the back of the headlamp unit housing.
4. Pull the tab away from the back of the headlamp unit housing to remove the boot seal from the housing and the bulb base (6).

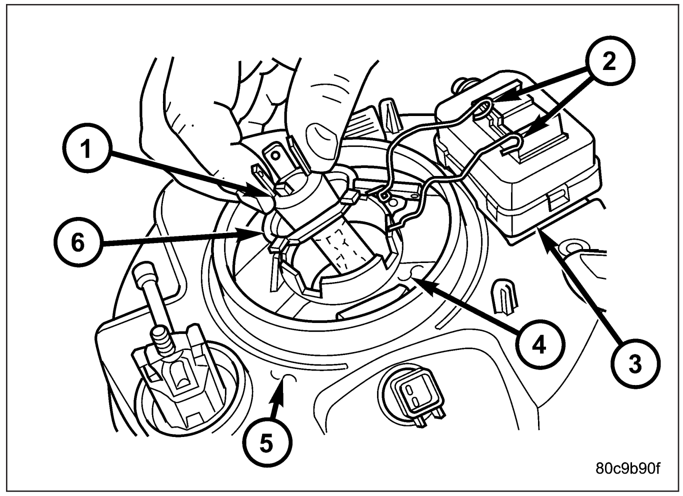



5. Pinch the two hooked ends of the wire headlamp bulb retainer clip (1) together and disengage them from the slots (6) in the flange of the reflector (4).
6. Pivot the headlamp bulb retainer clip up off of the bulb flange (5) and out of the way.




**CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.**

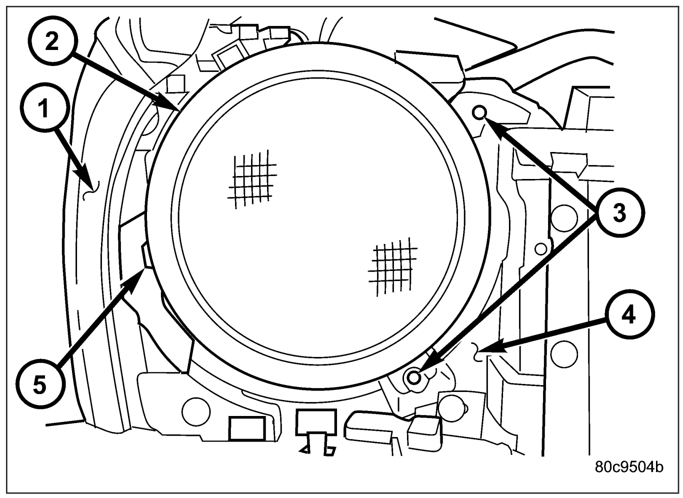
7. Pull the bulb (1) straight out of the keyed opening in the headlamp reflector (4).




## INSTALLATION

## LAMP

1. Position the headlamp unit (2) to the grille opening reinforcement (4).
2. Reconnect the wire harness connectors to the headlamp bulb socket (North America), the headlamp bulb base (Export), the front position lamp socket (if equipped), and the headlamp leveling motor (if equipped).
3. Engage the locator tab (5) on the outboard side of the headlamp unit into the engagement slot in the outboard edge of the grille opening reinforcement.
4. Align the two mounting tabs (3) on the inboard side of the headlamp unit housing to the mounting holes in the grille opening reinforcement.
5. Install and tighten the two screws that secure the mounting tabs on the inboard side of the headlamp housing to the grille opening reinforcement. Tighten the screws to 3 N·m (30 in. lbs.).



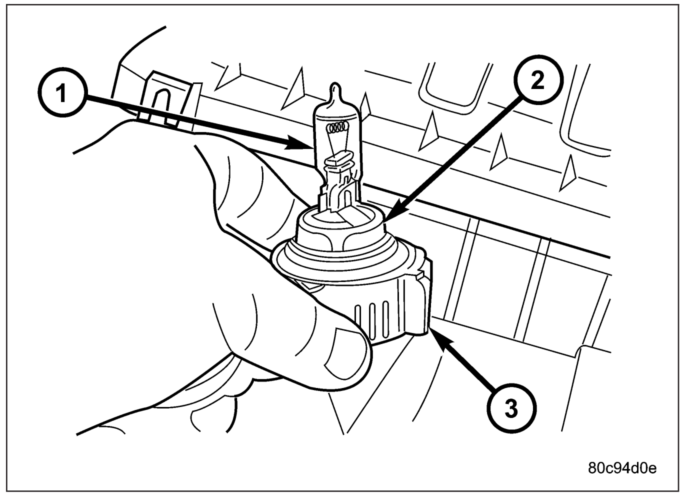

6. Reinstall the grille panel onto the grille opening reinforcement. (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).
7. Reconnect the battery negative cable.
8. Confirm proper headlamp unit alignment. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - ADJUSTMENTS).

## BULB - NORTH AMERICA

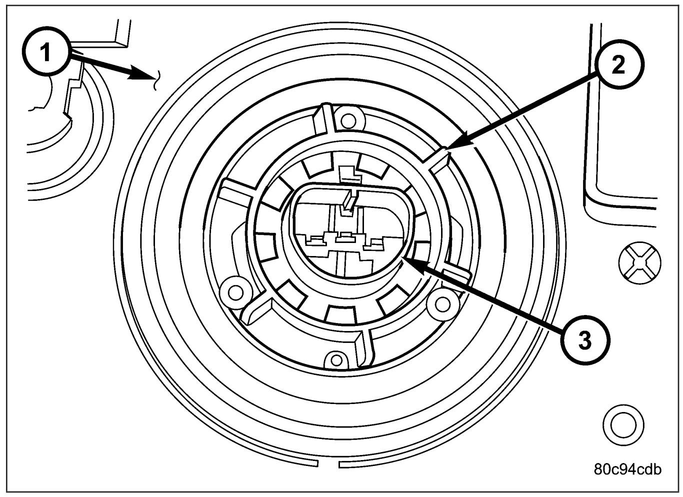
**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

**CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.**

1. Position the headlamp bulb (1) and socket (2) into the lock ring (3).
2. Reconnect the grille opening reinforcement wire harness connector to the headlamp bulb socket connector receptacle.




3. Position the lock ring (2), socket, and bulb (3) down behind the upper radiator crossmember and align them with the keyed opening on the back of the headlamp unit housing (1).
4. Push the socket and bulb unit straight into the headlamp housing until they are firmly seated.
5. Position the lock ring over the socket and engage it with the flange on the back of the headlamp housing.
6. Rotate the lock ring on the back of the headlamp housing clockwise about 30 degrees to lock it into place.
7. Reconnect the battery negative cable.

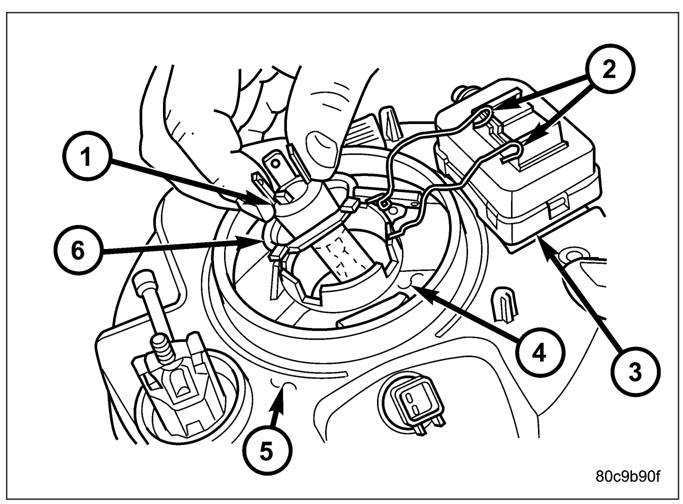



## BULB - EXPORT

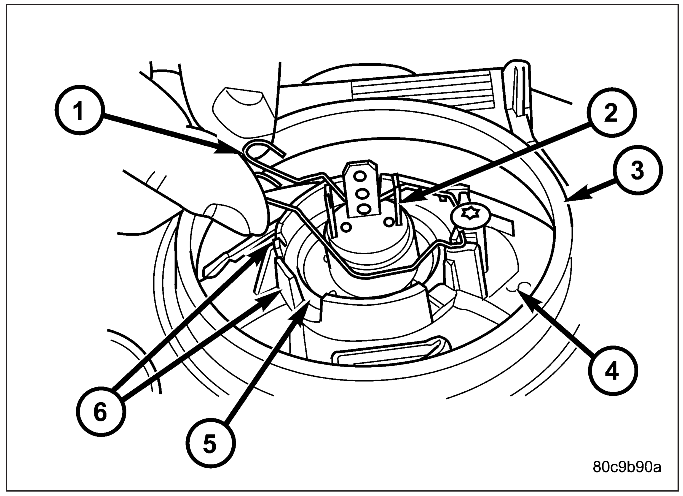
**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

**CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.**

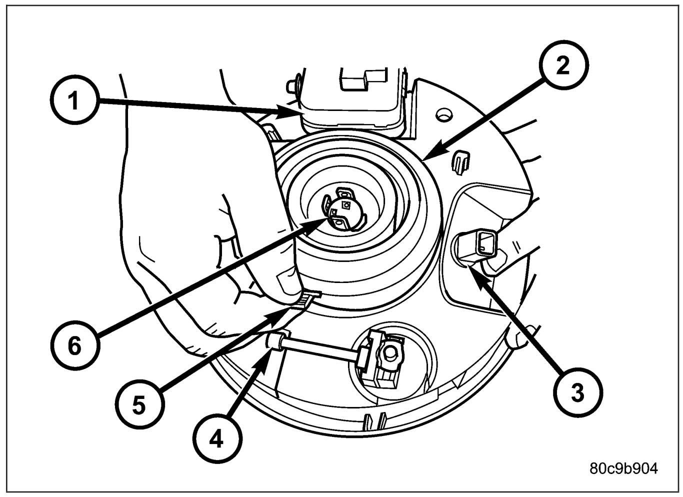
1. Position the bulb (1) into the keyed opening in the headlamp reflector (4).
2. Pivot the headlamp bulb retainer clip (2) back over the bulb flange (6).



3. Pinch the two hooked ends of the wire headlamp bulb retainer clip (1) together and engage them into the slots (6) in the flange of the reflector (4).




4. Position the center opening of the boot seal (2) over the base of the headlamp bulb (6) and pull it downward until the seal is fully engaged over the bulb base.
5. Position the outer circumference of the boot seal over the flange on the back of the headlamp unit housing and pull it downward until the seal is fully engaged over the flange.
6. Reinstall the headlamp unit onto the grille opening reinforcement. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - INSTALLATION).
7. Reconnect the battery negative cable.
8. Confirm proper headlamp unit alignment. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - ADJUSTMENTS).



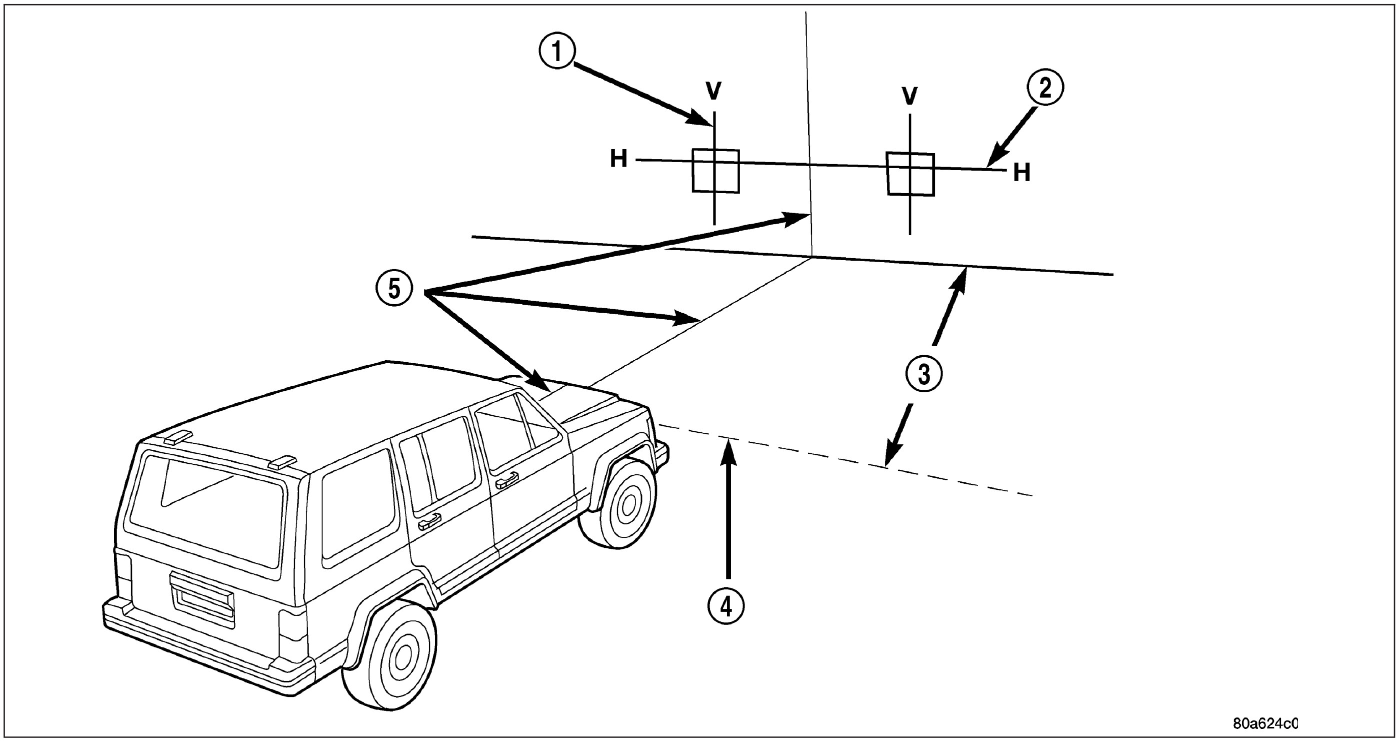

## ADJUSTMENTS

## HEADLAMP UNIT

### VEHICLE PREPARATION FOR HEADLAMP ALIGNMENT

1. Verify headlamp dimmer (multi-function) switch and high beam indicator operation.
2. If the vehicle is equipped with headlamp leveling, be certain that the headlamp leveling switch is in the “0” position.
3. Repair or replace any inoperative or damaged components that could hinder proper lamp alignment.
4. Verify proper tire inflation.
5. Clean headlamp lenses.
6. Verify that cargo area is not heavily loaded.
7. The fuel tank should be Full. Add 2.94 kilograms (6.5 pounds) of weight over the fuel tank for each estimated gallon of missing fuel.

## HEADLAMP ALIGNMENT SCREEN PREPARATION



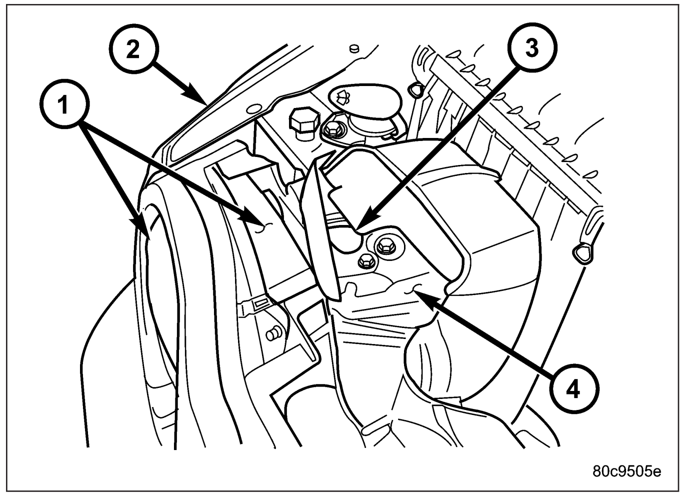

Prepare an alignment screen as illustrated.

1. Position the vehicle on a level surface perpendicular to a flat wall 7.62 meters (25 feet) away (3) from the front of the headlamp lens (4) for North American vehicles, or 10.0 meters (32.81 feet) away from the front of the headlamp lens (4) for Export vehicles. If necessary, tape a line on the floor at the appropriate distance away from and parallel to the wall.
2. Measure up on the wall 1.27 meters (5 feet) from the floor and tape a vertical line on the alignment screen at the centerline of the vehicle (5). Sight along the centerline of the vehicle (from the rear of the vehicle forward) to verify the accuracy of the centerline placement.
3. Rock the vehicle from side-to-side three times to allow the suspension to stabilize, then jounce the front suspension three times by pushing downward on the front bumper and releasing. Measure the distance from the center of the headlamp lens to the floor (2). Transfer this measurement to the alignment screen and tape a horizontal line on the wall at this mark. This line will be used for up-and-down adjustment reference.
4. Measure the distance from the centerline of the vehicle to the center of each headlamp being aligned. Transfer these measurements to the alignment screen and tape a vertical line this distance to each side of the vehicle centerline (1). These lines will be used for left/right reference.

## HEADLAMP ADJUSTMENT

**NOTE: A properly aligned headlamp will project a pattern on the alignment screen from just below horizontal to 75 millimeters (3 inches) below the headlamp centerline for vehicles in North America, or from just below horizontal to 125 millimeters (5 inches) below the headlamp horizontal centerline for vehicles in Export.**

1. Vehicles for all markets except Japan should have the headlamp low beams selected with the dimmer (multi-function) switch during the adjustment procedure. Vehicles for the Japanese market should have the headlamp high beams selected.
2. Cover the lens of the headlamp that is not being adjusted.
3. Turn the adjusting screw (3) until the top edge of the beam intensity pattern is positioned from just below horizontal to 75 millimeters (3 inches) below the headlamp horizontal centerline for vehicles in North America, or from just below horizontal to 125 millimeters (5 inches) below the headlamp horizontal centerline for Export vehicles.
4. Repeat the adjustment procedure for the opposite headlamp.

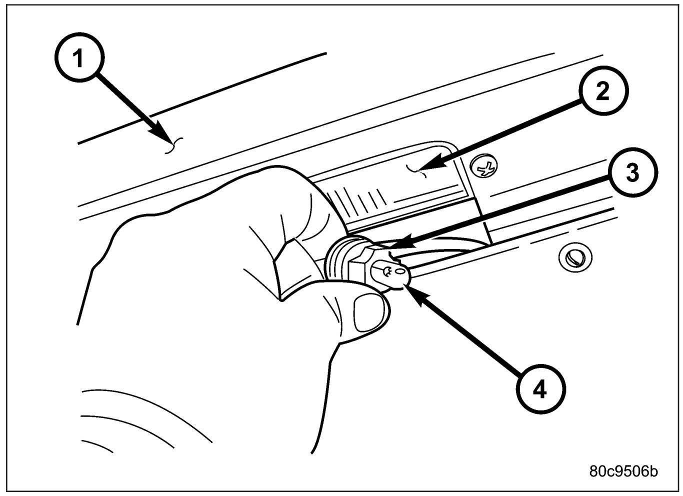


# LICENSE PLATE LAMP

## REMOVAL

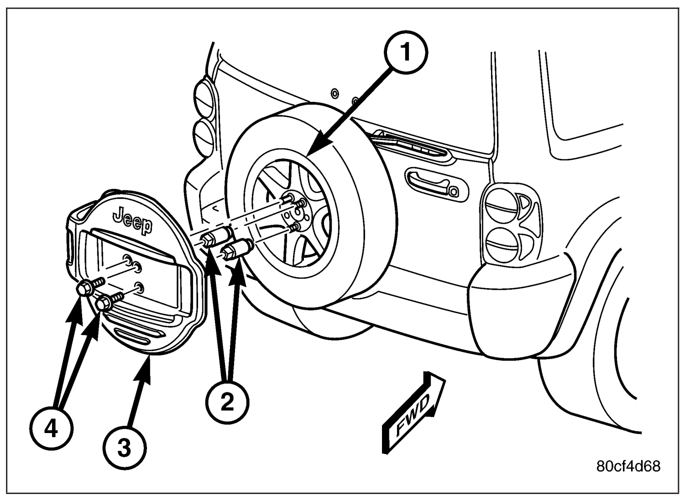
### BULB - NORTH AMERICA

1. Disconnect and isolate the battery negative cable.
2. Reach through the opening in the rear bumper fascia (1) between the license plate and the lamp (2) to access the socket (3) on the back of the license plate lamp unit housing.
3. Firmly grasp and pull the socket and bulb (4) straight out of the opening in the back of the license plate lamp housing.
4. Pull the bulb straight out of the socket.

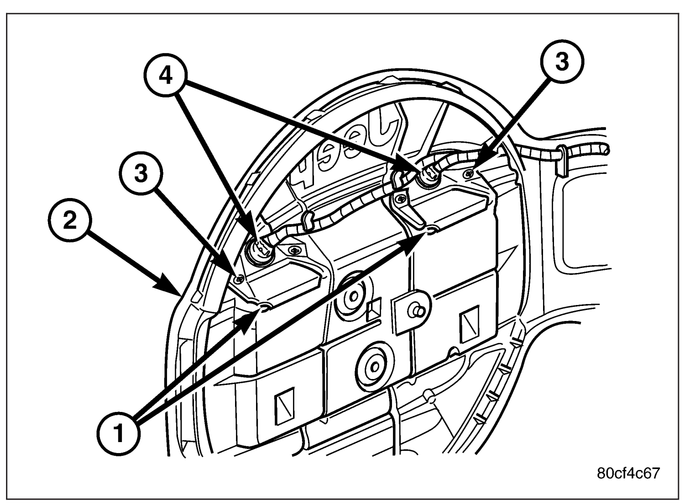



### BULB - EXPORT

1. Disconnect and isolate the battery negative cable.
2. Unsnap and lift up the bottom of the license mounting plate far enough to access and remove the two screws (4) that secure the license plate bracket (3) to the special lug nuts (2) on the spare tire (1).

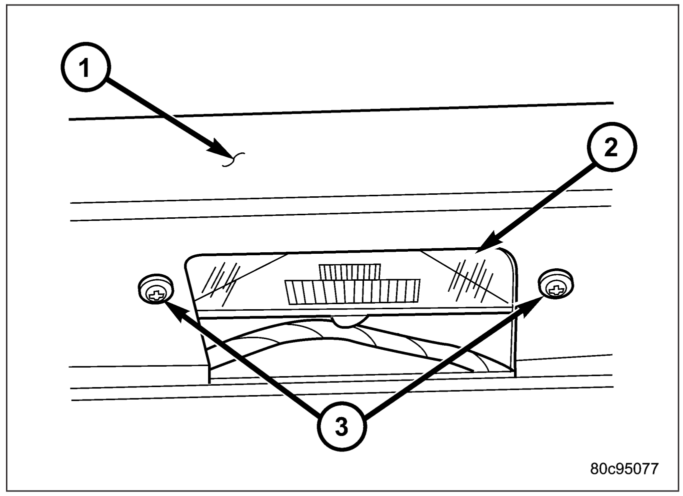



3. Swing the license plate bracket (2) away from the spare tire far enough to access the license plate lamp bulb sockets (4).
4. Firmly grasp the socket on the top of the license plate lamp unit housing for the bulb that is being removed.
5. Rotate the socket counterclockwise about 30 degrees to unlock it.
6. Pull the socket and bulb straight out from the keyed opening in the top of the lamp housing.
7. Pull the base of the bulb straight out of the socket.



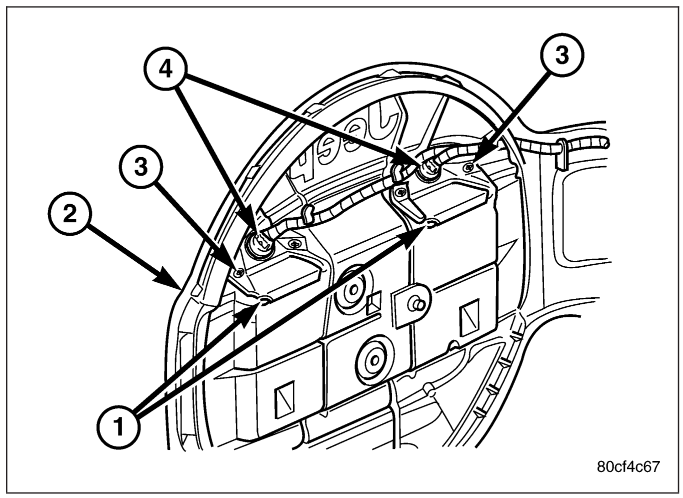
## LAMP - NORTH AMERICA

1. Disconnect and isolate the battery negative cable.
2. Remove the two screws (3) that secure the license plate lamp unit (2) to the rear bumper fascia (1).
3. Lower the lamp from the mounting hole in the fascia far enough to access and disconnect the lamp pigtail wire connector.
4. Remove the license plate lamp unit from the vehicle.




## LAMP - EXPORT

1. Disconnect and isolate the battery negative cable.
2. Remove the bulb and socket (4) from the license plate lamp unit (1) that is being removed. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/ LICENSE PLATE LAMP BULB - REMOVAL - EXPORT).
3. Remove the two screws (3) that secure the lamp unit to the back of the license plate bracket (2).
4. Remove the lamp unit from the back of the license plate bracket.

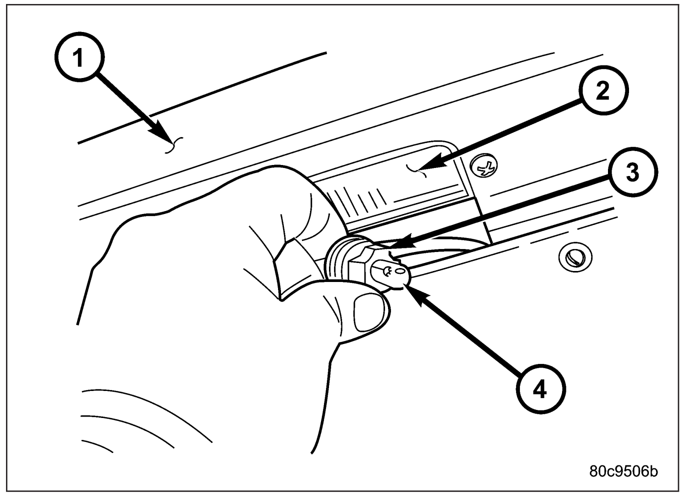



## INSTALLATION

## BULB - NORTH AMERICA

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

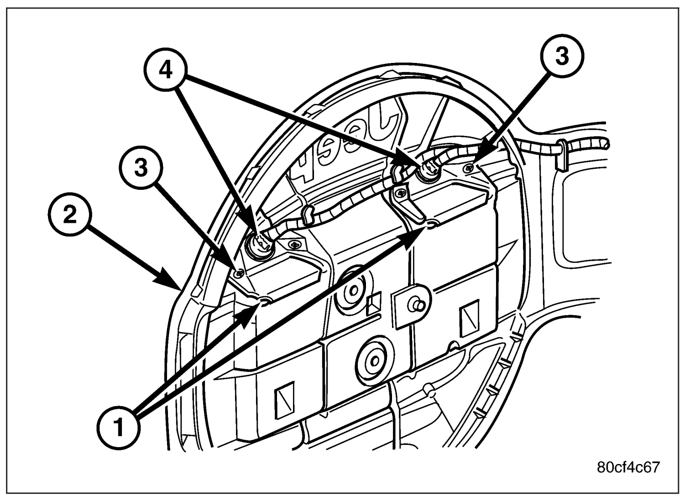
1. Align the base of the bulb (4) with the license plate lamp socket (3).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Reach through the opening in the rear bumper fascia (1) between the license plate and the lamp (2) to align the socket and bulb with the opening on the back of the lamp housing.
4. Insert the socket and bulb straight into the housing until the socket is firmly seated.
5. Reconnect the battery negative cable.



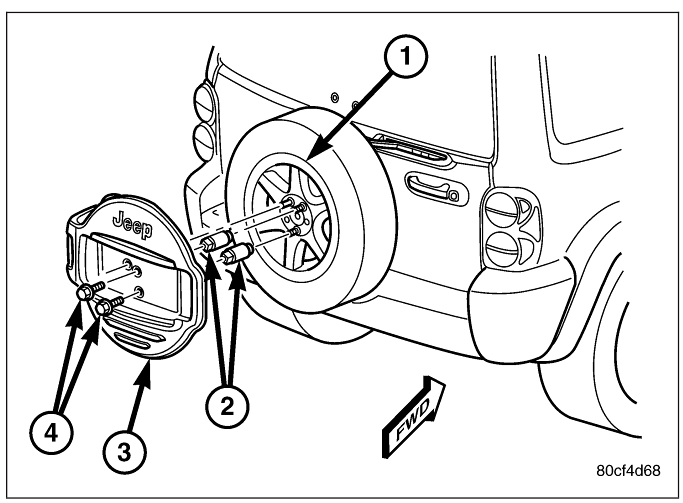

## BULB - EXPORT

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

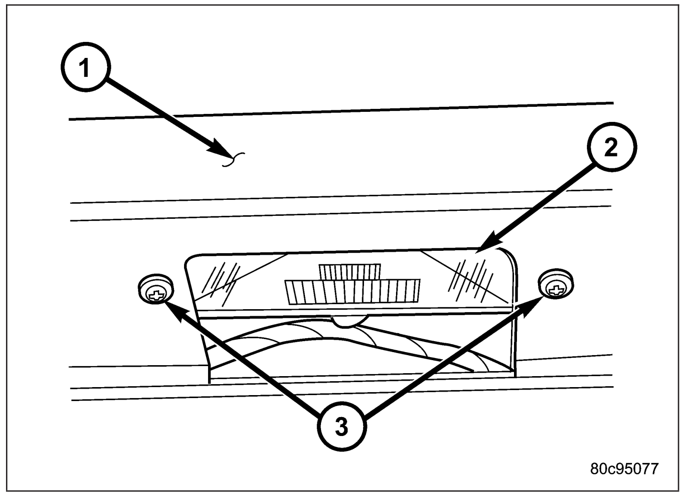
1. Align the base of the bulb with the license plate lamp socket (4).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the top of the license plate lamp unit (1).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.




6. Swing the license plate bracket (3) back against the spare tire (1).
7. Lift up the bottom of the license mounting plate far enough to install and tighten the two screws (4) that secure the license plate bracket to the special lug nuts (2) on the spare tire. Tighten the screws to 28 N·m (21 ft. lbs.).
8. Lower the bottom of the license mounting plate and snap it into place on the license plate bracket.
9. Reconnect the battery negative cable.

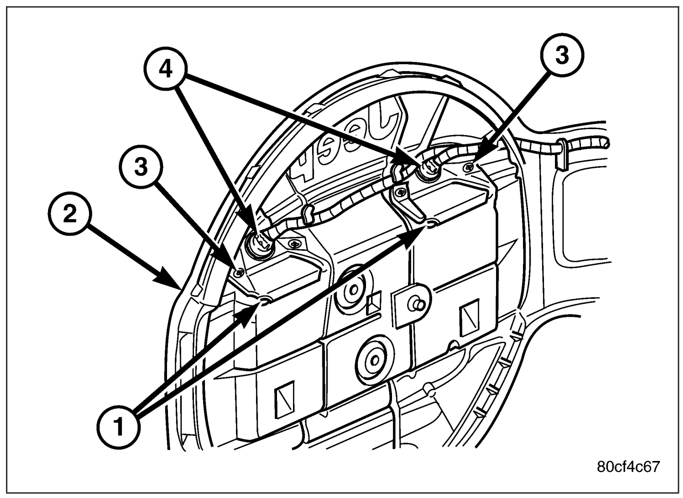


## LAMP - NORTH AMERICA




1. Position the license plate lamp unit (2) to the rear bumper fascia (1).
2. Reconnect the lamp socket pigtail wire connector.
3. Position the lamp unit into the mounting hole in the rear bumper fascia.
4. Install and tighten the two screws (3) that secure lamp unit to the fascia. Tighten the screws to 2 N·m (20 in. lbs.).
5. Reconnect the battery negative cable.

## LAMP - EXPORT




1. Position the license plate lamp unit (1) onto the back of the license plate bracket (2).
2. Install and tighten the two screws (3) that secure the lamp unit to the back of the license plate bracket. Tighten the screws to 2 N·m (20 in. lbs.).
3. Reinstall the bulb and socket (4) into the lamp unit. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LICENSE PLATE LAMP BULB - INSTALLATION - EXPORT).
4. Reconnect the battery negative cable.

# LAMP BAR

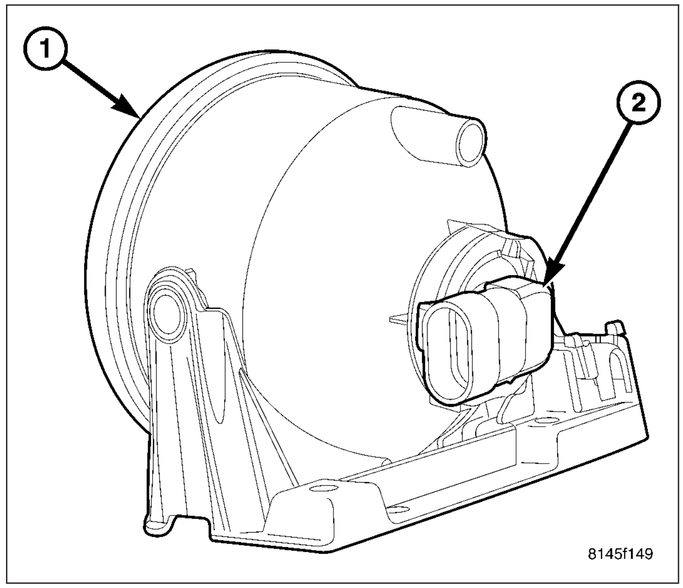
## REMOVAL

## BULB

**CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.**

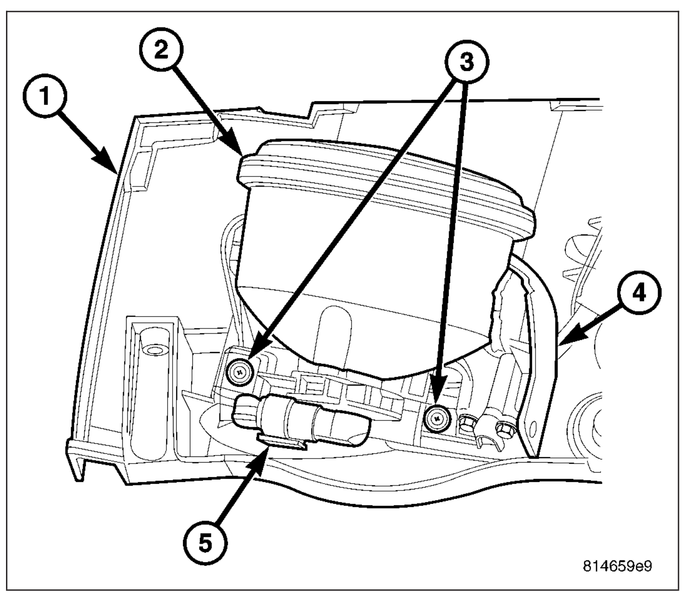
**NOTE: The optional light bar includes either two or four lamps, depending upon the requirements in the market for which the vehicle is manufactured. Each lamp contains a single bulb. The service procedures for each of these bulbs is the same.**

1. Disconnect and isolate the battery negative cable.
2. Remove the cover from the light bar lamps and reinforcement. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LIGHT BAR LAMP COVER - REMOVAL).
3. Disconnect the wire harness connector from the light bar lamp socket (2).
4. Firmly grasp the socket on the back of the lamp housing (1) and rotate it counterclockwise about 30 degrees to unlock it.
5. Pull the socket and bulb straight out from the keyed opening in the housing.
6. Pull the base of the bulb straight out of the socket.



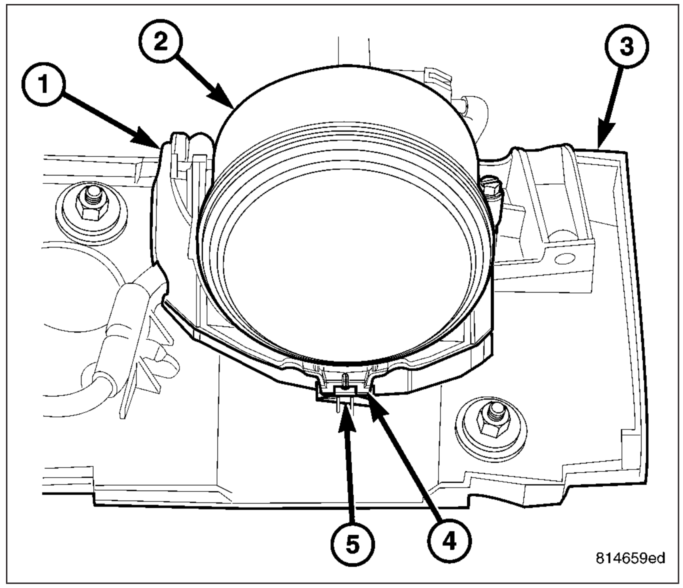

## LAMP

1. Disconnect and isolate the battery negative cable.
2. Remove the cover from the light bar lamps. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LIGHT BAR LAMP COVER - REMOVAL).
3. Disconnect the light bar wire harness connector (5) from the socket on the back of the lamp (2).
4. Remove the two screws (3) that secure the rear of the lamp bracket (4) to the reinforcement (1).



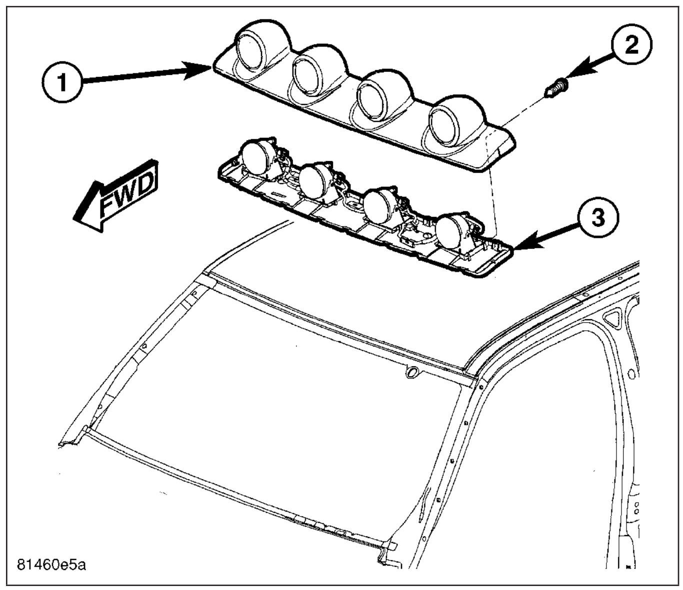
**NOTE: There is a hook on the forward edge of the lamp bracket secured under a tab that is integral to the reinforcement. The rear of the lamp must be lifted upward by the lamp socket/connector in order to disengage the hook from under the tab.**

5. Lift the lamp socket/connector on the rear of the lamp (2) upward far enough to disengage the hook (4) on the front edge of the lamp bracket (1) from under the integral tab (5) of the reinforcement (3).
6. Slide the lamp and bracket unit rearward and remove it from the reinforcement.



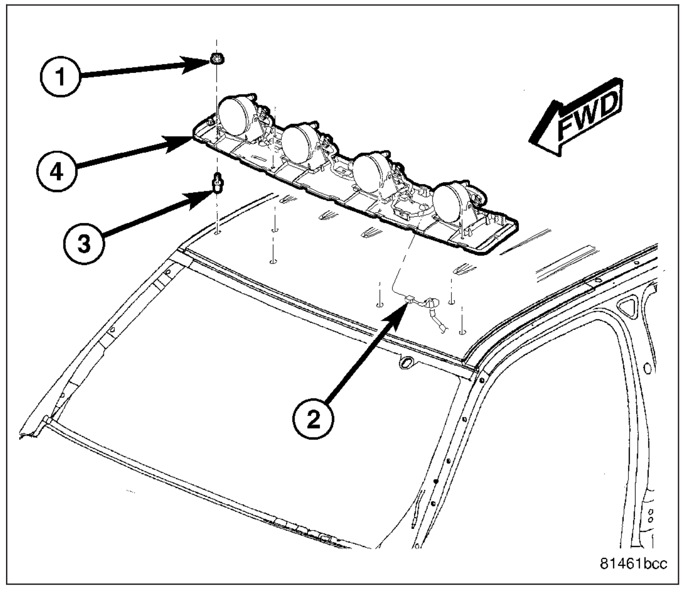

## COVER

1. Remove the four screws (2) that secure the cover (1) to the rear edge of the light bar reinforcement (3) on the roof panel.
2. Lift the rear edge of the cover upward and then slide it forward far enough to disengage the front edge of the cover from under the front edge of the light bar reinforcement.
3. Remove the light bar cover from the roof panel.



## REINFORCEMENT

1. Disconnect and isolate the battery negative cable.
2. Remove the cover from the light bar lamps. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LIGHT BAR LAMP COVER - REMOVAL).
3. Disconnect the jumper harness connector (2) from the light bar reinforcement harness connector.
4. Remove the four nuts (1) that secure the reinforcement (4) to the rivet studs (3) on the roof panel.




**CAUTION: Four strips of double-faced adhesive tape serve to protect the roof panel and supplement the hard fasteners that secure the light bar reinforcement. Any residual tape and adhesive must be removed carefully to prevent damage to roof panel. Following removal, the roof panel and the bottom of the reinforcement must be thoroughly cleaned with isopropyl alcohol or another suitable solvent.**

5. While lifting the light bar reinforcement upward from the roof panel, carefully feed the jumper wire and connector through the clearance hole in the reinforcement.
6. Remove the reinforcement from the vehicle.

## INSTALLATION

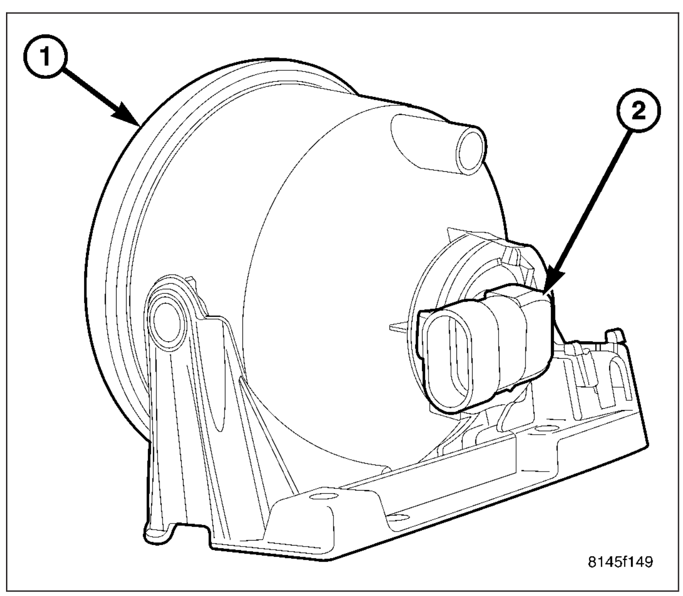
## BULB

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

**CAUTION: Do not contaminate the bulb glass by touching it with your fingers or by allowing it to contact other oily surfaces. Shortened bulb life will result.**

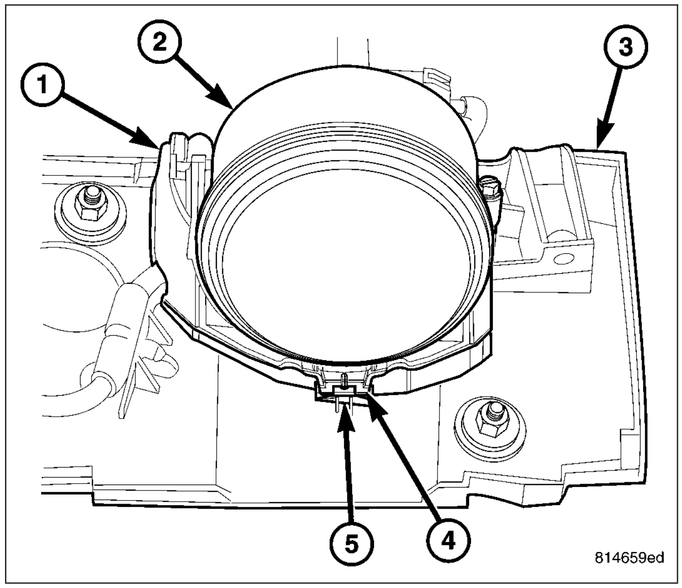
**NOTE: The optional light bar includes either two or four lamps, depending upon the requirements in the market for which the vehicle is manufactured. Each lamp contains a single bulb. The service procedures for each of these bulbs is the same.**

1. Align the base of the bulb with the light bar lamp socket (2).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of the light bar lamp housing (1).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Reconnect the wire harness connector to the socket.
7. Reinstall the cover over the light bar lamps and reinforcement. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LIGHT BAR LAMP COVER - INSTALLATION).
8. Reconnect the battery negative cable.



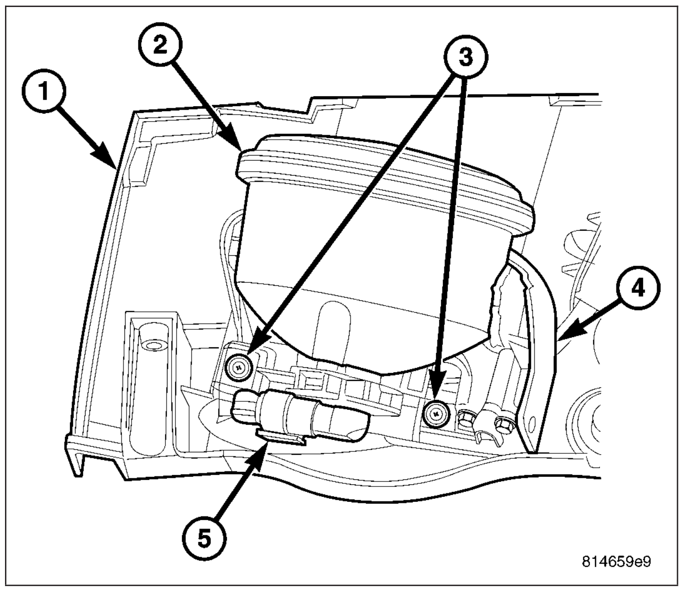
## LAMP

1. Position the lamp (2) and bracket (1) unit onto the light bar reinforcement (3).




**NOTE: There is a hook on the forward edge of the lamp bracket that must be secured under a tab that is integral to the reinforcement. The rear of the lamp must be lifted upward by the lamp socket/connector in order to engage the hook under the tab.**

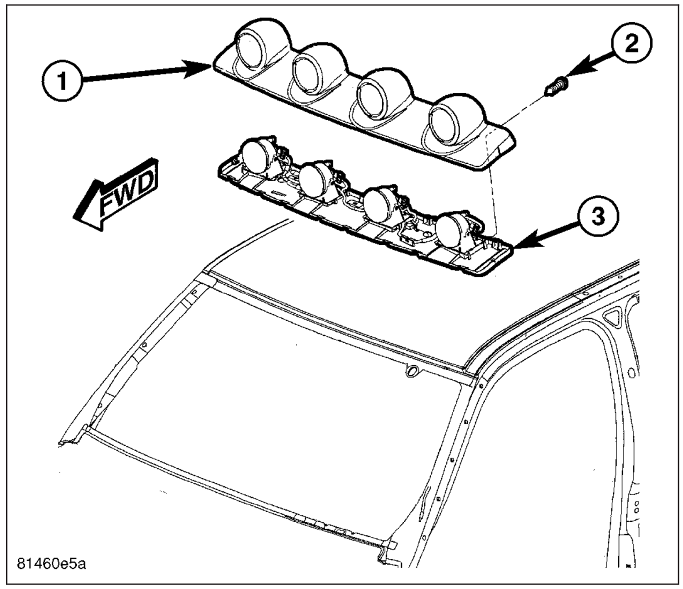
2. Lift the lamp socket/connector on the rear of the lamp upward far enough to engage the hook (4) on the front edge of the lamp bracket under the integral tab (5) of the reinforcement.
3. Slide the lamp and bracket forward and seat.




4. Install and tighten the two screws (3) that secure the rear of the lamp bracket (4) to the reinforcement (1). Tighten the screws to 2 N·m (17 in. lbs.).
5. Reconnect the light bar wire harness connector (5) to the socket on the back of the lamp (2).
6. Reconnect the battery negative cable.
7. Confirm proper lamp alignment. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/ LIGHT BAR LAMP - ADJUSTMENTS).
8. Reinstall the cover over the light bar lamps and reinforcement. (Refer to 8 - ELECTRICAL/LAMPS/ LIGHTING - EXTERIOR/LIGHT BAR LAMP COVER - INSTALLATION).

## COVER

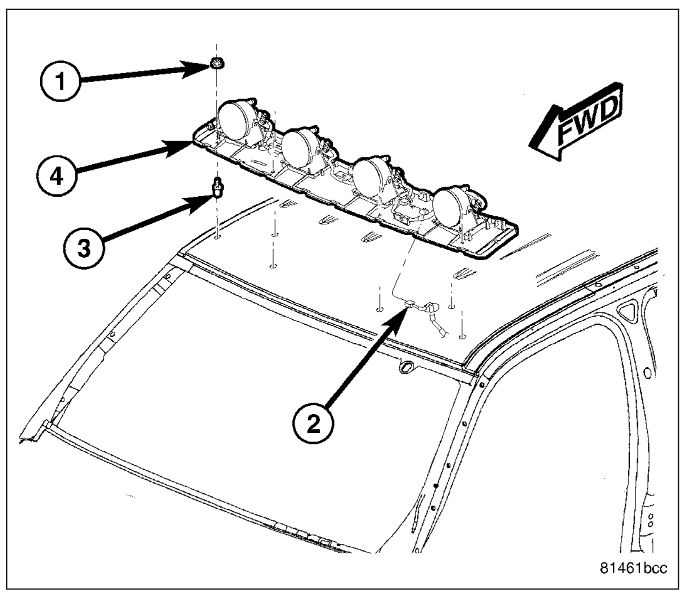
1. Position the front edge of the light bar cover (1) on the roof panel just ahead of the front edge of the light bar reinforcement (3).
2. Slide the cover rearward to engage the front edge of the cover under the forward edge of the reinforcement, then lower the rear edge of the cover into position.
3. Install and tighten the four screws (2) that secure the rear edge of the cover to the reinforcement. Tighten the screws to 2 N·m (17 in. lbs.).




## REINFORCEMENT

**CAUTION: Four strips of double-faced adhesive tape serve to protect the roof panel and supplement the hard fasteners that secure the light bar reinforcement. Any residual tape and adhesive must be removed carefully to prevent damage to roof panel. Following removal, the roof panel and the bottom of the reinforcement must be thoroughly cleaned with isopropyl alcohol or another suitable solvent. The mounting surfaces must be clean and dry before installation.**

1. Install four new strips of double-faced adhesive tape to the base of an existing reinforcement (4) being reinstalled.
2. Remove the release paper from the adhesive strips on the base of the new (4) or existing reinforcement.
3. With the aid of an assistant, carefully feed the jumper wire and connector (2) through the clearance hole in the reinforcement while positioning the unit over the rivet studs (3) on the roof panel.
4. Using hand pressure, press the reinforcement down firmly and evenly over each of the tape strips to be certain they are firmly secured to the roof panel.
5. Install and tighten the four nuts (1) that secure the reinforcement to the rivet studs on the roof panel. Tighten the nuts to 6 N·m (50 in. lbs.).
6. Reconnect the jumper harness connector to the light bar reinforcement harness connector.
7. Reconnect the battery negative cable.
8. Confirm proper lamp alignment. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LIGHT BAR LAMP - ADJUSTMENTS).
9. Reinstall the cover over the light bar lamps and reinforcement. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LIGHT BAR LAMP COVER - INSTALLATION).



# ADJUSTMENTS

## LIGHT BAR LAMP

### VEHICLE PREPARATION FOR LIGHT BAR LAMP ALIGNMENT

1. Repair or replace any ineffective or damaged components that could hinder proper lamp alignment.
2. Verify proper tire inflation.
3. Clean light bar lamp lenses.
4. Verify that cargo area is not heavily loaded.
5. The fuel tank should be Full. Add 2.94 kilograms (6.5 pounds) of weight over the fuel tank for each estimated gallon of missing fuel.

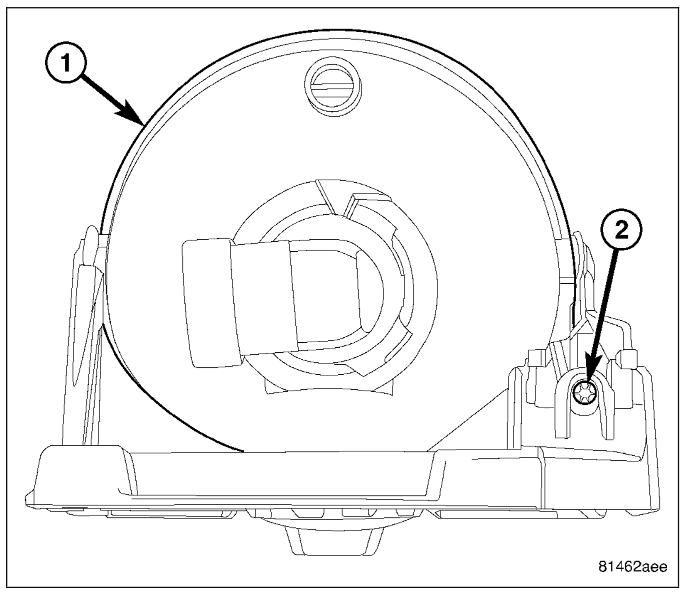
### LIGHT BAR LAMP ALIGNMENT SCREEN PREPARATION

1. Position the vehicle on a level surface perpendicular to a flat wall 7.62 meters (25 feet) away from the front of the headlamp lens. If necessary, tape a line on the floor at the appropriate distance away from and parallel to the wall.
2. Measure up on the wall 2.36 meters (93 inches) from the floor and tape a horizontal line on the alignment screen that is approximately as long as the vehicle is wide. This line will be used for the light bar lamp up-and-down (vertical) adjustment reference.

### LIGHT BAR LAMP ADJUSTMENT

**NOTE: Only the vertical aim of the light bar lamp beams is adjustable.**

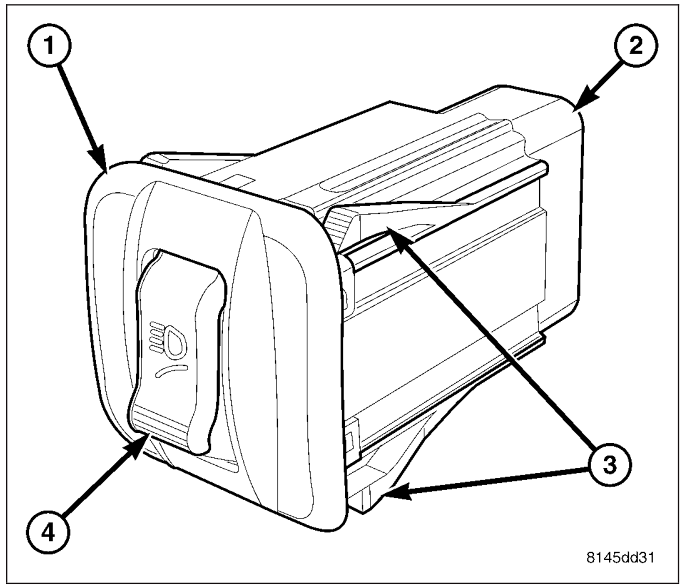
1. Rock the vehicle from side-to-side three times to allow the suspension to stabilize, then jounce the front suspension three times by pushing downward on the front bumper and releasing.
2. Turn the adjusting screw (2) on the back of the light bar lamp (1) until the beam intensity pattern is centered on the up-and-down (vertical) adjustment reference tape on the alignment screen.
3. Repeat the adjustment procedure for each lamp as required.



# LAMP BAR SWITCH

## DESCRIPTION

The light bar lamp switch (1) is used only on vehicles equipped with the optional light bar and off road lamps. The light bar lamp switch is mounted in the driver side outboard trim bezel on the instrument panel. Only the switch bezel and rocker (4) are visible on the outer surface of the instrument panel trim bezel. The black plastic switch rocker is marked with an icon that is similar in appearance to the International Control and Display Symbol icon for "High Beam", but has an additional curved line beneath it to represent the forward roofline of the vehicle. The icon is illuminated when the exterior lighting is turned On.




The black, molded plastic switch housing encloses the momentary switch rocker mechanism and the switch circuitry including an integral relay and active electronic elements. A connector receptacle (2) is integral to the back of the switch housing, while a two integral latch features (3) on the top and bottom of the housing secure the switch in the instrument panel trim bezel. The switch is connected to the vehicle electrical system through a dedicated take out and connector of the instrument panel wire harness.

The light bar lamp switch cannot be adjusted or repaired and, if ineffective or damaged, the unit must be replaced.

## OPERATION

In vehicles manufactured for North American markets, the light bar lamp switch operates on battery voltage received on a fused ignition switch output (run-start) circuit from a fuse in the Junction Block (JB) whenever the ignition switch is in the On or Start positions. In vehicles manufactured for export markets, the switch operates on battery voltage received from the park lamp relay in the JB on a park lamp relay output circuit whenever the park lamp relay is energized. The switch receives a path to ground through a splice block in the instrument panel wire harness secured by a nut to a ground stud on the driver side instrument panel end bracket near the JB.

The switch also receives battery voltage on a fused B(+) circuit that the relay within the switch controls to energize and de-energize the light bar lamps through an output on the lightbar switch output circuit. A panel lamps driver input is used to illuminate the icon on the switch rocker when the exterior lighting is turned On. In certain markets where it is required, the switch also receives a logic input on a low beam driver circuit, which allows the switch to disallow the light bar lamps from operating unless the park lamps are turned On and the low beam headlamps are turned Off.

Another output from the switch is a voltage signal that it provides to the Body Control Module (BCM) on a lightbar switch sense circuit. The BCM sends electronic messages over the Programmable Communications Interface (PCI) data bus to the instrument cluster based upon this input to control illumination of the light bar lamp indicator and/or the high beam indicator as required by the market for which the vehicle was manufactured.

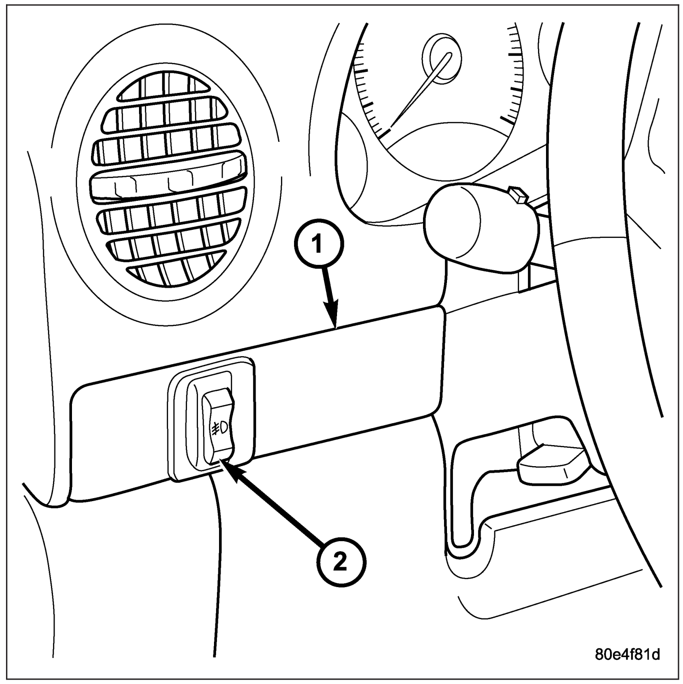
Because of active electronic elements within the light bar lamp switch, it cannot be tested using conventional diagnostic tools or procedures. If a problem is noted with the light bar lamp system operation, test and confirm the input and output circuits of the switch are in good condition before replacing the switch.

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: A light bar lamp switch is used only on vehicles equipped with the optional light bar and auxiliary off-road lamps.**

1. Disconnect negative battery cable.
2. Remove the driver side outboard bezel (1) from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL DRIVER SIDE BEZEL - REMOVAL).
3. Disconnect the instrument panel wire harness connector from the light bar lamp switch (2) connector receptacle.
4. From the back of the trim bezel, depress the two lower latch features on the switch housing and rock the bottom of the switch out through the face of the bezel.
5. From the back of the trim bezel, depress the two upper latch features on the switch housing and push the switch out through the face of the bezel.

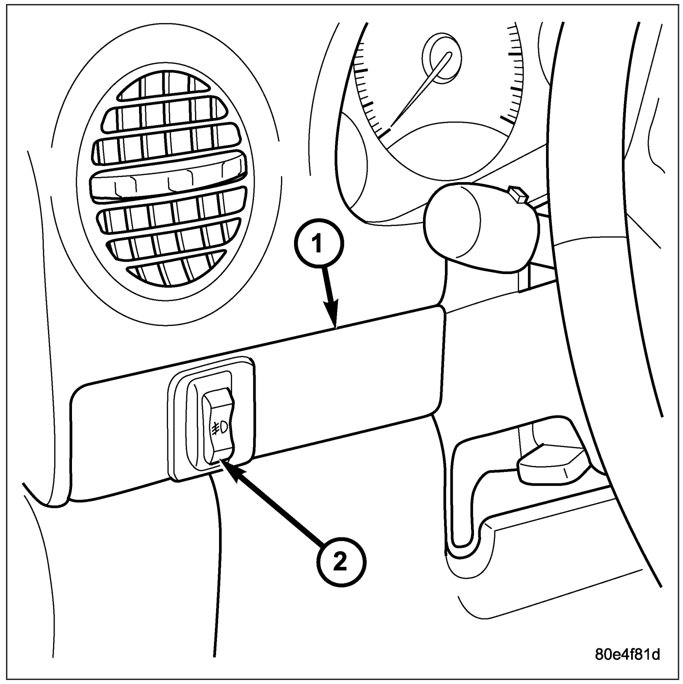



## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: A light bar lamp switch is used only on vehicles equipped with the optional light bar and auxiliary off-road lamps.**

1. From the face of the driver side outboard bezel (1), align the light bar lamp switch housing (2) to the mounting hole in the bezel.
2. Push the switch into the mounting hole until it is fully seated and each of the latch features is fully engaged.
3. Reconnect the instrument panel wire harness connector to the switch connector receptacle.
4. Reinstall the trim bezel and switch unit onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL DRIVER SIDE BEZEL - INSTALLATION).
5. Reconnect the battery negative cable.



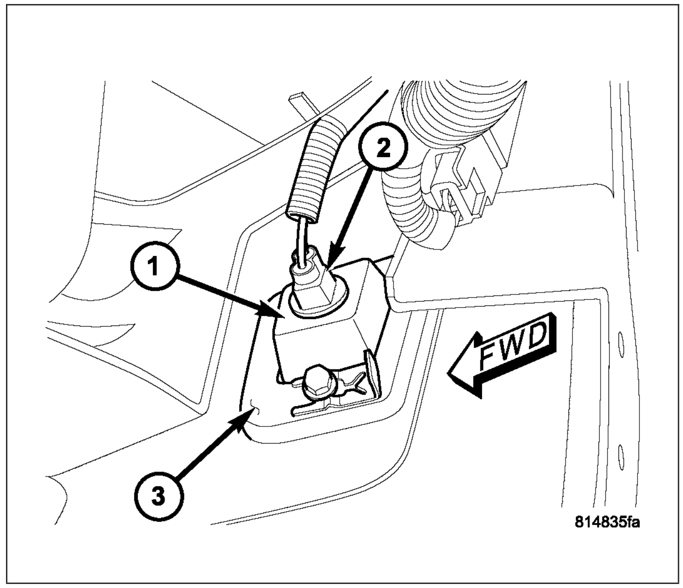
# MARKER LAMP

## REMOVAL

### BULB

**NOTE: The following procedure applies only to vehicles manufactured for the North American market. Vehicles manufactured for export markets do not have a bulb, socket or wiring provided to illuminate the front side marker lamp. The front side marker lamp housing and lens are present, but serve only as a reflector on export vehicles.**

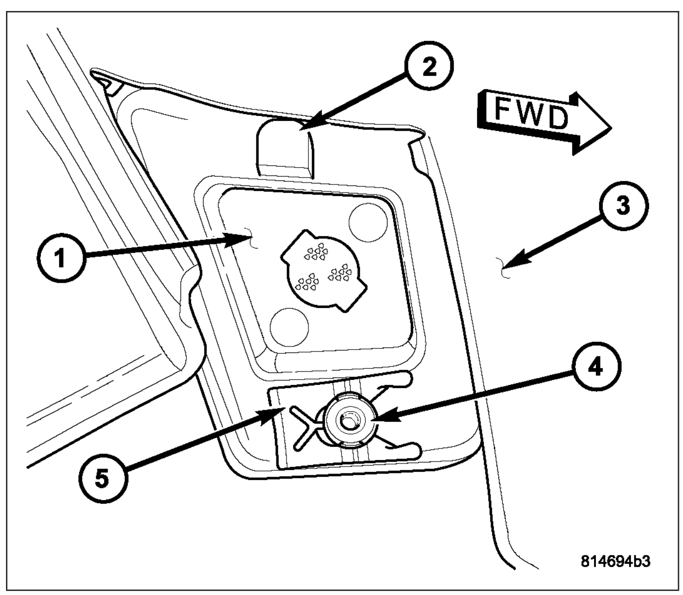
1. Turn the front wheels full lock toward the same side of the vehicle as the lamp being serviced.
2. Disconnect and isolate the battery negative cable.
3. Remove the four fasteners securing the front of the adjacent right or left front fender wheel liner to the lower edge of the front bumper fascia (3) and the outboard surface of the frame rail ahead of the front wheel.
4. Reach between the front of the wheel liner and the lower fascia to access the back of the front side marker lamp unit housing (1).
5. Firmly grasp the front side marker bulb socket (2) on the back of the lamp housing and rotate it counterclockwise about 30 degrees to unlock it.
6. Pull the socket and bulb straight out from the keyed opening in the housing.
7. Pull the base of the bulb straight out of the socket.




### LAMP

**NOTE: Vehicles manufactured for export markets do not have a bulb, socket or wiring provided to illuminate the front side marker lamp. The front side marker lamp housing and lens are present, but serve only as a reflector on export vehicles.**

1. Turn the front wheels full lock toward the same side of the vehicle as the lamp being serviced.
2. Disconnect and isolate the battery negative cable.
3. Remove the four fasteners securing the front of the adjacent right or left front fender wheel liner to the lower edge of the front bumper fascia and the outboard surface of the frame rail ahead of the front wheel.
4. Reach between the front of the wheel liner and the lower fascia (3) to access the back of the front side marker lamp unit housing (1).
5. If the vehicle is so equipped, firmly grasp the front side marker bulb socket on the back of the lamp housing and rotate it counterclockwise about 30 degrees to unlock it.
6. If the vehicle is so equipped, pull the socket and bulb straight out from the keyed opening in the housing.



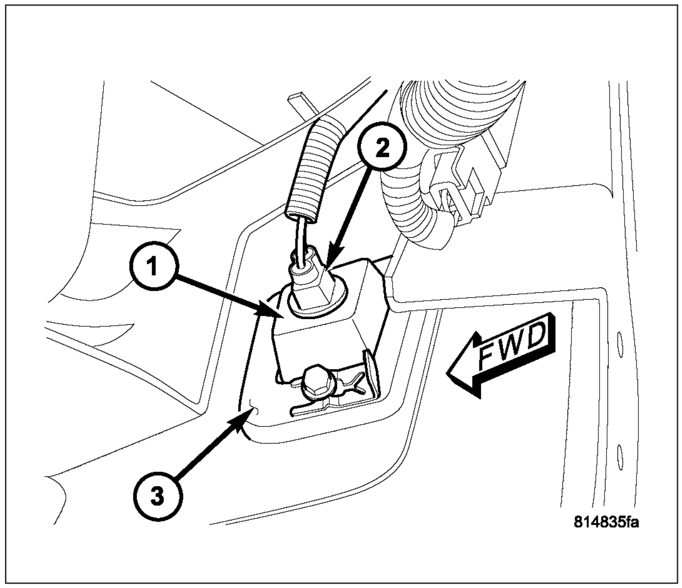
7. Slide the retaining clip (5) off of the pin (4) integral to the lower end of the lamp housing that secures the lamp to the fascia.
8. Push the lower end of the lamp out through the outside of the fascia far enough to disengage the tab (2) at the top of the lamp from the notch at the top of the lamp mounting hole.
9. Remove the lamp from the outside of the fascia.

## INSTALLATION

## BULB

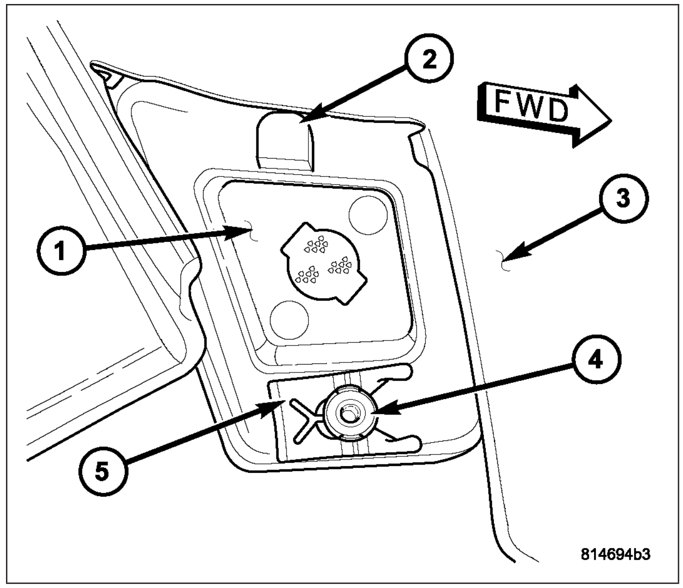
**NOTE: The following procedure applies only to vehicles manufactured for the North American market. Vehicles manufactured for export markets do not have a bulb, socket or wiring provided to illuminate the front side marker lamp. The front side marker lamp housing and lens are present, but serve only as a reflector on export vehicles.**

1. Align the base of the bulb with the front side marker bulb socket (2).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Reach between the front of the adjacent right or left front fender wheel liner and the lower bumper fascia (3) to access the back of the lamp housing (1).
4. Align the socket and bulb with the keyed opening on the back of the housing.
5. Insert the socket and bulb into the housing until the socket is firmly seated.
6. Rotate the socket clockwise about 30 degrees to lock it into place.
7. Reinstall the four fasteners securing the front of the wheel liner to the lower edge of the fascia and the outboard surface of the frame rail ahead of the front wheel.
8. Reconnect the battery negative cable.




## LAMP

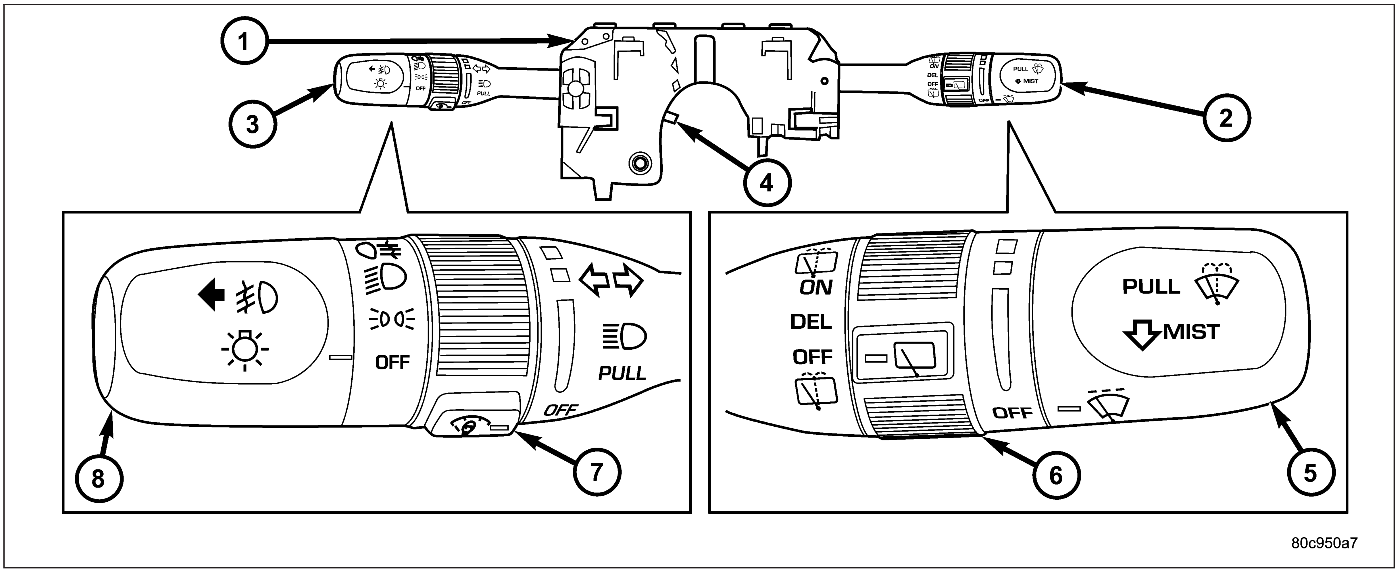
**NOTE: Vehicles manufactured for export markets do not have a bulb, socket or wiring provided to illuminate the front side marker lamp. The front side marker lamp housing and lens are present, but serve only as a reflector on export vehicles.**




1. Position the front side marker lamp unit (1) to the lamp mounting hole on the outside of the fascia.
2. Engage the tab (2) at the top of the lamp into the notch at the top of the mounting hole then push the pin (4) on the lower end of the lamp through the round hole at the base of the mounting hole.
3. Reach between the front of the adjacent right or left front fender wheel liner and the lower bumper fascia (3) to access the back of the lamp housing.
4. Slide the retaining clip (5) onto the pin on the lower end of the lamp housing to secure the lamp to the fascia.
5. If the vehicle is so equipped, align the socket and bulb with the keyed opening on the back of the housing.
6. If the vehicle is so equipped, insert the socket and bulb into the housing until the socket is firmly seated.
7. If the vehicle is so equipped, rotate the socket clockwise about 30 degrees to lock it into place.
8. Reinstall the four fasteners securing the front of the wheel liner to the lower edge of the fascia and the outboard surface of the frame rail ahead of the front wheel.
9. Reconnect the battery negative cable.

# MULTI-FUNCTION SWITCH

## DESCRIPTION




The multi-function switch (1) is located on the steering column, just below the steering wheel. The only visible components of the multi-function switch are the right (2) and left control stalks (3). One stalk extends through the steering column shrouds on each side of the steering column. The remainder of the switch including its mounting provisions, its electrical connection, and the turn signal cancel actuator (4) are concealed beneath the shrouds.

The switch housing and controls are constructed of molded black plastic. A saddle-like formation in the center of the lower switch housing straddles the steering column tube just below the column lock housing, and two locating posts integral to the lower surface of the switch housing engage two holes in the forward-facing side of the lock housing. Also several integral ledge-like locating tabs on the switch housing are supported and located by several mating points on the column lock housing. When the steering column shrouds are installed on the column, mounting tabs on the switch housing and the clockspring are clamped to the lock housing by the same two screws that secure the column shrouds to the column and each other.

There are several versions of the multi-function switch to support both optional equipment and regulatory equipment that is required only in certain markets. Each multi-function switch control stalk has both white nomenclature and International Control and Display Symbol graphics applied to it, which clearly identify its many functions. Each control stalk has a control knob (5 and 8) on its end with a flattened face to allow it to be easily rotated. On vehicles equipped with optional front fog lamps, the knob on the end of left control stalk can also be pulled outward to select those lamps.

Each control stalk also features a knurled control ring (6 and 7) located just below the control knob. The left control stalk is dedicated to providing driver controls for the interior and exterior lighting systems, while the right control stalk is dedicated to providing driver controls for the front and rear wiper systems.

Two integral connector receptacles on the multi-function switch housing connect the switch to the vehicle electrical system through two dedicated take outs and connectors of the instrument panel wire harness. The left connector receptacle contains nine terminal pins for the lighting control circuits of the switch, while the right connector receptacle contains six terminal pins for the wiper control circuits of the switch.

The multi-function switch cannot be adjusted or repaired. If any function of the switch is ineffective, or if the switch is damaged, the entire switch must be replaced as a unit.

## LEFT CONTROL STALK

The left (lighting) control stalk of the multi-function switch supports the following functions and features:

- **Front Fog Lamps** - For vehicles so equipped, the left multi-function switch control knob provides detent switching for the optional front fog lamps.
- **Headlamps** - The left multi-function switch control knob provides detent switching for the headlamps.
- **Headlamp Beam Selection** - The left multi-function switch control stalk provides detent switching for selection of the headlamp high or low beams.

- **Headlamp Optical Horn** - The left multi-function switch control stalk includes momentary switching of the headlamp high beam circuits to provide an optical horn feature (sometimes referred to as flash-to-pass), which allows the vehicle operator to momentarily flash the headlamp high beams as an optical signalling device.
- **Interior Lamps Defeat** - The left multi-function switch control ring provides detent switching to defeat the illumination of all interior courtesy lamps when a door, the rear flip-up glass, or the tailgate are opened.
- **Interior Lamps On** - The left multi-function switch control ring provides detent switching to simultaneously illuminate all interior courtesy lamps.
- **Panel Lamps Dimming** - The left multi-function switch control ring provides simultaneous adjustable control of the illumination intensity of all instrument panel lighting at one of six available illumination intensity levels.
- **Parade Mode** - The left multi-function switch control ring provides detent switching for a parade mode that maximizes the illumination intensity of all instrument panel lighting for visibility when driving in daylight with the exterior lamps turned on.
- **Park Lamps** - The left multi-function switch control knob provides detent switching for the park lamps.
- **Rear Fog Lamps** - For vehicles so equipped, the left multi-function switch control knob provides detent switching for the optional rear fog lamps. Rear fog lamps are optional only for vehicles manufactured for certain markets, where they are required.
- **Turn Signal Control** - The left multi-function switch control stalk provides both momentary non-detent switching and detent switching with automatic cancellation for both the left and right turn signal lamps.

### RIGHT CONTROL STALK

The right (wiper) control stalk of the multi-function switch supports the following functions and features:

- **Continuous Front Wipe Modes** - The right multi-function switch control knob provides two continuous front wipe switch positions, low speed or high speed.
- **Continuous Rear Wipe Mode** - The right multi-function switch control ring provides one continuous rear wipe switch position.
- **Front Washer Mode** - The right multi-function switch control stalk provides front washer system operation.
- **Front Wipe-After-Wash Mode** - The right multi-function switch control stalk provides a wipe-after-wash mode.
- **Front Wiper Mist Mode** - The right multi-function switch control stalk provides a front wiper system mist mode.
- **Intermittent Front Wipe Mode** - The right multi-function switch control knob provides an intermittent front wipe mode with five delay interval positions.
- **Intermittent Rear Wipe Mode** - The right multi-function switch control ring provides one fixed interval intermittent rear wipe mode switch position.
- **Rear Washer Mode** - The right multi-function switch control ring provides rear washer system operation.

## OPERATION

The multi-function switch uses a combination of resistor multiplexed and conventionally switched outputs to control the many functions and features it provides. The switch receives battery voltage on a fused ignition switch output (run-acc) circuit from a fuse in the Junction Block (JB) whenever the ignition switch is in the On or Accessory positions. The switch receives a path to ground at all times through a ground stud on the driver side instrument panel end bracket near the Junction Block (JB).

The multi-function switch can be diagnosed using conventional diagnostic tools and methods. However, proper testing of the multiplexed inputs to the Body Control Module (BCM) requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

Following are brief descriptions of how each of the two multi-function switch control stalks operate to control the functions and features they provide.

### LEFT CONTROL STALK

The left (lighting) control stalk of the multi-function switch operates as follows:

- **Front Fog Lamps** - For vehicles so equipped, the control knob on the end of the multi-function switch left (lighting) control stalk is pulled outward to activate the optional front fog lamps. The control knob is mechanically keyed so that it cannot be pulled outward unless it is first rotated to turn On the exterior lighting. The multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a fog lamp switch sense circuit, and the BCM responds by energizing or de-energizing the front fog lamp relay in the Junction Block (JB).

- **Headlamps** - The control knob on the end of the multi-function switch left (lighting) control stalk is rotated forward to its second detent position to activate the headlamps. The multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a headlamp switch sense circuit, and the BCM responds by energizing or de-energizing the selected low or high beam relay (Daytime Running Lamp relay in Canadian vehicles) in the Junction Block (JB).
- **Headlamp Beam Selection** - The left (lighting) control stalk of the multi-function switch is pulled towards the steering wheel past a detent to actuate the integral beam select switch circuitry. Each time the control stalk is activated in this manner, the opposite headlamp beam from what is currently selected will be energized. The multi-function switch provides a ground output to the Body Control Module (BCM) on a high beam switch sense circuit, and the BCM responds by energizing or de-energizing the selected low or high beam relay (Daytime Running Lamp relay in Canadian vehicles) in the Junction Block (JB).
- **Headlamp Optical Horn** - The left (lighting) control stalk of the multi-function switch is pulled towards the steering wheel to just before a detent, to momentarily activate the headlamp optical horn feature. The high beams will remain illuminated until the control stalk is released. The multi-function switch provides a ground output on a high beam relay control circuit to energize the headlamp high beam relay (Daytime Running Lamp relay in Canadian vehicles) in the Junction Block (JB).
- **Interior Lamps Defeat** - The control ring on the multi-function switch left (lighting) control stalk is rotated to a full rearward (clockwise) detent to defeat the illumination of all interior courtesy lamps. The multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a panel lamps dimmer switch circuit, and the BCM responds by de-energizing its internal courtesy lamp driver circuit.
- **Interior Lamps On** - The control ring on the multi-function switch left (lighting) control stalk is rotated to a full forward detent to illuminate all interior courtesy lamps. The multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a panel lamps dimmer switch circuit, and the BCM responds by energizing its internal courtesy lamp driver circuit.
- **Panel Lamps Dimming** - The control ring on the multi-function switch left (lighting) control stalk is rotated to one of six minor intermediate detents to simultaneously select the desired illumination intensity of all adjustable instrument panel and instrument cluster lighting. The control ring is rotated rearward to dim, or forward to brighten. The multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a panel lamps dimmer switch circuit, and the BCM responds by sending an electronic panel lamps dimming level message to the ElectroMechanical Instrument Cluster (EMIC) over the Programmable Communications Interface (PCI) data bus. The EMIC electronic circuitry then provides the proper PWM output to the cluster illumination lamps and the Vacuum Florescent Display (VFD) on the EMIC circuit board, and provides a matching Pulse Width Modulation (PWM) output on the hard wired fused panel lamps dimmer switch signal circuit.
- **Parade Mode** - The control ring on the multi-function switch left (lighting) control stalk is rotated to an intermediate detent that is one detent rearward from the full forward detent to select the Parade mode. The multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a panel lamps dimmer switch circuit, and the BCM responds by sending an electronic panel lamps dimming level message to the ElectroMechanical Instrument Cluster (EMIC) over the Programmable Communications Interface (PCI) data bus. The EMIC electronic circuitry then provides the proper PWM output to the cluster illumination lamps and the VFD on the EMIC circuit board, and provides a matching PWM output on the hard wired fused panel lamps dimmer switch signal circuit to illuminate all lamps at full (daylight) intensity with the exterior lamps turned On.
- **Park Lamps** - The control knob on the end of the multi-function switch left (lighting) control stalk is rotated forward to its first detent from the Off position to activate the park lamps. The multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a headlamp switch sense circuit, and the BCM responds by energizing or de-energizing the park lamp relay in the Junction Block (JB).
- **Rear Fog Lamps** - For vehicles so equipped, the control knob on the end of the multi-function switch left (lighting) control stalk is rotated forward to its third detent position to activate the rear fog lamps. The multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a headlamp switch sense circuit, and the BCM responds by energizing or de-energizing the rear fog lamp relay in the Junction Block (JB). Rear fog lamps are optional only for vehicles manufactured for markets, where they are required.
- **Turn Signal Control** - The left (lighting) control stalk of the multi-function switch is moved upward to activate the right turn signal circuitry, and downward to activate the left turn signal circuitry. The turn signal switch has a detent position in each direction that provides turn signals with automatic cancellation, and an intermediate, momentary position in each direction that provides turn signals only until the left multi-function switch control stalk is released. When the control stalk is moved to a turn signal switch detent position, the cancel actuator extends toward the center of the steering column. A turn signal cancel cam is integral to the clockspring and rotates with the steering wheel. The cam lobe contacts the cancel actuator when it is extended from the multi-

function switch. When the steering wheel is rotated during a turning maneuver, the turn signal cancel cam lobe will contact the turn signal cancel actuator. The cancel actuator latches against the cancel cam rotation in the direction opposite that which is signaled. If the left turn signal detent is selected, the lobe of the cancel cam will ratchet past the cancel actuator when the steering wheel is rotated to the left, but will unlatch the cancel actuator as the steering wheel rotates to the right and returns to center, which will cancel the turn signal event and release the control stalk from the detent so it returns to the neutral Off position. When a turn signal is activated, the multi-function switch provides a ground output on a right or left turn switch sense circuit to the combination flasher circuitry within the hazard switch, and the combination flasher flashes the turn signal lamps.

## RIGHT CONTROL STALK

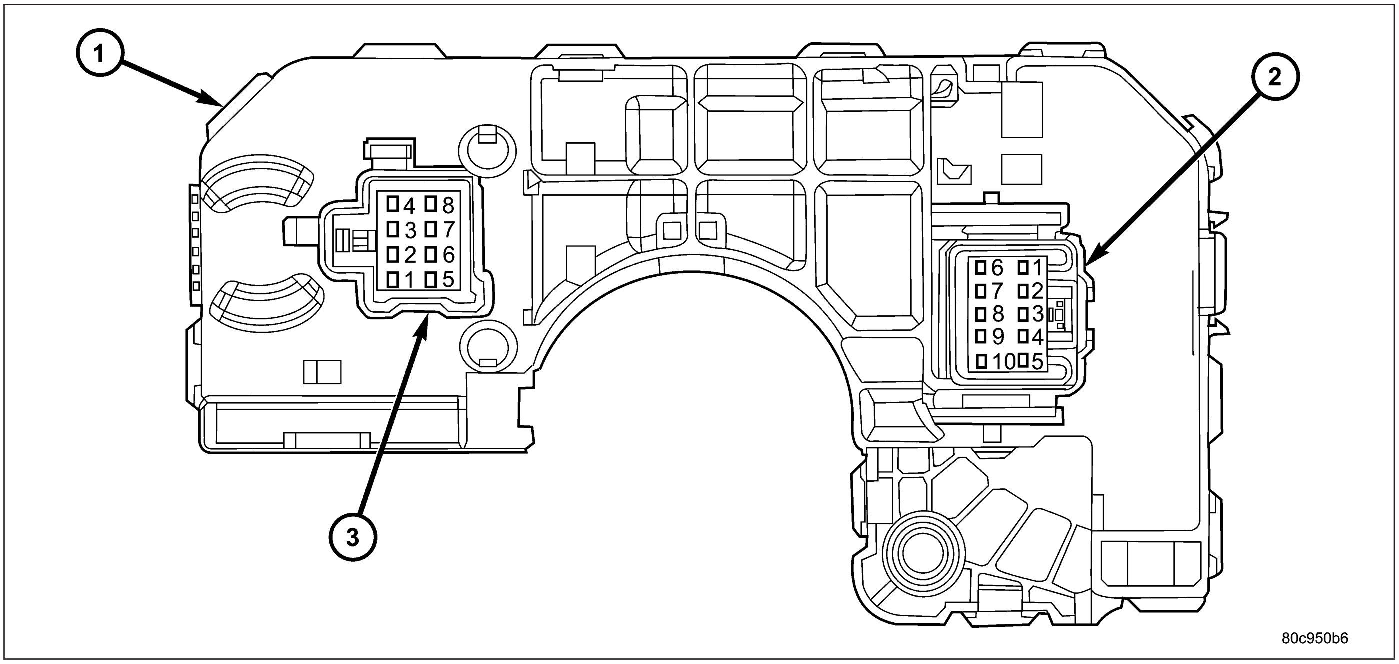
The right (wiper) control stalk of the multi-function switch operates as follows:

- **Continuous Front Wipe Modes** - The control knob on the end of the multi-function switch right (wiper) control stalk is rotated to an intermediate detent that is one detent rearward from the full forward detent to select the low speed continuous front wiper mode, or to its full forward detent to select the high speed continuous front wiper mode. The multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a front wiper switch circuit, and the BCM responds by energizing the wiper on/off relay in the Power Distribution Center (PDC) for the front low speed continuous wipe mode, or the wiper on/off relay and the wiper high/low relay in the PDC for the front high speed continuous wipe mode as required.
- **Continuous Rear Wipe Mode** - The control ring on the multi-function switch right (wiper) control stalk is rotated to the most forward detent to select the continuous rear wiper mode. The multi-function switch provides a battery voltage output to the rear wiper motor on a rear wiper on driver circuit to signal the rear wiper motor to operate in the continuous wipe mode.
- **Front Washer Mode** - The right (wiper) control stalk of the multi-function switch is pulled towards the steering wheel to momentarily activate the washer pump in the front washer mode. The washer pump will continue to operate in the front washer mode until the control stalk is released. The multi-function switch provides a ground output on a washer pump sense circuit, and battery voltage on a washer pump driver circuit to energize the washer pump in the front washer mode.
- **Front Wiper Mist Mode** - The right (wiper) control stalk of the multi-function switch is pushed towards the floor to momentarily activate the front wiper motor in the mist mode. The front wiper motor will continue to operate in the mist mode until the control stalk is released. The multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a front wiper switch circuit, and the BCM responds by energizing the wiper on/off relay in the Power Distribution Center (PDC) to operate the front wiper motor momentarily at low speed to provide the front wiper mist mode.
- **Intermittent Front Wipe Mode** - The control knob on the end of the multi-function switch right (wiper) control stalk is rotated to one of five minor intermediate detents to select the desired intermittent front wipe delay interval. The control knob is rotated rearward to increase the delay, or forward to decrease the delay. The multi-function switch provides a resistor multiplexed output to the Body Control Module (BCM) on a front wiper switch circuit, and the BCM responds by energizing the wiper on/off relay in the Power Distribution Center (PDC) to operate the front wiper motor at the selected delay intervals.
- **Intermittent Rear Wipe Mode** - The control ring on the multi-function switch right (wiper) control stalk is rotated to the center detent to select the intermittent rear wiper mode. The multi-function switch provides a battery voltage output to the rear wiper motor on a rear wiper intermittent driver circuit to signal the rear wiper motor to operate in the intermittent wipe mode.
- **Rear Washer Mode** - The control ring on the multi-function switch right (wiper) control stalk is rotated to either the full forward or full rearward momentary positions to activate the washer pump in the rear washer mode. The washer pump will continue to operate in the rear washer mode until the control ring is released. The multi-function switch provides a ground output on a washer pump driver circuit, and battery voltage on a washer pump sense circuit to energize the washer pump in the rear washer mode.

## DIAGNOSIS AND TESTING

## MULTI-FUNCTION SWITCH

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**




1. Remove the multi-function switch (1) from the steering column. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/MULTI-FUNCTION SWITCH - REMOVAL).
2. Disconnect the lighting C-1 (2) or wiper C-2 (3) wire harness connector from the back of the multi-function switch.
3. Using an ohmmeter, perform the continuity and resistance tests at the terminals in the multi-function switch connector as shown in the Multi-Function Switch Tests table.

| MULTI-FUNCTION SWITCH TESTS | | |
|---|---|---|
| EXTERIOR LIGHTING FUNCTIONS | | |
| SWITCH POSITION | CONNECTOR C-1 PINS | RESISTANCE (OHMS) ±10% |
| Off | 4 and 5 | 3781 |
| Park Lamps On | 4 and 5 | 911 |
| Headlamp Low Beams On | 4 and 5 | 349 |
| Rear Fog Lamps On | 4 and 5 | 75 |
| Headlamp High Beams On | 8 and 9 | 0 - 1 |
| Front Fog Lamps On | 2 and 4 | 0 - 1 |
| Optical Horn (Flash-to-Pass) On | 7 and 8 | 0 - 1 |
| Turn Signal Neutral | 6 and 8, 8 and 10 | Infinite (Open) |
| Turn Signal Left | 6 and 8 | 0 - 1 |
| Turn Signal Right | 8 and 10 | 0 - 1 |
| INTERIOR LIGHTING FUNCTIONS | | |

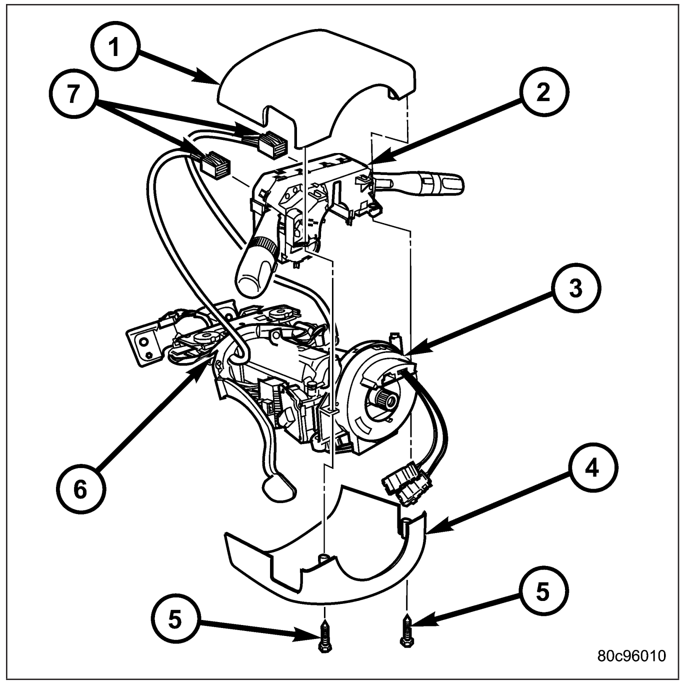
| MULTI-FUNCTION SWITCH TESTS | | |
|---|---|---|
| **SWITCH POSITION** | **CONNECTOR C-1 PINS** | **RESISTANCE (OHMS) ±10%** |
| Off (Courtesy Disable) | 1 and 4 | 63 |
| Dimming 1 | 1 and 4 | 200 |
| Dimming 2 | 1 and 4 | 557 |
| Dimming 3 | 1 and 4 | 914 |
| Dimming 4 | 1 and 4 | 1271 |
| Dimming 5 | 1 and 4 | 1628 |
| Dimming 6 | 1 and 4 | 1985 |
| Parade Mode On | 1 and 4 | 3565 |
| Courtesy On | 1 and 4 | 7885 |
| **FRONT WIPER FUNCTIONS** | | |
| **SWITCH POSITION** | **CONNECTOR C-1 AND C-2 PINS** | **RESISTANCE (OHMS) ±10%** |
| Front Wiper Off | C-1 Pin 4 and C-2 Pin 4 | 4587 |
| Delay 1 | C-1 Pin 4 and C-2 Pin 4 | 1267 |
| Delay 2 | C-1 Pin 4 and C-2 Pin 4 | 792 |
| Delay 3 | C-1 Pin 4 and C-2 Pin 4 | 531 |
| Delay 4 | C-1 Pin 4 and C-2 Pin 4 | 369 |
| Delay 5 | C-1 Pin 4 and C-2 Pin 4 | 262 |
| Front Wiper Low | C-1 Pin 4 and C-2 Pin 4 | 125 |
| Front Wiper High | C-1 Pin 4 and C-2 Pin 4 | 38 |
| Front Wiper Mist | C-1 Pin 4 and C-2 Pin 4 | 125 |
| Front Washer On | C-2 Pins 5 and 7 | 0 - 1 |
| **REAR WIPER FUNCTIONS** | | |
| **SWITCH POSITION** | **CONNECTOR C-2 PINS** | **RESISTANCE (OHMS) ±10%** |
| Rear Wiper Off | 1 and 5, 2 and 5 | Infinite (Open) |
| Rear Wiper Intermittent | 2 and 5 | 0 - 1 |
| Rear Wiper On | 1 and 5 | 0 - 1 |
| Rear Washer On | 2 and 5, 3 and 5 | 0 - 1 |

4. If the switch fails any of the tests, replace the ineffective multi-function switch as required.

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Disconnect and isolate the battery negative cable.
2. If the vehicle is equipped with the optional tilt steering column, move the tilt steering column to the fully lowered position and leave the tilt release lever in the released (down) position.
3. From below the steering column (6), remove the two screws (5) that secure the lower column shroud (4) to the upper shroud (1).
4. Using hand pressure, press inward on both sides of the upper shroud above the parting line of the lower shroud to release the snap features that secure the two shroud halves to each other.
5. Remove both shroud halves from the steering column.
6. Disconnect the two wire harness connectors (7) from the back of the multi-function switch housing (2).
7. Remove the multi-function switch from the steering column lock housing by carefully rocking the switch and pulling the switch housing upward far enough to disengage its alignment posts and locator tabs from the lock housing.

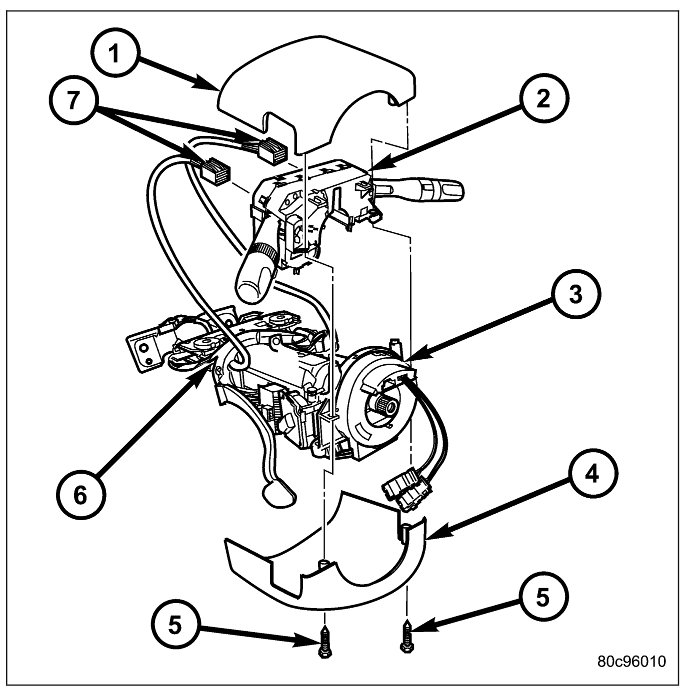



## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: Before attempting to install the multi-function switch, be certain that the left control stalk is in the neutral turn signal position and the turn signal cancel actuator is in the retracted (neutral) position.**

1. Position the multi-function switch (2) to the steering column (6).
2. Reconnect the two wire harness connectors (7) to the connector receptacles on the back of the switch housing.
3. Position the multi-function switch onto the steering column lock housing. Be certain that the switch alignment posts and locator tabs are fully seated on the lock housing.
4. Position the upper (1) and lower shroud halves (4) onto the steering column.
5. Align the snap features on the lower shroud with the receptacles in the upper shroud and apply hand pressure to snap them together.
6. Install and tighten the two screws (5) that secure the lower shroud to the upper shroud. Tighten the screws to 2 N·m (20 in. lbs.).
7. If the vehicle is equipped with the optional tilt steering column, move the tilt steering column back to



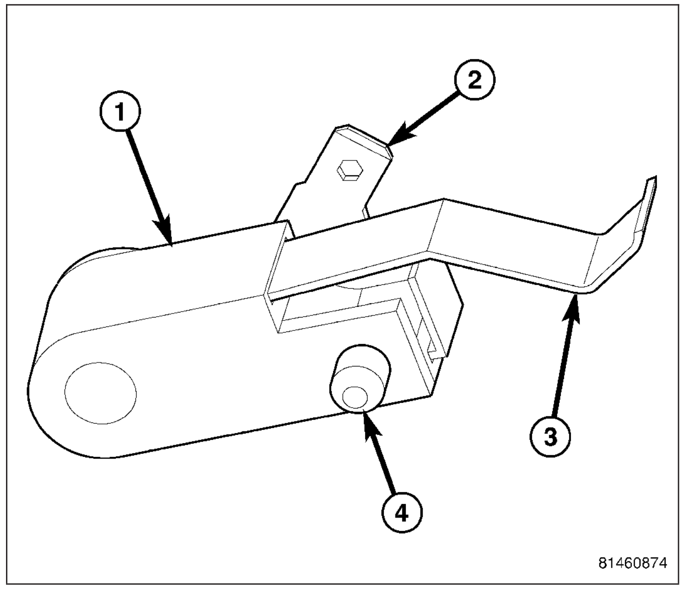
the fully raised position and move the tilt release lever into the locked (up) position.

8. Reconnect the battery negative cable.

# PARK BRAKE SWITCH

## DESCRIPTION

The park brake switch (1) is located on the park brake lever mechanism on the floor panel transmission tunnel below the center floor console. This switch includes a spade-type output terminal (2) that connects the switch to the vehicle electrical system through a dedicated take out and connector of the body wire harness. The output terminal is integral to the stationary contact within a molded plastic insulator. A locating tab (4) on the insulator engages a slot in the park brake lever mechanism for positive switch location. External to the insulator is a movable leaf contact (3) with an integral grounding lug on one end and an integral actuating lever and follower on the opposite end. The switch is secured to and grounded by a single screw to the park brake lever mechanism.




The park brake switch cannot be adjusted or repaired and, if ineffective or damaged, it must be replaced.

## OPERATION

The park brake switch is a normally closed, mechanically actuated leaf contact switch that is operated by the park brake lever mechanism. The switch is grounded through its mounting to the park brake lever mechanism and provides a ground input to the ElectroMechanical Instrument Cluster (EMIC) on a park brake switch sense circuit whenever the park brake is applied, and opens this circuit whenever the park brake is released. The park brake switch sense input to the EMIC is used for control of the brake indicator and may also be used as a logic input for other electronic features in the vehicle.

The park brake switch can be diagnosed using conventional diagnostic tools and methods. However, proper testing of the EMIC processing of the park brake switch sense input requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## DIAGNOSIS AND TESTING

## PARK BRAKE SWITCH

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: If the brake indicator stays on with the ignition switch in the On position and the park brake released, or comes on while driving, the brake system must be diagnosed and repaired prior to performing the following tests. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING). If no brake system problem is found, the following procedures will help to locate a shorted or open park brake switch sense circuit, or an ineffective park brake switch.**

#### INDICATOR ILLUMINATES DURING BULB TEST, BUT DOES NOT WHEN PARK BRAKE APPLIED

1. Disconnect and isolate the battery negative cable. Disconnect the body wire harness connector for the park brake switch from the switch terminal. Apply the parking brake. Check for continuity between the park brake switch terminal and a good ground. There should be continuity. If OK, go to Step 2. If not OK, replace the ineffective park brake switch.
2. Disconnect the instrument panel wire harness connector for the instrument cluster from the cluster connector receptacle. Check for continuity between the park brake switch sense circuit cavities of the body wire harness connector for the park brake switch and the instrument panel wire harness connector for the instrument cluster. There should be continuity. If not OK, repair the open park brake switch sense circuit between the park brake switch and the instrument cluster as required.

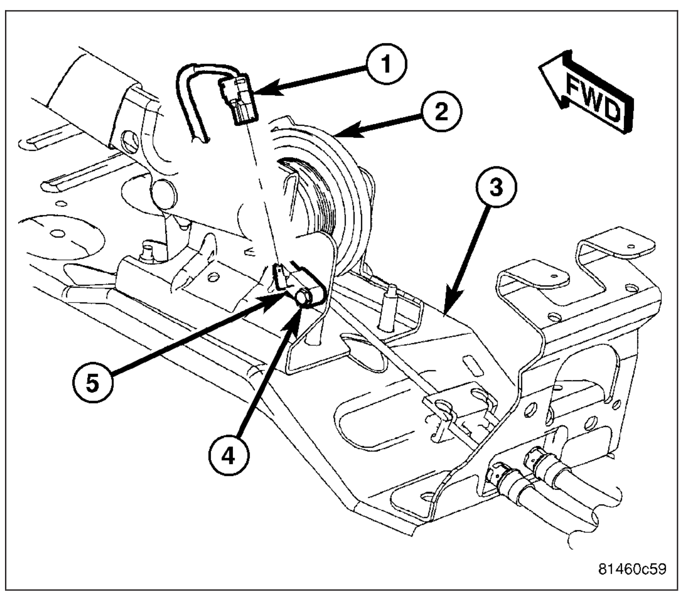
#### INDICATOR REMAINS ILLUMINATED - BRAKE SYSTEM CHECKS OK

1. Disconnect and isolate the battery negative cable. Disconnect the body wire harness connector for the park brake switch from the switch terminal. Check for continuity between the terminal of the park brake switch and a good ground. There should be no continuity with the park brake released, and continuity with the park brake applied. If OK, go to Step 2. If not OK, replace the ineffective park brake switch.
2. Disconnect the instrument panel wire harness connector for the instrument cluster from the cluster connector receptacle. Check for continuity between the park brake switch sense circuit cavity of the body wire harness connector for the park brake switch and a good ground. There should be no continuity. If not OK, repair the shorted park brake switch sense circuit between the park brake switch and the instrument cluster as required.

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

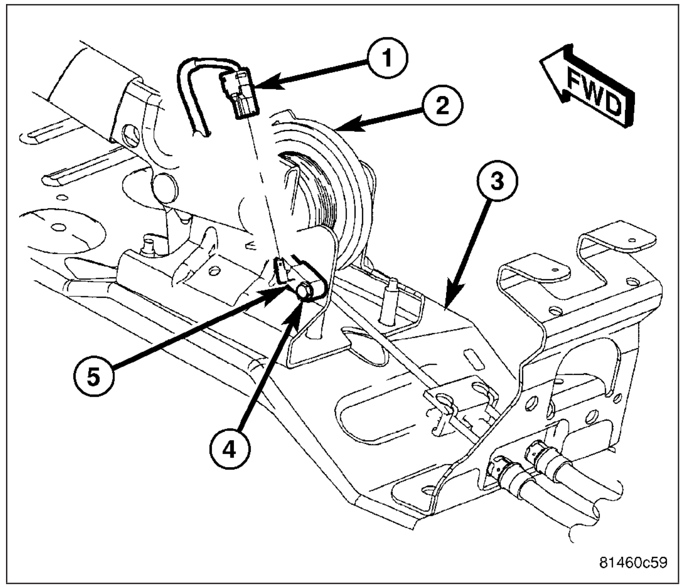
1. Disconnect and isolate the battery negative cable.
2. Remove the console from the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).
3. Apply the parking brake lever mechanism (2).
4. Disconnect the body wire harness connector (1) from the terminal of the park brake switch (5) located on the left side of the park brake lever mechanism.
5. Remove the screw (4) that secures the park brake switch to the park brake lever mechanism.
6. Remove the switch from the park brake lever mechanism.



## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

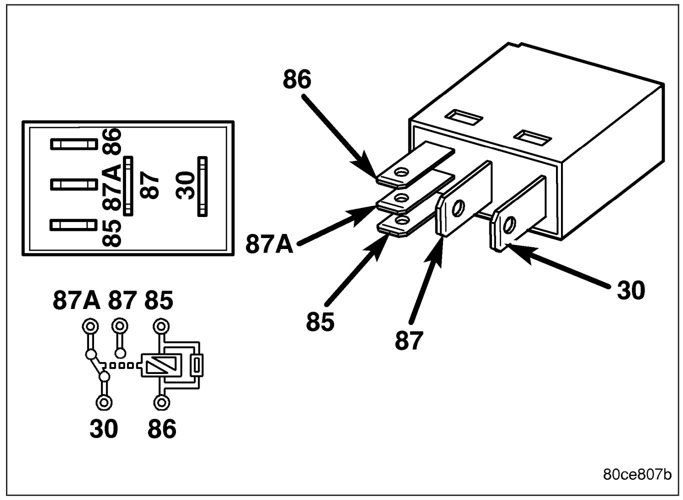
1. Position park brake switch (5) onto the left side of the park brake lever mechanism (2). Be certain to engage the locating pin on the back of the switch insulator into the locating slot in the lever mechanism bracket.
2. Install and tighten the screw (4) that secures the park brake switch to the park brake lever mechanism. Tighten the screw to 3 N·m (24 in. lbs.).
3. Reconnect the body wire harness connector (1) to the terminal of the park brake switch.
4. Reinstall the console onto the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION).
5. Reconnect the battery negative cable.
6. Turn the ignition switch to the On position and check for proper brake indicator operation with the parking brake applied, then release the parking brake and check that the brake indicator extinguishes.



# PARK LAMP RELAY

## DESCRIPTION

The park lamp relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. This relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs through five integral male spade-type terminals that extend from the relay base plate.




The park lamp relay is located in the Junction Block (JB) on the driver side outboard end bracket of the instrument panel. Refer to Junction Block in the wiring section of this service information for specific relay cavity assignment information. The park lamp relay cannot be adjusted or repaired and, if ineffective or damaged, the unit must be replaced.

## OPERATION

The park lamp relay is an electromechanical switch that uses a low current input from the Body Control Module (BCM) to control a high current output to the park lamps. Within the relay are an electromagnetic coil, a movable contact and two fixed contact points. A resistor is connected in parallel with the coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the field of the relay coil collapses.

The movable common supply contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This field draws the movable contact away from the normally closed contact, and holds it against the normally open contact. When the relay coil is de-energized, spring pressure returns the movable contact back against the normally closed contact.

The inputs and outputs of the park lamp relay include:

- **Common Supply Terminal (30)** - The common feed terminal is connected to the park lamps through the park lamp relay output circuit. This terminal provides ground to the park lamps when the relay is de-energized, and battery voltage to the park lamps whenever the relay is energized.
- **Coil Ground Terminal (85)** - The coil ground terminal is connected to a control output of the BCM through a park lamp relay control circuit. The BCM controls park lamp operation by controlling a ground path through this circuit.
- **Coil Battery Terminal (86)** - The coil battery terminal is connected to a fused B(+) circuit at all times.
- **Normally Open Terminal (87)** - The normally open terminal is connected to a fused B(+) circuit at all times.
- **Normally Closed Terminal (87A)** - The normally closed terminal is connected to ground at all times through a ground stud on the driver side instrument panel end bracket near the Junction Block (JB).

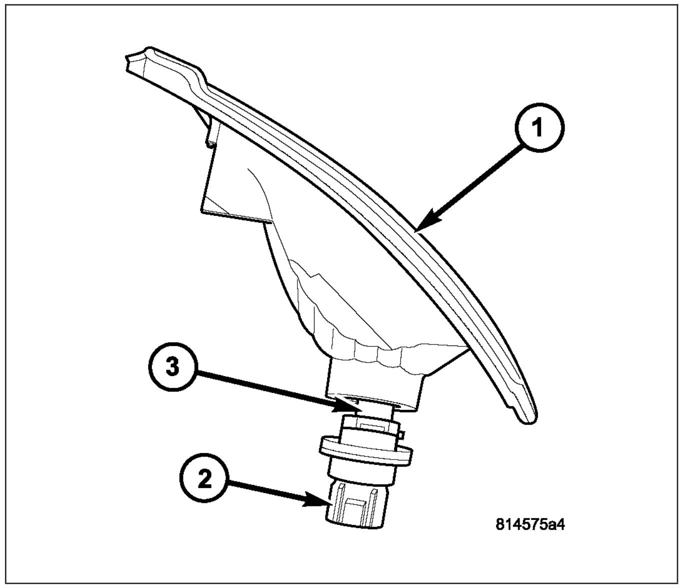
The park lamp relay can be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

# PARK/TURN SIGNAL LAMP

## REMOVAL

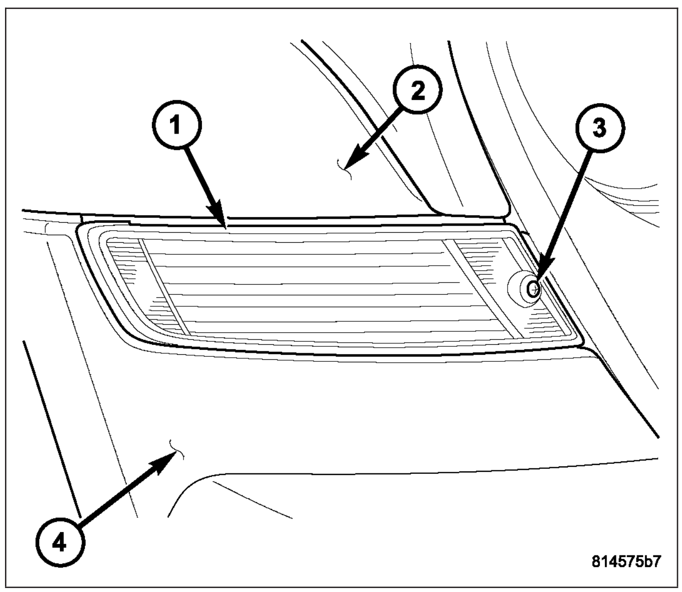
### BULB

1. Disconnect and isolate the battery negative cable.
2. Remove the front park/turn signal lamp unit (1) from the front fascia. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/PARK/TURN SIGNAL LAMP UNIT - REMOVAL).
3. Firmly grasp the park/turn signal bulb socket (2) on the back of the lamp unit housing and rotate it counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb (3) straight out from the keyed opening in the housing.
5. Pull the base of the bulb straight out of the socket.

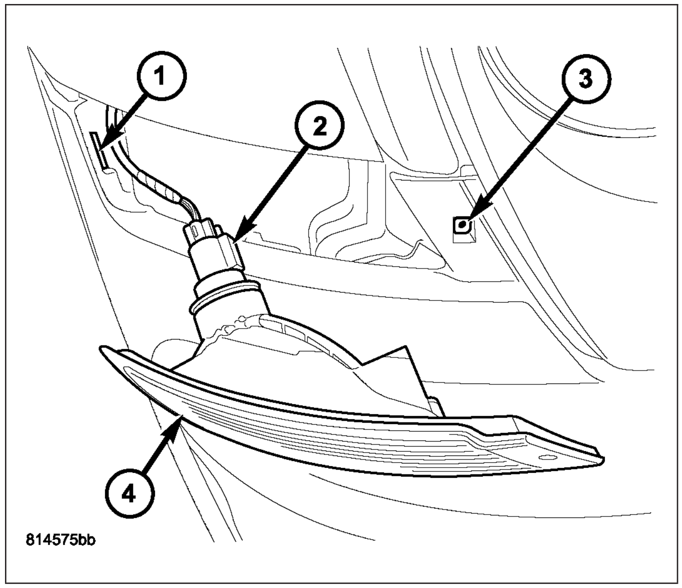



### LAMP

1. Disconnect and isolate the battery negative cable.
2. Remove the screw (3) that secures the inboard side of the front park/turn signal lamp unit (1) to the front bumper fascia (4).



3. Pull the inboard side of the lamp (4) away from the fascia far enough to disengage the tab that secures the outboard side of the lamp from the slot (1) in the front bumper fascia.
4. Disengage the lock feature and disconnect the wire harness connector (2) from the lamp socket.
5. Remove the front park/turn signal lamp unit from the vehicle.

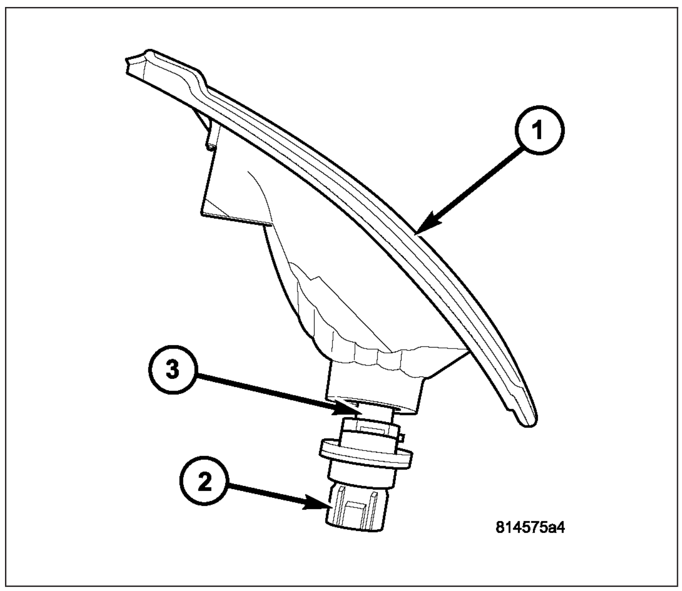



## INSTALLATION

## BULB

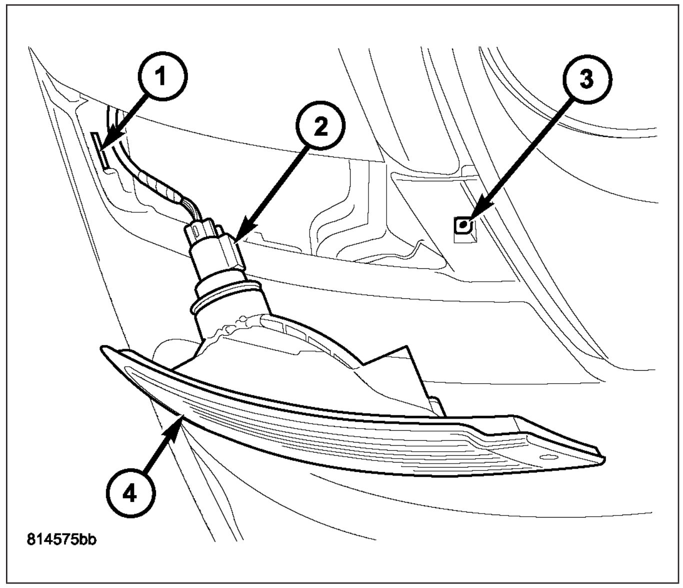
**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

1. Align the base of the bulb (3) with the park/turn signal bulb socket (2).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of the front park/turn signal lamp unit housing (1).
4. Insert the socket and bulb into the housing until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Reinstall the front park/turn signal lamp unit onto the front fascia. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/PARK/TURN SIGNAL LAMP UNIT - INSTALLATION).
7. Reconnect the battery negative cable.

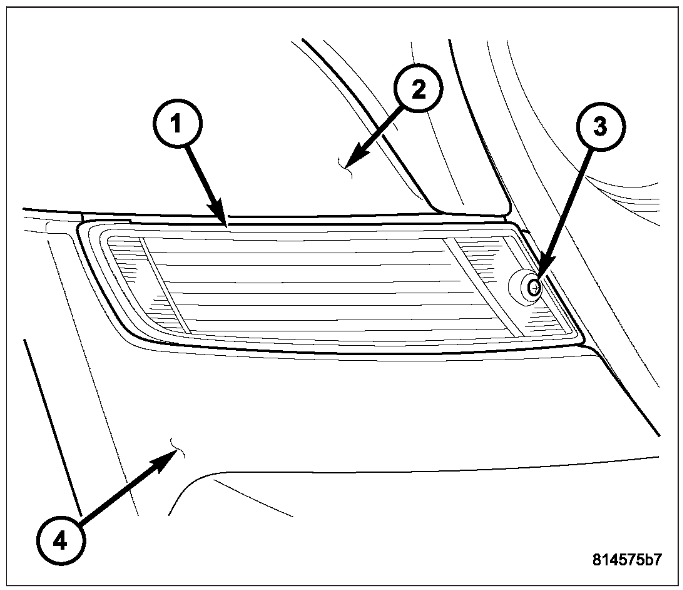


## LAMP

1. Check to be certain that the plastic nut (3) is in good condition and properly installed in the inboard side of the front park/turn signal lamp mounting hole in the front bumper fascia.
2. Position the lamp unit (4) near the mounting hole in the fascia.
3. Reconnect the wire harness connector (2) to the lamp socket and engage the lock feature.
4. Align and engage the tab on the outboard side of the lamp housing with the slot (1) in the fascia mounting hole.




5. Position the inboard side of the lamp (1) into the fascia (4) mounting hole.
6. Install and tighten the screw (3) that secures the inboard side of the lamp to the fascia. Tighten the screw to 2 N·m (20 in. lbs.).
7. Reconnect the battery negative cable.



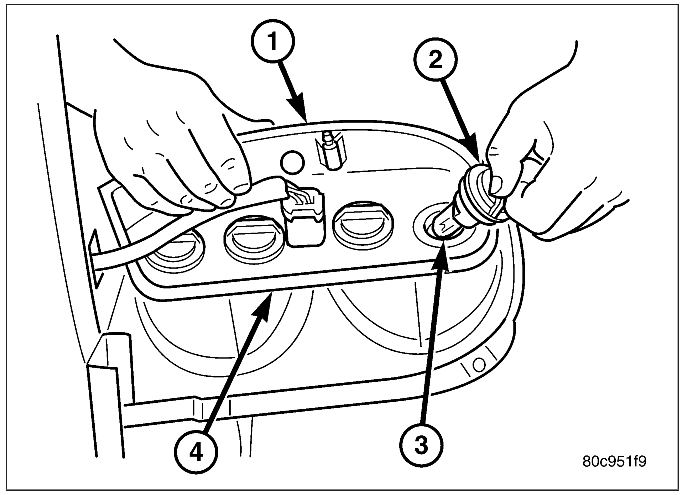
# REAR LAMP UNIT

## REMOVAL

### BULB

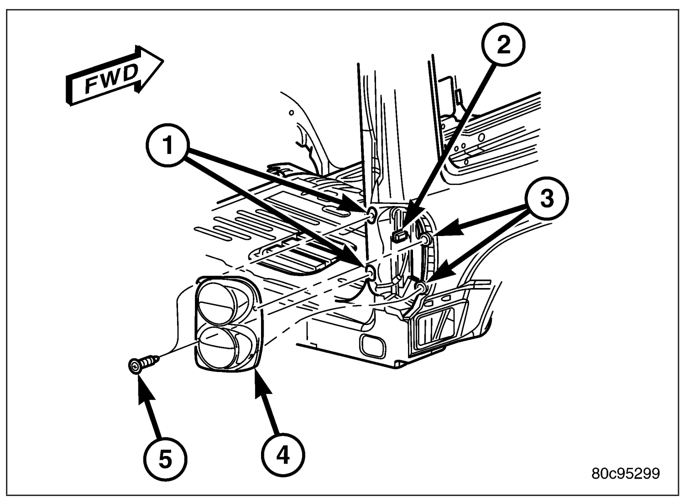
**NOTE: The rear lamp unit may contain up to four bulbs, depending upon the market for which the vehicle was manufactured. The service procedures for each bulb are the same, only the bulb sizes and types may differ.**

1. Disconnect and isolate the battery negative cable.
2. Remove the rear lamp unit (1) from the end of the quarter panel. (Refer to 8 - ELECTRICAL/LAMPS/ LIGHTING - EXTERIOR/REAR LAMP UNIT - REMOVAL).
3. Firmly grasp the socket (2) on the socket plate (4) on the back of the rear lamp unit housing for the bulb that is being removed and rotate it counter-clockwise about 30 degrees to unlock it.
4. Pull the socket and bulb (3) straight out of the keyed opening in the socket plate.
5. Pull the base of the bulb straight out of the rear lamp socket.




### LAMP

1. Disconnect and isolate the battery negative cable.
2. Open the tailgate to access and remove the two screws (5) that secure the rear lamp unit (4) to the two plastic nuts (1) in the side jamb of the tailgate opening.
3. Pull the outboard side of the rear lamp unit rearward far enough to unsnap the two ball studs on the outboard side of the lamp housing from the two plastic grommets (3) in the quarter panel.
4. Disconnect the wire harness connector (2) from the lamp socket plate connector.
5. Remove the lamp from the quarter panel.
6. Remove the two plastic grommets from the quarter panel and discard.



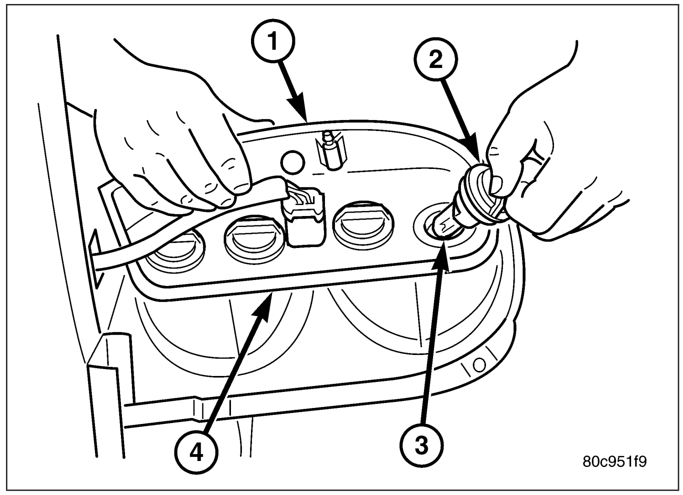

## INSTALLATION

### BULB

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

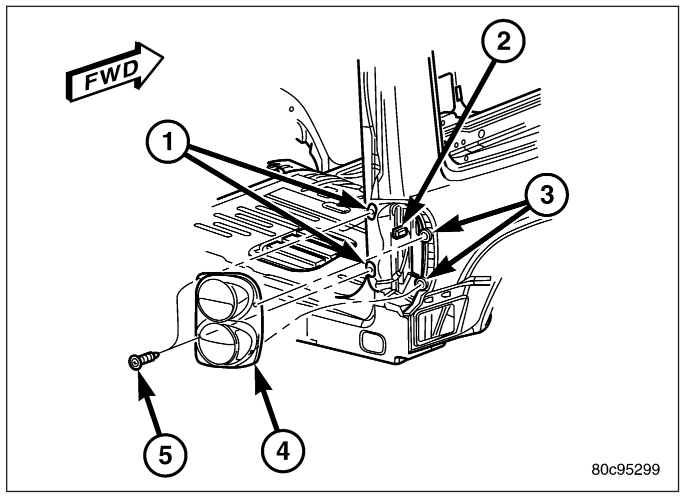
**NOTE: The rear lamp unit may contain up to four bulbs, depending upon the market for which the vehicle was manufactured. The service procedures for each bulb are the same, only the bulb sizes and types may differ.**

1. Align the base of the bulb (3) with the rear lamp socket (2).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening in the socket plate (4) on the back of the rear lamp unit housing (1).
4. Insert the socket and bulb straight into the socket plate until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Reinstall the rear lamp unit onto the end of the quarter panel. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/REAR LAMP UNIT - INSTALLATION).
7. Reconnect the battery negative cable.




## LAMP

1. Install two new plastic grommets (3) into the quarter panel.
2. Position the rear lamp unit (4) to the quarter panel.
3. Reconnect the wire harness connector (2) to the lamp socket plate connector.
4. Align the two ball studs on the outboard side of the rear lamp housing with the two plastic grommets in the quarter panel.
5. Using hand pressure, push firmly and evenly on the outboard side of the lamp until the two ball studs snap into the plastic grommets.
6. Install and tighten the two screws (5) that secure the inboard side of the lamp housing to the plastic nuts (1) in the side jamb of the tailgate opening. Tighten the screws to 2 N·m (20 in. lbs.).
7. Reconnect the battery negative cable.



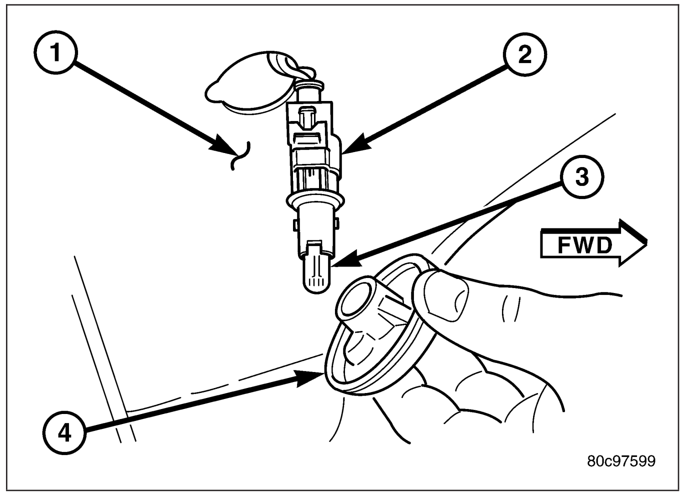
# REPEATER LAMP

## REMOVAL

## BULB

**NOTE: Side repeater lamps are used only on vehicles manufactured for certain markets where these lamps are required.**

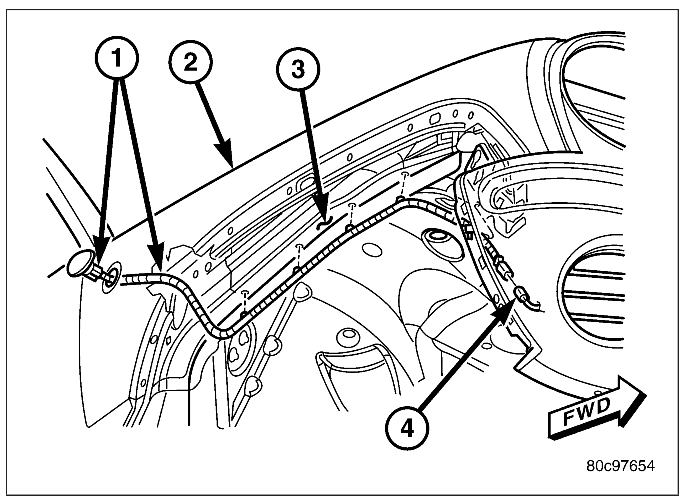
1. Disconnect and isolate the battery negative cable.
2. Remove the repeater lamp unit from the front fender panel (1). (Refer to 8 - ELECTRICAL/ LAMPS/LIGHTING - EXTERIOR/REPEATER LAMP UNIT - REMOVAL).
3. Rotate the repeater lamp socket (2) in the lamp lens (4) counterclockwise about 30 degrees to unlock it.
4. Pull the socket and bulb (3) straight out of the keyed opening in the lamp lens.
5. Pull the base of the bulb straight out of the lamp socket.




## LAMP

**NOTE: Side repeater lamps are used only on vehicles manufactured for certain markets where these lamps are required.**

1. Disconnect and isolate the battery negative cable.
2. Using a trim stick or another suitable wide flat-bladed tool, carefully pry at the clearance notch in the lower edge of the repeater lamp lens (1) to disengage the snap features of the lens from the mounting hole in the front fender panel (2).
3. Pull the lamp unit out from the front fender panel far enough to access and disconnect the wire harness connector from the lamp socket.
4. Remove the lamp unit from the front fender panel.

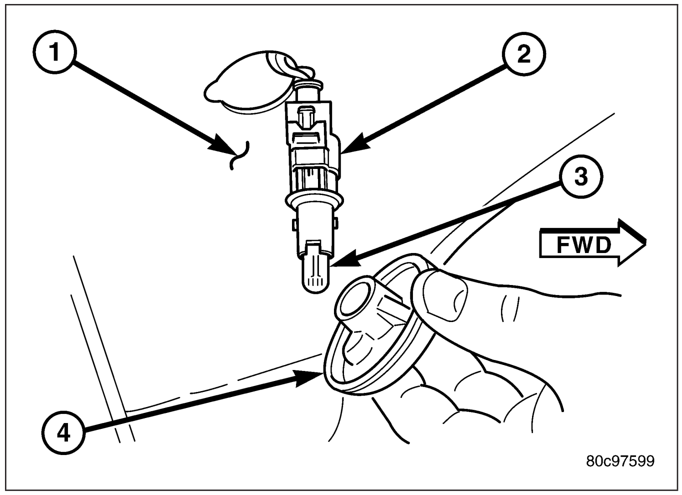



## INSTALLATION

## BULB

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

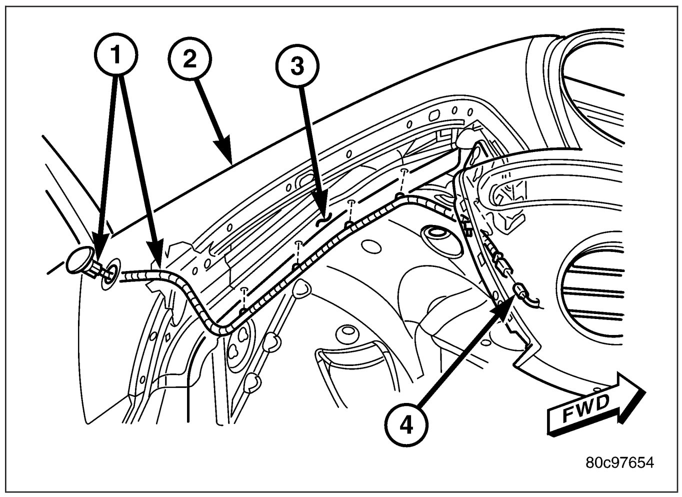
**NOTE: Side repeater lamps are used only on vehicles manufactured for certain markets where these lamps are required.**




1. Align the base of the bulb (3) with the repeater lamp socket (2).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the socket and bulb with the keyed opening on the back of the repeater lamp lens (4).
4. Insert the socket and bulb straight into the lens until the socket is firmly seated
5. Rotate the socket clockwise in the lens about 30 degrees to lock it into place.
6. Reinstall the repeater lamp unit onto the front fender panel (1). (Refer to 8 - ELECTRICAL/ LAMPS/LIGHTING - EXTERIOR/REPEATER LAMP UNIT - INSTALLATION).
7. Reconnect the battery negative cable.

## LAMP

**NOTE: Side repeater lamps are used only on vehicles manufactured for certain markets where these lamps are required.**

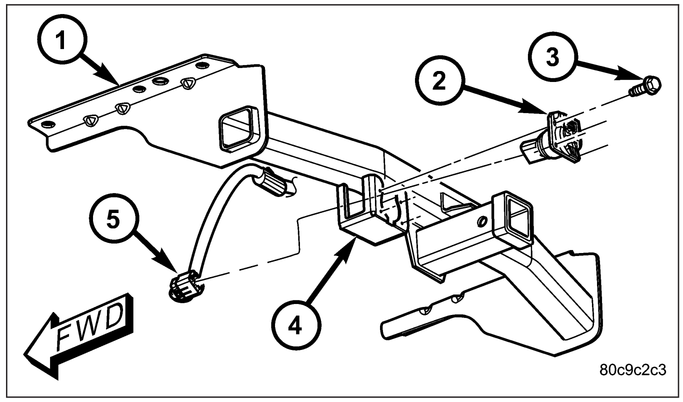



1. Position the repeater lamp unit (1) to the front fender panel (2).
2. Reconnect the wire harness connector to the lamp socket.
3. Position the lamp unit into the mounting hole in the front fender panel. Be certain that the clearance notch on the edge of the lamp lens is oriented towards the bottom.
4. Using hand pressure, press on the lamp lens firmly and evenly until the snap features of the lamp are fully engaged in the mounting hole of the front fender panel.
5. Reconnect the battery negative cable.

# TRAILER TOW CONNECTOR

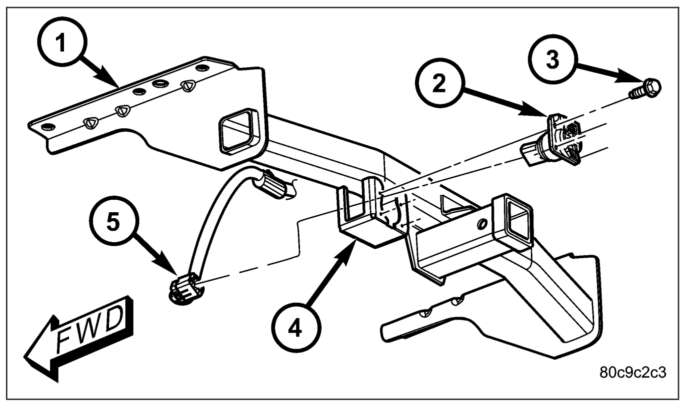
## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the four screws (3) that secure the trailer tow connector (2) to the bracket (4) on the trailer hitch receiver (1).
3. Pull the trailer tow connector rearward from the hitch receiver bracket far enough to access and disconnect the rear body wire harness connector (5).
4. Remove the trailer tow connector from the trailer hitch receiver.




## INSTALLATION

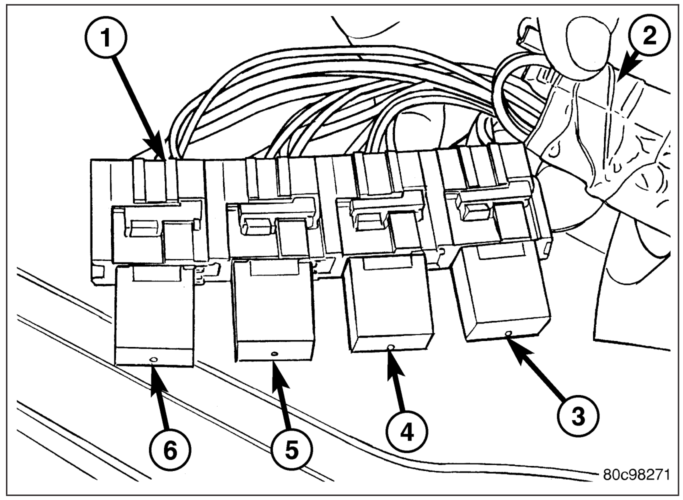
1. Position the trailer tow connector (2) to the trailer hitch receiver (1).
2. Reconnect the rear body wire harness connector (5) to the trailer tow connector.
3. Position the trailer tow connector into the bracket (4) on the trailer hitch receiver.
4. Install and tighten the four screws (3) that secure the trailer tow connector to the hitch receiver bracket. Tighten the screws to 4 N·m (35 in. lbs.).
5. Reconnect the battery negative cable.



# TRAILER TOW RELAY

## DESCRIPTION

Vehicles equipped with an optional factory-installed trailer towing package have four trailer tow relays. The trailer tow relays are conventional International Standards Organization (ISO) micro relays. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. Each relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs through five integral male spade-type terminals that extend from the relay base plate.




The trailer tow relays include one each for brake lamps (5), right turn lamps (4), left turn lamps (3) and a fused ignition switch output (run) circuit (6) which are provided for the trailer through the rear body wiring (2) and connectors. The relays are located in a connector bank (1) above the right rear wheelhouse and behind the quarter trim panel. The connector bank and relays are wrapped within a foam rubber isolator envelope for sound deadening and anti-rattle protection.

Refer to Trailer Tow in the wiring information for specific relay cavity assignment information. A trailer tow relay cannot be adjusted or repaired and, if ineffective or damaged, the unit must be replaced.

## OPERATION

The trailer tow relays are electromechanical switches that each use a low current input from the circuit that they isolate to control a high current output to the trailer brake and turn signal lamps, and a trailer accessory circuit. Within each relay are an electromagnetic coil, a movable contact and two fixed contact points. A resistor is connected in parallel with the coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the field of the relay coil collapses.

The movable common supply contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This field draws the movable contact away from the normally closed contact, and holds it against the normally open contact. When the relay coil is de-energized, spring pressure returns the movable contact back against the normally closed contact.

The inputs and outputs of the trailer tow relays include:

- **Common Supply Terminal (30)** - The common feed terminal is connected to the circuit connected to the normally open terminal (87) when the relay is energized, or to the circuit connected to the normally closed terminal (87A) when the relay is de-energized.
- **Coil Ground Terminal (85)** - The coil ground terminal is connected to a ground circuit at all times.
- **Coil Battery Terminal (86)** - The coil battery terminal is connected to the circuit that controls the relay output. When battery voltage is applied to this terminal, the relay is energized.
- **Normally Open Terminal (87)** - The normally open terminal is connected to the circuit connected to the common supply terminal (30) whenever the relay is energized.
- **Normally Closed Terminal (87A)** - The normally closed terminal is connected to the circuit connected to the common supply terminal (30) whenever the relay is de-energized.

The trailer tow relays can be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

## REMOVAL

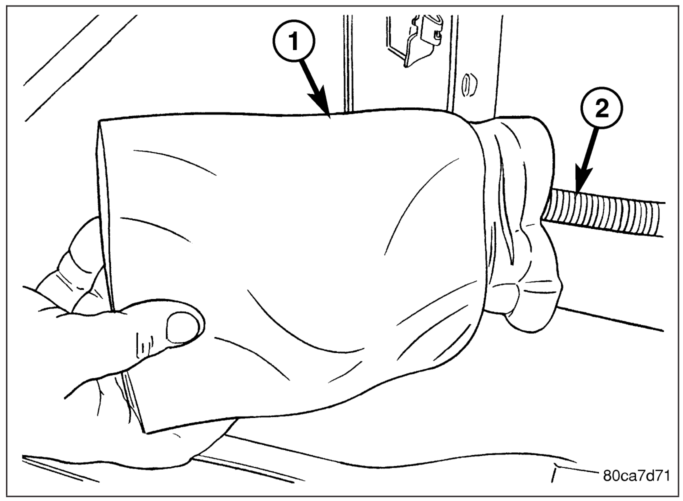
**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: Use proper precautions to protect your skin and the rear body wire harness from cuts or scrapes caused by contact with the sharp edges of the quarter inner panel sheet metal while servicing the trailer tow relay connector bank.**

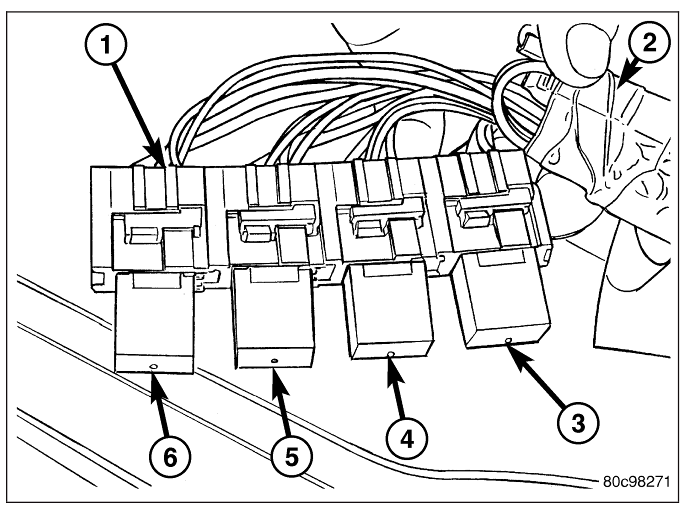
**CAUTION: Be certain any removed trailer tow relay is replaced with the same relay size and type that was removed.**

**NOTE: The trailer tow relay bank contains four relays. The service procedures for each relay are the same.**

1. Disconnect and isolate the battery negative cable.
2. Remove the trim from the right side quarter inner panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL).
3. Reach through the access hole in the quarter inner panel behind the right rear wheelhouse to locate and retrieve the trailer tow relay connector bank at the end of a take out of the rear body wire harness (2), which is wrapped within a foam rubber envelope (1) and placed on the top of the right rear wheelhouse between the quarter inner and outer panels.
4. Pull the trailer tow relay connector bank envelope into the cargo area far enough to access the relays for service.




5. Carefully remove the trailer tow relay connector bank (1) from the foam wrap.
6. Remove the appropriate relay (3, 4, 5 or 6) by grasping it firmly and pulling it straight out from the connector bank.



## INSTALLATION

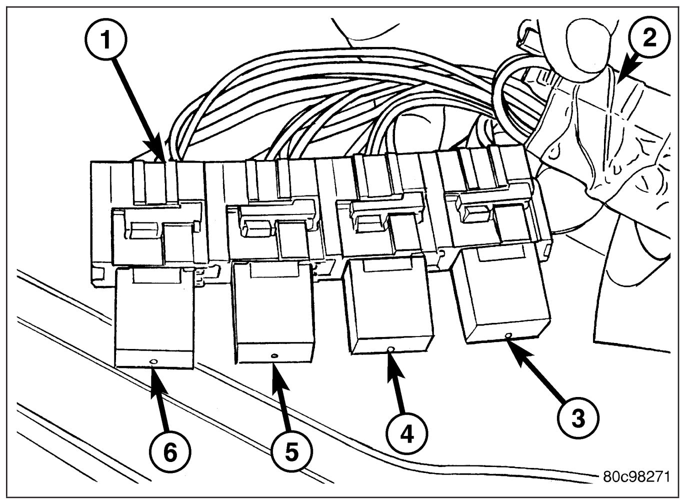
**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: Use proper precautions to protect your skin and the rear body wire harness from cuts or scrapes caused by contact with the sharp edges of the quarter inner panel sheet metal while servicing the trailer tow relay connector bank.**

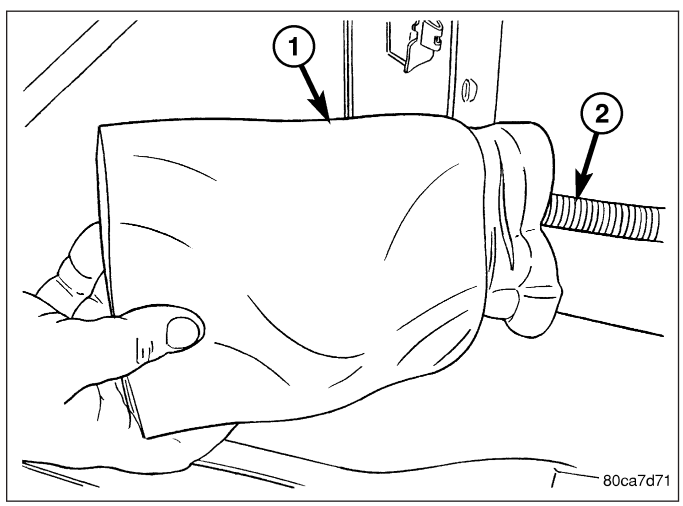
**CAUTION: Be certain any removed trailer tow relay is replaced with the same relay size and type that was removed.**

**NOTE: The trailer tow relay bank contains four relays. The service procedures for each relay are the same.**

1. Position the trailer tow relay (3, 4, 5 or 6) to the appropriate connector in the connector bank (1).
2. Align the relay terminals with the receptacles in the connector.
3. Push firmly and evenly on the top of the relay until the terminals are fully seated in the connector.



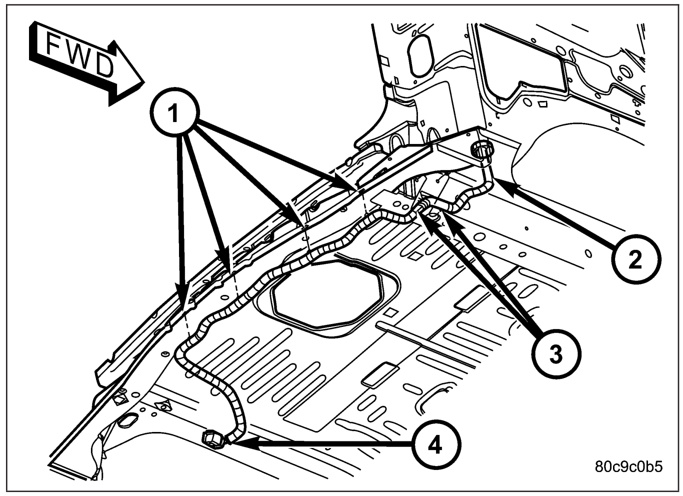

4. Carefully restore the foam wrap (1) around the trailer tow relay connector bank on the rear body wire harness take out (2).
5. Reach through the access hole in the quarter inner panel behind the right rear wheelhouse to place the relay connector bank on the top of the right rear wheelhouse between the quarter inner and outer panels.
6. Reinstall the trim onto the right side quarter inner panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - INSTALLATION).
7. Reconnect the battery negative cable.



# TRAILER TOW WIRING

## DESCRIPTION

Vehicles equipped with an optional factory-installed trailer towing package have a rear body wire harness that includes a trailer tow wiring take out (2) secured beneath the rear underbody with retainer clips (1 and 3). A molded connector (4) at the end of the take out is connected to a heavy duty, sealed, 7-pin trailer tow connector located on a bracket on the trailer hitch receiver. The rear body harness includes a second take out with a trailer tow relay connector bank and the four trailer tow relays that isolate the right turn signal, left turn signal, and brake lamp circuits of the vehicle from the electrical system of the trailer. The fourth relay in the connector bank provides a fused ignition switch output (run) source of battery voltage to the trailer tow connector through a trailer tow relay output circuit.

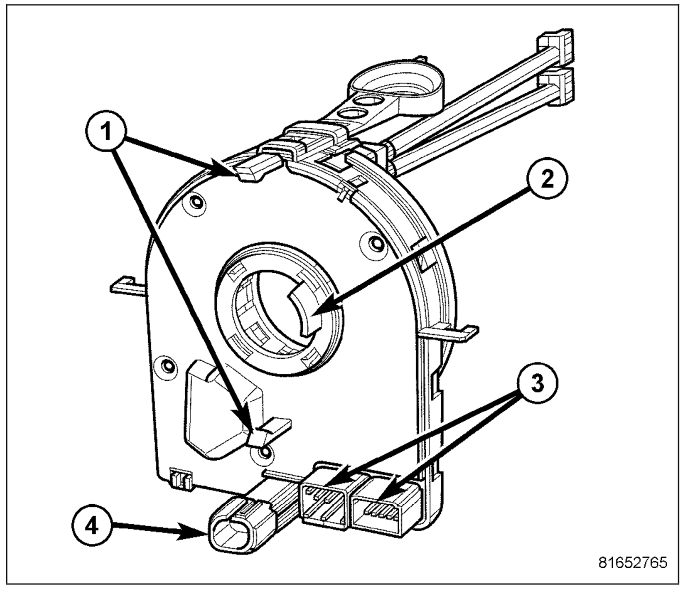



The package also includes an adapter harness (stored beneath the left rear seat cushion of the vehicle when it is shipped from the factory) that adapts the 7-pin trailer tow connector to a standard, light-duty, 4-pin trailer tow connector. Refer to the appropriate wiring information.

# TURN SIGNAL CANCEL CAM

## DESCRIPTION

The turn signal cancel cam (2) is concealed within the steering column. The cancel cam consists of a single lobe that is integral to the lower hub of the clockspring rotor. The clockspring mechanism provides turn signal cancellation as well as a constant electrical connection between the horn switch, driver airbag, speed control switches, and remote radio switches on the steering wheel and the instrument panel wire harness on the steering column. The housing of the clockspring is secured to the lock housing near the top of the steering column and remains stationary. The rotor of the clockspring, including the turn signal cancel cam lobe rotates with the steering wheel.




The turn signal cancel cam is serviced as a unit with the clockspring and cannot be repaired. If ineffective or damaged, the entire clockspring unit must be replaced. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

## OPERATION

When the multi-function switch left (lighting) control stalk is moved to a latched turn signal position, a turn signal cancel actuator is extended from the left inside surface of the switch housing toward the turn signal cancel cam. As the steering wheel is rotated to complete the turn, the cam lobe will contact the actuator, automatically cancelling the turn signal event and releasing the latched multi-function switch left control stalk to the neutral position.

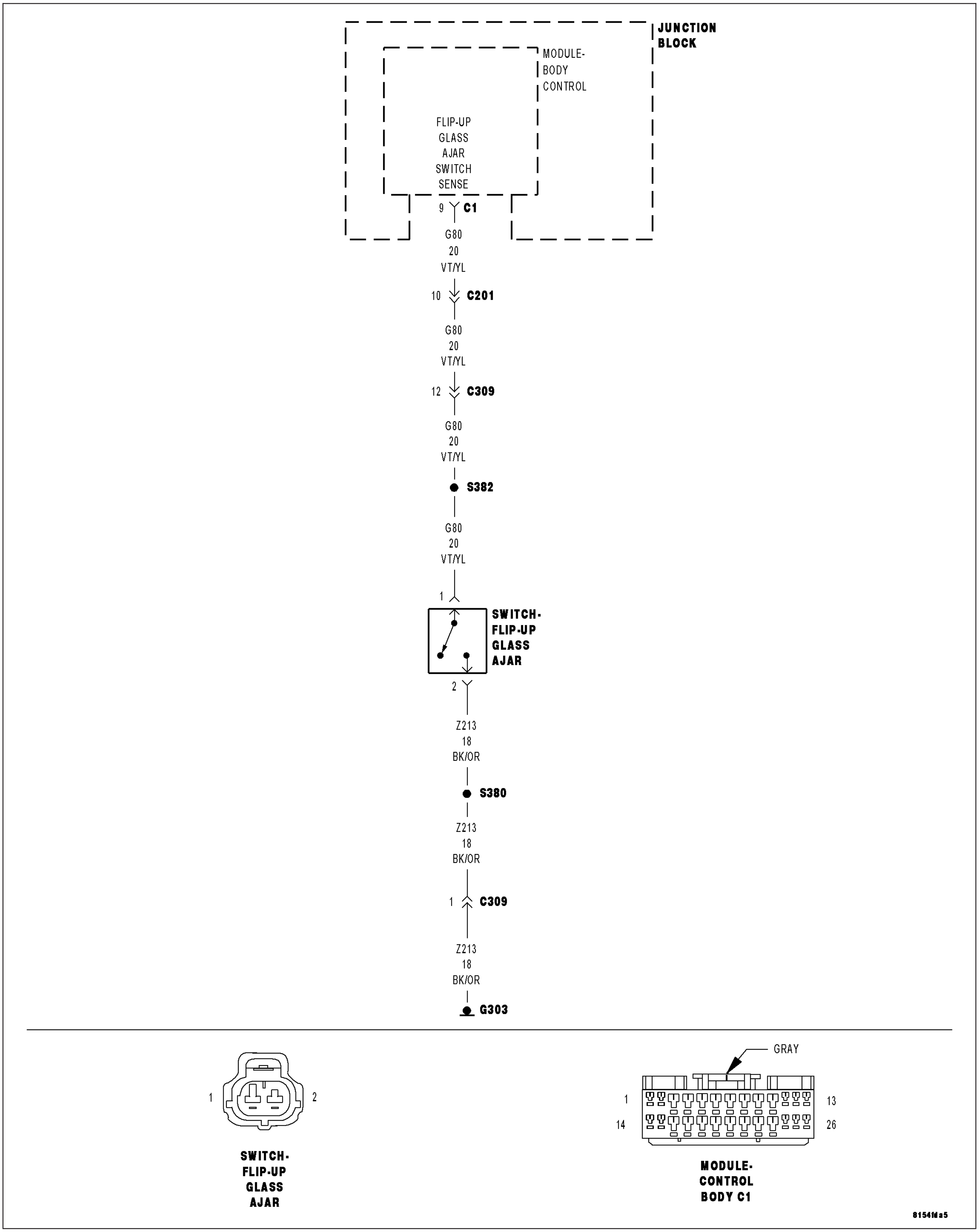
# LAMPS/LIGHTING - INTERIOR - ELECTRICAL DIAGNOSTICS

## TABLE OF CONTENTS

# LAMPS/LIGHTING - INTERIOR - ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## *FLIP-UP GLASS AJAR CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
|---|
| FLIP-UP GLASS AJAR SWITCH GROUND CIRCUIT OPEN |
| (G80) FLIP-UP GLASS AJAR SWITCH SENSE CIRCUIT OPEN |
| FLIP-UP GLASS AJAR SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. FLIP-UP GLASS AJAR FUNCTIONAL TEST

Open the Flip-up Glass.

With the scan tool in Data Display, read the FLIP-UP AJAR SW state.

**Does the scan tool display TRUE?**

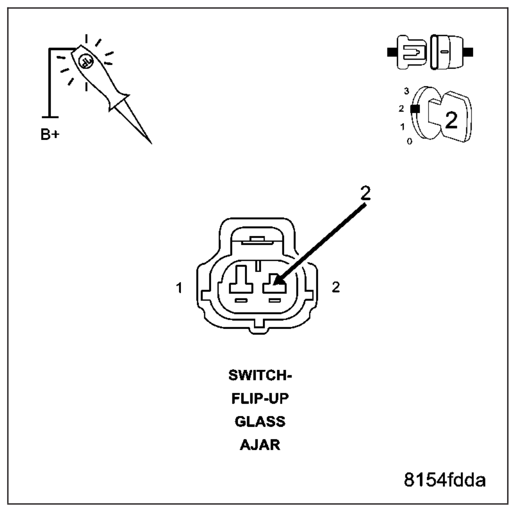
**Yes** >> The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires.

**No** >> Go To 2

### 2. OPEN FLIP-UP GLASS AJAR SWITCH GROUND CIRCUIT

Disconnect the Tailgate Flip-up Glass Ajar switch connector.

Using a 12-volt Test Light connected to 12-volts, test the Ground circuit.



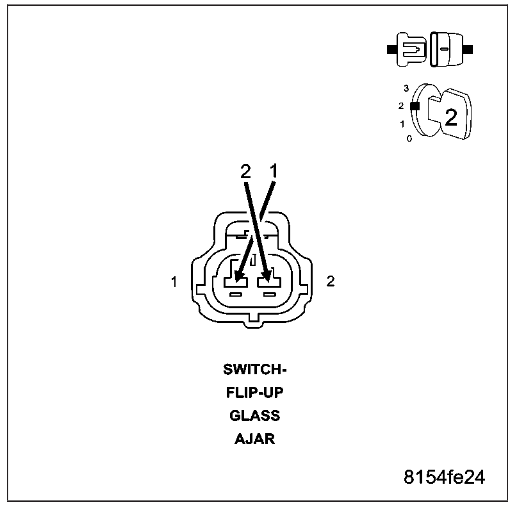

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 3. CHECK FOR OPEN FLIP-UP GLASS AJAR SWITCH




With the scan tool in Data Display, read the FLIP-UP AJAR SW state.

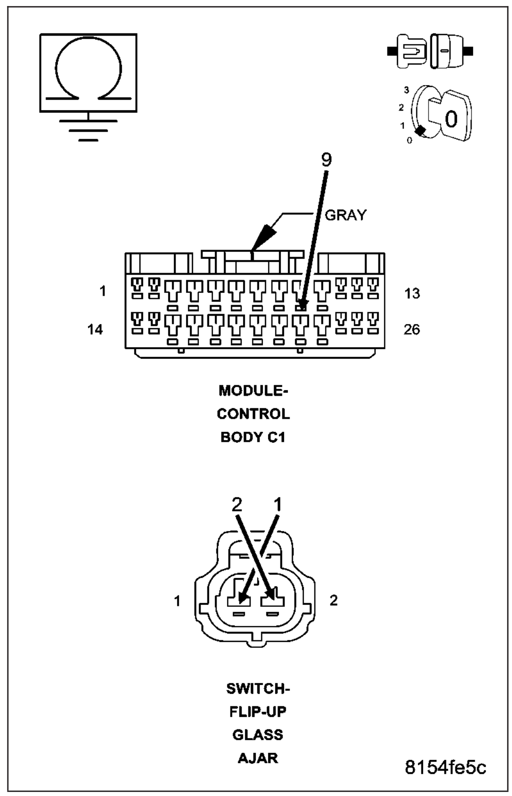
Connect a jumper wire between Sense circuit and the Ground circuit in the Tailgate Flip-Up Glass Ajar Switch connector.

**Does the scan tool display FLIP-UP AJAR SW: TRUE?**

**Yes** >> Replace the Flip-up Glass Ajar Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK FOR OPEN (G80) FLIP-UP GLASS AJAR SWITCH SENSE CIRCUIT




Turn the ignition off.

Leave the jumper wire from the previous step connected.

Disconnect the Body Control Module C1 harness connector.

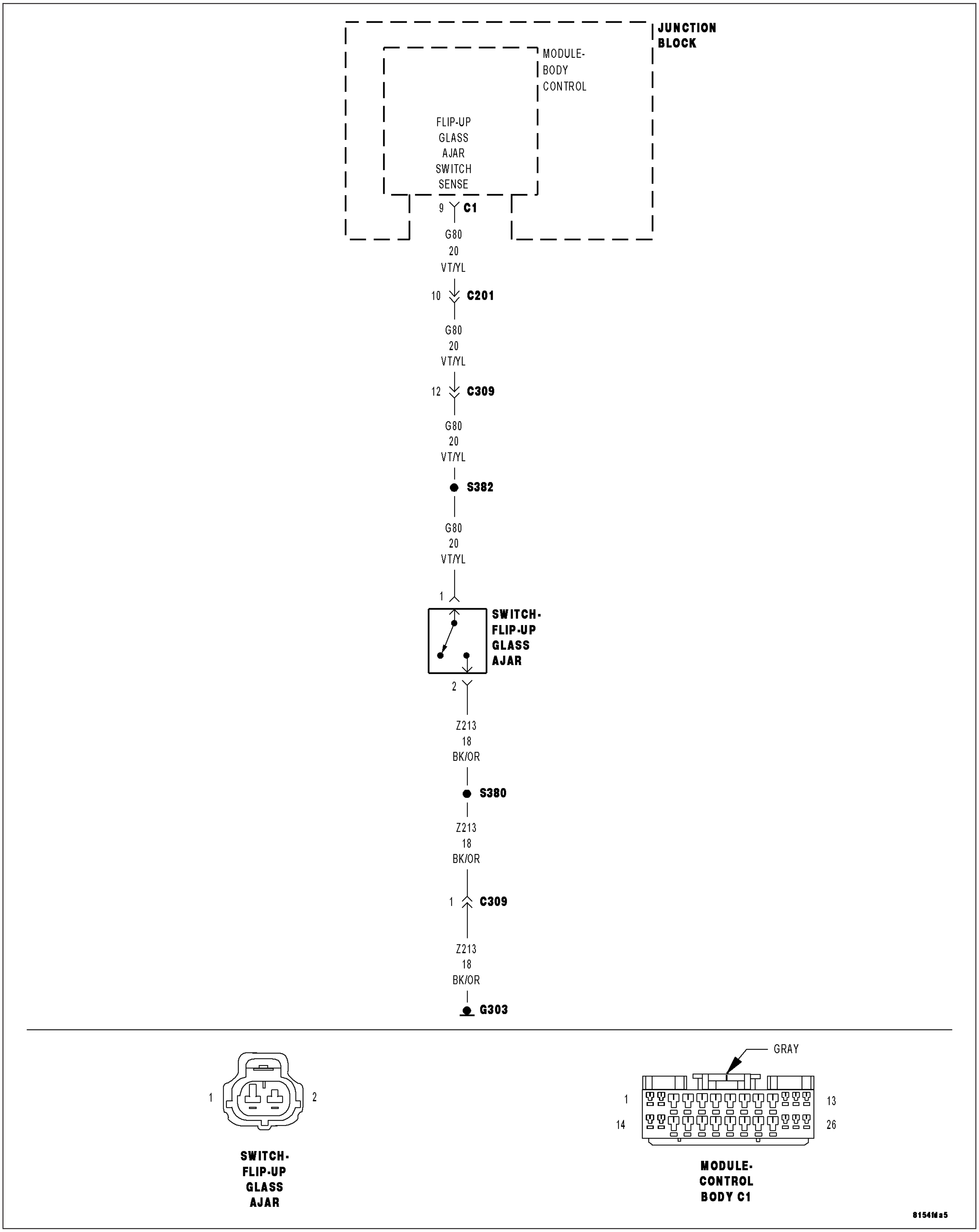
Measure the resistance between ground and the (G80) Flip-Up Glass Ajar Switch Sense circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (G80) Flip-up Glass Ajar Switch Sense circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *FLIP-UP GLASS AJAR CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

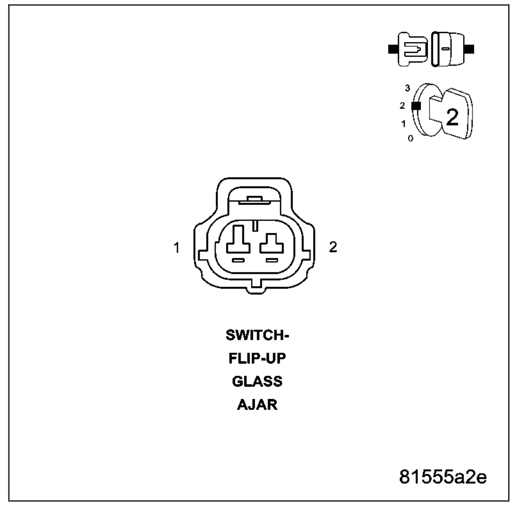
The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
|---|
| (G80) FLIP-UP GLASS AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND |
| FLIP-UP GLASS AJAR SWITCH |
| BODY CONTROL MODULE |

## 1. CHECK FOR SHORTED FLIP-UP GLASS AJAR SWITCH

With the scan tool in Data Display, read the FLIP-UP AJAR SW state.

Disconnect the Tailgate Flip-Up Glass Ajar Switch connector.




**Does the scan tool display FLIP-UP AJAR SW: FALSE?**

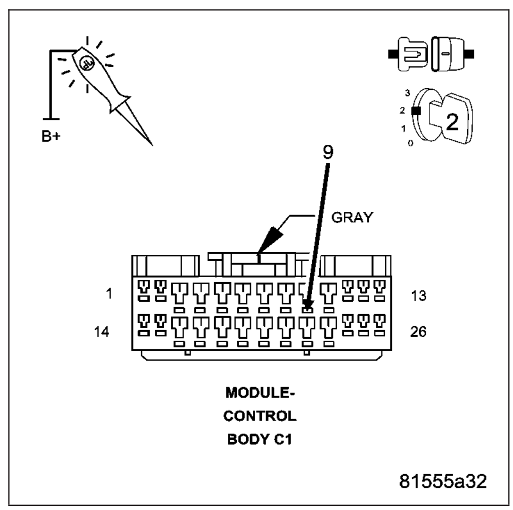
**Yes** >> Replace the Flip-up Glass Ajar Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2

## 2. CHECK FOR (G80) FLIP-UP GLASS AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND

Disconnect the Body Control Module C1 harness connector.

Using a 12–volt test light connected to 12–volts, test the (G80) Flip-Up Glass Ajar Switch Sense circuit for a short to ground.

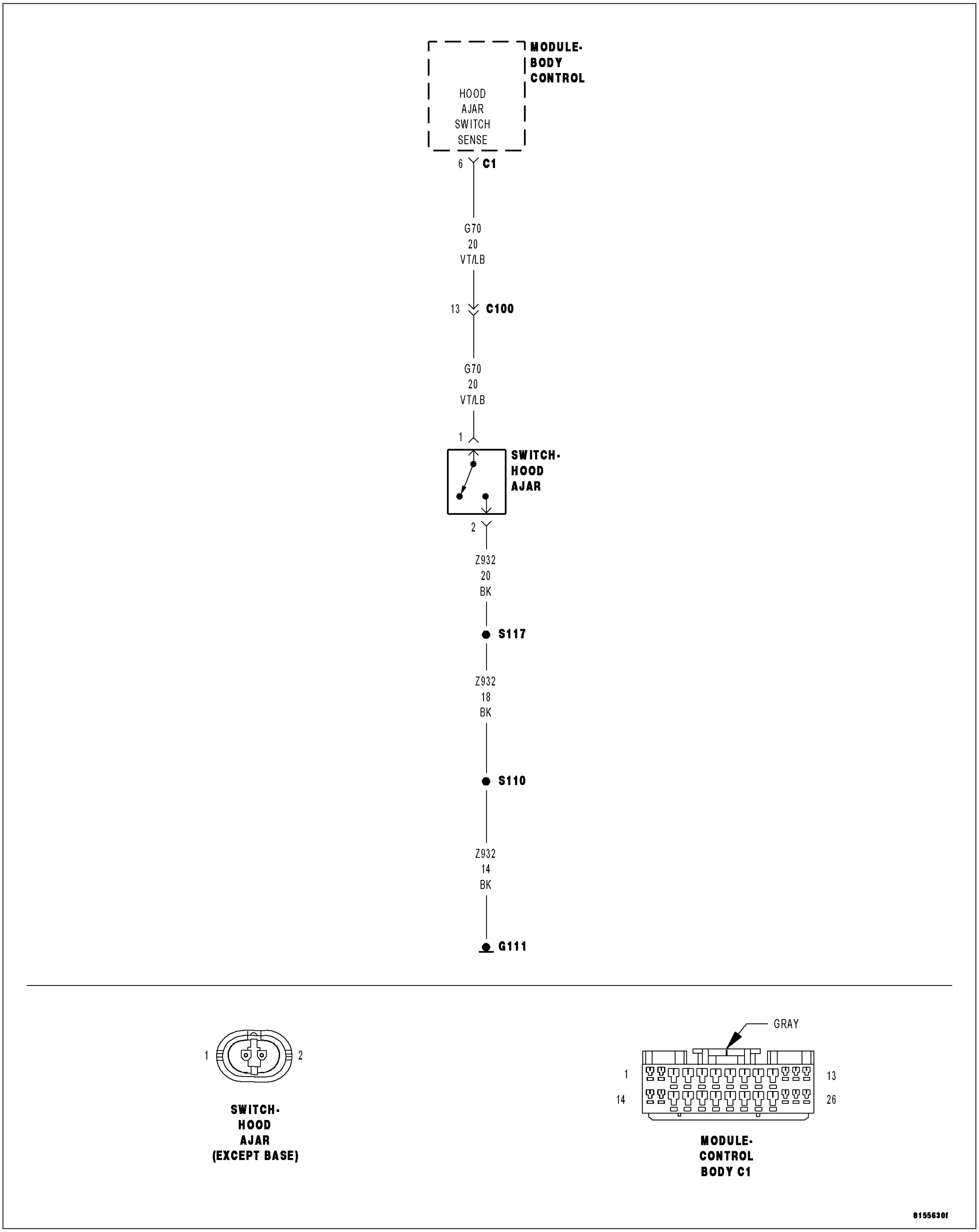



**Does the test light illuminate brightly?**

**No** >> Replace the Body Control Module in accordance with service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**Yes** >> Repair the (G80) Flip-up Glass Ajar Switch Sense circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *HOOD AJAR CIRCUIT OPEN – EXPORT ONLY




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
|---|
| HOOD AJAR SWITCH GROUND CIRCUIT OPEN |
| (G70) HOOD AJAR SWITCH SENSE CIRCUIT OPEN |
| FLIP-UP GLASS AJAR SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. FLIP-UP GLASS AJAR FUNCTIONAL TEST

Open the Hood.

With the scan tool in Data Display, read the FLIP-UP AJAR SW state.

**Does the scan tool display TRUE?**

**Yes** >> The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires.

**No** >> Go To 2

### 2. OPEN HOOD AJAR SWITCH GROUND CIRCUIT

Disconnect the Hood Ajar switch connector.

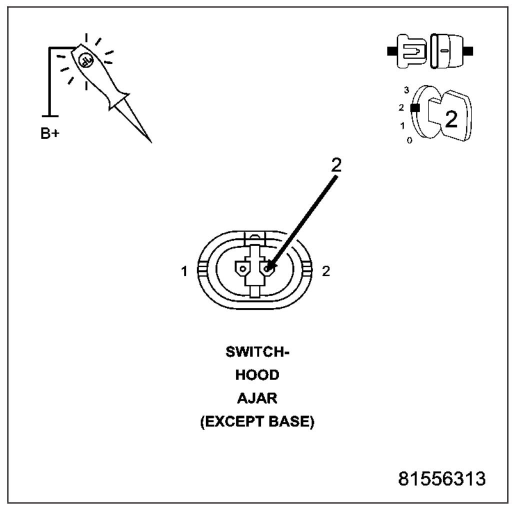
Using a 12-volt Test Light connected to 12-volts, test the Ground circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the Ground circuit for an open.

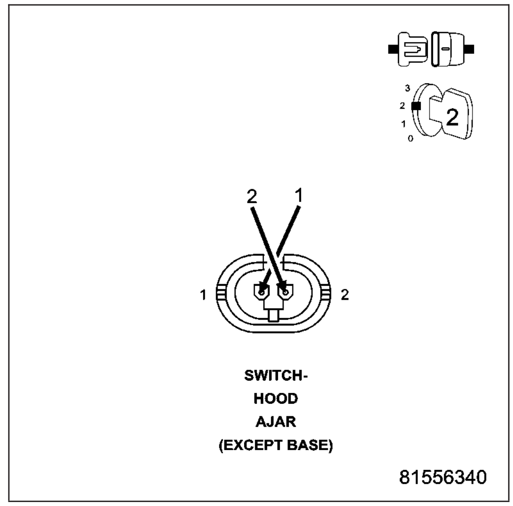
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## 3. CHECK FOR OPEN HOOD AJAR SWITCH

With the scan tool in Data Display, read the HOOD AJAR SW state.

Connect a jumper wire between the Sense circuit and the Ground circuit in the Hood Ajar Switch connector.




**Does the scan tool display HOOD AJAR SW: TRUE?**

**Yes** >> Replace the Hood Ajar Switch.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 4

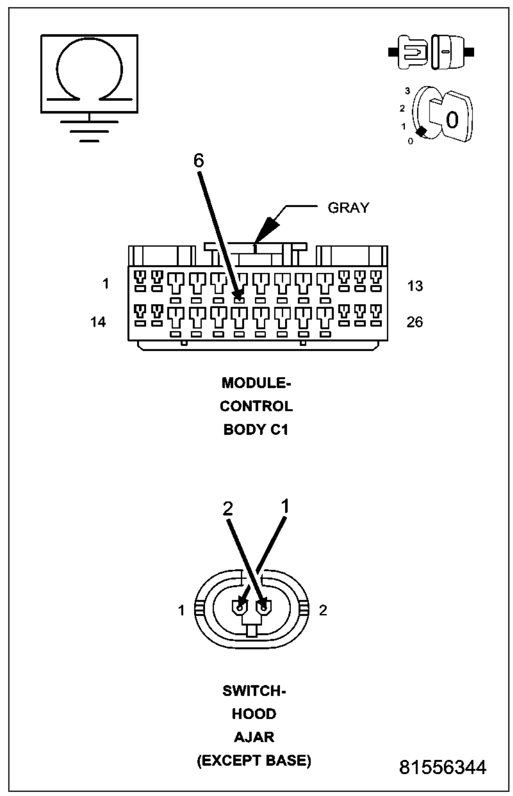
## 4. CHECK FOR OPEN (G70) HOOD AJAR SWITCH SENSE CIRCUIT

Turn the ignition off.

Leave the jumper wire from the previous step connected.

Disconnect the Body Control Module C1 harness connector.

Measure the resistance between ground and the (G70) Hood Ajar Switch Sense circuit in the BCM C1 connector.




**Is the resistance below 5.0 ohms?**

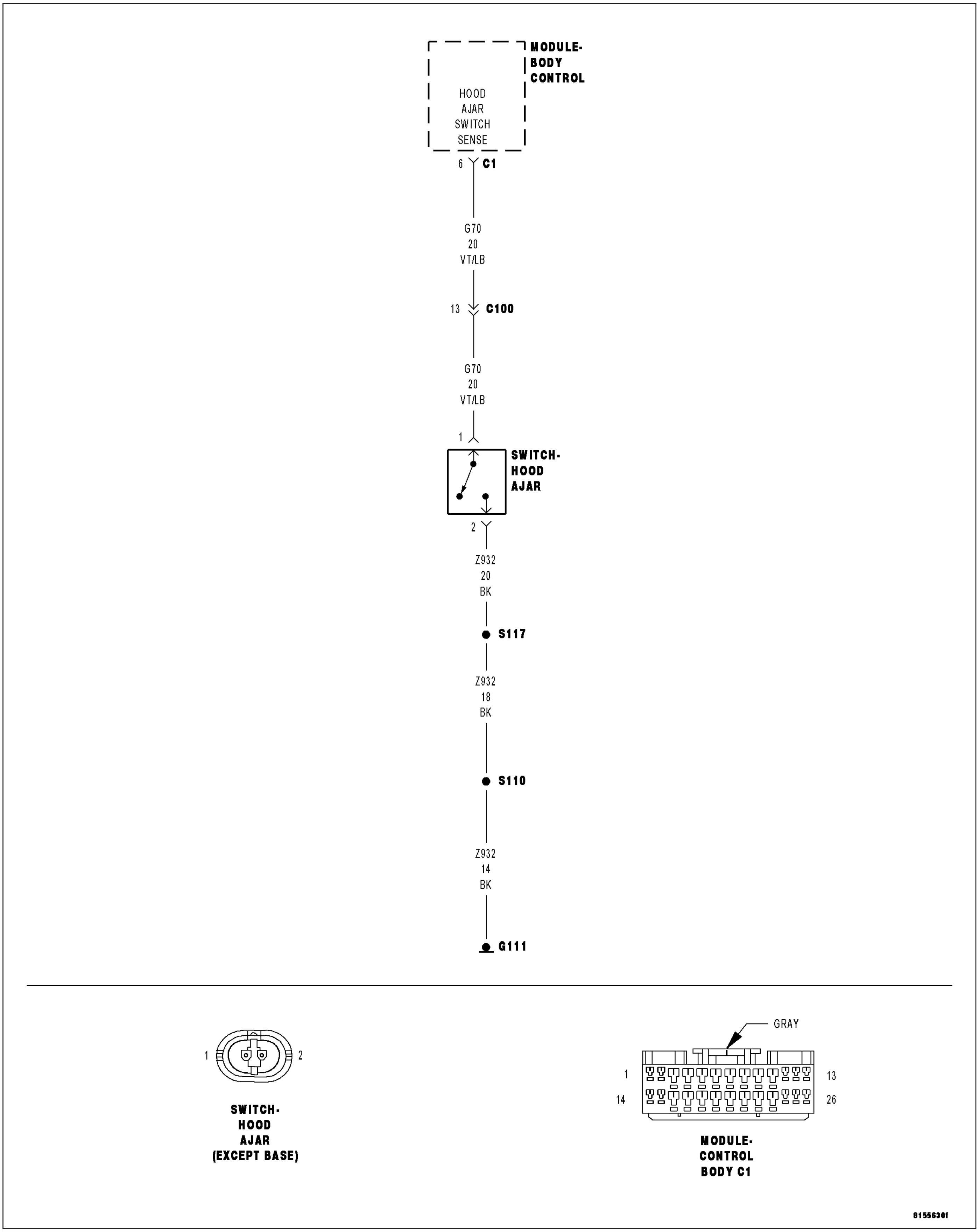
**Yes** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (G70) Hood Ajar Switch Sense circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *HOOD AJAR CIRCUIT SHORT TO GROUND – EXPORT ONLY




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
|---|
| (G70) HOOD AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND |
| HOOD AJAR SWITCH |
| BODY CONTROL MODULE |

### 1. CHECK FOR SHORTED HOOD AJAR SWITCH

With the scan tool in Data Display, read the HOOD AJAR SW state.

Disconnect the Hood Ajar Switch connector.

**Does the scan tool display HOOD AJAR SW: FALSE?**

**Yes** >> Replace the Hood Ajar Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK FOR (G70) HOOD AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND

Turn the ignition off.

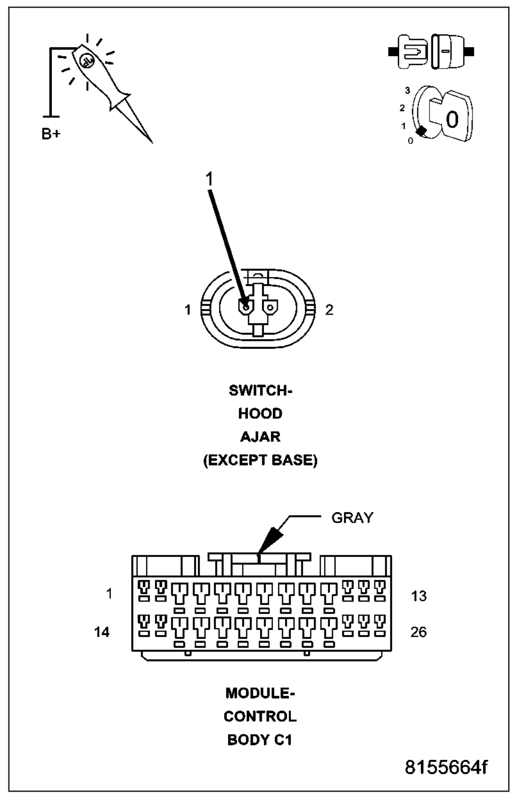
Disconnect the Body Control Module C1 harness connector.

Using a 12–volt test light connected to 12–volts, test the (G70) Hood Ajar Switch Sense circuit for a short to ground.

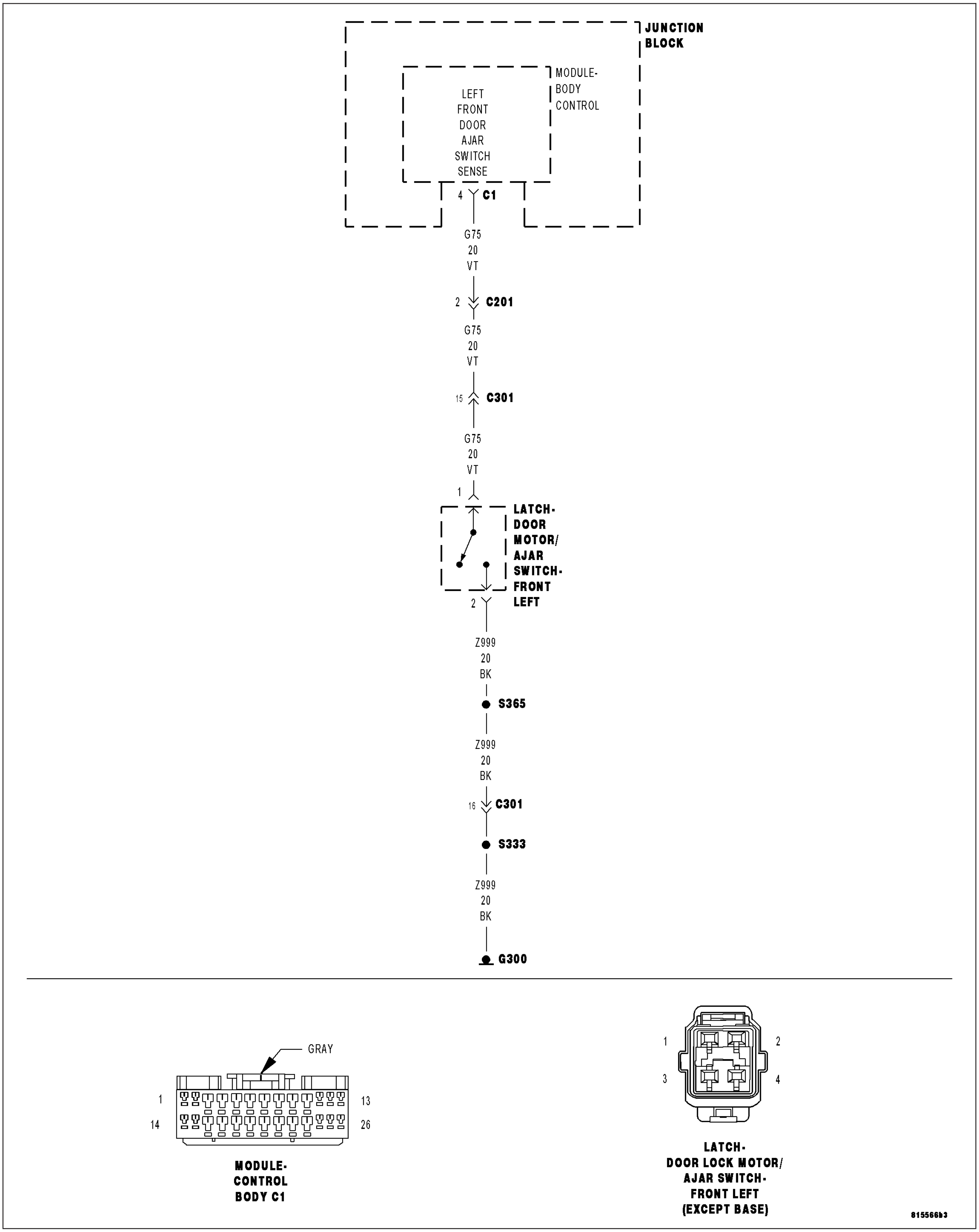
**Does the test light illuminate brightly?**

**No** >> Replace the Body Control Module in accordance with service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**Yes** >> Repair the (G70) Hood Ajar Switch Sense circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



# *LEFT FRONT DOOR AJAR CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
|---|
| LEFT FRONT DOOR AJAR SWITCH GROUND CIRCUIT OPEN |
| (G75) LEFT FRONT DOOR AJAR SWITCH SENSE CIRCUIT OPEN |
| DOOR LOCK MOTOR/AJAR SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. OPEN LEFT FRONT DOOR AJAR SWITCH GROUND CIRCUIT

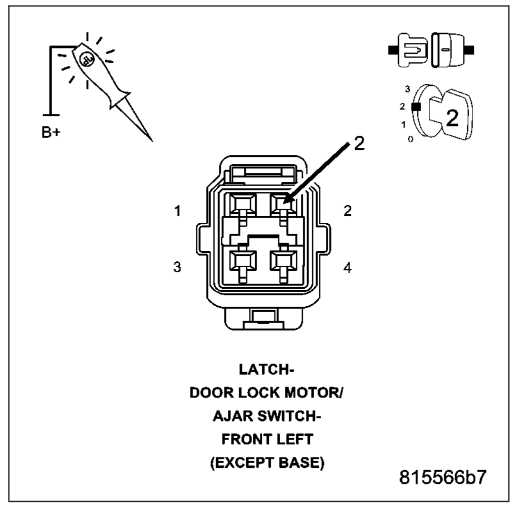
Disconnect the Left Front Door Lock Motor/Ajar switch connector.

Using a 12-volt Test Light connected to 12-volts, test the Ground circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 2

**No** >> Repair the Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)




### 2. CHECK FOR OPEN LEFT FRONT DOOR AJAR SWITCH

Connect a jumper wire between the Sense circuit and the Ground circuit.

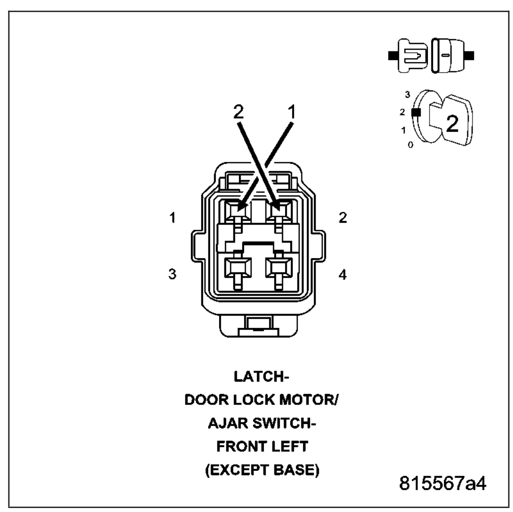
With the scan tool in Data Display, read the LEFT FRONT DOOR AJAR SW state.

**NOTE: For the Left Front Door Ajar state the scan tool will read “PASS” for RHD.**

**Does the scan tool display LEFT FRONT DOOR AJAR SW: TRUE?**

**Yes** >> Replace the Door Lock Motor/Ajar Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3



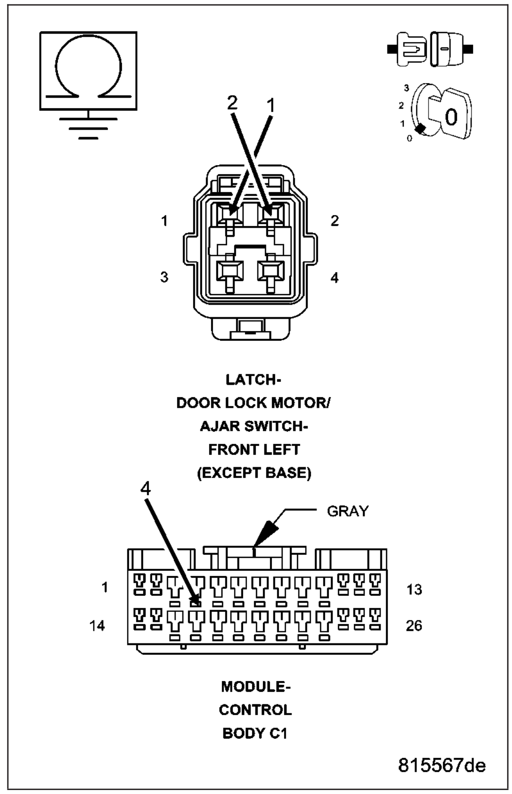
## 3. CHECK FOR OPEN (G75) LEFT FRONT DOOR AJAR SWITCH SENSE CIRCUIT

Turn the ignition off.

Leave the jumper wire from the previous step connected.

Disconnect the Body Control Module C1 harness connector.

Measure the resistance of the (G75) Left Front Door Ajar Switch Sense circuit in the BCM C1 connector.




**Is the resistance below 5.0 ohms?**

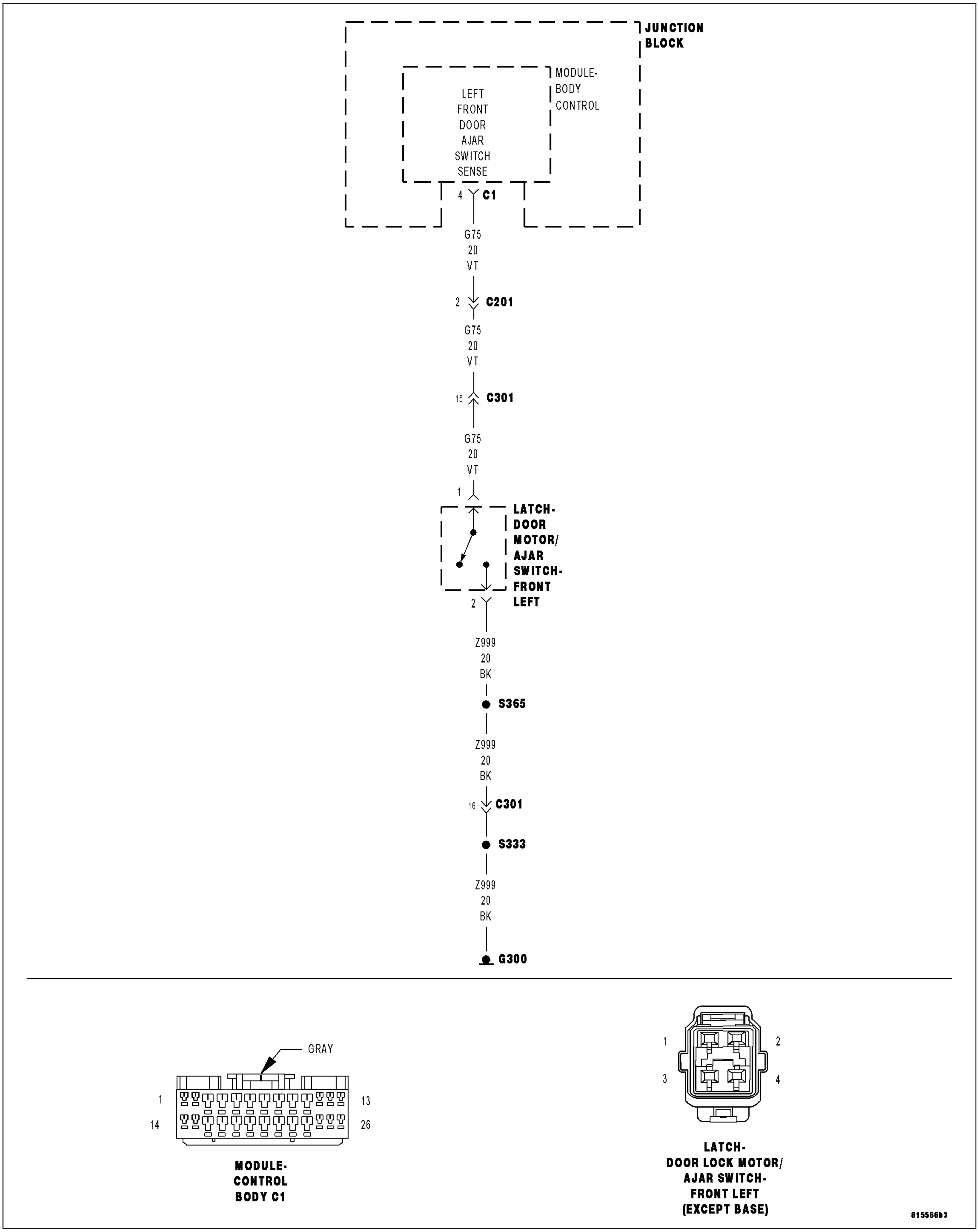
**Yes** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (G75) Left Front Door Ajar Switch Sense circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *LEFT FRONT DOOR AJAR CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
| --- |
| (G75) LEFT FRONT DOOR AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND |
| DOOR LOCK MOTOR/AJAR SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR SHORTED DOOR AJAR SWITCH

**NOTE: For the Left Front Door Ajar state the scan tool will read “PASS” for RHD.**

With the scan tool in Data Display, read the LEFT FRONT DOOR AJAR SW state.

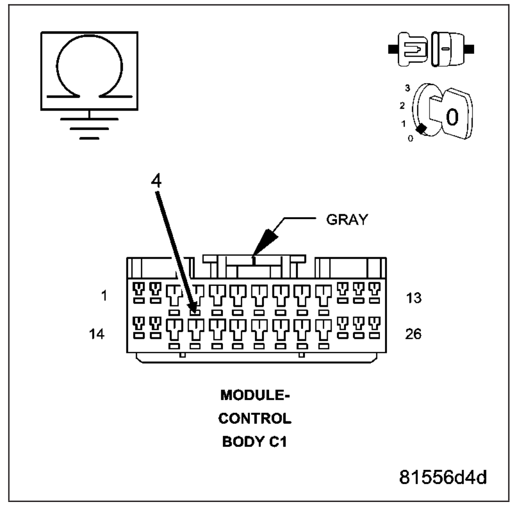
Disconnect the Door Lock Motor/Ajar Switch connector.

**Does the scan tool display LEFT FRONT DOOR AJAR SW: FALSE?**

**Yes** >> Replace the Door Lock Motor/Ajar Switch.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2




### 2. CHECK FOR (G75) LEFT FRONT DOOR AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Body Control Module C1 harness connector.

Measure the resistance between ground and the (G75) Left Front Door Ajar Switch Sense circuit in the BCM C1 connector.

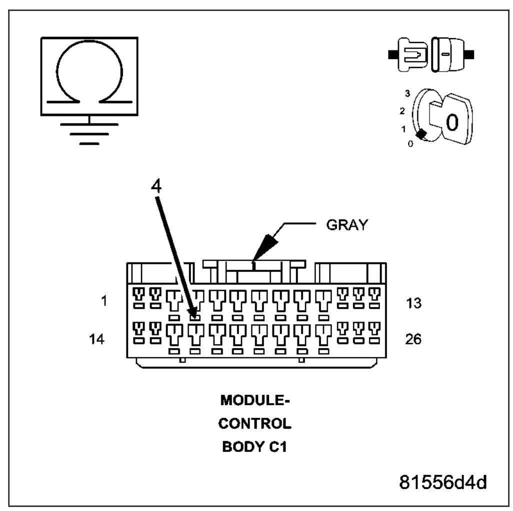
**Is the resistance below 1000.0 ohms?**

**No** >> Replace the Body Control Module in accordance with service information.

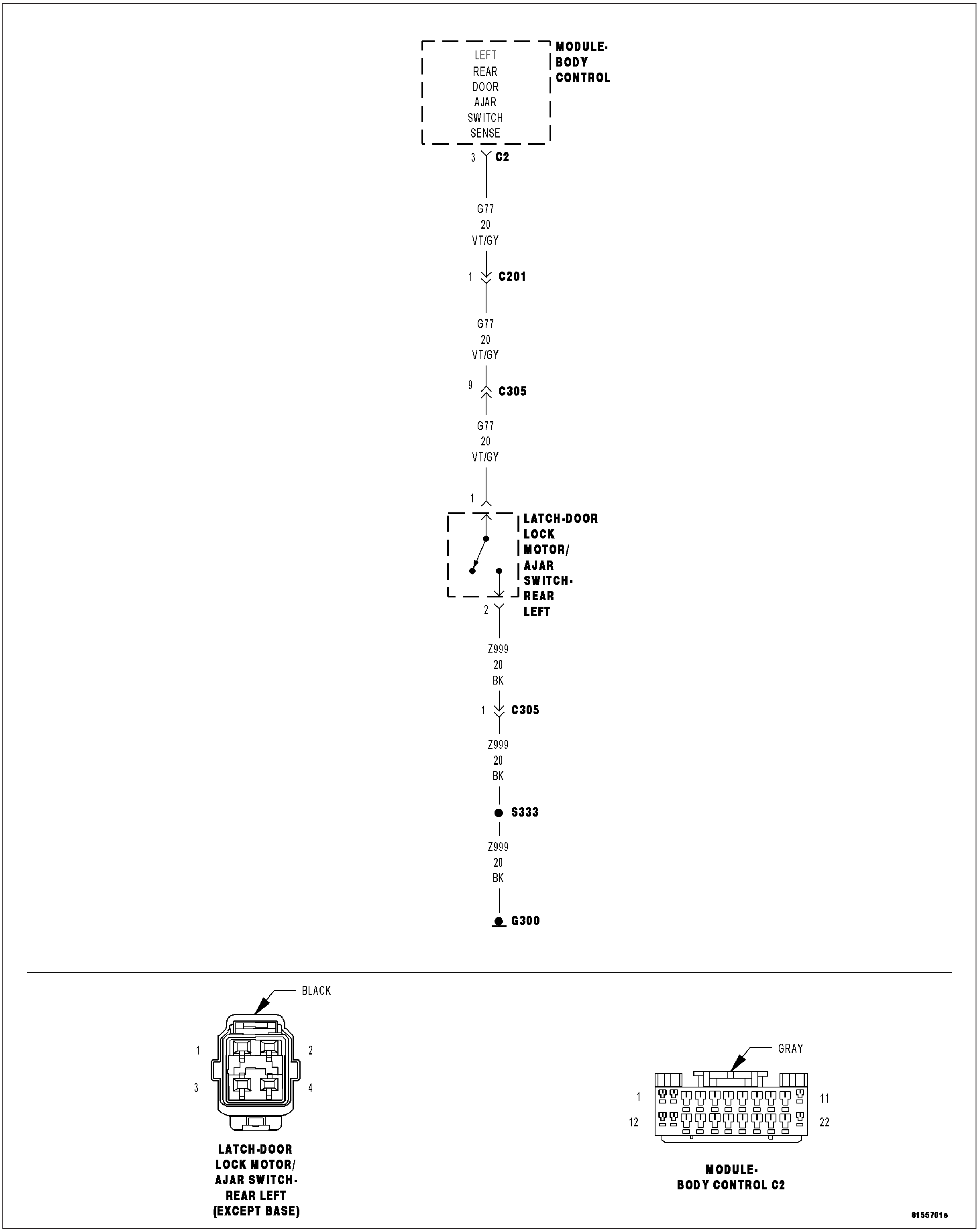
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**Yes** >> Repair the (G75) Left Front Door Ajar Switch Sense circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## *LEFT REAR DOOR AJAR CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
| --- |
| LEFT REAR DOOR AJAR SWITCH GROUND CIRCUIT OPEN |
| (G77) LEFT REAR DOOR AJAR SWITCH SENSE CIRCUIT OPEN |
| DOOR LOCK MOTOR/AJAR SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. OPEN LEFT REAR DOOR AJAR SWITCH GROUND CIRCUIT

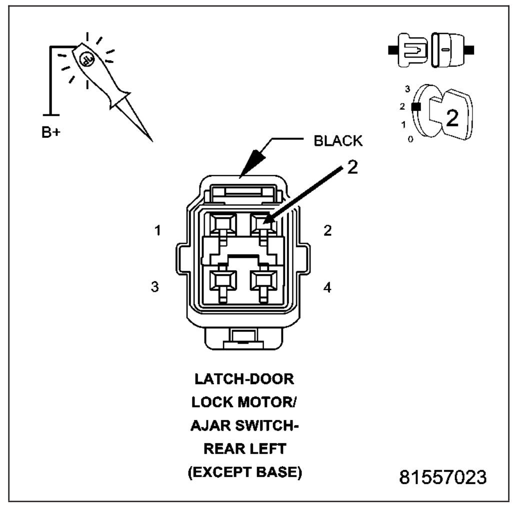
Disconnect the Left Rear Door Lock Motor/Ajar switch connector.

Using a 12-volt Test Light connected to 12-volts, test the Ground circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 2

**No** >> Repair the Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)




### 2. CHECK FOR OPEN LEFT FRONT DOOR AJAR SWITCH

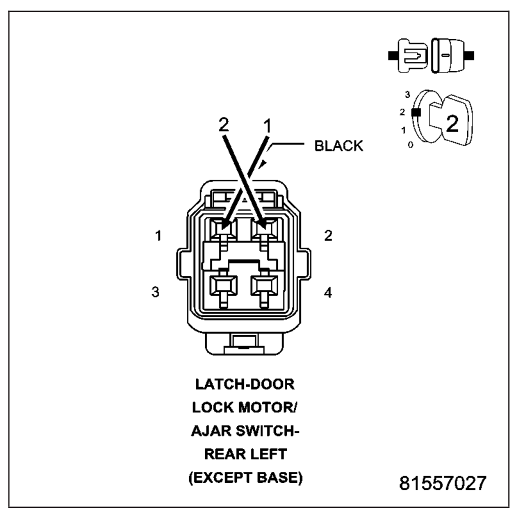
With the scan tool in Data Display, read the LEFT REAR DOOR AJAR SW state.

Connect a jumper wire between the Sense circuit and the Ground circuit.

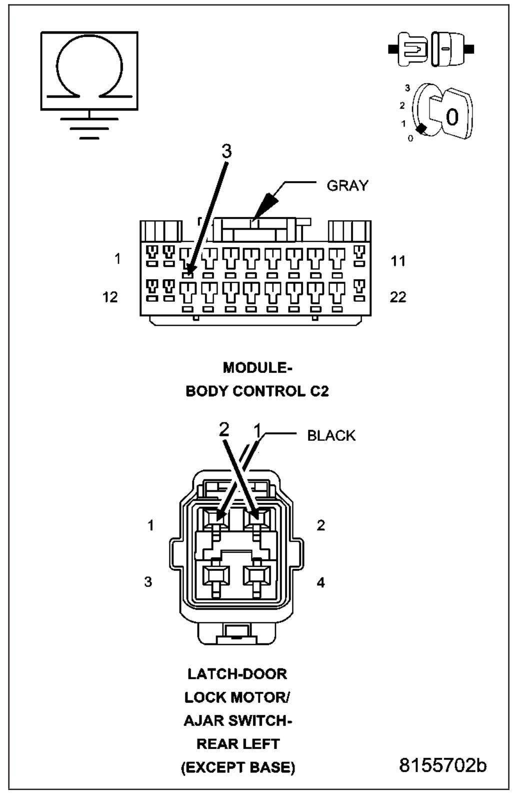
**Does the scan tool display LEFT REAR DOOR AJAR SW: TRUE?**

**Yes** >> Replace the Door Lock Motor/Ajar Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3



## 3. CHECK FOR OPEN (G77) LEFT REAR DOOR AJAR SWITCH SENSE CIRCUIT




Turn the ignition off.

Leave the jumper wire from the previous step connected.

Disconnect the Body Control Module C2 harness connector.

Measure the resistance between ground and the (G77) Left Rear Door Ajar Switch Sense circuit in the BCM C2 connector.

**Is the resistance below 1000.0 ohms?**

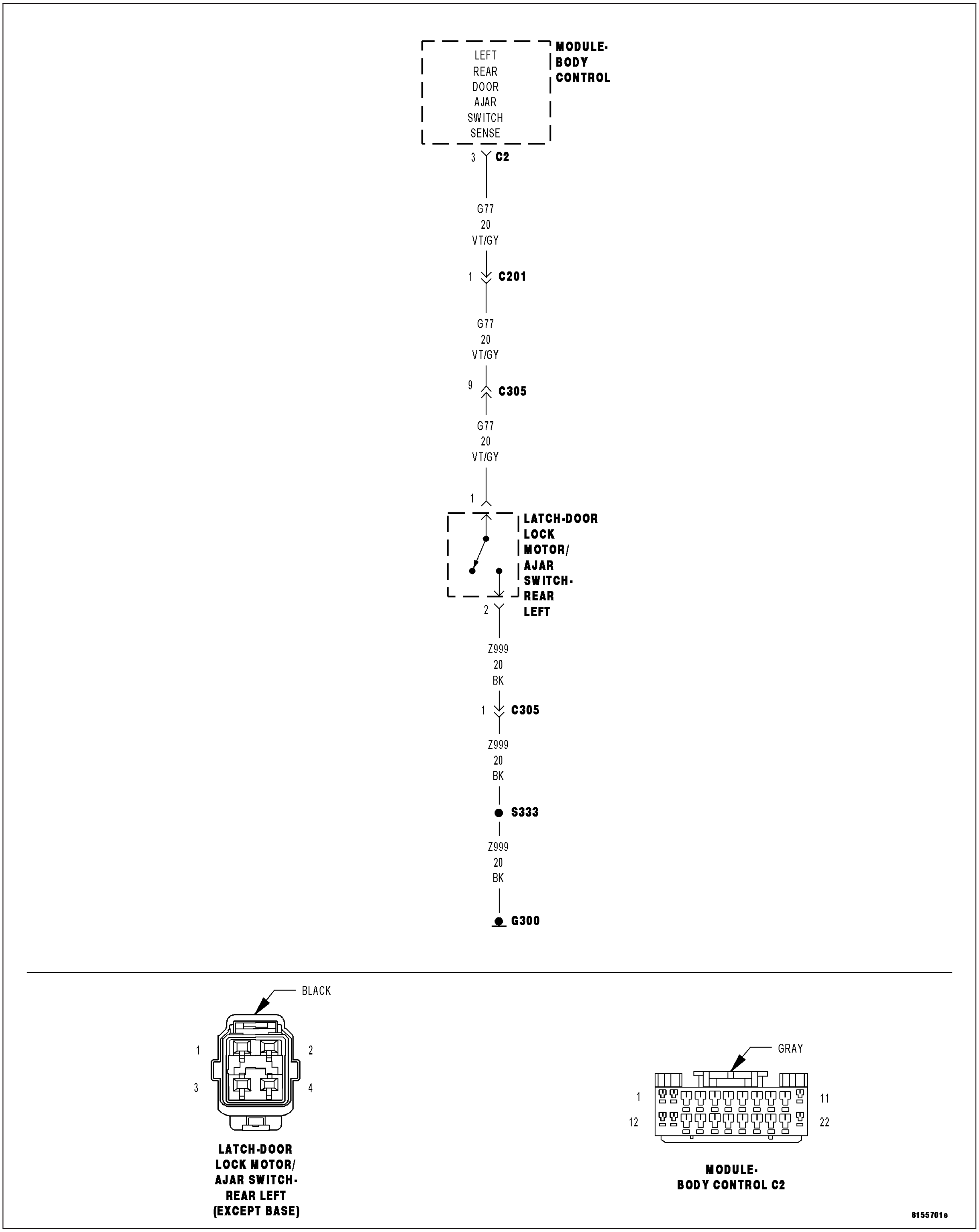
**No** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**Yes** >> Repair the (G75) Left Front Door Ajar Switch Sense circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *LEFT REAR DOOR AJAR CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
|---|
| (G77) LEFT REAR DOOR AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND |
| DOOR LOCK MOTOR/AJAR SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR SHORTED DOOR AJAR SWITCH

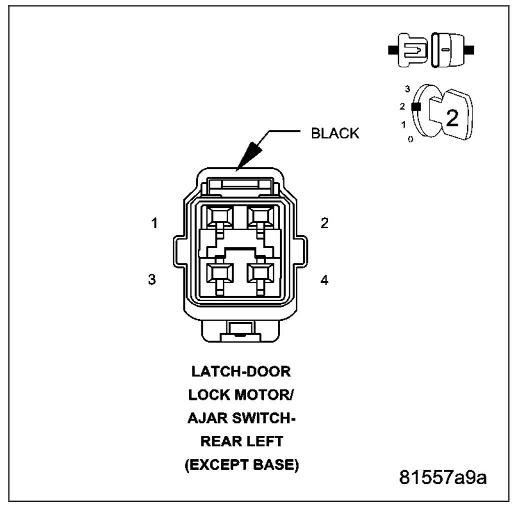
With the scan tool in Data Display, read the LEFT REAR DOOR AJAR SW state.

Disconnect the Door Lock Motor/Ajar Switch connector.

**Does the scan tool display LEFT REAR DOOR AJAR SW: FALSE?**

**Yes** >> Replace the Door Lock Motor/Ajar Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2




### 2. CHECK FOR (G77) LEFT REAR DOOR AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND

Turn the ignition off.

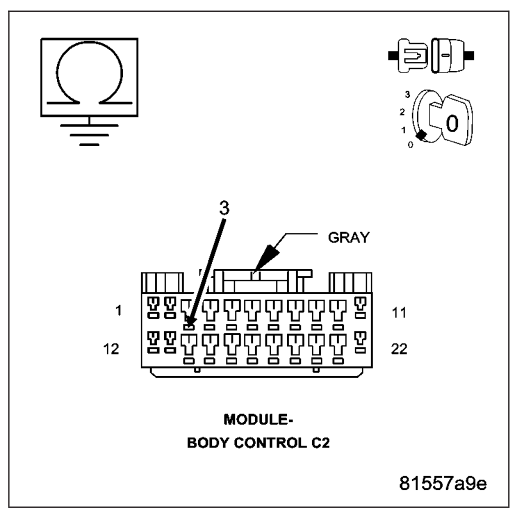
Disconnect the Body Control Module C2 harness connector.

Measure the resistance between ground and the (G77) Left Rear Door Ajar Switch Sense circuit in the BCM C2 connector.

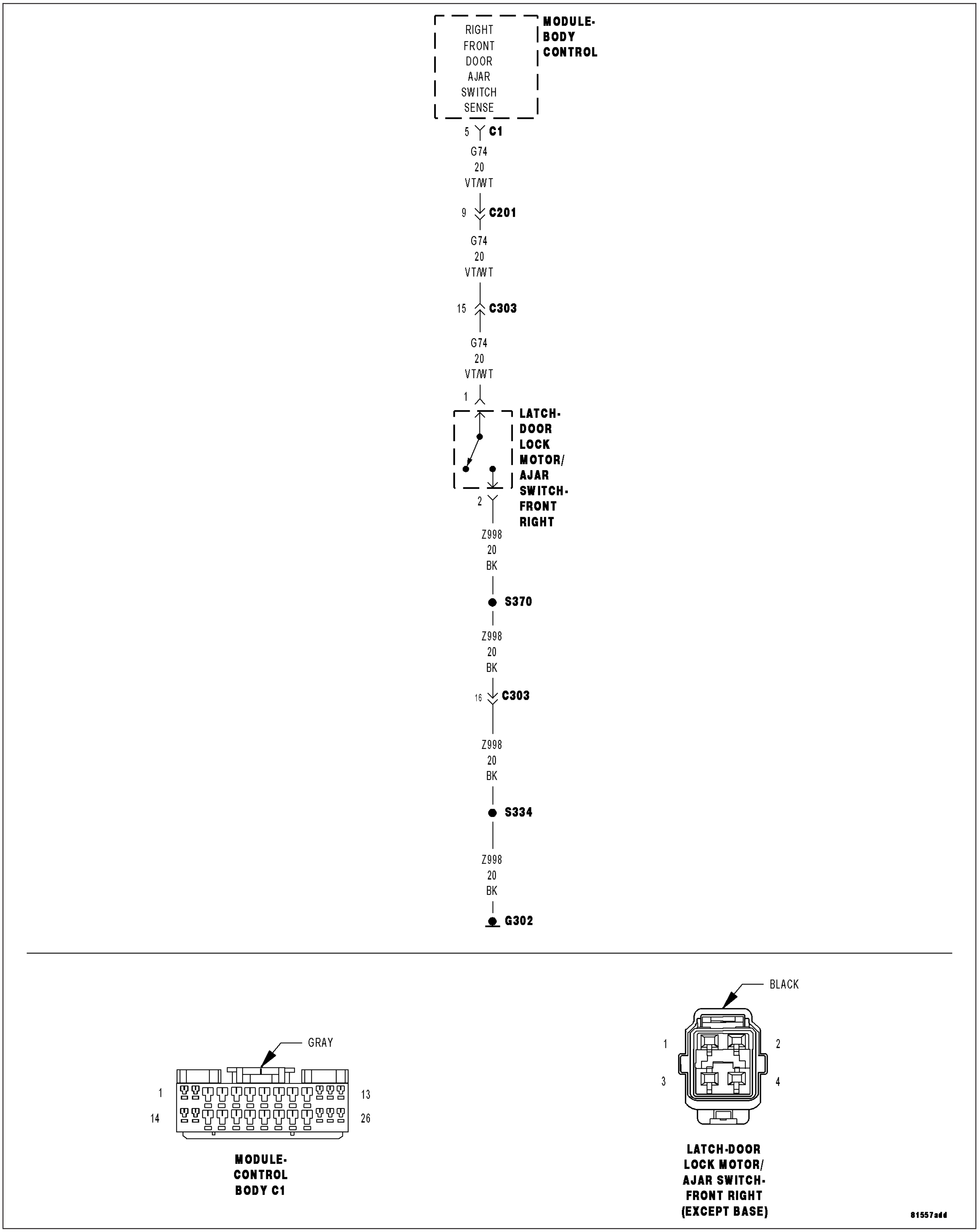
**Is the resistance below 1000.0 ohms?**

**No** >> Replace the Body Control Module in accordance with service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**Yes** >> Repair the (G77) Left Rear Door Ajar Switch Sense circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## *RIGHT FRONT DOOR AJAR CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
|---|
| RIGHT FRONT DOOR AJAR SWITCH GROUND CIRCUIT OPEN |
| (G74) RIGHT FRONT DOOR AJAR SWITCH SENSE CIRCUIT OPEN |
| DOOR LOCK MOTOR/AJAR SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. OPEN RIGHT FRONT DOOR AJAR SWITCH GROUND CIRCUIT

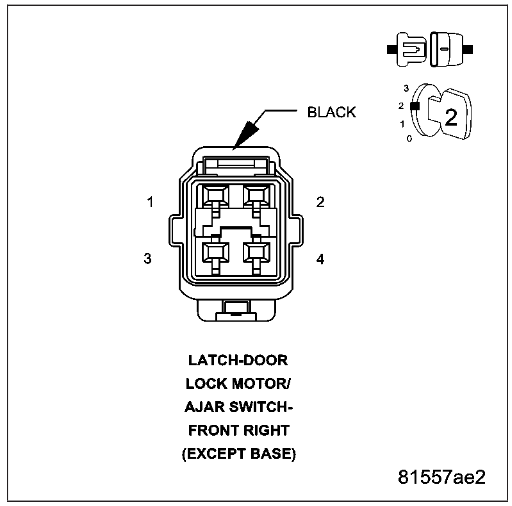
Disconnect the Right Front Door Lock Motor/Ajar switch connector.

Using a 12-volt Test Light connected to 12-volts, test the Ground circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 2

**No** >> Repair the Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)




### 2. CHECK FOR OPEN RIGHT FRONT DOOR AJAR SWITCH

With the scan tool in Data Display, read the LEFT FRONT DOOR AJAR SW state.

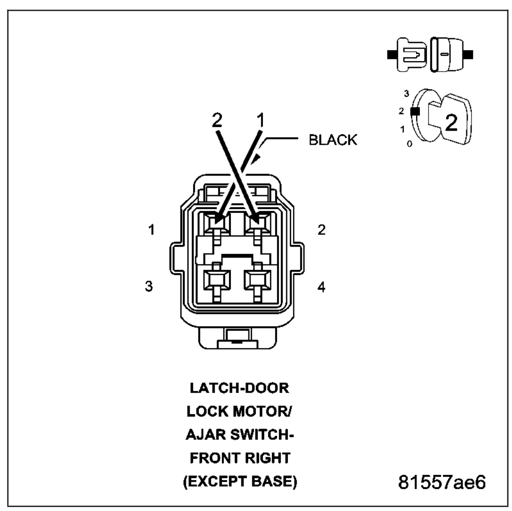
**NOTE: For the Right Front Door Ajar state the scan tool will read "DRIVER" for RHD.**

Connect a jumper wire between Sense circuit and the Ground circuit.

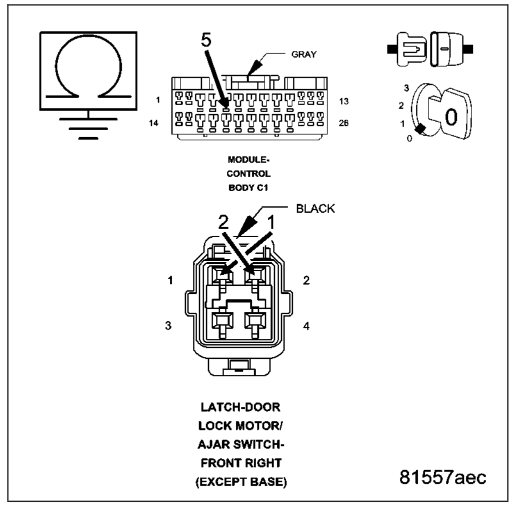
**Does the scan tool display LEFT FRONT DOOR AJAR SW: TRUE?**

**Yes** >> Replace the Door Lock Motor/Ajar Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3



## 3. CHECK FOR OPEN (G74) RIGHT FRONT DOOR AJAR SWITCH SENSE CIRCUIT




Turn the ignition off.

Leave the jumper wire from the previous step connected.

Disconnect the Body Control Module C1 harness connector.

Measure the resistance between ground and the (G74) Right Front Door Ajar Switch Sense circuit in the BCM C1 connector.

**Is the resistance below 5.0 ohms?**

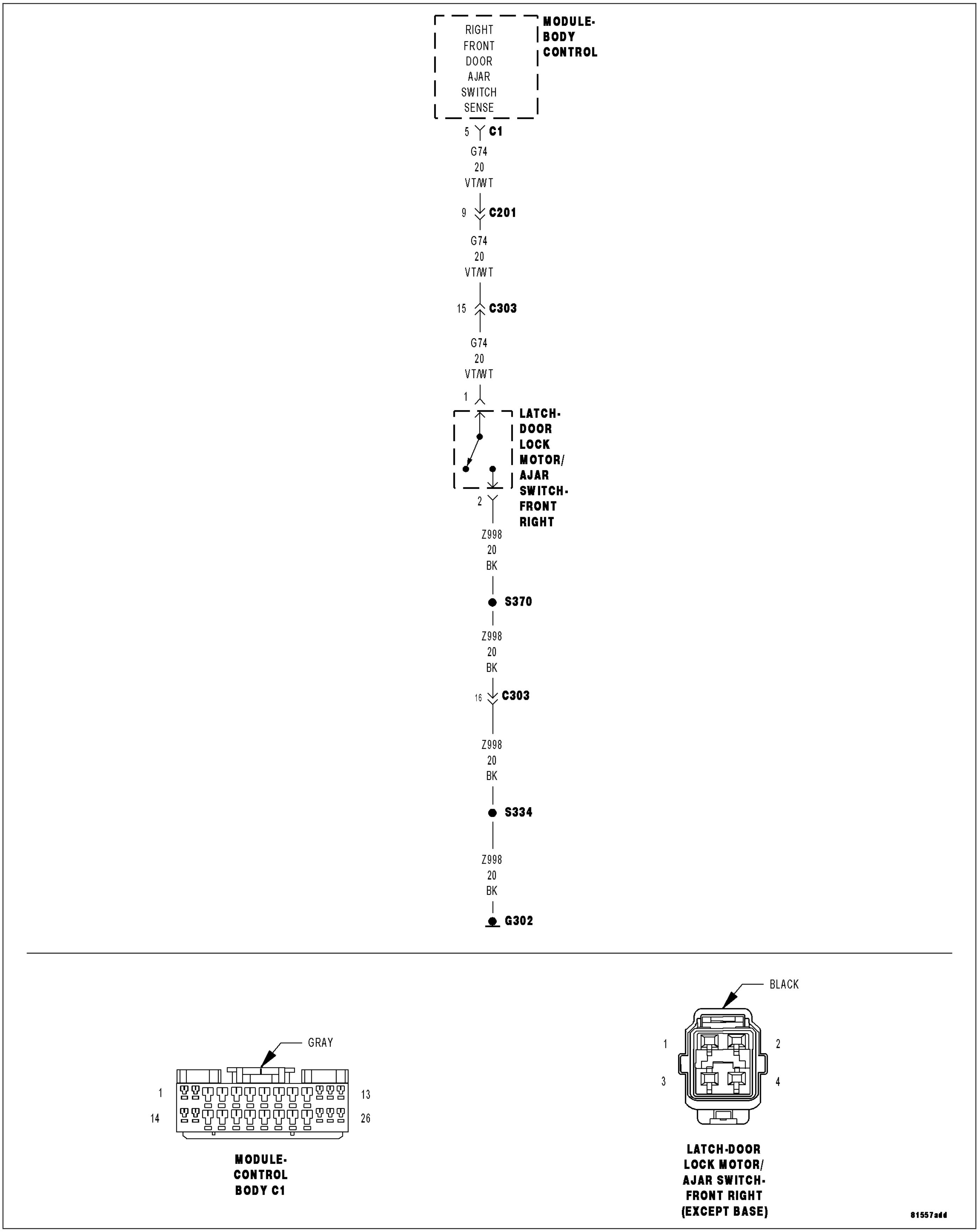
**Yes** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (G74) Right Front Door Ajar Switch Sense circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *RIGHT FRONT DOOR AJAR CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
|---|
| (G74) RIGHT FRONT DOOR AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND |
| DOOR LOCK MOTOR/AJAR SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR SHORTED DOOR AJAR SWITCH

**NOTE: For the Right Front Door Ajar state the scan tool will read "PASS" for RHD.**

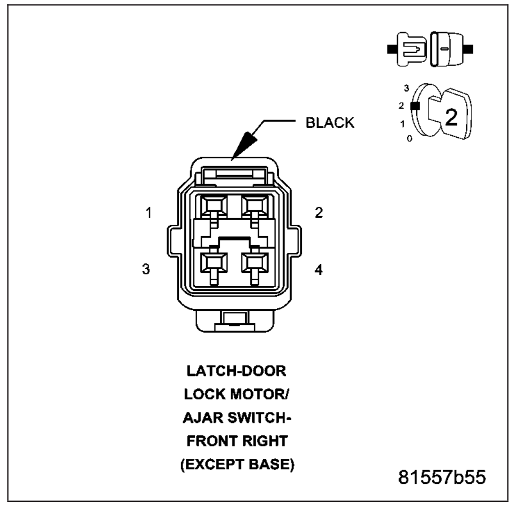
With the scan tool in Data Display, read the RIGHT FRONT DOOR AJAR SW state.

Disconnect the Door Lock Motor/Ajar Switch connector.

**Does the scan tool display RIGHT FRONT DOOR AJAR SW: FALSE?**

**Yes** >> Replace the Door Lock Motor/Ajar Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2




### 2. CHECK FOR (G74) RIGHT FRONT DOOR AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND

Turn the ignition off.

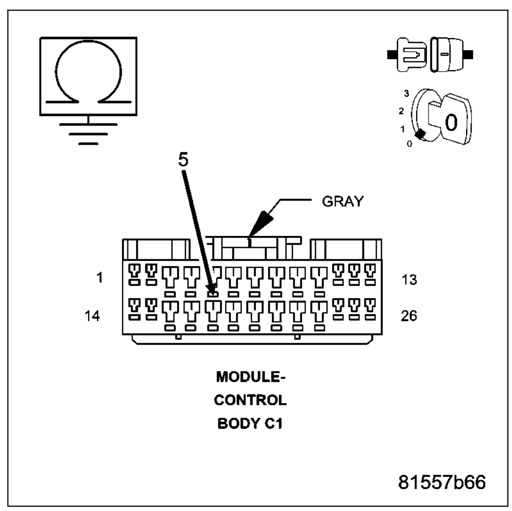
Disconnect the Body Control Module C1 harness connector.

Measure the resistance between ground and the (G74) Right Front Door Ajar Switch Sense circuit in the BCM C1 connector.

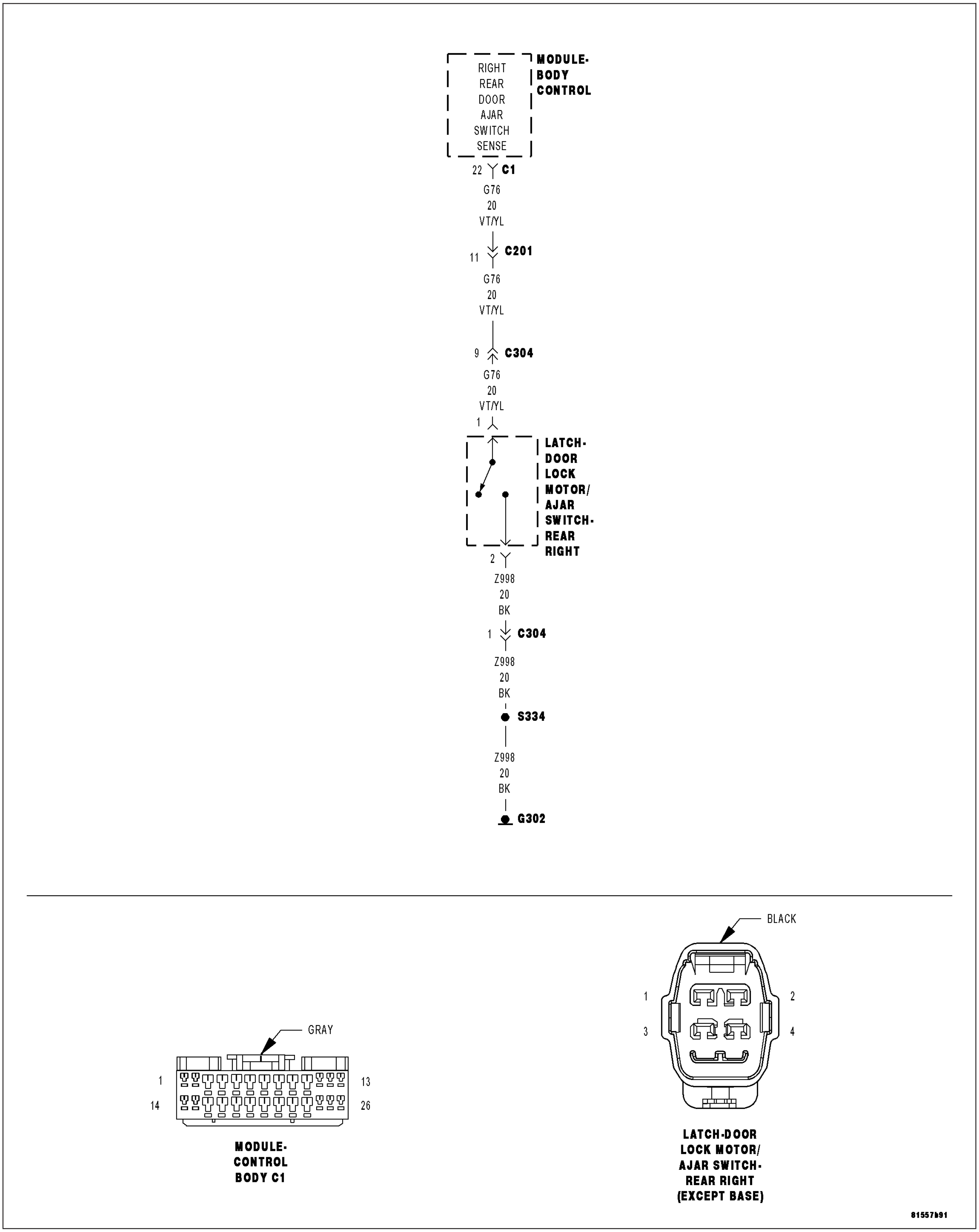
**Is the resistance below 1000.0 ohms?**

**Yes** >> Replace the Body Control Module in accordance with service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (G74) Right Front Door Ajar Switch Sense circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## *RIGHT REAR DOOR AJAR CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
|---|
| RIGHT REAR DOOR AJAR SWITCH GROUND CIRCUIT OPEN |
| (G76) RIGHT REAR DOOR AJAR SWITCH SENSE CIRCUIT OPEN |
| DOOR LOCK MOTOR/AJAR SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. OPEN RIGHT REAR DOOR AJAR SWITCH GROUND CIRCUIT

Disconnect the Right Rear Door Lock Motor/Ajar switch connector.

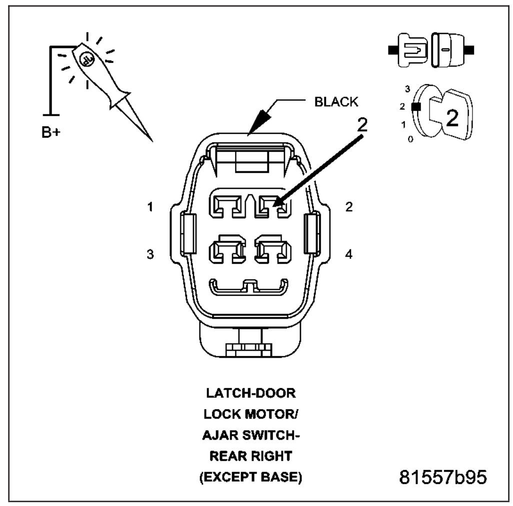
Using a 12-volt Test Light connected to 12-volts, test the Ground circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 2

**No** >> Repair the Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)




### 2. CHECK FOR OPEN RIGHT FRONT DOOR AJAR SWITCH

With the scan tool in Data Display, read the RIGHT REAR DOOR AJAR SW state.

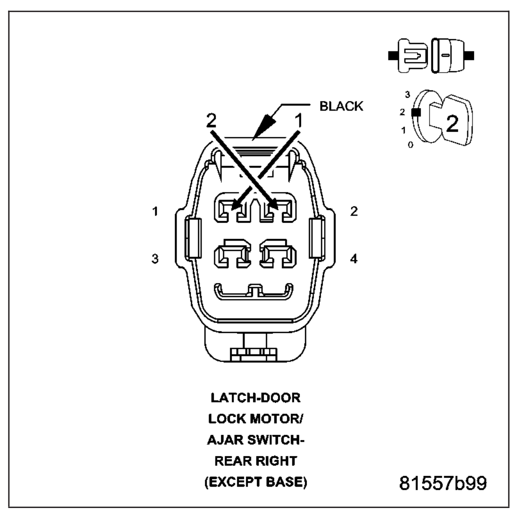
Connect a jumper wire between the Sense circuit and the Ground circuit.

**Does the scan tool display RIGHT REAR DOOR AJAR SW: TRUE?**

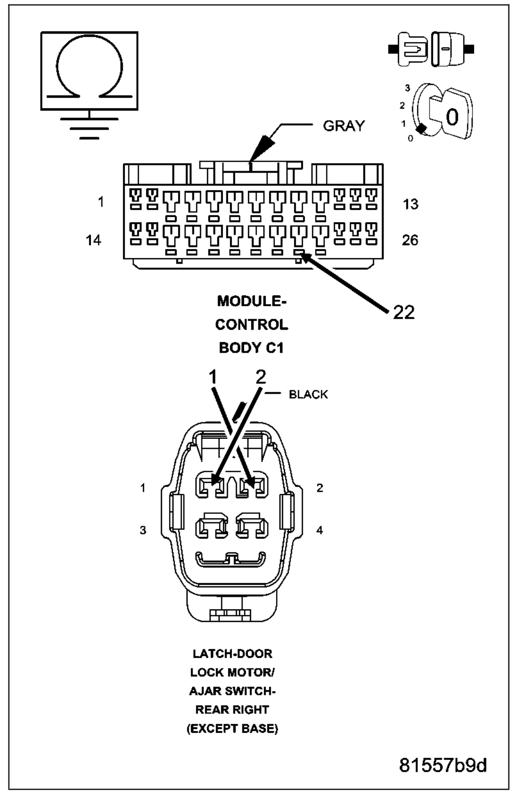
**Yes** >> Replace the Door Lock Motor/Ajar Switch.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3



## 3. CHECK FOR OPEN (G76) RIGHT REAR DOOR AJAR SWITCH SENSE CIRCUIT




Turn the ignition off.

Leave the jumper wire from the previous step connected.

Disconnect the Body Control Module C1 harness connector.

Measure the resistance between ground and the (G76) Right Rear Door Ajar Switch Sense circuit in the BCM C1 connector.

**Is the resistance below 5.0 ohms?**

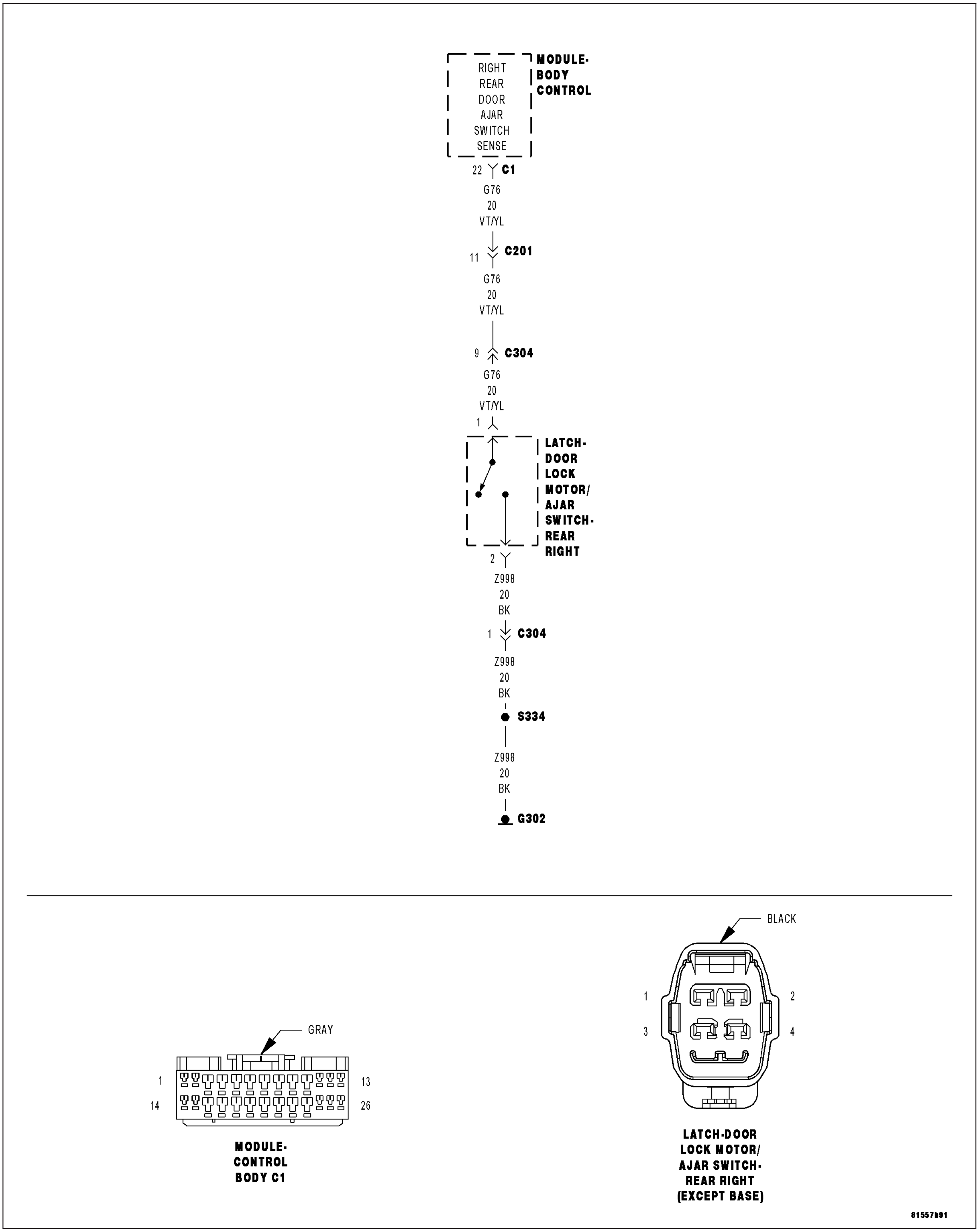
**Yes** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (G76) Right Front Door Ajar Switch Sense circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

# *RIGHT REAR DOOR AJAR CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

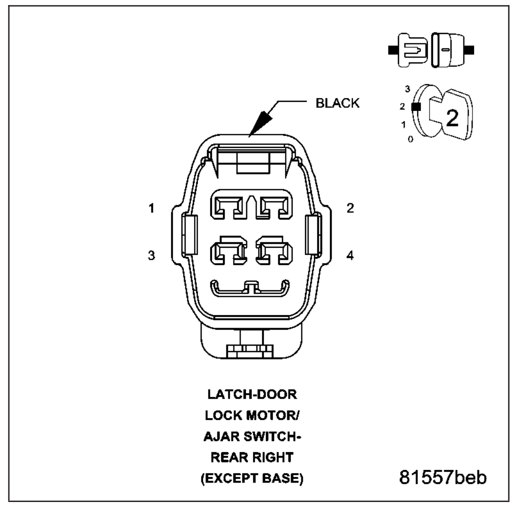
| Possible Causes |
|---|
| (G76) RIGHT REAR DOOR AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND |
| DOOR LOCK MOTOR/AJAR SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR SHORTED DOOR AJAR SWITCH

With the scan tool in Data Display, read the RIGHT REAR DOOR AJAR SW state.

Disconnect the Door Lock Motor/Ajar Switch connector.




**Does the scan tool display RIGHT REAR DOOR AJAR SW: FALSE?**

**Yes** >> Replace the Door Lock Motor/Ajar Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

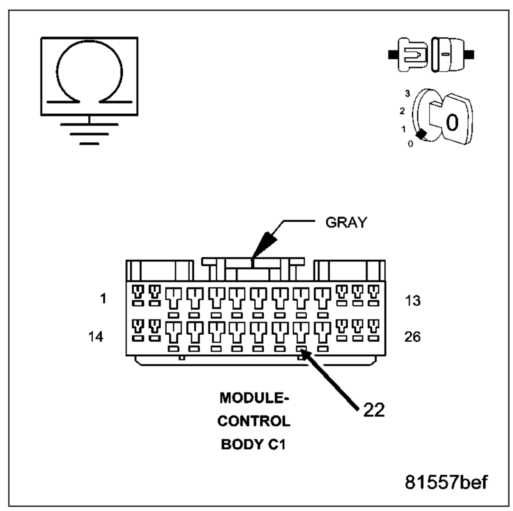
**No** >> Go To 2

### 2. CHECK FOR (G76) RIGHT REAR DOOR AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Body Control Module C1 harness connector.

Using a 12–volt test light connected to 12–volts, check the (G76) Right Rear Door Ajar Switch Sense circuit for a short to ground.

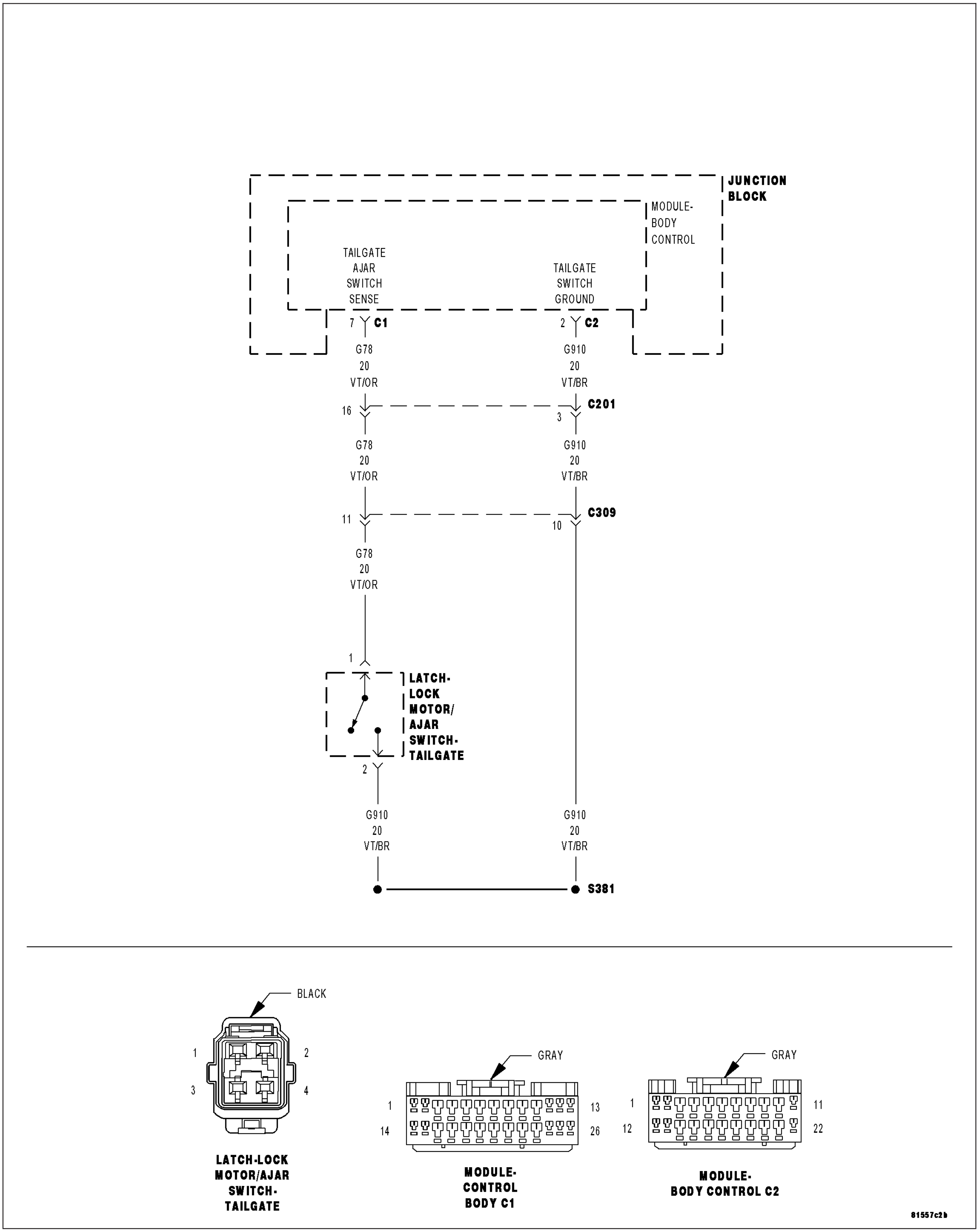



**Does the test light illuminate brightly?**

**No** >> Replace the Body Control Module in accordance with service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**Yes** >> Repair the (G76) Right Rear Door Ajar Switch Sense circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *TAILGATE AJAR CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
|---|
| TAILGATE AJAR SWITCH GROUND CIRCUIT OPEN |
| (G78) TAILGATE AJAR SWITCH SENSE CIRCUIT OPEN |
| TAILGATE LOCK MOTOR/AJAR SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. OPEN TAILGATE SWITCH GROUND CIRCUIT

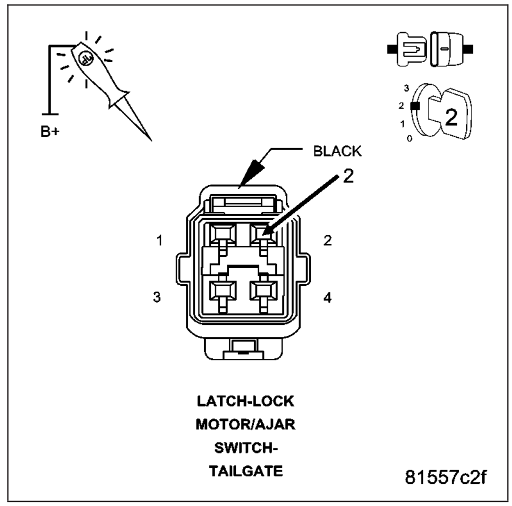
Disconnect the Tailgate Lock Motor/Ajar switch connector.

Using a 12-volt Test Light connected to 12-volts, test the Tailgate Switch Ground circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 2

**No** >> Repair the Tailgate Switch Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)




### 2. CHECK FOR OPEN TAILGATE AJAR SWITCH

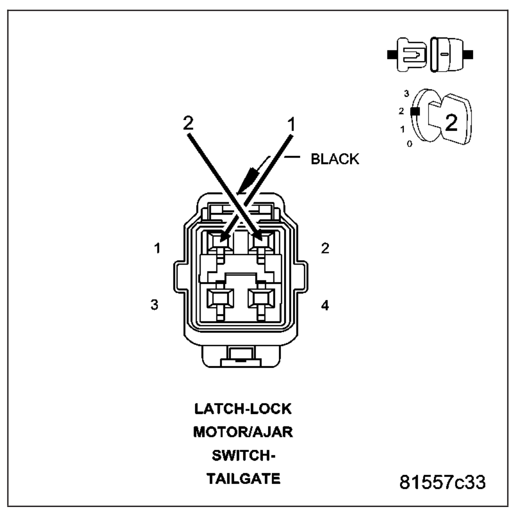
With the scan tool in Data Display, read the TAILGATE AJAR SW state.

Connect a jumper wire between the Sense circuit and the Ground circuit.

**Does the scan tool display TAILGATE AJAR SW: TRUE?**

**Yes** >> Replace the Tailgate Lock Motor/Ajar Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3



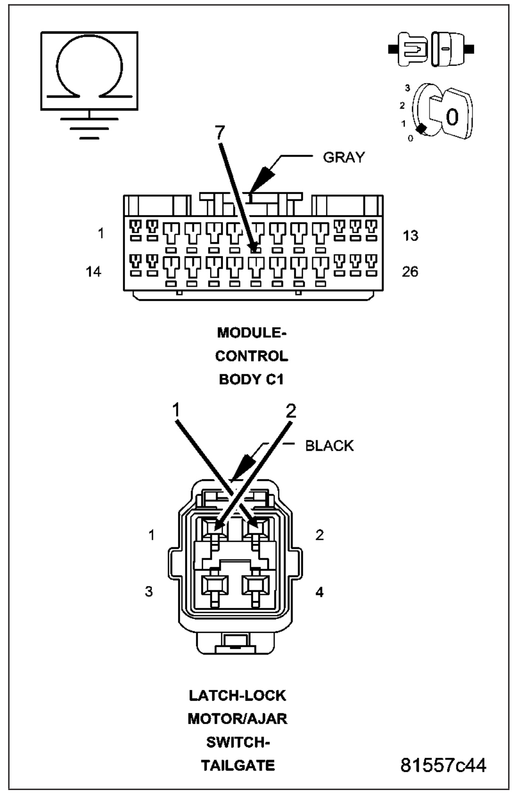
### 3. CHECK FOR OPEN (G78) TAILGATE AJAR SWITCH SENSE CIRCUIT

Turn the ignition off.

Leave the jumper wire from the previous step connected.

Disconnect the Body Control Module C1 harness connector.

Measure the resistance between ground and the (G78) Tailgate Ajar Switch Sense circuit in the BCM C1 connector.




**Is the resistance below 5.0 ohms?**

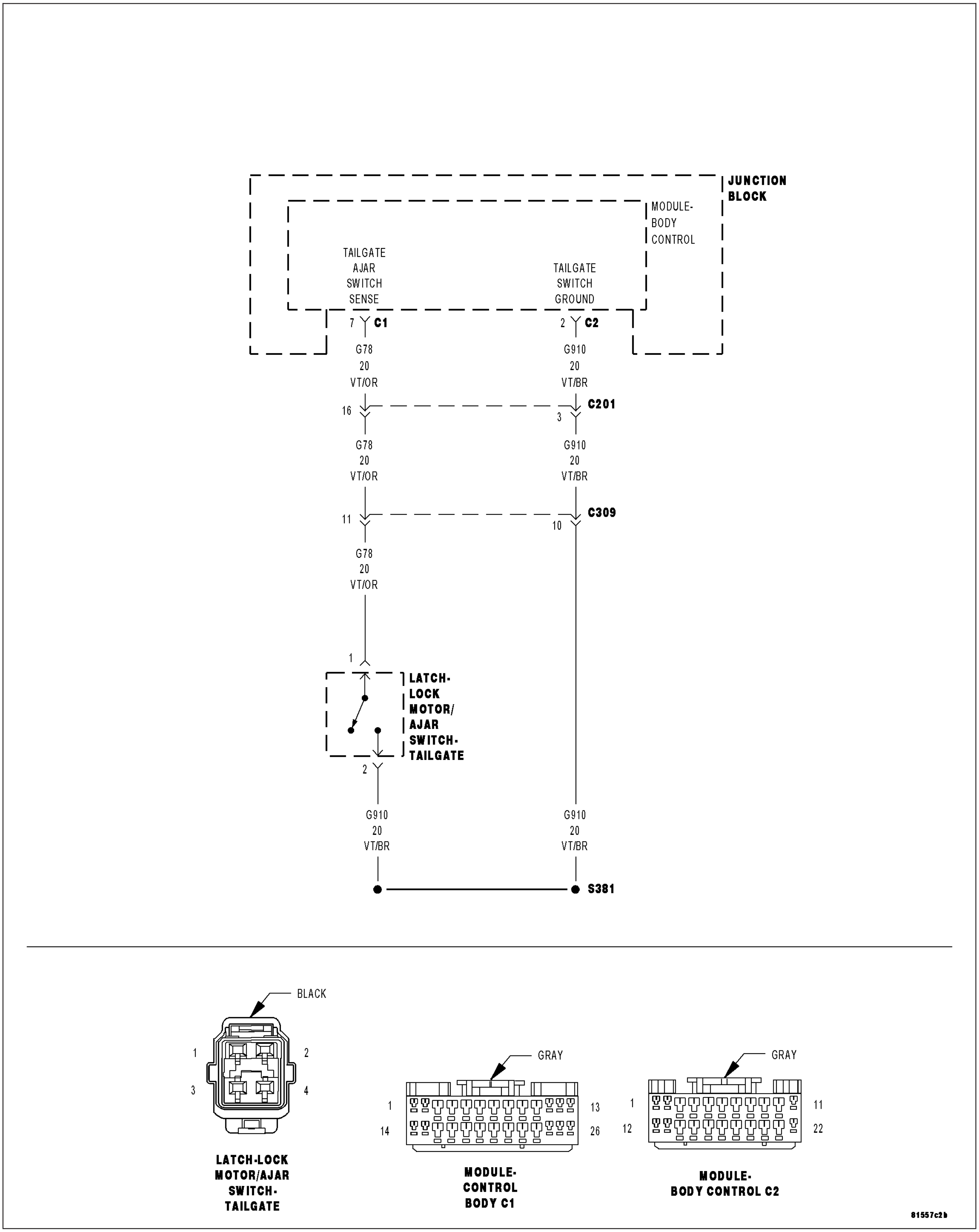
**Yes** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (G78) Tailgate Ajar Switch Sense circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *TAILGATE AJAR CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The scan tool will display the door state NOT the switch state. It will display as True/False. True states that the door is ajar (open). False states that the door is NOT ajar (closed).

| Possible Causes |
|---|
| (G78) TAILGATE AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND |
| TAILGATE LOCK MOTOR/AJAR SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR SHORTED TAILGATE AJAR SWITCH

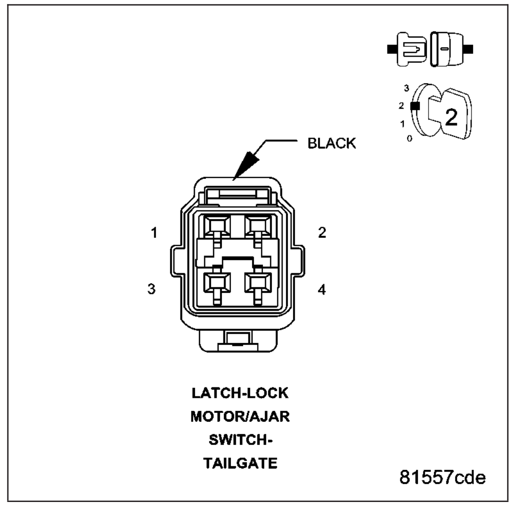
With the scan tool in Data Display, read the TAILGATE AJAR SW state.

Disconnect the Tailgate Lock Motor/Ajar Switch connector.

**Does the scan tool display TAILGATE AJAR SW: FALSE?**

**Yes** >> Replace the Tailgate Lock Motor/Ajar Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2




### 2. CHECK FOR (G78) TAILGATE AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Body Control Module C1 harness connector.

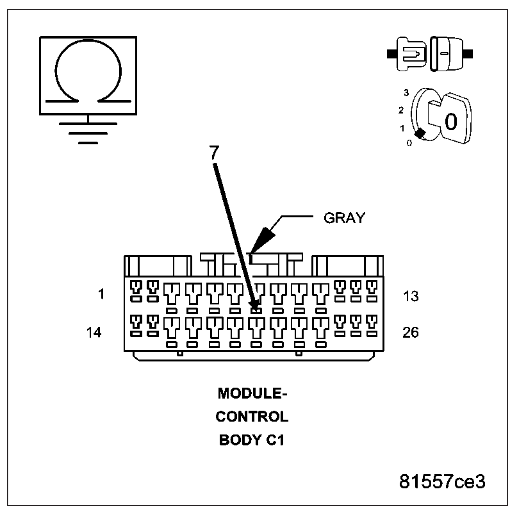
Turn the ignition on.

Using a 12–volt test light connected to 12–volts, test the (G78) Tailgate Ajar Switch Sense circuit for a short to ground.

**Does the test light illuminate brightly?**

**No** >> Replace the Body Control Module in accordance with service information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**Yes** >> Repair the (G78) Tailgate Ajar Switch Sense circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## *COURTESY LAMPS INOPERATIVE-ALL LAMPS

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| JUNCTION BLOCK |
| COURTESY LAMPS DRIVER CIRCUIT OPEN |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. JUNCTION BLOCK

Gain access to the junction block C24 Harness connector.
While back probing, measure the voltage of the Courtesy Lamp Driver circuit.

**Is the voltage above 10.0 volts?**

**Yes** >> Go To 2

**No** >> Replace the Junction Block.
Perform BODY VERIFICATION TEST - VER 1.

### 2. COURTESY LAMP DRIVER CIRCUIT SHORTED TO VOLTAGE

Using a jumper wire, test the Courtesy Lamps Driver circuit to the Junction Block C24 connector and ground.

**Do the courtesy lamps come on?**

**Yes** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the Courtesy Lamp Driver circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

# *COURTESY LAMPS INOPERATIVE-OVERHEAD LAMPS

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| JUNCTION BLOCK |
| OPEN BULB |
| COURTESY LAMP DRIVER CIRCUIT OPEN |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.
Turn the Courtesy Lamps on.
Verify that the Courtesy Lamps are inoperative.

**Do the Courtesy Lamps operate normally?**

**Yes** >> The condition that caused the symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched, or partially broken wires
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 2

### 2. OPEN BULB

Remove and inspect any inoperative courtesy lamp bulbs.

**Are any of the inspected bulbs open or shorted?**

**Yes** >> Replace the applicable open bulb.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. COURTESY LAMP DRIVER CIRCUIT OPEN

Turn the ignition on.
Measure the voltage of the Courtesy Lamp Driver circuit to ground.

**Is the voltage above 10.0 volts?**

**Yes** >> Repair the Courtesy Lamps Driver circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Junction Block.
Perform BODY VERIFICATION TEST - VER 1.

## *COURTESY LAMPS STAY ON AT ALL TIMES

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| COURTESY LAMPS DRIVER HEADLINER CIRCUIT SHORT TO GROUND |
| COURTESY LAMPS DRIVER CIRCUIT BODY HARNESS SHORT TO GROUND |
| PANEL LAMPS DIMMER SWITCH MUX SHORT TO GROUND |
| MULTIFUNCTION SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. COURTESY LAMPS DRIVER (HEADLINER) CIRCUIT SHORTED TO GROUND

Ensure the Dimmer Switch is off.
Close all the passenger doors.
Disconnect the Junction Block C24 connector from the front of the junction block.
Observe the Courtesy Lamps.

**Did the Courtesy Lamps turn off?**

**Yes** >> Repair the Courtesy Lamps Driver circuit in the headliner harness for a short to ground. Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 2

### 2. COURTESY LAMPS DRIVER CIRCUIT (BODY HARNESS) SHORTED TO GROUND

Ensure the Dimmer Switch is off.
Close all the passenger doors.
Disconnect the Junction Block C24 harness connector from the Junction Block.
Observe the Courtesy Lamps.

**Did Courtesy Lamps turn off?**

**Yes** >> Repair the Courtesy Lamps Driver circuit in the Body Harness for a short to ground. Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. PANEL LAMPS DIMMER SWITCH MUX SHORT TO GROUND

Disconnect the Body Control Module C2 connector.
Disconnect the Multifunction Switch harness connector.
Measure the resistance of the Panel Lamps Dimmer Switch MUX circuit to ground.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the Panel Lamps Dimmer Switch MUX circuit for a short to ground condition. Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. MULTIFUNCTION SWITCH

Turn the ignition off.
Disconnect the Body Control Module C2 connector.
Disconnect the Multifunction Switch harness connector.
Turn the ignition on.
Measure the resistance of the Multifunction Switch Ground circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Multifunction Switch.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

## DIMMING LEVEL SWITCH INPUT CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  BCM detects a voltage greater than 4.75 volts on the dimming level switch input for more than 5 seconds.

| Possible Causes |
|---|
| PANEL LAMPS DIMMER SWITCH MUX OPEN |
| SHORT TO BATTERY |
| MULTIFUNCTION SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC's.

Actuate the Dimming Level Switch.

With the scan tool, read the DTC information.

**Does the scan tool read: Dimming Level Switch Input CKT High?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. PANEL LAMPS DIMMER SWITCH MUX OPEN

Turn the ignition off.

Disconnect the BCM C2 harness connector.

Turn the ignition on to check the Courtesy Lamp operation.

**Did the Courtesy Lamps come on?**

**Yes** >> Go To 3

**No** >> Repair the Panel Lamps Dimmer Switch MUX circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

### 3. SHORT TO BATTERY

Ensure the Junction Block C24 harness connector on the front of the junction block is connected.

Turn on all overhead, map and rear rearing lamps by their own individual switches.

This will disconnect each lamp from the Courtesy Lamp Driver Circuit.

**Did any lamp fail to light when it was turned on by it's own switch?**

**Yes** >> Repair the short to battery condition.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. MULTIFUNCTION SWITCH

Turn the ignition off.

Disconnect the Junction Block C24 harness connector from the front of the junction block.

Remove the Body Control Module from the junction block.

Measure the voltage of the Courtesy Lamps Driver circuit.

**Is there any voltage on the Courtesy Lamps Driver Circuit?**

**Yes** >> Replace the Multifunction Switch.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

## DIMMING LEVEL SWITCH INPUT CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Ignition ON.
- **Set Condition:**
  BCM detects a voltage less than 0.25 volts on the dimming level switch input for more than 5 seconds.

| Possible Causes |
|---|
| COURTESY LAMPS DRIVER HEADLINER CIRCUIT SHORT TO GROUND |
| COURTESY LAMPS DRIVER CIRCUIT BODY HARNESS SHORT TO GROUND |
| PANEL LAMPS DIMMER SWITCH MUX SHORT TO GROUND |
| MULTIFUNCTION SWITCH |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC's.

Actuate the Dimming Level Switch.

With the scan tool, read the DTC information.

**Does the scan tool read: Dimming Level Switch Input CKT Low?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. PANEL LAMPS DIMMER SWITCH MUX OPEN

Turn the ignition off.

Disconnect the BCM C2 harness connector.

Cycle the ignition switch off than back on.

**Did any of the Courtesy Lamps come on?**

**Yes** >> Go To 3

**No** >> Repair the Panel Lamps Dimmer Switch MUX for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

### 3. PANEL LAMPS DIMMER SWITCH MUX SHORT TO GROUND

Ensure the Junction Block C24 harness connector on the front of the junction block is connected.

Turn on all overhead, map and rear rearing lamps by their own individual switches.

This will disconnect each lamp from the Courtesy Lamp Driver Circuit.

**Did any lamp fail to light when it was turned on by it's own switch?**

**Yes** >> Repair the Panel Lamps Dimmer Switch MUX circuit for a short to ground condition.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. MULTIFUNCTION SWITCH

Turn the ignition off.

Disconnect the Junction Block C24 harness connector from the front of the junction block.

Remove the Body Control Module from the junction block.

Measure the voltage of the Courtesy Lamps Driver circuit.

**Is voltage present on the Courtesy Lamps Driver Circuit?**

**Yes** >> Replace the Multifunction Switch.
Perform BODY VERIFICATION TEST - VER 1.

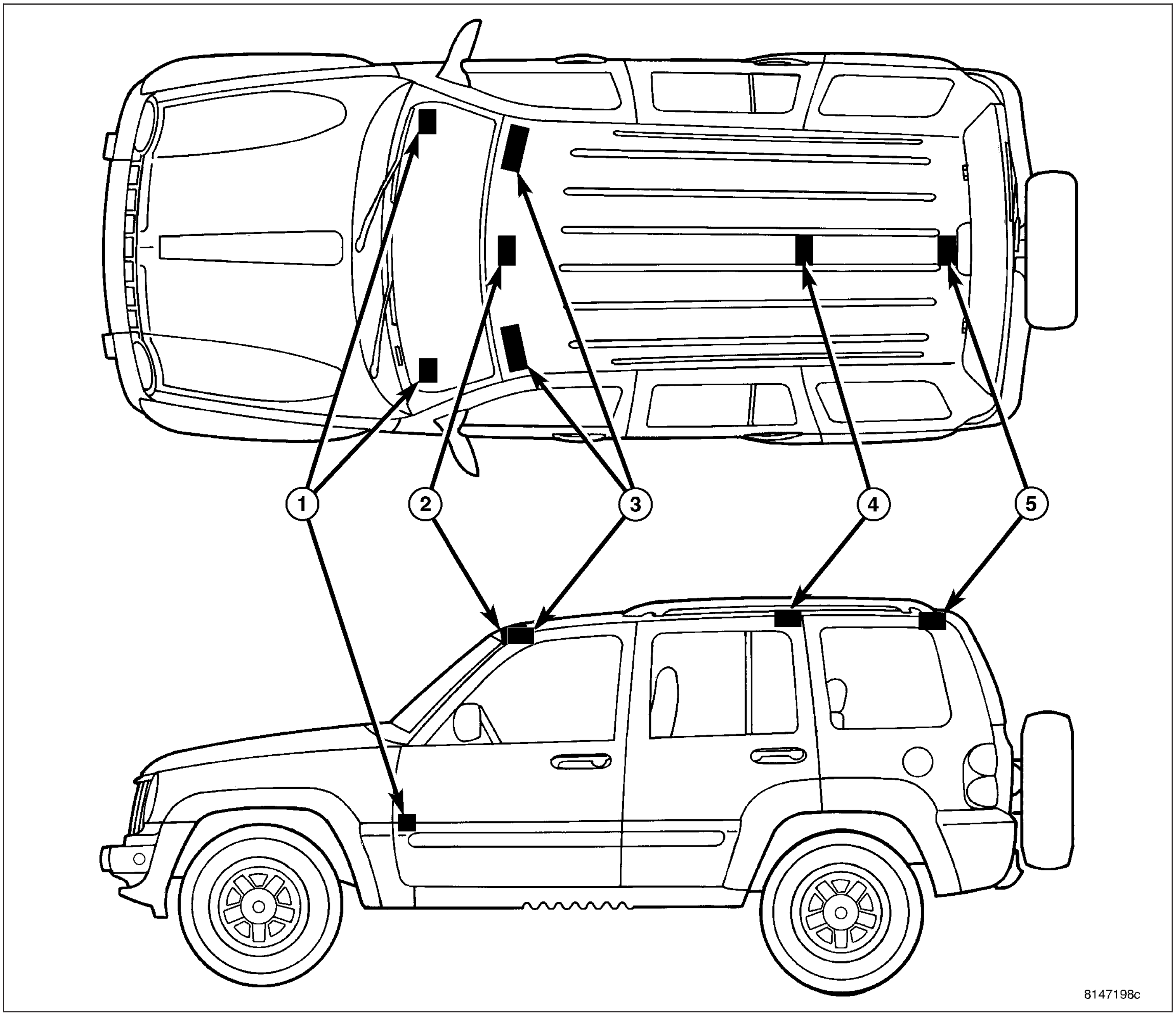
**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

# LAMPS/LIGHTING - INTERIOR

## TABLE OF CONTENTS

# LAMPS/LIGHTING - INTERIOR

## DESCRIPTION




The interior lighting system for this vehicle includes incandescent lighting on two separate circuits: the dome/courtesy lamp circuit and the panel lamps dimmer circuit. The lamps on the dome/courtesy circuit include:

- **Cargo Lamp (5) -** An available cargo lamp with an integral lens-actuated courtesy disable switch is located in the headliner near the rear roof header and is activated automatically whenever the rear flip-up glass is opened to illuminate the rear cargo area of the vehicle.
- **Courtesy Lamps (1) -** Available courtesy lamps are located below both the right and left side of the instrument panel and are illuminated whenever the dome/courtesy lamp circuit is energized.
- **Front Dome Lamp (2)** - A standard front dome lamp that does not include an on-off switch is located in the headliner near the windshield header, and is illuminated whenever the dome/courtesy lamp circuit is energized.
- **Reading Lamps (2)** - Available front seat driver side and passenger side reading lamps located in the headliner near the windshield header are controlled by both the dome/courtesy lamp circuit and independent lens-actuated switches.
- **Rear Dome Lamp (4)** - An available rear dome lamp is located in the center of the headliner above the rear seat is controlled by both the dome/courtesy lamp circuit and an independent lens-actuated switch.

- **Vanity Lamps (3)** - Available single intensity vanity lamps are located on each side of a covered mirror on both the right and left sun visors, and are controlled by an integral vanity mirror cover-actuated switch.

Most controls on the instrument panel and other controls located elsewhere on the interior of the vehicle are illuminated for night visibility. Some have miniature incandescent bulbs or Light-Emitting Diode (LED) units that are soldered to internal circuit boards and are not serviceable. The replaceable incandescent bulbs or bulb/bulb holder units in this vehicle include:

- **Ash Receiver Lamp** - An available ash receiver lamp is located above the ash receiver housing behind the instrument panel center bezel.
- **Compass Mini-Trip Control Illumination Lamps** - The optional Compass Mini-Trip Computer (CMTC) has three replaceable control illumination bulb/bulb holder units on its circuit board that are controlled by the panel lamps dimmer circuit.
- **Heater-Air Conditioner Control Illumination Lamps** - The heater-air conditioner control has two replaceable control illumination bulb/bulb holder units on its circuit board that are controlled by the panel lamps dimmer circuit.
- **Instrument Cluster Illumination Lamps** - The ElectroMechanical Instrument Cluster (EMIC) has nine replaceable general illumination bulb/bulb holder units on its circuit board that are controlled by the panel lamps dimmer circuit. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DESCRIPTION).
- **Transmission Range Indicator Illumination Lamp** - Vehicles equipped with an automatic transmission have an illuminated transmission range indicator integral to the console mounted gearshift mechanism. Illumination is provided by a replaceable incandescent bulb that is controlled by the panel lamps dimmer circuit.

Other components of the interior lighting system for this vehicle include:

- **Body Control Module** - The Body Control Module (BCM) is located on the Junction Block (JB) under the driver side outboard end of the instrument panel. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/BODY CONTROL MODULE - DESCRIPTION).
- **Door Ajar Switches** - A door ajar switch is integral to the door latch mechanism of each front and rear door.
- **Flip-Up Glass Ajar Switch** - A flip-up glass ajar switch is integral to the flip-up glass latch mechanism on the top of the tailgate inner panel.
- **Multi-Function Switch** - The multi-function switch is located on the top of the steering column, just below the steering wheel. The multi-function switch includes a left and right control stalk. The left control stalk is dedicated to providing almost all of the driver controls for both the exterior and interior lighting systems. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/MULTI-FUNCTION SWITCH - DESCRIPTION).
- **Tailgate Ajar Switch** - A tailgate ajar switch is integral to the latch mechanism of the tailgate.

Hard wired circuitry connects the interior lighting system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the interior lighting components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

## OPERATION

The interior lighting systems can be divided into two general classifications based upon the circuit that controls their operation: The courtesy lamp circuit, or the panel lamps dimmer circuit. The hard wired circuits and components of the interior lighting systems may be diagnosed and tested using conventional diagnostic tools and procedures.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the Body Control Module (BCM), the ElectroMechanical Instrument Cluster (EMIC), or the Programmable Communications Interface (PCI) data bus network. The most reliable, efficient, and accurate means to diagnose the BCM, the EMIC, the PCI data bus, or the electronic bus message inputs and outputs related to the various interior lighting systems requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

### COURTESY LAMP CIRCUIT

Depending upon the selected vehicle options the courtesy lamp circuit may include the courtesy lamps located below the instrument panel, the dome or map/reading lamps located in the headliner near the windshield and over the rear seat, the cargo lamp located in the headliner near the rear roof header, and the vanity lamps located in the sun visors. The lamps in the courtesy lamp circuit are provided with battery voltage at all times from a fuse in the Junction Block (JB). The Body Control Module (BCM) controls the ground path for these lamps based upon hard wired inputs from the door ajar switches, the flip-up glass ajar switch, the tailgate ajar switch the multi-function switch and the ignition switch.

After all of the ajar switch inputs to the BCM transition to open, the BCM will keep the lamps illuminated for about 27 seconds, then fade the lamps to off (theater dimming) over about three seconds. The BCM also provides courtesy lamp operation based upon a resistor multiplexed input from the interior lighting control ring on the left control stalk of the multi-function switch through the headlamp switch circuit, and provides an illuminated entry feature in response to certain electronic message inputs received from the optional Remote Keyless Entry (RKE) system.

A resistor multiplexed courtesy lamp defeat input from the control ring on the left control stalk of the multi-function switch will cause the BCM to override normal courtesy lamp operation based upon inputs from all of the ajar switches. A hard wired input from the courtesy lamp defeat switch in the optional cargo lamp will cause the BCM to override normal courtesy lamp operation based upon inputs from only the flip-up glass and tailgate ajar switches.

For those lamps on the courtesy lamp circuit with independent switching such as the optional reading lamps and vanity lamps, the BCM provides a ground path to the switches using another internal driver through the courtesy lamp load shed circuit. The BCM provides a battery saver (load shedding) feature for all courtesy lamps, which will automatically turn these lamps off if they are left on for more than about eight minutes with the ignition switch in the Off position.

### PANEL LAMPS DIMMER CIRCUIT

The panel lamps dimmer circuit includes the ElectroMechanical Instrument Cluster (EMIC), the heater-air conditioner control, the hazard switch and depending upon the selected vehicle options, the ash receiver and/or the automatic transmission range indicator illumination lamps. All lamps in the panel lamps dimmer circuit are provided a path to ground at all times through a hard wired ground circuit. These lamps illuminate based upon inputs to the Body Control Module (BCM) from the exterior lighting control knob and the interior lighting control ring on the left control stalk of the multi-function switch. The left control knob of the multi-function switch selects the exterior lights, while the left control ring selects the panel lamps intensity (dimming) level.

When the exterior lighting is turned On, the BCM energizes the park lamp relay and provides an electronic dimming level message to the ElectroMechanical Instrument Cluster (EMIC), the radio, and the Compass Mini-Trip Computer (CMTC) over the Programmable Communications Interface (PCI) data bus. The energized park lamp relay provides a hard wired battery voltage signal input to the EMIC on the park lamp relay output circuit. The EMIC responds to these inputs by supplying a 12-volt Pulse Width Modulated (PWM) output to all of the incandescent lamps in the panel lamps dimmer circuit over the fused panel lamps dimmer switch signal circuit. This shared PWM output synchronizes the selected illumination intensity level of all of the incandescent lamps in the panel lamps dimmer circuit.

The EMIC and the radio each use the electronic dimming level message from the BCM to control and synchronize the illumination intensity of their own Vacuum Fluorescent Display (VFD) units, while the CMTC uses the dimming level message to control the illumination intensity of both its VFD unit and its incandescent lighting. In addition, when the left control ring of the multi-function switch is moved to the Parade Mode detent position, all of the VFD units are illuminated at their full intensity levels for increased visibility when the vehicle is driven during daylight hours with the exterior lights turned On.

## WARNING

## WARNINGS - LAMPS/LIGHTING - INTERIOR

**WARNING:: To avoid personal injury or death, eye protection should be used when servicing any glass components.**

**CAUTION: Do not use bulbs with higher candle power than indicated in the Bulb Application table (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - SPECIFICATIONS). In addition, do not use fuses, circuit breakers or relays having a greater amperage value than indicated on the fuse panel or in the Owner's Manual. Damage to lamps, lenses, wiring and other related electrical components can result.**

## DIAGNOSIS AND TESTING

## LAMPS/LIGHTING - INTERIOR

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: When diagnosing the interior lighting circuits, remember that high generator output can burn out bulbs rapidly and repeatedly; and, that dim or flickering bulbs can be caused by low generator output or poor battery condition. If one of these symptoms is a problem on the vehicle, be certain to diagnose the battery and charging system, then repair as necessary.**

**NOTE: A good ground is necessary for proper lighting operation. If a lighting problem is being diagnosed that involves multiple symptoms, systems, or components, the problem can often be traced to a loose, corroded, or open ground.**

The hard wired interior lamp and lighting circuits may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the Body Control Module (BCM), the ElectroMechanical Instrument Cluster (EMIC), the Programmable Communications Interface (PCI) data bus, or the electronic message inputs used to provide interior lamp and lighting service or many of the electronic features of the interior lamp and lighting systems. The most reliable, efficient, and accurate means to diagnose the BCM, the EMIC, the PCI data bus, and the electronic message inputs for the interior lamps and lighting system requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## COURTESY LAMP CIRCUIT

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| A SINGLE LAMP IN THE COURTESY LAMP CIRCUIT DOES NOT ILLUMINATE | 1. Ineffective or missing bulb. | 1. Test and replace the courtesy lamp bulb as required. |
| | 2. Ineffective lamp switch. | 2. Test and replace a faulty map/reading lamp switch, cargo lamp switch, or sunvisor (vanity lamp switch) as required. |
| | 3. Ineffective ground circuit. | 3. Test and repair the open courtesy lamp driver circuit as required. |
| | 4. Ineffective ground circuit (independently switched lamps only). | 4. Test and repair the open courtesy lamp load shed circuit as required. |
| | 5. Ineffective feed circuit. | 5. Test and repair the open feed circuit as required. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| ALL LAMPS IN THE COURTESY LAMP CIRCUIT DO NOT ILLUMINATE | 1. Ineffective or missing fuse. | 1. Test and replace the fuse as required. |
| | 2. Ineffective ground circuit. | 2. Test and repair the open ground circuit as required. |
| | 3. Ineffective feed circuit. | 3. Test and repair the open feed circuit as required. |
| | 4. Ineffective cargo lamp (courtesy defeat switch). | 4. Test and replace the cargo lamp as required. |
| | 5. Ineffective rear courtesy lamp control circuit. | 5. Test and repair the shorted courtesy lamp control circuit as required. |
| | 6. Ineffective multi-function switch. | 6. Test and replace the multi-function switch as required. |
| | 7. Ineffective Body Control Module (BCM), BCM input, or BCM output. | 7. Use a diagnostic scan tool to test the BCM, its inputs, and its outputs. Refer to the appropriate diagnostic information. |
| A SINGLE LAMP IN THE COURTESY LAMP CIRCUIT DOES NOT EXTINGUISH | 1. Ineffective lamp switch. | 1. Test and replace a map/reading lamp switch, cargo lamp switch, or sunvisor (vanity lamp, switch and wiring) as required. |
| | 2. Ineffective ground circuit. | 2. Test and repair the shorted courtesy lamp driver (ground) circuit as required. |
| ALL LAMPS IN THE COURTESY LAMP CIRCUIT DO NOT EXTINGUISH | 1. Ineffective ajar switch. | 1. Test and replace a door, tailgate, or liftglass ajar switch as required. |
| | 2. Ineffective ajar switch sense circuit. | 2. Test and repair the shorted ajar switch sense circuit as required. |
| | 3. Ineffective ground circuit. | 3. Test and repair the shorted courtesy lamp driver (ground) circuit as required. |
| | 4. Ineffective Body Control Module (BCM), BCM input, or BCM output. | 4. Use a diagnostic scan tool to test the BCM, its inputs, and its outputs. Refer to the appropriate diagnostic information. |

## PANEL LAMPS DIMMER CIRCUIT

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| A SINGLE LAMP DOES NOT ILLUMINATE | 1. Ineffective or missing bulb. | 1. Test and replace lamp bulb as required. |
| | 2. Ineffective ground circuit. | 2. Test and repair lamp ground circuit as required. |
| | 3. Ineffective supply circuit. | 3. Test and repair open fused panel lamps dimmer switch signal circuit as required. |
| A SINGLE LAMP DOES NOT EXTINGUISH | 1. Ineffective supply circuit. | 1. Test and repair shorted fused panel lamps dimmer switch signal circuit as required. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| ALL LAMPS DO NOT ILLUMINATE | 1. Ineffective fused park lamp relay output circuit.<br>2. Ineffective or missing park lamp relay.<br>3. Ineffective fused panel lamps dimmer switch signal circuit.<br>4. Ineffective Body Control Module (BCM), BCM input, or BCM output.<br>5. Ineffective ElectroMechanical Instrument Cluster (EMIC), EMIC input, or EMIC output.<br>6. Ineffective multi-function switch. | 1. Test and repair open fused park lamp relay output circuit as required.<br>2. Test and replace park lamp relay as required.<br>3. Test and repair open fused panel lamps dimmer switch signal circuit as required.<br>4. Use a diagnostic scan tool to test the BCM, its inputs, and its outputs. Refer to the appropriate diagnostic information.<br>5. Use a diagnostic scan tool to test the EMIC, its inputs, and its outputs. Refer to the appropriate diagnostic information.<br>6. Test and replace the multi-function switch as required. |
| ALL LAMPS EXCEPT CLUSTER ILLUMINATION DO NOT EXTINGUISH | 1. Ineffective supply circuit. | 1. Test and repair shorted fused panel lamps dimmer switch signal circuit as required. |

## SPECIFICATIONS

## LAMPS/LIGHTING - INTERIOR

### COURTESY LAMPS

#### BULB APPLICATION TABLE

| LAMP | BULB |
|---|---|
| Cargo | 578 |
| Courtesy | 906 |
| Front Map/Reading | 578 |
| Rear Dome | 578 |
| Vanity Mirror | MOPAR 6501966 |

#### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Under Instrument Panel Courtesy Lamp Mounting Screw | 2 | - | 17 |

### PANEL LAMPS

#### BULB APPLICATION TABLE

| LAMP | BULB |
|---|---|
| Ash Receiver | 161 |
| Cluster Illumination | 103 |
| Compass Mini-Trip Illumination | MOPAR 4437661 |
| Heater-A/C Control Illumination | 74 |
| Transmission Range Indicator Illumination | S14V |

# AJAR SWITCH

## DESCRIPTION

### DOOR

This vehicle has four door ajar switches, one for each door. Each switch is concealed within and integral to its respective door latch unit. The switches are momentary leaf contact-type units that are actuated by the mechanisms internal to the door latch. A short pigtail wire and connector on each door latch connects the door ajar switch to the vehicle electrical system through its respective door wire harness. The door ajar switches cannot be adjusted or repaired and, if ineffective or damaged, the door latch unit must be replaced. (Refer to 23 - BODY/DOOR - FRONT/LATCH - REMOVAL) or (Refer to 23 - BODY/DOOR - REAR/LATCH - REMOVAL).

### FLIP-UP GLASS

A flip-up glass ajar switch is standard equipment in this vehicle. This switch is concealed within and integral to the flip-up glass latch. The switch is a momentary leaf contact-type unit that is actuated by the flip-up glass latch mechanism. An integral dedicated connector receptacle on the flip-up glass latch connects the flip-up glass ajar switch to the vehicle electrical system through the tailgate wire harness. The flip-up glass ajar switch cannot be adjusted or repaired and, if ineffective or damaged, the latch unit must be replaced. (Refer to 23 - BODY/SWING GATE/FLIP-UP GLASS LATCH - REMOVAL).

### TAILGATE

A tailgate ajar switch is standard equipment in this vehicle. This switch is concealed within and integral to the tailgate latch unit. The switch is a momentary leaf contact-type unit that is actuated by the mechanism internal to the tailgate latch. A pigtail wire harness and connector on the tailgate latch connects the tailgate ajar switch to the vehicle electrical system through the tailgate wire harness. The tailgate ajar switch cannot be adjusted or repaired and, if ineffective or damaged, the latch unit must be replaced. (Refer to 23 - BODY/SWING GATE/LATCH - REMOVAL).

## OPERATION

### DOOR

The door ajar switches are actuated by the mechanisms internal to the door latch. When a door is closed and properly latched, its door ajar switch is an open circuit. When a door is open or only partially latched, the door ajar switch is a closed circuit.

The door ajar switches are hard wired between a body ground and the Body Control Module (BCM). The front door ajar switches are connected to the BCM through a driver or passenger door ajar switch sense circuit, while the rear door ajar switches are connected to the BCM through a left or right rear door ajar switch sense circuit. The BCM reads the door ajar switch status through an internal pull-up, then sends electronic door ajar switch status messages to the ElectroMechanical Instrument Cluster (EMIC) over the Programmable Communications Interface (PCI) data bus and uses these inputs to control many electronic functions and features of the vehicle.

The door ajar switches can be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the BCM, the EMIC, the PCI data bus, or the electronic messaging used to convey door ajar switch status to other modules in the vehicle. The most reliable, efficient, and accurate means to diagnose the BCM, the EMIC, the PCI data bus, and both the hard wired and electronic message inputs and outputs affected by the door ajar switch inputs requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

### FLIP-UP GLASS

The flip-up glass ajar switch is actuated by the flip-up glass latch mechanism. When the flip-up glass is closed and properly latched, the flip-up glass ajar switch is an open circuit. When the flip-up glass is open or only partially latched, the flip-up glass ajar switch is a closed circuit. The flip-up glass ajar switch is hard wired between a body ground and both the Body Control Module (BCM) and the rear wiper motor.

The output of the switch is connected to the BCM and rear wiper motor through a flip-up glass ajar switch sense circuit. The BCM reads the flip-up glass ajar switch status through an internal pull-up, then sends electronic flip-up glass ajar switch status messages to the ElectroMechanical Instrument Cluster (EMIC) over the Programmable Communications Interface (PCI) data bus and uses this input to control many electronic functions and features of the vehicle. The rear wiper motor uses this input to restrict rear wiper operation when the flip-up glass is ajar.

The flip-up glass ajar switch can be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the BCM, the EMIC, the PCI data bus, or the electronic messaging used to convey flip-up glass ajar switch status to other modules in the vehicle. The most reliable, efficient, and accurate means to diagnose the BCM, the EMIC, the PCI data bus, and both the hard wired and electronic message inputs and outputs affected by the flip-up glass ajar switch inputs requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## TAILGATE

The tailgate switch is actuated by the mechanism internal to the tailgate latch. When the tailgate is closed and properly latched, the tailgate ajar switch is an open circuit. When the tailgate is open or only partially latched, the tailgate ajar switch is a closed circuit.

The tailgate ajar switch is hard wired between a body ground and the Body Control Module (BCM). The output of the switch is connected to the BCM through a tailgate ajar switch sense circuit. The BCM reads the tailgate ajar switch status through an internal pull-up, then sends electronic tailgate ajar switch status messages to the ElectroMechanical Instrument Cluster (EMIC) over the Programmable Communications Interface (PCI) data bus and uses this input to control many electronic functions and features of the vehicle.

The tailgate ajar switch can be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the BCM, the EMIC, the PCI data bus, or the electronic messaging used to convey tailgate ajar switch status to other modules in the vehicle. The most reliable, efficient, and accurate means to diagnose the BCM, the EMIC, the PCI data bus, and both the hard wired and electronic message inputs and outputs affected by the tailgate ajar switch input requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

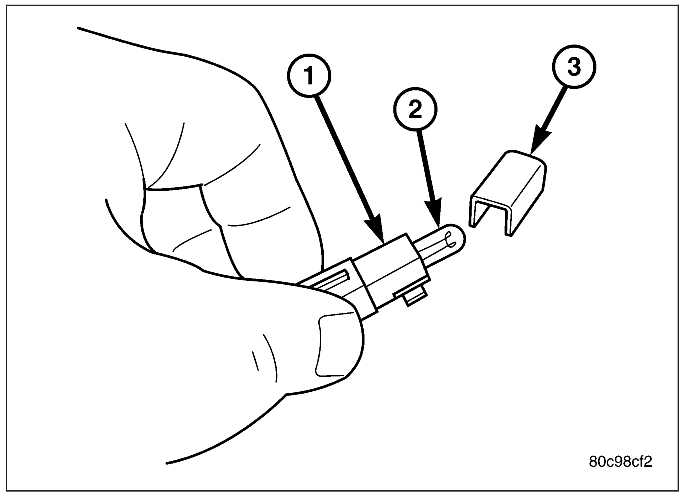
# ASH RECEIVER LAMP

## REMOVAL

### BULB

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

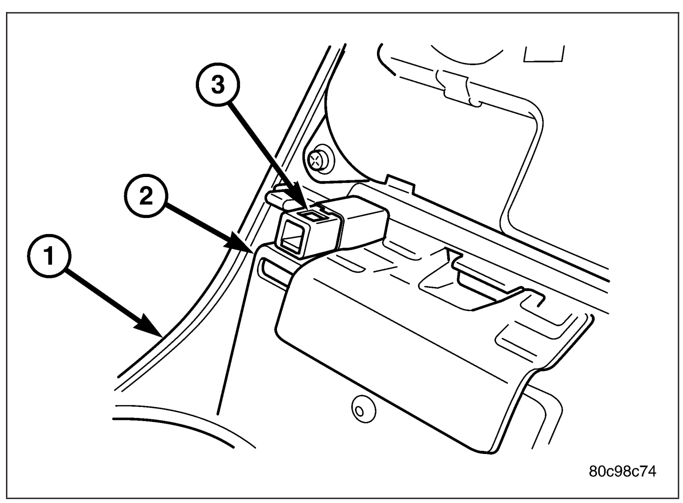
1. Disconnect and isolate the battery negative cable.
2. Remove the ash receiver lamp unit from the top of the ash receiver housing (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/ASH RECEIVER LAMP UNIT - REMOVAL).
3. Carefully disengage the ash receiver lamp hood (3) from the integral snap features on each side of the lamp socket (1) and remove the hood.
4. Pull the bulb (2) straight out of the socket.




### LAMP

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Disconnect and isolate the battery negative cable.
2. Remove the center bezel (1) from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL).
3. While pulling the lamp unit (3) away from the top of the ash receiver housing (2), carefully release the four integral latches that secure the lamp to the mounting hole in the top of the housing.
4. Remove the lamp from the top of the ash receiver housing.



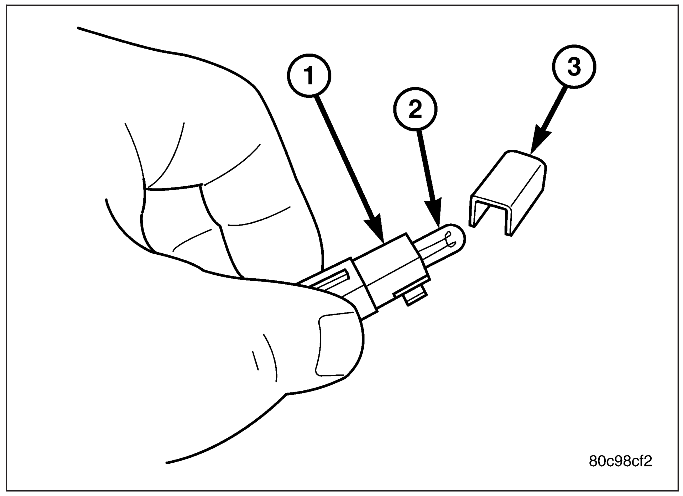
# INSTALLATION

## BULB

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

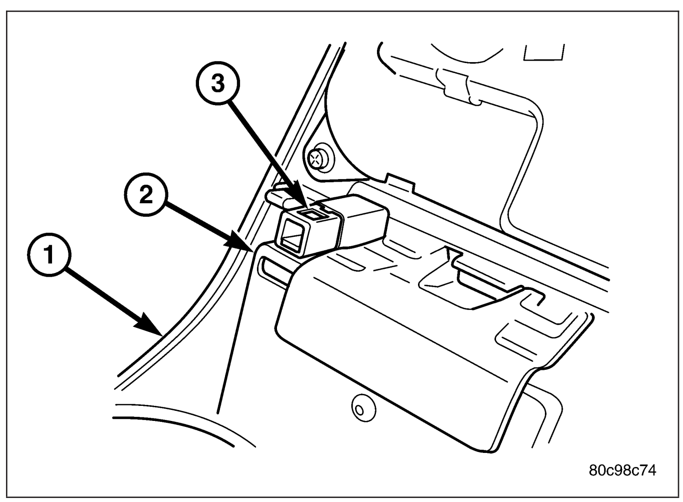
1. Align the base of the ash receiver lamp bulb (2) with the lamp socket (1).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Carefully slide the hood (3) onto the lamp socket until it is fully engaged with the integral snap features on each side of the socket.
4. Reinstall the lamp onto the top of the ash receiver housing (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/ASH RECEIVER LAMP UNIT - INSTALLATION).
5. Reconnect the battery negative cable.




## LAMP

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Align the four integral latches of the lamp unit (3) to the lamp mounting hole on the top of the ash receiver housing (2).
2. Using hand pressure, press firmly and evenly on the lamp until each of the four integral latches snap into place in the lamp mounting hole.
3. Reinstall the center bezel (1) onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).
4. Reconnect the battery negative cable.

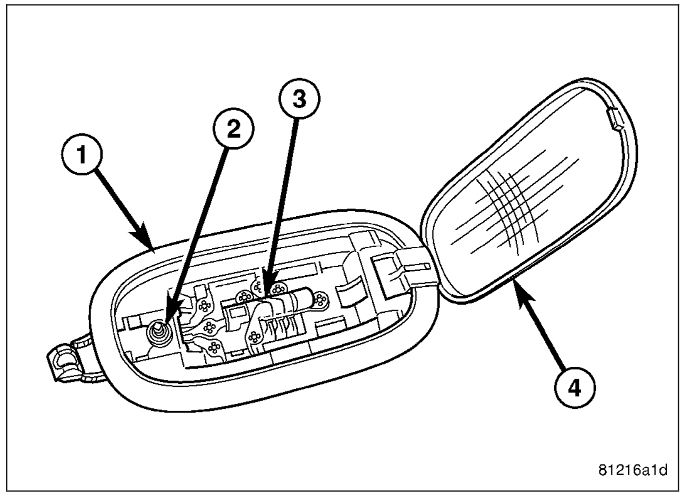


# CARGO LAMP

## REMOVAL

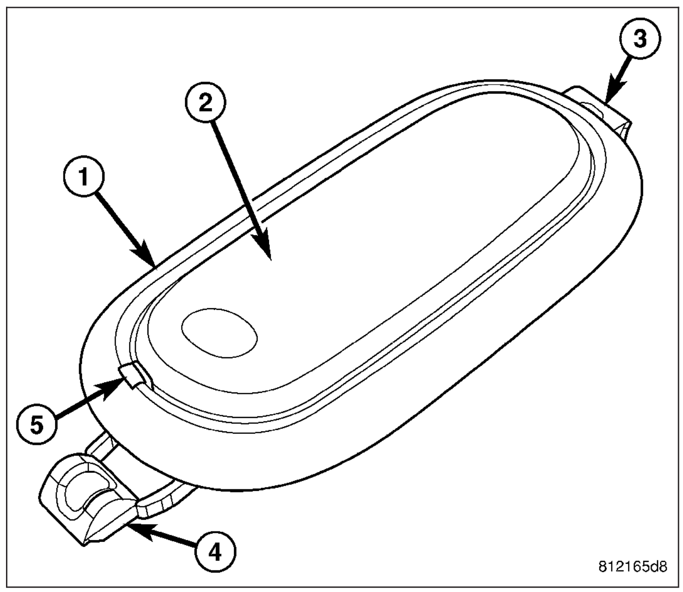
### BULB

1. Disconnect and isolate the battery negative cable.
2. Insert the tip of a small flat-bladed screwdriver into the notch on one side of the cargo lamp between the lens (4) and the lamp housing (1).
3. Gently pry the notched edge of the lens downward until it unsnaps from the housing.
4. Swing the notched end of the lens downward far enough to access the bulb (3).
5. Carefully unsnap the bulb from the two bulb holders within the cargo lamp housing.




### LAMP

1. Disconnect and isolate the battery negative cable.
2. Insert the tip of a small flat bladed screwdriver into the notch (5) between the lens (2) and the housing (1) on one side of the cargo lamp unit.
3. Gently pry the end of the lens outward until it unsnaps from the housing.
4. Swing the lens outward until it is perpendicular to the housing.
5. Pull the lens hinge/retainer (3) end of the housing outward slightly from the headliner, then slide the exposed end of the housing away from the mounting hole far enough to disengage the fixed retainer (4) on the notched end from the headliner.
6. Pull the lamp away from the headliner mounting hole far enough to access and disconnect the wire harness connector from the back of the lamp.
7. Remove the lamp from the vehicle.

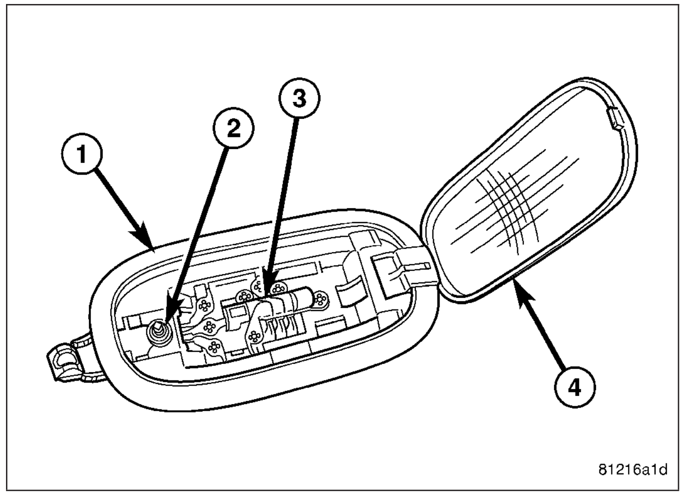



## INSTALLATION

### BULB

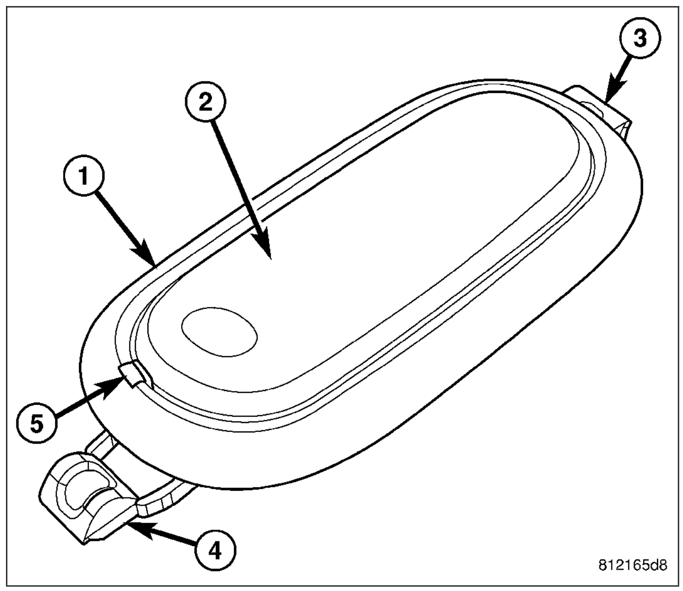
**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

1. Align the ends of the bulb (3) with the two bulb holders within the cargo lamp housing (1).
2. Carefully press the bulb firmly and evenly into the bulb holders until it snaps into place.
3. Swing the notched end of the lens (4) up into position against the housing, then press upward on the lens firmly and evenly until it snaps into the housing.
4. Reconnect the battery negative cable.




## LAMP

1. Position the dome lamp unit (1) to the mounting hole in the headliner.
2. Reconnect the wire harness connector to the connector on the back of the lamp.
3. Insert the fixed retainer (4) on the notched end of the lamp housing up into one side of the mounting hole in the headliner.
4. Slide the notched end of the housing into the mounting hole far enough to engage the lens hinge/retainer (3) into the opposite side of the hole in the headliner.
5. Gently and evenly press the lens hinge/retainer end of the lamp into the mounting hole until the bezel of the lamp housing is flush with the headliner.
6. Swing the notched end of the lamp lens (2) into position against the lamp housing, then press on the lens firmly and evenly until it snaps into the housing.
7. Reconnect the battery negative cable.



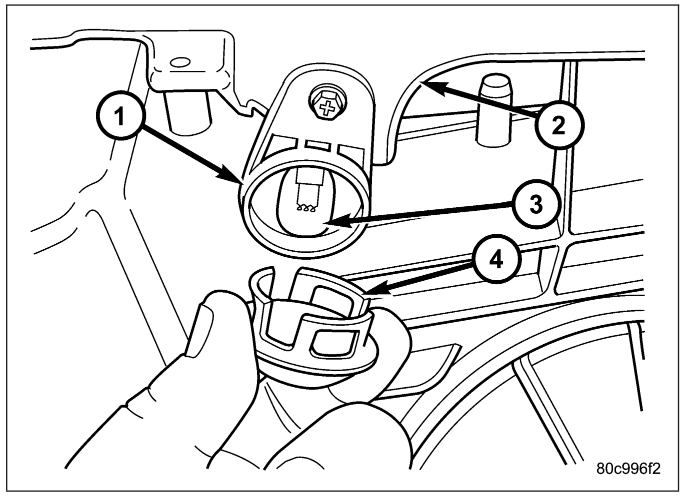
# COURTESY LAMP

## REMOVAL

### BULB

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

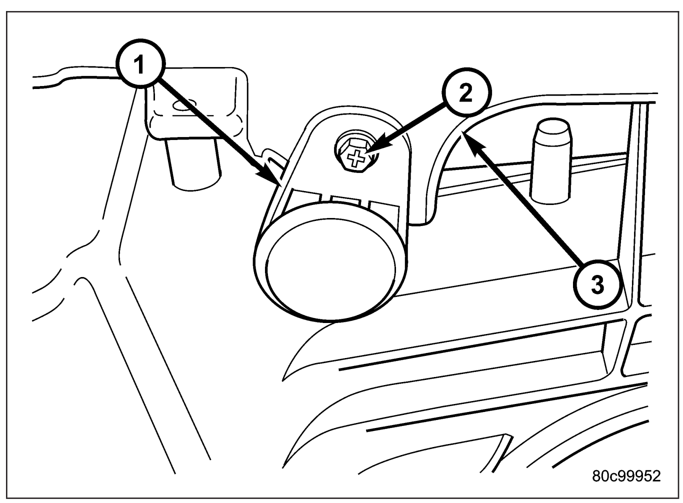
1. Disconnect and isolate the battery negative cable.
2. Support the courtesy lamp unit housing (1) with one hand while firmly grasping the flange on the outer circumference of the lens (4) with the other hand, then pull the lens straight down to unsnap it from the housing.
3. Pull the bulb (3) straight out of the courtesy lamp socket.




### LAMP

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Disconnect and isolate the battery negative cable.
2. Remove the screw (2) that secures the integral mounting tab of the courtesy lamp unit (1) to the lower instrument panel (3).
3. Pull the courtesy lamp down from the lower instrument panel far enough to access and disconnect the instrument panel wire harness connector from the back of the courtesy lamp.
4. Remove the courtesy lamp from under the instrument panel.



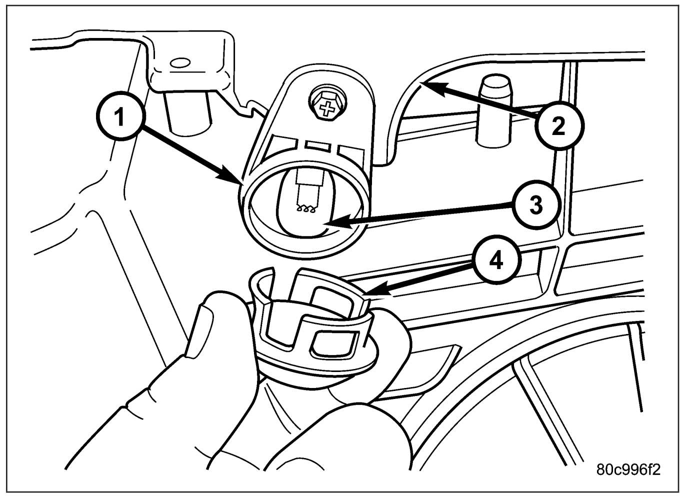
## INSTALLATION

## BULB

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

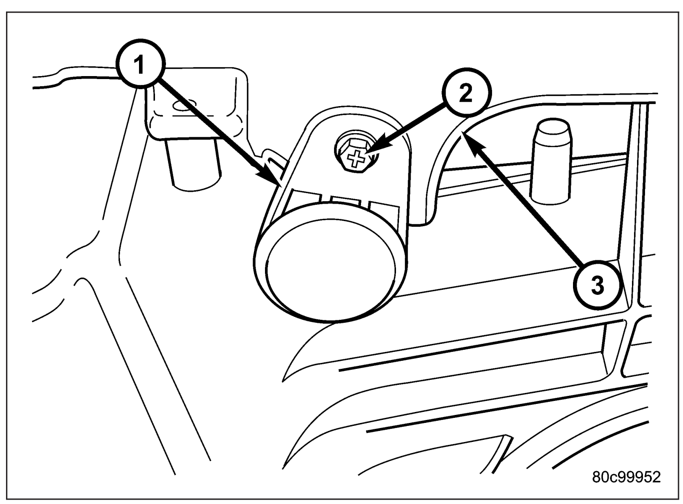
1. Align the base of the bulb (3) with the courtesy lamp socket.
2. Push the bulb straight into the lamp socket until the base is firmly seated.
3. Align the lens (4) with the courtesy lamp unit housing (1).
4. Support the lamp housing with one hand while firmly and evenly pushing the lens into the housing with the other hand, until the lens snaps into place.
5. Reconnect the battery negative cable.




## LAMP

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Position the courtesy lamp unit (1) under the instrument panel.
2. Reconnect the instrument panel wire harness connector to the back of the courtesy lamp.
3. Position the courtesy lamp to the lower instrument panel (3).
4. Install and tighten the screw (2) that secures the integral mounting tab of the courtesy lamp to the lower instrument panel. Tighten the screw to 2 N·m (17 in. lbs.).
5. Reconnect the negative battery cable.



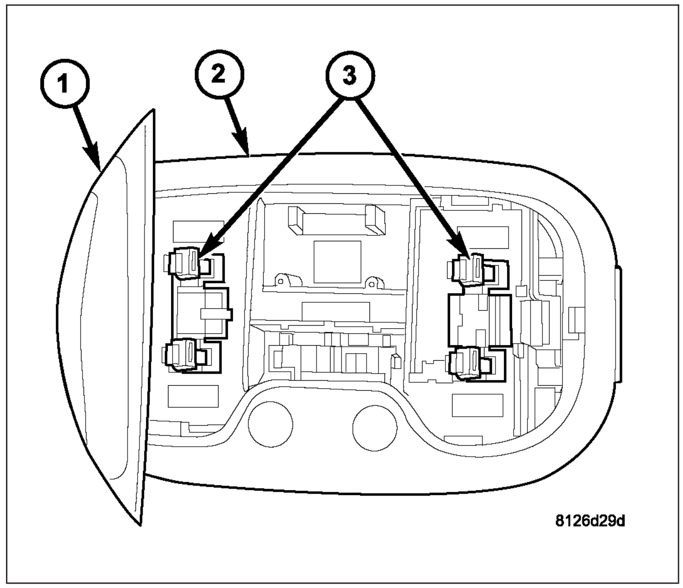
# DOME LAMP

## REMOVAL

### BULB - FRONT

**NOTE: Two different front dome lamps are available, one for vehicles without a sunroof and a second for vehicles with a sunroof. The only differences between these lamps are that the one for sunroof applications has a mount for a power sunroof switch within the lamp housing, an opening in the center of the lamp lens through which the sunroof switch rocker protrudes, and an opening on the back of the lamp housing through which the sunroof switch connector receptacle protrudes. The lamp and bulb service procedures are the same for either lamp.**

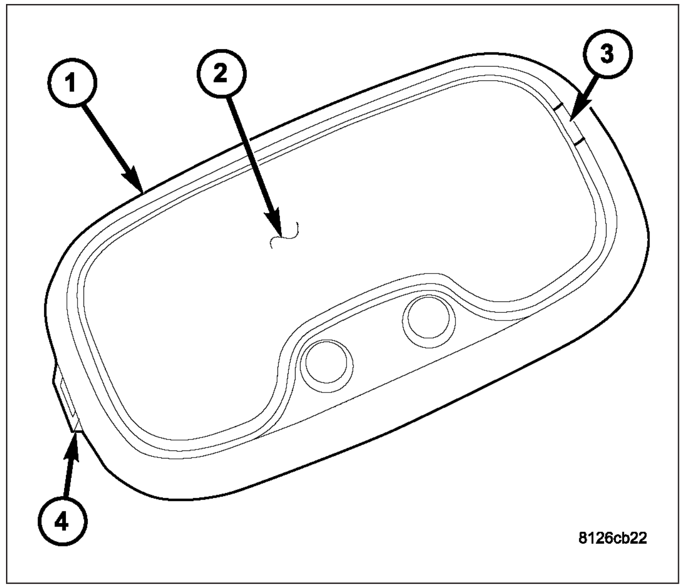
1. Disconnect and isolate the battery negative cable.
2. Remove the front dome lamp from the headliner. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOME LAMP - REMOVAL/FRONT DOME LAMP).
3. With the lamp lens (1) in the open position, carefully unsnap the bulb (3) from the two bulb holders within the front dome lamp housing (2).




### LAMP - FRONT

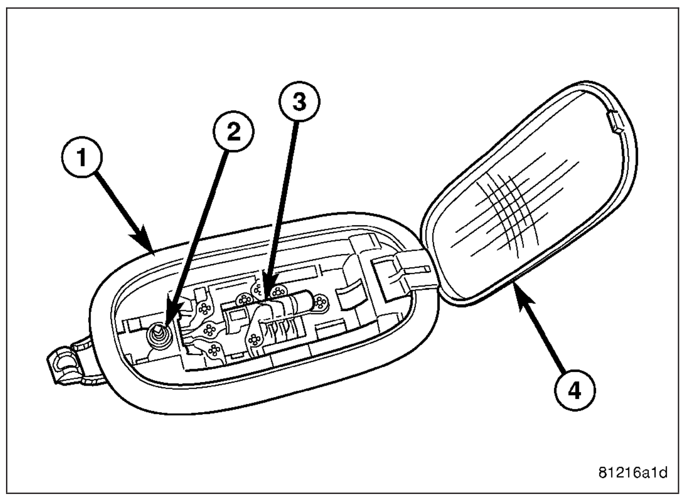
**NOTE: Two different front dome lamps are available, one for vehicles without a sunroof and a second for vehicles with a sunroof. The only differences between these lamps are that the one for sunroof applications has a mount for a power sunroof switch within the lamp housing, an opening in the center of the lamp lens through which the sunroof switch rocker protrudes, and an opening on the back of the lamp housing through which the sunroof switch connector receptacle protrudes. The lamp and bulb service procedures are the same for either lamp.**

1. Disconnect and isolate the battery negative cable.
2. Insert the tip of a small flat bladed screwdriver into the notch (3) between the lens (2) and the housing (1) on one side of the dome lamp unit.
3. Gently pry the end of the lens downward until it unsnaps from the housing.
4. Swing the lens downward until it is perpendicular to the housing.
5. Pull the lens hinge/retainer (4) end of the housing downward slightly from the headliner, then slide the lowered end of the housing away from the mounting hole far enough to disengage the fixed retainer on the notched end from the headliner.
6. Pull the lamp away from the headliner mounting hole far enough to disconnect the wire harness connector from the back of the lamp.
7. If the vehicle is equipped with an optional power sunroof, disconnect the wire harness connector from the sunroof switch connector receptacle on the back of the lamp.
8. Remove the lamp from the vehicle.



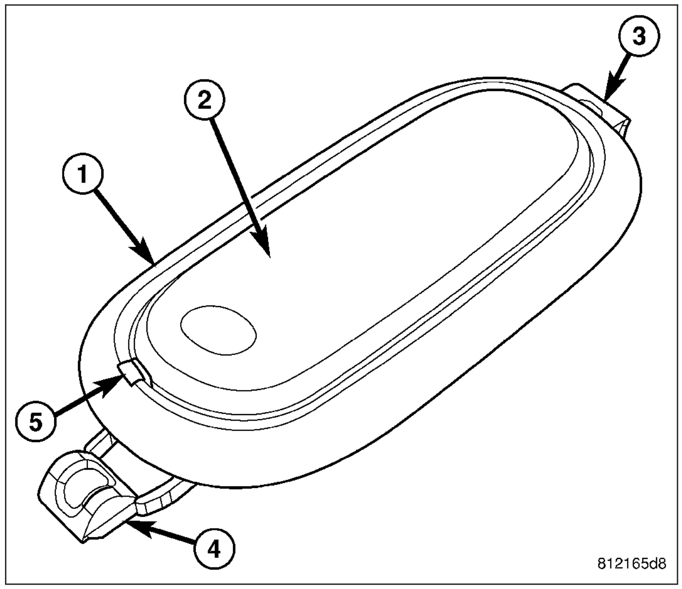

## BULB - REAR

1. Disconnect and isolate the battery negative cable.
2. Insert the tip of a small flat-bladed screwdriver into the notch on one side of the rear dome lamp between the lens (4) and the lamp housing (1).
3. Gently pry the notched edge of the lens downward until it unsnaps from the housing.
4. Swing the notched end of the lens downward far enough to access the bulb (3).
5. Carefully unsnap the bulb from the two bulb holders within the rear dome lamp housing.



## LAMP - REAR

1. Disconnect and isolate the battery negative cable.
2. Insert the tip of a small flat bladed screwdriver into the notch (5) between the lens (2) and the housing (1) on one side of the rear dome lamp unit.
3. Gently pry the end of the lens downward until it unsnaps from the housing.
4. Swing the lens downward until it is perpendicular to the housing.
5. Pull the lens hinge/retainer (3) end of the housing downward slightly from the headliner, then slide the exposed end of the housing away from the mounting hole far enough to disengage the fixed retainer (4) on the notched end from the headliner.
6. Pull the lamp away from the headliner mounting hole far enough to access and disconnect the wire harness connector from the back of the lamp.
7. Remove the lamp from the vehicle.



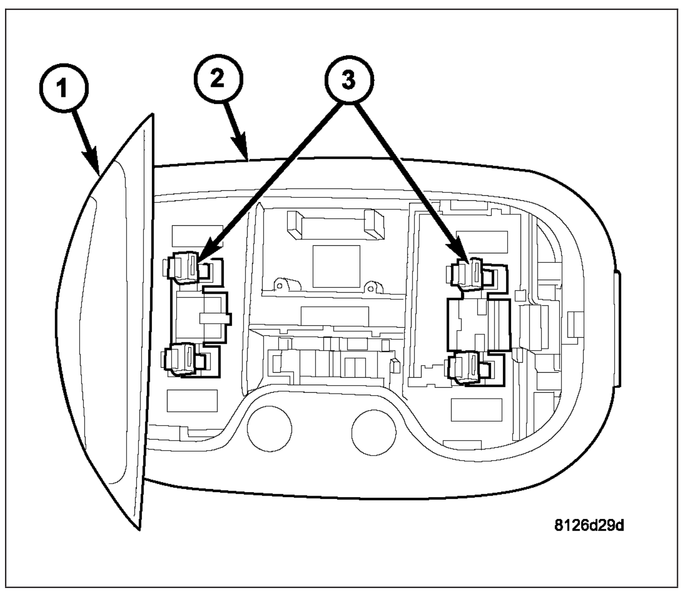

## INSTALLATION

## BULB - FRONT

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

**NOTE: Two different front dome lamps are available, one for vehicles without a sunroof and a second for vehicles with a sunroof. The only differences between these lamps are that the one for sunroof applications has a mount for a power sunroof switch within the lamp housing, an opening in the center of the lamp lens through which the sunroof switch rocker protrudes, and an opening on the back of the lamp housing through which the sunroof switch connector receptacle protrudes. The lamp and bulb service procedures are the same for either lamp.**

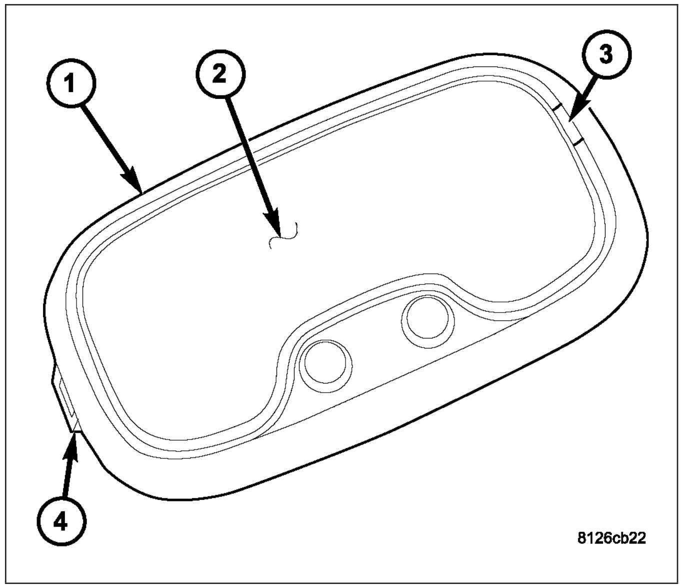
1. With the dome lamp lens (1) in the open position, align the ends of the bulb (3) with the two bulb holders within the front dome lamp housing (2).
2. Carefully press the bulb firmly and evenly into the bulb holders until it snaps into place.
3. Reinstall the lamp into the headliner. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/ DOME LAMP - INSTALLATION/FRONT DOME LAMP).
4. Reconnect the battery negative cable.



## LAMP - FRONT

**NOTE: Two different front dome lamps are available, one for vehicles without a sunroof and a second for vehicles with a sunroof. The only differences between these lamps are that the one for sunroof applications has a mount for a power sunroof switch within the lamp housing, an opening in the center of the lamp lens through which the sunroof switch rocker protrudes, and an opening on the back of the lamp housing through which the sunroof switch connector receptacle protrudes. The lamp and bulb service procedures are the same for either lamp.**

1. Position the dome lamp unit (1) to the mounting hole in the headliner.
2. Reconnect the wire harness connector to the connector on the back of the lamp.
3. If the vehicle is equipped with an optional power sunroof, reconnect the wire harness connector to the sunroof switch connector receptacle on the back of the lamp.
4. Insert the fixed retainer on the notched end of the lamp housing up into one side of the mounting hole in the headliner.
5. Slide the notched end of the housing into the mounting hole far enough to engage the lens hinge/retainer (4) into the opposite side of the hole in the headliner.
6. Gently and evenly press the lens hinge/retainer end of the lamp upward into the mounting hole until the bezel of the lamp housing is flush with the headliner.

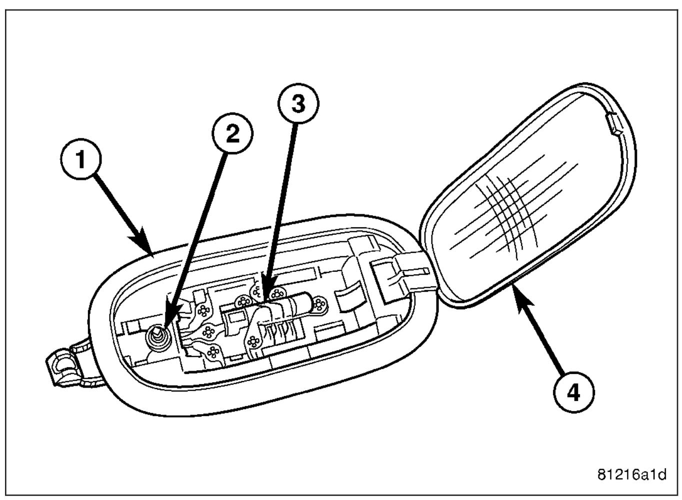



7. Swing the notched end of the lamp lens (2) up into position against the lamp housing, then press upward on the lens firmly and evenly until it snaps into the housing.
8. Reconnect the battery negative cable.

## BULB - REAR

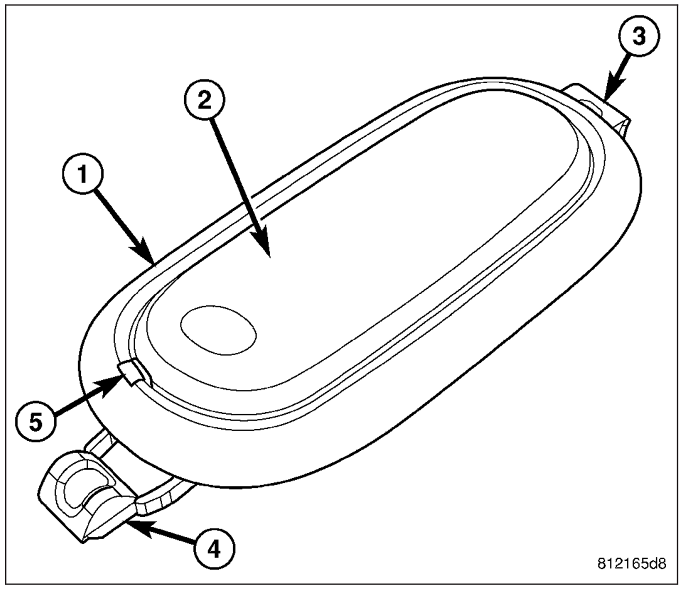
**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

1. Align the ends of the bulb (3) with the two bulb holders within the rear dome lamp housing (1).
2. Carefully press the bulb firmly and evenly into the bulb holders until it snaps into place.
3. Swing the notched end of the lens (4) up into position against the housing, then press upward on the lens firmly and evenly until it snaps into the housing.
4. Reconnect the battery negative cable.



## LAMP - REAR

1. Position the rear dome lamp unit (1) to the mounting hole in the headliner.
2. Reconnect the wire harness connector to the connector on the back of the lamp.
3. Insert the fixed retainer (4) on the notched end of the lamp housing up into one side of the mounting hole in the headliner.
4. Slide the notched end of the housing into the mounting hole far enough to engage the lens hinge/retainer (3) into the opposite side of the hole in the headliner.
5. Gently and evenly press the lens hinge/retainer end of the lamp into the mounting hole until the bezel of the lamp housing is flush with the headliner.
6. Swing the notched end of the lamp lens (2) into position against the lamp housing, then press on the lens firmly and evenly until it snaps into the housing.
7. Reconnect the battery negative cable.



# ILLUMINATION LAMP

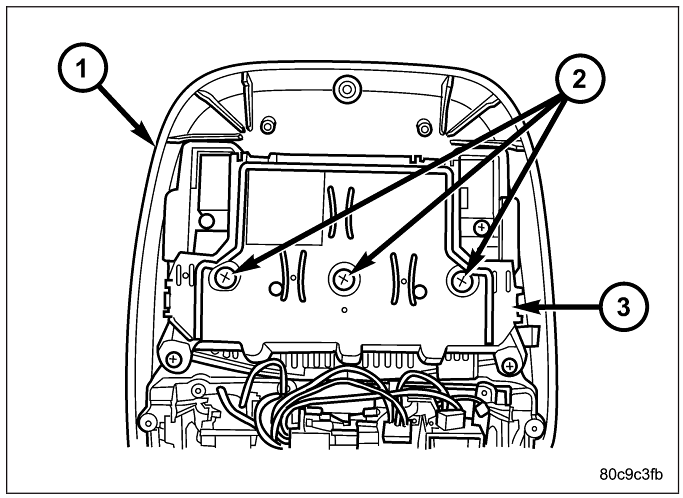
## REMOVAL

## BULB - CMTC CONTROL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: The Compass Mini-Trip Computer (CMTC) in the overhead console includes either two or three incandescent illumination bulb and bulb holder units. Three bulbs are used only on vehicles that also feature the optional Universal Garage Door Opener (UGDO).**

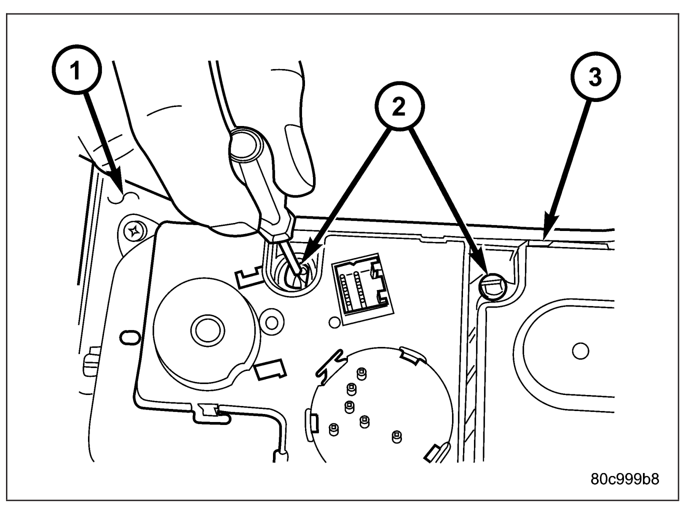
1. Disconnect and isolate the battery negative cable.
2. Remove the overhead console (1) from the headliner. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
3. Use a small thin-bladed screwdriver to rotate the bulb holder (2) counterclockwise about 30 degrees to unlock it from the keyed opening in the Compass Mini-Trip Computer (CMTC) unit (3) circuit board.
4. Pull the bulb holder and bulb straight out of the circuit board.




## BULB - A/C-HEAT CONTROL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

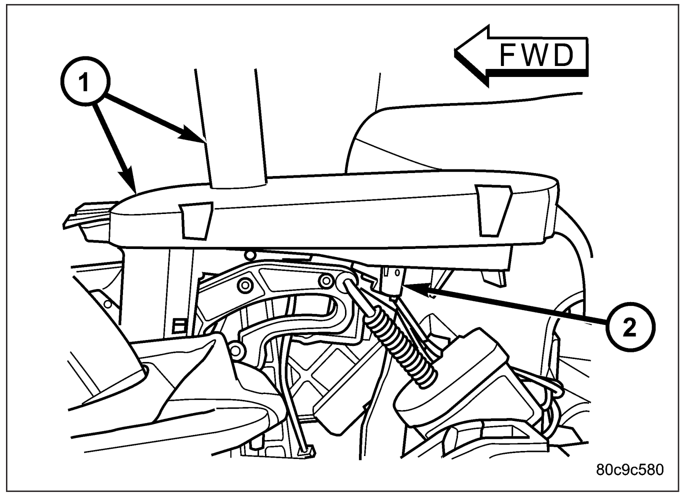
1. Disconnect and isolate the battery negative cable.
2. Remove the center bezel (1) from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL).
3. Use a small thin-bladed screwdriver to rotate the bulb holder (2) counterclockwise about 30 degrees to unlock it from the keyed opening on the A/C-heater control (3) circuit board.
4. Pull the bulb holder and bulb straight out of the circuit board.



## BULB - TRANSMISSION RANGE INDICATOR

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Disconnect and isolate the battery negative cable.
2. Remove the center console from the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).
3. From the left side of the vehicle, reach between the transmission range indicator (1) and the floor panel transmission tunnel to access the illumination lamp socket (2).
4. Rotate the socket counterclockwise about 30 degrees to unlock it from the bottom of the range indicator.
5. Pull the socket and bulb straight out of the keyed opening in the range indicator.
6. Pull the bulb straight out of the socket.




## INSTALLATION

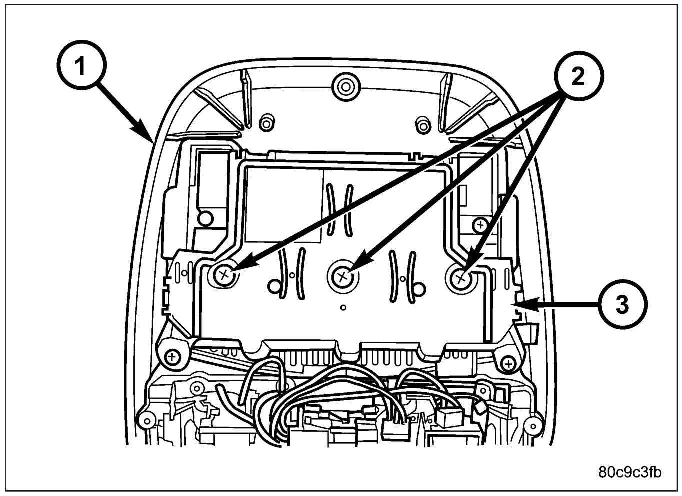
## BULB - CMTC CONTROL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

**NOTE: The Compass Mini-Trip Computer (CMTC) in the overhead console includes either two or three incandescent illumination bulb and bulb holder units. Three bulbs are used only on vehicles that also feature the optional Universal Garage Door Opener (UGDO).**

1. Align the bulb holder and bulb (2) with the keyed opening in the circuit board of the Compass Mini-Trip Computer (CMTC) (3).
2. Insert the bulb holder and bulb straight into the circuit board until the bulb holder is firmly seated.
3. Using a small thin-bladed screwdriver, rotate the bulb holder clockwise about 30 degrees on the circuit board to lock it into place.
4. Reinstall the overhead console (1) onto the headliner. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION).
5. Reconnect the battery negative cable.

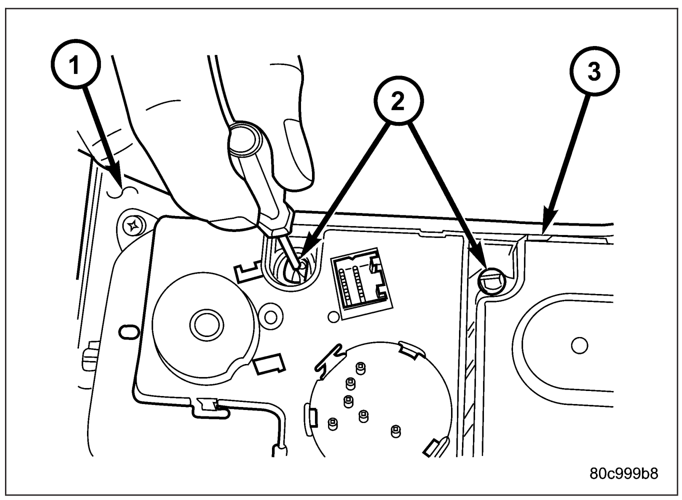



## BULB - A/C-HEAT CONTROL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

1. Align the bulb holder and bulb (2) with the keyed opening in the circuit board of the heater-A/C control (3).
2. Insert the bulb holder and bulb straight into the circuit board until the bulb holder is firmly seated.
3. Using a small thin-bladed screwdriver, rotate the bulb holder clockwise about 30 degrees on the circuit board to lock it into place.
4. Reinstall the center bezel (1) onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).
5. Reconnect the battery negative cable.

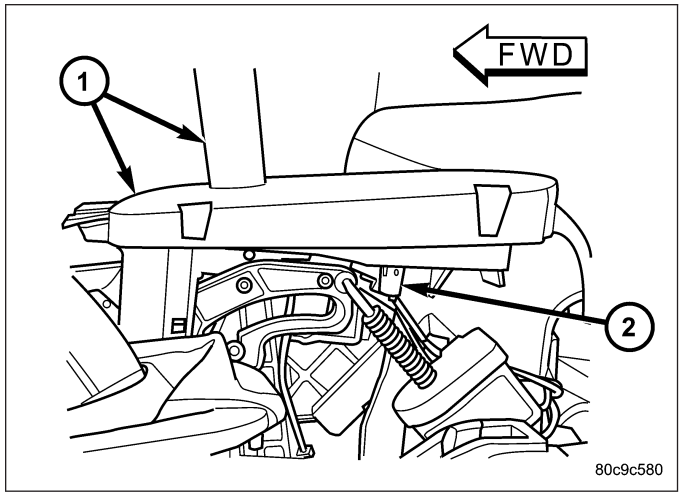



## BULB - TRANSMISSION RANGE INDICATOR

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

1. Align the base of the bulb with the transmission range indicator illumination lamp socket (2).
2. Push the bulb straight into the socket until the base is firmly seated.
3. Align the lamp socket and bulb with the keyed opening on the bottom of the indicator (1).
4. Insert the socket and bulb straight into the bottom of the indicator until the socket is firmly seated.
5. Rotate the socket clockwise about 30 degrees to lock it into place.
6. Reinstall the center console onto the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION).
7. Reconnect the battery negative cable.

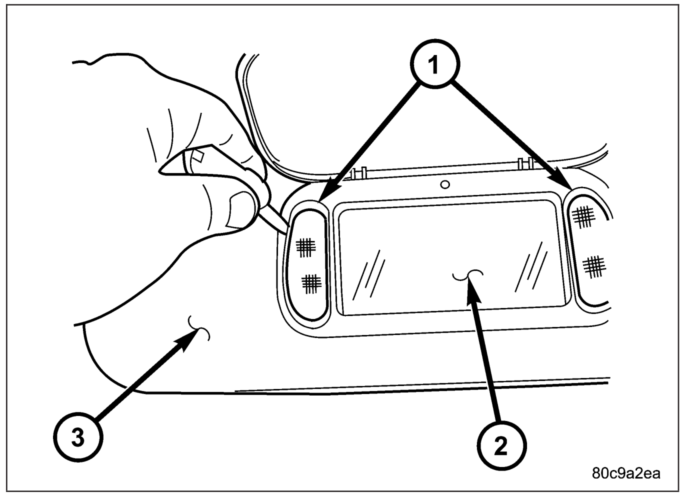


# VANITY LAMP

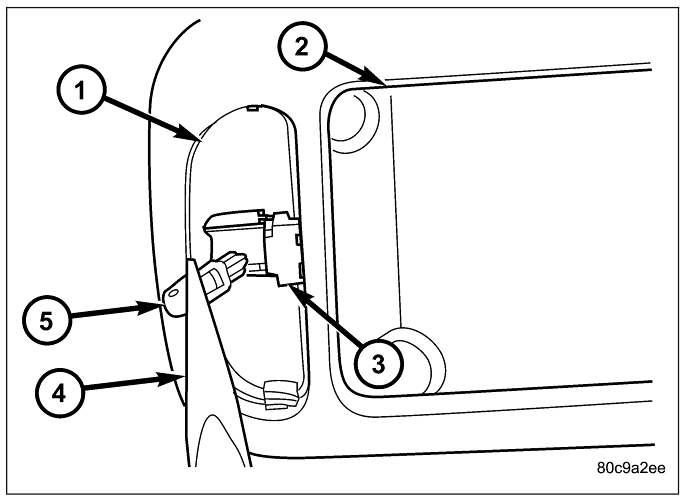
## REMOVAL - BULB

**NOTE: Vehicles equipped with optional vanity lamps have a mirror with a lamp that is integral to each sun visor. Each lamp is independently controlled by an integral switch that is automatically actuated by the mirror cover. The bulb types and service procedures are identical for both of these lamps.**

1. Disconnect and isolate the battery negative cable.
2. Insert a small thin-bladed tool on either side of the mirror (2) near the top or the bottom between the vanity lamp lens (1) and the sun visor (3) vanity lamp housing.
3. Carefully pry the lens outward until it unsnaps from the lamp housing.




4. Using small needle-nose pliers (4), carefully grasp the bulb (5) and pull the base out of the lamp socket (3).

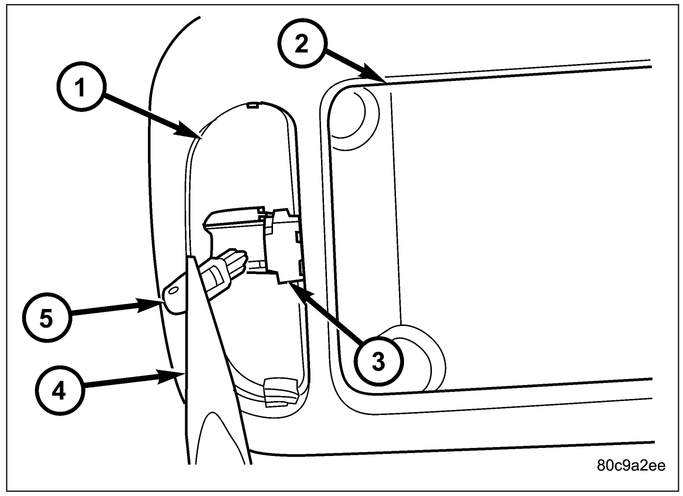



## INSTALLATION - BULB

**CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the lamp, the socket and/or the lamp wiring.**

**NOTE: Vehicles equipped with optional vanity lamps have a mirror with a lamp that is integral to each sun visor. Each lamp is independently controlled by an integral switch that is automatically actuated by the mirror cover. The bulb types and service procedures are identical for both of these lamps.**

1. Using small needle-nose pliers (4), carefully grasp the vanity lamp bulb (5) and align the base of the bulb with the socket (3) in the lamp housing of the sun visor.
2. Push the bulb base straight into the socket until the base is fully seated.
3. Insert one tab on the top or the bottom of the lens into the appropriate slot at the top or the bottom of the lamp housing.
4. Flex the lens far enough to engage the loose tab into its slot in the lamp housing.
5. Reconnect the battery negative cable.



# MESSAGE SYSTEMS

## TABLE OF CONTENTS



## OVERHEAD CONSOLE - ELECTICAL DIAGNOSTICS

### TABLE OF CONTENTS

# OVERHEAD CONSOLE - ELECTICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## BUS MESSAGES MISSING

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| NO RESPONSE FROM EVIC |
| INTERMITTENT CONDITION |
| NO RESPONSE - PCI BUS - PCM |
| NO RESPONSE - PCI BUS - BCM |
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. EVIC SELF TEST RESULT

**NOTE: The EVIC self test can performed manually or by using the scan tool.**

Turn the ignition off.

Perform the EVIC self test.

Depress and hold the RESET and C/T (EVIC) buttons while turning the ignition on.

**Does the EVIC display ″PASSED SELF TEST″?**

**Yes** >> Go To 2

**No** >> Go To 4

### 2. NO RESPONSE - PCI BUS - PCM

Turn the ignition on.

With the scan tool, select Body Computer, System Tests, then PCM Monitor.

**Does the scan tool display ″PCM Active on the Bus″?**

**Yes** >> Go To 3

**No** >> Refer to COMMUNICATION for the related symptom(s).

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 3. NO RESPONSE - PCI BUS - BCM

Turn the ignition on.

With the scan tool, attempt to I/D or communicate with the BCM.

**Was the scan tool able to I/D or communicate with the BCM?**

**Yes** >> Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Refer to COMMUNICATION for the related symptom(s).

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 4. NO RESPONSE - PCI BUS - EVIC

Turn the ignition off.

Perform the EVIC self test.

Press and hold the RESET and C/T buttons.

Turn the ignition on.

**Does the EVIC display ″BUS″?**

**Yes** >> Refer to symptom *NO RESPONSE FROM COMPASS in the Communication category.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## COMPASS TEST FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Compass inoperative.

| Possible Causes |
|---|
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. ELECTRONIC VEHICLE INFORMATION CENTER

Turn the ignition off.

Depress and hold the RESET and C/T buttons while turning the ignition on.

**NOTE: This test may also be performed using the scan tool.**

**Does the EVIC or scan tool display ″FAIL″?**

**Yes** >> Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## EVIC INTERNAL FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The EVIC detects an internal failure.

| Possible Causes |
|---|
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. ELECTRONIC VEHICLE INFORMATION CENTER

Turn the ignition off.

Depress and hold the RESET and C/T buttons while turning the ignition on.

**NOTE: This test may also be performed using the scan tool.**

**Does the EVIC or scan tool display ″FAIL″?**

**Yes** >> Replace the EVIC in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test Complete.

## NO BCM MESSAGES RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is turned on.
- **Set Condition:**
  No PCI Bus message received for 5 seconds after the ignition is turned on. No PCI Bus message is indicated by dashes in the VF display. When valid data is received, the data will replace the dashes.

| Possible Causes |
| --- |
| DTC PRESENT |
| NO RESPONSE - PCI BUS - BCM |
| ELECTRONIC VEHICLE INFORMATION CENTER |

### Diagnostic Test

#### 1. DTC PRESENT

With the scan tool, erase DTCs.

Cycle the ignition and wait approximately 1 minute.

With the scan tool, read DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

#### 2. ELECTRONIC VEHICLE INFORMATION CENTER

Turn the ignition on.

With the scan tool, attempt to I/D or communicate with the BCM.

**Was the scan tool able to communicate with the BCM?**

**Yes** >> Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Refer to the COMMUNICATION category and perform the appropriate symptom.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## NO PCM MESSAGES RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is turned on.
- **Set Condition:**
  No PCI Bus message received for 5 seconds after the ignition is turned on. No PCI Bus message is indicated by dashes in the VF display. When valid data is received, the data will replace the dashes.

| Possible Causes |
|---|
| DTC PRESENT |
| NO RESPONSE - PCI BUS - PCM |
| ELECTRONIC VEHICLE INFORMATION CENTER |

### Diagnostic Test

#### 1. DTC PRESENT

With the scan tool, erase DTCs.

Cycle the ignition and wait approximately 1 minute.

With the scan tool, read DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

#### 2. ELECTRONIC VEHICLE INFORMATION CENTER

Turn the ignition on.

With the scan tool, enter Body Computer, System Tests, then PCM Monitor.

**Does the scan tool display PCM Active on the Bus?**

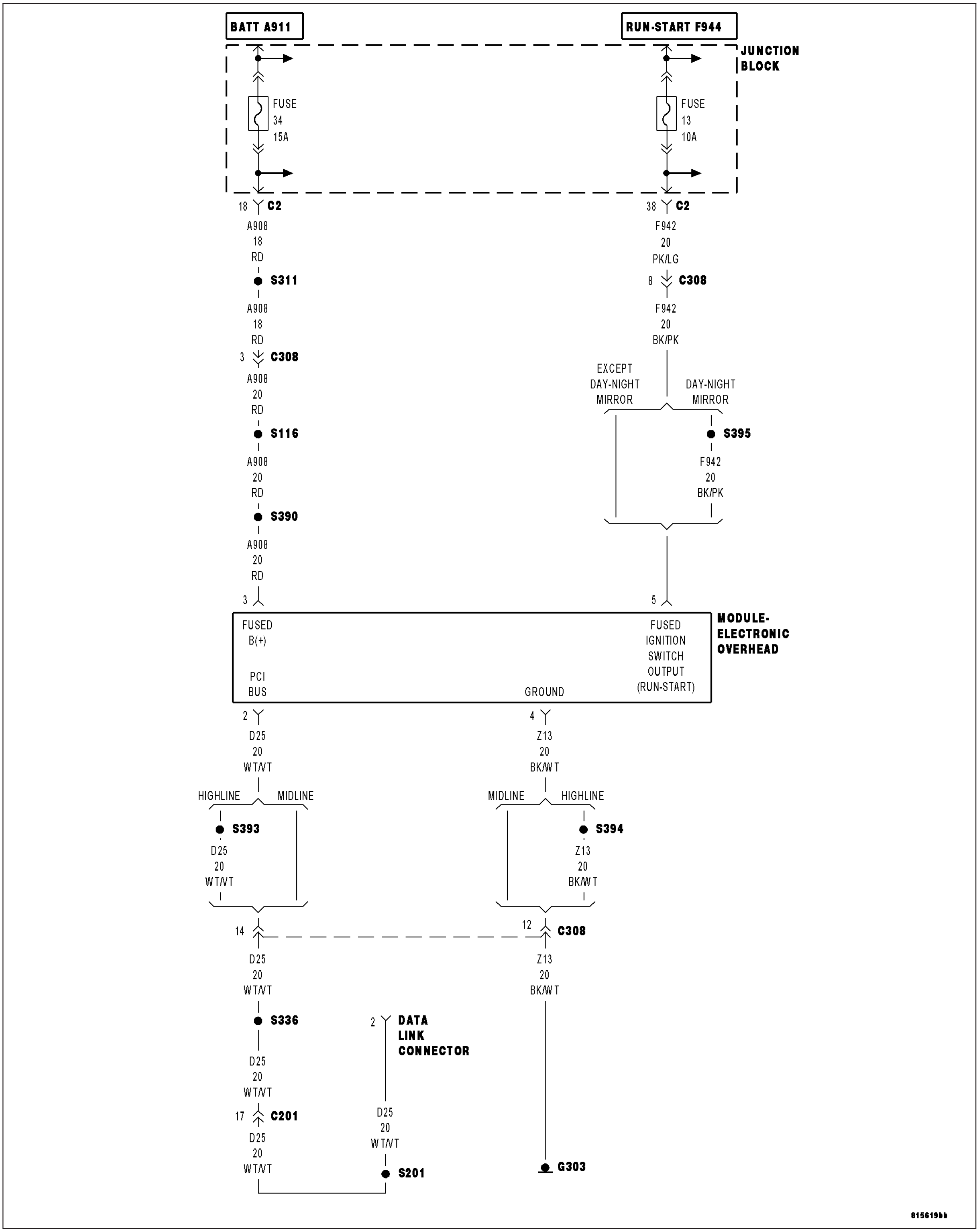
**Yes** >> Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Refer to the COMMUNICATION category and perform the appropriate symptom.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *EVIC INOPERATIVE




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (A908) FUSED B+ CIRCUIT OPEN |
| (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN |
| (Z13) GROUND CIRCUIT OPEN |
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

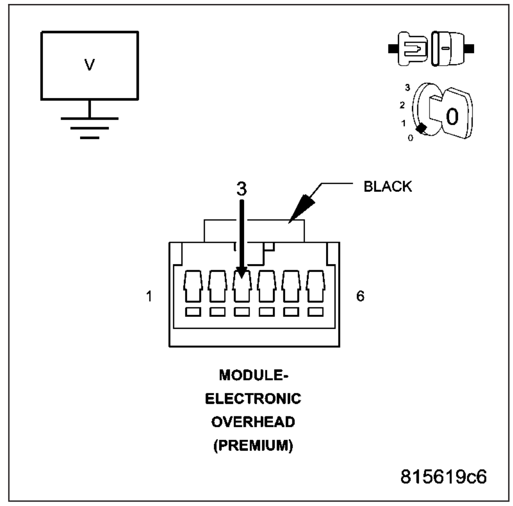
### 1. (A908) FUSED B+ CIRCUIT OPEN

**NOTE: Diagnose and repair any BCM, MIC, PCM, or COMMUNICATION DTCs before proceeding.**

Turn the ignition off.

Disconnect the Overhead Console harness connector.

Measure the voltage between the (A908) Fused B+ circuit and ground.




**Is the voltage above 10.5 volts?**

**Yes** >> Go To 2

**No** >> Repair the (A908) Fused B(+) circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

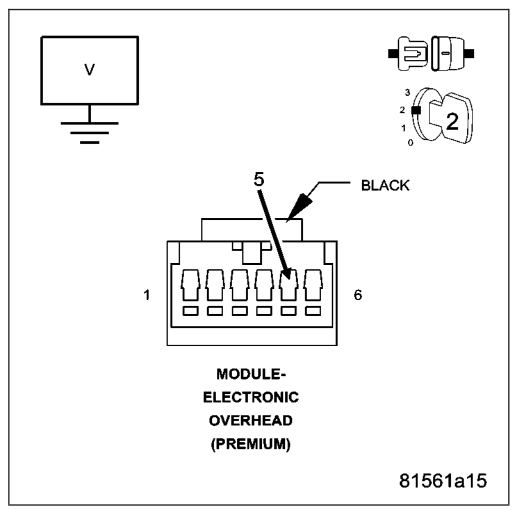
### 2. (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Overhead Console harness connector.

Turn the ignition on.

Measure the voltage between the (F942) Fused Ignition Switch Output circuit and ground.

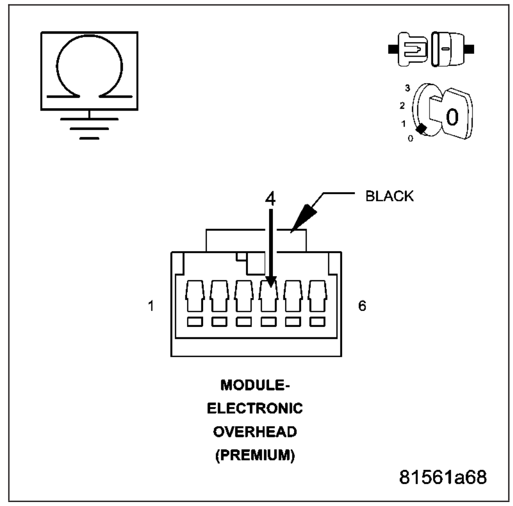



**Is the voltage below 10.5 volts?**

**Yes** >> Repair the (F942) Fused Ignition Switch Output circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (Z13) GROUND CIRCUIT OPEN




Turn the ignition off.

Disconnect the Overhead Console harness connector.

Measure the resistance between ground and the (Z13) EVIC ground circuit.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (Z13) Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *ANY SWITCH ON EVIC INOPERATIVE

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. ELECTRONIC VEHICLE INFORMATION CENTER

**NOTE: Diagnose and repair any BCM, MIC, WCM, PCM, or COMMUNICATION DTCs before proceeding**

**If all the possible causes above are operating correctly, view repair.**

**Repair**

Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *AVERAGE MILES/GAL INOPERATIVE OR WRONG

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. ELECTRONIC VEHICLE INFORMATION CENTER

**NOTE: Diagnose and repair any BCM, MIC, WCM, PCM, or COMMUNICATION DTCs before proceeding**

**NOTE: Average Miles/Gal is calculated in the BCM. The EVIC only displays this information.**

**If all the possible causes above are operating correctly, view repair.**

**Repair**

Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *BLANK SCREEN INOPERATIVE OR WRONG

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. ELECTRONIC VEHICLE INFORMATION CENTER

**NOTE: Diagnose and repair any BCM, MIC, WCM, PCM, or COMMUNICATION DTCs before proceeding**

**If all the possible causes above are operating correctly, view repair.**

**Repair**

Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *EVIC FAILS TO RESPOND TO INSTRUMENT PANEL DIMMING

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. ELECTRONIC VEHICLE INFORMATION CENTER

**NOTE: Diagnose and repair any BCM, MIC, WCM, PCM, or COMMUNICATION DTCs before proceeding**

**If all the possible causes above are operating correctly, view repair.**

**Repair**

Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *MILES TO EMPTY INOPERATIVE OR WRONG

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. ELECTRONIC VEHICLE INFORMATION CENTER

**NOTE: Diagnose and repair any BCM, MIC, WCM, PCM, or COMMUNICATION DTCs before proceeding**

**NOTE: The Miles to Empty calculation is performed by the BCM. The EVIC only displays this information.**

**If all the possible causes above are operating correctly, view repair.**

**Repair**

Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *MILES TO SERVICE INOPERATIVE OR WRONG

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
| --- |
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. ELECTRONIC VEHICLE INFORMATION CENTER

**NOTE: Diagnose and repair any BCM, MIC, WCM, PCM, or COMMUNICATION DTCs before proceeding**

**If all the possible causes above are operating correctly, view repair.**

**Repair**

Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *TIME ELAPSED INOPERATIVE OR WRONG

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. ELECTRONIC VEHICLE INFORMATION CENTER

**NOTE: Diagnose and repair any BCM, MIC, WCM, PCM, or COMMUNICATION DTCs before proceeding**

**If all the possible causes above are operating correctly, view repair.**

**Repair**

Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *TIRE PSI SCREEN INOPERATIVE OR WRONG

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. ELECTRONIC VEHICLE INFORMATION CENTER

**NOTE: Diagnose and repair any BCM, MIC, WCM, PCM, or COMMUNICATION DTCs before proceeding**

**If all the possible causes above are operating correctly, view repair.**

**Repair**

Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *TRIP MILES INOPERATIVE OR WRONG

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. ELECTRONIC VEHICLE INFORMATION CENTER

**NOTE: Diagnose and repair any BCM, MIC, WCM, PCM, or COMMUNICATION DTCs before proceeding**

**If all the possible causes above are operating correctly, view repair.**

**Repair**

Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *UNIVERSAL GARAGE DOOR OPENER (UGDO) INOPERATIVE

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| ELECTRONIC VEHICLE INFORMATION CENTER |

## Diagnostic Test

### 1. ELECTRONIC VEHICLE INFORMATION CENTER

**NOTE: Diagnose and repair any BCM, MIC, WCM, PCM, or COMMUNICATION DTCs before proceeding**

**If all the possible causes above are operating correctly, view repair.**

**Repair**

Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *TEMP DISPLAY INOPERATIVE OR WRONG

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| AMBIENT TEMPERATURE SENSOR |
| EVIC INOPERATIVE |

## Diagnostic Test

### 1. AMBIENT TEMPERATURE SENSOR

**NOTE: Diagnose and repair any PCM, EVIC, or Communication DTCs before proceeding with this test.**

**NOTE: The Ambient Temperature Sensor is hardwired to the PCM. Ambient temperature information is transmitted to the EVIC via the PCI Bus.**

Turn the ignition off.

Disconnect the Ambient Temperature Sensor harness connector.

Measure the resistance of the Ambient Temperature Sensor using the following temperature/resistance values:

10°C (50°F) Sensor Resistance = 17.99 - 21.81 Kilohms

20°C (68°F) Sensor Resistance = 11.37 - 13.61 Kilohms

25°C (77°F) Sensor Resistance = 9.12 - 10.88 Kilohms

30°C (86°F) Sensor Resistance = 7.37 - 8.75 Kilohms

40°C (104°F) Sensor Resistance = 4.90 - 5.75 Kilohms

50°C (122°F) Sensor Resistance = 3.33 - 3.88 Kilohms

**Is the Ambient Temperature Sensor resistance measurement between the min/max specifications?**

**Yes** >> Go To 2

**No** >> Replace the Ambient Temperature Sensor. NOTE: After any repair for an Ambient Temperature Sensor problem, the vehicle must be driven over 5 kilometers (3 miles) above 40 km/h (25 MPH) to update the EVIC display.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. EVIC INOPERATIVE

Perform the EVIC self test.

Turn the ignition off.

Press and hold the C/T and Reset buttons.

Turn the ignition on.

**NOTE: The self test can also be performed using the scan tool.**

Observe the EVIC display at the conclusion of the self test.

**Does the EVIC display ″PASSED SELF TEST″?**

**Yes** >> Test Complete.

**No** >> Replace the EVIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

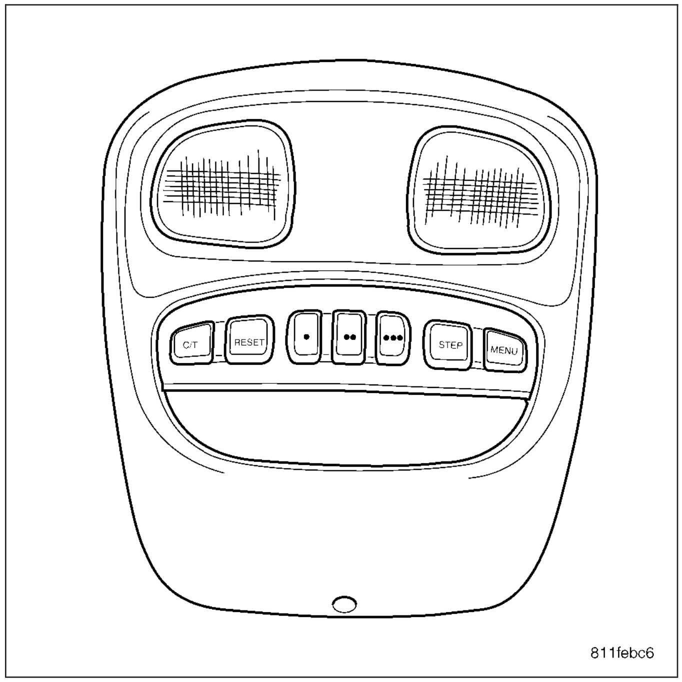
# OVERHEAD CONSOLE-SERVICE INFO

## TABLE OF CONTENTS

# OVERHEAD CONSOLE-SERVICE INFO

## DESCRIPTION

An overhead console is standard factory-installed equipment on this model. The overhead console includes an Electronic Vehicle Information Center Module. Some overhead consoles also contain a universal garage door transmitter. All overhead consoles are equipped with two reading and courtesy lamps. On vehicles equipped with a power sunroof, the sunroof switch is located between the two reading and courtesy lamps. The overhead console is mounted with one screw in the front and two snap clips in the rear. A molded plastic retainer bracket located above the headliner is used to provide secure overhead console attachment.




If any of the EVIC functions are faulty or damaged, the complete Electronic Overhead Module (EOM) must be replaced. Replaceable overhead console components include:

- The incandescent bulbs used for push button back-lighting
- Courtesy lamps
- Courtesy lamp lens
- EOM
- The overhead console housing

## OPERATION

Refer to the vehicle Owner's Manual for specific operation of overhead console and its systems.

## DIAGNOSIS AND TESTING - OVERHEAD CONSOLE

The most reliable, efficient, and accurate means to diagnose the overhead console or related system requires the use of a scan tool and the Service and Body Diagnostic Procedures Manuals. The scan tool can provide vital information to the technician trying to find a problem with a overhead console component. Diagnostic logic is built into the overhead console mounted module to help the person trying to locate the problem by the most efficient means possible. Anytime a problem is suspected, a scan tool must be obtained and used to retrieve any stored fault codes in the module. If diagnostic fault codes are present in the module, record them on a piece of paper immediately before proceeding any further. Then, use these fault codes to identify the problem by verifying the fault code. Example, If the module records "**TIRE PRESSURE N/A**" fault, locate the diagnostic procedure for this code in the appropriate Body Diagnostic Procedures Manual and follow the flow chart until the specific problem is located and resolved. Once the problem is thought to be corrected, erase the stored fault code using the scan tool and verify correct system operation. If the tire pressure monitoring system is functioning correctly, verify that there are no other stored codes in the module and return the vehicle to service.

If the fault code could not be verified, such as not finding anything wrong when following the diagnostic flow chart in the Body Diagnostic Procedures Manual. This is a good indication that an INTERMITTENT problem may be present. You must than attempt to find the intermittent problem, such as running a tire pressure monitoring system self test. Refer to the Tires/Wheels section for more information. Always, eliminate all other potential problems before attempting to replace the module.

### TESTING VOLTAGE AND GROUND SUPPLY TO OVERHEAD CONSOLE

1. Remove the overhead console from the headliner (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL) Disconnect the overhead console electrical connector. Check the fused B(+) circuit in the overhead console electrical connector. If OK, go to Step 2. If not OK, repair the open circuit or component as required. Refer to the Wiring section for detailed schematics.

2. Check the IGN RUN B(+) circuit in the overhead console electrical connector. If OK, go to Step 3. If not OK, repair the open IGN RUN B(+) circuit as required.
3. Check the Ground circuit in the overhead console electrical connector. If OK, go to Step 4. If not OK, repair the open ground circuit as required.
4. If the tire pressure monitoring system is not operating properly, refer to the Tires/Wheels section for more information on the tire pressure monitoring system.

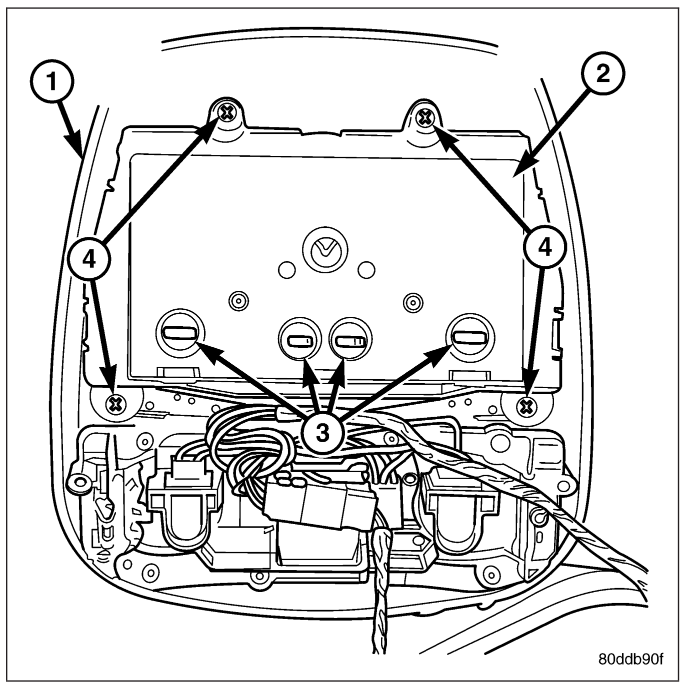
**NOTE: If the compass functions, but accuracy is suspect, it may be necessary to perform a variation adjustment. This procedure allows the compass unit to accommodate variations in the earth's magnetic field strength, based on geographic location. Refer to Compass Variation Adjustment in the Standard Procedures section of this group.**

**NOTE: If the compass reading displays dashes, and only "CAL" appears in the display, demagnetizing may be necessary to remove excessive residual magnetic fields from the vehicle. Refer to Compass Demagnetizing in the Standard Procedures section of this group.**

## STANDARD PROCEDURE

## STANDARD PROCEDURE - MODULE LAMP REPLACEMENT

1. Remove the overhead console (1), (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
2. Using a flat blade screwdriver twist out socket/lamp (3).
3. Replace lamp(s) as necessary.




## STANDARD PROCEDURE - COURTESY LAMP REPLACEMENT

1. Open hood, disconnect and isolate the negative battery cable.
2. Remove the overhead console from the headliner.
3. Remove the lamp and socket assembly from the overhead console.
4. Remove the lamp bulb by pulling it straight out of its socket.

## STANDARD PROCEDURE - COMPASS CALIBRATION

**CAUTION: Do not place any external magnets, such as magnetic roof mount antennas, in the vicinity of the compass. Do not use magnetic tools when servicing the overhead console.**

The electronic compass unit features a self-calibrating design, which simplifies the calibration procedure. This feature automatically updates the compass calibration while the vehicle is being driven. This allows the compass unit to compensate for small changes in the residual magnetism that the vehicle may acquire during normal use. If the compass readings appear to be erratic or out of calibration, perform the following calibration procedure. Also, new replacement Electronic Vehicle Information Center (EVIC) modules must have their compass calibrated using this procedure. Do not attempt to calibrate the compass near large metal objects such as other vehicles, large buildings, or bridges; or, near overhead or underground power lines.

Calibrate the compass manually as follows:

1. Turn the ignition switch to the On position. If the compass/thermometer data is not currently being displayed, momentarily depress and release the C/T push button to reach the compass/thermometer display.
2. Depress the Reset push button and hold the button down until “CAL” appears in the display. This takes about ten seconds, and appears about five seconds after “VARIANCE = XX” is displayed.
3. Release the Reset push button.
4. Drive the vehicle on a level surface, away from large metal objects and power lines, through three or more complete circles at between five and eight kilometers-per-hour (three and five miles-per-hour) in not less than 48 seconds. The “CAL” message will disappear from the display to indicate that the compass is now calibrated.

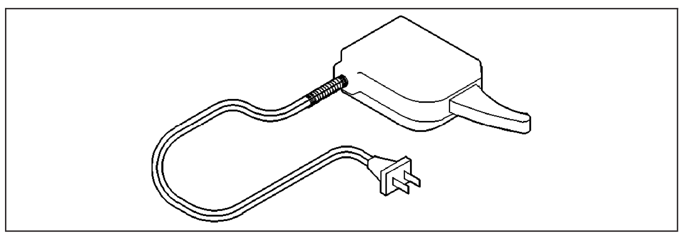
**NOTE: If the “CAL” message remains in the display, either there is excessive magnetism near the compass, or the unit is faulty. Repeat the calibration procedure one more time.**

**NOTE: If the wrong direction is still indicated in the compass display, the area selected for calibration may be too close to a strong magnetic field. Repeat the calibration procedure in another location.**

## STANDARD PROCEDURE - COMPASS DEMAGNETIZING

A degaussing tool (Special Tool 6029) is used to demagnetize, or degauss, the overhead console forward mounting screw and the roof panel above the overhead console. Equivalent units must be rated as continuous duty for 110/115 volts and 60 Hz. They must also have a field strength of over 350 gauss at 7 millimeters (0.25 inch) beyond the tip of the probe.

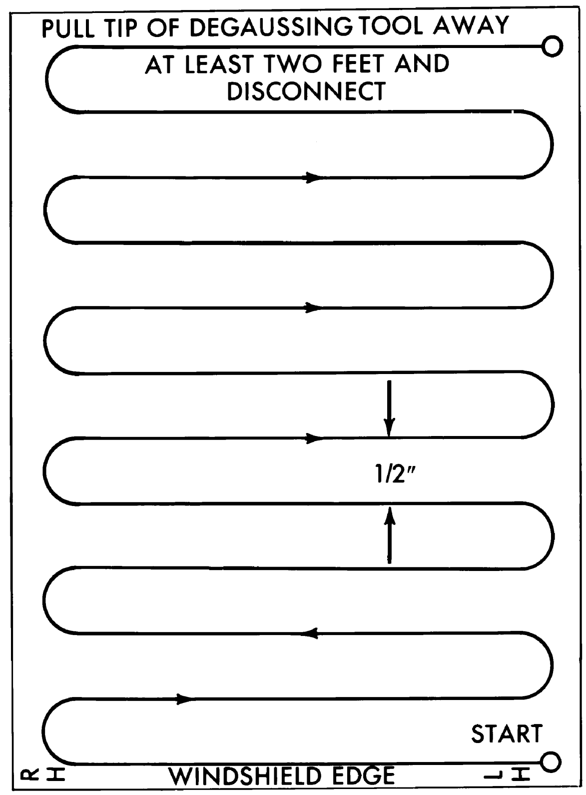
To demagnetize the roof panel and the overhead console forward mounting screw, proceed as follows:



***Degaussing Tool 6029***

1. Be certain that the ignition switch is in the Off position, before you begin the demagnetizing procedure.
2. Connect the degaussing tool to an electrical outlet, while keeping the tool at least 61 centimeters (2 feet) away from the compass unit.
3. Slowly approach the head of the overhead console forward mounting screw with the degaussing tool connected.
4. Contact the head of the screw with the plastic coated tip of the degaussing tool for about two seconds.
5. With the degaussing tool still energized, slowly back it away from the screw. When the tip of the tool is at least 61 centimeters (2 feet) from the screw head, disconnect the tool.

6. Place a piece of paper approximately 22 by 28 centimeters (8.5 by 11 inches), oriented on the vehicle lengthwise from front to rear, on the center line of the roof at the windshield header. The purpose of the paper is to protect the roof panel from scratches, and to define the area to be demagnetized.
7. Connect the degaussing tool to an electrical outlet, while keeping the tool at least 61 centimeters (2 feet) away from the compass unit.
8. Slowly approach the center line of the roof panel at the windshield header, with the degaussing tool connected.
9. Contact the roof panel with the plastic coated tip of the degaussing tool. Be sure that the template is in place to avoid scratching the roof panel. Using a slow, back-and-forth sweeping motion, and allowing 13 millimeters (0.50 inch) between passes, move the tool at least 11 centimeters (4 inches) to each side of the roof center line, and 28 centimeters (11 inches) back from the windshield header.
10. With the degaussing tool still energized, slowly back it away from the roof panel. When the tip of the tool is at least 61 centimeters (2 feet) from the roof panel, disconnect the tool.
11. Calibrate the compass, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - STANDARD PROCEDURE - COMPASS CALIBRATION). Adjust the compass variance, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - STANDARD PROCEDURE - COMPASS VARIATION ADJUSTMENT).



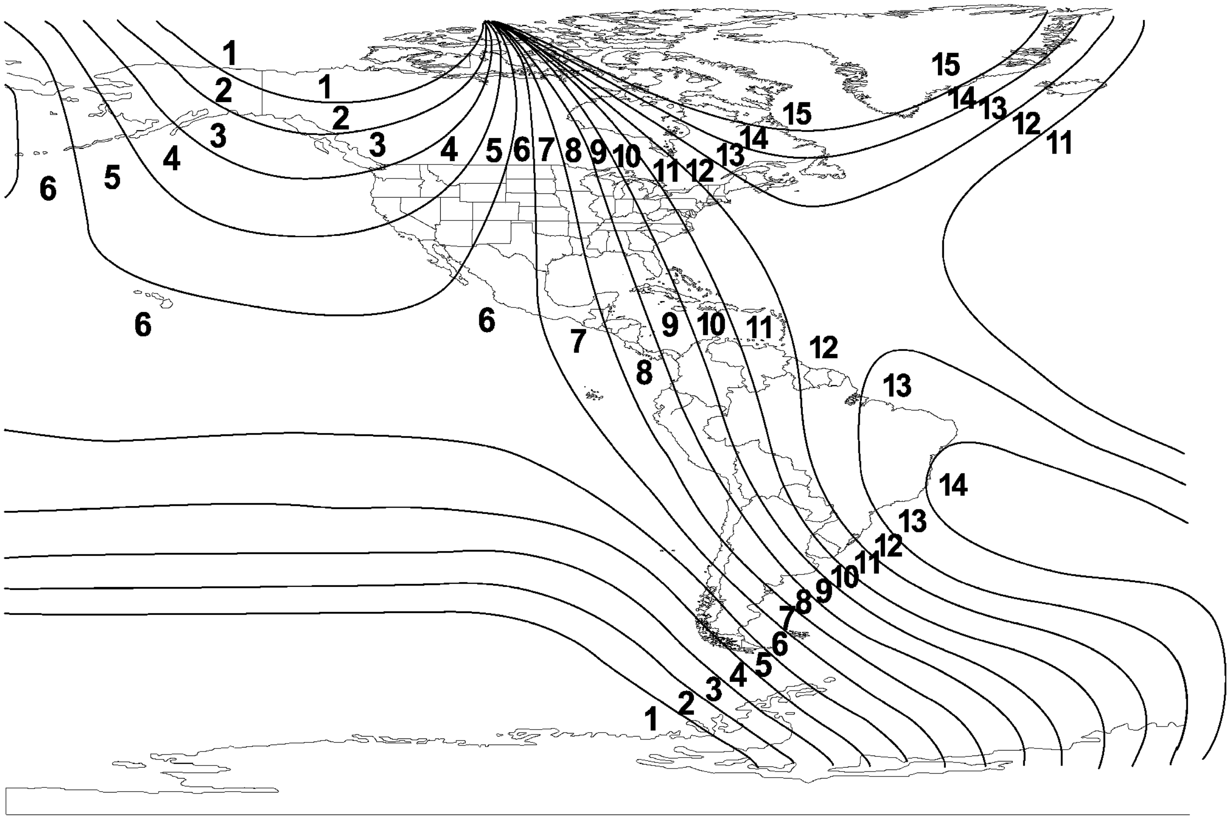
J908E-27

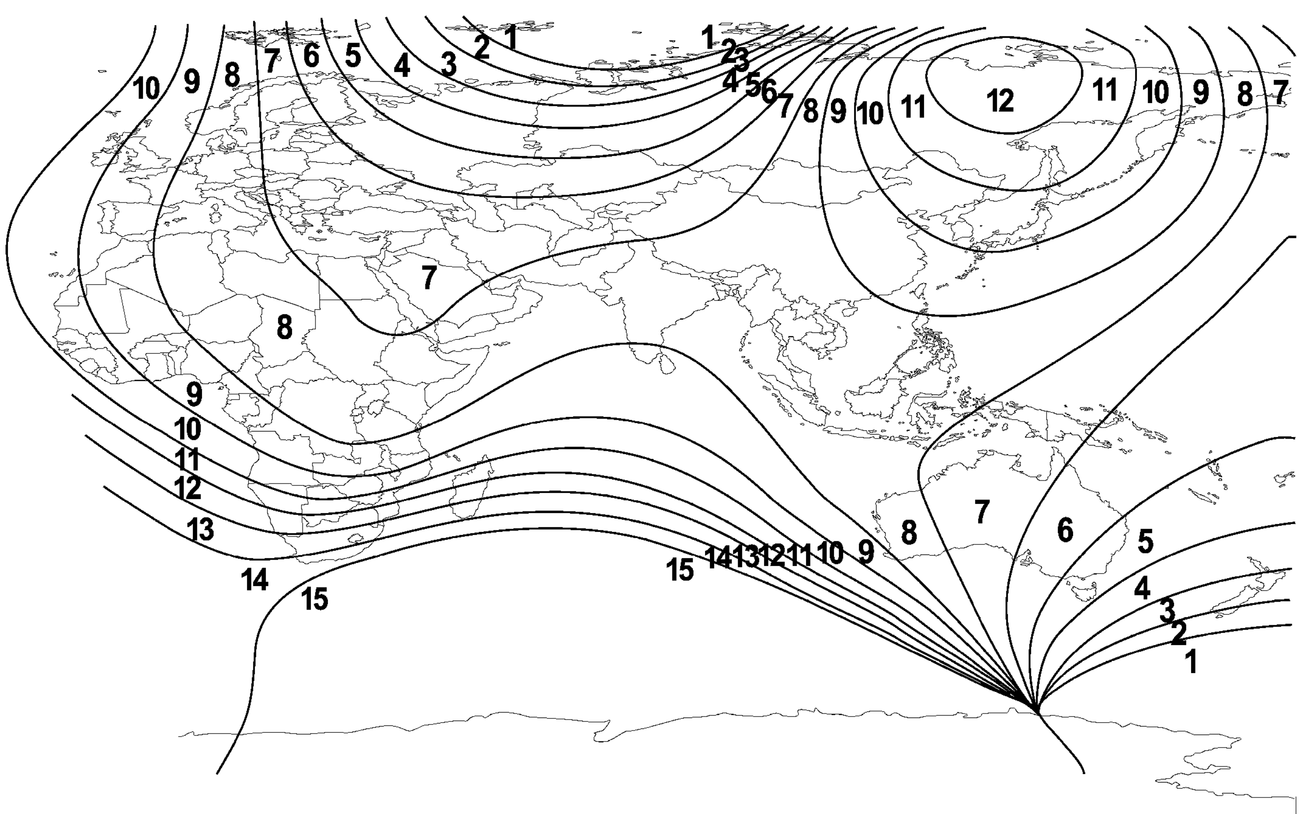
## STANDARD PROCEDURE - COMPASS VARIATION ADJUSTMENT

Compass variance, also known as magnetic declination, is the difference in angle between magnetic north and true geographic north. In some geographic locations, the difference between magnetic and geographic north is great enough to cause the compass to give false readings. If this problem occurs, the compass variance setting may need to be changed.

To set the compass variance:

1. Using the Variance Settings map, find your geographic location and note the zone number.


811994c8


8119948e

2. Turn the ignition switch to the On position. If the compass/thermometer data is not currently being displayed, momentarily depress and release the C/T push button to reach the compass/thermometer display.
3. Depress the Reset push button and hold the button down until “VARIANCE = XX” appears in the display. This takes about five seconds.
4. Release the Reset push button. “VARIANCE =XX ” will remain in the display. “XX” equals the current variance zone setting.
5. Momentarily depress and release the Step push button to step through the zone numbers, until the zone number for your geographic location appears in the display.
6. Momentarily depress and release the Reset push button to enter the displayed zone number into the Electronic Overhead Module memory.
7. Confirm that the correct directions are now indicated by the compass.

## STANDARD PROCEDURE - ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING

### EVIC PROGRAMMING MODE

The Electronic Vehicle Information Center (EVIC) provides the vehicle operator with a user interface, which allows the selection of several optional customer programmable electronic features to suit individual preferences. The EVIC must be placed into its programming mode in order to view or change the programmable features. To enter the EVIC programming mode and to view or change the selected programmable features options, proceed as follows:

1. Turn the ignition switch to the On position.
2. Depress and release the Menu push button. The first item in the programmable features menu list will appear in the EVIC display.
3. Momentarily depress and release the Menu push button to step through the programmable features list. Each programmable feature and its currently selected option will appear on the EVIC display in the sequence shown in the Programmable Features list that follows.
4. Momentarily depress and release the Step push button to step through the available options for the programmable feature being displayed.
5. The option that last appears in the display with a programmable feature before exiting the programming mode, becomes the newly selected programmable feature option.
6. The EVIC exits the programming mode and returns to its normal operating mode when the C/T push button is depressed or when the end of the programmable features menu list is reached, whichever occurs first.

### PROGRAMMABLE FEATURES

- **LANGUAGE? -** The options include English, Francais, Deutsch, Italiana, or Espanol. The default is English. All EVIC display nomenclature, including the trip computer functions, warning messages and the programmable features appear in the selected language.
- **DISPLAY U.S. OR METRIC? -** The options include U.S. and M. The default is U.S. This feature toggles the trip computer temperature, fuel economy and odometer display readings between U.S. and metric units of measure. It also changes the odometer display in the instrument cluster.
- **AUTO DOOR LOCKS? -** The options include Yes and No. The default is Yes. When Yes is selected, all doors lock automatically when vehicle speed reaches 25 km/h (15 mp/h). If YES is selected, a second programmable feature appears, **AUTO UNLOCK ON EXIT? -** The options again include Yes and No. The default is No. When Yes is selected, following each Auto Door Lock event all doors will automatically unlock when the driver door is opened, if the vehicle is stopped and the transmission gear selector is in Park or Neutral. The Auto Door Unlock event will only occur once following each Auto Door Lock event.
- **REMOTE UNLOCK -** The options include Driver Door 1st and All Doors. The default is Driver Door 1st. When Diver Door 1st is selected, only the driver door unlocks when the Unlock button of the Remote Keyless Entry (RKE) transmitter is depressed once. The Unlock button of the RKE transmitter must be depressed twice to unlock all doors. When All Doors is selected, all doors unlock when the Unlock button of the RKE transmitter is depressed once.
- **SOUND HORN ON LOCK? -** The options include Yes and No. The default is No. When Yes is selected, a short horn chirp will provide an audible confirmation when the RKE receiver recognizes a valid Lock signal

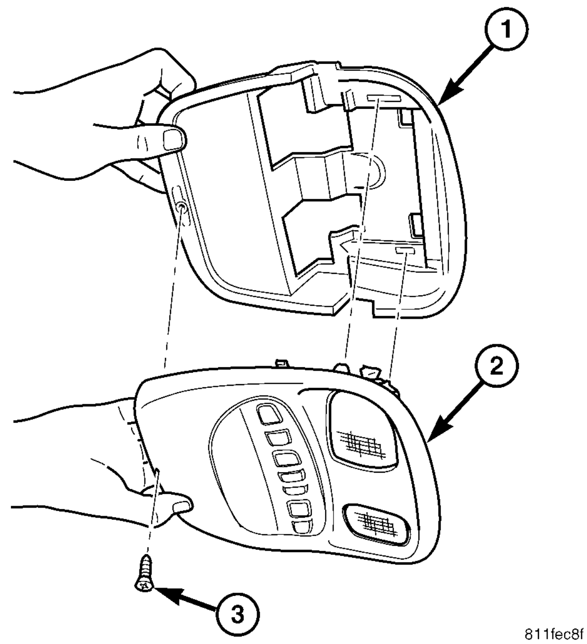
from an RKE transmitter. When No is selected, no horn chirp will occur with the RKE Lock event. This feature may be selected independent of the **FLASH LIGHTS WITH LOCKS?** programmable feature.

- **FLASH LIGHTS WITH LOCKS?** - The options include Yes and No. The default is Yes. When Yes is selected, a single flash of the hazard warning lamps will provide an optical confirmation when the RKE receiver recognizes a valid Lock signal from an RKE transmitter, and two flashes of the same lamps will occur when the RKE receiver recognizes a valid Unlock signal from an RKE transmitter. When No is selected, no lamp flash will occur with the RKE Lock or Unlock event. This feature may be selected independent of the **SOUND HORN ON LOCK?** programmable feature.
- **HEADLAMP DELAY =** - The options include Off, 30 Sec, 60 Sec, and 90 Sec. The default is 90 Sec. When a time interval is selected, the headlamps will remain on for that length of time when the headlamps are turned off after the ignition is turned off, or if the Auto mode is selected on vehicles with the Auto Headlamps option. When Off is selected, the headlamp delay feature is disabled.
- **SERVICE INTERVAL =** - The options will vary depending on the market and engine: **US/GAS engine** - the options include from 2000 to 6000 miles in 500 mile increments (3200 to 9600 kilometers in 800 kilometer increments). The default is 6000 miles (9600 kilometers). The selected distance becomes the interval at which the Perform Service warning message will be displayed by the EVIC. **EXPORT/GAS engine** - the options include from 2000 to 7500 miles in 500 mile increments (3200 to 12000 kilometers in 800 kilometer increments). The default is 7500 miles (12000 kilometers). The selected distance becomes the interval at which the Perform Service warning message will be displayed by the EVIC. **EXPORT/DIESEL engine** - the options include 3125, 6250, 9375, 12500 miles ( 5, 10, 15, 20 kilometers). The default is 12500 miles (20 kilometers). The selected distance becomes the interval at which the Perform Service warning message will be displayed by the EVIC. If a new distance is selected, a second programmable feature appears, **RESET SERVICE DISTANCE?** - The options include No and Yes. The default is Yes. When Yes is selected, the accumulated distance since the last previous Perform Service warning message will be reset to zero because the service interval has been changed. When No is selected, the distance until the next Perform Service warning message is reduced by the accumulated distance since the last previous message.
- **TRAIN REMOTE -** When this feature is selected the driver can choose to train up to four remote keyless entry transmitters. The options include Yes and No. The default is No. When Yes is selected and the MENU button is pressed the EVIC will display “PRESS A VALID FOB KEY”. Follow the directions displayed in the EVIC, you have approximately 30 seconds to train each transmitter, after each transmitter is trained the EVIC will display “FOB #? TRAINED”.
- **RETRAIN TIRE SENSORS** - This programmable feature only applies to vehicles equipped with the optional Tire Pressure Monitoring System. The options include Yes and No. The default is No. When Yes is selected, and the MENU button is depressed, the EVIC will enter the training mode starting with the left front tire. Refer to the tires and wheels section for additional information.

## REMOVAL

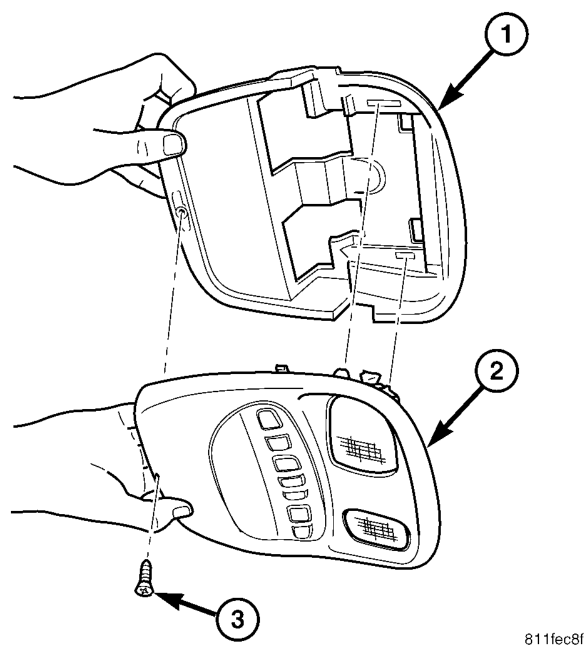
### OVERHEAD CONSOLE - REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the overhead console retaining screw (3) , located in the front of console (2) near the windshield.
3. Using your fingertips, grasp the sides of the overhead console (2) and pull straight down evenly to disengage the two snap clips at the rear of the unit.
4. Lower the overhead console far enough to access the wire harness connectors.
5. Disconnect the Electronic Overhead Module (EOM), courtesy lamps and power sunroof switch electrical connectors, if equipped.
6. Remove the overhead console (2) assembly from the vehicle.

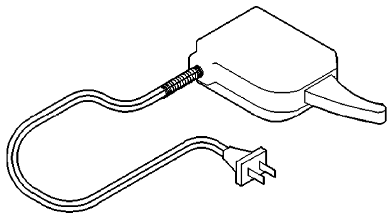



## INSTALLATION

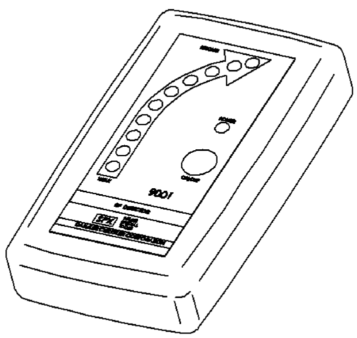
1. Position the overhead console (2) in the vehicle and connect the wire harness connectors.
2. Connect the Electronic Overhead Module (EOM), courtesy lamps and power sunroof switch electrical connectors, if equipped.
3. Grasp the sides of the overhead console (2) and push straight up evenly to engage the two snap clips at the rear of the unit.
4. Install the overhead console retaining screw (3), located in the front of console near the windshield. Torque the screw to 1 N·m (10 in. lbs.).
5. Connect the battery negative cable.



## SPECIAL TOOLS



*Degaussing Tool 6029*



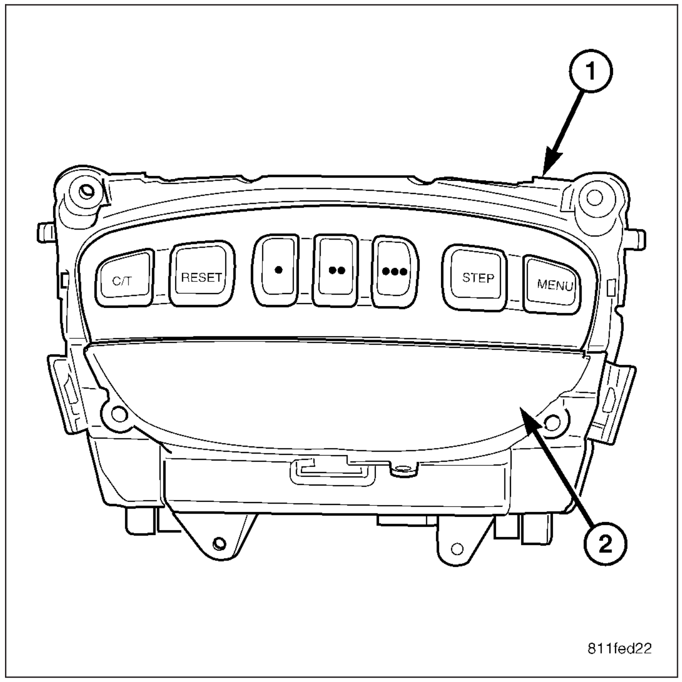

*Radio Frequency Detector 9001*

# ELECTRONIC VEHICLE INFO CENTER

## DESCRIPTION

The Electronic Overhead Module (EOM)(1) is located in the overhead console on some models. The EOM features a large Vacuum Fluorescent Display (VFD) screen (2) for displaying information, and back-lit push button function switches labeled C/T (compass/temperature), RESET, STEP, and MENU.

The EOM contains a central processing unit and interfaces with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, reduce internal controller hardware, and reduce component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities.




The Electronic Vehicle Information Center (EVIC) includes the following display options:

- **Average Fuel Economy** - provides the average fuel economy the vehicle is achieving.
- **Distance To Empty** - provides the approximate distance the vehicle can be driven on the current fuel level.
- **Trip Odometer** - shows the accumulated miles since the last trip computer reset.
- **Elapsed time** - shows the accumulated ignition-on time since the last trip computer reset.
- **Service Mileage** - shows the distance remaining until the next scheduled service interval.
- **Individual Tire Pressure** - shows the current individual tire air pressures.
- **Blank** - the EVIC computer VF display is turned off.

The EVIC “Menu” push button provides the vehicle operator with a user interface, which allows the selection of several optional customer programmable electronic features to suit individual preferences.

If the vehicle is equipped with the optional Universal Transmitter, the EVIC will also display messages and an icon indicating when the Universal Transmitter is being trained, which of the three transmitter buttons is transmitting, and when the transceiver is cleared.

Data input for all EVIC functions, including VFD dimming level, is received through PCI data bus messages. The EOM uses its internal programming and all of its data inputs to calculate and display the requested data. If the data displayed is incorrect, perform the self-diagnostic tests as described in this group. If these tests prove inconclusive, the use of a scan tool and the proper Diagnostic Procedures manual are recommended for further testing of the EOM and the PCI data bus.

The EOM cannot be repaired, and is available for service only as a unit. This unit includes the push button switches and the plastic module. If any of these components is faulty or damaged, the complete EOM must be replaced. The incandescent bulbs used for EVIC push button back-lighting and the lens are available for service replacement.

## DESCRIPTION - COMPASS

While in the compass/temperature mode, the compass will display the direction in which the vehicle is pointed using the eight major compass headings (Examples: north is N, northeast is NE). The self-calibrating compass unit requires no adjusting in normal use. The only calibration that may prove necessary is to drive the vehicle in three complete circles at 5 to 8 km/h (3 to 5 mp/h), on level ground, in not less than forty-eight seconds. This will reorient the compass unit to its vehicle.

The compass unit also will compensate for magnetism the body of the vehicle may acquire during normal use. However, avoid placing anything magnetic directly on the roof of the vehicle. Magnetic mounts for an antenna, a repair order hat, or a funeral procession flag can exceed the compensating ability of the compass unit if placed on the roof panel. Magnetic bit drivers used on the fasteners that hold the overhead console assembly to the roof header can also affect compass operation. If the vehicle roof should become magnetized, the demagnetizing and calibration procedures found in this group may be required to restore proper compass operation.

### DESCRIPTION - TEMPERATURE

The temperature displays the outside ambient temperature in whole degrees. The temperature display can be toggled from Fahrenheit to Celsius by selecting the desired U.S./Metric option from the customer programmable features, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - STANDARD PROCEDURE - ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING). The displayed temperature is not an instant reading of conditions, but an average temperature. It may take the thermometer display several minutes to respond to a major temperature change, such as driving out of a heated garage into winter temperatures.

When the ignition switch is turned to the Off position, the last displayed temperature reading stays in the EOM unit memory. When the ignition switch is turned to the On position again, the EOM will display the memory temperature for one minute; then update the display to the current average temperature reading within five minutes if temperature is less than memory.

The temperature function is supported by an ambient temperature sensor. The sensor is mounted outside the passenger compartment near the front and center of the vehicle, and is hard wired to the Powertrain Control Module (PCM). The PCM sends temperature status messages to the EOM over the PCI data bus network. The ambient temperature sensor is available as a separate service item.

## OPERATION

The EVIC has access to both non-switched and ignition switched sources of battery current so that some of its features remain operational at any time, while others may only operate with the ignition switch in the On position. When the ignition switch is turned to the On position, the EVIC module VFD will return to the last function being displayed before the ignition was turned to the Off position.

The compass/temperature display is the normal EVIC display. With the ignition switch in the On position, momentarily depressing and releasing the C/T (compass/temperature) push button switch will cause the EVIC to return to the compass/temperature display mode from any other mode. While in the compass/temperature display mode, momentarily depressing and releasing the Step push button will step through the available trip computer display options.

The EVIC trip computer features several functions that can be reset. The functions that can be reset are: average fuel economy, trip odometer and elapsed time. With the ignition switch in the On position and with one of the functions of the trip computer that can be reset currently displayed, depressing the Reset push button twice within three seconds will perform a global reset, and all of the trip computer information that can be reset will be reset. With the ignition switch in the On position and the function that is to be reset currently displayed, momentarily depressing and releasing the Reset push button once will perform a local reset, and only the value of the displayed function will be reset to zero. A global or local reset will only occur if the function currently displayed is a function that can be reset. The distance to service function can also be reset by pressing and holding the RESET button for 1 second. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Standard Procedures section of this group for more information on setting the Service Interval.

For more information on the features, control functions and setting procedures for the EVIC module, see the owner's manual in the vehicle glove box.

## DIAGNOSIS AND TESTING - ELECTRONIC VEHICLE INFORMATION CENTER

If the problem with the EVIC is an inaccurate or scrambled display, refer to **Self-Diagnostic Test** later in this section. If the problem with the EVIC is incorrect Vacuum Fluorescent Display (VFD) dimming levels, use a DRB scan tool and the proper Diagnostic Procedures manual to test for the correct dimming message inputs being received from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus. If the problem is a no-display condition, use the following procedures. For complete circuit diagrams, refer to **Overhead Console** in Wiring Diagrams.

1. Press the C/T button.

2. Check the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
3. Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the fused B(+) fuse in the PDC as required.
4. Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 5. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
5. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 6. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.
6. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the overhead console. Check for continuity between the ground circuit cavity of the roof wire harness connector for the EVIC module and a good ground. There should be continuity. If OK, go to Step 7. If not OK, repair the open ground circuit to ground as required.
7. Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the roof wire harness connector for the EVIC module. If OK, go to Step 8. If not OK, repair the open fused B(+) circuit to the fused B(+) fuse in the junction block as required.
8. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the roof wire harness connector for the EVIC module. If OK, refer to **Self-Diagnostic Test** in the Diagnosis and Testing section of this group for further diagnosis of the EVIC module and the PCI data bus. If not OK, repair the open fused ignition switch output (run/start) circuit to the fuse in the junction block as required.

## SELF-DIAGNOSTIC TEST

A self-diagnostic test is used to determine that the EVIC module is operating properly, and that all PCI data bus messages are being received for initial operation. Initiate the self-diagnostic test as follows:

1. With the ignition switch in the Off position, simultaneously depress and hold the **C/T button** and the **Reset button**.
2. Turn the ignition switch to the On position.
3. Continue to hold both buttons depressed until the EVIC software version information is displayed, then release both buttons.
4. Following completion of these tests, the EVIC module will display one of the following messages:

a. **PASS SELF TEST** - Momentarily depress and release the Reset button to return to the compass/temperature/trip computer display mode. The EVIC module is working properly.

b. **FAILED SELF TEST** - The EVIC module has an internal failure. The EVIC module is faulty and must be replaced.

c. **NOT RECEIVING J1850 MESSAGE** - The EVIC module is not receiving proper message input through the PCI data bus. This can result from one or more faulty electronic modules in the vehicle, or from a faulty PCI data bus. The use of a DRB scan tool and the proper Diagnostic Procedures manual are required for further diagnosis.

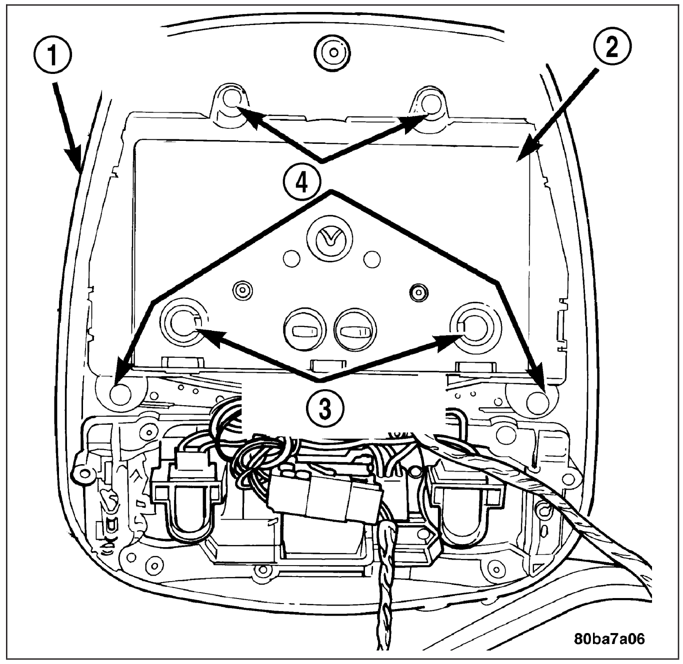
**NOTE: If the compass functions, but accuracy is suspect, it may be necessary to perform a variation adjustment. This procedure allows the compass unit to accommodate variations in the earth's magnetic field strength, based on geographic location. Refer to Compass Variation Adjustment in the Service Procedures section of this group.**

**NOTE: If the compass reading displays a blank, and only "CAL" appears in the display, demagnetizing may be necessary to remove excessive residual magnetic fields from the vehicle. Refer to Compass Demagnetizing in the Service Procedures section of this group.**

## REMOVAL

**NOTE: If the evic module is being replaced, the tire pressure monitoring system must be programmed. Refer to the tires/wheels section of this manual for detailed instructions.**

1. Disconnect and isolate the battery negative cable.
2. Remove the overhead console from the headliner, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
3. Remove the four screws (4) that secure the Electronic Overhead Module (EOM) (2) to the overhead console housing (1).
4. Remove the EOM (2) from the overhead console housing (1).

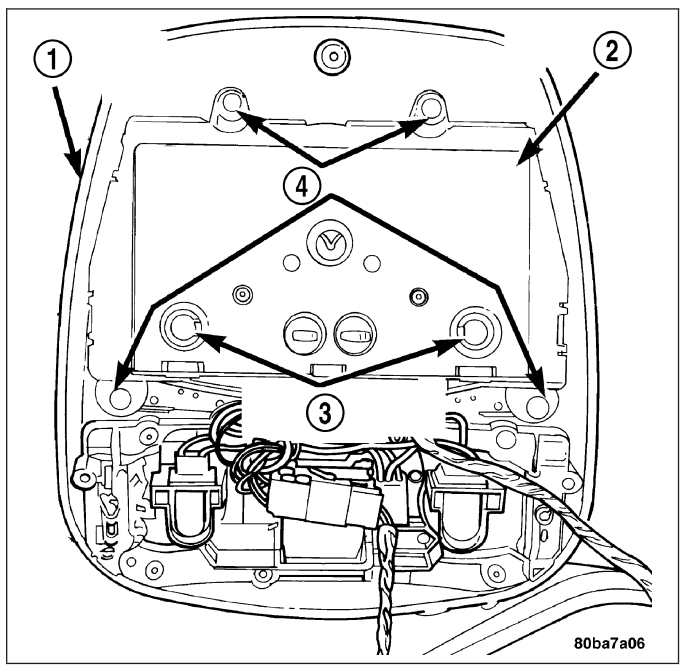



## INSTALLATION

**NOTE: If a new Electronic Overhead Module (EOM) has been installed, the compass will have to be calibrated and the variance set. Refer to compass variation adjustment and compass calibration in the standard procedures section of this group for detailed instructions.**

**NOTE: If a new Electronic Overhead Module (EOM) has been installed, the tire pressure sensors will have to be reprogrammed. Refer to the tires/wheels section of this manual for detailed instructions.**

1. Position the Electronic Overhead Module (EOM) (2) onto the overhead console housing (1).
2. Install the four screws (4) that secure the EOM (2) to the overhead console housing (1). Tighten the screws to 1 N·m (8 in. lbs.).
3. Install the overhead console (1) onto the headliner, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION).
4. Reconnect the battery negative cable.



# UNIVERSAL TRANSMITTER

## DESCRIPTION

On some KJ models a Universal Transmitter transceiver is standard factory-installed equipment. The universal transmitter transceiver is integral to the Electronic Vehicle Information Center Computer (EVIC), which is located in the overhead console. The only visible component of the universal transmitter are the three center transmitter push buttons centered between the four EVIC push buttons located just rearward of the EVIC display screen in the overhead console. The three universal transmitter push buttons are identified with one, two or three light indicators so that they be easily identified by sight.

Each of the three universal transmitter push buttons controls an independent radio transmitter channel. Each of these three channels can be trained to transmit a different radio frequency signal for the remote operation of garage door openers, motorized gate openers, home or office lighting, security systems or just about any other device that can be equipped with a radio receiver in the 286 to 399 MegaHertz (MHz) frequency range for remote operation. The universal transmitter is capable of operating systems using either rolling code or non-rolling code technology.

The EVIC module displays messages and a small house-shaped icon with one, two or three dots corresponding to the three transmitter buttons to indicate the status of the Universal Transmitter.

The Universal Transmitter cannot be repaired, and is available for service only as a unit with the EVIC module. This unit includes the push button switches and the plastic module and display lens. If any of these components is faulty or damaged, the complete EVIC module must be replaced.

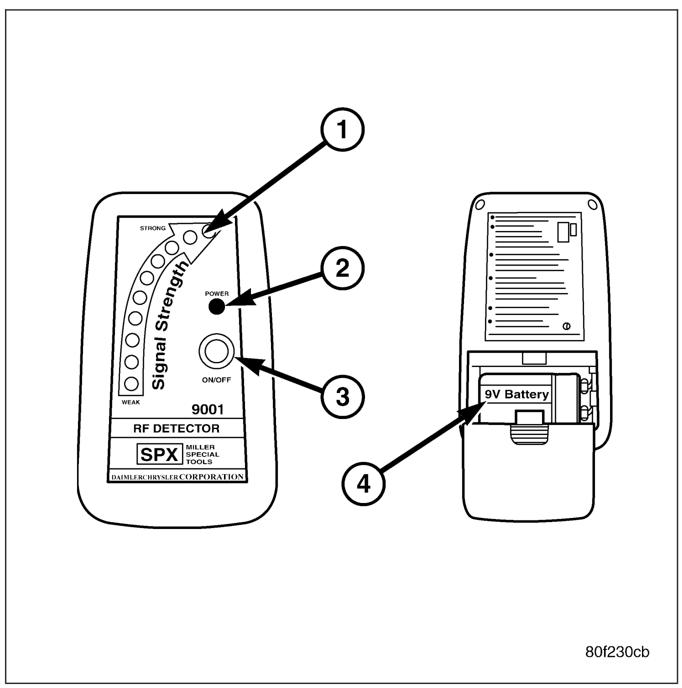
## OPERATION

The universal transmitter operates on a non-switched source of battery current so the unit will remain functional, regardless of the ignition switch position. For more information on the features, programming procedures and operation of the universal transmitter, see the owner's manual in the vehicle glove box.

## DIAGNOSIS AND TESTING - UNIVERSAL TRANSMITTER

If the Universal Transmitter is inoperative, but the Electronic Vehicle Information Center Computer (EVIC) is operating normally, see the owner's manual in the vehicle glove box for instructions on training the universal transmitter. Retrain the universal transmitter with a known good transmitter as instructed in the owner's manual and test the universal transmitter operation again. If the unit is still inoperative, test the universal transmitter with Radio Frequency Detector special tool as described below:

1. Turn the Radio Frequency (RF) Detector ON (3). A “chirp” will sound and the green power LED (2) will light. If the green LED does not light, replace the battery (4).
2. Hold the RF detector within one inch of the TRAINED universal transmitter and press any of the transmitters buttons.
3. The red signal detection LEDs (1) will light and the tool will beep if a radio signal is detected. Repeat this test three times.




If both the universal transmitter and the Electronic Overhead Module (EOM) are inoperative, (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE/ELECTRONIC VEHICLE INFO CENTER - DIAGNOSIS AND TESTING) for further diagnosis. For complete circuit diagrams, refer to **Wiring Diagrams**.

# STANDARD PROCEDURE

## STANDARD PROCEDURE - ERASING TRANSMITTER CODES

To erase **all** universal transmitter codes, simply hold down buttons 1 and 3 until the two green dots below the house symbol begin to flash and “CHANNELS CLEARED” is displayed.

**NOTE: Individual channels cannot be erased. Erasing the transmitter codes will erase ALL programmed codes.**

## STANDARD PROCEDURE - PROGRAMMING TRANSMITTER CODES

**WARNING: Before programming the universal transmitter to a garage door opener or gate operator, make sure that people and objects are out of the way of the device to prevent potential harm or damage. When programming a garage door opener, it is advised to park outside of the garage. Do not use universal transmitter with any garage door opener that lacks safety stop and reverse features as required by U.S. federal safety standards (this includes any garage door opener model manufactured before April 1, 1982). A garage door that cannot detect an object - signaling the door to stop and reverse - does not meet current U.S. federal safety standards.**

**WARNING: Your motorized door or gate will open and close while you are programming. Do not program the universal transmitter if people or pets are in the path of the door or gate. A moving door or gate can cause serious injury or death to people and pets or damage to objects.**

**NOTE: It is recommended that a new battery be placed in the hand-held transmitter of the device being programmed to the universal transmitter for quicker training and accurate transmission of the radio frequency signal.**

1. Turn off the engine.
2. Erase the factory test codes by pressing buttons 1 and 3. Release the buttons when the two green lights begin to flash (about 20 seconds).
3. Choose one of the three buttons to train. Position the end of your hand-held transmitter 1-3 inches (5-14 cm) away from the lower left corner of the EVIC display while keeping the display in view.
4. Simultaneously press and hold both the desired Transmitter button and the hand-held transmitter button. After a short time, the message TRAINING will show on Transmitter display. **Do not release the buttons until the message TRAINED appears on the display (this may take as long as 60 seconds), release both the Transmitter and hand-held transmitter buttons.**
5. Press and hold the just-trained Transmitter button. TRANSMIT should appear on the display. If your device activates when the Transmitter button is depressed and released, programming is complete. To train the other buttons, repeat the process. Be sure to keep your hand-held transmitter in case you need to retrain the universal transmitter.

**NOTE: If the message TRANSMIT appears on the Transmitter display but your device does not activate, the device may be equipped with a ″rolling code″ system. Continue with steps six through eight below to complete the programming of a rolling code equipped device (most commonly a garage door opener).**

6. At the garage door opener receiver (motor-head unit) in the garage, locate the ″learn″ or ″smart″ button. This can usually be found where the hanging antenna wire is attached to the motor-head unit. Firmly press and release the ″learn″ or ″smart″ button. (The name and color of the button may vary by manufacturer.)

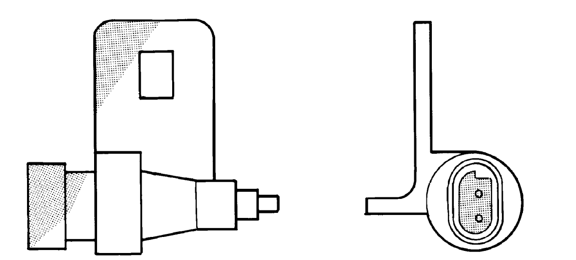
**NOTE: There are 30 seconds in which to initiate the next step.**

7. Return to the vehicle and firmly press, hold for two seconds and release the programmed Transmitter button. Repeat the ″press/hold/release″ sequence a second time, and, depending on the brand of the garage door opener (or other rolling code equipped device), repeat this sequence a third time to complete the programming process.
8. Transmitter should now activate your rolling code equipped device. To program the remaining two buttons, simply repeat the process.

# AMBIENT TEMP SENSOR

## DESCRIPTION

Ambient air temperature is monitored by the Electronic Overhead Module (EOM) through ambient temperature sensor messages received from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus network. The PCM receives a hard wired input from the ambient temperature sensor. The ambient temperature sensor is a variable resistor mounted in front the radiator, behind the grille, near the center of the vehicle.


938C-10

Refer to **Powertrain Control Module (PCM)** in Electronic Control Modules for more information. For complete circuit diagrams, refer to the Wiring information. The ambient temperature sensor cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

## OPERATION

The ambient temperature sensor is a variable resistor that operates on a five-volt reference sent to it by the Powertrain Control Module (PCM). The resistance in the sensor changes as temperature changes. This changes the temperature sensor return signal circuit voltage to the PCM. Based upon the resistance in the sensor, the PCM is programmed to correspond to a specific temperature. The PCM then sends the proper ambient temperature messages to the EVIC over the PCI data bus.

The thermometer function is supported by the ambient temperature sensor, a wiring circuit, the Powertrain Control Module (PCM), the Programmable Communications Interface (PCI) data bus, and a portion of the Electronic Vehicle Information Center (EVIC) Computer module.

The ambient temperature sensor circuit can also be diagnosed by referring to **Diagnosis and Testing - Ambient Temperature Sensor, and Diagnosis and Testing - Ambient Temperature Sensor Circuit**. If the temperature sensor and circuit are confirmed to be OK, but the temperature display is inoperative or incorrect, refer to **Diagnosis and Testing - Electronic Vehicle Information Center Computer** in this section. For complete circuit diagrams, refer to the Wiring information.

## DIAGNOSIS AND TESTING

## DIAGNOSIS AND TESTING - AMBIENT TEMPERATURE SENSOR

1. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the ambient temperature sensor wire harness connector.
2. Measure the resistance of the ambient temperature sensor. At room temperature (approx. 68°F), the sensor resistance should be between 10-13 Kilohms (10000-13000 ohms). The sensor resistance should be between these two values at 68°F. If OK, the sensor is OK at this time. If not OK, replace the faulty ambient temperature sensor.

## DIAGNOSIS AND TESTING - AMBIENT TEMPERATURE SENSOR CIRCUIT

1. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the ambient temperature sensor wire harness connector and the Powertrain Control Module (PCM) wire harness connector.
2. Connect a jumper wire between the two terminals in the body half of the ambient temperature sensor wire harness connector.
3. Check for continuity between the sensor return circuit and the ambient temperature sensor signal circuit cavities of the PCM wire harness connector. There should be continuity. If OK, go to Step 4. If not OK, repair the open sensor return circuit or ambient temperature sensor signal circuit to the ambient temperature sensor as required.
4. Remove the jumper wire from the body half of the ambient temperature sensor wire harness connector. Check for continuity between the sensor return circuit cavity of the PCM wire harness connector and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted sensor return circuit as required.

5. Check for continuity between the ambient temperature sensor signal circuit cavity of the PCM wire harness connector and a good ground. There should be no continuity. If OK, refer to **Diagnosis and Testing - Electronic Vehicle Information Center Computer** in this group. If not OK, repair the shorted ambient temperature sensor signal circuit as required.

## REMOVAL

1. Open hood, disconnect and isolate the negative battery cable.
2. Remove the grille from the vehicle.
3. Disconnect the ambient temperature sensor electrical connector.
4. Remove the ambient temperature sensor retaining screw and remove the sensor from the vehicle.

## INSTALLATION

1. Position the ambient temperature sensor and install the retaining screw.
2. Connect the ambient temperature sensor electrical connector.
3. Install the grille on the vehicle.
4. Connect the negative battery cable.

# POWER SYSTEMS

## TABLE OF CONTENTS



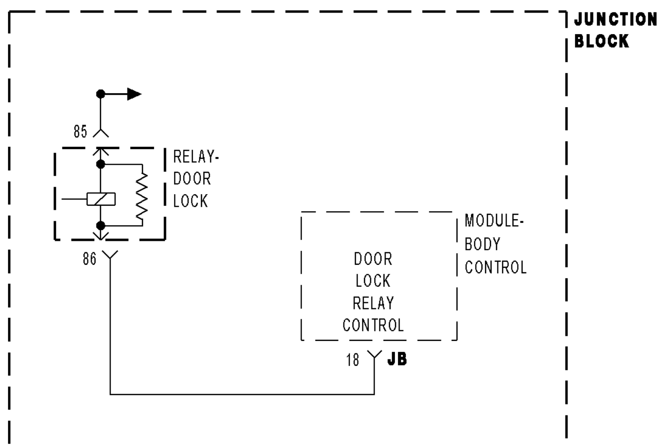
## POWER LOCKS - ELECTRICAL DIAGNOSTICS

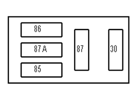
### TABLE OF CONTENTS

# POWER LOCKS - ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## DOOR LOCK RELAY CONTROL CIRCUIT OPEN OR SHORT TO GROUND




RELAY-
DOOR LOCK
(IN JUNCTION BLOCK)

8153c267

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  The BCM detects a low circuit on the Door Lock Relay Control circuit even though it is not attempting to lock the doors for more than 5 seconds. If the BCM is not grounding its side of the relay coil, the output should be high.

| Possible Causes |
| --- |
| RELAY OPEN OR SHORTED |
| JUNCTION BLOCK - DOOR LOCK RELAY CONTROL SHORT TO GROUND |
| JUNCTION BLOCK - DOOR LOCK RELAY CONTROL OPEN |
| BODY CONTROL MODULE - OPEN OR SHORTED |

## Diagnostic Test

### 1. CHECK TROUBLE CODE

**NOTE: If the door locks are totally inoperative, check fuse No. 6 before proceeding.**

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the door locks several times.

With the scan tool, read DTCs.

**Does the scan tool display DOOR LOCK RELAY CONTROL CIRCUIT OPEN OR SHORT TO GROUND?**

**Yes** >> Go To 2

**No** >> Problem is intermittent and not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors and repair as necessary. Ensure the relay is completely plugged in.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. CHECK FOR RELAY OPEN OR SHORTED

Turn the ignition off.

Remove the Door Lock Relay from the Junction Block.

Install a substitute relay in place of the Door Lock Relay.

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the Door Locks several times.

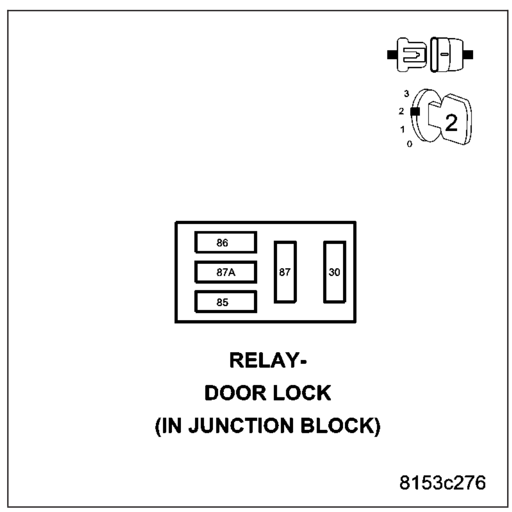
With the scan tool, read DTCs.

**Does the scan tool display DOOR LOCK RELAY CONTROL CIRCUIT OPEN/SHORT TO GROUND?**

**Yes** >> Go To 3

**No** >> Replace the original relay.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## 3. CHECK THE JUNCTION BLOCK FOR THE DOOR LOCK RELAY CONTROL CIRCUIT SHORT TO GROUND

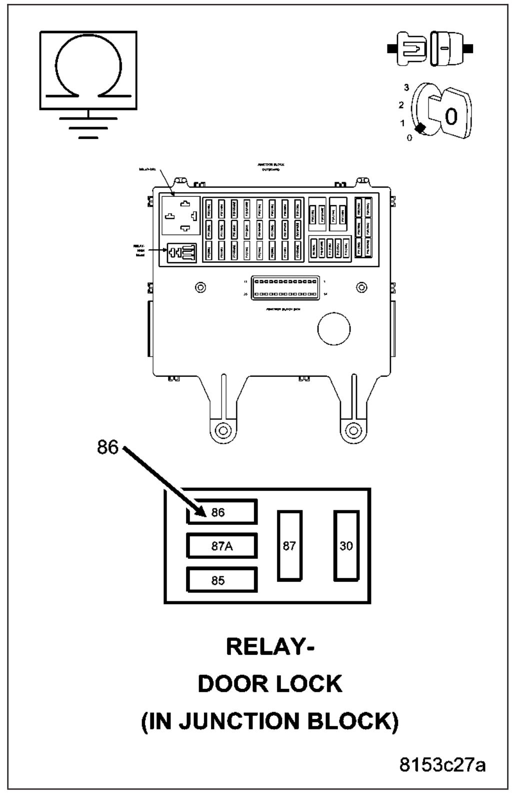
Turn the ignition off.

Remove the Door Lock Relay from the Junction Block.

Remove the Body Control Module from the Junction Block.

**NOTE: Ensure the Junction Block connectors are reconnected at this time.**

Measure the resistance between ground and the (P333) Door Lock Relay Control circuit in the relay connector of the Junction Block.




**Is the resistance below 100.0 ohms?**

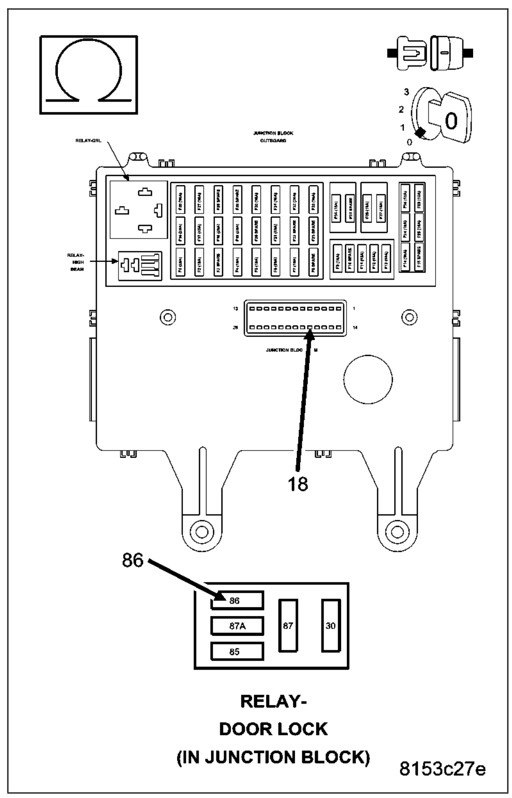
**Yes** >> Replace the Junction Block in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE JUNCTION BLOCK FOR THE DOOR LOCK RELAY CONTROL CIRCUIT OPEN

Measure the resistance of the (P333) Door Lock Relay Control circuit between the Relay connector and the Junction Block - BCM connector.




**Is the resistance below 2.0 ohms?**

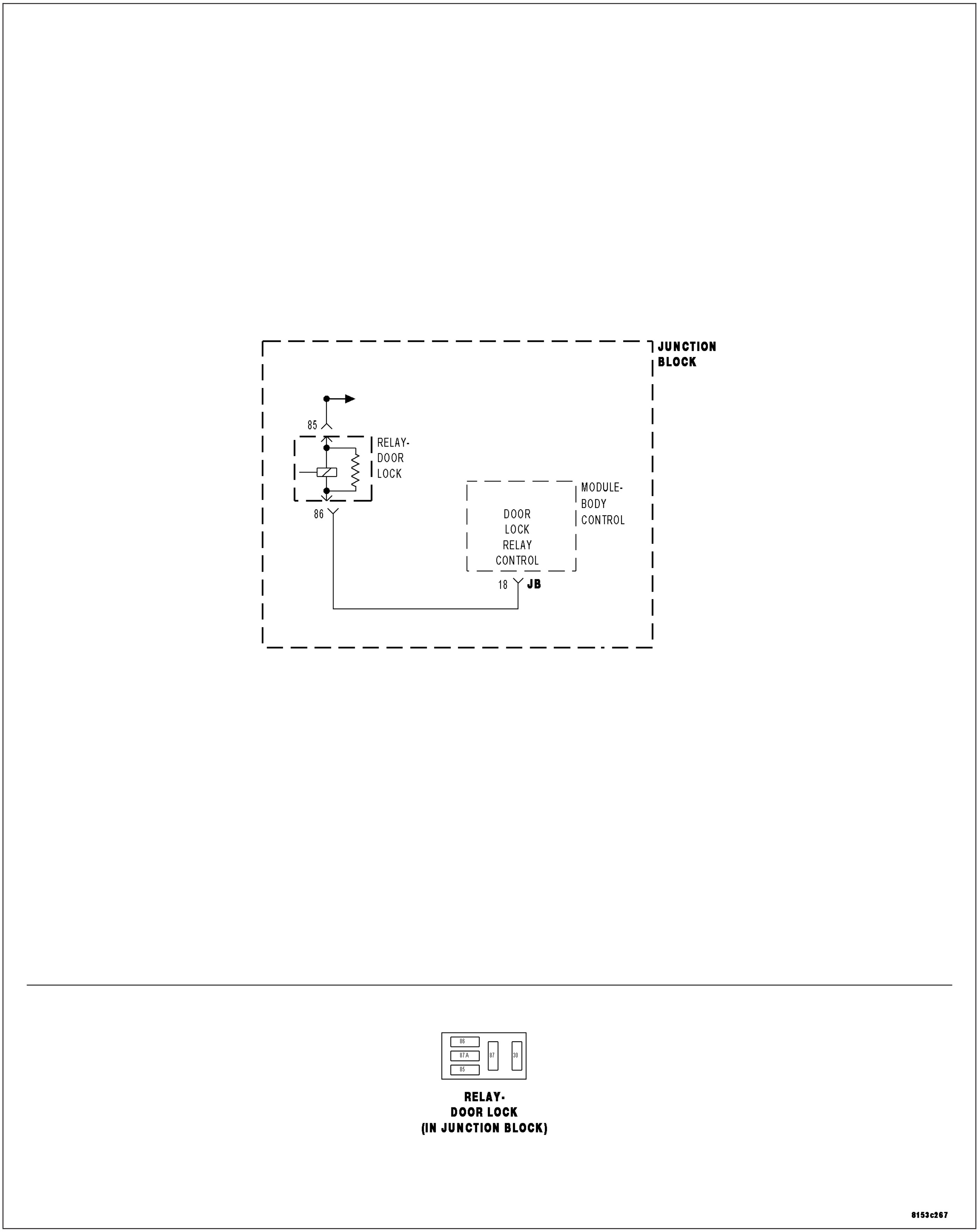
**Yes** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Junction Block.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## DOOR LOCK RELAY CONTROL CIRCUIT SHORT TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  The BCM detects a high circuit on the Door Lock Relay Control circuit when it is attempting to lock the doors for more than 5 seconds. If the BCM is not able to ground its side of the relay coil, the control circuit remains high.

| Possible Causes |
| --- |
| RELAY SHORTED |
| JUNCTION BLOCK - DOOR LOCK RELAY CONTROL SHORT TO VOLTAGE |
| BODY CONTROL MODULE - SHORTED |

## Diagnostic Test

### 1. CHECK TROUBLE CODE

**NOTE: If the door locks are totally inoperative, check fuse No. 6 before proceeding.**

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the door locks several times.

With the scan tool, read DTCs.

**Does the scan tool display DOOR LOCK RELAY CONTROL CIRCUIT SHORT TO VOLTAGE?**

**Yes** >> Go To 2

**No** >> Problem is intermittent and not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors and repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. CHECK FOR SHORTED RELAY

Turn the ignition off.

Remove the Door Lock Relay from the Junction Block.

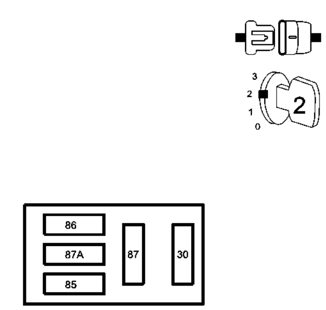
Install a substitute relay in place of the Door Lock Relay.

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the Door Locks several times.

With the scan tool, read DTCs.



RELAY-
DOOR LOCK
(IN JUNCTION BLOCK)
8153c276

**Does the scan tool display DOOR LOCK RELAY CONTROL CIRCUIT SHORT TO VOLTAGE?**

**Yes** >> Go To 3

**No** >> Replace the original relay.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 3. CHECK THE JUNCTION BLOCK FOR THE DOOR LOCK RELAY CONTROL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

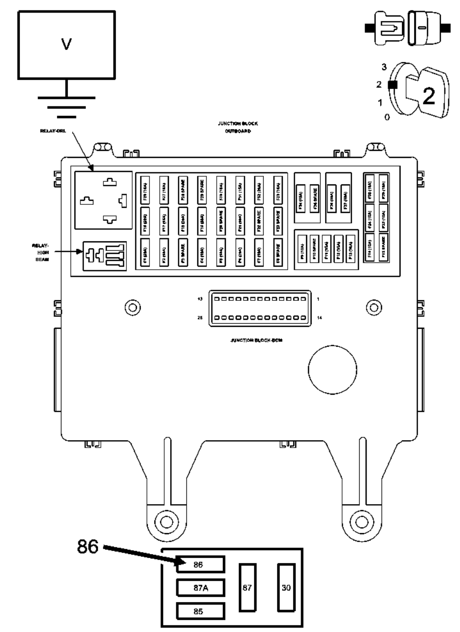
Remove the Door Lock Relay from the Junction Block.

Remove the Body Control Module from the Junction Block.

**NOTE: Ensure the Junction Block connectors are reconnected at this time.**

Turn the ignition on.

Measure the voltage between ground and the (P333) Door Lock Relay Control circuit in the relay connector of the Junction Block.



RELAY-
DOOR LOCK
(IN JUNCTION BLOCK)
81540dbe

**Is there any voltage present?**

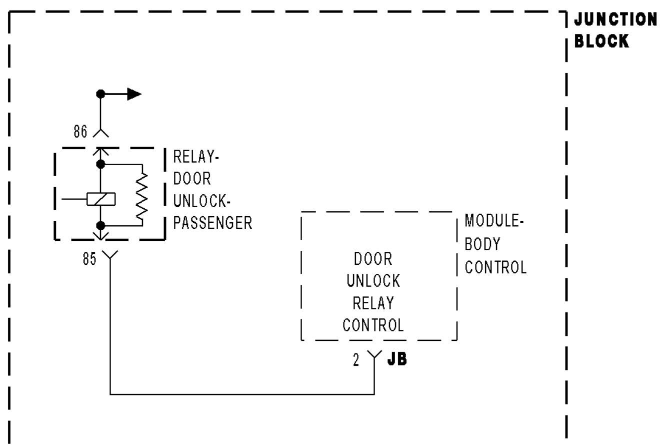
**Yes** >> Replace the Junction Block in accordance with service information.

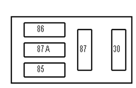
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Junction Block.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## DOOR UNLOCK RELAY CONTROL CIRCUIT OPEN OR SHORT TO GROUND




RELAY-
DOOR UNLOCK-PASSENGER
(IN JUNCTION BLOCK)

81541111

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  The BCM detects a low circuit on the Door Unlock Relay Control circuit even though it is not attempting to unlock the doors for more than 5 seconds. If the BCM is not grounding its side of the relay coil, the output should be high.

| Possible Causes |
| --- |
| RELAY OPEN OR SHORTED |
| JUNCTION BLOCK - DOOR UNLOCK RELAY CONTROL SHORT TO GROUND |
| JUNCTION BLOCK - DOOR UNLOCK RELAY CONTROL OPEN |
| BODY CONTROL MODULE - OPEN OR SHORTED |

## Diagnostic Test

### 1. CHECK TROUBLE CODE

**NOTE: If the door locks are totally inoperative, check fuse No. 6 before proceeding.**

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the door locks several times.

With the scan tool, read DTCs.

**Does the scan tool display DOOR UNLOCK RELAY CONTROL CIRCUIT OPEN OR SHORT TO GROUND?**

**Yes** >> Go To 2

**No** >> Problem is intermittent and not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors and repair as necessary. Ensure the relay is completely plugged in.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. CHECK FOR RELAY OPEN OR SHORTED

Turn the ignition off.

Remove the Door Unlock Relay from the Junction Block.

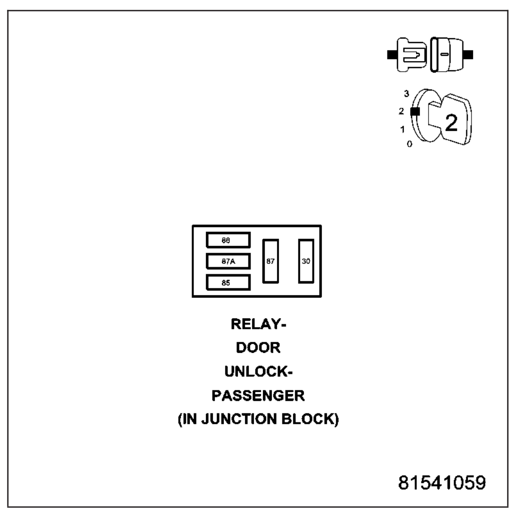
Install a substitute relay in place of the Door Unlock Relay.

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the Door Locks several times.

With the scan tool, read DTCs.




**Does the scan tool display DOOR UNLOCK RELAY CONTROL CIRCUIT OPEN/SHORT TO GROUND?**

**Yes** >> Go To 3

**No** >> Replace the original relay.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 3. CHECK THE JUNCTION BLOCK FOR THE DOOR UNLOCK RELAY CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Remove the Door Unlock Relay from the Junction Block.

Remove the Body Control Module from the Junction Block.

**NOTE: Ensure the Junction Block connectors are reconnected at this time.**

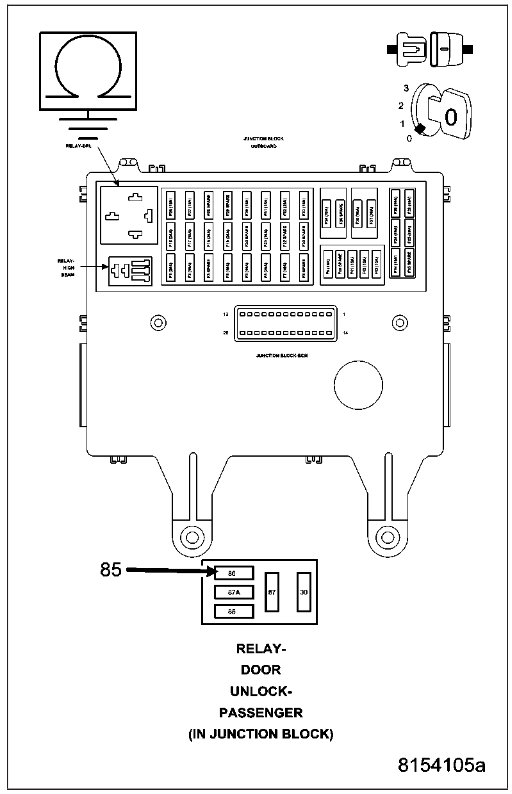
Measure the resistance between ground and the (P334) Door Unlock Relay Control circuit in the relay connector of the Junction Block.

**Is the resistance below 100.0 ohms?**

**Yes** >> Replace the Junction Block in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 4




## 4. CHECK THE JUNCTION BLOCK FOR THE DOOR UNLOCK RELAY CONTROL CIRCUIT OPEN

Measure the resistance of the (P334) Door Unlock Relay Control circuit between the Relay connector and the Junction Block - BCM connector.

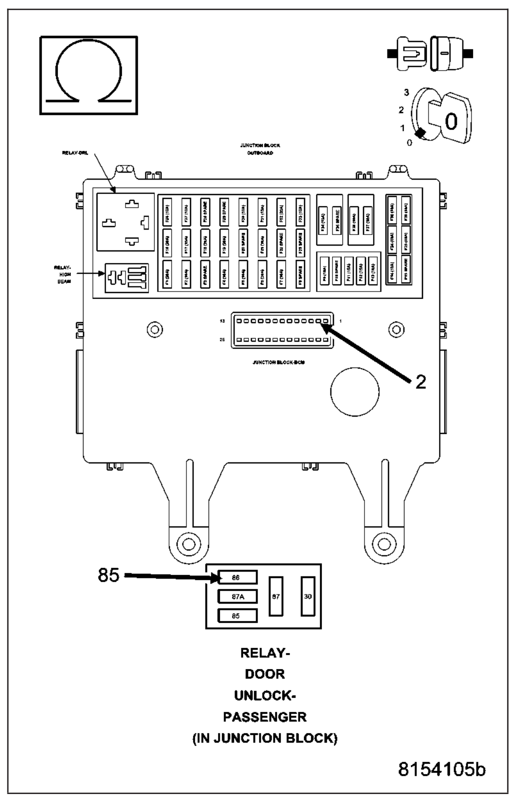
**Is the resistance below 2.0 ohms?**

**Yes** >> Replace the Body Control Module in accordance with service information.

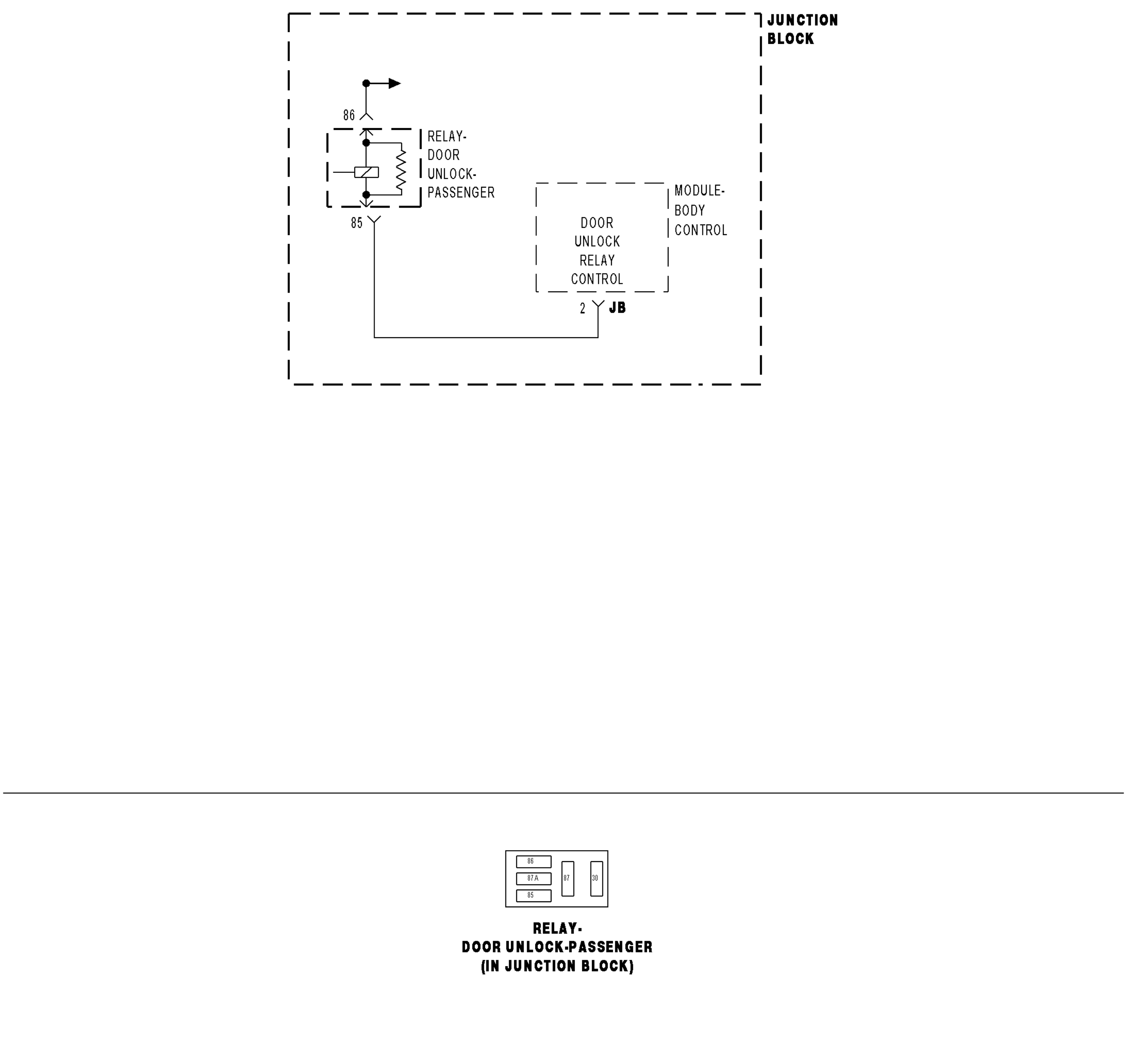
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Junction Block.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## DOOR UNLOCK RELAY CONTROL CIRCUIT SHORT TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  The BCM detects a high circuit on the Door Lock Relay Control circuit when it is attempting to lock the doors for more than 5 seconds. If the BCM is not able to ground its side of the relay coil, the control circuit remains high.

| Possible Causes |
|---|
| RELAY SHORTED |
| JUNCTION BLOCK - DOOR UNLOCK RELAY CONTROL SHORT TO VOLTAGE |
| BODY CONTROL MODULE - SHORTED |

## Diagnostic Test

### 1. CHECK TROUBLE CODE

**NOTE: If the door locks are totally inoperative, check fuse No. 6 before proceeding.**

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the door locks several times.

With the scan tool, read DTCs.

**Does the scan tool display DOOR UNLOCK RELAY CONTROL CIRCUIT SHORT TO VOLTAGE?**

**Yes** >> Go To 2

**No** >> Problem is intermittent and not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors and repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. CHECK FOR SHORTED RELAY

Turn the ignition off.

Remove the Door Unlock Relay from the Junction Block.

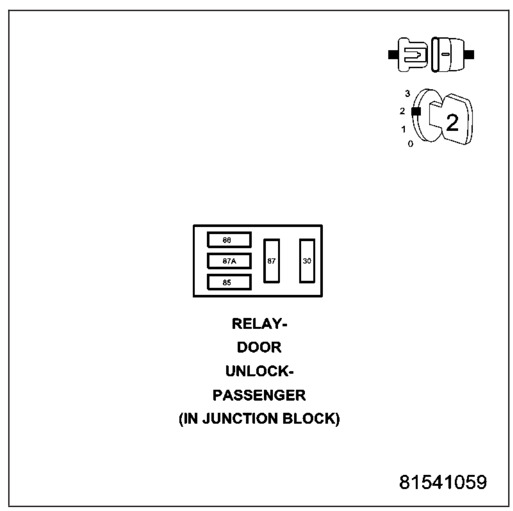
Install a substitute relay in place of the Door Unlock Relay.

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the Door Locks several times.

With the scan tool, read DTCs.




**Does the scan tool display DOOR UNLOCK RELAY CONTROL CIRCUIT SHORT TO VOLTAGE?**

**Yes** >> Go To 3

**No** >> Replace the original relay.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 3. CHECK THE JUNCTION BLOCK FOR THE DOOR UNLOCK RELAY CONTROL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

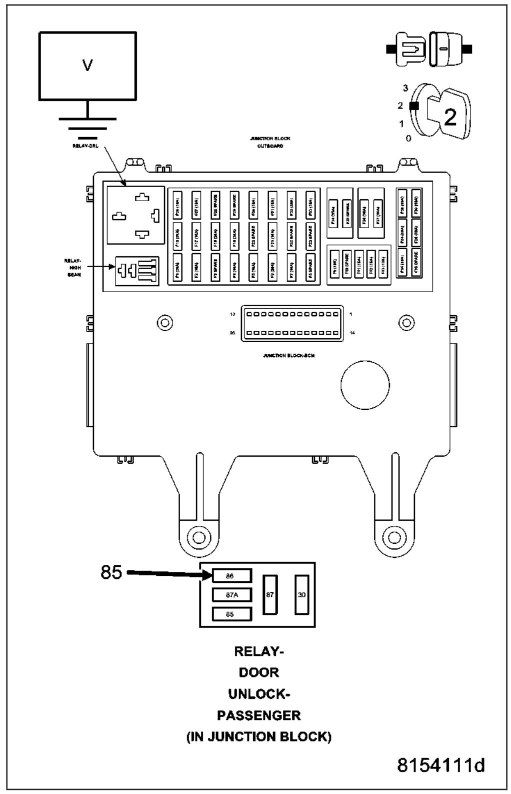
Remove the Door Unlock Relay from the Junction Block.

Remove the Body Control Module from the Junction Block.

**NOTE: Ensure the Junction Block connectors are reconnected at this time.**

Turn the ignition on.

Measure the voltage between ground and the (P334) Door Unlock Relay Control circuit in the relay connector of the Junction Block.




**Is there any voltage present?**

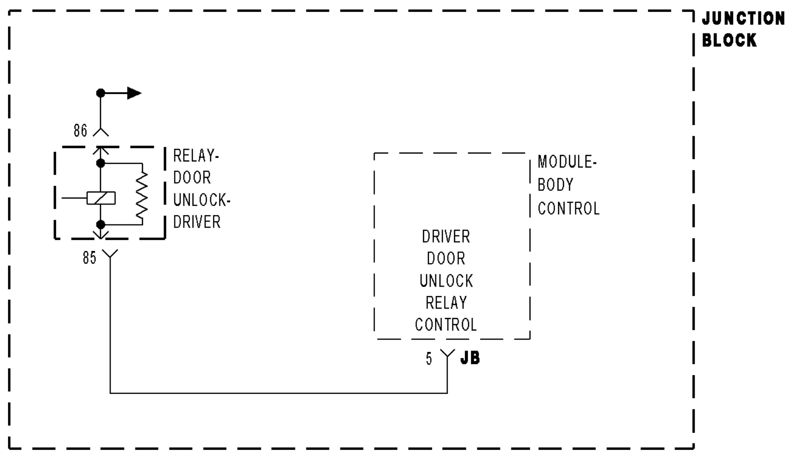
**Yes** >> Replace the Junction Block in accordance with service information.

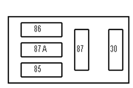
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Junction Block.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## DRIVER DOOR UNLOCK RELAY CONTROL CIRCUIT OPEN OR SHORT TO GROUND




RELAY-
DOOR UNLOCK-DRIVER
(IN JUNCTION BLOCK)

81541144

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  The BCM detects a low circuit on the Driver Door Unlock Relay Control circuit even though it is not attempting to unlock the doors for more than 5 seconds. If the BCM is not grounding its side of the relay coil, the output should be high.

| Possible Causes |
|---|
| RELAY OPEN OR SHORTED |
| JUNCTION BLOCK - DOOR UNLOCK RELAY CONTROL SHORT TO GROUND |
| JUNCTION BLOCK - DOOR UNLOCK RELAY CONTROL OPEN |
| BODY CONTROL MODULE - OPEN OR SHORTED |

## Diagnostic Test

### 1. CHECK TROUBLE CODE

**NOTE: If the door locks are totally inoperative, check fuse No. 6 before proceeding.**

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the door locks several times.

With the scan tool, read DTCs.

**Does the scan tool display DRIVER DOOR UNLOCK RELAY CONTROL CIRCUIT OPEN OR SHORT TO GROUND?**

**Yes** >> Go To 2

**No** >> Problem is intermittent and not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors and repair as necessary. Ensure the relay is completely plugged in.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. CHECK FOR RELAY OPEN OR SHORTED

Turn the ignition off.

Remove the Door Unlock Relay from the Junction Block.

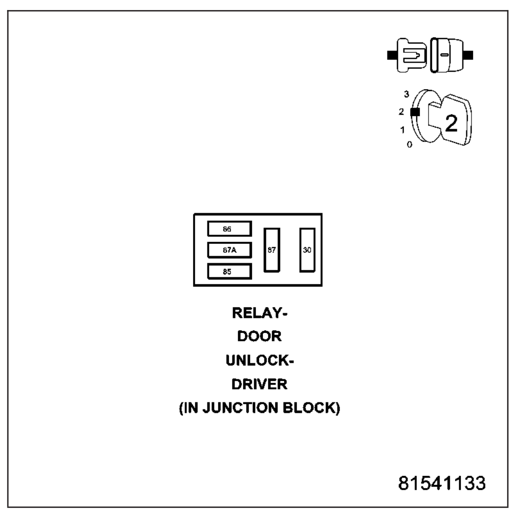
Install a substitute relay in place of the Door Unlock Relay.

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the Door Locks several times.

With the scan tool, read DTCs.




**Does the scan tool display DOOR UNLOCK RELAY CONTROL CIRCUIT OPEN/SHORT TO GROUND?**

**Yes** >> Go To 3

**No** >> Replace the original relay.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 3. CHECK THE JUNCTION BLOCK FOR THE (P109) DRIVER DOOR UNLOCK RELAY CONTROL CIRCUIT SHORT TO GROUND

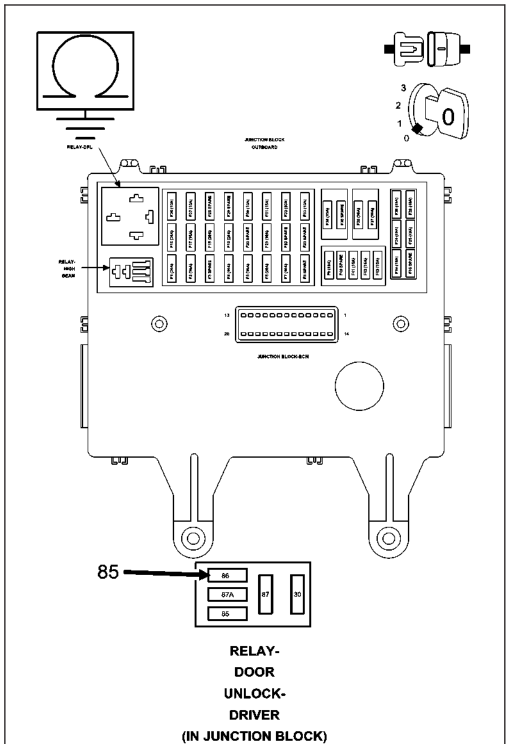
Turn the ignition off.

Remove the Door Unlock Relay from the Junction Block.

Remove the Body Control Module from the Junction Block.

**NOTE: Ensure the Junction Block connectors are reconnected at this time.**

Measure the resistance between ground and the (P109) Driver Door Unlock Relay Control circuit in the relay connector of the Junction Block.



81541134

**Is the resistance below 100.0 ohms?**

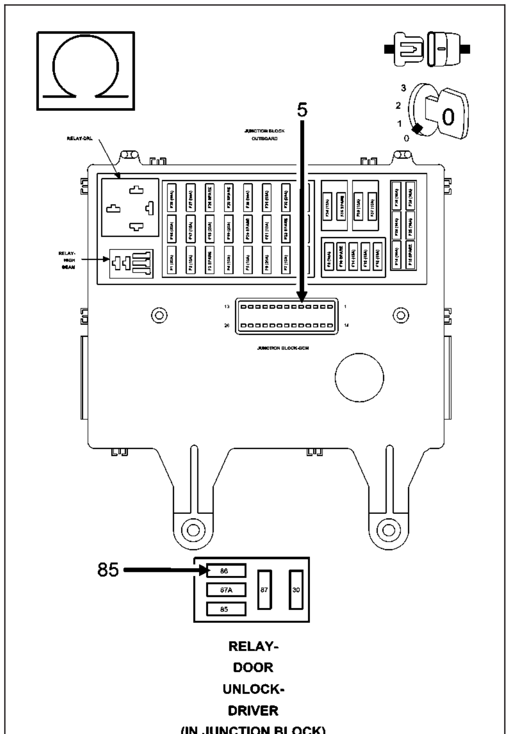
**Yes** >> Replace the Junction Block in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE JUNCTION BLOCK FOR THE (P109) DRIVER DOOR UNLOCK RELAY CONTROL CIRCUIT OPEN

Measure the resistance of the (P109) Driver Door Unlock Relay Control circuit between the Relay connector and the Junction Block - BCM connector.



81541135

**Is the resistance below 2.0 ohms?**

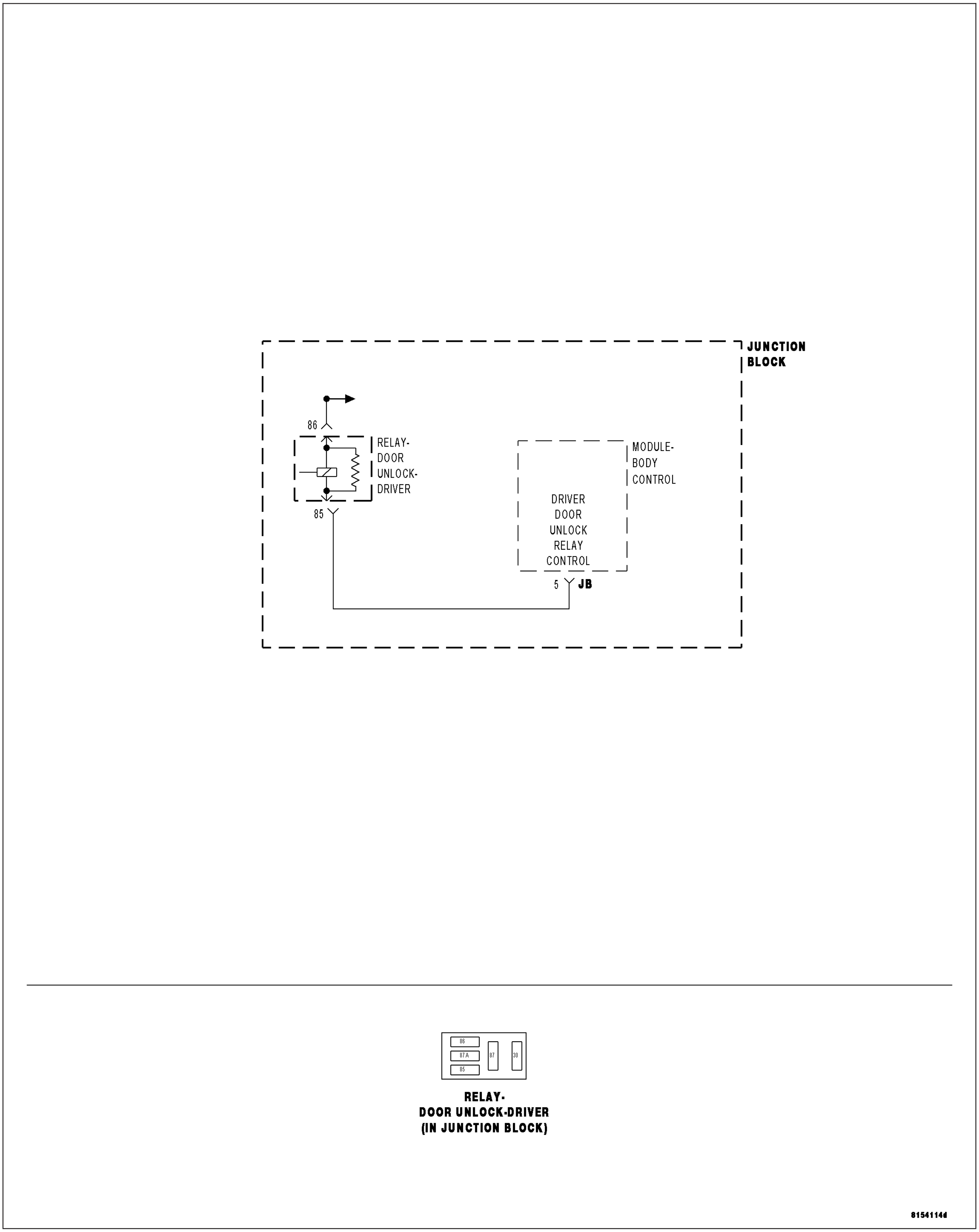
**Yes** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Junction Block.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## DRIVER DOOR UNLOCK RELAY CONTROL CIRCUIT SHORT TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  The BCM detects a high circuit on the Driver Door Unlock Relay Control circuit when it is attempting to Unlock the doors for more than 5 seconds. If the BCM is not able to ground its side of the relay coil, the control circuit remains high.

| Possible Causes |
| --- |
| RELAY SHORTED |
| JUNCTION BLOCK - DRIVER DOOR UNLOCK RELAY CONTROL SHORT TO VOLTAGE |
| BODY CONTROL MODULE - SHORTED |

## Diagnostic Test

### 1. CHECK TROUBLE CODE

**NOTE: If the door locks are totally inoperative, check fuse No. 6 before proceeding.**

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the door locks several times.

With the scan tool, read DTCs.

**Does the scan tool display DRIVER DOOR UNLOCK RELAY CONTROL CIRCUIT SHORT TO VOLTAGE?**

**Yes** >> Go To 2

**No** >> Problem is intermittent and not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors and repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. CHECK FOR SHORTED RELAY

Turn the ignition off.

Remove the Driver Door Unlock Relay from the Junction Block.

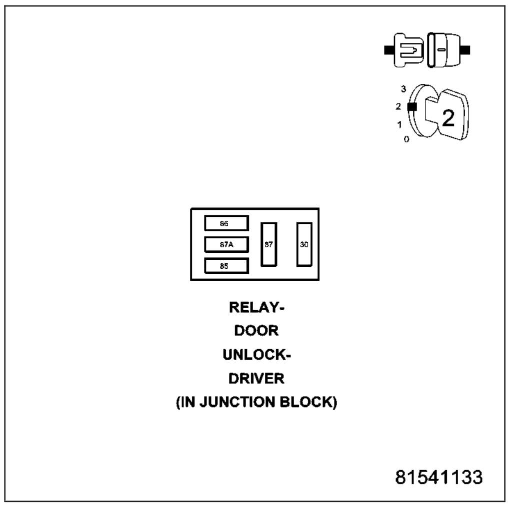
Install a substitute relay in place of the Driver Door Unlock Relay.

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the Door Locks several times.

With the scan tool, read DTCs.




**Does the scan tool display DRIVER DOOR UNLOCK RELAY CONTROL CIRCUIT SHORT TO VOLTAGE?**

**Yes** >> Go To 3

**No** >> Replace the original relay.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 3. CHECK THE JUNCTION BLOCK FOR THE (P109) DRIVER DOOR UNLOCK RELAY CONTROL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

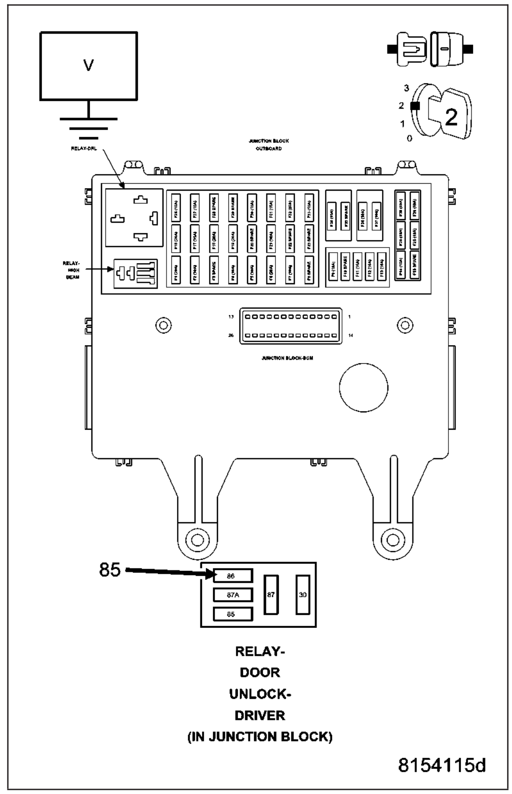
Remove the Driver Door Unlock Relay from the Junction Block.

Remove the Body Control Module from the Junction Block.

**NOTE: Ensure the Junction Block connectors are reconnected at this time.**

Turn the ignition on.

Measure the voltage between ground and the (P109) Driver Door Unlock Relay Control circuit in the relay connector of the Junction Block.




**Is there any voltage present?**

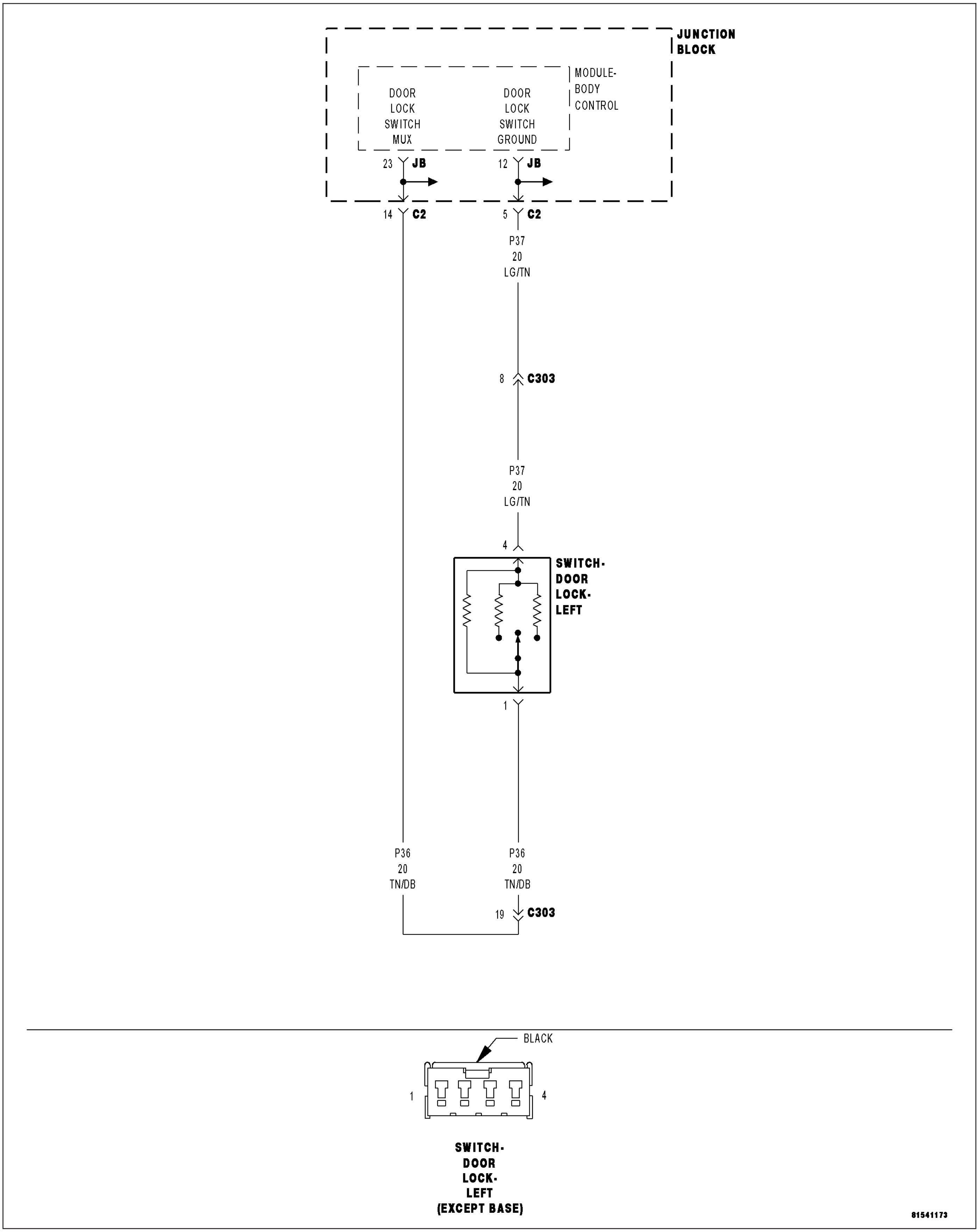
**Yes** >> Replace the Junction Block in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Junction Block.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## DOOR LOCK SWITCH OPEN OR SHORT TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the ignition is on.
- **Set Condition:**
  When the BCM detects a voltage of greater than 4.75 volts on the door lock switch mux input for over 5 seconds, this code will set. The normal voltage on the circuit is between 0.25 and 4.75 volts depending on switch positions. NOTE: Left and right switches are in parallel.

| Possible Causes |
|---|
| (P37) LEFT DOOR LOCK SWITCH GND WIRE OPEN |
| (P36) LEFT DOOR LOCK SWITCH MUX WIRE OPEN |
| (P36) LEFT DOOR LOCK SWITCH MUX WIRE SHORT TO VOLTAGE |
| (P37) RIGHT DOOR LOCK SWITCH GND WIRE OPEN |
| (P36) RIGHT DOOR LOCK SWITCH MUX WIRE OPEN |
| (P36) RIGHT DOOR LOCK SWITCH MUX WIRE SHORT TO VOLTAGE |
| LEFT DOOR LOCK SWITCH - OPEN |
| LEFT DOOR LOCK SWITCH - SHORTED |
| RIGHT DOOR LOCK SWITCH - OPEN |
| RIGHT DOOR LOCK SWITCH - SHORTED |
| JUNCTION BLOCK OPEN |
| BODY CONTROL MODULE - DOOR LOCK SWITCH MUX OPEN |

## Diagnostic Test

### 1. CHECK TROUBLE CODE

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the door locks several times from both door lock switches

With the scan tool read DTCs.

**Does the scan tool display DOOR LOCK SWITCH OPEN OR SHORT TO VOLTAGE?**

**Yes** >> Go To 2

**No** >> Problem is intermittent and not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors and repair as necessary.

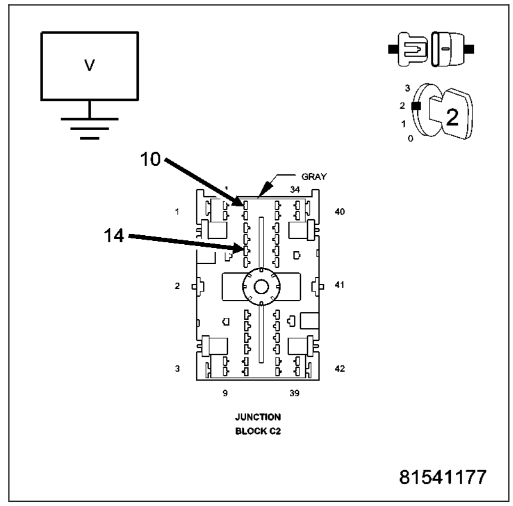
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 2. CHECK DOOR LOCK SWITCH MUX CIRCUIT FOR A SHORT TO VOLTAGE

Disconnect the Junction Block C2 connector.

Measure the voltage between ground and the (P36) Door Lock Switch Mux circuit cavity 14 in the C2 connector.

Measure the voltage between ground and the (P36) Door Lock Switch Mux circuit cavity 10 in the C2 connector.




**Which cavity had greater than 0.5 volts?**

**Cavity 14 - Left Door**
Go To 3

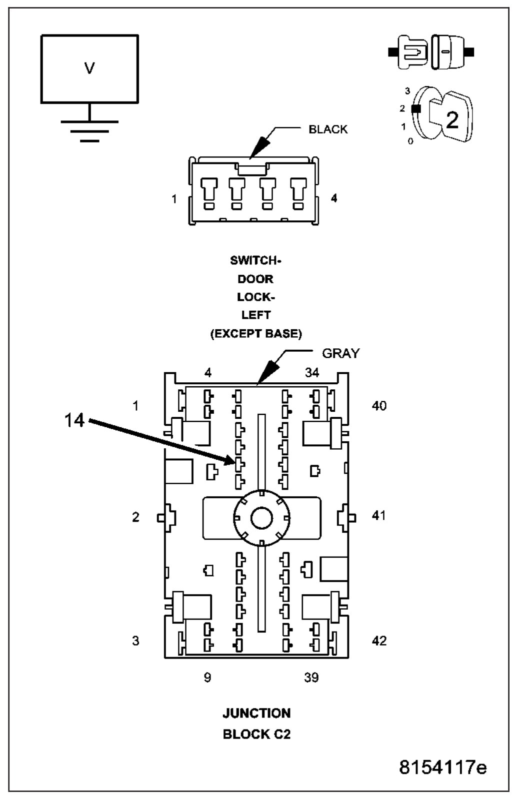
**Cavity 10 - Right Door**
Go To 4

**Neither circuit over 0.5 volts.**
Go To 5

## 3. CHECK LEFT DOOR LOCK SWITCH MUX WIRE FOR A SHORT TO VOLTAGE

Disconnect the Left Door Lock Switch connector.

Measure the voltage between ground and the (P36) Door Lock Switch Mux circuit cavity 14 in the JB-C2 connector.




**Is there any voltage present?**

**Yes** >> Repair the (P36) Door Lock Switch Mux wire for a short to voltage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

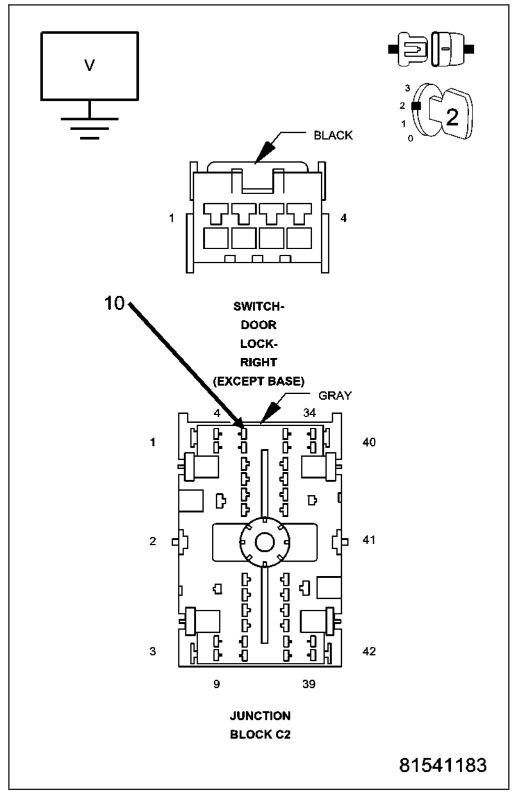
**No** >> Replace the Left Door Lock Switch.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 4. CHECK RIGHT DOOR LOCK SWITCH MUX WIRE FOR A SHORT TO VOLTAGE

Disconnect the Right Door Lock Switch connector.

Measure the voltage between ground and the (P36) Door Lock Switch Mux circuit cavity 10 in the JB-C2 connector.




**Is there any voltage present?**

**Yes** >> Repair the (P36) Door Lock Switch Mux wire for a short to voltage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Right Door Lock Switch.

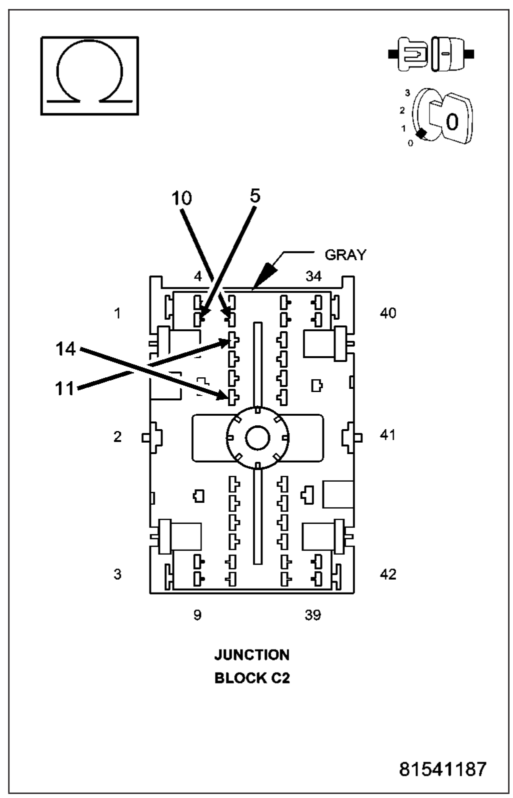
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 5. CHECK DOOR LOCK SWITCH MUX CIRCUIT FOR AN OPEN

Turn the ignition off.

Measure the resistance between the (P37) Door Lock Switch Ground cavity 5 and the (P36) Door Lock Switch Mux circuit cavity 10 in the JB-C2 connector.

Measure the resistance between the (P37) Door Lock Switch Ground cavity 11 and the (P36) Door Lock Switch Mux circuit cavity 14 in the JB-C2 connector.




**Which circuit was NOT between 4500 and 5500 ohms?**

**Cavities 5 & 10 - Right Door**
Go To 6

**Cavities 11 & 14 - Left Door**
Go To 8

**Both were approximately 5000 ohms.**
Go To 10

## 6. CHECK RIGHT DOOR LOCK SWITCH MUX WIRE FOR AN OPEN

Disconnect the Right Door Lock Switch connector.

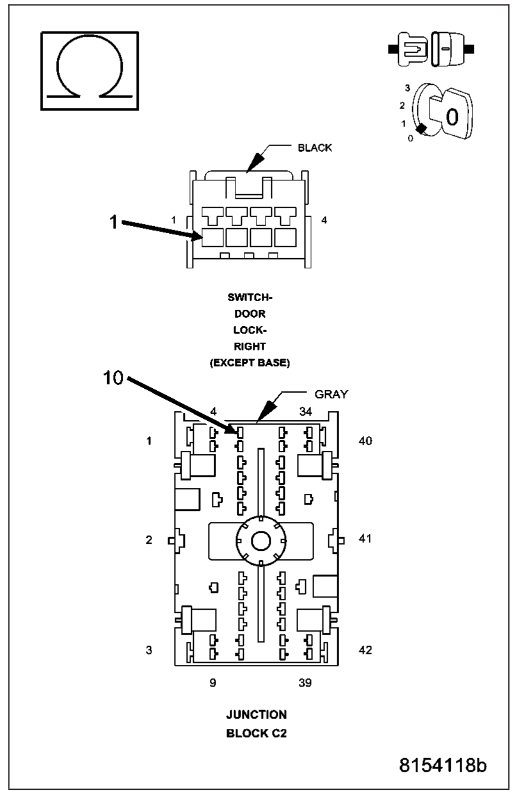
Measure the resistance of the (P36) Door Lock Switch Mux circuit between cavity 10 in the JB-C2 connector and the Right Door Lock Switch connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the (P36) Door Lock Switch Mux wire for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)




## 7. CHECK RIGHT DOOR LOCK SWITCH GROUND WIRE FOR AN OPEN

Measure the resistance of the (P37) Door Lock Switch Ground circuit between cavity 5 in the JB-C2 connector and the Right Door Lock Switch connector.

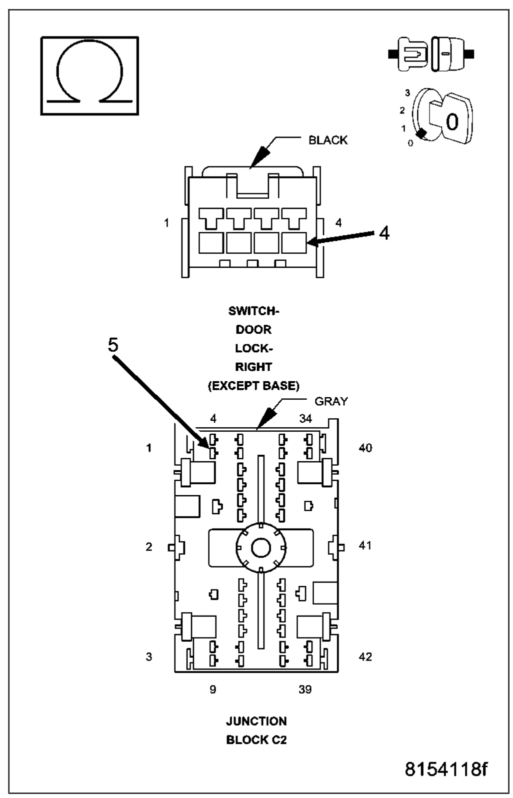
**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Right Door Lock Switch.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (P37) Door Lock Switch Ground wire for an open.

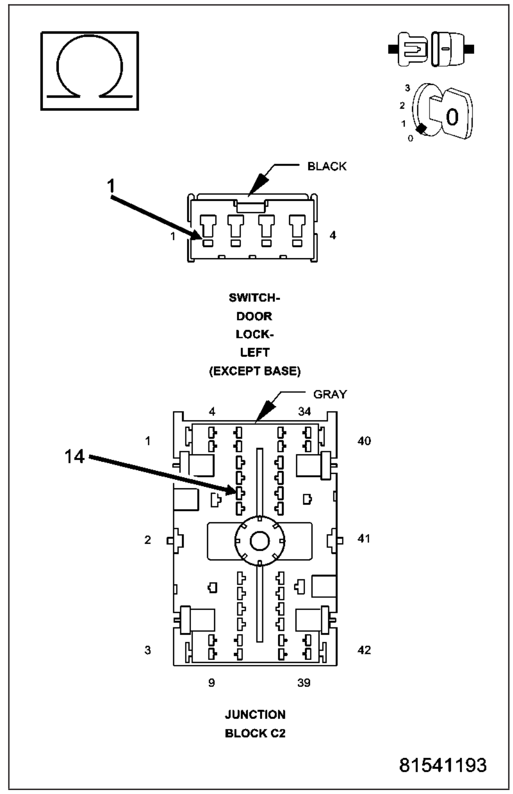
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



## 8. CHECK LEFT DOOR LOCK SWITCH MUX WIRE FOR AN OPEN

Disconnect the Left Door Lock Switch connector.

Measure the resistance of the (P36) Door Lock Switch Mux circuit between cavity 14 in the JB-C2 connector and the Left Door Lock Switch connector.




**Is the resistance below 5.0 ohms?**

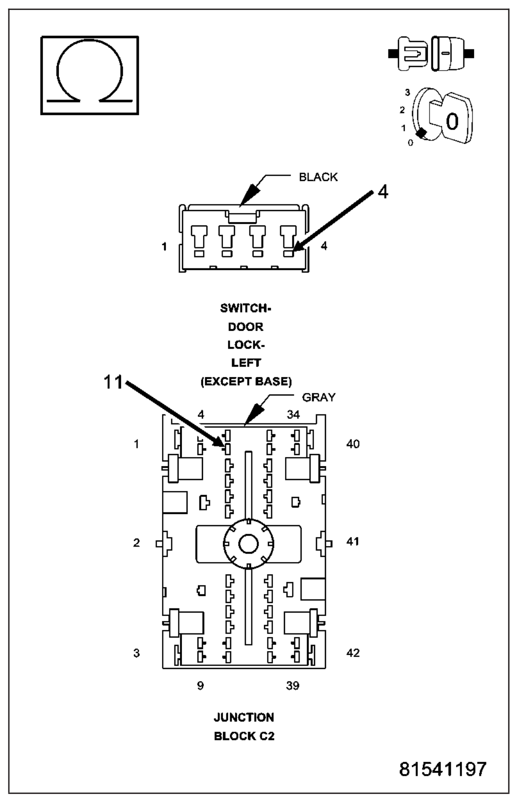
**Yes** >> Go To 9

**No** >> Repair the (P36) Door Lock Switch Mux wire for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 9. CHECK LEFT DOOR LOCK SWITCH GROUND WIRE FOR AN OPEN

Measure the resistance of the (P37) Door Lock Switch Ground circuit between cavity 11 in the JB-C2 connector and the Left Door Lock Switch connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Left Door Lock Switch.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (P37) Door Lock Switch Ground wire for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 10. CHECK THE JUNCTION BLOCK FOR AN OPEN

Disconnect the battery ground cable.

Disconnect all the Junction Block connectors and remove the Junction Block.

Remove the Body Control Module from the Junction Block.

**NOTE: Make all measurements in the Junction Block – NOT the harness connector.**

Measure the resistance of the (P36) Door Lock Switch Mux circuit between cavity 23 in the Junction Block - Body Control Module connector and cavity 10 in the Junction Block C2.

Measure the resistance of the (P36) Door Lock Switch Mux circuit between cavity 23 in the Junction Block - Body Control Module connector and cavity 14 in the Junction Block C2.

Measure the resistance of the (P37) Door Lock Switch Ground circuit between cavity 12 in the Junction Block - Body Control Module connector and cavity 5 in the Junction Block C2.

Measure the resistance of the (P37) Door Lock Switch Ground circuit between cavity 12 in the Junction Block - Body Control Module connector and cavity 11 in the Junction Block C2.

**Is the resistance below 1.0 ohm for each circuit?**

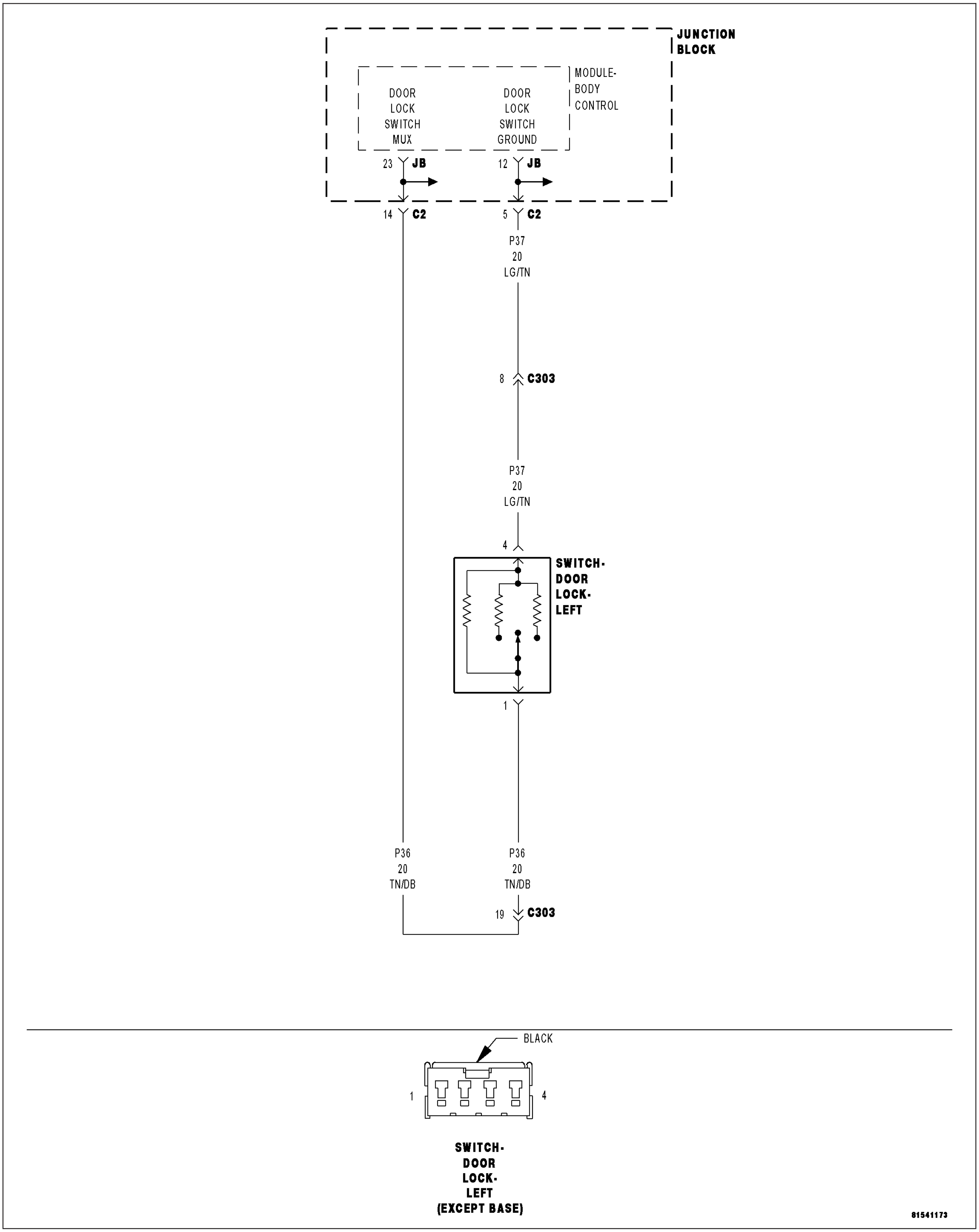
**Yes** >> Replace the Body Control Module.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Junction Block.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## DOOR LOCK SWITCH SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the ignition is on.
- **Set Condition:**
  When the BCM detects a voltage of less than 0.25 volts on the door lock switch mux input for over 5 seconds, this code will set. The normal voltage on the circuit is between 0.25 and 4.75 volts depending on switch positions. NOTE: Left and right switches are in parallel.

| Possible Causes |
|---|
| (P36) LEFT DOOR LOCK SWITCH MUX WIRE SHORT TO GROUND |
| (P36) RIGHT DOOR LOCK SWITCH MUX WIRE SHORT TO GROUND |
| LEFT DOOR LOCK SWITCH - SHORTED |
| RIGHT DOOR LOCK SWITCH - SHORTED |
| JUNCTION BLOCK SHORT TO GROUND |
| BODY CONTROL MODULE - DOOR LOCK SWITCH MUX SHORT TO GROUND |

## Diagnostic Test

### 1. CHECK TROUBLE CODE

Turn the ignition on.

With the scan tool, erase DTCs.

Operate the door locks several times from both door lock switches

With the scan tool read DTCs.

**Does the scan tool display DOOR LOCK SWITCH SHORT TO GROUND?**

**Yes** >> Go To 2

**No** >> Problem is intermittent and not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors and repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. CHECK THE LEFT DOOR LOCK SWITCH MUX CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

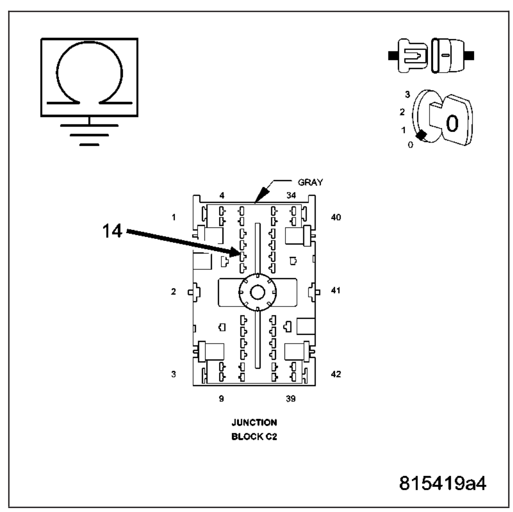
Disconnect the Junction Block C2 connector.

Measure the resistance between ground and the (P36) Door Lock Switch Mux circuit cavity 14 in the JB-C2 connector.

**Is the resistance below 1000.0 ohms?**

**Yes** >> Go To 3

**No** >> Go To 4



## 3. CHECK LEFT DOOR LOCK SWITCH MUX WIRE FOR A SHORT TO GROUND

Disconnect the Left Door Lock Switch connector.

Measure the resistance between ground and the (P36) Door Lock Switch Mux circuit cavity 14 in the JB-C2 connector.

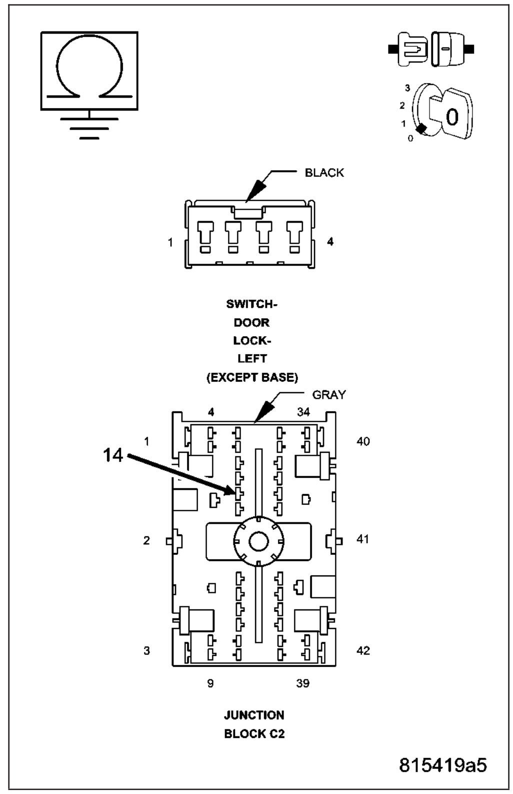
**Is the resistance below 1000.0?**

**Yes** >> Repair the (P36) Door Lock Switch Mux wire for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Left Door Lock Switch.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



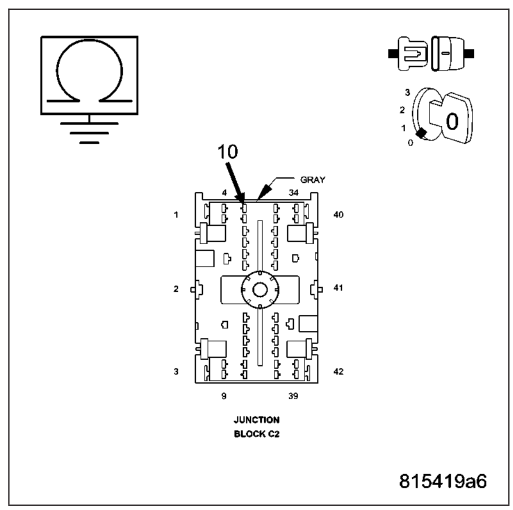

## 4. CHECK THE RIGHT DOOR LOCK SWITCH MUX CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (P36) Door Lock Switch Mux circuit cavity 10 in the JB-C2 connector.

**Is the resistance below 1000.0 ohms?**

**No** >> Go To 6

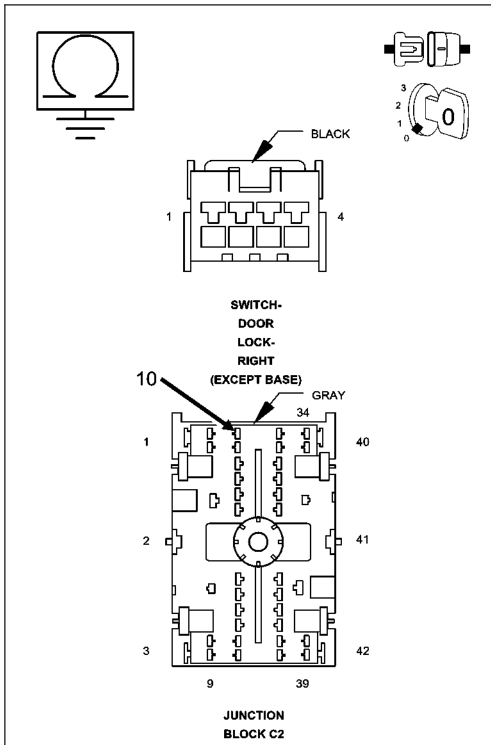
**Yes** >> Go To 5



## 5. CHECK RIGHT DOOR LOCK SWITCH MUX WIRE FOR A SHORT TO GROUND

Disconnect the Right Door Lock Switch connector.

Measure the resistance between ground and the (P36) Door Lock Switch Mux circuit cavity 10 in the JB-C2 connector.




815419a7

**Is the resistance below 1000.0 ohms?**

**Yes** >> Repair the (P36) Door Lock Switch Mux wire for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Right Door Lock Switch.

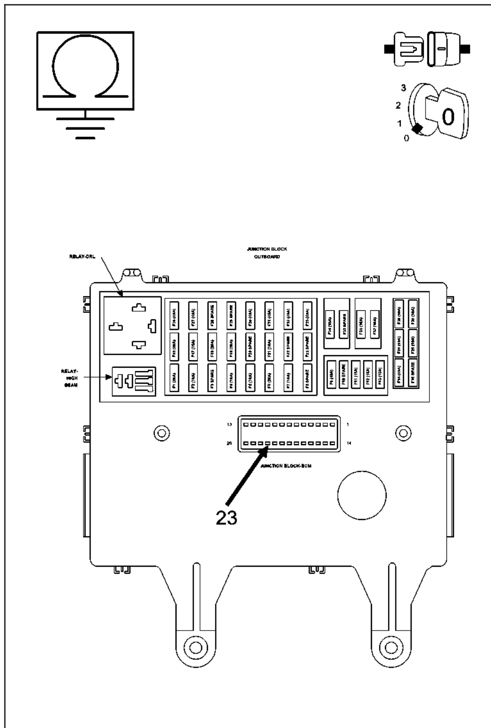
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 6. CHECK THE JUNCTION BLOCK FOR A SHORT TO GROUND

Remove the Body Control Module from the Junction Block.

**NOTE: Ensure the Junction Block C1, C2 and C3 connectors are connected before proceeding.**

Measure the resistance between ground and the (P36) Door Lock Switch Mux circuit cavity 23 in the Junction Block - Body Control Module connector.




815419a8

**Is the resistance below 2000.0 ohms?**

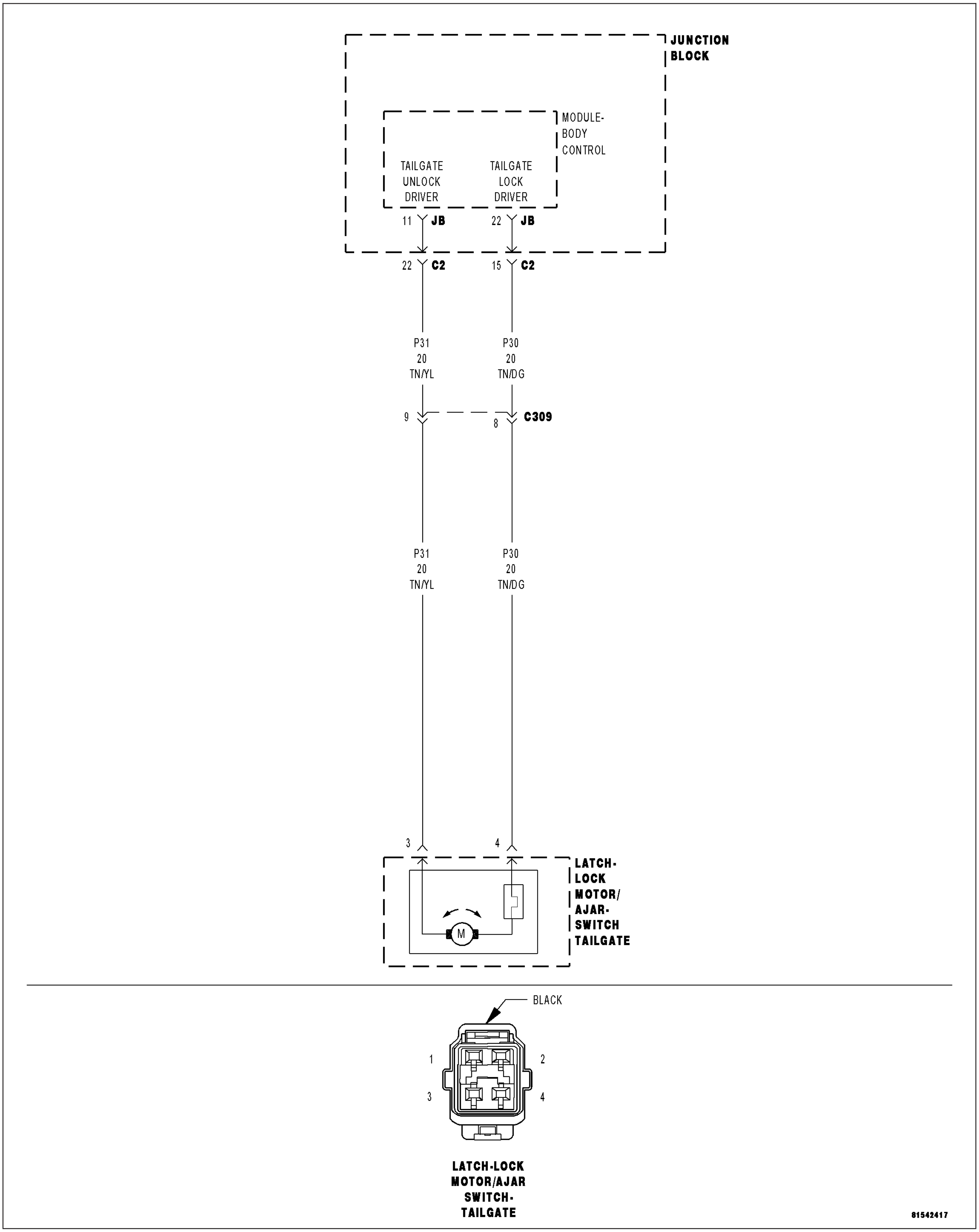
**Yes** >> Replace the Junction Block in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## TAILGATE LOCK MOTOR SHORT TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the ignition is on.
- **Set Condition:**
  When the BCM detects voltage on either the Tailgate Lock Driver or Unlock Driver circuit for longer than 5 seconds when the Tailgate is not being actuated. If there is, the BCM will disable the lock functions to protect the BCM.

| Possible Causes |
|---|
| TAILGATE (P30) LOCK OR (P31) UNLOCK CIRCUIT SHORT TO VOLTAGE |
| JUNCTION BLOCK - SHORT TO VOLTAGE |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. CHECK TROUBLE CODE

Turn the ignition on.

With the scan tool, erase DTCs.

Cycle the ignition switch from Off to On and wait 10 seconds.

With the scan tool , read DTCs.

**Does the scan tool display TAILGATE LOCK MOTOR SHORT TO VOLTAGE?**

**Yes** >> Go To 2

**No** >> Problem is intermittent and not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors and repair as necessary.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. CHECK TAILGATE LOCK OR UNLOCK CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the Junction Block C2 connector.

Turn the ignition on.

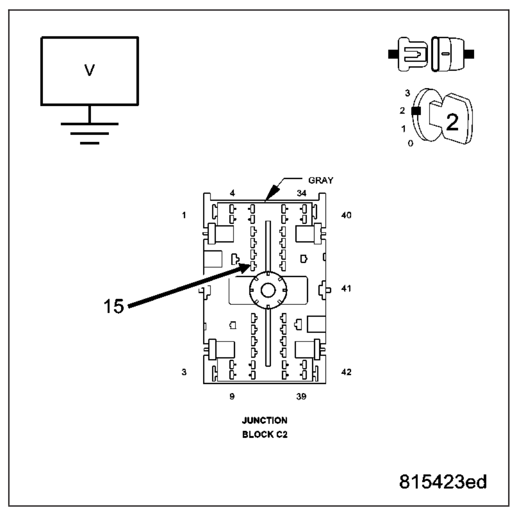
Measure the voltage between (P30) Tailgate Lock Driver circuit and ground.

**Is there any voltage present?**

**Yes** >> Repair the Tailgate (P30) Lock or (P31) Unlock Driver for a short to voltage.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3



## 3. CHECK JUNCTION BLOCK FOR A SHORT TO VOLTAGE

Turn the ignition off.

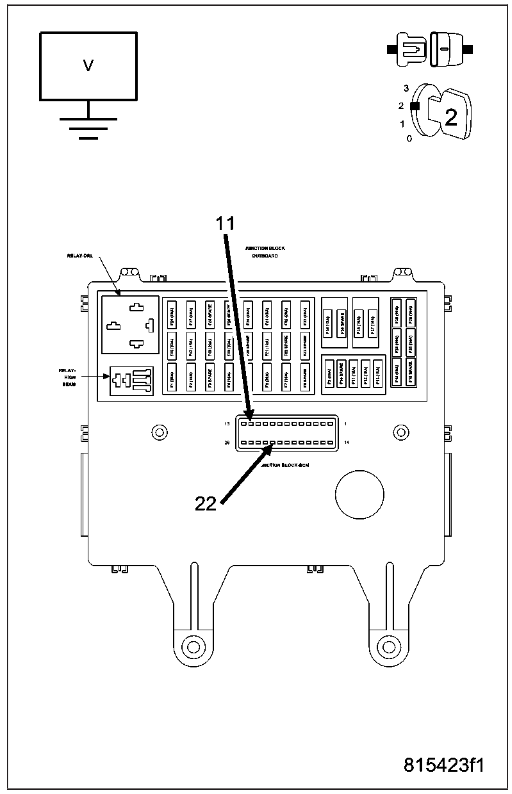
Remove the Body Control Module from the Junction Block.

**NOTE: Ensure the Junction Block C1, C2 and C3 connectors are connected at this time.**

Turn the ignition on.

Measure the voltage between the (P30) Tailgate Lock Driver circuit in the Junction Block - BCM connector and ground.

Measure the voltage between the (P31) Tailgate Unlock Driver circuit in the Junction Block - BCM connector and ground.




**Is there any voltage present on either circuit?**

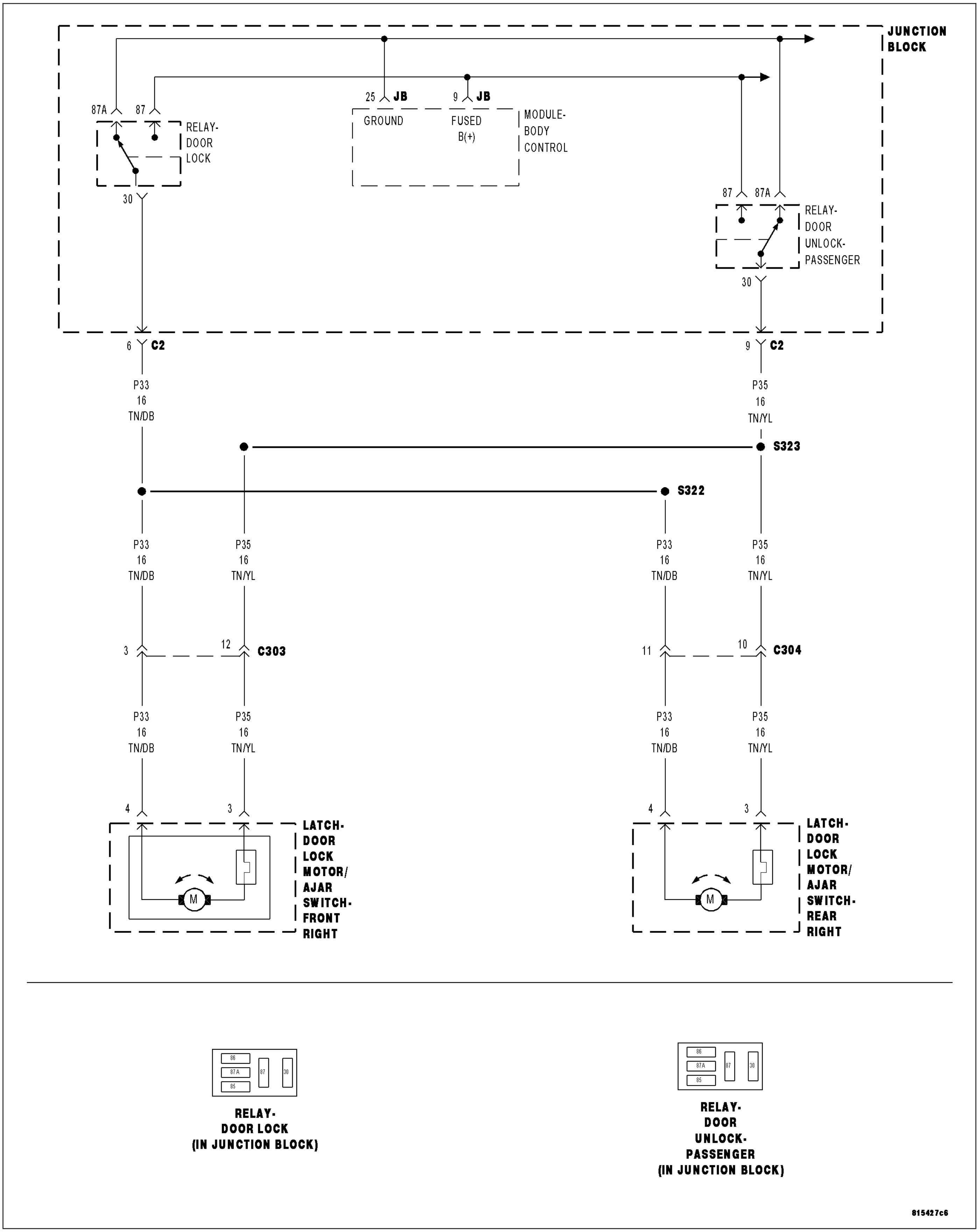
**Yes** >> Replace the Junction Block in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *ALL DOORS FAIL TO LOCK




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| KEY-IN IGNITION SWITCH SHORTED |
| (P33) DOOR LOCK RELAY OUTPUT CIRCUIT SHORT TO GROUND |
| DOOR LOCK RELAY |

## Diagnostic Test

### 1. DTC'S PRESENT

With the scan tool, read DTCs.

**Are there any Power Door Lock related codes present?**

**Yes** >> Refer to symptom list for problems related to POWER DOOR LOCKS/RKE.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK KEY-IN IGNITION SWITCH – SHORTED

Close both front doors.

Insert the key in the ignition switch but do not turn the switch on.

**Does the Chime continue to sound?**

**Yes** >> Refer to symptom list for problems related to CHIME.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3

### 3. CHECK DOOR LOCK RELAY OUTPUT CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

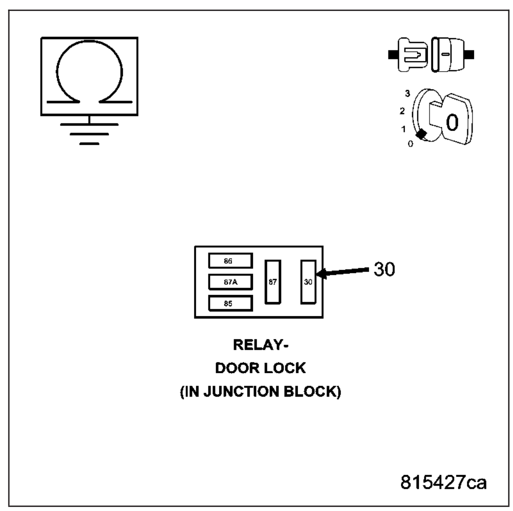
Remove the Door Lock, the Door Unlock and the Driver Door Unlock relays from the Junction Block.

Measure the resistance between ground and the (P33) Door Lock Relay Output circuit in the Door Lock relay connector.

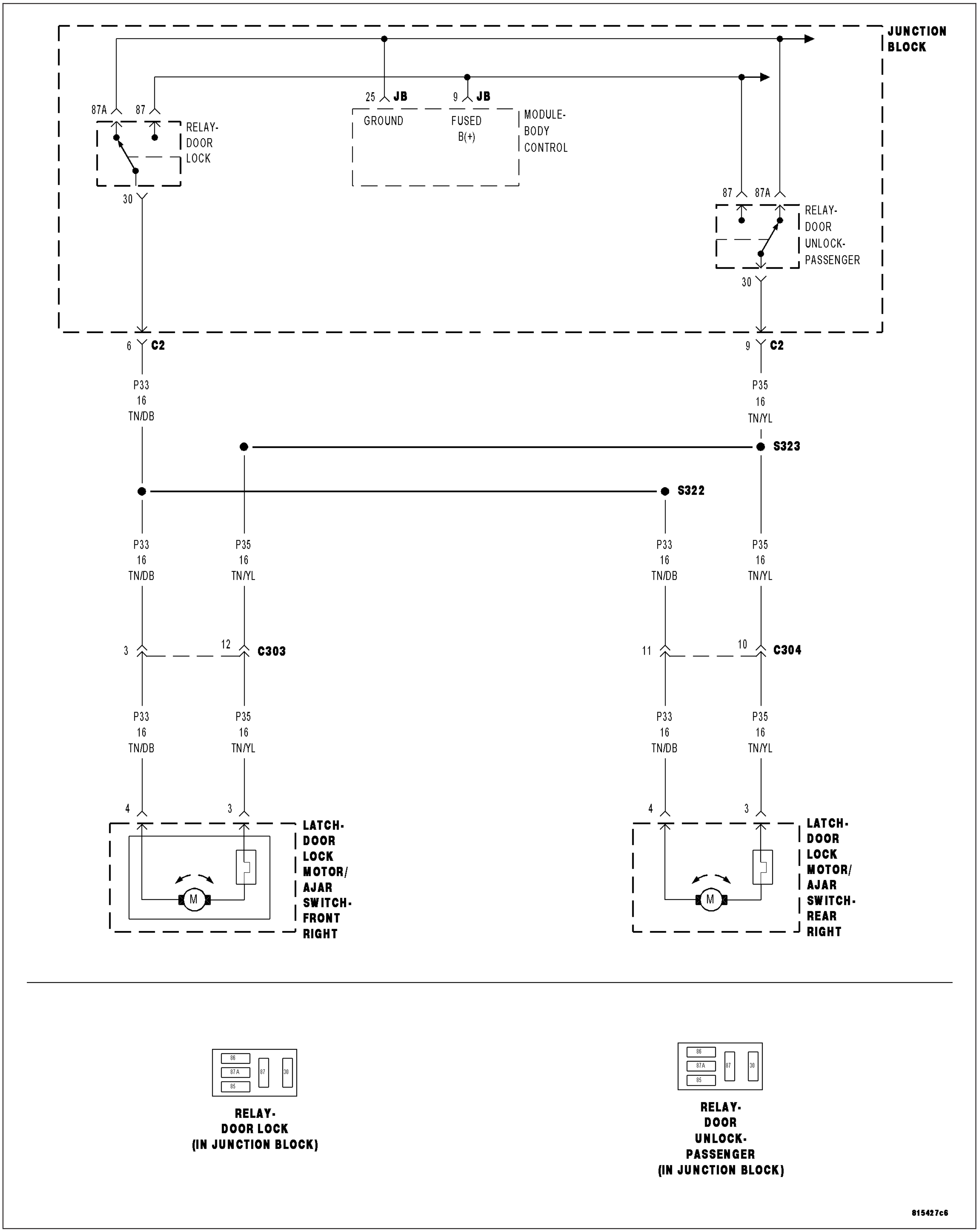
**Is the resistance below 1000.0 ohms?**

**Yes** >> Repair the (P33) Door Lock Relay Output circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Door Lock Relay.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



# *ALL PASSENGER DOORS FAIL TO LOCK AND UNLOCK




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (P35) DOOR UNLOCK RELAY OUTPUT CIRCUIT OPEN |
| DOOR UNLOCK RELAY |

## Diagnostic Test

### 1. DTC'S PRESENT

With the scan tool, read DTCs.

**Are there any Power Door Lock related codes present?**

**Yes** >> Refer to symptom list for problems related to POWER DOOR LOCKS/RKE.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK (P35) DOOR UNLOCK RELAY OUTPUT CIRCUIT OPEN

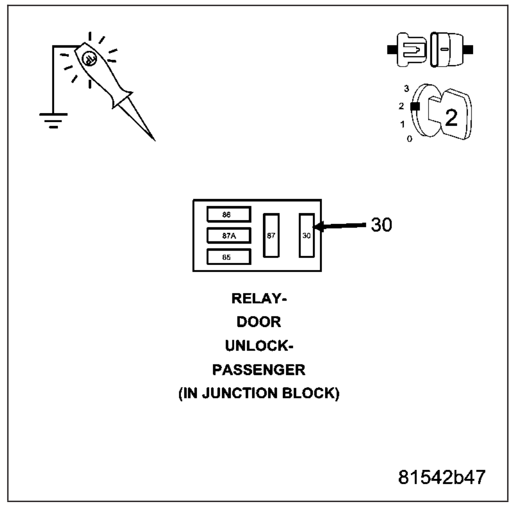
Turn the ignition off.

Remove the Door Unlock Relay from the Junction Block.

Using a 12-volt test light connected to ground, check the (P35) Door Unlock Relay Output circuit (cavity 30) in the relay connector.

Turn the ignition on.

With the scan tool, actuate the Door Locks (relay).




**Does the test light illuminate brightly when the relay is actuated?**

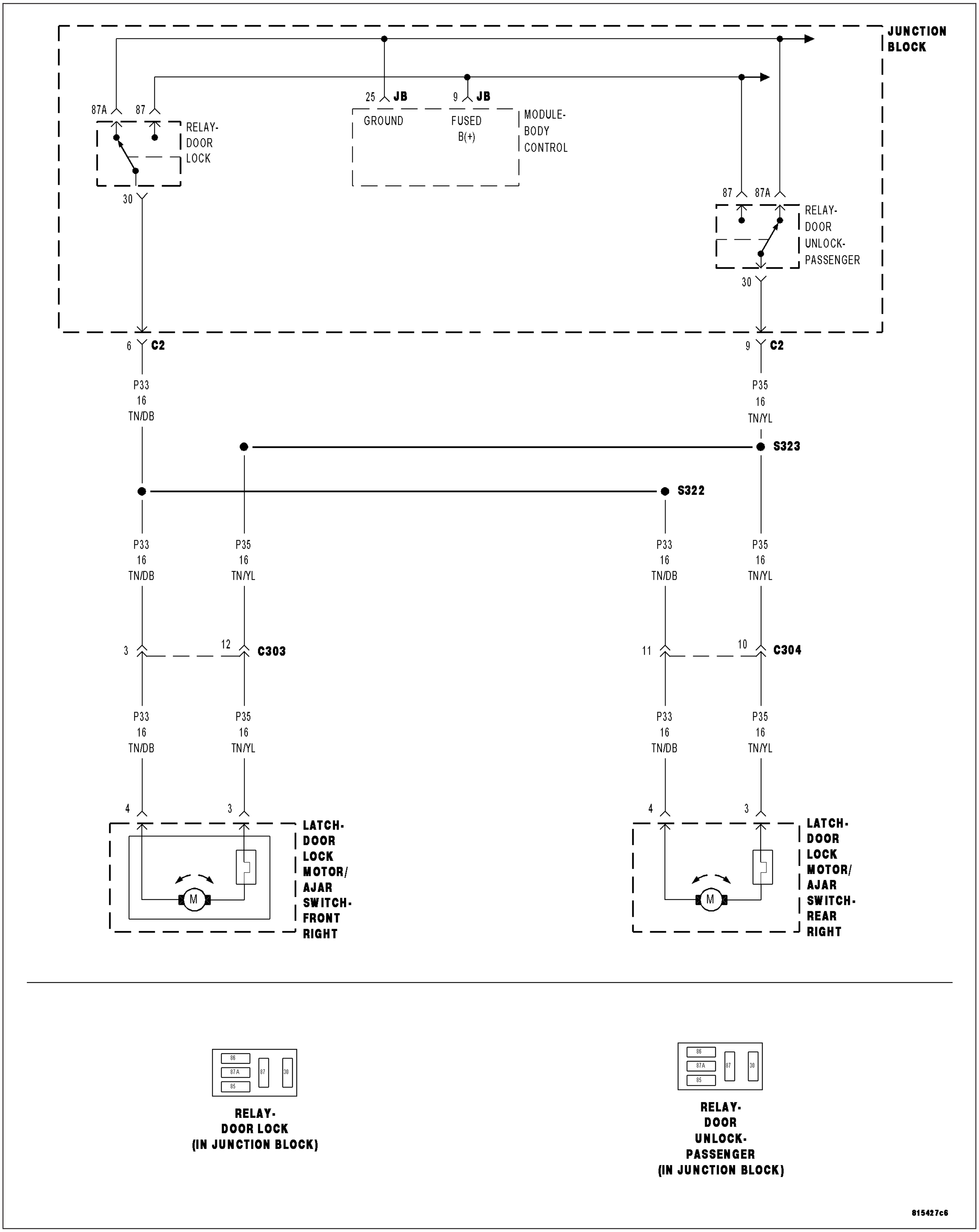
**Yes** >> Replace the Door Unlock Relay.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (P35) Door Unlock Relay Output circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *ALL PASSENGER DOORS FAIL TO UNLOCK




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (P35) DOOR UNLOCK RELAY OUTPUT CIRCUIT SHORT TO GROUND |
| DOOR UNLOCK RELAY |

## Diagnostic Test

### 1. DTC'S PRESENT

With the scan tool, read DTCs.

**Are there any Power Door Lock related codes present?**

**Yes** >> Refer to symptom list for problems related to POWER DOOR LOCKS/RKE.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK (P35) DOOR UNLOCK RELAY OUTPUT FOR SHORT TO GROUND

Turn the ignition off.

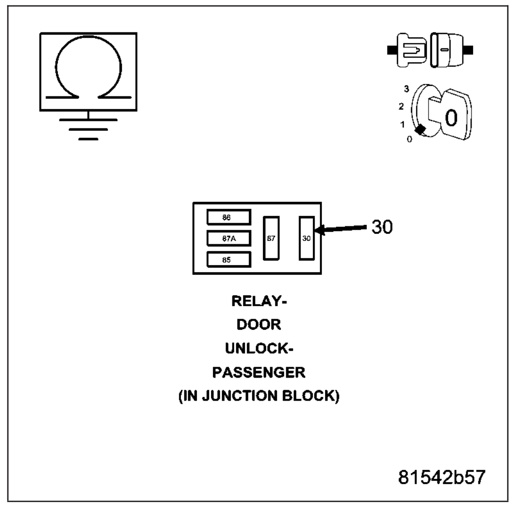
Remove the Door Lock, the Door Unlock and the Driver Door Unlock Relays from the Junction Block.

Measure the resistance between ground and the (P35) Door Unlock Relay Output circuit (cavity 30) in the Door Unlock Relay connector.

**Is the resistance below 1000.0 ohms?**

**No** >> Replace the Door Unlock Relay.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**Yes** >> Repair the (P35) Door Unlock Relay Output circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



# *AUTO DOOR LOCKS INOPERATIVE

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| AUTO (ROLLING) DOOR LOCKS NOT ENABLED |
| DOOR AJAR STATUS |
| PCM DTC'S PRESENT |
| BODY CONTROL MODULE - AUTO LOCKS INOPERATIVE |

## Diagnostic Test

### 1. READ AUTO DOOR LOCK STATUS ON SCAN TOOL

With the scan tool select: ″Body Controller″, ″Miscellaneous″, ″Auto Door Locks″

**Does the scan tool show ″Auto Door Locks: ENABLED″?**

**Yes** >> Go To 2

**No** >> With the scan tool, enable the Auto (Rolling) Door Locks, open and close the driver door at least once and retest the System.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

### 2. CHECK DOOR AJAR STATES

Ensure all doors are closed.

With the scan tool read all DOOR AJAR states

**Do any door ajar states show CLOSED?**

**Yes** >> Refer to symptom list for problems related to DOOR AJAR.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3

### 3. CHECK FOR PCM DTC's

With the scan tool read ″Engine″ DTC's.

**Are there any TPS DTC's present?**

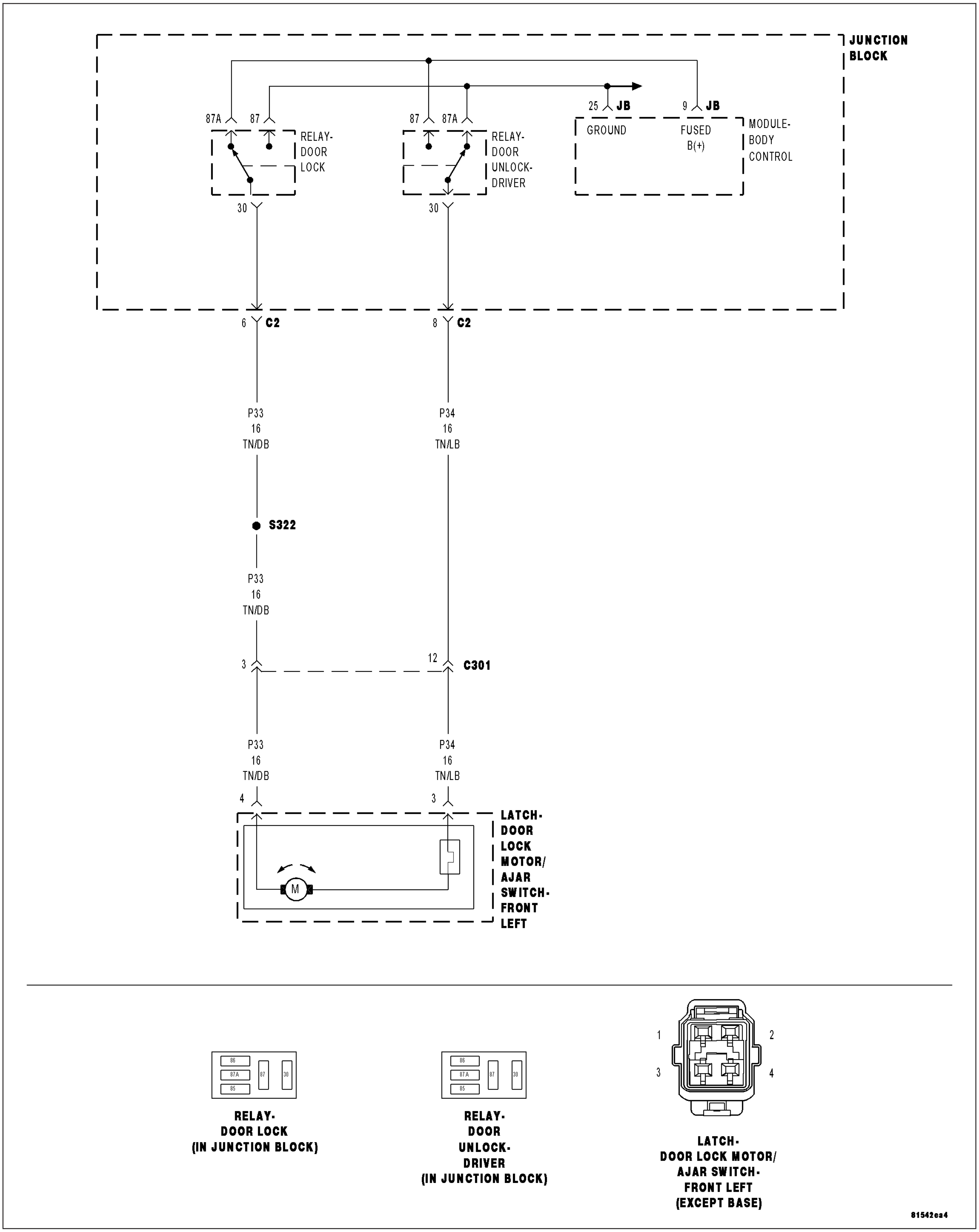
**Yes** >> Refer to symptom list for problems related to DRIVEABILITY..

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *DRIVER DOOR FAILS TO LOCK AND UNLOCK




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| DOOR LOCK MOTOR - OPEN |
| (P34) DRIVER DOOR UNLOCK RELAY OUTPUT WIRE OPEN |
| (P33) DOOR LOCK RELAY OUTPUT WIRE OPEN |
| DRIVER DOOR UNLOCK RELAY GROUND OPEN |

## Diagnostic Test

### 1. CHECK DOOR LOCK MOTOR

Turn the ignition off.

Remove the inner door trim panel to gain access to the Door Lock Motor connector.

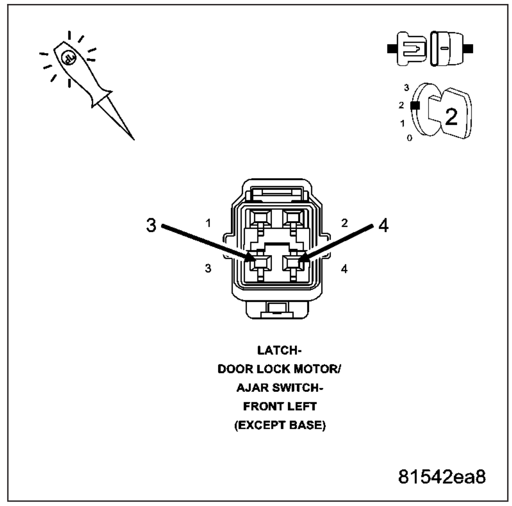
Disconnect the Driver Door Lock Motor connector.

Remove the key from the ignition switch.

Connect a test light between the Door Lock Relay Output and the Driver Door Unlock Relay Output circuits in the door lock motor connector.

Turn the ignition on.

Press the door lock switch to the Lock and Unlock positions.




**Did the test light illuminate brightly when the lock switch was pressed in both directions?**

**Yes** >> Replace the Door Lock Motor.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

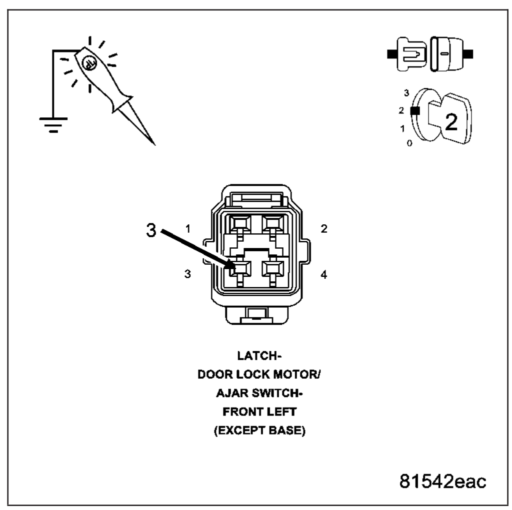
**No** >> Go To 2

### 2. CHECK (P34) DRIVER DOOR UNLOCK RELAY OUTPUT WIRE FOR AN OPEN

Using a 12-volt test light connected to ground, check the (P34) Driver Door Unlock Relay Output circuit in the door latch connector.

Close the driver door or trip the latch to the door closed position

With the scan tool actuate the DRIVER DOOR UNLOCK RELAY.




**Does the test light illuminate brightly when the relay is actuated?**

**Yes** >> Go To 3

**No** >> Repair the (P34) Driver Door Unlock Relay Output wire for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 3. CHECK (P33) DOOR LOCK RELAY OUTPUT WIRE FOR AN OPEN

Using a 12-volt test light connected to ground, check the (P33) Door Lock Relay Output circuit.

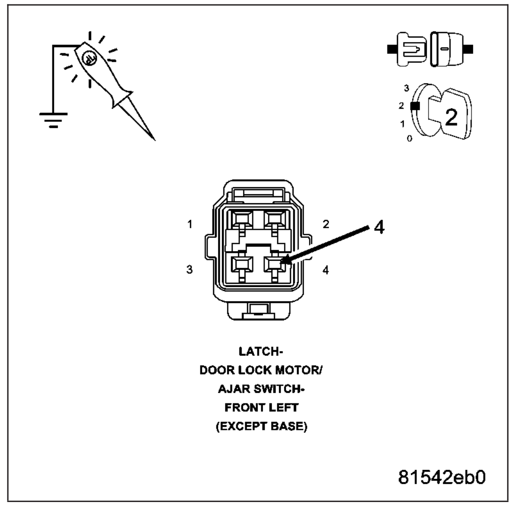
With the scan tool actuate the Door Lock Relay.

**Does the test light illuminate brightly when the relay is actuated?**

**Yes** >> Go To 4

**No** >> Repair the (P33) Door Lock Relay Output wire for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)




## 4. CHECK DRIVER DOOR UNLOCK RELAY GROUND

Remove the Driver Door Unlock Relay.

Using a 12-volt test light connected to 12-volts, check the Driver Door Unlock Relay Ground circuit (cavity 87a) in the relay connector.

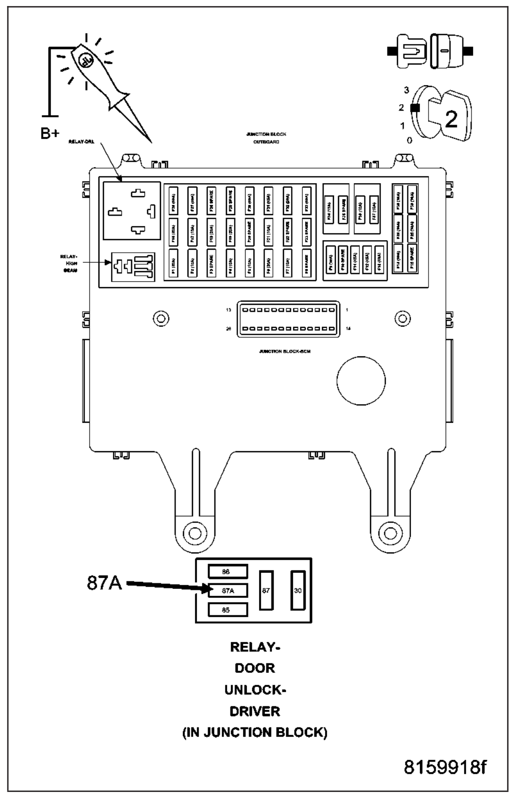
**Does the test light illuminate brightly?**

**Yes** >> Replace the Driver Door Unlock Relay.

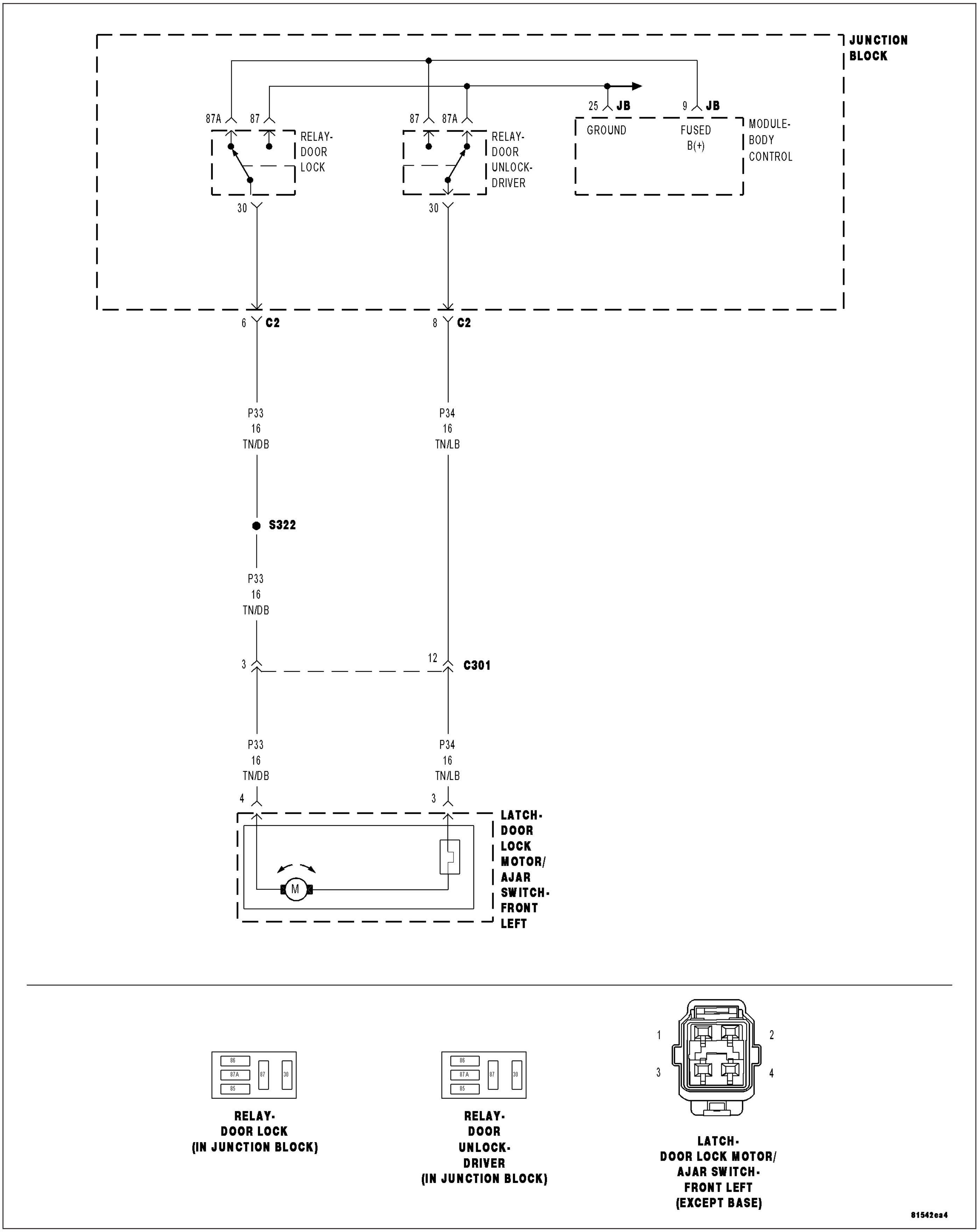
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the Driver Door Unlock Relay Ground circuit for an open or replace the Junction Block.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)



# *DRIVER DOOR FAILS TO UNLOCK




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (P34) DRIVER DOOR UNLOCK RELAY OUTPUT CIRCUIT SHORT TO GROUND |
| DRIVER DOOR UNLOCK RELAY |

## Diagnostic Test

### 1. DTC'S PRESENT

With the scan tool, read DTCs.

**Are there any Power Door Lock related codes present?**

**Yes** >> Refer to symptom list for problems related to POWER DOOR LOCKS/RKE.

**No** >> Go To 2

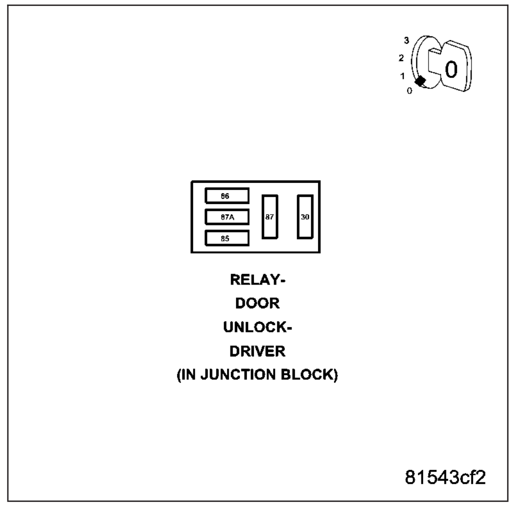
### 2. CHECK DRIVER DOOR UNLOCK RELAY

Install a substitute relay in place of the Driver Door Unlock relay in the Junction Block.

Lower the driver window.

Remove the key from the ignition switch.

Operate the door lock switch to lock and unlock positions several times.




**Did the Driver Door Lock and Unlock?**

**Yes** >> Replace the Driver Door Unlock Relay.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

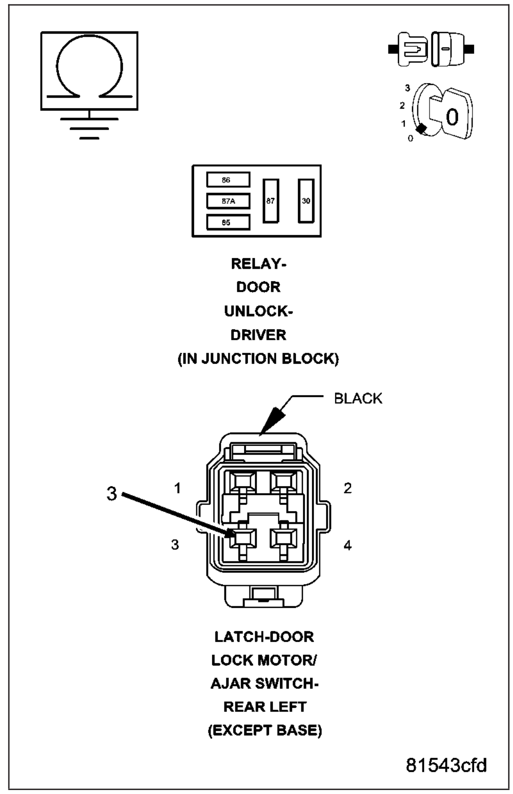
**Yes** >> Go To 3

## 3. CHECK (P34) DRIVER DOOR UNLOCK RELAY OUTPUT FOR A SHORT TO GROUND

Remove the Driver Door Unlock relay from the Junction Block.

Remove the Driver Door inner trim panel and disconnect the Driver Door Lock Motor connector.

Measure the resistance between ground and the (P34) Driver Door Unlock Relay Output circuit in the Door Lock Motor connector.




**Is the resistance below 1000.0 ohms?**

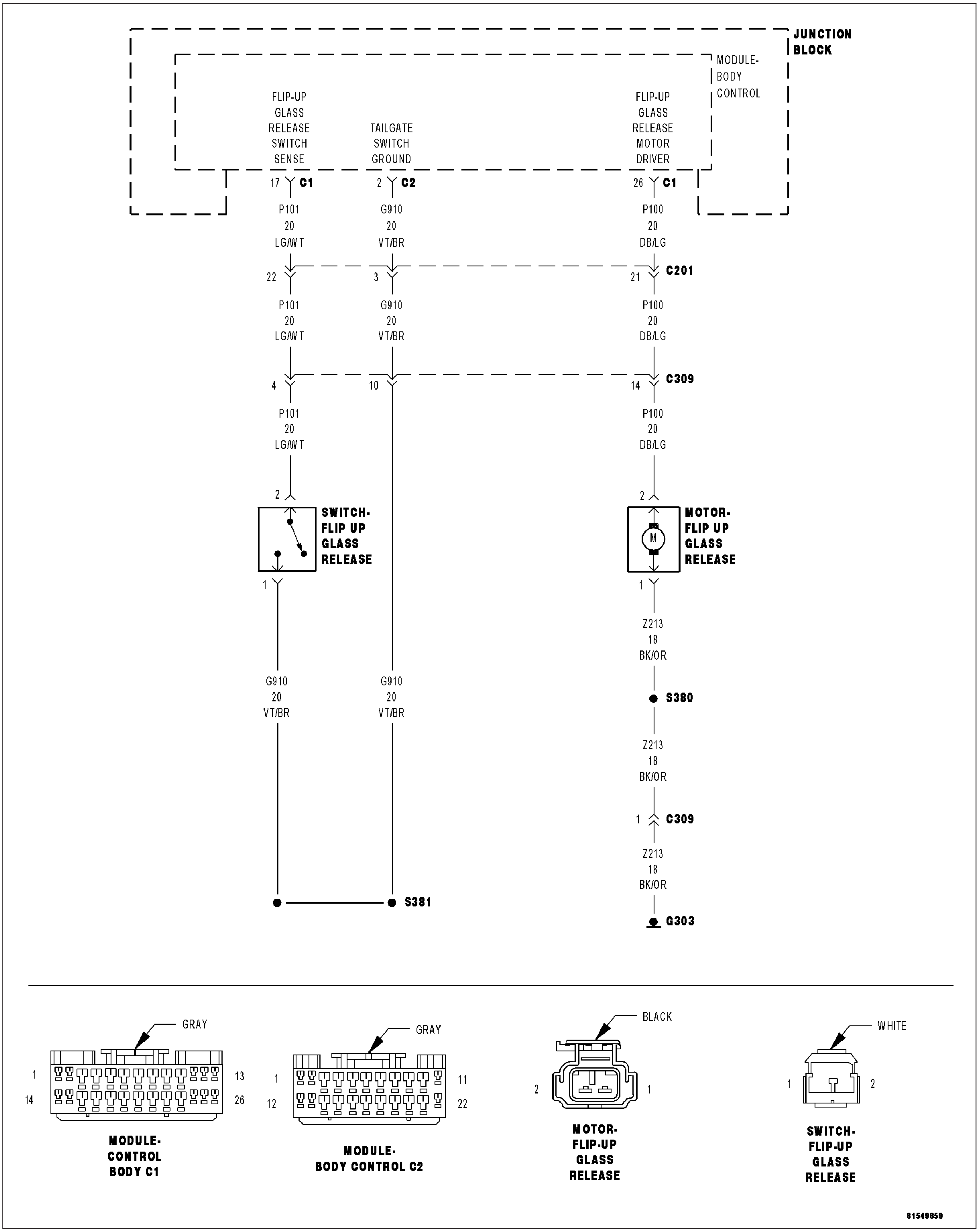
**Yes** >> Repair the (P34) Driver Door Unlock Relay Output circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Test complete.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *FLIP-UP GLASS RELEASE INOPERATIVE




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| G910 TAILGATE SWITCH GROUND OPEN |
| RELEASE MOTOR GROUND CIRCUIT OPEN |
| P100 FLIP-UP GLASS RELEASE MOTOR DRIVER WIRE OPEN |
| P101 FLIP-UP GLASS RELEASE SWITCH SENSE OPEN |
| FLIP-UP GLASS RELEASE MOTOR |
| FLIP-UP GLASS RELEASE SWITCH |
| BODY CONTROL MODULE - FLIP-UP GLASS RELEASE MOTOR DRIVER OPEN |
| BODY CONTROL MODULE - FLIP-UP GLASS RELEASE SWITCH SENSE OPEN |

## Diagnostic Test

### 1.

**WARNING: TEST RELEASE SWITCH**

With the scan tool in Inputs/Outputs, read the FLIP-UP GLASS REL SW state.

Observe the scan tool and move the tailgate handle from open to closed positions.

**Does the scan tool display OPEN then CLOSED as the handle is moved?**

**Yes** >> Go to 2

**No** >> Go to 5

### 2. CHECK FLIP-UP GLASS RELEASE MOTOR

Disconnect the Flip-Up Glass Release Motor connector.

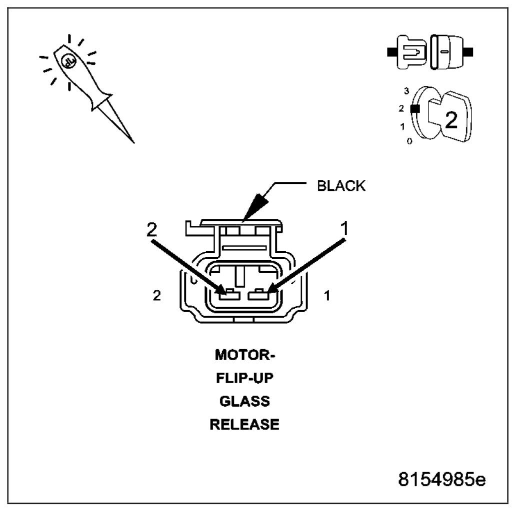
Connect a 12-volt test light between the (P100) Flip-Up Glass Release Motor Driver circuit and the (Z213) Ground circuit in the motor connector.

With the scan tool actuate the RELEASE FLIP-UP GLASS.

**Does the test light illuminate brightly when the motor is actuated?**

**Yes** >> Replace the Flip-Up Glass Release Motor.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

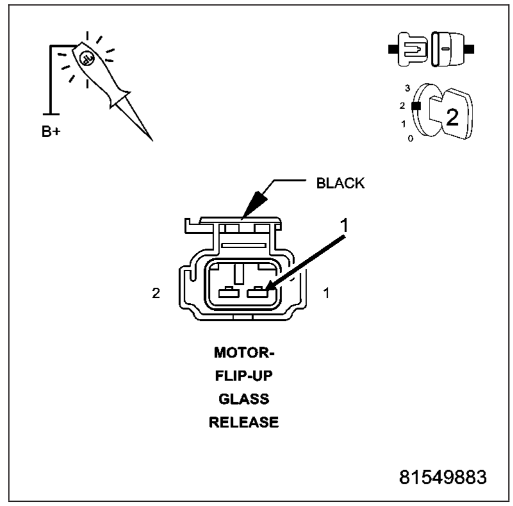
**No** >> Go To 3



## 3. CHECK FOR OPEN GROUND CIRCUIT

Using a 12-volt test light connected to 12-volts, check the (Z213) Ground circuit in the motor connector.

**Does the test light illuminate brightly?**




**Yes** >> Go To 4

**No** >> Repair the (Z213) Ground circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 4. TEST FOR OPEN (P100) FLIP-UP GLASS RELEASE MOTOR DRIVER WIRE

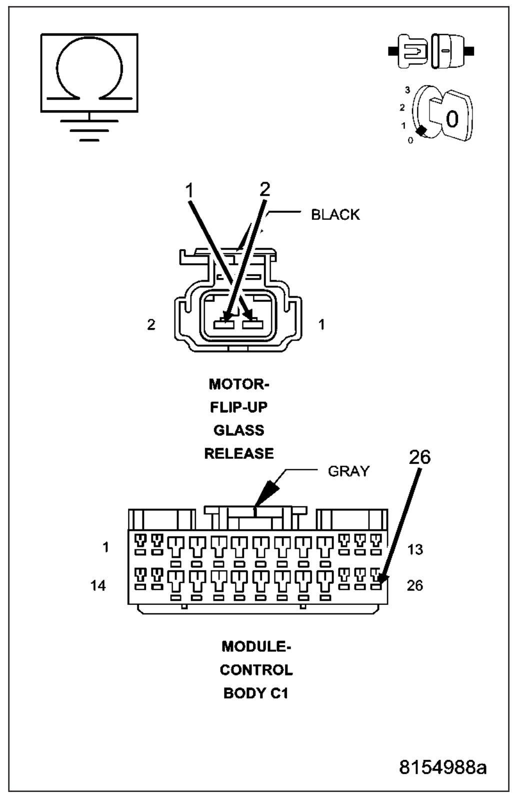
Turn the ignition off.

Connect a jumper wire between the (P100) Flip-Up Glass Release Motor Driver circuit and (Z213) Ground in the motor connector.

Disconnect the Body Control Module C1 connector.

Measure the resistance between ground and the (P100) Flip-Up Glass Release Motor Driver circuit.

**Is the resistance below 5.0 ohms?**




**Yes** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Repair the (P100) Flip-Up Glass Release Motor Driver circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

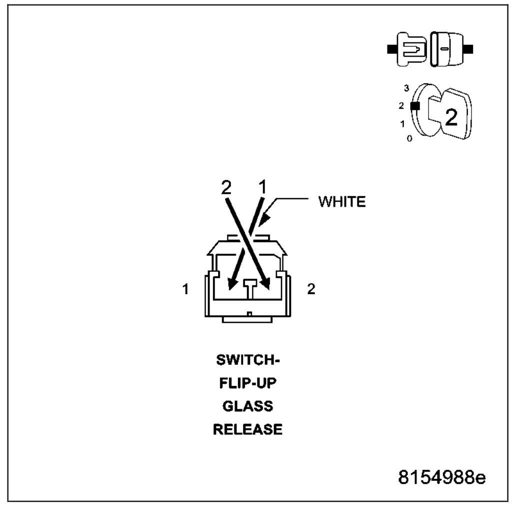
## 5. CHECK FLIP-UP GLASS RELEASE SWITCH

Remove the tailgate trim panel.

Disconnect the Flip-Up Glass Release Switch. connector.

Connect a jumper wire between the (P101) Flip-Up Glass Release Switch circuit and the (G910) Tailgate Switch Ground circuit in the switch connector.

With the scan tool in Data Display, read the Flip-Up Glass Rel Sw state.



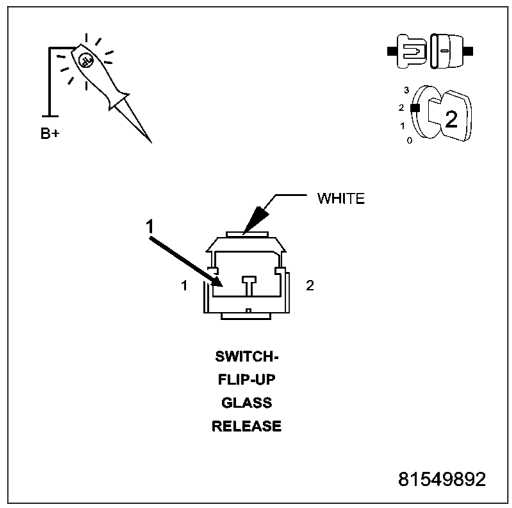

**Does the scan tool display CLOSED?**

**Yes** >> Replace the Flip-Up Glass Release Switch.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECK (G910) TAILGATE SWITCH GROUND FOR AN OPEN

Using a 12-volt test light connected to 12-volts, check the (G910) Tailgate Switch Ground circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 7

**No** >> Repair the (G910) Tailgate Switch Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

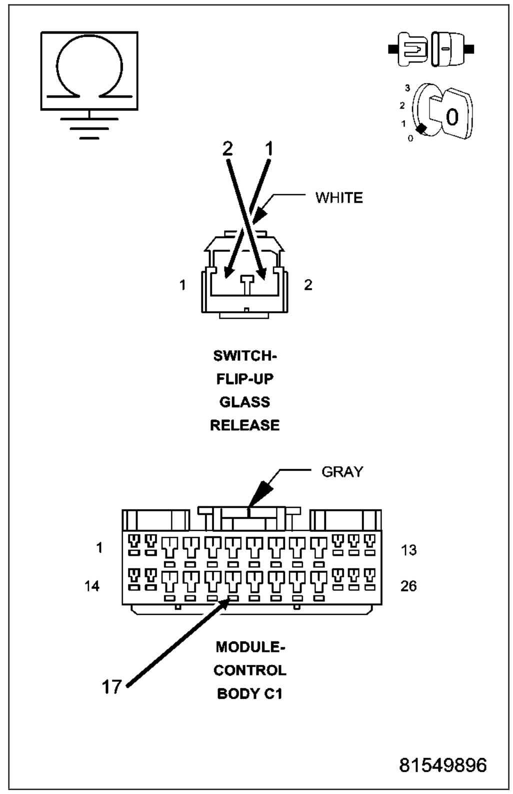
## 7. CHECK (P101) FLIP-UP GLASS RELEASE SWITCH SENSE WIRE FOR AN OPENl

Turn the ignition off.

Connect a jumper wire between the (P101) Flip-Up Glass Release Switch Sense circuit and (G910) Ground circuit in the Flip-Up Glass Release Switch connector.

Disconnect the Body Control Module C1 connector.

Measure the resistance between ground and the (P101) Flip-Up Glass Release Switch Sense circuit.



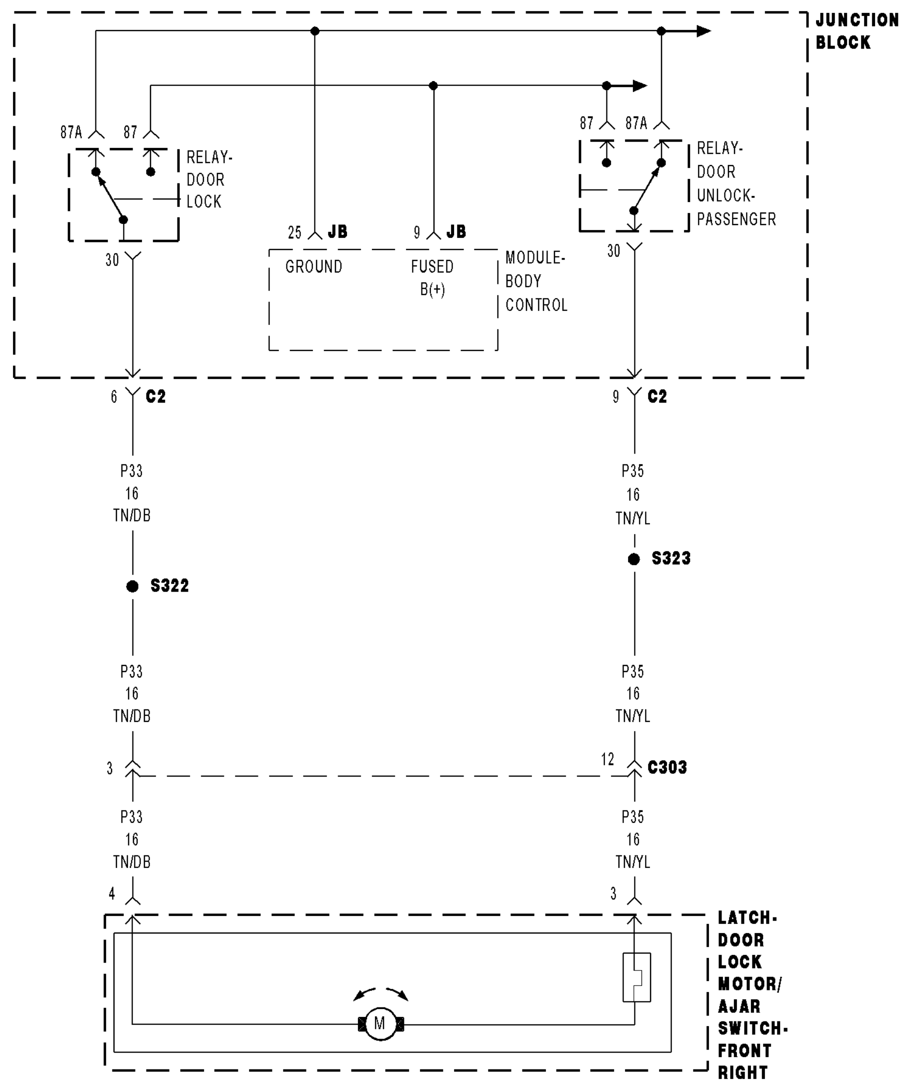

**Is the resistance below 5.0 ohms?**

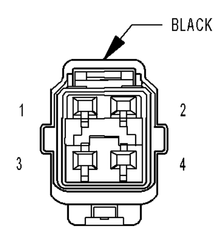
**Yes** >> Replace the Body Control Module in accordance with service information.

**No** >> Repair the (P101) Flip-Up Glass Release Switch Sense circuit for an open.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *ONE PASSENGER DOOR FAILS TO LOCK AND UNLOCK




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (P33) DOOR LOCK RELAY OUTPUT WIRE OPEN |
| (P35) DOOR UNLOCK RELAY OUTPUT WIRE OPEN |
| DOOR LOCK MOTOR - OPEN |

## Diagnostic Test

### 1. CHECK DOOR LOCK MOTOR

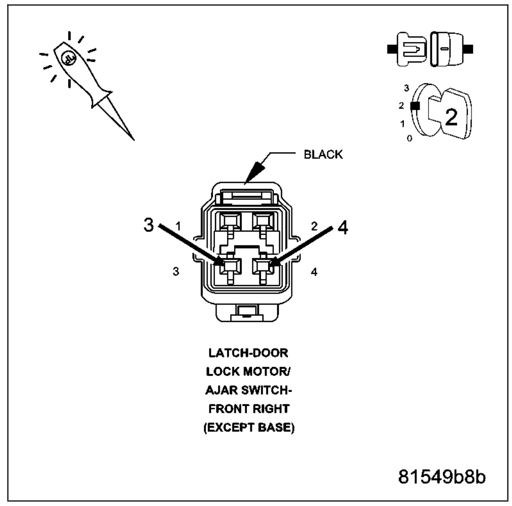
Remove the inner door trim panel to gain access to the Door Lock Motor connector.

Disconnect the appropriate Door Lock Motor connector.

Turn ignition on.

Connect a test light between the (P33) Lock Relay Output and the (P35) Unlock Relay Output circuits in the door lock motor connector.

Press the door lock switch to the Lock and Unlock positions.




**Did the test light illuminate when the lock switch was pressed in both directions?**

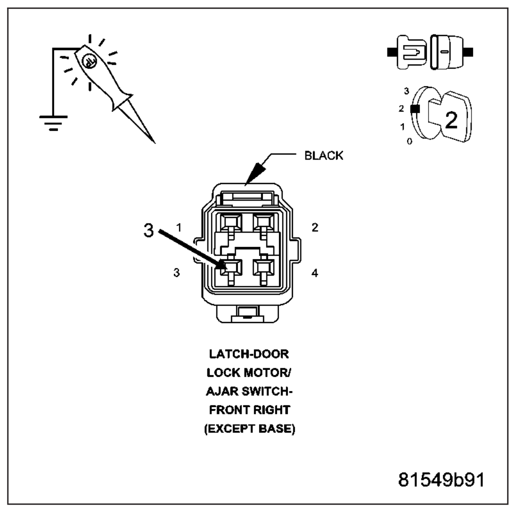
**Yes** >> Replace the Door Lock Motor.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK (P35) DOOR UNLOCK RELAY OUTPUT WIRE FOR AN OPEN

Using a 12-volt test light connected to ground, check the (P35) Door Unlock Relay Output circuit.

With the scan tool, actuate the Door Unlock Relay.




**Does the test light illuminate brightly when the relay is actuated?**

**Yes** >> Go To 3

**No** >> Repair the (P35) Door Unlock Relay Output wire for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

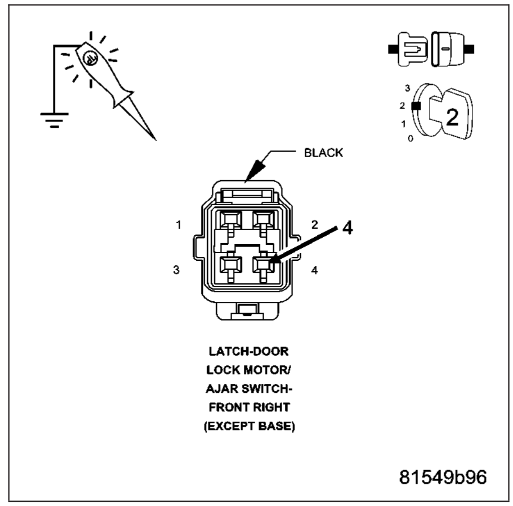
## 3. CHECK(P33) DOOR LOCK RELAY OUTPUT WIRE FOR AN OPEN

Turn ignition off.

Using a 12-volt test light connected to ground, check the (P33) Door Lock Relay Output circuit.

With the scan tool, actuate the Door Lock Relay.

**Does the test light illuminate brightly when the relay is actuated?**




**Yes** >> Test Complete.

**No** >> Repair the (P33) Door Lock Relay Output wire for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

# *REMOTE KEYLESS ENTRY INOPERATIVE

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| DOOR LOCK SYSTEM PROBLEM |
| RKE TRANSMITTER BATTERY VOLTAGE LOW |
| RKE TRANSMITTER NOT PROGRAMMED |
| RKE TRANSMITTER DEFECTIVE |
| BODY CONTROL MODULE |
| SKREEM MODULE - RKE INOPERATIVE |

## 1. DOOR LOCKS SYSTEM CHECK

Operate the door locks from both of the door lock switches.

**Did the door locks respond properly to both of the door lock switches?**

**Yes** >> Go To 2

**No** >> Refer to Power Door Locks/RKE in the Symptom List for the appropriate symptom.

## 2. 9001 TESTER AVAILABLE

**NOTE: NOTE: Ensure there is communication between the SKREEM and the BODY CONTROL MODULE before proceeding.**

**Do you have access to the Miller Special Tool ″9001 RF DETECTOR″?**

**No** >> Go To 3

**Yes** >> Go To 8

## 3. TEST BATTERIES WITH VOLTMETER

Using a voltmeter, test the Batteries in the RKE Transmitter.

**Is the voltage above 3.0 volts in each battery?**

**Yes** >> Go To 4

**No** >> Replace the Batteries.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 4. CHECK BODY CONTROL MODULE

With the scan tool actuate the door LOCK and then door UNLOCK relays.

**Do the door locks operate using the scan tool?**

**Yes** >> Go To 5

**No** >> Replace the Body Control Module in accordance with Service Information..
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 5. RKE TRANSMITTER NOT RESPONDING

With the scan tool select THEFT ALARM, SKIM, MONITORS and observe the “FOB No.” and ″FOB Button″.

Press the LOCK button and then the UNLOCK button on the Transmitter.

**Does the scan tool display:″ UNLOCK″, ″LOCK″ and the ″FOB Number″?**

**Yes** >> Replace the Body Control Module in accordance with Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. PROGRAM RKE TRANSMITTER WITH THE SCAN TOOL

With the scan tool select THEFT ALARM, SKIM, then PROGRAM NEW KEY. Follow instructions on the screen.

Exit PROGRAM NEW KEY. Try the Door Locks using the Transmitter.

**Did the Door Locks respond properly to the Transmitter commands ?**

**Yes** >> Repair complete. Using the scan tool, program other Transmitters used with this Vehicle.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. USE KNOWN GOOD TRANSMITTER

Secure a known good Transmitter.

Using the scan tool select THEFT ALARM, SKIM then PROGRAM NEW KEY and follow the instructions on the scan tool screen.

Exit PROGRAM new key. Try the Door Locks using the Transmitter.

**NOTE: When repairs are complete ensure all transmitters used with this vehicle are programmed.**

**Did the Door Locks respond properly to the Transmitter commands ?**

**Yes** >> Replace the Transmitter. Program all Transmitters that will be used with this Vehicle.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Sentry Key RemotE Entry Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 8. TEST TRANSMITTER WITH TESTER

Using the 9001 RF Detector, follow the instructions on the back of the tester and test the transmitter several times.

**Does the signal strength measure ″STRONG″?**

**Yes** >> Go To 9

**No** >> Check and replace the batteries if they are under 3.0 volts each and retest the transmitter. If the batteries are okay, replace the transmitter.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 9. PROGRAM RKE TRANSMITTER WITH THE SCAN TOOL

With the scan tool, select THEFT ALARM, SKIM then PROGRAM NEW KEY and follow the instructions on the screen.

Exit PROGRAM NEW KEY.

Activate the Door Locks using the RKE Transmitter.

**Did the door locks respond properly to the RKE transmitter commands?**

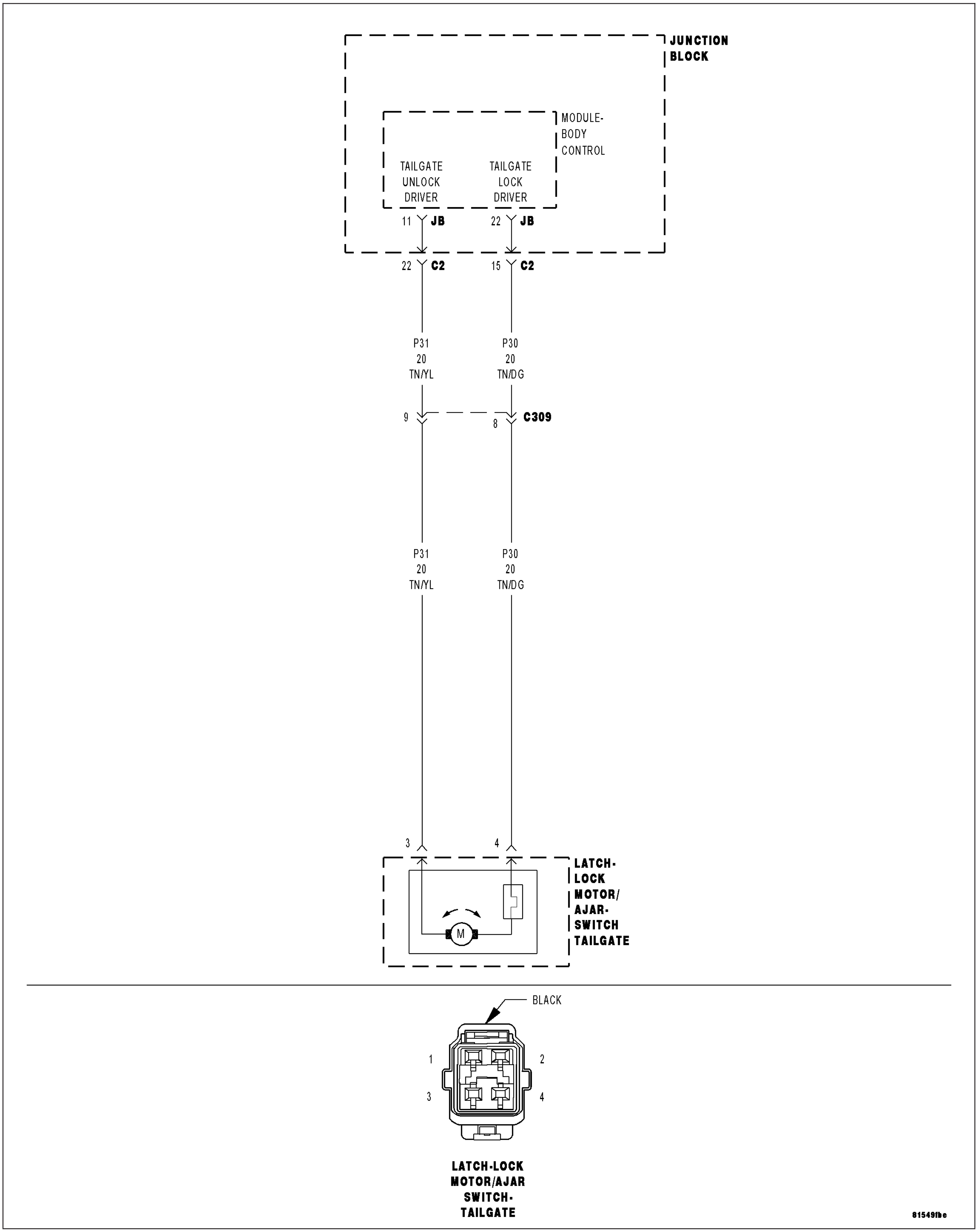
**Yes** >> Repair complete.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Sentry Key RemotE Entry Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## *TAILGATE LOCK INOPERATIVE




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| DTC'S PRESENT |
| (P30) TAILGATE LOCK DRIVER OPEN |
| (P30) TAILGATE LOCK DRIVER SHORT TO GROUND |
| (P31) TAILGATE UNLOCK DRIVER OPEN |
| (P31) TAILGATE UNLOCK DRIVER SHORT TO GROUND |
| TAILGATE LOCK MOTOR OPEN |
| JUNCTION BLOCK OPEN |
| BODY CONTROL MODULE - TAILGATE DRIVER OPEN |

## 1. CHECK DTC'S PRESENT

With the scan tool, read DTCs.

**Are there any Tailgate related codes present?**

**Yes** >> Refer to symptom list for problems related to POWER DOOR LOCKS/RKE.

**No** >> Go To 2

## 2. CHECK TAILGATE LOCK MOTOR

Disconnect the Tailgate Lock Motor connector.

Connect a test light between the Tailgate Lock Driver circuit and the Tailgate Unlock Driver circuit in the Lock Motor connector.

With the scan tool actuate the UNLOCK TAILGATE.

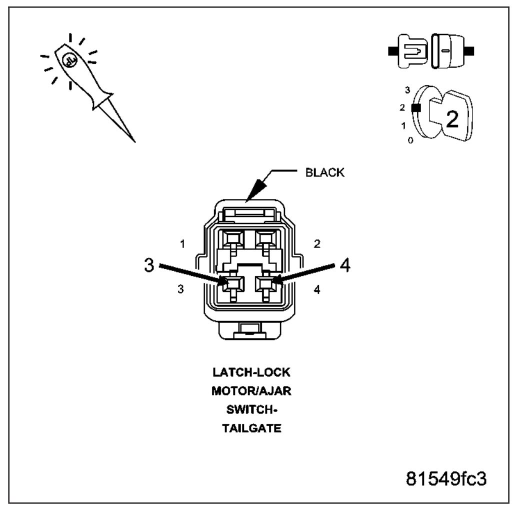
With the scan tool actuate the LOCK TAILGATE.

**Did the test light illuminate when the motor was actuated in both directions?**

**Yes** >> Replace the Tailgate Lock Motor.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 3



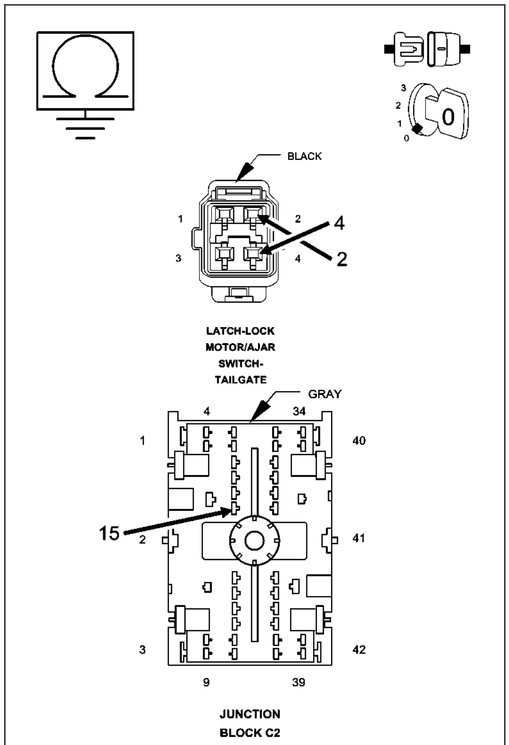
## 3. CHECK (P30) TAILGATE LOCK DRIVER CIRCUIT FOR AN OPEN

Turn the ignition off.

Connect a jumper wire between (P30) Tailgate Lock Driver circuit and the (G910) Tailgate Switch Ground in the Tailgate Lock Motor connector.

Disconnect the Junction Block C2 connector.

Measure the resistance between ground and the (P30) Tailgate Lock Driver circuit in the Junction Block C2 connector.



81549fc7

**Is the resistance below 5.0 ohms?**

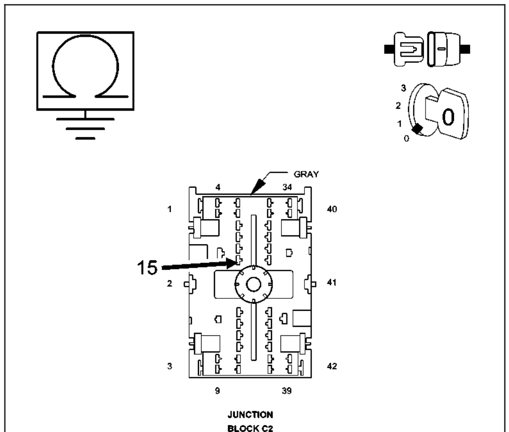
**Yes** >> Go To 4

**No** >> Repair the (P30) Tailgate Lock Driver circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 4. CHECK (P31) TAILGATE UNLOCK DRIVER CIRCUIT FOR AN OPEN

Connect a jumper wire between (P31) Tailgate Unlock Driver circuit and the (G910) Tailgate Switch Ground in the Tailgate Lock Motor connector.

Measure the resistance between ground and the (P31) Tailgate Unlock Driver circuit in the Junction Block C2 connector.



81549fcf

**Is the resistance below 5.0 ohms?**

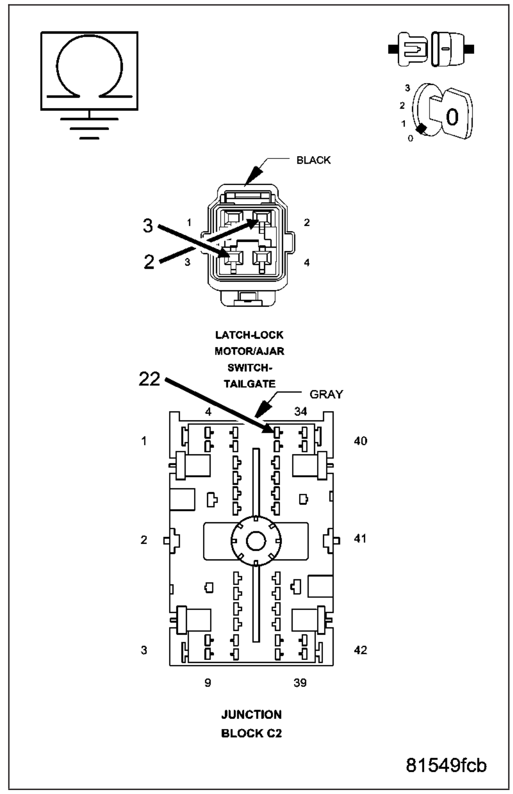
**Yes** >> Go To 5

**No** >> Repair the (P31) Tailgate Unlock Driver circuit for an open.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 5. CHECK (P30) TAILGATE LOCK DRIVER CIRCUIT FOR A SHORT TO GROUND

Disconnect the Jumper wire installed in the previous step.

Measure the resistance between ground and the (P30) Tailgate Lock Driver circuit in the Junction Block C2 connector.




**Is the resistance below 1000.0 ohms?**

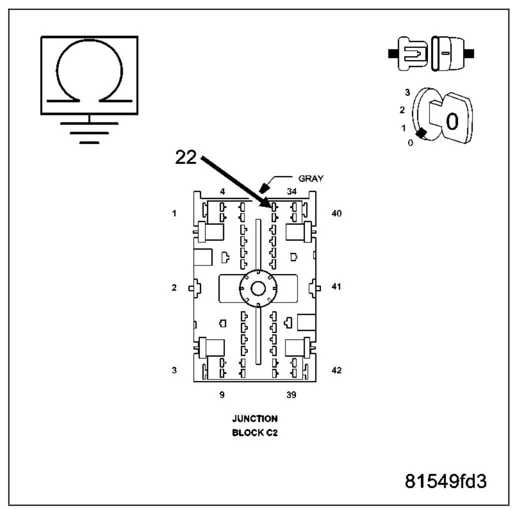
**Yes** >> Repair the (P30) Tailgate Lock Driver circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECK (P31) TAILGATE UNLOCK DRIVER CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (P31) Tailgate Unlock Driver circuit in the Junction Block C2 connector.




**Is the resistance below 1000.0 ohms?**

**Yes** >> Repair the (P31) Tailgate Unlock Driver circuit for a short to ground.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

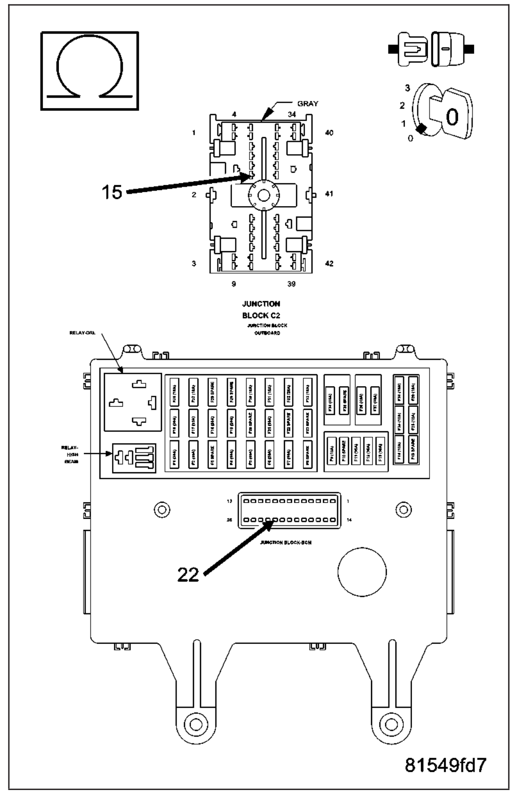
**No** >> Go To 7

## 7. CHECK JUNCTION BLOCK (P30) TAILGATE LOCK DRIVER CIRCUIT FOR AN OPEN

Remove the Junction Block.

Remove the Body Control Module from the Junction Block.

Measure the resistance of the (P30) Tailgate Lock Driver circuit between Junction Block C2 connector and the Junction Block - BCM connector.




**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 8

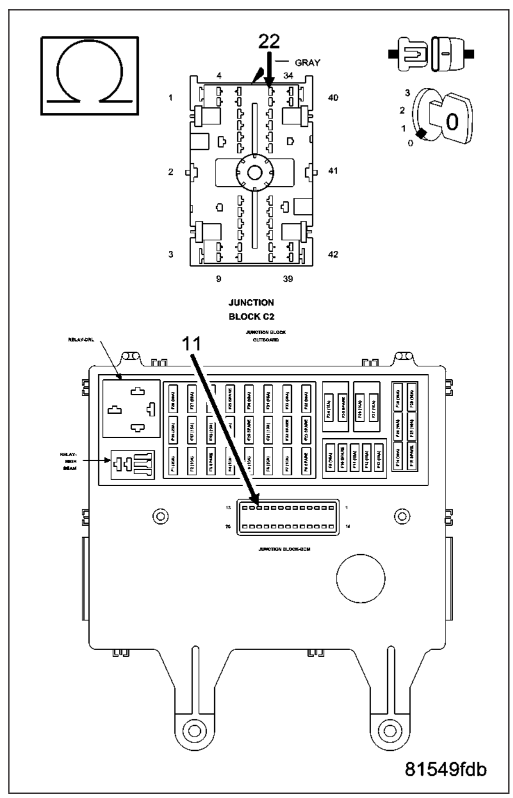
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Junction Block in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## 8. CHECK JUNCTION BLOCK (P31) TAILGATE UNLOCK DRIVER CIRCUIT FOR AN OPEN

Measure the resistance of the (P31) Tailgate Unlock Driver circuit between Junction Block C2 connector and the Junction Block - BCM connector.




**Is the resistance below 1.0 ohm?**

**Yes** >> Replace the Body Control Module in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Junction Block in accordance with service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

# POWER LOCKS

## TABLE OF CONTENTS

# POWER LOCKS

## DESCRIPTION

### POWER LOCKS

The power lock system allows all of the doors and the tailgate to be locked or unlocked electrically by operating a switch on either front door trim panel. The power lock system receives non-switched battery current through a fuse in the Junction Block (JB), so that the power locks remain operational, regardless of the ignition switch position.

The Body Control Module (BCM) locks the doors and tailgate automatically when the vehicle is driven beyond the speed of 25.7 Km/h (15 mph), all doors are closed and the accelerator pedal is depressed. The rolling door lock feature can be disabled if desired.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences.

The power lock system for this vehicle can also be operated remotely using the available Remote Keyless Entry (RKE) system radio frequency transmitters, if equipped.

Certain functions and features of the power lock system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. For proper diagnosis of these electronic modules or of the PCI data bus network, the use of a scan tool and the appropriate diagnostic information are required.

### REMOTE KEYLESS ENTRY

The RKE system allows the use of a remote battery-powered radio transmitter to signal the Body Control Module (BCM) to actuate the power lock system. The RKE receiver operates on non-switched battery current through a fuse in the Junction Block (JB), so that the system remains operational, regardless of the ignition switch position.

Certain RKE transmitters are also equipped with a Panic button. If the Panic button on the RKE transmitter is depressed, the horn will sound and the exterior lights will flash on the vehicle for about three minutes, or until the Panic button is depressed a second time. A vehicle speed of about 25.7 Km/h (15 mph) will also cancel the panic event.

The RKE system can also perform other functions on this vehicle. If the vehicle is equipped with the optional Vehicle Theft Security System (VTSS), the RKE transmitter will arm the VTSS when the Lock button is depressed, and disarm the VTSS when the Unlock button is depressed.

The RKE system includes two transmitters when the vehicle is shipped from the factory, but the system can retain the vehicle access codes of up to four transmitters. The transmitter codes are retained in the RKE receiver memory, even if the battery is disconnected. If an RKE transmitter is faulty or lost, new transmitter vehicle access codes can be programmed into the system using a scan tool.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences. Customer programmable feature options affecting the RKE system include:

- **Remote Unlock Sequence** - Allows the option of having only the driver side front door unlock when the RKE transmitter Unlock button is depressed the first time. The remaining doors and the tailgate unlock when the button is depressed a second time within 5 seconds of the first unlock press. Another option is having all doors and the tailgate unlock upon the first depression of the RKE transmitter Unlock button.
- **Sound Horn on Lock** - Allows the option of having the horn sound a short chirp as an audible verification that the RKE system received a valid Lock request from the RKE transmitter, or having no audible verification. This feature is not available on export vehicles.
- **Flash Lights with Lock and Unlock** - Allows the option of having the lights flash as an optical verification that the RKE system received a valid Lock request or Unlock request from the RKE transmitter, or having no optical verification.
- **Flip-up Glass Release** - Allows the operation of a one half second press or a one second press of the rear release button to open flip-up glass.
- **Programming Additional Transmitters** - Allows up to four transmitter vehicle access codes to be stored in the receiver memory. This feature is not available on export vehicles.

Certain functions and features of the RKE system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. For diagnosis of these electronic modules or of the PCI data bus network, the use of a scan tool and the appropriate diagnostic information are required.

### TAILGATE / FLIP-UP GLASS POWER RELEASE SYSTEM

The entire system is controlled by the Body Control Module (BCM). The tailgate / flip-up glass power release system allows the flip-up glass latch to be released electrically by actuating a switch located integral to the outside tailgate handle. By pulling the handle to the first detent or turning the key cylinder to unlock, the flip-up glass will open. Pulling the handle to the second detent will allow the tailgate to open.

The tailgate / flip-up glass release system operates on non-switched battery current supplied through a fuse in the junction block so that the system remains functional, regardless of the ignition switch position. However, the BCM prevents the flip-up glass latch from being actuated when the tailgate latch is locked.

The tailgate will lock and can not be unlocked if the rear wiper switch is activated. The tailgate will also lock if battery power is lost and then restored.

The tailgate/flip-up glass will not function with the battery discharged or disconnected.

### COMBINATION FLASHER

This flasher can be energized by the BCM to flash all of the park/turn signal lamps as a optical alert for the RKE panic function and, if the Flash Lights with Lock/Unlock programmable feature is enabled, as an optical verification for the RKE lock/unlock event.

### HORN RELAY

This relay can be energized by the BCM to sound the horns as an audible alert for the RKE panic function and, if the Sound Horn on Lock programmable feature is enabled, as an audible verification for the RKE lock event.

### LOW BEAM HEADLAMP RELAY

This relay can be energized by the BCM to flash the headlamp low beams as an optical alert for the RKE panic function.

## OPERATION

### POWER LOCKS

The Body Control Module (BCM) locks or unlocks the doors when an actuation input signal from a door lock switch or Remote Keyless Entry Module (RKE) is received. The BCM turns on the output drivers and provides a voltage level to the door lock motor for a specified time. All passenger doors can be locked or unlocked using a mechanical button mounted on the door trim panel. The front passenger doors and tailgate can be locked or unlocked by using the key cylinder (tailgate cylinder does not lock/unlock vehicle. It only unlocks the tailgate). The tailgate will lock and can not be unlocked if the rear wiper switch is activated (this prevents the wiper from operating when the tailgate is ajar). The tailgate will also lock if battery power is lost and then restored.

### AUTOMATIC DOOR LOCKS

When the automatic door locks are ENABLED the door locks will lock when the vehicle is moving at about 25.7 Km/h (15 mph), all doors are closed and the accelerator pedal is depressed. This feature can be switched ON or OFF as desired. When the system is DISABLED the door locks will operate normally, but will not lock automatically when the vehicle is rolling. Once the automatic door locks have been actuated, they will not try to lock the doors again until a door is opened.

### DOOR LOCK INHIBIT

If the key is in the ignition, in any position, and either front door is ajar, the doors can not be locked, but the unlock function still operates. Pressing the RKE lock/unlock button under these conditions will result in a normal lock/unlock activation.

After the key is removed from the Ignition Switch, or the doors are closed, the power door locks will operate normally.

## DOOR LOCK CIRCUIT PROTECTION

The BCM controls the door lock relays. If the door lock switch is actuated continuously for more than five seconds the BCM will turn the output driver OFF (the BCM would consider the switch stuck). Each lock motor is protected with a Positive Temperature Coefficient device that prevents motor burn out.

## REMOTE KEYLESS ENTRY

- **LOCK**: Pressing the LOCK button locks all doors, sounds horn (chirp) if enabled, and arms the Vehicle Theft Security System, if enabled. The chirp verifies that the RKE receiver has sent a message to the BCM for door lock operation. If a door has not been closed before pressing the LOCK button, the vehicle may not be secured and the VTSS (if equipped) will not arm until the door is closed.
- **UNLOCK**: Pressing the UNLOCK button once will unlock the driver's door and activate the illuminated entry system and disarm Vehicle Theft Security System, if equipped. Pressing the UNLOCK button twice within five seconds will unlock all doors.
- **TAILGATE**: Pressing the TAILGATE BUTTON unlocks the tailgate remotely and opens the flip-up glass.
- **PANIC**: If equipped, pressing the PANIC button sounds the horns at half second intervals, flashes the exterior lamps, and turns ON the interior lamps. The panic alarm will remain on for three minutes, or until the PANIC button is actuated again or the ignition switch is turned to the RUN position.

The Remote Keyless Entry Module is capable of retaining the transmitter Vehicle Access Code(s) in its memory even after vehicle power has been interrupted.

## DIAGNOSIS AND TESTING - POWER LOCKS

**The Body Control Module (BCM) enters a reduced power mode after the key is turned OFF. All diagnosis and testing of the power lock system must be done with the key in the ON position unless otherwise stated.**

**The most reliable, efficient, and accurate means to diagnose the power lock system requires the use of a scan tool and the proper Diagnostic Procedures manual. The scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the power lock motors are being sent the proper hard wired outputs by the relays for them to perform their power lock system functions.**

Following are tests that will help to diagnose the hard wired components and circuits of the power lock system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the power lock system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the power lock system components must be checked.

The Body Control Module (BCM) will set Diagnostic Trouble Codes (DTC) for the power lock system.

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

## PRELIMINARY DIAGNOSIS

As a preliminary diagnosis for the power lock system, note the system operation while you actuate both the Lock and Unlock functions with the power lock switches and with the Remote Keyless Entry (RKE) transmitter. Then, proceed as follows:

- If the entire power lock system fails to function with either the power lock switches or the RKE transmitter, check the fused B(+) fuse in the junction Block (JB).
- If the power lock system functions with both power lock switches, but not with the RKE transmitter, proceed to diagnosis of the Remote Keyless Entry (RKE) system. (Refer to 8 - ELECTRICAL/POWER LOCKS/KEYLESS ENTRY TRANSMITTER - DIAGNOSIS AND TESTING) or (Refer to 8 - ELECTRICAL/POWER LOCKS/REMOTE KEYLESS ENTRY MODULE - DIAGNOSIS AND TESTING).
- If the power lock system functions with the RKE transmitter, but not with one or both power lock switches, proceed to diagnosis of the door lock switches. (Refer to 8 - ELECTRICAL/POWER LOCKS/POWER LOCK SWITCH - DIAGNOSIS AND TESTING).
- If the driver side power lock switch operates only the driver side front door power lock motor, but all other power lock motors operate with the passenger side power lock switch or the RKE transmitter, use a scan tool and the appropriate diagnostic information to diagnose the Programmable Communications Interface (PCI) data bus.

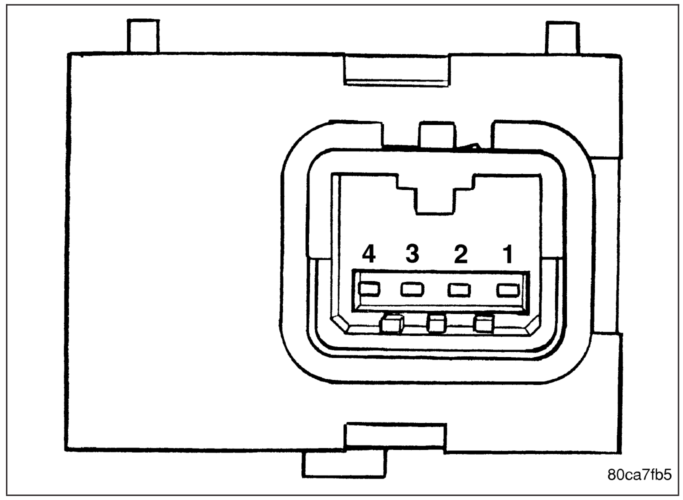
- If only one power lock motor fails to operate with both power lock switches and the RKE transmitter, proceed to diagnosis of the power lock motor. (Refer to 8 - ELECTRICAL/POWER LOCKS/POWER LOCK MOTOR - DIAGNOSIS AND TESTING).

# DOOR LOCK / UNLOCK SWITCH

## DIAGNOSIS AND TESTING - DOOR LOCK/UNLOCK SWITCH

1. Remove the switch to be tested (Refer to 8 - ELECTRICAL/POWER LOCKS/POWER LOCK SWITCH - REMOVAL).
2. Using an ohmmeter, Test switch for resistance values.

**DOOR LOCK SWITCH TEST**

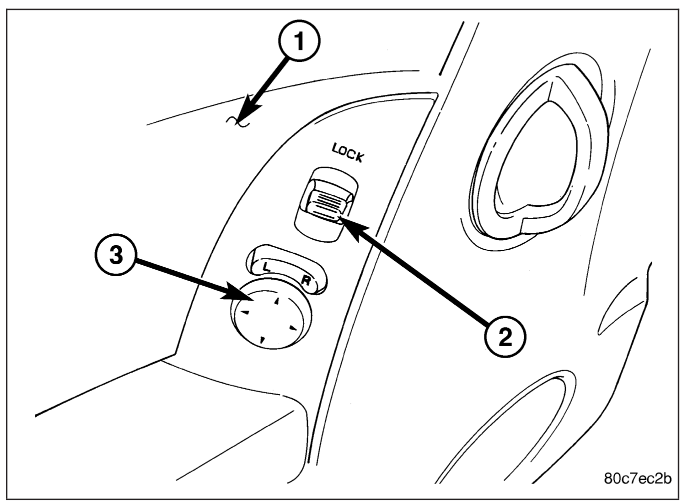



| SWITCH POSITION | PINS | RESISTANCE VALUE |
|---|---|---|
| UNACTUATED | 1 AND 4 | 5.0K OHM ± 10 % |
| LOCK | 1 AND 4 | 1.4K OHM ±10 % |
| UNLOCK | 1 AND 4 | 426 OHM ± 10 % |

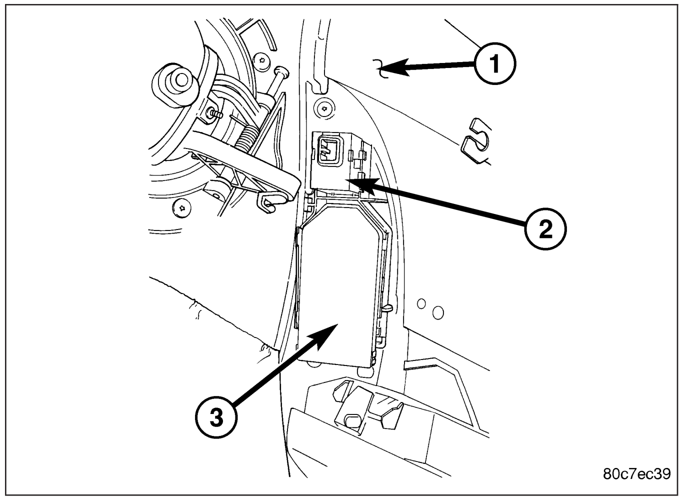
3. If test results are not obtained as shown in the test table, replace the switch.

## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the door trim panel (1) (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
3. Disconnect electrical harness connector from switch (2).

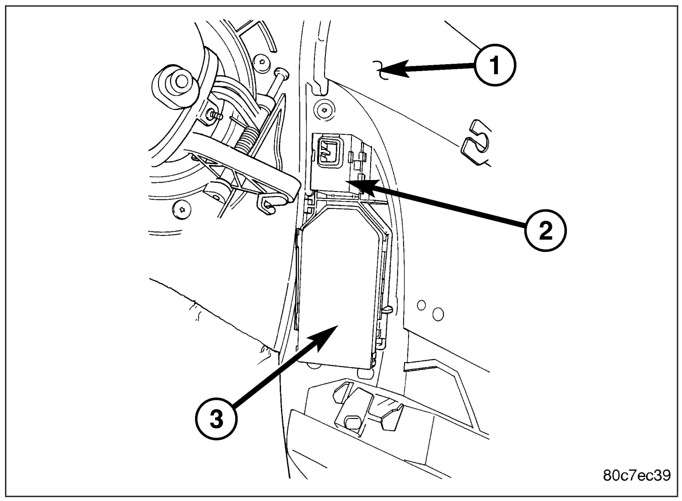


4. From behind the door trim panel (1), gently pry the switch (2) from the door trim panel.




## INSTALLATION

1. Press the switch (2) into place.
2. Connect the electrical harness connector to the switch.
3. Install the door trim panel (1) (Refer to 23 - BODY/ DOOR - FRONT/TRIM PANEL - INSTALLATION).
4. Connect the battery negative cable.



# DOOR LOCK MOTOR

## DESCRIPTION

The lock mechanisms are actuated by a reversible electric motor mounted within each door and tailgate. The power lock motors are integral to the door latch units.

The power lock motors cannot be adjusted or repaired and, if faulty or damaged, the door latch unit must be replaced.

## OPERATION

The door lock motors are controlled by relays. A positive and negative battery connection to the two motor terminals will cause the motor to move in one direction. Reversing the current will cause the motor to move in the opposite direction.

## DIAGNOSIS AND TESTING - DOOR LOCK MOTOR

The most reliable, efficient, and accurate means to diagnose the power lock system requires the use of a scan tool and the proper Diagnostic Procedures manual. Refer to the appropriate wiring information.

# FLIP-UP GLASS RELEASE SWITCH

## DIAGNOSIS AND TESTING - FLIP-UP GLASS RELEASE SWITCH

1. Disconnect and isolate the battery negative cable.
2. Remove the tailgate trim panel (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/TRIM PANEL - REMOVAL).
3. Disconnect the wire harness connector.
4. Using an ohmmeter, check for continuity between the pins of the wire harness connector while pulling on the tailgate handle.
5. If no continuity is found, replace the tailgate handle assembly (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/EXTERIOR HANDLE - REMOVAL).

# DOOR LOCK RELAY

## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Reach up under instrument panel and remove the relay from Junction Block (JB).

## INSTALLATION

1. Position the horn relay in the proper receptacle in the Junction Block (JB).
2. Push down firmly on the relay until the terminals are fully seated.
3. Connect the battery negative cable.

# REMOTE KEYLESS ENTRY MODULE

## DESCRIPTION

When an RKE lock message is sent to the Body Control Module (BCM), the BCM actuates the doors and the tailgate lock, the interior lighting is turned off, the horn chirps (if this feature is enabled), the exterior lamps flash (if this feature is enabled) and, if the vehicle is so equipped, the Vehicle Theft Security System (VTSS) is armed. When an RKE unlock message is sent to the BCM, the BCM actuates the driver side front door (or all doors and the tailgate if this feature is enabled) unlock, the interior lighting is turned on and, if the vehicle is so equipped, the VTSS is disarmed. The exterior lamps flash if this feature is enabled

When an RKE panic message is sent to the BCM, the BCM actuates the driver side front door (or all doors and the tailgate if this feature is enabled) unlock, the interior lighting is turned on and, if the vehicle is so equipped, the VTSS is disarmed. The panic message will also cause the exterior lamps (including the headlights) to flash, and the horn to pulse for about three minutes, or until a second panic message is sent to the BCM. A vehicle speed of about 25.7 Km/h (15 mph) will also cancel the panic event.

## OPERATION

Whenever the vehicle battery power is interrupted, the Remote Keyless Module (RKE) Module will retain all vehicle access codes in its memory. When replacing or adding a key fob transmitter (maximum of 4) a scan tool is required to program the RKE Module to accept the new Vehicle Access Code if a customer owned transmitter is not available.

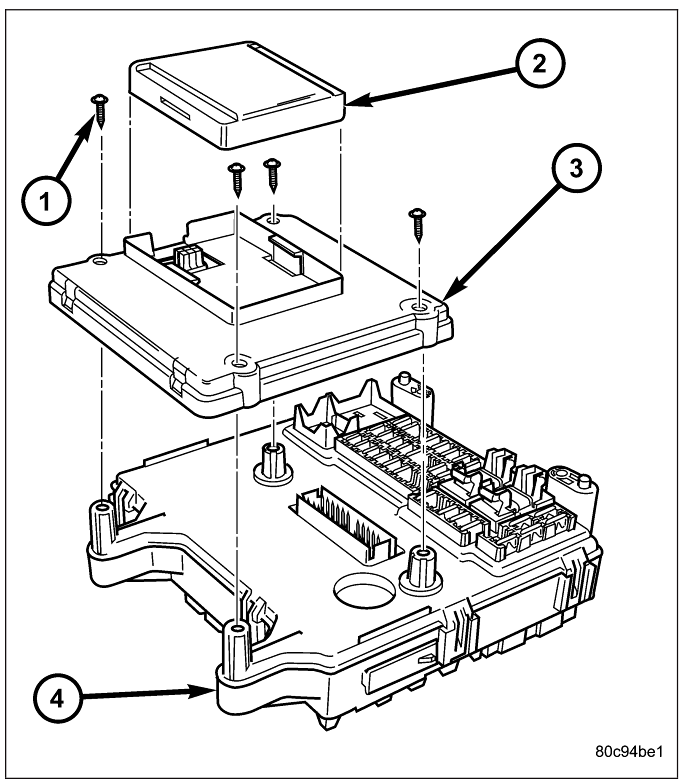
If a functioning transmitter is available, (Refer to 8 - ELECTRICAL/POWER LOCKS/KEYLESS ENTRY TRANSMITTER - STANDARD PROCEDURE)

## DIAGNOSIS AND TESTING - REMOTE KEYLESS ENTRY MODULE

Refer to the proper Body Diagnostic Procedures Manual for testing the Remote Keyless Entry system using a scan tool.

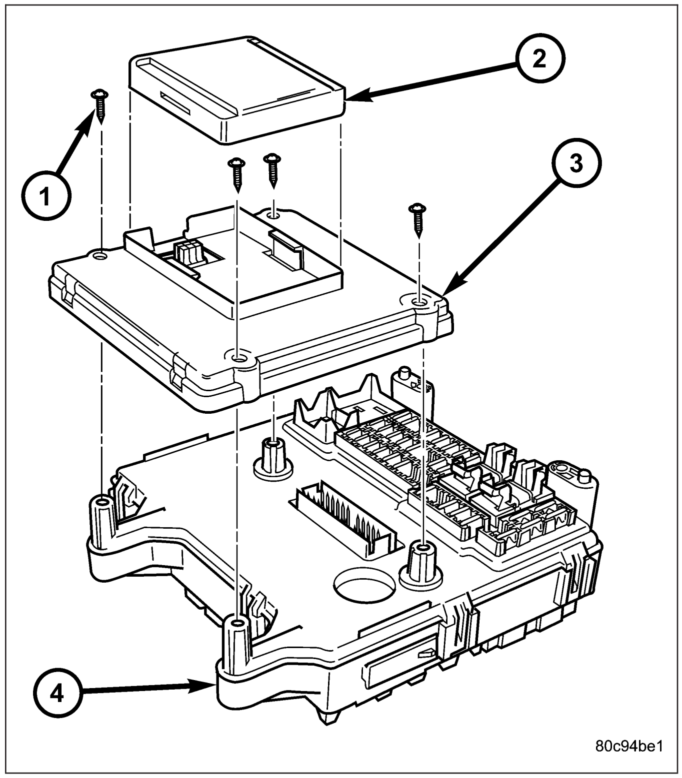
## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the Junction Block (JB) (4) (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/JUNCTION BLOCK - REMOVAL).
3. Remove Remote Keyless Entry module (2) from Body Control Module (3).



## INSTALLATION

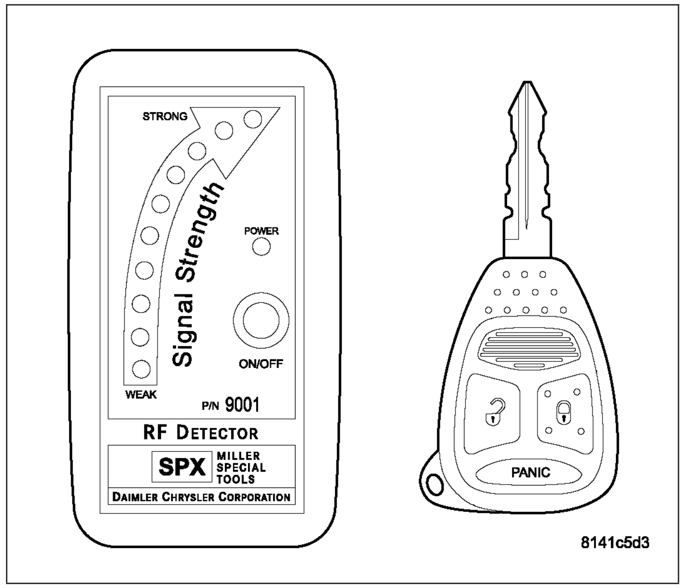
1. Install Remote Keyless Entry module (2) to Body Control Module (3).
2. Install Junction Block (JB) (4) (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/JUNCTION BLOCK - INSTALLATION).
3. Connect the battery negative cable.



# REMOTE KEYLESS ENTRY TRANSMITTER

## DIAGNOSIS AND TESTING - REMOTE KEYLESS ENTRY TRANSMITTER

Using special tool 9001, first test to ensure that the transmitter is functioning. Typical testing distance is 2.5 centimeters (1 inch) for Asian transmitters and 30.5 centimeters (12 inches) for all others. To test, position the transmitter as shown. Press any transmitter button, then test each button individually. The tool will beep if a radio signal strength that lights five or more LED’s is detected. Repeat this test three times. If transmitter fails any of the test refer to the Diagnostic Procedures manual.




## STANDARD PROCEDURE

## STANDARD PROCEDURE - RKE TRANSMITTER CUSTOMER PREFERENCES

### AUTOMATIC (ROLLING) LOCKS

The rolling locks feature can be toggled ON/OFF by using the scan tool only.

### HORN CHIRP DISABLING / ENABLING

The horn chirp can be toggled using the scan tool or by using the Remote Keyless Entry (RKE) transmitter.

To DISABLE (cancel) the horn chirp feature, press and hold the transmitter LOCK button for four to ten seconds. While pressing the LOCK button in, press the UNLOCK button. Release both buttons.

To ENABLE the horn chirp feature, repeat the above procedure.

### OPTICAL CHIRP (FLASH) DISABLING / ENABLING

The optical chirp can be toggled using the scan tool or by using the Remote Keyless Entry (RKE) transmitter.

To DISABLE (cancel) the optical chirp feature, press and hold the transmitter LOCK button for four to ten seconds. While pressing the LOCK button in, press the TAILGATE RELEASE button. Release both buttons.

To ENABLE the optical chirp feature, repeat the above procedure.

### TAIL GATE RELEASE DELAY

Press the UNLOCK button for four to ten seconds. While pressing the UNLOCK button, press the TAIL GATE RELEASE button. Release both buttons.

This will toggle between PRESS AND HOLD and PRESS (no delay).

### UNLOCK SEQUENCE

The unlock sequence can be toggled using the scan tool or by using the Remote Keyless Entry (RKE) transmitter.

Press and hold the transmitter UNLOCK button for four to ten seconds. While pressing the UNLOCK button in, press the LOCK button. Release both buttons.

This will toggle between Driver door first and Unlock all doors function.

## STANDARD PROCEDURE - RKE TRANSMITTER PROGRAMING

New Remote Keyless Entry (RKE) transmitters can be programed using the scan tool and the proper Diagnostic Procedures manual, if no functioning transmitter is available. The scan tool can provide confirmation that the PCI data bus is functional, and that all of the electronic modules are sending and receiving the proper messages on the PCI data bus.

The following procedure can be used as long as one functioning transmitter is available:

1. Turn ignition to the RUN position (allow ignition chimes to stop).
2. Using any original (working) transmitter, press the UNLOCK button for 4 to 10 seconds.
3. Within the specified 4 to 10 seconds, continue pressing the UNLOCK button and press the PANIC button for 1 second, and release both buttons (a chime will sound to indicate that the transmitter programming mode has been entered - allow 3 seconds for chime to sound).
4. Press LOCK and UNLOCK buttons simultaneously for 1 second and release.
5. Press and release any button on the same transmitter and a chime will sound after successfully programming the transmitter.
6. Repeat steps 4 to 6 to program additional transmitters.
7. Turn ignition to the OFF position. Transmitter programming mode will discontinue after 60 seconds. All transmitter programming must be completed within time specified.

## STANDARD PROCEDURE - RKE TRANSMITTER BATTERIES

The Remote Keyless Entry (RKE) transmitter case snaps open and shut for battery access. To replace the RKE transmitter batteries:

1. Using a thin coin, gently pry at the notch in the center seam of the RKE transmitter case halves near the key ring until the two halves unsnap.
2. Lift the back half of the transmitter case off of the RKE transmitter.
3. Remove the two batteries from the RKE transmitter.
4. Replace the two batteries with new Panasonic 2016 (if equipped with one battery, use 2032), or equivalent. Be certain that the batteries are installed with their polarity correctly oriented.
5. Align the two RKE transmitter case halves with each other, and squeeze them firmly and evenly together until they snap back into place.

## SPECIFICATIONS - REMOTE KEYLESS ENTRY TRANSMITTER

### RANGE

Normal operation range is up to a distance of 3 to 7 meters (10 to 23 ft.) of the vehicle. Range may be better or worse depending on the environment around the vehicle.

# TAILGATE CYLINDER LOCK SWITCH

## DESCRIPTION

The tailgate cylinder lock switch is integral to the key lock cylinder inside the tailgate. The tailgate cylinder lock switch is a normally-open momentary switch that is hard wired directly to the Body Control Module (BCM), and closes a path to ground through an internal resistor when the lock cylinder is rotated to the unlock or lock position.

The tailgate cylinder lock switch cannot be adjusted or repaired.

## OPERATION

The tailgate cylinder lock switch is actuated when the key is inserted in the lock cylinder and turned to the unlock or lock position. The tailgate cylinder lock switch closes a path to ground through an internal resistor for the Body Control Module (BCM) when the tailgate key lock cylinder is in the lock or unlock position, and opens the ground path when the lock cylinder is in the neutral position. The BCM reads the switch status, then sends the proper switch status messages to other electronic modules over the Programmable Communications Interface (PCI) data bus network. The tailgate cylinder lock switch unlock status message is used by the BCM as an input for Vehicle Theft Security System (VTSS) operation and to tell the BCM to lock or unlock the tailgate. There is no mechanical linkage between the tailgate key cylinder and the latches.

## DIAGNOSIS AND TESTING - TAILGATE CYLINDER LOCK SWITCH

1. Disconnect and isolate the battery negative cable.
2. Remove tailgate trim panel (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/TRIM PANEL - REMOVAL).
3. Disconnect tailgate cylinder lock switch harness connector.
4. Using a ohmmeter, test for resistances as shown in the Tailgate Cylinder Lock Switch Table.

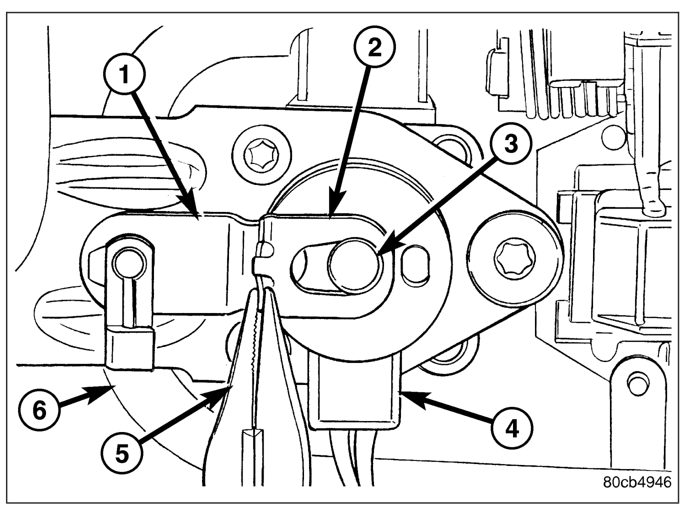
**TAILGATE CYLINDER LOCK SWITCH TABLE**

| SWITCH POSITION | RESISTANCE |
|---|---|
| NEUTRAL | 0 OHMS |
| LOCK (CLOCKWISE) | 2 K OHMS ± 10 % |
| UNLOCK (COUNTER-CLOCKWISE) | 470 OHMS ± 10 % |

5. If switch resistance is not correct, replace switch.

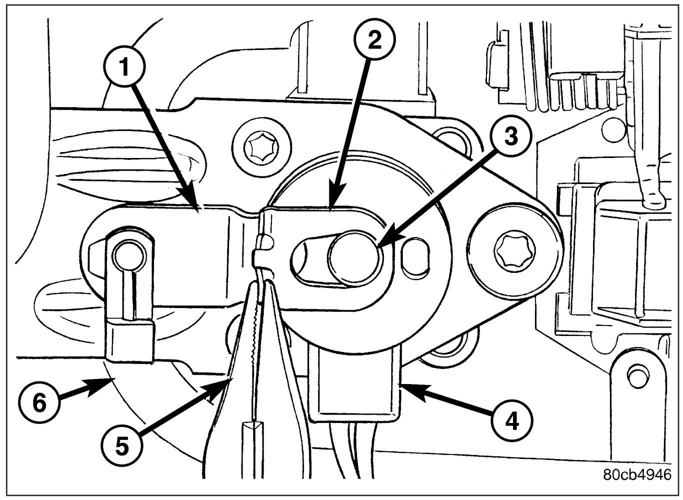
## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the tailgate trim panel. (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/TRIM PANEL - REMOVAL).
3. Remove the retainer clip from the pin on the back of the door lock cylinder (3).
4. Remove the washer from the pin on the back of the door lock cylinder.
5. Remove the door cylinder lock switch (4) from the back of the lock cylinder.



## INSTALLATION

1. Position the tailgate cylinder lock switch (4) onto the back of the lock cylinder (3) with the wire harness oriented toward the bottom.
2. Position the washer over the switch.
3. Install the retainer (2) clip onto the pin on the back of the tailgate lock cylinder. Be certain that the center tab of the retainer is engaged in the retention hole on the lock lever.
4. Install the trim panel (Refer to 23 - BODY/DECKLID/HATCH/LIFTGATE/TAILGATE/TRIM PANEL - INSTALLATION).
5. Connect the battery negative cable.



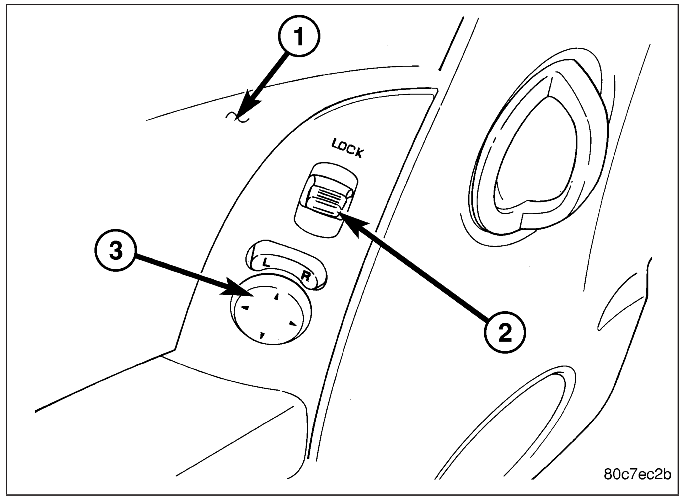
# POWER MIRRORS

## TABLE OF CONTENTS

# POWER MIRRORS

## DESCRIPTION

The power operated sideview mirrors allow the driver to adjust both outside mirrors electrically from the drivers seat by operating a switch (3) on the driver side front door trim panel (1).




## OPERATION

The power mirrors receive ignition current through a fuse in the junction block, and will only operate when the ignition switch is in the Run position.

## DIAGNOSIS AND TESTING - POWER MIRRORS

### WIRING VOLTAGE TEST

The following wiring test determines whether or not voltage is continuous through the body harness to switch.

1. Remove the power mirror switch (Refer to 8 - ELECTRICAL/POWER MIRRORS/POWER MIRROR SWITCH - REMOVAL).
2. Disconnect wire connector from back of power mirror switch.
3. Switch ignition to the RUN position.
4. Connect the clip end of a 12 volt test light to Pin 5 in the harness connector at the mirror switch. Touch the test light probe to Pin 3.

If the test light illuminates, the wiring circuit between the battery and switch is OK.

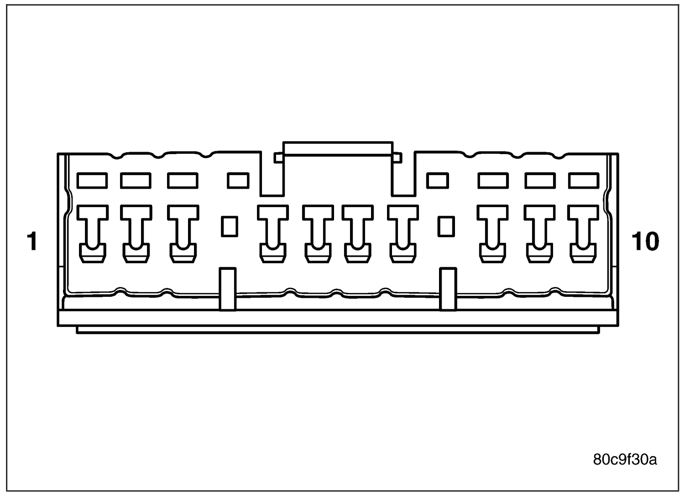
If the lamp does not illuminate, first check fuse 25 in the Junction Block (JB). If fuse 25 is OK, then check for a broken wire.

Refer to the appropriate wiring information.

## POWER MIRROR MOTOR TEST

If the power mirror switch is receiving proper current and ground and mirrors do not operate, proceed with power mirror motor test. Refer to the appropriate wiring information.

1. Remove front door trim panel to gain access to power mirror wire connector (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
2. Disconnect wire harness connector to power mirror switch.
3. Using two jumper wires:
   - Connect one to a 12 volt source
   - Connect the other to a good body ground
   - Refer to the Mirror Motor Test Chart for proper wire connections at the switch connector




### MIRROR MOTOR TEST CHART

| 12 VOLTS | GROUND | MIRROR REACTION | |
|---|---|---|---|
| SWITCH CONNECTOR | | RIGHT | LEFT |
| PIN 2 | PIN 6 | - | UP |
| PIN 6 | PIN 1 | - | LEFT |
| PIN 6 | PIN 2 | - | DOWN |
| PIN 1 | PIN 6 | - | RIGHT |
| PIN 9 | PIN 6 | UP | - |
| PIN 6 | PIN 10 | LEFT | - |
| PIN 6 | PIN 9 | DOWN | - |
| PIN 10 | PIN 6 | RIGHT | - |

4. If results shown in table are not obtained, check for open or shorted circuit. Replace mirror assembly as necessary.

# AUTOMATIC DAY / NIGHT MIRROR

## DESCRIPTION - REAR VIEW MIRROR

The automatic dimming inside day/night rear view mirror system is a completely self-contained unit that replaces the standard equipment inside rear view mirror. This system will automatically change the reflectance of the inside rear view mirror to protect the driver from the unwanted headlight glare of trailing vehicles while driving at night. The automatic day/night inside mirror receives ignition switched battery current through a fuse in the junction block, and will only operate when the ignition switch is in the On position.

The automatic day/night mirror sensitivity cannot be repaired or adjusted. If any component of this unit is inoperative or damaged, the entire automatic day/night inside rear view mirror unit must be replaced.

## OPERATION - REAR VIEW MIRROR

The automatic day/night mirror switch allows the driver a manual control of whether the automatic dimming feature is operational. This switch is a momentary rocker-type switch located on the lower rear-facing surface of the mirror housing. When Auto is selected, a Light-Emitting Diode (LED) on the mirror housing just to the right of the switch illuminates to indicate that automatic day/night mirror is turned on. When Off is selected, the LED is turned off. The mirror also senses the backup lamp circuit, and will automatically disable its self-dimming feature whenever the transmission gear selector is in the Reverse position.

A thin layer of electrochromatic material between two pieces of conductive glass make up the face of the mirror. Two photocell sensors are used to monitor light levels and adjust the reflectance of the mirror. The ambient photocell sensor faces forward, to detect the outside light levels. The headlamp sensor is located on the mirror housing just to the left of the switch and facing rearward, to detect the light level received at the rear window side of the mirror. When the difference between the two light levels becomes too great (the light level received at the rear of the mirror is much higher than that at the front of the mirror), the mirror begins to darken.

## DIAGNOSIS AND TESTING - AUTOMATIC DAY / NIGHT MIRROR

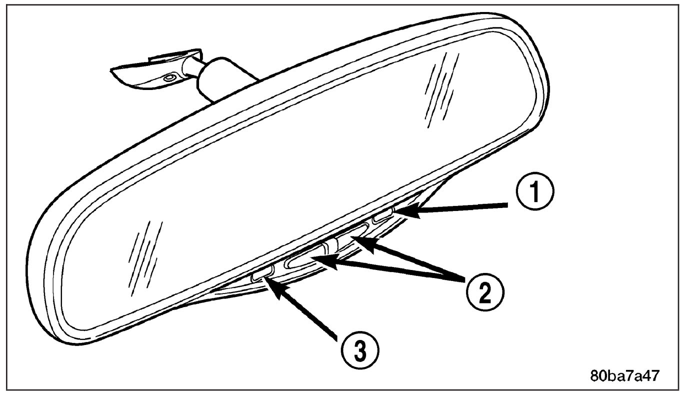
For complete circuit diagrams, refer to the appropriate wiring information.

1. Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
2. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.
3. Disconnect the overhead wire harness connector from the automatic day/night mirror connector receptacle. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the overhead wire harness connector for the automatic day/night mirror. If OK, go to Step 4. If not OK, repair the open fused ignition switch output (run/start) circuit to the fuse in the junction block as required.
4. Turn the ignition switch to the Off position. Check for continuity between the ground circuit cavity of the overhead wire harness connector for the automatic day/night mirror and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open ground circuit to ground as required.
5. Turn the ignition switch to the On position. Set the parking brake. Place the transmission gear selector lever in the Reverse position. Check for battery voltage at the backup lamp switch output circuit cavity of the overhead wire harness connector for the automatic day/night mirror. If OK, reconnect the overhead wire harness connector

to the automatic day/night mirror connector receptacle and go to Step 6. If not OK, repair the open backup lamp switch output circuit as required.

6. Place the transmission gear selector lever in the Neutral position. Place the automatic day/night mirror switch (2) in the Auto (LED (1) next to the switch is lighted) position. Cover the forward facing ambient photocell sensor to keep out any ambient light.

**NOTE: The ambient photocell sensor must be covered completely, so that no light reaches the sensor. Use a finger pressed tightly against the sensor, or cover the sensor completely with electrical tape.**



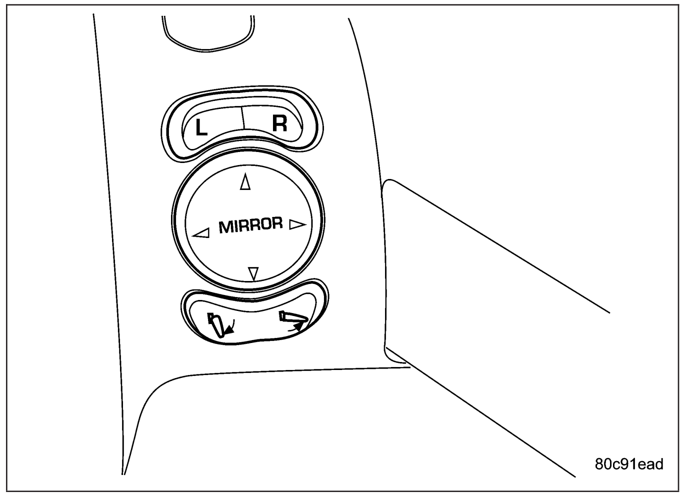

7. Shine a light into the rearward facing headlamp photocell sensor (3). The automatic day/night mirror should darken. If OK, go to Step 8. If not OK, replace the faulty automatic day/night mirror unit.
8. With the mirror darkened, place the transmission gear selector lever in the Reverse position. The automatic day/night mirror should return to its normal reflectance. If not OK, replace the faulty automatic day/night mirror unit.

# POWER FOLDAWAY MIRROR SWITCH - EXPORT

## DESCRIPTION

These vehicles may be equipped with Power Foldaway Mirrors. This feature allows both the driver and passenger side view mirrors to fold inward (retract) on demand. The vehicle has an additional switch located below the power mirror switch that controls the folding function of the mirror assembly.

The fold-away side view mirror is attached to the vehicle's door in the same manner as mirrors without the fold-away option. The fold-away mirrors unique option is the internal motor which allows the mirrors to fold inward. The fold-away mirror motor is not serviceable separately and if a motor is found to be faulty, the entire side view mirror must be replaced.




## OPERATION

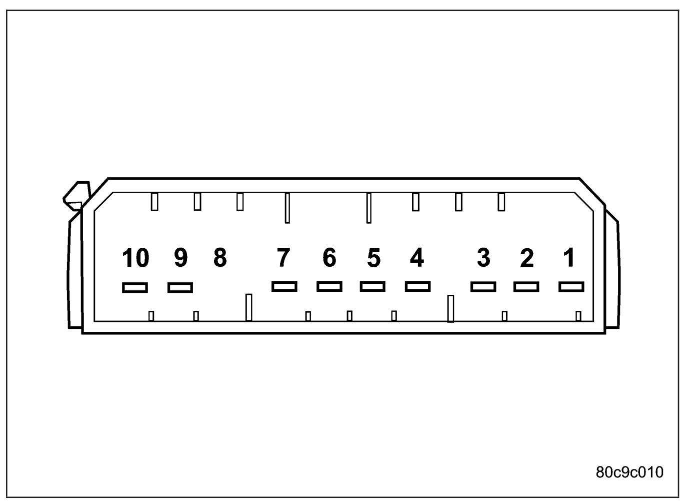
When the mirror retract switch is depressed, both of the side view mirrors will fold inward, Thus making the overall width of the vehicle the smallest possible. This can be helpful were parking space is a absolute minimum.

The power fold away mirrors will operate only when the ignition is in the On position.

The power fold away mirror system consists of the following components: mirror switch, side view mirror, relay, wires and fuse. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

## DIAGNOSIS AND TESTING - POWER FOLDAWAY MIRROR SWITCH - EXPORT

1. Disconnect and isolate the battery negative cable.
2. Remove power foldaway mirror switch (Refer to 8 - ELECTRICAL/POWER MIRRORS/POWER MIRROR SWITCH - REMOVAL).
3. Disconnect wire harness connector.
4. Using a ohmmeter, test for continuity between the terminals of the switch.
5. If results shown in the table are not obtained, replace the switch.



**POWER FOLDAWAY MIRROR SWITCH TEST**

| SWITCH POSITION | CONTINUITY BETWEEN |
|---|---|
| RETRACT | 5 AND 4 |
| | 3 AND 7 |
| EXTEND | 5 AND 7 |
| | 3 AND 4 |
| MIRROR SELECT SWITCH IN ″LEFT″ POSITION | |
| UP | 5 AND 2 |
| | 3 AND 6 |
| DOWN | 5 AND 6 |
| | 3 AND 2 |
| LEFT | 5 AND 6 |
| | 3 AND 1 |
| RIGHT | 5 AND 1 |
| | 3 AND 6 |
| MIRROR SELECT SWITCH IN ″RIGHT″ POSITION | |
| UP | 5 AND 9 |
| | 3 AND 6 |
| DOWN | 5 AND 6 |
| | 3 AND 9 |
| LEFT | 5 AND 6 |
| | 3 AND 10 |
| RIGHT | 5 AND 10 |
| | 3 AND 6 |

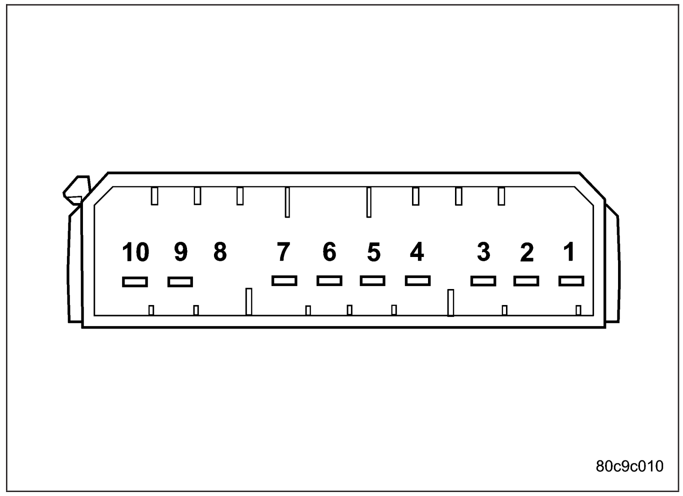
## REMOVAL

For removal procedures (Refer to 8 - ELECTRICAL/POWER MIRRORS/POWER MIRROR SWITCH - REMOVAL).

# POWER MIRROR SWITCH

## DIAGNOSIS AND TESTING - POWER MIRROR SWITCH

1. Remove power mirror switch (Refer to 8 - ELECTRICAL/POWER MIRRORS/POWER MIRROR SWITCH - REMOVAL).
2. Disconnect wiring harness connector from switch.
3. Using a ohmmeter, test for continuity between the terminals of the switch.
4. If results shown in the table are not obtained, replace the switch.

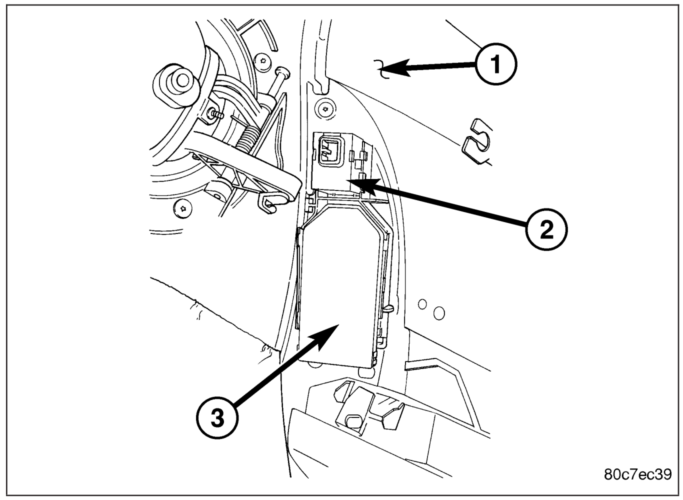



**POWER MIRROR SWITCH TEST**

| SWITCH POSITION | CONTINUITY BETWEEN |
|---|---|
| MIRROR SELECT SWITCH IN ″LEFT″ POSITION | |
| UP | 5 AND 2 |
| | 3 AND 6 |
| DOWN | 5 AND 6 |
| | 3 AND 2 |
| LEFT | 5 AND 6 |
| | 3 AND 1 |
| RIGHT | 5 AND 1 |
| | 3 AND 6 |
| MIRROR SELECT SWITCH IN ″RIGHT″ POSITION | |
| UP | 5 AND 9 |
| | 3 AND 6 |
| DOWN | 5 AND 6 |
| | 3 AND 9 |
| LEFT | 5 AND 6 |
| | 3 AND 10 |
| RIGHT | 5 AND 10 |
| | 3 AND 6 |

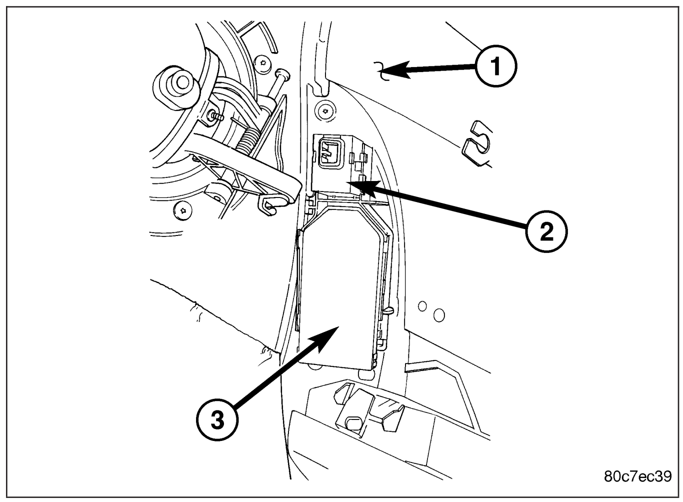
## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove door trim panel (1) (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
3. Disconnect wire harness connector from switch (3).
4. Remove switch from door trim panel.




## INSTALLATION

1. Install switch to door trim panel (1).
2. Connect wire harness connector to switch (3).
3. Install door trim panel (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION).
4. Connect battery negative cable.



# SIDEVIEW MIRROR

## REMOVAL

1. For removal procedures, (Refer to 23 - BODY/EXTERIOR/SIDE VIEW MIRROR - REMOVAL).

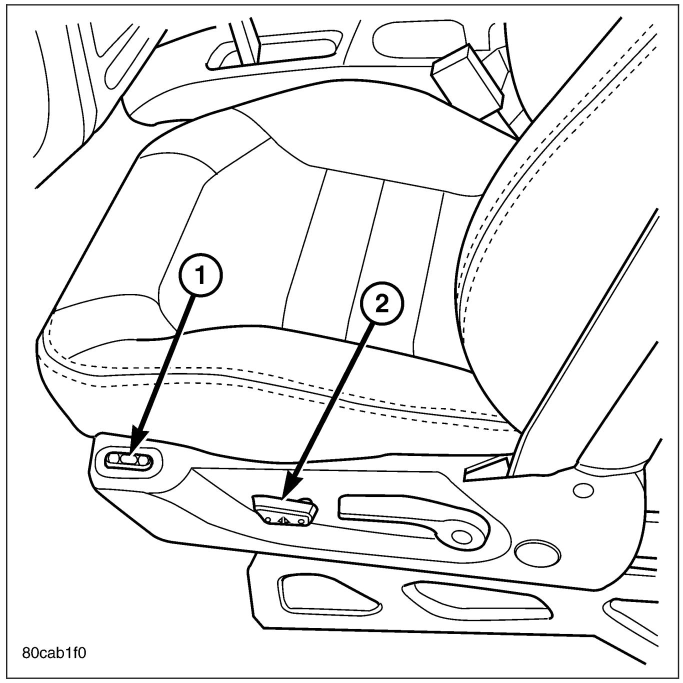
# POWER SEATS-SERVICE INFO

## TABLE OF CONTENTS

# POWER SEATS-SERVICE INFO

## DESCRIPTION

Individually controlled, electrically powered front seats are available as factory-installed equipment on this model. Vehicles with this option can be visually identified by the power seat switches (2), mounted on each of the front seat cushion side shields. The power seat system option allows the front seating positions to be electrically adjusted for optimum vehicle control and comfort. The power seat cushion can be adjusted forward, rearward, front up, front down, rear up, or rear down. The power seat system for this vehicle includes the following major components:




- **Power Seat Switches** - Two power seat switches are used per vehicle, one for the driver and one for the front seat passenger. Refer to the left and right power seat switch information later in this section.
- **Power Seat Tracks** - Two power seat tracks are used per vehicle, one for the driver and one for the front seat passenger seats. Refer to the power seat track information later in this section.
- **Circuit Breaker** - An automatic resetting circuit breaker is located in the Junction Block and is used to protect the power seat system from current overload.

Hard wired circuitry connects the power seat system components to each other through the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the power seat system components through the use of a combination of soldered splices, splice block connectors and many different types of wire harness terminal connectors and insulators. Refer to the **Wiring** section of this manual for more information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

## OPERATION

The power seat system receives battery current through a fuse in the Power Distribution Center (PDC) and a circuit breaker in the Junction Block, regardless of the ignition switch position.

When a power seat switch control knob or knobs are actuated, a battery feed and a ground path are applied through the switch contacts to the appropriate power seat track adjuster motor. The selected adjuster motor operates to move the seat track through its drive unit in the selected direction until the switch is released, or until the travel limit of the seat track is reached. When the switch is moved in the opposite direction, the battery feed and ground path to the motor are reversed through the switch contacts. This causes the adjuster motor to run in the opposite direction.

Refer to the owner’s manual in the vehicle glove box for more information on the features, use and operation of the power seat system.

## DIAGNOSIS AND TESTING - POWER SEATS

Before any testing of the power seat system is attempted, the battery should be fully-charged and all wire harness connections and pins cleaned and tightened to ensure proper continuity and grounds. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and joint connector location views for the various wire harness connectors, splices and grounds.

1. If all power seats are inoperative, check the automatic resetting circuit breaker in the Junction Block. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/CIRCUIT BREAKER - DIAGNOSIS AND TESTING).

2. With the dome lamp on, apply the power seat switch in the direction of the failure.
3. If the dome lamp dims, the seat or the power seat track may be jammed. Check under and behind the seat for binding or obstructions.
4. If the dome lamp does not dim, proceed with testing of the individual power seat system components and circuits.

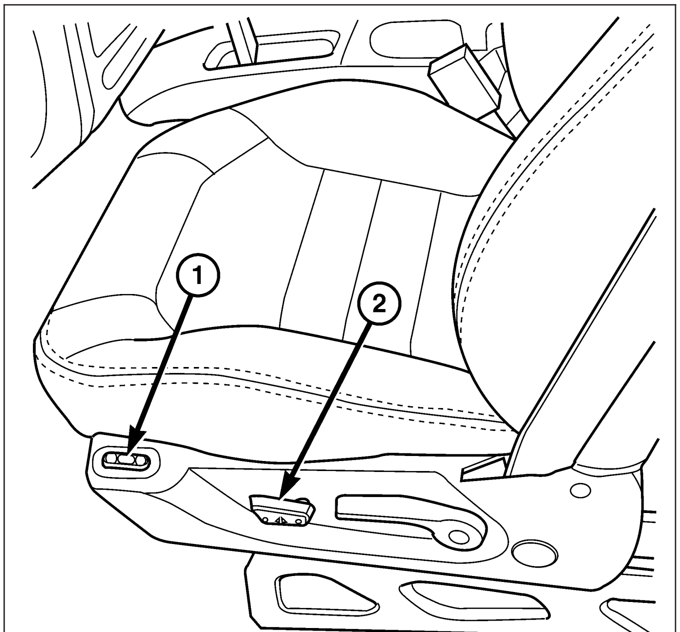
# POWER SEAT SWITCH

## DESCRIPTION

Vehicles equipped with the power seat option utilize a six-way power seat switch (2). This six-way power seat switch features one seat cushion shaped knob, visible on the outboard seat cushion side shield.

The switch is secured to the back of the seat cushion side shield with two screws. However, the control knob must be removed before the seat switch can be removed from the side shield.

The individual switches internal to the power seat switch assembly cannot be repaired. If one switch is damaged or faulty, the entire power seat switch assembly must be replaced.




80cab1f0

## OPERATION

The power seat tracks can be adjusted in six different ways using the power seat switches. See the owner's manual in the vehicle glove box for more information on the power seat switch functions and the seat adjusting procedures.

When a power seat switch control knob or knobs are actuated, a battery feed and a ground path are applied through the switch contacts to the power seat track adjuster motor. The selected adjuster motor operates to move the seat track through its drive unit in the selected direction until the switch is released, or until the travel limit of the seat track is reached. When the switch is moved in the opposite direction, the battery feed and ground path to the motor are reversed through the switch contacts. This causes the adjuster motor to run in the opposite direction.

No power seat switch should be held applied in any direction after the seat track has reached its travel limit. The power seat adjuster motors each contain a self-resetting circuit breaker to protect them from overload. However, consecutive or frequent resetting of the circuit breaker must not be allowed to continue, or the motor may be damaged.

## DIAGNOSIS AND TESTING

## POWER SEAT SWITCH

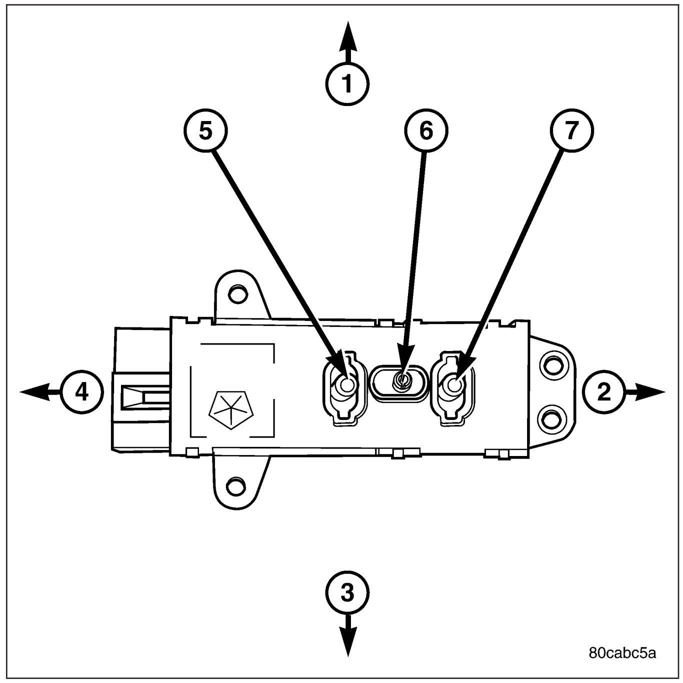
**For complete circuit diagrams, refer to the appropriate wiring information.** The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

1. Disconnect and isolate the battery negative cable.
2. Remove the power seat switch, (Refer to 8 - ELECTRICAL/POWER SEATS/DRIVER SEAT SWITCH - REMOVAL).
3. Use an ohmmeter to test the continuity of the power seat switch in each switch position, refer to the switch illustration and the Power Seat Switch Direction Chart . See the Power Seat Switch Continuity Chart for test

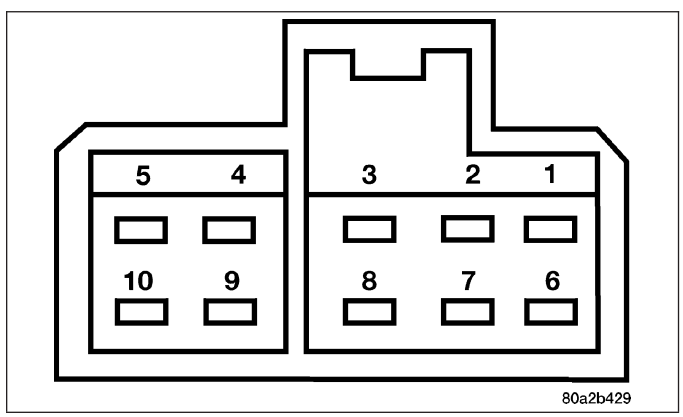
results. If OK, (Refer to 8 - ELECTRICAL/POWER SEATS/POWER SEAT TRACK - DIAGNOSIS AND TESTING) for further power seat system diagnosis. If not OK, replace the faulty power seat switch assembly.

**NOTE: The left power seat switch is shown, the right power seat switch is similar.**

**Power Seat Switch Direction Chart**




| ILLUSTRATION CALL-OUT NUMBER | POWER SEAT SWITCH DIRECTION |
|---|---|
| 1 | UP |
| 2 | REARWARD |
| 3 | DOWN |
| 4 | FORWARD |
| 5 | FRONT RISER SWITCH |
| 6 | CENTER SEAT SWITCH |
| 7 | REAR RISER SWITCH |

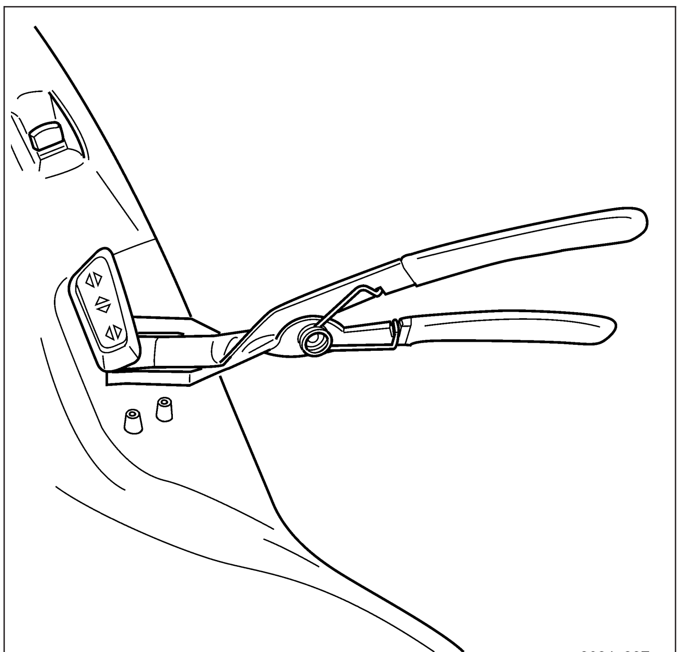


**Power Seat Switch Continuity Chart**

| SWITCH POSITION | CONTINUITY BETWEEN PINS | |
|---|---|---|
| | LEFT POWER SEAT | RIGHT POWER SEAT |
| OFF | PIN 1 to 3<br>PIN 1 to 6<br>PIN 1 to 7<br>PIN 1 to 8<br>PIN 1 to 9<br>PIN 1 to 10 | PIN 1 to 3<br>PIN 1 to 6<br>PIN 1 to 7<br>PIN 1 to 8<br>PIN 1 to 9<br>PIN 1 to 10 |
| FRONT RISER UP | PIN 1 to 8<br>PIN 5 to 9 | PIN 1 to 8<br>PIN 5 to 8 |
| FRONT RISER DOWN | PIN 1 to 9<br>PIN 5 to 8 | PIN 1 to 9<br>PIN 5 to 9 |
| CENTER SWITCH FORWARD | PIN 1 to 6<br>PIN 5 to 3 | PIN 1 to 6<br>PIN 5 to 3 |
| CENTER SWITCH REARWARD | PIN 1 to 3<br>PIN 5 to 6 | PIN 1 to 3<br>PIN 5 to 6 |
| REAR RISER UP | PIN 1 to 7<br>PIN 5 to 10 | PIN 1 to 7<br>PIN 5 to 7 |
| REAR RISER DOWN | PIN 1 to 10<br>PIN 5 to 7 | PIN 1 to 10<br>PIN 5 to 10 |

## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Using a push pin remover or another suitable wide flat-bladed tool, gently pry the power seat switch knob off of the switch control levers.
3. Remove the two forward-most screws that secure the outboard seat cushion side shield to the seat cushion frame.
4. Remove the recliner handle retaining screw and remove the recliner handle.
5. Pull the outboard seat cushion side shield away from the seat cushion frame far enough to access the power seat switch wire harness tie-strap and connector. Cut the tie-strap, if equipped.
6. Disconnect the power seat wire harness connector from the power seat switch connector receptacle. Depress the connector retaining tab and pull straight apart.
7. Using a very short phillips-headed screwdriver, remove the two screws that secure the power seat switch to the inside of the outboard seat cushion side shield.


8094e937

8. Remove the power seat switch from the outboard seat cushion side shield.

## INSTALLATION

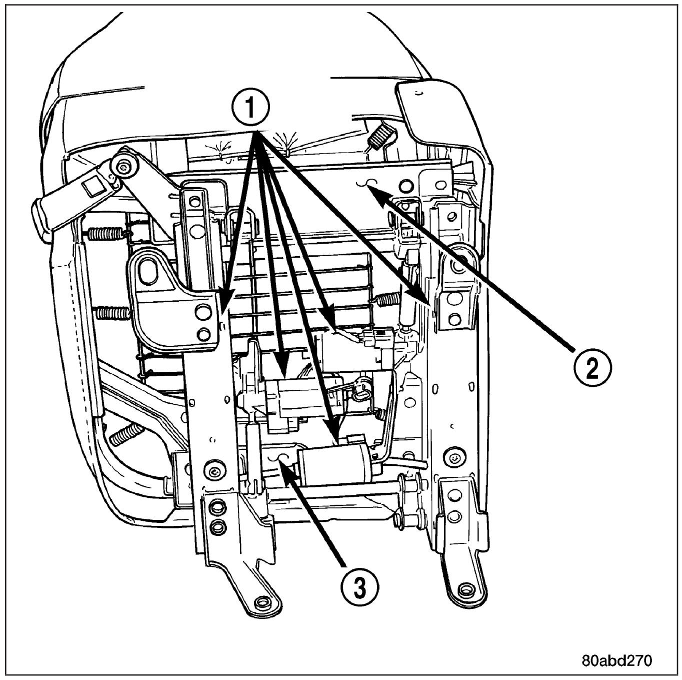
1. Reconnect the power seat wire harness connector to the power seat switch connector receptacle.
2. Position the power seat switch onto the outboard seat cushion side shield. Make certain the alignment dowel is inserted into the corresponding hole in the power seat switch.
3. Install and tighten the two screws that secure the power seat switch to the inside of the outboard seat cushion side shield. Tighten the screws to 1.5 N·m (14 in. lbs.).
4. Position the outboard seat cushion side shield onto the seat cushion frame
5. Install and tighten the two screws that secure the outboard seat cushion side shield to the seat cushion frame. Tighten the screws to 1.5 N·m (14 in. lbs.).
6. Install the recliner handle and retaining screw. Tighten the screws to 1.5 N·m (14 in. lbs.).
7. Position the power seat switch knob onto the switch control levers and push firmly and evenly until it snaps into place.
8. Reconnect the battery negative cable.

# POWER SEAT TRACK

## DESCRIPTION

The six-way power seat option includes a power seat track assembly (3) located under each front seat cushion frame (2). The power seat track assembly replaces the standard manually operated seat tracks. The lower half of the power seat track is secured at the front with two bolts to the floor panel seat cross member, and at the rear with one bolt and one nut to the floor panel. Four bolts secure the bottom of the seat cushion frame to the upper half of the power seat track unit.

The power seat track assembly cannot be repaired, and is serviced only as a complete assembly. If any component in this assembly is faulty or damaged, the entire power seat track must be replaced.



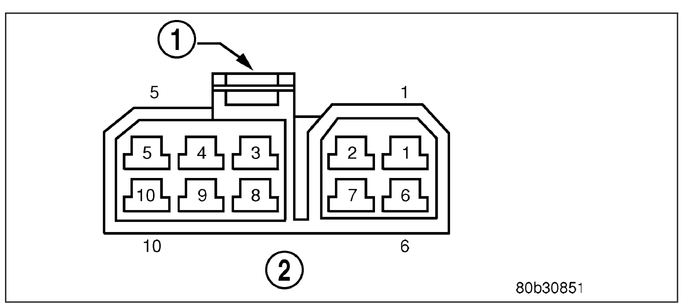

## OPERATION

The power seat track unit includes three reversible electric motors that are secured to the upper half of the track unit. Each motor moves the seat adjuster through a combination of worm-drive gearboxes and screw-type drive units. Each of the three driver side power seat track motors also has a position potentiometer integral to the motor assembly, which electronically monitors the motor position.

The front and rear of the seat are operated by two separate vertical adjustment motors. These motors can be operated independently of each other, tilting the entire seat assembly forward or rearward; or, they can be operated in unison by selecting the proper power seat switch functions, which will raise or lower the entire seat assembly. The third motor is the horizontal adjustment motor, which moves the seat track in the forward and rearward directions.

## DIAGNOSIS AND TESTING - POWER SEAT TRACK

1. Remove the power seat switch from the seat (Refer to 8 - ELECTRICAL/POWER SEATS/DRIVER SEAT SWITCH - REMOVAL).
2. Checking the body harness side of the power seat switch electrical connector, check Pin 1 for ground and Pin 5 for battery voltage. If either of these two are not present repair the body harness as required.
3. To test the seat motors and verify proper seat responses, refer to the SEAT TRACK MOTOR TEST TABLE . Using two jumper wires, connect one to a battery supply and the second to a ground. Connect the other ends to the seat wire harness connector as described in the SEAT TRACK MOTOR TEST TABLE .



**SEAT TRACK MOTOR TEST TABLE**

| SEAT SWITCH CONNECTOR | | | |
|---|---|---|---|
| CONNECT JUMPER | | SEAT ACTION | |
| B(+) | B(–) | LEFT SIDE | RIGHT SIDE |
| PIN 9 | PIN 8 | FRONT RISER UP | FRONT RISER DOWN |
| PIN 8 | PIN 9 | FRONT RISER DOWN | FRONT RISER UP |
| PIN 3 | PIN 6 | FORWARD | FORWARD |
| PIN 6 | PIN 3 | REARWARD | REARWARD |
| PIN 10 | PIN 7 | REAR RISER UP | REAR RISER DOWN |
| PIN 7 | PIN 10 | REAR RISER DOWN | REAR RISER UP |

## REMOVAL

1. Remove the appropriate seat from the vehicle. (Refer to 23 - BODY/SEATS/SEAT - REMOVAL).
2. Remove the seat cushion side shield from the seat (Refer to 23 - BODY/SEATS/SEAT CUSHION SIDE COVERS - REMOVAL).
3. Remove four seat track mounting bolts from cushion pan.
4. Disconnect the power seat electrical and remove the seat track from the seat cushion.

## INSTALLATION

1. Position the seat track and install the retaining bolts in the seat cushion pan. Torque the bolts to 45-60 N·m.
2. Route and connect the power seat electrical on the seat track and cushion pan.
3. Install the seat cushion side shield on the seat. Refer to the Body section for the procedure.
4. Install the seat in the vehicle (Refer to 23 - BODY/SEATS/SEAT - INSTALLATION).
5. Connect the negative battery cable.

# POWER TOP - SUNROOF

## TABLE OF CONTENTS

# POWER TOP - SUNROOF

## DESCRIPTION

**WARNING: Keep fingers and other body parts out of sunroof opening at all times.**

The power sunroof system allows the sunroof to be opened, closed or placed in the vent position electrically by actuating a switch located in the overhead console in between the two reading lamps. The sunroof system receives battery feed through a 30 amp circuit breaker in the junction block. The sunroof system power is supplied when the ignition switch is in the RUN and ACCESSORY positions. The sunroof will continue to operate normally with the key in the OFF position or with the key removed while the Accessory Delay System is active.

The sunroof glass panel tilts upward at the rear for ventilation and slides rearward under the roof when open. The panel seals flush with the roof in the closed position to eliminate wind noise. The sunroof includes a manual-sliding sunshade to cover the deep-tinted glass panel.

The sunroof is electrically operated from a combination push-button/rocker style switch located in the overhead console in between the two reading lamps. The “VENT” switch is a push button type switch and opens the sunroof to the vent position only. The other switch “OPEN/CLOSED” is a rocker type switch for opening and closing the sunroof. Pressing and releasing the open button once, the sunroof will express open and the wind deflector will raise. If the button is pressed a second time the sunroof will stop in that position. Pressing and holding the close button will close the sunroof. If the close button is released the sunroof will stop in that position.

## OPERATION

This vehicle has a vent, tilt and slide power sunroof system with express (one-touch) open feature. The sunroof system receives battery feed through the “sunroof” relay and a 20 amp mini fuse located in the junction block. The sunroof system power is supplied when the ignition switch is in the RUN and ACCESSORY positions. The sunroof will operate normally with the key in any position while the Accessory Delay system is active.

The sunroof is electrically operated from two switches located in the overhead console in between the two reading lamps. The “VENT” switch is a push button type switch and opens the sunroof to the vent position only. The other switch “OPEN/CLOSED” is a rocker type switch for opening and closing the sunroof. Pressing and releasing the open button once, the sunroof will express open and the wind deflector will raise. If the button is pressed a second time the sunroof will stop in that position. Pressing and holding the close button will close the sunroof. If the close button is released the sunroof will stop in that position.

## DIAGNOSIS AND TESTING

## SUNROOF

Refer to SUNROOF DIAGNOSIS CHART for possible causes. Before beginning sunroof diagnostics verify that all other power accessories are in proper operating condition. If not, a common electrical problem may exist.

Check the condition of the circuit protection and inspect all wiring connector pins for proper engagement and continuity. For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

**SUNROOF DIAGNOSIS CHART**

| SYMPTOM | POSSIBLE CAUSE | CORRECTION |
|---|---|---|
| Sunroof completely inoperative. | Inoperative control switch. | Perform sunroof switch diagnostics, (Refer to 8 - ELECTRICAL/POWER TOP/SWITCH - DIAGNOSIS AND TESTING). |
| | Inoperative circuit ground between sunroof motor/module, control switch, and body harness. | Inspect ground connections and wiring. Repair as necessary. |
| | Inoperative power circuit between sunroof motor/module, control switch, and body harness. | Check the condition of the circuit protection and inspect all wiring. Repair as necessary. |
| | Inoperative sunroof motor/module. | Replace the sunroof motor/module, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - REMOVAL). |
| Audible whine when switch is depressed, sunroof does not operate. | Inoperative sunroof motor/module. | Replace the sunroof motor/module, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - REMOVAL). |
| | Binding cable. | Repair or replace binding cable as necessary. |
| Audible clicking or ratcheting when switch is pressed, sunroof does not operate. | Broken or worn drive cable. | Repair or replace binding cable as necessary. |
| | Worn drive motor gear. | Replace the sunroof motor/module, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - REMOVAL). |
| | Mechanisms not synchronized. | Synchronize mechanisms, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - STANDARD PROCEDURE - SUNROOF MOTOR/MODULE CALIBRATION). |
| Sunroof vents and opens, but does not close. | Broken or disengaged trough guide. | Repair trough guide as necessary. |
| | Binding cable. | Repair or replace binding cable as necessary. |
| | Inoperative sunroof ″CLOSE″ circuit. | Check the condition of the circuit, connections and wiring. Repair as necessary. |
| | Inoperative control switch. | Perform sunroof switch diagnostics, (Refer to 8 - ELECTRICAL/POWER TOP/SWITCH - DIAGNOSIS AND TESTING). |
| | Inoperative sunroof motor/module. | Replace the sunroof motor/module, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - REMOVAL). |

| SYMPTOM | POSSIBLE CAUSE | CORRECTION |
|---|---|---|
| Sunroof vents, but does not open. | Binding cable or mechanism. | Repair or replace binding cable as necessary. |
| | Inoperative sunroof ″OPEN″ circuit. | Check the condition of the circuit, connections and wiring. Repair as necessary. |
| | Inoperative control switch. | Perform sunroof switch diagnostics, (Refer to 8 - ELECTRICAL/POWER TOP/SWITCH - DIAGNOSIS AND TESTING). |
| | Inoperative sunroof motor/module. | Replace the sunroof motor/module, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - REMOVAL). |
| Sunroof does not vent | Binding cable or mechanism. | Repair or replace binding cable as necessary. |
| | Inoperative sunroof ″VENT″ circuit. | Check the condition of the circuit, connections and wiring. Repair as necessary. |
| | Inoperative control switch. | Perform sunroof switch diagnostics, (Refer to 8 - ELECTRICAL/POWER TOP/SWITCH - DIAGNOSIS AND TESTING). |
| | Inoperative sunroof motor/module. | Replace the sunroof motor/module, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - REMOVAL). |
| Glass movement not consistant or glass does not operate smoothly | Glass and Track timing.<br>Glass and Track alignment.<br>Cables and Guide alignment. | Perform the necessary adjustments, (Refer to 23 - BODY/SUNROOF/ GLASS PANEL - ADJUSTMENTS). |

# MOTOR/MODULE - SUNROOF

## DIAGNOSIS AND TESTING -

**For complete circuit diagrams, refer to the appropriate wiring information.** The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

If the power top is completely inoperative perform the following diagnostic steps.

1. Check the Accessory delay 30 amp Circuit breaker in the Junction Block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the inoperative circuit breaker.
2. Partially remove the headliner to access the sunroof motor/module.
3. Disconnect the motor/module electrical connector. With the ignition switch in the “RUN” position check for Battery voltage at the Accessory Relay Output terminal of the harness connector. If OK, go to Step 4. If not OK repair the Accessory Relay Output circuit as necessary.
4. Using an ohmmeter test for continuity between the harness connector ground circuit and a known good ground. Continuity should be present. If OK, go to Step 5. If not OK, repair the open ground circuit as necessary.
5. Turn the ignition switch to the “OFF” position. Reconnect the motor/module electrical connector. With the ignition switch in the “RUN” position check for 5 volts on the “VENT”, “CLOSE” and “OPEN” control circuits at the back side of the motor/module connector. If OK, go to Step 6. If not OK, replace the motor/module assembly, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - REMOVAL).
6. Turn the ignition switch to the “OFF” position. Disconnect the motor/module and sunroof switch electrical connectors. Using an ohmmeter check for continuity on the “VENT”, “CLOSE” and “OPEN” circuits between the motor/module and sunroof switch. Continuity should be present. If OK, (Refer to 8 - ELECTRICAL/POWER TOP/SWITCH - DIAGNOSIS AND TESTING) for diagnosis of the sunroof switch. If not OK, repair the control circuits as necessary.

## STANDARD PROCEDURE

## STANDARD PROCEDURE - POWER SUNROOF TIMING

**NOTE: Perform the timing procedures if any of the following conditions exist:**

- Glass skewed in the channel
- One side of the glass dropping before the other while moving from “VENT” to “CLOSE”
- Glass reversing direction when closing the sunroof
- Glass will not close or may stop at the wrong location
- The glass may over travel the “OPEN” position and stall the motor
- The glass may over travel the “CLOSE” position and stall the motor

**NOTE: The timing of the motor/module and the sunroof assembly play a critical role in the proper function of the sunroof. If the motor/module is removed and the sunroof glass or cables are moved the sunroof module will have to be timed. REFER to the following procedure for the necessary steps.**

1. Perform the motor/module re-initialization procedure, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - STANDARD PROCEDURE).
2. Remove the motor/module, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - REMOVAL).
3. Remove sunroof glass panel (Refer to 23 - BODY/SUNROOF/GLASS PANEL - REMOVAL).
4. Now place both right and left arms in the closed position. Using a screwdriver, push the plastic cable all the way forward in the track until the glass mounting arm drops into the closed position.
5. Repeat this on the other side.
6. To verify correct timing, there is an 1/8 inch hole in the cable ramp that must be aligned with the front glass mounting screw hole.
7. Using an awl, verify alignment of both right and left timing holes. The tracks will now be timed to the fully closed position.
8. Install the motor/module (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - INSTALLATION).

9. Install the sunroof glass panel, (Refer to 23 - BODY/SUNROOF/GLASS PANEL - INSTALLATION).
10. Perform the motor/module re-initialization procedure, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - STANDARD PROCEDURE).

## STANDARD PROCEDURE - RE-INITIALIZATION

**NOTE: If for some reason the sunroof is not operating normally it may be necessary to re-initialize the sunroof assembly. This procedure should be attempted prior to any diagnosis of the sunroof system.**

**NOTE: The re-initialization procedure is not complete if any one of the following conditions occurs before the re-initialization procedure is completed:**

- The sunroof switch is not held in the CLOSE position.
- The ignition or battery power is lost.
- The glass panel has not reached its closed position.

**NOTE: If the re-initialization procedure is not carried out completely, it must be started over.**

1. Cycle the sunroof to full “OPEN” position.
2. Once the sunroof is in the full “OPEN” position, press and continuously hold the “OPEN” button on the sunroof switch.
3. After a delay of 10 seconds the sunroof will begin to move past the normal “OPEN” position to the **hard stop** position. It will then reverse to the normal “OPEN” position also known as the **soft stop**. Once the sunroof has reversed to the **soft stop**, immediately (within 5 seconds of stopping travel) release the “OPEN” button and continuously press it again.
4. After a delay of three seconds the sunroof will begin moving to the “VENT” and then “CLOSED” position. When the roof reaches the fully “CLOSED” position and stops the “OPEN” button can be released.

The re-initialization procedure is now complete. Operate the sunroof in all directions to verify proper operation.

## STANDARD PROCEDURE - INITIALIZATION

**NOTE: This procedure should be attempted any time a new motor/module is installed in the sunroof assembly. It must be performed on initial vehicle power up to be successful.**

**NOTE: The initialization procedure is not complete if any one of the following conditions occurs before the initialization procedure is completed:**

- The sunroof switch is not held in the CLOSE position.
- The ignition or battery power is lost.
- The glass panel has not reached its closed position.

**NOTE: if the initialization procedure is not carried out completely, it must be started over.**

1. Turn the ignition key to the “RUN” position.
2. Move the sunroof to the full open position.
3. Continuously press the “OPEN” button on the sunroof switch.
4. The sunroof will begin to move past the normal “OPEN” position to the **hard stop** position. It will then reverse to the normal “OPEN” position also known as the **soft stop**. Once the sunroof has reversed to the **soft stop**, immediately (within 5 seconds of stopping travel) release the “OPEN” button and continuously press it again.
5. After a delay of three seconds the sunroof will begin moving to the “VENT” and then “CLOSED” position. When the roof reaches the fully “CLOSED” position and stops the “OPEN” button can be released.

The initialization procedure is now complete. Operate the sunroof in all directions to verify proper operation.

## REMOVAL

**NOTE: The sunroof system is timed from the factory so that the motor/module shuts off automatically when the sunroof window reaches a certain position. Extreme care must be taken when removing the motor/module from the sunroof assembly or this timing may be thrown off causing damage to the sunroof system. Anytime the motor/module needs to be removed from the sunroof assembly the sunroof window must be in the FULLY CLOSED POSITION if possible.**
**If glass panel is not in the fully closed position and the motor/module is removed or inoperative, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - STANDARD PROCEDURE).**

1. Disconnect and isolate the negative battery cable.
2. Remove A-pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL).
3. Remove sun visors (Refer to 23 - BODY/INTERIOR/SUN VISOR - REMOVAL).
4. Remove map lamps/mini console, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/READING LAMP - REMOVAL).
5. Remove the sunroof switch, (Refer to 8 - ELECTRICAL/POWER TOP/SWITCH - REMOVAL).
6. Remove sunroof opening trim lace. (Refer to 23 - BODY/SUNROOF/OPENING TRIM LACE - REMOVAL).
7. Remove headliner as necessary to gain access to sunroof motor/module. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL).
8. Disconnect the motor/module wire harness connectors.
9. Remove the motor/module attaching screws.
10. Remove motor/module from the sunroof housing assembly.

## INSTALLATION

**NOTE: Before installing a new motor/module or the original motor/module ensure that the sunroof glass panel is in the FULLY CLOSED POSITION. If sunroof glass panel is not in the FULLY CLOSED POSITION, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - STANDARD PROCEDURE).**

1. Ensure that sunroof assembly is in the FULLY CLOSED position before mounting the motor/module. If not in the fully closed position (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - STANDARD PROCEDURE).
2. Place motor/module into position on the sunroof housing and install attaching screws. Tighten the screws to 3.5 N·m (31 in. lbs.) torque.
3. Connect the motor/module, and sunroof switch wire connectors.
4. Install sunroof glass panel (Refer to 23 - BODY/SUNROOF/GLASS PANEL - INSTALLATION).
5. Connect the battery negative cable.
6. Perform the motor/module initialization procedure, (Refer to 8 - ELECTRICAL/POWER TOP/MOTOR - STANDARD PROCEDURE - MOTOR/MODULE INITIALIZATION).
7. Verify sunroof operation and alignment, and adjust as necessary. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - ADJUSTMENTS).
8. Disconnect and isolate battery negative cable.
9. Installing the headliner (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION).
10. Install sunroof opening trim lace. (Refer to 23 - BODY/SUNROOF/OPENING TRIM LACE - INSTALLATION).
11. Install the sunroof switch, (Refer to 8 - ELECTRICAL/POWER TOP/SWITCH - INSTALLATION).
12. Install the map lamps/mini console, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/READING LAMP - INSTALLATION).
13. Install sun visors (Refer to 23 - BODY/INTERIOR/SUN VISOR - INSTALLATION).
14. Install A-pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION).
15. Connect the battery negative cable.

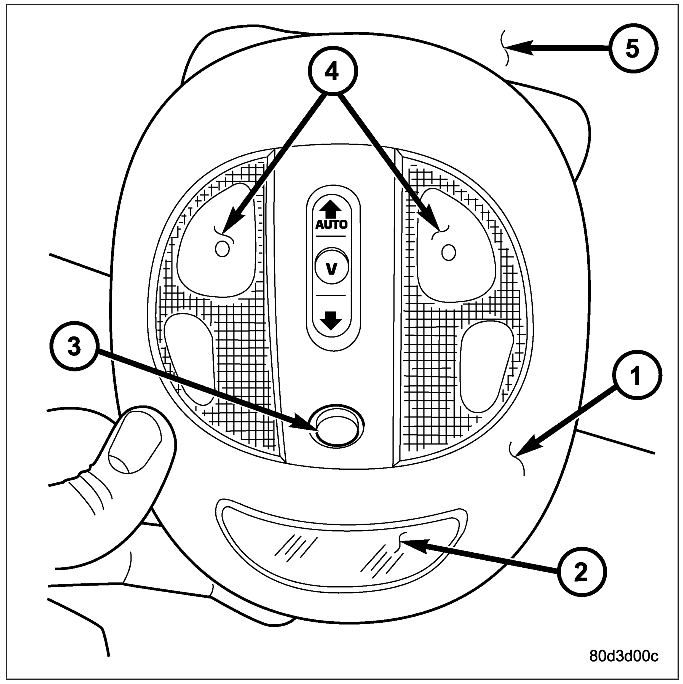
# SWITCH - SUNROOF

## DESCRIPTION

The power sunroof switch is a combination push-button and rocker switch located in the overhead console (1) positioned between the two reading lamps (4). The switch is mounted in the overhead console with four plastic retaining tabs, molded into the switch housing. The sunroof switch is a direct contact unit that is directly wired to the sunroof motor/module assembly. The sunroof switch performs the following functions:

- Power sunroof open
- Power sunroof auto open
- Power sunroof closed
- Power sunroof vent

The power sunroof switch cannot be repaired. If the individual components are damaged or inoperative the switch assembly must be replaced, (Refer to 8 - ELECTRICAL/POWER TOP/SWITCH - REMOVAL).




## OPERATION

The sunroof is electrically operated from two switches located on the windshield header, rearward of the map lamp. The “VENT” switch is a push button type switch and opens the sunroof to the vent position only. The other switch “OPEN/CLOSED” is a rocker type switch for opening and closing the sunroof. Pressing and releasing the open button once, the sunroof will express open and the wind deflector will raise. If the button is pressed a second time the sunroof will stop in that position. Pressing and holding the close button will close the sunroof. If the close button is released the sunroof will stop in that position.

The switch is grounded at on terminal and receives a 5 volt signal from the sunroof motor/module on the remaining three terminals. The switch pulls down the 5 volt reference voltage from the module signaling it to perform the desired function.

**For complete circuit diagrams, refer to the appropriate wiring information.** The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

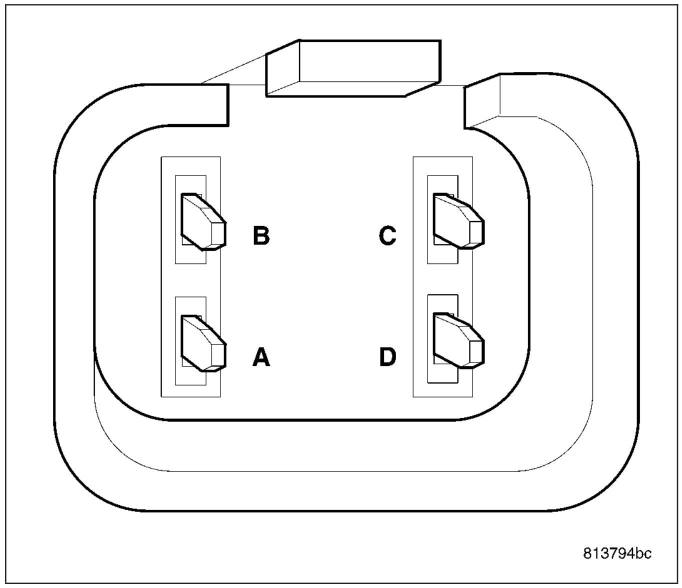
## DIAGNOSIS AND TESTING

## SUNROOF SWITCH

**For complete circuit diagrams, refer to the appropriate wiring information.** The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

1. Remove the power sunroof switch, (Refer to 8 - ELECTRICAL/POWER TOP/SWITCH - REMOVAL).
2. Disconnect the power sunroof switch wire harness connector.
3. With the ignition key in the “RUN” position check for 5 volts on the “OPEN”, “CLOSE” and “VENT” circuits of the sunroof switch harness connector. If OK, go to Step 4. If not OK, inspect the wiring harness and connectors between the motor/module and switch for damage and repair as necessary.

4. With the ignition key in the “OFF” position check for continuity between the ground circuit of the sunroof switch harness connector and a known good ground. Continuity should be present. If OK, go to Step 5. If not OK, inspect the wiring harness and connector and repair the ground circuit as necessary.
5. Using an ohmmeter, test the continuity of the power sunroof switch in each switch position. Refer to the POWER SUNROOF SWITCH CONTINUITY TABLE . If OK, inspect the wiring harness and connectors for damage and repair as necessary. If not OK, replace the power sunroof switch, (Refer to 8 - ELECTRICAL/POWER TOP/SWITCH - REMOVAL).




**POWER SUNROOF SWITCH CONTINUITY TABLE**

| SWITCH POSITION | CONTINUITY BETWEEN PINS |
|---|---|
| OFF | NO CONTINUITY |
| SUNROOF OPEN | B & C |
| SUNROOF CLOSED | B & D |
| SUNROOF VENT | B & A |

## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the overhead console from the headliner (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
3. Disconnect the switch electrical connector.
4. To remove the switch from the overhead console, push on the back of the switch until it comes free from the overhead console.

## INSTALLATION

1. Install the switch in the overhead console assembly. Be certain the switch is securely snapped in place.
2. Connect the sunroof control switch electrical connector. Be certain the switch connector is securely snapped in place.
3. Install the overhead console (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION).
4. Connect the battery negative cable.
5. Confirm proper sunroof system operation.

# POWER WINDOWS

## TABLE OF CONTENTS

# POWER WINDOWS

## DESCRIPTION

The power window system allows each of the door windows to be raised and lowered electrically by actuating a switch on the center console. A master switch on the front of the center console allows the driver to raise or lower each of the passenger door windows and to lock out the individual switches on the rear of the center console from operation. The power window system receives battery feed through fuse 13 in the Power Distribution Center (PDC), only when the ignition switch is in the RUN or ACCESSORY position.

## OPERATION

### WINDOW SWITCH

The power window switches control the battery and ground feeds to the power window motors. Both of the rear door power window switches receive their battery and ground feeds through the circuitry of the front window switch. When the power window lockout switch is in the Lock position, the battery feed for the rear door window switches is interrupted.

### WINDOW MOTOR

Front door window lift motors use permanent type magnets. The B+ and ground applied at the motor terminal pins will cause the motor to rotate in one direction. Reversing current through the motor terminals will cause the motor to rotate in the opposite direction.

Refer to the appropriate wiring information.

## DIAGNOSIS AND TESTING - POWER WINDOWS

### WIRING VOLTAGE TEST

The following wiring test determines whether or not voltage is continuous through the body harness to the front switch.

1. Remove the power window switch and bezel (Refer to 8 - ELECTRICAL/POWER WINDOWS/POWER WINDOW SWITCH - REMOVAL).
2. Disconnect wire connector from back of power window switch.
3. Switch ignition to the ON position.
4. Connect the clip end of a 12 volt test light to Pin 14 of the window switch harness connector. Touch the test light probe to Pin 10.
   - If the test light illuminates, the wiring circuit between the battery and switch is OK.
   - If the lamp does not illuminate, first check fuse 13 in the Power Distribution Center (PDC). If fuse 13 is OK, then check for a broken wire.

Refer to the appropriate wiring information.

### POWER WINDOW MOTOR TEST

If the power window motor is receiving proper current and ground and does not operate, proceed with motor test. Refer to the appropriate wiring information.

1. Remove front door trim panel as necessary to gain access to power window motor wire connector (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL).
2. Disconnect power window motor wire connector from door harness.
3. Using two jumper wires, connect one to a battery (+) source and the other to a good ground (-).
4. Connect the Negative (-) jumper probe to one of the motor connector terminals.
5. Momentarily touch the Positive (+) jumper probe to the other motor connector terminal.

When positive probe is connected the motor should rotate in one direction to either move window up or down. If window is all the way up or down the motor will grunt and the inner door panel will flex when actuated in that one direction.

6. Reverse jumper probes at the motor connector terminals and window should now move in opposite direction. If window does not move or grunt, replace the motor.

If window moved completely up or down, reverse the jumper probes and cycle window to the opposite position to verify full operation.

If motor grunts and does not move, verify that regulator is not binding.

# WINDOW MOTOR

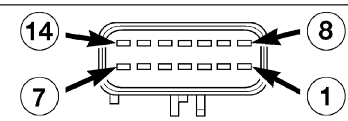
## REMOVAL

The window motor is incorporated into the window regulator assembly. If the window motor requires replacement, the window regulator must be replaced. (Refer to 23 - BODY/DOOR - FRONT/WINDOW REGULATOR - REMOVAL) or (Refer to 23 - BODY/DOORS - REAR/WINDOW REGULATOR - REMOVAL).

# WINDOW SWITCH

## DIAGNOSIS AND TESTING - WINDOW SWITCH

1. Remove the switch to be tested (Refer to 8 - ELECTRICAL/POWER WINDOWS/POWER WINDOW SWITCH - REMOVAL).
2. Using an ohmmeter, Test front switch for continuity.

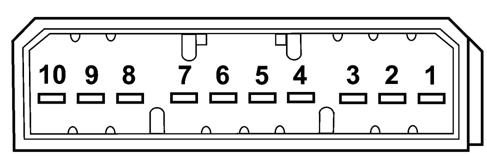


80a7e2ba

**POWER WINDOW FRONT SWITCH TEST**

| SWITCH POSITION | CONTINUITY BETWEEN |
|---|---|
| OFF | 14 AND 4 |
| | 14 AND 5 |
| | 14 AND 6 |
| | 14 AND 7 |
| | 14 AND 9 |
| | 14 AND 11 |
| | 14 AND 12 |
| | 14 AND 13 |
| LEFT FRONT UP | 10 AND 11 |
| LEFT FRONT DOWN | 10 AND 9 |
| RIGHT FRONT UP | 10 AND 12 |
| RIGHT FRONT DOWN | 10 AND 13 |
| LEFT REAR UP | 10 AND 5 |
| LEFT REAR DOWN | 10 AND 4 |
| RIGHT REAR UP | 10 AND 7 |
| RIGHT REAR DOWN | 10 AND 6 |
| LOCKOUT (LOCKED) | NO CONTINUITY BETWEEN 10 AND 2 |
| LOCKOUT (UNLOCKED) | 10 AND 2 |

3. If the proper results are not obtained, replace the front window switch.
4. Test rear switch for continuity.



80c9b8cf

**POWER WINDOW REAR SWITCH TEST**

| SWITCH POSITION | CONTINUITY BETWEEN |
|---|---|
| OFF | 1 AND 3 |
| | 4 AND 2 |
| | 7 AND 10 |
| | 8 AND 9 |
| LEFT UP | 10 AND 6 |
| LEFT DOWN | 6 AND 8 |
| RIGHT UP | 5 AND 2 |
| RIGHT DOWN | 5 AND 3 |

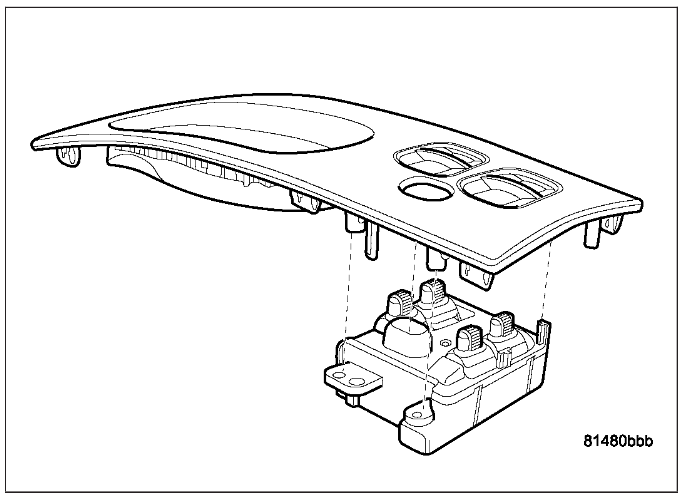
5. If the proper results are not obtained, replace the rear window switch.

The power window master switch has a Auto-Down feature on both front windows. The switch is equipped with two detent positions when actuating the power window OPEN. The first detent position allows the window to roll down and stop when the switch is released. The second detent position actuates an integral express roll down relay that rolls the window down after the switch is released. When the express down circuit senses stall current (window has reached end of down travel), the switch will turn current off to the motor. The AUTO feature can be cancelled by actuating the switch UP or DOWN while window is in motion. If the electronic circuit in the switch fails to detect a stall current, the auto down circuit will time out within 9 to 14 seconds.

## REMOVAL

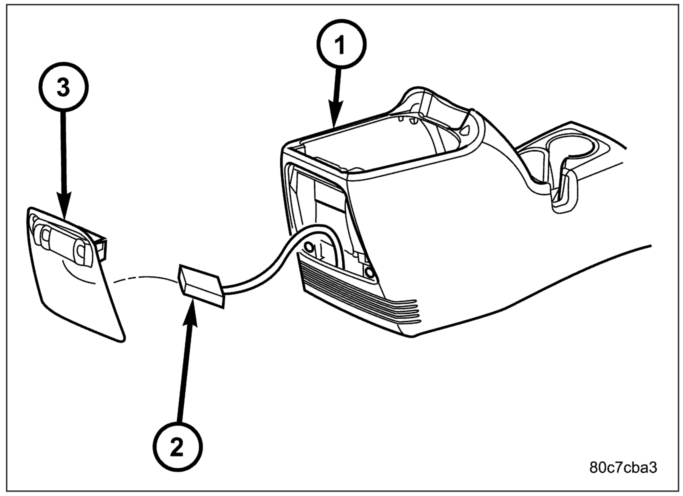
### FRONT

1. Disconnect and isolate the battery negative cable.
2. Remove the shift bezel.
3. Remove the mounting fasteners and switch.
4. Disconnect electrical harness connector.



### REAR

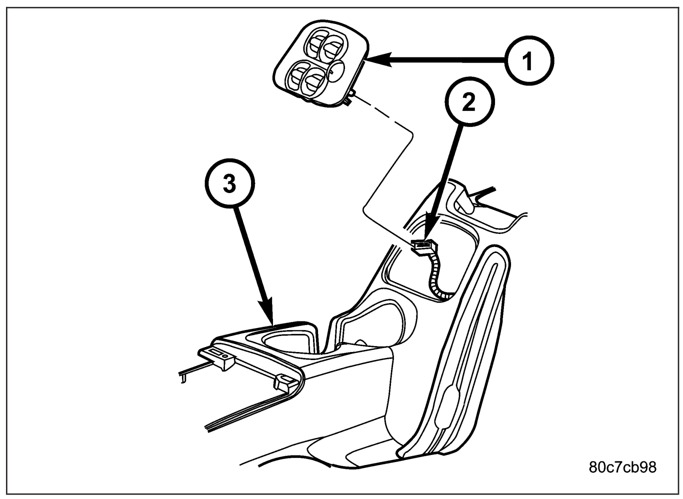
1. Disconnect and isolate the battery negative cable.
2. Using a trim stick, gently pry the switch (3) from the console (1).
3. Disconnect electrical harness connector (2).




## INSTALLATION

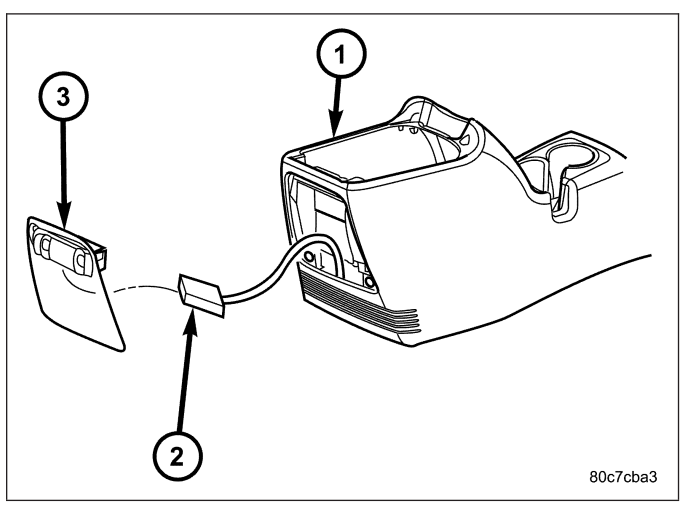
### FRONT

1. Connect electrical harness connector (2) to switch (1).
2. Install switch to shifter bezel. Install and tighten mounting fasteners.
3. Install shifter bezel.
4. Connect battery negative cable.




### REAR

1. Connect electrical harness connector (2) to switch (3).
2. Install switch into opening in console (1) and press into place.
3. Connect battery negative cable.



# RESTRAINTS

## TABLE OF CONTENTS



# RESTRAINTS - ELECTRICAL DIAGNOSTICS

## TABLE OF CONTENTS

# RESTRAINTS - ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## AIRBAG WARNING INDICATOR OPEN

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  The Instrument Cluster (IC) broadcasts the airbag warning indicator status on the Bus. The Occupant Restraint Controller (ORC) expects this status message once every second. The ORC will set this DTC immediately if the status is OPEN.

| Possible Causes |
|---|
| INSTRUMENT CLUSTER (IC) |
| OCCUPANT RESTRAINT CONTROLLER (ORC) |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**WARNING: When disconnecting or connecting airbag system components, the ignition must be turned off and the battery must be disconnected.**

Turn the ignition on.

**Select ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 3

### 2. VERIFYING IC INDICATOR STATUS

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, select the MONITORS and read the AIRBAG INDICATOR STATUS (Short, Open, OK).

Turn the ignition off, wait 15 seconds, then turn the ignition on.

Observe the AIRBAG INDICATOR STATUS during the IC bulb check and for 10 seconds afterwards.

**Does the scan tool display AIRBAG INDICATOR STATUS: OPEN?**

**Yes** >> Replace the IC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all DTCs Airbag System Modules and IC.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

With the scan tool, check for active DTCs in the ORC and IC.

**Does the scan tool display any active DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in the applicable section.

**No** >> No problem found at this time. Erase all codes before returning vehicle to customer.

## AIRBAG WARNING INDICATOR SHORT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  The Instrument Cluster (IC) broadcasts the airbag warning indicator status on the Bus. The Occupant Restraint Controller (ORC) expects this status message once every second. The ORC will set this DTC immediately if the status is SHORT.

| Possible Causes |
|---|
| INSTRUMENT CLUSTER (IC) |
| OCCUPANT RESTRAINT CONTROLLER (ORC) |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**WARNING: When disconnecting or connecting airbag system components, the ignition must be turned off and the battery must be disconnected.**

Turn the ignition on.

**Select ACTIVE or STORED DTC**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 3

### 2. VERIFYING IC INDICATOR STATUS

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, select the MONITORS and read the AIRBAG INDICATOR STATUS (Short, Open, OK).

Turn the ignition off, wait 15 seconds, then turn the ignition on.

Observe the AIRBAG INDICATOR STATUS during the IC bulb check and for 10 seconds afterwards.

**Does the scan tool display AIRBAG INDICATOR STATUS: SHORT?**

**Yes** >> Replace the IC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all DTCs in Airbag System Modules and IC.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

With the scan tool, check for active DTCs in the ORC and IC.

**Does the scan tool display any active DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in the applicable section.

**No** >> No problem found at this time. Erase all codes before returning vehicle to customer.

## CALIBRATION MISMATCH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the Ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) will set this DTC if the VIN stored in the Powertrain Control Module (PCM) does not match the VIN stored in the ORC.

| Possible Causes |
|---|
| INCORRECT PCM |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: When disconnecting or connecting airbag system components, the ignition must be turned off and the battery must be disconnected.**

Turn the ignition on.

**Select ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 3

### 2. VERIFY THAT THE CURRENT VIN AND THE ACTUAL VIN MATCH

With the scan tool, select System Tests and select VIN Verification.

Compare the current VIN displayed by the scan tool and the VIN on the vehicle VIN plate.

**Does the current VIN match the VIN on the vehicle VIN plate?**

**Yes** >>

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

Replace the ORC in accordance with the service information.

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Replace and program the PCM in accordance with the service information. Ensure that the PCM is replaced with the correct vehicle line PCM.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase DTCs in all Airbag System Modules.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

With the scan tool, check for active DTCs in the ORC.

**Does the scan tool display any active DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning vehicle to customer.

## CLUSTER MESSAGE MISMATCH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on following the instrument cluster (MIC) bulb check.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) broadcasts the Airbag Lamp On/Off request message on the Bus one time each second. In turn, the MIC broadcasts the Airbag Lamp On/Off status message on the Bus one time each second. The ORC compares the request message and the status message and will set this DTC if they do not match.

| Possible Causes |
| --- |
| INSTRUMENT CLUSTER (IC) |
| OCCUPANT RESTRAINT CONTROLLER (ORC) |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: When disconnecting or connecting airbag system components, the ignition must be turned off and the battery must be disconnected.**
Turn the ignition on.

**Select ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR ACTIVE MIC DTCs

With the scan tool, read active IC DTCs.

**Does the scan tool display any DTCs?**

**Yes** >> (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING) for the diagnostic test procedures.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).
Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. VERIFY THAT THE AIRBAG LAMP REQUEST AND STATUS MESSAGE MATCH

Turn the ignition off, wait 5 seconds, then turn the ignition on. Allow the IC bulb check to complete before proceeding.

With the scan tool in ORC, select Monitor Display and select Warning Lamp Status ORC.

Compare the ABAG IND REQ BY ACM status and the ABAG IND ON BY MIC status which display as either ON or OFF.

**Does the ABAG IND REQ BY ACM status match the ABAG IND ON BY MIC status?**

**Yes** >>

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

Replace the ORC in accordance with the Service Information.

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Replace the MIC in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all DTCs in Airbag System Modules and IC.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

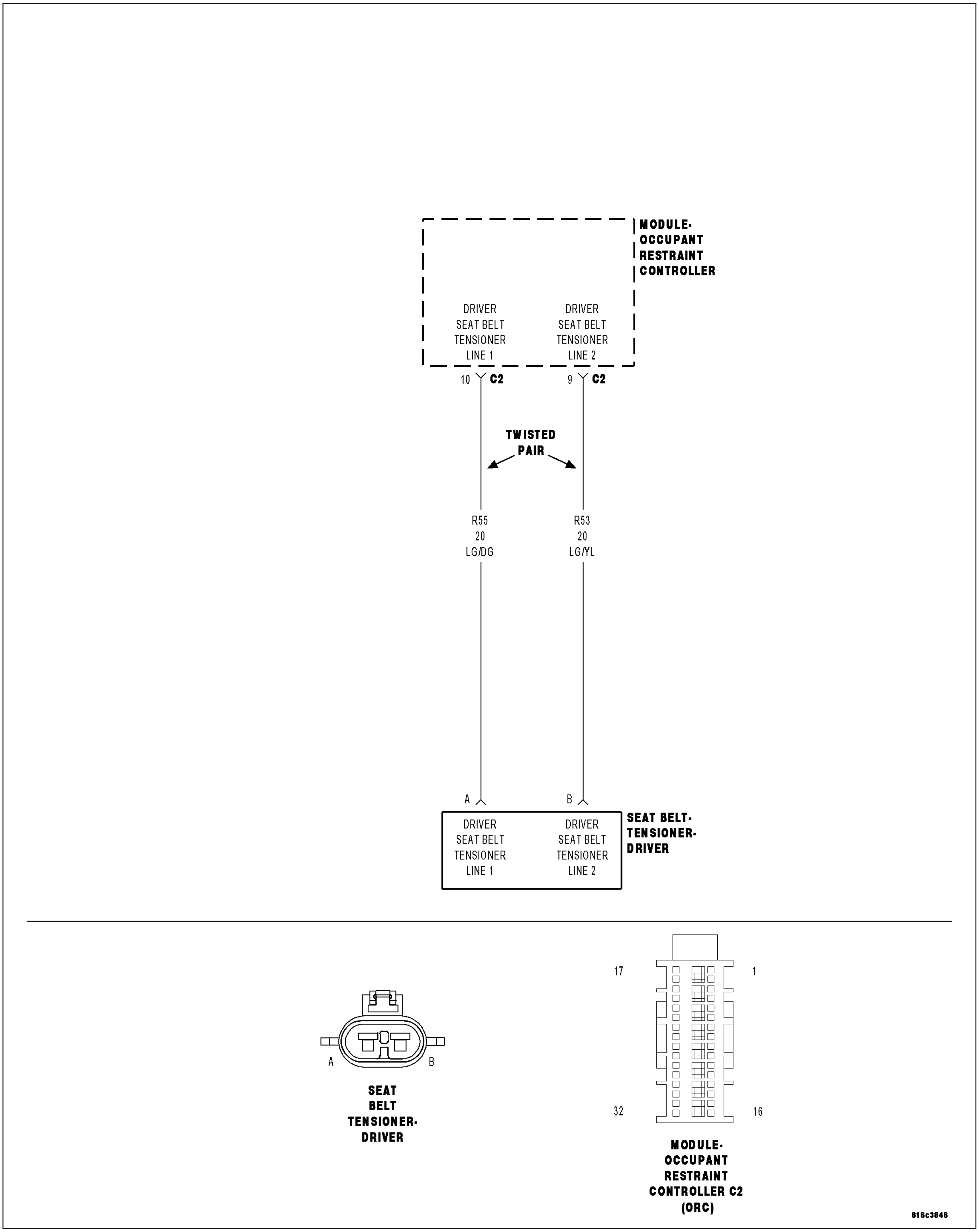
With the scan tool, check for active DTCs in the ORC and the IC.

**Does the scan tool display any active DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in the applicable section.

**No** >> No problem found at this time. Erase all codes before returning vehicle to customer.

## DRIVER SEAT BELT TENSIONER CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Seat Belt Tensioner circuits. The ORC will set this DTC if it detects an open or high resistance on the Driver Seat Belt Tensioner circuits.

| Possible Causes |
|---|
| (R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT OR (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT OPEN |
| DRIVER SEAT BELT PRETENSIONER |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

### 2. CHECK FOR OPEN DRIVER SEAT BELT PRETENSIONER

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Driver Seat Belt Pretensioner connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Driver Seat Belt Pretensioner connector.

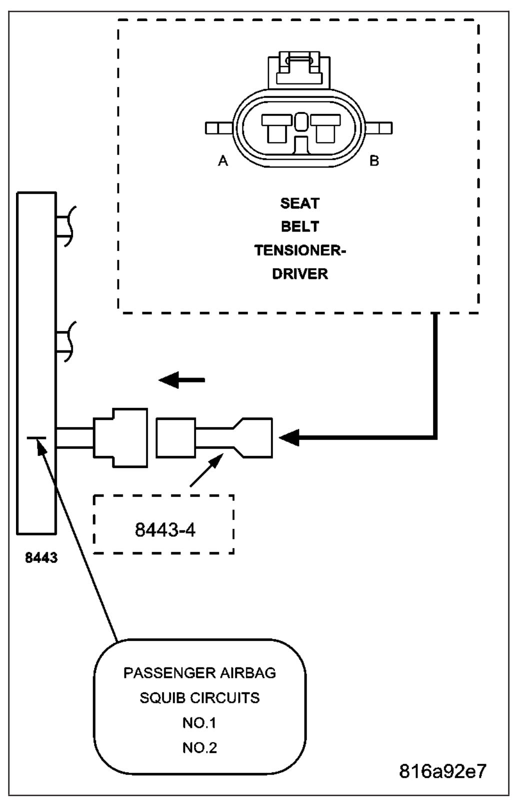
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

**Does the scan tool display: DRIVER SEAT BELT TENSIONER CIRCUIT OPEN?**

**Yes** >> Go To 3

**No** >> Replace the Driver Seat Belt Pretensioner in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK (R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT FOR AN OPEN

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the 8443 Load Tool and Jumper from the Driver Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

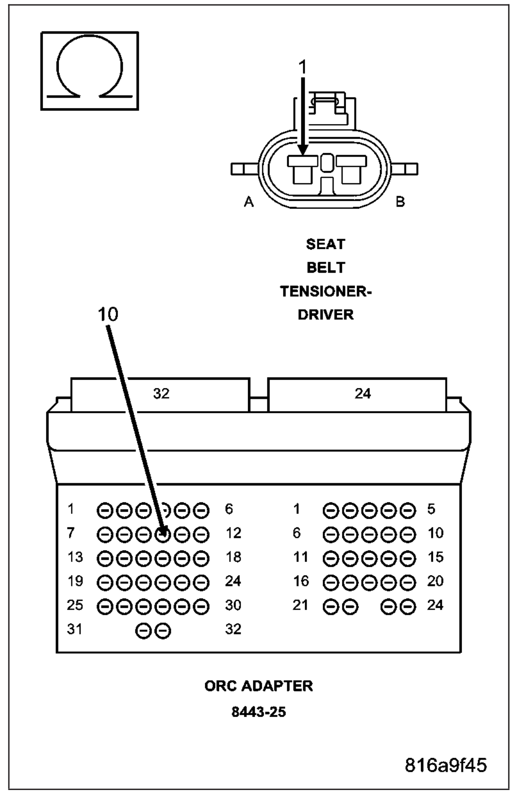
Measure the resistance of the (R55) Driver Seat Belt Tensioner Line 1 circuit between the Driver Seat Belt Pretensioner connector and the 8443 ORC Adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 4

**No** >> Repair the (R55) Driver Seat Belt Tensioner Line 1 circuit for an open.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.




## 4. CHECK (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R53) Driver Seat Belt Tensioner Line 2 circuit between the Driver Seat Belt Pretensioner connector and the 8443 ORC Adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

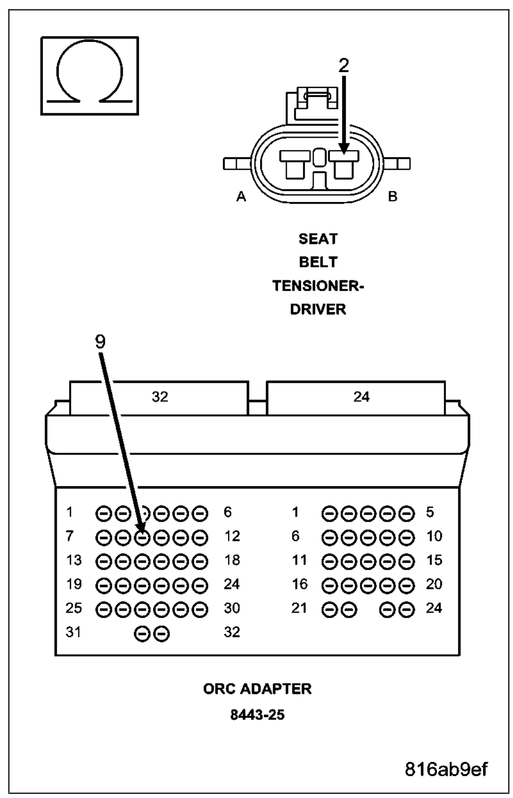
**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Repair the (R53) Driver Seat Belt Tensioner Line 2 circuit for an open.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

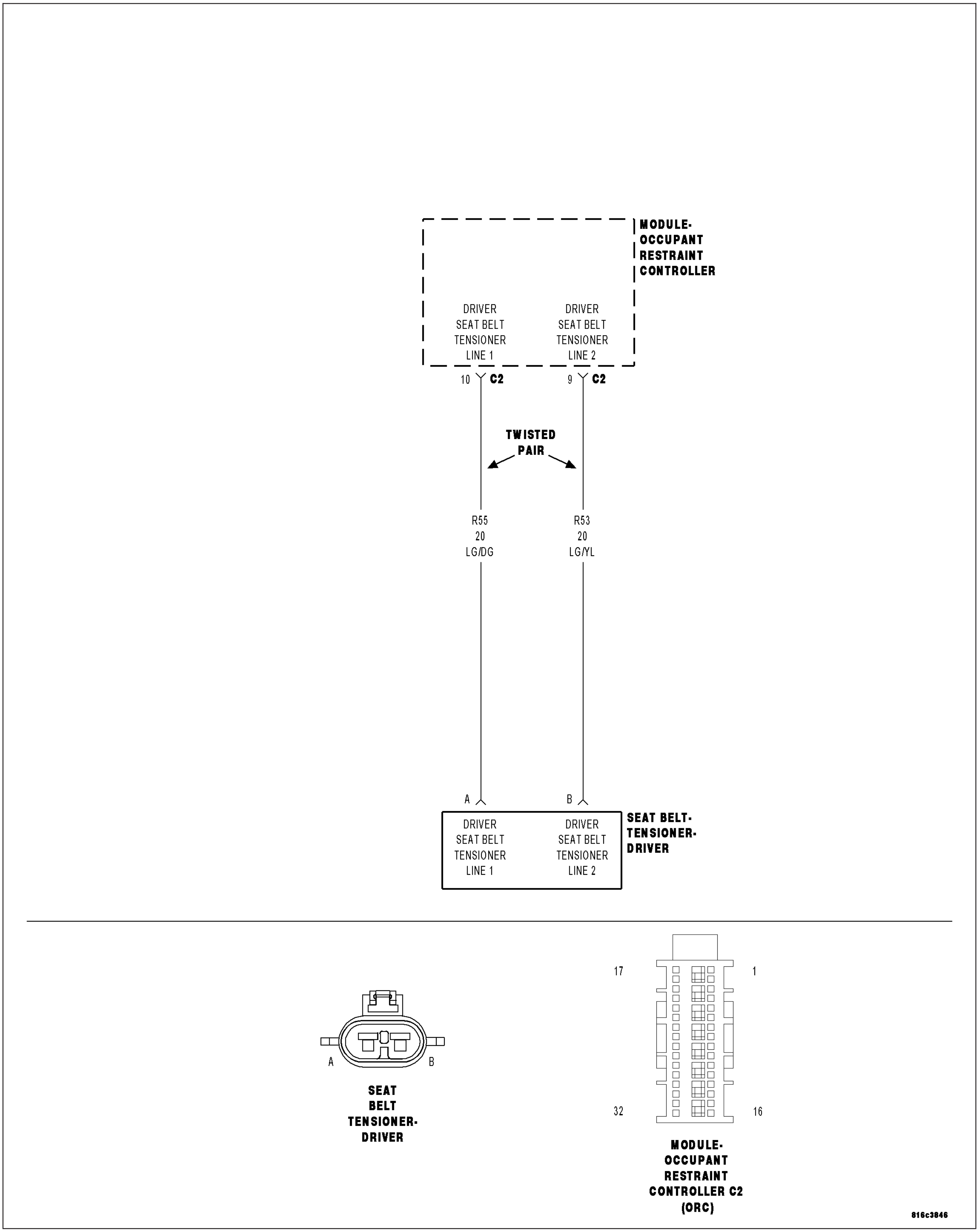
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## DRIVER SEAT BELT TENSIONER CIRCUIT SHORT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Seat Belt Tensioner circuits. The ORC will set this DTC if it detects low resistance between the Driver Seat Belt Tensioner circuits.

| Possible Causes |
| --- |
| (R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT SHORTED TO (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT |
| DRIVER SEAT BELT PRETENSIONER |
| ORC |

## Diagnostic Test

### 1. SELECT ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED DRIVER SEAT BELT PRETENSIONER

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Driver Seatbelt Pretensioner connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Driver Seat Belt Pretensioner connector.

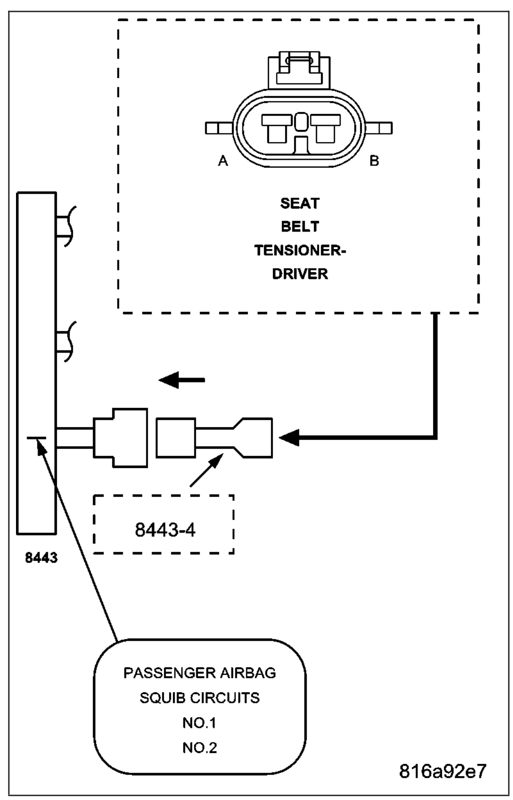
**WARNING: To avoid personal injury or death, turn the ignition on then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

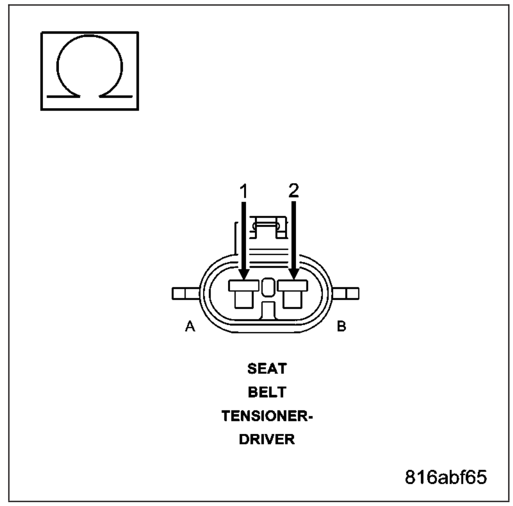
**Does the scan tool display: DRIVER SEAT BELT TENSIONER CIRCUIT SHORT?**

**Yes** >> Go To 3

**No** >> Replace the Driver Seat Belt Pretensioner in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK (R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT FOR A SHORT TO (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Driver Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance between the (R55) Driver Seat Belt Tensioner Line 1 circuit and the (R53) Driver Seat Belt Tensioner Line 2 circuit at the Driver Seat Belt Pretensioner connector.

**Is the resistance below 10K ohms?**

**Yes** >> Repair the (R55) Driver Seat Belt Tensioner Line 1 circuit for a short to the (R53) Driver Seat Belt Tensioner Line 2 circuit.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

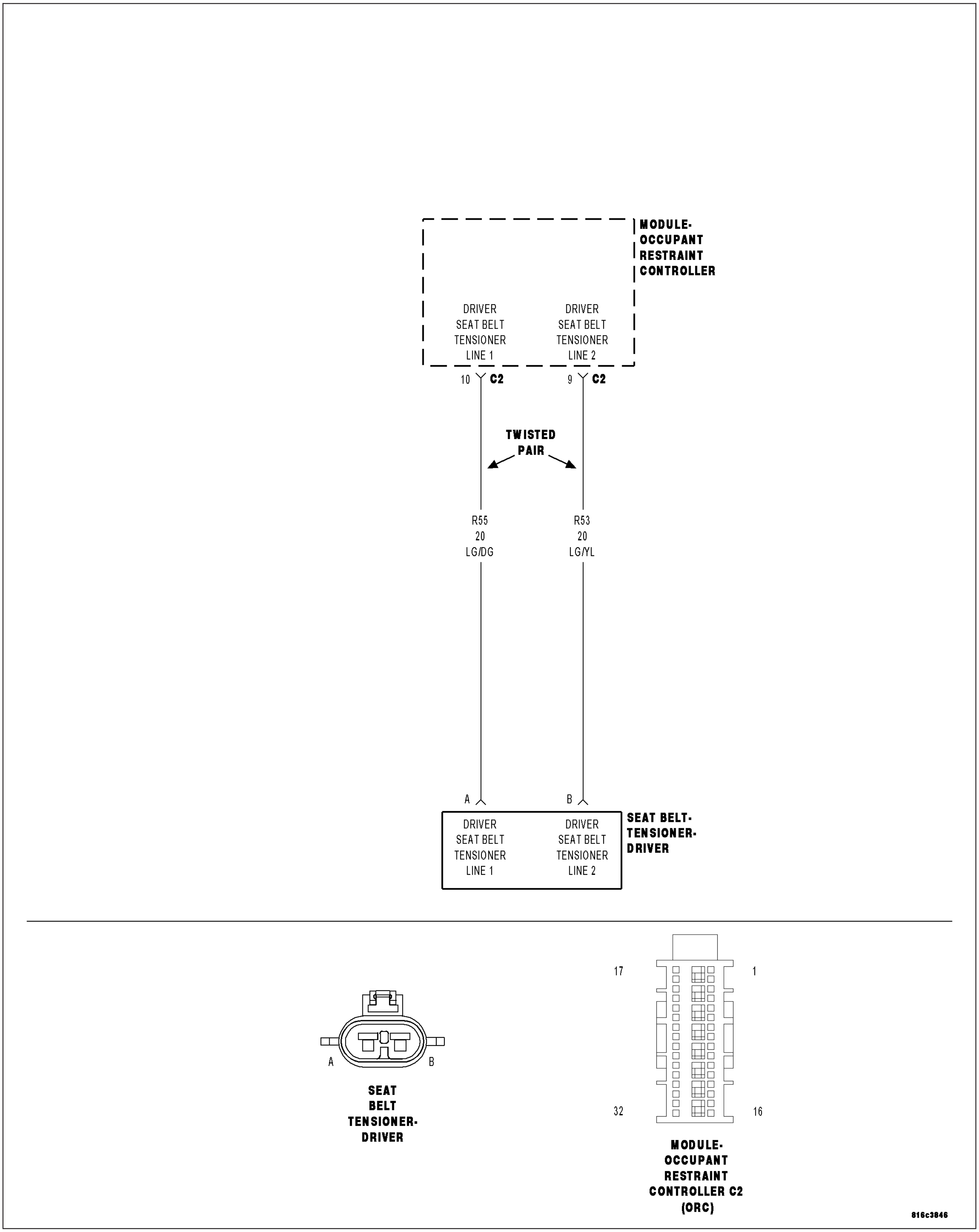
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## DRIVER SEAT BELT TENSIONER SHORT TO BATTERY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the voltage on the Driver Seat Belt Tensioner circuits. The ORC will set this DTC if it detects voltage on the Driver Seat Belt Tensioner circuits.

| Possible Causes |
|---|
| (R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT OR (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT SHORTED TO BATTERY |
| DRIVER SEAT BELT PRETENSIONER |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED DRIVER SEAT BELT PRETENSIONER

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Driver Seat Belt Pretensioner connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Driver Seat Belt Pretensioner connector.

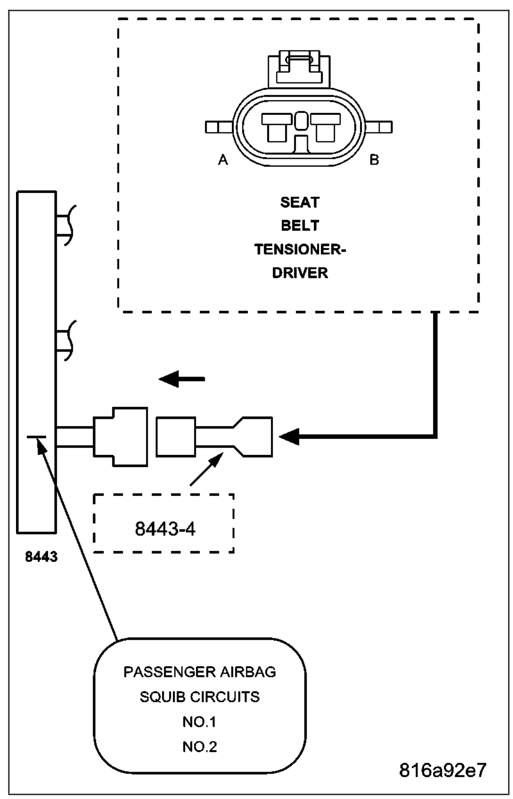
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

**Does the scan tool display: DRIVER SEAT BELT TENSIONER SHORT TO BATTERY?**

**Yes** >> Go To 3

**No** >> Replace the Driver Seat Belt Pretensioner in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK (R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT AND (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT FOR A SHORT TO BATTERY

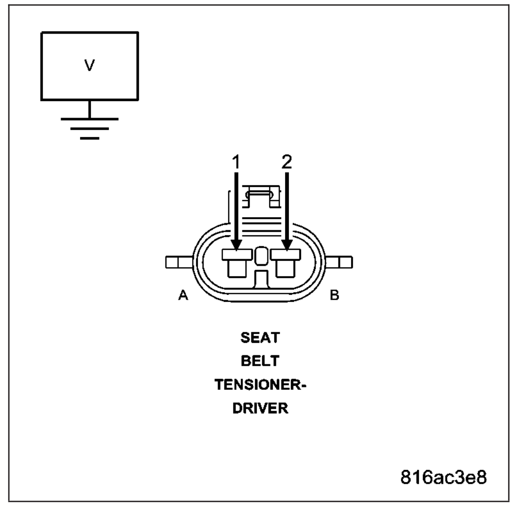
**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Driver Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the voltage of the (R55) Driver Seat Belt Tensioner Line 1 circuit between the Driver Seat Belt Pretensioner connector and ground.

Measure the voltage of the (R53) Driver Seat Belt Tensioner Line 2 circuit between the Driver Seat Belt Pretensioner connector and ground.




**Is there any voltage present on either circuit?**

**Yes** >> Repair the Driver Seat Belt Tensioner circuits with voltage present for a short to battery.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

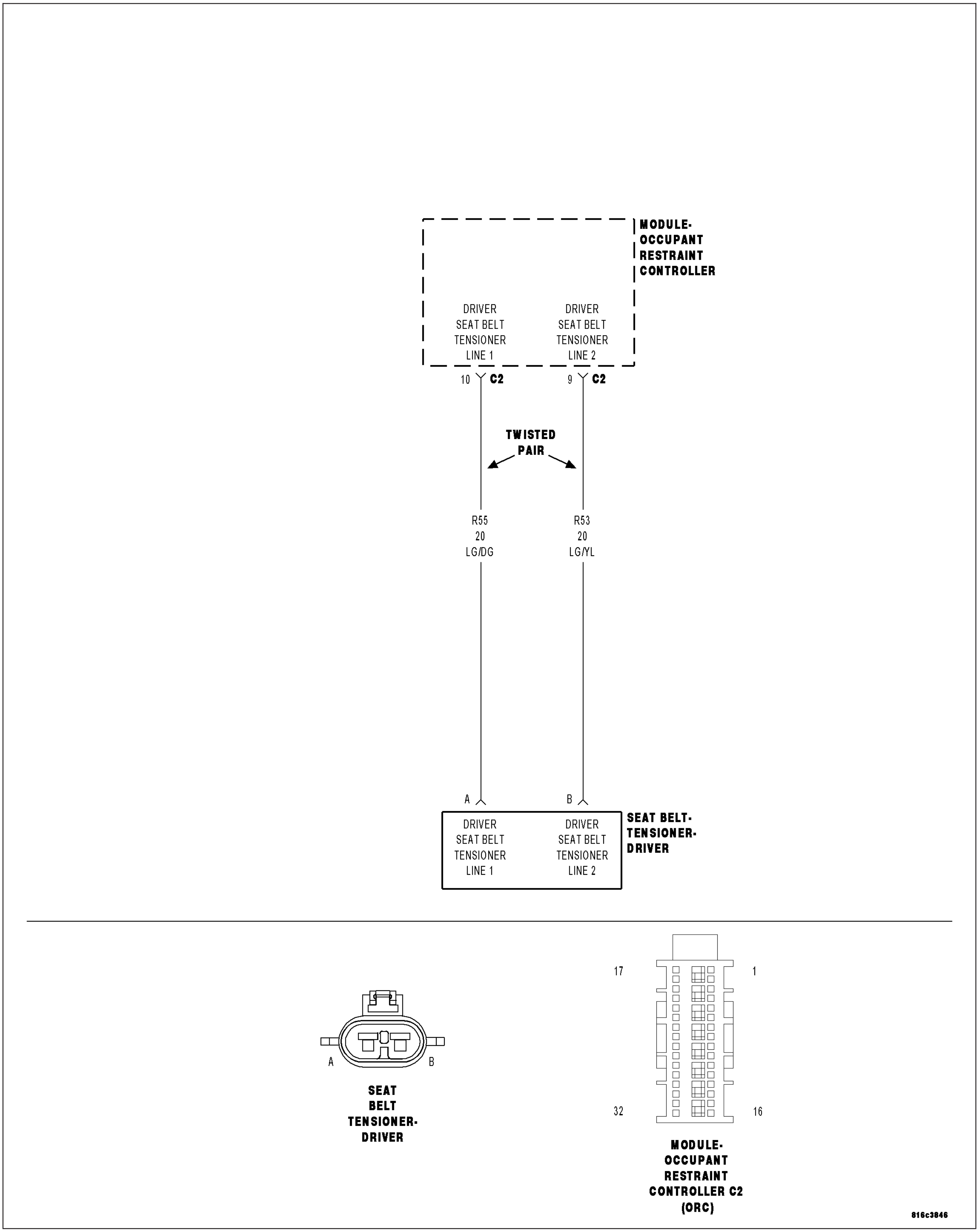
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## DRIVER SEAT BELT TENSIONER SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Seat Belt Tensioner circuits. The ORC will set this DTC if it detects low resistance on the Driver Seat Belt Tensioner circuits.

| Possible Causes |
|---|
| (R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT OR (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT SHORTED TO GROUND |
| DRIVER SEAT BELT PRETENSIONER |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED DRIVER SEAT BELT PRETENSIONER

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Driver Seat Belt Pretensioner connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Driver Seat Belt Pretensioner connector.

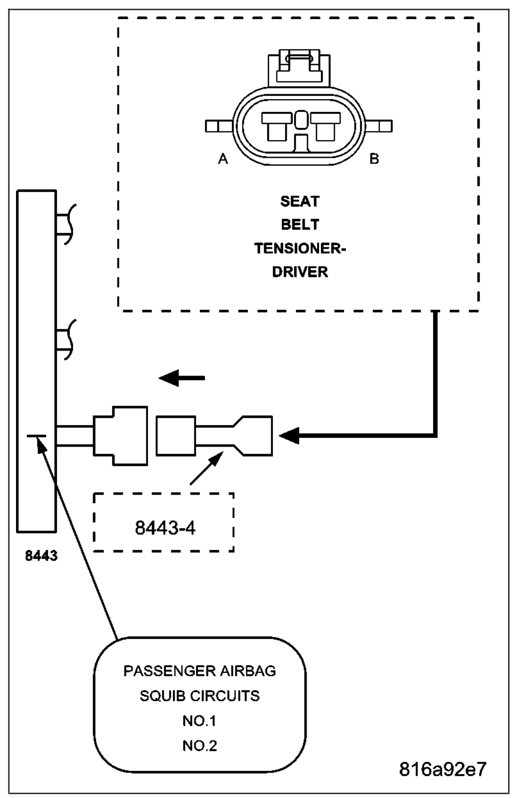
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

**Does the scan tool display: DRIVER SEAT BELT TENSIONER SHORT TO GROUND?**

**Yes** >> Go To 3

**No** >> Replace the Driver Seat Belt Pretensioner in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK (R55) DRIVER SEAT BELT TENSIONER LINE 1 CIRCUIT AND (R53) DRIVER SEAT BELT TENSIONER LINE 2 CIRCUIT FOR A SHORT TO GROUND

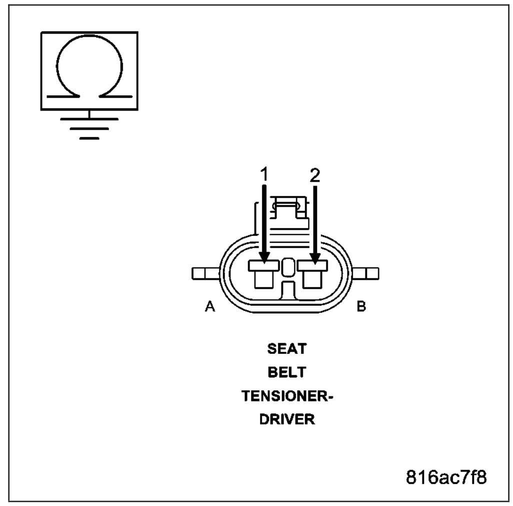
**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Driver Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the (R55) Driver Seat Belt Tensioner Line 1 circuit between ground and the Driver Seat Belt Pretensioner connector.

Measure the resistance of the (R53) Driver Seat Belt Tensioner Line 2 circuit between ground and the Driver Seat Belt Pretensioner connector.




**Is the resistance below 10K ohms on either circuit?**

**Yes** >> Repair the Driver Seat Belt Tensioner circuits with a resistance below 10K ohms for a short to ground.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

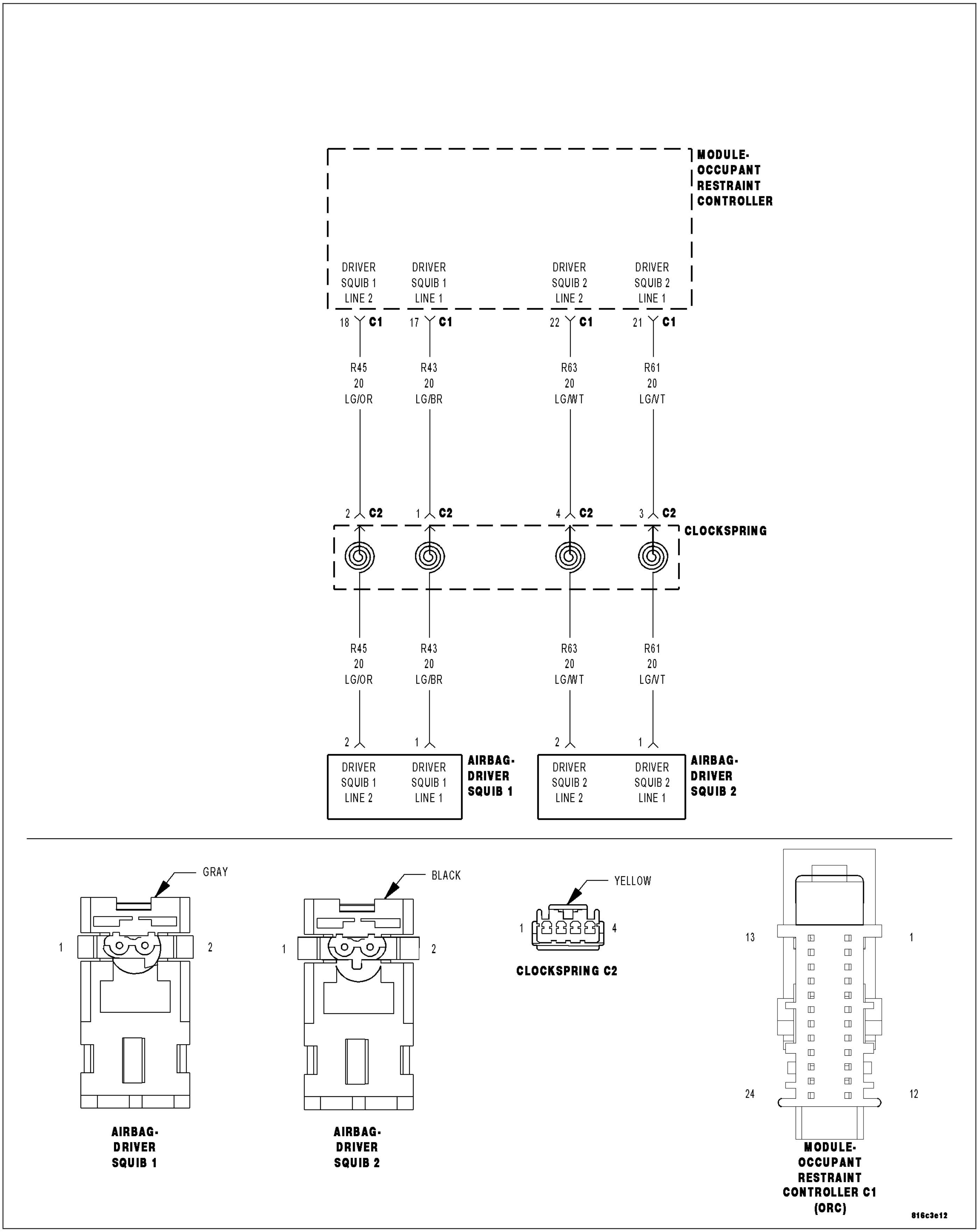
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## DRIVER SQUIB 1 CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 1 circuits. The ORC will set this DTC if it detects an open or high resistance on the Driver Squib 1 circuits.

| Possible Causes |
|---|
| DRIVER SQUIB 1 LINE 2 CIRCUIT OPEN |
| DRIVER SQUIB 1 LINE 1 CIRCUIT OPEN |
| CLOCKSPRING |
| DRIVER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 6

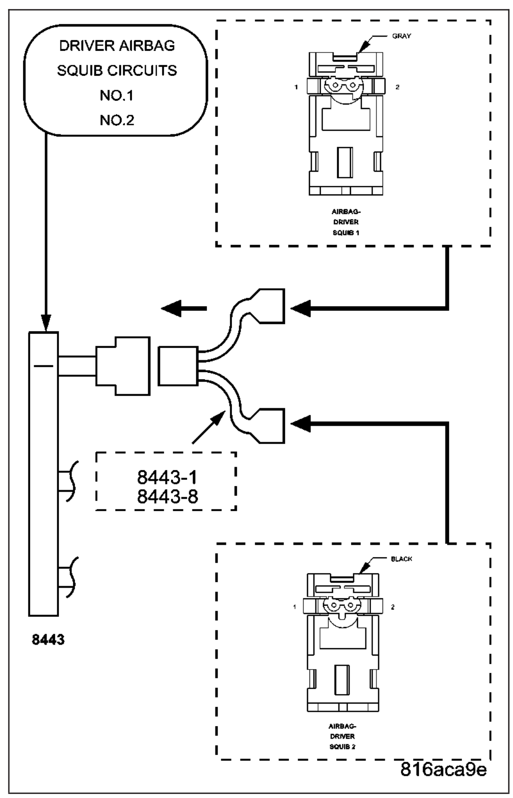
### 2. CHECK FOR OPEN SQUIB CIRCUITS IN DRIVER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Driver Airbag Squib connectors.

**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, read the active ORC DTCs.




**Does the scan tool display: DRIVER SQUIB 1 CIRCUIT OPEN?**

**Yes** >> Go To 3

**No** >> Replace the Driver Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

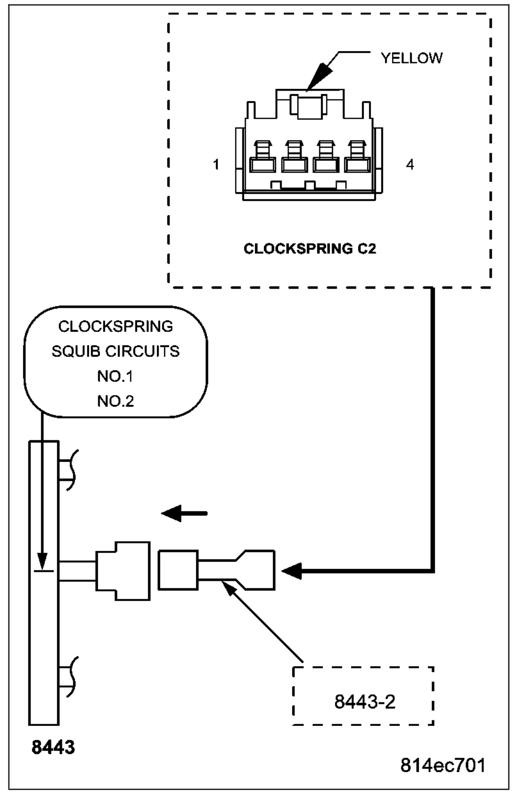
## 3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR AN OPEN

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Driver Airbag Squib connectors.

Disconnect the Clockspring connector.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool and appropriate Jumper to the Clockspring connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, read the active ORC DTCs.




**Does the scan tool display: DRIVER SQUIB 1 CIRCUIT OPEN?**

**Yes** >> Go To 4

**No** >> Replace the Clockspring in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

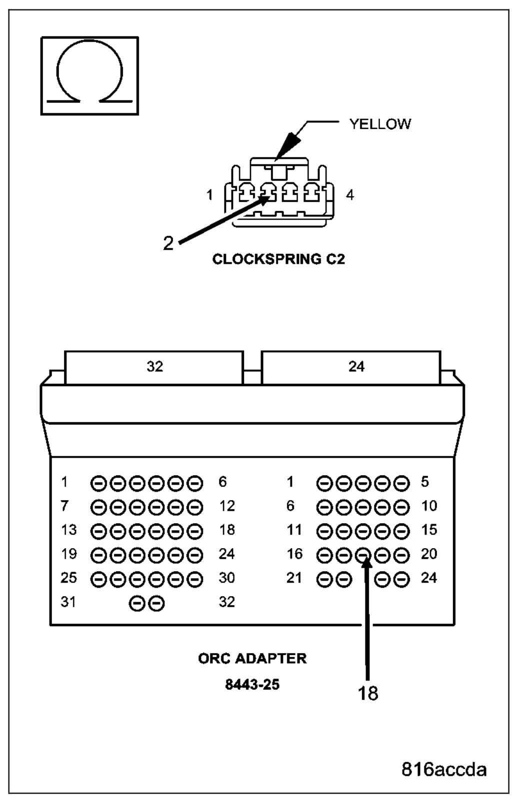
## 4. CHECK DRIVER SQUIB 1 LINE 2 CIRCUIT FOR AN OPEN

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Clockspring connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the Driver Squib 1 Line 2 circuit between the Clockspring connector and the ORC Load Tool Adaptor.



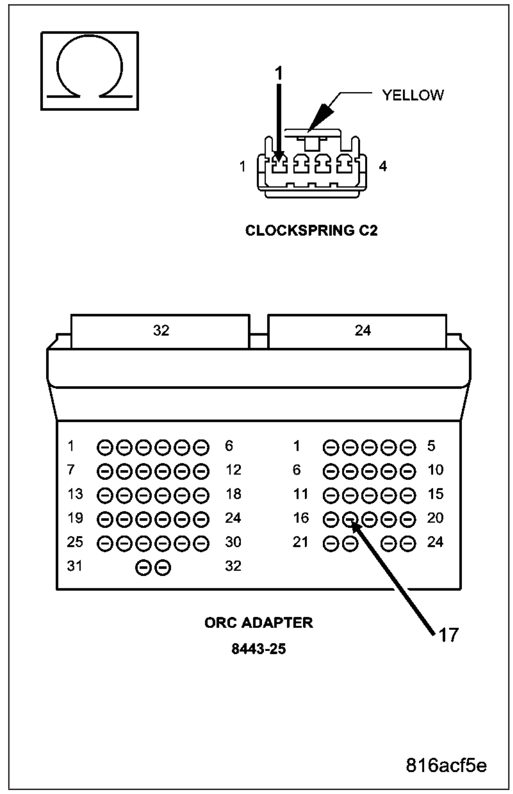

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 5

**No** >> Repair the Driver Squib 1 Line 2 circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECK DRIVER SQUIB 1 LINE 1 CIRCUIT FOR AN OPEN

Measure the resistance of the Driver Squib 1 Line 1 circuit between the Clockspring connector and the ORC Load Tool Adaptor.




**Is the resistance below 1.0 ohm?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Repair the Driver Squib 1 Line 1 circuit for an open.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 6. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

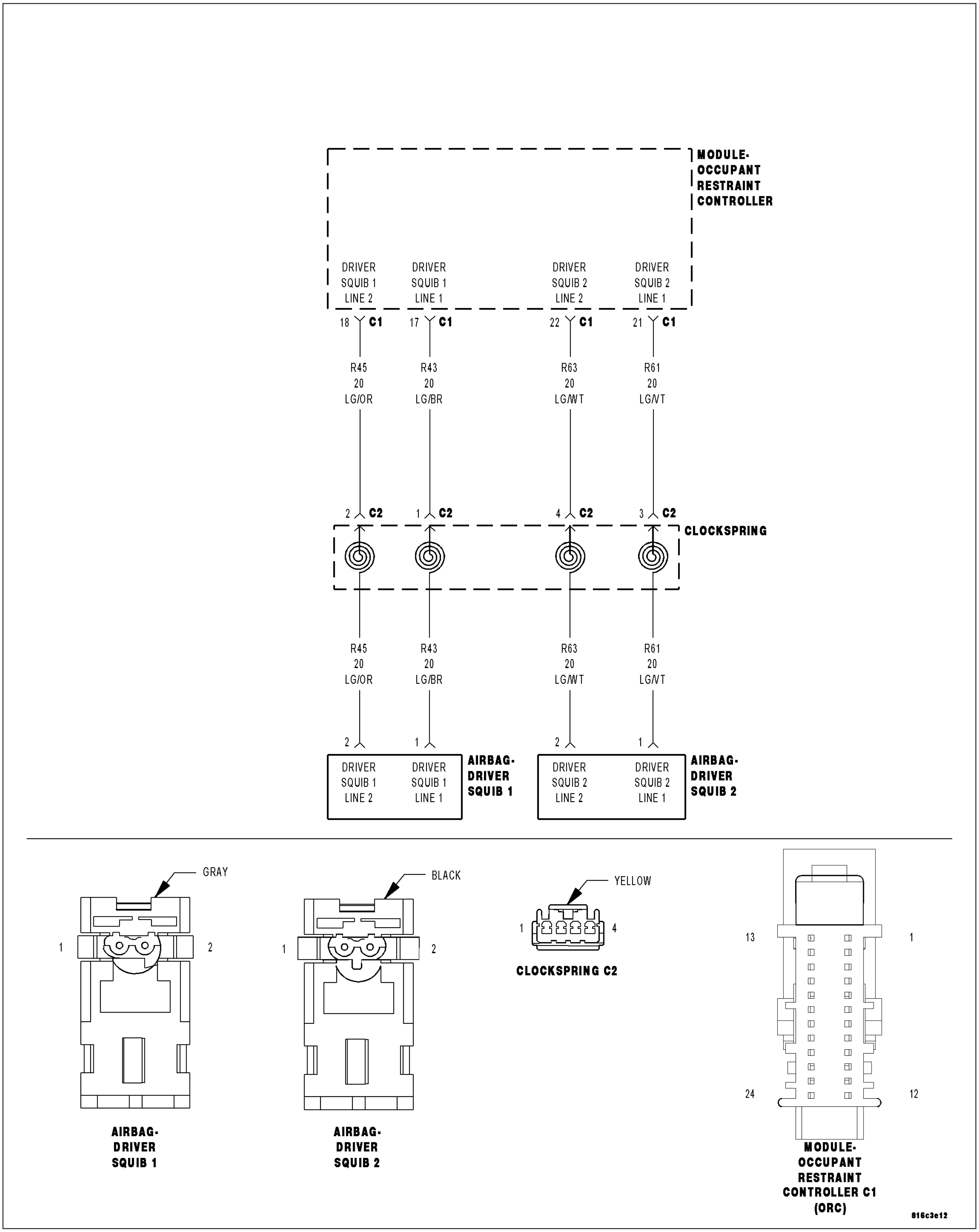
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## DRIVER SQUIB 1 CIRCUIT SHORT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 1 circuits. The ORC will set this DTC if it detects low resistance between the Driver Squib 1 circuits.

| Possible Causes |
| --- |
| DRIVER SQUIB 1 LINE 2 CIRCUIT SHORTED TO DRIVER SQUIB 1 LINE 1 CIRCUIT |
| CLOCKSPRING |
| DRIVER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

Disconnect the Driver Airbag Squib connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

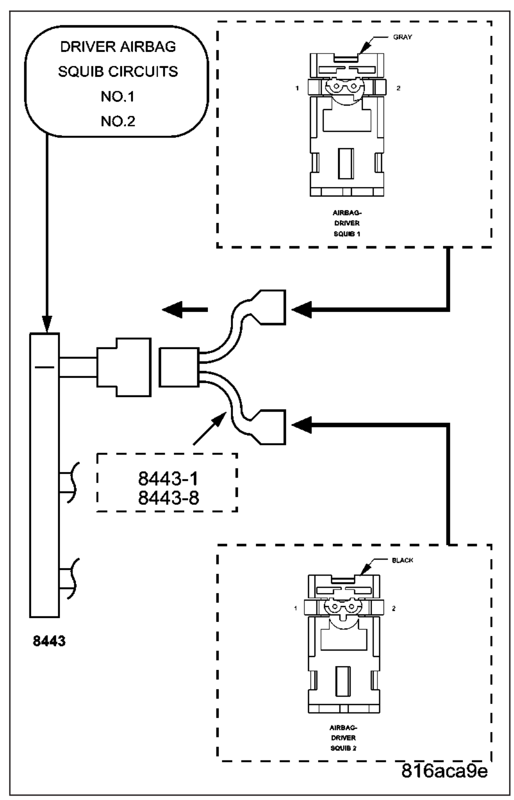
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

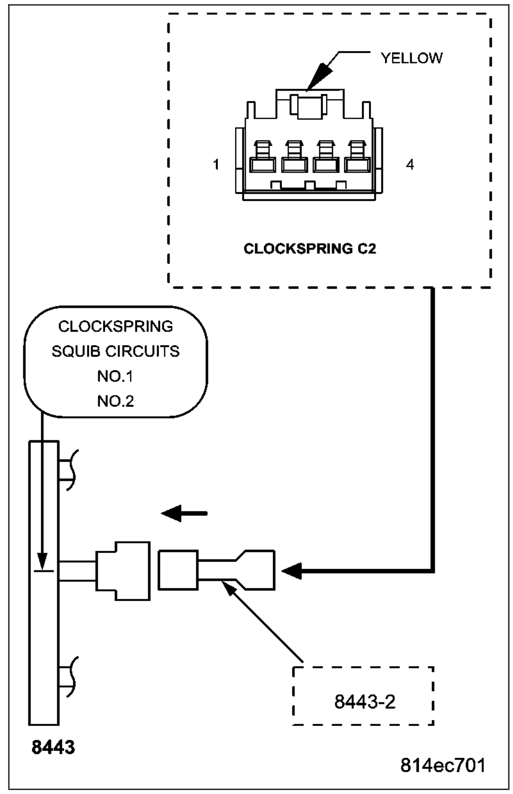
**Does the scan tool display: DRIVER SQUIB 1 CIRCUIT SHORT?**

**Yes** >> Go To 3

**No** >> Replace the Driver Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR A SHORT TOGETHER




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool ORC from the Driver Airbag Squib connectors.

Disconnect the Clockspring connector.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool and appropriate Jumper to the Clockspring connector.

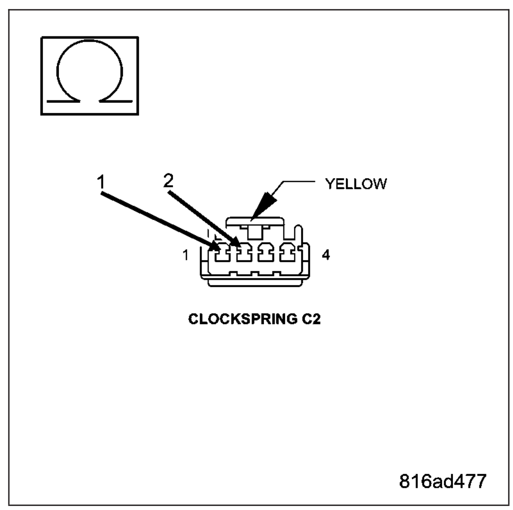
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, read the active ORC DTCs.

**Does the scan tool display: DRIVER SQUIB 1 CIRCUIT SHORT?**

**Yes** >> Go To 4

**No** >> Replace the Clockspring in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECK DRIVER SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO DRIVER SQUIB 1 LINE 1 CIRCUIT




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Clockspring connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance between the Driver Squib 1 Line 2 circuit and the Driver Squib 1 Line 1 circuit at the Clockspring connector.

**Is the resistance below 10K ohms?**

**Yes** >> Repair the Driver Squib 1 Line 2 circuit for a short to the Driver Squib 1 Line 1 circuit.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

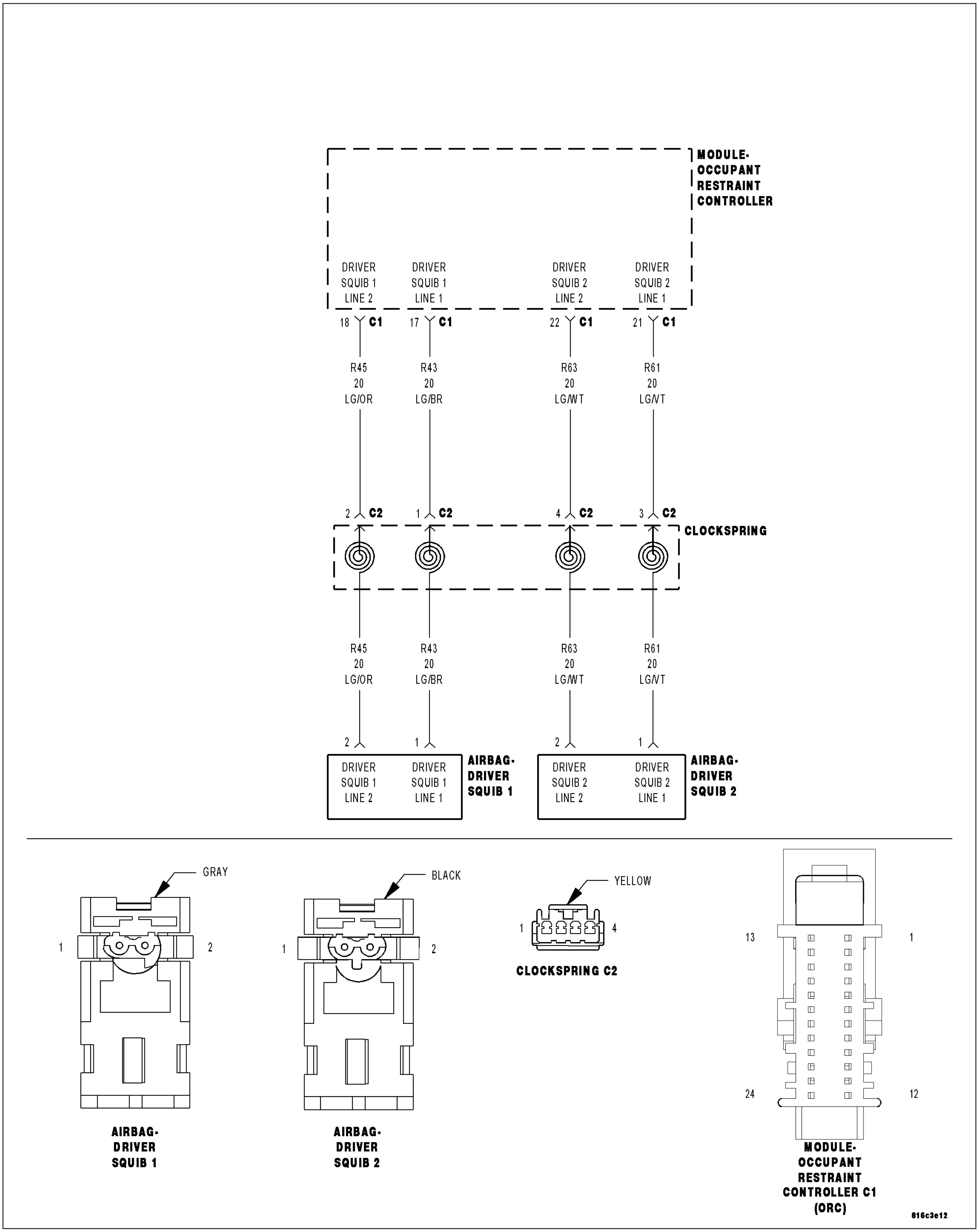
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## DRIVER SQUIB 1 SHORT TO BATTERY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the voltage on the Driver Squib 1 circuits. The ORC will set this DTC if it detects voltage on the Driver Squib 1 circuits.

| Possible Causes |
| --- |
| DRIVER SQUIB 1 LINE 2 CIRCUIT OR DRIVER SQUIB 1 LINE 1 CIRCUIT SHORTED TO BATTERY |
| CLOCKSPRING |
| DRIVER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Driver Airbag Squib connectors.

**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

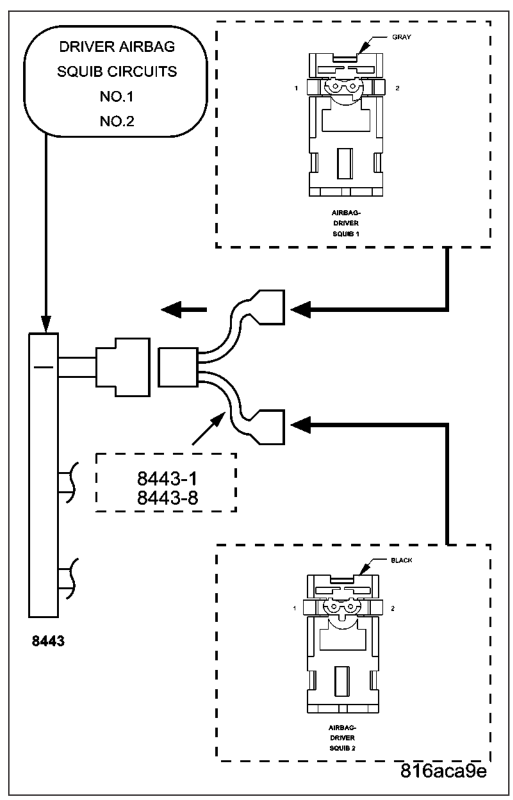
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

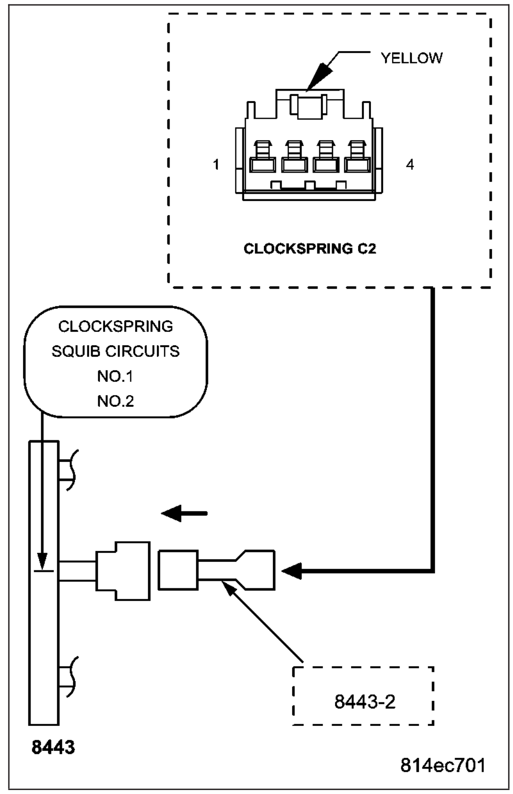
**Does the scan tool display: DRIVER SQUIB 1 SHORT TO BATTERY?**

**Yes** >> Go To 3

**No** >> Replace the Driver Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR A SHORT TO BATTERY




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the 8443 Load Tool and Jumper from the Driver Airbag Squib connectors.

Disconnect the Clockspring connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Clockspring connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

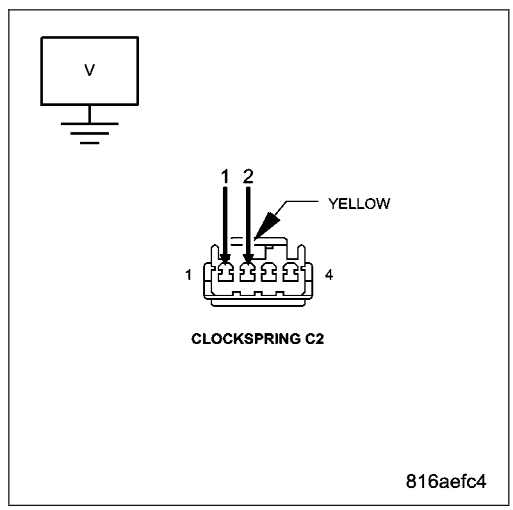
**Does the scan tool display: DRIVER SQUIB 1 SHORT TO BATTERY?**

**Yes** >> Go To 4

**No** >> Replace the Clockspring in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECK DRIVER SQUIB 1 LINE 2 CIRCUIT AND DRIVER SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO BATTERY




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the 8443 Load Tool and Jumper from the Clockspring connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

Measure the voltage of the Driver Squib 1 Line 2 circuit between the Clockspring connector and ground.

Measure the voltage of the Driver Squib 1 Line 1 circuit between the Clockspring connector and ground.

**Is there any voltage present for either measurement?**

**Yes** >> Repair the Driver Squib 1 circuits with voltage present for a short to Battery.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

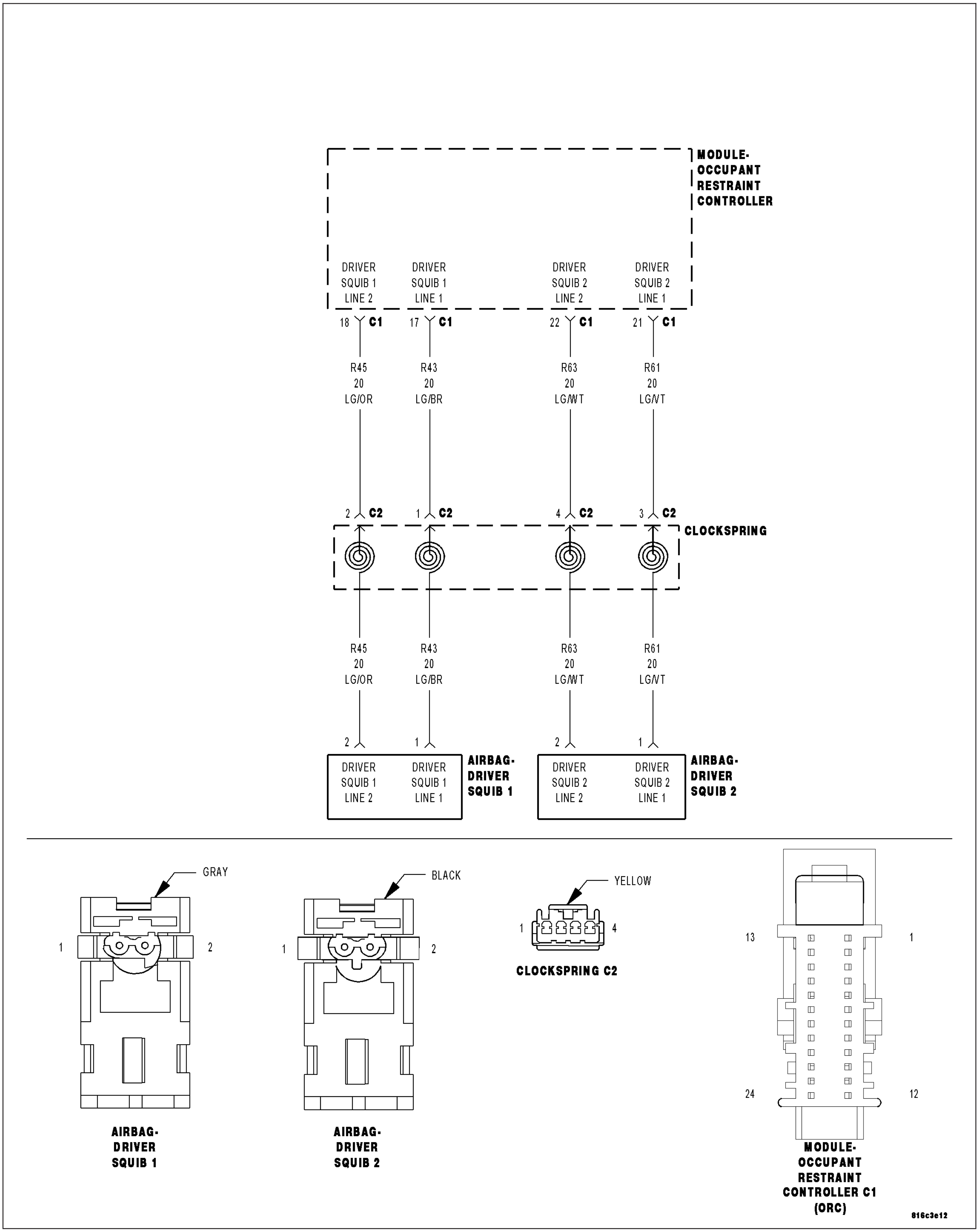
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## DRIVER SQUIB 1 SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 1 circuits. The ORC will set this DTC if it detects low resistance on the Driver Squib 1 circuits.

| Possible Causes |
| --- |
| DRIVER SQUIB 1 LINE 2 CIRCUIT OR DRIVER SQUIB 1 LINE 1 CIRCUIT SHORTED TO GROUND |
| CLOCKSPRING |
| DRIVER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

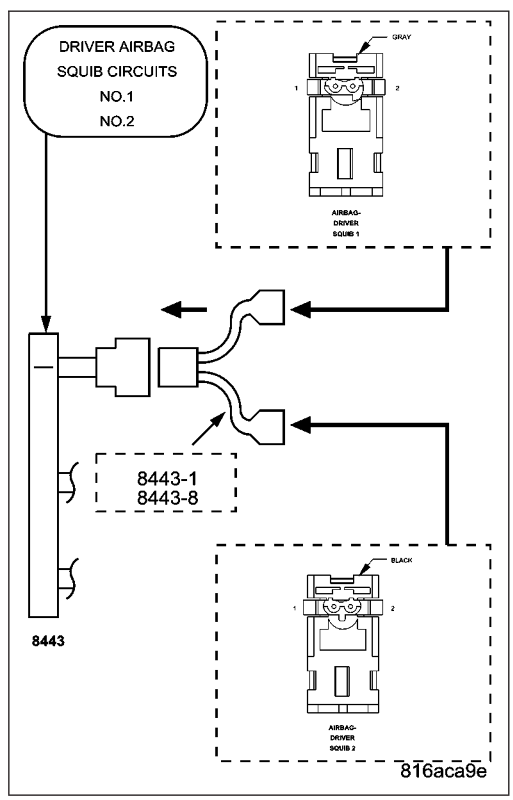
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Driver Airbag Squib connectors.

**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

**Does the scan tool display: DRIVER SQUIB 1 SHORT TO GROUND?**

**Yes** >> Go To 3

**No** >> Replace the Driver Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

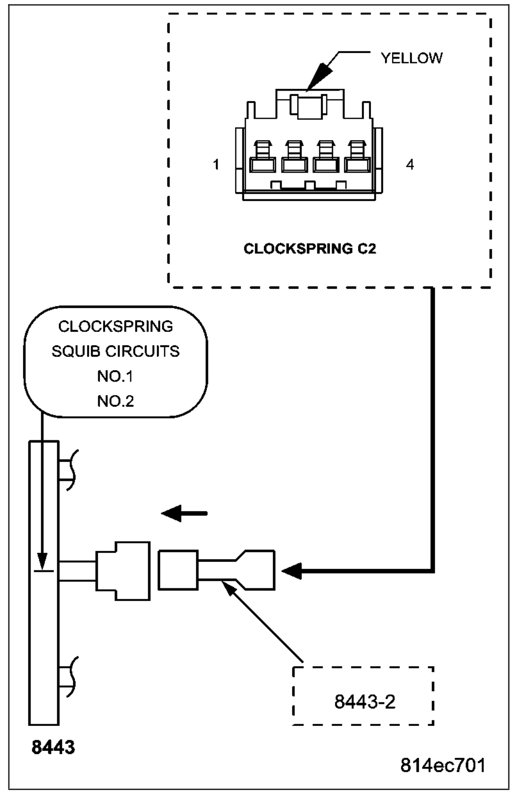
## 3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR A SHORT TO GROUND

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool Jumper from the Driver Airbag Squib connectors.

Disconnect the Clockspring connector.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool and appropriate Jumper to the Clockspring connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, read the active ORC DTCs.




**Does the scan tool display: DRIVER SQUIB 1 SHORT TO GROUND?**

**Yes** >> Go To 4

**No** >> Replace the Clockspring in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECK DRIVER SQUIB 1 LINE 2 CIRCUIT AND DRIVER SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO GROUND

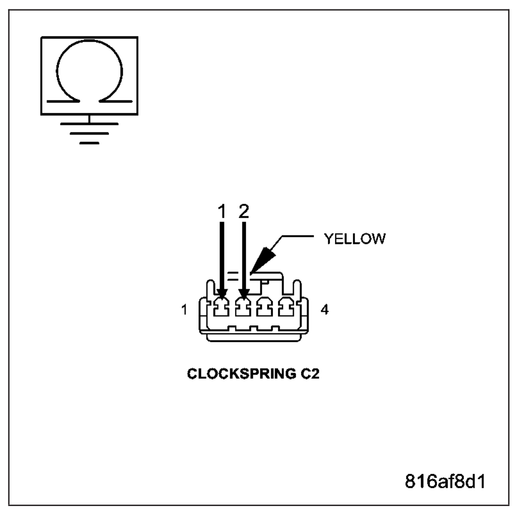
**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Clockspring connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the Driver Squib 1 Line 2 circuit between ground and the Clockspring connector.

Measure the resistance of the Driver Squib 1 Line 1 circuit between ground and the Clockspring connector.




**Is the resistance below 10K ohms for either measurement?**

**Yes** >> Repair the Driver Squib 1 circuits with a resistance below 10K ohms for a short to ground.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

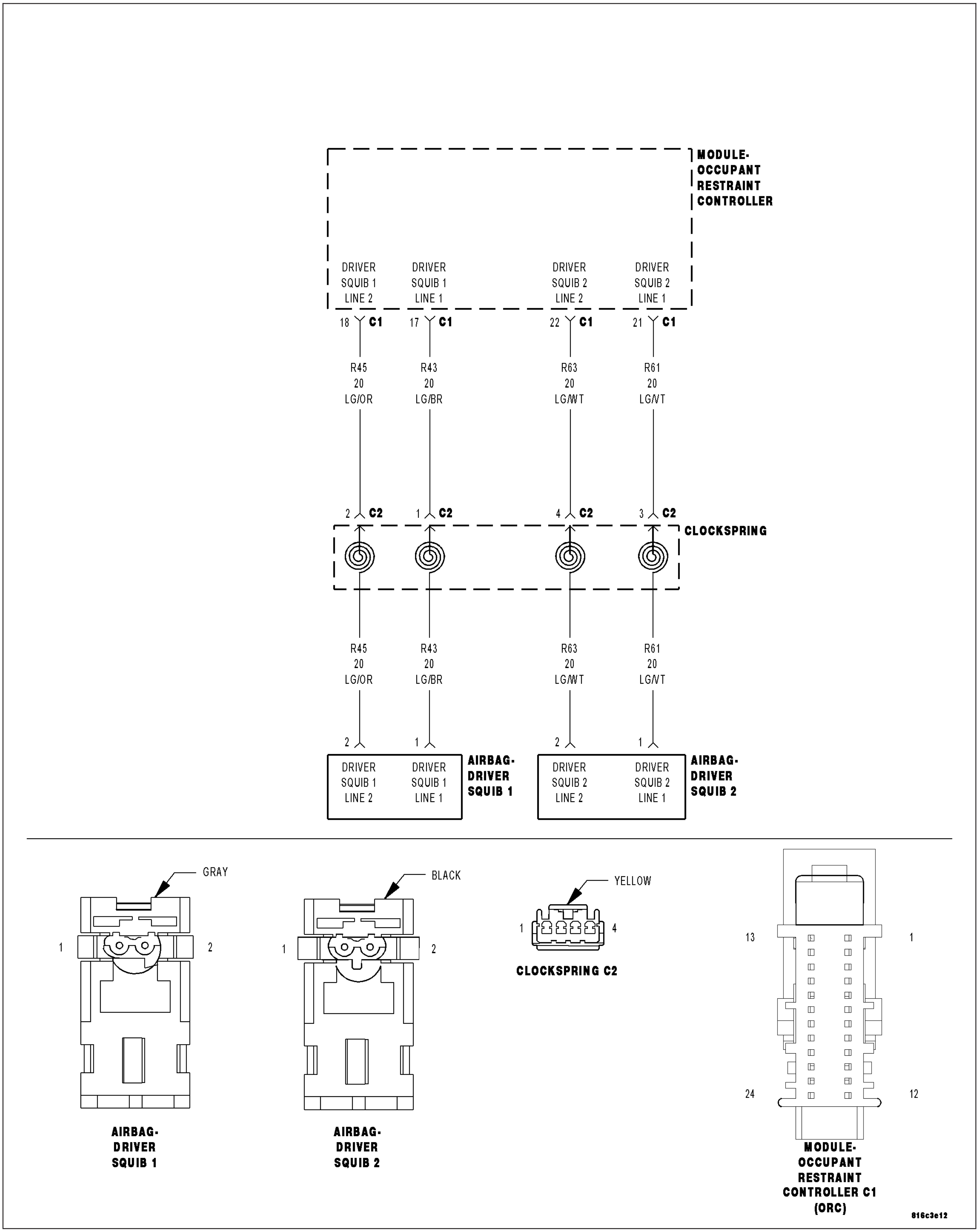
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## DRIVER SQUIB 2 CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 2 circuits. The ORC will set this DTC if it detects an open or high resistance on the Driver Squib 2 circuits.

| Possible Causes |
|---|
| DRIVER SQUIB 2 LINE 1 CIRCUIT OPEN |
| DRIVER SQUIB 2 LINE 2 CIRCUIT OPEN |
| CLOCKSPRING |
| DRIVER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 6

### 2. CHECK FOR OPEN SQUIB CIRCUITS IN DRIVER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Driver Airbag Squib connectors.

**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

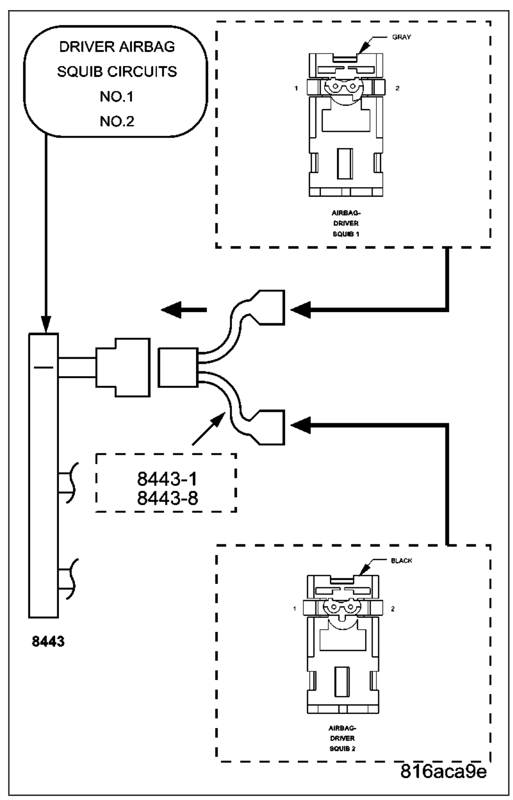
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

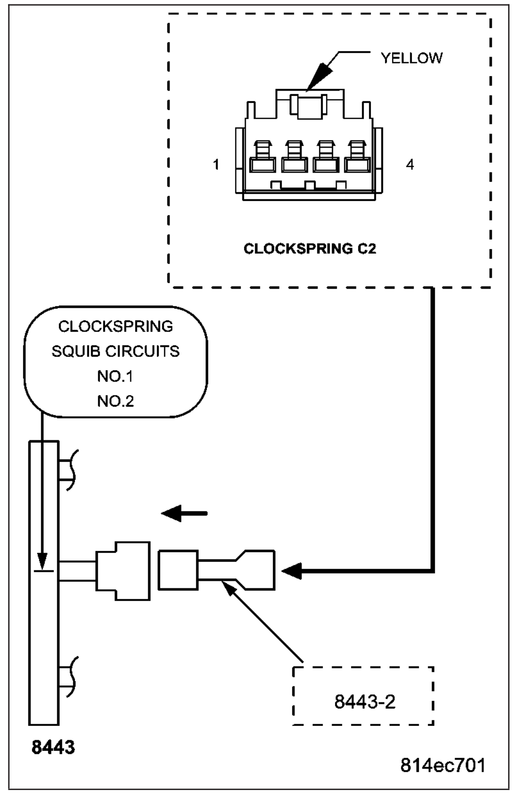
**Does the scan tool display: DRIVER SQUIB 2 CIRCUIT OPEN?**

**Yes** >> Go To 3

**No** >> Replace the Driver Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR AN OPEN




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Driver Airbag Squib connectors.

Disconnect the Clockspring connector.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool and appropriate Jumper to the Clockspring connector.

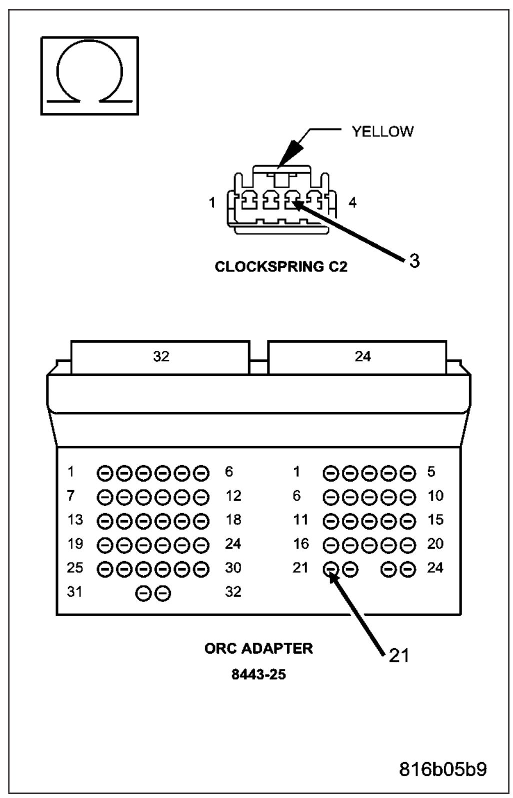
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, read the active ORC DTCs.

**Does the scan tool display: DRIVER SQUIB 2 CIRCUIT OPEN?**

**Yes** >> Go To 4

**No** >> Replace the Clockspring in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECK DRIVER SQUIB 2 LINE 1 CIRCUIT FOR AN OPEN




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Clockspring connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the Driver Squib 2 Line 1 circuit between the Clockspring connector and the ORC Load Tool Adaptor.

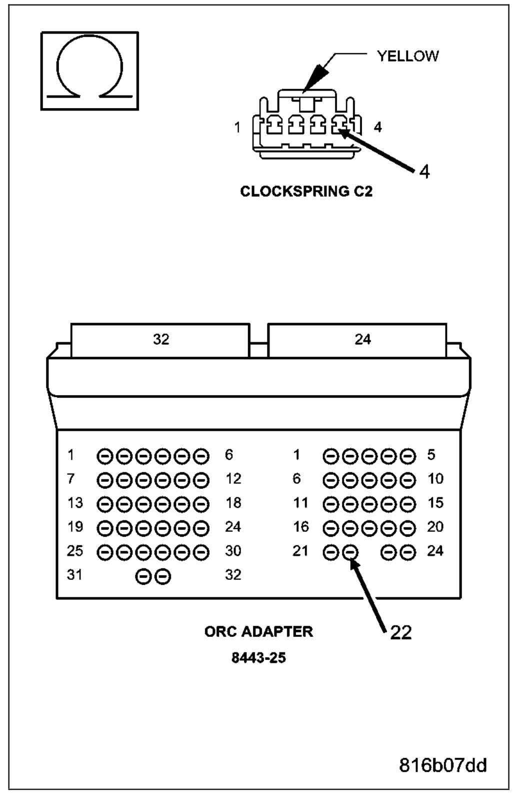
**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 5

**No** >> Repair the Driver Squib 2 Line 1 circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECK DRIVER SQUIB 2 LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the Driver Squib 2 Line 2 circuit between the Clockspring connector and the ORC Load Tool Adaptor.




**Is the resistance below 1.0 ohm?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Repair the Driver Squib 2 Line 2 circuit for an open.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 6. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

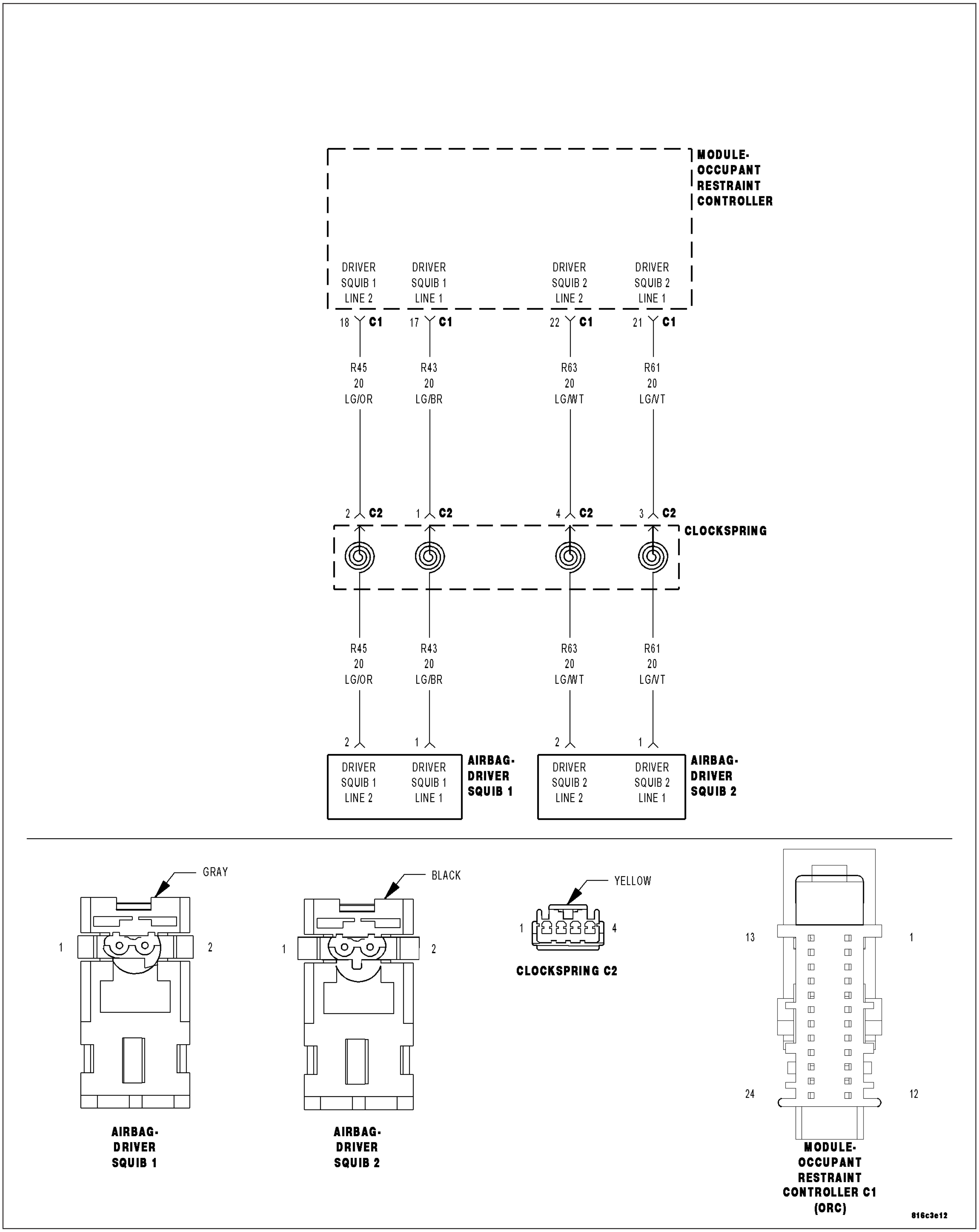
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## DRIVER SQUIB 2 CIRCUIT SHORT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 2 circuits. The ORC will set this DTC if it detects low resistance between the Driver Squib 2 circuits.

| Possible Causes |
|---|
| DRIVER SQUIB 2 LINE 1 CIRCUIT SHORTED TO DRIVER SQUIB 2 LINE 2 CIRCUIT |
| CLOCKSPRING |
| DRIVER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The Scan Tool, SRS Airbag Load Tool MRL 8443 and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

Disconnect the Driver Airbag Squib connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

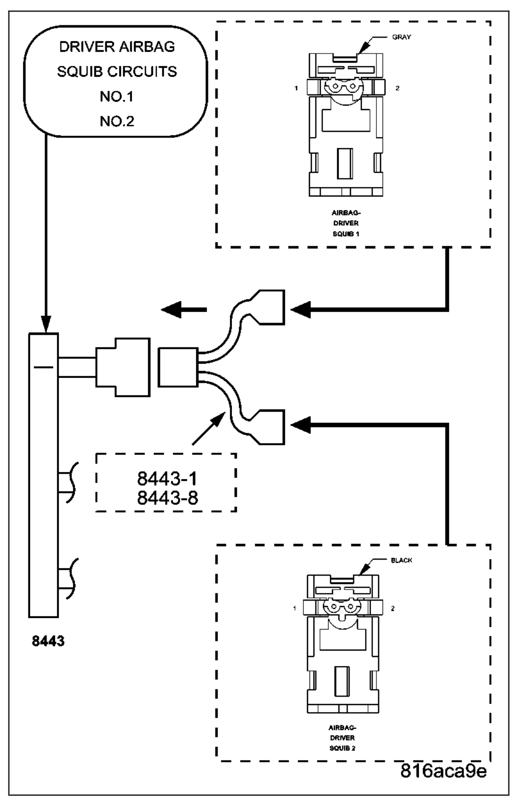
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

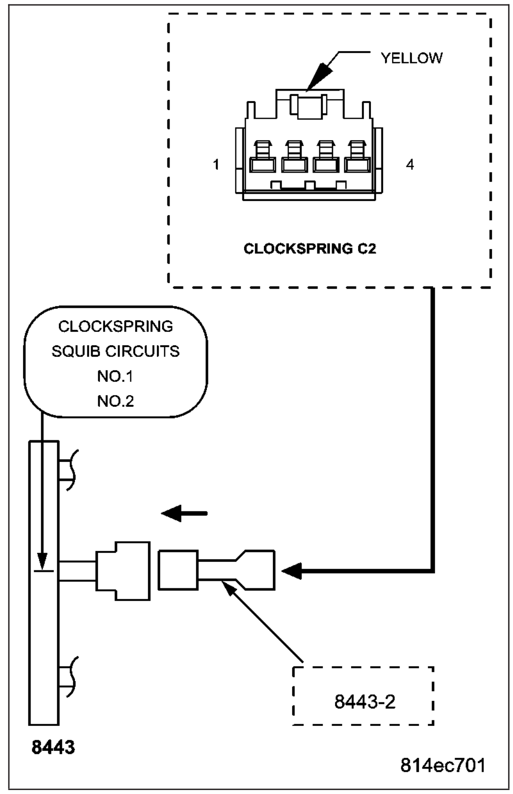
**Does the scan tool display: DRIVER SQUIB 2 CIRCUIT SHORT?**

**Yes** >> Go To 3

**No** >> Replace the Driver Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR A SHORT TOGETHER




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool ORC from the Driver Airbag Squib connectors.

Disconnect the Clockspring connector.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool and appropriate Jumper to the Clockspring connector.

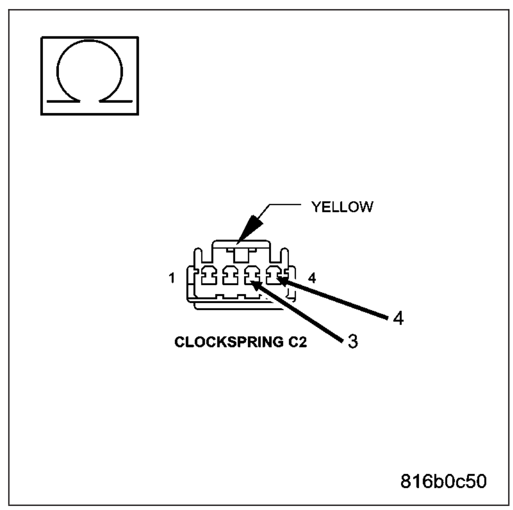
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, read the active ORC DTCs.

**Does the scan tool display: DRIVER SQUIB 2 CIRCUIT SHORT?**

**Yes** >> Go To 4

**No** >> Replace the Clockspring in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECK DRIVER SQUIB 2 LINE 1 CIRCUIT FOR A SHORT TO DRIVER SQUIB 2 LINE 2 CIRCUIT




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Clockspring connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance between the Driver Squib 2 Line 1 circuit and the Driver Squib 2 Line 2 circuit at the Clockspring connector.

**Is the resistance below 10K ohms?**

**Yes** >> Repair the Driver Squib 2 Line 1 circuit for a short to the Driver Squib 2 Line 2 circuit.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

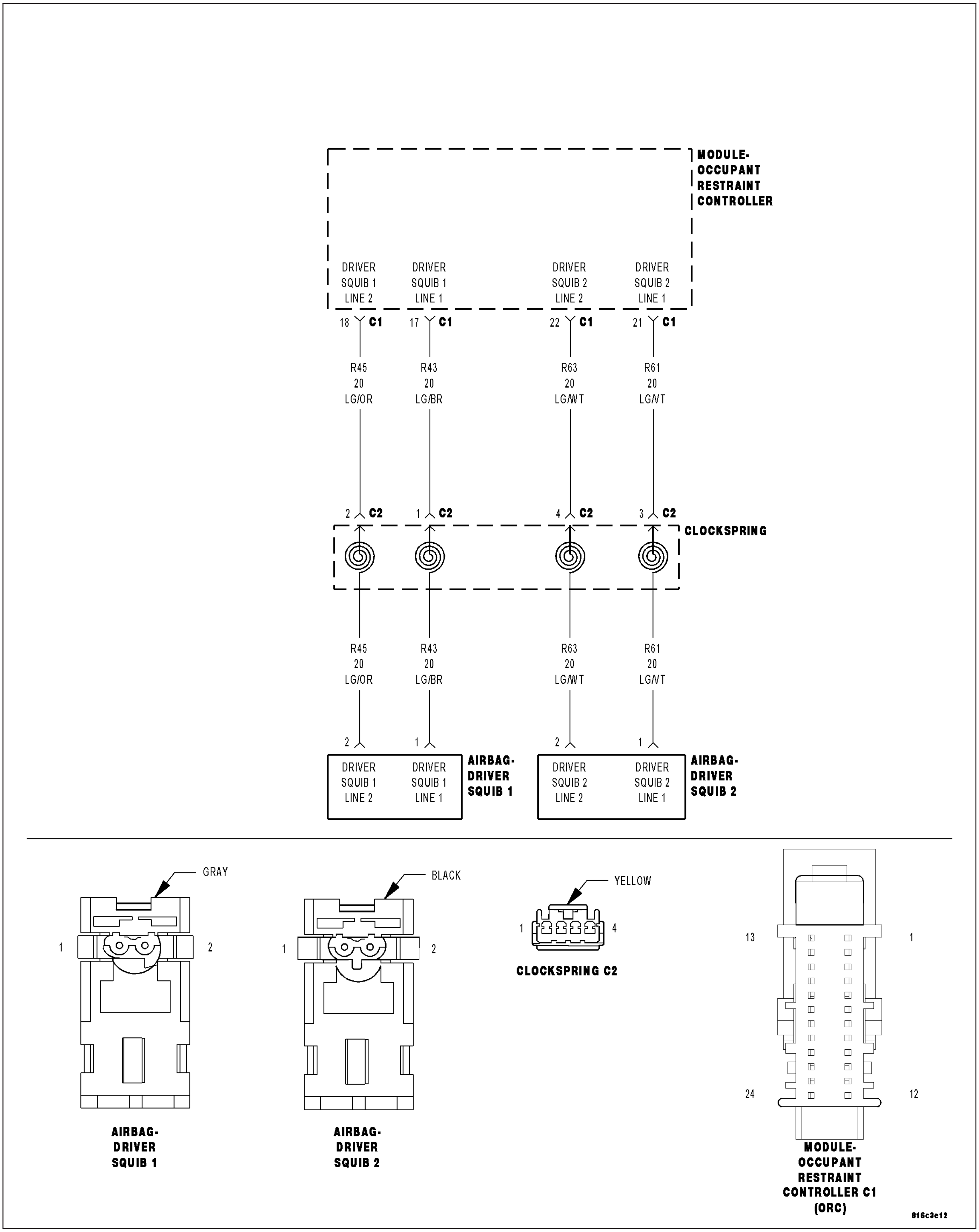
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## DRIVER SQUIB 2 SHORT TO BATTERY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the voltage on the Driver Squib 2 circuits. The ORC will set this DTC if it detects voltage on the Driver Squib 2 circuits.

| Possible Causes |
|---|
| DRIVER SQUIB 2 LINE 1 CIRCUIT OR DRIVER SQUIB 2 LINE 2 CIRCUIT SHORTED TO BATTERY |
| CLOCKSPRING |
| DRIVER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443 and DVOM are required to perform the following test.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

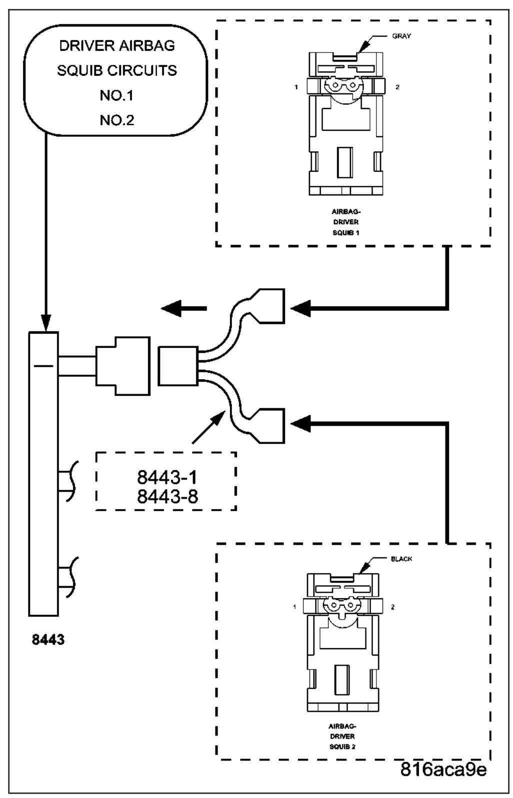
### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Driver Airbag Squib connectors.

**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, read the active ORC DTCs.




**Does the scan tool display: DRIVER SQUIB 2 SHORT TO BATTERY?**

**Yes** >> Go To 3

**No** >> Replace the Driver Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR A SHORT TO BATTERY

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the 8443 Load Tool and Jumper from the Driver Airbag Squib connectors.

Disconnect the Clockspring connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Clockspring connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

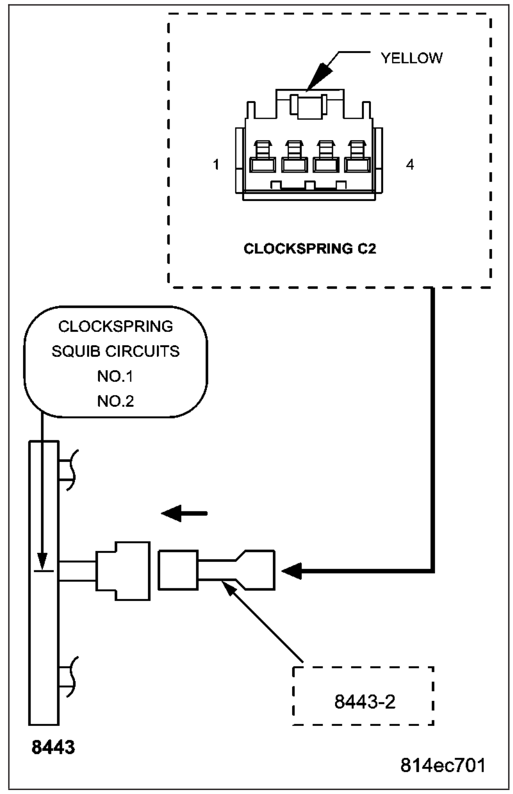
With the scan tool, read the active ORC DTCs.

**Does the scan tool display: DRIVER SQUIB 2 SHORT TO BATTERY?**

**Yes** >> Go To 4

**No** >> Replace the Clockspring in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.




## 4. CHECK DRIVER SQUIB 2 LINE 1 CIRCUIT AND DRIVER SQUIB 2 LINE 2 CIRCUIT FOR A SHORT TO BATTERY

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the 8443 Load Tool and Jumper from the Clockspring connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC C2 connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

Measure the voltage of the Driver Squib 2 Line 1 circuit between the Clockspring connector and ground.

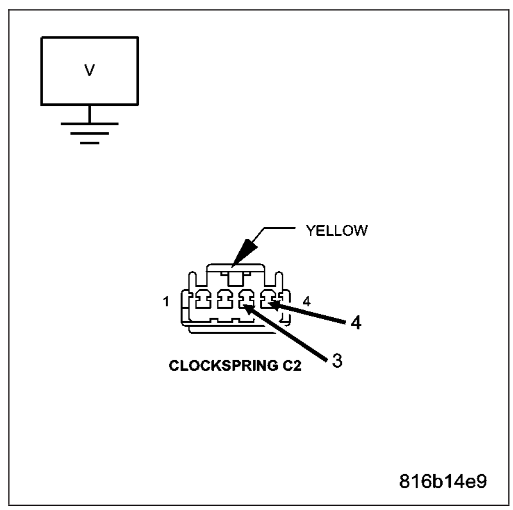
Measure the voltage of the Driver Squib 2 Line 2 circuit between the Clockspring connector and ground.

**Is there any voltage present for either measurement?**

**Yes** >> Repair the Driver Squib 2 circuits with voltage present for a short to Battery.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>




**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

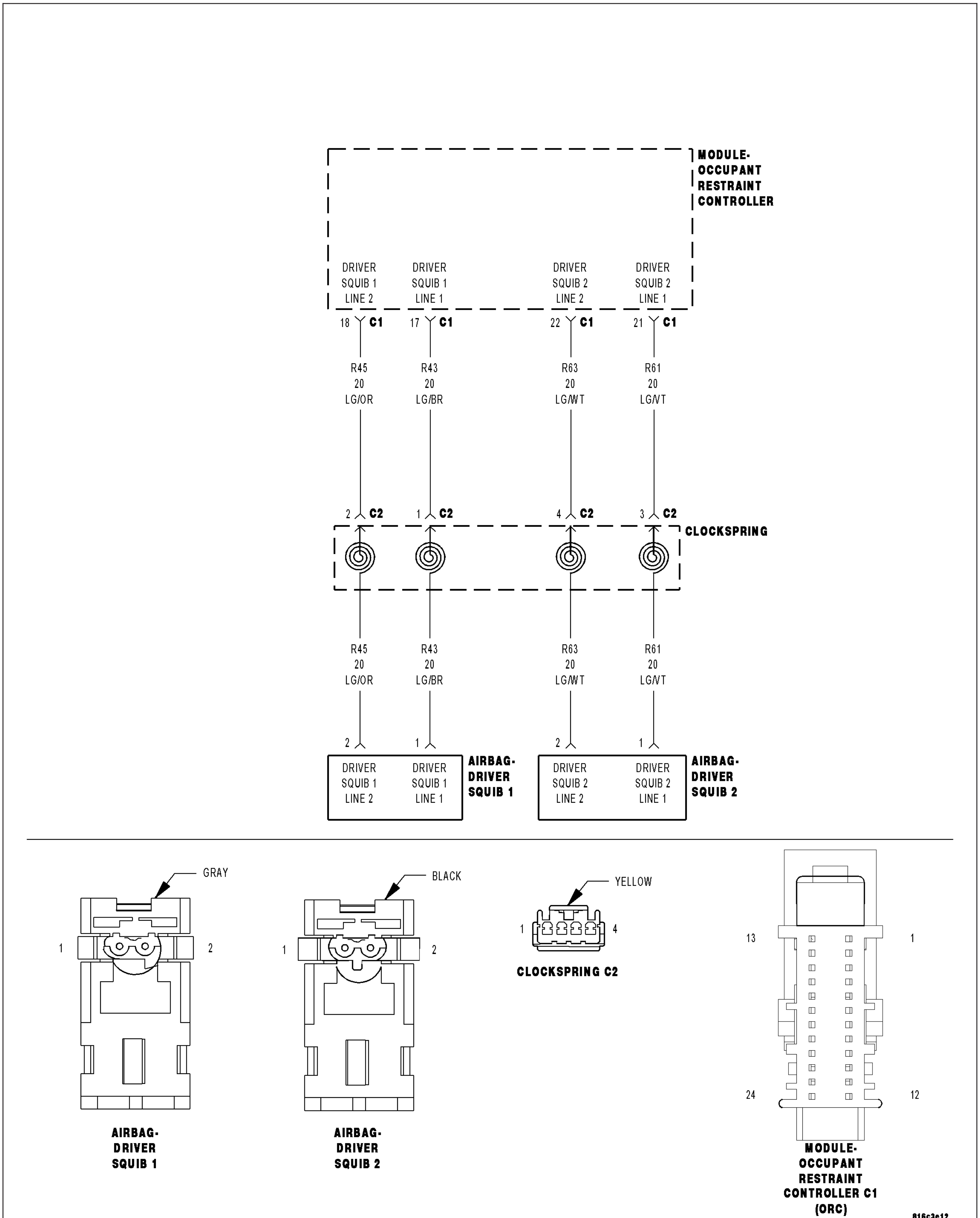
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## DRIVER SQUIB 2 SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Driver Squib 2 circuits. The ORC will set this DTC if it detects low resistance on the Driver Squib 2 circuits.

| Possible Causes |
|---|
| DRIVER SQUIB 2 LINE 1 CIRCUIT OR DRIVER SQUIB 2 LINE 2 CIRCUIT SHORTED TO GROUND |
| CLOCKSPRING |
| DRIVER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN DRIVER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Driver Airbag Squib connectors.

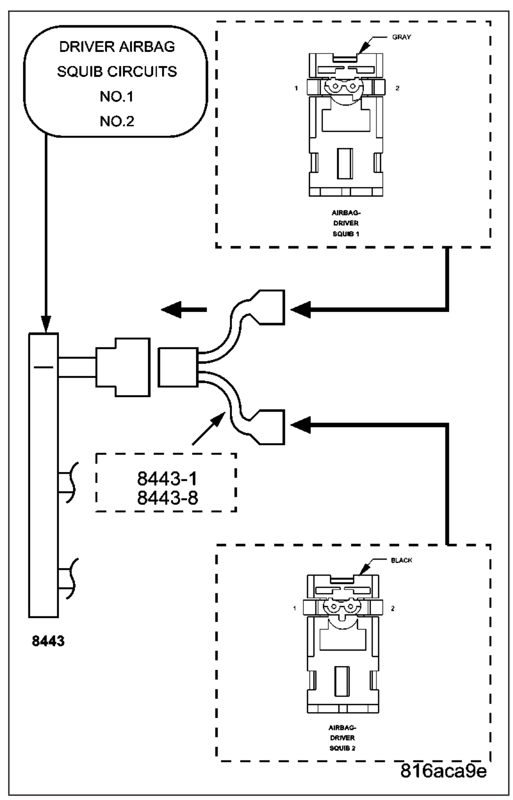
**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Driver Airbag Squib connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

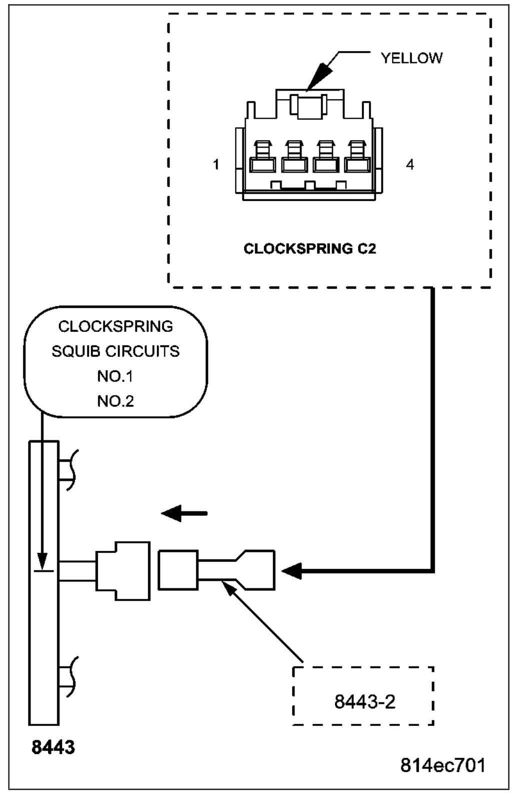



**Does the scan tool display: DRIVER SQUIB 2 SHORT TO GROUND?**

**Yes** >> Go To 3

**No** >> Replace the Driver Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK CLOCKSPRING SQUIB CIRCUITS FOR A SHORT TO GROUND




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool Jumper from the Driver Airbag Squib connectors.

Disconnect the Clockspring connector.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool and appropriate Jumper to the Clockspring connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, read the active ORC DTCs.

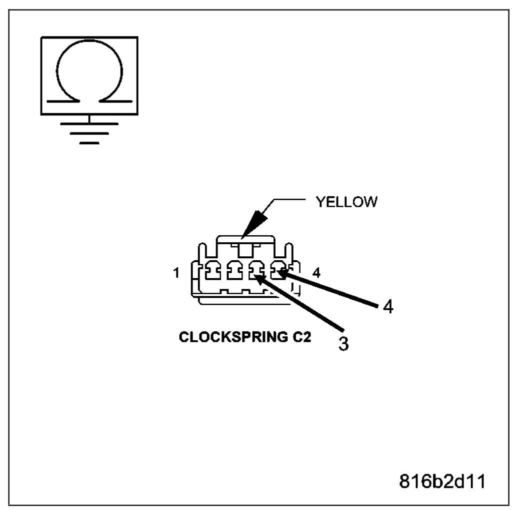
**Does the scan tool display: DRIVER SQUIB 2 SHORT TO GROUND?**

**Yes** >> Go To 4

**No** >> Replace the Clockspring in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECK DRIVER SQUIB 2 LINE 1 CIRCUIT AND DRIVER SQUIB 2 LINE 2 CIRCUIT FOR A SHORT TO GROUND




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Clockspring connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the Driver Squib 2 Line 1 circuit between ground and the Clockspring connector.

Measure the resistance of the Driver Squib 2 Line 2 circuit between ground and the Clockspring connector.

**Is the resistance below 10K ohms for either measurement?**

**Yes** >> Repair the Driver Squib 2 circuits with a resistance below 10K ohms for a short to ground.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## DEPLOYMENT DATA RECORD FULL

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controllers (ORC) on board diagnostics monitors the airbag deployment counter. The Airbag Deployment Counter increments each time the vehicle is in an impact that deploys a front or side airbag. The ORC will set this DTC when the Airbag Deployment Counter reaches 3.

| Possible Causes |
| --- |
| ORC |

### Diagnostic Test

#### 1. REPLACE THE ORC

**Repair**

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## INTERROGATE OCM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Classification Module (OCM) broadcasts a status message on the Bus that provides classification and system fault data to the Occupant Restraint Controller (ORC). The ORC will set this DTC if the message indicates that there is an active fault in the occupant classification system.

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**CAUTION: Repair all other active ORC DTCs before proceeding with this test. Refer to the Table Of Contents in this Section for a complete list of airbag system diagnostic procedures.**

**NOTE: Ensure that the battery is fully charged.**

**WARNING: When disconnecting or connecting airbag system components, the ignition must be turned off and the battery must be disconnected.**

Turn the ignition on.

**Select ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 3

### 2. CHECK FOR ACTIVE DTCs IN THE OCM

With the scan tool, read active OCM DTCs.

**Does the scan tool display any DTCs?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table Of Contents in this Section for a complete list of airbag system diagnostic procedures.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

### 3. TEST FOR AN INTERMITTENT CONDITION

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

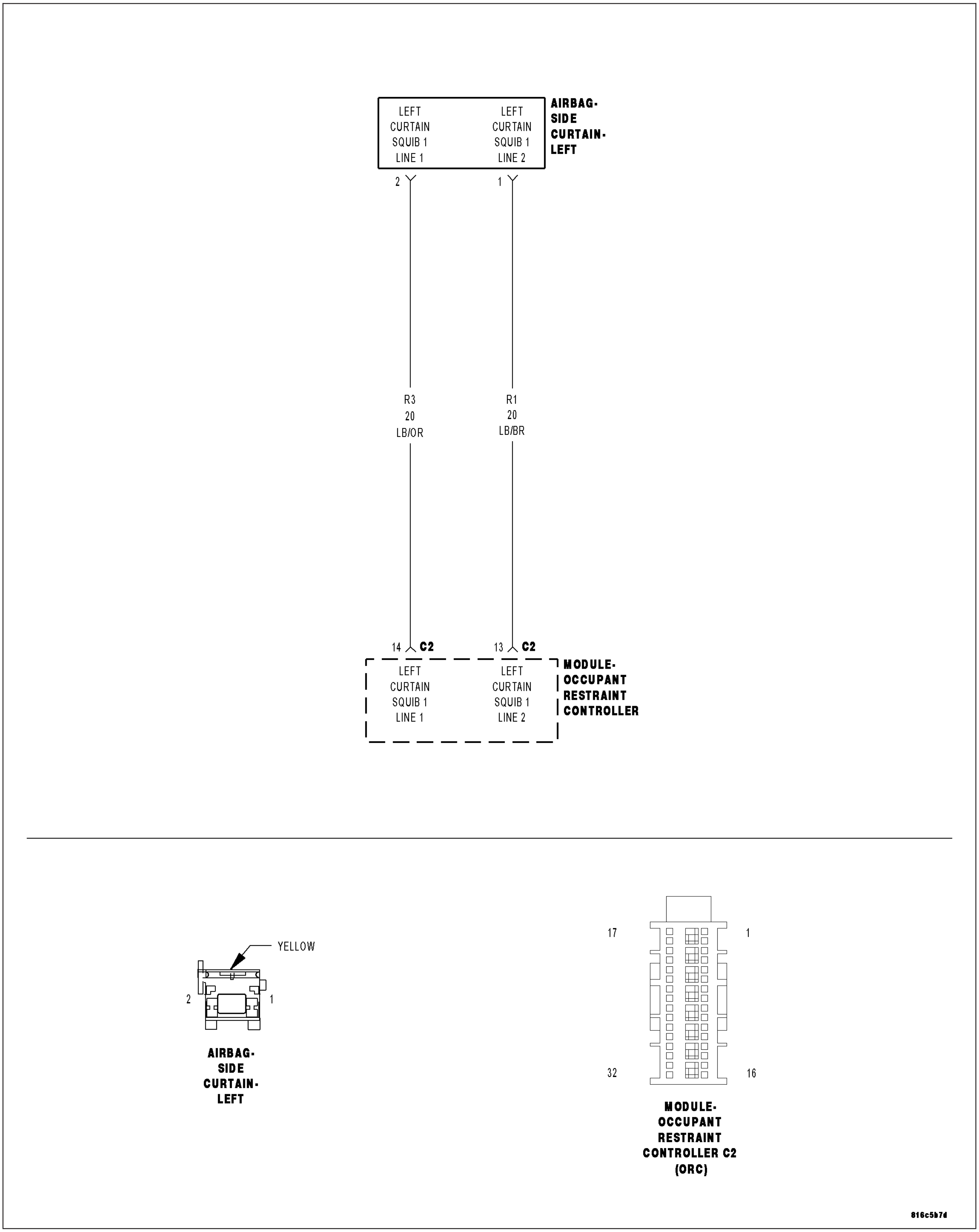
With the scan tool, read the active ORC DTCs.

**Does the scan tool display any active DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## LEFT CURTAIN SQUIB 1 CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Left Curtain Squib 1 circuits. The ORC will set this DTC if it detects an open or high resistance on the Left Curtain Squib 1 circuits.

| Possible Causes |
|---|
| (R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT OPEN |
| (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT OPEN |
| LEFT SIDE CURTAIN AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

### 2. CHECK FOR OPEN SQUIB CIRCUITS IN LEFT SIDE CURTAIN AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Left Side Curtain Airbag connector.

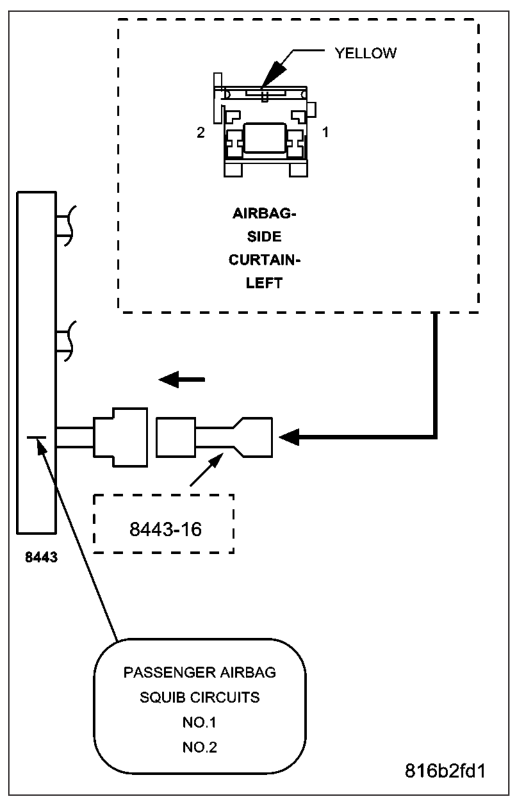
**WARNING: To avoid personal injury or death, do not place an intact undeployed curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Left Side Curtain Airbag connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.




**Does the scan tool display: LEFT CURTAIN SQUIB 1 CIRCUIT OPEN?**

**Yes** >> Go To 3

**No** >> Replace the Left Side Curtain Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK (R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT FOR AN OPEN

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

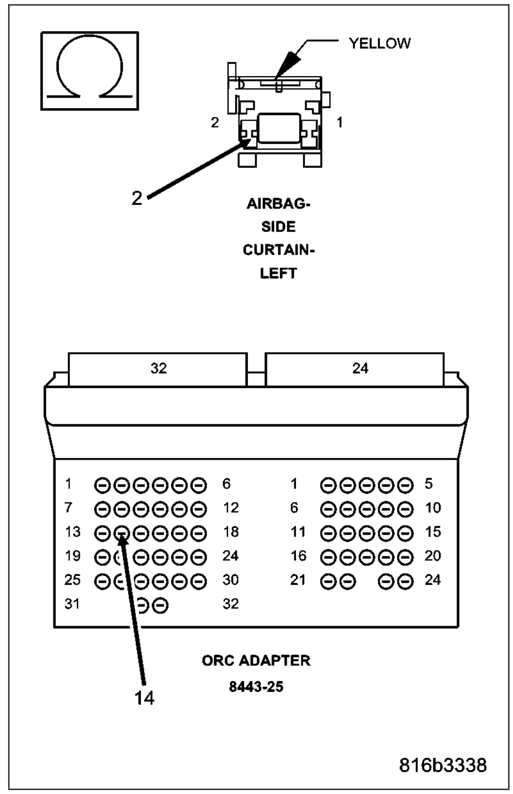
Disconnect the 8443 Load Tool and Jumper from the Left Side Curtain Airbag connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the (R3) Left Curtain Squib 1 Line 1 circuit between the Left Side Curtain Airbag connector and the Load Tool ORC Adaptor.




**Is the resistance below 1.0 ohm?**

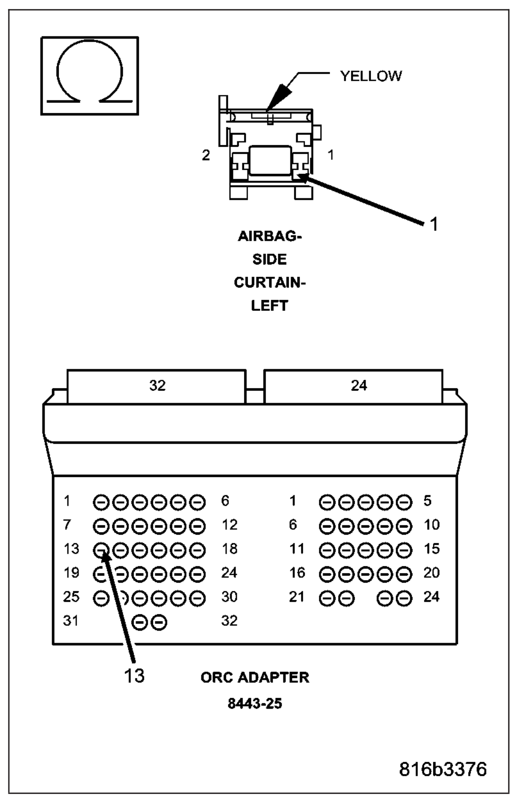
**Yes** >> Go To 4

**No** >> Repair the (R3) Left Curtain Squib 1 Line 1 circuit for an open.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECK (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R1) Left Curtain Squib 1 Line 2 circuit between the Left Side Curtain Airbag connector and the Load Tool ORC Adaptor.




**Is the resistance below 1.0 ohm?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Repair the (R1) Left Curtain Squib 1 Line 2 circuit for an open.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

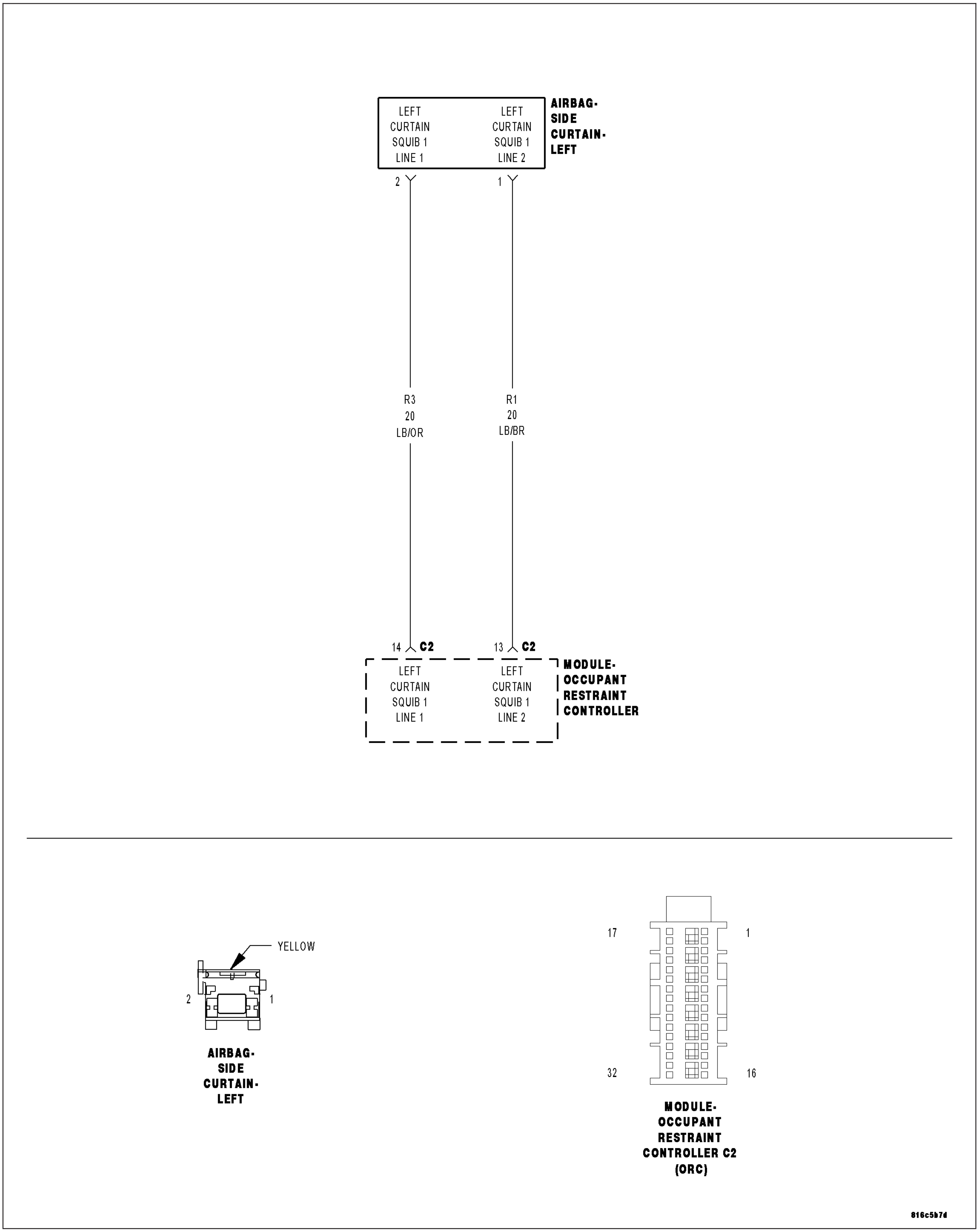
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## LEFT CURTAIN SQUIB 1 CIRCUIT SHORT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on, the Occupant Restraint Controller (ORC) monitors the resistance of the Left Curtain Squib 1 circuits.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Left Curtain Squib 1 circuits. The ORC will set this DTC if it detects low resistance between the Left Curtain Squib 1 circuits.

| Possible Causes |
|---|
| (R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT SHORTED TO (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT |
| LEFT SIDE CURTAIN AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN LEFT SIDE CURTAIN AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Left Side Curtain Airbag connector.

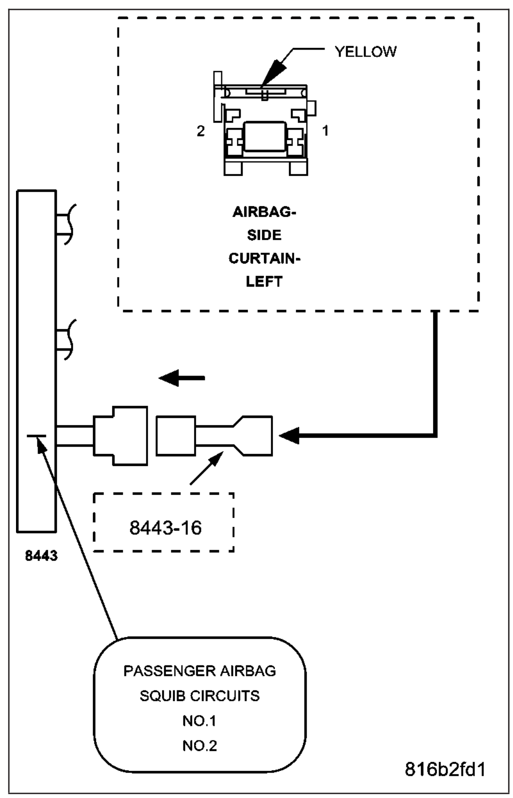
**WARNING: To avoid personal injury or death, do not place an intact undeployed curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Left Side Curtain Airbag connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

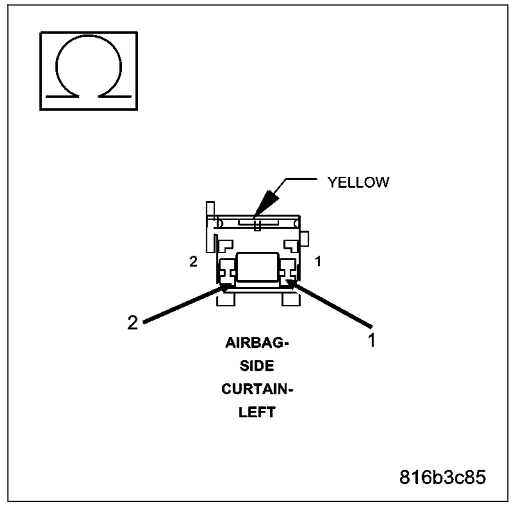



**Does the scan tool display: LEFT CURTAIN SQUIB 1 CIRCUIT SHORT?**

**Yes** >> Go To 3

**No** >> Replace the Left Side Curtain Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK (R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Left Side Curtain Airbag connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance between the (R3) Left Curtain Squib 1 Line 1 circuit and the (R1) Left Curtain Squib 1 Line 2 circuit at the Left Side Curtain Airbag connector.

**Is the resistance below 10K ohms?**

**Yes** >> Repair the (R3) Left Curtain Squib 1 Line 1 circuit for a short to the (R1) Left Curtain Squib 1 Line 2 circuit.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

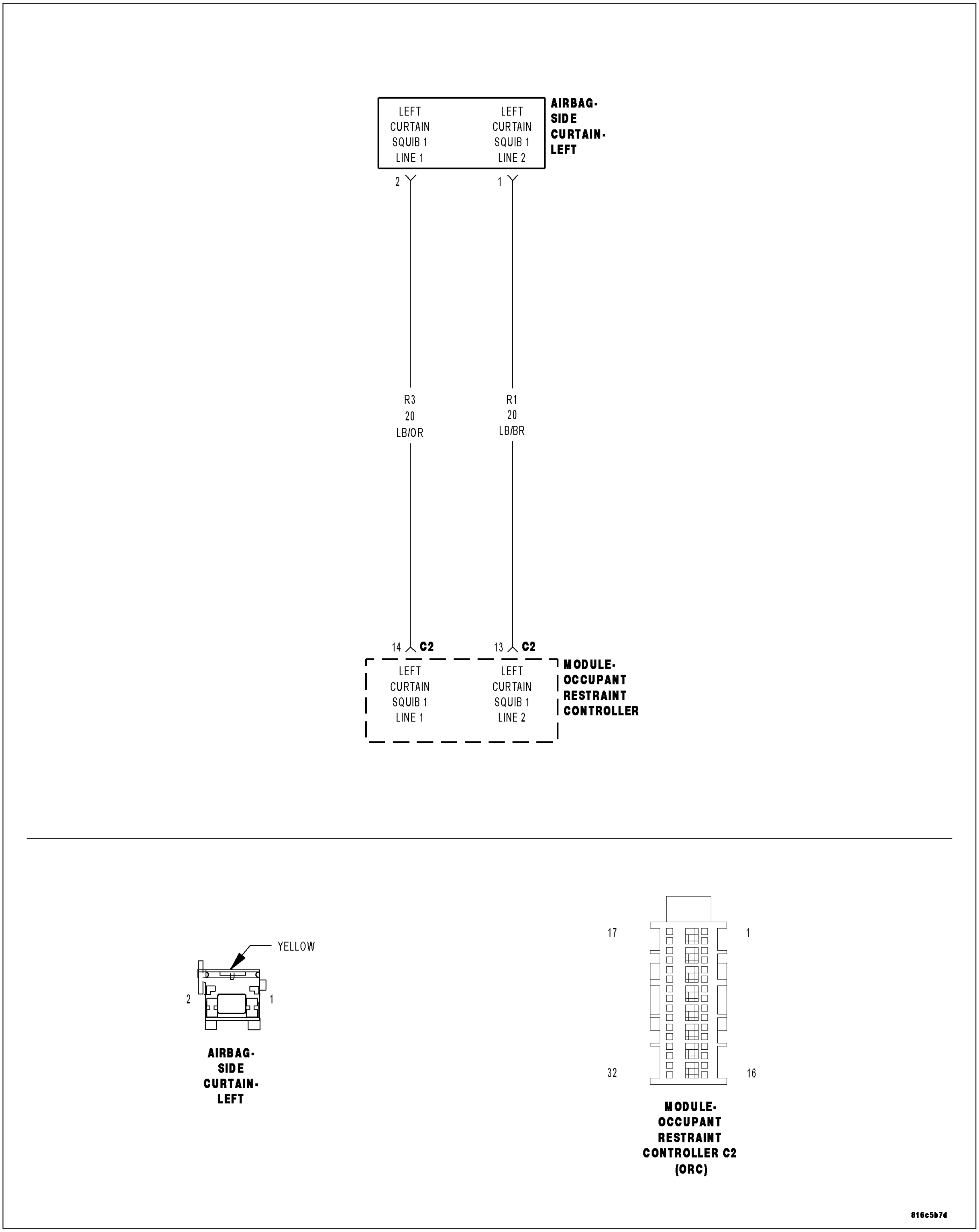
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## LEFT CURTAIN SQUIB 1 SHORT TO BATTERY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the voltage on the Left Curtain Squib 1 circuits. The ORC will set this DTC if it detects voltage on the Left Curtain Squib 1 circuits.

| Possible Causes |
| --- |
| (R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT OR (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT SHORTED TO BATTERY |
| LEFT SIDE CURTAIN AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN LEFT SIDE CURTAIN AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Left Side Curtain Airbag connector.

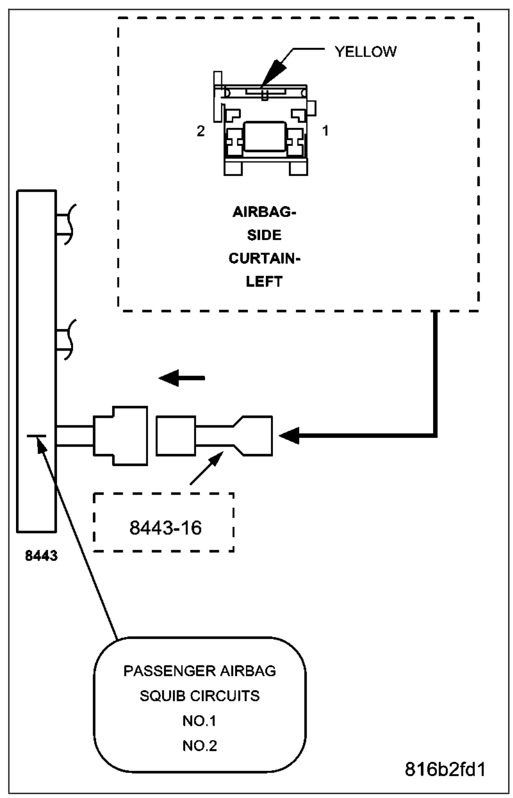
**WARNING: To avoid personal injury or death, do not place an intact undeployed curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Left Side Curtain Airbag connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

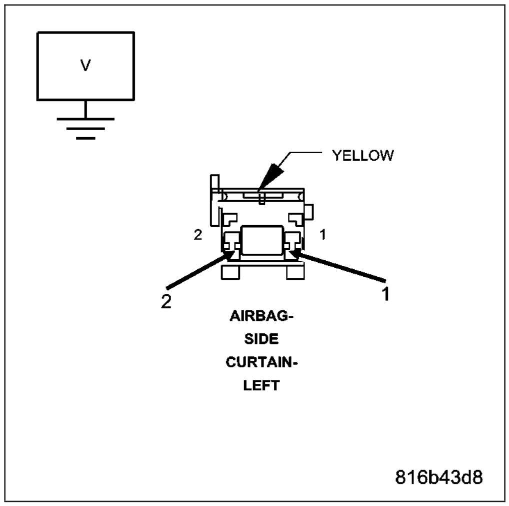



**Does the scan tool display: LEFT CURTAIN SQUIB 1 SHORT TO BATTERY?**

**Yes** >> Go To 3

**No** >> Replace the Left Side Curtain Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK (R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT AND (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO BATTERY




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Left Side Curtain Airbag connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the voltage of the (R3) Left Curtain Squib 1 Line 1 circuit between the Left Side Curtain Airbag connector and ground.

Measure the voltage of the (R1) Left Curtain Squib 1 Line 2 circuit between the Left Side Curtain Airbag connector and ground.

**Is there any voltage present on either circuit?**

**Yes** >> Repair the Left Curtain Squib 1 circuits with voltage present for a short to battery.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

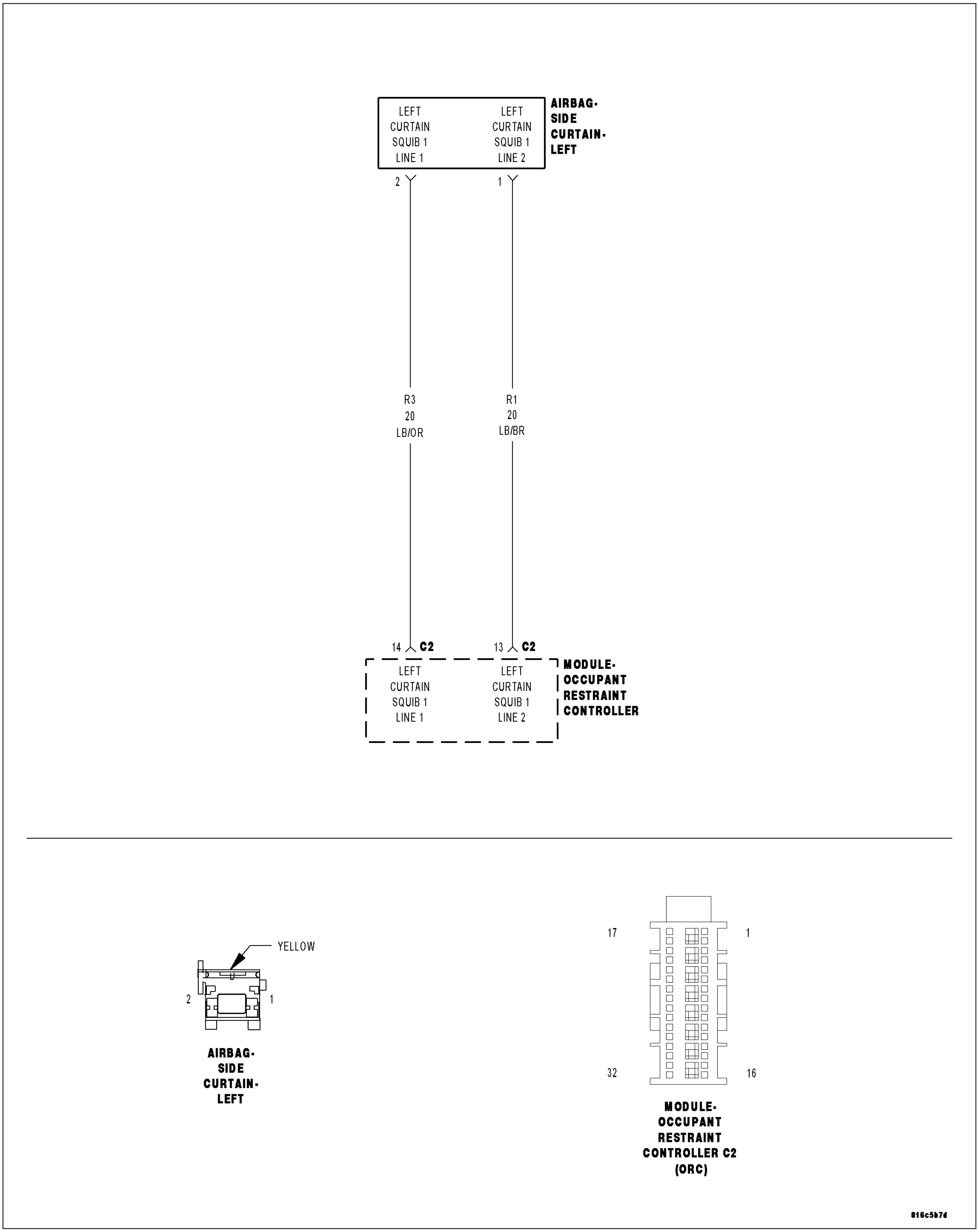
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## LEFT CURTAIN SQUIB 1 SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Left Curtain Squib 1 circuits. The ORC will set this DTC if it detects low resistance on the Left Curtain Squib 1 circuits.

| Possible Causes |
| --- |
| (R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT OR (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT SHORTED TO GROUND |
| LEFT SIDE CURTAIN AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN LEFT SIDE CURTAIN AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Left Side Curtain Airbag connector.

**WARNING: To avoid personal injury or death, do not place an intact undeployed curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

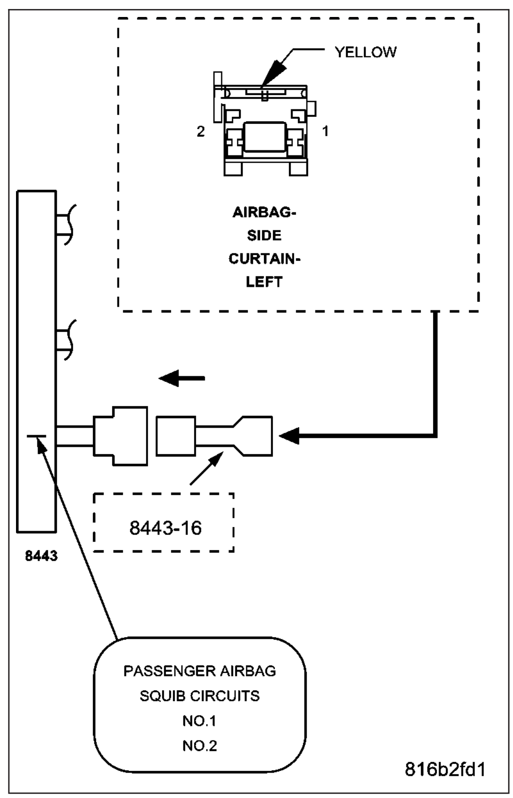
**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool and appropriate Jumper to the Left Side Curtain Airbag connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, read the active ORC DTCs.

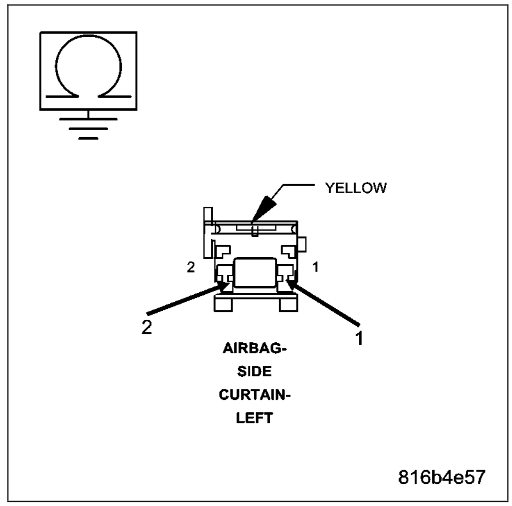
**Does the scan tool display: LEFT CURTAIN SQUIB 1 SHORT TO GROUND?**

**Yes** >> Go To 3

**No** >> Replace the Left Side Curtain Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK (R3) LEFT CURTAIN SQUIB 1 LINE 1 CIRCUIT AND (R1) LEFT CURTAIN SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO GROUND




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Left Side Curtain Airbag connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the (R3) Left Curtain Squib 1 Line 1 circuit between ground and the Left Side Curtain Airbag connector.

Measure the resistance of the (R1) Left Curtain Squib 1 Line 2 circuit between ground and the Left Side Curtain Airbag connector.

**Is the resistance below 10K ohms on either circuit?**

**Yes** >> Repair the Left Curtain Squib 1 circuits with a resistance below 10K ohms for a short to ground.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## LEFT FRONT IMPACT SENSOR INTERNAL 1

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) supplies power to and communicates continuously with each impact sensor via each sensor's signal circuit. The power supply also enables each sensor's self-diagnostic capabilities. If an impact sensor detects an internal fault, it sends the applicable Impact Sensor Internal 1 message to the ORC. The ORC will set this DTC if it receives the Left Front Impact Sensor internal 1 message.

| Possible Causes |
|---|
| LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT SHORTED TO LEFT FRONT IMPACT SENSOR GROUND CIRCUIT |
| LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT OPEN |
| LEFT FRONT IMPACT SENSOR GROUND CIRCUIT OPEN |
| LEFT FRONT IMPACT SENSOR |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: When disconnecting or connecting airbag system components, the ignition must be turned off and the battery must be disconnected.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 8

### 2. CHECK THE LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Occupant Restraint Controller (ORC) connector(s).

Disconnect the Left Front Impact Sensor connector.

**NOTE: Check connectors - Clean and repair as necessary.**

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage of the Left Front Impact Sensor Signal circuit between the Left Front Impact Sensor connector and ground.

**Is there any voltage present?**

**Yes** >> Repair the Left Front Impact Sensor Signal circuit for a short to voltage.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. CHECK THE LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Measure the resistance of the Left Front Impact Sensor Signal circuit between ground and the Left Front Impact Sensor connector.

**Is the resistance below 100k ohms?**

**Yes** >> Repair the Left Front Impact Sensor Signal circuit for a short to ground.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. CHECK THE LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO THE LEFT FRONT IMPACT SENSOR GROUND CIRCUIT

Measure the resistance between the Left Front Impact Sensor Signal circuit and the Left Front Impact Sensor Ground circuit at the Left Front Impact Sensor connector.

**Is the resistance below 100k ohms?**

**Yes** >> Repair the Left Front Impact Sensor Signal circuit for a short to the Left Front Impact Sensor Ground circuit.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. CHECK THE LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR AN OPEN

Connect the appropriate Load Tool Adaptor to the ORC connector.

Measure the resistance of the Left Front Impact Sensor Signal circuit between the Left Front Impact Sensor connector and the Airbag Load Tool adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 6

**No** >> Repair the Left Front Impact Sensor Signal circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 6. CHECK THE LEFT FRONT IMPACT SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the Left Front Impact Sensor Ground circuit between the Left Front Impact Sensor connector and the Airbag Load Tool adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 7

**No** >> Repair the Left Front Impact Sensor Ground circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 7. REPLACE THE LEFT FRONT IMPACT SENSOR AND THEN CHECK FOR ACTIVE DTCs

Replace the Left Front Impact Sensor in accordance with the Service Information.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, erase all DTCs in all Restraint System Modules.

Turn the Ignition off, wait 15 seconds, then turn the Ignition on.

Wait one minute before proceeding.

With the scan tool, read active ORC DTCs.

**Does the scan tool display: LEFT FRONT IMPACT SENSOR INTERNAL 1?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 8. TEST FOR AN INTERMITTENT CONDITION

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

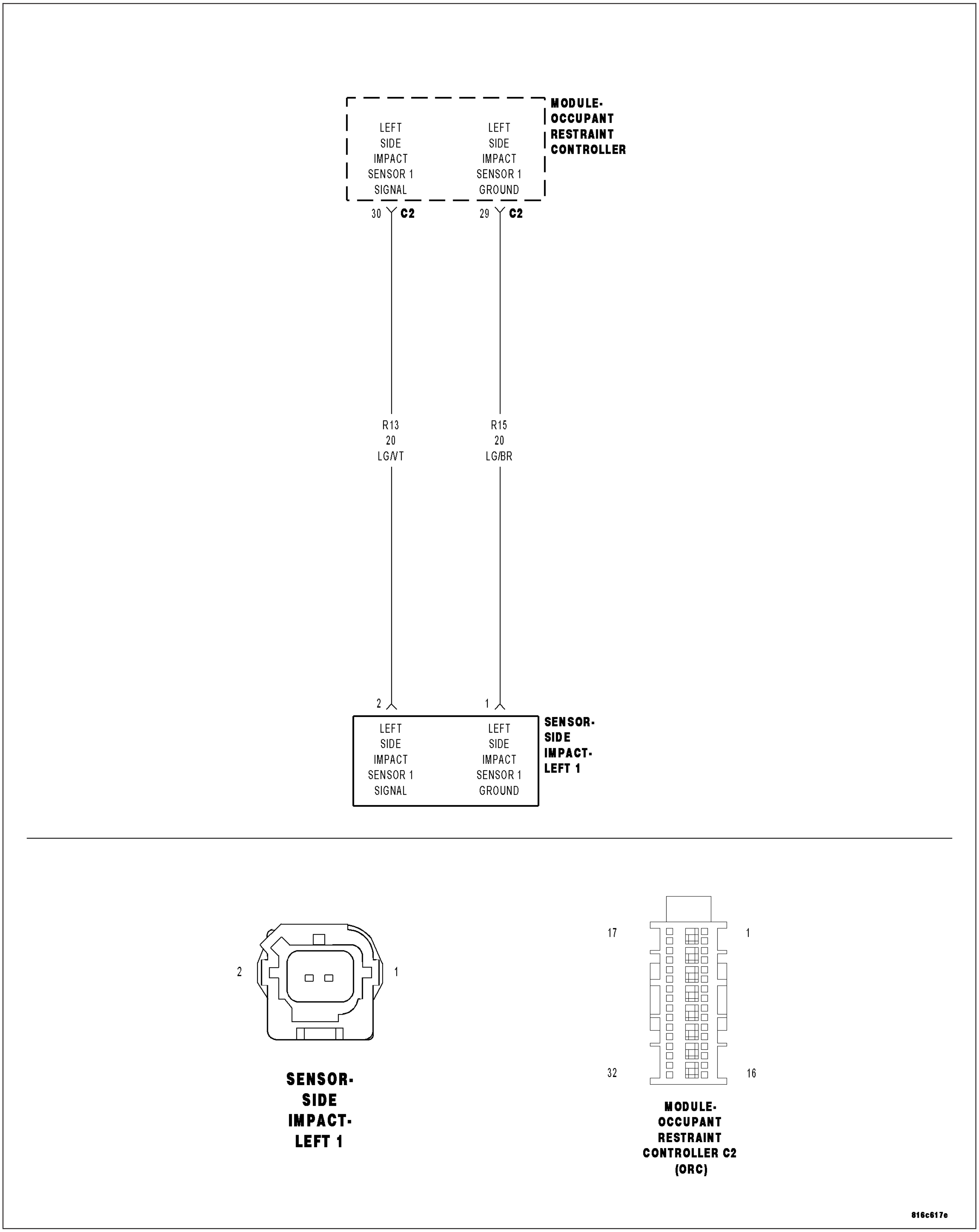
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## LEFT SIDE IMPACT SENSOR 1 INTERNAL 1




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) supplies power to and communicates continuously with each impact sensor via each sensor's signal circuit. The power supply also enables each sensor's self-diagnostic capabilities. If an impact sensor detects an internal fault, it sends the applicable Impact Sensor Internal 1 message to the ORC. The ORC will set this DTC if it receives the Left Side Impact Sensor internal 1 message.

| Possible Causes |
| --- |
| (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT SHORTED TO BATTERY |
| (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT SHORTED TO GROUND |
| (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT SHORTED TO (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT |
| (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT OPEN |
| (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT OPEN |
| LEFT SIDE IMPACT SENSOR 1 |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 8

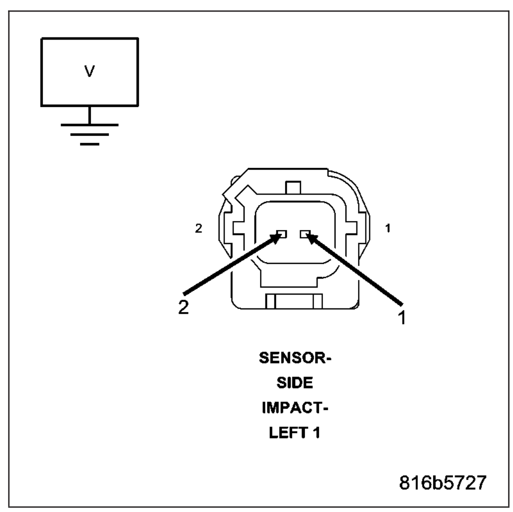
### 2. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT AND THE (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR A SHORT TO BATTERY

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Left side Impact Sensor 1 connector.

Disconnect the ORC connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage of the (R13) Left Side Impact Sensor 1 Signal circuit between the Left Side Impact Sensor 1 connector and ground.

Measure the voltage of the (R15) Left Side Impact Sensor 1 Ground circuit between the Left Side Impact Sensor 1 connector and ground.




**Is there any voltage present on either circuit?**

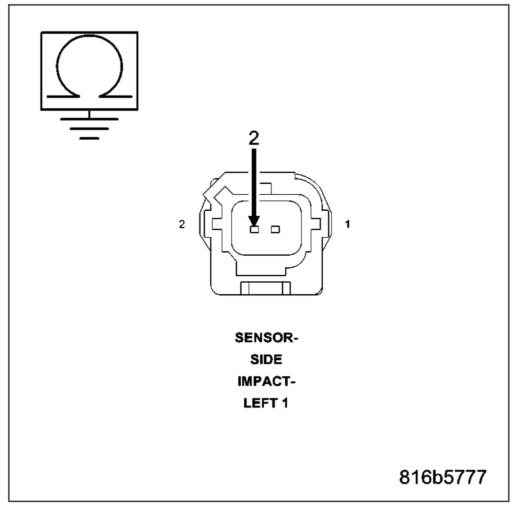
**Yes** >> Repair the circuits with voltage present for a short to battery.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR A SHORT TO GROUND

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Measure the resistance of the (R13) Left Side Impact Sensor 1 Signal circuit between ground and the Left Side Impact Sensor 1 connector.



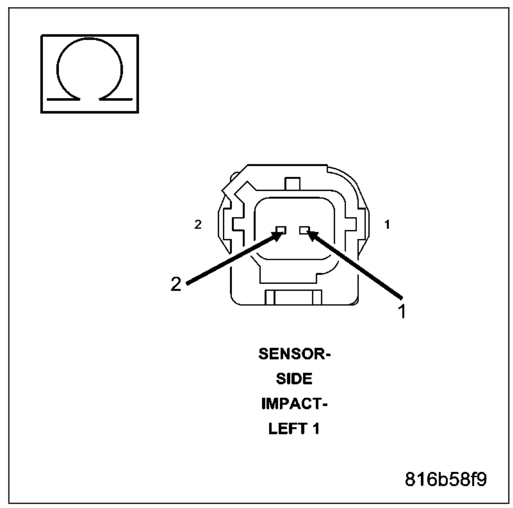

**Is the resistance below 100K ohms?**

**Yes** >> Repair the (R13) Left Side Impact Sensor 1 Signal circuit for a short to ground.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR A SHORT TO THE (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT

Measure the resistance between the (R13) Left Side Impact Sensor 1 Signal circuit and the (R15) Left Side Impact Sensor 1 Ground circuit at the Left Side Impact Sensor 1 connector.




**Is the resistance below 100K ohms?**

**Yes** >> Repair the (R13) Left Side Impact Sensor 1 Signal circuit for the (R15) Left Side Impact Sensor 1 Ground circuit.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. CHECK THE (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

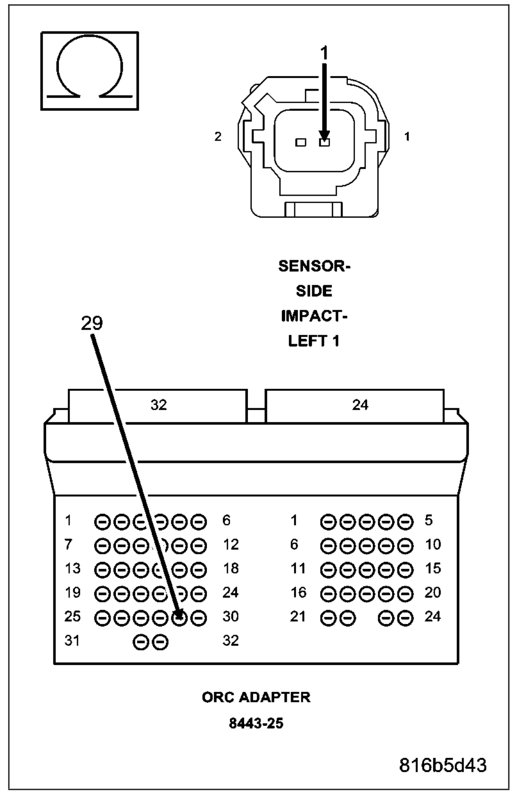
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the (R15) Left Side Impact Sensor 1 Ground circuit between the Left Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 6

**No** >> Repair the (R15) Left Side Impact Sensor 1 Ground circuit for an open or high resistance.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



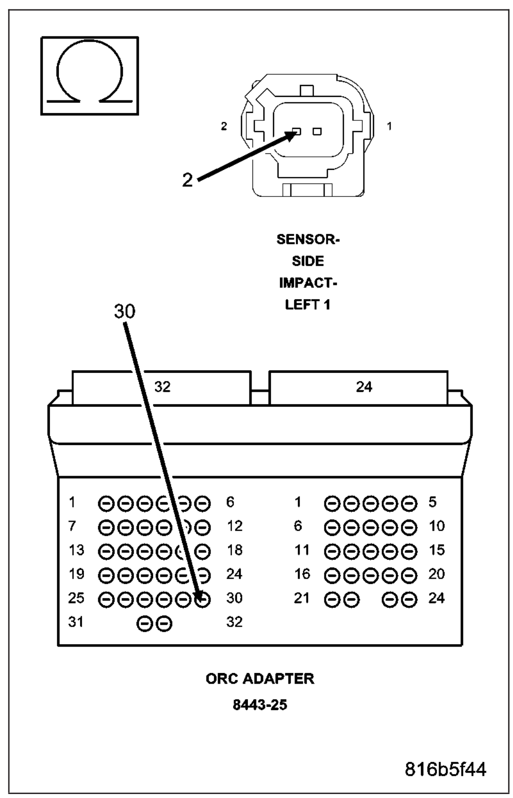

## 6. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R13) Left Side Impact Sensor 1 Signal circuit between the Left Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 7

**No** >> Repair the (R13) Left Side Impact Sensor 1 Signal circuit for an open or high resistance.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 7. CHECK THE LEFT SIDE IMPACT SENSOR 1 OPERATION

Replace the Left Side Impact Sensor 1 in accordance with the Service Information.

Remove any special tools or jumper wires and reconnect all previously disconnected components, except the battery.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, erase all Airbag System Module DTCs.

Turn the Ignition Off, wait 15 seconds, then turn the Ignition On. Wait one minute before proceeding.

With the scan tool, read active ORC DTCs.

**Does the scan tool display: LEFT SIDE IMPACT SENSOR 1 INTERNAL 1?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with Service Instructions.

Perform AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 8. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

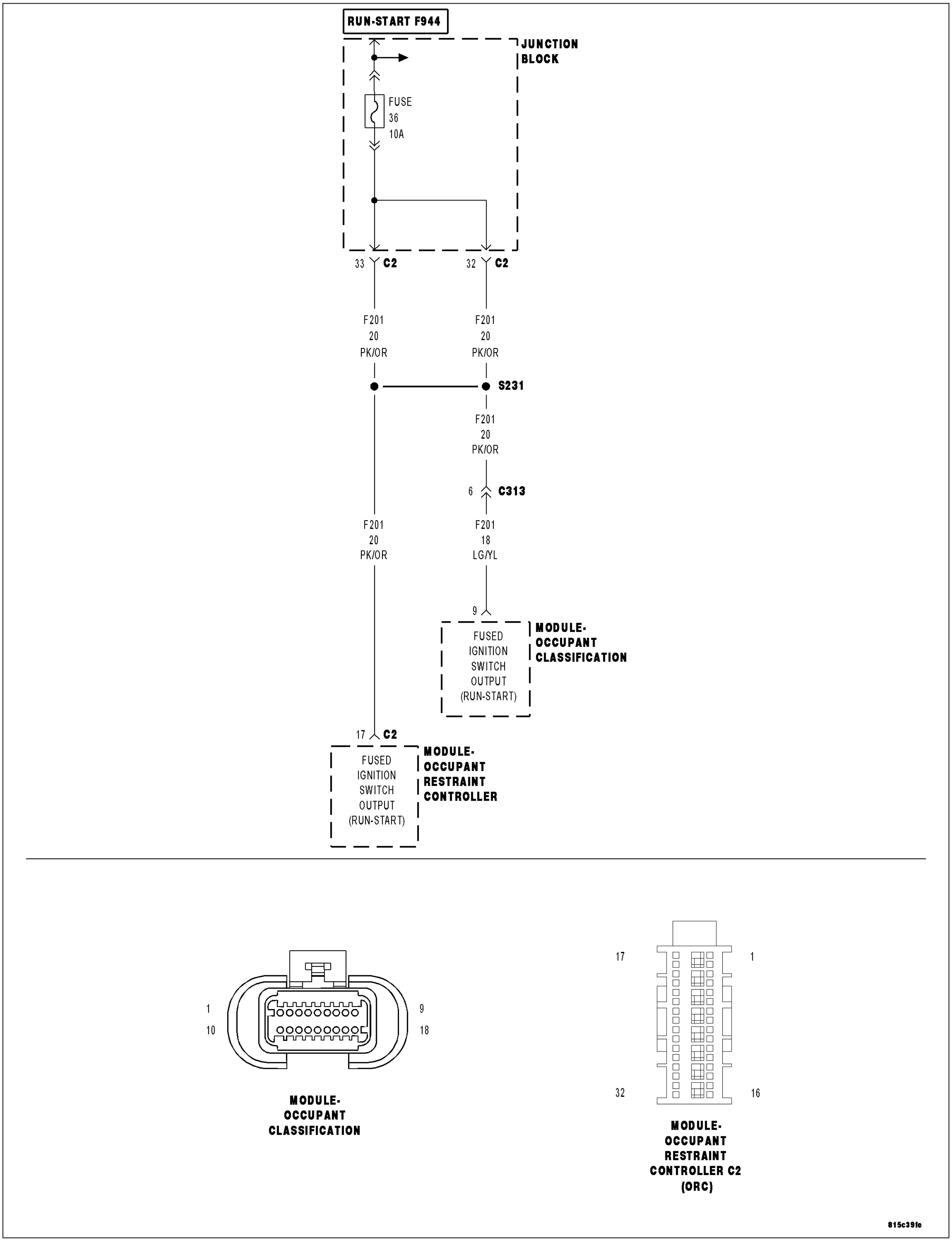
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## LOSS OF IGNITION RUN - START



For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run-Start position.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the voltage of the (F201) Fused Ignition Switch Output (Run-Start) circuit and will set this DTC if it drops below approximately 4.5 volts. Note: this condition will also cause a No Response from the Occupant Classification module (OCM).

| Possible Causes |
|---|
| (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) SHORTED TO GROUND |
| (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT OPEN |
| (F944) IGNITION SWITCH OUTPUT CIRCUIT OPEN |
| JUNCTION BLOCK 36 AIRBAG RUN-START CIRCUIT FUSE OPEN |
| OCCUPANT CLASSIFICATION MODULE (OCM) |
| OCCUPANT RESTRAINT CONTROLLER (ORC) |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

Turn the ignition on.

**Select ACTIVE or STORED DTC:**

**ACTIVE ORC DTC**
Go To 2

**STORED ORC DTC**
Go To 10

### 2. CHECK THE AIRBAG RUN-START CIRCUIT FUSE

Turn the ignition off.

Remove and inspect the Airbag Run-Start circuit fuse.

**NOTE: Check connectors - Clean and repair as necessary.**

**Is the fuse open?**

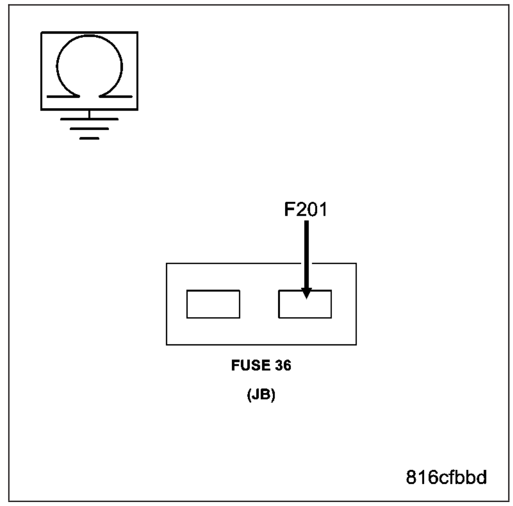
**Yes** >> Go To 3

**No** >> Go To 8

## 3. CHECK FOR A SHORTED (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Measure the resistance of the (F201) Fused Ignition Switch Output (Run-Start) circuit between ground and the Airbag Run-Start fuse terminal (output side).




**Is the resistance below 100.0 ohms?**

**Yes** >> Go To 4

**No** >> Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors. Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. Replace the Airbag Run-Start circuit fuse.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING EQUIPMENT

**Is the vehicle equipped with an Occupant Classification System?**

**Yes** >> Go To 5

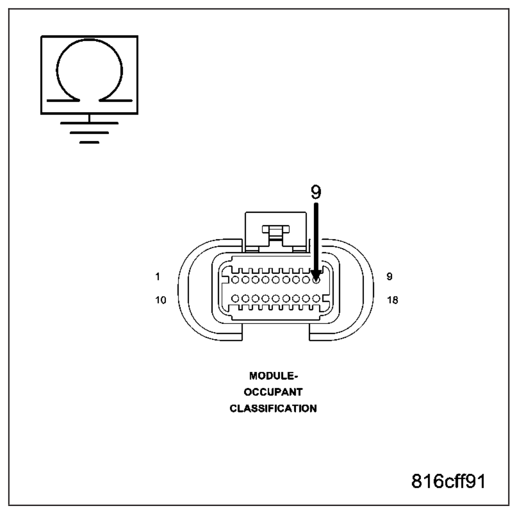
**No** >> Go To 6

## 5. CHECK THE OCCUPANT CLASSIFICATION MODULE (OCM) FOR A SHORT TO GROUND

Disconnect the OCM harness connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Measure the resistance of the (F201) Fused Ignition Switch Output (Run-Start) circuit between ground and the Airbag Run-Start fuse terminal (output side).




**Is the resistance below 100.0 ohms?**

**Yes** >> Go To 6

**No** >> Go To 7

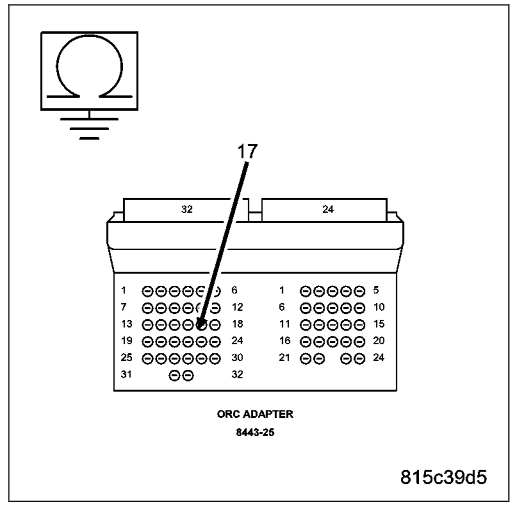
## 6. CHECK THE OCCUPANT RESTRAINT CONTROLLER (ORC) FOR A SHORT TO GROUND

Disconnect the ORC C1 and C2 connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the Load Tool ORC 8443–25 Adaptor to the ORC C2 connector.

Measure the resistance of the (F201) Fused Ignition Switch Output (Run-Start) circuit.




***JB F201 OHM OUTPUT R ST***

**Is the resistance below 100.0 ohms?**

**Yes** >> Repair the (F201) Fused Ignition Switch Output (Run-Start) circuit for a short to ground. Replace the Airbag Run-Start circuit fuse.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information. Replace the Airbag Run-Start circuit fuse.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 7. DETERMINE THE CORRECT REPAIR

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Determine the correct repair by verifying if the front passenger seat has a Bladder and Cushion Service Kit as follows:

- If possible, check the vehicle's repair history.
- The Service Kit wiring harness uses tamper resistant material on the harness connector. Inspect for the tamper resistant material on the harness connector.

**Does the seat have a Bladder and Cushion Service Kit?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

**Replace OCS Bladder and Cushion Kit in accordance with the Service information.**

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the OCM in accordance with the Service Information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 8. CHECK THE (F944) IGNITION SWITCH OUTPUT CIRCUIT FOR AN OPEN

Turn the ignition on.

Measure the voltage of the (F944) Ignition Switch Output circuit at the Airbag Run-Start circuit fuse terminal (input side).

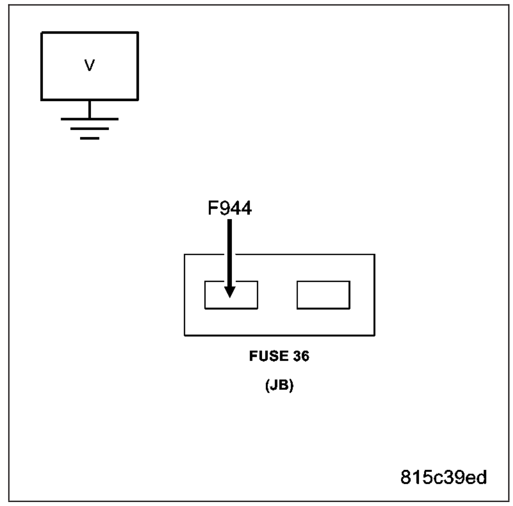
**NOTE: Reinstall the fuse after performing this test.**

**Is the voltage above 4.5 volts?**

**Yes** >> Go To 9

**No** >> Repair the (F944) Ignition Switch Output circuit for an open. Reinstall the Airbag Run-Start circuit fuse.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.




***JB F944 VOLTS INPUT R ST***

## 9. CHECK THE (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT FOR AN OPEN

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the ORC C1 and C2 connector.

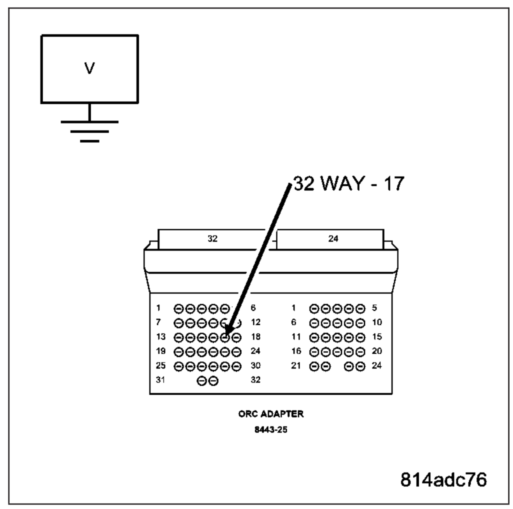
**NOTE: Check connectors - Clean and repair as necessary.**

**NOTE: If not done so previously, reinstall the Airbag Run-Start circuit fuse.**

Connect the appropriate Load Tool Adaptor to the ORC C2 connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

Measure the voltage of the (F201) Fused Ignition Switch Output (Run-Start) Circuit.




**Is the voltage above 4.5 volts?**

**Yes** >>

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**WARNING: If the Occupant Restraint Controller is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: When reconnecting Airbag System components the Ignition must be turned off and the Battery must be disconnected.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Repair (F201) Fused Ignition Switch Output (Run-Start) circuit for an open.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 10. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

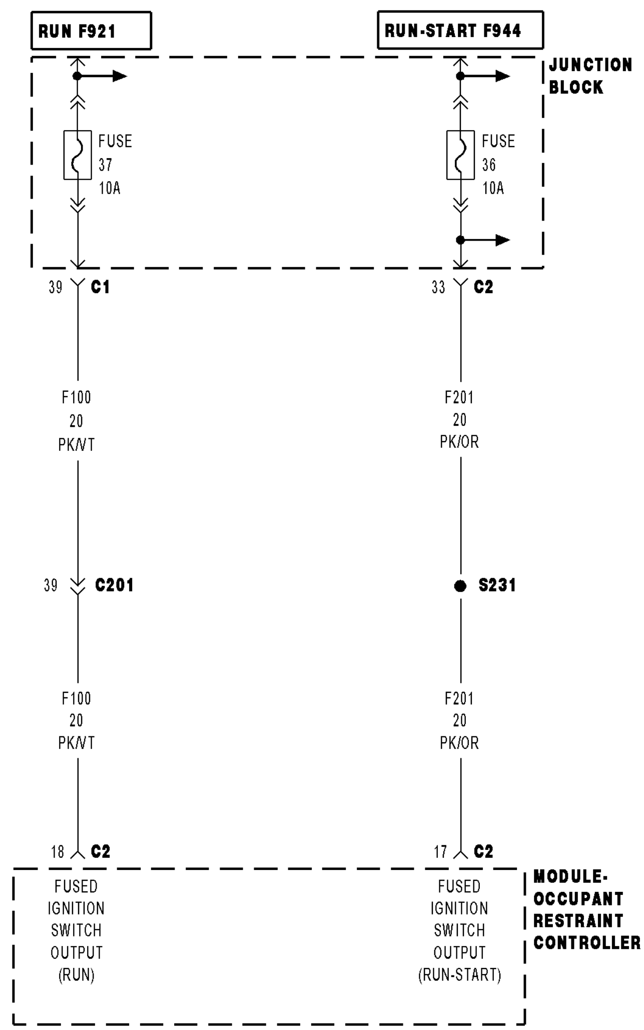
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

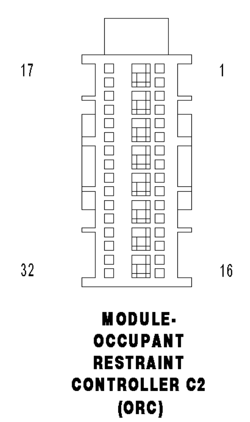
**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## LOSS OF IGNITION RUN ONLY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition in the Run position.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the voltage of the (F100) Fused Ignition Switch Output (Run) circuit and will set this DTC if it drops below approximately 6.0 volts.

| Possible Causes |
| --- |
| (F100) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT SHORTED TO GROUND |
| IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN |
| (F100) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN |
| AIRBAG RUN ONLY CIRCUIT FUSE OPEN |
| ORC, FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT SHORTED TO GROUND |
| ORC, FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**Select ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 7

### 2. CHECK THE AIRBAG RUN ONLY CIRCUIT FUSE

Turn the ignition off.

Remove and inspect the Airbag Run Only circuit fuse.

**NOTE: Check connectors - Clean and repair as necessary.**

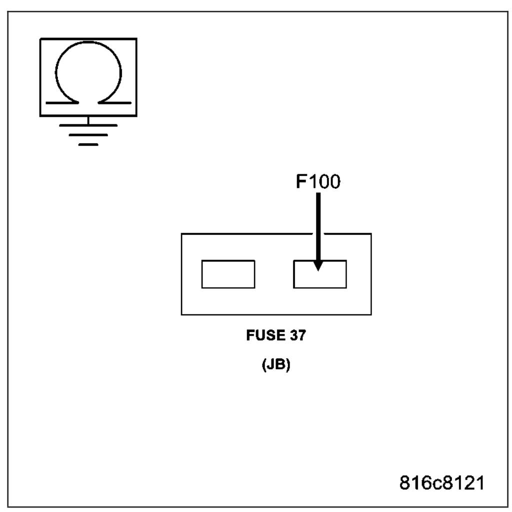
**Is the fuse open?**

**Yes** >> Go To 3

**No** >> Go To 5

### 3. CHECK THE (F100) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT RESISTANCE

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Measure the resistance of the (F100) Fused Ignition Switch Output (Run) circuit between ground and the Airbag Run Only circuit fuse terminal (output side).

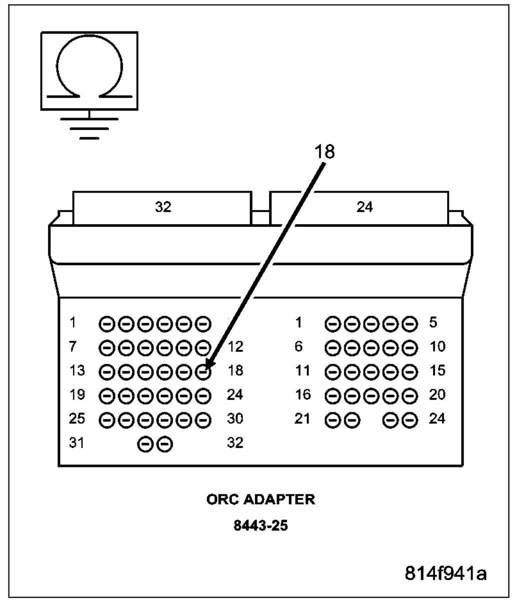



**Is the resistance below 100.0 ohms?**

**Yes** >> Go To 4

**No** >> Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors. Look for chafed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. Replace the Airbag Run Only circuit fuse.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECK THE (F100) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT FOR A SHORT TO GROUND




Disconnect the ORC C2 connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the appropriate Load Tool Adaptor to the ORC C2 connector.

Measure the resistance of the (F100) Fused Ignition Switch Output (Run) circuit between ground and the ORC Adapter.

**Is the resistance below 100.0 ohms?**

**Yes** >> Repair the (F100) Fused Ignition Switch Output (Run) circuit for a short to ground. Replace the Airbag Run Only circuit fuse.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

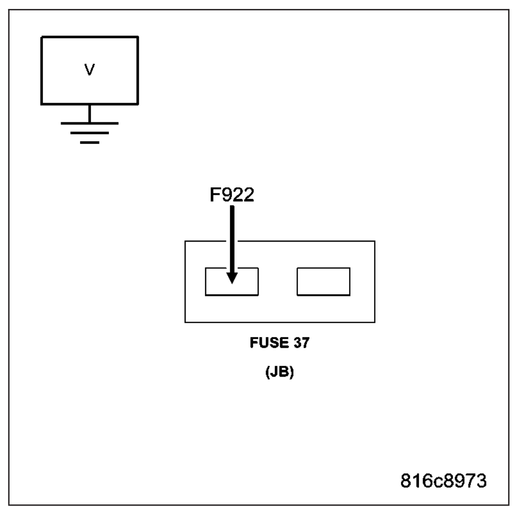
**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information. Replace the Airbag Run Only circuit fuse.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECK THE IGNITION SWITCH OUTPUT (RUN) CIRCUIT FOR AN OPEN




Turn the ignition on.

Measure the voltage of the Ignition Switch Output (Run) circuit at the Airbag Run Only circuit fuse terminal (input side).

**NOTE: Reinstall the fuse after performing this test.**

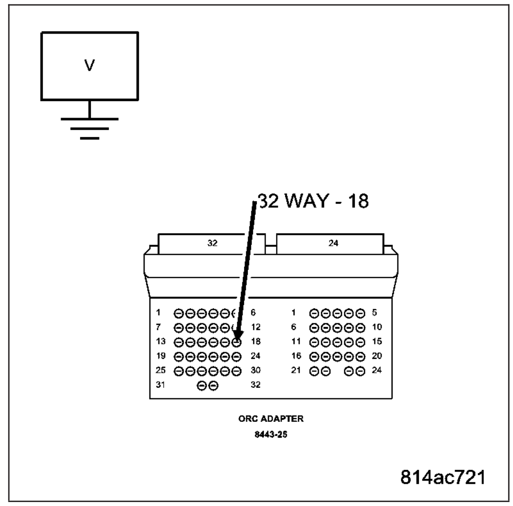
**Is the voltage above 6.0 volts?**

**Yes** >> Go To 6

**No** >> Repair the Ignition Switch Output Run circuit for an open. Reinstall the Airbag Run Only circuit fuse.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 6. CHECK THE (F100) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT FOR AN OPEN




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the ORC C2 connector.

**NOTE: Check connectors - Clean and repair as necessary.**

**NOTE: If not done so previously, reinstall the Airbag Run-Start circuit fuse.**
Connect the appropriate Load Tool Adapter to the ORC C2 connector.

**NOTE: If not done so previously, reinstall the Airbag Run Only circuit fuse.**

**WARNING: To avoid personal injury or death, turn the ignition on, then, reconnect the battery.**
Measure the voltage of the (F100) Fused Ignition Switch Output (Run) Only circuit.

**Is the voltage above 6.0 volts?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

Replace the ORC in accordance with the Service Information. Replace the Airbag Run Only circuit fuse.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Repair the (F23 Fused Ignition Switch Output (Run) circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 7. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

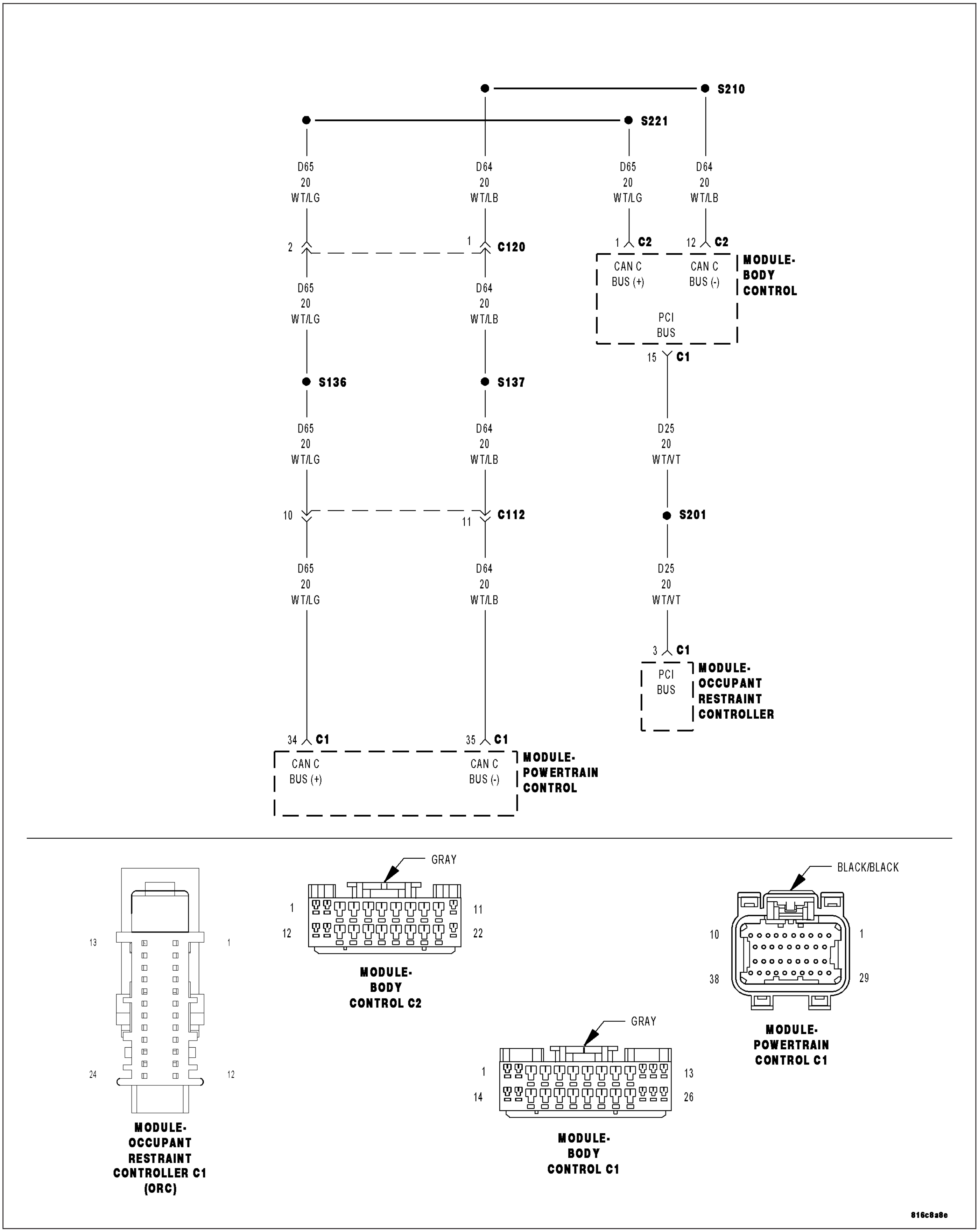
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## MISSING CURRENT VIN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During power-up.
- **Set Condition:**
  The Powertrain Control Module (PCM) broadcasts the current VIN on the Bus. The Occupant Restraint Controller (ORC) will set this DTC if the VIN stored in the ORC does not match the current VIN.

| Possible Causes |
|---|
| PCM COMMUNICATION FAILURE |
| PCM |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure the battery is fully charged.**
Turn the ignition on.

**Select ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 3

### 2. VERIFY THAT THE PCM IS PROGRAMMED WITH THE CORRECT VIN

With the scan tool, select System Tests and select VIN Verification.

Compare the VIN displayed by the Scan Tool and the VIN on the Vehicle VIN plate.

**Does the current VIN match the VIN on the vehicle VIN plate?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Replace and program the PCM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

### 3. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

With the scan tool, check for active DTCs in the ORC.

**Does the scan tool display any DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in the applicable section.

**No** >> No problem found at this time. Erase all codes before returning vehicle to customer.

## MODULE NOT CONFIGURED FOR OCS

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Occupant Restraint Controller (ORC) is not configured for an Occupant Classification System (OCS) and it detects OCS messages on the Bus.

| Possible Causes |
|---|
| ORC |

### Diagnostic Test

#### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

Turn the ignition on.

**Select ACTIVE or STORED DTC:**

**ACTIVE DTC**

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**STORED DTC**

Go To 2

#### 2. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

With the scan tool, check for active DTCs in the ORC.

**Does the scan tool display any DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in the applicable section.

**No** >> No problem found at this time. Erase all codes before returning vehicle to customer.

## NO CLUSTER MESSAGE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Instrument Cluster (IC) broadcasts the airbag warning indicator status on the Bus. The Occupant Restraint Controller (ORC) expects this status message once every second. The ORC will set this DTC if it fails to receive this status message for 10 consecutive seconds.

| Possible Causes |
|---|
| MIC COMMUNICATION FAILURE |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 3

### 2. VERIFY THAT THE IC IS ACTIVE ON THE BUS

With the scan tool, attempt to communicate with the IC.

**Will the scan tool communicate with the IC?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the service information.

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic test procedures.

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

### 3. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

With the scan tool, check for active DTCs in the ORC.

**Does the scan tool display any DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in the applicable section.

**No** >> No problem found at this time. Erase all codes before returning vehicle to customer.

## NO LEFT FRONT IMPACT SENSOR COMMUNICATION

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Occupant Restraint Controller (ORC) supplies power to and communicates continuously with each impact sensor via each sensor’s signal circuit.
- **Set Condition:**
  The ORC will set this DTC if it is unable to either establish or maintain communication with the Left Front Impact Sensor.

| Possible Causes |
|---|
| LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT SHORTED TO LEFT FRONT IMPACT SENSOR GROUND CIRCUIT |
| LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT OPEN |
| LEFT FRONT IMPACT SENSOR GROUND CIRCUIT OPEN |
| LEFT FRONT IMPACT SENSOR |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 8

### 2. CHECK THE LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Occupant Restraint Controller (ORC) connector(s).

Disconnect the Left Front Impact Sensor connector.

**NOTE: Check connectors - Clean and repair as necessary.**

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

Measure the voltage of the Left Front Impact Sensor Signal circuit between the Left Front Impact Sensor connector and ground.

**Is there any voltage present?**

**Yes** >> Repair the Left Front Impact Sensor Signal circuit for a short to voltage.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. CHECK THE LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Measure the resistance of the Left Front Impact Sensor Signal circuit between ground and the Left Front Impact Sensor connector.

**Is the resistance below 100k ohms?**

**Yes** >> Repair the Left Front Impact Sensor Signal circuit for a short to ground.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. CHECK THE LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO THE LEFT FRONT IMPACT SENSOR GROUND CIRCUIT

Measure the resistance between the Left Front Impact Sensor Signal circuit and the Left Front Impact Sensor Ground circuit at the Left Front Impact Sensor connector.

**Is the resistance below 100k ohms?**

**Yes** >> Repair the Left Front Impact Sensor Signal circuit for a short to the Left Front Impact Sensor Ground circuit.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. CHECK THE LEFT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR AN OPEN

Connect the appropriate Load Tool Adaptor to the ORC connector.

Measure the resistance of the Left Front Impact Sensor Signal circuit between the Left Front Impact Sensor connector and the Airbag Load Tool adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 6

**No** >> Repair the Left Front Impact Sensor Signal circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 6. CHECK THE LEFT FRONT IMPACT SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the Left Front Impact Sensor Ground circuit between the Left Front Impact Sensor connector and the Airbag Load Tool adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 7

**No** >> Repair the Left Front Impact Sensor Ground circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 7. REPLACE THE LEFT FRONT IMPACT SENSOR AND THEN CHECK FOR ACTIVE DTCs

Replace the Left Front Impact Sensor in accordance with the Service Information.

Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, erase all DTCs in all Restraint System Modules.

Turn the Ignition off, wait 15 seconds, then turn the Ignition on.

Wait one minute before proceeding.

With the scan tool, read active ORC DTCs.

**Does the scan tool display: NO LEFT FRONT IMPACT SENSOR COMMUNICATION?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service information.

Perform AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 8. TEST FOR AN INTERMITTENT CONDITION

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

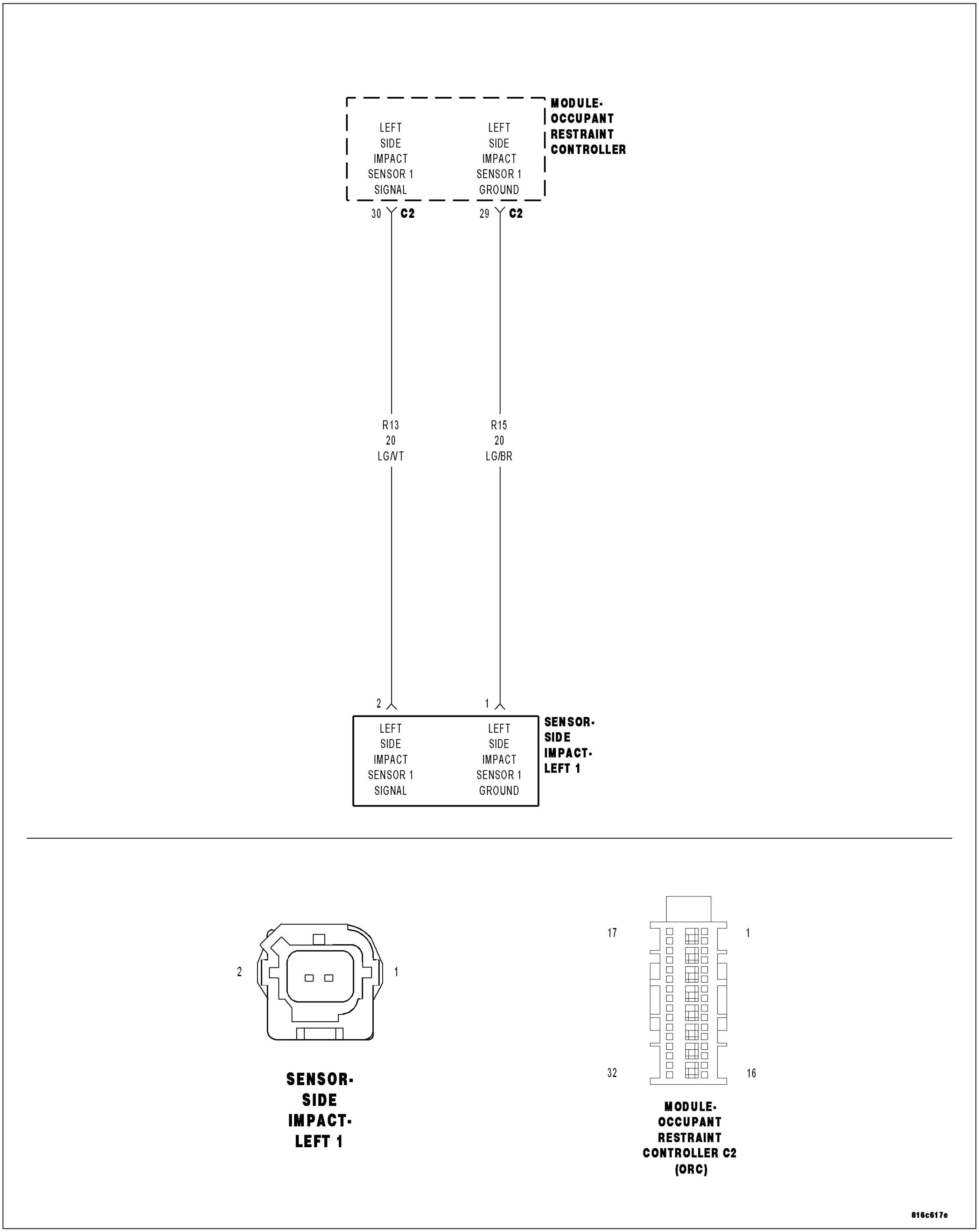
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## NO LEFT SIDE IMPACT SENSOR 1 COMMUNICATION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Occupant Restraint Controller (ORC) supplies power to and communicates continuously with each impact sensor via each sensor's signal circuit.
- **Set Condition:**
  The ORC will set this DTC if it is unable to either establish or maintain communication with the Left Side Impact Sensor.

| Possible Causes |
|---|
| (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT SHORTED TO BATTERY |
| (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT SHORTED TO GROUND |
| (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT SHORTED TO (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT |
| (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT OPEN |
| (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT OPEN |
| LEFT SIDE IMPACT SENSOR 1 |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 8

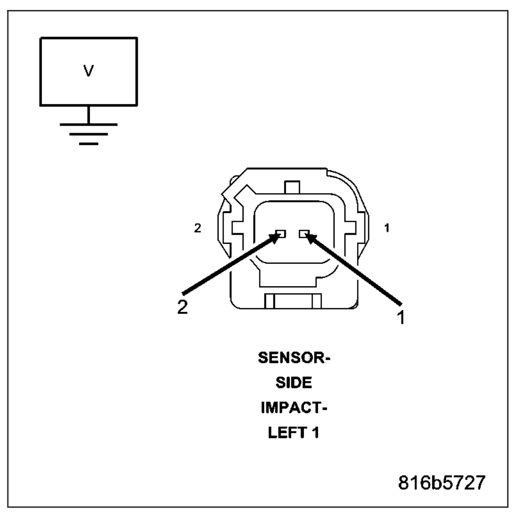
### 2. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT AND THE (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR A SHORT TO BATTERY

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Left side Impact Sensor 1 connector.

Disconnect the ORC connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage of the (R13) Left Side Impact Sensor 1 Signal circuit between the Left Side Impact Sensor 1 connector and ground.

Measure the voltage of the (R15) Left Side Impact Sensor 1 Ground circuit between the Left Side Impact Sensor 1 connector and ground.




**Is there any voltage present on either circuit?**

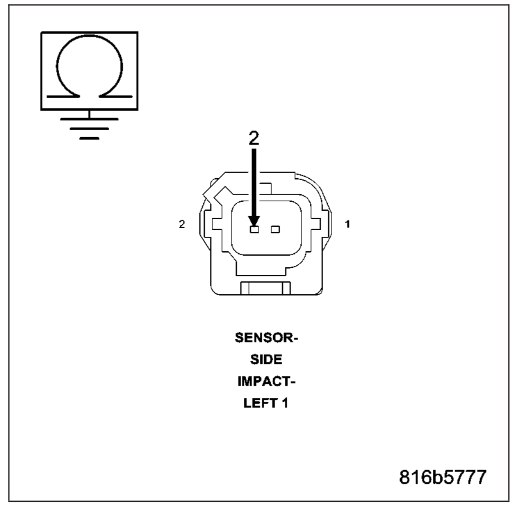
**Yes** >> Repair the circuits with voltage present for a short to battery.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR A SHORT TO GROUND

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Measure the resistance of the (R13) Left Side Impact Sensor 1 Signal circuit between ground and the Left Side Impact Sensor 1 connector.



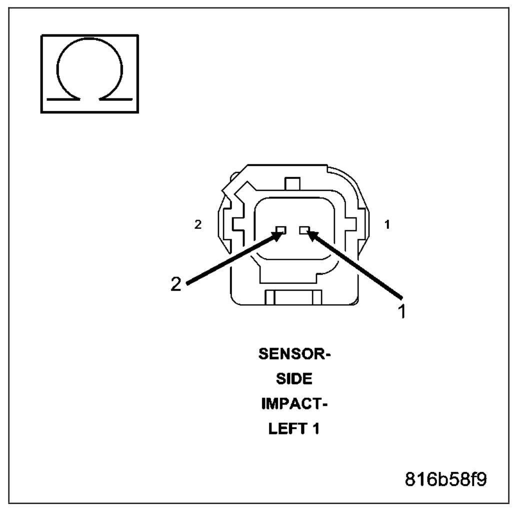

**Is the resistance below 100K ohms?**

**Yes** >> Repair the (R13) Left Side Impact Sensor 1 Signal circuit for a short to ground.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR A SHORT TO THE (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT

Measure the resistance between the (R13) Left Side Impact Sensor 1 Signal circuit and the (R15) Left Side Impact Sensor 1 Ground circuit at the Left Side Impact Sensor 1 connector.




**Is the resistance below 100K ohms?**

**Yes** >> Repair the (R13) Left Side Impact Sensor 1 Signal circuit for the (R15) Left Side Impact Sensor 1 Ground circuit.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. CHECK THE (R15) LEFT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

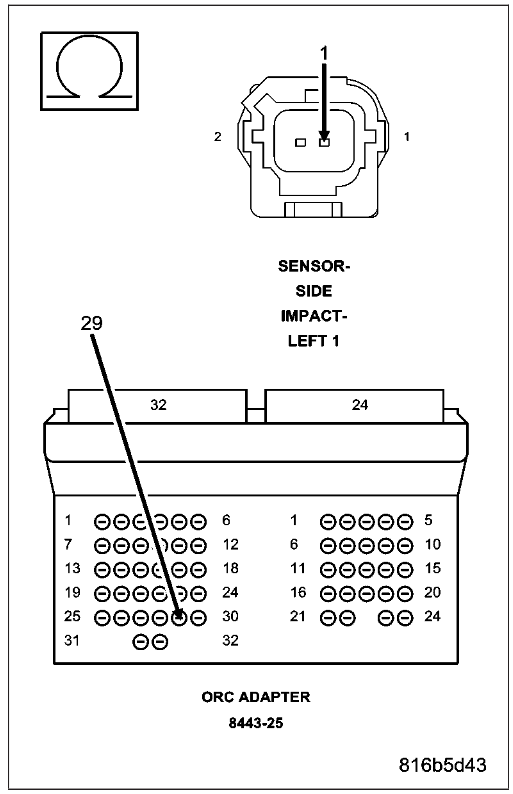
Connect the 8443 Load Tool ORC Adaptor to the Occupant Controller Module connector.

Measure the resistance of the (R15) Left Side Impact Sensor 1 Ground circuit between the Left Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 6

**No** >> Repair the (R15) Left Side Impact Sensor 1 Ground circuit for an open or high resistance.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



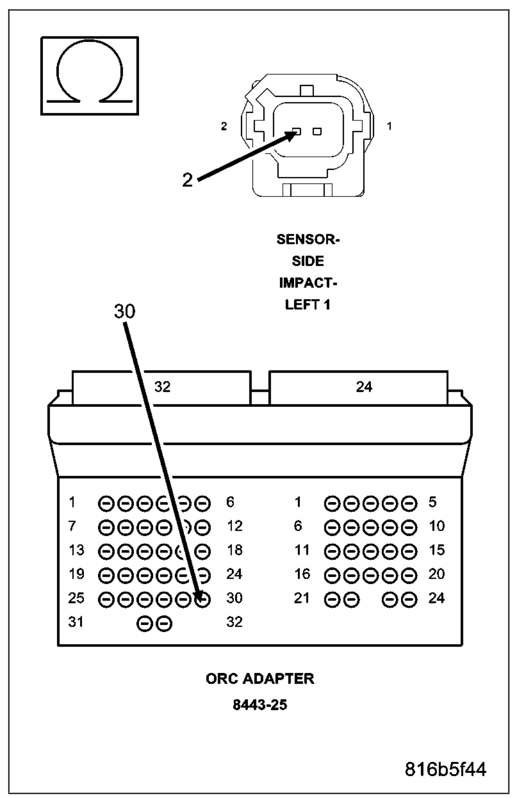

## 6. CHECK THE (R13) LEFT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R13) Left Side Impact Sensor 1 Signal circuit between the Left Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 7

**No** >> Repair the (R13) Left Side Impact Sensor 1 Signal circuit for an open or high resistance.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 7. CHECK THE LEFT SIDE IMPACT SENSOR 1 OPERATION

Replace the Left Side Impact Sensor 1 in accordance with the Service Information.

Remove any special tools or jumper wires and reconnect all previously disconnected components, except the battery.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, erase all Airbag System Module DTCs.

Turn the Ignition Off, wait 15 seconds, then turn the Ignition On. Wait one minute before proceeding.

With the scan tool, read active ORC DTCs.

**Does the scan tool display: NO LEFT SIDE IMPACT SENSOR 1 COMMUNICATION?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with Service Instructions.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 8. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## NO ORC MESSAGE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) broadcasts messages on the Bus that provide data to the Occupant Classification Module (OCM). The OCM will set this DTC if it does not receive a valid message from the ORC within 3 consecutive seconds.

| Possible Causes |
|---|
| ORC COMMUNICATION FAILURE |
| OCM |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. VERIFY THAT THE ORC IS ACTIVE ON THE BUS

With the scan tool, attempt communications with the ORC.

**Will the scan tool communicate with the ORC?**

**Yes** >> Go To 3

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the No Response From ORC diagnostic test procedure.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

### 3. DETERMINE THE CORRECT REPAIR

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**
Determine the correct repair by verifying if the front passenger seat has a Bladder and Cushion Service Kit as follows:

- If possible, check the vehicle's repair history.
- The Service Kit wiring harness uses tamper resistant material on the harness connector. Inspect for the tamper resistant material on the harness connector.

**Does the seat have a Bladder and Cushion Service Kit?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the OCM in accordance with the Service Information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC TO SET

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: When disconnecting or connecting airbag system components, the ignition must be turned off and the battery must be disconnected.**

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. INSPECT THE OCCUPANT RESTRAINT AND BODY SYSTEM WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC TO SET

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

**Are any of these conditions present?**

**Yes** >> Repair as necessary in accordance with the Service Information.

**No** >> Go To 6

## 6. TEST FOR AN INTERMITTENT CONDITION

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question.

**Does the scan tool display any active DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## NO PCI LOOPBACK

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) broadcasts messages on the Bus. The ORC on-board diagnostic monitors the Bus for valid ORC messages. The ORC will set this DTC immediately if it fails to detect valid ORC messages on the Bus. NOTE: Any Bus Failure may cause a stored code to set.

| Possible Causes |
| --- |
| OCCUPANT RESTRAINT CONTROLLER (ORC) |

### Diagnostic Test

#### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

Turn the ignition on.

**Select ACTIVE or STORED DTC:**

**ACTIVE DTC**

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**STORED DTC**

Go To 2

#### 2. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of Airbag System diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

With the scan tool, check for active DTCs in the ORC.

**Does the scan tool display any DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## NO PCI TRANSMISSION

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) broadcasts messages on the Bus. The ORC on-board diagnostic monitors the Bus for valid ORC messages. The ORC will set this DTC immediately if it fails to detect valid ORC messages on the Bus. NOTE: Any Bus Failure may cause a stored code to set.

| Possible Causes |
| --- |
| OCCUPANT RESTRAINT CONTROLLER (ORC) |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

Turn the ignition on.

**Select ACTIVE or STORED DTC:**

**ACTIVE DTC**

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**STORED DTC**

Go To 2

### 2. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of Airbag System diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

With the scan tool, check for active DTCs in the ORC.

**Does the scan tool display any DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## NO RIGHT FRONT IMPACT SENSOR COMMUNICATION

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Occupant Restraint Controller (ORC) supplies power to and communicates continuously with each impact sensor via each sensor's signal circuit.
- **Set Condition:**
  The ORC will set this DTC if it is unable to either establish or maintain communication with the Right Front Impact Sensor.

| Possible Causes |
|---|
| RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT SHORTED TO RIGHT FRONT IMPACT SENSOR GROUND CIRCUIT |
| RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT OPEN |
| RIGHT FRONT IMPACT SENSOR GROUND CIRCUIT OPEN |
| RIGHT FRONT IMPACT SENSOR |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 8

### 2. CHECK THE RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Occupant Restraint Controller (ORC) connector(s).

Disconnect the Right Front Impact Sensor connector.

**NOTE: Check connectors - Clean and repair as necessary.**

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage of the Right Front Impact Sensor Signal circuit between the Right Front Impact Sensor connector and ground.

**Is there any voltage present?**

**Yes** >> Repair the Right Front Impact Sensor Signal circuit for a short to voltage.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. CHECK THE RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Measure the resistance of the Right Front Impact Sensor Signal circuit between ground and the Right Front Impact Sensor connector.

**Is the resistance below 100k ohms?**

**Yes** >> Repair the Right Front Impact Sensor Signal circuit for a short to ground.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. CHECK THE RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO THE RIGHT FRONT IMPACT SENSOR GROUND CIRCUIT

Measure the resistance between the Right Front Impact Sensor Signal circuit and the Right Front Impact Sensor Ground circuit at the Right Front Impact Sensor connector.

**Is the resistance below 100k ohms?**

**Yes** >> Repair the Right Front Impact Sensor Signal circuit for a short to the Right Front Impact Sensor Ground circuit.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. CHECK THE RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR AN OPEN

Connect the appropriate Load Tool Adaptor to the ORC connector.

Measure the resistance of the Right Front Impact Sensor Signal circuit between the Right Front Impact Sensor connector and the Airbag Load Tool adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 6

**No** >> Repair the Right Front Impact Sensor Signal circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 6. CHECK THE RIGHT FRONT IMPACT SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the Right Front Impact Sensor Ground circuit between the Right Front Impact Sensor connector and the Airbag Load Tool adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 7

**No** >> Repair the Right Front Impact Sensor Ground circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 7. REPLACE THE RIGHT FRONT IMPACT SENSOR AND THEN CHECK FOR ACTIVE DTCs

Replace the Right Front Impact Sensor in accordance with the Service Information.

Remove any special tools or jumper wires and reconnect all previously disconnected components, except the battery.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, erase all DTCs in all Airbag System Modules.

Turn the Ignition off, wait 15 seconds, then turn the Ignition on.

Wait one minute before proceeding.

With the scan tool, read active ORC DTCs.

**Does the scan tool display: NO RIGHT FRONT IMPACT SENSOR COMMUNICATION?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 8. TEST FOR AN INTERMITTENT CONDITION

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

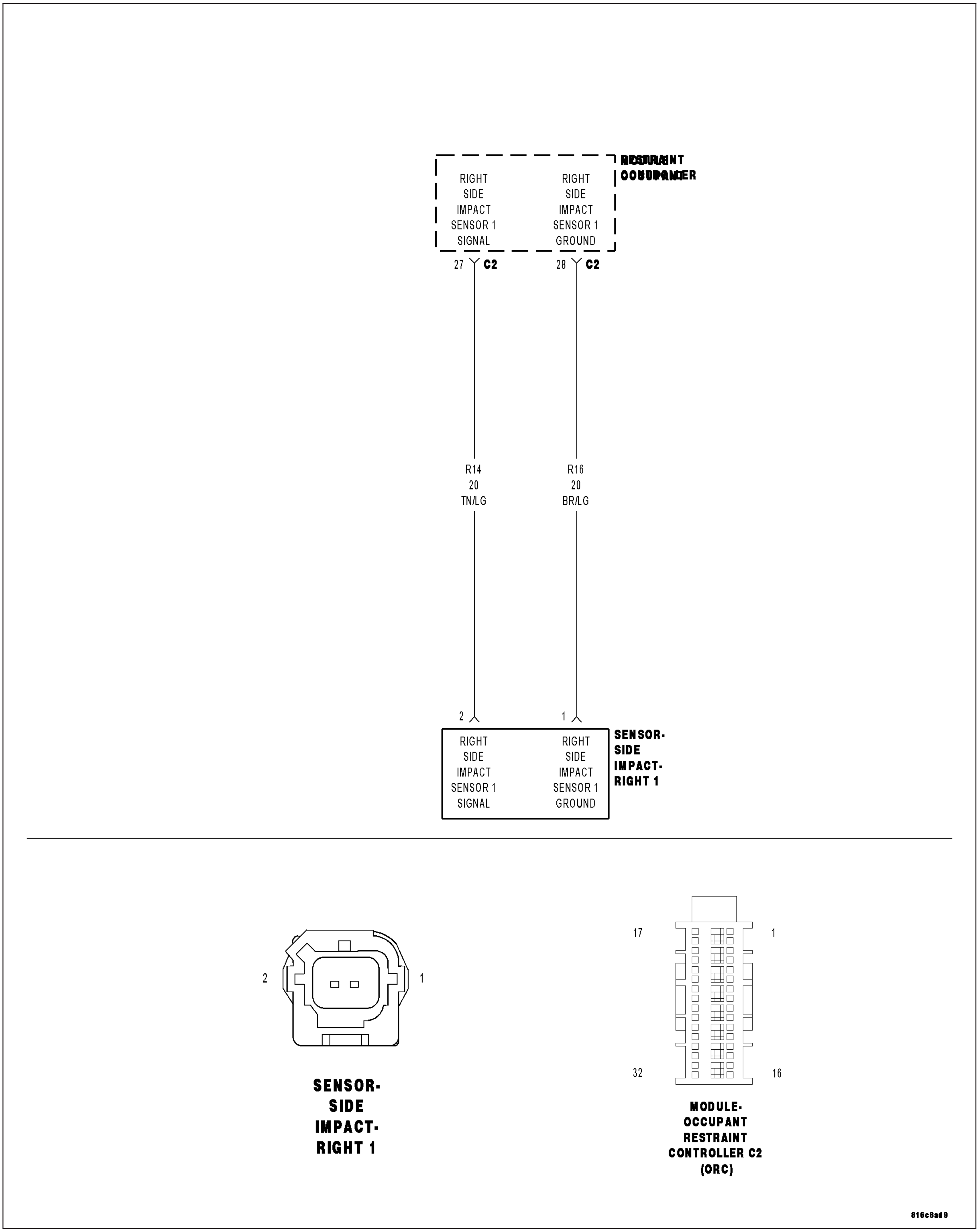
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## NO RIGHT SIDE IMPACT SENSOR 1 COMMUNICATION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Occupant Restraint Controller (ORC) supplies power to and communicates continuously with each impact sensor via each sensor's signal circuit.
- **Set Condition:**
  The ORC will set this DTC if it is unable to either establish or maintain communication with the Right Side Impact Sensor.

| Possible Causes |
| --- |
| (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT SHORTED TO BATTERY |
| (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT SHORTED TO GROUND |
| (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT SHORTED TO (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT |
| (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT OPEN |
| (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT OPEN |
| RIGHT SIDE IMPACT SENSOR 1 |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 8

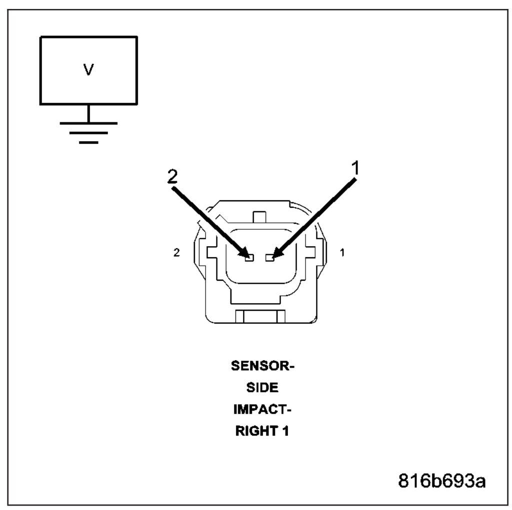
### 2. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT AND THE (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR A SHORT TO BATTERY

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Right side Impact Sensor 1 connector.

Disconnect the ORC connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage of the (R14) Right Side Impact Sensor 1 Signal circuit between the Right Side Impact Sensor 1 connector and ground.

Measure the voltage of the (R16) Right Side Impact Sensor 1 Ground circuit between the Right Side Impact Sensor 1 connector and ground.




**Is there any voltage present on either circuit?**

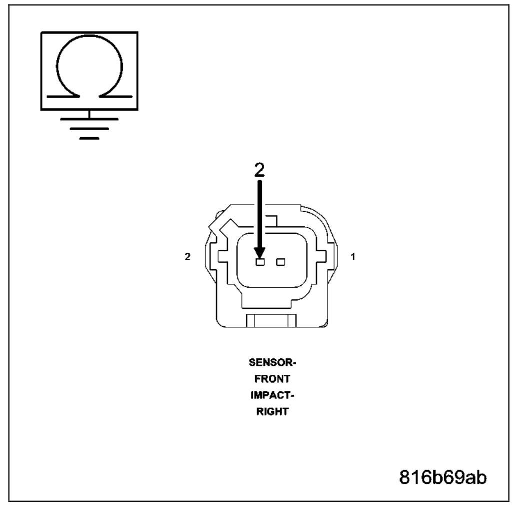
**Yes** >> Repair the circuits with voltage present for a short to battery.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR A SHORT TO GROUND

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Measure the resistance of the (R14) Right Side Impact Sensor 1 Signal circuit between ground and the Right Side Impact Sensor 1 connector.




**Is the resistance below 100K ohms?**

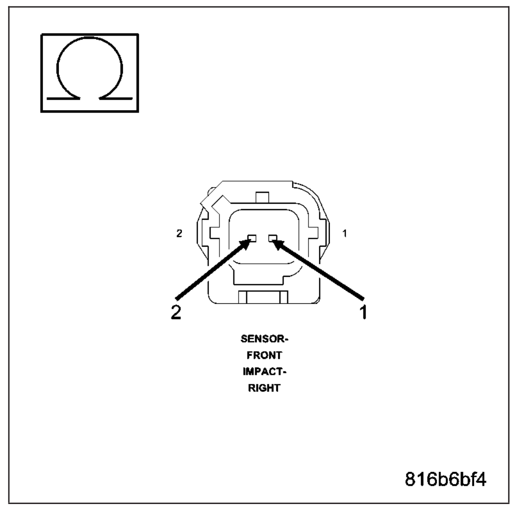
**Yes** >> Repair the (R14) Right Side Impact Sensor 1 Signal circuit for a short to ground.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR A SHORT TO THE (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT

Measure the resistance between the (R14) Right Side Impact Sensor 1 Signal circuit and the (R16) Right Side Impact Sensor 1 Ground circuit at the Right Side Impact Sensor 1 connector.




**Is the resistance below 100K ohms?**

**Yes** >> Repair the (R14) Right Side Impact Sensor 1 Signal circuit for a short to the (R16) Right Side Impact Sensor 1 Ground circuit.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. CHECK THE (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

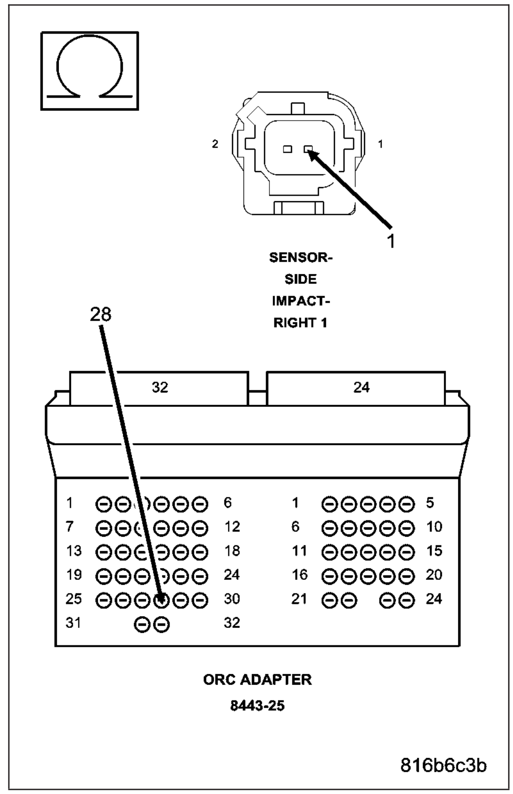
Connect the 8443 Load Tool ORC Adaptor to the Occupant Control Module connector.

Measure the resistance of the (R16) Right Side Impact Sensor 1 Ground circuit between the Right Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 6

**No** >> Repair the (R16) Right Side Impact Sensor 1 Ground circuit for an open or high resistance.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



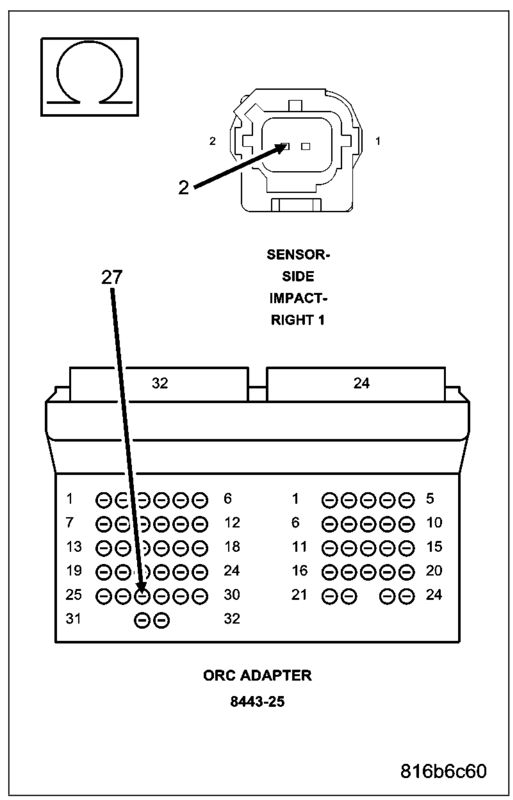

## 6. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R14) Right Side Impact Sensor 1 Signal circuit between the Right Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 7

**No** >> Repair the (R14) Right Side Impact Sensor 1 Signal circuit for an open or high resistance.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 7. CHECK THE RIGHT SIDE IMPACT SENSOR 1 OPERATION

Replace the Right Side Impact Sensor 1 in accordance with the Service Information.

Remove any special tools or jumper wires and reconnect all previously disconnected components, except the battery.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, erase all Airbag System Module DTCs.

Turn the Ignition Off, wait 15 seconds, then turn the Ignition On. Wait one minute before proceeding.

With the scan tool, read active ORC DTCs.

**Does the scan tool display: NO RIGHT SIDE IMPACT SENSOR 1 COMMUNICATION?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with Service Instructions.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 8. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

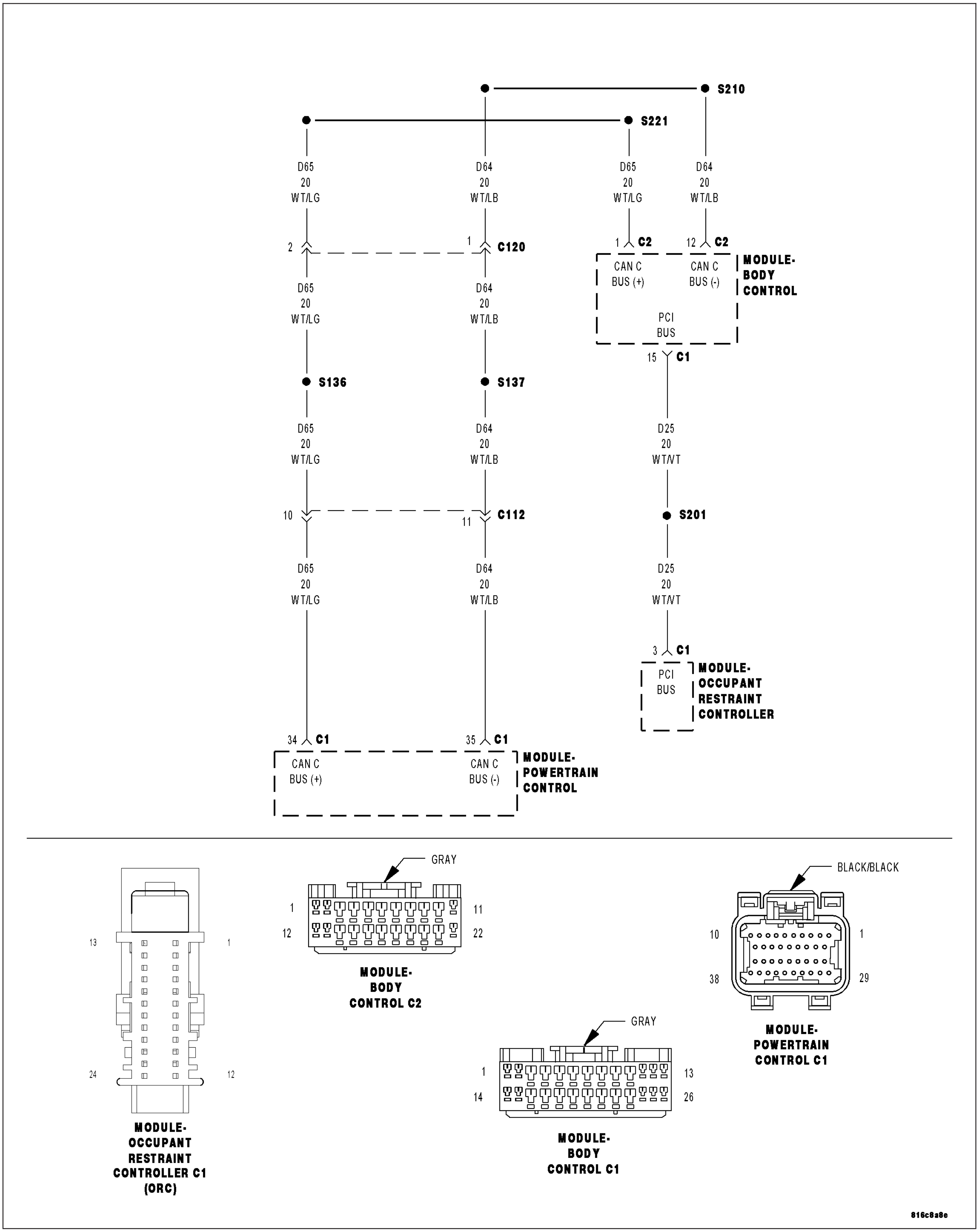
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## OCM CONFIGURATION MISMATCH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the Bus for the Occupant Classification Module (OCM) messages and then compares the messages to the known configuration. The ORC will set this DTC if it is not configured for Passenger Only OCM and OCM messages are broadcast on the Bus.

| Possible Causes |
|---|
| PCM |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**Select ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 3

### 2. VERIFY THAT THE PCM IS PROGRAMMED WITH THE CORRECT VIN

With the scan tool, select System Tests and select VIN Verification.

Compare the VIN displayed by the scan tool and the VIN on the Vehicle VIN plate.

**Does the current VIN match the VIN on the vehicle VIN plate?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Replace and program the PCM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

### 3. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

With the scan tool, check for active DTCs in the ORC.

**Does the scan tool display any DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning vehicle to customer.

## OCCUPANT CLASSIFICATION MODULE DATA TRANSFER ERROR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Upon validating the VIN, the Occupant Classification Module (OCM) sends seat calibration data to the Occupant Restraint Controller (ORC). In turn, the ORC transmits this data back to the OCM. This provides a means for the OCM to verify that the ORC received the calibration data correctly. The OCM will set this DTC if it fails to receive the data back correctly from the ORC.

| Possible Causes |
|---|
| ORC COMMUNICATION FAILURE |
| OCM |

### Diagnostic Test

#### 1. DETERMINE ACTIVE OR STORED DTC

**CAUTION: Repair all other active OCM and ORC DTCs before proceeding with this test. Refer to the Table Of Contents in this Section for a complete list of airbag system diagnostic procedures.**

**NOTE: Ensure that the battery is fully charged.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

#### 2. VERIFY THAT THE ORC IS ACTIVE ON THE BUS

With the scan tool, attempt to communication with the ORC.

**Will the scan tool communicate with the ORC?**

**Yes** >> Go To 3

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the No Response From ORC diagnostic test procedure.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

#### 3. DETERMINE THE CORRECT REPAIR

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Determine the correct repair by verifying if the front passenger seat has a Bladder and Cushion Service Kit as follows:

- If possible, check the vehicle's repair history.
- The Service Kit wiring harness uses tamper resistant material on the harness connector. Inspect for the tamper resistant material on the harness connector.

**Does the seat have a Bladder and Cushion Service Kit?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the OCM in accordance with the Service Information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC TO SET

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase the ORC and OCM DTCs.

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. INSPECT THE OCCUPANT RESTRAINT AND BODY SYSTEM WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC TO SET

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

**Are any of these conditions present?**

**Yes** >> Repair as necessary in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 6

## 6. TEST FOR AN INTERMITTENT CONDITION

Turn the ignition on.
With the scan tool, read and erase the OCM and ORC DTCs.
Turn the ignition off, wait 15 seconds, then turn the ignition on.
With the scan tool, read the active OCM and ORC DTCs.

**Does the scan tool display any active DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## OCM INTERNAL 1

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Classification Module (OCM) will set this DTC if it detects an out of range internal circuit or low voltage on the (F201) Fused Ignition Switch Output (Run-Start) circuit.

| Possible Causes |
|---|
| BATTERY VOLTAGE LOW |
| (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT VOLTAGE LOW |
| OCM |

### 1. CHECK FOR ACTIVE DTCs IN THE OCCUPANT RESTRAINT CONTROLLER (ORC)

**NOTE: Ensure that the battery is fully charged.**

Turn the ignition on.

With the scan tool, read active Occupant Restraint Controller (ORC) DTCs.

**NOTE: Some DTCs require up to one minute to mature.**

**Does the scan tool display: Loss Of Ignition Run - Start?**

**Yes** >> Diagnose and repair the DTC. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.

**No** >> Go To 2

### 2. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC TO SET

With the scan tool, record and erase OCM DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. CHECK THE (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT AND GROUND CIRCUIT FUNCTION AT THE OCM HARNESS CONNECTOR

If disconnected, reconnect the Seat harness connector to the (C313) Vehicle Body in-line harness connector.

If not done so previously, disconnect the OCM harness connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage between the Fused Ignition Switch Output (Run-Start) circuit and the Ground circuit.

**Is the voltage below 11.0 volts?**

**Yes** >> Go To 4

**No** >> Go To 5

## 4. CHECK THE (F201) FUSED IGNITION SWITCH OUTPUT (RUN-START) CIRCUIT VOLTAGE AT THE (C313) VEHICLE BODY IN-LINE HARNESS CONNECTOR

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Seat harness connector from the (C313) Vehicle Body in-line harness connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage of the Fused Ignition Switch Output (Run-Start) circuit at the (C313) Vehicle Body harness in-line harness connector.

**Is the voltage below 11.0 volts?**

**Yes** >>

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Repair as necessary to fix the low voltage condition to the Seat harness connector.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. DETERMINE ACTIVE OR STORE DTC

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Reconnect all disconnected OCS harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, read active OCM DTCs.

**NOTE: Some DTCs require up to one minute to mature.**

**Does the scan tool display: OCM Internal 1?**

**Yes** >> Go To 6

**No** >> Go To 7

## 6. DETERMINE THE CORRECT REPAIR

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Determine the correct repair by verifying if the front passenger seat has a Bladder and Cushion Service Kit as follows:

- If possible, check the vehicle's repair history.
- The Service Kit wiring harness uses tamper resistant material on the harness connector. Inspect for the tamper resistant material on the harness connector.

**Does the seat have a Bladder and Cushion Service Kit?**

**Yes** >>

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace the OCM in accordance with the Service Information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 7. TEST FOR AN INTERMITTENT CONDITION

With the scan tool, monitor for active codes while performing the following:

**NOTE: The Passenger Airbag On-Off Indicator will illuminate within one second of a fault becoming active.**

- Verify that all connectors are completely seated and locked.
- Wiggle the wiring harness and connectors of the related circuit.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question.

**NOTE: Some DTCs require up to one minute to mature.**

**Does the scan tool display any active DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## OCCUPANT CLASSIFICATION UNDETERMINED STATUS

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Classification Module (OCM) broadcasts a status message on the Bus that provides classification and system fault data to the Occupant Restraint Controller (ORC). Both the OCM and the ORC will set this DTC if an active fault in the Occupant Classification System (OCS) affects occupant classification determination.

**NOTE: Diagnose and repair all other active OCM DTCs except INTERROGATE OCM before diagnosing this DTC. Refer to the Table of Contents in this section for a complete list of airbag system diagnostic procedures.**

Perform SYSTEM VERIFICATION REQUIRED test.

## ORC ACCELEROMETER 1

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) on board diagnostics continuously performs internal circuit tests. The ORC will set this DTC if it identifies an out of range internal circuit.

| Possible Causes |
|---|
| ORC |

## Diagnostic Test

### 1. REPLACE THE ORC

**NOTE: Ensure that the battery is fully charged.**

**Repair**

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## ORC ACCELEROMETER 2

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) on board diagnostics continuously performs internal circuit tests. The ORC will set this DTC if it identifies an out of range internal circuit.

| Possible Causes |
|---|
| ORC |

## Diagnostic Test

### 1. REPLACE THE ORC

**NOTE: Ensure that the battery is fully charged.**

**Repair**

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## ORC INTERNAL 1

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) on board diagnostics continuously performs internal circuit tests. The ORC will set this DTC if it identifies an out of range internal circuit.

| Possible Causes |
|---|
| ORC |

## Diagnostic Test

### 1. REPLACE THE ORC

**NOTE: Ensure that the battery is fully charged.**

**Repair**

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## ORC INTERNAL 2

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) on board diagnostics continuously performs internal circuit tests. The ORC will set this DTC if it identifies an out of range internal circuit.

| Possible Causes |
|---|
| ORC |

## Diagnostic Test

### 1. REPLACE THE ORC

**NOTE: Ensure that the battery is fully charged.**

**Repair**

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## ORC STORED ENERGY FIRING 1

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) on board diagnostics continuously performs internal circuit tests. The ORC will set this DTC if it identifies an out of range internal circuit.

| Possible Causes |
|---|
| ORC |

## Diagnostic Test

### 1. REPLACE THE ORC

**NOTE: Ensure that the battery is fully charged.**

**Repair**

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## B2255-OCCUPANT RESTRAINT CONTROLLER ROLL OVER FEATURE DISABLE

- **When Monitored:**
  With the ignition on. The module's on board diagnostics continuously performs internal circuit tests.
- **Set Condition:**
  This DTC will set if the ORC Roll Over Feature has been disabled via the scan tool.

| Possible Causes |
|---|
| OCCUPANT RESTRAINT CONTROLLER |

## Diagnostic Test

### 1. OCCUPANT RESTRAINT CONTROLLER ROLL OVER FEATURE DISABLED

Turn the ignition on.

With the scan tool read the ORC Roll Over Feature status Enabled or Disabled.

**Does the scan tool show Roll Over Feature Disabled?**

**Repair**

Perform the *ORC VERIFICATION TEST-VER. 1.

## ORC OUTPUT DRIVER 1

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) on board diagnostics continuously performs internal circuit tests. The ORC will set this DTC if it identifies an out of range internal circuit.

| Possible Causes |
| --- |
| ORC |

## Diagnostic Test

### 1. REPLACE THE ORC

**NOTE: Ensure that the battery is fully charged.**

**Repair**

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## PASSENGER BTS OPEN

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Occupant Classification Module (OCM) detects voltage above the high threshold on the Seat Belt Tension Sensor Signal circuit.

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Refer to ***Belt Tension Sensor / Pressure Sensor Faults** for the diagnostic procedure.

**STORED DTC**
Go To 2

### 2. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH NO LOAD APPLIED TO THE SENSOR

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
Verify that the passenger seat belt is unbuckled and that there is no load on the passenger seat belt and retractor assembly.

With the scan tool in OCM, select Sensor Display and select Passenger Belt Tension Sensor Output.

Read the Passenger Belt Tension Sensor Output on the scan tool display.

**Is the Passenger BTS Output between 39 and 69?**

**Yes** >> Go To 3

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.
Perform BELT TENSION SENSOR VERIFICATION TEST.

### 3. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH A LOAD APPLIED TO THE SENSOR

Apply 11 kg (24 lbs) to 12 kg (26 lbs) of pressure to the Passenger Belt Tension Sensor using the spring scale Miller special tool 8828 as follows:

- Connect the hook at the bottom of the spring scale through the Passenger Belt Tension Sensor webbing loop so that the end of the hook faces the passenger seat.
- Place the maximum reading indicator at the bottom of the spring scale.
- Grab the horizontal bar at the top of the spring scale. Pull the spring scale straight upward keeping the horizontal bar level with the door sill and the spring scale in-line with the Passenger Belt Tension Sensor.
- Apply and hold 11 kg (24 lbs) to 12 kg (26 lbs) of pressure on the sensor while an assistant monitors the Passenger Belt Tension Sensor Output on the scan tool display.

**Is the Passenger BTS Output between 153 and 204 with 11 kg (24 lbs) to 12 kg (26 lbs) of pressure applied to the sensor?**

**Yes** >> Maintain the 11 kg (24 lbs) to 12 kg (26 lbs) of pressure on the Passenger Belt Tension Sensor and Go To 4

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.
Perform BELT TENSION SENSOR VERIFICATION TEST.

## 4. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH THE LOAD RELEASED

Release the pressure applied with the spring scale while monitoring the Passenger Belt Tension Sensor Output on the scan tool display. Make sure that there is no load applied to the sensor. The output must return to between 39 and 69 within 20 seconds of releasing the load.

**Does the Passenger BTS Output return to between 39 and 69 within 20 seconds of releasing the load?**

**Yes** >> Go To 5

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.

Perform BELT TENSION SENSOR VERIFICATION TEST.

## 5. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC(s) TO SET

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 6

## 6. TEST FOR AN INTERMITTENT CONDITION

Reconnect all disconnected components and harness connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER BTS SHORT TO BATTERY

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Occupant Classification Module (OCM) detects Belt Tension Sensor A/D counts are greater than 233.

### Diagnostic Test

#### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Refer to ***Belt Tension Sensor / Pressure Sensor Faults** for the diagnostic procedure.

**STORED DTC**
Go To 2

#### 2. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH NO LOAD APPLIED TO THE SENSOR

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

Verify that the passenger seat belt is unbuckled and that there is no load on the passenger seat belt and retractor assembly.

With the scan tool in OCM, select Sensor Display and select Passenger Belt Tension Sensor Output.

Read the Passenger Belt Tension Sensor Output on the scan tool display.

**Is the Passenger BTS Output between 39 and 69?**

**Yes** >> Go To 3

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.
Perform BELT TENSION SENSOR VERIFICATION TEST.

#### 3. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH A LOAD APPLIED TO THE SENSOR

Apply 11 kg (24 lbs) to 12 kg (26 lbs) of pressure to the Passenger Belt Tension Sensor using the spring scale Miller special tool 8828 as follows:

- Connect the hook at the bottom of the spring scale through the Passenger Belt Tension Sensor webbing loop so that the end of the hook faces the passenger seat.
- Place the maximum reading indicator at the bottom of the spring scale.
- Grab the horizontal bar at the top of the spring scale. Pull the spring scale straight upward keeping the horizontal bar level with the door sill and the spring scale in-line with the Passenger Belt Tension Sensor.
- Apply and hold 11 kg (24 lbs) to 12 kg (26 lbs) of pressure on the sensor while an assistant monitors the Passenger Belt Tension Sensor Output on the scan tool display.

**Is the Passenger BTS Output between 153 and 204 with 11 kg (24 lbs) to 12 kg (26 lbs) of pressure applied to the sensor?**

**Yes** >> Maintain the 11 kg (24 lbs) to 12 kg (26 lbs) of pressure on the Passenger Belt Tension Sensor and Go To 4

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.
Perform BELT TENSION SENSOR VERIFICATION TEST.

## 4. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH THE LOAD RELEASED

Release the pressure applied with the spring scale while monitoring the Passenger Belt Tension Sensor Output on the scan tool display. Make sure that there is no load applied to the sensor. The output must return to between 39 and 69 within 20 seconds of releasing the load.

**Does the Passenger BTS Output return to between 39 and 69 within 20 seconds of releasing the load?**

**Yes** >> Go To 5

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.

Perform BELT TENSION SENSOR VERIFICATION TEST.

## 5. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC(s) TO SET

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 6

## 6. TEST FOR AN INTERMITTENT CONDITION

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER BTS SHORT TO GROUND

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Occupant Classification Module (OCM) detects Belt Tension Sensor A/D counts are less than 13.

### Diagnostic Test

#### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Refer to ***Belt Tension Sensor / Pressure Sensor Faults** for the diagnostic procedure.

**STORED DTC**
Go To 2

#### 2. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH NO LOAD APPLIED TO THE SENSOR

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
Verify that the passenger seat belt is unbuckled and that there is no load on the passenger seat belt and retractor assembly.

With the scan tool in OCM, select Sensor Display and select Passenger Belt Tension Sensor Output.

Read the Passenger Belt Tension Sensor Output on the scan tool display.

**Is the Passenger BTS Output between 39 and 69?**

**Yes** >> Go To 3

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.
Perform BELT TENSION SENSOR VERIFICATION TEST.

#### 3. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH A LOAD APPLIED TO THE SENSOR

Apply 11 kg (24 lbs) to 12 kg (26 lbs) of pressure to the Passenger Belt Tension Sensor using the spring scale Miller special tool 8828 as follows:

- Connect the hook at the bottom of the spring scale through the Passenger Belt Tension Sensor webbing loop so that the end of the hook faces the passenger seat.
- Place the maximum reading indicator at the bottom of the spring scale.
- Grab the horizontal bar at the top of the spring scale. Pull the spring scale straight upward keeping the horizontal bar level with the door sill and the spring scale in-line with the Passenger Belt Tension Sensor.
- Apply and hold 11 kg (24 lbs) to 12 kg (26 lbs) of pressure on the sensor while an assistant monitors the Passenger Belt Tension Sensor Output on the scan tool display.

**Is the Passenger BTS Output between 153 and 204 with 11 kg (24 lbs) to 12 kg (26 lbs) of pressure applied to the sensor?**

**Yes** >> Maintain the 24 to 26 lbs of pressure on the Passenger Belt Tension Sensor and Go To 4

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.
Perform BELT TENSION SENSOR VERIFICATION TEST.

## 4. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH THE LOAD RELEASED

Release the pressure applied with the spring scale while monitoring the Passenger Belt Tension Sensor Output on the scan tool display. Make sure that there is no load applied to the sensor. The output must return to between 39 and 69 within 20 seconds of releasing the load.

**Does the Passenger BTS Output return to between 39 and 69 within 20 seconds of releasing the load?**

**Yes** >> Go To 5

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.

Perform BELT TENSION SENSOR VERIFICATION TEST.

## 5. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC(s) TO SET

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 6

## 6. TEST FOR AN INTERMITTENT CONDITION

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related circuit.
- If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER BTS SHORT TOGETHER

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Occupant Classification Module (OCM) detects the same value on two Seat Belt Tension Sensor circuits.

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Refer to ***Belt Tension Sensor / Pressure Sensor Faults** for the diagnostic procedure.

**STORED DTC**
Go To 2

### 2. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH NO LOAD APPLIED TO THE SENSOR

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
Verify that the passenger seat belt is unbuckled and that there is no load on the passenger seat belt and retractor assembly.

With the scan tool in OCM, select Sensor Display and select Passenger Belt Tension Sensor Output.

Read the Passenger Belt Tension Sensor Output on the scan tool display.

**Is the Passenger BTS Output between 39 and 69?**

**Yes** >> Go To 3

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.
Perform BELT TENSION SENSOR VERIFICATION TEST.

### 3. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH A LOAD APPLIED TO THE SENSOR

Apply 11 kg (24 lbs) to 12 kg (26 lbs) of pressure to the Passenger Belt Tension Sensor using the spring scale Miller special tool 8828 as follows:

- Connect the hook at the bottom of the spring scale through the Passenger Belt Tension Sensor webbing loop so that the end of the hook faces the passenger seat.
- Place the maximum reading indicator at the bottom of the spring scale.
- Grab the horizontal bar at the top of the spring scale. Pull the spring scale straight upward keeping the horizontal bar level with the door sill and the spring scale in-line with the Passenger Belt Tension Sensor.
- Apply and hold 11 kg (24 lbs) to 12 kg (26 lbs) of pressure on the sensor while an assistant monitors the Passenger Belt Tension Sensor Output on the scan tool display.

**Is the Passenger BTS Output between 153 and 204 with 11 kg (24 lbs) to 12 kg (26 lbs) of pressure applied to the sensor?**

**Yes** >> Maintain the 11 kg (24 lbs) to 12 kg (26 lbs) of pressure on the Passenger Belt Tension Sensor and Go To 4

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.
Perform BELT TENSION SENSOR VERIFICATION TEST.

## 4. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH THE LOAD RELEASED

Release the pressure applied with the spring scale while monitoring the Passenger Belt Tension Sensor Output on the scan tool display. Make sure that there is no load applied to the sensor. The output must return to between 39 and 69 within 20 seconds of releasing the load.

**Does the Passenger BTS Output return to between 39 and 69 within 20 seconds of releasing the load?**

**Yes** >> Go To 5

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.

Perform BELT TENSION SENSOR VERIFICATION TEST.

## 5. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING & CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC(s) TO SET

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chaffed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

**Replace the OCS Bladder and Cushion Kit in accordance with the Service information.**

Perform SYSTEM VERIFICATION REQUIRED test.

Perform AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 6

## 6. TEST FOR AN INTERMITTENT CONDITION

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER FLUID LEVEL TOO LOW

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Classification Module (OCM) will set this DTC if the Passenger Bladder Pressure Sensor input value is less than 25 A/D counts for more than 20 seconds.

| Possible Causes |
|---|
| PASSENGER BLADDER PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SEAT BELT TENSION SENSOR POWER CIRCUIT SHORTED TO PASSENGER BLADDER PRESSURE SENSOR SIGNAL CIRCUIT |
| SEAT WEIGHT BLADDER AND PRESSURE SENSOR |
| OCM |

## Diagnostic Test

### 1. REPLACE THE OCS BLADDER AND CUSHION KIT

**NOTE: Ensure that the battery is fully charged.**

**Repair**

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## PASSENGER PRESSURE SENSOR OPEN

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Occupant Classification Module (OCM) detects voltage above the high threshold on the Passenger Bladder Pressure Sensor Signal circuit.

### Diagnostic Test

#### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Refer to ***Belt Tension Sensor / Pressure Sensor Faults** for the diagnostic procedure.

**STORED DTC**
Go To 2

#### 2. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC(s) TO SET

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform System Verification Required test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

#### 3. TEST FOR AN INTERMITTENT CONDITION

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER PRESSURE SENSOR SHORT TO BATTERY

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Occupant Classification Module (OCM) detects Passenger Seat Weight Sensor A/D counts are greater than 233.

### Diagnostic Test

#### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Refer to ***Belt Tension Sensor / Pressure Sensor Faults** for the diagnostic procedure.

**STORED DTC**
Go To 2

#### 2. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC(s) TO SET

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.
Perform SYSTEM VERIFICATION REQUIRED test.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

#### 3. TEST FOR AN INTERMITTENT CONDITION

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER PRESSURE SENSOR SHORT TO GROUND

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Occupant Classification Module (OCM) detects Passenger Seat Weight Sensor A/D counts are less than 13.

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Refer to ***Belt Tension Sensor / Pressure Sensor Faults** for the diagnostic procedure.

**STORED DTC**
Go To 2

### 2. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC(s) TO SET

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. TEST FOR AN INTERMITTENT CONDITION

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER PRESSURE SENSOR SHORT TOGETHER

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Occupant Classification Module (OCM) detects the same value on two Passenger Bladder Pressure Sensor circuits.

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Refer to ***Belt Tension Sensor / Pressure Sensor Faults** for the diagnostic procedure.

**STORED DTC**
Go To 2

### 2. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC(s) TO SET

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. TEST FOR AN INTERMITTENT CONDITION

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

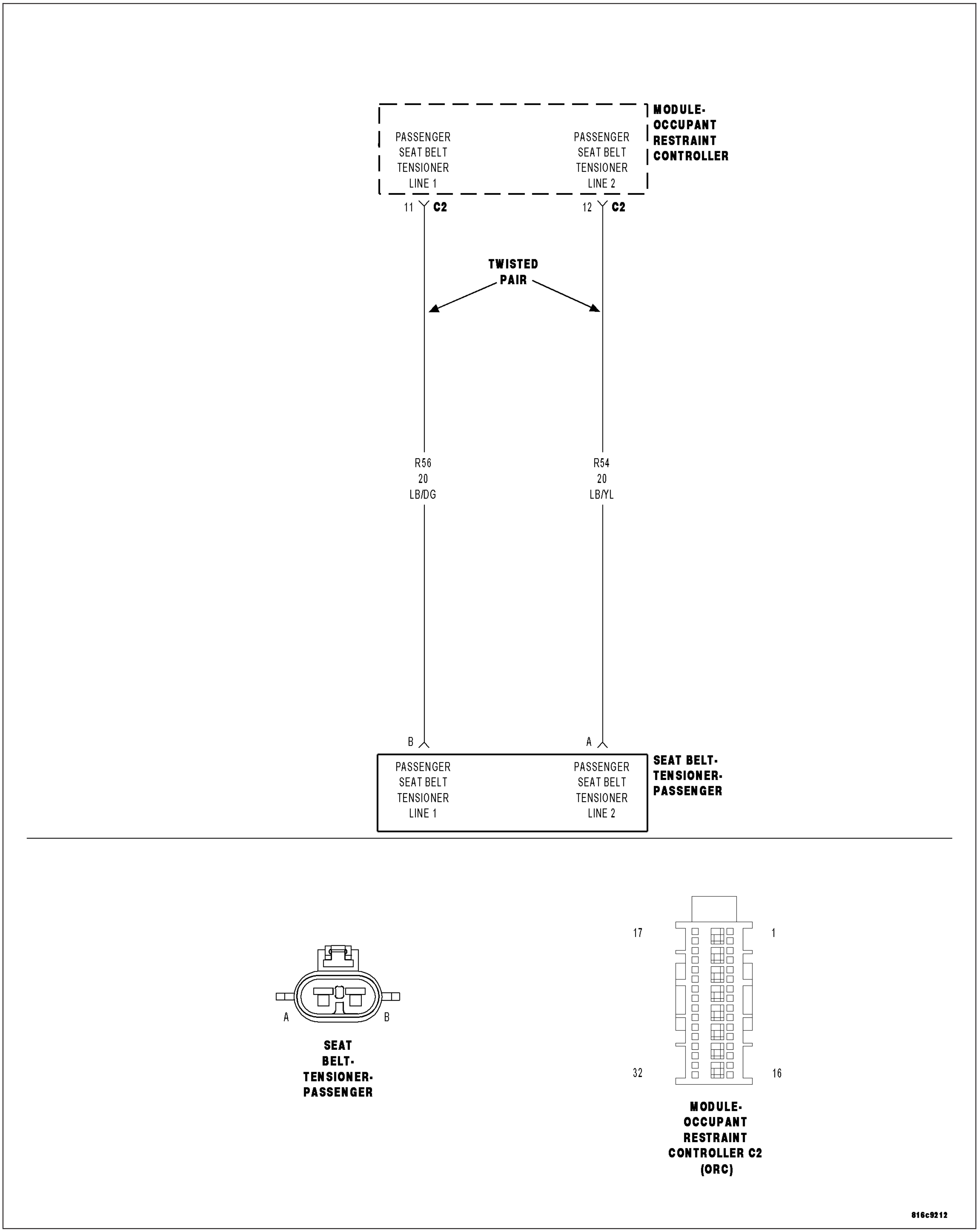
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER SEAT BELT TENSIONER CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Seat Belt Tensioner circuits. The ORC will set this DTC if it detects an open or high resistance on the Passenger Seat Belt Tensioner circuits.

| Possible Causes |
|---|
| (R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT OR (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT OPEN |
| PASSENGER SEAT BELT PRETENSIONER |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

### 2. CHECK FOR OPEN PASSENGER SEAT BELT PRETENSIONER

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Passenger Seat Belt Pretensioner connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Passenger Seat Belt Pretensioner connector.

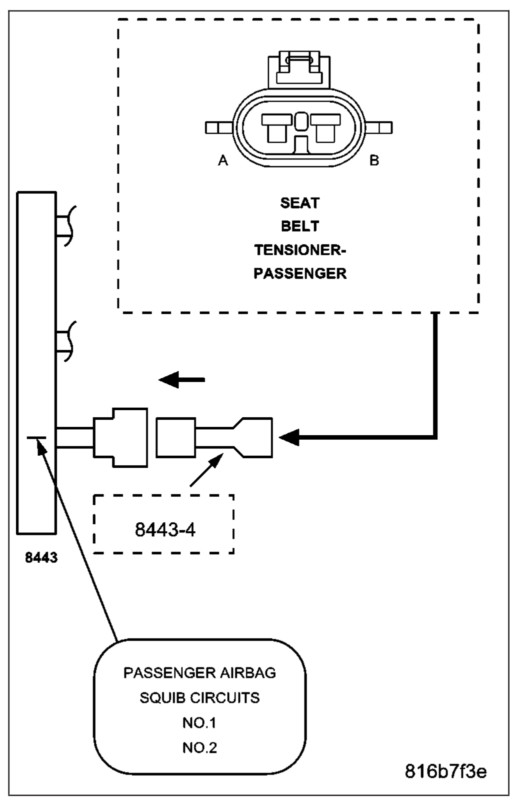
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

**Does the scan tool display: PASSENGER SEAT BELT TENSIONER CIRCUIT OPEN?**

**Yes** >> Go To 3

**No** >> Replace the Passenger Seat Belt Pretensioner in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK (R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT FOR AN OPEN

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

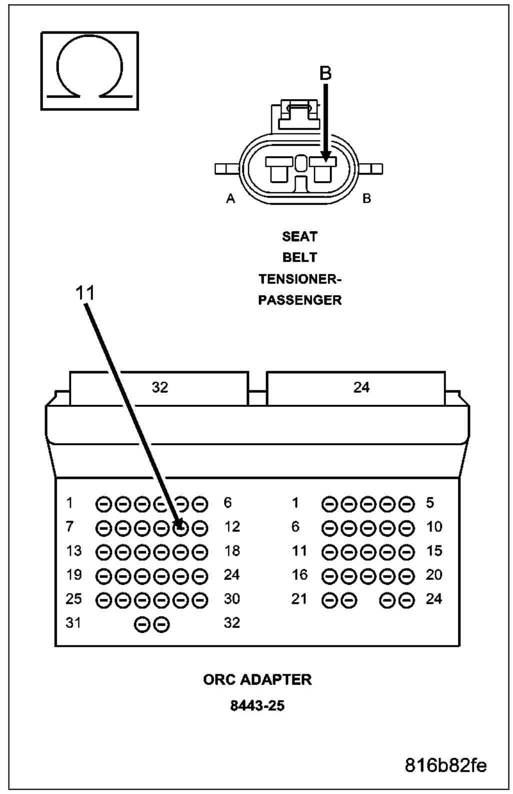
Disconnect the 8443 Load Tool and Jumper from the Passenger Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC C1 connector.

Measure the resistance of the (R56) Passenger Seat Belt Tensioner Line 1 circuit between the Passenger Seat Belt Pretensioner connector and the 8443 ORC Adaptor.




**Is the resistance below 1.0 ohm?**

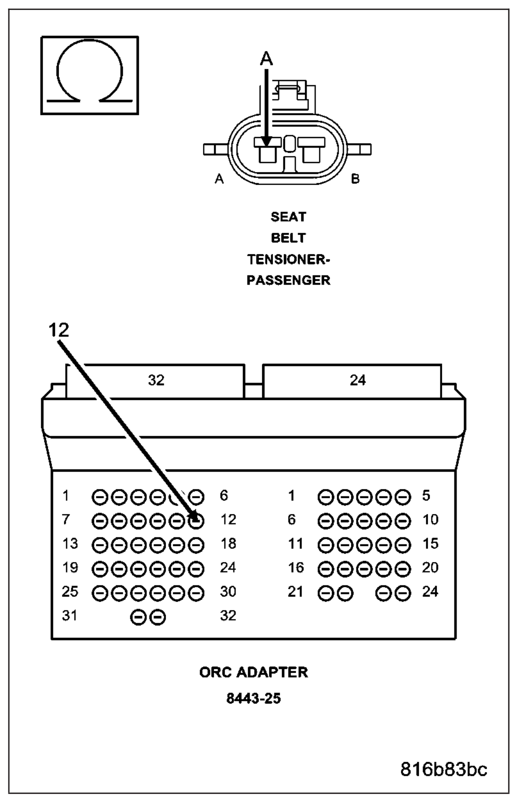
**Yes** >> Go To 4

**No** >> Repair the (R56) Passenger Seat Belt Tensioner Line 1 circuit for an open.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECK (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R54) Passenger Seat Belt Tensioner Line 2 circuit between the Passenger Seat Belt Pretensioner connector and the 8443 ORC Adaptor.




**Is the resistance below 1.0 ohm?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Repair the (R54) Passenger Seat Belt Tensioner Line 2 circuit for an open.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

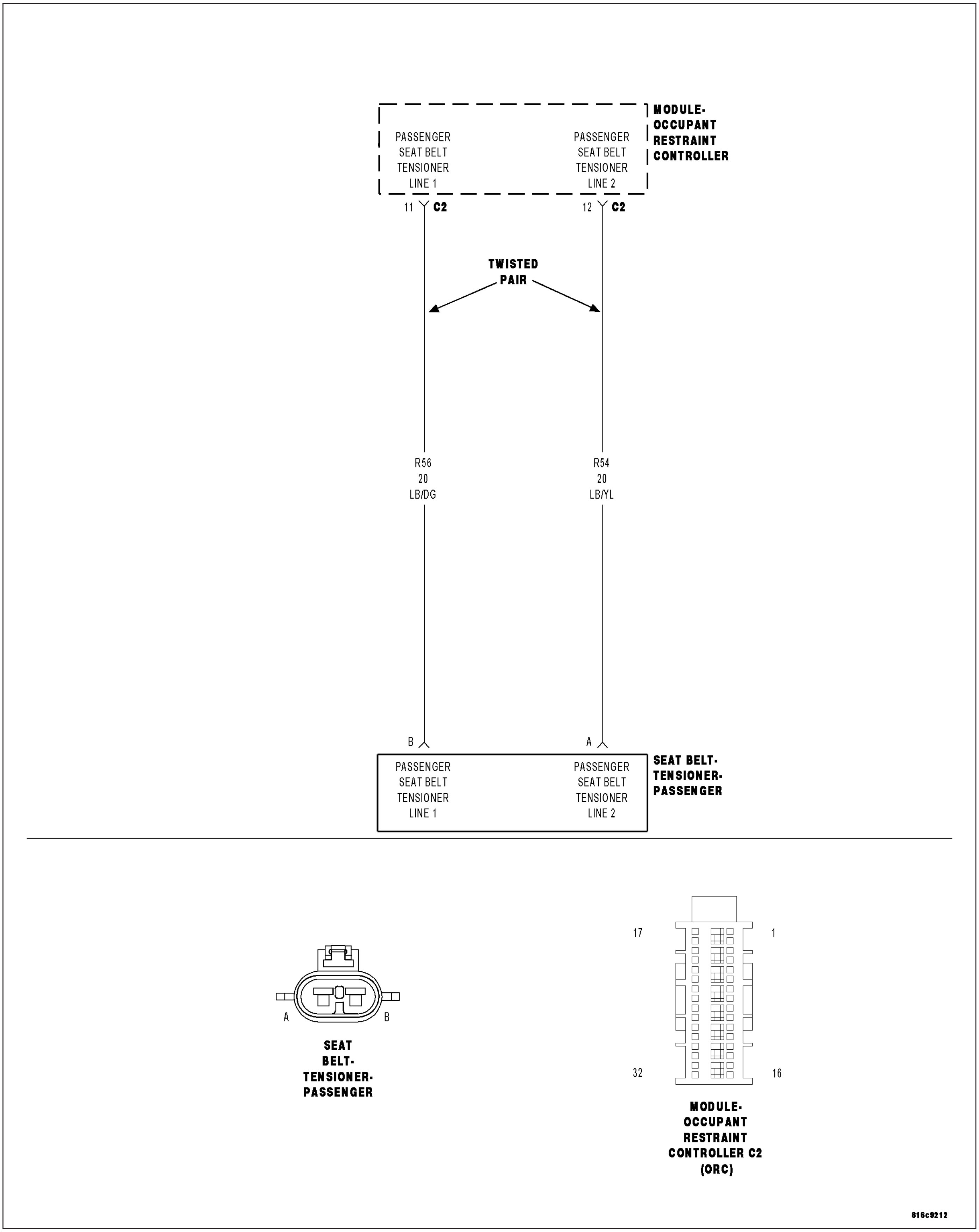
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER SEAT BELT TENSIONER CIRCUIT SHORT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Seat Belt Tensioner circuits. The ORC will set this DTC if it detects low resistance between the Passenger Seat Belt Tensioner circuits.

| Possible Causes |
| --- |
| (R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT SHORTED TO (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT |
| PASSENGER SEAT BELT PRETENSIONER |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED PASSENGER SEAT BELT PRETENSIONER

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

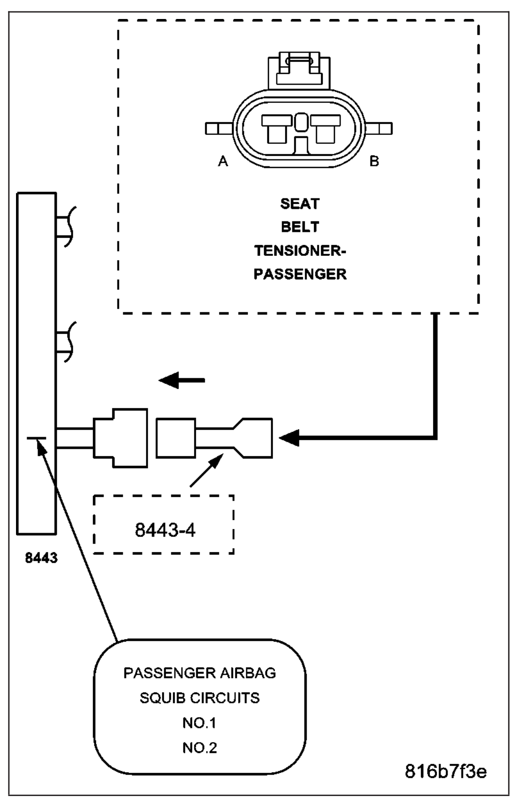
Disconnect the Passenger Seat Belt Pretensioner connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Passenger Seat Belt Pretensioner connector.

**WARNING: To avoid personal injury or death, turn the ignition on then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

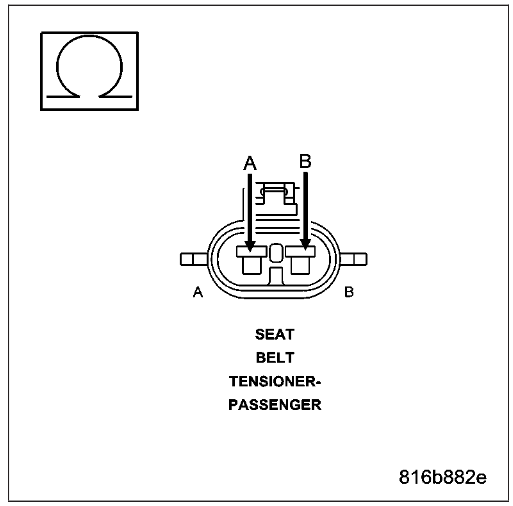



**Does the scan tool display: PASSENGER SEAT BELT TENSIONER CIRCUIT SHORT?**

**Yes** >> Go To 3

**No** >> Replace the Passenger Seat Belt Pretensioner in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK (R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT FOR A SHORT TO THE (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Passenger Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance between the (R56) Passenger Seat Belt Tensioner Line 1 circuit and the (R54) Passenger Seat Belt Tensioner Line 2 circuit at the Passenger Seat Belt Pretensioner connector.

**Is the resistance below 10K ohms?**

**Yes** >> Repair the (R56) Passenger Seat Belt Tensioner Line 1 circuit for a short to the (R54) Passenger Seat Belt Tensioner Line 2 circuit.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

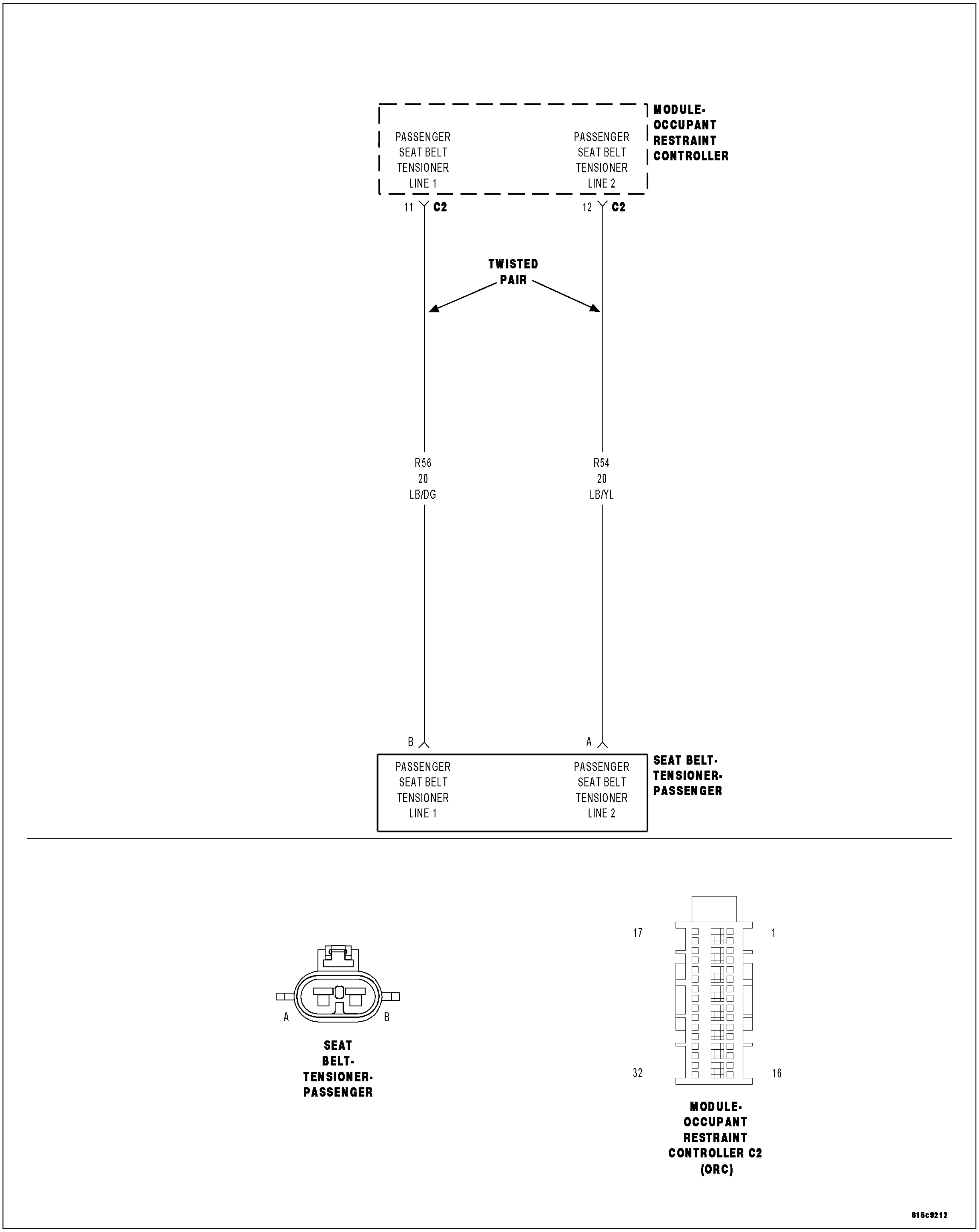
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER SEAT BELT TENSIONER SHORT TO BATTERY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the voltage on the Passenger Seat Belt Tensioner circuits. The ORC will set this DTC if it detects voltage on the Passenger Seat Belt Tensioner circuits.

| Possible Causes |
|---|
| (R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT OR (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT SHORTED TO BATTERY |
| PASSENGER SEAT BELT PRETENSIONER |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED PASSENGER SEAT BELT PRETENSIONER

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Passenger Seat Belt Pretensioner connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Passenger Seat Belt Pretensioner connector.

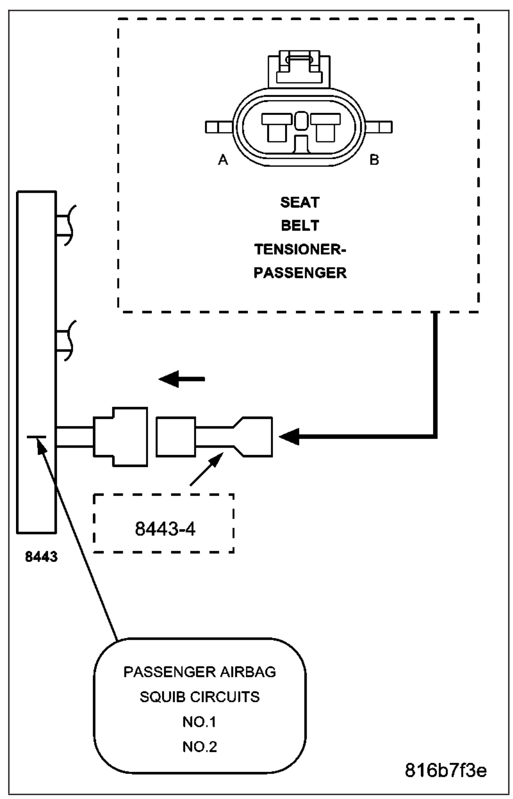
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

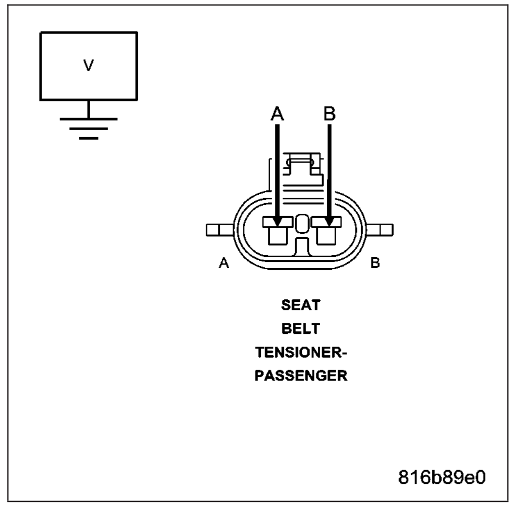
**Does the scan tool display: PASSENGER SEAT BELT TENSIONER SHORT TO BATTERY?**

**Yes** >> Go To 3

**No** >> Replace the Passenger Seat Belt Pretensioner in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK (R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT AND (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT FOR A SHORT TO BATTERY




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Passenger Seat Belt Pretensioner connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage of the (R56) Passenger Seat Belt Tensioner Line 1 circuit between the Passenger Seat Belt Pretensioner connector and ground.

Measure the voltage of the (R54) Passenger Seat Belt Tensioner Line 2 circuit between the Passenger Seat Belt Pretensioner connector and ground.

**Is there any voltage present on either circuit?**

**Yes** >> Repair the Passenger Seat Belt Tensioner circuits with voltage present for a short to battery.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

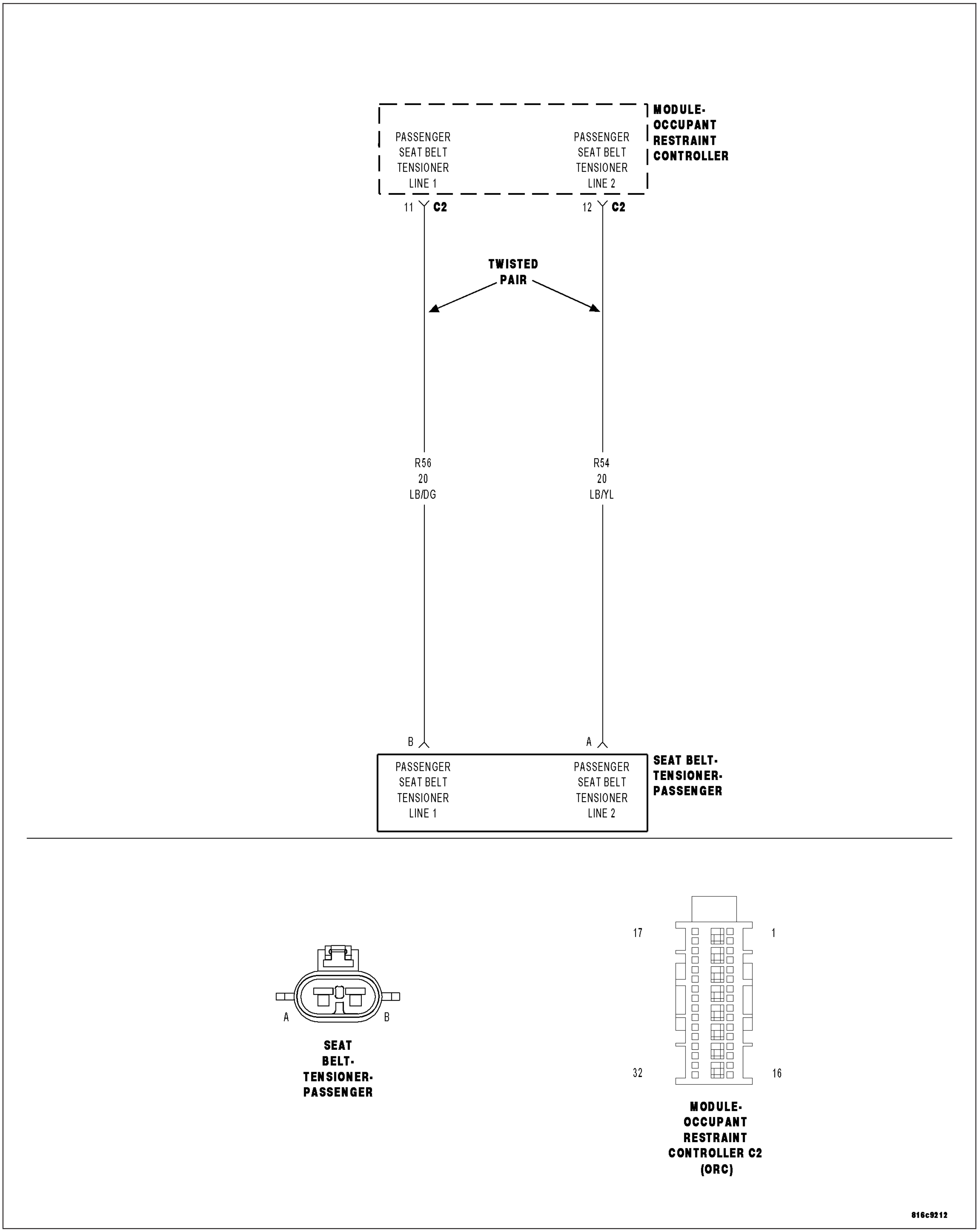
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER SEAT BELT TENSIONER SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Seat Belt Tensioner circuits. The ORC will set this DTC if it detects low resistance on the Passenger Seat Belt Tensioner circuits.

| Possible Causes |
|---|
| (R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT OR (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT SHORTED TO GROUND |
| PASSENGER SEAT BELT PRETENSIONER |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED PASSENGER SEAT BELT PRETENSIONER

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Passenger Seat Belt Pretensioner connector.

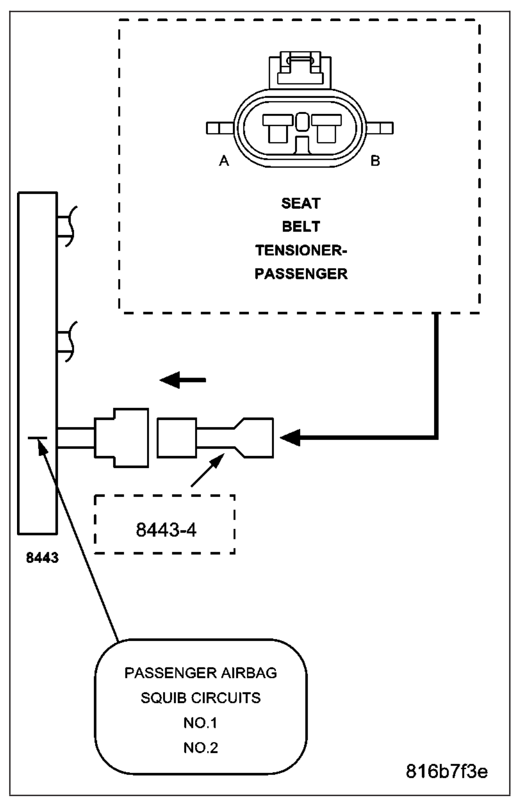
**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool and appropriate Jumper to the Passenger Seat Belt Pretensioner connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, read the active ORC DTCs.

**Does the scan tool display: PASSENGER SEAT BELT TENSIONER SHORT TO GROUND?**

**Yes** >> Go To 3

**No** >> Replace the Passenger Seat Belt Pretensioner in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK (R56) PASSENGER SEAT BELT TENSIONER LINE 1 CIRCUIT AND (R54) PASSENGER SEAT BELT TENSIONER LINE 2 CIRCUIT FOR A SHORT TO GROUND

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the 8443 Load Tool and Jumper from the Passenger Seat Belt Pretensioner connector.

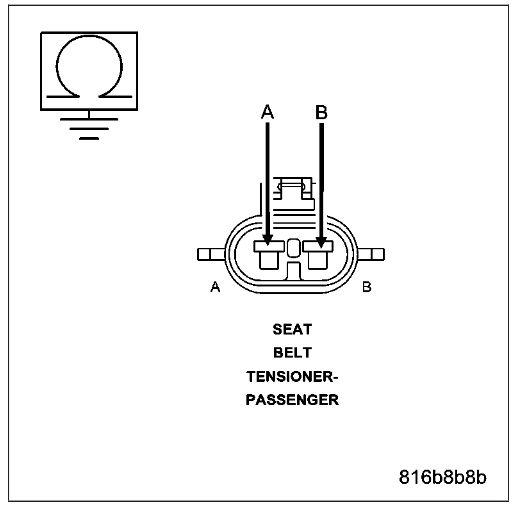
Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the (R56) Passenger Seat Belt Tensioner Line 1 circuit between ground and the Passenger Seat Belt Pretensioner connector.

Measure the resistance of the (R54) Passenger Seat Belt Tensioner Line 2 circuit between ground and the Passenger Seat Belt Pretensioner connector.




**Is the resistance below 10K ohms on either circuit?**

**Yes** >> Repair the Passenger Seat Belt Tensioner circuits with a resistance below 10k ohms for a short to ground.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

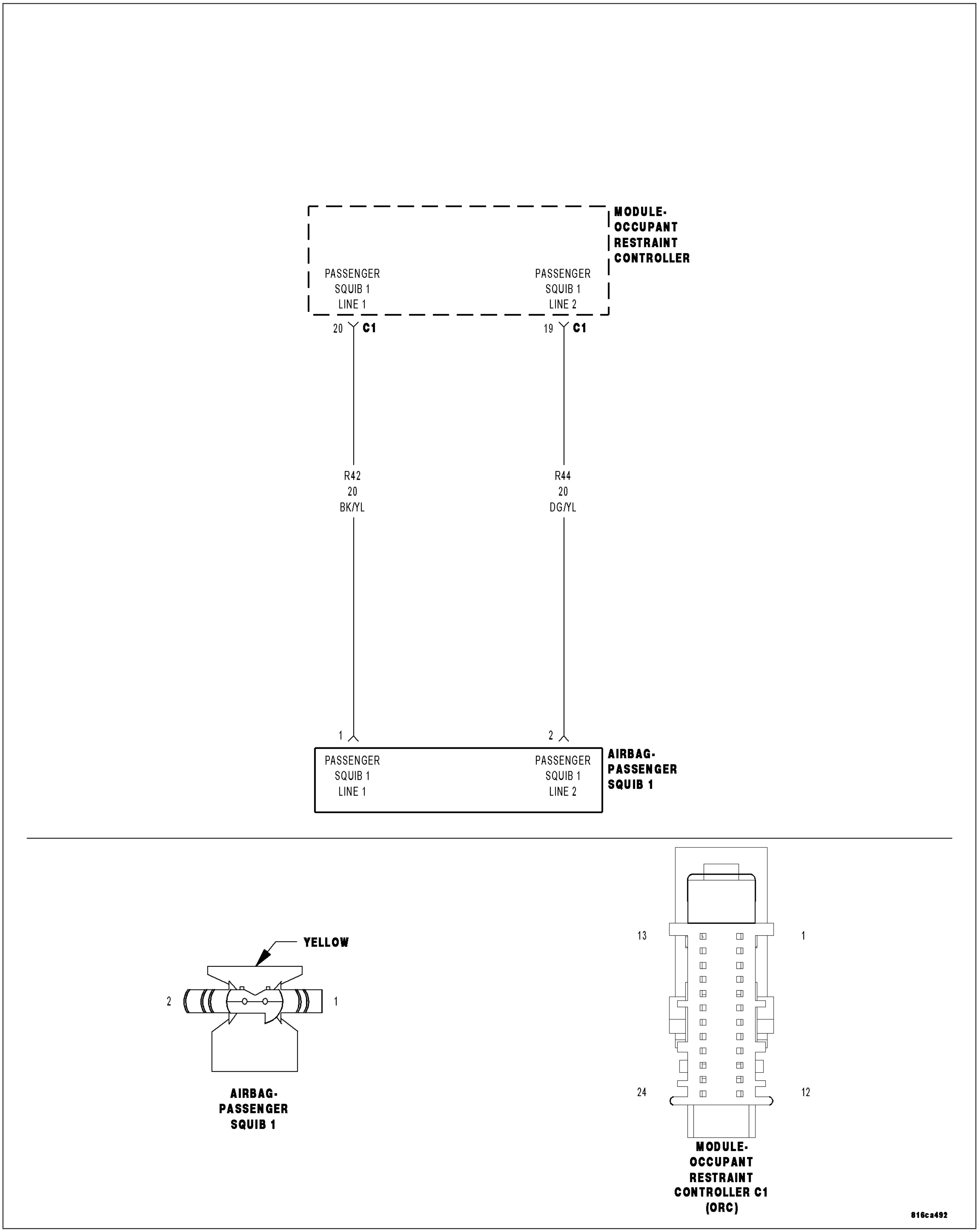
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER SQUIB 1 CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 1 circuits. The ORC will set this DTC if it detects an open or high resistance on the Passenger Squib 1 circuits.

| Possible Causes |
|---|
| PASSENGER SQUIB 1 LINE 2 CIRCUIT OPEN |
| PASSENGER SQUIB 1 LINE 1 CIRCUIT OPEN |
| PASSENGER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

### 2. CHECK FOR OPEN SQUIB CIRCUITS IN PASSENGER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Passenger Airbag Squib connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

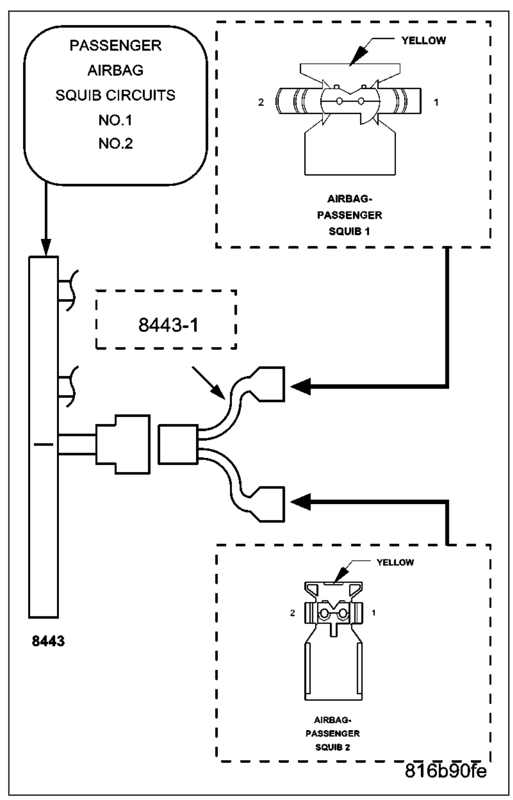
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

**Does the scan tool display: PASSENGER SQUIB 1 CIRCUIT OPEN?**

**Yes** >> Go To 3

**No** >> Replace the Passenger Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK PASSENGER SQUIB 1 LINE 2 CIRCUIT FOR AN OPEN

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

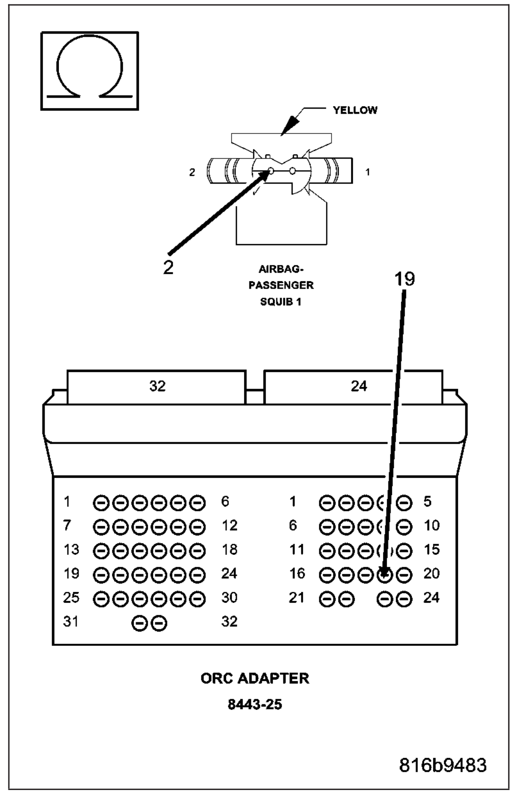
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the Passenger Squib 1 Line 2 circuit between the Passenger Airbag Squib connector and the 8443 ORC Adaptor.



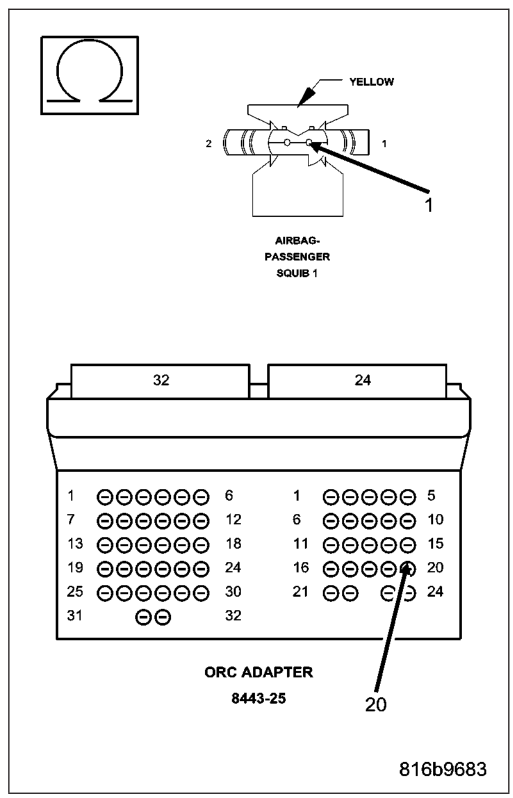

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 4

**No** >> Repair the Passenger Squib 1 Line 2 circuit for and open. Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECK PASSENGER SQUIB 1 LINE 1 CIRCUIT FOR AN OPEN

Measure the resistance of the Passenger Squib 1 Line 1 circuit between the Passenger Airbag Squib connector and the 8443 ORC Adaptor.




**Is the resistance below 1.0 ohm?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Repair the Passenger Squib 1 Line 1 circuit for an open. Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

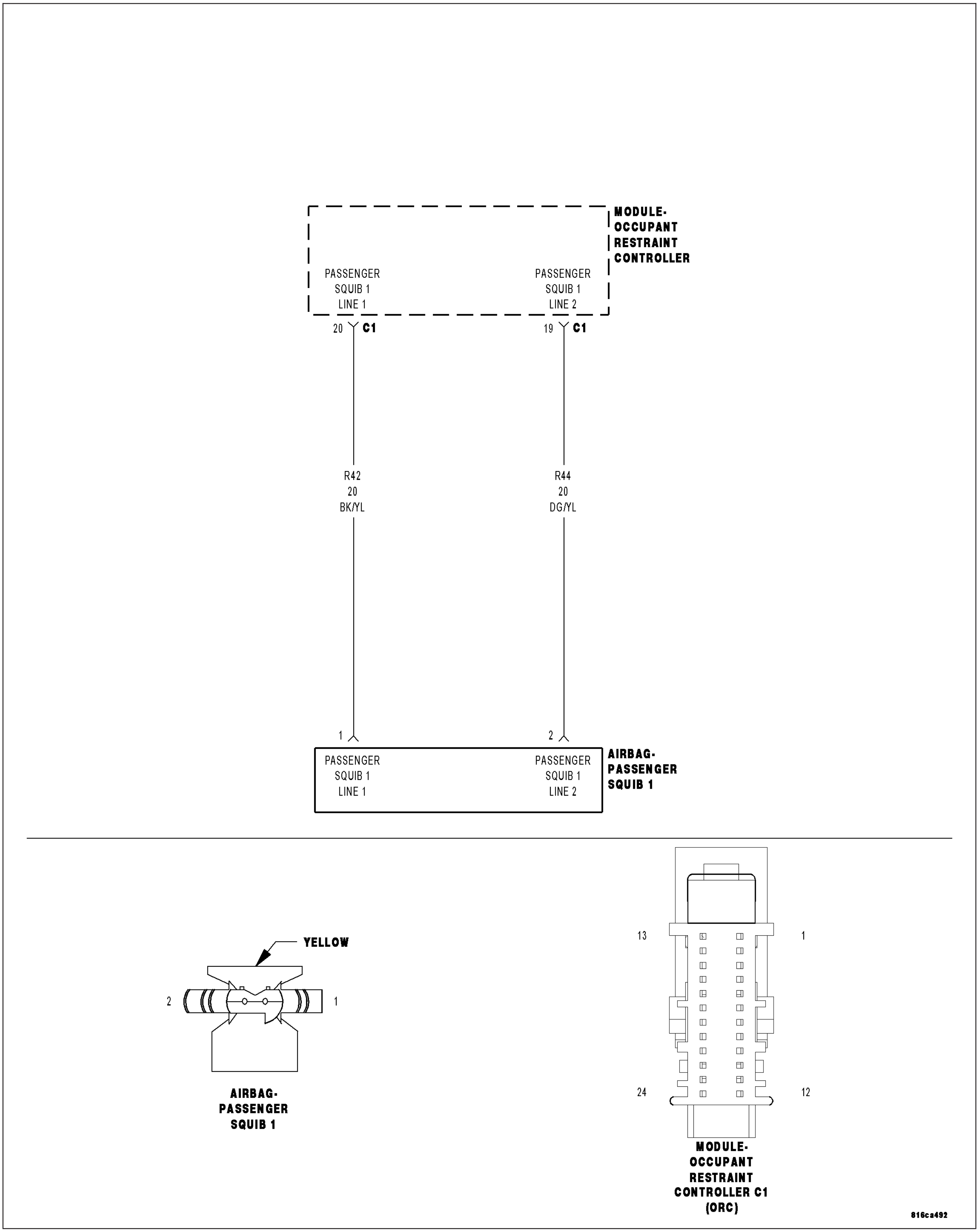
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER SQUIB 1 CIRCUIT SHORT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 1 circuits. The ORC will set this DTC if it detects low resistance between the Passenger Squib 1 circuits.

| Possible Causes |
|---|
| PASSENGER SQUIB 1 LINE 2 CIRCUIT SHORTED TO PASSENGER SQUIB 1 LINE 1 CIRCUIT |
| PASSENGER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

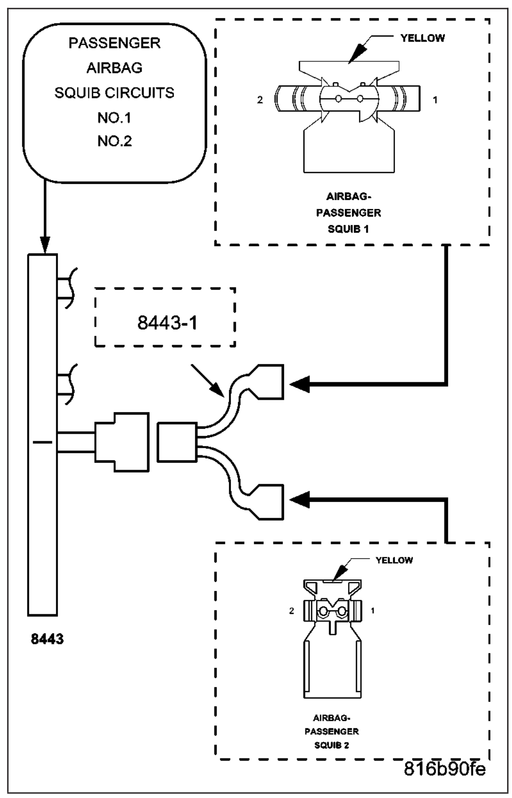
Disconnect the Passenger Airbag Squib connector.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.




**Does the scan tool display: PASSENGER SQUIB 1 CIRCUIT SHORT?**

**Yes** >> Go To 3

**No** >> Replace the Passenger Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK PASSENGER SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO PASSENGER SQUIB 1 LINE 1 CIRCUIT

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

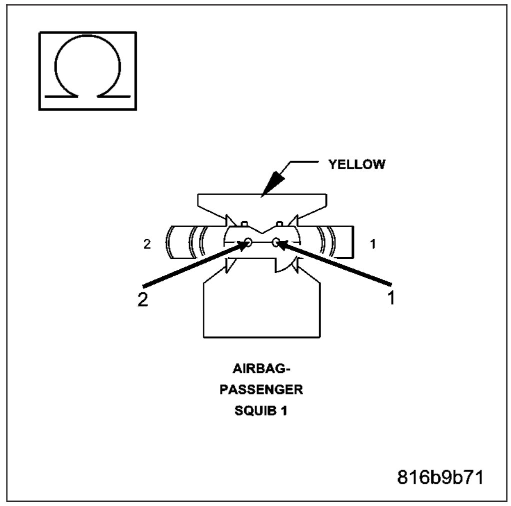
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance between the Passenger Squib 1 Line 2 circuit and the Passenger Squib 1 Line 1 circuit at the Passenger Airbag Squib connector.




**Is the resistance below 10K ohms?**

**Yes** >> Repair the Passenger Squib 1 Line 2 circuit for a short to the Passenger Squib 1 Line 1 circuit.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

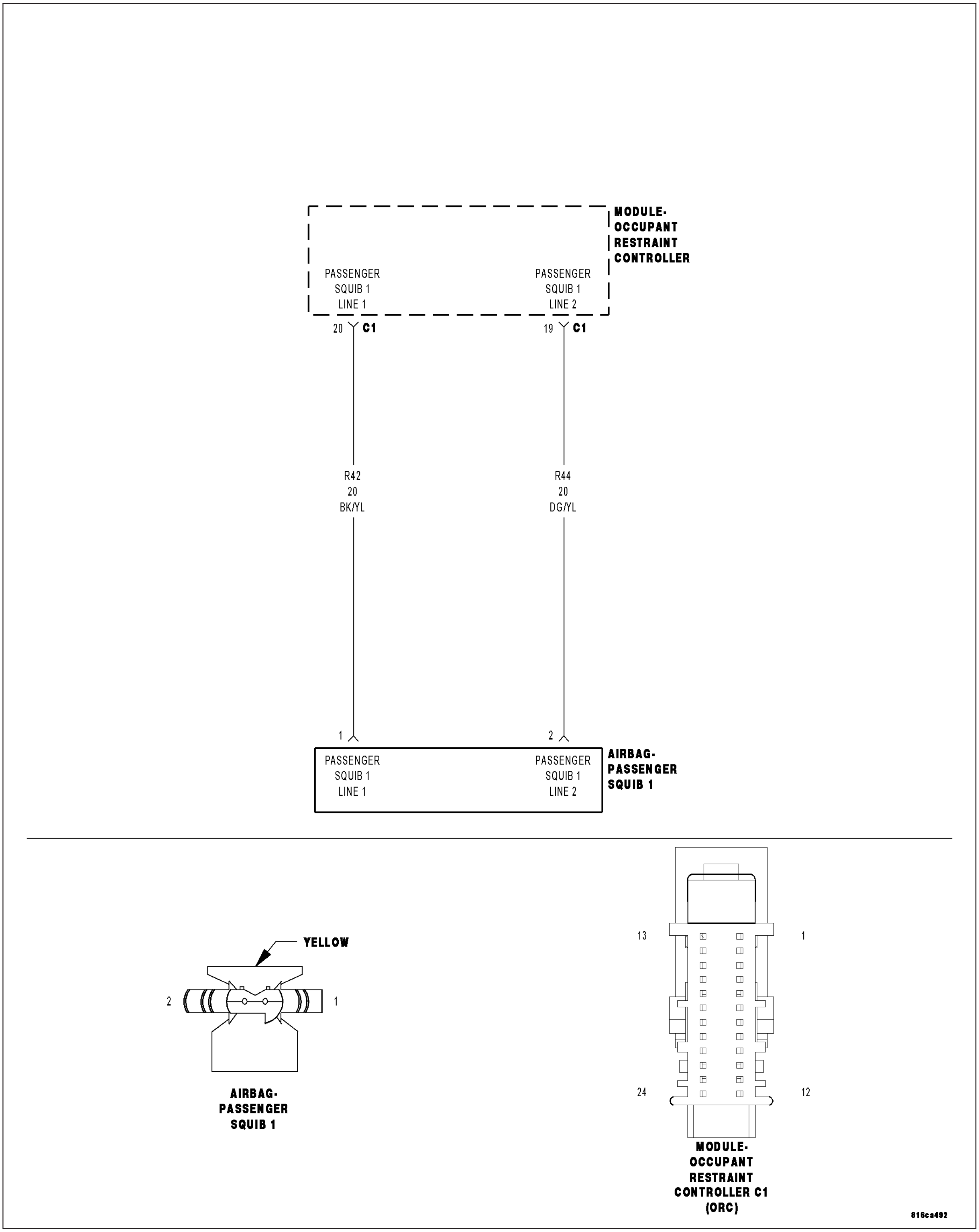
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER SQUIB 1 SHORT TO BATTERY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the voltage on the Passenger Squib 1 circuits. The ORC will set this DTC if it detects voltage on the Passenger Squib 1 circuits.

| Possible Causes |
|---|
| PASSENGER SQUIB 1 LINE 2 CIRCUIT OR PASSENGER SQUIB 1 LINE 1 CIRCUIT SHORTED TO BATTERY |
| PASSENGER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

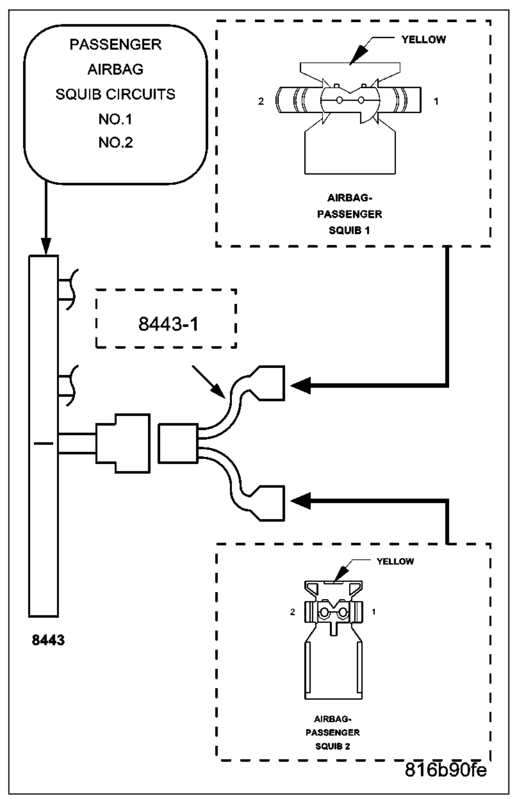
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Passenger Airbag Squib connector.

**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

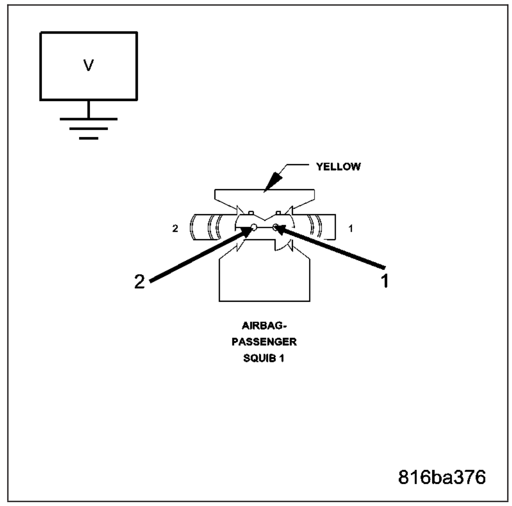
With the scan tool, read the active ORC DTCs.

**Does the scan tool display: PASSENGER SQUIB 1 SHORT TO BATTERY?**

**Yes** >> Go To 3

**No** >> Replace the Passenger Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK PASSENGER SQUIB 1 LINE 2 CIRCUIT AND PASSENGER SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO BATTERY




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the voltage of the Passenger Squib 1 Line 2 circuit between the Passenger Airbag Squib connector and ground.

Measure the voltage of the Passenger Squib 1 Line 1 circuit between the Passenger Airbag Squib connector and ground.

**Is there any voltage present on either circuit?**

**Yes** >> Repair the Passenger Squib 1 circuits with voltage present for a short to battery.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

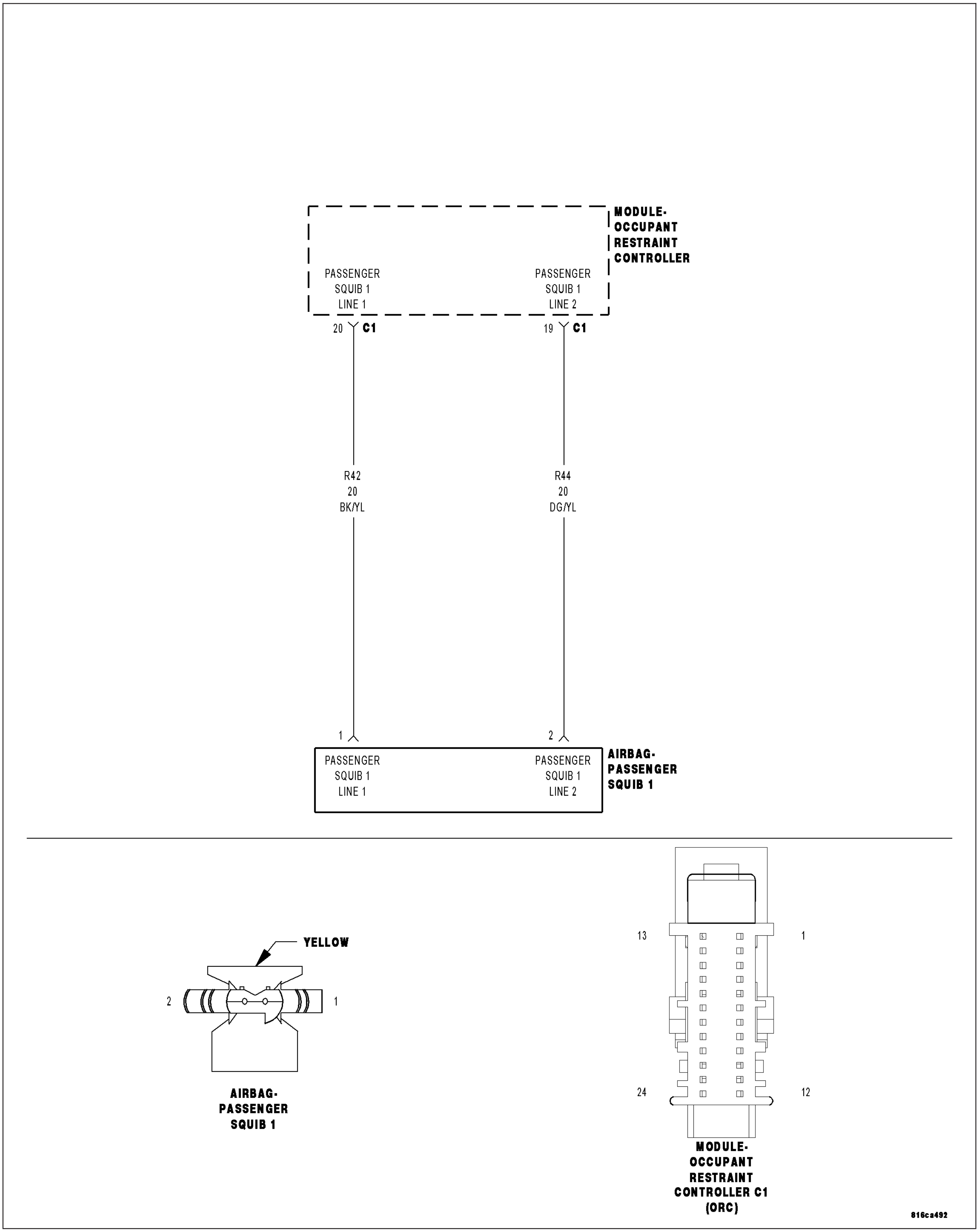
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER SQUIB 1 SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 1 circuits. The ORC will set this DTC if it detects low resistance on the Passenger Squib 1 circuits.

| Possible Causes |
|---|
| PASSENGER SQUIB 1 LINE 2 CIRCUIT OR PASSENGER SQUIB 1 LINE 1 CIRCUIT SHORTED TO GROUND |
| PASSENGER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Passenger Airbag Squib connector.

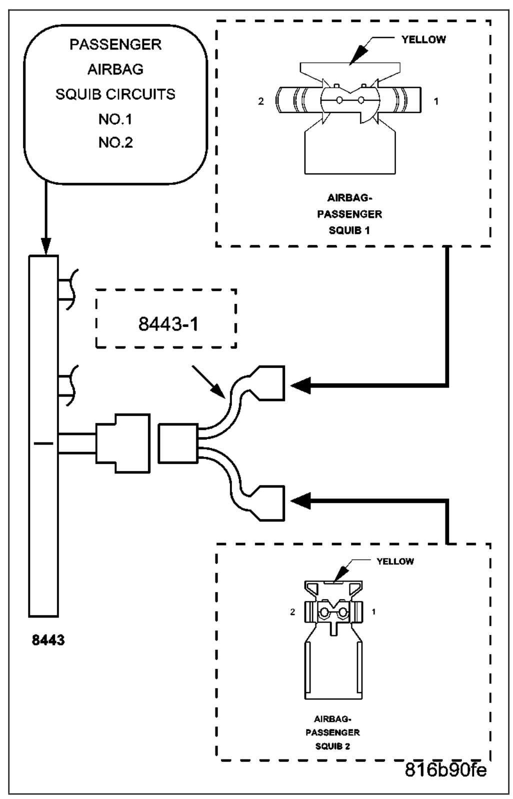
**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

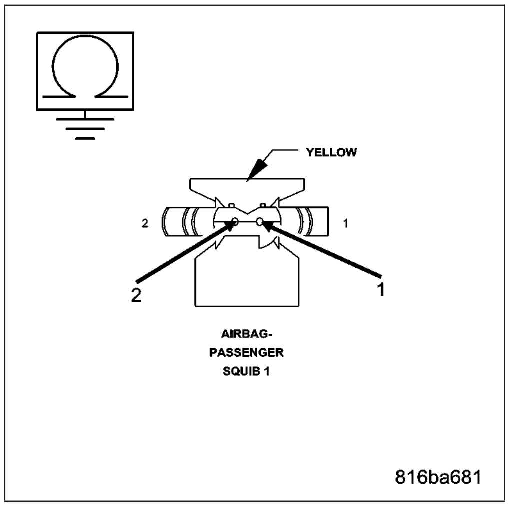



**Does the scan tool display: PASSENGER SQUIB 1 SHORT TO GROUND?**

**Yes** >> Go To 3

**No** >> Replace the Passenger Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK PASSENGER SQUIB 1 LINE 2 CIRCUIT AND PASSENGER SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO GROUND




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the Passenger Squib 1 Line 2 circuit between ground and the Passenger Airbag Squib connector.

Measure the resistance of the Passenger Squib 1 Line 1 circuit between ground and the Passenger Airbag Squib connector.

**Is the resistance below 10K ohms on either circuit?**

**Yes** >> Repair the Passenger Squib 1 circuits with a resistance below 10K ohms for a short to ground.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

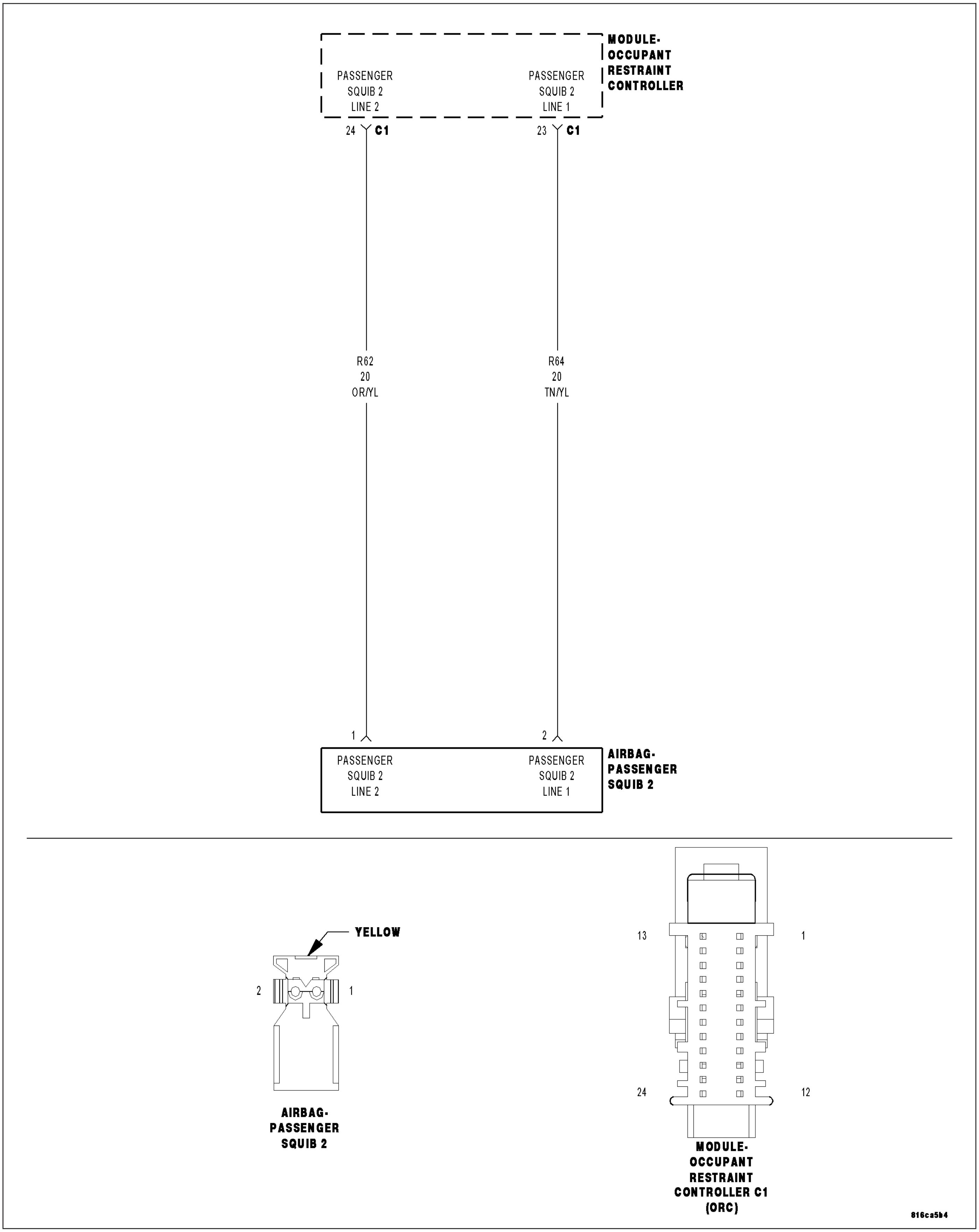
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER SQUIB 2 CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 2 circuits. The ORC will set this DTC if it detects an open or high resistance on the Passenger Squib 2 circuits.

| Possible Causes |
|---|
| (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT OPEN |
| (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT OPEN |
| PASSENGER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

### 2. CHECK FOR OPEN SQUIB CIRCUITS IN PASSENGER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Passenger Airbag Squib connector.

**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

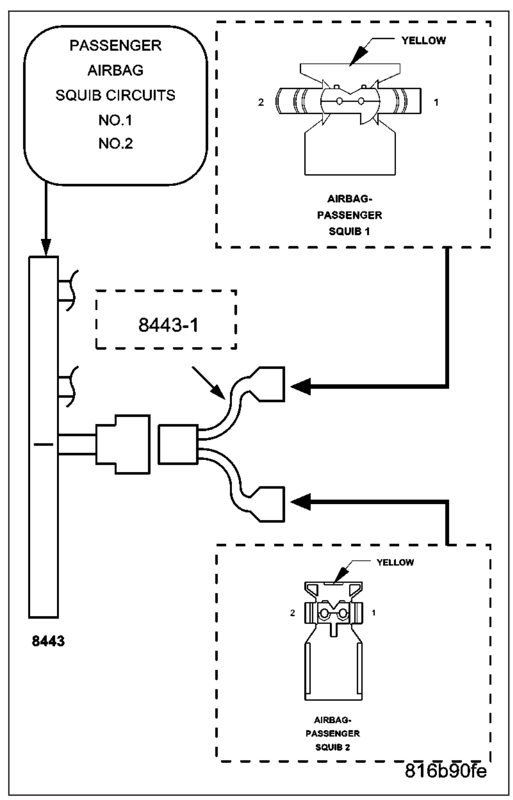
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

**Does the scan tool display: PASSENGER SQUIB 2 CIRCUIT OPEN?**

**Yes** >> Go To 3

**No** >> Replace the Passenger Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT FOR AN OPEN

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

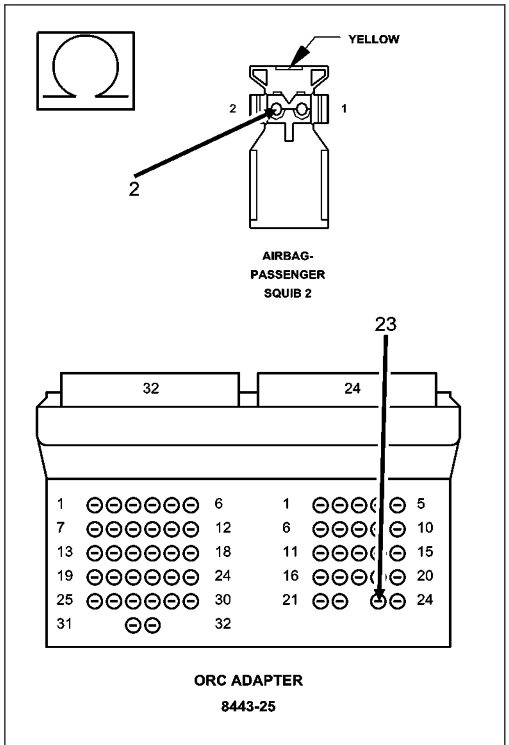
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the (R64) Passenger Squib 2 Line 1 circuit between the Passenger Airbag Squib connector and the 8443 Load Tool ORC Adaptor.



816ba88e

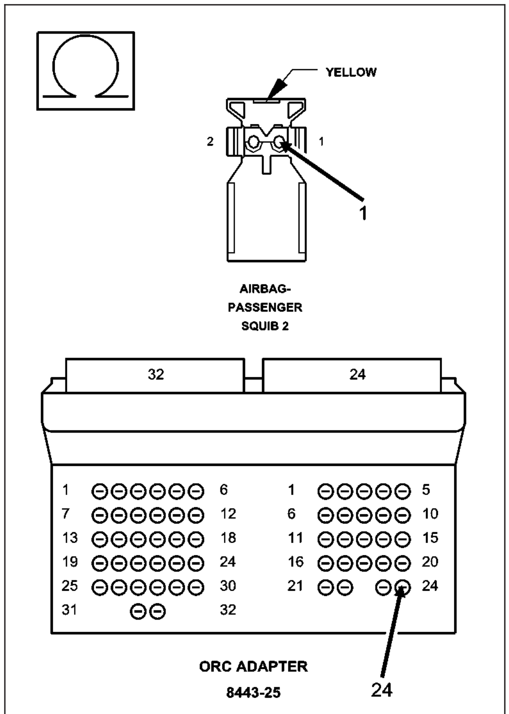
**Is the resistance below 1.0 ohm?**

**Yes** >> Go to 4

**No** >> Repair the (R64) Passenger Squib 2 Line 1 circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECK (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT FOR AN OPEN

Measure the resistance of the (R62) Passenger Squib 2 Line 2 circuit between the Passenger Airbag Squib connector and the 8443 Load Tool ORC Adaptor.



816bab49

**Is the resistance below 1.0 ohm?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Repair the (R62) Passenger Squib 2 Line 2 circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

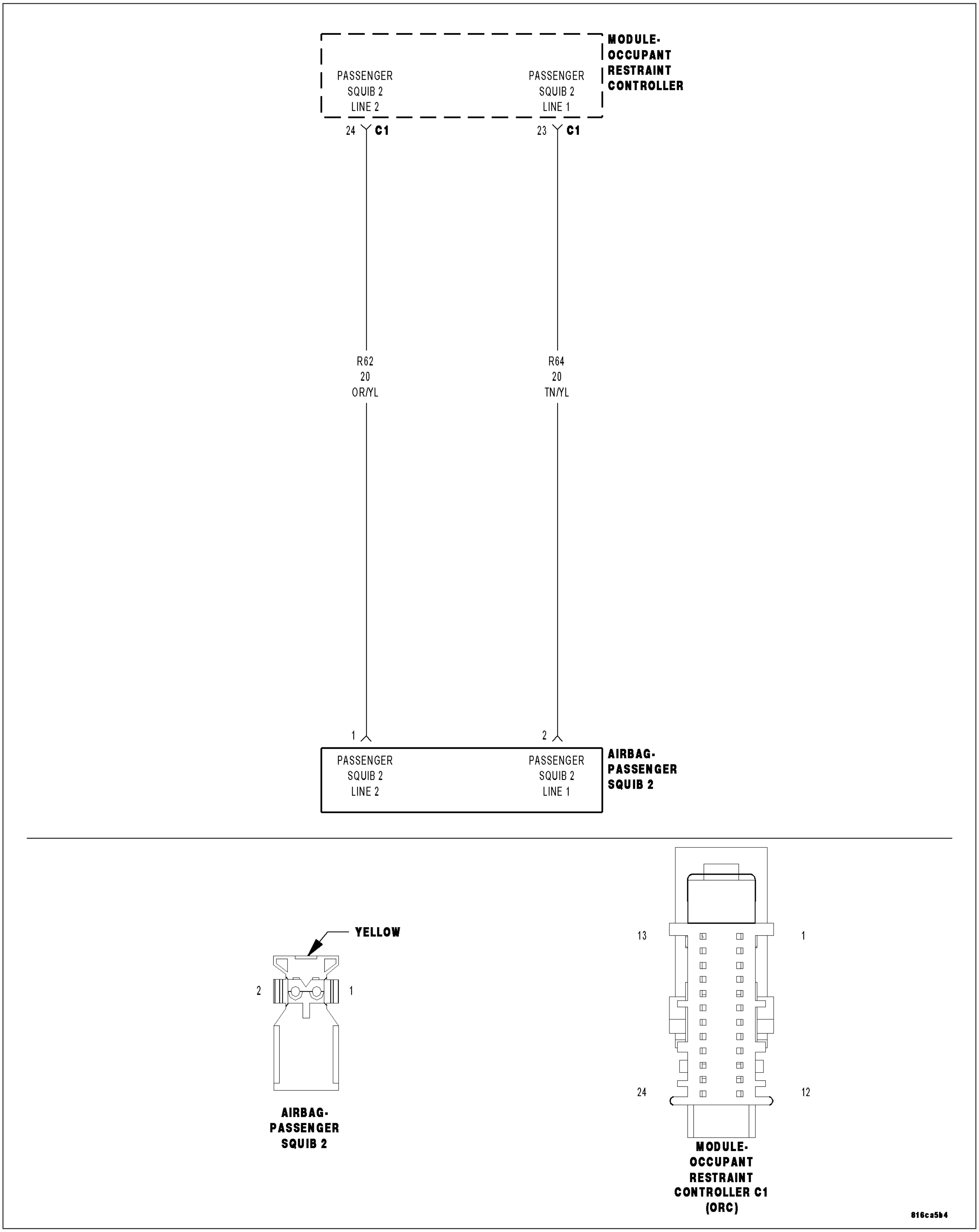
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER SQUIB 2 CIRCUIT SHORT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 2 circuits. The ORC will set this DTC if it detects low resistance between the Passenger Squib 2 circuits.

| Possible Causes |
|---|
| (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT SHORTED TO (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT |
| PASSENGER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Passenger Airbag Squib connector.

**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

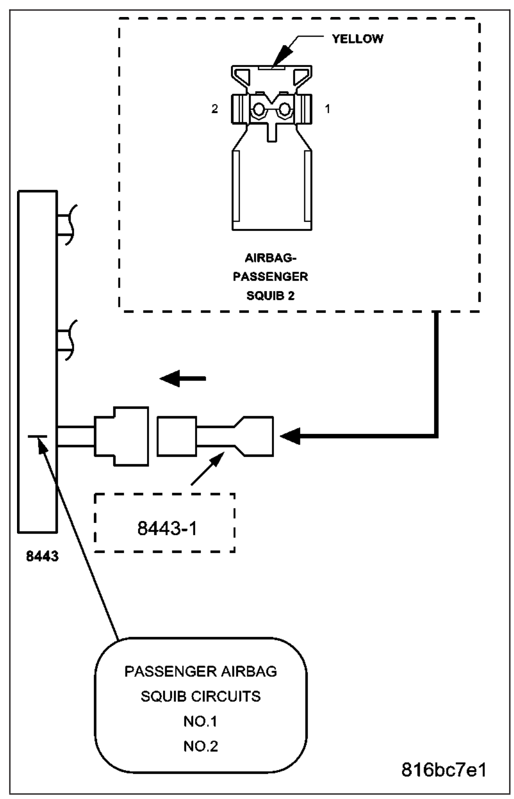
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery**

With the scan tool, read the active ORC DTCs.

**Does the scan tool display: PASSENGER SQUIB 2 CIRCUIT SHORT?**

**Yes** >> Go To 3

**No** >> Replace the Passenger Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT FOR A SHORT TO (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

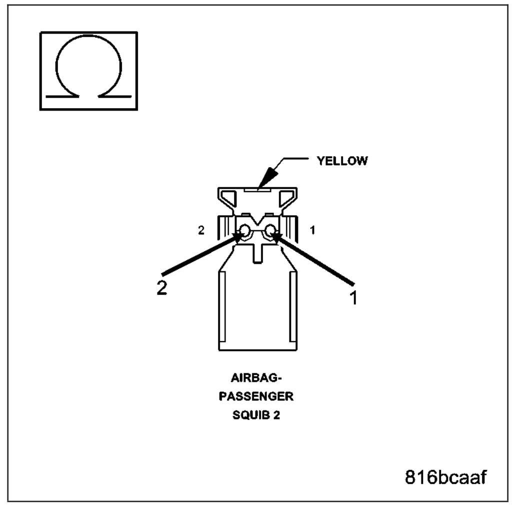
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance between the (R64) Passenger Squib 2 Line 1 circuit and the (R62) Passenger Squib 2 Line 2 circuit at the Passenger Airbag Squib connector.




**Is the resistance below 10K ohms?**

**Yes** >> Repair the (R64) Passenger Squib 2 Line 1 circuit for a short to the (R62) Passenger Squib 2 Line 2 circuit.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

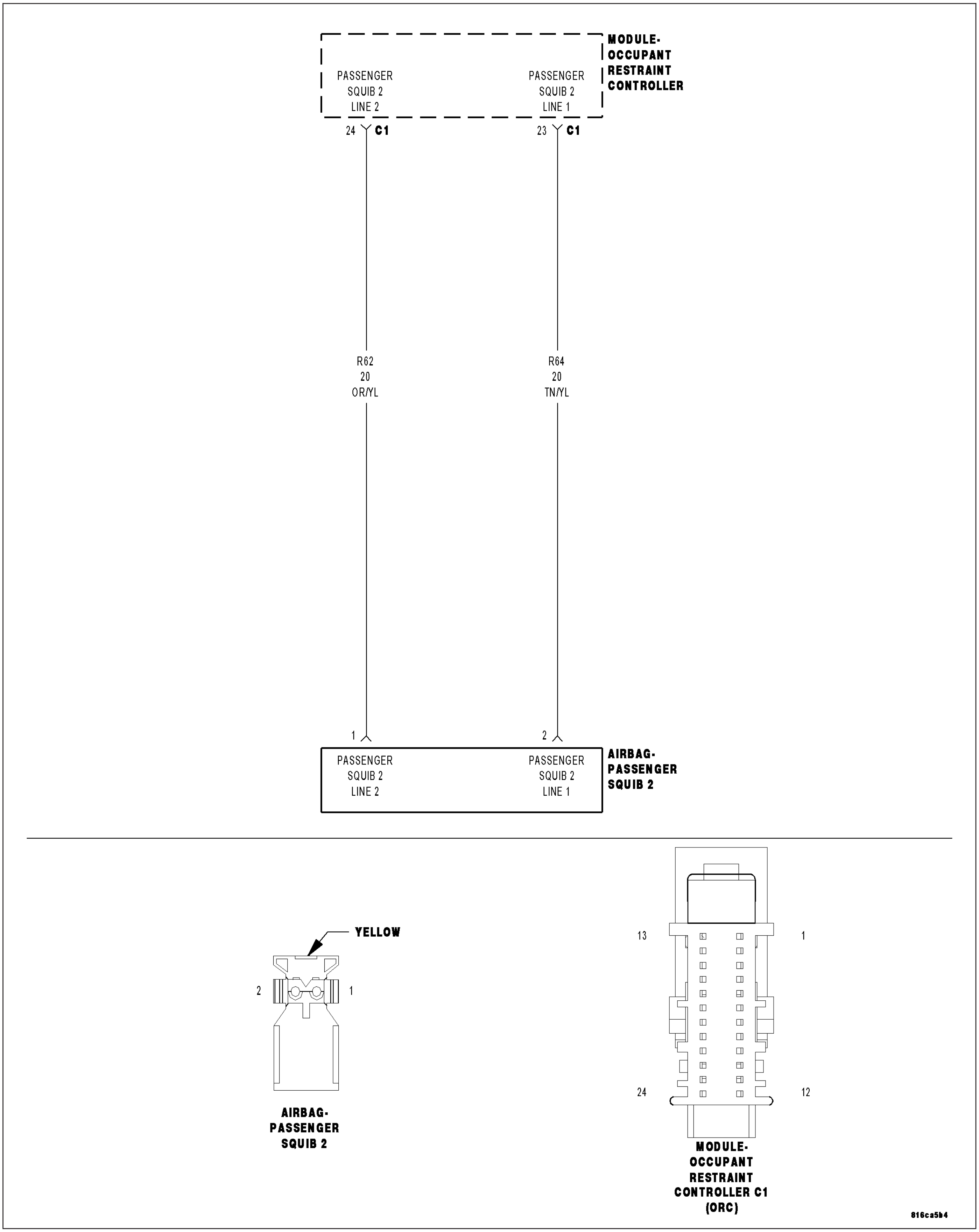
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER SQUIB 2 SHORT TO BATTERY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the voltage of the Passenger Squib 2 circuits. The ORC will set this DTC if it detects voltage on the Passenger Squib 2 circuits.

| Possible Causes |
|---|
| (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT OR (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT SHORTED TO BATTERY |
| PASSENGER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Passenger Airbag Squib connector.

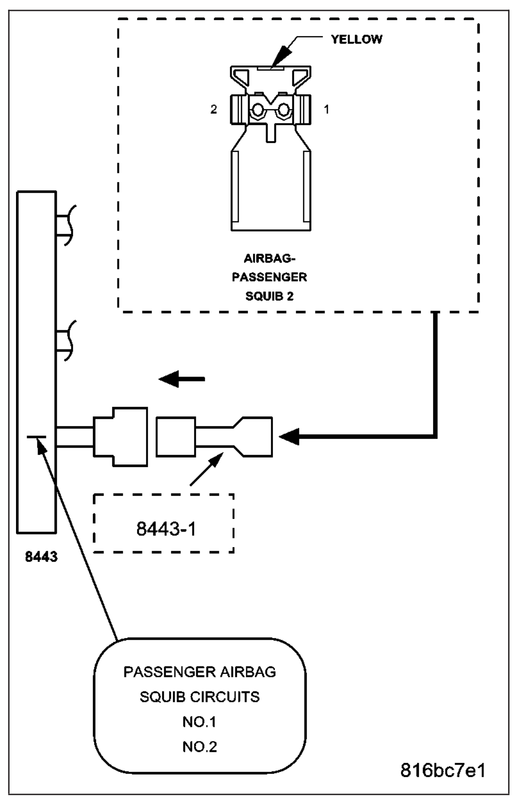
**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

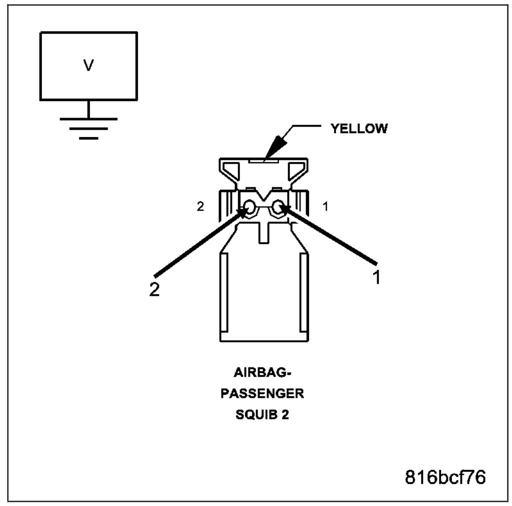



**Does the scan tool display: PASSENGER SQUIB 2 SHORT TO BATTERY?**

**Yes** >> Go To 3

**No** >> Replace the Passenger Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT AND (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT FOR A SHORT TO BATTERY




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the voltage of the (R64) Passenger Squib 2 Line 1 circuit between the Passenger Airbag Squib connector and ground.

Measure the voltage of the (R62) Passenger Squib 2 Line 2 circuit between the Passenger Airbag Squib connector and ground.

**Is there any voltage present on either circuit?**

**Yes** >> Repair the Passenger Squib 2 circuits with voltage present for a short to battery.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

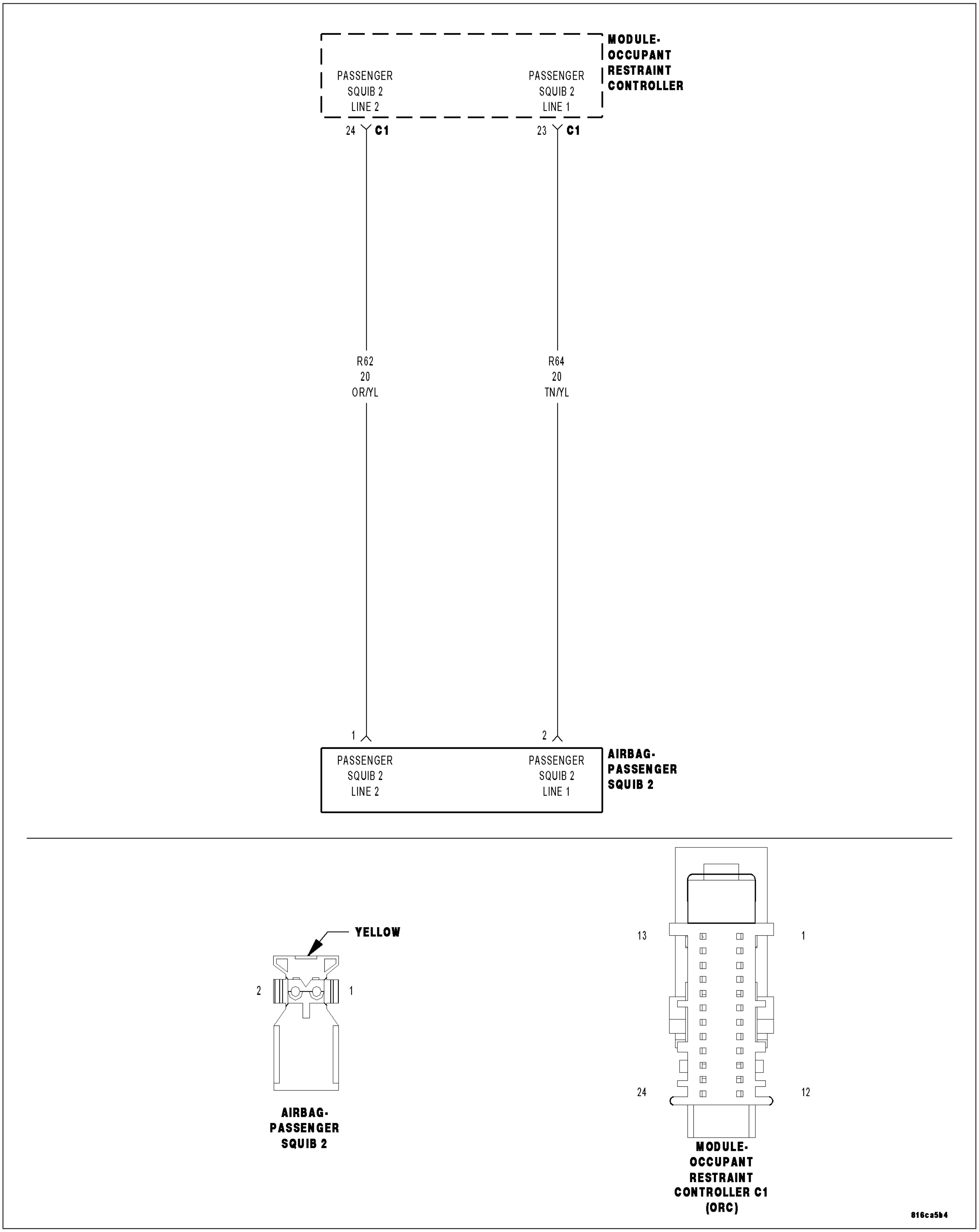
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PASSENGER SQUIB 2 SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Passenger Squib 2 circuits. The ORC will set this DTC if it detects low resistance on the Passenger Squib 2 circuits.

| Possible Causes |
| --- |
| (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT OR (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT SHORTED TO GROUND |
| PASSENGER AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN PASSENGER AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Passenger Airbag Squib connector.

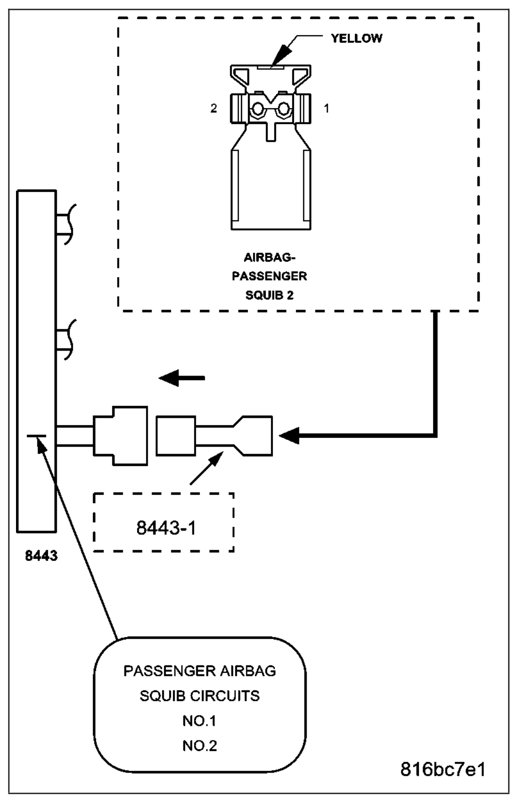
**WARNING: To avoid personal injury or death, do not place an intact undeployed airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool to the Passenger Airbag Squib connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

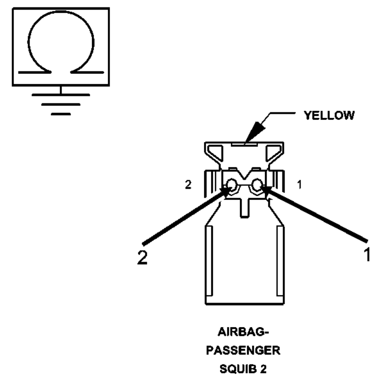



**Does the scan tool display: PASSENGER SQUIB 2 SHORT TO GROUND?**

**Yes** >> Go To 3

**No** >> Replace the Passenger Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK (R64) PASSENGER SQUIB 2 LINE 1 CIRCUIT AND (R62) PASSENGER SQUIB 2 LINE 2 CIRCUIT FOR A SHORT TO GROUND




816bd885

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the 8443 Load Tool from the Passenger Airbag Squib connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the (R64) Passenger Squib 2 Line 1 circuit between ground and the Passenger Airbag Squib connector.

Measure the resistance of the (R62) Passenger Squib 2 Line 2 circuit between ground and the Passenger Airbag Squib connector.

**Is the resistance below 10K ohms on either circuit?**

**Yes** >> Repair the Passenger Squib 2 circuits with a resistance below 10K ohms for a short to ground.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

Wiggle the wiring harness and connectors of the related airbag circuit.

Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PCI BUS SHORT TO BATTERY

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition.
- **Set Condition:**
  If the Occupant Classification Module (OCM) detects a short to voltage on the PCI Bus circuit.

| Possible Causes |
|---|
| PCI BUS CIRCUIT SHORTED TO VOLTAGE |
| OCM |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

Turn the ignition on.

**NOTE: Ensure the battery is fully charged.**

**Select ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 3

### 2. DETERMINE THE CORRECT REPAIR

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Determine the correct repair by verifying if the front passenger seat has a Bladder and Cushion Service Kit as follows:

- If possible, check the vehicle's repair history.
- The Service Kit wiring harness uses tamper resistant material on the harness connector. Inspect for the tamper resistant material on the harness connector.

**Does the seat have a Bladder and Cushion Service Kit?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace the OCM in accordance with the Service Information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC TO SET

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. INSPECT THE RELATED BODY WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC TO SET

Using the wiring diagram/schematic as a guide, inspect the related body wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

**Are any of these conditions present?**

**Yes** >> Repair as necessary in accordance with the Service Information.

**No** >> Go To 5

## 5. TEST FOR AN INTERMITTENT CONDITION

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related circuit.
- If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## PCI BUS SHORT TO GROUND

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition.
- **Set Condition:**
  If the Occupant Classification Module (OCM) detects a short to ground on the PCI Bus circuit.

| Possible Causes |
|---|
| PCI BUS CIRCUIT SHORTED TO GROUND |
| OCM |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure the battery is fully charged.**
Turn the ignition on.

**Select ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 3

### 2. DETERMINE THE CORRECT REPAIR

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**
Determine the correct repair by verifying if the front passenger seat has a Bladder and Cushion Service Kit as follows:

- If possible, check the vehicle's repair history.
- The Service Kit wiring harness uses tamper resistant material on the harness connector. Inspect for the tamper resistant material on the harness connector.

**Does the seat have a Bladder and Cushion Service Kit?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace the OCM in accordance with the Service Information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC TO SET

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. INSPECT THE RELATED BODY WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC TO SET

Using the wiring diagram/schematic as a guide, inspect the related body wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

**Are any of these conditions present?**

**Yes** >> Repair as necessary in accordance with the Service Information.

**No** >> Go To 5

## 5. TEST FOR AN INTERMITTENT CONDITION

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related circuit.
- If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

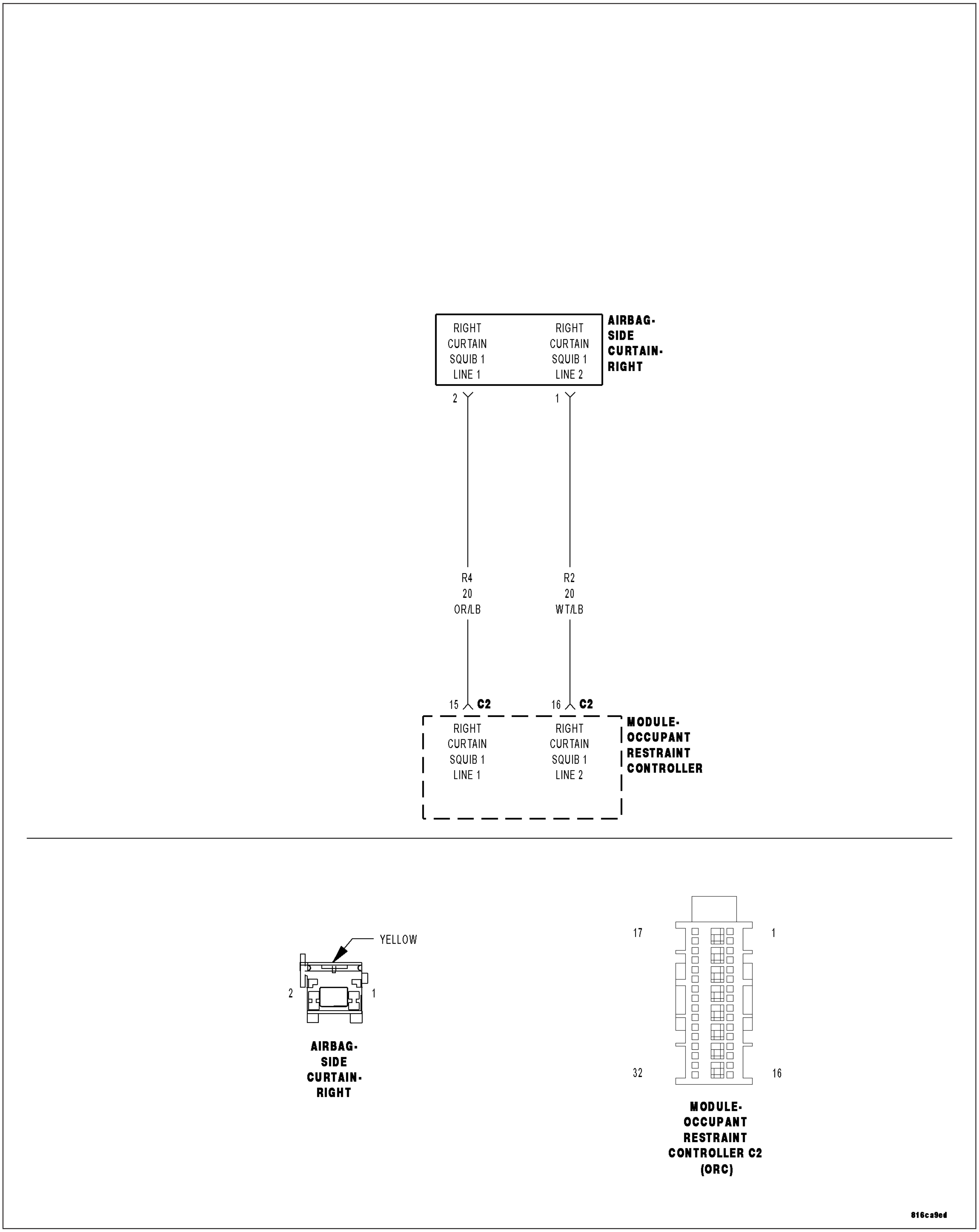
**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## RE-ZERO INCOMPLETE

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the OCS Verification system test is not run to completion after initiating the test.

Refer to **System Verification Required** for the diagnostic procedure.

## RIGHT CURTAIN SQUIB 1 CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Right Curtain Squib 1 circuits. The ORC will set this DTC if it detects an open or high resistance on the Right Curtain Squib 1 circuits.

| Possible Causes |
|---|
| (R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT OPEN |
| (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT OPEN |
| RIGHT SIDE CURTAIN AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

### 2. CHECK FOR OPEN SQUIB CIRCUITS IN RIGHT SIDE CURTAIN AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Right Side Curtain Airbag connector.

**WARNING: To avoid personal injury or death, do not place an intact uncoupled curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Right Side Curtain Airbag connector.

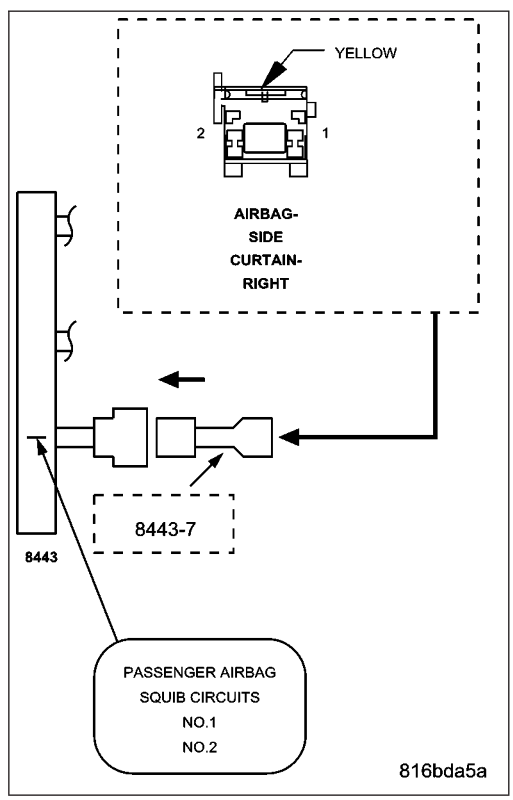
**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.

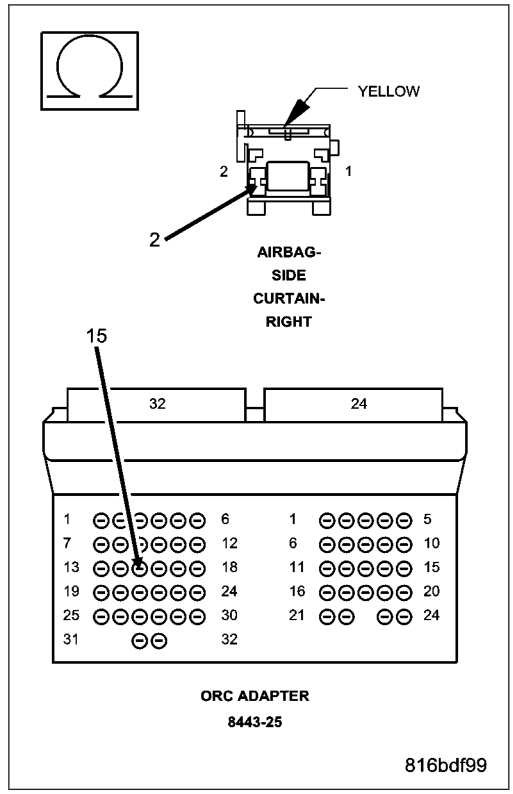
**Does the scan tool display: RIGHT CURTAIN SQUIB 1 CIRCUIT OPEN?**

**Yes** >> Go to 3

**No** >> Replace the Right Side Curtain Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 3. CHECK (R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT FOR AN OPEN




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the 8443 Load Tool and Jumper from the Right Side Curtain Airbag connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the (R4) Right Curtain Squib 1 Line 1 circuit between the Right Side Curtain Airbag connector and the 8443 ORC Adaptor.

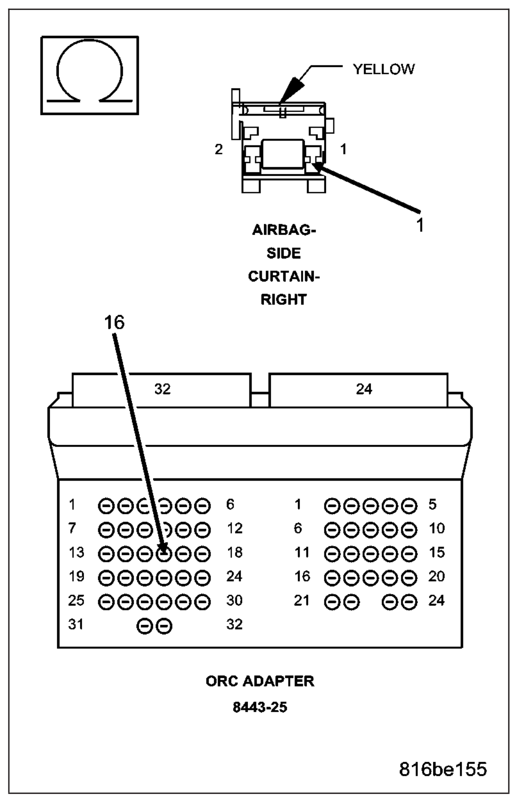
**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 4

**No** >> Repair the (R4) Right Curtain Squib 1 Line 1 circuit for an open.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECK (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT FOR AN OPEN




Measure the resistance of the (R2) Right Curtain Squib 1 Line 2 circuit between the Right Side Curtain Airbag connector and the 8443 ORC Adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Repair the (R2) Right Curtain Squib 1 Line 2 circuit for an open.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

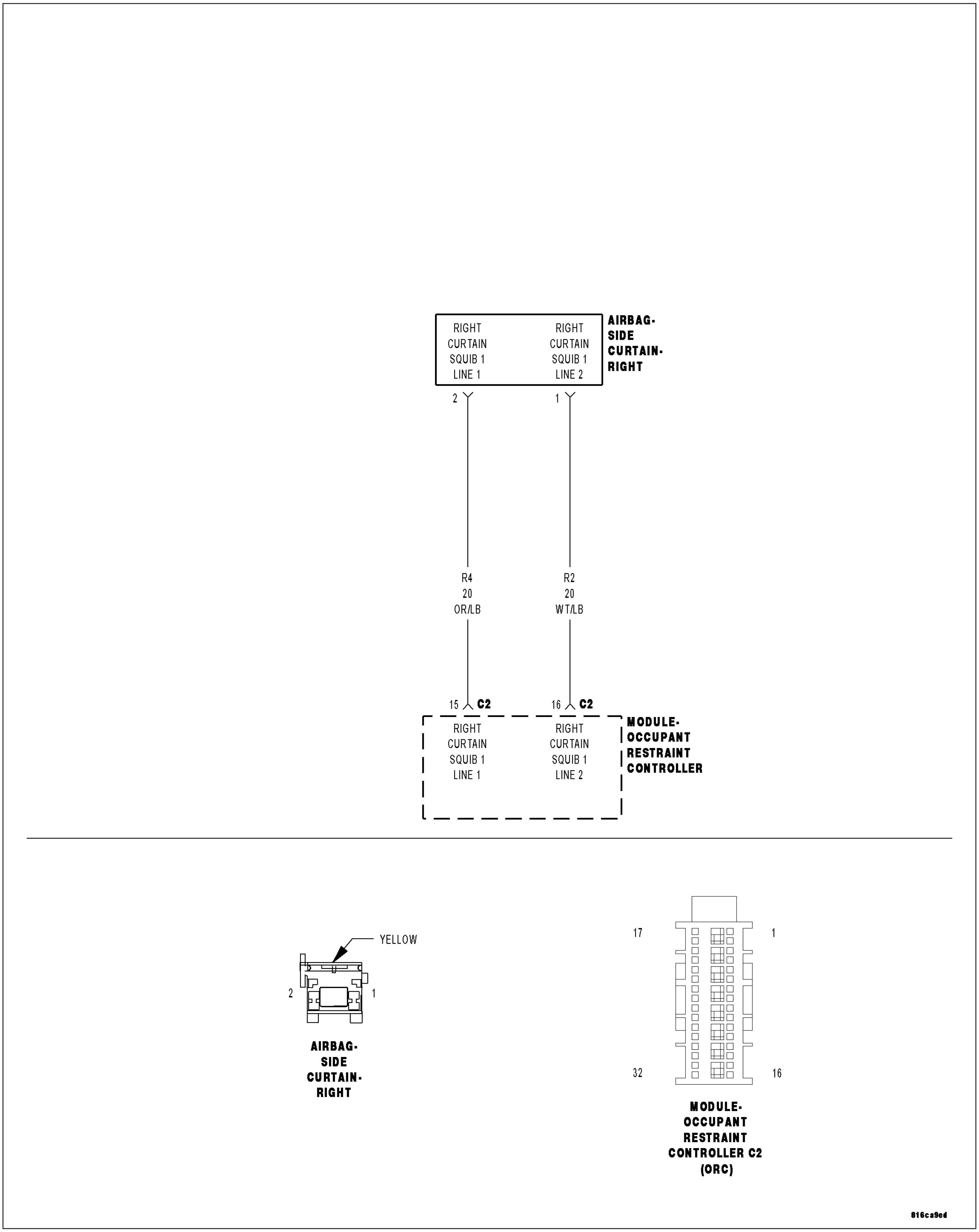
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## RIGHT CURTAIN SQUIB 1 CIRCUIT SHORT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Right Curtain Squib 1 circuits. The ORC will set this DTC if it detects low resistance between the Right Curtain Squib 1 circuits.

| Possible Causes |
|---|
| (R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT SHORTED TO (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT |
| RIGHT SIDE CURTAIN AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN RIGHT SIDE CURTAIN AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Right Side Curtain Airbag connector.

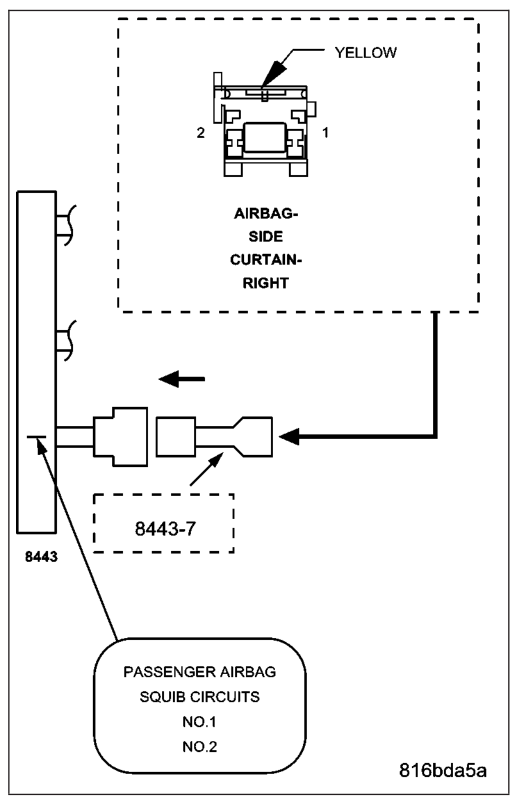
**WARNING: To avoid personal injury or death, do not place an intact uncoupled curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Right Side Curtain Airbag connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, read the active ORC DTCs.




**Does the scan tool display: RIGHT CURTAIN SQUIB 1 CIRCUIT SHORT?**

**Yes** >> Go to 3

**No** >> Replace the Right Side Curtain Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK (R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT FOR A SHORT TO (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

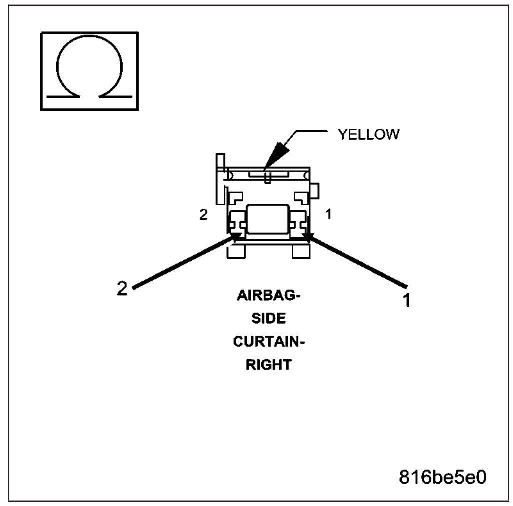
Disconnect the 8443 Load Tool and Jumper from the Right Side Curtain Airbag connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance between the (R4) Right Curtain Squib 1 Line 1 circuit and the (R2) Right Curtain Squib 1 Line 2 circuit at the Right Side Curtain Airbag connector.




**Is the resistance below 10K ohms?**

**Yes** >> Repair the (R4) Right Curtain Squib 1 Line 1 circuit for a short to the (R2) Right Curtain Squib 1 Line 2 circuit.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

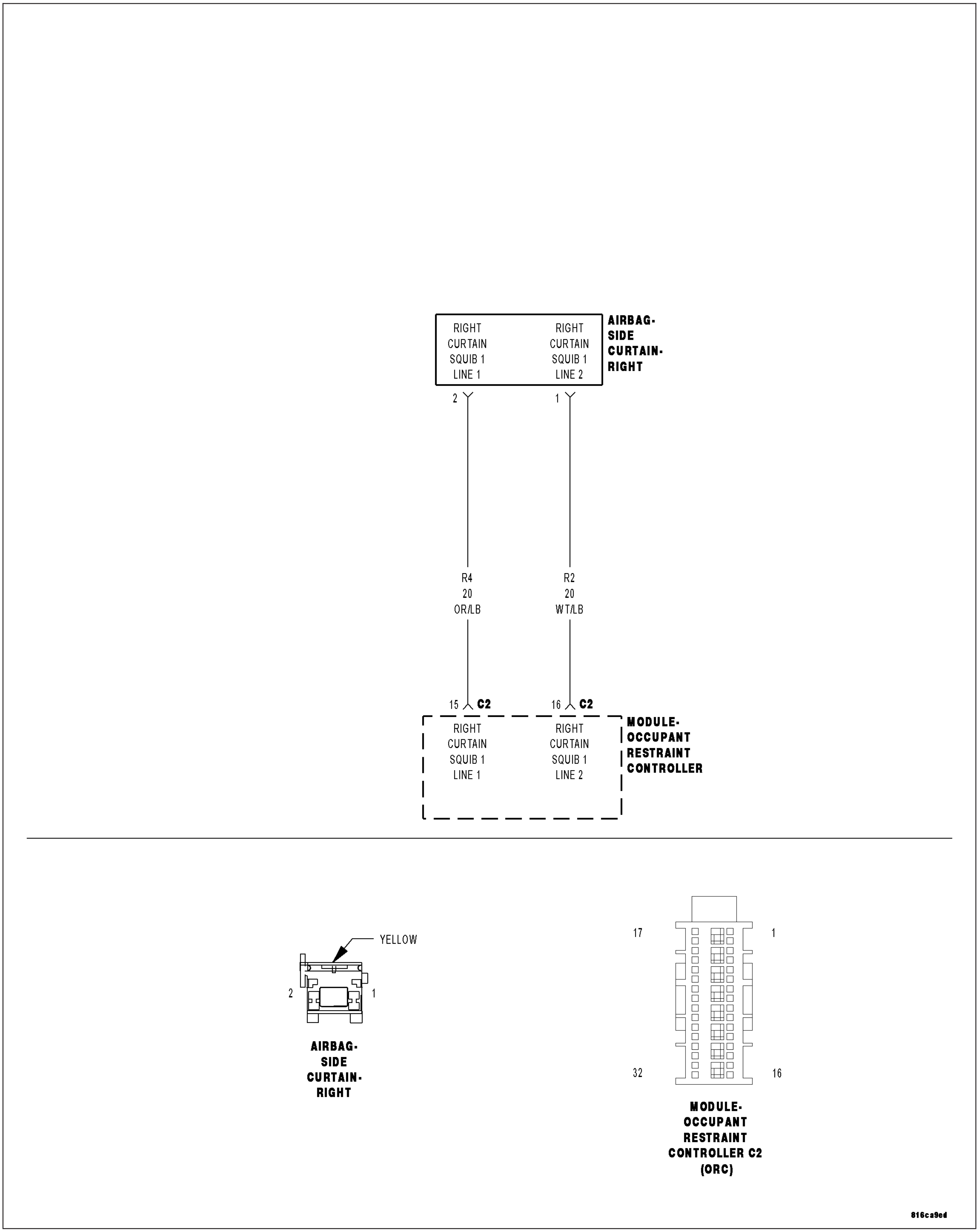
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## RIGHT CURTAIN SQUIB 1 SHORT TO BATTERY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the voltage on the Right Curtain Squib 1 circuits. The ORC will set this DTC if it detects voltage on the Right Curtain Squib 1 circuits.

| Possible Causes |
|---|
| (R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT OR (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT SHORTED TO BATTERY |
| RIGHT SIDE CURTAIN AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**

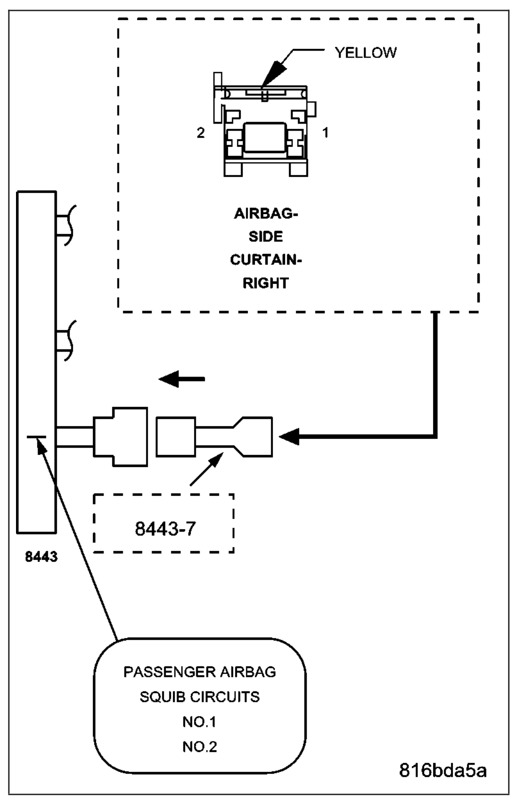
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN RIGHT SIDE CURTAIN AIRBAG




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the Right Side Curtain Airbag connector.

**WARNING: To avoid personal injury or death, do not place an intact uncoupled curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**

Connect the 8443 Load Tool and appropriate Jumper to the Right Side Curtain Airbag connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

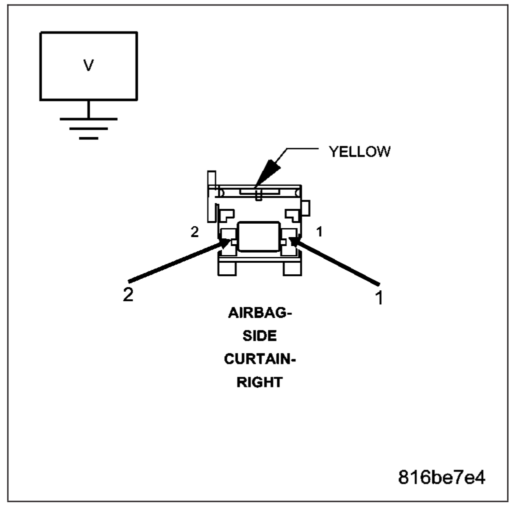
With the scan tool, read the active ORC DTCs.

**Does the scan tool display: RIGHT CURTAIN SQUIB 1 SHORT TO BATTERY?**

**Yes** >> Go To 3

**No** >> Replace the Right Side Curtain Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK (R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT AND (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO BATTERY




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Right Side Curtain Airbag connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the voltage of the (R4) Right Curtain Squib 1 Line 1 circuit between the Right Side Curtain Airbag connector and ground.

Measure the voltage of the (R2) Right Curtain Squib 1 Line 2 circuit between the Right Side Curtain Airbag connector and ground.

**Is there any voltage present on either circuit?**

**Yes** >> Repair the Right Curtain Squib 1 circuits with voltage present for a short to battery.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

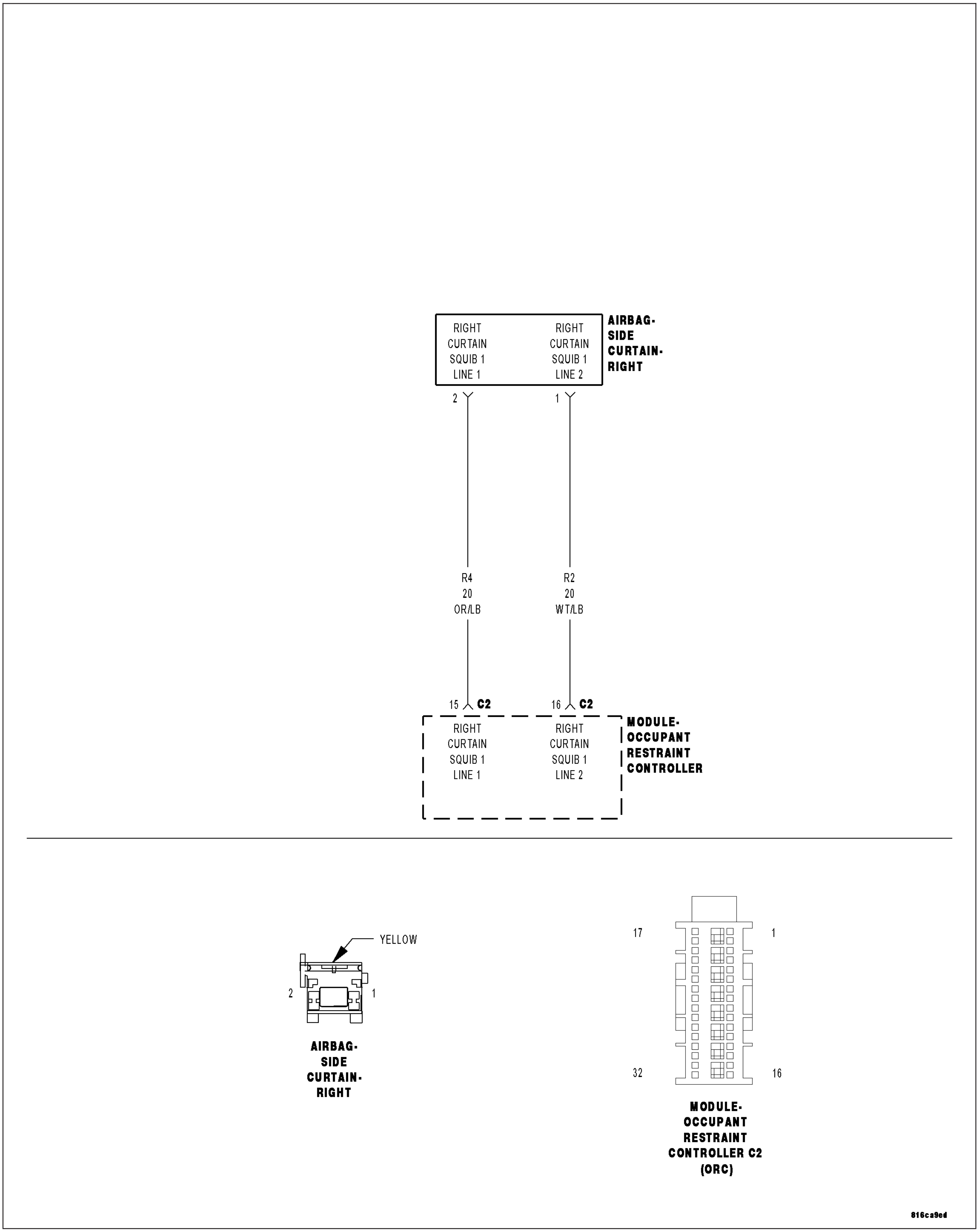
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## RIGHT CURTAIN SQUIB 1 SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance of the Right Curtain Squib 1 circuits. The ORC will set this DTC if it detects low resistance on the Right Curtain Squib 1 circuits.

| Possible Causes |
|---|
| (R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT OR (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT SHORTED TO GROUND |
| RIGHT SIDE CURTAIN AIRBAG |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**

**NOTE: The scan tool, SRS Airbag Load Tool MRL 8443, and DVOM are required to perform the following test.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 4

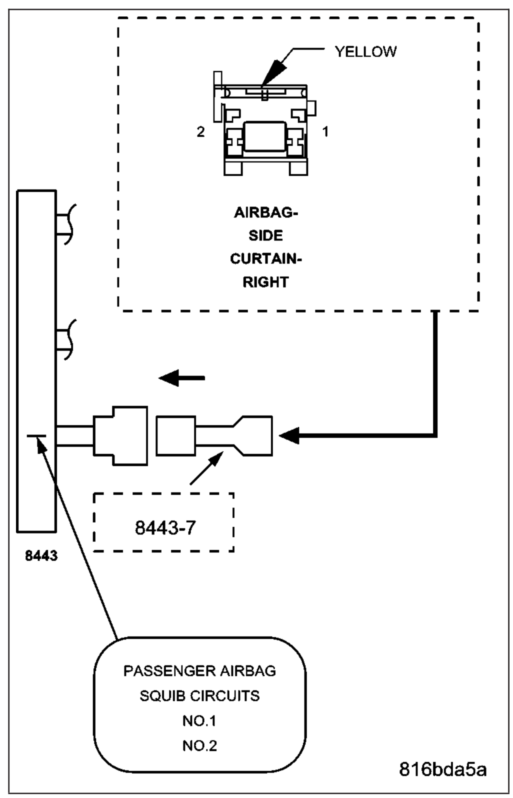
### 2. CHECK FOR SHORTED SQUIB CIRCUITS IN RIGHT SIDE CURTAIN AIRBAG

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Right Side Curtain Airbag connector.

**WARNING: To avoid personal injury or death, do not place an intact undeployed curtain airbag face down on a hard surface, the airbag will propel into the air if accidentally deployed.**

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool and appropriate Jumper to the Right Side Curtain Airbag connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, read the active ORC DTCs.

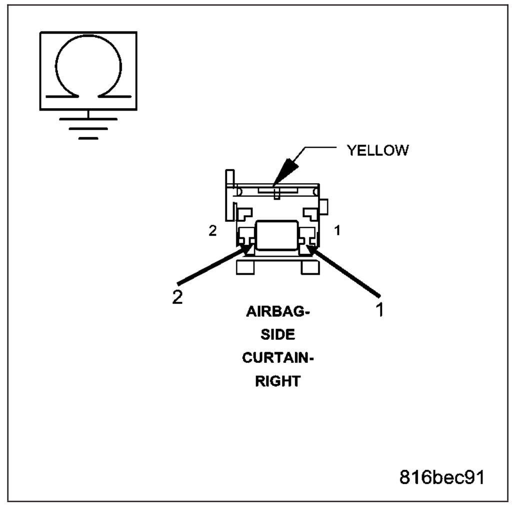



**Does the scan tool display: RIGHT CURTAIN SQUIB 1 SHORT TO GROUND?**

**Yes** >> Go To 3

**No** >> Replace the Right Side Curtain Airbag in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK (R4) RIGHT CURTAIN SQUIB 1 LINE 1 CIRCUIT AND (R2) RIGHT CURTAIN SQUIB 1 LINE 2 CIRCUIT FOR A SHORT TO GROUND




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the 8443 Load Tool and Jumper from the Right Side Curtain Airbag connector.

Disconnect the ORC connectors.

**NOTE: Check connectors - Clean and repair as necessary.**
Connect the 8443 Load Tool ORC Adaptor to the ORC connector.

Measure the resistance of the (R4) Right Curtain Squib 1 Line 1 circuit between ground and the Right Side Curtain Airbag connector.

Measure the resistance of the (R2) Right Curtain Squib 1 Line 2 circuit between ground and the Right Side Curtain Airbag connector.

**Is the resistance below 10K ohms on either circuit?**

**Yes** >> Repair the Right Curtain Squib 1 circuits with a resistance below 10K ohms for a short to ground.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions can result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 4. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## RIGHT FRONT IMPACT SENSOR INTERNAL 1

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) supplies power to and communicates continuously with each impact sensor via each sensor's signal circuit. The power supply also enables each sensor's self-diagnostic capabilities. If an impact sensor detects an internal fault, it sends the applicable Impact Sensor Internal 1 message to the ORC. The ORC will set this DTC if it receives the Right Front Impact Sensor internal 1 message.

| Possible Causes |
|---|
| RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT SHORTED TO RIGHT FRONT IMPACT SENSOR GROUND CIRCUIT |
| RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT OPEN |
| RIGHT FRONT IMPACT SENSOR GROUND CIRCUIT OPEN |
| RIGHT FRONT IMPACT SENSOR |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 8

### 2. CHECK THE RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Occupant Restraint Controller (ORC) connector(s).

Disconnect the Right Front Impact Sensor connector.

**NOTE: Check connectors - Clean and repair as necessary.**

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage of the Right Front Impact Sensor Signal circuit between the Right Front Impact Sensor connector and ground.

**Is there any voltage present?**

**Yes** >> Repair the Right Front Impact Sensor Signal circuit for a short to voltage.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. CHECK THE RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Measure the resistance of the Right Front Impact Sensor Signal circuit between ground and the Right Front Impact Sensor connector.

**Is the resistance below 100k ohms?**

**Yes** >> Repair the Right Front Impact Sensor Signal circuit for a short to ground.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. CHECK THE RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR A SHORT TO THE RIGHT FRONT IMPACT SENSOR GROUND CIRCUIT

Measure the resistance between the Right Front Impact Sensor Signal circuit and the Right Front Impact Sensor Ground circuit at the Right Front Impact Sensor connector.

**Is the resistance below 100k ohms?**

**Yes** >> Repair the Right Front Impact Sensor Signal circuit for a short to the Right Front Impact Sensor Ground circuit.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. CHECK THE RIGHT FRONT IMPACT SENSOR SIGNAL CIRCUIT FOR AN OPEN

Connect the appropriate Load Tool Adaptor to the ORC connector.

Measure the resistance of the Right Front Impact Sensor Signal circuit between the Right Front Impact Sensor connector and the Airbag Load Tool adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 6

**No** >> Repair the Right Front Impact Sensor Signal circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 6. CHECK THE RIGHT FRONT IMPACT SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the Right Front Impact Sensor Ground circuit between the Right Front Impact Sensor connector and the Airbag Load Tool adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 7

**No** >> Repair the Right Front Impact Sensor Ground circuit for an open.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 7. REPLACE THE RIGHT FRONT IMPACT SENSOR AND THEN CHECK FOR ACTIVE DTCs

Replace the Right Front Impact Sensor in accordance with the Service Information.

Remove any special tools or jumper wires and reconnect all previously disconnected components, except the battery.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, erase all DTCs in all Airbag System Modules.

Turn the Ignition off, wait 15 seconds, then turn the Ignition on.

Wait one minute before proceeding.

With the scan tool, read active ORC DTCs.

**Does the scan tool display: RIGHT FRONT IMPACT SENSOR INTERNAL 1?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 8. TEST FOR AN INTERMITTENT CONDITION

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.
- Continue the test until either a code becomes active or the problem area is isolated.

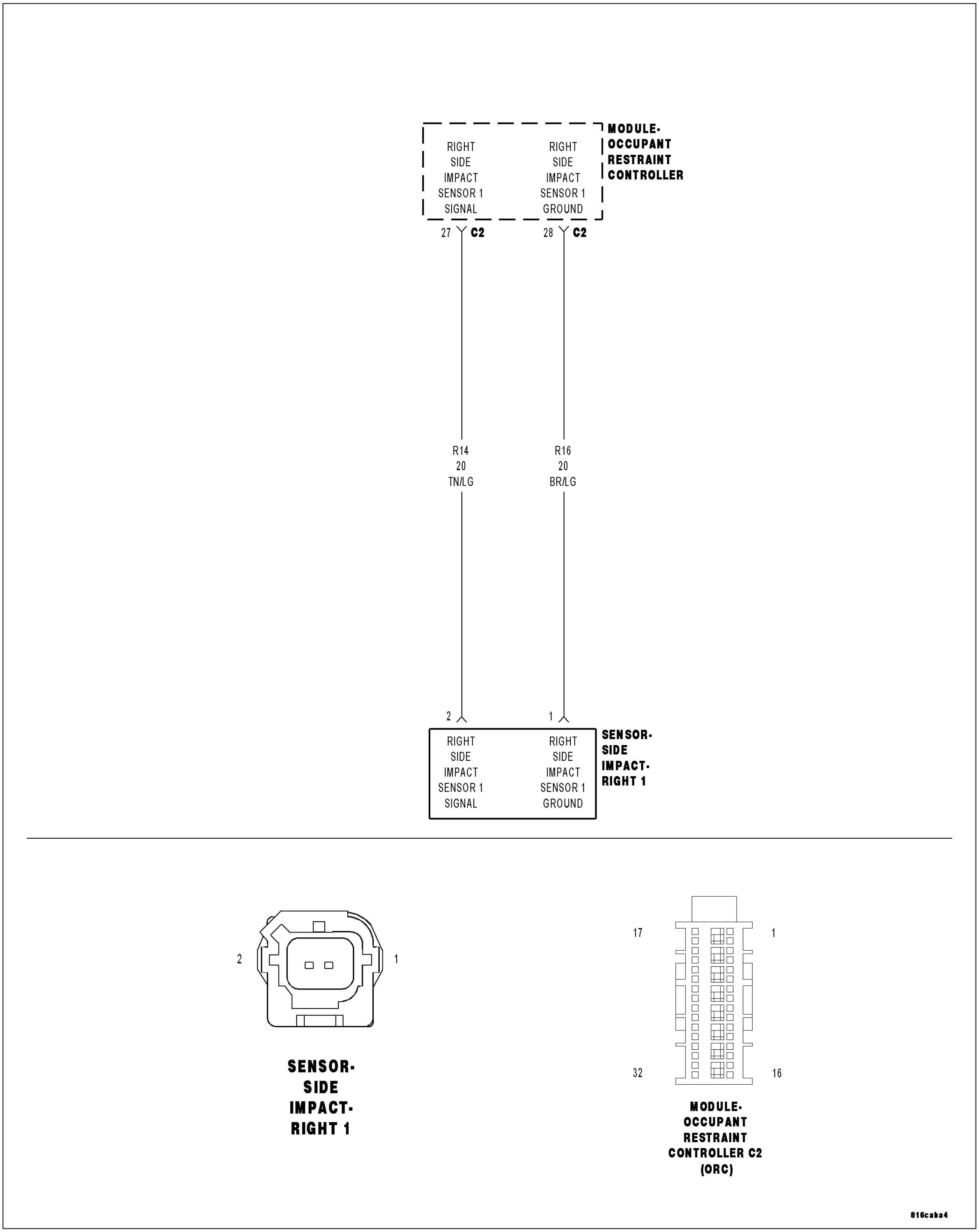
In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## RIGHT SIDE IMPACT SENSOR 1 INTERNAL 1




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) supplies power to and communicates continuously with each impact sensor via each sensor's signal circuit. The power supply also enables each sensor's self-diagnostic capabilities. If an impact sensor detects an internal fault, it sends the applicable Impact Sensor Internal 1 message to the ORC. The ORC will set this DTC if it receives the Right Side Impact Sensor internal 1 message.

| Possible Causes |
|---|
| (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT SHORTED TO BATTERY |
| (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT SHORTED TO GROUND |
| (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT SHORTED TO (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT |
| (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT OPEN |
| (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT OPEN |
| RIGHT SIDE IMPACT SENSOR 1 |
| ORC |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

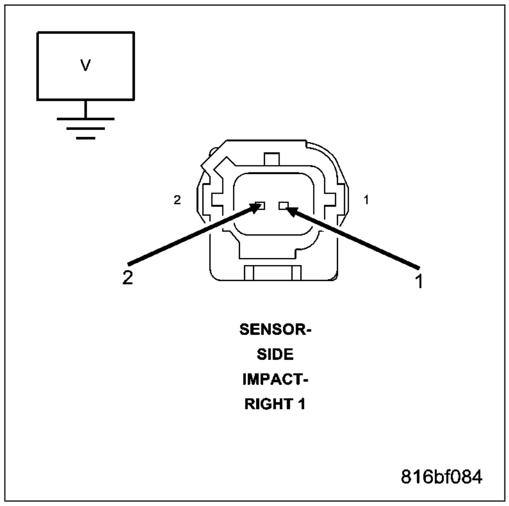
**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 8

### 2. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT AND THE (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR A SHORT TO BATTERY




**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Right side Impact Sensor 1 connector.

Disconnect the ORC connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage of the (R14) Right Side Impact Sensor 1 Signal circuit between the Right Side Impact Sensor 1 connector and ground.

Measure the voltage of the (R16) Right Side Impact Sensor 1 Ground circuit between the Right Side Impact Sensor 1 connector and ground.

**Is there any voltage present on either circuit?**

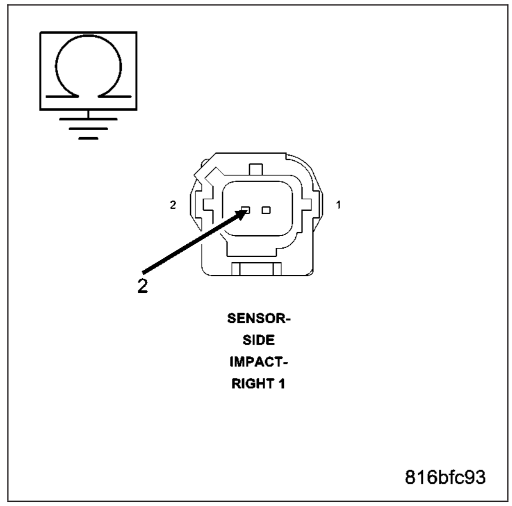
**Yes** >> Repair the circuits with voltage present for a short to battery.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR A SHORT TO GROUND

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Measure the resistance of the (R14) Right Side Impact Sensor 1 Signal circuit between ground and the Right Side Impact Sensor 1 connector.




**Is the resistance below 100K ohms?**

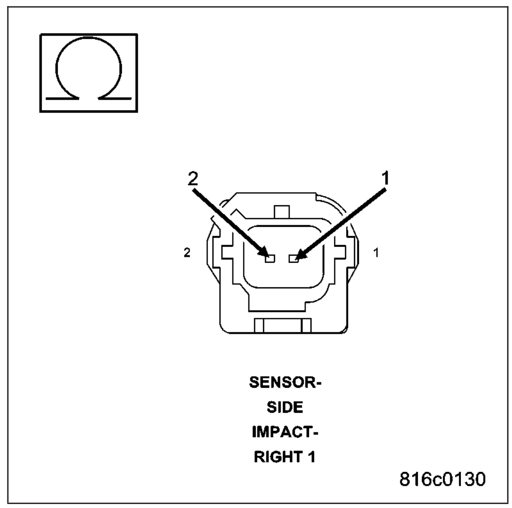
**Yes** >> Repair the (R14) Right Side Impact Sensor 1 Signal circuit for a short to ground.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR A SHORT TO THE (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT

Measure the resistance between the (R14) Right Side Impact Sensor 1 Signal circuit and the (R16) Right Side Impact Sensor 1 Ground circuit at the Right Side Impact Sensor 1 connector.




**Is the resistance below 100K ohms?**

**Yes** >> Repair the (R14) Right Side Impact Sensor 1 Signal circuit for a short to the (R16) Right Side Impact Sensor 1 Ground circuit.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. CHECK THE (R16) RIGHT SIDE IMPACT SENSOR 1 GROUND CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

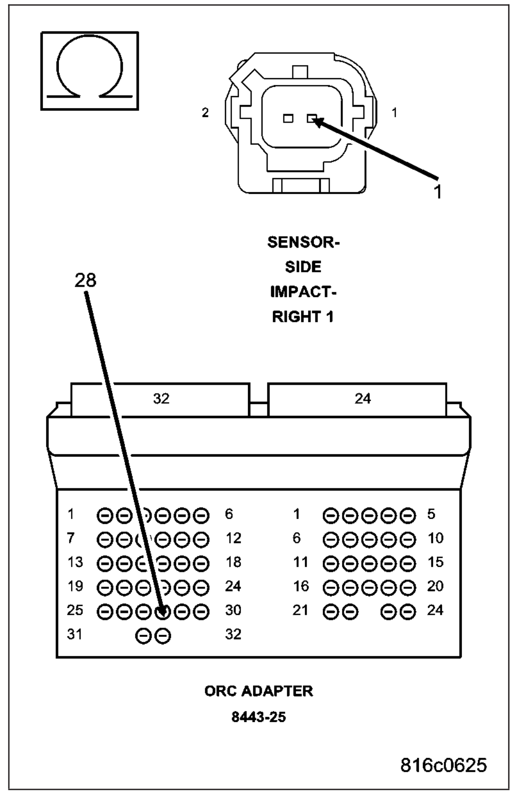
Connect the 8443 Load Tool ORC Adaptor to the Occupant Control Module connector.

Measure the resistance of the (R16) Right Side Impact Sensor 1 Ground circuit between the Right Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 6

**No** >> Repair the (R16) Right Side Impact Sensor 1 Ground circuit for an open or high resistance.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



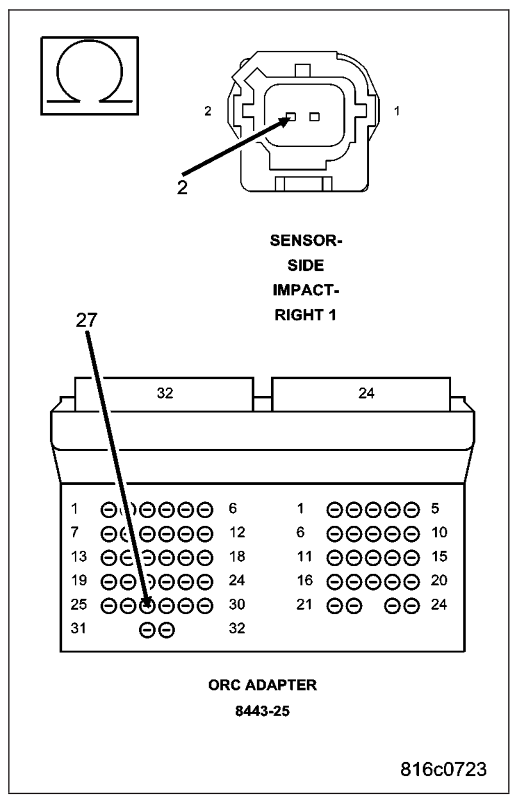

## 6. CHECK THE (R14) RIGHT SIDE IMPACT SENSOR 1 SIGNAL CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

Measure the resistance of the (R14) Right Side Impact Sensor 1 Signal circuit between the Right Side Impact Sensor 1 connector and the 8443 Load Tool ORC Adaptor.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 7

**No** >> Repair the (R14) Right Side Impact Sensor 1 Signal circuit for an open or high resistance.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.



## 7. CHECK THE RIGHT SIDE IMPACT SENSOR 1 OPERATION

Replace the Right Side Impact Sensor 1 in accordance with the Service Information.

Remove any special tools or jumper wires and reconnect all previously disconnected components, except the battery.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, erase all Airbag System Module DTCs.

Turn the Ignition Off, wait 15 seconds, then turn the Ignition On. Wait one minute before proceeding.

With the scan tool, read active ORC DTCs.

**Does the scan tool display: NO RIGHT SIDE IMPACT SENSOR 1 COMMUNICATION?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with Service Instructions.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 8. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related airbag circuit.
- Continue the test until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## SEAT NOT CALIBRATED

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If either the SYSTEM VERIFICATION REQUIRED test failed or if the Occupant Classification Module (OCM) is not calibrated.

Refer to **System Verification Required** for the diagnostic procedure.

## SQUIB CONFIGURATION

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Restraint Controller (ORC) monitors the resistance across its side airbag squib terminals to detect for side airbag squibs in the airbag system. The ORC will set this DTC if it is not configured for side airbags and it detects valid squib circuit resistance across these terminals.

| Possible Causes |
|---|
| POWERTRAIN CONTROL MODULE (PCM) |
| ORC |

### Diagnostic Test

#### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC.**

**Active DTC**
Go To 2

**Stored DTC**
Go To 3

#### 2. CHECK ORC CONFIGURATION

With the scan tool, read the VIN and the ORC part number. Verify that the VIN and the ORC part number match the vehicle.

**Is the correct ORC installed in the vehicle?**

**Yes** >> Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
Perform NGC POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

#### 3. TEST FOR AN INTERMITTENT CONDITION

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**
With the scan tool, record and erase all Airbag System Module DTCs.

**NOTE: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, monitor for active codes while performing the following:

Wiggle the wiring harness and connectors of the related airbag circuit.

If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question.

**Does the scan tool display any active DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## SYSTEM VERIFICATION REQUIRED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Occupant Classification Module (OCM) will set this DTC if either the Occupant Restraint Controller (ORC) broadcasts the airbag deployment message on the Bus, or following a complete seat replacement, or following an OCS Bladder and Cushion Kit installation.

| Possible Causes |
| --- |
| AIRBAG, CURTAIN, OR SEAT BELT TENSIONER DEPLOYED |
| SEAT REPLACED |
| OCS BLADDER AND CUSHION KIT INSTALLED |
| OCM |

### Diagnostic Test

#### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Verify that the scan tool has the latest software update before proceeding with this test.**

**NOTE: Ensure that the battery is fully charged.**

Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 7

#### 2. VERIFY IF AN AIRBAG, CURTAIN, OR SEAT BELT TENSIONER DEPLOYED

Turn the ignition off.

Verify if an airbag, curtain, or seat belt tensioner deployed.

**Has an airbag, curtain, or seat belt tensioner deployed?**

**Yes** >>

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Refer to the Service Information for a list of components that require inspection and replacement following an airbag, curtain, or tensioner deployment. Replace all required (per the Service Information), deployed, and damaged airbag system components in accordance with the service information.

Perform BELT TENSION SENSOR VERIFICATION test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. VERIFY IF OTHER OCS DTCs ARE ACTIVE

Verify if any of the following OCS DTCs are active:

- Passenger Fluid Level Too Low
- OCM Internal 1
- OCM Data Transfer Error
- Passenger Pressure Sensor Open
- Passenger Pressure Sensor Short To Ground
- Passenger Pressure Sensor Short To Battery
- Passenger Pressure Sensor Short Together
- Vehicle Body Style Mismatch
- VIN Mismatch

**Are any of these DTCs active?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in this section for a complete list of Airbag System DTCs. When the repair is complete, Go To 4

**No** >> Go To 4

## 4. PERFORM THE OCS VERIFICATION SYSTEM TEST

**CAUTION: Do not perform this test step unless directed here by the previous test steps.**

**NOTE: The OCS Verification system test requires the use of special tool OCS Seat Weights MRL 9077.**

**NOTE: Verify that the vehicle's interior temperature and the passenger seat temperature are between 12.77°C (55°F) and 35°C (95°F) for at least 30 minutes before proceeding with this test.**

**NOTE: Active DTCs will set in the OCM until the scan tool displays the words The OCS has been Verified.**

Verify that the front passenger seat is empty and the seat belt is retracted.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

With the scan tool in OCM, select System Test and then select Verify OCS.

- Follow the directions displayed on the scan tool.
- Allow 30 seconds for the seat to stabilize after adding or removing weight from the seat before continuing with the test.
- Proceed as follows when the test is complete.

**Select the result:**

**The OCS has been Verified**
The OCS has passed the test and the repair is complete.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**Test Failed - No EOL Calibration**
Go To 5

**Test Failed - K Allow is FF**
Go To 5

**Test Failed - K Empty Count is 0**
Go To 5

**Test Failed - Active DTCs Present**
Correct the condition that caused the failure. Then Go To 6.

**Test Failed - Temperature Out of Range**
Correct the condition that caused the failure. Then, Go To 6.

**Test Failed - Seat Pressure Too High**
Correct the condition that caused the failure. Then, Go To 6.

**Test Failed - Seat Pressure Too Low**
Correct the condition that caused the failure. Then, Go To 6.

**Test Failed - Power Up Time Too Short**

Correct the condition that caused the failure. Then, Go To 6.

**Test Failed - Power Up Time Too Long**

Correct the condition that caused the failure. Then, Go To 6.

**Test Failed - Seat Pressure Not Stable**

Correct the condition that caused the failure. Then, Go To 6.

**Test Failed - Seat is Empty**

Correct the condition that caused the failure. Then, Go To 6.

**Test Failed - Weight Above Threshold**

Correct the condition that caused the failure. Then, Go To 6.

**Test Failed - Weight Below Threshold**

Correct the condition that caused the failure. Then Go To 6.

**Test Failed - Seat Occupied**

Correct the condition that caused the failure. Then, Go To 6.

## 5. REPLACE THE OCS BLADDER AND CUSHION KIT

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

**Repair**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information. Then, perform the System Verification Required test again to remove the DTC that set from making this repair.

## 6. PERFORM THE OCS VERIFICATION SYSTEM TEST AGAIN

With the scan tool in OCS, select System Test and then select OCS Verification.

- Follow the directions displayed on the scan tool.
- Allow 30 seconds for the seat to stabilize after adding or removing weight from the seat before continuing with the test.
- Active DTCs will set in the OCM until the scan tool displays the words “The OCS has been Verified.”
- Proceed as follows when the test is complete.

**Select the result:**

**The OCS has been Verified**

The OCS has passed the test and the repair is complete.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**Test Failed**

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information. Then, perform the System Verification Required test again to remove the DTC that set from making this repair.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 7. ERASE THE STORED DTC AND THEN CHECK IF DTC SETS ACTIVE

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase OCM DTCs.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

Wait one minute before proceeding.

With the scan tool, read active DTCs.

**Does the scan tool display any ACTIVE DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> No problem found at this time. Erase all codes before returning the vehicle to the customer.

## VEHICLE BODY STYLE MISMATCH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  The Powertrain Control Module (PCM) broadcasts the vehicle Body Style message on the Bus. The Occupant Restraint Controller (ORC) monitors the Bus for this message and will set this DTC if it does not receive this message.
  The Occupant Classification Module (OCM) is programmed for a specific body style. Installing a module intended for a different body style (incorrect part number) will set this DTC.

| Possible Causes |
|---|
| POWERTRAIN CONTROL MODULE (PCM) |
| OCCUPANT RESTRAINT CONTROLLER (ORC) |
| OCCUPANT CLASSIFICATION MODULE (OCM) |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**Select ACTIVE or STORED DTC:**

**ACTIVE ORC DTC**
Go To 2

**STORED ORC DTC**
Go To 5

### 2. VERIFY THAT THE PCM IS PROGRAMMED WITH THE CORRECT VIN

With the scan tool, select System Tests and select VIN Verification.

Compare the VIN displayed by the Scan Tool and the VIN on the Vehicle VIN plate.

**Does the current VIN match the VIN on the vehicle VIN plate?**

**Yes** >> Go To 3

**No** >> Replace and program the PCM in accordance with the Service Information.
Perform NGC POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

### 3. VERIFY THAT THE PCM IS BROADCASTING THE CORRECT BODY STYLE

With the scan tool, check for active DTCs in the ORC.

**Does the scan tool display VEHICLE BODY STYLE MISMATCH active DTC?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> 4

## 4. VERIFYING OCM REPLACEMENT PART

With the scan tool, check for active DTCs in the OCM.

**Does the scan tool display VEHICLE BODY STYLE MISMATCH active DTC?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the OCM in accordance with the Service Information.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. CHECKING STORED OR INTERMITTENT CODES

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

Turn the ignition off, wait 15 seconds, then turn the ignition on.

With the scan tool, check for active DTCs in the ORC and OCM.

**Does the scan tool display any DTCs?**

**Yes** >> Select the appropriate diagnostic procedure from the Table of Contents in the applicable section.

**No** >> No problem found at this time. Erase all codes before returning vehicle to customer.

## VIN MISMATCH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Powertrain Control Module (PCM) broadcasts the current VIN on the Bus. The Occupant Classification Module (OCM) will set this DTC if the VIN stored in the OCM does not match the current VIN.

| Possible Causes |
|---|
| PCM COMMUNICATION FAILURE |
| SEAT OR OCS COMPONENTS SERVICED WITH PARTS FROM ANOTHER VEHICLE |
| PCM |
| OCM |

## Diagnostic Test

### 1. DETERMINE ACTIVE OR STORED DTC

**NOTE: Ensure that the battery is fully charged.**
Turn the ignition on.

**SELECT ACTIVE or STORED DTC:**

**ACTIVE DTC**
Go To 2

**STORED DTC**
Go To 5

### 2. VERIFY THAT THE PCM IS PROGRAMMED WITH THE CORRECT VIN

With the scan tool, select System Tests and select VIN Verification.

Compare the current VIN displayed by the Scan Tool and the VIN on the Vehicle VIN plate.

**Does the current VIN match the VIN on the vehicle VIN plate?**

**Yes** >> Go To 3

**No** >> Replace and program the PCM in accordance with the Service Information.
Perform NGC POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

### 3. VERIFY IF EITHER THE FRONT PASSENGER SEAT OR ANY OCS COMPONENTS WERE SWAPPED FROM ANOTHER VEHICLE

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**
Verify if either the front passenger seat or any Occupant Classification System (OCS) components were swapped from another vehicle.

**Were either the front passenger seat or any OCS components swapped from another vehicle?**

**Yes,** >> Installed OCS Components From Another Vehicle

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Either reinstall the original OCS equipment or replace the OCS Bladder and Cushion Kit in accordance with the Service information. Then, perform the System Verification Required test in this section to remove the DTC that set from making this repair.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**Yes,** >> Installed Complete Seat From Another Vehicle

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Perform the Clear VIN Mismatch procedure using the scan tool. Then, perform the System Verification Required test in this section to remove the DTC that set from making this repair.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. DETERMINE THE CORRECT REPAIR

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Determine the correct repair by verifying if the front passenger seat has a Bladder and Cushion Service Kit as follows:

- If possible, check the vehicle's repair history.
- The Service Kit wiring harness uses tamper resistant material on the harness connector. Inspect for the tamper resistant material on the harness connector.

**Does the seat have a Bladder and Cushion Service Kit?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace the OCM in accordance with the Service Information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 5. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC TO SET

**NOTE: Diagnose and repair all active codes before diagnosing stored codes. Refer to the Table of Contents in this Section for a complete list of airbag system diagnostic procedures.**

With the scan tool, record and erase all Airbag System Module DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect the related wiring and connectors for chaffed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 6

## 6. INSPECT THE RELATED BODY WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC TO SET

Using the wiring diagram/schematic as a guide, inspect the related body wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals. Repair as necessary.

**Are any of these conditions present?**

**Yes** >> Repair as necessary in accordance with the Service Information.

**No** >> Go To 7

## 7. TEST FOR AN INTERMITTENT CONDITION

Reconnect all disconnected components and harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

With the scan tool, monitor for active codes while performing the following:

- Wiggle the wiring harness and connectors of the related circuit until either a code becomes active or the problem area is isolated.

In the previous steps you have attempted to recreate the conditions responsible for setting the DTC in question / causing the intermittent condition.

**Are any ACTIVE DTCs present?**

**Yes - ACTIVE**

Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No - STORED**

No problem found at this time. Erase all codes before returning the vehicle to the customer.

## *AIRBAG INDICATOR ON WITHOUT ACTIVE TROUBLE CODES

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| ACTIVE INSTRUMENT CLUSTER (MIC) FAULTS |
| OCCUPANT RESTRAINT CONTROLLER (ORC) |

### Diagnostic Test

#### 1. VERIFY IF THE AIRBAG INDICATOR REQUEST STATUS IS ON OR OFF

**CAUTION: Diagnose and repair all active DTCs before performing this procedure.**

**NOTE: Ensure that the battery is fully charged.**

Turn the ignition on.

With the scan tool in ORC, select Monitor Display and select Warning Lamp Status ORC.

Read the AIRBAG IND REQ BY ACM status.

**Is the status ON?**

**Yes** >>

**WARNING: If the Occupant Restraint Controller (ORC) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the ORC in accordance with the Service Information.

Perform the *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING) for problems related to Instrument Cluster.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

# *AIRBAG SYSTEM VERIFICATION TEST - VER 1

For a complete wiring diagram **Refer to Section 8W**.

## 1. *AIRBAG SYSTEM VERIFICATION TEST - VER 1

1. Remove all special tools and jumper wires and reconnect all previously disconnected components - except the Battery.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

1. If repairs were made to the Occupant Classification System (OCS), perform the Belt Tension Sensor Verification Test in this Section before proceeding.
2. Connect the scan tool to the Data Link Connector - use the most current software available.
3. With the scan tool, erase stored DTCs in all Airbag System Modules.
4. Turn the ignition off, and wait 15 seconds, then turn the ignition on.
5. Wait one minute, and read active DTCs in all Airbag System Modules.
6. Read the stored DTCs in all Airbag System Modules.

**Are any DTCs present or if the original condition still present?**

**Yes** >> Repair is not complete. Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No** >> Repair is complete.

## *BELT TENSION SENSOR / PRESSURE SENSOR FAULTS

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| OCS WIRING CHAFED, PIERCED, PINCHED, OR BROKEN |
| OCS WIRING CONNECTOR TERMINAL(S) BROKEN, BENT, PUSHED OUT, CORRODED, OR CONTAMINATED |
| PASSENGER BLADDER PRESSURE SENSOR POWER, SIGNAL, OR GROUND CIRCUIT OPEN |
| PASSENGER BLADDER PRESSURE SENSOR POWER, SIGNAL, OR GROUND CIRCUIT SHORTED TO VOLTAGE |
| PASSENGER BLADDER PRESSURE SENSOR POWER, SIGNAL, OR GROUND CIRCUIT SHORTED TO GROUND |
| SEAT BELT TENSION SENSOR POWER, SIGNAL, OR GROUND CIRCUIT OPEN |
| SEAT BELT TENSION SENSOR POWER, SIGNAL, OR GROUND CIRCUIT SHORTED TO VOLTAGE |
| SEAT BELT TENSION SENSOR POWER, SIGNAL, OR GROUND CIRCUIT SHORTED TO GROUND |
| BELT TENSION SENSOR |
| PASSENGER SEAT WEIGHT SENSOR |
| OCM |

## Diagnostic Test

### 1. INSPECT THE OCCUPANT CLASSIFICATION SYSTEM (OCS) WIRING AND CONNECTORS FOR CONDITIONS THAT CAUSED THE DTC(s) TO SET

Turn the ignition on.

With the scan tool, record and erase Occupant Classification Module (OCM) DTCs.

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Using the wiring diagram/schematic as a guide, inspect Occupant Classification System (OCS) wiring and connectors for chafed, pierced, pinched, and partially broken wires, and for broken, bent, pushed out, corroded, and contaminated terminals.

**Are any of these conditions present?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

If the condition is present in the OCM / OCM connector terminals / OCM wiring harness / Passenger Seat Weight Sensor, replace the OCS Bladder and Cushion Kit in accordance with the Service information. If the condition is present in the Passenger Belt Tension Sensor / sensor wiring, replace the Front Passenger Seat Belt and Retractor Assembly and the Belt Tension Sensor in accordance with the Service Information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 2

## 2. CHECK FOR ACTIVE OCM DTCs

Reconnect all disconnected OCS harness connectors.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
With the scan tool, select OCM. Wait two minutes before proceeding.

With the scan tool, read active OCM DTCs.

**Does the scan tool display any active Belt Tension Sensor or Pressure Sensor Related DTCs?**

**Yes** >> Record the DTCs displayed by the scan tool for reference in a later step. Then, Go To 3.

**No, But Other DTCs Active**
Select the appropriate diagnostic procedure from the Table of Contents in this section.

**No DTCs Active**
Perform SYSTEM VERIFICATION REQUIRED test.
Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 3. CHECK THE VOLTAGE OF THE PASSENGER BLADDER PRESSURE SENSOR POWER, SIGNAL, AND GROUND CIRCUIT

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Passenger Seat Weight Sensor.

Disconnect the Belt Tension Sensor.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage of the Passenger Bladder Pressure Sensor Power circuit. The voltage should be approximately 4.9 volts.

Measure the voltage of the Passenger Bladder Pressure Sensor Signal circuit. The voltage should be approximately 2.5 volts.

Measure the voltage of the Passenger Bladder Pressure Sensor Ground circuit. The voltage should be 0.0 volts.

**Is the voltage correct on all three circuits?**

**Yes** >> Go To 4

**No** >> Go To 13

## 4. CHECK THE VOLTAGE BETWEEN THE PASSENGER BLADDER PRESSURE SENSOR POWER AND GROUND CIRCUIT

Measure the voltage between the Passenger Bladder Pressure Sensor Power circuit and the Passenger Bladder Pressure Sensor Ground circuit. The voltage should be approximately 4.9 volts.

**Is the voltage correct?**

**Yes** >> Go To 5

**No** >> Go To 24

## 5. CHECK THE VOLTAGE OF THE SEAT BELT TENSION SENSOR POWER, SIGNAL, AND GROUND CIRCUIT

Measure the voltage of the Seat Belt Tension Sensor Power circuit. The voltage should be approximately 4.9 volts.

Measure the voltage of the Seat Belt Tension Sensor Signal circuit. The voltage should be approximately 2.5 volts.

Measure the voltage of the Seat Belt Tension Sensor Ground circuit. The voltage should be 0.0 volts.

**Is the voltage correct on all three circuits?**

**Yes** >> Go To 6

**No** >> Go To 13

## 6. CHECK THE VOLTAGE BETWEEN THE SEAT BELT TENSION SENSOR POWER AND GROUND CIRCUIT

Measure the voltage between the Seat Belt Tension Sensor Power circuit and the Seat Belt Tension Sensor Ground circuit. The voltage should be approximately 4.9 volts.

**Is the voltage correct?**

**Yes** >> Go To 7

**No** >> Go To 25

## 7. CHECK THE VOLTAGE OF THE PASSENGER BLADDER PRESSURE SENSOR POWER, SIGNAL, AND GROUND CIRCUIT WITH THE BELT TENSION SENSOR CONNECTED

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Connect the Belt Tension Sensor.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage of the Passenger Bladder Pressure Sensor Power circuit. The voltage should be approximately 4.9 volts.

Measure the voltage of the Passenger Bladder Pressure Sensor Signal circuit. The voltage should be approximately 2.5 volts.

Measure the voltage of the Passenger Bladder Pressure Sensor Ground circuit. The voltage should be 0.0 volts.

**Is the voltage correct on all three circuits?**

**Yes** >> Go To 8

**No** >>

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Replace the Front Passenger Seat Belt and Retractor Assembly and the Belt Tension Sensor in accordance with the Service Information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 8. CHECK THE VOLTAGE OF THE SEAT BELT TENSION SENSOR POWER, SIGNAL, AND GROUND CIRCUIT WITH THE PASSENGER SEAT WEIGHT SENSOR CONNECTED

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**
Disconnect the Belt Tension Sensor.

Connect the Passenger Seat Weight Sensor.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**
Measure the voltage of the Seat Belt Tension Sensor Power circuit. The voltage should be approximately 4.9 volts.

Measure the voltage of the Seat Belt Tension Sensor Signal circuit. The voltage should be approximately 2.5 volts.

Measure the voltage of the Seat Belt Tension Sensor Ground circuit. The voltage should be 0.0 volts.

**Is the voltage correct on all three circuits?**

**Yes** >> Go To 9

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 9. CHECK FOR AN OPEN PASSENGER SEAT WEIGHT SENSOR

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the OCM harness connector.

Measure the resistance between the Passenger Bladder Pressure Sensor Power circuit and the Passenger Bladder Pressure Sensor Ground circuit in the OCM harness connector.

**NOTE: Verify that the DVOM is connected with the positive lead to the Power circuit and the negative lead to the Ground circuit.**

**Is the resistance approximately 3.25k ohms?**

**Yes** >> Go To 10

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 10. CHECK FOR AN OPEN PASSENGER SEAT WEIGHT SENSOR

Measure the resistance between the Passenger Bladder Pressure Sensor Signal circuit and the Passenger Bladder Pressure Sensor Ground circuit in the OCM harness connector.

**NOTE: Verify that the DVOM is connected with the positive lead to the Signal circuit and the negative lead to the Ground circuit.**

**Is the resistance approximately 106k ohms?**

**Yes** >> Go To 11

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 11. CHECK FOR AN OPEN SEAT BELT TENSION SENSOR

Connect the Belt Tension Sensor.

Measure the resistance between the Seat Belt Tension Sensor Power circuit and the Seat Belt Tension Sensor Ground circuit in the OCM harness connector.

**NOTE: Verify that the DVOM is connected with the positive lead to the Power circuit and the negative lead to the Ground circuit.**

**Is the resistance approximately 7.5k ohms?**

**Yes** >> Go To 12

**No** >> Replace the Front Passenger Seat Belt and Retractor Assembly and the Belt Tension Sensor in accordance with the Service Information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 12. CHECK FOR AN OPEN SEAT BELT TENSION SENSOR

Measure the resistance between the Seat Belt Tension Sensor Signal circuit and the Seat Belt Tension Sensor Ground circuit in the OCM harness connector.

**NOTE: Verify that the DVOM is connected with the positive lead to the Signal circuit and the negative lead to the Ground circuit.**

**Is the resistance approximately 19.5m ohms?**

**Yes** >> Go To 26

**No** >> Replace the Front Passenger Seat Belt and Retractor Assembly and the Belt Tension Sensor in accordance with the Service Information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 13. CHECK THE PASSENGER BLADDER PRESSURE SENSOR AND THE SEAT BELT TENSION SENSOR POWER, SIGNAL, AND GROUND CIRCUIT FOR A SHORT TO VOLTAGE

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the OCM harness connector.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

Measure the voltage of the Passenger Bladder Pressure Sensor Power circuit.

Measure the voltage of the Passenger Bladder Pressure Sensor Signal circuit.

Measure the voltage of the Passenger Bladder Pressure Sensor Ground circuit.

Measure the voltage of the Seat Belt Tension Sensor Power circuit.

Measure the voltage of the Seat Belt Tension Sensor Signal circuit.

Measure the voltage of the Seat Belt Tension Sensor Ground circuit.

**Is there any voltage present on any of the circuits?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 14

## 14. CHECK THE PASSENGER BLADDER PRESSURE SENSOR POWER CIRCUIT FOR AN OPEN

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Measure the resistance of the Passenger Bladder Pressure Sensor Power circuit between the OCM connector and the Passenger Seat Weight Sensor connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 15

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 15. CHECK THE PASSENGER BLADDER PRESSURE SENSOR SIGNAL CIRCUIT FOR AN OPEN

Measure the resistance of the Passenger Bladder Pressure Sensor Signal circuit between the OCM connector and the Passenger Seat Weight Sensor connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 16

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 16. CHECK THE SEAT BELT TENSION SENSOR POWER CIRCUIT FOR AN OPEN

Measure the resistance of the Seat Belt Tension Sensor Power circuit between the OCM connector and the Belt Tension Sensor connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 17

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 17. CHECK THE SEAT BELT TENSION SENSOR SIGNAL CIRCUIT FOR AN OPEN

Measure the resistance of the Seat Belt Tension Sensor Signal circuit between the OCM connector and the Belt Tension Sensor connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 18

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 18. CHECK THE PASSENGER BLADDER PRESSURE SENSOR AND THE SEAT BELT TENSION SENSOR POWER, SIGNAL, AND GROUND CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the Passenger Bladder Pressure Sensor Power circuit.

Measure the resistance between ground and the Passenger Bladder Pressure Sensor Signal circuit.

Measure the resistance between ground and the Passenger Bladder Pressure Sensor Ground circuit.

Measure the resistance between ground and the Seat Belt Tension Sensor Power circuit.

Measure the resistance between ground and the Seat Belt Tension Sensor Signal circuit.

Measure the resistance between ground and the Seat Belt Tension Sensor Ground circuit.

**Is the resistance below 10k ohms on any of the circuits?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 19

## 19. CHECK THE PASSENGER BLADDER PRESSURE SENSOR POWER CIRCUIT FOR A SHORT TO THE OTHER SENSOR CIRCUITS

Measure the resistance between the Passenger Bladder Pressure Sensor Power circuit and the Passenger Bladder Pressure Sensor Signal circuit.

Measure the resistance between the Passenger Bladder Pressure Sensor Power circuit and the Passenger Bladder Pressure Sensor Ground circuit.

Measure the resistance between the Passenger Bladder Pressure Sensor Power circuit and the Seat Belt Tension Sensor Power circuit.

Measure the resistance between the Passenger Bladder Pressure Sensor Power circuit and the Seat Belt Tension Sensor Signal circuit.

Measure the resistance between the Passenger Bladder Pressure Sensor Power circuit and the Seat Belt Tension Sensor Ground circuit.

**Is the resistance below 10k ohms on any of the circuits?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 20

## 20. CHECK THE PASSENGER BLADDER PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO THE OTHER SENSOR CIRCUITS

Measure the resistance between the Passenger Bladder Pressure Sensor Signal circuit and the Passenger Bladder Pressure Sensor Ground circuit.

Measure the resistance between the Passenger Bladder Pressure Sensor Signal circuit and the Seat Belt Tension Sensor Power circuit.

Measure the resistance between the Passenger Bladder Pressure Sensor Signal circuit and the Seat Belt Tension Sensor Signal circuit.

Measure the resistance between the Passenger Bladder Pressure Sensor Signal circuit and the Seat Belt Tension Sensor Ground circuit.

**Is the resistance below 10k ohms on any of the circuits?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 21

## 21. CHECK THE PASSENGER BLADDER PRESSURE SENSOR GROUND CIRCUIT FOR A SHORT TO THE OTHER SENSOR CIRCUITS

Measure the resistance between the Passenger Bladder Pressure Sensor Ground circuit and the Seat Belt Tension Sensor Power circuit.

Measure the resistance between the Passenger Bladder Pressure Sensor Ground circuit and the Seat Belt Tension Sensor Signal circuit.

Measure the resistance between the Passenger Bladder Pressure Sensor Ground circuit and the Seat Belt Tension Sensor Ground circuit.

**Is the resistance below 10k ohms on any of the circuits?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 22

## 22. CHECK THE SEAT BELT TENSION SENSOR POWER CIRCUIT FOR A SHORT TO THE OTHER SENSOR CIRCUITS

Measure the resistance between the Seat Belt Tension Sensor Power circuit and the Seat Belt Tension Sensor Signal circuit.

Measure the resistance between the Seat Belt Tension Sensor Power circuit and the Seat Belt Tension Sensor Ground circuit.

**Is the resistance below 10k ohms on any of the circuits?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 23

## 23. CHECK THE SEAT BELT TENSION SENSOR SIGNAL CIRCUIT FOR A SHORT TO THE SEAT BELT TENSION SENSOR GROUND CIRCUIT

Measure the resistance between the Seat Belt Tension Sensor Signal circuit and the Seat Belt Tension Sensor Ground circuit.

**Is the resistance below 10k ohms?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Go To 26

## 24. CHECK FOR AN OPEN PASSENGER BLADDER PRESSURE SENSOR GROUND CIRCUIT

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the OCM harness connector.

Measure the resistance of the Passenger Bladder Pressure Sensor Ground circuit between the Passenger Seat Weight Sensor harness connector and the OCM harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 26

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 25. CHECK FOR AN OPEN SEAT BELT TENSION SENSOR GROUND CIRCUIT

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

Disconnect the OCM harness connector.

Measure the resistance of the Seat Belt Tension Sensor Ground circuit between the Belt Tension Sensor harness connector and the OCM harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 26

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Replace the OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

## 26. DETERMINE THE CORRECT REPAIR

**NOTE: The Occupant Classification Module (OCM) and the Passenger Seat Bladder and Cushion Kit are the only serviceable OCS components.**

Determine the correct repair by verifying if the front passenger seat has a Bladder and Cushion Service Kit as follows:

- If possible, check the vehicle's repair history.
- The Service Kit wiring harness uses tamper resistant material on the harness connector. Inspect for the tamper resistant material on the harness connector.

**Does the seat have a Bladder and Cushion Service Kit?**

**Yes** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace OCS Bladder and Cushion Kit in accordance with the Service information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >>

**WARNING: If the Occupant Classification Module (OCM) is dropped at any time, it must be replaced. Failure to take the proper precautions could result in accidental airbag deployment and personal injury or death.**

**WARNING: To avoid personal injury or death, turn the ignition off, disconnect the battery and wait two minutes before proceeding.**

**NOTE: The Bladder and Cushion Kit are calibrated as an assembly. Do not disconnect the Bladder from the Cushion Kit. Service only as an assembly.**

Replace the OCM in accordance with the Service Information.

Perform SYSTEM VERIFICATION REQUIRED test.

Perform *AIRBAG SYSTEM VERIFICATION TEST - VER 1.

# *BELT TENSION SENSOR VERIFICATION TEST

For a complete wiring diagram **Refer to Section 8W**.

## Diagnostic Test

### 1. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH NO LOAD APPLIED TO THE SENSOR

**NOTE: Ensure that the battery is fully charged.**

Remove any special tools or jumper wires and reconnect all previously disconnected components.

**WARNING: To avoid personal injury or death, turn the ignition on, then reconnect the battery.**

Verify that the passenger seat belt is unbuckled and that there is no load on the passenger seat belt and retractor assembly.

With the scan tool in OCM, select Sensor Display and select Passenger Belt Tension Sensor Output.

Read the Passenger Belt Tension Sensor Output on the scan tool display.

**Is the Passenger BTS Output between 39 and 69?**

**Yes** >> Go To 2

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.

Perform BELT TENSION SENSOR VERIFICATION TEST.

### 2. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH A LOAD APPLIED TO THE SENSOR

Apply 11 kg (24 lbs) to 12 kg (26 lbs) of pressure to the Passenger Belt Tension Sensor using the spring scale Miller special tool 8828 as follows:

- Connect the hook at the bottom of the spring scale through the Passenger Belt Tension Sensor webbing loop so that the end of the hook faces the passenger seat.
- Place the maximum reading indicator at the bottom of the spring scale.
- Grab the horizontal bar at the top of the spring scale. Pull the spring scale straight upward keeping the horizontal bar level with the door sill and the spring scale in-line with the Passenger Belt Tension Sensor.
- Apply and hold 11 kg (24 lbs) to 12 kg (26 lbs) of pressure on the sensor while an assistant monitors the Passenger Belt Tension Sensor Output on the scan tool display.

**Is the Passenger BTS Output between 153 and 204 with 11 kg (24 lbs) to 12 kg (26 lbs) of pressure applied to the sensor?**

**Yes** >> Maintain the 11 kg (24 lbs) to 12 kg (26 lbs) of pressure on the Passenger Belt Tension Sensor and Go To 3

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.

Perform BELT TENSION SENSOR VERIFICATION TEST.

### 3. CHECK THE PASSENGER BELT TENSION SENSOR OUTPUT WITH THE LOAD RELEASED

Release the pressure applied with the spring scale while monitoring the Passenger Belt Tension Sensor Output on the scan tool display. Make sure that there is no load applied to the sensor. The output must return to between 39 and 69 within 20 seconds of releasing the load.

**Does the Passenger BTS Output return to between 39 and 69 within 20 seconds of releasing the load?**

**Yes** >> Perform AIRBAG SYSTEM VERIFICATION TEST - VER 1.

**No** >> Replace the Front Passenger Seat Belt Retractor and Passenger Belt Tension Sensor Assembly in accordance with the Service Information.

Perform BELT TENSION SENSOR VERIFICATION TEST.

# RESTRAINTS - SERVICE INFORMATION

## TABLE OF CONTENTS

# RESTRAINTS - SERVICE INFORMATION

## DESCRIPTION

An occupant restraint system is standard factory-installed safety equipment on this model. Available occupant restraints for this model include both active and passive types. Active restraints are those which require the vehicle occupants to take some action to employ, such as fastening a seat belt; while passive restraints require no action by the vehicle occupants to be employed.

### ACTIVE RESTRAINTS

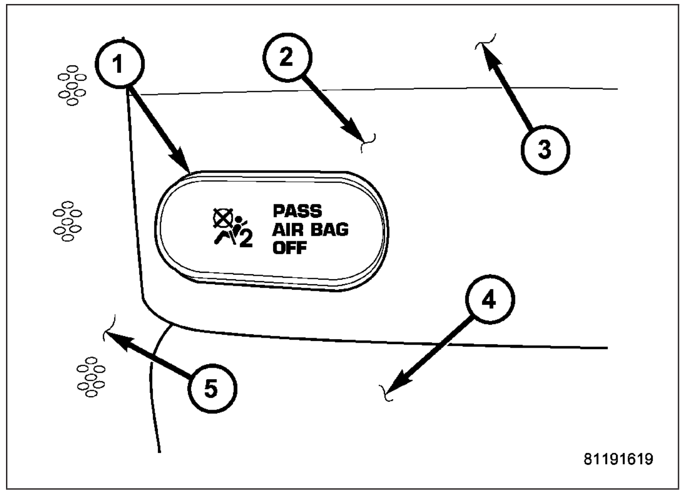
The active restraints for this model include:

- **Front Seat Belts** - Both front seating positions are equipped with three-point seat belt systems employing lower B-pillar mounted inertia latch-type emergency locking retractors, height-adjustable upper B-pillar mounted turning loops, a traveling lower seat belt anchor secured to the outboard side of the seat frame, and a traveling end-release seat belt buckle secured to the inboard side of the seat frame. The driver side front seat belt buckle includes an integral Hall-effect seat belt switch that detects whether the driver side front seat belt has been fastened.
- **Rear Seat Belts** - All three rear seating positions are equipped with three-point seat belt systems. The outboard seating position belts employ lower C-pillar mounted inertia latch-type emergency locking retractors, fixed position upper C-pillar mounted turning loops, self-cinching latch plates for compatibility with child seats, and fixed lower seat belt anchors secured to the floor panel. The rear seat center seating position belt has an inertia latch-type emergency locking retractor that is integral to the rear seat back panel, and a cable from the seat back latch locks the center belt retractor spool unless the seat back is fully latched. The rear seat center seating position belt lower anchor is secured to the floor panel. All three rear seat belts have fixed end-release seat belt buckles secured to the floor panel, a single buckle unit on the right side and a double buckle unit on the left side.
- **Child Restraint Anchors** - All vehicles are equipped with three, fixed-position, child seat upper tether anchors for the rear seat. Two anchors are integral to the back of the right rear seat back panel, and one is integral to the left rear seat back panel. Two lower anchors are also provided for each outboard rear seating position. These lower anchors are accessed from the front of the rear seat where the seat back meets the seat cushion. Two lower anchors are integral to the right rear seat back panel, and two are integral to the left rear seat back panel.

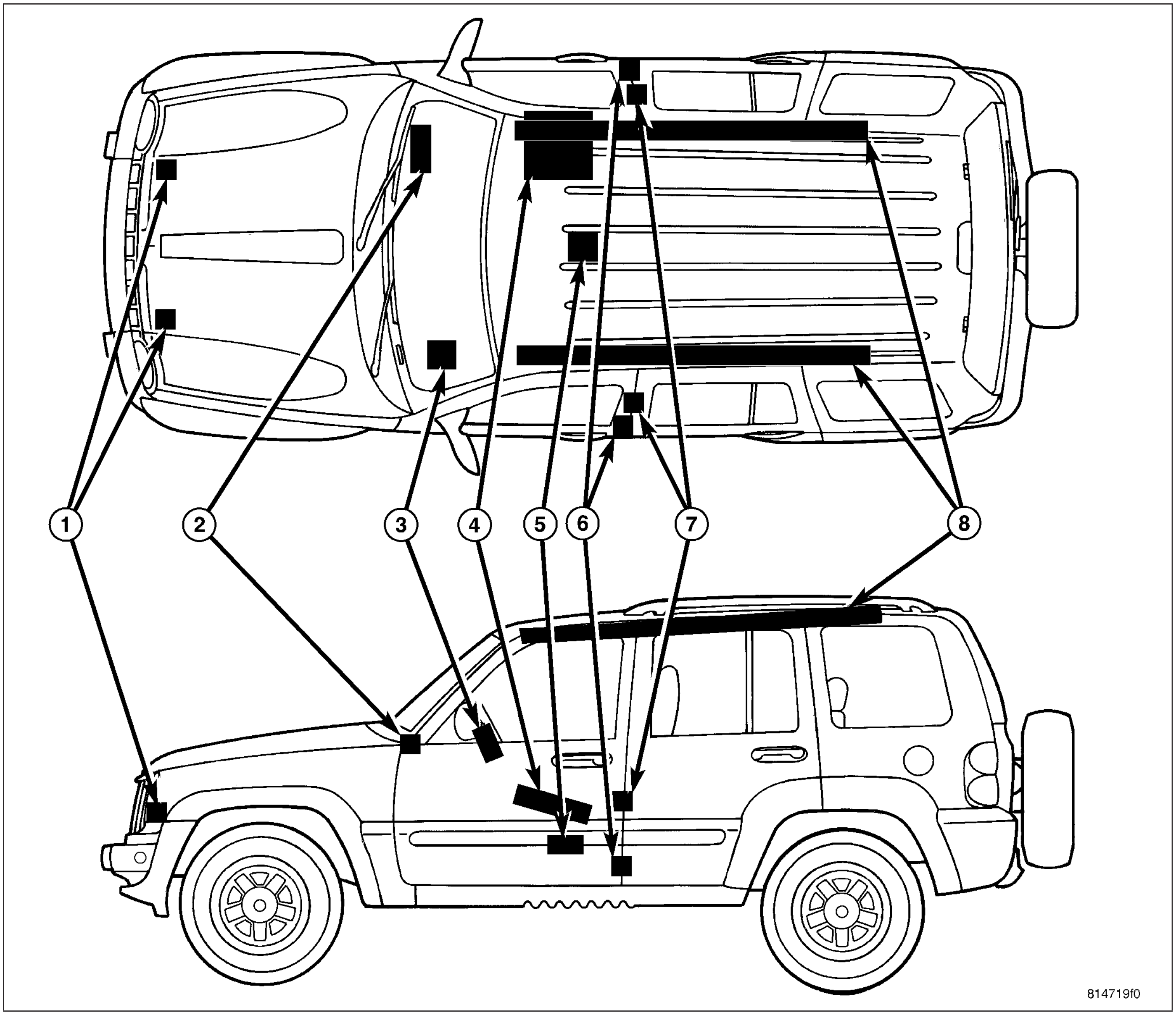
### PASSIVE RESTRAINTS

The passive restraints available for this model include the following:

8098029e




- **Dual Front Airbags** - Multistage driver and front passenger airbags are available for this model. This airbag system is a passive, inflatable, Supplemental Restraint System (SRS) and vehicles with this equipment can be readily identified by the “SRS - AIRBAG” logo molded into the driver airbag trim cover in the center of the steering wheel and also into the passenger airbag door on the instrument panel above the glove box. Vehicles with the airbag system can also be identified by the airbag indicator, which will illuminate in the ElectroMechanical Instrument Cluster (EMIC) for about seven seconds as a bulb test each time the ignition switch is turned to the On position. A pyrotechnic-type seat belt tensioner is also integral to the driver and passenger front seat belt retractors of all airbag equipped models to work in conjunction with the dual front airbags.
- **Occupant Classification System** - Vehicles manufactured for sale in North America also include an Occupant Classification System (OCS) with components that are located on the passenger side front seat cushion. These components include an Occupant Classification Module (OCM) and a seat weight bladder and pressure sensor assembly. In addition, this system includes a belt tension sensor integral to the lower anchor of the passenger side front seat belt. Vehicles equipped with the OCS components can be readily identified by a passenger airbag on/off indicator (1) located in the inboard end cap of the grab handle (2) on the instrument panel above the glove box door (4).
- **Side Curtain Airbags** - Optional side curtain airbags are available for this model when it is also equipped with dual front airbags. This airbag system is a passive, inflatable, Supplemental Restraint System (SRS) and vehicles with this equipment can be readily identified by a molded identification trim button with the “SRS - AIRBAG” logo located on the headliner above each B-pillar.




The supplemental restraint system includes the following major components, which are described in further detail elsewhere in this service information:

- **Airbag Control Module (5)** - The Airbag Control Module (ACM) is also sometimes referred to as the Occupant Restraint Controller (ORC). The ACM is located on a mount on the floor panel transmission tunnel behind the transmission gear selector, and is concealed below the center floor console.
- **Airbag Indicator** - The airbag indicator is integral to the ElectroMechanical Instrument Cluster (EMIC), which is located on the instrument panel in front of the driver.
- **Belt Tension Sensor (4)** - Vehicles equipped with the Occupant Classification System (OCS) include a belt tension sensor. This sensor is integral to the passenger side front seat belt lower anchor which is secured to the outboard side of the passenger side front seat cushion frame.
- **Clockspring** - The clockspring is located near the top of the steering column, directly beneath the steering wheel. On vehicles equipped with an optional Electronic Stability Program (ESP) the clockspring includes an integral Steering Angle Sensor (SAS).
- **Driver Airbag (3)** - The driver airbag is located in the center of the steering wheel, beneath the driver airbag trim cover.
- **Driver Knee Blocker** - The driver knee blocker is a structural unit secured to the back side of and integral to the instrument panel steering column opening cover.
- **Front Impact Sensor (1)** - Two front impact sensors are used on vehicles equipped with dual front airbags, one left side and one right side. One sensor is located on the back side of each vertical member of the radiator support.

- **Occupant Classification Module (4)** - Vehicles equipped with the Occupant Classification System (OCS) include an Occupant Classification Module (OCM) which is secured to a stamped steel mounting bracket on the underside of the passenger side front seat cushion frame.
- **Passenger Airbag (2)** - The passenger airbag is located on the instrument panel, beneath the passenger airbag door and above the glove box on the passenger side of the vehicle.
- **Passenger Airbag On/Off Indicator** - The Occupant Classification System (OCS) includes a passenger airbag on/off indicator which is located in the inboard grab handle end cap on the instrument panel between the passenger airbag door and the glove box. Vehicles without the OCS have only a trim bezel above the glove box, instead of a grab handle.
- **Passenger Knee Blocker** - The passenger knee blocker is a structural reinforcement that is integral to and concealed within the glove box door.
- **Seat Belt Tensioner (6)** - A seat belt tensioner is integral to both front seat belt retractor units on vehicles equipped with dual front airbags. The seat belt retractor and tensioner units are secured to the right and left inner B-pillars and concealed beneath the lower B-pillar trim.
- **Seat Weight Sensor (4)** - Vehicles equipped with the Occupant Classification System (OCS) include a seat weight sensor, which includes a liquid-filled bladder, a pressure sensor, and a short hose that connects the bladder to the sensor. The bladder is sandwiched between an insulator pad on the top of the passenger side front seat cushion spring and the seat cushion foam padding, while the pressure sensor is secured to the Occupant Classification Module (OCM) mounting bracket on the underside of the passenger side front seat cushion frame.
- **Side Curtain Airbag (8)** - In vehicles equipped with this option, a side curtain airbag is secured to each inside roof side rail, and extends from the A-pillar to just beyond the C-pillar. The side curtain airbags are concealed above the headliner trim.
- **Side Impact Sensor (7)** - Two side impact sensors are used on vehicles equipped with the optional side curtain airbags, one left side and one right side. One sensor is located behind the lower B-pillar trim above the front seat belt retractor on each inner B-pillar.

The ACM, the OCM, and the EMIC each contain a microprocessor and programming that allow them to communicate with each other using the Programmable Communications Interface (PCI) data bus network. This method of communication is used by the ACM for control of the airbag indicator in the EMIC on all models equipped with dual front airbags. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - DESCRIPTION).

Hard wired circuitry connects the supplemental restraint system components to each other through the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system, and to the supplemental restraint system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

## OPERATION

### ACTIVE RESTRAINTS

The primary passenger restraints in this or any other vehicle are the standard equipment factory-installed seat belts and child restraint anchors. Seat belts and child restraint anchors are referred to as an active restraint because the vehicle occupants are required to physically fasten and properly adjust these restraints in order to benefit from them. See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the factory-installed active restraints.

### PASSIVE RESTRAINTS

The passive restraints are referred to as a supplemental restraint system because they were designed and are intended to enhance the protection for the occupants of the vehicle **only** when used in conjunction with the seat belts. They are referred to as passive restraints because the vehicle occupants are not required to do anything to make them operate; however, the vehicle occupants must be wearing their seat belts in order to obtain the maximum safety benefit from the factory-installed supplemental restraint system.

The supplemental restraint system electrical circuits are continuously monitored and controlled by a microprocessor and software contained within the Airbag Control Module (ACM). An airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) illuminates for about seven seconds as a bulb test each time the ignition switch is turned to the On or Start positions. Following the bulb test, the airbag indicator is turned on or off by the ACM to indicate the status of the supplemental restraint system. If the airbag indicator comes on at any time other than during the bulb test, it indicates that there is a problem in the supplemental restraint system electrical circuits. Such a problem may cause airbags not to deploy when required, or to deploy when not required.

Deployment of the supplemental restraints depends upon the angle and severity of an impact. Deployment is not based upon vehicle speed; rather, deployment is based upon the rate of deceleration as measured by the forces of gravity (G force) upon the impact sensors. When an impact is severe enough, the microprocessor in the ACM signals the inflator of the appropriate airbag units to deploy their airbag cushions. The front seat belt tensioners are provided with a deployment signal by the ACM in conjunction with the front airbags.

During a frontal vehicle impact, the knee blockers work in concert with properly fastened and adjusted seat belts to restrain both the driver and the front seat passenger in the proper position for an airbag deployment. The knee blockers also absorb and distribute the crash energy from the driver and the front seat passenger to the structure of the instrument panel. The seat belt tensioners remove the slack from the front seat belts to provide further assurance that the driver and front seat passenger are properly positioned and restrained for an airbag deployment.

Typically, the vehicle occupants recall more about the events preceding and following a collision than they do of an airbag deployment itself. This is because the airbag deployment and deflation occur very rapidly. In a typical 48 kilometer-per-hour (30 mile-per-hour) barrier impact, from the moment of impact until the airbags are fully inflated takes about 40 milliseconds. Within one to two seconds from the moment of impact, the airbags are almost entirely deflated. The times cited for these events are approximations, which apply only to a barrier impact at the given speed. Actual times will vary somewhat, depending upon the vehicle speed, impact angle, severity of the impact, and the type of collision.

When the ACM monitors a problem in any of the dual front airbag system circuits or components, including the seat belt tensioners, it stores a fault code or Diagnostic Trouble Code (DTC) in its memory circuit and sends an electronic message to the EMIC to turn on the airbag indicator. Proper testing of the supplemental restraint system components, the Programmable Communications Interface (PCI) data bus, the electronic message inputs to and outputs from the EMIC or the ACM, as well as the retrieval or erasure of a DTC from the ACM or the EMIC requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the factory-installed passive restraints.

## OCCUPANT CLASSIFICATION SYSTEM

Vehicles manufactured for the North American market are equipped with the Occupant Classification System (OCS). The OCS automatically suppresses or enables passenger airbag and seat belt tensioner operation based upon whether or not the passenger side front seat is occupied and, if the seat is occupied, classifies the size of the occupant and whether the seat is occupied by a child seat.

The OCS has an Occupant Classification Module (OCM) that monitors inputs from the seat weight bladder pressure sensor under the passenger side front seat cushion and from the belt tension sensor on the passenger side front seat belt lower anchor. Based upon those inputs the microprocessor within the OCM classifies the occupant of the passenger side front seat. The OCM then sends electronic occupant classification messages to the Airbag Control Module (ACM). The microprocessor and programming of the ACM determines whether to enable or disable the deployment circuits for the passenger airbag and seat belt tensioner; and, if enabled, what force level should be used to deploy each front airbag.

The OCS electrical circuits and components are continuously monitored by the OCM, and the OCM is continuously monitored by the ACM. A passenger airbag on/off indicator is located in the inboard end cap of the instrument panel grab handle. This indicator receives battery current whenever the ignition switch is in the On or Start positions, and illuminates only when the ACM pulls the indicator control circuit to ground. The indicator illuminates for about seven seconds as a bulb test each time the ignition switch is turned to the On or Start positions. Following the bulb test, the indicator is turned on or off by the ACM based upon the electronic occupant classification messages received from the OCM. This indicator is illuminated whenever the passenger airbag and seat belt tensioner operation has been suppressed, and is turned off whenever the seat is empty or when the seat is occupied and the passenger airbag and seat belt tensioner are enabled.

When the OCM monitors a problem in any of the OCS circuits or components, it stores a fault code or DTC in its memory circuit and sends an electronic message to the ACM. The ACM then sends an electronic message to the

EMIC to turn on the airbag indicator. If for any reason the OCM is unable to classify the occupant it sends an electronic message to the ACM, and the ACM suppresses passenger airbag and seat belt tensioner operation. Proper testing of the OCS components, the Programmable Communications Interface (PCI) data bus, the electronic message inputs to and outputs from the OCM, the EMIC or the ACM, as well as the retrieval or erasure of a DTC from the OCM, the ACM or the EMIC requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the OCS.

## WARNING

## WARNINGS - RESTRAINT SYSTEM

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death on vehicles equipped with airbags, before performing any welding operations disconnect and isolate the battery negative (ground) cable and disconnect all wire harness connectors from the Airbag Control Module (ACM). Failure to take the proper precautions could result in accidental airbag deployment and other possible damage to the supplemental restraint system circuits and components.**

**WARNING: To avoid personal injury or death, do not attempt to dismantle an airbag unit or tamper with its inflator. Do not puncture, incinerate, or bring into contact with electricity. Do not store at temperatures exceeding 93° C (200° F). An airbag inflator unit may contain sodium azide and potassium nitrate. These materials are poisonous and extremely flammable. Contact with acid, water, or heavy metals may produce harmful and irritating gases (sodium hydroxide is formed in the presence of moisture) or combustible compounds. An airbag inflator unit may also contain a gas canister pressurized to over 2500 psi.**

**WARNING: To avoid personal injury or death, when handling a seat belt tensioner retractor, proper care should be exercised to keep fingers out from under the retractor cover and away from the seat belt webbing where it exits from the retractor cover.**

**WARNING: To avoid personal injury or death, replace all restraint system components only with parts specified in the DaimlerChrysler Mopar Parts Catalog. Substitute parts may appear interchangeable, but internal differences may result in inferior occupant protection.**

**WARNING: To avoid personal injury or death, the fasteners, screws, and bolts originally used for the restraint system components must never be replaced with any substitutes. These fasteners have special coatings and are specifically designed for the restraint system. Any time a new fastener is needed, replace it with the correct fasteners provided in the service package or specified in the DaimlerChrysler Mopar Parts Catalog.**

**WARNING: To avoid personal injury or death, when a steering column has an airbag unit attached, never place the column on the floor or any other surface with the steering wheel or airbag unit face down.**

## DIAGNOSIS AND TESTING

## SUPPLEMENTAL RESTRAINT SYSTEM

Proper diagnosis and testing of the supplemental restraint system components, the Programmable Communications Interface (PCI) data bus, the data bus electronic message inputs to and outputs from the ElectroMechanical Instrument Cluster (EMIC), the Airbag Control Module (ACM), or the Occupant Classification Module (OCM) as well as the retrieval or erasure of a Diagnostic Trouble Code (DTC) from the ACM or OCM requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

## STANDARD PROCEDURE

## HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS

At no time should any source of electricity be permitted near the inflator on the back of a non-deployed airbag or seat belt tensioner. When carrying a non-deployed airbag, the trim cover or airbag cushion side of the unit should be pointed away from the body to minimize injury in the event of an accidental deployment. If the airbag unit is placed on a bench or any other surface, the trim cover or airbag cushion side of the unit should be face up to minimize movement in the event of an accidental deployment.

When handling a non-deployed seat belt tensioner, take proper care to keep fingers out from under the retractor cover and away from the seat belt webbing where it exits from the retractor cover. In addition, the supplemental restraint system should be disarmed whenever any steering wheel, steering column, seat belt tensioner, driver airbag, passenger airbag, Occupant Classification System (OCS), front impact sensor, side impact sensor, side curtain airbag, or instrument panel components require diagnosis or service. Failure to observe this warning could result in accidental airbag deployment and possible personal injury.

All damaged, faulty or non-deployed airbags and seat belt tensioners which are replaced on vehicles are to be handled and disposed of properly. If an airbag or seat belt tensioner unit is faulty or damaged and non-deployed, refer to the Hazardous Substance Control System for proper disposal. Dispose of all non-deployed and deployed airbags and seat belt tensioners in a manner consistent with state, provincial, local and federal regulations.

### SUPPLEMENTAL RESTRAINT STORAGE

Airbags and seat belt tensioners must be stored in their original, special container until they are used for service. Also, they must be stored in a clean, dry environment; away from sources of extreme heat, sparks, and high electrical energy. Always place or store any airbag on a surface with its trim cover or airbag cushion side facing up, to minimize movement in case of an accidental deployment.

## SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT

Any vehicle which is to be returned to use following a supplemental restraint deployment, must have the deployed restraints replaced. In addition, if the driver airbag has been deployed, the clockspring must be replaced. If the passenger airbag is deployed, the passenger airbag door and both passenger airbag mounting brackets must be replaced. The seat belt tensioners are deployed by the same signal that deploys the driver and passenger airbags and must also be replaced if either front airbag has been deployed. If a side curtain airbag has been deployed, the complete airbag unit, the headliner, as well as the upper A, B, C and D-pillar trim must be replaced. These components are not intended for reuse and will be damaged or weakened as a result of a supplemental restraint deployment, which may or may not be obvious during a visual inspection.

On vehicles with an optional sunroof, the sunroof drain tubes and hoses must be closely inspected following a side curtain airbag deployment. It is also critical that the mounting surfaces and/or mounting brackets for the Airbag Control Module (ACM), side impact sensors, and front impact sensors be closely inspected and restored to their original conditions following any vehicle impact damage. Because the ACM and each front and side impact sensor are used by the supplemental restraint system to monitor or confirm the direction and severity of a vehicle impact, improper orientation or insecure fastening of these components may cause airbags not to deploy when required, or to deploy when not required.

All other vehicle components should be closely inspected following any supplemental restraint deployment, but are to be replaced only as required by the extent of the visible damage incurred.

## AIRBAG SQUIB STATUS

Multistage airbags with multiple initiators (squibs) must be checked to determine that all squibs were used during the deployment event. The driver and passenger airbags in this model are deployed by electrical signals generated by the Airbag Control Module (ACM) through the driver or passenger squib 1 and squib 2 circuits to the two initiators in the airbag inflators. Typically, both initiators are used and all potentially hazardous chemicals are burned during an airbag deployment event. However, it is possible for only one initiator to be used due to an airbag system fault; therefore, it is always necessary to confirm that both initiators have been used in order to avoid the improper handling or disposal of potentially live pyrotechnic or hazardous materials. The following procedure should be performed using a diagnostic scan tool to verify the status of both airbag squibs before either deployed airbag is removed from the vehicle for disposal.

**CAUTION: Deployed front airbags having two initiators (squibs) in the airbag inflator may or may not have live pyrotechnic material within the inflator. Do not dispose of these airbags unless you are sure of complete deployment. Refer to the Hazardous Substance Control System for proper disposal procedures. Dispose of all non-deployed and deployed airbags and seat belt tensioners in a manner consistent with state, provincial, local, and federal regulations.**

1. Be certain that the diagnostic scan tool contains the latest version of the proper diagnostic software. Connect the scan tool to the 16-way Data Link Connector (DLC). The DLC is located on the driver side lower edge of the instrument panel, inboard of the steering column.
2. Turn the ignition switch to the On position.
3. Using the scan tool, read and record the active (current) Diagnostic Trouble Code (DTC) data.

Using the active DTC information, refer to the **Airbag Squib Status** table to determine the status of both driver and/or passenger airbag squibs.

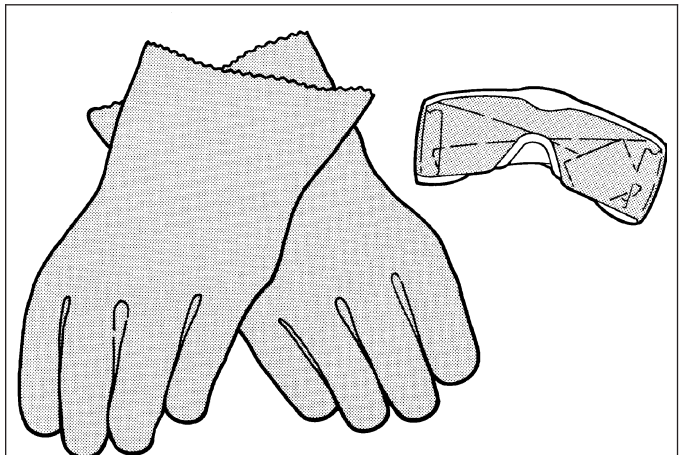
<table>
<tr><th colspan="3">AIRBAG SQUIB STATUS</th></tr>
<tr><th>IF the Active DTC is:</th><th>Conditions</th><th>Squib Status</th></tr>
<tr><td>Driver or Passenger Squib 1 open</td><td rowspan="2">AND the stored DTC minutes for both Driver or Passenger squibs are within 15 minutes of each other</td><td rowspan="2">Both Squib 1 and 2 were used.</td></tr>
<tr><td>Driver or Passenger Squib 2 open</td></tr>
<tr><td>Driver or Passenger Squib 1 open</td><td rowspan="2">AND the stored DTC minutes for Driver or Passenger Squib 2 open is GREATER than the stored DTC minutes for Driver or Passenger Squib 1 by 15 minutes or more</td><td rowspan="2">Squib 1 was used; Squib 2 is live.</td></tr>
<tr><td>Driver or Passenger Squib 2 open</td></tr>
</table>

| AIRBAG SQUIB STATUS | | |
|---|---|---|
| **IF the Active DTC is:** | **Conditions** | **Squib Status** |
| Driver or Passenger Squib 1 open | **AND** the stored DTC minutes for Driver or Passenger Squib 1 open is GREATER than the stored DTC minutes for Driver or Passenger Squib 2 by 15 minutes or more | Squib 1 is live; Squib 2 was used. |
| Driver or Passenger Squib 2 open | | |
| Driver or Passenger Squib 1 open | **AND** Driver or Passenger Squib 2 open is NOT an active code | Squib 1 was used; Squib 2 is live. |
| Driver or Passenger Squib 2 open | **AND** Driver or Passenger Squib 1 open is NOT an active code | Squib 1 is live; Squib 2 was used. |

**If** none of the Driver or Passenger Squib 1 or 2 open are active codes, the status of the airbag squibs is unknown. In this case the airbag should be handled and disposed of as if the squibs were both live.

## CLEANUP PROCEDURE

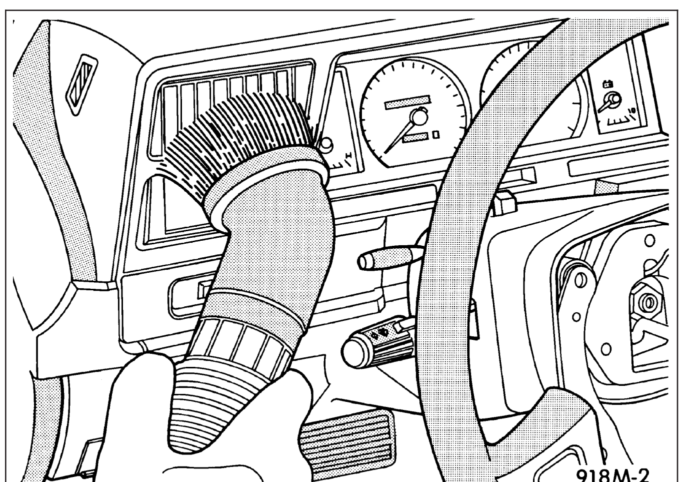
Following a supplemental restraint deployment, the vehicle interior will contain a powdery residue. This residue consists primarily of harmless particulate by-products of the small pyrotechnic charge that initiates the propellant used to deploy a supplemental restraint. However, this residue may also contain traces of sodium hydroxide powder, a chemical by-product of the propellant material that is used to generate the inert gas that inflates the airbag. Since sodium hydroxide powder can irritate the skin, eyes, nose, or throat, be certain to wear safety glasses, rubber gloves, and a long-sleeved shirt during cleanup.



918M-4

**WARNING: To avoid personal injury or death, if you experience skin irritation during cleanup, run cool water over the affected area. Also, if you experience irritation of the nose or throat, exit the vehicle for fresh air until the irritation ceases. If irritation continues, see a physician.**

1. Begin the cleanup by using a vacuum cleaner to remove any residual powder from the vehicle interior. Clean from outside the vehicle and work your way inside, so that you avoid kneeling or sitting on a non-cleaned area.
2. Be certain to vacuum the heater and air conditioning outlets as well. Run the heater and air conditioner blower on the lowest speed setting and vacuum any powder expelled from the outlets.



918M-2

**CAUTION: Deployed front airbags having two initiators (squibs) in the airbag inflator may or may not have live pyrotechnic material within the inflator. Do not dispose of these airbags unless you are sure of complete deployment. Refer to AIRBAG SQUIB STATUS . All damaged, faulty, or non-deployed supplemental restraints which are replaced on vehicles are to be handled and disposed of properly. If an airbag or seat belt tensioner unit is faulty or damaged and non-deployed, refer to the Hazardous Substance Control System for proper disposal. Be certain to dispose of all non-deployed and deployed supplemental restraints in a manner consistent with state, provincial, local and federal regulations.**

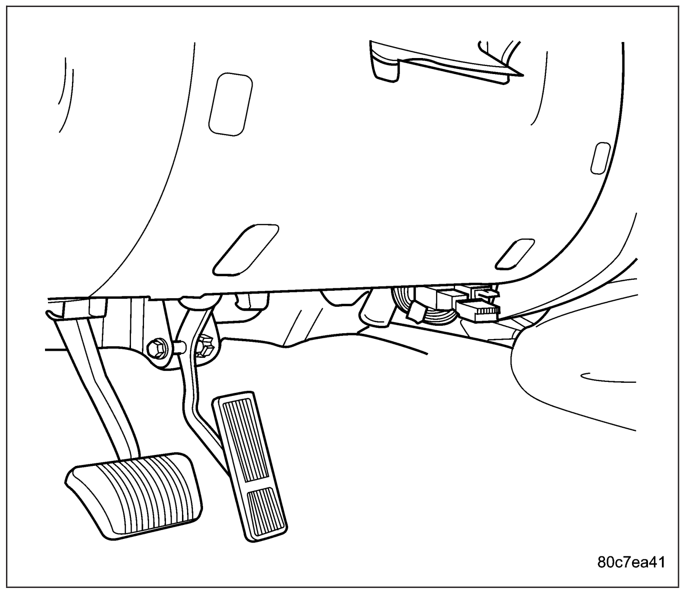
3. Next, remove the deployed supplemental restraints from the vehicle. Refer to the appropriate service removal procedures.
4. You may need to vacuum the interior of the vehicle a second time to recover all of the powder.

## SUPPLEMENTAL RESTRAINTS VERIFICATION TEST

The following procedure should be performed using a diagnostic scan tool to verify proper supplemental restraint system operation following the service or replacement of any supplemental restraint system component. In addition, if the vehicle is equipped with the Occupant Classification System and one of the passenger front seat supplemental restraint components has been replaced, following successful completion of the supplemental restraint system verification test procedure, perform the Occupant Classification System Verification Test using a diagnostic scan tool. Refer to the appropriate diagnostic procedures.

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: On vehicles equipped with the Occupant Classification System (OCS), never replace both the Airbag Control Module (ACM) and the Occupant Classification Module (OCM) at the same time. If both require replacement, replace the OCM first. Then perform the supplemental restraint verification test including an ignition-On time of at least one minute before replacing the ACM. Both the ACM and the OCM store OCS calibration data, which they transfer to one another during the first minute of ignition-On time after one of them is replaced. If both modules are replaced at the same time, an irreversible fault will be set in both modules. If the data transfer is not allowed sufficient time to complete between modules (at least one minute of ignition-On), an irreversible fault will be set in the module requiring the data.**




1. During the following test, the battery negative cable remains disconnected and isolated, as it was during the supplemental restraint system component removal and installation procedures.
2. Be certain that the diagnostic scan tool contains the latest version of the proper diagnostic software. Connect the scan tool to the 16-way Data Link Connector (DLC). The DLC is located on the driver side lower edge of the instrument panel, inboard of the steering column.
3. Turn the ignition switch to the On position and exit the vehicle with the scan tool.

**CAUTION: On vehicles equipped with the Occupant Classification System (OCS), if the Airbag Control Module (ACM) or the Occupant Classification Module (OCM) have been replaced, leave the ignition switch in the On position with the battery connected for at least one minute to allow the data transfer between the ACM and the OCM to complete. If the data transfer is not allowed sufficient time to complete between modules (at least one minute of ignition-On), an irreversible fault will be set in the module requiring the data.**

4. Check to be certain that nobody is in the vehicle, then reconnect the battery negative cable.
5. Using the scan tool, read and record the active (current) Diagnostic Trouble Code (DTC) data.
6. Next, use the scan tool to read and record any stored (historical) DTC data.
7. If any DTC is found in Step 5 or Step 6, refer to the appropriate diagnostic information.

8. Use the scan tool to erase the stored DTC data. If any problems remain, the stored DTC data will not erase. Refer to the appropriate diagnostic information to diagnose any stored DTC that will not erase. If the stored DTC information is successfully erased, go to Step 9.
9. Turn the ignition switch to the Off position for about fifteen seconds, and then back to the On position. Observe the airbag indicator in the instrument cluster. It should illuminate for six to eight seconds, and then go out. This indicates that the supplemental restraint system is functioning normally and that the repairs are complete. If the airbag indicator fails to light, or lights and stays on, there is still an active supplemental restraint system fault or malfunction. Refer to the appropriate diagnostic information to diagnose the problem.

## SPECIFICATIONS

## RESTRAINT SYSTEMS

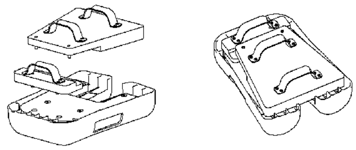
### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Airbag Control Module Mounting Screws | 11 | 8 | - |
| Steering Column Shroud Mounting Screws | 2 | - | 18 |
| Curtain Airbag Inflator Bracket Mounting Screws | 12 | - | 105 |
| Curtain Airbag Mounting Screws | 12 | - | 105 |
| Curtain Airbag Front Tether Retainer Mounting Screw | 14 | - | 120 |
| Driver Airbag Mounting Screws | 10 | - | 90 |
| Front Impact Sensor Mounting Screw | 7 | - | 65 |
| Side Impact Sensor Mounting Screw | 11 | - | 100 |
| Occupant Classification Module Mounting Screws | 2 | - | 20 |
| Passenger Airbag Mounting Screws | 6 | - | 55 |
| Passenger Airbag Door Mounting Screws (Small) | 2 | - | 20 |
| Passenger Airbag Door Mounting Screws (Large) | 4 | - | 35 |
| Passenger Airbag Bracket Mounting Screws | 2 | - | 20 |
| Front Seat Track to Seat Cushion Frame Mounting Screws | 28 | - | 21 |
| Front Seat Cushion Side Shield Mounting Screws | 1 | - | 9 |
| Front Seat Belt Buckle Lower Anchor Mounting Screw | 43 | 32 | - |

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Rear Seat Belt Buckle Lower Anchor Bracket Mounting Screw | 43 | 32 | - |
| Front Seat Belt Retractor Lower Bracket Mounting Screw | 43 | 32 | - |
| Front Seat Belt Turning Loop Mounting Nut | 34 | 25 | - |
| Front Seat Belt Lower Anchor Mounting Screw | 47 | 35 | - |
| Rear Center Seat Belt Retractor Mounting Screw | 27 | 20 | - |
| Rear Center Seat Belt Web Guide Mounting Screws | 2 | - | 20 |
| Rear Center Seat Belt Lower Anchor Bracket Mounting Screw | 43 | 32 | - |
| Rear Outboard Seat Belt Retractor Lower Bracket Mounting Screw | 43 | 32 | - |
| Rear Outboard Seat Belt Lower Anchor Mounting Screw | 43 | 32 | - |
| Rear Outboard Seat Belt Turning Loop Mounting Screw | 43 | 32 | - |
| Seat Belt Turning Loop Adjuster Mounting Screw | 34 | 25 | - |

## SPECIAL TOOLS

## RESTRAINT SYSTEMS

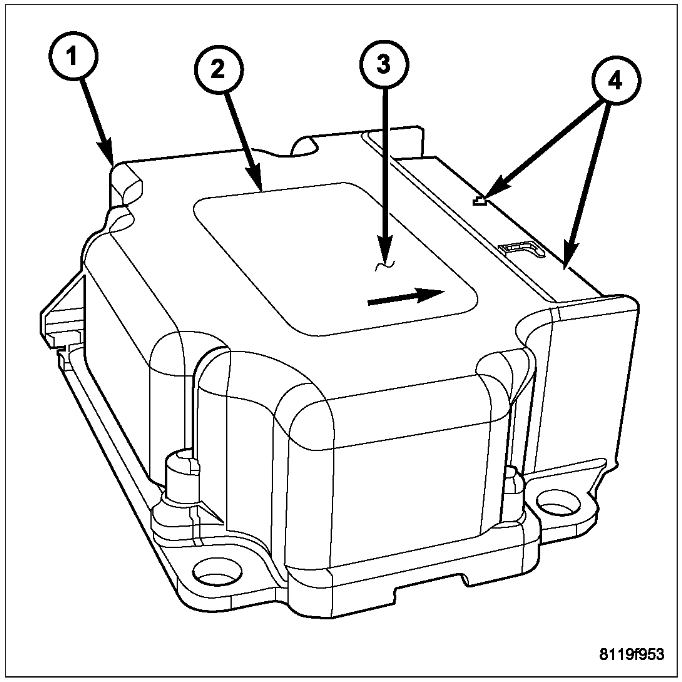


*OCS Seat Weight Tool #9077*

# AIRBAG CONTROL MODULE

## DESCRIPTION

The Airbag Control Module (ACM) (1) is also sometimes referred to as the Occupant Restraint Controller (ORC). The ACM is secured with three screws to a stamped steel mounting bracket welded onto the top of the floor panel transmission tunnel just forward of the park brake mechanism and beneath the center floor console in the passenger compartment of the vehicle. Concealed within a hollow in the center of the die cast aluminum ACM housing is the electronic circuitry of the ACM which includes a microprocessor, an electronic impact sensor, an electronic safing sensor, and an energy storage capacitor. A stamped metal cover plate is secured to the bottom of the ACM housing with four screws to enclose and protect the internal electronic circuitry and components.




An arrow (3) printed on the label (2) on the top of the ACM housing provides a visual verification of the proper orientation of the unit, and should always be pointed toward the front of the vehicle. The ACM housing has integral mounting flanges on three corners. The mounting flange to the right of the connector receptacle has an integral locating pin on its lower surface. Both right side flanges have round mounting holes, while the flange on the left side has a slotted mounting hole. A molded plastic electrical connector (4) with two receptacles, one containing twenty-four terminal pins and the other containing thirty-two terminal pins, exits the forward facing side of the ACM housing. These terminal pins connect the ACM to the vehicle electrical system through two dedicated take outs and connectors, one from the instrument panel wire harness and the other from the body wire harness.

A molded plastic protective cover is installed over the ACM to protect the unit from condensation or water intrusion. Integral latch tabs on each side of the cover engage slots on each side at the base of the ACM housing to secure the cover in place over the ACM.

The impact sensor and safing sensor internal to the ACM are calibrated for the specific vehicle, and are only serviced as a unit with the ACM. In addition, there are unique versions of the ACM for vehicles with or without the optional side curtain airbags. The ACM cannot be repaired or adjusted and, if damaged or faulty, it must be replaced. The ACM cover is available for individual service replacement.

## OPERATION

The microprocessor in the Airbag Control Module (ACM) contains the supplemental restraint system logic circuits and controls all of the supplemental restraint system components. The ACM uses On-Board Diagnostics (OBD) and can communicate with other electronic modules in the vehicle as well as with the diagnostic scan tool using the Programmable Communications Interface (PCI) data bus. This method of communication is used for control of the airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) and for supplemental restraint system diagnosis and testing through the 16-way data link connector located on the driver side lower edge of the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/AIRBAG INDICATOR - OPERATION).

The ACM microprocessor continuously monitors all of the supplemental restraint system electrical circuits to determine the system readiness. If the ACM detects a monitored system fault, it sets an active and stored Diagnostic Trouble Code (DTC) and sends electronic messages to the EMIC over the PCI data bus to turn on the airbag indicator. An active fault only remains for the duration of the fault, or in some cases for the duration of the current ignition switch cycle, while a stored fault causes a DTC to be stored in memory by the ACM. For some DTCs, if a fault does not recur for a number of ignition cycles, the ACM will automatically erase the stored DTC. For other internal faults, the stored DTC is latched forever.

The ACM also monitors a Hall effect-type seat belt switch located in the buckle of the driver side front seat belt to determine whether that seat belt is buckled, and provides an input to the EMIC over the PCI data bus to control the seatbelt indicator operation based upon the status of the driver side front seat belt switch.

On models equipped with the Occupant Classification System (OCS), the ACM communicates with the Occupant Classification Module (OCM) over the PCI data bus. The ACM stores OCS calibration data for retrieval when the OCM must be replaced with a new unit. The ACM will internally disable the passenger airbag and seat belt tensioner deployment circuits if the OCM detects that the passenger side front seat is unoccupied or that it is occupied by a load that is inappropriate for an airbag deployment. The ACM also provides a control output to the passenger airbag on/off indicator through the passenger airbag on/off indicator driver circuit. The OCM notifies the ACM when it has detected a monitored system fault and stored a DTC in its memory for any faulty OCS component or circuit, then the ACM sets a DTC and controls the airbag indicator operation accordingly.

The ACM receives battery current through two circuits; a fused ignition switch output (run) circuit through a fuse in the Junction Block (JB), and a fused ignition switch output (run-start) circuit through a second fuse in the JB. The ACM receives ground through a ground circuit and take out of the body wire harness. This take out has a single eyelet terminal connector that is secured by a ground screw to the top of the right front seat riser on the floor panel beneath the right front seat. These connections allow the ACM to be operational whenever the ignition switch is in the Start or On positions.

The ACM also contains an energy-storage capacitor. When the ignition switch is in the Start or On positions, this capacitor is continually being charged with enough electrical energy to deploy the supplemental restraint components for up to one second following a battery disconnect or failure. The purpose of the capacitor is to provide backup supplemental restraint system protection in case there is a loss of battery current supply to the ACM during an impact.

Two sensors are contained within the ACM, an electronic impact sensor and a safing sensor. The ACM also monitors inputs from two remote front impact sensors located on the back of the right and left vertical members of the radiator support near the front of the vehicle. The electronic impact sensors are accelerometers that sense the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. On vehicles equipped with optional side curtain airbags the ACM also monitors inputs from two additional remote impact sensors located on the left and right inner B-pillars to control deployment of the side curtain airbag units.

The safing sensor is an electronic accelerometer sensor within the ACM that provides an additional logic input to the ACM microprocessor. The safing sensor is used to verify the need for a supplemental restraint deployment by detecting impact energy of a lesser magnitude than that of the primary electronic impact sensors, and must exceed a safing threshold in order for the airbags to deploy. Vehicles equipped with optional side curtain airbags, feature a second safing sensor within the ACM to provide confirmation to the ACM microprocessor of side impact forces. This second safing sensor is a bi-directional unit that detects impact forces from either side of the vehicle.

Pre-programmed decision algorithms in the ACM microprocessor determine when the deceleration rate as signaled by the impact sensors and the safing sensors indicate an impact that is severe enough to require supplemental restraint system protection and, based upon the severity of the monitored impact, determines the level of front airbag deployment force required for each front seating position. When the programmed conditions are met, the ACM sends the proper electrical signals to deploy the dual multistage front airbags at the programmed force levels, the front seat belt tensioners and, if the vehicle is so equipped, either side curtain airbag unit. For vehicles equipped with the OCS, the passenger front airbag and seat belt tensioner will be deployed by the ACM only if enabled by the OCM (passenger airbag on/off indicator Off) at the time of the impact.

The hard wired inputs and outputs for the ACM may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ACM, the PCI data bus network, or the electronic message inputs to and outputs from the ACM. The most reliable, efficient, and accurate means to diagnose the ACM, the PCI data bus, and the electronic message inputs to and outputs from the ACM requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

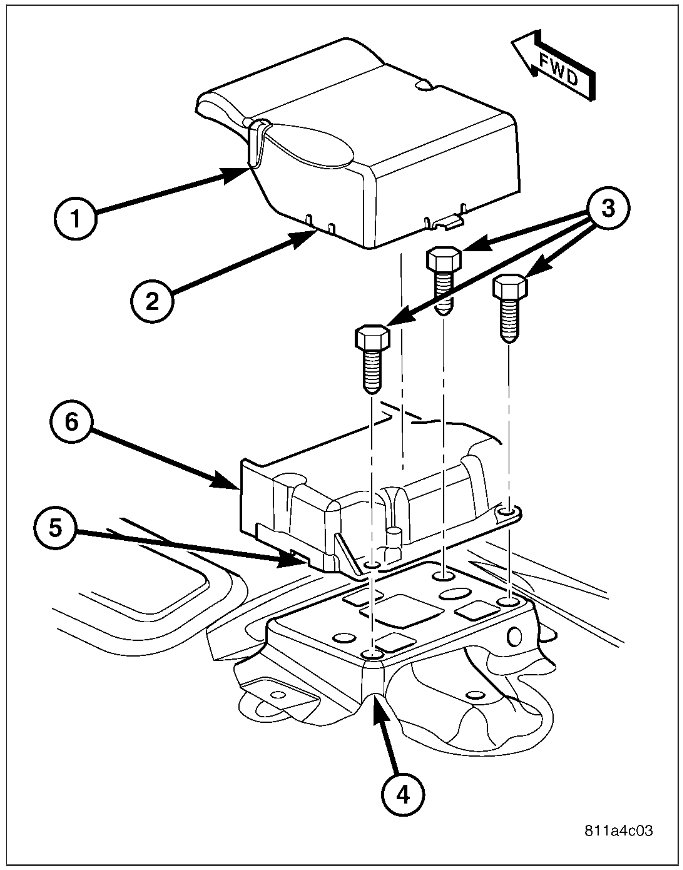
**WARNING: To avoid personal injury or death, never strike or drop the airbag control module, as it can damage the impact sensor or affect its calibration. The airbag control module contains the impact sensor, which enables the system to deploy the supplemental restraints. If an airbag control module is accidentally dropped during service, the module must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper supplemental restraint deployment.**

**CAUTION: On vehicles equipped with the Occupant Classification System (OCS), never replace both the Airbag Control Module (ACM) and the Occupant Classification Module (OCM) at the same time. If both require replacement, replace the OCM first. Then perform the supplemental restraint verification test including an ignition-On time of at least one minute before replacing the ACM. Both the ACM and the OCM store OCS calibration data, which they transfer to one another during the first minute of ignition-On time after one of them is replaced. If both modules are replaced at the same time, an irreversible fault will be set in both modules. If the data transfer is not allowed sufficient time to complete between modules (at least one minute of ignition-On), an irreversible fault will be set in the module requiring the data.**

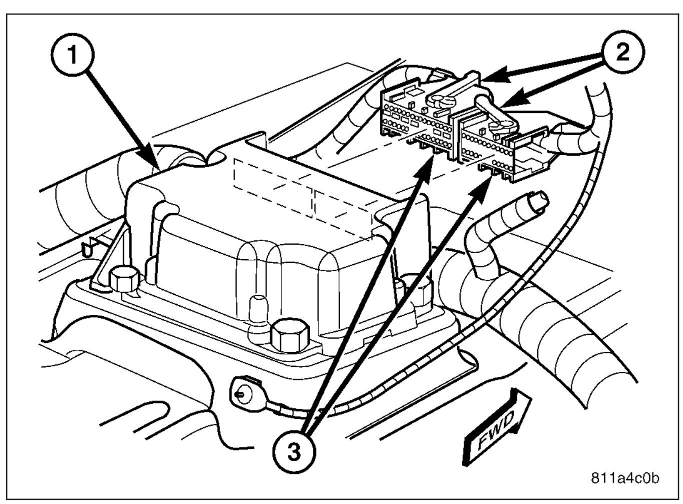
1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the center console from the top of the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL).

**CAUTION: Use care when disengaging the Airbag Control Module (ACM) cover latches from the ACM or the cover may be damaged.**

3. The ACM cover (1) is secured to the ACM by a latch tab (2) located on each side of the cover. Gently pry both latch tabs away from the ACM far enough to disengage the latches from the slots (5) in the base of the ACM housing, then lift the cover off of the ACM.




4. Disconnect the two wire harness connectors (3) (one each from the instrument panel and the body wire harnesses) for the ACM (1) from the ACM connector receptacles located on the forward facing side of the module. To disconnect the wire harness connectors from the ACM, depress the release tab and lift the lever arm (2) on each connector.
5. Remove the three screws that secure the ACM to the ACM bracket that is welded onto the top of the floor panel transmission tunnel.
6. Remove the ACM from the floor panel transmission tunnel.



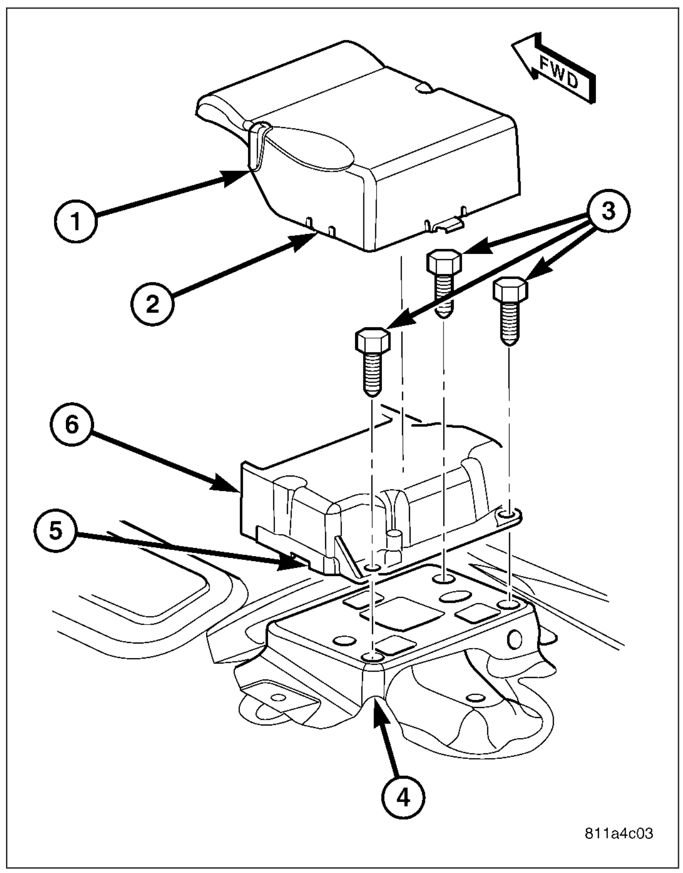
## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

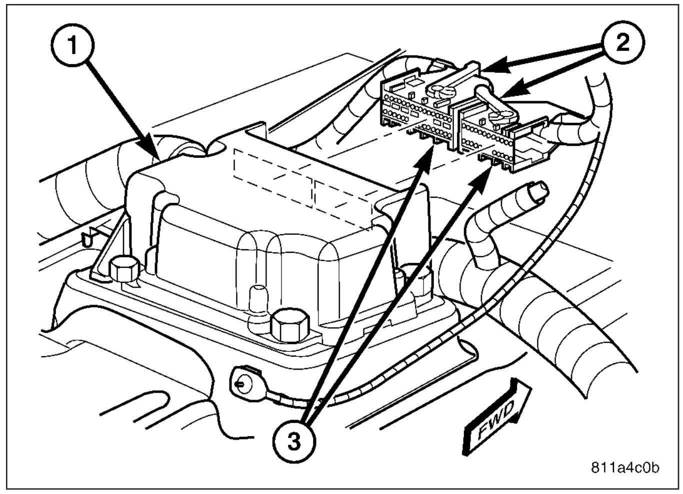
**WARNING: To avoid personal injury or death, never strike or drop the airbag control module, as it can damage the impact sensor or affect its calibration. The airbag control module contains the impact sensor, which enables the system to deploy the supplemental restraints. If an airbag control module is accidentally dropped during service, the module must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper supplemental restraint deployment.**

**CAUTION: On vehicles equipped with the Occupant Classification System (OCS), never replace both the Airbag Control Module (ACM) and the Occupant Classification Module (OCM) at the same time. If both require replacement, replace the OCM first. Then perform the supplemental restraint verification test including an ignition-On time of at least one minute before replacing the ACM. Both the ACM and the OCM store OCS calibration data, which they transfer to one another during the first minute of ignition-On time after one of them is replaced. If both modules are replaced at the same time, an irreversible fault will be set in both modules. If the data transfer is not allowed sufficient time to complete between modules (at least one minute of ignition-On), an irreversible fault will be set in the module requiring the data.**

1. Carefully position the Airbag Control Module (ACM) (6) to the ACM bracket (4) on the floor panel transmission tunnel. When the ACM is correctly positioned, the arrow on the ACM label will be pointed forward in the vehicle and the locating pin on the bottom of the right ACM mounting flange will be engaged into the locating hole in the ACM bracket.
2. Install and tighten the three screws (3) that secure the ACM to the ACM bracket that is welded onto the floor panel transmission tunnel. Tighten the screws to 11 N·m (8 ft. lbs.).



**CAUTION: The lever arms (2) of the wire harness connectors for the ACM MUST be in the unlatched position before they are inserted into their connector receptacles on the ACM or they may become damaged.**

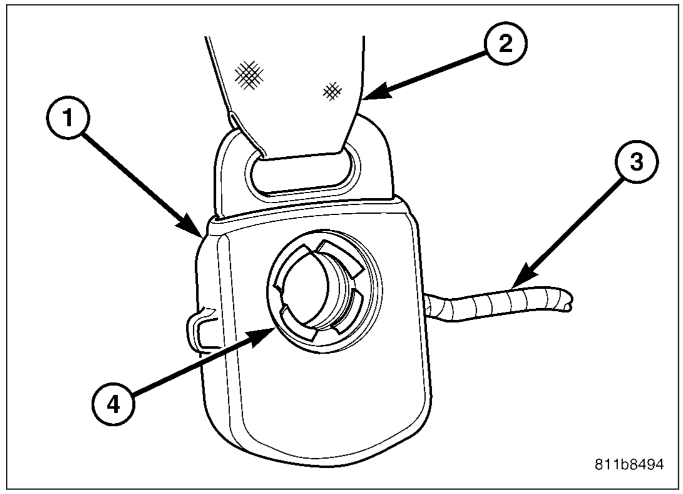



3. Reconnect the two wire harness connectors (3) (one each from the instrument panel and the body wire harnesses) for the ACM (1) to the ACM connector receptacles located on the forward facing side of the module. Be certain that the latches on both connectors are each fully engaged.
4. Carefully position the ACM cover back over the top of the ACM. Be certain both cover latches are engaged in the slots in the base of the ACM housing.
5. Reinstall the center console onto the top of the floor panel transmission tunnel. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION).
6. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

# BELT TENSION SENSOR

## DESCRIPTION

Vehicles equipped with the Occupant Classification System (OCS) include a belt tension sensor (1). This sensor is integral to the passenger side front seat belt (2) lower anchor which is secured to the outboard side of the passenger side front seat cushion frame. The lower anchor and belt tension sensor are concealed beneath an access cover on the outboard seat cushion side shield on the passenger side front seat. The belt tension sensor consists of a molded plastic housing with a central mounting hole (4), a metal seat belt anchor loop, and a short pigtail wire. The electronic circuitry of the belt tension sensor is concealed and protected within the molded plastic housing. The sensor is connected to the vehicle electrical system through its pigtail wire (3) to a dedicated take out of the passenger side front seat wire harness with a keyed and latching molded plastic connector insulator to ensure a proper and secure connection.




The belt tension sensor cannot be repaired and, if faulty or damaged, the entire passenger side front seat belt and retractor unit must be replaced. (Refer to 8 - ELECTRICAL/RESTRAINTS/FRONT SEAT BELT & RETRACTOR - REMOVAL).

## OPERATION

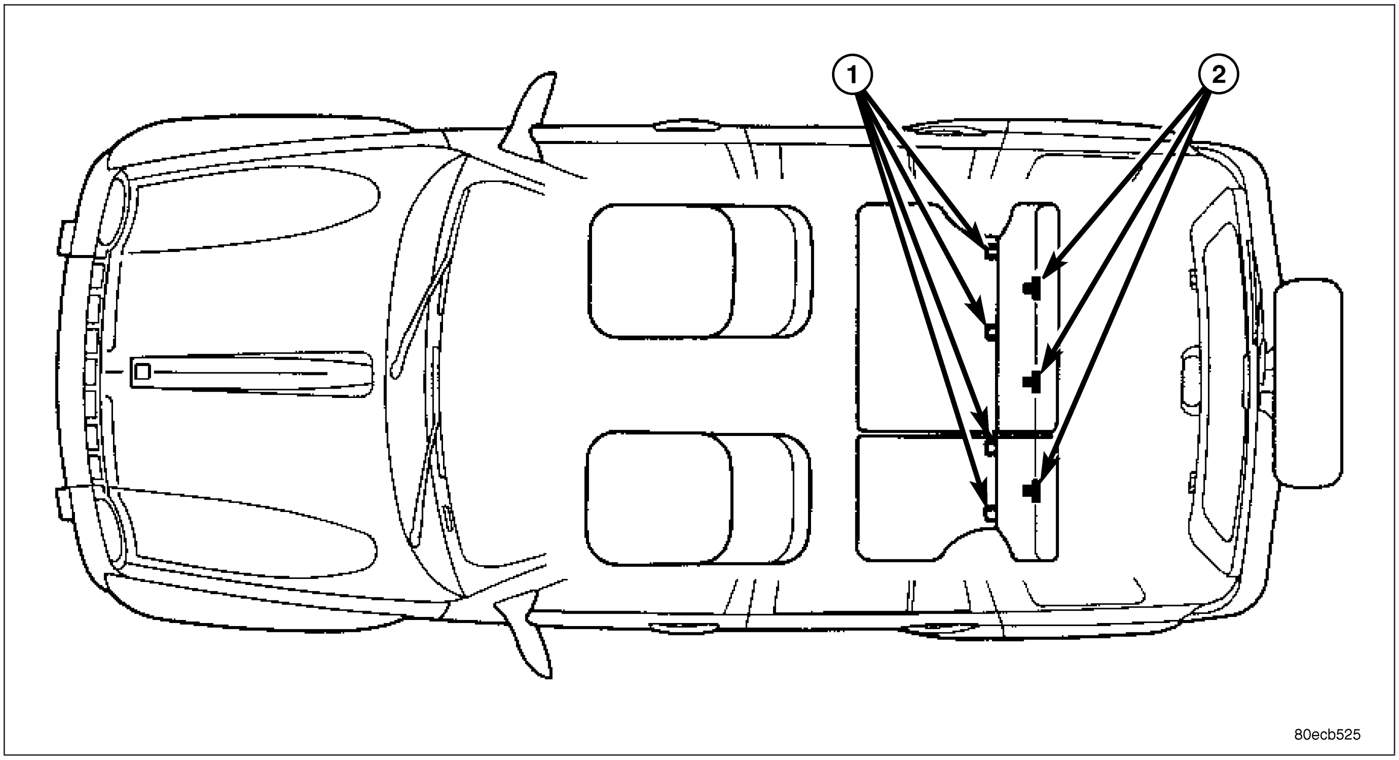
The belt tension sensor unit is designed to sense the relative cinch load applied to the passenger side front seat belt, which provides a logic input to the microprocessor of the Occupant Classification Module (OCM). When a load is applied to the seat belt, the changes in the load are measured by the belt tension sensor through the seat belt lower anchor. As the load changes, the circuitry of the belt tension sensor changes the output voltage of the sensor.

The belt tension sensor receives a nominal five volts and a ground through dedicated hard wired circuits from the OCM. The OCM then monitors the belt tension sensor output voltage on a dedicated hard wired data communication circuit. The hard wired circuits between the belt tension sensor and the OCM may be diagnosed and tested using conventional diagnostic tools and procedures. However, the most reliable, efficient, and accurate means to diagnose the belt tension sensor input to the OCM, and the electronic message communication between the OCM and the Airbag Control Module (ACM) requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

# CHILD RESTRAINT ANCHOR

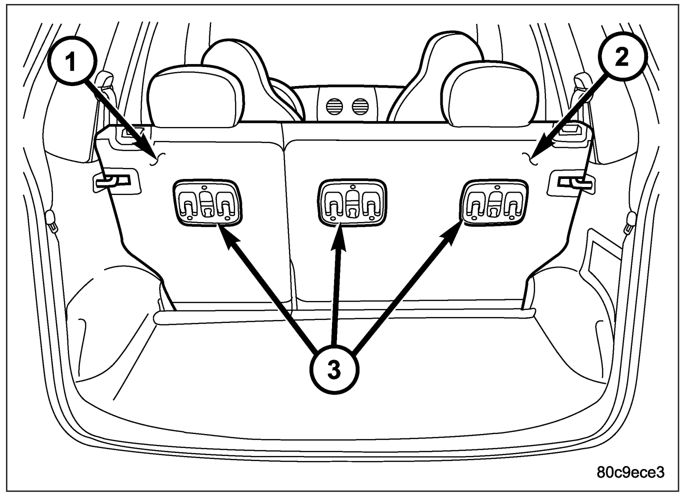
## DESCRIPTION

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

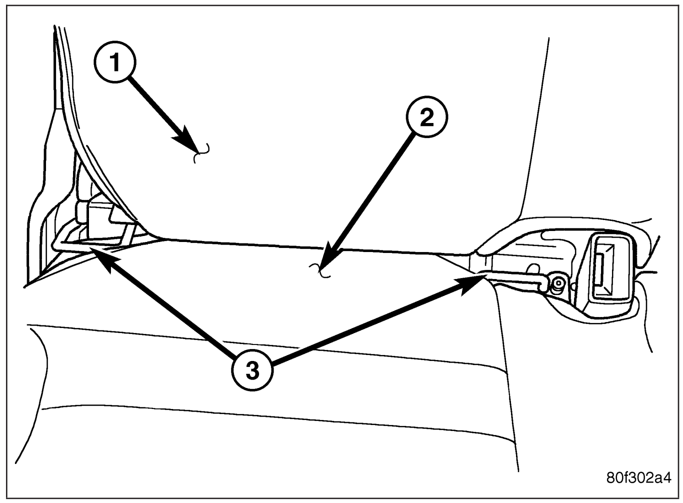



This model is equipped with a Lower Anchors and Tether for CHildren, or LATCH child restraint anchorage system. The LATCH system provides for the installation of suitable child restraints in certain seating positions without using the standard equipment seat belt provided for that seating position. The rear seats in this model are equipped with a fixed-position child restraint upper tether anchor (2) for both the center and the two outboard seating positions, and child restraint lower anchors (1) for the two outboard seating positions only.

The three upper tether anchors are integral to the rear seat back panels. Two anchors are integral to the back of the right rear seat back panel (2), and one is integral to the left rear seat back panel (1). These anchors are each constructed from a short piece of heavy-gauge steel wire stock that is securely welded into a stamped cup integral to the seat back panel. There is a separate molded plastic trim bezel (3) located around each of the three anchors. The child restraint upper tether anchors cannot be adjusted or repaired and, if faulty or damaged, they must be replaced as a unit with their respective rear seat back panels.




The lower anchors (3) for this model are also integral to their respective rear seat back panels. These anchors are also constructed from heavy-gauge steel wire stock that is formed into a U-shape, then securely welded to the lower edge of the seat back panel. They are each accessed from the front of their respective seats, at each side where the seat back (1) meets the seat cushion (2). These lower anchors cannot be adjusted or repaired and, if faulty or damaged, they must be replaced as a unit with the seat back panel.



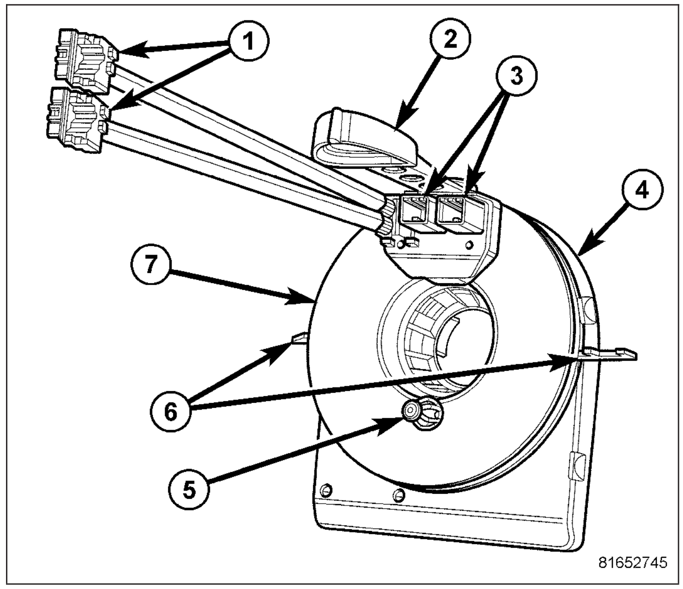

## OPERATION

See the owner's manual in the vehicle glove box for more information on the proper use of all of the factory-installed child restraint anchors.

# CLOCKSPRING

## DESCRIPTION

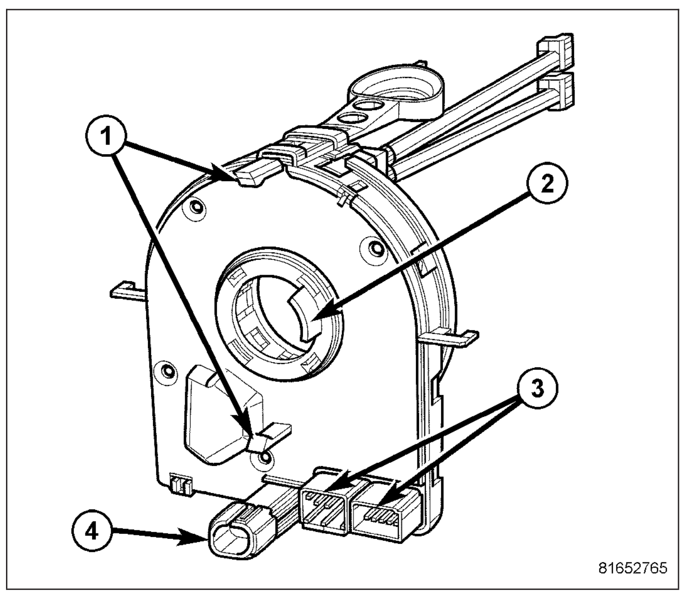
The clockspring assembly is secured with two plastic latches integral to the back of the case onto the upper steering column housing near the top of the steering column behind the steering wheel. Two additional mounting tabs (6) with slotted holes integral to the sides of the case are secured by two screws that secure the upper and lower steering column shrouds to the column housing and to each other. On models equipped with an optional Electronic Stability Program (ESP), the clockspring also includes an integral, internal Steering Angle Sensor (SAS) that is serviced as a unit with the clockspring.




The clockspring consists of a flat, round molded plastic case (4) with a stubby tail that hangs below the steering column. Within the plastic case is a spool-like molded plastic rotor with a large exposed hub. The upper surface of the rotor hub has a large center hole, an engagement dowel (5), two short pigtail wires with connectors (1), and two connector receptacles (3) that face toward the steering wheel.

Service replacement clocksprings are shipped pre-centered and with a molded plastic locking pin (2) that snaps into a receptacle on the rotor and is engaged with tabs on the upper surface of the clockspring case. The locking pin secures the centered clockspring rotor to the clockspring case during shipment and handling, but must be removed from the clockspring after it is installed on the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

Besides the two latch features (1), the lower surface of the case facing toward the instrument panel includes two integral connector receptacles (3). On units with the SAS there is an additional applied connector (4) with a short pigtail wire on the lower surface of the case, inboard of the two integral connectors. The lower surface of the rotor hub has a molded plastic turn signal cancel cam with a single lobe (2) that is integral to the rotor.




Within the plastic case and wound around the rotor spool is a long ribbon-like tape that consists of several thin copper wire leads sandwiched between two thin plastic membranes. The outer end of the tape terminates at the connector receptacles that face the instrument panel, while the inner end of the tape terminates at the pigtail wires and connector receptacles that face the steering wheel.

The clockspring cannot be repaired. If the clockspring is faulty, damaged, or if the driver airbag has been deployed, the clockspring must be replaced.

## OPERATION

The clockspring is a mechanical electrical circuit component that is used to provide continuous electrical continuity between the fixed instrument panel wire harness and the electrical components mounted on or in the rotating steering wheel. On this model the rotating electrical components include the driver airbag, the horn switch, the speed control switches, and the remote radio switches, if the vehicle is so equipped. The clockspring case is positioned and secured to the upper steering column housing near the top of the steering column. The connector receptacles on the tail of the fixed clockspring case connect the clockspring to the vehicle electrical system through two take outs with connectors from the instrument panel wire harness.

The clockspring rotor is movable and is keyed by the engagement dowel that is molded onto the upper surface of the rotor hub to an opening that is cast into the steering wheel armature. The lobe of the turn signal cancel cam on the lower surface of the clockspring rotor hub contacts a turn signal cancel actuator of the multi-function switch to provide automatic turn signal cancellation. On units with an integral, internal Steering Angle Sensor (SAS), a connector and pigtail wire on the lower clockspring case connects the sensor to the vehicle electrical system through a third dedicated take out and connector of the instrument panel wire harness.

The yellow-sleeved pigtail wires on the upper surface of the clockspring rotor connect the clockspring to the multistage driver airbag, while a steering wheel wire harness connects the connector receptacle on the upper surface of the clockspring rotor to the horn switch and, if the vehicle is so equipped, to the optional speed control switches and remote radio switches on the steering wheel.

Like the clockspring in a timepiece, the clockspring tape has travel limits and can be damaged by being wound too tightly during full stop-to-stop steering wheel rotation. To prevent this from occurring, the clockspring is centered when it is installed on the steering column. Centering the clockspring indexes the clockspring tape to the movable steering components so that the tape can operate within its designed travel limits. However, if the clockspring is removed from the steering column or if the steering shaft is disconnected from the steering gear, the clockspring spool can change position relative to the other steering components. The clockspring must be re-centered following completion of this service or the tape may be damaged.

Service replacement clocksprings are shipped pre-centered and with a locking pin installed. This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

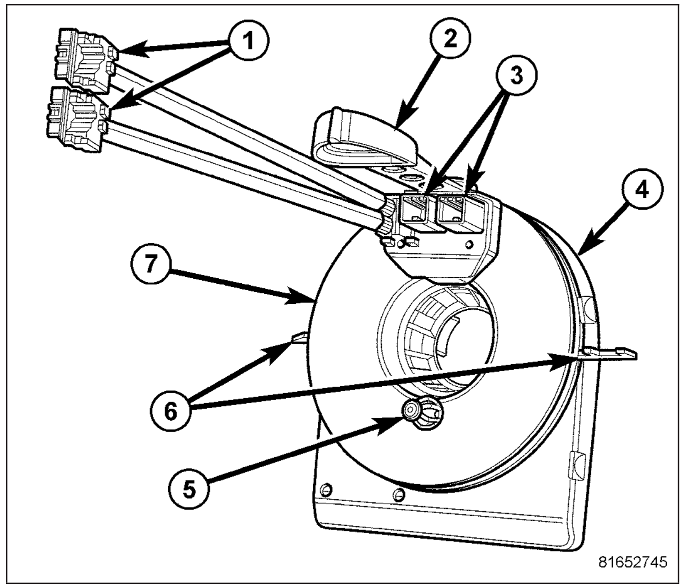
## STANDARD PROCEDURE

## CLOCKSPRING CENTERING

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.**

1. Place the front wheels in the straight-ahead position.
2. Remove the clockspring from the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).
3. Rotate the clockspring rotor (7) clockwise to the end of its travel. **Do not apply excessive torque.**
4. From the end of the clockwise travel, rotate the rotor about two and one-half turns counterclockwise. The engagement dowel (5) should end up at the bottom, and the airbag pigtail wires (1) and connector receptacles (3) should be at the top. Turn the rotor slightly clockwise or counterclockwise as necessary so that the slots for the clockspring locking pin (2) are in alignment.
5. The clockspring is now centered. Secure the clockspring rotor to the clockspring case to maintain clockspring centering until it is reinstalled on the steering column.



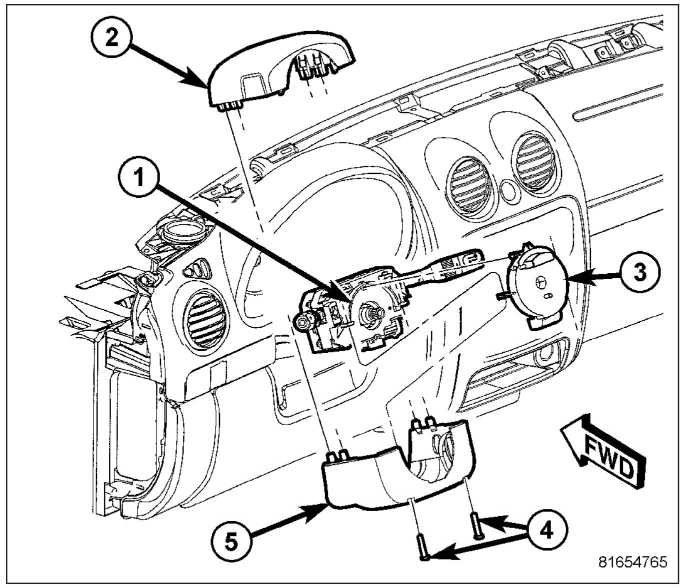

6. The front wheels should still be in the straight-ahead position. Reinstall the clockspring onto the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: A service replacement clockspring is shipped with the clockspring pre-centered and with a molded plastic locking pin installed. This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).**

**NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.**




1. Place the front wheels in the straight ahead position.
2. Disconnect and isolate the battery negative cable.
3. Remove the driver airbag from the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).
4. Disconnect the steering wheel wire harness connectors from the upper clockspring connector receptacles.

**CAUTION: Be certain that the screws that secure the steering wheel puller to the steering wheel are fully engaged in the steering wheel armature without passing through the steering wheel and damaging the clockspring.**

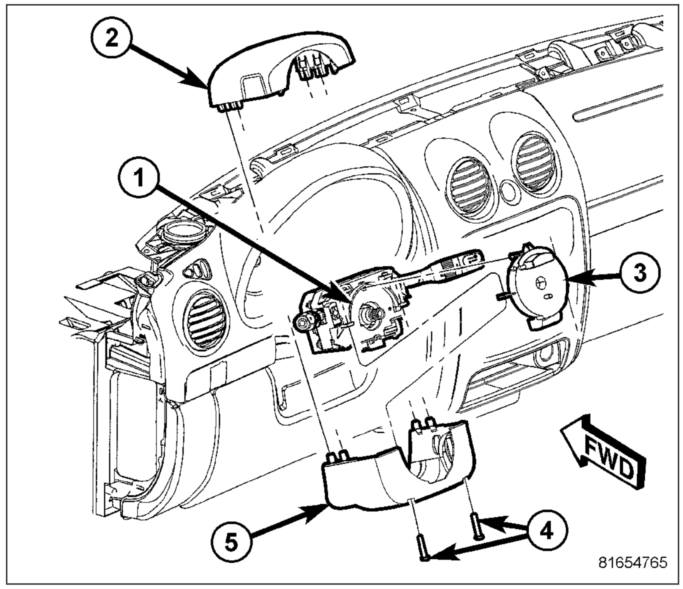
5. Remove the steering wheel from the steering column (8). (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - REMOVAL).
6. If the vehicle is equipped with the optional tilt steering column, move the column to the fully lowered position and leave the tilt release lever in the released (down) position.
7. From below the steering column, remove the two screws (4) that secure the lower shroud (5) to the upper shroud (2).
8. Using hand pressure, push gently inward on both sides of the upper shroud above the parting line between the upper and lower shrouds to release the snap features that secure the two shroud halves to each other.
9. Remove both the upper and lower shrouds from the steering column.
10. Disconnect the two instrument panel wire harness connectors for the clockspring from the two connector receptacles located below the steering column on the back of the clockspring (3) case.
11. If the vehicle is equipped with the optional Electronic Stability Program (ESP) there will be an applied pigtail wire connector located below the steering column on the back of the clockspring case for the Steering Angle Sensor (SAS) that is internal to the clockspring. Disconnect the instrument panel wire harness connector for the SAS from the pigtail connector.
12. Using a small thin-bladed screwdriver, release the two integral plastic latches that secure the back of the clockspring case to the steering column lock housing (1).
13. Remove the clockspring from the steering column lock housing. The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver airbag has been deployed.
14. If the removed clockspring is to be reused, be certain to secure the clockspring rotor to the clockspring case to maintain clockspring centering until it is reinstalled on the steering column. If clockspring centering is not maintained, the clockspring must be centered again before it is reinstalled. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**CAUTION: A service replacement clockspring is shipped with the clockspring pre-centered and with a molded plastic locking pin installed. This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).**

**NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.**




1. Carefully slide the centered clockspring (3) down over the steering column upper shaft until the two integral plastic latches on the back of the clockspring case are fully engaged through their openings in the steering column lock housing (1).
2. If the vehicle is equipped with the optional Electronic Stability Program (ESP) there will be an applied pigtail wire connector located below the steering column on the back of the clockspring case for the Steering Angle Sensor (SAS) that is internal to the clockspring. Reconnect the instrument panel wire harness connector for the SAS to the pigtail connector.
3. Reconnect the two instrument panel wire harness connectors for the clockspring to the two connector receptacles located below the steering column on the back of the clockspring case.
4. Position the upper (2) and lower (5) shrouds onto the steering column.
5. Align the snap features on the lower shroud with the receptacles in the upper shroud and apply hand pressure to snap them together.
6. From below the steering column, install and tighten the two screws (4) that secure the lower shroud to the upper shroud. Tighten the screws to 2 N·m (18 in. lbs.).
7. If the vehicle is equipped with the optional tilt steering column, move the column back to the fully raised position and move the tilt release lever back to the locked (up) position.
8. If a new clockspring has been installed, remove the plastic locking pin that secures the clockspring rotor to the clockspring case to maintain clockspring centering.
9. Reinstall the steering wheel onto the steering column. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - INSTALLATION).

**NOTE: Be certain that the steering wheel mounting screw is tightened to the proper torque specification to ensure proper clockspring operation.**

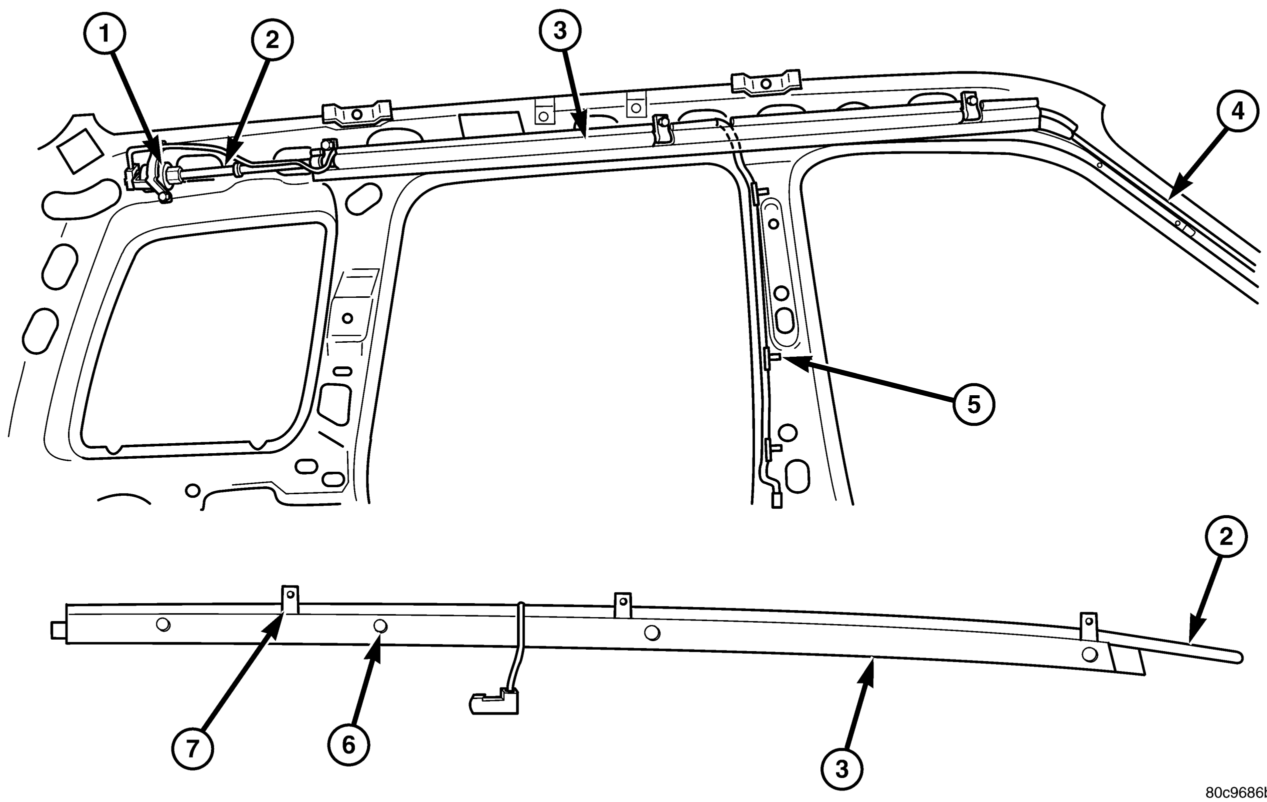
10. Reconnect the steering wheel wire harness connector to the upper clockspring connector receptacle.
11. Reinstall the driver airbag onto the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).
12. Reconnect the battery negative cable.

# CURTAIN AIRBAG

## DESCRIPTION

Optional side curtain airbags are available for this model when it is also equipped with dual front airbags. These airbags are passive, inflatable, Supplemental Restraint System (SRS) components, and vehicles with this equipment can be readily identified by a molded identification trim button with the “SRS - AIRBAG” logo located on the headliner above each B-pillar. This system is designed to reduce injuries to the vehicle occupants in the event of a side impact collision.

8098029e



80c9686b

Vehicles equipped with side curtain airbags have two individually controlled curtain airbag units. These airbag units are concealed and mounted above the headliner where they are each secured to one of the roof side rails. Each folded airbag cushion is contained within a long extruded plastic channel (3) that extends along the roof rail from the A-pillar at the front of the vehicle to just behind the C-pillar at the rear of the vehicle. The channel is secured with plastic push-in fasteners to the roof rail (6).

A tether (4) extends down the A-pillar from the front of the airbag cushion, where it is retained to the pillar with a plastic push-in routing clip and is secured to the base of the A-pillar near the belt line with a screw. The hybrid-type inflator (1) for each airbag is secured to the roof rail at the rear of the airbag unit between the C-pillar and the D-pillar, and is connected to the airbag cushion by a long tubular manifold (2). The bracket holding the inflator and three other brackets (7) holding the manifold are secured to the roof rail with screws.

A two-wire pigtail harness is routed forward from the airbag inflator through a trough along the top of the plastic airbag channel on the roof rail and down the B-pillar, where it is retained by three routing clips (5). The pigtail harness is connected to a take out and connector of the body wire harness on the B-pillar, which connects the airbag unit to the Airbag Control Module (ACM).

The side curtain airbag unit cannot be adjusted or repaired and must be replaced if deployed, faulty, or in any way damaged. Once a side curtain airbag has been deployed, the complete airbag unit, the headliner, the upper A, B, and C-pillar trim, and all other visibly damaged components must be replaced.

## OPERATION

Each side curtain airbag is deployed individually by an electrical signal generated by the Airbag Control Module (ACM) to which it is connected through left or right curtain airbag line 1 and line 2 (or squib) circuits. The hybrid-type inflator assembly for each airbag contains a small canister of highly compressed inert gas. When the ACM sends the proper electrical signal to the airbag inflator, the electrical energy creates enough heat to ignite chemical pellets within the inflator.

Once ignited, these chemicals burn rapidly and produce the pressure necessary to rupture a containment disk in the inert gas canister. The inflator and inert gas canister are sealed and connected to a tubular manifold so that all of the released gas is directed into the folded curtain airbag cushion, causing the cushion to inflate. As the airbag cushion inflates it will drop down from the roof rail between the edge of the headliner and the side glass/body pillars to form a curtain-like cushion to protect the vehicle occupants during a side impact collision.

The front tether keeps the front portion of the bag taut to the side of the vehicle, thus ensuring that the bag will deploy in the proper position. Following the airbag deployment, the airbag cushion quickly deflates by venting the inert gas through the loose weave of the cushion fabric, and the deflated cushion hangs down loosely from the roof rail.

## REMOVAL

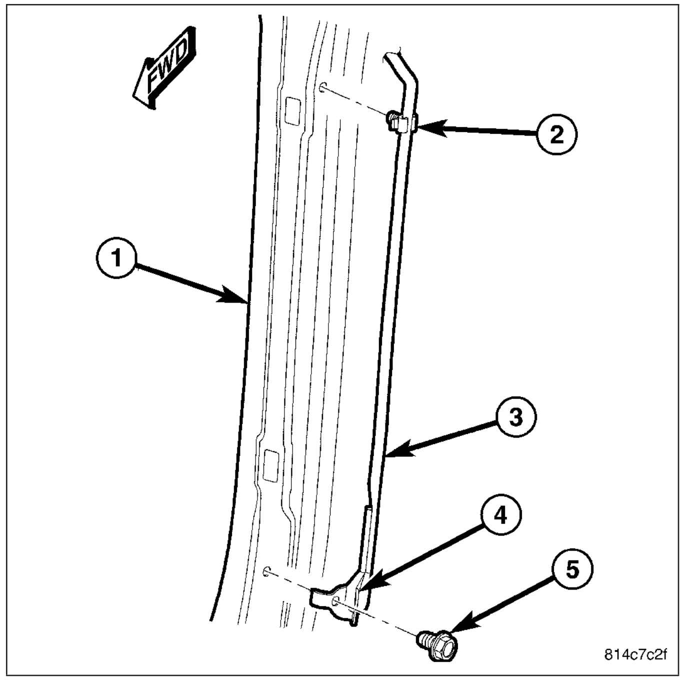
The following procedure is for replacement of a faulty or damaged side curtain airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the side curtain airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

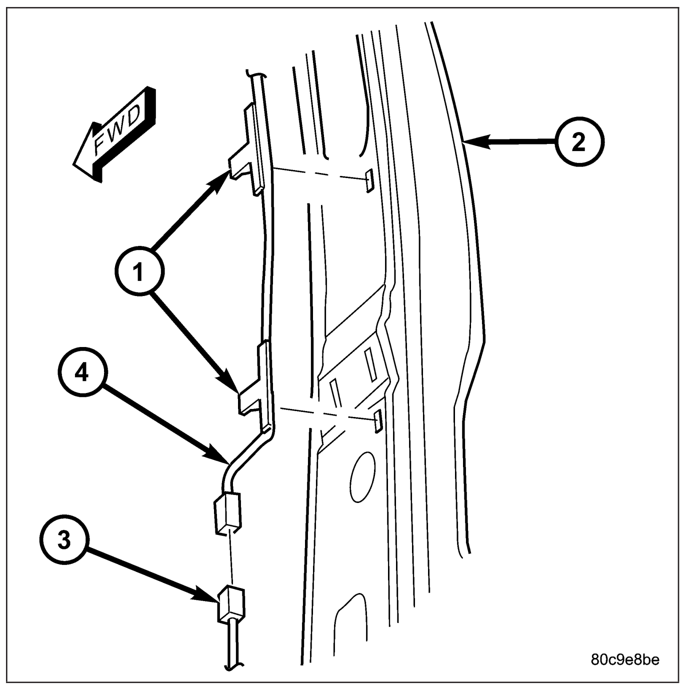
**WARNING: To avoid personal injury or death, when removing a deployed airbag, rubber gloves, eye protection, and a long-sleeved shirt should be worn. There may be deposits on the airbag unit and other interior surfaces. In large doses, these deposits may cause irritation to the skin and eyes.**

**WARNING: To avoid personal injury or death, use extreme care to prevent any foreign material from entering the side curtain airbag, or becoming entrapped between the side curtain airbag cushion and the headliner. Failure to observe this warning could result in occupant injuries upon airbag deployment.**

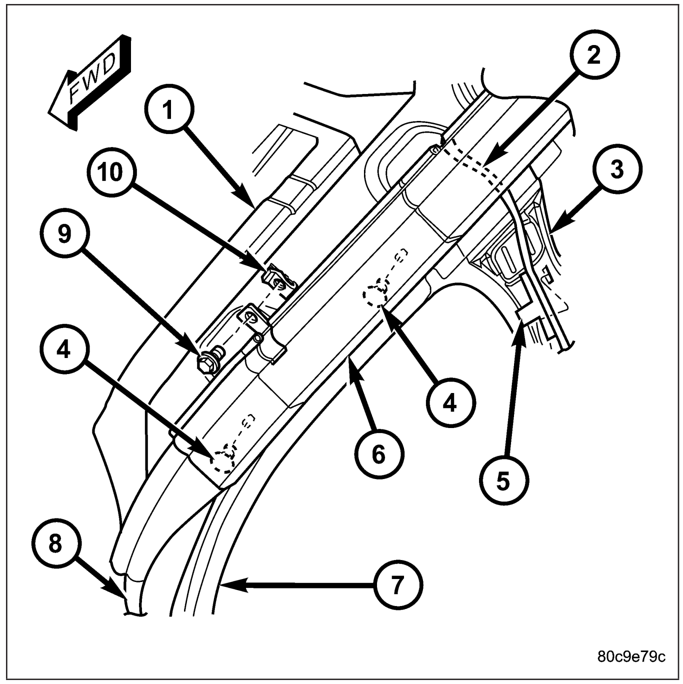
1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the lower trim from the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL).
3. Remove the headliner from the vehicle. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL).
4. Remove the screw (5) that secures the side curtain airbag tether retainer (4) to the base of the A-pillar (1) near the belt line.
5. Disengage the side curtain airbag tether (3) plastic retainer clip (2) from the A-pillar.

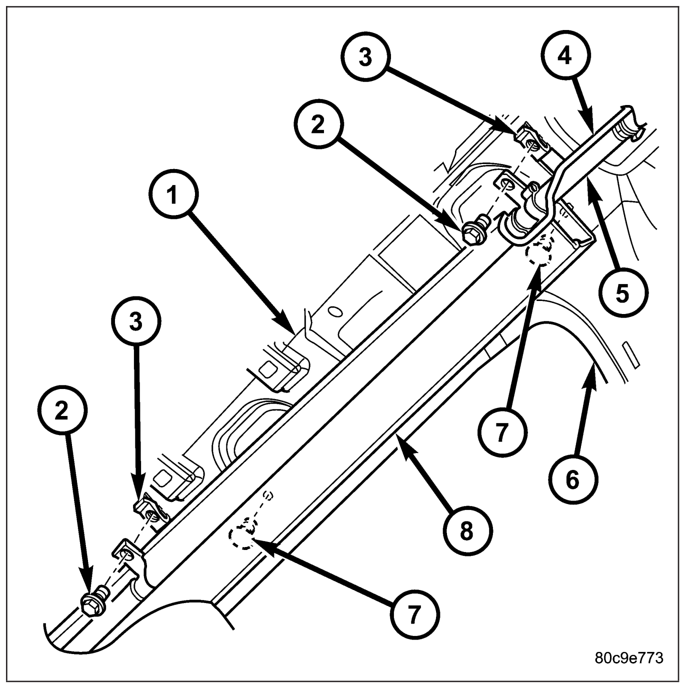



6. Disconnect the side curtain airbag pigtail wire connector (4) from the body wire harness connector (3) near the base of the B-pillar (2).
7. Disengage the three side curtain airbag pigtail wire retainer clips (1) from the B-pillar.

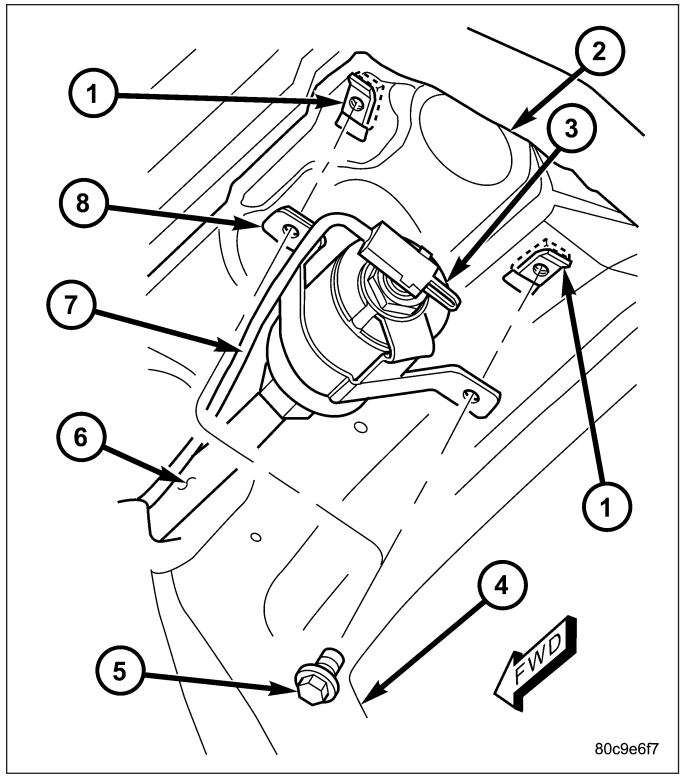


8. Remove the three screws (9 or 2) that secure the side curtain airbag manifold tube (5) brackets to the U-nuts (10 or 3) in the roof rail (1).



9. Remove the two screws (5) that secure the side curtain airbag inflator (3) bracket (8) to the U-nuts (1) in the roof rail (2).
10. Grasp the extruded plastic side curtain airbag channel firmly and pull it straight away from the roof rail far enough to disengage all four plastic push-in fasteners that secure it.
11. Remove the side curtain airbag from the vehicle as a unit.




## INSTALLATION

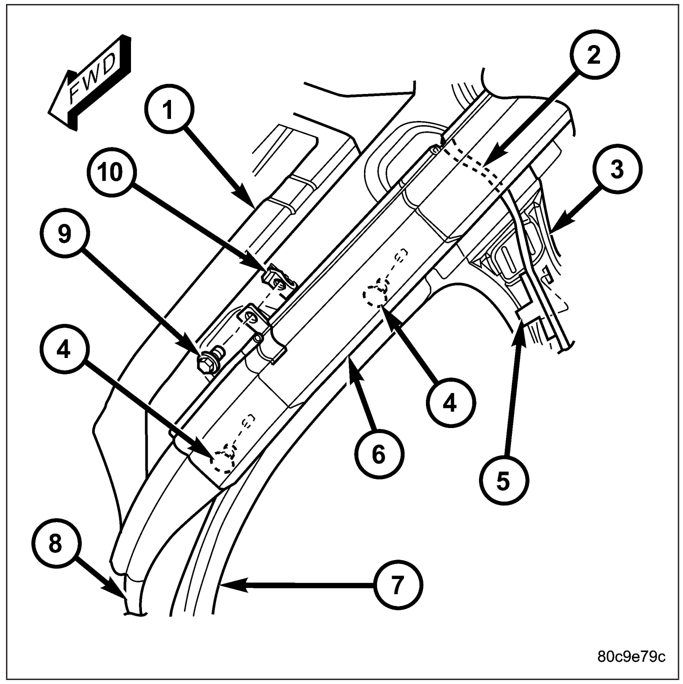
The following procedure is for replacement of a faulty or damaged side curtain airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the side curtain airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

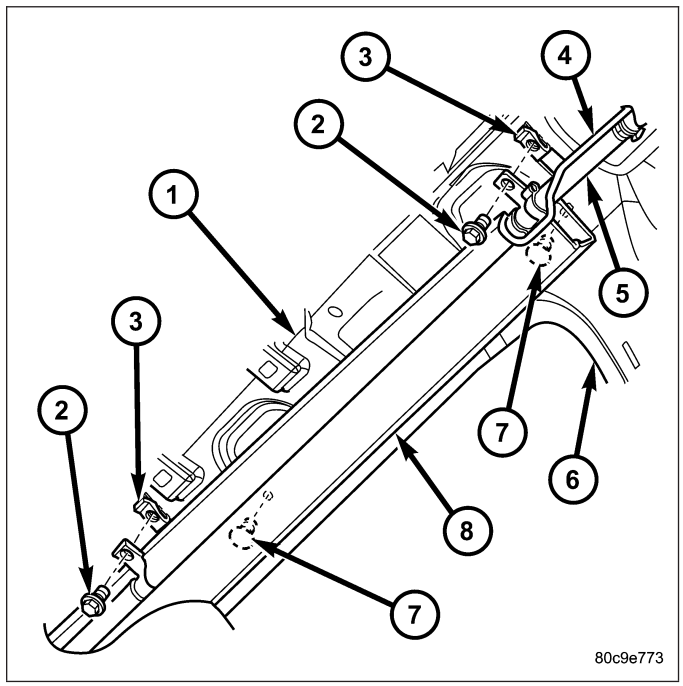
**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, when removing a deployed airbag, rubber gloves, eye protection, and a long-sleeved shirt should be worn. There may be deposits on the airbag unit and other interior surfaces. In large doses, these deposits may cause irritation to the skin and eyes.**

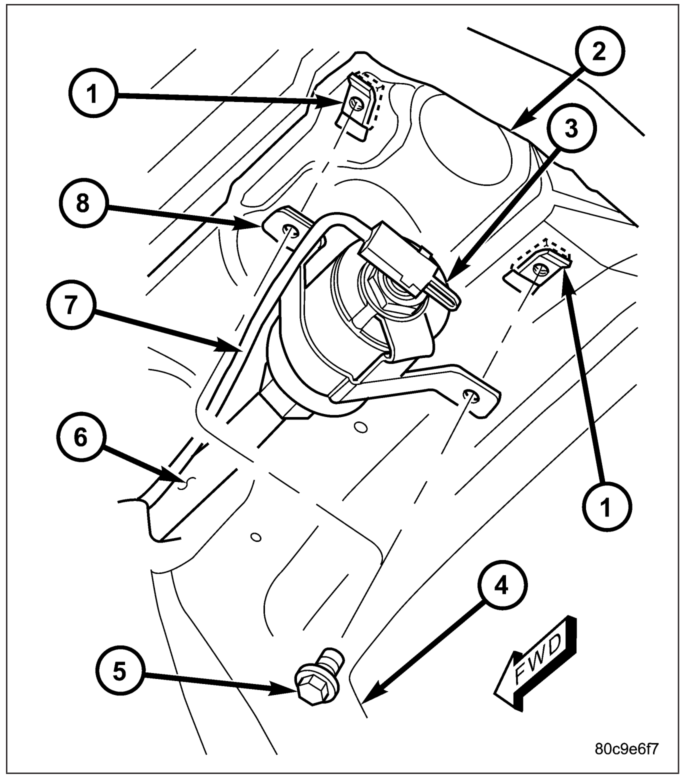
**WARNING: To avoid personal injury or death, use extreme care to prevent any foreign material from entering the side curtain airbag, or becoming entrapped between the side curtain airbag cushion and the headliner. Failure to observe this warning could result in occupant injuries upon airbag deployment.**

1. Position the side curtain airbag into the vehicle as a unit.
2. Align all four plastic push-in fasteners (4 or 7) that secure the extruded plastic side curtain airbag channel (6 or 8) with their holes in the roof side rail (1) and push them straight into the roof rail until they are fully seated.



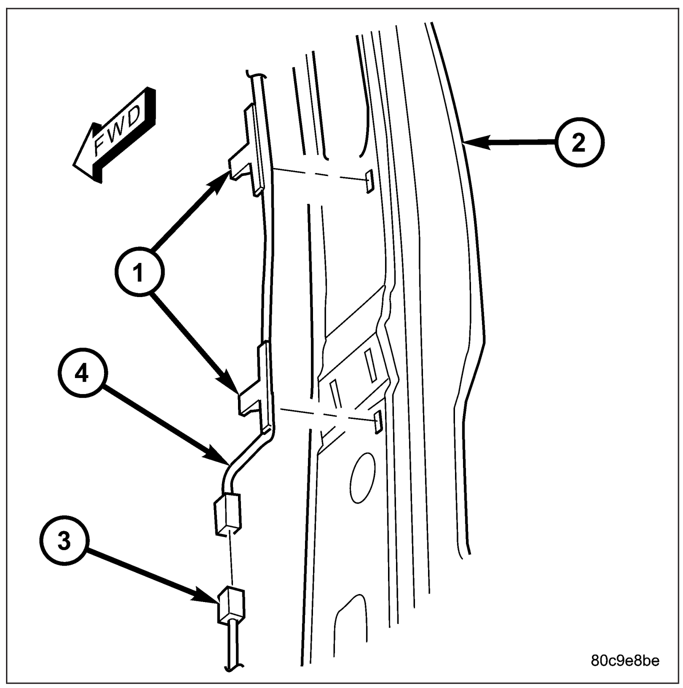
3. Install and tighten the upper screw (5) that secures the side curtain airbag inflator bracket (8) to the U-nut (1) in the roof rail, followed by the lower screw. Tighten the screws to 12 N·m (105 in. lbs.).
4. Working from the rear of the vehicle to the front, install and tighten each of the three screws that secure the side curtain airbag manifold tube brackets to the U-nuts in the roof rail. Tighten the screws to 12 N·m (105 in. lbs.).



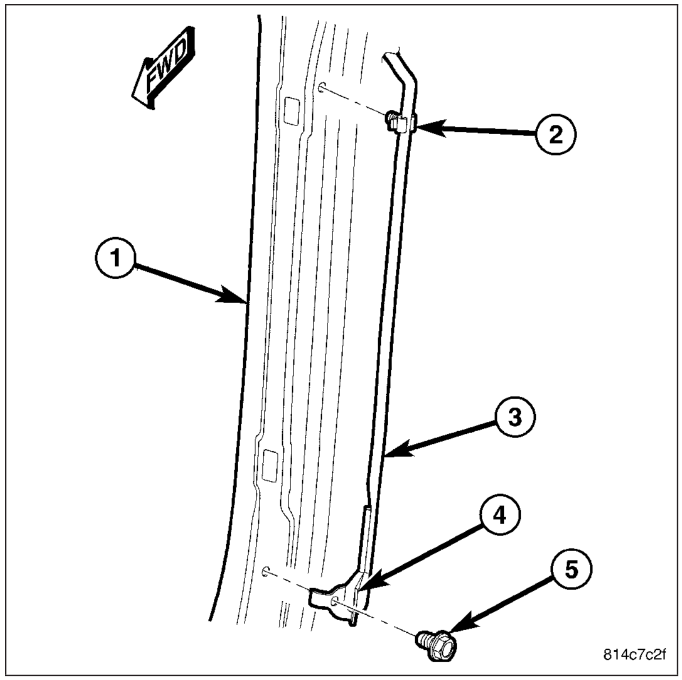

5. Route the side curtain airbag pigtail wire (4) through the trough along the top of the extruded plastic airbag channel on the roof side rail, then between the channel and the body down the B-pillar (2).

**NOTE: Be certain that the side curtain airbag pigtail wire is routed behind the airbag channel, between the channel and the body above the B-pillar.**

6. Engage the three side curtain airbag pigtail wire retainer clips (1) into the B-pillar.
7. Reconnect the side curtain airbag pigtail wire connector to the body wire harness connector (3) near the base of the B-pillar.



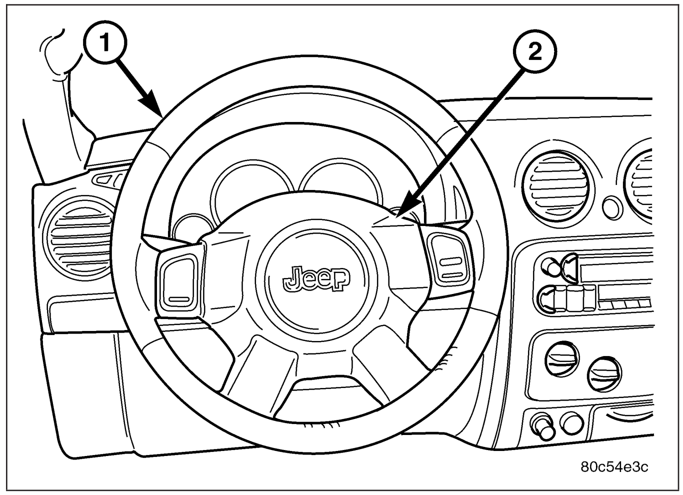
8. Engage the side curtain airbag tether (3) plastic retainer clip (2) into the A-pillar (1).
9. Install and tighten the screw (5) that secures the side curtain airbag tether retainer (4) to the base of the A-pillar near the belt line. Tighten the screw to 14 N·m (120 in. lbs.).
10. Reinstall the headliner into the vehicle. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION).
11. Reinstall the lower trim onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION).
12. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).



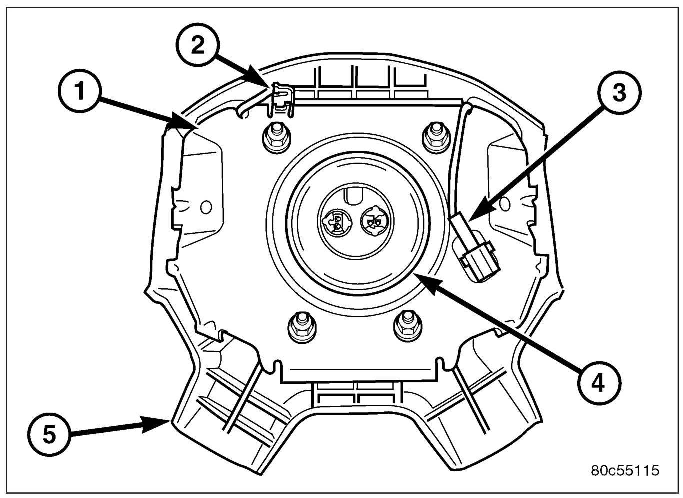
# DRIVER AIRBAG

## DESCRIPTION

The black, injection molded, thermoplastic driver airbag protective trim cover (2) is the most visible part of the driver airbag. The driver airbag is located in the center of the steering wheel (1), where it is secured with two screws to the two horizontal spokes of the four-spoke steering wheel armature. All models have a bright silver Jeep® logo applied to the center of the trim cover. Concealed beneath the driver airbag trim cover are the horn switch, the folded airbag cushion, the airbag cushion retainer, the airbag housing, the airbag inflator, and the retainers that secure the inflator to the airbag housing. The airbag cushion, housing, and inflator are secured within an integral receptacle molded into the back of the trim cover.




The resistive membrane-type horn switch is secured with heat stakes to the inside surface of the driver airbag trim cover (5), between the trim cover and the folded airbag cushion. The horn switch ground pigtail wire (2) has a female spade terminal connector that receives a path to ground through a male spade terminal that is integral to the driver airbag housing stamping (1) and is located near the upper right corner on the back of the housing. The horn switch feed pigtail wire (3) has a white, molded plastic insulator that is secured by an integral retainer to a mounting hole located near the lower left corner on the back of the housing, and is connected to the vehicle electrical system through a take out and connector of the steering wheel wire harness.




The airbag used in this model is a multistage unit that complies with revised federal airbag standards to deploy with less force than those used in some prior models. A 71 centimeter (28.0 inch) diameter, radial deploying fabric cushion with internal tethers is used. The airbag inflator (4) is a dual-initiator, non-azide, pyrotechnic-type unit with four mounting studs and is secured to the stamped metal airbag housing using four hex nuts with washers. Two keyed and color-coded connector receptacles on the driver airbag inflator connect the two inflator initiators to the vehicle electrical system through two yellow or black-jacketed, two-wire pigtail harnesses of the clockspring.

The driver airbag unit cannot be repaired, and must be replaced if deployed or in any way damaged.

## OPERATION

The multistage driver airbag is deployed by electrical signals generated by the Airbag Control Module (ACM) through the driver airbag squib 1 and squib 2 circuits to the two initiators in the airbag inflator. By using two initiators, the airbag can be deployed at multiple levels of force. The force level is controlled by the ACM to suit the monitored impact conditions by providing one of three delay intervals between the electrical signals provided to the two initiators. The longer the delay between these signals, the less forcefully the airbag will deploy.

When the ACM sends the proper electrical signals to each initiator, the electrical energy generates enough heat to initiate a small pyrotechnic charge which, in turn ignites chemical pellets within the inflator. Once ignited, these chemical pellets burn rapidly and produce a large quantity of inert gas. The inflator is sealed to the back of the airbag housing and a diffuser in the inflator directs all of the inert gas into the airbag cushion, causing the cushion to inflate. As the cushion inflates, the driver airbag trim cover will split at predetermined breakout lines, then fold back out of the way along with the horn switch unit. Following an airbag deployment, the airbag cushion quickly deflates by venting the inert gas towards the instrument panel through vent holes within the fabric used to construct the back (steering wheel side) panel of the airbag cushion.

Some of the chemicals used to create the inert gas may be considered hazardous while in their solid state before they are burned, but they are securely sealed within the airbag inflator. Typically, both initiators are used and all potentially hazardous chemicals are burned during an airbag deployment event. However, it is possible for only one initiator to be used during a deployment due to an airbag system fault; therefore, it is necessary to always confirm that both initiators have been used in order to avoid the improper disposal of potentially live pyrotechnic or hazardous materials. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

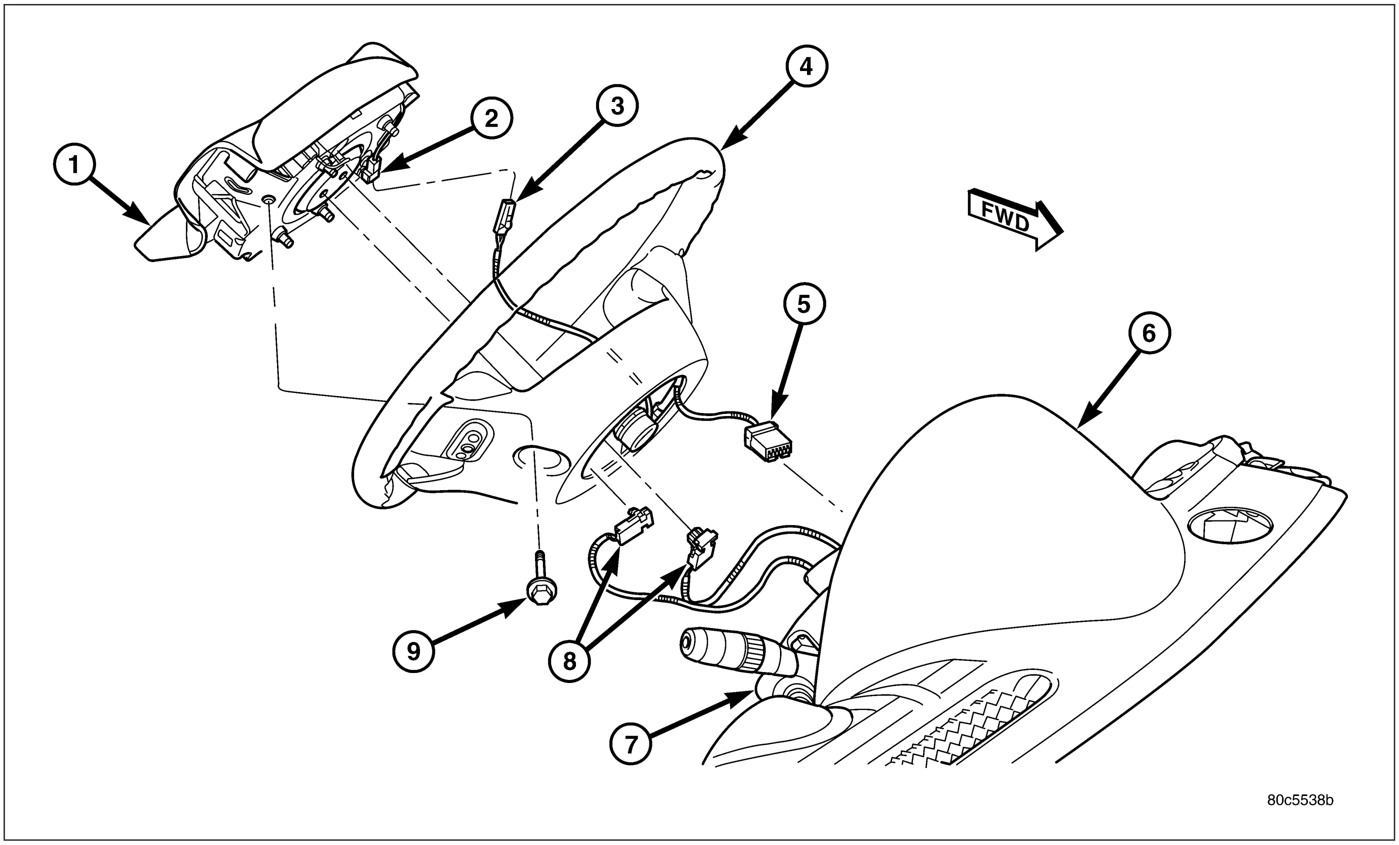
The inert gas that is produced when the chemicals are burned is harmless. However, a small amount of residue from the burned chemicals may cause some temporary discomfort if it contacts the skin, eyes, or breathing passages. If skin or eye irritation is noted, rinse the affected area with plenty of cool, clean water. If breathing passages are irritated, move to another area where there is plenty of clean, fresh air to breath. If the irritation is not alleviated by these actions, contact a physician.

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, when removing a deployed airbag, rubber gloves, eye protection, and a long-sleeved shirt should be worn. There may be deposits on the airbag cushion and other interior surfaces. In large doses, these deposits may cause irritation to the skin and eyes.**

**NOTE: The following procedure is for replacement of a faulty or damaged driver airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the driver airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).**




1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. From the underside of the steering wheel, remove the two screws (9) that secure the driver airbag (1) to the steering wheel armature.
3. Pull the driver airbag away from the steering wheel (4) far enough to access the three electrical connections on the back of the airbag housing.
4. Disconnect the steering wheel wire harness connector (3) for the horn switch from the horn switch feed pigtail wire connector (2), which is located on the back of the driver airbag housing.

**CAUTION: Do not pull on the clockspring pigtail wires or pry on the connector insulator to disengage the connector from the driver airbag inflator connector receptacle. Improper removal of these pigtail wires and their connector insulators can result in damage to the airbag circuits or connector insulators.**

5. The clockspring driver airbag pigtail wire connectors (8) are secured by integral latches to the airbag inflator connector receptacles, which are located on the back of the driver airbag housing. Depress the latches on each side of each connector insulator and pull the insulators straight out from the airbag inflator to disconnect them from the connector receptacles.
6. Remove the driver airbag from the steering wheel.
7. If the driver airbag has been deployed, the clockspring must be replaced. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

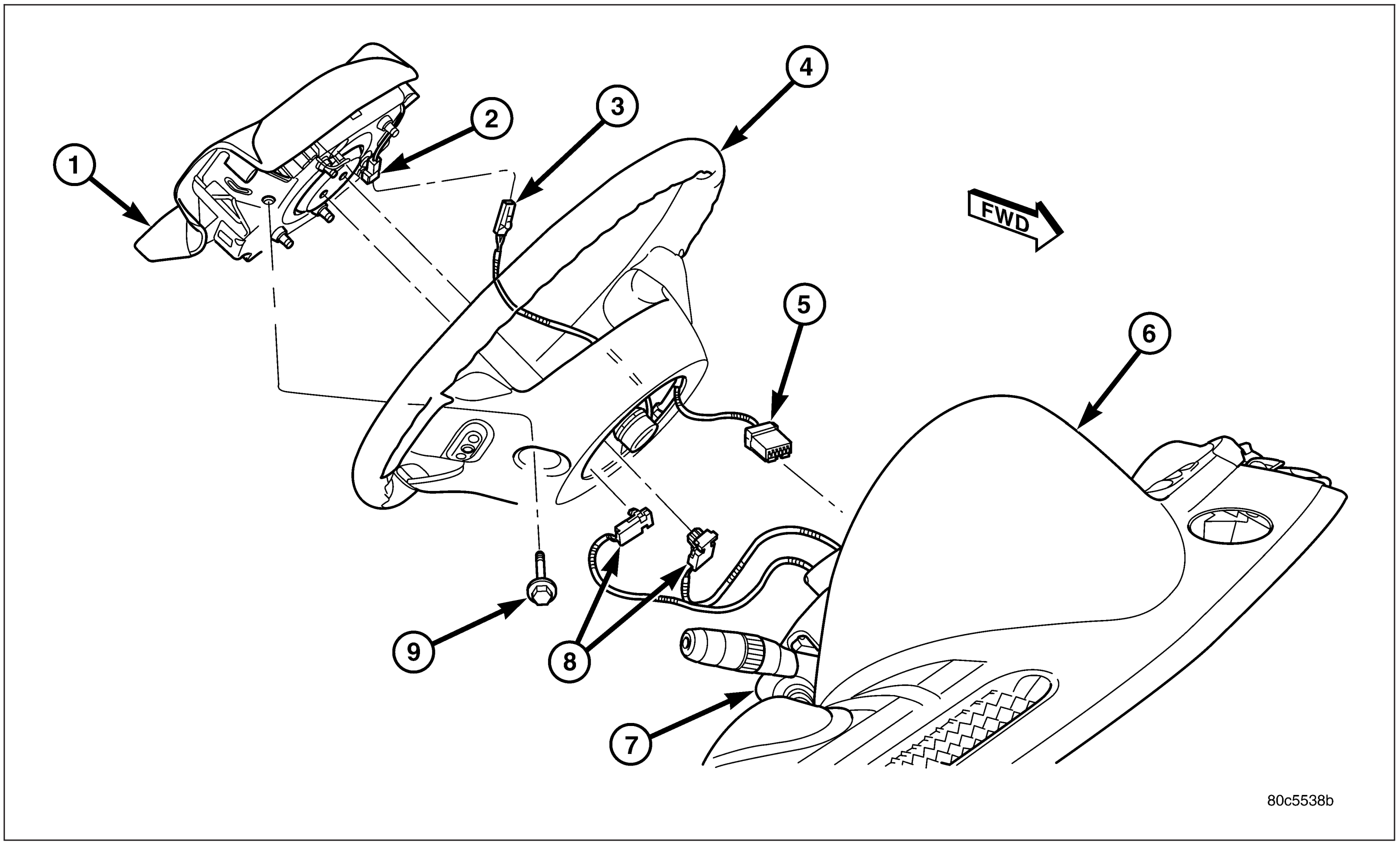
## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, use extreme care to prevent any foreign material from entering the driver airbag, or becoming entrapped between the driver airbag cushion and the driver airbag trim cover. Failure to observe this warning could result in occupant injuries upon airbag deployment.**

**WARNING: To avoid personal injury or death, the driver airbag trim cover must never be painted. Replacement airbags are serviced with trim covers in the original colors. Paint may change the way in which the material of the trim cover responds to an airbag deployment. Failure to observe this warning could result in occupant injuries upon airbag deployment.**

**NOTE: The following procedure is for replacement of a faulty or damaged driver airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the driver airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).**




1. Position the driver airbag (1) close enough to the steering wheel (4) to reconnect the three electrical connections on the back of the airbag housing.
2. When installing the driver airbag, reconnect the two clockspring driver airbag pigtail wire connectors (8) to the airbag inflator connector receptacles by pressing straight in on the connectors. Be certain to engage each keyed and color-coded connector to the matching connector receptacle. You can be certain that each connector is fully engaged in its receptacle by listening carefully for a distinct, audible click as the connector latches snap into place.
3. Reconnect the steering wheel wire harness connector (3) for the horn switch to the horn switch feed pigtail wire connector (2), which is located at the back of the driver airbag housing.
4. Carefully position the driver airbag in the steering wheel. Be certain that the clockspring pigtail wires and steering wheel wire harness in the steering wheel hub area are not pinched between the driver airbag and the steering wheel armature.

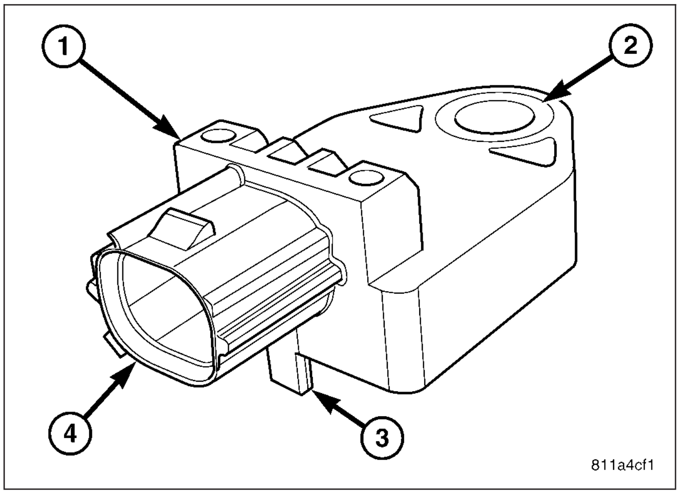
5. From the underside of the steering wheel, install and tighten the two screws (9) that secure the driver airbag to the steering wheel armature. Tighten the screws to 10 N·m (90 in. lbs.).
6. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

# IMPACT SENSOR

## DESCRIPTION

### FRONT

Two front impact sensors (1) are used on this model, one each for the left and right sides of the vehicle. These sensors are mounted remotely from the impact sensor that is internal to the Airbag Control Module (ACM). Each front sensor is secured with a screw to the backs of the right and left vertical members of the radiator support within the engine compartment. The sensor housing has an integral connector receptacle (4), an integral anti-rotation pin (3), and an integral mounting hole (2) with a metal sleeve to provide crush protection.

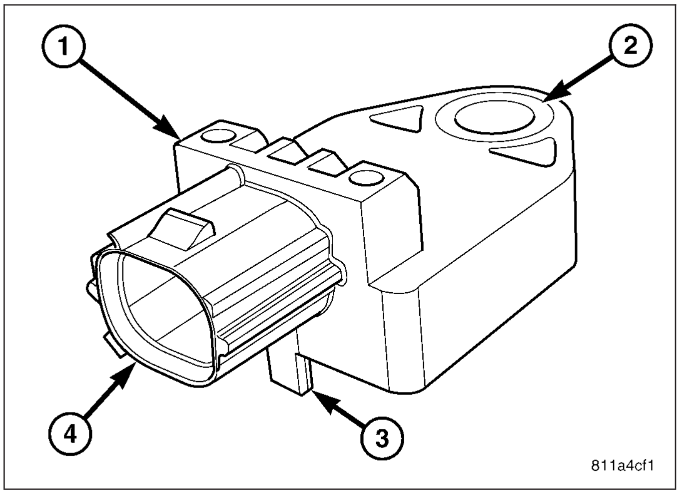



The right and left front impact sensors are identical in construction and calibration. A cavity in the center of the molded black plastic impact sensor housing contains the electronic circuitry of the sensor which includes an electronic communication chip and an electronic impact sensor. Potting material fills the cavity to seal and protect the internal electronic circuitry and components. The front impact sensors are each connected to the vehicle electrical system through a dedicated take out and connector of the headlamp and dash wire harness.

The impact sensors cannot be repaired or adjusted and, if damaged or faulty, they must be replaced.

### SIDE

Two side impact sensors (1) are used on this model when it is equipped with the optional side curtain airbags, one each for the left and right sides of the vehicle. These sensors are mounted remotely from the impact sensor that is internal to the Airbag Control Module (ACM). Each side sensor is secured with a screw to the inner right or left B-pillar above the front seat belt retractor within the passenger compartment. The sensor housing has an integral connector receptacle (4), an integral anti-rotation pin (3), and an integral mounting hole (2) with a metal sleeve to provide crush protection.




The right and left side impact sensors are identical in construction and calibration. A cavity in the center of the molded black plastic impact sensor housing contains the electronic circuitry of the sensor which includes an electronic communication chip and an electronic impact sensor. Potting material fills the cavity to seal and protect the internal electronic circuitry and components. The side impact sensors are each connected to the vehicle electrical system through a dedicated take out and connector of the body wire harness.

The impact sensors cannot be repaired or adjusted and, if damaged or faulty, they must be replaced.

## OPERATION

## FRONT

The front impact sensors are electronic accelerometers that sense the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. Each sensor also contains an electronic communication chip that allows the unit to communicate the sensor status as well as sensor fault information to the microprocessor in the Airbag Control Module (ACM).

The ACM microprocessor continuously monitors all of the passive restraint system electrical circuits to determine the system readiness. If the ACM detects a monitored system fault, it sets a Diagnostic Trouble Code (DTC) and controls the airbag indicator operation accordingly. The impact sensors each receive battery current and ground through dedicated left and right sensor plus and minus circuits from the ACM. The impact sensors and the ACM communicate by modulating the voltage in the sensor plus circuit.

The hard wired circuits between the front impact sensors and the ACM may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ACM, the impact sensors, or the electronic message inputs to or outputs from the impact sensors. The most reliable, efficient, and accurate means to diagnose the impact sensors, the ACM, and the electronic message communication between the sensors and the ACM requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## SIDE

The side impact sensors are electronic accelerometers that sense the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. Each sensor also contains an electronic communication chip that allows the unit to communicate the sensor status as well as sensor fault information to the microprocessor in the Airbag Control Module (ACM).

The ACM microprocessor continuously monitors all of the side passive restraint system electrical circuits to determine the system readiness. If the ACM detects a monitored system fault, it sets a Diagnostic Trouble Code (DTC) and controls the airbag indicator operation accordingly. The impact sensors each receive battery current and ground through dedicated left and right sensor plus and minus circuits from the ACM. The impact sensors and the ACM communicate by modulating the voltage in the sensor plus circuit.

The hard wired circuits between the side impact sensors and the ACM may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ACM, the impact sensors, or the electronic message inputs to or outputs from the impact sensors. The most reliable, efficient, and accurate means to diagnose the impact sensors, the ACM, and the electronic message communication between the sensors and the ACM requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

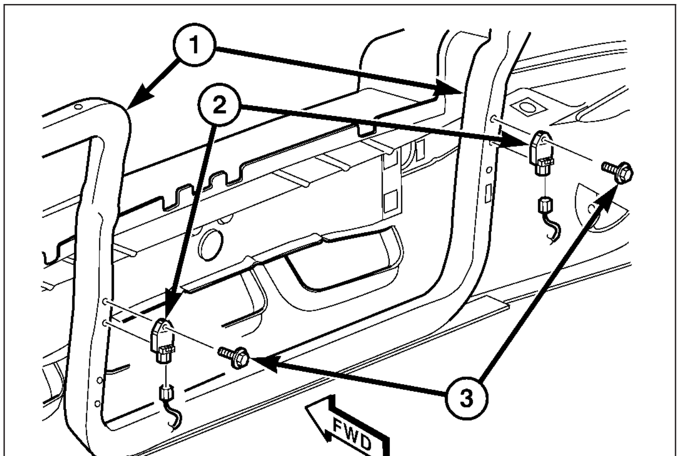
## REMOVAL

## FRONT

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, never strike or drop the front impact sensor, as it can damage the impact sensor or affect its calibration. The front impact sensor enables the system to deploy the front supplemental restraints. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper front supplemental restraint deployment.**

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the screw (3) that secures the right or left front impact sensor (2) to the back of the right or left radiator support vertical member (1).
3. Disconnect the headlamp and dash wire harness connector for the front impact sensor from the sensor connector receptacle.
4. Remove the right or left front impact sensor from the engine compartment.



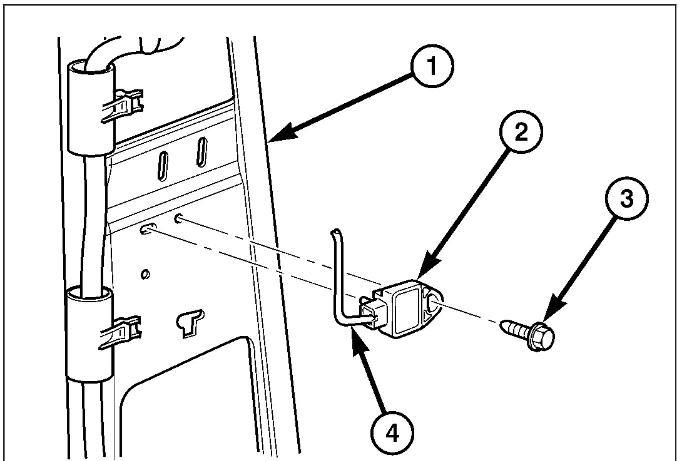
811a5c8a

## SIDE

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, never strike or drop the side impact sensor, as it can damage the impact sensor or affect its calibration. The side impact sensor enables the system to deploy the side curtain supplemental restraints. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper side supplemental restraint deployment.**

1. Adjust the driver or passenger side front seat to its most forward position for easiest access to the B-pillar trim.
2. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
3. Remove the lower trim from the inside of the right or left B-pillar (1). (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL).
4. Remove the screw (3) that secures the right or left side impact sensor (2) to the lower B-pillar.
5. Disconnect the body wire harness connector (4) for the side impact sensor from the sensor connector receptacle.
6. Remove the right or left side impact sensor from the passenger compartment.



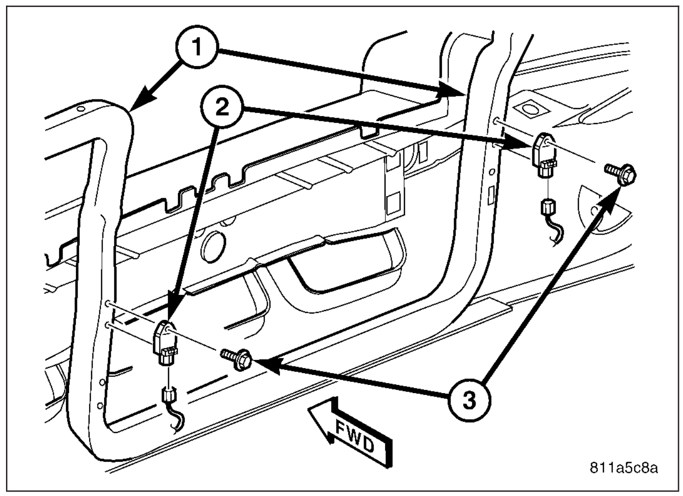
811b8d1c

# INSTALLATION

## FRONT

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, never strike or drop the front impact sensor, as it can damage the impact sensor or affect its calibration. The front impact sensor enables the system to deploy the front supplemental restraints. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper front supplemental restraint deployment.**

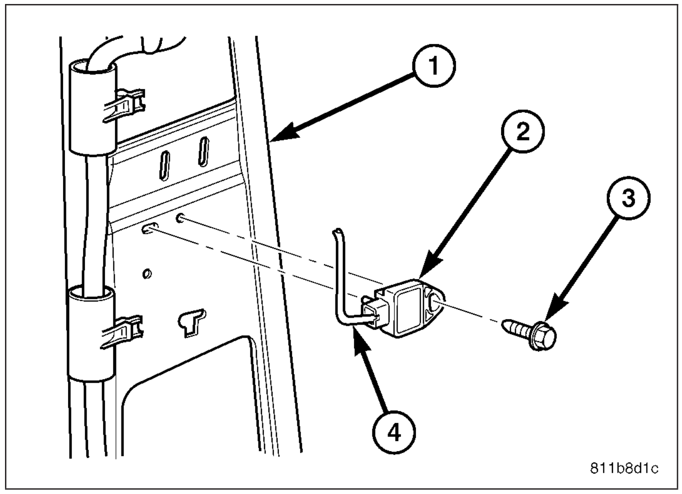



1. Position the right or left front impact sensor (2) into the engine compartment.
2. Reconnect the headlamp and dash wire harness connector for the front impact sensor to the sensor connector receptacle.
3. Position the sensor onto the back of the right or left radiator support vertical member (1). Be certain that the anti-rotation pin on the back of the sensor is engaged in the lower clearance hole of the radiator support.
4. Install and tighten the screw (3) that secures the sensor to the back of the support vertical member. Tighten the screw to 7 N·m (65 in. lbs.).
5. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

## SIDE

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, never strike or drop the side impact sensor, as it can damage the impact sensor or affect its calibration. The side impact sensor enables the system to deploy the side curtain supplemental restraints. If an impact sensor is accidentally dropped during service, the sensor must be scrapped and replaced with a new unit. Failure to observe this warning could result in accidental, incomplete, or improper side supplemental restraint deployment.**

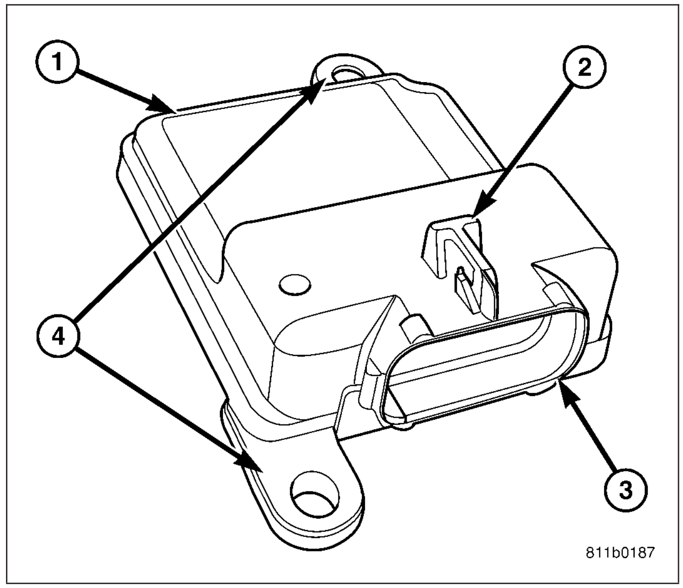



1. Position the right or left side impact sensor (2) near the lower B-pillar (1) in the passenger compartment.
2. Reconnect the body wire harness connector (4) for the side impact sensor to the sensor connector receptacle.
3. Position the right or left side impact sensor onto the inner B-pillar. Be certain that the anti-rotation pin on the back of the sensor is engaged in the clearance hole of the B-pillar.
4. Install and tighten the screw (3) that secures the right or left side impact sensor to the inner B-pillar. Tighten the screw to 11 N·m (100 in. lbs.).
5. Reinstall the lower trim onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION).
6. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

# OCCUPANT CLASSIFICATION MODULE

## DESCRIPTION

The Occupant Classification Module (OCM) (1) is secured with two screws to a stamped steel mounting bracket welded onto the underside of the passenger side front seat cushion frame near the inboard front corner. Concealed within a hollow in the center of the molded plastic OCM housing is a microprocessor and the other electronic circuitry of the module. The module housing is sealed to enclose and protect the internal electronic circuitry. The OCM software is flash programmable.




Two mounting tabs (4), a connector lock tower (2), and a connector receptacle (3) are integral to the OCM housing. The connector receptacle contains terminal pins that connect the OCM to the vehicle electrical system through a dedicated take out and connector of the passenger side front seat wire harness. A molded plastic lock pin is integral to one end of a long tether, while the other end of the tether is secured to the seat wire harness. After the wire harness has been connected to the module, the lock pin is engaged through the lock tower on the module housing preventing the connector latches from becoming disengaged and ensuring that a secure electrical connection is maintained at all times.

A non-calibrated OCM is the only component of the Occupant Classification System (OCS) that is available for separate service replacement. The OCS components of the passenger side front seat cushion including the cushion frame, springs, insulator pad, seat weight bladder and pressure sensor, seat cushion foam, wiring harness and the OCM are a factory-calibrated and assembled unit. Once this unit is connected to a vehicle electrically, the calibration settings are uploaded from the calibrated OCM and stored in the memory of the ACM. If only the OCM is subsequently replaced, the new, non-calibrated OCM learns the proper calibration settings from the ACM after it is connected to the vehicle electrically.

The OCM cannot be adjusted or repaired and, if damaged or faulty, it must be replaced. The components of the passenger side front seat cushion including the cushion frame, springs, insulator pad, seat weight bladder and pressure sensor, seat cushion foam, wire harness and the OCM are serviced only as a factory-calibrated, assembled and tamper-evident unit. Only the OCM and the seat cushion trim are available for separate service replacement. Once a service replacement package has been installed in a vehicle, the OCM can thereafter be serviced only by replacing the entire passenger side front seat cushion unit with another complete service replacement package.

## OPERATION

The microprocessor in the Occupant Classification Module (OCM) contains the Occupant Classification System (OCS) logic circuits. The OCM uses On-Board Diagnostics (OBD) and can communicate with other electronic modules in the vehicle as well as with the diagnostic scan tool using the Programmable Communications Interface (PCI) data bus. This method of communication is also used for OCS diagnosis and testing through the 16-way data link connector located on the driver side lower edge of the instrument panel.

The OCM provides a nominal five volts to both the pressure sensor of the seat weight bladder beneath the passenger side front seat cushion and to the belt tension sensor on the passenger side front seat belt lower anchor through dedicated hard wired sensor voltage and sensor ground circuits. The OCM then monitors the return voltage from each of the sensors on dedicated hard wired data communication circuits. The bladder pressure sensor input allows the OCM to determine whether the passenger side front seat is occupied and the relative size of the occupant by providing a weight-sensing reference to the load on the seat cushion. The belt tension sensor provides an additional logic input to the OCM microprocessor that allows it to distinguish between the lower seat belt cinch loads of a belted occupant and the higher loads associated with a belted child seat.

Pre-programmed decision algorithms and OCS calibration allow the OCM microprocessor to determine when passenger airbag protection is appropriate based upon the seat cushion load as signaled by the bladder pressure sensor and the seat belt cinch load as signaled by the belt tension sensor. When the programmed conditions are met, the OCM sends the proper electronic occupant classification messages over the PCI data bus to the Airbag Control Module (ACM), and the ACM enables or disables the deployment circuits for the passenger front supplemental restraints. The ACM also provides a control output for the passenger airbag on/off indicator in the instrument panel grab handle based upon the electronic occupant classification messages it receives from the OCM.

The OCM microprocessor continuously monitors all of the OCS electrical circuits and components to determine the system readiness. If the OCM detects a monitored system fault, it sets an active and stored Diagnostic Trouble Code (DTC) and sends the appropriate electronic messages to the ACM over the PCI data bus. Then the ACM sets a DTC and sends messages to control the airbag indicator operation accordingly. An active fault only remains for the duration of the fault, or in some cases for the duration of the current ignition switch cycle, while a stored fault causes a DTC to be stored in memory by the OCM and the ACM. For some DTCs, if a fault does not recur for a number of ignition cycles, the OCM will automatically erase the stored DTC. For other internal faults, the stored DTC is latched forever.

The OCM receives battery current on a fused ignition switch output (run-start) circuit through a fuse in the Junction Block (JB). The OCM receives ground through a ground circuit and take out of the body wire harness, which it shares with the ACM. This take out has a single eyelet terminal connector that is secured by a ground screw to the top of the right front seat riser on the floor panel beneath the right front seat. These connections allow the OCM to be operational whenever the ignition switch is in the Start or On positions.

The hard wired inputs and outputs for the OCM may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the OCM, the PCI data bus network, or the electronic message inputs to and outputs from the OCM. The most reliable, efficient, and accurate means to diagnose the OCM, the PCI data bus network, and the electronic message inputs to and outputs from the OCM requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## REMOVAL

A non-calibrated Occupant Classification Module (OCM) is the only component of the Occupant Classification System (OCS) that is available for separate service replacement, as outlined in the procedures that follow. The OCS components of the passenger side front seat cushion including the cushion frame, springs, pad, seat weight bladder and pressure sensor, seat cushion foam and the OCM are a factory-calibrated and assembled unit. Once this unit is connected to a vehicle electrically, the calibration settings are uploaded from the OCM and stored in the memory of the Airbag Control Module (ACM). If only the OCM is subsequently replaced, the new, non-calibrated OCM learns the proper calibration settings from the ACM after it is connected to the vehicle electrically.

If any of the remaining OCS components of the passenger side front seat cushion require replacement, they are serviced only as a factory-calibrated, assembled, and tamper-evident service replacement package. This package includes the assembled frame, springs, pad, seat weight bladder and pressure sensor, foam, wiring and a calibrated OCM. When installing this package, always replace all of the existing components with the new components as a unit. Do not attempt to separate or disconnect any of the new OCS components contained in the service replacement package from each other, and do not attempt to reuse any of the replaced components in this or any other vehicle.

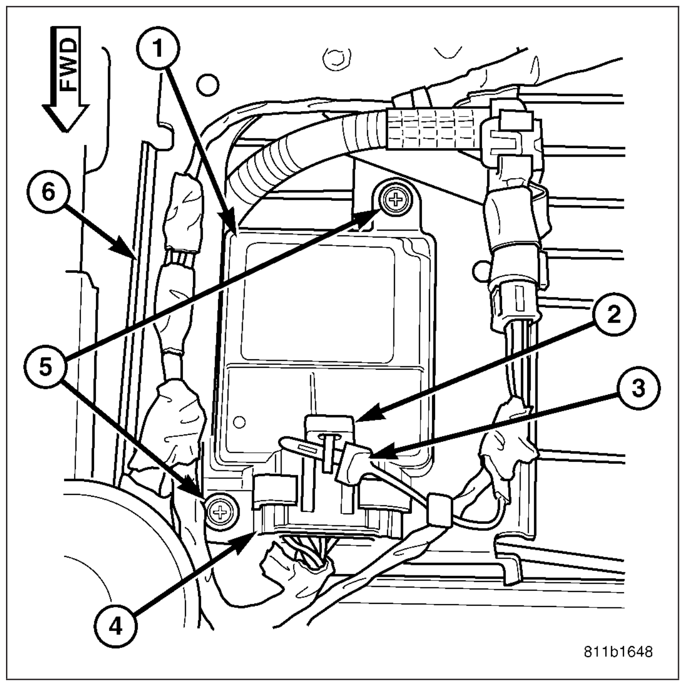
Once any of the original factory-installed components except the OCM have been replaced with the service replacement package components, the OCM can only be serviced by replacing the entire passenger side front seat cushion unit with another complete service replacement package. Any time any one of these components is removed or replaced for any reason, the OCM must be re-calibrated using a diagnostic scan tool, the Occupant Classification Seat Weight special tool, and the Occupant Classification System Verification Test. Refer to the appropriate diagnostic procedures.

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death on vehicles equipped with the Occupant Classification System (OCS), only the Occupant Classification Module (OCM) and the seat cushion trim may be serviced separately. All other components of the passenger side front seat cushion assembly must be serviced only as a complete factory-calibrated, assembled and tamper-evident service replacement package. This package includes the frame, springs, pad, bladder and pressure sensor, foam, wiring and a calibrated OCM. When installing this package always replace all of the existing components with the new components as a unit. Do not attempt to separate or disconnect any of the new OCS components in the service replacement package from each other, and do not attempt to reuse any of the replaced components in this or any other vehicle. Failure to take the proper precautions could result in failure of the passenger airbag to deploy when required, or in passenger airbag deployment when not required.**

**CAUTION: On vehicles equipped with the Occupant Classification System (OCS), never replace both the Airbag Control Module (ACM) and the Occupant Classification Module (OCM) at the same time. If both require replacement, replace the OCM first. Then perform the supplemental restraint verification test including an ignition-On time of at least one minute before replacing the ACM. Both the ACM and the OCM store OCS calibration data, which they transfer to one another during the first minute of ignition-On time after one of them is replaced. If both modules are replaced at the same time, an irreversible fault will be set in both modules. If the data transfer is not allowed sufficient time to complete between modules (at least one minute of ignition-On), an irreversible fault will be set in the module requiring the data.**

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Reach under the front edge of the passenger side front seat cushion to access and remove the lock pin (3) from the connector lock tower (2) on the Occupant Classification Module (OCM) (1).
3. Disconnect the passenger side front seat wire harness connector (4) for the OCM from the OCM connector receptacle located on the forward facing side of the module.
4. Remove the two screws (5) that secure the OCM to the OCM bracket (6) that is welded onto the underside of the passenger side front seat cushion frame.
5. Remove the OCM from under the passenger side front seat.




## INSTALLATION

A non-calibrated Occupant Classification Module (OCM) is the only component of the Occupant Classification System (OCS) that is available for separate service replacement, as outlined in the procedures that follow. The OCS components of the passenger side front seat cushion including the cushion frame, springs, pad, seat weight bladder and pressure sensor, seat cushion foam and the OCM are a factory-calibrated and assembled unit. Once this unit is connected to a vehicle electrically, the calibration settings are uploaded from the OCM and stored in the memory of the Airbag Control Module (ACM). If only the OCM is subsequently replaced, the new, non-calibrated OCM learns the proper calibration settings from the ACM after it is connected to the vehicle electrically.

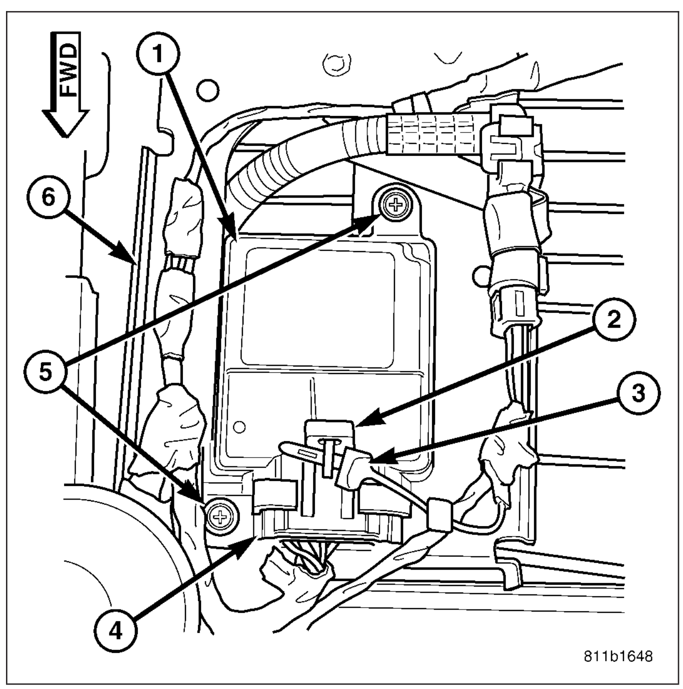
If any of the remaining OCS components of the passenger side front seat cushion require replacement, they are serviced only as a factory-calibrated, assembled, and tamper-evident service replacement package. This package includes the assembled frame, springs, pad, seat weight bladder and pressure sensor, foam, wiring and a calibrated OCM. When installing this package, always replace all of the existing components with the new components as a unit. Do not attempt to separate or disconnect any of the new OCS components contained in the service replacement package from each other, and do not attempt to reuse any of the replaced components in this or any other vehicle.

Once any of the original factory-installed components except the OCM have been replaced with the service replacement package components, the OCM can only be serviced by replacing the entire passenger side front seat cushion unit with another complete service replacement package. Any time any one of these components is removed or replaced for any reason, the OCM must be re-calibrated using a diagnostic scan tool, the Occupant Classification Seat Weight special tool, and the Occupant Classification System Verification Test. Refer to the appropriate diagnostic procedures.

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death on vehicles equipped with the Occupant Classification System (OCS), only the Occupant Classification Module (OCM) and the seat cushion trim may be serviced separately. All other components of the passenger side front seat cushion assembly must be serviced only as a complete factory-calibrated, assembled and tamper-evident service replacement package. This package includes the frame, springs, pad, bladder and pressure sensor, foam, wiring and a calibrated OCM. When installing this package always replace all of the existing components with the new components as a unit. Do not attempt to separate or disconnect any of the new OCS components in the service replacement package from each other, and do not attempt to reuse any of the replaced components in this or any other vehicle. Failure to take the proper precautions could result in failure of the passenger airbag to deploy when required, or in passenger airbag deployment when not required.**

**CAUTION: On vehicles equipped with the Occupant Classification System (OCS), never replace both the Airbag Control Module (ACM) and the Occupant Classification Module (OCM) at the same time. If both require replacement, replace the OCM first. Then perform the supplemental restraint verification test including an ignition-On time of at least one minute before replacing the ACM. Both the ACM and the OCM store OCS calibration data, which they transfer to one another during the first minute of ignition-On time after one of them is replaced. If both modules are replaced at the same time, an irreversible fault will be set in both modules. If the data transfer is not allowed sufficient time to complete between modules (at least one minute of ignition-On), an irreversible fault will be set in the module requiring the data.**



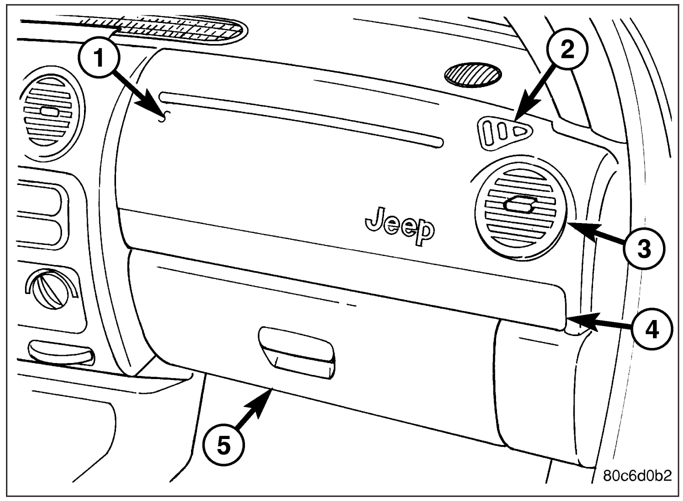

1. Carefully position the Occupant Classification Module (OCM) (1) to the OCM bracket (6) that is welded onto the underside of the passenger side front seat cushion frame. When the OCM is correctly positioned, the connector receptacle on the module will be pointed forward in the vehicle.
2. Install and tighten the two screws (5) that secure the OCM to the OCM bracket that is welded onto the underside of the passenger side front seat cushion frame. Tighten the screws to 2 N·m (20 in. lbs.).
3. Reconnect the passenger side front seat wire harness connector (4) for the OCM to the OCM connector receptacle located on the forward facing side of the module. Be certain that the latches on the connector are each fully engaged.
4. Reinstall the lock pin (3) into the connector lock tower (2) on the OCM.
5. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

6. Following successful completion of the supplemental restraint system verification test procedure, perform the Occupant Classification System Verification Test using a diagnostic scan tool and the Occupant Classification Seat Weight special tool. Refer to the appropriate diagnostic procedures.

# PASSENGER AIRBAG

## DESCRIPTION

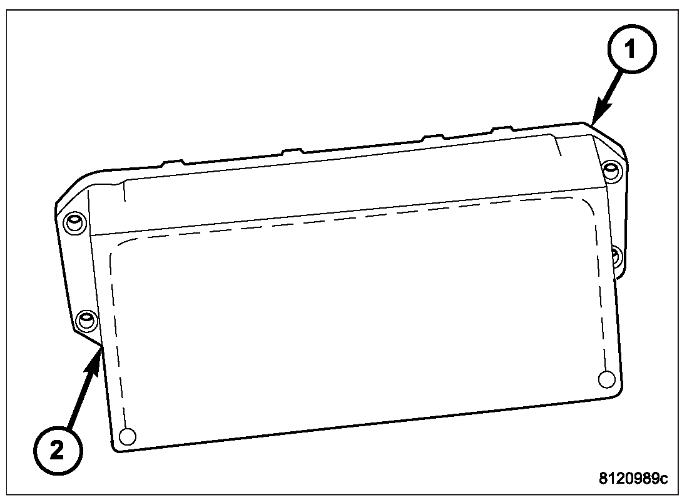
The rearward facing surface of the injection molded, thermoplastic passenger airbag door (1) is the most visible part of the passenger airbag. The passenger airbag door is located above the glove box (5) opening on the instrument panel in front of the front seat passenger seating position. The integral upper mounting flange of the airbag door is secured with five screws and the lower mounting flange with six screws to the instrument panel structural support.




The passenger airbag door includes an integral air conditioning panel outlet (3) housing and an integral side window demister outlet (2). An integral stamped metal bracket that reinforces the upper airbag door mounting flange is secured to the back of the door unit with heat stakes. The upper airbag door fasteners and mounting flange are concealed beneath the instrument panel top cover, while the lower fasteners and mounting flange are concealed beneath a bezel (4) on the instrument panel above the glove box opening.

Located behind the passenger airbag door within the instrument panel is the passenger airbag unit. The passenger airbag unit is secured by two screws on each side to two stamped metal mounting brackets that are fastened with screws to the instrument panel structural support.

The passenger airbag unit used in this model is a multistage unit that complies with revised federal airbag standards to deploy with less force than those used in some prior models. The passenger airbag unit consists of a molded, glass-filled nylon plastic housing (1), a molded plastic inner airbag cushion cover (2), the airbag cushion, the airbag inflator and a heat shield. The airbag housing contains the airbag inflator and the heat shield, while the inner cover contains the folded airbag cushion. The inner cover completely encloses the airbag cushion and is permanently retained to the housing. The airbag cushion is constructed of a coated nylon fabric.




The airbag inflator is a dual-initiator, pyrotechnic-type unit that is secured to and sealed within the airbag housing. The passenger airbag is connected to the vehicle electrical system through two dedicated take outs of the instrument panel wire harness with connector insulators that connect directly to the two inflator initiators. The connector insulators are uniquely keyed and color-coded to ensure they can only be connected to the correct initiator.

The passenger airbag cannot be repaired, and must be replaced if deployed, faulty, or in any way damaged. If the passenger airbag is deployed, the passenger airbag door and both passenger airbag mounting brackets must also be replaced. The passenger airbag door and the passenger airbag mounting brackets are available for individual service replacement.

## OPERATION

The multistage passenger airbag is deployed by electrical signals generated by the Airbag Control Module (ACM) through the passenger airbag squib 1 and squib 2 circuits to the two initiators in the airbag inflator. By using two initiators, the airbag can be deployed at multiple levels of force. The force level is controlled by the ACM to suit the monitored impact conditions by providing one of three delay intervals between the electrical signals provided to the two initiators. The longer the delay between these signals, the less forcefully the airbag will deploy.

The pyrotechnic-type inflator assembly includes two separate internal chambers filled with solid propellant. When the ACM sends the proper electrical signal to the airbag initiator, the initiator converts the electrical energy into chemical energy. This chemical energy ignites the solid propellant. As the solid propellant burns it produces a large quantity of inert gas. The inflator is sealed to the airbag cushion so that the inert gas is directed into the airbag cushion, causing the cushion to inflate. As the cushion inflates, the passenger airbag door will split at predetermined tear seam lines on the inside surface of the door and the door will pivot out of the way. Following a passenger airbag deployment, the airbag cushion quickly deflates by venting the inert gas through vent holes within the fabric used to construct the sides of the airbag cushion.

Typically, both initiators are used during an airbag deployment event. However, it is possible for only one initiator to be used during a deployment due to an airbag system fault; therefore, it is necessary to always confirm that both initiators have been used in order to avoid the improper disposal of potentially live pyrotechnic materials. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

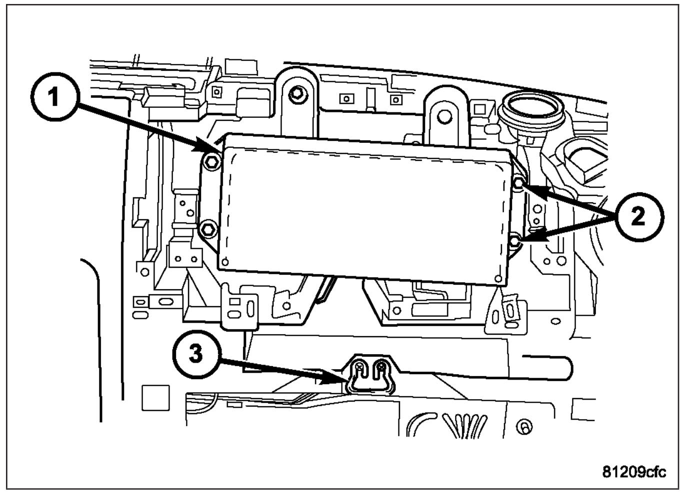
## REMOVAL

## AIRBAG

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, when removing a deployed airbag, rubber gloves, eye protection, and a long-sleeved shirt should be worn. There may be deposits on the airbag unit and other interior surfaces. In large doses, these deposits may cause irritation to the skin and eyes.**

**NOTE: The following procedure is for replacement of a faulty or damaged passenger airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the passenger airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).**




1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the passenger airbag door from the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG DOOR - REMOVAL).
3. Remove the two screws (2) on each side of the passenger airbag housing (1) that secure the passenger airbag to the metal brackets on the instrument panel support structure.
4. Disengage the passenger airbag wire harness connector from the retainer securing the connector to the metal bracket on the instrument panel support structure above the airbag by sliding both halves of the connector to the left.
5. Pull the passenger airbag away from the instrument panel far enough to access the two wire harness connectors for the airbag.

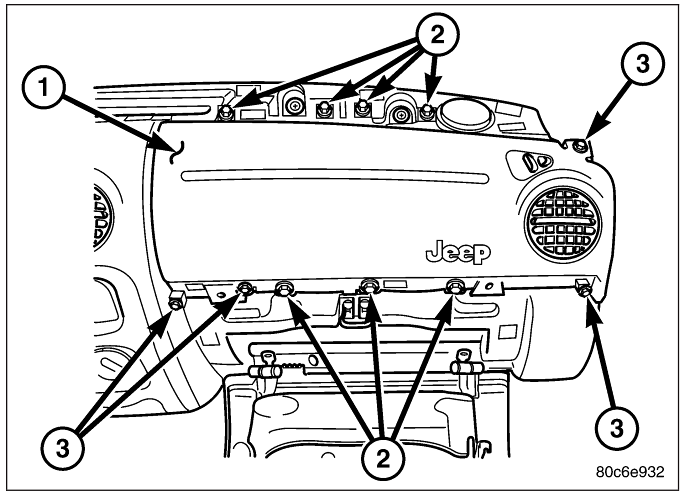
**CAUTION: Do not pull on the instrument panel wire harness passenger airbag take outs or pry on the connector insulators to disengage the connectors from the passenger airbag inflator connector receptacles. Improper removal of these wires and their connector insulators can result in damage to the airbag circuits or connector insulators.**

6. The instrument panel passenger airbag wire harness connectors are secured by integral latches to the airbag inflator connector receptacles, which are located on the sides of the passenger airbag housing. Depress the latches on each side of each connector insulator and pull the insulators straight out from the airbag inflator to disconnect them from the connector receptacles.
7. Remove the passenger airbag from the instrument panel as a unit.
8. If the passenger airbag has been deployed, both passenger airbag mounting brackets on the instrument panel must be replaced. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG MOUNTING BRACKET - REMOVAL).

## DOOR

**WARNING: To avoid personal injury or death on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, driver airbag, passenger airbag, occupant classification system, seat belt tensioner, front impact sensor, side impact sensor, side curtain airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death on vehicles equipped with airbags, when removing a deployed airbag, rubber gloves, eye protection, and a long-sleeved shirt should be worn. There may be deposits on the airbag unit and other interior surfaces. In large doses, these deposits may cause irritation to the skin and eyes.**

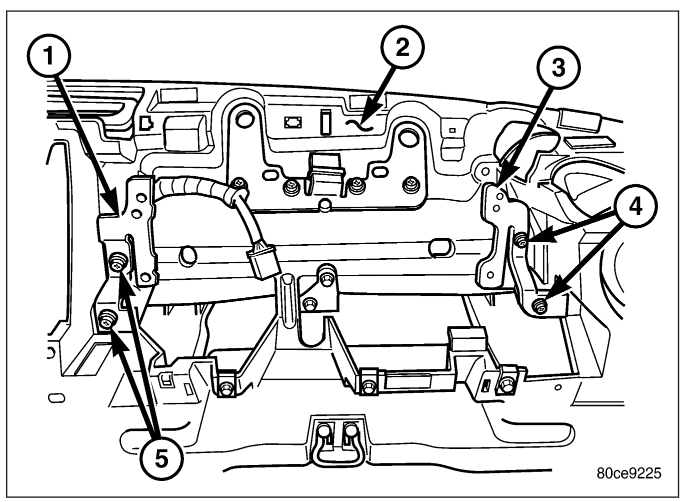



1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the top cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - REMOVAL).
3. Remove the passenger side bezel from the upper glove box opening of the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP PASSENGER SIDE BEZEL - REMOVAL).
4. Remove the three small screws that secure the passenger airbag door to the glove box opening upper reinforcement.
5. Remove the three large screws (3) that secure the passenger airbag door (1) to the glove box opening upper reinforcement.
6. Remove the one small screw (3) that secures the passenger airbag door to the top of the instrument panel.
7. Remove the four large screws (2) that secure the passenger airbag door to the top of the instrument panel.
8. Remove the passenger airbag door from the instrument panel.

## BRACKETS

**WARNING: To avoid personal injury or death on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, driver airbag, passenger airbag, occupant classification system, seat belt tensioner, front impact sensor, side impact sensor, side curtain airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: The passenger airbag mounting brackets cannot be repaired. They must be replaced if faulty or damaged, or if the passenger airbag has been deployed.**




1. Remove the passenger airbag from the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL).
2. Remove the two screws (4 or 5) that secure the inboard (1) and/or outboard passenger airbag mounting bracket (3) to the instrument panel support structure (2).
3. Remove the inboard and/or outboard passenger airbag mounting bracket(s) from the instrument panel support structure.

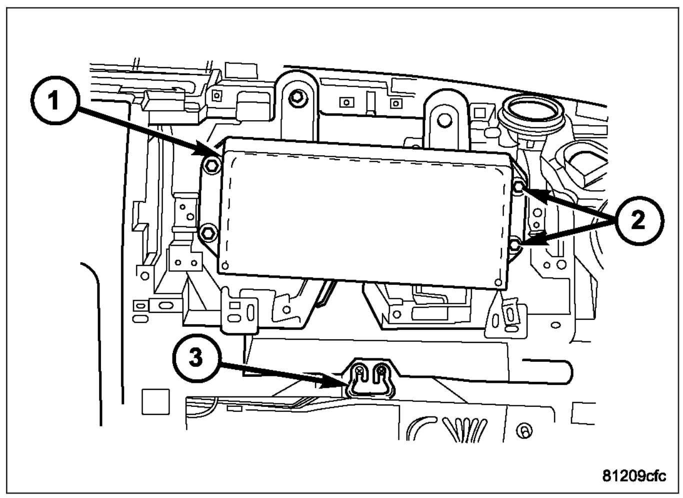
## INSTALLATION

## AIRBAG

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, use extreme care to prevent any foreign material from entering the passenger airbag, or becoming entrapped between the passenger airbag cushion and the passenger airbag door. Failure to observe this warning could result in occupant injuries upon airbag deployment.**

**NOTE: The following procedure is for replacement of a faulty or damaged passenger airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the passenger airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).**

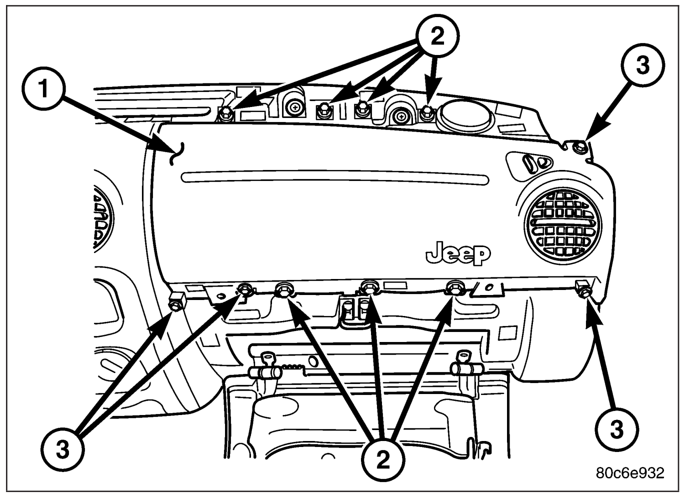



1. Position the passenger airbag unit (1) close enough to the instrument panel to reconnect the electrical connections on each side of the airbag housing.
2. When installing the passenger airbag, reconnect the two instrument panel wire harness connectors to the airbag inflator connector receptacles by pressing straight in on the connectors. Be certain to engage each keyed and color-coded connector to the matching connector receptacle. You can be certain that each connector is fully engaged in its receptacle by listening carefully for a distinct, audible click as the connector latches snap into place.
3. Carefully position the passenger airbag unit onto the two metal brackets on the instrument panel support structure. Be certain that the alignment pin features on each side of the airbag are engaged in the alignment holes in the metal brackets.
4. Install and tighten the two screws (2) on each side of the passenger airbag housing that secure the passenger airbag to the metal brackets on the instrument panel support structure. Tighten the screws to 6 N·m (55 in. lbs.).
5. Reinstall the passenger airbag door onto the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG DOOR - INSTALLATION).
6. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

## DOOR

**WARNING: To avoid personal injury or death on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, driver airbag, passenger airbag, occupant classification system, seat belt tensioner, front impact sensor, side impact sensor, side curtain airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death on vehicles equipped with airbags, the passenger airbag door must never be painted. Replacement passenger airbag doors are serviced in the original colors. Paint may change the way in which the material of the airbag door responds to an airbag deployment. Failure to observe this warning could result in occupant injuries upon airbag deployment.**



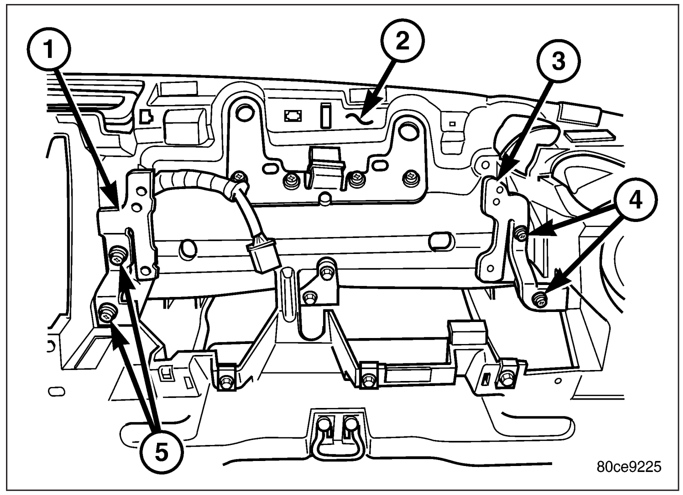

1. Position the passenger airbag door (1) onto the instrument panel.
2. Install and tighten the four large screws (2) that secure the passenger airbag door to the top of the instrument panel. Tighten the screws to 4 N·m (35 in. lbs.).
3. Install and tighten the one small screw (3) that secures the passenger airbag door to the top of the instrument panel. Tighten the screw to 2 N·m (20 in. lbs.).
4. Install and tighten the three large screws (2) that secure the passenger airbag door to the glove box opening upper reinforcement. Tighten the screws to 4 N·m (35 in. lbs.).
5. Install and tighten the three small screws (3) that secure the passenger airbag door to the glove box opening upper reinforcement. Tighten the screws to 2 N·m (20 in. lbs.).
6. Reinstall the passenger side bezel onto the upper glove box opening of the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/IP PASSENGER SIDE BEZEL - INSTALLATION).
7. Reinstall the top cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - INSTALLATION).
8. Reconnect the battery negative cable.

## BRACKETS

**WARNING: To avoid personal injury or death on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, driver airbag, passenger airbag, occupant classification system, seat belt tensioner, front impact sensor, side impact sensor, side curtain airbag, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: The passenger airbag mounting brackets cannot be repaired. They must be replaced if faulty or damaged, or if the passenger airbag has been deployed.**

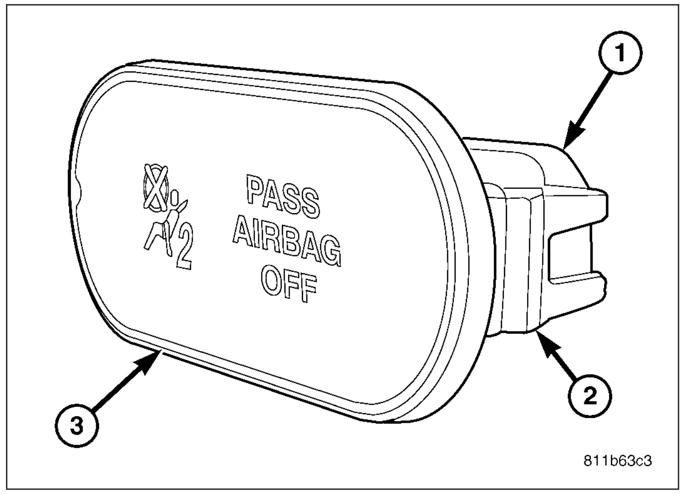
1. Position the inboard (1) and/or outboard passenger airbag mounting bracket (3) to the instrument panel support structure (2).
2. Install and tighten the two screws (4 or 5) that secure the inboard and/or outboard passenger airbag mounting bracket(s) to the instrument panel support structure. Tighten the screws to 2 N·m (20 in. lbs.).
3. Reinstall the passenger airbag to the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - INSTALLATION).



# PASSENGER AIRBAG ON/OFF INDICATOR

## DESCRIPTION

Vehicles equipped with the Occupant Classification System (OCS) include a passenger airbag on/off indicator (3), which is located in the inboard grab handle end cap located on the instrument panel between the passenger airbag door and the glove box. The passenger airbag on/off indicator and the grab handle are present only in vehicles equipped with the OCS. Vehicles without the OCS have only a trim bezel on the instrument panel, instead of a grab handle.




The passenger airbag on/off indicator consists of a molded plastic housing with an integral connector receptacle (1) at the back, an integral latch tab (2) on each side, and an oblong dark translucent outer lens. The opaque words “PASS AIRBAG OFF” and an opaque International Control and Display Symbol icon for “Passenger Airbag Off or Not Available” are imprinted on the back of the lens within the indicator. The dark outer lens prevents the indicator text and icon from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the lens causes the “PASS AIRBAG OFF” text and icon to appear silhouetted against an amber field through the translucent lens when the indicator is illuminated from behind by the LED.

The passenger airbag on/off indicator cannot be repaired or adjusted and, if faulty or damaged, the indicator unit must be replaced.

## OPERATION

In vehicles equipped with the Occupant Classification System (OCS), the passenger airbag on/off indicator gives an indication when the passenger airbag and seat belt tensioner deployment circuits are disabled by the Airbag Control Module (ACM). This indicator is controlled by a transistor within the ACM through a hard wired output based upon ACM programming and electronic occupant classification messages received by the ACM over the Programmable Communications Interface (PCI) data bus from the Occupant Classification Module (OCM).

The passenger airbag on/off indicator Light Emitting Diode (LED) is completely controlled by the ACM. The LED receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the ACM transistor. The ACM will turn on the passenger airbag on/off indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the passenger airbag on/off indicator is illuminated for about six seconds.
- **Child Seat Detected (or Load Less Than Fifth Percentile Female) Occupant Classification Message** - Each time the ACM receives a message from the OCM indicating a child seat has been detected in the passenger side front seat (or that the seat load is less than that of a fifth percentile female) the passenger airbag and seat belt tensioner deployment circuits are deactivated and the passenger airbag on/off indicator will be illuminated. The indicator remains illuminated until the ACM receives an occupant classification message indicating that the passenger side front seat is empty, that the seat is occupied by a load equal to or greater than a fifth percentile female, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Load Undetermined Occupant Classification Message** - Each time the ACM receives a message from the OCM indicating that a load cannot be determined in the passenger side front seat, the passenger airbag and seat belt tensioner deployment circuits are deactivated and the passenger airbag on/off indicator will be illuminated. The indicator remains illuminated until the ACM receives an occupant classification message indicating that the passenger side front seat is empty, that the seat is occupied by a load equal to or greater than a fifth percentile female, or until the ignition switch is turned to the Off position, whichever occurs first.

- **Communication Error** - If the ACM receives invalid occupant classification messages or no messages from the OCM, the passenger airbag on/off indicator is illuminated. The indicator remains illuminated until the ACM receives a valid message from the OCM indicating that the passenger side front seat is empty, that the seat is occupied by a load equal to or greater than a fifth percentile female, or until the ignition switch is turned to the Off position, whichever occurs first.

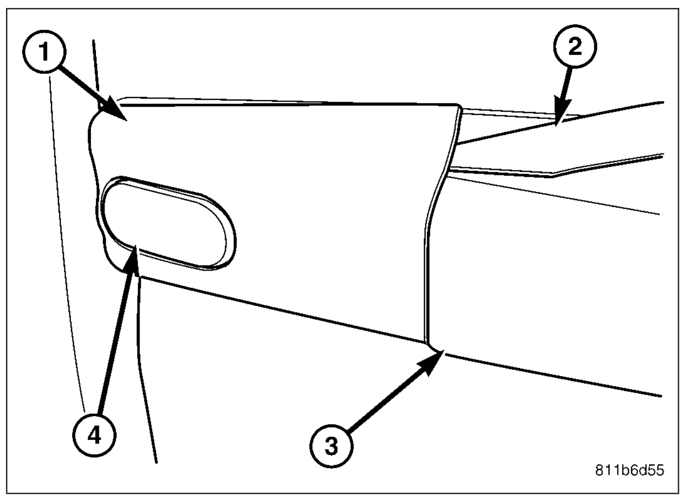
The ACM continually monitors the occupant classification messages from the OCM to decide whether the passenger airbag and seat belt tensioner deployment circuits should be activated or deactivated. Note that there may be several seconds of delay between changes in the detected occupant status and passenger airbag on/off indications. This is a programmed feature of the OCM used to prevent a flashing indicator condition resulting from the normal shifting of occupant weight on the passenger seat cushion. The ACM then provides the proper control output to turn the passenger airbag on/off indicator on or off.

The ACM will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. For proper diagnosis of the OCM, the ACM, the PCI data bus, or the electronic message inputs to the ACM that control the passenger airbag on/off indicator, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

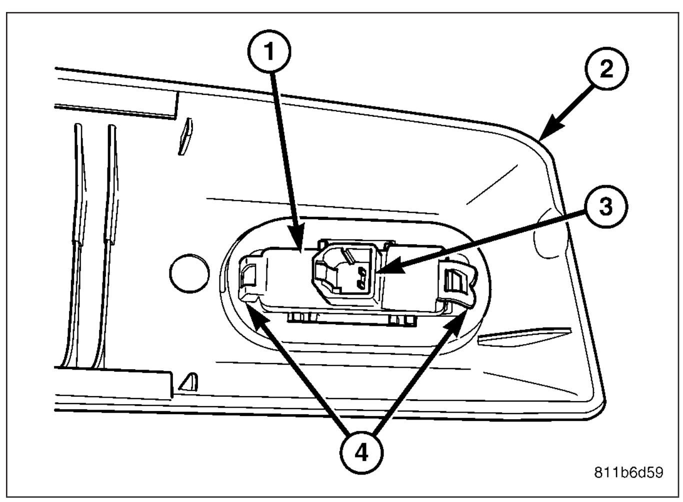
## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Using a trim stick (2) or another suitable wide flat-bladed tool, gently pry the inboard grab handle end cap (1) upwards at the parting line between the cap and the grab handle (3) far enough to disengage the cap from the handle.

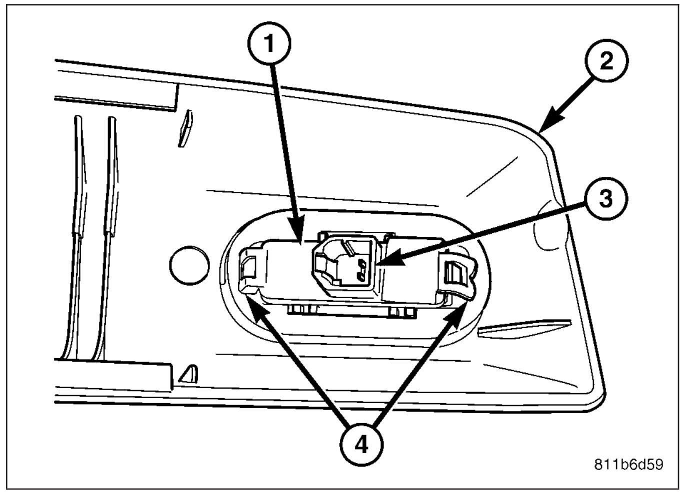



3. Pull the end cap (2) away from the instrument panel far enough to access and disconnect the wire harness connector for the passenger airbag on/off indicator from the connector receptacle (3) on the back of the indicator housing (1).
4. From the back of the inboard end cap, depress the two latches (4) toward the indicator housing and push the indicator out through the face of the end cap.



## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**




1. From the face of the inboard end cap (2), align the passenger airbag on/off indicator housing (1) with the mounting hole.
2. Using hand pressure, push the indicator firmly and evenly into inboard end cap until the two latches (4) are fully engaged on the back of the cap.
3. Position the indicator and end cap unit close enough to the instrument panel to reconnect the wire harness connector for the indicator to the indicator connector receptacle (3). Be certain that the connector is fully engaged in the receptacle.
4. Align the indicator and end cap unit with the inboard end of the grab handle, and engage the lower snap feature of the end cap to the bottom of the grab handle.
5. Using hand pressure, push the upper edge of the end cap firmly and evenly over the top of the grab handle until the cap snaps into place.
6. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).
7. Following successful completion of the supplemental restraint system verification test procedure, perform the Occupant Classification System Verification Test using a diagnostic scan tool. Refer to the appropriate diagnostic procedures.

# SEAT BELT BUCKLE

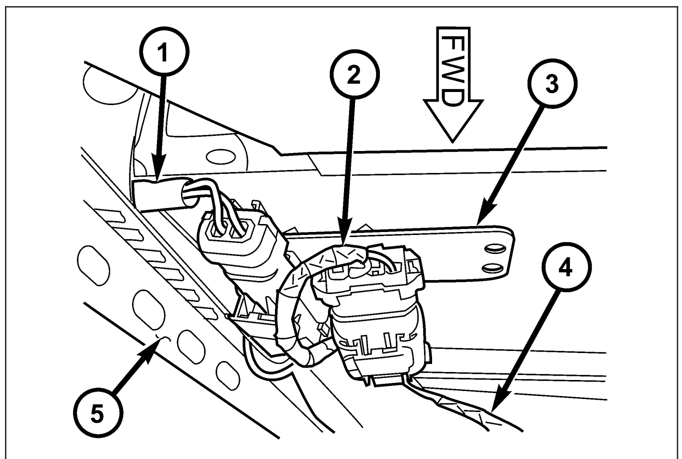
## REMOVAL

## FRONT

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

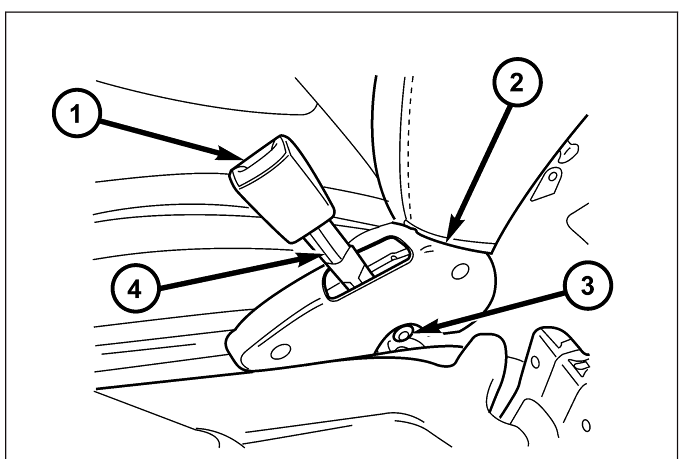
**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

1. On the driver side only, disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. On the driver side only, remove the front seat and seat track from the floor panel as a unit. (Refer to 23 - BODY/SEATS/SEAT - FRONT - REMOVAL).
3. On the driver side only, disconnect the seat belt switch pigtail wire (1) connector from the seat wire harness connector (2) on the seat cushion frame bracket (3) located under the rear edge of the seat cushion near the inboard side of the seat.



80c733d8

4. Remove the screw (3) that secures the front seat belt buckle (1) anchor to the bracket near the rear of the inboard seat track.
5. On the driver side only, remove the two screws that secure the inboard seat cushion side shield (2) to the seat cushion frame.
6. On the driver side only, remove the two screws that secure the inboard seat track to the rear inboard corner of the seat cushion frame.
7. On the driver side only, disconnect the seat belt switch pigtail wire routing clip from the locating hole in the seat cushion frame.
8. On the driver side only, remove the seat belt switch pigtail wire from between the seat cushion frame and the seat track by gently prying the inboard seat track away from the inboard rear corner of the seat cushion frame far enough to slide the pigtail wire from between them.



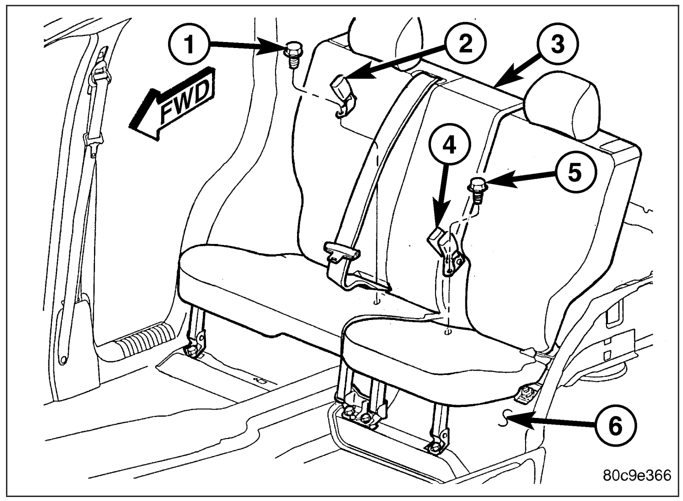
80c733dc

9. Remove the buckle from the seat.

## REAR

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

1. Unlatch the rear seat back (3) and fold it forward far enough to access the screw (1 or 5) that secures the rear seat belt buckle (2 or 4) anchor to the rear floor panel (6) between the rear seat back and the rear seat cushion.
2. Remove the screw that secures the rear seat belt buckle anchor to the rear floor panel.
3. Lift the rear seat belt buckle anchor off of the stud on the rear floor panel.
4. Remove the rear seat belt buckle and anchor from between the rear seat back and the rear seat cushion as a unit.



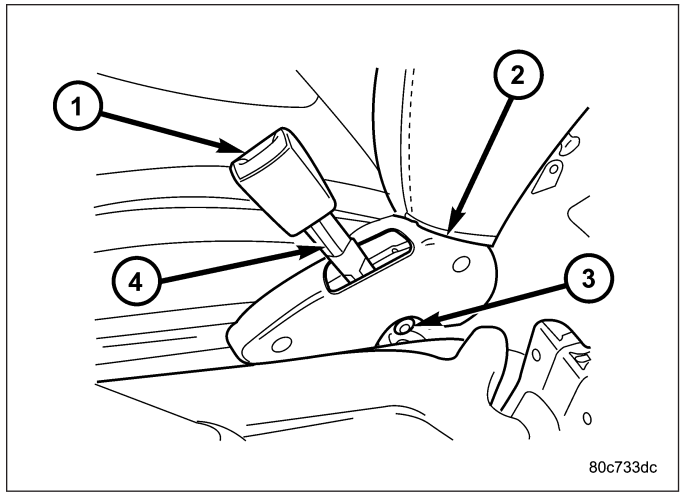

## INSTALLATION

## FRONT

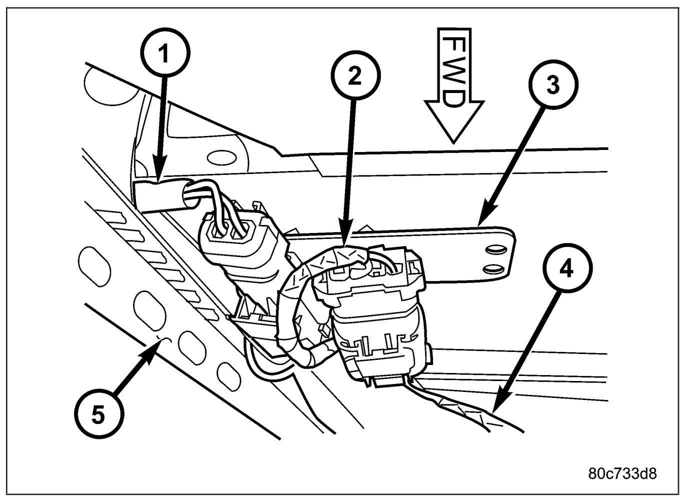
**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

1. Position the front seat belt buckle (1) lower anchor through the inboard seat cushion side shield (2).
2. On the driver side only, position the seat belt switch pigtail wire (4) between the seat cushion frame and the seat track by gently prying the inboard seat track away from the inboard rear corner of the seat cushion frame far enough to slide the pigtail wire into position between them.
3. On the driver side only, engage the seat belt switch pigtail wire routing clip into the locating hole in the seat cushion frame.
4. On the driver side only, install and tighten the two screws that secure the inboard seat track to the rear inboard corner of the seat cushion frame. Tighten the screws to 28 N·m (21 ft. lbs.).



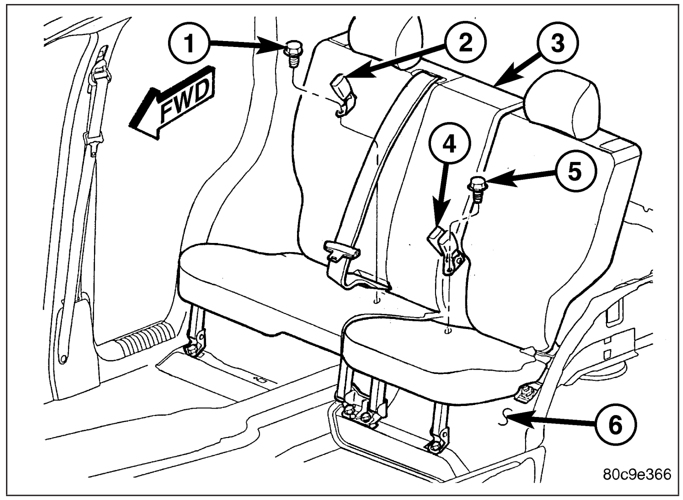

5. On the driver side only, position the inboard seat cushion side shield to the seat cushion frame.
6. On the driver side only, install and tighten the two screws that secure the inboard seat cushion side shield to the seat cushion frame. Tighten the screws to 1 N·m (9 in. lbs.).
7. Position the front seat belt buckle lower anchor to the bracket on the inboard side of the seat track.
8. Install and tighten the screw (3) that secures the front seat belt buckle anchor to the bracket on the inboard side of the seat track. Tighten the screw to 43 N·m (32 ft. lbs.).
9. On the driver side only, reconnect the seat belt switch pigtail wire (1) connector to the seat wire harness (2) connector on the seat cushion frame bracket (3) located under the rear edge of the seat cushion near the inboard side of the seat.
10. On the driver side only, reinstall the front seat and seat track to the floor panel as a unit. (Refer to 23 - BODY/SEATS/SEAT - FRONT - INSTALLATION).
11. For the driver side only, do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).




## REAR

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

1. Unlatch the rear seat back (3) and fold it forward far enough to access the mounting location for the rear seat belt buckle (2 or 4) anchor to the rear floor panel (6) between the rear seat back and the rear seat cushion.
2. Position the rear seat belt buckle and anchor between the rear seat back and the rear seat cushion as a unit.
3. Lower the rear seat belt buckle anchor over the stud on the rear floor panel.
4. Install and tighten the screw (1 or 5) that secures the rear seat belt buckle anchor to the rear floor panel. Tighten the screw to 43 N·m (32 ft. lbs.).



# SEAT BELT & RETRACTOR

## REMOVAL

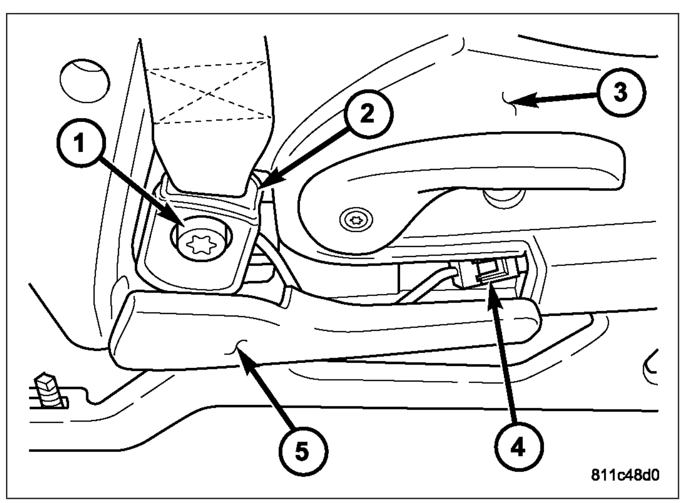
## FRONT

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

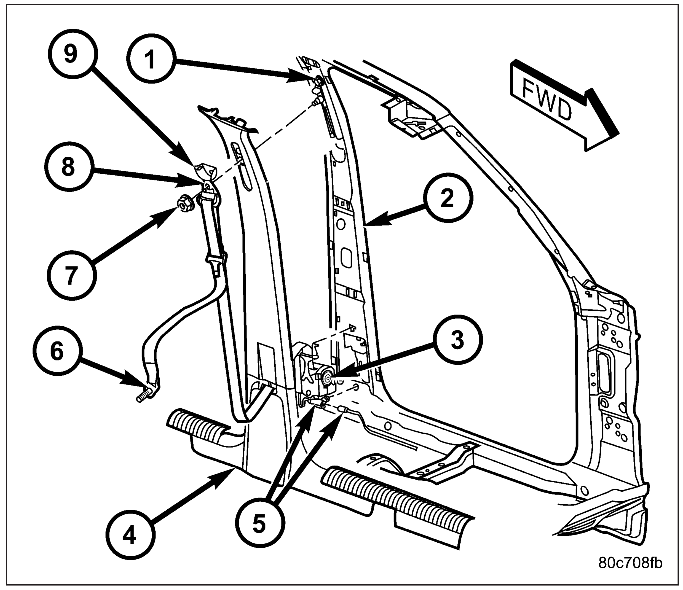
**NOTE: On vehicles equipped with the Occupant Classification System (OCS), the passenger side front seat belt and retractor unit includes a belt tension sensor that is integral to the lower seat belt anchor, which is secured to the outboard side of the passenger side front seat cushion frame. Any time any OCS component is removed or replaced for any reason, the OCM must be re-calibrated using a diagnostic scan tool, the Occupant Classification Seat Weight special tool, and the Occupant Classification System Verification Test. Refer to the appropriate diagnostic procedures.**

**NOTE: The following procedure is for replacement of a faulty or damaged seat belt and retractor unit. The front retractor also includes a seat belt tensioner. If the front seat belt or retractor is faulty or damaged, but the seat belt tensioner is not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat belt tensioner has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the unit from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).**




1. Adjust the front seat to its most forward position for easiest access to the front seat belt lower anchor (2) and the B-pillar trim.
2. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
3. Using a trim stick or another suitable wide flat-bladed tool, gently pry the seat belt anchor cover to remove it from the rear of the outboard seat side shield (3).
4. On the passenger side only if the vehicle is equipped with the Occupant Classification System, disconnect the belt tension sensor pigtail wire connector (4) from the seat wire harness connector.
5. Remove the screw (1) that secures the lower anchor/belt tension sensor to the bracket on the outboard side of the front seat cushion frame.

6. Unsnap and lift the trim cover (9) to access the nut (7) that secures the front seat belt turning loop (6) to the height adjuster (1) on the upper B-pillar (2).
7. Remove the nut that secures the seat belt turning loop to the height adjuster stud on the upper B-pillar.
8. Remove the seat belt turning loop from the height adjuster stud.
9. Remove the upper trim (4) from the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - REMOVAL).
10. Remove the lower trim (4) from the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL).
11. Disconnect the body wire harness connector from the seat belt tensioner pigtail wire connector (5).
12. Remove the screw that secures the lower retractor (3) bracket to the B-pillar.

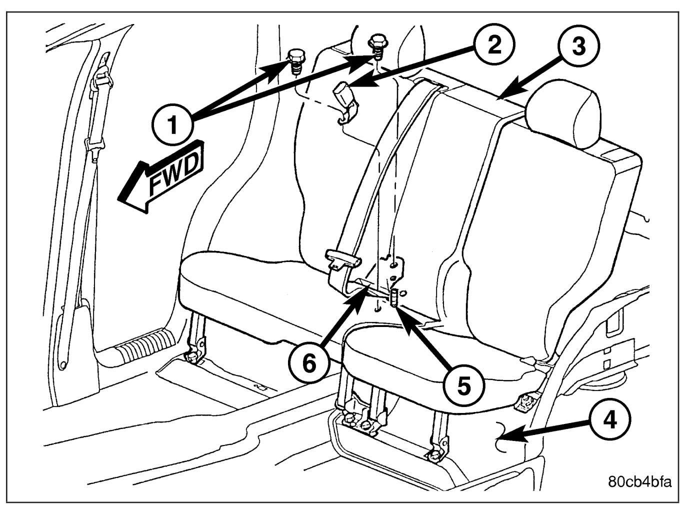



13. Disengage the engagement tab on the upper retractor bracket/seat belt web guide from the engagement slot in the B-pillar.
14. Remove the front seat belt and retractor from the B-pillar as a unit.

## REAR CENTER

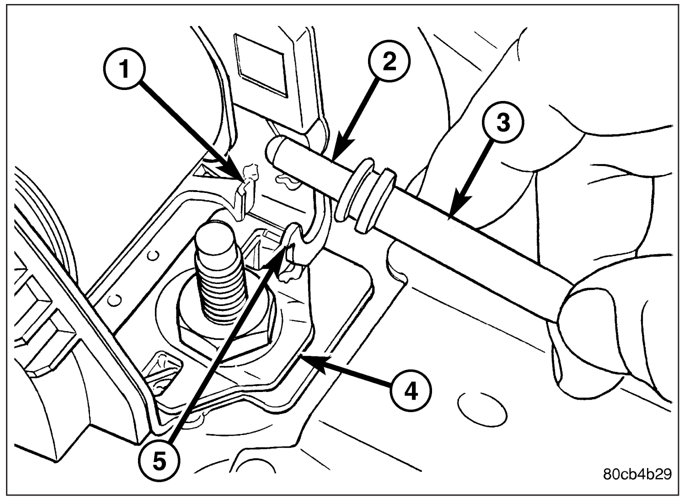
**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

1. Remove the right center seat belt buckle unit (2) from the floor panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR SEAT BELT BUCKLE - REMOVAL).
2. Unlatch and fold the right rear seat back (3) forward and separate the cargo area carpet from the base of the seat back panel.
3. Reach between the base of the right rear seat back and the forward edge of the rear cargo floor to access and remove the screw (1) that secures the rear center seat belt lower anchor to the floor panel.
4. Lift the rear center seat belt lower anchor off of the stud on the rear floor panel.
5. Remove the right rear seat back panel from the vehicle. (Refer to 23 - BODY/SEATS/SEAT BACK - REAR - REMOVAL).

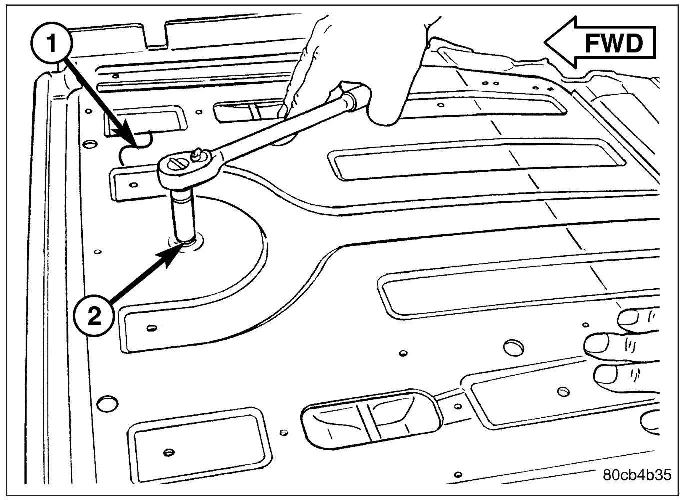



6. Remove the two screws that secure the belt web guide to the top of the right rear seat back panel.
7. Remove the trim from the right rear seat back. (Refer to 23 - BODY/SEATS/SEAT BACK COVER - REAR - REMOVAL).
8. Route the rear seat belt lower anchor and belt web guide through the top of the seat back panel.

9. Disengage the seat back latch cable fitting (3) from the cable support (5) on the retractor (4), which is a light snap fit.

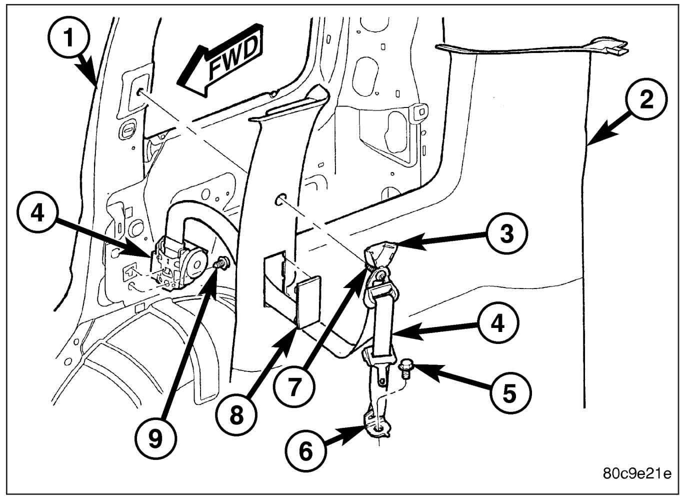



10. Remove the screw (2) that secures the retractor to the rear seat back panel (1).
11. Remove the rear center seat belt and retractor unit from the seat back panel.




## REAR OUTBOARD

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**




1. Unsnap and lift the trim cover (3) to access the screw (7) that secures the rear outboard seat belt turning loop to the upper C-pillar (1).
2. Remove the screw that secures the seat belt turning loop to the upper C-pillar.
3. Remove the screw (5) that secures the lower seat belt anchor (6) to the bracket on the outboard side of the rear seat cushion frame.
4. Remove the quarter trim panel (2) from the C-pillar. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL).
5. Route the seat belt lower anchor and turning loop through the access hole in the quarter trim panel.
6. Remove the screw (9) that secures the retractor (4) bracket to the lower C-pillar.
7. Lift the retractor upward far enough to disengage the retractor tab from the engagement hole in the lower C-pillar.
8. Remove the rear outboard seat belt and retractor from the C-pillar as a unit.

## INSTALLATION

## FRONT

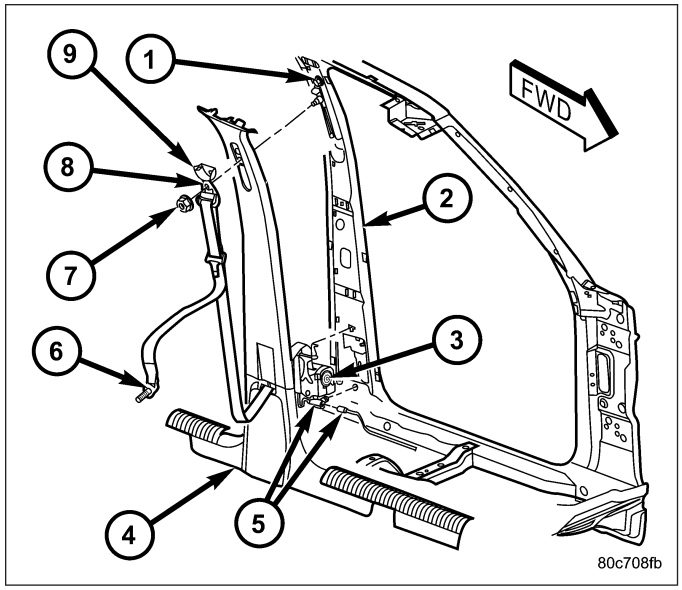
**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

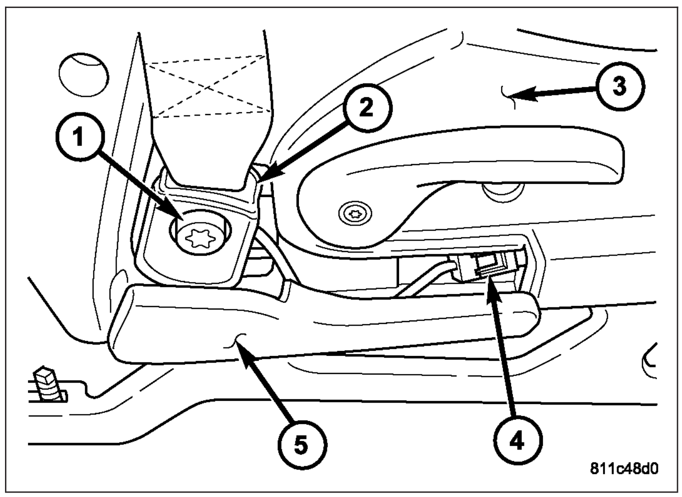
**NOTE: On vehicles equipped with the Occupant Classification System (OCS), the passenger side front seat belt and retractor unit includes a belt tension sensor that is integral to the lower seat belt anchor, which is secured to the outboard side of the passenger side front seat cushion frame. Any time any OCS component is removed or replaced for any reason, the OCM must be re-calibrated using a diagnostic scan tool, the Occupant Classification Seat Weight special tool, and the Occupant Classification System Verification Test. Refer to the appropriate diagnostic procedures.**

**NOTE: The following procedure is for replacement of a faulty or damaged seat belt and retractor unit. The front retractor also includes a seat belt tensioner. If the front seat belt or retractor is faulty or damaged, but the seat belt tensioner is not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat belt tensioner has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the unit from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).**

1. Position the front seat belt and retractor (3) to the B-pillar (2) as a unit. Be certain to engage the engagement tab on the upper retractor bracket/seat belt web guide into the engagement slot in the lower B-pillar.
2. Install and tighten the screw that secures the lower retractor bracket to the B-pillar. Tighten the screw to 43 N·m (32 ft. lbs.).
3. Reconnect the body wire harness connector to the seat belt tensioner pigtail wire connector (5).
4. Reinstall the lower trim (4) onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION).
5. Reinstall the upper trim (4) onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - INSTALLATION).
6. Position the seat belt turning loop (8) onto the height adjuster (1) stud on the upper B-pillar.




7. Install and tighten the nut (7) that secures the seat belt turning loop to the height adjuster stud. Tighten the nut to 34 N·m (25 ft. lbs.).
8. Fold and snap the trim cover (9) back into place to conceal the nut that secures the turning loop to the height adjuster.
9. Position the front seat belt lower anchor/belt tension sensor (2) to the bracket on the outboard side of the front seat cushion frame.
10. Install and tighten the screw (1) that secures the lower anchor/belt tension sensor to the bracket on the outboard side of the front seat cushion frame. Tighten the screw to 47 N·m (35 ft. lbs.).
11. On the passenger side only if the vehicle is equipped with the Occupant Classification System, reconnect the belt tension sensor pigtail wire connector (4) to the seat wire harness connector for the sensor.
12. Align the seat belt anchor cover to the opening near the rear of the outboard seat side shield (5). Using hand pressure, press firmly and evenly on the cover until it snaps into place.

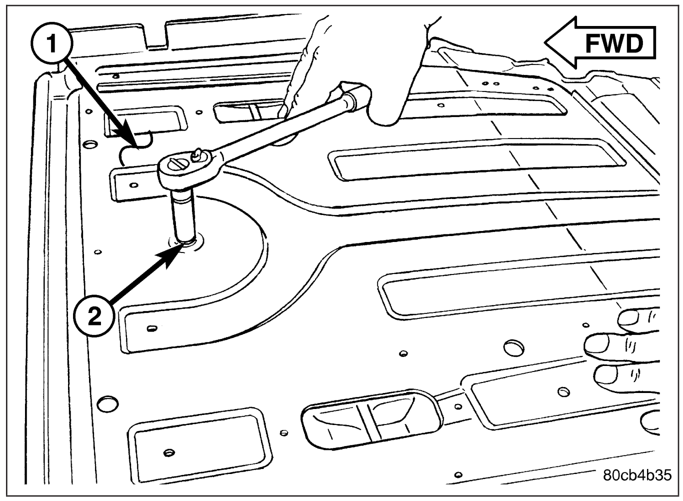



13. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).
14. For the passenger side front seat belt and retractor only if the vehicle is equipped with the Occupant Classification System, following successful completion of the supplemental restraint system verification test procedure, perform the Occupant Classification System Verification Test using a diagnostic scan tool and the Occupant Classification Seat Weight special tool. Refer to the appropriate diagnostic procedures.

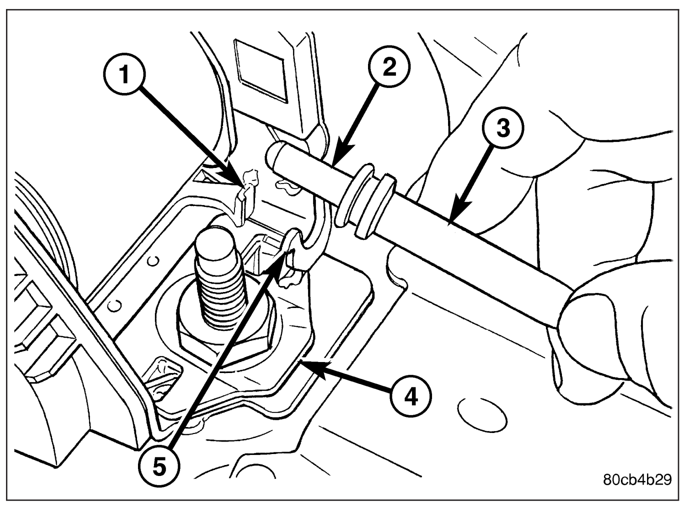
## REAR CENTER

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

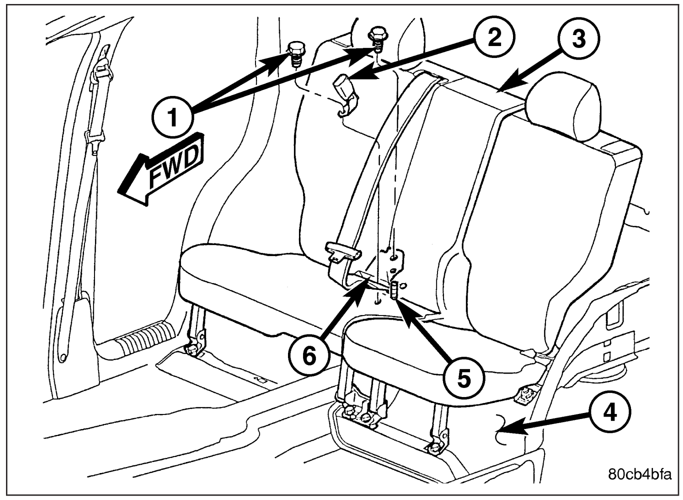
1. Position the rear center seat belt and retractor unit onto the seat back panel (1).
2. Install and tighten the screw (2) that secures the retractor to the rear seat back panel. Tighten the screw to 27 N·m (20 ft. lbs.).




3. Position the seat back latch cable plunger (2) against the retractor latch lever (1), then engage the cable fitting (3) into the cable support (5) on the retractor (4), which is a light snap fit.
4. Route the rear seat belt lower anchor and belt web guide through the top of the seat back panel.
5. Reinstall the trim onto the right rear seat back. (Refer to 23 - BODY/SEATS/SEAT BACK COVER - REAR - INSTALLATION).
6. Install and tighten the two screws that secure the belt web guide to the top of the right rear seat back panel. Tighten the screws to 2 N·m (20 in. lbs.).
7. Reinstall the right rear seat back panel into the vehicle. (Refer to 23 - BODY/SEATS/SEAT BACK - REAR - INSTALLATION).



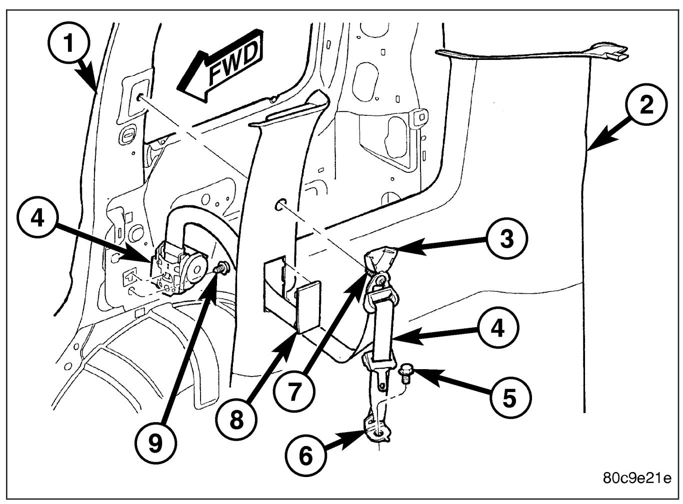
8. Position the rear center seat belt lower anchor (6) onto the stud (5) on the rear floor panel.
9. Reach between the base of the right rear seat back (3) and the forward edge of the rear cargo floor to install and tighten the screw (1) that secures the rear center seat belt lower anchor to the floor panel. Tighten the screw to 43 N·m (32 ft. lbs.).
10. Restore the cargo area carpet to the base of the seat back panel and unfold the right rear seat back to its upright position.
11. Reinstall the right center seat belt buckle unit (2) onto the floor panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT BUCKLE - INSTALLATION).




## REAR OUTBOARD

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

1. Position the rear outboard seat belt and retractor (4) to the C-pillar (1) as a unit.
2. Engage the retractor tab into the engagement hole in the lower C-pillar.
3. Install and tighten the screw (9) that secures the retractor bracket to the lower C-pillar. Tighten the screw to 43 N·m (32 ft. lbs.).
4. Route the seat belt lower anchor (6) and turning loop through the access hole in the quarter trim panel (2).
5. Reinstall the quarter trim panel onto the C-pillar. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - INSTALLATION).

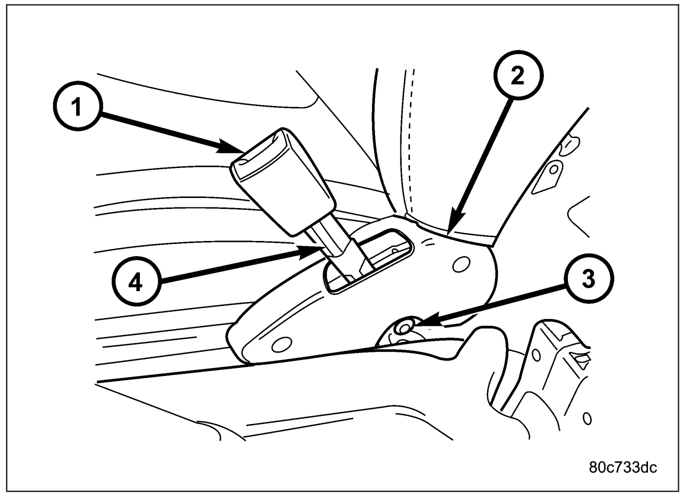



6. Position the lower seat belt anchor to the bracket on the outboard side of the rear seat cushion frame. Be certain that the anti-rotation tab on the anchor is engaged in the slot in the seat bracket.
7. Install and tighten the screw (5) that secures the lower seat belt anchor to the bracket on the outboard side of the rear seat cushion frame. Tighten the screw to 43 N·m (32 ft. lbs.).
8. Position the seat belt turning loop to the upper C-pillar.
9. Install and tighten the screw (7) that secures the seat belt turning loop to the upper C-pillar. Tighten the screw to 43 N·m (32 ft. lbs.).
10. Fold and snap the trim cover (3) back into place to conceal the screw that secures the rear outboard seat belt turning loop to the upper C-pillar.

# SEAT BELT SWITCH

## DESCRIPTION

The seat belt switches for this model are actually Hall Effect-type sensors. This sensor consists of a fixed-position, Hall Effect Integrated Circuit (IC) chip and a small permanent magnet that are integral to the driver side and passenger side front seat belt buckle (1). The front seat belt buckles are located on stamped steel stanchions and secured with a screw (3) to the inboard side of each front seat cushion frame between the seat and the floor panel transmission tunnel.




The seat belt switches are connected to the vehicle electrical system through a two-lead pigtail wire (4) and connector on the front seat belt buckle-half, which is connected to a wire harness connector and take out of the seat wire harness beneath the rear edge of each front seat cushion frame. A radio noise suppression capacitor is connected in parallel with the IC where the two pigtail wire leads connect to the IC pins.

The seat belt switches cannot be adjusted or repaired and, if ineffective or damaged, the entire front seat belt buckle-half unit must be replaced.

## OPERATION

The seat belt switches are designed to provide a status signal to the seat belt switch sense inputs of the Electro-Mechanical Instrument Cluster (EMIC) indicating whether the driver side and passenger side front seat belts are fastened. The EMIC uses these inputs to control the seat belt indicator based upon the status of the driver side and passenger side front seat belt switches.

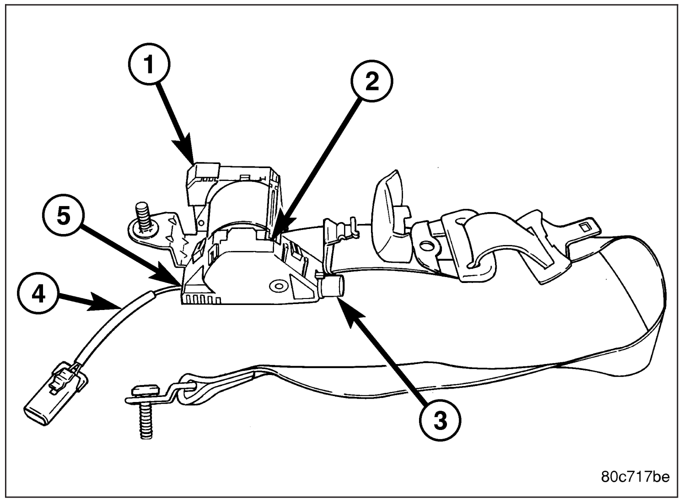
A spring-loaded plastic slide with a small, enclosed permanent magnet is integral to the buckle latch mechanism. When a seat belt tip-half is inserted and latched into the seat belt buckle, the slide is pushed downward and into close proximity of the Hall Effect Integrated Circuit (IC) chip within the buckle. The field of the permanent magnet induces a current within the chip. The chip provides this induced current as an output to the EMIC, which monitors the current to determine the status of the front seat belts. When the seat belt is unbuckled, the spring-loaded slide and permanent magnet move upward and away from the IC, causing the output current from the seat belt switch to be reduced.

The seat belt switch receives a supply of current from the EMIC, and the EMIC senses the status of the front seat belt through its pigtail wire connection to the seat wire harness. The EMIC also monitors the condition of the seat belt switch circuit and will store a Diagnostic Trouble Code (DTC) for any fault that is detected in the seat belt switch circuit. For proper diagnosis of the seat belt switch, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# SEAT BELT TENSIONER

## DESCRIPTION

Seat belt tensioners supplement the dual front airbag system for all versions of this model. The seat belt tensioners are integral to the front seat belt and retractor units (1), which are secured to the B-pillars on the right and left sides of the vehicle. The retractors are concealed beneath the molded plastic B-pillar trim. The seat belt tensioner consists primarily of a molded plastic tensioner housing (2), a tubular metal piston housing (3), a piston, a short rack gear, a set of pinion gears, a pyrotechnically activated gas generator (5), and a short pigtail wire (4).




All of these components are located on one side of the retractor spool on the outside of the retractor housing. The seat belt tensioners are controlled by the Airbag Control Module (ACM) and are connected to the vehicle electrical system through dedicated take outs of the body wire harness by keyed and latching molded plastic connector insulators to ensure a secure connection.

The seat belt tensioners cannot be repaired and, if faulty or damaged, the entire front seat belt and retractor unit must be replaced. The seat belt tensioners are not intended for reuse and must be replaced following any front airbag deployment. A locked retractor that will not allow the seat belt webbing to be retracted or extracted is a sure indication that the seat belt tensioner has been deployed and requires replacement. (Refer to 8 - ELECTRICAL/ RESTRAINTS/FRONT SEAT BELT & RETRACTOR - REMOVAL).

## OPERATION

The seat belt tensioners are deployed by a signal generated by the Airbag Control Module (ACM) through the driver or passenger seat belt tensioner line 1 and line 2 (or squib) circuits. When the ACM sends the proper electrical signal to the tensioners, the electrical energy generates enough heat to initiate a small pyrotechnic gas generator. The gas generator is installed in one end of the tubular metal piston housing, which contains a piston and a small rack gear. As the gas expands, it pushes the piston and the rack gear through the tube. The rack gear engages a pinion gear that drives a gear set in the tensioner housing, which rotates the seat belt retractor spool causing the slack to be removed from the front seat belts.

Removing excess slack from the front seat belts not only keeps the occupants properly positioned for an airbag deployment following a frontal impact of the vehicle, but also helps to reduce injuries that the occupants of the front seat might experience in these situations as a result of a harmful contact with the steering wheel, steering column, instrument panel and/or windshield. Also, the seat belt retractor has a torsion bar mechanism that is designed to deform in order to control the loading being applied to the occupants by the seat belts during a frontal impact, further reducing the potential for occupant injuries.

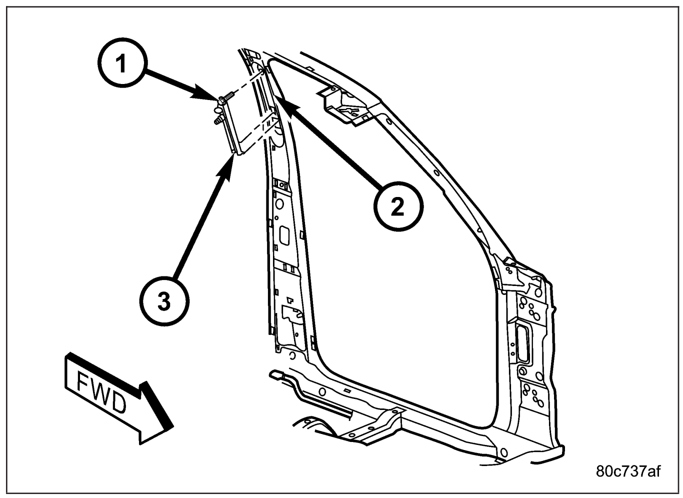
The ACM monitors the condition of the seat belt tensioners through circuit resistance, and will illuminate the airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) and store a Diagnostic Trouble Code (DTC) for any fault that is detected. For proper diagnosis of the seat belt tensioners, a diagnostic scan tool is required. Refer to the appropriate diagnostic information.

# SEAT BELT TURNING LOOP ADJUSTER

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

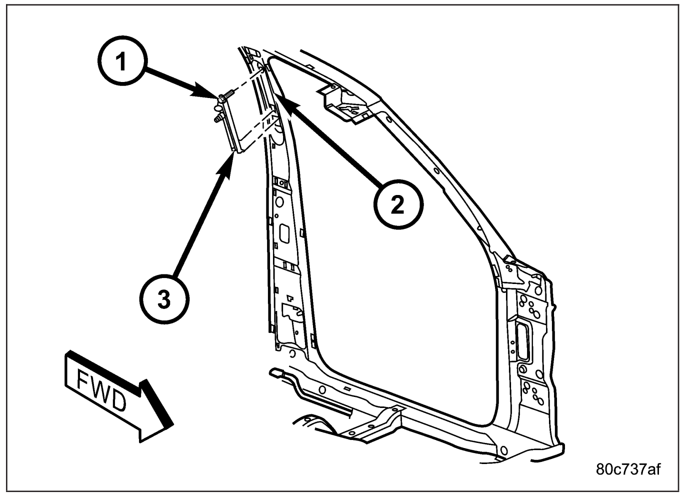



1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Unsnap and lift the trim cover to access the nut that secures the front seat belt turning loop to the height adjuster on the upper B-pillar.
3. Remove the nut that secures the seat belt turning loop to the height adjuster stud on the upper B-pillar.
4. Remove the seat belt turning loop from the height adjuster stud.
5. Remove the upper trim from the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - REMOVAL).
6. Remove the screw (1) that secures the seat belt turning loop adjuster (3) to the upper B-pillar (2).
7. Pull the upper end of the turning loop adjuster away from the B-pillar far enough to disengage the hooks on the lower end of the adjuster from the slots in the B-pillar.
8. Remove the seat belt turning loop adjuster from the B-pillar.

## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**

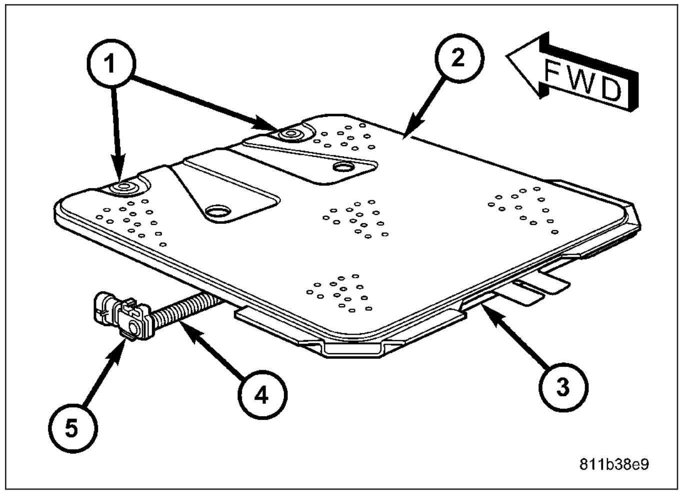



1. Position the seat belt turning loop adjuster (3) to the B-pillar (2).
2. Engage the hooks on the lower end of the adjuster into the slots in the B-pillar.
3. Tilt the upper end of the turning loop adjuster up into position against the B-pillar.
4. Install and tighten the screw (1) that secures the seat belt turning loop adjuster to the upper B-pillar. Tighten the screw to 34 N·m (25 ft. lbs.).
5. Reinstall the upper trim onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - INSTALLATION).
6. Position the seat belt turning loop onto the height adjuster stud on the upper B-pillar.
7. Install and tighten the nut that secures the seat belt turning loop to the height adjuster stud. Tighten the nut to 34 N·m (25 ft. lbs.).
8. Fold and snap the trim cover back into place to conceal the nut that secures the front seat belt turning loop to the height adjuster on the upper B-pillar.
9. Reconnect the battery negative cable.

# SEAT WEIGHT SENSOR

## DESCRIPTION

Vehicles equipped with the Occupant Classification System (OCS) have a seat weight bladder (2) and pressure sensor (5) unit that is integral to the passenger side front seat cushion. The bladder is sandwiched between the seat cushion springs and seat cushion foam. A heavy jute-like insulator pad (3) is installed between the lower surface of the bladder and the seat cushion springs. The pad is secured to the underside of the bladder by diagonal straps that form pockets at each of the two rear corners of the bladder, while two plastic push-in fasteners (1) locate and secure the forward edge of the bladder and the pad to the front edge of the seat cushion frame. The seat cushion foam is installed loosely over the top of the bladder, then secured by the installation of the trim cover to the seat cushion.




The bladder consists of two rectangular sheets of an elastomeric material and a molded plastic elbow fitting. The two sheets of material are sealed together around their perimeter and heat staked to each other at numerous regular points within their field. The elbow fitting is sealed to a small round hole in the lower surface of the bladder and is pointed downward where it passes through a clearance hole in the insulator pad and extends to just below the seat cushion springs. Then the bladder is filled with a silicone fluid to become a pliable, quilted membrane.

Under the seat cushion a short tube (4) is securely clamped at one end to the bladder nipple, and at the other end to a nipple on the electronic pressure sensor. The pressure sensor is contained within a molded plastic housing with an integral nipple formation near one end and an integral electrical connector receptacle at the opposite end. The sensor housing also features an integral mount that snaps over a tab integral to the stamped steel Occupant Classification Module (OCM) mounting bracket welded to the underside of the passenger side front seat cushion frame. The pressure sensor connector receptacle contains terminal pins that connect the sensor to the vehicle electrical system and the OCM through a dedicated take out and connector of the passenger side front seat wire harness.

The seat weight bladder and pressure sensor cannot be adjusted or repaired. The components of the passenger side front seat cushion of a vehicle equipped with the OCS including the cushion frame, springs, insulator pad, seat weight bladder and pressure sensor, seat cushion foam, wire harness and the OCM are serviced only as a factory-calibrated, assembled and tamper-evident unit. Only the OCM and the seat cushion trim are available for separate service replacement. Once a service replacement package has been installed in a vehicle, the OCM can thereafter be serviced only by replacing the entire passenger side front seat cushion unit with another complete service replacement package.

## OPERATION

The seat weight bladder and pressure sensor unit is designed to sense the relative weight of a load applied to the passenger side front seat cushion, which provides a logic input to the microprocessor of the Occupant Classification Module (OCM). When a load is applied to the seat cushion, fluid within the bladder becomes pressurized. These changes in bladder fluid pressure are measured by the pressure sensor under the seat cushion through the bladder tube. As the pressure within the bladder changes, the circuitry of the pressure sensor changes the output voltage of the sensor.

The pressure sensor receives a nominal five volts and a ground through dedicated hard wired circuits from the OCM. The OCM then monitors the pressure sensor output voltage on a dedicated hard wired data communication circuit. The hard wired circuits between the pressure sensor and the OCM may be diagnosed and tested using conventional diagnostic tools and procedures. However, the most reliable, efficient, and accurate means to diagnose the bladder and pressure sensor input to the OCM, and the electronic message communication between the OCM and the Airbag Control Module (ACM) requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## REMOVAL

If any of the Occupant Classification System (OCS) components of the passenger side front seat cushion require replacement, they are serviced only as a factory-calibrated, assembled, and tamper-evident service replacement package. This package includes the assembled frame, springs, pad, seat weight bladder and pressure sensor, foam, wiring and a calibrated Occupant Classification Module (OCM). When installing this package, always replace all of the existing components with the new components as a unit. Do not attempt to separate or disconnect any of the new OCS components contained in the service replacement package from each other, and do not attempt to reuse any of the replaced components in this or any other vehicle.

Once any of the original factory-installed components except the OCM have been replaced with the service replacement package components, the OCM can only be serviced by replacing the entire passenger side front seat cushion unit with another complete service replacement package. Any time any one of these components is removed or replaced for any reason, the OCM must be re-calibrated using a diagnostic scan tool, the Occupant Classification Seat Weight special tool, and the Occupant Classification System Verification Test. Refer to the appropriate diagnostic procedures.

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death on vehicles equipped with the Occupant Classification System (OCS), only the Occupant Classification Module (OCM) and the seat cushion trim may be serviced separately. All other components of the passenger side front seat cushion assembly must be serviced only as a complete factory-calibrated, assembled and tamper-evident service replacement package. This package includes the frame, springs, pad, bladder and pressure sensor, foam, wiring and a calibrated OCM. When installing this package always replace all of the existing components with the new components as a unit. Do not attempt to separate or disconnect any of the new OCS components in the service replacement package from each other, and do not attempt to reuse any of the replaced components in this or any other vehicle. Failure to take the proper precautions could result in failure of the passenger airbag to deploy when required, or in passenger airbag deployment when not required.**

**WARNING: To avoid personal injury or death on vehicles equipped with the Occupant Classification System (OCS), do not modify the front passenger seat assembly or center floor console in any way. Do not use any prior year, subsequent year, secondary or aftermarket seat trim covers. At no time should any Supplemental Restraint System (SRS) or OCS component be modified or replaced with any part except those which are specified for the particular vehicle application in the DaimlerChrysler Mopar Parts Catalog. Failure to observe these precautions could cause an OCS miscalibration condition, which may result in the passenger airbag failing to deploy when required or deploying when not required.**

**CAUTION: On vehicles equipped with the Occupant Classification System (OCS), never replace both the Airbag Control Module (ACM) and the Occupant Classification Module (OCM) at the same time. If both require replacement, replace one. Then perform the supplemental restraint verification test before replacing the other. Both the ACM and the OCM store OCS calibration data, which they transfer to one another when one of them is replaced. If both are replaced at the same time, an irreversible fault will be set in both modules.**

1. Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.
2. Remove the passenger side front seat from the vehicle. (Refer to 23 - BODY/SEATS/SEAT - FRONT - REMOVAL).
3. Remove the seat cushion assembly from the passenger side front seat. (Refer to 23 - BODY/SEATS/SEAT CUSHION - FRONT - REMOVAL).
4. Remove the trim cover from the passenger side front seat cushion. (Refer to 23 - BODY/SEATS/SEAT CUSHION COVER - FRONT - REMOVAL).

5. Discard the entire passenger side front seat cushion frame, springs, pad, bladder and pressure sensor, foam, wiring and Occupant Classification Module (OCM) and replace with the entire contents of the factory-calibrated, assembled and tamper-evident service replacement package.

## INSTALLATION

If any of the Occupant Classification System (OCS) components of the passenger side front seat cushion require replacement, they are serviced only as a factory-calibrated, assembled, and tamper-evident service replacement package. This package includes the assembled frame, springs, pad, seat weight bladder and pressure sensor, foam, wiring and a calibrated Occupant Classification Module (OCM). When installing this package, always replace all of the existing components with the new components as a unit. Do not attempt to separate or disconnect any of the new OCS components contained in the service replacement package from each other, and do not attempt to reuse any of the replaced components in this or any other vehicle.

Once any of the original factory-installed components except the OCM have been replaced with the service replacement package components, the OCM can only be serviced by replacing the entire passenger side front seat cushion unit with another complete service replacement package. Any time any one of these components is removed or replaced for any reason, the OCM must be re-calibrated using a diagnostic scan tool, the Occupant Classification Seat Weight special tool, and the Occupant Classification System Verification Test. Refer to the appropriate diagnostic procedures.

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death on vehicles equipped with the Occupant Classification System (OCS), only the Occupant Classification Module (OCM) and the seat cushion trim may be serviced separately. All other components of the passenger side front seat cushion assembly must be serviced only as a complete factory-calibrated, assembled and tamper-evident service replacement package. This package includes the frame, springs, pad, bladder and pressure sensor, foam, wiring and a calibrated OCM. When installing this package always replace all of the existing components with the new components as a unit. Do not attempt to separate or disconnect any of the new OCS components in the service replacement package from each other, and do not attempt to reuse any of the replaced components in this or any other vehicle. Failure to take the proper precautions could result in failure of the passenger airbag to deploy when required, or in passenger airbag deployment when not required.**

**WARNING: To avoid personal injury or death on vehicles equipped with the Occupant Classification System (OCS), do not modify the front passenger seat assembly or center floor console in any way. Do not use any prior year, subsequent year, secondary or aftermarket seat trim covers. At no time should any Supplemental Restraint System (SRS) or OCS component be modified or replaced with any part except those which are specified for the particular vehicle application in the DaimlerChrysler Mopar Parts Catalog. Failure to observe these precautions could cause an OCS miscalibration condition, which may result in the passenger airbag failing to deploy when required or deploying when not required.**

**CAUTION: On vehicles equipped with the Occupant Classification System (OCS), never replace both the Airbag Control Module (ACM) and the Occupant Classification Module (OCM) at the same time. If both require replacement, replace one. Then perform the supplemental restraint verification test before replacing the other. Both the ACM and the OCM store OCS calibration data, which they transfer to one another when one of them is replaced. If both are replaced at the same time, an irreversible fault will be set in both modules.**

1. Discard the entire passenger side front seat cushion frame, springs, pad, bladder and pressure sensor, foam, wiring and Occupant Classification Module (OCM) and replace with the entire contents of the factory-calibrated, assembled and tamper-evident service replacement package.
2. Reinstall the trim cover onto the passenger side front seat cushion. (Refer to 23 - BODY/SEATS/SEAT CUSHION COVER - FRONT - INSTALLATION).

3. Reinstall the seat cushion assembly onto the passenger side front seat. (Refer to 23 - BODY/SEATS/SEAT CUSHION - FRONT - INSTALLATION).
4. Reinstall the passenger side front seat into the vehicle. (Refer to 23 - BODY/SEATS/SEAT - FRONT - INSTALLATION).
5. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).
6. Following successful completion of the supplemental restraint system verification test procedure, perform the Occupant Classification System Verification Test using a diagnostic scan tool and the Occupant Classification Seat Weight special tool. Refer to the appropriate diagnostic procedures.

# SPEED CONTROL

## TABLE OF CONTENTS

# SPEED CONTROL

## DESCRIPTION

The speed control system is electronically controlled and vacuum operated. Electronic control of the speed control system is integrated into the Powertrain Control Module (PCM). The controls consist of two steering wheel mounted switches. The switches are labeled: ON/OFF, RES/ACCEL, SET, COAST, and CANCEL.

The system is designed to operate at speeds above 30 mph (50 km/h).

**WARNING: The use of speed control is not recommended when driving conditions do not permit maintaining a constant speed, such as in heavy traffic or on roads that are winding, icy, snow covered, or slippery.**

## OPERATION

When speed control is selected by depressing the ON switch, the PCM allows a set speed to be stored in PCM RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between 35 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:

- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.
- Depressing the clutch pedal (if equipped).

**NOTE: Depressing the OFF switch or turning off the ignition switch will erase the set speed stored in the PCM.**

For added safety, the speed control system is programmed to disengage for any of the following conditions:

- An indication of Park or Neutral
- A rapid increase rpm (indicates that the clutch has been disengaged)
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The speed signal increases at a rate of 10 mph per second (indicates that the coefficient of friction between the road surface and tires is extremely low)
- The speed signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)

Once the speed control has been disengaged, depressing the RES/ACCEL switch (when speed is greater than 30 mph) restores the vehicle to the target speed that was stored in the PCM.

While the speed control is engaged, the driver can increase the vehicle speed by depressing the RES/ACCEL switch. The new target speed is stored in the PCM when the RES/ACCEL is released. The PCM also has a ″tap-up″ feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the RES/ACCEL switch.

A “tap down” feature is used to decelerate without disengaging the speed control system. To decelerate from an existing recorded target speed, momentarily depress the COAST switch. For each switch activation, speed will be lowered approximately 1 mph.

### OVERSHOOT/UNDERSHOOT

If the vehicle operator repeatedly presses and releases the SET button with their foot off of the accelerator (referred to as a “lift foot set”), the vehicle may accelerate and exceed the desired set speed by up to 5 mph (8 km/h). It may also decelerate to less than the desired set speed, before finally achieving the desired set speed.

The Speed Control System has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths. When the speed control is set with the vehicle operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts accordingly. If the “lift foot sets” are continually used, a speed control overshoot/undershoot condition will develop.

To “unlearn” the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed using the accelerator pedal (not decelerating or accelerating), and then turning the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds. This procedure must be performed approximately 10–15 times to completely unlearn the overshoot/undershoot condition.

## DIAGNOSIS AND TESTING - ROAD TEST

Perform a vehicle road test to verify reports of speed control system malfunction. The road test should include attention to the speedometer. Speedometer operation should be smooth and without flutter at all speeds.

Flutter in the speedometer indicates a problem which might cause surging in the speed control system. The cause of any speedometer problems should be corrected before proceeding. Refer to Group 8J, Instrument Cluster for speedometer diagnosis.

If a road test verifies a system problem and the speedometer operates properly, check for:

- A Diagnostic Trouble Code (DTC). If a DTC exists, conduct tests per the Powertrain Diagnostic Procedures service manual.
- A misadjusted brake (stop) lamp switch. This could also cause an intermittent problem.
- Loose, damaged or corroded electrical connections at the servo. Corrosion should be removed from electrical terminals and a light coating of Mopar MultiPurpose Grease, or equivalent, applied.
- Leaking vacuum reservoir.
- Loose or leaking vacuum hoses or connections.
- Defective one-way vacuum check valve.
- Secure attachment of both ends of the speed control servo cable.
- Smooth operation of throttle linkage and throttle body air valve.
- Failed speed control servo. Do the servo vacuum test.

**CAUTION: When test probing for voltage or continuity at electrical connectors, care must be taken not to damage connector, terminals or seals. If these components are damaged, intermittent or complete system failure may occur.**

## SPECIFICATIONS

## TORQUE

| DESCRIPTION | N-m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Servo Mounting Bracket-to-Servo Nuts | 9 | - | 75 |
| Servo Mounting Bracket-to-Body Bolts | 12 | - | 105 |
| Speed Control Switch Mounting Screws | 1.5 | - | 14 |
| Vacuum Reservoir Mounting Screws | 3 | - | 20 |

# CABLE - SPEED CONTROL

## DESCRIPTION

The speed control servo cable is connected between the speed control vacuum servo diaphragm and the throttle body control linkage.

## OPERATION

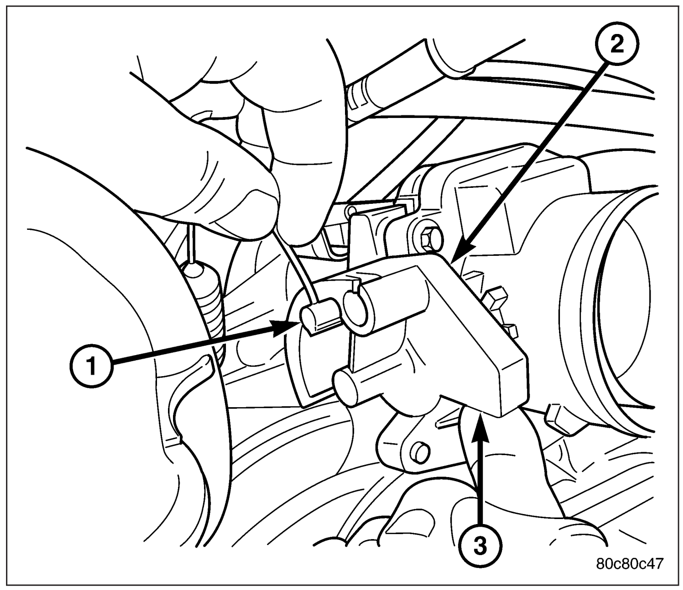
This cable causes the throttle control linkage to open or close the throttle valve in response to movement of the vacuum servo diaphragm.

## REMOVAL - 3.7L

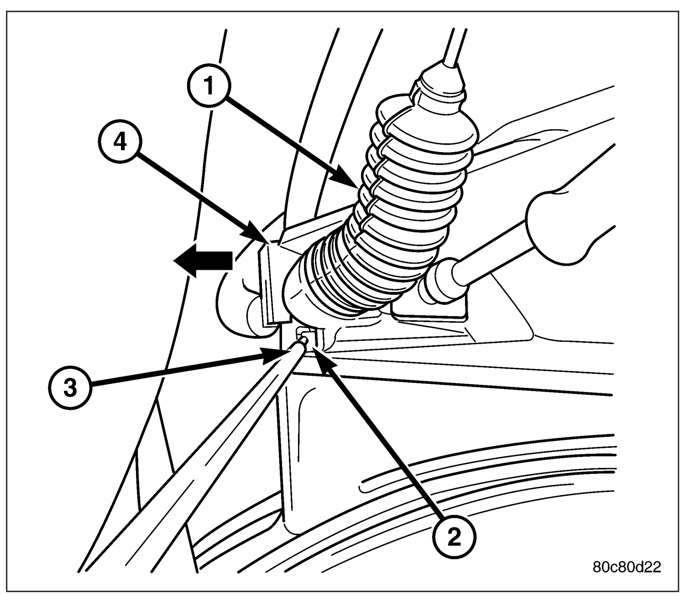
1. Disconnect negative battery cable at battery.
2. Remove air filter resonator at throttle body.

The accelerator cable must be partially removed to gain access to speed control cable.

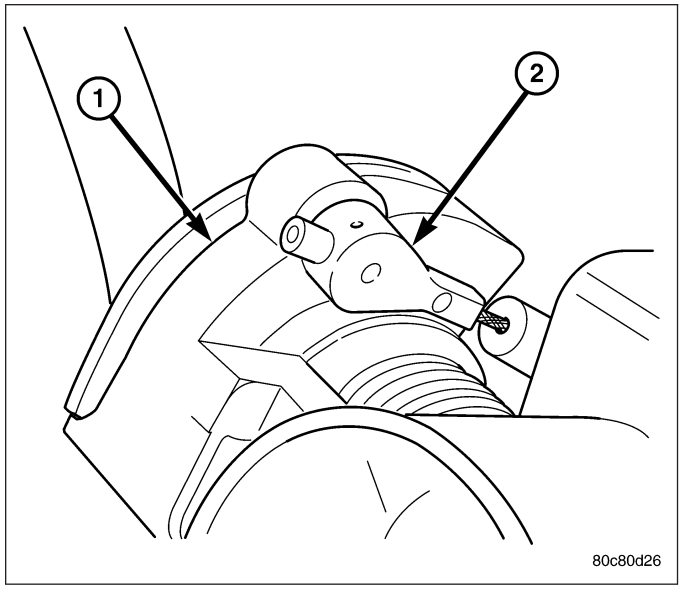
3. Hold throttle in wide open position. While held in this position, slide throttle cable pin (1) from throttle body bellcrank (2).



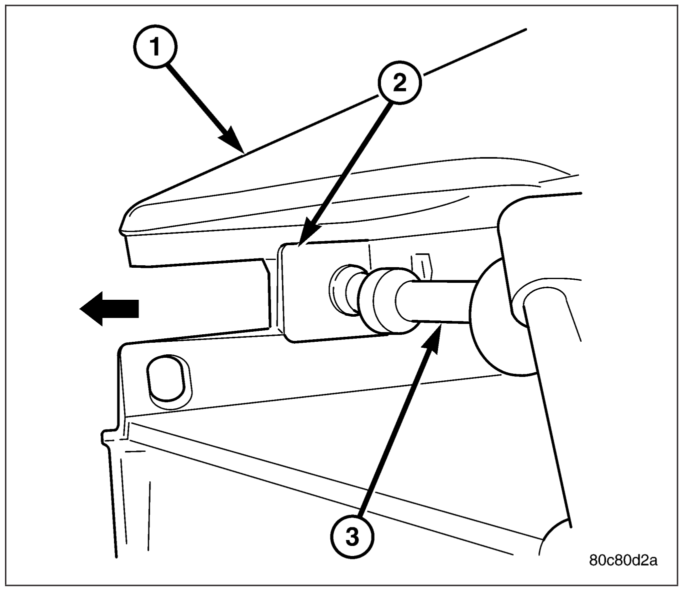

4. Using a pick or small screwdriver, press release tab (2) to release plastic cable mount from bracket. **Press on tab only enough to release cable from bracket. If tab is pressed too much, it will be broken.** Slide plastic mount (4) towards right side of vehicle to remove throttle cable from throttle body bracket.



5. Using finger pressure only, disconnect servo cable connector (2) at throttle body bellcrank pin by pushing connector off bellcrank pin towards front of vehicle. **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**



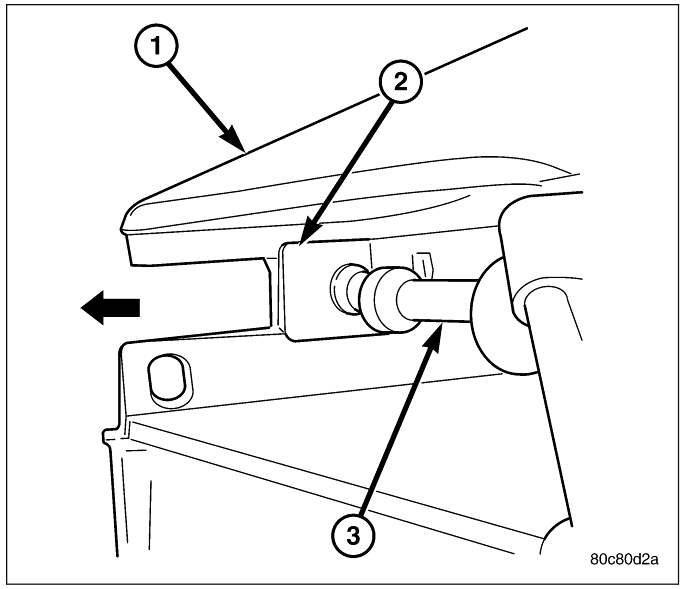

6. Slide speed control cable plastic mount (2) towards right of vehicle to remove cable from throttle body bracket.
7. Remove servo cable from servo. Refer to Servo Removal/Installation.



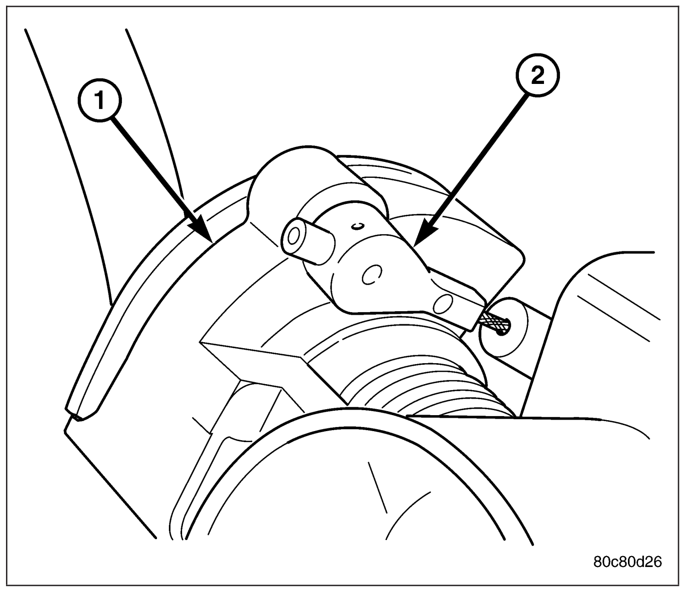

## INSTALLATION - 3.7L

1. Install end of cable to speed control servo. Refer to Servo Removal/Installation.

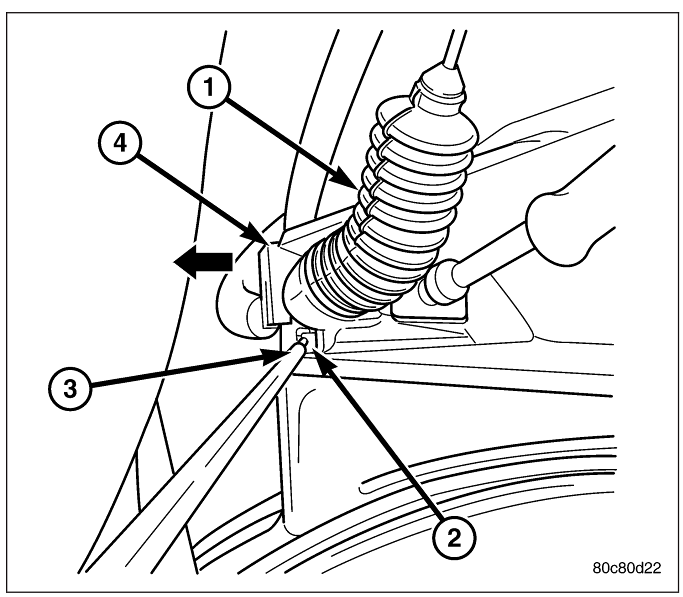
2. Slide speed control cable plastic mount (2) into throttle body bracket.



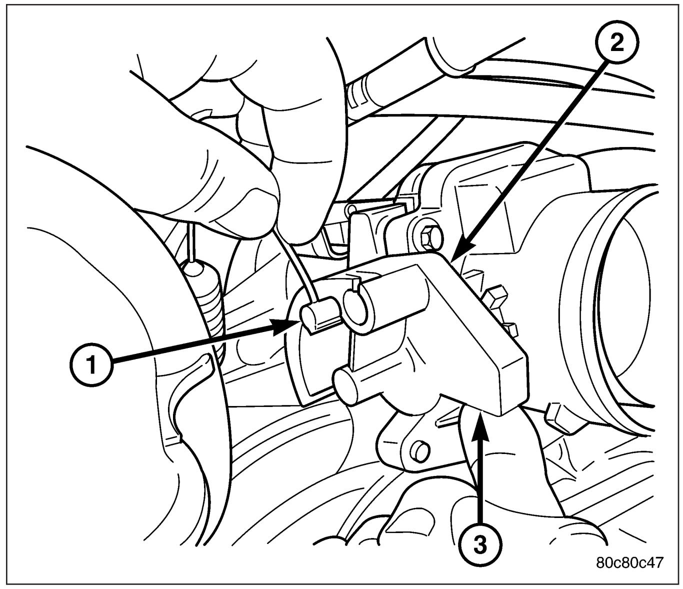

3. Install speed control cable connector (2) onto throttle body bellcrank pin (push rearward to snap into location).




4. Slide throttle (accelerator) cable plastic mount (4) into throttle body bracket. Continue sliding until cable release tab (2) is aligned to hole in throttle body mounting bracket.



5. While holding throttle to wide open position, place throttle cable pin (1) into throttle body bellcrank (2).
6. Install air filter resonator box to throttle body.
7. Connect negative battery cable at battery.
8. Before starting engine, operate accelerator pedal to check for any binding.



# SERVO - SPEED CONTROL

## DESCRIPTION

The servo unit consists of a solenoid valve body, and a vacuum chamber. The solenoid valve body contains three solenoids:

- Vacuum
- Vent
- Dump

The vacuum chamber contains a diaphragm with a cable attached to control the throttle linkage.

## OPERATION

The Powertrain Control Module (PCM) controls the solenoid valve body. The solenoid valve body controls the application and release of vacuum to the diaphragm of the vacuum servo. The servo unit cannot be repaired and is serviced only as a complete assembly.

Power is supplied to the servo's by the PCM through the brake switch. The PCM controls the ground path for the vacuum and vent solenoids.

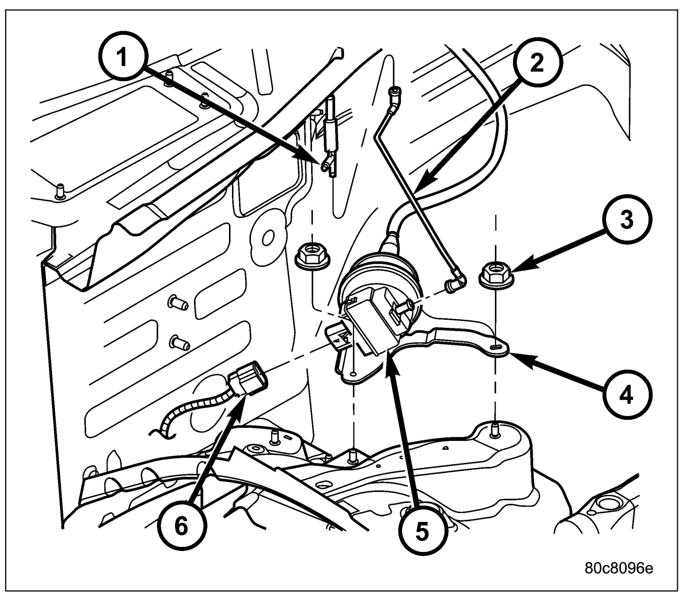
The dump solenoid is energized anytime it receives power. If power to the dump solenoid is interrupted, the solenoid dumps vacuum in the servo. This provides a safety backup to the vent and vacuum solenoids.

The vacuum and vent solenoids must be grounded at the PCM to operate. When the PCM grounds the vacuum servo solenoid, the solenoid allows vacuum to enter the servo and pull open the throttle plate using the cable. When the PCM breaks the ground, the solenoid closes and no more vacuum is allowed to enter the servo. The PCM also operates the vent solenoid via ground. The vent solenoid opens and closes a passage to bleed or hold vacuum in the servo as required.

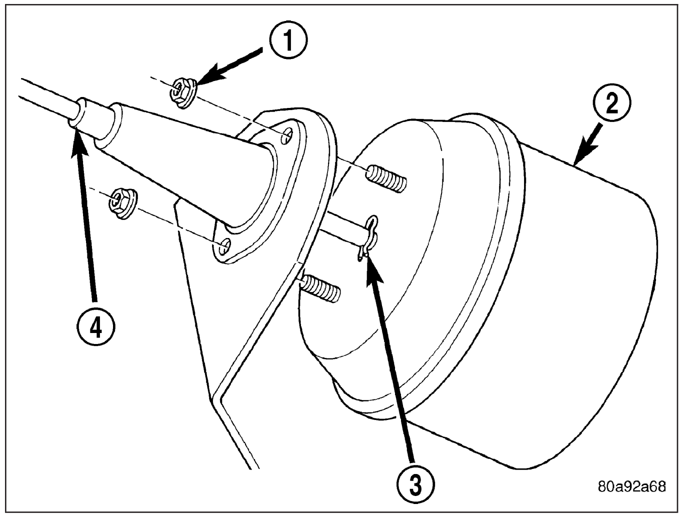
The PCM duty cycles the vacuum and vent solenoids to maintain the set speed, or to accelerate and decelerate the vehicle. To increase throttle opening, the PCM grounds the vacuum and vent solenoids. To decrease throttle opening, the PCM removes the grounds from the vacuum and vent solenoids. When the brake is released, if vehicle speed exceeds 30 mph to resume, 35 mph to set, and the RES/ACCEL switch has been depressed, ground for the vent and vacuum circuits is restored.

## REMOVAL

1. Disconnect negative battery cable at battery.
2. Disconnect vacuum line (2) at servo.
3. Disconnect electrical connector (6) at servo.
4. Remove coolant bottle nuts/bolts. Position bottle forward a few inches.
5. Disconnect servo cable at throttle body. Refer to servo Cable Removal/Installation.
6. Remove servo bracket mounting nuts (3).

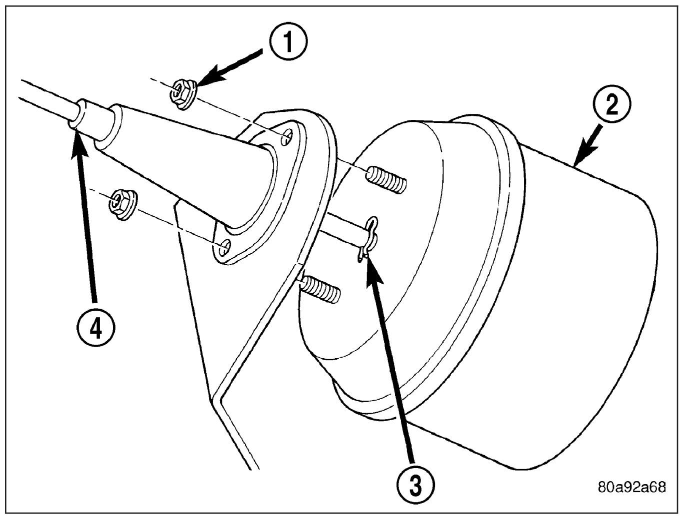


7. Remove two mounting nuts (1) holding servo cable sleeve to bracket.
8. Pull speed control cable sleeve and servo away from servo mounting bracket to expose cable retaining clip (3) and remove clip. Note: The servo mounting bracket displayed in graphic is a typical bracket and may/may not be applicable to this model vehicle.
9. Remove servo from mounting bracket. While removing, note orientation of servo to bracket.

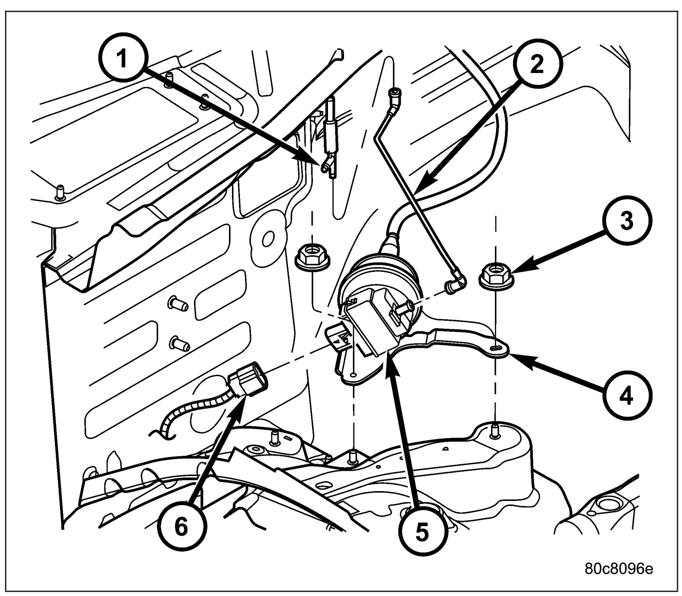



## INSTALLATION

1. Position servo to mounting bracket.
2. Align hole in cable connector with hole in servo pin. Install cable-to-servo retaining clip (3).
3. Insert servo mounting studs through holes in servo mounting bracket.
4. Install servo-to-mounting bracket nuts (1) and tighten. Refer to torque specifications.




5. Install servo mounting bracket-to-body nuts (3) and tighten. Refer to torque specifications.
6. Connect vacuum line (2) at servo.
7. Connect electrical connector (6) at servo.
8. Connect servo cable to throttle body. Refer to servo Cable Removal/Installation.
9. Install coolant bottle.
10. Connect negative battery cable to battery.
11. Before starting engine, operate accelerator pedal to check for any binding.



# SWITCH - SPEED CONTROL

## DESCRIPTION

There are two separate switch pods that operate the speed control system. The steering-wheel-mounted switches use multiplexed circuits to provide inputs to the PCM for ON, OFF, RESUME, ACCELERATE, SET, DECEL and CANCEL modes. Refer to the Owner's Manual for more information on speed control switch functions and setting procedures.

The individual switches cannot be repaired. If one switch fails, the entire switch module must be replaced.

## OPERATION

When speed control is selected by depressing the ON, OFF switch, the PCM allows a set speed to be stored in its RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between approximately 35 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:

- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.

The speed control can be disengaged also by any of the following conditions:

- An indication of Park or Neutral
- The VSS signal increases at a rate of 10 mph per second (indicates that the co-efficient of friction between the road surface and tires is extremely low)
- Depressing the clutch pedal.
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The VSS signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)
- If the actual speed is not within 20 mph of the set speed

The previous disengagement conditions are programmed for added safety.

Once the speed control has been disengaged, depressing the ACCEL switch restores the vehicle to the target speed that was stored in the PCM's RAM.

**NOTE: Depressing the OFF switch will erase the set speed stored in the PCM's RAM.**

If, while the speed control is engaged, the driver wishes to increase vehicle speed, the PCM is programmed for an acceleration feature. With the ACCEL switch held closed, the vehicle accelerates slowly to the desired speed. The new target speed is stored in the PCM's RAM when the ACCEL switch is released. The PCM also has a ″tap-up″ feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the ACCEL switch.

The PCM also provides a means to decelerate without disengaging speed control. To decelerate from an existing recorded target speed, depress and hold the COAST switch until the desired speed is reached. Then release the switch. The ON, OFF switch operates two components: the PCM's ON, OFF input, and the battery voltage to the brake switch, which powers the speed control servo.

### Multiplexing

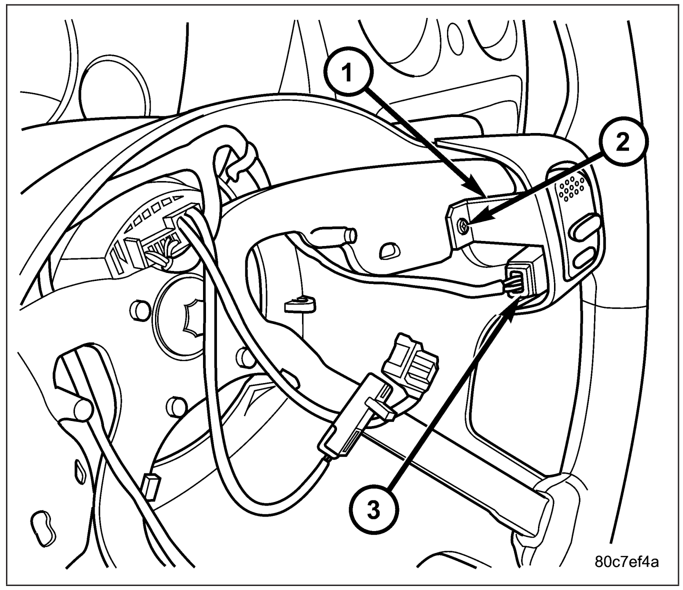
The PCM sends out 5 volts through a fixed resistor and monitors the voltage change between the fixed resistor and the switches. If none of the switches are depressed, the PCM will measure 5 volts at the sensor point (open circuit). If a switch with no resistor is closed, the PCM will measure 0 volts (grounded circuit). Now, if a resistor is added to a switch, then the PCM will measure some voltage proportional to the size of the resistor. By adding a different resistor to each switch, the PCM will see a different voltage depending on which switch is pushed.

Another resistor has been added to the 'at rest circuit' causing the PCM to never see 5 volts. This was done for diagnostic purposes. If the switch circuit should open (bad connection), then the PCM will see the 5 volts and know the circuit is bad. The PCM will then set an open circuit fault.

## REMOVAL

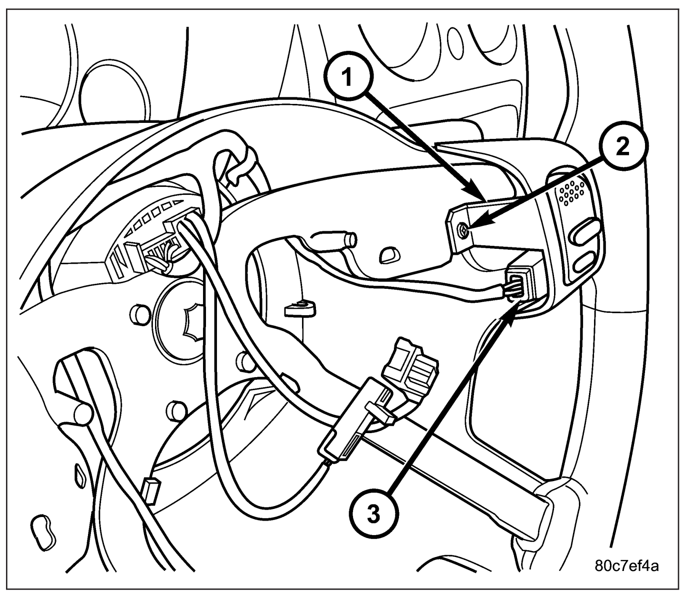
**WARNING: Before attempting to diagnose, remove or install any airbag system or related steering wheel and steering column components you must first disconnect and isolate the negative (ground) battery cable. Wait 2 minutes for system capacitor to discharge before further system service. Failure to do so could result in accidental deployment and possible personal injury.**

1. Disconnect and isolate negative battery cable from battery.
2. Remove airbag module. Refer to Restraint Systems.
3. Unplug electrical connector (3).
4. Remove speed control switch mounting screw (2) and remove switch (1) from steering wheel.




## INSTALLATION

1. Position switch to steering wheel.
2. Install switch mounting screw (2) and tighten to 1.5 N·m (14 in. lbs.).
3. Plug electrical connector into switch.
4. Install airbag module. Refer to Restraint Systems.
5. Connect negative battery cable to battery.

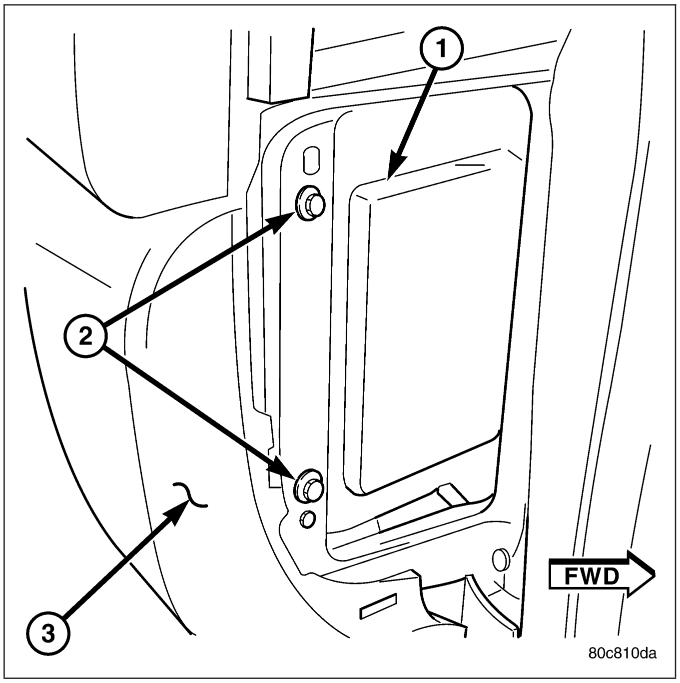


# RESERVOIR - VACUUM

## DESCRIPTION

The vacuum reservoir (1) is a plastic storage tank connected to an engine vacuum source by vacuum lines.

The reservoir (1) is located behind, and at the outer end of the instrument panel. To gain access for testing or removal, remove glovebox assembly. Also remove fuse box access cover panel at end of instrument panel. On vehicles equipped with LHD (Left Hand Drive), this fuse access panel is located at right end of instrument panel. On vehicles equipped with RHD (Right Hand Drive), this access panel is located at left end of instrument panel.




## OPERATION

The vacuum reservoir is used to supply the vacuum needed to maintain proper speed control operation when engine vacuum drops, such as in climbing a grade while driving. A one-way check valve is used in the vacuum line between the reservoir and the vacuum source. This check valve is used to trap engine vacuum in the reservoir. On certain vehicle applications, this reservoir is shared with the heating/air-conditioning system. The vacuum reservoir cannot be repaired and must be replaced if faulty.

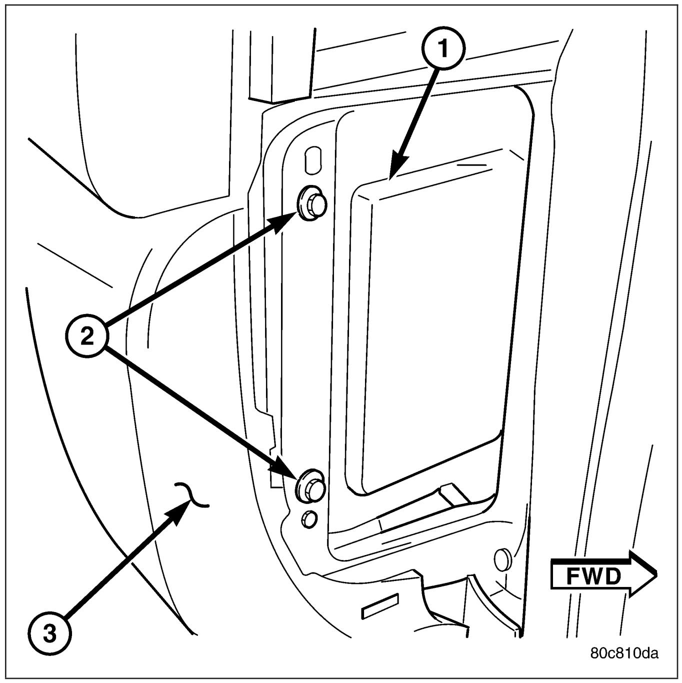
## DIAGNOSIS AND TESTING - VACUUM RESERVOIR

1. Disconnect vacuum hose at speed control servo and install a vacuum gauge into the disconnected hose.
2. Start engine and observe gauge at idle. Vacuum gauge should read at least ten inches of mercury.
3. If vacuum is less than ten inches of mercury, determine source of leak. Check vacuum line to engine for leaks. Also check actual engine intake manifold vacuum. If manifold vacuum does not meet this requirement, check for poor engine performance and repair as necessary.
4. If vacuum line to engine is not leaking, check for leak at vacuum reservoir. To locate and gain access to reservoir, refer to Vacuum Reservoir Removal/Installation in this group. Disconnect vacuum line at reservoir and connect a hand-operated vacuum pump to reservoir fitting. Apply vacuum. Reservoir vacuum should not bleed off. If vacuum is being lost, replace reservoir.
5. Verify operation of one-way check valve and check it for leaks. **Certain models may be equipped with 2 check-valves.**
   a. Locate one-way check valve. The valve is located in vacuum line between vacuum reservoir and engine vacuum source. Disconnect vacuum hoses (lines) at each end of valve.
   b. Connect a hand-operated vacuum pump to reservoir end of check valve. Apply vacuum. Vacuum should not bleed off. If vacuum is being lost, replace one-way check valve.
   c. Connect a hand-operated vacuum pump to vacuum source end of check valve. Apply vacuum. Vacuum should flow through valve. If vacuum is not flowing, replace one-way check valve. Seal the fitting at opposite end of valve with a finger and apply vacuum. If vacuum will not hold, diaphragm within check valve has ruptured. Replace valve.

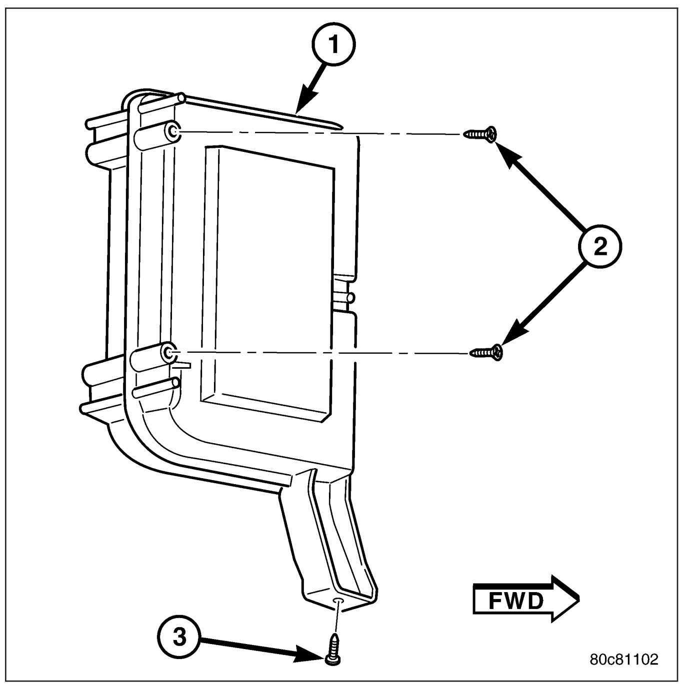
## REMOVAL

The vacuum reservoir (1) is located behind, and at the outer end of the instrument panel. To gain access for testing or removal, remove glovebox assembly. Also remove fuse box access cover panel at end of instrument panel. On vehicles equipped with LHD (Left Hand Drive), this fuse access panel is located at right end of instrument panel. On vehicles equipped with RHD (Right Hand Drive), this access panel is located at left end of instrument panel.

1. Remove glovebox assembly. Access to reservoir vacuum line and fitting can now be made.
2. Remove vacuum line at reservoir.
3. Remove fuse access cover panel at end of instrument panel.
4. Through fuse access opening, remove two horizontally mounted screws (2).

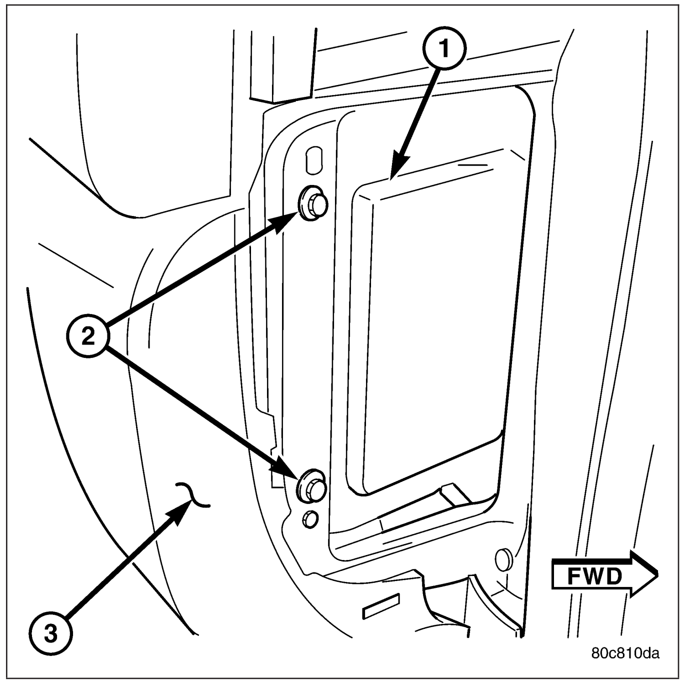



5. From bottom of instrument panel, remove one vertically mounted screw (3).
6. Remove reservoir from instrument panel.

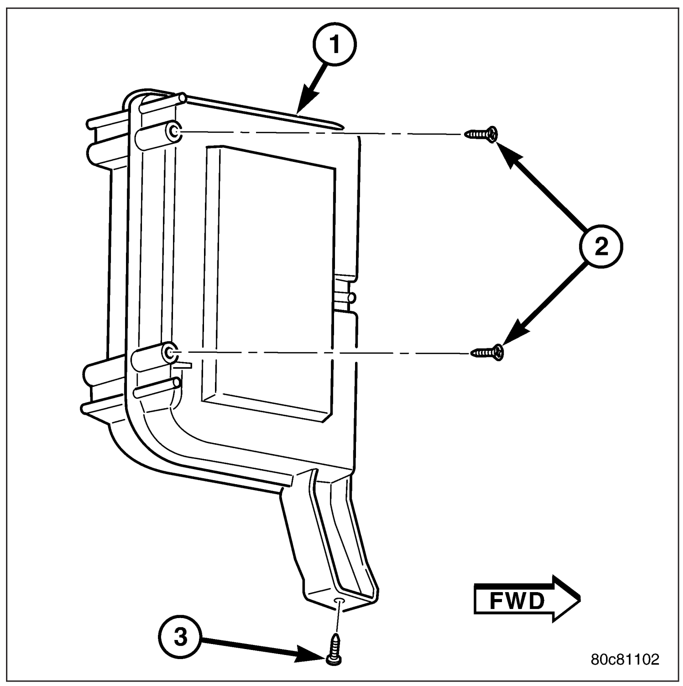


## INSTALLATION

1. Position reservoir (1) to instrument panel.
2. Install two horizontal mounting screws (2) but do not tighten.




3. Install one vertically mounted screw (3). Tighten all three mounting screws to 3 N·m (20 in. lbs.).
4. Connect vacuum line to reservoir fitting.
5. Install glovebox assembly.
6. Install fuse box access cover panel.



# VEHICLE THEFT SECURITY

## TABLE OF CONTENTS



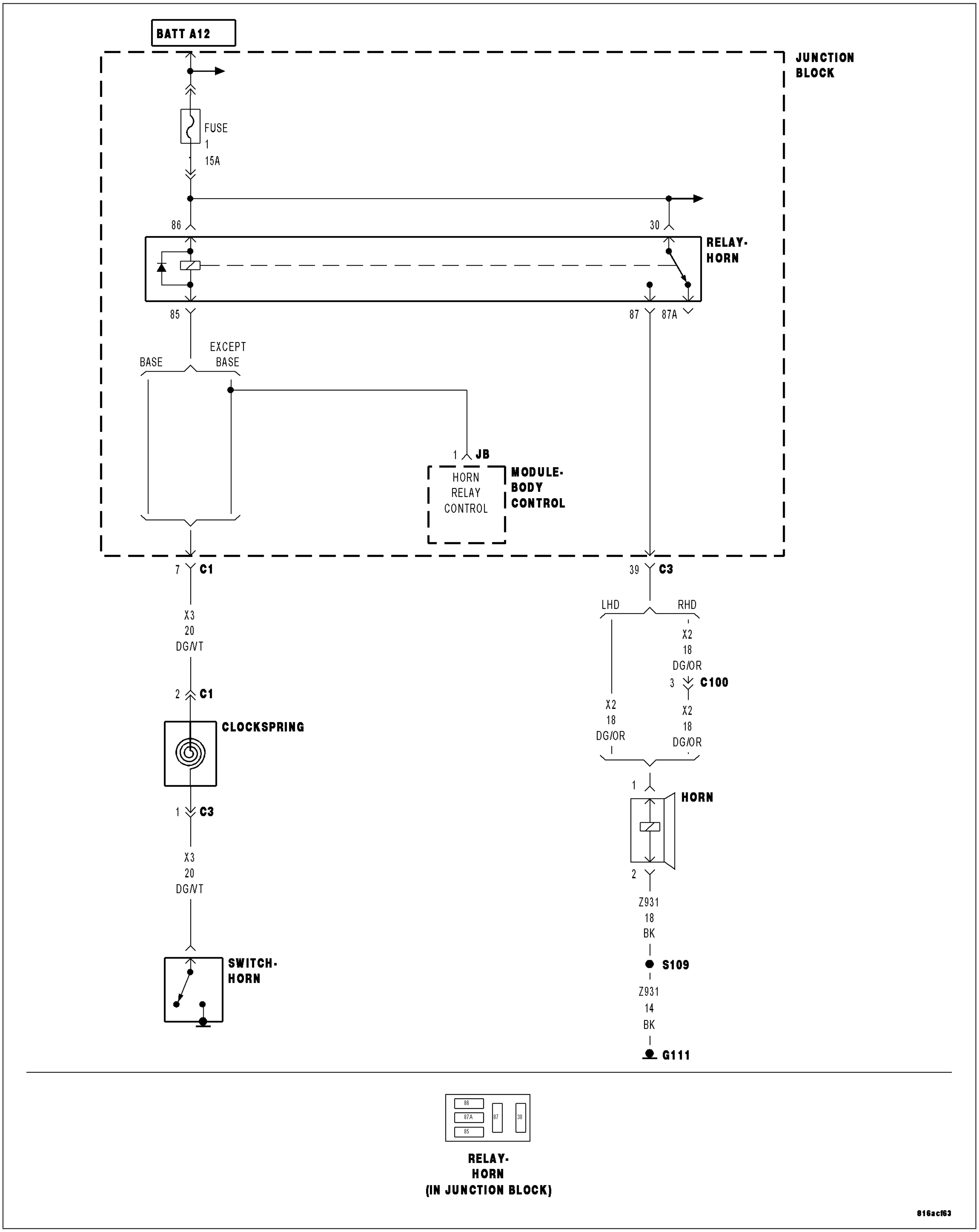
## VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS

### TABLE OF CONTENTS

# VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## HORN RELAY OUTPUT HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Body Control Module (BCM) detects unwanted voltage on the (X3) Horn Relay Control circuit.

| Possible Causes |
|---|
| HORN RELAY SHORTED |
| (X3) HORN RELAY CONTROL CIRCUIT SHORTED |
| BODY CONTROL MODULE (BCM) |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.
With the scan tool, erase BCM DTCs.
With the scan tool, actuate the Horn Relay.
With the scan tool, read BCM DTCs.

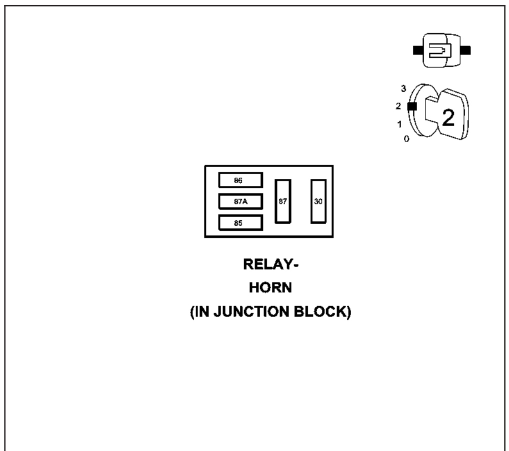
**Does the scan tool display: HORN RELAY OUTPUT HIGH?**

**Yes** >> Go To 2

**No** >> The condition that caused this symptom is not currently present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

### 2. CHECK FOR A SHORTED HORN RELAY

Turn the ignition off.
Install a substitute Horn Relay in place of the existing relay.
Turn the ignition on.
With the scan tool, erase BCM DTCs.
With the scan tool, actuate the Horn Relay.
With the scan tool, read BCM DTCs.



816acf67

**Does the scan tool display: HORN RELAY OUTPUT HIGH?**

**Yes** >> Go To 3

**No** >> Replace the original Horn Relay in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. CHECK FOR A SHORTED (X3) HORN RELAY CONTROL CIRCUIT

Turn the ignition off.

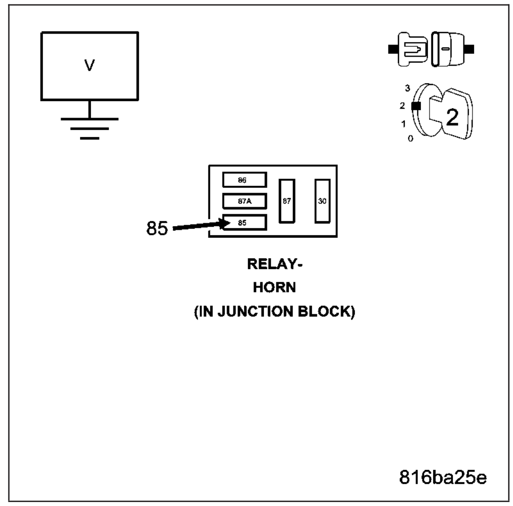
Remove the substitute Horn Relay from the Junction Block.

Remove the BCM from the Junction Block.

**NOTE: Ensure that the Junction Block connectors are reconnected at this time.**

Turn the ignition on.

Measure the voltage of the (X3) Horn Relay Control circuit in the Horn Relay connector in the Junction Block.




**Is there any voltage present?**

**Yes** >> Replace the Junction Block in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## ITM–BCM MESSAGE NOT RECEIVED (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  When the Intrusion Transceiver Module (ITM) transmits bus messages.
- **Set Condition:**
  If the ITM fails to receive status messages from the Body Control Module (BCM).

| Possible Causes |
|---|
| BUS COMMUNICATION FAILURE |
| INTRUSION TRANSCEIVER MODULE (ITM) |

### Diagnostic Test

#### 1. VERIFY THAT THE BCM IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, verify that the BCM is active on the bus.

**Is the BCM active on the bus?**

**Yes** >> Go To 2

**No** >> Refer to (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

#### 2. VERIFY THAT THE DTC IS ACTIVE

With the scan tool, erase ITM DTCs.

Turn the ignition off.

Arm the VTSS and wait one minute.

Disarm the VTSS and turn the ignition on.

With the scan tool, read ITM DTCs.

**Did this DTC reset?**

**Yes** >> Replace the ITM in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced or partially broken wires.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## ITM–EEPROM FAILURE (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while the VTSS is armed and during change of the VTSS state.
- **Set Condition:**
  If the EEPROM erase/write does not correctly complete the operation.

| Possible Causes |
|---|
| INTRUSION TRANSCEIVER MODULE (ITM) |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, erase the ITM DTCs.

Turn the ignition off.

Arm the VTSS and wait one minute.

Disarm the VTSS and turn the ignition on.

With the scan tool, read ITM DTCs.

**Did this DTC reset?**

**Yes** >> Replace the ITM in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that caused this symptom is currently not present. Test complete.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## ITM–LOOPBACK FAILURE (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while the VTSS is armed, pre-armed, or reset.
- **Set Condition:**
  If the Intrusion Transceiver Module (ITM) fails an internal bus test.

| Possible Causes |
|---|
| INTRUSION TRANSCEIVER MODULE (ITM) |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, erase the ITM DTCs.

Turn the ignition off.

Arm the VTSS and wait one minute.

Disarm the VTSS and turn the ignition on.

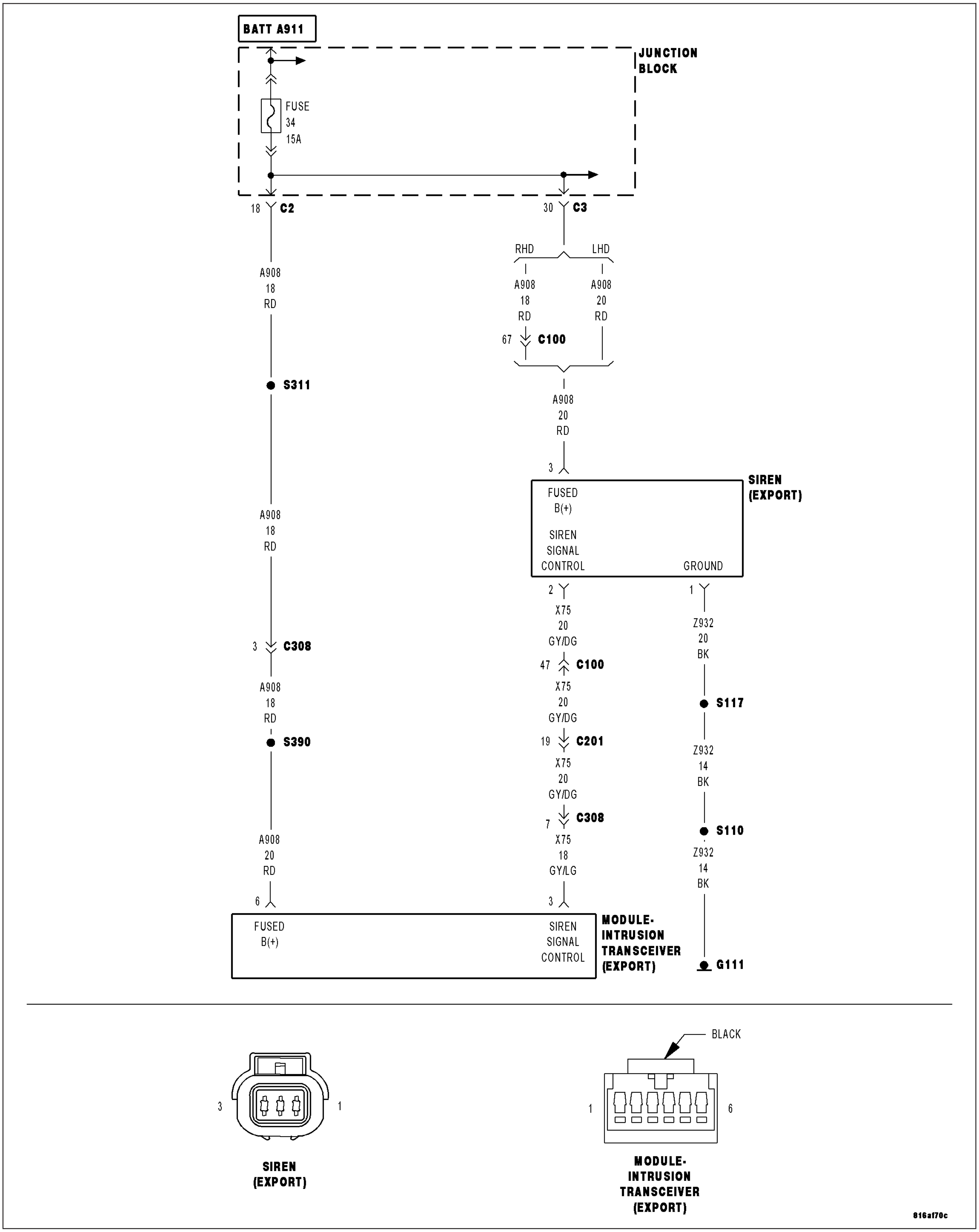
With the scan tool, read ITM DTCs.

**Did this DTC reset?**

**Yes** >> Replace the ITM in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that caused this symptom is currently not present. Test complete.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## ITM–NO SERIAL COMMUNICATION (EXPORT ONLY)




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while the VTSS is armed.
- **Set Condition:**
  If the Intrusion Transceiver Module (ITM) fails to receive messages from the Siren.

| Possible Causes |
|---|
| (A908) FUSED B+ CIRCUIT OPEN |
| (Z932) GROUND CIRCUIT OPEN |
| (X75) SIREN SIGNAL CONTROL CIRCUIT SHORTED TO GROUND |
| (X75) SIREN SIGNAL CONTROL CIRCUIT OPEN |
| VTSS SIREN |
| INTRUSION TRANSCEIVER MODULE (ITM) |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, erase the ITM DTCs.

Turn the ignition off.

Arm the VTSS and wait one minute.

Disarm the VTSS and turn the ignition on.

With the scan tool, read ITM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

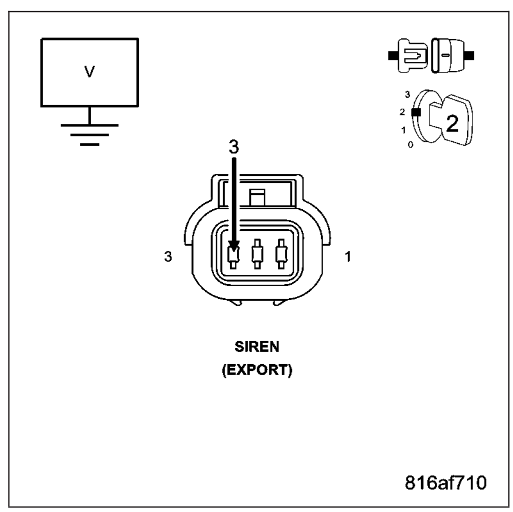
**No** >> The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced or partially broken wires.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

### 2. CHECK THE (A908) FUSED B+ CIRCUIT FOR AN OPEN

Disconnect the Siren harness connector.

Measure the voltage of the (A908) Fused B(+) circuit in the Siren harness connector.




**Is the voltage above 10.0 volts?**

**Yes** >> Go To 3

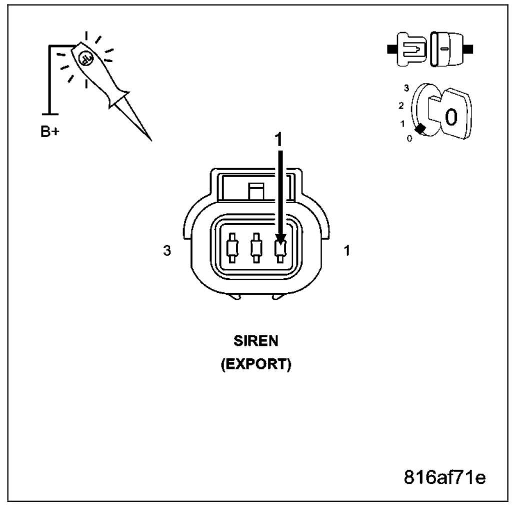
**No** >> Repair the (A908) Fused B+ circuit for an open.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

## 3. CHECK THE (Z932) GROUND CIRCUIT FOR AN OPEN

Turn the ignition off.

Using a 12-volt test light connected to 12 volts, check the (Z932) Ground circuit in the Siren harness connector.




**Does the test light illuminate brightly?**

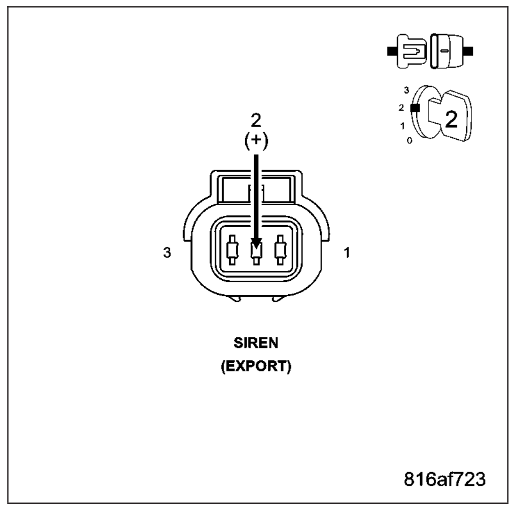
**Yes** >> Go To 4

**No** >> Repair the (Z932) Ground circuit for an open.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

## 4. CHECK THE (X75) SIREN SIGNAL CONTROL CIRCUIT FUNCTION

Using the DRBIII®, set up the lab scope as follows:




- Turn the ignition on.
- Use the Scope input cable CH7058, Cable to Probe adapter CH7062 and the red and black test probes.
- Connect the scope input cable to the channel one connector on the DRBIII®.
- Attach the red and black leads and the cable to probe adapter to the scope input cable.
- Select DRBIII® Standalone.
- Select lab scope.
- Select Live.
- Select 12 volt square wave.
- Press F2 for Scope.
- Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete.

Connect the black lead to the chassis ground.

Connect the red lead to the (X75) Siren Signal Control circuit in the Siren harness connector.

Start the engine and hold the engine RPM's above 600.

Observe the voltage displayed on the DRBIII® Lab Scope.

**Is there a voltage square wave present for one to two seconds?**

**Yes** >> Replace the VTSS Siren in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK THE (X75) SIREN SIGNAL CONTROL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off.

Disconnect the ITM harness connector.

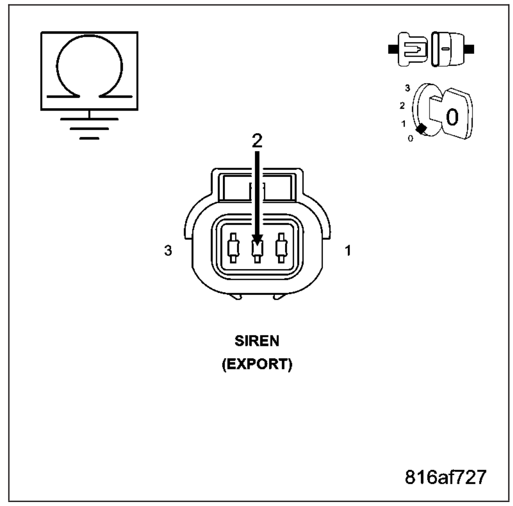
Measure the resistance between ground and the (X75) Siren Signal Control circuit in the Siren harness connector.

**Is the resistance below 100.0 ohms?**

**Yes** >> Repair the (X75) Siren Signal Control circuit for a short to ground.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Go To 6




## 6. CHECK THE (X75) SIREN SIGNAL CONTROL CIRCUIT FOR AN OPEN

Measure the resistance of the (X75) Siren Signal Control circuit between the ITM harness connector and the Siren harness connector.

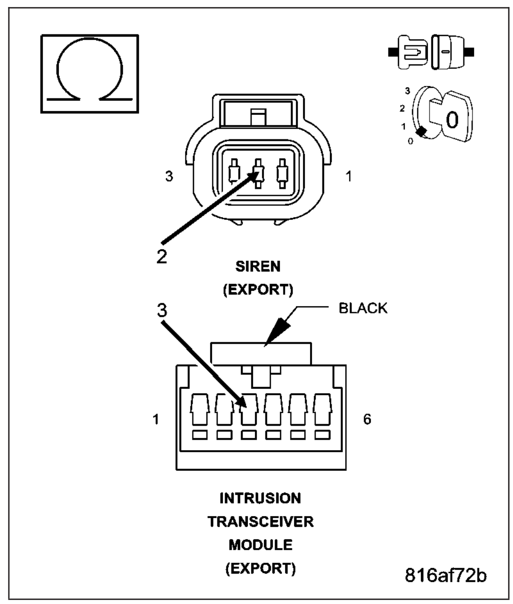
**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the ITM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (X75) Siren Signal Control circuit for an open.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.



## ITM–PCM MESSAGE NOT RECEIVED (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Intrusion Transceiver Module (ITM) fails to receive bus messages from the Powertrain Control Module (PCM).

| Possible Causes |
|---|
| BUS COMMUNICATION FAILURE |
| INTRUSION TRANSCEIVER MODULE (ITM) |

### Diagnostic Test

#### 1. VERIFY THAT THE PCM AND BCM ARE ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, verify that the PCM and BCM are active on the bus.

**Are both modules active on the bus?**

**Yes** >> Go To 2

**No** >> Refer to (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

#### 2. VERIFY THAT THE DTC IS ACTIVE

With the scan tool, erase ITM DTCs.

Turn the ignition off.

Arm the VTSS and wait one minute.

Disarm the VTSS and turn the ignition on.

With the scan tool, read ITM DTCs.

**Did this DTC reset?**

**Yes** >> Replace the ITM in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced or partially broken wires.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## ITM–PRE-ARM TIMEOUT FAILURE (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  During the VTSS pre-arm process.
- **Set Condition:**
  If the Intrusion Transceiver Module (ITM) fails to receive the arm message from the Body Control Module (BCM) after sixty seconds.

| Possible Causes |
|---|
| BUS COMMUNICATION FAILURE |
| INTRUSION TRANSCEIVER MODULE (ITM) |

### Diagnostic Test

#### 1. VERIFY THAT THE BCM IS ACTIVE ON THE BUS

Turn the ignition on.

With the scan tool, verify that the BCM is active on the bus.

**Is the BCM active on the bus?**

**Yes** >> Go To 2

**No** >> Refer to (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for no response related diagnostic procedures.

#### 2. VERIFY THAT THE DTC IS ACTIVE

With the scan tool, erase ITM DTCs.

Turn the ignition off.

Arm the VTSS and wait one minute.

Disarm the VTSS and turn the ignition on.

With the scan tool, read ITM DTCs.

**Did this DTC reset?**

**Yes** >> Replace the ITM in accordance with the service information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced or partially broken wires.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## ITM–SIREN BATTERY HAS BEEN TAMPERED (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while the VTSS is armed.
- **Set Condition:**
  If the siren detects the loss of vehicle battery voltage.

| Possible Causes |
|---|
| SIREN WIRE HARNESS TAMPERED WITH OR DAMAGED |
| INTRUSION TRANSCEIVER MODULE (ITM) |

## Diagnostic Test

### 1. INSPECT THE SIREN WIRE HARNESS SIGNS OF TAMPERING AND DAMAGE

Turn the ignition off.

Inspect the wiring harness to the siren for signs of tampering and damage.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Go To 2

### 2. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, erase ITM DTCs.

Turn the ignition off.

Arm the VTSS and wait one minute.

Disarm the VTSS and turn the ignition on.

With the scan tool, read ITM DTCs.

**Did this DTC reset?**

**Yes** >> Replace the Siren in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced or partially broken wires.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## ITM–SIREN COMMUNICATION FAILURE (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while the VTSS is armed.
- **Set Condition:**
  If the Siren fails to receive messages from the Intrusion Transceiver Module (ITM).

Refer to **ITM–No Serial Communication (Export Only)** in this Section for the diagnostic test procedure.

## ITM–SIREN EEPROM FAILURE (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while the VTSS is armed.
- **Set Condition:**
  If the checksum of the EEPROM does not calculate to the correct value.

| Possible Causes |
|---|
| SIREN |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, erase the ITM DTCs.

Turn the ignition off.

Arm the VTSS and wait one minute.

Disarm the VTSS and turn the ignition on.

With the scan tool, read ITM DTCs.

**Did this DTC reset?**

**Yes** >> Replace the Siren in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that caused this symptom is currently not present. Test complete.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## ITM–SIREN INTERNAL BATTERY (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with engine speed over 600 rpm.
- **Set Condition:**
  The Intrusion Transceiver Module (ITM) will set this DTC if the internal battery within the siren does not charge as expected.

| Possible Causes |
|---|
| SIREN |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, erase the ITM DTCs.

Turn the ignition off.

Arm the VTSS and wait one minute.

Disarm the VTSS and turn the ignition on.

With the scan tool, read ITM DTCs.

**Did this DTC reset?**

**Yes** >> Replace the Siren in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that caused this symptom is currently not present. Test complete.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## ITM–SIREN ROM FAILURE (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while the VTSS is armed.
- **Set Condition:**
  If the checksum of the ROM does not calculate to the correct value.

| Possible Causes |
|---|
| SIREN |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, erase the ITM DTCs.

Turn the ignition off.

Arm the VTSS and wait one minute.

Disarm the VTSS and turn the ignition on.

With the scan tool, read ITM DTCs.

**Did this DTC reset?**

**Yes** >> Replace the Siren in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that caused this symptom is currently not present. Test complete.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## ITM–TRANSDUCER FAILURE (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously during VTSS pre-arm mode.
- **Set Condition:**
  The Intrusion Transceiver Module (ITM) sends a test ultrasonic signal during the pre-arm process. If the test signal is not correctly received this code will set.

| Possible Causes |
|---|
| INTRUSION TRANSCEIVER MODULE SENSORS BLOCKED / DIRTY |
| INTRUSION TRANSCEIVER MODULE (ITM) |

### Diagnostic Test

#### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, erase the ITM DTCs.

Turn the ignition off.

Arm the VTSS and wait one minute.

Disarm the VTSS and turn the ignition on.

With the scan tool, read ITM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that caused this symptom is currently not present. Test complete.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

#### 2. INSPECT ITM SENSORS FOR BLOCKAGE FROM DUST / DEBRIS

Inspect the louvers of the Intrusion Transceiver Module for blockage from dust / debris.

**Were any problems found?**

**Yes** >> Clean as necessary.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Replace the ITM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## ITM–VIN MISMATCH (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  While the Intrusion Transceiver Module (ITM) is being disarmed.
- **Set Condition:**
  If the VIN stored in the ITM fails to match the VIN in the Body Control Module (BCM).

| Possible Causes |
|---|
| MODULE PROGRAMMED WITH INCORRECT VIN |

## Diagnostic Test

### 1. VERIFY THAT THE ITM, BCM, AND PCM ARE PROGRAMMED WITH THE CORRECT VIN

**NOTE: Never install an ITM or Siren which was removed from another vehicle.**

Turn the ignition on.

Display and record the VIN programmed in the ITM, BCM, and PCM as follows:

- With the scan tool, select ECU View, select the applicable module, select More Options, and select ECU Details.

**Are the ITM, BCM, and PCM programmed with the correct VIN?**

**Yes** >> Go To 2

**No** >> Replace and program all modules that are programmed with the incorrect VIN.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

### 2. VERIFY THAT THE DTC IS ACTIVE

With the scan tool, erase the ITM DTCs.

Turn the ignition off.

Arm the VTSS and wait one minute.

Disarm the VTSS and turn the ignition on.

With the scan tool, read ITM DTCs.

**Did this DTC reset?**

**Yes** >> Replace the ITM in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that caused this symptom is currently not present. Test complete.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## SKREEM/SKIM–ANTENNA FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Every 250 milliseconds with the ignition on.
- **Set Condition:**
  The SKREEM/SKIM micro-controller determines that an antenna circuit fault has occurred for 2.0 consecutive seconds.

| Possible Causes |
| --- |
| SKREEM/SKIM INTERNAL FAILURE |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

**NOTE: This trouble code indicates an internal module fault.**

Turn the ignition on.

With the scan tool, record and erase SKREEM/SKIM DTCs.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test complete, the conditions that set this DTC are not present at this time.

## SKREEM/SKIM–COP FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The COP timer is not reset by the micro-controller every 65.5 milliseconds.

| Possible Causes |
|---|
| SKREEM/SKIM INTERNAL DTC FAILURE |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

**NOTE: This trouble code indicates an internal module fault.**

Turn the ignition on.

With the scan tool, record and erase the SKREEM/SKIM DTCs.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test complete, the conditions that set this DTC are not present at this time.

## SKREEM/SKIM–EEPROM FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the value written to EEPROM memory does not equal the value read back after the write operation.

| Possible Causes |
|---|
| SKREEM/SKIM INTERNAL DTC FAILURE |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

**NOTE: This trouble code indicates an internal module fault.**

Turn the ignition on.

With the scan tool, record and erase the SKREEM/SKIM DTCs.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test complete, the conditions that set this DTC are not present at this time.

## SKREEM/SKIM–INTERNAL FAULT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The SKREEM/SKIM has detected a fault during an internal self test.

| Possible Causes |
|---|
| SKREEM/SKIM INTERNAL DTC FAILURE |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

**NOTE: This trouble code indicates an internal module fault.**

Turn the ignition on.

With the scan tool, record and erase the SKREEM/SKIM DTCs.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test complete, the conditions that set this DTC are not present at this time.

## SKREEM/SKIM–PCM STATUS FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the SKREEM/SKIM fails to receive the PCM STATUS message from the PCM for at least 20.0 consecutive seconds.

| Possible Causes |
| --- |
| WIRE HARNESS FAILURE |
| SKREEM/SKIM |
| PCM |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

**NOTE: Verify that the PCM has good power and ground connections before continuing.**

Turn the ignition on.

With the scan tool, record and erase the SKREEM/SKIM DTCs.

Turn the ignition off.

Wait 2 minutes.

Turn the ignition on.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> Perform the Intermittent Condition diagnostic procedure in this Section.

### 2. INSPECT RELATED WIRING FOR CONDITION CAUSING THE FAULT

Turn the ignition off.

**NOTE: Visually inspect the related wiring harness and PCI Bus circuits for any chafed, pierced, pinched, and partially broken wires.**

**NOTE: Visually inspect the related wiring harness connectors for broken, bent, pushed out, and corroded terminals.**

**NOTE: Refer to any Technical Service Bulletins (TSB) that may apply.**

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. VERIFY THAT THE DTC IS STILL ACTIVE

**NOTE: Obtain the SKIM PIN before proceeding.**

Turn the ignition on.

With the scan tool, erase all PCM and SKREEM/SKIM DTCs.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the PCM in accordance with the Service Information.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test complete, the conditions that set this DTC are not present at this time.

## SKREEM/SKIM–RAM FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The RAM fails a test that checks the RAM's ability to retain memory.

| Possible Causes |
|---|
| SKREEM/SKIM INTERNAL DTC FAILURE |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

**NOTE: This trouble code indicates an internal module fault.**

Turn the ignition on.

With the scan tool, record and erase the SKREEM/SKIM DTCs.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test complete, the conditions that set this DTC are not present at this time.

## SKREEM/SKIM–ROLLING CODE FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on, after ignition on during any rolling code handshake that occurs with the PCM due to a SKREEM/SKIM or PCM reset.
- **Set Condition:**
  When a PCM STATUS message with a Valid Key status is not received by the SKREEM/SKIM within 3.5 seconds of transmitting the last Valid Key Code message to the PCM.

| Possible Causes |
|---|
| PCM NOT PROGRAMMED OR PROGRAMMED WITH INCORRECT VIN |
| SKREEM/SKIM |
| PCM |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, erase the SKREEM/SKIM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on and wait 2 minutes.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> Perform the Intermittent Condition diagnostic procedure is this section.

### 2. VERIFY THAT THE PCM IS PROGRAMMED WITH THE CORRECT VIN

Display and record the VIN programmed in the PCM as follows:

- With the scan tool, select ECU View, select PCM, select More Options, and select ECU Details.

**NOTE: Make sure that a VIN is programmed in the PCM. If the VIN does not display, attempt to program the PCM with the correct VIN before continuing.**

**Is the PCM programmed with the correct VIN?**

**Yes** >> Go To 3

**No** >> Using the scan tool, perform PCM Replaced to update the VIN in the PCM.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

## 3. VERIFY THAT THE DTC IS STILL ACTIVE

Turn the ignition off.

Replace and program the SKREEM/SKIM in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase all PCM and SKREEM/SKIM DTCs.

Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle.

With the scan tool, check for SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the PCM in accordance with the Service Information.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> The repair is complete.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

## SKREEM/SKIM–SERIAL LINK EXTERNAL FAULT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on, after ignition on during any rolling code handshake that occurs with the PCM due to a SKREEM/SKIM reset, or during SECRET KEY transfers to the PCM.
- **Set Condition:**
  If the SKREEM/SKIM fails to receive the PCI BUS message transmission acknowledgement from the PCM after 3 transmit attempts.

| Possible Causes |
|---|
| WIRE HARNESS FAILURE |
| SKREEM/SKIM |
| PCM |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

**NOTE: Verify that the PCM has good power and ground connections before continuing.**

Turn the ignition on.

With the scan tool, record and erase the SKREEM/SKIM DTCs.

Turn the ignition off.

Wait 2 minutes.

Turn the ignition on.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> Perform the Intermittent Condition diagnostic procedure in this Section.

### 2. INSPECT RELATED WIRING FOR CONDITION CAUSING THE FAULT

Turn the ignition off.

**NOTE: Visually inspect the related wiring harness and PCI Bus circuits for chafed, pierced, pinched, and partially broken wires.**

**NOTE: Visually inspect the related wiring harness connectors for broken, bent, pushed out, and corroded terminals.**

**NOTE: Refer to any Technical Service Bulletins (TSB) that may apply.**

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Go To 3

## 3. VERIFY THAT THE DTC IS STILL ACTIVE

**NOTE: Obtain the SKIM PIN before proceeding.**

Turn the ignition on.

With the scan tool, erase all PCM and SKREEM/SKIM DTCs.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the PCM in accordance with the Service Information.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test complete, the conditions that set this DTC are not present at this time.

## SKREEM/SKIM–SERIAL LINK INTERNAL FAULT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The SKREEM/SKIM fails an internal J1850 communication self test.

| Possible Causes |
|---|
| SKREEM/SKIM INTERNAL DTC FAILURE |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

**NOTE: This trouble code indicates an internal module fault.**

Turn the ignition on.

With the scan tool, record and erase the SKREEM/SKIM DTCs.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test complete, the conditions that set this DTC are not present at this time.

## SKREEM/SKIM–STOCK OVERFLOW FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The micro-controller has exceeded its stack space limit.

| Possible Causes |
|---|
| SKREEM/SKIM INTERNAL DTC FAILURE |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

**NOTE: This trouble code indicates an internal module fault.**

Turn the ignition on.

With the scan tool, record and erase the SKREEM/SKIM DTCs.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test complete, the conditions that set this DTC are not present at this time.

## SKREEM/SKIM–TRANSPONDER COMMUNICATION FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When SKREEM/SKIM fails to receive a transponder response after 8 consecutive transponder read attempts within 2.0 seconds.

| Possible Causes |
|---|
| IGNITION KEY PROGRAMMING |
| IGNITION KEY |
| SKREEM/SKIM |

### Diagnostic Test

#### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, record and erase SKREEM/SKIM DTCs.

**NOTE: Perform the following test several times to make sure the DTC is current.**

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM/SKIM DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Refer to the Intermittent Condition diagnostic procedure in this Section.

#### 2. VERIFY IF MULTIPLE IGNITION KEYS EXIST

**Are there multiple vehicle ignition keys available?**

**Yes** >> Go To 3

**No** >> Go To 4

#### 3. CHECK KEY OPERATION

**NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each remaining key, one at a time.**

With the scan tool, erase the SKREEM/SKIM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM/SKIM DTCs.

**Is the DTC present for all ignition keys?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Replace all ignition keys that cause the DTC to set.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

## 4. REPROGRAM THE IGNITION KEYS

With the scan tool, attempt to reprogram the ignition keys to the SKREEM/SKIM.

With the scan tool, erase the SKREEM/SKIM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 5

**No** >> Test Complete.

## 5. PROGRAM A NEW IGNITION KEY

Replace the existing ignition key with a new key.

With the scan tool, program the new ignition key to the SKREEM/SKIM.

With the scan tool, erase the SKREEM/SKIM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test Complete.

## SKREEM/SKIM–TRANSPONDER CYCLIC REDUNDANCY CHECK (CRC) FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When 5 consecutive transponder signal transmissions are sent to the SKREEM/SKIM with the correct message format but with invalid data.

| Possible Causes |
|---|
| IGNITION KEY PROGRAMMING |
| IGNITION KEY |
| SKREEM/SKIM |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, record and erase SKREEM/SKIM DTCs.

**NOTE: Perform the following test several times to make sure the DTC is current.**

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM/SKIM DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Refer to the Intermittent Condition diagnostic procedure in this Section.

### 2. VERIFY IF MULTIPLE IGNITION KEYS EXIST

**Are there multiple vehicle ignition keys available?**

**Yes** >> Go To 3

**No** >> Go To 4

### 3. CHECK KEY OPERATION

**NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each remaining key, one at a time.**

With the scan tool, erase the SKREEM/SKIM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM/SKIM DTCs.

**Is the DTC present for all ignition keys?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Replace all ignition keys that cause the DTC to set.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

## 4. REPROGRAM THE IGNITION KEYS

With the scan tool, attempt to reprogram the ignition keys to the SKREEM/SKIM.
With the scan tool, erase the SKREEM/SKIM DTCs.
Turn the ignition off.
Wait 10 seconds.
Turn the ignition on.
With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 5

**No** >> Test Complete.

## 5. PROGRAM A NEW IGNITION KEY

Replace the existing ignition key with a new key.
With the scan tool, program the new ignition key to the SKREEM/SKIM.
With the scan tool, erase the SKREEM/SKIM DTCs.
Turn the ignition off.
Wait 10 seconds.
Turn the ignition on.
With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test Complete.

## SKREEM/SKIM–TRANSPONDER ID MISMATCH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When the transponder ID read by the SKREEM/SKIM does not match any of the transponder IDs stored in the SKREEM/SKIM's memory.

| Possible Causes |
|---|
| IGNITION KEY PROGRAMMING |
| IGNITION KEY |
| SKREEM/SKIM |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, record and erase SKREEM/SKIM DTCs.

**NOTE: Perform the following test several times to make sure the DTC is current.**

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM/SKIM DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Refer to the Intermittent Condition diagnostic procedure in this Section.

### 2. VERIFY IF MULTIPLE IGNITION KEYS EXIST

**Are there multiple vehicle ignition keys available?**

**Yes** >> Go To 3

**No** >> Go To 4

### 3. CHECK KEY OPERATION

**NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each remaining key, one at a time.**

With the scan tool, erase the SKREEM/SKIM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM/SKIM DTCs.

**Is the DTC present for all ignition keys?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Replace all ignition keys that cause the DTC to set.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

## 4. REPROGRAM THE IGNITION KEYS

With the scan tool, attempt to reprogram the ignition keys to the SKREEM/SKIM.
With the scan tool, erase the SKREEM/SKIM DTCs.
Turn the ignition off.
Wait 10 seconds.
Turn the ignition on.
With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 5

**No** >> Test Complete.

## 5. PROGRAM A NEW IGNITION KEY

Replace the existing ignition key with a new key.
With the scan tool, program the new ignition key to the SKREEM/SKIM.
With the scan tool, erase the SKREEM/SKIM DTCs.
Turn the ignition off.
Wait 10 seconds.
Turn the ignition on.
With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test Complete.

## SKREEM/SKIM–TRANSPONDER RESPONSE MISMATCH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At ignition on and during Key Programming Mode.
- **Set Condition:**
  When transponder's crypt algorithm results fail to match the SKREEM/SKIM result.

| Possible Causes |
|---|
| IGNITION KEY PROGRAMMING |
| IGNITION KEY |
| SKREEM/SKIM |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.

With the scan tool, record and erase SKREEM/SKIM DTCs.

**NOTE: Perform the following test several times to make sure the DTC is current.**

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM/SKIM DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Refer to the Intermittent Condition diagnostic procedure in this Section.

### 2. VERIFY IF MULTIPLE IGNITION KEYS EXIST

**Are there multiple vehicle ignition keys available?**

**Yes** >> Go To 3

**No** >> Go To 4

### 3. CHECK KEY OPERATION

**NOTE: Perform the following steps using one of the vehicle ignition keys. When finished, repeat the procedure using each remaining key, one at a time.**

With the scan tool, erase the SKREEM/SKIM DTCs.

Turn the ignition off.

Wait 10 seconds.

Turn the ignition on.

With the scan tool, read the SKREEM/SKIM DTCs.

**Is the DTC present for all ignition keys?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Replace all ignition keys that cause the DTC to set.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

## 4. REPROGRAM THE IGNITION KEYS

With the scan tool, attempt to reprogram the ignition keys to the SKREEM/SKIM.
With the scan tool, erase the SKREEM/SKIM DTCs.
Turn the ignition off.
Wait 10 seconds.
Turn the ignition on.
With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 5

**No** >> Test Complete.

## 5. PROGRAM A NEW IGNITION KEY

Replace the existing ignition key with a new key.
With the scan tool, program the new ignition key to the SKREEM/SKIM.
With the scan tool, erase the SKREEM/SKIM DTCs.
Turn the ignition off.
Wait 10 seconds.
Turn the ignition on.
With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the SKREEM/SKIM in accordance with the Service Information.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> Test Complete.

## SKREEM/SKIM–VIN MISMATCH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  When the VIN received from the PCM does not match the VIN stored in the SKREEM/SKIM's EEPROM.

| Possible Causes |
|---|
| PCM NOT PROGRAMMED OR PROGRAMMED WITH INCORRECT VIN |
| SKREEM/SKIM |
| PCM |

## Diagnostic Test

### 1. VERIFY THAT THE DTC IS ACTIVE

Turn the ignition on.
With the scan tool, record and erase the SKREEM/SKIM DTCs.
Turn the ignition off.
Wait 10 seconds.
Turn the ignition on and wait 2 minutes.
With the scan tool, read the SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> Refer to the Intermittent Condition diagnostic procedure in this Section.

### 2. VERIFY THAT THE PCM IS PROGRAMMED WITH THE CORRECT VIN

Display and record the VIN programmed in the PCM as follows:

- With the scan tool, select ECU View, select PCM, select More Options, and select ECU Details.

**NOTE: Make sure that a VIN is programmed in the PCM. If the VIN does not display, attempt to program the PCM with the correct VIN before continuing.**

**Is the PCM programmed with the correct VIN?**

**Yes** >> Go To 3

**No** >> Using the scan tool, perform PCM Replaced to update the VIN in the PCM.
Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

## 3. VERIFY THAT THE DTC IS STILL ACTIVE

Turn the ignition off.

Replace and program the SKREEM/SKIM in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase all PCM and SKREEM/SKIM DTCs.

Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle.

With the scan tool, check for SKREEM/SKIM DTCs.

**Did this DTC reset?**

**Yes** >> Replace and program the PCM in accordance with the Service Information.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

**No** >> The repair is complete.

Perform SKIS VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE).

## *ALARM TRIPS ON ITS OWN

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| VTSS RELATED WIRING |
| IGNITION RUN RUN/START |
| DOOR |
| HOOD SECURITY SWITCH |
| FLIPPER GLASS |
| LIFTGATE/SWINGATE |
| INTRUSION TRANSCEIVER MODULE (ITM) |

## Diagnostic Test

### 1. CHECK THE LAST ALARM CAUSED BY STATE WITH THE SCAN TOOL

Turn the ignition on.

With the scan tool in BCM, select Data Display and look for any of the following VTA Triggers indicated as causing the symptom:

- Ignition Run Run/Start
- Front driver door
- Hood Security Switch
- Flipper Glass
- Liftgate/Swingate Ajar
- All other door
- ITM

**Does the scan tool indicate that any of the above triggered the VTA?**

**Yes** >> Check for a possible intermittent condition caused by the trigger displayed on scan tool.
Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Go To 2

### 2. INSPECT FOR A HOOD AJAR

**Is this an export vehicle equipped with a hood ajar switch?**

**Yes** >> Go To 3

**No** >> Go To 4

### 3. ATTEMPT TO TRIP THE ALARM VIA THE HOOD AJAR SWITCH

Remove the ignition key (but keep in hand).

Lock the vehicle and close all doors, the liftgate, and the hood.

Allow the VTSS to arm.

Lightly tap on hood near ajar switch to simulate wind and noise vibration.

**Did the VTSS trip to the alarming state?**

**Yes** >> Replace the hood ajar switch in accordance with the Service Information.
Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Go To 4

## 4. TEST FOR AN INTERMITTENT CONDITION

**NOTE: The condition that caused the alarm is not present at this time. The following list may help you in identifying the cause of the intermittent condition.**

Refer to any Technical Service Bulletins (TSB) that may apply.

Visually inspect related wiring harnesses. Look for chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wiring harness connectors. Look for loose connections, broken, bent, pushed out, or corroded terminals.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Test Complete.

## *DRIVER DOOR DOES NOT TRIP VTSS

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| DRIVER DOOR AJAR CIRCUIT |
| BODY CONTROL MODULE (BCM) |

## Diagnostic Test

### 1. CHECK DRIVER DOOR AJAR SWITCH FUNCTION

Verify that the lighting control on the multi-function switch is not in the Interior Lamps Defeat position.

Open the driver door while observing the interior lamps.

Close the driver door while observing the interior lamps.

**Do the interior lamps function correctly with regard to the door position?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING) for Ajar Switch related diagnostic procedures.

### 2. CHECK DRIVER DOOR AJAR SWITCH STATUS WITH THE SCAN TOOL

**NOTE: The VTSS must arm properly for the result of this test to be valid.**

Turn the ignition on.

Open the driver door.

With the scan tool in BCM, select Data Display and read the Door Ajar Switch status for the driver door.

**Does the scan tool display: CLOSED?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING) for Ajar Switch related diagnostic procedures.

## *FLIP-UP GLASS DOES NOT TRIP VTSS

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| FLIP-UP GLASS AJAR CIRCUIT |
| BODY CONTROL MODULE (BCM) |

## Diagnostic Test

### 1. CHECK FLIP-UP GLASS AJAR SWITCH FUNCTION

Verify that the lighting control on the multi-function switch is not in the Interior Lamps Defeat position.

Open the flip-up glass while observing the interior lamps.

Close the flip-up glass while observing the interior lamps.

**Do the interior lamps function correctly with regard to the flip-up glass position?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING) for Ajar Switch related diagnostic procedures.

### 2. CHECK FLIP-UP GLASS AJAR SWITCH STATUS WITH THE SCAN TOOL

**NOTE: The VTSS must arm properly for the result of this test to be valid.**

Turn the ignition on.

Open the flip-up glass.

With the scan tool in BCM, select Data Display and read the Flip-Up Glass Ajar Switch status for the driver door.

**Does the scan tool display: CLOSED?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING) for Ajar Switch related diagnostic procedures.

## *FRONT PASSENGER DOOR DOES NOT TRIP VTSS

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
| --- |
| FRONT PASSENGER DOOR AJAR CIRCUIT |
| BODY CONTROL MODULE (BCM) |

### 1. CHECK FRONT PASSENGER DOOR AJAR SWITCH FUNCTION

Verify that the lighting control on the multi-function switch is not in the Interior Lamps Defeat position.

Open the front passenger door while observing the interior lamps.

Close the front passenger door while observing the interior lamps.

**Do the interior lamps function correctly with regard to the door position?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING) for Ajar Switch related diagnostic procedures.

### 2. CHECK FRONT PASSENGER DOOR AJAR SWITCH STATUS WITH THE SCAN TOOL

**NOTE: The VTSS must arm properly for the result of this test to be valid.**

Turn the ignition on.

Open the front passenger door.

With the scan tool in BCM, select Data Display and read the Door Ajar Switch status for the front passenger door.

**Does the scan tool display: CLOSED?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING) for Ajar Switch related diagnostic procedures.

## *HAZARD LAMPS INOPERATIVE WITH VTSS

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| BODY CONTROL MODULE (BCM) DTCS PRESENT |
| HAZARD LAMPS / RELATED CIRCUITS |
| (L91) HAZARD LAMP CONTROL CIRCUIT OPEN |
| HAZARD LAMP SWITCH |
| BODY CONTROL MODULE (BCM) |

## Diagnostic Test

### 1. CHECK FOR DTCs IN THE BCM

Turn the ignition on.

With the scan tool, read BCM DTCs.

**Does the scan tool display any DTCs?**

**Yes** >> Diagnose and repair the DTC(s) Refer to the Table of Contents in the applicable Section for the diagnostic procedure(s).
Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Go To 2

### 2. CHECK HAZARD LAMP OPERATION USING THE HAZARD SWITCH

Operate the Hazard Lamps with the Hazard Switch.

**Do the hazard lamps operate?**

**Yes** >> Go To 3

**No** >> Diagnose and repair the hazard lamps. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - DIAGNOSIS AND TESTING).
Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

### 3. ACTUATE THE HAZARD LAMPS WITH THE SCAN TOOL

Turn the Hazard Switch off.

With the scan tool in BCM, actuate the Hazard Lamps.

**Do the Hazard Lamps operate?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. CHECK (L91) HAZARD LAMP CONTROL CIRCUIT FUNCTION

Using the scan tool, turn the Hazard Lamp actuator off.

Turn the ignition off.

Disconnect the BCM C1 harness connector.

Connect a jumper wire between the (L91) Hazard Lamp Control circuit and ground.

**Do the Hazard Lamps operate?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 5

## 5. CHECK (L91) HAZARD LAMP CONTROL CIRCUIT FOR AN OPEN

Disconnect the Hazard Switch harness connector.

Measure the resistance of the (L91) Hazard Lamp Control circuit between the BCM C1 harness connector and the Hazard Switch harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Hazard Switch in accordance with the Service Information.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Repair the (L91) Hazard Lamp Control circuit for an open.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

# *HEADLAMPS FAIL TO FLASH WITH VTSS

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| BODY CONTROL MODULE (BCM) DTCS PRESENT |
| HEADLAMP / RELATED CIRCUITS |
| INCORRECT COUNTRY CODE SETTING PROGRAMMED IN BCM |
| BODY CONTROL MODULE (BCM) |

## Diagnostic Test

### 1. CHECK FOR DTCs IN THE BCM

Turn the ignition on.

With the scan tool, read BCM DTCs.

**Does the scan tool display any DTCs?**

**Yes** >> Diagnose and repair the DTC(s) Refer to the Table of Contents in the applicable Section for the diagnostic procedure(s).

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Go To 2

### 2. CHECK LOW BEAM HEADLAMP OPERATION

Turn the Low Beam Headlamps on.

**Do the Low Beam Headlamps operate properly?**

**Yes** >> Go To 3

**No** >> (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - DIAGNOSIS AND TESTING) for Headlamp related diagnostic procedures.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

### 3. VERIFY THE BCM IS PROGRAMMED WITH THE CORRECT COUNTRY CODE SETTING

With the scan tool in BCM, check the country code setting.

**Is the BCM programmed with the correct country code setting?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Program the BCM with the correct country code setting.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

## *HOOD DOES NOT TRIP VTSS (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

Refer to **(ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING)** for Ajar Switch related diagnostic procedures.

## *HORN FAILS TO SOUND WITH VTSS

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| BODY CONTROL MODULE (BCM) DTCS PRESENT |
| HORN / RELATED CIRCUITS |
| INCORRECT COUNTRY CODE SETTING PROGRAMMED IN BCM |
| BODY CONTROL MODULE (BCM) |

## Diagnostic Test

### 1. CHECK FOR DTCs IN THE BCM

Turn the ignition on.

With the scan tool, read BCM DTCs.

**Does the scan tool display any DTCs?**

**Yes** >> Diagnose and repair the DTC(s) Refer to the Table of Contents in the applicable Section for the diagnostic procedure(s).

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Go To 2

### 2. VERIFY VTSS OPERATION

**NOTE: The Horn must be operational from the horn button for the results of this test to be valid.**

Open the driver door window.

Remove the key from the ignition switch.

Lock the doors with the RKE transmitter or power door lock switch.

Close all of the doors and the tailgate.

Wait approximately 15 seconds for the VTSS indicator to flash at a slower rate indicating that the Vehicle Theft Security System is armed.

Manually unlock the driver door lock.

Trip the VTSS by opening the driver door.

**Did the Horn sound when the VTSS was tripped?**

**Yes** >> The condition that caused this symptom is not currently present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Go To 3

### 3. VERIFY THE BCM IS PROGRAMMED WITH THE CORRECT COUNTRY CODE SETTING

With the scan tool in BCM, check the country code setting.

**Is the BCM programmed with the correct country code setting?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Program the BCM with the correct country code setting.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

## *INTRUSION TRANSCEIVER MODULE SENSITIVITY (EXPORT ONLY)

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| INTRUSION TRANSCEIVER MODULE (ITM) PROGRAMMED WITH INCORRECT INTERIOR TYPE |

## Diagnostic Test

### 1. VERIFY THE ITM IS PROGRAMMED WITH THE CORRECT INTERIOR TYPE

With the scan tool, verify that the ITM is programmed with the correct interior type.

**Is the ITM programmed with the correct Interior Type?**

**Yes** >> Test Complete.

**No** >> Program the ITM with the correct interior type.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## *LEFT REAR DOOR DOES NOT TRIP VTSS

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| LEFT REAR DOOR AJAR CIRCUIT |
| BODY CONTROL MODULE (BCM) |

## Diagnostic Test

### 1. CHECK LEFT REAR DOOR AJAR SWITCH FUNCTION

Verify that the lighting control on the multi-function switch is not in the Interior Lamps Defeat position.

Open the left rear door while observing the interior lamps.

Close the left rear door while observing the interior lamps.

**Do the interior lamps function correctly with regard to the door position?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING) for Ajar Switch related diagnostic procedures.

### 2. CHECK DRIVER DOOR AJAR SWITCH STATUS WITH THE SCAN TOOL

**NOTE: The VTSS must arm properly for the result of this test to be valid.**

Turn the ignition on.

Open the driver door.

With the scan tool in BCM, select Data Display and read the Door Ajar Switch status for the left rear door.

**Does the scan tool display: CLOSED?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING) for Ajar Switch related diagnostic procedures.

## *RIGHT REAR DOOR DOES NOT TRIP VTSS

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| RIGHT REAR DOOR AJAR CIRCUIT MALFUNCTION |
| BODY CONTROL MODULE (BCM) |

### Diagnostic Test

#### 1. CHECK RIGHT REAR DOOR AJAR SWITCH FUNCTION

Verify that the lighting control on the multi-function switch is not in the Interior Lamps Defeat position.

Open the right rear door while observing the interior lamps.

Close the right rear door while observing the interior lamps.

**Do the interior lamps function correctly with regard to the door position?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING) for Ajar Switch related diagnostic procedures.

#### 2. CHECK RIGHT REAR DOOR AJAR SWITCH STATUS WITH THE SCAN TOOL

**NOTE: The VTSS must arm properly for the result of this test to be valid.**

Turn the ignition on.

Open the right rear door.

With the scan tool in BCM, select Data Display and read the Door Ajar Switch status for the right rear door.

**Does the scan tool display: CLOSED?**

**Yes** >> Replace and program the BCM in accordance with the Service Information.
Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING) for Ajar Switch related diagnostic procedures.

## *TAILGATE DOES NOT TRIP VTSS

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| TAILGATE AJAR SWITCH CIRCUIT |
| BODY CONTROL MODULE (BCM) |

Refer to **(ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING)** for Ajar Switch related diagnostic procedures.

## *VTSS WILL NOT ARM

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| VEHICLE THEFT SECURITY SYSTEM (VTSS) DISABLED IN BODY CONTROL MODULE (BCM) |
| BODY CONTROL MODULE (BCM) DTCS PRESENT |
| AJAR SWITCH CIRCUITS |
| BODY CONTROL MODULE (BCM) |

## Diagnostic Test

### 1. VERIFY THAT VTSS IS ENABLED IN THE BCM

Turn the ignition on.

With the scan tool in BCM, check that the VTSS is enabled.

**Is the VTSS enabled?**

**Yes** >> Go To 2

**No** >> With the scan tool, enable the VTSS.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

### 2. CHECK FOR DTCs IN THE BCM

With the scan tool, read BCM DTCs.

**Does the scan tool display any DTCs?**

**Yes** >> Diagnose and repair the DTC(s) Refer to the Table of Contents in the applicable Section for the diagnostic procedure(s).

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Go To 3

### 3. CHECK AJAR SWITCH STATES WITH THE SCAN TOOL

Verify that the tailgate, flip-up glass, and all doors are closed.

With the scan tool in BCM, select Data Display and read the Ajar Switch states.

**Do any Ajar Switch states display: Closed?**

**Yes** >> Diagnose and repair all Ajar Switch circuits that display as Closed on the scan tool. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR - DIAGNOSIS AND TESTING) for Ajar Switch related diagnostic procedures.

Perform VTSS VERIFICATION TEST - 1A. (Refer to VTSS VERIFICATION TEST - 1A - STANDARD PROCEDURE) in this Section.

**No** >> Replace and program the BCM in accordance with the Service Information.

Perform BODY VERIFICATION TEST - VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## INTERMITTENT CONDITION

| POSSIBLE CAUSES |
|---|
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.**

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Refer to any Technical Service Bulletins (TSBs) that may apply.

Review the scan tool Freeze Frame information. If possible, try to duplicate the conditions under which the DTC set.

With the engine running at normal operating temperature, monitor the scan tool parameters related to the DTC while wiggling the wire harness. Look for parameter values to change and/or a DTC to set.

Turn the ignition off.

Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

Perform a voltage drop test on the related circuits between the suspected inoperative component and the PCM.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Inspect and clean all PCM, engine, and chassis grounds that are related to the most current DTC.

If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits.

For any Relay DTCs, actuate the Relay with the scan tool and wiggle the related wire harness to try to interrupt the actuation.

For intermittent Evaporative Emission trouble codes perform a visual and physical inspection of the related parts including hoses and the Fuel Filler cap.

For intermittent Misfire DTCs check for restrictions in the Intake and Exhaust system, proper installation of Sensors, vacuum leaks, and binding components that are run by the accessory drive belt.

Use the scan tool to perform a System Test if one applies to failing component.

A co-pilot, data recorder, and/or lab scope should be used to help diagnose intermittent conditions.

**Were any problems found during the above inspections?**

**Yes** >> Perform the necessary repairs.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Test Complete.

## STANDARD PROCEDURE

## SKREEM/SKIM VERIFICATION

For a complete wiring diagram **Refer to Section 8W**.

### Diagnostic Test

### 1. SKREEM/SKIM VERIFICATION

**NOTE: When entering the PIN, care should be taken because the SKREEM will only allow 3 consecutive attempts to enter the correct PIN. If 3 consecutive incorrect PIN's are entered the SKREEM will Lock Out the scan tool. To exit Lock Mode, the ignition key must remain the Run position for I hour. All accessories must be off. A battery charger connected to the battery during this time period is recommended.**

**NOTE: On vehicles equipped with a premium Tire Pressure Monitoring (TPM) system, when the SKREEM and/or the spare tire pressure sensor is replaced with a new unit, a diagnostic scan tool MUST be used to run a routine that allows the SKREEM to be programmed with the ID number and location of the spare tire pressure sensor mounted in the wheel of the spare tire. Follow the programming steps outlined in the diagnostic scan tool for "Learn Spare Tire Sensor ID" under "Miscellaneous Functions" for the "WCM/Wireless Control Module" menu item as appropriate. In addition, if the SKREEM is replaced, the spare tire must be dismounted from its wheel to access and note the ID number on the spare tire pressure sensor so that the ID code for that sensor can be programmed into the new SKREEM.**

1. Reconnect the previously disconnected components and connectors.
2. Obtain the vehicle's unique Personal Identification Number (PIN) assigned to it's original SKREEM. This number can be obtained from the vehicle invoice or from the DaimlerChrysler Customer Center (Phone 1-800-992-1997).
3. With the scan tool, select Miscellaneous Functions, WCM/Wireless Control Module. Then select the desired procedure and follow the display on the scan tool.
4. If the vehicle is equipped with Tire Pressure Monitoring System program the Palcard Pressure Values into the WCM/SKREEM.
5. Ensure all the customer's key have been programmed into the new module if necessary.
6. With the scan tool, ease all DTCs. Perform 5 ignition key cycles, leaving the key on for at least 90 seconds per cycle.
7. With the scan tool, read SKREEM DTC(s).
8.

**NOTE: If this vehicle is equipped with a Steering Column Lock Module, it must be replaced along with the SKREEM.**

**Are there any SKREEM DTC(s) present?**

**Yes** >> Repair not complete, refer to the appropriate symptom.

**No** >> Repair is complete.

# VTSS VERIFICATION TEST - 1A

## Diagnostic Test

### 1. Perform VTSS Verification Test

1. Open the driver door and roll down the window.
2. Remove the ignition key (but keep in hand).
3. Lock the doors with RKE transmitter or power door lock switch.
4. Ensure all doors, tailgate, and tailgate flip-up glass are closed.
5. If the VTSS Indicator Lamp flashes rapidly and after approximately 16 seconds changes to a slower flash, the system is operational. However, If the indicator fails to flash as described, there is a problem with the system.

**Does the VTSS Indicator Lamp flash as specified?**

**Yes** >> The repair is complete.

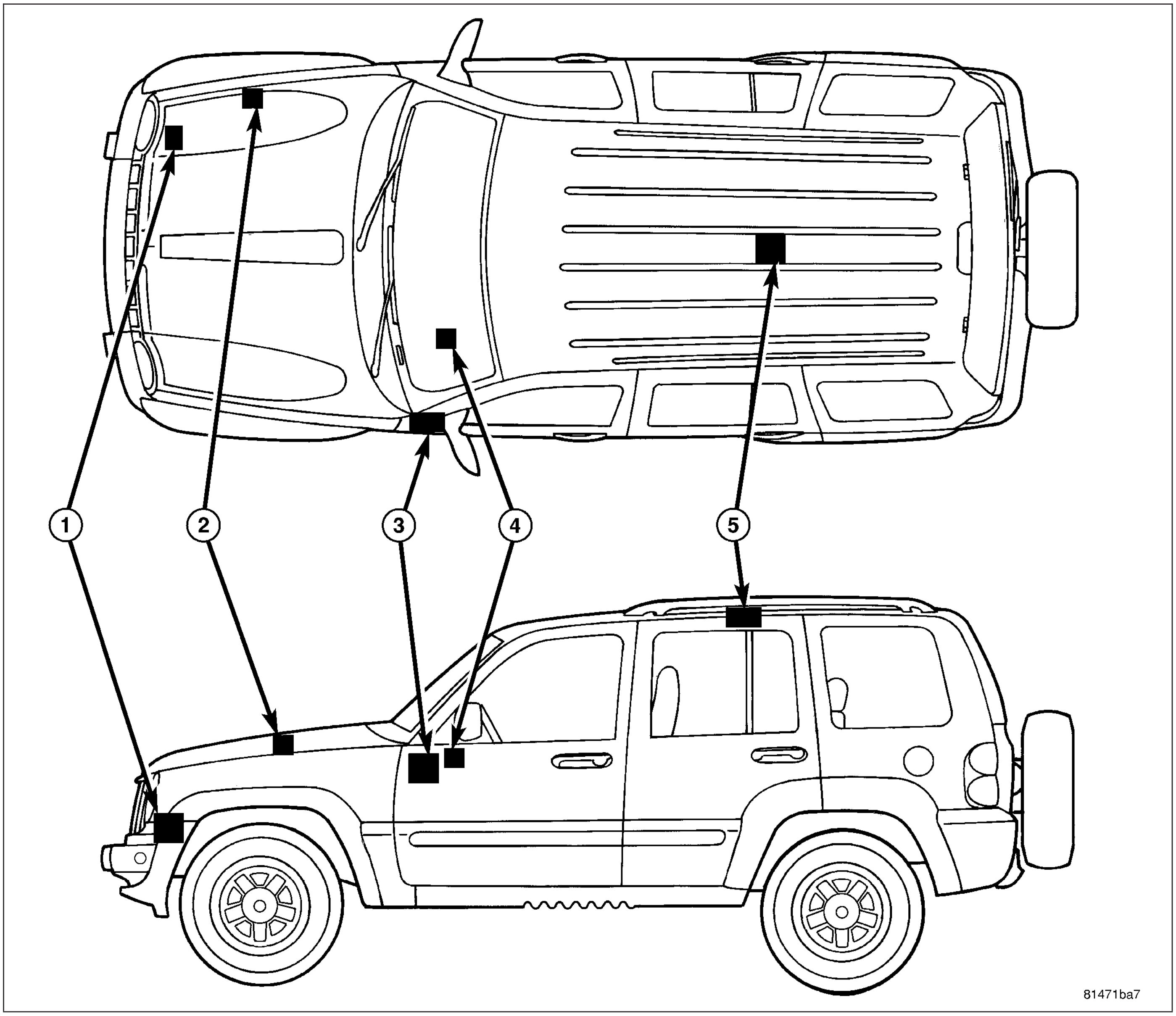
**No** >> Diagnose and repair the DTC or symptom that is still present. Refer to the Table of Contents in this Section for a complete list of VTSS symptoms.

# VEHICLE THEFT SECURITY - SERVICE INFORMATION

## TABLE OF CONTENTS

# VEHICLE THEFT SECURITY - SERVICE INFORMATION

## DESCRIPTION




The Vehicle Theft Security System (VTSS) is an available factory-installed option on this vehicle. The VTSS is comprised of two primary subsystems: Vehicle Theft Alarm (VTA) and Sentry Key Immobilizer System (SKIS).

The VTA is an active system that provides visual and audible responses as deterrents to and warnings of unauthorized vehicle tampering. The SKIS is a passive system that effectively immobilizes the vehicle against unauthorized operation. Following are paragraphs which describe the various components that are included in each of these subsystems of the VTSS.

Except for the Sentry Key transponders, which rely upon Radio Frequency (RF) communication, hard wired circuitry connects the VTA and SKIS components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the SKIS components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

### VEHICLE THEFT ALARM

The VTA is available in two different configurations for this vehicle: One configuration is designed for vehicles manufactured for sale in North America; while, the other configuration is designed for vehicles manufactured for sale in markets outside of North America, also referred to as Rest-Of-World (ROW) or export. In addition, the VTA for export is available in two versions: base and premium. All vehicles equipped with VTA are also equipped with the Remote Keyless Entry (RKE) system and the Sentry Key Immobilizer System (SKIS), regardless of their market destination.

The North American and export base version of the VTA provides perimeter vehicle protection by monitoring the vehicle doors, the tailgate, the rear flip-up glass and, for vehicles built for certain markets where it is required equipment, the hood. If unauthorized vehicle use or tampering is detected, these systems respond by pulsing the horn and flashing certain exterior lamps.

The export premium version of the VTA is only available in vehicles manufactured for sale in certain markets where it is required equipment. The export premium version of the VTA provides the same perimeter protection features as the base version, but adds interior vehicle intrusion protection. The export premium VTA also replaces the pulsing horn feature of the base version with an alarm siren as the audible deterrent, while retaining the flashing exterior lamps visual deterrent.

The VTA includes the following major components, which are described in further detail elsewhere in this service information:

- **Body Control Module (3)** - The Body Control Module (BCM) is located on the Junction Block (JB) behind the driver side end of the instrument panel. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ BODY CONTROL MODULE - DESCRIPTION).
- **Combination Flasher** - An electronic combination flasher is integral to the hazard switch located in the center of the instrument panel above the radio. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/COMBINATION FLASHER - DESCRIPTION).
- **Door Ajar Switches** - A door ajar switch is integral to the latch of each door in the vehicle. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOOR AJAR SWITCH - DESCRIPTION).
- **Flip-Up Glass Ajar Switch** - A flip-up glass ajar switch is integral to the rear flip-up glass latch, located on the top of the tailgate near the center. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/FLIP-UP GLASS AJAR SWITCH - DESCRIPTION).
- **Hood Ajar Switch (2)** - A hood ajar switch is located on the right inner fender side shield of Export vehicles built for sale in markets where it is required equipment. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/HOOD AJAR SWITCH - DESCRIPTION).
- **Horn Relay** - The horn relay is located on the Junction Block (JB) behind the driver side end of the instrument panel. (Refer to 8 - ELECTRICAL/HORN/HORN RELAY - DESCRIPTION).
- **Intrusion Transceiver Module (5)** - An Intrusion Transceiver Module (ITM) is located near the center of the headliner in the passenger compartment of Export vehicles built for sale in markets where it is required equipment. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/UK SECURITY SYSTEM MODULE - DESCRIPTION).
- **Security Indicator** - A security indicator is integral to the ElectroMechanical Instrument Cluster (EMIC). (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/SECURITY INDICATOR - DESCRIPTION).
- **Siren (1)** - An alarm siren is located on the front of the right front wheel house panel in the engine compartment of Export vehicles built for sale in markets where it is required equipment. (Refer to 8 - ELECTRICAL/ VEHICLE THEFT SECURITY/SIREN - DESCRIPTION).
- **Tailgate Ajar Switch** - A tailgate ajar switch is integral to the latch for the tailgate in the vehicle. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/TAILGATE AJAR SWITCH - DESCRIPTION).

### SENTRY KEY IMMOBILIZER SYSTEM

The Sentry Key Immobilizer System (SKIS) is available as a factory-installed option on this vehicle. Vehicles equipped with the Vehicle Theft Alarm (VTA) are also equipped with SKIS. The SKIS provides passive vehicle protection by preventing the engine from operating unless a valid electronically encoded key is detected in the ignition lock cylinder.

The SKIS includes the following major components, which are described in further detail elsewhere in this service information:

- **Powertrain Control Module** - The Powertrain Control Module (PCM) is located on the left inner fender shield in the engine compartment. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DESCRIPTION).
- **Sentry Key Remote Entry Module (4)** - The Sentry Key REmote Entry Module (SKREEM) is sometimes referred to as the Wireless Control Module (WCM). The SKREEM is located on the right side of the steering column near the ignition lock cylinder housing and an integral molded plastic antenna ring circles the ignition lock cylinder like a halo. The SKREEM and its antenna are concealed beneath the steering column shrouds. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/SENTRY KEY REMOTE ENTRY MODULE - DESCRIPTION).
- **Sentry Key Transponder** - The Sentry Key transponder is contained within the Remote Keyless Entry (RKE) transmitter on the ignition key. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/TRANSPONDER KEY - DESCRIPTION).
- **Security Indicator** - A security indicator is integral to the ElectroMechanical Instrument Cluster (EMIC). (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/SECURITY INDICATOR - DESCRIPTION).

## OPERATION

The Vehicle Theft Security System (VTSS) is divided into two basic subsystems: Vehicle Theft Alarm (VTA) and Sentry Key Immobilizer System (SKIS). Following are paragraphs that briefly describe the operation of each of these two subsystems.

## VEHICLE THEFT ALARM

The Body Control Module (BCM) is used on this vehicle to control and integrate many of the electronic functions and features included in the Vehicle Theft Alarm (VTA). In the VTA system, the BCM receives inputs indicating the status of the door ajar switches, the ignition switch, the tailgate ajar switch, the flip-up glass ajar switch, the power lock switches and, in vehicles built for certain markets where it is required, the hood ajar switch.

The BCM will process the information from all of these inputs and send control outputs to energize or de-energize the combination flasher, the horn relay (except vehicles with the export premium version of the VTA), and the security indicator as appropriate. In addition, in vehicles built for certain markets where the export premium version of the VTA is required, the BCM also exchanges electronic messages with the Intrusion Transceiver Module (ITM) over the Programmable Communications Interface (PCI) data bus to provide the features found in this version of the VTA.

The hard wired circuits and components of the VTA may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the BCM, the EMIC, the ITM, the PCI data bus or the electronic message inputs used to provide the electronic features of the VTA. The most reliable, efficient, and accurate means to diagnose the BCM, the EMIC, the ITM, the PCI data bus, and the electronic message inputs for the VTA requires the use of a diagnostic scan tool. See the “Vehicle Theft Security System” menu item on the scan tool. Refer to the appropriate diagnostic information.

Following are paragraphs that briefly describe the operation of each of the VTA features. See the owner’s manual in the vehicle glove box for more information on the features, use and operation of the VTA.

### ENABLING

The BCM must have the VTA function electronically enabled in order for the VTA to perform as designed. The logic in the BCM keeps its VTA function dormant until it is enabled using a diagnostic scan tool. The VTA function of the BCM is enabled on vehicles equipped with the VTA option at the factory, but a service replacement BCM must be VTA-enabled by the dealer using a diagnostic scan tool. Refer to the appropriate diagnostic information.

### PRE-ARMING

The VTA has a pre-arming sequence. Pre-arming is initiated when a door, the tailgate, or the flip-up glass is open when the vehicle is locked using a power door lock switch, or when the Remote Keyless Entry (RKE) transmitter “Lock” button is depressed. Pre-arming will not occur if the key is in the ignition switch or the headlamps are turned on with the driver side front door open. When the VTA is pre-armed, the arming sequence is delayed until all of the doors, the tailgate and the flip-up glass have been closed. The VTA will remain in “Pre-Armed” mode for up to sixteen seconds after all doors, the tailgate and the flip-up glass have been closed.

### ARMING

Passive arming of the VTA occurs when the vehicle is exited with the key removed from the ignition switch, the headlamps are turned off, and the doors are locked while they are open using the power lock switch. Active arming occurs when the LOCK button on the RKE transmitter is depressed to lock the vehicle after all of the doors, the tailgate and the flip-up glass are closed. For active arming to occur, the doors, the tailgate and the flip-up glass must be closed and the ignition switch must be in the OFF position when the RKE transmitter LOCK button is depressed. The power lock switch will not function if the key is in the ignition switch or the headlamps are turned on with the driver side front door open.

Once the VTA begins the passive or active arming sequence, the security indicator in the instrument cluster will flash rapidly for about sixteen seconds. This indicates that VTA arming is in progress. If the ignition switch is turned to the ON position, if a door or the tailgate is unlocked and opened by any means, or the RKE PANIC button (if equipped) is depressed during the sixteen second arming process, the security indicator will stop flashing and the arming process will abort.

On vehicles equipped with the hood ajar switch, the VTA arming sequence will occur regardless of whether the hood is open or closed, but the underhood area will not be protected unless the hood is closed when the VTA arming sequence begins. Also, if the status of the hood ajar switch changes from open to closed during the sixteen second arming process, the security indicator will stop flashing and the VTA arming sequence will abort. Once the sixteen second arming process is successfully completed, the security indicator will flash at a slower rate, indicating that the VTA is armed.

### DISARMING

For vehicles built for the North American market, passive disarming of the VTA occurs by turning the ignition switch to the ON position using a valid Sentry Key Immobilizer System (SKIS) key. Active disarming of the VTA for any market occurs when the vehicle is unlocked by depressing the UNLOCK button of the RKE transmitter. Once the alarm has been activated, either disarming method will also deactivate the alarm. Depressing the PANIC button (if equipped) on the RKE transmitter will **not** disarm the VTA.

### POWER-UP MODE

When the armed VTA senses that the battery has been disconnected and reconnected, it enters its power-up mode. In the power-up mode the alarm system remains armed following a battery failure or disconnect. If the VTA was armed prior to a battery disconnect or failure, the technician or vehicle operator will have to actively or passively disarm the alarm system after the battery is reconnected. The power-up mode will also apply if the battery goes dead while the system is armed, and battery jump-starting is attempted. The VTA will be armed until the technician or vehicle operator has actively or passively disarmed the alarm system. If the VTA is in the disarmed mode prior to a battery disconnect or failure, it will remain disarmed after the battery is reconnected or replaced, or if jump-starting is attempted.

### ALARM

The VTA alarm output varies by the version of the VTA with which the vehicle is equipped. In all cases, the alarm provides both visual and audible outputs; however, the time intervals of these outputs vary by the requirements of the market for which the vehicle is manufactured. In all cases, the visual output will be a flashing on and off of the exterior lamps. For vehicles equipped with the North American or the export base version of the VTA, the audible output will be a pulsing of the horn. For vehicles with the export premium version of the VTA, the audible output will be a cycling of the alarm siren. See the owner's manual in the vehicle glove box for details of the alarm output requirements of the specific market for which the vehicle was manufactured. The inputs that will trigger the alarm include the door ajar switches, the tailgate ajar switch, the flip-up glass ajar switch, and in vehicles built for certain markets where they are required, the hood ajar switch and the Intrusion Transceiver Module (ITM).

### TAMPER ALERT

The VTA tamper alert feature will pulse the horn (or the alarm siren for the export premium version of the VTA) three times upon VTA disarming, if the alarm was triggered and has since timed-out, or if the battery has been disconnected and reconnected. This feature alerts the vehicle operator that the VTA alarm was activated while the vehicle was unattended.

#### INTRUSION ALARM

The intrusion alarm is an exclusive feature of the export premium version of the VTA, which is only available in certain markets where it is required. When the VTA is armed, a motion sensor in the Intrusion Transceiver Module (ITM) monitors the interior of the vehicle for movement. If motion is detected, the ITM sends an electronic message to the BCM over the PCI data bus to invoke the visual alarm feature, and sends an electronic message to the alarm siren in the engine compartment over a dedicated serial bus to invoke the audible alarm feature. The motion detect feature of the ITM can be disabled by depressing the “Lock” button on the RKE transmitter three times within fifteen seconds during VTA arming, while the security indicator is still flashing rapidly. The VTA provides a single short siren “chirp” as an audible confirmation that the motion detect disable request has been received.

The ITM must be electronically enabled in order for the intrusion alarm to perform as designed. The logic in the ITM keeps its intrusion alarm function dormant until it is enabled using a diagnostic scan tool. The intrusion alarm function of the ITM is enabled on vehicles equipped with this option at the factory, but a service replacement ITM must be configured and enabled by the dealer using a diagnostic scan tool. Refer to the appropriate diagnostic information.

### SENTRY KEY IMMOBILIZER SYSTEM

The Sentry Key Immobilizer System (SKIS) is designed to provide passive protection against unauthorized vehicle use by disabling the engine after about two seconds of running, whenever any method other than a valid Sentry Key is used to start the vehicle. The SKIS is considered a passive protection system because it is always active when the ignition system is energized and does not require any customer intervention. The SKIS uses Radio Frequency (RF) communication to obtain confirmation that the key in the ignition switch is a valid key for operating the vehicle. The microprocessor-based SKIS hardware and software also uses electronic messages to communicate with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - OPERATION).

Pre-programmed Sentry Key transponders are provided with the vehicle from the factory. Each Sentry REmote Entry Module (SKREEM) will recognize a maximum of eight Sentry Keys. If the customer would like additional keys other than those provided with the vehicle, they may be purchased from any authorized dealer. These additional keys must be programmed to the SKREEM in the vehicle in order for the system to recognize them as valid keys. This can be done by the dealer using a diagnostic scan tool or, if Customer Learn programming is an available SKIS feature in the market where the vehicle was purchased, the customer can program the additional keys, as long as at least two valid Sentry Keys are already available. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - TRANSPONDER PROGRAMMING).

The SKREEM performs a self-test of the SKIS each time the ignition switch is turned to the ON position, and will store fault information in the form of a Diagnostic Trouble Code (DTC) if a system malfunction is detected. The SKIS can be diagnosed, and any stored DTC can be retrieved using a diagnostic scan tool. Refer to the appropriate diagnostic information.

## DIAGNOSIS AND TESTING

### VEHICLE THEFT SECURITY SYSTEM

The Vehicle Theft Security System (VTSS) is divided into two basic subsystems: Vehicle Theft Alarm (VTA) and Sentry Key Immobilizer System (SKIS). Following are the recommended procedures for diagnosis and testing of each of these two subsystems.

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

### VEHICLE THEFT ALARM

Models equipped with the export premium version of the Vehicle Theft Alarm (VTA) provide some preliminary diagnostic feedback by illuminating the security indicator located in the ElectroMechanical Instrument Cluster (EMIC). If the security indicator illuminates with the ignition switch in the On position, it indicates that there is a communication problem between the Intrusion Transceiver Module (ITM) and the Body Control Module (BCM), or between the ITM and the siren module. The BCM will also turn on the security indicator if it receives a message from the ITM indicating that the ITM has stored a Diagnostic Trouble Code (DTC) for a siren module fault.

The hard wired VTA circuits and components may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the Body Control Module (BCM), the ElectroMechanical Instrument Cluster (EMIC), the Intrusion Transceiver Module (ITM), the Programmable Communications Interface (PCI) data bus, or the electronic message inputs used to provide the electronic features of the VTA. The most reliable, efficient, and accurate means to diagnose the BCM, the EMIC, the ITM, the PCI data bus, and the electronic message inputs for the VTA requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## SENTRY KEY IMMOBILIZER SYSTEM

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

The hard wired Sentry Key Immobilizer System (SKIS) components and circuits may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the Sentry Key REmote Entry Module (SKREEM), the ElectroMechanical Instrument Cluster (EMIC), the Powertrain Control Module (PCM), the Programmable Communications Interface (PCI) data bus, or the electronic message inputs used to provide the electronic features of the SKIS. The most reliable, efficient, and accurate means to diagnose the SKREEM, the EMIC, the PCM, the CAN data bus, and the electronic message inputs for the SKIS requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

**SENTRY KEY IMMOBILIZER SYSTEM DIAGNOSIS**

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| SECURITY INDICATOR FAILS TO LIGHT DURING BULB TEST | 1. Light-Emitting Diode (LED) inoperative. | 1. Perform the instrument cluster actuator test. (Refer to 8 - ELECTRICAL/ INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING - ACTUATOR TEST). |
| | 2. Fuse inoperative. | 2. Check the SKREEM fused B(+) fuse and the fused ignition switch output (run-start) fuse in the Junction Block (JB). Replace fuses, if required. |
| | 3. Ground path inoperative. | 3. Check for continuity to ground at the connector for the SKREEM. Repair wiring, if required. |
| | 4. Battery feed inoperative. | 4. Check for battery voltage at the connector for the SKREEM. Repair wiring, if required. |
| | 5. Ignition feed inoperative. | 5. Check for battery voltage at the connector for the SKREEM with the ignition switch in the ON position. Repair wiring, if required. |

| SENTRY KEY IMMOBILIZER SYSTEM DIAGNOSIS | | |
|---|---|---|
| **CONDITION** | **POSSIBLE CAUSES** | **CORRECTION** |
| SECURITY INDICATOR FLASHES FOLLOWING BULB TEST | 1. Invalid key in ignition switch lock cylinder. | 1. Replace the key with a known valid key. |
| | 2. Key-related fault. | 2. Use a diagnostic scan tool and the appropriate diagnostic information for further diagnosis. |
| SECURITY INDICATOR LIGHTS SOLID FOLLOWING BULB TEST | 1. SKIS system malfunction/ fault detected. | 1. Use a diagnostic scan tool and the appropriate diagnostic information for further diagnosis. |
| | 2. SKIS system inoperative. | 2. Use a diagnostic scan tool and the appropriate diagnostic information for further diagnosis. |

## STANDARD PROCEDURE

## SKIS INITIALIZATION

The Sentry Key Immobilizer System (SKIS) must be initialized following a Sentry Key REmote Entry Module (SKREEM) replacement. SKIS initialization requires the use of a diagnostic scan tool. Initialization will also require that you have access to the unique four-digit PIN code that was assigned to the original SKREEM. The PIN code **must** be used to enter the Secured Access Mode in the SKREEM. This PIN number may be obtained from the vehicle owner, from the original vehicle invoice, or from the DaimlerChrysler Customer Center. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE - PCM/SKREEM PROGRAMMING).

**NOTE: If a Powertrain Control Module (PCM) is replaced on a vehicle equipped with the Sentry Key Immobilizer System (SKIS), the unique Secret Key data must be transferred from the Sentry Key REmote Entry Module (SKREEM) to the new PCM using the PCM replacement procedure. This procedure also requires the use of a diagnostic scan tool and the unique four-digit PIN code to enter the Secured Access Mode in the SKREEM. Refer to the appropriate diagnostic information for the proper PCM replacement procedures.**

## SENTRY KEY TRANSPONDER PROGRAMMING

All Sentry Keys included with the vehicle are pre-programmed to work with the Sentry Key Immobilizer System (SKIS) when it is shipped from the factory. The Sentry Key REmote Entry Module (SKREEM) can be programmed to recognize up to a total of eight Sentry Keys. When programming a blank Sentry Key transponder, the key must first be cut to match the ignition switch lock cylinder in the vehicle for which it will be used. Once the additional or new key has been cut, the SKREEM must be programmed to recognize it as a valid key. There are two possible methods to program the SKREEM to recognize a new or additional valid key, the Secured Access Method and the Customer Learn Method. Following are the details of these two programming methods.

### SECURED ACCESS METHOD

The Secured Access method applies to all vehicles. This method requires the use of a diagnostic scan tool. This method will also require that you have access to the unique four-digit PIN code that was assigned to the original SKREEM. The PIN code **must** be used to enter the Secured Access Mode in the SKREEM. This PIN number may be obtained from the vehicle owner, from the original vehicle invoice, or from the DaimlerChrysler Customer Center. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE - PCM/SKREEM PROGRAMMING).

### CUSTOMER LEARN METHOD

The Customer Learn feature is only available on domestic vehicles, or those vehicles which have a U.S. country code designator. This programming method also requires access to at least two valid Sentry Keys. If two valid Sentry Keys are not available, or if the vehicle does not have a U.S. country code designator, the Secured Access Method **must** be used to program new or additional valid keys to the SKREEM. The Customer Learn programming method procedures are as follows:

1. Obtain the blank Sentry Key(s) that are to be programmed as valid keys for the vehicle. Cut the blank key(s) to match the ignition switch lock cylinder mechanical key codes.
2. Insert one of the two valid Sentry Keys into the ignition switch and turn the ignition switch to the ON position.
3. After the ignition switch has been in the ON position for longer than three seconds, but no more than fifteen seconds, cycle the ignition switch back to the OFF position. Replace the first valid Sentry Key in the ignition switch lock cylinder with the second valid Sentry Key and turn the ignition switch back to the ON position. The second valid Sentry Key must be inserted in the lock cylinder within fifteen seconds of removing the first valid key.
4. About ten seconds after the completion of Step 3, the security indicator in the instrument cluster will start to flash and a single audible chime will sound to indicate that the system has entered the Customer Learn programming mode.
5. Within sixty seconds of entering the Customer Learn programming mode, turn the ignition switch to the OFF position, replace the valid Sentry Key with a blank Sentry Key transponder, and turn the ignition switch back to the ON position.
6. About ten seconds after the completion of Step 5, a single audible chime will sound and the security indicator will stop flashing, stay on solid for three seconds, then turn off to indicate that the blank Sentry Key has been successfully programmed. The SKIS will immediately exit the Customer Learn programming mode. After the ignition is cycled the vehicle may be started using the newly programmed valid Sentry Key.

Each of these steps must be repeated and completed in their entirety for each additional Sentry Key that is to be programmed. If the above steps are not completed in the given sequence, or within the allotted time, the SKIS will exit the Customer Learn programming mode and the programming will be unsuccessful. The SKREEM will also automatically exit the Customer Learn programming mode if it sees a non-blank Sentry Key transponder when it should see a blank, if it has already programmed eight (8) valid Sentry Keys, or if the ignition switch is turned to the OFF position for more than about fifty seconds.

**NOTE: If an attempt is made to start the vehicle while in the Customer Learn mode (security indicator flashing), the SKIS will respond as though the vehicle were being started with an invalid key. In other words, the engine will stall after about two seconds of operation. No faults will be set.**

**NOTE: Once a Sentry Key has been programmed as a valid key to a vehicle, it cannot be programmed as a valid key for use on any other vehicle.**

## SPECIFICATIONS

## VEHICLE THEFT/SECURITY SYSTEMS

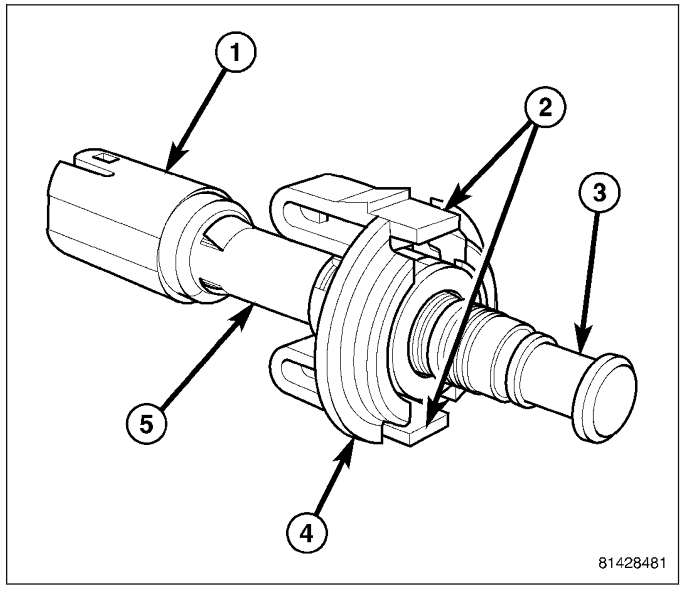
### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Hood Ajar Switch Bracket Mounting Screws | 7 | - | 60 |
| Steering Column Shroud Mounting Screws | 2 | - | 18 |
| Alarm Siren Module Bracket Mounting Screws | 6 | - | 50 |

# HOOD AJAR SWITCH

## DESCRIPTION

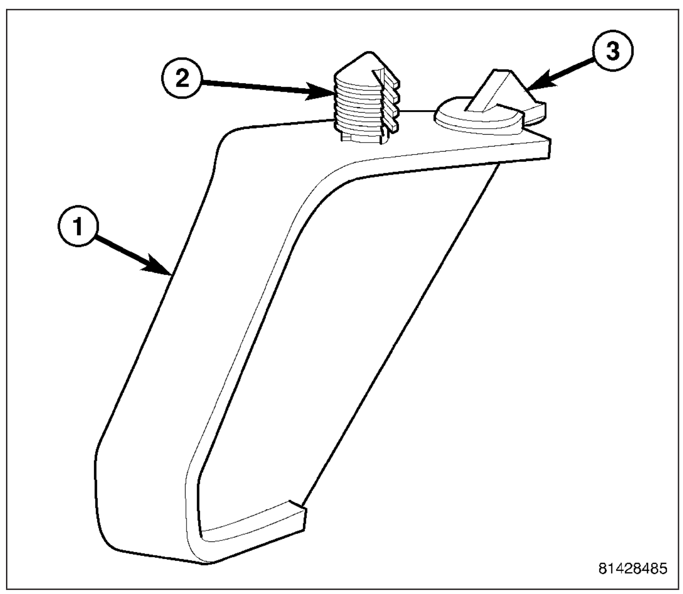
The hood ajar switch is a normally closed, single pole, spring-loaded plunger actuated switch that is used only on vehicles equipped with the Vehicle Theft Security System (VTSS) for sale in certain export markets where it is required equipment. The molded plastic switch body (5) has an integral molded connector receptacle (1) on the lower end containing two terminal pins. The switch is connected to the vehicle electrical system through a dedicated take out of the headlamp and dash wire harness.




The switch plunger (3) extends through a mounting collar (4) and sleeve on the upper end of the switch body. The sleeve has a one-time, self-adjustment feature that is activated after the switch is installed by closing the hood. Two integral latches (2) lock the switch into a keyed mounting hole in the stamped steel switch mounting bracket. The mounting bracket is secured with screws to the right inner fender shield near the fender ledge in the engine compartment.

A molded plastic striker (1) with an integral retainer (2) and mounting tab (3) is secured to the underside of the hood panel inner reinforcement to actuate the switch plunger as the hood panel is closed.

An installed hood ajar switch cannot be readjusted or repaired. If the switch is damaged, inoperative, or requires readjustment, it must be replaced with a new unit. The hood ajar switch striker is not intended for reuse. If the striker is removed from the hood inner reinforcement for any reason, it must be replaced with a new unit.




## OPERATION

The hood ajar switch is a normally closed switch that is held open as the spring-loaded switch plunger is depressed by the striker on the hood panel when the hood panel is closed and latched. When the hood is opened, the spring-loaded switch plunger extends from the switch body and the switch contacts are closed. The switch is connected in series between ground and the hood ajar switch sense input of the Body Control Module (BCM). The BCM uses an internal resistor pull up to monitor the state of the hood ajar switch contacts.

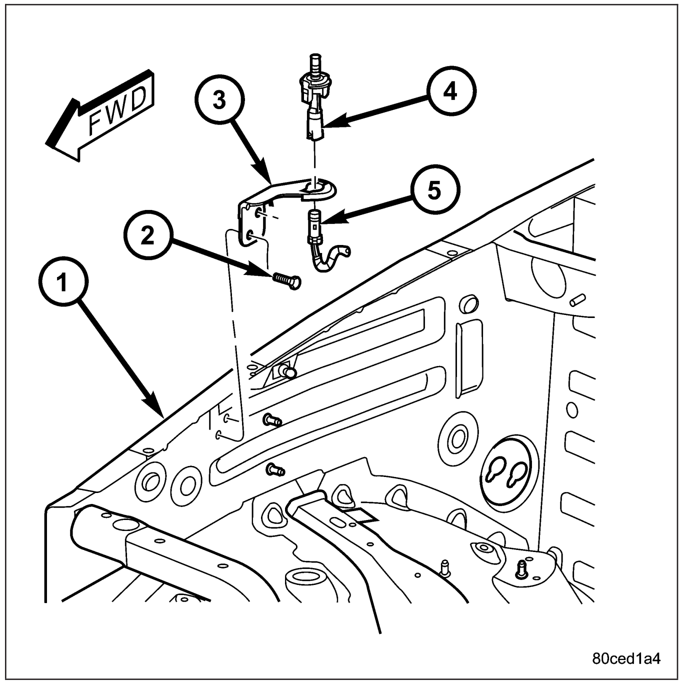
The components of the switch self-adjustment feature include an integral stop on the shaft of the plunger and a ribbed, ratcheting sleeve at the top of the switch body from which the plunger extends. With the switch mounting collar secured in its mounting bracket, the plunger is depressed by the striker on the hood inner reinforcement as the hood is closed. As the plunger is depressed, the plunger stop contacts the top of the sleeve and the sleeve is driven downward, ratcheting through the switch mounting collar until the hood is fully closed and latched. The ribs on the sleeve are engaged within the mounting collar to maintain this adjusted position.

The hood ajar switch and circuits may be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the BCM or its responses to the hood ajar switch input. The most reliable, efficient, and accurate means to diagnose the hood ajar switch, the BCM, and both the hard wired and electronic message inputs and outputs affected by the hood ajar switch input requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## REMOVAL

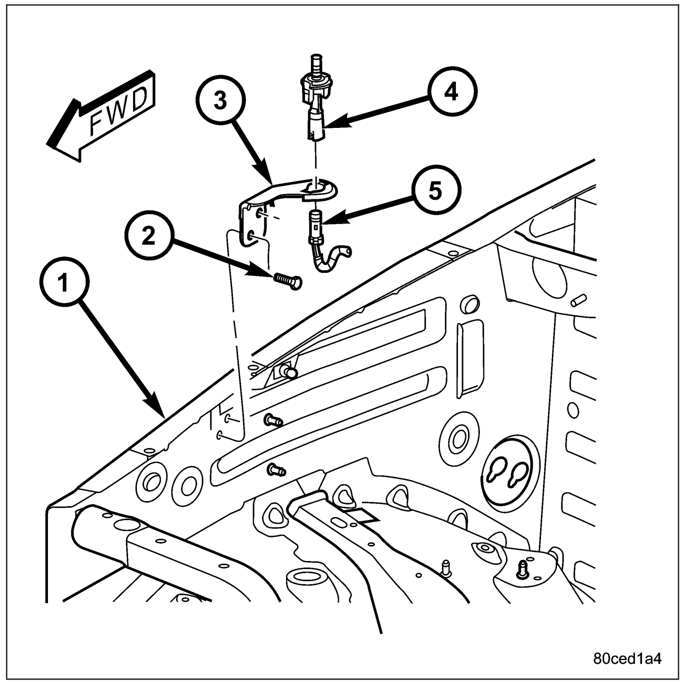
## SWITCH

1. Unlatch and open the hood.
2. Disconnect and isolate the battery negative cable.
3. From the top of the mounting bracket (3) on the right front fender inner shield (1), squeeze the two hood ajar switch (4) latch tabs together and pull the switch upward.
4. Pull the hood ajar switch up through the hole in the mounting bracket far enough to access and disconnect the wire harness connector (5) from the switch connector receptacle.
5. Remove the hood ajar switch from the mounting bracket.



## BRACKET

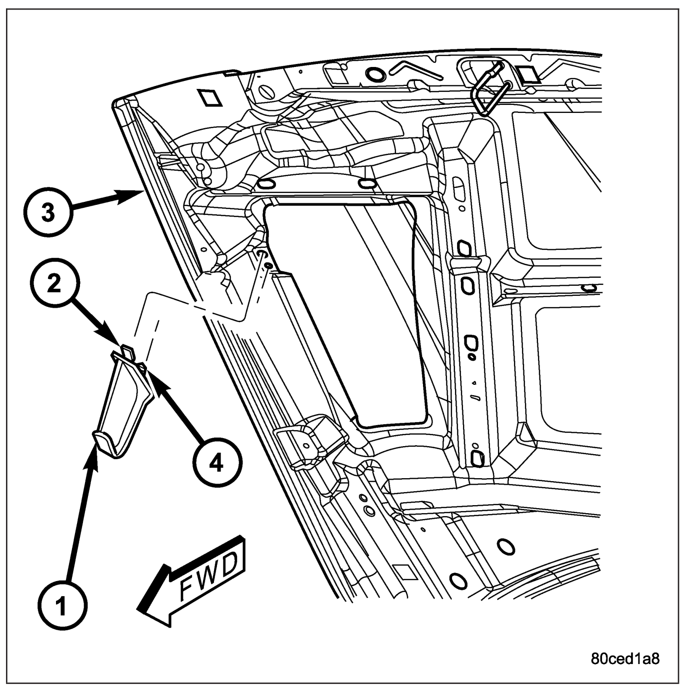
1. Remove the hood ajar switch (4) from the mounting bracket (3). (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/HOOD AJAR SWITCH - REMOVAL).
2. If necessary, remove and set aside the engine air cleaner housing for access to the hood ajar switch mounting bracket screws (2).
3. Remove the two screws that secure the hood ajar switch bracket to the right fender inner shield (1).
4. Remove the hood ajar switch bracket from the right fender inner shield.




## STRIKER

**NOTE: The hood ajar switch striker is not intended for reuse. If the striker is removed from the hood inner reinforcement for any reason, it must be replaced.**

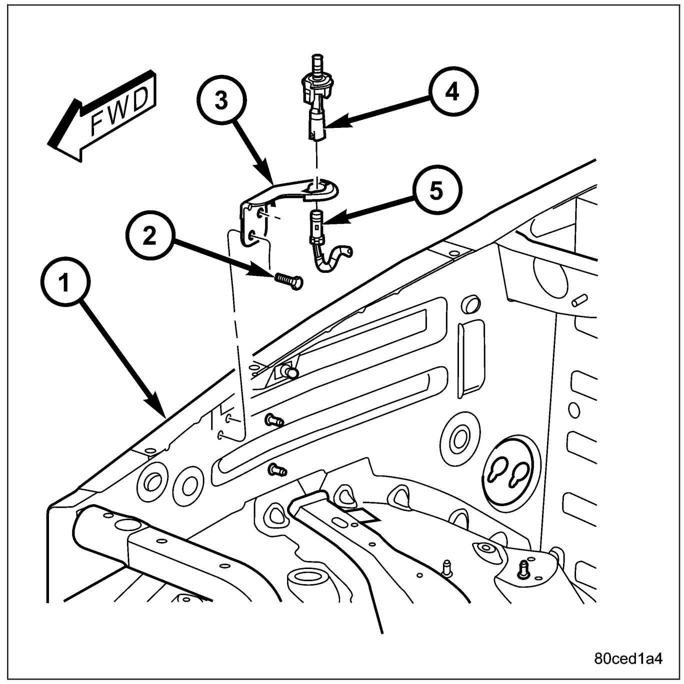
1. Unlatch and open the hood (3).
2. Using a trim stick or another suitable wide flat-bladed tool, pry the rearward end of the hood ajar switch striker (1) away from the inner hood panel reinforcement far enough to disengage the integral retainer (4) from its mounting hole.
3. Move the hood ajar switch striker slightly rearward to disengage the integral mounting tab (2) from the forward mounting hole.
4. Remove the hood ajar switch striker from the inner hood panel reinforcement and discard.



## INSTALLATION

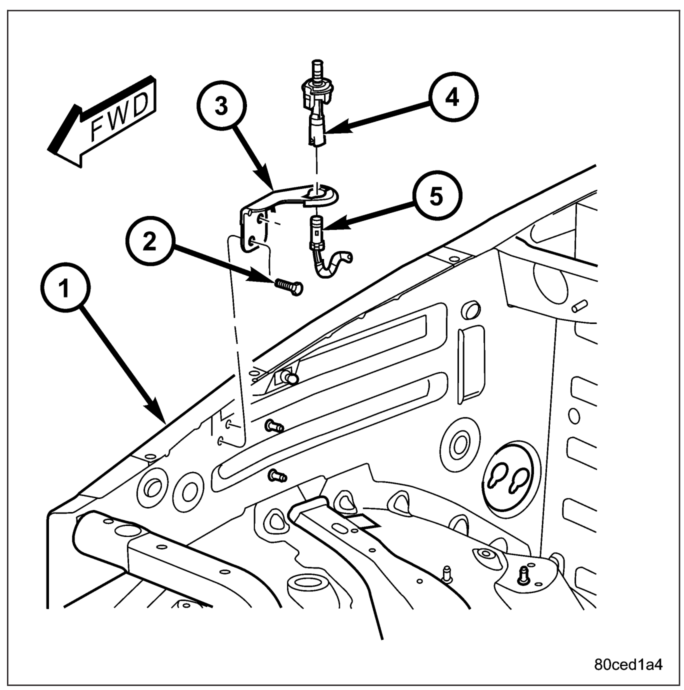
## SWITCH

1. Position the hood ajar switch (4) near the hole in the mounting bracket (3) on the right inner fender side shield (1).
2. Pull the wire harness connector (5) through the switch mounting bracket and reconnect it to the switch connector receptacle.
3. From the top of the mounting bracket, press the switch downward into the mounting hole until the integral switch latch tabs lock it into place.
4. Reconnect the battery negative cable.
5. Close and latch the hood.




## BRACKET

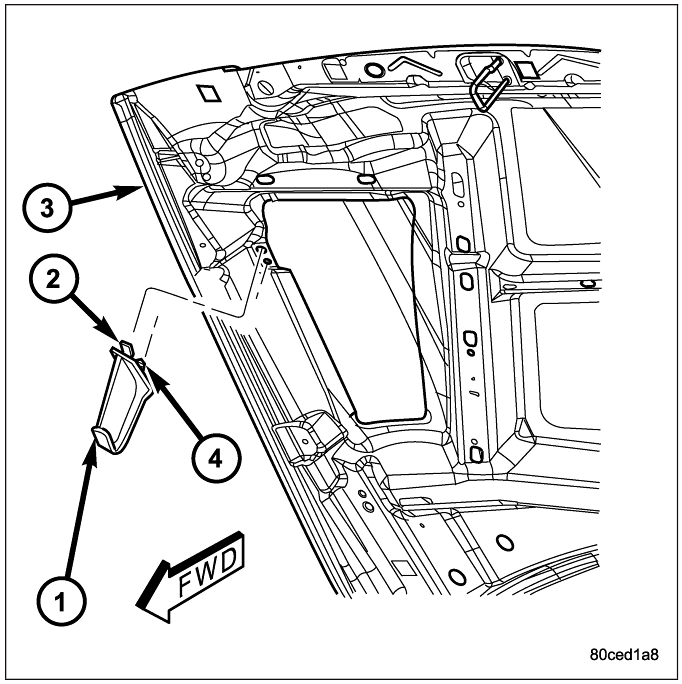
1. Position the hood ajar switch bracket (3) onto the right fender inner shield (1).
2. Install and tighten the two screws (2) that secure the hood ajar switch bracket to the right fender inner shield. Tighten the screws to 7 N·m (60 in. lbs.).
3. If removed, reinstall the engine air cleaner housing.
4. Reinstall the hood ajar switch (4) into the mounting bracket. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY/HOOD AJAR SWITCH - INSTALLATION).




## STRIKER

**NOTE: The hood ajar switch striker is not intended for reuse. If the striker is removed from the hood inner reinforcement for any reason, it must be replaced.**

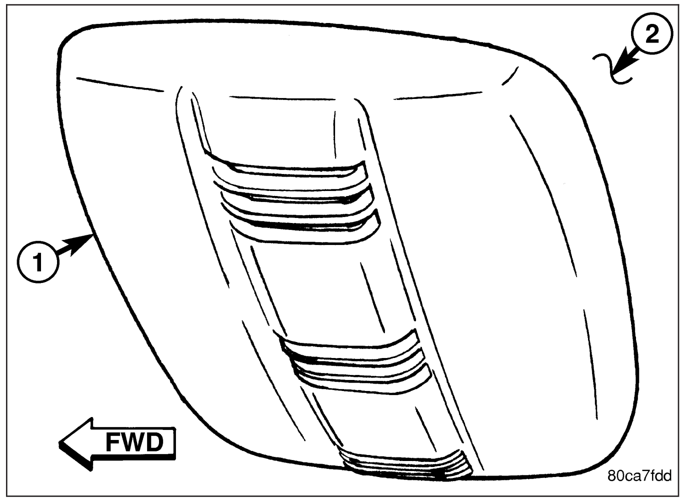
1. Position the new hood ajar switch striker (1) to the inner hood panel reinforcement (3).
2. Insert the mounting tab (2) on the front of the hood ajar switch striker into the forward mounting hole.
3. Align the retainer (4) on the rear of the hood ajar switch striker with the rearward mounting hole.
4. Using hand pressure, press the hood ajar switch striker rearward and upward against the inner hood panel reinforcement until the retainer is fully engaged in the rearward mounting hole.
5. Close and latch the hood.



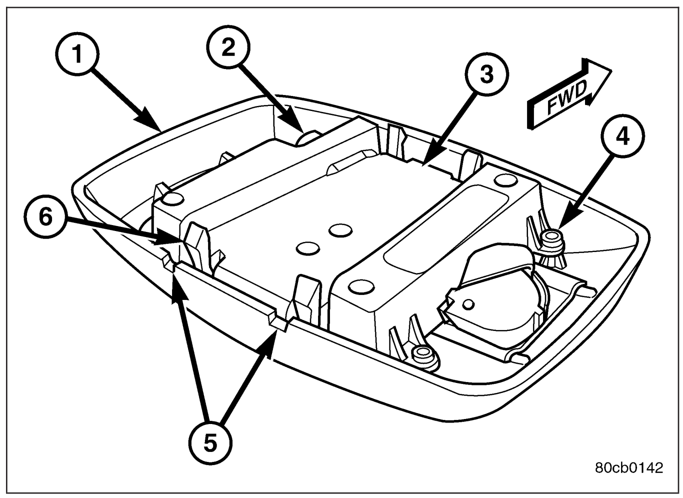
# UK SECURITY SYSTEM MODULE

## DESCRIPTION

An Intrusion Transceiver Module (ITM) (1) is part of the export premium version of the Vehicle Theft Alarm (VTA) in the Vehicle Theft Security System (VTSS). The export premium version of the VTA is only available in vehicles built for certain export markets, where the additional features offered by this system are required. The ITM is located in the passenger compartment, on the lower surface of the headliner (2) near the center of the vehicle. This component is designed to provide interior motion detection, and serve as an interface between the Body Control Module (BCM) and the alarm siren module.




The ITM is concealed beneath a molded plastic trim cover (1) that approximates the size and shape of a typical dome lamp housing. Rather than a lens, the trim cover features three sets of louvered openings. Each of the louvered openings is covered on the inside by a single molded black plastic sight shield that extends the length of the center rib for appearance. The entire module is secured to a molded plastic mounting bracket above the headliner. Besides the ITM, the trim cover also conceals two plastic pins integral to the mounting bracket that are used to secure the bracket to the headliner with two stamped nuts that are installed from below. An adhesive-backed foam pad is installed above the ITM bracket between the headliner and the roof panel to provide additional headliner stabilization and support for the ITM mounting. Two small notch-like service holes (5) on the rear edge of the trim cover afford access to the two integral rear latches (6) of the ITM housing (3) for service removal.




Concealed within the housing is the electronic circuitry of the ITM which includes a microprocessor, and an ultrasonic receive transducer. A molded plastic connector receptacle (2) containing six terminal pins that is soldered to a small circuit board and extends through a clearance hole in the left front corner of the ITM housing, and an ultrasonic transmit transducer housing extends from the center of the right side of the ITM housing. Both the transmit transducer on the right side of the module and the receive transducer on the ITM circuit board are aimed through two small round holes in the sight shield of the trim cover. The ITM is connected to the vehicle electrical system by a wire harness that is integral to the headliner.

The ITM unit cannot be adjusted or repaired and, if inoperative or damaged, it must be replaced.

## OPERATION

The microprocessor in the Intrusion Transceiver Module (ITM) contains the motion sensor logic circuits and controls all of the features of the export premium version of the Vehicle Theft Alarm (VTA). The ITM uses On-Board Diagnostics (OBD) and can communicate with other electronic modules in the vehicle as well as with a diagnostic scan tool using the Programmable Communications Interface (PCI) data bus network. This method of communication is used by the ITM to communicate with the Body Control Module (BCM) and for diagnosis and testing through the 16-way data link connector located on the driver side lower edge of the instrument panel. The ITM also communicates with the alarm siren module over a dedicated serial bus circuit.

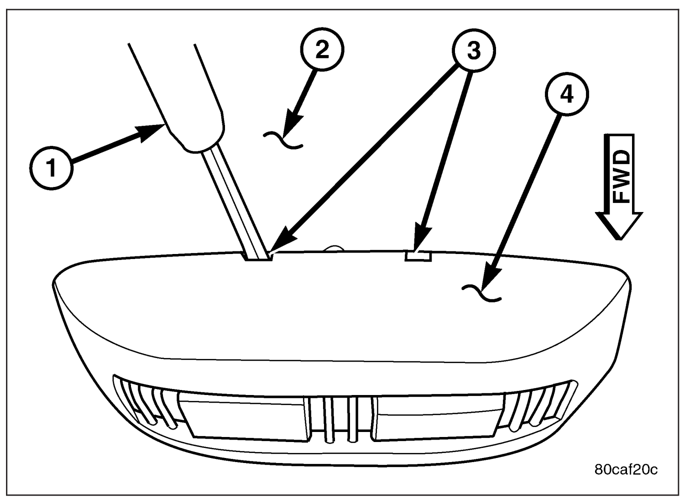
The ITM microprocessor continuously monitors inputs from its on-board motion sensor circuitry as well as inputs from the BCM and the alarm siren module. The on-board ITM motion sensor circuitry transmits ultrasonic signals into the vehicle cabin through a transmit transducer, then listens to the returning signals as they bounce off of objects in the vehicle interior. If an object is moving in the interior, a detection circuit in the ITM senses this movement through the modulation of the returning ultrasonic signals that occurs due to the Doppler effect. The motion detect function of the ITM can be disabled by depressing the “Lock” button on the Remote Keyless Entry (RKE) transmitter three times within fifteen seconds, while the VTA is arming (security indicator is still flashing rapidly). The ITM will signal the alarm siren module to provide a single siren “chirp” as an audible confirmation that the motion sensor function has been disabled.

If movement is detected, the ITM sends an electronic message to the BCM over the PCI data bus to flash the exterior lighting and sends an electronic message to the alarm siren module over a dedicated serial bus line to sound the siren. When the BCM detects a breach in the perimeter protection through a door, tailgate, flip-up glass, or hood ajar switch input, it sends an electronic message to the ITM and the ITM sends an electronic message to the BCM over the PCI data bus to flash the exterior lighting and sends an electronic message to the alarm siren module over a dedicated serial bus line to sound the siren. The ITM also monitors inputs from the alarm siren module for siren battery or siren input/output circuit tamper alerts, and for siren battery condition alerts, then sets an active or stored Diagnostic Trouble Code (DTC) for any monitored system faults it detects. An active fault only remains for the current ignition switch cycle, while a stored fault causes a DTC to be stored in memory by the ITM. If a fault does not recur for fifty ignition cycles, the ITM will automatically erase the stored DTC.

The ITM is connected to the vehicle electrical system through the overhead wire harness. The ITM receives battery current through a fuse in the Junction Block (JB), and receives ground through the body wire harness from a ground screw located at the base of the left D-pillar behind the quarter trim panel. These connections allow the ITM to remain operational, regardless of the ignition switch position. The hard wired inputs and outputs for the ITM may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ITM, the PCI data bus, or the electronic message inputs to and outputs from the ITM. The most reliable, efficient, and accurate means to diagnose the ITM, the PCI data bus, and the electronic message inputs to and outputs from the ITM requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

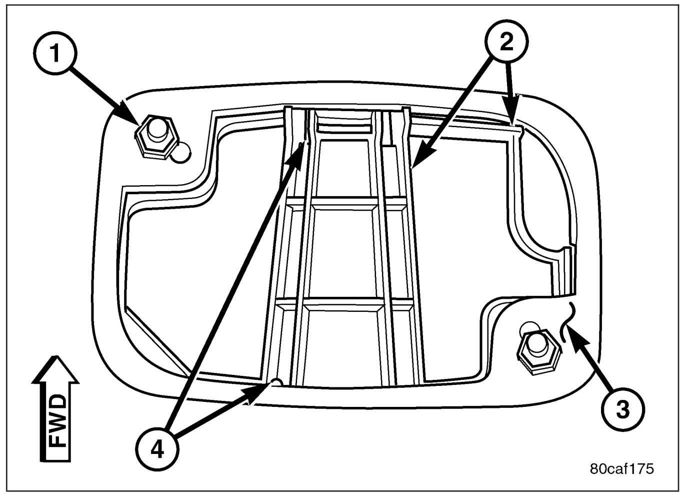
## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. While lightly pulling downward on either rear corner of the Intrusion Transceiver Module (ITM) trim cover (4), insert a small thin-bladed screwdriver (1) through each of the service holes (3) on the rear edge of the trim cover to depress and release the two integral rear latch features of the module from the mounting bracket above the headliner (2).
3. Pull the ITM trim cover rearward far enough to disengage the two integral front latch features of the module from the mounting bracket above the headliner.
4. Pull the ITM and trim cover down from the headliner far enough to access and disconnect the overhead wire harness connector for the ITM from the module connector receptacle.
5. Remove the ITM from the headliner.



## INSTALLATION

1. Position the Intrusion Transceiver Module (ITM) to the headliner (3).
2. Reconnect the overhead wire harness connector for the ITM to the module connector receptacle.
3. Align the two front latch features of the ITM with the mounting bracket (2) above the headliner.
4. Push the ITM trim cover forward far enough to insert the two integral rear latch features of the module into the two rear latch receptacles (4) of the mounting bracket above the headliner.
5. Push upward firmly and evenly on the rear edge of the ITM trim cover until the two rear latch features of the module are engaged in the mounting bracket above the headliner.
6. Reconnect the battery negative cable.

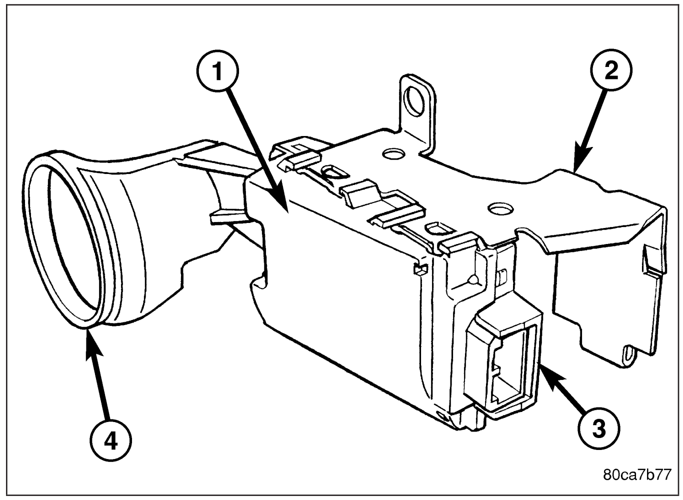



**NOTE: If the Intrusion Transceiver Module (ITM) has been replaced with a new unit, the new ITM MUST be initialized before the Vehicle Theft Security System can operate as designed. The use of a diagnostic scan tool is required to initialize the ITM. Refer to the appropriate diagnostic information.**

# SENTRY KEY REMOTE ENTRY MODULE

## DESCRIPTION

The Sentry Key REmote Entry Module (SKREEM) (1) is sometimes referred to as the Wireless Control Module (WCM). The SKREEM is the primary component of the Sentry Key Immobilizer System (SKIS) and is also the receiver for the Remote Keyless Entry (RKE) system and the Tire Pressure Monitor (TPM) system. The SKREEM is located on the right side of the steering column, near the ignition lock cylinder housing and is concealed beneath the steering column shrouds. The molded black plastic housing for the SKREEM has an integral molded plastic halo-like antenna ring (4) that extends from one end. When the SKREEM is properly installed on the steering column, the antenna ring is oriented around the circumference of the ignition lock cylinder housing.




A single integral connector receptacle (3) is located on the opposite end of the SKREEM housing from the antenna ring. A stamped metal mounting bracket (2) secured to the SKREEM housing is used to secure the component to the right lower flange of the steering column jacket. The SKREEM is connected to the vehicle electrical system through a single take out and connector of the instrument panel wire harness.

Several SKREEM modules are used, specific to optional vehicle equipment and the market in which the vehicle is sold. The SKREEM cannot be adjusted or repaired. If inoperative or damaged, the entire SKREEM unit must be replaced.

## OPERATION

The Sentry Key REmote Entry Module (SKREEM) contains a Radio Frequency (RF) transceiver and a microprocessor. The SKIM transmits RF signals to, and receives RF signals from the Sentry Key transponder through a tuned antenna enclosed within the molded plastic antenna ring integral to the SKREEM housing. If this antenna ring is not mounted properly around the ignition lock cylinder housing, communication problems between the SKREEM and the transponder may arise. These communication problems will result in Sentry Key transponder-related faults.

The SKREEM also serves as the Remote Keyless Entry (RKE) and the Tire Pressure Monitor (TPM) RF receiver. (Refer to 8 - ELECTRICAL/POWER LOCKS - DESCRIPTION) or (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING - DESCRIPTION). The SKREEM communicates over the Programmable Communications Interface (PCI) data bus with the Body Control Module (BCM), the Electronic Vehicle Information Center (EVIC), the Powertrain Control Module (PCM) or the diagnostic scan tool.

The SKREEM retains in memory the ID numbers of any Sentry Key transponder that is programmed into it. A maximum of eight Sentry Key transponders can be programmed into the SKREEM. For added system security, each SKREEM is programmed with a unique Secret Key code. This code is stored in memory, sent over the PCI data bus to the PCM, and is encoded to the transponder of every Sentry Key that is programmed into the SKREEM. Therefore, the Secret Key code is a common element that is found in every component of the Sentry Key Immobilizer System (SKIS). Another security code, called a PIN, is used to gain access to the SKREEM Secured Access Mode. The Secured Access Mode is required during service to perform the SKIS initialization and Sentry Key transponder programming procedures. The SKREEM also stores the Vehicle Identification Number (VIN) in its memory, which it learns through a PCI data bus message from the PCM during SKIS initialization.

In the event that a SKREEM replacement is required, the Secret Key code can be transferred to the new SKREEM from the PCM using the diagnostic scan tool and the SKIS initialization procedure. Proper completion of the SKIS initialization will allow the existing Sentry Keys to be programmed into the new SKREEM so that new keys will not be required. In the event that the original Secret Key code cannot be recovered, SKREEM replacement will also require new Sentry Keys. The diagnostic scan tool will alert the technician during the SKIS initialization procedure if new Sentry Keys are required.

When the ignition switch is turned to the ON position, the SKREEM transmits an RF signal to the transponder in the ignition key. The SKREEM then waits for an RF signal response from the transponder. If the response received identifies the key as valid, the SKREEM sends a valid key message to the PCM over the PCI data bus. If the response received identifies the key as invalid, or if no response is received from the key transponder, the SKREEM sends an invalid key message to the PCM. The PCM will enable or disable engine operation based upon the status of the SKREEM messages. It is important to note that the default condition in the PCM is an invalid key; therefore, if no message is received from the SKREEM by the PCM, the engine will be disabled and the vehicle immobilized after two seconds of running.

The SKREEM also sends SKIS indicator status messages to the BCM over the PCI data bus to tell the BCM how to operate the security indicator in the ElectroMechanical Instrument Cluster (EMIC). This indicator status message tells the BCM to turn the indicator on for about three seconds each time the ignition switch is turned to the ON position as a bulb test. After completion of the bulb test, the SKREEM sends indicator status messages to the BCM to turn the indicator off, turn the indicator on, or to flash the indicator on and off. If the security indicator flashes upon ignition ON or stays on solid after the bulb test, it signifies a SKIS fault.

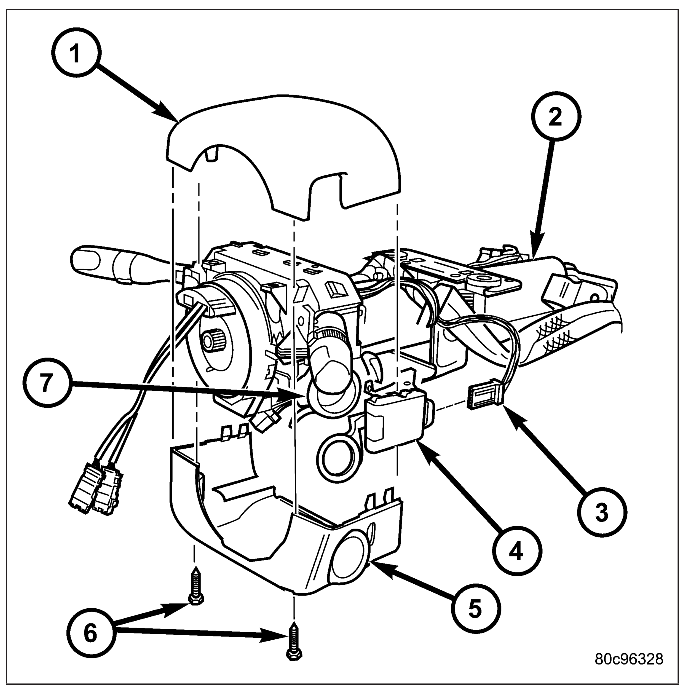
If the SKREEM detects a system malfunction or if the SKIS has become inoperative, the security indicator will stay on solid. If the SKREEM detects an invalid key or if a key transponder-related fault exists, the security indicator will flash. If the vehicle is equipped with the Customer Learn transponder programming feature, the SKREEM will also send messages to the BCM to flash the security indicator and to generate a single audible chime whenever the Customer Learn programming mode is being utilized. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - SENTRY KEY TRANSPONDER PROGRAMMING).

The SKIS performs a self-test each time the ignition switch is turned to the On position, and will store fault information in the form of a Diagnostic Trouble Code (DTC) in SKREEM memory if a system malfunction is detected. The SKREEM can be diagnosed, and any stored DTC can be retrieved using a diagnostic scan tool. Refer to the appropriate diagnostic information.

## REMOVAL

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

1. Disconnect and isolate the negative battery cable.
2. If the vehicle is equipped with a tilt steering column, move the tilt steering column to the fully lowered position and leave the tilt release lever in the released (down) position.
3. From below the steering column (2), remove the two screws (6) that secure the lower shroud (5) to the upper shroud (1).
4. Using hand pressure, push gently inward on both sides of the upper shroud near the parting line of the lower shroud to release the snap features that secure the two shroud halves to each other.
5. Remove both the upper and lower shrouds from the steering column.
6. Disconnect the wire harness connector (3) from the Sentry Key REmote Entry Module (SKREEM) (4).
7. The SKREEM mounting bracket features a clip that secures the module to the right lower flange of the steering column jacket. Pull downward on the connector end of the SKREEM mounting bracket to release this clip from the steering column.

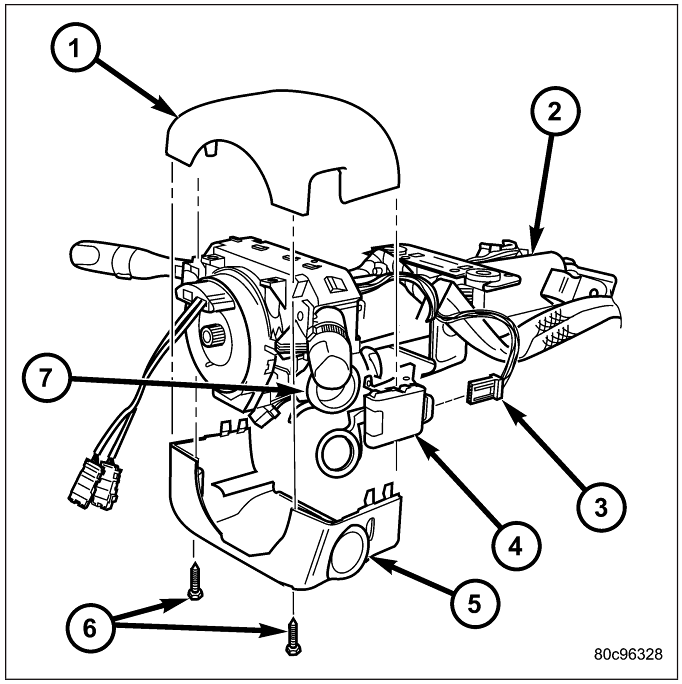



8. Rotate the SKREEM and its mounting bracket downwards and then to the side away from the steering column to disengage the antenna ring from around the ignition lock cylinder housing (7).

9. Lift the multi-function switch upward off of the upper steering column housing far enough to remove the SKREEM antenna ring formation from between the ignition key release button and the multi-function switch housing.
10. Remove the SKREEM from the steering column.

## INSTALLATION

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**



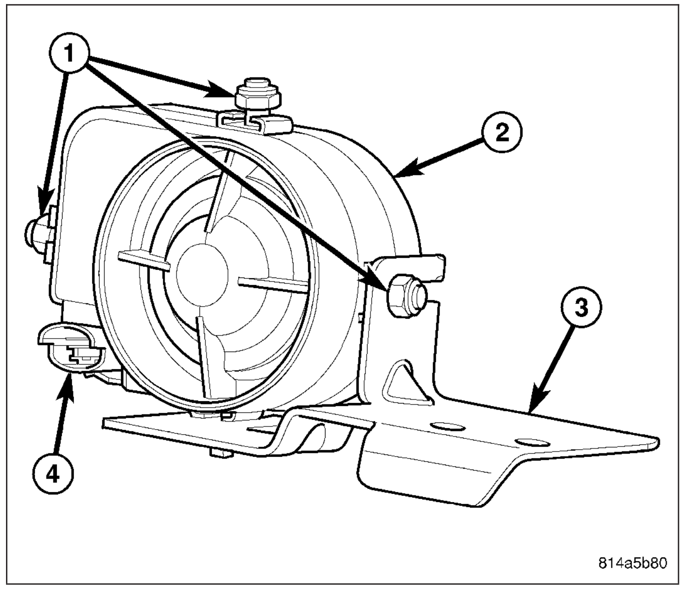

1. Position the SKREEM (4) to the right side of the steering column (2).
2. Lift the multi-function switch upward off of the upper steering column housing far enough to insert the SKREEM antenna ring formation between the ignition key release button and the multi-function switch housing.
3. Slide the SKREEM antenna ring around the ignition switch lock cylinder housing (7), then rotate the SKREEM and its mounting bracket upwards and toward the steering column.
4. Align the SKREEM mounting bracket clip with the right lower flange of the steering column jacket and, push upward firmly and evenly on the connector end of the module mounting bracket to engage this clip with the steering column.
5. Reconnect the wire harness connector (3) to the SKREEM.
6. Position both the upper (1) and lower shrouds (5) onto the steering column.
7. Align the snap features on the lower shroud with the receptacles in the upper shroud and apply hand pressure to snap them together.
8. From below the steering column, install and tighten the two screws (6) that secure the lower shroud to the upper shroud. Tighten the screws to 2 N·m (18 in. lbs.).
9. If the vehicle is equipped with a tilt steering column, move the column to the fully raised position and secure it in place by moving the tilt release lever back to the locked (up) position.
10. Reconnect the negative battery cable.

**NOTE: If the Sentry Key REmote Entry Module (SKREEM) is replaced with a new unit, a diagnostic scan tool MUST be used to initialize the new SKREEM and to program at least two Sentry Key transponders before the vehicle can be operated. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - SKIS INITIALIZATION).**

# SIREN

## DESCRIPTION

An alarm siren module (2) is part of the export premium version of the Vehicle Theft Alarm (VTA) in the Vehicle Theft Security System (VTSS). The export premium version of the VTA is only available in vehicles built for certain markets where the additional features offered by this system are required. The alarm siren module is located in the engine compartment, on the front extension of the right front wheel house panel below and behind the right headlamp. This assembly is designed to provide the audible alert requirements for the export premium VTA.




The alarm siren module consists of microprocessor-based electronic control circuitry, the siren, and a nickel metal hydride backup battery. All of the alarm module components are protected and sealed within a molded plastic housing. A stamped steel mounting bracket (3) is secured to the module with three stud plates and nuts (1) that fit into slotted holes at the top and each side of the bracket. Two mounting holes in the horizontal surface of the bracket are used to secure the alarm siren module to the wheel house extension with screws. A connector receptacle (4) extends forward from the alarm siren housing, and connects the module to the vehicle electrical system through a dedicated take out of the headlamp and dash wire harness.

The alarm siren module cannot be repaired or adjusted and, if inoperative or damaged, it must be replaced.

## OPERATION

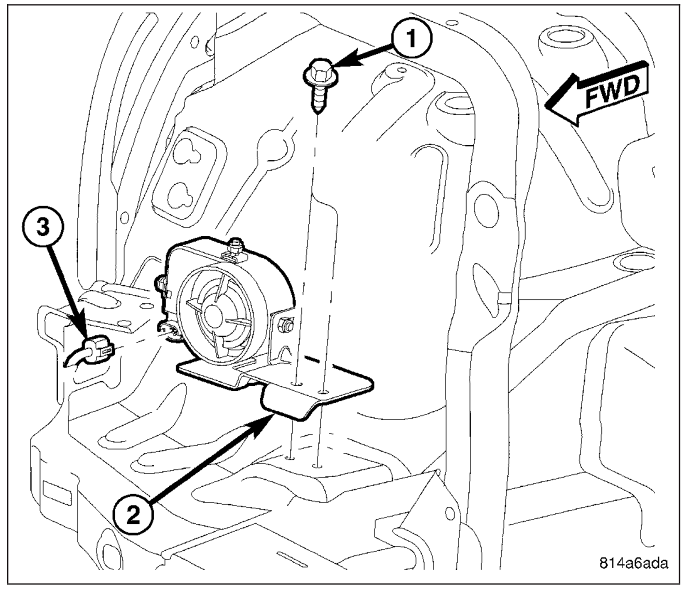
The microprocessor within the alarm siren module performs the tasks required to provide the siren features and functions based upon internal programming and electronic arm and disarm message inputs received from the Intrusion Transceiver Module (ITM) over a dedicated serial bus communication circuit. Upon receiving a request from the ITM, the alarm siren module will self-detect problems with its internal and external power supply and communication circuits, then send electronic messages indicating the problem to the ITM. The ITM will store a Diagnostic Trouble Code (DTC) for a detected alarm siren module fault that can be retrieved with a diagnostic scan tool over the Programmable Communications Interface (PCI) data bus through the 16-way data link connector located on the driver side lower edge of the instrument panel.

When the export premium version of the Vehicle Theft Alarm (VTA) is armed, the alarm siren module microprocessor continuously monitors inputs from the ITM for messages to sound its internal siren and to enter its auto-detect mode. While in the auto-detect mode, if the alarm siren module detects that its power supply or communication circuits are being tampered with or have been sabotaged, it will sound an alarm and continue to operate through its on-board backup battery. If the alarm siren module is in its disarmed mode when its power supply or communication circuits are interrupted, the siren will not sound. The alarm module will also notify the ITM when the backup battery requires charging, and the ITM will send a message that will allow the backup battery to be charged through the battery voltage and ground circuits to the alarm module only when the ignition switch is in the ON position and the engine is running. This will prevent the recharging of the alarm backup battery from depleting the charge in the main vehicle battery while the vehicle is not being operated.

The alarm siren module receives battery voltage through a fuse in the Power Distribution Center (PDC), and receives ground through a ground location on the left inner fender shield in the engine compartment. These connections allow the alarm siren module to remain operational, regardless of the ignition switch position. The hard wired inputs and outputs for the alarm siren module may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the internal circuitry or the backup battery of the alarm siren module, the ITM, the serial bus communication line, or the electronic message inputs to and outputs from the alarm siren module. The most reliable, efficient, and accurate means to diagnose the alarm siren module, the ITM, the serial bus communication line, and the electronic message inputs to and outputs from the alarm siren module requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## REMOVAL

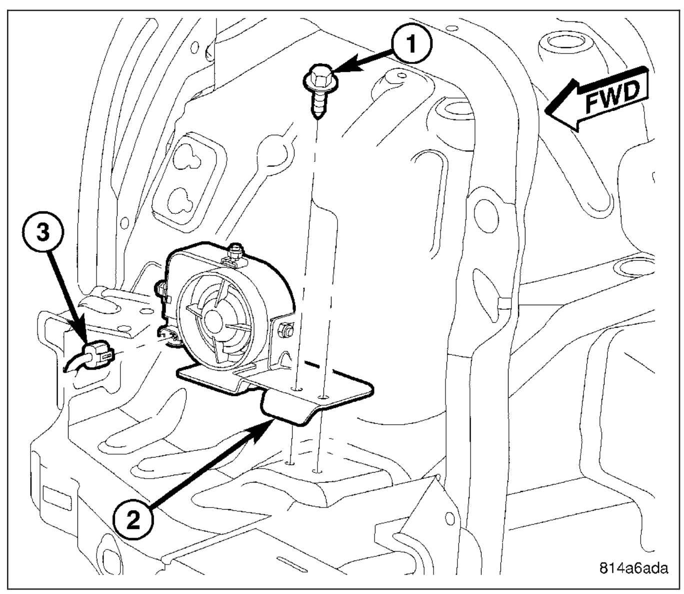
1. Disconnect and isolate the battery negative cable.
2. Disconnect the wire harness connector (3) from the connector receptacle of the alarm siren module (2).
3. Remove the two screws (1) that secure the alarm siren module to the front extension of the right front wheel house panel.
4. Remove the alarm siren module from the front extension of the right front wheel house panel.




## INSTALLATION

1. Position the alarm siren module (2) onto the front extension of the right front wheel house panel.
2. Install and tighten the two screws (1) that secure the alarm siren module to the front extension of the right front wheel house panel. Tighten the screws to 6 N·m (50 in. lbs.).
3. Reconnect the wire harness connector (3) for the alarm siren module.
4. Reconnect the battery negative cable.

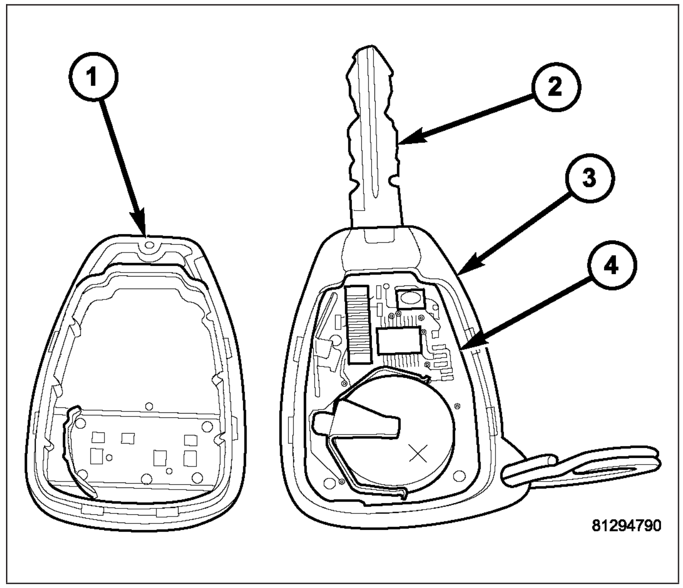
**NOTE: If the alarm siren module has been replaced with a new unit, the new unit MUST be configured in the Intrusion Transceiver Module (ITM) before the Vehicle Theft Security System can operate as designed. The use of a diagnostic scan tool is required to configure the alarm siren module settings in the ITM. Refer to the appropriate diagnostic information.**



# TRANSPONDER KEY

## DESCRIPTION

Each ignition key (2) used in the Sentry Key Immobilizer System (SKIS) has an integral transponder chip included on the circuit board (4) beneath the cover (1) of the integral Remote Keyless Entry (RKE) transmitter (3). In addition to having to be cut to match the mechanical coding of the ignition lock cylinder and programmed for operation of the RKE system, each new Sentry Key has a unique transponder identification code that is permanently programmed into it by the manufacturer, and which must be programmed into the Sentry Key REmote Entry Module (SKREEM) to be recognized by the SKIS as a valid key.




The Sentry Key transponder cannot be adjusted or repaired. If inoperative or damaged, the entire key and RKE transmitter unit must be replaced.

## OPERATION

When the ignition switch is turned to the ON position, the Sentry Key REmote Entry Module (SKREEM) communicates through its antenna with the Sentry Key transponder using a Radio Frequency (RF) signal. The SKREEM then listens for a RF response from the transponder through the same antenna. The Sentry Key transponder chip is within the range of the SKREEM transceiver antenna ring when it is inserted into the ignition lock cylinder. The SKREEM determines whether a valid key is present in the ignition lock cylinder based upon the response from the transponder. If a valid key is detected, that fact is communicated by the SKREEM to the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus, and the PCM allows the engine to continue running. If the PCM receives an invalid key message, or receives no message from the SKREEM over the PCI data bus, the engine will be disabled after about two seconds of operation. The Body Control Module (BCM) will also respond to the invalid key message on the PCI data bus by flashing the security indicator in the ElectroMechanical Instrument Cluster (EMIC) on and off.

Each Sentry Key has a unique transponder identification code permanently programmed into it by the manufacturer. Likewise, the SKREEM has a unique Secret Key code programmed into it by the manufacturer. When a Sentry Key is programmed into the memory of the SKREEM, the SKREEM stores the transponder identification code from the Sentry Key, and the Sentry Key learns the Secret Key code from the SKREEM. Once the Sentry Key learns the Secret Key code of the SKREEM, it is permanently stored in the memory of the transponder. Therefore, once a Sentry Key has been programmed to a particular vehicle, it cannot be used on any other vehicle. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - TRANSPONDER PROGRAMMING).

The Sentry Key Immobilizer System (SKIS) performs a self-test each time the ignition switch is turned to the ON position, and will store key-related fault information in the form of a Diagnostic Trouble Code (DTC) in SKREEM memory if a Sentry Key transponder problem is detected. The Sentry Key transponder chip can be diagnosed, and any stored DTC can be retrieved using a diagnostic scan tool. Refer to the appropriate diagnostic information.

# WIPERS/WASHERS

## TABLE OF CONTENTS



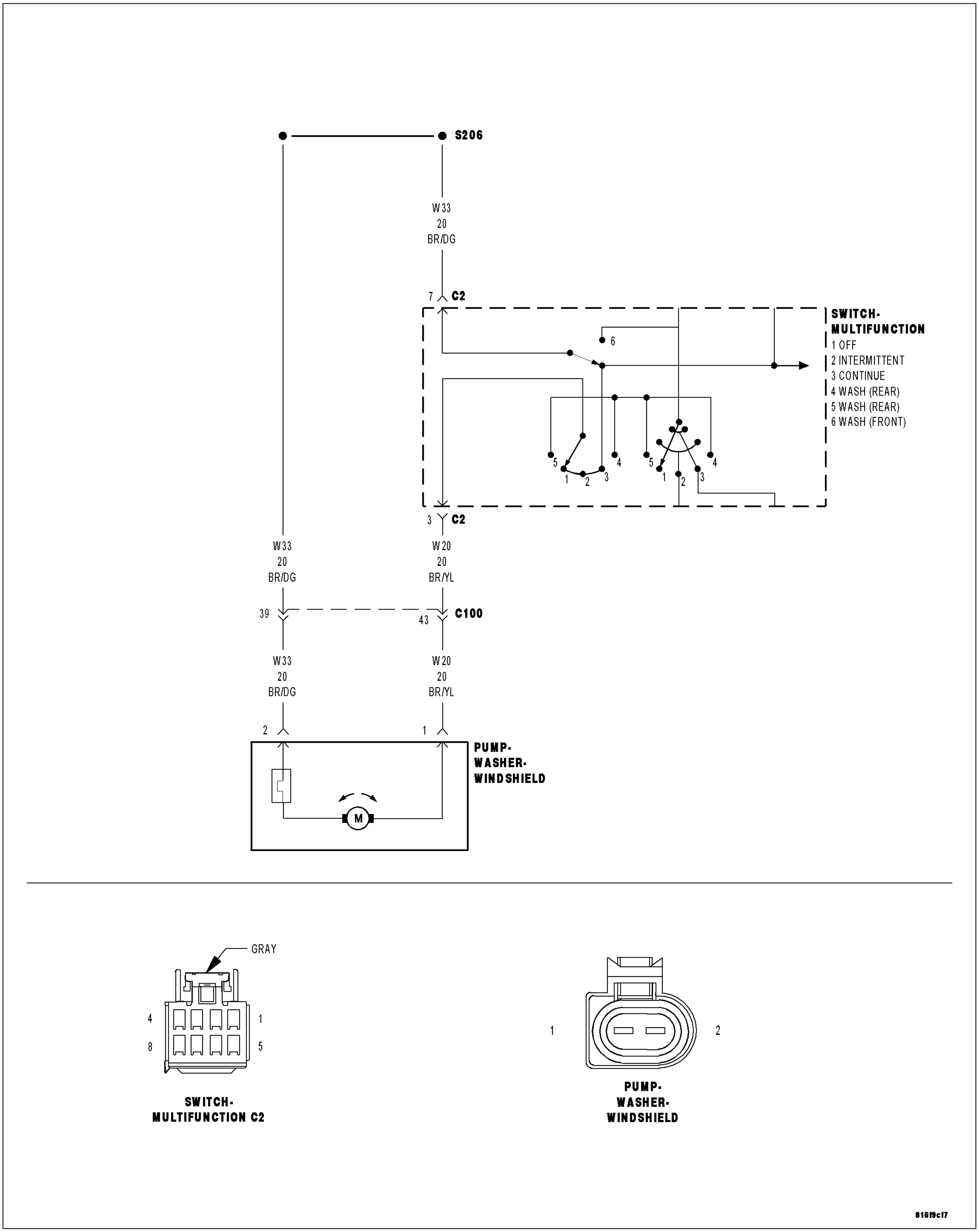
## WIPERS/WASHERS ELECTRICAL DIAGNOSTICS

### TABLE OF CONTENTS

# WIPERS/WASHERS ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## FRONT WASHER PUMP INOPERATIVE




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Possible Causes
- **Set Condition:**
  Possible Causes

| Possible Causes |
|---|
| FRONT WASHER PUMP |
| FRONT WASHER PUMP GROUND CIRCUIT OPEN |
| MULTIFUNCTION SWITCH |
| FRONT WASHER PUMP SENSE CIRCUIT OPEN |
| FRONT WASHER PUMP DRIVER CIRCUIT OPEN |
| FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. FRONT WASHER PUMP

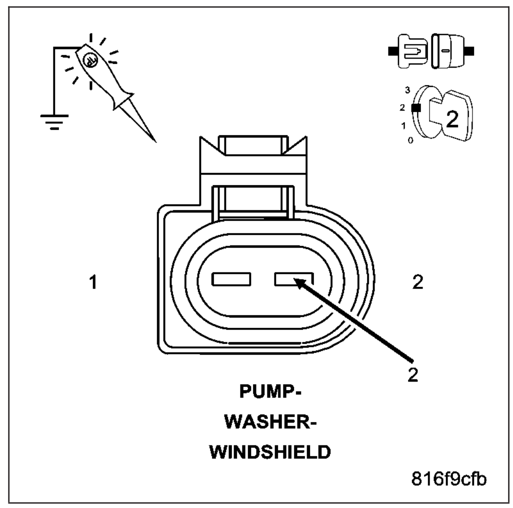
Turn the ignition off.

Disconnect the Front Washer Pump harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the Front Washer Pump Driver circuit.

Actuate the Front Washers.




**Does the test light illuminate brightly?**

**Yes** >> Replace the Front Washer Pump.
Perform BODY VERIFICATION TEST - VER 1.

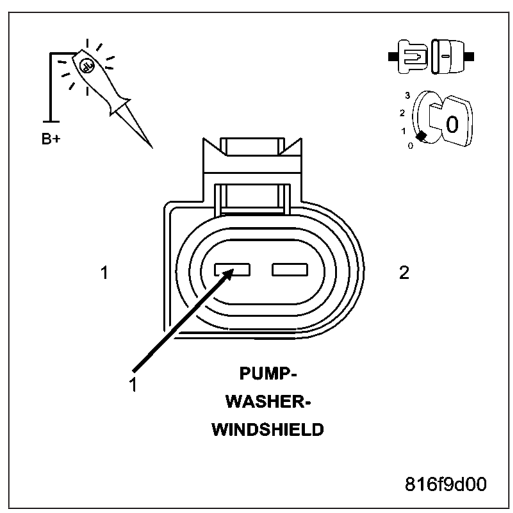
**No** >> Go To 2

### 2. FRONT WASHER PUMP GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Front Washer Pump.

Using a 12-volt test light connected to 12-volts, check the Front Washer Pump Ground circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the Front Washer Pump Ground Circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.

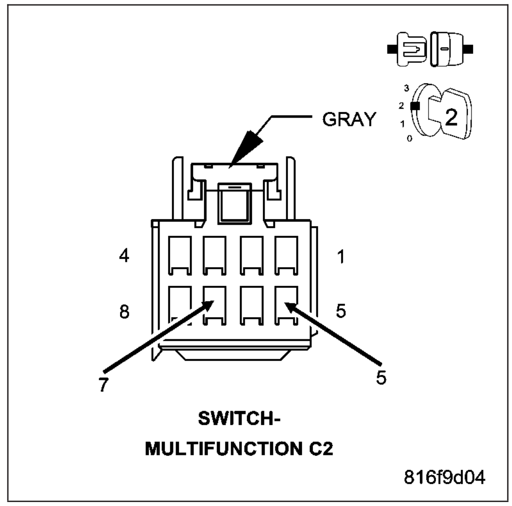
## 3. MULTIFUNCTION SWITCH

Turn the ignition off.

Disconnect the right side Multifunction Switch C2 harness connector.

Connect a jumper wire between the Fused Ignition Switch Output circuit and the Front Washer Pump Driver circuit in the Multifunction Switch harness connector.

Turn the ignition on.




**Does the Front Washer Pump operate?**

**Yes** >> Replace the Multifunction Switch.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

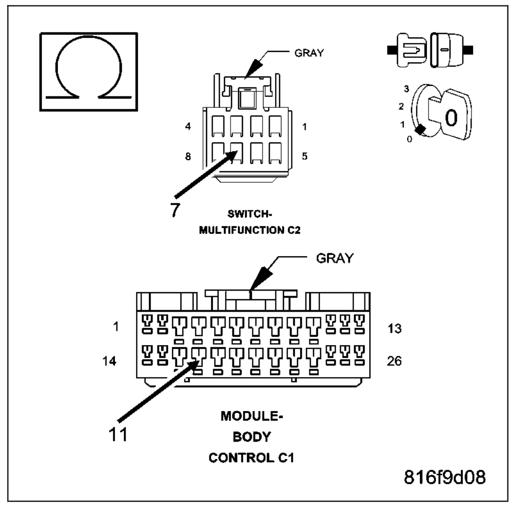
## 4. FRONT WASHER PUMP SENSE CIRCUIT OPEN

Turn the ignition off.

Disconnect the right side Multifunction Switch.

Disconnect the Body Control Module.

Measure the resistance of the Front Washer Pump Sense circuit.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the Front Washer Pump Sense Circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 5

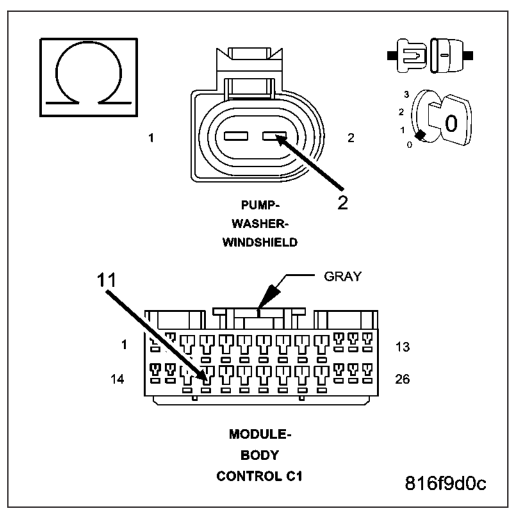
## 5. FRONT WASHER PUMP DRIVER CIRCUIT OPEN

Turn the ignition off.

Disconnect the Front Washer Pump.

Disconnect the Body Control Module from the Junction Block.

Measure the resistance of the Front Washer Pump Driver circuit.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the Front Washer Pump Driver Circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.

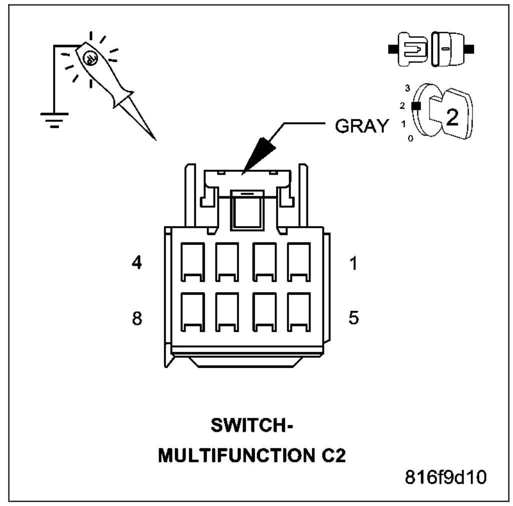
**No** >> Go To 6

## 6. FUSED IGNITION SWITCH OUTPUT OPEN

Turn the ignition off.

Disconnect the Multifunction Switch.

Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output circuit.




**Does the test light illuminate brightly?**

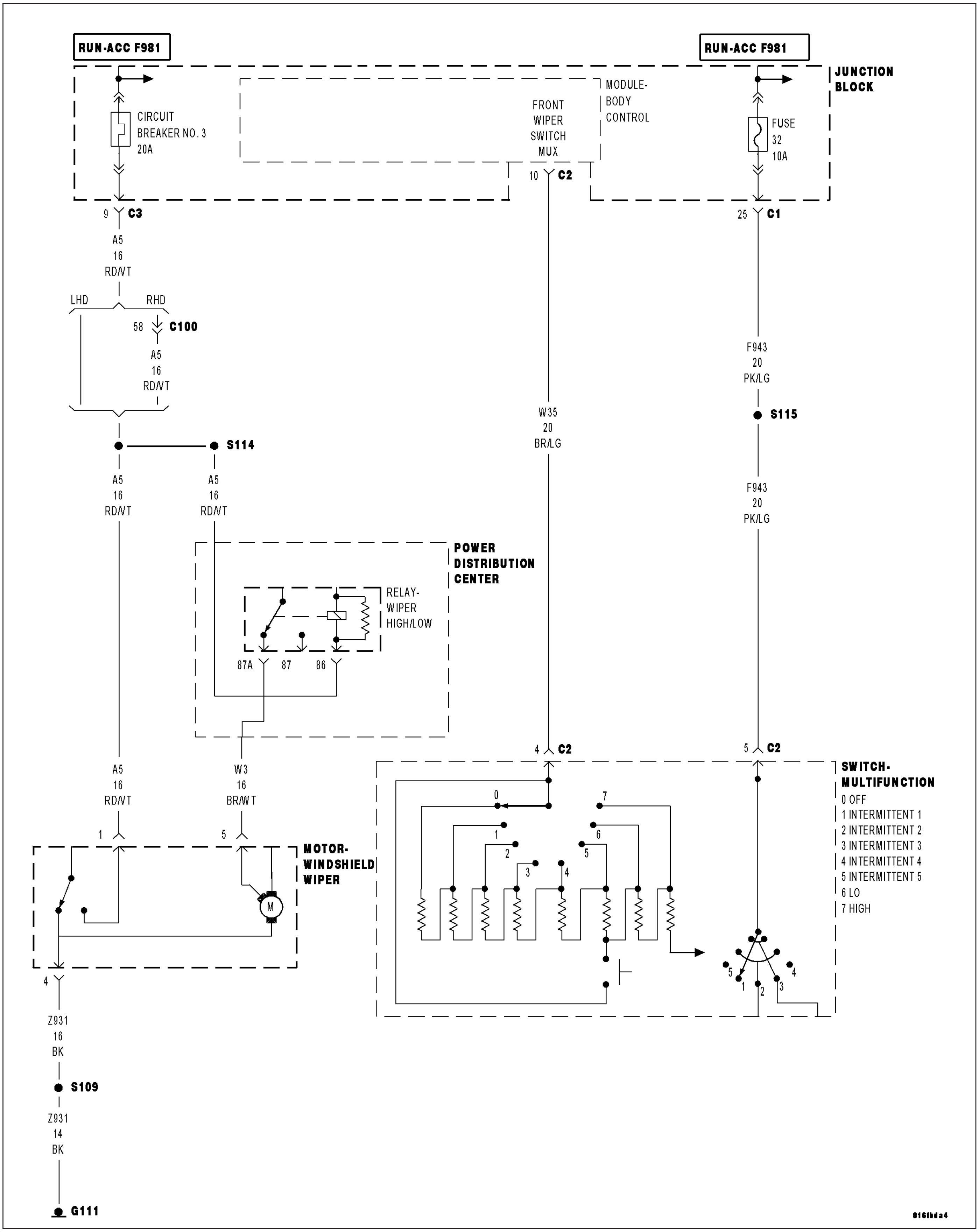
**Yes** >> Repair the Fused Ignition Switch Output circuit for an open. If the fuse is open make sure to check for a short to ground.

Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.

Perform BODY VERIFICATION TEST - VER 1.

## FRONT WIPER LOW SPEED INOPERATIVE




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Possible Causes
- **Set Condition:**
  Possible Causes

| Possible Causes |
|---|
| MULTIFUNCTION SWITCH |
| FRONT WIPER MOTOR GROUND CIRCUIT OPEN |
| FRONT WIPER MOTOR LOW DRIVER CIRCUIT OPEN |
| FRONT WIPER MOTOR |
| FUSED IGNITION SWITCH OUTPUT CIRCUIT |

## Diagnostic Test

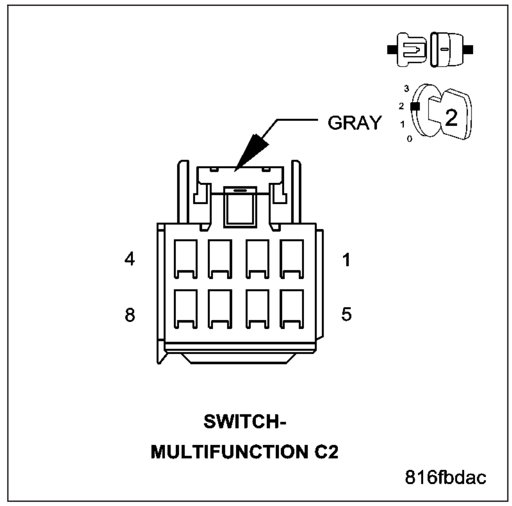
### 1. MULTIFUNCTION SWITCH

Turn the ignition off.

Disconnect the right side Multifunction Switch harness connector.

Connect a jumper wire between the Fused Ignition Switch Output circuit and the Front Wiper Motor Low Driver circuit in the Multifunction Switch harness connector.

Turn the ignition on.




**Does the Front Wiper Motor function normally?**

**Yes** >> Replace the Multifunction Switch.
Perform BODY VERIFICATION TEST - VER 1.

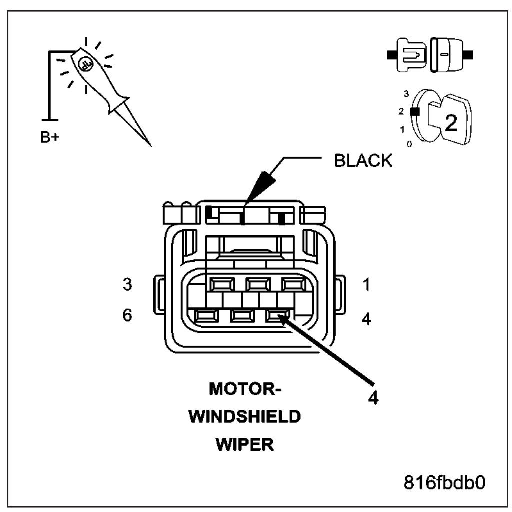
**No** >> Go To 2

### 2. FRONT WIPER MOTOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Front Wiper Motor.

Using a 12-volt test light connected to 12-volts, check the Front Wiper Motor Ground circuit.

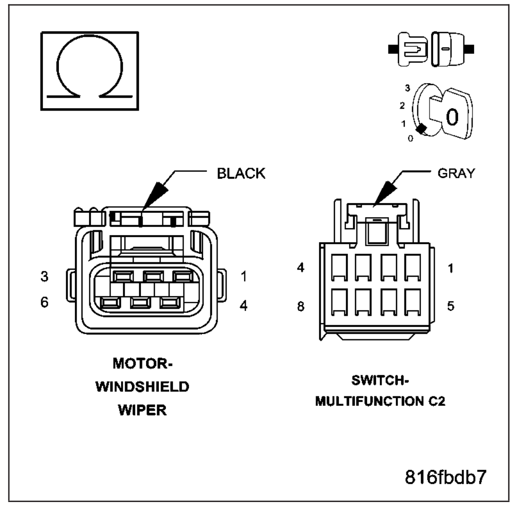



**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the Front Wiper Motor Ground Circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.

## 3. FRONT WIPER MOTOR LOW DRIVER CIRCUIT OPEN




Turn the ignition off.

Disconnect the Front Wiper Motor.

Disconnect the right side Multifunction Switch.

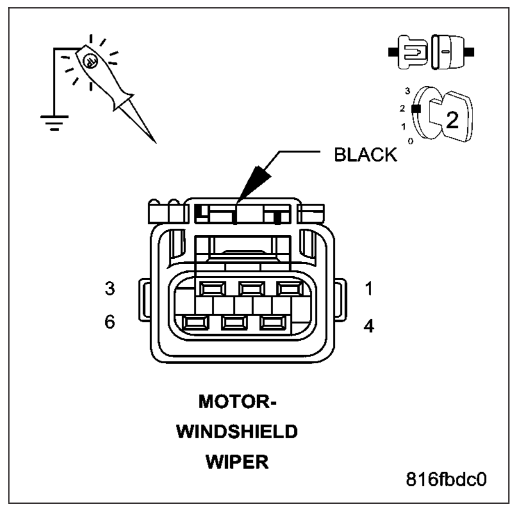
Measure the resistance of the Front Wiper Motor Low Driver circuit.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the Front Wiper Motor Low Driver Circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. FRONT WIPER MOTOR




Turn the ignition off.

Disconnect the Front Wiper Motor harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the Front Wiper Motor Low Driver circuit.

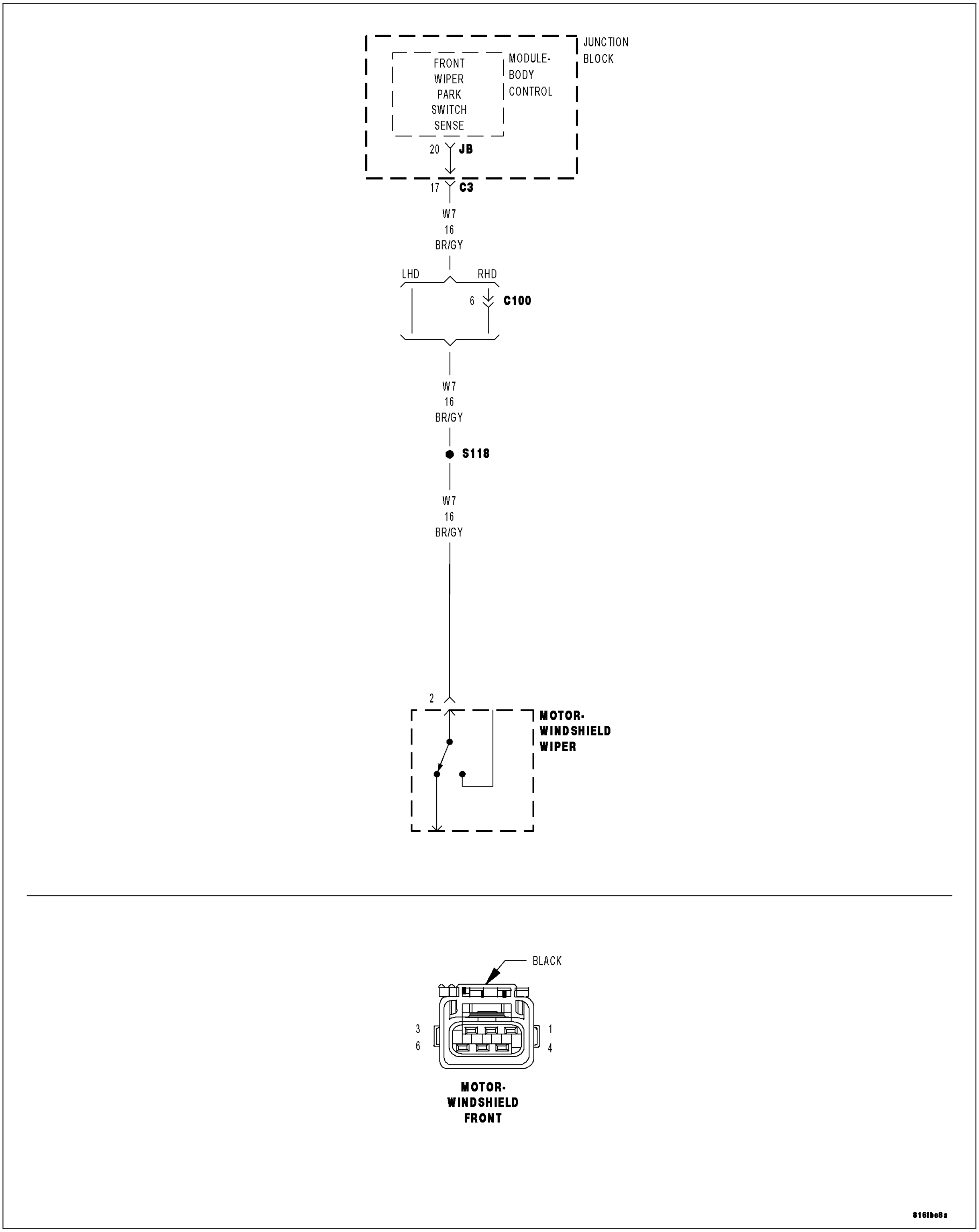
Turn the Front Wipers on to Low.

**Does the test light illuminate brightly?**

**Yes** >> Replace the Front Wiper Motor.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the Fused B+ Output circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.

## WIPER HIGH/LOW RELAY OUTPUT CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  BCM detects a high level on the Wiper High/Low relay output when it is attempting to turn the wipers on for more than 5 seconds.

| Possible Causes |
|---|
| MISSING RELAY |
| OPEN CIRCUIT BREAKER |
| WIPER HIGH/LOW RELAY |
| BODY CONTROL MODULE |
| FRONT WIPER PARK SWITCH SENSE CIRCUIT OPEN |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC's.

Turn the Front Wipers on.

With the scan tool, read the DTC information.

**Does the scan tool read: WIPER HIGH/LOW RELAY CIRCUIT HIGH?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. MISSING RELAY

Turn the ignition off.

Check the PDC to make certain the Wiper High/Low Relay is present.

**Is the Wiper High/Low Relay present?**

**Yes** >> Go To 3

**No** >> Replace the missing Wiper High/Low Relay.
Perform BODY VERIFICATION TEST - VER 1.

### 3. OPEN CIRCUIT BREAKER

Turn the ignition off.

Check the Junction Block Circuit Breaker 3.

**Is the Circuit Breaker open?**

**Yes** >> Replace the open Circuit Breaker.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. WIPER HIGH/LOW RELAY

Turn the ignition off.

Install a known good relay in place of the Wiper High/Low Relay.

Turn the Wipers On.

**Do the Wipers operate normally?**

**Yes** >> Replace the Wiper High/Low Relay.
Perform BODY VERIFICATION TEST - VER 1.

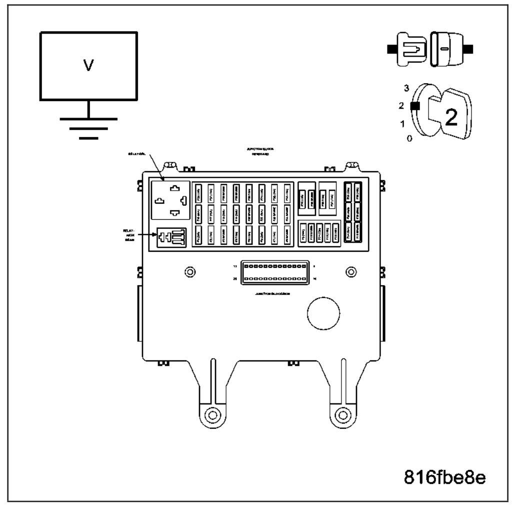
**No** >> Go To 5

## 5. BODY CONTROL MODULE

Turn the ignition off

Remove the Wiper High/Low Relay.

Measure the voltage of the Fused B+ circuit of the Wiper High/Low Relay.

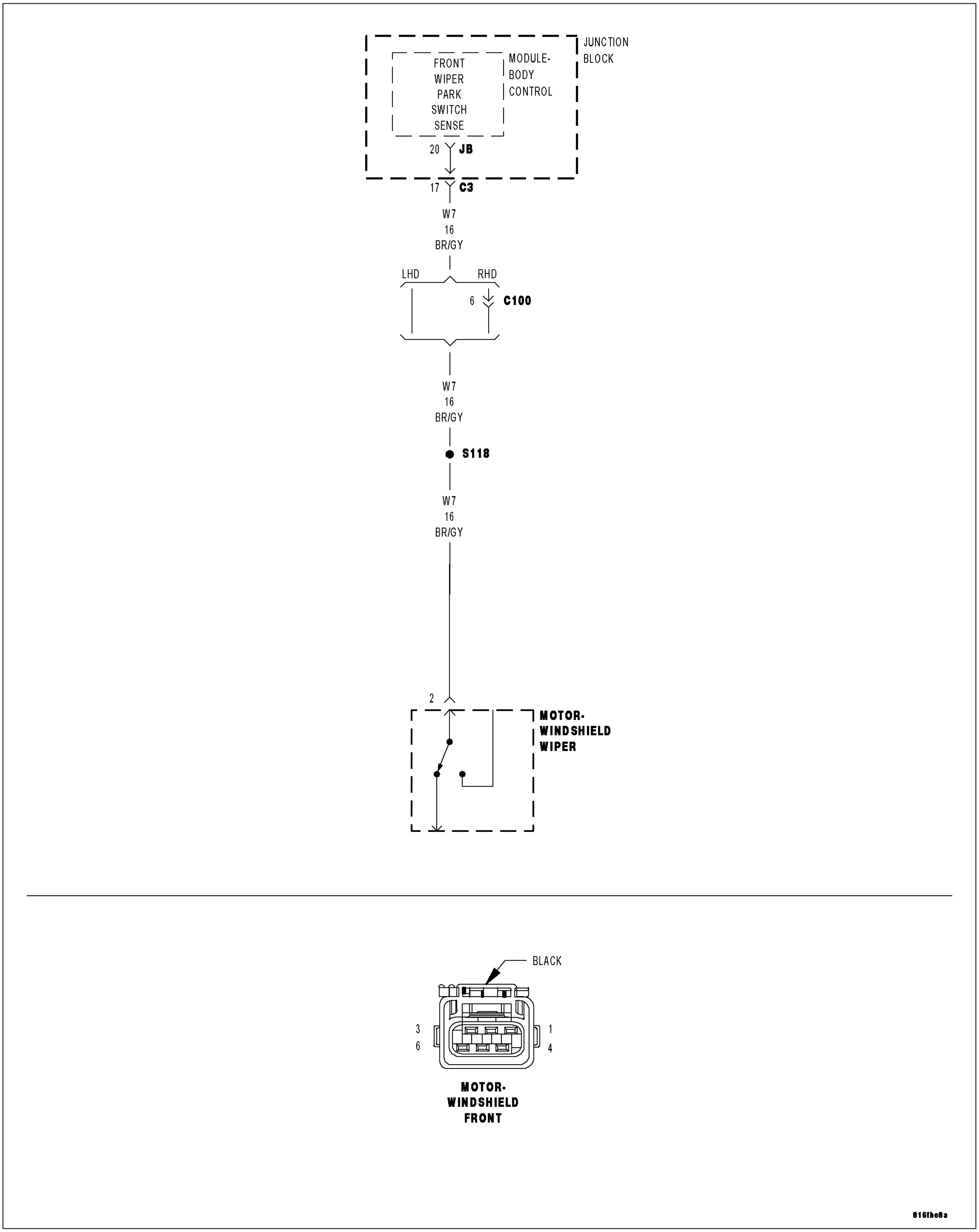



**Is the voltage above 10 volts?**

**Yes** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the Front Wiper Park Switch Sense circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

## WIPER HIGH/LOW RELAY OUTPUT CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With ignition on.
- **Set Condition:**
  BCM detects a low (ground) signal on the wiper on/off relay output even though it is not attempting to drive the output for more than 5 seconds.

| Possible Causes |
|---|
| WIPER HIGH/LOW RELAY SHORT TO GROUND |
| WIPER HIGH/LOW RELAY |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC's.

Turn the Wipers on.

With the scan tool, read the DTC information.

**Does the scan tool read: WIPER HIGH/LOW RELAY OUTPUT CIRCUIT LOW?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. WIPER HIGH/LOW RELAY SHORT TO GROUND

Turn the ignition off.

Disconnect the Wiper High/Low Relay.

Measure the resistance between ground and the Wiper High/Low Relay Control circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the Wiper High/Low Relay Control circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. WIPER HIGH/LOW RELAY

Turn the ignition off.

Disconnect the Wiper High/Low Relay harness connector.

Measure the voltage of the Wiper High/Low Relay harness connector coil side feed circuit to ground.

**Is the voltage above 10.0 volts?**

**Yes** >> Replace the Wiper High/Low Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

## WIPER MODE SWITCH CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  BCM detects a voltage greater than 4.75 volts on the Wiper Mode Switch Input for more than 5 seconds.

| Possible Causes |
|---|
| MULTIFUNCTION SWITCH |
| FRONT WIPER SWITCH MUX CIRCUIT OPEN |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, erase all BCM DTC's.

Turn the Wipers on.

With the scan tool, read DTCs.

**Does the scan tool display: WIPER MODE SWITCH CIRCUIT HIGH?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. MULTIFUNCTION SWITCH

Turn the ignition off.

Disconnect the Multifunction Switch harness connector.

Connect a jumper wire between the Front Wiper Switch MUX circuit to ground.

Turn the ignition on.

With the DRBIII®, select Body, Body Controller and read: Wiper Switch volts.

**Does the scan tool display: Multifunction Switch voltage below 0.5volts?**

**Yes** >> Replace the Multifunction Switch.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. FRONT WIPER SWITCH MUX CIRCUIT OPEN

Turn the ignition off.

Disconnect the Body Control Module harness connector.

Disconnect the Multifunction Switch harness connector.

Measure resistance of the Front Wiper Switch MUX circuit from the Body Control Module connector to the Multifunction Switch harness connector.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the Front Wiper Switch MUX circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

## WIPER MODE SWITCH CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the igntion on.
- **Set Condition:**
  BCM detects a voltage less than 0.25 volts on the Wiper Mode Switch Input for more than 5 seconds.

| Possible Causes |
|---|
| MULTIFUNCTION SWITCH SHORTED |
| FRONT WIPER SWITCH MUX CIRCUIT SHORT TO GROUND |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC's.

Turn the Wipers on.

With the scan tool, read DTCs.

**Does the scan tool display: WIPER MODE SWITCH CIRCUIT LOW?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. MULTIFUNCTION SWITCH SHORTED

Turn the ignition off.

Disconnect the Multifunction Switch harness connector.

Turn the ignition on.

With the DRBIII®, select Body, Body Control Module and read: Multifunction Switch voltage..

**Does the scan tool display: Multifunction Switch voltage above 4.75 volts?**

**Yes** >> Replace the Multifunction Switch.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. FRONT WIPER SWITCH MUX CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Body Control Module harness connector.

Disconnect the Multifunction Switch harness connector.

Measure resistance between ground and the Front Wiper Switch MUX circuit.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the Front Wiper Switch MUX Circuit for a short to ground condition.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

## WIPER ON/OFF RELAY OUTPUT CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  BCM detects a high level on the Wiper On/Off Relay output when it is attempting to turn the wipers on for more than 5 seconds.

| Possible Causes |
|---|
| MISSING RELAY |
| OPEN CIRCUIT BREAKER |
| WIPER ON/OFF RELAY |
| BODY CONTROL MODULE |
| FRONT WIPER PARK SWITCH SENSE CIRCUIT OPEN |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC's.

Turn the Front Wipers on.

With the scan tool, read the DTC information.

**Does the scan tool read: WIPER ON/OFF RELAY CIRCUIT HIGH?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

### 2. MISSING RELAY

Turn the ignition off.

Check the PDC to make certain the Wiper On/Off Relay is present.

**Is the Wiper On/Off Relay present?**

**Yes** >> Go To 3

**No** >> Replace the missing Wiper On/Off Relay.
Perform BODY VERIFICATION TEST - VER 1.

### 3. OPEN CIRCUIT BREAKER

Turn the ignition off.

Check the Junction Block Circuit Breaker 3.

**Is the Circuit Breaker open?**

**Yes** >> Replace the open Circuit Breaker.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. WIPER ON/OFF RELAY

Turn the ignition off.
Install a known good relay in place of the Wiper On/Off Relay.
Turn the Wipers On.

**Do the Wipers operate normally?**

**Yes** >> Replace the Wiper On/Off Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. BODY CONTROL MODULE

Turn the ignition off
Remove the Wiper On/Off Relay.
Measure the voltage of the Fused B+ circuit of the Wiper On/Off Relay.

**Is the voltage above 10 volts?**

**Yes** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Repair the Front Wiper Park Switch Sense circuit for an open condition.
Perform BODY VERIFICATION TEST - VER 1.

## WIPER ON/OFF RELAY OUTPUT CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  BCM detects a low (ground) signal on the Wiper On/Off Relay output even though it is not attempting to drive the output for more than 5 seconds.

| Possible Causes |
|---|
| WIPER ON/OFF RELAY SHORT TO GROUND |
| WIPER ON/OFF RELAY |
| BODY CONTROL MODULE |

### Diagnostic Test

#### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, clear all BCM DTC's.

Turn the Wipers on.

With the scan tool, read the DTC information.

**Does the scan tool read: WIPER ON/OFF RELAY OUTPUT CIRCUIT LOW?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

#### 2. WIPER ON/OFF RELAY SHORT TO GROUND

Turn the ignition off.

Disconnect the Wiper On/Off Relay.

Measure the resistance between ground and the Wiper On/Off Relay Control circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the Wiper On/Off Relay Control circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

#### 3. WIPER ON/OFF RELAY

Turn the ignition off.

Disconnect the Wiper On/Off Relay harness connector.

Measure the voltage of the Wiper On/Off Relay harness connector coil side feed circuit to ground.

**Is the voltage above 10.0 volts?**

**Yes** >> Replace the Wiper On/Off Relay.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

## WIPER PARK SWITCH FAILURE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the Wipers on (any speed).
- **Set Condition:**
  BCM fails to detect a park signal from the wiper motor for 8 consecutive seconds.

| Possible Causes |
|---|
| MULTIFUNCTION SWITCH |
| FRONT WIPER MOTOR GROUND CIRCUIT OPEN |
| FRONT WIPER MOTOR LOW DRIVER CIRCUIT OPEN |
| FRONT WIPER MOTOR |
| FUSED IGNITION SWITCH OUTPUT CIRCUIT |

### Diagnostic Test

#### 1. INTERMITTENT CONDITION

Turn the ignition on.

With the scan tool, erase all BCM DTC's.

Turn the Wipers on.

With the scan tool, read DTCs.

**Does the scan tool display: WIPER PARK SWITCH FAILURE?**

**Yes** >> Go To 2

**No** >> The condition is not present at this time. Monitor scan tool parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins that may apply. Visually inspect the related wiring harness and connector terminals.
Perform BODY VERIFICATION TEST - VER 1.

#### 2. FRONT WIPER PARK SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the Front Wiper Motor harness connector.

Disconnect the Junction Block C3 harness connector.

Turn the ignition on.

Measure the voltage of the Wiper Park Switch Sense circuit in the Front Wiper Motor harness connector.

**Is there any voltage present?**

**Yes** >> Repair the Wiper Park Switch Sense circuit for a short to voltage.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. FRONT WIPER PARK SWITCH SENSE CIRCUIT OPEN

Turn the ignition off.

Disconnect the Front Wiper Motor harness connector.

Disconnect the Junction Block C3 harness connector.

Measure the resistance of the Wiper Park Switch Sense circuit between the Junction Block C3 harness connector and the Wiper Motor harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Front Wiper Park Switch Sense circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.

## 4. FRONT WIPER PARK SWITCH SENSE CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect the Front Wiper Motor harness connector.

Disconnect the Junction Block C3 harness connector.

Measure the resistance between ground and the Wiper Park Switch Sense circuit in the Junction Block C3 harness connector.

**Is the resistance below 100.0 ohms?**

**Yes** >> Repair the Front Wiper Park Switch Sense circuit for a short to ground.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Go To 5

## 5. GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Front Wiper Motor harness connector.

Using a 12-volt test light connected to 12-volts, test the Ground circuit in the Front Wiper Motor harness connector.

**Does the test light illuminate brightly?**

**Yes** >> Go To 6

**No** >> Repair the Wiper Motor Ground circuit for an open.
Perform BODY VERIFICATION TEST - VER 1.

## 6. WIPER MOTOR

Turn the ignition off.

Disconnect the Front Wiper Motor harness connector.

Turn the ignition on.

Connect a jumper wire from the Wiper Park Switch Sense circuit to ground.

With the scan tool in Inputs/Outputs read: Wiper Park Switch state.

**Did the Wiper Park Switch Input change state when connected to ground?**

**Yes** >> Replace the Wiper Motor.
Perform BODY VERIFICATION TEST - VER 1.

**No** >> Replace the Body Control Module.
Perform BODY VERIFICATION TEST - VER 1.

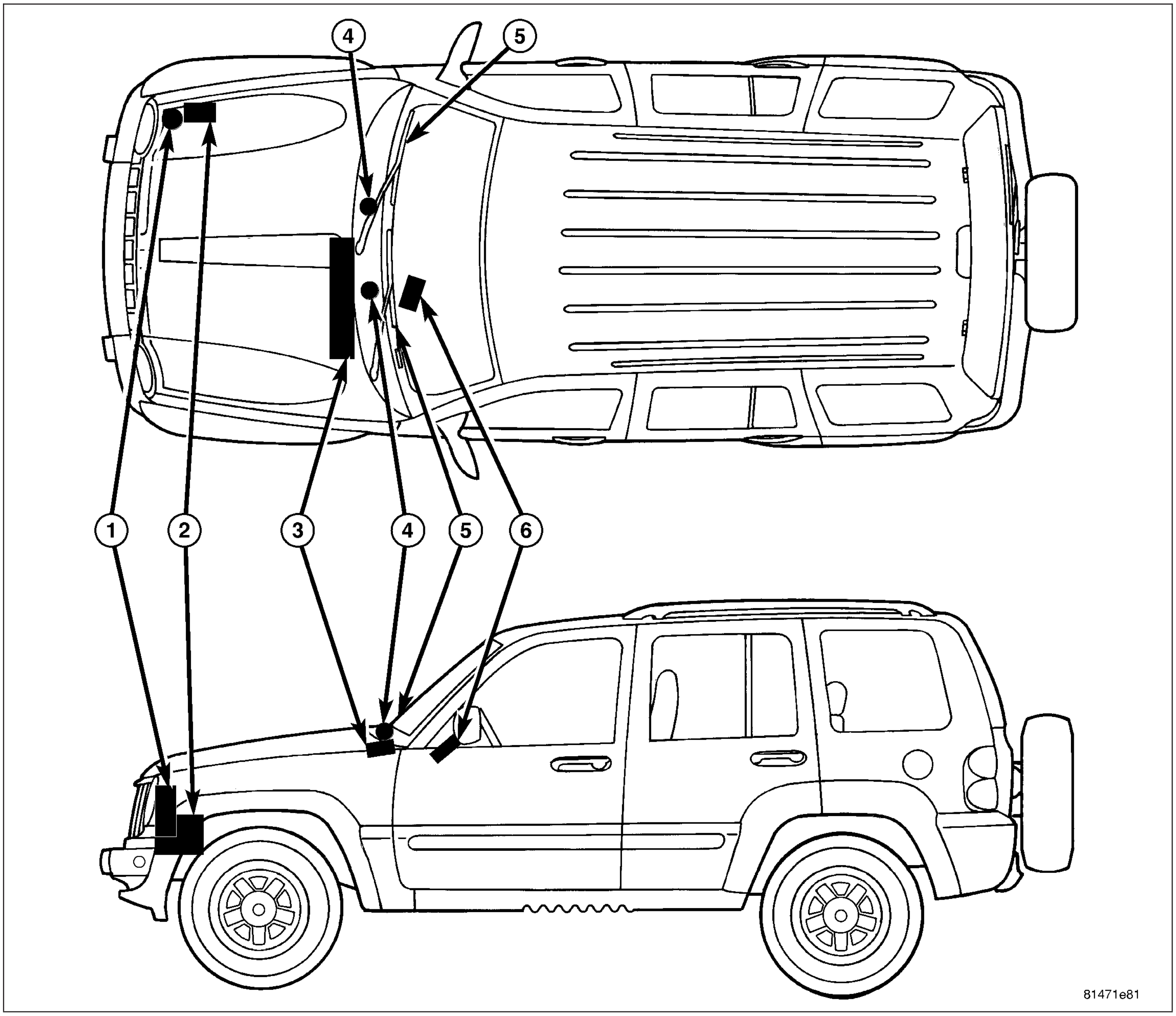
# WIPERS/WASHERS - SERVICE INFORMATION

## TABLE OF CONTENTS

# WIPERS/WASHERS - SERVICE INFORMATION

## DESCRIPTION

## FRONT




An electrically operated intermittent front wiper and washer system is standard factory-installed safety equipment on this vehicle. The wiper and washer system includes the following major components, which are described in further detail elsewhere in this service information:

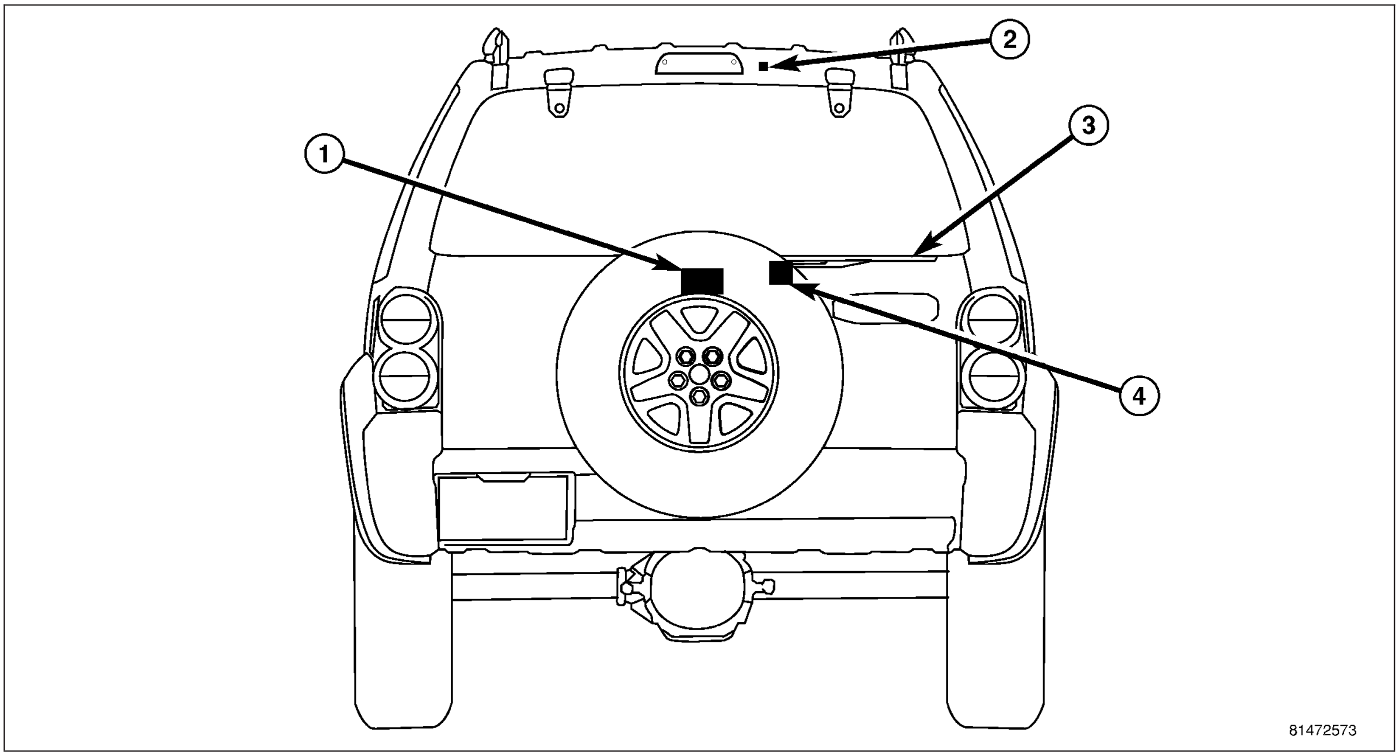
- **Body Control Module** - The Body Control Module (BCM) is located on the Junction Block (JB) under the driver side outboard end of the instrument panel. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/BODY CONTROL MODULE - DESCRIPTION).
- **Front Check Valve** - The front washer system check valve is integral to the wye fitting located in the washer plumbing between the cowl plenum washer hose and the front washer nozzles, and is concealed beneath the cowl plenum cover/grille panel at the base of the windshield.
- **Front Washer Nozzle (4)** - Two fluidic front washer nozzles are secured by integral latch features to dedicated openings in the cowl plenum cover/grille panel located near the base of the windshield.
- **Front Washer Plumbing** - The plumbing for the washer system consists of rubber hoses and molded plastic fittings. The plumbing is routed along the right side of the engine compartment from the washer reservoir, and

through the dash panel into the cowl plenum beneath the cowl plenum cover/grille panel to the washer nozzles.

- **Front Wiper Arms & Blades (5)** - The two front wiper arms are secured with nuts to the threaded ends of the two wiper pivot shafts, which extend through the cowl plenum cover/grille panel located near the base of the windshield. The two front wiper blades are secured to the two wiper arms with an integral latch, and are parked on the glass near the bottom of the windshield when the wiper system is not in operation.
- **Front Wiper Module (3)** - The wiper pivot shafts are the only visible components of the front wiper module. The remainder of the module is concealed within the cowl plenum area beneath the cowl plenum cover/grille panel. The wiper module includes the wiper module bracket, four rubber-isolated wiper module mounts, the wiper motor, the wiper motor crank arm, the two wiper drive links, and the two wiper pivots.
- **Multi-Function Switch (6)** - The multi-function switch is located on the top of the steering column, just below the steering wheel. The multi-function switch includes a left (lighting) control stalk and a right (wiper) control stalk. The right control stalk is dedicated to providing all of the driver controls for both the front and rear wiper systems. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/MULTI-FUNCTION SWITCH - DESCRIPTION).
- **Washer Fluid Level Switch** - The washer fluid level switch is located in a dedicated hole near the center of the rearward facing surface of the washer reservoir, behind the right front wheel house splash shield.
- **Washer Pump/Motor** - The reversible electric washer pump/motor unit is located in a dedicated hole on the lower outboard side of the washer reservoir, behind the right front wheel house splash shield. This single reversible washer pump/motor provides washer fluid to either the front or rear washer system plumbing, depending upon the direction of the pump motor rotation.
- **Washer Reservoir (1 & 2)** - The washer reservoir (2) is concealed behind the right front wheel house splash shield ahead of the right front wheel. The washer reservoir filler neck (1) is the only visible portion of the reservoir, and it is accessed from the right front corner of the engine compartment.
- **Wiper High/Low Relay** - The wiper high/low relay is an International Standards Organization (ISO) micro relay located in the Power Distribution Center (PDC) in the engine compartment near the battery.
- **Wiper On/Off Relay** - The wiper on/off relay is an International Standards Organization (ISO) micro relay located in the Power Distribution Center (PDC) in the engine compartment near the battery.

Hard wired circuitry connects the front wiper and washer system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the front wiper and washer system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

## REAR




An electrically operated fixed interval intermittent rear wiper and washer system is standard factory-installed equipment on this vehicle. The rear wiper and washer system includes the following major components, which are described in further detail elsewhere in this service information:

- **Multi-Function Switch** - The multi-function switch is located on the top of the steering column, just below the steering wheel. The multi-function switch includes a left (lighting) control stalk and a right (wiper) control stalk. The right control stalk is dedicated to providing all of the driver controls for both the front and rear wiper systems. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/MULTI-FUNCTION SWITCH - DESCRIPTION).
- **Rear Check Valve** - The rear washer system check valve function is performed by the diaphragm integral to the valve body of the washer pump/motor unit in this vehicle. (Refer to 8 - ELECTRICAL/FRONT WIPERS/ WASHERS/WASHER PUMP/MOTOR - DESCRIPTION).
- **Rear Washer Nozzle (2)** - A fluidic rear washer nozzle is secured by a latch feature to a mounting hole in the roof outer panel above the rear flip-up glass opening.
- **Rear Washer Plumbing** - The plumbing for the rear washer system consists of rubber hoses and molded plastic fittings. The plumbing is routed along the right side of the engine compartment from the washer reservoir, through the dash into the passenger compartment, up the right cowl side and A-pillar to the headliner, and above the headliner to the rear washer nozzle on the rear roof header.
- **Rear Wiper Arm & Blade (3)** - The single rear wiper arm is secured by a nut directly to the rear wiper motor output shaft, which extends through the center of the tailgate outer panel near the base of the rear flip-up glass. The single rear wiper blade is secured to the rear wiper arm with an integral latch, and is parked off of the rear flip-up glass when the rear wiper system is not in operation.
- **Rear Wiper Arm Park Ramp (4)** - The molded rubber rear wiper arm park ramp is secured with a screw to the tailgate outer panel to the right of the rear wiper motor output shaft bezel. When the rear wiper system is not in operation, the rear wiper arm is parked off of the rear flip-up glass on this ramp so that it will not interfere with or be damaged by the flip-up glass operation.
- **Rear Wiper Module (1)** - The rear wiper motor output shaft is the only visible component of the rear wiper module. The remainder of the module is concealed within the tailgate below the rear flip-up glass opening. The rear wiper module includes the module bracket, the rear wiper motor, and the rear wiper electronic control circuitry.
- **Washer Pump/Motor** - The reversible electric washer pump/motor unit is located in a dedicated hole on the lower outboard side of the washer reservoir, behind the right front wheel house splash shield. This single

reversible washer pump/motor provides washer fluid to either the front or rear washer system plumbing, depending upon the direction of the pump motor rotation. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/WASHER PUMP MOTOR - DESCRIPTION).

- **Washer Reservoir** - The washer reservoir is concealed behind the right front wheel house splash shield ahead of the right front wheel. The washer reservoir filler neck is the only visible portion of the reservoir, and it is accessed from the right front corner of the engine compartment. This single washer reservoir is shared by both the front and rear washer systems. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/WASHER RESERVOIR - DESCRIPTION).

Hard wired circuitry connects the rear wiper and washer system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the rear wiper and washer system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

## OPERATION

## FRONT

The front wiper and washer system is designed to provide the vehicle operator with a convenient, safe, and reliable means of maintaining visibility through the windshield glass. The various components of this system are designed to convert electrical energy produced by the vehicle electrical system into the mechanical action of the wiper blades to wipe the outside surface of the glass, as well as into the hydraulic action of the washer system to apply washer fluid stored in an on-board reservoir to the area of the glass to be wiped. When combined, these components provide the means to effectively maintain clear visibility for the vehicle operator by removing excess accumulations of rain, snow, bugs, mud, or other minor debris from the outside windshield glass surface that might be encountered while driving the vehicle under numerous types of inclement operating conditions.

The vehicle operator initiates all front wiper and washer system functions with the right (wiper) control stalk of the multi-function switch that extends from the right side of the steering column, just below the steering wheel. Rotating the control knob on the end of the control stalk, selects the Off, Delay, Low, or High front wiper system operating modes. In the Delay mode, the control knob also allows the vehicle operator to select from one of five intermittent wipe Delay intervals. Pulling the right control stalk downwards actuates the momentary front wiper system Mist mode switch, while pulling the right control stalk towards the steering wheel actuates the momentary front washer system switch. The multi-function switch provides hard wired resistor multiplexed inputs to the Body Control Module (BCM) for all of the front wiper system functions, as well as a separate hard wired sense input to the BCM for the front washer system function.

The front wiper and washer system will only operate when the ignition switch is in the Accessory or On positions. Battery current is directed from a B(+) fuse in the Power Distribution Center (PDC) to the wiper and washer system circuit breaker in the Junction Block (JB) through a fused ignition switch output (run-acc) circuit. The automatic resetting circuit breaker then provides battery current through a fused ignition switch output (run-acc) circuit to the wiper high/low relay, the wiper on/off relay, and the park switch within the front wiper motor. A separate fuse in the JB provides battery current through another fused ignition switch output (run-acc) circuit to the multi-function switch. The multi-function switch circuitry uses this battery feed and a ground circuit input to directly control the operation and direction of the reversible electric washer pump/motor unit. The BCM uses low side drivers to control front wiper system operation by energizing or de-energizing the wiper high/low and wiper on/off relays.

The hard wired circuits and components of the front wiper and washer system may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the Body Control Module (BCM), or the inputs to or outputs from the BCM that control the front wiper and washer system operating modes. The most reliable, efficient, and accurate means to diagnose the BCM, or the BCM inputs and outputs related to the various front wiper and washer system operating modes requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

### OPERATING MODES

Following are paragraphs that briefly describe the operation of each of the wiper and washer system operating modes.

### CONTINUOUS WIPE MODE

When the Low position of the control knob on the right (wiper) control stalk of the multi-function switch is selected, the Body Control Module (BCM) energizes the wiper on/off relay. This directs battery current through the normally open contacts of the energized wiper on/off relay and the normally closed contacts of the de-energized wiper high/low relay to the low speed brush of the front wiper motor, causing the front wipers to cycle at low speed. When the High position of the control knob is selected, the BCM energizes both the wiper on/off relay and the wiper high/low relay. This directs battery current through the normally open contacts of the energized wiper on/off relay and the normally open contacts of the energized wiper high/low relay to the high speed brush of the front wiper motor, causing the front wipers to cycle at high speed.

When the Off position of the control knob is selected, the BCM de-energizes both the wiper on/off and wiper high/low relays, then one of two events will occur. The event that occurs depends upon the position of the wiper blades on the windshield at the moment that the control knob Off position is selected. If the wiper blades are in the down position on the windshield when the Off position is selected, the park switch that is integral to the front wiper motor is closed to ground and the wiper motor ceases to operate.

If the wiper blades are not in the down position on the windshield at the moment the Off position is selected, the park switch is closed to battery current from the fused ignition switch output (run-acc) circuit of the front wiper motor. The park switch directs this battery current to the low speed brush of the wiper motor through the wiper park switch sense circuit and the normally closed contacts of the de-energized wiper on/off and wiper high/low relays. This causes the wiper motor to continue running at low speed until the wiper blades are in the down position on the windshield and the park switch is again closed to ground.

### INTERMITTENT WIPE MODE

When the control knob on the right (wiper) control stalk of the multi-function switch is moved to one of the Delay interval positions, the BCM electronic intermittent wipe logic circuit responds by calculating the correct length of time between wiper sweeps based upon the selected delay interval input. The BCM monitors the changing state of the wiper motor park switch through a hard wired front wiper park switch sense circuit input. This input allows the BCM to determine the proper intervals at which to energize and de-energize the wiper on/off relay to operate the front wiper motor intermittently for one low speed cycle at a time.

The BCM logic is also programmed to provide an immediate wipe cycle and begin a new delay interval timing cycle each time a shorter delay interval is selected, and to add the remaining delay timing interval to the new delay interval timing before the next wipe cycle occurs each time a longer delay interval is selected.

### MIST WIPE MODE

When the right (wiper) control stalk of the multi-function switch is moved to the momentary Mist position, the BCM energizes the wiper on/off relay for as long as the Mist switch is held closed, then de-energizes the relay when the state of the Mist switch input changes to open. The BCM can operate the front wiper motor in this mode for only one low speed cycle at a time, or for an indefinite number of sequential low speed cycles, depending upon how long the Mist switch is held closed.

### WASH MODE

When the right (wiper) control stalk of the multi-function switch is moved to the momentary front Wash position while the control knob is in the Low or High positions, the circuitry within the switch directs battery current and ground to the washer pump/motor unit. This will cause the washer pump/motor unit to be energized for as long as the front Wash switch is held closed, and to de-energize when the front Wash switch is released.

When the right (wiper) control stalk of the multi-function switch is moved to the momentary front Wash position while the control knob is in one of the Delay interval positions, the front washer pump/motor operation is the same. However, the BCM energizes the wiper on/off relay to override the selected delay interval and operate the front wiper motor in a continuous low speed mode for as long as the front Wash switch is held closed, then de-energizes the relay and reverts to the selected delay mode interval several wipe cycles after the front Wash switch is released. The BCM detects the front Wash switch state through a hard wired washer pump driver circuit input from the multi-function switch.

#### WIPE-AFTER-WASH MODE

When the right (wiper) control stalk of the multi-function switch is moved to the momentary front Wash position while the control knob is in the Off position, the BCM detects that switch state through a hard wired washer pump driver circuit input from the multi-function switch. The BCM responds to this input by energizing the wiper on/off relay for as long as the Wash switch is held closed, then de-energizes the relay several wipe cycles after the front Wash switch is released. The BCM monitors the changing state of the wiper motor park switch through a hard wired front wiper park switch sense circuit input. This input allows the BCM to count the number of wipe cycles that occur after the front Wash switch state changes to open, and to determine the proper interval at which to de-energize the wiper on/off relay to complete the wipe-after-wash mode cycle.

## REAR

The rear wiper and washer system is designed to provide the vehicle operator with a convenient, safe, and reliable means of maintaining visibility through the rear flip-up glass. The various components of this system are designed to convert electrical energy produced by the vehicle electrical system into the mechanical action of the wiper blade to wipe the outside surface of the glass, as well as into the hydraulic action of the washer system to apply washer fluid stored in an on-board reservoir to the area of the glass to be wiped. When combined, these components provide the means to effectively maintain clear visibility for the vehicle operator by removing excess accumulations of rain, snow, bugs, mud, or other minor debris from the rear flip-up glass surface that might be encountered while driving the vehicle under numerous types of inclement operating conditions.

The vehicle operator initiates all rear wiper and washer system functions with the right (wiper) control stalk of the multi-function switch that extends from the right side of the steering column, just below the steering wheel. Rotating the control ring on the control stalk to a detent position selects the Off, Delay, or On rear wiper system operating modes. Rotating the control ring on the control stalk to either of two Wash positions actuates the momentary rear washer system switch. The multi-function switch provides hard wired outputs to the rear wiper module and the washer pump/motor unit for all rear wiper and washer system functions.

The rear wiper and washer system will only operate when the ignition switch is in the Accessory or On positions, and the rear flip-up glass and tailgate ajar switches are closed. Battery current is directed from a fuse in the Junction Block (JB) to the multi-function switch through a fused ignition switch output (run-accessory) circuit. The internal circuitry of the right (wiper) control stalk of the multi-function switch then provides battery current signals through a rear wiper on driver circuit and a rear wiper intermittent driver circuit to the rear wiper module and to the Body Control Module (BCM). The BCM uses these rear wiper system inputs as a signal to lock the rear flip-up glass and the tailgate to prevent the rear flip-up glass or tailgate from being opened for as long as the rear wiper is operating. The multi-function switch circuitry also uses this battery current and a ground circuit input to directly control the operation and direction of the reversible electric washer pump/motor unit.

A separate fuse in the JB provides battery current to the electronic control circuitry of the rear wiper module through a fused B(+) circuit. The rear wiper module uses this fused B(+) input to park the rear wiper blade off of the rear flip-up glass if the ignition switch is turned to the Off position while the rear wiper is operating, or if the ignition switch is turned to the Off position before the rear wiper blade has parked. However, if the ignition switch is turned to the Off position while the rear wiper is operating, then turned back On, the rear wiper switch must be cycled to the Off position and back to the On or Delay position before the rear wiper will operate again. In addition, the rear wiper module receives an input from the rear flip-up glass ajar switch on a flip-up glass ajar switch sense circuit, which prevents the rear wiper from operating when the flip-up glass is not closed or fully latched.

The hard wired circuits and components of the rear wiper and washer system may be diagnosed and tested using conventional diagnostic tools and procedures.

### OPERATING MODES

Following are paragraphs that briefly describe the operation of each of the rear wiper and washer system operating modes.

#### CONTINUOUS WIPE MODE

When the On position of the control ring on the right (wiper) control stalk of the multi-function switch is selected, the multi-function switch circuitry directs a battery current signal to the rear wiper module through the rear wiper on driver circuit, causing the rear wiper to cycle continuously at a fixed speed.

#### INTERMITTENT WIPE MODE

When the Delay position of the control ring on the right (wiper) control stalk of the multi-function switch is selected, the multi-function switch circuitry directs a battery current signal to the rear wiper module through the rear wiper intermittent driver circuit, causing the rear wiper to cycle intermittently at a fixed delay interval.

#### WASH MODE

When the momentary Wash (after On) position of the control ring on the right (wiper) control stalk of the multi-function switch is selected, the multi-function switch circuitry directs both battery current and ground to the washer pump/motor unit, and a battery current signal to be provided to the rear wiper module through the rear wiper on driver circuit. This will cause the washer pump/motor unit to be energized and the rear wiper to cycle continuously at a fixed speed for as long as the rear Wash switch is held closed.

#### WIPE-AFTER-WASH MODE

When the momentary Wash (before Off) position of the control ring on the right (wiper) control stalk of the multi-function switch is selected, the multi-function switch circuitry directs both battery current and ground to the washer pump/motor unit, and a battery current signal to be provided to the rear wiper module through the rear wiper on driver circuit. This will cause the washer pump/motor unit to be energized and the rear wiper to cycle continuously at a fixed speed for as long as the rear Wash switch is held closed. When the control ring is released to the Off position, the washer pump/motor is de-energized, but the circuitry within the rear wiper module will provide several additional wipe cycles to complete the wipe-after-wash mode cycle.

## DIAGNOSIS AND TESTING

## FRONT

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: If the front wiper motor operates, but the wipers do not move on the windshield, replace the inoperative front wiper module. If the washer pump/motor operates, but no washer fluid is dispensed on the glass; or, if the wipers operate, but chatter, lift, or do not clear the glass, clean and inspect the front wiper and washer system components as required. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - CLEANING) and (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - INSPECTION).**

The hard wired front wiper and washer system circuits and components of the may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the Body Control Module (BCM), or the inputs to or outputs from the BCM that provide front wiper and washer system service or many of the electronic features of the front wiper and washer systems. The most reliable, efficient, and accurate means to diagnose the BCM, or the BCM inputs and outputs for the front wiper and washer system requires the use of a diagnostic scan tool. Refer to the appropriate diagnostic information.

## REAR

### WIPER SYSTEM

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: The diagnosis found here addresses an electrically inoperative rear wiper system. If the rear wiper motor operates, but the wiper does not move on the rear flip-up glass, inspect the mechanical connection between the rear wiper arm and the rear wiper motor output shaft. If OK, replace the inoperative rear wiper module. If the wiper operates, but chatters, lifts, or does not clear the glass, clean and inspect the rear wiper system components as required. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - CLEANING) and (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - INSPECTION).**

1. Check that the interior lighting switch on the left (lighting) control stalk of the multi-function switch is not in the dome lamp disable position. With all four doors and the tailgate closed, open the rear flip-up glass. The interior lamps should light. Close the rear flip-up glass. Note whether the interior lamps remain lighted. They should turn off after about thirty seconds. If OK, go to Step 2. If not OK, go to Step 9.
2. Check the fused B(+) fuse (Fuse 17 - 15 ampere) in the Junction Block (JB). If OK, go to Step 3. If not OK, repair the shorted circuit or component as required and replace the inoperative fuse.
3. Check for battery voltage at the fused B(+) fuse (Fuse 17 - 15 ampere) in the JB. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit between the JB and the Power Distribution Center (PDC) as required.
4. Check the fused ignition switch output (run-acc) fuse (Fuse 22 - 10 ampere) in the JB. If OK, go to Step 5. If not OK, repair the shorted circuit or component as required and replace the inoperative fuse.
5. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run-acc) fuse (Fuse 22 - 10 ampere) in the JB. If OK, turn the ignition switch to the Off position and go to Step 6. If not OK, repair the open fused ignition switch output (run-acc) circuit between the JB and the ignition switch as required.
6. Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the multi-function switch (Connector C-2) from the switch connector receptacle. Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run-acc) circuit cavity of the instrument panel wire harness connector for the multi-function switch (Connector C-2). If OK, go to Step 7. If not OK, repair the open fused ignition switch output (run-acc) circuit between the multi-function switch and the JB as required.
7. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Test the multi-function switch. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/MULTI-FUNCTION SWITCH - DIAGNOSIS AND TESTING). If the multi-function switch tests OK, reconnect the instrument panel wire harness connectors for the multi-function switch to the switch connector receptacles and go to Step 8. If the multi-function switch does not test OK, replace the inoperative switch.
8. Remove the tailgate inner trim panel. Disconnect the tailgate wire harness connector for the rear wiper module from the module connector receptacle. Check for continuity between the ground circuit cavity of the tailgate wire harness connector for the rear wiper module and a good ground. There should be continuity. If OK, go to Step 9. If not OK, repair the open ground circuit to ground (G303) as required.
9. Check for continuity between the flip-up glass ajar switch sense circuit cavity of the tailgate wire harness connector for the rear wiper module and a good ground. There should be continuity with the rear flip-up glass open, and no continuity with the rear flip-up glass closed. If OK, go to Step 10. If not OK, repair the open flip-up glass ajar circuit between the rear wiper module and the flip-up glass ajar switch as required.
10. Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the tailgate wire harness connector for the rear wiper module. If OK, go to Step 11. If not OK, repair the open fused B(+) circuit between the rear wiper module and the JB as required.
11. Turn the ignition switch to the On position. Turn the control ring on the right (wiper) control stalk of the multi-function switch to the Delay position. Check for battery voltage at the rear wiper intermittent driver circuit cavity

of the tailgate wire harness connector for the rear wiper module. If OK, go to Step 12. If not OK, repair the open rear wiper intermittent driver circuit between the rear wiper module and the multi-function switch as required.

12. Turn the control ring on the right (wiper) control stalk of the multi-function switch to the On position. Check for battery voltage at the rear wiper on driver circuit cavity of the tailgate wire harness connector for the rear wiper module. If OK, replace the inoperative rear wiper module. If not OK, repair the open rear wiper on driver circuit between the rear wiper module and the multi-function switch as required.

### WASHER SYSTEM

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**NOTE: The diagnosis found here addresses an electrically inoperative rear washer system. If the washer pump/motor operates, but no washer fluid is emitted from the rear washer nozzle, be certain to check the fluid level in the reservoir. Also inspect the rear washer system components as required. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - INSPECTION).**

1. Turn the ignition switch to the On position. Turn the control ring on the right (wiper) control stalk of the multi-function switch to the On position. Check whether the rear wiper system is operating. If OK, go to Step 2. If not OK, test and repair the rear wiper system before continuing with these tests. Refer to WIPER SYSTEM .
2. Pull the right (wiper) control stalk of the multi-function switch toward the steering wheel. Check whether the front washer system is operating. If OK, test the multi-function switch. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/MULTI-FUNCTION SWITCH - DIAGNOSIS AND TESTING). If the multi-function switch tests OK, go to Step 3. If the multi-function switch does not test OK, replace the inoperative switch.
3. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the headlamp and dash wire harness connector for the washer pump/motor unit from the pump/motor unit connector receptacle. Check for continuity between the washer pump driver circuit cavity of the headlamp and dash wire harness connector for the washer pump/motor unit and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted washer pump driver circuit between the washer pump/motor unit and the multi-function switch as required.
4. Check for continuity between the washer pump driver circuit cavities of the headlamp and dash wire harness connector for the washer pump/motor unit and the instrument panel wire harness connector for the multi-function switch (Connector C-2). There should be continuity. If OK, go to Step 5. If not OK, repair the open washer pump driver circuit between the washer pump/motor unit and the multi-function switch as required.
5. Check for continuity between the washer pump sense circuit cavity of the headlamp and dash wire harness connector for the washer pump/motor unit and a good ground. There should be no continuity. If OK, go to Step 6. If not OK, repair the shorted washer pump sense circuit between the washer pump/motor unit and the multi-function switch as required.
6. Check for continuity between the washer pump sense circuit cavities of the headlamp and dash wire harness connector for the washer pump/motor unit and the instrument panel wire harness connector for the multi-function switch (Connector C-2). There should be continuity. If OK, replace the inoperative washer pump/motor unit. If not OK, repair the open washer pump sense circuit between the washer pump/motor unit and the multi-function switch as required.

## CLEANING

## FRONT

### WIPER SYSTEM

The squeegees of wiper blades exposed to the elements for a long time tend to lose their wiping effectiveness. Periodic cleaning of the squeegees is suggested to remove any deposits of salt or road film. The wiper blades, arms, and windshield glass should only be cleaned using a sponge or soft cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the wiper blades continue to leave streaks, smears, hazing, or beading on the glass after thorough cleaning of the squeegees and the glass, the entire wiper blade assembly must be replaced.

**CAUTION: Protect the rubber squeegees of the wiper blades from any petroleum-based cleaners, solvents, or contaminants. These products can rapidly deteriorate the rubber squeegees.**

### WASHER SYSTEM

If the washer system is contaminated with foreign material, drain the washer reservoir using a siphon. Remove the washer pump/motor from the reservoir. Clean foreign material from the inside of the washer pump/motor inlet grommet seal/filter screen and flush the washer reservoir using clean washer fluid, a mild detergent, or a non-abrasive cleaner. Flush foreign material from the washer system plumbing by first disconnecting the washer hoses from the washer nozzles, then running the washer pump/motor to run clean washer fluid or water through the system. Plugged or restricted washer nozzles should be carefully back-flushed using compressed air. If the washer nozzle obstruction cannot be cleared, replace the washer nozzle.

**CAUTION: Never introduce petroleum-based cleaners, solvents, or contaminants into the washer system. These products can rapidly deteriorate the rubber seals and hoses of the washer system, as well as the rubber squeegees of the wiper blades.**

**CAUTION: Never use compressed air to flush the washer system plumbing. Compressed air pressures are too great for the washer system plumbing components and will result in further system damage. Never use sharp instruments to clear a plugged washer nozzle or damage to the nozzle orifice and improper nozzle spray patterns will result.**

## REAR

### WIPER SYSTEM

The squeegee of a wiper blade exposed to the elements for a long time tends to lose its wiping effectiveness. Periodic cleaning of the squeegee is suggested to remove any deposits of salt or road film. The wiper blade, arm, and rear flip-up glass should only be cleaned using a sponge or soft cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the wiper blade continues to leave streaks, smears, hazing, or beading on the glass after thorough cleaning of the squeegees and the glass, the entire wiper blade assembly must be replaced.

**CAUTION: Protect the rubber squeegee of the wiper blade from any petroleum-based cleaners, solvents, or contaminants. These products can rapidly deteriorate the rubber squeegee.**

### WASHER SYSTEM

If the washer system is contaminated with foreign material, drain the washer reservoir using a siphon. Remove the washer pump/motor from the reservoir. Clean foreign material from the inside of the washer pump/motor inlet grommet seal/filter screen and flush the washer reservoir using clean washer fluid, a mild detergent, or a non-abrasive cleaner. Flush foreign material from the washer system plumbing by first disconnecting the washer hose from the washer nozzle, then running the washer pump/motor to run clean washer fluid or water through the system. A plugged or restricted washer nozzle should be carefully back-flushed using compressed air. If the washer nozzle obstruction cannot be cleared, replace the washer nozzle.

**CAUTION: Never introduce petroleum-based cleaners, solvents, or contaminants into the washer system. These products can rapidly deteriorate the rubber seals and hoses of the washer system, as well as the rubber squeegee of the wiper blade.**

**CAUTION: Never use compressed air to flush the washer system plumbing. Compressed air pressures are too great for the washer system plumbing components and will result in further system damage. Never use sharp instruments to clear a plugged washer nozzle or damage to the nozzle orifice and improper nozzle spray patterns will result.**

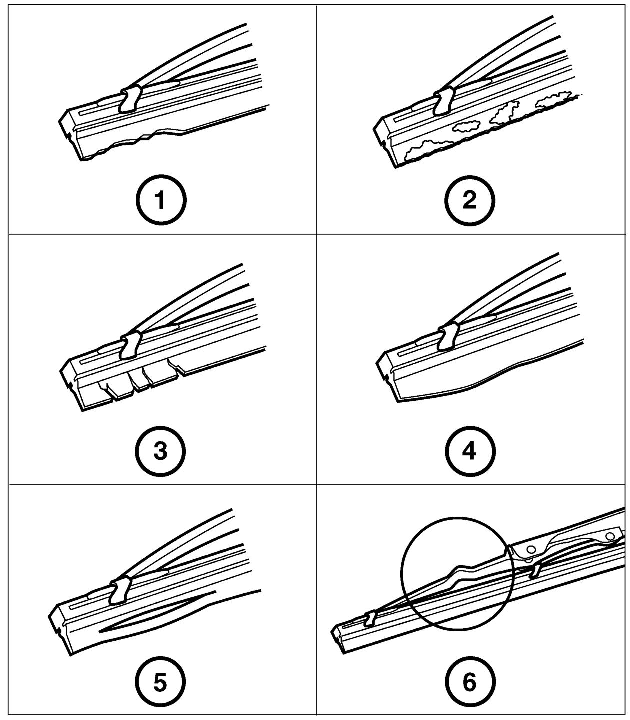
# INSPECTION

## FRONT

### WIPER SYSTEM

The wiper blades and wiper arms should be inspected periodically, not just when wiper performance problems are experienced. This inspection should include the following points:

1. Carefully inspect the wiper blades for any indications of worn or uneven edges (1), foreign material deposits (2), hardening or cracking (3), deformation or fatigue (4), or splitting (5). Inspect the wiper blade support components and the wiper arms for damage (6) or corrosion. If the wiper arms and blades are contaminated with any foreign material, clean them and the glass as required. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - CLEANING). If a wiper blade or arm is damaged, or if corrosion is evident, replace the affected wiper arm or blade with a new unit. Do not attempt to repair a wiper arm or blade that is damaged or corroded.
2. Carefully lift the wiper blade off of the glass. Note the action of the wiper arm hinge. The wiper arm should pivot freely at the hinge, but with no lateral looseness evident. If there is any binding evident in the wiper arm hinge, or there is evident lateral play in the wiper arm hinge, replace the wiper arm.




**CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.**

3. Once proper hinge action of the wiper arm is confirmed, check the hinge for proper spring tension. Remove the wiper blade from the wiper arm. Either place a small postal scale between the blade end of the wiper arm and the glass, or carefully lift the blade end of the arm away from the glass using a small fish scale. Compare the scale readings between the right and left wiper arms. Replace a wiper arm if it has comparatively lower spring tension, as evidenced by a lower scale reading.
4. After cleaning and inspecting the wiper components and the glass, if the wiper blade still fails to clear the glass without smearing, streaking, chattering, hazing, or beading, replace the wiper blade.

### WASHER SYSTEM

The washer system components should be inspected periodically, not just when washer performance problems are experienced. This inspection should include the following points:

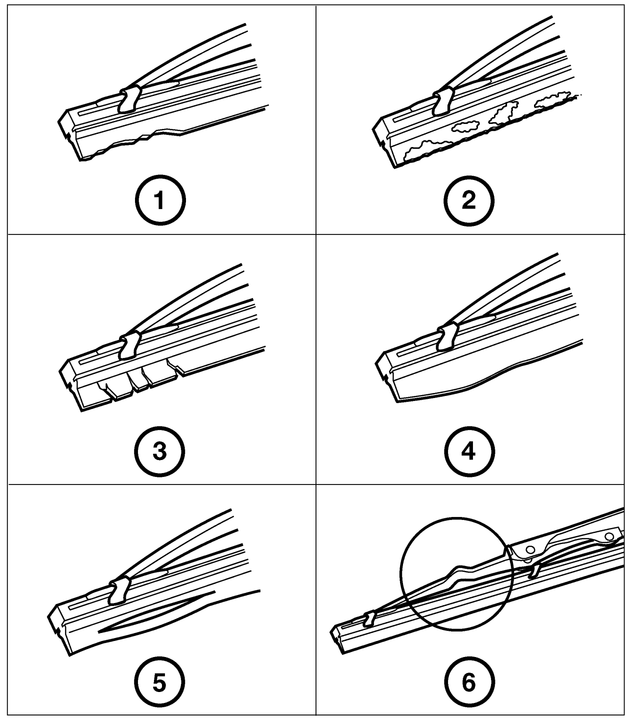
1. Check for ice or other foreign material in the washer reservoir. If contaminated, clean and flush the washer system. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - CLEANING).
2. Inspect the washer plumbing for pinched, leaking, deteriorated, or incorrectly routed hoses and damaged or disconnected hose fittings. Replace damaged or deteriorated hoses and hose fittings. Leaking washer hoses can sometimes be repaired by cutting the hose at the leak and splicing it back together using an in-line connector fitting. Similarly, sections of deteriorated hose can be cut out and replaced by splicing in new sections of hose using in-line connector fittings. Whenever routing a washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts. Also, sharp bends that might pinch the washer hose must be avoided.

## REAR

### WIPER SYSTEM

The rear wiper blade and wiper arm should be inspected periodically, not just when wiper performance problems are experienced. This inspection should include the following points:

1. Carefully inspect the wiper blade for any indications of worn or uneven edges (1), foreign material deposits (2), hardening or cracking (3), deformation or fatigue (4), or splitting (5). Inspect the wiper blade support components and the wiper arm for damage (6). If the wiper arms and blades are contaminated with any foreign material, clean them and the glass as required. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - CLEANING). If a wiper blade or arm is damaged, replace the affected wiper blade or arm with a new unit. Do not attempt to repair a wiper arm or blade that is damaged or corroded.
2. Carefully lift the wiper blade off of the glass. Note the action of the wiper arm hinge. The wiper arm should pivot freely at the hinge, but with no lateral looseness evident. If there is any binding evident in the wiper arm hinge, or there is evident lateral play in the wiper arm hinge, replace the wiper arm.




809ac961

**CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.**

3. Once proper hinge action of the wiper arm is confirmed, check the hinge for proper spring tension. The spring tension of the wiper arm should be sufficient to cause the rubber squeegee to conform to the curvature of the glass. Replace a wiper arm if it has low or no spring tension.
4. After cleaning and inspecting the wiper components and the glass, if the wiper blade still fails to clear the glass without smearing, streaking, chattering, hazing, or beading, replace the wiper blade.

### WASHER SYSTEM

The washer system components should be inspected periodically, not just when washer performance problems are experienced. This inspection should include the following points:

1. Check for ice or other foreign material in the washer reservoir. If contaminated, clean and flush the washer system. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - CLEANING).
2. Inspect the washer plumbing for pinched, leaking, deteriorated, or incorrectly routed hoses and damaged or disconnected hose fittings. Replace damaged or deteriorated hoses and hose fittings. Leaking washer hoses can sometimes be repaired by cutting the hose at the leak and splicing it back together using an in-line connector fitting. Similarly, sections of deteriorated hose can be cut out and replaced by splicing in new sections of hose using in-line connector fittings. Whenever routing a washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts. Also, sharp bends that might pinch the washer hose must be avoided.

# SPECIFICATIONS

## WIPER & WASHER SYSTEMS

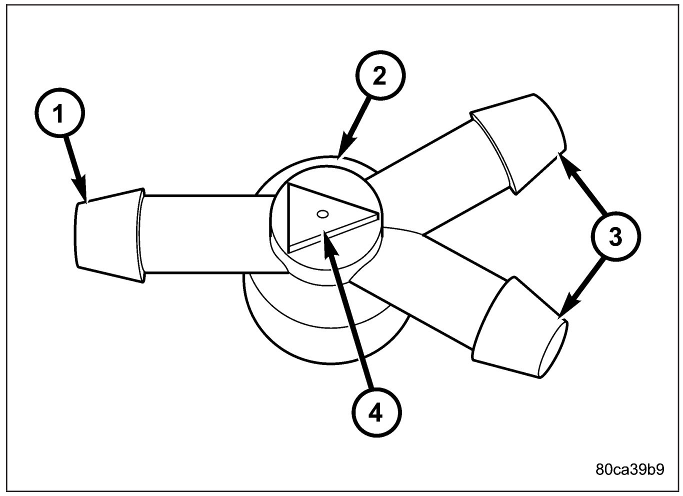
### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Rear Wiper Motor Output Shaft Mounting Nut | 5 | - | 43 |
| Rear Wiper Motor Mounting Screws | 6 | - | 57 |
| Washer Reservoir Mounting Screws | 7 | - | 65 |
| Front Wiper Arm Mounting Nuts | 24 | 18 | - |
| Rear Wiper Arm Mounting Nut | 18 | 13 | - |
| Rear Wiper Arm Park Ramp Mounting Screw | 5 | - | 45 |
| Front Wiper Module Mounting Screws | 8 | - | 72 |
| Front Wiper Module Mounting Nuts | 8 | - | 72 |

# CHECK VALVE

## DESCRIPTION

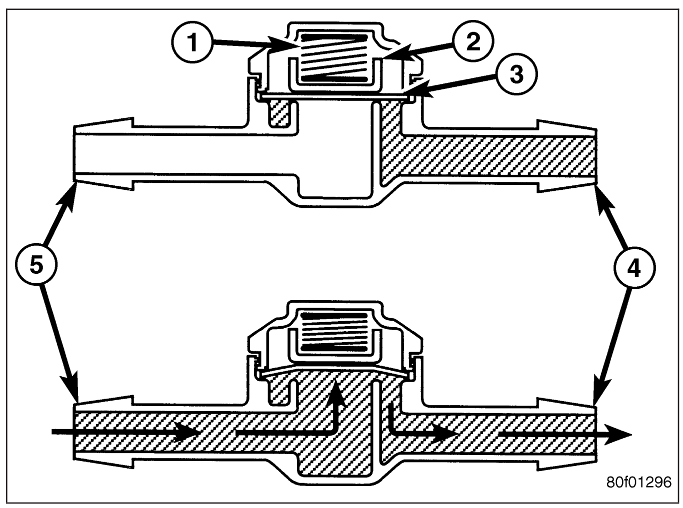
A single front washer system check valve (2) is standard equipment on this vehicle, and is installed in the front washer system plumbing. The front check valve is integral to the front washer nozzle plumbing wye fitting located in the cowl plenum area beneath the cowl plenum cover/grille panel near the base of the windshield. The check valve consists of a molded plastic body with a raised arrowhead (4) molded into its center section that indicates the direction of the flow through the valve, and three barbed hose nipples (1 & 3) formed in a wye configuration on the outside circumference of the center section of the valve body.




The front check valve cannot be adjusted or repaired and, if inoperative or damaged, it must be replaced.

## OPERATION

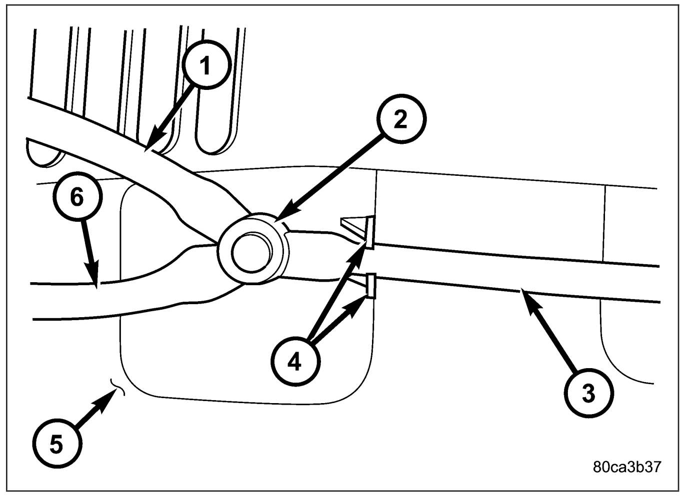
The front check valve provides more than one function in this application. It serves as a wye connector fitting between the cowl grille panel and washer nozzle sections of the front washer supply hose. It prevents washer fluid from draining out of the front washer supply hoses back to the washer reservoir. This drain-back would result in a lengthy delay when the front washer switch is actuated until washer fluid was dispensed through the front washer nozzles, because the washer pump would have to refill the front washer plumbing from the reservoir to the nozzles. Such a drain-back condition could also result in water, dirt, or other outside contaminants being siphoned into the washer system through the washer nozzle orifice. This water could subsequently freeze and plug the nozzle, while other contaminants could interfere with proper nozzle operation and cause improper nozzle spray patterns. In addition, the check valve prevents washer fluid from siphoning through the washer nozzles after the washer system is turned Off.




When the washer pump pressurizes and pumps washer fluid from the reservoir (5) through the washer plumbing, the fluid pressure unseats a diaphragm (3) from over a sump well within the valve by overriding the spring pressure (1) applied to it by a piston (2). With the diaphragm unseated, washer fluid is allowed to flow toward the two washer nozzles (4). When the washer pump stops operating, the spring pressure on the piston seats the diaphragm over the sump well in the valve and fluid flow in either direction within the washer plumbing is prevented.

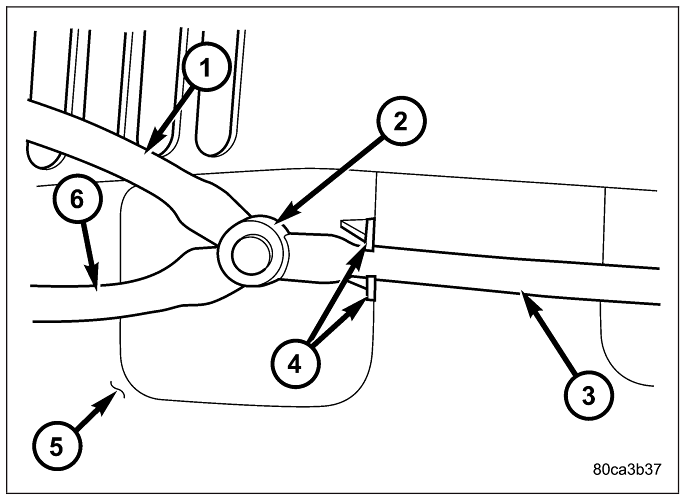
## REMOVAL

1. Unlatch and open the hood.
2. Remove both front wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - FRONT/FRONT WIPER ARM - REMOVAL).
3. Remove the cowl plenum cover/grille panel from over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - REMOVAL).
4. From the underside of the cowl plenum cover/grille panel (5), disconnect the cowl plenum (3) and washer nozzle hoses (1 & 6) from the three barbed nipples of the front check valve (2).
5. Remove the front check valve from the underside of the cowl plenum cover/grille panel.




## INSTALLATION

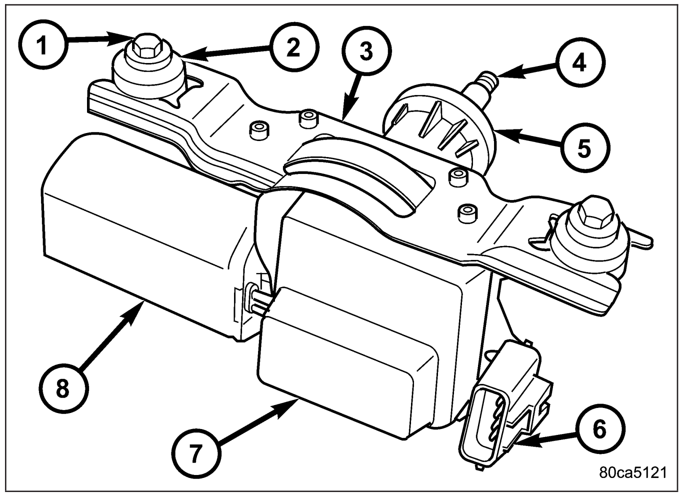
1. Position the front check valve (2) to the underside of the cowl plenum cover/grille panel (5). Be certain that the flow direction arrow molded into the front check valve body is oriented towards the front washer nozzles.
2. From the underside of the cowl plenum cover/grille panel, reconnect the cowl plenum (3) and washer nozzle hoses (1 & 6) to the three barbed nipples of the front check valve.
3. Reinstall the cowl plenum cover/grille panel over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - INSTALLATION).
4. Reinstall both front wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER ARM - INSTALLATION).
5. Close and latch the hood.



# REAR WIPER MOTOR

## DESCRIPTION

The rear wiper motor is concealed within the tailgate, below the rear flip-up glass opening and behind the tailgate inner trim panel. The end of the motor output shaft (4) that protrudes through the tailgate outer panel to drive the rear wiper arm and blade is the only visible component of the rear wiper motor. A rubber gasket (5), a bezel, and a nut secure and seal the motor output shaft to the tailgate outer panel. A molded plastic nut cover snaps onto the bezel to conceal the nut and improve appearance. An integral connector receptacle (6) connects the rear wiper motor to the vehicle electrical system through a dedicated take out and connector of the tailgate wire harness. The rear wiper motor consists of the following major components:




- **Bracket (3)** - The rear wiper motor bracket consists of a stamped steel mounting plate for the wiper motor that is secured with screws through two rubber insulators to the tailgate inner panel.
- **Rear Wiper Module (7)** - The rear wiper motor electronic controls are concealed beneath a molded plastic cover and includes the rear wiper system electronic logic and rear wiper motor electronic controls.
- **Motor (8)** - The permanent magnet rear wiper motor is secured with screws to the rear wiper motor bracket. The wiper motor includes an integral transmission, and the motor output shaft.

The rear wiper motor cannot be adjusted or repaired. If any component of the motor is inoperative or damaged, the entire rear wiper motor unit must be replaced. The motor output shaft gasket, bezel, nut, and nut cover are available for individual service replacement.

## OPERATION

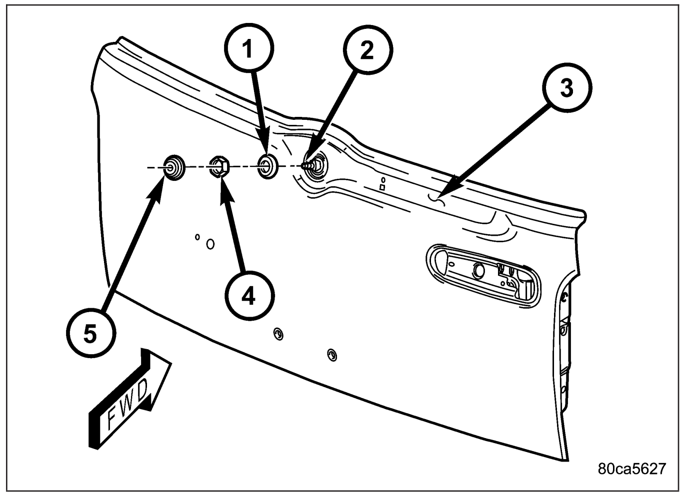
The rear wiper motor receives non-switched battery current through a fuse in the Junction Block (JB) on a fused B(+) circuit and is connected to ground at all times. The rear wiper motor operation is controlled by the vehicle operator through battery current signal inputs received by the rear wiper motor electronic control module from the rear wiper switch circuitry that is integral to the right (wiper) control stalk of the multi-function switch on the steering column. The module also receives an external control input from the flip-up glass ajar switch sense circuit. If the rear wiper module senses that the flip-up glass is ajar, it will not allow the rear wiper motor to operate.

The rear wiper module electronic control logic uses these inputs, its internal inputs, and its programming to provide a continuous wipe mode, an intermittent wipe mode, a wipe-after-wash mode, and off-the-glass wiper blade parking. The wiper blade cycling is controlled by the internal electronic controls of the module. The module controls current flow to the wiper motor brushes and provides an electronic speed control that speeds the wiper blade near the center of the glass, but slows the wiper blade during directional reversals at each end of the wipe pattern and during wiper blade off-the-glass parking for quieter operation.

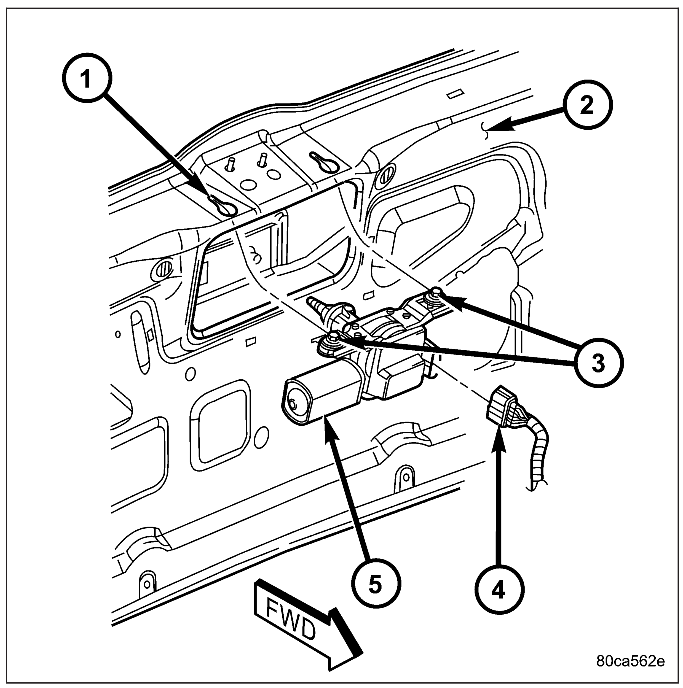
The wiper motor transmission converts the rotary output of the wiper motor to the back and forth wiping motion of the rear wiper arm and blade on the rear flip-up glass. The rear wiper motor may be diagnosed using conventional diagnostic tools and methods.

## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the rear wiper arm from the rear wiper motor output shaft. (Refer to 8 - ELECTRICAL/ REAR WIPERS/WASHERS/REAR WIPER ARM - REMOVAL).
3. Using a small thin-bladed tool, gently pry at the notch in the base of the rear wiper motor output shaft bezel (1) to unsnap the nut cover (5) from the bezel. **Be certain to take proper precautions to protect the outer tailgate panel and its paint finish from damage during this procedure.**
4. Remove the nut (4) that secures the rear wiper motor output shaft (2) to the outer tailgate panel (3).
5. Remove the bezel and gasket from the rear wiper motor output shaft.

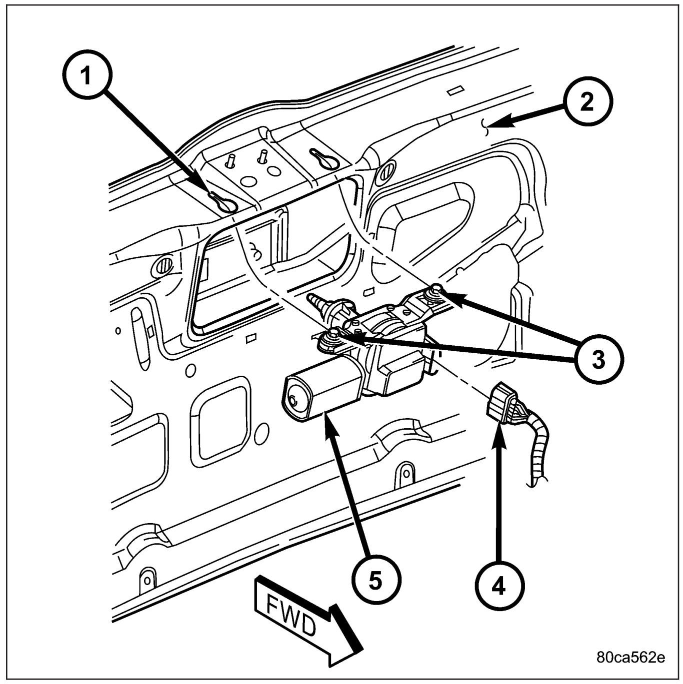



6. Remove the trim panel from the tailgate inner panel. (Refer to 23 - BODY/SWING GATE/TRIM PANEL - REMOVAL).
7. Disconnect the tailgate wire harness connector for the flip-up glass ajar switch from the flip-up glass latch connector receptacle.
8. Disconnect the tailgate wire harness connector (4) for the rear wiper motor (5) from the motor connector receptacle.
9. Loosen the two screws (3) that secure the rear wiper motor mounting bracket to the top of the tailgate inner panel (2).
10. Slide the rear wiper motor and mounting bracket forward far enough to disengage the two mounting screws from the keyed slots (1) in the top of the tailgate inner panel.
11. Remove the rear wiper motor and mounting bracket from the tailgate as a unit.

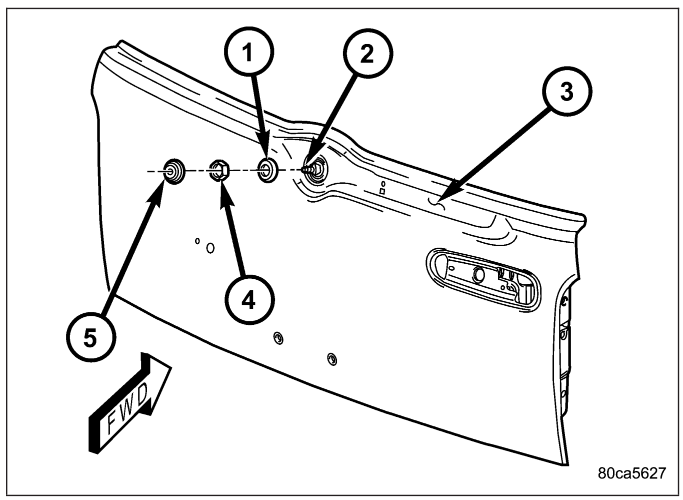


## INSTALLATION

1. Position the rear wiper motor (5) and bracket into the tailgate (2) as a unit.
2. Insert the rear wiper motor output shaft through the hole in the tailgate outer panel and engage the two mounting screws (3) into the keyed slots (1) in the top of tailgate inner panel.




3. From the outside of the tailgate (3), center the rear wiper motor output shaft (2) in the tailgate outer panel clearance hole and install the gasket and bezel (1) over the centered shaft.
4. Install and tighten the nut (4) that secures the rear wiper motor output shaft to the outer tailgate panel. Tighten the nut to 5 N·m (43 in. lbs.).
5. From the inside of the tailgate, tighten the two screws that secure the rear wiper motor mounting bracket to the top of the tailgate inner panel. Tighten the screws to 6 N·m (57 in. lbs.).
6. Reconnect the tailgate wire harness connector for the rear wiper motor to the motor connector receptacle.
7. Reconnect the tailgate wire harness connector for the flip-up glass ajar switch to the flip-up glass latch connector receptacle.

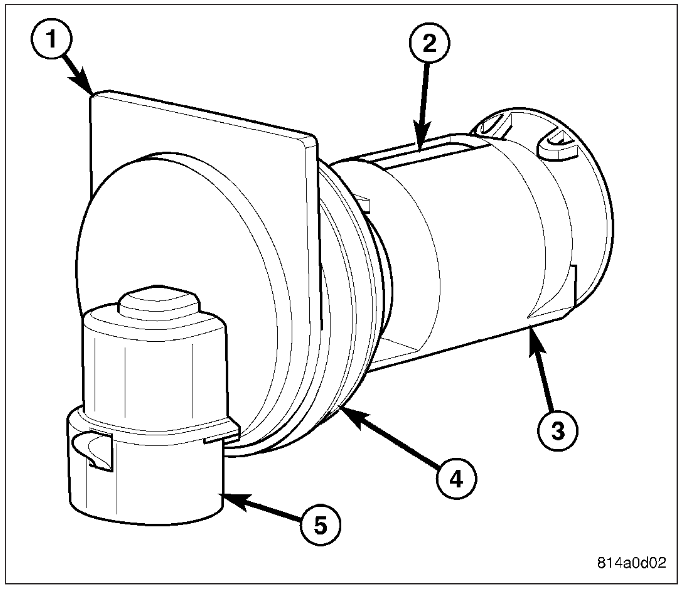



8. Reinstall the trim panel onto the tailgate inner panel. (Refer to 23 - BODY/SWING GATE/TRIM PANEL - INSTALLATION).
9. From the outside of the tailgate, press the nut cover (5) firmly and evenly over the rear wiper motor output shaft bezel using hand pressure until it snaps into place.
10. Reinstall the rear wiper arm onto the rear wiper motor output shaft. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER ARM - INSTALLATION).
11. Reconnect the battery negative cable.

# WASHER FLUID LEVEL SWITCH

## DESCRIPTION

The washer fluid level switch is a single pole, single throw reed-type switch mounted just above the sump area near the bottom of the washer reservoir. Only the molded plastic switch mounting flange (1) and the integral connector receptacle (5) are visible when the switch is installed in the reservoir. A short nipple formation (4) extends from the inner surface of the switch mounting flange, and a barb on the nipple near the switch mounting flange is pressed through a rubber grommet seal installed in the mounting hole of the reservoir.




A molded plastic float (3) rides saddle-like over a molded plastic beam that extends axially from the switch mounting flange. A small permanent magnet (2) is secured in a receptacle on the top of the float, and the reed switch is concealed within the beam. A diagnostic resistor is connected between the two switch terminals within the switch mounting flange. The washer fluid level switch cannot be adjusted or repaired. If inoperative or damaged, the switch must be replaced.

## OPERATION

The washer fluid level switch uses a float to monitor the level of the washer fluid in the washer reservoir. The float contains a small magnet. When the float moves, the proximity of this magnet to a stationary reed switch within the beam formation of the switch changes. When the fluid level in the washer reservoir is at or above the float level, the float rises and the influence of the float magnetic field is removed from the reed switch causing the normally open reed switch contacts to open. When the fluid level in the washer reservoir falls below the level of the float, the float falls and the influence of the float magnetic field is applied to the reed switch, causing the contacts of the normally open reed switch to close.

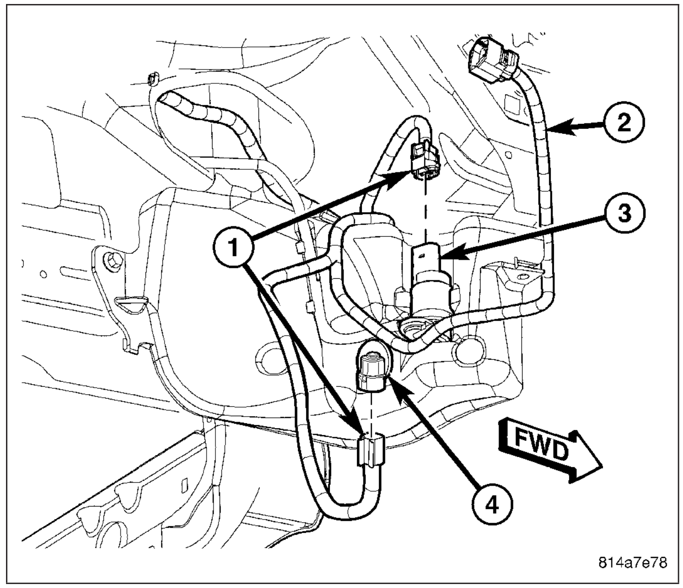
The washer fluid level switch is connected to the vehicle electrical system through a dedicated take out and connector of the headlamp and dash wire harness. The switch is connected in series between ground and the washer fluid switch sense input to the ElectroMechanical Instrument Cluster (EMIC). The switch receives a path to ground at all times through another take out of the headlamp and dash wire harness with a single eyelet terminal connector that is secured under a ground screw near the front of the left front fender inner shield in the engine compartment. When the switch closes, the EMIC senses the ground on the washer fluid switch sense circuit. The EMIC is programmed to respond to this input by illuminating the washer fluid indicator and by sounding an audible chime tone warning.

The washer fluid level switch input to the EMIC may be diagnosed using conventional diagnostic tools and methods. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/WASHER FLUID INDICATOR - DIAGNOSIS AND TESTING).

## REMOVAL

**NOTE: The washer fluid level switch can be removed from the washer reservoir without removing the reservoir from the vehicle.**

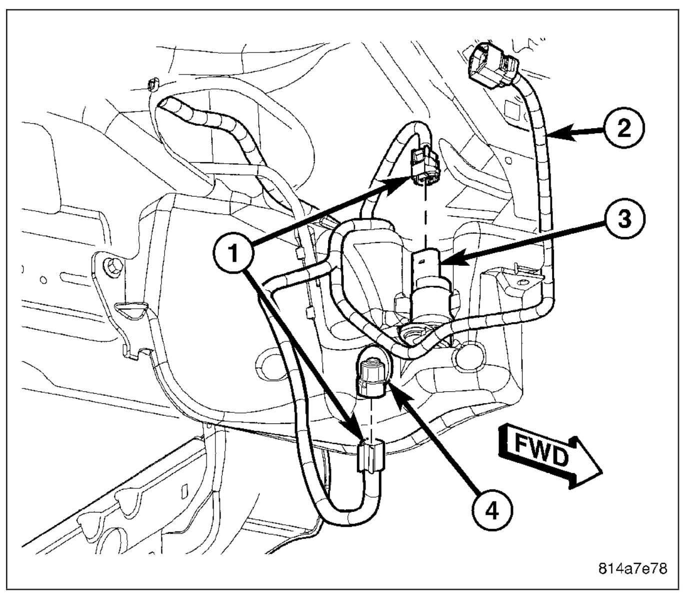
1. Disconnect and isolate the battery negative cable.
2. Siphon the washer fluid from the washer reservoir into a clean container for reuse.
3. Turn the steering wheel to move the front wheels to the full right position.
4. Raise and support the vehicle.
5. Remove the plastic push-in fasteners that secure the forward end of the front wheelhouse splash shield to the inner fender panel and the front fascia. (Refer to 23 - BODY/EXTERIOR/FRONT WHEELHOUSE SPLASH SHIELD - REMOVAL).
6. Pull the forward end of the front wheelhouse splash shield away from the inner fender panel and front fascia far enough to access the washer fluid level switch (4) for service.
7. Disconnect the headlamp and dash wire harness (2) connector (1) for the washer fluid level switch from the switch connector receptacle.




8. Using a trim stick or another suitable wide flat-bladed tool, gently pry the barbed nipple of the washer fluid level switch out of the rubber grommet seal on the reservoir just above the sump. Care must be taken not to damage the reservoir.
9. Remove the washer fluid level switch from the washer reservoir.
10. Remove the rubber grommet seal from the washer fluid level switch mounting hole in the washer reservoir and discard.

## INSTALLATION

1. Install a new rubber grommet seal into the washer fluid level switch mounting hole in the washer reservoir. Always use a new rubber grommet seal on the reservoir.
2. Insert the float of the washer fluid level switch (4) through the rubber grommet seal and into the washer reservoir. The connector receptacle of the washer fluid level switch should be pointed downward.
3. Using hand pressure, press firmly and evenly on the washer fluid level switch mounting flange until the barbed nipple is fully seated in the rubber grommet seal in the washer reservoir mounting hole.
4. Reconnect the headlamp and dash wire harness (2) connector (1) for the washer fluid level switch to the switch connector receptacle.
5. Reposition the forward end of the front wheelhouse splash shield to the inner fender panel and the front fascia.



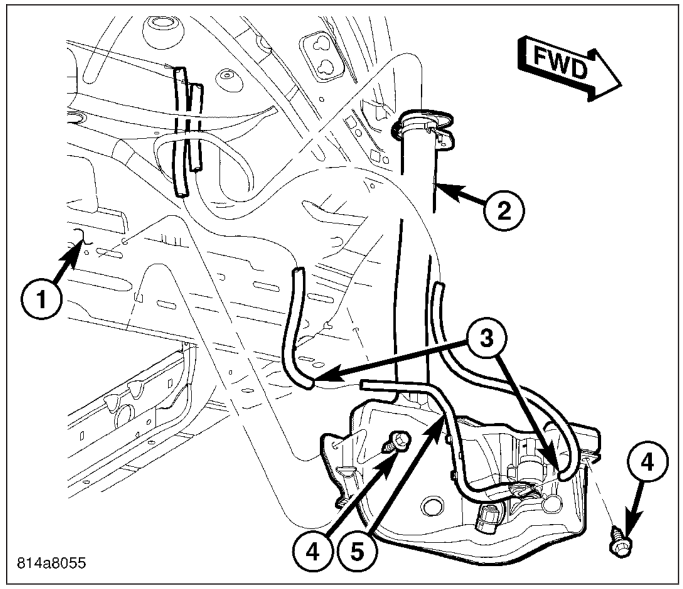

6. Reinstall the plastic push-in fasteners that secure the front wheelhouse splash shield to the inner fender panel and the front fascia. (Refer to 23 - BODY/EXTERIOR/FRONT WHEELHOUSE SPLASH SHIELD - INSTALLATION).
7. Lower the vehicle.
8. Reconnect the battery negative cable.
9. Refill the washer reservoir with the washer fluid siphoned from the reservoir during the removal procedure.

# WASHER HOSES/TUBES

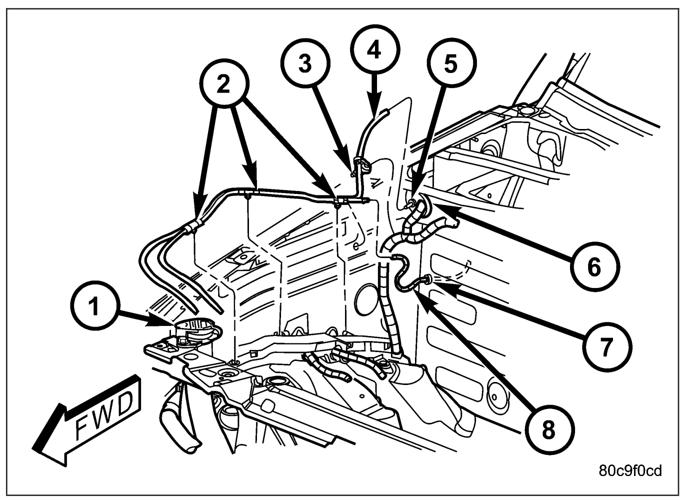
## DESCRIPTION

### FRONT

The front washer plumbing consists of a small diameter rubber hose (3) that is routed from the barbed outlet nipple of the reversible electric washer pump/motor unit on the washer reservoir (2) and along the reservoir filler neck into the engine compartment.



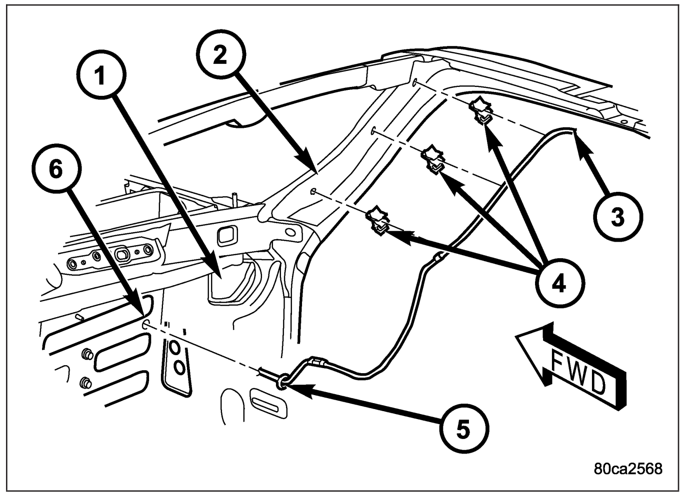

Within the engine compartment, the front washer hose (4) is routed side by side with the engine compartment rear washer hose along the top of the right front fender wheel house to the dash panel. Molded plastic routing clips (2) secure the hoses to the headlamp and dash wire harness in the engine compartment. The front washer hose is connected in the engine compartment to the barbed nipple of a molded plastic in-line fitting (5) installed through a rubber grommet (6) in a hole in the right side of the dash plenum panel. The barbed nipple of the in-line fitting protrudes through the other side of the rubber grommet into the cowl plenum area, where the cowl plenum washer hose joins the front washer hose to the front check valve/wye fitting.




The cowl plenum washer hose is routed through integral routing clips on the underside of the cowl plenum cover/grille panel to the molded plastic wye fitting. The cowl plenum washer hose is connected to one nipple on the wye fitting and the two washer nozzle hoses are connected to the other two wye fitting nipples. The washer nozzle hoses are then routed along the underside of the cowl plenum cover/grille panel to the two front washer nozzles.

Washer hose is available for service only as roll stock, which must then be cut to length. The molded plastic washer hose fittings cannot be repaired. If these fittings are inoperative or damaged, they must be replaced.

## REAR




The rear washer plumbing consists of small diameter rubber hose routed from the barbed outlet nipple of the reversible electric washer pump/motor unit on the washer reservoir through a trough molded into the reservoir rearward of the washer pump up to the top of the reservoir. Near the base of the reservoir filler neck an in-line plastic fitting connects the reservoir rear washer hose to the engine compartment rear washer hose, which is routed through the reservoir filler neck opening in the front extension of the right front fender wheel house panel in to the engine compartment. The engine compartment rear washer hose is routed side by side with the front washer hose along the top of the right front fender wheel house to the dash panel. Molded plastic routing clips secure the hoses to the headlamp and dash wire harness in the engine compartment.

The engine compartment rear washer hose is connected to the headliner washer hose (3) near the right side of the dash panel with a molded plastic in-line fitting. The headliner hose has a rubber grommet (5) that allows it to pass through the dash panel from the passenger compartment into the engine compartment. The headliner hose is routed below the instrument panel in the passenger compartment near the right cowl side inner panel (1). The hose is routed up the right A-pillar (2) to the headliner. Mounting clips (4) secure the hose to the A-pillar. The headliner hose is glued to top of the headliner and routed along the right roof side rail to the rear of the vehicle. At the rear of the vehicle, the headliner hose passes through a hole at the rear portion of the roof rear inner header panel and is connected to the rear washer nozzle.

Washer hose is available for service only as roll stock, which must then be cut to length. The headliner washer hose is integral to the headliner unit and, if inoperative or damaged, the headliner unit must be replaced. However, the headliner hose is marked with a white cut line on the A-pillar where the hose should be cut and spliced with a plastic in-line connector fitting to facilitate headliner removal without the need to remove the instrument panel. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL AND INSTALLATION). The molded plastic washer hose fittings cannot be repaired. If these fittings are inoperative or damaged, they must be replaced.

## OPERATION

## FRONT

Washer fluid in the washer reservoir is pressurized and fed by the washer pump/motor through the front washer system plumbing and fittings to the two front washer nozzles. Whenever routing the washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts; and, sharp bends that might pinch the hose must be avoided.

## REAR

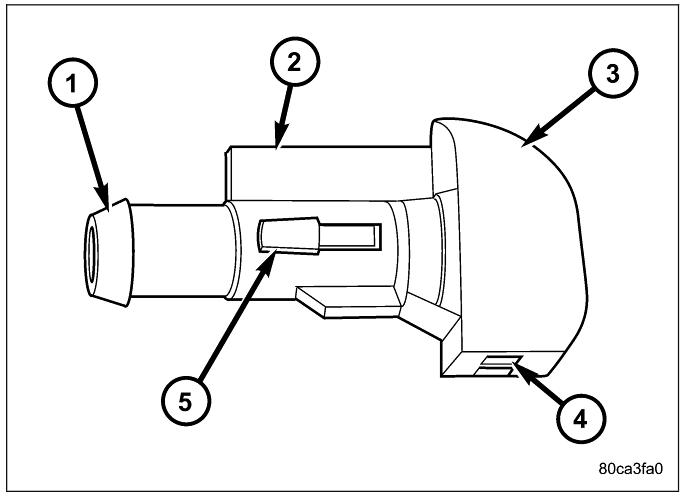
Washer fluid in the washer reservoir is pressurized and fed by the washer pump/motor through the rear washer system plumbing and fittings to the rear washer nozzle located on the roof panel above the rear flip-up glass opening. Whenever routing the washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts; and, sharp bends that might pinch the hose must be avoided.

# WASHER NOZZLE

## DESCRIPTION

### FRONT

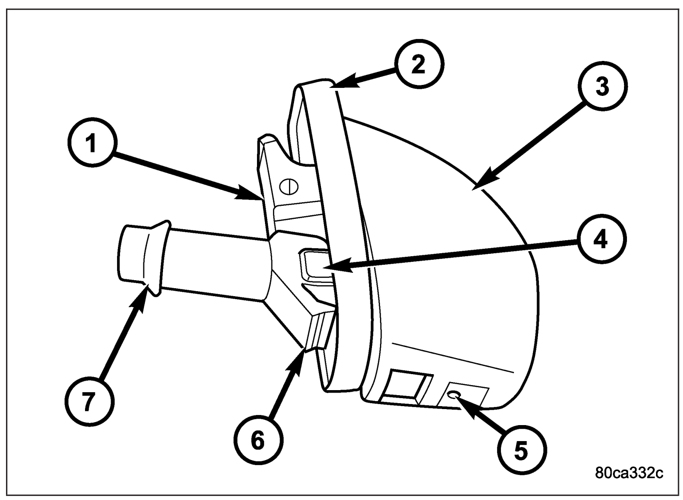
The two front washer nozzles (3) have integral latch features (5) and an anti-rotation tab (2) that secure them in dedicated holes in the cowl plenum cover/grille panel located near the base of the windshield. The domed upper surface of the washer nozzle is visible on the top of the plenum cover/grille panel, and the nozzle orifice (4) is oriented towards the windshield glass. The washer plumbing fittings (1) for the washer nozzles are concealed beneath the cowl plenum cover/grille panel. These fluidic washer nozzles are constructed of molded plastic.




The cowl plenum cover/grille panel must be removed from the vehicle to access the nozzles for service. The washer nozzles cannot be adjusted or repaired. If inoperative or damaged, they must be replaced.

### REAR

The rear washer nozzle (3) is a fluidic-type unit constructed of molded plastic. The nozzle is secured by a snap fit in a dedicated mounting hole located in the rear edge of the roof panel above the rear flip-up glass opening and to the right of the Center High Mounted Stop Lamp (CHMSL) unit. The nozzle orifice (5) is oriented downward toward the glass. A rubber gasket (2) on the back of the nozzle seals the nozzle to the roof panel opening. The back of the nozzle includes an integral alignment feature (4) on the left side, an integral engagement tab (1) on the top, an integral latch feature (6) on the bottom, and the washer plumbing nipple (7) which are all concealed between the outer roof panel and the rear roof inner header.




The rear washer nozzle latch feature is a one time component, and will be damaged if the nozzle is removed from its mounting hole for service. The rear washer nozzle cannot be adjusted or repaired. If inoperative or damaged, the entire nozzle unit must be replaced.

## OPERATION

### FRONT

The two front washer nozzles are designed to dispense washer fluid into the wiper pattern area on the outside of the windshield glass. Pressurized washer fluid is fed to each nozzle from the washer reservoir by the washer pump/motor unit through a single hose, which is attached to a barbed nipple on each front washer nozzle below the cowl plenum cover/grille panel. A fluidic matrix within the washer nozzle causes the pressurized washer fluid to be emitted from the nozzle orifice as an oscillating stream to more effectively cover a larger area of the glass to be cleaned.

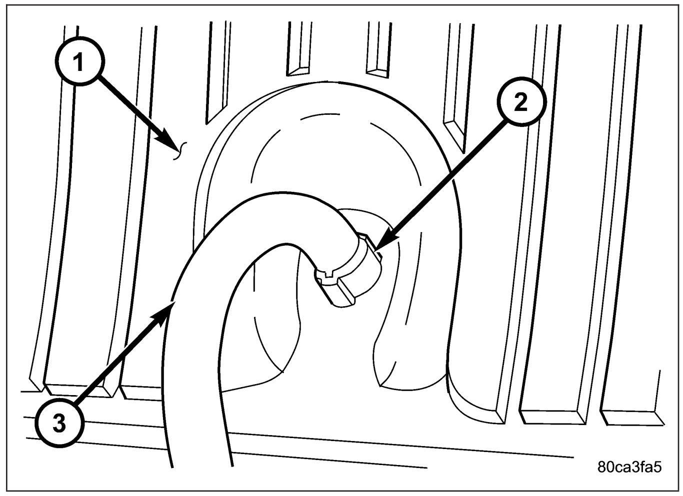
## REAR

The rear washer nozzle is designed to dispense washer fluid into the wiper pattern area on the outside of the rear flip-up glass. Pressurized washer fluid is fed to the nozzle from the washer reservoir by the washer pump/motor through a single hose, which is attached to a barbed nipple on the back of the rear washer nozzle. A fluidic matrix within the washer nozzle causes the pressurized washer fluid to be emitted from the nozzle orifice as an oscillating stream to more effectively cover a larger area of the glass to be cleaned.

## REMOVAL

## FRONT

1. Unlatch and open the hood.
2. Remove both front wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER ARM - REMOVAL).
3. Remove the cowl plenum cover/grille panel from over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - REMOVAL).
4. From the underside of the cowl plenum cover/grille panel (1), disconnect the washer nozzle hose (3) from the barbed nipple of the front washer nozzle (2).
5. From the underside of the cowl plenum cover/grille panel, release the integral latch features of the front washer nozzle and push the nozzle out through the mounting hole toward the top side of the cowl plenum cover/grille panel.

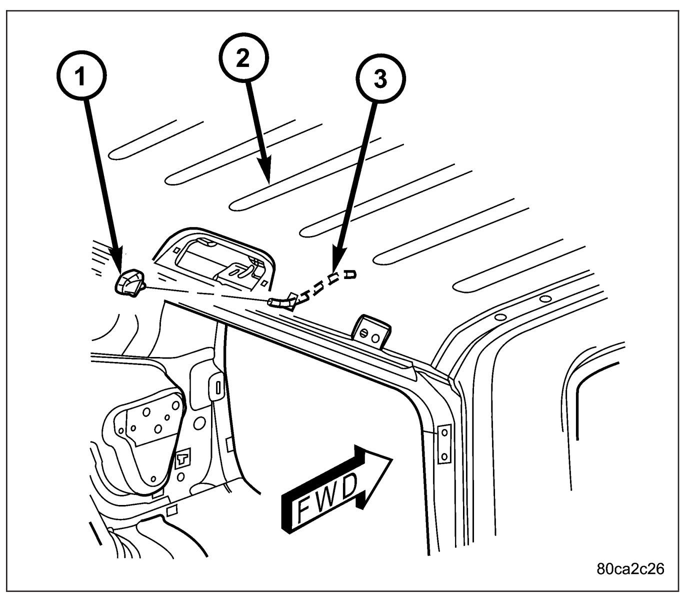



6. Remove the front washer nozzle from the top of the cowl plenum cover/grille panel.

## REAR

**NOTE: The rear washer nozzle latch feature is a one time component, and will be damaged if the nozzle is removed from its mounting hole for service. If removed from its mounting hole for any reason, the rear washer nozzle must be replaced with a new unit.**

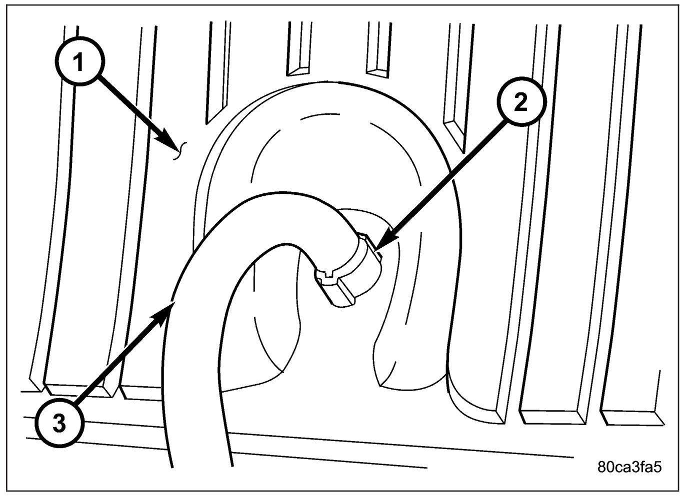
1. Using a trim stick or another suitable wide flat-bladed tool, gently pry the bottom of the rear washer nozzle (1) away from the roof panel (2) until the latch feature at the bottom of the nozzle that secures it in the mounting hole of the roof panel unsnaps.
2. Pull the rear washer nozzle out from the roof panel far enough to access the headliner washer hose (3).
3. Disconnect the washer hose from the barbed nipple on the back of the rear washer nozzle.
4. Discard the rear washer nozzle.



# INSTALLATION

## FRONT

1. From the top of the cowl plenum cover/grille panel, position the nipple end of the front washer nozzle (2) through the mounting hole and engage the anti-rotation tab of the nipple into the anti-rotation notch in the mounting hole.
2. Push firmly and evenly on the top of the front washer nozzle until the integral latch features lock into place on the underside of the cowl plenum cover/grille panel (1).
3. From the underside of the cowl grille cover, reconnect the washer hose (3) to the barbed nipple of the front washer nozzle.
4. Reinstall the washer hose for the front washer nozzle into its routing clips on the underside of the cowl plenum cover/grille panel.

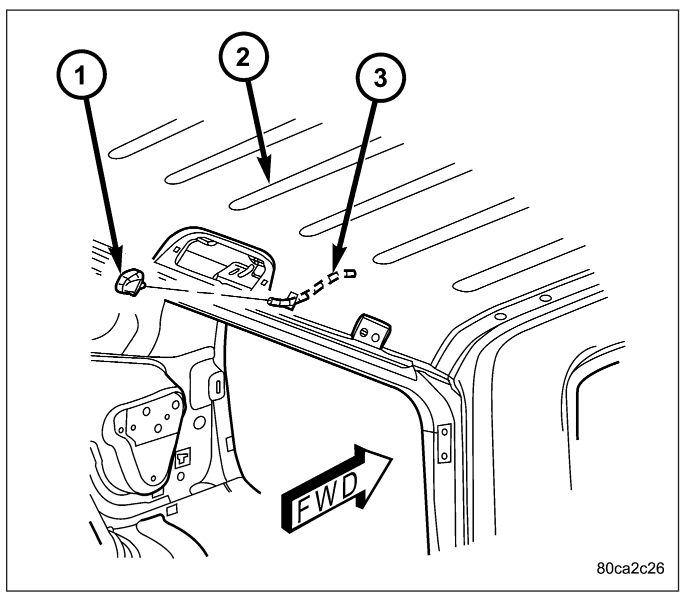



5. Reinstall the cowl plenum cover/grille panel over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - INSTALLATION).
6. Reinstall both front wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER ARM - INSTALLATION).
7. Close and latch the hood.

## REAR

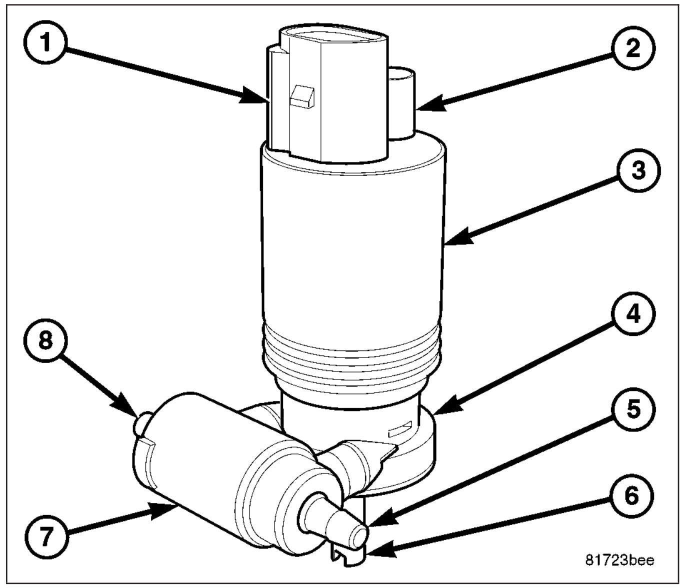
**NOTE: The rear washer nozzle latch feature is a one time component, and will be damaged if the nozzle is removed from its mounting hole for service. If removed from its mounting hole for any reason, the rear washer nozzle must be replaced with a new unit.**

1. Position the new rear washer nozzle (1) to the mounting hole in the roof panel (2). Be certain that a new rubber gasket is in position on the back of the nozzle.
2. Reconnect the headliner washer hose (3) to the barbed nipple on the back of the rear washer nozzle.
3. Insert the rear washer nozzle and hose into the mounting hole in the roof panel and align the nozzle with the hole.
4. Engage the tab at the top of the nozzle behind the sheet metal at the top of the roof panel mounting hole.
5. Using hand pressure, press firmly and evenly on the hood of the rear washer nozzle until the lower latch feature snaps into place behind the sheet metal at the bottom of the roof panel mounting hole.



# WASHER PUMP/MOTOR

## DESCRIPTION



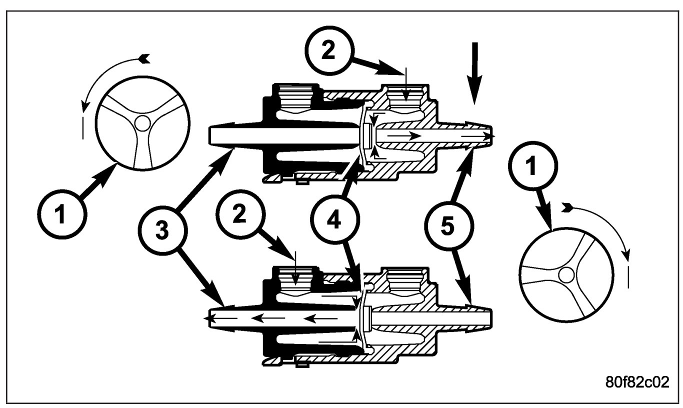

The washer pump/motor unit is located on the top of a sump area of the washer reservoir, on the outboard side of the right front frame rail ahead of the right front wheel house splash shield. A small permanently lubricated and sealed reversible electric motor (3) is coupled to the rotor-type washer pump (4). The use of an integral valve body (7) allows the washer pump/motor unit to provide washer fluid to either the front or the rear washer systems, depending upon the direction of the motor/pump impeller rotation.

An inlet nipple (6) on the pump housing passes through a rubber grommet seal/filter screen installed in a dedicated mounting hole of the washer reservoir sump. The filter screen prevents most debris from entering the pump housing. When the pump is installed in the reservoir the front barbed outlet nipple (5) on the pump valve body housing connects the unit to the front washer hose, and the rear barbed outlet nipple (8) connects the unit to the rear washer hose. The letters “F” and “R” molded into the valve body housing adjacent to each nipple provide further clarification of the nipple assignments.

The washer pump/motor unit is retained on the reservoir by the interference fit between the pump inlet nipple and the grommet seal, which is a light press fit. The top of the washer pump is also secured to the washer reservoir by the use of a snap fit between the motor housing and a receptacle molded into the reservoir that allows for mounting of the washer pump without the use of fasteners. An integral connector receptacle (1) on the top of the motor housing connects the unit to the vehicle electrical system through a dedicated take out and connector of the headlamp and dash wire harness.

The washer pump/motor unit cannot be repaired. If inoperative or damaged, the entire washer pump/motor unit must be replaced.

## OPERATION




The washer pump/motor unit features a reversible electric motor. The direction of the motor is controlled by hard wired outputs from the momentary front and rear washer switch circuitry contained within the right (wiper) control stalk of the multi-function switch. When battery current and ground are applied to the two pump motor terminals, the motor rotates in one direction. When the polarity of these connections is reversed, the motor rotates in the opposite direction.

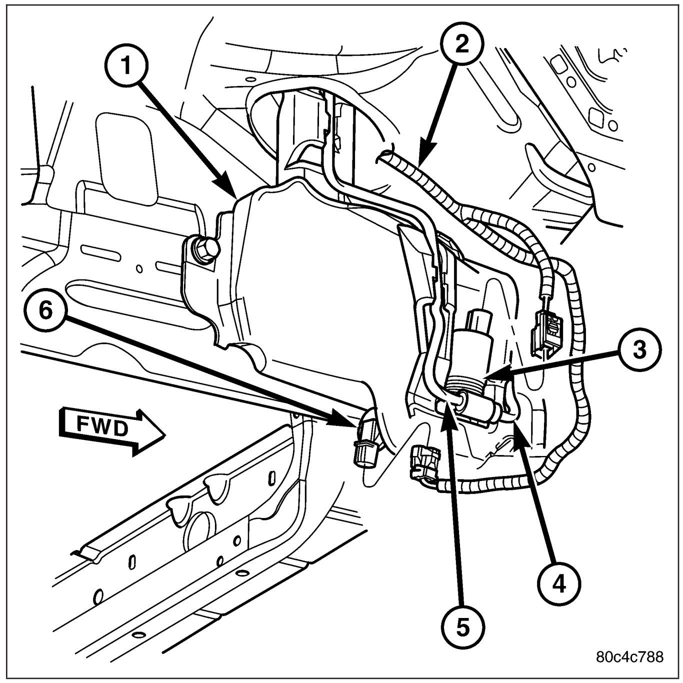
When the pump motor is energized, the rotor-type pump pressurizes the washer fluid and forces it through one of the two pump outlet nipples, and into the front or rear washer plumbing. Washer fluid is drawn through the pump inlet nipple from the washer reservoir to the inlet port of the washer pump housing. An integral valve body is located in a housing on the outlet port side (2) of the pump housing. A diaphragm (4) in this valve body controls which washer system plumbing receives the washer fluid being pressurized by the pump. When the pump is not operating the diaphragm is biased to close all washer fluid flow in the rear washer system and, in this way it also performs the function of the rear washer system check valve.

When the pump impeller (1) rotates in the counterclockwise direction (viewed from the bottom), the biased diaphragm is sealing off the rear washer system outlet and nipple so the pressurized washer fluid is pushed out through the pump front outlet port and the front washer outlet nipple (5). When the pump impeller rotates in the clockwise direction (viewed from the bottom), pressurized washer fluid is pushed out through the pump rear outlet port and moves the diaphragm to open the rear washer outlet nipple and seal off the front washer outlet nipple, then the pressurized washer fluid is pushed out through the rear washer outlet nipple (3).

The washer pump/motor unit may be diagnosed using conventional diagnostic tools and methods.

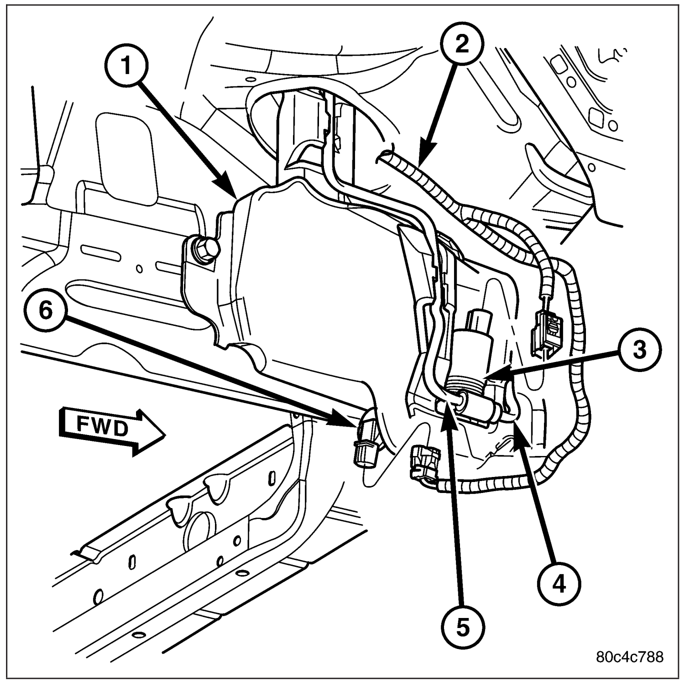
## REMOVAL

**NOTE: The washer pump/motor can be removed from the washer reservoir without removing the reservoir from the vehicle.**




1. Disconnect and isolate the battery negative cable.
2. Siphon the washer fluid from the washer reservoir into a clean container for reuse.
3. Turn the steering wheel to move the front wheels to the full right position.
4. Raise and support the vehicle.
5. Remove the plastic push-in fasteners that secure the forward end of the front wheelhouse splash shield to the inner fender panel and the front fascia. (Refer to 23 - BODY/EXTERIOR/FRONT WHEELHOUSE SPLASH SHIELD - REMOVAL).
6. Pull the forward end of the front wheelhouse splash shield away from the inner fender panel and front fascia far enough to access the washer pump/motor for service.
7. Disconnect the two washer hoses (4 and 5) from the two washer pump/motor unit (3) outlet nipples.
8. Disconnect the headlamp and dash wire harness (2) connector from the washer pump/motor unit connector receptacle on the top of the motor housing.
9. Firmly grasp the top of the washer pump/motor housing and pull it lightly outward from the washer reservoir far enough to disengage the top of the motor from the receptacle in the reservoir. Care must be taken not to damage the reservoir.
10. Pull the washer pump/motor unit straight up and out of the washer reservoir far enough to disengage the inlet nipple from the rubber grommet seal/filter screen in the reservoir.
11. Remove the rubber grommet seal/filter screen for the washer pump from the pump mounting hole in the washer reservoir and discard.

## INSTALLATION

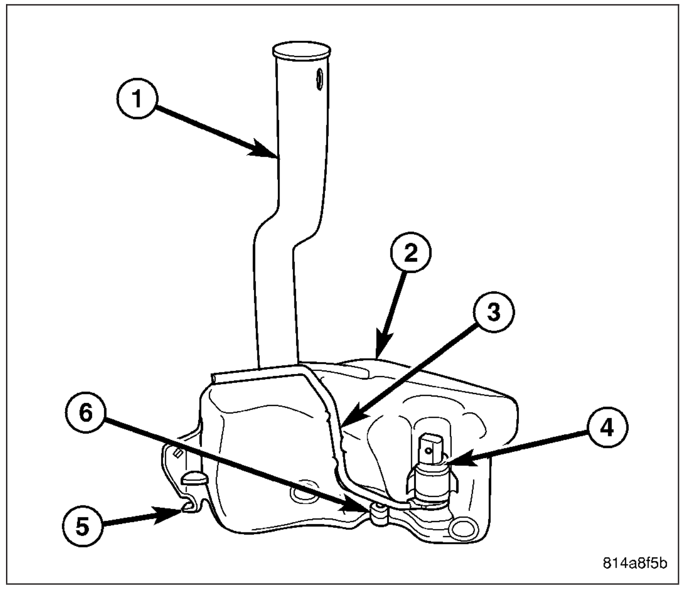



1. Install a new rubber grommet seal/filter screen unit into the washer pump mounting hole in the washer reservoir. Always use a new rubber grommet seal/filter screen on the reservoir.
2. Position the inlet nipple of the washer pump (3) to the rubber grommet seal/filter screen in the washer reservoir (1).
3. Using hand pressure, press firmly and evenly downward on the washer pump/motor unit until the inlet nipple is fully seated in the rubber grommet seal/filter screen in the pump mounting hole of the reservoir.
4. Align the top of the washer pump/motor housing with the receptacle in the washer reservoir.
5. Using hand pressure, press firmly and evenly on the top of washer pump/motor unit until the motor housing snaps into the reservoir receptacle.
6. Reconnect the headlamp and dash wire harness (2) connector for the washer pump/motor unit to the connector receptacle on the top of the motor housing.
7. Reconnect the front and rear washer hoses to the two barbed pump outlet nipples. Be certain that the hose in the trough on the reservoir located behind the pump is connected to the rear (black) nipple, and the hose in front of the pump is connected to the front (blue) nipple.
8. Reposition the forward end of the front wheelhouse splash shield to the inner fender panel and the front fascia.
9. Reinstall the plastic push-in fasteners that secure the front wheelhouse splash shield to the inner fender panel and the front fascia. (Refer to 23 - BODY/EXTERIOR/FRONT WHEELHOUSE SPLASH SHIELD - INSTALLATION).
10. Lower the vehicle.
11. Reconnect the battery negative cable.
12. Refill the washer reservoir with the washer fluid siphoned from the reservoir during the removal procedure.

# WASHER RESERVOIR

## DESCRIPTION

A single washer fluid reservoir (2) is used for both the front and rear washer systems. The molded plastic washer fluid reservoir is mounted on the outboard side of the right front frame rail in front of the right front wheel, where it is concealed by the right front wheel house splash shield. The only visible component of the washer reservoir is the filler neck (1) and cap unit, which extends through a hole in the right front wheel house extension panel into the engine compartment. A bright yellow plastic filler cap with an integral bail strap and filler neck mounting bracket is labeled with an International Control and Display Symbol icon for “Windshield Washer.” The cap snaps over the open end of the filler neck.




There is a dedicated hole in the top of a ledge-like sump area of the reservoir provided for the mounting of the washer pump/motor unit (4), and another dedicated hole inboard of the pump for the washer fluid level switch (6). A receptacle molded into the reservoir allows for mounting of the washer pump without the use of fasteners. The reservoir also features an integral rear hose routing trough (3) on its outboard side. The washer reservoir is secured to the outboard side of the right front frame rail by two screws and an integral molded hook tab (5) that engages in a slot in the right front frame rail. A blind rivet secures the reservoir filler neck bracket to the upper radiator cross-member in the front of the engine compartment. The forward end of the right front fender wheel house splash shield must be removed to access the washer reservoir for service.

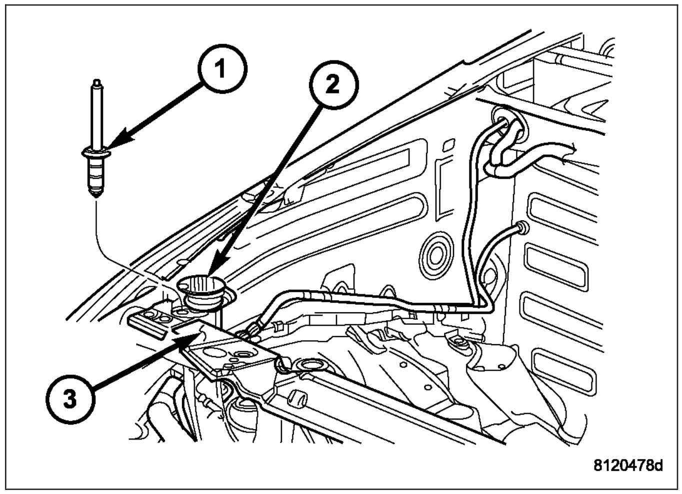
The washer reservoir cannot be repaired and, if inoperative or damaged, it must be replaced. The washer reservoir, the grommet seal/filter screen for the washer pump/motor unit, the grommet seal for washer fluid level switch, and the filler cap are each available for individual service replacement.

## OPERATION

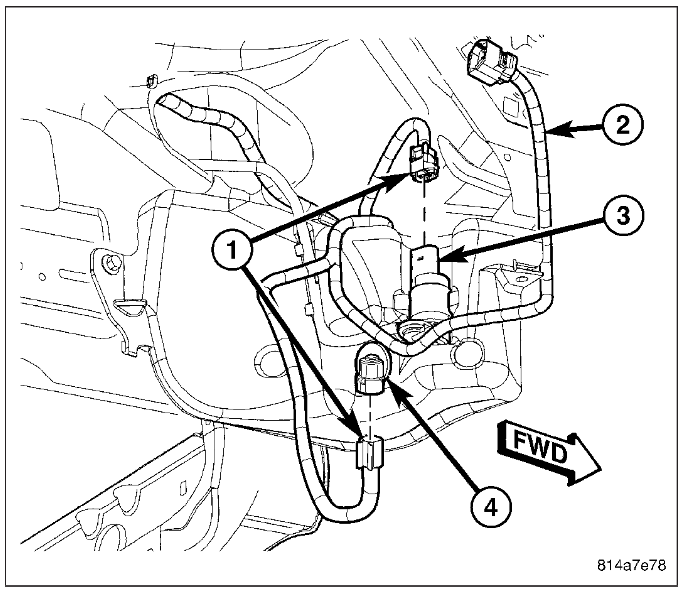
The washer fluid reservoir provides a secure, on-vehicle storage location for a large reserve of washer fluid for operation of the front and rear washer systems. The washer reservoir filler neck provides a clearly marked and readily accessible point from which to add washer fluid to the reservoir. The washer/pump motor unit is located in a sump area near the front of the reservoir to be certain that washer fluid will be available to the pump as the fluid level in the reservoir becomes depleted. The washer pump/motor unit is mounted above the lowest position in the sump. The washer fluid level switch is mounted just above the sump area of the reservoir so that there will be adequate warning to the vehicle operator that the washer fluid level is low, before the washer system will no longer operate.

## REMOVAL

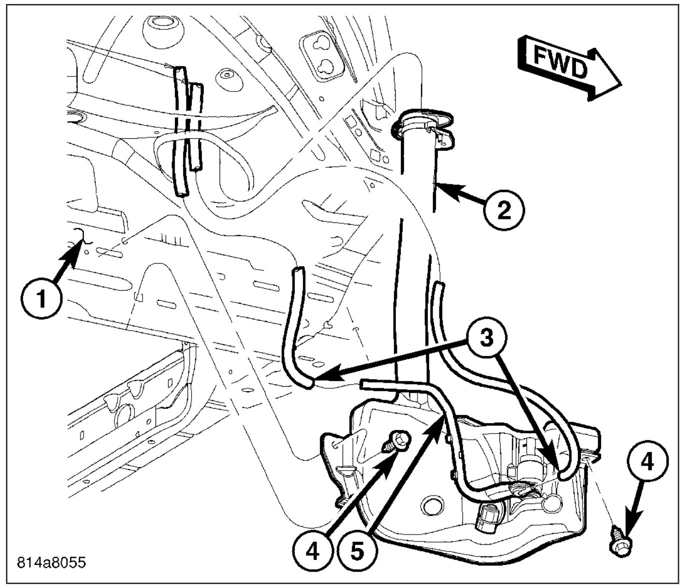
1. Disconnect and isolate the battery negative cable.
2. Siphon the washer fluid from the washer reservoir into a clean container for reuse.
3. Turn the steering wheel to move the front wheels to the full right position.
4. Remove the air cleaner housing from the top of the right front fender wheel house. (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - REMOVAL).
5. Remove the blind rivet (1) that secures the washer reservoir filler neck support bracket (2) to the upper radiator crossmember (3).




6. Raise and support the vehicle.
7. Remove the plastic push-in fasteners that secure the forward end of the front wheelhouse splash shield to the inner fender panel and the front fascia. (Refer to 23 - BODY/EXTERIOR/FRONT WHEELHOUSE SPLASH SHIELD - REMOVAL).
8. Pull the forward end of the front wheelhouse splash shield away from the inner fender panel and front fascia far enough to access the washer reservoir for service.
9. Disconnect the headlamp and dash wire harness (2) connector (1) for the washer pump/motor unit from the connector receptacle on the top of the motor housing (3).
10. Disconnect the headlamp and dash wire harness connector for the washer fluid level switch from the switch connector receptacle (4).

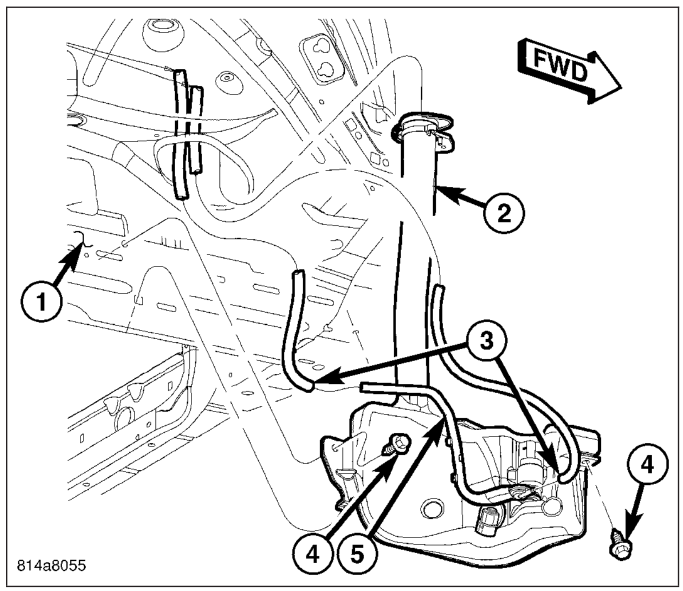


11. Disconnect the two washer hoses (3 & 5) from the two washer pump/motor unit outlet nipples.
12. Disengage the rear washer hose from the integral washer reservoir trough.
13. Remove the two screws (4) that secure the washer reservoir to the right front frame rail (1).
14. Disengage the hook tab at the back of the washer reservoir from the slot in the right front frame rail.
15. Lower the washer reservoir far enough for the filler neck (2) to be removed from the clearance hole in the right front fender wheel house panel extension.
16. Remove the washer reservoir from the right front fender wheel house.



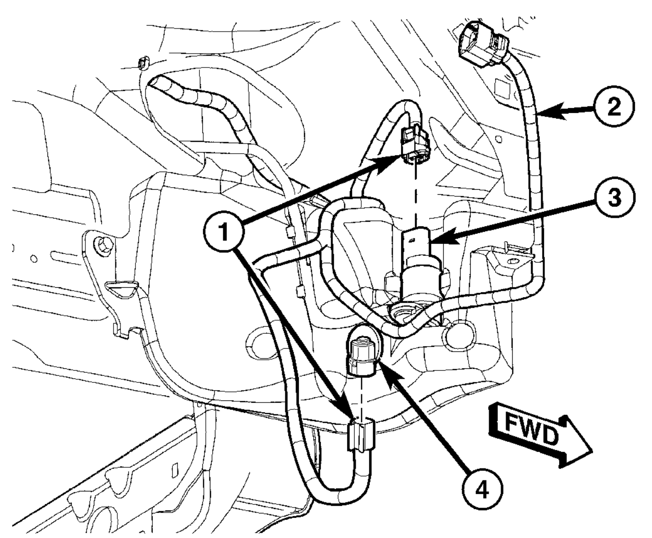

## INSTALLATION

1. Position the washer reservoir into the right front fender wheel house.
2. Insert the washer reservoir filler neck (2) through the clearance hole in the right front fender wheel house panel extension.
3. Raise the washer reservoir far enough to engage the hook tab at the back of the reservoir into the slot in the right front frame rail (1).
4. Install and tighten the two screws (4) that secure the reservoir to the right front frame rail. Tighten the screws to 7 N·m (65 in. lbs.).
5. Engage the rear washer hose (5) into the integral washer reservoir trough. Be certain that the rear washer hose is routed rearward of the washer pump/motor unit, and the front washer hose is routed forward of the washer pump/motor unit. The rear washer hose can be identified by an in line hose connector that joins the reservoir hose to the engine compartment hose located near the top of main body of the reservoir.



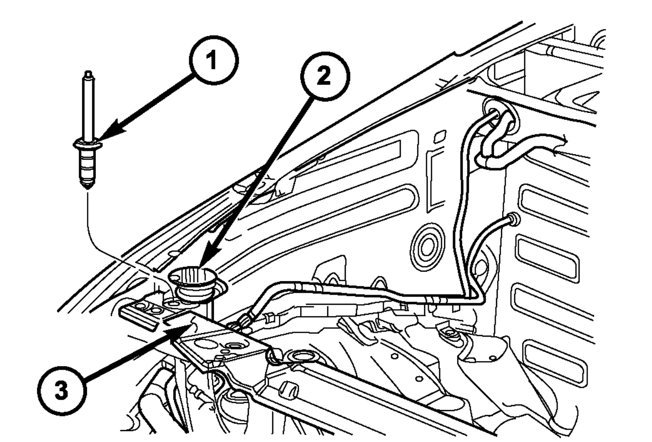

6. Reconnect the front and rear washer hoses (3) to the washer pump/motor outlet nipples. Be certain that the rear washer hose in the trough rearward of the washer pump/motor unit is connected to the rear (black) nipple, and the hose forward of the washer pump/motor is connected to the front (blue) nipple.

7. Reconnect the headlamp and dash wire harness (2) connector (1) for the washer fluid level switch to the switch connector receptacle (4).
8. Reconnect the headlamp and dash wire harness connector for the washer pump/motor to the connector receptacle (3) on the top of the motor housing.
9. Reposition the forward end of the front wheelhouse splash shield to the inner fender panel and the front fascia.
10. Reinstall the plastic push-in fasteners that secure the front wheelhouse splash shield to the inner fender panel and the front fascia. (Refer to 23 - BODY/EXTERIOR/FRONT WHEELHOUSE SPLASH SHIELD - INSTALLATION).
11. Lower the vehicle.



814a7e78

12. Install a new blind rivet (1) to secure the washer reservoir filler neck support bracket (2) to the upper radiator crossmember (3).
13. Reinstall the air cleaner housing onto the top of the right front fender wheel house. (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - INSTALLATION).
14. Reconnect the battery negative cable.
15. Refill the washer reservoir with the washer fluid siphoned from the reservoir during the removal procedure.



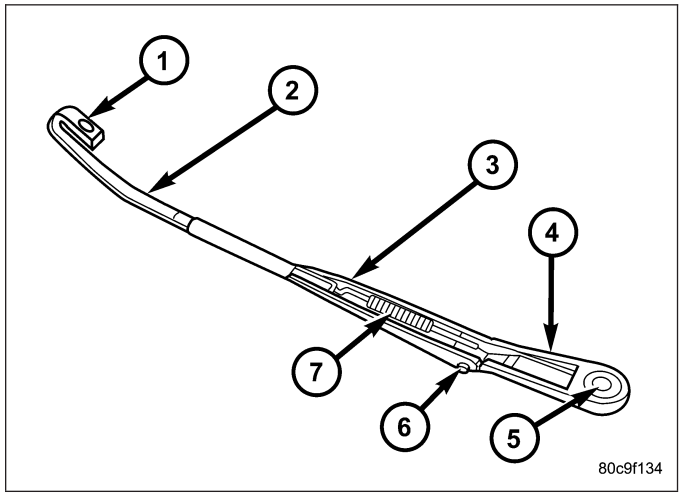
8120478d

# WIPER ARM

## DESCRIPTION

### FRONT

The front wiper arms are the rigid members located between the wiper pivots that protrude from the cowl plenum cover/grille panel near the base of the windshield and the wiper blades on the windshield glass. These wiper arms feature an over-center hinge that allows easy access to the windshield glass for cleaning. The wiper arm has a die cast metal pivot end (4) with a large tapered mounting hole (5) at one end. A molded black plastic cap fits over the wiper arm retaining nut to conceal the nut and this mounting hole following wiper arm installation.

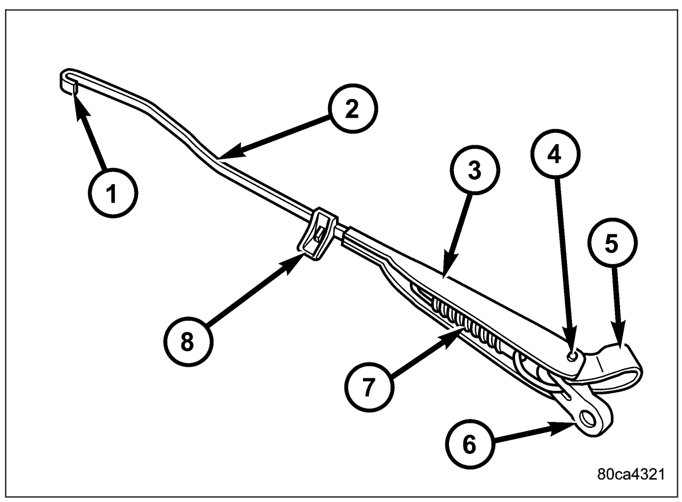



The wide end of a tapered, stamped steel channel (3) hinges on and is secured with a hinge pin (6) to the blade end of the wiper arm pivot end. One end of a long, rigid, stamped steel strap (2) with a small hole near its pivot end is riveted and crimped within the narrow end of the stamped steel channel. The tip of the wiper blade end of this strap is bent back under itself to form a small hook (1). Concealed within the stamped steel channel, one end of a long tension spring (7) is engaged with a wire hook on the underside of the die cast pivot end, while the other end of the spring is hooked through the small hole in the steel strap. The entire wiper arm has a satin black finish applied to all of its visible surfaces.

A wiper arm cannot be adjusted or repaired. If damaged or inoperative, the entire wiper arm unit must be replaced.

### REAR

The rear wiper arm is the rigid member located between the rear wiper motor output shaft that protrudes from the outer tailgate panel near the base of the rear flip-up glass opening and the rear wiper blade. This wiper arm features an over-center hinge that allows easy access to the tailgate and rear flip-up glass for cleaning, after the spare tire is removed. The wiper arm has a die cast metal pivot end (6) with a large tapered mounting hole at one end. A molded plastic pivot cover (5) is secured loosely to and pivots on the wiper arm hinge pin (4) to conceal the wiper arm retaining nut.




The wide end of a tapered, stamped steel channel (3) is secured with a hinge pin to the pivot end of the wiper arm. One end of a long, rigid, stamped steel strap (2) with a small hole near its pivot end is riveted and crimped within the narrow end of the stamped steel channel. The tip of the wiper blade end of this strap is bent back under itself to form a small hook (1). Concealed within the stamped steel channel, one end of a long tension spring (7) is engaged with a wire hook on the underside of the die cast pivot end, while the other end of the spring is hooked through the small hole in the steel strap. A molded plastic wiper arm support (8) is snapped onto the wiper arm strap where it exits the channel. The entire wiper arm has a satin black finish applied to all of its visible surfaces.

A wiper arm cannot be adjusted or repaired. If damaged or inoperative, the entire wiper arm unit must be replaced.

## OPERATION

### FRONT

The front wiper arms are designed to mechanically transmit the motion from the wiper pivots to the wiper blades. The wiper arm must be properly indexed to the wiper pivot in order to maintain the proper wiper blade travel on the glass. The tapered mounting hole in the wiper arm pivot end interlocks with the serrations on the tapered outer circumference of the wiper pivot shaft, allowing positive engagement and finite adjustment of this connection. The mounting nut locks the wiper arm to the threaded stud of the wiper pivot shaft. The spring-loaded wiper arm hinge controls the down-force applied through the tip of the wiper arm to the wiper blade on the glass. The hook formation on the tip of the wiper arm provides a cradle for securing and latching the wiper blade pivot block to the wiper arm.

### REAR

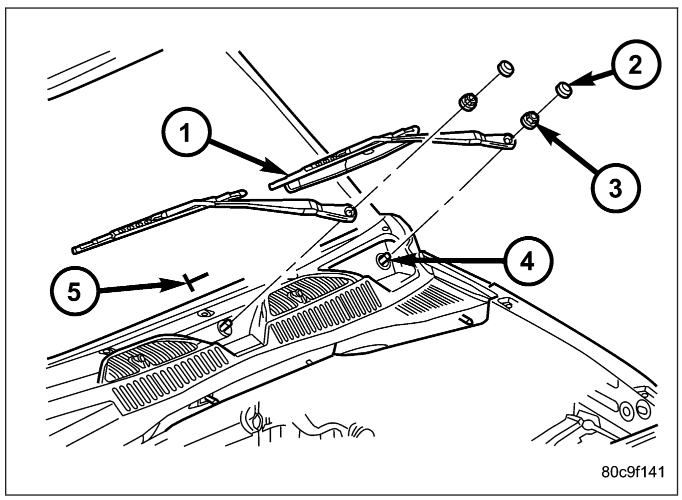
The rear wiper arm is designed to mechanically transmit the motion from the rear wiper motor output shaft to the rear wiper blade. The wiper arm must be properly indexed to the motor output shaft in order to maintain the proper wiper blade travel on the glass. The wiper arm support is designed to lift and support the rear wiper arm and blade off of the glass when the rear wiper blade is parked. This support and the park ramp on the tailgate outer panel below the glass also provide an alignment reference to ensure accurate rear wiper arm and blade installation.

The tapered hole in the wiper arm pivot end interlocks with the serrations on the outer circumference of the tapered motor output shaft, allowing positive engagement and finite adjustment of this connection. A hex nut secures the wiper arm pivot end to the threads on the rear wiper motor output shaft and the pivot cover hinges and snaps over this connection for a neat appearance. The spring-loaded wiper arm hinge controls the down-force applied through the tip of the wiper arm to the wiper blade on the glass. The hook formation on the tip of the wiper arm provides a cradle for securing and latching the wiper blade pivot block to the wiper arm.

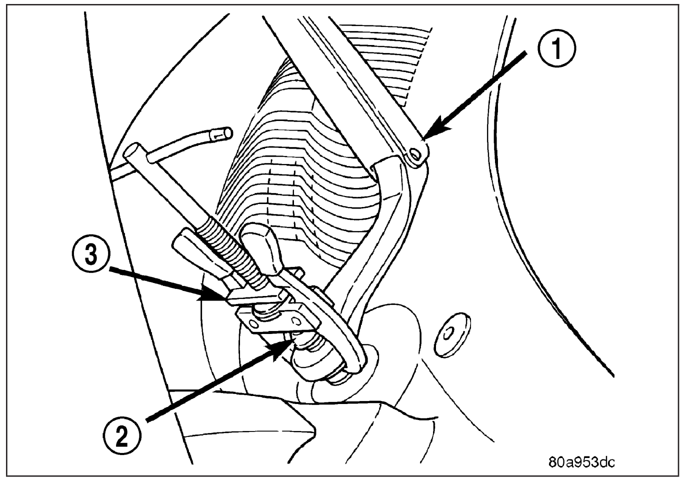
## REMOVAL

### FRONT

1. Lift the front wiper arm (1) to its over-center position to hold the wiper blade off of the glass and relieve the spring tension on the wiper arm to wiper pivot shaft connection.
2. Carefully pry the plastic nut cap (2) off of the pivot end of the wiper arm.
3. Remove the nut (3) that secures the wiper arm to the wiper pivot shaft (4).

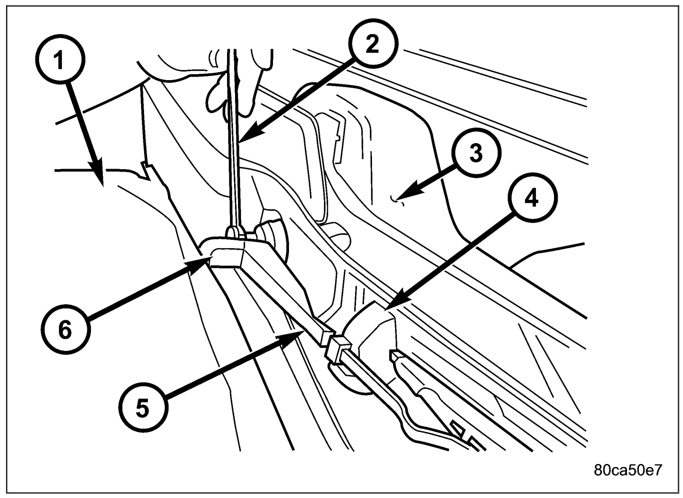


4. If necessary, use a suitable battery terminal puller (3) to disengage the wiper arm (1) from the wiper pivot shaft (2).
5. Remove the front wiper arm pivot end from the wiper pivot shaft.




## REAR

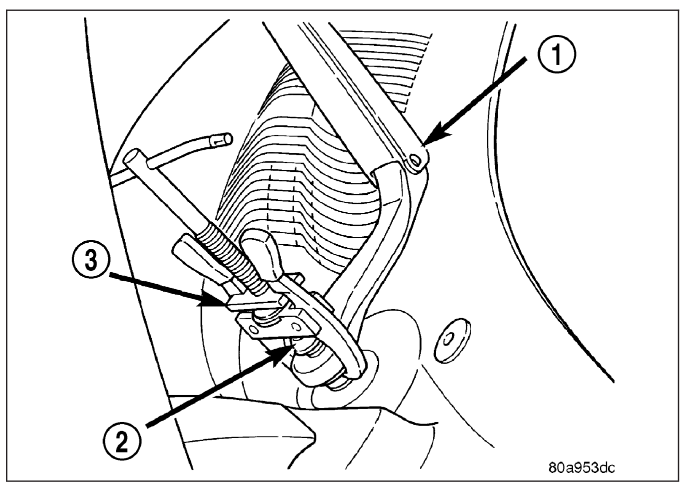
1. Lift the rear wiper arm pivot cover (6) by lifting it at the rear wiper motor output shaft end of the arm (5).
2. Remove the nut that secures the rear wiper arm to the rear wiper motor output shaft.




3. If necessary, use a battery terminal puller (3) to disengage the wiper arm (1) from the rear wiper motor output shaft splines (2).

**NOTE: Depending upon the size and type of puller used, it may be necessary to remove the spare tire from the tailgate. Refer to the owner's manual in the vehicle glove box for information on removing the spare tire from the tailgate.**

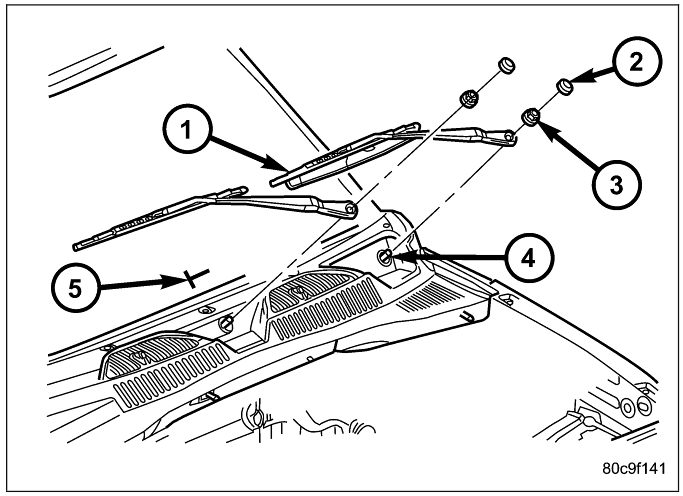
4. Remove the rear wiper arm pivot end from the motor output shaft.



## INSTALLATION

### FRONT

**NOTE: Be certain that the wiper motor is in the park position before attempting to install the front wiper arms. Turn the ignition switch to the On position and move the control knob on the right (wiper) control stalk of the multi-function switch to its Off position. If the wiper pivots move, wait until they stop moving, then turn the ignition switch back to the Off position. The wiper motor is now in its park position.**

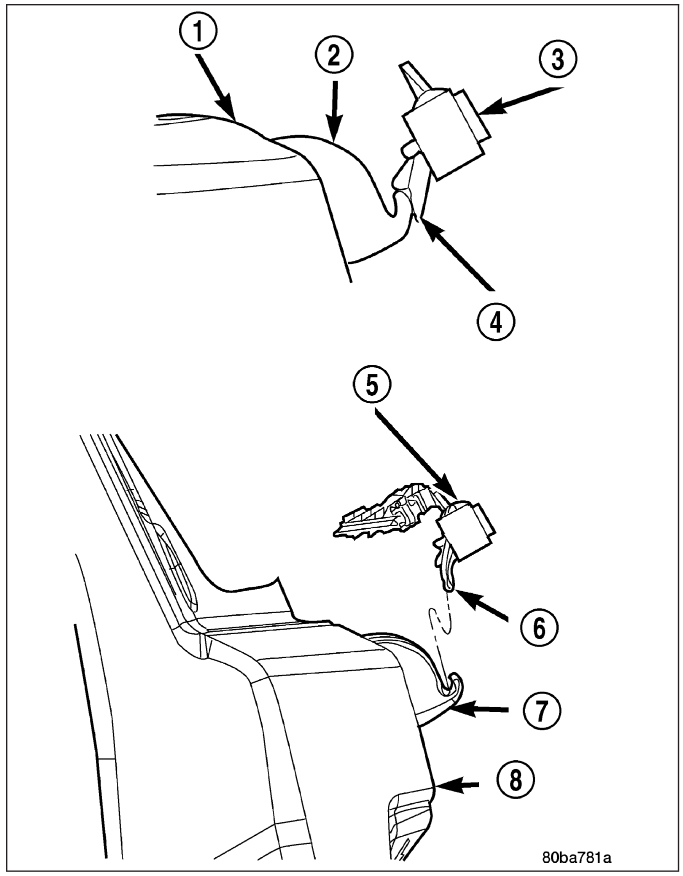



1. The front wiper arms must be indexed to the wiper pivot shafts with the wiper motor in the park position to be properly installed. Position the front wiper arm pivot ends onto the wiper pivot shafts (4) so that the tip of the wiper blade (1) is aligned with the T-shaped wiper alignment lines (5) located in the lower edge of the windshield glass.
2. Once the wiper blade is aligned, lift the wiper arm away from the windshield slightly to relieve the spring tension on the pivot end and push the pivot hole on the end of the wiper arm down firmly and evenly over the wiper pivot shaft.
3. Install and tighten the nut (3) that secures the wiper arm to the wiper pivot shaft. Tighten the nut to 24 N·m (18 ft. lbs.).
4. Wet the windshield glass, then operate the front wipers. Turn the front wipers Off, then check for the correct wiper arm position and readjust as required.
5. Reinstall the plastic nut cap (2) onto the wiper arm pivot nut.

### REAR

**NOTE: Always install the wiper arm and blade with the wiper motor in the Park position.**

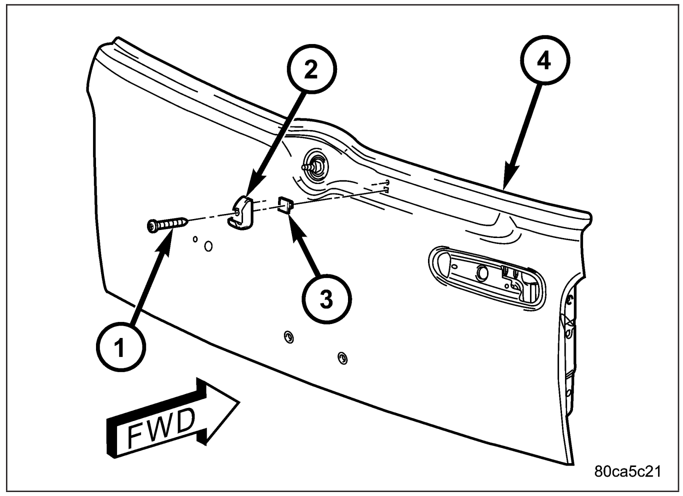
1. The rear wiper arm (3) must be indexed to the motor output shaft with the rear wiper motor in the park position to be properly installed. Place the wiper arm onto the tailgate (1) with the wiper arm support positioned on the park ramp (2) and the tapered mounting hole on the pivot end of the arm positioned over the rear wiper motor output shaft.
2. Position the tab on the back of the rear wiper arm support on the tailgate park ramp in the Installation Position (4).
3. With the wiper arm in the Installation Position, push the tapered mounting hole on the pivot end of the wiper arm down over the rear wiper motor output shaft.
4. Install and tighten the nut that secures the rear wiper arm to the rear wiper motor output shaft. Tighten the nut to 18 N·m (13 ft. lbs.).
5. Close the rear wiper arm pivot cover.
6. Lift the rear wiper arm (5) support away from the park ramp (7), then place the wiper arm support in the park ramp on the tailgate (8) in the Park Position (6).



# WIPER ARM PARK RAMP

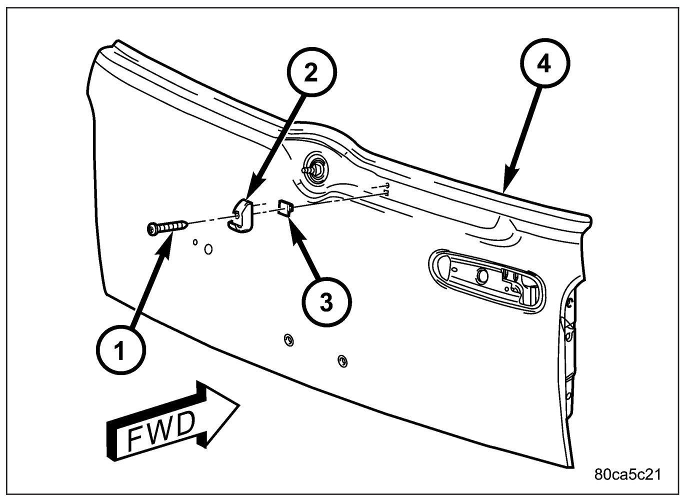
## REMOVAL

1. Disengage the rear wiper arm support from the wiper arm park ramp on the right side of the tailgate just below the rear flip-up glass.
2. Lift the wiper arm and blade away from the tailgate until the wiper arm hinge is in its over-center position.
3. Remove the screw (1) that secures the wiper arm park ramp (2) to the tailgate outer panel (4).
4. Remove the wiper arm park ramp from the tailgate outer panel.




## INSTALLATION

1. Check to be certain that the rivet nut (3) is properly installed and in good condition in the tailgate outer panel (4).
2. Position the wiper arm park ramp (2) onto the tailgate outer panel.
3. Install and tighten the screw (1) that secures the wiper arm park ramp to the tailgate outer panel. Tighten the screw to 5 N·m (45 in. lbs.).
4. Lower the rear wiper arm and blade and place the wiper arm support onto the wiper arm park ramp.

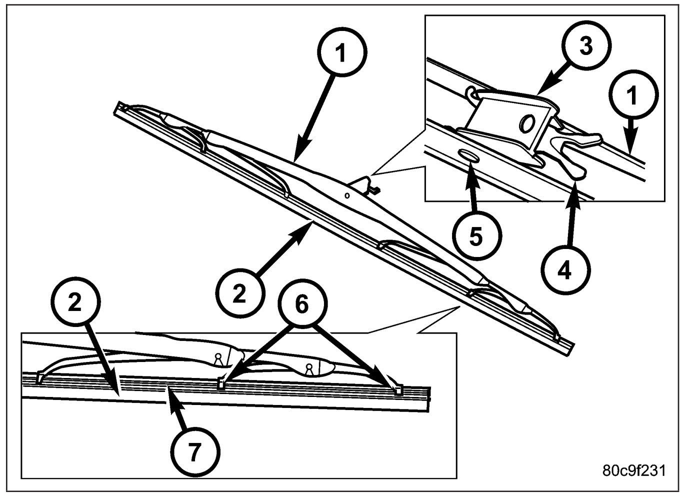


# WIPER BLADE

## DESCRIPTION

### FRONT

Each front wiper blade is secured by an integral latching pivot block (3) to the hook formation on the tip of the front wiper arms, and rests on the glass near the base of the windshield when the wipers are not in operation. The wiper blade consists of the following components:

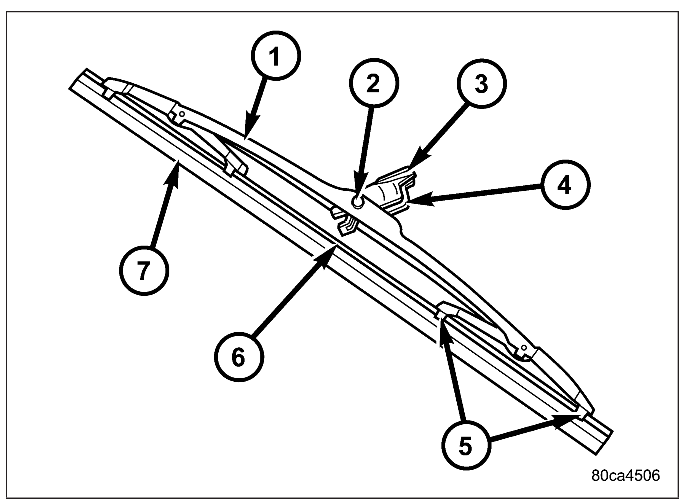



- **Superstructure (1)** - The superstructure includes several stamped steel bridges and links with claw formations (6) that grip the wiper blade element. Also included in this unit is the latching, molded plastic pivot block that secures the superstructure to the wiper arm. On vehicles manufactured for certain markets where it is required, the driver side front wiper blade has an additional molded black plastic airfoil secured to the superstructure, which is oriented toward the base of the windshield when the front wipers are in their parked position. All of the metal components of the wiper blade have a satin black finish applied.
- **Element (2)** - The wiper element or squeegee is the resilient rubber member of the wiper blade that contacts the glass.
- **Flexor (7)** - The flexor is a rigid metal component running along the length of each side of the wiper element where it is gripped by the claws of the superstructure.

All vehicles have two 47.50 centimeter (18.70 inch) long front wiper blades with non-replaceable rubber elements (squeegees). The wiper blades cannot be adjusted or repaired. If inoperative, worn, or damaged the entire wiper blade unit must be replaced.

### REAR

The rear wiper blade is secured by an integral latching pivot block to the hook formation on the tip of the rear wiper arm, and rests off the glass on a park ramp on the tailgate near the base of the rear flip-up glass opening when the wiper is not in operation. The rear wiper blade consists of the following components:




- **Superstructure (1)** - The superstructure includes a stamped steel bridge and plastic links with claw formations (5) that grip the wiper blade element. Also included in this unit is the latching, molded plastic pivot block (4) that secures the superstructure to the wiper arm. All of the metal components of the wiper blade have a satin black finish applied.

- **Element (7)** - The wiper element or squeegee is the resilient rubber member of the wiper blade that contacts the glass.
- **Flexor (6)** - The flexor is a rigid metal component running along the length of each side of the wiper element where it is gripped by the claws of the superstructure.

All vehicles have a single 28.00 centimeter (11.00 inch) rear wiper blade with a non-replaceable rubber element (squeegee). The wiper blade cannot be adjusted or repaired. If inoperative, worn, or damaged the entire wiper blade unit must be replaced.

## OPERATION

## FRONT

The wiper blades are moved back and forth across the glass by the wiper arms when the wipers are being operated. The wiper blade superstructure is the flexible frame that grips the wiper blade element and evenly distributes the force of the spring-loaded wiper arm along the length of the element. The combination of the wiper arm force and the flexibility of the superstructure makes the element conform to and maintain proper contact with the glass, even as the blade is moved over the varied curvature that may be encountered across the glass surface.

The wiper element flexor provides the claws of the blade superstructure with a rigid, yet flexible component on the element which can be gripped. The rubber element is designed to be stiff enough to maintain an even cleaning edge as it is drawn across the glass, yet resilient enough to conform to the glass surface and flip from one cleaning edge to the other each time the wiper blade changes directions. The airfoil used on the driver side wiper blade of vehicles manufactured for certain markets is designed to reduce the lifting effect caused by air moving over the vehicle at higher highway speeds.

## REAR

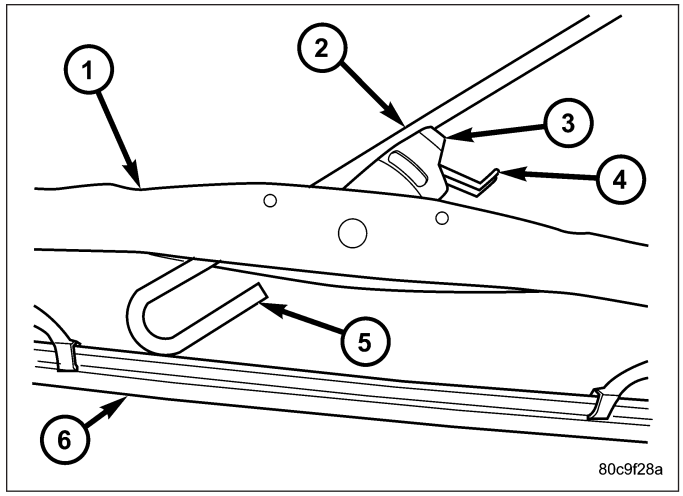
The rear wiper blade is moved back and forth across the glass by the wiper arm when the rear wiper system is in operation. The wiper blade superstructure is the flexible frame that grips the wiper blade element and evenly distributes the force of the spring-loaded wiper arm along the length of the element. The combination of the wiper arm force and the flexibility of the superstructure makes the element conform to and maintain proper contact with the glass, even as the blade is moved over the varied curvature found across the glass surface.

The wiper element flexor provides the claws of the blade superstructure with a rigid, yet flexible component on the element which can be gripped. The rubber element is designed to be stiff enough to maintain an even cleaning edge as it is drawn across the glass, but resilient enough to conform to the glass surface and flip from one cleaning edge to the other each time the wiper blade changes directions.

## REMOVAL

## FRONT

**NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.**



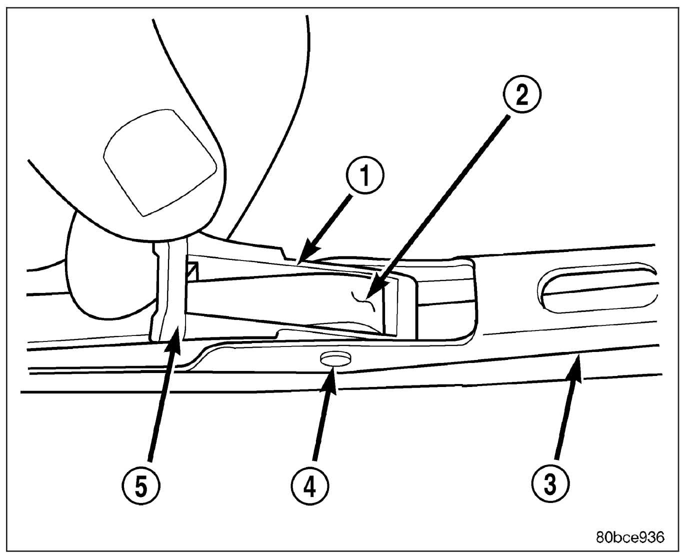

1. Lift the front wiper arm (2) to raise the wiper blade and element off of the glass, until the wiper arm hinge is in its over-center position.
2. To remove the wiper blade from the wiper arm, depress the pivot block latch release tab (4) under the tip of the arm and slide the blade away from the tip towards the pivot end of the arm far enough to disengage the pivot block (3) from the hook formation (5) on the end of the arm.
3. Extract the hook formation on the tip of the wiper arm through the opening in the wiper blade superstructure (1) just ahead of the wiper blade pivot block/latch unit.

**CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.**

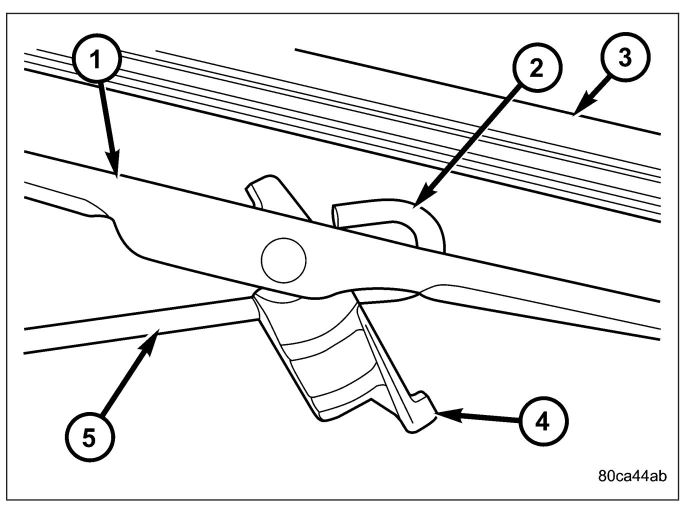
4. Gently lower the tip of the wiper arm onto the glass.

## REAR

**NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the rear wiper motor output shaft.**




1. Disengage the rear wiper arm support from the rear wiper arm park ramp on the right side of the tailgate just below the rear flip-up glass.
2. Lift the rear wiper arm to raise the wiper blade and element off of the tailgate and the rear flip-up glass.
3. To remove the wiper blade from the wiper arm, carefully lift up the pivot block latch release tab (5) on the top of the wiper arm to unlatch it from the arm (2).




4. Raise the pivot block latch release tab (4) until it is perpendicular to the rear wiper blade superstructure (1).
5. Slide the rear wiper blade away from the tip of the arm towards the pivot end of the arm far enough to disengage the pivot block from the hook formation (2) on the end of the arm (5).
6. Extract the hook formation on the tip of the wiper arm from the window in the wiper blade pivot block/latch unit.

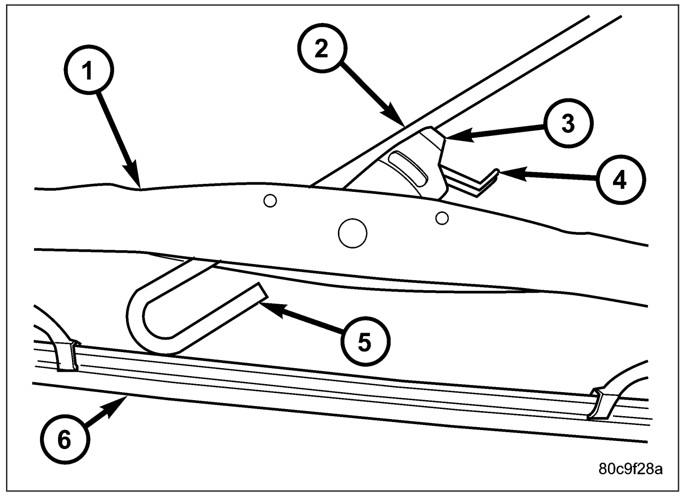
**CAUTION: Do not allow the wiper arm to spring back against the tailgate or the flip-up glass without the wiper blade in place or they may be damaged.**

7. Gently lower the wiper arm and place the arm support in the park ramp.

## INSTALLATION

## FRONT

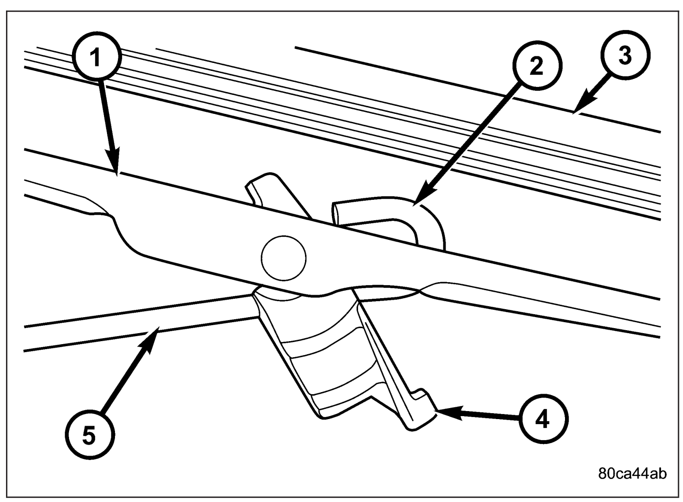
**NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.**




1. Lift the front wiper arm (2) off of the windshield glass, until the wiper arm hinge is in its over-center position.
2. Position the front wiper blade near the hook formation (5) on the tip of the arm with the notched end of the wiper element flexor oriented towards the end of the wiper arm that is nearest to the wiper pivot.
3. Insert the hook formation on the tip of the wiper arm through the opening in the wiper blade superstructure (1) ahead of the wiper blade pivot block/latch unit far enough to engage the pivot block (3) into the hook.
4. Slide the wiper blade pivot block/latch up into the hook formation on the tip of the wiper arm until the latch release tab (4) snaps into its locked position. Latch engagement will be accompanied by an audible click.
5. Gently lower the wiper blade onto the glass.

## REAR

**NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the rear wiper motor output shaft.**

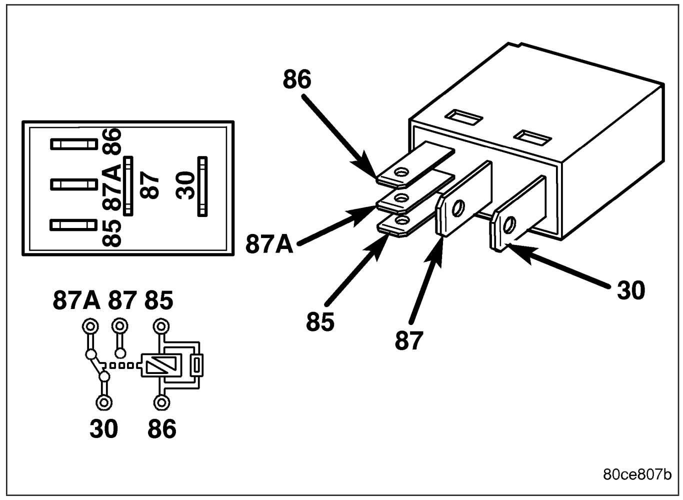



1. Lift the rear wiper arm support out of the tail gate park ramp.
2. Position the rear wiper blade (1) near the hook formation (2) on the tip of the arm (5) with the notched end of the wiper element (3) flexor oriented towards the end of the wiper arm that is nearest to the rear wiper motor output shaft.
3. Raise the pivot block latch release tab (4) until it is perpendicular to the rear wiper blade superstructure.
4. Insert the hook formation on the tip of the wiper arm through the window in the wiper blade pivot block/latch unit.
5. Slide the wiper blade pivot block/latch up into the hook formation on the tip of the wiper arm until the hook is firmly seated against the pivot block.
6. Press the pivot block latch release tab downward until it snaps into its locked position over the top of the wiper arm.
7. Gently lower the wiper arm and place the arm support in the tailgate park ramp.

# WIPER HIGH/LOW RELAY

## DESCRIPTION

The wiper high/low relay is located in the Power Distribution Center (PDC) in the engine compartment near the battery. The wiper high/low relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs by five integral male spade-type terminals that extend from the bottom of the relay base.




The wiper high/low relay cannot be adjusted or repaired and, if inoperative or damaged, the unit must be replaced.

## OPERATION

The wiper high/low relay is an electromechanical switch that uses a low current input from the Body Control Module (BCM) to control a high current output to the front wiper motor. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. A resistor is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The wiper high/low relay terminals are connected to the vehicle electrical system through a connector receptacle in the Power Distribution Center (PDC). The inputs and outputs of the wiper high/low relay include:

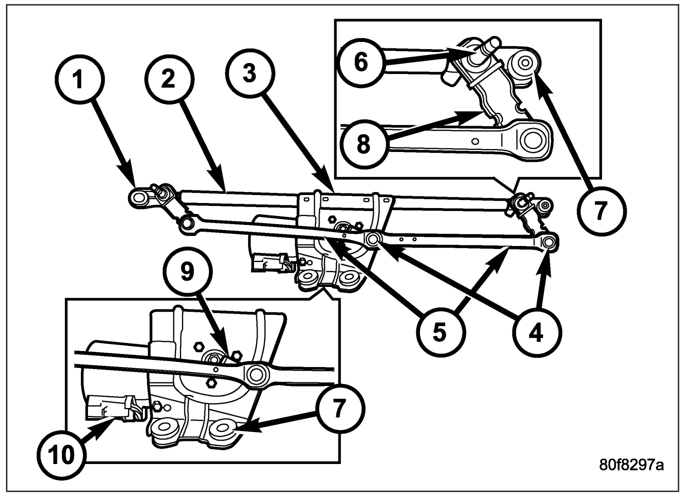
- **Common Feed Terminal** - The common feed terminal (30) is connected to the common feed terminal (30) of the wiper on/off relay at all times through the wiper on/off relay output circuit. Therefore, the wiper high/low relay common feed terminal is only powered when the wiper on/off relay is energized.
- **Coil Ground Terminal** - The coil ground terminal (85) is connected to a control output of the Body Control Module (BCM) through the front wiper high/low relay control circuit. The BCM controls front wiper motor operation by controlling a ground path through this circuit.
- **Coil Battery Terminal** - The coil battery terminal (86) receives battery current at all times from a circuit breaker in the Junction Block (JB) through a fused ignition switch output (run-acc) circuit.
- **Normally Open Terminal** - The normally open terminal (87) is connected to the high speed brush of the front wiper motor through the front wiper high/low relay high speed output circuit. Therefore, when the wiper high/low relay is energized, the wiper motor high speed brush is powered.
- **Normally Closed Terminal** - The normally closed terminal (87A) is connected to the low speed brush of the front wiper motor through the front wiper high/low relay low speed output circuit. Therefore, the wiper motor low speed brush can only be powered when the wiper high/low relay is de-energized.

The wiper high/low relay can be diagnosed using conventional diagnostic tools and methods.

# WIPER MODULE

## DESCRIPTION

The front wiper module bracket is secured with two nuts below the wiper motor through rubber insulators (7) to two weld studs on the bottom of the cowl plenum panel beneath the cowl plenum cover/grille panel. Two screws secure the top of the module bracket to the cowl plenum panel through rubber insulators located on the outboard end of each pivot bracket. The ends of the wiper pivot shafts that protrude through dedicated openings in the cowl plenum cover/grille panel to drive the wiper arms and blades are the only visible components of the front wiper module. The front wiper module consists of the following major components:



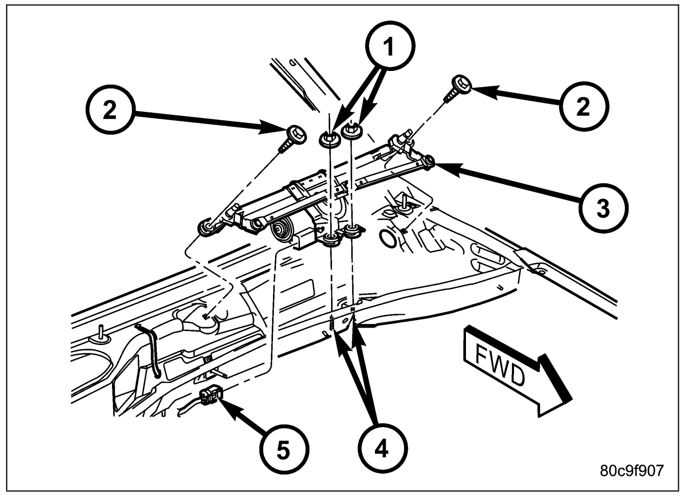

- **Bracket** - The front wiper module bracket consists of a long tubular steel main member (2) that has a die cast pivot bracket (1) formation near each end where the two wiper pivots are secured. A stamped steel mounting plate (3) for the wiper motor is secured with welds near the center of the main member. A short stamped steel tab that extends laterally from one side of the mounting plate provides a mounting location for the wiper motor pigtail wire connector (10).
- **Crank Arm (9)** - The front wiper motor crank arm is a stamped steel unit with a slotted hole on the driven end that is secured to the wiper motor output shaft with a nut, and has a ball stud secured to the drive end.
- **Linkage (5)** - Two stamped steel drive links connect the wiper motor crank arm to the wiper pivot lever arms. The right side drive link has a plastic socket-type bushing (4) on each end. The left side drive link has a plastic socket-type bushing on one end, and a plastic sleeve-type bushing on the other end. The socket-type bushing on one end of each drive link is snap-fit over the ball stud on the lever arm of its respective pivot. The left side drive link sleeve-type bushing end is then fit over the motor crank arm ball stud, and the other socket-type bushing of the right side drive link is snap-fit over the exposed end of the wiper motor crank arm ball stud.
- **Motor** - The front wiper motor is secured with three screws to the motor mounting plate near the center of the wiper module bracket. The wiper motor output shaft passes through a hole in the module bracket, where a nut secures the wiper motor crank arm to the motor output shaft. The two-speed permanent magnet wiper motor features an integral transmission, an internal park switch, and an internal automatic resetting circuit breaker.
- **Pivots** - The two front wiper pivots are secured within the die cast pivot brackets on the outboard ends of the wiper module main member. The lever arms (8) that extend from the center of the pivot shafts (6) each have a ball stud on their end. The upper end of each pivot shaft where the wiper arms will be fastened each is tapered and serrated with a threaded stud formation at the tip. The lower ends of the pivot shafts are installed through lubricated bushings in the pivot brackets and are secured with snap rings.

The front wiper module cannot be adjusted or repaired. If any component of the module is inoperative or damaged, the entire front wiper module unit must be replaced.

## OPERATION

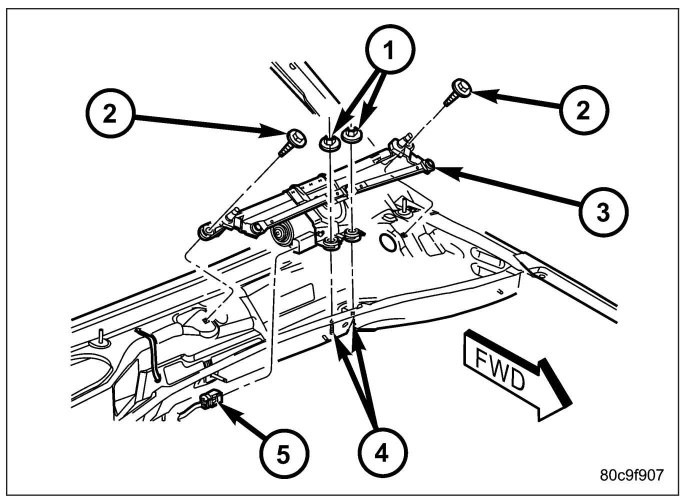
The front wiper module operation is controlled by the battery current inputs received by the wiper motor from the wiper on/off and wiper high/low relays. The wiper motor speed is controlled by current flow to either the low speed or the high speed set of brushes. The park switch is a single pole, single throw, momentary switch within the wiper motor that is mechanically actuated by the wiper motor transmission components. The park switch alternately closes the wiper park switch sense circuit to ground or to battery current, depending upon the position of the wipers on the glass. This feature allows the motor to complete its current wipe cycle after the wiper system has been turned Off, and to park the wiper blades in the lowest portion of the wipe pattern. The automatic resetting circuit breaker protects the motor from overloads. The wiper motor crank arm, the two wiper linkage members, and the two wiper pivots mechanically convert the rotary output of the wiper motor to the back and forth wiping motion of the wiper arms and blades on the glass.

## REMOVAL




1. Unlatch and open the hood.
2. Disconnect and isolate the battery negative cable.
3. Remove both front wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - FRONT/FRONT WIPER ARM - REMOVAL).
4. Remove the cowl plenum cover/grille panel from over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - REMOVAL).
5. Disconnect the headlamp and dash wire harness connector (5) for the front wiper motor from the motor pigtail wire connector.
6. Remove the two screws (2) that secure the front wiper module (3) to the top of the cowl plenum panel at the pivot brackets.
7. Remove the two nuts (1) that secure the front wiper module to the two weld studs (4) on the bottom of the cowl plenum panel.
8. Lift the front wiper module up from the cowl plenum panel far enough to disengage the two lower insulators from the weld studs on the bottom of the plenum panel.
9. Remove the front wiper module from the cowl plenum panel as a unit.

## INSTALLATION

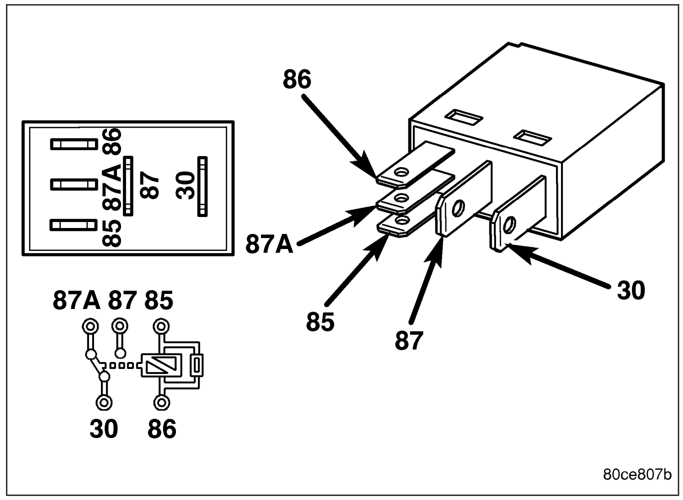



1. Position the front wiper module (3) to the cowl plenum as a unit.
2. Lower the front wiper module lower mounting insulators over the two weld studs (4) on the bottom of the cowl plenum panel.
3. Install the two screws (2) that secure the front wiper module to the top of the cowl plenum panel at the pivot brackets. Tighten the screw on the driver side, followed by the screw on the passenger side. Tighten the screws to 8 N·m (72 in. lbs.).
4. Install and tighten the two nuts (1) that secure the front wiper module to the two weld studs on the bottom of the cowl plenum panel. Tighten the nuts to 8 N·m (72 in. lbs.).
5. Reconnect the headlamp and dash wire harness connector (5) for the front wiper motor to the motor pigtail wire connector.
6. Reinstall the cowl plenum cover/grille panel over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - INSTALLATION).
7. Close and latch the hood.
8. Reinstall both front wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER ARM - INSTALLATION).
9. Reconnect the battery negative cable.

# WIPER ON/OFF RELAY

## DESCRIPTION

The wiper on/off relay is located in the Power Distribution Center (PDC) in the engine compartment near the battery. The wiper on/off relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs by five integral male spade-type terminals that extend from the bottom of the relay base.




The wiper on/off relay cannot be adjusted or repaired and, if inoperative or damaged, the unit must be replaced.

## OPERATION

The wiper on/off relay is an electromechanical switch that uses a low current input from the Body Control Module (BCM) to control a high current output to the front wiper motor. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. A resistor is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The wiper on/off relay terminals are connected to the vehicle electrical system through a connector receptacle in the Power Distribution Center (PDC). The inputs and outputs of the wiper on/off relay include:

- **Common Feed Terminal** - The common feed terminal (30) is connected to the common feed terminal of the wiper high/low relay at all times through the wiper on/off relay output circuit. Therefore, the wiper high/low relay is able to control the wiper motor speed only when the wiper on/off relay is energized.
- **Coil Ground Terminal** - The coil ground terminal (85) is connected to a control output of the Body Control Module (BCM) through the front wiper on/off relay control circuit. The BCM controls front wiper motor operation by controlling a ground path through this circuit.
- **Coil Battery Terminal** - The coil battery terminal (86) receives battery current at all times from a circuit breaker in the Junction Block (JB) through a fused ignition switch output (run-acc) circuit.
- **Normally Open Terminal** - The normally open terminal (87) receives battery current from a circuit breaker in the Junction Block (JB) through a fused ignition switch output (run-acc) circuit. When the front wiper on/off relay is energized, the wiper high/low relay is able to control the wiper motor speed.
- **Normally Closed Terminal** - The normally closed terminal (87A) is connected to the wiper park switch in the front wiper motor through the front wiper park switch sense circuit, and is connected to the wiper park switch whenever the relay is de-energized.

The wiper on/off relay can be diagnosed using conventional diagnostic tools and methods.

# NAVIGATION/TELECOMMUNICATION

## TABLE OF CONTENTS



## NAVIGATION/TELECOMMUNICATION - ELECTRICAL DIAGNOSTICS

### TABLE OF CONTENTS

# NAVIGATION/TELECOMMUNICATION - ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## AMP MESSAGE NOT RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module does not receive the PCI Bus message from the Amplifier.

| Possible Causes |
|---|
| LOST COMMUNICATION WITH AMPLIFIER |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. ATTEMPT TO COMMUNICATE WITH THE AMPLIFIER

Turn the ignition on.

With the scan tool, attempt to communicate with the Amplifier.

**Was the scan tool able to communicate with the Amplifier?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the related symptom.

### 2. ERASE DTC AND ATTEMPT TO RESET

With the scan tool, erase the HFM DTC's.

Cycle the ignition switch from off to on and wait approximately 1 minute.

With the scan tool, read the HFM DTC's.

**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## AUDIO HARDWARE MESSAGE NOT RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module does not receive the PCI Bus message from the radio indicating what kind of radio the vehicle is equipped with.

| Possible Causes |
|---|
| LOST COMMUNICATION WITH RADIO |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. ATTEMPT TO COMMUNICATE WITH THE RADIO

Turn the ignition on.

Turn the radio on.

With the scan tool, attempt to communicate with the radio.

**Was the scan tool able to communicate with the radio?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the related symptom.

### 2. ERASE DTC AND ATTEMPT TO RESET

With the scan tool, erase the HFM DTC’s.

Cycle the ignition switch from off to on and wait approximately 1 minute.

With the scan tool, read the HFM DTC’s.

**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## BLUETOOTH ERROR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault during an internal diagnostic check.

| Possible Causes |
|---|
| HANDS FREE MODULE |

## Diagnostic Test

### 1. ERASE DTC AND ATTEMPT TO RESET

Turn the ignition on.

With the scan tool, read and record the HFM DTC's and then erase the DTC's.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the HFM DTC's.

**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## BODY STYLE MESSAGE NOT RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module does not receive the body style message from the PCM.

| Possible Causes |
|---|
| LOST COMMUNICATION WITH PCM |
| PCM NOT ACTIVE ON THE BUS NETWORK |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. ATTEMPT TO COMMUNICATE WITH THE PCM

Turn the ignition on.

With the scan tool, attempt to communicate with the PCM.

**Was the scan tool able to communicate with the PCM?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the related symptom.

### 2. CHECK PCM ACTIVITY ON THE BUS NETWORK

With the scan tool, select System Monitors then J1850 Module Scan.

**Does the scan tool indicate that the PCM is present or active on the bus network?**

**Yes** >> Go To 3

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the related symptom.

### 3. ERASE DTC AND ATTEMPT TO RESET

With the scan tool, erase the HFM DTC’s.

Cycle the ignition switch from off to on and wait approximately 1 minute.

With the scan tool, read the HFM DTC’s.

**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## FLASH CHECKSUM ERROR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault during an internal diagnostic check.

| Possible Causes |
|---|
| HANDS FREE MODULE |

## Diagnostic Test

### 1. ERASE DTC AND ATTEMPT TO RESET

Turn the ignition on.

With the scan tool, read and record the HFM DTC's and then erase the DTC's.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the HFM DTC's.

**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## FLASH WRITE ERROR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault during an internal diagnostic check.

| Possible Causes |
|---|
| HANDS FREE MODULE |

## Diagnostic Test

### 1. ERASE DTC AND ATTEMPT TO RESET

Turn the ignition on.

With the scan tool, read and record the HFM DTC's and then erase the DTC's.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the HFM DTC's.

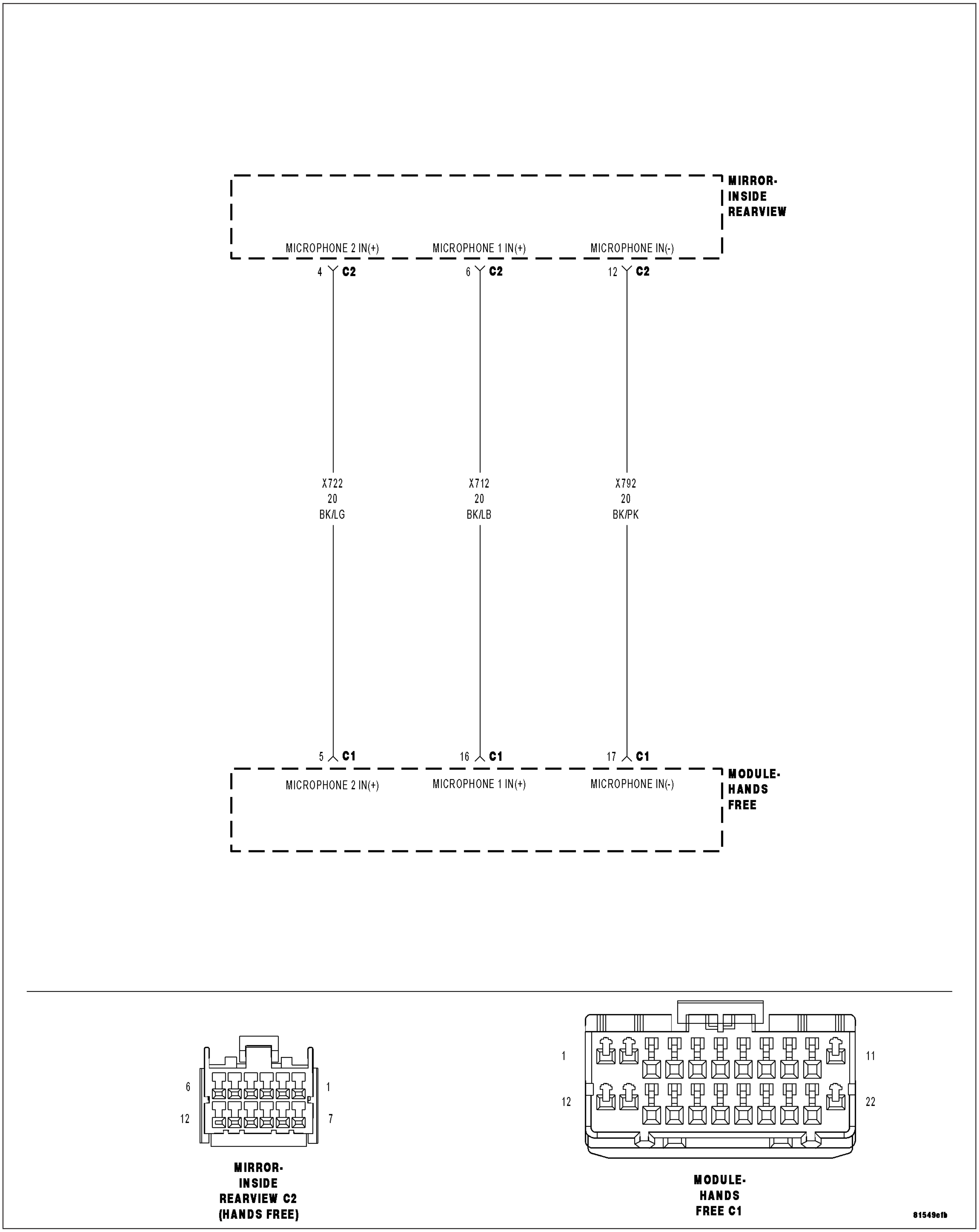
**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## GENERAL MICROPHONE FAULT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault in any of the microphone circuits.

| Possible Causes |
|---|
| (X712) MICROPHONE 1 IN (+) CIRCUIT OPEN |
| (X722) MICROPHONE 2 IN (+) CIRCUIT OPEN |
| (X792) MICROPHONE IN (-) CIRCUIT OPEN |
| (X712) (X722) (X792) MICROPHONE CIRCUITS SHORTED TO GROUND |
| (X712) (X722) (X792) MICROPHONE CIRCUITS SHORTED TO VOLTAGE |
| (X712) (X722) (X792) MICROPHONE CIRCUITS SHORTED TOGETHER |
| AUTOMATIC DAY/NIGHT MIRROR |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, read and record the HFM DTC's and then erase the DTC's.

Attempt to make a phone call with the system.

With the scan tool, read the HFM DTC's.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (X712) MICROPHONE 1 IN (+) CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module C1 harness connector.

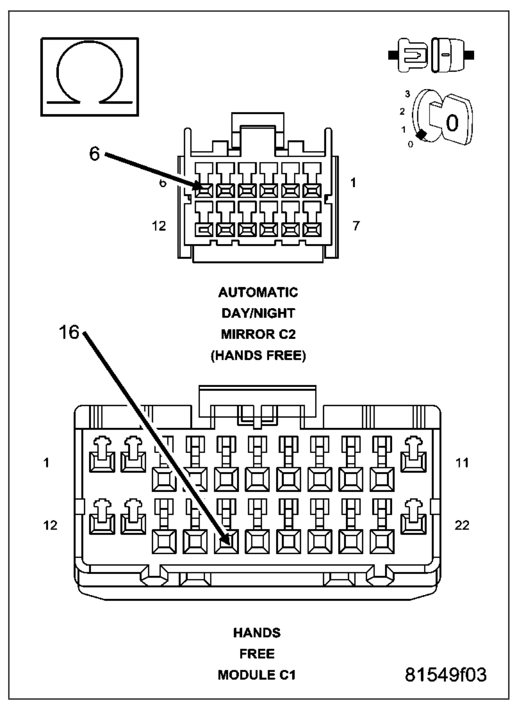
Disconnect the Automatic Day/Night Mirror C2 harness connector.

Measure the resistance of the (X712) Microphone 1 IN (+) circuit between the HFM connector and the Automatic Day/Night Mirror connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 3

**No** >> Repair the (X712) Microphone 1 IN (+) circuit for an open.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



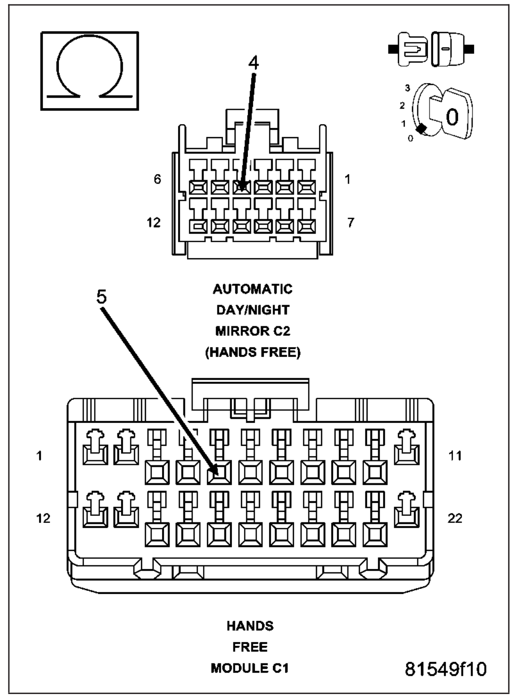
## 3. (X722) MICROPHONE 2 IN (+) CIRCUIT OPEN

Measure the resistance of the (X722) Microphone 2 IN (+) circuit between the HFM connector and the Automatic Day/Night Mirror connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the (X722) Microphone 2 IN (+) circuit for an open. Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



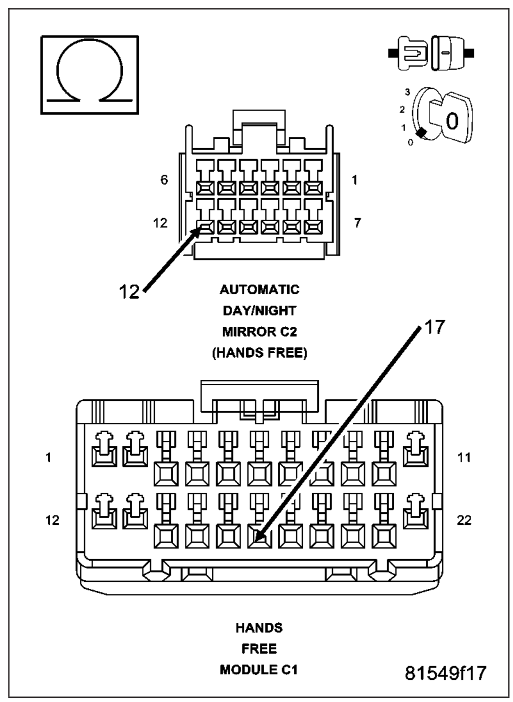

## 4. (X792) MICROPHONE IN (-) CIRCUIT OPEN

Measure the resistance of the (X792) Microphone IN (-) circuit between the HFM connector and the Automatic Day/Night Mirror connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (X792) Microphone IN (-) circuit for an open. Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



## 5. (X712) (X722) (X792) MICROPHONE CIRCUITS SHORTED TO GROUND

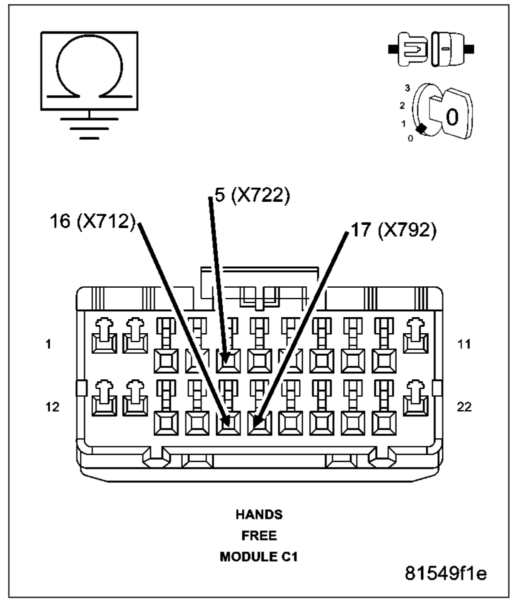
Measure the resistance between ground and each (X712) (X722) (X792) Microphone circuit.

**Is the resistance below 100.0 ohms?**

**Yes** >> Repair the Microphone circuit that measured below 100.0 ohms for short to ground.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 6




## 6. (X712) (X722) (X792) MICROPHONE CIRCUITS SHORTED TO VOLTAGE

Turn the ignition on.

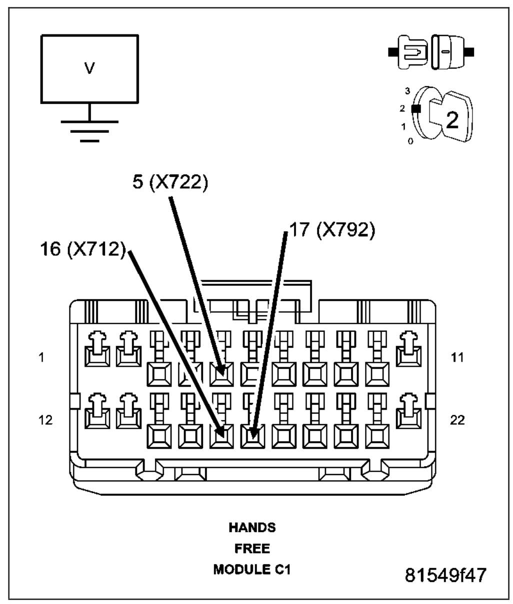
Measure the voltage of each (X712) (X722) (X792) Microphone circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Microphone circuit that measured above 1.0 volt for short to voltage.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

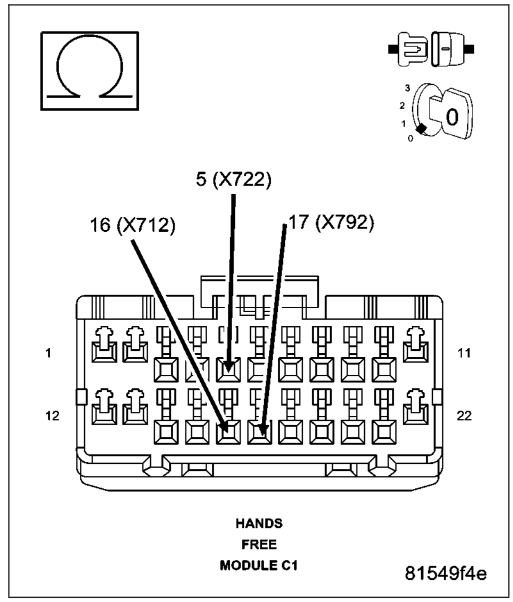
**No** >> Go To 7



## 7. (X712) (X722) (X792) MICROPHONE CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Measure the resistance between each (X712) (X722) (X792) Microphone circuit.




**Is the resistance below 100.0 ohms?**

**Yes** >> Repair the Microphone circuit that measured below 100.0 ohms for a short together.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 8

## 8. AUTOMATIC DAY/NIGHT MIRROR

Replace the Automatic Day/Night Mirror in accordance with the service information.

Cycle the ignition switch from off to on at least 5 times, leaving the ignition on for a minimum of 90 seconds per cycle.

Attempt to make a phone call with the system.

With the scan tool, read the HFM DTC's.

**Did this DTC reset?**

**Yes** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair is complete.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## IGNITION POWER MESSAGE NOT RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module does not receive an ignition power status message from the Body Control Module (BCM).

| Possible Causes |
| --- |
| LOST COMMUNICATION WITH BODY CONTROL MODULE (BCM) |
| HANDS FREE MODULE |

### Diagnostic Test

#### 1. ATTEMPT TO COMMUNICATE WITH THE BODY CONTROL MODULE (BCM)

Turn the ignition on.

With the scan tool, attempt to communicate with the BCM.

**Was the scan tool able to communicate with the BCM?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the related symptom.

#### 2. ERASE DTC AND ATTEMPT TO RESET

With the scan tool, erase the HFM DTC's.

Cycle the ignition switch from off to on and wait approximately 1 minute.

With the scan tool, read the HFM DTC's.

**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## INVALID BODY STYLE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module receives an invalid body style message from the PCM.

| Possible Causes |
| --- |
| LOST COMMUNICATION WITH PCM |
| PCM NOT ACTIVE ON THE BUS NETWORK |
| HANDS FREE MODULE |

### Diagnostic Test

#### 1. ATTEMPT TO COMMUNICATE WITH THE PCM

Turn the ignition on.

With the scan tool, attempt to communicate with the PCM.

**Was the scan tool able to communicate with the PCM?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the related symptom.

#### 2. CHECK PCM ACTIVITY ON THE BUS NETWORK

With the scan tool, select System Monitors then J1850 Module Scan.

**Does the scan tool indicated that the PCM is present or active on the bus network?**

**Yes** >> Go To 3

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the related symptom.

#### 3. ERASE DTC AND ATTEMPT TO RESET

With the scan tool, erase the HFM DTC's.

Cycle the ignition switch from off to on and wait approximately 1 minute.

With the scan tool, read the HFM DTC's.

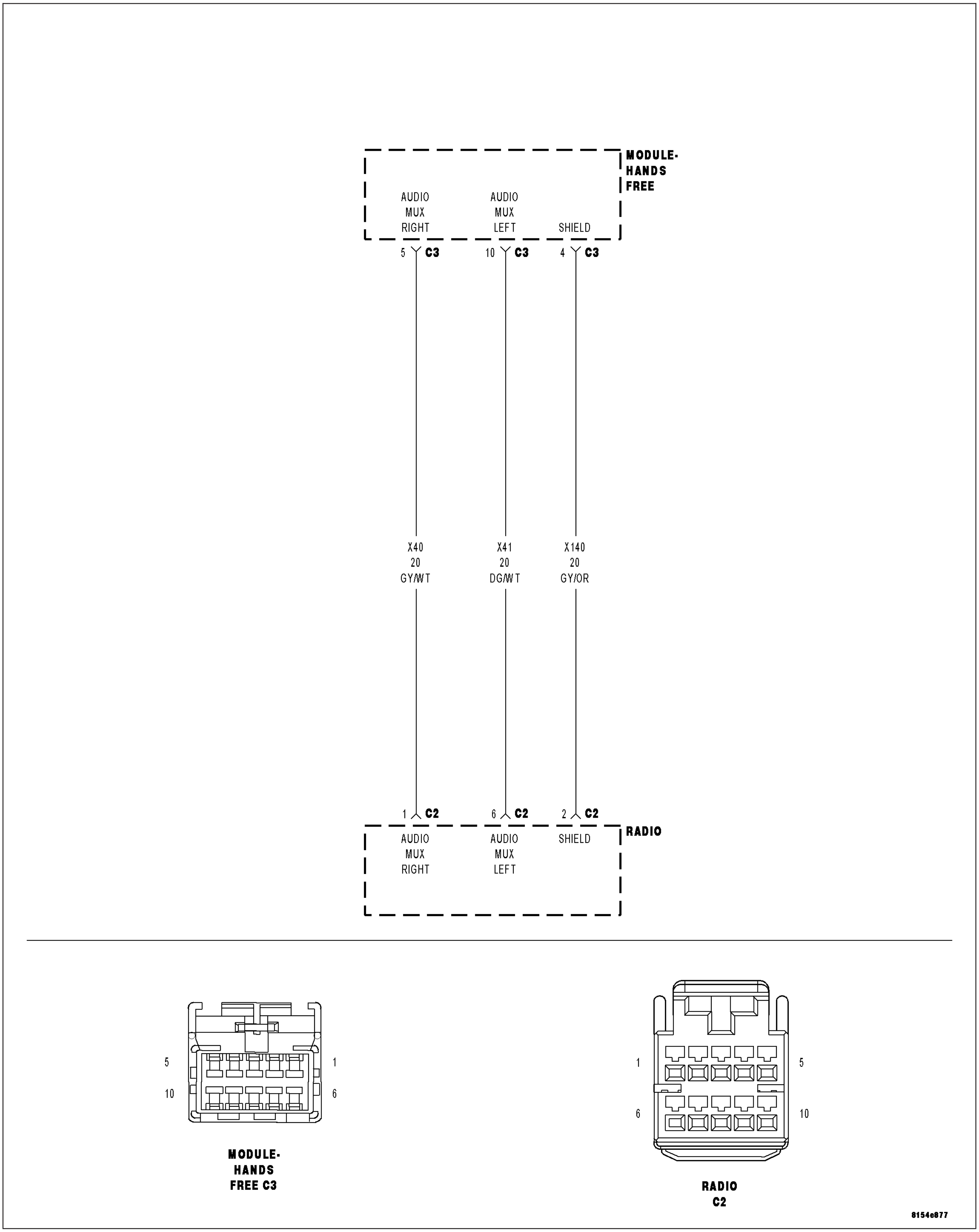
**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## LEFT AUDIO INPUT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects low voltage on the (X41) Audio MUX Left circuit.

| Possible Causes |
|---|
| (X41) AUDIO MUX LEFT CIRCUIT OPEN |
| (X41) AUDIO MUX LEFT CIRCUIT SHORT TO GROUND |
| (X140) AUDIO RETURN CIRCUIT OPEN |
| (X41) AUDIO MUX LEFT CIRCUIT SHORT TO (X140) AUDIO RETURN CIRCUIT |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

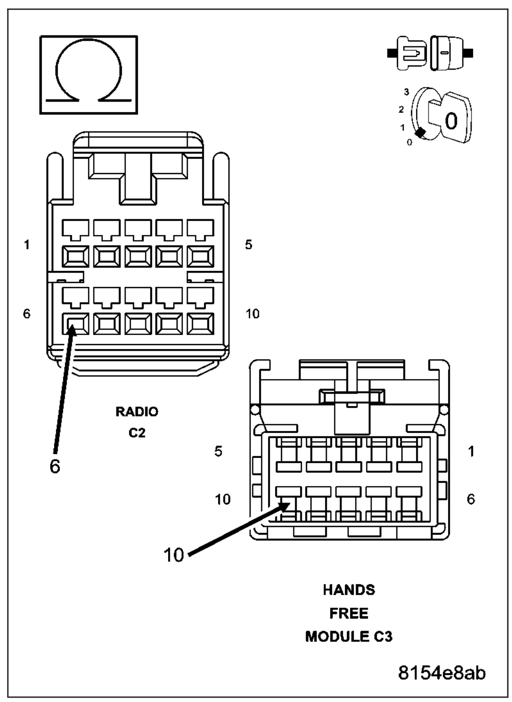
### 2. (X41) AUDIO MUX LEFT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Disconnect the Radio C2 harness connector.

Measure the resistance of the (X41) Audio MUX Left circuit between the HFM connector and the radio connector.




**Is the resistance below 5.0 ohms?**

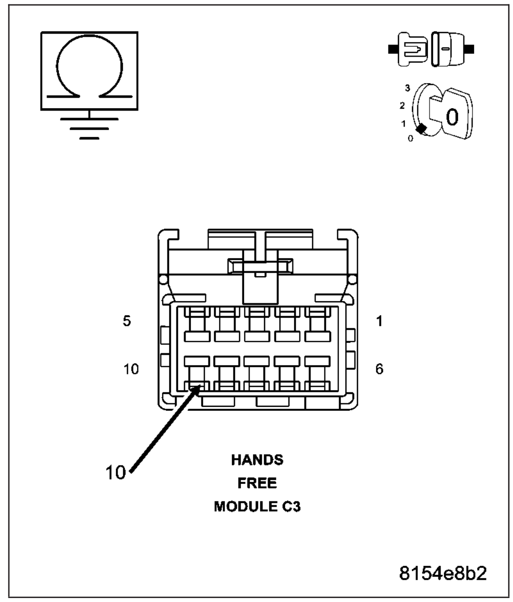
**Yes** >> Go To 3

**No** >> Repair the (X41) Audio MUX Left circuit for an open

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. (X41) AUDIO MUX LEFT CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (X41) Audio MUX Left circuit.



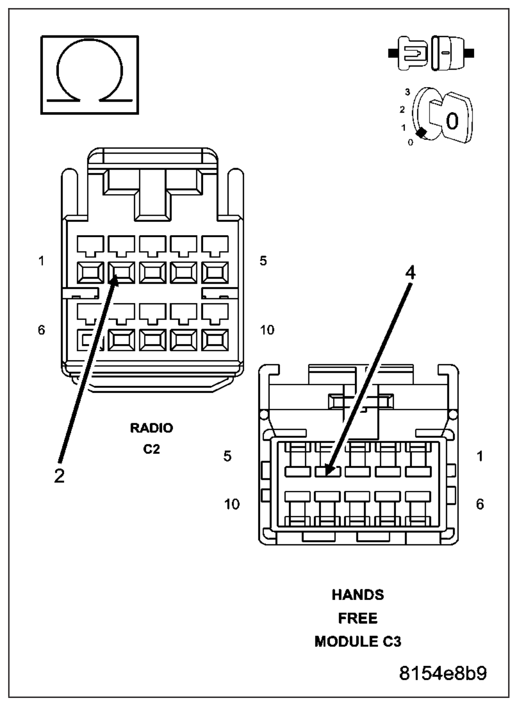

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (X41) Audio MUX Left circuit for short to ground. Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. (X140) AUDIO RETURN CIRCUIT OPEN

Measure the resistance of the (X140) Audio Return circuit between the HFM connector and the radio connector.



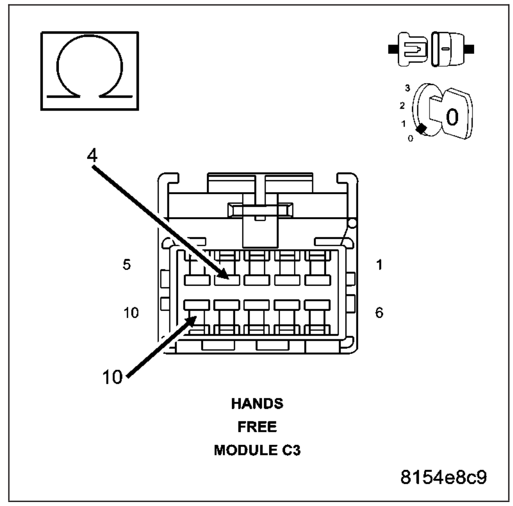

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (X140) Audio Return circuit for an open. Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 5. (X41) AUDIO MUX LEFT CIRCUIT SHORT TO (X140) AUDIO RETURN CIRCUIT

Measure the resistance between the (X41) Audio MUX Left circuit and the (X140) Audio Return circuit.




**Is the resistance below 5.0 ohms?**

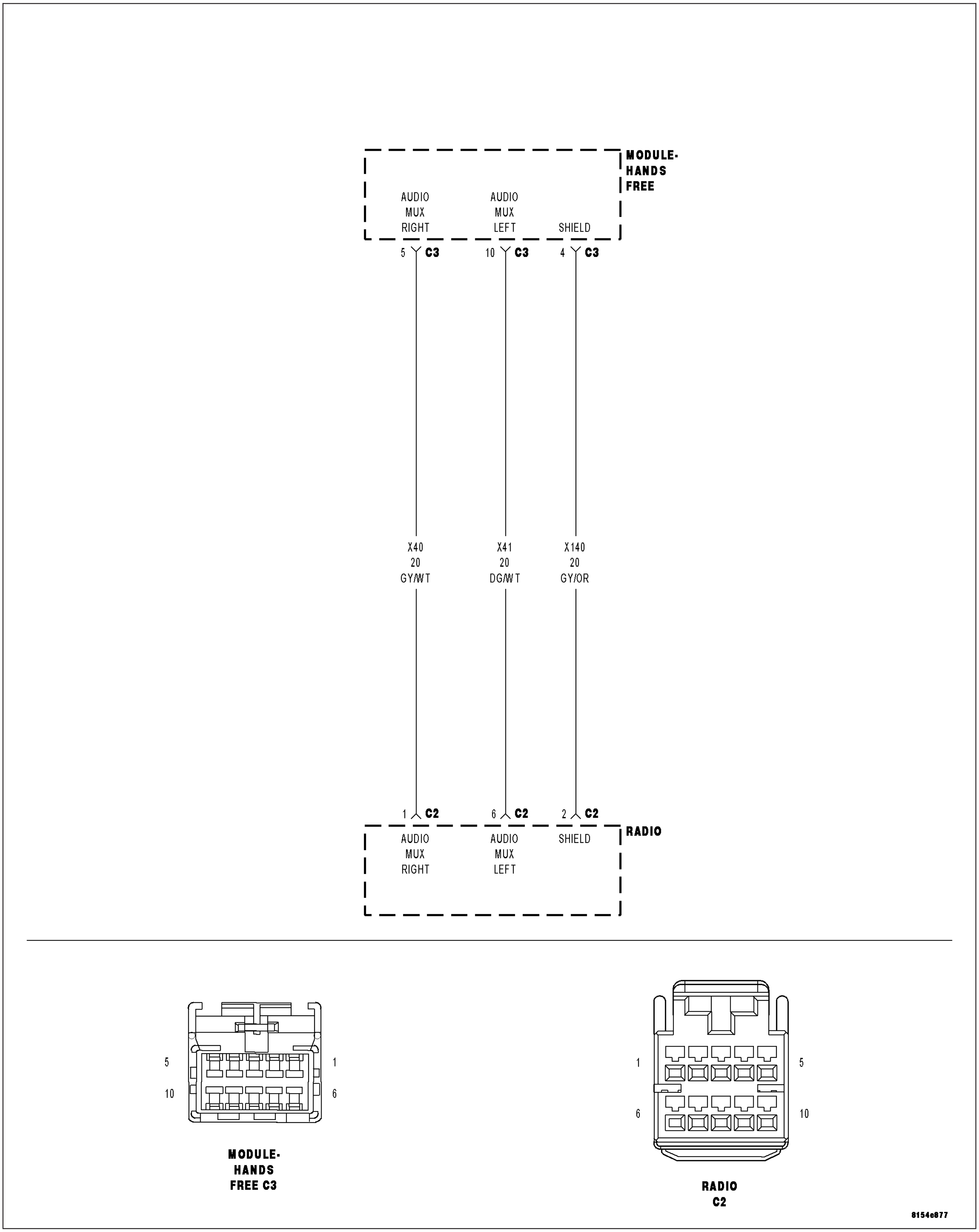
**Yes** >> Repair the (X41) Audio MUX Left circuit for a short to the (X140) Audio Return circuit.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## LEFT AUDIO INPUT SHORT TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects high voltage on the (X41) Audio MUX Left circuit.

| Possible Causes |
|---|
| (X41) AUDIO MUX LEFT CIRCUIT OPEN |
| (X140) AUDIO RETURN CIRCUIT OPEN |
| (X41) AUDIO MUX LEFT CIRCUIT SHORT TO VOLTAGE |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

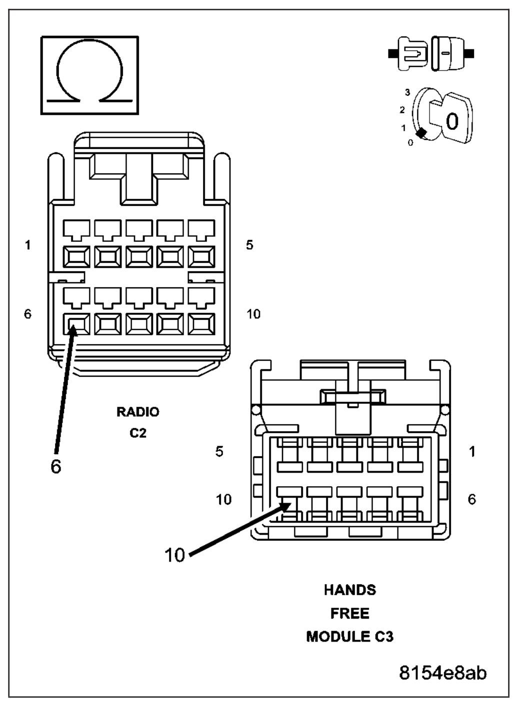
### 2. (X41) AUDIO MUX LEFT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Disconnect the Radio C2 harness connector.

Measure the resistance of the (X41) Audio MUX Left circuit between the HFM connector and the radio connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 3

**No** >> Repair the (X41) Audio MUX Left circuit for an open

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. (X140) AUDIO RETURN CIRCUIT OPEN

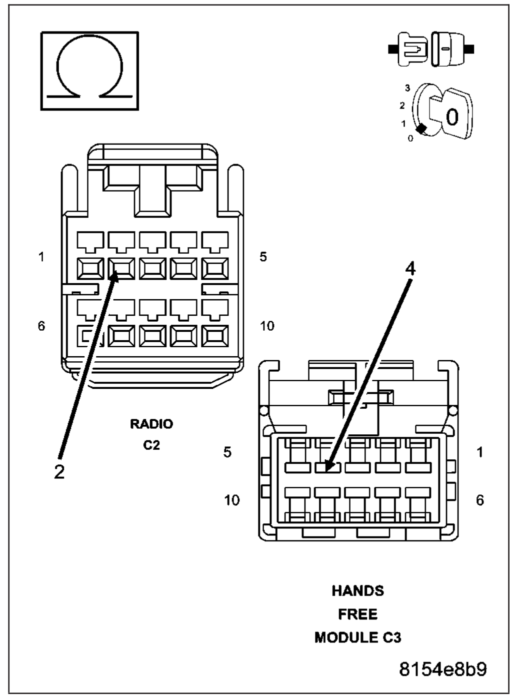
Measure the resistance of the (X140) Audio Return circuit between the HFM connector and the radio connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the (X140) Audio Return circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).




## 4. (X41) AUDIO MUX LEFT CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (X41) Audio MUX Left circuit.

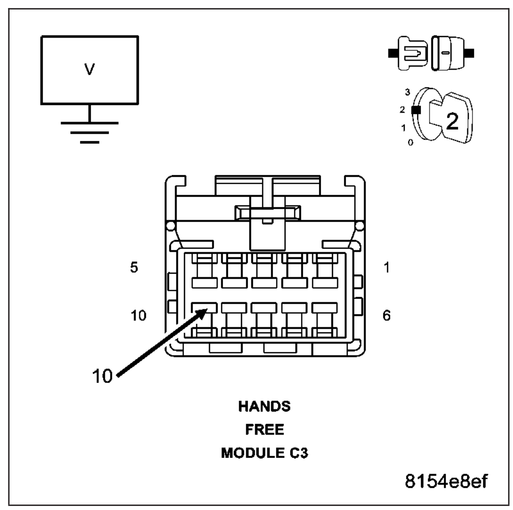
**Is the voltage above 1.0 volts?**

**Yes** >> Repair the (X41) Audio MUX Left circuit for a short to voltage.

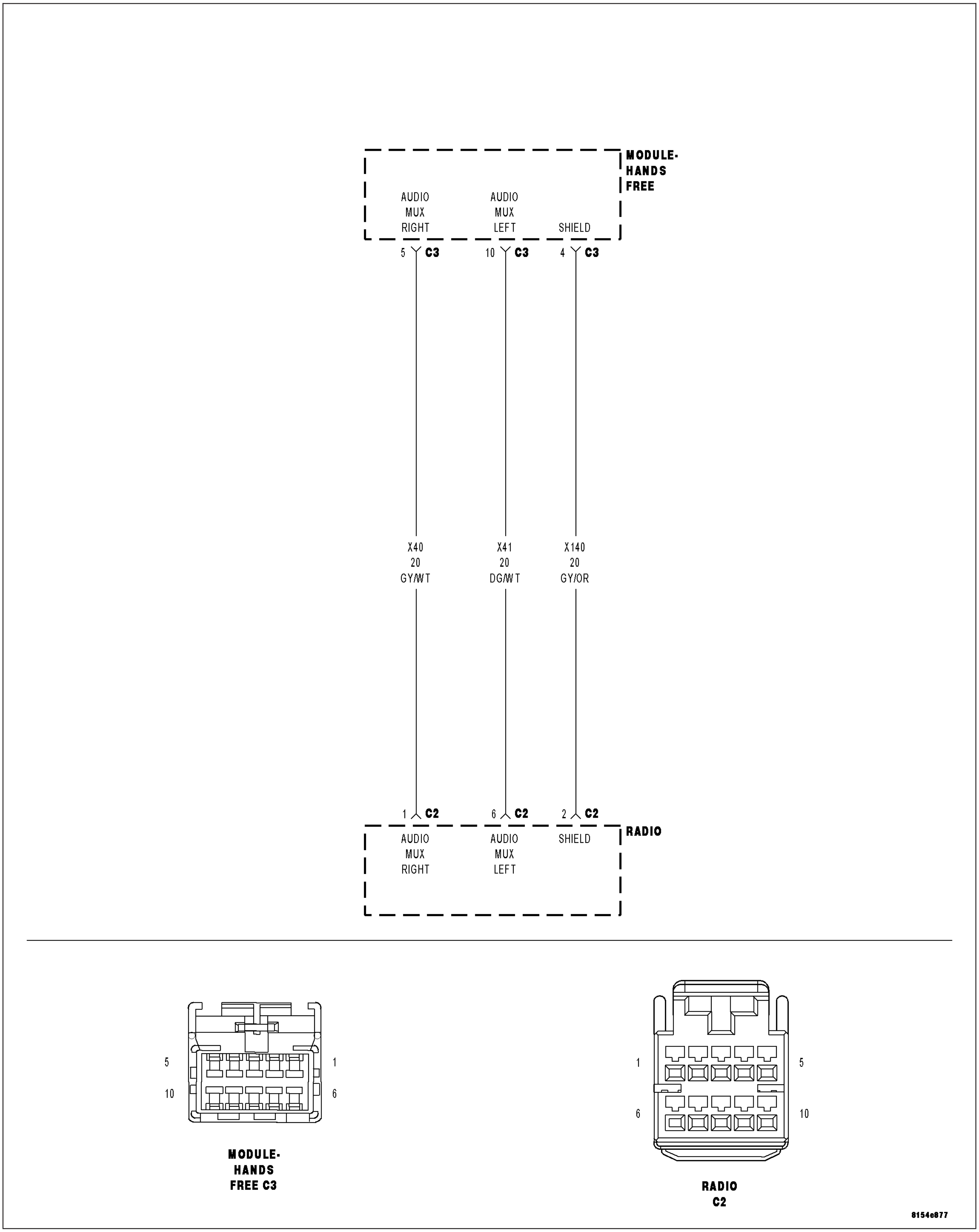
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



## LEFT AUDIO OUTPUT 1 SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a short to ground on the (X41) Audio MUX Left circuit.

| Possible Causes |
| --- |
| (X41) AUDIO MUX LEFT CIRCUIT OPEN |
| (X41) AUDIO MUX LEFT CIRCUIT SHORT TO GROUND |
| (X140) AUDIO RETURN CIRCUIT OPEN |
| (X41) AUDIO MUX LEFT CIRCUIT SHORT TO (X140) AUDIO RETURN CIRCUIT |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (X41) AUDIO MUX LEFT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Disconnect the Radio C2 harness connector.

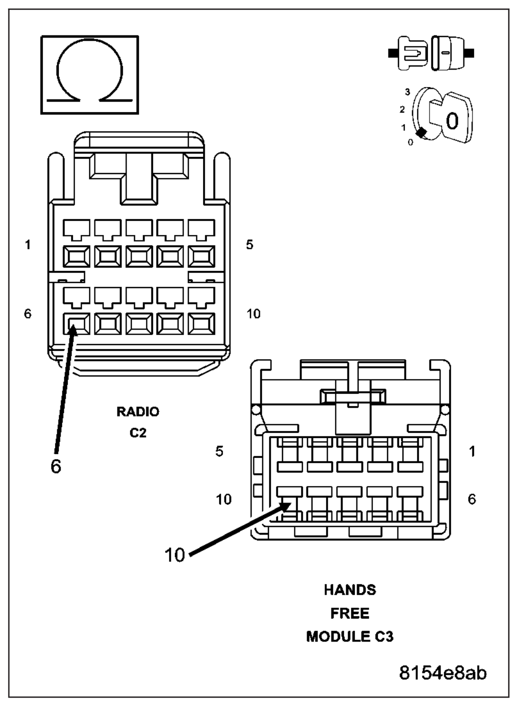
Measure the resistance of the (X41) Audio MUX Left circuit between the HFM connector and the radio connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 3

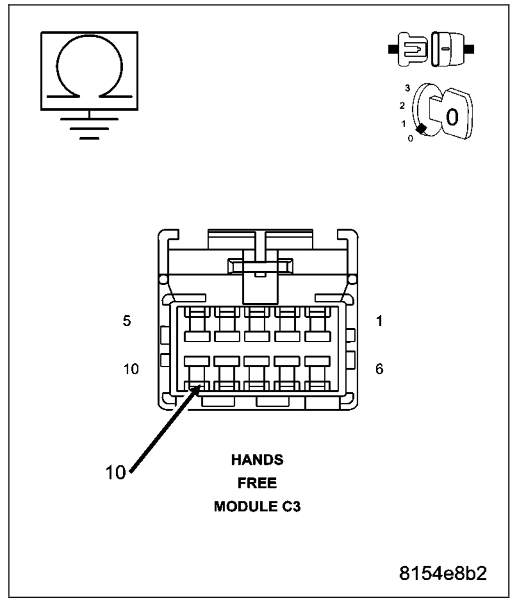
**No** >> Repair the (X41) Audio MUX Left circuit for an open

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



## 3. (X41) AUDIO MUX LEFT CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (X41) Audio MUX Left circuit.



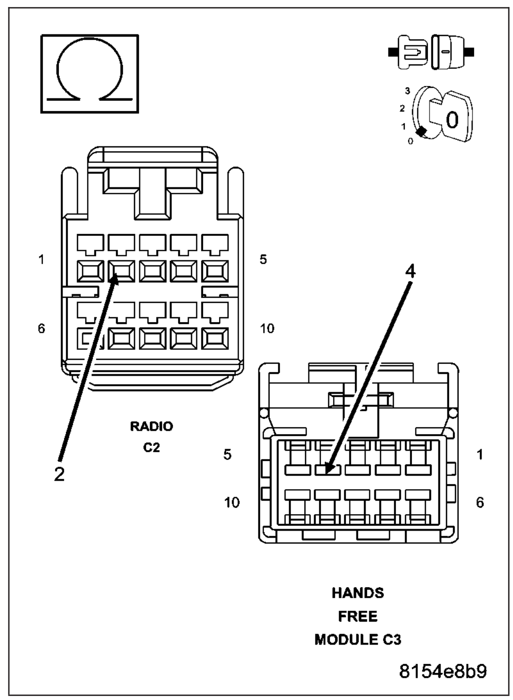

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (X41) Audio MUX Left circuit for short to ground. Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. (X140) AUDIO RETURN CIRCUIT OPEN

Measure the resistance of the (X140) Audio Return circuit between the HFM connector and the radio connector.



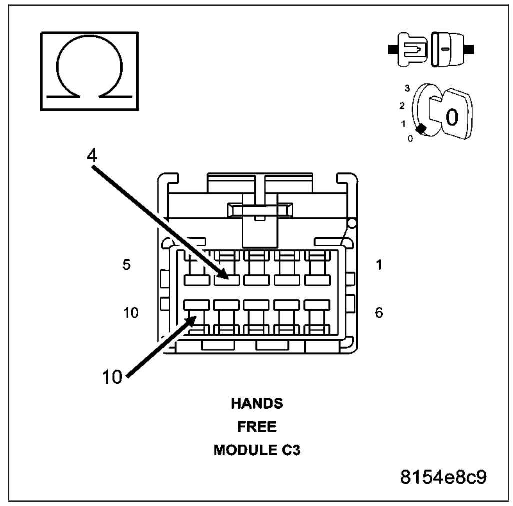

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (X140) Audio Return circuit for an open. Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 5. (X41) AUDIO MUX LEFT CIRCUIT SHORT TO (X140) AUDIO RETURN CIRCUIT

Measure the resistance between the (X41) Audio MUX Left circuit and the (X140) Audio Return circuit.




**Is the resistance below 5.0 ohms?**

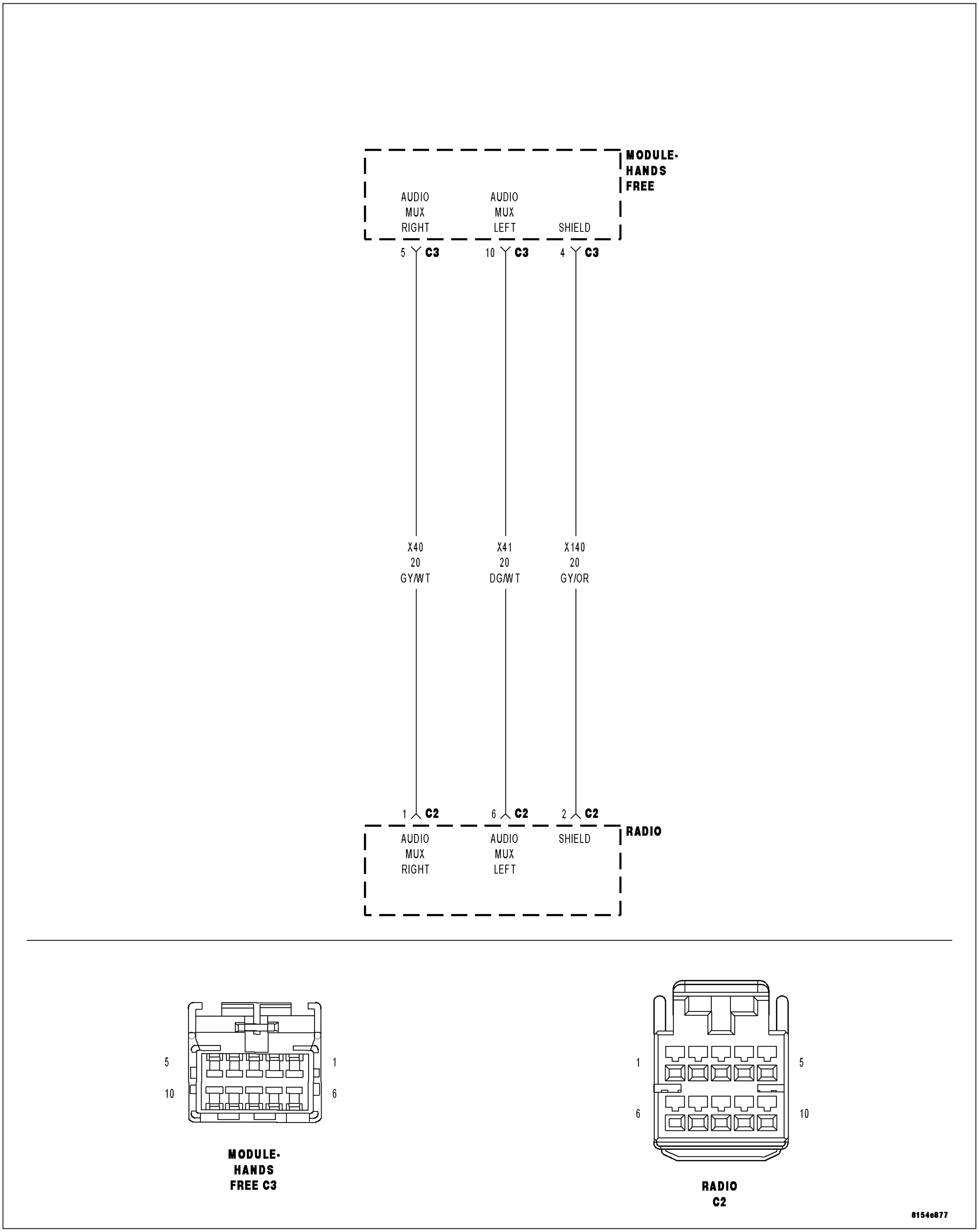
**Yes** >> Repair the (X41) Audio MUX Left circuit for a short to the (X140) Audio Return circuit.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## LEFT AUDIO OUTPUT 1 SHORT TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a short voltage on the (X41) Audio MUX Left circuit.

| Possible Causes |
|---|
| (X41) AUDIO MUX LEFT CIRCUIT OPEN |
| (X140) AUDIO RETURN CIRCUIT OPEN |
| (X41) AUDIO MUX LEFT CIRCUIT SHORT TO VOLTAGE |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

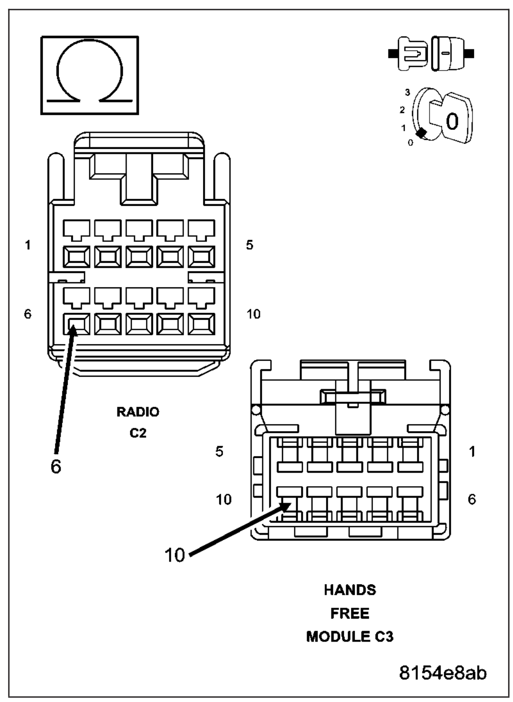
### 2. (X41) AUDIO MUX LEFT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Disconnect the Radio C2 harness connector.

Measure the resistance of the (X41) Audio MUX Left circuit between the HFM connector and the radio connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 3

**No** >> Repair the (X41) Audio MUX Left circuit for an open

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. (X140) AUDIO RETURN CIRCUIT OPEN

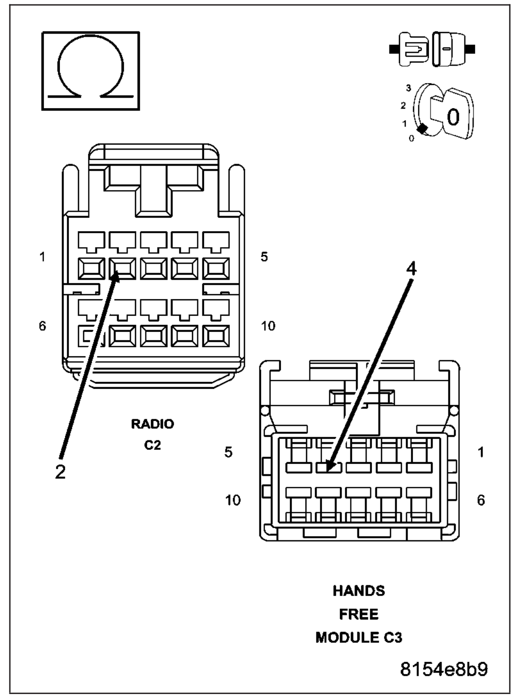
Measure the resistance of the (X140) Audio Return circuit between the HFM connector and the radio connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the (X140) Audio Return circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).




## 4. (X41) AUDIO MUX LEFT CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (X41) Audio MUX Left circuit.

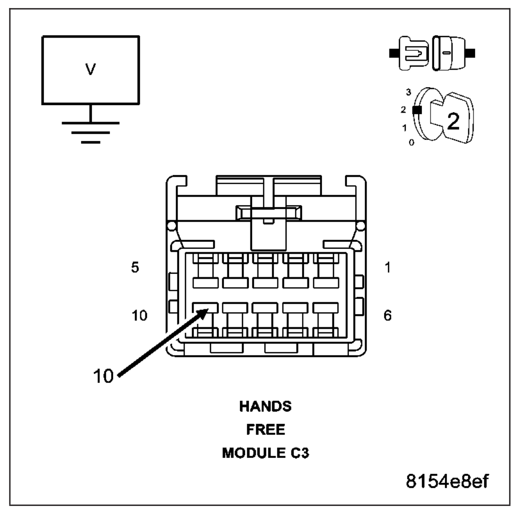
**Is the voltage above 1.0 volts?**

**Yes** >> Repair the (X41) Audio MUX Left circuit for a short to voltage.

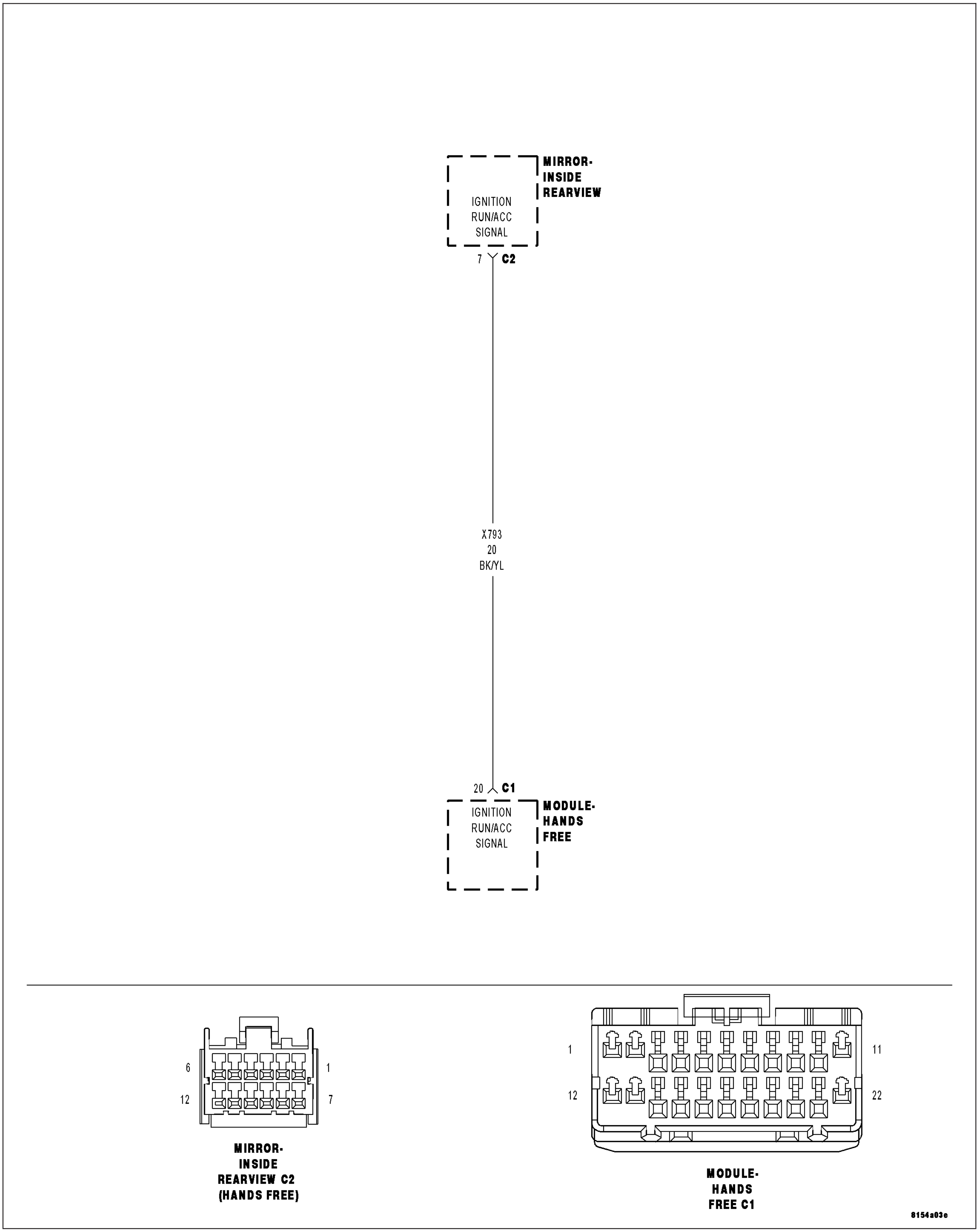
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



## MIRROR POWER CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects low voltage on the (X793) Microphone Feed circuit.

| Possible Causes |
|---|
| (X793) MICROPHONE FEED CIRCUIT OPEN |
| (X793) MICROPHONE FEED CIRCUIT SHORT TO GROUND |
| AUTOMATIC DAY/NIGHT MIRROR |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

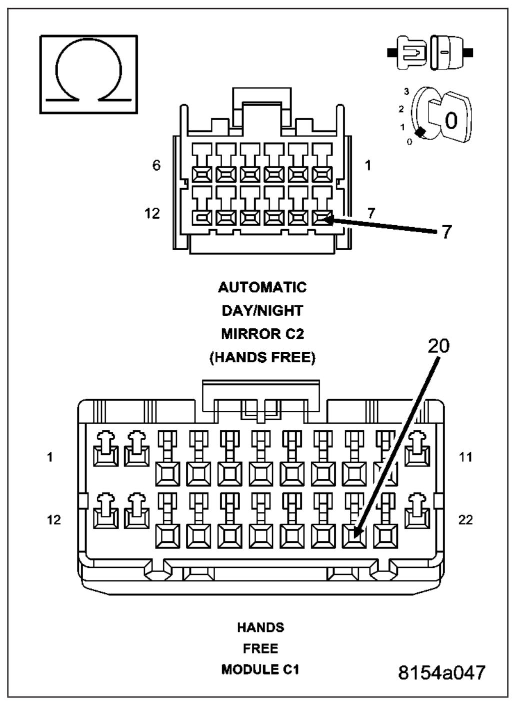
### 2. (X793) MICROPHONE FEED CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module C1 harness connector.

Disconnect the Automatic Day/Night Mirror C2 harness connector.

Measure the resistance of the (X793) Microphone Feed circuit between the HFM connector and the Automatic Day/Night Mirror connector.




**Is the resistance below 5.0 ohms?**

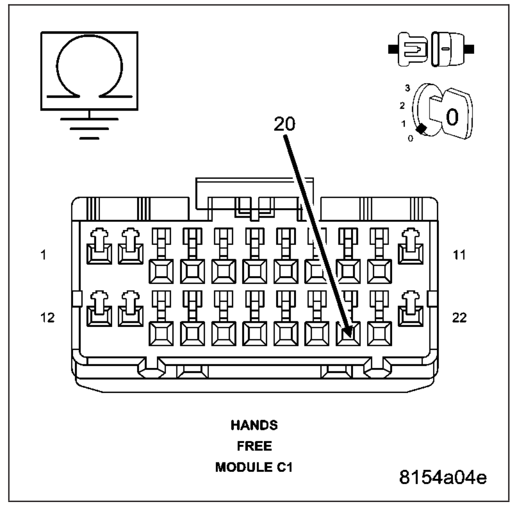
**Yes** >> Go To 3

**No** >> Repair the (X793) Microphone Feed circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. (X793) MICROPHONE FEED CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (X793) Microphone Feed circuit




**Is the resistance below 100.0 ohms?**

**Yes** >> Repair the (X793) Microphone Feed circuit for short to ground.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. AUTOMATIC DAY/NIGHT MIRROR

Replace the Inside Automatic Day/Night Mirror in accordance with the service information.

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

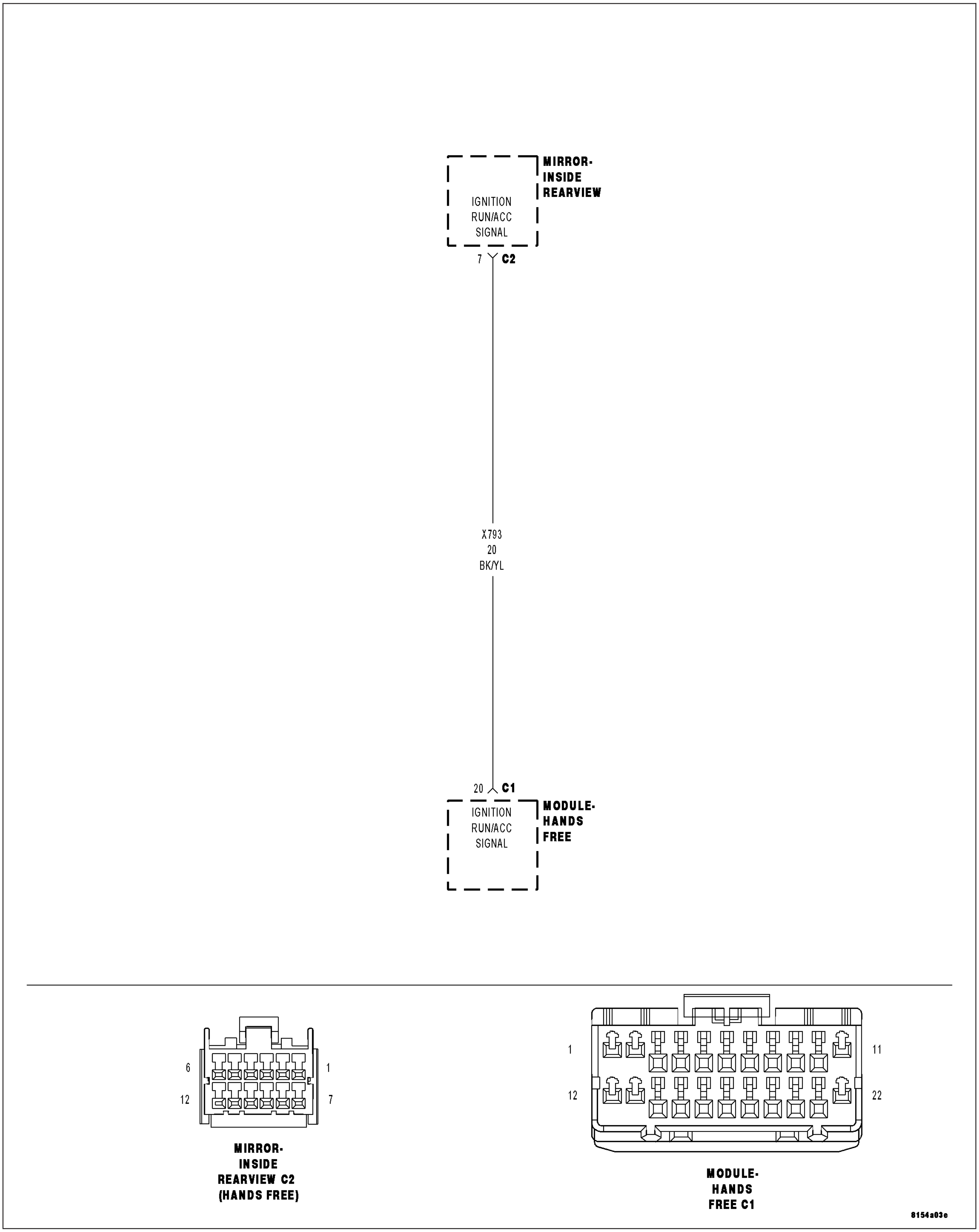
**Yes** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair is complete.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## MIRROR POWER CIRCUIT SHORT TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects high voltage on the (X793) Microphone Feed circuit.

| Possible Causes |
|---|
| (X793) MICROPHONE FEED CIRCUIT OPEN |
| (X793) MICROPHONE FEED CIRCUIT SHORT TO VOLTAGE |
| AUTOMATIC DAY/NIGHT MIRROR |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

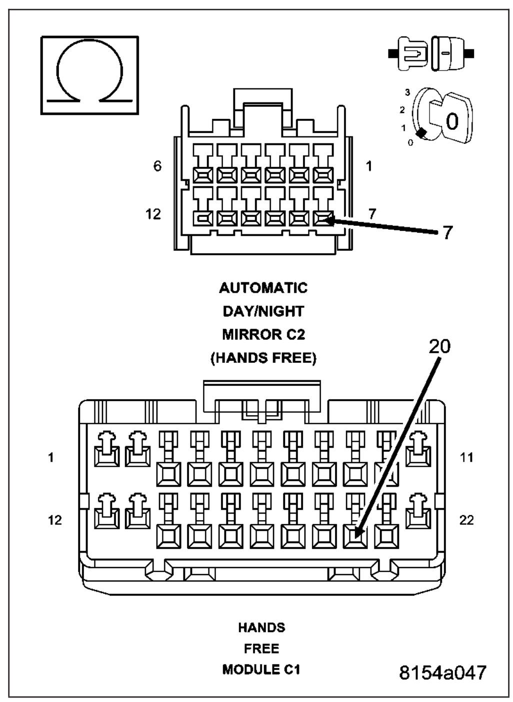
### 2. (X793) MICROPHONE FEED CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module C1 harness connector.

Disconnect the Automatic Day/Night Mirror C2 harness connector.

Measure the resistance of the (X793) Microphone Feed circuit between the HFM connector and the Automatic Day/Night Mirror connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 3

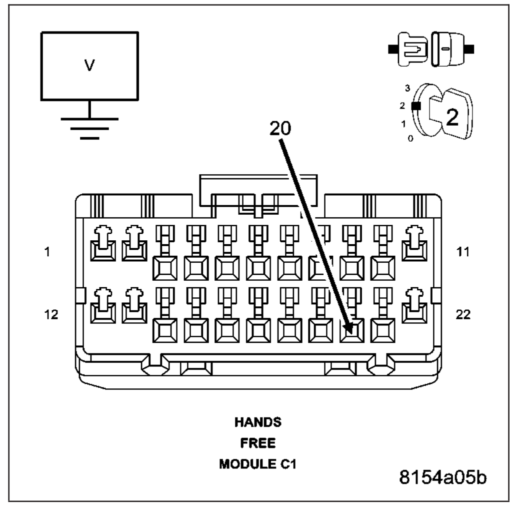
**No** >> Repair the (X793) Microphone Feed circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. (X793) MICROPHONE FEED CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (X793) Microphone Feed circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the (X793) Microphone Feed circuit for short to voltage.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. AUTOMATIC DAY/NIGHT MIRROR

Replace the Automatic Day/Night Mirror in accordance with the service information.

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

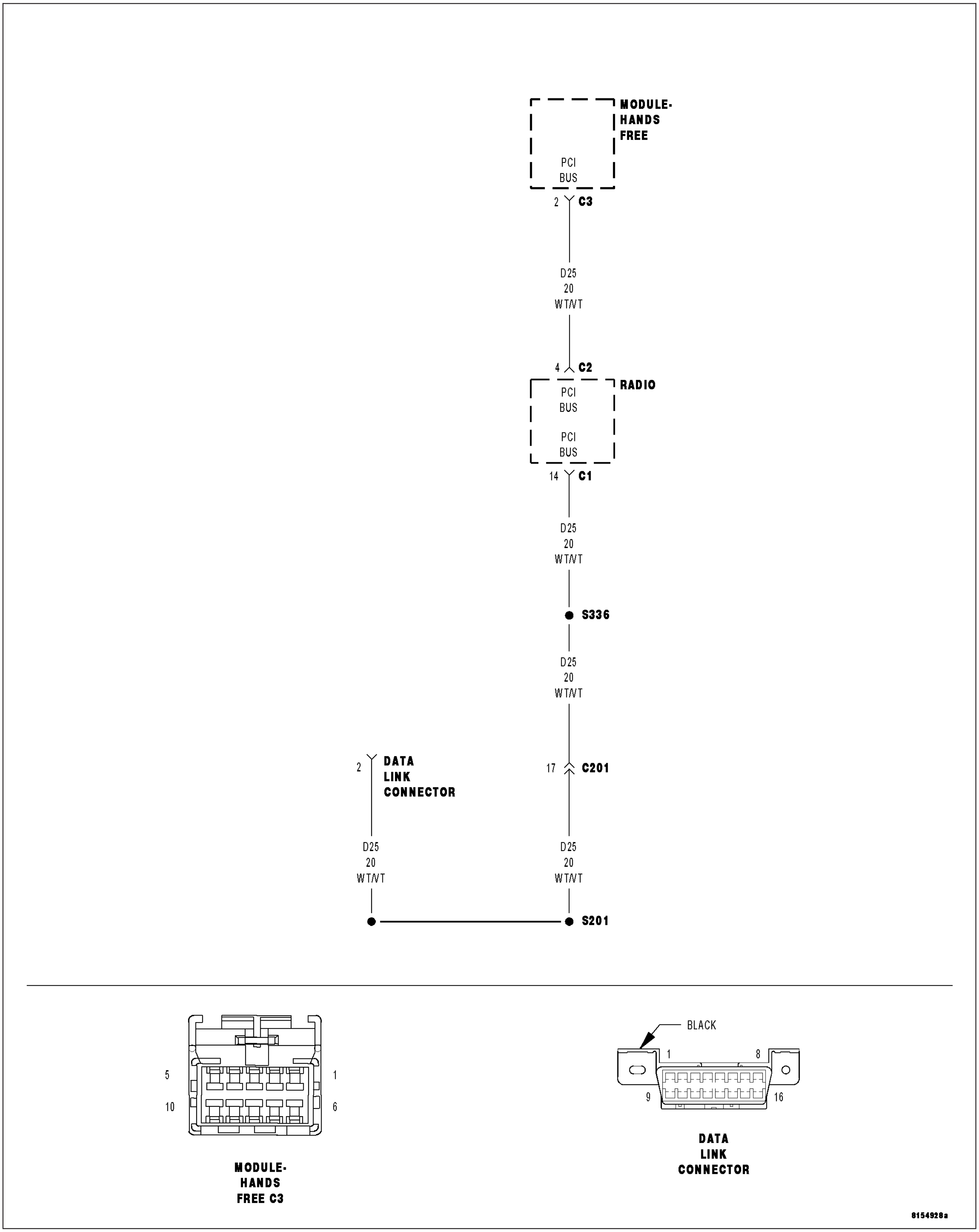
**Yes** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair is complete.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## PCI BUS BUSY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detected a fault on the (D25) PCI Bus circuit.

| Possible Causes |
|---|
| (D25) PCI BUS CIRCUIT FAULT |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR AN INTERMITTENT CONDITION

**NOTE: For this code to be active, the scan tool will not be able to communicate with any modules on the vehicle (except any CAN Bus module).**

**NOTE: Clear the DTC. If this DTC continues to set and the scan tool can still communicate with the module, it will be necessary to replace the module.**

**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.**

With the engine running at normal operating temperature, wiggle the wiring harnesses. This is to try and duplicate the complete bus failure condition.

Refer to any Technical Service Bulletins (TSB) that may apply.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

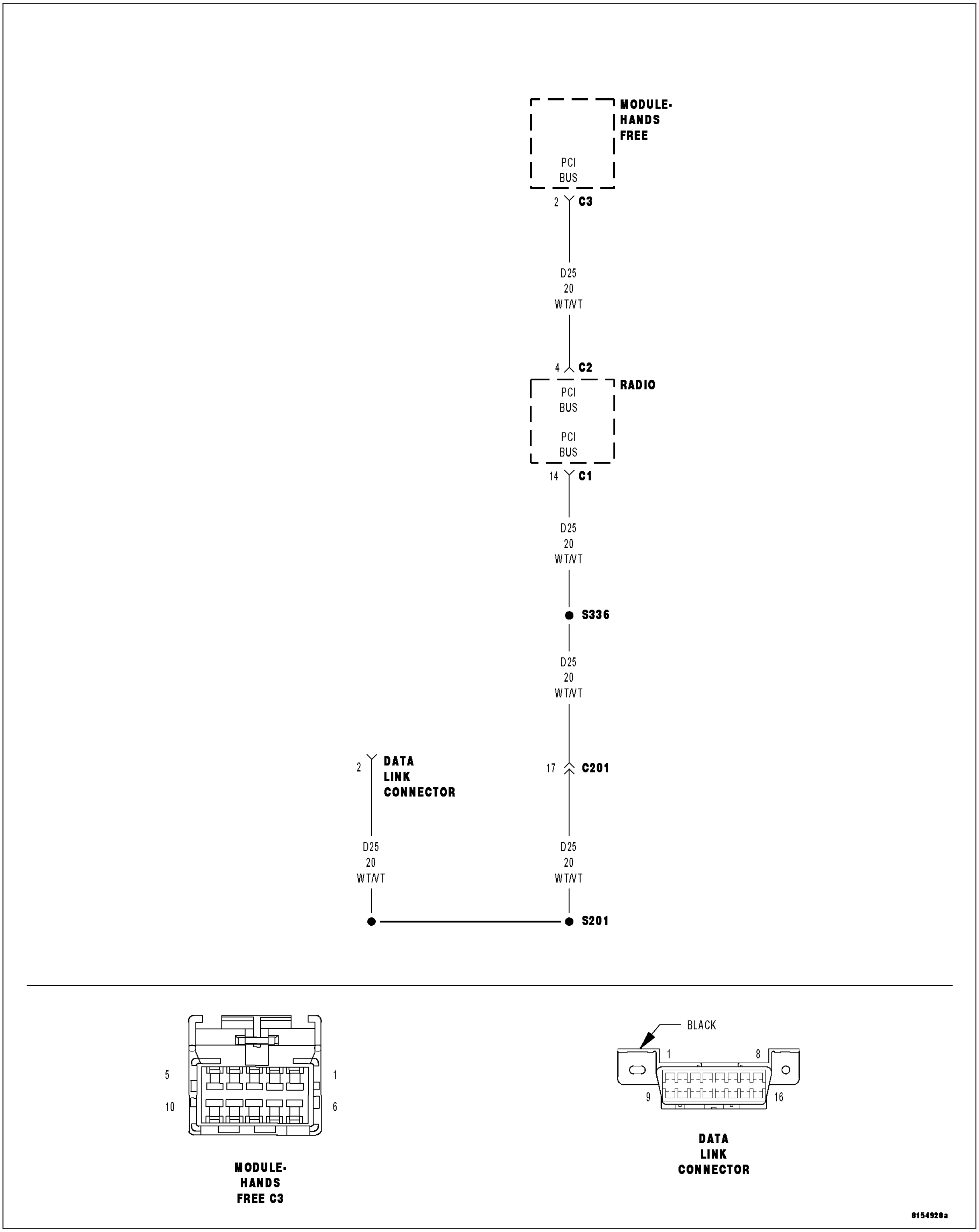
Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Test complete.

## PCI BUS CIRCUIT OPEN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detected an open on the (D25) PCI Bus circuit.

| Possible Causes |
|---|
| (D25) PCI BUS CIRCUIT OPEN |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR AN INTERMITTENT CONDITION

**NOTE: For this code to be active, the scan tool will not be able to communicate with any modules on the vehicle (except any CAN Bus module).**

**NOTE: Clear the DTC. If this DTC continues to set and the scan tool can still communicate with the module, it will be necessary to replace the module.**

**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.**

With the engine running at normal operating temperature, wiggle the wiring harnesses. This is to try and duplicate the complete bus failure condition.

Refer to any Technical Service Bulletins (TSB) that may apply.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

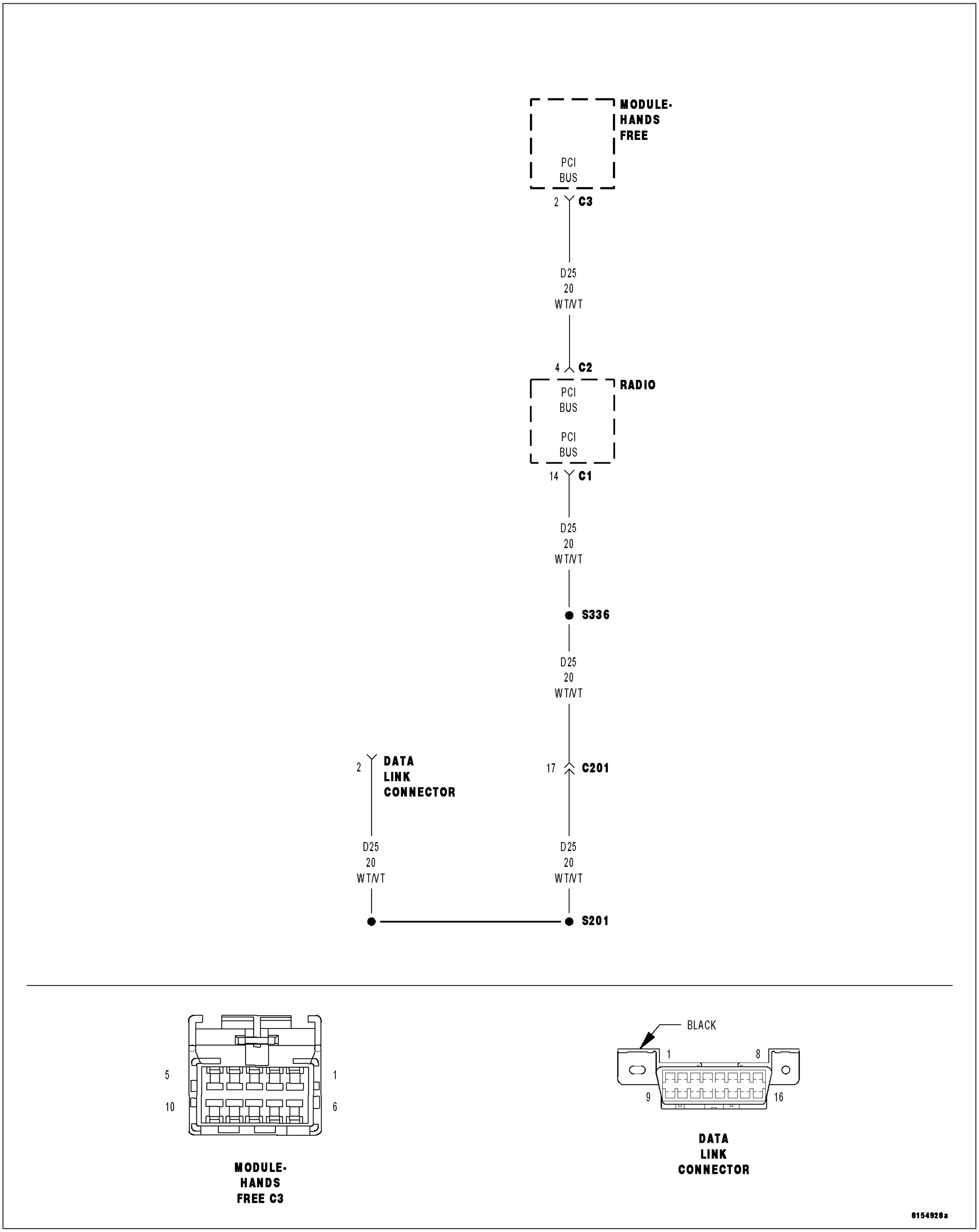
Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Test complete.

## PCI BUS CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detected a short to ground on the (D25) PCI Bus circuit.

| Possible Causes |
|---|
| (D25) PCI BUS CIRCUIT SHORTED TO GROUND |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR AN INTERMITTENT CONDITION

**NOTE: For this code to be active, the scan tool will not be able to communicate with any modules on the vehicle (except any CAN Bus module).**

**NOTE: Clear the DTC. If this DTC continues to set and the scan tool can still communicate with the module, it will be necessary to replace the module.**

**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.**

With the engine running at normal operating temperature, wiggle the wiring harnesses. This is to try and duplicate the complete bus failure condition.

Refer to any Technical Service Bulletins (TSB) that may apply.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

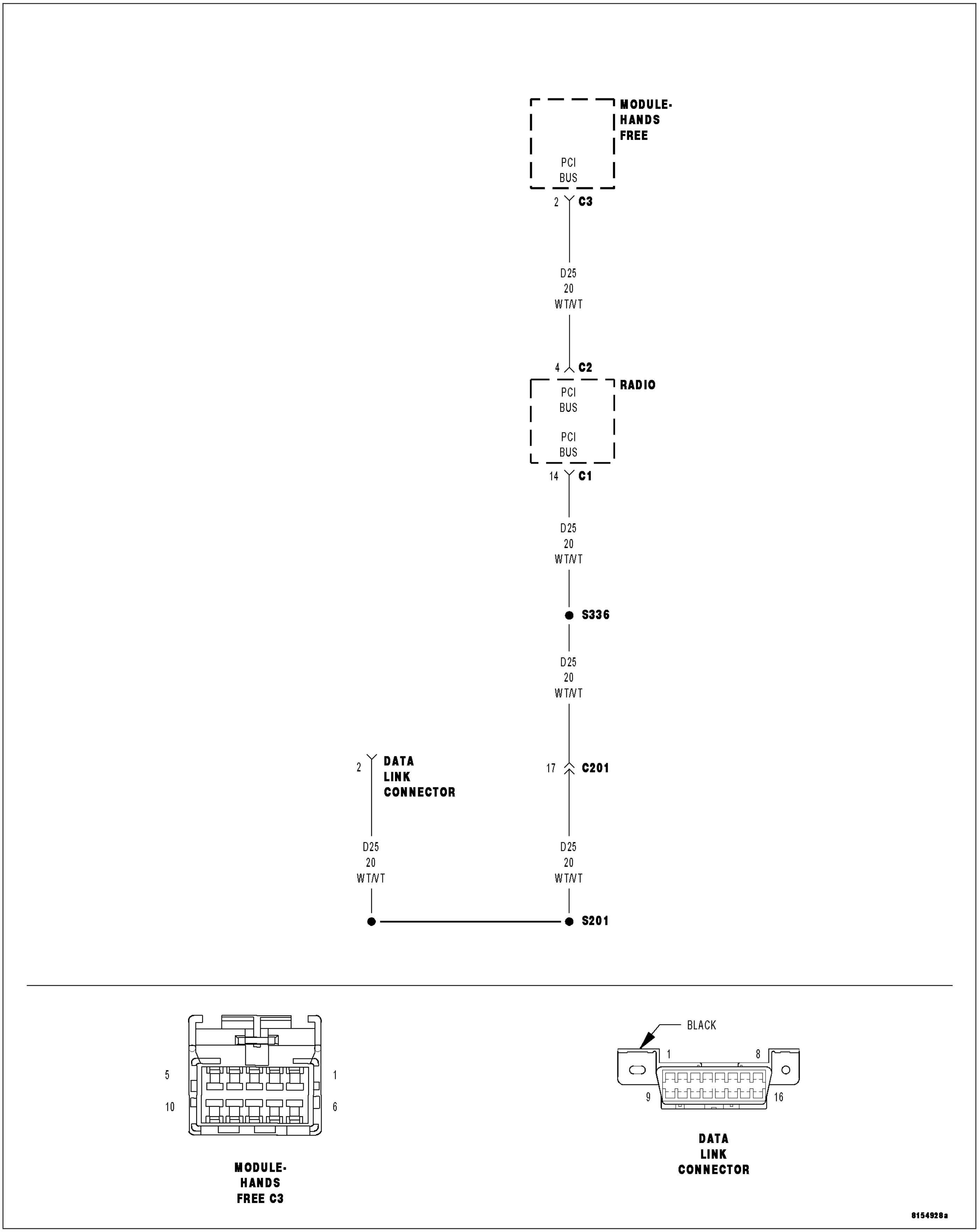
**Were any of the above conditions present?**

**Yes** >> Repair as necessary.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Test complete.

## PCI BUS CIRCUIT SHORT TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detected a short to voltage on the (D25) PCI Bus circuit.

| Possible Causes |
| --- |
| (D25) PCI BUS CIRCUIT SHORTED TO VOLTAGE |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR AN INTERMITTENT CONDITION

**NOTE: For this code to be active, the scan tool will not be able to communicate with any modules on the vehicle (except any CAN Bus module).**

**NOTE: Clear the DTC. If this DTC continues to set and the scan tool can still communicate with the module, it will be necessary to replace the module.**

**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.**

With the engine running at normal operating temperature, wiggle the wiring harnesses. This is to try and duplicate the complete bus failure condition.

Refer to any Technical Service Bulletins (TSB) that may apply.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Test complete.

## PCI BUS INTERNAL ERROR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault during an internal diagnostic check.

| Possible Causes |
| --- |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. ERASE DTC AND ATTEMPT TO RESET

Turn the ignition on.

With the scan tool, read and record the HFM DTC's and then erase the DTC's.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the HFM DTC's.

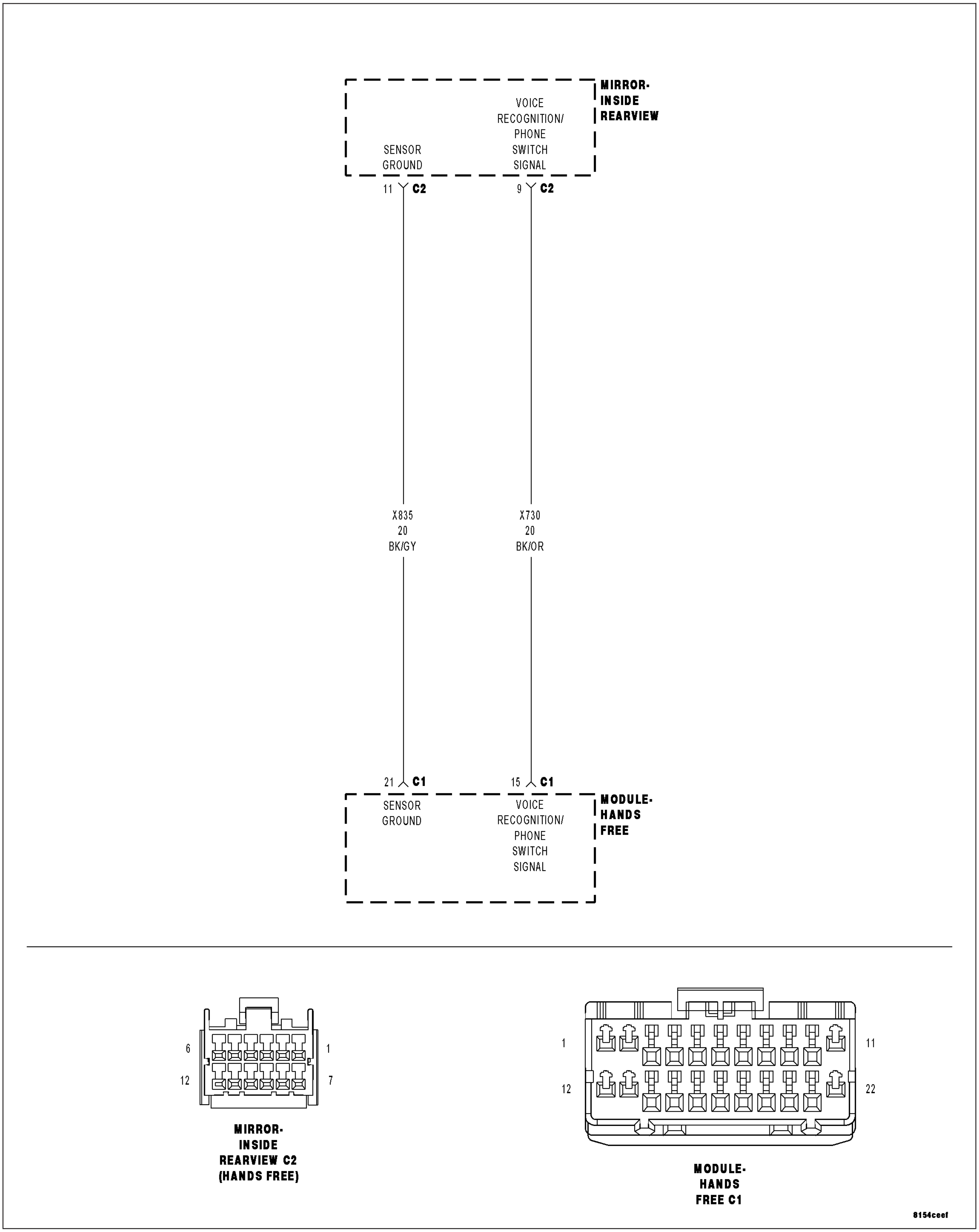
**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## PHONE SWITCH STUCK




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects voltage between 2.8 volts and 3.3 volts on the (X730) Voice Recognition/ Phone Switch Signal circuit for more than 30 seconds.

| Possible Causes |
|---|
| AUTOMATIC DAY/NIGHT MIRROR |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTCS

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. CHECK THE VOLTAGE OF THE (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL

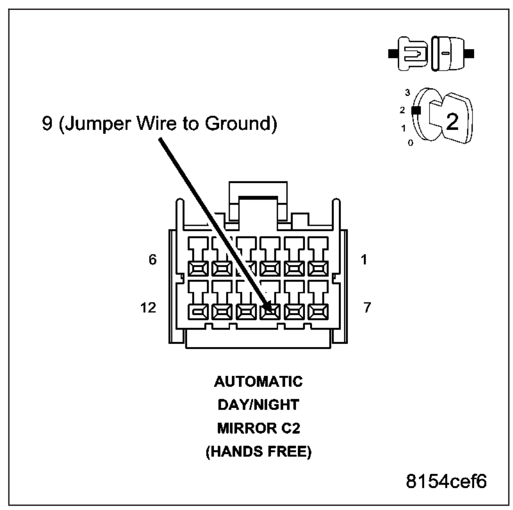
Turn the ignition off.

Disconnect the Automatic Day/Night Mirror C2 harness connector.

Turn the ignition on.

With the scan tool, monitor the VR Phone Switch voltage.

While monitoring the VR Phone Switch voltage, momentarily connect a jumper wire between (X730) Voice Recognition/Phone Switch Signal circuit and ground.




**NOTE: The sensor voltage should switch from above 4.7 volts when the jumper is not connected to below 0.6 volts when the jumper is connected.**

**Does the sensor voltage switch from above 4.7 volts to below 0.6 volt as described?**

**Yes** >> Replace the Automatic Day/Night Mirror in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## PRNDL MESSAGE NOT RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module does not receive a gear selector message from the TCM.

| Possible Causes |
|---|
| LOST COMMUNICATION WITH TCM |
| HANDS FREE MODULE |

### Diagnostic Test

#### 1. ATTEMPT TO COMMUNICATE WITH THE TCM

Turn the ignition on.

Turn the radio on.

With the scan tool, attempt to communicate with the TCM.

**Was the scan tool able to communicate with the TCM?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the related symptom.

#### 2. ERASE DTC AND ATTEMPT TO RESET

With the scan tool, erase the HFM DTC's.

Cycle the ignition switch from off to on and wait approximately 1 minute.

With the scan tool, read the HFM DTC's.

**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## RADIO MESSAGE NOT RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module does not receive a message from the radio.

| Possible Causes |
|---|
| LOST COMMUNICATION WITH RADIO |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. ATTEMPT TO COMMUNICATE WITH THE RADIO

Turn the ignition on.

Turn the radio on.

With the scan tool, attempt to communicate with the radio.

**Was the scan tool able to communicate with the radio?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the related symptom.

### 2. ERASE DTC AND ATTEMPT TO RESET

With the scan tool, erase the HFM DTC's.

Cycle the ignition switch from off to on and wait approximately 1 minute.

With the scan tool, read the HFM DTC's.

**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## RAM WRITE ERROR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault during an internal diagnostic check.

| Possible Causes |
| --- |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. ERASE DTC AND ATTEMPT TO RESET

Turn the ignition on.

With the scan tool, read and record the HFM DTC's and then erase the DTC's.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the HFM DTC's.

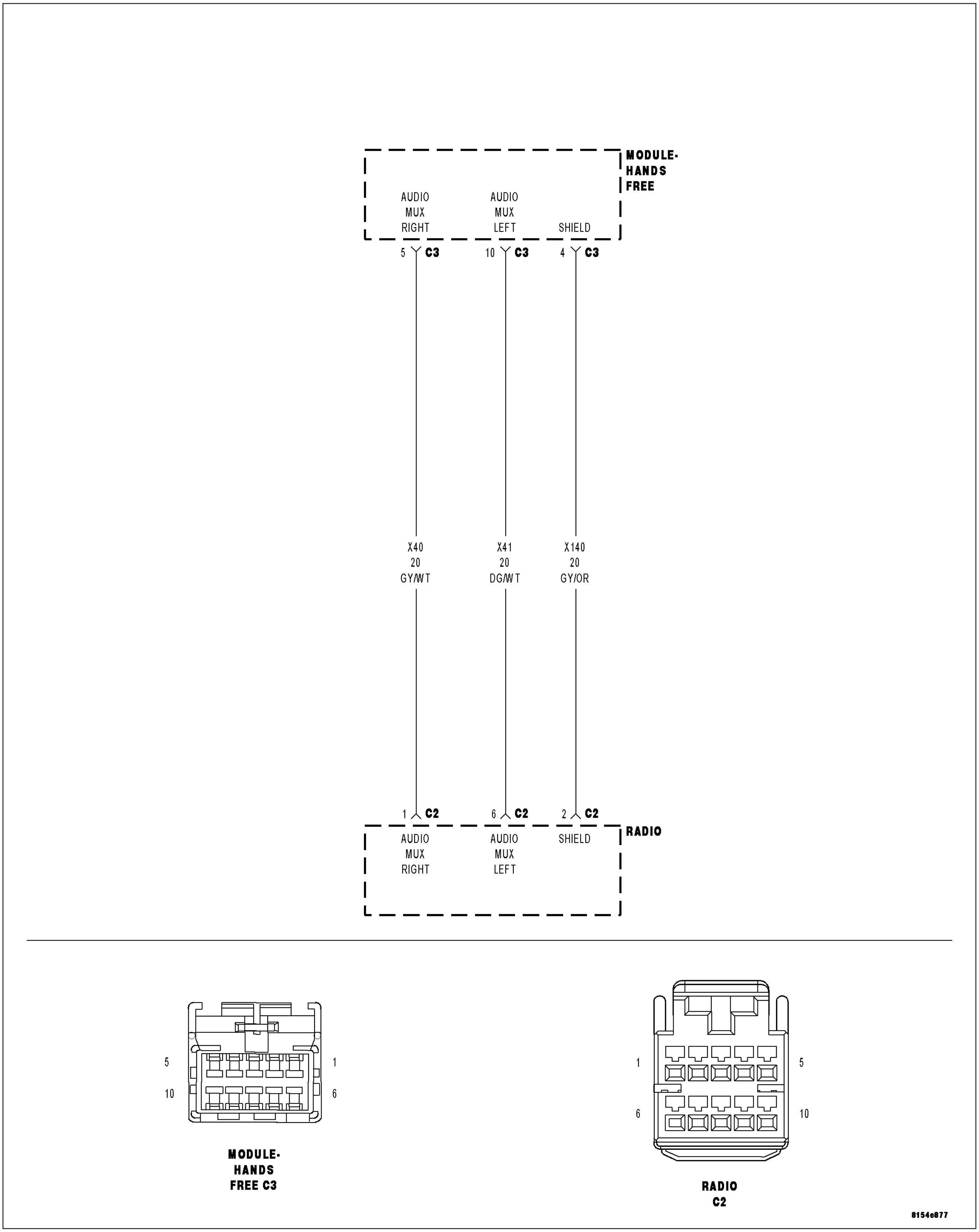
**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## RIGHT AUDIO INPUT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects low voltage on the (X40) Audio MUX Right circuit.

| Possible Causes |
| --- |
| (X40) AUDIO MUX RIGHT CIRCUIT OPEN |
| (X40) AUDIO MUX RIGHT CIRCUIT SHORT TO GROUND |
| (X140) AUDIO RETURN CIRCUIT OPEN |
| (X40) AUDIO MUX RIGHT CIRCUIT SHORT TO (X140) AUDIO RETURN CIRCUIT |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (X40) AUDIO MUX RIGHT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Disconnect the Radio C2 harness connector.

Measure the resistance of the (X40) Audio MUX Right circuit between the HFM connector and the radio connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 3

**No** >> Repair the (X40) Audio MUX Right circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

### 3. (X40) AUDIO MUX RIGHT CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (X40) Audio MUX Right circuit.

**Is the resistance below 5.0 ohms?**

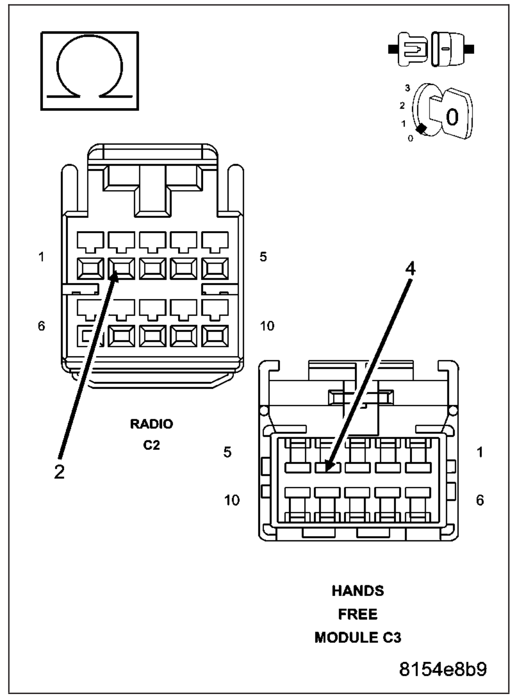
**Yes** >> Repair the (X40) Audio MUX Right circuit for short to ground.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. (X140) AUDIO RETURN CIRCUIT OPEN

Measure the resistance of the (X140) Audio Return circuit between the HFM connector and the radio connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (X140) Audio Return circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 5. (X40) AUDIO MUX RIGHT CIRCUIT SHORT TO (X140) AUDIO RETURN CIRCUIT

Measure the resistance between the (X40) Audio MUX Right circuit and the (X140) Audio Return circuit.

**Is the resistance below 5.0 ohms?**

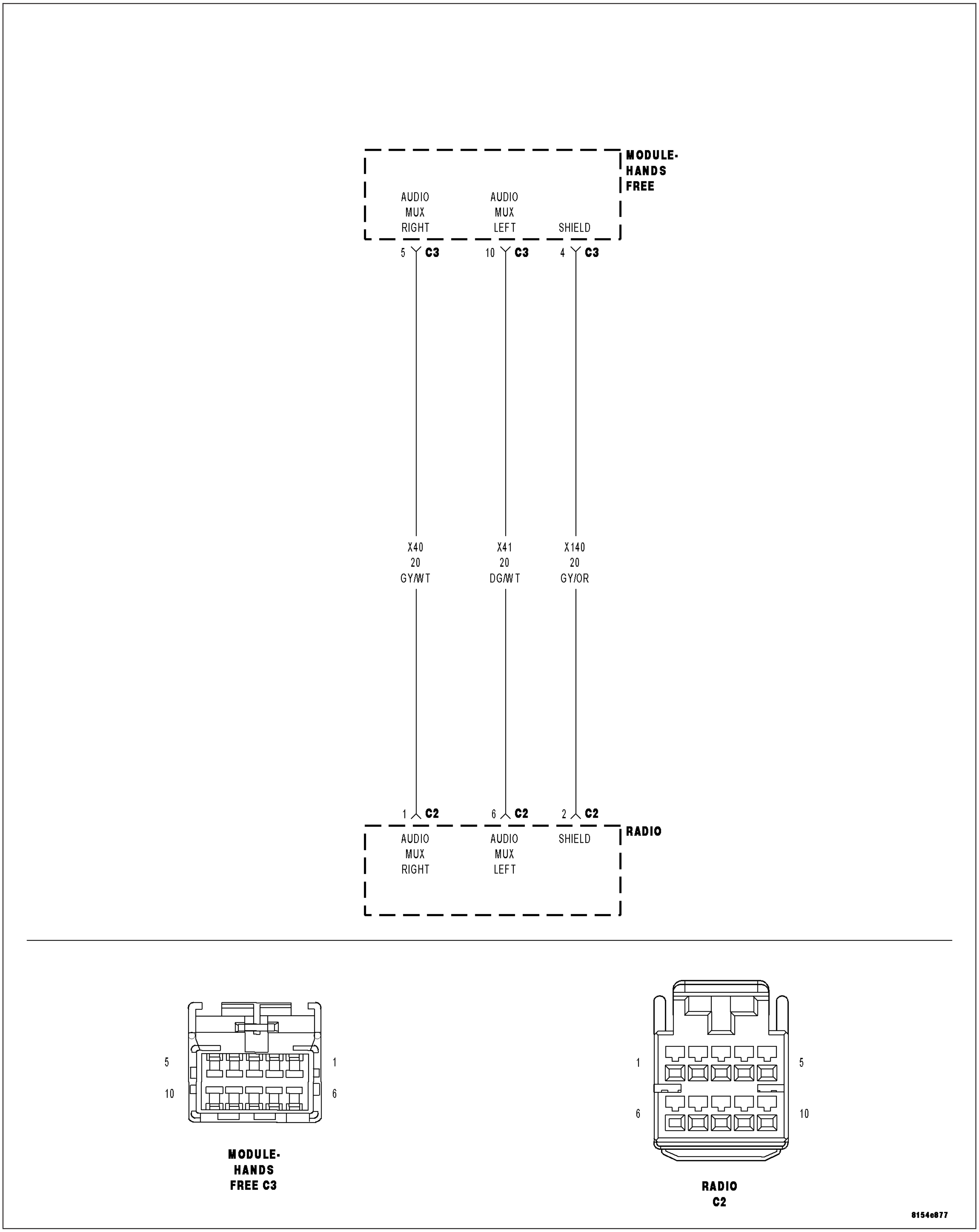
**Yes** >> Repair the (X40) Audio MUX Right circuit for a short to the (X140) Audio Return circuit.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## RIGHT AUDIO INPUT SHORT TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects high voltage on the (X40) Audio MUX Right circuit.

| Possible Causes |
|---|
| (X40) AUDIO MUX RIGHT CIRCUIT OPEN |
| (X140) AUDIO RETURN CIRCUIT OPEN |
| (X40) AUDIO MUX RIGHT CIRCUIT SHORT TO VOLTAGE |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (X40) AUDIO MUX RIGHT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Disconnect the Radio C2 harness connector.

Measure the resistance of the (X40) Audio MUX Right circuit between the HFM connector and the radio connector.

**Is the resistance below 5.0 ohms?**

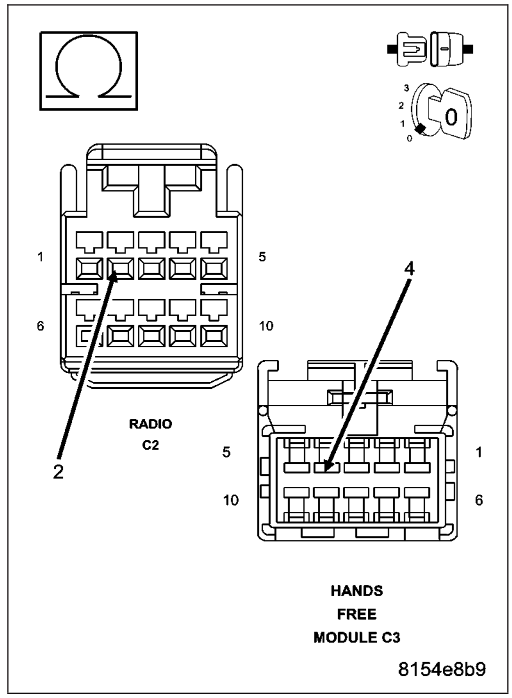
**Yes** >> Go To 3

**No** >> Repair the (X40) Audio MUX Right circuit for an open

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. (X140) AUDIO RETURN CIRCUIT OPEN

Measure the resistance of the (X140) Audio Return circuit between the HFM connector and the radio connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the (X140) Audio Return circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 4. (X40) AUDIO MUX RIGHT CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (X40) Audio MUX Right circuit.

**Is the voltage above 1.0 volts?**

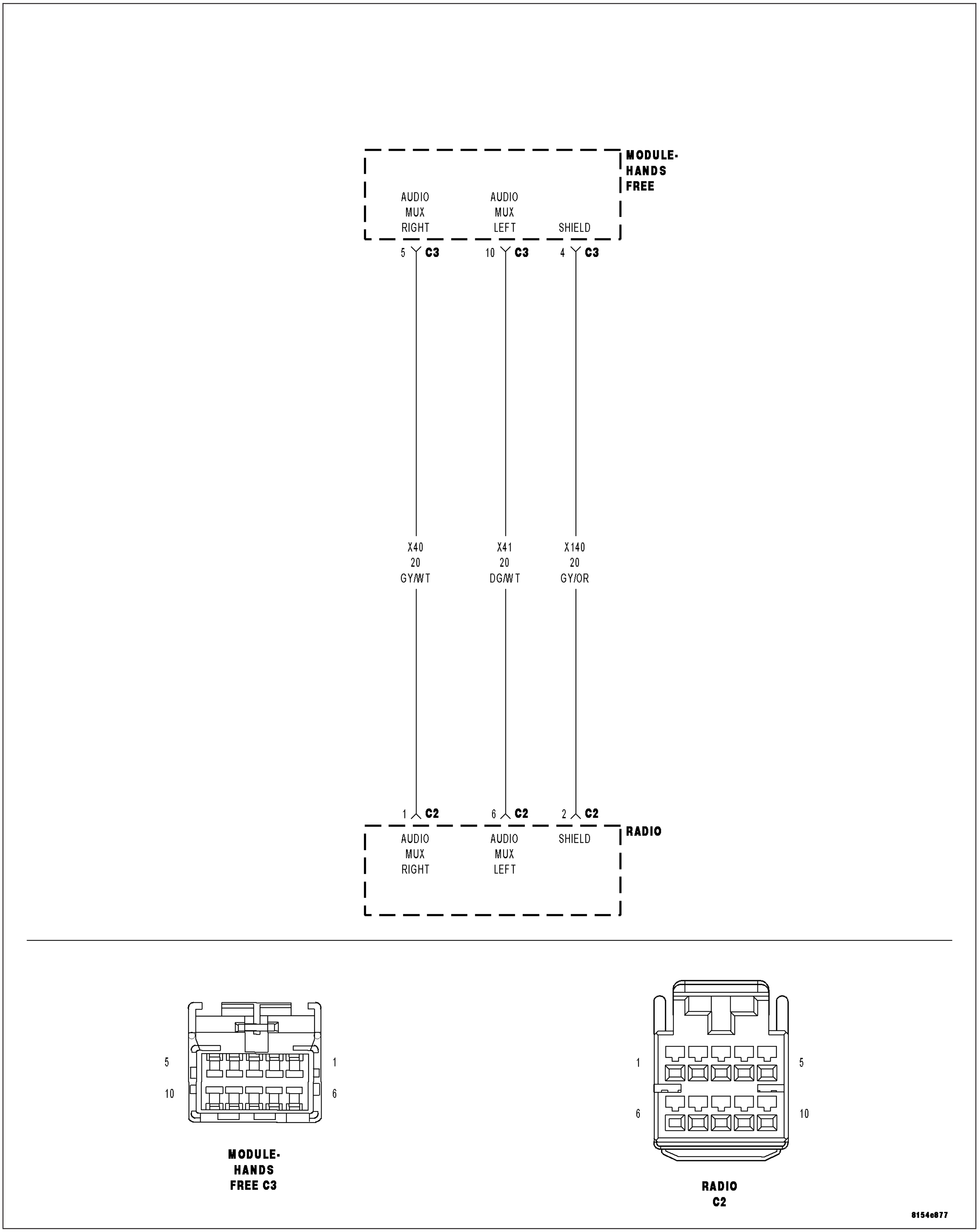
**Yes** >> Repair the (X40) Audio MUX Right circuit for a short to voltage.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## RIGHT AUDIO OUTPUT 1 SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects low voltage on the (X40) Audio MUX Right circuit.

| Possible Causes |
| --- |
| (X40) AUDIO MUX RIGHT CIRCUIT OPEN |
| (X40) AUDIO MUX RIGHT CIRCUIT SHORT TO GROUND |
| (X140) AUDIO RETURN CIRCUIT OPEN |
| (X40) AUDIO MUX RIGHT CIRCUIT SHORT TO (X140) AUDIO RETURN CIRCUIT |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (X40) AUDIO MUX RIGHT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Disconnect the Radio C2 harness connector.

Measure the resistance of the (X40) Audio MUX Right circuit between the HFM connector and the radio connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 3

**No** >> Repair the (X40) Audio MUX Right circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

### 3. (X40) AUDIO MUX RIGHT CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (X40) Audio MUX Right circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (X40) Audio MUX Right circuit for short to ground.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. (X140) AUDIO RETURN CIRCUIT OPEN

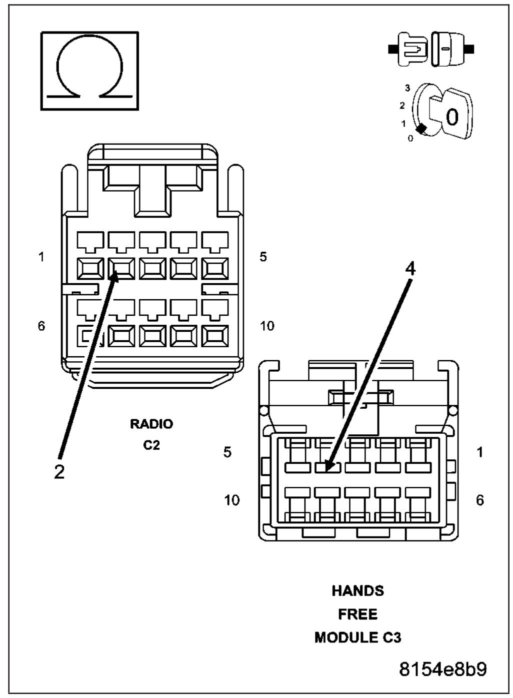
Measure the resistance of the (X140) Audio Return circuit between the HFM connector and the radio connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (X140) Audio Return circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).




## 5. (X40) AUDIO MUX RIGHT CIRCUIT SHORT TO (X140) AUDIO RETURN CIRCUIT

Measure the resistance between the (X40) Audio MUX Right circuit and the (X140) Audio Return circuit.

**Is the resistance below 5.0 ohms?**

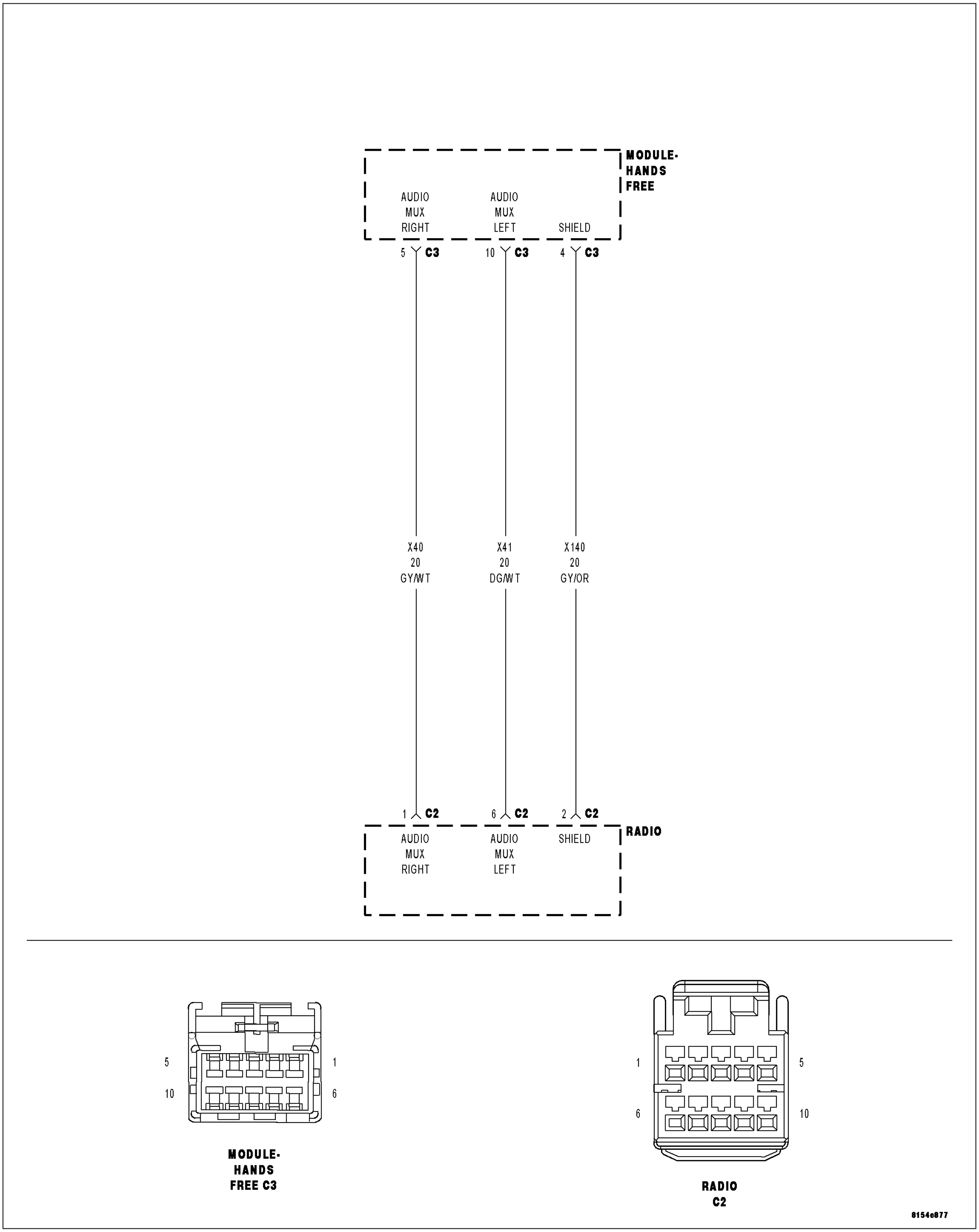
**Yes** >> Repair the (X40) Audio MUX Right circuit for a short to the (X140) Audio Return circuit.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## RIGHT AUDIO OUTPUT 1 SHORT TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects high voltage on the (X40) Audio MUX Right circuit.

| Possible Causes |
|---|
| (X40) AUDIO MUX RIGHT CIRCUIT OPEN |
| (X140) AUDIO RETURN CIRCUIT OPEN |
| (X40) AUDIO MUX RIGHT CIRCUIT SHORT TO VOLTAGE |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. (X40) AUDIO MUX RIGHT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module harness connector.

Disconnect the Radio C2 harness connector.

Measure the resistance of the (X40) Audio MUX Right circuit between the HFM connector and the radio connector.

**Is the resistance below 5.0 ohms?**

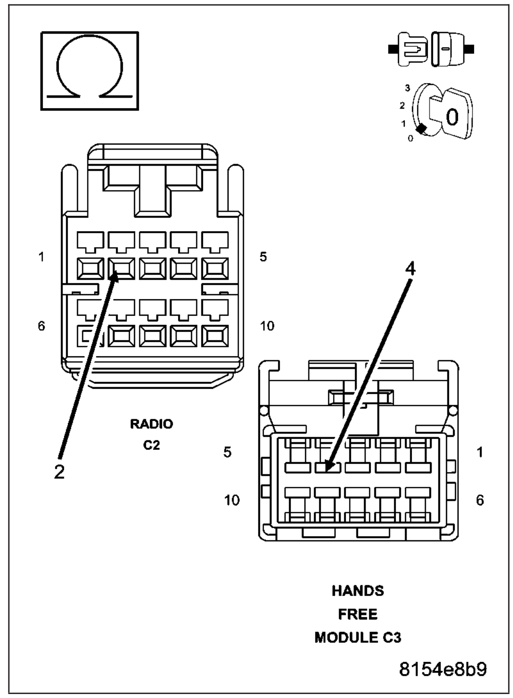
**Yes** >> Go To 3

**No** >> Repair the (X40) Audio MUX Right circuit for an open

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 3. (X140) AUDIO RETURN CIRCUIT OPEN

Measure the resistance of the (X140) Audio Return circuit between the HFM connector and the radio connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the (X140) Audio Return circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## 4. (X40) AUDIO MUX RIGHT CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (X40) Audio MUX Right circuit.

**Is the voltage above 1.0 volts?**

**Yes** >> Repair the (X40) Audio MUX Right circuit for a short to voltage.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## ROM CHECKSUM ERROR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects a fault during an internal diagnostic check.

| Possible Causes |
| --- |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. ERASE DTC AND ATTEMPT TO RESET

Turn the ignition on.

With the scan tool, read and record the HFM DTC's and then erase the DTC's.

Perform 5 ignition key cycles, leaving the ignition key on for a minimum of 90 seconds per cycle.

With the scan tool, read the HFM DTC's.

**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## RPM MESSAGE NOT RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module does not detect a Bus message indicating current engine RPM.

| Possible Causes |
|---|
| LOST COMMUNICATION WITH PCM |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. ATTEMPT TO COMMUNICATE WITH THE PCM

Start and idle the engine.

With the scan tool, select Engine and read the Engine RPM.

**Was the scan tool able to communicate with the PCM and read engine RPM?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the related symptom.

### 2. ERASE DTC AND ATTEMPT TO RESET

With the scan tool, erase the HFM DTC's.

Cycle the ignition switch from off to on and wait approximately 1 minute.

With the scan tool, read the HFM DTC's.

**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## VIN MESSAGE NOT RECEIVED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module does not receive the VIN message from the PCM.

| Possible Causes |
|---|
| LOST COMMUNICATION WITH PCM |
| PCM NOT ACTIVE ON THE BUS NETWORK |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. ATTEMPT TO COMMUNICATE WITH THE PCM

Turn the ignition on.

With the scan tool, attempt to communicate with the PCM.

**Was the scan tool able to communicate with the PCM?**

**Yes** >> Go To 2

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the related symptom.

### 2. CHECK PCM ACTIVITY ON THE BUS NETWORK

With the scan tool, select System Monitors then J1850 Module Scan.

**Does the scan tool indicate that the PCM is present or active on the bus network?**

**Yes** >> Go To 3

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) and perform the related symptom.

### 3. ERASE DTC AND ATTEMPT TO RESET

With the scan tool, erase the HFM DTC's.

Cycle the ignition switch from off to on and wait approximately 1 minute.

With the scan tool, read the HFM DTC's.

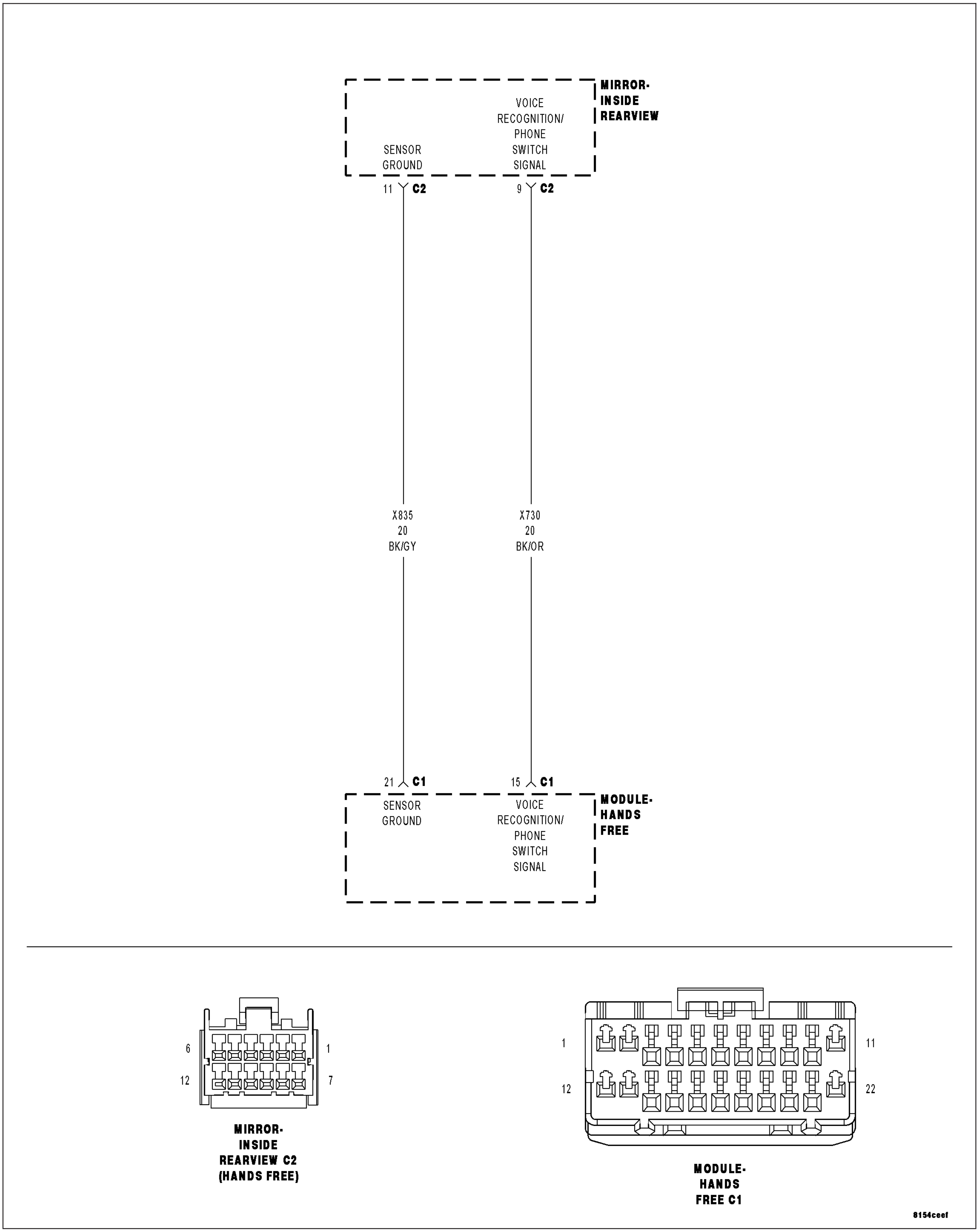
**Did this DTC reset?**

**Yes** >> Replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

## VOICE RECOGNITION SWITCH STUCK




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects voltage between 3.5 volts and 4.0 volts on the (X730) Voice Recognition/ Phone Switch Signal circuit for more than 30 seconds.

| Possible Causes |
|---|
| AUTOMATIC DAY/NIGHT MIRROR |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTCS

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. CHECK THE VOLTAGE OF THE (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL

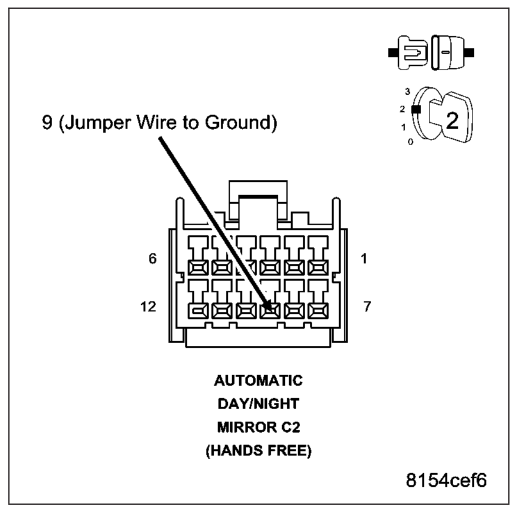
Turn the ignition off.

Disconnect the Automatic Day/Night Mirror C2 harness connector.

Turn the ignition on.

With the scan tool, monitor the VR Phone Switch voltage.

While monitoring the VR Phone Switch voltage, momentarily connect a jumper wire between (X730) Voice Recognition/Phone Switch Signal circuit and ground.




**NOTE: The sensor voltage should switch from above 4.7 volts when the jumper is not connected to below 0.6 volts when the jumper is connected.**

**Does the sensor voltage switch from above 4.7 volts to below 0.6 volt as described?**

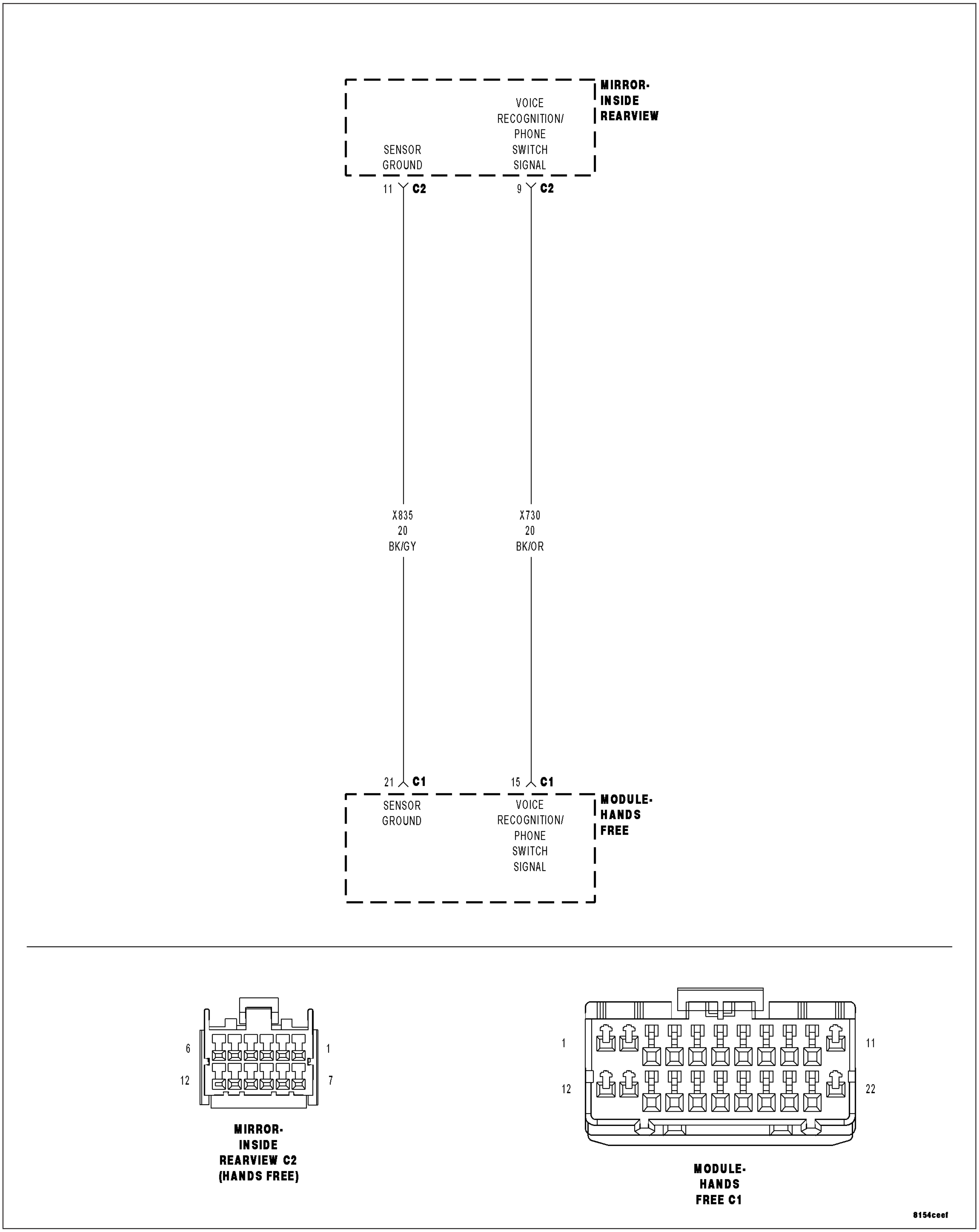
**Yes** >> Replace the Automatic Day/Night Mirror in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## VOICE RECOGNITION/PHONE SWITCH CIRCUIT RATIONALITY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects an invalid voltage signal on the (X730) Voice Recognition/Phone Switch Signal circuit.

| Possible Causes |
|---|
| AUTOMATIC DAY/NIGHT MIRROR |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. CHECK THE VOLTAGE OF THE (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL

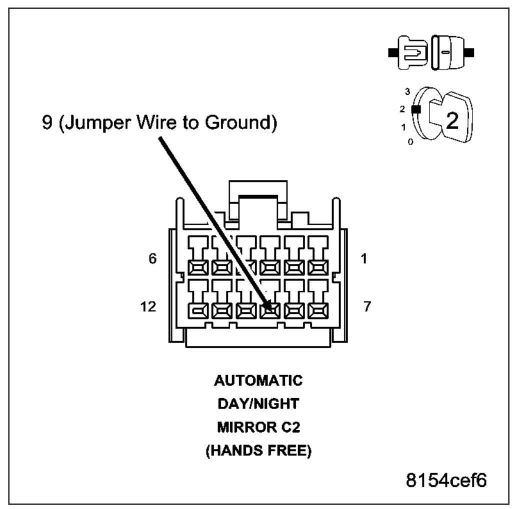
Turn the ignition off.

Disconnect the Automatic Day/Night Mirror C2 harness connector.

Turn the ignition on.

With the scan tool, monitor the VR Phone Switch voltage.

While monitoring the VR Phone Switch voltage, momentarily connect a jumper wire between the (X730) Voice Recognition/Phone Switch Signal circuit and ground.




**NOTE: The sensor voltage should switch from above 4.7 volts when the jumper is not connected to below 0.6 volts when the jumper is connected.**

**Does the sensor voltage switch from above 4.7 volts to below 0.6 volt as described?**

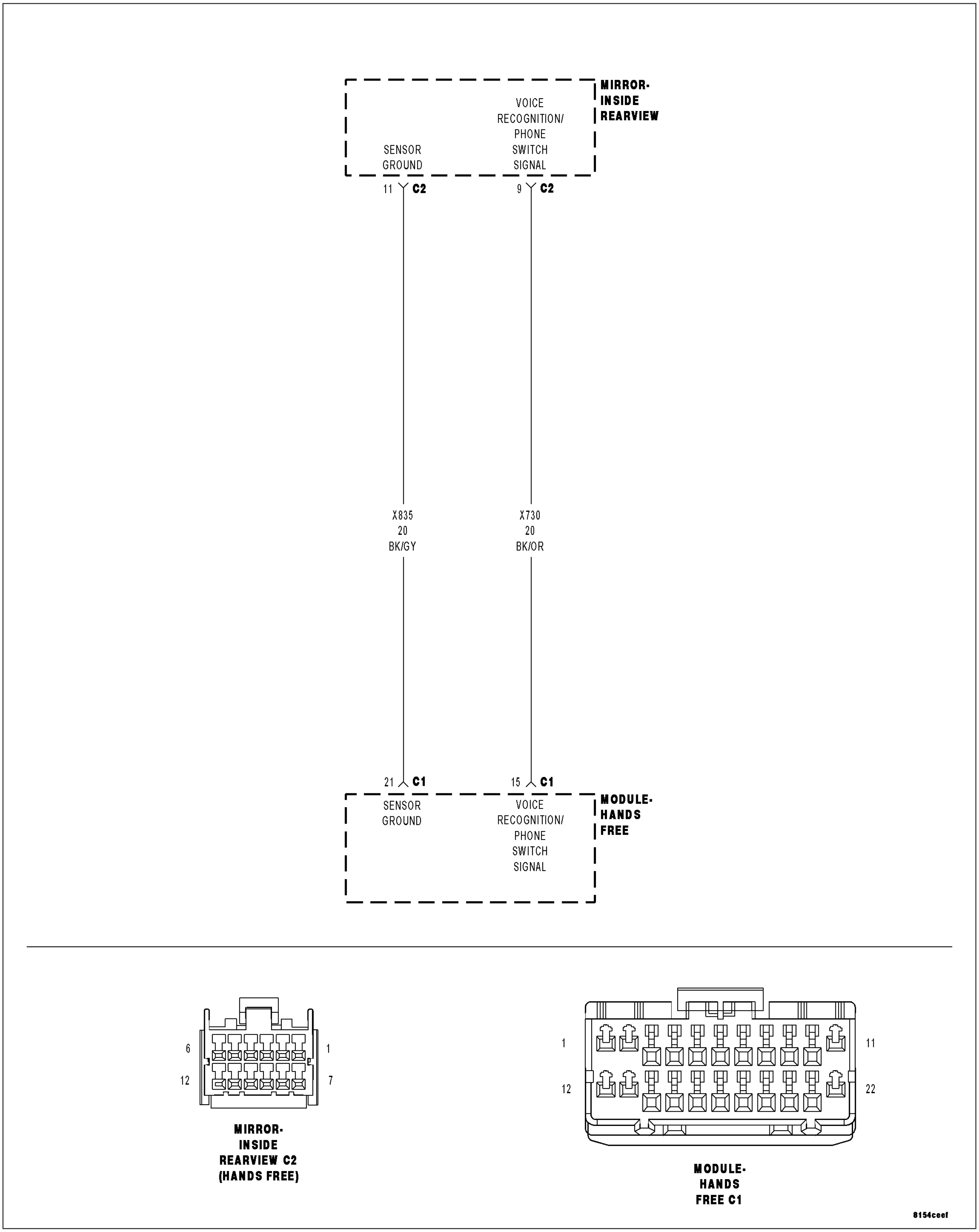
**Yes** >> Replace the Automatic Day/Night Mirror in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## VOICE RECOGNITION/PHONE SWITCH CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects voltage below 0.6 volts on the (X730) Voice Recognition/Phone Switch Signal circuit.

| Possible Causes |
| --- |
| (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT SHORT TO (X835) SENSOR GROUND CIRCUIT |
| (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT SHORT TO GROUND |
| AUTOMATIC DAY/NIGHT MIRROR |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. CHECK THE VOLTAGE OF THE (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL

Turn the ignition off.

Disconnect the Automatic Day/Night Mirror C2 harness connector.

Turn the ignition on.

With the scan tool, monitor the VR Phone Switch voltage.

**Is the voltage above 4.7 volts?**

**Yes** >> Replace the Automatic Day/Night Mirror in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

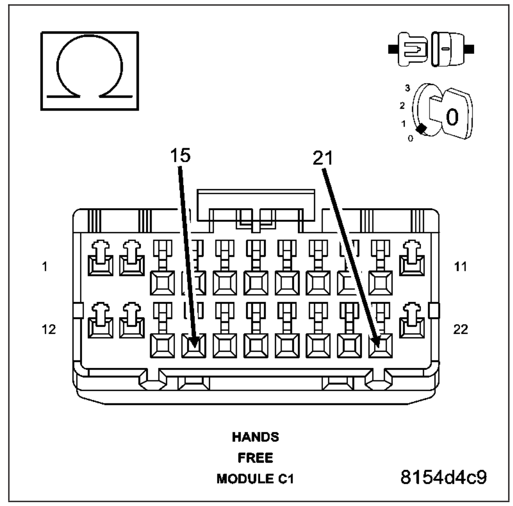
**No** >> Go To 3

## 3. (X730) VOICE/RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT SHORTED TO THE (X835) SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the Hands Free Module C1 harness connector.

Measure the resistance between the (X730) Voice Recognition/Phone Switch Signal circuit and the (X835) Sensor Ground circuit.




**Is the resistance below 100.0 ohms?**

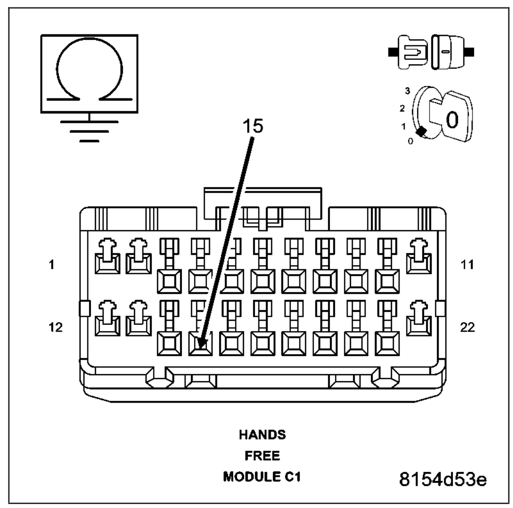
**Yes** >> Repair the (X730) Voice Recognition/Phone Switch Signal circuit for a short to the (X835) Sensor Ground circuit.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4

## 4. (X730) VOICE/RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (X730) Voice Recognition/Phone Switch Signal circuit.




**Is the resistance below 100.0 ohms?**

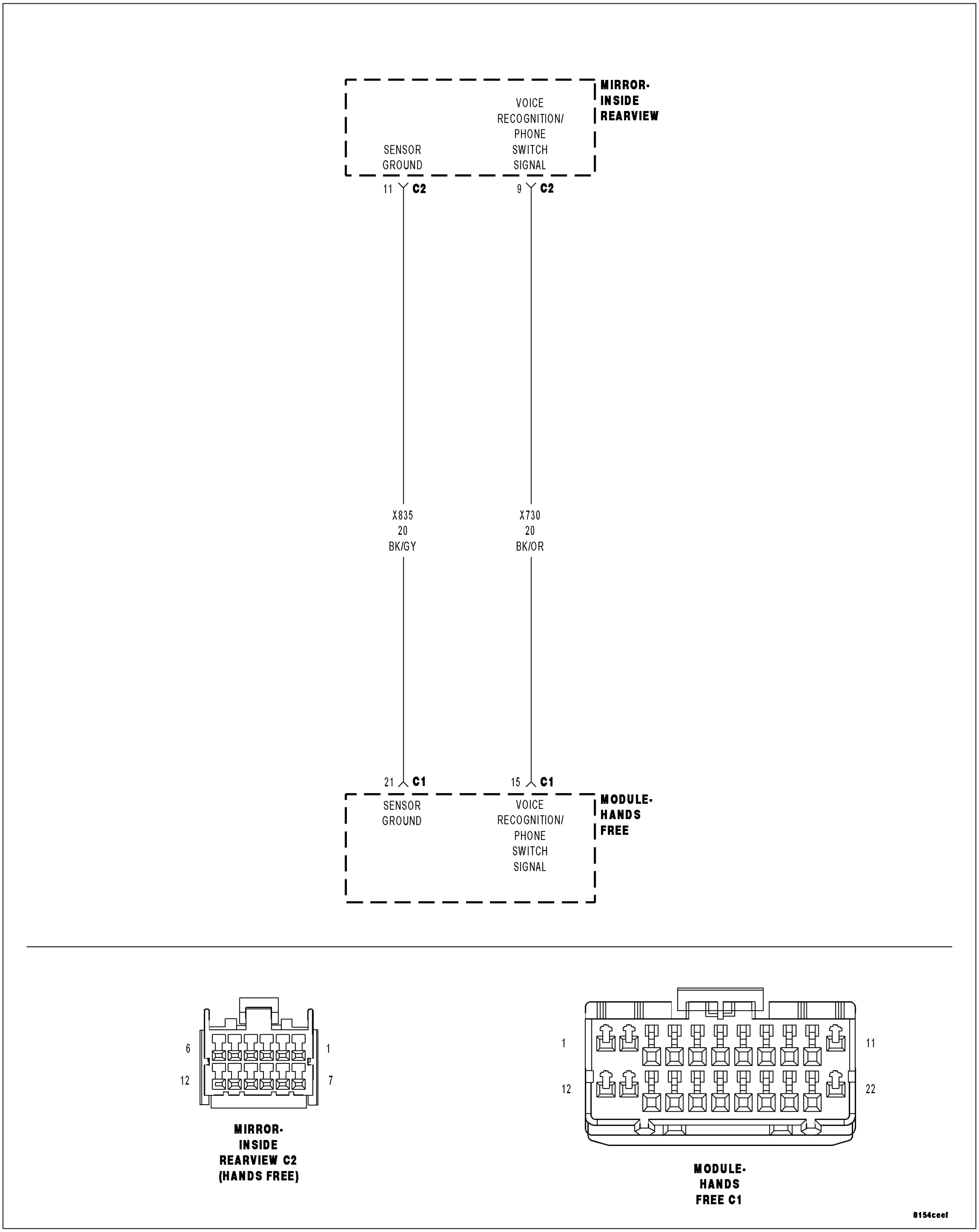
**Yes** >> Repair the (X730) Voice Recognition/Phone Switch Signal circuit for a short to ground.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## VOICE RECOGNITION/PHONE SWITCH CIRCUIT SHORT TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Hands Free Module detects voltage above 4.7 volts on the (X730) Voice Recognition/Phone Switch Signal circuit.

| Possible Causes |
|---|
| (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT SHORT TO VOLTAGE |
| (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT OPEN |
| (X835) SENSOR GROUND CIRCUIT OPEN |
| AUTOMATIC DAY/NIGHT MIRROR |
| HANDS FREE MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

Turn the ignition on.

With the scan tool, erase the HFM DTCs.

Attempt to make a phone call using the system.

With the scan tool, read the HFM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> The condition that set this DTC is no longer present. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.

### 2. CHECK THE VOLTAGE OF THE (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL

Turn the ignition off.

Disconnect the Automatic Day/Night Mirror C2 harness connector.

Turn the ignition on.

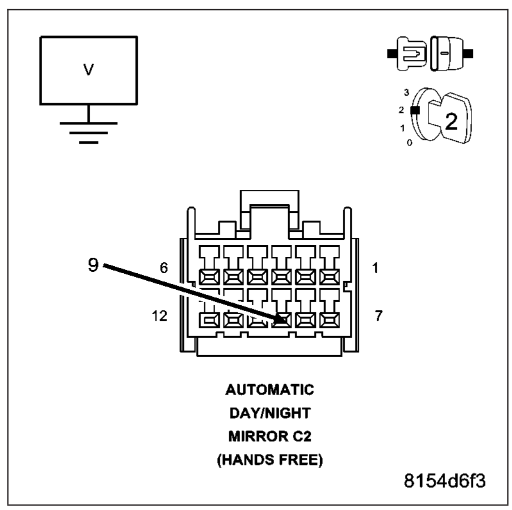
Measure the voltage of the (X730) Voice Recognition/Phone Switch Signal circuit.

**Is the voltage above 5.3 volts?**

**Yes** >> Repair the (X730) Voice Recognition/Phone Switch Signal circuit for a short to voltage.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 3



## 3. AUTOMATIC DAY/NIGHT MIRROR

Turn the ignition off.

Connect a jumper wire between (X730) Voice Recognition/Phone Switch Signal circuit and the (X835) Sensor Ground circuit.

Turn the ignition on.

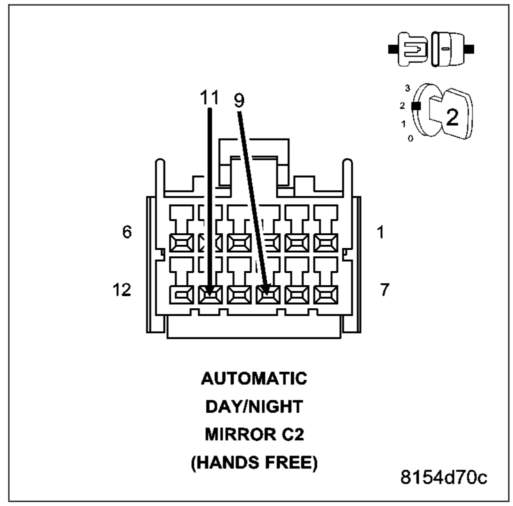
With the scan tool, monitor the VR Phone Switch Voltage.

**Is the voltage approximately 0 volts?**

**Yes** >> Replace the Automatic Day/Night Mirror in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Go To 4




## 4. (X730) VOICE RECOGNITION/PHONE SWITCH SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Hands Free Module C1 harness connector.

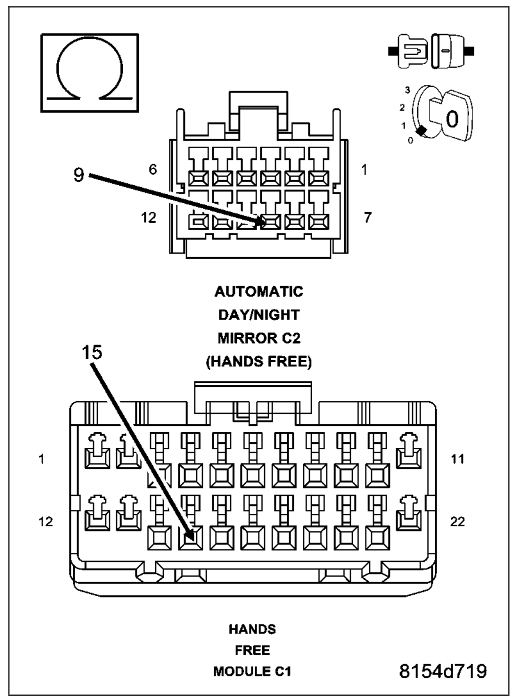
Measure the resistance of the (X730) Voice Recognition/Phone Switch Signal circuit between the HFM connector and the Automatic Day/Night Mirror connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

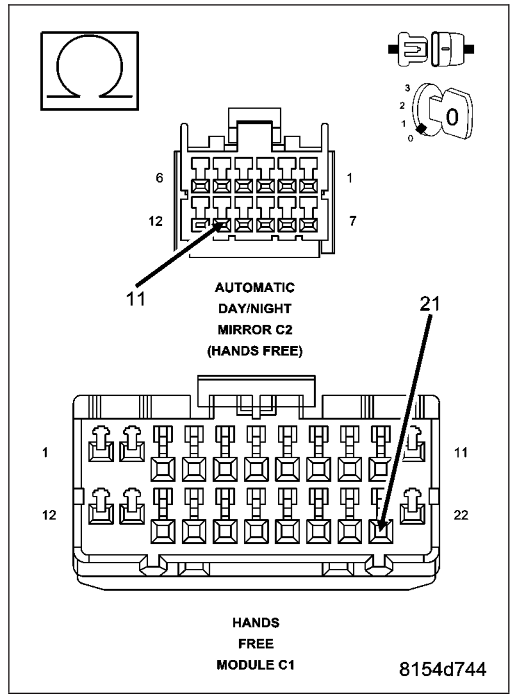
**No** >> Repair the (X730) Voice Recognition/Phone Switch Signal circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).



## 5. (X835) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (X835) Sensor Ground circuit between the HFM connector and the Automatic Day/Night Mirror connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Inspect the wiring and connectors for damage or shorted circuits. If ok, replace and program the Hands Free Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Repair the (X835) Sensor Ground circuit for an open.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

# NAVIGATION/TELECOMMUNICATION

## TABLE OF CONTENTS

# NAVIGATION/TELECOMMUNICATION

## DESCRIPTION

### TELECOMMUNICATIONS

The hands-free cellular system on this vehicle uses Bluetooth™ technology to provide wireless communication between the operator's compatible cellular telephone and the vehicle's on-board receiver.

The system uses voice recognition technology to control operation. The incoming voice is broadcast through the vehicle's radio speakers, automatically overriding any other audio signals on the front speakers when the hands-free system is in use. A microphone in the rearview mirror picks up vehicle occupant's voices. If a call is in progress when the ignition is switched off, the call will be transferred to the hand-held telephone.

The system will communicate with a telephone that is anywhere within the vehicle. However, covering the hand held phone or the hands-free phone module with a metal object may block the signal. The system will recognize up to seven telephones, each of which is given a spoken identification by the user during the setup process. The system includes Spanish and French voice recognition in addition to English.

## OPERATION

### TELECOMMUNICATION

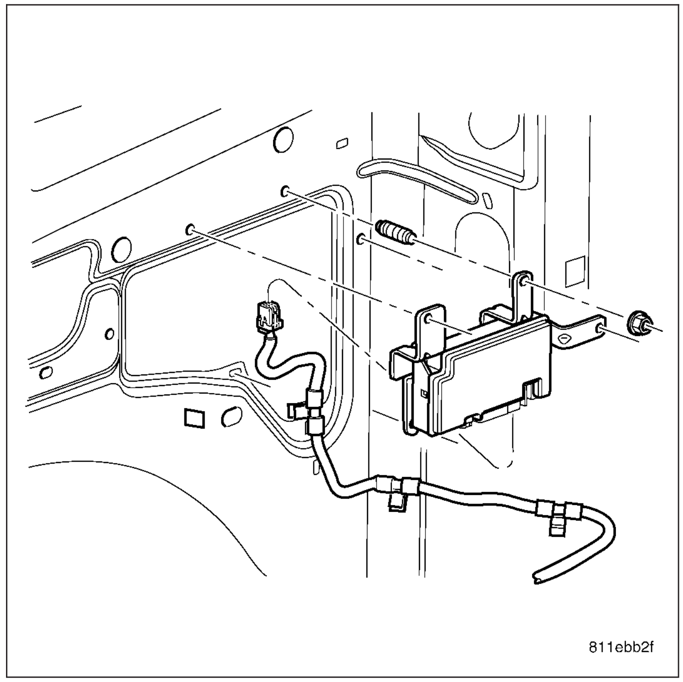
Two buttons on the rearview mirror, identified with ISO icons, control the system: A ″phone″ button turns the system on and off; a ″voice recognition″ (or voice command) button prompts the hands-free system to listen for a voice command. The system includes the following features:

- Phone book - Stores telephone numbers for later recall by name or other verbal identification, called a voice tag, and memory location.
- Four memory locations - Home, Work, Mobile, and Pager. A maximum of 32 unique names or voice tags may be stored at the same time, with a different number in each of the four memory locations.
- Voice tag dialing - Dials the number associated with a voice tag and memory location.
- Digit dialing - Dials the telephone number by recognizing the names of the digits as they are spoken.
- Receiving calls - A voice prompt notifies the user of an incoming call. Pressing the UConnect button accepts or rejects the call.
- Privacy Mode - Switches the call to the handheld telephone and the hands-free system and back again using the “voice recognition” (or “voice command”) button and a voice command, if desired.

# HANDS FREE MODULE

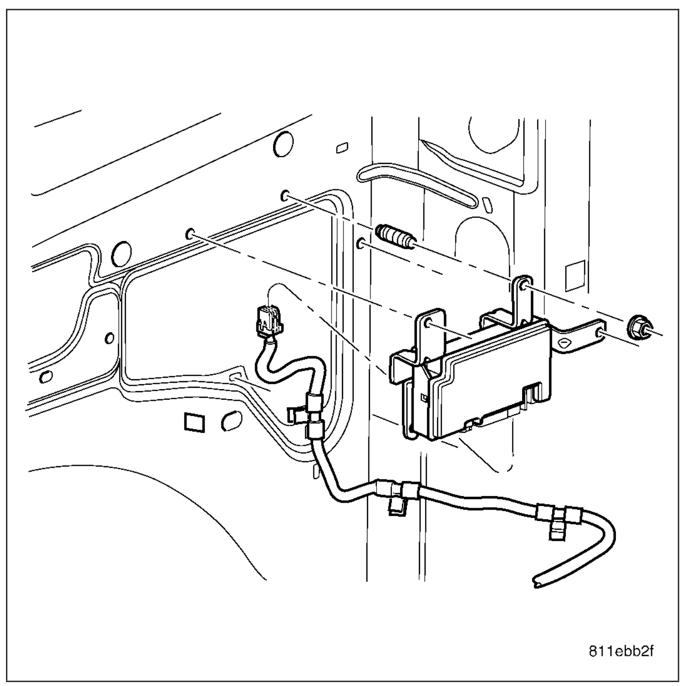
## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Remove the right quarter trim panel (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL).
3. Remove mounting fasteners.
4. Disconnect electrical harness connector.




## INSTALLATION

1. Connect electrical harness connector.
2. Position module, and install mounting fasteners.
3. Install quarter trim panel (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - INSTALLATION).
4. Connect battery negative cable.



# WIRING

## TABLE OF CONTENTS

# 8W-01 WIRING DIAGRAM INFORMATION

## TABLE OF CONTENTS

# WIRING DIAGRAM INFORMATION

## DESCRIPTION

## DESCRIPTION - HOW TO USE WIRING DIAGRAMS

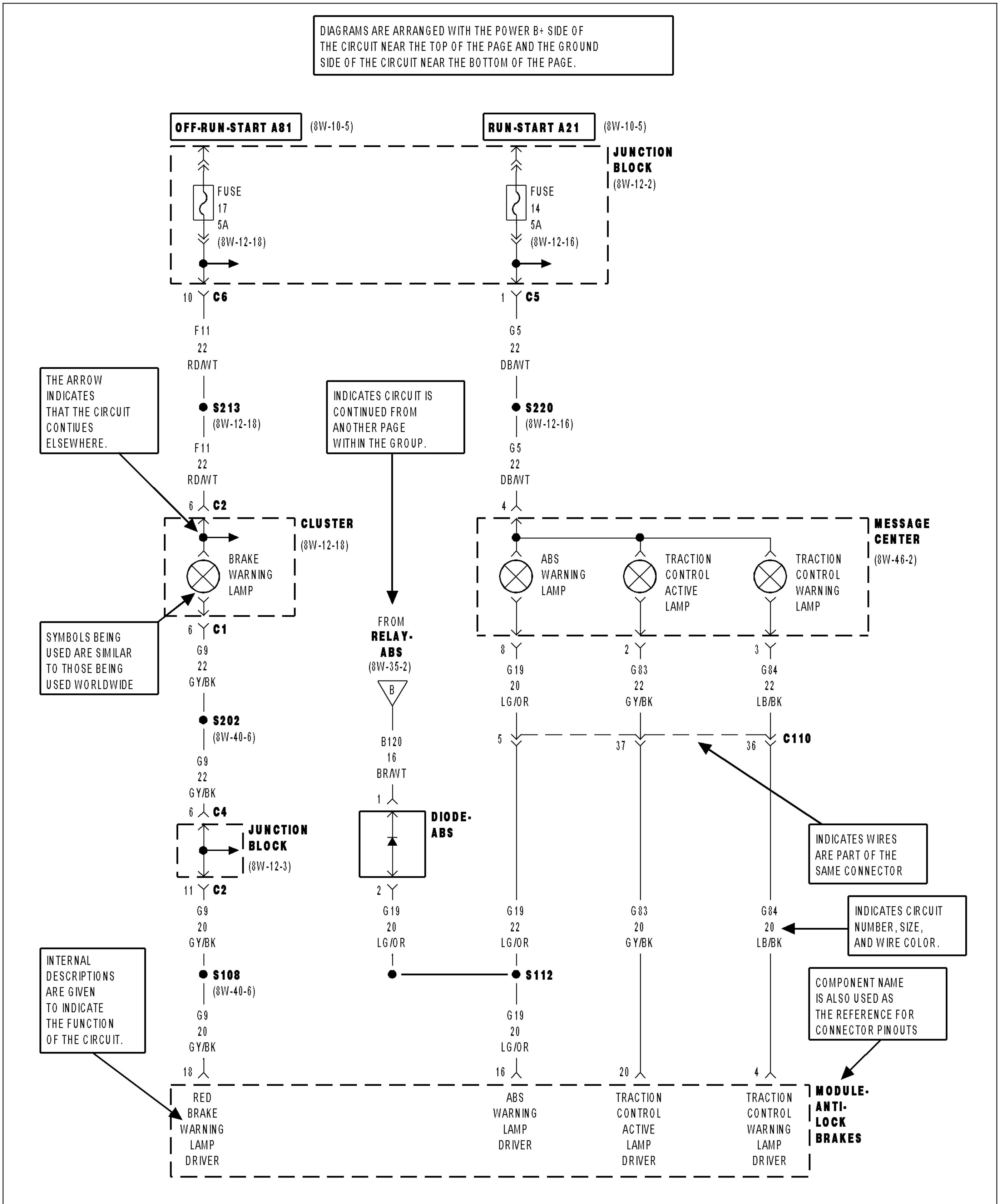
DaimlerChrysler Corporation wiring diagrams are designed to provide information regarding the vehicles wiring content. In order to effectively use the wiring diagrams to diagnose and repair DaimlerChrysler Corporation vehicles, it is important to understand all of their features and characteristics.

Diagrams are arranged such that the power (B+) side of the circuit is placed near the top of the page, and the ground (B-) side of the circuit is placed near the bottom of the page.

All switches, components, and modules are shown in the at rest position with the doors closed and the key removed from the ignition.

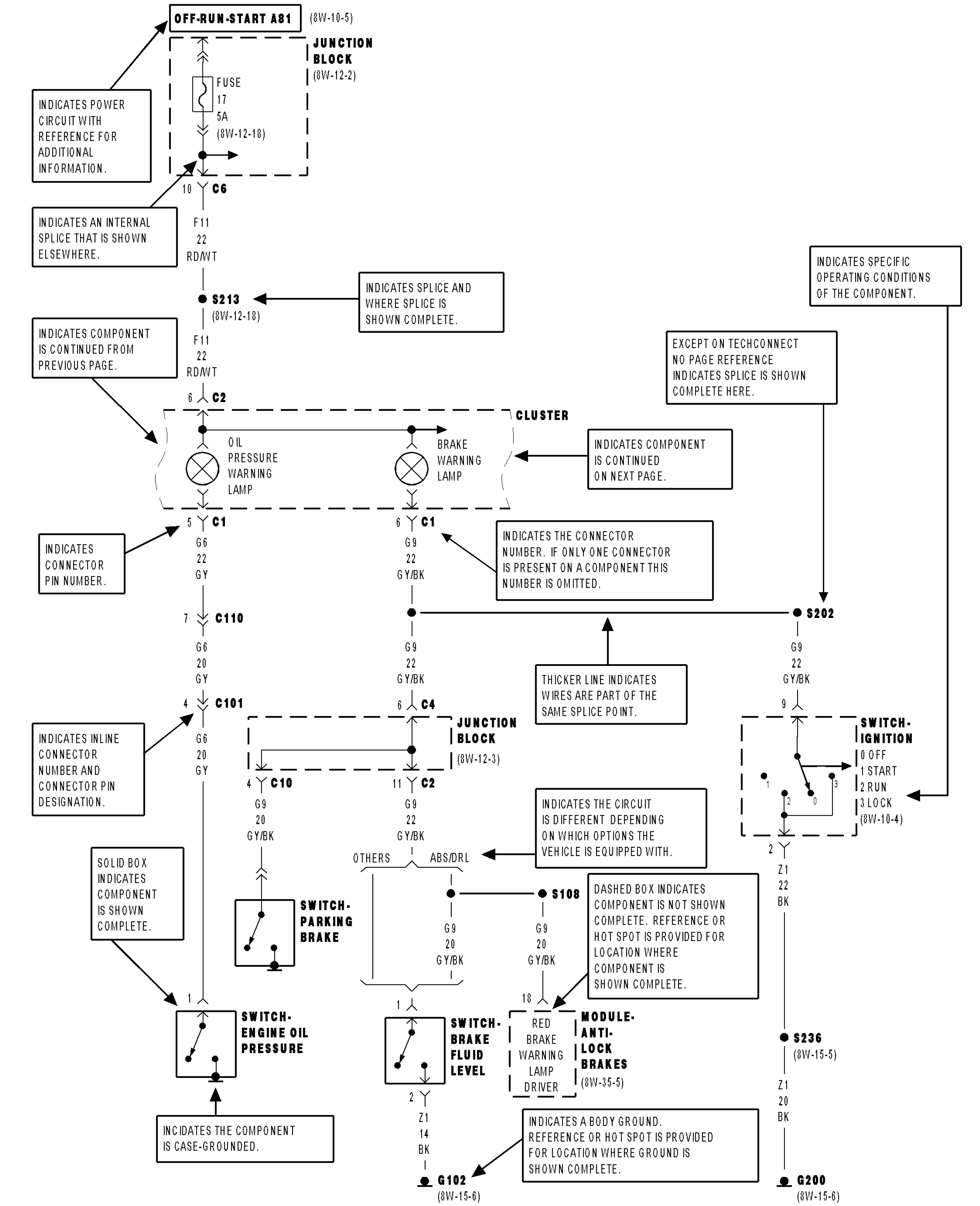
Components are shown two ways. A solid line around a component indicates that the component is complete. A dashed line around the component indicates that the component is being shown is not complete. Incomplete components have a reference number to indicate the page where the component is shown complete.

It is important to realize that no attempt is made on the diagrams to represent components and wiring as they appear on the vehicle. For example, a short piece of wire is treated the same as a long one. In addition, switches and other components are shown as simply as possible, with regard to function only.




The System shown here is an EXAMPLE ONLY. It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.

8153c2c5

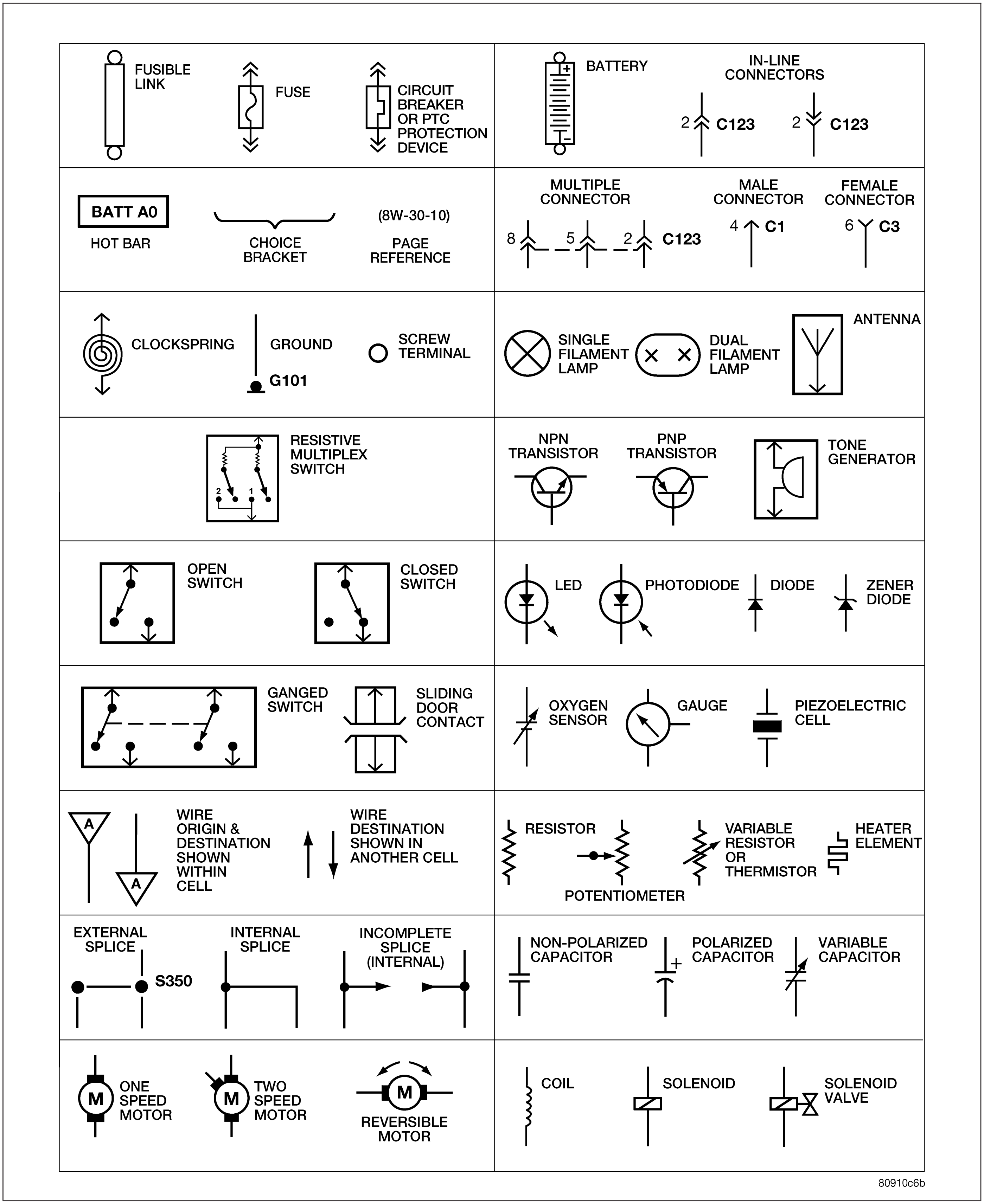



The System shown here is an EXAMPLE ONLY. It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.

8153c2c9

## SYMBOLS

International symbols are used throughout the wiring diagrams. These symbols are consistent with those being used around the world.



FUSIBLE LINK
FUSE
CIRCUIT BREAKER OR PTC PROTECTION DEVICE
BATTERY
IN-LINE CONNECTORS
2 C123
2 C123
BATT A0
HOT BAR
CHOICE BRACKET
(8W-30-10)
PAGE REFERENCE
MULTIPLE CONNECTOR
8 5 2 C123
MALE CONNECTOR
4 C1
FEMALE CONNECTOR
6 C3
CLOCKSPRING
GROUND
G101
SCREW TERMINAL
SINGLE FILAMENT LAMP
DUAL FILAMENT LAMP
ANTENNA
RESISTIVE MULTIPLEX SWITCH
2 1
NPN TRANSISTOR
PNP TRANSISTOR
TONE GENERATOR
OPEN SWITCH
CLOSED SWITCH
LED
PHOTODIODE
DIODE
ZENER DIODE
GANGED SWITCH
SLIDING DOOR CONTACT
OXYGEN SENSOR
GAUGE
PIEZOELECTRIC CELL
A
A
WIRE ORIGIN & DESTINATION SHOWN WITHIN CELL
WIRE DESTINATION SHOWN IN ANOTHER CELL
RESISTOR
POTENTIOMETER
VARIABLE RESISTOR OR THERMISTOR
HEATER ELEMENT
EXTERNAL SPLICE
S350
INTERNAL SPLICE
INCOMPLETE SPLICE (INTERNAL)
NON-POLARIZED CAPACITOR
POLARIZED CAPACITOR
VARIABLE CAPACITOR
M
ONE SPEED MOTOR
M
TWO SPEED MOTOR
M
REVERSIBLE MOTOR
COIL
SOLENOID
SOLENOID VALVE
80910c6b

## TERMINOLOGY

This is a list of terms and definitions used in the wiring diagrams.

LHD . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Left Hand Drive Vehicles
RHD . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Right Hand Drive Vehicles
ATX . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Automatic Transmissions-Front Wheel Drive
MTX . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Manual Transmissions-Front Wheel Drive
AT . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Automatic Transmissions-Rear Wheel Drive
MT . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Manual Transmissions-Rear Wheel Drive
SOHC . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Single Over Head Cam Engine
DOHC . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Double Over Head Cam Engine
Export . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Vehicles Built For Sale In Markets Other Than North America
Except Export . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Vehicles Built For Sale In North America

## DESCRIPTION - CIRCUIT INFORMATION

Each wire shown in the diagrams contains a code which identifies the main circuit, a specific part of the main circuit, gage of wire, and color. An example would be **A 2 18 LB/YL**. This is a Battery Feed circuit, level two, eighteen gauge, light blue with a yellow tracer.

### WIRE COLOR CODE CHART

| COLOR CODE | COLOR |
|---|---|
| BL | BLUE |
| BK | BLACK |
| BR | BROWN |
| DB | DARK BLUE |
| DG | DARK GREEN |
| GY | GRAY |
| LB | LIGHT BLUE |
| LG | LIGHT GREEN |
| OR | ORANGE |
| PK | PINK |
| RD | RED |
| TN | TAN |
| VT | VIOLET |
| WT | WHITE |
| YL | YELLOW |
| * | WITH TRACER |

## DESCRIPTION - CIRCUIT FUNCTIONS

All circuits in the diagrams use an alpha/numeric code to identify the wire and it's function. To identify which circuit code applies to a system, refer to the Circuit Identification Code Chart. This chart shows the main circuits only and does not show the secondary codes that may apply to some models.

**CIRCUIT IDENTIFICATION CODE CHART**

| CIRCUIT | FUNCTION |
|---|---|
| A | BATTERY FEED |
| B | BRAKE CONTROLS |
| C | CLIMATE CONTROLS |
| D | DIAGNOSTIC CIRCUITS |
| E | DIMMING ILLUMINATION CIRCUITS |
| F | FUSED CIRCUITS |
| G | MONITORING CIRCUITS (GAUGES) |
| H | MULTIPLE |
| I | NOT USED |
| J | OPEN |
| K | POWERTRAIN CONTROL MODULE |
| L | EXTERIOR LIGHTING |
| M | INTERIOR LIGHTING |
| N | MULTIPLE |
| O | NOT USED |
| P | POWER OPTION (BATTERY FEED) |
| Q | POWER OPTIONS (IGNITION FEED) |
| R | PASSIVE RESTRAINT |
| S | SUSPENSION/STEERING |
| T | TRANSMISSION/TRANSAXLE/ TRANSFER CASE |
| U | OPEN |
| V | SPEED CONTROL, WIPER/ WASHER |
| W | WIPERS |
| X | AUDIO SYSTEMS |
| Y | TEMPORARY |
| Z | GROUNDS |

## DESCRIPTION - SECTION IDENTIFICATION AND INFORMATION

The wiring diagrams are grouped into individual sections. If a component is most likely found in a particular group, it will be shown complete (all wires, connectors, and pins) within that group. For example, the Auto Shutdown Relay is most likely to be found in Group 30, so it is shown there complete. It can, however, be shown partially in another group if it contains some associated wiring.

Splice diagrams in Section 8W-70 show the entire splice and provide references to other sections the splices serves. Section 8W-70 only contains splice diagrams that are not shown in their entirety somewhere else in the wiring diagrams.

Section 8W-80 shows each connector and the circuits involved with that connector. The connectors are identified using the name/number on the diagram pages.

## DESCRIPTION - CONNECTOR, GROUND AND SPLICE INFORMATION

**CAUTION: Not all connectors are serviced. Some connectors are serviced only with a harness. A typical example might be the Supplemental Restraint System connectors. Always check parts availability before attempting a repair.**

### IDENTIFICATION

In-line connectors are identified by a number, as follows:

- In-line connectors located in the engine compartment are C100 series numbers.
- In-line connectors located in the instrument panel area are C200 series numbers.
- In-line connectors located in the body are C300 series numbers.
- Jumper harness connectors are C400 series numbers.
- Grounds and ground connectors are identified with a “G” and follow the same series numbering as the in-line connectors.
- Splices are identified with an “S” and follow the same series numbering as the in-line connectors. In addition, S001–S099 numbers are located in the engine compartment.
- Component connectors are identified by the component name instead of a number. Multiple connectors on a component use a C1, C2, etc. identifier.

### LOCATIONS

Section 8W-91 contains connector/ground/splice location illustrations. The illustrations contain the connector name (or number)/ground number/splice number and component identification. Connector/ground/splice location charts in section 8W-91 reference the figure numbers of the illustrations.

The abbreviation T/O is used in the component location section to indicate a point in which the wiring harness branches out to a component. The abbreviation N/S means Not Shown in the illustrations

## WARNING

## WARNINGS - GENERAL

**WARNINGS** provide information to prevent personal injury and vehicle damage. Below is a list of general warnings that should be followed any time a vehicle is being serviced.

**WARNING: Always wear safety glasses for eye protection.**

**WARNING: Use safety stands anytime a procedure requires being under a vehicle.**

**WARNING: Be sure that the ignition switch always is in the off position, unless the procedure requires it to be on.**

**WARNING: Set the parking brake when working on any vehicle. An automatic transmission should be in park. A manual transmission should be in neutral.**

**WARNING: Operate the engine only in a well-ventilated area.**

**WARNING: Keep away from moving parts when the engine is running, especially the fan and belts.**

**WARNING: To prevent serious burns, avoid contact with hot parts such as the radiator, exhaust manifold(s), tail pipe, catalytic converter and muffler.**

**WARNING: Do not allow flame or sparks near the battery. Gases are always present in and around the battery.**

**WARNING: Always remove rings, watches, loose hanging jewelry and avoid loose clothing.**

## DIAGNOSIS AND TESTING - WIRING HARNESS

### TROUBLESHOOTING TOOLS

When diagnosing a problem in an electrical circuit there are several common tools necessary. These tools are listed and explained below.

- Jumper Wire - This is a test wire used to connect two points of a circuit. It can be used to bypass an open in a circuit.

**WARNING: Never use a jumper wire across a load, such as a motor, connected between a battery feed and ground.**

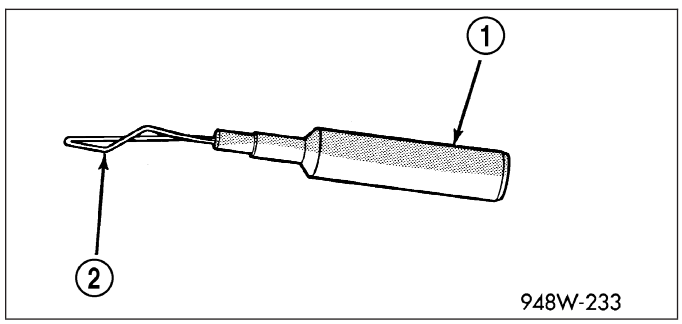
- Voltmeter - Used to check for voltage on a circuit. Always connect the black lead to a known good ground and the red lead to the positive side of the circuit.

**CAUTION: Most of the electrical components used in today's vehicles are Solid State. When checking voltages in these circuits, use a meter with a 10 - megohm or greater impedance rating.**

- Ohmmeter - Used to check the resistance between two points of a circuit. Low or no resistance in a circuit means good continuity.

**CAUTION: Most of the electrical components used in today's vehicles are Solid State. When checking resistance in these circuits use a meter with a 10 - megohm or greater impedance rating. In addition, make sure the power is disconnected from the circuit. Circuits that are powered up by the vehicle's electrical system can cause damage to the equipment and provide false readings.**

- Probing Tools - These tools are used for probing terminals in connectors. Select the proper size tool from Special Tool Package 6807, and insert the probing end (2) into the terminal being tested. Use the other end of the tool (1) to insert the meter probe.




### INTERMITTENT AND POOR CONNECTIONS

Most intermittent electrical problems are caused by faulty electrical connections or wiring. It is also possible for a sticking component or relay to cause a problem. Before condemning a component or wiring assembly, check the following items.

- Connectors are fully seated
- Spread terminals, or terminal push out
- Terminals in the wiring assembly are fully seated into the connector/component and locked into position
- Dirt or corrosion on the terminals. Any amount of corrosion or dirt could cause an intermittent problem
- Damaged connector/component casing exposing the item to dirt or moisture
- Wire insulation that has rubbed through causing a short to ground
- Some or all of the wiring strands broken inside of the insulation
- Wiring broken inside of the insulation

## TROUBLESHOOTING WIRING PROBLEMS

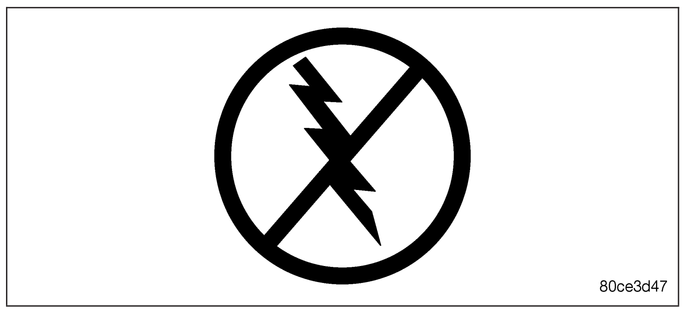
When troubleshooting wiring problems there are six steps which can aid in the procedure. The steps are listed and explained below. Always check for non-factory items added to the vehicle before doing any diagnosis. If the vehicle is equipped with these items, disconnect them to verify these add-on items are not the cause of the problem.

1. Verify the problem.
2. Verify any related symptoms. Do this by performing operational checks on components that are in the same circuit. Refer to the wiring diagrams.
3. Analyze the symptoms. Use the wiring diagrams to determine what the circuit is doing, where the problem most likely is occurring and where the diagnosis will continue.
4. Isolate the problem area.
5. Repair the problem area.
6. Verify the proper operation. For this step, check for proper operation of all items on the repaired circuit. Refer to the wiring diagrams.

## STANDARD PROCEDURE

## STANDARD PROCEDURE - ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

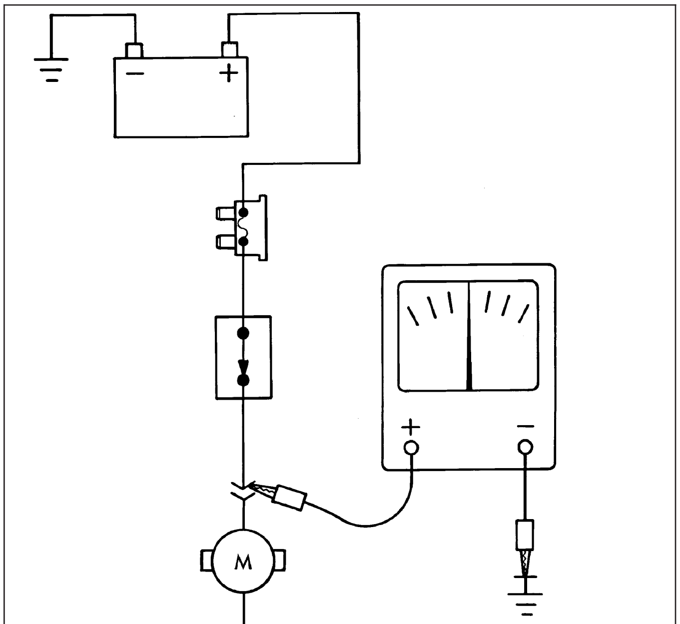
All ESD sensitive components are solid state and a symbol is used to indicate this. When handling any component with this symbol, comply with the following procedures to reduce the possibility of electrostatic charge build up on the body and inadvertent discharge into the component. If it is not known whether the part is ESD sensitive, assume that it is.




1. Always touch a known good ground before handling the part. This should be repeated while handling the part and more frequently after sliding across a seat, sitting down from a standing position, or walking a distance.
2. Avoid touching electrical terminals of the part, unless instructed to do so by a written procedure.
3. When using a voltmeter, be sure to connect the ground lead first.
4. Do not remove the part from it’s protective packing until it is time to install the part.
5. Before removing the part from it’s package, ground the package to a known good ground on the vehicle.

## STANDARD PROCEDURE - TESTING OF VOLTAGE POTENTIAL

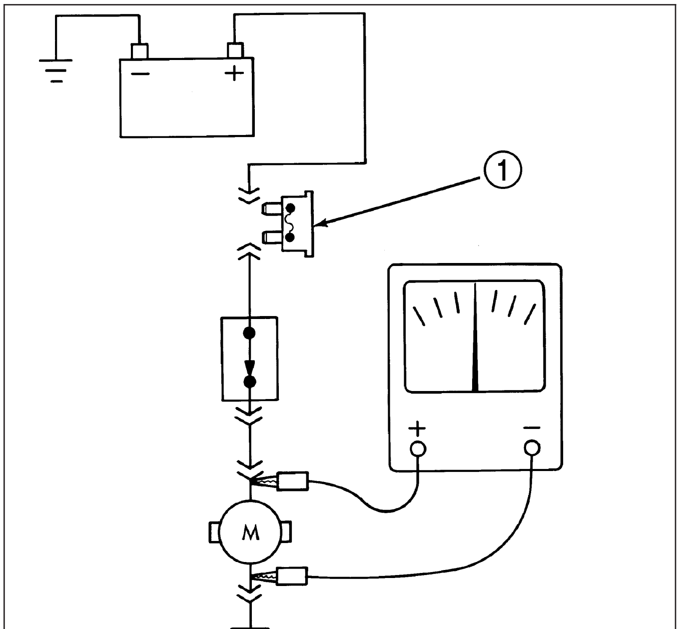
1. Connect the ground lead of a voltmeter to a known good ground.
2. Connect the other lead of the voltmeter to the selected test point. The vehicle ignition may need to be turned ON to check voltage. Refer to the appropriate test procedure.




948W-194

## STANDARD PROCEDURE - TESTING FOR CONTINUITY

1. Remove the fuse (1) for the circuit being checked or, disconnect the battery.
2. Connect one lead of the ohmmeter to one side of the circuit being tested
3. Connect the other lead to the other end of the circuit being tested. Low or no resistance means good continuity.




948W-195

## STANDARD PROCEDURE - TESTING FOR A SHORT TO GROUND

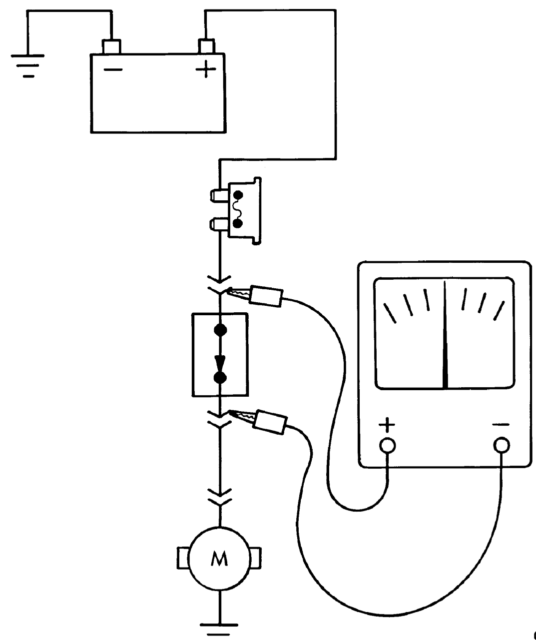
1. Remove the fuse and disconnect all items involved with the fuse.
2. Connect a test light or a voltmeter across the terminals of the fuse.
3. Starting at the fuse block, wiggle the wiring harness about six to eight inches apart and watch the voltmeter/test lamp.
4. If the voltmeter registers voltage or the test lamp glows, there is a short to ground in that general area of the wiring harness.

## STANDARD PROCEDURE - TESTING FOR A SHORT TO GROUND ON FUSES POWERING SEVERAL LOADS

1. Refer to the wiring diagrams and disconnect or isolate all items on the suspected fused circuits.
2. Replace the blown fuse.
3. Supply power to the fuse by turning ON the ignition switch or re-connecting the battery.
4. Start connecting or energizing the items in the fuse circuit one at a time. When the fuse blows the circuit with the short to ground has been isolated.

## STANDARD PROCEDURE - TESTING FOR A VOLTAGE DROP

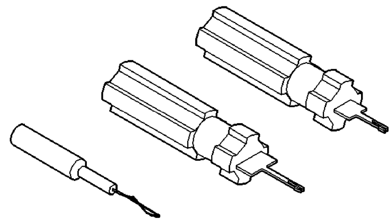
1. Connect the positive lead of the voltmeter to the side of the circuit closest to the battery.
2. Connect the other lead of the voltmeter to the other side of the switch, component or circuit.
3. Operate the item.
4. The voltmeter will show the difference in voltage between the two points.



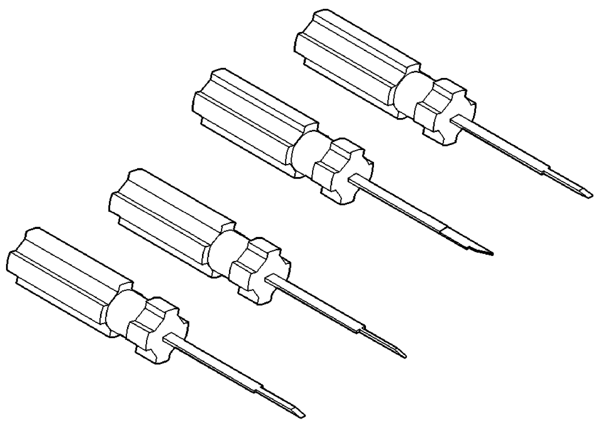

948W-196

## SPECIAL TOOLS

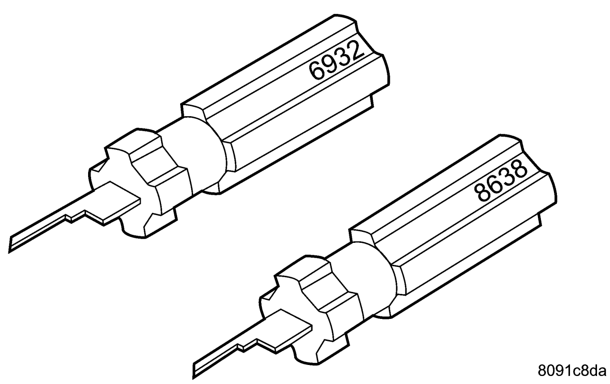
## WIRING/TERMINAL



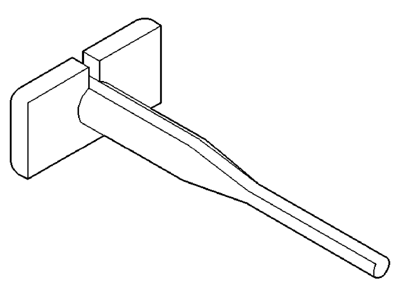
*PROBING TOOL PACKAGE 6807*



*TERMINAL PICK TOOL SET 6680*




*TERMINAL REMOVING TOOLS 6932 AND 8638*

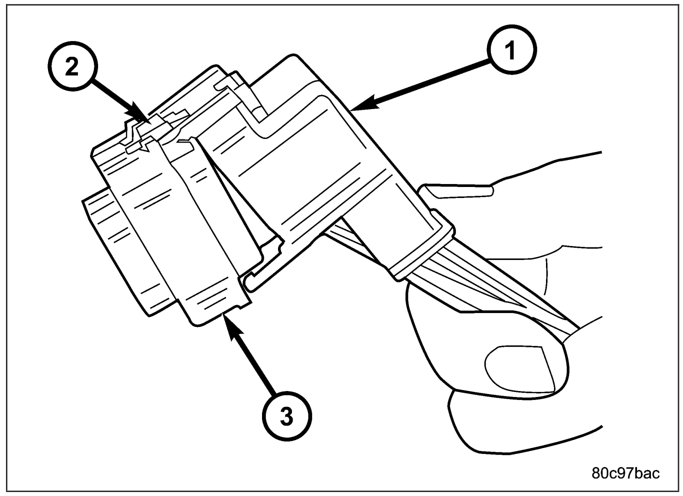


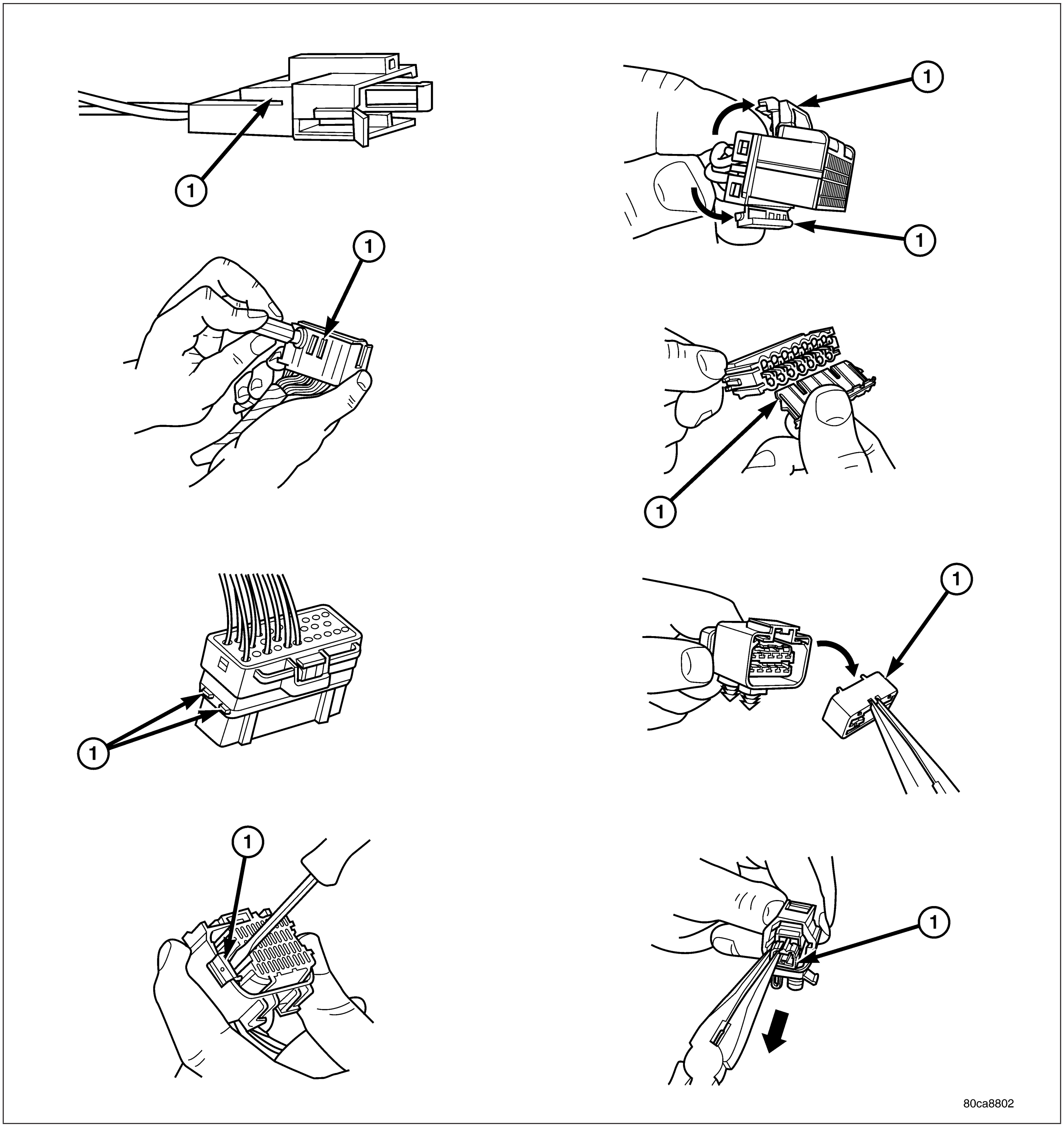
*TERMINAL REMOVING TOOL 6934*

# CONNECTOR

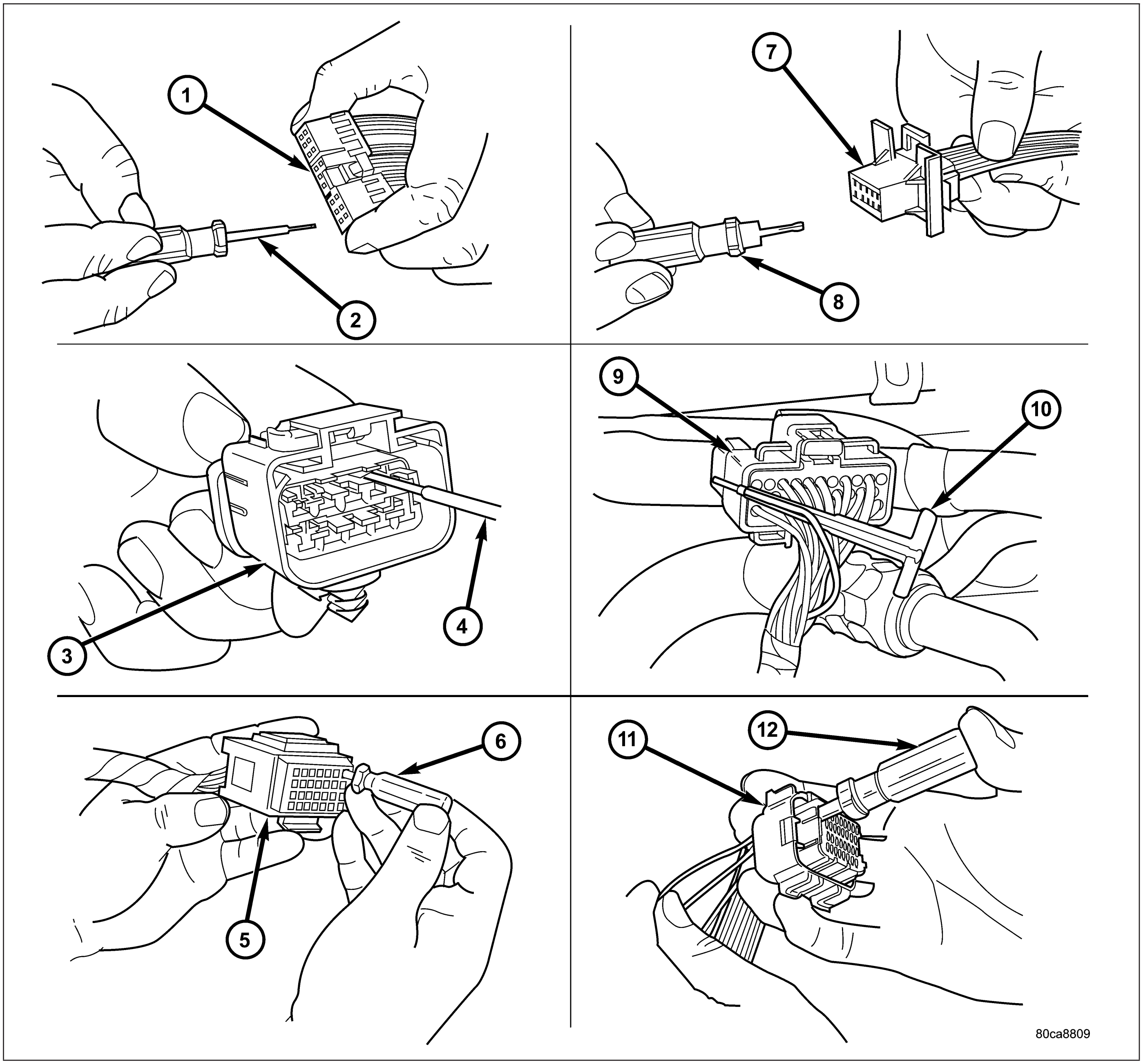
## REMOVAL

1. Disconnect battery.
2. Release Connector Lock (2).
3. Disconnect the connector (3) being repaired from its mating half/component.
4. Remove the dress cover (if applicable) (1).






5. Release the Secondary Terminal Lock, if required (1).




1 - TYPICAL CONNECTOR
2 - PICK FROM SPECIAL TOOL KIT 6680
3 - APEX CONNECTOR
4 - PICK FROM SPECIAL TOOL KIT 6680
5 - AUGAT CONNECTOR
6 - SPECIAL TOOL 6932
7 - MOLEX CONNECTOR
8 - SPECIAL TOOL 6742
9 - THOMAS AND BETTS CONNECTOR
10 - SPECIAL TOOL 6934
11 - TYCO CONNECTOR
12 - SPECIAL TOOL 8638

6. Position the connector locking finger away from the terminal using the proper special tool. Pull on the wire to remove the terminal from the connector.

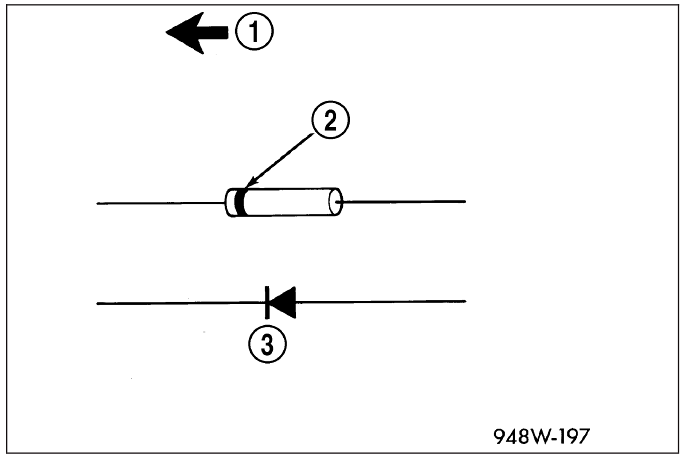
## INSTALLATION

1. Insert the removed terminal in the same cavity on the repair connector.
2. Repeat steps for each terminal in the connector, being sure that all wires are inserted into the proper cavities. For additional connector pin-out identification, refer to the wiring diagrams.
3. When the connector is re-assembled, the secondary terminal lock must be placed in the locked position to prevent terminal push out.
4. Replace dress cover (if applicable).
5. Connect connector to its mating half/component.
6. Connect battery and test all affected systems.

# DIODE

## REMOVAL

1. Disconnect the battery.
2. Locate the diode in the harness, and remove the protective covering.
3. Remove the diode from the harness, pay attention to the current flow direction (1) (2) (3).




## INSTALLATION

1. Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.
2. Install the new diode in the harness, making sure current flow is correct. If necessary, refer to the appropriate wiring diagram for current flow.
3. Solder the connection together using rosin core type solder only. **Do not use acid core solder.**
4. Tape the diode to the harness using electrical tape. Make sure the diode is completely sealed from the elements.
5. Re-connect the battery and test affected systems.

# TERMINAL

## REMOVAL

1. Follow steps for removing terminals described in the connector removal section.
2. Cut the wire 6 inches from the back of the connector.

## INSTALLATION

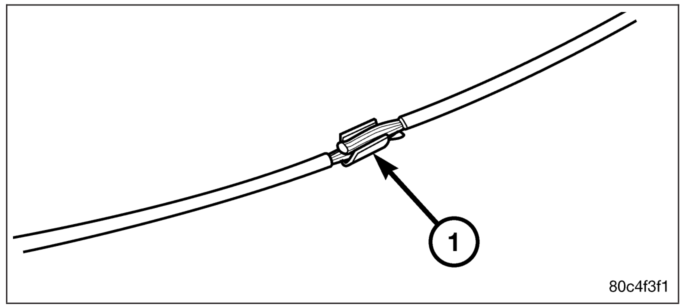
1. Select a wire from the terminal repair kit that best matches the color and gage of the wire being repaired.
2. Cut the repair wire to the proper length and remove one–half (1/2) inch of insulation.
3. Splice the repair wire to the wire harness (see wire splicing procedure) (Refer to 8 - ELECTRICAL/WIRING DIAGRAM INFORMATION/WIRE - STANDARD PROCEDURE).
4. Insert the repaired wire into the connector.
5. Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.
6. Re-tape the wire harness starting at 1–1/2 inches behind the connector and 2 inches past the repair.
7. Connect battery and test all affected systems.

# WIRE

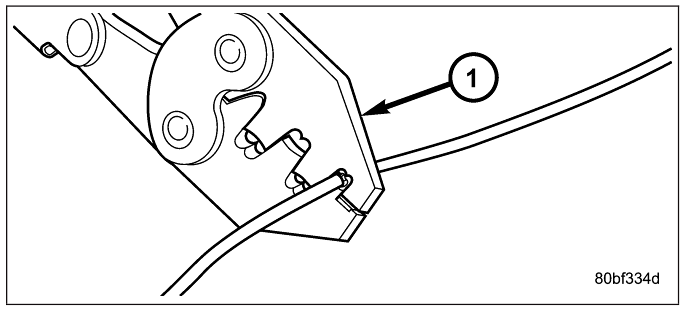
## STANDARD PROCEDURE - WIRE SPLICING

When splicing a wire, it is important that the correct gage be used as shown in the wiring diagrams.

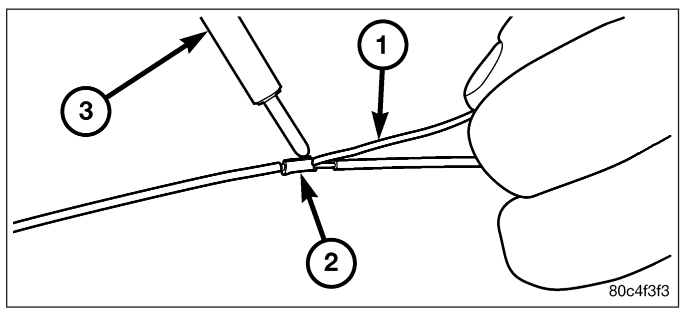
1. Remove one-half (1/2) inch of insulation from each wire that needs to be spliced.
2. Place a piece of adhesive lined heat shrink tubing on one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.
3. Place the strands of wire overlapping each other inside of the splice clip (1).




4. Using crimping tool (1), Mopar p/n 05019912AA, crimp the splice clip and wires together.

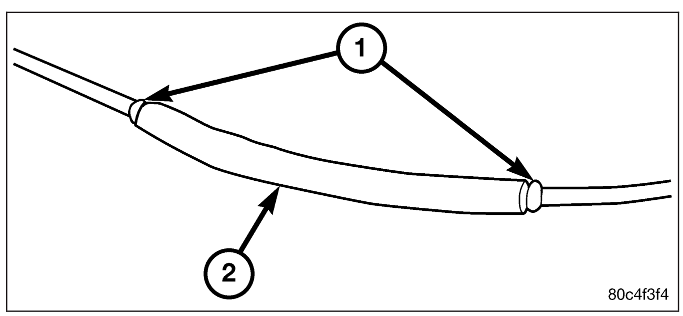



5. Solder (3) the connection (2) together using rosin core type solder (1) only.




**CAUTION: DO NOT USE ACID CORE SOLDER.**

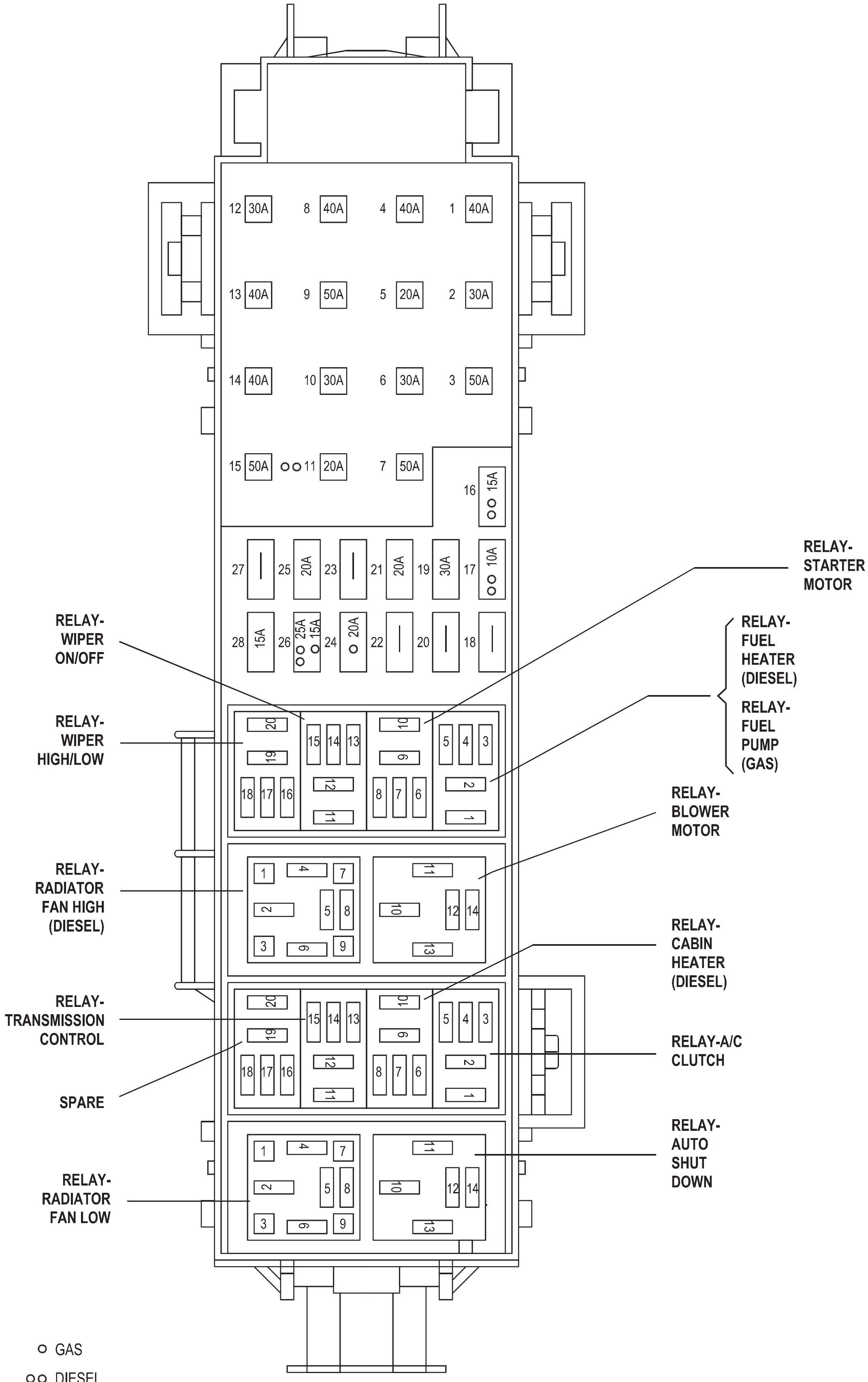
6. Center the heat shrink tubing (2) over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant (1) comes out of both ends of the tubing.



# 8W-02 COMPONENT INDEX

# 8W-10 POWER DISTRIBUTION

POWER DISTRIBUTION CENTER




J068W-2

KJ601002

FUSES

| FUSE | AMPS | FUSED CIRCUIT | FUNCTION NAME |
|---|---|---|---|
| 1 | 40A | A122 12RD | FUSED B(+) |
| 2 | 30A | A16 12RD/BR | FUSED B(+) |
| 3 | 50A | A912 10RD | FUSED B(+) |
| 4 | 40A | A107 12TN/RD | FUSED B(+) |
| 5 | 20A | A903 16RD ■■ | FUSED B(+) |
| 6 | 30A | A907 14RD | FUSED B(+) |
| 7 | 50A | A911 10RD | FUSED B(+) |
| 8 | 40A | A916 12RD | FUSED B(+) |
| 9 | 50A | A901 10RD | FUSED B(+) |
| 10 | 30A | A100 14RD/VT | FUSED B(+) |
| 11 | 20A | A34 18RD/WT ○○ | FUSED B(+) |
| 12 | 30A | A904 14RD | FUSED B(+) |
| 13 | 40A | A139 12RD/YL | FUSED B(+) |
| 14 | 40A | A1 12RD | FUSED B(+) |
| 15 | 50A | A12 10RD/BR | FUSED B(+) |
| 16 | 15A | K347 20BR/YL ○○ | FUSED B(+) |
| 17 | 10A | A129 20RD/BR ○○ | FUSED B(+) |
| 18 | - | - | - |
| 19 | 30A | A906 12RD | FUSED B(+) |
| 20 | - | - | - |
| 21 | 20A | A112 18OR/RD | FUSED B(+) |
| 22 | - | - | - |
| 23 | - | - | - |
| 24 | 20A | A209 18RD ○ | FUSED B(+) |
| 25 | 20A | A200 12RD/DG | FUSED B(+) |
| 26 | 25A | F142 18PK/GY ○ | FUSED ASD RELAY OUTPUT |
| 26 | 25A | K345 16BR/LB ○○ | FUSED ASD RELAY OUTPUT |
| 27 | - | - | - |
| 28 | 15A | F26 20PK/OR | FUSED IGNITION SWITCH OUTPUT (START) |

○ GAS
○○ DIESEL
■■ A/T

RELAYS

**RELAY-A/C-COMPRESSOR CLUTCH**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | C13 20LB/OR | A/C CLUTCH RELAY CONTROL |
| 86 | F1 18DB | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 86 | INTERNAL | FUSED ASD RELAY OUTPUT |
| 87 | C3 18DB/YL | A/C CLUTCH RELAY CONTROL |
| 87A | - | - |

**RELAY-AUTO SHUT DOWN**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | K342 20BR/WT | ASD RELAY CONTROL |
| 86 | INTERNAL | FUSED B(+) |
| 87 | INTERNAL | ASD RELAY CONTROL |
| 87A | - | - |

**RELAY-BLOWER MOTOR**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | Z932 18BK | GROUND |
| 86 | F20 12PK/WT | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 87 | A111 12DG/RD | BLOWER MOTOR RELAY OUTPUT |
| 87A | - | - |

RELAYS

**RELAY-CABIN HEATER (DIESEL)**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | K132 20DB/LB | CABIN HEATER RELAY CONTROL |
| 86 | INTERNAL | FUSED ASD RELAY CONTROL |
| 87 | A119 18RD/OR | CABIN HEATER RELAY CONTROL |
| 87A | - | - |

**RELAY-FUEL HEATER (DIESEL)**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | Z932 20BK | GROUND |
| 86 | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 87 | A993 16RD | FUEL HEATER RELAY OUTPUT |
| 87A | - | - |

**RELAY-FUEL PUMP (GAS)**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | K31 20BR | FUEL PUMP RELAY CONTROL |
| 86 | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 87 | N1 18DG/OR | FUEL PUMP RELAY OUTPUT |
| 87A | - | - |

RELAYS

**RELAY-HIGH SPEED RADIATOR FAN (GAS)**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | N112 20DB/OR | HIGH SPEED RAD FAN RELAY CONTROL |
| 86 | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 87 | N24 12DG/DB | HIGH SPEED RAD FAN RELAY OUTPUT |
| 87A | - | - |

**RELAY-LOW SPEED RADIATOR FAN (GAS)**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | N201 20DB/LG | LOW SPEED RAD FAN RELAY CONTROL |
| 86 | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 87 | N23 12DB/LG | LOW SPEED RAD FAN RELAY OUTPUT |
| 87A | - | - |

**RELAY-STARTER MOTOR**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | A916 12RD | FUSED B(+) |
| 85 | T752 20DG/OR | ENGINE STARTER MOTOR RELAY CONTROL |
| 86 | INTERNAL | FUSED IGNITION SWITCH OUTPUT (START) |
| 87 | T750 12YL/GY | STARTER MOTOR RELAY OUTPUT |
| 87A | - | - |

RELAYS

**RELAY-TRANSMISSION CONTROL (A/T)**

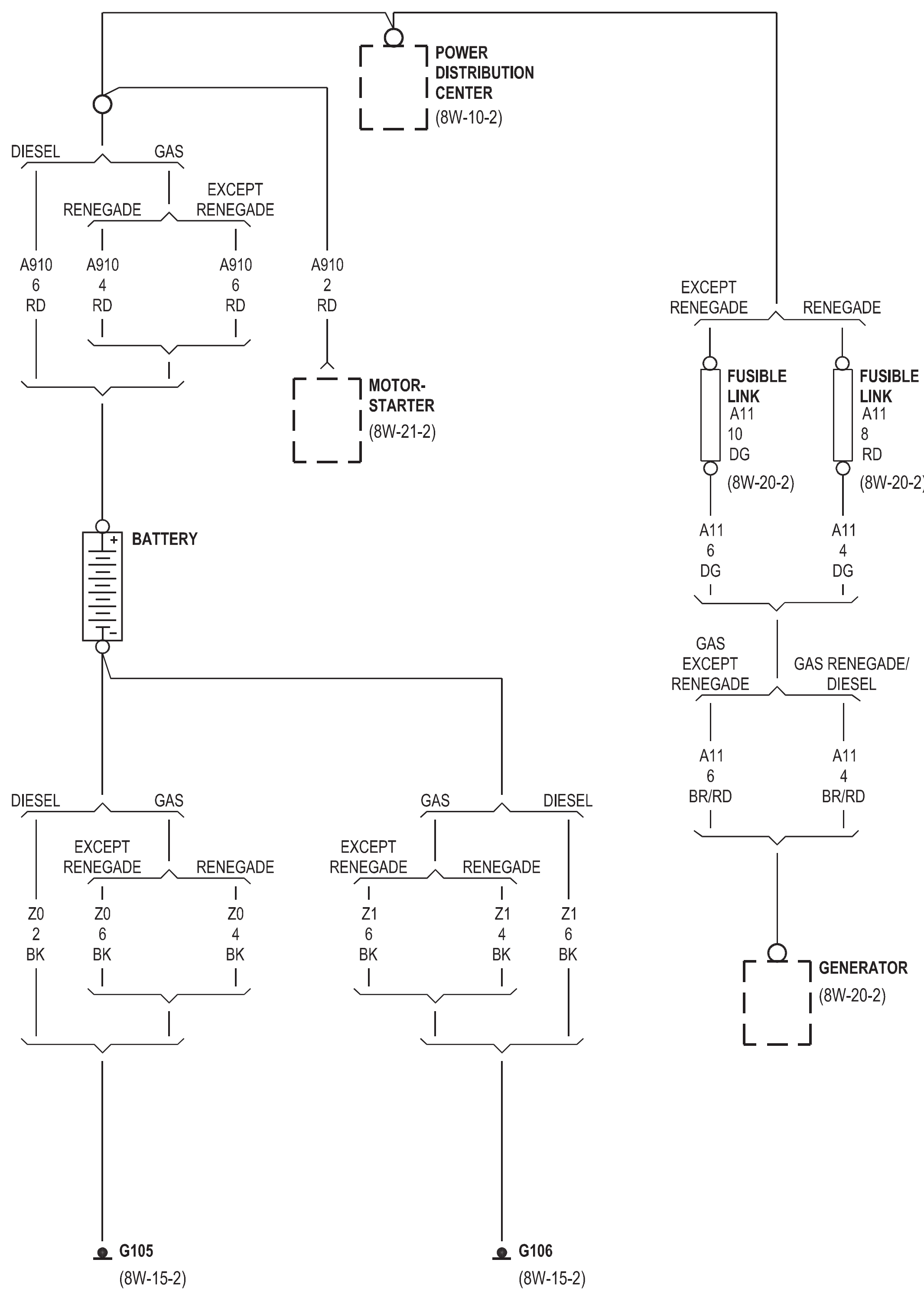
| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | Z932 20BK | GROUND |
| 86 | T515 20YL/DB | TRANSMISSION CONTROL RELAY CONTROL |
| 87 | T16 16YL/OR | TRANSMISSION CONTROL RELAY OUTPUT |
| 87A | - | - |

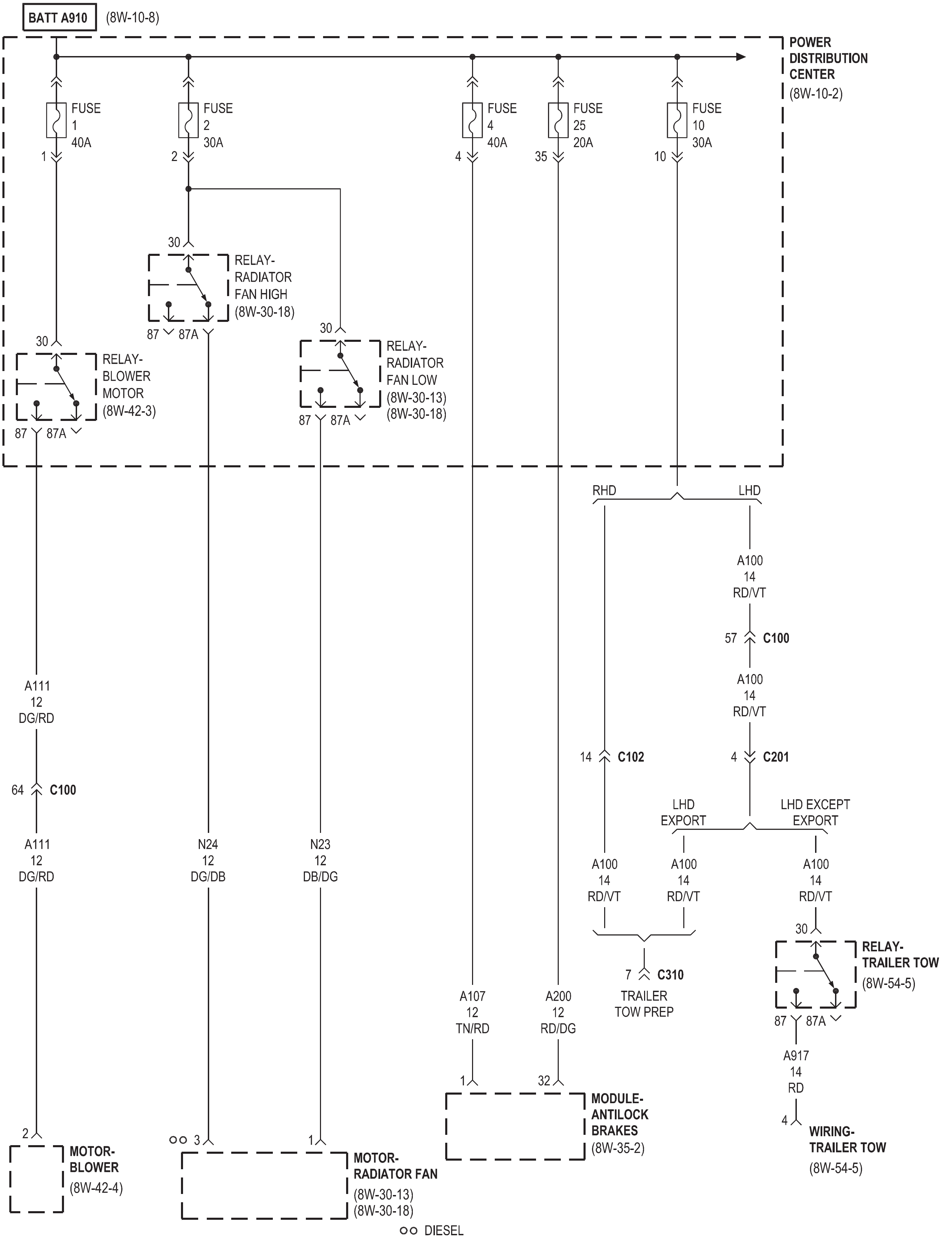
**RELAY-WIPER HIGH/LOW**

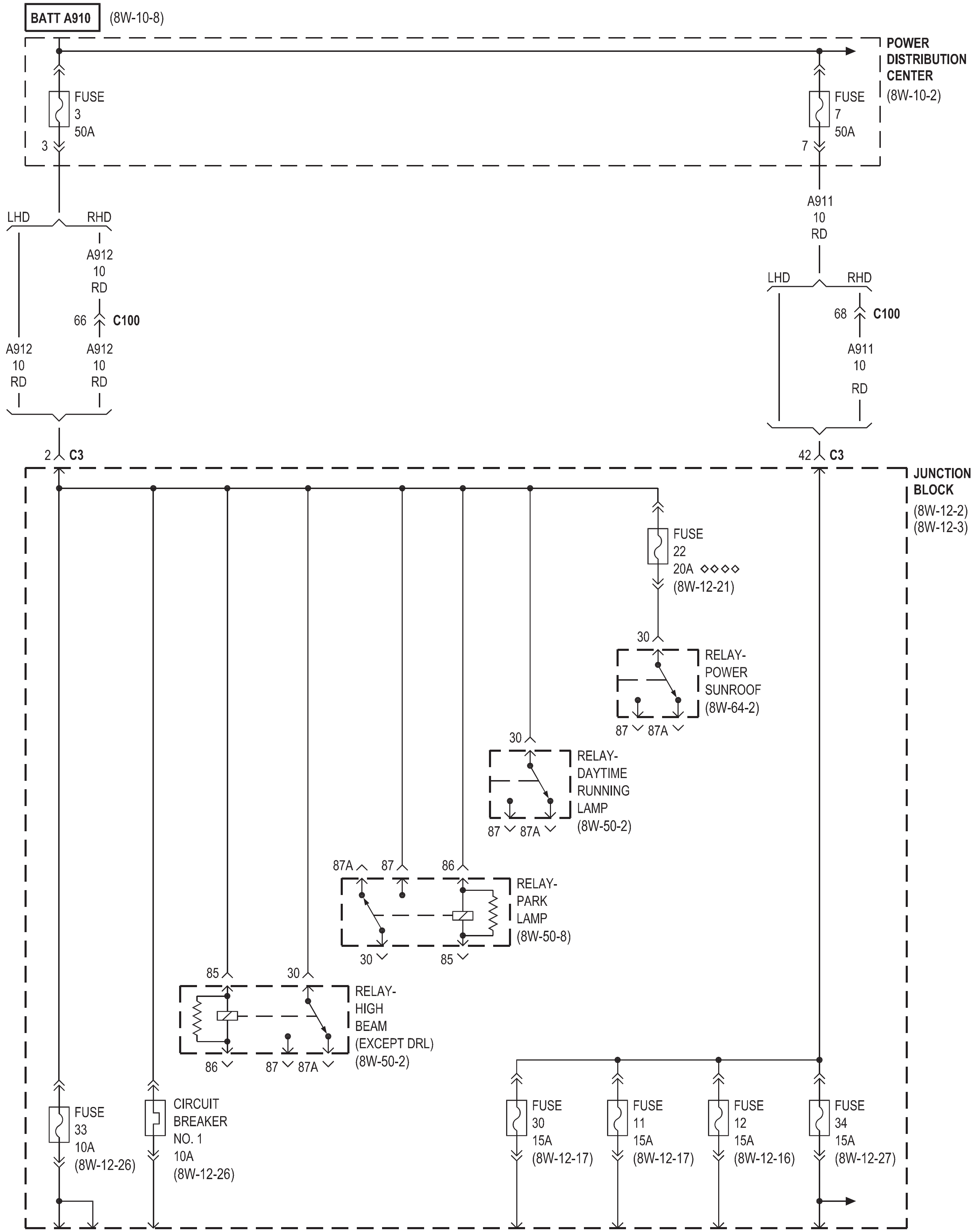
| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | W5 16BR/LG | FRONT WIPER ON/OFF RELAY OUTPUT |
| 85 | W2 20BR/LG | FRONT WIPER HIGH/LOW RELAY CONTROL |
| 86 | A5 16RD/VT | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 87 | W4 16BR/OR | FRONT WIPER ON/OFF RELAY HIGH SPEED OUTPUT |
| 87A | W3 16BR/WT | FRONT WIPER ON/OFF RELAY LOW SPEED OUTPUT |

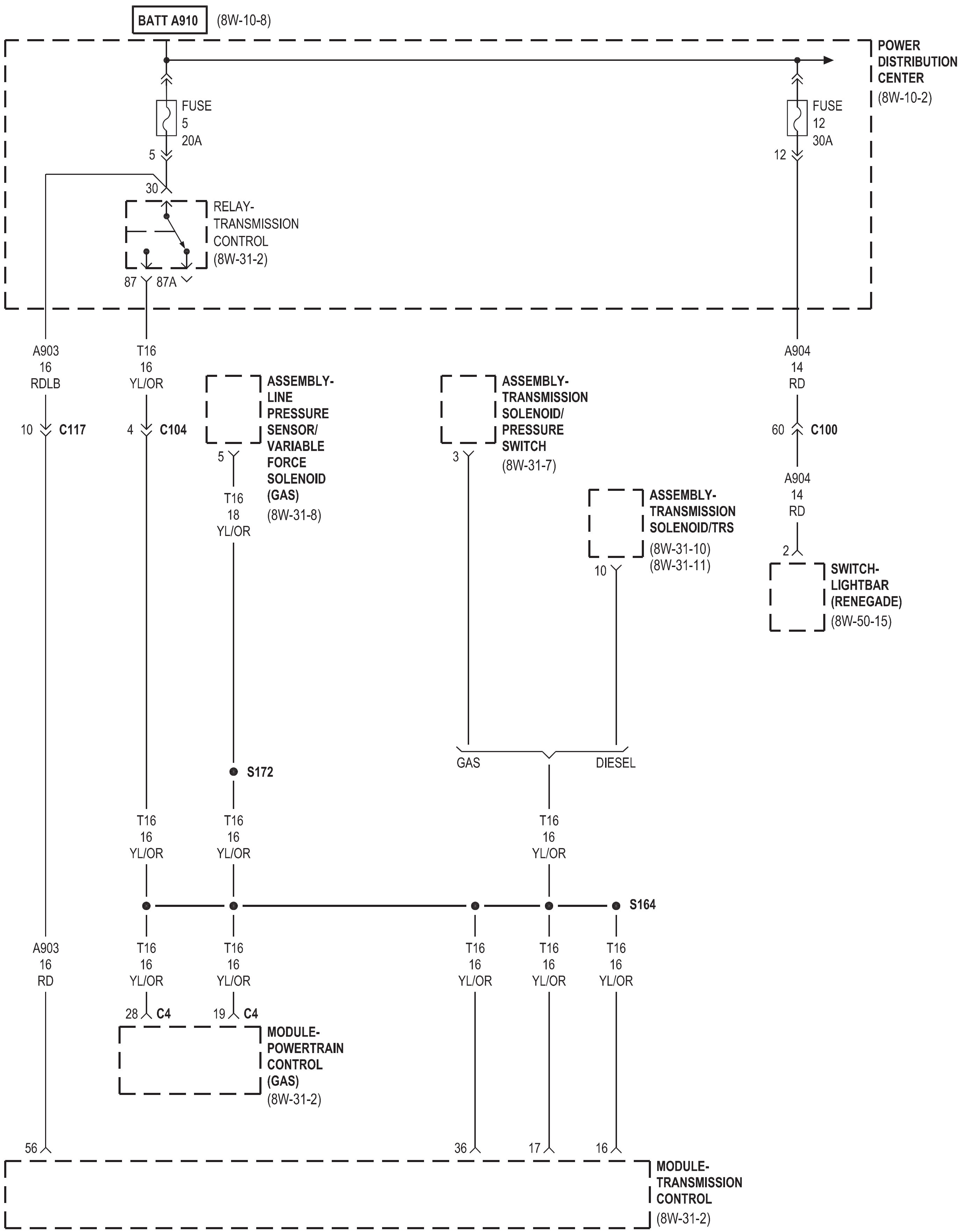
**RELAY-WIPER ON/OFF**

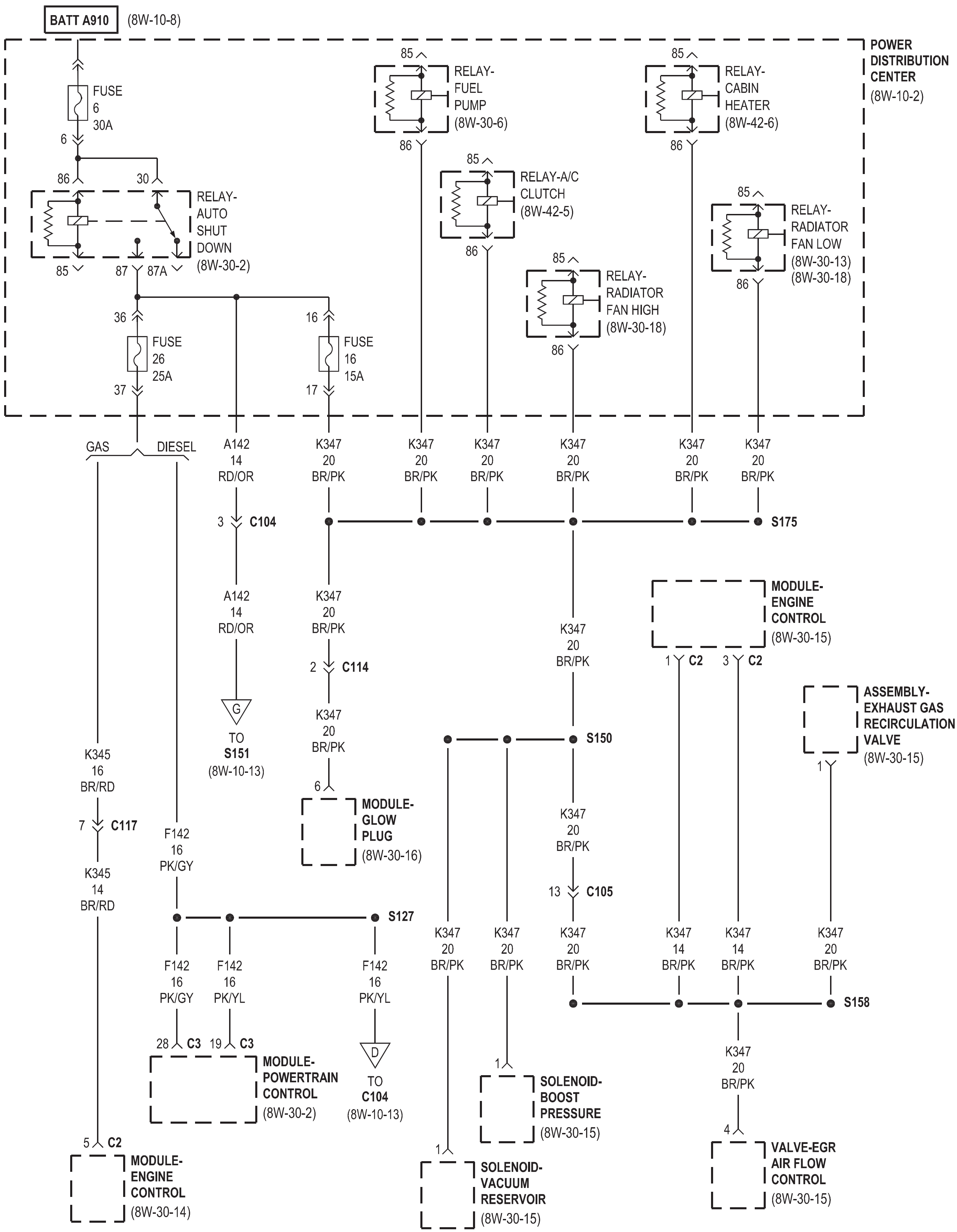
| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | A142 16DG/OR | FUSED B(+) |
| 85 | K132 12VT | ENGINE STARTER MOTOR RELAY CONTROL |
| 86 | C41 20LB/DG | FUSED IGNITION SWITCH OUTPUT (START) |
| 87 | A122 12RD | STARTER MOTOR RELAY OUTPUT |
| 87A | - | - |


POWER DISTRIBUTION CENTER
(8W-10-2)
DIESEL
GAS
RENEGADE
EXCEPT RENEGADE
A910 6 RD
A910 4 RD
A910 6 RD
A910 2 RD
MOTOR-STARTER
(8W-21-2)
BATTERY
EXCEPT RENEGADE
RENEGADE
FUSIBLE LINK
A11 10 DG
(8W-20-2)
FUSIBLE LINK
A11 8 RD
(8W-20-2)
A11 6 DG
A11 4 DG
GAS EXCEPT RENEGADE
GAS RENEGADE/ DIESEL
A11 6 BR/RD
A11 4 BR/RD
GENERATOR
(8W-20-2)
DIESEL
GAS
EXCEPT RENEGADE
RENEGADE
Z0 2 BK
Z0 6 BK
Z0 4 BK
GAS
DIESEL
EXCEPT RENEGADE
RENEGADE
Z1 6 BK
Z1 4 BK
Z1 6 BK
G105
(8W-15-2)
G106
(8W-15-2)

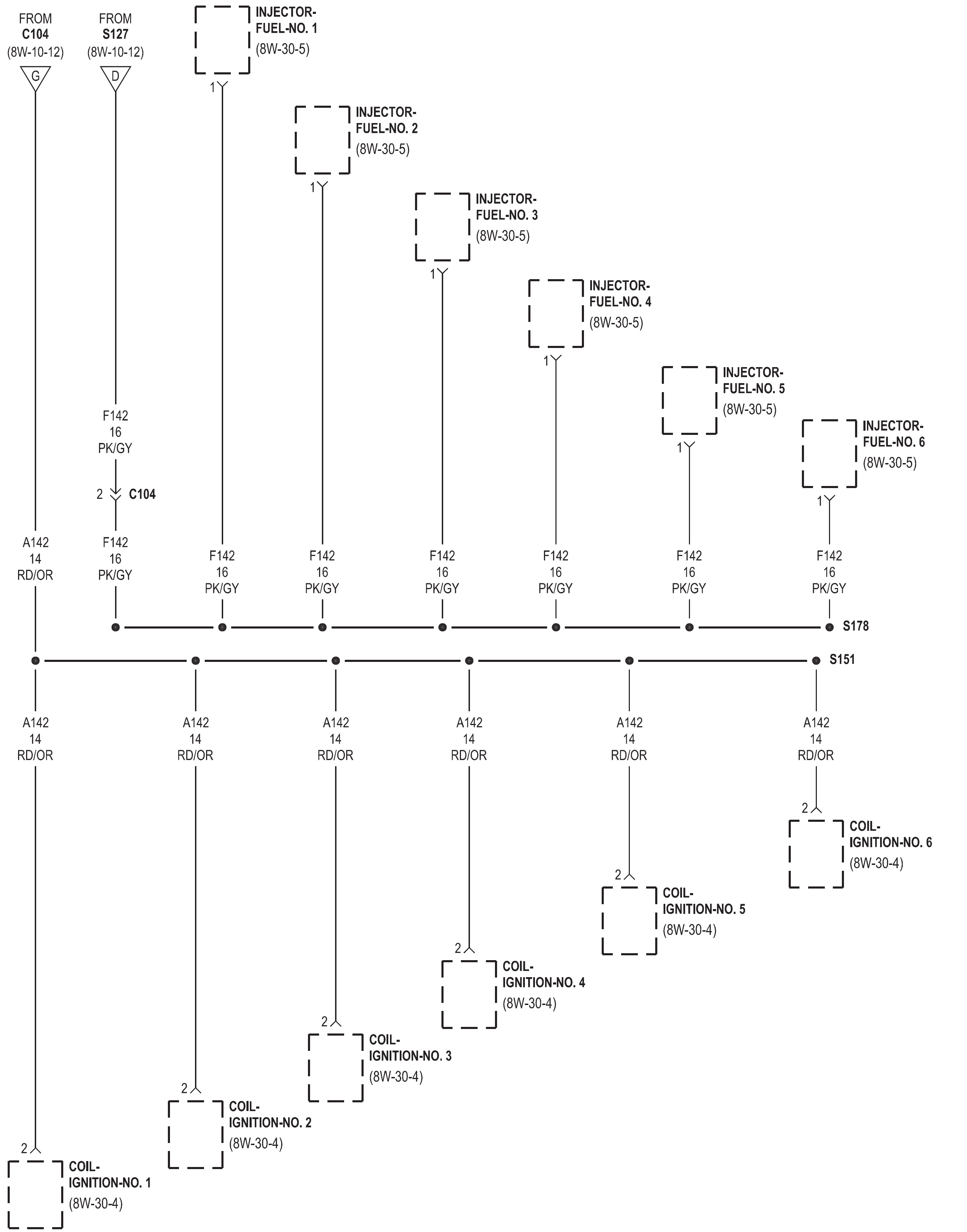

BATT A910
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
1
40A
FUSE
2
30A
FUSE
4
40A
FUSE
25
20A
FUSE
10
30A
RELAY-
RADIATOR
FAN HIGH
(8W-30-18)
RELAY-
BLOWER
MOTOR
(8W-42-3)
RELAY-
RADIATOR
FAN LOW
(8W-30-13)
(8W-30-18)
RHD
LHD
A100
14
RD/VT
57 C100
A100
14
RD/VT
14 C102
4 C201
LHD
EXPORT
LHD EXCEPT
EXPORT
A111
12
DG/RD
64 C100
A111
12
DG/RD
N24
12
DG/DB
N23
12
DB/DG
A100
14
RD/VT
A100
14
RD/VT
A100
14
RD/VT
7 C310
TRAILER
TOW PREP
RELAY-
TRAILER TOW
(8W-54-5)
A107
12
TN/RD
A200
12
RD/DG
A917
14
RD
MODULE-
ANTILOCK
BRAKES
(8W-35-2)
WIRING-
TRAILER TOW
(8W-54-5)
MOTOR-
BLOWER
(8W-42-4)
MOTOR-
RADIATOR FAN
(8W-30-13)
(8W-30-18)
○○ DIESEL

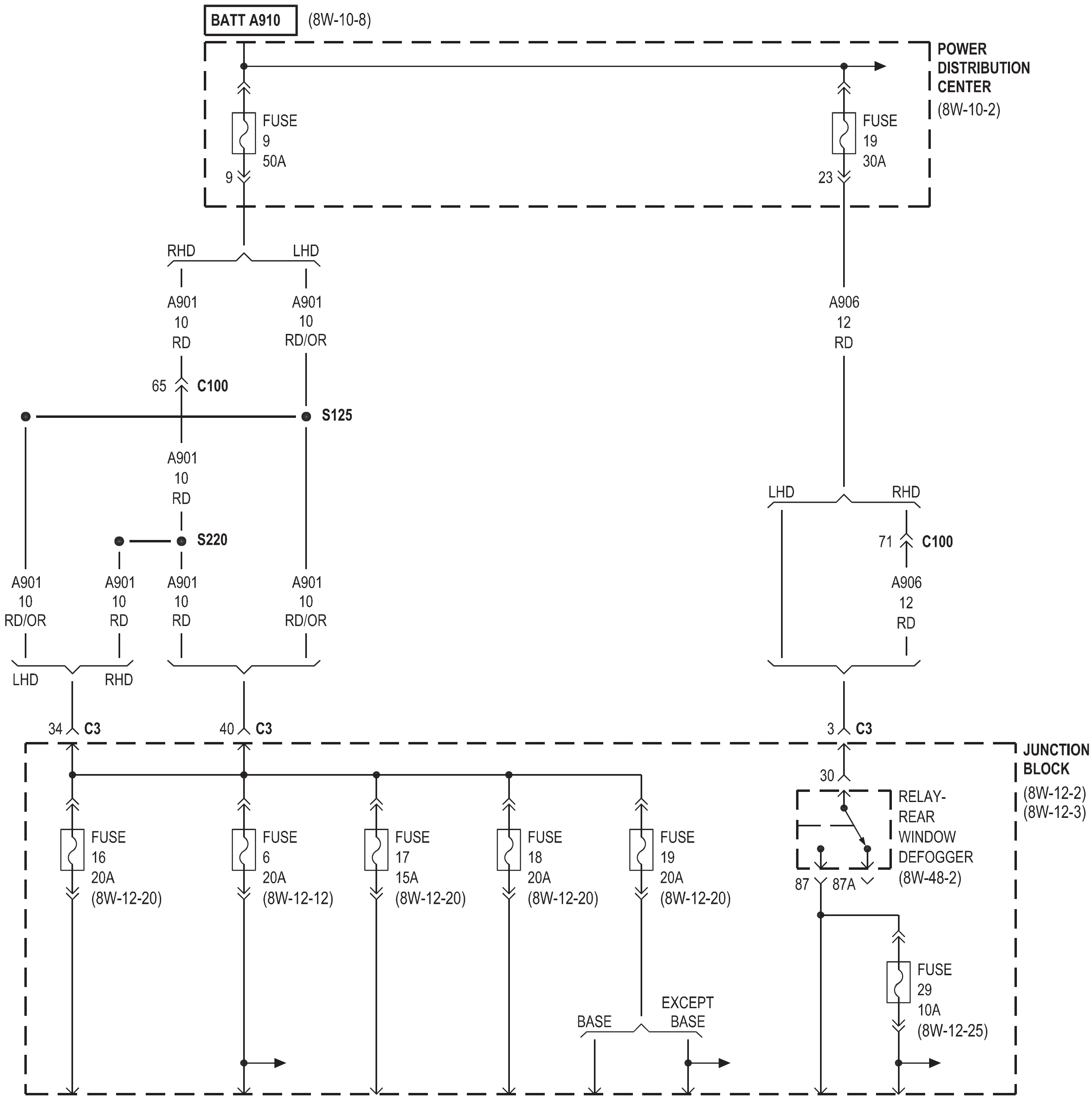

BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 3 50A
3
FUSE 7 50A
7
A911 10 RD
LHD
RHD
A912 10 RD
66
C100
68
A911 10 RD
2
C3
42
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 22 20A
(8W-12-21)
30
RELAY- POWER SUNROOF
(8W-64-2)
87
87A
RELAY- DAYTIME RUNNING LAMP
(8W-50-2)
86
85
RELAY- PARK LAMP
(8W-50-8)
RELAY- HIGH BEAM (EXCEPT DRL)
(8W-50-2)
FUSE 33 10A
(8W-12-26)
CIRCUIT BREAKER NO. 1 10A
(8W-12-26)
FUSE 30 15A
(8W-12-17)
FUSE 11 15A
(8W-12-17)
FUSE 12 15A
(8W-12-16)
FUSE 34 15A
(8W-12-27)

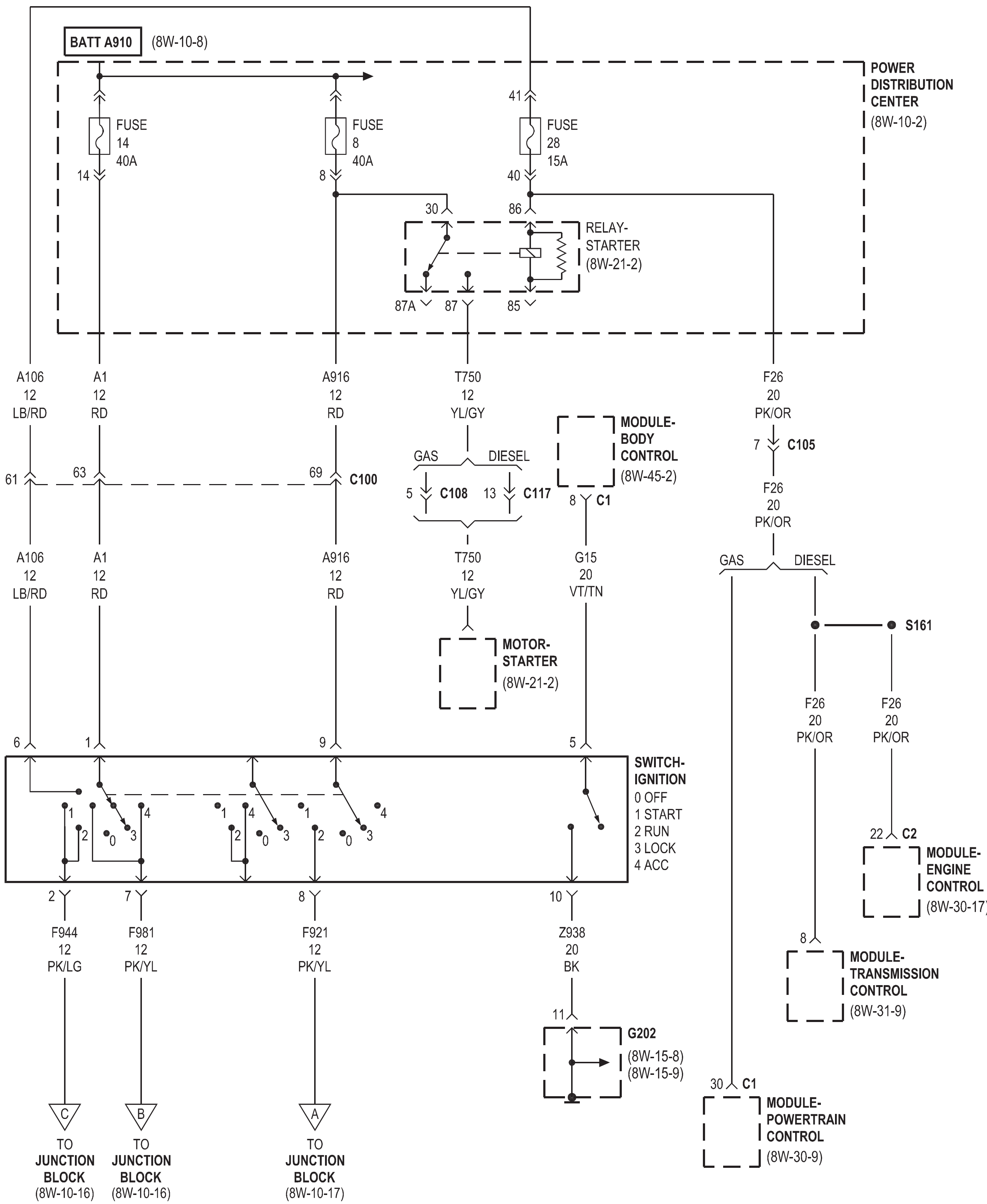

BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 5 20A
5
FUSE 12 30A
12
30
RELAY-TRANSMISSION CONTROL
(8W-31-2)
87
87A
A903 16 RDLB
T16 16 YL/OR
A904 14 RD
10
C117
4
C104
60
C100
ASSEMBLY-LINE PRESSURE SENSOR/VARIABLE FORCE SOLENOID (GAS)
(8W-31-8)
5
T16 18 YL/OR
ASSEMBLY-TRANSMISSION SOLENOID/PRESSURE SWITCH
(8W-31-7)
3
ASSEMBLY-TRANSMISSION SOLENOID/TRS
(8W-31-10)
(8W-31-11)
10
A904 14 RD
2
SWITCH-LIGHTBAR (RENEGADE)
(8W-50-15)
GAS
DIESEL
S172
T16 16 YL/OR
T16 16 YL/OR
T16 16 YL/OR
S164
A903 16 RD
T16 16 YL/OR
T16 16 YL/OR
T16 16 YL/OR
T16 16 YL/OR
T16 16 YL/OR
28
C4
19
C4
MODULE-POWERTRAIN CONTROL (GAS)
(8W-31-2)
56
36
17
16
MODULE-TRANSMISSION CONTROL
(8W-31-2)



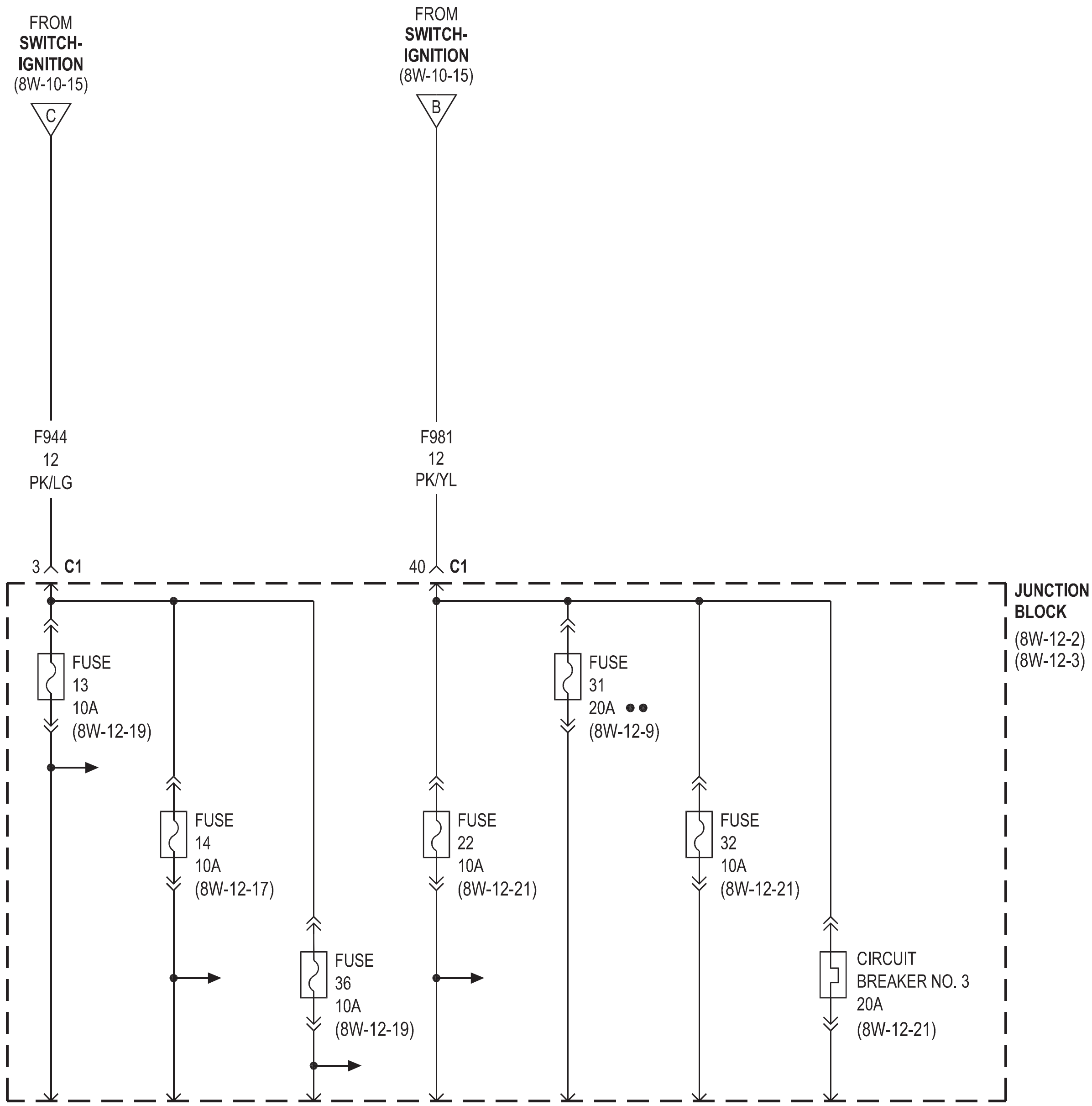

J068W-2 KJ601012


FROM
C104
(8W-10-12)
G
FROM
S127
(8W-10-12)
D
INJECTOR-
FUEL-NO. 1
(8W-30-5)
INJECTOR-
FUEL-NO. 2
(8W-30-5)
INJECTOR-
FUEL-NO. 3
(8W-30-5)
INJECTOR-
FUEL-NO. 4
(8W-30-5)
INJECTOR-
FUEL-NO. 5
(8W-30-5)
INJECTOR-
FUEL-NO. 6
(8W-30-5)
1
F142
16
PK/GY
2
C104
A142
14
RD/OR
S178
S151
2
COIL-
IGNITION-NO. 1
(8W-30-4)
COIL-
IGNITION-NO. 2
(8W-30-4)
COIL-
IGNITION-NO. 3
(8W-30-4)
COIL-
IGNITION-NO. 4
(8W-30-4)
COIL-
IGNITION-NO. 5
(8W-30-4)
COIL-
IGNITION-NO. 6
(8W-30-4)

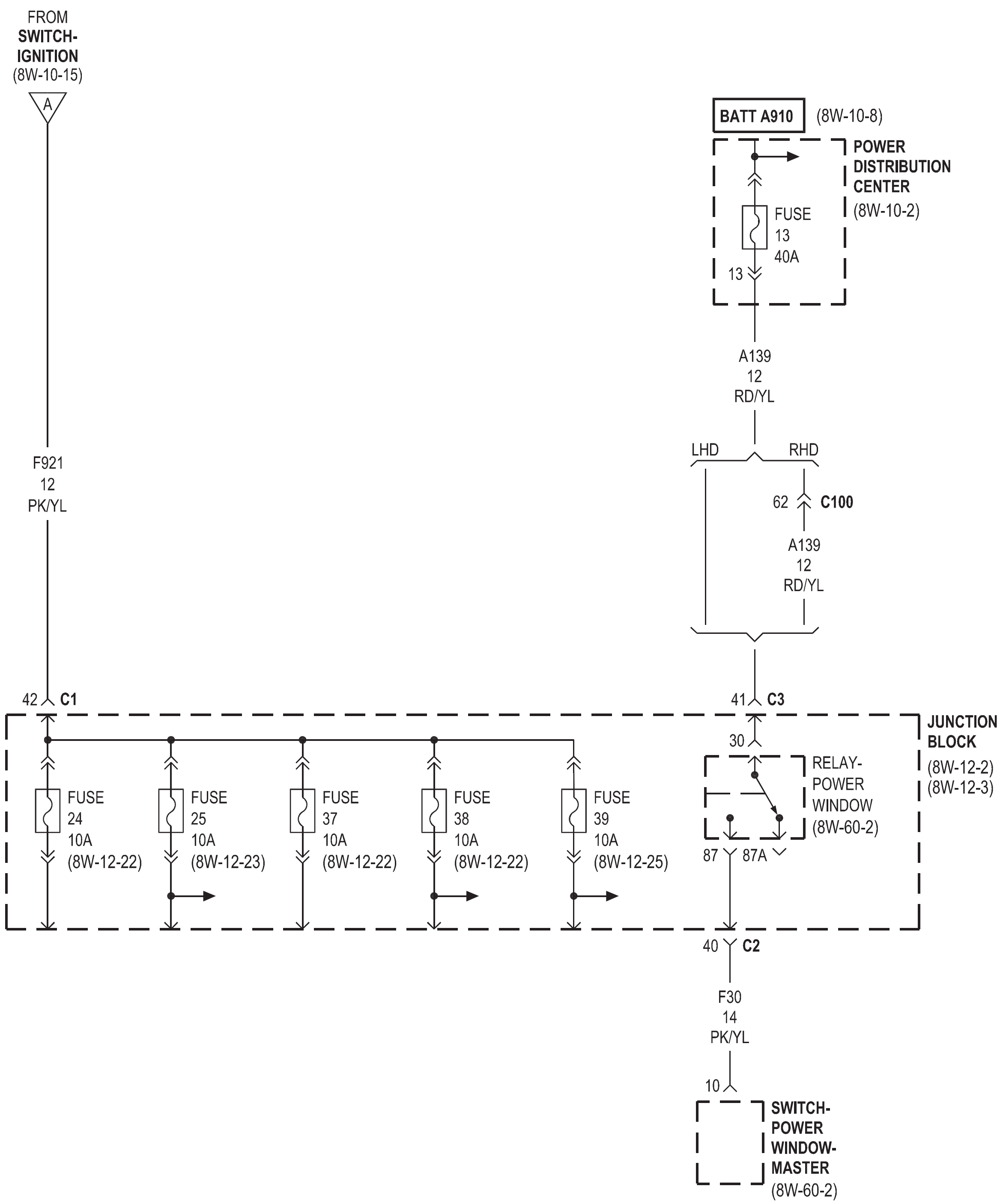

BATT A910
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
9
50A
9
FUSE
19
30A
23
RHD
LHD
A901
10
RD
A901
10
RD/OR
A906
12
RD
65
C100
S125
A901
10
RD
S220
LHD
RHD
71
C100
A901
10
RD/OR
A901
10
RD
A901
10
RD
A901
10
RD/OR
A906
12
RD
LHD
RHD
34
C3
40
C3
3
C3
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
30
RELAY-
REAR
WINDOW
DEFOGGER
(8W-48-2)
87
87A
FUSE
16
20A
(8W-12-20)
FUSE
6
20A
(8W-12-12)
FUSE
17
15A
(8W-12-20)
FUSE
18
20A
(8W-12-20)
FUSE
19
20A
(8W-12-20)
FUSE
29
10A
(8W-12-25)
BASE
EXCEPT
BASE

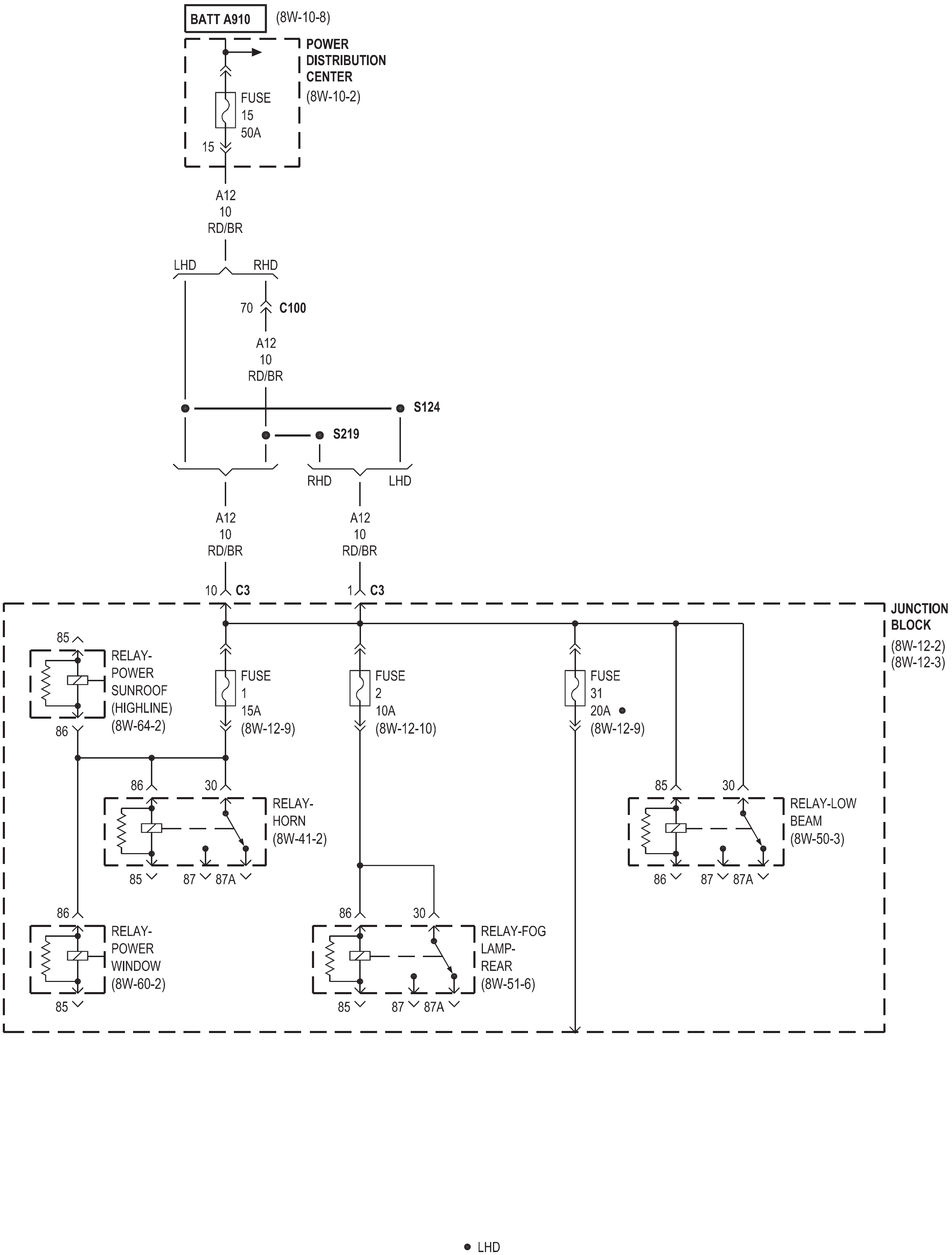


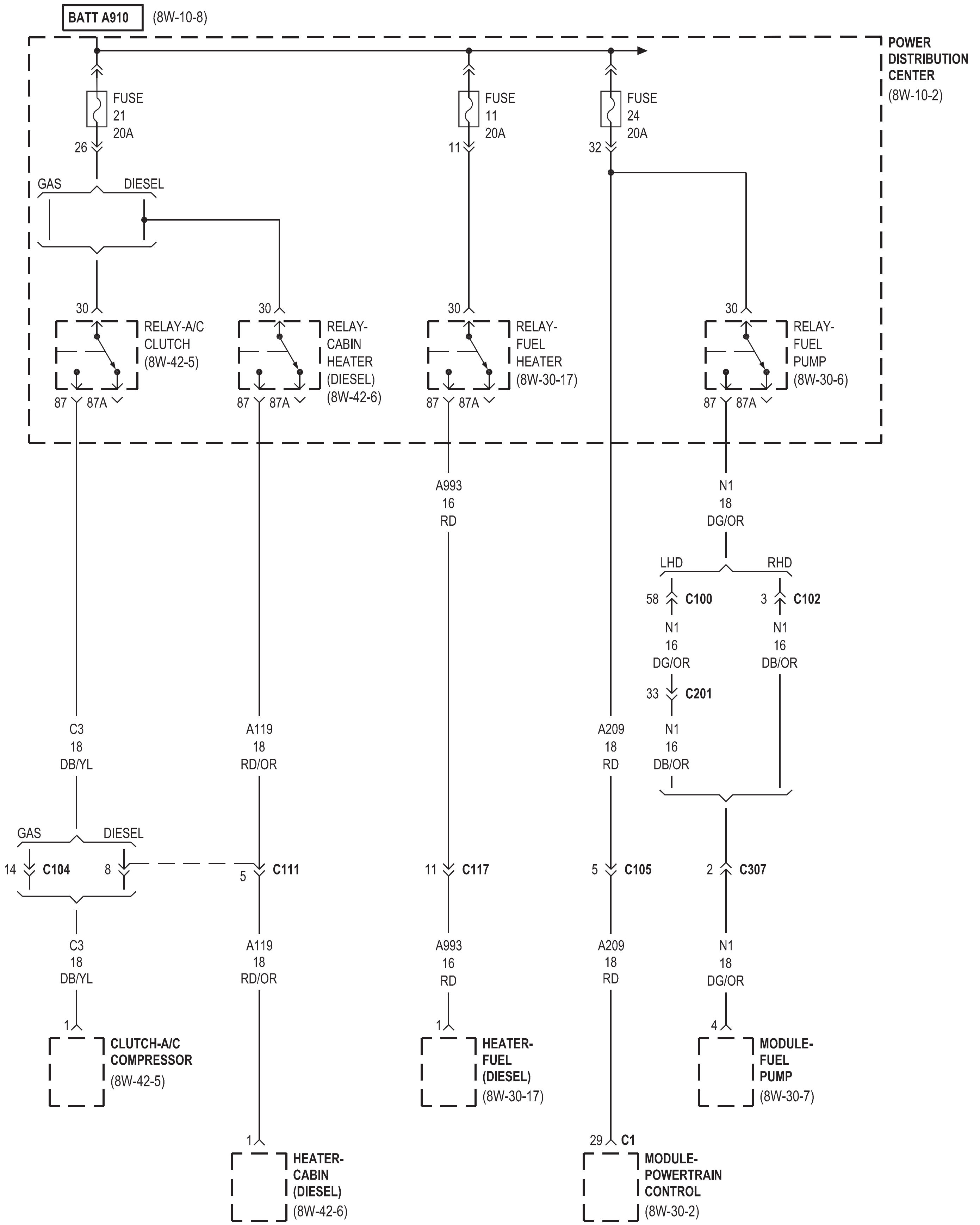
BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 14 40A
FUSE 8 40A
FUSE 28 15A
41
14
8
40
30
86
RELAY-STARTER
(8W-21-2)
87A
87
85
A106 12 LB/RD
A1 12 RD
A916 12 RD
T750 12 YL/GY
F26 20 PK/OR
MODULE-BODY CONTROL
(8W-45-2)
7 C105
GAS
DIESEL
61
63
69
C100
5 C108
13 C117
8 C1
A106 12 LB/RD
A1 12 RD
A916 12 RD
T750 12 YL/GY
G15 20 VT/TN
F26 20 PK/OR
GAS
DIESEL
S161
MOTOR-STARTER
(8W-21-2)
F26 20 PK/OR
F26 20 PK/OR
6
1
9
5
SWITCH-IGNITION
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
22 C2
MODULE-ENGINE CONTROL
(8W-30-17)
2
7
8
10
F944 12 PK/LG
F981 12 PK/YL
F921 12 PK/YL
Z938 20 BK
8
MODULE-TRANSMISSION CONTROL
(8W-31-9)
11
G202
(8W-15-8)
(8W-15-9)
30 C1
MODULE-POWERTRAIN CONTROL
(8W-30-9)
C
B
A
TO JUNCTION BLOCK (8W-10-16)
TO JUNCTION BLOCK (8W-10-16)
TO JUNCTION BLOCK (8W-10-17)


FROM
SWITCH-
IGNITION
(8W-10-15)
C
FROM
SWITCH-
IGNITION
(8W-10-15)
B
F944
12
PK/LG
F981
12
PK/YL
3 C1
40 C1
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
13
10A
(8W-12-19)
FUSE
31
20A ●●
(8W-12-9)
FUSE
14
10A
(8W-12-17)
FUSE
22
10A
(8W-12-21)
FUSE
32
10A
(8W-12-21)
FUSE
36
10A
(8W-12-19)
CIRCUIT
BREAKER NO. 3
20A
(8W-12-21)

●● RHD

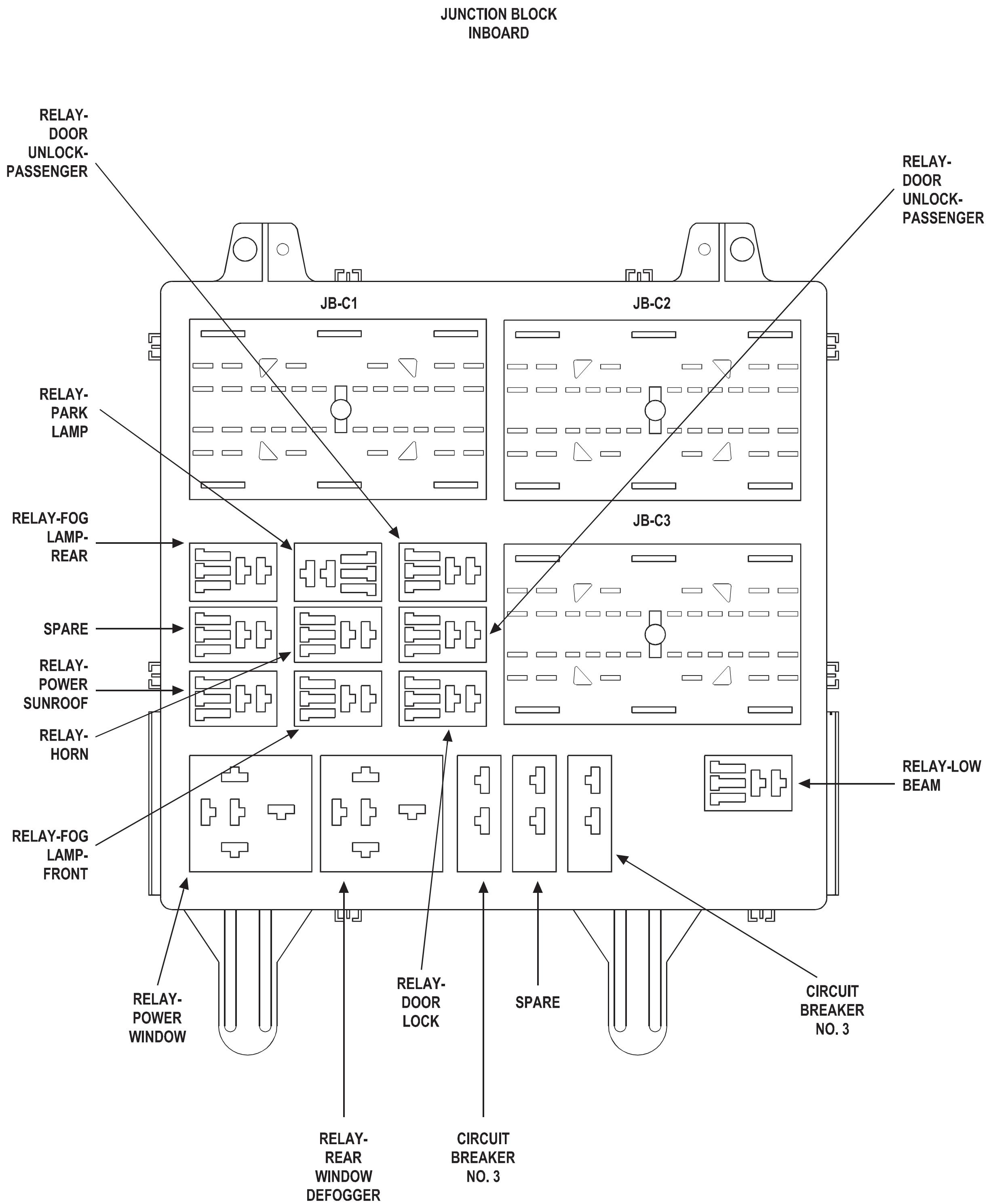

FROM
SWITCH-
IGNITION
(8W-10-15)
A
F921
12
PK/YL
42 C1
BATT A910
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
13
40A
13
A139
12
RD/YL
LHD
RHD
62 C100
A139
12
RD/YL
41 C3
30
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
24
10A
(8W-12-22)
FUSE
25
10A
(8W-12-23)
FUSE
37
10A
(8W-12-22)
FUSE
38
10A
(8W-12-22)
FUSE
39
10A
(8W-12-25)
RELAY-
POWER
WINDOW
(8W-60-2)
87
87A
40 C2
F30
14
PK/YL
10
SWITCH-
POWER
WINDOW-
MASTER
(8W-60-2)

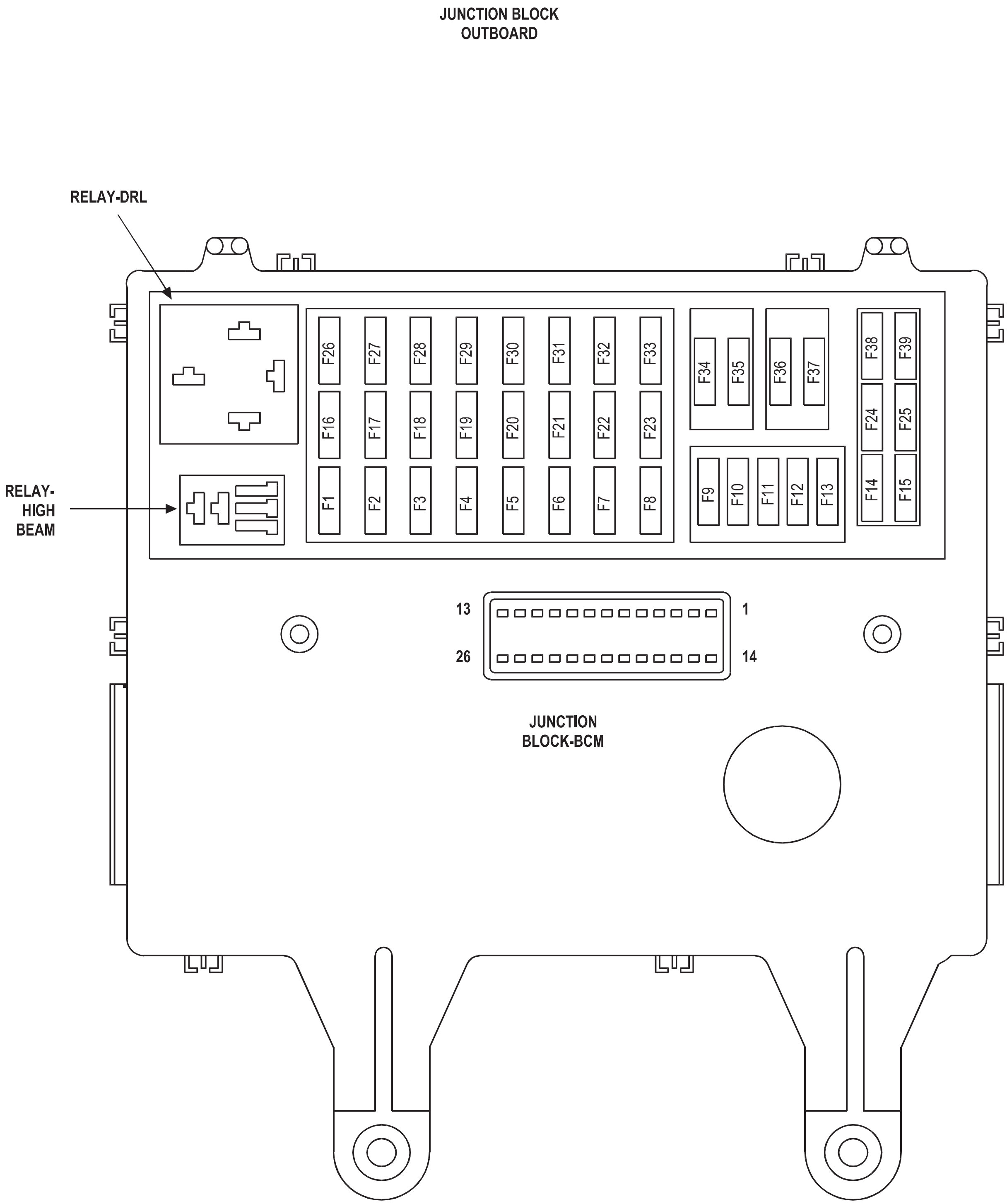

BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 15 50A
15
A12 10 RD/BR
LHD
RHD
70
C100
A12 10 RD/BR
S124
S219
RHD
LHD
A12 10 RD/BR
A12 10 RD/BR
10 C3
1 C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
85
RELAY-POWER SUNROOF (HIGHLINE)
(8W-64-2)
86
FUSE 1 15A
(8W-12-9)
FUSE 2 10A
(8W-12-10)
FUSE 31 20A ●
(8W-12-9)
86
30
RELAY-HORN
(8W-41-2)
85 87 87A
85
30
RELAY-LOW BEAM
(8W-50-3)
86 87 87A
86
RELAY-POWER WINDOW
(8W-60-2)
85
86
30
RELAY-FOG LAMP-REAR
(8W-51-6)
85 87 87A
● LHD



BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 21 20A
26
FUSE 11 20A
11
FUSE 24 20A
32
GAS
DIESEL
30
RELAY-A/C CLUTCH
(8W-42-5)
87 87A
30
RELAY-CABIN HEATER (DIESEL)
(8W-42-6)
87 87A
30
RELAY-FUEL HEATER
(8W-30-17)
87 87A
30
RELAY-FUEL PUMP
(8W-30-6)
87 87A
A993 16 RD
N1 18 DG/OR
LHD
RHD
58 C100
3 C102
N1 16 DG/OR
N1 16 DB/OR
33 C201
N1 16 DB/OR
C3 18 DB/YL
A119 18 RD/OR
A209 18 RD
GAS
DIESEL
14 C104 8
5 C111
11 C117
5 C105
2 C307
C3 18 DB/YL
A119 18 RD/OR
A993 16 RD
A209 18 RD
N1 18 DG/OR
1
CLUTCH-A/C COMPRESSOR
(8W-42-5)
1
HEATER-FUEL (DIESEL)
(8W-30-17)
4
MODULE-FUEL PUMP
(8W-30-7)
1
HEATER-CABIN (DIESEL)
(8W-42-6)
29 C1
MODULE-POWERTRAIN CONTROL
(8W-30-2)

# 8W-12 JUNCTION BLOCK


JUNCTION BLOCK
INBOARD
RELAY-DOOR UNLOCK-PASSENGER
RELAY-DOOR UNLOCK-PASSENGER
JB-C1
JB-C2
JB-C3
RELAY-PARK LAMP
RELAY-FOG LAMP-REAR
SPARE
RELAY-POWER SUNROOF
RELAY-HORN
RELAY-FOG LAMP-FRONT
RELAY-LOW BEAM
RELAY-POWER WINDOW
RELAY-DOOR LOCK
SPARE
CIRCUIT BREAKER NO. 3
RELAY-REAR WINDOW DEFOGGER
CIRCUIT BREAKER NO. 3


JUNCTION BLOCK
OUTBOARD
RELAY-DRL
RELAY-
HIGH
BEAM
F26
F27
F28
F29
F30
F31
F32
F33
F16
F17
F18
F19
F20
F21
F22
F23
F1
F2
F3
F4
F5
F6
F7
F8
F34
F35
F36
F37
F9
F10
F11
F12
F13
F38
F39
F24
F25
F14
F15
13
1
26
14
JUNCTION
BLOCK-BCM

FUSES

| FUSE NO. | AMPS | FUSED CIRCUIT | FUNCTION |
|---|---|---|---|
| 1 | 15A | INTERNAL | FUSED B(+) |
| 2 | 10A | INTERNAL ◪ | FUSED B(+) |
| 3 | - | - | - |
| 4 | 10A | L44 18WT/TN | FUSED RIGHT LOW BEAM OUTPUT |
| 5 | 10A | L43 18WT/DB | FUSED LEFT LOW BEAM OUTPUT |
| 6 | 20A | INTERNAL | FUSED B(+) |
| 7 | 10A | INTERNAL | FUSED PARK LAMP RELAY OUTPUT |
| 8 | - | - | - |
| 9 | 10A | INTERNAL | FUSED PARK LAMP RELAY OUTPUT |
| 10 | - | - | - |
| 11 | 15A | A107 18BR/RD | FUSED B(+) |
| 12 | 15A | A103 18GY/RD | FUSED B(+) |
| 13 | 10A | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 14 | 10A | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 15 | - | - | - |
| 16 | 20A | A305 16RD/LB | FUSED B(+) |
| 17 | 15A | A44 18RD/OR | FUSED B(+) |
| 18 | 20A | X1 16DG/BR | FUSED B(+) |
| 19 | 20A | A913 16RD ▿ | FUSED B(+) |
| 19 | 20A | INTERNAL ▿▿ | FUSED B(+) |
| 20 | - | - | - |
| 21 | 20A | INTERNAL | FUSED B(+) |
| 22 | 10A | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 23 | - | - | - |
| 24 | 10A | F20 20PK/GY | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 25 | 10A | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 26 | 10A | L34 18WT/GY | FUSED RIGHT HIGH BEAM OUTPUT |
| 27 | 10A | L33 18WT/LG | FUSED LEFT HIGH BEAM OUTPUT |
| 28 | - | - | - |
| 29 | 10A | INTERNAL | FUSED REAR WINDOW DEFOGGER RELAY OUTPUT |
| 30 | 15A | A902 18RD | FUSED B(+) |

▿ BASE

▿▿ EXCEPT BASE ◪ LHD HIGHLINE/RHD

J068W-2 KJ601204

FUSES
(CONTINUED)

| FUSE NO. | AMPS | FUSED CIRCUIT | FUNCTION |
|---|---|---|---|
| 31 | 20A ●● | F307 16LB/PK | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 31 | 20A ● | A207 16RD/LG | FUSED B(+) |
| 32 | 10A | F943 20PK/LG | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 33 | 10A | INTERNAL | FUSED B(+) |
| 34 | 15A | INTERNAL | FUSED B(+) |
| 35 | - | - | - |
| 36 | 10A | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 37 | 10A | F100 20PK/VT | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 38 | 10A | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 39 | 10A | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN) |

CIRCUIT BREAKERS

| C.B. | AMPS | FUSED CIRCUIT | FUNCTION |
|---|---|---|---|
| 1 | 25A ◆◆◆◆ | F307 16LB/PK | FUSED B(+) |
| 2 | - | - | - |
| 3 | 20A ● | V6 16DB/YL | WINDSHIELD WIPER SYSTEM FEED |
| | 20A ●● | V6 14DB/YL | WINDSHIELD WIPER SYSTEM FEED |

● LHD
●● RHD
◆◆◆◆ MIDLINE/HIGHLINE

**RELAY-REAR WINDOW DEFOGGER**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | INTERNAL | REAR WINDOW DEFOGGER RELAY CONTROL |
| 86 | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 87 | INTERNAL | REAR WINDOW DEFOGGER RELAY OUTPUT |
| 87A | - | - |

**RELAY-DOOR LOCK**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | LOCK RELAY OUTPUT |
| 85 | INTERNAL | FUSED B(+) |
| 86 | INTERNAL | DOOR LOCK RELAY CONTROL |
| 87 | INTERNAL | FUSED B(+) |
| 87A | INTERNAL | GROUND |

**RELAY-DOOR UNLOCK-DRIVER**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | DRIVER DOOR UNLOCK RELAY OUTPUT |
| 85 | INTERNAL | DRIVER DOOR UNLOCK RELAY CONTROL |
| 86 | INTERNAL | FUSED B(+) |
| 87 | INTERNAL | FUSED B(+) |
| 87A | INTERNAL | GROUND |

**RELAY-FOG LAMP-FRONT**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | INTERNAL | FRONT FOG LAMP RELAY CONTROL |
| 86 | INTERNAL | FUSED B(+) |
| 87 | INTERNAL | FRONT FOG LAMP RELAY OUTPUT |
| 87A | - | - |

**RELAY-HIGH BEAM**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | INTERNAL | FUSED B(+) |
| 86 | INTERNAL | HIGH BEAM RELAY CONTROL |
| 87 | INTERNAL | FRONT FOG LAMP RELAY OUTPUT |
| 87A | - | - |

**RELAY-HORN**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | INTERNAL | HORN RELAY CONTROL |
| 86 | INTERNAL | FUSED B(+) |
| 87 | INTERNAL | HORN RELAY OUTPUT |
| 87A | - | - |

**RELAY-LOW BEAM**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | INTERNAL | FUSED B(+) |
| 86 | INTERNAL | LOW BEAM RELAY CONTROL |
| 87 | INTERNAL | LOW BEAM RELAY OUTPUT |
| 87A | - | - |

**RELAY-PARK LAMP**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | PARK LAMP RELAY OUTPUT |
| 85 | INTERNAL | PARK LAMP RELAY CONTROL |
| 86 | INTERNAL | FUSED B(+) |
| 87 | INTERNAL | FUSED B(+) |
| 87A | INTERNAL | GROUND |

**RELAY-DOOR UNLOCK-PASSENGER**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | UNLOCK RELAY OUTPUT |
| 85 | INTERNAL | DOOR UNLOCK RELAY CONTROL |
| 86 | INTERNAL | FUSED B(+) |
| 87 | INTERNAL | FUSED B(+) |
| 87A | INTERNAL | GROUND |

**RELAY-POWER WINDOW**

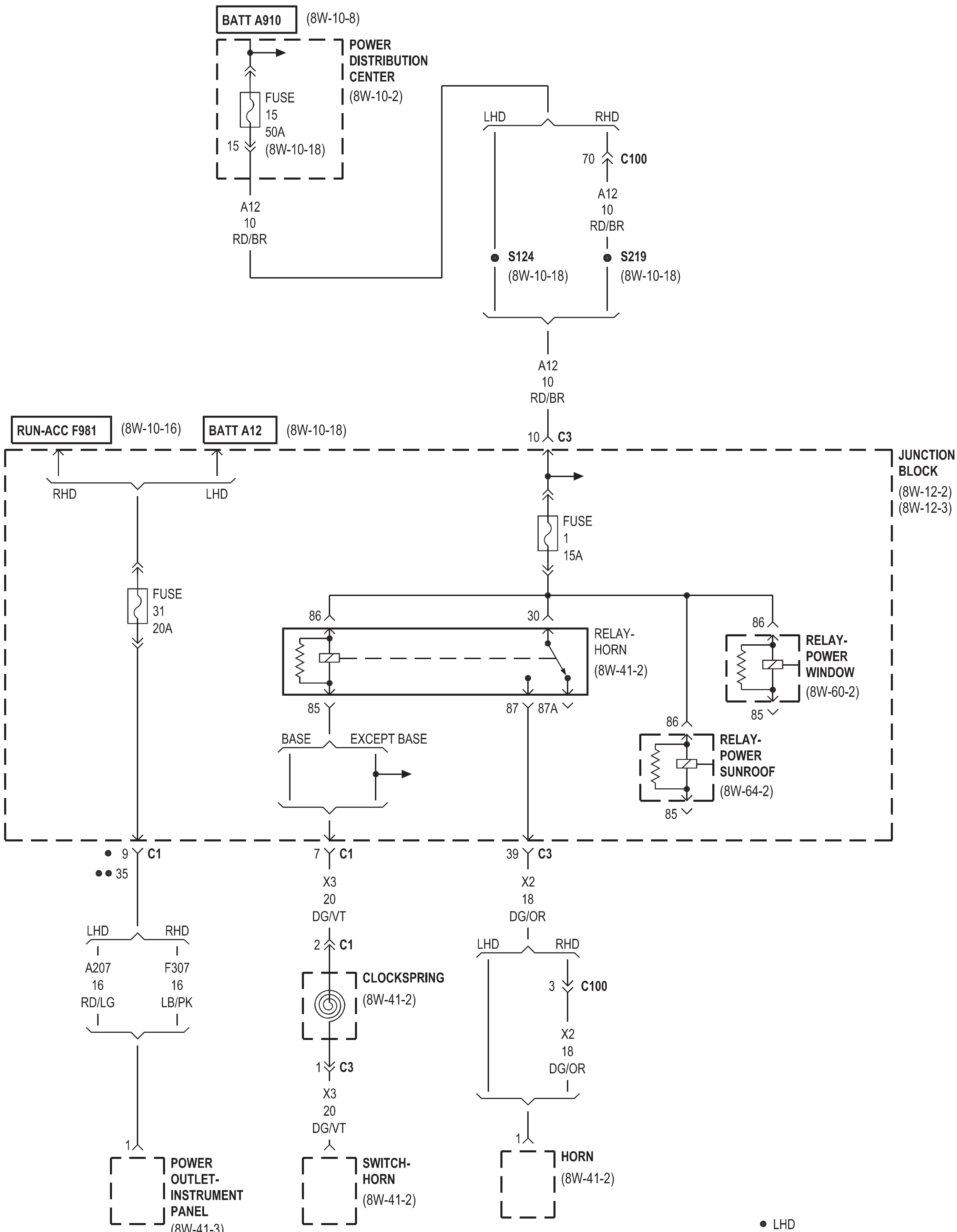
| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | INTERNAL | ACCESSORY DELAY RELAY CONTROL |
| 86 | INTERNAL | FUSED B(+) |
| 87 | INTERNAL | IGNITION SWITCH OUTPUT (RUN-ACC) |
| 87A | - | - |

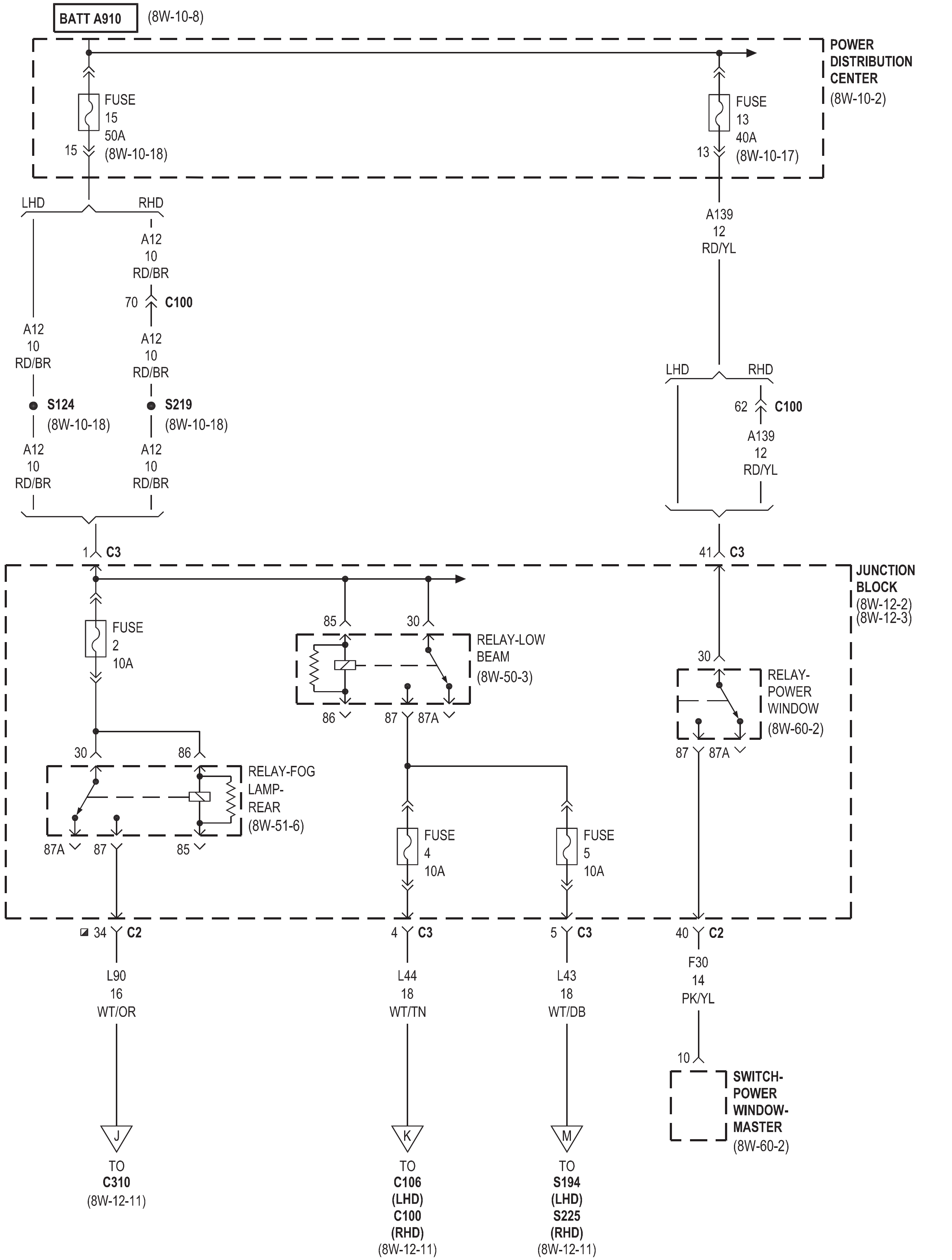
**RELAY-POWER SUNROOF**

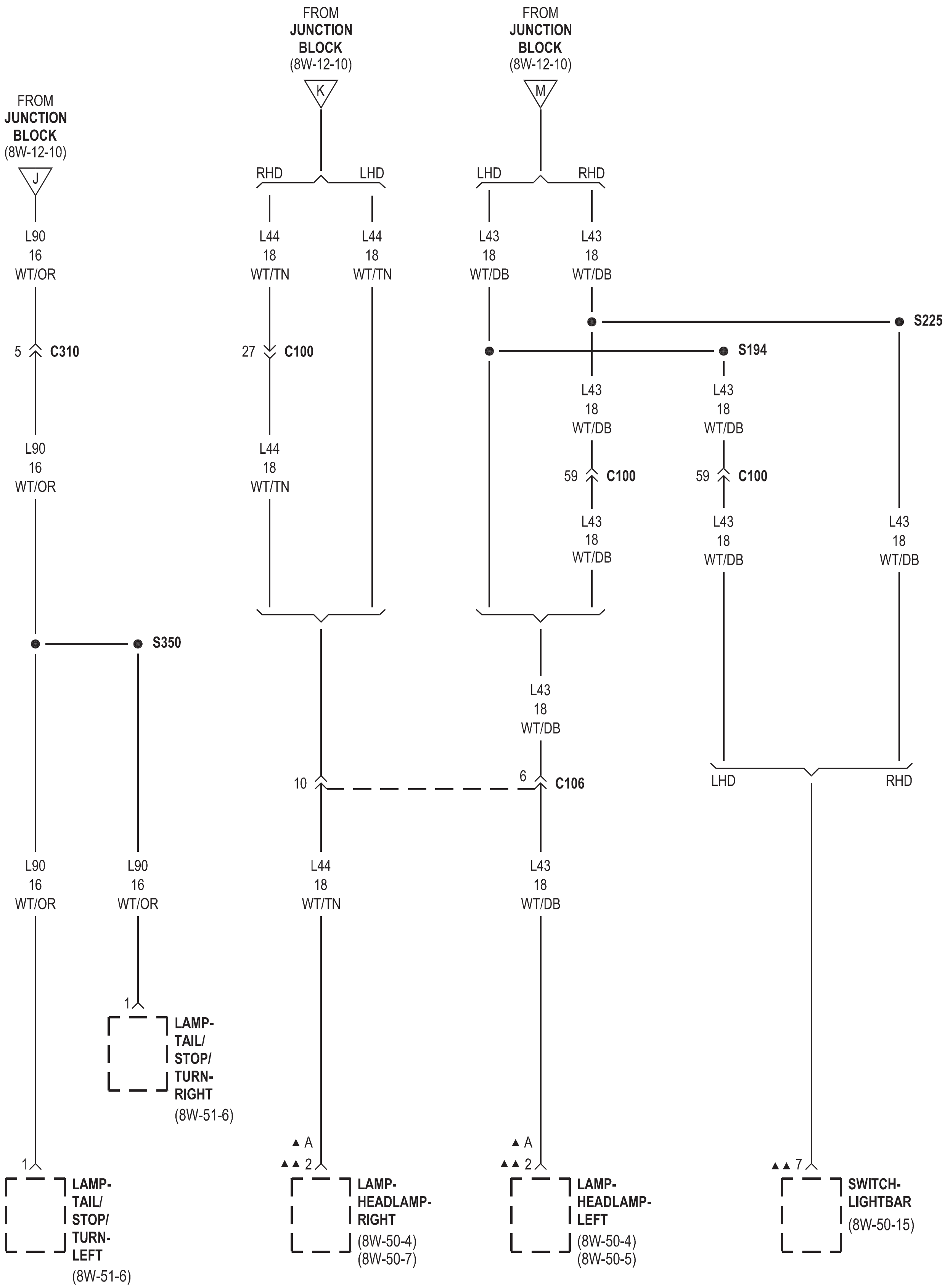
| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | INTERNAL | ACCESSORY DELAY RELAY CONTROL |
| 86 | INTERNAL | FUSED B(+) |
| 87 | INTERNAL | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 87A | - | - |

**RELAY-FOG LAMP-REAR**

| CAVITY | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | INTERNAL | FUSED B(+) |
| 85 | INTERNAL | REAR FOG LAMP RELAY CONTROL |
| 86 | INTERNAL | FUSED B(+) |
| 87 | INTERNAL | REAR FOG LAMP RELAY OUTPUT |
| 87A | - | - |

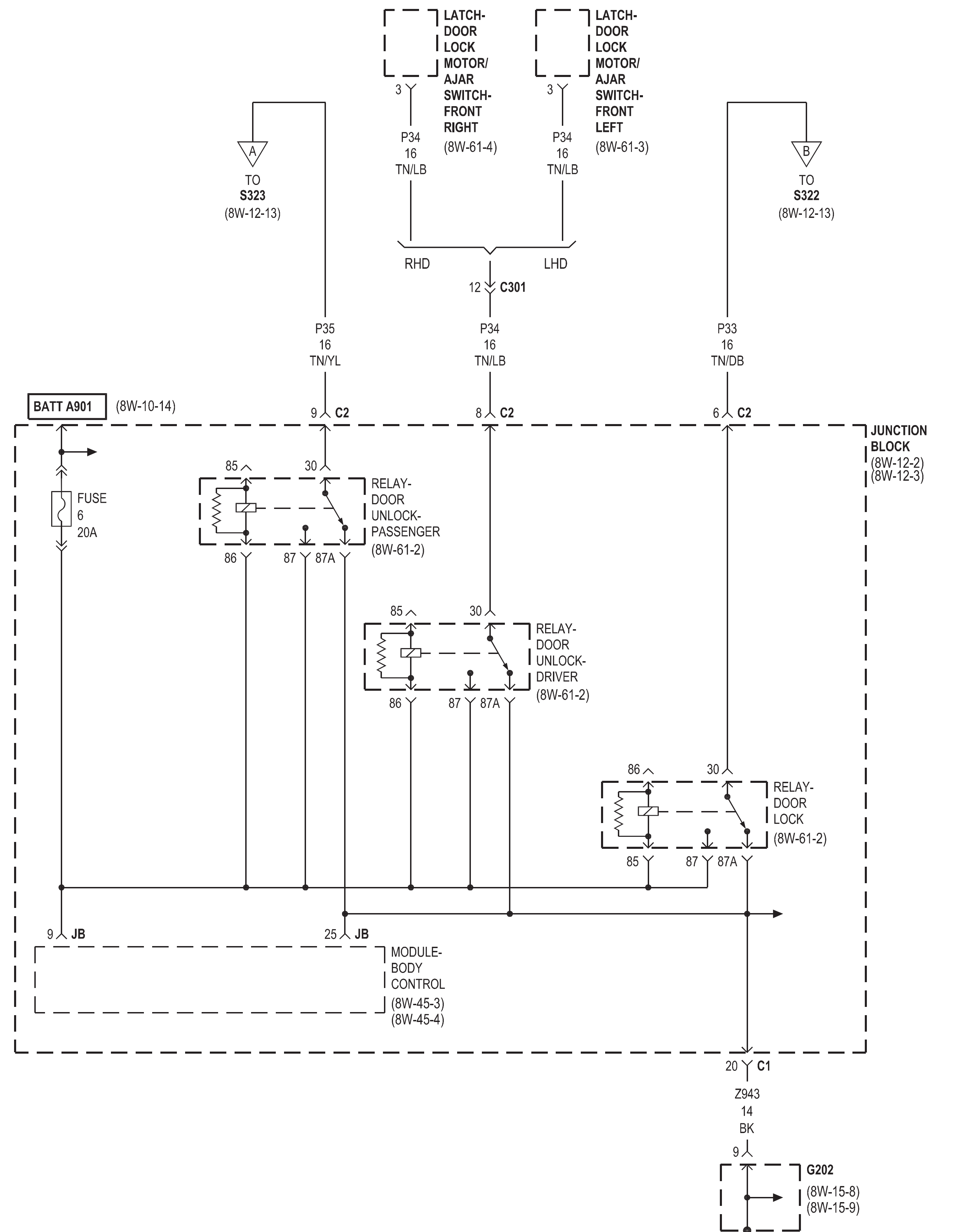

BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
15
50A
(8W-10-18)
15
A12
10
RD/BR
LHD
RHD
70
C100
A12
10
RD/BR
S124
(8W-10-18)
S219
(8W-10-18)
A12
10
RD/BR
RUN-ACC F981
(8W-10-16)
BATT A12
(8W-10-18)
10
C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
RHD
LHD
FUSE
1
15A
FUSE
31
20A
86
30
RELAY-HORN
(8W-41-2)
86
RELAY-POWER WINDOW
(8W-60-2)
85
85
87
87A
BASE
EXCEPT BASE
86
RELAY-POWER SUNROOF
(8W-64-2)
85
9
C1
35
7
C1
39
C3
X3
20
DG/VT
X2
18
DG/OR
LHD
RHD
A207
16
RD/LG
F307
16
LB/PK
2
C1
CLOCKSPRING
(8W-41-2)
LHD
RHD
3
C100
X2
18
DG/OR
1
C3
X3
20
DG/VT
1
POWER OUTLET-INSTRUMENT PANEL
(8W-41-3)
SWITCH-HORN
(8W-41-2)
1
HORN
(8W-41-2)
LHD
RHD


BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 15 50A (8W-10-18)
15
FUSE 13 40A (8W-10-17)
13
LHD
RHD
A12 10 RD/BR
70 C100
A12 10 RD/BR
S124 (8W-10-18)
S219 (8W-10-18)
A139 12 RD/YL
62 C100
1 C3
41 C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 2 10A
85
30
RELAY-LOW BEAM (8W-50-3)
86
87
87A
30
RELAY-POWER WINDOW (8W-60-2)
87 87A
30
86
RELAY-FOG LAMP-REAR (8W-51-6)
87A 87 85
FUSE 4 10A
FUSE 5 10A
34 C2
4 C3
5 C3
40 C2
L90 16 WT/OR
L44 18 WT/TN
L43 18 WT/DB
F30 14 PK/YL
10
SWITCH-POWER WINDOW-MASTER (8W-60-2)
J
K
M
TO C310 (8W-12-11)
TO C106 (LHD) C100 (RHD) (8W-12-11)
TO S194 (LHD) S225 (RHD) (8W-12-11)
LHD HIGHLINE/RHD

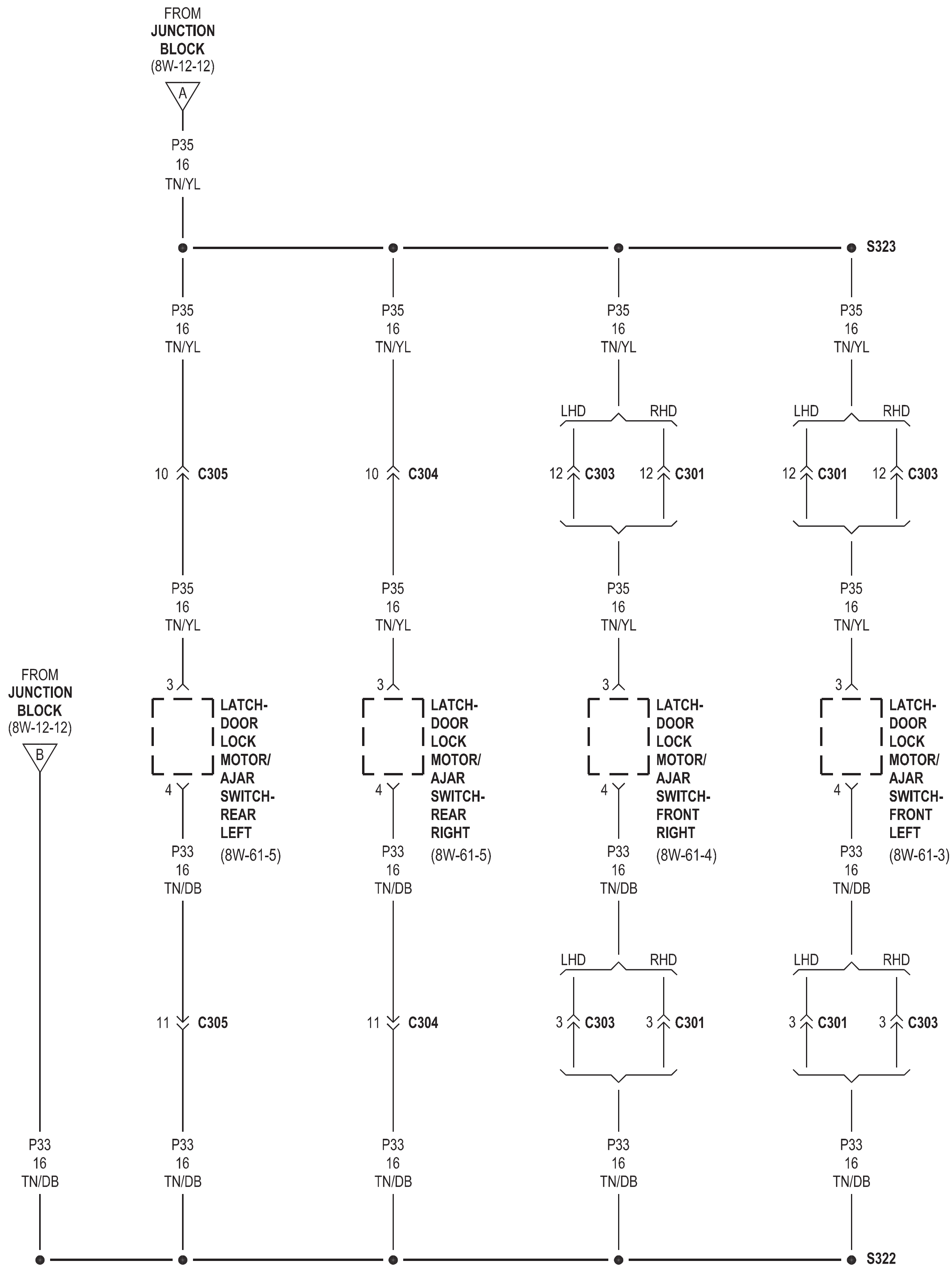


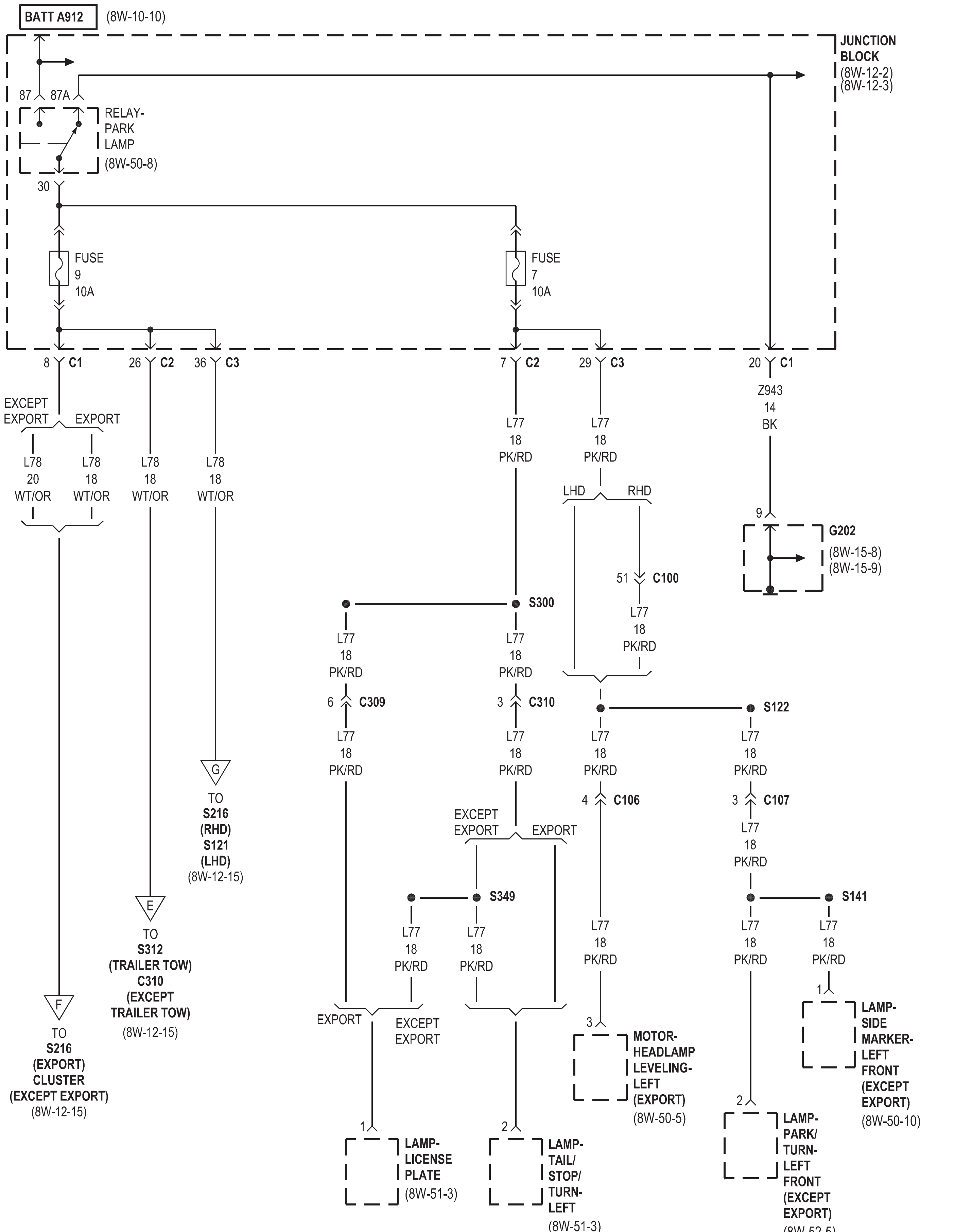

▲ EXCEPT EXPORT

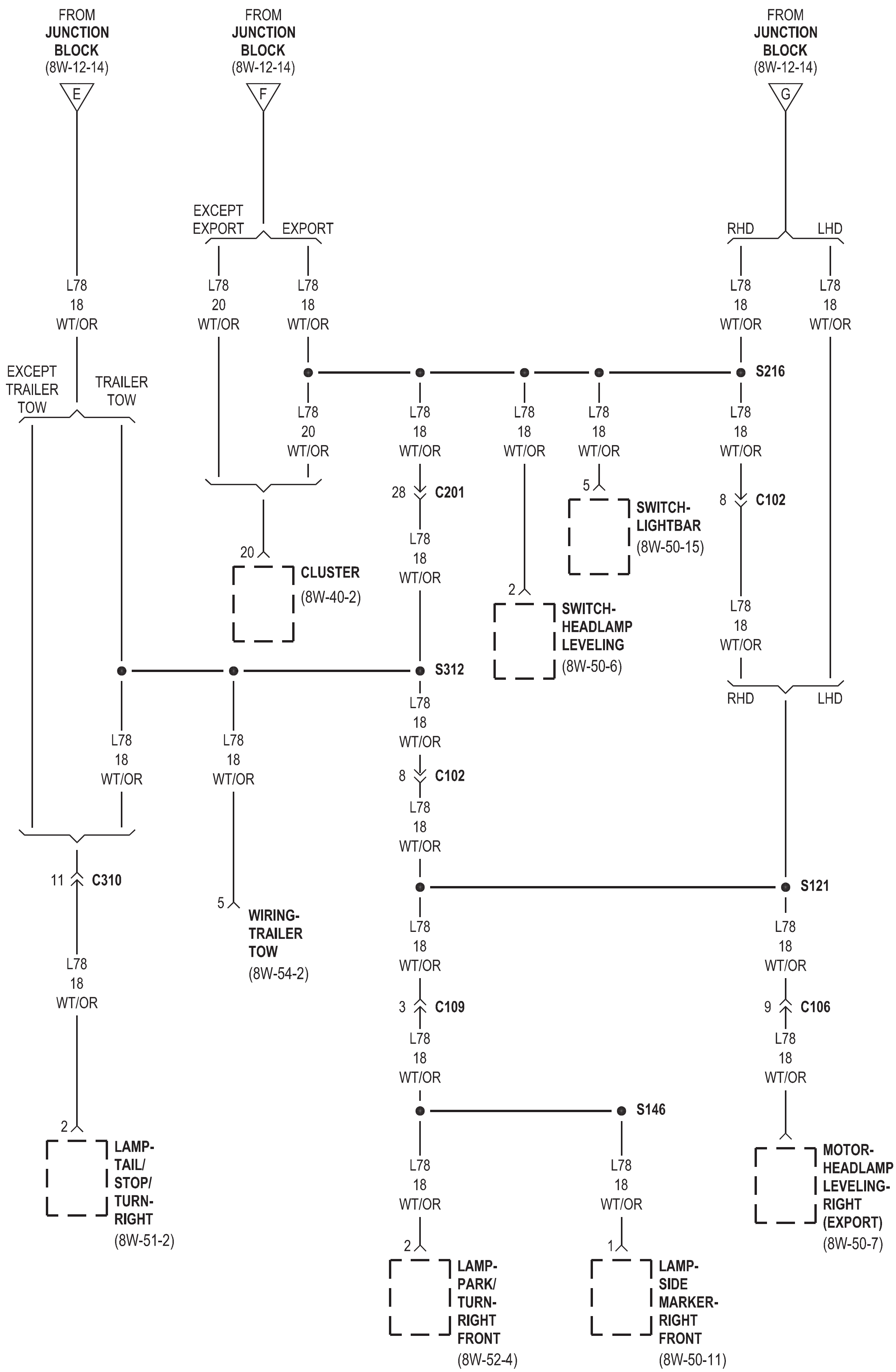
▲▲ EXPORT

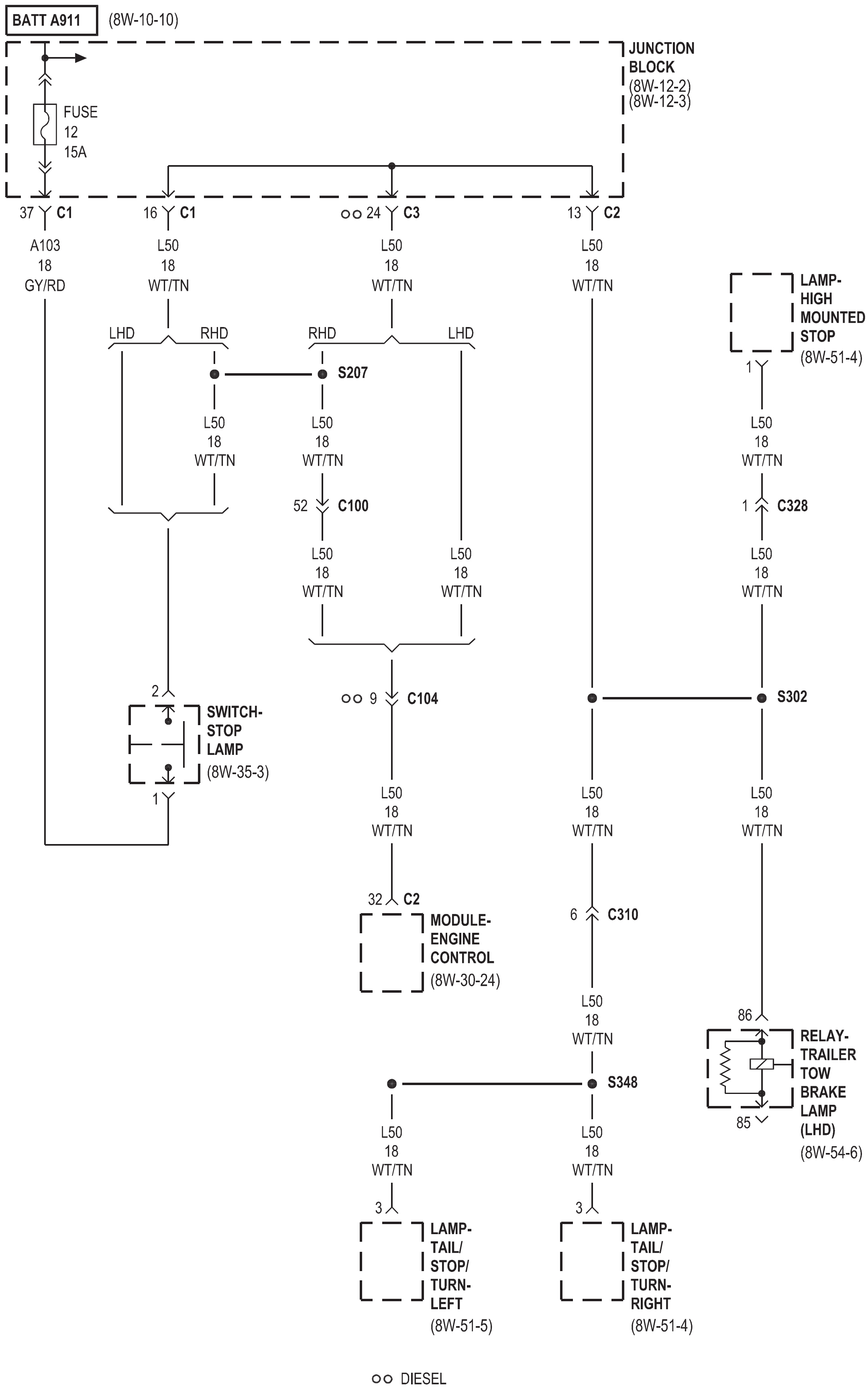

LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT RIGHT
(8W-61-4)
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT LEFT
(8W-61-3)
3
P34 16 TN/LB
3
P34 16 TN/LB
A
TO S323
(8W-12-13)
B
TO S322
(8W-12-13)
RHD
LHD
12 C301
P35 16 TN/YL
P34 16 TN/LB
P33 16 TN/DB
BATT A901
(8W-10-14)
9 C2
8 C2
6 C2
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 6 20A
85
30
RELAY-DOOR UNLOCK-PASSENGER
(8W-61-2)
86
87
87A
85
30
RELAY-DOOR UNLOCK-DRIVER
(8W-61-2)
86
87
87A
86
30
RELAY-DOOR LOCK
(8W-61-2)
85
87
87A
9 JB
25 JB
MODULE-BODY CONTROL
(8W-45-3)
(8W-45-4)
20 C1
Z943 14 BK
9
G202
(8W-15-8)
(8W-15-9)

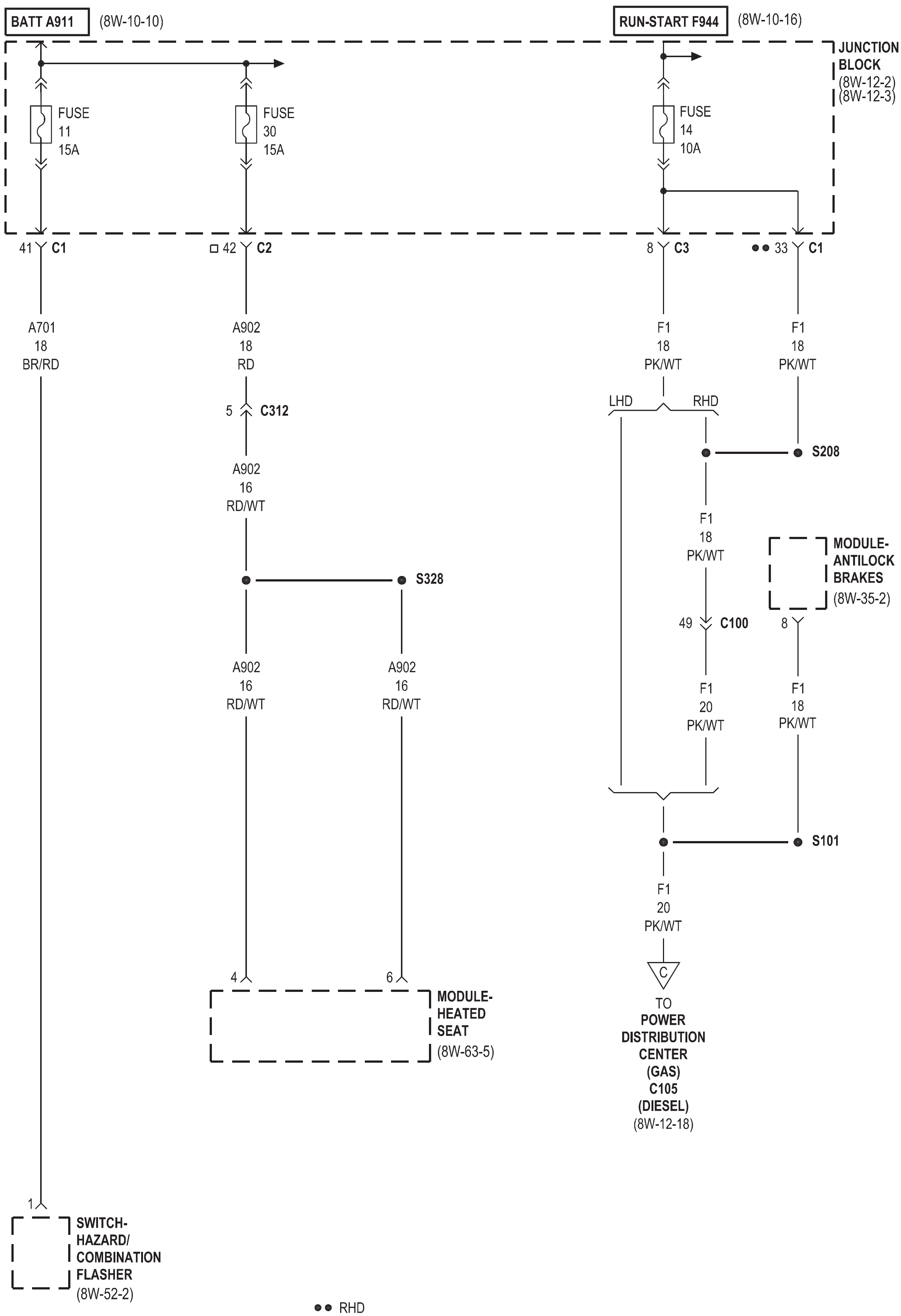
# EXCEPT BASE

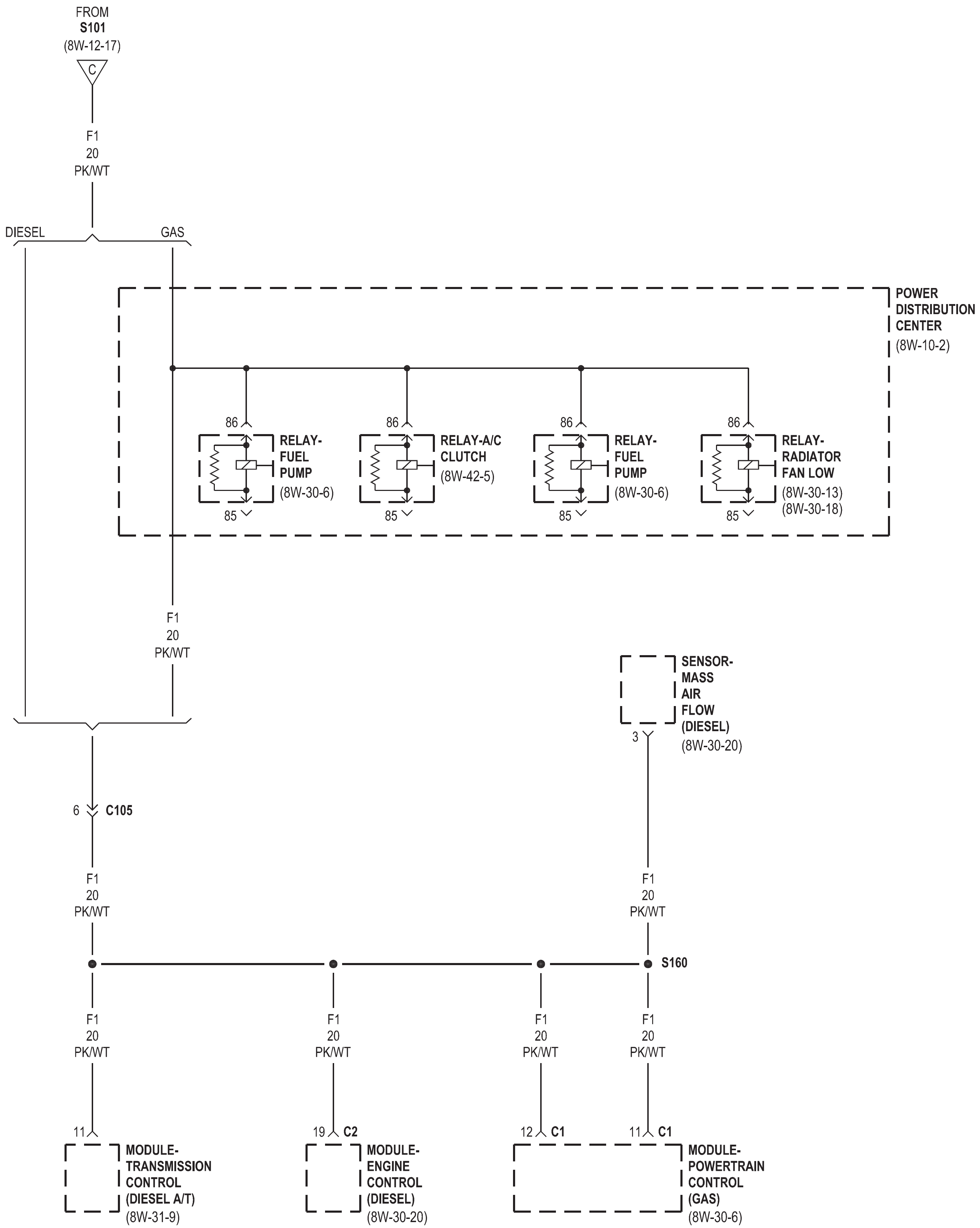

FROM JUNCTION BLOCK (8W-12-12)
A
P35 16 TN/YL
S323
P35 16 TN/YL
10 C305
10 C304
LHD RHD
12 C303
12 C301
12 C301
12 C303
3
4
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-REAR LEFT (8W-61-5)
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-REAR RIGHT (8W-61-5)
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT RIGHT (8W-61-4)
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT LEFT (8W-61-3)
FROM JUNCTION BLOCK (8W-12-12)
B
P33 16 TN/DB
11 C305
11 C304
3 C303
3 C301
3 C301
3 C303
S322

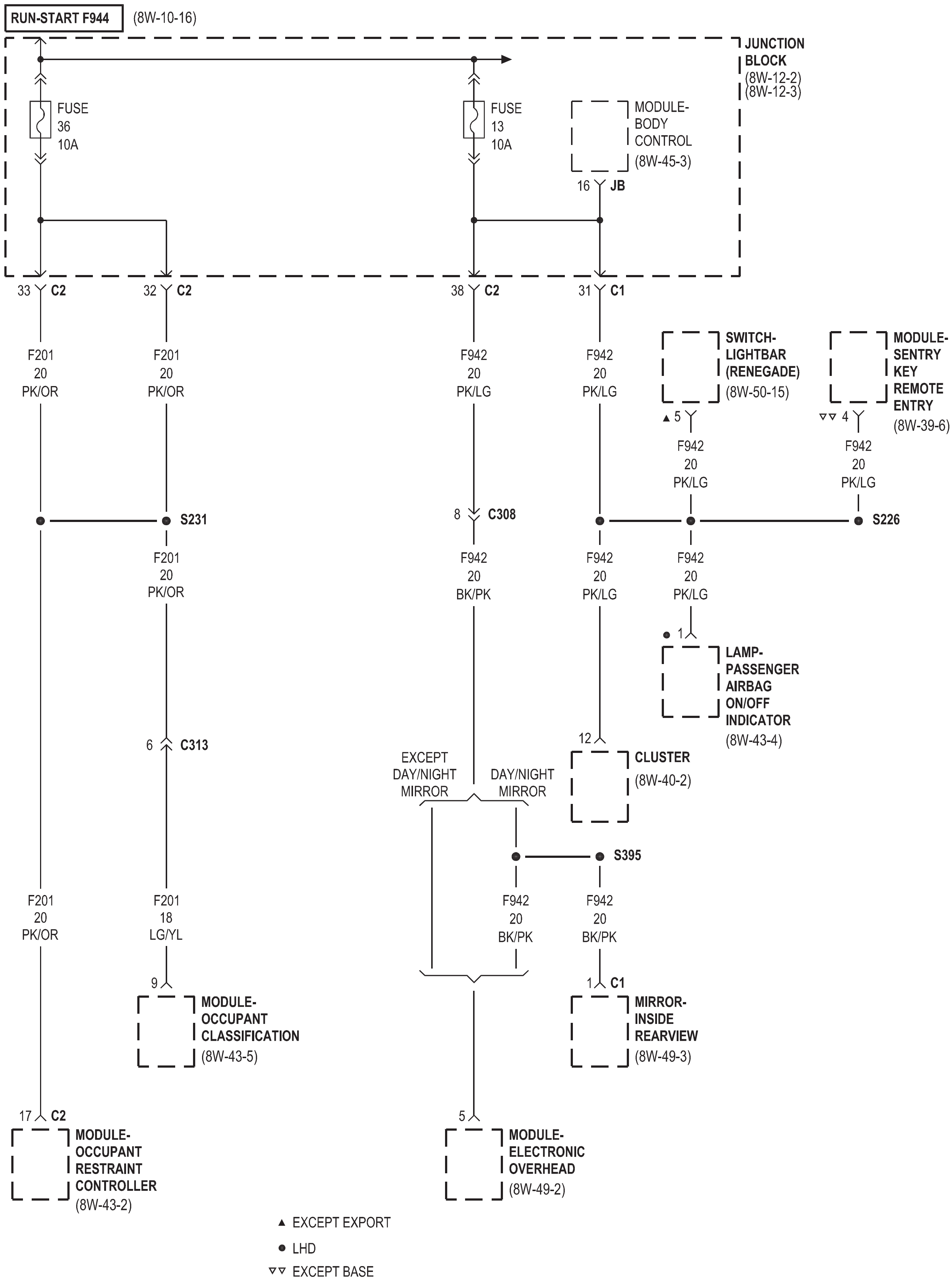

BATT A912
(8W-10-10)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
87
87A
RELAY-
PARK
LAMP
(8W-50-8)
30
FUSE
9
10A
FUSE
7
10A
8 C1
26 C2
36 C3
7 C2
29 C3
20 C1
EXCEPT
EXPORT
EXPORT
L78
20
WT/OR
L78
18
WT/OR
L78
18
WT/OR
L78
18
WT/OR
L77
18
PK/RD
L77
18
PK/RD
Z943
14
BK
LHD
RHD
9
G202
(8W-15-8)
(8W-15-9)
51 C100
L77
18
PK/RD
S300
L77
18
PK/RD
L77
18
PK/RD
6 C309
3 C310
L77
18
PK/RD
L77
18
PK/RD
S122
L77
18
PK/RD
L77
18
PK/RD
4 C106
3 C107
L77
18
PK/RD
G
TO
S216
(RHD)
S121
(LHD)
(8W-12-15)
EXCEPT
EXPORT
EXPORT
S349
S141
L77
18
PK/RD
L77
18
PK/RD
L77
18
PK/RD
L77
18
PK/RD
L77
18
PK/RD
E
TO
S312
(TRAILER TOW)
C310
(EXCEPT
TRAILER TOW)
(8W-12-15)
F
TO
S216
(EXPORT)
CLUSTER
(EXCEPT EXPORT)
(8W-12-15)
EXPORT
EXCEPT
EXPORT
1
LAMP-
LICENSE
PLATE
(8W-51-3)
2
LAMP-
TAIL/
STOP/
TURN-
LEFT
(8W-51-3)
3
MOTOR-
HEADLAMP
LEVELING-
LEFT
(EXPORT)
(8W-50-5)
2
LAMP-
PARK/
TURN-
LEFT
FRONT
(EXCEPT
EXPORT)
(8W-52-5)
1
LAMP-
SIDE
MARKER-
LEFT
FRONT
(EXCEPT
EXPORT)
(8W-50-10)

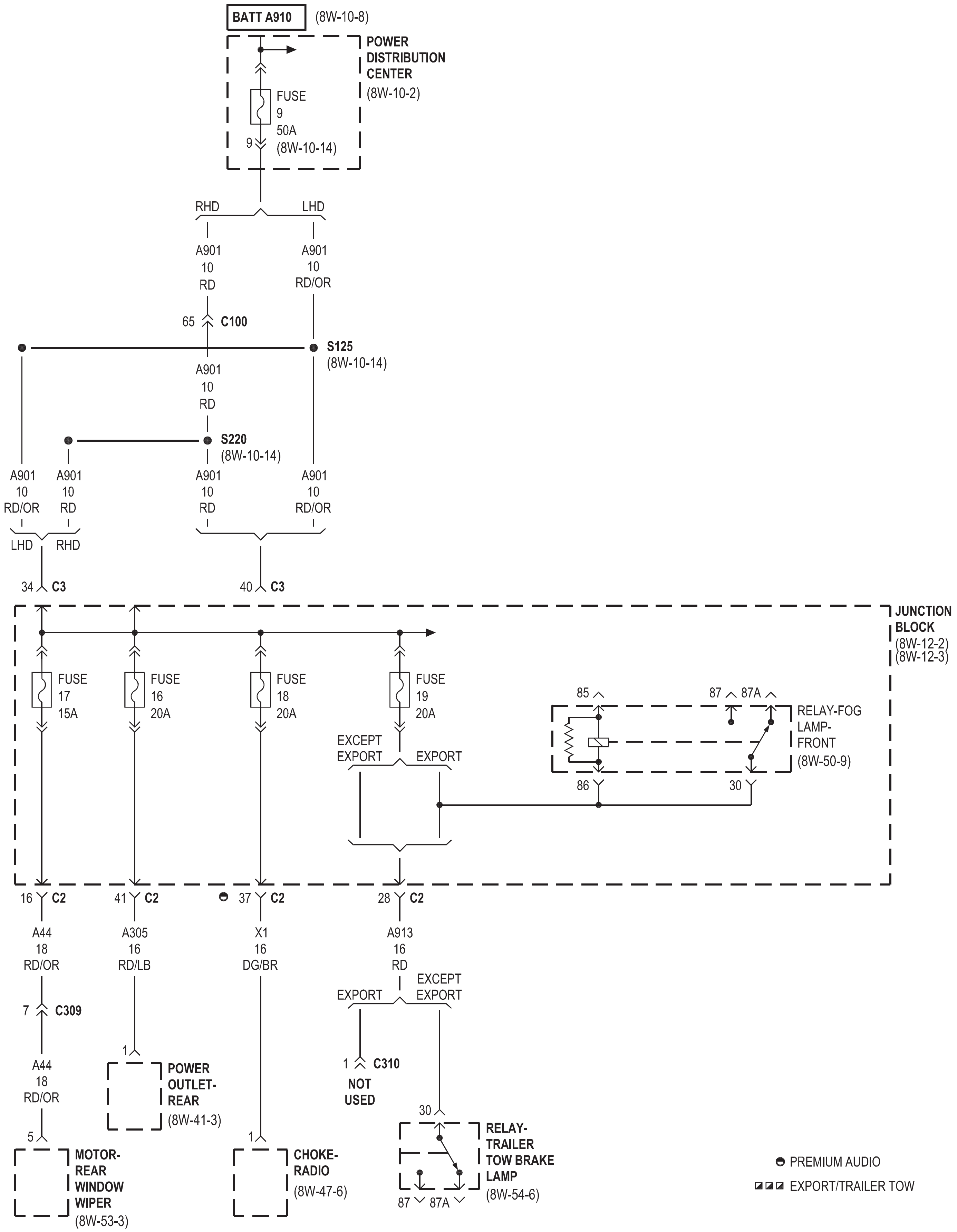

FROM
JUNCTION
BLOCK
(8W-12-14)
E
FROM
JUNCTION
BLOCK
(8W-12-14)
F
FROM
JUNCTION
BLOCK
(8W-12-14)
G
EXCEPT
EXPORT
EXPORT
RHD
LHD
L78
18
WT/OR
L78
20
WT/OR
S216
EXCEPT
TRAILER
TOW
TRAILER
TOW
28
C201
8
C102
5
SWITCH-
LIGHTBAR
(8W-50-15)
20
CLUSTER
(8W-40-2)
2
SWITCH-
HEADLAMP
LEVELING
(8W-50-6)
S312
11
C310
5
WIRING-
TRAILER
TOW
(8W-54-2)
S121
3
C109
9
C106
S146
2
LAMP-
TAIL/
STOP/
TURN-
RIGHT
(8W-51-2)
MOTOR-
HEADLAMP
LEVELING-
RIGHT
(EXPORT)
(8W-50-7)
LAMP-
PARK/
TURN-
RIGHT
FRONT
(8W-52-4)
1
LAMP-
SIDE
MARKER-
RIGHT
FRONT
(8W-50-11)

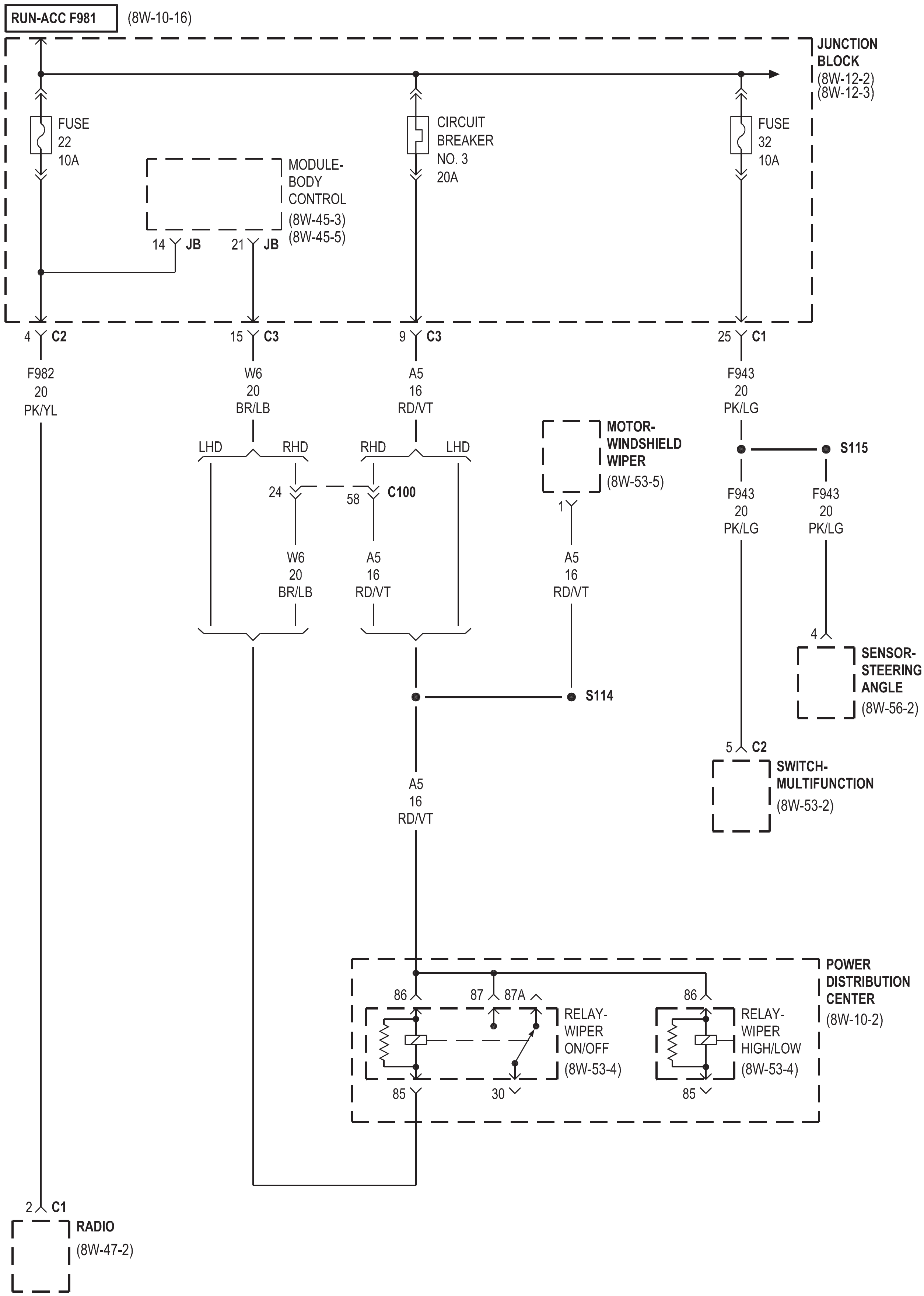

BATT A911
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 12 15A
37 C1
A103 18 GY/RD
16 C1
L50 18 WT/TN
24 C3
13 C2
LHD
RHD
S207
52 C100
9 C104
S302
SWITCH-STOP LAMP
(8W-35-3)
LAMP-HIGH MOUNTED STOP
(8W-51-4)
1 C328
32 C2
MODULE-ENGINE CONTROL
(8W-30-24)
6 C310
S348
86
85
RELAY-TRAILER TOW BRAKE LAMP (LHD)
(8W-54-6)
LAMP-TAIL/STOP/TURN-LEFT
(8W-51-5)
LAMP-TAIL/STOP/TURN-RIGHT
(8W-51-4)
DIESEL

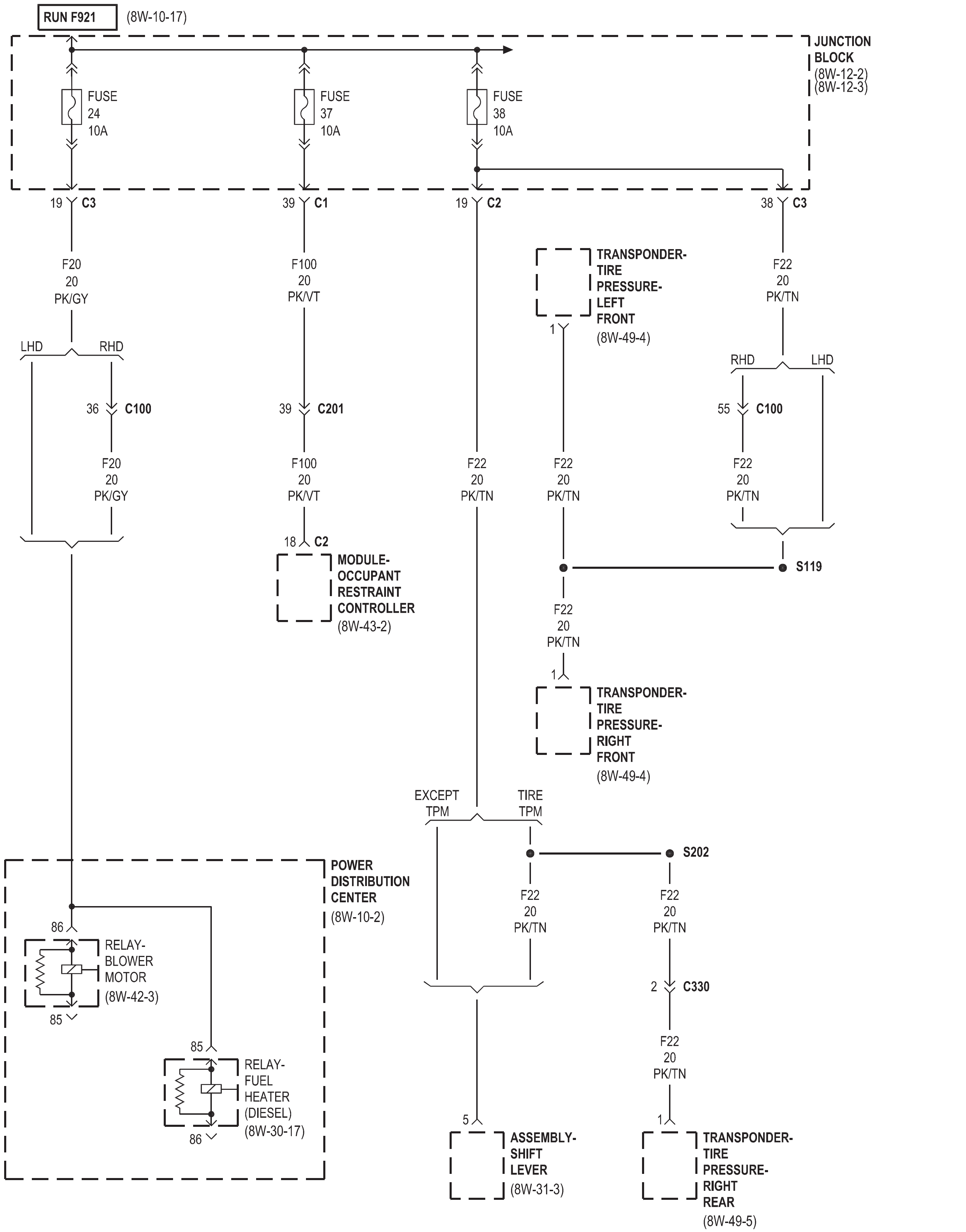

BATT A911
(8W-10-10)
RUN-START F944
(8W-10-16)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
11
15A
FUSE
30
15A
FUSE
14
10A
41 C1
42 C2
8 C3
33 C1
A701
18
BR/RD
A902
18
RD
F1
18
PK/WT
F1
18
PK/WT
LHD
RHD
5 C312
A902
16
RD/WT
S208
F1
18
PK/WT
MODULE-
ANTILOCK
BRAKES
(8W-35-2)
S328
49 C100
8
A902
16
RD/WT
A902
16
RD/WT
F1
20
PK/WT
F1
18
PK/WT
S101
F1
20
PK/WT
4
6
MODULE-
HEATED
SEAT
(8W-63-5)
C
TO
POWER
DISTRIBUTION
CENTER
(GAS)
C105
(DIESEL)
(8W-12-18)
1
SWITCH-
HAZARD/
COMBINATION
FLASHER
(8W-52-2)
●● RHD
□ HEATED SEATS

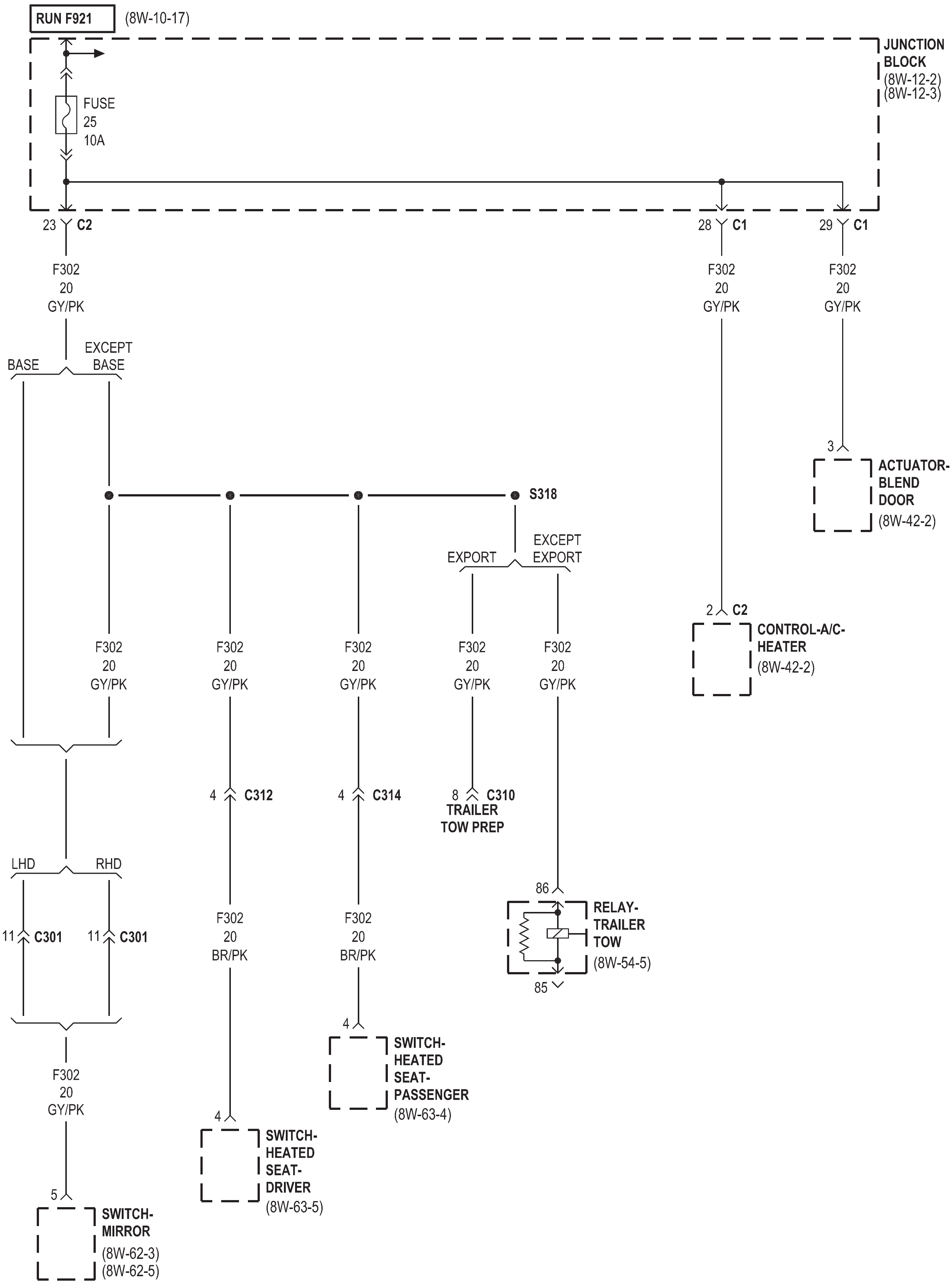

FROM
S101
(8W-12-17)
C
F1
20
PK/WT
DIESEL
GAS
POWER
DISTRIBUTION
CENTER
(8W-10-2)
86
85
RELAY-
FUEL
PUMP
(8W-30-6)
RELAY-A/C
CLUTCH
(8W-42-5)
RELAY-
FUEL
PUMP
(8W-30-6)
RELAY-
RADIATOR
FAN LOW
(8W-30-13)
(8W-30-18)
SENSOR-
MASS
AIR
FLOW
(DIESEL)
(8W-30-20)
3
6
C105
S160
11
19
C2
12
C1
MODULE-
TRANSMISSION
CONTROL
(DIESEL A/T)
(8W-31-9)
MODULE-
ENGINE
CONTROL
(DIESEL)
(8W-30-20)
MODULE-
POWERTRAIN
CONTROL
(GAS)
(8W-30-6)

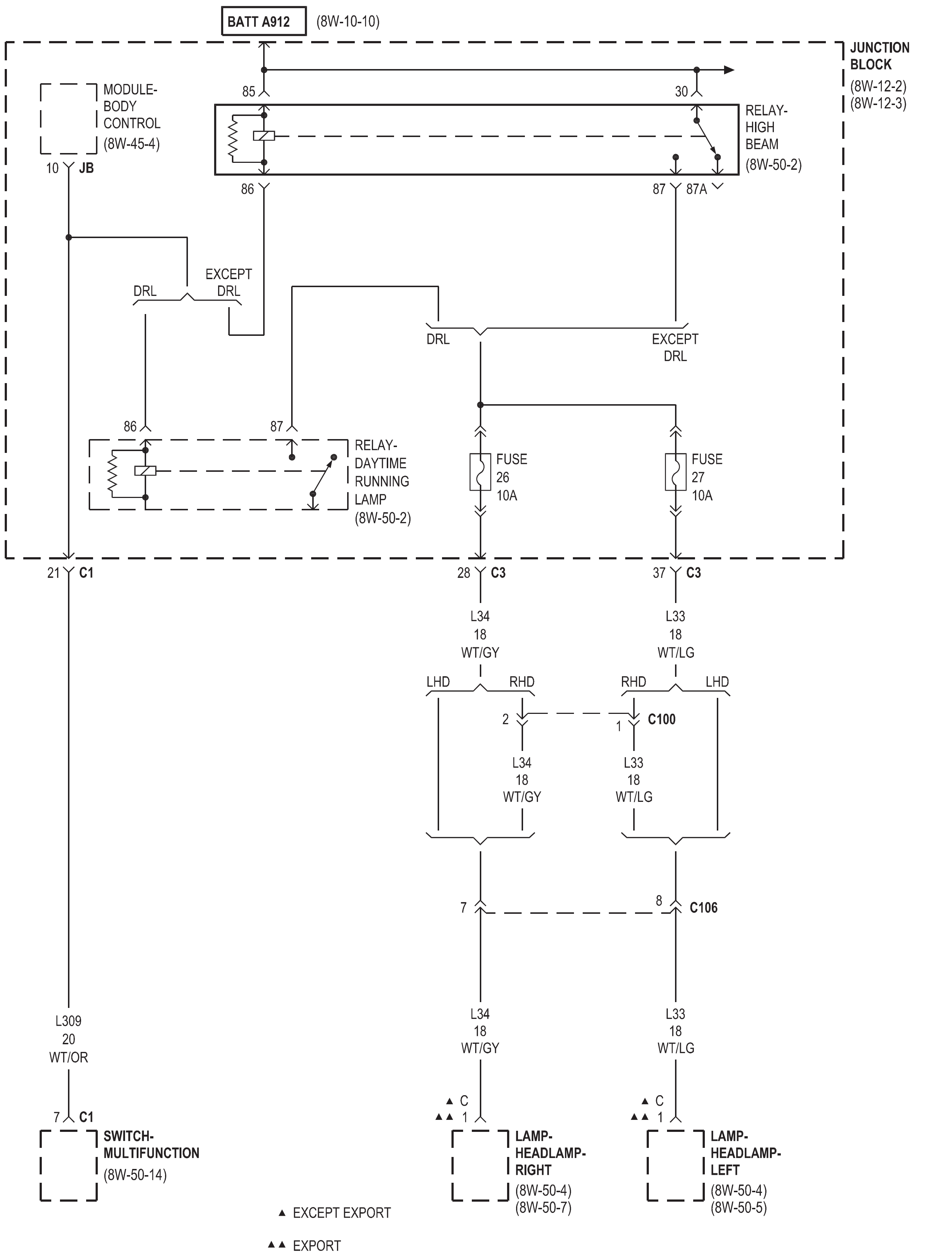

RUN-START F944
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 36 10A
FUSE 13 10A
MODULE-BODY CONTROL
(8W-45-3)
16 JB
33 C2
32 C2
38 C2
31 C1
F201 20 PK/OR
F942 20 PK/LG
SWITCH-LIGHTBAR (RENEGADE)
(8W-50-15)
MODULE-SENTRY KEY REMOTE ENTRY
(8W-39-6)
5
4
S231
8 C308
S226
F942 20 BK/PK
1
LAMP-PASSENGER AIRBAG ON/OFF INDICATOR
(8W-43-4)
6 C313
12
CLUSTER
(8W-40-2)
EXCEPT DAY/NIGHT MIRROR
DAY/NIGHT MIRROR
S395
F201 18 LG/YL
9
MODULE-OCCUPANT CLASSIFICATION
(8W-43-5)
1 C1
MIRROR-INSIDE REARVIEW
(8W-49-3)
17 C2
MODULE-OCCUPANT RESTRAINT CONTROLLER
(8W-43-2)
5
MODULE-ELECTRONIC OVERHEAD
(8W-49-2)
▲ EXCEPT EXPORT
● LHD
▽▽ EXCEPT BASE

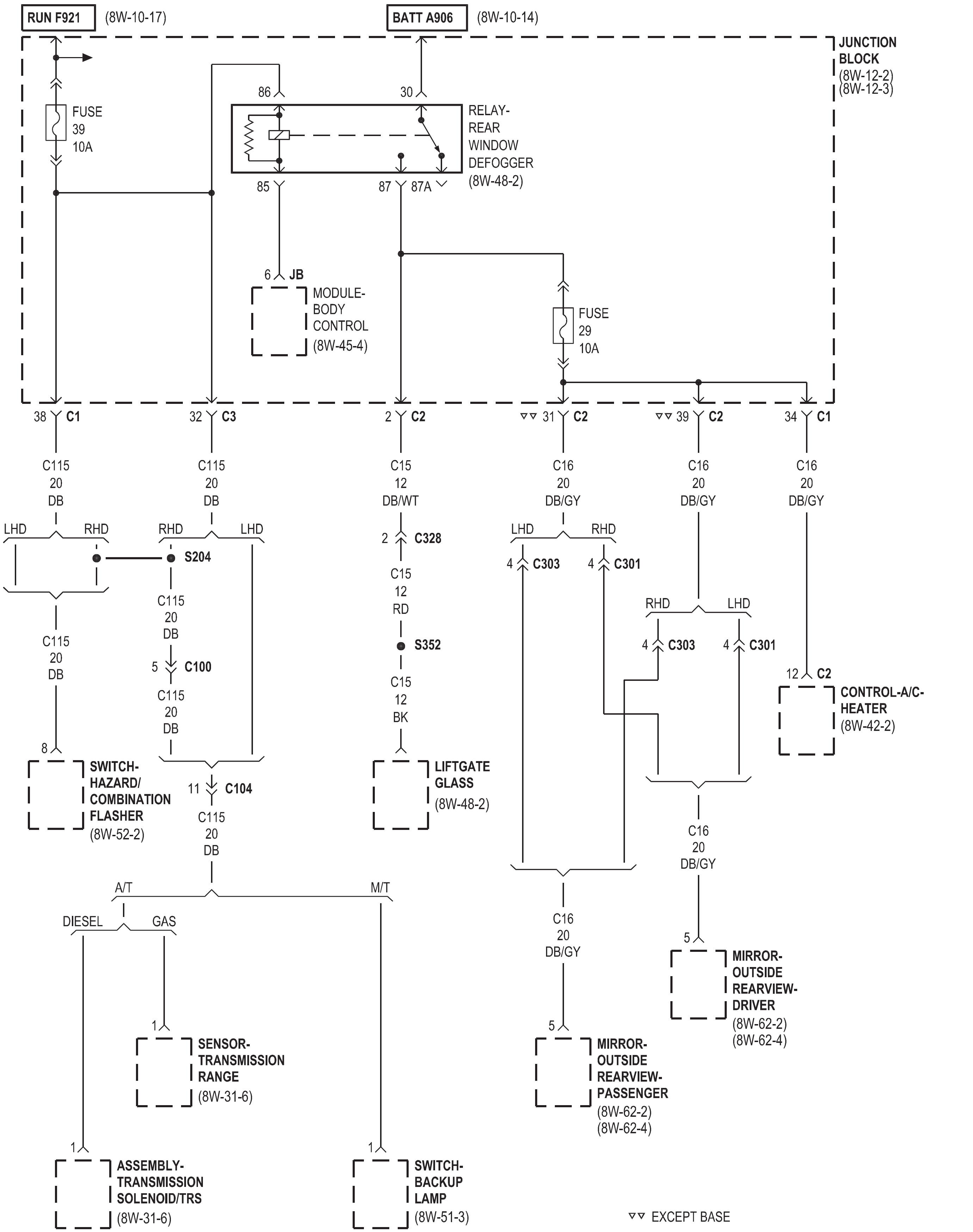

BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 9 50A (8W-10-14)
9
RHD
LHD
A901 10 RD
A901 10 RD/OR
65 C100
S125
(8W-10-14)
A901 10 RD
S220
(8W-10-14)
A901 10 RD/OR
A901 10 RD
A901 10 RD
A901 10 RD/OR
LHD
RHD
34 C3
40 C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 17 15A
FUSE 16 20A
FUSE 18 20A
FUSE 19 20A
EXCEPT EXPORT
EXPORT
85
87
87A
RELAY-FOG LAMP-FRONT
(8W-50-9)
86
30
16 C2
41 C2
37 C2
28 C2
A44 18 RD/OR
A305 16 RD/LB
X1 16 DG/BR
A913 16 RD
EXPORT
EXCEPT EXPORT
7 C309
A44 18 RD/OR
1
POWER OUTLET-REAR
(8W-41-3)
1 C310
NOT USED
30
RELAY-TRAILER TOW BRAKE LAMP
(8W-54-6)
87
87A
5
MOTOR-REAR WINDOW WIPER
(8W-53-3)
1
CHOKE-RADIO
(8W-47-6)
PREMIUM AUDIO
EXPORT/TRAILER TOW

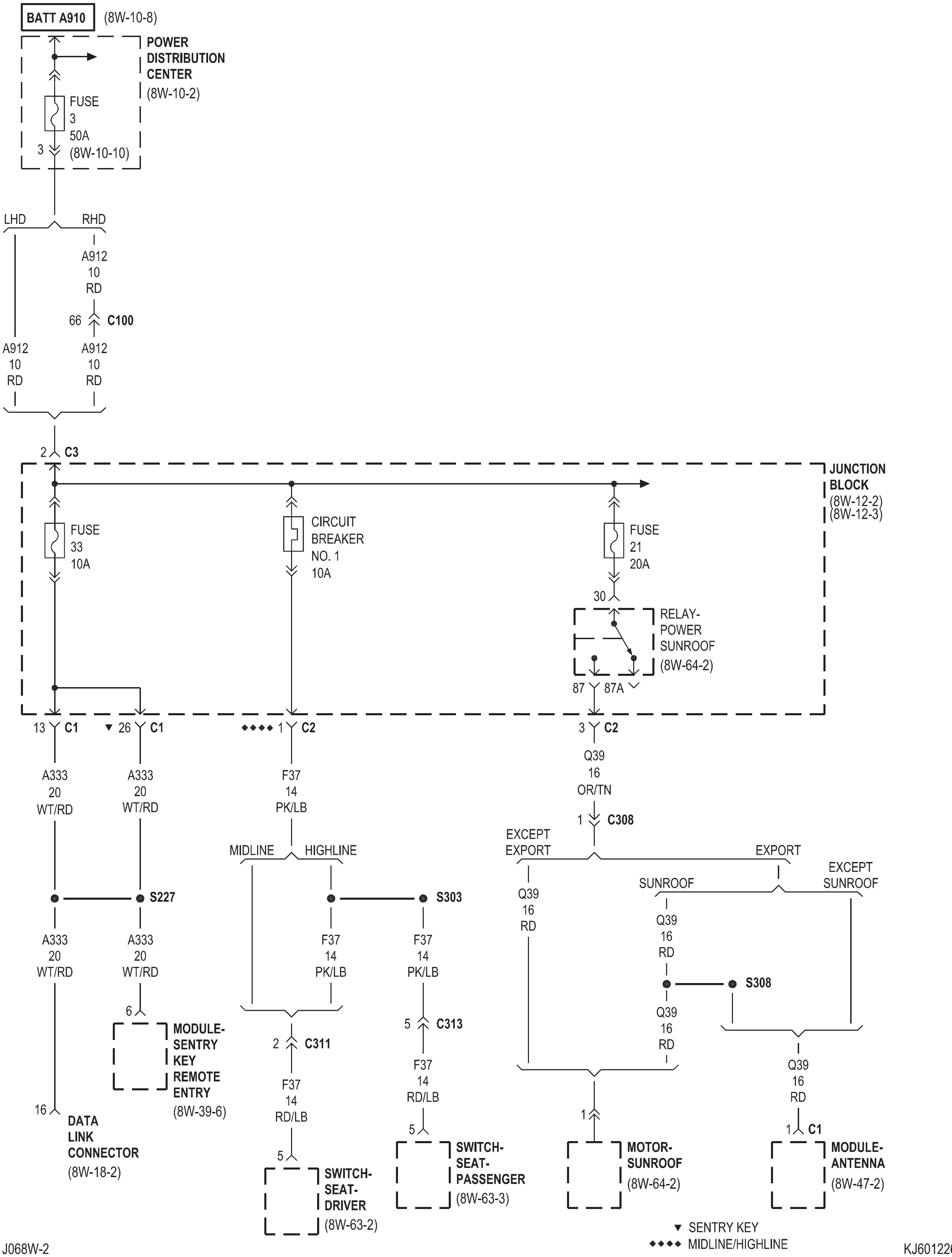

RUN-ACC F981
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 22 10A
CIRCUIT BREAKER NO. 3 20A
FUSE 32 10A
MODULE-BODY CONTROL
(8W-45-3)
(8W-45-5)
14 JB
21 JB
4 C2
15 C3
9 C3
25 C1
F982 20 PK/YL
W6 20 BR/LB
A5 16 RD/VT
F943 20 PK/LG
LHD
RHD
RHD
LHD
24
58
C100
MOTOR-WINDSHIELD WIPER
(8W-53-5)
1
S115
F943 20 PK/LG
F943 20 PK/LG
W6 20 BR/LB
A5 16 RD/VT
A5 16 RD/VT
4
SENSOR-STEERING ANGLE
(8W-56-2)
S114
5 C2
SWITCH-MULTIFUNCTION
(8W-53-2)
A5 16 RD/VT
POWER DISTRIBUTION CENTER
(8W-10-2)
86
87
87A
86
RELAY-WIPER ON/OFF
(8W-53-4)
RELAY-WIPER HIGH/LOW
(8W-53-4)
85
30
85
2 C1
RADIO
(8W-47-2)

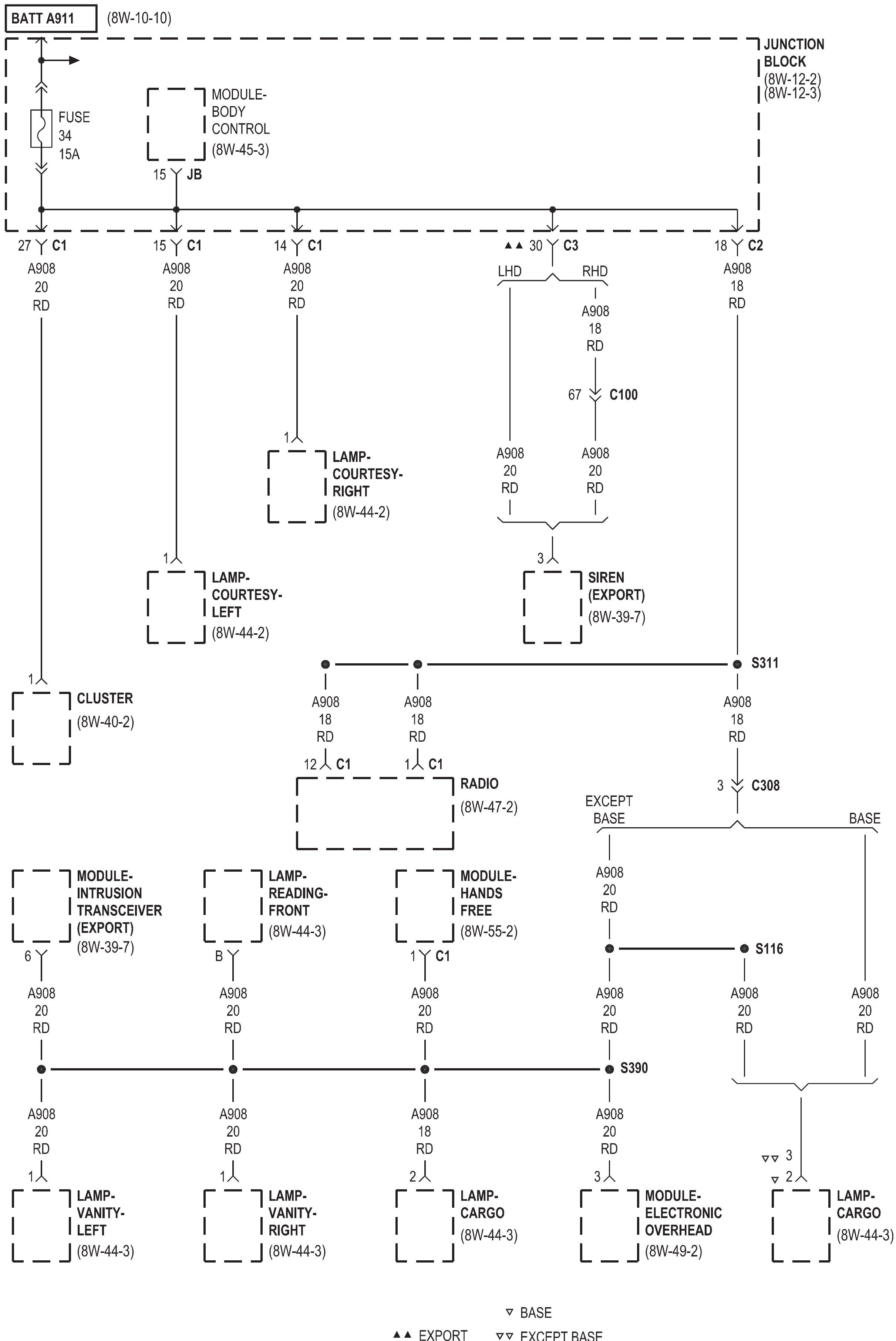

RUN F921
(8W-10-17)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 24 10A
FUSE 37 10A
FUSE 38 10A
19 C3
39 C1
19 C2
38 C3
F20 20 PK/GY
F100 20 PK/VT
F22 20 PK/TN
LHD
RHD
36 C100
39 C201
55 C100
18 C2
MODULE-OCCUPANT RESTRAINT CONTROLLER
(8W-43-2)
TRANSPONDER-TIRE PRESSURE-LEFT FRONT
(8W-49-4)
1
S119
TRANSPONDER-TIRE PRESSURE-RIGHT FRONT
(8W-49-4)
EXCEPT TPM
TIRE TPM
S202
2 C330
POWER DISTRIBUTION CENTER
(8W-10-2)
86
85
RELAY-BLOWER MOTOR
(8W-42-3)
RELAY-FUEL HEATER (DIESEL)
(8W-30-17)
5
ASSEMBLY-SHIFT LEVER
(8W-31-3)
TRANSPONDER-TIRE PRESSURE-RIGHT REAR
(8W-49-5)

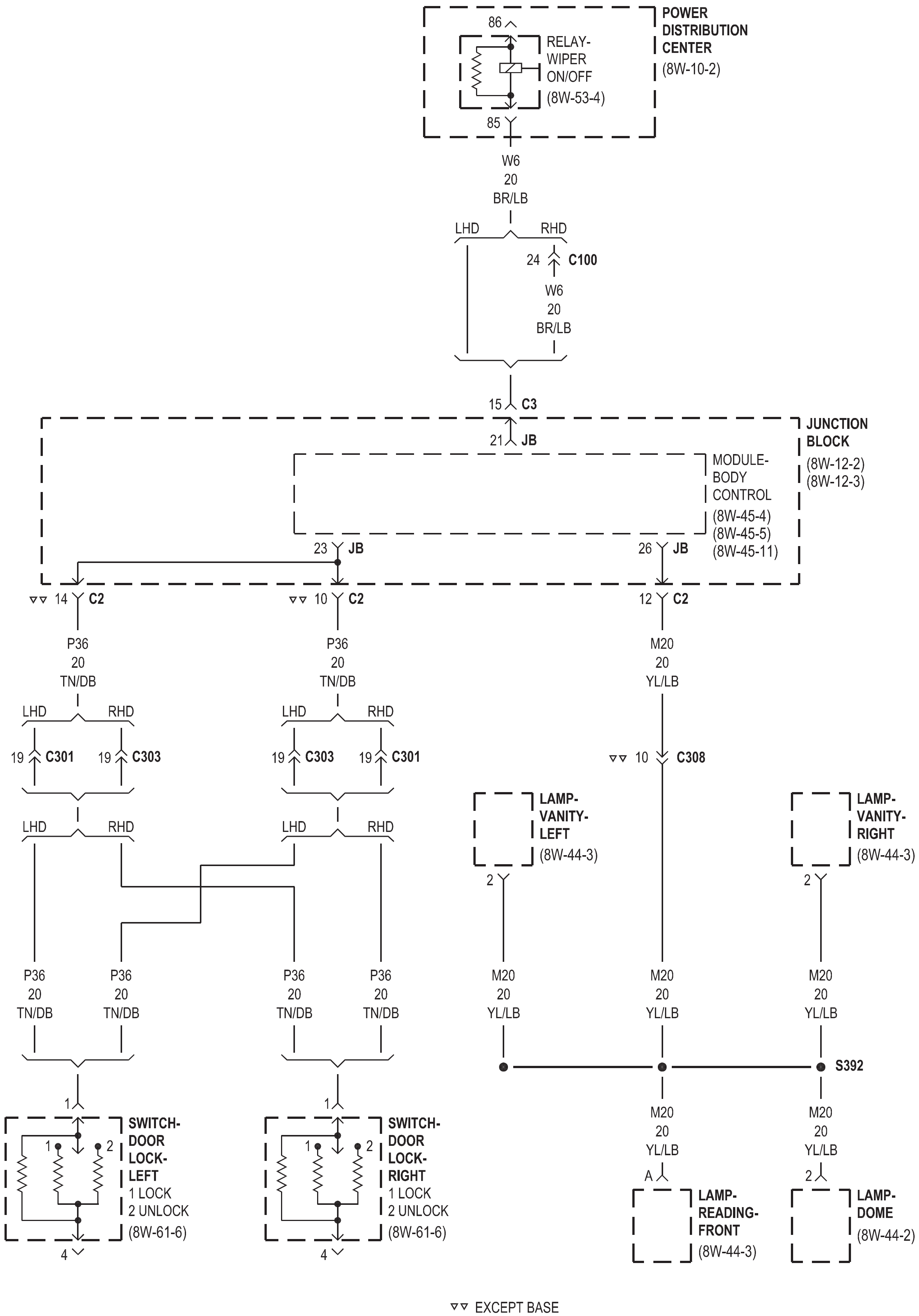

RUN F921
(8W-10-17)
FUSE
25
10A
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
23 C2
28 C1
29 C1
F302
20
GY/PK
BASE
EXCEPT
BASE
3
ACTUATOR-
BLEND
DOOR
(8W-42-2)
S318
EXPORT
EXCEPT
EXPORT
2 C2
CONTROL-A/C-
HEATER
(8W-42-2)
4 C312
4 C314
8 C310
TRAILER
TOW PREP
LHD
RHD
11 C301
11 C301
F302
20
BR/PK
86
RELAY-
TRAILER
TOW
(8W-54-5)
85
4
SWITCH-
HEATED
SEAT-
PASSENGER
(8W-63-4)
SWITCH-
HEATED
SEAT-
DRIVER
(8W-63-5)
5
SWITCH-
MIRROR
(8W-62-3)
(8W-62-5)


BATT A912
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
MODULE-BODY CONTROL
(8W-45-4)
10 JB
85
30
RELAY-HIGH BEAM
(8W-50-2)
86
87
87A
DRL
EXCEPT DRL
DRL
EXCEPT DRL
86
87
RELAY-DAYTIME RUNNING LAMP
(8W-50-2)
FUSE 26 10A
FUSE 27 10A
21 C1
28 C3
37 C3
L34 18 WT/GY
L33 18 WT/LG
LHD
RHD
RHD
LHD
2
1 C100
L34 18 WT/GY
L33 18 WT/LG
7
8 C106
L309 20 WT/OR
L34 18 WT/GY
L33 18 WT/LG
▲ C
▲▲ 1
▲ C
▲▲ 1
7 C1
SWITCH-MULTIFUNCTION
(8W-50-14)
LAMP-HEADLAMP-RIGHT
(8W-50-4)
(8W-50-7)
LAMP-HEADLAMP-LEFT
(8W-50-4)
(8W-50-5)
▲ EXCEPT EXPORT
▲▲ EXPORT

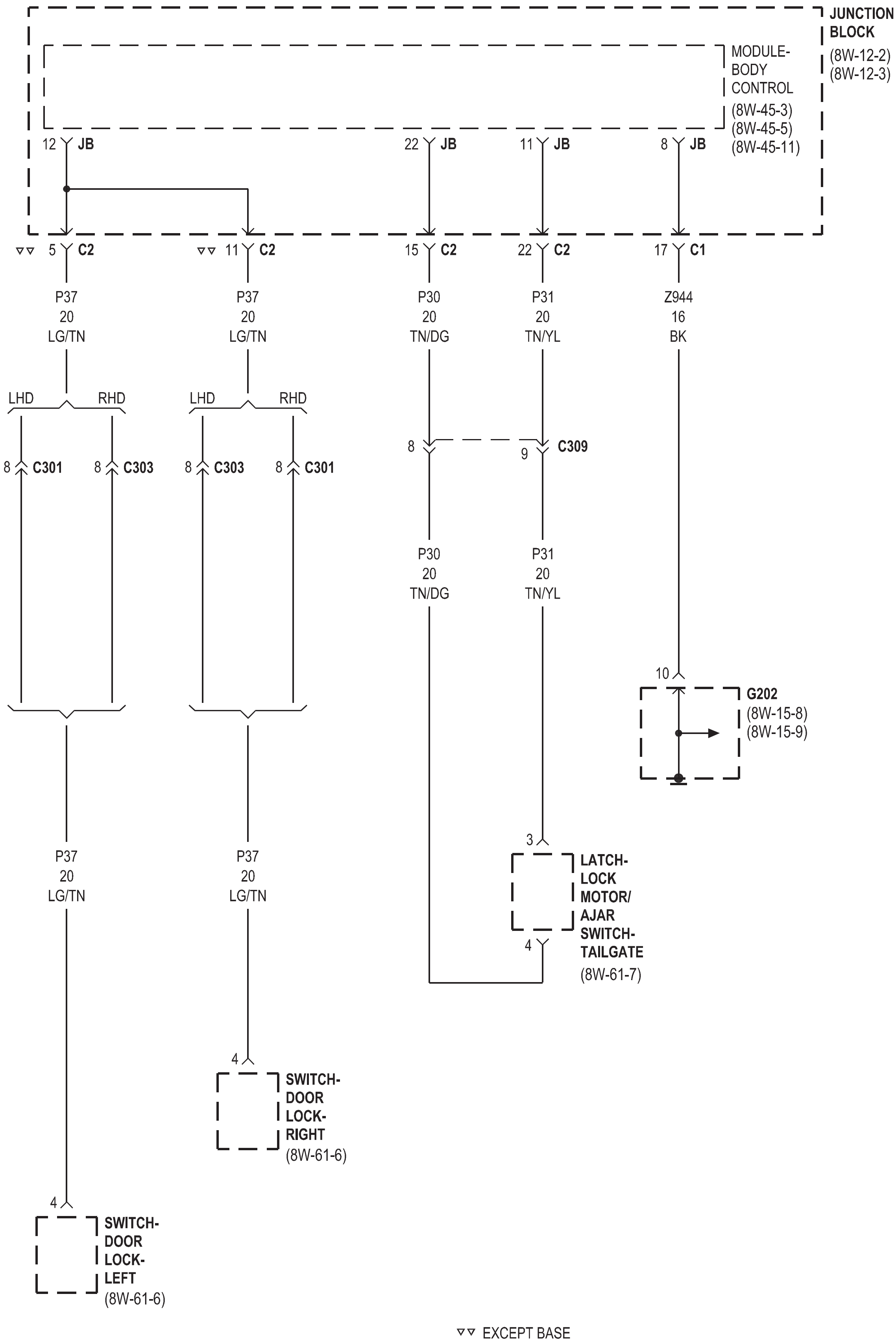

RUN F921
(8W-10-17)
BATT A906
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 39 10A
86
30
RELAY-REAR WINDOW DEFOGGER
(8W-48-2)
85
87
87A
6 JB
MODULE-BODY CONTROL
(8W-45-4)
FUSE 29 10A
38 C1
32 C3
2 C2
31 C2
39 C2
34 C1
C115 20 DB
C115 20 DB
C15 12 DB/WT
C16 20 DB/GY
C16 20 DB/GY
C16 20 DB/GY
LHD
RHD
RHD
LHD
S204
2 C328
C15 12 RD
S352
C15 12 BK
LHD
RHD
4 C303
4 C301
RHD
LHD
4 C303
4 C301
12 C2
CONTROL-A/C-HEATER
(8W-42-2)
C115 20 DB
C115 20 DB
5 C100
C115 20 DB
8
SWITCH-HAZARD/COMBINATION FLASHER
(8W-52-2)
11 C104
C115 20 DB
LIFTGATE GLASS
(8W-48-2)
C16 20 DB/GY
A/T
M/T
DIESEL
GAS
C16 20 DB/GY
5
MIRROR-OUTSIDE REARVIEW-DRIVER
(8W-62-2)
(8W-62-4)
1
SENSOR-TRANSMISSION RANGE
(8W-31-6)
5
MIRROR-OUTSIDE REARVIEW-PASSENGER
(8W-62-2)
(8W-62-4)
1
ASSEMBLY-TRANSMISSION SOLENOID/TRS
(8W-31-6)
1
SWITCH-BACKUP LAMP
(8W-51-3)
▽▽ EXCEPT BASE

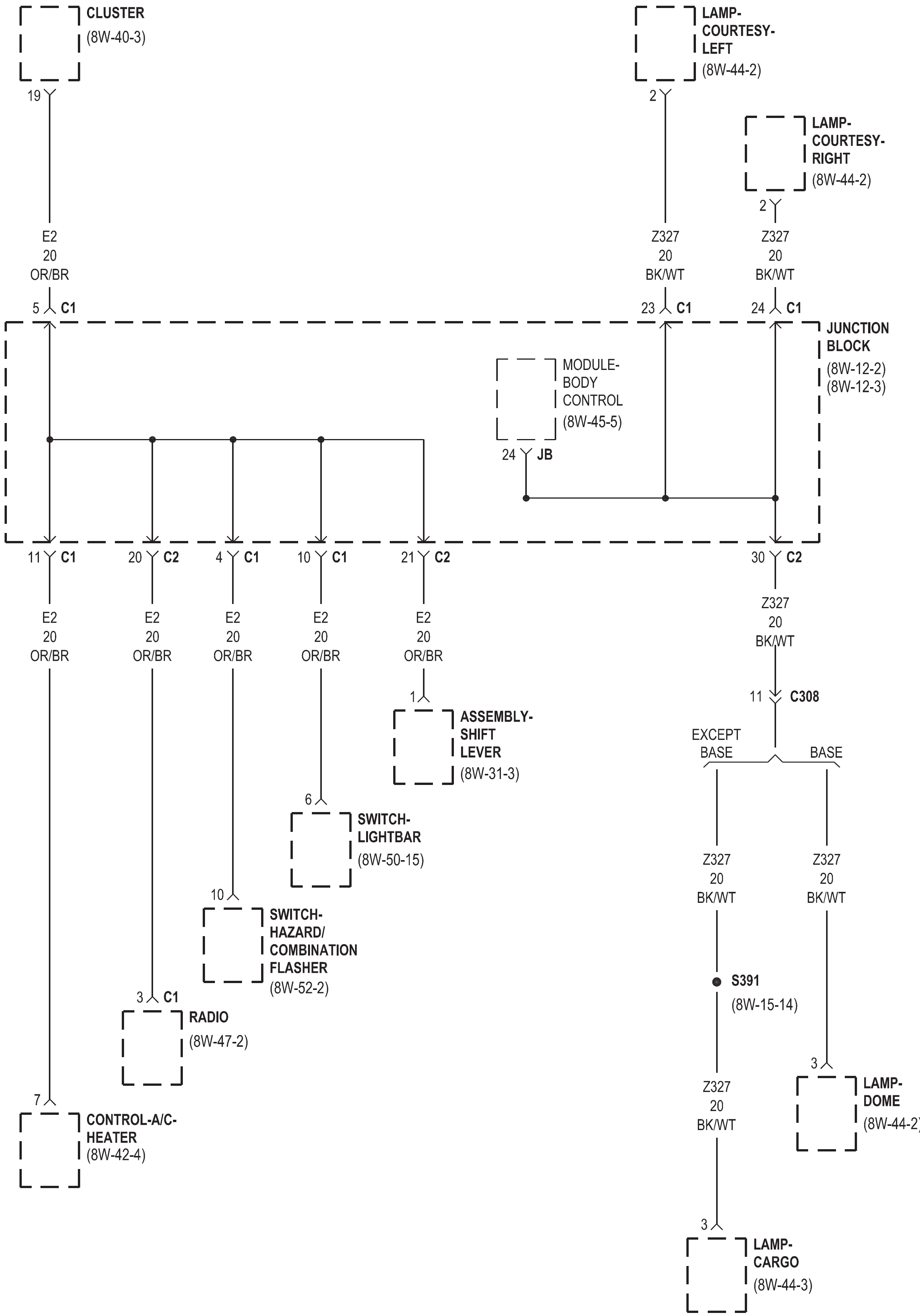

BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
3
50A
(8W-10-10)
3
LHD
RHD
A912
10
RD
66
C100
A912
10
RD
2
C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
33
10A
CIRCUIT BREAKER NO. 1
10A
FUSE
21
20A
30
RELAY-POWER SUNROOF
(8W-64-2)
87
87A
13
C1
26
C1
1
C2
3
C2
A333
20
WT/RD
F37
14
PK/LB
Q39
16
OR/TN
1
C308
MIDLINE
HIGHLINE
EXCEPT EXPORT
EXPORT
SUNROOF
EXCEPT SUNROOF
S227
S303
Q39
16
RD
S308
6
MODULE-SENTRY KEY REMOTE ENTRY
(8W-39-6)
2
C311
5
C313
F37
14
RD/LB
16
DATA LINK CONNECTOR
(8W-18-2)
5
SWITCH-SEAT-DRIVER
(8W-63-2)
SWITCH-SEAT-PASSENGER
(8W-63-3)
1
MOTOR-SUNROOF
(8W-64-2)
1
C1
MODULE-ANTENNA
(8W-47-2)
▼ SENTRY KEY
◆◆◆◆ MIDLINE/HIGHLINE


BATT A911
(8W-10-10)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
34
15A
MODULE-
BODY
CONTROL
(8W-45-3)
15 JB
27 C1
15 C1
14 C1
30 C3
18 C2
A908
20
RD
LHD
RHD
A908
18
RD
67 C100
LAMP-
COURTESY-
RIGHT
(8W-44-2)
LAMP-
COURTESY-
LEFT
(8W-44-2)
SIREN
(EXPORT)
(8W-39-7)
S311
CLUSTER
(8W-40-2)
12 C1
1 C1
RADIO
(8W-47-2)
3 C308
EXCEPT
BASE
BASE
MODULE-
INTRUSION
TRANSCEIVER
(EXPORT)
(8W-39-7)
LAMP-
READING-
FRONT
(8W-44-3)
MODULE-
HANDS
FREE
(8W-55-2)
S116
S390
LAMP-
VANITY-
LEFT
(8W-44-3)
LAMP-
VANITY-
RIGHT
(8W-44-3)
LAMP-
CARGO
(8W-44-3)
MODULE-
ELECTRONIC
OVERHEAD
(8W-49-2)
LAMP-
CARGO
(8W-44-3)
▽ BASE
▲▲ EXPORT
▽▽ EXCEPT BASE

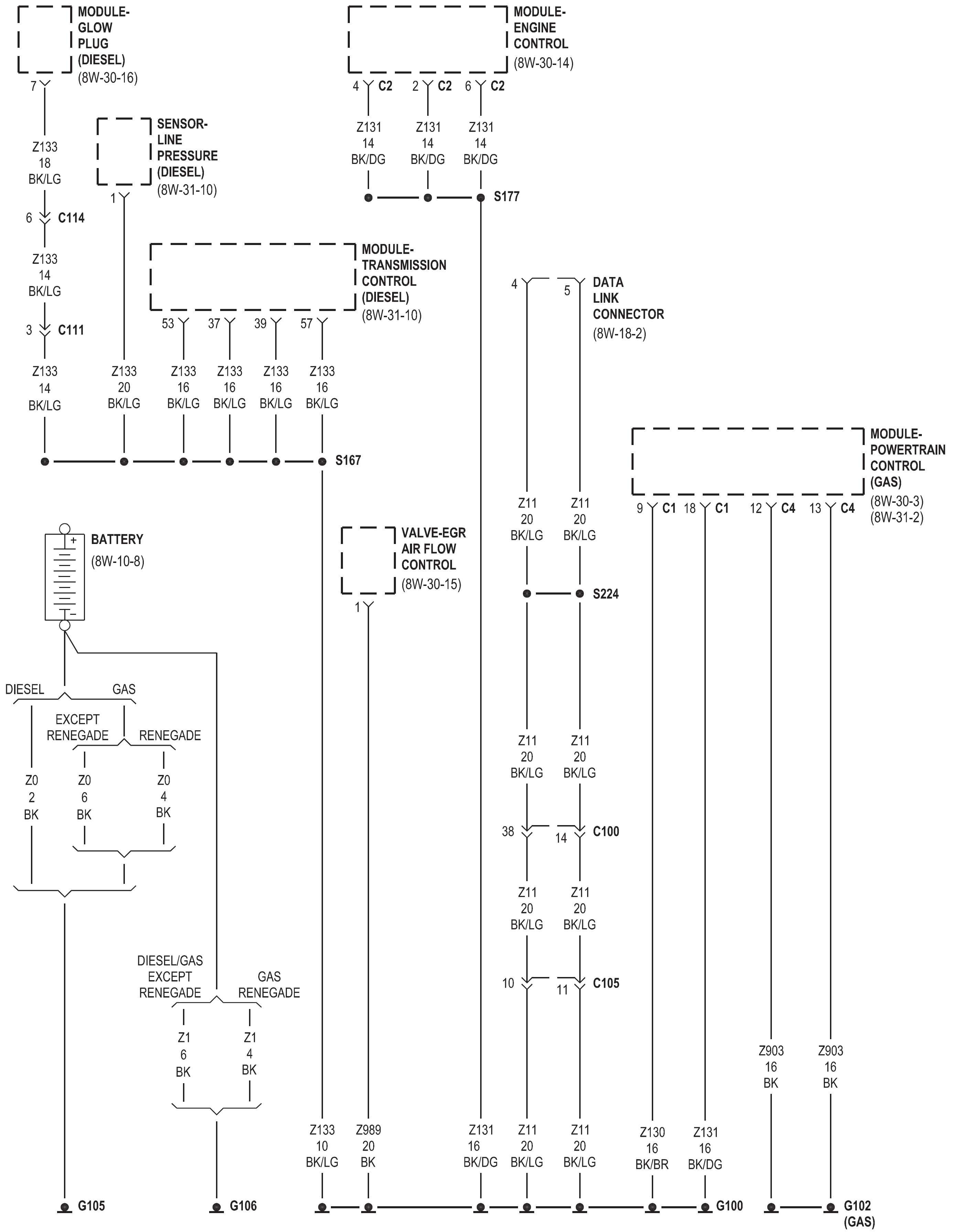


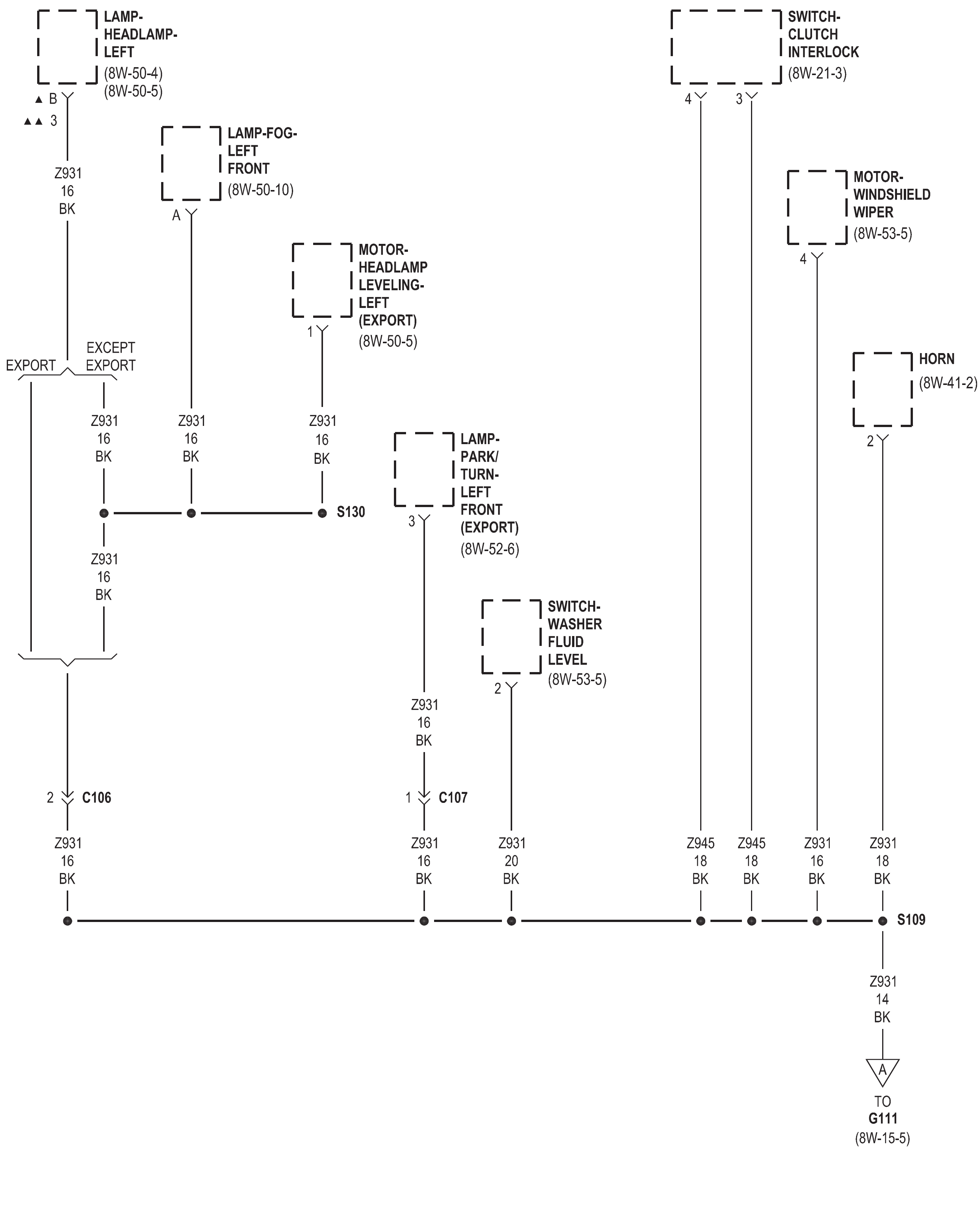
POWER DISTRIBUTION CENTER
(8W-10-2)
86
RELAY-WIPER ON/OFF
(8W-53-4)
85
W6
20
BR/LB
LHD
RHD
24
C100
W6
20
BR/LB
15
C3
21
JB
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
MODULE-BODY CONTROL
(8W-45-4)
(8W-45-5)
(8W-45-11)
23
JB
26
JB
14
C2
10
C2
12
C2
P36
20
TN/DB
M20
20
YL/LB
LHD
RHD
19
C301
19
C303
19
C303
19
C301
10
C308
LAMP-VANITY-LEFT
(8W-44-3)
LAMP-VANITY-RIGHT
(8W-44-3)
2
P36
20
TN/DB
M20
20
YL/LB
S392
1
SWITCH-DOOR LOCK-LEFT
1 LOCK
2 UNLOCK
(8W-61-6)
SWITCH-DOOR LOCK-RIGHT
1 LOCK
2 UNLOCK
(8W-61-6)
4
A
LAMP-READING-FRONT
(8W-44-3)
LAMP-DOME
(8W-44-2)
▿▿ EXCEPT BASE


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
MODULE-BODY CONTROL
(8W-45-3)
(8W-45-5)
(8W-45-11)
12 JB
22 JB
11 JB
8 JB
5 C2
11 C2
15 C2
22 C2
17 C1
P37 20 LG/TN
P37 20 LG/TN
P30 20 TN/DG
P31 20 TN/YL
Z944 16 BK
LHD
RHD
LHD
RHD
8 C301
8 C303
8 C303
8 C301
8
9 C309
P30 20 TN/DG
P31 20 TN/YL
10
G202
(8W-15-8)
(8W-15-9)
P37 20 LG/TN
P37 20 LG/TN
3
LATCH-LOCK MOTOR/AJAR SWITCH-TAILGATE
4
(8W-61-7)
4
SWITCH-DOOR LOCK-RIGHT
(8W-61-6)
4
SWITCH-DOOR LOCK-LEFT
(8W-61-6)
▿▿ EXCEPT BASE


CLUSTER
(8W-40-3)
19
E2
20
OR/BR
5 C1
LAMP-
COURTESY-
LEFT
(8W-44-2)
2
Z327
20
BK/WT
23 C1
LAMP-
COURTESY-
RIGHT
(8W-44-2)
2
Z327
20
BK/WT
24 C1
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
MODULE-
BODY
CONTROL
(8W-45-5)
24 JB
11 C1
20 C2
4 C1
10 C1
21 C2
30 C2
E2
20
OR/BR
Z327
20
BK/WT
11 C308
EXCEPT
BASE
BASE
1
ASSEMBLY-
SHIFT
LEVER
(8W-31-3)
6
SWITCH-
LIGHTBAR
(8W-50-15)
10
SWITCH-
HAZARD/
COMBINATION
FLASHER
(8W-52-2)
3 C1
RADIO
(8W-47-2)
7
CONTROL-A/C-
HEATER
(8W-42-4)
S391
(8W-15-14)
3
LAMP-
DOME
(8W-44-2)
3
LAMP-
CARGO
(8W-44-3)

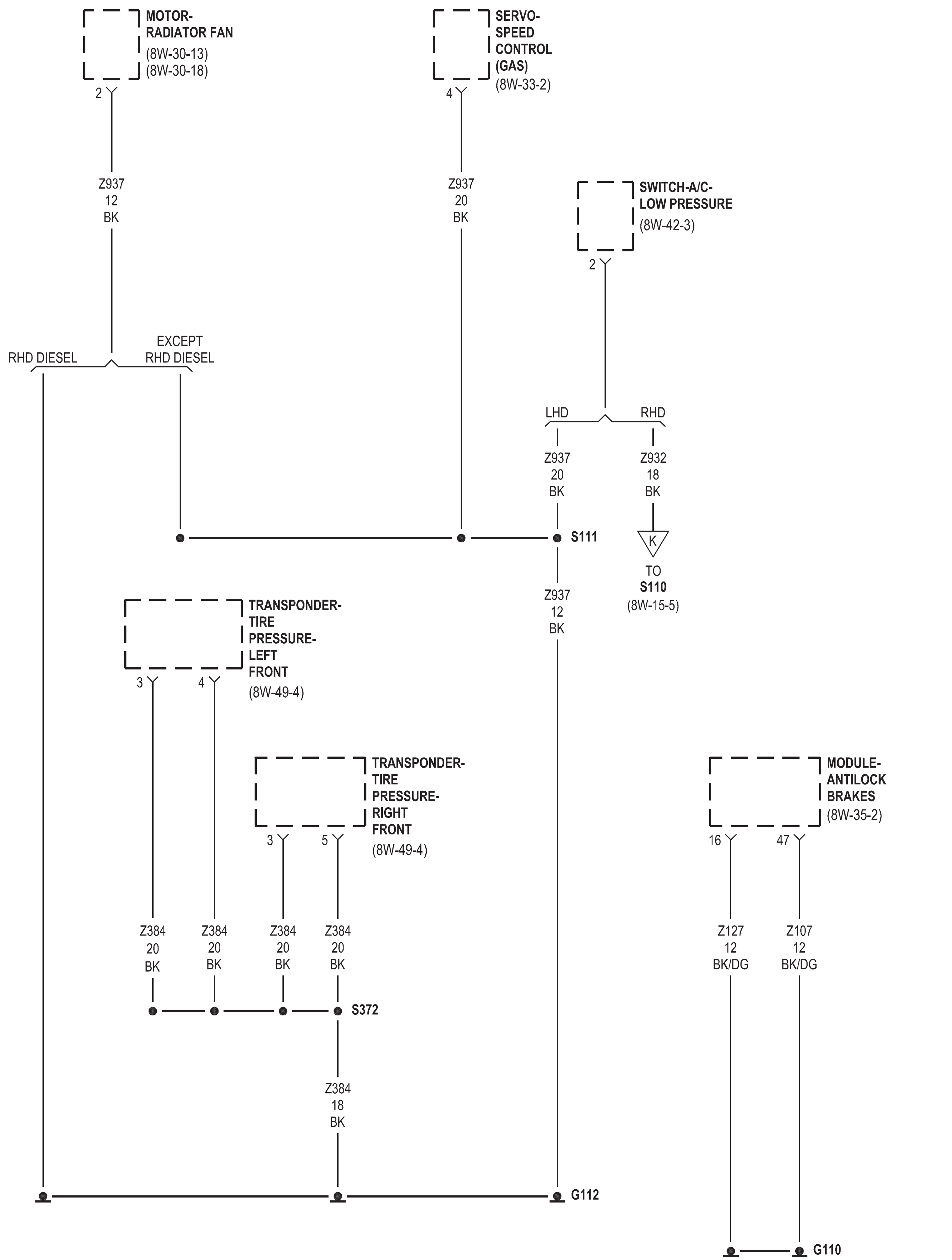
# 8W-15 GROUND DISTRIBUTION

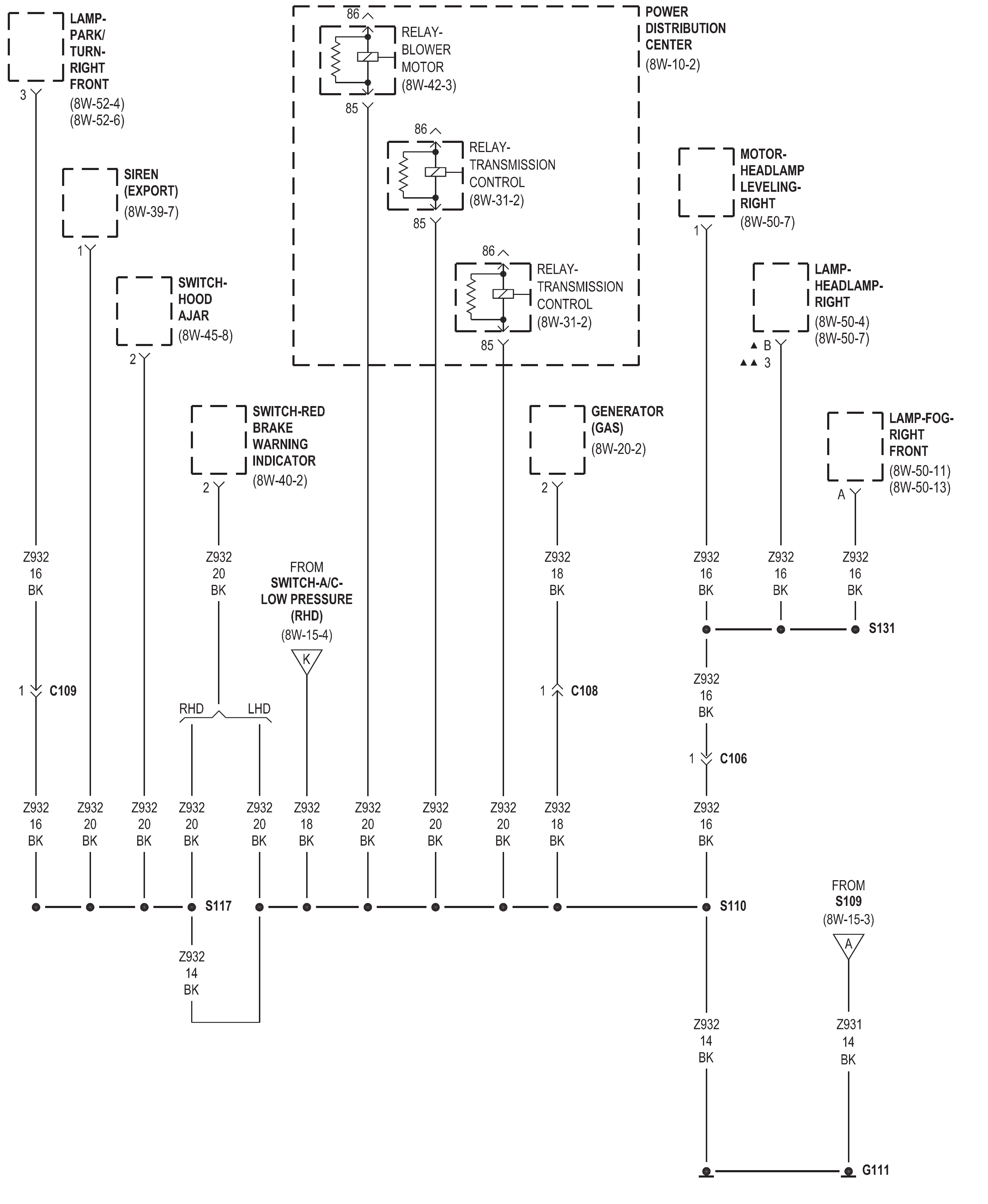

MODULE-GLOW PLUG (DIESEL)
(8W-30-16)
SENSOR-LINE PRESSURE (DIESEL)
(8W-31-10)
MODULE-ENGINE CONTROL
(8W-30-14)
MODULE-TRANSMISSION CONTROL (DIESEL)
(8W-31-10)
DATA LINK CONNECTOR
(8W-18-2)
MODULE-POWERTRAIN CONTROL (GAS)
(8W-30-3)
(8W-31-2)
BATTERY
(8W-10-8)
VALVE-EGR AIR FLOW CONTROL
(8W-30-15)
Z133 18 BK/LG
C114
Z133 14 BK/LG
C111
Z133 20 BK/LG
Z133 16 BK/LG
S167
Z131 14 BK/DG
C2
S177
Z11 20 BK/LG
S224
C100
C105
C1
C4
DIESEL
GAS
EXCEPT RENEGADE
RENEGADE
Z0 2 BK
Z0 6 BK
Z0 4 BK
DIESEL/GAS EXCEPT RENEGADE
GAS RENEGADE
Z1 6 BK
Z1 4 BK
Z133 10 BK/LG
Z989 20 BK
Z131 16 BK/DG
Z130 16 BK/BR
Z903 16 BK
G105
G106
G100
G102 (GAS)




▲ EXCEPT EXPORT

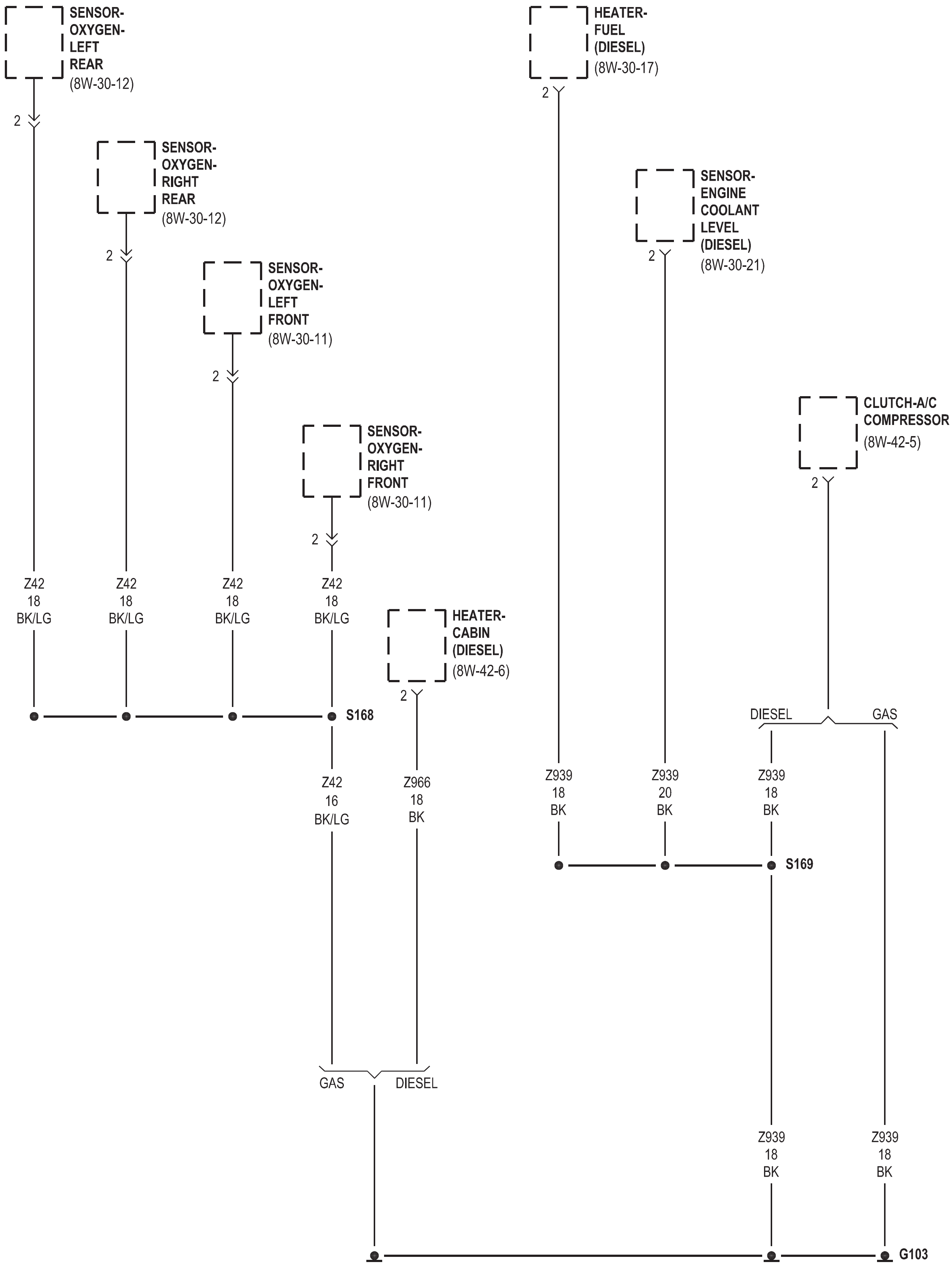
▲▲ EXPORT

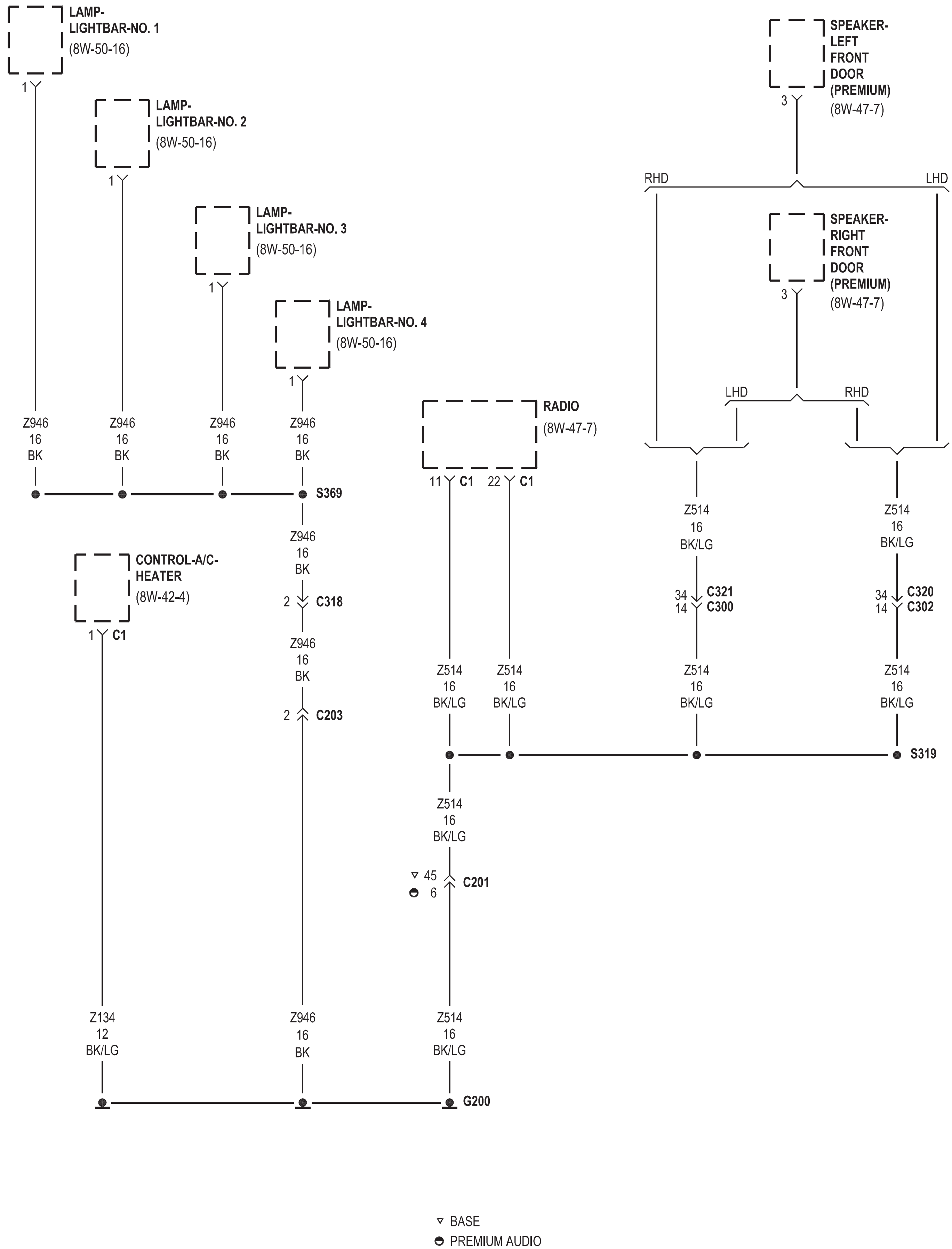

MOTOR-
RADIATOR FAN
(8W-30-13)
(8W-30-18)
2
Z937
12
BK
SERVO-
SPEED
CONTROL
(GAS)
(8W-33-2)
4
Z937
20
BK
SWITCH-A/C-
LOW PRESSURE
(8W-42-3)
2
RHD DIESEL
EXCEPT
RHD DIESEL
LHD
RHD
Z937
20
BK
Z932
18
BK
S111
K
TO
S110
(8W-15-5)
Z937
12
BK
TRANSPONDER-
TIRE
PRESSURE-
LEFT
FRONT
(8W-49-4)
3
4
TRANSPONDER-
TIRE
PRESSURE-
RIGHT
FRONT
(8W-49-4)
3
5
MODULE-
ANTILOCK
BRAKES
(8W-35-2)
16
47
Z384
20
BK
Z384
20
BK
Z384
20
BK
Z384
20
BK
Z127
12
BK/DG
Z107
12
BK/DG
S372
Z384
18
BK
G112
G110

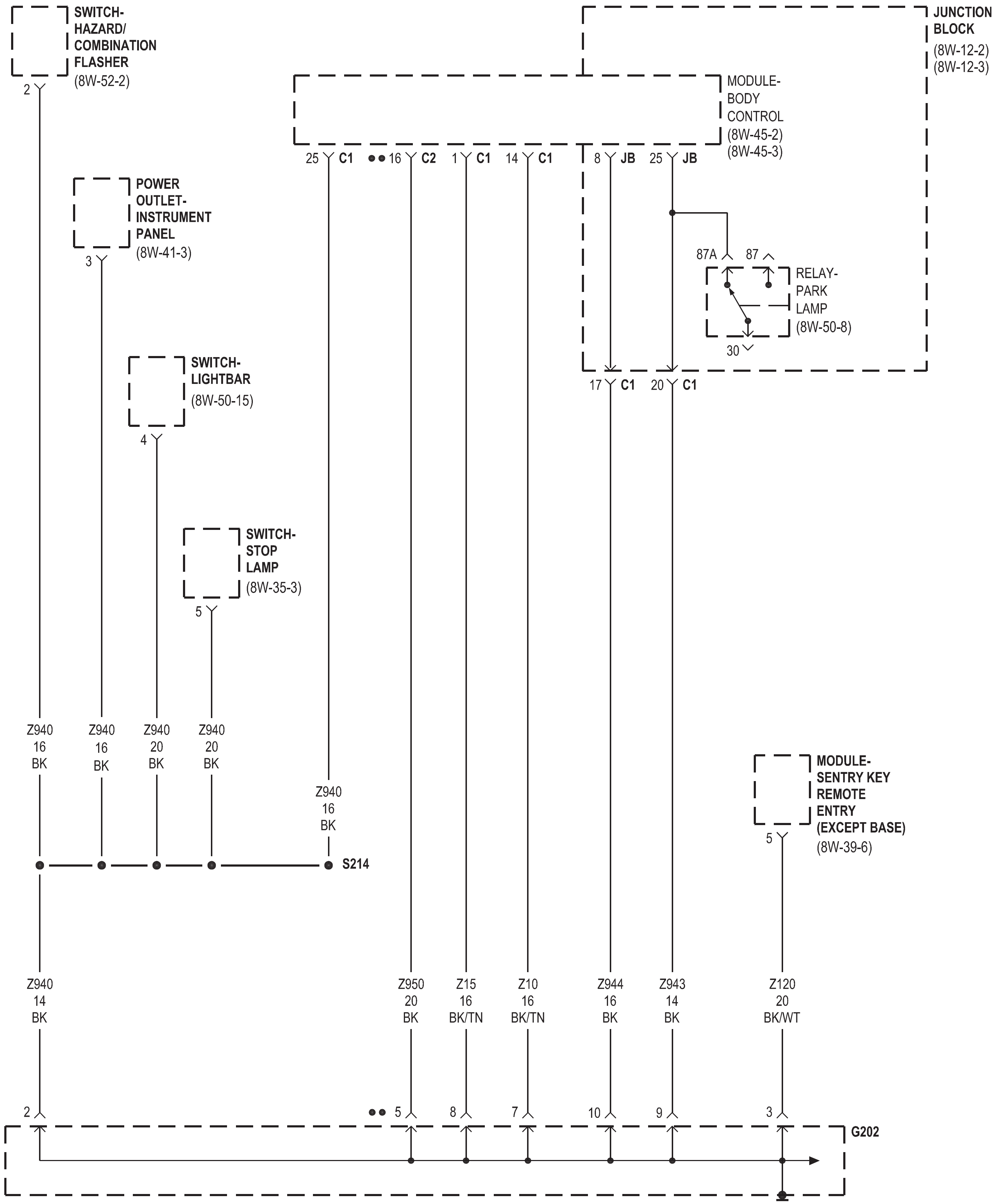


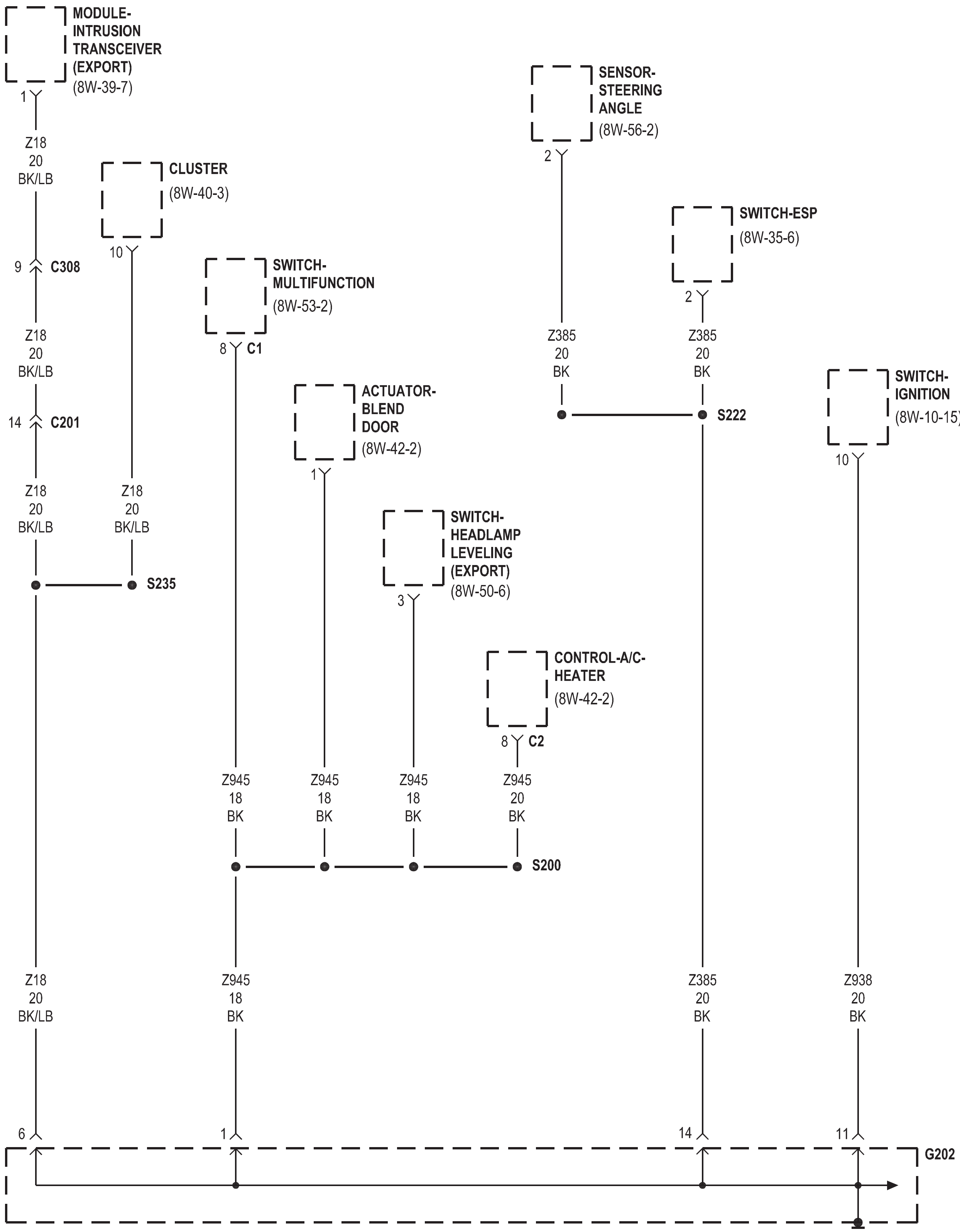

▲ EXCEPT EXPORT

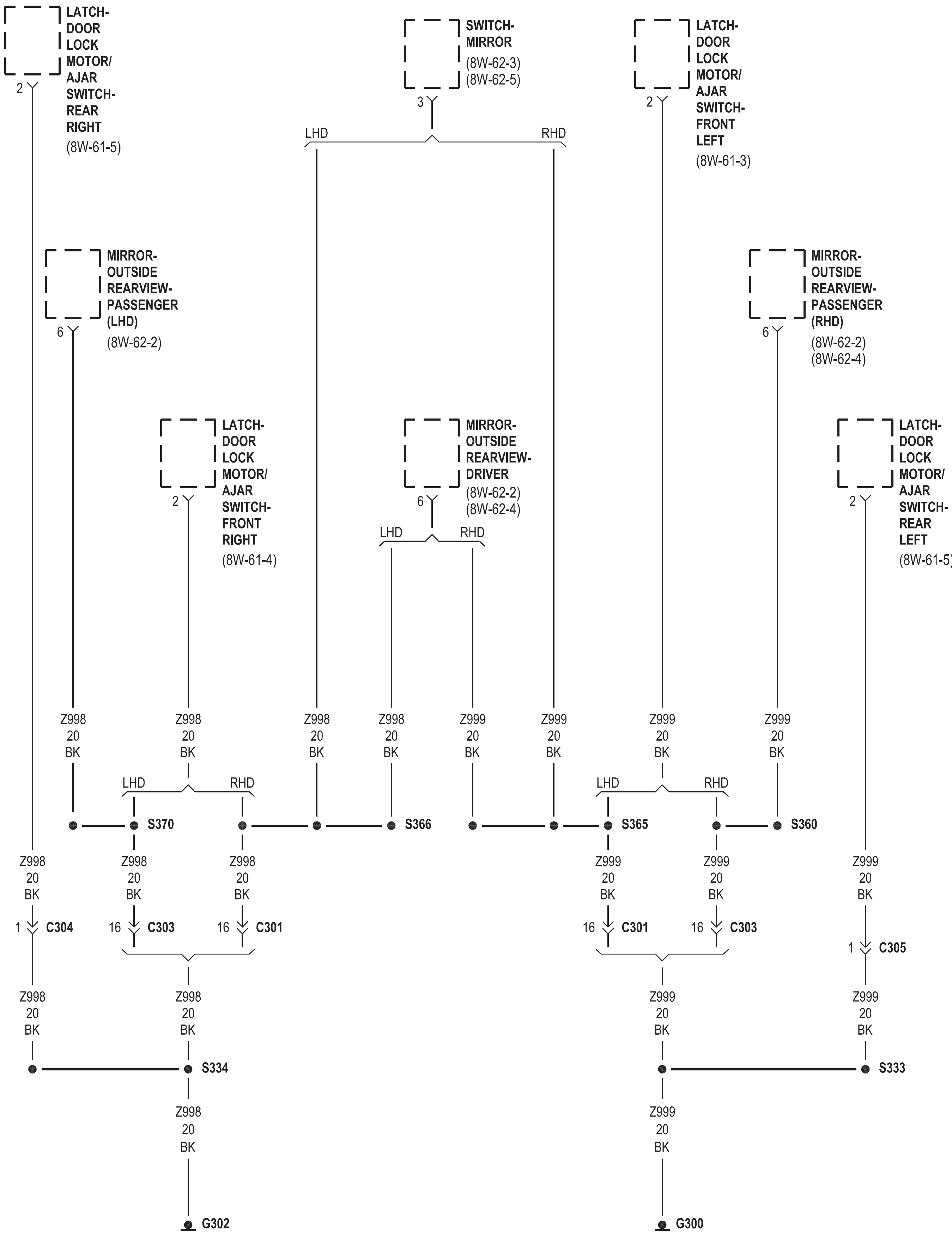
▲▲ EXPORT

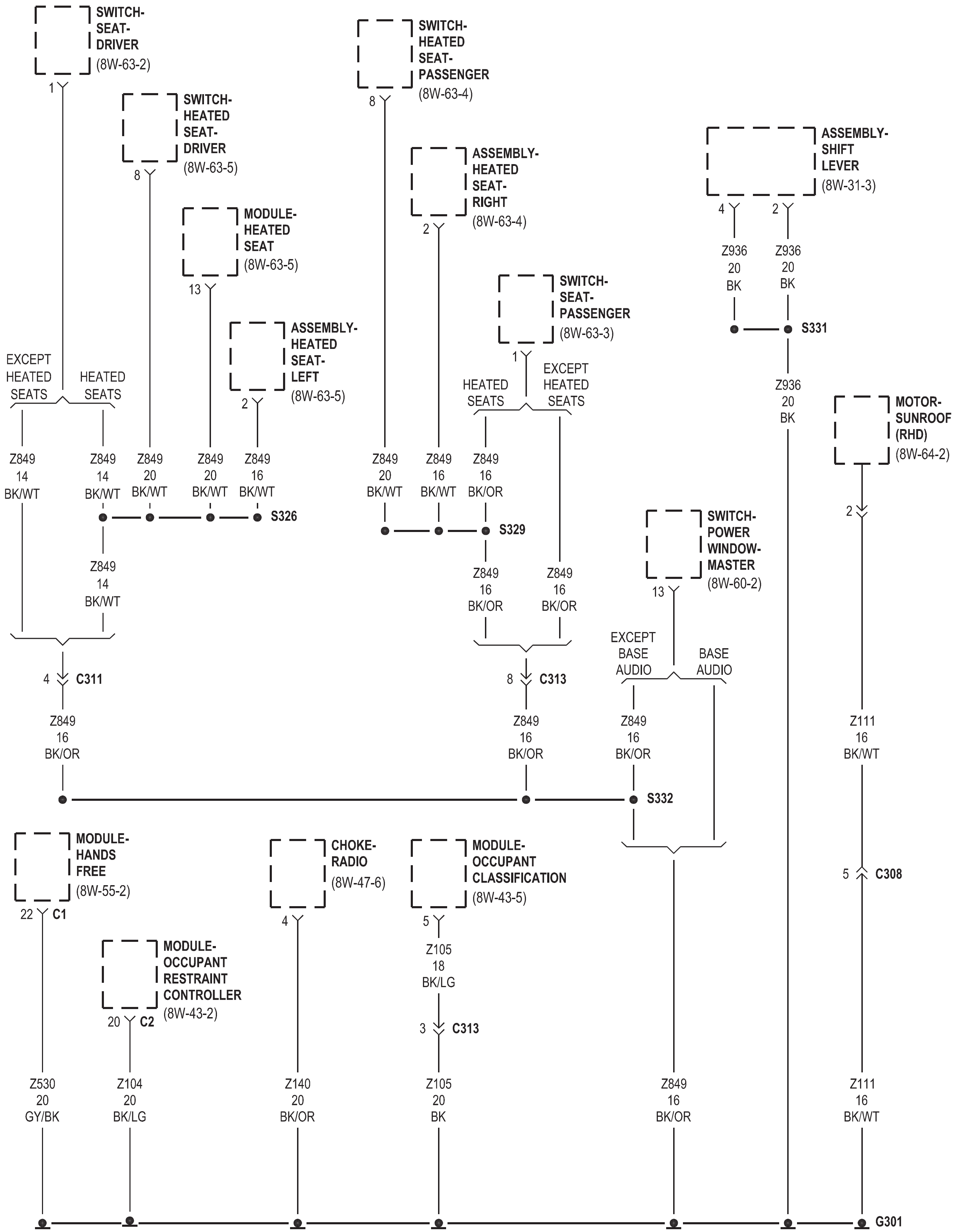

SENSOR-
OXYGEN-
LEFT
REAR
(8W-30-12)
SENSOR-
OXYGEN-
RIGHT
REAR
(8W-30-12)
SENSOR-
OXYGEN-
LEFT
FRONT
(8W-30-11)
SENSOR-
OXYGEN-
RIGHT
FRONT
(8W-30-11)
HEATER-
FUEL
(DIESEL)
(8W-30-17)
SENSOR-
ENGINE
COOLANT
LEVEL
(DIESEL)
(8W-30-21)
CLUTCH-A/C
COMPRESSOR
(8W-42-5)
HEATER-
CABIN
(DIESEL)
(8W-42-6)
2
Z42
18
BK/LG
S168
Z42
16
BK/LG
Z966
18
BK
Z939
18
BK
Z939
20
BK
DIESEL
GAS
S169
GAS
DIESEL
G103

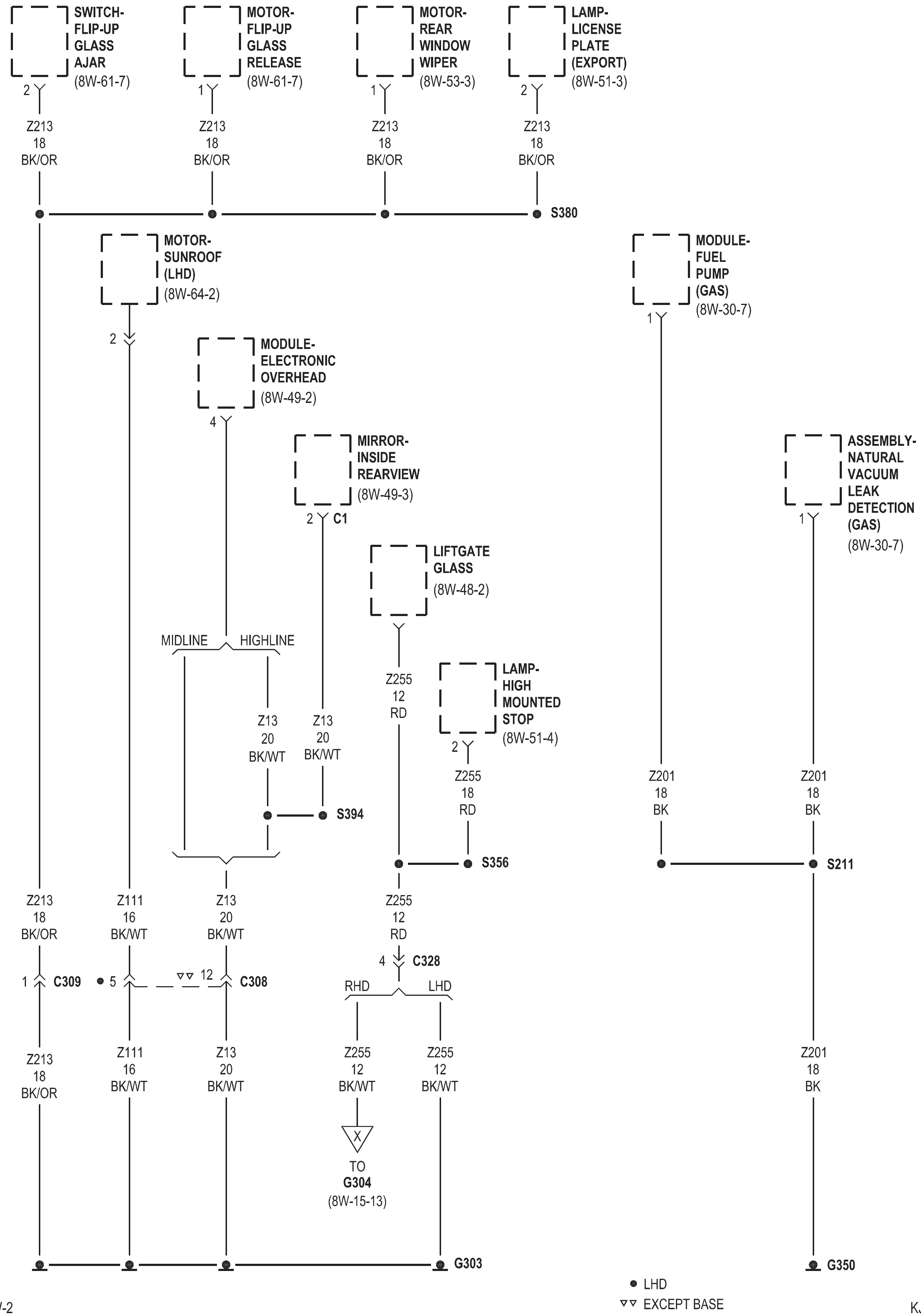

LAMP-
LIGHTBAR-NO. 1
(8W-50-16)
LAMP-
LIGHTBAR-NO. 2
(8W-50-16)
LAMP-
LIGHTBAR-NO. 3
(8W-50-16)
LAMP-
LIGHTBAR-NO. 4
(8W-50-16)
Z946
16
BK
S369
C318
C203
CONTROL-A/C-
HEATER
(8W-42-4)
C1
Z134
12
BK/LG
G200
RADIO
(8W-47-7)
11 C1
22 C1
Z514
16
BK/LG
S319
C201
45
6
SPEAKER-
LEFT
FRONT
DOOR
(PREMIUM)
(8W-47-7)
SPEAKER-
RIGHT
FRONT
DOOR
(PREMIUM)
(8W-47-7)
RHD
LHD
C321
C300
C320
C302
BASE
PREMIUM AUDIO

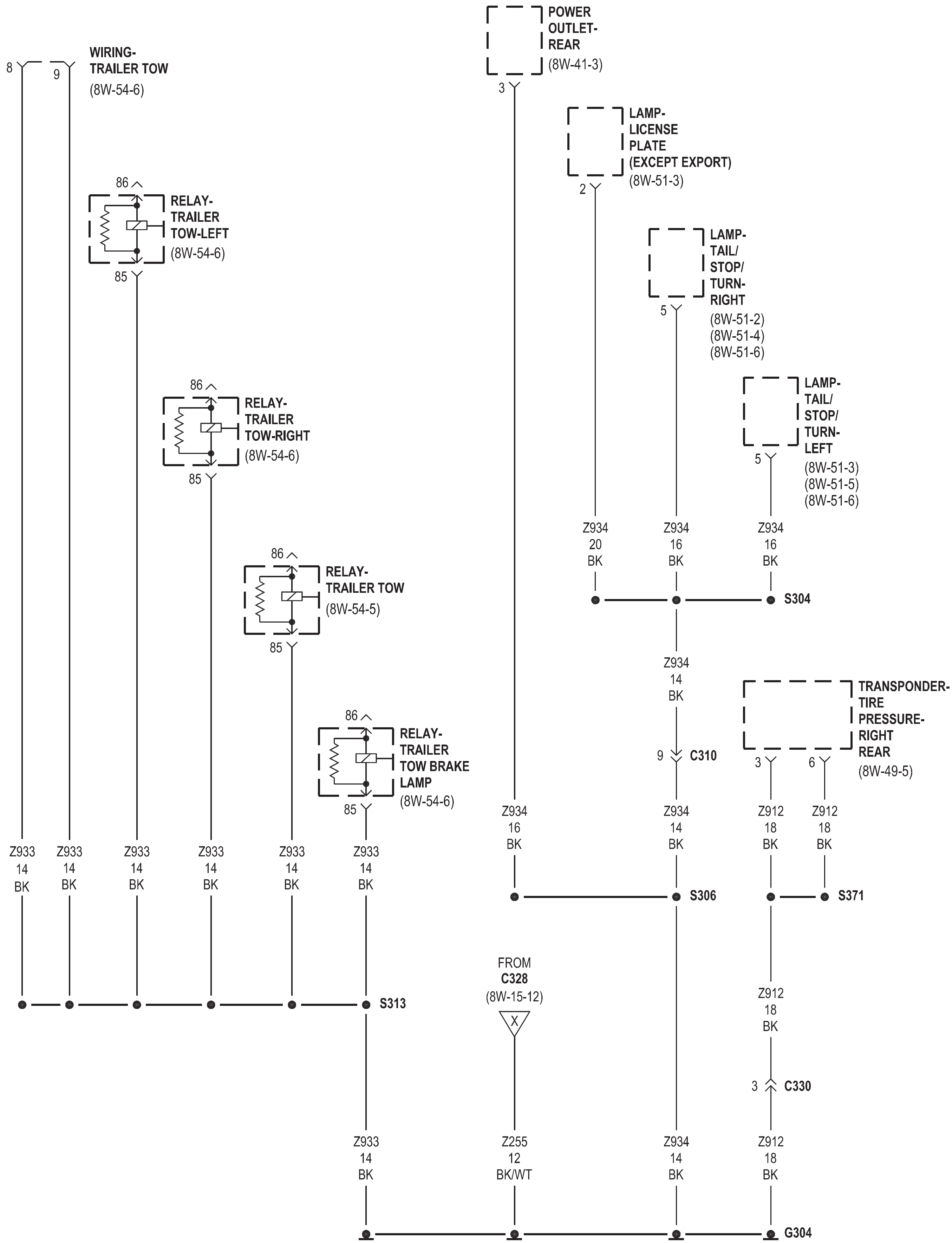

SWITCH-
HAZARD/
COMBINATION
FLASHER
(8W-52-2)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
MODULE-
BODY
CONTROL
(8W-45-2)
(8W-45-3)
25 C1
16 C2
1 C1
14 C1
8 JB
25 JB
POWER
OUTLET-
INSTRUMENT
PANEL
(8W-41-3)
87A
87
RELAY-
PARK
LAMP
(8W-50-8)
30
SWITCH-
LIGHTBAR
(8W-50-15)
17 C1
20 C1
SWITCH-
STOP
LAMP
(8W-35-3)
Z940
16
BK
Z940
16
BK
Z940
20
BK
Z940
20
BK
Z940
16
BK
MODULE-
SENTRY KEY
REMOTE
ENTRY
(EXCEPT BASE)
(8W-39-6)
S214
Z940
14
BK
Z950
20
BK
Z15
16
BK/TN
Z10
16
BK/TN
Z944
16
BK
Z943
14
BK
Z120
20
BK/WT
G202
RHD


MODULE-
INTRUSION
TRANSCEIVER
(EXPORT)
(8W-39-7)
1
Z18
20
BK/LB
9
C308
Z18
20
BK/LB
14
C201
Z18
20
BK/LB
CLUSTER
(8W-40-3)
10
Z18
20
BK/LB
S235
SWITCH-
MULTIFUNCTION
(8W-53-2)
8
C1
ACTUATOR-
BLEND
DOOR
(8W-42-2)
1
SWITCH-
HEADLAMP
LEVELING
(EXPORT)
(8W-50-6)
3
CONTROL-A/C-
HEATER
(8W-42-2)
8
C2
Z945
18
BK
Z945
18
BK
Z945
18
BK
Z945
20
BK
S200
SENSOR-
STEERING
ANGLE
(8W-56-2)
2
SWITCH-ESP
(8W-35-6)
2
Z385
20
BK
Z385
20
BK
S222
SWITCH-
IGNITION
(8W-10-15)
10
Z18
20
BK/LB
Z945
18
BK
Z385
20
BK
Z938
20
BK
6
1
14
11
G202

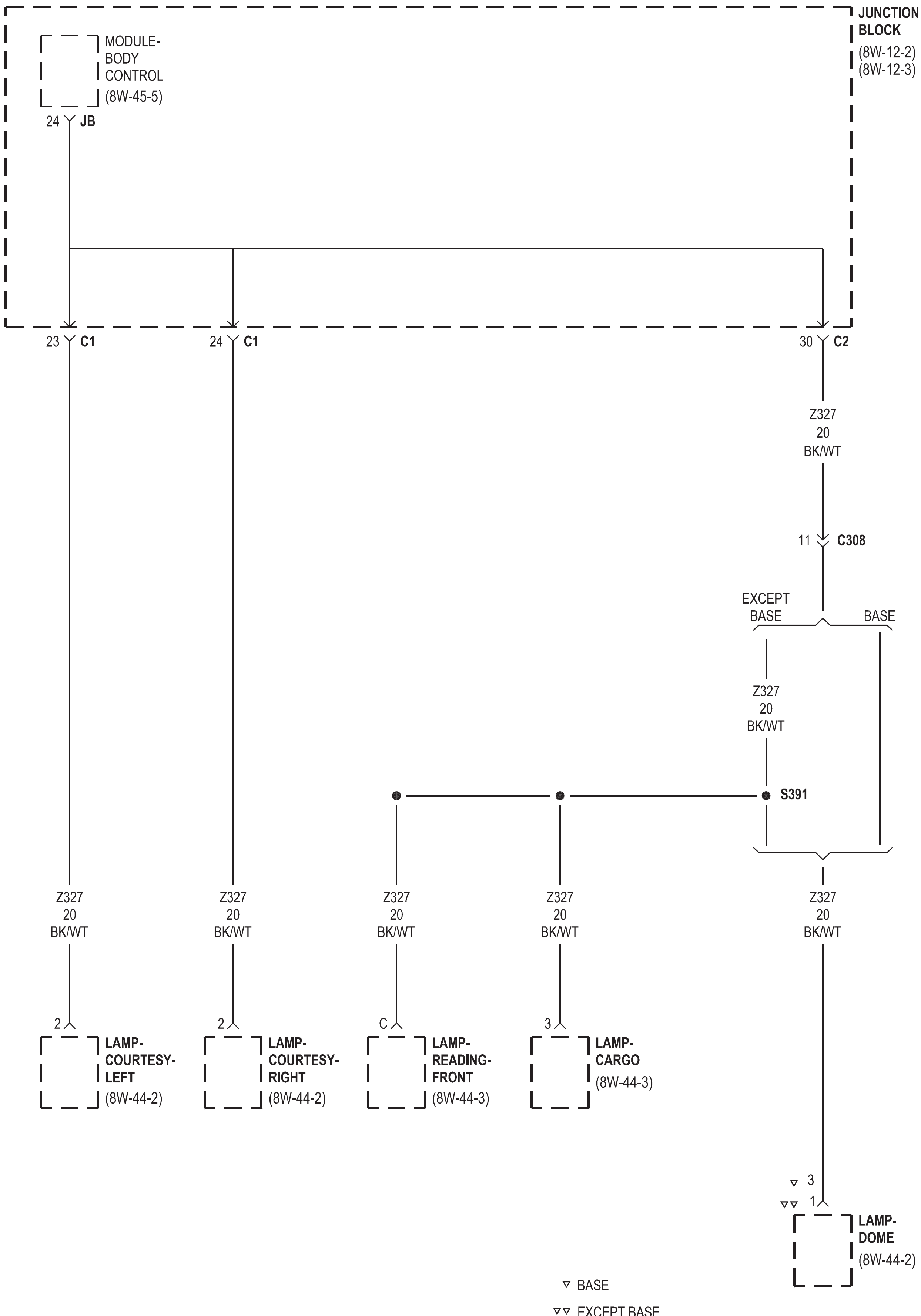

LATCH-DOOR LOCK MOTOR/AJAR SWITCH-REAR RIGHT
(8W-61-5)
SWITCH-MIRROR
(8W-62-3)
(8W-62-5)
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT LEFT
(8W-61-3)
MIRROR-OUTSIDE REARVIEW-PASSENGER (LHD)
(8W-62-2)
MIRROR-OUTSIDE REARVIEW-PASSENGER (RHD)
(8W-62-2)
(8W-62-4)
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT RIGHT
(8W-61-4)
MIRROR-OUTSIDE REARVIEW-DRIVER
(8W-62-2)
(8W-62-4)
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-REAR LEFT
(8W-61-5)
LHD
RHD
Z998 20 BK
Z999 20 BK
S370
S366
S365
S360
C304
C303
C301
C305
S334
S333
G302
G300


SWITCH-SEAT-DRIVER (8W-63-2)
SWITCH-HEATED SEAT-DRIVER (8W-63-5)
MODULE-HEATED SEAT (8W-63-5)
ASSEMBLY-HEATED SEAT-LEFT (8W-63-5)
SWITCH-HEATED SEAT-PASSENGER (8W-63-4)
ASSEMBLY-HEATED SEAT-RIGHT (8W-63-4)
SWITCH-SEAT-PASSENGER (8W-63-3)
ASSEMBLY-SHIFT LEVER (8W-31-3)
MOTOR-SUNROOF (RHD) (8W-64-2)
SWITCH-POWER WINDOW-MASTER (8W-60-2)
EXCEPT HEATED SEATS
HEATED SEATS
EXCEPT BASE AUDIO
BASE AUDIO
Z849 14 BK/WT
Z849 20 BK/WT
Z849 16 BK/WT
Z849 16 BK/OR
Z936 20 BK
Z111 16 BK/WT
S326
S329
S331
S332
C311
C313
C308
MODULE-HANDS FREE (8W-55-2)
C1
MODULE-OCCUPANT RESTRAINT CONTROLLER (8W-43-2)
C2
CHOKE-RADIO (8W-47-6)
MODULE-OCCUPANT CLASSIFICATION (8W-43-5)
Z105 18 BK/LG
Z530 20 GY/BK
Z104 20 BK/LG
Z140 20 BK/OR
Z105 20 BK
Z849 16 BK/OR
G301

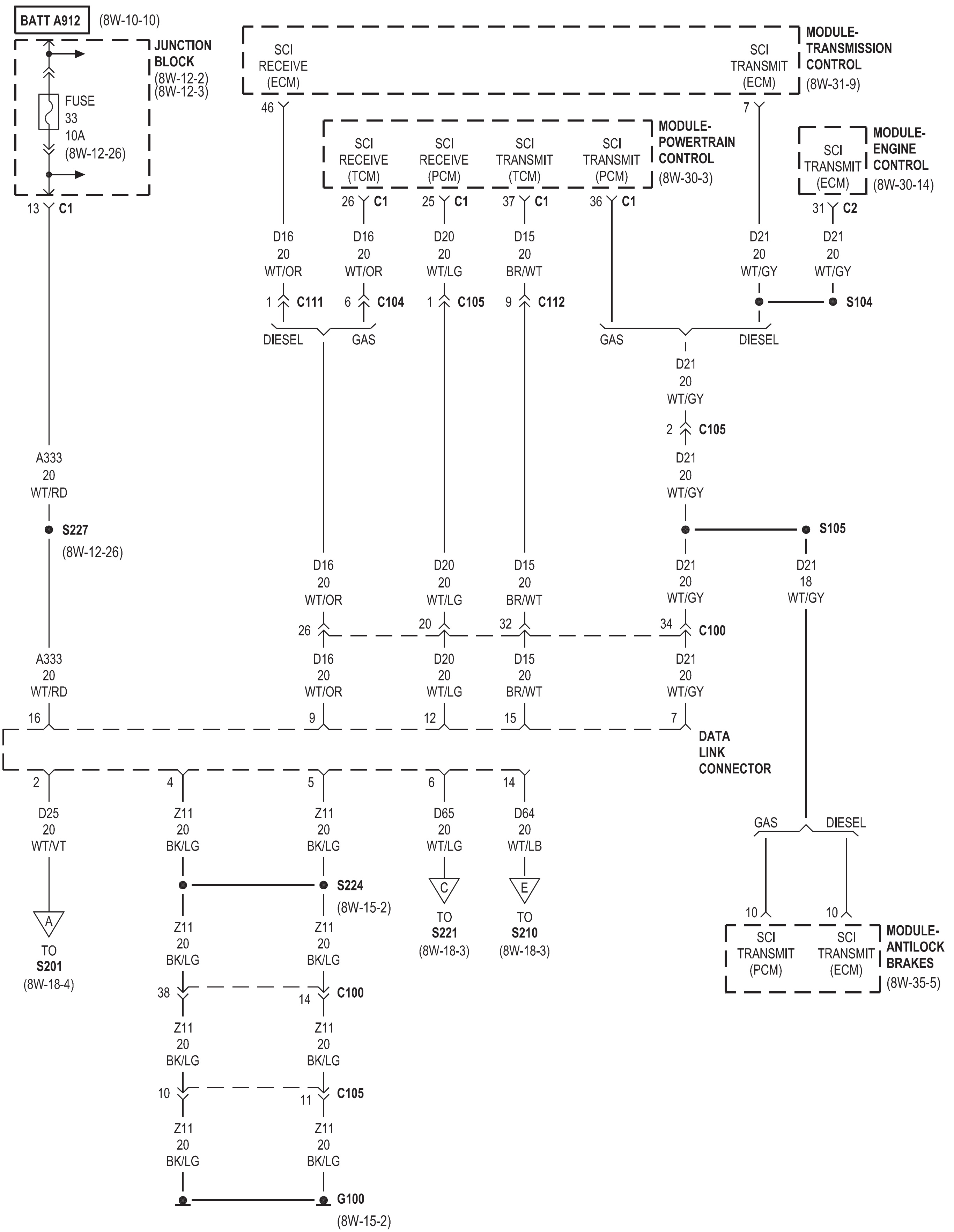

SWITCH-
FLIP-UP
GLASS
AJAR
(8W-61-7)
MOTOR-
FLIP-UP
GLASS
RELEASE
(8W-61-7)
MOTOR-
REAR
WINDOW
WIPER
(8W-53-3)
LAMP-
LICENSE
PLATE
(EXPORT)
(8W-51-3)
Z213
18
BK/OR
S380
MOTOR-
SUNROOF
(LHD)
(8W-64-2)
MODULE-
FUEL
PUMP
(GAS)
(8W-30-7)
MODULE-
ELECTRONIC
OVERHEAD
(8W-49-2)
MIRROR-
INSIDE
REARVIEW
(8W-49-3)
C1
ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION
(GAS)
(8W-30-7)
LIFTGATE
GLASS
(8W-48-2)
MIDLINE
HIGHLINE
LAMP-
HIGH
MOUNTED
STOP
(8W-51-4)
Z13
20
BK/WT
Z255
12
RD
Z255
18
RD
Z201
18
BK
S394
S356
S211
Z111
16
BK/WT
C309
C308
C328
RHD
LHD
Z255
12
BK/WT
TO
G304
(8W-15-13)
G303
G350
LHD
EXCEPT BASE

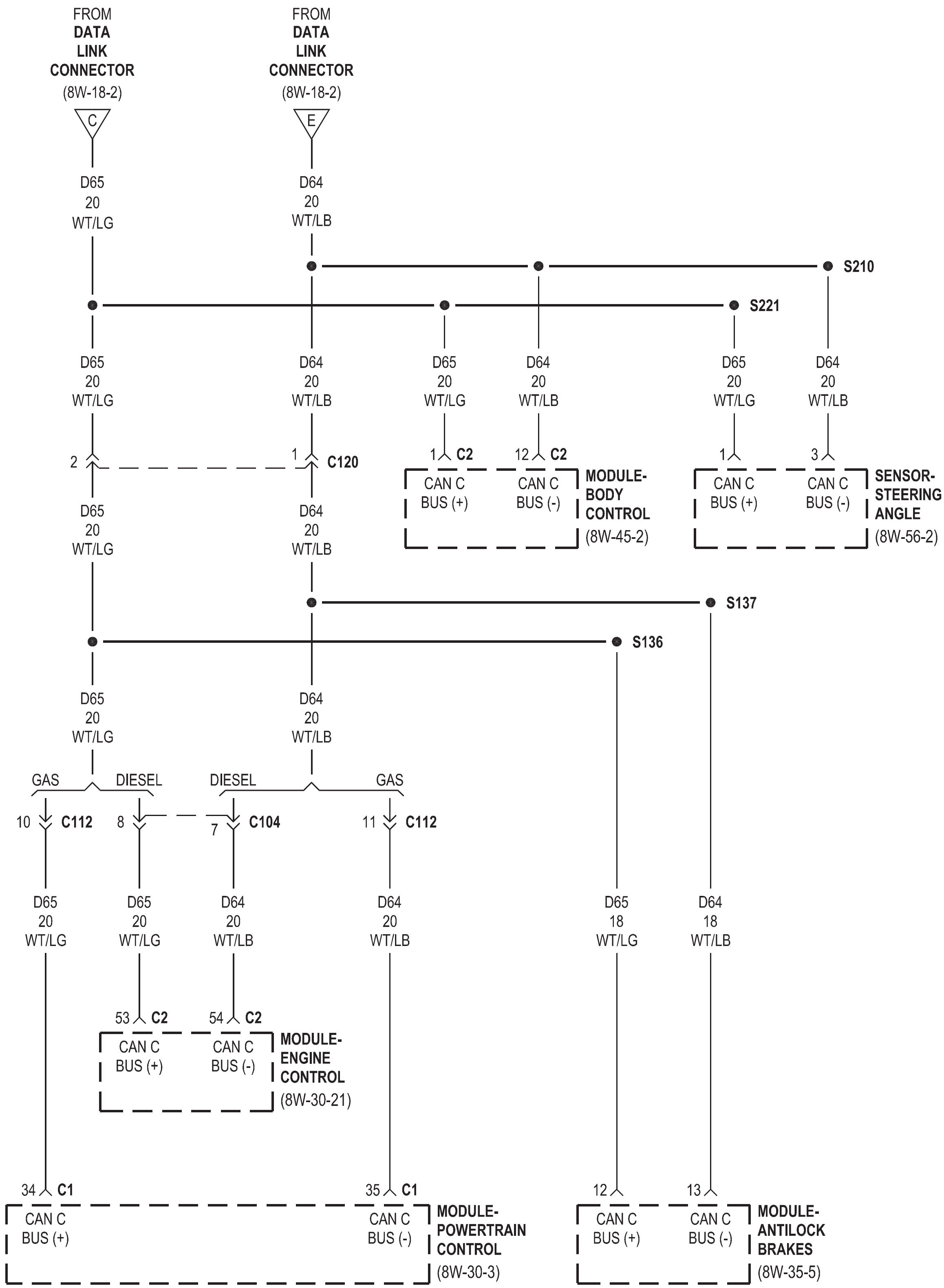


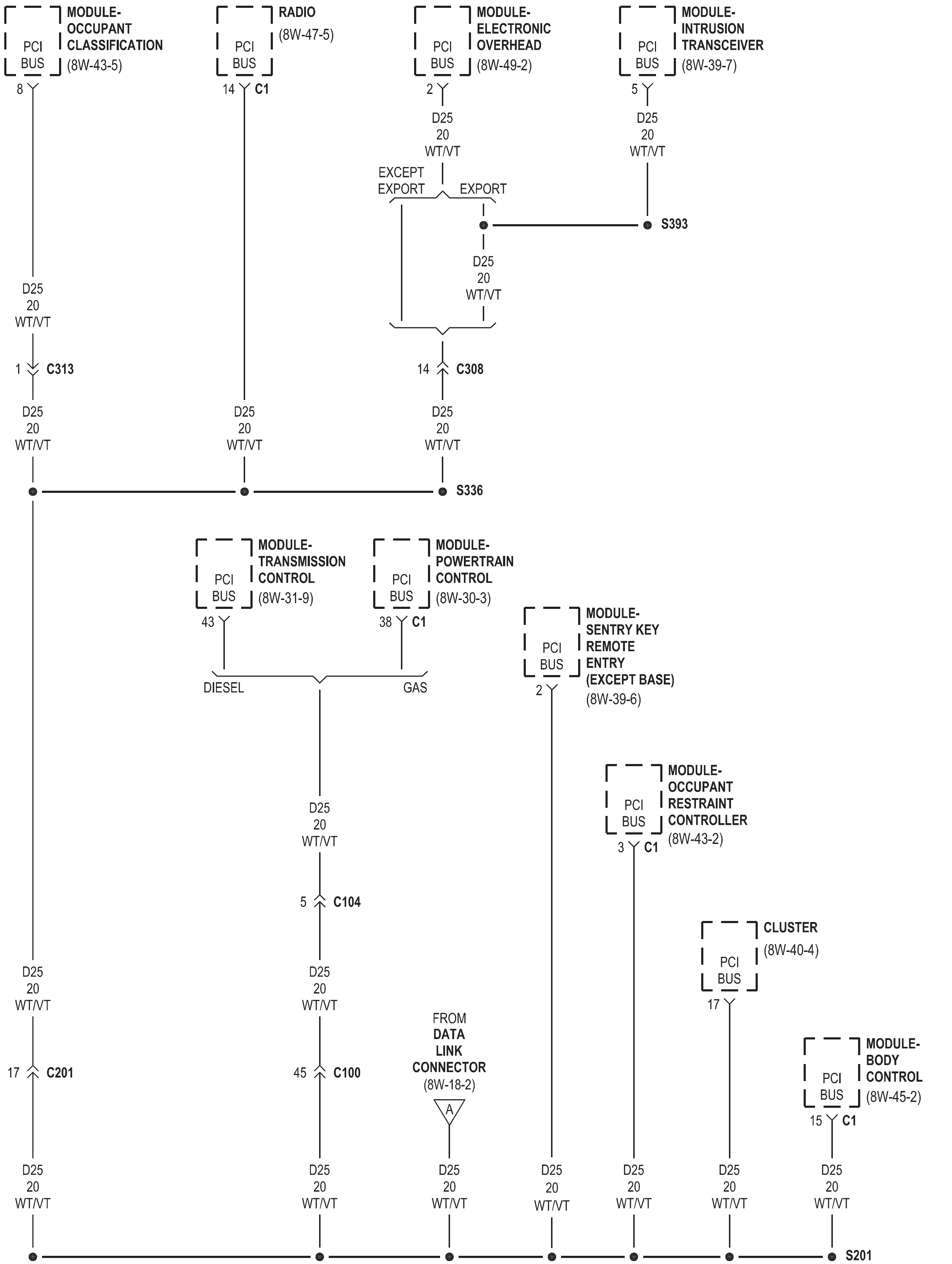
WIRING-
TRAILER TOW
(8W-54-6)
8
9
POWER
OUTLET-
REAR
(8W-41-3)
3
LAMP-
LICENSE
PLATE
(EXCEPT EXPORT)
(8W-51-3)
2
LAMP-
TAIL/
STOP/
TURN-
RIGHT
(8W-51-2)
(8W-51-4)
(8W-51-6)
5
LAMP-
TAIL/
STOP/
TURN-
LEFT
(8W-51-3)
(8W-51-5)
(8W-51-6)
5
RELAY-
TRAILER
TOW-LEFT
(8W-54-6)
86
85
RELAY-
TRAILER
TOW-RIGHT
(8W-54-6)
86
85
RELAY-
TRAILER TOW
(8W-54-5)
86
85
RELAY-
TRAILER
TOW BRAKE
LAMP
(8W-54-6)
86
85
Z934 20 BK
Z934 16 BK
Z934 16 BK
S304
Z934 14 BK
TRANSPONDER-
TIRE
PRESSURE-
RIGHT
REAR
(8W-49-5)
3
6
9
C310
Z934 16 BK
Z934 14 BK
Z912 18 BK
Z912 18 BK
Z933 14 BK
Z933 14 BK
Z933 14 BK
Z933 14 BK
Z933 14 BK
Z933 14 BK
S306
S371
FROM
C328
(8W-15-12)
X
S313
Z912 18 BK
3
C330
Z933 14 BK
Z255 12 BK/WT
Z934 14 BK
Z912 18 BK
G304


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
MODULE-BODY CONTROL
(8W-45-5)
24 JB
23 C1
24 C1
30 C2
Z327
20
BK/WT
11 C308
EXCEPT BASE
BASE
Z327
20
BK/WT
S391
Z327 20 BK/WT
Z327 20 BK/WT
Z327 20 BK/WT
Z327 20 BK/WT
Z327 20 BK/WT
2
LAMP-COURTESY-LEFT
(8W-44-2)
2
LAMP-COURTESY-RIGHT
(8W-44-2)
C
LAMP-READING-FRONT
(8W-44-3)
3
LAMP-CARGO
(8W-44-3)
▽ 3
▽▽ 1
LAMP-DOME
(8W-44-2)
▽ BASE
▽▽ EXCEPT BASE

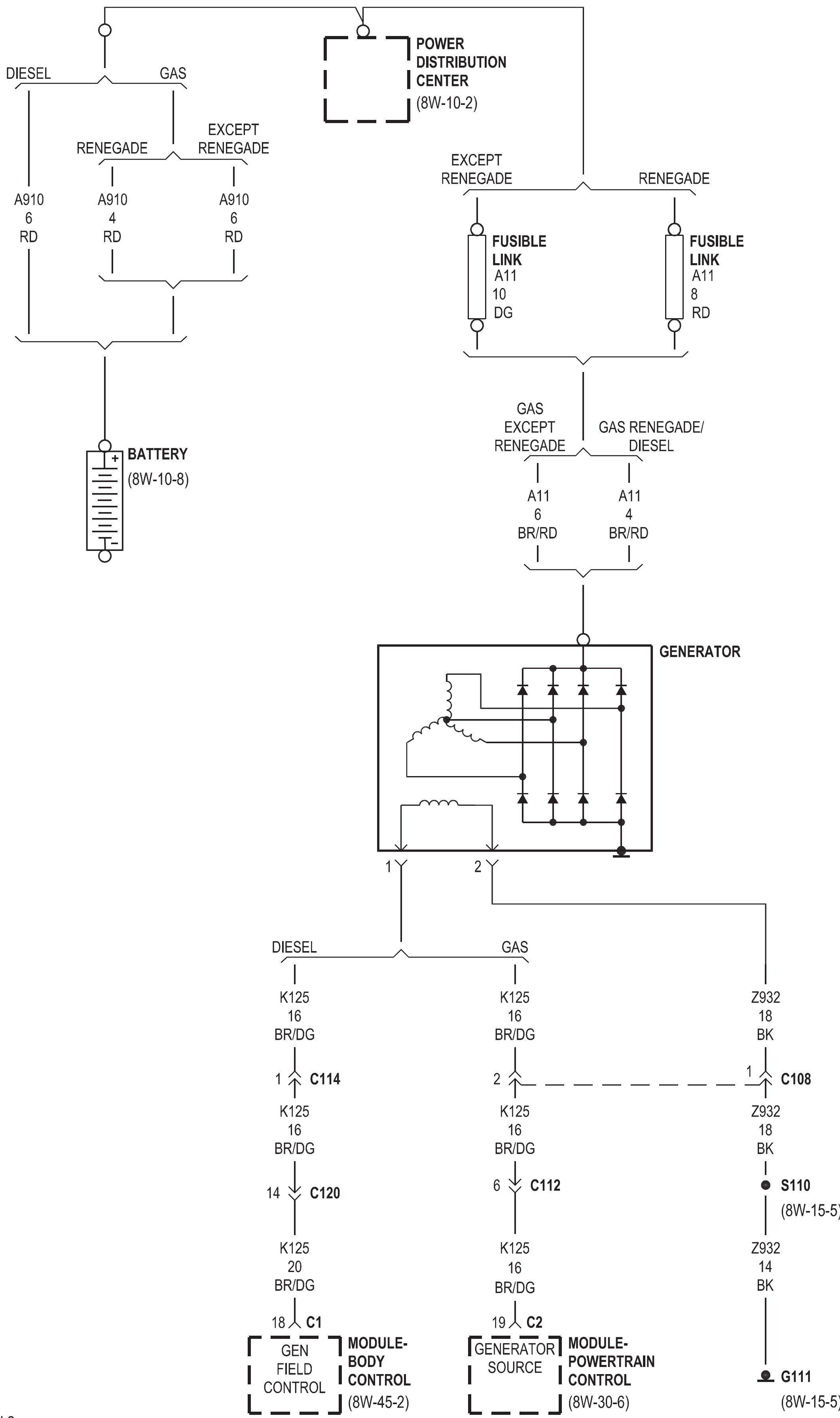
# 8W-18 BUS COMMUNICATIONS


BATT A912
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
33
10A
(8W-12-26)
13 C1
A333
20
WT/RD
S227
(8W-12-26)
A333
20
WT/RD
16
SCI RECEIVE (ECM)
SCI TRANSMIT (ECM)
MODULE-TRANSMISSION CONTROL
(8W-31-9)
46
7
SCI RECEIVE (TCM)
SCI RECEIVE (PCM)
SCI TRANSMIT (TCM)
SCI TRANSMIT (PCM)
MODULE-POWERTRAIN CONTROL
(8W-30-3)
26 C1
25 C1
37 C1
36 C1
SCI TRANSMIT (ECM)
MODULE-ENGINE CONTROL
(8W-30-14)
31 C2
D16
20
WT/OR
D16
20
WT/OR
D20
20
WT/LG
D15
20
BR/WT
D21
20
WT/GY
D21
20
WT/GY
1 C111
6 C104
1 C105
9 C112
S104
DIESEL
GAS
GAS
DIESEL
D21
20
WT/GY
2 C105
D21
20
WT/GY
S105
D16
20
WT/OR
D20
20
WT/LG
D15
20
BR/WT
D21
20
WT/GY
D21
18
WT/GY
26
20
32
34 C100
D16
20
WT/OR
D20
20
WT/LG
D15
20
BR/WT
D21
20
WT/GY
9
12
15
7
DATA LINK CONNECTOR
2
4
5
6
14
D25
20
WT/VT
Z11
20
BK/LG
Z11
20
BK/LG
D65
20
WT/LG
D64
20
WT/LB
A
TO S201
(8W-18-4)
S224
(8W-15-2)
C
TO S221
(8W-18-3)
E
TO S210
(8W-18-3)
Z11
20
BK/LG
Z11
20
BK/LG
38
14 C100
Z11
20
BK/LG
Z11
20
BK/LG
10
11 C105
Z11
20
BK/LG
Z11
20
BK/LG
G100
(8W-15-2)
GAS
DIESEL
10
10
SCI TRANSMIT (PCM)
SCI TRANSMIT (ECM)
MODULE-ANTILOCK BRAKES
(8W-35-5)

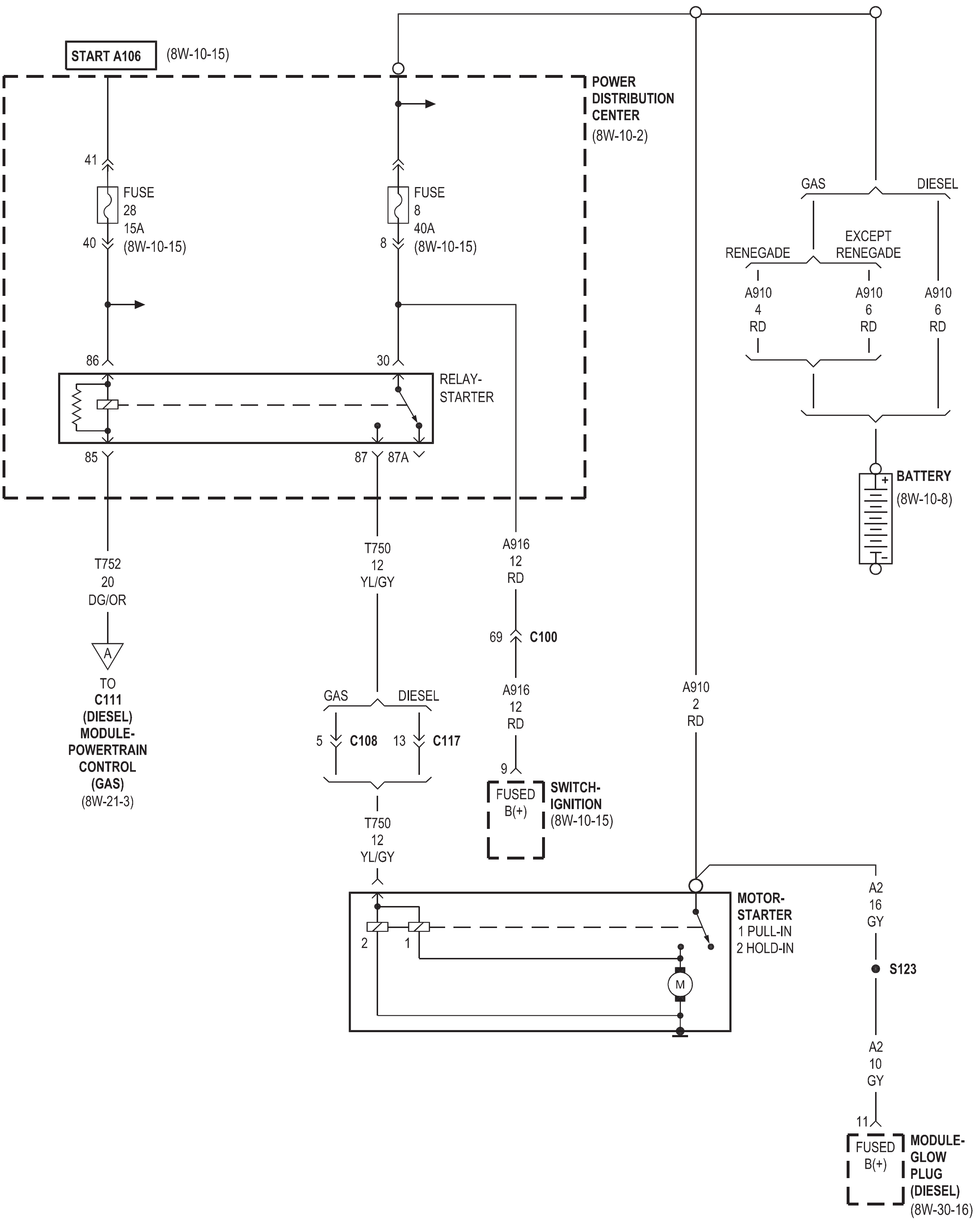

FROM
DATA
LINK
CONNECTOR
(8W-18-2)
C
FROM
DATA
LINK
CONNECTOR
(8W-18-2)
E
D65
20
WT/LG
D64
20
WT/LB
S210
S221
D65
20
WT/LG
D64
20
WT/LB
D65
20
WT/LG
D64
20
WT/LB
D65
20
WT/LG
D64
20
WT/LB
2
1
C120
1
C2
12
C2
MODULE-
BODY
CONTROL
(8W-45-2)
CAN C
BUS (+)
CAN C
BUS (-)
1
3
SENSOR-
STEERING
ANGLE
(8W-56-2)
CAN C
BUS (+)
CAN C
BUS (-)
D65
20
WT/LG
D64
20
WT/LB
S137
S136
D65
20
WT/LG
D64
20
WT/LB
GAS
DIESEL
DIESEL
GAS
10
C112
8
7
C104
11
C112
D65
20
WT/LG
D65
20
WT/LG
D64
20
WT/LB
D64
20
WT/LB
D65
18
WT/LG
D64
18
WT/LB
53
C2
54
C2
CAN C
BUS (+)
CAN C
BUS (-)
MODULE-
ENGINE
CONTROL
(8W-30-21)
34
C1
35
C1
CAN C
BUS (+)
CAN C
BUS (-)
MODULE-
POWERTRAIN
CONTROL
(8W-30-3)
12
13
CAN C
BUS (+)
CAN C
BUS (-)
MODULE-
ANTILOCK
BRAKES
(8W-35-5)


MODULE-
OCCUPANT
CLASSIFICATION
(8W-43-5)
PCI
BUS
RADIO
(8W-47-5)
MODULE-
ELECTRONIC
OVERHEAD
(8W-49-2)
MODULE-
INTRUSION
TRANSCEIVER
(8W-39-7)
8
14 C1
2
5
D25
20
WT/VT
EXCEPT
EXPORT
EXPORT
S393
1 C313
14 C308
S336
MODULE-
TRANSMISSION
CONTROL
(8W-31-9)
MODULE-
POWERTRAIN
CONTROL
(8W-30-3)
43
38 C1
MODULE-
SENTRY KEY
REMOTE
ENTRY
(EXCEPT BASE)
(8W-39-6)
2
DIESEL
GAS
MODULE-
OCCUPANT
RESTRAINT
CONTROLLER
(8W-43-2)
3 C1
5 C104
CLUSTER
(8W-40-4)
17
MODULE-
BODY
CONTROL
(8W-45-2)
15 C1
17 C201
45 C100
FROM
DATA
LINK
CONNECTOR
(8W-18-2)
A
S201

# 8W-20 CHARGING SYSTEM

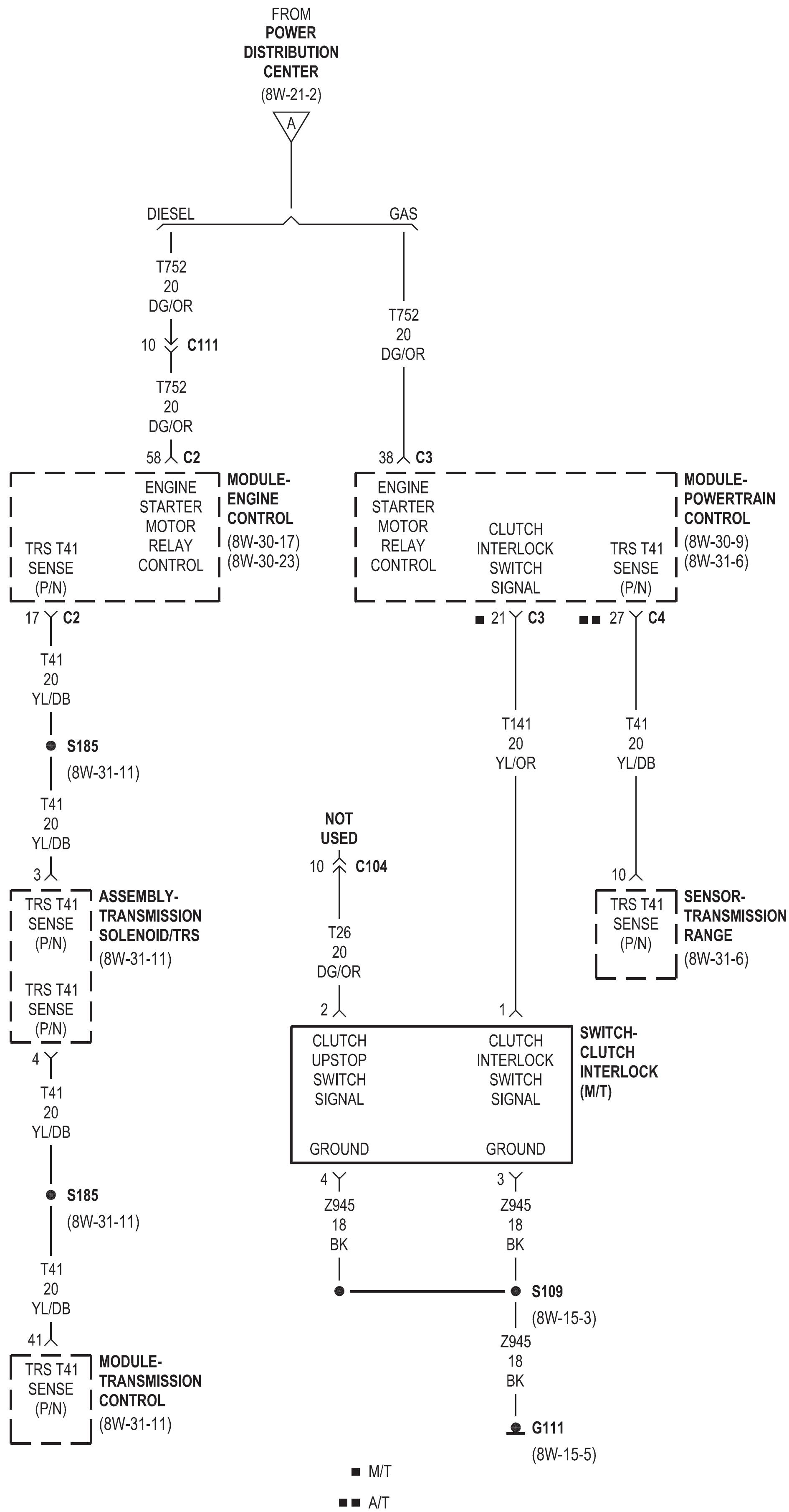

POWER
DISTRIBUTION
CENTER
(8W-10-2)
DIESEL
GAS
RENEGADE
EXCEPT
RENEGADE
A910
6
RD
A910
4
RD
A910
6
RD
EXCEPT
RENEGADE
RENEGADE
FUSIBLE
LINK
A11
10
DG
FUSIBLE
LINK
A11
8
RD
BATTERY
(8W-10-8)
GAS
EXCEPT
RENEGADE
GAS RENEGADE/
DIESEL
A11
6
BR/RD
A11
4
BR/RD
GENERATOR
1
2
DIESEL
GAS
K125
16
BR/DG
K125
16
BR/DG
Z932
18
BK
1
C114
2
1
C108
K125
16
BR/DG
K125
16
BR/DG
Z932
18
BK
14
C120
6
C112
S110
(8W-15-5)
K125
20
BR/DG
K125
16
BR/DG
Z932
14
BK
18
C1
19
C2
GEN
FIELD
CONTROL
MODULE-
BODY
CONTROL
(8W-45-2)
GENERATOR
SOURCE
MODULE-
POWERTRAIN
CONTROL
(8W-30-6)
G111
(8W-15-5)

# 8W-21 STARTING SYSTEM

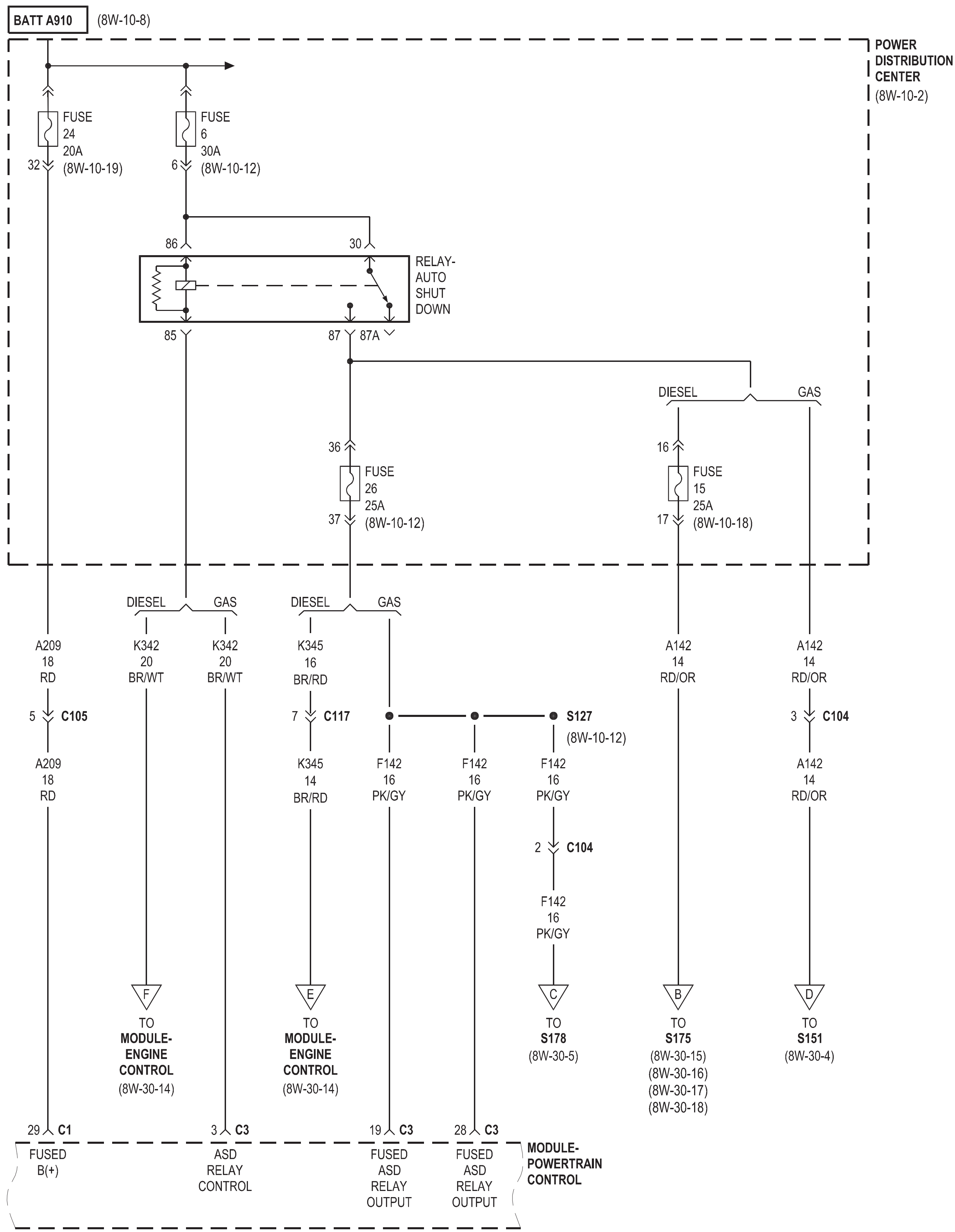


START A106
(8W-10-15)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
41
FUSE
28
15A
40
(8W-10-15)
FUSE
8
40A
8
(8W-10-15)
86
30
RELAY-
STARTER
85
87
87A
T752
20
DG/OR
A
TO
C111
(DIESEL)
MODULE-
POWERTRAIN
CONTROL
(GAS)
(8W-21-3)
T750
12
YL/GY
GAS
DIESEL
5
C108
13
C117
T750
12
YL/GY
A916
12
RD
69
C100
A916
12
RD
9
FUSED
B(+)
SWITCH-
IGNITION
(8W-10-15)
A910
2
RD
GAS
DIESEL
RENEGADE
EXCEPT
RENEGADE
A910
4
RD
A910
6
RD
A910
6
RD
BATTERY
(8W-10-8)
+
-
2
1
M
MOTOR-
STARTER
1 PULL-IN
2 HOLD-IN
A2
16
GY
S123
A2
10
GY
11
FUSED
B(+)
MODULE-
GLOW
PLUG
(DIESEL)
(8W-30-16)

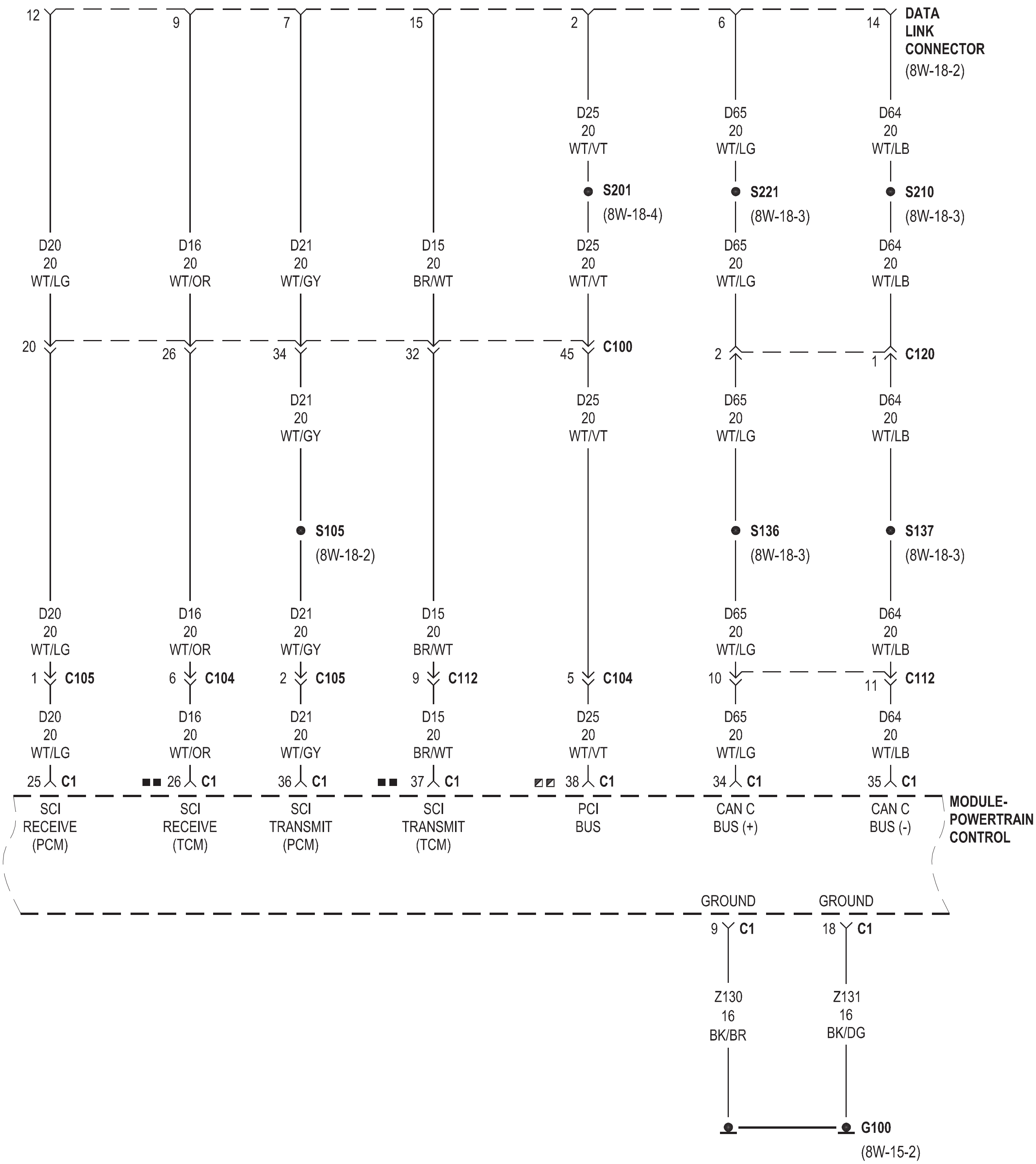
M/T


FROM
POWER
DISTRIBUTION
CENTER
(8W-21-2)
A
DIESEL
GAS
T752
20
DG/OR
10
C111
T752
20
DG/OR
58
C2
38
C3
ENGINE
STARTER
MOTOR
RELAY
CONTROL
TRS T41
SENSE
(P/N)
MODULE-
ENGINE
CONTROL
(8W-30-17)
(8W-30-23)
CLUTCH
INTERLOCK
SWITCH
SIGNAL
MODULE-
POWERTRAIN
CONTROL
(8W-30-9)
(8W-31-6)
17
C2
■ 21
C3
■■ 27
C4
T41
20
YL/DB
S185
(8W-31-11)
T141
20
YL/OR
NOT
USED
10
C104
T26
20
DG/OR
3
ASSEMBLY-
TRANSMISSION
SOLENOID/TRS
(8W-31-11)
10
SENSOR-
TRANSMISSION
RANGE
(8W-31-6)
2
1
CLUTCH
UPSTOP
SWITCH
SIGNAL
GROUND
SWITCH-
CLUTCH
INTERLOCK
(M/T)
4
3
Z945
18
BK
S109
(8W-15-3)
41
MODULE-
TRANSMISSION
CONTROL
(8W-31-11)
G111
(8W-15-5)
■ M/T
■■ A/T

# 8W-30 FUEL/IGNITION SYSTEM

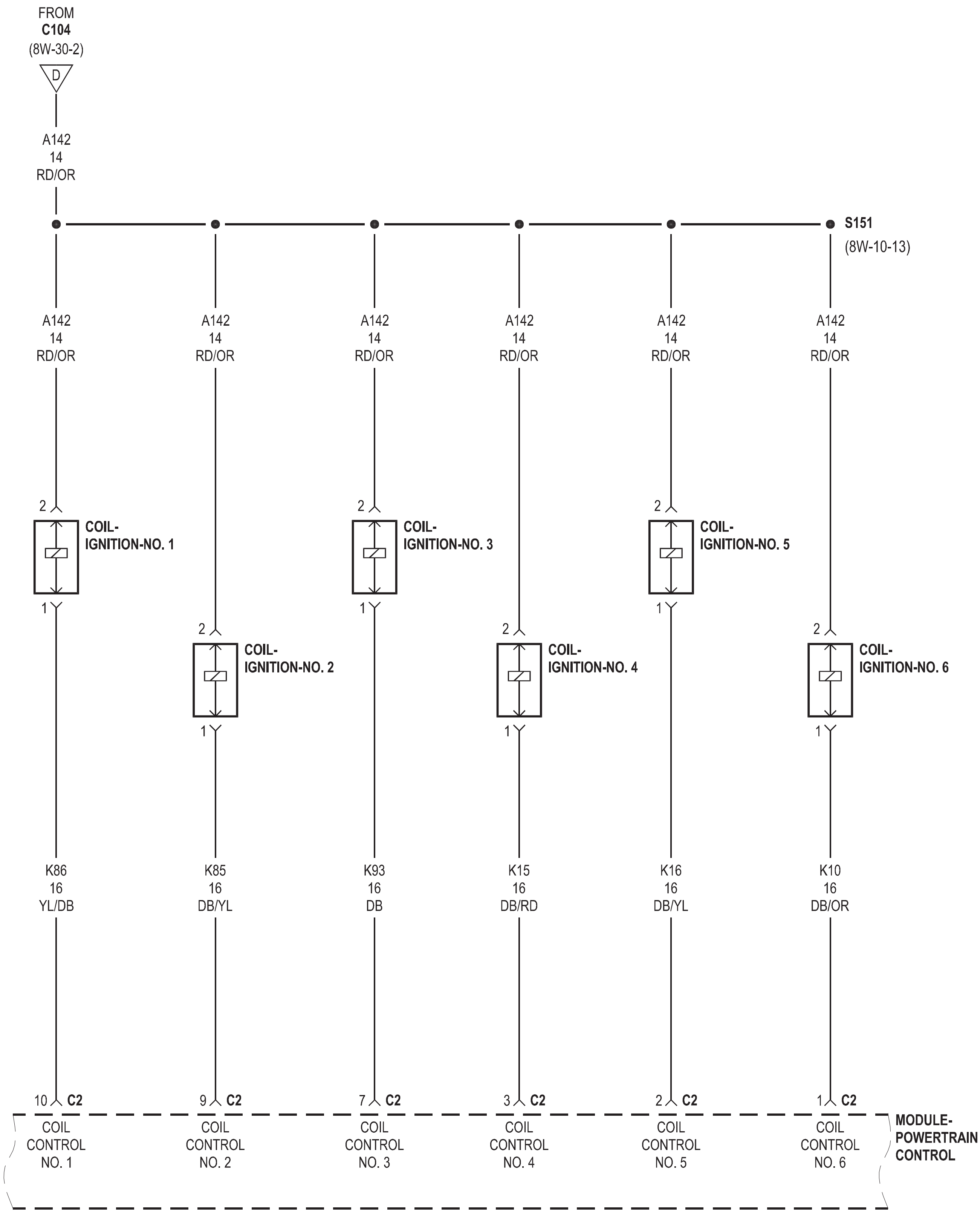


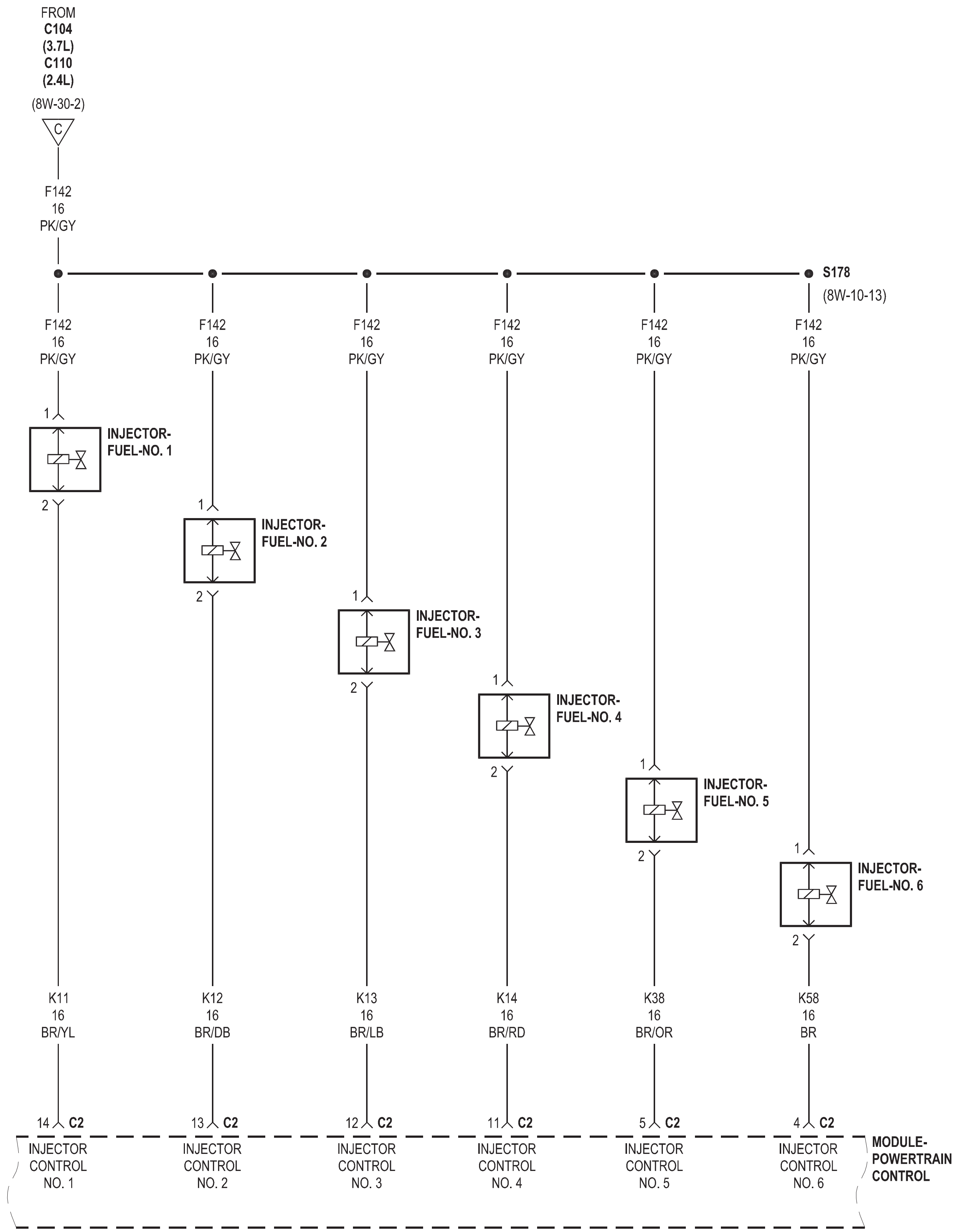
BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 24 20A (8W-10-19)
32
FUSE 6 30A (8W-10-12)
6
86
30
RELAY-AUTO SHUT DOWN
85
87
87A
DIESEL
GAS
36
FUSE 26 25A (8W-10-12)
37
16
FUSE 15 25A (8W-10-18)
17
DIESEL
GAS
DIESEL
GAS
A209 18 RD
K342 20 BR/WT
K342 20 BR/WT
K345 16 BR/RD
A142 14 RD/OR
A142 14 RD/OR
5
C105
7
C117
S127
(8W-10-12)
3
C104
A209 18 RD
K345 14 BR/RD
F142 16 PK/GY
F142 16 PK/GY
F142 16 PK/GY
A142 14 RD/OR
2
C104
F142 16 PK/GY
F
E
C
B
D
TO MODULE-ENGINE CONTROL (8W-30-14)
TO MODULE-ENGINE CONTROL (8W-30-14)
TO S178 (8W-30-5)
TO S175 (8W-30-15) (8W-30-16) (8W-30-17) (8W-30-18)
TO S151 (8W-30-4)
29 C1
3 C3
19 C3
28 C3
FUSED B(+)
ASD RELAY CONTROL
FUSED ASD RELAY OUTPUT
FUSED ASD RELAY OUTPUT
MODULE-POWERTRAIN CONTROL



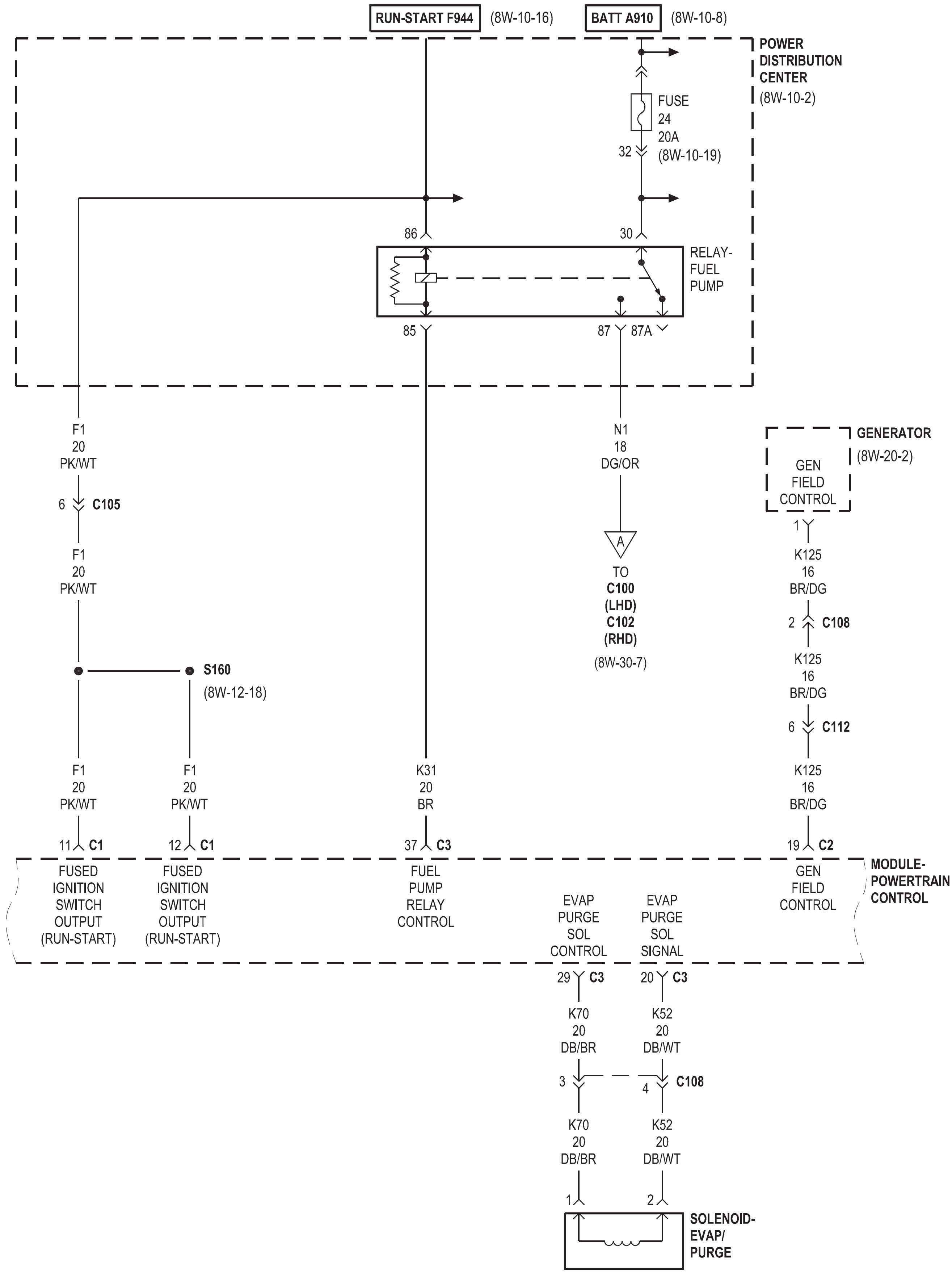

◪◪ EXCEPT 4WD

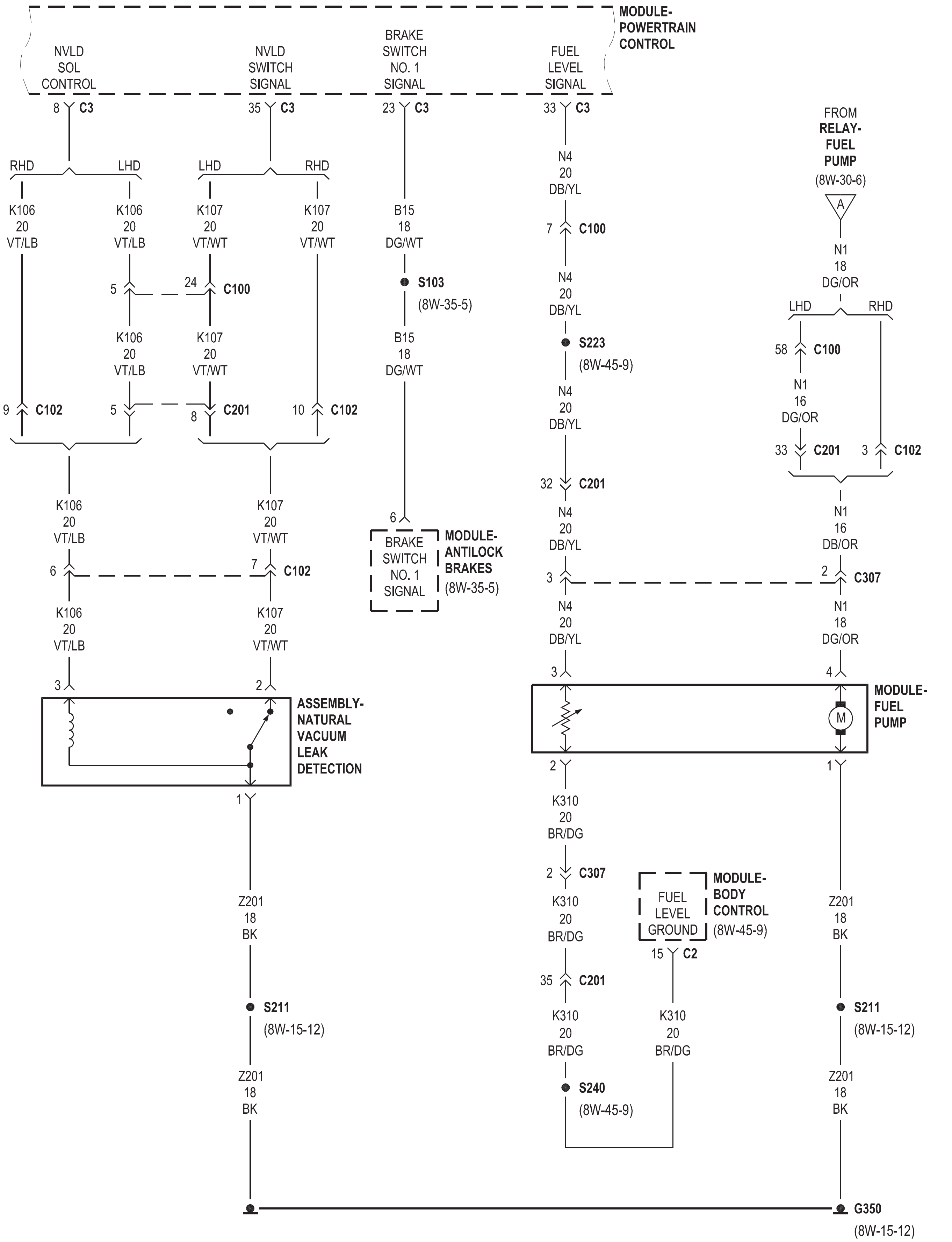
■■ A/T

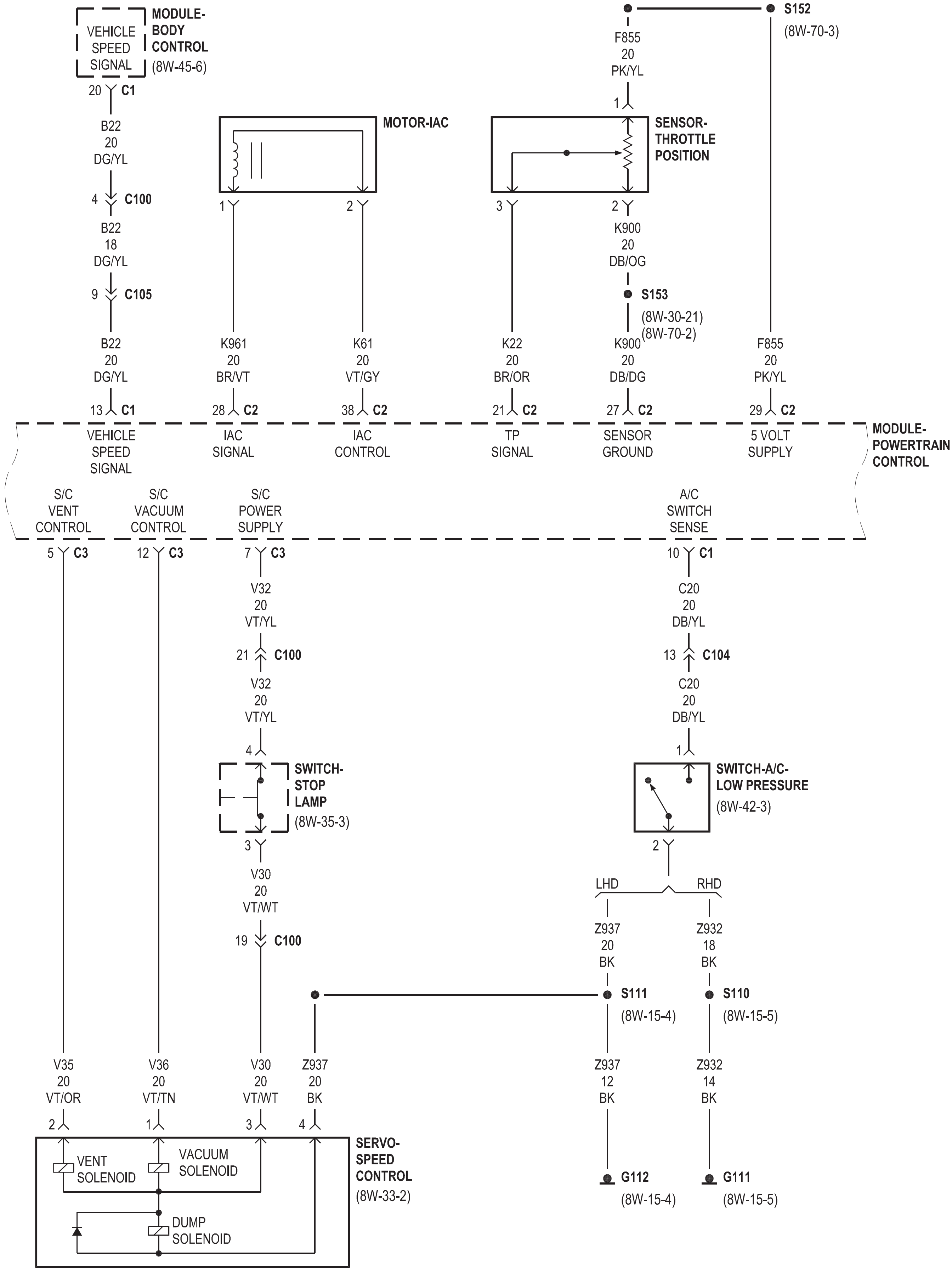

FROM
C104
(8W-30-2)
D
A142
14
RD/OR
S151
(8W-10-13)
A142
14
RD/OR
2
COIL-
IGNITION-NO. 1
1
COIL-
IGNITION-NO. 2
COIL-
IGNITION-NO. 3
COIL-
IGNITION-NO. 4
COIL-
IGNITION-NO. 5
COIL-
IGNITION-NO. 6
K86
16
YL/DB
K85
16
DB/YL
K93
16
DB
K15
16
DB/RD
K16
16
DB/YL
K10
16
DB/OR
10 C2
9 C2
7 C2
3 C2
2 C2
1 C2
COIL
CONTROL
NO. 1
COIL
CONTROL
NO. 2
COIL
CONTROL
NO. 3
COIL
CONTROL
NO. 4
COIL
CONTROL
NO. 5
COIL
CONTROL
NO. 6
MODULE-
POWERTRAIN
CONTROL

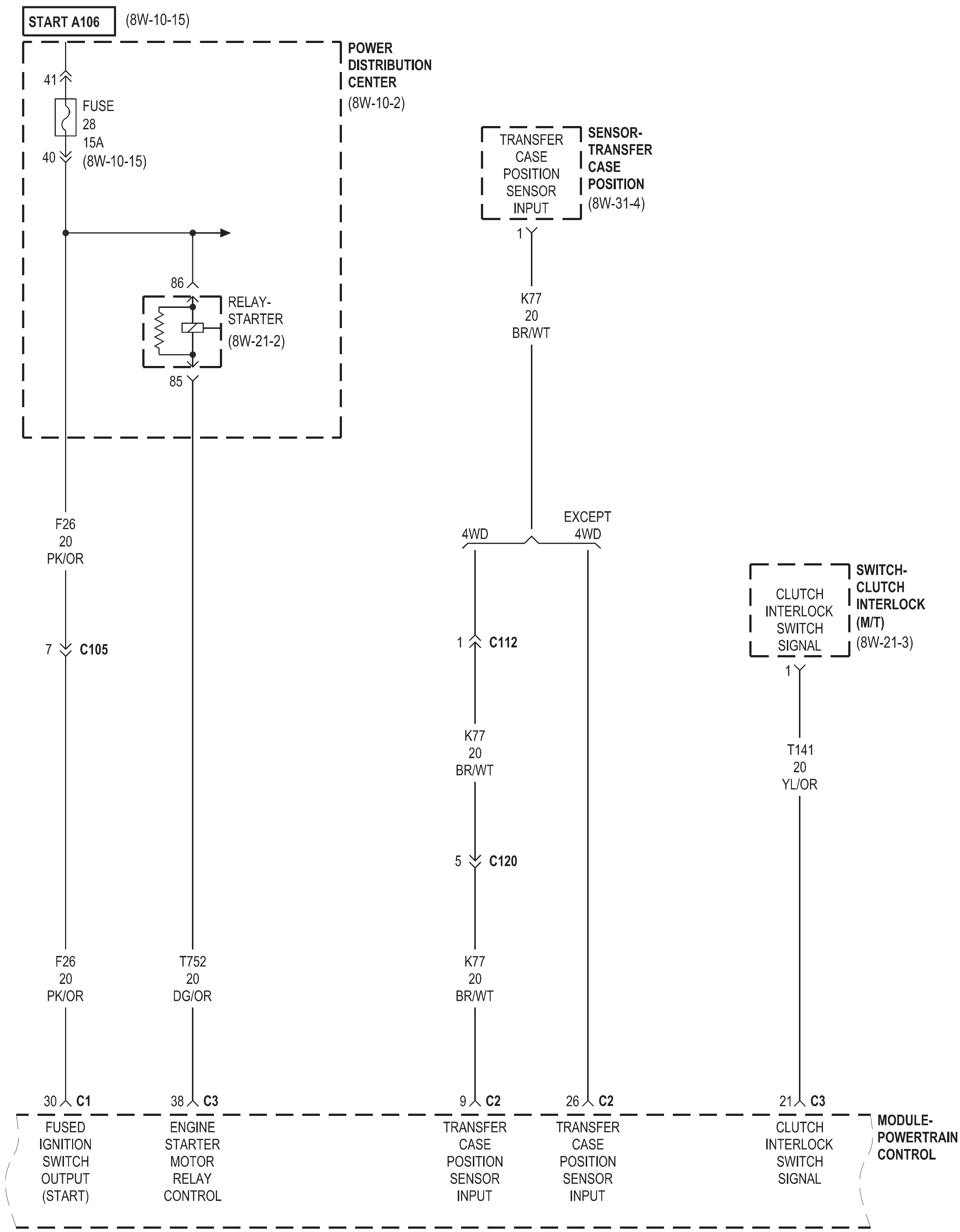

FROM
C104
(3.7L)
C110
(2.4L)
(8W-30-2)
C
F142
16
PK/GY
S178
(8W-10-13)
F142
16
PK/GY
1
2
INJECTOR-
FUEL-NO. 1
INJECTOR-
FUEL-NO. 2
INJECTOR-
FUEL-NO. 3
INJECTOR-
FUEL-NO. 4
INJECTOR-
FUEL-NO. 5
INJECTOR-
FUEL-NO. 6
K11
16
BR/YL
K12
16
BR/DB
K13
16
BR/LB
K14
16
BR/RD
K38
16
BR/OR
K58
16
BR
14 C2
13 C2
12 C2
11 C2
5 C2
4 C2
INJECTOR
CONTROL
NO. 1
INJECTOR
CONTROL
NO. 2
INJECTOR
CONTROL
NO. 3
INJECTOR
CONTROL
NO. 4
INJECTOR
CONTROL
NO. 5
INJECTOR
CONTROL
NO. 6
MODULE-
POWERTRAIN
CONTROL

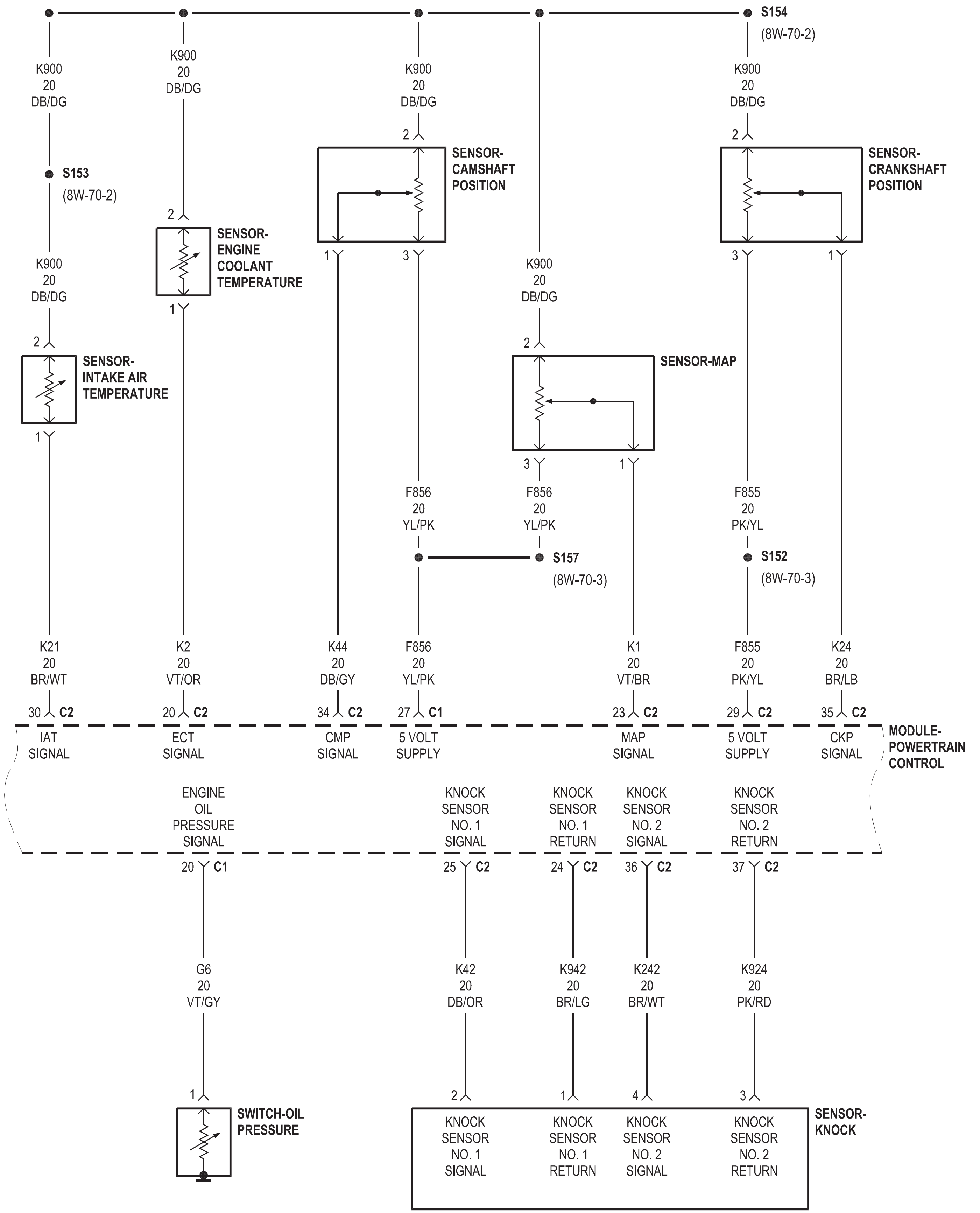
GAS

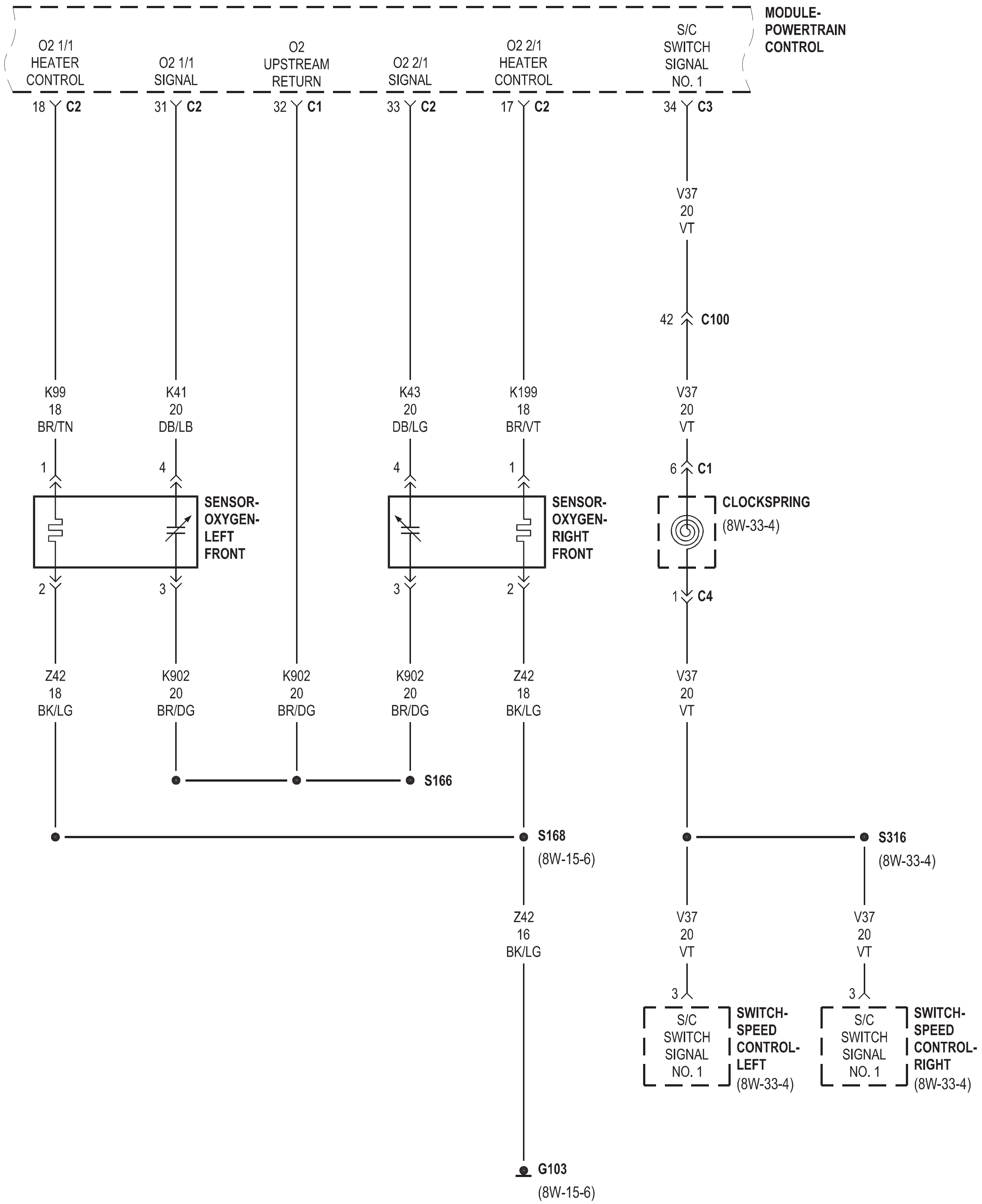

RUN-START F944
(8W-10-16)
BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 24 20A
(8W-10-19)
32
86
30
RELAY-FUEL PUMP
85
87
87A
F1 20 PK/WT
6 C105
F1 20 PK/WT
N1 18 DG/OR
A
TO C100 (LHD) C102 (RHD)
(8W-30-7)
GENERATOR
(8W-20-2)
GEN FIELD CONTROL
1
K125 16 BR/DG
2 C108
K125 16 BR/DG
6 C112
S160
(8W-12-18)
F1 20 PK/WT
F1 20 PK/WT
K31 20 BR
K125 16 BR/DG
11 C1
12 C1
37 C3
19 C2
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUEL PUMP RELAY CONTROL
EVAP PURGE SOL CONTROL
EVAP PURGE SOL SIGNAL
GEN FIELD CONTROL
MODULE-POWERTRAIN CONTROL
29 C3
20 C3
K70 20 DB/BR
K52 20 DB/WT
3
4 C108
K70 20 DB/BR
K52 20 DB/WT
1
2
SOLENOID-EVAP/PURGE

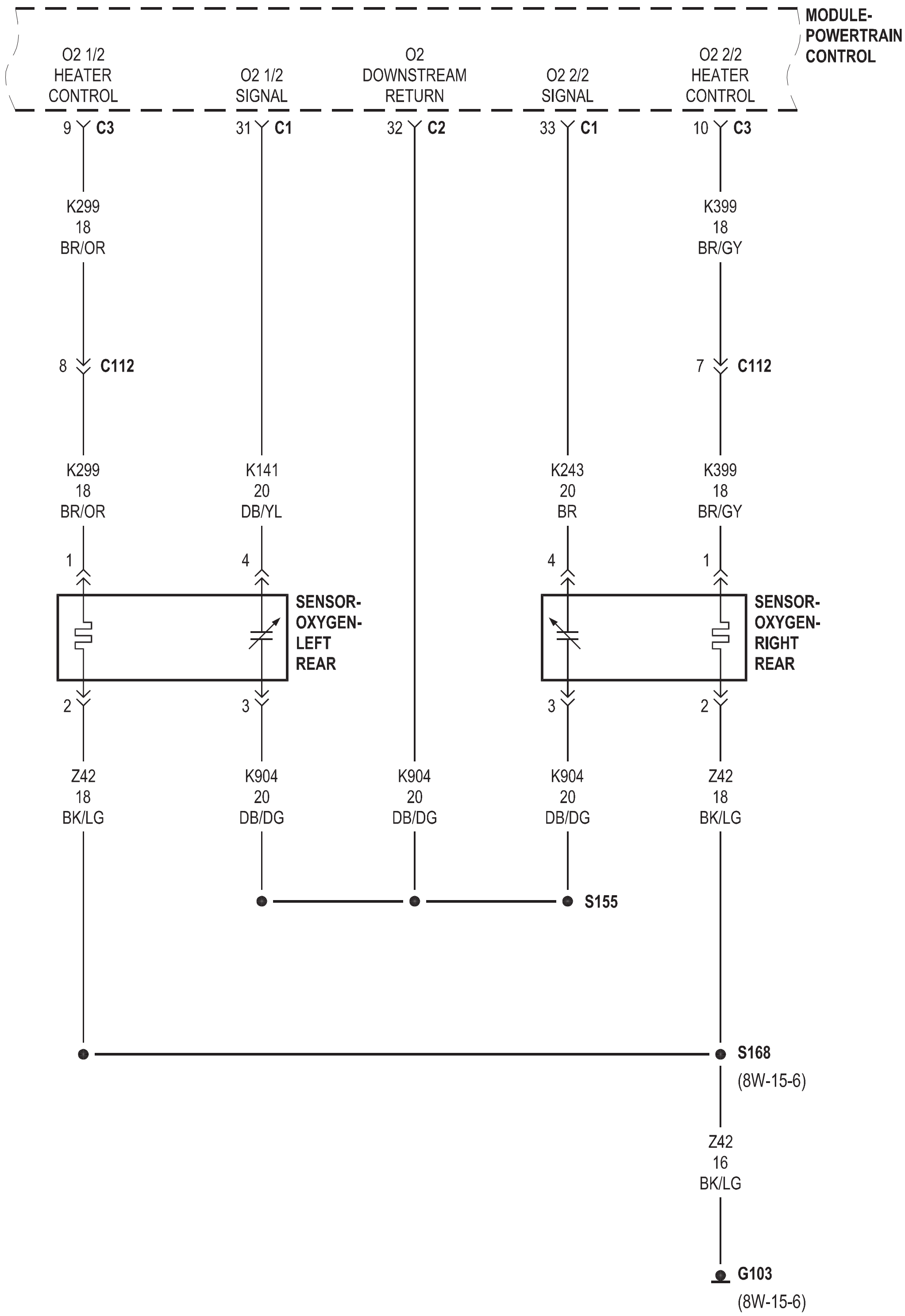

MODULE-
POWERTRAIN
CONTROL
NVLD
SOL
CONTROL
NVLD
SWITCH
SIGNAL
BRAKE
SWITCH
NO. 1
SIGNAL
FUEL
LEVEL
SIGNAL
8 C3
35 C3
23 C3
33 C3
RHD
LHD
LHD
RHD
K106
20
VT/LB
K107
20
VT/WT
B15
18
DG/WT
N4
20
DB/YL
7 C100
5
24 C100
S103
(8W-35-5)
S223
(8W-45-9)
9 C102
5
8 C201
10 C102
32 C201
FROM
RELAY-
FUEL
PUMP
(8W-30-6)
A
N1
18
DG/OR
58 C100
N1
16
DG/OR
33 C201
3 C102
N1
16
DB/OR
6
MODULE-
ANTILOCK
BRAKES
(8W-35-5)
6
7 C102
3
2 C307
ASSEMBLY-
NATURAL
VACUUM
LEAK
DETECTION
MODULE-
FUEL
PUMP
M
K310
20
BR/DG
2 C307
35 C201
MODULE-
BODY
CONTROL
(8W-45-9)
FUEL
LEVEL
GROUND
15 C2
Z201
18
BK
S211
(8W-15-12)
S240
(8W-45-9)
G350
(8W-15-12)

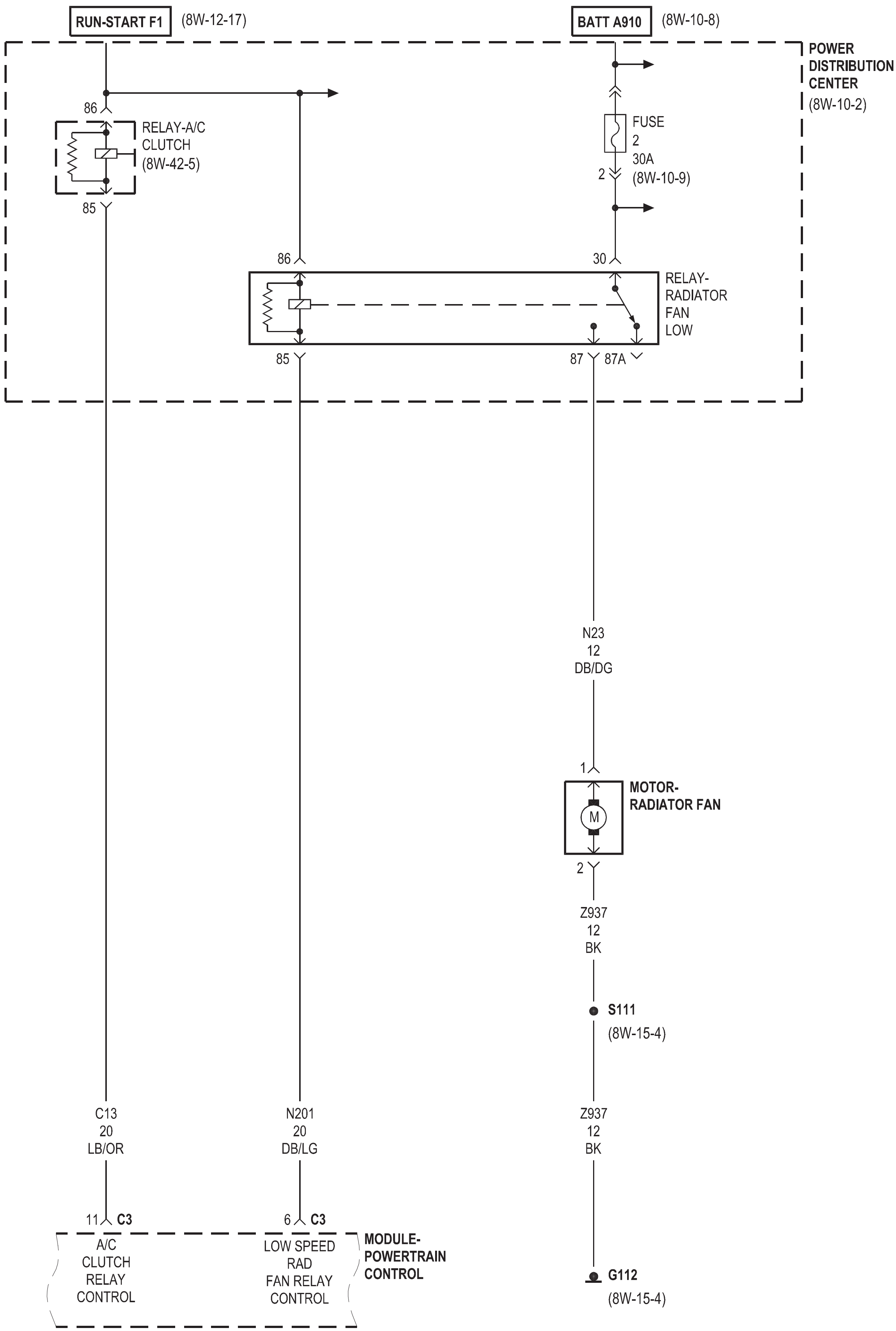

MODULE-BODY CONTROL
(8W-45-6)
VEHICLE SPEED SIGNAL
20 C1
B22 20 DG/YL
4 C100
B22 18 DG/YL
9 C105
B22 20 DG/YL
13 C1
MOTOR-IAC
1
2
K961 20 BR/VT
28 C2
K61 20 VT/GY
38 C2
S152
(8W-70-3)
F855 20 PK/YL
1
SENSOR-THROTTLE POSITION
3
2
K900 20 DB/OG
S153
(8W-30-21)
(8W-70-2)
K22 20 BR/OR
21 C2
K900 20 DB/DG
27 C2
F855 20 PK/YL
29 C2
MODULE-POWERTRAIN CONTROL
VEHICLE SPEED SIGNAL
IAC SIGNAL
IAC CONTROL
TP SIGNAL
SENSOR GROUND
5 VOLT SUPPLY
S/C VENT CONTROL
S/C VACUUM CONTROL
S/C POWER SUPPLY
A/C SWITCH SENSE
5 C3
12 C3
7 C3
10 C1
V32 20 VT/YL
21 C100
V32 20 VT/YL
4
SWITCH-STOP LAMP
(8W-35-3)
3
V30 20 VT/WT
19 C100
C20 20 DB/YL
13 C104
C20 20 DB/YL
1
SWITCH-A/C-LOW PRESSURE
(8W-42-3)
2
LHD
RHD
Z937 20 BK
Z932 18 BK
S111
(8W-15-4)
S110
(8W-15-5)
V35 20 VT/OR
V36 20 VT/TN
V30 20 VT/WT
Z937 20 BK
Z937 12 BK
Z932 14 BK
2
1
3
4
VENT SOLENOID
VACUUM SOLENOID
DUMP SOLENOID
SERVO-SPEED CONTROL
(8W-33-2)
G112
(8W-15-4)
G111
(8W-15-5)

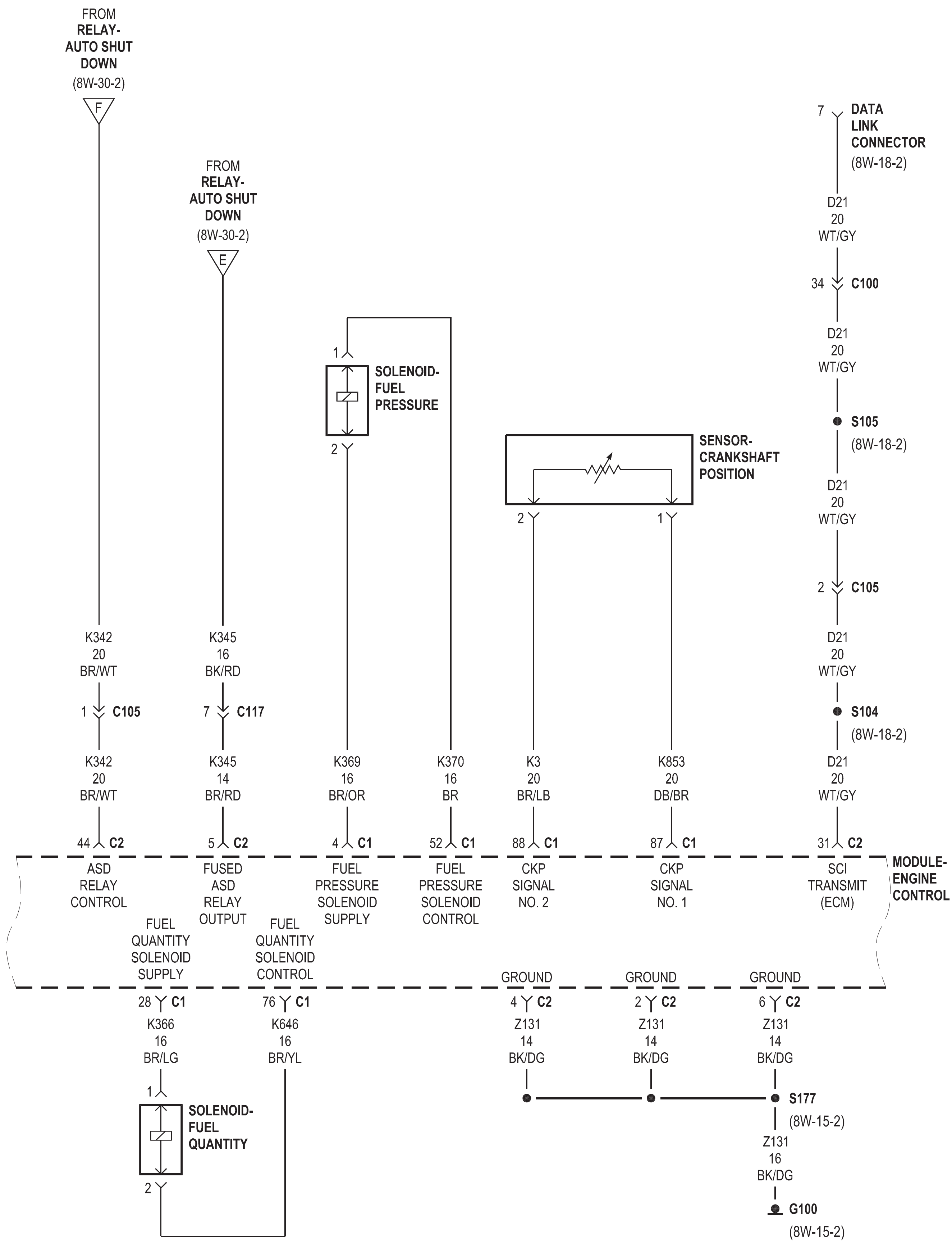

START A106
(8W-10-15)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
41
FUSE
28
15A
(8W-10-15)
40
86
RELAY-
STARTER
(8W-21-2)
85
TRANSFER
CASE
POSITION
SENSOR
INPUT
SENSOR-
TRANSFER
CASE
POSITION
(8W-31-4)
1
K77
20
BR/WT
F26
20
PK/OR
4WD
EXCEPT
4WD
SWITCH-
CLUTCH
INTERLOCK
(M/T)
(8W-21-3)
CLUTCH
INTERLOCK
SWITCH
SIGNAL
1
7 C105
1 C112
K77
20
BR/WT
T141
20
YL/OR
5 C120
F26
20
PK/OR
T752
20
DG/OR
K77
20
BR/WT
30 C1
38 C3
9 C2
26 C2
21 C3
MODULE-
POWERTRAIN
CONTROL
FUSED
IGNITION
SWITCH
OUTPUT
(START)
ENGINE
STARTER
MOTOR
RELAY
CONTROL
TRANSFER
CASE
POSITION
SENSOR
INPUT
TRANSFER
CASE
POSITION
SENSOR
INPUT
CLUTCH
INTERLOCK
SWITCH
SIGNAL

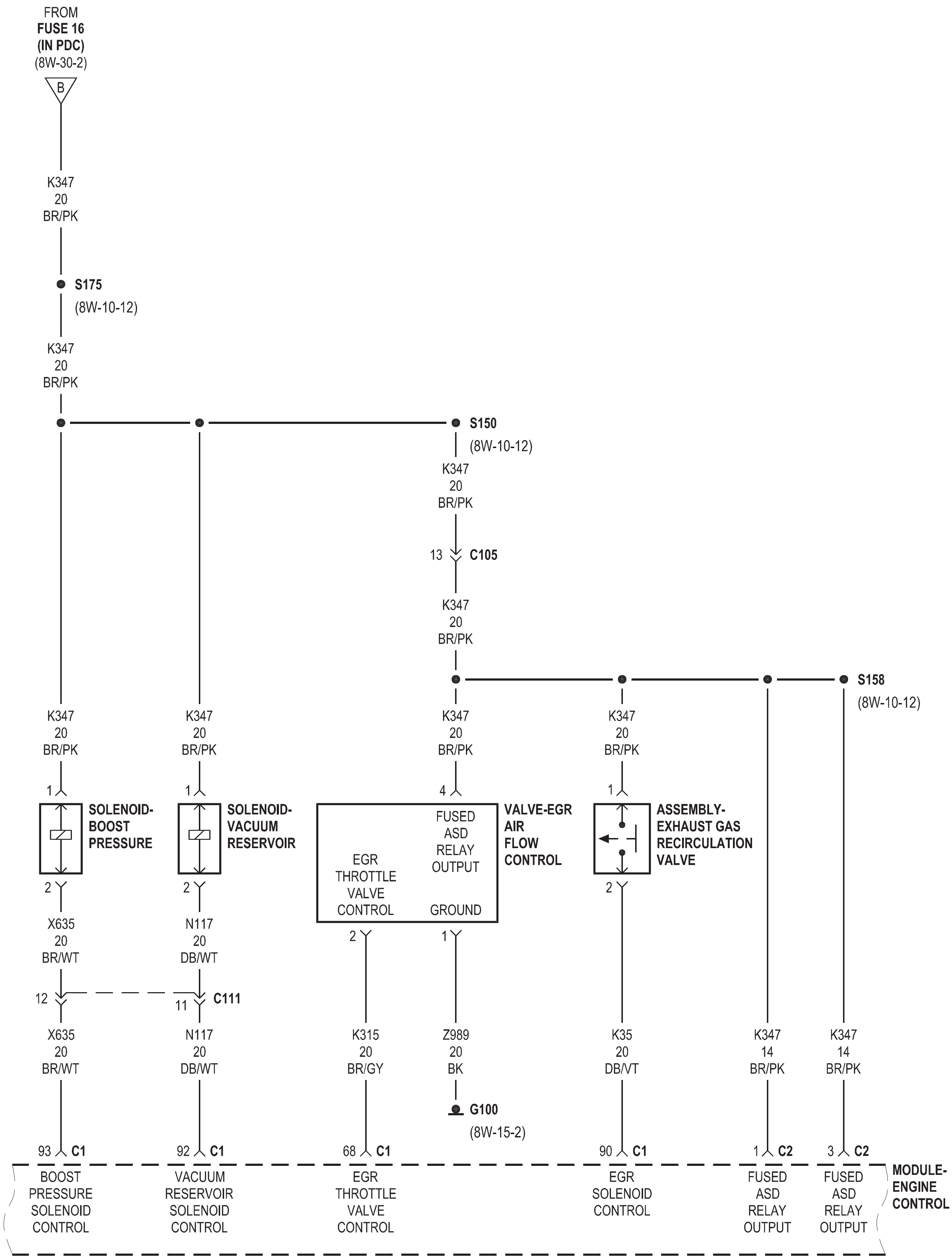

S154
(8W-70-2)
K900
20
DB/DG
S153
(8W-70-2)
SENSOR-
CAMSHAFT
POSITION
SENSOR-
CRANKSHAFT
POSITION
SENSOR-
ENGINE
COOLANT
TEMPERATURE
SENSOR-
INTAKE AIR
TEMPERATURE
SENSOR-MAP
F856
20
YL/PK
S157
(8W-70-3)
F855
20
PK/YL
S152
(8W-70-3)
K21
20
BR/WT
K2
20
VT/OR
K44
20
DB/GY
K1
20
VT/BR
K24
20
BR/LB
30 C2
20 C2
34 C2
27 C1
23 C2
29 C2
35 C2
IAT
SIGNAL
ECT
SIGNAL
CMP
SIGNAL
5 VOLT
SUPPLY
MAP
SIGNAL
CKP
SIGNAL
MODULE-
POWERTRAIN
CONTROL
ENGINE
OIL
PRESSURE
SIGNAL
KNOCK
SENSOR
NO. 1
SIGNAL
RETURN
NO. 2
20 C1
25 C2
24 C2
36 C2
37 C2
G6
20
VT/GY
K42
DB/OR
K942
BR/LG
K242
BR/WT
K924
PK/RD
SWITCH-OIL
PRESSURE
SENSOR-
KNOCK

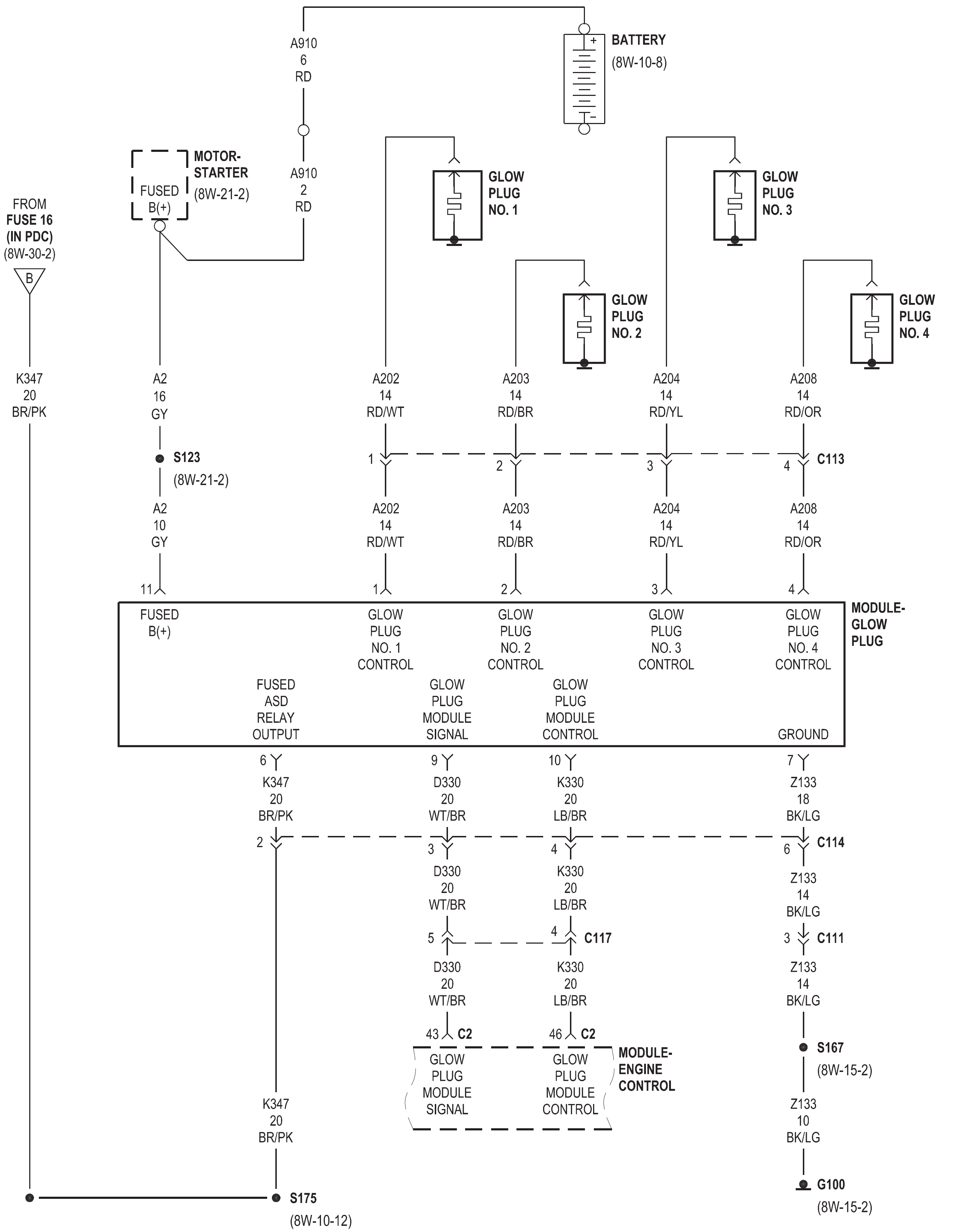

MODULE-
POWERTRAIN
CONTROL
O2 1/1
HEATER
CONTROL
O2 1/1
SIGNAL
O2
UPSTREAM
RETURN
O2 2/1
SIGNAL
O2 2/1
HEATER
CONTROL
S/C
SWITCH
SIGNAL
NO. 1
18 C2
31 C2
32 C1
33 C2
17 C2
34 C3
V37
20
VT
42 C100
K99
18
BR/TN
K41
20
DB/LB
K43
20
DB/LG
K199
18
BR/VT
V37
20
VT
1
4
4
1
6 C1
SENSOR-
OXYGEN-
LEFT
FRONT
SENSOR-
OXYGEN-
RIGHT
FRONT
CLOCKSPRING
(8W-33-4)
2
3
3
2
1 C4
Z42
18
BK/LG
K902
20
BR/DG
K902
20
BR/DG
K902
20
BR/DG
Z42
18
BK/LG
V37
20
VT
S166
S168
(8W-15-6)
S316
(8W-33-4)
Z42
16
BK/LG
V37
20
VT
V37
20
VT
3
3
S/C
SWITCH
SIGNAL
NO. 1
SWITCH-
SPEED
CONTROL-
LEFT
(8W-33-4)
S/C
SWITCH
SIGNAL
NO. 1
SWITCH-
SPEED
CONTROL-
RIGHT
(8W-33-4)
G103
(8W-15-6)


MODULE-
POWERTRAIN
CONTROL
O2 1/2
HEATER
CONTROL
O2 1/2
SIGNAL
O2
DOWNSTREAM
RETURN
O2 2/2
SIGNAL
O2 2/2
HEATER
CONTROL
9 C3
31 C1
32 C2
33 C1
10 C3
K299
18
BR/OR
K399
18
BR/GY
8 C112
7 C112
K299
18
BR/OR
K141
20
DB/YL
K243
20
BR
K399
18
BR/GY
1
4
4
1
SENSOR-
OXYGEN-
LEFT
REAR
SENSOR-
OXYGEN-
RIGHT
REAR
2
3
3
2
Z42
18
BK/LG
K904
20
DB/DG
K904
20
DB/DG
K904
20
DB/DG
Z42
18
BK/LG
S155
S168
(8W-15-6)
Z42
16
BK/LG
G103
(8W-15-6)

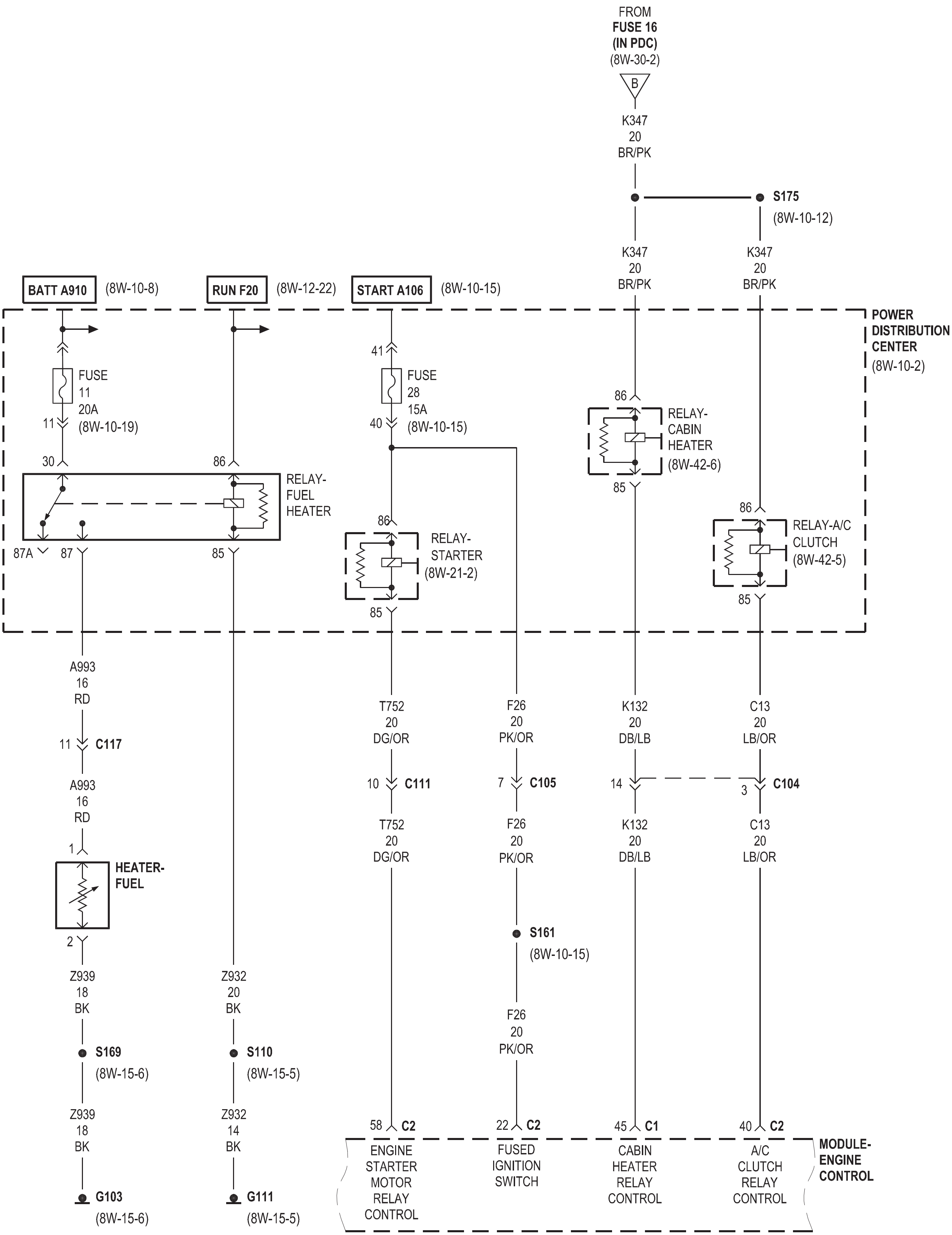

RUN-START F1
(8W-12-17)
BATT A910
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
86
RELAY-A/C
CLUTCH
(8W-42-5)
85
FUSE
2
30A
(8W-10-9)
2
86
30
RELAY-
RADIATOR
FAN
LOW
85
87
87A
N23
12
DB/DG
1
MOTOR-
RADIATOR FAN
M
2
Z937
12
BK
S111
(8W-15-4)
C13
20
LB/OR
N201
20
DB/LG
Z937
12
BK
11 C3
6 C3
A/C
CLUTCH
RELAY
CONTROL
LOW SPEED
RAD
FAN RELAY
CONTROL
MODULE-
POWERTRAIN
CONTROL
G112
(8W-15-4)

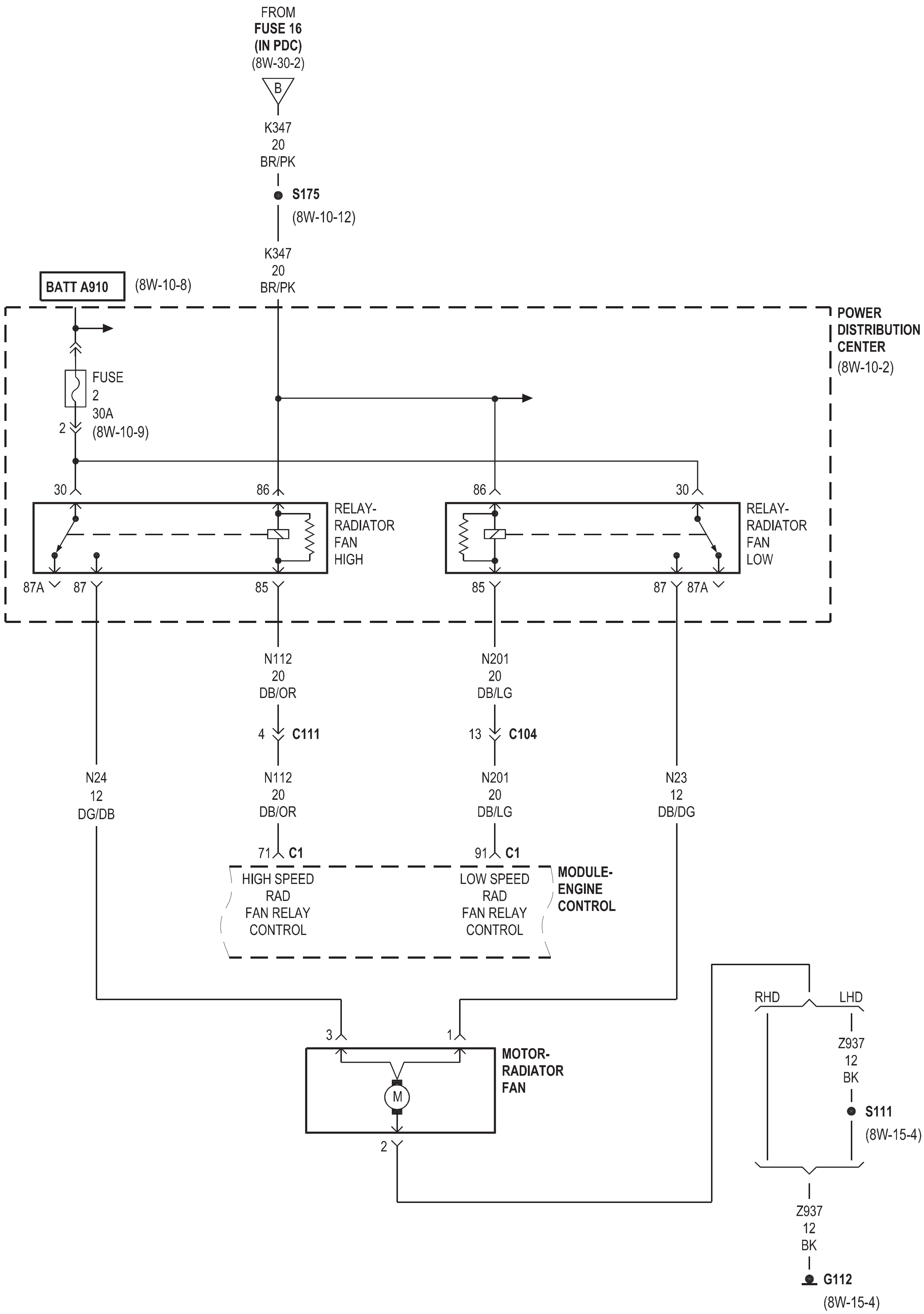

FROM
RELAY-
AUTO SHUT
DOWN
(8W-30-2)
F
FROM
RELAY-
AUTO SHUT
DOWN
(8W-30-2)
E
7 DATA
LINK
CONNECTOR
(8W-18-2)
D21
20
WT/GY
34 C100
D21
20
WT/GY
S105
(8W-18-2)
D21
20
WT/GY
2 C105
D21
20
WT/GY
S104
(8W-18-2)
D21
20
WT/GY
1
SOLENOID-
FUEL
PRESSURE
2
SENSOR-
CRANKSHAFT
POSITION
2
1
K342
20
BR/WT
1 C105
K342
20
BR/WT
K345
16
BK/RD
7 C117
K345
14
BR/RD
K369
16
BR/OR
K370
16
BR
K3
20
BR/LB
K853
20
DB/BR
44 C2
5 C2
4 C1
52 C1
88 C1
87 C1
31 C2
MODULE-
ENGINE
CONTROL
ASD
RELAY
CONTROL
FUSED
ASD
RELAY
OUTPUT
FUEL
PRESSURE
SOLENOID
SUPPLY
FUEL
PRESSURE
SOLENOID
CONTROL
CKP
SIGNAL
NO. 2
CKP
SIGNAL
NO. 1
SCI
TRANSMIT
(ECM)
FUEL
QUANTITY
SOLENOID
SUPPLY
FUEL
QUANTITY
SOLENOID
CONTROL
GROUND
GROUND
GROUND
28 C1
76 C1
4 C2
2 C2
6 C2
K366
16
BR/LG
K646
16
BR/YL
Z131
14
BK/DG
Z131
14
BK/DG
Z131
14
BK/DG
1
SOLENOID-
FUEL
QUANTITY
2
S177
(8W-15-2)
Z131
16
BK/DG
G100
(8W-15-2)

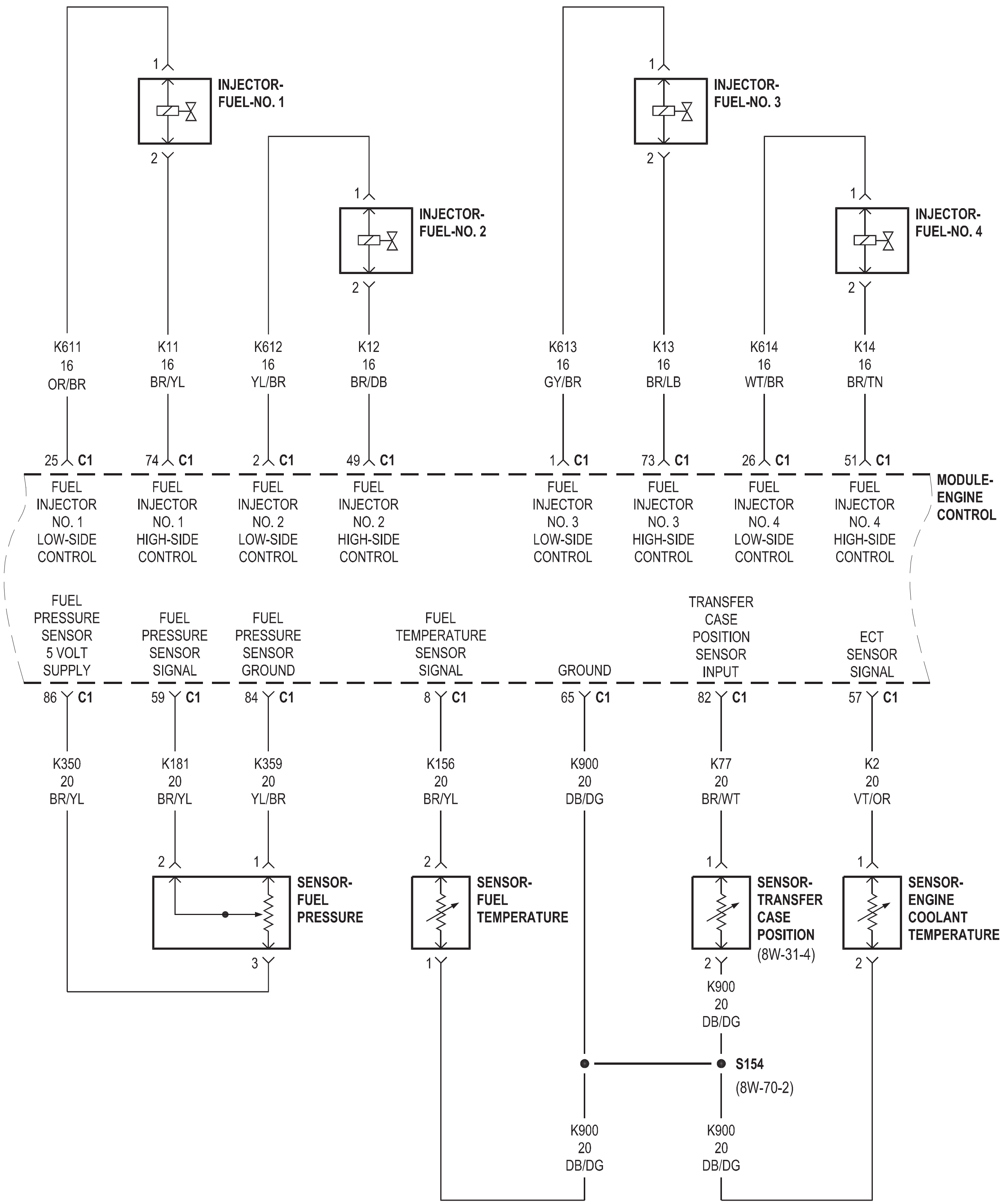

FROM
FUSE 16
(IN PDC)
(8W-30-2)
B
K347
20
BR/PK
S175
(8W-10-12)
K347
20
BR/PK
S150
(8W-10-12)
K347
20
BR/PK
13
C105
K347
20
BR/PK
S158
(8W-10-12)
K347
20
BR/PK
K347
20
BR/PK
K347
20
BR/PK
K347
20
BR/PK
1
SOLENOID-
BOOST
PRESSURE
2
1
SOLENOID-
VACUUM
RESERVOIR
2
4
FUSED
ASD
RELAY
OUTPUT
EGR
THROTTLE
VALVE
CONTROL
GROUND
VALVE-EGR
AIR
FLOW
CONTROL
2
1
1
ASSEMBLY-
EXHAUST GAS
RECIRCULATION
VALVE
2
X635
20
BR/WT
N117
20
DB/WT
12
11
C111
X635
20
BR/WT
N117
20
DB/WT
K315
20
BR/GY
Z989
20
BK
G100
(8W-15-2)
K35
20
DB/VT
K347
14
BR/PK
K347
14
BR/PK
93 C1
92 C1
68 C1
90 C1
1 C2
3 C2
BOOST
PRESSURE
SOLENOID
CONTROL
VACUUM
RESERVOIR
SOLENOID
CONTROL
EGR
THROTTLE
VALVE
CONTROL
EGR
SOLENOID
CONTROL
FUSED
ASD
RELAY
OUTPUT
FUSED
ASD
RELAY
OUTPUT
MODULE-
ENGINE
CONTROL

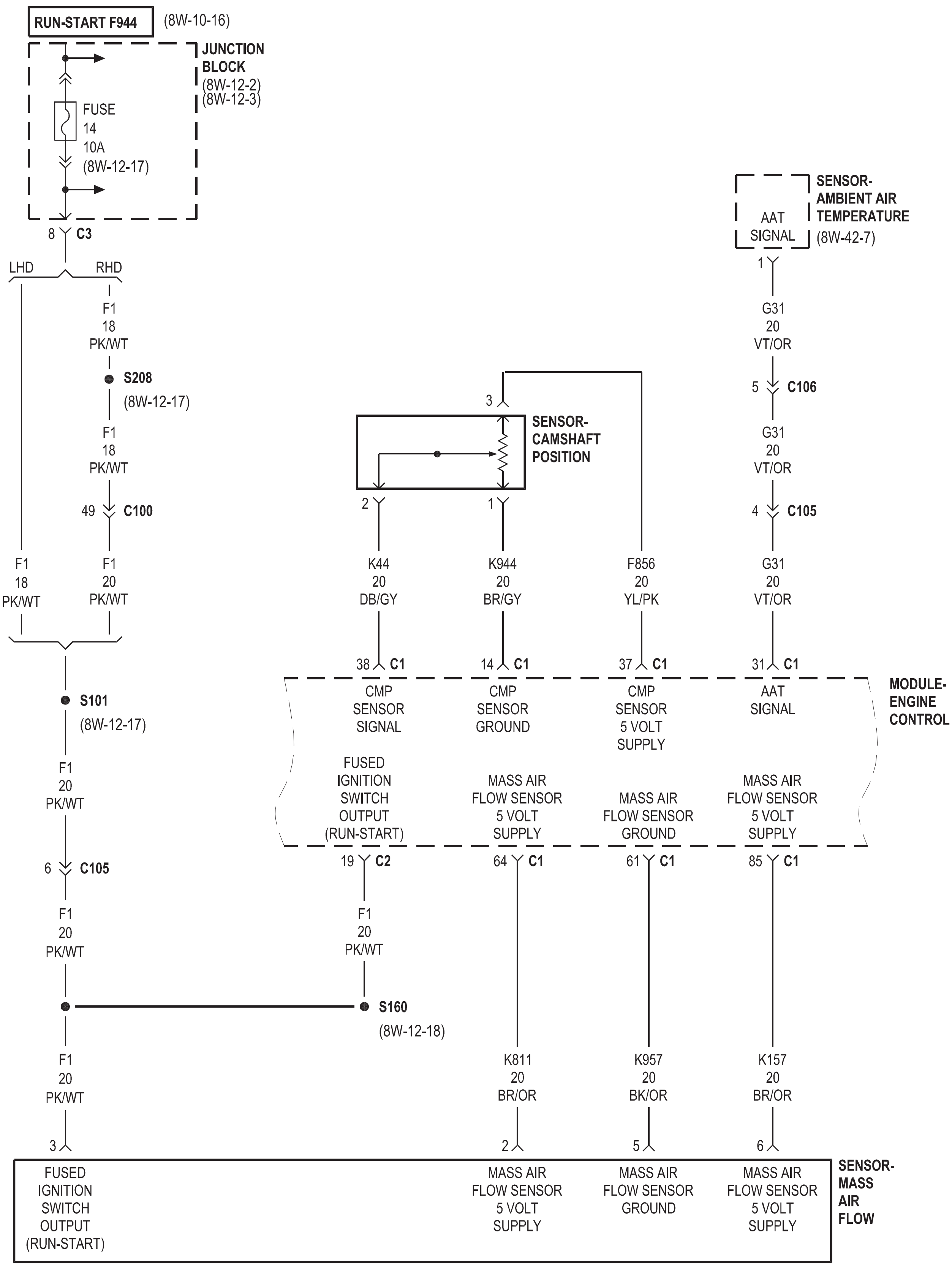

A910
6
RD
BATTERY
(8W-10-8)
MOTOR-
STARTER
(8W-21-2)
FUSED
B(+)
A910
2
RD
FROM
FUSE 16
(IN PDC)
(8W-30-2)
B
GLOW
PLUG
NO. 1
GLOW
PLUG
NO. 3
GLOW
PLUG
NO. 2
GLOW
PLUG
NO. 4
K347
20
BR/PK
A2
16
GY
A202
14
RD/WT
A203
14
RD/BR
A204
14
RD/YL
A208
14
RD/OR
S123
(8W-21-2)
C113
A2
10
GY
MODULE-
GLOW
PLUG
FUSED
B(+)
GLOW
PLUG
NO. 1
CONTROL
GLOW
PLUG
NO. 2
CONTROL
GLOW
PLUG
NO. 3
CONTROL
GLOW
PLUG
NO. 4
CONTROL
FUSED
ASD
RELAY
OUTPUT
GLOW
PLUG
MODULE
SIGNAL
GLOW
PLUG
MODULE
CONTROL
GROUND
D330
20
WT/BR
K330
20
LB/BR
Z133
18
BK/LG
C114
Z133
14
BK/LG
C117
C111
C2
MODULE-
ENGINE
CONTROL
S167
(8W-15-2)
Z133
10
BK/LG
G100
(8W-15-2)
S175
(8W-10-12)

# DIESEL

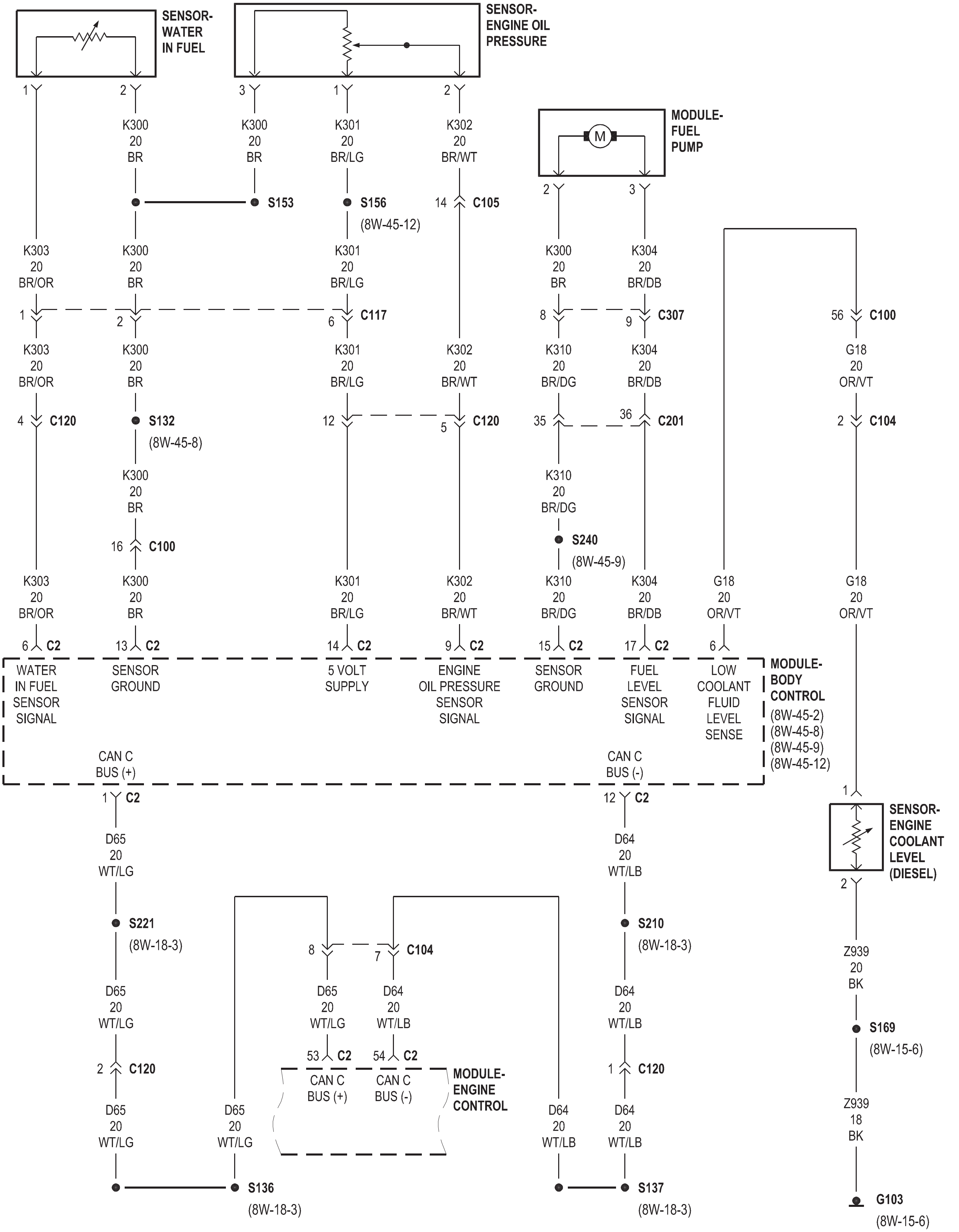

FROM
FUSE 16
(IN PDC)
(8W-30-2)
B
K347
20
BR/PK
S175
(8W-10-12)
K347
20
BR/PK
K347
20
BR/PK
BATT A910
(8W-10-8)
RUN F20
(8W-12-22)
START A106
(8W-10-15)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
11
20A
(8W-10-19)
41
FUSE
28
15A
40
(8W-10-15)
11
30
86
RELAY-
FUEL
HEATER
87A
87
85
86
RELAY-
CABIN
HEATER
(8W-42-6)
85
86
RELAY-
STARTER
(8W-21-2)
85
86
RELAY-A/C
CLUTCH
(8W-42-5)
85
A993
16
RD
11
C117
A993
16
RD
1
HEATER-
FUEL
2
Z939
18
BK
S169
(8W-15-6)
Z939
18
BK
G103
(8W-15-6)
Z932
20
BK
S110
(8W-15-5)
Z932
14
BK
G111
(8W-15-5)
T752
20
DG/OR
10
C111
T752
20
DG/OR
F26
20
PK/OR
7
C105
F26
20
PK/OR
S161
(8W-10-15)
F26
20
PK/OR
K132
20
DB/LB
14
K132
20
DB/LB
C13
20
LB/OR
3
C104
C13
20
LB/OR
58
C2
22
C2
45
C1
40
C2
ENGINE
STARTER
MOTOR
RELAY
CONTROL
FUSED
IGNITION
SWITCH
CABIN
HEATER
RELAY
CONTROL
A/C
CLUTCH
RELAY
CONTROL
MODULE-
ENGINE
CONTROL

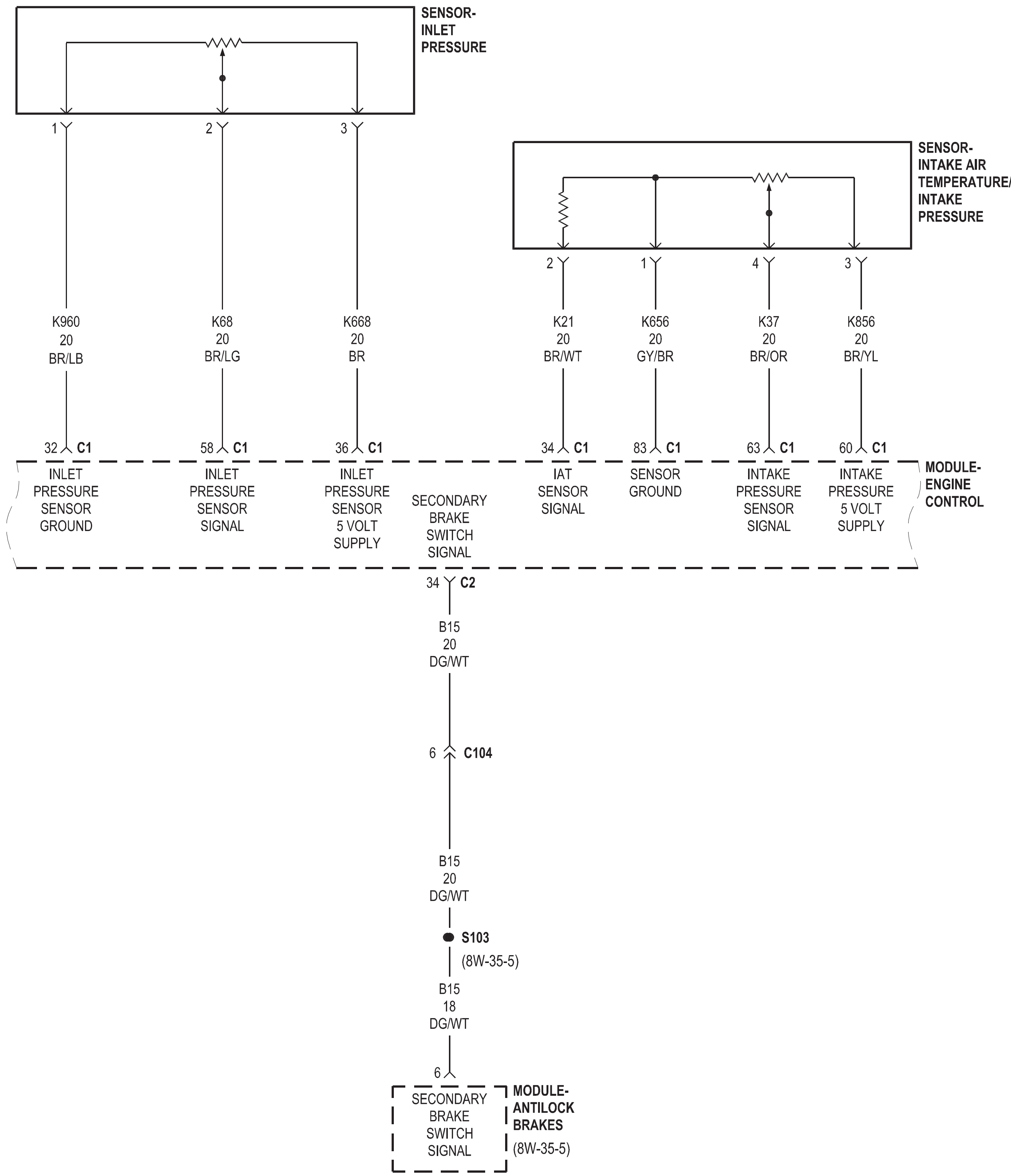

FROM
FUSE 16
(IN PDC)
(8W-30-2)
B
K347
20
BR/PK
S175
(8W-10-12)
K347
20
BR/PK
BATT A910
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
2
30A
(8W-10-9)
2
30
86
86
30
RELAY-
RADIATOR
FAN
HIGH
RELAY-
RADIATOR
FAN
LOW
87A
87
85
85
87
87A
N112
20
DB/OR
4
C111
N201
20
DB/LG
13
C104
N24
12
DG/DB
N112
20
DB/OR
N201
20
DB/LG
N23
12
DB/DG
71
C1
91
C1
HIGH SPEED
RAD
FAN RELAY
CONTROL
LOW SPEED
RAD
FAN RELAY
CONTROL
MODULE-
ENGINE
CONTROL
RHD
LHD
3
1
MOTOR-
RADIATOR
FAN
M
Z937
12
BK
S111
(8W-15-4)
2
Z937
12
BK
G112
(8W-15-4)

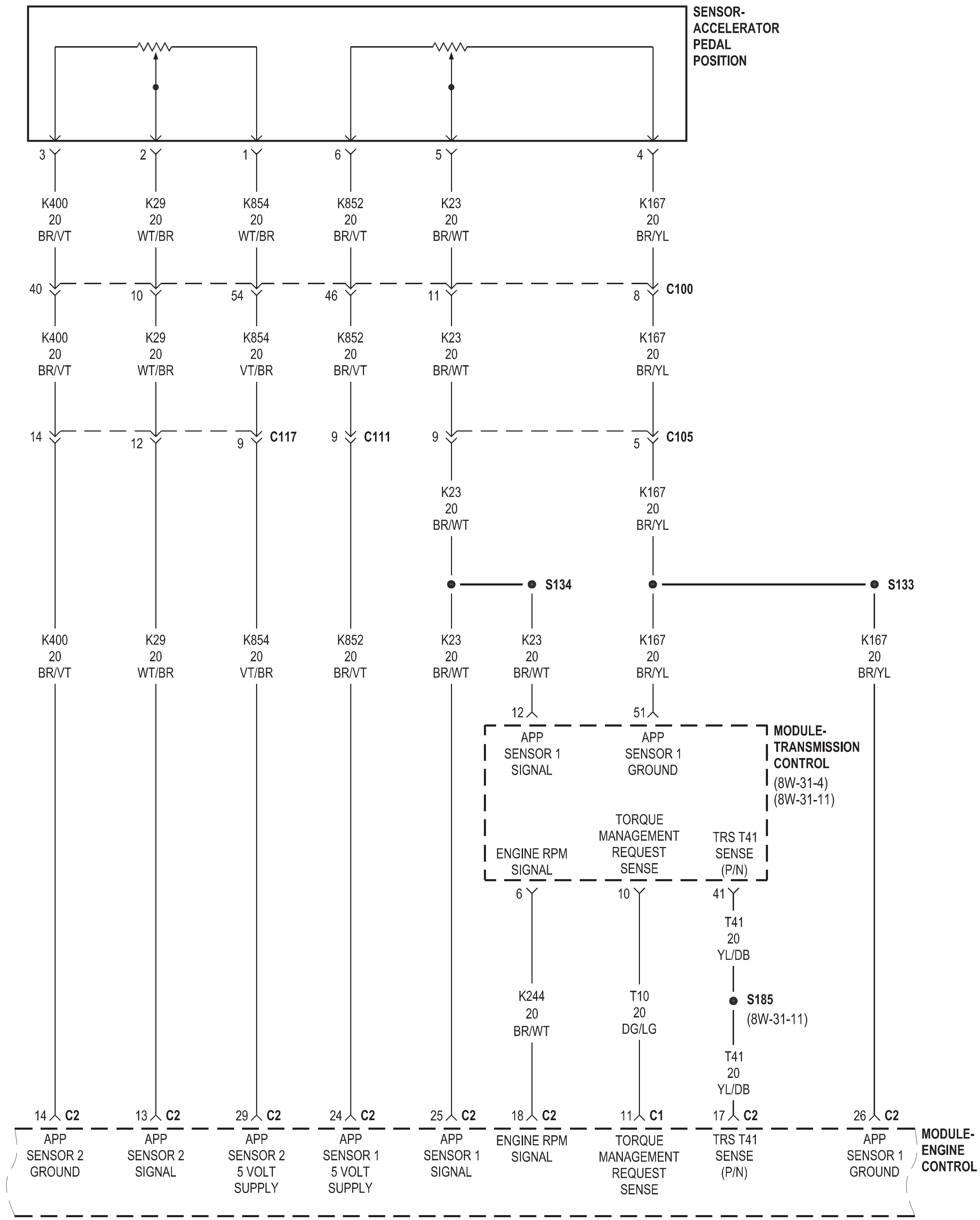

INJECTOR-FUEL-NO. 1
INJECTOR-FUEL-NO. 2
INJECTOR-FUEL-NO. 3
INJECTOR-FUEL-NO. 4
K611 16 OR/BR
K11 16 BR/YL
K612 16 YL/BR
K12 16 BR/DB
K613 16 GY/BR
K13 16 BR/LB
K614 16 WT/BR
K14 16 BR/TN
25 C1
74 C1
2 C1
49 C1
1 C1
73 C1
26 C1
51 C1
MODULE-ENGINE CONTROL
FUEL INJECTOR NO. 1 LOW-SIDE CONTROL
FUEL INJECTOR NO. 1 HIGH-SIDE CONTROL
FUEL INJECTOR NO. 2 LOW-SIDE CONTROL
FUEL INJECTOR NO. 2 HIGH-SIDE CONTROL
FUEL INJECTOR NO. 3 LOW-SIDE CONTROL
FUEL INJECTOR NO. 3 HIGH-SIDE CONTROL
FUEL INJECTOR NO. 4 LOW-SIDE CONTROL
FUEL INJECTOR NO. 4 HIGH-SIDE CONTROL
FUEL PRESSURE SENSOR 5 VOLT SUPPLY
FUEL PRESSURE SENSOR SIGNAL
FUEL PRESSURE SENSOR GROUND
FUEL TEMPERATURE SENSOR SIGNAL
GROUND
TRANSFER CASE POSITION SENSOR INPUT
ECT SENSOR SIGNAL
86 C1
59 C1
84 C1
8 C1
65 C1
82 C1
57 C1
K350 20 BR/YL
K181 20 BR/YL
K359 20 YL/BR
K156 20 BR/YL
K900 20 DB/DG
K77 20 BR/WT
K2 20 VT/OR
SENSOR-FUEL PRESSURE
SENSOR-FUEL TEMPERATURE
SENSOR-TRANSFER CASE POSITION
(8W-31-4)
SENSOR-ENGINE COOLANT TEMPERATURE
K900 20 DB/DG
S154
(8W-70-2)
K900 20 DB/DG
K900 20 DB/DG

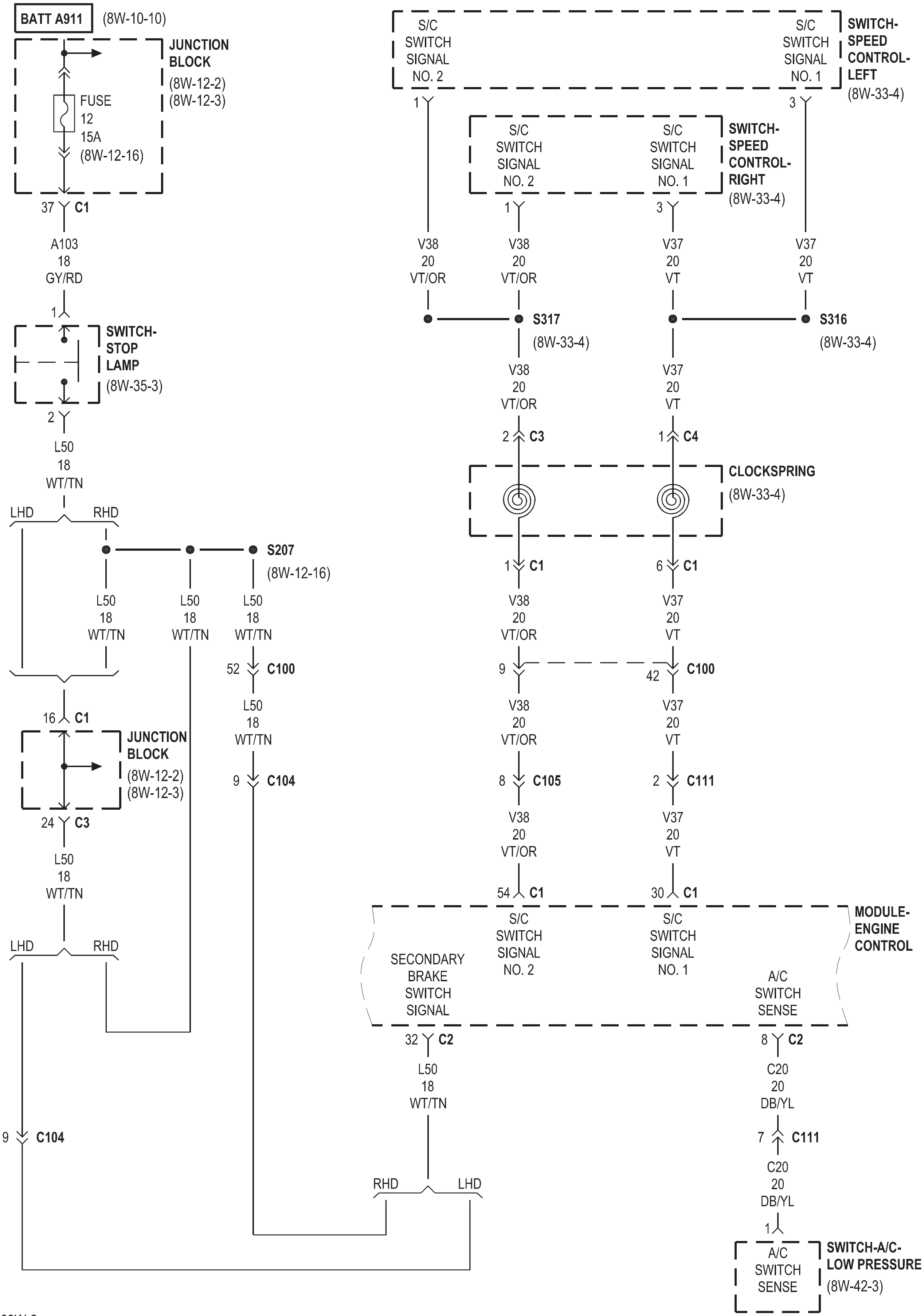

RUN-START F944
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
14
10A
(8W-12-17)
8 C3
LHD
RHD
F1
18
PK/WT
S208
(8W-12-17)
F1
18
PK/WT
49 C100
F1
18
PK/WT
F1
20
PK/WT
S101
(8W-12-17)
F1
20
PK/WT
6 C105
F1
20
PK/WT
S160
(8W-12-18)
F1
20
PK/WT
3
SENSOR-CAMSHAFT POSITION
3
2
1
K44
20
DB/GY
K944
20
BR/GY
F856
20
YL/PK
SENSOR-AMBIENT AIR TEMPERATURE
AAT SIGNAL
(8W-42-7)
1
G31
20
VT/OR
5 C106
G31
20
VT/OR
4 C105
G31
20
VT/OR
38 C1
14 C1
37 C1
31 C1
MODULE-ENGINE CONTROL
CMP SENSOR SIGNAL
CMP SENSOR GROUND
CMP SENSOR 5 VOLT SUPPLY
AAT SIGNAL
FUSED IGNITION SWITCH OUTPUT (RUN-START)
MASS AIR FLOW SENSOR 5 VOLT SUPPLY
MASS AIR FLOW SENSOR GROUND
MASS AIR FLOW SENSOR 5 VOLT SUPPLY
19 C2
64 C1
61 C1
85 C1
F1
20
PK/WT
K811
20
BR/OR
K957
20
BK/OR
K157
20
BR/OR
2
5
6
FUSED IGNITION SWITCH OUTPUT (RUN-START)
MASS AIR FLOW SENSOR 5 VOLT SUPPLY
MASS AIR FLOW SENSOR GROUND
MASS AIR FLOW SENSOR 5 VOLT SUPPLY
SENSOR-MASS AIR FLOW

## DIESEL

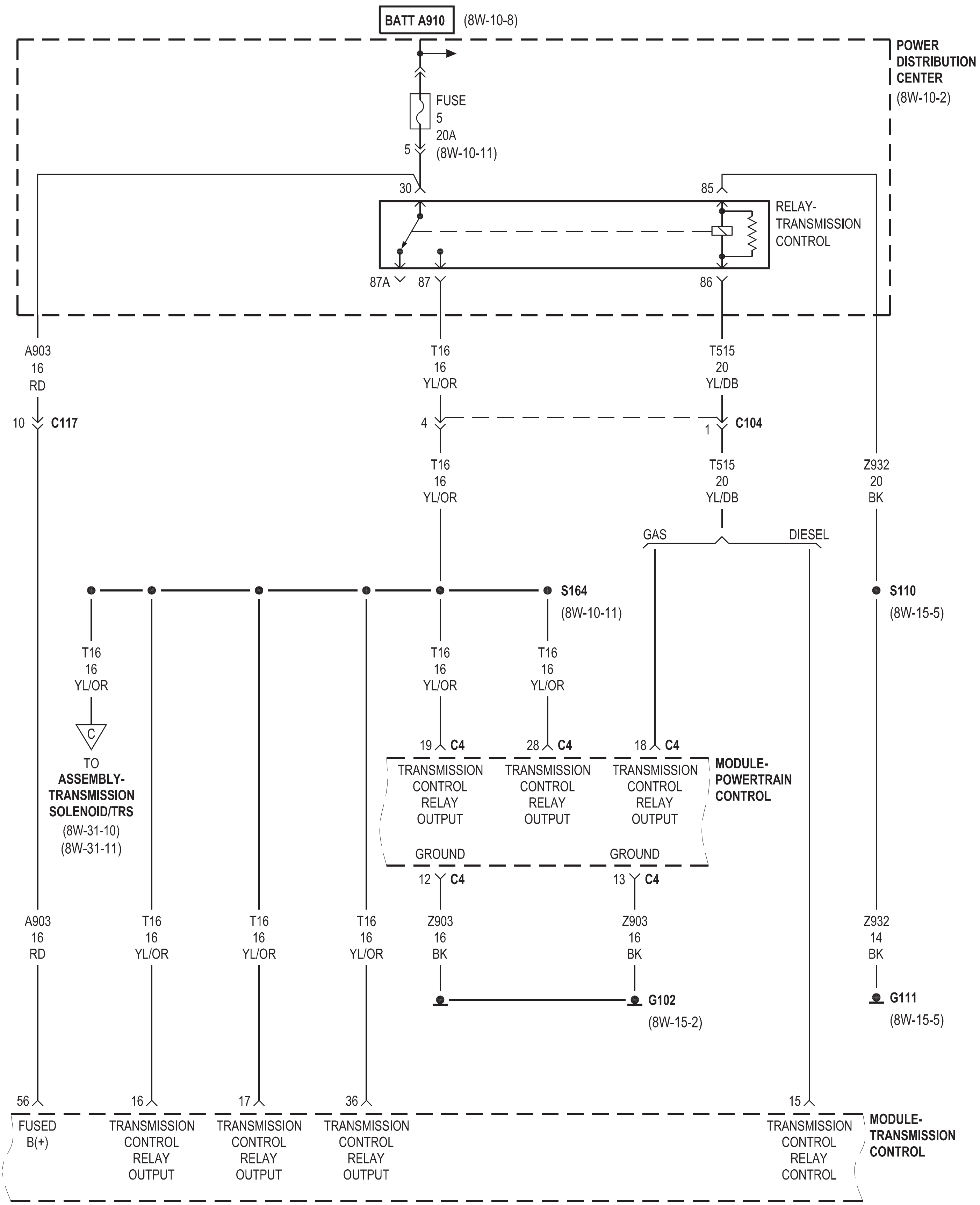

SENSOR-
WATER
IN FUEL
SENSOR-
ENGINE OIL
PRESSURE
MODULE-
FUEL
PUMP
M
K300 20 BR
K301 20 BR/LG
K302 20 BR/WT
K303 20 BR/OR
K304 20 BR/DB
K310 20 BR/DG
G18 20 OR/VT
S153
S156
(8W-45-12)
C105
C117
C307
C100
C120
C201
C104
S132
(8W-45-8)
S240
(8W-45-9)
C2
WATER
IN FUEL
SENSOR
SIGNAL
SENSOR
GROUND
5 VOLT
SUPPLY
ENGINE
OIL PRESSURE
SENSOR
SIGNAL
SENSOR
GROUND
FUEL
LEVEL
SENSOR
SIGNAL
LOW
COOLANT
FLUID
LEVEL
SENSE
MODULE-
BODY
CONTROL
(8W-45-2)
(8W-45-8)
(8W-45-9)
(8W-45-12)
CAN C
BUS (+)
CAN C
BUS (-)
SENSOR-
ENGINE
COOLANT
LEVEL
(DIESEL)
D65 20 WT/LG
D64 20 WT/LB
S221
(8W-18-3)
S210
(8W-18-3)
Z939 20 BK
S169
(8W-15-6)
Z939 18 BK
MODULE-
ENGINE
CONTROL
CAN C
BUS (+)
CAN C
BUS (-)
S136
(8W-18-3)
S137
(8W-18-3)
G103
(8W-15-6)

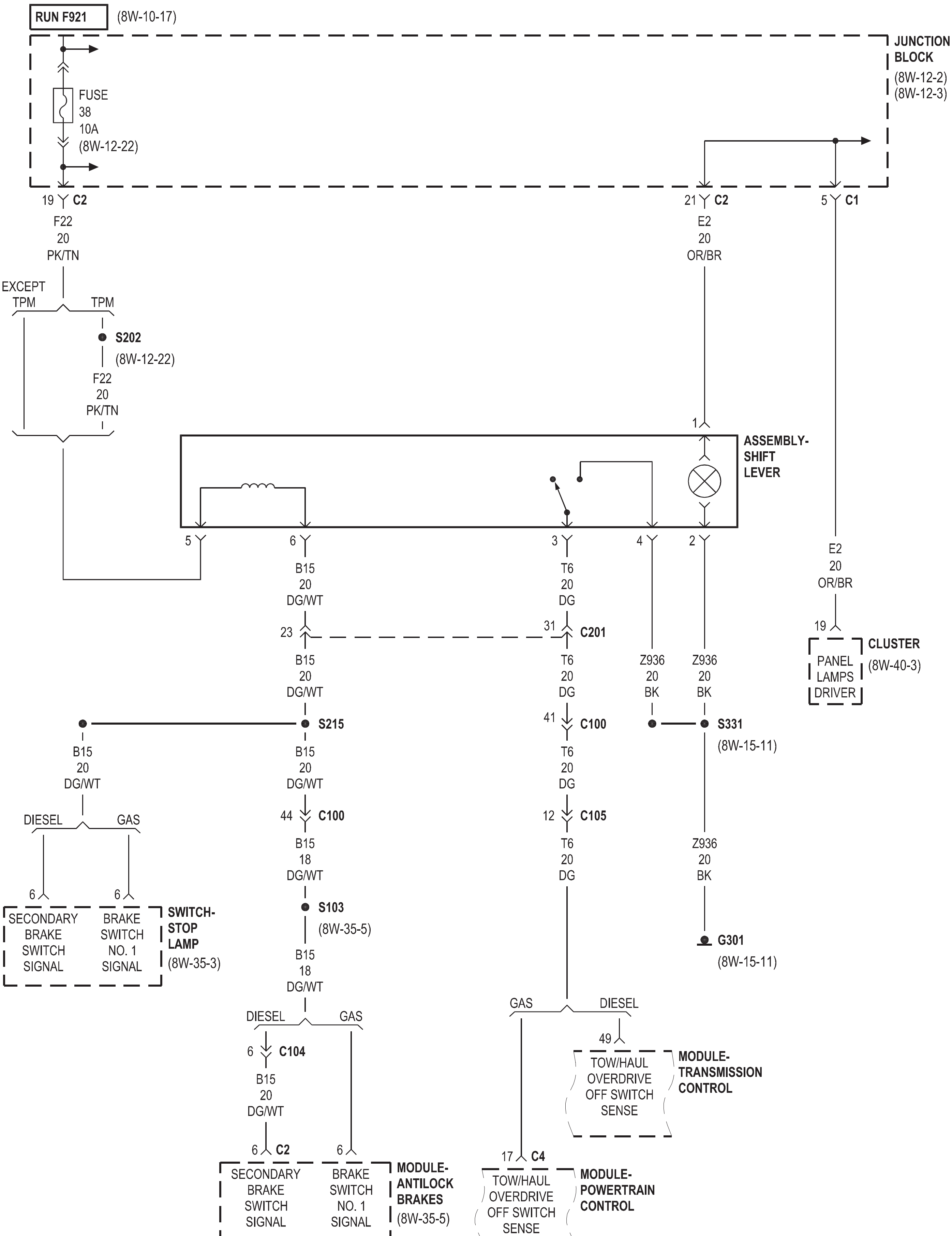

SENSOR-
INLET
PRESSURE
1
2
3
SENSOR-
INTAKE AIR
TEMPERATURE/
INTAKE
PRESSURE
2
1
4
3
K960
20
BR/LB
K68
20
BR/LG
K668
20
BR
K21
20
BR/WT
K656
20
GY/BR
K37
20
BR/OR
K856
20
BR/YL
32 C1
58 C1
36 C1
34 C1
83 C1
63 C1
60 C1
INLET PRESSURE SENSOR GROUND
INLET PRESSURE SENSOR SIGNAL
INLET PRESSURE SENSOR 5 VOLT SUPPLY
SECONDARY BRAKE SWITCH SIGNAL
IAT SENSOR SIGNAL
SENSOR GROUND
INTAKE PRESSURE SENSOR SIGNAL
INTAKE PRESSURE 5 VOLT SUPPLY
MODULE-
ENGINE
CONTROL
34 C2
B15
20
DG/WT
6 C104
B15
20
DG/WT
S103
(8W-35-5)
B15
18
DG/WT
6
SECONDARY BRAKE SWITCH SIGNAL
MODULE-
ANTILOCK
BRAKES
(8W-35-5)

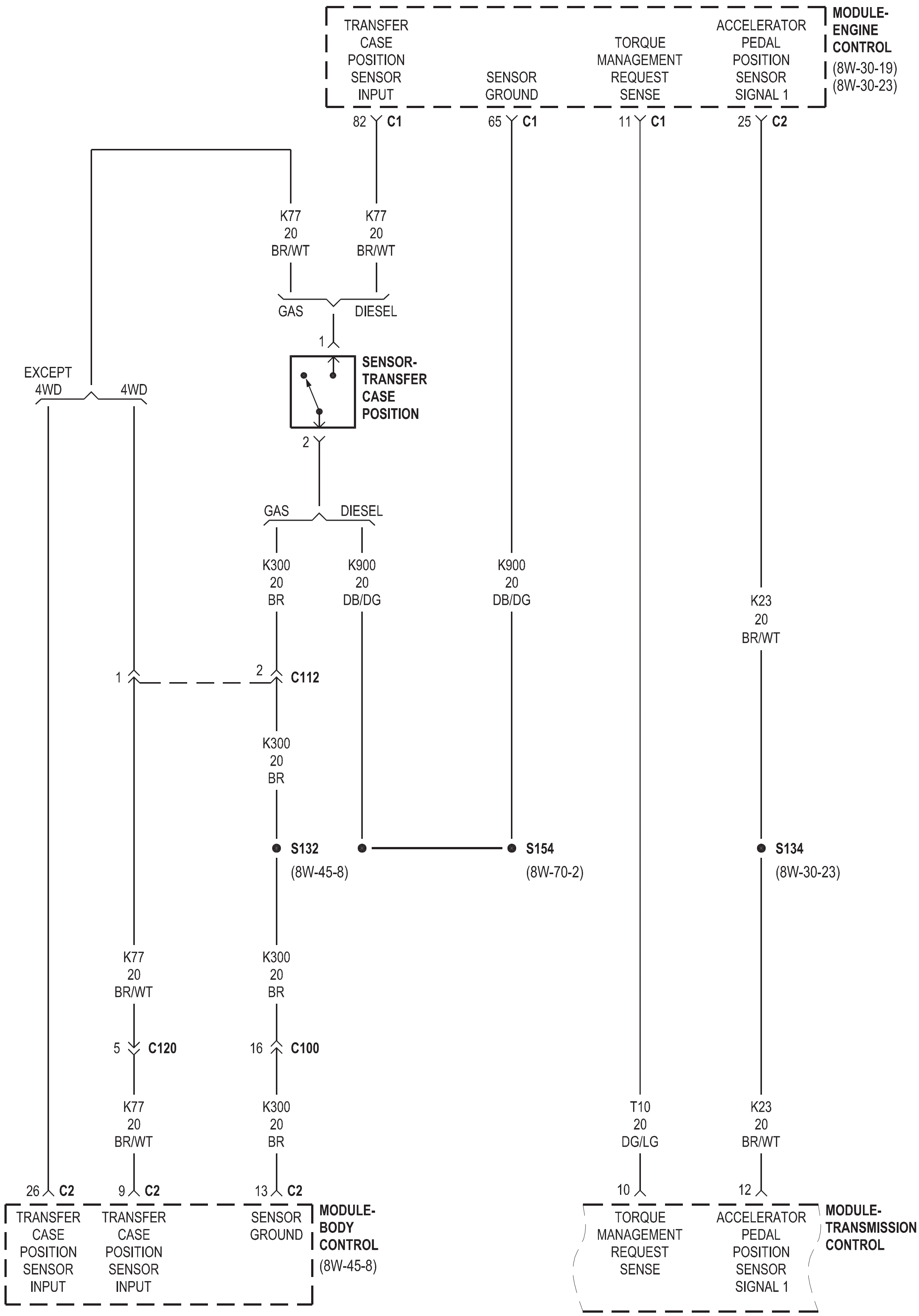

SENSOR-
ACCELERATOR
PEDAL
POSITION
3
2
1
6
5
4
K400
20
BR/VT
K29
20
WT/BR
K854
20
WT/BR
K852
20
BR/VT
K23
20
BR/WT
K167
20
BR/YL
40
10
54
46
11
8
C100
K400
20
BR/VT
K29
20
WT/BR
K854
20
VT/BR
K852
20
BR/VT
K23
20
BR/WT
K167
20
BR/YL
14
12
9
C117
9
C111
9
5
C105
K23
20
BR/WT
K167
20
BR/YL
S134
S133
K400
20
BR/VT
K29
20
WT/BR
K854
20
VT/BR
K852
20
BR/VT
K23
20
BR/WT
K23
20
BR/WT
K167
20
BR/YL
K167
20
BR/YL
12
51
APP SENSOR 1 SIGNAL
APP SENSOR 1 GROUND
MODULE-
TRANSMISSION
CONTROL
(8W-31-4)
(8W-31-11)
ENGINE RPM SIGNAL
TORQUE MANAGEMENT REQUEST SENSE
TRS T41 SENSE (P/N)
6
10
41
T41
20
YL/DB
K244
20
BR/WT
T10
20
DG/LG
S185
(8W-31-11)
T41
20
YL/DB
14 C2
13 C2
29 C2
24 C2
25 C2
18 C2
11 C1
17 C2
26 C2
APP SENSOR 2 GROUND
APP SENSOR 2 SIGNAL
APP SENSOR 2 5 VOLT SUPPLY
APP SENSOR 1 5 VOLT SUPPLY
APP SENSOR 1 SIGNAL
ENGINE RPM SIGNAL
TORQUE MANAGEMENT REQUEST SENSE
TRS T41 SENSE (P/N)
APP SENSOR 1 GROUND
MODULE-
ENGINE
CONTROL

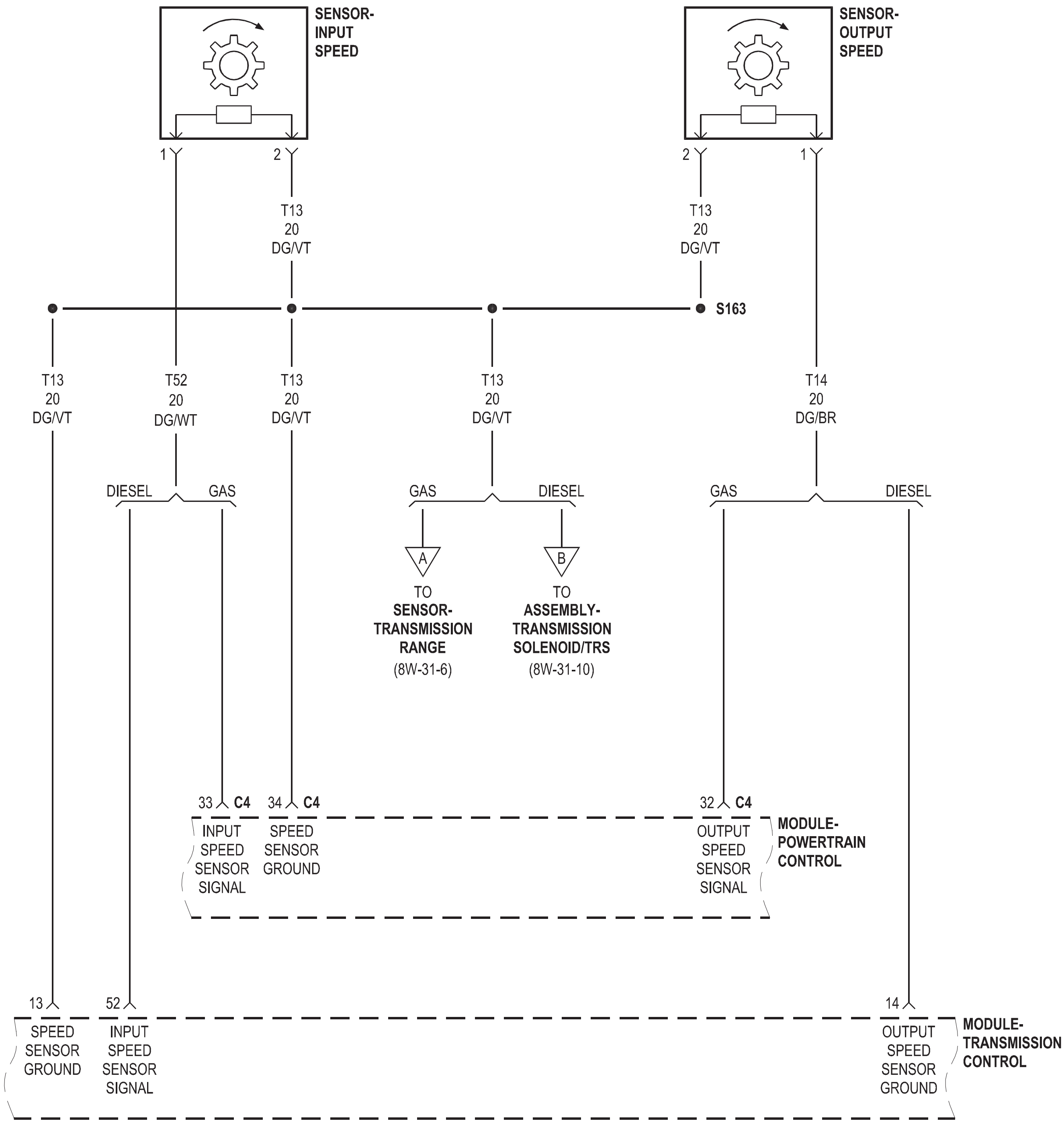

BATT A911 (8W-10-10)
JUNCTION BLOCK (8W-12-2) (8W-12-3)
FUSE 12 15A (8W-12-16)
37 C1
A103 18 GY/RD
1
SWITCH-STOP LAMP (8W-35-3)
2
L50 18 WT/TN
LHD RHD
S207 (8W-12-16)
L50 18 WT/TN
52 C100
9 C104
16 C1
JUNCTION BLOCK (8W-12-2) (8W-12-3)
24 C3
9 C104
RHD LHD
S/C SWITCH SIGNAL NO. 2
S/C SWITCH SIGNAL NO. 1
SWITCH-SPEED CONTROL-LEFT (8W-33-4)
SWITCH-SPEED CONTROL-RIGHT (8W-33-4)
1 3
V38 20 VT/OR
V37 20 VT
S317 (8W-33-4)
S316 (8W-33-4)
2 C3
1 C4
CLOCKSPRING (8W-33-4)
1 C1
6 C1
9 42 C100
8 C105
2 C111
54 C1
30 C1
MODULE-ENGINE CONTROL
SECONDARY BRAKE SWITCH SIGNAL
A/C SWITCH SENSE
32 C2
8 C2
L50 18 WT/TN
C20 20 DB/YL
7 C111
SWITCH-A/C-LOW PRESSURE (8W-42-3)

# 8W-31 TRANSMISSION CONTROL SYSTEM

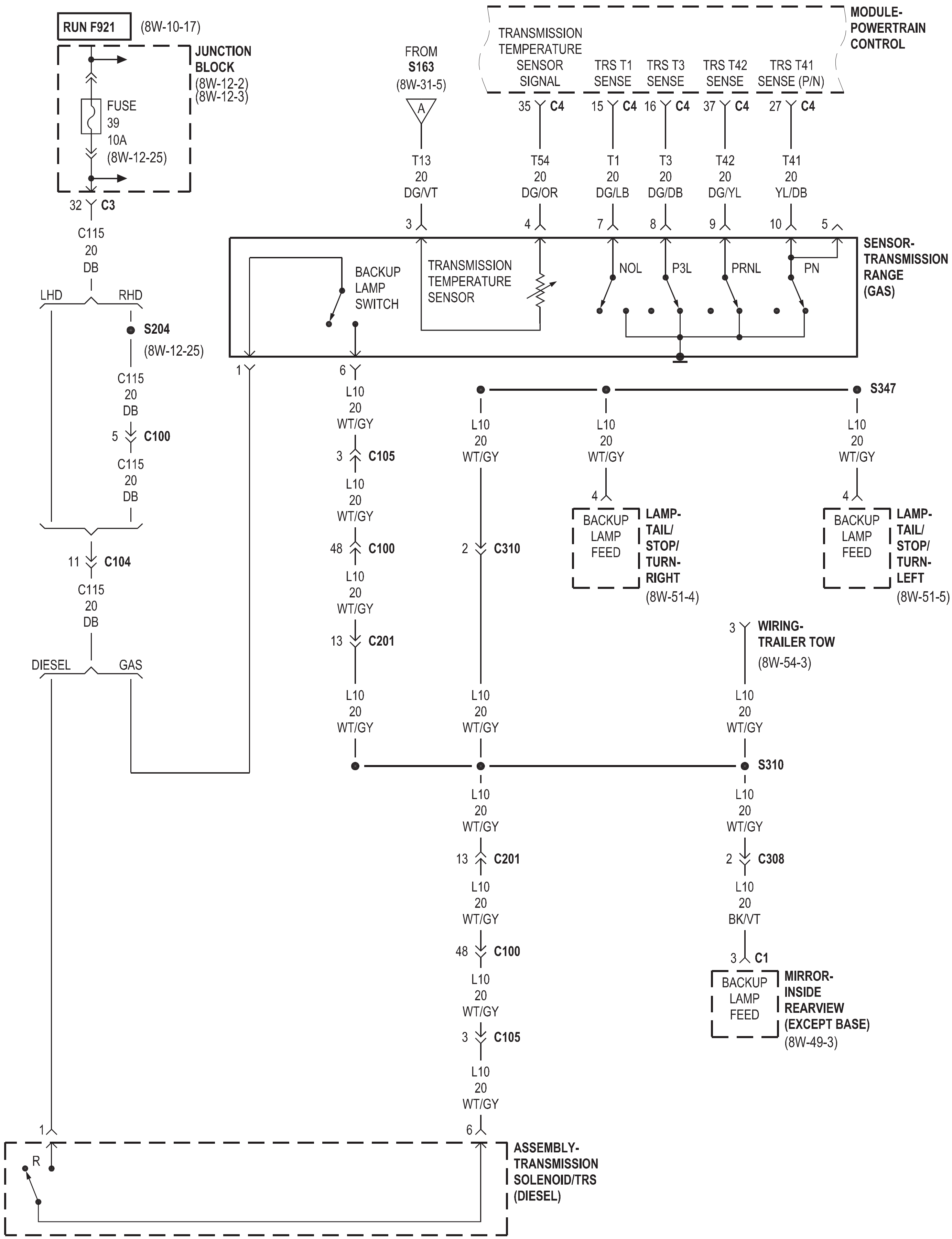

BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
5
20A
(8W-10-11)
5
30
85
RELAY-TRANSMISSION CONTROL
87A
87
86
A903
16
RD
T16
16
YL/OR
T515
20
YL/DB
10
C117
4
1
C104
Z932
20
BK
GAS
DIESEL
S164
(8W-10-11)
S110
(8W-15-5)
C
TO
ASSEMBLY-TRANSMISSION SOLENOID/TRS
(8W-31-10)
(8W-31-11)
19 C4
28 C4
18 C4
TRANSMISSION CONTROL RELAY OUTPUT
MODULE-POWERTRAIN CONTROL
GROUND
GROUND
12 C4
13 C4
Z903
16
BK
Z932
14
BK
G102
(8W-15-2)
G111
(8W-15-5)
56
16
17
36
15
FUSED B(+)
TRANSMISSION CONTROL RELAY OUTPUT
TRANSMISSION CONTROL RELAY CONTROL
MODULE-TRANSMISSION CONTROL

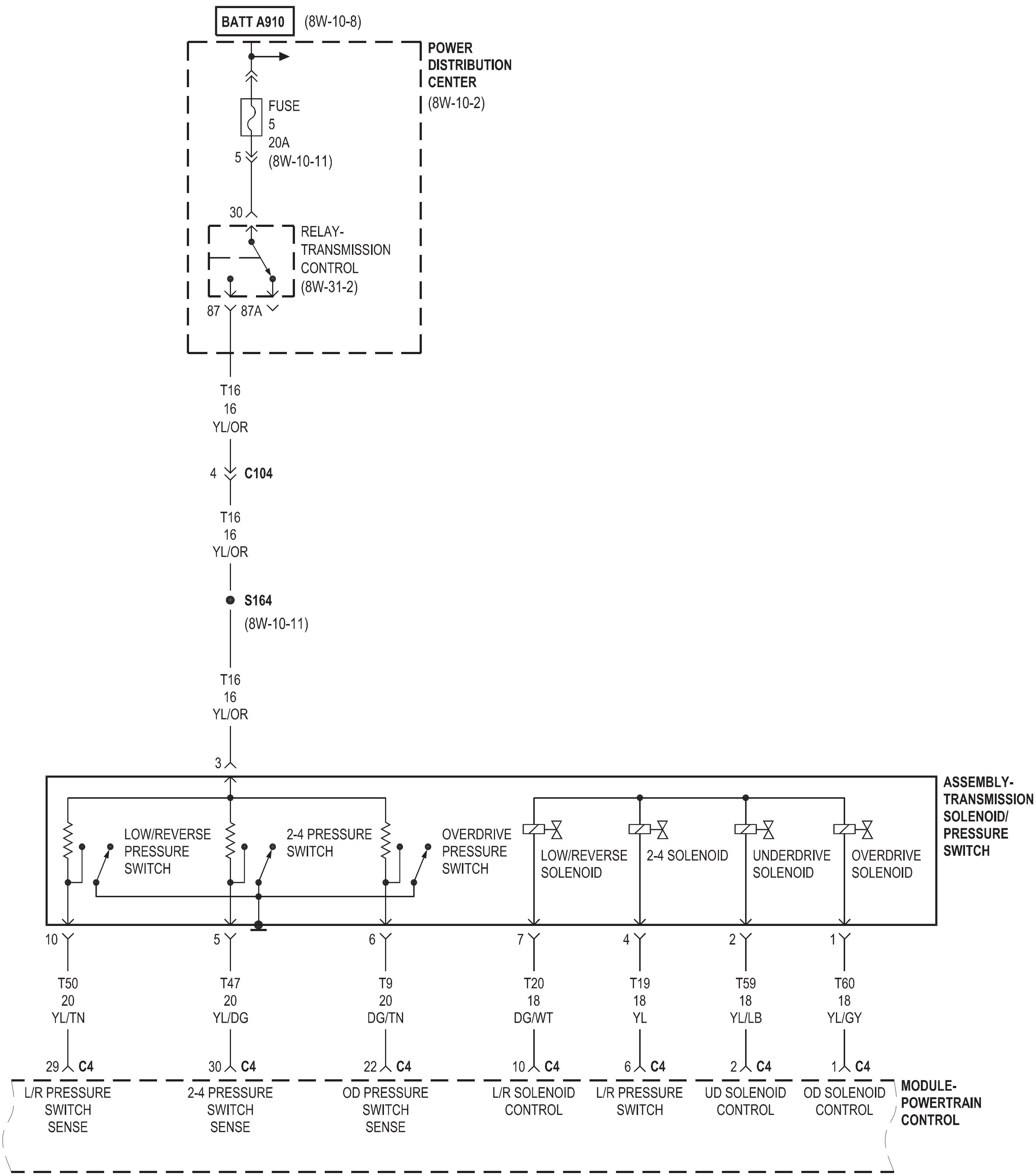

RUN F921
(8W-10-17)
FUSE
38
10A
(8W-12-22)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
19 C2
F22
20
PK/TN
21 C2
E2
20
OR/BR
5 C1
EXCEPT TPM
TPM
S202
(8W-12-22)
F22
20
PK/TN
1
ASSEMBLY-SHIFT LEVER
5
6
3
4
2
B15
20
DG/WT
T6
20
DG
E2
20
OR/BR
23
31 C201
19
CLUSTER
PANEL LAMPS DRIVER
(8W-40-3)
Z936
20
BK
S215
41 C100
S331
(8W-15-11)
44 C100
12 C105
B15
18
DG/WT
DIESEL
GAS
6
SECONDARY BRAKE SWITCH SIGNAL
BRAKE SWITCH NO. 1 SIGNAL
SWITCH-STOP LAMP
(8W-35-3)
S103
(8W-35-5)
G301
(8W-15-11)
49
TOW/HAUL OVERDRIVE OFF SWITCH SENSE
MODULE-TRANSMISSION CONTROL
6 C104
6 C2
MODULE-ANTILOCK BRAKES
(8W-35-5)
17 C4
MODULE-POWERTRAIN CONTROL


TRANSFER CASE POSITION SENSOR INPUT
SENSOR GROUND
TORQUE MANAGEMENT REQUEST SENSE
ACCELERATOR PEDAL POSITION SENSOR SIGNAL 1
MODULE-ENGINE CONTROL
(8W-30-19)
(8W-30-23)
82 C1
65 C1
11 C1
25 C2
K77 20 BR/WT
K77 20 BR/WT
GAS
DIESEL
1
SENSOR-TRANSFER CASE POSITION
2
EXCEPT 4WD
4WD
GAS
DIESEL
K300 20 BR
K900 20 DB/DG
K900 20 DB/DG
K23 20 BR/WT
1
2
C112
K300 20 BR
S132
(8W-45-8)
S154
(8W-70-2)
S134
(8W-30-23)
K77 20 BR/WT
K300 20 BR
5 C120
16 C100
K77 20 BR/WT
K300 20 BR
T10 20 DG/LG
K23 20 BR/WT
26 C2
9 C2
13 C2
10
12
TRANSFER CASE POSITION SENSOR INPUT
TRANSFER CASE POSITION SENSOR INPUT
SENSOR GROUND
MODULE-BODY CONTROL
(8W-45-8)
TORQUE MANAGEMENT REQUEST SENSE
ACCELERATOR PEDAL POSITION SENSOR SIGNAL 1
MODULE-TRANSMISSION CONTROL

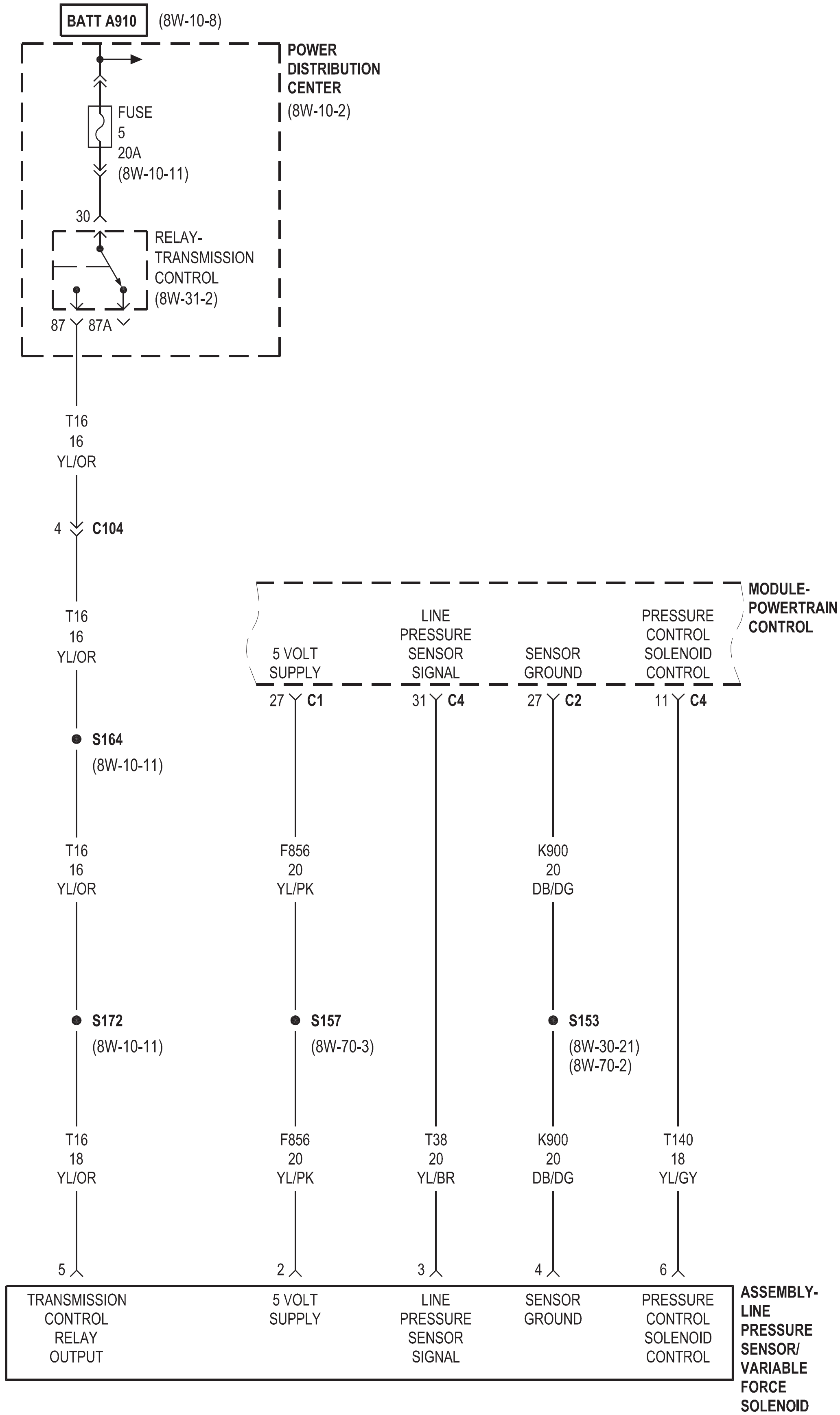

SENSOR-
INPUT
SPEED
SENSOR-
OUTPUT
SPEED
1
2
2
1
T13
20
DG/VT
T13
20
DG/VT
S163
T13
20
DG/VT
T52
20
DG/WT
T13
20
DG/VT
T13
20
DG/VT
T14
20
DG/BR
DIESEL
GAS
GAS
DIESEL
GAS
DIESEL
A
B
TO
SENSOR-
TRANSMISSION
RANGE
(8W-31-6)
TO
ASSEMBLY-
TRANSMISSION
SOLENOID/TRS
(8W-31-10)
33 C4
34 C4
32 C4
INPUT
SPEED
SENSOR
SIGNAL
SPEED
SENSOR
GROUND
OUTPUT
SPEED
SENSOR
SIGNAL
MODULE-
POWERTRAIN
CONTROL
13
52
14
SPEED
SENSOR
GROUND
INPUT
SPEED
SENSOR
SIGNAL
OUTPUT
SPEED
SENSOR
GROUND
MODULE-
TRANSMISSION
CONTROL

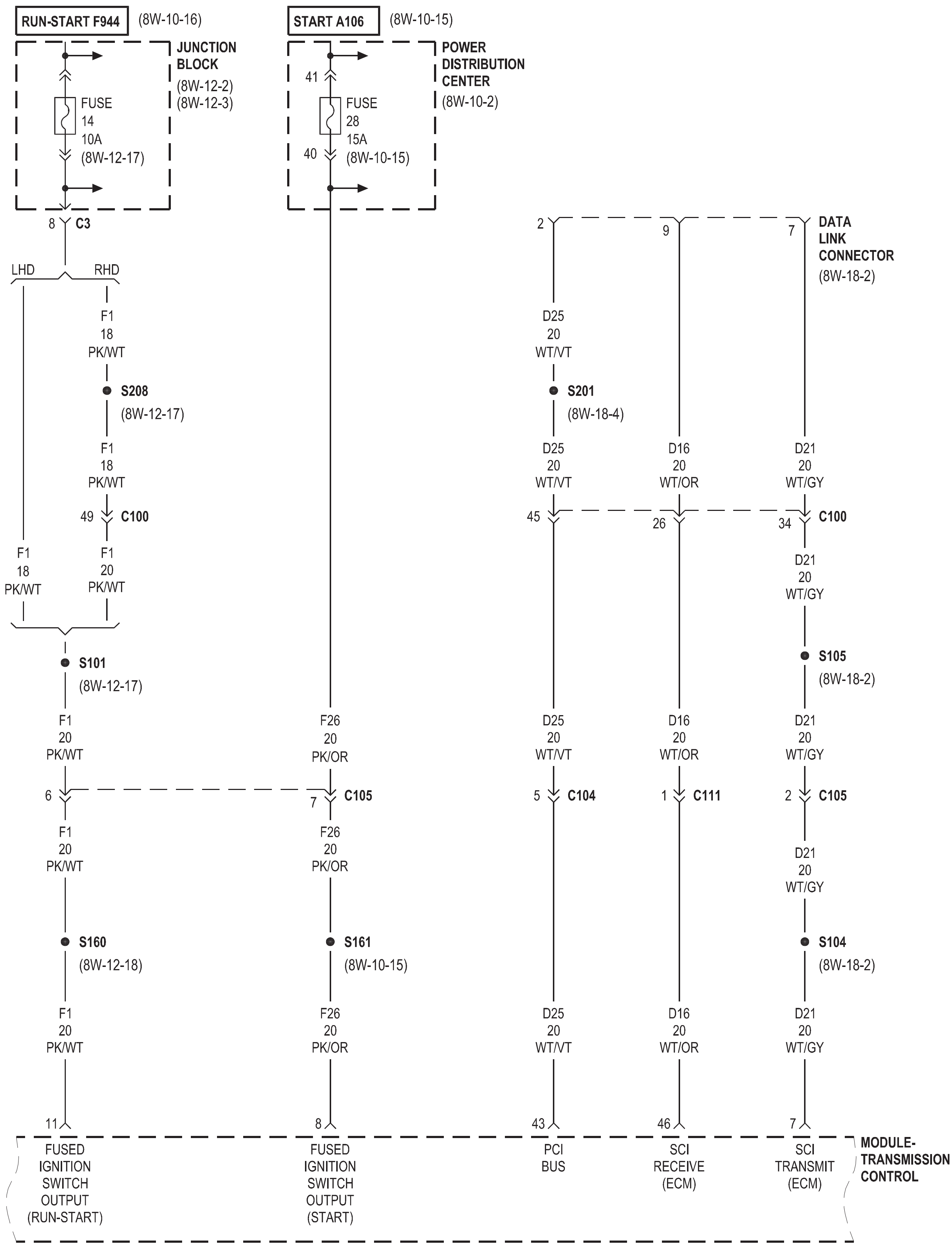
GAS

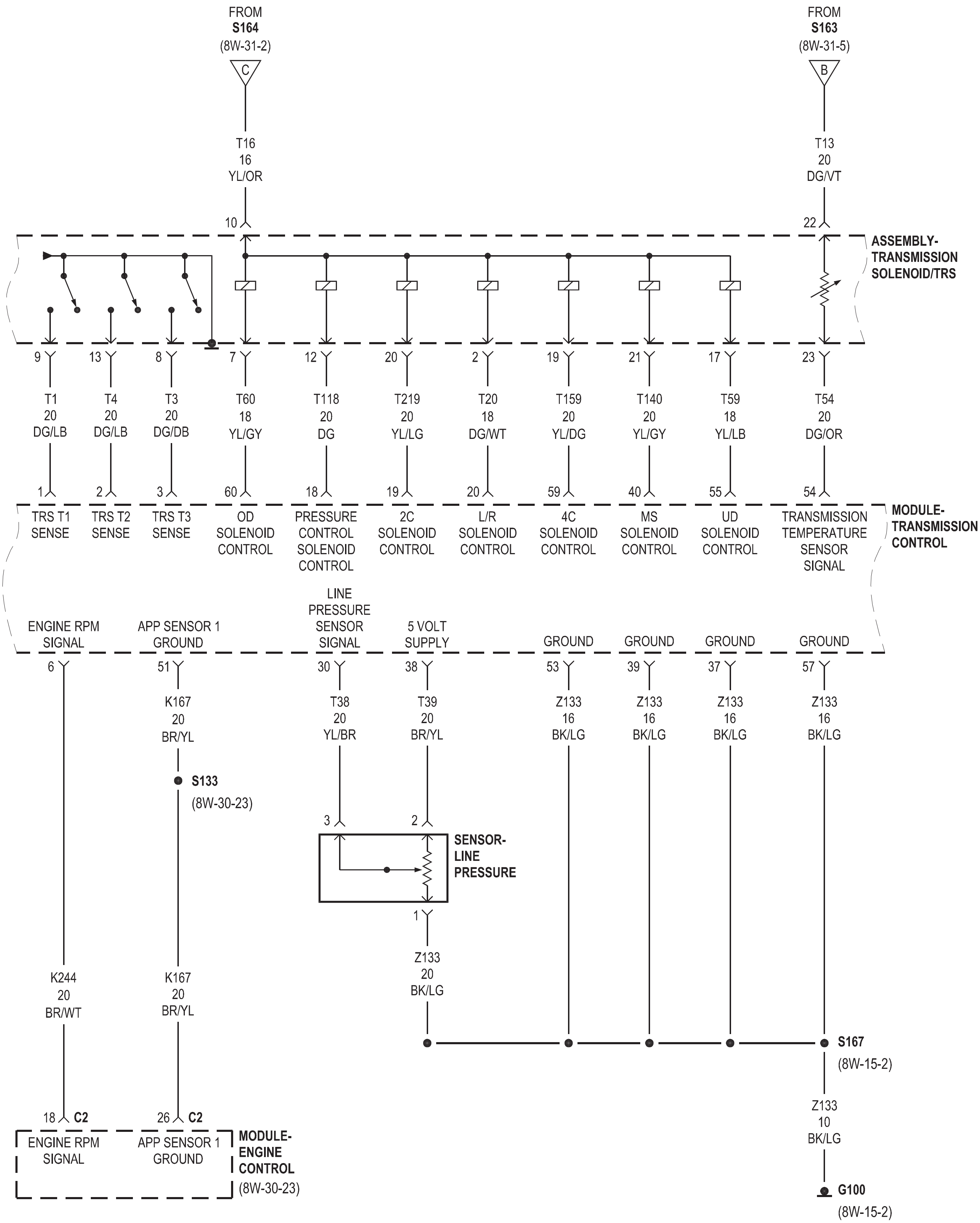

RUN F921
(8W-10-17)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
39
10A
(8W-12-25)
32 C3
C115 20 DB
LHD
RHD
S204
(8W-12-25)
C115 20 DB
5 C100
C115 20 DB
11 C104
C115 20 DB
DIESEL
GAS
FROM S163 (8W-31-5)
A
MODULE-POWERTRAIN CONTROL
TRANSMISSION TEMPERATURE SENSOR SIGNAL
TRS T1 SENSE
TRS T3 SENSE
TRS T42 SENSE
TRS T41 SENSE (P/N)
35 C4
15 C4
16 C4
37 C4
27 C4
T13 20 DG/VT
T54 20 DG/OR
T1 20 DG/LB
T3 20 DG/DB
T42 20 DG/YL
T41 20 YL/DB
SENSOR-TRANSMISSION RANGE (GAS)
BACKUP LAMP SWITCH
TRANSMISSION TEMPERATURE SENSOR
NOL
P3L
PRNL
PN
L10 20 WT/GY
3 C105
48 C100
13 C201
2 C310
S347
BACKUP LAMP FEED
LAMP-TAIL/STOP/TURN-RIGHT
(8W-51-4)
LAMP-TAIL/STOP/TURN-LEFT
(8W-51-5)
3 WIRING-TRAILER TOW
(8W-54-3)
S310
2 C308
L10 20 BK/VT
3 C1
MIRROR-INSIDE REARVIEW (EXCEPT BASE)
(8W-49-3)
ASSEMBLY-TRANSMISSION SOLENOID/TRS (DIESEL)
R

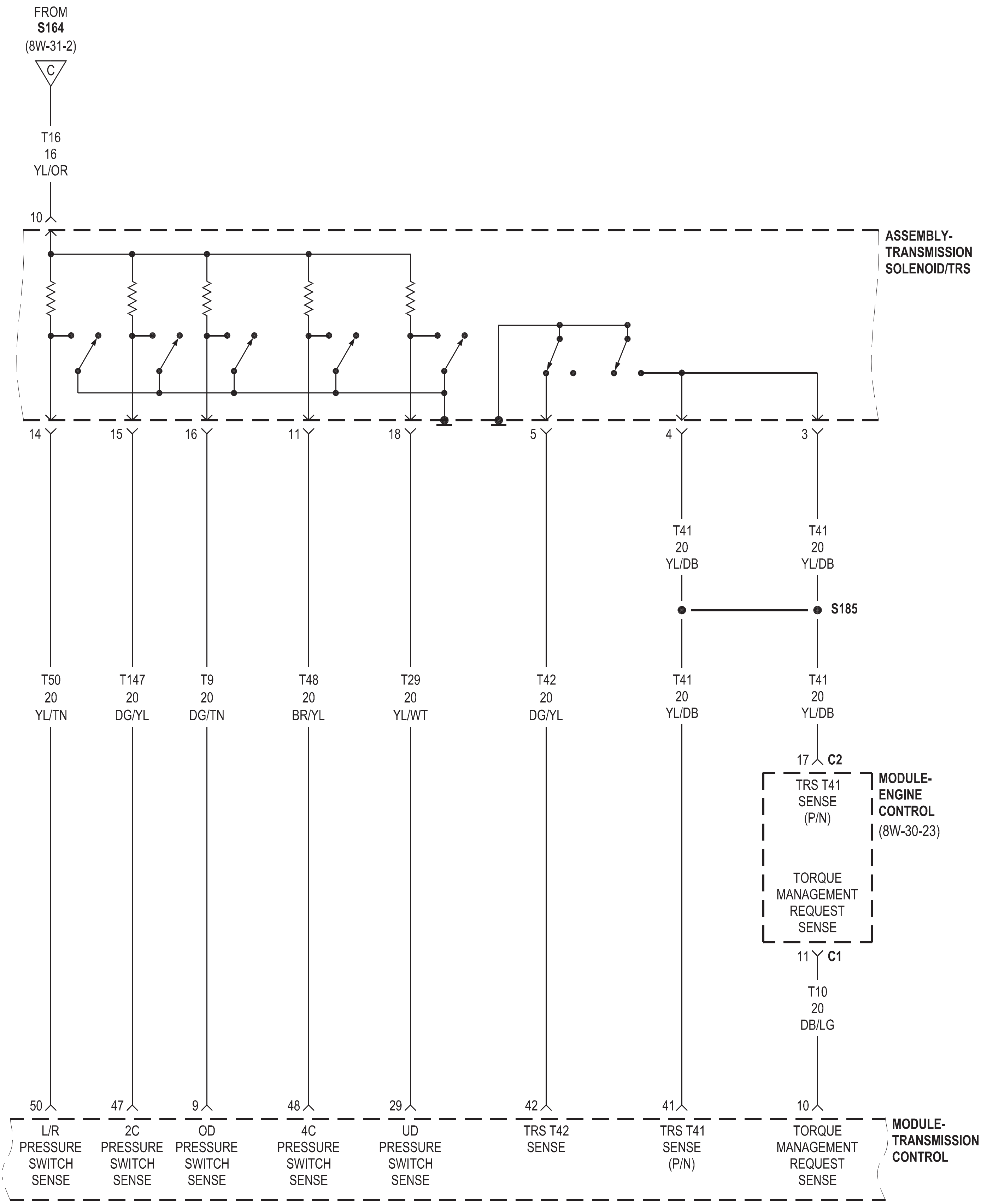

BATT A910
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
5
20A
(8W-10-11)
5
30
RELAY-
TRANSMISSION
CONTROL
(8W-31-2)
87
87A
T16
16
YL/OR
4
C104
T16
16
YL/OR
S164
(8W-10-11)
T16
16
YL/OR
3
ASSEMBLY-
TRANSMISSION
SOLENOID/
PRESSURE
SWITCH
LOW/REVERSE
PRESSURE
SWITCH
2-4 PRESSURE
SWITCH
OVERDRIVE
PRESSURE
SWITCH
LOW/REVERSE
SOLENOID
2-4 SOLENOID
UNDERDRIVE
SOLENOID
OVERDRIVE
SOLENOID
10
5
6
7
4
2
1
T50
20
YL/TN
T47
20
YL/DG
T9
20
DG/TN
T20
18
DG/WT
T19
18
YL
T59
18
YL/LB
T60
18
YL/GY
29 C4
30 C4
22 C4
10 C4
6 C4
2 C4
1 C4
L/R PRESSURE
SWITCH
SENSE
2-4 PRESSURE
SWITCH
SENSE
OD PRESSURE
SWITCH
SENSE
L/R SOLENOID
CONTROL
L/R PRESSURE
SWITCH
UD SOLENOID
CONTROL
OD SOLENOID
CONTROL
MODULE-
POWERTRAIN
CONTROL

# GAS

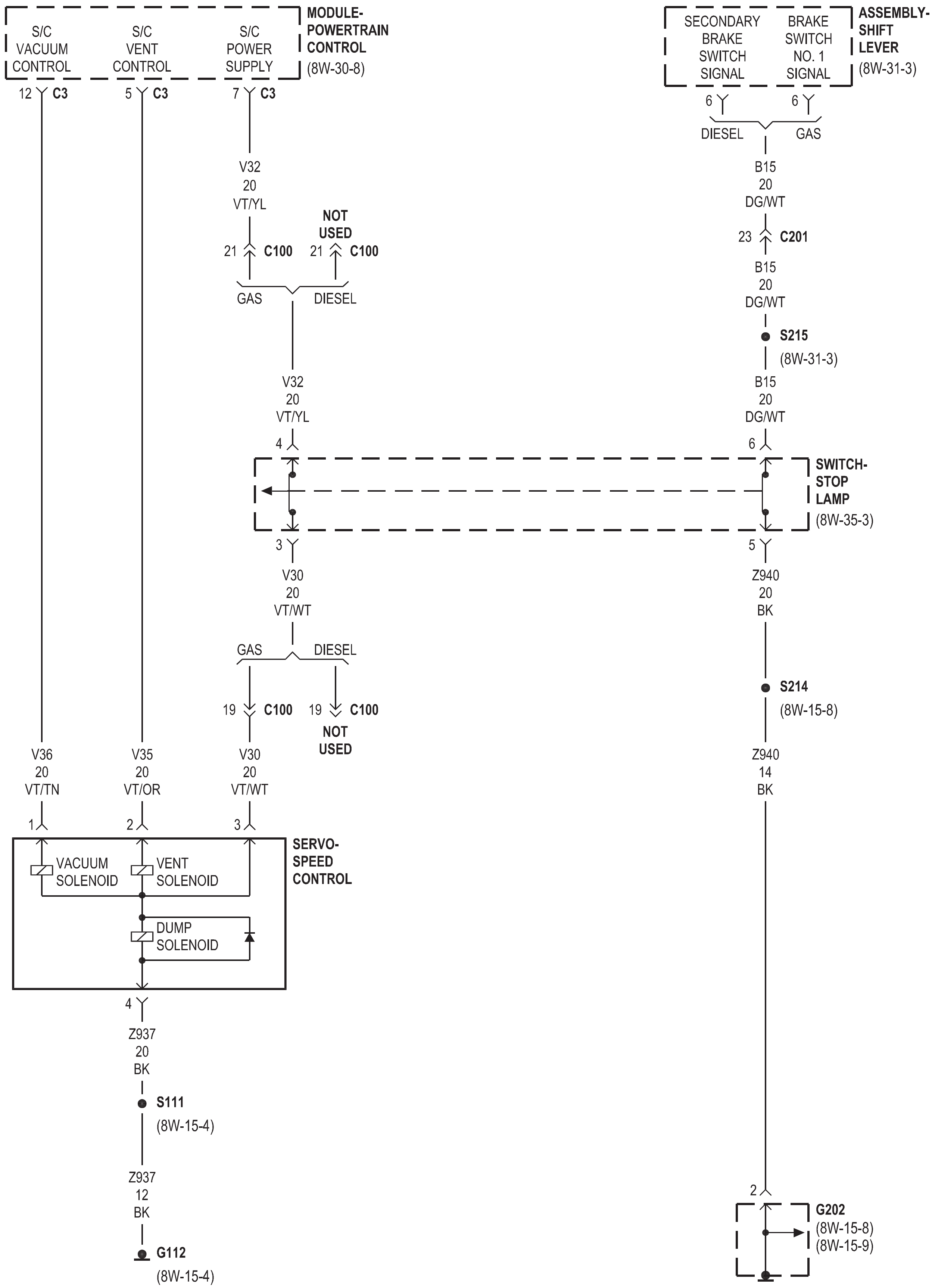

BATT A910
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
5
20A
(8W-10-11)
30
RELAY-
TRANSMISSION
CONTROL
(8W-31-2)
87
87A
T16
16
YL/OR
4
C104
T16
16
YL/OR
S164
(8W-10-11)
T16
16
YL/OR
S172
(8W-10-11)
T16
18
YL/OR
MODULE-
POWERTRAIN
CONTROL
5 VOLT
SUPPLY
LINE
PRESSURE
SENSOR
SIGNAL
SENSOR
GROUND
PRESSURE
CONTROL
SOLENOID
CONTROL
27 C1
31 C4
27 C2
11 C4
F856
20
YL/PK
K900
20
DB/DG
S157
(8W-70-3)
S153
(8W-30-21)
(8W-70-2)
F856
20
YL/PK
T38
20
YL/BR
K900
20
DB/DG
T140
18
YL/GY
5
2
3
4
6
TRANSMISSION
CONTROL
RELAY
OUTPUT
5 VOLT
SUPPLY
LINE
PRESSURE
SENSOR
SIGNAL
SENSOR
GROUND
PRESSURE
CONTROL
SOLENOID
CONTROL
ASSEMBLY-
LINE
PRESSURE
SENSOR/
VARIABLE
FORCE
SOLENOID

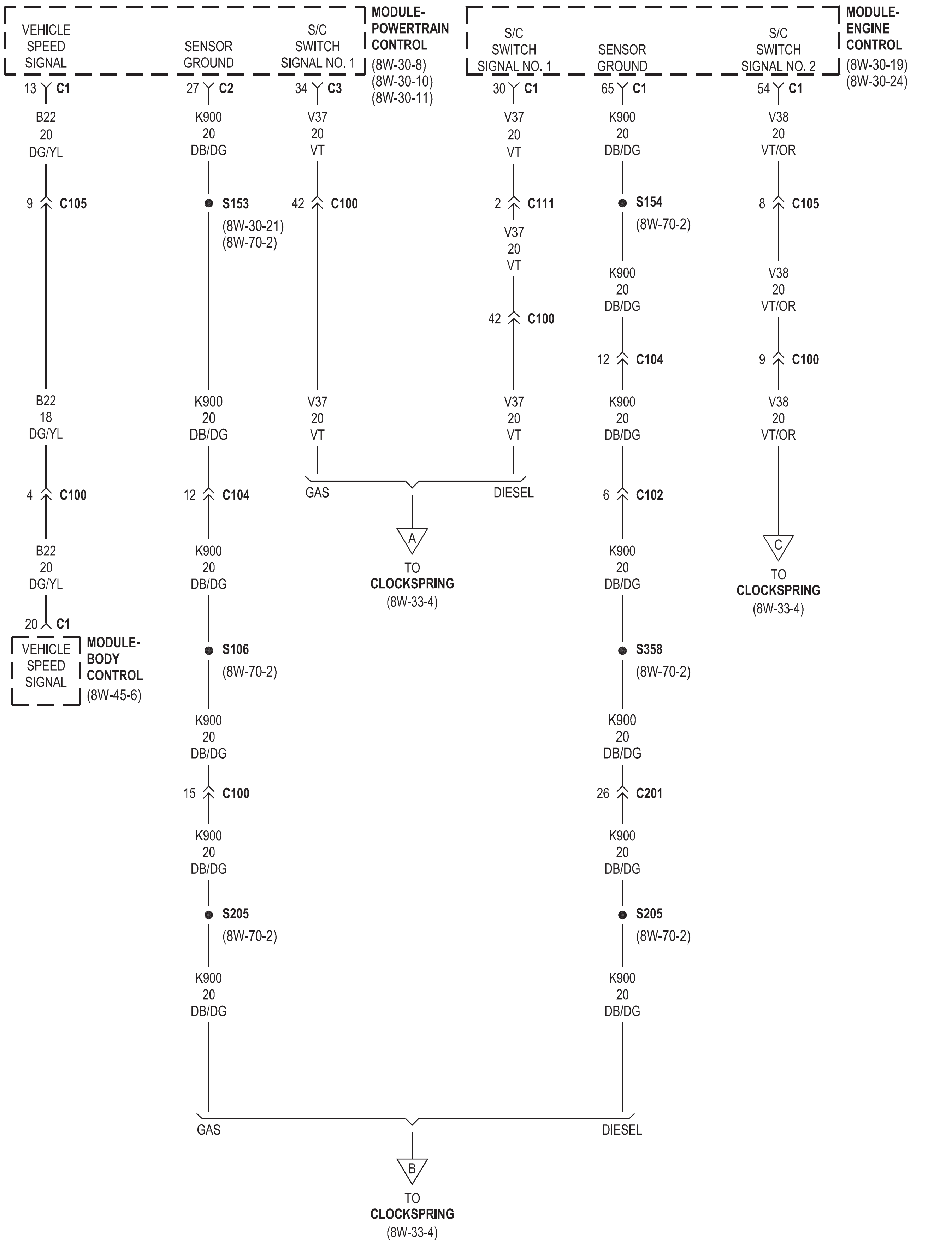

RUN-START F944
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 14 10A (8W-12-17)
8 C3
LHD
RHD
F1 18 PK/WT
S208
(8W-12-17)
F1 18 PK/WT
49 C100
F1 18 PK/WT
F1 20 PK/WT
S101
(8W-12-17)
F1 20 PK/WT
6
F1 20 PK/WT
S160
(8W-12-18)
F1 20 PK/WT
11
START A106
(8W-10-15)
POWER DISTRIBUTION CENTER
(8W-10-2)
41
FUSE 28 15A (8W-10-15)
40
F26 20 PK/OR
7 C105
F26 20 PK/OR
S161
(8W-10-15)
F26 20 PK/OR
8
2
9
7
DATA LINK CONNECTOR
(8W-18-2)
D25 20 WT/VT
S201
(8W-18-4)
D25 20 WT/VT
D16 20 WT/OR
D21 20 WT/GY
45
26
34 C100
D21 20 WT/GY
S105
(8W-18-2)
D25 20 WT/VT
D16 20 WT/OR
D21 20 WT/GY
5 C104
1 C111
2 C105
D21 20 WT/GY
S104
(8W-18-2)
D25 20 WT/VT
D16 20 WT/OR
D21 20 WT/GY
43
46
7
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED IGNITION SWITCH OUTPUT (START)
PCI BUS
SCI RECEIVE (ECM)
SCI TRANSMIT (ECM)
MODULE-TRANSMISSION CONTROL

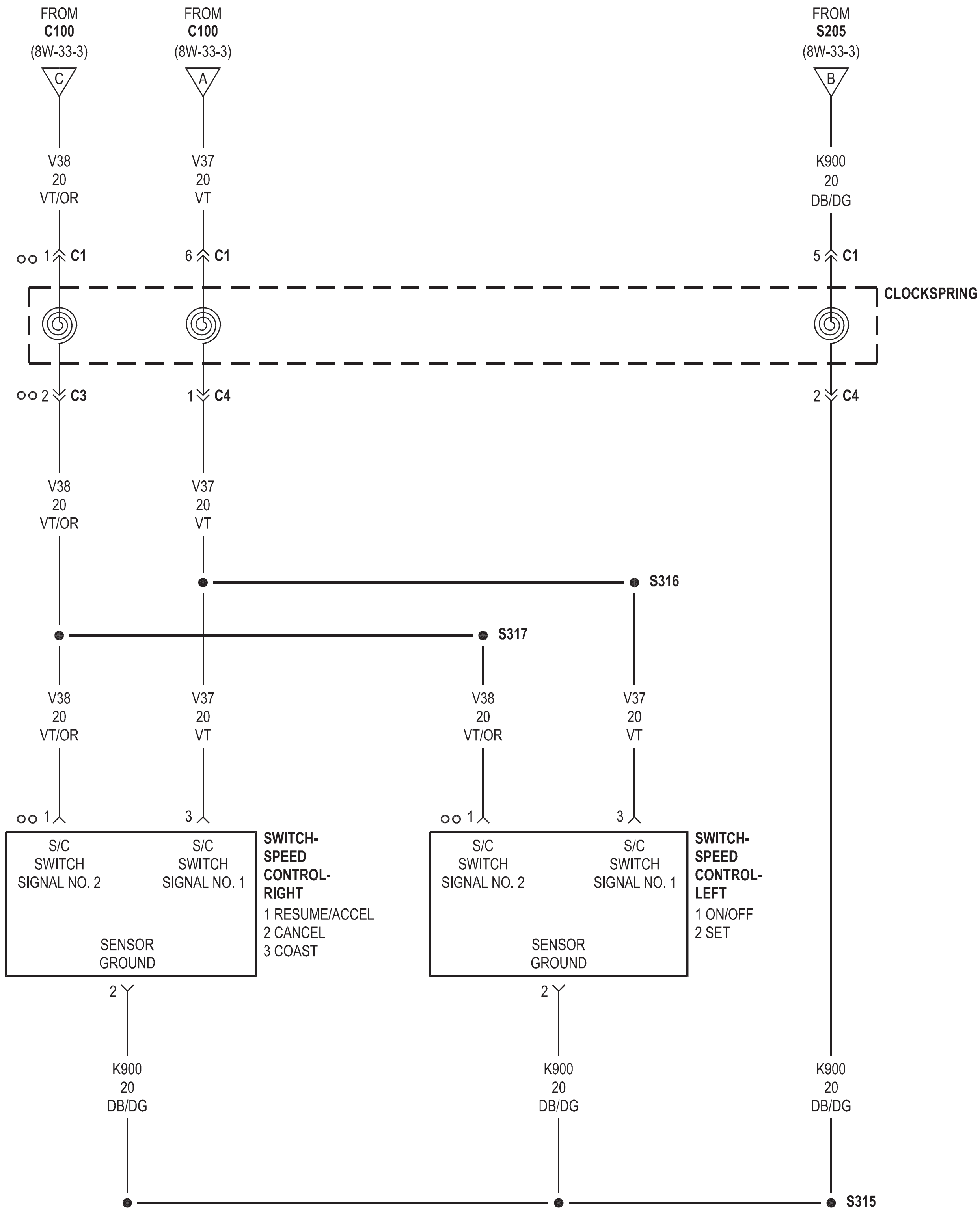

FROM
S164
(8W-31-2)
C
FROM
S163
(8W-31-5)
B
T16
16
YL/OR
T13
20
DG/VT
10
22
ASSEMBLY-
TRANSMISSION
SOLENOID/TRS
9
13
8
7
12
20
2
19
21
17
23
T1
20
DG/LB
T4
20
DG/LB
T3
20
DG/DB
T60
18
YL/GY
T118
20
DG
T219
20
YL/LG
T20
18
DG/WT
T159
20
YL/DG
T140
20
YL/GY
T59
18
YL/LB
T54
20
DG/OR
1
2
3
60
18
19
20
59
40
55
54
TRS T1
SENSE
TRS T2
SENSE
TRS T3
SENSE
OD
SOLENOID
CONTROL
PRESSURE
CONTROL
SOLENOID
CONTROL
2C
SOLENOID
CONTROL
L/R
SOLENOID
CONTROL
4C
SOLENOID
CONTROL
MS
SOLENOID
CONTROL
UD
SOLENOID
CONTROL
TRANSMISSION
TEMPERATURE
SENSOR
SIGNAL
MODULE-
TRANSMISSION
CONTROL
ENGINE RPM
SIGNAL
APP SENSOR 1
GROUND
LINE
PRESSURE
SENSOR
SIGNAL
5 VOLT
SUPPLY
GROUND
GROUND
GROUND
GROUND
6
51
30
38
53
39
37
57
K167
20
BR/YL
T38
20
YL/BR
T39
20
BR/YL
Z133
16
BK/LG
Z133
16
BK/LG
Z133
16
BK/LG
Z133
16
BK/LG
S133
(8W-30-23)
3
2
SENSOR-
LINE
PRESSURE
1
Z133
20
BK/LG
K244
20
BR/WT
K167
20
BR/YL
S167
(8W-15-2)
Z133
10
BK/LG
18 C2
26 C2
ENGINE RPM
SIGNAL
APP SENSOR 1
GROUND
MODULE-
ENGINE
CONTROL
(8W-30-23)
G100
(8W-15-2)


FROM
S164
(8W-31-2)
C
T16
16
YL/OR
10
ASSEMBLY-
TRANSMISSION
SOLENOID/TRS
14
15
16
11
18
5
4
3
T41
20
YL/DB
T41
20
YL/DB
S185
T50
20
YL/TN
T147
20
DG/YL
T9
20
DG/TN
T48
20
BR/YL
T29
20
YL/WT
T42
20
DG/YL
T41
20
YL/DB
T41
20
YL/DB
17
C2
TRS T41
SENSE
(P/N)
MODULE-
ENGINE
CONTROL
(8W-30-23)
TORQUE
MANAGEMENT
REQUEST
SENSE
11
C1
T10
20
DB/LG
50
47
9
48
29
42
41
10
L/R
PRESSURE
SWITCH
SENSE
2C
PRESSURE
SWITCH
SENSE
OD
PRESSURE
SWITCH
SENSE
4C
PRESSURE
SWITCH
SENSE
UD
PRESSURE
SWITCH
SENSE
TRS T42
SENSE
TRS T41
SENSE
(P/N)
TORQUE
MANAGEMENT
REQUEST
SENSE
MODULE-
TRANSMISSION
CONTROL

# 8W-33 VEHICLE SPEED CONTROL


S/C
VACUUM
CONTROL
S/C
VENT
CONTROL
S/C
POWER
SUPPLY
MODULE-
POWERTRAIN
CONTROL
(8W-30-8)
12 C3
5 C3
7 C3
V32
20
VT/YL
NOT
USED
21 C100
21 C100
GAS
DIESEL
V32
20
VT/YL
4
SECONDARY
BRAKE
SWITCH
SIGNAL
BRAKE
SWITCH
NO. 1
SIGNAL
ASSEMBLY-
SHIFT
LEVER
(8W-31-3)
6
6
DIESEL
GAS
B15
20
DG/WT
23 C201
B15
20
DG/WT
S215
(8W-31-3)
B15
20
DG/WT
6
SWITCH-
STOP
LAMP
(8W-35-3)
3
5
V30
20
VT/WT
GAS
DIESEL
19 C100
19 C100
NOT
USED
Z940
20
BK
S214
(8W-15-8)
Z940
14
BK
V36
20
VT/TN
V35
20
VT/OR
V30
20
VT/WT
1
2
3
VACUUM
SOLENOID
VENT
SOLENOID
DUMP
SOLENOID
SERVO-
SPEED
CONTROL
4
Z937
20
BK
S111
(8W-15-4)
Z937
12
BK
G112
(8W-15-4)
2
G202
(8W-15-8)
(8W-15-9)

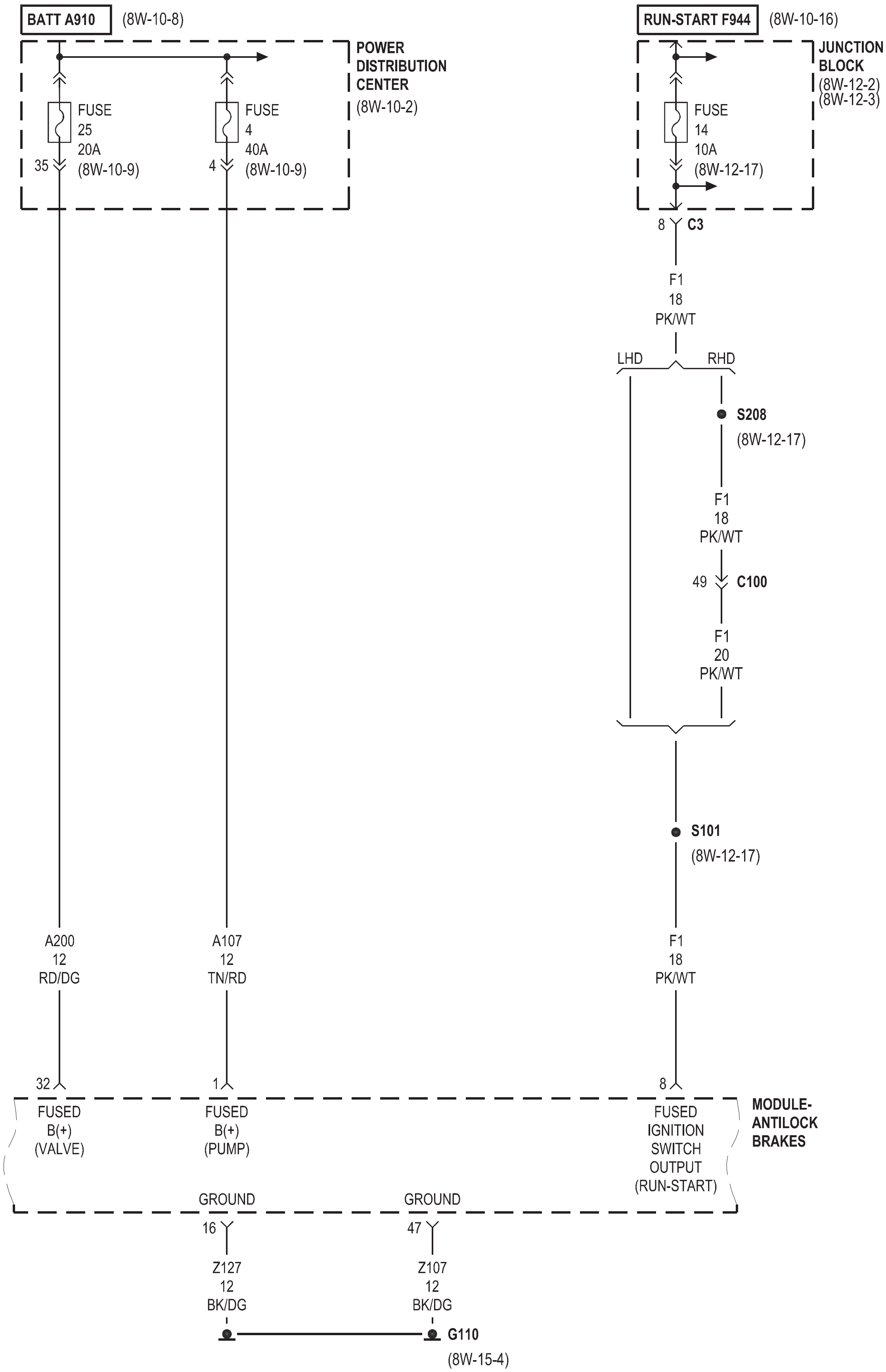

VEHICLE SPEED SIGNAL
SENSOR GROUND
S/C SWITCH SIGNAL NO. 1
MODULE-POWERTRAIN CONTROL
(8W-30-8)
(8W-30-10)
(8W-30-11)
S/C SWITCH SIGNAL NO. 1
SENSOR GROUND
S/C SWITCH SIGNAL NO. 2
MODULE-ENGINE CONTROL
(8W-30-19)
(8W-30-24)
13 C1
27 C2
34 C3
30 C1
65 C1
54 C1
B22 20 DG/YL
K900 20 DB/DG
V37 20 VT
V38 20 VT/OR
9 C105
S153 (8W-30-21) (8W-70-2)
42 C100
2 C111
S154 (8W-70-2)
8 C105
12 C104
9 C100
B22 18 DG/YL
4 C100
12 C104
6 C102
GAS
DIESEL
A TO CLOCKSPRING (8W-33-4)
C TO CLOCKSPRING (8W-33-4)
20 C1
VEHICLE SPEED SIGNAL
MODULE-BODY CONTROL
(8W-45-6)
S106 (8W-70-2)
S358 (8W-70-2)
15 C100
26 C201
S205 (8W-70-2)
B TO CLOCKSPRING (8W-33-4)



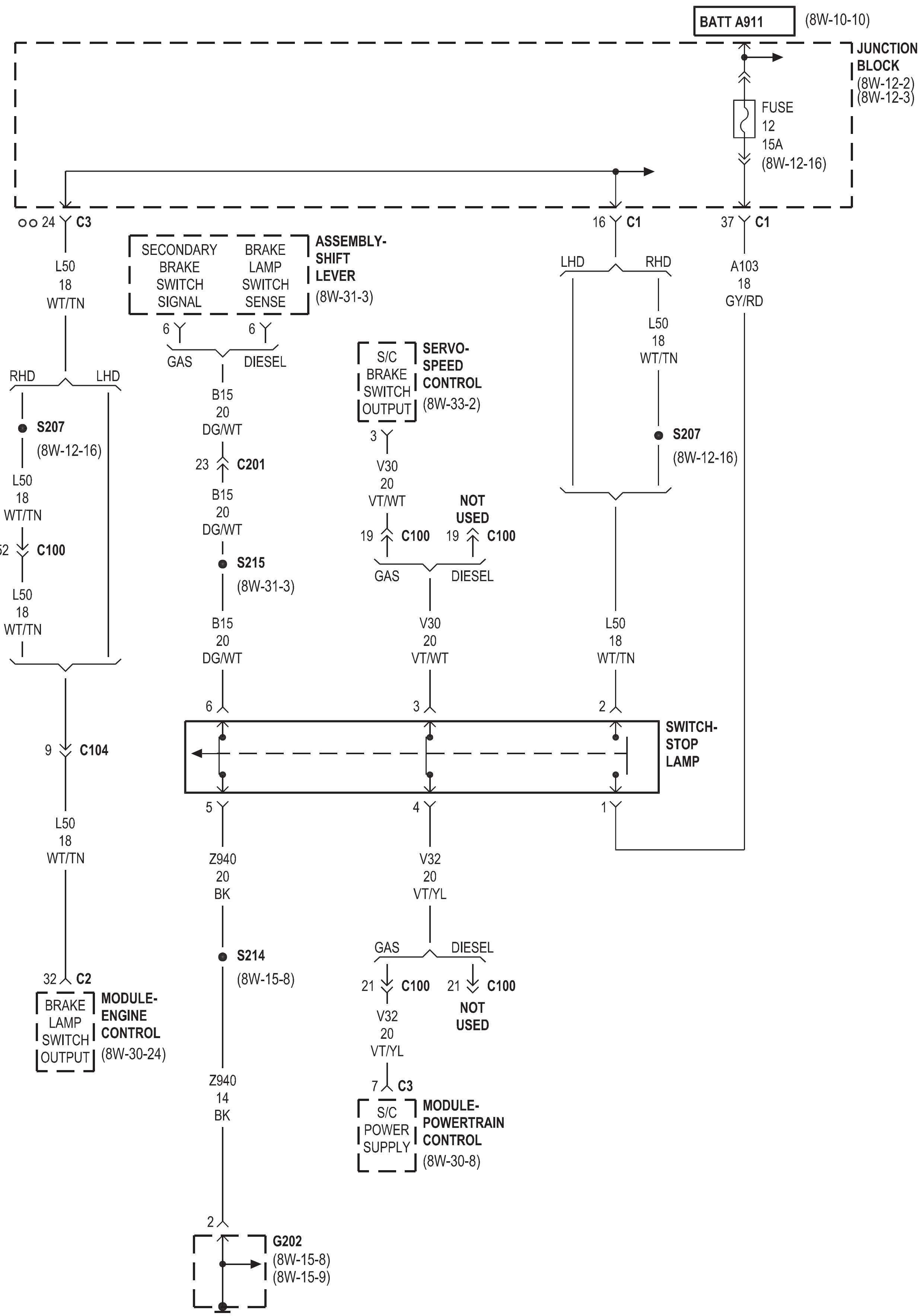
FROM
C100
(8W-33-3)
C
FROM
C100
(8W-33-3)
A
FROM
S205
(8W-33-3)
B
V38
20
VT/OR
V37
20
VT
K900
20
DB/DG
1 C1
6 C1
5 C1
CLOCKSPRING
2 C3
1 C4
2 C4
V38
20
VT/OR
V37
20
VT
S316
S317
V38
20
VT/OR
V37
20
VT
V38
20
VT/OR
V37
20
VT
1
3
1
3
S/C
SWITCH
SIGNAL NO. 2
S/C
SWITCH
SIGNAL NO. 1
SENSOR
GROUND
SWITCH-
SPEED
CONTROL-
RIGHT
1 RESUME/ACCEL
2 CANCEL
3 COAST
S/C
SWITCH
SIGNAL NO. 2
S/C
SWITCH
SIGNAL NO. 1
SENSOR
GROUND
SWITCH-
SPEED
CONTROL-
LEFT
1 ON/OFF
2 SET
2
2
K900
20
DB/DG
K900
20
DB/DG
K900
20
DB/DG
S315

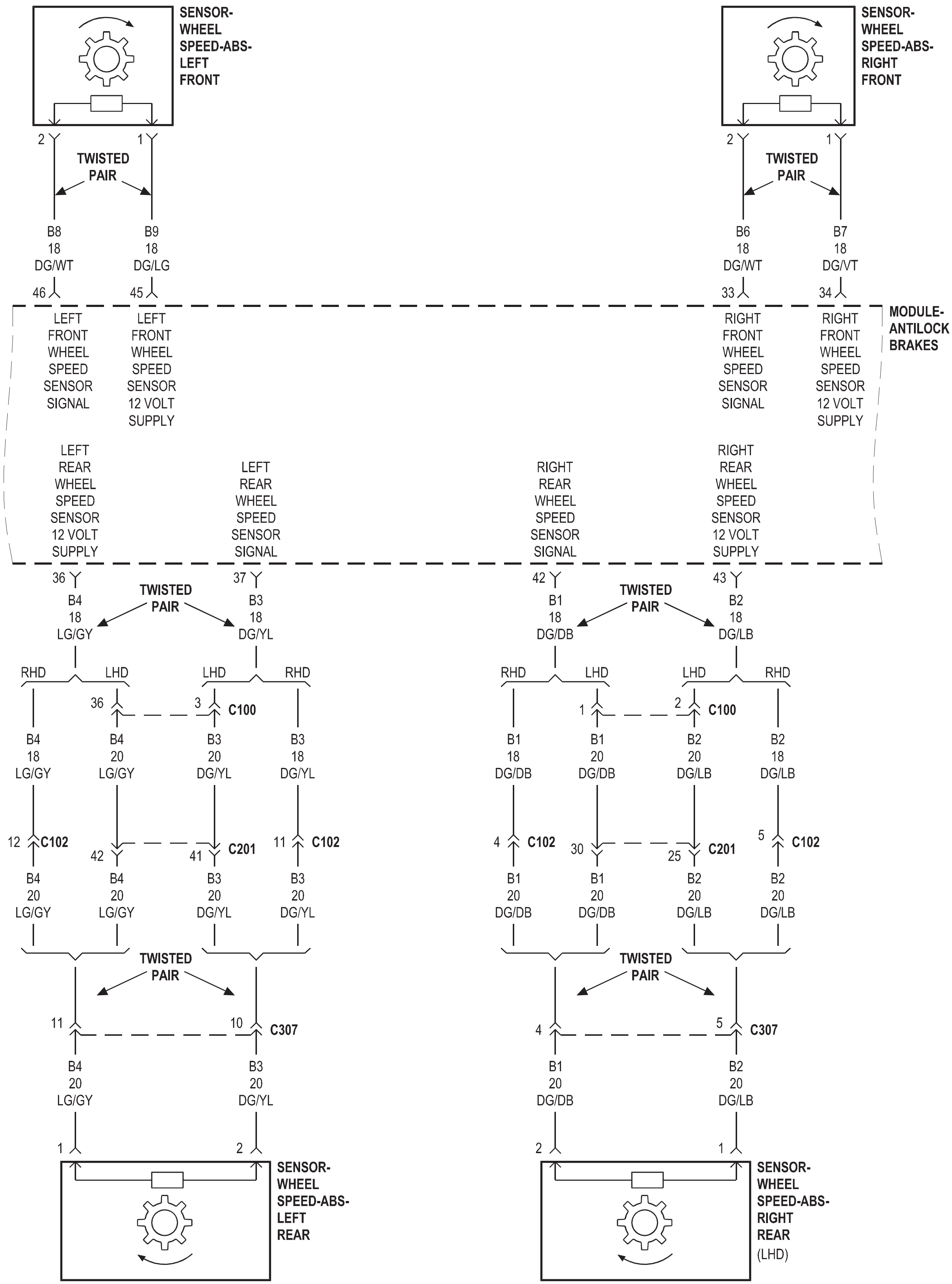

○○ DIESEL

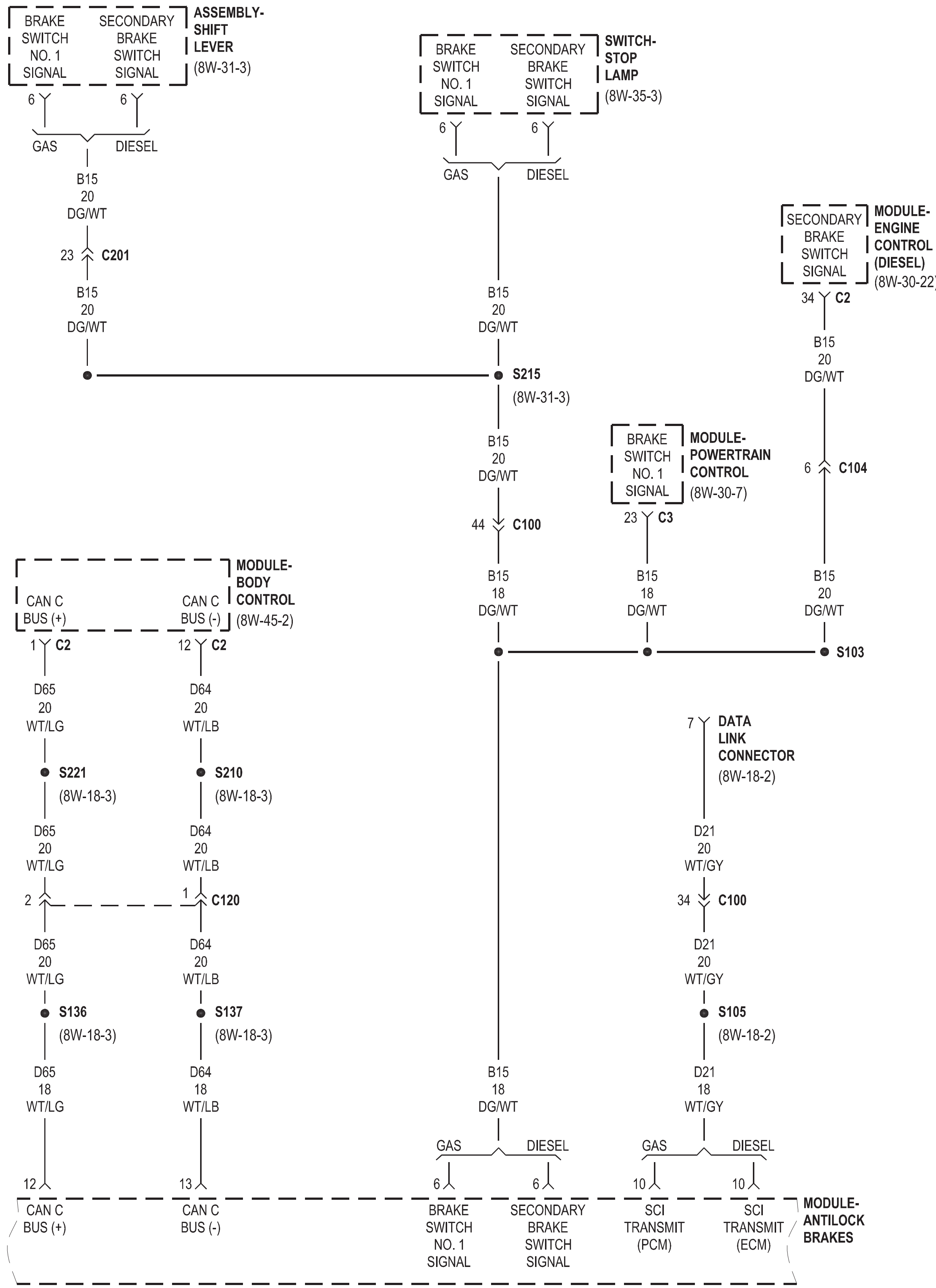
# 8W-35 ANTILOCK BRAKES

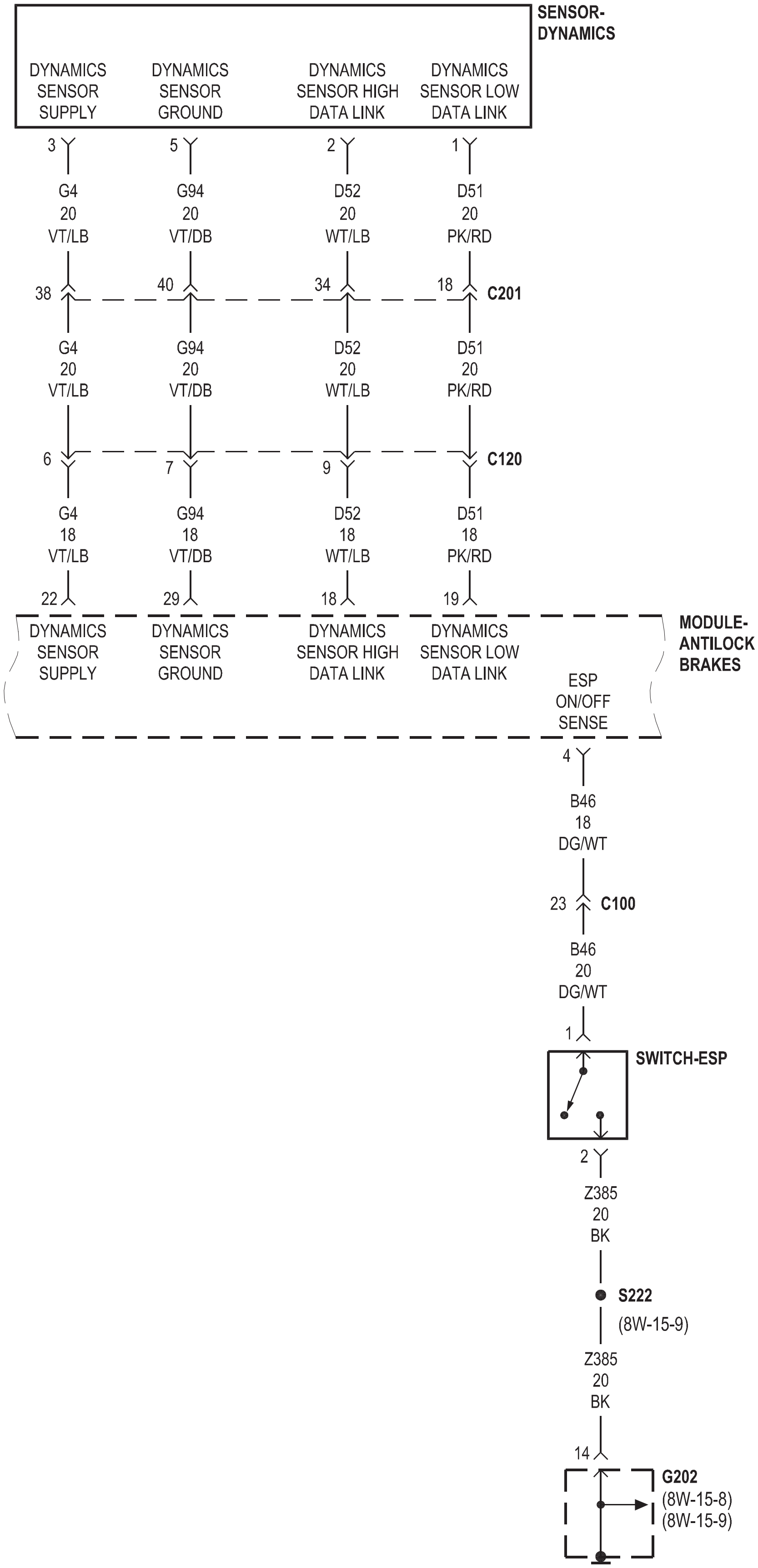


BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 25 20A
35
(8W-10-9)
FUSE 4 40A
4
(8W-10-9)
RUN-START F944
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 14 10A
(8W-12-17)
8 C3
F1 18 PK/WT
LHD
RHD
S208
(8W-12-17)
F1 18 PK/WT
49 C100
F1 20 PK/WT
S101
(8W-12-17)
A200 12 RD/DG
A107 12 TN/RD
F1 18 PK/WT
32
1
8
MODULE-ANTILOCK BRAKES
FUSED B(+) (VALVE)
FUSED B(+) (PUMP)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
GROUND
GROUND
16
47
Z127 12 BK/DG
Z107 12 BK/DG
G110
(8W-15-4)

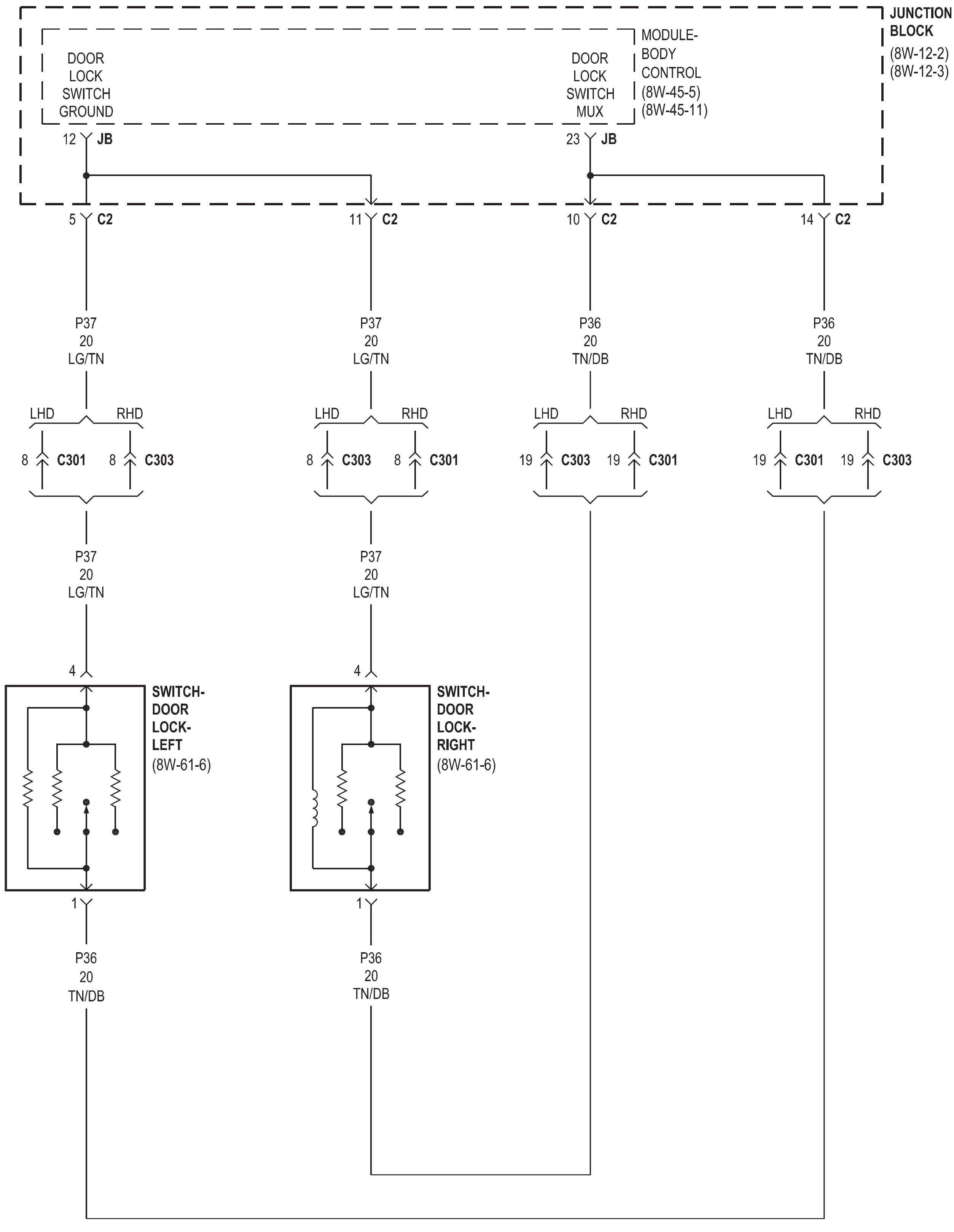

BATT A911
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
12
15A
(8W-12-16)
24 C3
16 C1
37 C1
L50
18
WT/TN
SECONDARY BRAKE SWITCH SIGNAL
BRAKE LAMP SWITCH SENSE
ASSEMBLY-SHIFT LEVER
(8W-31-3)
LHD
RHD
A103
18
GY/RD
6
6
GAS
DIESEL
S/C BRAKE SWITCH OUTPUT
SERVO-SPEED CONTROL
(8W-33-2)
RHD
LHD
B15
20
DG/WT
S207
(8W-12-16)
3
23 C201
V30
20
VT/WT
NOT USED
19 C100
19 C100
52 C100
S215
(8W-31-3)
6
3
2
SWITCH-STOP LAMP
9 C104
5
4
1
Z940
20
BK
V32
20
VT/YL
S214
(8W-15-8)
21 C100
21 C100
32 C2
BRAKE LAMP SWITCH OUTPUT
MODULE-ENGINE CONTROL
(8W-30-24)
Z940
14
BK
7 C3
S/C POWER SUPPLY
MODULE-POWERTRAIN CONTROL
(8W-30-8)
2
G202
(8W-15-8)
(8W-15-9)
○○ DIESEL

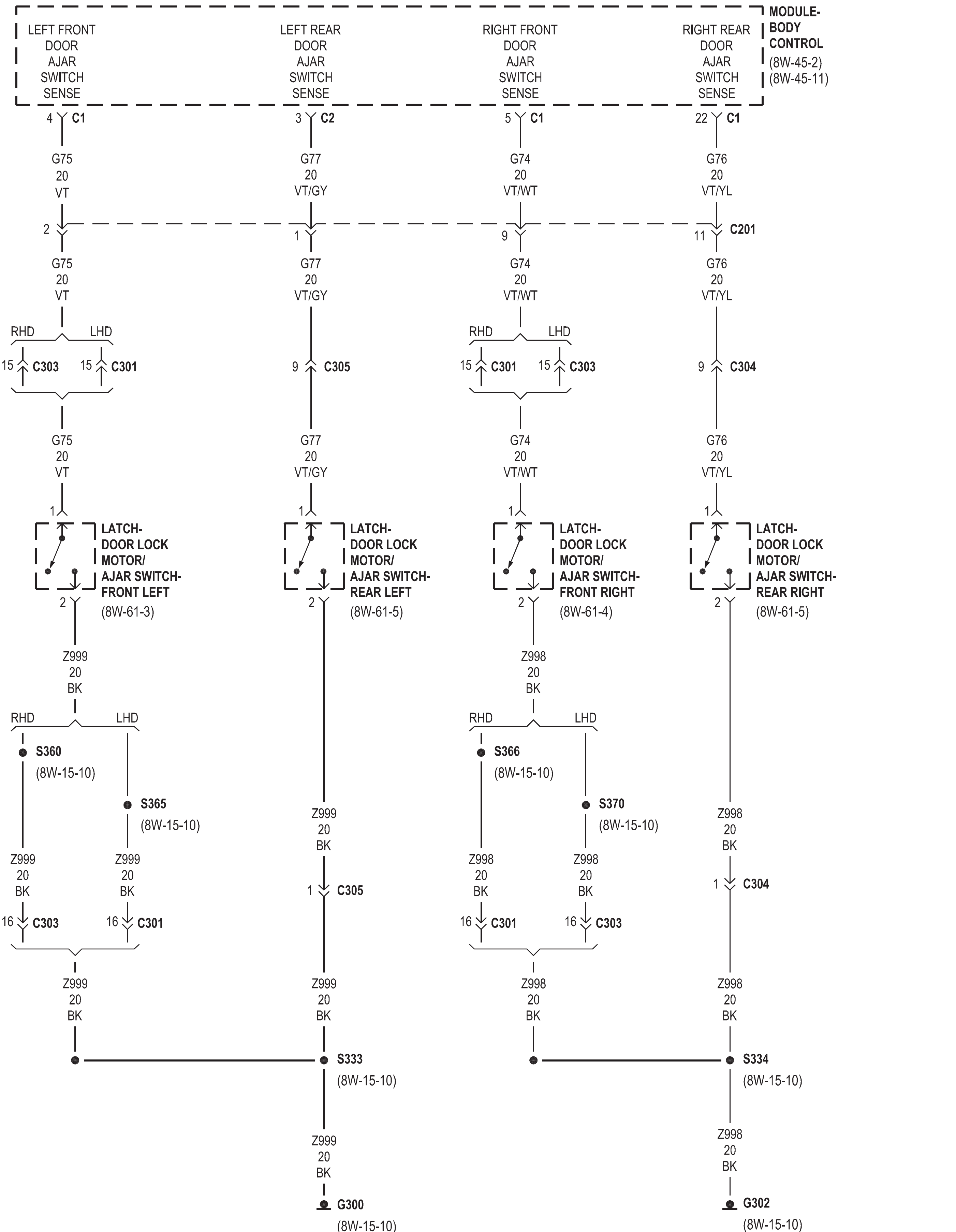

SENSOR-WHEEL SPEED-ABS-LEFT FRONT
SENSOR-WHEEL SPEED-ABS-RIGHT FRONT
TWISTED PAIR
B8 18 DG/WT
B9 18 DG/LG
B6 18 DG/WT
B7 18 DG/VT
MODULE-ANTILOCK BRAKES
LEFT FRONT WHEEL SPEED SENSOR SIGNAL
LEFT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
RIGHT FRONT WHEEL SPEED SENSOR SIGNAL
RIGHT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY
LEFT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
LEFT REAR WHEEL SPEED SENSOR SIGNAL
RIGHT REAR WHEEL SPEED SENSOR SIGNAL
RIGHT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY
B4 18 LG/GY
B3 18 DG/YL
B1 18 DG/DB
B2 18 DG/LB
RHD
LHD
C100
C102
C201
C307
B4 20 LG/GY
B3 20 DG/YL
B1 20 DG/DB
B2 20 DG/LB
SENSOR-WHEEL SPEED-ABS-LEFT REAR
SENSOR-WHEEL SPEED-ABS-RIGHT REAR (LHD)

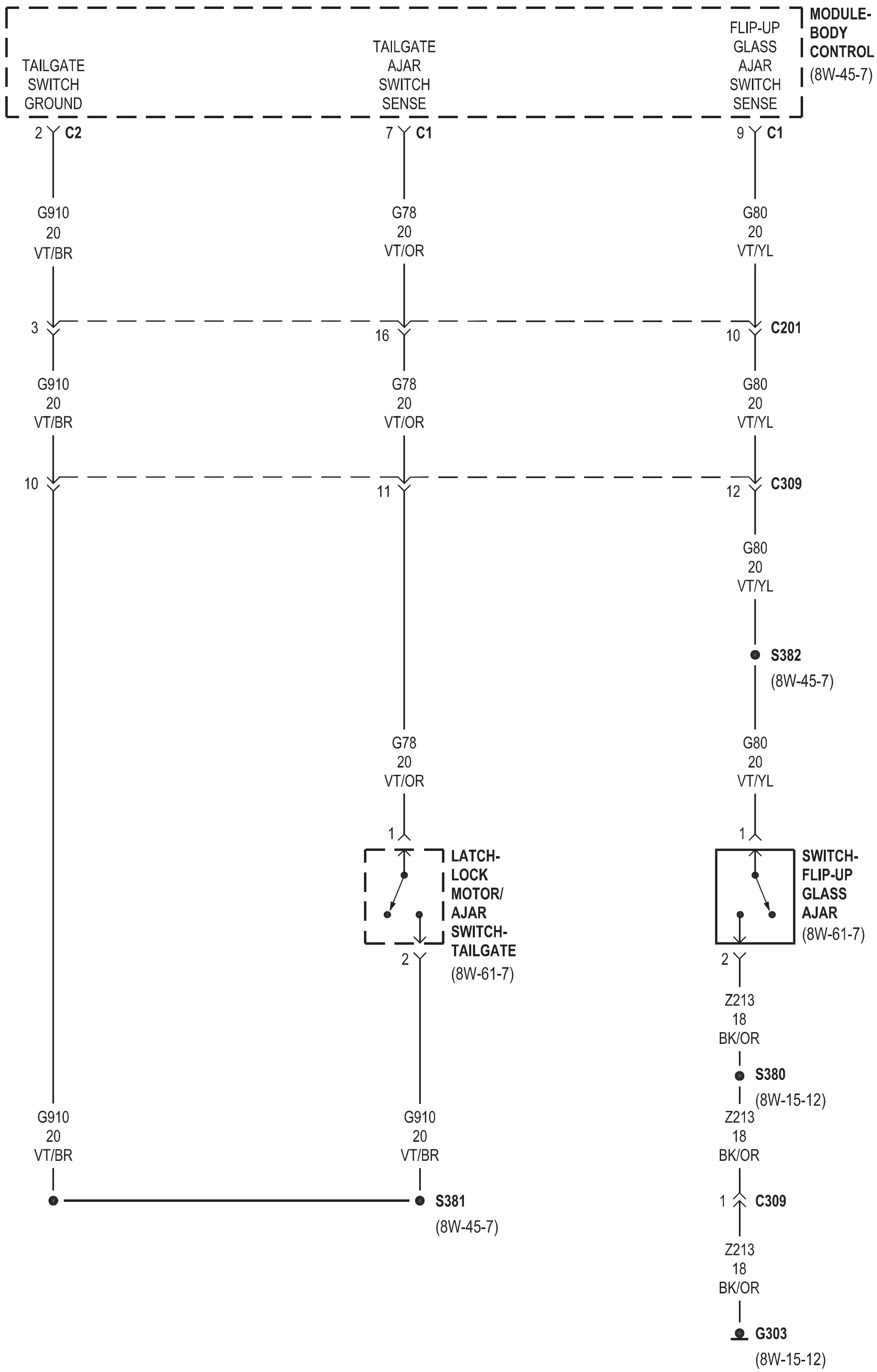

BRAKE SWITCH NO. 1 SIGNAL
SECONDARY BRAKE SWITCH SIGNAL
ASSEMBLY-SHIFT LEVER
(8W-31-3)
6
6
GAS
DIESEL
B15
20
DG/WT
23
C201
B15
20
DG/WT
BRAKE SWITCH NO. 1 SIGNAL
SECONDARY BRAKE SWITCH SIGNAL
SWITCH-STOP LAMP
(8W-35-3)
6
6
GAS
DIESEL
B15
20
DG/WT
S215
(8W-31-3)
B15
20
DG/WT
44
C100
B15
18
DG/WT
SECONDARY BRAKE SWITCH SIGNAL
MODULE-ENGINE CONTROL (DIESEL)
(8W-30-22)
34
C2
B15
20
DG/WT
6
C104
B15
20
DG/WT
BRAKE SWITCH NO. 1 SIGNAL
MODULE-POWERTRAIN CONTROL
(8W-30-7)
23
C3
B15
18
DG/WT
S103
CAN C BUS (+)
CAN C BUS (-)
MODULE-BODY CONTROL
(8W-45-2)
1
C2
12
C2
D65
20
WT/LG
D64
20
WT/LB
S221
(8W-18-3)
S210
(8W-18-3)
D65
20
WT/LG
D64
20
WT/LB
2
1
C120
D65
20
WT/LG
D64
20
WT/LB
S136
(8W-18-3)
S137
(8W-18-3)
D65
18
WT/LG
D64
18
WT/LB
7
DATA LINK CONNECTOR
(8W-18-2)
D21
20
WT/GY
34
C100
D21
20
WT/GY
S105
(8W-18-2)
D21
18
WT/GY
B15
18
DG/WT
GAS
DIESEL
GAS
DIESEL
12
13
6
6
10
10
CAN C BUS (+)
CAN C BUS (-)
BRAKE SWITCH NO. 1 SIGNAL
SECONDARY BRAKE SWITCH SIGNAL
SCI TRANSMIT (PCM)
SCI TRANSMIT (ECM)
MODULE-ANTILOCK BRAKES

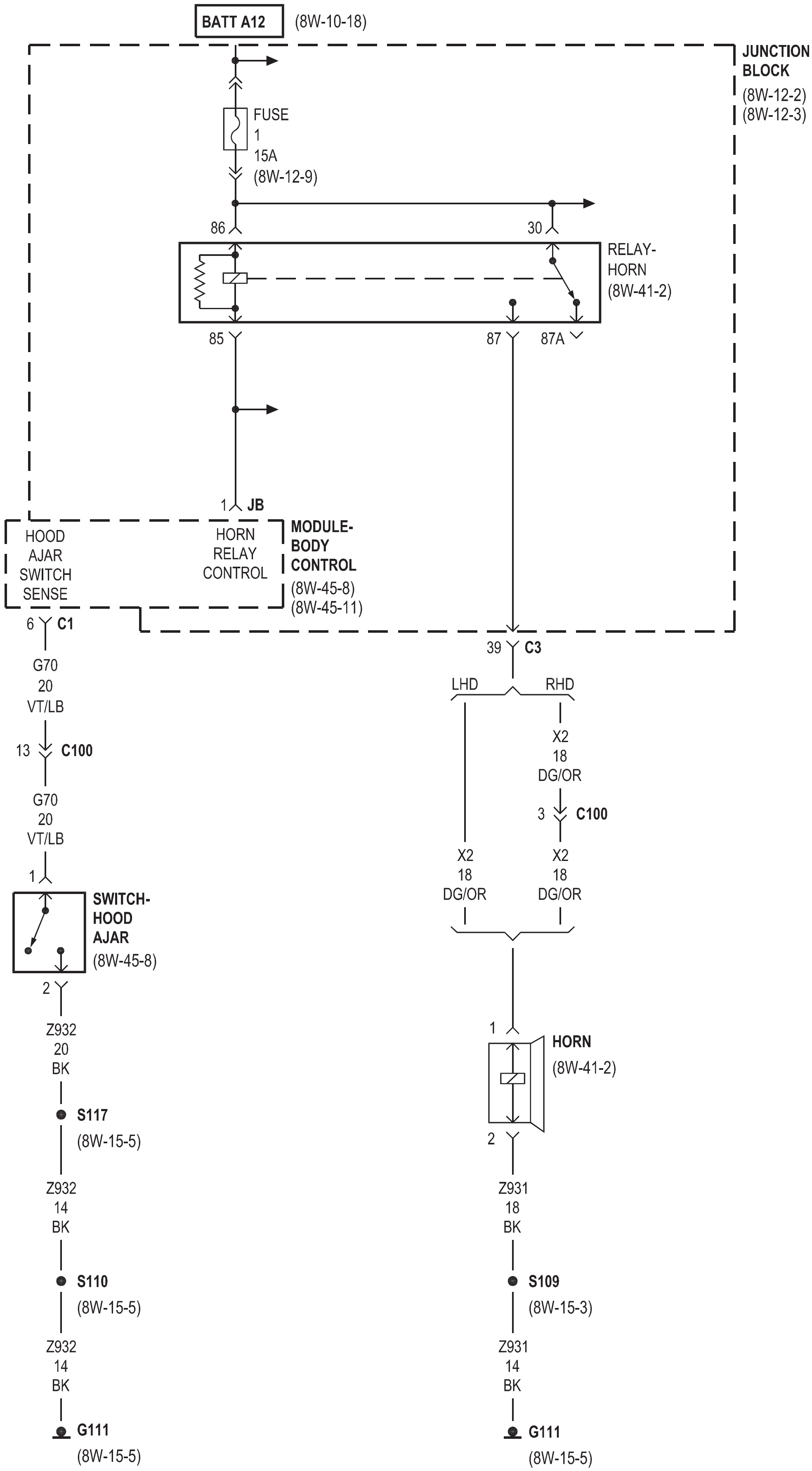

SENSOR-DYNAMICS
DYNAMICS SENSOR SUPPLY
DYNAMICS SENSOR GROUND
DYNAMICS SENSOR HIGH DATA LINK
DYNAMICS SENSOR LOW DATA LINK
3
5
2
1
G4 20 VT/LB
G94 20 VT/DB
D52 20 WT/LB
D51 20 PK/RD
38
40
34
18
C201
G4 20 VT/LB
G94 20 VT/DB
D52 20 WT/LB
D51 20 PK/RD
6
7
9
C120
G4 18 VT/LB
G94 18 VT/DB
D52 18 WT/LB
D51 18 PK/RD
22
29
18
19
MODULE-ANTILOCK BRAKES
DYNAMICS SENSOR SUPPLY
DYNAMICS SENSOR GROUND
DYNAMICS SENSOR HIGH DATA LINK
DYNAMICS SENSOR LOW DATA LINK
ESP ON/OFF SENSE
4
B46 18 DG/WT
23
C100
B46 20 DG/WT
1
SWITCH-ESP
2
Z385 20 BK
S222
(8W-15-9)
Z385 20 BK
14
G202
(8W-15-8)
(8W-15-9)

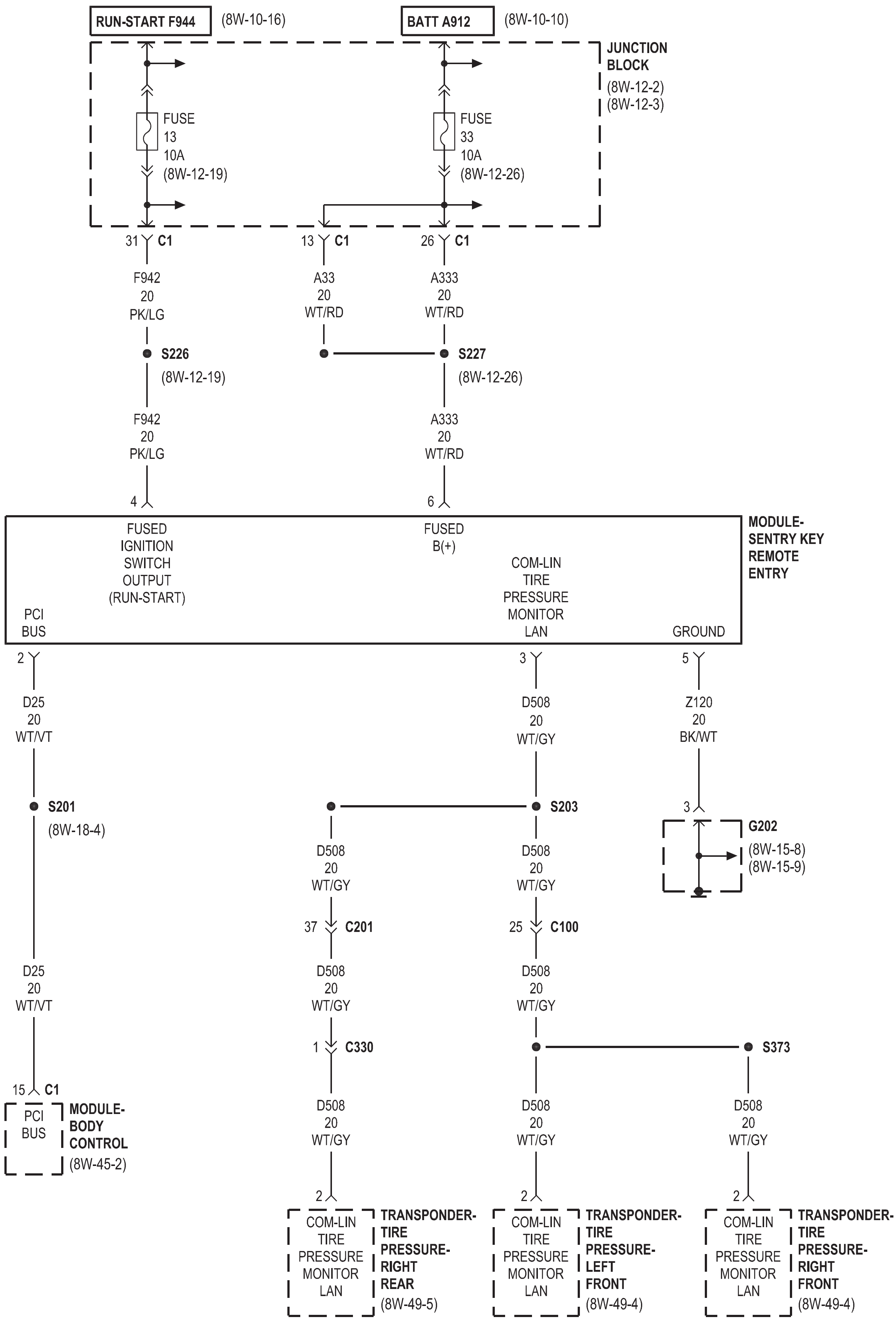
# 8W-39 VEHICLE THEFT SECURITY SYSTEM

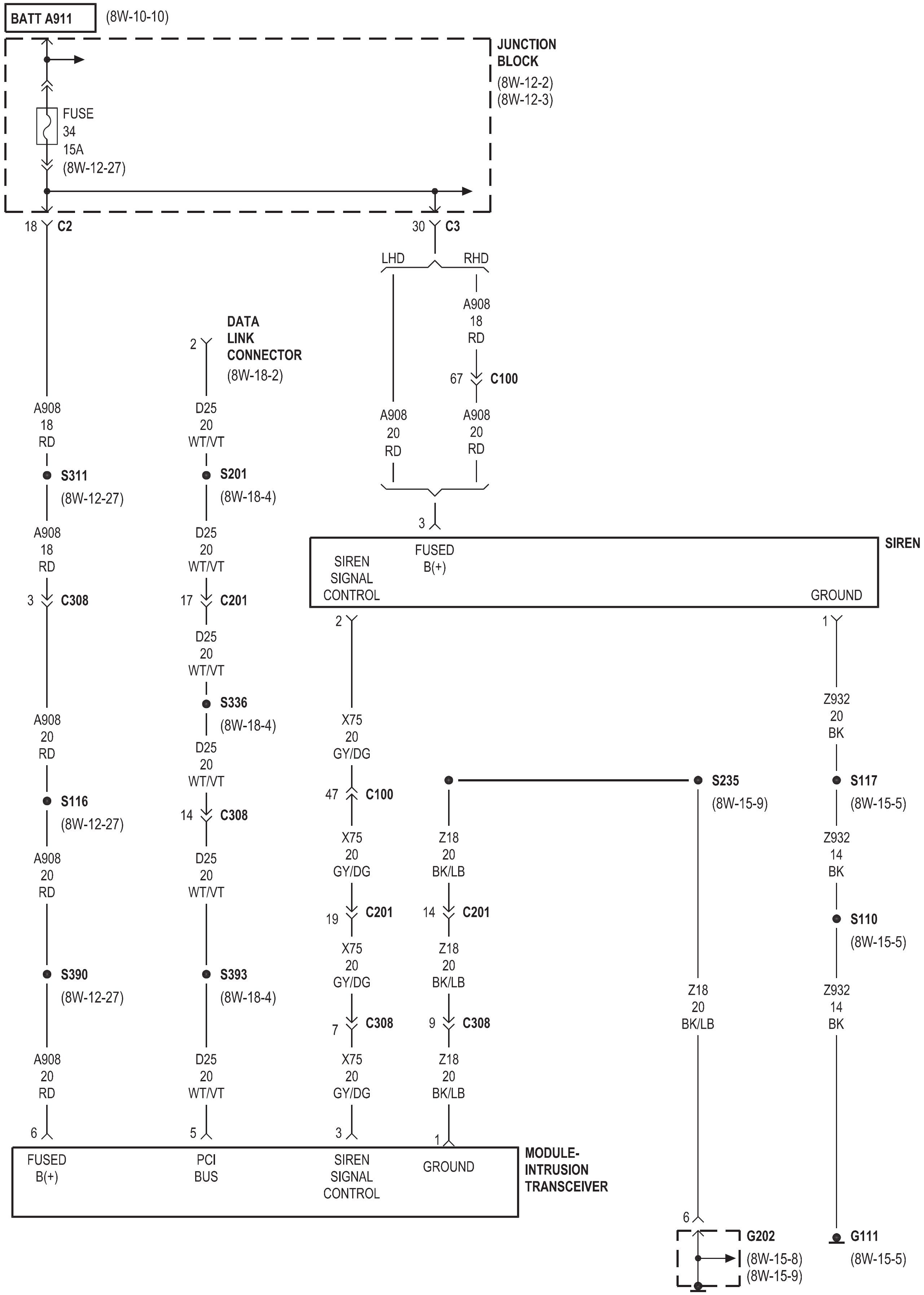

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
MODULE-BODY CONTROL
(8W-45-5)
(8W-45-11)
DOOR LOCK SWITCH GROUND
DOOR LOCK SWITCH MUX
12 JB
23 JB
5 C2
11 C2
10 C2
14 C2
P37 20 LG/TN
P37 20 LG/TN
P36 20 TN/DB
P36 20 TN/DB
LHD RHD
8 C301 8 C303
8 C303 8 C301
19 C303 19 C301
19 C301 19 C303
P37 20 LG/TN
P37 20 LG/TN
4
4
SWITCH-DOOR LOCK-LEFT
(8W-61-6)
SWITCH-DOOR LOCK-RIGHT
(8W-61-6)
1
1
P36 20 TN/DB
P36 20 TN/DB


MODULE-BODY CONTROL
(8W-45-2)
(8W-45-11)
LEFT FRONT DOOR AJAR SWITCH SENSE
LEFT REAR DOOR AJAR SWITCH SENSE
RIGHT FRONT DOOR AJAR SWITCH SENSE
RIGHT REAR DOOR AJAR SWITCH SENSE
4 C1
3 C2
5 C1
22 C1
G75 20 VT
G77 20 VT/GY
G74 20 VT/WT
G76 20 VT/YL
2
1
9
11
C201
RHD
LHD
15 C303
15 C301
9 C305
15 C301
15 C303
9 C304
1
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT LEFT
(8W-61-3)
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-REAR LEFT
(8W-61-5)
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT RIGHT
(8W-61-4)
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-REAR RIGHT
(8W-61-5)
2
Z999 20 BK
Z998 20 BK
S360
(8W-15-10)
S365
(8W-15-10)
S366
(8W-15-10)
S370
(8W-15-10)
1 C305
1 C304
16 C303
16 C301
16 C301
16 C303
S333
(8W-15-10)
S334
(8W-15-10)
G300
(8W-15-10)
G302
(8W-15-10)


MODULE-
BODY
CONTROL
(8W-45-7)
TAILGATE
SWITCH
GROUND
TAILGATE
AJAR
SWITCH
SENSE
FLIP-UP
GLASS
AJAR
SWITCH
SENSE
2 C2
7 C1
9 C1
G910
20
VT/BR
G78
20
VT/OR
G80
20
VT/YL
3
16
10
C201
10
11
12
C309
S382
(8W-45-7)
1
LATCH-
LOCK
MOTOR/
AJAR
SWITCH-
TAILGATE
(8W-61-7)
2
SWITCH-
FLIP-UP
GLASS
AJAR
(8W-61-7)
Z213
18
BK/OR
S380
(8W-15-12)
S381
(8W-45-7)
1 C309
G303
(8W-15-12)

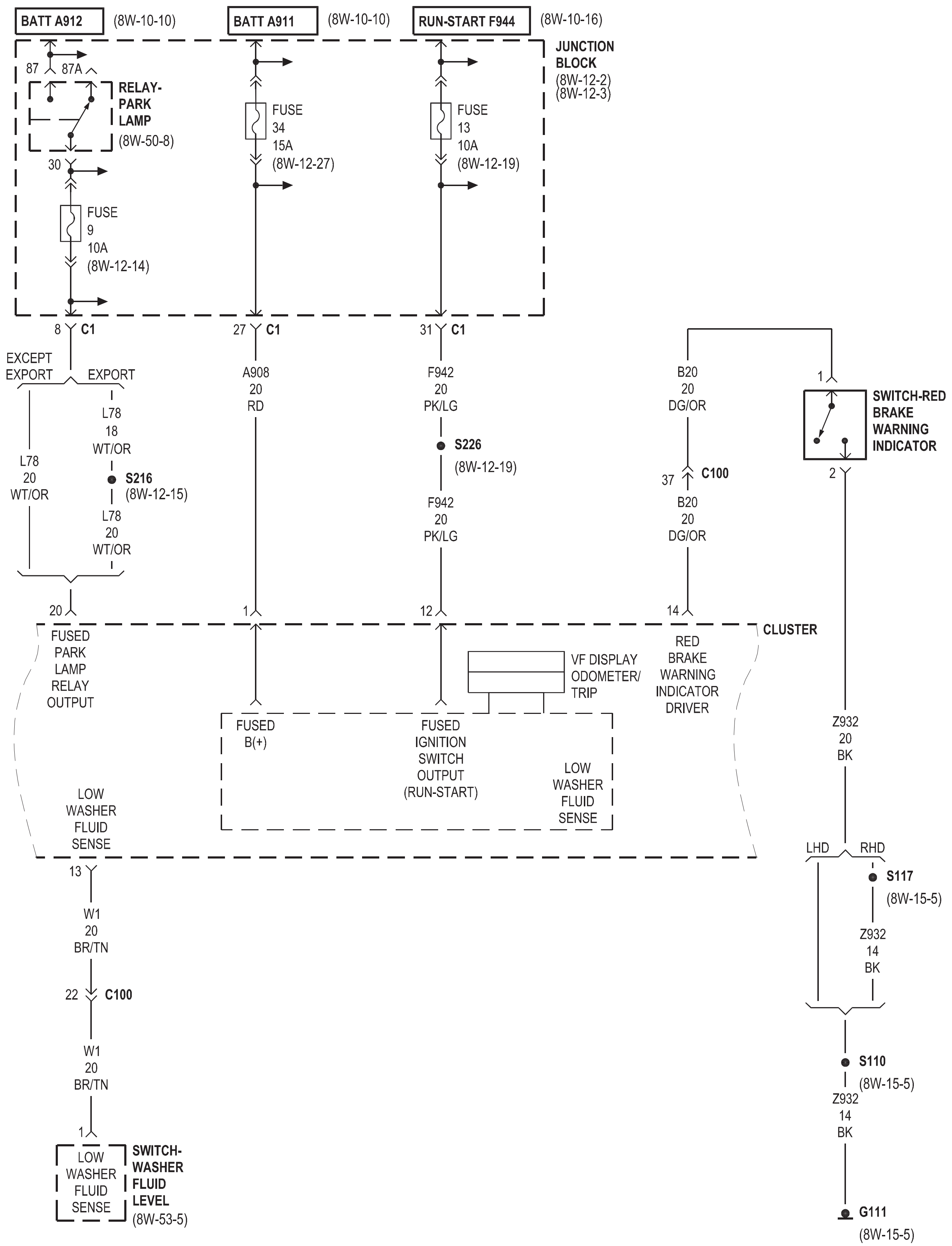

BATT A12
(8W-10-18)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
1
15A
(8W-12-9)
86
30
RELAY-HORN
(8W-41-2)
85
87
87A
1 JB
HOOD AJAR SWITCH SENSE
HORN RELAY CONTROL
MODULE-BODY CONTROL
(8W-45-8)
(8W-45-11)
6 C1
39 C3
LHD
RHD
G70
20
VT/LB
13 C100
G70
20
VT/LB
X2
18
DG/OR
3 C100
X2
18
DG/OR
X2
18
DG/OR
1
SWITCH-HOOD AJAR
(8W-45-8)
2
Z932
20
BK
S117
(8W-15-5)
Z932
14
BK
S110
(8W-15-5)
Z932
14
BK
G111
(8W-15-5)
1
HORN
(8W-41-2)
2
Z931
18
BK
S109
(8W-15-3)
Z931
14
BK
G111
(8W-15-5)

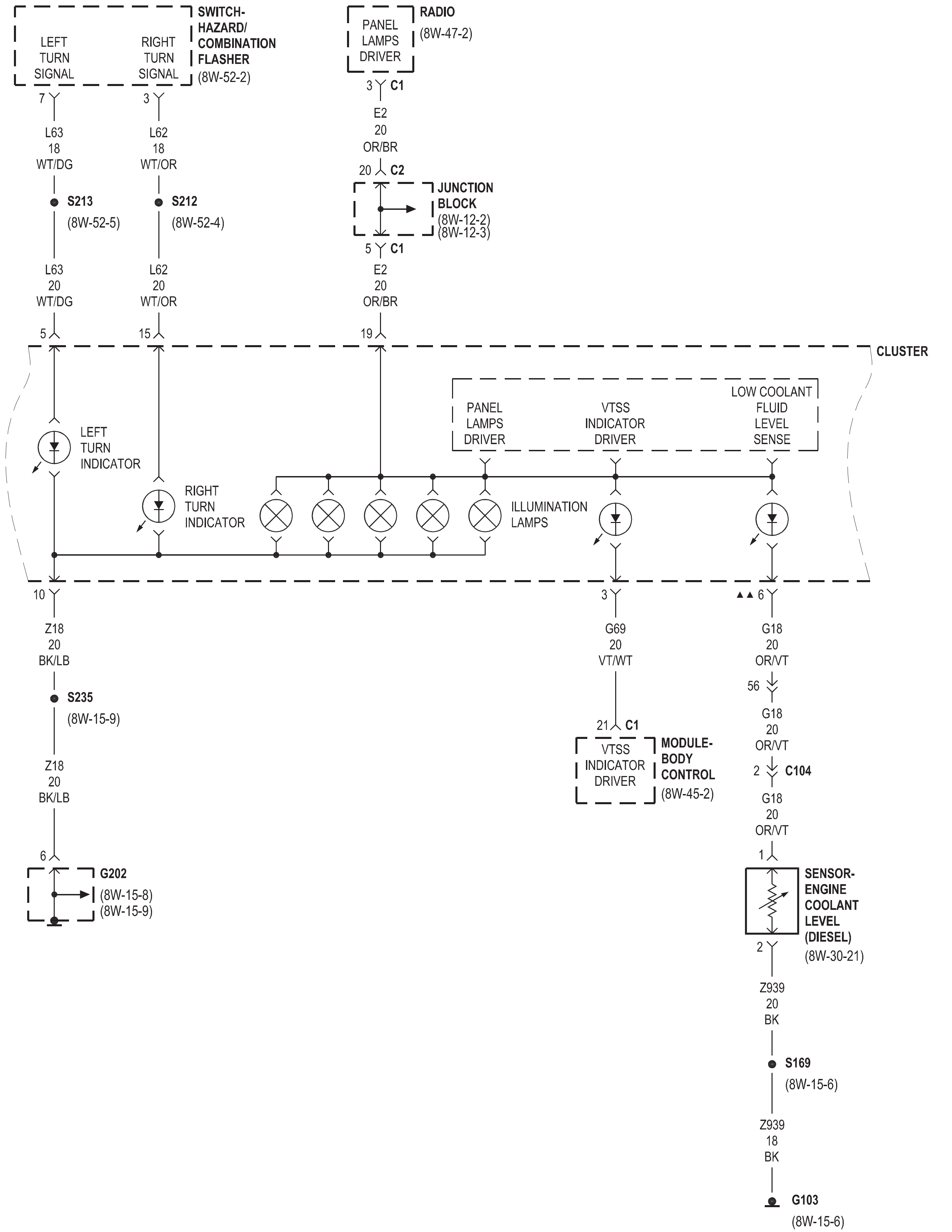

RUN-START F944
(8W-10-16)
BATT A912
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 13 10A (8W-12-19)
FUSE 33 10A (8W-12-26)
31 C1
13 C1
26 C1
F942 20 PK/LG
A33 20 WT/RD
A333 20 WT/RD
S226 (8W-12-19)
S227 (8W-12-26)
F942 20 PK/LG
A333 20 WT/RD
4
6
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED B(+)
COM-LIN TIRE PRESSURE MONITOR LAN
PCI BUS
GROUND
MODULE-SENTRY KEY REMOTE ENTRY
2
3
5
D25 20 WT/VT
D508 20 WT/GY
Z120 20 BK/WT
S201 (8W-18-4)
S203
3
G202 (8W-15-8) (8W-15-9)
D508 20 WT/GY
D508 20 WT/GY
37 C201
25 C100
D25 20 WT/VT
D508 20 WT/GY
D508 20 WT/GY
1 C330
S373
15 C1
PCI BUS
MODULE-BODY CONTROL (8W-45-2)
D508 20 WT/GY
D508 20 WT/GY
D508 20 WT/GY
2
2
2
COM-LIN TIRE PRESSURE MONITOR LAN
TRANSPONDER-TIRE PRESSURE-RIGHT REAR (8W-49-5)
COM-LIN TIRE PRESSURE MONITOR LAN
TRANSPONDER-TIRE PRESSURE-LEFT FRONT (8W-49-4)
COM-LIN TIRE PRESSURE MONITOR LAN
TRANSPONDER-TIRE PRESSURE-RIGHT FRONT (8W-49-4)

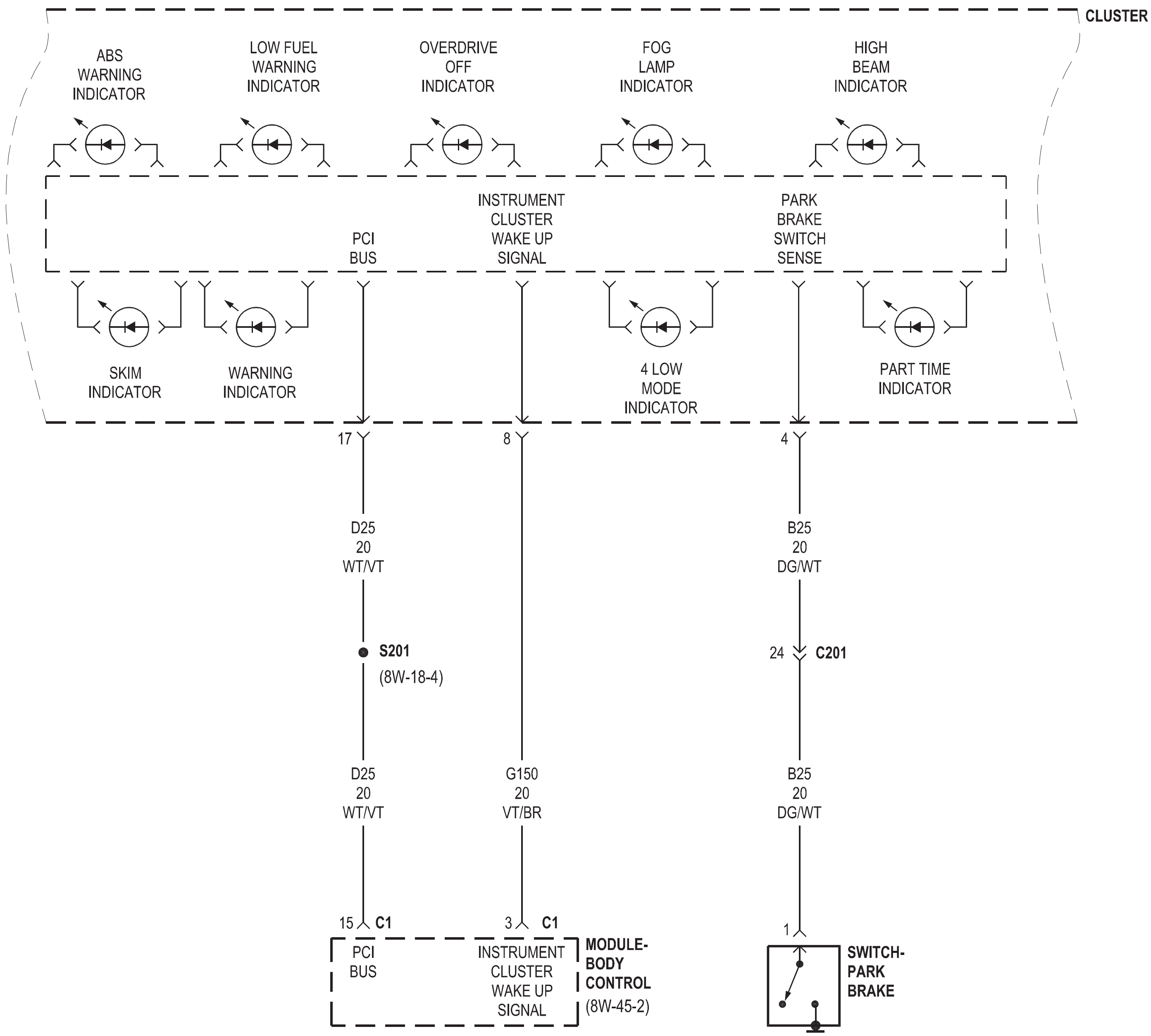


BATT A911
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
34
15A
(8W-12-27)
18 C2
30 C3
LHD
RHD
A908
18
RD
67 C100
A908
20
RD
DATA LINK CONNECTOR
(8W-18-2)
2
D25
20
WT/VT
S311
(8W-12-27)
S201
(8W-18-4)
3 C308
17 C201
S336
(8W-18-4)
14 C308
S116
(8W-12-27)
S390
(8W-12-27)
S393
(8W-18-4)
SIREN
FUSED
B(+)
SIREN SIGNAL CONTROL
GROUND
X75
20
GY/DG
47 C100
19 C201
7 C308
Z18
20
BK/LB
14 C201
9 C308
S235
(8W-15-9)
Z932
20
BK
S117
(8W-15-5)
Z932
14
BK
S110
(8W-15-5)
MODULE-INTRUSION TRANSCEIVER
FUSED B(+)
PCI BUS
SIREN SIGNAL CONTROL
GROUND
G202
(8W-15-8)
(8W-15-9)
G111
(8W-15-5)

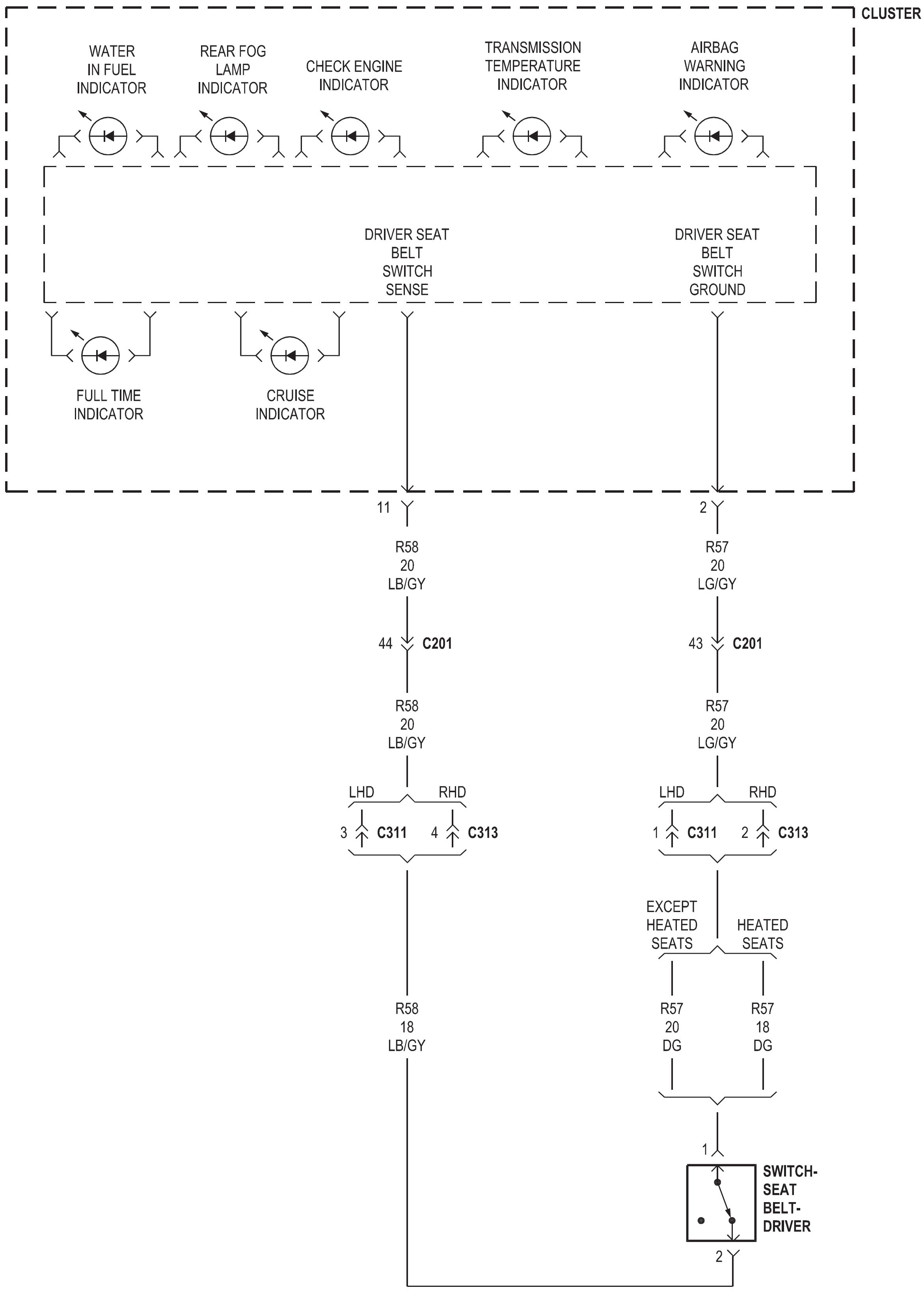
# 8W-40 INSTRUMENT CLUSTER


BATT A912
(8W-10-10)
BATT A911
(8W-10-10)
RUN-START F944
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
87
87A
RELAY-PARK LAMP
(8W-50-8)
30
FUSE 9 10A
(8W-12-14)
FUSE 34 15A
(8W-12-27)
FUSE 13 10A
(8W-12-19)
8 C1
27 C1
31 C1
EXCEPT EXPORT
EXPORT
L78 18 WT/OR
S216
(8W-12-15)
L78 20 WT/OR
L78 20 WT/OR
A908 20 RD
F942 20 PK/LG
S226
(8W-12-19)
F942 20 PK/LG
B20 20 DG/OR
37 C100
B20 20 DG/OR
1
SWITCH-RED BRAKE WARNING INDICATOR
2
20
1
12
14
CLUSTER
FUSED PARK LAMP RELAY OUTPUT
VF DISPLAY ODOMETER/ TRIP
RED BRAKE WARNING INDICATOR DRIVER
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
LOW WASHER FLUID SENSE
LOW WASHER FLUID SENSE
Z932 20 BK
LHD
RHD
S117
(8W-15-5)
Z932 14 BK
13
W1 20 BR/TN
22 C100
W1 20 BR/TN
1
LOW WASHER FLUID SENSE
SWITCH-WASHER FLUID LEVEL
(8W-53-5)
S110
(8W-15-5)
Z932 14 BK
G111
(8W-15-5)

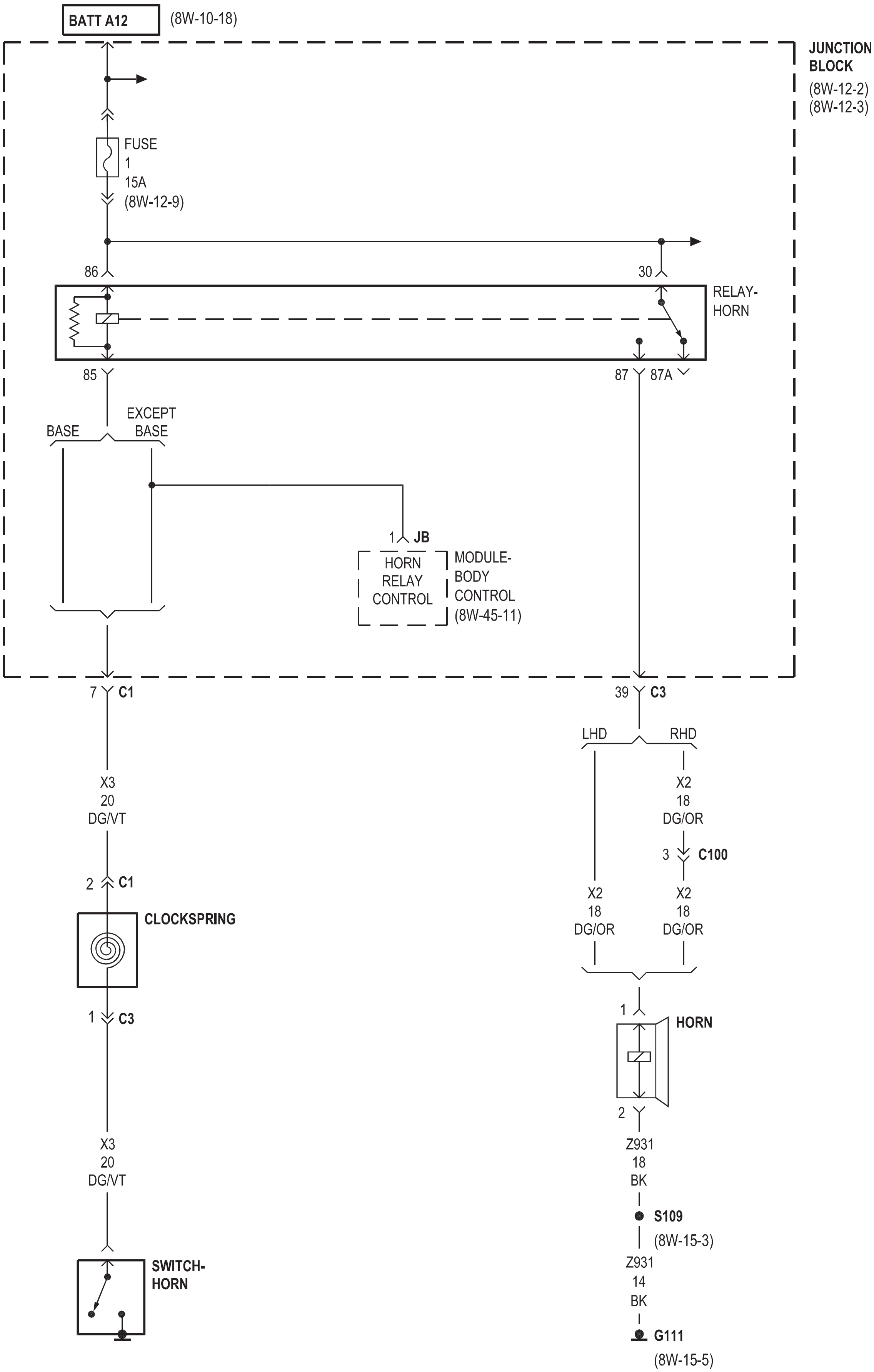

SWITCH-
HAZARD/
COMBINATION
FLASHER
(8W-52-2)
LEFT
TURN
SIGNAL
RIGHT
TURN
SIGNAL
7
3
L63
18
WT/DG
L62
18
WT/OR
S213
(8W-52-5)
S212
(8W-52-4)
L63
20
WT/DG
L62
20
WT/OR
5
15
RADIO
(8W-47-2)
PANEL
LAMPS
DRIVER
3 C1
E2
20
OR/BR
20 C2
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
5 C1
E2
20
OR/BR
19
CLUSTER
LEFT
TURN
INDICATOR
RIGHT
TURN
INDICATOR
PANEL
LAMPS
DRIVER
VTSS
INDICATOR
DRIVER
LOW COOLANT
FLUID
LEVEL
SENSE
ILLUMINATION
LAMPS
10
Z18
20
BK/LB
S235
(8W-15-9)
Z18
20
BK/LB
6
G202
(8W-15-8)
(8W-15-9)
3
G69
20
VT/WT
21 C1
MODULE-
BODY
CONTROL
(8W-45-2)
VTSS
INDICATOR
DRIVER
▲▲ 6
G18
20
OR/VT
56
G18
20
OR/VT
2 C104
G18
20
OR/VT
1
SENSOR-
ENGINE
COOLANT
LEVEL
(DIESEL)
(8W-30-21)
2
Z939
20
BK
S169
(8W-15-6)
Z939
18
BK
G103
(8W-15-6)



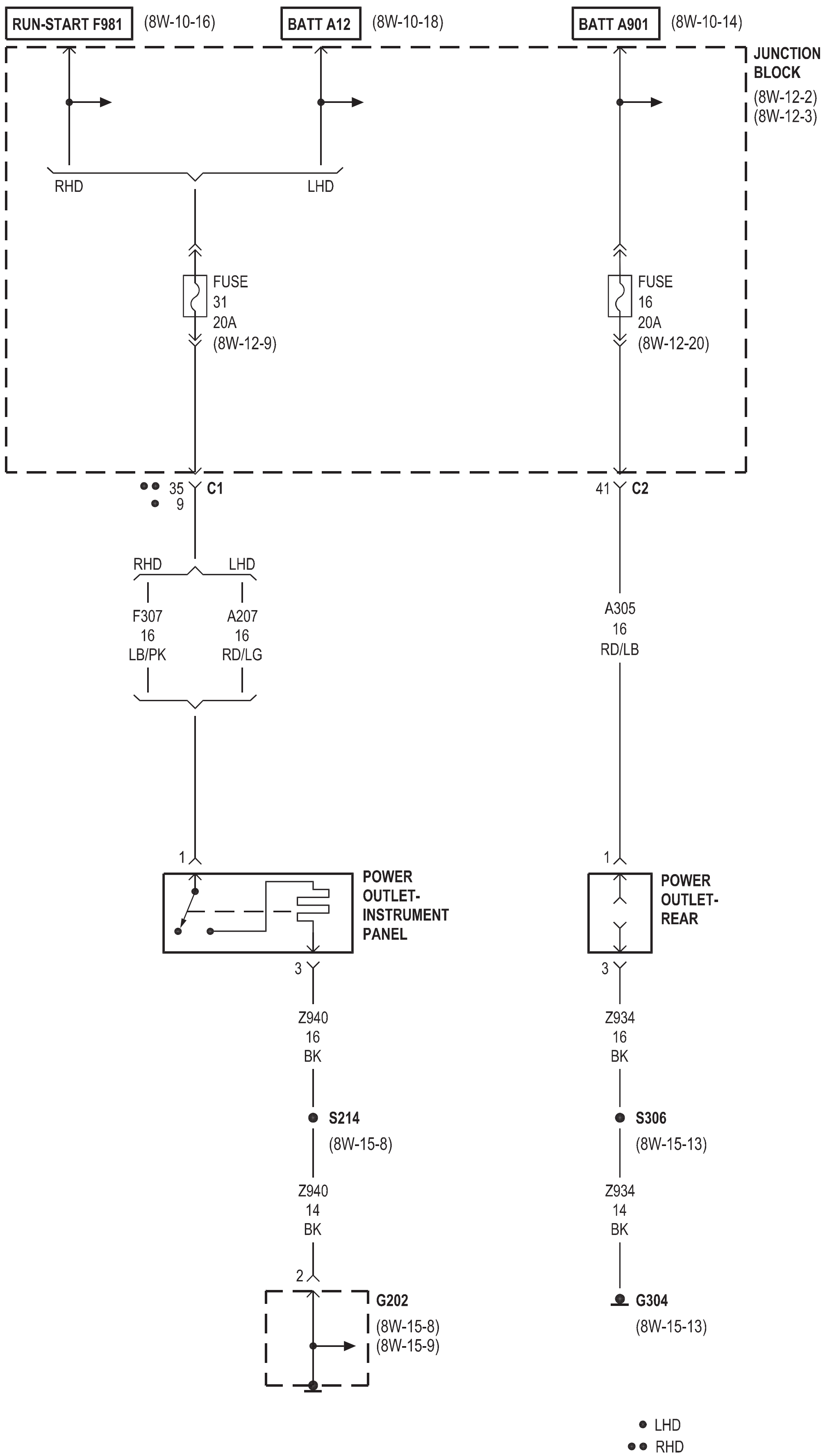
CLUSTER
ABS WARNING INDICATOR
LOW FUEL WARNING INDICATOR
OVERDRIVE OFF INDICATOR
FOG LAMP INDICATOR
HIGH BEAM INDICATOR
INSTRUMENT CLUSTER WAKE UP SIGNAL
PARK BRAKE SWITCH SENSE
PCI BUS
SKIM INDICATOR
WARNING INDICATOR
4 LOW MODE INDICATOR
PART TIME INDICATOR
17
8
4
D25 20 WT/VT
B25 20 DG/WT
S201
(8W-18-4)
24
C201
D25 20 WT/VT
G150 20 VT/BR
B25 20 DG/WT
15
C1
3
C1
1
PCI BUS
INSTRUMENT CLUSTER WAKE UP SIGNAL
MODULE-BODY CONTROL
(8W-45-2)
SWITCH-PARK BRAKE


CLUSTER
WATER IN FUEL INDICATOR
REAR FOG LAMP INDICATOR
CHECK ENGINE INDICATOR
TRANSMISSION TEMPERATURE INDICATOR
AIRBAG WARNING INDICATOR
DRIVER SEAT BELT SWITCH SENSE
DRIVER SEAT BELT SWITCH GROUND
FULL TIME INDICATOR
CRUISE INDICATOR
11
2
R58 20 LB/GY
R57 20 LG/GY
44 C201
43 C201
R58 20 LB/GY
R57 20 LG/GY
LHD
RHD
3 C311
4 C313
LHD
RHD
1 C311
2 C313
EXCEPT HEATED SEATS
HEATED SEATS
R58 18 LB/GY
R57 20 DG
R57 18 DG
1
SWITCH- SEAT BELT- DRIVER
2

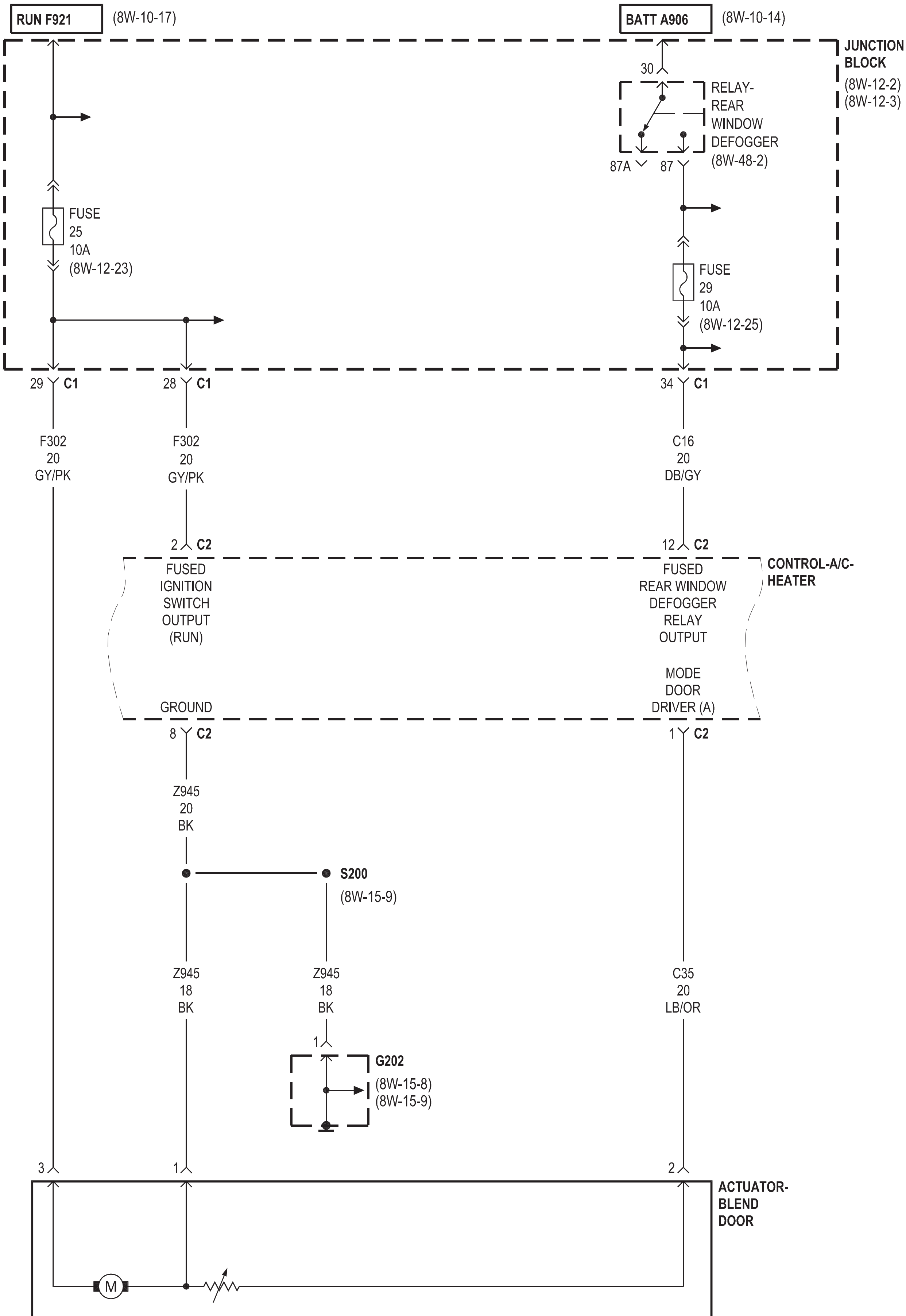
# 8W-41 HORN/CIGAR LIGHTER/POWER OUTLET

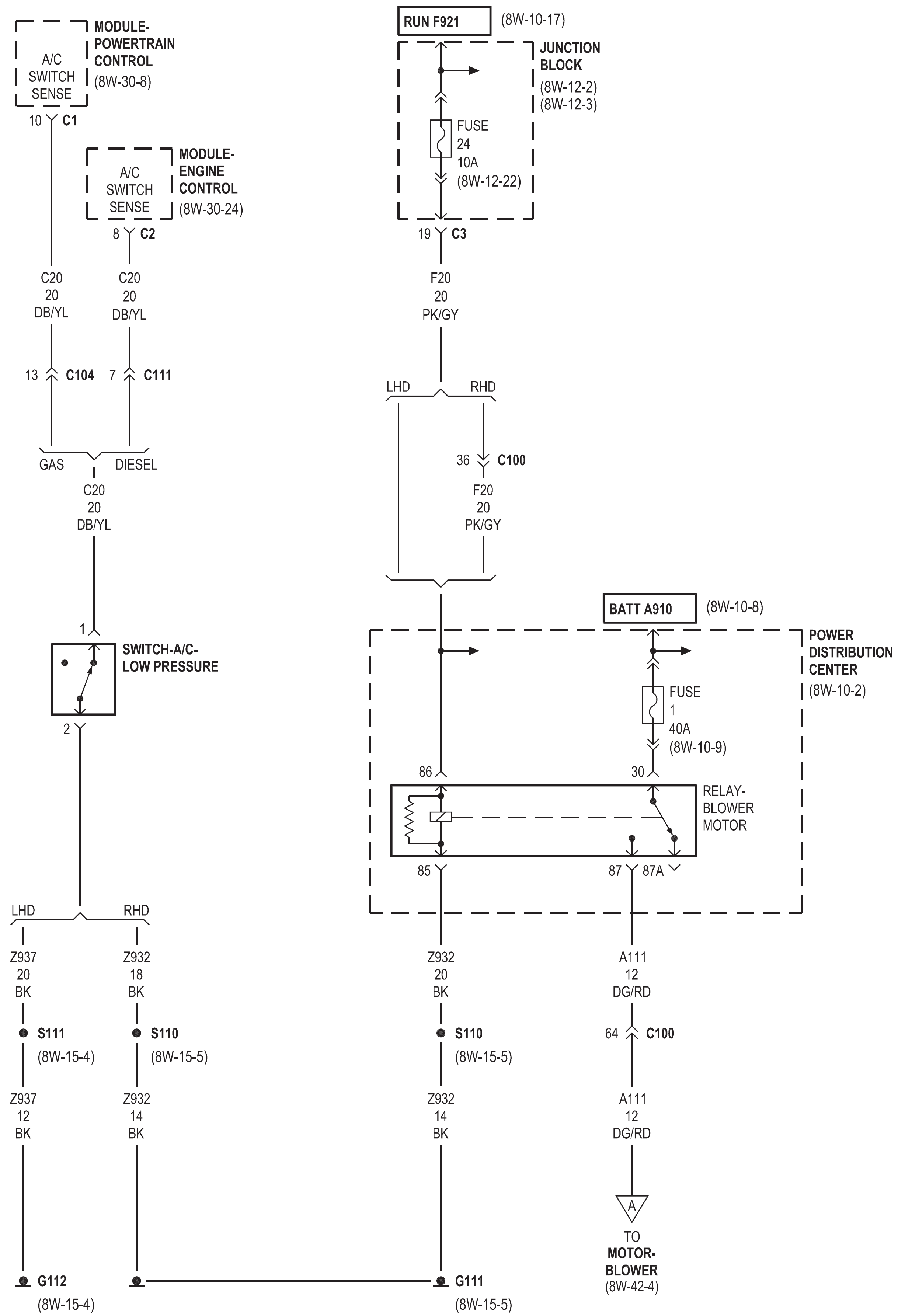

BATT A12
(8W-10-18)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
1
15A
(8W-12-9)
86
30
RELAY-HORN
85
87
87A
BASE
EXCEPT BASE
1 JB
HORN RELAY CONTROL
MODULE-BODY CONTROL
(8W-45-11)
7 C1
39 C3
LHD
RHD
X3
20
DG/VT
X2
18
DG/OR
3 C100
X2
18
DG/OR
X2
18
DG/OR
2 C1
CLOCKSPRING
1 C3
1
HORN
2
X3
20
DG/VT
Z931
18
BK
S109
(8W-15-3)
Z931
14
BK
SWITCH-HORN
G111
(8W-15-5)

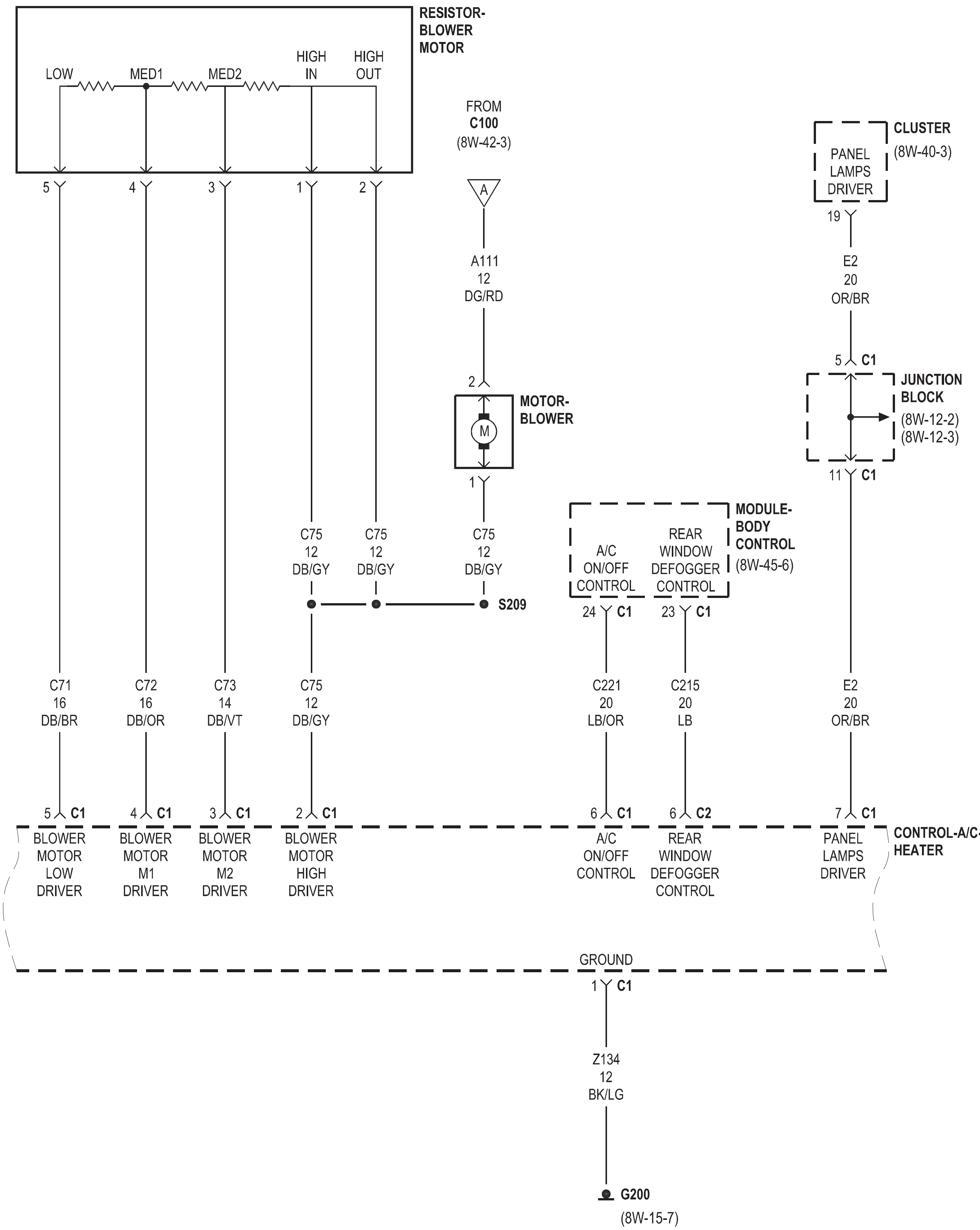
J068W-2


RUN-START F981
(8W-10-16)
BATT A12
(8W-10-18)
BATT A901
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
RHD
LHD
FUSE
31
20A
(8W-12-9)
FUSE
16
20A
(8W-12-20)
35
9
C1
41
C2
RHD
LHD
F307
16
LB/PK
A207
16
RD/LG
A305
16
RD/LB
1
POWER OUTLET-INSTRUMENT PANEL
1
POWER OUTLET-REAR
3
3
Z940
16
BK
Z934
16
BK
S214
(8W-15-8)
S306
(8W-15-13)
Z940
14
BK
Z934
14
BK
2
G202
(8W-15-8)
(8W-15-9)
G304
(8W-15-13)
LHD
RHD

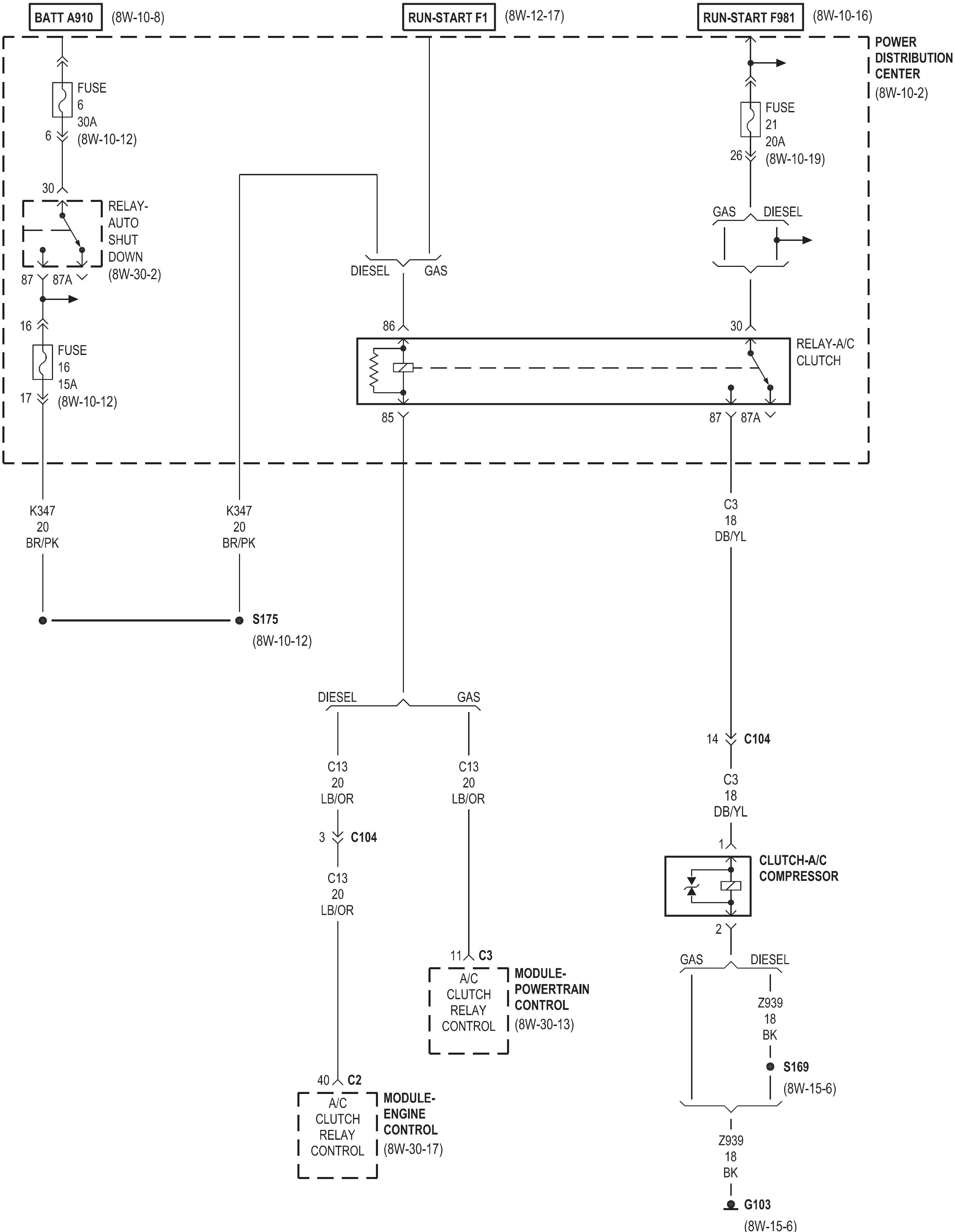
# 8W-42 AIR CONDITIONING-HEATER

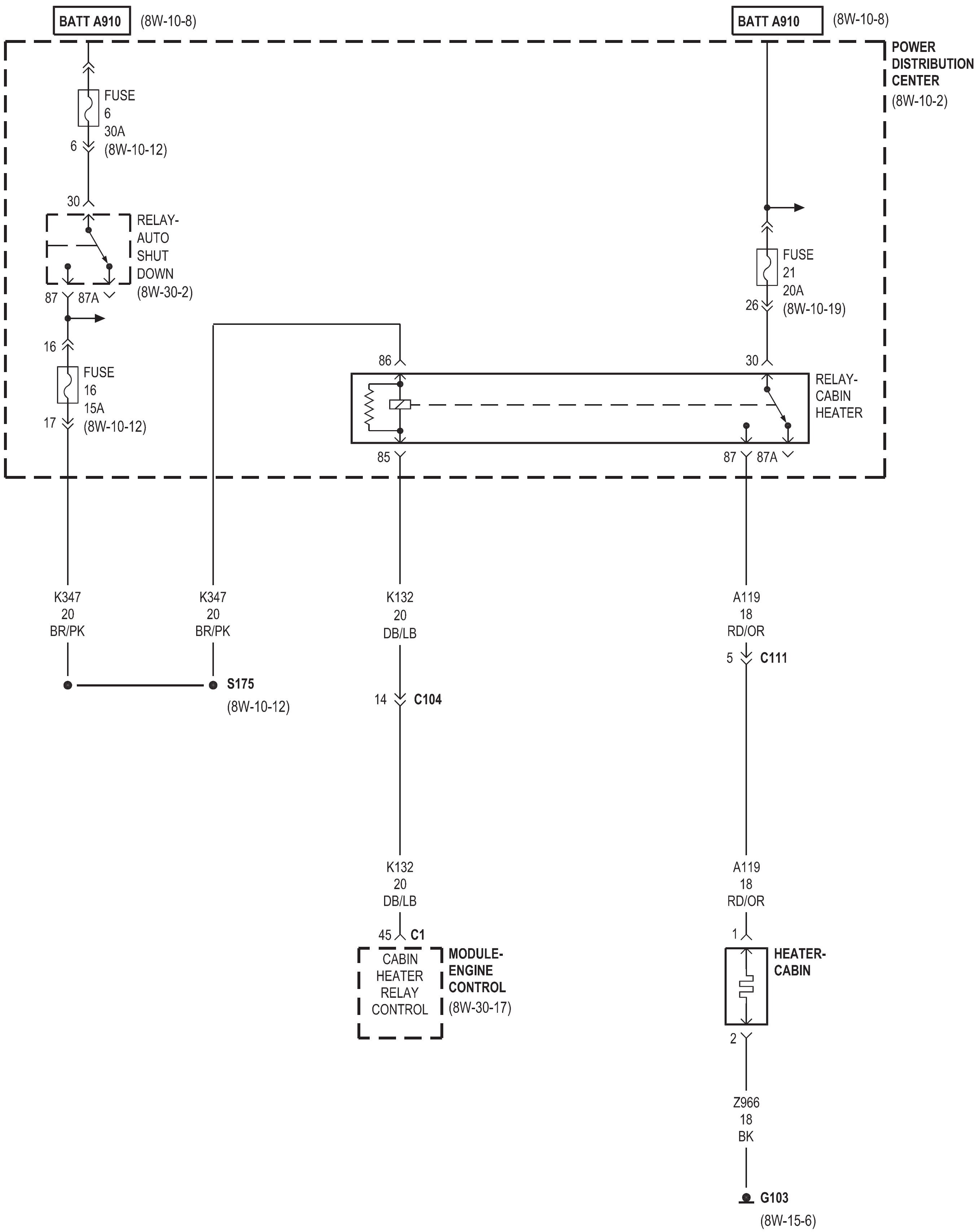

RUN F921
(8W-10-17)
BATT A906
(8W-10-14)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
30
RELAY-
REAR
WINDOW
DEFOGGER
(8W-48-2)
87A
87
FUSE
25
10A
(8W-12-23)
FUSE
29
10A
(8W-12-25)
29 C1
28 C1
34 C1
F302
20
GY/PK
F302
20
GY/PK
C16
20
DB/GY
2 C2
12 C2
CONTROL-A/C-
HEATER
FUSED
IGNITION
SWITCH
OUTPUT
(RUN)
FUSED
REAR WINDOW
DEFOGGER
RELAY
OUTPUT
MODE
DOOR
DRIVER (A)
GROUND
8 C2
1 C2
Z945
20
BK
S200
(8W-15-9)
Z945
18
BK
Z945
18
BK
C35
20
LB/OR
1
G202
(8W-15-8)
(8W-15-9)
3
1
2
ACTUATOR-
BLEND
DOOR
M

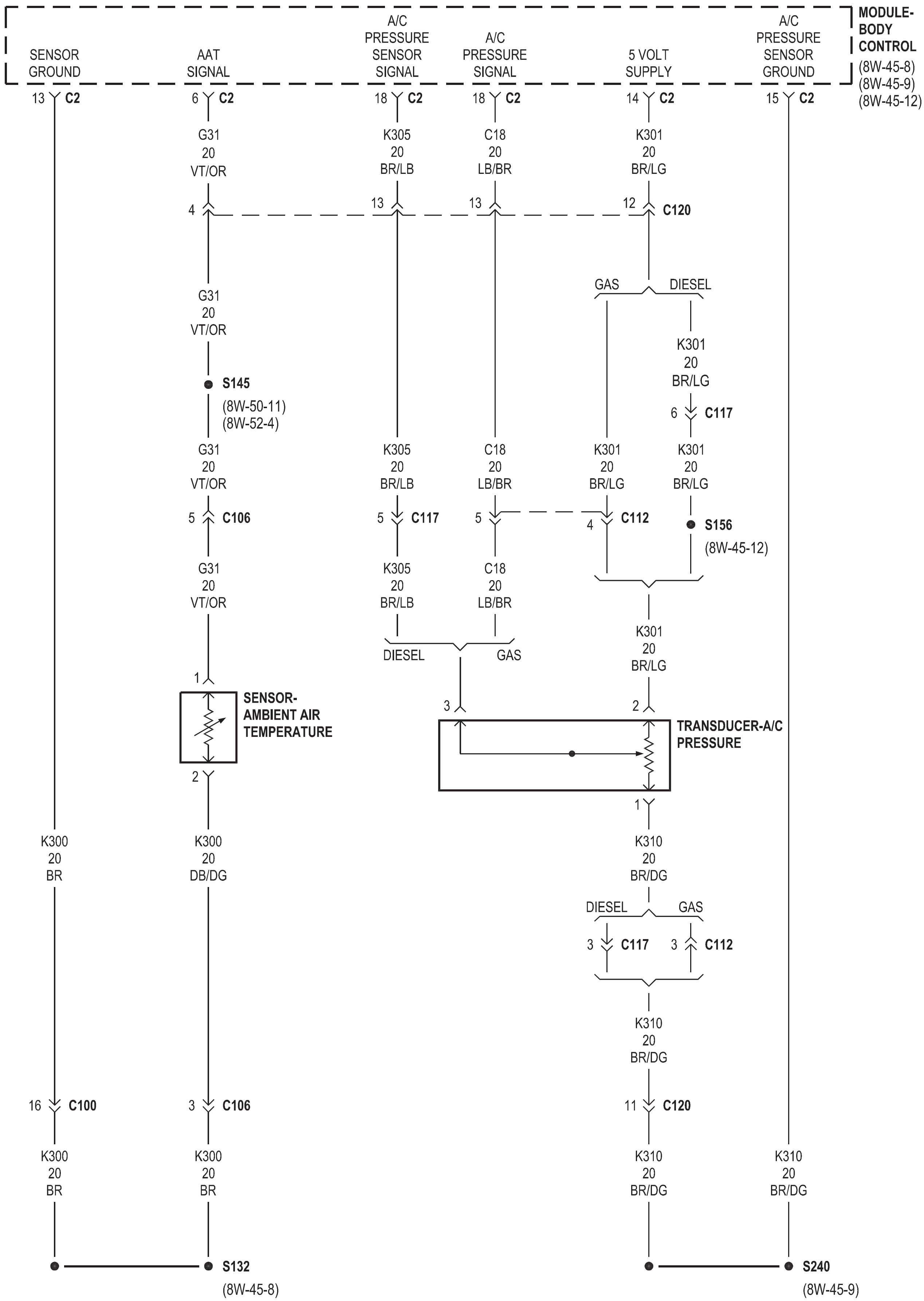

MODULE-
POWERTRAIN
CONTROL
A/C
SWITCH
SENSE
(8W-30-8)
10 C1
MODULE-
ENGINE
CONTROL
A/C
SWITCH
SENSE
(8W-30-24)
8 C2
C20
20
DB/YL
C20
20
DB/YL
13 C104
7 C111
GAS
DIESEL
C20
20
DB/YL
1
SWITCH-A/C-
LOW PRESSURE
2
LHD
RHD
Z937
20
BK
Z932
18
BK
S111
(8W-15-4)
S110
(8W-15-5)
Z937
12
BK
Z932
14
BK
G112
(8W-15-4)
RUN F921
(8W-10-17)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
24
10A
(8W-12-22)
19 C3
F20
20
PK/GY
LHD
RHD
36 C100
F20
20
PK/GY
BATT A910
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
1
40A
(8W-10-9)
86
30
RELAY-
BLOWER
MOTOR
85
87
87A
Z932
20
BK
A111
12
DG/RD
S110
(8W-15-5)
64 C100
Z932
14
BK
A111
12
DG/RD
A
TO
MOTOR-
BLOWER
(8W-42-4)
G111
(8W-15-5)



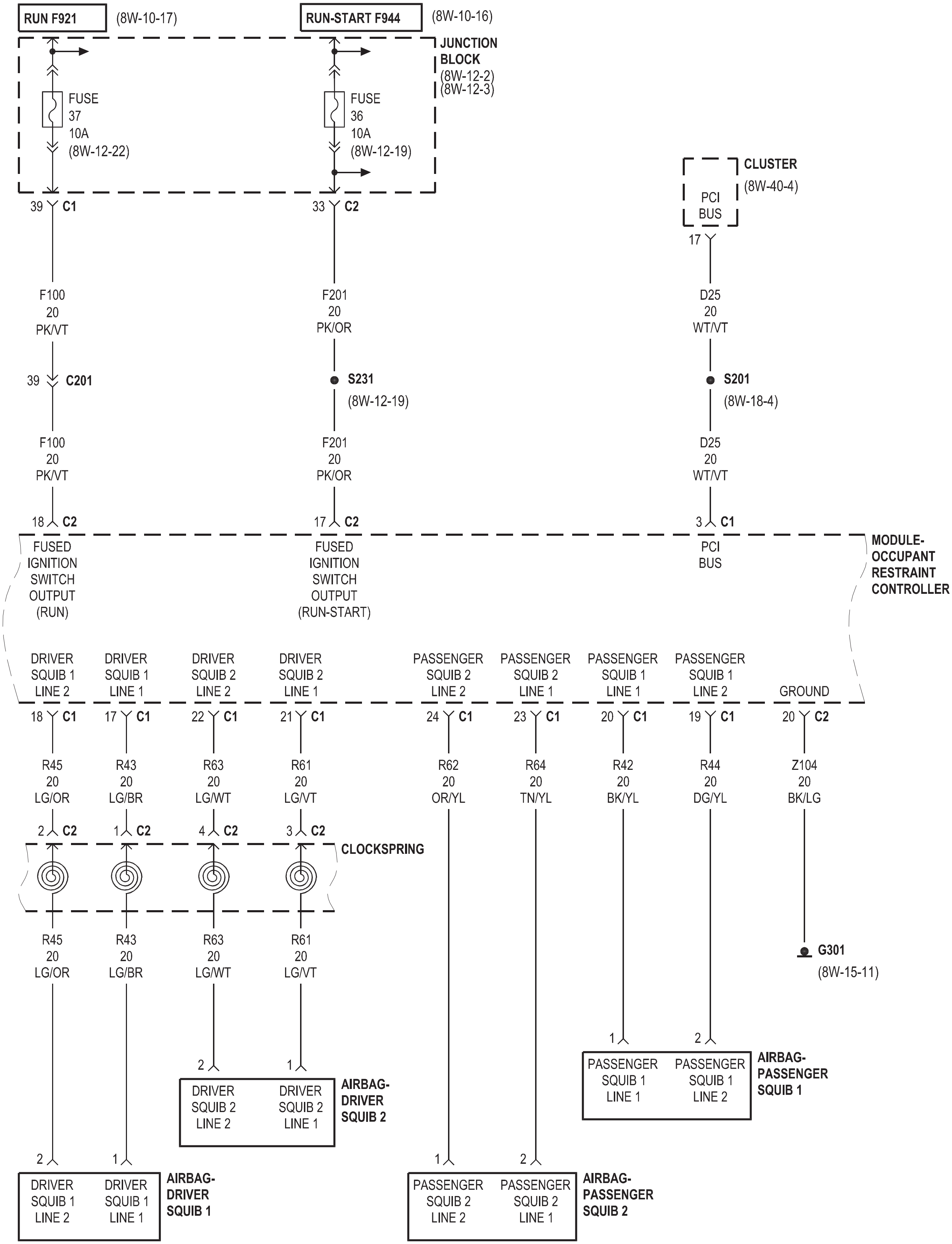
RESISTOR-BLOWER MOTOR
LOW
MED1
MED2
HIGH IN
HIGH OUT
FROM C100 (8W-42-3)
A
A111 12 DG/RD
MOTOR-BLOWER
M
CLUSTER (8W-40-3)
PANEL LAMPS DRIVER
19
E2 20 OR/BR
5 C1
JUNCTION BLOCK (8W-12-2) (8W-12-3)
11 C1
MODULE-BODY CONTROL (8W-45-6)
A/C ON/OFF CONTROL
REAR WINDOW DEFOGGER CONTROL
24 C1
23 C1
C75 12 DB/GY
S209
C71 16 DB/BR
C72 16 DB/OR
C73 14 DB/VT
C75 12 DB/GY
C221 20 LB/OR
C215 20 LB
E2 20 OR/BR
5 C1
4 C1
3 C1
2 C1
6 C1
6 C2
7 C1
CONTROL-A/C-HEATER
BLOWER MOTOR LOW DRIVER
BLOWER MOTOR M1 DRIVER
BLOWER MOTOR M2 DRIVER
BLOWER MOTOR HIGH DRIVER
A/C ON/OFF CONTROL
REAR WINDOW DEFOGGER CONTROL
PANEL LAMPS DRIVER
GROUND
1 C1
Z134 12 BK/LG
G200 (8W-15-7)

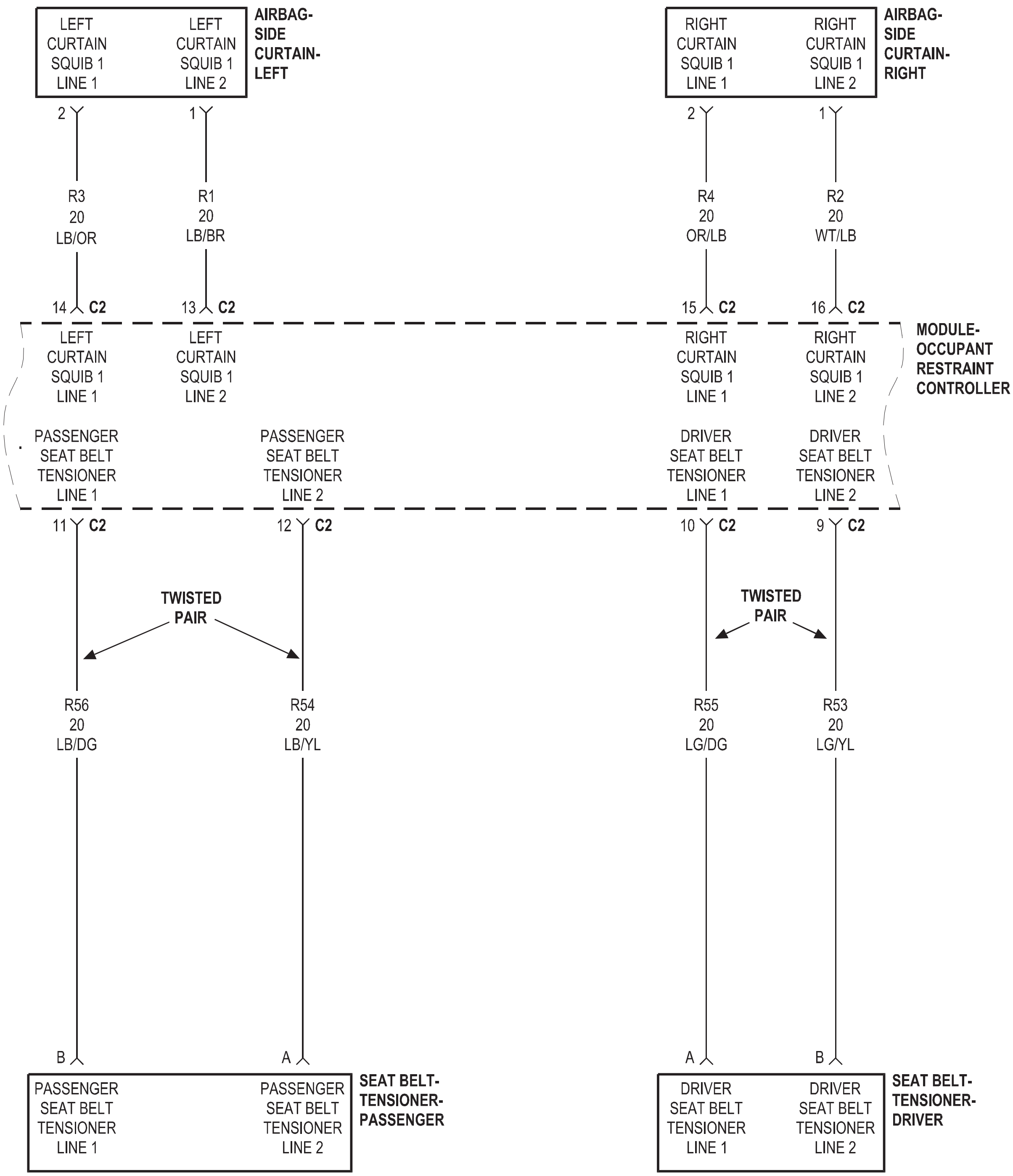

BATT A910
(8W-10-8)
RUN-START F1
(8W-12-17)
RUN-START F981
(8W-10-16)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 6 30A (8W-10-12)
RELAY-AUTO SHUT DOWN (8W-30-2)
FUSE 16 15A (8W-10-12)
FUSE 21 20A (8W-10-19)
GAS DIESEL
DIESEL GAS
RELAY-A/C CLUTCH
K347 20 BR/PK
K347 20 BR/PK
S175 (8W-10-12)
C3 18 DB/YL
C104
C13 20 LB/OR
C3
A/C CLUTCH RELAY CONTROL
MODULE-POWERTRAIN CONTROL (8W-30-13)
C2
A/C CLUTCH RELAY CONTROL
MODULE-ENGINE CONTROL (8W-30-17)
CLUTCH-A/C COMPRESSOR
Z939 18 BK
S169 (8W-15-6)
G103 (8W-15-6)

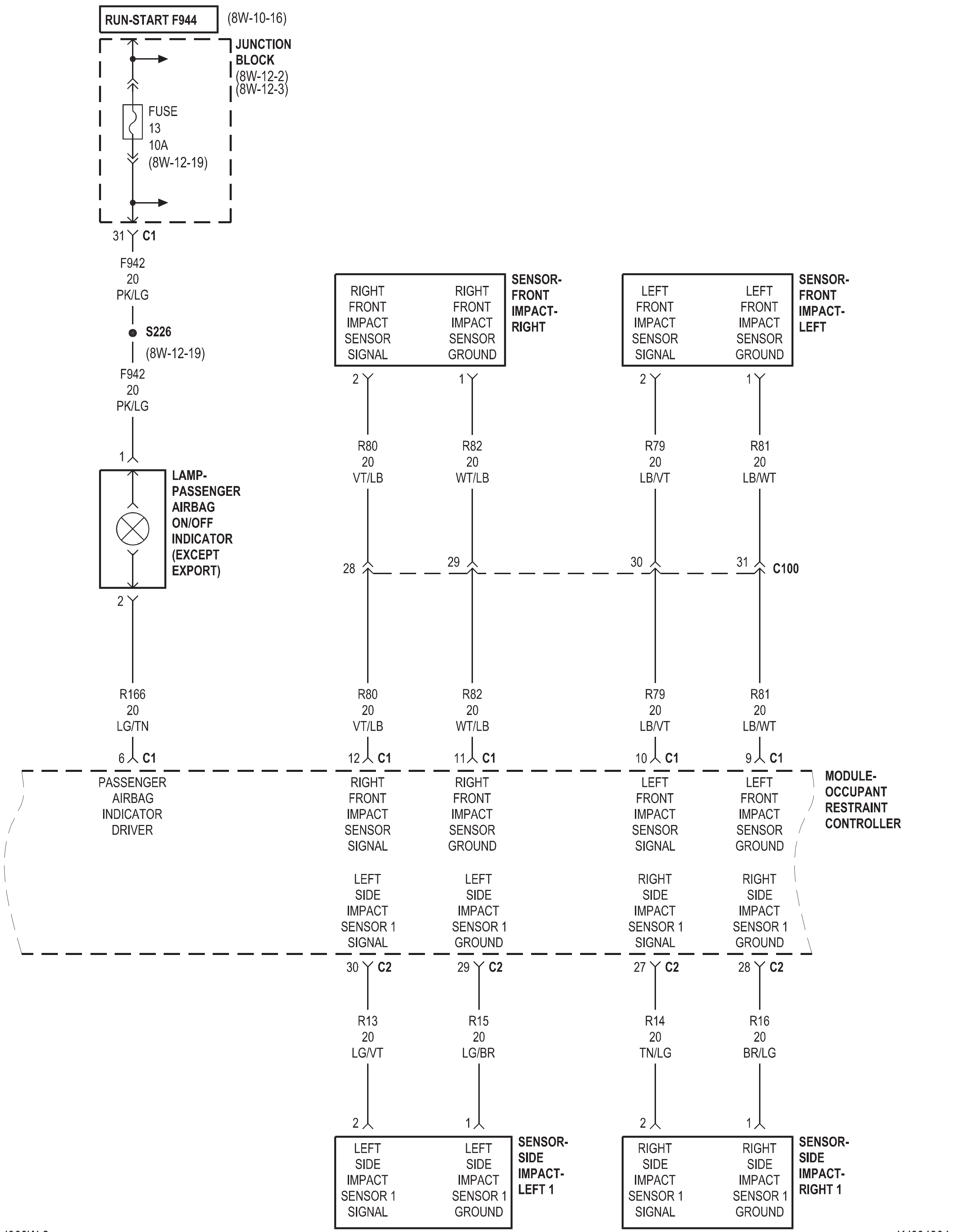

BATT A910
(8W-10-8)
BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 6 30A
(8W-10-12)
6
30
RELAY-AUTO SHUT DOWN
(8W-30-2)
87
87A
16
FUSE 16 15A
(8W-10-12)
17
FUSE 21 20A
(8W-10-19)
26
86
30
RELAY-CABIN HEATER
85
87
87A
K347 20 BR/PK
K347 20 BR/PK
S175
(8W-10-12)
K132 20 DB/LB
14
C104
A119 18 RD/OR
5
C111
K132 20 DB/LB
45
C1
CABIN HEATER RELAY CONTROL
MODULE-ENGINE CONTROL
(8W-30-17)
A119 18 RD/OR
1
HEATER-CABIN
2
Z966 18 BK
G103
(8W-15-6)

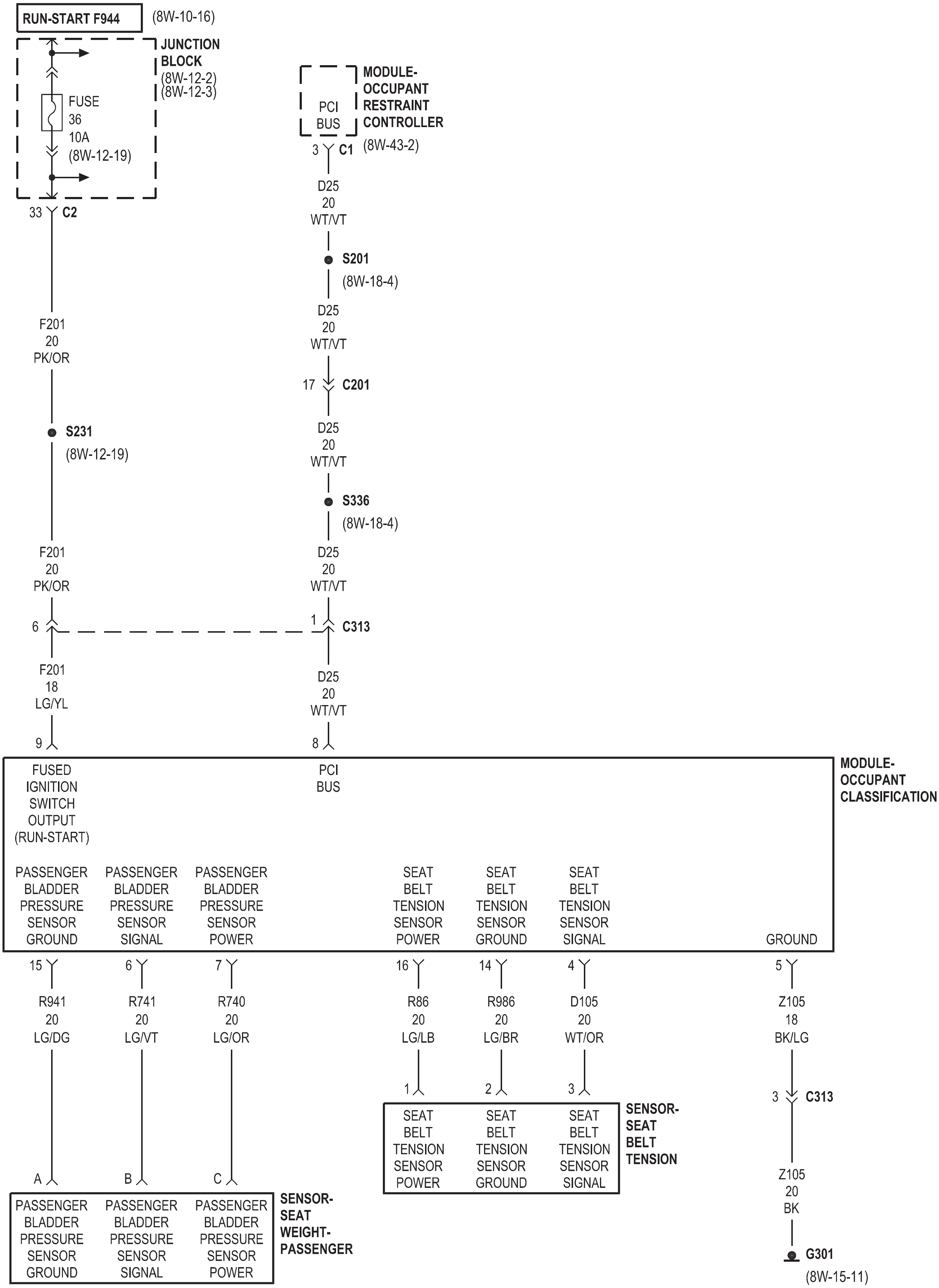

MODULE-BODY CONTROL
(8W-45-8)
(8W-45-9)
(8W-45-12)
SENSOR GROUND
AAT SIGNAL
A/C PRESSURE SENSOR SIGNAL
A/C PRESSURE SIGNAL
5 VOLT SUPPLY
A/C PRESSURE SENSOR GROUND
13 C2
6 C2
18 C2
18 C2
14 C2
15 C2
G31 20 VT/OR
K305 20 BR/LB
C18 20 LB/BR
K301 20 BR/LG
4
13
13
12 C120
GAS
DIESEL
G31 20 VT/OR
K301 20 BR/LG
S145
(8W-50-11)
(8W-52-4)
6 C117
G31 20 VT/OR
K305 20 BR/LB
C18 20 LB/BR
K301 20 BR/LG
K301 20 BR/LG
5 C106
5 C117
5
4 C112
S156
(8W-45-12)
G31 20 VT/OR
K305 20 BR/LB
C18 20 LB/BR
K301 20 BR/LG
DIESEL
GAS
1
SENSOR-AMBIENT AIR TEMPERATURE
2
3
2
TRANSDUCER-A/C PRESSURE
1
K300 20 BR
K300 20 DB/DG
K310 20 BR/DG
DIESEL
GAS
3 C117
3 C112
K310 20 BR/DG
16 C100
3 C106
11 C120
K300 20 BR
K300 20 BR
K310 20 BR/DG
K310 20 BR/DG
S132
(8W-45-8)
S240
(8W-45-9)

# 8W-43 AIRBAG SYSTEM

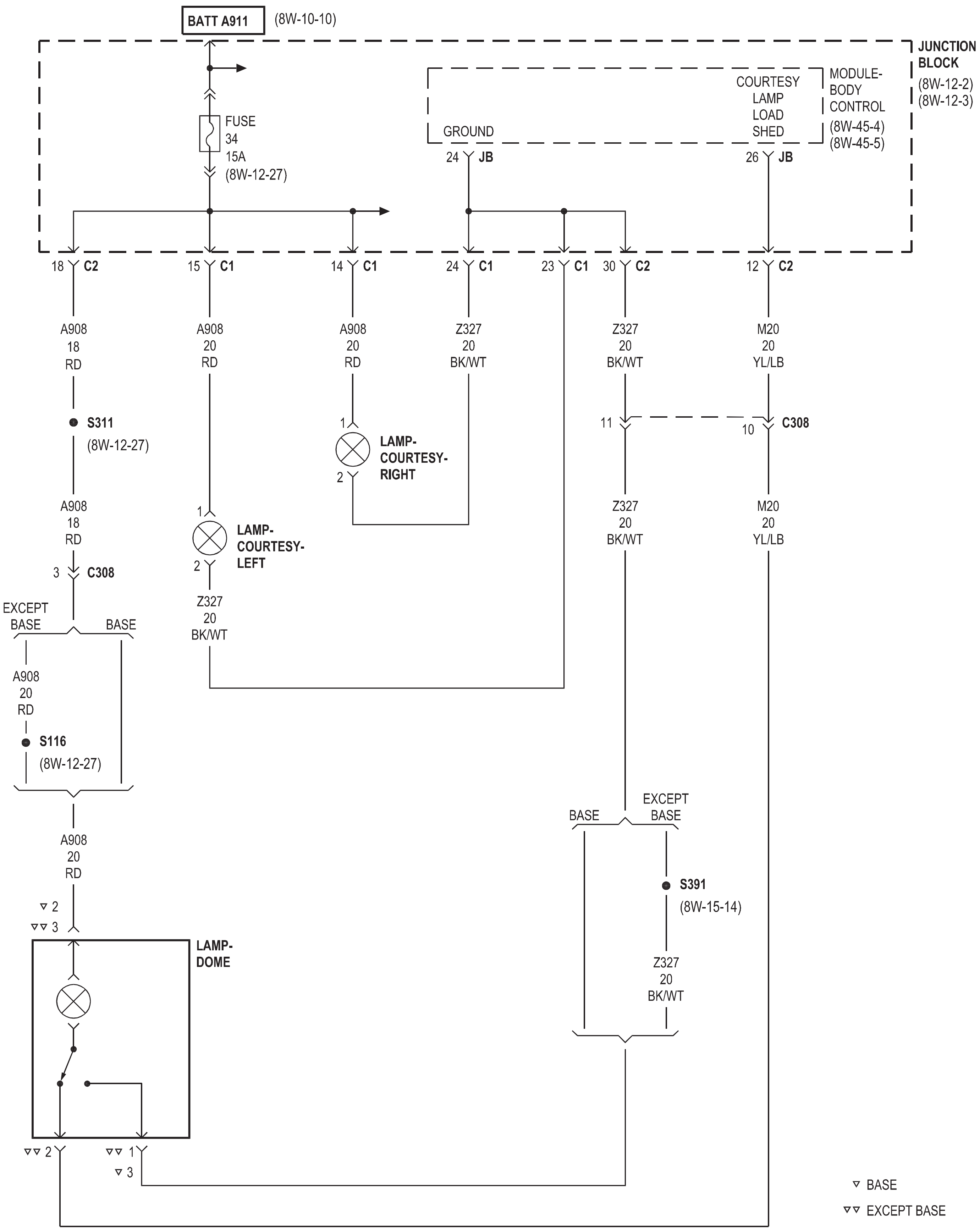

RUN F921
(8W-10-17)
RUN-START F944
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 37 10A (8W-12-22)
FUSE 36 10A (8W-12-19)
39 C1
33 C2
CLUSTER
(8W-40-4)
PCI BUS
17
F100 20 PK/VT
F201 20 PK/OR
D25 20 WT/VT
39 C201
S231
(8W-12-19)
S201
(8W-18-4)
F100 20 PK/VT
F201 20 PK/OR
D25 20 WT/VT
18 C2
17 C2
3 C1
FUSED IGNITION SWITCH OUTPUT (RUN)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
PCI BUS
MODULE-OCCUPANT RESTRAINT CONTROLLER
DRIVER SQUIB 1 LINE 2
DRIVER SQUIB 1 LINE 1
DRIVER SQUIB 2 LINE 2
DRIVER SQUIB 2 LINE 1
PASSENGER SQUIB 2 LINE 2
PASSENGER SQUIB 2 LINE 1
PASSENGER SQUIB 1 LINE 1
PASSENGER SQUIB 1 LINE 2
GROUND
18 C1
17 C1
22 C1
21 C1
24 C1
23 C1
20 C1
19 C1
20 C2
R45 20 LG/OR
R43 20 LG/BR
R63 20 LG/WT
R61 20 LG/VT
R62 20 OR/YL
R64 20 TN/YL
R42 20 BK/YL
R44 20 DG/YL
Z104 20 BK/LG
2 C2
1 C2
4 C2
3 C2
CLOCKSPRING
R45 20 LG/OR
R43 20 LG/BR
R63 20 LG/WT
R61 20 LG/VT
G301
(8W-15-11)
1
2
PASSENGER SQUIB 1 LINE 1
PASSENGER SQUIB 1 LINE 2
AIRBAG-PASSENGER SQUIB 1
2
1
DRIVER SQUIB 2 LINE 2
DRIVER SQUIB 2 LINE 1
AIRBAG-DRIVER SQUIB 2
2
1
DRIVER SQUIB 1 LINE 2
DRIVER SQUIB 1 LINE 1
AIRBAG-DRIVER SQUIB 1
1
2
PASSENGER SQUIB 2 LINE 2
PASSENGER SQUIB 2 LINE 1
AIRBAG-PASSENGER SQUIB 2

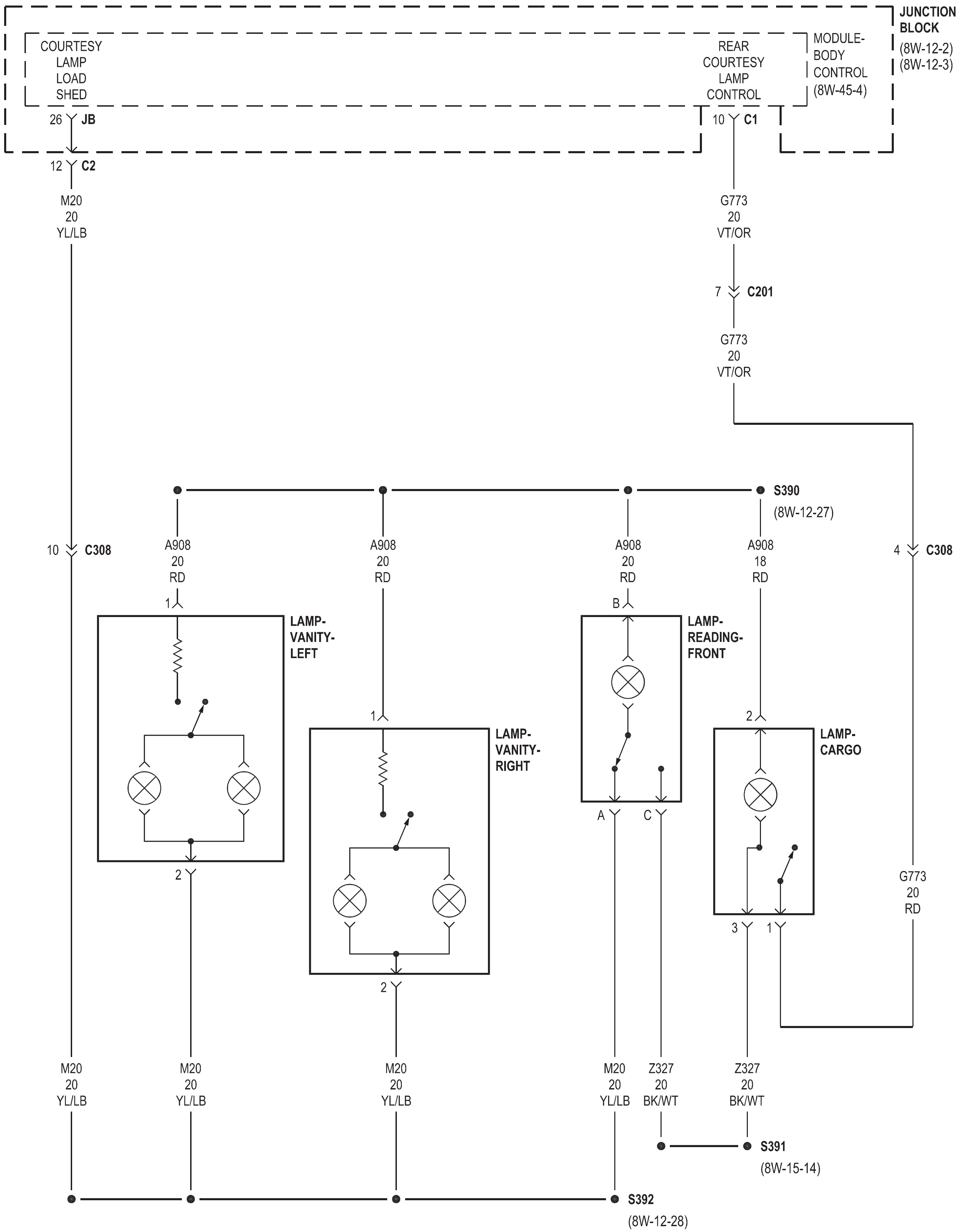

LEFT CURTAIN SQUIB 1 LINE 1
LEFT CURTAIN SQUIB 1 LINE 2
AIRBAG-SIDE CURTAIN-LEFT
RIGHT CURTAIN SQUIB 1 LINE 1
RIGHT CURTAIN SQUIB 1 LINE 2
AIRBAG-SIDE CURTAIN-RIGHT
2
1
2
1
R3 20 LB/OR
R1 20 LB/BR
R4 20 OR/LB
R2 20 WT/LB
14 C2
13 C2
15 C2
16 C2
LEFT CURTAIN SQUIB 1 LINE 1
LEFT CURTAIN SQUIB 1 LINE 2
RIGHT CURTAIN SQUIB 1 LINE 1
RIGHT CURTAIN SQUIB 1 LINE 2
MODULE-OCCUPANT RESTRAINT CONTROLLER
PASSENGER SEAT BELT TENSIONER LINE 1
PASSENGER SEAT BELT TENSIONER LINE 2
DRIVER SEAT BELT TENSIONER LINE 1
DRIVER SEAT BELT TENSIONER LINE 2
11 C2
12 C2
10 C2
9 C2
TWISTED PAIR
TWISTED PAIR
R56 20 LB/DG
R54 20 LB/YL
R55 20 LG/DG
R53 20 LG/YL
B
A
A
B
PASSENGER SEAT BELT TENSIONER LINE 1
PASSENGER SEAT BELT TENSIONER LINE 2
SEAT BELT-TENSIONER-PASSENGER
DRIVER SEAT BELT TENSIONER LINE 1
DRIVER SEAT BELT TENSIONER LINE 2
SEAT BELT-TENSIONER-DRIVER


RUN-START F944
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 13 10A (8W-12-19)
31 C1
F942 20 PK/LG
S226
(8W-12-19)
F942 20 PK/LG
1
LAMP-PASSENGER AIRBAG ON/OFF INDICATOR (EXCEPT EXPORT)
2
R166 20 LG/TN
6 C1
RIGHT FRONT IMPACT SENSOR SIGNAL
RIGHT FRONT IMPACT SENSOR GROUND
SENSOR-FRONT IMPACT-RIGHT
LEFT FRONT IMPACT SENSOR SIGNAL
LEFT FRONT IMPACT SENSOR GROUND
SENSOR-FRONT IMPACT-LEFT
2
1
2
1
R80 20 VT/LB
R82 20 WT/LB
R79 20 LB/VT
R81 20 LB/WT
28
29
30
31
C100
R80 20 VT/LB
R82 20 WT/LB
R79 20 LB/VT
R81 20 LB/WT
12 C1
11 C1
10 C1
9 C1
PASSENGER AIRBAG INDICATOR DRIVER
RIGHT FRONT IMPACT SENSOR SIGNAL
RIGHT FRONT IMPACT SENSOR GROUND
LEFT FRONT IMPACT SENSOR SIGNAL
LEFT FRONT IMPACT SENSOR GROUND
MODULE-OCCUPANT RESTRAINT CONTROLLER
LEFT SIDE IMPACT SENSOR 1 SIGNAL
LEFT SIDE IMPACT SENSOR 1 GROUND
RIGHT SIDE IMPACT SENSOR 1 SIGNAL
RIGHT SIDE IMPACT SENSOR 1 GROUND
30 C2
29 C2
27 C2
28 C2
R13 20 LG/VT
R15 20 LG/BR
R14 20 TN/LG
R16 20 BR/LG
2
1
2
1
LEFT SIDE IMPACT SENSOR 1 SIGNAL
LEFT SIDE IMPACT SENSOR 1 GROUND
SENSOR-SIDE IMPACT-LEFT 1
RIGHT SIDE IMPACT SENSOR 1 SIGNAL
RIGHT SIDE IMPACT SENSOR 1 GROUND
SENSOR-SIDE IMPACT-RIGHT 1

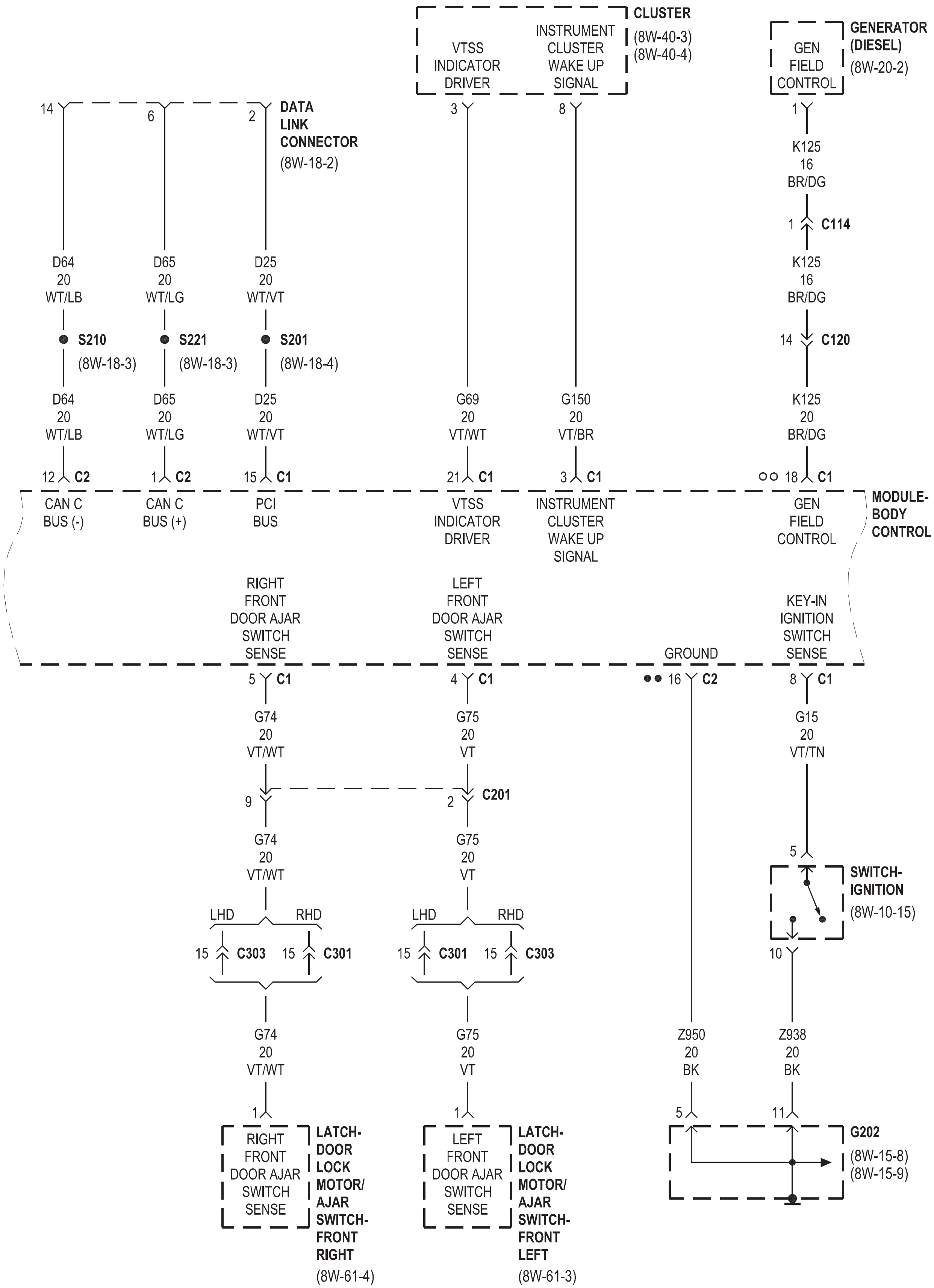

RUN-START F944
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
36
10A
(8W-12-19)
33 C2
F201
20
PK/OR
S231
(8W-12-19)
F201
20
PK/OR
6
F201
18
LG/YL
9
PCI BUS
MODULE-OCCUPANT RESTRAINT CONTROLLER
(8W-43-2)
3 C1
D25
20
WT/VT
S201
(8W-18-4)
D25
20
WT/VT
17 C201
D25
20
WT/VT
S336
(8W-18-4)
D25
20
WT/VT
1 C313
D25
20
WT/VT
8
FUSED IGNITION SWITCH OUTPUT (RUN-START)
PCI BUS
MODULE-OCCUPANT CLASSIFICATION
PASSENGER BLADDER PRESSURE SENSOR GROUND
PASSENGER BLADDER PRESSURE SENSOR SIGNAL
PASSENGER BLADDER PRESSURE SENSOR POWER
SEAT BELT TENSION SENSOR POWER
SEAT BELT TENSION SENSOR GROUND
SEAT BELT TENSION SENSOR SIGNAL
GROUND
15
R941
20
LG/DG
6
R741
20
LG/VT
7
R740
20
LG/OR
16
R86
20
LG/LB
14
R986
20
LG/BR
4
D105
20
WT/OR
5
Z105
18
BK/LG
1
2
3
SEAT BELT TENSION SENSOR POWER
SEAT BELT TENSION SENSOR GROUND
SEAT BELT TENSION SENSOR SIGNAL
SENSOR-SEAT BELT TENSION
3 C313
Z105
20
BK
G301
(8W-15-11)
A
B
C
PASSENGER BLADDER PRESSURE SENSOR GROUND
PASSENGER BLADDER PRESSURE SENSOR SIGNAL
PASSENGER BLADDER PRESSURE SENSOR POWER
SENSOR-SEAT WEIGHT-PASSENGER

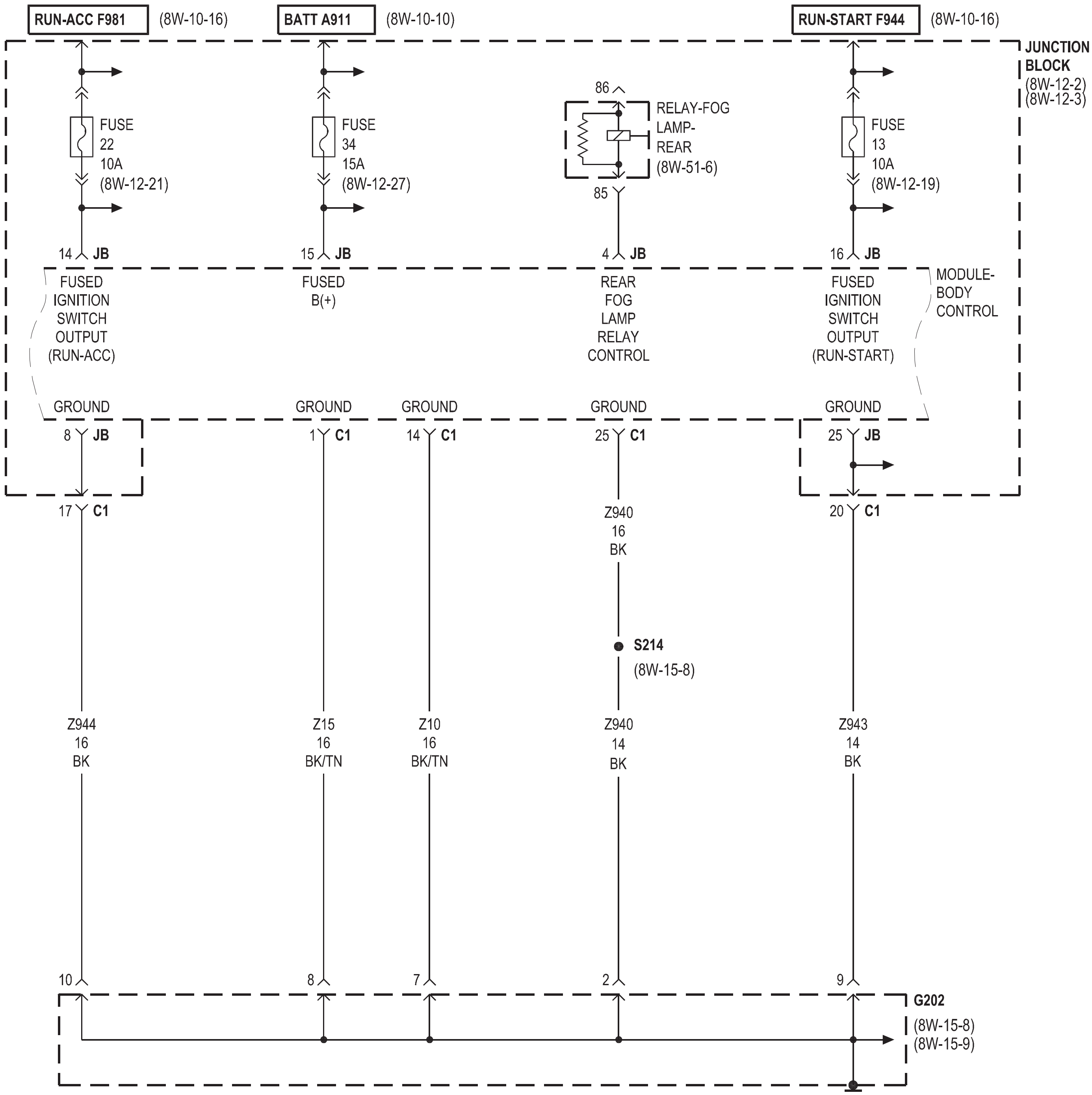
# 8W-44 INTERIOR LIGHTING

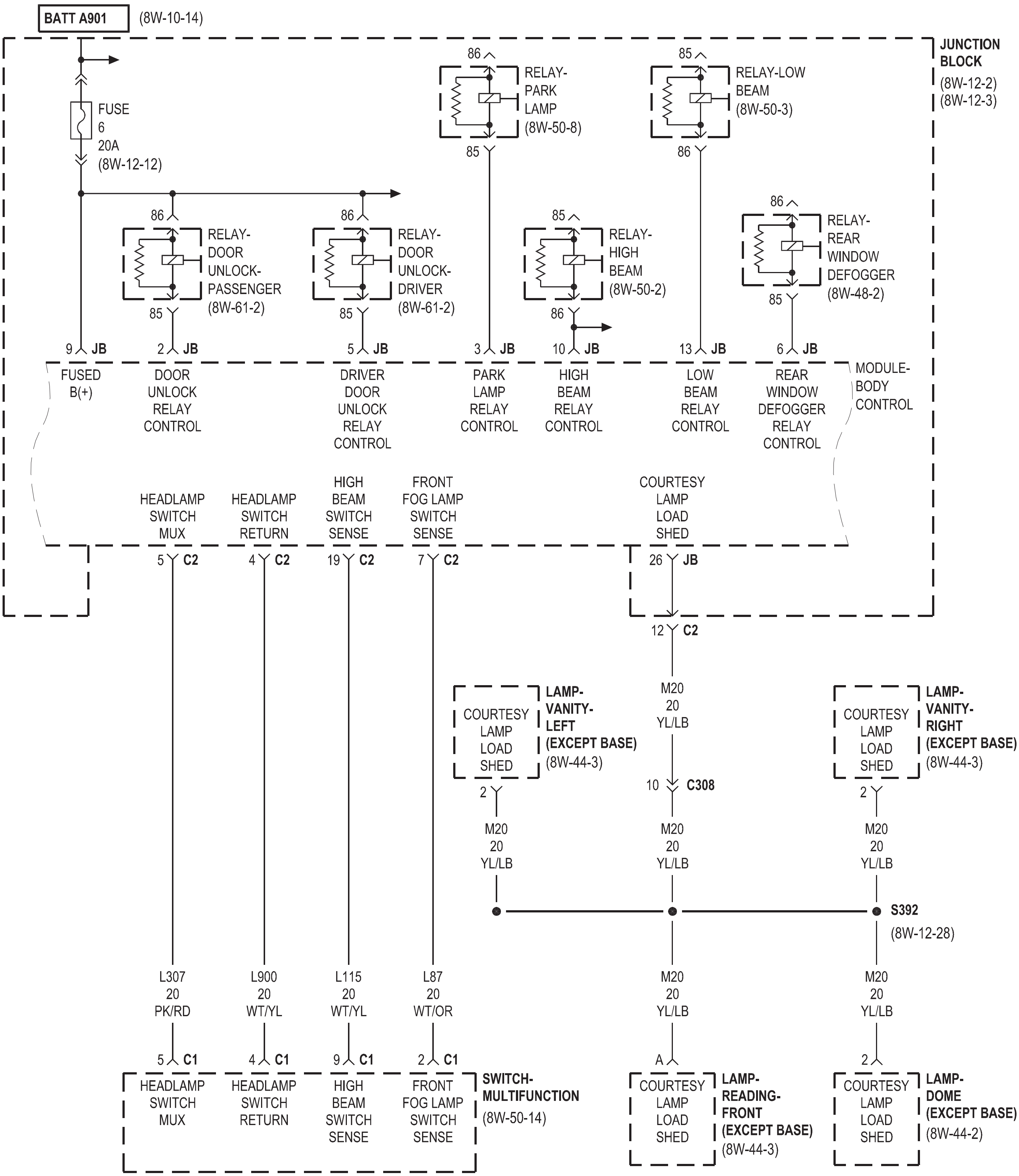

BATT A911
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
34
15A
(8W-12-27)
GROUND
COURTESY LAMP LOAD SHED
MODULE-BODY CONTROL
(8W-45-4)
(8W-45-5)
24 JB
26 JB
18 C2
15 C1
14 C1
24 C1
23 C1
30 C2
12 C2
A908 18 RD
A908 20 RD
A908 20 RD
Z327 20 BK/WT
Z327 20 BK/WT
M20 20 YL/LB
S311
(8W-12-27)
LAMP-COURTESY-RIGHT
LAMP-COURTESY-LEFT
11
10
C308
Z327 20 BK/WT
M20 20 YL/LB
A908 18 RD
3 C308
EXCEPT BASE
BASE
Z327 20 BK/WT
A908 20 RD
S116
(8W-12-27)
BASE
EXCEPT BASE
S391
(8W-15-14)
Z327 20 BK/WT
A908 20 RD
▿ 2
▿▿ 3
LAMP-DOME
▿▿ 2
▿▿ 1
▿ 3
▿ BASE
▿▿ EXCEPT BASE

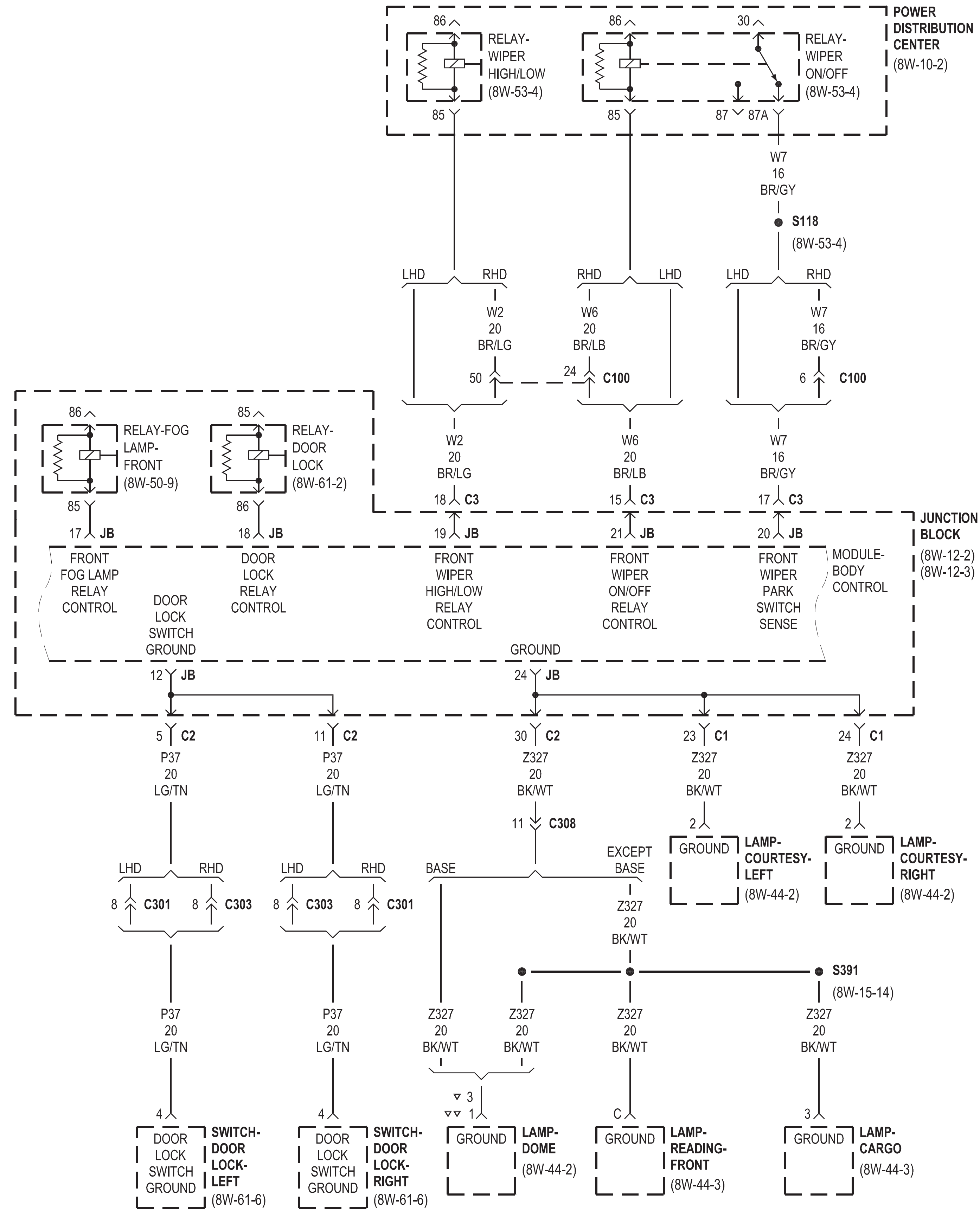

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COURTESY LAMP LOAD SHED
REAR COURTESY LAMP CONTROL
MODULE-BODY CONTROL
(8W-45-4)
26 JB
10 C1
12 C2
M20 20 YL/LB
G773 20 VT/OR
7 C201
G773 20 VT/OR
S390
(8W-12-27)
10 C308
A908 20 RD
A908 20 RD
A908 20 RD
A908 18 RD
4 C308
LAMP-VANITY-LEFT
LAMP-VANITY-RIGHT
LAMP-READING-FRONT
LAMP-CARGO
G773 20 RD
M20 20 YL/LB
M20 20 YL/LB
M20 20 YL/LB
M20 20 YL/LB
Z327 20 BK/WT
Z327 20 BK/WT
S391
(8W-15-14)
S392
(8W-12-28)

# 8W-45 BODY CONTROL MODULE

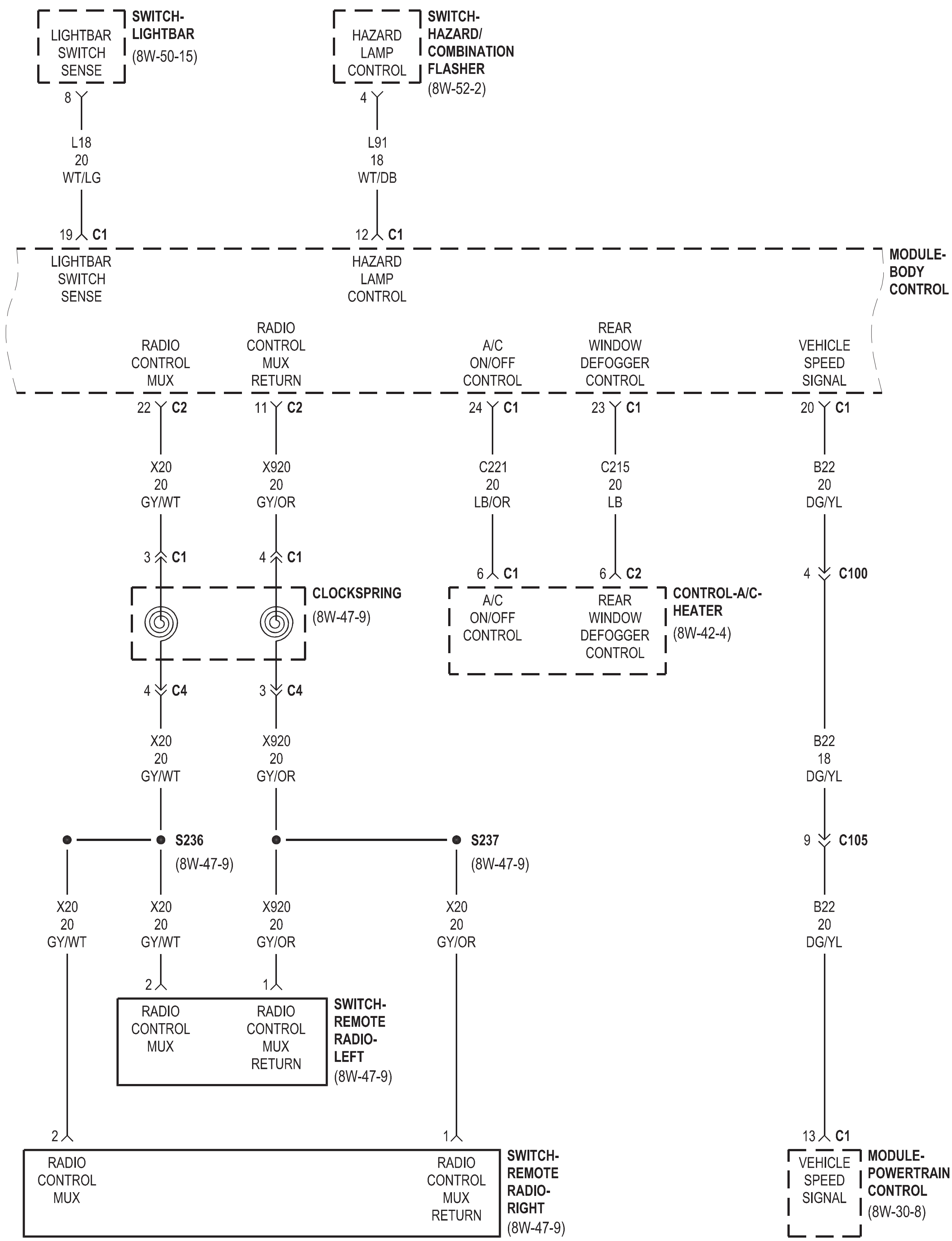

CLUSTER
(8W-40-3)
(8W-40-4)
VTSS INDICATOR DRIVER
INSTRUMENT CLUSTER WAKE UP SIGNAL
GENERATOR (DIESEL)
(8W-20-2)
GEN FIELD CONTROL
DATA LINK CONNECTOR
(8W-18-2)
14
6
2
3
8
1
K125 16 BR/DG
1 C114
K125 16 BR/DG
14 C120
D64 20 WT/LB
D65 20 WT/LG
D25 20 WT/VT
S210 (8W-18-3)
S221 (8W-18-3)
S201 (8W-18-4)
D64 20 WT/LB
D65 20 WT/LG
D25 20 WT/VT
G69 20 VT/WT
G150 20 VT/BR
K125 20 BR/DG
12 C2
1 C2
15 C1
21 C1
3 C1
18 C1
MODULE-BODY CONTROL
CAN C BUS (-)
CAN C BUS (+)
PCI BUS
VTSS INDICATOR DRIVER
INSTRUMENT CLUSTER WAKE UP SIGNAL
GEN FIELD CONTROL
RIGHT FRONT DOOR AJAR SWITCH SENSE
LEFT FRONT DOOR AJAR SWITCH SENSE
GROUND
KEY-IN IGNITION SWITCH SENSE
5 C1
4 C1
16 C2
8 C1
G74 20 VT/WT
G75 20 VT
G15 20 VT/TN
9
2 C201
G74 20 VT/WT
G75 20 VT
5
SWITCH-IGNITION
(8W-10-15)
10
LHD RHD
15 C303 15 C301
LHD RHD
15 C301 15 C303
G74 20 VT/WT
G75 20 VT
Z950 20 BK
Z938 20 BK
1
1
5
11
RIGHT FRONT DOOR AJAR SWITCH SENSE
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT RIGHT
(8W-61-4)
LEFT FRONT DOOR AJAR SWITCH SENSE
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT LEFT
(8W-61-3)
G202
(8W-15-8)
(8W-15-9)
○○ DIESEL
●● RHD

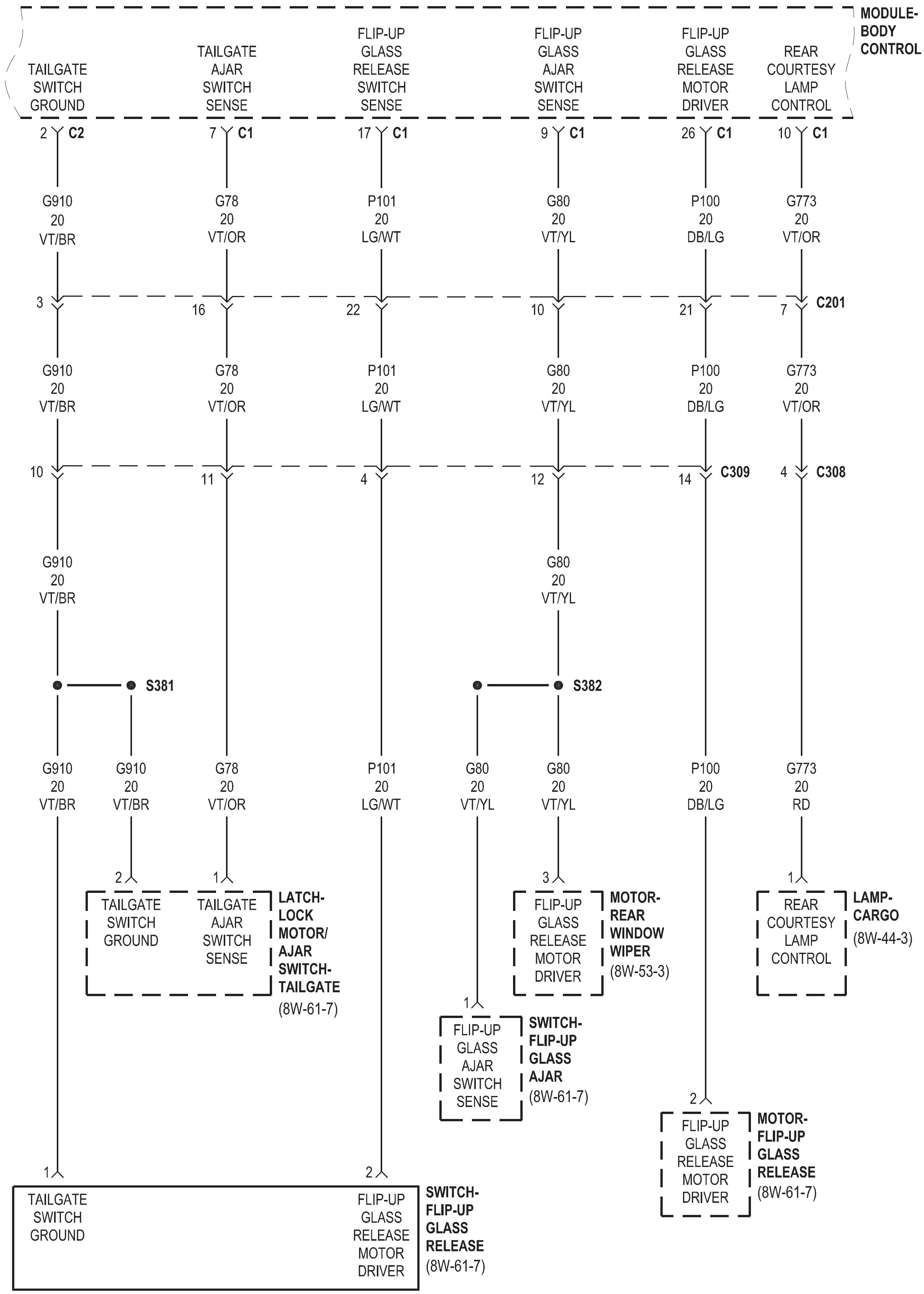

RUN-ACC F981
(8W-10-16)
BATT A911
(8W-10-10)
RUN-START F944
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
22
10A
(8W-12-21)
FUSE
34
15A
(8W-12-27)
86
RELAY-FOG LAMP-REAR
(8W-51-6)
85
FUSE
13
10A
(8W-12-19)
14 JB
15 JB
4 JB
16 JB
MODULE-BODY CONTROL
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
FUSED B(+)
REAR FOG LAMP RELAY CONTROL
FUSED IGNITION SWITCH OUTPUT (RUN-START)
GROUND
GROUND
GROUND
GROUND
GROUND
8 JB
1 C1
14 C1
25 C1
25 JB
17 C1
20 C1
Z940
16
BK
S214
(8W-15-8)
Z944
16
BK
Z15
16
BK/TN
Z10
16
BK/TN
Z940
14
BK
Z943
14
BK
10
8
7
2
9
G202
(8W-15-8)
(8W-15-9)

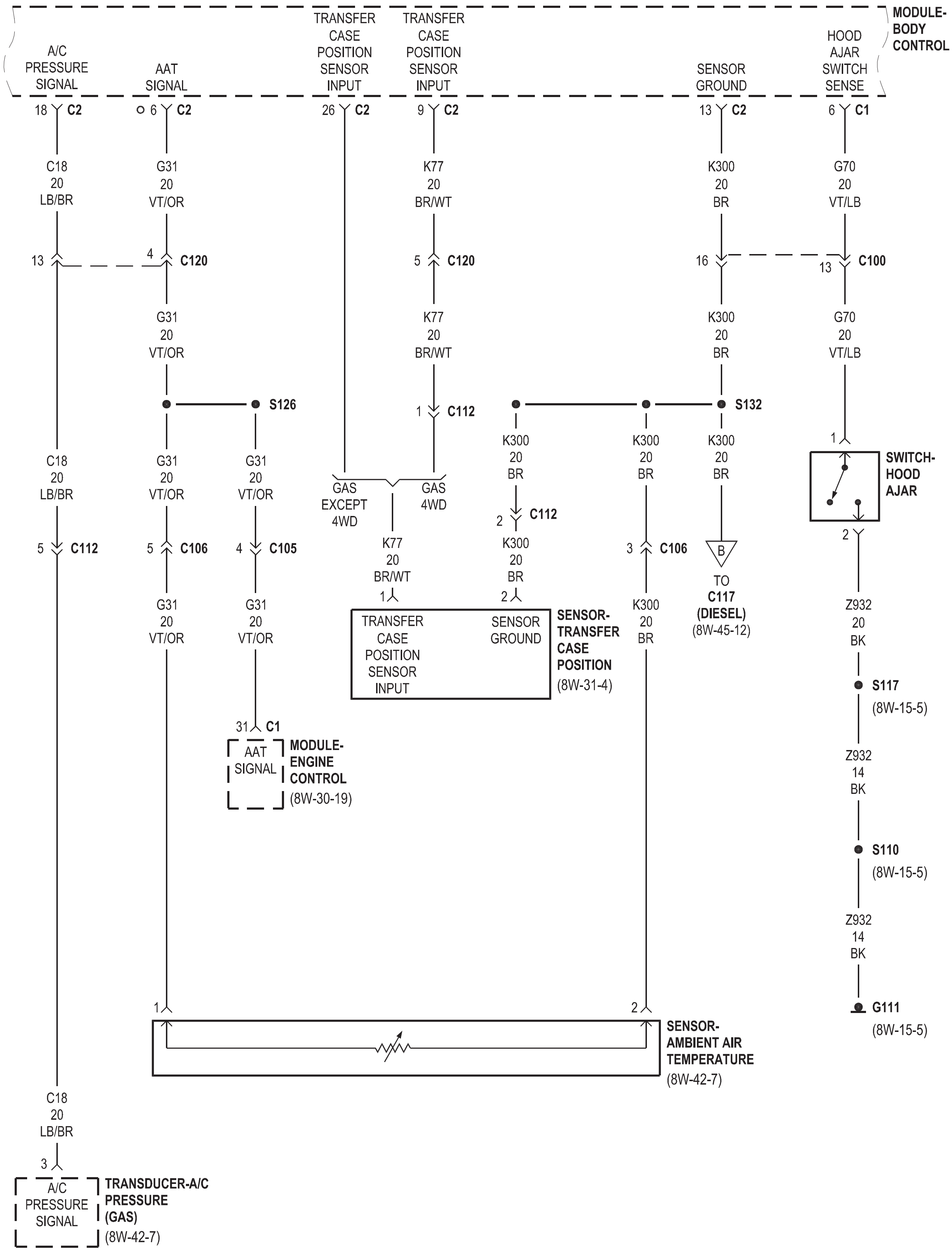

BATT A901
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
20A
(8W-12-12)
RELAY-PARK LAMP
(8W-50-8)
RELAY-LOW BEAM
(8W-50-3)
RELAY-DOOR UNLOCK-PASSENGER
(8W-61-2)
RELAY-DOOR UNLOCK-DRIVER
(8W-61-2)
RELAY-HIGH BEAM
(8W-50-2)
RELAY-REAR WINDOW DEFOGGER
(8W-48-2)
9 JB
2 JB
5 JB
3 JB
10 JB
13 JB
6 JB
FUSED B(+)
DOOR UNLOCK RELAY CONTROL
DRIVER DOOR UNLOCK RELAY CONTROL
PARK LAMP RELAY CONTROL
HIGH BEAM RELAY CONTROL
LOW BEAM RELAY CONTROL
REAR WINDOW DEFOGGER RELAY CONTROL
MODULE-BODY CONTROL
HEADLAMP SWITCH MUX
HEADLAMP SWITCH RETURN
HIGH BEAM SWITCH SENSE
FRONT FOG LAMP SWITCH SENSE
COURTESY LAMP LOAD SHED
5 C2
4 C2
19 C2
7 C2
26 JB
12 C2
M20 20 YL/LB
10 C308
LAMP-VANITY-LEFT (EXCEPT BASE)
(8W-44-3)
LAMP-VANITY-RIGHT (EXCEPT BASE)
(8W-44-3)
S392
(8W-12-28)
L307 20 PK/RD
L900 20 WT/YL
L115 20 WT/YL
L87 20 WT/OR
5 C1
4 C1
9 C1
2 C1
SWITCH-MULTIFUNCTION
(8W-50-14)
LAMP-READING-FRONT (EXCEPT BASE)
(8W-44-3)
LAMP-DOME (EXCEPT BASE)
(8W-44-2)

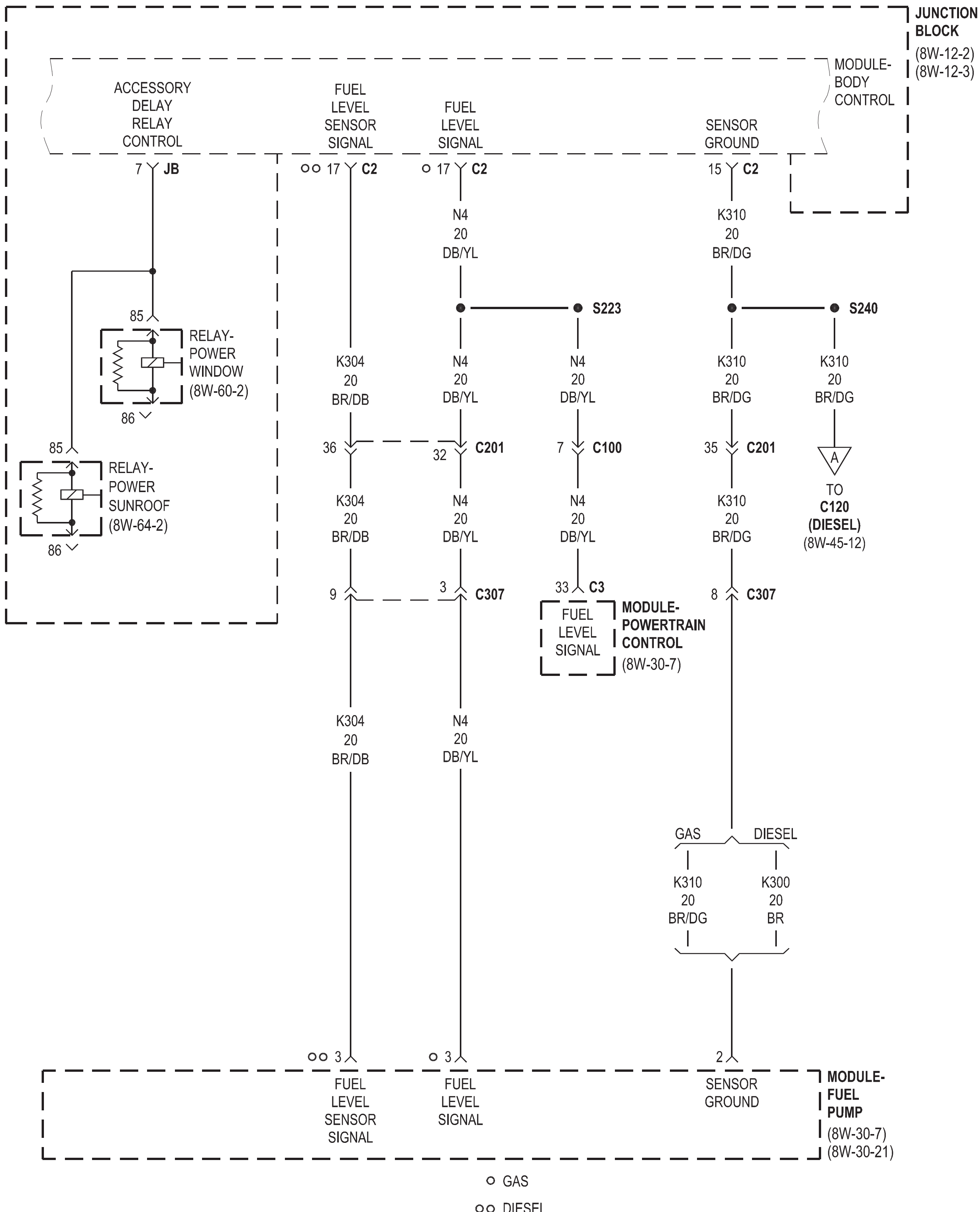


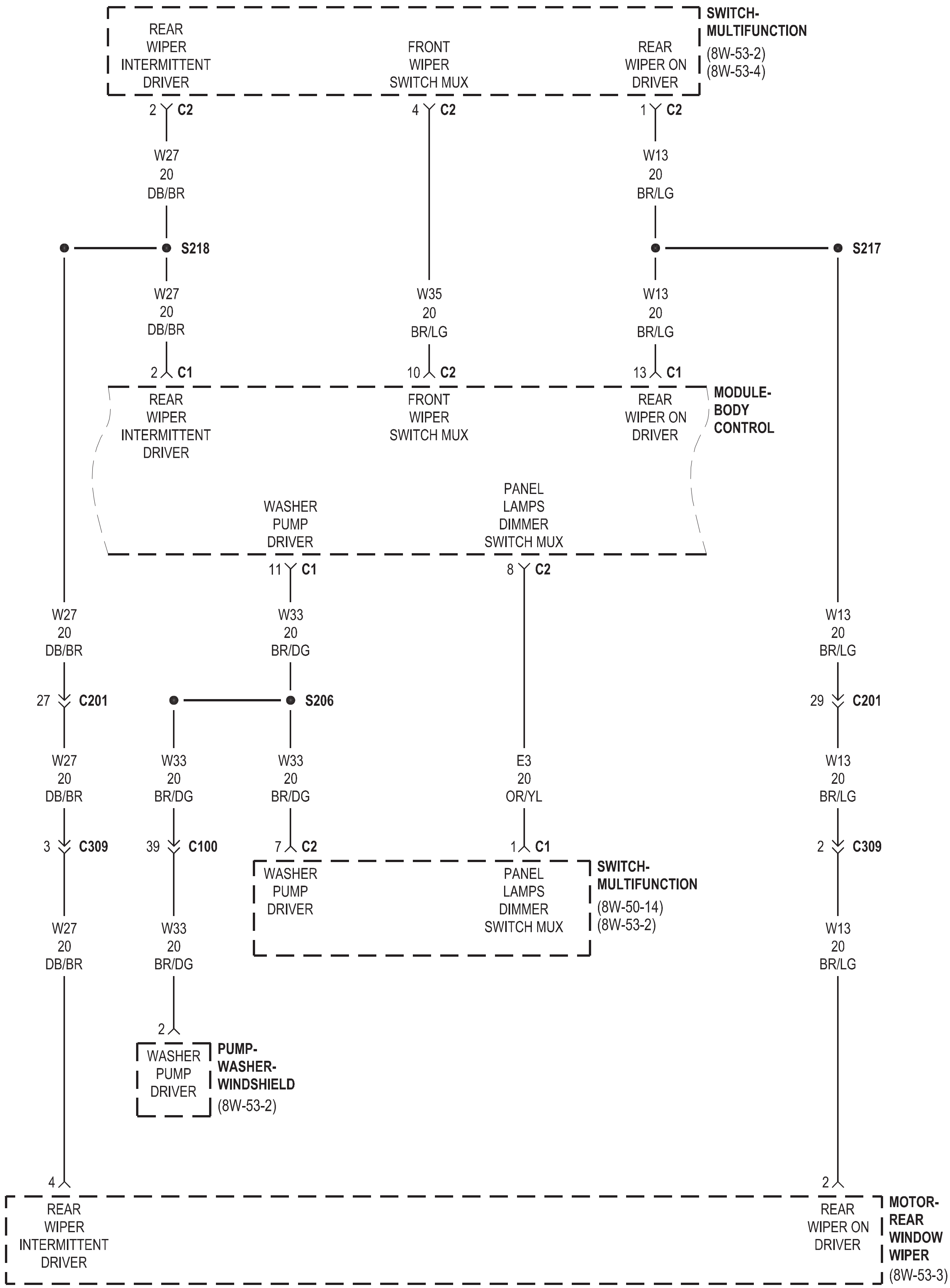

□□ LHD EXCEPT BASE ▿▿ EXCEPT BASE ▿ BASE

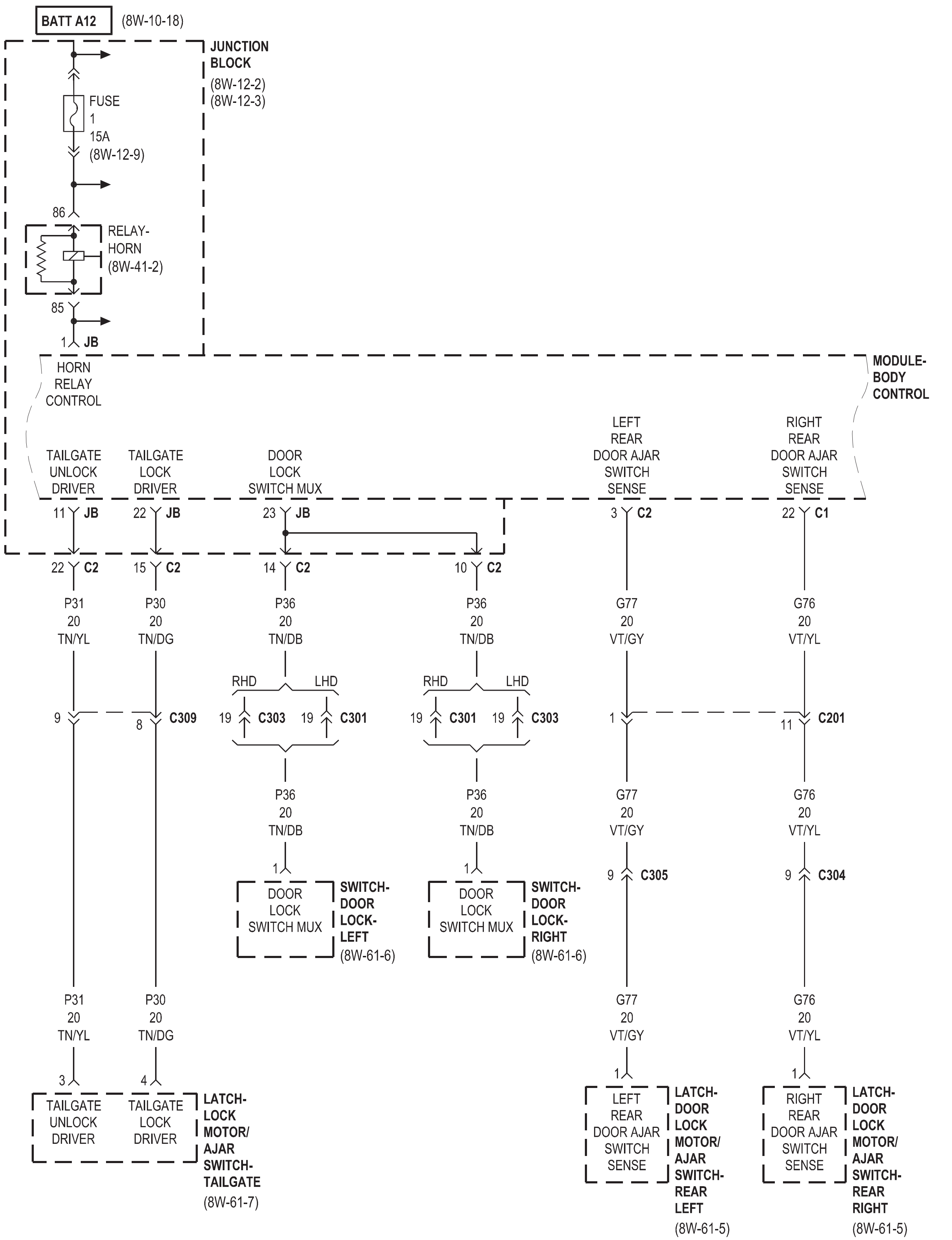

LIGHTBAR SWITCH SENSE
SWITCH-LIGHTBAR
(8W-50-15)
HAZARD LAMP CONTROL
SWITCH-HAZARD/COMBINATION FLASHER
(8W-52-2)
8
L18 20 WT/LG
19 C1
4
L91 18 WT/DB
12 C1
LIGHTBAR SWITCH SENSE
HAZARD LAMP CONTROL
MODULE-BODY CONTROL
RADIO CONTROL MUX
RADIO CONTROL MUX RETURN
A/C ON/OFF CONTROL
REAR WINDOW DEFOGGER CONTROL
VEHICLE SPEED SIGNAL
22 C2
11 C2
24 C1
23 C1
20 C1
X20 20 GY/WT
X920 20 GY/OR
C221 20 LB/OR
C215 20 LB
B22 20 DG/YL
3 C1
4 C1
6 C1
6 C2
4 C100
CLOCKSPRING
(8W-47-9)
A/C ON/OFF CONTROL
REAR WINDOW DEFOGGER CONTROL
CONTROL-A/C-HEATER
(8W-42-4)
4 C4
3 C4
X20 20 GY/WT
X920 20 GY/OR
B22 18 DG/YL
S236
(8W-47-9)
S237
(8W-47-9)
9 C105
X20 20 GY/WT
X20 20 GY/WT
X920 20 GY/OR
X20 20 GY/OR
B22 20 DG/YL
2
1
RADIO CONTROL MUX
RADIO CONTROL MUX RETURN
SWITCH-REMOTE RADIO-LEFT
(8W-47-9)
2
1
13 C1
RADIO CONTROL MUX
RADIO CONTROL MUX RETURN
SWITCH-REMOTE RADIO-RIGHT
(8W-47-9)
VEHICLE SPEED SIGNAL
MODULE-POWERTRAIN CONTROL
(8W-30-8)

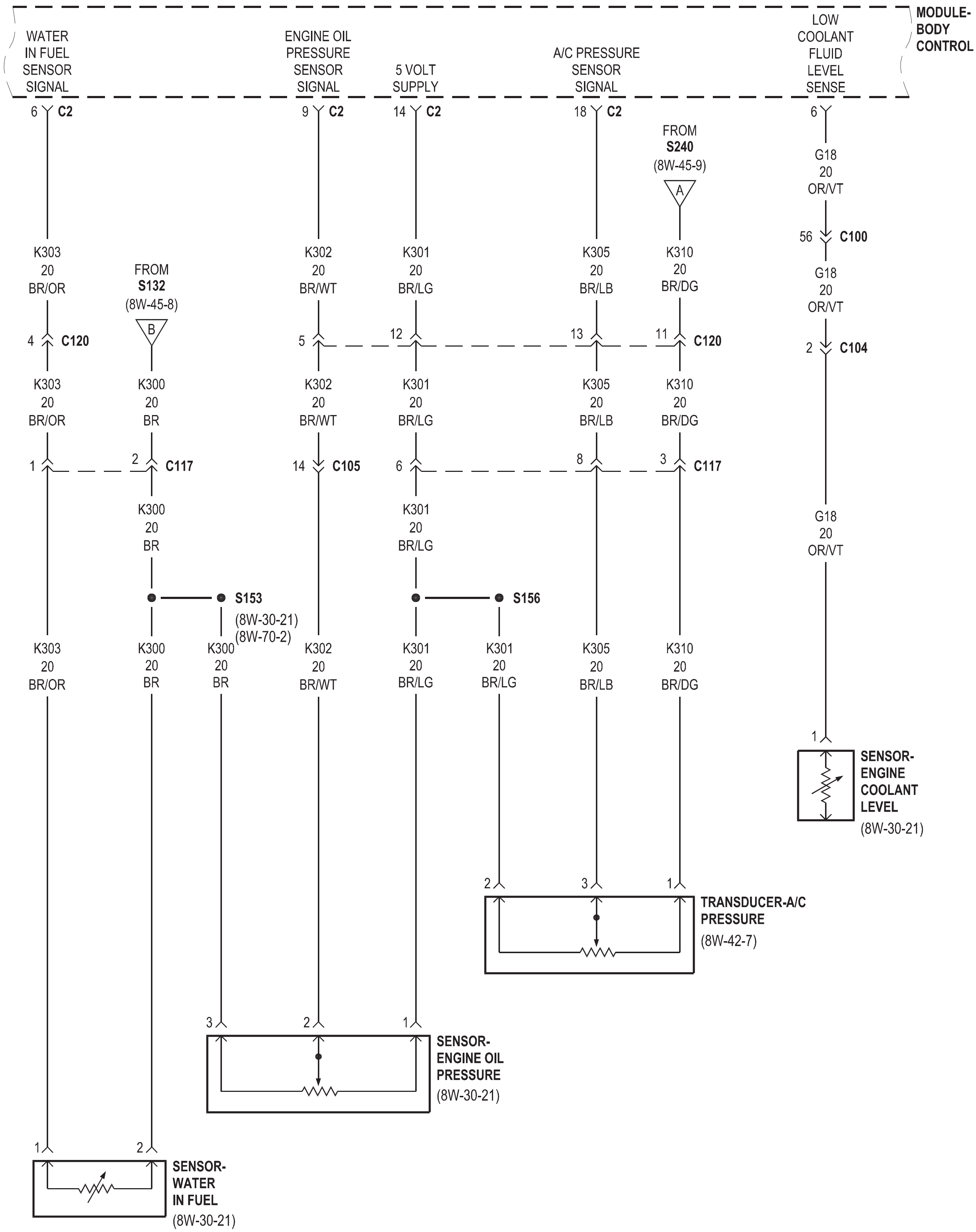

MODULE-BODY CONTROL
TAILGATE SWITCH GROUND
TAILGATE AJAR SWITCH SENSE
FLIP-UP GLASS RELEASE SWITCH SENSE
FLIP-UP GLASS AJAR SWITCH SENSE
FLIP-UP GLASS RELEASE MOTOR DRIVER
REAR COURTESY LAMP CONTROL
2 C2
7 C1
17 C1
9 C1
26 C1
10 C1
G910 20 VT/BR
G78 20 VT/OR
P101 20 LG/WT
G80 20 VT/YL
P100 20 DB/LG
G773 20 VT/OR
C201
3
16
22
10
21
7
C309
C308
10
11
4
12
14
4
S381
S382
G773 20 RD
TAILGATE SWITCH GROUND
TAILGATE AJAR SWITCH SENSE
LATCH-LOCK MOTOR/AJAR SWITCH-TAILGATE
(8W-61-7)
FLIP-UP GLASS RELEASE MOTOR DRIVER
MOTOR-REAR WINDOW WIPER
(8W-53-3)
REAR COURTESY LAMP CONTROL
LAMP-CARGO
(8W-44-3)
FLIP-UP GLASS AJAR SWITCH SENSE
SWITCH-FLIP-UP GLASS AJAR
(8W-61-7)
FLIP-UP GLASS RELEASE MOTOR DRIVER
MOTOR-FLIP-UP GLASS RELEASE
(8W-61-7)
TAILGATE SWITCH GROUND
FLIP-UP GLASS RELEASE MOTOR DRIVER
SWITCH-FLIP-UP GLASS RELEASE
(8W-61-7)


MODULE-BODY CONTROL
A/C PRESSURE SIGNAL
AAT SIGNAL
TRANSFER CASE POSITION SENSOR INPUT
TRANSFER CASE POSITION SENSOR INPUT
SENSOR GROUND
HOOD AJAR SWITCH SENSE
18 C2
6 C2
26 C2
9 C2
13 C2
6 C1
C18 20 LB/BR
G31 20 VT/OR
K77 20 BR/WT
K300 20 BR
G70 20 VT/LB
13
4 C120
5 C120
16
13 C100
S126
1 C112
S132
GAS EXCEPT 4WD
GAS 4WD
5 C112
5 C106
4 C105
2 C112
3 C106
B
TO C117 (DIESEL) (8W-45-12)
1
2
SWITCH-HOOD AJAR
Z932 20 BK
S117 (8W-15-5)
Z932 14 BK
S110 (8W-15-5)
G111 (8W-15-5)
TRANSFER CASE POSITION SENSOR INPUT
SENSOR GROUND
SENSOR-TRANSFER CASE POSITION (8W-31-4)
31 C1
AAT SIGNAL
MODULE-ENGINE CONTROL (8W-30-19)
SENSOR-AMBIENT AIR TEMPERATURE (8W-42-7)
3
A/C PRESSURE SIGNAL
TRANSDUCER-A/C PRESSURE (GAS) (8W-42-7)

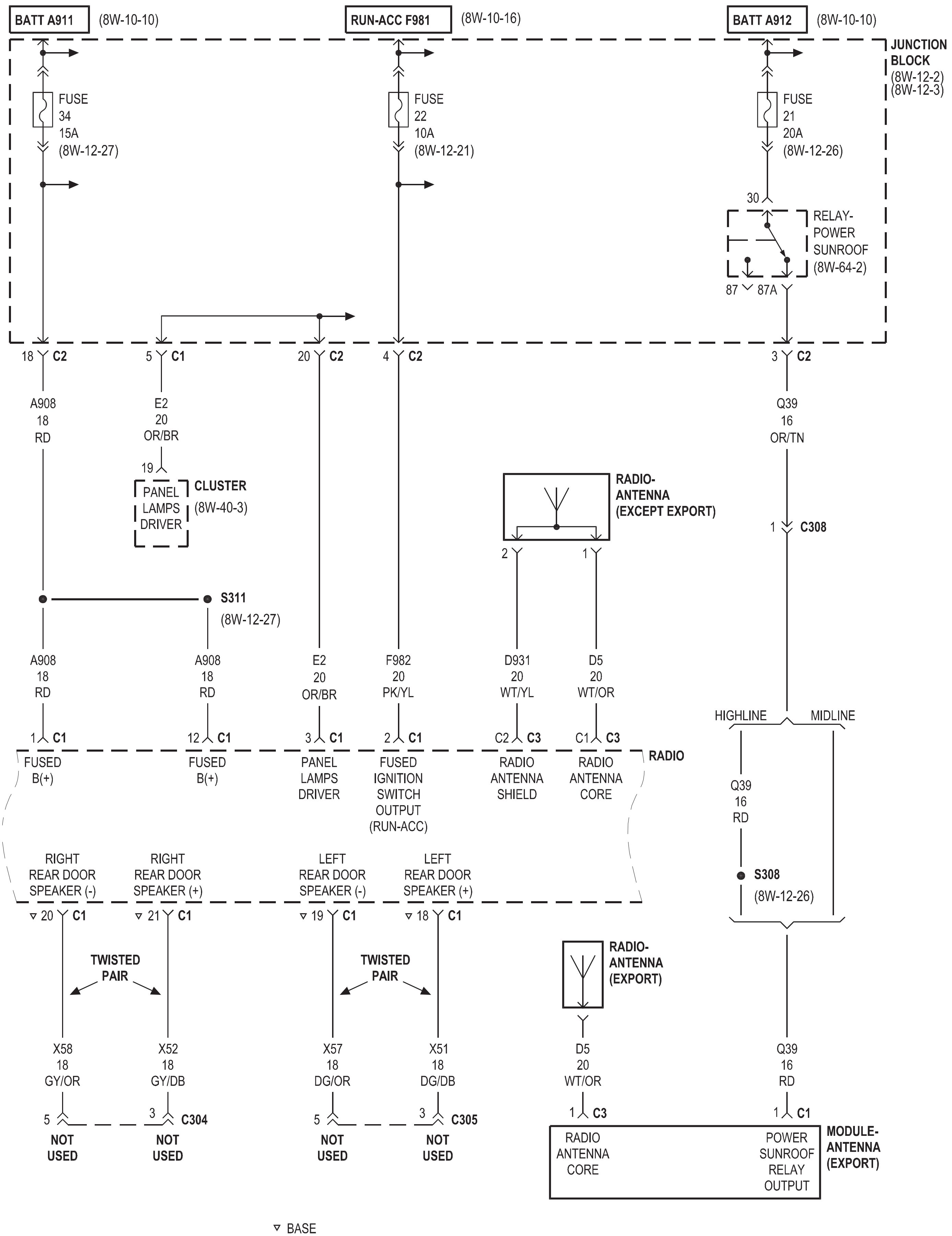

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
MODULE-BODY CONTROL
ACCESSORY DELAY RELAY CONTROL
FUEL LEVEL SENSOR SIGNAL
FUEL LEVEL SIGNAL
SENSOR GROUND
7 JB
17 C2
17 C2
15 C2
N4 20 DB/YL
K310 20 BR/DG
S223
S240
85
RELAY-POWER WINDOW (8W-60-2)
86
85
RELAY-POWER SUNROOF (8W-64-2)
86
K304 20 BR/DB
N4 20 DB/YL
N4 20 DB/YL
K310 20 BR/DG
K310 20 BR/DG
36
32 C201
7 C100
35 C201
A
TO C120 (DIESEL) (8W-45-12)
K304 20 BR/DB
N4 20 DB/YL
N4 20 DB/YL
K310 20 BR/DG
9
3 C307
33 C3
8 C307
FUEL LEVEL SIGNAL
MODULE-POWERTRAIN CONTROL (8W-30-7)
K304 20 BR/DB
N4 20 DB/YL
GAS
DIESEL
K310 20 BR/DG
K300 20 BR
3
3
2
FUEL LEVEL SENSOR SIGNAL
FUEL LEVEL SIGNAL
SENSOR GROUND
MODULE-FUEL PUMP
(8W-30-7)
(8W-30-21)
GAS
DIESEL

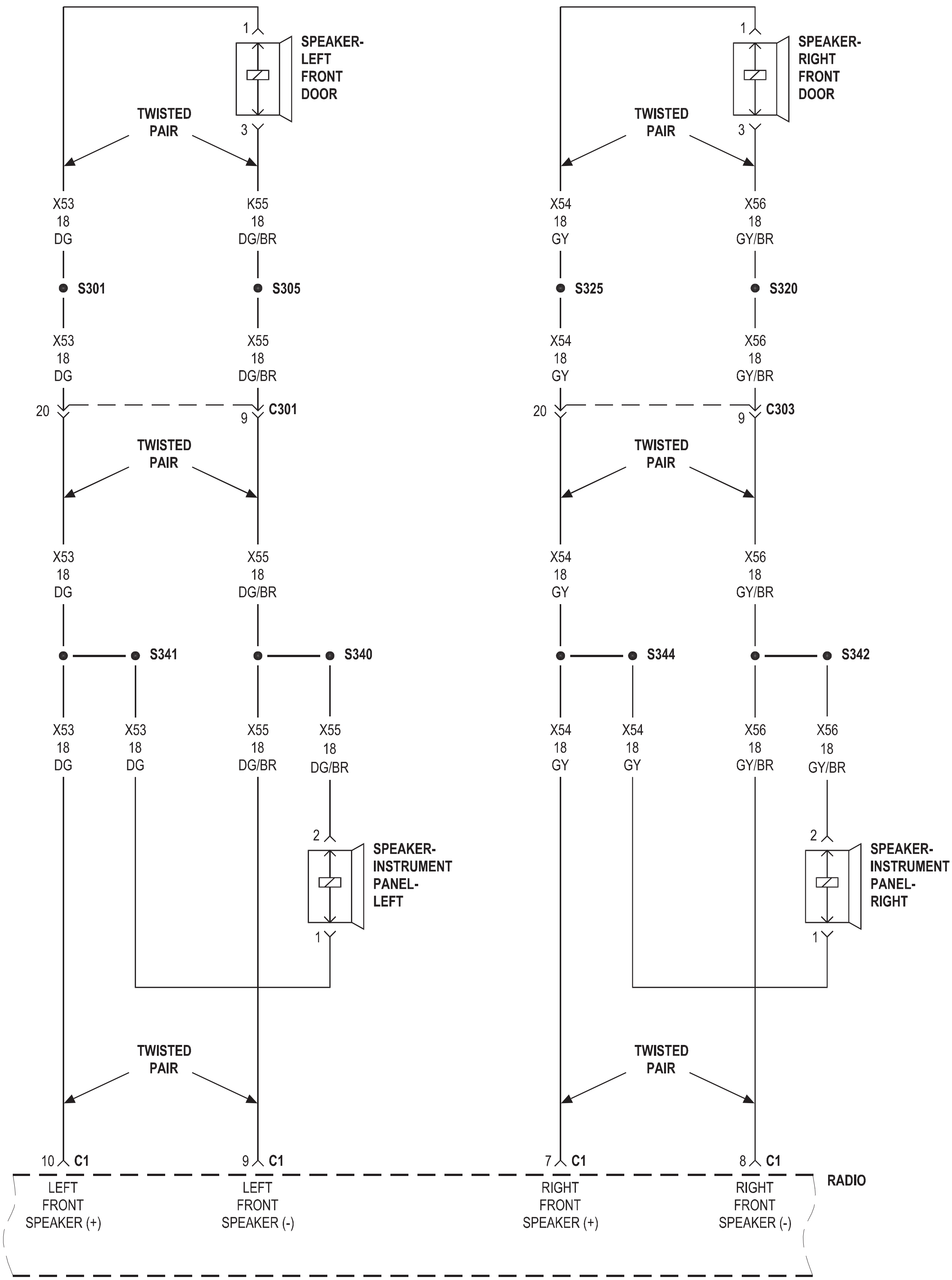

REAR WIPER INTERMITTENT DRIVER
FRONT WIPER SWITCH MUX
REAR WIPER ON DRIVER
SWITCH-MULTIFUNCTION
(8W-53-2)
(8W-53-4)
2 C2
4 C2
1 C2
W27 20 DB/BR
W13 20 BR/LG
S218
S217
W27 20 DB/BR
W35 20 BR/LG
W13 20 BR/LG
2 C1
10 C2
13 C1
REAR WIPER INTERMITTENT DRIVER
FRONT WIPER SWITCH MUX
REAR WIPER ON DRIVER
MODULE-BODY CONTROL
WASHER PUMP DRIVER
PANEL LAMPS DIMMER SWITCH MUX
11 C1
8 C2
W27 20 DB/BR
W33 20 BR/DG
W13 20 BR/LG
27 C201
S206
29 C201
W27 20 DB/BR
W33 20 BR/DG
W33 20 BR/DG
E3 20 OR/YL
W13 20 BR/LG
3 C309
39 C100
7 C2
1 C1
2 C309
WASHER PUMP DRIVER
PANEL LAMPS DIMMER SWITCH MUX
SWITCH-MULTIFUNCTION
(8W-50-14)
(8W-53-2)
W27 20 DB/BR
W33 20 BR/DG
W13 20 BR/LG
2
WASHER PUMP DRIVER
PUMP-WASHER-WINDSHIELD
(8W-53-2)
4
2
REAR WIPER INTERMITTENT DRIVER
REAR WIPER ON DRIVER
MOTOR-REAR WINDOW WIPER
(8W-53-3)

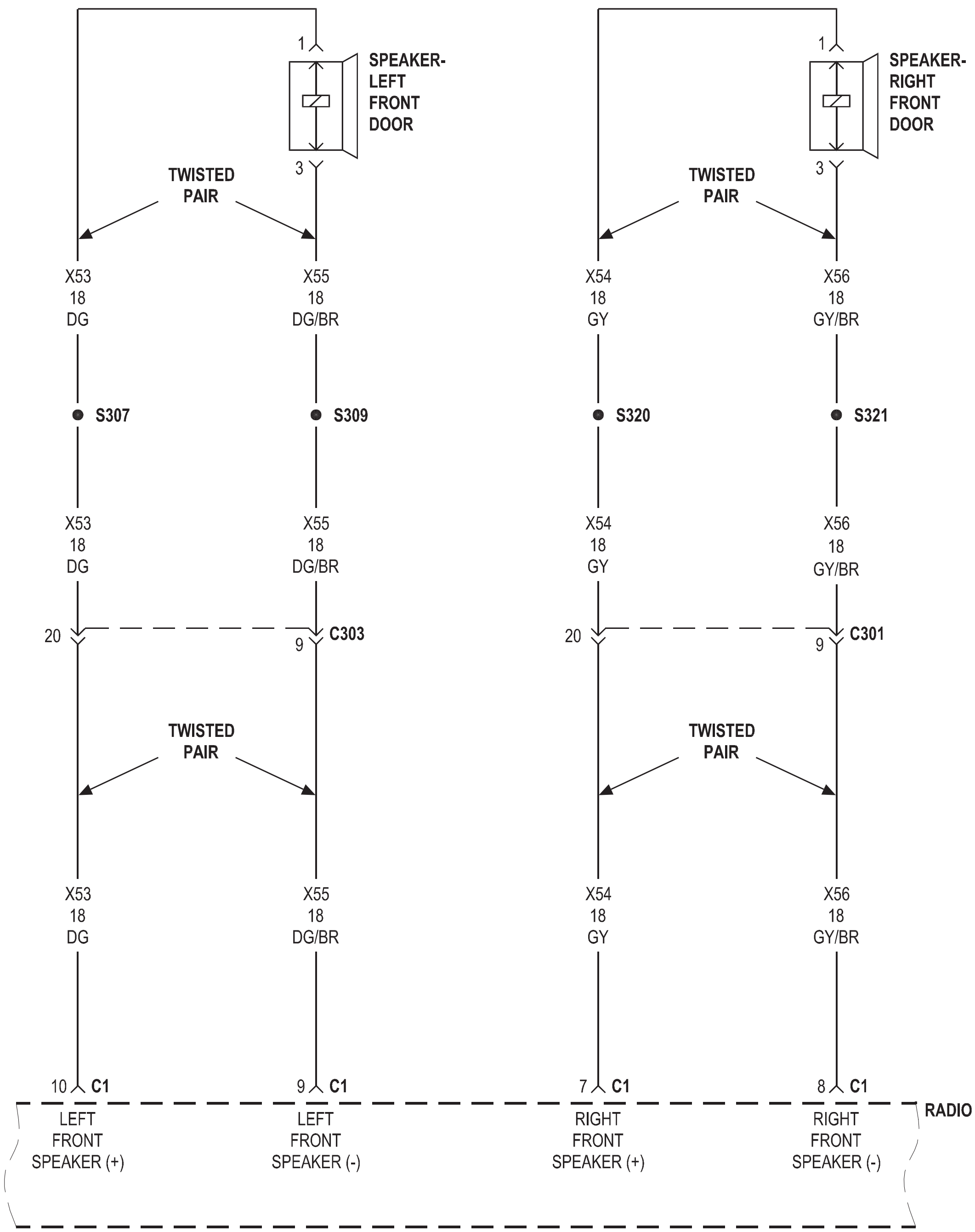

BATT A12
(8W-10-18)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 1 15A (8W-12-9)
86
RELAY-HORN (8W-41-2)
85
1 JB
HORN RELAY CONTROL
MODULE-BODY CONTROL
TAILGATE UNLOCK DRIVER
TAILGATE LOCK DRIVER
DOOR LOCK SWITCH MUX
LEFT REAR DOOR AJAR SWITCH SENSE
RIGHT REAR DOOR AJAR SWITCH SENSE
11 JB
22 JB
23 JB
3 C2
22 C1
22 C2
15 C2
14 C2
10 C2
P31 20 TN/YL
P30 20 TN/DG
P36 20 TN/DB
P36 20 TN/DB
G77 20 VT/GY
G76 20 VT/YL
RHD LHD
RHD LHD
9 8 C309
19 C303 19 C301
19 C301 19 C303
1 11 C201
P36 20 TN/DB
P36 20 TN/DB
G77 20 VT/GY
G76 20 VT/YL
1
1
9 C305
9 C304
DOOR LOCK SWITCH MUX
SWITCH-DOOR LOCK-LEFT (8W-61-6)
DOOR LOCK SWITCH MUX
SWITCH-DOOR LOCK-RIGHT (8W-61-6)
P31 20 TN/YL
P30 20 TN/DG
G77 20 VT/GY
G76 20 VT/YL
3 4
TAILGATE UNLOCK DRIVER
TAILGATE LOCK DRIVER
LATCH-LOCK MOTOR/AJAR SWITCH-TAILGATE (8W-61-7)
1
LEFT REAR DOOR AJAR SWITCH SENSE
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-REAR LEFT (8W-61-5)
1
RIGHT REAR DOOR AJAR SWITCH SENSE
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-REAR RIGHT (8W-61-5)

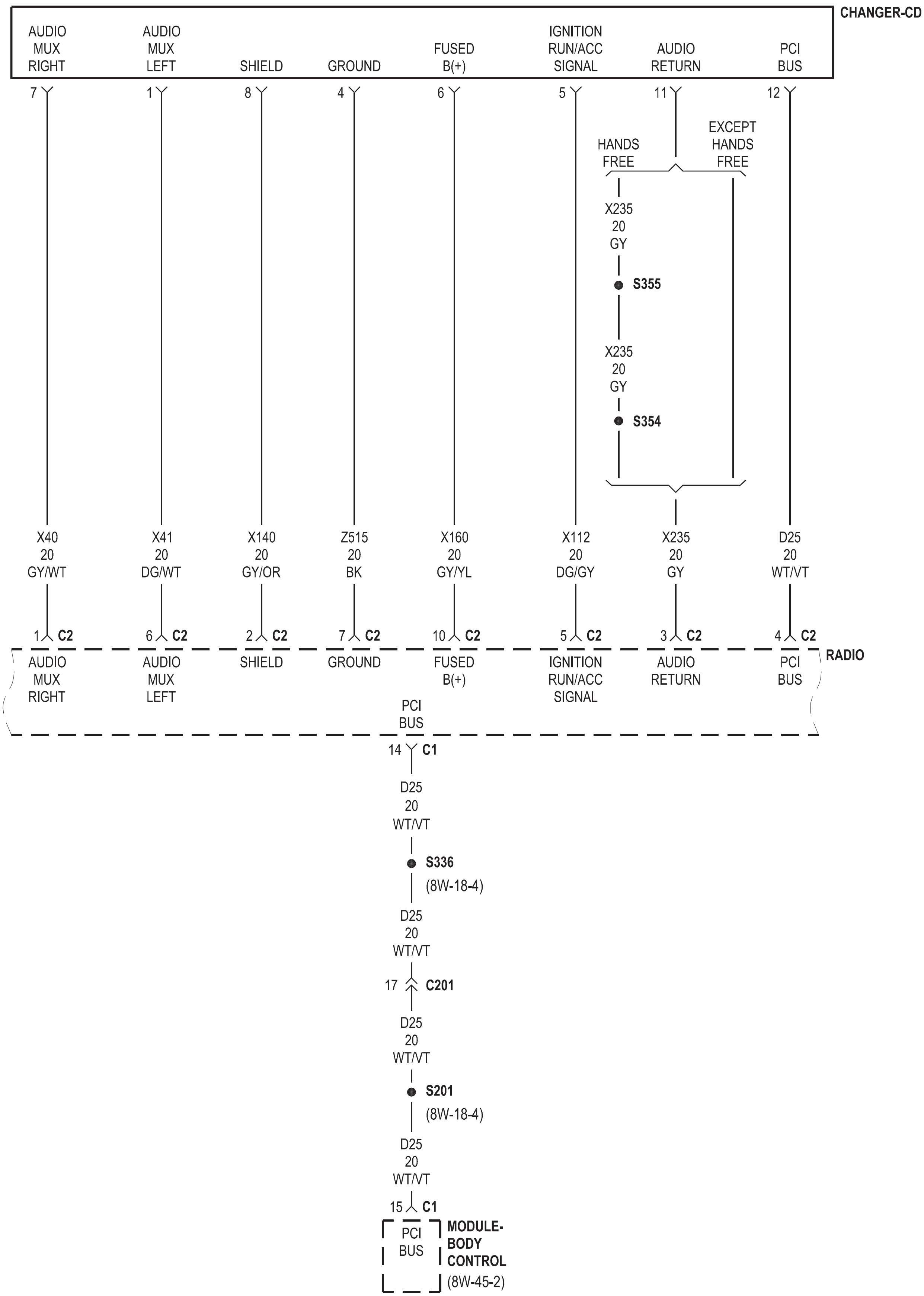

MODULE-BODY CONTROL
WATER IN FUEL SENSOR SIGNAL
ENGINE OIL PRESSURE SENSOR SIGNAL
5 VOLT SUPPLY
A/C PRESSURE SENSOR SIGNAL
LOW COOLANT FLUID LEVEL SENSE
6 C2
9 C2
14 C2
18 C2
6
FROM S240 (8W-45-9)
A
G18 20 OR/VT
56 C100
K303 20 BR/OR
FROM S132 (8W-45-8)
B
K302 20 BR/WT
K301 20 BR/LG
K305 20 BR/LB
K310 20 BR/DG
4 C120
5
12
13
11 C120
2 C104
K300 20 BR
1
2 C117
14 C105
6
8
3 C117
S153 (8W-30-21) (8W-70-2)
S156
SENSOR-ENGINE COOLANT LEVEL (8W-30-21)
TRANSDUCER-A/C PRESSURE (8W-42-7)
SENSOR-ENGINE OIL PRESSURE (8W-30-21)
SENSOR-WATER IN FUEL (8W-30-21)

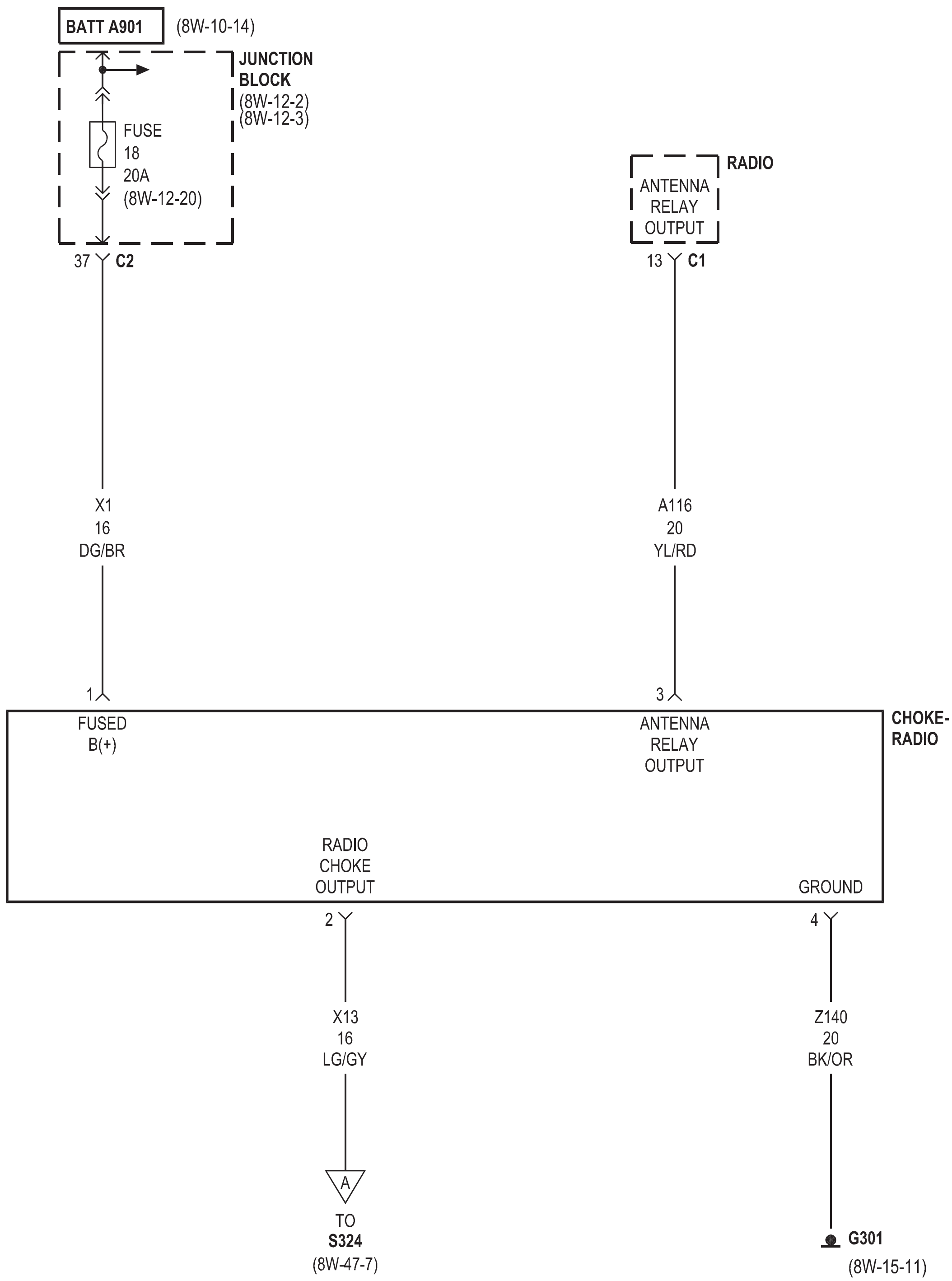
# 8W-47 AUDIO SYSTEM

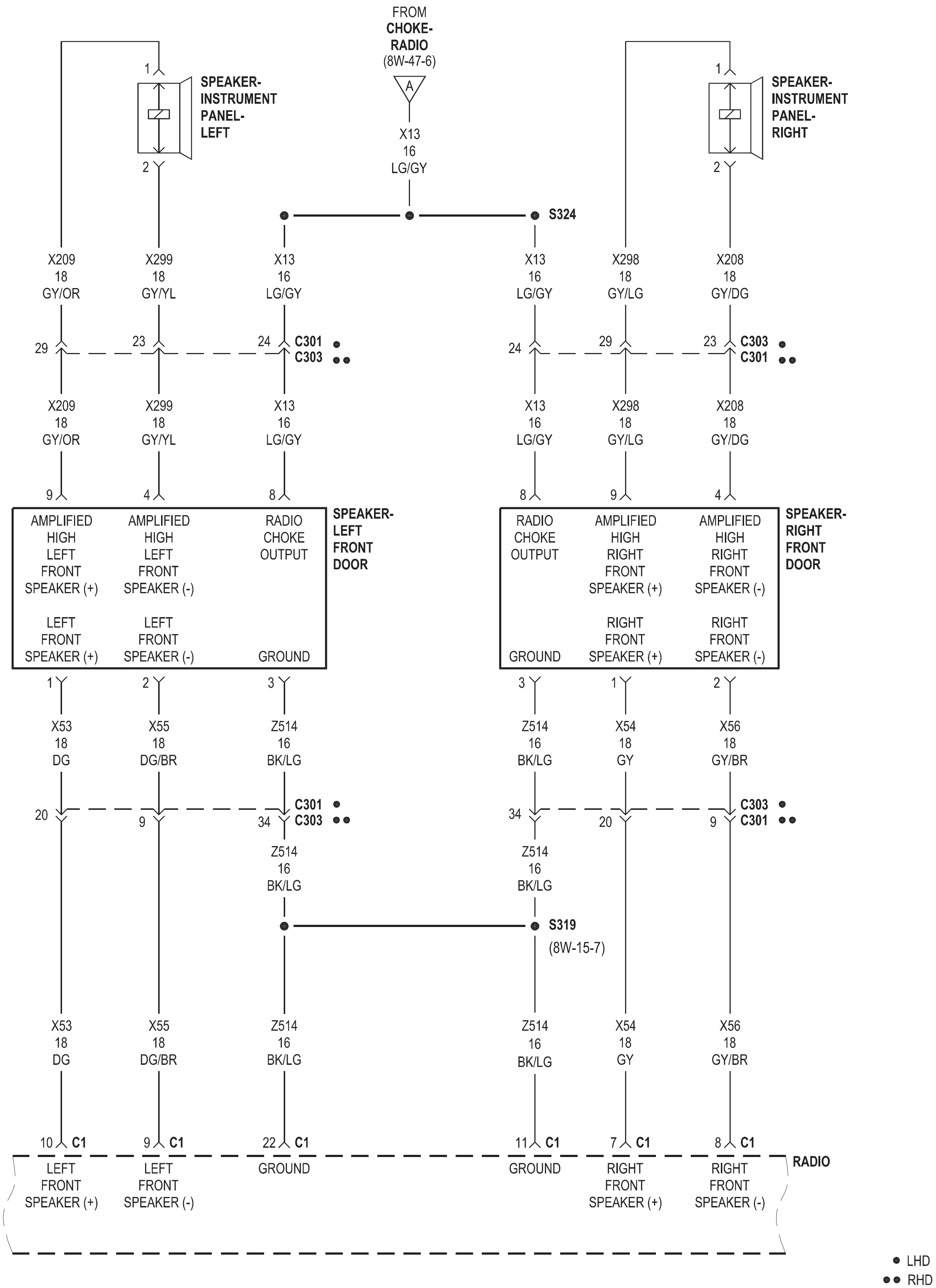

BATT A911
(8W-10-10)
RUN-ACC F981
(8W-10-16)
BATT A912
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 34 15A (8W-12-27)
FUSE 22 10A (8W-12-21)
FUSE 21 20A (8W-12-26)
30
RELAY-POWER SUNROOF (8W-64-2)
87
87A
18 C2
5 C1
20 C2
4 C2
3 C2
A908 18 RD
E2 20 OR/BR
Q39 16 OR/TN
19
PANEL LAMPS DRIVER
CLUSTER
(8W-40-3)
RADIO-ANTENNA (EXCEPT EXPORT)
2
1
1 C308
S311
(8W-12-27)
A908 18 RD
A908 18 RD
E2 20 OR/BR
F982 20 PK/YL
D931 20 WT/YL
D5 20 WT/OR
HIGHLINE
MIDLINE
1 C1
12 C1
3 C1
2 C1
C2 C3
C1 C3
RADIO
FUSED B(+)
FUSED B(+)
PANEL LAMPS DRIVER
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
RADIO ANTENNA SHIELD
RADIO ANTENNA CORE
Q39 16 RD
RIGHT REAR DOOR SPEAKER (-)
RIGHT REAR DOOR SPEAKER (+)
LEFT REAR DOOR SPEAKER (-)
LEFT REAR DOOR SPEAKER (+)
S308
(8W-12-26)
▽ 20 C1
▽ 21 C1
▽ 19 C1
▽ 18 C1
TWISTED PAIR
TWISTED PAIR
RADIO-ANTENNA (EXPORT)
X58 18 GY/OR
X52 18 GY/DB
X57 18 DG/OR
X51 18 DG/DB
D5 20 WT/OR
Q39 16 RD
5
3 C304
5
3 C305
1 C3
1 C1
NOT USED
NOT USED
NOT USED
NOT USED
RADIO ANTENNA CORE
POWER SUNROOF RELAY OUTPUT
MODULE-ANTENNA (EXPORT)
▽ BASE

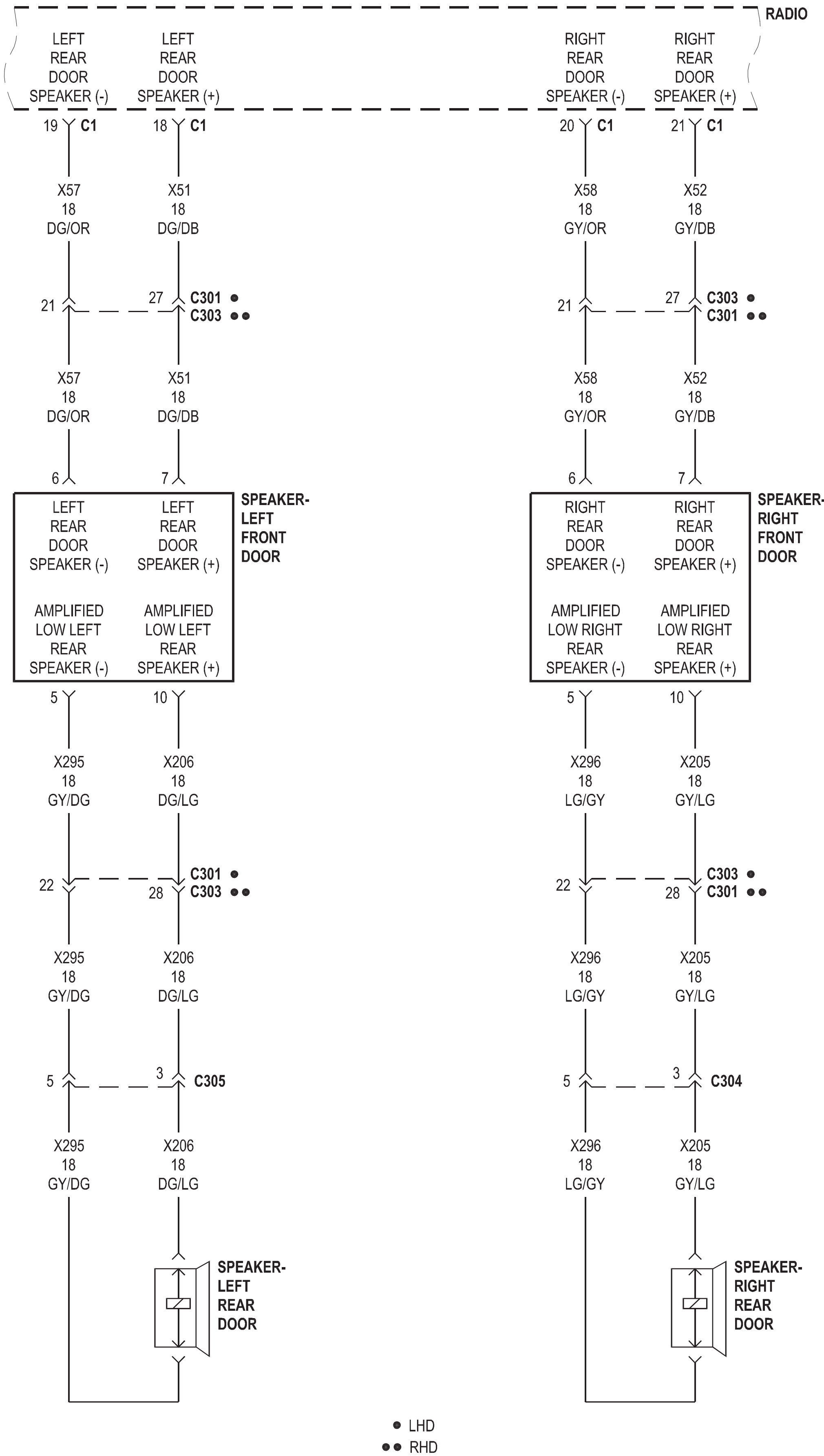

SPEAKER-LEFT FRONT DOOR
SPEAKER-RIGHT FRONT DOOR
TWISTED PAIR
1
3
X53 18 DG
K55 18 DG/BR
X54 18 GY
X56 18 GY/BR
S301
S305
S325
S320
X55 18 DG/BR
20
9
C301
C303
S341
S340
S344
S342
SPEAKER-INSTRUMENT PANEL-LEFT
SPEAKER-INSTRUMENT PANEL-RIGHT
2
10 C1
9 C1
7 C1
8 C1
RADIO
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)

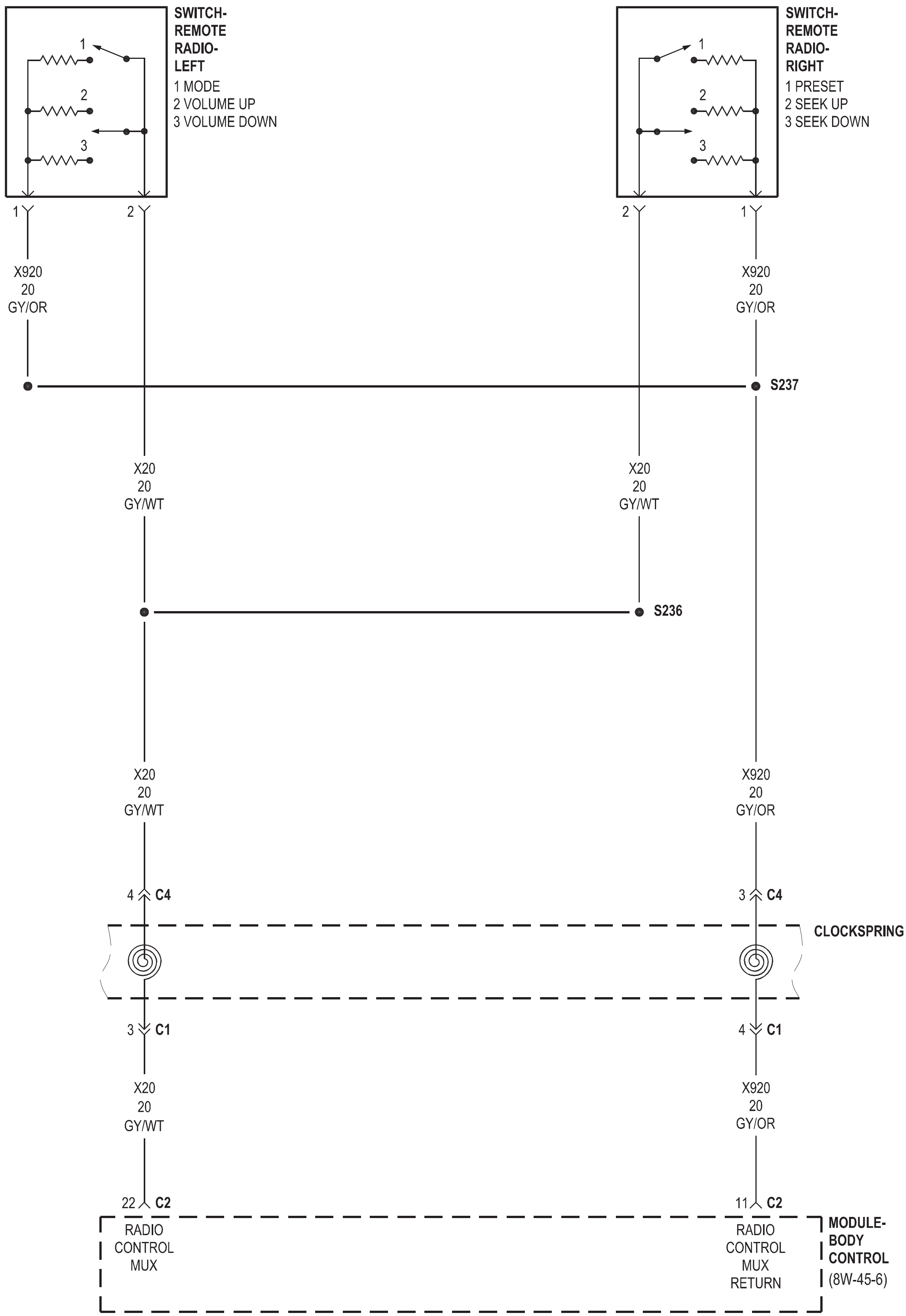

1
SPEAKER-
LEFT
FRONT
DOOR
3
TWISTED
PAIR
X53
18
DG
X55
18
DG/BR
S307
S309
X53
18
DG
X55
18
DG/BR
20
C303
9
TWISTED
PAIR
X53
18
DG
X55
18
DG/BR
10 C1
9 C1
1
SPEAKER-
RIGHT
FRONT
DOOR
3
TWISTED
PAIR
X54
18
GY
X56
18
GY/BR
S320
S321
X54
18
GY
X56
18
GY/BR
20
C301
9
TWISTED
PAIR
X54
18
GY
X56
18
GY/BR
7 C1
8 C1
RADIO
LEFT
FRONT
SPEAKER (+)
LEFT
FRONT
SPEAKER (-)
RIGHT
FRONT
SPEAKER (+)
RIGHT
FRONT
SPEAKER (-)


CHANGER-CD
AUDIO MUX RIGHT
AUDIO MUX LEFT
SHIELD
GROUND
FUSED B(+)
IGNITION RUN/ACC SIGNAL
AUDIO RETURN
PCI BUS
7
1
8
4
6
5
11
12
HANDS FREE
EXCEPT HANDS FREE
X235 20 GY
S355
X235 20 GY
S354
X40 20 GY/WT
X41 20 DG/WT
X140 20 GY/OR
Z515 20 BK
X160 20 GY/YL
X112 20 DG/GY
X235 20 GY
D25 20 WT/VT
1 C2
6 C2
2 C2
7 C2
10 C2
5 C2
3 C2
4 C2
RADIO
AUDIO MUX RIGHT
AUDIO MUX LEFT
SHIELD
GROUND
FUSED B(+)
IGNITION RUN/ACC SIGNAL
AUDIO RETURN
PCI BUS
PCI BUS
14 C1
D25 20 WT/VT
S336
(8W-18-4)
D25 20 WT/VT
17 C201
D25 20 WT/VT
S201
(8W-18-4)
D25 20 WT/VT
15 C1
PCI BUS
MODULE-BODY CONTROL
(8W-45-2)

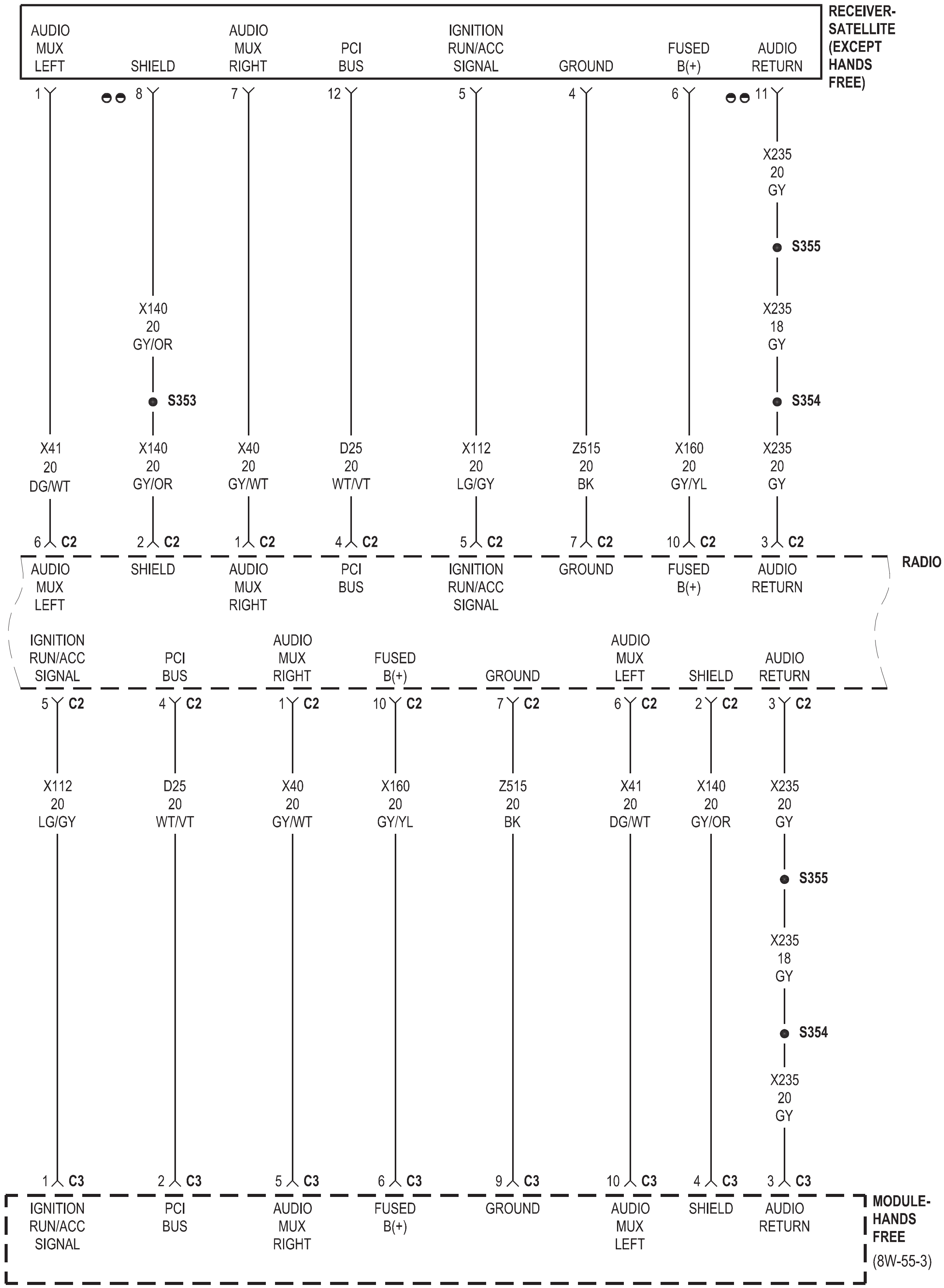

BATT A901
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
18
20A
(8W-12-20)
37 C2
RADIO
ANTENNA RELAY OUTPUT
13 C1
X1
16
DG/BR
A116
20
YL/RD
1
3
FUSED B(+)
ANTENNA RELAY OUTPUT
CHOKE-RADIO
RADIO CHOKE OUTPUT
GROUND
2
4
X13
16
LG/GY
Z140
20
BK/OR
A
TO S324
(8W-47-7)
G301
(8W-15-11)


FROM
CHOKE-
RADIO
(8W-47-6)
A
X13
16
LG/GY
S324
SPEAKER-
INSTRUMENT
PANEL-
LEFT
SPEAKER-
INSTRUMENT
PANEL-
RIGHT
X209 18 GY/OR
X299 18 GY/YL
X13 16 LG/GY
X13 16 LG/GY
X298 18 GY/LG
X208 18 GY/DG
C301
C303
C303
C301
SPEAKER-
LEFT
FRONT
DOOR
AMPLIFIED HIGH LEFT FRONT SPEAKER (+)
AMPLIFIED HIGH LEFT FRONT SPEAKER (-)
RADIO CHOKE OUTPUT
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
GROUND
SPEAKER-
RIGHT
FRONT
DOOR
RADIO CHOKE OUTPUT
AMPLIFIED HIGH RIGHT FRONT SPEAKER (+)
AMPLIFIED HIGH RIGHT FRONT SPEAKER (-)
GROUND
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
X53 18 DG
X55 18 DG/BR
Z514 16 BK/LG
Z514 16 BK/LG
X54 18 GY
X56 18 GY/BR
S319
(8W-15-7)
C1
RADIO
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
GROUND
GROUND
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
LHD
RHD


RADIO
LEFT REAR DOOR SPEAKER (-)
LEFT REAR DOOR SPEAKER (+)
RIGHT REAR DOOR SPEAKER (-)
RIGHT REAR DOOR SPEAKER (+)
19 C1
18 C1
20 C1
21 C1
X57 18 DG/OR
X51 18 DG/DB
X58 18 GY/OR
X52 18 GY/DB
21
27
C301 ●
C303 ●●
C303 ●
C301 ●●
6
7
SPEAKER-LEFT FRONT DOOR
SPEAKER-RIGHT FRONT DOOR
AMPLIFIED LOW LEFT REAR SPEAKER (-)
AMPLIFIED LOW LEFT REAR SPEAKER (+)
RIGHT REAR DOOR SPEAKER (-)
RIGHT REAR DOOR SPEAKER (+)
AMPLIFIED LOW RIGHT REAR SPEAKER (-)
AMPLIFIED LOW RIGHT REAR SPEAKER (+)
5
10
X295 18 GY/DG
X206 18 DG/LG
X296 18 LG/GY
X205 18 GY/LG
22
28
3
C305
C304
SPEAKER-LEFT REAR DOOR
SPEAKER-RIGHT REAR DOOR
● LHD
●● RHD

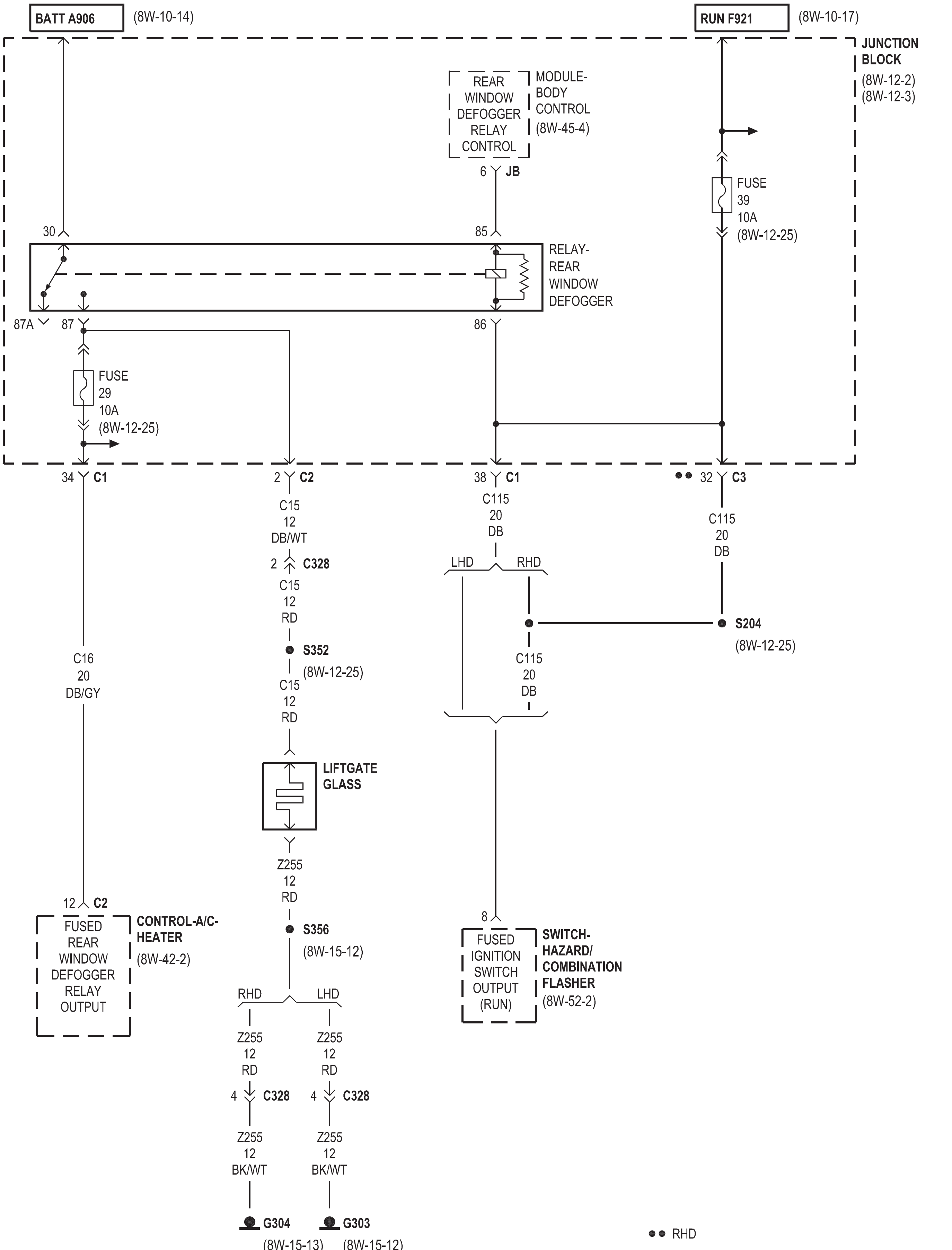

SWITCH-
REMOTE
RADIO-
LEFT
1 MODE
2 VOLUME UP
3 VOLUME DOWN
SWITCH-
REMOTE
RADIO-
RIGHT
1 PRESET
2 SEEK UP
3 SEEK DOWN
X920
20
GY/OR
S237
X20
20
GY/WT
S236
C4
CLOCKSPRING
C1
C2
RADIO
CONTROL
MUX
RADIO
CONTROL
MUX
RETURN
MODULE-
BODY
CONTROL
(8W-45-6)

## SATELLITE RADIO

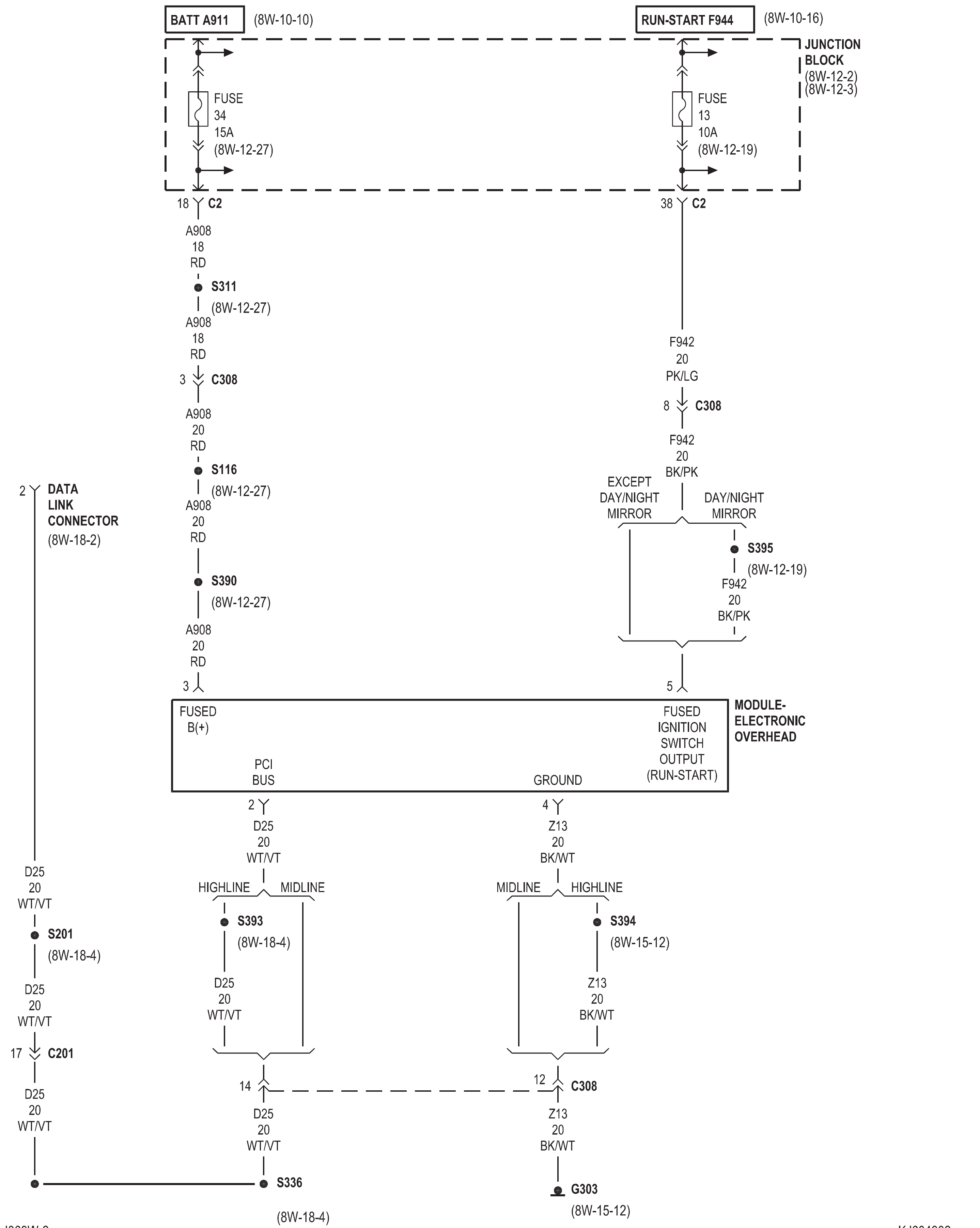



HANDS FREE

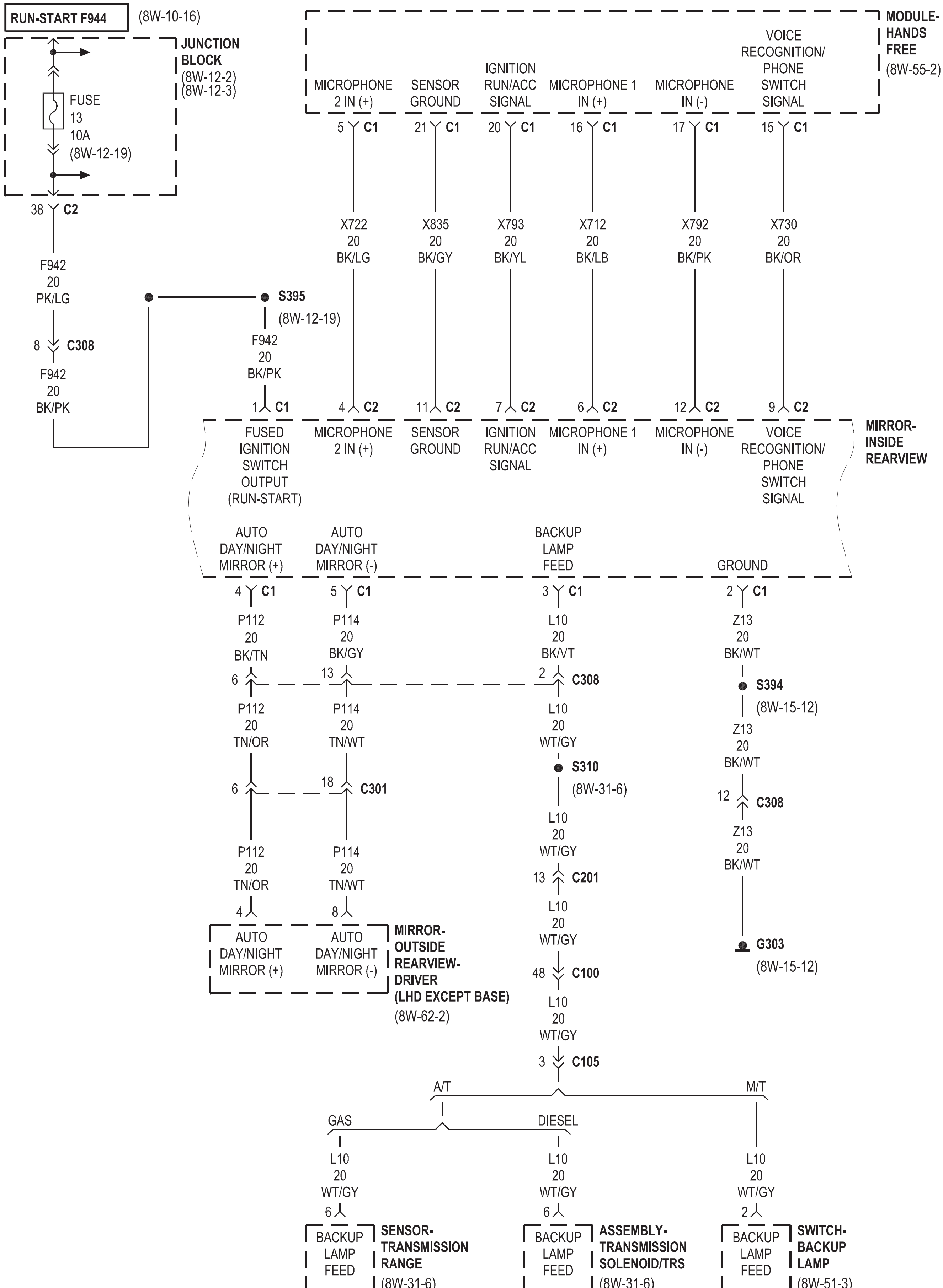
# 8W-48 REAR WINDOW DEFOGGER

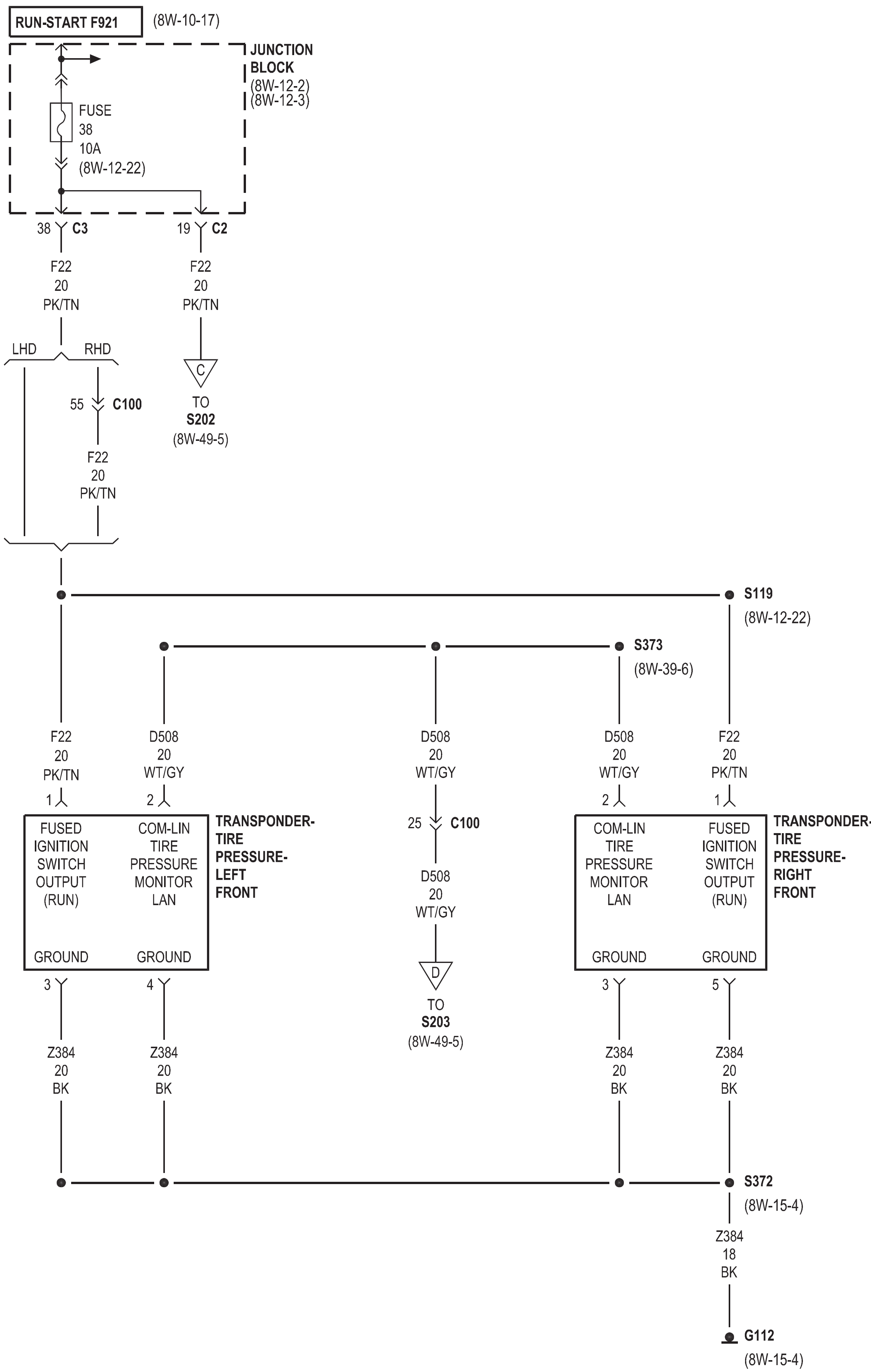

BATT A906
(8W-10-14)
RUN F921
(8W-10-17)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
REAR WINDOW DEFOGGER RELAY CONTROL
MODULE-BODY CONTROL
(8W-45-4)
6 JB
FUSE 39 10A
(8W-12-25)
30
85
RELAY-REAR WINDOW DEFOGGER
87A
87
86
FUSE 29 10A
(8W-12-25)
34 C1
2 C2
38 C1
32 C3
C15 12 DB/WT
2 C328
C15 12 RD
S352
(8W-12-25)
C15 12 RD
C115 20 DB
LHD
RHD
C115 20 DB
S204
(8W-12-25)
C115 20 DB
C16 20 DB/GY
LIFTGATE GLASS
Z255 12 RD
S356
(8W-15-12)
12 C2
FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
CONTROL-A/C-HEATER
(8W-42-2)
8
FUSED IGNITION SWITCH OUTPUT (RUN)
SWITCH-HAZARD/COMBINATION FLASHER
(8W-52-2)
RHD
LHD
Z255 12 RD
Z255 12 RD
4 C328
4 C328
Z255 12 BK/WT
Z255 12 BK/WT
G304
(8W-15-13)
G303
(8W-15-12)
●● RHD

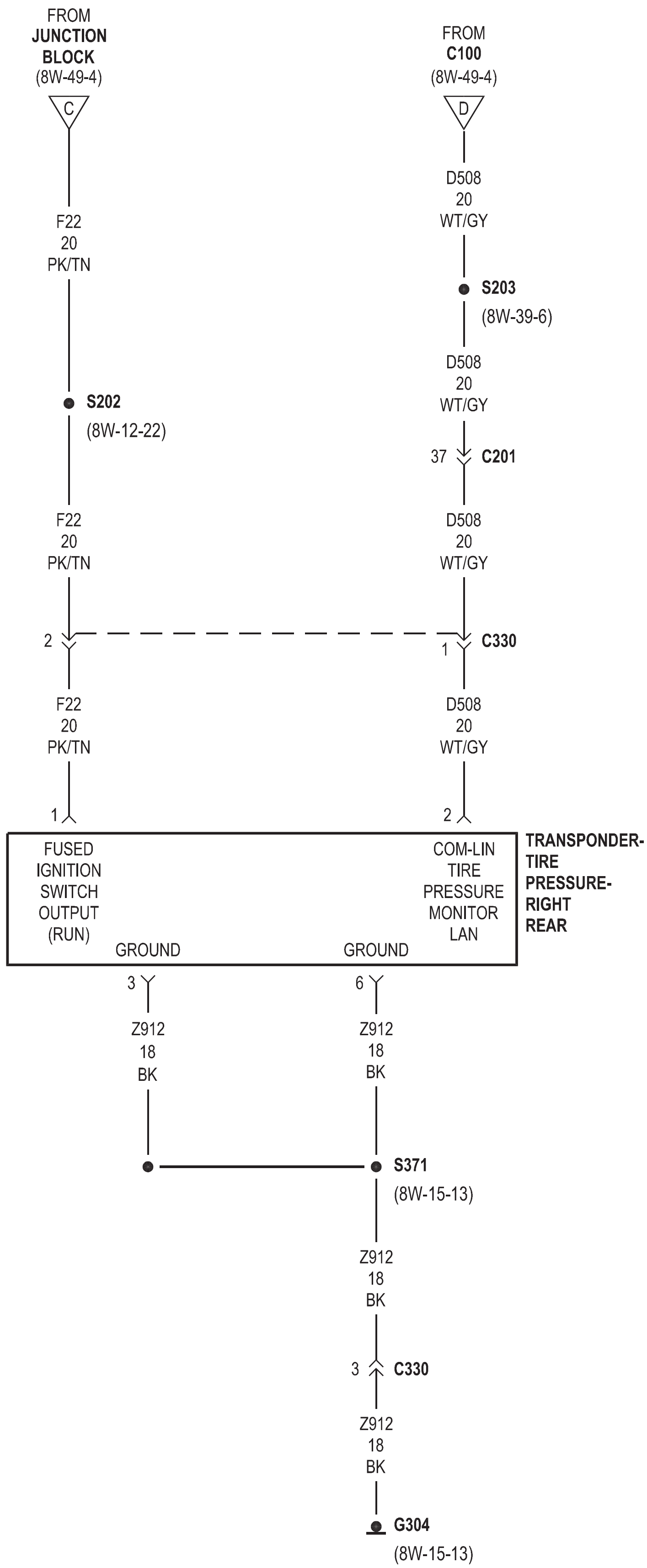
# 8W-49 OVERHEAD CONSOLE


BATT A911
(8W-10-10)
RUN-START F944
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 34 15A (8W-12-27)
FUSE 13 10A (8W-12-19)
18 C2
38 C2
A908 18 RD
S311 (8W-12-27)
A908 18 RD
3 C308
A908 20 RD
S116 (8W-12-27)
A908 20 RD
S390 (8W-12-27)
A908 20 RD
3
F942 20 PK/LG
8 C308
F942 20 BK/PK
EXCEPT DAY/NIGHT MIRROR
DAY/NIGHT MIRROR
S395 (8W-12-19)
F942 20 BK/PK
5
2 DATA LINK CONNECTOR (8W-18-2)
FUSED B(+)
PCI BUS
GROUND
FUSED IGNITION SWITCH OUTPUT (RUN-START)
MODULE-ELECTRONIC OVERHEAD
2
D25 20 WT/VT
4
Z13 20 BK/WT
HIGHLINE
MIDLINE
MIDLINE
HIGHLINE
S393 (8W-18-4)
D25 20 WT/VT
S394 (8W-15-12)
Z13 20 BK/WT
D25 20 WT/VT
S201 (8W-18-4)
D25 20 WT/VT
17 C201
D25 20 WT/VT
14
12 C308
D25 20 WT/VT
Z13 20 BK/WT
S336
(8W-18-4)
G303
(8W-15-12)

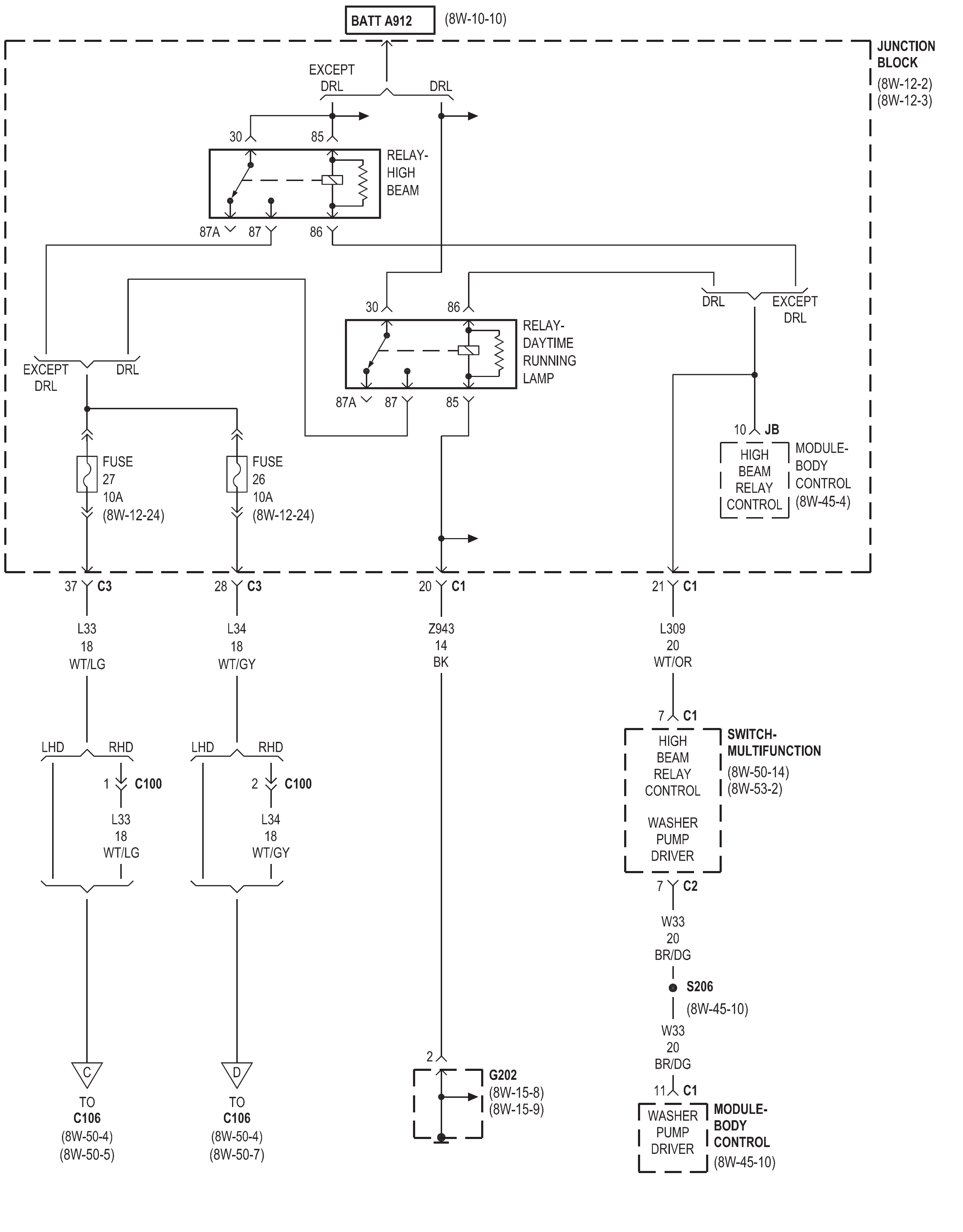
EXCEPT BASE


RUN-START F944
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
13
10A
(8W-12-19)
38 C2
F942
20
PK/LG
8 C308
F942
20
BK/PK
S395
(8W-12-19)
F942
20
BK/PK
MODULE-HANDS FREE
(8W-55-2)
MICROPHONE 2 IN (+)
SENSOR GROUND
IGNITION RUN/ACC SIGNAL
MICROPHONE 1 IN (+)
MICROPHONE IN (-)
VOICE RECOGNITION/ PHONE SWITCH SIGNAL
5 C1
21 C1
20 C1
16 C1
17 C1
15 C1
X722 20 BK/LG
X835 20 BK/GY
X793 20 BK/YL
X712 20 BK/LB
X792 20 BK/PK
X730 20 BK/OR
1 C1
4 C2
11 C2
7 C2
6 C2
12 C2
9 C2
MIRROR-INSIDE REARVIEW
FUSED IGNITION SWITCH OUTPUT (RUN-START)
MICROPHONE 2 IN (+)
SENSOR GROUND
IGNITION RUN/ACC SIGNAL
MICROPHONE 1 IN (+)
MICROPHONE IN (-)
VOICE RECOGNITION/ PHONE SWITCH SIGNAL
AUTO DAY/NIGHT MIRROR (+)
AUTO DAY/NIGHT MIRROR (-)
BACKUP LAMP FEED
GROUND
4 C1
5 C1
3 C1
2 C1
P112 20 BK/TN
P114 20 BK/GY
L10 20 BK/VT
Z13 20 BK/WT
6
13
2 C308
S394
(8W-15-12)
P112 20 TN/OR
P114 20 TN/WT
L10 20 WT/GY
Z13 20 BK/WT
S310
(8W-31-6)
6
18 C301
12 C308
L10 20 WT/GY
Z13 20 BK/WT
P112 20 TN/OR
P114 20 TN/WT
13 C201
4
8
L10 20 WT/GY
G303
(8W-15-12)
AUTO DAY/NIGHT MIRROR (+)
AUTO DAY/NIGHT MIRROR (-)
MIRROR-OUTSIDE REARVIEW-DRIVER (LHD EXCEPT BASE)
(8W-62-2)
48 C100
L10 20 WT/GY
3 C105
A/T
M/T
GAS
DIESEL
L10 20 WT/GY
L10 20 WT/GY
L10 20 WT/GY
6
6
2
BACKUP LAMP FEED
SENSOR-TRANSMISSION RANGE
(8W-31-6)
BACKUP LAMP FEED
ASSEMBLY-TRANSMISSION SOLENOID/TRS
(8W-31-6)
BACKUP LAMP FEED
SWITCH-BACKUP LAMP
(8W-51-3)

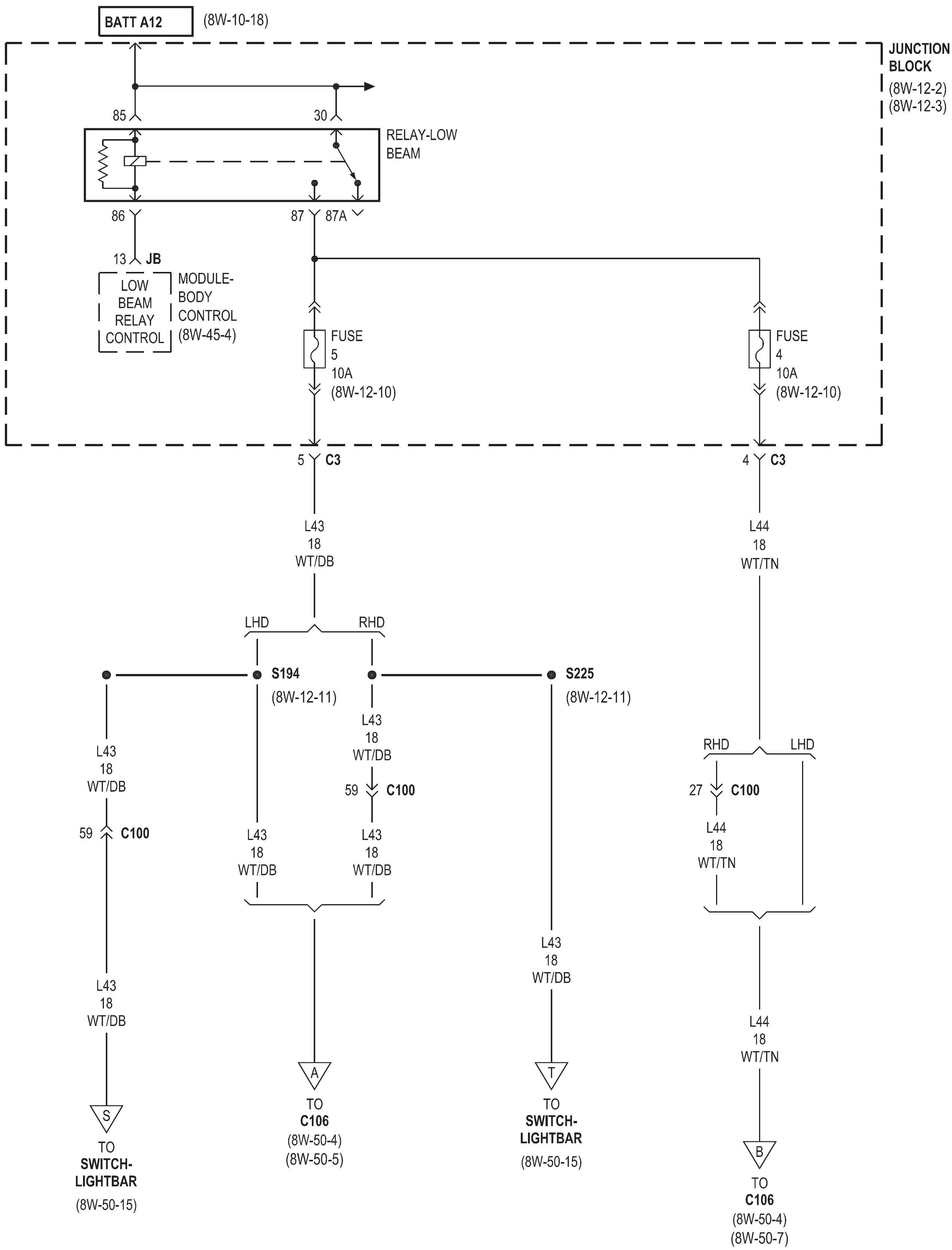

RUN-START F921
(8W-10-17)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
38
10A
(8W-12-22)
38 C3
19 C2
F22
20
PK/TN
LHD
RHD
55 C100
C
TO
S202
(8W-49-5)
S119
(8W-12-22)
S373
(8W-39-6)
D508
20
WT/GY
TRANSPONDER-TIRE PRESSURE-LEFT FRONT
FUSED IGNITION SWITCH OUTPUT (RUN)
COM-LIN TIRE PRESSURE MONITOR LAN
GROUND
25 C100
D
TO
S203
(8W-49-5)
TRANSPONDER-TIRE PRESSURE-RIGHT FRONT
Z384
20
BK
S372
(8W-15-4)
Z384
18
BK
G112
(8W-15-4)

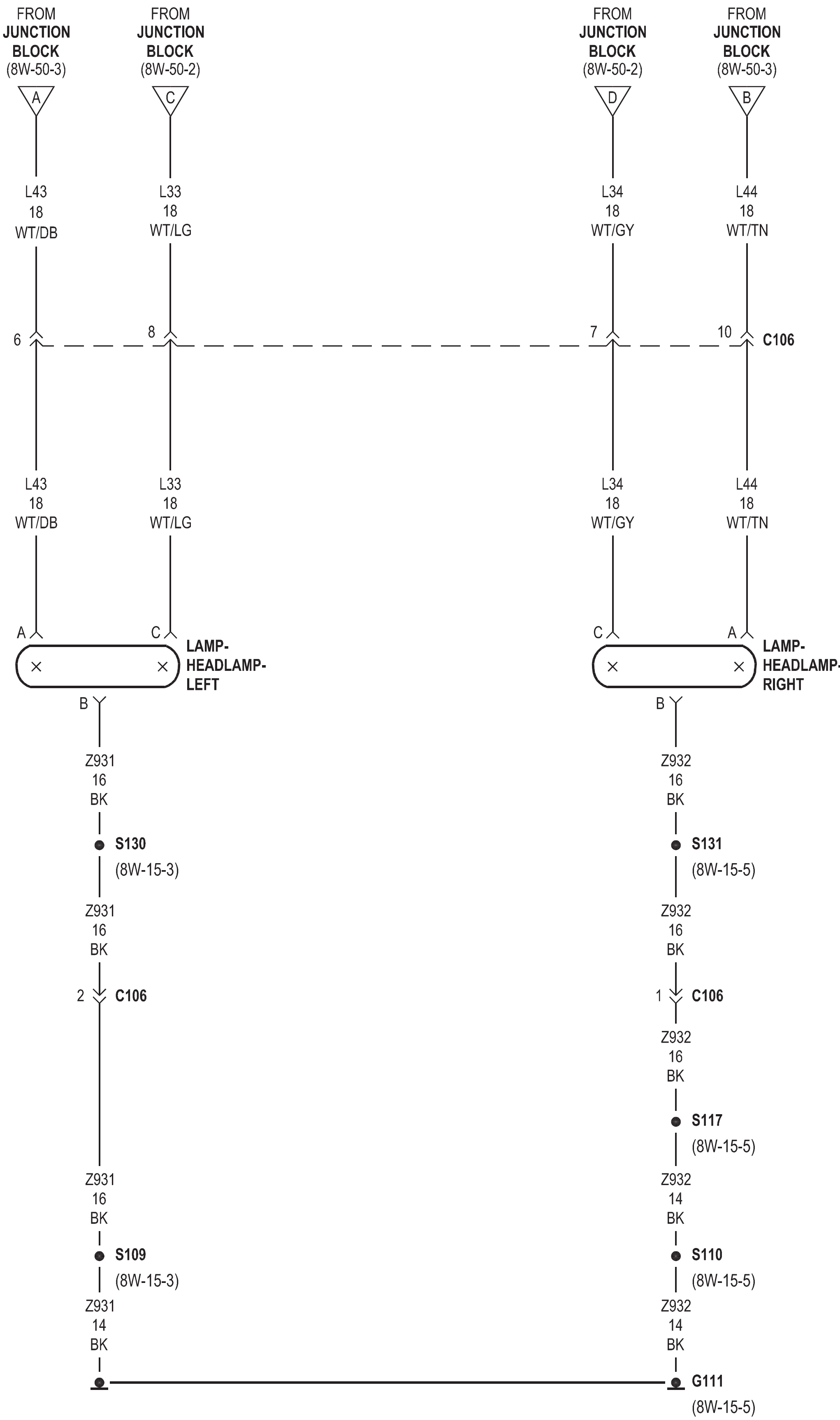

FROM
JUNCTION
BLOCK
(8W-49-4)
C
FROM
C100
(8W-49-4)
D
D508
20
WT/GY
F22
20
PK/TN
S203
(8W-39-6)
D508
20
WT/GY
S202
(8W-12-22)
37
C201
F22
20
PK/TN
D508
20
WT/GY
2
1
C330
F22
20
PK/TN
D508
20
WT/GY
1
2
FUSED
IGNITION
SWITCH
OUTPUT
(RUN)
COM-LIN
TIRE
PRESSURE
MONITOR
LAN
TRANSPONDER-
TIRE
PRESSURE-
RIGHT
REAR
GROUND
GROUND
3
6
Z912
18
BK
Z912
18
BK
S371
(8W-15-13)
Z912
18
BK
3
C330
Z912
18
BK
G304
(8W-15-13)

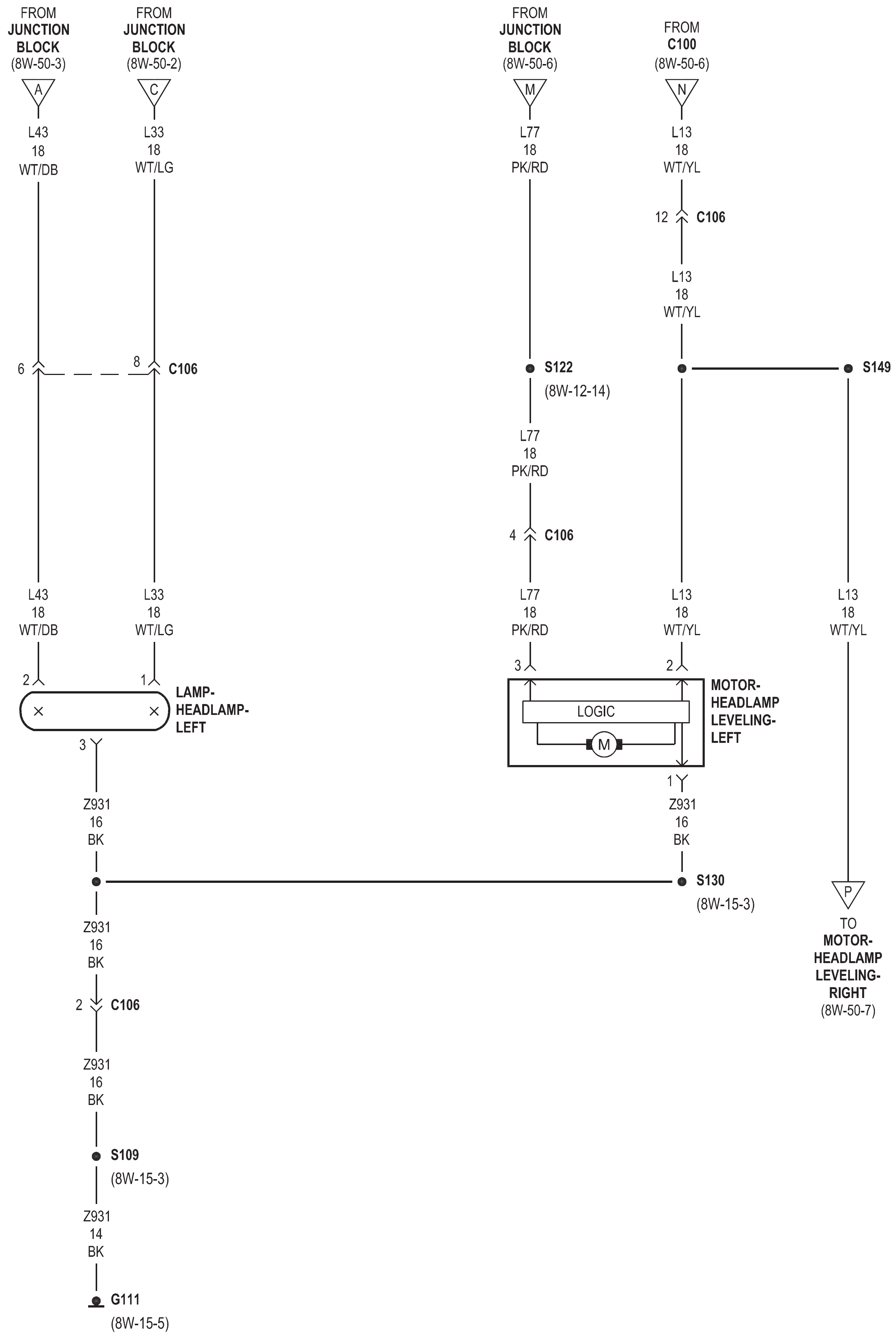
# 8W-50 FRONT LIGHTING

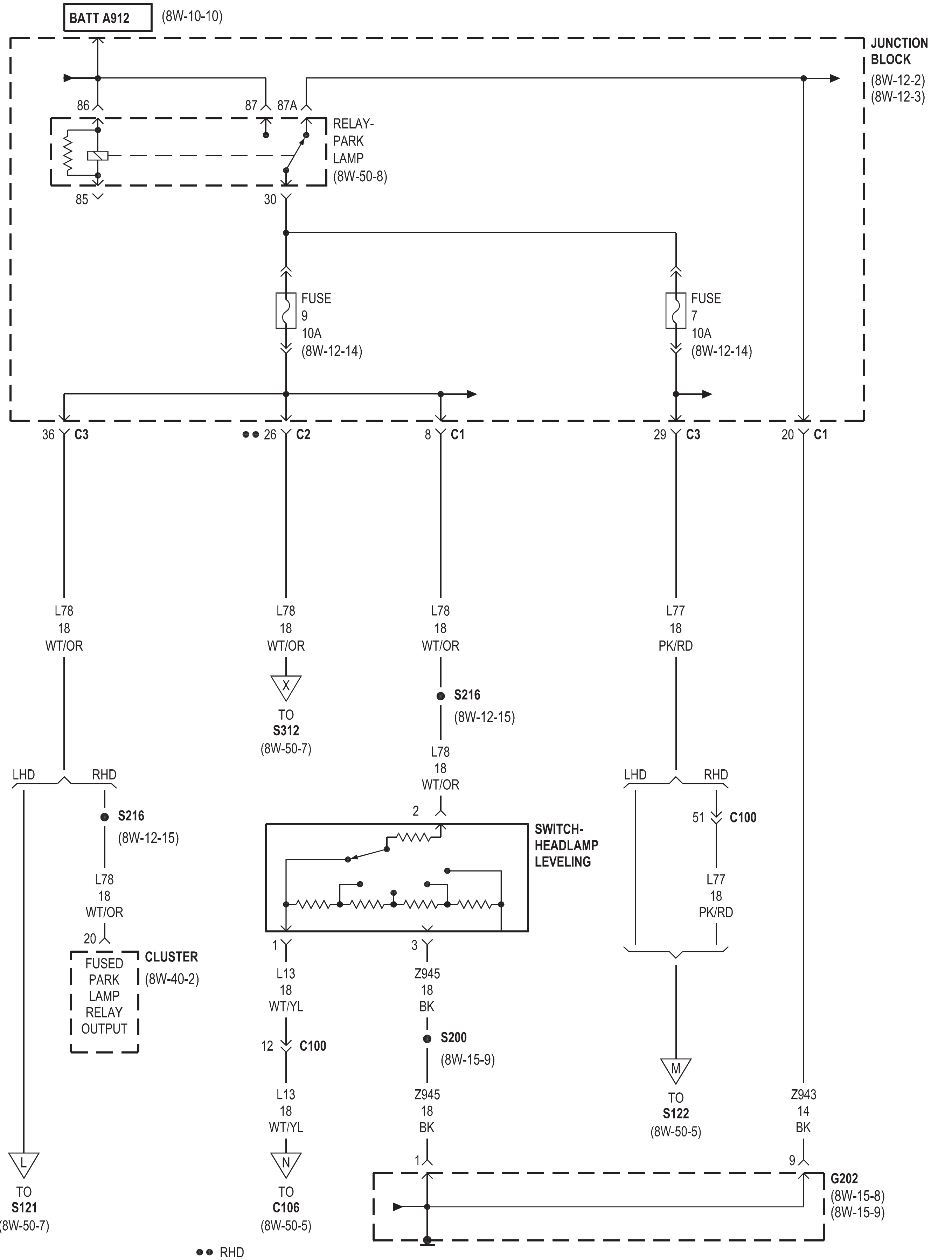


BATT A912
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
EXCEPT DRL
DRL
30
85
RELAY-HIGH BEAM
87A
87
86
30
86
RELAY-DAYTIME RUNNING LAMP
87A
87
85
DRL
EXCEPT DRL
EXCEPT DRL
DRL
FUSE 27 10A (8W-12-24)
FUSE 26 10A (8W-12-24)
10 JB
HIGH BEAM RELAY CONTROL
MODULE-BODY CONTROL (8W-45-4)
37 C3
28 C3
20 C1
21 C1
L33 18 WT/LG
L34 18 WT/GY
Z943 14 BK
L309 20 WT/OR
LHD
RHD
1 C100
L33 18 WT/LG
LHD
RHD
2 C100
L34 18 WT/GY
7 C1
HIGH BEAM RELAY CONTROL
WASHER PUMP DRIVER
SWITCH-MULTIFUNCTION
(8W-50-14)
(8W-53-2)
7 C2
W33 20 BR/DG
S206
(8W-45-10)
W33 20 BR/DG
11 C1
WASHER PUMP DRIVER
MODULE-BODY CONTROL
(8W-45-10)
2
G202
(8W-15-8)
(8W-15-9)
C
TO C106
(8W-50-4)
(8W-50-5)
D
TO C106
(8W-50-4)
(8W-50-7)


BATT A12
(8W-10-18)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
85
30
RELAY-LOW BEAM
86
87
87A
13 JB
LOW BEAM RELAY CONTROL
MODULE-BODY CONTROL
(8W-45-4)
FUSE 5 10A (8W-12-10)
FUSE 4 10A (8W-12-10)
5 C3
4 C3
L43 18 WT/DB
L44 18 WT/TN
LHD
RHD
S194
(8W-12-11)
S225
(8W-12-11)
L43 18 WT/DB
59 C100
59 C100
L43 18 WT/DB
L43 18 WT/DB
L43 18 WT/DB
L43 18 WT/DB
L43 18 WT/DB
RHD
LHD
27 C100
L44 18 WT/TN
L44 18 WT/TN
S
TO SWITCH-LIGHTBAR
(8W-50-15)
A
TO C106
(8W-50-4)
(8W-50-5)
T
TO SWITCH-LIGHTBAR
(8W-50-15)
B
TO C106
(8W-50-4)
(8W-50-7)

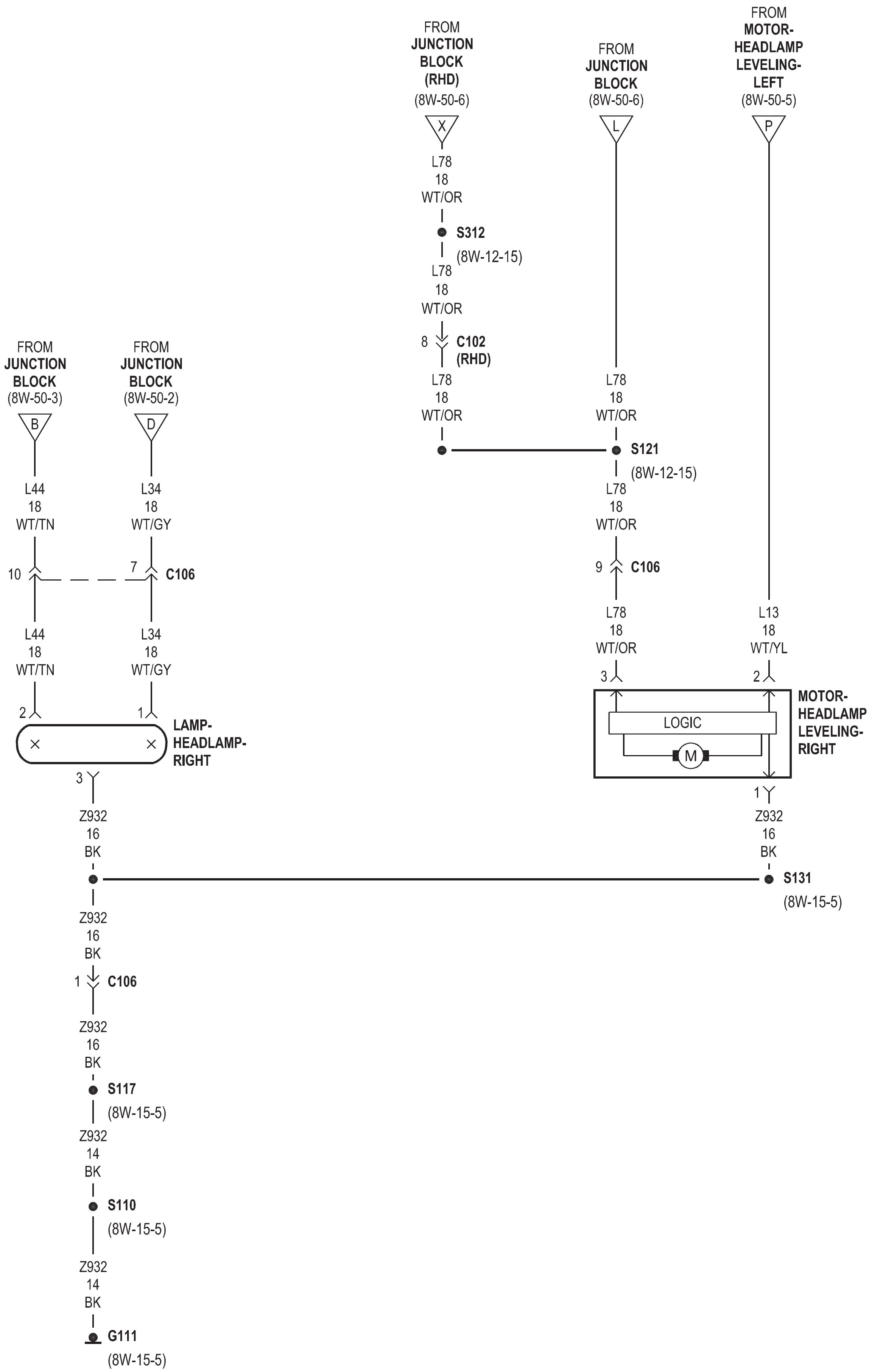

FROM JUNCTION BLOCK (8W-50-3)
A
FROM JUNCTION BLOCK (8W-50-2)
C
FROM JUNCTION BLOCK (8W-50-2)
D
FROM JUNCTION BLOCK (8W-50-3)
B
L43 18 WT/DB
L33 18 WT/LG
L34 18 WT/GY
L44 18 WT/TN
6
8
7
10
C106
L43 18 WT/DB
L33 18 WT/LG
L34 18 WT/GY
L44 18 WT/TN
A
C
LAMP-HEADLAMP-LEFT
C
A
LAMP-HEADLAMP-RIGHT
B
B
Z931 16 BK
Z932 16 BK
S130 (8W-15-3)
S131 (8W-15-5)
Z931 16 BK
Z932 16 BK
2
C106
1
C106
Z932 16 BK
S117 (8W-15-5)
Z931 16 BK
Z932 14 BK
S109 (8W-15-3)
S110 (8W-15-5)
Z931 14 BK
Z932 14 BK
G111 (8W-15-5)


FROM
JUNCTION
BLOCK
(8W-50-3)
A
L43
18
WT/DB
FROM
JUNCTION
BLOCK
(8W-50-2)
C
L33
18
WT/LG
FROM
JUNCTION
BLOCK
(8W-50-6)
M
L77
18
PK/RD
FROM
C100
(8W-50-6)
N
L13
18
WT/YL
12
C106
6
8
C106
S122
(8W-12-14)
S149
4
C106
2
1
LAMP-
HEADLAMP-
LEFT
3
3
2
LOGIC
M
MOTOR-
HEADLAMP
LEVELING-
LEFT
1
Z931
16
BK
S130
(8W-15-3)
P
TO
MOTOR-
HEADLAMP
LEVELING-
RIGHT
(8W-50-7)
2
C106
S109
(8W-15-3)
Z931
14
BK
G111
(8W-15-5)

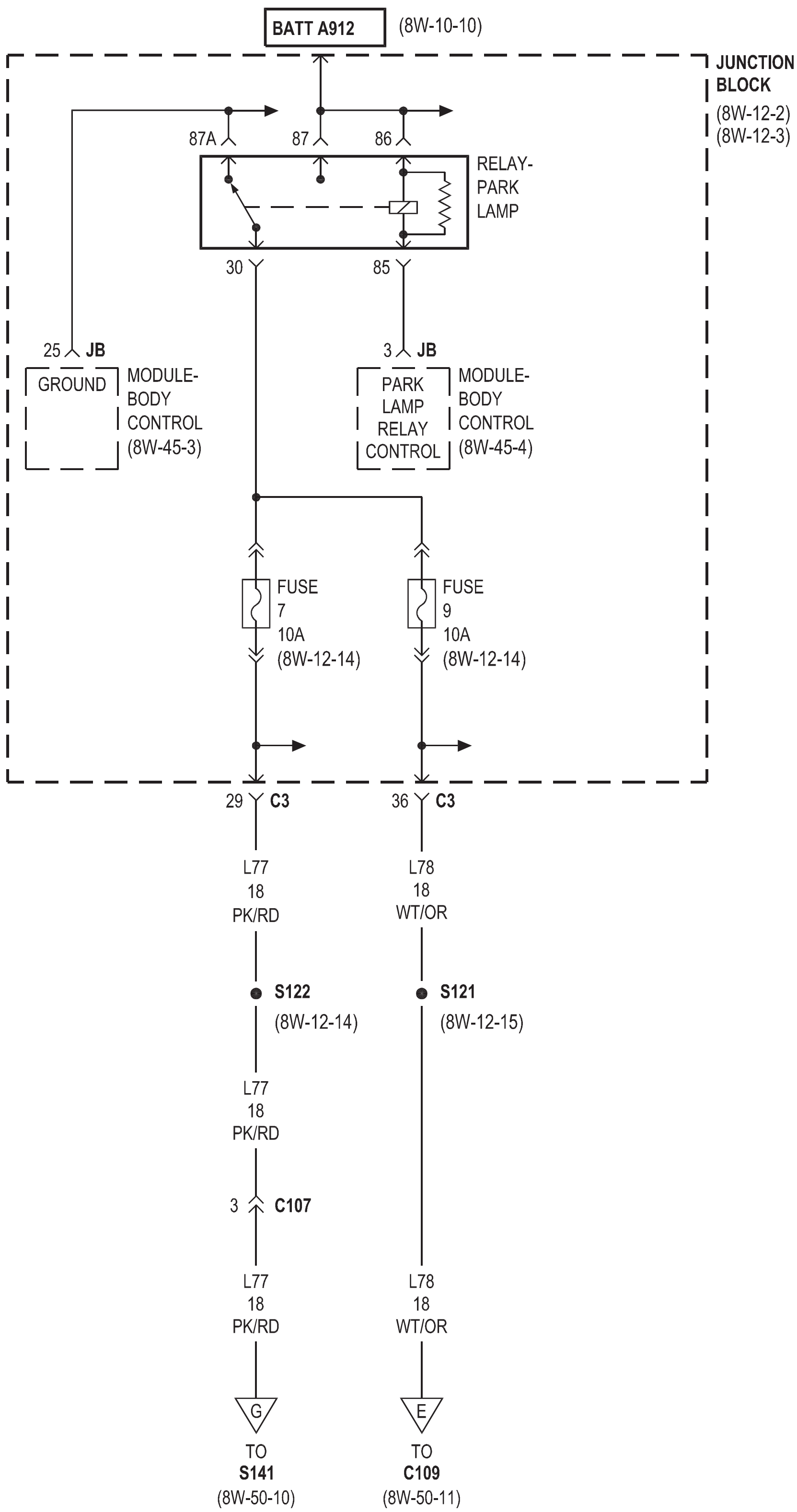


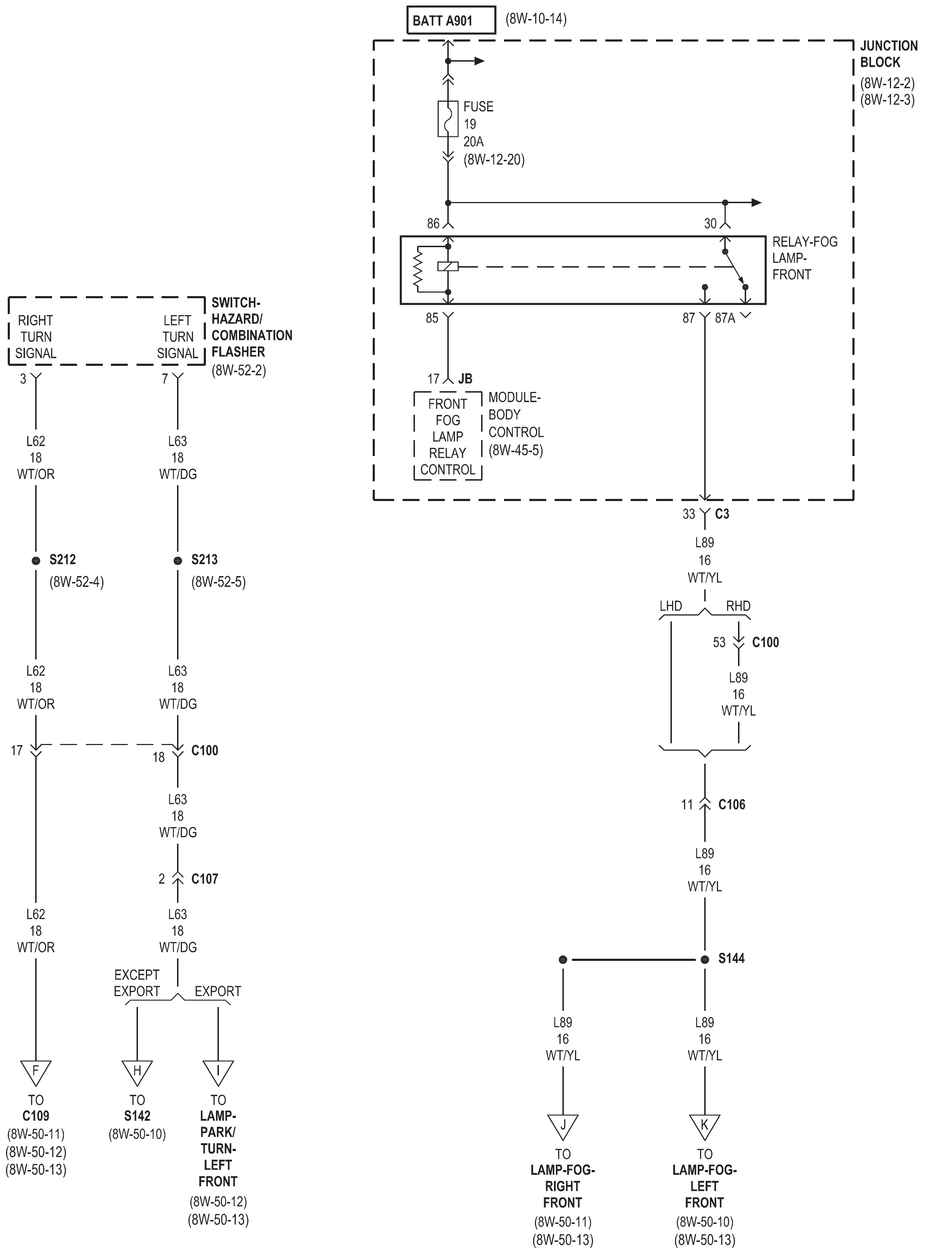
BATT A912
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
86
87
87A
RELAY-PARK LAMP
(8W-50-8)
85
30
FUSE 9 10A
(8W-12-14)
FUSE 7 10A
(8W-12-14)
36 C3
●● 26 C2
8 C1
29 C3
20 C1
L78 18 WT/OR
L78 18 WT/OR
L78 18 WT/OR
L77 18 PK/RD
X
TO S312
(8W-50-7)
S216
(8W-12-15)
L78 18 WT/OR
LHD
RHD
S216
(8W-12-15)
L78 18 WT/OR
20
CLUSTER
(8W-40-2)
FUSED PARK LAMP RELAY OUTPUT
2
SWITCH-HEADLAMP LEVELING
1
3
L13 18 WT/YL
12 C100
L13 18 WT/YL
N
TO C106
(8W-50-5)
Z945 18 BK
S200
(8W-15-9)
Z945 18 BK
LHD
RHD
51 C100
L77 18 PK/RD
M
TO S122
(8W-50-5)
Z943 14 BK
1
9
G202
(8W-15-8)
(8W-15-9)
L
TO S121
(8W-50-7)
●● RHD

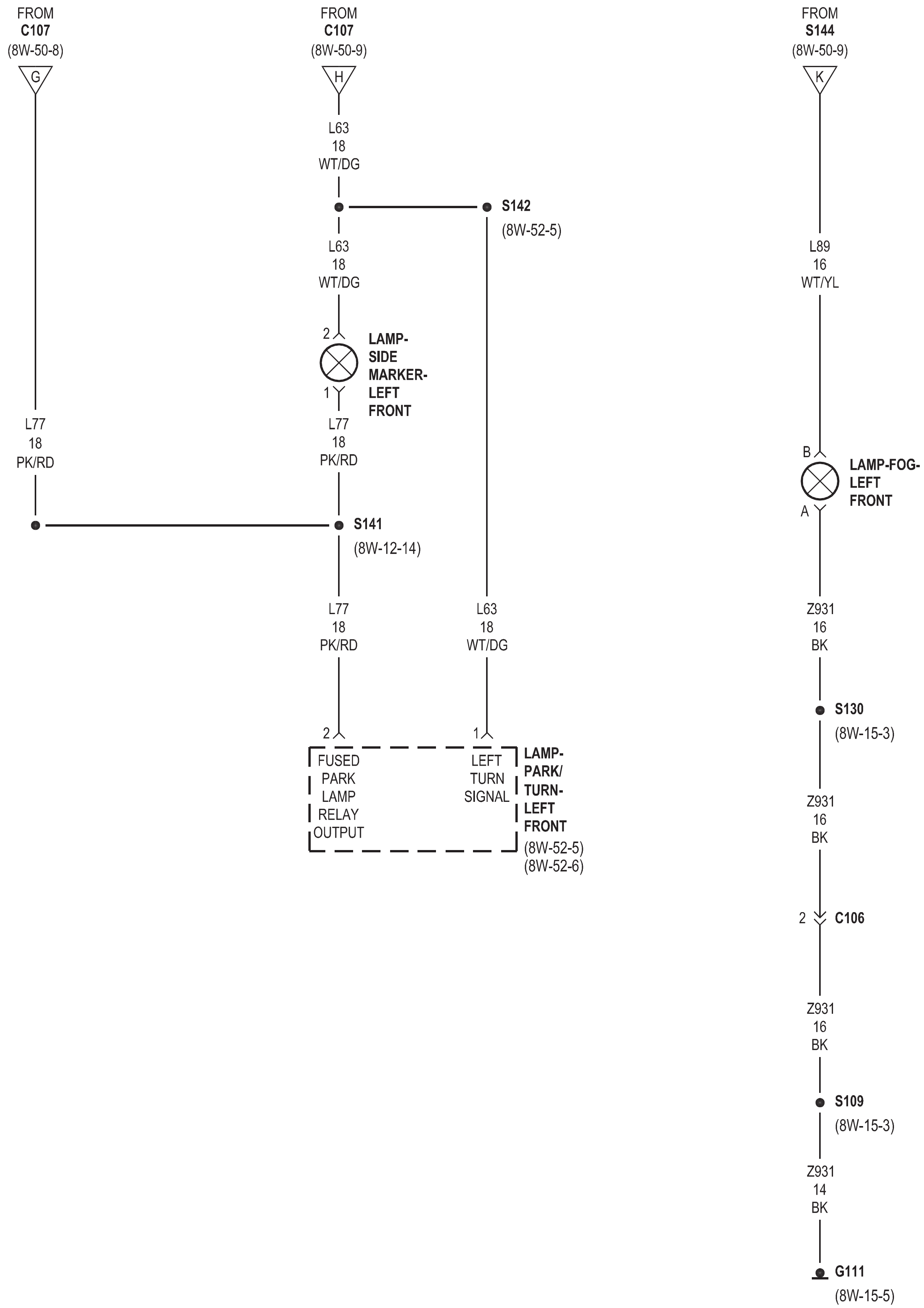
# EXPORT

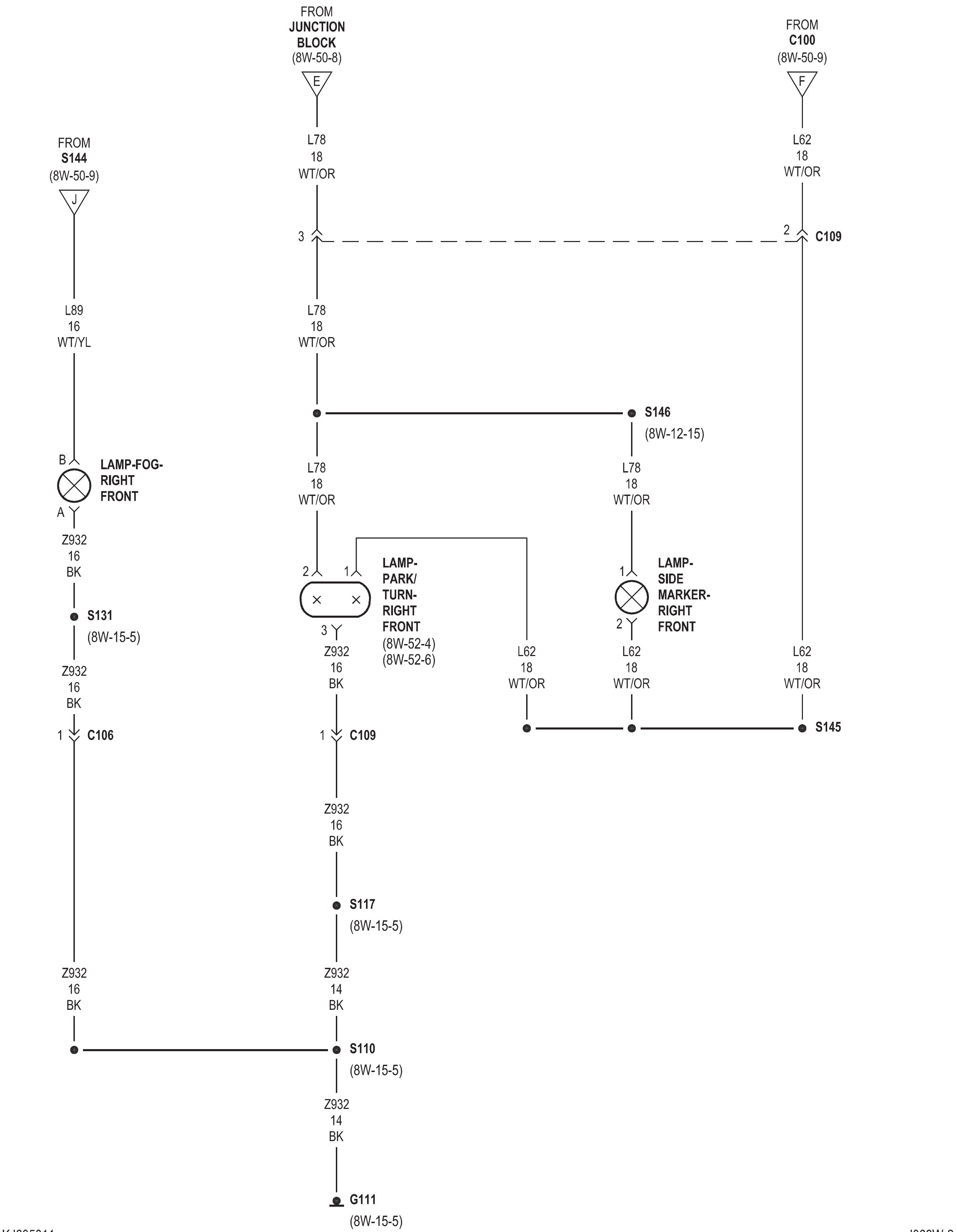

FROM
JUNCTION
BLOCK
(RHD)
(8W-50-6)
X
L78
18
WT/OR
S312
(8W-12-15)
L78
18
WT/OR
8
C102
(RHD)
L78
18
WT/OR
FROM
JUNCTION
BLOCK
(8W-50-6)
L
L78
18
WT/OR
S121
(8W-12-15)
L78
18
WT/OR
9
C106
L78
18
WT/OR
FROM
MOTOR-
HEADLAMP
LEVELING-
LEFT
(8W-50-5)
P
L13
18
WT/YL
3
2
LOGIC
M
MOTOR-
HEADLAMP
LEVELING-
RIGHT
1
Z932
16
BK
S131
(8W-15-5)
FROM
JUNCTION
BLOCK
(8W-50-3)
B
L44
18
WT/TN
10
FROM
JUNCTION
BLOCK
(8W-50-2)
D
L34
18
WT/GY
7
C106
L44
18
WT/TN
L34
18
WT/GY
2
1
LAMP-
HEADLAMP-
RIGHT
3
Z932
16
BK
Z932
16
BK
1
C106
Z932
16
BK
S117
(8W-15-5)
Z932
14
BK
S110
(8W-15-5)
Z932
14
BK
G111
(8W-15-5)

# EXCEPT EXPORT

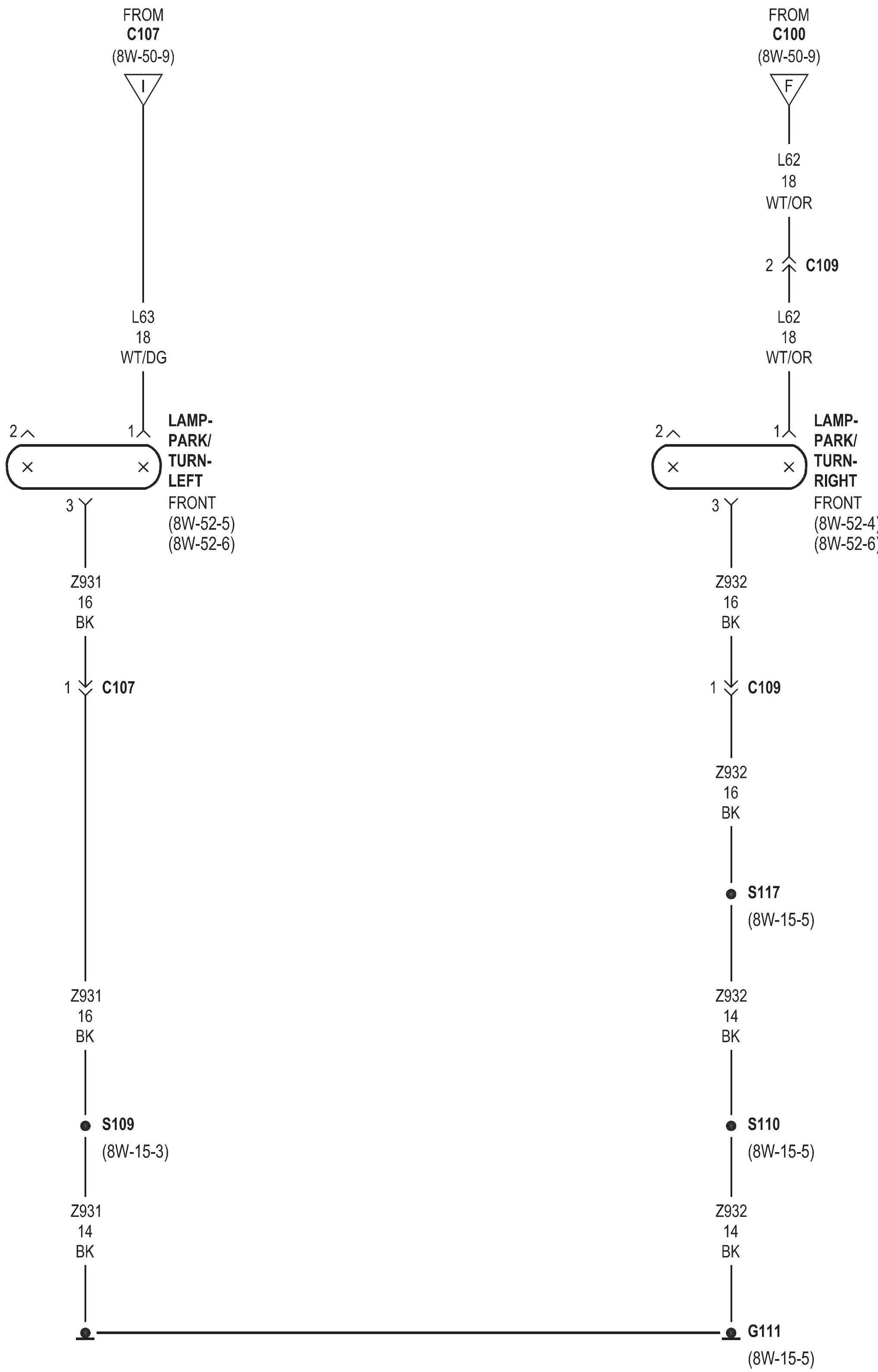



BATT A901
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
19
20A
(8W-12-20)
86
30
RELAY-FOG LAMP-FRONT
85
87
87A
17 JB
FRONT FOG LAMP RELAY CONTROL
MODULE-BODY CONTROL
(8W-45-5)
33 C3
L89
16
WT/YL
LHD
RHD
53 C100
11 C106
S144
TO LAMP-FOG-RIGHT FRONT
(8W-50-11)
(8W-50-13)
TO LAMP-FOG-LEFT FRONT
(8W-50-10)
(8W-50-13)
RIGHT TURN SIGNAL
LEFT TURN SIGNAL
SWITCH-HAZARD/COMBINATION FLASHER
(8W-52-2)
3
7
L62
18
WT/OR
L63
18
WT/DG
S212
(8W-52-4)
S213
(8W-52-5)
17
18
C100
2 C107
EXCEPT EXPORT
EXPORT
F
H
I
J
K
TO C109
(8W-50-11)
(8W-50-12)
(8W-50-13)
TO S142
(8W-50-10)
TO LAMP-PARK/TURN-LEFT FRONT
(8W-50-12)
(8W-50-13)

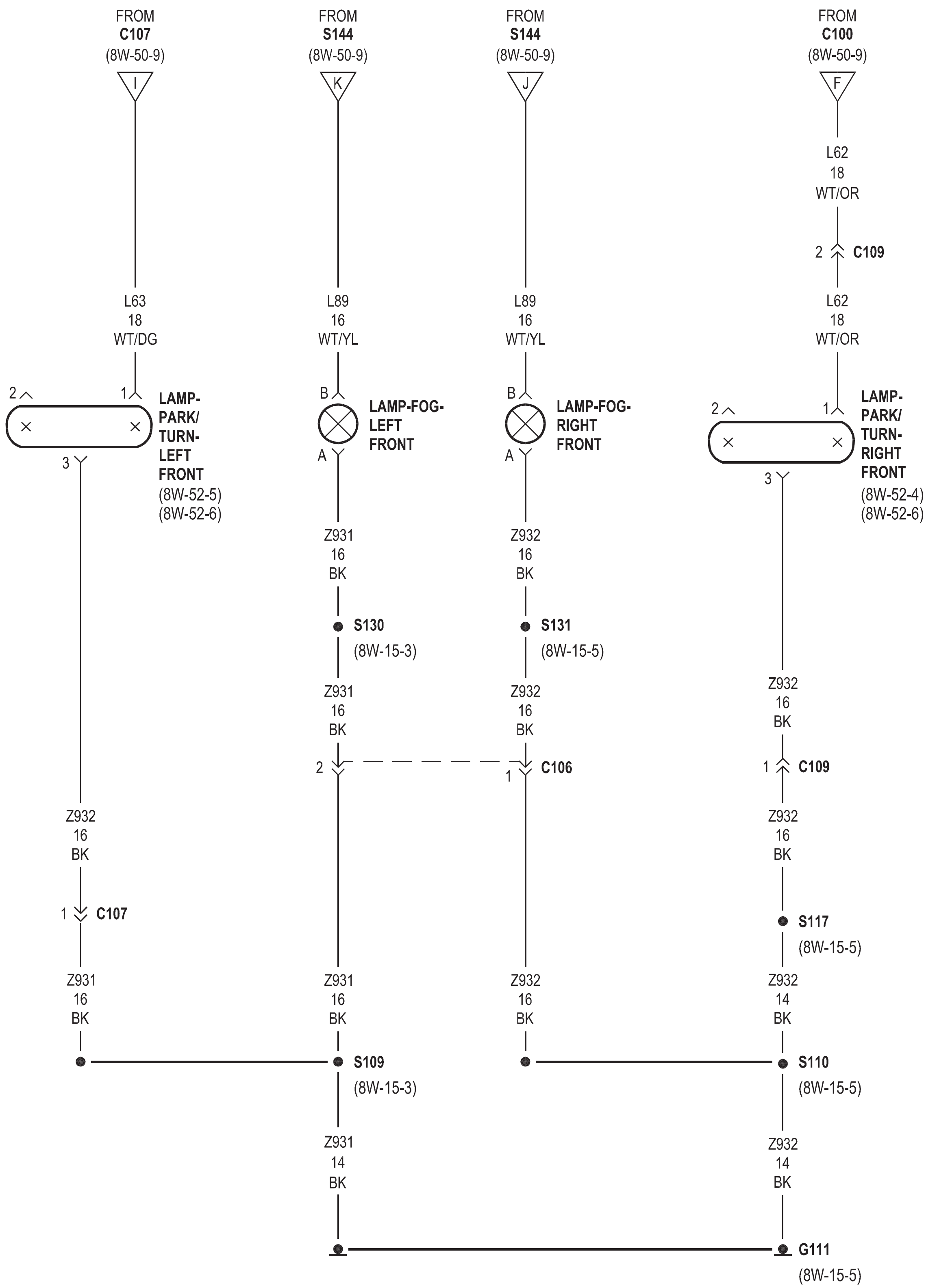

FROM
C107
(8W-50-8)
G
FROM
C107
(8W-50-9)
H
FROM
S144
(8W-50-9)
K
L63
18
WT/DG
S142
(8W-52-5)
L63
18
WT/DG
L89
16
WT/YL
2
LAMP-
SIDE
MARKER-
LEFT
FRONT
1
L77
18
PK/RD
L77
18
PK/RD
B
LAMP-FOG-
LEFT
FRONT
A
S141
(8W-12-14)
L77
18
PK/RD
L63
18
WT/DG
Z931
16
BK
S130
(8W-15-3)
2
1
FUSED
PARK
LAMP
RELAY
OUTPUT
LEFT
TURN
SIGNAL
LAMP-
PARK/
TURN-
LEFT
FRONT
(8W-52-5)
(8W-52-6)
Z931
16
BK
2
C106
Z931
16
BK
S109
(8W-15-3)
Z931
14
BK
G111
(8W-15-5)

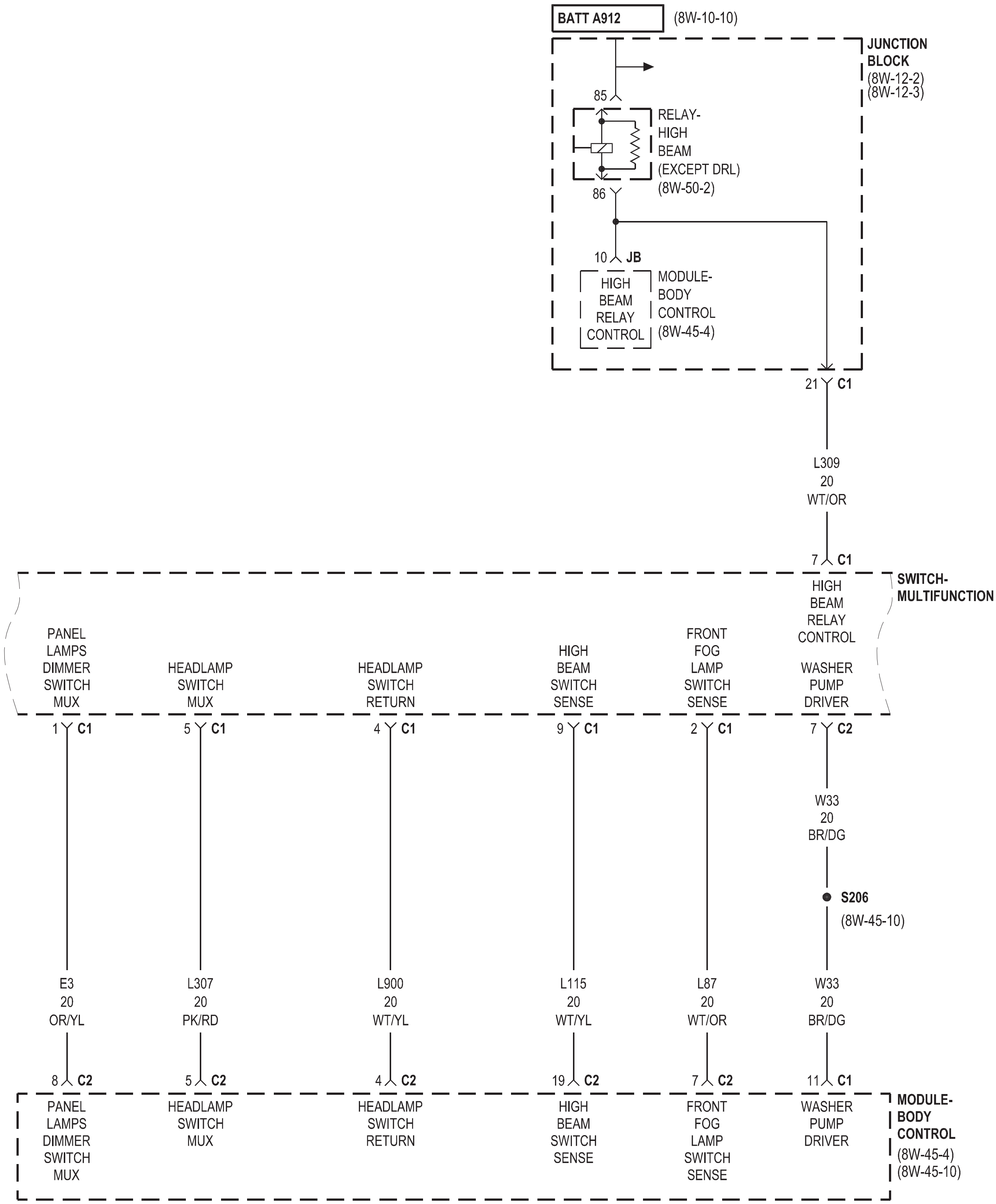

FROM
S144
(8W-50-9)
J
FROM
JUNCTION
BLOCK
(8W-50-8)
E
FROM
C100
(8W-50-9)
F
L78
18
WT/OR
L62
18
WT/OR
3
2
C109
L89
16
WT/YL
S146
(8W-12-15)
B
LAMP-FOG-
RIGHT
FRONT
A
Z932
16
BK
LAMP-
PARK/
TURN-
RIGHT
FRONT
(8W-52-4)
(8W-52-6)
LAMP-
SIDE
MARKER-
RIGHT
FRONT
S131
(8W-15-5)
1
C106
C109
S145
S117
(8W-15-5)
Z932
14
BK
S110
(8W-15-5)
G111
(8W-15-5)

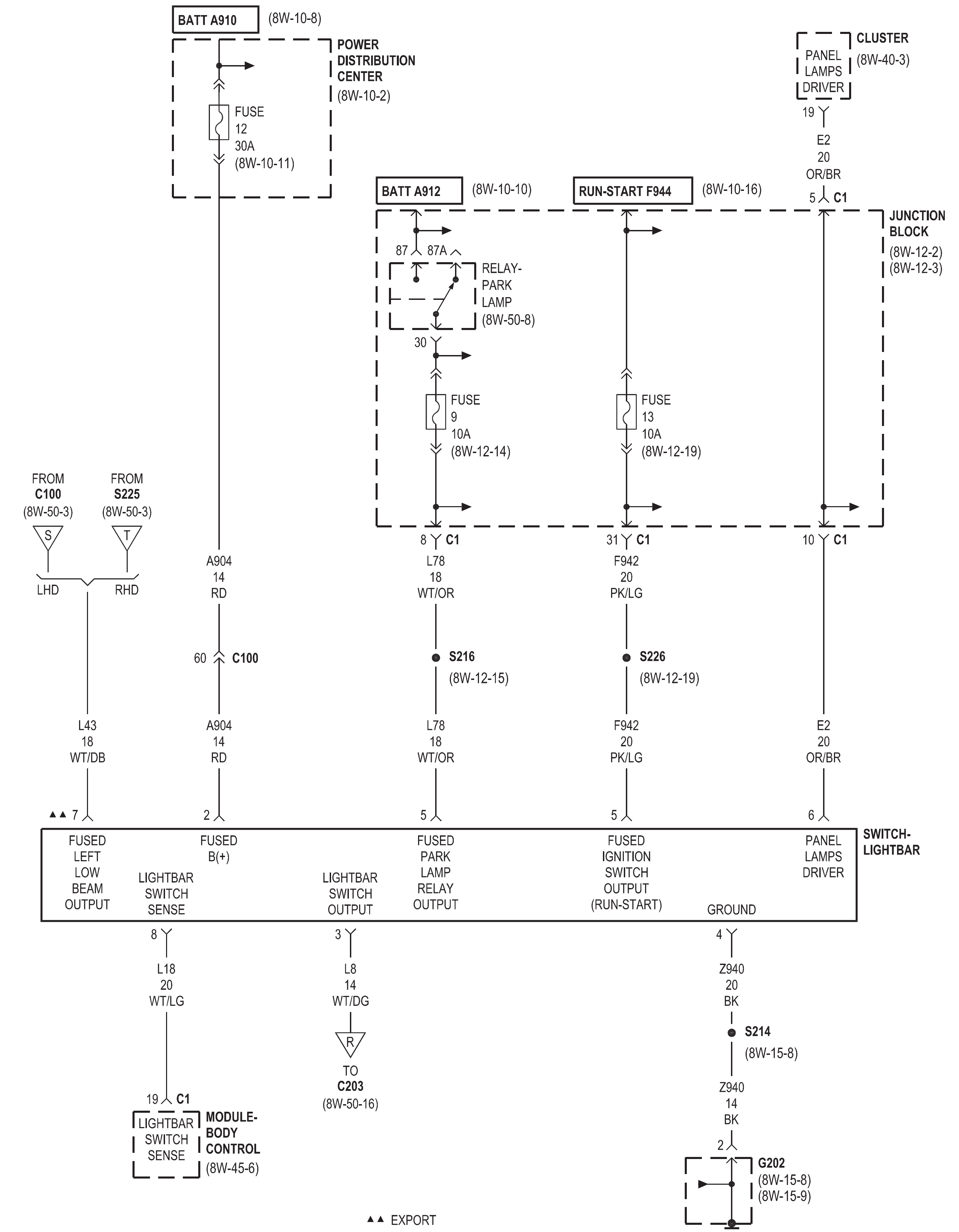
## EXPORT EXCEPT FOG LAMPS



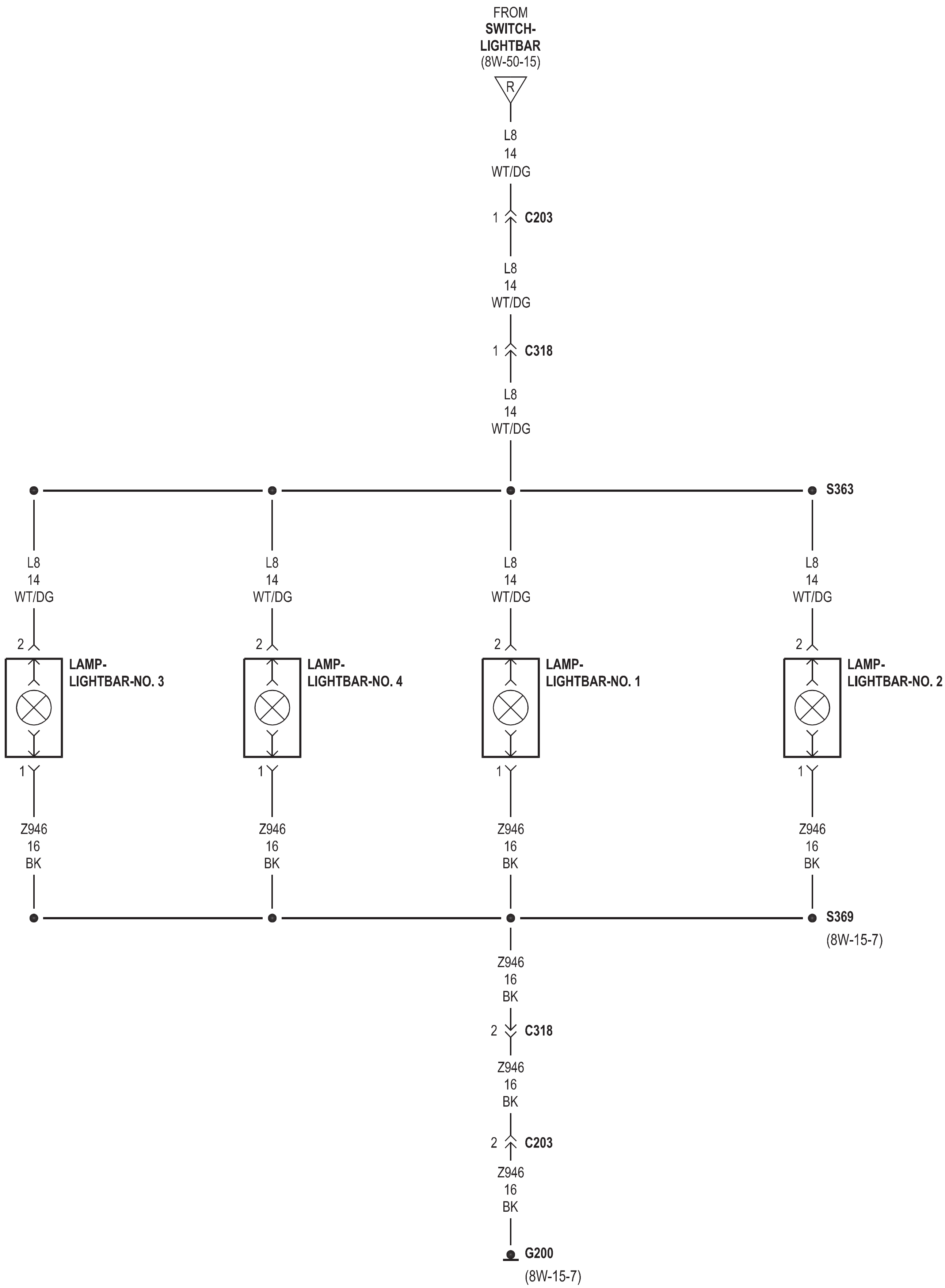
# EXPORT FOG LAMPS




BATT A912
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
85
RELAY-
HIGH
BEAM
(EXCEPT DRL)
(8W-50-2)
86
10 JB
HIGH BEAM RELAY CONTROL
MODULE-
BODY
CONTROL
(8W-45-4)
21 C1
L309
20
WT/OR
7 C1
SWITCH-MULTIFUNCTION
PANEL LAMPS DIMMER SWITCH MUX
HEADLAMP SWITCH MUX
HEADLAMP SWITCH RETURN
HIGH BEAM SWITCH SENSE
FRONT FOG LAMP SWITCH SENSE
HIGH BEAM RELAY CONTROL
WASHER PUMP DRIVER
1 C1
5 C1
4 C1
9 C1
2 C1
7 C2
W33
20
BR/DG
S206
(8W-45-10)
E3 20 OR/YL
L307 20 PK/RD
L900 20 WT/YL
L115 20 WT/YL
L87 20 WT/OR
W33 20 BR/DG
8 C2
5 C2
4 C2
19 C2
7 C2
11 C1
MODULE-BODY CONTROL
(8W-45-4)
(8W-45-10)
PANEL LAMPS DIMMER SWITCH MUX
HEADLAMP SWITCH MUX
HEADLAMP SWITCH RETURN
HIGH BEAM SWITCH SENSE
FRONT FOG LAMP SWITCH SENSE
WASHER PUMP DRIVER

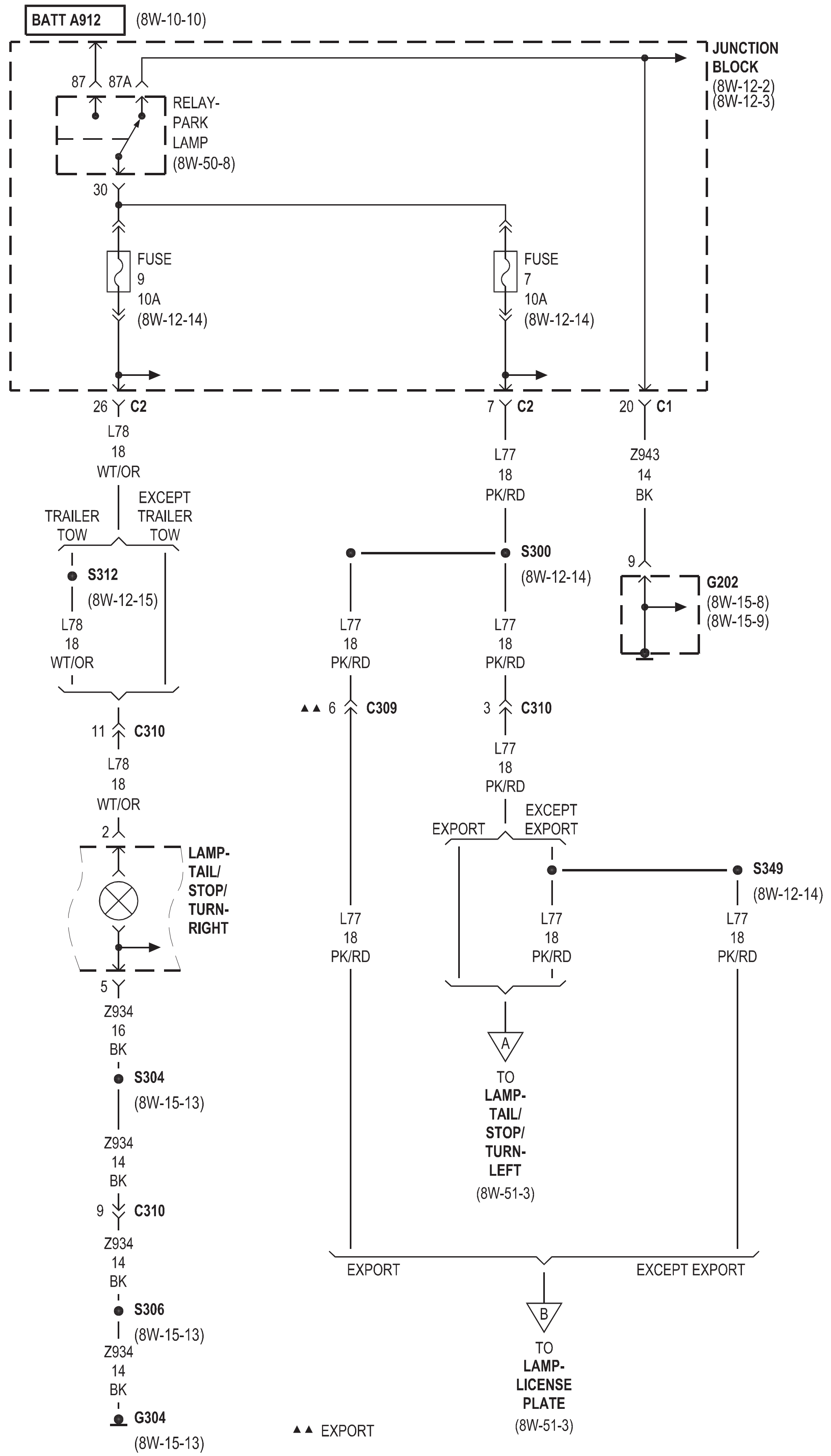

BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 12 30A (8W-10-11)
CLUSTER
PANEL LAMPS DRIVER
(8W-40-3)
19
E2 20 OR/BR
5 C1
BATT A912
(8W-10-10)
RUN-START F944
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
87 87A
RELAY-PARK LAMP
(8W-50-8)
30
FUSE 9 10A (8W-12-14)
FUSE 13 10A (8W-12-19)
8 C1
31 C1
10 C1
FROM C100 (8W-50-3)
FROM S225 (8W-50-3)
S
T
LHD
RHD
A904 14 RD
L78 18 WT/OR
F942 20 PK/LG
60 C100
S216 (8W-12-15)
S226 (8W-12-19)
L43 18 WT/DB
A904 14 RD
L78 18 WT/OR
F942 20 PK/LG
E2 20 OR/BR
▲▲ 7
2
5
5
6
SWITCH-LIGHTBAR
FUSED LEFT LOW BEAM OUTPUT
LIGHTBAR SWITCH SENSE
FUSED B(+)
LIGHTBAR SWITCH OUTPUT
FUSED PARK LAMP RELAY OUTPUT
FUSED IGNITION SWITCH OUTPUT (RUN-START)
GROUND
PANEL LAMPS DRIVER
8
3
4
L18 20 WT/LG
L8 14 WT/DG
Z940 20 BK
R
TO C203 (8W-50-16)
S214 (8W-15-8)
Z940 14 BK
19 C1
LIGHTBAR SWITCH SENSE
MODULE-BODY CONTROL
(8W-45-6)
2
G202
(8W-15-8)
(8W-15-9)
▲▲ EXPORT

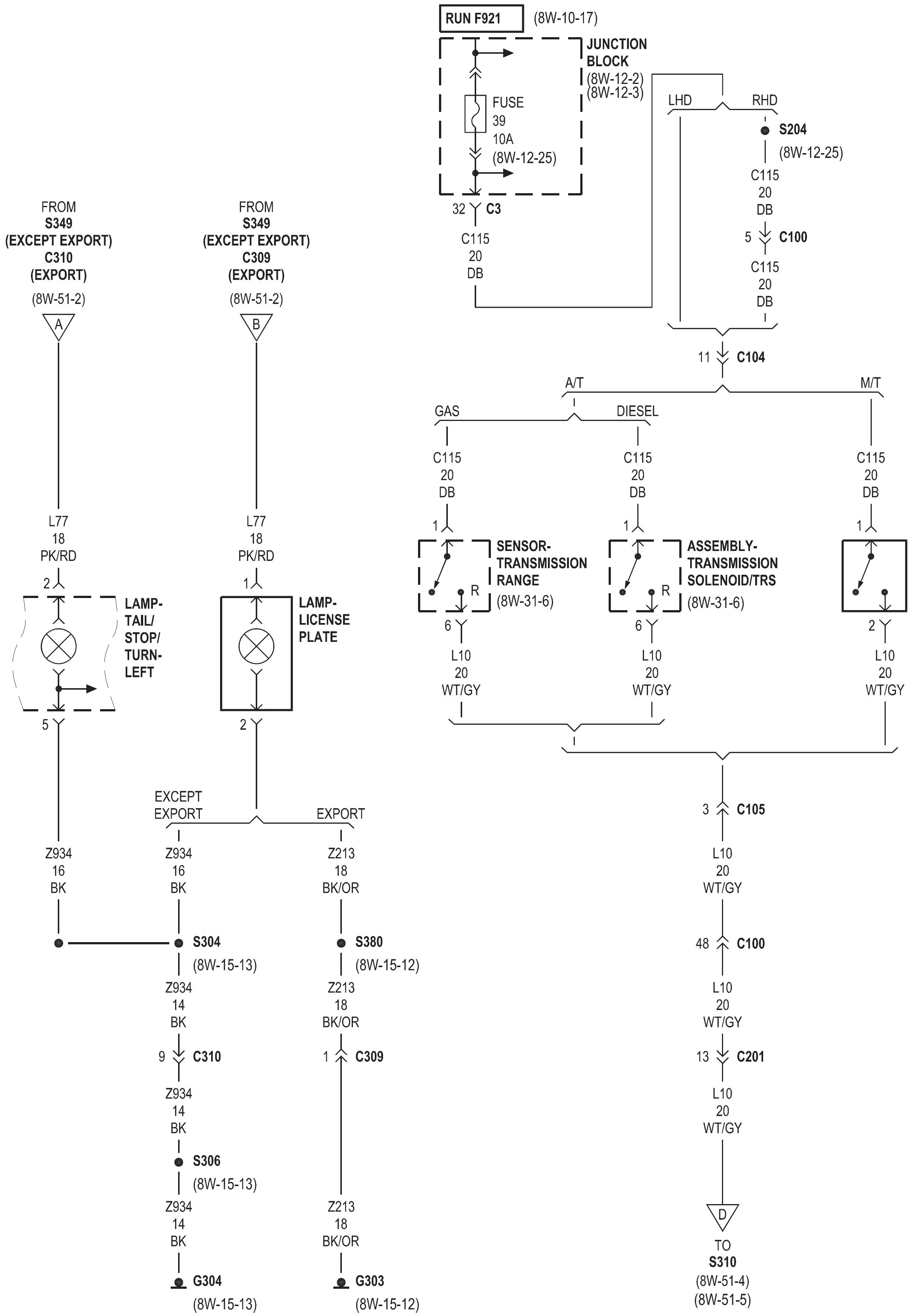
RENEGADE

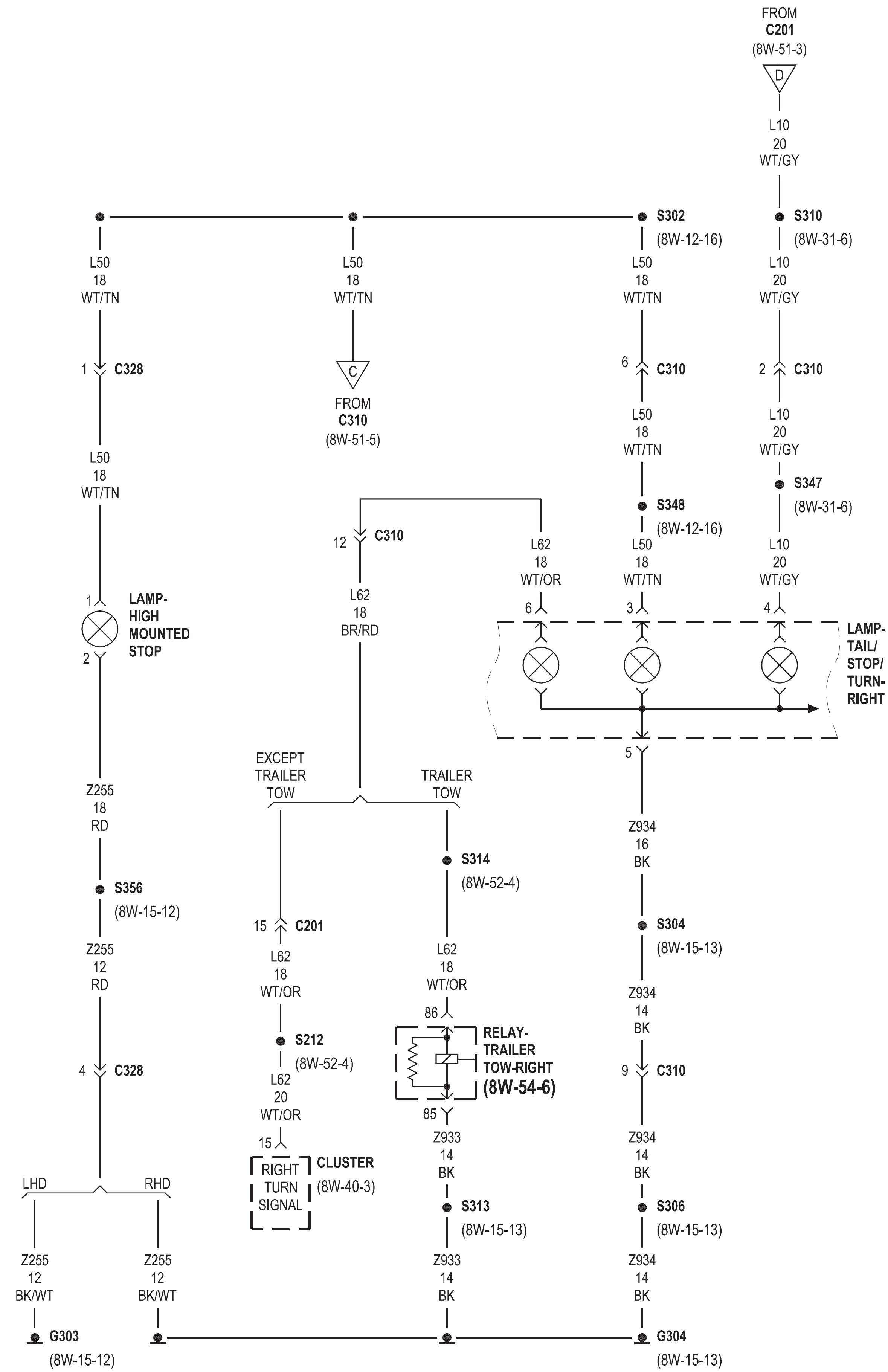


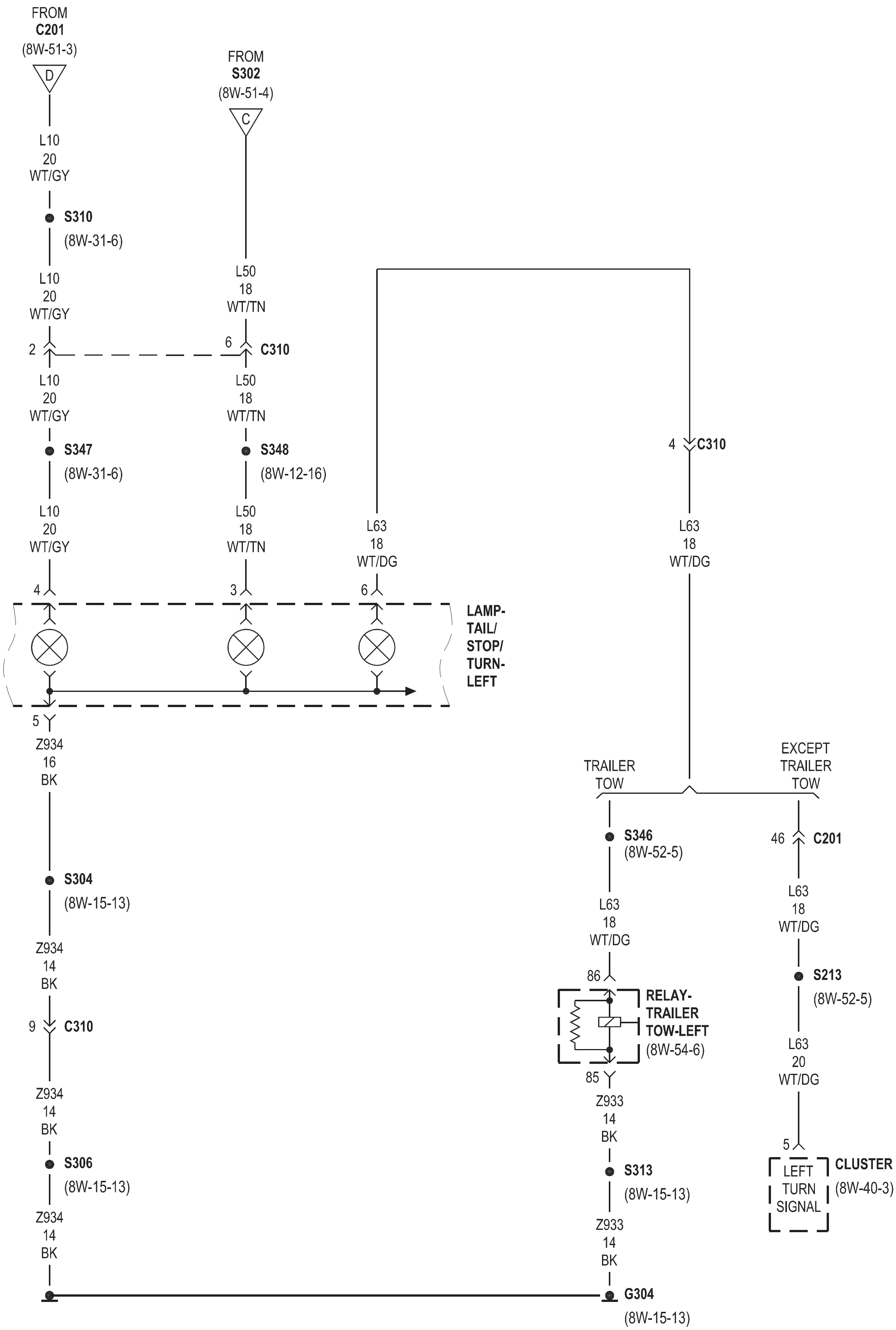
FROM
SWITCH-
LIGHTBAR
(8W-50-15)
R
L8
14
WT/DG
1
C203
L8
14
WT/DG
1
C318
L8
14
WT/DG
S363
L8
14
WT/DG
2
LAMP-
LIGHTBAR-NO. 3
LAMP-
LIGHTBAR-NO. 4
LAMP-
LIGHTBAR-NO. 1
LAMP-
LIGHTBAR-NO. 2
1
Z946
16
BK
S369
(8W-15-7)
Z946
16
BK
2
C318
Z946
16
BK
2
C203
Z946
16
BK
G200
(8W-15-7)

# 8W-51 REAR LIGHTING

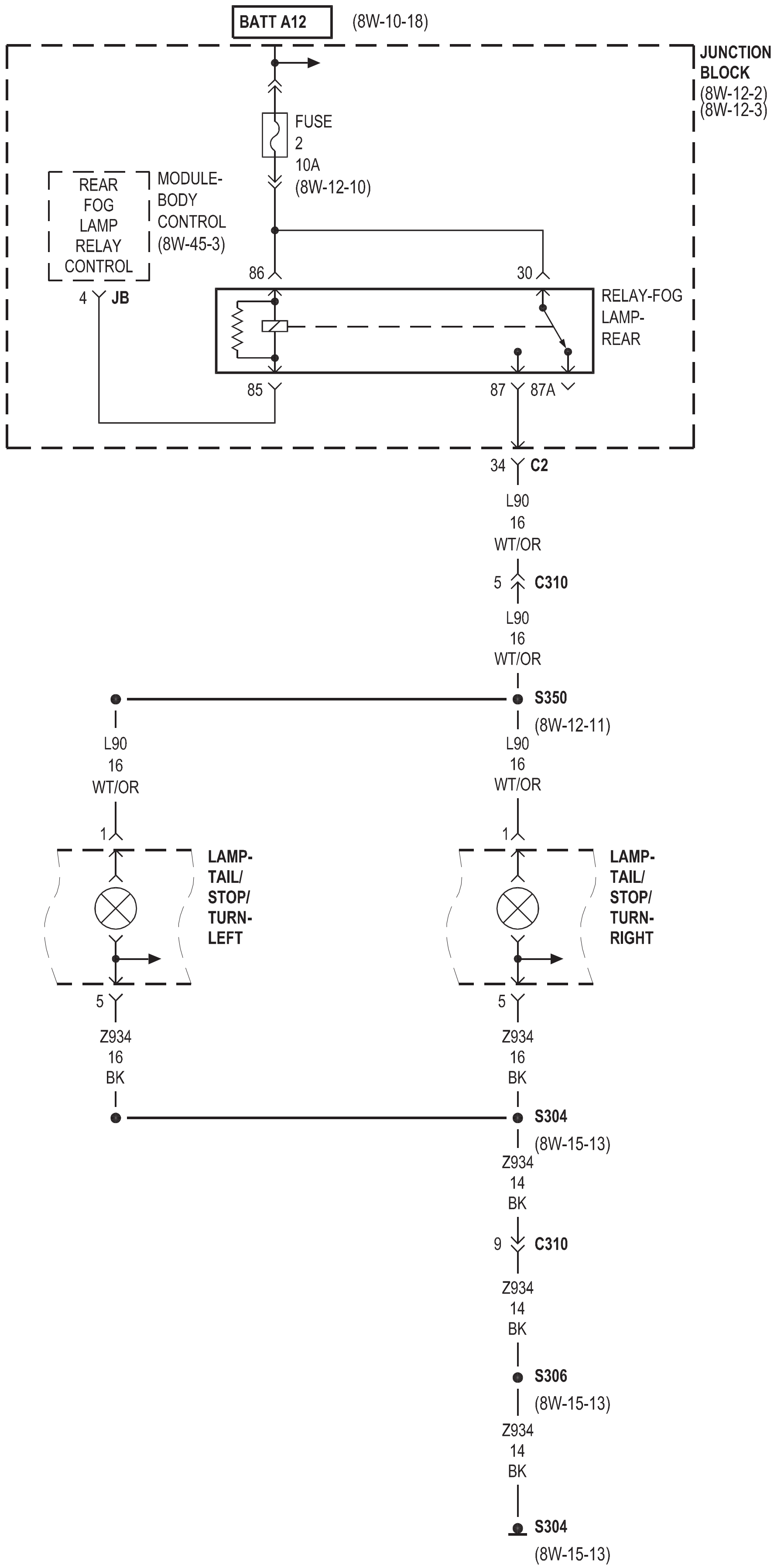

BATT A912
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
87
87A
RELAY-PARK LAMP
(8W-50-8)
30
FUSE 9 10A (8W-12-14)
FUSE 7 10A (8W-12-14)
26 C2
7 C2
20 C1
L78 18 WT/OR
TRAILER TOW
EXCEPT TRAILER TOW
S312
(8W-12-15)
L78 18 WT/OR
11 C310
L78 18 WT/OR
2
LAMP-TAIL/STOP/TURN-RIGHT
5
Z934 16 BK
S304
(8W-15-13)
Z934 14 BK
9 C310
Z934 14 BK
S306
(8W-15-13)
Z934 14 BK
G304
(8W-15-13)
L77 18 PK/RD
S300
(8W-12-14)
L77 18 PK/RD
L77 18 PK/RD
▲▲ 6 C309
3 C310
L77 18 PK/RD
EXPORT
EXCEPT EXPORT
S349
(8W-12-14)
L77 18 PK/RD
L77 18 PK/RD
L77 18 PK/RD
A
TO LAMP-TAIL/STOP/TURN-LEFT
(8W-51-3)
EXPORT
EXCEPT EXPORT
B
TO LAMP-LICENSE PLATE
(8W-51-3)
Z943 14 BK
9
G202
(8W-15-8)
(8W-15-9)
▲▲ EXPORT


RUN F921
(8W-10-17)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
39
10A
(8W-12-25)
LHD
RHD
S204
(8W-12-25)
32 C3
C115
20
DB
5 C100
11 C104
A/T
M/T
GAS
DIESEL
1
SENSOR-TRANSMISSION RANGE
R
(8W-31-6)
ASSEMBLY-TRANSMISSION SOLENOID/TRS
R
(8W-31-6)
SWITCH-BACKUP LAMP
6
2
L10
20
WT/GY
3 C105
48 C100
13 C201
D
TO
S310
(8W-51-4)
(8W-51-5)
FROM
S349
(EXCEPT EXPORT)
C310
(EXPORT)
(8W-51-2)
A
FROM
S349
(EXCEPT EXPORT)
C309
(EXPORT)
(8W-51-2)
B
L77
18
PK/RD
2
LAMP-TAIL/STOP/TURN-LEFT
5
1
LAMP-LICENSE PLATE
2
EXCEPT EXPORT
EXPORT
Z934
16
BK
Z213
18
BK/OR
S304
(8W-15-13)
S380
(8W-15-12)
Z934
14
BK
9 C310
1 C309
S306
(8W-15-13)
G304
(8W-15-13)
G303
(8W-15-12)


FROM
C201
(8W-51-3)
D
L10
20
WT/GY
S302
(8W-12-16)
S310
(8W-31-6)
L50
18
WT/TN
L10
20
WT/GY
1 C328
C
FROM
C310
(8W-51-5)
6 C310
2 C310
S347
(8W-31-6)
S348
(8W-12-16)
12 C310
L62
18
WT/OR
1
LAMP-
HIGH
MOUNTED
STOP
2
L62
18
BR/RD
6 3 4
LAMP-
TAIL/
STOP/
TURN-
RIGHT
5
EXCEPT
TRAILER
TOW
TRAILER
TOW
Z255
18
RD
Z934
16
BK
S314
(8W-52-4)
S356
(8W-15-12)
S304
(8W-15-13)
15 C201
Z255
12
RD
L62
18
WT/OR
Z934
14
BK
86
S212
(8W-52-4)
RELAY-
TRAILER
TOW-RIGHT
(8W-54-6)
4 C328
L62
20
WT/OR
9 C310
85
Z933
14
BK
15
CLUSTER
(8W-40-3)
RIGHT
TURN
SIGNAL
LHD
RHD
S313
(8W-15-13)
S306
(8W-15-13)
Z255
12
BK/WT
G303
(8W-15-12)
G304
(8W-15-13)

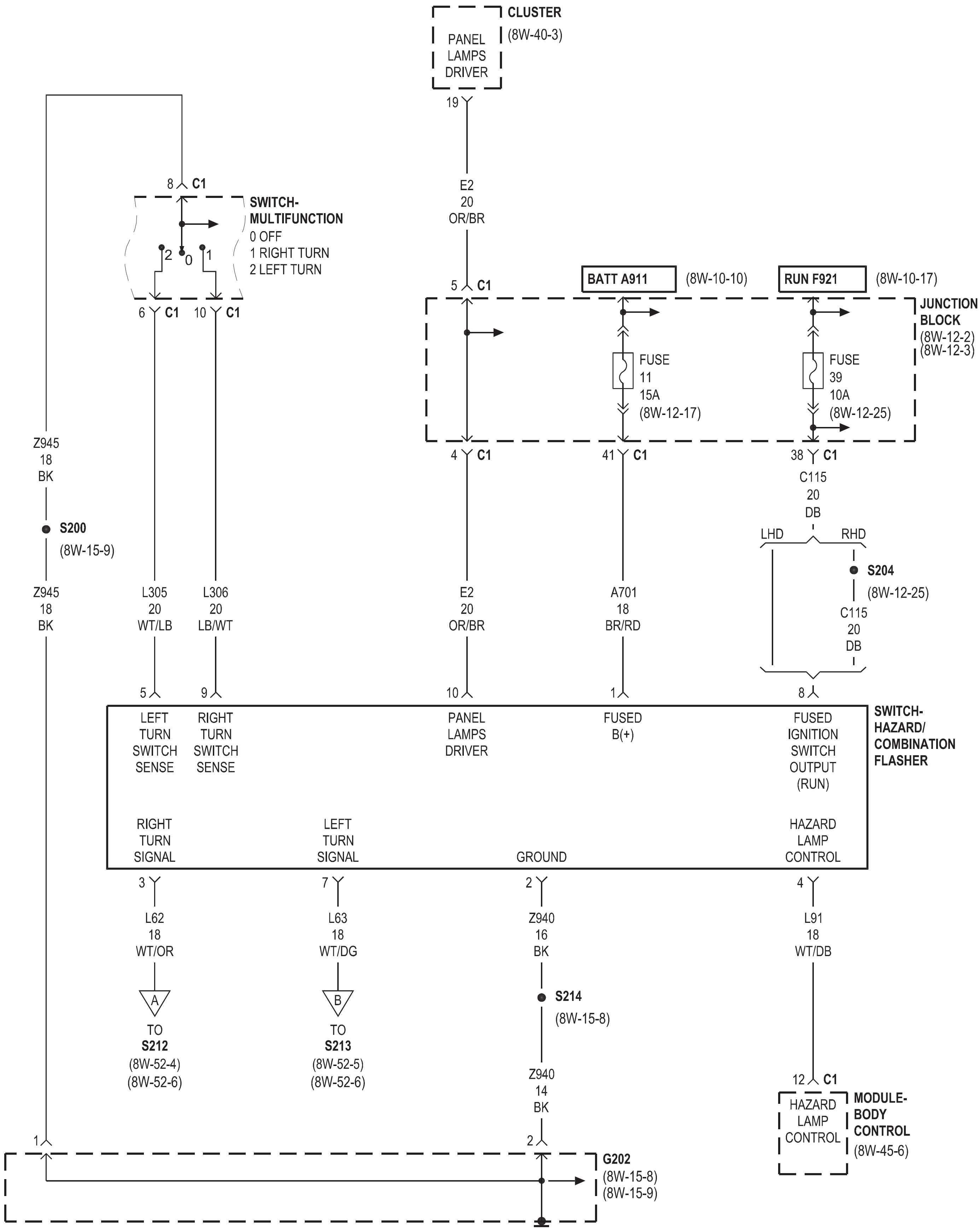

FROM
C201
(8W-51-3)
D
FROM
S302
(8W-51-4)
C
L10
20
WT/GY
S310
(8W-31-6)
L50
18
WT/TN
2
6
C310
S347
(8W-31-6)
S348
(8W-12-16)
4
C310
L63
18
WT/DG
4
3
6
LAMP-
TAIL/
STOP/
TURN-
LEFT
5
Z934
16
BK
TRAILER
TOW
EXCEPT
TRAILER
TOW
S346
(8W-52-5)
46
C201
S304
(8W-15-13)
Z934
14
BK
S213
(8W-52-5)
86
RELAY-
TRAILER
TOW-LEFT
(8W-54-6)
9
C310
L63
20
WT/DG
85
Z933
14
BK
5
LEFT
TURN
SIGNAL
CLUSTER
(8W-40-3)
S306
(8W-15-13)
S313
(8W-15-13)
G304
(8W-15-13)

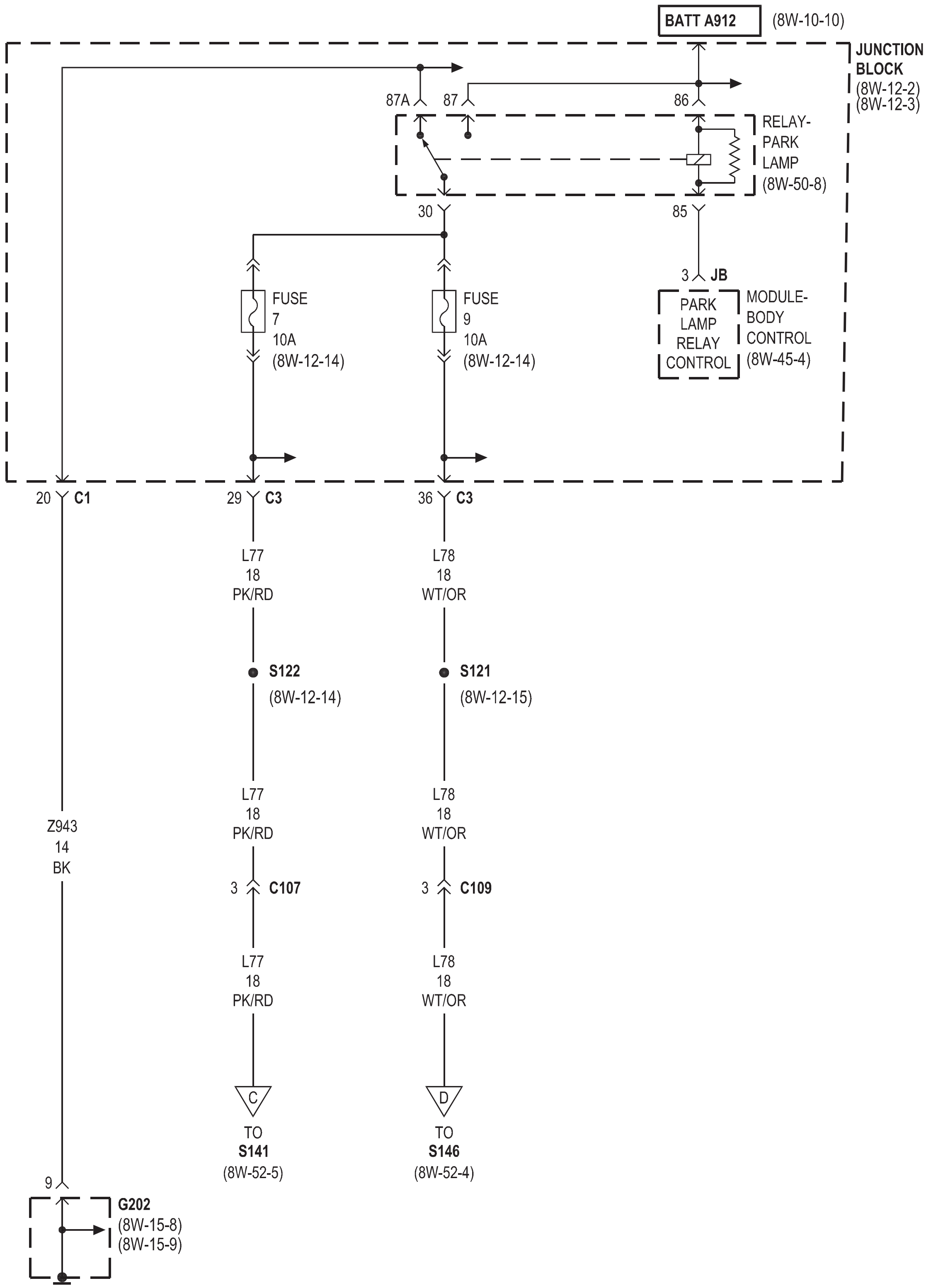
EXPORT



BATT A12
(8W-10-18)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
2
10A
(8W-12-10)
REAR
FOG
LAMP
RELAY
CONTROL
MODULE-
BODY
CONTROL
(8W-45-3)
4
JB
86
30
RELAY-FOG
LAMP-
REAR
85
87
87A
34
C2
L90
16
WT/OR
5
C310
L90
16
WT/OR
S350
(8W-12-11)
L90
16
WT/OR
L90
16
WT/OR
1
LAMP-
TAIL/
STOP/
TURN-
LEFT
1
LAMP-
TAIL/
STOP/
TURN-
RIGHT
5
Z934
16
BK
5
Z934
16
BK
S304
(8W-15-13)
Z934
14
BK
9
C310
Z934
14
BK
S306
(8W-15-13)
Z934
14
BK
S304
(8W-15-13)

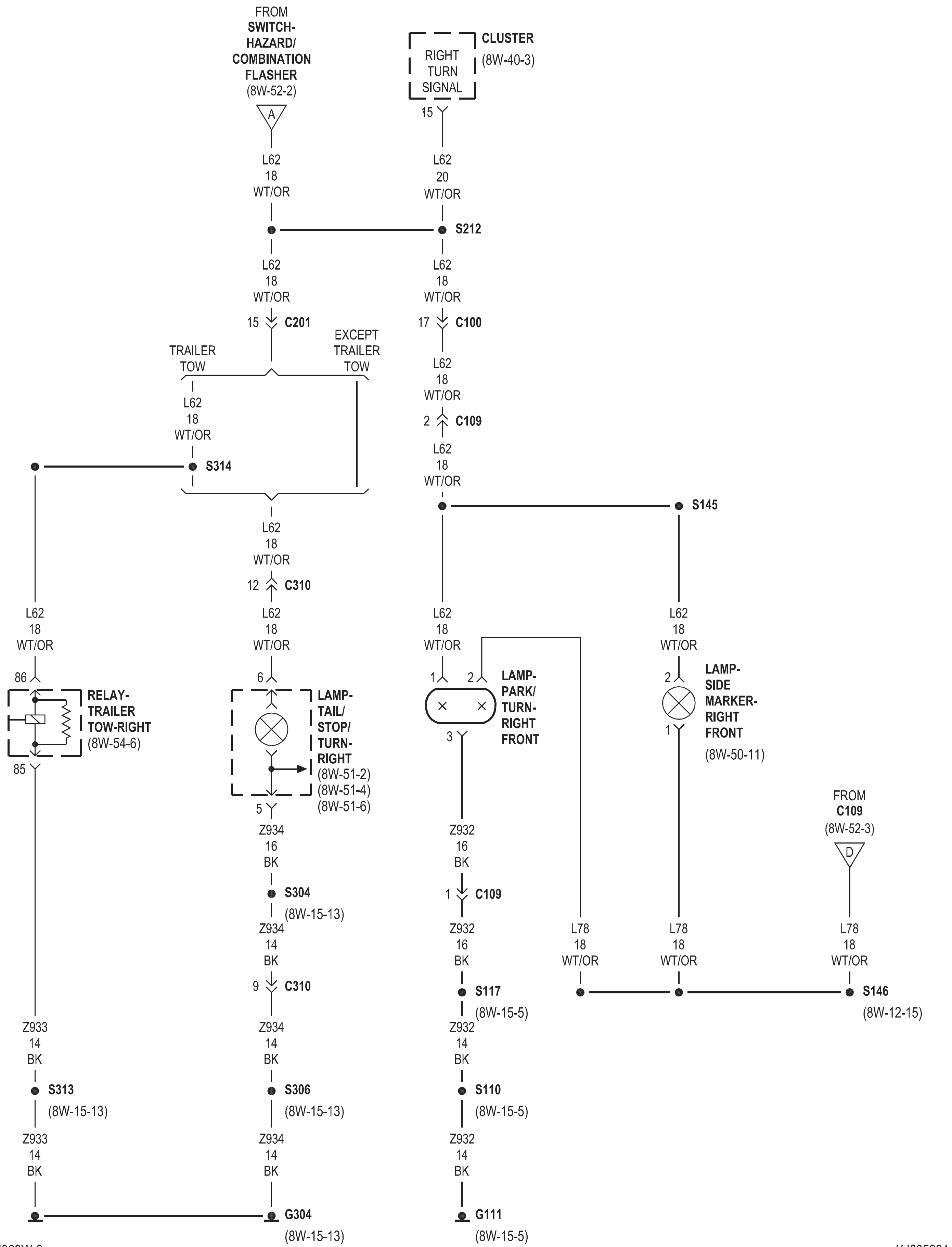
# 8W-52 TURN SIGNALS


CLUSTER
(8W-40-3)
PANEL
LAMPS
DRIVER
19
E2
20
OR/BR
8 C1
SWITCH-
MULTIFUNCTION
0 OFF
1 RIGHT TURN
2 LEFT TURN
2 0 1
6 C1 10 C1
5 C1
BATT A911
(8W-10-10)
RUN F921
(8W-10-17)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
11
15A
(8W-12-17)
FUSE
39
10A
(8W-12-25)
4 C1 41 C1 38 C1
C115
20
DB
LHD RHD
S204
(8W-12-25)
C115
20
DB
Z945
18
BK
S200
(8W-15-9)
Z945
18
BK
L305
20
WT/LB
L306
20
LB/WT
E2
20
OR/BR
A701
18
BR/RD
5 9 10 1 8
LEFT
TURN
SWITCH
SENSE
RIGHT
TURN
SWITCH
SENSE
PANEL
LAMPS
DRIVER
FUSED
B(+)
FUSED
IGNITION
SWITCH
OUTPUT
(RUN)
SWITCH-
HAZARD/
COMBINATION
FLASHER
RIGHT
TURN
SIGNAL
LEFT
TURN
SIGNAL
GROUND
HAZARD
LAMP
CONTROL
3 7 2 4
L62
18
WT/OR
L63
18
WT/DG
Z940
16
BK
L91
18
WT/DB
A
B
TO
S212
(8W-52-4)
(8W-52-6)
TO
S213
(8W-52-5)
(8W-52-6)
S214
(8W-15-8)
Z940
14
BK
12 C1
HAZARD
LAMP
CONTROL
MODULE-
BODY
CONTROL
(8W-45-6)
1 2
G202
(8W-15-8)
(8W-15-9)

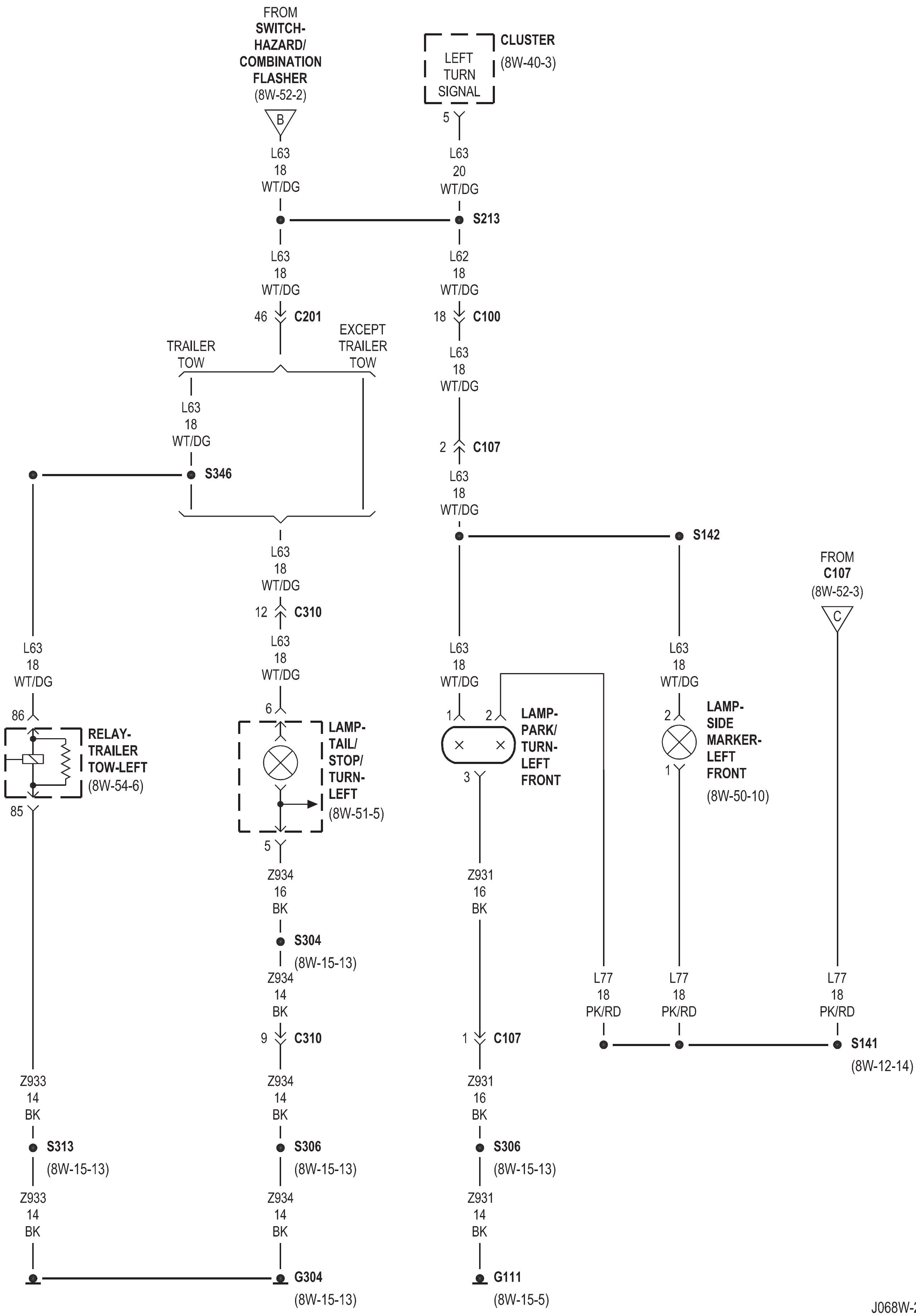


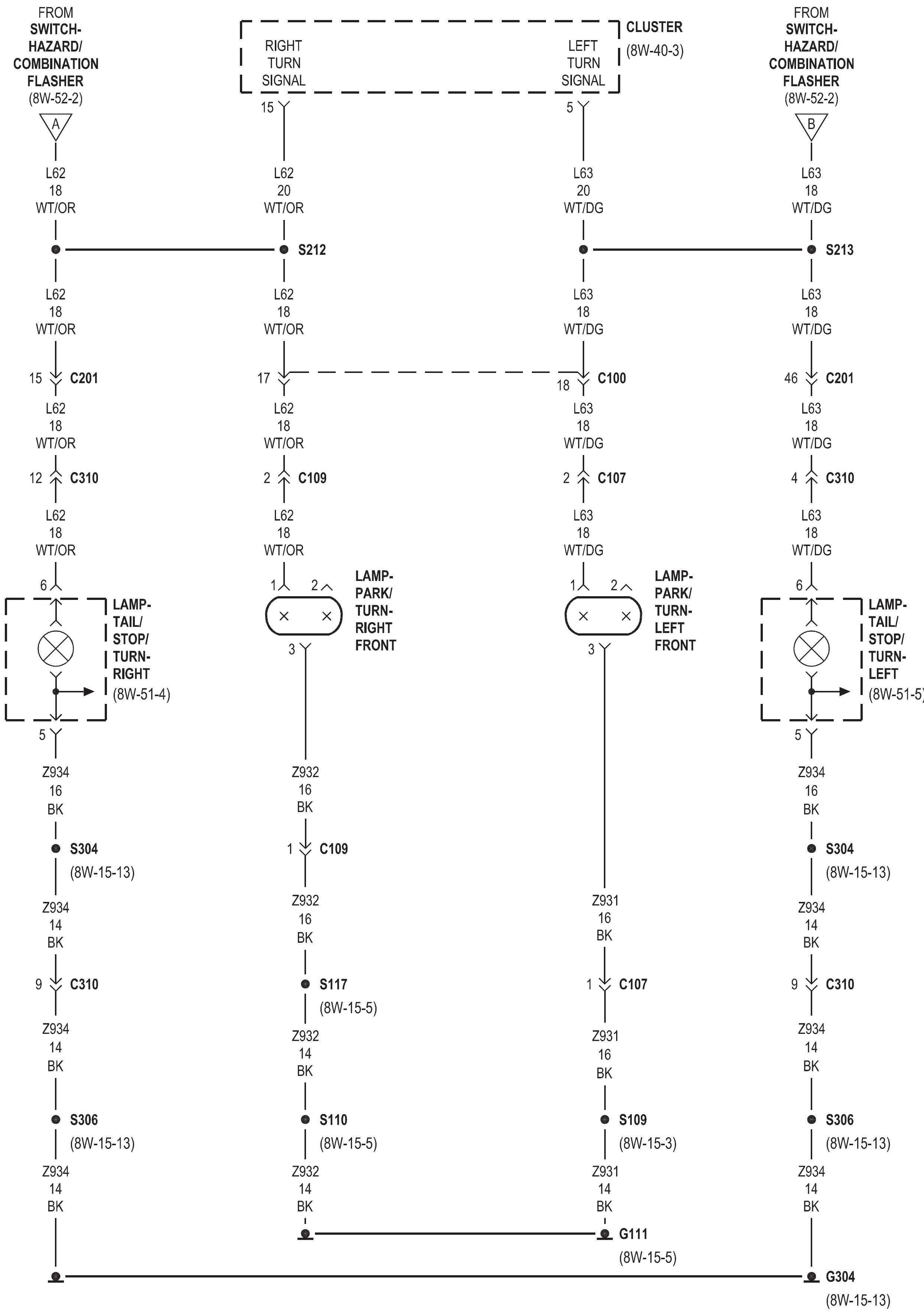
BATT A912
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
87A
87
86
RELAY-PARK LAMP
(8W-50-8)
30
85
FUSE 7 10A
(8W-12-14)
FUSE 9 10A
(8W-12-14)
3 JB
PARK LAMP RELAY CONTROL
MODULE-BODY CONTROL
(8W-45-4)
20 C1
29 C3
36 C3
L77 18 PK/RD
L78 18 WT/OR
S122
(8W-12-14)
S121
(8W-12-15)
Z943 14 BK
3 C107
3 C109
C
D
TO S141
(8W-52-5)
TO S146
(8W-52-4)
9
G202
(8W-15-8)
(8W-15-9)

## EXCEPT EXPORT

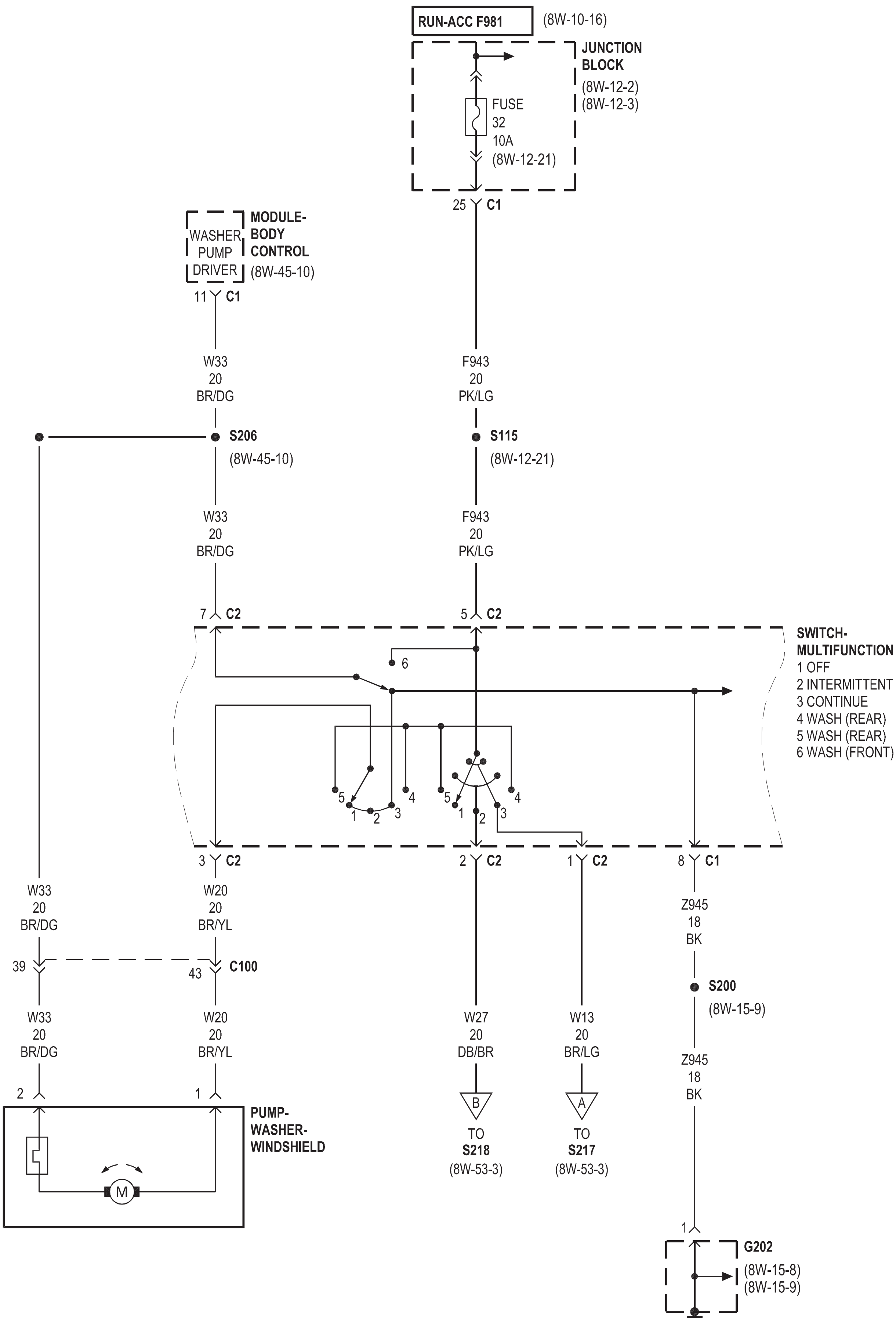


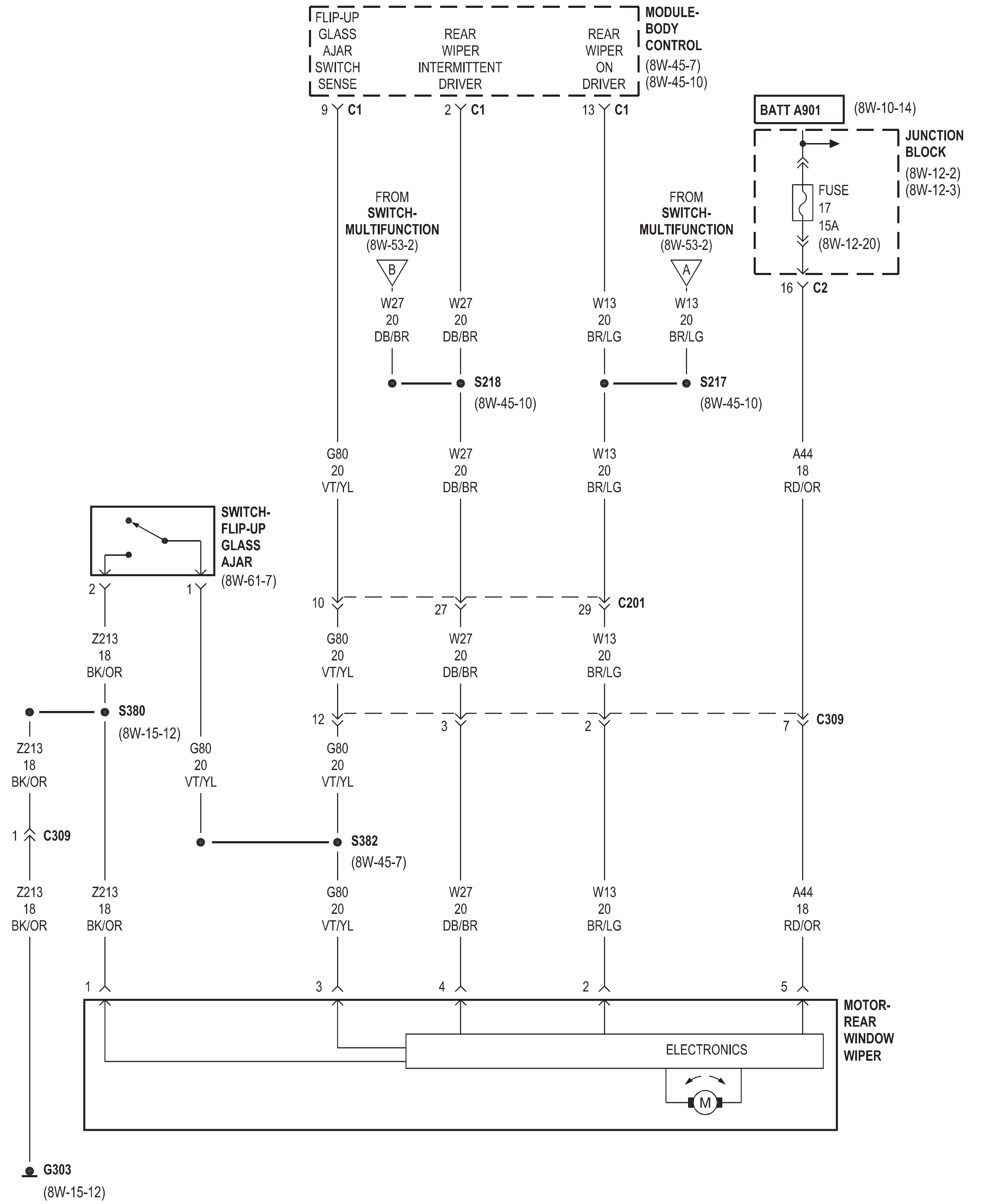
# EXCEPT EXPORT

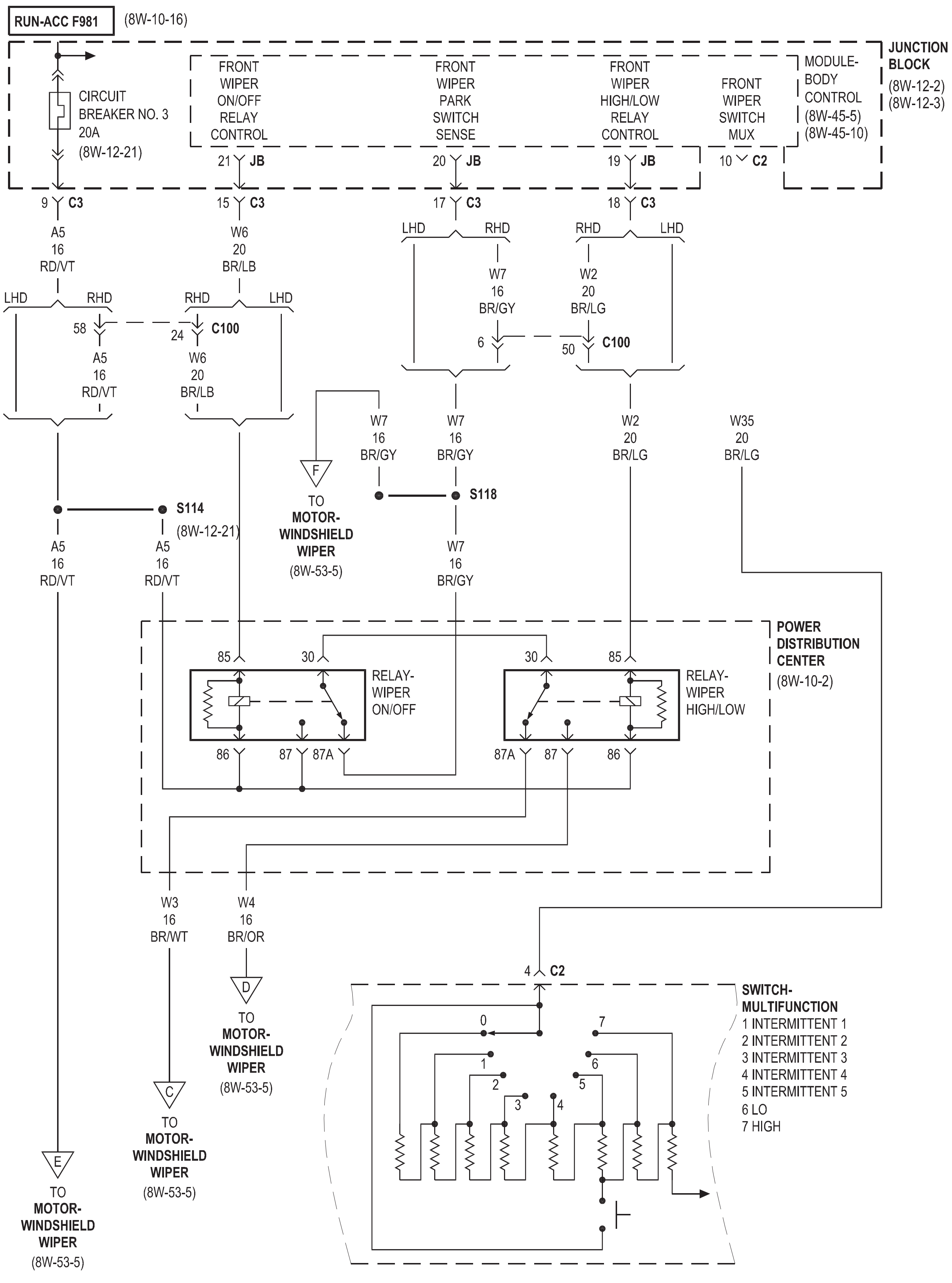



FROM
SWITCH-HAZARD/COMBINATION FLASHER
(8W-52-2)
A
RIGHT TURN SIGNAL
LEFT TURN SIGNAL
CLUSTER
(8W-40-3)
FROM
SWITCH-HAZARD/COMBINATION FLASHER
(8W-52-2)
B
15
5
L62 18 WT/OR
L62 20 WT/OR
L63 20 WT/DG
L63 18 WT/DG
S212
S213
L62 18 WT/OR
L62 18 WT/OR
L63 18 WT/DG
L63 18 WT/DG
15 C201
17
18 C100
46 C201
L62 18 WT/OR
L62 18 WT/OR
L63 18 WT/DG
L63 18 WT/DG
12 C310
2 C109
2 C107
4 C310
L62 18 WT/OR
L62 18 WT/OR
L63 18 WT/DG
L63 18 WT/DG
6
1 2
1 2
6
LAMP-TAIL/STOP/TURN-RIGHT
(8W-51-4)
LAMP-PARK/TURN-RIGHT FRONT
LAMP-PARK/TURN-LEFT FRONT
LAMP-TAIL/STOP/TURN-LEFT
(8W-51-5)
3
3
5
5
Z934 16 BK
Z932 16 BK
Z934 16 BK
S304
(8W-15-13)
1 C109
S304
(8W-15-13)
Z934 14 BK
Z932 16 BK
Z931 16 BK
Z934 14 BK
9 C310
S117
(8W-15-5)
1 C107
9 C310
Z934 14 BK
Z932 14 BK
Z931 16 BK
Z934 14 BK
S306
(8W-15-13)
S110
(8W-15-5)
S109
(8W-15-3)
S306
(8W-15-13)
Z934 14 BK
Z932 14 BK
Z931 14 BK
Z934 14 BK
G111
(8W-15-5)
G304
(8W-15-13)

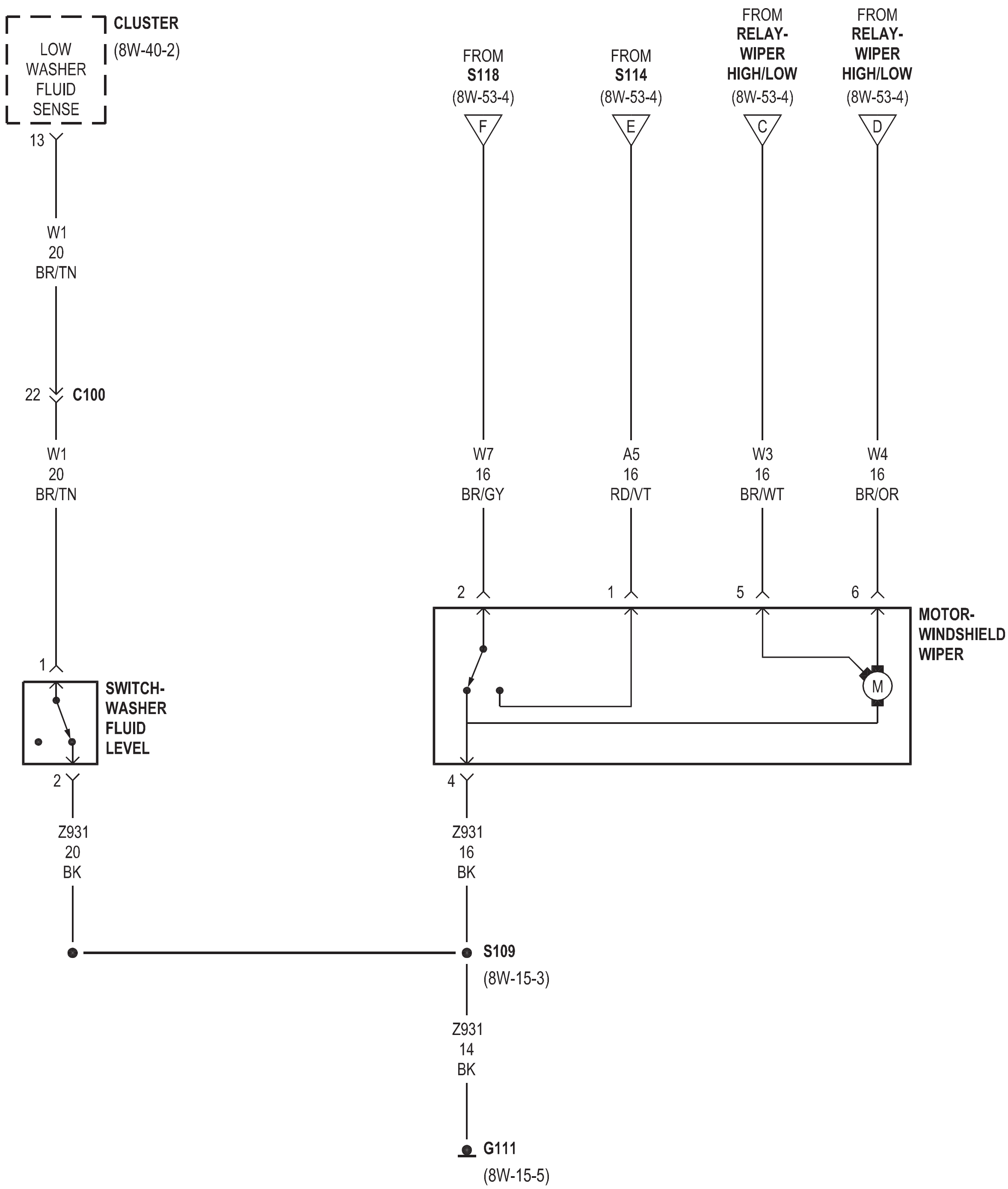
# 8W-53 WIPERS


RUN-ACC F981
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
32
10A
(8W-12-21)
25 C1
WASHER PUMP DRIVER
MODULE-BODY CONTROL
(8W-45-10)
11 C1
W33
20
BR/DG
F943
20
PK/LG
S206
(8W-45-10)
S115
(8W-12-21)
W33
20
BR/DG
F943
20
PK/LG
7 C2
5 C2
SWITCH-MULTIFUNCTION
1 OFF
2 INTERMITTENT
3 CONTINUE
4 WASH (REAR)
5 WASH (REAR)
6 WASH (FRONT)
6
5
1
2
3
4
5
1
2
3
4
3 C2
2 C2
1 C2
8 C1
W33
20
BR/DG
W20
20
BR/YL
Z945
18
BK
39
43
C100
S200
(8W-15-9)
W33
20
BR/DG
W20
20
BR/YL
W27
20
DB/BR
W13
20
BR/LG
Z945
18
BK
2
1
PUMP-WASHER-WINDSHIELD
M
B
A
TO
S218
(8W-53-3)
TO
S217
(8W-53-3)
1
G202
(8W-15-8)
(8W-15-9)

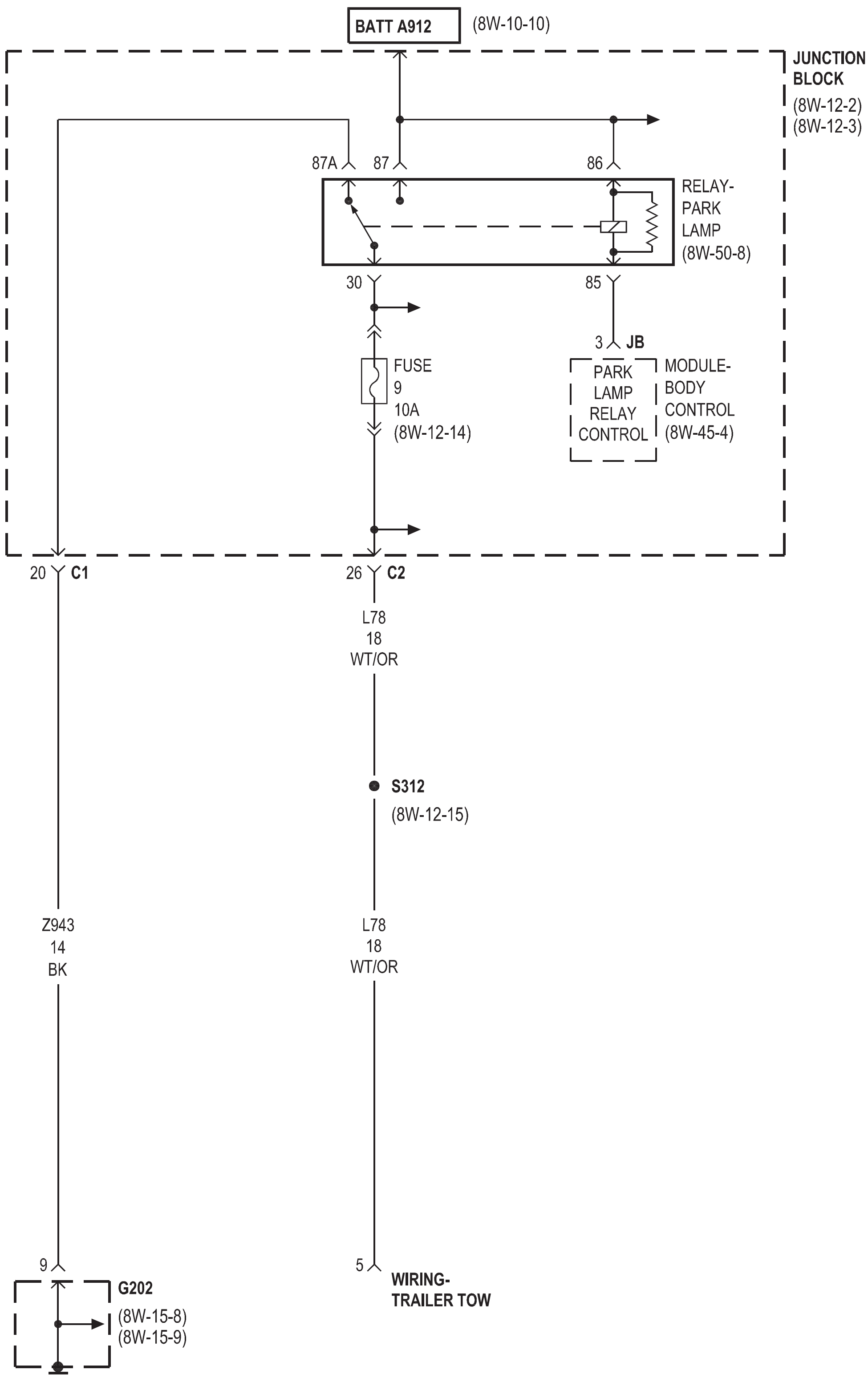

MODULE-BODY CONTROL
(8W-45-7)
(8W-45-10)
FLIP-UP GLASS AJAR SWITCH SENSE
REAR WIPER INTERMITTENT DRIVER
REAR WIPER ON DRIVER
9 C1
2 C1
13 C1
BATT A901
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 17 15A (8W-12-20)
16 C2
FROM SWITCH-MULTIFUNCTION (8W-53-2)
B
A
W27 20 DB/BR
W13 20 BR/LG
S218 (8W-45-10)
S217 (8W-45-10)
G80 20 VT/YL
A44 18 RD/OR
SWITCH-FLIP-UP GLASS AJAR (8W-61-7)
2
1
10
27
29
C201
Z213 18 BK/OR
S380 (8W-15-12)
12
3
2
7
C309
1 C309
S382 (8W-45-7)
1
3
4
2
5
MOTOR-REAR WINDOW WIPER
ELECTRONICS
M
G303 (8W-15-12)

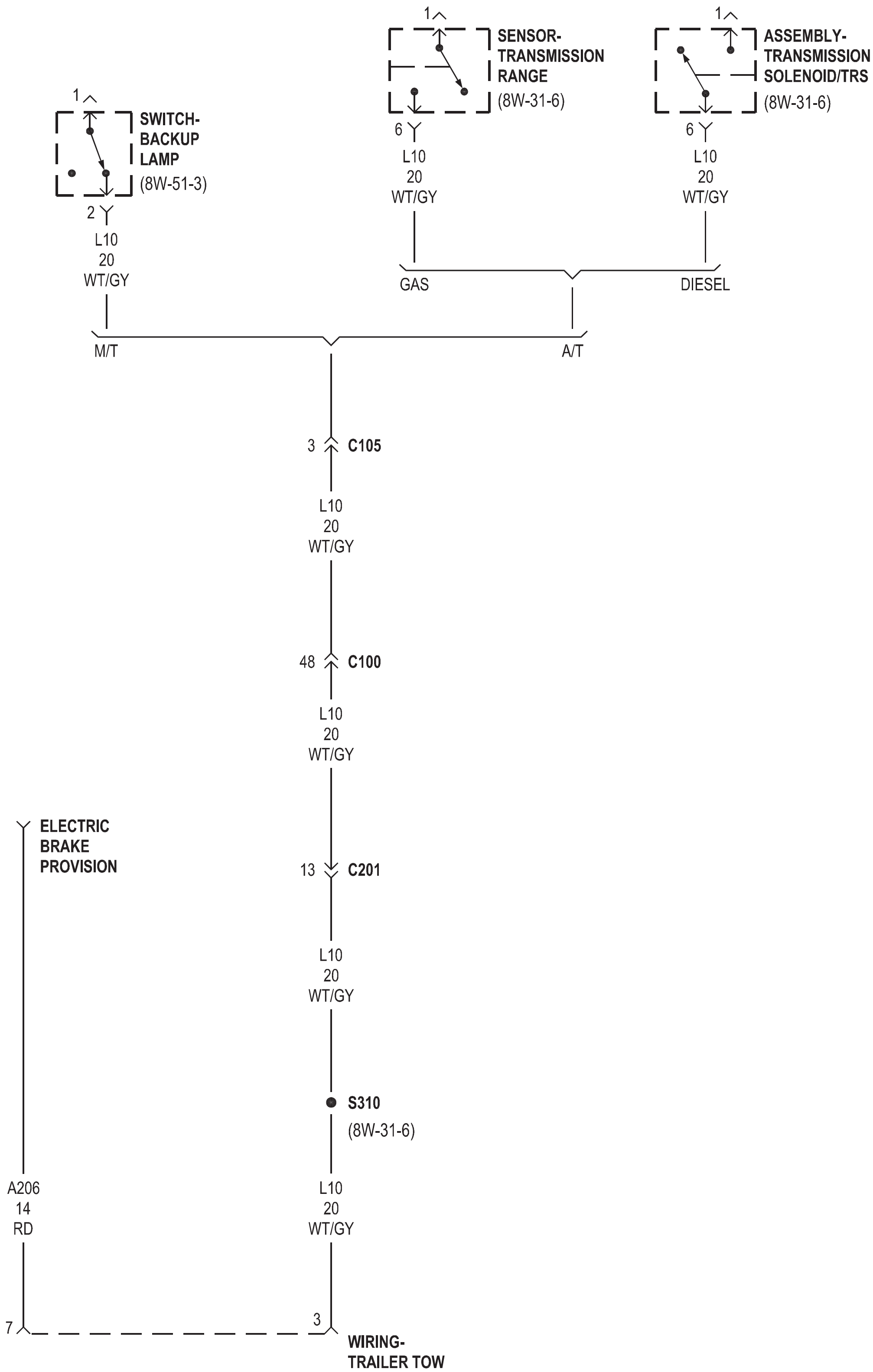


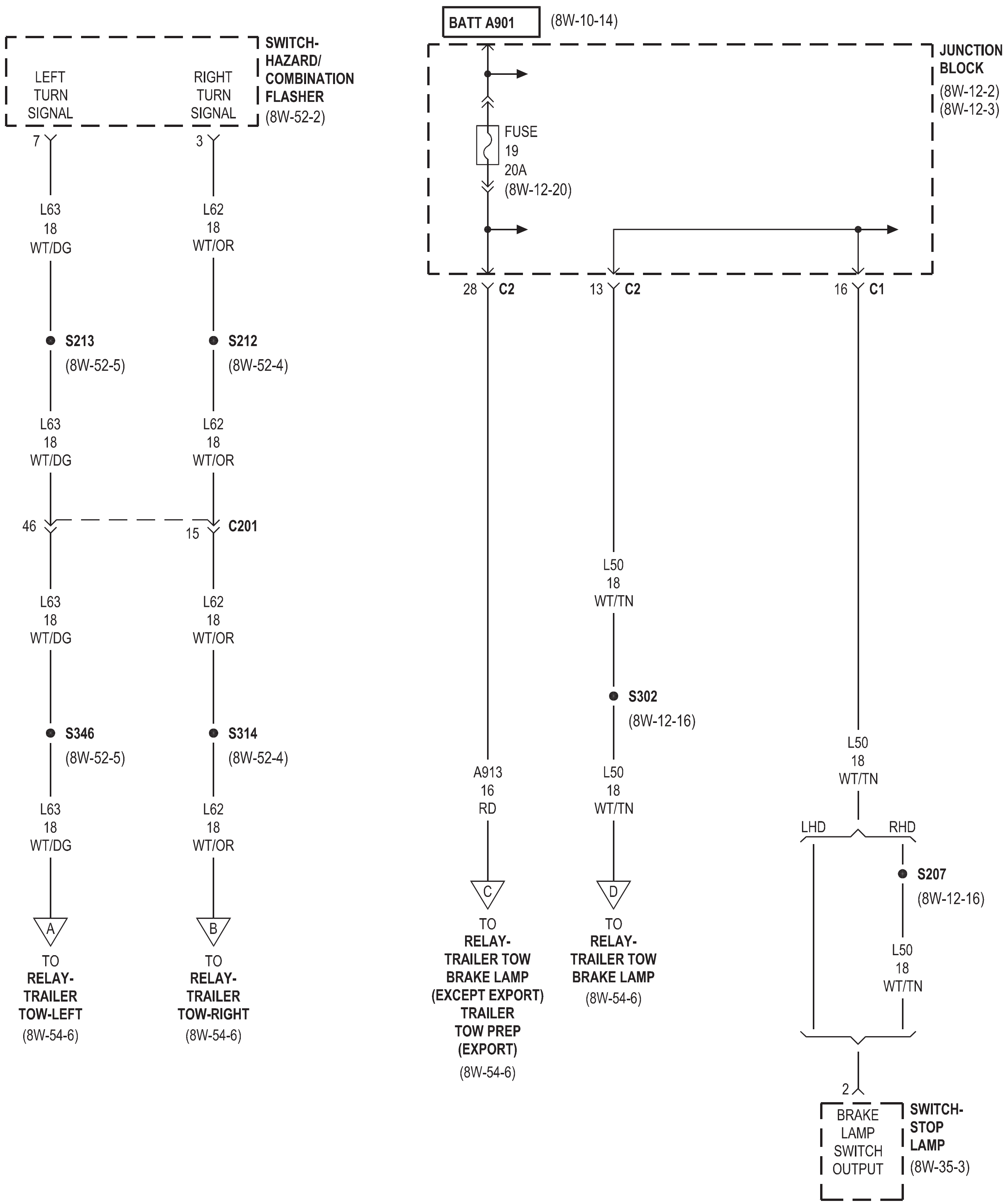
RUN-ACC F981
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 3 20A (8W-12-21)
FRONT WIPER ON/OFF RELAY CONTROL
FRONT WIPER PARK SWITCH SENSE
FRONT WIPER HIGH/LOW RELAY CONTROL
FRONT WIPER SWITCH MUX
MODULE-BODY CONTROL (8W-45-5) (8W-45-10)
21 JB
20 JB
19 JB
10 C2
9 C3
15 C3
17 C3
18 C3
A5 16 RD/VT
W6 20 BR/LB
LHD
RHD
W7 16 BR/GY
W2 20 BR/LG
58
24 C100
6
50 C100
W7 16 BR/GY
W2 20 BR/LG
W35 20 BR/LG
F
TO MOTOR-WINDSHIELD WIPER (8W-53-5)
S118
S114 (8W-12-21)
POWER DISTRIBUTION CENTER (8W-10-2)
85
30
86
87
87A
RELAY-WIPER ON/OFF
RELAY-WIPER HIGH/LOW
W3 16 BR/WT
W4 16 BR/OR
D
C
E
4 C2
SWITCH-MULTIFUNCTION
1 INTERMITTENT 1
2 INTERMITTENT 2
3 INTERMITTENT 3
4 INTERMITTENT 4
5 INTERMITTENT 5
6 LO
7 HIGH
0
1
2
3
4
5
6
7

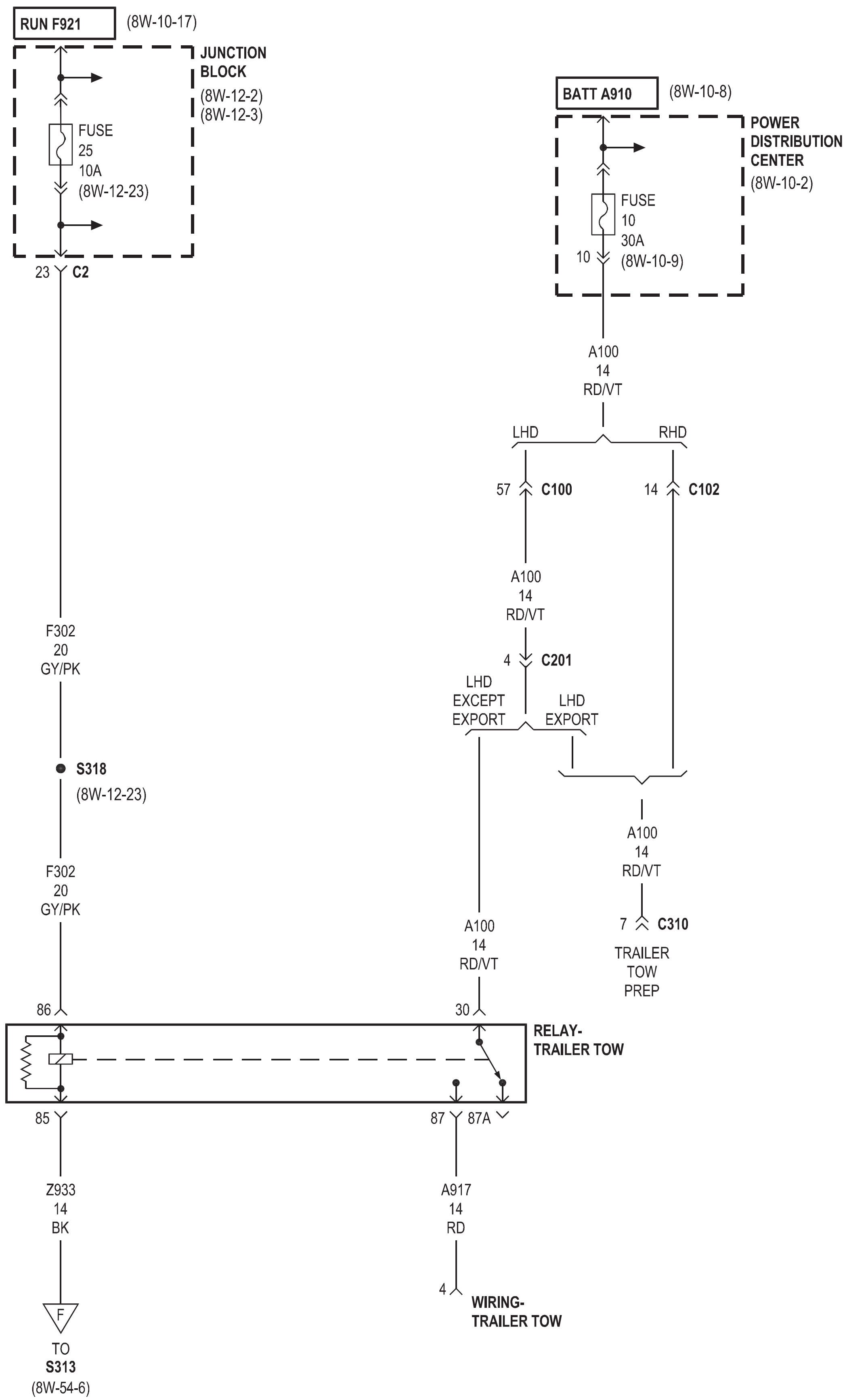

CLUSTER
(8W-40-2)
LOW WASHER FLUID SENSE
13
W1
20
BR/TN
22
C100
W1
20
BR/TN
1
SWITCH-WASHER FLUID LEVEL
2
Z931
20
BK
FROM S118 (8W-53-4)
F
FROM S114 (8W-53-4)
E
FROM RELAY-WIPER HIGH/LOW (8W-53-4)
C
FROM RELAY-WIPER HIGH/LOW (8W-53-4)
D
W7
16
BR/GY
A5
16
RD/VT
W3
16
BR/WT
W4
16
BR/OR
2
1
5
6
MOTOR-WINDSHIELD WIPER
M
4
Z931
16
BK
S109
(8W-15-3)
Z931
14
BK
G111
(8W-15-5)

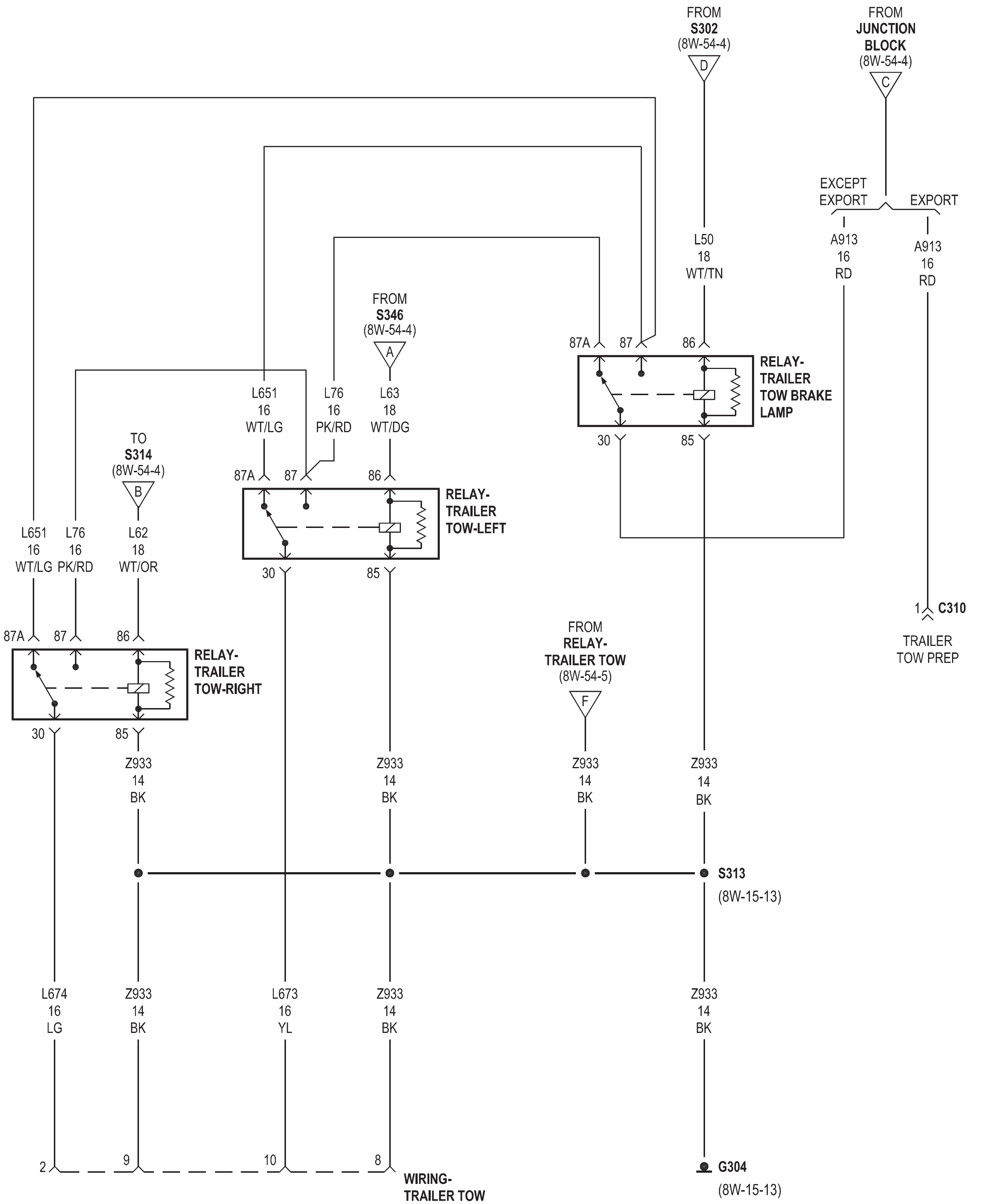
# 8W-54 TRAILER TOW


BATT A912
(8W-10-10)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
87A
87
86
RELAY-
PARK
LAMP
(8W-50-8)
30
85
3
JB
FUSE
9
10A
(8W-12-14)
PARK
LAMP
RELAY
CONTROL
MODULE-
BODY
CONTROL
(8W-45-4)
20
C1
26
C2
L78
18
WT/OR
S312
(8W-12-15)
Z943
14
BK
L78
18
WT/OR
9
G202
(8W-15-8)
(8W-15-9)
5
WIRING-
TRAILER TOW

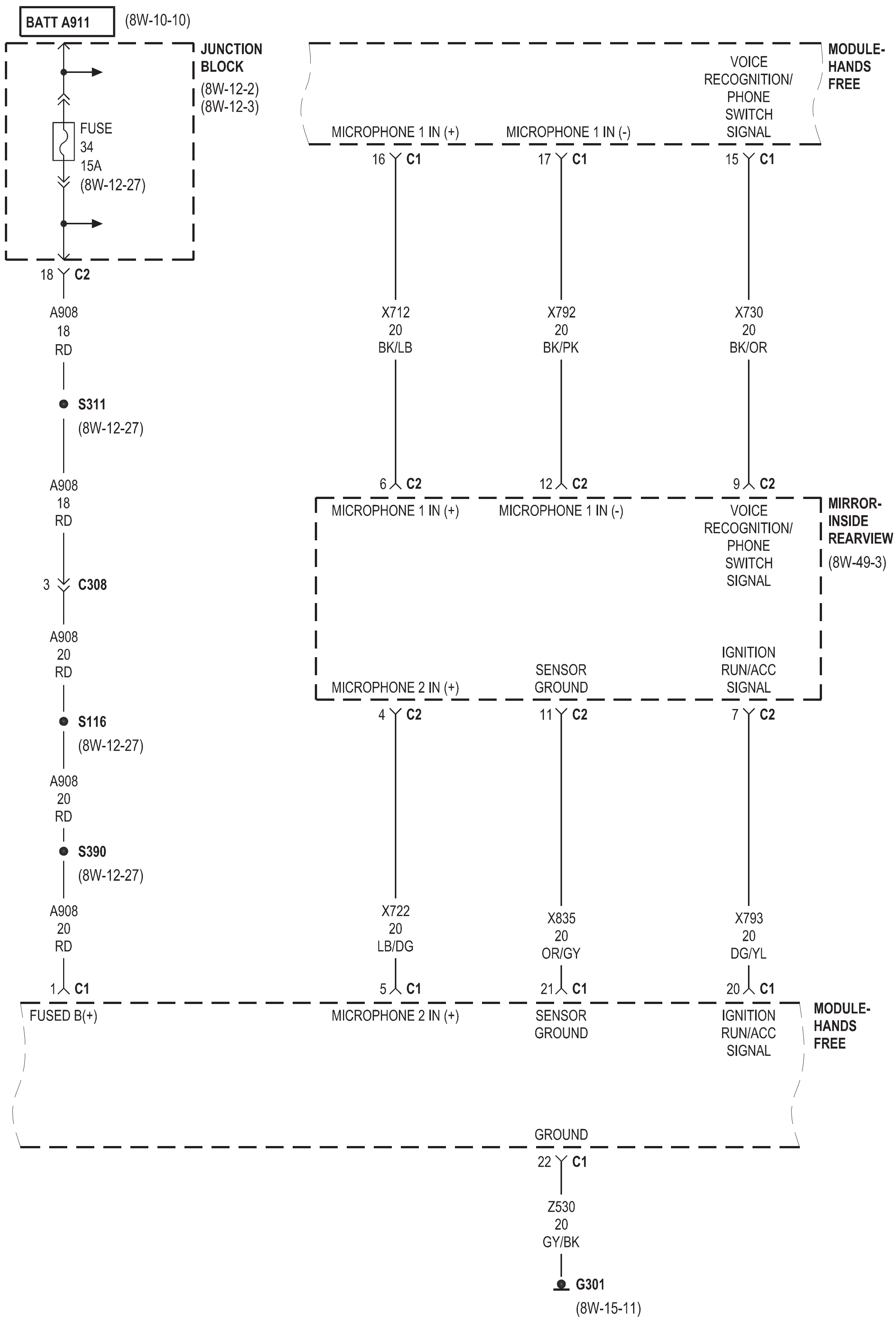

SWITCH-
BACKUP
LAMP
(8W-51-3)
SENSOR-
TRANSMISSION
RANGE
(8W-31-6)
ASSEMBLY-
TRANSMISSION
SOLENOID/TRS
(8W-31-6)
L10
20
WT/GY
GAS
DIESEL
M/T
A/T
C105
C100
C201
ELECTRIC
BRAKE
PROVISION
S310
(8W-31-6)
A206
14
RD
WIRING-
TRAILER TOW

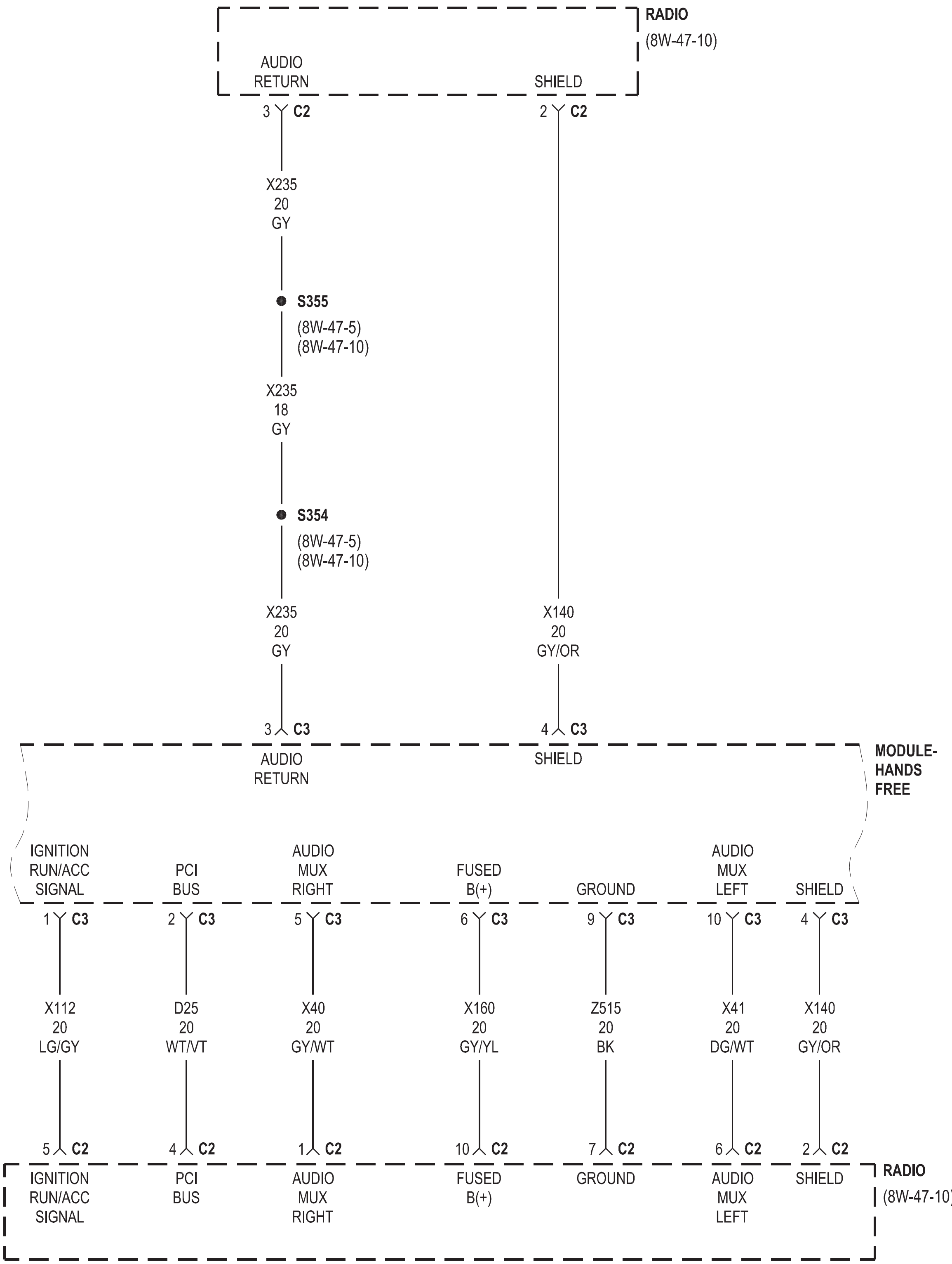

SWITCH-
HAZARD/
COMBINATION
FLASHER
(8W-52-2)
LEFT
TURN
SIGNAL
RIGHT
TURN
SIGNAL
7
3
L63
18
WT/DG
L62
18
WT/OR
S213
(8W-52-5)
S212
(8W-52-4)
46
15
C201
S346
(8W-52-5)
S314
(8W-52-4)
A
B
TO
RELAY-
TRAILER
TOW-LEFT
(8W-54-6)
TO
RELAY-
TRAILER
TOW-RIGHT
(8W-54-6)
BATT A901
(8W-10-14)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
19
20A
(8W-12-20)
28
C2
13
C2
16
C1
L50
18
WT/TN
S302
(8W-12-16)
A913
16
RD
C
D
TO
RELAY-
TRAILER TOW
BRAKE LAMP
(EXCEPT EXPORT)
TRAILER
TOW PREP
(EXPORT)
(8W-54-6)
TO
RELAY-
TRAILER TOW
BRAKE LAMP
(8W-54-6)
LHD
RHD
S207
(8W-12-16)
2
BRAKE
LAMP
SWITCH
OUTPUT
SWITCH-
STOP
LAMP
(8W-35-3)


RUN F921
(8W-10-17)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
25
10A
(8W-12-23)
23 C2
F302
20
GY/PK
S318
(8W-12-23)
F302
20
GY/PK
86
85
Z933
14
BK
F
TO
S313
(8W-54-6)
BATT A910
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
10
30A
(8W-10-9)
10
A100
14
RD/VT
LHD
RHD
57 C100
14 C102
A100
14
RD/VT
4 C201
LHD EXCEPT EXPORT
LHD EXPORT
A100
14
RD/VT
7 C310
TRAILER TOW PREP
A100
14
RD/VT
30
RELAY-TRAILER TOW
87
87A
A917
14
RD
4
WIRING-TRAILER TOW


FROM
S302
(8W-54-4)
D
FROM
JUNCTION
BLOCK
(8W-54-4)
C
EXCEPT
EXPORT
EXPORT
L50
18
WT/TN
A913
16
RD
A913
16
RD
FROM
S346
(8W-54-4)
A
87A
87
86
RELAY-
TRAILER
TOW BRAKE
LAMP
30
85
L651
16
WT/LG
L76
16
PK/RD
L63
18
WT/DG
TO
S314
(8W-54-4)
B
87A
87
86
RELAY-
TRAILER
TOW-LEFT
30
85
L651
16
WT/LG
L76
16
PK/RD
L62
18
WT/OR
1
C310
TRAILER
TOW PREP
87A
87
86
RELAY-
TRAILER
TOW-RIGHT
30
85
FROM
RELAY-
TRAILER TOW
(8W-54-5)
F
Z933
14
BK
Z933
14
BK
Z933
14
BK
Z933
14
BK
S313
(8W-15-13)
L674
16
LG
Z933
14
BK
L673
16
YL
Z933
14
BK
Z933
14
BK
2
9
10
8
WIRING-
TRAILER TOW
G304
(8W-15-13)

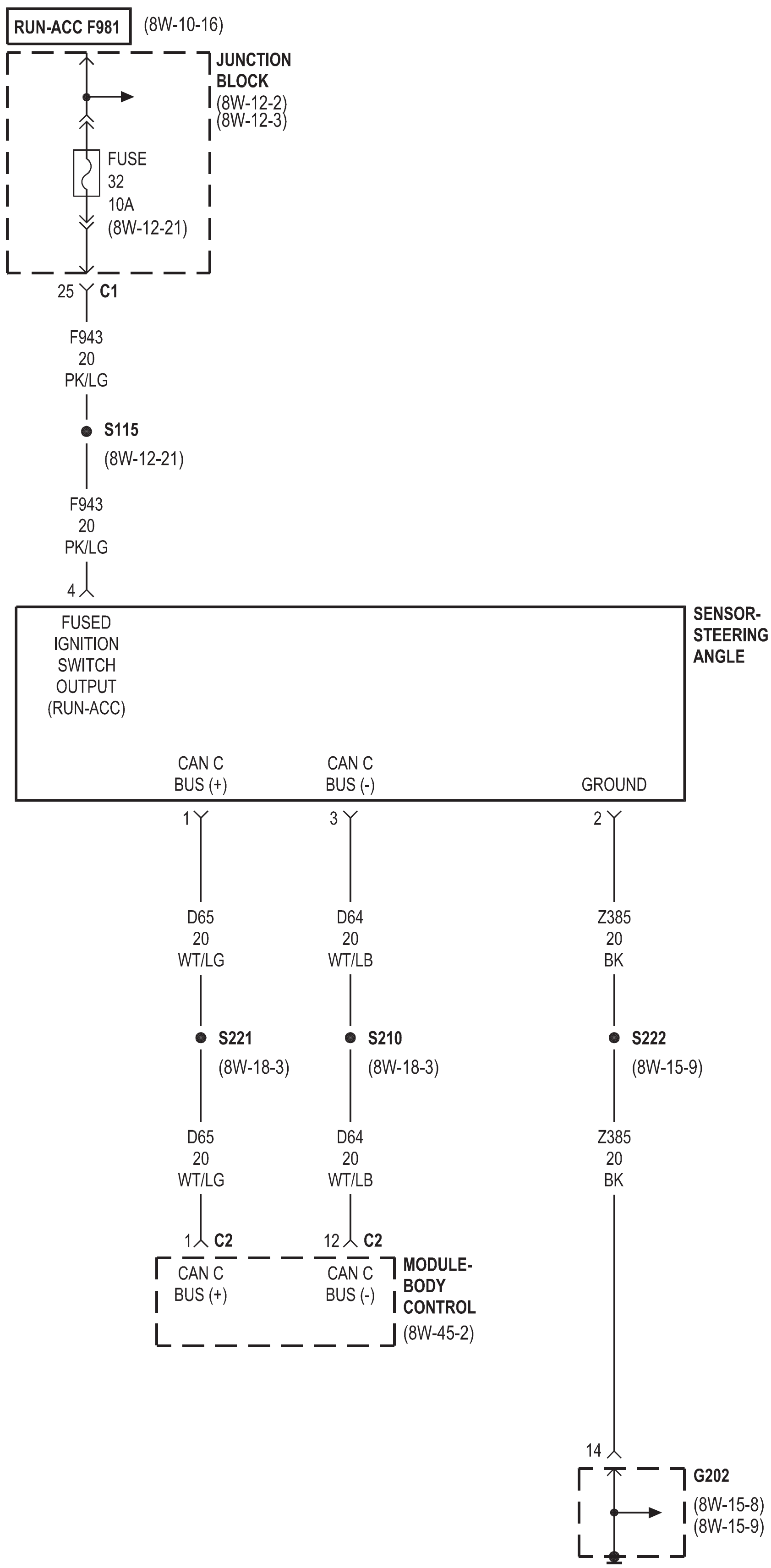
# 8W-55 NAVIGATION/TELECOMMUNICATIONS


BATT A911
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
34
15A
(8W-12-27)
18 C2
A908
18
RD
S311
(8W-12-27)
A908
18
RD
3 C308
A908
20
RD
S116
(8W-12-27)
A908
20
RD
S390
(8W-12-27)
A908
20
RD
1 C1
MODULE-HANDS FREE
VOICE RECOGNITION/ PHONE SWITCH SIGNAL
MICROPHONE 1 IN (+)
MICROPHONE 1 IN (-)
16 C1
17 C1
15 C1
X712
20
BK/LB
X792
20
BK/PK
X730
20
BK/OR
6 C2
12 C2
9 C2
MIRROR-INSIDE REARVIEW
(8W-49-3)
MICROPHONE 1 IN (+)
MICROPHONE 1 IN (-)
VOICE RECOGNITION/ PHONE SWITCH SIGNAL
MICROPHONE 2 IN (+)
SENSOR GROUND
IGNITION RUN/ACC SIGNAL
4 C2
11 C2
7 C2
X722
20
LB/DG
X835
20
OR/GY
X793
20
DG/YL
5 C1
21 C1
20 C1
MODULE-HANDS FREE
FUSED B(+)
MICROPHONE 2 IN (+)
SENSOR GROUND
IGNITION RUN/ACC SIGNAL
GROUND
22 C1
Z530
20
GY/BK
G301
(8W-15-11)

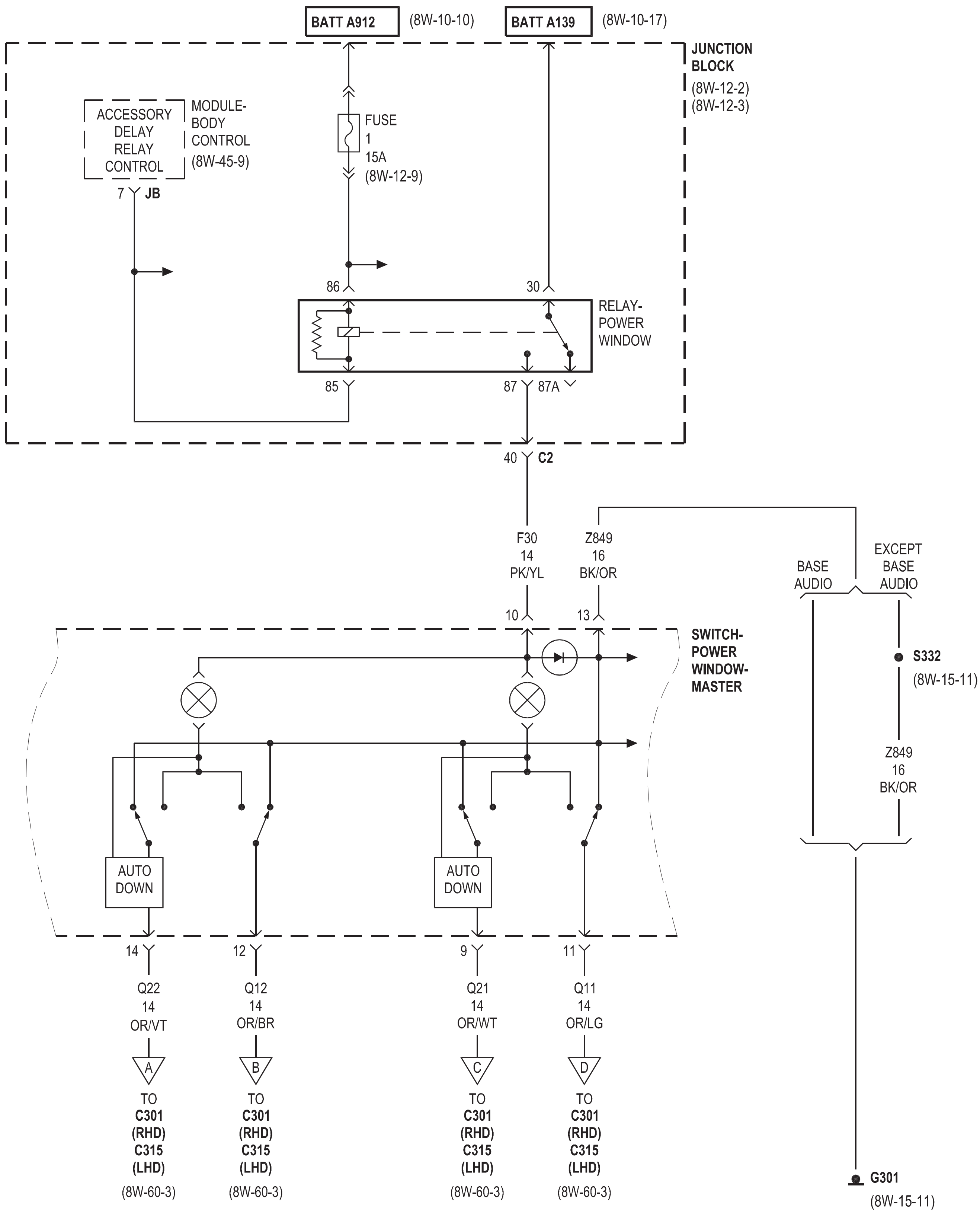


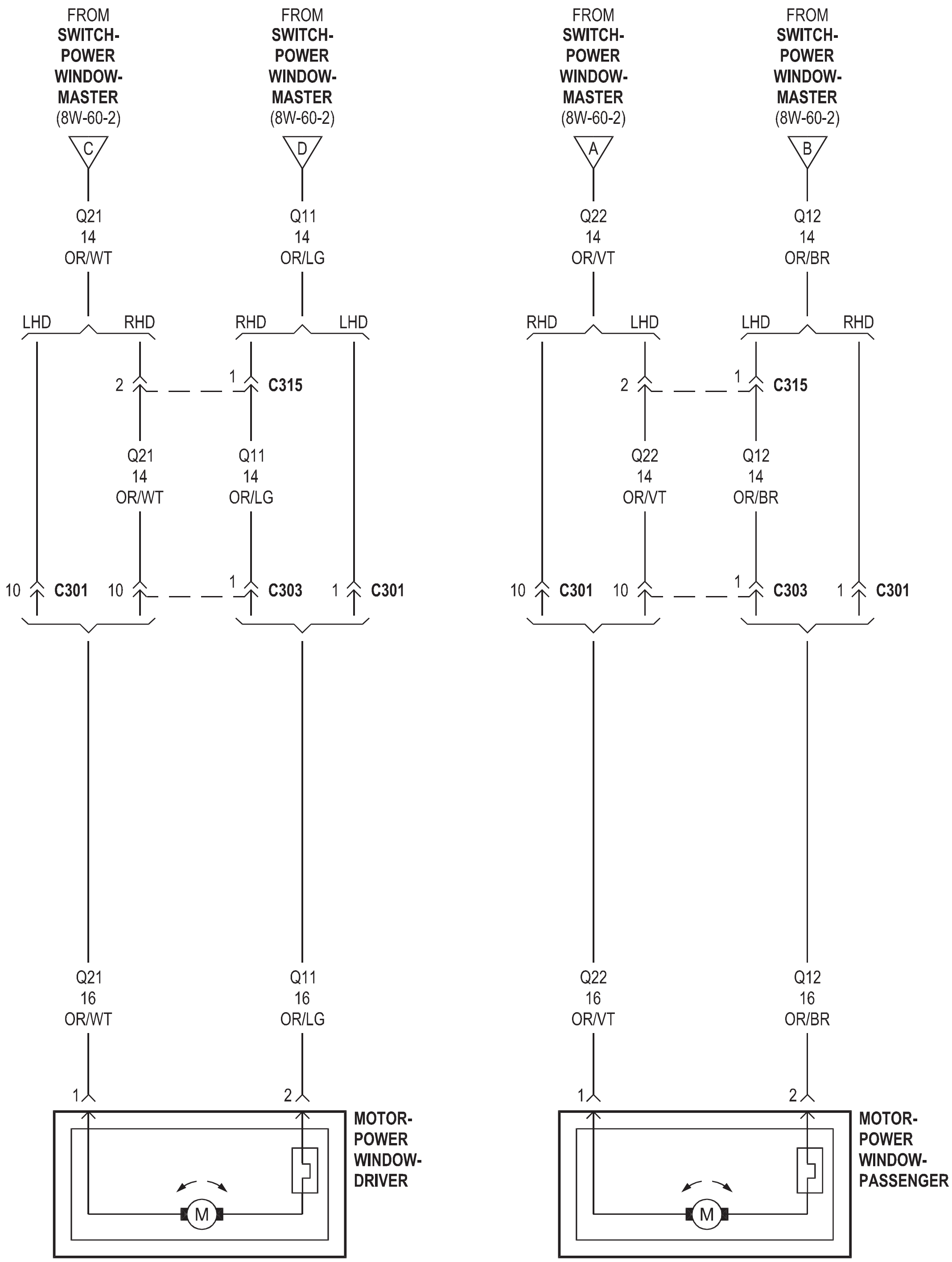
RADIO
(8W-47-10)
AUDIO RETURN
SHIELD
3 C2
2 C2
X235 20 GY
S355
(8W-47-5)
(8W-47-10)
X235 18 GY
S354
(8W-47-5)
(8W-47-10)
X235 20 GY
X140 20 GY/OR
3 C3
4 C3
AUDIO RETURN
SHIELD
MODULE-HANDS FREE
IGNITION RUN/ACC SIGNAL
PCI BUS
AUDIO MUX RIGHT
FUSED B(+)
GROUND
AUDIO MUX LEFT
SHIELD
1 C3
2 C3
5 C3
6 C3
9 C3
10 C3
4 C3
X112 20 LG/GY
D25 20 WT/VT
X40 20 GY/WT
X160 20 GY/YL
Z515 20 BK
X41 20 DG/WT
X140 20 GY/OR
5 C2
4 C2
1 C2
10 C2
7 C2
6 C2
2 C2
RADIO
(8W-47-10)
IGNITION RUN/ACC SIGNAL
PCI BUS
AUDIO MUX RIGHT
FUSED B(+)
GROUND
AUDIO MUX LEFT
SHIELD

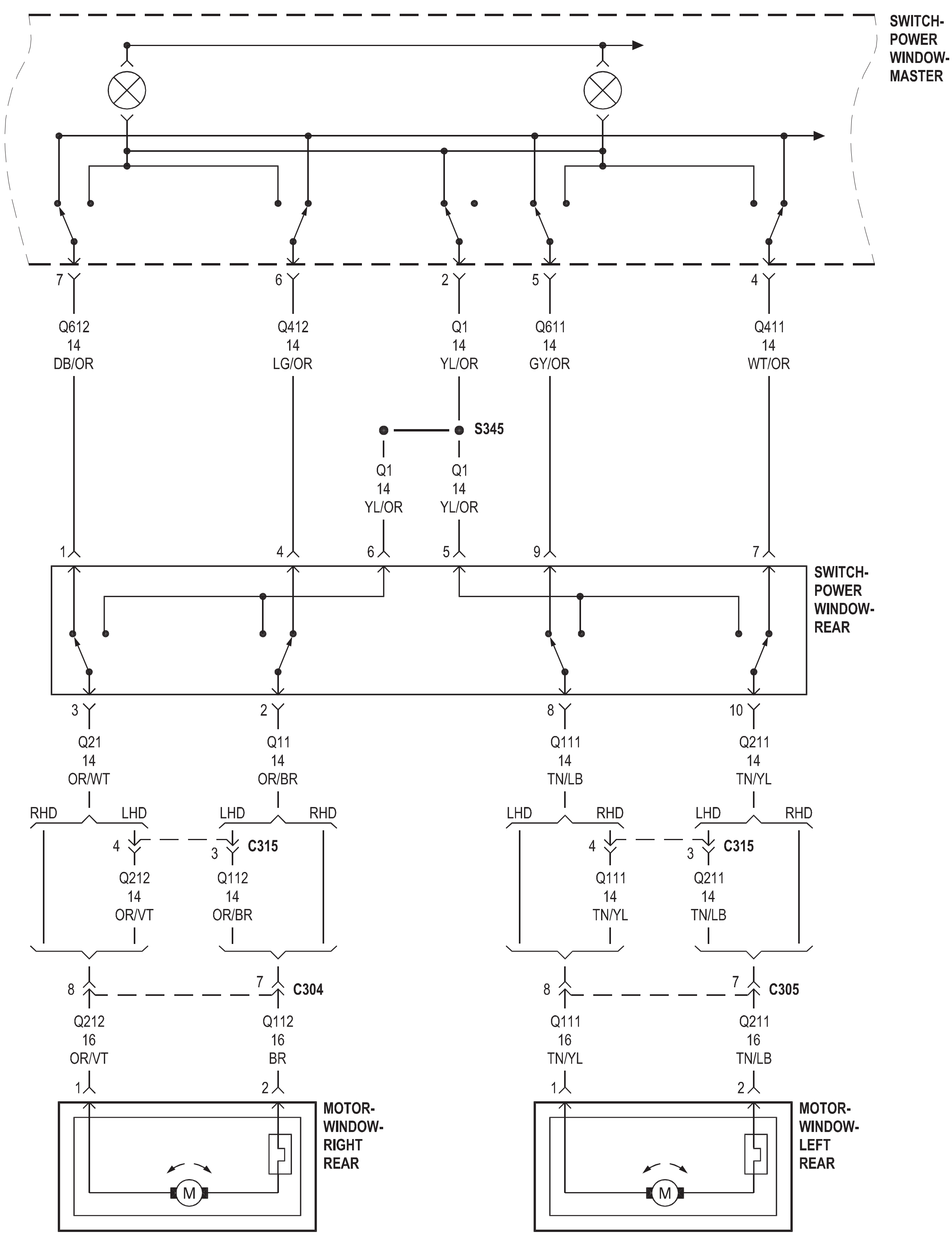
# 8W-56 CONVENIENCE SYSTEMS


RUN-ACC F981
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
32
10A
(8W-12-21)
25
C1
F943
20
PK/LG
S115
(8W-12-21)
F943
20
PK/LG
4
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
SENSOR-STEERING ANGLE
CAN C BUS (+)
CAN C BUS (-)
GROUND
1
3
2
D65
20
WT/LG
D64
20
WT/LB
Z385
20
BK
S221
(8W-18-3)
S210
(8W-18-3)
S222
(8W-15-9)
D65
20
WT/LG
D64
20
WT/LB
Z385
20
BK
1
C2
12
C2
CAN C BUS (+)
CAN C BUS (-)
MODULE-BODY CONTROL
(8W-45-2)
14
G202
(8W-15-8)
(8W-15-9)

# 8W-60 POWER WINDOWS

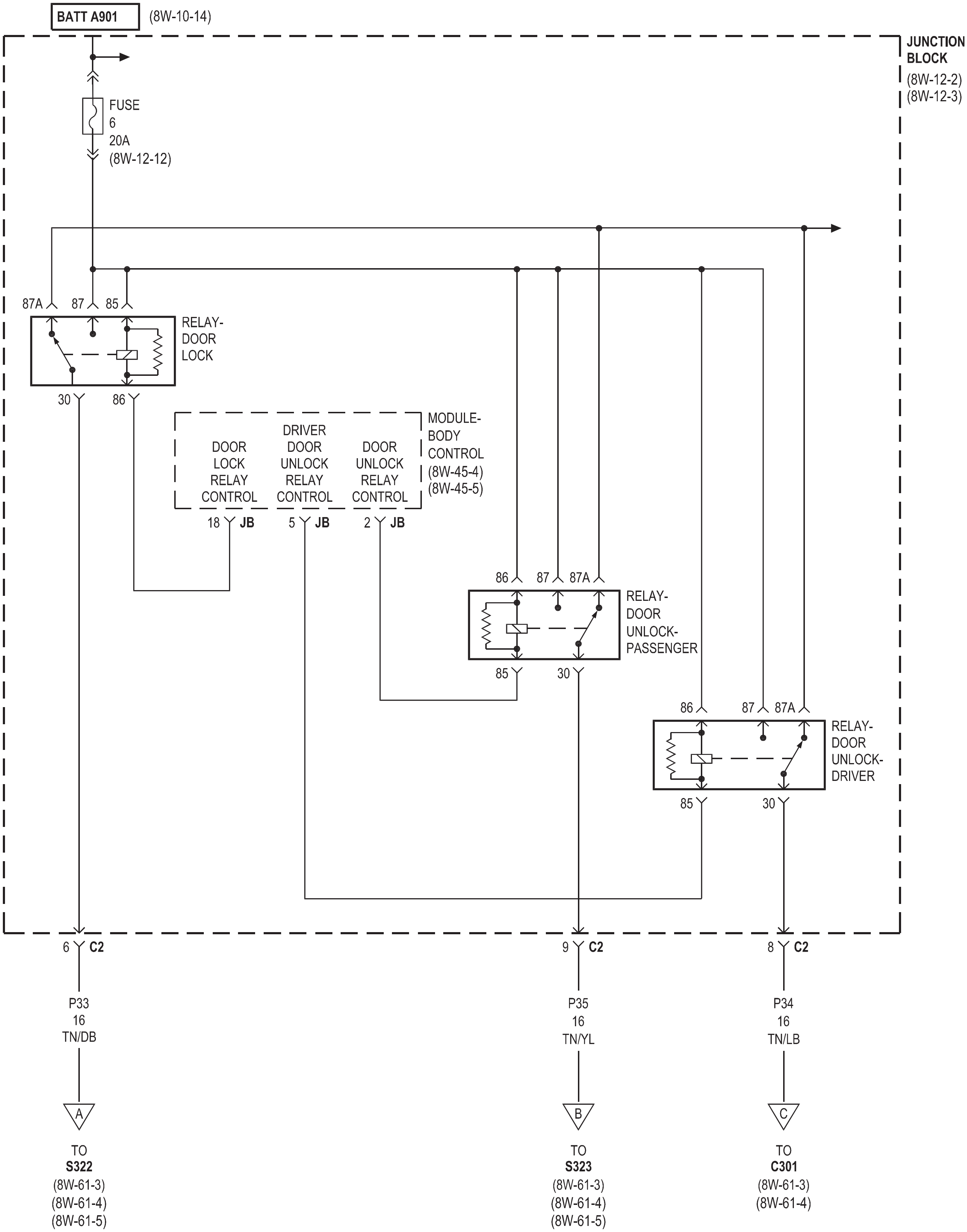

BATT A912
(8W-10-10)
BATT A139
(8W-10-17)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
ACCESSORY DELAY RELAY CONTROL
MODULE-BODY CONTROL
(8W-45-9)
FUSE
1
15A
(8W-12-9)
7 JB
86
30
RELAY-POWER WINDOW
85
87
87A
40 C2
F30
14
PK/YL
Z849
16
BK/OR
BASE AUDIO
EXCEPT BASE AUDIO
10
13
SWITCH-POWER WINDOW-MASTER
S332
(8W-15-11)
Z849
16
BK/OR
AUTO DOWN
AUTO DOWN
14
12
9
11
Q22
14
OR/VT
Q12
14
OR/BR
Q21
14
OR/WT
Q11
14
OR/LG
A
B
C
D
TO C301 (RHD) C315 (LHD)
(8W-60-3)
TO C301 (RHD) C315 (LHD)
(8W-60-3)
TO C301 (RHD) C315 (LHD)
(8W-60-3)
TO C301 (RHD) C315 (LHD)
(8W-60-3)
G301
(8W-15-11)


FROM
SWITCH-
POWER
WINDOW-
MASTER
(8W-60-2)
C
D
A
B
Q21
14
OR/WT
Q11
14
OR/LG
Q22
14
OR/VT
Q12
14
OR/BR
LHD
RHD
C315
C301
C303
Q21
16
OR/WT
Q11
16
OR/LG
Q22
16
OR/VT
Q12
16
OR/BR
M
MOTOR-
POWER
WINDOW-
DRIVER
MOTOR-
POWER
WINDOW-
PASSENGER

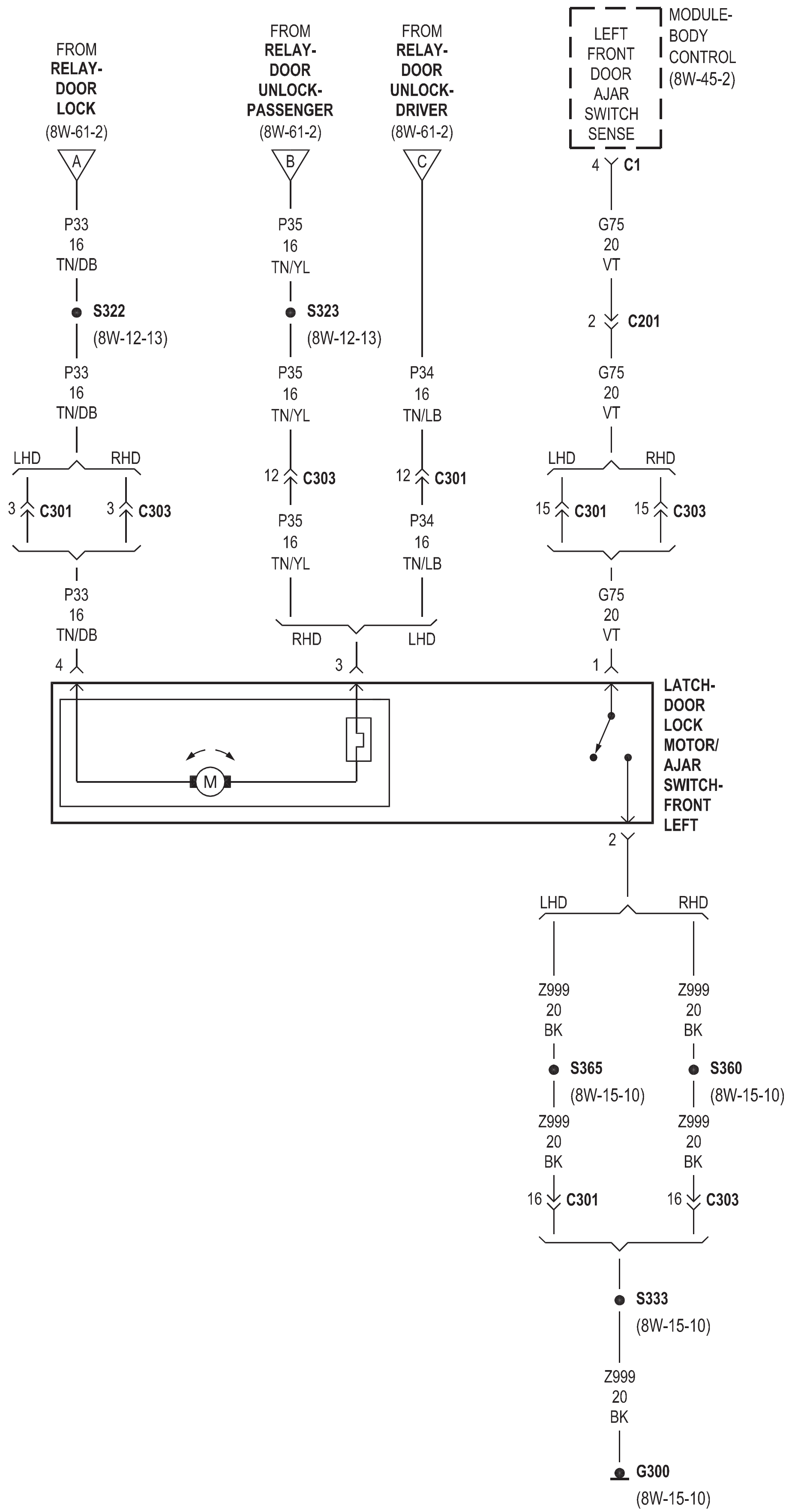


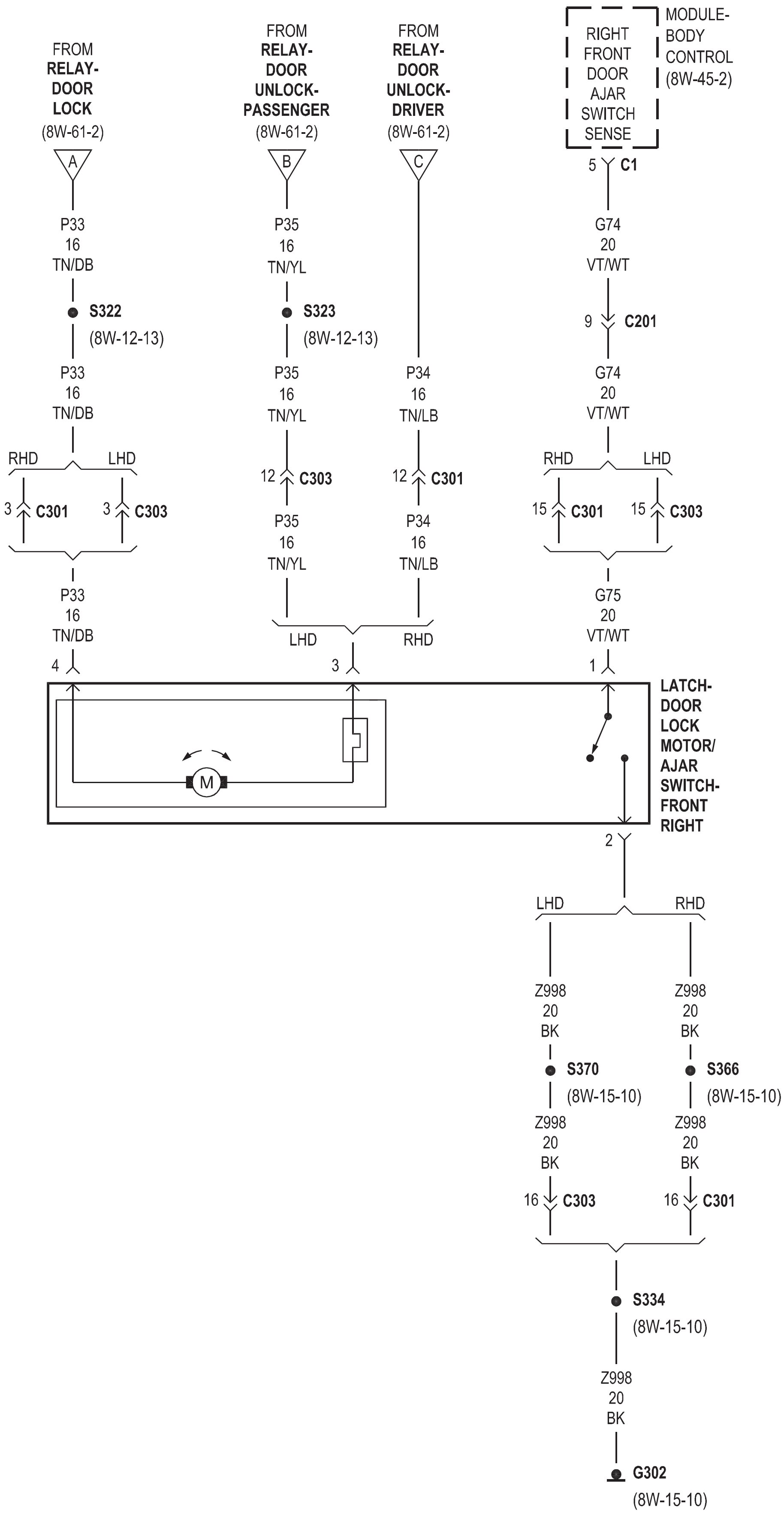
SWITCH-
POWER
WINDOW-
MASTER
7
6
2
5
4
Q612
14
DB/OR
Q412
14
LG/OR
Q1
14
YL/OR
Q611
14
GY/OR
Q411
14
WT/OR
S345
Q1
14
YL/OR
Q1
14
YL/OR
1
4
6
5
9
7
SWITCH-
POWER
WINDOW-
REAR
3
2
8
10
Q21
14
OR/WT
Q11
14
OR/BR
Q111
14
TN/LB
Q211
14
TN/YL
RHD
LHD
LHD
RHD
LHD
RHD
LHD
RHD
4
3
C315
4
3
C315
Q212
14
OR/VT
Q112
14
OR/BR
Q111
14
TN/YL
Q211
14
TN/LB
8
7
C304
8
7
C305
Q212
16
OR/VT
Q112
16
BR
Q111
16
TN/YL
Q211
16
TN/LB
1
2
1
2
M
MOTOR-
WINDOW-
RIGHT
REAR
M
MOTOR-
WINDOW-
LEFT
REAR

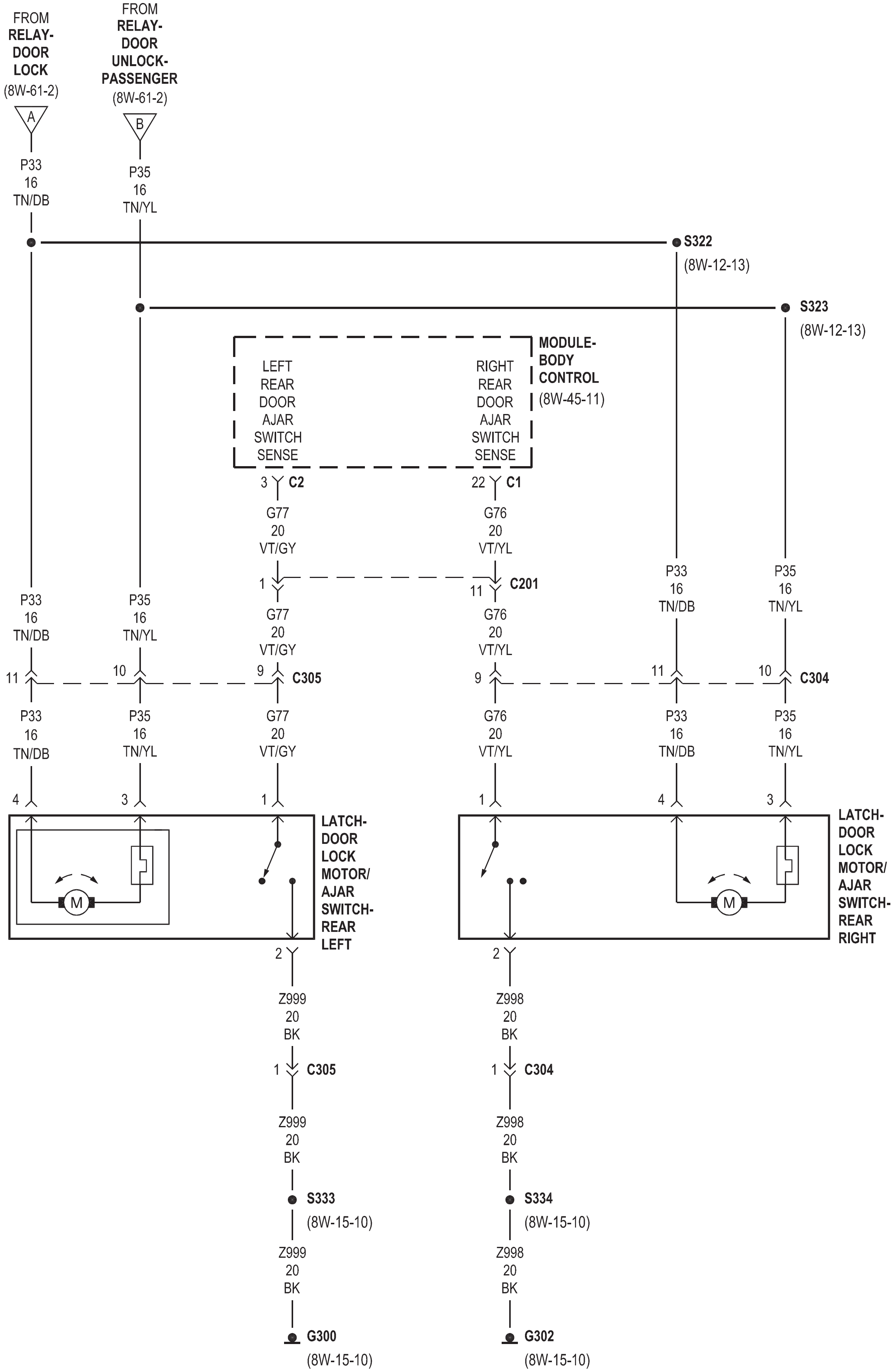
# 8W-61 POWER DOOR LOCKS

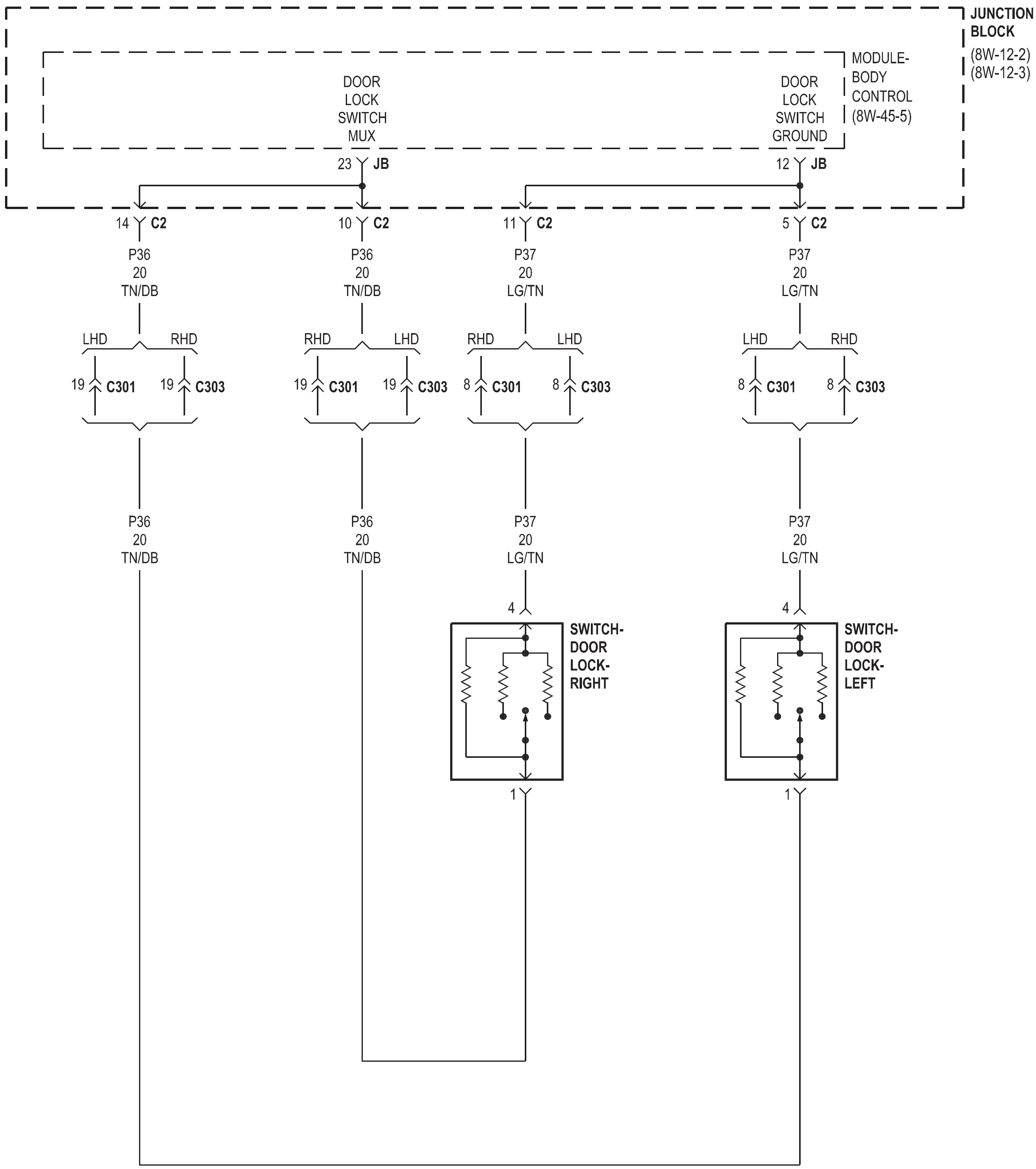


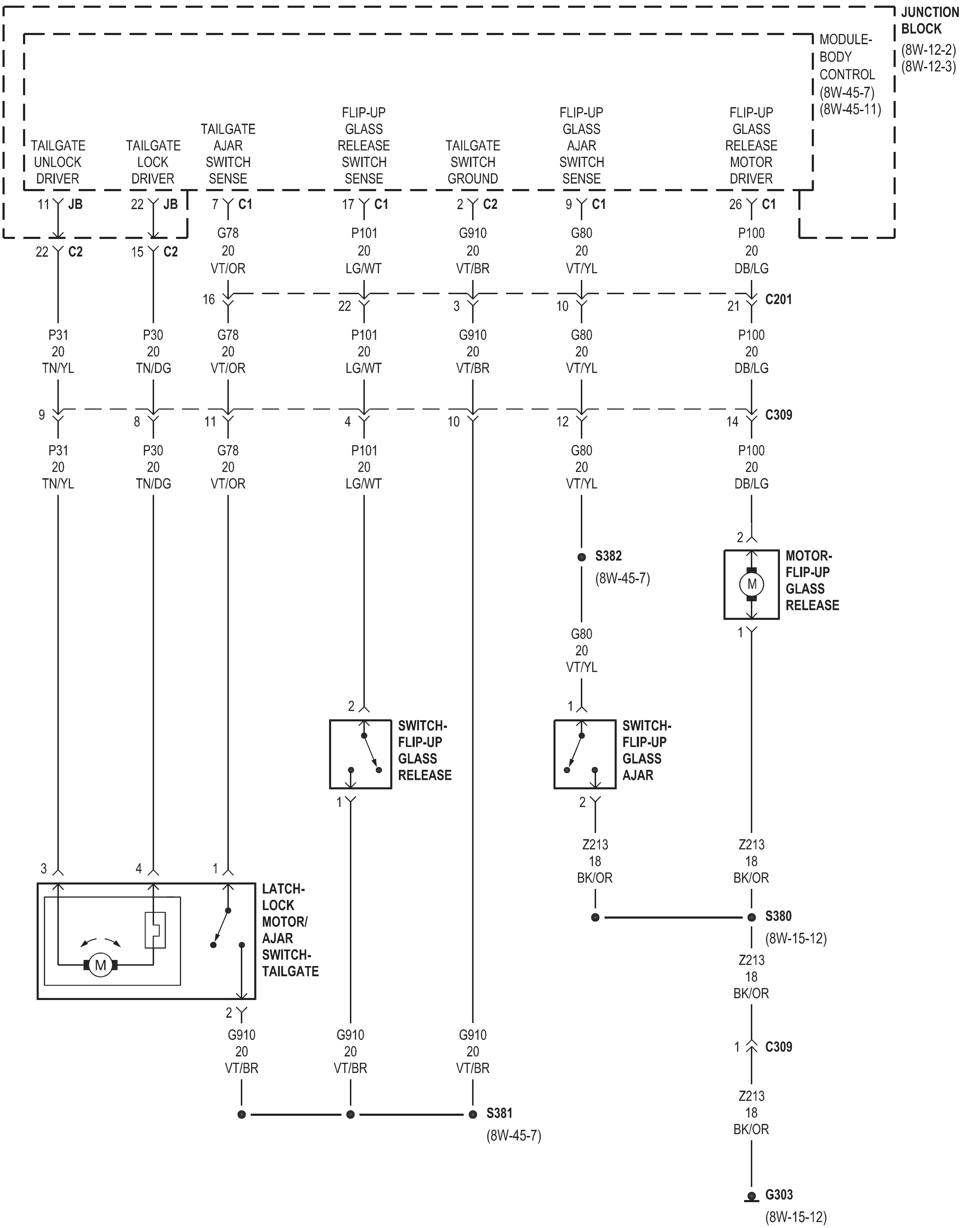
BATT A901
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
20A
(8W-12-12)
87A
87
85
RELAY-DOOR LOCK
30
86
MODULE-BODY CONTROL
(8W-45-4)
(8W-45-5)
DOOR LOCK RELAY CONTROL
DRIVER DOOR UNLOCK RELAY CONTROL
DOOR UNLOCK RELAY CONTROL
18 JB
5 JB
2 JB
86
87
87A
RELAY-DOOR UNLOCK-PASSENGER
85
30
86
87
87A
RELAY-DOOR UNLOCK-DRIVER
85
30
6 C2
9 C2
8 C2
P33
16
TN/DB
P35
16
TN/YL
P34
16
TN/LB
A
B
C
TO S322
(8W-61-3)
(8W-61-4)
(8W-61-5)
TO S323
(8W-61-3)
(8W-61-4)
(8W-61-5)
TO C301
(8W-61-3)
(8W-61-4)


FROM
RELAY-DOOR LOCK
(8W-61-2)
A
P33 16 TN/DB
S322
(8W-12-13)
P33 16 TN/DB
LHD RHD
3 C301
3 C303
P33 16 TN/DB
4
FROM
RELAY-DOOR UNLOCK-PASSENGER
(8W-61-2)
B
P35 16 TN/YL
S323
(8W-12-13)
P35 16 TN/YL
12 C303
P35 16 TN/YL
FROM
RELAY-DOOR UNLOCK-DRIVER
(8W-61-2)
C
P34 16 TN/LB
12 C301
P34 16 TN/LB
RHD LHD
3
LEFT FRONT DOOR AJAR SWITCH SENSE
MODULE-BODY CONTROL
(8W-45-2)
4 C1
G75 20 VT
2 C201
G75 20 VT
LHD RHD
15 C301
15 C303
G75 20 VT
1
M
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT LEFT
2
LHD RHD
Z999 20 BK
S365
(8W-15-10)
Z999 20 BK
16 C301
Z999 20 BK
S360
(8W-15-10)
Z999 20 BK
16 C303
S333
(8W-15-10)
Z999 20 BK
G300
(8W-15-10)

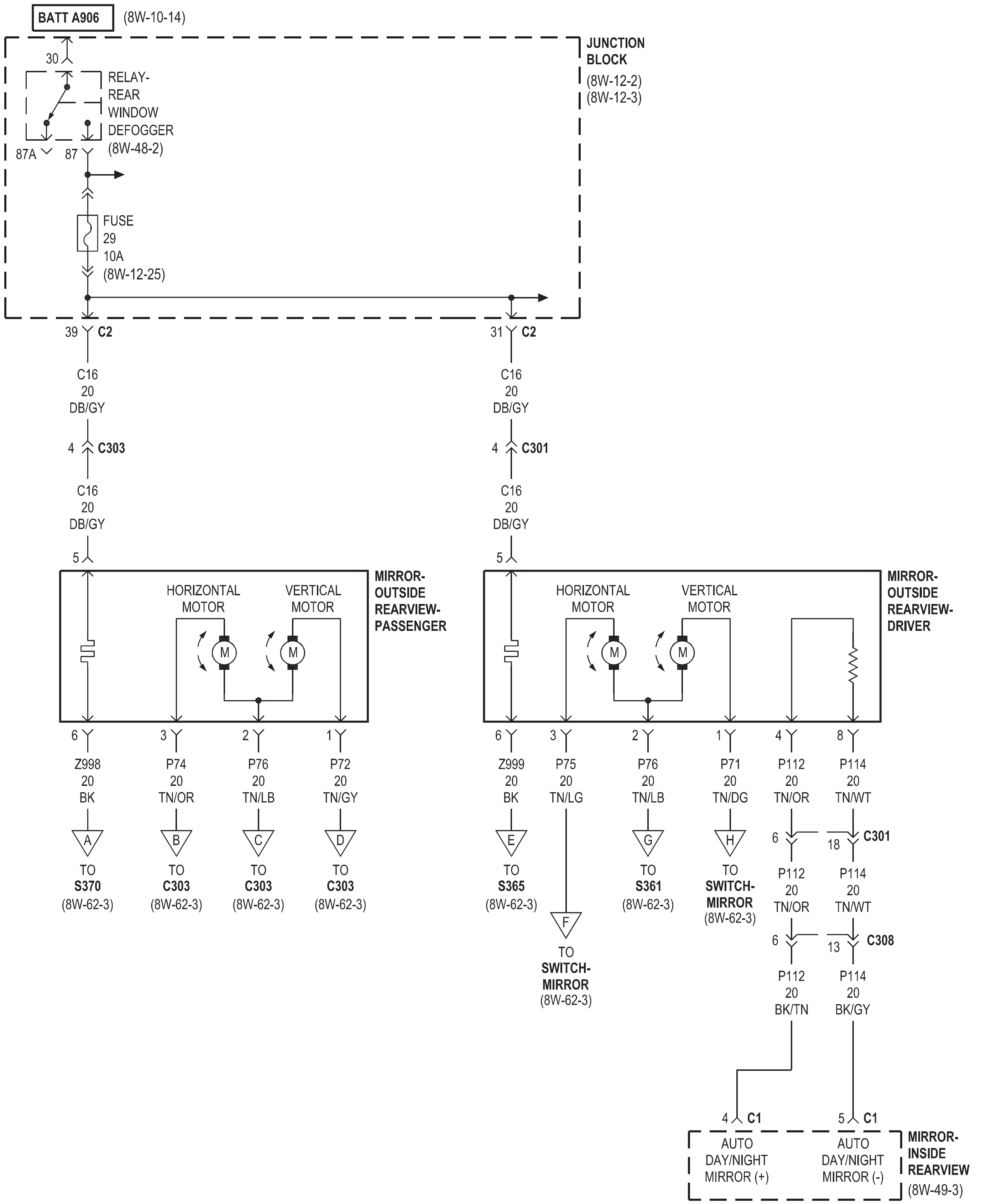

FROM
RELAY-
DOOR
LOCK
(8W-61-2)
A
P33
16
TN/DB
S322
(8W-12-13)
P33
16
TN/DB
RHD
LHD
3
C301
3
C303
P33
16
TN/DB
4
FROM
RELAY-
DOOR
UNLOCK-
PASSENGER
(8W-61-2)
B
P35
16
TN/YL
S323
(8W-12-13)
P35
16
TN/YL
12
C303
P35
16
TN/YL
LHD
3
FROM
RELAY-
DOOR
UNLOCK-
DRIVER
(8W-61-2)
C
P34
16
TN/LB
12
C301
P34
16
TN/LB
RHD
RIGHT
FRONT
DOOR
AJAR
SWITCH
SENSE
MODULE-
BODY
CONTROL
(8W-45-2)
5
C1
G74
20
VT/WT
9
C201
G74
20
VT/WT
RHD
LHD
15
C301
15
C303
G75
20
VT/WT
1
M
LATCH-
DOOR
LOCK
MOTOR/
AJAR
SWITCH-
FRONT
RIGHT
2
LHD
RHD
Z998
20
BK
S370
(8W-15-10)
Z998
20
BK
16
C303
Z998
20
BK
S366
(8W-15-10)
Z998
20
BK
16
C301
S334
(8W-15-10)
Z998
20
BK
G302
(8W-15-10)

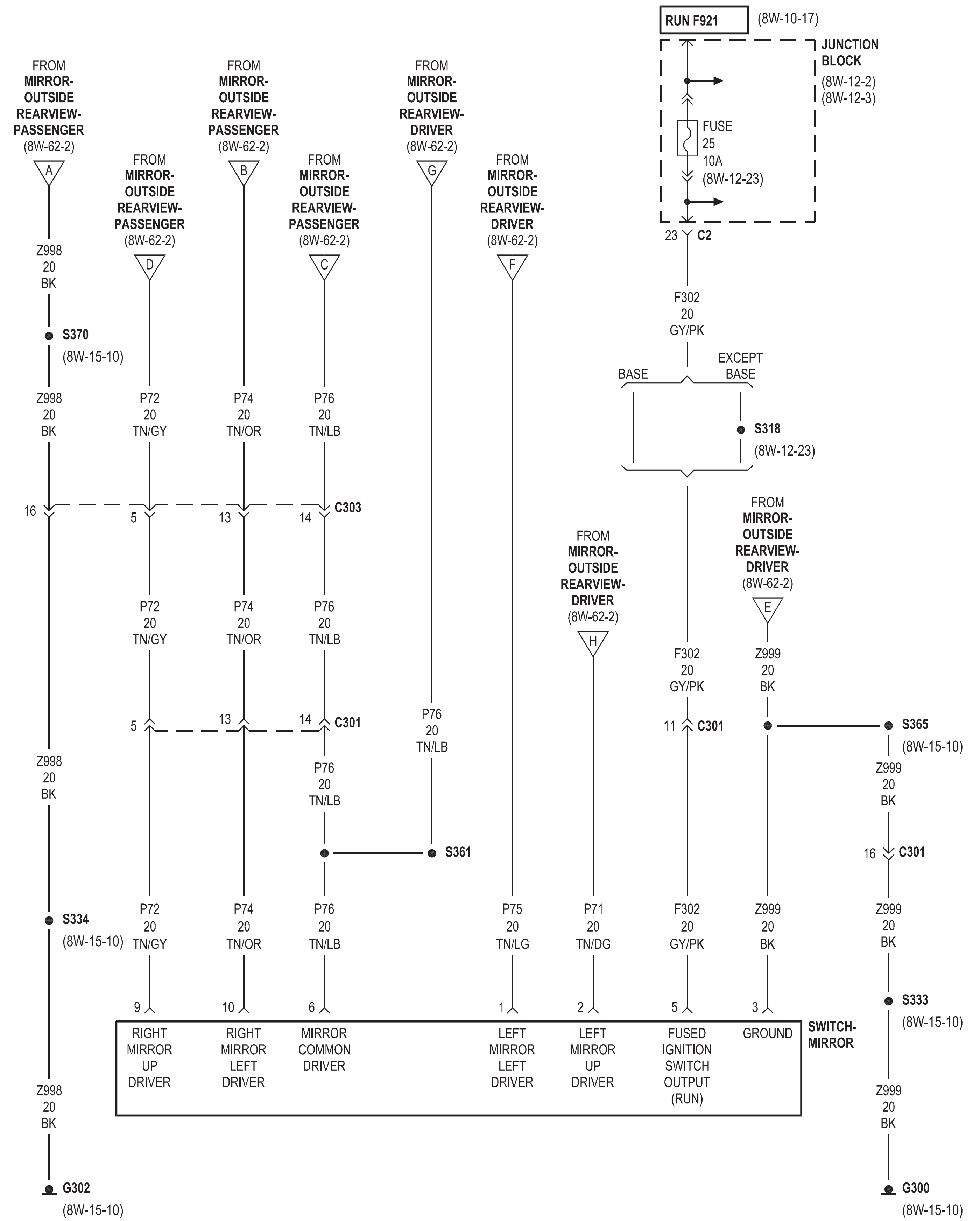

FROM
RELAY-DOOR LOCK
(8W-61-2)
A
FROM
RELAY-DOOR UNLOCK-PASSENGER
(8W-61-2)
B
P33 16 TN/DB
P35 16 TN/YL
S322
(8W-12-13)
S323
(8W-12-13)
MODULE-BODY CONTROL
(8W-45-11)
LEFT REAR DOOR AJAR SWITCH SENSE
RIGHT REAR DOOR AJAR SWITCH SENSE
3 C2
22 C1
G77 20 VT/GY
G76 20 VT/YL
1
11 C201
11
10
9 C305
9
10 C304
4
3
1
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-REAR LEFT
LATCH-DOOR LOCK MOTOR/AJAR SWITCH-REAR RIGHT
M
2
Z999 20 BK
Z998 20 BK
1 C305
1 C304
S333
(8W-15-10)
S334
(8W-15-10)
G300
(8W-15-10)
G302
(8W-15-10)


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
MODULE-BODY CONTROL
(8W-45-5)
DOOR LOCK SWITCH MUX
DOOR LOCK SWITCH GROUND
23 JB
12 JB
14 C2
10 C2
11 C2
5 C2
P36 20 TN/DB
P37 20 LG/TN
LHD
RHD
19 C301
19 C303
8 C301
8 C303
4
1
SWITCH-DOOR LOCK-RIGHT
SWITCH-DOOR LOCK-LEFT

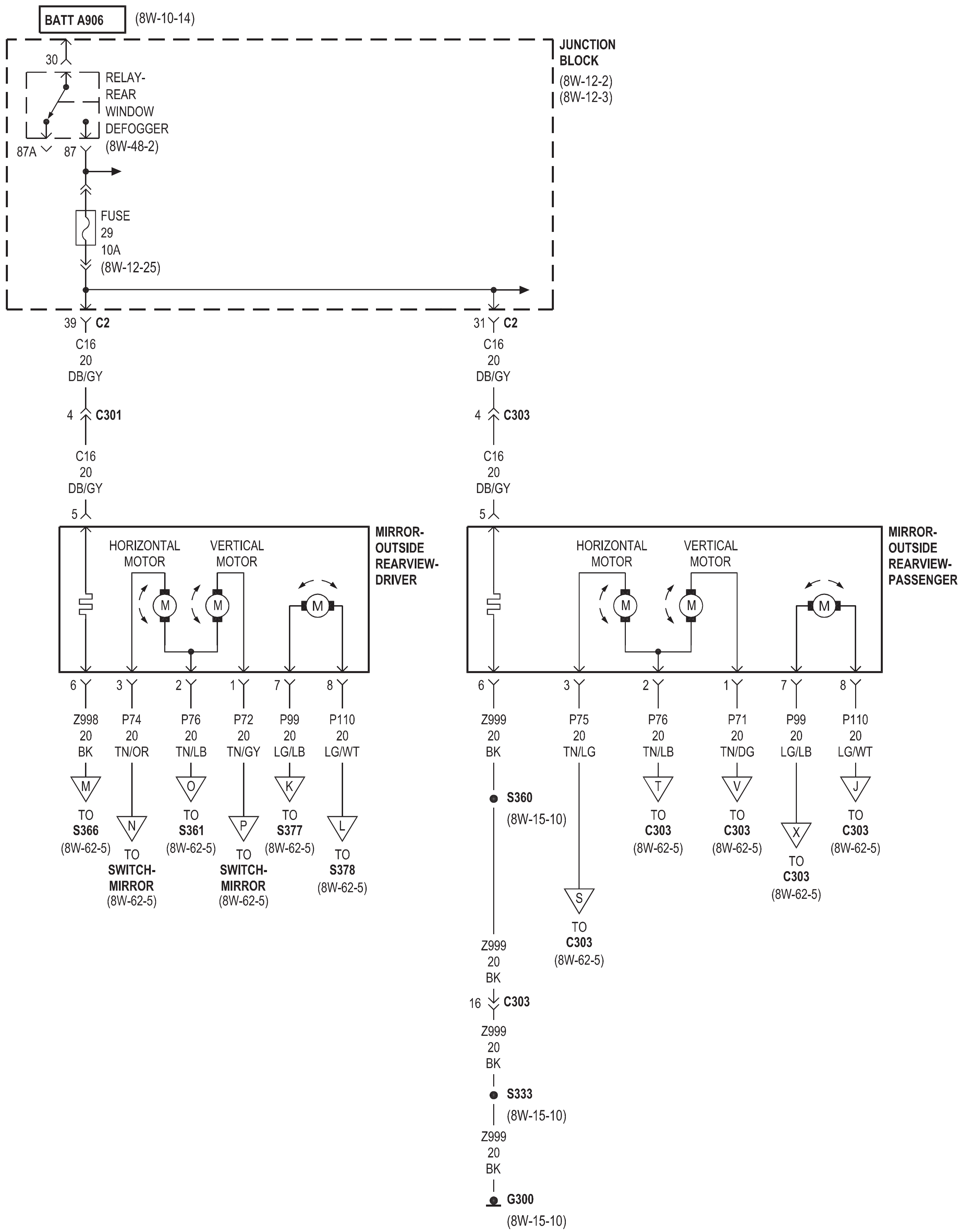

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
MODULE-BODY CONTROL
(8W-45-7)
(8W-45-11)
TAILGATE UNLOCK DRIVER
TAILGATE LOCK DRIVER
TAILGATE AJAR SWITCH SENSE
FLIP-UP GLASS RELEASE SWITCH SENSE
TAILGATE SWITCH GROUND
FLIP-UP GLASS AJAR SWITCH SENSE
FLIP-UP GLASS RELEASE MOTOR DRIVER
11 JB
22 JB
7 C1
17 C1
2 C2
9 C1
26 C1
22 C2
15 C2
G78 20 VT/OR
P101 20 LG/WT
G910 20 VT/BR
G80 20 VT/YL
P100 20 DB/LG
C201
P31 20 TN/YL
P30 20 TN/DG
C309
S382
(8W-45-7)
MOTOR-FLIP-UP GLASS RELEASE
SWITCH-FLIP-UP GLASS RELEASE
SWITCH-FLIP-UP GLASS AJAR
LATCH-LOCK MOTOR/ AJAR SWITCH-TAILGATE
Z213 18 BK/OR
S380
(8W-15-12)
S381
(8W-45-7)
G303
(8W-15-12)

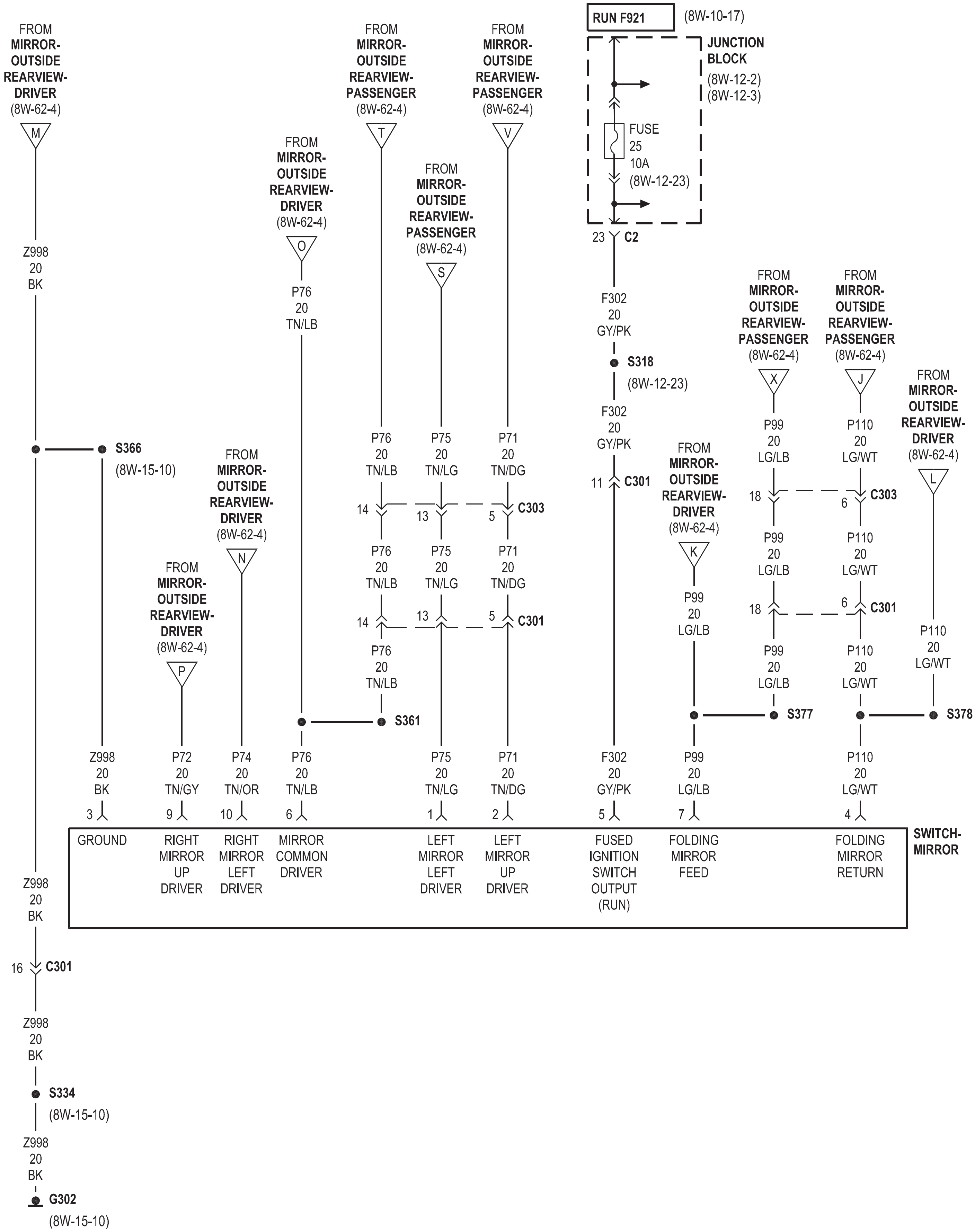
# 8W-62 POWER MIRRORS


BATT A906
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
30
RELAY-REAR WINDOW DEFOGGER
(8W-48-2)
87A
87
FUSE
29
10A
(8W-12-25)
39 C2
31 C2
C16
20
DB/GY
4 C303
4 C301
5
MIRROR-OUTSIDE REARVIEW-PASSENGER
MIRROR-OUTSIDE REARVIEW-DRIVER
HORIZONTAL MOTOR
VERTICAL MOTOR
M
6 Z998 20 BK
3 P74 20 TN/OR
2 P76 20 TN/LB
1 P72 20 TN/GY
A TO S370 (8W-62-3)
B TO C303 (8W-62-3)
C TO C303 (8W-62-3)
D TO C303 (8W-62-3)
6 Z999 20 BK
3 P75 20 TN/LG
2 P76 20 TN/LB
1 P71 20 TN/DG
4 P112 20 TN/OR
8 P114 20 TN/WT
E TO S365 (8W-62-3)
F TO SWITCH-MIRROR (8W-62-3)
G TO S361 (8W-62-3)
H TO SWITCH-MIRROR (8W-62-3)
6
18 C301
P112 20 TN/OR
P114 20 TN/WT
6
13 C308
P112 20 BK/TN
P114 20 BK/GY
4 C1
5 C1
AUTO DAY/NIGHT MIRROR (+)
AUTO DAY/NIGHT MIRROR (-)
MIRROR-INSIDE REARVIEW
(8W-49-3)


RUN F921
(8W-10-17)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
25
10A
(8W-12-23)
23 C2
F302
20
GY/PK
BASE
EXCEPT BASE
S318
(8W-12-23)
FROM MIRROR-OUTSIDE REARVIEW-PASSENGER
(8W-62-2)
A
B
C
D
FROM MIRROR-OUTSIDE REARVIEW-DRIVER
(8W-62-2)
G
F
H
E
Z998
20
BK
S370
(8W-15-10)
P72
20
TN/GY
P74
20
TN/OR
P76
20
TN/LB
16
5
13
14
C303
C301
11
P76
20
TN/LB
S361
S334
(8W-15-10)
P75
20
TN/LG
P71
20
TN/DG
Z999
20
BK
S365
(8W-15-10)
16 C301
S333
(8W-15-10)
9
10
6
1
2
5
3
RIGHT MIRROR UP DRIVER
RIGHT MIRROR LEFT DRIVER
MIRROR COMMON DRIVER
LEFT MIRROR LEFT DRIVER
LEFT MIRROR UP DRIVER
FUSED IGNITION SWITCH OUTPUT (RUN)
GROUND
SWITCH-MIRROR
G302
(8W-15-10)
G300
(8W-15-10)

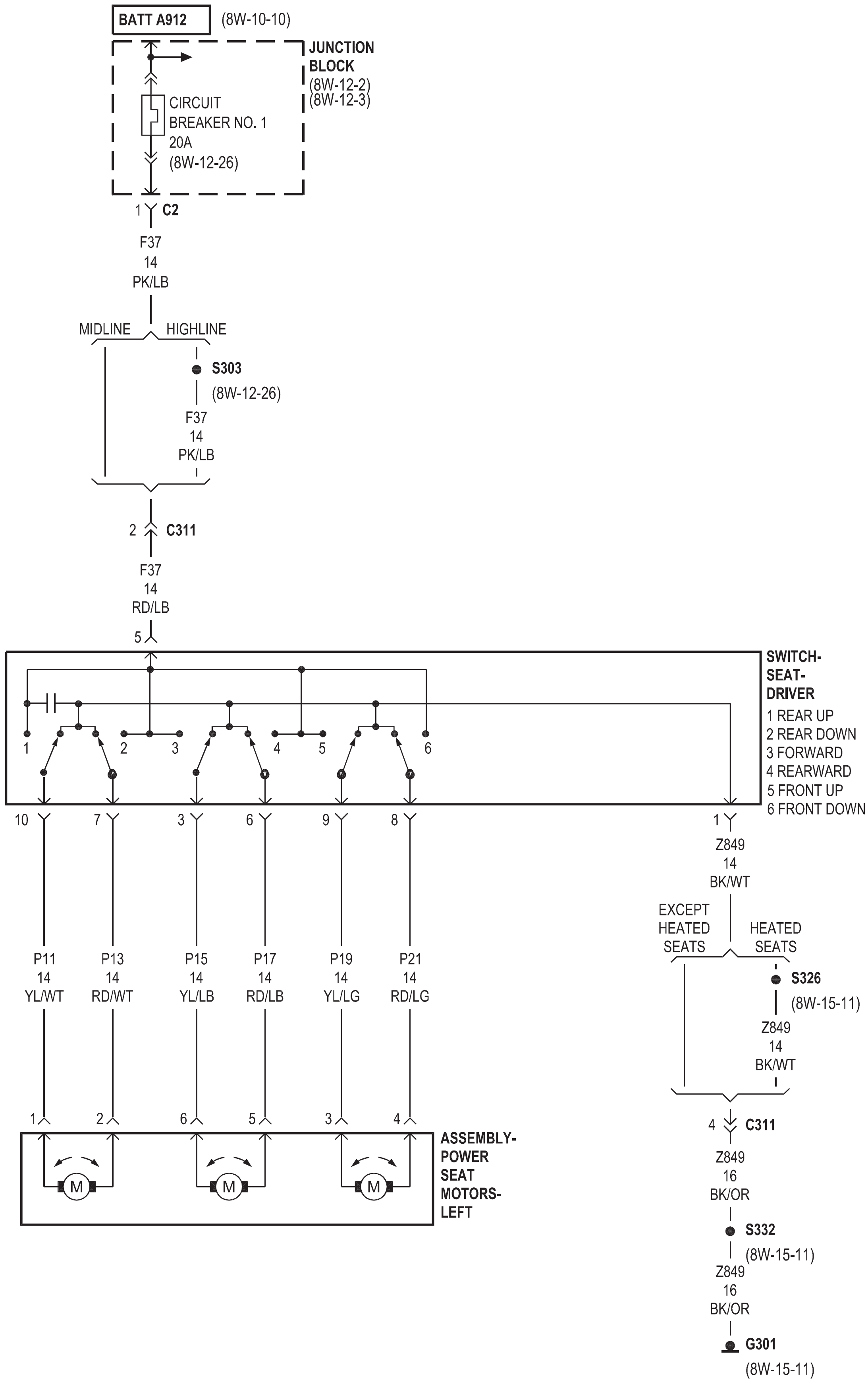
# RHD EXCEPT BASE

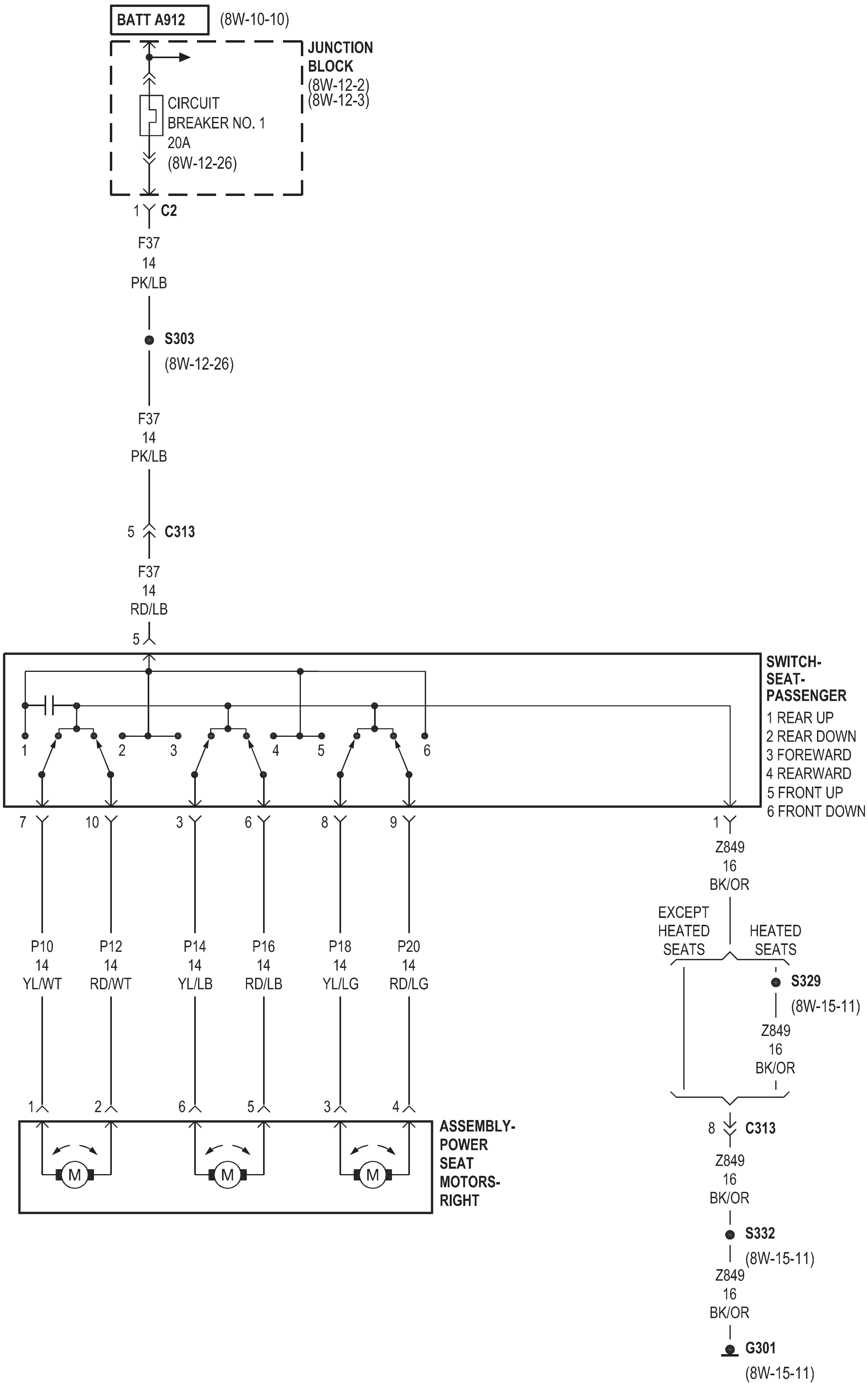





KJ606205 J068W-2

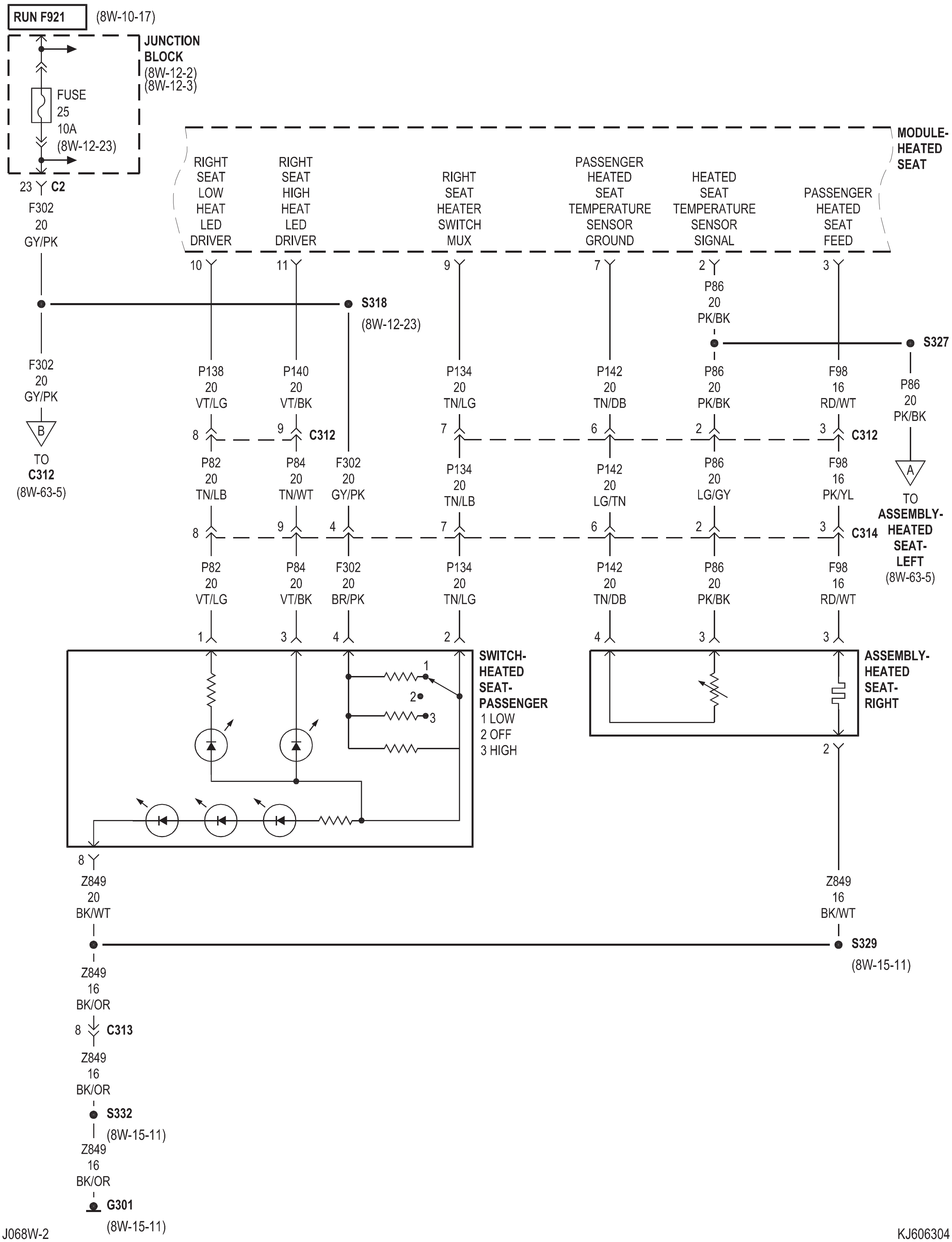
# 8W-63 POWER SEAT


BATT A912
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 1
20A
(8W-12-26)
1 C2
F37
14
PK/LB
MIDLINE
HIGHLINE
S303
(8W-12-26)
F37
14
PK/LB
2 C311
F37
14
RD/LB
5
SWITCH-SEAT-DRIVER
1 REAR UP
2 REAR DOWN
3 FORWARD
4 REARWARD
5 FRONT UP
6 FRONT DOWN
1 2 3 4 5 6
10 7 3 6 9 8
1
Z849
14
BK/WT
EXCEPT HEATED SEATS
HEATED SEATS
S326
(8W-15-11)
Z849
14
BK/WT
P11 14 YL/WT
P13 14 RD/WT
P15 14 YL/LB
P17 14 RD/LB
P19 14 YL/LG
P21 14 RD/LG
1 2 6 5 3 4
M
M
M
ASSEMBLY-POWER SEAT MOTORS-LEFT
4 C311
Z849
16
BK/OR
S332
(8W-15-11)
Z849
16
BK/OR
G301
(8W-15-11)

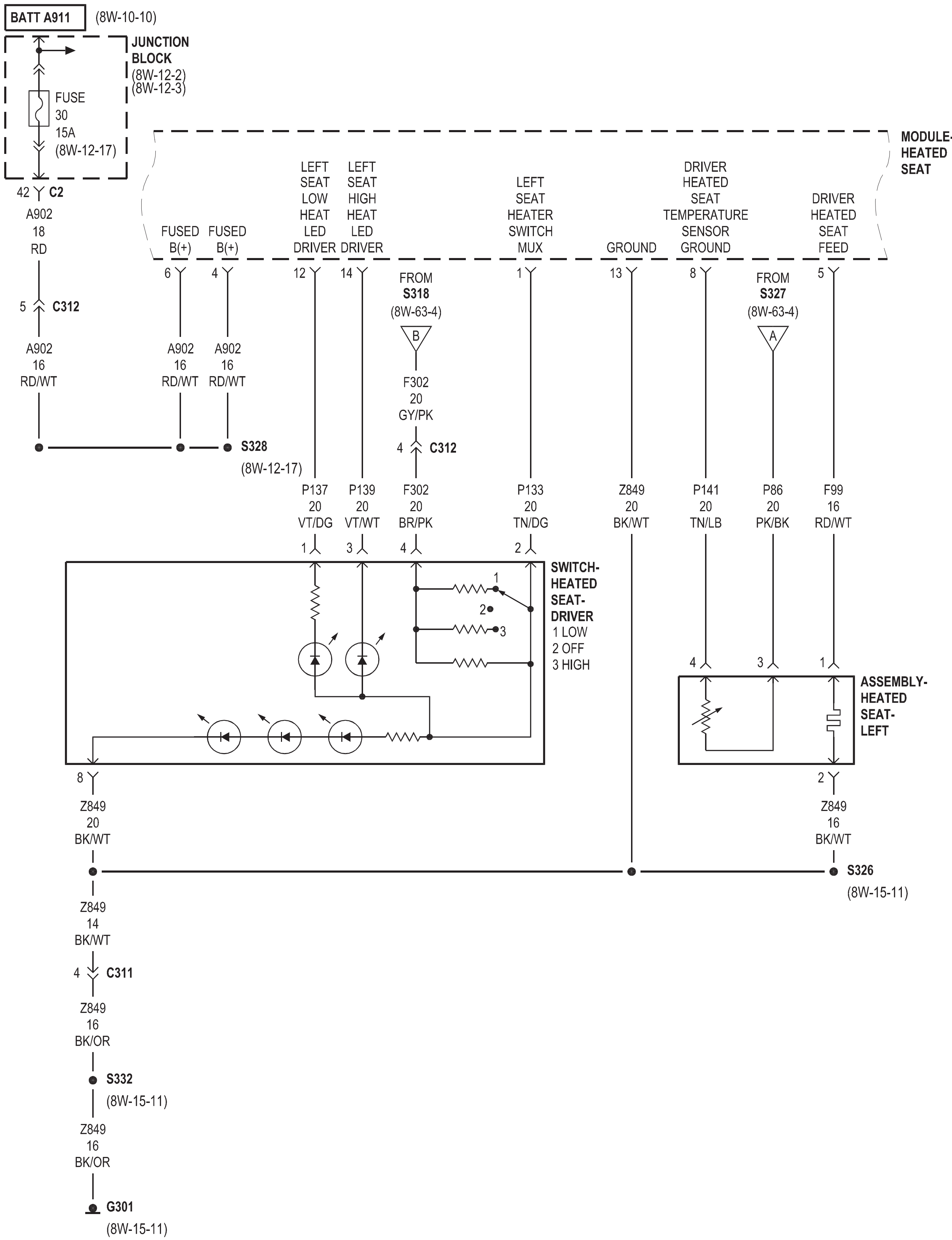


BATT A912
(8W-10-10)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 1
20A
(8W-12-26)
1 C2
F37
14
PK/LB
S303
(8W-12-26)
F37
14
PK/LB
5 C313
F37
14
RD/LB
5
SWITCH-SEAT-PASSENGER
1 REAR UP
2 REAR DOWN
3 FOREWARD
4 REARWARD
5 FRONT UP
6 FRONT DOWN
1 2 3 4 5 6
7 10 3 6 8 9 1
Z849
16
BK/OR
EXCEPT HEATED SEATS
HEATED SEATS
P10 14 YL/WT
P12 14 RD/WT
P14 14 YL/LB
P16 14 RD/LB
P18 14 YL/LG
P20 14 RD/LG
S329
(8W-15-11)
Z849
16
BK/OR
1 2 6 5 3 4
M M M
ASSEMBLY-POWER SEAT MOTORS-RIGHT
8 C313
Z849
16
BK/OR
S332
(8W-15-11)
Z849
16
BK/OR
G301
(8W-15-11)

HEATED SEATS

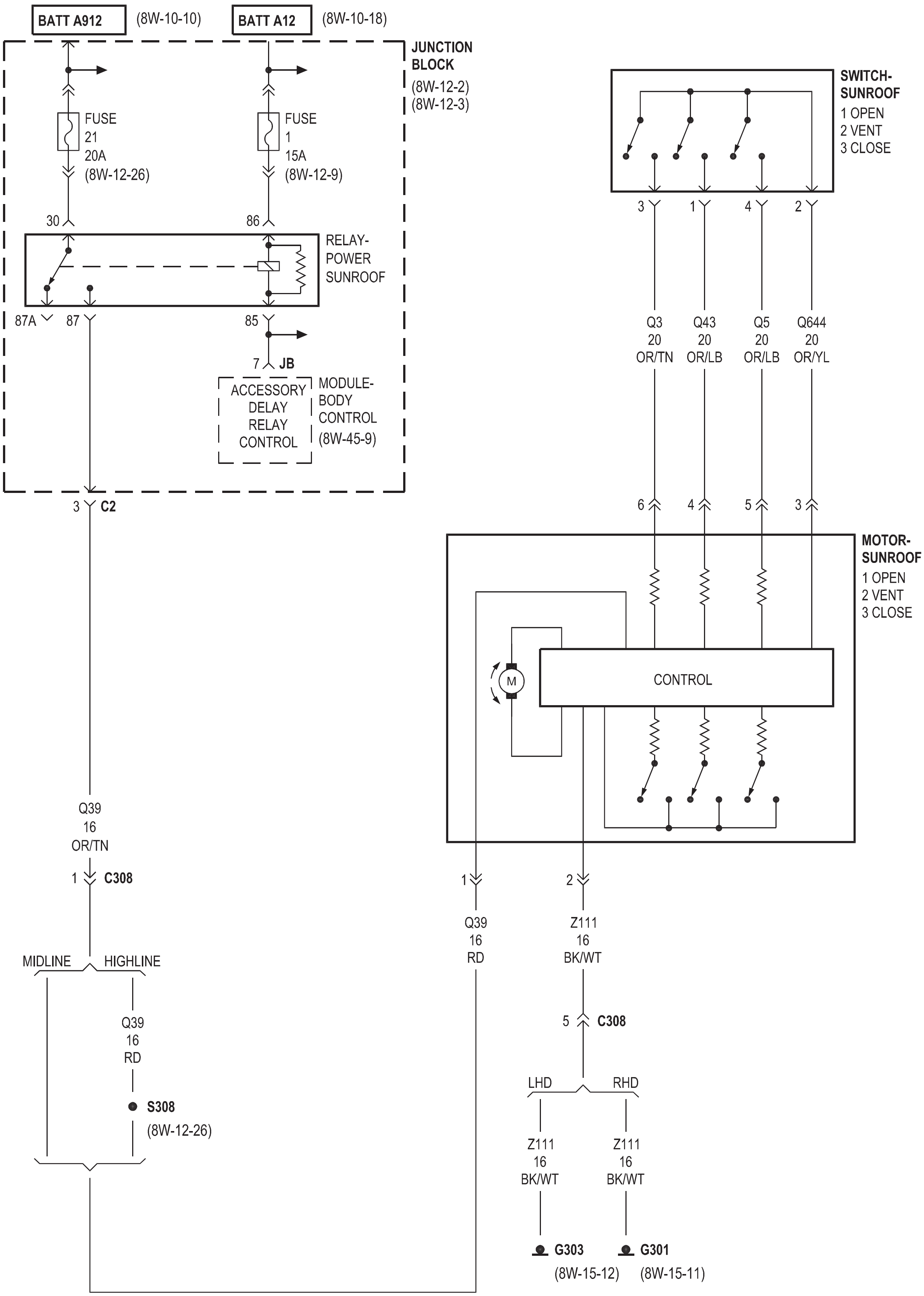


# HEATED SEATS

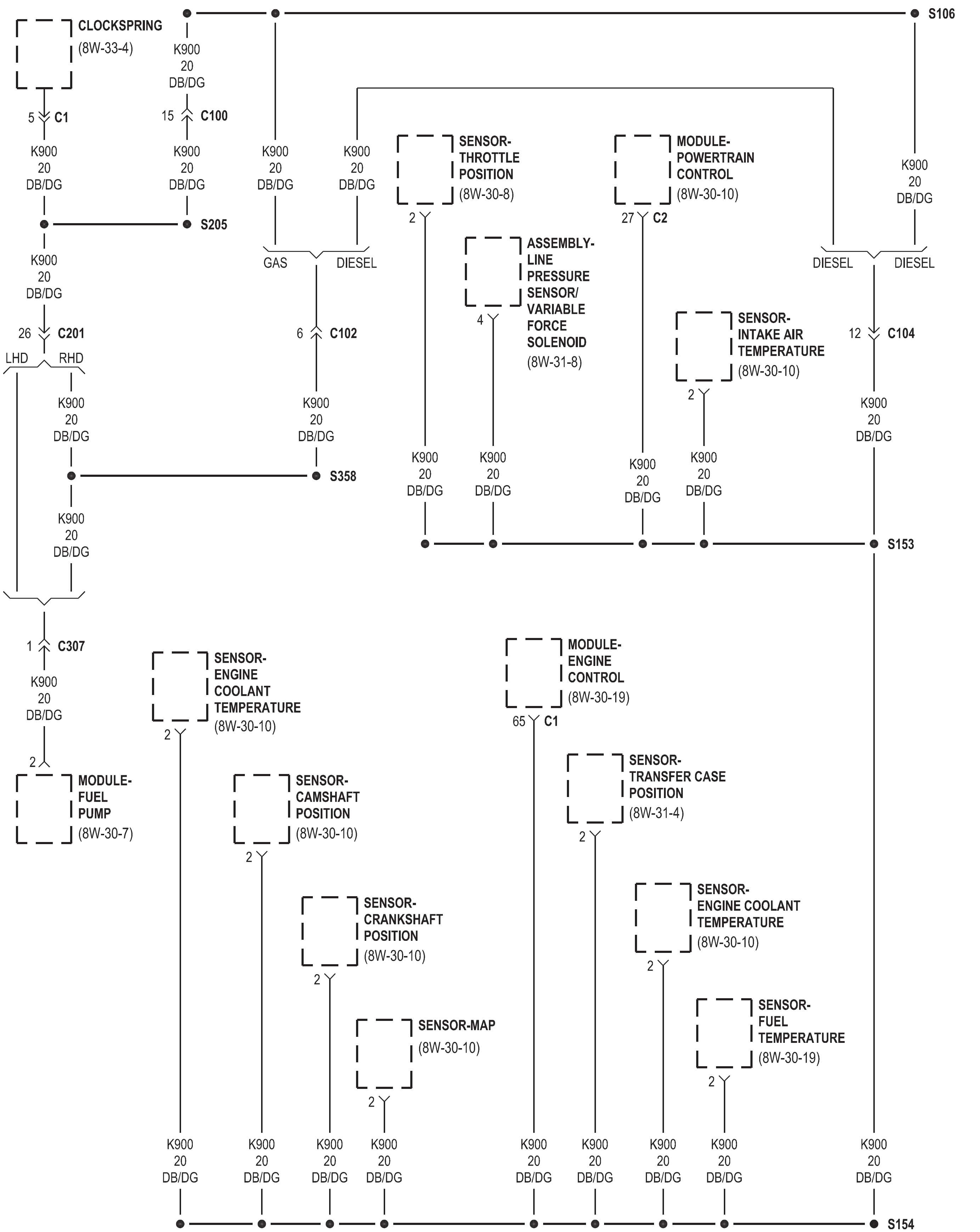


# 8W-64 POWER SUNROOF

# EXCEPT BASE

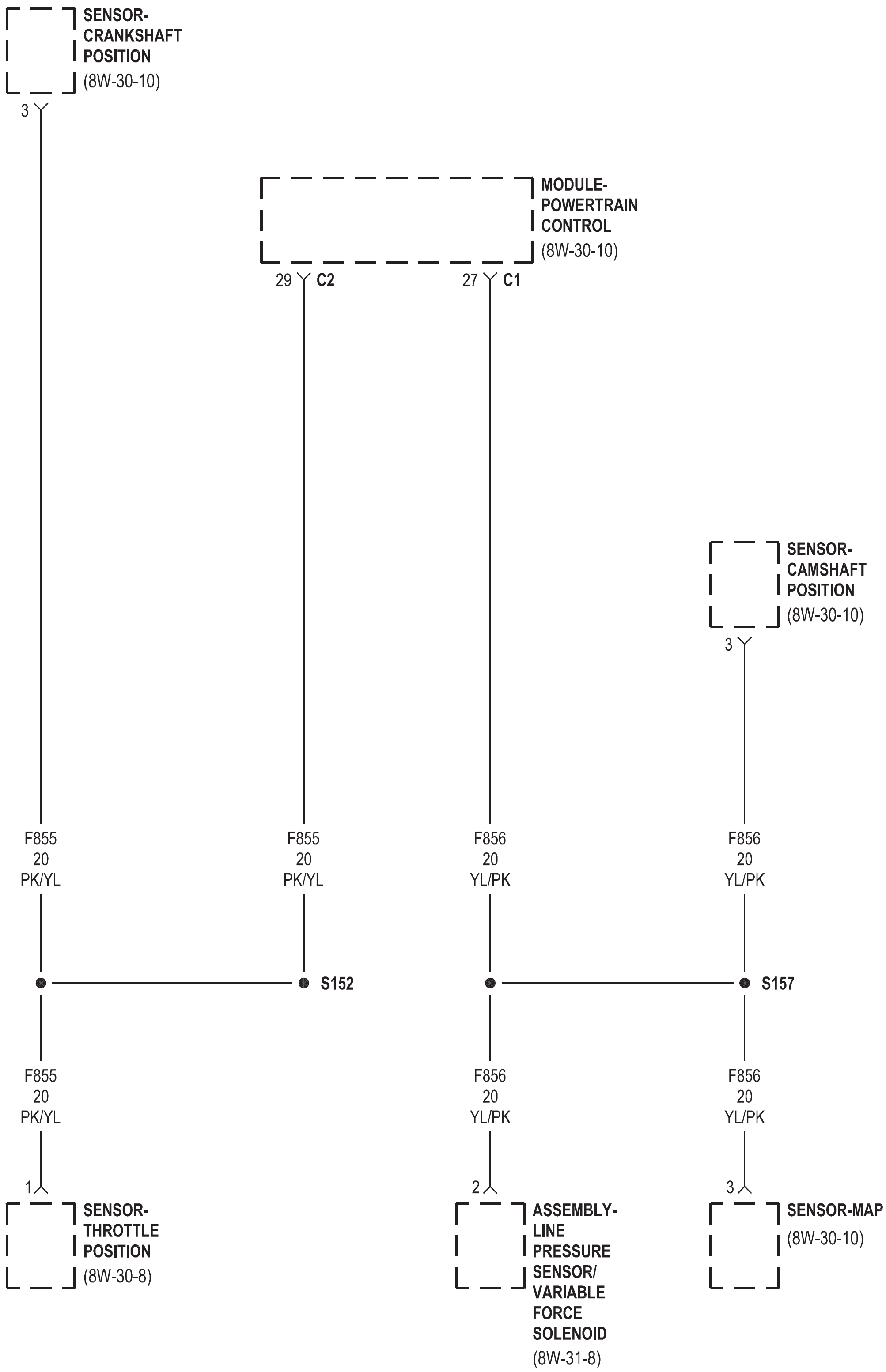

BATT A912
(8W-10-10)
BATT A12
(8W-10-18)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 21 20A (8W-12-26)
FUSE 1 15A (8W-12-9)
30
86
RELAY-POWER SUNROOF
87A
87
85
7 JB
ACCESSORY DELAY RELAY CONTROL
MODULE-BODY CONTROL
(8W-45-9)
3 C2
Q39 16 OR/TN
1 C308
MIDLINE
HIGHLINE
Q39 16 RD
S308
(8W-12-26)
SWITCH-SUNROOF
1 OPEN
2 VENT
3 CLOSE
3
1
4
2
Q3 20 OR/TN
Q43 20 OR/LB
Q5 20 OR/LB
Q644 20 OR/YL
6
4
5
3
MOTOR-SUNROOF
1 OPEN
2 VENT
3 CLOSE
M
CONTROL
1
2
Q39 16 RD
Z111 16 BK/WT
5 C308
LHD
RHD
Z111 16 BK/WT
Z111 16 BK/WT
G303
(8W-15-12)
G301
(8W-15-11)

# 8W-70 SPLICE INFORMATION

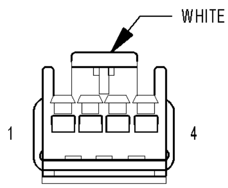


S106
CLOCKSPRING
(8W-33-4)
K900
20
DB/DG
5 C1
15 C100
S205
GAS
DIESEL
SENSOR-
THROTTLE
POSITION
(8W-30-8)
MODULE-
POWERTRAIN
CONTROL
(8W-30-10)
27 C2
ASSEMBLY-
LINE
PRESSURE
SENSOR/
VARIABLE
FORCE
SOLENOID
(8W-31-8)
26 C201
LHD
RHD
6 C102
SENSOR-
INTAKE AIR
TEMPERATURE
(8W-30-10)
12 C104
S358
S153
1 C307
SENSOR-
ENGINE
COOLANT
TEMPERATURE
(8W-30-10)
MODULE-
ENGINE
CONTROL
(8W-30-19)
65 C1
MODULE-
FUEL
PUMP
(8W-30-7)
SENSOR-
CAMSHAFT
POSITION
(8W-30-10)
SENSOR-
TRANSFER CASE
POSITION
(8W-31-4)
SENSOR-
CRANKSHAFT
POSITION
(8W-30-10)
SENSOR-
ENGINE COOLANT
TEMPERATURE
(8W-30-10)
SENSOR-MAP
(8W-30-10)
SENSOR-
FUEL
TEMPERATURE
(8W-30-19)
S154

GAS


SENSOR-
CRANKSHAFT
POSITION
(8W-30-10)
3
MODULE-
POWERTRAIN
CONTROL
(8W-30-10)
29 C2
27 C1
SENSOR-
CAMSHAFT
POSITION
(8W-30-10)
3
F855
20
PK/YL
F855
20
PK/YL
F856
20
YL/PK
F856
20
YL/PK
S152
S157
F855
20
PK/YL
F856
20
YL/PK
F856
20
YL/PK
1
2
3
SENSOR-
THROTTLE
POSITION
(8W-30-8)
ASSEMBLY-
LINE
PRESSURE
SENSOR/
VARIABLE
FORCE
SOLENOID
(8W-31-8)
SENSOR-MAP
(8W-30-10)

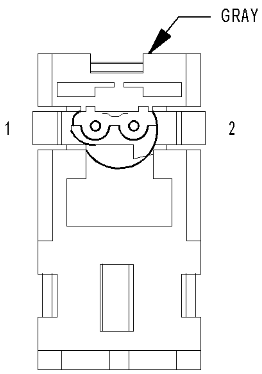
# 8W-80 CONNECTOR PIN-OUTS




ACTUATOR-BLEND DOOR

ACTUATOR-BLEND DOOR - WHITE 4 WAY

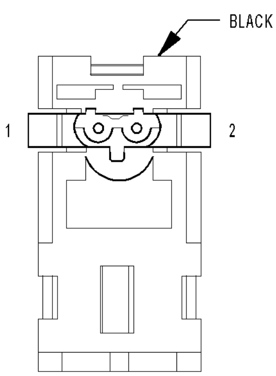
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z945 18BK | GROUND |
| 2 | C35 20LB/OR | MODE DOOR DRIVER (A) |
| 3 | F302 20GY/PK | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 4 | - | - |




AIRBAG-DRIVER SQUIB 1

AIRBAG-DRIVER SQUIB 1 - GRAY 2 WAY

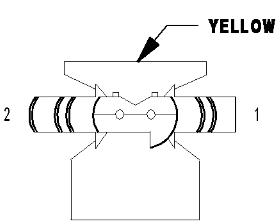
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R43 20LG/BR | DRIVER SQUIB 1 LINE 1 |
| 2 | R45 20LG/OR | DRIVER SQUIB 1 LINE 2 |




AIRBAG-DRIVER SQUIB 2

AIRBAG-DRIVER SQUIB 2 - BLACK 2 WAY

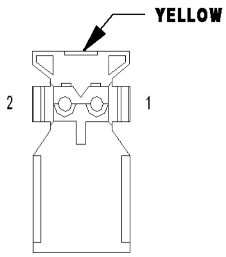
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R61 20LG/VT | DRIVER SQUIB 2 LINE 1 |
| 2 | R63 20LG/WT | DRIVER SQUIB 2 LINE 2 |




AIRBAG-PASSENGER SQUIB 1

AIRBAG-PASSENGER SQUIB 1 - YELLOW 2 WAY

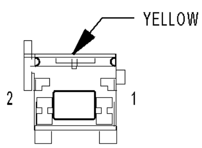
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R42 20BK/YL | PASSENGER SQUIB 1 LINE 1 |
| 2 | R44 20DG/YL | PASSENGER SQUIB 1 LINE 2 |




AIRBAG-PASSENGER SQUIB 2

AIRBAG-PASSENGER SQUIB 2 - YELLOW 2 WAY

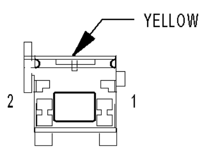
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R62 20OR/YL | PASSENGER SQUIB 2 LINE 2 |
| 2 | R64 20TN/YL | PASSENGER SQUIB 2 LINE 1 |




AIRBAG-SIDE CURTAIN-LEFT

AIRBAG-SIDE CURTAIN-LEFT - YELLOW 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R1 20LB/BR | LEFT CURTAIN SQUIB 1 LINE 2 |
| 2 | R3 20LB/OR | LEFT CURTAIN SQUIB 1 LINE 1 |




AIRBAG-SIDE CURTAIN-RIGHT

AIRBAG-SIDE CURTAIN-RIGHT - YELLOW 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R2 20WT/LB | RIGHT CURTAIN SQUIB 1 LINE 2 |
| 2 | R4 20OR/LB | RIGHT CURTAIN SQUIB 1 LINE 1 |

CONNECTOR NOT AVAILABLE

ASSEMBLY-EXHAUST GAS RECIRCULATION VALVE (DIESEL) - 6 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K347 20BR/PK | FUSED ASD RELAY OUTPUT |
| 2 | - | - |
| 3 | - | - |
| 4 | - | - |
| 5 | K35 20DB/VT | EGR SOLENOID CONTROL |
| 6 | - | - |

**CONNECTOR NOT AVAILABLE**

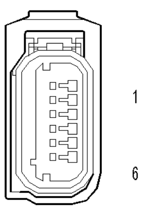
ASSEMBLY-HEATED SEAT-LEFT (HIGHLINE) - 4 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F99 16RD/WT | DRIVER HEATED SEAT FEED |
| 2 | Z849 16BK/WT | GROUND |
| 3 | P86 20PK/BK | HEATED SEAT TEMPERATURE SENSOR SIGNAL |
| 4 | P141 20TN/LB | DRIVER HEATED SEAT TEMPERATURE SENSOR GROUND |

**CONNECTOR NOT AVAILABLE**

ASSEMBLY-HEATED SEAT-RIGHT (HIGHLINE) - 4 WAY

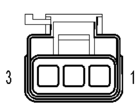
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F98 16RD/WT | PASSENGER HEATED SEAT FEED |
| 2 | Z849 16BK/WT | GROUND |
| 3 | P86 20PK/BK | HEATED SEAT TEMPERATURE SENSOR SIGNAL |
| 4 | P142 20TN/DB | PASSENGER HEATED SEAT TEMPERATURE SENSOR GROUND |




**ASSEMBLY-LINE PRESSURE SENSOR/VARIABLE FORCE SOLENOID**

ASSEMBLY-LINE PRESSURE SENSOR/VARIABLE FORCE SOLENOID - 6 WAY

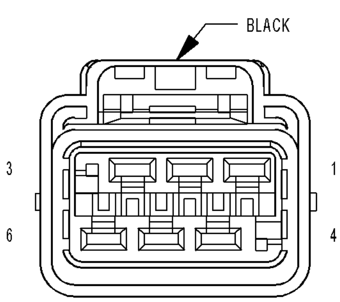
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | F856 20YL/PK | 5 VOLT SUPPLY |
| 3 | T38 20YL/BR | LINE PRESSURE SENSOR SIGNAL |
| 4 | K900 20DB/DG | SENSOR GROUND |
| 5 | T16 18YL/OR | TRANSMISSION CONTROL RELAY OUTPUT |
| 6 | T118 18YL/GY | PRESSURE CONTROL SOLENOID CONTROL |




**ASSEMBLY-NATURAL VACUUM LEAK DETECTION (GAS)**

ASSEMBLY-NATURAL VACUUM LEAK DETECTION (GAS) - 3 WAY

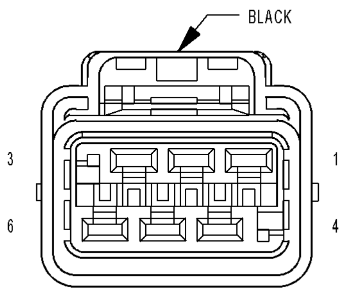
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z201 18BK | GROUND |
| 2 | K107 20VT/WT | NVLD SWITCH SIGNAL |
| 3 | K106 20VT/LB | NVLD SOL CONTROL |




**ASSEMBLY-POWER SEAT MOTORS-LEFT (MIDLINE/HIGHLINE)**

ASSEMBLY-POWER SEAT MOTORS-LEFT (MIDLINE/HIGHLINE) - BLACK 6 WAY

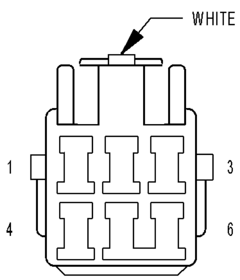
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | P11 14YL/WT | DRIVER SEAT REAR UP DRIVER |
| 2 | P13 14RD/WT | DRIVER SEAT REAR DOWN DRIVER |
| 3 | P19 14YL/LG | DRIVER SEAT FRONT UP DRIVER |
| 4 | P21 14RD/LG | DRIVER SEAT FRONT DOWN DRIVER |
| 5 | P17 14RD/LB | DRIVER SEAT HORIZONTAL REARWARD DRIVER |
| 6 | P15 14YL/LB | DRIVER SEAT HORIZONTAL FORWARD DRIVER |




**ASSEMBLY-POWER SEAT MOTORS-RIGHT (MIDLINE/HIGHLINE)**

ASSEMBLY-POWER SEAT MOTORS-RIGHT (MIDLINE/HIGHLINE) - BLACK 6 WAY

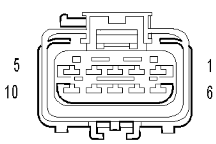
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | P10 14YL/WT | PASSENGER SEAT REAR UP DRIVER |
| 2 | P12 14RD/WT | PASSENGER SEAT REAR DOWN DRIVER |
| 3 | P18 14YL/LG | PASSENGER SEAT FRONT UP DRIVER |
| 4 | P20 14RD/LG | PASSENGER SEAT FRONT DOWN DRIVER |
| 5 | P16 14RD/LB | PASSENGER SEAT HORIZONTAL REARWARD DRIVER |
| 6 | P14 14YL/LB | PASSENGER SEAT HORIZONTAL FORWARD DRIVER |




**ASSEMBLY-SHIFT LEVER**

ASSEMBLY-SHIFT LEVER - WHITE 6 WAY

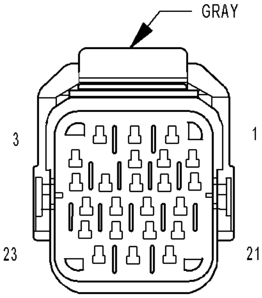
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | E2 20OR/BR | PANEL LAMPS DRIVER |
| 2 | Z936 20BK | GROUND |
| 3 | T6 20DG | TOW/HAUL OVERDRIVE OFF SWITCH SENSE |
| 4 | Z936 20BK | GROUND |
| 5 | F22 20PK/TN | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 6 | B15 20DG/WT (DIESEL) | SECONDARY BRAKE SWITCH SIGNAL |
| 6 | B15 20DG/WT (GAS) | BRAKE SWITCH NO. 1 SIGNAL |




**ASSEMBLY-TRANSMISSION SOLENOID/PRESSURE SWITCH (42RLE)**

ASSEMBLY-TRANSMISSION SOLENOID/PRESSURE SWITCH (42RLE) - 10 WAY

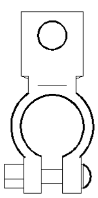
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | T60 18YL/GY | OD SOLENOID CONTROL |
| 2 | T59 18YL/LB | UD SOLENOID CONTROL |
| 3 | T16 16YL/OR | TRANSMISSION CONTROL RELAY OUTPUT |
| 4 | T19 18YL | 2-4 SOLENOID CONTROL |
| 5 | T47 20YL/DG | 2-4 PRESSURE SWITCH SENSE |
| 6 | T9 20DG/TN | OD PRESSURE SWITCH SENSE |
| 7 | T20 18DG/WT | L/R SOLENOID CONTROL |
| 8 | - | - |
| 9 | - | - |
| 10 | T50 20YL/TN | L/R PRESSURE SWITCH SENSE |




ASSEMBLY-TRANSMISSION SOLENOID/TRS (2.8L 45RFE)

ASSEMBLY-TRANSMISSION SOLENOID/TRS (2.8L 45RFE) - GRAY 23 WAY

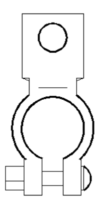
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | C115 20DB | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 2 | T20 18DG/WT | L/R SOLENOID CONTROL |
| 3 | T41 20YL/DB | TRS T41 SENSE (P/N) |
| 4 | T41 20YL/DB | TRS T41 SENSE (P/N) |
| 5 | T42 20DG/YL | TRS T42 SENSE |
| 6 | L10 20WT/GY | BACK-UP LAMP FEED |
| 7 | T60 18YL/GY | OD SOLENOID CONTROL |
| 8 | T3 20DG/DB | TRS T3 SENSE |
| 9 | T1 20DG/LB | TRS T1 SENSE |
| 10 | T16 16YL/OR | TRANSMISSION CONTROL RELAY OUTPUT |
| 11 | T48 20BR/YL | 4C PRESSURE SWITCH SENSE |
| 12 | T118 20DG | PRESSURE CONTROL SOLENOID CONTROL |
| 13 | T4 20DG/LB | TRS T2 SENSE |
| 14 | T50 20YL/TN | L/R PRESSURE SWITCH SENSE |
| 15 | T147 20DG/YL | 2C PRESSURE SWITCH SENSE |
| 16 | T9 20DG/TN | OD PRESSURE SWITCH SENSE |
| 17 | T59 18YL/LB | UD SOLENOID CONTROL |
| 18 | T29 20YL/WT | UD PRESSURE SWITCH SENSE |
| 19 | T159 20YL/DG | 4C SOLENOID CONTROL |
| 20 | T219 20YL/LG | 2C SOLENOID CONTROL |
| 21 | T140 20YL/GY | MS SOLENOID CONTROL |
| 22 | T13 20DG/VT | SPEED SENSOR GROUND |
| 23 | T54 20DG/OR | TRANSMISSION TEMPERATURE SENSOR SIGNAL |



BATTERY (+)

BATTERY (+)

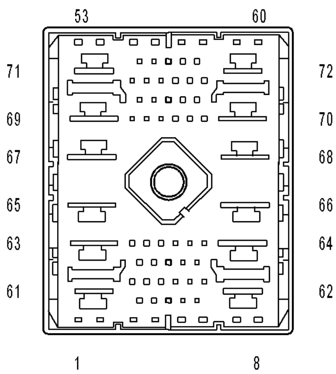
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A910 2RD (DIESEL) | B+ |
| 1 | A910 6RD (GAS EXCEPT RENEGADE) | B+ |
| 1 | A910 4RD (GAS RENEGADE) | B+ |
| 2 | A910 6RD (EXCEPT GAS RENEGADE) | B+ |



BATTERY (-)

BATTERY (-)

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z0 2BK (DIESEL) | GROUND |
| 1 | Z0 6BK (GAS EXCEPT RENEGADE) | GROUND |
| 1 | Z0 4BK (GAS RENEGADE) | GROUND |
| 2 | Z1 6BK (EXCEPT GAS RENEGADE) | GROUND |
| 2 | Z1 4BK (GAS RENEGADE) | GROUND |

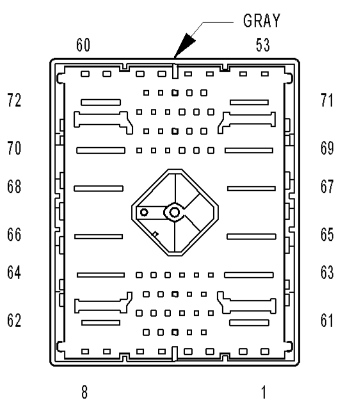



C100 (LHD) - (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | B1 18DG/DB |
| 2 | B2 18DG/LB |
| 3 | B3 18DG/YL (ABS) |
| 4 | B22 18DG/YL (GAS) |
| 5 | K106 20VT/LB (GAS) |
| 6 | - |
| 7 | N4 20 DB/YL (EXCEPT ABS) |
| 8 | K167 20BR/YL (DIESEL) |
| 9 | V38 20VT/OR (DIESEL) |
| 10 | K29 20WT/BR (DIESEL) |
| 11 | K23 20BR/WT (DIESEL) |
| 12 | L13 18WT/YL |
| 13 | G70 20VT/LB (VTSS) |
| 14 | Z11 20BK/LG |
| 15 | K914 20BR/WT (DIESEL) |
| 15 | K900 20DB/DG (GAS) |
| 16 | K300 20BR (ABS) |
| 17 | L62 18WT/OR |
| 18 | L63 18WT/DG |
| 19 | V30 20VT/WT (SPEED CONTROL) |
| 20 | D20 20WT/LG (GAS) |
| 21 | V32 20VT/YL (GAS) |
| 22 | W1 20BR/TN |
| 23 | B46 18 DG/WT (ABS) |
| 24 | K107 20VT/WT (GAS) |
| 25 | D508 20WT/GY (TIRE PRESSURE MONITORING) |
| 26 | D16 20WT/OR (EXCEPT M/T) |
| 27 | - |
| 28 | R80 20VT/LB |
| 29 | R82 20WT/LB |
| 30 | R79 20LB/VT |
| 31 | R81 20LB/WT |
| 32 | D15 20BR/WT (GAS) |
| 33 | B1 18DG/DB (EXCEPT ABS) |
| 34 | D21 20WT/GY |
| 35 | B2 18DG/LB (EXCEPT ABS) |
| 36 | B4 18LG/GY (ABS) |
| 37 | B20 20DG/OR |
| 38 | Z11 20BK/LG |
| 39 | W33 20BR/DG |
| 40 | K400 20BR/VT (DIESEL) |
| 41 | T6 20DG (A/T) |
| 42 | V37 20VT |
| 43 | W20 20BR/YL |
| 44 | B15 18DG/WT |
| 45 | D25 20WT/VT |
| 46 | K852 20BR/VT (DIESEL) |
| 47 | X75 20GY/DG (VTSS) |
| 48 | L10 20WT/GY |
| 49 | - |
| 50 | - |
| 51 | - |
| 52 | K300 20BR (DIESEL) |

C100 (LHD) - (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 52 | L50 18WT/TN (GAS) |
| 53 | - |
| 54 | K854 20VT/BR (DIESEL) |
| 55 | - |
| 56 | G18 20OR/VT (DIESEL) |
| 57 | A100 14RD/VT |
| 58 | K392 18BR/WT (DIESEL) |
| 58 | N1 18DG/OR (GAS) |
| 59 | L43 18WT/DB |
| 60 | A904 14RD |
| 61 | A106 12LB/RD |
| 62 | - |
| 63 | A1 12RD |
| 64 | A111 12DG/RD |
| 65 | - |
| 66 | - |
| 67 | - |
| 68 | - |
| 69 | A916 12RD |
| 70 | - |
| 71 | - |
| 72 | - |



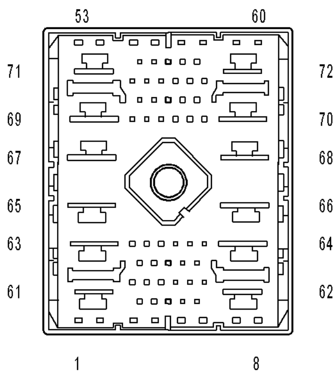

C100
(LHD)

C100 (LHD) - (I/P SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | B1 20DG/DB |
| 2 | B2 20DG/LB |
| 3 | B3 20DG/YL |
| 4 | B22 20DG/YL |
| 5 | K106 20VT/LB |
| 6 | - |
| 7 | N4 20DB/YL |
| 8 | K167 20BR/YL (DIESEL) |
| 9 | V38 20VT/OR |
| 10 | K29 20WT/BR (DIESEL) |
| 11 | K23 20BR/WT (DIESEL) |
| 12 | L13 18WT/YL (EXPORT) |
| 13 | G70 20VT/LB |
| 14 | Z11 20BK/LG |
| 15 | K900 20DB/DG |
| 16 | K300 20BR |
| 17 | L62 18WT/OR |
| 18 | L63 18WT/DG |
| 19 | V30 20VT/WT |
| 20 | D20 20WT/LG |
| 21 | V32 20VT/YL |
| 22 | W1 20BR/TN |
| 23 | B46 20DG/WT |
| 24 | K107 20VT/WT |
| 25 | D508 20WT/GY |
| 26 | D16 20WT/OR |
| 27 | - |
| 28 | R80 20VT/LB |

C100 (LHD) - (I/P SIDE)

| CAV | CIRCUIT |
|---|---|
| 29 | R82 20WT/LB |
| 30 | R79 20LB/VT |
| 31 | R81 20LB/WT |
| 32 | D15 20BR//WT |
| 33 | B12 20DG/OR |
| 34 | D21 20WT/GY |
| 35 | F512 20PK/OR |
| 36 | B4 20LG/GY |
| 37 | B20 20DG/OR |
| 38 | Z11 20BK/LG |
| 39 | W33 20BR/DG |
| 40 | K400 20BR/VT (DIESEL) |
| 41 | T6 20DG |
| 42 | V37 20VT |
| 43 | W20 20BR/YL |
| 44 | B15 20DG/WT |
| 45 | D25 20WT/VT |
| 46 | K852 20BR/VT (DIESEL) |
| 47 | X75 20GY/DG |
| 48 | L10 20WT/GY |
| 49 | - |
| 50 | - |
| 51 | - |
| 52 | - |
| 53 | - |
| 54 | K854 20VT/BR (DIESEL) |
| 55 | - |
| 56 | - |
| 57 | A100 14RD/VT |
| 58 | N1 16DG/OR |
| 59 | L43 18WT/DB (EXPORT) |
| 60 | A904 14RD (LIGHTBAR) |
| 61 | A106 12LB/RD |
| 62 | - |
| 63 | A1 12RD |
| 64 | A111 12DG/RD |
| 65 | - |
| 66 | - |
| 67 | A908 18RD |
| 68 | - |
| 69 | A916 12RD |
| 70 | - |
| 71 | - |
| 72 | - |



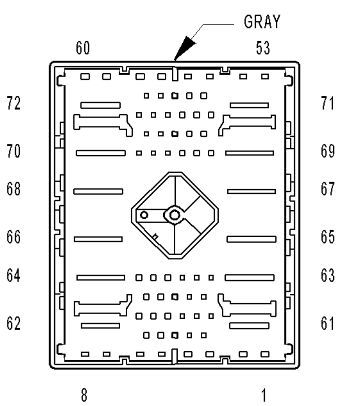

C100
(RHD)

C100 (RHD) - (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | L33 18WT/LG |
| 2 | L34 18WT/GY |
| 3 | X2 18DG/OR |
| 4 | B22 18DG/YL (GAS) |
| 5 | C115 20DB |
| 6 | W7 16BR/GY |
| 7 | - |
| 8 | K167 20BR/YL (DIESEL) |
| 9 | V38 20VT/OR (DIESEL) |
| 10 | K29 20WT/BR (DIESEL) |
| 11 | K23 20BR/WT (DIESEL) |
| 12 | L13 18WT/YL |
| 13 | G70 20VT/LB (VTSS) |
| 14 | Z11 20BK/LG |
| 15 | K914 20BR/WT (DIESEL) |
| 15 | K900 20DB/DG (GAS) |
| 16 | K300 20BR (ABS) |
| 17 | L62 18WT/OR |
| 18 | L63 18WT/DG |
| 19 | V30 20VT/WT (SPEED CONTROL) |
| 20 | D20 20WT/LG (GAS) |
| 21 | V32 20VT/YL (GAS) |
| 22 | W1 20BR/TN |
| 23 | B46 18DG/WT (ABS) |
| 24 | W6 20BR/LB |
| 25 | D508 20WT/GY (TIRE PRESSURE MONITORING) |
| 26 | D16 20WT/OR (EXCEPT M/T) |
| 27 | L44 18WT/TN |
| 28 | R80 20VT/LB |
| 29 | R82 20WT/LB |
| 30 | R79 20LB/VT |
| 31 | R81 20LB/WT |
| 32 | D15 20BR/WT (GAS) |
| 33 | - |
| 34 | D21 20WT/GY |
| 35 | - |
| 36 | F20 20PK/GY |
| 37 | B20 20DG/OR |
| 38 | Z11 20BK/LG |
| 39 | W33 20BR/DG |
| 40 | K400 20BR/VT (DIESEL) |
| 41 | T6 20DG (A/T) |
| 42 | V37 20VT |
| 43 | W20 20BR/YL |
| 44 | B15 18DG/WT |
| 45 | D25 20WT/VT |
| 46 | K852 20BR/VT (DIESEL) |
| 47 | X75 20GY/DG (VTSS) |
| 48 | L10 20WT/GY |
| 49 | F1 20PK/WT |
| 50 | W2 20BR/LG |
| 51 | L77 18PK/RD |
| 52 | L50 18WT/TN (DIESEL) |

C100 (RHD) - (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 53 | L89 16WT/YL |
| 54 | K854 20VT/BR (DIESEL) |
| 55 | F22 20PK/TN (TIRE PRESSURE MONITORING) |
| 56 | G18 20OR/VT (DIESEL) |
| 57 | - |
| 58 | A5 16RD/VT |
| 59 | L43 18WT/DB |
| 60 | A904 14RD |
| 61 | A106 12LB/RD |
| 62 | A139 12RD/YL |
| 63 | A1 12RD |
| 64 | A111 12DG/RD |
| 65 | A901 10RD/OR |
| 66 | A912 10RD |
| 67 | A908 20RD |
| 68 | A911 10RD |
| 69 | A916 12RD |
| 70 | A12 10RD/BR |
| 71 | A906 12RD |
| 72 | - |



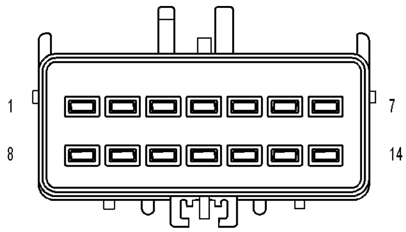

**C100 (RHD)**

C100 (RHD) - (I/P SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | L33 18WT/LG |
| 2 | L34 18WT/GY |
| 3 | X2 18DG/OR |
| 4 | B22 20DG/YL |
| 5 | C115 20DB |
| 6 | W7 16BR/GY |
| 7 | N4 20DB/YL |
| 8 | K167 20BR/YL (DIESEL) |
| 9 | V38 20VT/OR |
| 10 | K29 20WT/BR (DIESEL) |
| 11 | K23 20BR/WT (DIESEL) |
| 12 | L13 18WT/YL |
| 13 | G70 20VT/LB |
| 14 | Z11 20BK/LG |
| 15 | K900 20DB/DG |
| 16 | K300 20BR |
| 17 | L62 18WT/OR |
| 18 | L63 18WT/DG |
| 19 | V30 20VT/WT |
| 20 | D20 20WT/LG |
| 21 | V32 20VT/YL |
| 22 | W1 20BR/TN |
| 23 | B46 20DG/WT |
| 24 | W6 20BR/LB |
| 25 | D508 20WT/GY |
| 26 | D16 20WT/OR |
| 27 | L44 18WT/TN |
| 28 | R80 20VT/LB |
| 29 | R82 20WT/LB |
| 30 | R79 20LB/VT |

C100 (RHD) - (I/P SIDE)

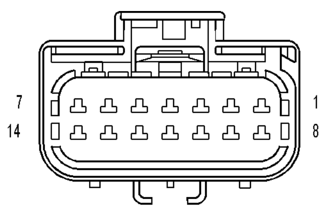
| CAV | CIRCUIT |
|---|---|
| 31 | R81 20LB/WT |
| 32 | D15 20BR/WT |
| 33 | B12 20DG/OR |
| 34 | D21 20WT/GY |
| 35 | F512 20PK/OR |
| 36 | F20 20PK/GY |
| 37 | B20 20DG/OR |
| 38 | Z11 20BK/LG |
| 39 | W33 20BR/DG |
| 40 | K400 20BR/VT (DIESEL) |
| 41 | T6 20DG |
| 42 | V37 20VT |
| 43 | W20 20BR/YL |
| 44 | B15 20DG/WT |
| 45 | D25 20WT/VT |
| 46 | K852 20BR/VT (DIESEL) |
| 47 | X75 20GY/DG |
| 48 | L10 20WT/GY |
| 49 | F1 18PK/WT |
| 50 | W2 20BR/LG |
| 51 | L77 18PK/RD |
| 52 | L50 18WT/TN |
| 53 | L89 16WT/YL |
| 54 | K854 20VT/BR (DIESEL) |
| 55 | F22 20PK/TN |
| 56 | G18 20OR/VT (DIESEL) |
| 57 | - |
| 58 | A5 16RD/VT |
| 59 | L43 18WT/DB |
| 60 | A904 14RD (LIGHTBAR) |
| 61 | A106 12LB/RD |
| 62 | A139 12RD/YL |
| 63 | A1 12RD |
| 64 | A111 12DG/RD |
| 65 | A901 10RD |
| 66 | A912 10RD |
| 67 | A908 18RD |
| 68 | A911 10RD |
| 69 | A916 12RD |
| 70 | A12 10RD/BR |
| 71 | A906 12RD |
| 72 | - |




C102
(RHD)

C102 (RHD) - (HEADLAMP AND DASH SIDE)

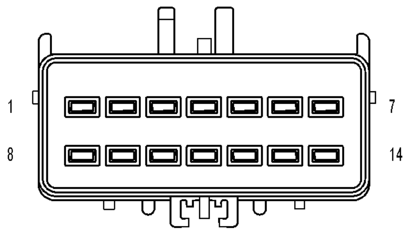
| CAV | CIRCUIT |
|---|---|
| 1 | - |
| 2 | - |
| 3 | K392 18BR/WT (DIESEL) |
| 3 | N1 18DG/OR (GAS) |
| 4 | B1 18DG/DB |
| 5 | B2 18DG/LB |
| 6 | K900 20DB/DG |
| 7 | - |
| 8 | L78 18WT/OR |
| 9 | K106 20VT/LB (GAS) |
| 10 | K107 20VT/WT (GAS) |
| 11 | B3 18DG/YL |
| 12 | B4 18LG/GY |
| 13 | - |
| 14 | A100 14RD/VT |




C102
(RHD)

C102 (RHD) - LT GRAY (UNIBODY SIDE)

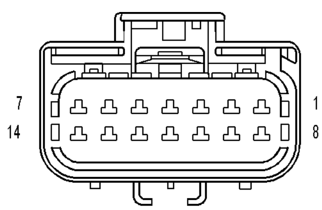
| CAV | CIRCUIT |
|---|---|
| 1 | - |
| 2 | - |
| 3 | N1 18DB/OR |
| 3 | K392 18BR/WT |
| 4 | B1 20DG/DB |
| 5 | B2 20DG/LB |
| 6 | K900 20DB/DG |
| 7 | - |
| 8 | L78 18WT/OR |
| 9 | K106 20VT/LB |
| 10 | K107 20VT/WT |
| 11 | B3 20DG/YL |
| 12 | B4 20LG/GY |
| 13 | - |
| 14 | A100 14RD/VT |




C104

C104 - (HEADLAMP AND DASH SIDE)

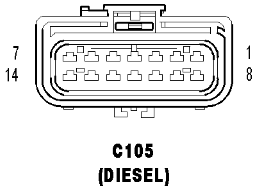
| CAV | CIRCUIT |
|---|---|
| 1 | T515 20YL/DB (A/T) |
| 2 | G18 20OR/VT (DIESEL) |
| 2 | F142 16PK/GY (GAS) |
| 3 | C13 20LB/OR (DIESEL) |
| 3 | A142 14RD/OR (GAS) |
| 4 | T16 16YL/OR (A/T) |
| 4 | T141 20YL/OR (DIESEL M/T) |
| 5 | D25 20WT/VT |
| 6 | B15 20DG/WT (DIESEL) |
| 6 | D16 20WT/OR (GAS A/T) |
| 7 | D64 20WT/LB (DIESEL) |
| 8 | D65 20WT/LG (DIESEL) |
| 9 | L50 18WT/TN (DIESEL) |
| 10 | T26 20DG/OR (GAS M/T) |
| 11 | C115 20DB |
| 12 | K900 20DB/DG (EXCEPT DIESEL LHD) |
| 13 | N201 20DB/LG (DIESEL) |
| 13 | C20 20DB/YL (GAS) |
| 14 | K132 20DB/LB (DIESEL) |
| 14 | C3 18DB/YL (GAS) |




C104

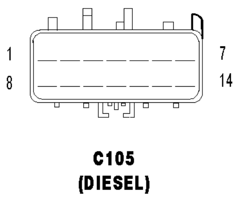
C104 - (INJECTOR SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | T515 20YL/DB (A/T) |
| 2 | G18 20OR/VT (DIESEL) |
| 2 | F142 16PK/GY (GAS) |
| 3 | C13 20LB/OR (DIESEL) |
| 3 | A142 14RD/OR (GAS) |
| 4 | T16 16YL/OR (A/T) |
| 5 | D25 20WT/VT (EXCEPT ESP) |
| 6 | D16 20WT/OR (A/T GAS) |
| 6 | B15 20DG/WT (DIESEL) |
| 7 | D64 20WT/LB (DIESEL) |
| 8 | D65 20WT/LG (DIESEL) |
| 9 | L50 18WT/TN (DIESEL) |
| 10 | Z131 20BK/DG |
| 11 | C115 20DB |
| 12 | K900 20DB/DG |
| 13 | N201 20DB/LG (DIESEL) |
| 13 | C20 20DB/YL (GAS) |
| 14 | K132 20DB/LB (DIESEL) |
| 14 | C3 18DB/YL (GAS) |



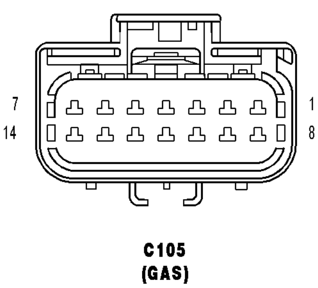

C105 (DIESEL) - (ENGINE SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | K342 20BR/WT |
| 2 | D21 20WT/GY |
| 3 | L10 20WT/GY |
| 4 | G31 20VT/OR |
| 5 | K167 20BR/YL |
| 6 | F1 20PK/WT |
| 7 | F26 20PK/OR |
| 8 | V38 20VT/OR |
| 9 | K23 20BR/WT |
| 10 | Z11 20BK/LG |
| 11 | Z11 20BK/LG |
| 12 | T6 20DG (A/T) |
| 13 | K347 20BR/PK |
| 14 | K302 20BR/WT |



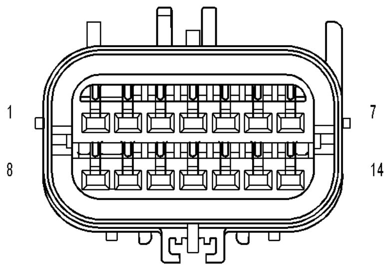

C105 (DIESEL) - (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | K342 20BR/WT |
| 2 | D21 20WT/GY |
| 3 | L10 20WT/GY |
| 4 | G31 20VT/OR |
| 5 | K167 20BR/YL |
| 6 | F1 20PK/WT |
| 7 | F26 20PK/OR |
| 8 | V38 20VT/OR |
| 9 | K23 20BR/WT |
| 10 | Z11 20BK/LG |
| 11 | Z11 20BK/LG |
| 12 | T6 20DG (A/T) |
| 13 | K347 20BR/PK |
| 14 | K302 20BR/WT |




C105 (GAS) - BLACK (ENGINE SIDE)

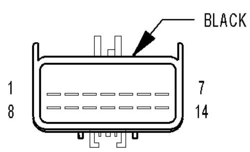
| CAV | CIRCUIT |
|---|---|
| 1 | D20 20WT/LG |
| 2 | D21 20WT/GY |
| 3 | L10 20WT/GY |
| 4 | - |
| 5 | A209 18RD |
| 6 | F1 20PK/WT |
| 7 | F26 20PK/OR |
| 8 | - |
| 9 | - |
| 10 | Z11 20BK/LG |
| 11 | Z11 20BK/LG |
| 12 | T6 20DG (A/T) |
| 13 | - |
| 14 | - |




C105
(GAS)

C105 (GAS) - BLACK (HEADLAMP AND DASH SIDE)

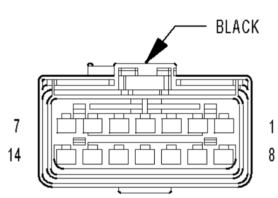
| CAV | CIRCUIT |
|---|---|
| 1 | D20 20WT/LG |
| 2 | D21 20WT/GY |
| 3 | L10 20WT/GY |
| 4 | G31 20VT/OR |
| 5 | A209 18RD |
| 6 | F1 20PK/WT |
| 7 | F26 20PK/OR |
| 8 | - |
| 9 | B22 18DG/YL |
| 10 | Z11 20BK/LG |
| 11 | Z11 20BK/LG |
| 12 | T6 20DG (A/T) |
| 13 | - |
| 14 | - |




C106

C106 - BLACK (GOR SIDE)

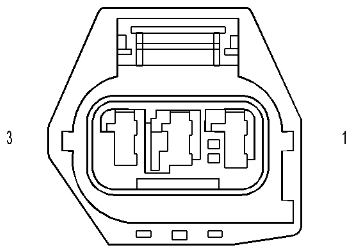
| CAV | CIRCUIT |
|---|---|
| 1 | Z932 16BK |
| 2 | Z931 16BK |
| 3 | K900 20DB/DG |
| 4 | L77 18PK/RD (HEADLAMP LEVELING) |
| 5 | G31 20VT/OR |
| 6 | L43 18WT/DB |
| 7 | L34 18WT/GY |
| 8 | L33 18WT/LG |
| 9 | L78 18WT/OR (HEADLAMP LEVELING) |
| 10 | L44 18WT/TN |
| 11 | L89 16WT/YL |
| 12 | L13 18WT/YL |
| 13 | - |
| 14 | - |




C106

C106 - BLACK (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Z932 16BK |
| 2 | Z931 16BK |
| 3 | K900 20DB/DG |
| 3 | K300 20BR (ABS) |
| 4 | L77 18PK/RD |
| 5 | G31 20VT/OR |
| 6 | L43 18WT/DB |
| 7 | L34 18WT/GY |
| 8 | L33 18WT/LG |
| 9 | L78 18WT/OR |
| 10 | L44 18WT/TN |
| 11 | L89 16WT/YL |
| 12 | L13 18WT/YL |
| 13 | - |
| 14 | - |




C107

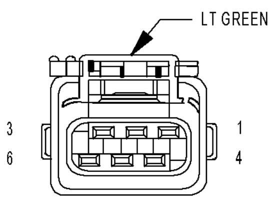
C107 - (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Z931 16BK |
| 2 | L63 18WT/DG |
| 3 | L77 18PK/RD |

CONNECTOR NOT AVAILABLE

C107 - (LEFT FRONT FASCIA SIDE)

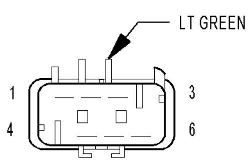
| CAV | CIRCUIT |
|---|---|
| 1 | Z931 16BK |
| 2 | L63 18WT/DG |
| 3 | L77 18PK/RD |




C108
(GAS)

C108 (GAS) - LT GREEN (BATTERY SIDE)

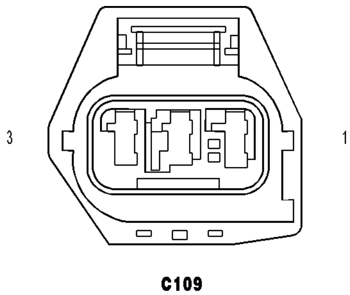
| CAV | CIRCUIT |
|---|---|
| 1 | Z932 18BK |
| 2 | K125 16BR/DG |
| 3 | K70 20DB/BR |
| 4 | K52 20DB/WT |
| 5 | T750 12YL/GY |
| 6 | - |




C108
(GAS)

C108 (GAS) - LT GREEN (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Z932 18BK |
| 2 | K125 16BR/DG |
| 3 | K70 20DB/BR |
| 4 | K52 20DB/WT |
| 5 | T750 12YL/GY |
| 6 | - |



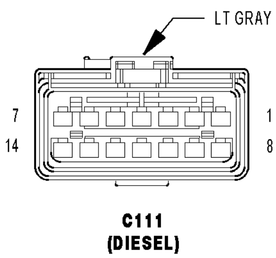

C109 - (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Z932 16BK |
| 2 | L62 18WT/OR |
| 3 | L78 18WT/OR |

CONNECTOR NOT AVAILABLE

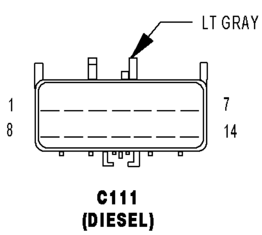
C109 - (RIGHT FRONT FASCIA SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Z932 16BK |
| 2 | L62 18WT/OR |
| 3 | L78 18WT/OR |



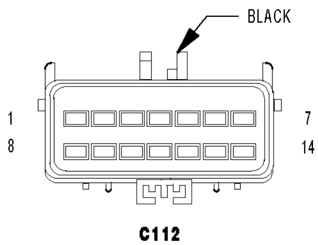

C111 (DIESEL) - LT GRAY (ENGINE SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | D16 20WT/OR (A/T) |
| 2 | V37 20VT |
| 3 | Z133 14BK/LG |
| 4 | N112 20DB/OR |
| 5 | A119 18RD/OR |
| 6 | - |
| 7 | C20 20DB/YL |
| 8 | C3 18DB/YL |
| 9 | K852 20BR/VT |
| 10 | T752 20DG/OR |
| 11 | N117 20DB/WT |
| 12 | X635 20BR/WT |
| 13 | K391 20BR/YL |
| 14 | - |



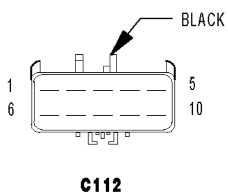

C111 (DIESEL) - LT GRAY (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | D16 20WT/OR (A/T) |
| 2 | V37 20VT |
| 3 | Z133 14BK/LG |
| 4 | N112 20DB/OR |
| 5 | A119 18RD/OR |
| 6 | K914 20BR/WT |
| 7 | C20 20DB/YL |
| 8 | C3 18DB/YL |
| 9 | K852 20BR/VT |
| 10 | T752 20DG/OR |
| 11 | N117 20DB/WT |
| 12 | X635 20BR/WT |
| 13 | K391 20BR/YL |
| 14 | - |



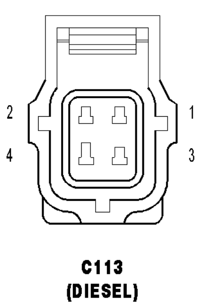

C112 - BLACK (ENGINE SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | K77 20BR/WT (4WD) |
| 2 | K300 20BR (4WD) |
| 3 | K310 20BR/DG |
| 4 | K301D 20BR/LG |
| 5 | C18 20LB/BR |
| 6 | K125 16BR/DG |
| 7 | K399 18BR/GY |
| 8 | K299 18BR/OR |
| 9 | D15 20BR/WT (A/T) |
| 10 | D65 20WT/LG |
| 11 | D64 20WT/LB |
| 12 | - |
| 13 | - |
| 14 | - |




C112 - BLACK (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | K77A 20BR/WT |
| 2 | K300D 20BR |
| 3 | K310A 20BR/DG |
| 4 | K301A 20BR/LG |
| 5 | C18A 20LB/BR |
| 6 | K125 16BR/DG |
| 7 | K399 18BR/GY |
| 8 | K299 18BR/OR |
| 9 | D15 20BR/WT |
| 10 | D65B 20WT/LG |
| 11 | D64B 20WT/LB |
| 12 | - |
| 13 | - |
| 14 | - |




C113 (DIESEL) - (BATTERY SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | A202 14RD/WT |
| 2 | A203 14RD/BR |
| 3 | A204 14RD/YL |
| 4 | A208 14RD/OR |

**CONNECTOR NOT AVAILABLE**

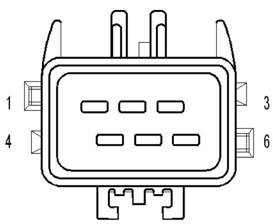
C113 (DIESEL) - (ENGINE SIDE)

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A202 14RD/WT | NO FUNCTION DEFINED |
| 2 | A203 14RD/BR | NO FUNCTION DEFINED |
| 3 | A204 14RD/YL | NO FUNCTION DEFINED |
| 4 | A208 14RD/OR | FUSED B(+) |

**CONNECTOR NOT AVAILABLE**

C114 - (BATTERY SIDE)

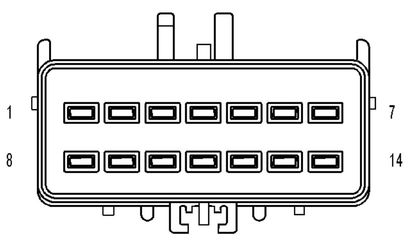
| CAV | CIRCUIT |
|---|---|
| 1 | K125 16BR/DG |
| 2 | K347 20BR/PK |
| 3 | D330 20WT/BR |
| 4 | K330 20LB/BR |
| 5 | - |
| 6 | Z133 18BK/LG |




**C114**

C114 - (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | K125 16BR/DG |
| 2 | K347 20BR/PK |
| 3 | D330 20WT/BR |
| 4 | K330 20LB/BR |
| 5 | - |
| 6 | Z133 14BK/LG |




**C117 (DIESEL)**

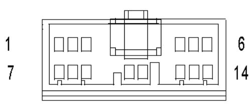
C117 (DIESEL) - (HEADLAMP AND DASH)

| CAV | CIRCUIT |
|---|---|
| 1 | K303 20BR/OR |
| 2 | K300 20BR |
| 3 | K310 20BR/DG |
| 4 | K330 20LB/BR |
| 5 | D330 20WT/BR |
| 6 | K301 20BR/LG |
| 7 | K345 16BR/RD |
| 8 | K305 20BR/LB |
| 9 | K854 20VT/BR |
| 10 | A903 16RD/LB (A/T) |
| 10 | T26 20DG/OR (M/T) |
| 11 | A993 16RD |
| 12 | K29 20WT/BR |
| 13 | T750 12YL/GY |
| 14 | K400 20BR/VT |

**CONNECTOR NOT AVAILABLE**

C117 (DIESEL) - (INJECTOR SIDE)

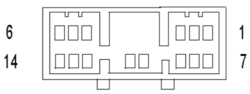
| CAV | CIRCUIT |
|---|---|
| 1 | K303 20BR/OR |
| 2 | K300 20BR |
| 3 | K310 20BR/DG |
| 4 | K330 20LB/BR |
| 5 | D330 20WT/BR |
| 6 | K301 20BR/LG |
| 7 | K345 14BR/RD |
| 8 | K305 20BR/LB |
| 9 | K854 20VT/BR |
| 10 | A903 16RD (A/T) |
| 10 | T26 20DG/OR (M/T) |
| 11 | A993 16RD |
| 12 | K29 20WT/BR |
| 13 | T750 12YL/GY |
| 14 | K400 20BR/VT |



C120

C120 - (HEADLAMP AND DASH SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | D64 20WT/LB |
| 2 | D65 20WT/LG |
| 3 | - |
| 4 | K303 20BR/OR (DIESEL) |
| 4 | G31 20VT/OR (GAS) |
| 5 | K302 20BR/WT (DIESEL) |
| 5 | K77 20BR/WT (GAS) |
| 6 | G4 18VT/LB |
| 7 | G94 18VT/DB |
| 8 | D51 18PK/RD |
| 9 | D52 18WT/LB |
| 10 | - |
| 11 | K310 20BR/DG |
| 12 | K301 20BR/LG |
| 13 | K305 20BR/LB (DIESEL) |
| 13 | C18 20LB/BR (GAS) |
| 14 | K125 16BR/DG (DIESEL) |



C120

C120 - (I/P SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | D64A 20WT/LB |
| 2 | D65A 20WT/LG |
| 3 | - |
| 4 | K303 20BR/OR (DIESEL) |
| 4 | G31 20VT/OR (GAS) |
| 5 | K302 20BR/WT (DIESEL) |
| 5 | K77 20BR/WT (GAS) |
| 6 | G4 20VT/LB |
| 7 | G94 20VT/DB |
| 8 | D51 20PK/RD |
| 9 | D52 20WT/LB |
| 10 | - |
| 11 | K310B 20BR/DG |
| 12 | K301 20BR/LG |
| 13 | K305 20BR/LB (DIESEL) |
| 13 | C18 20LB/BR (GAS) |
| 14 | K125 20BR/DG (DIESEL) |
| 18 | - |
| 19 | - |
| 20 | - |

**CONNECTOR NOT AVAILABLE**

C201 - (INSTRUMENT PANEL SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | G77 20VT/GY |
| 2 | G75 20VT |
| 3 | G910 20VT/BR |
| 4 | A100 14RD/VT (LHD) |
| 5 | K106 20VT/LB (LHD) |
| 6 | - |
| 7 | G773 20VT/OR |
| 8 | K107 20VT/WT (LHD) |
| 9 | G74 20VT/WT |
| 10 | G80 20VT/YL |
| 11 | G76 20VT/YL |
| 12 | - |
| 13 | L10 20WT/GY |
| 14 | Z18 20BK/LB |
| 15 | L62 18WT/OR |
| 16 | G78 20VT/OR |
| 17 | D25 20WT/VT |
| 18 | D51 20PK/RD (ESP) |
| 19 | X75 20GY/DG |
| 20 | - |
| 21 | P100 20DB/LG |
| 22 | P101 20LG/WT |
| 23 | B15 20DG/WT |
| 24 | B25 20DG/WT |
| 25 | B2 20DG/LB (LHD) |
| 26 | K900 20DB/DG |
| 27 | W27 20DB/BR |
| 28 | - |
| 29 | W13 20BR/LG |

C201 - (INSTRUMENT PANEL SIDE)

| CAV | CIRCUIT |
|---|---|
| 30 | B1 20DG/DB (LHD) |
| 31 | T6 20DG |
| 32 | N4 20DB/YL |
| 33 | N1 16DG/OR (LHD) |
| 34 | D52 20WT/LB (ESP) |
| 35 | K310 20BR/DG (ESP) |
| 36 | K304 20BR/DB (DIESEL) |
| 37 | D508 20WT/GY |
| 38 | G4 20VT/LB (ESP) |
| 39 | F100 20PK/VT |
| 40 | G94 20VT/DB (ESP) |
| 41 | B3 20DG/YL (LHD) (ESP) |
| 42 | B4 20LG/GY (LHD) (ESP) |
| 43 | R57 20LG/GY |
| 44 | R58 20LB/GY |
| 45 | Z514 16BK/LG |
| 46 | L63 18WT/DG |
| 47 | - |
| 48 | - |

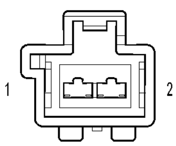
**CONNECTOR NOT AVAILABLE**

C201 - (UNIBODY SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | G77 20VT/GY |
| 2 | G75 20VT |
| 3 | G910 20VT/BR |
| 4 | A100 14RD/VT (LHD EXPORT) (TRAILER TOW) |
| 5 | K106 20VT/LB (LHD) |
| 6 | Z514 16BK/LG |
| 7 | G773 20VT/OR |
| 8 | K107 20VT/WT (LHD) |
| 9 | G74 20VT/WT |
| 10 | G80 20VT/YL |
| 11 | G76 20VT/YL |
| 12 | L63 18WT/DG |
| 13 | L10 20WT/GY |
| 14 | Z18 20BK/LB |
| 15 | L62 18WT/OR |
| 16 | G78 20VT/OR |
| 17 | D25 20WT/VT |
| 18 | D51 20PK/RD (ESP) |
| 19 | X75 20GY/DG |
| 20 | - |
| 21 | P100 20DB/LG |
| 22 | P101 20LG/WT |
| 23 | B15 20DG/WT |
| 24 | B25 20DG/WT |
| 25 | B2 20DG/LB (LHD) |
| 26 | K900 20DB/DG |
| 27 | W27 20DB/BR |
| 28 | - |
| 29 | W13 20BR/LG |
| 30 | B1 20DG/DB (LHD) |
| 31 | T6 20DG |

C201 - (UNIBODY SIDE)

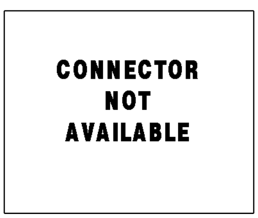
| CAV | CIRCUIT |
|---|---|
| 32 | N4 20DB/YL |
| 33 | N1 16DB/OR (LHD) |
| 34 | D52 20WT/LB (ESP) |
| 35 | K310 20BR/DG (ESP) |
| 36 | K304 20BR/DB |
| 37 | D508 20WT/GY |
| 38 | G4 20VT/LB (ESP) |
| 39 | F100 20PK/VT |
| 40 | G94 20VT/DB (ESP) |
| 41 | B3 20DG/YL (LHD) (ESP) |
| 42 | B4 20LG/GY (LHD) (ESP) |
| 43 | R57 20LG/GY |
| 44 | R58 20LB/GY |
| 45 | Z514 16BK/LG |
| 46 | L63 18WT/DG |
| 47 | - |
| 48 | - |




C203
(RENEGADE)

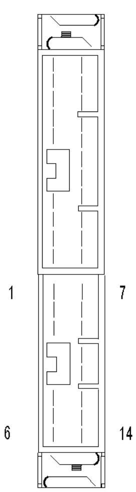
C203 (RENEGADE) - (INSTRUMENT PANEL SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | L8 14WT/DG |
| 2 | Z946 16BK |




C203 (RENEGADE) - (LIGHTBAR JUMPER SIDE)

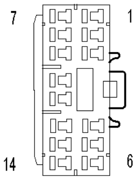
| CAV | CIRCUIT |
|---|---|
| 1 | L8 14WT/DG |
| 2 | Z946 16BK |




C300
(LHD)

C300 (LHD) - (PASSENGER DOOR SIDE)

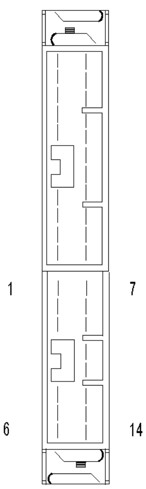
| CAV | CIRCUIT |
|---|---|
| 1 | X58 18GY/OR |
| 2 | X296 18LG/GY |
| 3 | X208 18GY/DG |
| 4 | X13 16LG/GY |
| 5 | - |
| 6 | - |
| 7 | X52 18GY/DB |
| 8 | X205 18GY/LG |
| 9 | X298 18GY/LG |
| 10 | - |
| 11 | - |
| 12 | - |
| 13 | - |
| 14 | Z514 16BK/LG |



C300
(LHD)

C300 (LHD) - (UNIBODY SIDE)

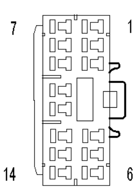
| CAV | CIRCUIT |
|---|---|
| 1 | X58 18GY/OR |
| 2 | X296 18LG/GY |
| 3 | X208 18GY/DG |
| 4 | X13 16LG/GY |
| 5 | - |
| 6 | - |
| 7 | X52 18GY/DB |
| 8 | X205 18GY/LG |
| 9 | X298 18GY/LG |
| 10 | - |
| 11 | - |
| 12 | - |
| 13 | - |
| 14 | Z514 16BK/LG |



C300
(RHD)

C300 (RHD) - (PASSENGER DOOR SIDE)

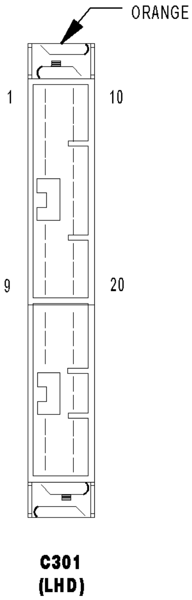
| CAV | CIRCUIT |
|---|---|
| 1 | X57 18DG/OR |
| 2 | X295 18GY/DG |
| 3 | X299 18GY/YL |
| 4 | X13 16LG/GY |
| 5 | - |
| 6 | - |
| 7 | X51 18DG/DB |
| 8 | X206 18DG/LG |
| 9 | X209 18GY/OR |
| 10 | - |
| 11 | - |
| 12 | - |
| 13 | - |
| 14 | Z514 16BK/LG |



C300
(RHD)

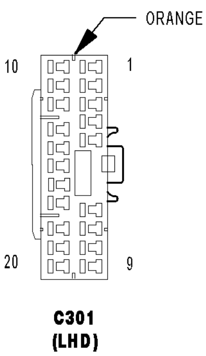
C300 (RHD) - (UNIBODY SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | X57 18DG/OR |
| 2 | X295 18GY/DG |
| 3 | X299 18GY/YL |
| 4 | X13 16LG/GY |
| 5 | - |
| 6 | - |
| 7 | X51 18DG/DB |
| 8 | X206 18DG/LG |
| 9 | X209 18GY/OR |
| 10 | - |
| 11 | - |
| 12 | - |
| 13 | - |
| 14 | Z514 16BK/LG |



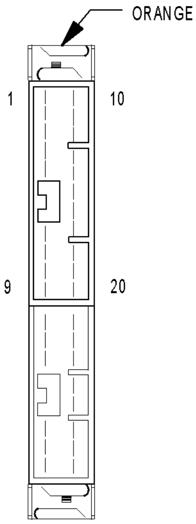

C301 (LHD) - ORANGE (DRIVER DOOR SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Q11 14OR/LG |
| 2 | F982 20PK/YL |
| 3 | P33 16TN/DB |
| 4 | C16 20DB/GY |
| 5 | P72 20TN/GY |
| 6 | P112 20TN/OR |
| 7 | - |
| 8 | P37 20LG/TN |
| 9 | X55 18DG/BR |
| 10 | Q21 14OR/WT |
| 11 | F302 20GY/PK |
| 12 | P34 16TN/LB |
| 13 | P74 20TN/OR |
| 14 | P76 20TN/LB |
| 15 | G75 20VT |
| 16 | Z999 20BK |
| 17 | - |
| 18 | P114 20TN/WT |
| 19 | P36 20TN/DB |
| 20 | X53 18DG |




C301 (LHD) - ORANGE (UNIBODY SIDE)

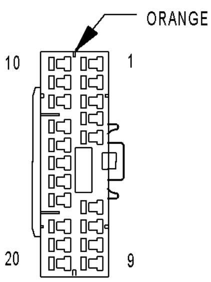
| CAV | CIRCUIT |
|---|---|
| 1 | Q11 14OR/LG |
| 2 | - |
| 3 | P33 16TN/DB |
| 4 | C16 20DB/GY |
| 5 | P72 20TN/GY |
| 6 | P112 20TN/OR |
| 7 | - |
| 8 | P37 20LG/TN |
| 9 | X55 18DG/BR |
| 10 | Q21 14OR/WT |
| 11 | F302 20GY/PK |
| 12 | P34 16TN/LB |
| 13 | P74 20TN/OR |
| 14 | P76 20TN/LB |
| 15 | G75 20VT |
| 16 | Z999 20BK |
| 17 | - |
| 18 | P114 20TN/WT |
| 19 | P36 20TN/DB |
| 20 | X53 18DG |




C301
(RHD)

C301 (RHD) - ORANGE (DRIVER DOOR SIDE)

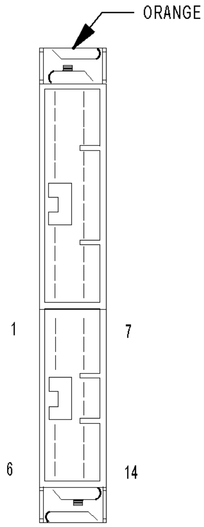
| CAV | CIRCUIT |
|---|---|
| 1 | Q12 14OR/BR |
| 2 | F982 20PK/YL |
| 3 | P33 16TN/DB |
| 4 | C16 20DB/GY |
| 5 | P71 20TN/DG |
| 6 | P110 20LG/WT |
| 7 | - |
| 8 | P37 20LG/TN |
| 9 | X56 18GY/BR |
| 10 | Q22 14OR/VT |
| 11 | F302 20GY/PK |
| 12 | P34 16TN/LB |
| 13 | P75 20TN/LG |
| 14 | P76 20TN/LB |
| 15 | G74 20VT/WT |
| 16 | Z998 20BK |
| 17 | - |
| 18 | P99 20LG/LB |
| 19 | P36 20TN/DB |
| 20 | X54 18GY |




C301
(RHD)

C301 (RHD) - ORANGE (UNIBODY SIDE)

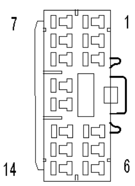
| CAV | CIRCUIT |
|---|---|
| 1 | Q12 14OR/BR |
| 2 | - |
| 3 | P33 16TN/DB |
| 4 | C16 20DB/GY |
| 5 | P71 20TN/DG |
| 6 | P110 20LG/WT |
| 7 | - |
| 8 | P37 20LG/TN |
| 9 | X56 18GY/BR |
| 10 | Q22 14OR/VT |
| 11 | F302 20GYPK |
| 12 | P34 16TN/LB |
| 13 | P75 20TN/LG |
| 14 | P76 20TN/LB |
| 15 | G74 20VT/WT |
| 16 | Z998 20BK |
| 17 | - |
| 18 | P99 20LG/LB |
| 19 | P36 20TN/DB |
| 20 | X54 18GY |




C302
(LHD PREMIUM)

C302 (LHD PREMIUM) - (DRIVER DOOR SIDE)

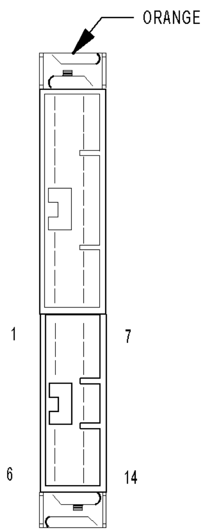
| CAV | CIRCUIT |
|---|---|
| 1 | X57 18DG/OR |
| 2 | X295 18GY/DG |
| 3 | X299 18GY/YL |
| 4 | X13 16LG/GY |
| 5 | - |
| 6 | - |
| 7 | X51 18DG/DB |
| 8 | X206 18DG/LG |
| 9 | X209 18GY/OR |
| 10 | - |
| 11 | - |
| 12 | - |
| 13 | - |
| 14 | Z514 16BK/LG |




C302
(LHD)

C302 (LHD) - (UNIBODY SIDE)

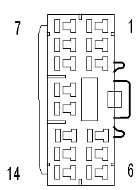
| CAV | CIRCUIT |
|---|---|
| 1 | X57 18DG/OR |
| 2 | X295 18GY/DG |
| 3 | X299 18GY/YL |
| 4 | X13 16LG/GY |
| 5 | - |
| 6 | - |
| 7 | X51 18DG/DB |
| 8 | X206 18DG/LG |
| 9 | X209 18GY/OR |
| 10 | - |
| 11 | - |
| 12 | - |
| 13 | - |
| 14 | Z514 16BK/LG |




C302
(RHD PREMIUM)

C302 (RHD PREMIUM) - ORANGE (DRIVER DOOR SIDE)

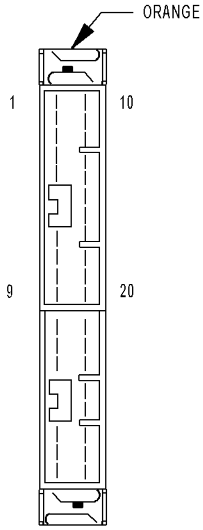
| CAV | CIRCUIT |
|---|---|
| 1 | X58 18GY/OR |
| 2 | X296 18LG/GY |
| 3 | X208 18GY/DG |
| 4 | X13 16LG/GY |
| 5 | - |
| 6 | - |
| 7 | X52 18GY/DB |
| 8 | X205 18GY/LG |
| 9 | X298 18GY/LG |
| 10 | - |
| 11 | - |
| 12 | - |
| 13 | - |
| 14 | Z514 16BK/LG |




C302
(RHD)

C302 (RHD) - (UNIBODY SIDE)

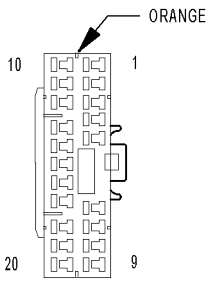
| CAV | CIRCUIT |
|---|---|
| 1 | X58 18GY/OR |
| 2 | X296 18LG/GY |
| 3 | X208 18GY/DG |
| 4 | X13 16LG/GY |
| 5 | - |
| 6 | - |
| 7 | X52 18GY/DB |
| 8 | X205 18GY/LG |
| 9 | X298 18GY/LG |
| 10 | - |
| 11 | - |
| 12 | - |
| 13 | - |
| 14 | Z514 16BK/LG |




C303
(LHD EXCEPT
BASE)

C303 (LHD EXCEPT BASE) - ORANGE (PASSENGER DOOR SIDE)

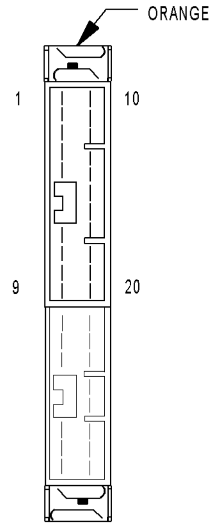
| CAV | CIRCUIT |
|---|---|
| 1 | Q12 14OR/BR |
| 2 | F982 20PK/YL |
| 3 | P33 16TN/DB |
| 4 | C16 20DB/GY |
| 5 | P72 20TN/GY |
| 6 | - |
| 7 | - |
| 8 | P37 20LG/TN |
| 9 | X56 18GY/BR |
| 10 | Q22 14OR/VT |
| 11 | - |
| 12 | P35 16TN/YL |
| 13 | P74 20TN/OR |
| 14 | P76 20TN/LB |
| 15 | G74 20VT/WT |
| 16 | Z998 20BK |
| 17 | - |
| 18 | - |
| 19 | P36 20TN/DB |
| 20 | X54 18GY |




C303
(LHD)

C303 (LHD) - ORANGE (UNIBODY SIDE)

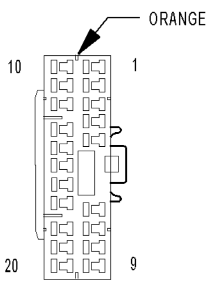
| CAV | CIRCUIT |
|---|---|
| 1 | Q12 14OR/BR |
| 2 | - |
| 3 | P33 16TN/DB |
| 4 | C16 20DB/GY |
| 5 | P72 20TN/GY |
| 6 | - |
| 7 | - |
| 8 | P37 20LG/TN |
| 9 | X56 18GY/BR |
| 10 | Q22 14OR/VT |
| 11 | - |
| 12 | P35 16TN/YL |
| 13 | P74 20TN/OR |
| 14 | P76 20TN/LB |
| 15 | G74 20VT/WT |
| 16 | Z998 20BK |
| 17 | - |
| 18 | - |
| 19 | P36 20TN/DB |
| 20 | X54 18GY |




C303
(RHD EXCEPT
BASE)

C303 (RHD EXCEPT BASE) - ORANGE (PASSENGER DOOR SIDE)

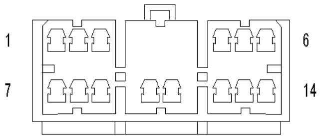
| CAV | CIRCUIT |
|---|---|
| 1 | Q11 14OR/LG |
| 2 | F982 20PK/YL |
| 3 | P33 16TN/DB |
| 4 | C16 20DB/GY |
| 5 | P71 20TN/DG |
| 6 | P110 20LG/WT |
| 7 | - |
| 8 | P37 20LG/TN |
| 9 | X55 18DG/BR |
| 10 | Q21 14OR/WT |
| 11 | - |
| 12 | P35 16TN/YL |
| 13 | P75 20TN/LG |
| 14 | P76 20TN/LB |
| 15 | G75 20VT |
| 16 | Z999 20BK |
| 17 | - |
| 18 | P99 20LG/LB |
| 19 | P36 20TN/DB |
| 20 | X53 18DG |




C303
(RHD)

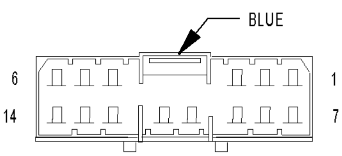
C303 (RHD) - ORANGE (UNIBODY SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Q11 14OR/LG |
| 2 | - |
| 3 | P33 16TN/DB |
| 4 | C16 20DB/GY |
| 5 | P71 20TN/DG |
| 6 | P110 20LG/WT |
| 7 | - |
| 8 | P37 20LG/TN |
| 9 | X55 18DG/BR |
| 10 | Q21 14OR/WT |
| 11 | - |
| 12 | P35 16TN/YL |
| 13 | P75 20TN/LG |
| 14 | P76 20TN/LB |
| 15 | G75 20VT |
| 16 | Z999 20BK |
| 17 | - |
| 18 | P99 20LG/LB |
| 19 | P36 20TN/DB |
| 20 | X53 18DG |



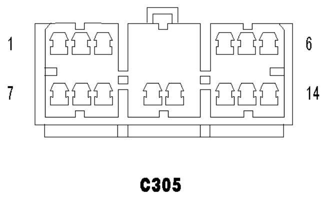

C304 - (UNIBODY SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Z998 20BK |
| 2 | - |
| 3 | X52 18GY/DB (BASE AUDIO) |
| 3 | X205 18GY/LG (PREMIUM AUDIO) |
| 4 | - |
| 5 | X58 18GY/OR (BASE AUDIO) |
| 5 | X296 18LG/GY (PREMIUM AUDIO) |
| 6 | - |
| 7 | Q112 14OR/BR |
| 8 | Q212 14OR/VT |
| 9 | G76 20VT/YL |
| 10 | P35 16TN/YL |
| 11 | P33 16TN/DB |
| 12 | - |
| 13 | - |
| 14 | - |



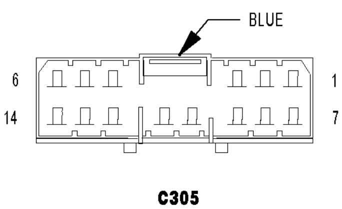

C304 - BLUE (REAR DOOR SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Z998 20BK |
| 2 | - |
| 3 | X205 18GY/LG |
| 4 | - |
| 5 | X296 18LG/GY |
| 6 | - |
| 7 | Q112 16OR/BR |
| 8 | Q212 16OR/VT |
| 9 | G76 20VT/YL |
| 10 | P35 16TN/YL |
| 11 | P33 16TN/DB |
| 12 | - |
| 13 | - |
| 14 | - |



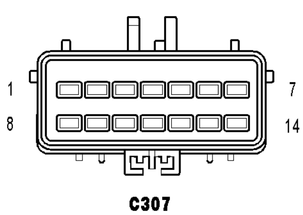

C305 - (UNIBODY SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Z999 20BK |
| 2 | - |
| 3 | X51 18DG/DB (BASE AUDIO) |
| 3 | X206 18DG/LG (PREMIUM AUDIO) |
| 4 | - |
| 5 | X57 18DG/OR (BASE AUDIO) |
| 5 | X295 18GY/DG (PREMIUM AUDIO) |
| 6 | - |
| 7 | Q111 14TN/YL |
| 8 | Q211 14TN/LB |
| 9 | G77 20VT/GY |
| 10 | P35 16TN/YL |
| 11 | P33 16TN/DB |
| 12 | - |
| 13 | - |
| 14 | - |



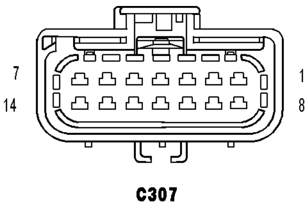

C305 - BLUE (LEFT REAR DOOR SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Z999 20BK |
| 2 | - |
| 3 | X206 18DG/LG |
| 4 | - |
| 5 | X295 18GY/DG |
| 6 | - |
| 7 | Q111 16TN/YL |
| 8 | Q211 16TN/LB |
| 9 | G77 20VT/GY |
| 10 | P35 16TN/YL |
| 11 | P33 16TN/DB |
| 12 | - |
| 13 | - |
| 14 | - |



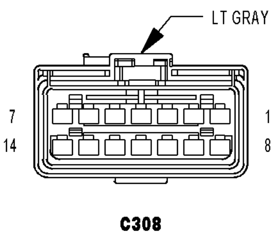

C307 - (FUEL TANK SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | - |
| 2 | N1 18DG/OR (GAS) |
| 3 | N4 20DB/YL (GAS) |
| 4 | B1 20DG/DB |
| 5 | B2 20DG/LB |
| 6 | K106 20VT/LB (GAS) |
| 7 | K107 20VT/WT (GAS) |
| 8 | K300 20BR (DIESEL) |
| 9 | K304 20BR/DB (DIESEL) |
| 10 | B3 20DG/YL |
| 11 | B4 20LG/GY |
| 12 | - |
| 13 | - |
| 14 | - |



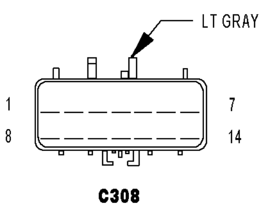

C307 - (UNIBODY SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | - |
| 2 | N1 16DB/OR |
| 3 | N4 20DB/YL |
| 4 | B1 20DG/DB |
| 5 | B2 20DG/LB |
| 6 | K106 20VT/LB |
| 7 | K107 20VT/WT |
| 8 | K310 20BR/DG (ESP) |
| 9 | K304 20BR/DB |
| 10 | B3 20DG/YL (ESP) |
| 11 | B4 20LG/GY (ESP) |
| 12 | - |
| 13 | - |
| 14 | - |



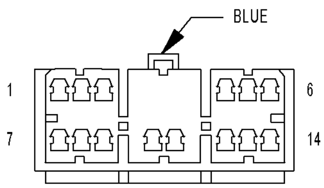

C308 - LT GRAY (OVERHEAD SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Q39 16RD |
| 2 | L10 20BK/VT (DAY/NIGHT MIRROR) |
| 3 | A908 20RD |
| 4 | G773 20RD (EXCEPT BASE) |
| 5 | Z111 16BK/WT (SUNROOF) |
| 6 | P112 20BK/TN (DAY/NIGHT MIRROR) |
| 7 | X75 18GY/DG (EXPORT) |
| 8 | F942 20BK/PK (COMPASS MINI TRIP COMPUTER) |
| 9 | Z18 20BK/LB (EXPORT) |
| 10 | M20 20YL/LB (EXCEPT BASE) |
| 11 | Z327 20BK/WT |
| 12 | Z13 20BK/WT (COMPASS MINI TRIP COMPUTER) |
| 13 | P114 20BK/GY (DAY/NIGHT MIRROR) |
| 14 | D25 20WT/VT (COMPASS MINI TRIP COMPUTER) |



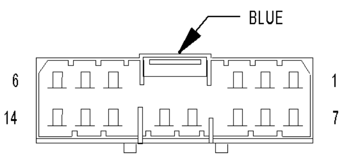

C308 - LT GRAY (UNIBODY SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Q39 16OR/TN |
| 2 | L10 20WT/GY |
| 3 | A908 18RD |
| 4 | G773 20VT/OR |
| 5 | Z111 16BK/WT |
| 6 | P112 20TN/OR (LHD) |
| 7 | X75 18GY/DG |
| 8 | F942 20PK/LG |
| 9 | Z18 20BK/LB |
| 10 | M20 20YL/LB |
| 11 | Z327 20BK/WT |
| 12 | Z13 20BK/WT |
| 13 | P114 20TN/WT (LHD) |
| 14 | D25 20WT/VT |



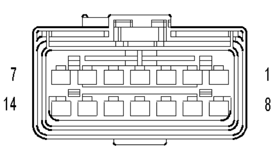

C309 - (SPLITGATE SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Z213 18BK/OR |
| 2 | W13 20BR/LG |
| 3 | W27 20DB/BR |
| 4 | P101 20LG/WT |
| 5 | - |
| 6 | L77 18PK/RD (EXPORT) |
| 7 | A44 18RD/OR |
| 8 | P30 20TN/DG |
| 9 | P31 20TN/YL |
| 10 | G910 20VT/BR |
| 11 | G78 20VT/OR |
| 12 | G80 20VT/YL |
| 13 | - |
| 14 | P100 20DB/LG |



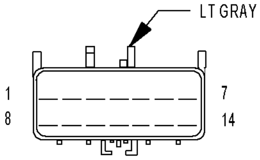

C309 - (UNIBODY SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Z213 18BK/OR |
| 2 | W13 20BR/LG |
| 3 | W27 20DB/BR |
| 4 | P101 20LG/WT |
| 5 | - |
| 6 | L77 18PK/RD |
| 7 | A44 18RD/OR |
| 8 | P30 20TN/DG |
| 9 | P31 20TN/YL |
| 10 | G910 20VT/BR |
| 11 | G78 20VT/OR |
| 12 | G80 20VT/YL |
| 13 | - |
| 14 | P100 20DB/LG |




C310 - (UNIBODY SIDE)

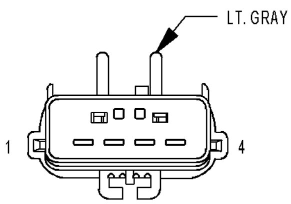
| CAV | CIRCUIT |
|---|---|
| 1 | A913 16RD (EXPORT) |
| 2 | L10 20WT/GY |
| 3 | L77 18PK/RD |
| 4 | L63 18WT/DG |
| 5 | L90 16WT/OR |
| 6 | L50 18WT/TN |
| 7 | A100 14RD/VT (EXPORT) |
| 8 | F302 20GY/PK (EXPORT) |
| 9 | Z934 14BK |
| 10 | - |
| 11 | L78 18WT/OR |
| 12 | L62 18WT/OR |
| 13 | - |
| 14 | A206 14RD (EXPORT) |




C310

C310 - LT GRAY (REAR LIGHTING SIDE)

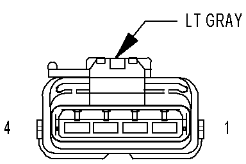
| CAV | CIRCUIT |
|---|---|
| 1 | - |
| 2 | L10 20WT/GY |
| 3 | L77 18PK/RD |
| 4 | L63 18WT/DG |
| 5 | L90 16WT/OR (EXPORT) |
| 6 | L50 18WT/TN |
| 7 | - |
| 8 | - |
| 9 | Z934 16BK |
| 10 | - |
| 11 | L78 18WT/OR |
| 12 | L62 18WT/OR |
| 13 | - |
| 14 | - |




C311

C311 - LT GRAY (DRIVER SEAT SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | R57 18LG/GY |
| 1 | R57 18DG (HEATED SEATS) |
| 2 | R59 18LB |
| 2 | F37 18PK/LB (HEATED SEATS) |
| 3 | R59 18LG/TN (HEATED SEATS) |
| 4 | Z238 18 (HEATED SEATS) |




C311

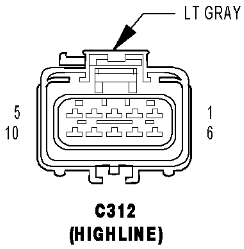
C311 - LT GRAY (UNIBODY SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | Z998 20BK |
| 2 | F37 14PK/LB (PREMIUM AUDIO) |
| 3 | R57 20LG/GY (LHD) |
| 3 | R58 20LB/GY (RHD) |
| 4 | Z849 16BK/OR (PREMIUM AUDIO) |

**CONNECTOR NOT AVAILABLE**

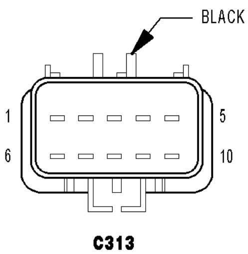
C312 - LT GRAY (SEAT SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | |
| 2 | P86 20LG/GY |
| 3 | F98 16PK/YL |
| 4 | F302 20GY/PK |
| 5 | A902 18RD |
| 6 | P142 20LG/TN |
| 7 | P134 TN/LB |
| 8 | P82 20TN/LB |
| 9 | P84 20TN/WT |
| 10 | |



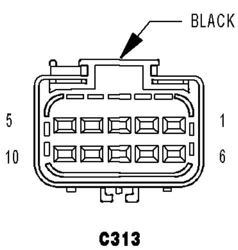

C312 - LT GRAY (UNIBODY SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | - |
| 2 | P86 20LG/GY |
| 3 | F98 16PK/YL |
| 4 | F302 20GY/PK |
| 5 | A902 18RD |
| 6 | P142 20LG/TN |
| 7 | P134 20TN/LB |
| 8 | P82 20TN/LB |
| 9 | P84 20TN/WT |
| 10 | - |



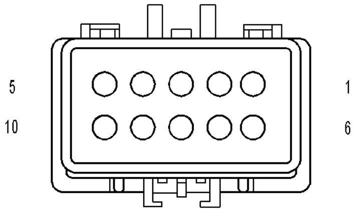

C313 - BLACK (RIGHT SEAT SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | D25 18WT/VT |
| 2 | R57 18LG/GY |
| 3 | Z105 18BK/LG |
| 4 | R59 18LG/TN |
| 5 | F37 18PK/LB |
| 6 | F201 18LG/YL |
| 7 | - |
| 8 | Z849 14BK/WT |
| 9 | - |
| 10 | - |




C313 - BLACK (UNIBODY SIDE)

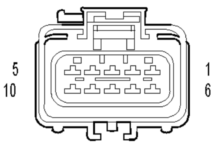
| CAV | CIRCUIT |
|---|---|
| 1 | D25 20WT/VT (LHD) |
| 2 | R57 20LG/GY (RHD) |
| 3 | Z105 20BK (LHD) |
| 4 | R58 20LB/GY (LHD) |
| 5 | F37 14PK/LB (POWER SEATS) (RHD) |
| 6 | F201 20PK/OR (LHD) |
| 7 | - |
| 8 | Z849 16BK/OR (POWER SEATS) (RHD) |
| 9 | - |
| 10 | Z999 20BK |




C314
(HEATED SEATS)

C314 (HEATED SEATS) - (SEAT SIDE)

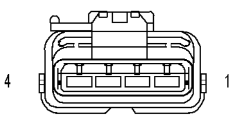
| CAV | CIRCUIT |
|---|---|
| 1 | - |
| 2 | P86 18LG/GY |
| 3 | F98 18PK/YL |
| 4 | F302 20BR/PK |
| 5 | - |
| 6 | P142 20LG/TN |
| 7 | P134 20LG/OR |
| 8 | P82 20VT/LG |
| 9 | P84 20VT/BK |
| 10 | - |




C314

C314 - (UNIBODY SIDE)

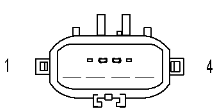
| CAV | CIRCUIT |
|---|---|
| 1 | - |
| 2 | P86 20LG/GY |
| 3 | F98 16PK/YL |
| 4 | F302 20GY/PK |
| 5 | - |
| 6 | P142 20LG/TN |
| 7 | P134 20TN/LB |
| 8 | P82 20TN/LB |
| 9 | P84 20TN/WT |
| 10 | - |




C315
(LHD MIDLINE/
HIGHLINE)

C315 (LHD MIDLINE/HIGHLINE) - (UNIBODY SIDE)

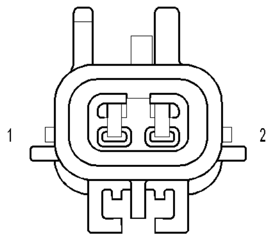
| CAV | CIRCUIT |
|---|---|
| 1 | Q12 14OR/BR |
| 2 | Q22 14OR/VT |
| 3 | Q112 14OR/BR |
| 4 | Q212 14OR/VT |




C315
(RHD MIDLINE
/HIGHLINE)

C315 (RHD MIDLINE/HIGHLINE) - (UNIBODY SIDE)

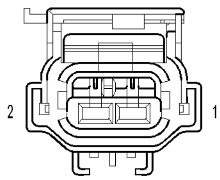
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Q11 14OR/LG | LEFT FRONT WINDOW DRIVER UP |
| 2 | Q21 14OR/WT | LEFT FRONT WINDOW DRIVER DOWN |
| 3 | Q111 14TN/YL | LEFT REAR WINDOW DRIVER UP |
| 4 | Q211 14TN/LB | LEFT REAR WINDOW DRIVER DOWN |




C318

C318 - (LIGHT BAR SIDE)

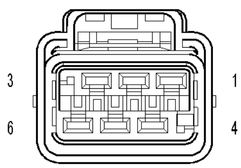
| CAV | CIRCUIT |
|---|---|
| 1 | Z846 16BK |
| 2 | L8 14WT/DG |




C318

C318 - (LIGHTBAR JUMPER SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | L8 14WT/DG |
| 1 | Z846 16BK |




C328

C328 - (OVERHEAD SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | L50 18WT/TN |
| 2 | C15 12RD |
| 3 | - |
| 4 | Z255 12RD |
| 5 | - |
| 6 | - |

CONNECTOR NOT AVAILABLE

C328 - (UNIBODY SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | L50C 18WT/TN |
| 2 | C15 12DB/WT |
| 3 | - |
| 4 | Z255 12BK/WT |
| 5 | - |
| 6 | - |

**CONNECTOR NOT AVAILABLE**

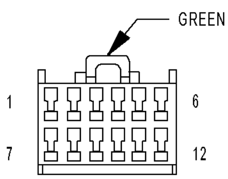
C330 - (REAR FASCIA SIDE)

| CAV | CIRCUIT |
|---|---|
| 1 | D508 20WT/GY |
| 2 | F22 20PK/TN |
| 3 | Z912 18BK |
| 4 | - |

**CONNECTOR NOT AVAILABLE**

C330 - (UNIBODY SIDE)

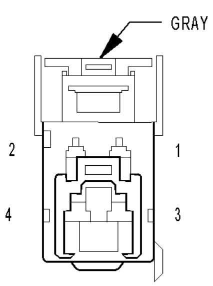
| CAV | CIRCUIT |
|---|---|
| 1 | D508 20WT/GY (TPM) |
| 2 | F22 20PK/TN (TPM) |
| 3 | Z912 18BK |
| 4 | - |




**CHANGER-CD**

CHANGER-CD - GREEN 12 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X41 20DG/WT | AUDIO MUX LEFT |
| 2 | - | |
| 3 | - | |
| 4 | Z515 20BK | GROUND |
| 5 | X112 20LG/GY | IGNITION RUN/ACC SIGNAL |
| 6 | X160 20GY/YL | FUSED B(+) |
| 7 | X40 20GY/WT | AUDIO MUX RIGHT |
| 8 | X140 20GY/OR | SHIELD |
| 9 | - | |
| 10 | - | |
| 11 | X235 20GY | AUDIO RETURN |
| 12 | D25 20WT/VT | PCI BUS |




**RADIO CHOKE (MIDLINE/ PREMIUM)**

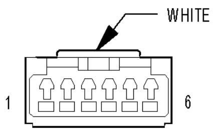
CHOKE-RADIO (MIDLINE/PREMIUM) - GRAY 4 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X1 16DG/BR | ANTENNA RELAY OUTPUT |
| 2 | X13 16LG/GY | RADIO CHOKE OUTPUT |
| 3 | A116 20YL/RD | ANTENNA RELAY OUTPUT |
| 4 | Z140 20BK/OR | GROUND |

**CONNECTOR NOT AVAILABLE**

CIRCUIT BREAKERS (JB)

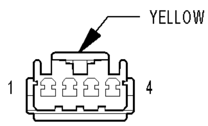
| CB NO. | AMPS | FUSED CIRCUIT | FUNCTION |
|---|---|---|---|
| 1 | 20A | A5 16RD/VT | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 3 | 10A | F37 14PK/LB | FUSED B(+) |



CLOCKSPRING C1

CLOCKSPRING C1 - WHITE 6 WAY

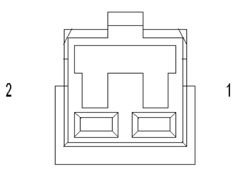
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | V38 20VT/OR (DIESEL) | S/C SWITCH SIGNAL NO. 2 |
| 2 | X3 20DG/VT | HORN RELAY CONTROL |
| 3 | X20 20GY/WT (EXCEPT BASE) | RADIO CONTROL MUX |
| 4 | X920 20GY/OR (EXCEPT BASE) | RADIO CONTROL MUX RETURN |
| 5 | K900 20DB/DG | SENSOR GROUND |
| 6 | V37 20VT | S/C SWITCH SIGNAL NO. 1 |



CLOCKSPRING C2

CLOCKSPRING C2 - YELLOW 4 WAY

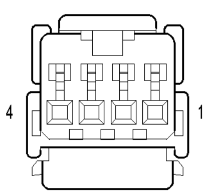
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R43 20LG/BR | DRIVER SQUIB 1 LINE 1 |
| 2 | R45 20LG/OR | DRIVER SQUIB 1 LINE 2 |
| 3 | R61 20LG/VT | DRIVER SQUIB 2 LINE 1 |
| 4 | R63 20LG/WT | DRIVER SQUIB 2 LINE 2 |



CLOCKSPRING C3

CLOCKSPRING C3 - 2 WAY

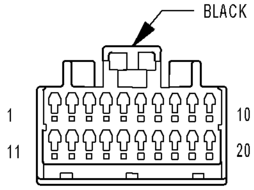
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X3 20DG/VT | HORN RELAY CONTROL |
| 2 | V38 20VT/OR | S/C SWITCH SIGNAL NO. 2 |



CLOCKSPRING C4 (EXCEPT BASE)

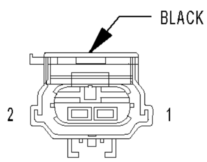
CLOCKSPRING C4 (EXCEPT BASE) - 4 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | V37 20VT | S/C SWITCH SIGNAL NO. 1 |
| 2 | K900 20DB/DG | SENSOR GROUND |
| 3 | X920 20GY/OR (HIGHLINE) | RADIO CONTROL MUX RETURN |
| 4 | X20 20GY/WT (HIGHLINE) | RADIO CONTROL MUX |



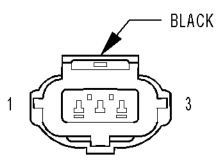

CLUSTER - BLACK 20 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A908 18RD | FUSED B(+) |
| 2 | R57 20LG/GY | DRIVER SEAT BELT SWITCH SENSE |
| 3 | G69 20VT/WT | VTSS INDICATOR DRIVER |
| 4 | B25 20DG/WT | PARK BRAKE SWITCH SENSE |
| 5 | L63 20WT/DG | LEFT TURN SIGNAL |
| 6 | G18 20OR/VT | LOW COOLANT FLUID LEVEL SENSE |
| 7 | - | - |
| 8 | G150 20VT/BR | INSTRUMENT CLUSTER WAKE UP SIGNAL |
| 9 | - | - |
| 10 | Z18 20BK/LB | GROUND |
| 11 | R58 20LB/GY | PASSENGER SEAT BELT SWITCH SENSE |
| 12 | F942 20PK/LG | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 13 | W1 20BR/TN | LOW WASHER FLUID SENSE |
| 14 | B20 20DG/OR | RED BRAKE WARNING INDICATOR DRIVER |
| 15 | L62 18WT/OR | RIGHT TURN SIGNAL |
| 16 | - | - |
| 17 | D25 20WT/VT | PCI BUS |
| 18 | - | - |
| 19 | E2 20OR/BR | PANEL LAMPS DRIVER |
| 20 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |



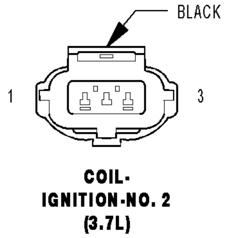

CLUTCH-A/C COMPRESSOR - BLACK 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | C3 18DB/YL | A/C CLUTCH RELAY OUTPUT |
| 2 | Z939 18BK | GROUND |



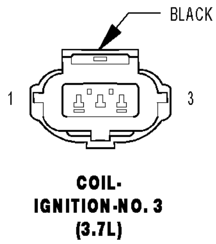

COIL-IGNITION-NO. 1 (3.7L) - BLACK 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K86 16YL/DB | COIL CONTROL NO. 1 |
| 2 | A142 14RD/OR | ASD RELAY OUTPUT |
| 3 | - | - |



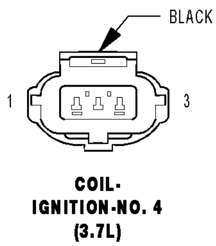

COIL-IGNITION-NO. 2 (3.7L) - BLACK 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K85 16DB/YL | COIL CONTROL NO. 2 |
| 2 | A142 14RD/OR | ASD RELAY OUTPUT |
| 3 | - | - |



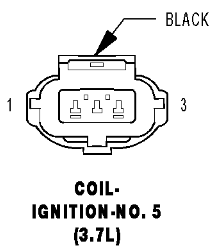

COIL-IGNITION-NO. 3 (3.7L) - BLACK 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K93 16DB | COIL CONTROL NO. 3 |
| 2 | A142 14RD/OR | ASD RELAY OUTPUT |
| 3 | - | - |



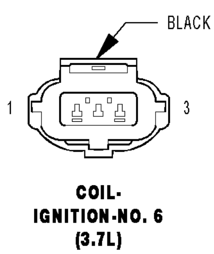

COIL-IGNITION-NO. 4 (3.7L) - BLACK 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K15 16DB/RD | COIL CONTROL NO. 4 |
| 2 | A142 14RD/OR | ASD RELAY OUTPUT |
| 3 | - | - |



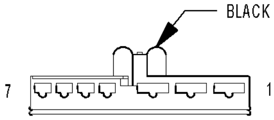

COIL-IGNITION-NO. 5 (3.7L) - BLACK 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K16 16DB/YL | COIL CONTROL NO. 5 |
| 2 | A142 14RD/OR | ASD RELAY OUTPUT |
| 3 | - | - |



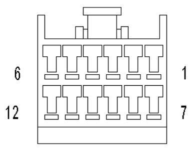

COIL-IGNITION-NO. 6 (3.7L) - BLACK 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K10 16DB/OR | COIL CONTROL NO. 6 |
| 2 | A142 14RD/OR | ASD RELAY OUTPUT |
| 3 | - | - |



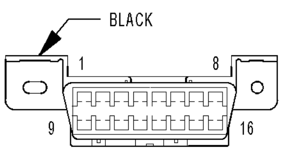

CONTROL-A/C-HEATER C1 - BLACK 7 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z134 12BK/LG | GROUND |
| 2 | C75 12DB/GY | BLOWER MOTOR HIGH DRIVER |
| 3 | C73 14DB/VT | BLOWER MOTOR M2 DRIVER |
| 4 | C72 16DB/OR | BLOWER MOTOR M1 DRIVER |
| 5 | C71 16DB/BR | BLOWER MOTOR LOW DRIVER |
| 6 | C221 20LB/OR | A/C ON/OFF CONTROL |
| 7 | E2 20OR/BR | PANEL LAMPS DRIVER |



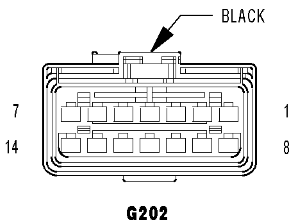

CONTROL-A/C-HEATER C2 - 12 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | C35 20LB/OR | MODE DOOR DRIVER (A) |
| 2 | F302 20GY/PK | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 3 | - | - |
| 4 | - | - |
| 5 | - | - |
| 6 | C215 20LB | REAR WINDOW DEFOGGER CONTROL |
| 7 | - | - |
| 8 | Z945 20BK | GROUND |
| 9 | - | - |
| 10 | - | - |
| 11 | - | - |
| 12 | C16 20DB/GY | FUSED REAR WINDOW DEFOGGER RELAY OUTPUT |



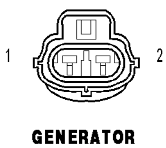

DATA LINK CONNECTOR - BLACK 16 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | D25 20WT/VT | PCI BUS |
| 3 | - | - |
| 4 | Z11 20BK/LG | GROUND |
| 5 | Z11 20BK/LG | GROUND |
| 6 | D65 20WT/LG | CAN C BUS(+) |
| 7 | D21 20WT/GY (DIESEL) | SCI TRANSMIT (ECM) |
| 7 | D21 20WT/GY (GAS) | SCI TRANSMIT (PCM) |
| 8 | - | - |
| 9 | D16 20WT/OR | SCI RECEIVE (TCM) |
| 10 | - | - |
| 11 | - | - |
| 12 | D20 20WT/LG (DIESEL) | SCI RECEIVE (ECM) |
| 12 | D20 20WT/LG (GAS) | SCI RECEIVE (PCM) |
| 13 | - | - |
| 14 | D64 20WT/LB | CAN C BUS(-) |
| 15 | D15 20BR/WT | SCI TRANSMIT (TCM) |
| 16 | A333 20WT/RD | FUSED B(+) |



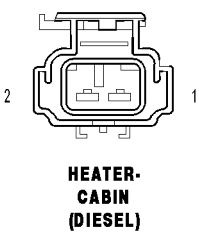

G202 - BLACK 14 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z945 18BK | GROUND |
| 2 | Z940 14BK | GROUND |
| 3 | Z120 20BK/WT (EXCEPT BASE) | GROUND |
| 4 | - | - |
| 5 | Z950 20BK | GROUND |
| 6 | Z18 20BK/LB | GROUND |
| 7 | Z10 16BK/TN | GROUND |
| 8 | Z15 16BK/TN | GROUND |
| 9 | Z943 14BK | GROUND |
| 10 | Z944 16BK | GROUND |
| 11 | Z938 20BK | GROUND |
| 12 | - | - |
| 13 | - | - |
| 14 | Z385C 20BK | GROUND |



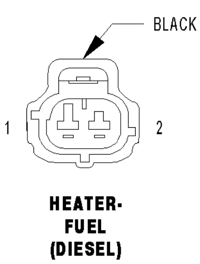

GENERATOR - 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K125 16BR/DG | GEN FIELD CONTROL |
| 2 | Z932 18BK (GAS) | GROUND |



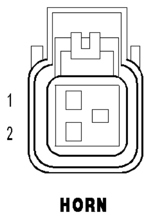

HEATER-CABIN (DIESEL) - 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A119 18RD/OR | CABIN HEATER RELAY OUTPUT |
| 2 | Z966 18BK | GROUND |



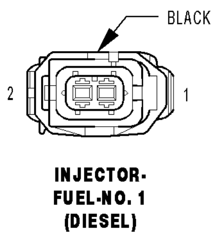

HEATER-FUEL (DIESEL) - BLACK 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A993 16RD | FUEL HEATER RELAY OUTPUT |
| 2 | Z939 18BK | GROUND |




HORN - 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X2 18DG/OR | HORN RELAY OUTPUT |
| 2 | Z931 18BK | GROUND |

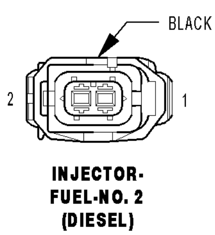



INJECTOR-FUEL-NO. 1 (DIESEL) - BLACK 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K611 16OR/BR | FUEL INJECTOR NO. 1 LOW-SIDE CONTROL |
| 2 | K11 16BR/YL | FUEL INJECTOR NO. 1 HIGH-SIDE CONTROL |

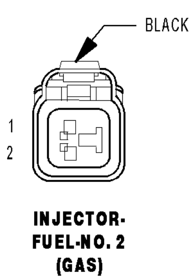

INJECTOR-FUEL-NO. 1 (GAS) - BLACK 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F142 16PK/GY | FUSED ASD RELAY OUTPUT |
| 2 | K11 16BR/YL | INJECTOR CONTROL NO. 1 |



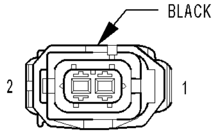

INJECTOR-FUEL-NO. 2 (DIESEL) - BLACK 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K612 16YL/BR | FUEL INJECTOR NO. 2 LOW-SIDE CONTROL |
| 2 | K12 16BR/DB | FUEL INJECTOR NO. 2 HIGH-SIDE CONTROL |




INJECTOR-FUEL-NO. 2 (GAS) - BLACK 2 WAY

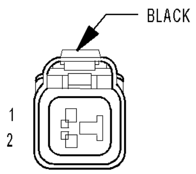
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F142 16PK/GY | FUSED ASD RELAY OUTPUT |
| 2 | K12 16BR/DB | INJECTOR CONTROL NO. 2 |




FUEL
INJECTOR
NO. 3
(DIESEL)

INJECTOR-FUEL-NO. 3 (DIESEL) - BLACK 2 WAY

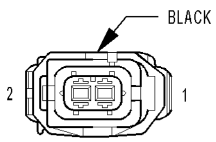
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K613 16GY/BR | FUEL INJECTOR NO. 3 LOW-SIDE CONTROL |
| 2 | K13 16BR/LB | FUEL INJECTOR NO. 3 HIGH-SIDE CONTROL |




INJECTOR-
FUEL-NO. 3
(GAS)

INJECTOR-FUEL-NO. 3 (GAS) - BLACK 2 WAY

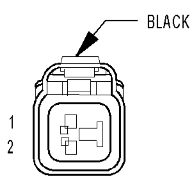
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F142 16PK/GY | FUSED ASD RELAY OUTPUT |
| 2 | K13 16BR/LB | INJECTOR CONTROL NO. 3 |




INJECTOR-
FUEL-NO. 4
(DIESEL)

INJECTOR-FUEL-NO. 4 (DIESEL) - BLACK 2 WAY

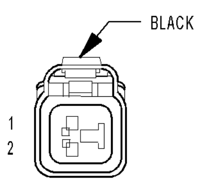
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K614 16WT/BR | FUEL INJECTOR NO. 4 LOW-SIDE CONTROL |
| 2 | K14 16BR/TN | FUEL INJECTOR NO. 4 HIGH-SIDE CONTROL |




INJECTOR-
FUEL-NO. 4
(GAS)

INJECTOR-FUEL-NO. 4 (GAS) - BLACK 2 WAY

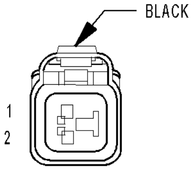
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F142 16PK/GY | FUSED ASD RELAY OUTPUT |
| 2 | K14 16BR/RD | INJECTOR CONTROL NO. 4 |




INJECTOR-
FUEL-NO. 5
(GAS)

INJECTOR-FUEL-NO. 5 (GAS) - BLACK 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F142 16PK/GY | FUSED ASD RELAY OUTPUT |
| 2 | K38 16BR/OR | INJECTOR CONTROL NO. 5 |




INJECTOR-FUEL-NO. 6 (GAS)

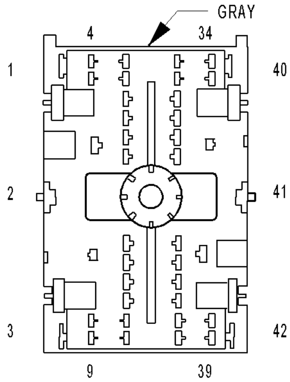
INJECTOR-FUEL-NO. 6 (GAS) - BLACK 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F142 16PK/GY | FUSED ASD RELAY OUTPUT |
| 2 | K58 16BR | INJECTOR CONTROL NO. 6 |

CONNECTOR NOT AVAILABLE

JUNCTION BLOCK C1 - 42 WAY

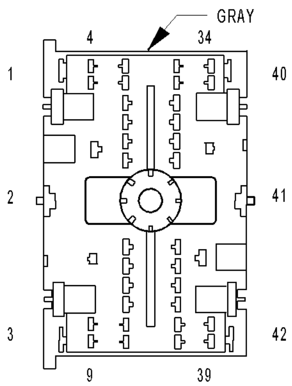
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | - | - |
| 3 | F944 12PK/LG | IGNITION SWITCH OUTPUT (RUN-START) |
| 4 | E2 20OR/BR | PANEL LAMPS DRIVER |
| 5 | E2 20OR/BR | PANEL LAMPS DRIVER |
| 6 | - | - |
| 7 | X3 20DG/VT | HORN RELAY CONTROL |
| 8 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |
| 9 | A207 16RD/LG (LHD) | FUSED B(+) |
| 10 | E2 20OR/BR (LIGHTBAR) | PANEL LAMPS DRIVER |
| 11 | E2 20OR/BR | PANEL LAMPS DRIVER |
| 12 | - | - |
| 13 | A333 20WT/RD | FUSED B(+) |
| 14 | A908 20RD | FUSED B(+) |
| 15 | A908 20RD | FUSED B(+) |
| 16 | L50 18WT/TN | BRAKE LAMP SWITCH OUTPUT |
| 17 | Z944 16BK | GROUND |
| 18 | - | - |
| 19 | - | - |
| 20 | Z943 14BK | GROUND |
| 21 | L309 20WT/OR | HIGH BEAM RELAY CONTROL |
| 22 | - | - |
| 23 | Z327 20BK/WT | GROUND |
| 24 | Z327 20BK/WT | GROUND |
| 25 | F943 20PK/LG | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 26 | A333 20WT/RD (SKIM) | FUSED B(+) |
| 27 | A908 18RD | FUSED B(+) |
| 28 | F302 20GY/PK | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 29 | F302 20GY/PK | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 30 | - | - |
| 31 | F942 20PK/LG | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 32 | - | - |
| 33 | F1 18PK/WT (RHD) | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 34 | C16 20DB/GY | FUSED REAR WINDOW DEFOGGER RELAY OUTPUT |
| 35 | F307 16LB/PK (RHD) | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 36 | - | - |
| 37 | A103 18GY/RD | FUSED B(+) |
| 38 | C115 20DB | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 39 | F100 20PK/VT | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 40 | F981 12PK/YL | IGNITION SWITCH OUTPUT (RUN-ACC) |
| 41 | A701 18BR/RD | FUSED B(+) |
| 42 | F921 12PK/YL | IGNITION SWITCH OUTPUT (RUN) |



JUNCTION BLOCK C2

JUNCTION BLOCK C2 - GRAY 42 WAY

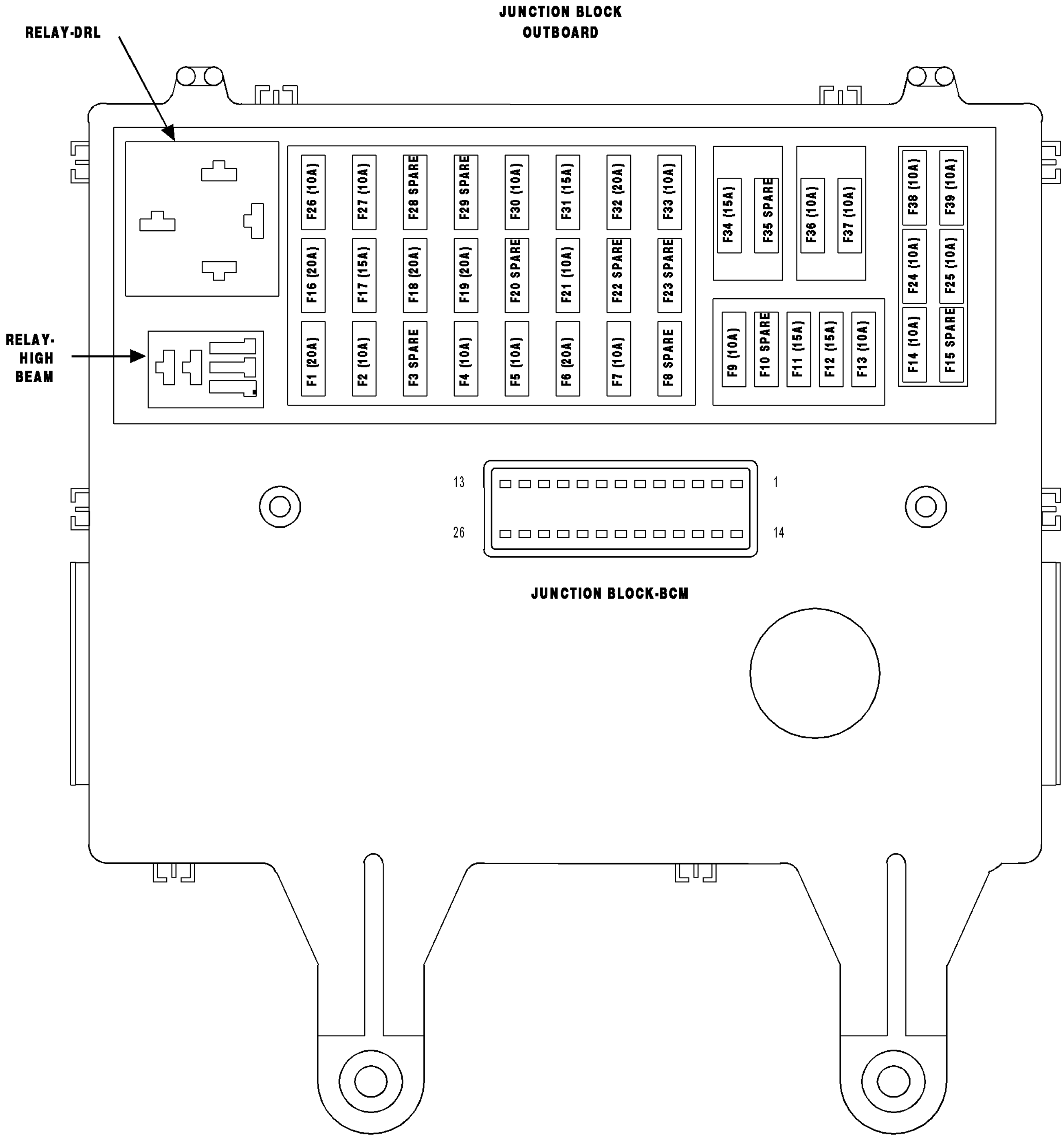
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F37 14PK/LB (MIDLINE/HIGHLINE) | FUSED B(+) |
| 2 | C15 12DB/WT | REAR WINDOW DEFOGGER RELAY OUTPUT |
| 3 | Q39 16OR/TN | POWER SUNROOF RELAY OUTPUT |
| 4 | F892 20PK/YL | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 5 | P37 20LG/TN (EXCEPT BASE) | DOOR LOCK SWITCH GROUND |
| 6 | P33 16TN/DB | LOCK RELAY OUTPUT |
| 7 | L77 18PK/RD | FUSED PARK LAMP RELAY OUTPUT |
| 8 | P34 16TN/LB | DRIVER DOOR UNLOCK RELAY OUTPUT |
| 9 | P35 16TN/YL | UNLOCK RELAY OUTPUT |
| 10 | P36 20TN/DB | DOOR LOCK SWITCH MUX |
| 11 | P37 20LG/TN (EXCEPT BASE) | DOOR LOCK SWITCH GROUND |
| 12 | M20 20YL/LB | COURTESY LAMP LOAD SHED |
| 13 | L50 18WT/TN | BRAKE LAMP SWITCH OUTPUT |
| 14 | P36 20TN/DB | DOOR LOCK SWITCH MUX |
| 15 | P30 20TN/DG | TAILGATE LOCK DRIVER |
| 16 | A44 18RD/OR | FUSED B(+) |
| 17 | - | - |
| 18 | A908 18RD | FUSED B(+) |
| 19 | F22 20PK/TN | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 20 | E2 20OR/BR | PANEL LAMPS DRIVER |
| 21 | E2 20OR/BR | PANEL LAMPS DRIVER |
| 22 | P31 20TN/YL | TAILGATE UNLOCK DRIVER |
| 23 | F302 20GY/PK | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 24 | - | - |
| 25 | - | - |
| 26 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |
| 27 | - | - |
| 28 | A913 16RD (EXPORT/TRAILER TOW) | FUSED B(+) |
| 29 | - | - |
| 30 | Z327 20BK/WT | GROUND |
| 31 | C16 20DB/GY | FUSED REAR WINDOW DEFOGGER RELAY OUTPUT |
| 32 | F201 20PK/OR | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 33 | F201 20PK/OR | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 34 | L90 16WT/OR | REAR FOG LAMP RELAY OUTPUT |
| 35 | - | - |
| 36 | - | - |
| 37 | X1 16DG/BR (PREMIUM AUDIO) | FUSED B(+) |
| 38 | F942 20PK/LG | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 39 | C16 20DB/GY | FUSED REAR WINDOW DEFOGGER RELAY OUTPUT |
| 40 | F30 14PK/YL | POWER WINDOW RELAY OUTPUT |
| 41 | A305 16RD/LB | FUSED B(+) |
| 42 | A902 18RD (HEATED SEATS) | FUSED B(+) |




**JUNCTION BLOCK C3**

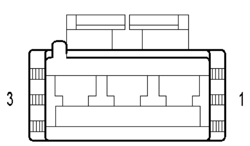
JUNCTION BLOCK C3 - GRAY 42 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A12 10RD/BR | FUSED B(+) |
| 2 | A912 10RD | FUSED B(+) |
| 3 | A906 12RD | FUSED B(+) |
| 4 | L44 18WT/TN | FUSED RIGHT LOW BEAM OUTPUT |
| 5 | L43 18WT/DB | FUSED LEFT LOW BEAM OUTPUT |
| 6 | - | - |
| 7 | - | - |
| 8 | F1 20PK/WT | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 9 | A5 16RD/VT | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 10 | A12 10RD/BR | FUSED B(+) |
| 11 | - | - |
| 12 | - | - |
| 13 | - | - |
| 14 | - | - |
| 15 | W6 20BR/LB | FRONT WIPER ON/OFF RELAY CONTROL |
| 16 | - | - |
| 17 | W7 16BR/GY | FRONT WIPER PARK SWITCH SENSE |
| 18 | W2 20BR/LG | FRONT WIPER HIGH/LOW RELAY CONTROL |
| 19 | F20 20PK/GY | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 20 | - | - |
| 21 | - | - |
| 22 | - | - |
| 23 | - | - |
| 24 | L50 18WT/TN | BRAKE LAMP SWITCH OUTPUT |
| 25 | - | - |
| 26 | - | - |
| 27 | - | - |
| 28 | L34 18WT/GY | FUSED RIGHT HIGH BEAM DRIVER |
| 29 | L77 18PK/RD | FUSED PARK LAMP RELAY OUTPUT |
| 30 | A908 20RD (LHD EXPORT) | FUSED B(+) |
| 30 | A908 18RD (RHD EXPORT) | FUSED B(+) |
| 31 | - | - |
| 32 | C115 20DB | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 33 | L89 16WT/YL | FRONT FOG LAMP RELAY OUTPUT |
| 34 | A901 10RD | FUSED B(+) |
| 35 | - | - |
| 36 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |
| 37 | L33 18WT/LG | FUSED LEFT HIGH BEAM DRIVER |
| 38 | F22 20PK/TN (ABS) | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 39 | X2 18DG/OR | HORN RELAY OUTPUT |
| 40 | A901 10RD | FUSED B(+) |
| 41 | A139 12RD/YL | FUSED B(+) |
| 42 | A911 10RD | FUSED B(+) |


JUNCTION BLOCK
OUTBOARD
RELAY-DRL
RELAY-
HIGH
BEAM
F26 (10A)
F27 (10A)
F28 SPARE
F29 SPARE
F30 (10A)
F31 (15A)
F32 (20A)
F33 (10A)
F16 (20A)
F17 (15A)
F18 (20A)
F19 (20A)
F20 SPARE
F21 (10A)
F22 SPARE
F23 SPARE
F1 (20A)
F2 (10A)
F3 SPARE
F4 (10A)
F5 (10A)
F6 (20A)
F7 (10A)
F8 SPARE
F34 (15A)
F35 SPARE
F36 (10A)
F37 (10A)
F9 (10A)
F10 SPARE
F11 (15A)
F12 (15A)
F13 (10A)
F38 (10A)
F39 (10A)
F24 (10A)
F25 (10A)
F14 (10A)
F15 SPARE
13
1
26
14
JUNCTION BLOCK-BCM

JUNCTION BLOCK-BCM - 26 WAY

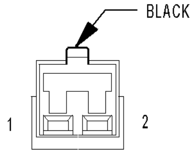
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X3 (PREMIUM) | HORN RELAY CONTROL |
| 2 | P334 | DOOR UNLOCK RELAY CONTROL |
| 3 | L779 | PARK LAMP RELAY CONTROL |
| 4 | L239 (RHD/LHD HIGHLINE) | REAR FOG LAMP RELAY CONTROL |
| 5 | P109 (EXCEPT BASE) | DRIVER DOOR UNLOCK RELAY CONTROL |
| 6 | C515 | REAR WINDOW DEFOGGER RELAY CONTROL |
| 7 | P305 (EXCEPT BASE) | ACCESSORY DELAY RELAY CONTROL |
| 8 | Z944 | GROUND |
| 9 | A213 | FUSED B(+) |
| 10 | L309 | HIGH BEAM RELAY CONTROL |
| 11 | P31 | TAILGATE UNLOCK DRIVER |
| 12 | P37 | DOOR LOCK SWITCH GROUND |
| 13 | L45 | LOW BEAM RELAY CONTROL |
| 14 | F98 | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 15 | A908 | FUSED B(+) |
| 16 | F942 | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 17 | L139 (EXCEPT BASE) | FRONT FOG LAMP RELAY CONTROL |
| 18 | P333 | DOOR LOCK RELAY CONTROL |
| 19 | W2 | FRONT WIPER HIGH/LOW RELAY CONTROL |
| 20 | W7 | FRONT WIPER PARK SWITCH SENSE |
| 21 | W6 | FRONT WIPER ON/OFF RELAY CONTROL |
| 22 | P30 | TAILGATE LOCK DRIVER |
| 23 | P36 | DOOR LOCK SWITCH MUX |
| 24 | Z327 | GROUND |
| 25 | Z943 | GROUND |
| 26 | M20 | COURTESY LAMP LOAD SHED |




LAMP-CARGO (EXCEPT BASE)

LAMP-CARGO (EXCEPT BASE) - BLACK 3 WAY

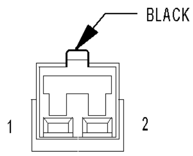
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | G773 20RD | REAR COURTESY LAMP CONTROL |
| 2 | A908 18RD | FUSED B(+) |
| 3 | Z327 20BK/WT | GROUND |




LAMP-COURTESY-LEFT

LAMP-COURTESY-LEFT - BLACK 2 WAY

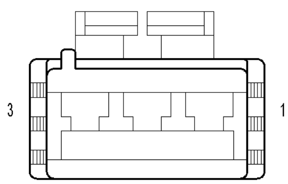
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A908 20RD | FUSED B(+) |
| 2 | Z327 20BK/WT | GROUND |




LAMP-COURTESY-RIGHT

LAMP-COURTESY-RIGHT - BLACK 2 WAY

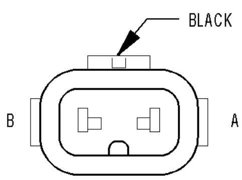
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A908 20RD | FUSED B(+) |
| 2 | Z327 20BK/WT | GROUND |




LAMP-DOME

LAMP-DOME - 3 WAY

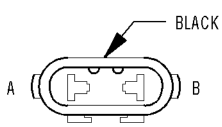
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z327 20BK/WT (EXCEPT BASE) | GROUND |
| 2 | A908 18RD (BASE) | FUSED B(+) |
| 2 | M20 20YL/LB (EXCEPT BASE) | COURTESY LAMP LOAD SHED |
| 3 | Z327 20RD (BASE) | GROUND |
| 3 | A908 20RD (EXCEPT BASE) | FUSED B(+) |




LAMP-FOG-LEFT FRONT

LAMP-FOG-LEFT FRONT - BLACK 2 WAY

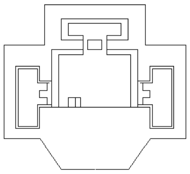
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| A | Z931 16BK | GROUND |
| B | L89 16WT/YL | FRONT FOG LAMP RELAY OUTPUT |




LAMP-FOG-RIGHT FRONT

LAMP-FOG-RIGHT FRONT - BLACK 2 WAY

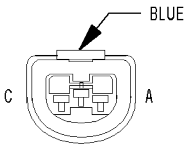
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| A | Z932 16BK | GROUND |
| A | Z932 16BK (EXPORT) | GROUND |
| B | L89 16WT/YL | FRONT FOG LAMP RELAY OUTPUT |



LAMP-
HEADLAMP-
LEFT
(EXPORT)

LAMP-HEADLAMP-LEFT (EXPORT) - 3 WAY

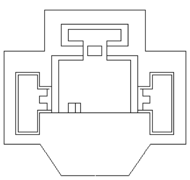
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L33 18WT/LG | FUSED LEFT HIGH BEAM OUTPUT |
| 2 | L43 18WT/DB | FUSED LEFT LOW BEAM OUTPUT |
| 3 | Z931 16BK | GROUND |




LAMP-
HEADLAMP-
LEFT
(EXCEPT EXPORT)

LAMP-HEADLAMP-LEFT (EXCEPT EXPORT) - 3 WAY

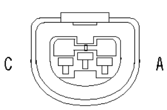
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| A | L43 18WT/DB | FUSED LEFT LOW BEAM OUTPUT |
| B | Z931 16BK | GROUND |
| C | L33 18WT/LG | FUSED LEFT HIGH BEAM OUTPUT |



LAMP-
HEADLAMP-
RIGHT
(EXPORT)

LAMP-HEADLAMP-RIGHT (EXPORT) - 3 WAY

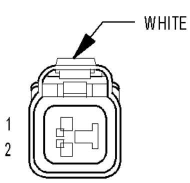
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L34 18WT/GY | FUSED RIGHT HIGH BEAM OUTPUT |
| 2 | L44 18WT/TN | FUSED RIGHT LOW BEAM OUTPUT |
| 3 | Z932 16BK | GROUND |




LAMP-
HEADLAMP-
RIGHT
(EXCEPT EXPORT)

LAMP-HEADLAMP-RIGHT (EXCEPT EXPORT) - 3 WAY

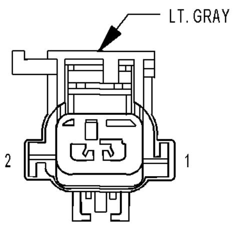
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| A | L44 18WT/TN | FUSED RIGHT LOW BEAM OUTPUT |
| B | Z932 16BK | GROUND |
| C | L34 18WT/GY | FUSED RIGHT HIGH BEAM OUTPUT |




LAMP-
HIGH
MOUNTED
STOP

LAMP-HIGH MOUNTED STOP - WHITE 2 WAY

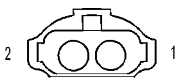
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| A1 | L50 18WT/TN | BRAKE LAMP SWITCH OUTPUT |
| A2 | Z255 18RD | GROUND |




**LAMP-LICENSE PLATE (EXCEPT EXPORT)**

LAMP-LICENSE PLATE (EXCEPT EXPORT) - LT GRAY 2 WAY

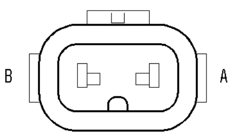
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L77 18PK/RD | FUSED PARK LAMP RELAY OUTPUT |
| 2 | Z934 16BK | GROUND |




**LAMP-LICENSE PLATE (EXPORT)**

LAMP-LICENSE PLATE (EXPORT) - 2 WAY

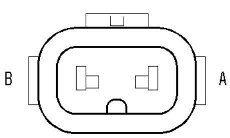
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L77 18PK/RD | FUSED PARK LAMP RELAY OUTPUT |
| 2 | Z213 18BK/OR | GROUND |




**LAMP-LIGHTBAR-NO. 1**

LAMP-LIGHTBAR-NO. 1 - 2 WAY

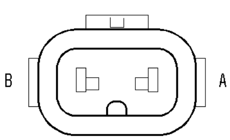
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z946 16BK | GROUND |
| 2 | L8 14WT/DG | LIGHTBAR SWITCHED OUTPUT |




**LAMP-LIGHTBAR-NO. 2**

LAMP-LIGHTBAR-NO. 2 - 2 WAY

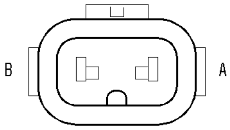
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z946 16BK | GROUND |
| 2 | L8 14WT/DG | LIGHTBAR SWITCHED OUTPUT |




**LAMP-LIGHTBAR-NO. 3**

LAMP-LIGHTBAR-NO. 3 - 2 WAY

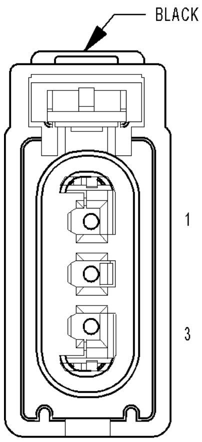
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z946 16BK | GROUND |
| 2 | L8 14WT/DG | LIGHTBAR SWITCHED OUTPUT |




LAMP-LIGHTBAR-NO. 4

LAMP-LIGHTBAR-NO. 4 - 2 WAY

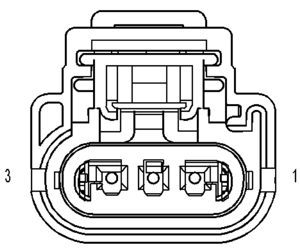
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z946 16BK | GROUND |
| 2 | L8 14WT/DG | LIGHTBAR SWITCHED OUTPUT |




LAMP-PARK/TURN-LEFT FRONT (EXPORT)

LAMP-PARK/TURN-LEFT FRONT (EXPORT) - BLACK 3 WAY

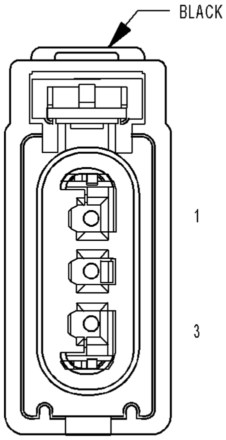
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L63 18WT/DG | LEFT TURN SIGNAL |
| 2 | - | - |
| 3 | Z931 16BK | GROUND |




LAMP-PARK/TURN-LEFT FRONT (EXCEPT EXPORT)

LAMP-PARK/TURN-LEFT FRONT (EXCEPT EXPORT) - 3 WAY

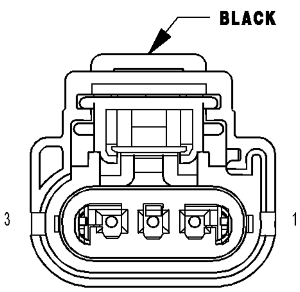
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L63 18WT/DG | LEFT TURN SIGNAL |
| 2 | L77 18PK/RD | FUSED PARK LAMP RELAY OUTPUT |
| 3 | - | |




LAMP-PARK/TURN-RIGHT FRONT (EXPORT)

LAMP-PARK/TURN-RIGHT FRONT (EXPORT) - BLACK 3 WAY

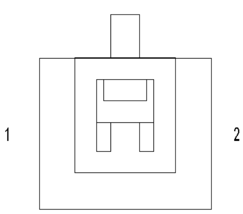
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L62 18WT/OR | RIGHT TURN SIGNAL |
| 2 | - | - |
| 3 | Z932 16BK | GROUND |




LAMP-PARK/TURN-RIGHT FRONT (EXCEPT EXPORT)

LAMP-PARK/TURN-RIGHT FRONT (EXCEPT EXPORT) - BLACK 3 WAY

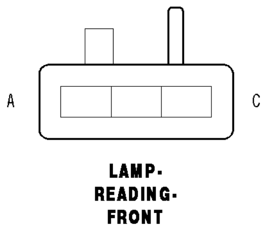
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L62 18WT/OR | RIGHT TURN SIGNAL |
| 2 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |
| 3 | Z932 16BK | GROUND |




LAMP-PASSENGER AIRBAG ON/OFF INDICATOR (EXCEPT EXPORT)

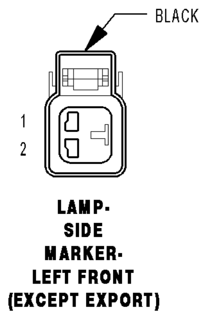
LAMP-PASSENGER AIRBAG ON/OFF INDICATOR (EXCEPT EXPORT) - 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F942 20PK/LG | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 2 | R166 20LG/TN | PASSENGER AIRBAG INDICATOR DRIVER |



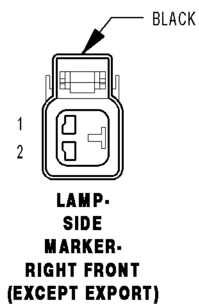

LAMP-READING-FRONT - 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| A | M20 20YL/LB | COURTESY LAMP LOAD SHED |
| B | A908 20RD | FUSED B(+) |
| C | Z327 20BK/WT | GROUND |



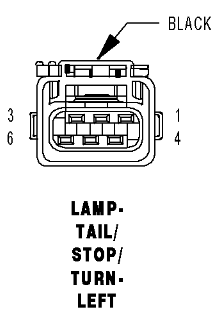

LAMP-SIDE MARKER-LEFT FRONT (EXCEPT EXPORT) - BLACK 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L77 18PK/RD | FUSED PARK LAMP RELAY OUTPUT |
| 1 | L77 18PK/RD | FUSED PARK LAMP RELAY OUTPUT |
| 1 | L77 18PK/RD | FUSED PARK LAMP RELAY OUTPUT |
| 2 | L63 18WT/DG | LEFT TURN SIGNAL |
| 2 | L63 18WT/DG | LEFT TURN SIGNAL |
| 2 | L63 18WT/DG | LEFT TURN SIGNAL |



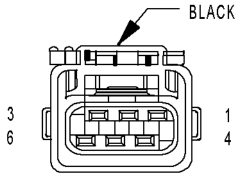

LAMP-SIDE MARKER-RIGHT FRONT (EXCEPT EXPORT) - BLACK 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |
| 1 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |
| 1 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |
| 2 | L62 18WT/OR | RIGHT TURN SIGNAL |
| 2 | L62 18WT/OR | RIGHT TURN SIGNAL |
| 2 | L62 18WT/OR | RIGHT TURN SIGNAL |




LAMP-TAIL STOP TURN-LEFT - BLACK 6 WAY

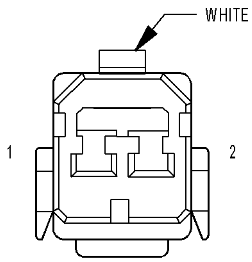
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L90 16WT/OR (EXPORT) | REAR FOG LAMP RELAY OUTPUT |
| 2 | L77 18PK/RD | FUSED PARK LAMP RELAY OUTPUT |
| 3 | L50 18WT/TN | BRAKE LAMP SWITCH OUTPUT |
| 4 | L10 20WT/GY | BACK-UP LAMP FEED |
| 5 | Z934 16BK | GROUND |
| 6 | L63 18WT/DG | LEFT TURN SIGNAL |




LAMP-
TAIL/
STOP/
TURN-
RIGHT

LAMP-TAIL STOP TURN-RIGHT - BLACK 6 WAY

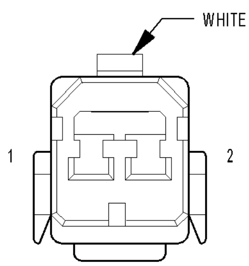
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L90 16WT/OR (EXPORT) | REAR FOG LAMP RELAY OUTPUT |
| 2 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |
| 3 | L50 18WT/TN | BRAKE LAMP SWITCH OUTPUT |
| 4 | L10 20WT/GY | BACK-UP LAMP FEED |
| 5 | Z934 16BK | GROUND |
| 6 | L62 18WT/OR | RIGHT TURN SIGNAL |




LAMP-
VANITY-
LEFT
(EXCEPT BASE)

LAMP-VANITY-LEFT (EXCEPT BASE) - WHITE 2 WAY

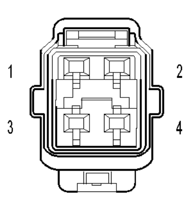
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A908 20RD | FUSED B(+) |
| 2 | M20 20YL/LB | COURTESY LAMP LOAD SHED |




LAMP-
VANITY-
RIGHT
(EXCEPT BASE)

LAMP-VANITY-RIGHT (EXCEPT BASE) - 2 WAY

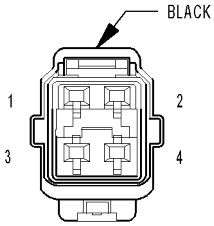
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A908 18RD | FUSED B(+) |
| 2 | M20 20YL/LB | COURTESY LAMP LOAD SHED |




LATCH-
DOOR LOCK MOTOR/
AJAR SWITCH-
FRONT LEFT
(EXCEPT BASE)

LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT LEFT (EXCEPT BASE) - 4 WAY

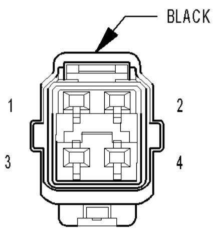
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | G75 20VT | LEFT FRONT DOOR AJAR SWITCH SENSE |
| 2 | Z999 20BK | GROUND |
| 3 | P34 16TN/LB (LHD) | DRIVER DOOR UNLOCK RELAY OUTPUT |
| 3 | P35 16TN/YL (RHD) | UNLOCK RELAY OUTPUT |
| 4 | P33 16TN/DB | LOCK RELAY OUTPUT |




LATCH-DOOR LOCK MOTOR/ AJAR SWITCH- FRONT RIGHT (EXCEPT BASE)

LATCH-DOOR LOCK MOTOR/AJAR SWITCH-FRONT RIGHT (EXCEPT BASE) - 4 WAY

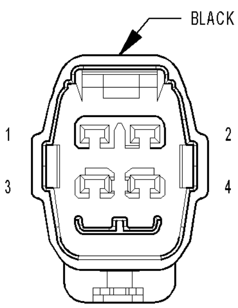
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | G74 20VT/WT | RIGHT FRONT DOOR AJAR SWITCH SENSE |
| 2 | Z998 20BK | GROUND |
| 3 | P35 16TN/YL (LHD) | UNLOCK RELAY OUTPUT |
| 3 | P34 16TN/LB (RHD) | DRIVER DOOR UNLOCK RELAY OUTPUT |
| 4 | P33 16TN/DB | LOCK RELAY OUTPUT |




LATCH-DOOR LOCK MOTOR/ AJAR SWITCH- REAR LEFT (EXCEPT BASE)

LATCH-DOOR LOCK MOTOR/AJAR SWITCH-REAR LEFT (EXCEPT BASE) - BLACK 4 WAY

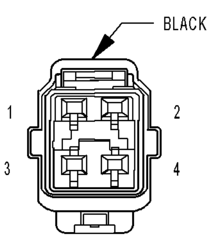
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | G77 20TVT/GY | LEFT REAR DOOR AJAR SWITCH SENSE |
| 2 | Z999 20BK | GROUND |
| 3 | P35 16TN/YL | UNLOCK RELAY OUTPUT |
| 4 | P33 16TN/DB | LOCK RELAY OUTPUT |




LATCH-DOOR LOCK MOTOR/ AJAR SWITCH- REAR RIGHT (EXCEPT BASE)

LATCH-DOOR LOCK MOTOR/AJAR SWITCH-REAR RIGHT (EXCEPT BASE) - BLACK 4 WAY

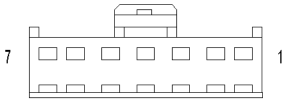
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | G76 20VT/YL | RIGHT REAR DOOR AJAR SWITCH SENSE |
| 2 | Z998 20BK | GROUND |
| 3 | P35 16TN/YL | UNLOCK RELAY OUTPUT |
| 4 | P33 16TN/DB | LOCK RELAY OUTPUT |




LATCH-LOCK MOTOR/AJAR SWITCH- TAILGATE

LATCH-LOCK MOTOR/AJAR SWITCH-TAILGATE - BLACK 4 WAY

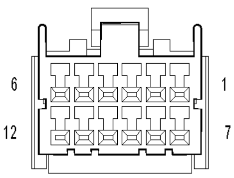
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | G78 20VT/OR | TAILGATE AJAR SWITCH SENSE |
| 2 | G910 20VT/BR | TAILGATE SWITCH GROUND |
| 3 | P31 20TN/YL | TAILGATE UNLOCK DRIVER |
| 4 | P30 20TN/DG | TAILGATE LOCK DRIVER |




MIRROR-INSIDE REARVIEW C1

MIRROR-INSIDE REARVIEW C1 - 7 WAY

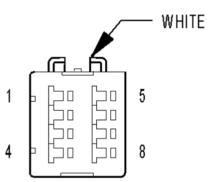
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F942 20BK/PK | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 2 | Z13 20BK/WT | GROUND |
| 3 | L10 20BK/VT | BACK-UP LAMP FEED |
| 4 | P112 20BK/TN | AUTO DAY/NIGHT MIRROR (+) |
| 5 | P114 20BK/GY | AUTO DAY/NIGHT MIRROR (-) |
| 6 | - | - |
| 7 | - | - |




MIRROR-INSIDE REARVIEW C2 (HANDS FREE)

MIRROR-INSIDE REARVIEW C2 (HANDS FREE) - 12 WAY

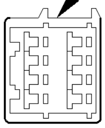
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | - | - |
| 3 | - | - |
| 4 | X722 20BK/LG | MICROPHONE 2 IN(+) |
| 5 | - | - |
| 6 | X712 20DG/LB | MICROPHONE 1 IN(+) |
| 7 | X793 20BK/YL | MICROPHONE FEED |
| 8 | - | - |
| 9 | X730 20BK/YL | VOICE RECOGNITION/PHONE SWITCH SIGNAL |
| 10 | - | - |
| 11 | X835 20BK/GY | SENSOR GROUND |
| 12 | X792 20BK/DG | MICROPHONE IN(-) |




MIRROR-OUTSIDE REARVIEW-DRIVER (EXCEPT BASE)

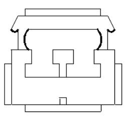
MIRROR-OUTSIDE REARVIEW-DRIVER (EXCEPT BASE) - WHITE 8 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | P71 20TN/DG (LHD) | LEFT MIRROR UP DRIVER |
| 1 | P72 20TN/GY (RHD) | RIGHT MIRROR UP DRIVER |
| 2 | P76 20TN/LB | MIRROR COMMON DRIVER |
| 3 | P75 20TN/LG (LHD) | LEFT MIRROR LEFT DRIVER |
| 3 | P74 20TN/OR (RHD) | RIGHT MIRROR LEFT DRIVER |
| 4 | P112 20TN/OR (EXCEPT POWER FOLD) | AUTO DAY/NIGHT MIRROR (+) |
| 5 | C16 20DB/GY | FUSED REAR WINDOW DEFOGGER RELAY OUTPUT |
| 6 | Z999 20BK | GROUND |
| 7 | P99 20LG/LB (POWER FOLD) | FOLDING MIRROR FEED |
| 8 | P114 20TN/WT (EXCEPT POWER FOLD) | AUTO DAY/NIGHT MIRROR (-) |
| 8 | P110 20LG/WT (POWER FOLD) | FOLDING MIRROR RETURN |



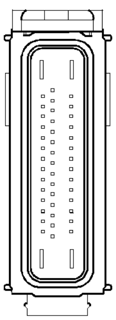

MIRROR-OUTSIDE REARVIEW-PASSENGER (EXCEPT BASE) - WHITE 8 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | P72 20TN/GY (LHD) | RIGHT MIRROR UP DRIVER |
| 1 | P71 20TN/DG (RHD) | RIGHT MIRROR UP DRIVER |
| 2 | P76 20TN/LB | MIRROR COMMON DRIVER |
| 3 | P74 20TN/OR (LHD) | RIGHT MIRROR LEFT DRIVER |
| 3 | P75 20TN/LG (RHD) | LEFT MIRROR LEFT DRIVER |
| 4 | - | - |
| 5 | C16 20DB/GY | FUSED REAR WINDOW DEFOGGER RELAY OUTPUT |
| 6 | Z998 20BK (LHD) | GROUND |
| 6 | Z999 20BK (RHD) | GROUND |
| 7 | P99 20LG/LB (RHD) | FOLDING MIRROR FEED |
| 8 | P110 20LG/WT (RHD) | FOLDING MIRROR RETURN |




MODULE-ANTENNA C1 (EXPORT) - 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Q39 16RD | POWER SUNROOF RELAY OUTPUT |
| 2 | - | - |

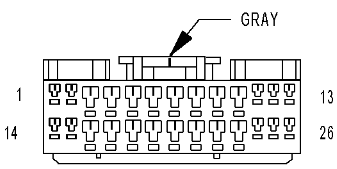



MODULE-ANTILOCK BRAKES - 47 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A107 12TN/RD | FUSED B(+)(PUMP) |
| 2 | - | - |
| 3 | - | - |
| 4 | B46 18DG/WT | ESP ON/OFF SENSE |
| 5 | - | - |
| 6 | B15 18DG/WT (DIESEL) | SECONDARY BRAKE SWITCH SIGNAL |
| 6 | B15 18DG/WT (GAS) | BRAKE SWITCH NO. 1 SIGNAL |
| 7 | - | - |
| 8 | F1 18PK/WT | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 9 | - | - |
| 10 | D21 18WT/GY (DIESEL) | SCI TRANSMIT (ECM) |
| 10 | D21 18WT/GY (GAS) | SCI TRANSMIT (PCM) |
| 11 | - | - |
| 12 | D65 18WT/LG | CAN C BUS (+) |
| 13 | D64 18WT/LB | CAN C BUS (-) |
| 14 | - | - |
| 15 | - | - |
| 16 | Z127 12BK/DG | GROUND |
| 17 | - | - |
| 18 | D52 18WT/LB | DYNAMICS SENSOR HIGH DATA LINK |
| 19 | D51 18PK/RD | DYNAMICS SENSOR LOW DATA LINK |
| 20 | - | - |
| 21 | - | - |
| 22 | G4 18VT/LB | DYNAMICS SENSOR SUPPLY |
| 23 | - | - |
| 24 | - | - |
| 25 | - | - |
| 26 | | |
| 27 | - | - |
| 28 | - | - |

MODULE-ANTILOCK BRAKES - 47 WAY

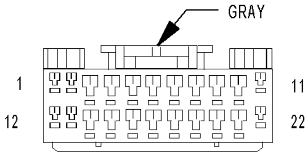
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 29 | G94 18VT/DB | DYNAMICS SENSOR GROUND |
| 30 | - | - |
| 31 | - | - |
| 32 | A200 12RD/DG | FUSED B(+) (VALVE) |
| 33 | B6 18DG/WT | RIGHT FRONT WHEEL SPEED SENSOR SIGNAL |
| 34 | B7 18DG/VT | RIGHT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY |
| 35 | - | - |
| 36 | B4 18LG/GY | LEFT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY |
| 37 | B3 18DG/YL | LEFT REAR WHEEL SPEED SENSOR SIGNAL |
| 38 | - | - |
| 39 | - | - |
| 40 | - | - |
| 41 | - | - |
| 42 | B1 18DG/DB | RIGHT REAR WHEEL SPEED SENSOR SIGNAL |
| 43 | B2 18DG/LB | RIGHT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY |
| 44 | - | - |
| 45 | B9 18DG/LG | LEFT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY |
| 46 | B8 18DG/WT | LEFT FRONT WHEEL SPEED SENSOR SIGNAL |
| 47 | Z107 12BK/DG | GROUND |




**MODULE-BODY CONTROL C1**

MODULE-BODY CONTROL C1 - GRAY 26 WAY

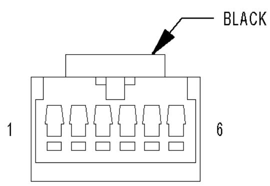
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z15 16BK/TN | GROUND |
| 2 | W27 20DB/BR | REAR WIPER INTERMITTENT DRIVER |
| 3 | G150 20VT/BR | INSTRUMENT CLUSTER WAKE UP SIGNAL |
| 4 | G75 20VT | LEFT FRONT DOOR AJAR SWITCH SENSE |
| 5 | G74 20VT/WT | RIGHT FRONT DOOR AJAR SWITCH SENSE |
| 6 | G70 20VT/LB | HOOD AJAR SWITCH SENSE |
| 7 | G78 20VT/OR | TAILGATE AJAR SWITCH SENSE |
| 8 | G15 20VT/TN | KEY-IN IGNITION SWITCH SENSE |
| 9 | G80 20VT/YL | FLIP-UP GLASS AJAR SWITCH SENSE |
| 10 | G773 20VT/OR | REAR COURTESY LAMP CONTROL |
| 11 | W33 20BR/DG | WASHER PUMP DRIVER |
| 12 | L91 18WT/DB | HAZARD LAMP CONTROL |
| 13 | W13 20BR/LG | REAR WIPER ON DRIVER |
| 14 | Z10 16BK/TN | GROUND |
| 15 | D25 20WT/VT | PCI BUS |
| 16 | - | - |
| 17 | P101 20LG/WT | FLIP-UP GLASS RELEASE SWITCH SENSE |
| 18 | K125 20BR/DDG (DIESEL) | GEN FIELD CONTROL |
| 19 | L18 20WT/LG (RENEGADE) | LIGHTBAR SWITCH SENSE |
| 20 | B22 20DG/YL | VEHICLE SPEED SIGNAL |
| 21 | G69 20VT/WT | VTSS INDICATOR DRIVER |
| 22 | G76 20VT/YL | RIGHT REAR DOOR AJAR SWITCH SENSE |
| 23 | C215 20LB | REAR WINDOW DEFOGGER CONTROL |
| 24 | C221 20LB/OR | A/C ON/OFF CONTROL |
| 25 | Z940 16BK | GROUND |
| 26 | P100 20DB/LG | FLIP-UP GLASS RELEASE MOTOR DRIVER |




**MODULE-
BODY CONTROL C2**

MODULE-BODY CONTROL C2 - GRAY 22 WAY

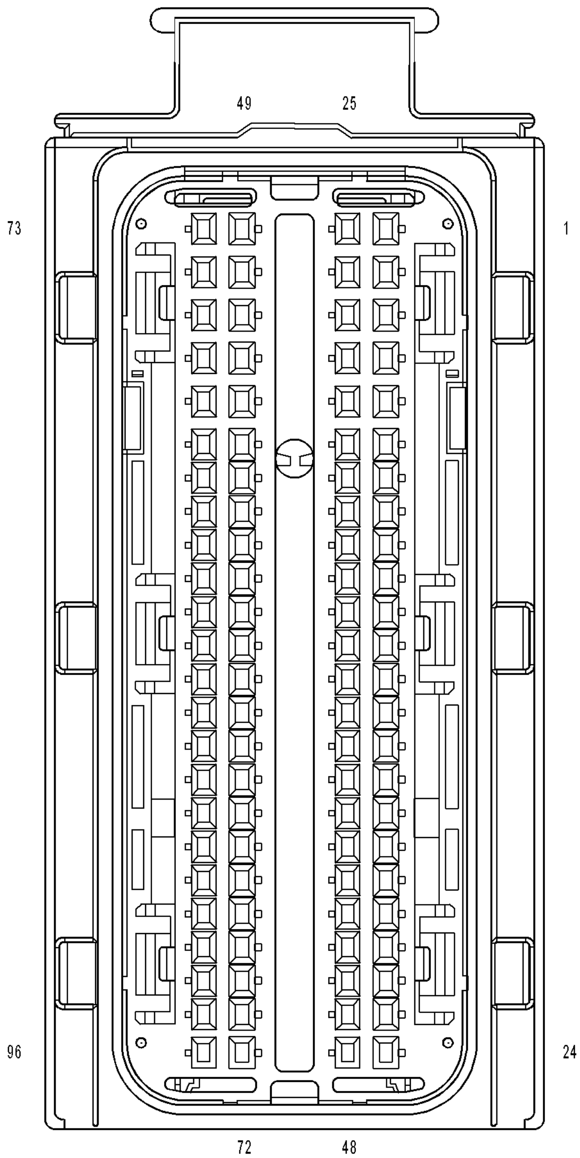
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | D65 20WT/LG | CAN C BUS (+) |
| 2 | K310 20BR/DG | SENSOR GROUND |
| 2 | G910 20VT/BR | TAILGATE SWITCH GROUND |
| 3 | G77 20VT/GY | LEFT REAR DOOR AJAR SWITCH SENSE |
| 4 | L900 20WT/YL | HEADLAMP SWITCH RETURN |
| 5 | L307 20PK/RD | HEADLAMP SWITCH MUX |
| 6 | K303 20BR/OR (DIESEL) | WATER IN FUEL SENSOR SIGNAL |
| 6 | G31 20VT/OR (GAS) | AAT SIGNAL |
| 7 | L87 20WT/OR (EXCEPT BASE) | FRONT FOG LAMP SWITCH SENSE |
| 8 | E3 20OR/YL | PANEL LAMPS DIMMER SWITCH MUX |
| 9 | K302 20BR/WT (DIESEL) | ENGINE OIL PRESSURE SENSOR SIGNAL |
| 9 | K77 20BR/WT (GAS) | TRANSFER CASE POSITION SENSOR INPUT |
| 10 | W35 20BR/LG | FRONT WIPER SWITCH MUX |
| 11 | X920 20GY/OR | RADIO CONTROL MUX RETURN |
| 12 | D64 20WT/LB | CAN C BUS (-) |
| 13 | K300 20BR | SENSOR GROUND |
| 14 | K301 20BR/LG | 5 VOLT SUPPLY |
| 15 | K310 20BR/DG | SENSOR GROUND |
| 16 | Z950 20BK (RHD) | GROUND |
| 17 | K304 20BR/DB (DIESEL) | FUEL LEVEL SENSOR SIGNAL |
| 17 | N4 20DB/YL (GAS) | FUEL LEVEL SIGNAL |
| 18 | K305 20BR/LB (DIESEL) | A/C PRESSURE SENSOR SIGNAL |
| 18 | C18 20LB/BR (GAS) | A/C PRESSURE SIGNAL |
| 19 | L115 20WT/YL | HIGH BEAM SWITCH SENSE |
| 20 | F512 20PK/OR | VEHICLE SPEED SENSOR SUPPLY |
| 21 | B12 20DG/OR | VEHICLE SPEED SIGNAL |
| 22 | X20 20GY/WT (EXCEPT BASE) | RADIO CONTROL MUX |




**MODULE-
ELECTRONIC
OVERHEAD
(PREMIUM)**

MODULE-ELECTRONIC OVERHEAD (PREMIUM) - BLACK 6 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | D25 20WT/VT | PCI BUS |
| 3 | A908 20RD | FUSED B(+) |
| 4 | Z13 20BK/WT | GROUND |
| 5 | F942 20BK/PK | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 6 | - | - |



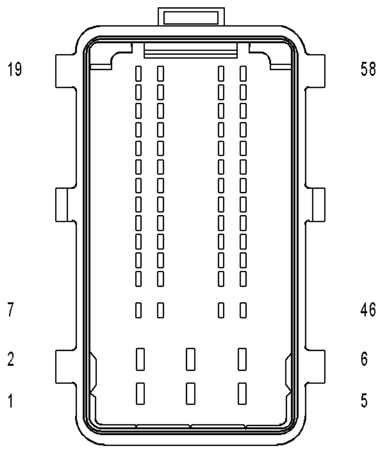

MODULE-ENGINE CONTROL C1 (DIESEL)

MODULE-ENGINE CONTROL C1 (DIESEL) - 96 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K613 16GY/BR | FUEL INJECTOR NO. 1 LOW-SIDE CONTROL |
| 2 | K612 16YL/BR | FUEL INJECTOR NO. 2 LOW-SIDE CONTROL |
| 3 | - | - |
| 4 | K369 16BR/OR | FUEL PRESSURE SOLENOID SUPPLY |
| 5 | - | - |
| 6 | - | - |
| 7 | - | - |
| 8 | K156 20BR/YL | FUEL TEMPERATURE SENSOR SIGNAL |
| 9 | - | - |
| 10 | - | - |
| 11 | T10 20DG/LG (A/T) | TORQUE MANAGEMENT REQUEST SENSE |
| 12 | - | - |
| 13 | - | - |
| 14 | K944 20BR/GY | CMP SENSOR GROUND |
| 15 | - | - |
| 16 | - | - |
| 17 | - | - |
| 18 | - | - |
| 19 | - | - |
| 20 | - | - |
| 21 | - | - |
| 22 | - | - |
| 23 | - | - |
| 24 | - | - |
| 25 | K611 16OR/BR | FUEL INJECTOR NO. 1 LOW-SIDE CONTROL |
| 26 | K614 16WT/BR | FUEL INJECTOR NO. 4 LOW-SIDE CONTROL |
| 27 | - | - |
| 28 | K366 16BR/LG | FUEL QUANTITY SOLENOID SUPPLY |
| 29 | - | - |
| 30 | V37 20VT | S/C SWITCH SIGNAL NO. 1 |
| 31 | G31 20VT/OR | AAT SIGNAL |
| 32 | K960 20BR/LB | INLET PRESSURE SENSOR GROUND |
| 33 | - | - |
| 34 | K21 20BR/WT | IAT SENSOR SIGNAL |
| 35 | - | - |
| 36 | K668 20BR | INLET PRESSURE SENSOR 5 VOLT SUPPLY |
| 37 | F856 20YL/PK | CMP SENSOR 5 VOLT SUPPLY |
| 38 | K44 20DB/GY | CMP SENSOR SIGNAL |
| 39 | - | - |
| 40 | - | - |
| 41 | - | - |
| 42 | - | - |
| 43 | - | - |
| 44 | - | - |
| 45 | K132 20DB/LB | CABIN HEATER RELAY CONTROL |
| 46 | - | - |
| 47 | - | - |
| 48 | - | - |
| 49 | K12 16BR/DB | FUEL INJECTOR NO. 2 HIGH-SIDE CONTROL |
| 50 | - | - |
| 51 | K14 16BR/TN | FUEL INJECTOR NO. 4 HIGH-SIDE CONTROL |
| 52 | K370 16BR | FUEL PRESSURE SOLENOID CONTROL |
| 53 | - | - |
| 54 | V38 20VT/OR | S/C SWITCH SIGNAL NO. 2 |

MODULE-ENGINE CONTROL C1 (DIESEL) - 96 WAY

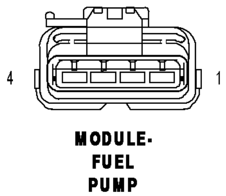
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 55 | - | - |
| 56 | - | - |
| 57 | K2 20VT/OR | ECT SENSOR SIGNAL |
| 58 | K68 20BR/LG | INLET PRESSURE SENSOR SIGNAL |
| 59 | K181 20BR/YL | FUEL PRESSURE SENSOR SIGNAL |
| 60 | K856 20BR/YL | INTAKE PRESSURE SENSOR 5 VOLT SUPPLY |
| 61 | K957 20BK/OR | MAF SENSOR GROUND |
| 62 | - | - |
| 63 | K37 20BR/OR | INTAKE PRESSURE SENSOR SIGNAL |
| 64 | K811 20BR/OR | MAF SENSOR 5 VOLT SUPPLY |
| 65 | K900 20DB/DG | SENSOR GROUND |
| 66 | - | - |
| 67 | - | - |
| 68 | K315 20BR/GY | EGR THROTTLE VALVE CONTROL |
| 69 | - | - |
| 70 | - | - |
| 71 | N112 20DB/OR | HIGH SPEED RAD FAN RELAY CONTROL |
| 72 | - | - |
| 73 | K13 16BR/LB | FUEL INJECTOR NO. 3 HIGH-SIDE CONTROL |
| 74 | K11 16BR/YL | FUEL INJECTOR NO. 1 HIGH-SIDE CONTROL |
| 75 | - | - |
| 76 | K646 16BR/YL | FUEL QUANTITY SOLENOID CONTROL |
| 77 | - | - |
| 78 | - | - |
| 79 | T26 20DG/OR | CLUTCH UPSTOP SWITCH SIGNAL |
| 80 | - | - |
| 81 | - | - |
| 82 | K77 20BR/WT | TRANSFER CASE POSITION SENSOR INPUT |
| 83 | K656 20GY/BR | SENSOR GROUND |
| 84 | K359 20YL/BR | FUEL PRESSURE SENSOR GROUND |
| 85 | K157 20BR/OR | MAF SENSOR SIGNAL |
| 86 | K350 20BR/YL | FUEL PRESSURE SENSOR 5 VOLT SUPPLY |
| 87 | K853 20DB/BR | CKP SIGNAL NO. 1 |
| 88 | K3 20BR/LB | CKP SIGNAL NO. 2 |
| 89 | - | - |
| 90 | K35 20DB/VT | EGR SOLENOID CONTROL |
| 91 | N201 20DB/LG | LOW SPEED RAD FAN RELAY CONTROL |
| 92 | N117 20DB/WT | VACUUM RESERVOIR SOLENOID CONTROL |
| 93 | X635 20BR/WT | BOOST PRESSURE SOLENOID CONTROL |
| 94 | - | - |
| 95 | - | - |
| 96 | - | - |




MODULE-ENGINE CONTROL C2 (DIESEL)

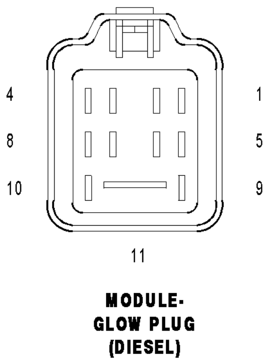
MODULE-ENGINE CONTROL C2 (DIESEL) - 58 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K347 14BR/PK | FUSED ASD RELAY OUTPUT |
| 2 | Z131 14BK/DG | GROUND |
| 3 | K347 14BR/PK | FUSED ASD RELAY OUTPUT |
| 4 | Z131 14BK/DG | GROUND |
| 5 | K345 14BR/RD | FUSED ASD RELAY OUTPUT |
| 6 | Z131 14BK/DG | GROUND |
| 7 | - | - |
| 8 | C20 20DB/YL | A/C SWITCH SENSE |
| 9 | - | - |
| 10 | - | - |
| 11 | - | - |
| 12 | - | - |
| 13 | K29 20WT/BR | APP SENSOR 2 SIGNAL |
| 14 | K400 20BR/VT | APP SENSOR 2 GROUND |
| 15 | - | - |
| 16 | - | - |
| 17 | T41 20YL/DB (A/T) | TRS T41 SENSE (P/N) |
| 17 | T141 20YL/OR (M/T) | CLUTCH INTERLOCK SWITCH SIGNAL |
| 18 | K244 20BR/WT (A/T) | ENGINE RPM SIGNAL |
| 19 | F1 20PK/WT | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 20 | - | - |
| 21 | - | - |
| 22 | F26 20PK/OR | FUSED IGNITION SWITCH OUTPUT (START) |
| 23 | - | - |
| 24 | K852 20BR/VT | APP SENSOR 1 5 VOLT SUPPLY |
| 25 | K23 20BR/WT | APP SENSOR 1 SIGNAL |
| 26 | K167 20BR/YL | APP SENSOR 1 GROUND |
| 27 | - | - |
| 28 | - | - |
| 29 | K854 20VT/BR | SENSOR 2 5 VOLT SUPPLY |
| 30 | - | - |
| 31 | D21 20WT/GY | SCI TRANSMIT (ECM) |
| 32 | L50 18WT/TN | PRIMARY BRAKE SWITCH SIGNAL |
| 33 | - | - |
| 34 | B15 20DG/WT | SECONDARY BRAKE SWITCH SIGNAL |
| 35 | - | - |
| 36 | - | - |
| 37 | - | - |
| 38 | - | - |
| 39 | - | - |
| 40 | C13 20LB/OR | A/C CLUTCH RELAY CONTROL |
| 41 | - | - |
| 42 | - | - |
| 43 | D330 20WT/BR | GLOW PLUG MODULE SIGNAL |
| 44 | K342 20BR/WT | ASD RELAY CONTROL |
| 45 | K391 20BR/YL | FUEL PUMP RELAY CONTROL |
| 46 | K330 20LB/BR | GLOW PLUG MODULE CONTROL |
| 47 | - | - |
| 48 | - | - |
| 49 | - | - |
| 50 | - | - |
| 51 | - | - |
| 52 | - | - |
| 53 | D65 20WT/LG | CAN C BUS (+) |
| 54 | D64 20WT/LB | CAN C BUS (-) |
| 55 | - | - |
| 56 | - | - |
| 57 | - | - |
| 58 | T752 20DG/OR | ENGINE STARTER MOTOR RELAY CONTROL |



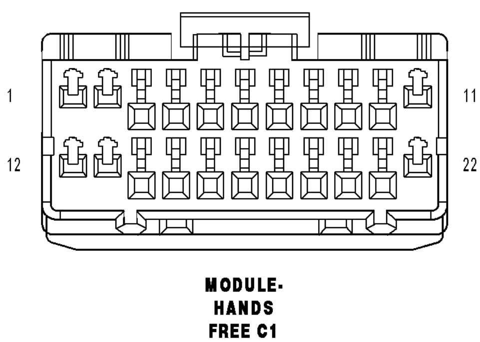

MODULE-FUEL PUMP - 4 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z201 18BK (GAS) | GROUND |
| 2 | K300 20BR (DIESEL) | SENSOR GROUND |
| 2 | K310 20BR/DG (GAS) | SENSOR GROUND |
| 3 | K304 20BR/DB (DIESEL) | FUEL LEVEL SENSOR SIGNAL |
| 3 | N4 20DB/YL (GAS) | FUEL LEVEL SIGNAL |
| 4 | N1 18DG/OR (GAS) | FUEL PUMP RELAY OUTPUT |



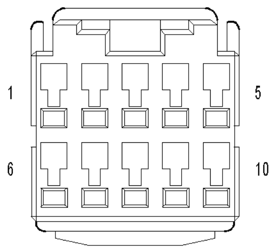

MODULE-GLOW PLUG (DIESEL) - 11 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A202 14RD/WT | GLOW PLUG NO. 1 CONTROL |
| 2 | A203 14RD/BR | GLOW PLUG NO. 2 CONTROL |
| 3 | A204 14RD/YL | GLOW PLUG NO. 3 CONTROL |
| 4 | A208 14RD/OR | GLOW PLUG NO. 4 CONTROL |
| 5 | - | - |
| 6 | K347 20BR/PK | FUSED ASD RELAY OUTPUT |
| 7 | Z133 18BK/LG | GROUND |
| 8 | - | - |
| 9 | D330 20WT/BR | GLOW PLUG MODULE SIGNAL |
| 10 | K330 20LB/BR | GLOW PLUG MODULE CONTROL |
| 11 | A2 10GY | FUSED B(+) |




MODULE-HANDS FREE C1 - 22 WAY

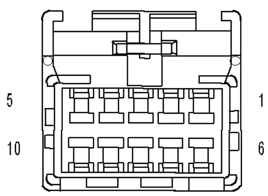
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A908 18RD | FUSED B(+) |
| 2 | - | - |
| 3 | - | - |
| 4 | - | - |
| 5 | X722 20BK/LG | MICROPHONE 2 IN(+) |
| 6 | - | - |
| 7 | - | - |
| 8 | - | - |
| 9 | - | - |
| 10 | - | - |
| 11 | - | - |
| 12 | - | - |
| 13 | - | - |
| 14 | - | - |
| 15 | X730 20BK/OR | VOICE RECOGNITION/PHONE SWITCH SIGNAL |
| 16 | X712 20BK/LB | MICROPHONE 1 IN(+) |
| 17 | X792 20BK/PK | MICROPHONE IN(-) |
| 18 | - | - |
| 19 | - | - |
| 20 | X793 20BK/YL | MICROPHONE FEED |
| 21 | X835 20BK/GY | SENSOR GROUND |
| 22 | Z530 20GY/BK | GROUND |




MODULE-HANDS FREE C2 (SATELLITE)

MODULE-HANDS FREE C2 (SATELLITE) - 10 WAY

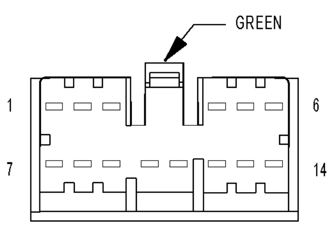
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X40 20GY/WT | AUDIO MUX RIGHT |
| 2 | X140 20GY/OR | SHIELD |
| 3 | - | - |
| 4 | D25 20WT/VT | PCI BUS |
| 5 | X112 20LG/GY | IGNITION RUN/ACC SIGNAL |
| 6 | X41 20DG/WT | AUDIO MUX LEFT |
| 7 | Z515 20BK | GROUND |
| 8 | - | |
| 9 | - | |
| 10 | X160 20GY/YL | FUSED B(+) |




MODULE-HANDS FREE C3

MODULE-HANDS FREE C3 - 10 WAY

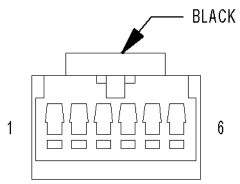
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X112 20LG/GY | IGNITION RUN/ACC SIGNAL |
| 2 | D25 20WT/VT | PCI BUS |
| 3 | X235 20GY | AUDIO RETURN |
| 4 | X140 20GY/OR | SHIELD |
| 5 | X40 20GY/WT | AUDIO MUX RIGHT |
| 6 | X160 20GY/YL | FUSED B(+) |
| 7 | - | - |
| 8 | - | - |
| 9 | Z515 20BK | GROUND |
| 10 | X41 20DG/WT | AUDIO MUX LEFT |




MODULE-HEATED SEAT (HIGHLINE)

MODULE-HEATED SEAT (HIGHLINE) - GREEN 14 WAY

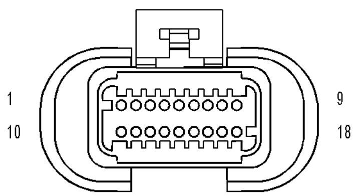
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | P133 20TN/DG | LEFT SEAT HEATER SWITCH MUX |
| 2 | P86 20PK/BK | HEATED SEAT TEMPERATURE SENSOR SIGNAL |
| 3 | F98 16RD/WT | PASSENGER HEATED SEAT FEED |
| 4 | A902 16RD/WT | FUSED B(+) |
| 5 | F99 16RD/WT | DRIVER HEATED SEAT FEED |
| 6 | A902 16RD/WT | FUSED B(+) |
| 7 | P142 20TN/DB | PASSENGER HEATED SEAT TEMPERATURE SENSOR GROUND |
| 8 | P141 20TN/LB | DRIVER HEATED SEAT TEMPERATURE SENSOR GROUND |
| 9 | P134 20TN/LG | RIGHT SEAT HEATER SWITCH MUX |
| 10 | P138 20VT/LG | RIGHT SEAT LOW HEAT LED DRIVER |
| 11 | P140 20VT/BK | RIGHT SEAT HIGH HEAT LED DRIVER |
| 12 | P137 20VT/DG | LEFT SEAT LOW HEAT LED DRIVER |
| 13 | Z849 20BK/WT | GROUND |
| 14 | P139 20VT/WT | LEFT SEAT HIGH HEAT LED DRIVER |




**MODULE-INTRUSION TRANSCEIVER (EXPORT)**

MODULE-INTRUSION TRANSCEIVER (EXPORT) - BLACK 6 WAY

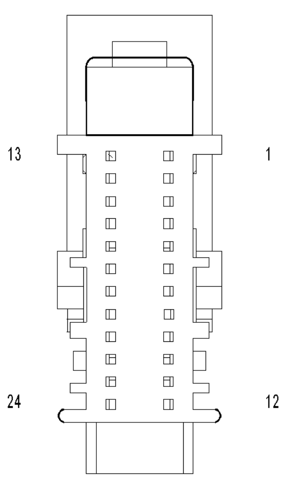
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z18 20BK/LB | GROUND |
| 2 | - | - |
| 3 | X75 18GY/LG | SIREN SIGNAL CONTROL |
| 4 | - | - |
| 5 | D25 20WT/VT | PCI BUS |
| 6 | A908 18RD | FUSED B(+) |




**MODULE-OCCUPANT CLASSIFICATION**

MODULE-OCCUPANT CLASSIFICATION - 18 WAY

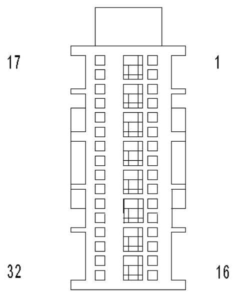
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | - | - |
| 3 | - | - |
| 4 | D105 20WT/OR | SEAT BELT TENSION SENSOR SIGNAL |
| 5 | Z105 18BK/LG | GROUND |
| 6 | R741 20LG/VT | PASSENGER BLADDER PRESSURE SENSOR SIGNAL |
| 7 | R740 20LG/OR | PASSENGER BLADDER PRESSURE SENSOR POWER |
| 8 | D25 20WT/VT | PCI BUS |
| 9 | F201 18LG/YL | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 10 | - | - |
| 11 | - | - |
| 12 | - | - |
| 13 | - | - |
| 14 | R986 20LG/BR | SEAT BELT TENSION SENSOR GROUND |
| 15 | R941 20LG/DG | PASSENGER BLADDER PRESSURE SENSOR GROUND |
| 16 | R86 20LG/LB | SEAT BELT TENSION SENSOR POWER |
| 17 | - | - |
| 18 | - | - |




**MODULE-OCCUPANT RESTRAINT CONTROLLER C1 (ORC)**

MODULE-OCCUPANT RESTRAINT CONTROLLER C1 (ORC) - 24 WAY

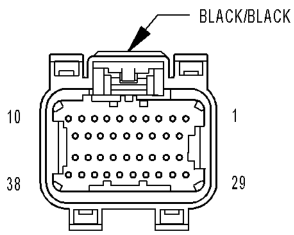
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | - | - |
| 3 | D25 20WT/VT | PCI BUS |
| 4 | - | - |
| 5 | - | - |
| 6 | R166 20LG/TN (EXCEPT EXPORT) | PASSENGER AIRBAG INDICATOR DRIVER |
| 7 | - | - |
| 8 | - | - |
| 9 | R81 20LB/WT | LEFT FRONT IMPACT SENSOR GROUND |
| 10 | R79 20LB/VT | LEFT FRONT IMPACT SENSOR SIGNAL |
| 11 | R82 20WT/LB | RIGHT FRONT IMPACT SENSOR GROUND |
| 12 | R80 20VT/LB | RIGHT FRONT IMPACT SENSOR SIGNAL |
| 13 | - | - |
| 14 | - | - |
| 15 | - | - |
| 16 | - | - |
| 17 | R43 20LG/BR | DRIVER SQUIB 1 LINE 1 |
| 18 | R45 20LG/OR | DRIVER SQUIB 1 LINE 2 |
| 19 | R44 20DG/YL | PASSENGER SQUIB 1 LINE 2 |
| 20 | R42 20BK/YL | PASSENGER SQUIB 1 LINE 1 |
| 21 | R61 20LG/VT | DRIVER SQUIB 2 LINE 1 |
| 22 | R63 20LG/WT | DRIVER SQUIB 2 LINE 2 |
| 23 | R64 20TN/YL | PASSENGER SQUIB 2 LINE 1 |
| 24 | R62 20OR/YL | PASSENGER SQUIB 2 LINE 2 |




MODULE-OCCUPANT RESTRAINT CONTROLLER C2 (ORC)

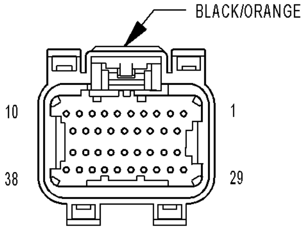
MODULE-OCCUPANT RESTRAINT CONTROLLER C2 (ORC) - 32 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | - | - |
| 3 | - | - |
| 4 | - | - |
| 5 | - | - |
| 6 | - | - |
| 7 | - | - |
| 8 | - | - |
| 9 | R53 20LG/YL | DRIVER SEAT BELT TENSIONER LINE 2 |
| 10 | R55 20LG/DG | DRIVER SEAT BELT TENSIONER LINE 1 |
| 11 | R56 20LB/DG | PASSENGER SEAT BELT TENSIONER LINE 1 |
| 12 | R54 20LB/YL | PASSENGER SEAT BELT TENSIONER LINE 2 |
| 13 | R1 20LB/BR (SAB) | LEFT CURTAIN SQUIB 1 LINE 2 |
| 14 | R3 20LB/OR (SAB) | LEFT CURTAIN SQUIB 1 LINE 1 |
| 15 | R4 20OR/LB (SAB) | RIGHT CURTAIN SQUIB 1 LINE 1 |
| 16 | R2 20WT/LB (SAB) | RIGHT CURTAIN SQUIB 1 LINE 2 |
| 17 | F201 20PK/OR | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 18 | F100 20PK/VT | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 19 | - | - |
| 20 | Z104 20BK/LG | GROUND |
| 21 | - | - |
| 22 | - | - |
| 23 | - | - |
| 24 | - | - |
| 25 | - | - |
| 26 | - | - |
| 27 | R14 20TN/LG (SAB) | RIGHT SIDE IMPACT SENSOR 1 SIGNAL |
| 28 | R16 20BR/LG (SAB) | RIGHT SIDE IMPACT SENSOR 1 GROUND |
| 29 | R15 20LG/BR (SAB) | LEFT SIDE IMPACT SENSOR 1 GROUND |
| 30 | R13 20LG/VT (SAB) | LEFT SIDE IMPACT SENSOR 1 SIGNAL |
| 31 | - | - |
| 32 | - | - |




MODULE-POWERTRAIN CONTROL C1 - BLACK/BLACK 38 WAY

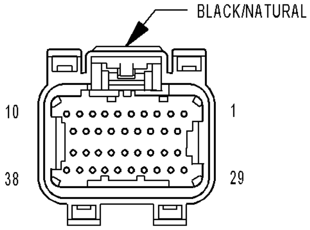
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | - | - |
| 3 | - | - |
| 4 | - | - |
| 5 | - | - |
| 6 | - | - |
| 7 | - | - |
| 8 | - | - |
| 9 | Z130 16BK/BR | GROUND |
| 10 | C20 20DB/YL | A/C SWITCH SENSE |
| 11 | F1 20PK/WT | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 12 | F1 20PK/WT | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 13 | - | - |
| 14 | - | - |
| 15 | - | - |
| 16 | - | - |
| 17 | - | - |
| 18 | Z131 16BK/DG | GROUND |
| 19 | - | - |
| 20 | G6 20VT/GY | ENGINE OIL PRESSURE SIGNAL |
| 21 | - | - |
| 22 | - | - |
| 23 | - | - |
| 24 | - | - |
| 25 | D20 20WT/LG | SCI RECEIVE (PCM) |
| 26 | D16 20WT/OR (A/T) | SCI RECEIVE (TCM) |
| 27 | F856 20YL/PK | 5 VOLT SUPPLY |
| 28 | - | - |
| 29 | A209 18RD | FUSED B(+) |
| 30 | F26 20PK/OR | FUSED IGNITION SWITCH OUTPUT (START) |
| 31 | K141 20DB/YL | O2 1/2 SIGNAL |
| 32 | K902 20BR/DG | O2 UPSTREAM RETURN |
| 33 | K243 20BR | O2 2/2 SIGNAL |
| 34 | D65 20WT/LG | CAN C BUS (+) |
| 35 | D64 20WT/LB | CAN C BUS (-) |
| 36 | D21 20WT/GY | SCI TRANSMIT (PCM) |
| 37 | D15 20BR/WT (A/T) | SCI TRANSMIT (TCM) |
| 38 | - | - |




MODULE-POWERTRAIN CONTROL C2

MODULE-POWERTRAIN CONTROL C2 - BLACK/ORANGE 38 WAY

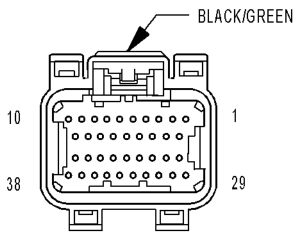
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K10 16DB/OR | COIL CONTROL NO. 6 |
| 2 | K16 16DB/YL | COIL CONTROL NO. 5 |
| 3 | K15 16DB/RD | COIL CONTROL NO. 4 |
| 4 | K58 16BR | INJECTOR CONTROL NO. 6 |
| 5 | K38 16BR/OR | INJECTOR CONTROL NO. 5 |
| 6 | - | - |
| 7 | K93 16DB | COIL CONTROL NO. 3 |
| 8 | - | - |
| 9 | K85 16DB/YL | COIL CONTROL NO. 2 |
| 10 | K86 16YL/DB | COIL CONTROL NO. 1 |
| 11 | K14 16BR/RD | INJECTOR CONTROL NO. 4 |
| 12 | K13 16BR/LB | INJECTOR CONTROL NO. 3 |
| 13 | K12 16BR/DB | INJECTOR CONTROL NO. 2 |
| 14 | K11 16BR/YL | INJECTOR CONTROL NO. 1 |
| 15 | - | - |
| 16 | - | - |
| 17 | K199 18BR/BK | O2 2/1 HEATER CONTROL |
| 18 | K99 18BR/TN | O2 1/1 HEATER CONTROL |
| 19 | K125 16BR/DG | GEN FIELD CONTROL |
| 20 | K2 20VT/OR | ECT SIGNAL |
| 21 | K22 20BR/OR | TP SIGNAL |
| 22 | - | - |
| 23 | K1 20VT/BR | MAP SIGNAL |
| 24 | K942 20BR/LG | KNOCK SENSOR NO. 1 RETURN |
| 25 | K42 20DB/OR | KNOCK SENSOR NO. 1 SIGNAL |
| 26 | K77 20BR/WT (4WD) | TRANSFER CASE POSITION SENSOR INPUT |
| 27 | K900 20DB/DG | SENSOR GROUND |
| 28 | K961 20BR/VT | IAC SIGNAL |
| 29 | F855 20PK/YL | 5 VOLT SUPPLY |
| 30 | K21 20BR/WT | IAT SIGNAL |
| 31 | K41 20DB/LB | O2 1/1 SIGNAL |
| 32 | K904 20DB/DG | O2 DOWNSTREAM RETURN |
| 33 | K43 20DB/LG (GAS) | O2 2/1 SIGNAL |
| 34 | K44 20DB/GY | CMP SIGNAL |
| 35 | K24 20BR/LB | CKP SIGNAL |
| 36 | K242 20BR/WT (GAS) | KNOCK SENSOR NO. 2 SIGNAL |
| 37 | K924 20PK/RD (GAS) | KNOCK SENSOR NO. 2 RETURN |
| 38 | K61 20VT/GY | IAC CONTROL |




MODULE-POWERTRAIN CONTROL C3

MODULE-POWERTRAIN CONTROL C3 - BLACK/NATURAL 38 WAY

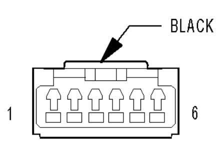
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | - | - |
| 3 | K342 20BR/WT | ASD RELAY CONTROL |
| 4 | - | - |
| 5 | V35 20VT/OR (EXCEPT BASE) | S/C VENT CONTROL |
| 6 | N201 20DB/LG | LOW SPEED RAD FAN RELAY CONTROL |
| 7 | V32 20VT/YL | S/C POWER SUPPLY |
| 8 | K106 20VT/LB | NVLD SOL CONTROL |
| 9 | K299 18BR/OR | O2 1/2 HEATER CONTROL |
| 10 | K399 18BR/GY | O2 2/2 HEATER CONTROL |
| 11 | C13 20LB/OR | A/C CLUTCH RELAY CONTROL |
| 12 | V36 20VT/TN (EXCEPT BASE) | S/C VACUUM CONTROL |
| 13 | - | - |
| 14 | - | - |
| 15 | - | - |
| 16 | - | - |
| 17 | - | - |
| 18 | - | - |
| 19 | F142 16PK/GY | FUSED ASD RELAY OUTPUT |
| 20 | K52 20DB/WT | EVAP PURGE SOL SIGNAL |
| 21 | T141 20YL/OR (M/T) | CLUTCH INTERLOCK SWITCH SIGNAL |
| 22 | - | - |
| 23 | B15 18DG/WT (GAS) | BRAKE SWITCH NO. 1 SIGNAL |
| 24 | - | - |
| 25 | - | - |
| 26 | - | - |
| 27 | - | - |
| 28 | F142 16PK/GY | FUSED ASD RELAY OUTPUT |
| 29 | K70 20DB/BR | EVAP PURGE SOL CONTROL |
| 30 | - | - |
| 31 | - | - |
| 32 | - | - |
| 33 | - | - |
| 34 | V37 20VT (EXCEPT BASE) | S/C SWITCH SIGNAL NO. 1 |
| 35 | K107 20VT/WT | NVLD SWITCH SIGNAL |
| 36 | - | - |
| 37 | K31 20BR | FUEL PUMP RELAY CONTROL |
| 38 | T752 20DG/OR | ENGINE STARTER MOTOR RELAY CONTROL |




MODULE-POWERTRAIN CONTROL C4 (3.7L A/T)

MODULE-POWERTRAIN CONTROL C4 (3.7L A/T) - BLACK/GREEN 38 WAY

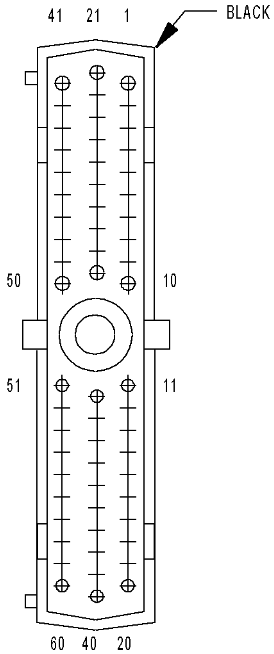
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | T60 18YL/GY | OD SOLENOID CONTROL |
| 2 | T59 18YL/LB | UD SOLENOID CONTROL |
| 3 | - | - |
| 4 | - | - |
| 5 | - | - |
| 6 | T19 18YL | 2-4 SOLENOID CONTROL |
| 7 | - | - |
| 8 | - | - |
| 9 | - | - |
| 10 | T20 18DG/WT | L/R SOLENOID CONTROL |
| 11 | T118 20YL/GY | PRESSURE CONTROL SOLENOID CONTROL |
| 12 | Z903 16BK | GROUND |
| 13 | Z903 16BK | GROUND |
| 14 | - | - |
| 15 | T1 20DG/LB | TRS T1 SENSE |
| 16 | T3 20DG/DB | TRS T3 SENSE |
| 17 | T6 20DG | TOW/HAUL OVERDRIVE OFF SWITCH SENSE |
| 18 | T515 20YL/DB | TRANSMISSION CONTROL RELAY CONTROL |
| 19 | T16 16YL/OR | TRANSMISSION CONTROL RELAY OUTPUT |
| 20 | - | - |
| 21 | - | - |
| 22 | T9 20DG/TN | OD PRESSURE SWITCH SENSE |
| 23 | - | - |
| 24 | - | - |
| 25 | - | - |
| 26 | - | - |
| 27 | T41 20YL/DB | TRS T41 SENSE (P/N) |
| 28 | T16 16YL/OR | TRANSMISSION CONTROL RELAY OUTPUT |
| 29 | T50 20YL/TN | L/R PRESSURE SWITCH SENSE |
| 30 | T47 20YL/DG | 2-4 PRESSURE SWITCH SENSE |
| 31 | T38 20YL/BR | LINE PRESSURE SENSOR SIGNAL |
| 32 | T14 20DG/BR | OUTPUT SPEED SENSOR SIGNAL |
| 33 | T52 20DG/WT | INPUT SPEED SENSOR SIGNAL |
| 34 | T13 20DG/VT | SPEED SENSOR GROUND |
| 35 | T54 20DG/OR | TRANSMISSION TEMPERATURE SENSOR SIGNAL |
| 36 | - | - |
| 37 | T42 20DG/YL | TRS T42 SENSE |
| 38 | - | - |




MODULE-SENTRY KEY REMOTE ENTRY (EXCEPT BASE)

MODULE-SENTRY KEY REMOTE ENTRY (EXCEPT BASE) - BLACK 6 WAY

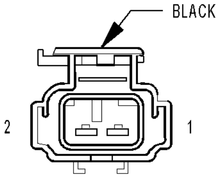
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | D25 20WT/VT | PCI BUS |
| 3 | D508 20WT/GY | COM-LIN TIRE PRESSURE MONITOR LAN |
| 4 | F942 20PK/LG | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 5 | Z120 20BK/WT | GROUND |
| 6 | A333 20WT/RD | FUSED B(+) |




**MODULE-TRANSMISSION CONTROL (2.8L)**

MODULE-TRANSMISSION CONTROL (2.8L) - BLACK 60 WAY

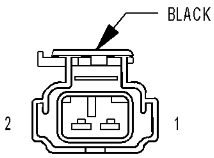
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | T1 20DG/LB | TRS T1 SENSE |
| 2 | T4 20DG/LB | TRS T2 SENSE |
| 3 | T3 20DG/DB | TRS T3 SENSE |
| 4 | - | - |
| 5 | - | - |
| 6 | K244 20BR/WT | ENGINE RPM SIGNAL |
| 7 | D21 20WT/GY | SCI TRANSMIT (ECM) |
| 8 | F26 20PK/OR | FUSED IGNITION SWITCH OUTPUT (START) |
| 9 | T9 20DG/TN | OD PRESSURE SWITCH SENSE |
| 10 | T10 20DG/LG | TORQUE MANAGEMENT REQUEST SENSE |
| 11 | F1 20PK/WT | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 12 | K23 20BR/WT | APP SENSOR 1 SIGNAL |
| 13 | T13 20DG/VT | SPEED SENSOR GROUND |
| 14 | T14 20DG/BR | OUTPUT SPEED SENSOR SIGNAL |
| 15 | T515 20YL/DB | TRANSMISSION CONTROL RELAY CONTROL |
| 16 | T16 16YL/OR | TRANSMISSION CONTROL RELAY OUTPUT |
| 17 | T16 16YL/OR | TRANSMISSION CONTROL RELAY OUTPUT |
| 18 | T118 20DG | PRESSURE CONTROL SOLENOID CONTROL |
| 19 | T219 20YL/LG | 2C SOLENOID CONTROL |
| 20 | T20 18DG/WT | L/R SOLENOID CONTROL |
| 21 | - | - |
| 22 | - | - |
| 23 | - | - |
| 24 | - | - |
| 25 | - | - |
| 26 | - | - |
| 27 | - | - |
| 28 | - | - |
| 29 | T29 20YL/WT | UD PRESSURE SWITCH SENSE |
| 30 | T38 20YL/BR | LINE PRESSURE SENSOR SIGNAL |
| 31 | - | - |
| 32 | - | - |
| 33 | - | - |
| 34 | - | - |
| 35 | - | - |
| 36 | T16 16YL/OR | TRANSMISSION CONTROL RELAY OUTPUT |
| 37 | Z133 16BK/LG | GROUND |
| 38 | T39 20BR/YL | 5 VOLT SUPPLY |
| 39 | Z133 16BK/LG | GROUND |
| 40 | T140 20YL/GY | MS SOLENOID CONTROL |
| 41 | T41 20YL/DB | TRS T41 SENSE (P/N) |
| 42 | T42 20DG/YL | TRS T42 SENSE |
| 43 | D25 20WT/VT | PCI BUS |
| 44 | - | - |
| 45 | - | - |
| 46 | D16 20WT/OR | SCI RECEIVE (ECM) |
| 47 | T147 20DG/YL | 2C PRESSURE SWITCH SENSE |
| 48 | T48 20BR/YL | 4C PRESSURE SWITCH SENSE |
| 49 | T6 20DG | TOW/HAUL OVERDRIVE OFF SWITCH SENSE |
| 50 | T50 20YL/TN | L/R PRESSURE SWITCH SENSE |
| 51 | K167 20BR/YL | APP SENSOR 1 GROUND |
| 52 | T52 20DG/WT | INPUT SPEED SENSOR SIGNAL |
| 53 | Z133 16BK/LG | GROUND |
| 54 | T54 20DG/OR | TRANSMISSION TEMPERATURE SENSOR SIGNAL |
| 55 | T59 18YL/LB | UD SOLENOID CONTROL |
| 56 | A903 16RD | FUSED B(+) |
| 57 | Z133 16BK/LG | GROUND |
| 58 | - | - |
| 59 | T159 20YL/DG | 4C SOLENOID CONTROL |
| 60 | T60 18YL/GY | OD SOLENOID CONTROL |




MOTOR-
BLOWER

MOTOR-BLOWER - BLACK 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | C75 12DB/GY | BLOWER MOTOR HIGH DRIVER |
| 2 | A111 12DG/RD | BLOWER MOTOR RELAY OUTPUT |




MOTOR-
FLIP-UP
GLASS
RELEASE

MOTOR-FLIP-UP GLASS RELEASE - BLACK 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z213 18BK/OR | GROUND |
| 2 | P100 20DB/LG | FLIP-UP GLASS RELEASE MOTOR DRIVER |

**CONNECTOR NOT AVAILABLE**

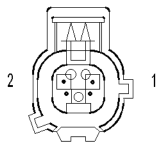
MOTOR-HEADLAMP LEVELING-LEFT (EXPORT) - BLACK 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z981 16BK | GROUND |
| 1 | Z981 16BK | GROUND |
| 1 | Z981 16BK | GROUND |
| 1 | Z981 16BK | GROUND |
| 2 | L13 18WT/YL | HEADLAMP ADJUST SIGNAL |
| 2 | L13 18WT/YL | HEADLAMP ADJUST SIGNAL |
| 2 | L13 18WT/YL | HEADLAMP ADJUST SIGNAL |
| 3 | L77 18PK/RD | FUSED PARK LAMP RELAY OUTPUT |

**CONNECTOR NOT AVAILABLE**

MOTOR-HEADLAMP LEVELING-RIGHT (EXPORT) - BLACK 3 WAY

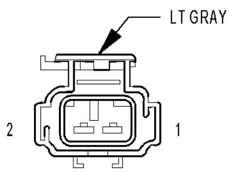
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z932 16BK | GROUND |
| 1 | Z932 16BK | GROUND |
| 1 | Z932 16BK | GROUND |
| 1 | Z932 16BK | GROUND |
| 2 | L13 18WT/YL | HEADLAMP ADJUST SIGNAL |
| 3 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |
| 3 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |
| 3 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |




**MOTOR-IAC**

MOTOR-IAC - 2 WAY

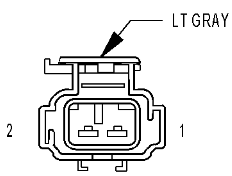
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K961 20BR/VT | IAC SIGNAL |
| 2 | K61 20VT/GY | IAC CONTROL |




**MOTOR-POWER WINDOW-DRIVER (MIDLINE/HIGHLINE)**

MOTOR-POWER WINDOW-DRIVER (MIDLINE/HIGHLINE) - LT GRAY 2 WAY

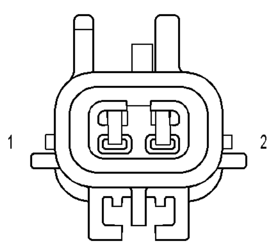
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Q21 14OR/WT | LEFT FRONT WINDOW DRIVER DOWN |
| 2 | Q11 14OR/LG | LEFT FRONT WINDOW DRIVER UP |




**MOTOR-POWER WINDOW-PASSENGER (MIDLINE/HIGHLINE)**

MOTOR-POWER WINDOW-PASSENGER (MIDLINE/HIGHLINE) - LT GRAY 2 WAY

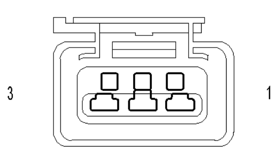
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Q22 16OR/VT (LHD) | PASSENGER FRONT WINDOW DRIVER DOWN |
| 1 | Q22 16OR/VT (RHD) | DRIVER FRONT WINDOW DRIVER DOWN |
| 2 | Q12 16OR/BR (LHD) | RIGHT FRONT WINDOW DRIVER UP |
| 2 | Q12 16OR/BR (RHD) | RIGHT FRONT WINDOW DRIVER UP |




**MOTOR-RADIATOR FAN (GAS)**

MOTOR-RADIATOR FAN (GAS)

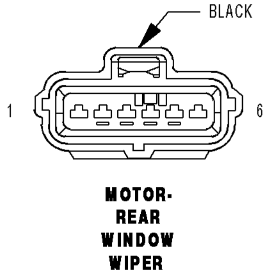
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | N23 12DB/DG | LOW SPEED RAD FAN RELAY OUTPUT |
| 2 | Z937 12BK | GROUND |




**MOTOR-RADIATOR FAN (DIESEL)**

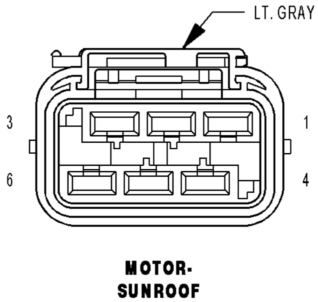
MOTOR-RADIATOR FAN (DIESEL) - 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | N23 12DB/DG | LOW SPEED RAD FAN RELAY OUTPUT |
| 2 | Z937 12BK | GROUND |
| 3 | N24 12DG/DB | HIGH SPEED RAD FAN RELAY OUTPUT |



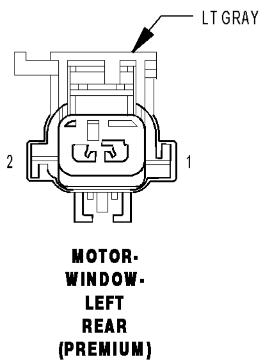

MOTOR-REAR WINDOW WIPER - BLACK 6 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z213 18BK/OR | GROUND |
| 2 | W13 20BR/LG | REAR WIPER ON DRIVER |
| 3 | G80 20VT/YL | FLIP-UP GLASS AJAR SWITCH SENSE |
| 4 | W27 20DB/BR | REAR WIPER INTERMITTENT DRIVER |
| 5 | A44 18RD/OR | FUSED B(+) |
| 6 | - | - |



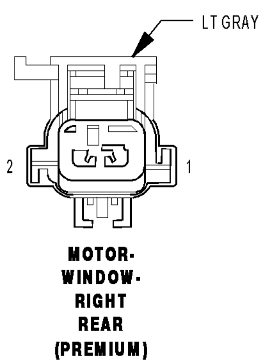

MOTOR-SUNROOF - LT GRAY 6 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Q39 16RD | REAR WINDOW DEFOGGER RELAY OUTPUT |
| 2 | Z111 16BK/WT | GROUND |
| 3 | Q644 20OR/YL | SUNROOF SWITCH GROUND |
| 4 | Q43 20OR/LB | SUNROOF VENT |
| 5 | Q5 20OR/LB | SUNROOF CLOSE |
| 6 | Q3 20OR/TN | SUNROOF OPEN |



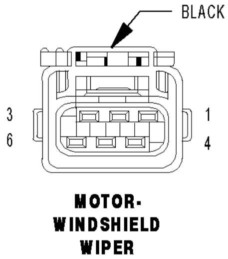

MOTOR-WINDOW-LEFT REAR (PREMIUM) - LT GRAY 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Q211 16TN/LB | LEFT REAR WINDOW DRIVER DOWN |
| 2 | Q111 16TN/YL | LEFT REAR WINDOW DRIVER UP |



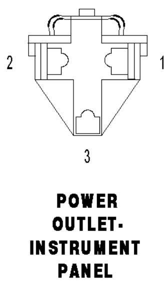

MOTOR-WINDOW-RIGHT REAR (PREMIUM) - LT GRAY 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Q212 16OR/VT | RIGHT REAR WINDOW DRIVER DOWN |
| 2 | Q112 16OR/BR | RIGHT REAR WINDOW DRIVER UP |



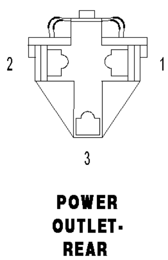

MOTOR-WINDSHIELD WIPER - BLACK 6 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A5 16RD/VT | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 2 | W7 16BR/GY | FRONT WIPER PARK SWITCH SENSE |
| 3 | - | - |
| 4 | Z931 16BK | GROUND |
| 5 | W3 16BR/WT | FRONT WIPER HIGH/LOW RELAY LOW SPEED OUTPUT |
| 6 | W4 16BR/OR | FRONT WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT |



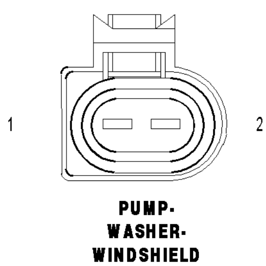

POWER OUTLET-INSTRUMENT PANEL - 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A207 16RD/LG (LHD) | FUSED B(+) |
| 1 | F307 16LB/PK (RHD) | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 2 | - | - |
| 3 | Z940 16BK | GROUND |



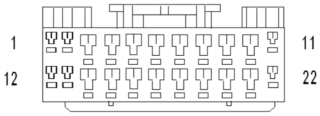

POWER OUTLET-REAR - GRAY 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A305 16RD/LB | FUSED B(+) |
| 2 | - | - |
| 3 | Z934 16BK | GROUND |




PUMP-WASHER-WINDSHIELD - 2 WAY

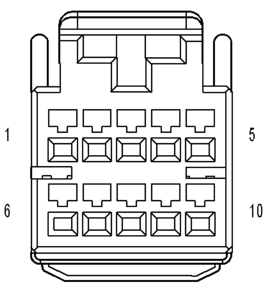
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | W20 20BR/YL | WASHER MOTOR SENSE |
| 2 | W33 20BR/DG | WASHER PUMP DRIVER |




RADIO C1

RADIO C1 - 22 WAY

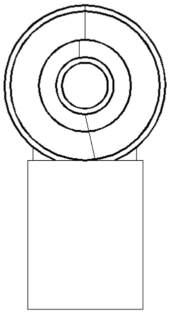
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A908 18RD | FUSED B(+) |
| 2 | F982 20PK/YL | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 3 | E2 20OR/BR | PANEL LAMPS DRIVER |
| 4 | - | - |
| 5 | - | - |
| 6 | - | - |
| 7 | X54 18GY | RIGHT FRONT SPEAKER (+) |
| 8 | X56 18GY/BR | RIGHT FRONT SPEAKER (-) |
| 9 | X55 18DG/BR | LEFT FRONT SPEAKER (-) |
| 10 | X53 18DG | LEFT FRONT SPEAKER (+) |
| 11 | Z514 16BK/LG | GROUND |
| 12 | A908 18RD | FUSED B(+) |
| 13 | A116 20YL/RD (RADIO CHOKE) | ANTENNA RELAY OUTPUT |
| 14 | D25 20WT/VT | PCI BUS |
| 15 | - | - |
| 16 | - | - |
| 17 | - | - |
| 18 | X51 18DG/DB | LEFT REAR DOOR SPEAKER (+) |
| 19 | X57 18DG/OR | LEFT REAR DOOR SPEAKER (-) |
| 20 | X58 18GY/OR | RIGHT REAR DOOR SPEAKER (-) |
| 21 | X52 18GY/DB | RIGHT REAR DOOR SPEAKER (+) |
| 22 | Z514 16BK/LG | GROUND |




RADIO C2

RADIO C2 - 10 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X40 20GY/WT | AUDIO MUX RIGHT |
| 2 | X140 20GY/OR | SHIELD |
| 3 | X235 20GY | AUDIO RETURN |
| 4 | D25 20WT/VT | PCI BUS |
| 5 | X112 20DG/GY (BASE) | IGNITION RUN/ACC SIGNAL |
| 5 | X112 20LG/GY (EXCEPT BASE) | IGNITION RUN/ACC SIGNAL |
| 6 | X41 20DG/WT | AUDIO MUX LEFT |
| 7 | Z515 20BK | GROUND |
| 8 | - | - |
| 9 | - | - |
| 10 | X160 20GY/YL | FUSED B(+) |



RADIO C3
(EXCEPT EXPORT)

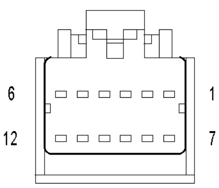
RADIO C3 (EXCEPT EXPORT) - 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| C1 | D5 20WT/OR | RADIO ANTENNA CORE |
| C2 | D931 20WT/YL | RADIO ANTENNA SHIELD |

CONNECTOR
NOT
AVAILABLE

RADIO-ANTENNA (EXCEPT EXPORT) - 2 WAY

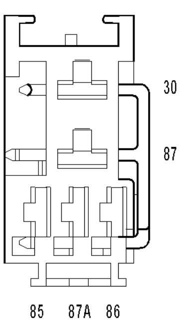
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | D5 20WT/OR | RADIO ANTENNA CORE |
| 2 | D931 20WT/YL | RADIO ANTENNA SHIELD |




RECEIVER-
SATELLITE

RECEIVER-SATELLITE - 12 WAY

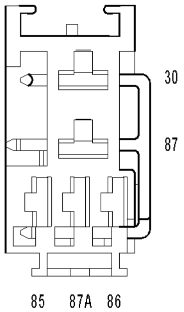
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X41 20DG/WT | AUDIO MUX LEFT |
| 2 | - | - |
| 3 | - | - |
| 4 | Z515 20BK | GROUND |
| 5 | X112 20LG/GY | IGNITION RUN/ACC SIGNAL |
| 6 | X160 20GY/YL | FUSED B(+) |
| 7 | X40 20GY/WT | AUDIO MUX RIGHT |
| 8 | X140 20GY/OR | SHIELD |
| 9 | - | - |
| 10 | - | - |
| 11 | - | - |
| 12 | D25 20WT/VT | PCI BUS |




RELAY-
TRAILER TOW

RELAY-TRAILER TOW

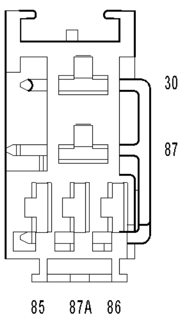
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | A100 14RD/VT | FUSED B(+) |
| 85 | Z933 14BK | GROUND |
| 86 | F302 20GY/PK | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 87 | A917 14RD | TRAILER TOW RELAY OUTPUT |
| 87A | - | - |




RELAY-TRAILER TOW BRAKE LAMP

RELAY-TRAILER TOW BRAKE LAMP - 5 WAY

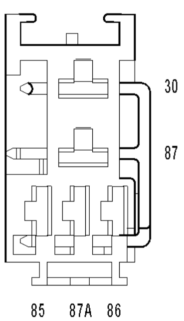
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | A913 16RD | FUSED B(+) |
| 85 | Z933 14BK | GROUND |
| 86 | L50 18WT/TN | BRAKE LAMP SWITCH OUTPUT |
| 87 | L651 16WT/LG | TRAILER TOW BRAKE LAMP RELAY OUTPUT |
| 87 | L651 16WT/LG | TRAILER TOW BRAKE LAMP RELAY OUTPUT |
| 87A | L76 16PK/RD | TRAILER TOW BRAKE LAMP RELAY OUTPUT |




RELAY-TRAILER TOW-LEFT

RELAY-TRAILER TOW-LEFT

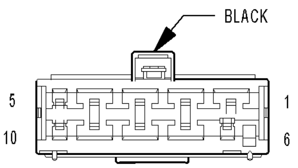
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | L673 16YL | LEFT TURN SIGNAL |
| 85 | Z993 14BK | GROUND |
| 86 | L63 18WT/DG | LEFT TURN SIGNAL |
| 87 | L76 16PK/RD | TRAILER TOW BRAKE LAMP RELAY OUTPUT |
| 87 | L76 16PK/RD | TRAILER TOW BRAKE LAMP RELAY OUTPUT |
| 87A | L651 16WT/LG | TRAILER TOW BRAKE LAMP RELAY OUTPUT |




RELAY-TRAILER TOW-RIGHT

RELAY-TRAILER TOW-RIGHT - 5 WAY

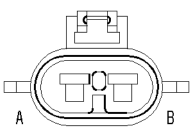
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 30 | L674 16LG | RIGHT TURN SIGNAL |
| 85 | Z933 14BK | GROUND |
| 86 | L62 18WT/OR | RIGHT TURN SIGNAL |
| 87 | L76 16PK/RD | TRAILER TOW BRAKE LAMP RELAY OUTPUT |
| 87A | L651 16WT/LG | TRAILER TOW BRAKE LAMP RELAY OUTPUT |




RESISTOR-BLOWER MOTOR

RESISTOR-BLOWER MOTOR - BLACK 10 WAY

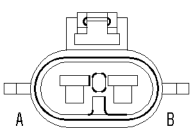
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | C75 12DB/GY | BLOWER MOTOR HIGH DRIVER |
| 2 | C75 12DB/GY | BLOWER MOTOR HIGH DRIVER |
| 3 | C73 14DB/VT | BLOWER MOTOR M2 DRIVER |
| 4 | C72 16DB/OR | BLOWER MOTOR M1 DRIVER |
| 5 | C71 16DB/BR | BLOWER MOTOR LOW DRIVER |
| 6 | - | - |
| 7 | - | - |
| 8 | - | - |
| 9 | - | - |
| 10 | - | - |




SEAT BELT TENSIONER-DRIVER

SEAT BELT-TENSIONER-DRIVER - 2 WAY

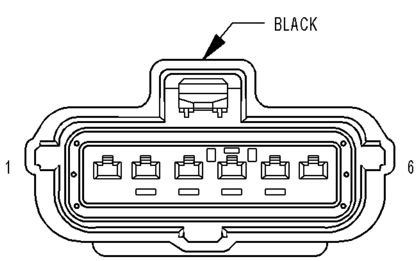
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| A | R55 20LG/DG | DRIVER SEAT BELT TENSIONER LINE 1 |
| B | R53 20LG/YL | DRIVER SEAT BELT TENSIONER LINE 2 |




SEAT BELT TENSIONER-PASSENGER

SEAT BELT-TENSIONER-PASSENGER - 2 WAY

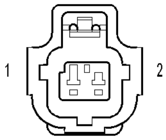
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| A | R54 20LB/YL | PASSENGER SEAT BELT TENSIONER LINE 2 |
| B | R56 20LB/DG | PASSENGER SEAT BELT TENSIONER LINE 1 |




SENSOR-ACCELERATOR PEDAL POSITION (DIESEL)

SENSOR-ACCELERATOR PEDAL POSITION (DIESEL) - BLACK 6 WAY

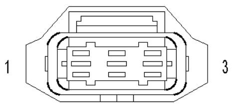
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K854 20VT/BR | APP SENSOR 2 5 VOLT SUPPLY |
| 2 | K29 20 WT/BR | APP SENSOR 2 SIGNAL |
| 3 | K400 20BR/VT | APP SENSOR 2 GROUND |
| 4 | K167 20BR/YL | APP SENSOR 1 GROUND |
| 5 | K23 20BR/WT | APP SENSOR 1 SIGNAL |
| 6 | K852 20BR/VT | APP SENSOR 1 5 VOLT SUPPLY |




SENSOR-AMBIENT AIR TEMPERATURE

SENSOR-AMBIENT AIR TEMPERATURE - 2 WAY

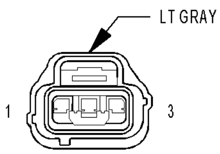
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | G31 20VT/OR | AAT SIGNAL |
| 2 | K300 20BR | SENSOR GROUND |




SENSOR-CAMSHAFT POSITION (DIESEL)

SENSOR-CAMSHAFT POSITION (DIESEL) - 3 WAY

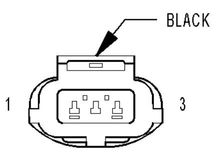
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K944 20BR/GY | CMP SENSOR GROUND |
| 2 | K44 20DB/GY | CMP SENSOR SIGNAL |
| 3 | F856 20YL/PK | CMP SENSOR 5 VOLT SUPPLY |




SENSOR-CAMSHAFT POSITION (3.7L)

SENSOR-CAMSHAFT POSITION (3.7L) - LT GRAY 3 WAY

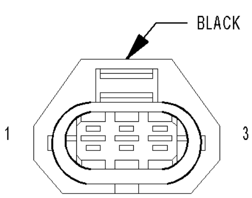
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K44 20DB/GY | CMP SIGNAL |
| 2 | K900 20DB/DG | SENSOR GROUND |
| 3 | F856 20YL/PK | 5 VOLT SUPPLY |




SENSOR-CRANKSHAFT POSITION (3.7L)

SENSOR-CRANKSHAFT POSITION (3.7L) - BLACK 3 WAY

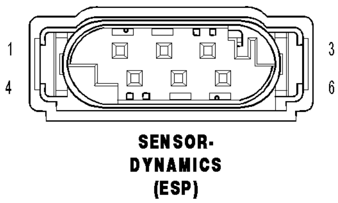
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K24 20BR/LB | CKP SIGNAL |
| 2 | K900 20DB/DG | SENSOR GROUND |
| 3 | F855 20PK/YL | 5 VOLT SUPPLY |




SENSOR-CRANKSHAFT POSITION (DIESEL)

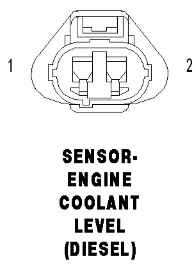
SENSOR-CRANKSHAFT POSITION (DIESEL) - BLACK 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K853 20DB/BR | CKP SIGNAL NO. 1 |
| 2 | K3 20BR/LB | CKP SIGNAL NO. 2 |
| 3 | - | - |



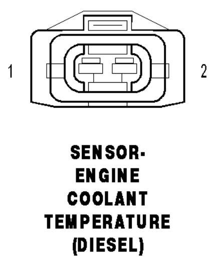

SENSOR-DYNAMICS (ESP) - 6 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | D51 20PK/RD | DYNAMICS SENSOR LOW DATA LINK |
| 2 | D52 20WT/LB | DYNAMICS SENSOR HIGH DATA LINK |
| 3 | G4 20VT/LB | DYNAMICS SENSOR SUPPLY |
| 4 | - | - |
| 5 | G94 20VT/DB | DYNAMICS SENSOR GROUND |
| 6 | - | - |



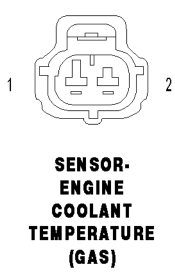

SENSOR-ENGINE COOLANT LEVEL (DIESEL) - 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | G18 20OR/VT | LOW COOLANT FLUID LEVEL SENSE |
| 2 | Z939 20BK | GROUND |



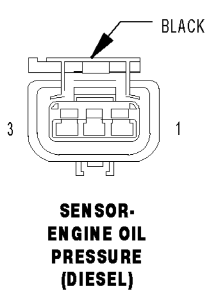

SENSOR-ENGINE COOLANT TEMPERATURE (DIESEL) - 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K2 20VT/OR | ECT SENSOR SIGNAL |
| 2 | K900 20DB/DG | SENSOR GROUND |



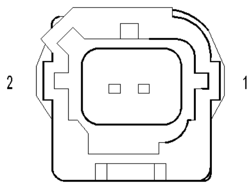

SENSOR-ENGINE COOLANT TEMPERATURE (GAS) - 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K2 20VT/OR | ECT SIGNAL |
| 2 | K900 20DB/DG | SENSOR GROUND |




SENSOR-ENGINE OIL PRESSURE (DIESEL) - BLACK 3 WAY

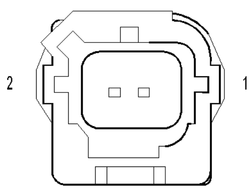
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K301 20BR/LG | 5 VOLT SUPPLY |
| 2 | K302 20BR/WT | ENGINE OIL PRESSURE SENSOR SIGNAL |
| 3 | K300 20BR | SENSOR GROUND |




SENSOR-FRONT IMPACT-LEFT

SENSOR-FRONT IMPACT-LEFT - 2 WAY

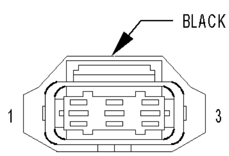
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R81 20LB/WT | LEFT FRONT IMPACT SENSOR GROUND |
| 2 | R79 20LB/VT | LEFT FRONT IMPACT SENSOR SIGNAL |




SENSOR-FRONT IMPACT-RIGHT

SENSOR-FRONT IMPACT-RIGHT - 2 WAY

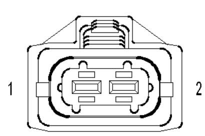
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R82 20WT/LB | RIGHT FRONT IMPACT SENSOR GROUND |
| 2 | R80 20VT/LB | RIGHT FRONT IMPACT SENSOR SIGNAL |




SENSOR-FUEL PRESSURE (DIESEL)

SENSOR-FUEL PRESSURE (DIESEL) - BLACK 3 WAY

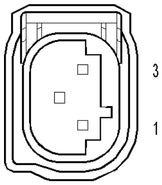
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K359 20YL/BR | FUEL PRESSURE SENSOR GROUND |
| 2 | K181 20BR/YL | FUEL PRESSURE SENSOR SIGNAL |
| 3 | K350 20BR/YL | FUEL PRESSURE SENSOR 5 VOLT SUPPLY |




SENSOR-FUEL TEMPERATURE (DIESEL)

SENSOR-FUEL TEMPERATURE (DIESEL) - 2 WAY

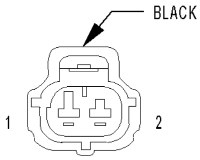
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K900 20DB/DG | SENSOR GROUND |
| 2 | K156 20BR/YL | FUEL TEMPERATURE SENSOR SIGNAL |




SENSOR-
INLET
PRESSURE
(DIESEL)

SENSOR-INLET PRESSURE (DIESEL) - 3 WAY

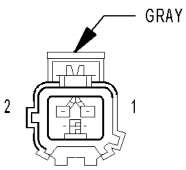
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K960 20BR/LB | INLET PRESSURE SENSOR GROUND |
| 2 | K68 20BR/LG | INLET PRESSURE SENSOR SIGNAL |
| 3 | K668 20BR | INLET PRESSURE SENSOR 5 VOLT SUPPLY |




SENSOR-
INPUT
SPEED
(A/T)

SENSOR-INPUT SPEED (A/T) - BLACK 2 WAY

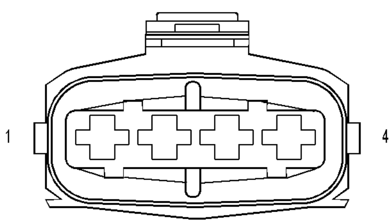
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | T52 20DG/WT | INPUT SPEED SENSOR SIGNAL |
| 2 | T13 20DG/VT | SPEED SENSOR GROUND |




SENSOR-
INTAKE AIR
TEMPERATURE
(GAS)

SENSOR-INTAKE AIR TEMPERATURE (GAS) - GRAY 2 WAY

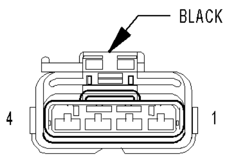
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K21 20BR/WT | IAT SIGNAL |
| 2 | K900 20DB/DG | SENSOR GROUND |




SENSOR-
INTAKE AIR
TEMPERATURE/
INTAKE
PRESSURE
(DIESEL)

SENSOR-INTAKE AIR TEMPERATURE/INTAKE PRESSURE (DIESEL) - 4 WAY

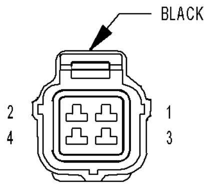
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K656 20GY/BR | SENSOR GROUND |
| 2 | K21 20BR/WT | IAT SENSOR SIGNAL |
| 3 | K856 20BR/YL | INTAKE PRESSURE SENSOR 5 VOLT SUPPLY |
| 4 | K37 20BR/OR | INTAKE PRESSURE SENSOR SIGNAL |




SENSOR-KNOCK (3.7L)

SENSOR-KNOCK (3.7L) - BLACK 4 WAY

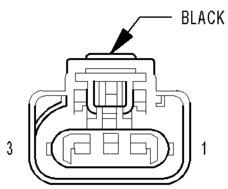
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K942 20BR/LG | KNOCK SENSOR NO. 1 RETURN |
| 2 | K42 20DB/OR | KNOCK SENSOR NO. 1 SIGNAL |
| 3 | K924 20PK/RD | KNOCK SENSOR NO. 2 RETURN |
| 4 | K242 20BR/WT | KNOCK SENSOR NO. 2 SIGNAL |




SENSOR-LINE PRESSURE (2.8L 45RFE)

SENSOR-LINE PRESSURE (2.8L 45RFE) - BLACK 4 WAY

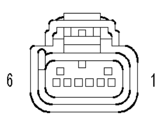
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z133 20BK/LG | GROUND |
| 2 | T39 20BR/YL | 5 VOLT SUPPLY |
| 3 | T38 20YL/BR | LINE PRESSURE SENSOR SIGNAL |
| 4 | - | - |




SENSOR-MAP (GAS)

SENSOR-MAP (GAS) - BLACK 3 WAY

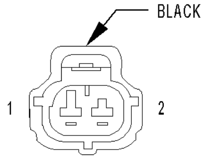
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K1 20VT/BR | MAP SIGNAL |
| 2 | K900 20DB/DG | SENSOR GROUND |
| 3 | F856 20YL/PK | 5 VOLT SUPPLY |




SENSOR-MASS AIR FLOW (DIESEL)

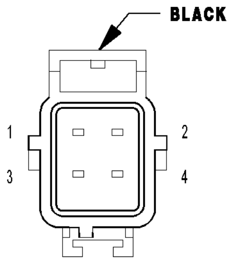
SENSOR-MASS AIR FLOW (DIESEL) - 6 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | K811 20BK/OR | MAF SENSOR 5 VOLT SUPPLY |
| 3 | F1 20PK/WT | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 4 | - | - |
| 5 | K957 20BR/OR | MAF SENSOR GROUND |
| 6 | K157 20BR/OR | MAF SENSOR SIGNAL |



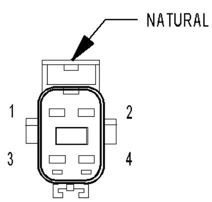

SENSOR-OUTPUT SPEED (A/T) - BLACK 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | T14 20DG/BR | OUTPUT SPEED SENSOR SIGNAL |
| 2 | T13 20DG/VT | SPEED SENSOR GROUND |



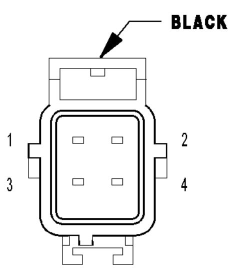

SENSOR-OXYGEN-LEFT FRONT (3.7L) - BLACK 4 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K99 18BR/TN | O2 1/1 HEATER CONTROL |
| 2 | Z42 18BK/LG | GROUND |
| 3 | K902 20BR/DG | O2 UPSTREAM RETURN |
| 4 | K41 20DB/LB | O2 1/1 SIGNAL |



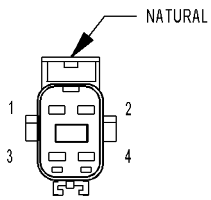

SENSOR-OXYGEN-LEFT REAR - NATURAL 4 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K299 18BR/OR | O2 1/2 HEATER CONTROL |
| 2 | Z42 18BK/LG | GROUND |
| 3 | K904 20DB/DG | O2 DOWNSTREAM RETURN |
| 4 | K141 20DB/YL | O2 1/2 SIGNAL |




SENSOR-OXYGEN-RIGHT FRONT (3.7L) - BLACK 4 WAY

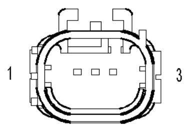
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K199 18BR/BK | O2 2/1 HEATER CONTROL |
| 2 | Z42 18BK/LG | GROUND |
| 3 | K902 20BR/DG | O2 UPSTREAM RETURN |
| 4 | K43 20DB/LG | O2 2/1 SIGNAL |




SENSOR-OXYGEN-RIGHT REAR (3.7L)

SENSOR-OXYGEN-RIGHT REAR (3.7L) - NATURAL 4 WAY

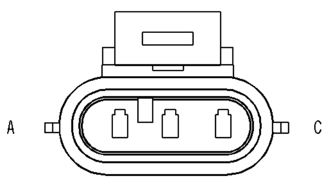
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K399 18BR/GY | O2 2/2 HEATER CONTROL |
| 2 | Z42 18BK/LG | GROUND |
| 3 | K904 20DB/DG | O2 DOWNSTREAM RETURN |
| 4 | K243 20BR | O2 2/2 SIGNAL |




SENSOR-SEAT BELT TENSION

SENSOR-SEAT BELT TENSION - 3 WAY

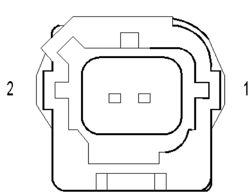
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R86 20LG/LB | SEAT BELT TENSION SENSOR POWER |
| 2 | R986 20LG/BR | SEAT BELT TENSION SENSOR GROUND |
| 3 | D105 20WT/OR | SEAT BELT TENSION SENSOR SIGNAL |




SENSOR-SEAT WEIGHT-PASSENGER

SENSOR-SEAT WEIGHT-PASSENGER - 3 WAY

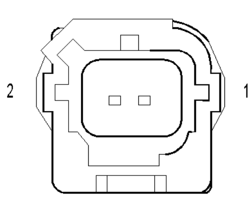
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| A | R941 20LG/DG | PASSENGER BLADDER PRESSURE SENSOR GROUND |
| B | R741 20LG/VT | PASSENGER BLADDER PRESSURE SENSOR SIGNAL |
| C | R740 20LG/OR | PASSENGER BLADDER PRESSURE SENSOR POWER |




SENSOR-SIDE IMPACT-LEFT 1

SENSOR-SIDE IMPACT-LEFT 1 - 2 WAY

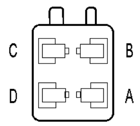
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R15 20LG/BR | LEFT SIDE IMPACT SENSOR 1 GROUND |
| 2 | R13 20LG/VT | LEFT SIDE IMPACT SENSOR 1 SIGNAL |




SENSOR-SIDE IMPACT-RIGHT 1

SENSOR-SIDE IMPACT-RIGHT 1 - 2 WAY

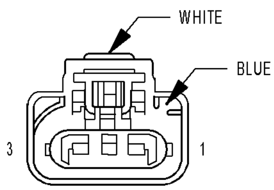
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R16 20BR/LG | RIGHT SIDE IMPACT SENSOR 1 GROUND |
| 2 | R14 20TN/LG | RIGHT SIDE IMPACT SENSOR 1 SIGNAL |




SENSOR-STEERING ANGLE

SENSOR-STEERING ANGLE - 4 WAY

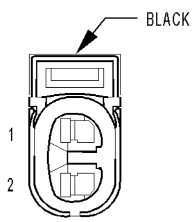
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| A | D65 20WT/LG | CAN C BUS (+) |
| B | Z385 20BK | GROUND |
| C | D64 20WT/LB | CAN C BUS (-) |
| D | F943 20PK/LG | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |




SENSOR-THROTTLE POSITION (GAS)

SENSOR-THROTTLE POSITION (GAS) - WHITE/BLUE 3 WAY

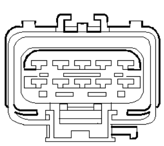
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F855 20PK/YL | 5 VOLT SUPPLY |
| 2 | K900 20DB/DG | SENSOR GROUND |
| 3 | K22 20BR/OR | TP SIGNAL |




SENSOR-TRANSFER CASE POSITION

SENSOR-TRANSFER CASE POSITION - BLACK 2 WAY

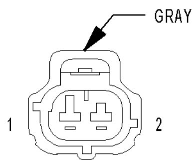
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K77 20BR/WT | TRANSFER CASE POSITION SENSOR INPUT |
| 2 | K300 20BR | SENSOR GROUND |



SENSOR-TRANSMISSION RANGE (42RLE)

SENSOR-TRANSMISSION RANGE (42RLE) - 10 WAY

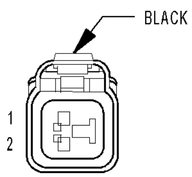
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | C115 20DB | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 2 | - | - |
| 3 | T13 20DG/VT | SPEED SENSOR GROUND |
| 4 | T54 20DG/OR | TRANSMISSION TEMPERATURE SENSOR SIGNAL |
| 5 | - | - |
| 6 | L10 20WT/GY | BACK-UP LAMP FEED |
| 7 | T1 20DG/LB | TRS T1 SENSE |
| 8 | T3 20DG/DB | TRS T3 SENSE |
| 9 | T42 20DG/YL | TRS T42 SENSE |
| 10 | T41 20YL/DB | TRS T41 SENSE (P/N) |




**SENSOR-WATER IN FUEL (DIESEL)**

SENSOR-WATER IN FUEL (DIESEL) - GRAY 2 WAY

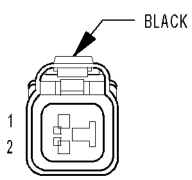
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K303 20BR/OR | WATER IN FUEL SENSOR SIGNAL |
| 2 | K300 20BR | SENSOR GROUND |




**SENSOR-WHEEL SPEED-ABS-LEFT FRONT (ABS)**

SENSOR-WHEEL SPEED-ABS-LEFT FRONT (ABS) - BLACK 2 WAY

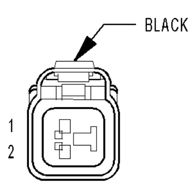
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | B9 18DG/LG | LEFT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY |
| 2 | B8 18DG/WT | LEFT FRONT WHEEL SPEED SENSOR SIGNAL |




**SENSOR-WHEEL SPEED-ABS-LEFT REAR (ABS)**

SENSOR-WHEEL SPEED-ABS-LEFT REAR (ABS) - BLACK

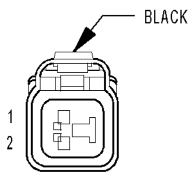
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | B4 18DG/GY | LEFT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY |
| 2 | B3 18DG/YL | LEFT REAR WHEEL SPEED SENSOR SIGNAL |




**SENSOR-WHEEL SPEED-ABS-RIGHT FRONT (ABS)**

SENSOR-WHEEL SPEED-ABS-RIGHT FRONT (ABS) - BLACK 2 WAY

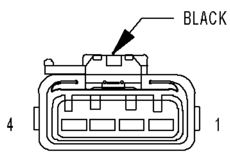
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | B7 18DG/VT | RIGHT FRONT WHEEL SPEED SENSOR 12 VOLT SUPPLY |
| 2 | B6 18DG/WT | RIGHT FRONT WHEEL SPEED SENSOR SIGNAL |




SENSOR-WHEEL SPEED-ABS-RIGHT REAR (ABS)

SENSOR-WHEEL SPEED-ABS-RIGHT REAR (ABS) - BLACK

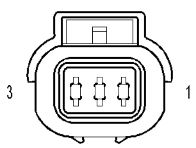
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | B2 18DG/LB | RIGHT REAR WHEEL SPEED SENSOR 12 VOLT SUPPLY |
| 2 | B1 18DG/OR | RIGHT REAR WHEEL SPEED SIGNAL |




SERVO-SPEED CONTROL

SERVO-SPEED CONTROL - BLACK 4 WAY

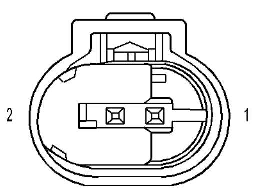
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | V36 20VT/TN | S/C VACUUM CONTROL |
| 2 | V35 20VT/OR | S/C VENT CONTROL |
| 3 | V30 20VT/WT | S/C BRAKE SWITCH OUTPUT |
| 4 | Z937 20BK | GROUND |




SIREN (EXPORT)

SIREN (EXPORT) - 3 WAY

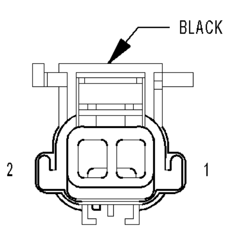
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z932 20BK | GROUND |
| 2 | X75 18GY/DG | SIREN SIGNAL CONTROL |
| 3 | A908 20RD | FUSED B(+) |




SOLENOID-BOOST PRESSURE (DIESEL)

SOLENOID-BOOST PRESSURE (DIESEL) - 2 WAY

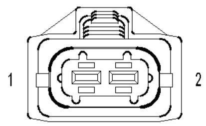
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K347 20BR/PK | FUSED ASD RELAY OUTPUT |
| 2 | X635 20BR/WT | BOOST PRESSURE SOLENOID CONTROL |




SOLENOID-EVAP/PURGE (GAS)

SOLENOID-EVAP/PURGE (GAS) - BLACK 2 WAY

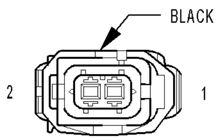
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K70 20DB/BR | EVAP PURGE SOL CONTROL |
| 2 | K52 20DB/WT | EVAP PURGE SOL SIGNAL |




SOLENOID-FUEL PRESSURE (DIESEL)

SOLENOID-FUEL PRESSURE (DIESEL) - 2 WAY

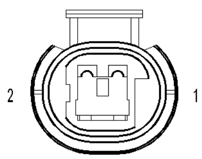
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K370 16BR | FUEL PRESSURE SOLENOID CONTROL |
| 2 | K369 16BR/OR | FUEL PRESSURE SOLENOID SUPPLY |




SOLENOID-FUEL QUANTITY (DIESEL)

SOLENOID-FUEL QUANTITY (DIESEL) - BLACK 2 WAY

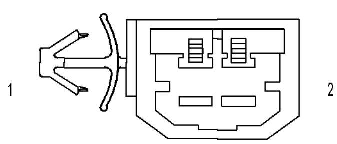
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K366 16BR/LG | FUEL QUANTITY SOLENOID SUPPLY |
| 2 | K646 16BR/YL | FUEL QUANTITY SOLENOID CONTROL |




SOLENOID-VACUUM RESERVOIR (DIESEL)

SOLENOID-VACUUM RESERVOIR (DIESEL) - 2 WAY

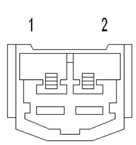
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K347 20BR/PK | FUSED ASD RELAY OUTPUT |
| 2 | N117 20DB/WT | VACUUM RESERVOIR SOLENOID CONTROL |




SPEAKER-INSTRUMENT PANEL-LEFT (BASE)

SPEAKER-INSTRUMENT PANEL-LEFT (BASE) - WHITE 2 WAY

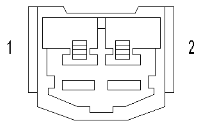
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X53 18DG | LEFT FRONT SPEAKER (+) |
| 2 | X55 18DG/BR | LEFT FRONT SPEAKER (-) |




SPEAKER-INSTRUMENT PANEL-LEFT (PREMIUM)

SPEAKER-INSTRUMENT PANEL-LEFT (PREMIUM) - 2 WAY

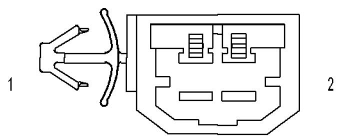
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X209 18GY/OR | AMPLIFIED HIGH LEFT FRONT SPEAKER (+) |
| 2 | X299 18GY/YL | AMPLIFIED HIGH LEFT FRONT SPEAKER (-) |




SPEAKER-INSTRUMENT PANEL-RIGHT (PREMIUM)

SPEAKER-INSTRUMENT PANEL-RIGHT (PREMIUM) - 2 WAY

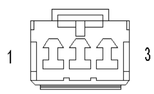
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X298 18GY/LG | AMPLIFIED HIGH RIGHT FRONT SPEAKER (+) |
| 2 | X208 18GY/DG | AMPLIFIED HIGH RIGHT FRONT SPEAKER (-) |




SPEAKER-INSTRUMENT PANEL-RIGHT (BASE)

SPEAKER-INSTRUMENT PANEL-RIGHT (BASE) - WHITE 2 WAY

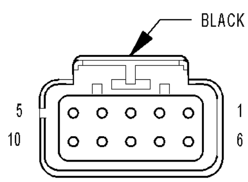
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X54 18GY | RIGHT FRONT SPEAKER (+) |
| 2 | X56 18GY/BR | RIGHT FRONT SPEAKER (-) |




SPEAKER-LEFT FRONT DOOR (BASE)

SPEAKER-LEFT FRONT DOOR (BASE) - 3 WAY

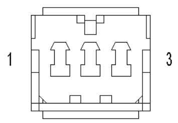
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X53 18DG | LEFT FRONT SPEAKER (+) |
| 2 | - | - |
| 3 | X55 18DG/BR | LEFT FRONT SPEAKER (-) |




SPEAKER-LEFT FRONT DOOR (PREMIUM)

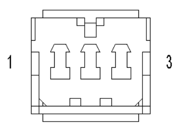
SPEAKER-LEFT FRONT DOOR (PREMIUM) - 10 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X53 18DG | LEFT FRONT SPEAKER (+) |
| 2 | X55 18DG/BR | LEFT FRONT SPEAKER (-) |
| 3 | Z514 16BK/LG | GROUND |
| 4 | X299 18GY/YL | AMPLIFIED HIGH LEFT FRONT SPEAKER (-) |
| 5 | X295 18GY/DG | AMPLIFIED LOW LEFT REAR SPEAKER (-) |
| 6 | X57 18DG/OR | LEFT REAR DOOR SPEAKER (-) |
| 7 | X51 18DG/DB | LEFT REAR DOOR SPEAKER (+) |
| 8 | X13 16LG/GY | RADIO CHOKE OUTPUT |
| 9 | X209 18GY/OR | AMPLIFIED HIGH LEFT FRONT SPEAKER (+) |
| 10 | X206 18DG/LG | AMPLIFIED LOW LEFT REAR SPEAKER (+) |



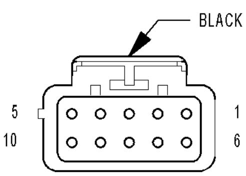

SPEAKER-LEFT REAR DOOR (PREMIUM) - 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X206 18DG/LG | AMPLIFIED LOW LEFT REAR SPEAKER (+) |
| 2 | - | - |
| 3 | X295 18GY/DG | AMPLIFIED LOW LEFT REAR SPEAKER (-) |



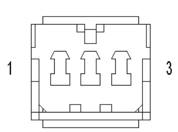

SPEAKER-RIGHT FRONT DOOR (BASE) - 3 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X54 18GY | RIGHT FRONT SPEAKER (+) |
| 2 | - | - |
| 3 | X56 18GY/BR | RIGHT FRONT SPEAKER (-) |



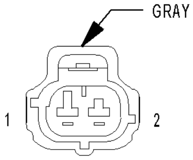

SPEAKER-RIGHT FRONT DOOR (PREMIUM) - BLACK 10 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X54 18GY | RIGHT FRONT SPEAKER (+) |
| 2 | X56 18GY/BR | RIGHT FRONT SPEAKER (-) |
| 3 | Z514 16BK/LG | GROUND |
| 4 | X208 18GY/DG | AMPLIFIED HIGH RIGHT FRONT SPEAKER (-) |
| 5 | X296 18LG/GY | AMPLIFIED LOW RIGHT REAR SPEAKER (-) |
| 6 | X58 18GY/OR | RIGHT REAR DOOR SPEAKER (-) |
| 7 | X52 18GY/DB | RIGHT REAR DOOR SPEAKER (+) |
| 8 | X13 16LG/GY | RADIO CHOKE OUTPUT |
| 9 | X298 18GY/LG | AMPLIFIED HIGH RIGHT FRONT SPEAKER (+) |
| 10 | X205 18GY/LG | AMPLIFIED LOW RIGHT REAR SPEAKER (+) |




SPEAKER-RIGHT REAR DOOR (PREMIUM) - 3 WAY

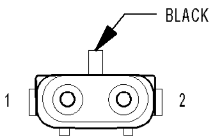
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X205 18GY/LG | AMPLIFIED LOW RIGHT REAR SPEAKER (+) |
| 2 | - | - |
| 3 | X296 18LG/GY | AMPLIFIED LOW RIGHT REAR SPEAKER (-) |




SWITCH-A/C-
LOW PRESSURE

SWITCH-A/C-LOW PRESSURE - GRAY 2 WAY

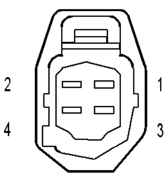
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | C20 20DB/YL | A/C SWITCH SENSE |
| 2 | Z937 20BK (LHD) | GROUND |
| 2 | Z932 18BK (RHD) | GROUND |




SWITCH-
BACKUP
LAMP
(M/T)

SWITCH-BACK UP LAMP (M/T) - BLACK 2 WAY

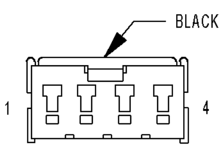
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | C115 20DB | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 2 | L10 20WT/GY | BACK-UP LAMP FEED |




SWITCH-
CLUTCH
INTERLOCK
(A/T)

SWITCH-CLUTCH INTERLOCK (M/T) - 4 WAY

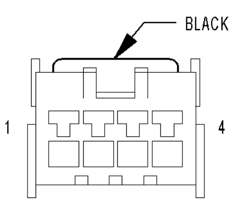
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | T141 20YL/OR | CLUTCH INTERLOCK SWITCH SIGNAL |
| 2 | T26 20DG/OR | CLUTCH UPSTOP SWITCH SIGNAL |
| 3 | Z945 18BK | GROUND |
| 4 | Z945 18BK | GROUND |




SWITCH-
DOOR
LOCK-
LEFT
(EXCEPT BASE)

SWITCH-DOOR LOCK-LEFT (EXCEPT BASE) - BLACK 4 WAY

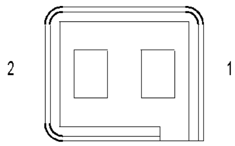
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | P36 20TN/DB | DOOR LOCK SWITCH MUX |
| 2 | - | - |
| 3 | - | - |
| 4 | P37 20LG/TN | DOOR LOCK SWITCH GROUND |




SWITCH-
DOOR
LOCK-
RIGHT
(EXCEPT BASE)

SWITCH-DOOR LOCK-RIGHT (EXCEPT BASE) - BLACK 4 WAY

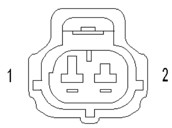
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | P36 20TN/DB | DOOR LOCK SWITCH MUX |
| 2 | - | - |
| 3 | - | - |
| 4 | P37 20LG/TN | DOOR LOCK SWITCH GROUND |




SWITCH-ESP

SWITCH-ESP - 2 WAY

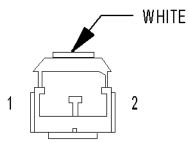
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | B46 20DG/WT | ESP/TCS ON/OFF SWITCH |
| 2 | Z385 20BK | GROUND |




SWITCH-FLIP-UP GLASS AJAR

SWITCH-FLIP-UP GLASS AJAR - 2 WAY

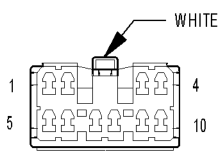
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | G80 20VT/YL | FLIP-UP GLASS AJAR SWITCH SENSE |
| 2 | Z213 18BK/OR | GROUND |




SWITCH-FLIP-UP GLASS RELEASE

SWITCH-FLIP-UP GLASS RELEASE - WHITE 2 WAY

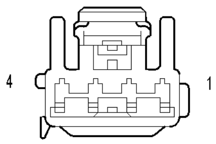
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | G910 20VT/BR | TAILGATE SWITCH GROUND |
| 2 | P101 20LG/WT | FLIP-UP GLASS RELEASE SWITCH SENSE |




SWITCH-HAZARD/COMBINATION FLASHER

SWITCH-HAZARD/COMBINATION FLASHER - WHITE 10 WAY

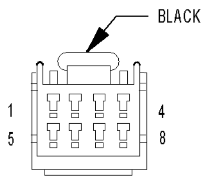
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A701 18BR/RD | FUSED B(+) |
| 2 | Z940 16BK | GROUND |
| 3 | L62 18WT/OR | RIGHT TURN SIGNAL |
| 4 | L91 18WT/DB | HAZARD LAMP CONTROL |
| 5 | L305 20WT/LB | LEFT TURN SWITCH SENSE |
| 6 | - | - |
| 7 | L63 18WT/DG | LEFT TURN SIGNAL |
| 8 | C115 20DB | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 9 | L306 20LB/WT | RIGHT TURN SWITCH SENSE |
| 10 | E2 20OR/BR | PANEL LAMPS DRIVER |




SWITCH-HEADLAMP LEVELING (EXPORT)

SWITCH-HEADLAMP LEVELING (EXPORT) - 4 WAY

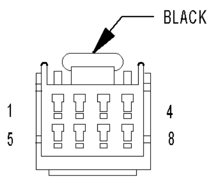
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | L13 18WT/YL | HEADLAMP ADJUST SIGNAL |
| 2 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |
| 3 | Z945 18BK | GROUND |
| 4 | - | - |




SWITCH-HEATED SEAT-DRIVER (HIGHLINE)

SWITCH-HEATED SEAT-DRIVER (HIGHLINE) - BLACK 8 WAY

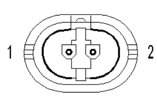
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | P137 20VT/DG | LEFT SEAT LOW HEAT LED DRIVER |
| 2 | P133 20TN/DG | LEFT SEAT HEATER SWITCH MUX |
| 3 | P139 20VT/WT | LEFT SEAT HIGH HEAT LED DRIVER |
| 4 | F302 20BR/PK | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 5 | - | - |
| 6 | - | - |
| 7 | - | - |
| 8 | Z849 20BK/WT | GROUND |




SWITCH-HEATED SEAT-PASSENGER (HIGHLINE)

SWITCH-HEATED SEAT-PASSENGER (HIGHLINE) - BLACK 8 WAY

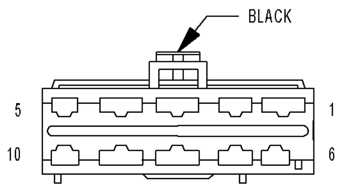
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | P82 20VT/LG | RIGHT SEAT LOW HEAT LED DRIVER |
| 2 | P134 20TN/LG | RIGHT SEAT HEATER SWITCH MUX |
| 3 | P84 20VT/BK | RIGHT SEAT HIGH HEAT LED DRIVER |
| 4 | F302 20BR/PK | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 5 | - | - |
| 6 | - | - |
| 7 | - | - |
| 8 | Z849 20BK/TN | GROUND |




SWITCH-HOOD AJAR (EXCEPT BASE)

SWITCH-HOOD AJAR (EXCEPT BASE) - 2 WAY

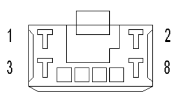
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | G70 20VT/LB | HOOD AJAR SWITCH SENSE |
| 2 | Z932 20BK | GROUND |




SWITCH-IGNITION

SWITCH-IGNITION - BLACK 10 WAY

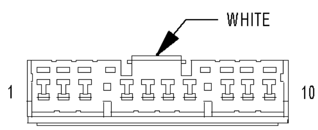
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A1 12RD | FUSED B(+) |
| 2 | F944 12PK/LG | IGNITION SWITCH OUTPUT (RUN-START) |
| 3 | - | - |
| 4 | - | - |
| 5 | G15 20VT/TN | KEY-IN IGNITION SWITCH SENSE |
| 6 | A106 12LB/RD | IGNITION SWITCH OUTPUT (START) |
| 7 | F981 12PK/YL | IGNITION SWITCH OUTPUT (RUN-ACC) |
| 8 | F921 12PK/YL | IGNITION SWITCH OUTPUT (RUN) |
| 9 | A916 12RD | FUSED B(+) |
| 10 | Z938 20BK | GROUND |




SWITCH-LIGHTBAR (RENEGADE)

SWITCH-LIGHTBAR (RENEGADE) - 8 WAY

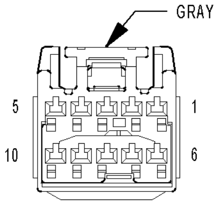
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | A904 14RD | FUSED B(+) |
| 3 | L8 14WT/DG | LIGHTBAR SWITCHED OUTPUT |
| 4 | Z940 20BK | GROUND |
| 5 | F942 20PK/LG (EXCEPT EXPORT) | FUSED IGNITION SWITCH OUTPUT (RUN-START) |
| 5 | L78 18WT/OR (EXPORT) | FUSED PARK LAMP RELAY OUTPUT |
| 6 | E2 20OR/BR | PANEL LAMPS DRIVER |
| 7 | L43 18WT/DB (EXPORT) | FUSED LEFT LOW BEAM OUTPUT |
| 8 | L18 20WT/LG | LIGHTBAR SWITCH SENSE |




SWITCH-MIRROR (EXCEPT BASE)

SWITCH-MIRROR (EXCEPT BASE) - WHITE 10 WAY

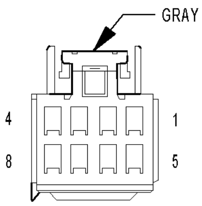
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | P75 20TN/LG | LEFT MIRROR LEFT DRIVER |
| 2 | P71 20TN/LG | LEFT MIRROR UP DRIVER |
| 3 | Z999 20BK (LHD) | GROUND |
| 3 | Z998 20BK (RHD) | GROUND |
| 4 | P110 20LG/WT (RHD) | FOLDING MIRROR RETURN |
| 5 | F302 20GY/PK | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 6 | P76 20TN/LB | MIRROR COMMON DRIVER |
| 7 | P99 20LG/LB (RHD) | FOLDING MIRROR FEED |
| 8 | - | - |
| 9 | P72 20TN/GY | RIGHT MIRROR UP DRIVER |
| 10 | P74 20TN/OR | RIGHT MIRROR LEFT DRIVER |




SWITCH-MULTIFUNCTION C1

SWITCH-MULTIFUNCTION C1 - GRAY 10 WAY

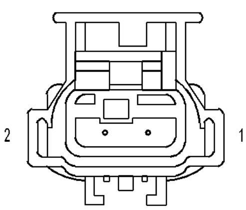
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | E3 20OR/YL | PANEL LAMPS DIMMER SWITCH MUX |
| 2 | L87 20WT/OR | FRONT FOG LAMP SWITCH SENSE |
| 3 | - | - |
| 4 | L900 20WT/YL | HEADLAMP SWITCH RETURN |
| 5 | L307 20PK/RD | HEADLAMP SWITCH MUX |
| 6 | L305 20WT/LB | LEFT TURN SWITCH SENSE |
| 7 | L309 20WT/OR | HIGH BEAM RELAY CONTROL |
| 8 | Z945 18BK | GROUND |
| 9 | L115 20WT/YL | HIGH BEAM SWITCH SENSE |
| 10 | L306 20LB/WT | RIGHT TURN SWITCH SENSE |




SWITCH-MULTIFUNCTION C2

SWITCH-MULTIFUNCTION C2 - GRAY 8 WAY

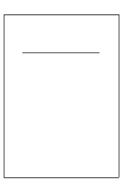
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | W13 20BR/LG | REAR WIPER ON DRIVER |
| 2 | W27 20DB/BR | REAR WIPER INTERMITTENT DRIVER |
| 3 | W20 20BR/YL | WASHER MOTOR SENSE |
| 4 | W35 20BR/LG | FRONT WIPER SWITCH MUX |
| 5 | F943 20PK/LG | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 6 | - | - |
| 7 | W33 20BR/DG | WASHER PUMP DRIVER |
| 8 | - | - |




SWITCH-OIL PRESSURE (GAS)

SWITCH-OIL PRESSURE (GAS) - 2 WAY

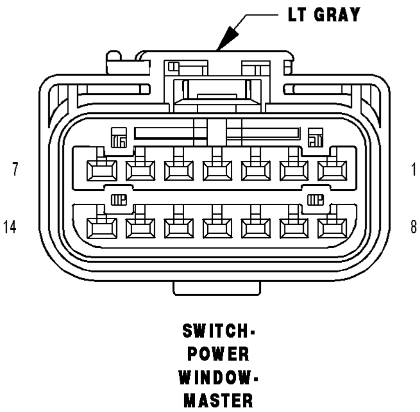
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | G6 20VT/GY | ENGINE OIL PRESSURE SIGNAL |
| 2 | - | - |



SWITCH-PARK BRAKE

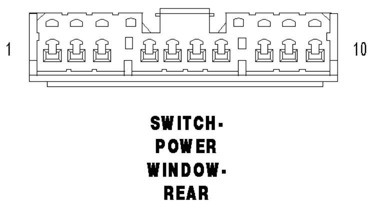
SWITCH-PARK BRAKE

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | B25 20DG/WT | PARK BRAKE SWITCH SENSE |



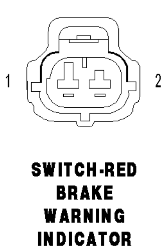

SWITCH-POWER WINDOW-MASTER - LT GRAY 14 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | Q1 14YL/OR | POWER WINDOW SWITCH FEED |
| 3 | - | - |
| 4 | Q411 14WT/OR | LEFT REAR WINDOW DRIVER (UP) |
| 5 | Q611 14GY/OR | LEFT REAR WINDOW DRIVER (DOWN) |
| 6 | Q412 14LG/OR | MASTER WINDOW SWITCH RIGHT REAR (UP) |
| 7 | Q612 14DB/OR | RIGHT REAR WINDOW DRIVER (DOWN) |
| 8 | - | - |
| 9 | Q21 14OR/WT | LEFT FRONT WINDOW DRIVER DOWN |
| 10 | F30 14PK/YL | FUSED IGNITION SWITCH OUTPUT (RUN-ACC) |
| 11 | Q11 14OR/LG | LEFT FRONT WINDOW DRIVER UP |
| 12 | Q12 14OR/BR | RIGHT FRONT WINDOW DRIVER UP |
| 13 | Z849 16BK/OR | GROUND |
| 14 | Q22 14OR/VT | RIGHT FRONT WINDOW DRIVER DOWN |



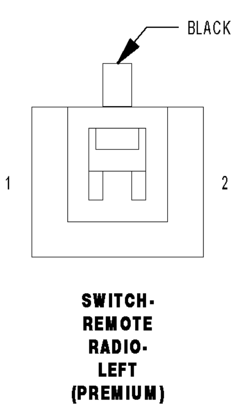

SWITCH-POWER WINDOW-REAR - 10 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Q12 14DB/OR | RIGHT FRONT WINDOW DRIVER UP |
| 2 | Q112 14OR/BR | RIGHT REAR WINDOW DRIVER UP |
| 3 | Q212 14OR/VT | RIGHT REAR WINDOW DRIVER DOWN |
| 4 | Q412 14LG/OR | MASTER WINDOW SWITCH RIGHT REAR (UP) |
| 5 | Q1 14YL/OR | POWER WINDOW SWITCH FEED |
| 6 | Q1 14YL/OR | POWER WINDOW SWITCH FEED |
| 7 | Q411 14WT/OR | LEFT REAR WINDOW DRIVER (UP) |
| 8 | Q211 14TN/LB | LEFT REAR WINDOW DRIVER DOWN |
| 9 | Q611 14GY/OR | LEFT REAR WINDOW DRIVER (DOWN) |
| 10 | Q111 14TN/YL | LEFT REAR WINDOW DRIVER UP |



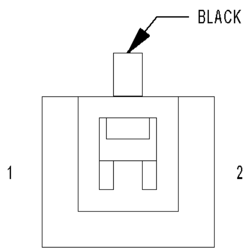

SWITCH-RED BRAKE WARNING INDICATOR - 2 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | B20 20DG/OR | RED BRAKE WARNING INDICATOR DRIVER |
| 2 | Z932 20BK | GROUND |




SWITCH-REMOTE RADIO-LEFT (PREMIUM) - BLACK 2 WAY

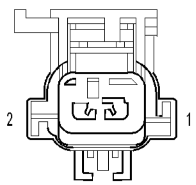
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X920 20GY/OR | RADIO CONTROL MUX RETURN |
| 2 | X20 20GY/WT | RADIO CONTROL MUX |




**SWITCH-REMOTE RADIO-RIGHT (PREMIUM)**

SWITCH-REMOTE RADIO-RIGHT (PREMIUM) - BLACK 2 WAY

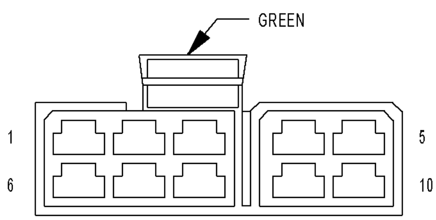
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | X920 20GY/OR | RADIO CONTROL MUX RETURN |
| 2 | X20 20GY/WT | RADIO CONTROL MUX |




**SWITCH-SEAT BELT-DRIVER**

SWITCH-SEAT BELT-DRIVER

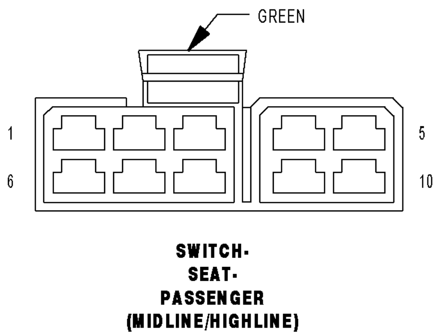
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | R57 20DG (EXCEPT HEATED SEATS) | DRIVER SEAT BELT SWITCH SENSE |
| 1 | R57 18DG (HEATED SEATS) | DRIVER SEAT BELT SWITCH SENSE |
| 2 | R59 20LB (EXCEPT HEATED SEATS) | DRIVER SEAT BELT SWITCH GROUND |
| 2 | R59 18LB (HEATED SEATS) | DRIVER SEAT BELT SWITCH GROUND |




**SWITCH-SEAT-DRIVER (MIDLINE/HIGHLINE)**

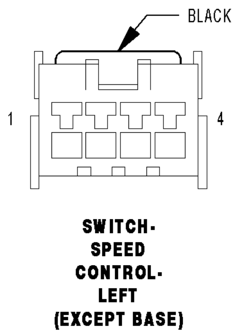
SWITCH-SEAT-DRIVER (MIDLINE/HIGHLINE) - GREEN 10 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z849 14BK/WT | GROUND |
| 2 | - | - |
| 3 | P15 14YL/LB | DRIVER SEAT HORIZONTAL FORWARD DRIVER |
| 4 | - | - |
| 5 | F37 14RD/LB | FUSED B(+) |
| 6 | P17 14RD/LB | DRIVER SEAT HORIZONTAL REARWARD DRIVER |
| 7 | P13 14RD/WT | DRIVER SEAT REAR DOWN DRIVER |
| 8 | P21 14RD/LG | DRIVER SEAT FRONT DOWN DRIVER |
| 9 | P19 14YL/LG | DRIVER SEAT FRONT UP DRIVER |
| 10 | P11 14YL/WT | DRIVER SEAT REAR UP DRIVER |



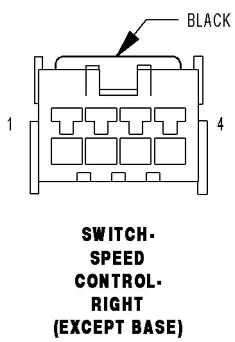

SWITCH-SEAT-PASSENGER (MIDLINE/HIGHLINE) - GREEN 10 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z849 16BK/OR | GROUND |
| 2 | - | - |
| 3 | P14 14YL/LB | PASSENGER SEAT HORIZONTAL FORWARD DRIVER |
| 4 | - | - |
| 5 | F37 14RD/LB | FUSED B(+) |
| 6 | P16 14RD/LB | PASSENGER SEAT HORIZONTAL REARWARD DRIVER |
| 7 | P10 14YL/WT | PASSENGER SEAT REAR UP DRIVER |
| 8 | P18 14YL/LG | PASSENGER SEAT FRONT UP DRIVER |
| 9 | P20 14RD/LG | PASSENGER SEAT FRONT DOWN DRIVER |
| 10 | P12 14RD/WT | PASSENGER SEAT REAR DOWN DRIVER |



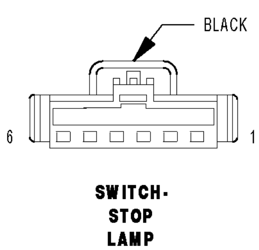

SWITCH-SPEED CONTROL-LEFT (EXCEPT BASE) - BLACK 4 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | V38 20VT/OR | S/C SWITCH SIGNAL NO. 2 |
| 2 | K900 20DB/DG | SENSOR GROUND |
| 3 | V37 20VT | S/C SWITCH SIGNAL NO. 1 |
| 4 | - | - |



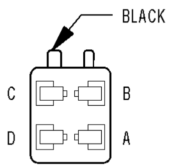

SWITCH-SPEED CONTROL-RIGHT (EXCEPT BASE) - BLACK 4 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | V38 20VT/OR | S/C SWITCH SIGNAL NO. 2 |
| 2 | K900 20DB/DG | SENSOR GROUND |
| 3 | V37 20VT | S/C SWITCH SIGNAL NO. 1 |
| 4 | - | - |




SWITCH-STOP LAMP - BLACK 6 WAY

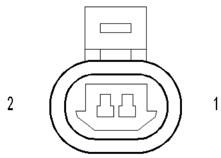
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | A103 18GY/RD | FUSED B(+) |
| 2 | L50 18WT/TN (DIESEL) | PRIMARY BRAKE SWITCH SIGNAL |
| 2 | L50 18WT/TN (GAS) | BRAKE LAMP SWITCH OUTPUT |
| 3 | V30 20VT/WT | S/C BRAKE SWITCH OUTPUT |
| 4 | V32 20VT/YL | S/C POWER SUPPLY |
| 5 | Z940 20BK | GROUND |
| 6 | B15 20DG/WT (DIESEL) | SECONDARY BRAKE SWITCH SIGNAL |
| 6 | B15 20DG/WT (GAS) | BRAKE SWITCH NO. 1 SIGNAL |




SWITCH-SUNROOF

SWITCH-SUNROOF - BLACK 4 WAY

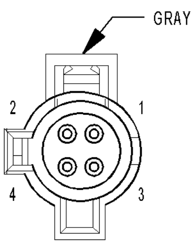
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Q43 20OR/LB | SUNROOF VENT |
| 2 | Q644 20OR/YL | SUNROOF SWITCH GROUND |
| 3 | Q3 20OR/TN | SUNROOF OPEN |
| 4 | Q5 20OR/LB | SUNROOF CLOSE |




SWITCH-WASHER FLUID LEVEL

SWITCH-WASHER FLUID LEVEL - 2 WAY

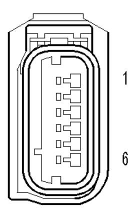
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | W1 20BR/TN | LOW WASHER FLUID SENSE |
| 2 | Z931 20BK | GROUND |




TRANSDUCER-A/C PRESSURE

TRANSDUCER-A/C PRESSURE - BLACK 4 WAY

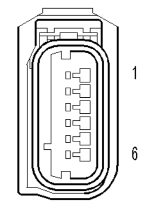
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | K310 20BR/DG | SENSOR GROUND |
| 2 | K301 20BR/LG | 5 VOLT SUPPLY |
| 3 | C18 20LB/BR | A/C PRESSURE SIGNAL |




TRANSPONDER-TIRE PRESSURE-LEFT FRONT

TRANSPONDER-TIRE PRESSURE-LEFT FRONT - 6 WAY

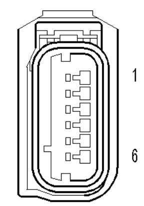
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F22 20PK/TN | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 2 | D508 20WT/GY | COM-LIN TIRE PRESSURE MONITOR LAN |
| 3 | Z384 20BK | GROUND |
| 4 | Z384 20BK | GROUND |
| 5 | - | |
| 6 | - | |




TRANSPONDER-TIRE PRESSURE-RIGHT FRONT

TRANSPONDER-TIRE PRESSURE-RIGHT FRONT - 6 WAY

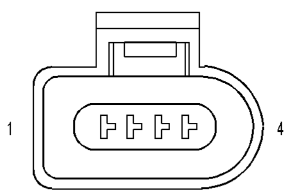
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F22 20PK/TN | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 2 | D508 20WT/GY | COM-LIN TIRE PRESSURE MONITOR LAN |
| 3 | Z384 20BK | GROUND |
| 4 | - | |
| 5 | Z384 20BK | GROUND |
| 6 | - | |




TRANSPONDER-TIRE PRESSURE-RIGHT REAR

TRANSPONDER-TIRE PRESSURE-RIGHT REAR - 6 WAY

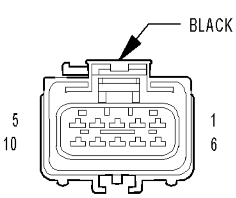
| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | F22 20PK/TN | FUSED IGNITION SWITCH OUTPUT (RUN) |
| 2 | D508 20WT/GY | COM-LIN TIRE PRESSURE MONITOR LAN |
| 3 | Z912 18BK | GROUND |
| 4 | - | |
| 5 | - | |
| 6 | Z912 18BK | GROUND |




VALVE-EGR AIR FLOW CONTROL (DIESEL)

VALVE-EGR AIR FLOW CONTROL (DIESEL) - 4 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | Z989 20BK | GROUND |
| 2 | K315 20BR/GY | EGR THROTTLE VALVE CONTROL |
| 3 | - | - |
| 4 | K347 20BR/PK | FUSED ASD RELAY OUTPUT |




WIRING-TRAILER TOW

WIRING-TRAILER TOW - BLACK 10 WAY

| CAV | CIRCUIT | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | L674 16LG | RIGHT TURN SIGNAL |
| 3 | L10 20WT/GY | BACK-UP LAMP FEED |
| 4 | A917 14RD | TRAILER TOW RELAY OUTPUT |
| 5 | L78 18WT/OR | FUSED PARK LAMP RELAY OUTPUT |
| 6 | - | - |
| 7 | A206 14RD | TRAILER TOW BRAKE B(+) |
| 8 | Z933 14BK | GROUND |
| 9 | Z933 14BK | GROUND |
| 10 | L73 16YL | LEFT TURN SIGNAL |

# 8W-91 CONNECTOR/GROUND/SPLICE LOCATION

TABLE OF CONTENTS

page



## CONNECTOR/GROUND/SPLICE LOCATION

### DESCRIPTION

This section provides illustrations identifying connector, ground, and splice locations in the vehicle. Connector, ground, and splice indexes are provided. Use the wiring diagrams in each section for connector, ground, and splice identification. Refer to the appropriate index for the proper figure number. For items that are not shown in this section N/S is placed in the Fig. column.

**CONNECTORS**

| CONNECTOR NAME/NUMBER | COLOR | LOCATION | FIG. |
|---|---|---|---|
| Actuator-Blend Door | BK | Behind Right Side of Instrument Panel | N/S |
| Airbag-Driver Squib 1 | GY | In Steering Wheel | 31 |
| Airbag-Driver Squib 2 | BK | In Steering Wheel | 31 |
| Airbag-Passenger Squib 1 | YL | Passenger Side Instrument Panel | N/S |
| Airbag-Passenger Squib 2 | YL | Passenger Side Instrument Panel | N/S |
| Airbag-Side Curtain-Left | YL | Left Mid B-Pillar | 36, 39 |
| Airbag-Side Curtain-Right | YL | Right Mid B-Pillar | 35, 40 |
| Antenna Cable-Radio (Export) | | Right Side Instrument Panel | 45 |
| Antenna-Radio (Except Export) | | Center Instrument Panel | 34 |
| Antenna-Radio (Export) | | Center Instrument Panel | 45 |
| Assembly-Exhaust Gas Recirculation Valve | | Right Rear Side of Engine Compartment | 22 |
| Assembly-Heated Seat-Left | LG | At Left Seat | N/S |
| Assembly-Heated Seat-Right | LG | At Right Seat | N/S |
| Assembly-Line Pressure Sensor/ Variable Force Solenoid | | Left Side Transmission | 5 |
| Assembly-Natural Vacuum Leak Detection | BK | Near Fuel Tank | 54 |
| Assembly-Power Seat Motors-Left | BK | At Left Seat | N/S |
| Assembly-Power Seat Motors-Right | BK | At Right Seat | N/S |
| Assembly-Shift Lever | WT | Center Console | 37 |

| CONNECTOR NAME/NUMBER | COLOR | LOCATION | FIG. |
|---|---|---|---|
| Assembly-Transmission Solenoid/ Pressure Switch (42RLE) | | Right Side of Transmission | 6 |
| Assembly-Transmission Solenoid/ Trs (2,8L 45RFE) | GY | Left Side of Transmission | 18 |
| Backlite-Electric Heated | BK | At Rear Window | 51 |
| Battery (-) | | Left Front Engine Compartment | 25, 26, 27 |
| Battery (+) | | Left Front Engine Compartment | 25, 26, 27 |
| C100 | GY | Left Kick Panel | 30, 33 |
| C102 (RHD) | | Left Kick Panel | 30, 39 |
| C104 | BK | Right Rear Side of Engine Compartment | 8, 10, 13 |
| C105 | GY | Right Rear Side of Engine Compartment | 8, 10, 13 |
| C106 | BK | Left Front Side of Engine Compartment | 24 |
| C107 | BK | Left Front Side of Engine Compartment | 24 |
| C108 (Gas) | GY | Left Front Side of Engine | 25, 28, 29 |
| C109 | | Right Front Engine Compartment | N/S |
| C111 (Diesel) | LG | Right Rear Side of Engine Compartment | 13 |
| C112 (Gas) | BK | Right Side of Engine Compartment | 8, 9, 29 |
| C113 (Diesel) | LG | Left Rear Side of Engine Compartment | 27 |
| C114 | | Left Front Engine Compartment | 27, 28 |
| C117 (Diesel)-(Injector Side) | | Right Rear Engine Compartment | 13 |
| C120 | | Left Kick Panel | 30 |
| C201 | BK | Behind Center of Instrument Panel | 33, 38 |
| C203 | | Left A-Pillar | 32 |
| C300 (LHD) | OR | Left A-Pillar | 36, 42 |
| C300 (RHD) | OR | Right A-Pillar | 40, 42 |
| C301 (LHD) | OR | Left A-Pillar | 36, 42 |
| C301 (RHD) | OR | Right A-Pillar | 40, 42 |
| C302 (LHD) | OR | Right A-Pillar | 35, 42 |
| C302 (RHD) | OR | Left A-Pillar | 39, 42 |
| C303 (LHD) | OR | Right A-Pillar | 35, 42 |
| C303 (RHD) | OR | Left A-Pillar | 39, 42 |
| C304 | DB | Right Mid B-Pillar | 35, 40, 43 |
| C305 | DB | Left Mid B-Pillar | 36, 39, 43 |
| C306 (LHD) | WT | Left Lower B-Pillar | N/S |
| C307 | LG | Left Lower B-Pillar | 36, 39, 44, 54 |
| C308 | LG | Left Rear Quarter Panel | 44 |
| C309 | DB | Left Rear Quarter Panel | 44, 51 |
| C310 | LG | Right Rear Quarter Panel | 49, 50 |
| C311 | LG | Left Front Seat | 36, 39 |

| CONNECTOR NAME/NUMBER | COLOR | LOCATION | FIG. |
|---|---|---|---|
| C312 (Highline) | LG | Left Front Seat | 36, 39 |
| C313 | LG | Right Front Seat | 37, 40, 41 |
| C314 | LG | Right Front Seat | 37, 40, 41 |
| C315 (Midline/Highline) (LHD) | LG | Right Front Seat | 35, 37 |
| C315 (Midline/Highline) (RHD) | LG | Left Front Seat | 39 |
| C318 | | Front of Roof in Light Bar Harness | 32, 53 |
| C328 (Overhead Side) | | Left Rear Headliner | 44 |
| C330 | | Right Rear Body | 49 |
| Changer CD | GN | Right Rear Body | N/S |
| Choke-Radio | GY | Center of Instrument Panel | N/S |
| Clockspring C1 | WT | Behind Steering Wheel | N/S |
| Clockspring C2 | YL | Behind Steering Wheel | N/S |
| Clockspring C3 | BK | At Steering Wheel | N/S |
| Clockspring C4 (Except Base) | | Steering Wheel Side of Clockspring | 31 |
| Cluster | BK | Rear of Cluster | N/S |
| Clutch-A/C Compressor | BK | At A/C Compressor | 2, 15 |
| Coil-Ignition-No. 1 | BK | Left Side of Engine Near Fuel Injector No.1 | 1 |
| Coil-Ignition-No. 2 | BK | Right Side of Engine Near Fuel Injector No.2 | 2 |
| Coil-Ignition-No. 3 | BK | Left Side of Engine Near Fuel Injector No.3 | 1 |
| Coil-Ignition-No. 4 | BK | Right Side of Engine Near Fuel Injector No.4 | 2 |
| Coil-Ignition-No. 5 | BK | Left Side of Engine Near Fuel Injector No.5 | 1 |
| Coil-Ignition-No. 6 | BK | Right Side of Engine Near Fuel Injector No.6 | 2 |
| Control-A/C Heater C1 | BK | Center of Dash, Behind A/C-Heater Controls | N/S |
| Control-A/C Heater C1 | WT | Center of Dash, Behind A/C-Heater Controls | N/S |
| Data Link Connector | BK | Under Center of Instrument Panel | N/S |
| Generator | BK | Left Front Side of Engine | 15, 25, 27 |
| Glow Plug No. 1 | | Top of Engine | N/S |
| Glow Plug No. 2 | | Top of Engine | N/S |
| Glow Plug No. 3 | | Top of Engine | N/S |
| Glow Plug No. 4 | | Top of Engine | N/S |
| Heater-Cabin (Diesel) | BK | Right Front Side of Engine | 16 |
| Heater-Fuel (Diesel) | BK | Left Rear Side of Engine Compartment | 14 |
| Horn | BK | Left Front Side of Engine Compartment | 24 |
| Injector-Fuel-No. 1 (Diesel) | BK | At Fuel Injector | 19 |
| Injector-Fuel-No. 1 (Gas) | BK | At Fuel Injector | 1 |

| CONNECTOR NAME/NUMBER | COLOR | LOCATION | FIG. |
|---|---|---|---|
| Injector-Fuel-No. 2 (Diesel) | BK | At Fuel Injector | 19 |
| Injector-Fuel-No. 2 (Gas) | BK | At Fuel Injector | 2 |
| Injector-Fuel-No. 3 (Diesel) | BK | At Fuel Injector | 19 |
| Injector-Fuel-No. 3 (Gas) | BK | At Fuel Injector | 1 |
| Injector-Fuel-No. 4 (Diesel) | BK | At Fuel Injector | 17 |
| Injector-Fuel-No. 4 (Gas) | BK | At Fuel Injector | N/S |
| Injector-Fuel-No. 5 (Gas) | BK | At Fuel Injector | 1 |
| Injector-Fuel-No. 6 (Gas) | BK | At Fuel Injector | 2 |
| Junction Block C1 | GY | Under Left Side of Instrument Panel | N/S |
| Junction Block C2 | GN | Under Left Side of Instrument Panel | N/S |
| Junction Block C3 | LB | Under Left Side of Instrument Panel | N/S |
| Junction Block-BCM | | Under Left Side of Instrument Panel | N/S |
| Lamp-Cargo (Except Base) | BK | Center Rear Headliner | N/S |
| Lamp-Courtesy-Left | BK | Left Side of Instrument Panel | N/S |
| Lamp-Courtesy-Right | BK | Right Side of Instrument Panel | N/S |
| Lamp-Dome (Base) | | Front Center Headliner | N/S |
| Lamp-Fog Left Front | BK | Left Side of Front Bumper | N/S |
| Lamp-Fog Right Front | BK | Right Side of Front Bumper | N/S |
| Lamp-Headlamp-Left (Except Export) | DB | Behind Left Headlamp | N/S |
| Lamp-Headlamp-Left (Export) | | Behind Left Headlamp | N/S |
| Lamp-Headlamp-Right (Except Export) | DB | Behind Right Headlamp | N/S |
| Lamp-Headlamp-Right (Export) | | Behind Right Headlamp | N/S |
| Lamp-High Mounted Stop | WT | At Lamp | 51 |
| Lamp-License Plate (Except Export) | LG | On Bumper | 51 |
| Lamp-License Plate (Except Export) | LG | In Tailgate | 49 |
| Lamp-Lightbar-No. 1 | | Front of Roof in Light Bar Harness | 53 |
| Lamp-Lightbar-No. 2 | | Front of Roof in Light Bar Harness | 53 |
| Lamp-Lightbar-No. 3 | | Front of Roof in Light Bar Harness | 53 |
| Lamp-Lightbar-No. 4 | | Front of Roof in Light Bar Harness | 53 |
| Lamp-Park/Turn-Left Front | BK | At Lamp | N/S |
| Lamp-Park/Turn-Right Front | BK | At Lamp | N/S |
| Lamp-Passenger Airbag On/Off Indicator | | Near Passenger Airbag | N/S |
| Lamp-Reading-Front | | At Overhead Console | N/S |
| Lamp-Side Marker-Left Front | BK | Left Front Fender | N/S |
| Lamp-Side Marker-Right Front | BK | Right Front Fender | N/S |
| Lamp-Tail Stop Turn-Left | BK | Left Rear Quarter Panel | 49 |
| Lamp-Tail Stop Turn-Right | BK | Right Rear Quarter Panel | 49 |
| Lamp-Vanity-Left | WT | Left Front of Headliner | N/S |
| Lamp-Vanity-Right | WT | On Visor | N/S |
| Latch-Door Lock Motor/Ajar Switch-Front Left (Except Base) | BK | In Driver Door | 42 |

| CONNECTOR NAME/NUMBER | COLOR | LOCATION | FIG. |
|---|---|---|---|
| Latch-Door Lock Motor/Ajar Switch-Front Right (Except Base) | BK | In Passenger Door | 42 |
| Latch-Door Lock Motor/Ajar Switch-Rear Left (Except Base) | BK | In Left Rear Door | 43 |
| Latch-Door Lock Motor/Ajar Switch-Rear Right (Except Base) | BK | In Right Rear Door | 43 |
| Latch-Lock Motor/Ajar Switch-Tailgate | BK | In Tailgate | 51 |
| Mirror-Inside Rearview C1 | | Top Center Windshield | N/S |
| Mirror-Inside Rearview C2 (Hands Free) | | Top Center Windshield | N/S |
| Mirror-Outside Rearview-Driver (Except Base) | WT | In Left Front Door | 42 |
| Mirror-Outside Rearview-Passenger (Except Base) | WT | In Right Front Door | 42 |
| Module-Antenna C1 (Export) | | Above Right Quarter Window | 45 |
| Module-Antenna C2 (Export) | | Above Right Quarter Window | 45 |
| Module-Antilock Brakes | BK | Left Side of Engine Compartment | 28 |
| Module-Body Control C1 | GY | Under Left Side of Instrumental Panel | N/S |
| Module-Body Control C2 | GY | Under Left Side of Instrumental Panel | N/S |
| Module-Body Control JB | | Under Left Side of Instrumental Panel | N/S |
| Module-Electronic Overhead | BK | At Overhead Console | N/S |
| Module-Engine Control C1 | BK | Left Rear Side of Engine Compartment | 14 |
| Module-Engine Control C2 | BK | Left Rear Side of Engine Compartment | 14 |
| Module-Fuel Pump | LG | At Fuel Tank | 54 |
| Module-Glow Plug (Diesel) | | Top of Engine | N/S |
| Module-Hands Free C1 | | Right Rear Side of Cargo Area | 47 |
| Module-Hands Free C2 (Satellite) | | Right Rear Side of Cargo Area | 47 |
| Module-Hands Free C3 | | Right Rear Side of Cargo Area | 47 |
| Module-Heated Seat (Highline) | GN | At Left Seat | N/S |
| Module-Intrusion Transceiver (Export) | BK | Overhead Console | N/S |
| Module-Occupant Classification | | Under Passenger Seat | N/S |
| Module-Occupant Restraint Controller C1 (ORC) | YL | Under Center Console | 33, 38 |
| Module-Occupant Restraint Controller C2 (ORC) | BK | Under Center Console | 37, 41 |
| Module-Powertrain Control C1 | BK/BK | At Powertrain Control Module | 8, 9 |
| Module-Powertrain Control C2 | BK/OR | At Powertrain Control Module | 8, 9 |
| Module-Powertrain Control C3 | BK/NAT | At Powertrain Control Module | 9, 29 |
| Module-Powertrain Control C4 | BK/GN | At Powertrain Control Module | 8, 9 |

| CONNECTOR NAME/NUMBER | COLOR | LOCATION | FIG. |
|---|---|---|---|
| Module-Sentry Key Remote Entry | BK | Under Left Side of Instrument Panel | N/S |
| Module-Transmission Control (Diesel LHD) | BK | Right Rear Side of Engine Compartment | 13 |
| Module-Transmission Control (Diesel RHD) | BK | Left Rear Engine Compartment | 13, 14 |
| Motor-Blower | BK | Behind Right Side of Instrument Panel | N/S |
| Motor-Flip-Up Glass Release | BK | In Tailgate | 51 |
| Motor-Headlamp Leveling-Left (Export) | BK | At Left Headlamp | N/S |
| Motor-Headlamp Leveling-Right (Export) | BK | At Right Headlamp | N/S |
| Motor-IAC | BK | On Throttle Body | 1 |
| Motor-Power Window-Driver (Midline/Highline) | LG | In Left Front Door | 42 |
| Motor-Power Window-Passenger (Midline/Highline) | LG | In Right Front Door | 42 |
| Motor-Radiator Fan | BK | Right Front Side of Engine Compartment | 23 |
| Motor-Rear Window Wiper | BK | In Tailgate | 51 |
| Motor-Sunroof | LG | Overhead Console | N/S |
| Motor-Window-Left Rear | LG | In Left Rear Door | 43 |
| Motor-Window-Right Rear | LG | In Right Rear Door | 43 |
| Motor-Windshield Wiper (LHD) | BK | Left Side Cowl | 20 |
| Motor-Windshield Wiper (RHD) | BK | Right Side Cowl | 20 |
| Power Distribution Center | | Left Engine Compartment | 28 |
| Power Distribution Center-Eyelet | | Right Side Engine Compartment | 26, |
| Power Outlet-Instrument Panel | RD | Behind Outlet | N/S |
| Power Outlet-Rear | GY | Right Rear Quarter Panel | 49, 52 |
| Pump-Washer-Windshield | BK | Right Front Side of Engine Compartment | 23 |
| Radio Antenna (Except Export) | | Center Instrument Panel | N/S |
| Radio C1 | GY | Rear of Radio | N/S |
| Radio C2 | | Rear of Radio | N/S |
| Radio C3 (Except Export) | | Rear of Radio | N/S |
| Receiver-Satellite | | Right Rear Side of Cargo Area | 47 |
| Receiver-Satellite Antenna | | Right Rear Cargo Area | 47 |
| Relay-Trailer Tow | | Right Quarter Panel | 50 |
| Relay-Trailer Tow Brake Lamp | | Right Quarter Panel | 50 |
| Relay-Trailer Tow Left | | Right Quarter Panel | 50 |
| Relay-Trailer Tow Right | | Right Quarter Panel | 50 |
| Resistor-Blower Motor | BK | Behind Right Side of Instrument Panel | N/S |
| Satellite Antenna | | Center Rear Roof | 48 |
| Seat Belt-Tensioner-Driver (LHD) | YL | Lower Left B-Pillar | 36 |

| CONNECTOR NAME/NUMBER | COLOR | LOCATION | FIG. |
|---|---|---|---|
| Seat Belt-Tensioner-Driver (RHD) | YL | Lower Right B-Pillar | 40 |
| Seat Belt-Tensioner-Passenger | | Base of Right B-Pillar | 39 |
| Sensor-Accelerator Pedal Position (Diesel) | BK | At Base of Pedal | N/S |
| Sensor-Ambient Air Temperature | BK | Front of Engine Compartment | N/S |
| Sensor-Camshaft Position (3.7L) | LG | Right Side of Engine | 4 |
| Sensor-Camshaft Position (Diesel) | | Top of Engine | 17 |
| Sensor-Crankshaft Position (3.7L) | BK | Right Lower Side of Engine | 4 |
| Sensor-Crankshaft Position (Diesel) | BK | Right Rear Side of Engine | 11, 18 |
| Sensor-Dynamics (ESP) | | Under Center Console | 37, 41 |
| Sensor-Engine Coolant Level (Diesel) | LG | Rear Side of Engine Compartment | 13 |
| Sensor-Engine Coolant Temperature (Diesel) | BK | Left Side of Engine | 16 |
| Sensor-Engine Coolant Temperature (Gas) | BK | Front Side of Engine | 2 |
| Sensor-Engine Oil Pressure (Diesel) | BK | Right Rear Side of Engine | 12, 18 |
| Sensor-Front Impact-Left | BK | Left Front Side of Engine Compartment | 23, 24 |
| Sensor-Front Impact-Right | BK | Right Front Side of Engine Compartment | 23 |
| Sensor-Fuel Pressure (Diesel) | | Left Side of Engine | 17 |
| Sensor-Fuel Temperature (Diesel) | | Center Rear of Engine Compartment | 14 |
| Sensor-Inlet Pressure (Diesel) | | Left Rear Engine | 16 |
| Sensor-Input Speed | BK | Left Side of Transmission | 5, 18 |
| Sensor-Intake Air Temperature (Gas) | GY | Left Side of Intake Manifold | 1 |
| Sensor-Intake Air Temperature/ Intake Pressure (Diesel) | | On Diesel Injector Harness | N/S |
| Sensor-Knock (3.7L) | BK | Near Fuel Injector No.5 | 1 |
| Sensor-Line Pressure (2.8L 45RFE) | BK | Right Side of Transmission | 18 |
| Sensor-MAP (Gas) | BK | Front Side of Engine | 2 |
| Sensor-Mass Air Flow (Diesel) | | Top of Engine | 16 |
| Sensor-Output Speed | BK | Left Side of Transmission | 5, 18 |
| Sensor-Oxygen-Left Front (3.7L) | BK | Lower Left Side of Engine | 5, 7 |
| Sensor-Oxygen-Left Rear (3.7L) | NAT | Left Side of Transmission | 5 |
| Sensor-Oxygen-Right Front (3.7L) | BK | Lower Right Side of Engine | 6 |
| Sensor-Oxygen-Right Rear (3.7L) | NAT | Right Side of Transmission | 6, 7 |
| Sensor-Seat Belt Tension | | Under Passenger Seat | N/S |
| Sensor-Seat Weight-Passenger | | In Passenger Seat | N/S |
| Sensor-Side Impact-Left 1 | YL | Left B-Pillar | 36, 39 |
| Sensor-Side Impact-Right 1 | YL | Right B-Pillar | 35, 40 |
| Sensor-Throttle Position (Gas) | WT | On Throttle Body | 1 |
| Sensor-Transfer Case Position | BK | Rear of Transmission | 5, 7, 17, 18 |

| CONNECTOR NAME/NUMBER | COLOR | LOCATION | FIG. |
|---|---|---|---|
| Sensor-Transmission Range (42RLE) | | Left Side of Transmission | 5 |
| Sensor-Water In Fuel (Diesel) | GY | Left Rear Side of Engine Compartment | 14 |
| Sensor-Wheel Speed-ABS-Left Front | BK | Left Side of Engine Compartment | 28 |
| Sensor-Wheel Speed-ABS-Left Rear | BK | Front of Fuel Tank | 54 |
| Sensor-Wheel Speed-ABS-Right Front | BK | Right Rear Lower Side of Engine Compartment | 21 |
| Sensor-Wheel Speed-ABS-Left Rear | BK | Front of Fuel Tank | 54 |
| Sensor-Wheel Speed-ABS-Right Rear | BK | Front of Fuel Tank | 54 |
| Sensor-Wheel Speed-Rear | BK | On Rear Axle | N/S |
| Servo-Speed Control | BK | Right Rear Side of Engine Compartment | 21, 22 |
| Siren (Export) | | Right Front Side of Engine Compartment | 23 |
| Solenoid-Boost Pressure (Diesel) | | Right Rear Engine Compartment | 21 |
| Solenoid-Evap/Purge (Gas) | BK | Right Side of Battery | 26 |
| Solenoid-Fuel Pressure (Diesel) | BK | Left Side of Engine | 15 |
| Solenoid-Fuel Quantity (Diesel) | | Top of Engine | 17 |
| Solenoid-Vacuum Reservoir (Diesel) | | Right Rear Engine Compartment | 21 |
| Speaker-Instrument Panel-Left | BK | Left Side of Instrument Panel | 33, 38 |
| Speaker-Instrument Panel-Right | WT | Right Side of Instrument Panel | 33, 38 |
| Speaker-Left Front Door | BK | Behind Left Front Door Panel | 42 |
| Speaker-Left Rear Door (Premium) | | In Left Rear Door | 43 |
| Speaker-Right Front Door | BK | Behind Right Front Door Panel | 42 |
| Speaker-Right Rear Door (Premium) | | In Right Rear Door | 43 |
| Starter | | At Starter | 15, 25, 27 |
| Starter-Eyelet | | Right Front Side of Engine | N/S |
| Switch-A/C-High Pressure (Diesel) | GY | Left Front Side of Engine Compartment | 15 |
| Switch-A/C-Low Pressure (LHD) | GY | Right Rear Side of Engine Compartment | 20 |
| Switch-A/C-Low Pressure (RHD) | GY | Left Rear Side of Engine Compartment | 29 |
| Switch-Back Up Lamp (M/T) | BK | Left Side of Transmission | 7, 17 |
| Switch-Clutch Interlock(M/T LHD) | BK | Left Rear Side of Transmission | 29 |
| Switch-Clutch Interlock(M/T RHD) | BK | Right Rear Side of Engine Compartment | 21 |
| Switch-Cylinder Lock-Tailgate | LG | In Tailgate | 51 |
| Switch-Door Lock-Left (Except Base) | BK | In Left Front Door | 42 |
| Switch-Door Lock-Right (Except Base) | BK | In Right Front Door | 42 |
| Switch-ESP | | Near Steering Column | N/S |

| CONNECTOR NAME/NUMBER | COLOR | LOCATION | FIG. |
|---|---|---|---|
| Switch-Flip-Up Glass Ajar | GY | In Tailgate | 51 |
| Switch-Flip-Up Glass Release | WT | In Tailgate | 51 |
| Switch-Hazard/Combination Flasher | WT | On Steering Column | N/S |
| Switch-Headlamp Leveling (Export) | BK | Center of Instrument Panel | N/S |
| Switch-Heated Seat-Driver | BK | At Left Seat | N/S |
| Switch-Heated Seat-Passenger | BK | At Right Seat | N/S |
| Switch-Hood Ajar | | Right Side of Engine Compartment | 21 |
| Switch-Horn | | At Steering Wheel | 31 |
| Switch-Ignition | | At Steering Column | N/S |
| Switch-Lightbar | | Near Instrument Cluster | N/S |
| Switch-Mirror | WT | In Left Front Door | 42 |
| Switch-Multifunction C1 | GY | At Steering Column | N/S |
| Switch-Multifunction C2 | GY | At Steering Column | N/S |
| Switch-Oil Pressure (3.7L) | BK | Left Front Side of Engine | 3 |
| Switch-Parking Brake | BK | Center Console | 37, 41 |
| Switch-Power Window-Master | LG | Center Console | 37, 41 |
| Switch-Power Window-Rear | WT | Center Console | 37, 41 |
| Switch-Red Brake Warning Indicator (LHD) | GY | Left Rear Side of Engine Compartment | 29 |
| Switch-Red Brake Warning Indicator (RHD) | GY | Right Rear Side of Engine Compartment | 21 |
| Switch-Remote Radio-Left | BK | On Steering Wheel | N/S |
| Switch-Remote Radio-Left | BK | On Steering Wheel | N/S |
| Switch-Seat Belt-Driver | LG | At Driver Seat | N/S |
| Switch-Seat-Driver | GN | At Driver Seat | N/S |
| Switch-Seat-Passenger | GN | At Passenger Seat | N/S |
| Switch-Speed Control-Left | BK | On Steering Wheel | 31 |
| Switch-Speed Control-Right | BK | On Steering Wheel | 31 |
| Switch-Stop Lamp | BK | At Brake Pedal | N/S |
| Switch-Sunroof | BK | Overhead Console | N/S |
| Switch-Washer Fluid Level | LG | At Washer Fluid Reservoir | 23 |
| Transducer-A/C Pressure | BK | Front Side of Engine | 2 |
| Transponder-Tire Pressure-Left Front | | Left Front Engine Compartment | 24 |
| Transponder-Tire Pressure-Right Front | | Right Front Engine Compartment | 23 |
| Transponder-Tire Pressure-Right Rear | | Right Rear Lower Body | 49 |
| Valve-EGR Air Flow Control (Diesel) | | Left Rear Engine | 15 |
| Wiring-Electric Brake Provision | | Left Side of Instrument Panel | 36 |
| Wiring-Trailer Tow | BK | At Trailer Hitch | 50, 52 |

**GROUNDS**

| GROUND NUMBER | LOCATION | FIG. |
|---|---|---|
| G100 | Left Side of Engine Compartment | 8, 9, 14 |
| G102 (A/T Gas) | Left Rear Side of Engine Compartment | N/S |
| G102 (Diesel) | Left Rear Side of Engine Compartment | 13 |
| G103 (3.7L) | Right Front Side of Engine | 4 |
| G103 (Diesel) | Right Front Side of Engine | 15 |
| G105 | Left Side of Engine Compartment | 25, 27 |
| G106 | Left Side of Engine Compartment | 25, 27 |
| G110 | Left Side of Engine Compartment | 28, 29 |
| G111 | Left Side of Engine Compartment | 24 |
| G112 | Left Front Side of Engine Compartment | 24 |
| G200 | Near Body Control Module | N/S |
| G201 | Under Center Console | 33, 38 |
| G202 | Left Kick Panel (Black Connector) | N/S |
| G203 | Under Center of Instrument Panel | N/S |
| G300 | Left Front Corner of Driver Seat, Under Carpet | 36, 37, 39 |
| G301 | Under Carpet at Front Center of Driver Seat | 37, 39, 41 |
| G302 | Right Front Seat | 35, 40 |
| G303 | Left Rear Quarter Panel | 44 |
| G304 | Right Rear Lower Quarter | 49 |
| G310 | Under Right Front Seat | 37 |
| G320 | At Fuel Tank | N/S |
| G350 | Body Near Left B-Pillar | 54 |

**SPLICES**

| SPLICE NUMBER | LOCATION | FIG. |
|---|---|---|
| S101 | Near T/O to Power Distribution Center | 28 |
| S102 (LHD) | Near G111 | 24 |
| S102 (RHD) | In T/O for Power Distribution Center | 28 |
| S103 (Diesel) | Right Side Engine Compartment | 23 |
| S103 (Gas) | Left Rear Engine Compartment | 29 |
| S104 | Rear Engine Compartment | 13 |
| S105 | In T/O for C100 | 30 |
| S106 | In T/O for C100 | 29 |
| S107 (RHD) | In T/O for PDC | 28 |
| S108 | Near T/O for C106 | N/S |
| S109 | In Trough Near T/O for High Note Horn | 23 |
| S110 | Near T/O for C106 | 24, 47 |
| S111 | In Trough Near T/O for High Note Horn | 23 |
| S112 | Near T/O to Power Distribution Center | N/S |
| S113 (LHD) | In T/O for C100 | N/S |
| S114 | Left Front Engine Compartment | 24 |

| SPLICE NUMBER | LOCATION | FIG. |
|---|---|---|
| S115 | Near T/O for Power Distribution Center | 28 |
| S117 | Right Side Engine Compartment | 23 |
| S118 | Left Front Engine Compartment | 24 |
| S119 | Right Front Lower Engine Compartment | 23 |
| S121 | Left Front Engine Compartment | 24 |
| S122 | Left Front Engine Compartment | 24 |
| S123 | In Trough, Front of Engine Compartment | N/S |
| S124 | In T/O for Junction Block C3 | 30 |
| S125 | In T/O for Junction Block C3 | 30 |
| S126 (Gas) | Right Side Engine Compartment | 23 |
| S127 | Near T/O for Power Distribution Center | 28 |
| S128 | Center Instrument Panel | N/S |
| S129 | Right Side Engine Compartment | 23 |
| S130 | Near T/O for Left Headlamp | N/S |
| S131 | In T/O for Right Headlamp | N/S |
| S132 (Diesel) | Left Front Engine Compartment | 24 |
| S132 (Gas) | In T/O for C112 | 29 |
| S133 | In T/O for Transmission Control Module | 13, 14 |
| S134 | In T/O for Transmission Control Module | 13, 14 |
| S135 (LHD) | In T/O for Junction Block C3 | N/S |
| S135 (RHD) | In T/O for C100 | N/S |
| S136 | Lower Front Engine Compartment | 23 |
| S137 | Lower Front Engine Compartment | 23 |
| S140 | Near T/O for Left Front Park/Turn Signal Lamp | N/S |
| S141 | Near T/O for Left Fog Lamp | N/S |
| S142 | Near T/O for Left Front Park/Turn Signal Lamp | N/S |
| S143 | Near T/O for Right Front Park/Turn Signal Lamp | N/S |
| S144 | Near T/O for Left Fog Lamp | N/S |
| S145 | Near T/O for Right Front Park/Turn Signal Lamp | N/S |
| S147 | Front Lighting Harness | N/S |
| S148 | Front Lighting Harness | N/S |
| S149 | Front Lighting Harness | N/S |
| S150 | Right Side Engine Compartment | 21 |
| S151 (3.7L) | Rear of Engine | 5, 6, 7 |
| S151 (Diesel) | In Trough Near T/O for Accelerator Pedal Position Sensor | N/S |
| S152 | In Trough Near T/O for Fuel Injector No.4 | 2 |
| S153 (3.7L) | Right Front Engine | 2, 4 |
| S153 (Diesel) | In Trough Near T/O for Generator | 15, 19 |
| S154 | Near T/O for IAC Motor | 15 |
| S155 | Near T/O for Knock Sensor | 5 |
| S156 (3.7L) | Near T/O for Powertrain Control Module C1 | N/S |
| S156 (Diesel) | Left Side Engine | 15 |
| S157 | Near T/O for Oxygen Sensor 1/1 Upstream | 5 |

| SPLICE NUMBER | LOCATION | FIG. |
|---|---|---|
| S158 | In Trough Near T/O for C112 | N/S |
| S159 | Near T/O for Knock Sensor | N/S |
| S160 (3.7L) | In T/O for C105 | 8, 10 |
| S160 (Diesel) | In T/O for Transmission Control Module | 13 |
| S161 (LHD) | Right Rear Engine Compartment | 13 |
| S161 (RHD) | In T/O for Transmission Control Module | 13, 14 |
| S163 (3.7L) | Left Rear Engine Compartment | 8 |
| S163 (Diesel) | Near T/O for Generator | 15 |
| S164 | In Trough on Right Rear Side of Engine Compartment | 8, 13 |
| S165 | In Trough on Right Rear Side of Engine Compartment | N/S |
| S166 | Near T/O for G100 | 8 |
| S167 | Rear Engine Compartment | 14 |
| S168 (3.7L) | Near T/O for Fuel Injector No.6 | 2 |
| S169 (3.7L) | Near T/O for Oxygen Sensor 1/1 Upstream | N/S |
| S169 (Diesel) | Near T/O for Generator | 15 |
| S172 | In T/O for VLP Assembly | 5 |
| S175 | In Trough on Top of Engine | 17, 19 |
| S177 | In Trough Near T/O for G100 | 14 |
| S178 | Near T/O for Oxygen Sensor 2/2 Downstream | 5, 6, 7 |
| S181 | In Trough Near T/O for G100 | N/S |
| S182 | Left Side Engine Compartment | 28 |
| S184 | Near T/O for Powertrain Control Module C1 | N/S |
| S185 | Near T/O for Fuel Pressure Solenoid | 15 |
| S194 | In T/O for Junction Block C3 | 30 |
| S199 | Neat T/O for Accelerator Pedal Position Sensor | N/S |
| S200 | Near T/O for C201 | N/S |
| S201 | Near T/O for Left Instrument Panel Lamp | N/S |
| S202 (LHD) | Left Side Body Near G301 | 36 |
| S202 (RHD) | Floor Near Right Front Door | 40 |
| S203 (RHD) | Near T/O for Blend Door Actuator | N/S |
| S204 | Near T/O for Data Link Connector | N/S |
| S205 | In T/O for C100 | 30 |
| S206 | Near T/O for Multifunction Switch C2 | N/S |
| S207 | In T/O for C100 | N/S |
| S208 | Near T/O for G202 | N/S |
| S210 | In T/O for Steering Angle Sensor | N/S |
| S211 | Fuel Tank Harness Near NVLD T/O | 54 |
| S212 | Near T/O for Diagnostic Junction Port | N/S |
| S213 | Near T/O for Diagnostic Junction Port | N/S |
| S214 | Near T/O for Airbag Control Module C1 (ORC C1) | N/S |
| S215 | Near T/O for Multifunction Switch C2 | N/S |
| S216 | In T/O for Instrument Cluster | N/S |
| S217 | Near T/O for Multifunction Switch C2 | N/S |

| SPLICE NUMBER | LOCATION | FIG. |
|---|---|---|
| S218 | Near T/O for Multifunction Switch C2 | N/S |
| S219 | In T/O for Junction Block C3 | N/S |
| S220 | In T/O for Junction Block C3 | N/S |
| S221 (RHD) | In T/O for IP Side of C120 | N/S |
| S222 | In T/O for Steering Angle Sensor | N/S |
| S223 | Near Left Courtesy Lamp T/O | N/S |
| S224 (RHD) | In T/O for C100 | 30 |
| S225 (LHD) | Near T/O for G203 | N/S |
| S225 (RHD) | In T/O for C100 | 30 |
| S227 (RHD) | In T/O for C120 (IP Side) | N/S |
| S230 | In T/O for A/C Heater Control C1 | N/S |
| S231 | Near T/O for Park Brake Switch | 41 |
| S236 | In Steering Wheel | 31 |
| S237 | In Steering Wheel | 31 |
| S240 (RHD) | Near T/O for Blend Door Actuaror | N/S |
| S300 (LHD) | Near T/O for C309 | 44 |
| S300 (RHD) | Near T/O for C310 | 49 |
| S301 | In T/O For Radio C1 | N/S |
| S302 | Near T/O for C307 | 44 |
| S303 (LHD) | Near T/O for Shifter Assembly | 37 |
| S303 (RHD) | Floor Near Right Front Door | 40 |
| S304 | Near T/O for License Lamp | 49 |
| S306 (LHD) | Near T/O for Junction Block C2 | 50 |
| S306 (RHD) | In T/O for C319 | 49 |
| S308 (LHD) | In T/O for Rear Power Outlet | N/S |
| S308 (RHD) | Near T/O for Rear Power Outlet | N/S |
| S310 | Near T/O for C303 | 49 |
| S311 | In T/O for Radio C1 | N/S |
| S312 | Near T/O for G330 | 49 |
| S313 | In T/O for Trailer Tow Relays | 50 |
| S314 | In T/O for Trailer Tow Relays | 50 |
| S315 | Left Steering Wheel | 31 |
| S316 | In Steering Wheel | 31 |
| S317 | Right Steering Wheel | 31 |
| S318 (LHD) | Near T/O for Left Instrument Panel Speaker | 33, 36 |
| S318 (RHD) | Floor Near Right Front Door | 40 |
| S319 (LHD) | Near T/O for C201 | 33 |
| S319 (RHD) | Near T/O for Left Instrument Panel | 38 |
| S322 | Near T/O for Left Instrument Panel | 33, 38 |
| S323 (LHD) | Near T/O for Left Instrument Panel | 33 |
| S323 (RHD) | Near T/O for Right Instrument Panel Speaker | 38 |
| S324 (Premium) | Near T/O for Right Instrument Panel Speaker | 33, 38 |
| S326 | Near T/O for Heated Seat Module | N/S |

| SPLICE NUMBER | LOCATION | FIG. |
|---|---|---|
| S327 | Near T/O for Left Heated Seat Assembly | N/S |
| S328 | In T/O for Heated Seat Module | N/S |
| S329 | Near T/O for Right Heated Seat Switch | N/S |
| S331 | Under Carpet Near Driver Seat Right Front Fastner | 37, 41 |
| S332 | Under Carpet Near Driver Seat Right Front Fastner | 37, 41 |
| S333 | Near Driver Seat Belt Tensioner | 36 |
| S334 | Below Right B-Pillar | 35, 40 |
| S336 (LHD) | Near T/O for Left Instrument Panel | 33 |
| S336 (RHD) | Near T/O for Right Instrument Panel Speaker | 38 |
| S340 (Base) | Near T/O for C201 | 33 |
| S341 | Near T/O for C201 | 33, 42 |
| S342 (Base) | Near T/O for Right Instrument Panel Speaker | 33 |
| S344 (Base) | Near T/O for Right Instrument Panel Speaker | 33 |
| S345 | Center Console | 37, 41 |
| S346 | In T/O for Trailer Tow Relays | 50 |
| S347 | Near T/O for Right Tail/Stop Lamp | 49 |
| S348 | Near T/O for Right Tail/Stop Lamp | 49 |
| S349 | Near T/O for License Lamp | 49 |
| S351 | In T/O for Rear Window Defogger | 51 |
| S352 | In T/O for Rear Window Defogger | 51 |
| S353 | In T/O for Radio C2 | N/S |
| S354 | In T/O for CD Changer | 46 |
| S355 | In T/O for Radio C2 | N/S |
| S356 | Near T/O for Center High Mounted Stop Lamp | 51 |
| S358 | Center Instrument Panel | 38 |
| S360 | Near T/O for Left Power Mirror | 42 |
| S361 | Near T/O for Left Power Mirror | 42 |
| S363 | Left Side Lightbar | 53 |
| S364 | Near T/O for Left Front Door Speaker | N/S |
| S369 | Left Side Lightbar | 53 |
| S370 | Near T/O for Right Power Mirror | 42 |
| S371 | Near T/O for Right Door Lock Switch | 42 |
| S372 | Lower Front Engine Compartment | 23 |
| S373 | Right Front Lower Engine Compartment | 23 |
| S377 (RHD) | Near T/O for Right Door Lock Switch | 42 |
| S378 (RHD) | Near T/O for Right Front Power Window Motor | 42 |
| S379 (RHD) | In Rear Body Harness near T/O for C310 | N/S |
| S380 | Near T/O for Rear Wiper Motor | 51 |
| S381 | Near T/O for Tailgate Cylinder Lock Switch | 51 |
| S382 | Near T/O for License Lamp | 51 |
| S390 | Near T/O for Intrusion Sensor | N/S |
| S391 | Near T/O for Left Visor/Vanity Lamp | N/S |
| S392 | Near T/O for Left Visor/Vanity Lamp | N/S |

| SPLICE NUMBER | LOCATION | FIG. |
|---|---|---|
| S393 | Near T/O for Intrusion Sensor | N/S |
| S394 | Near T/O for Rear Map/Reading Lamp | N/S |
| S395 | Neat T/O for Rear Map/Reading Lamp | N/S |

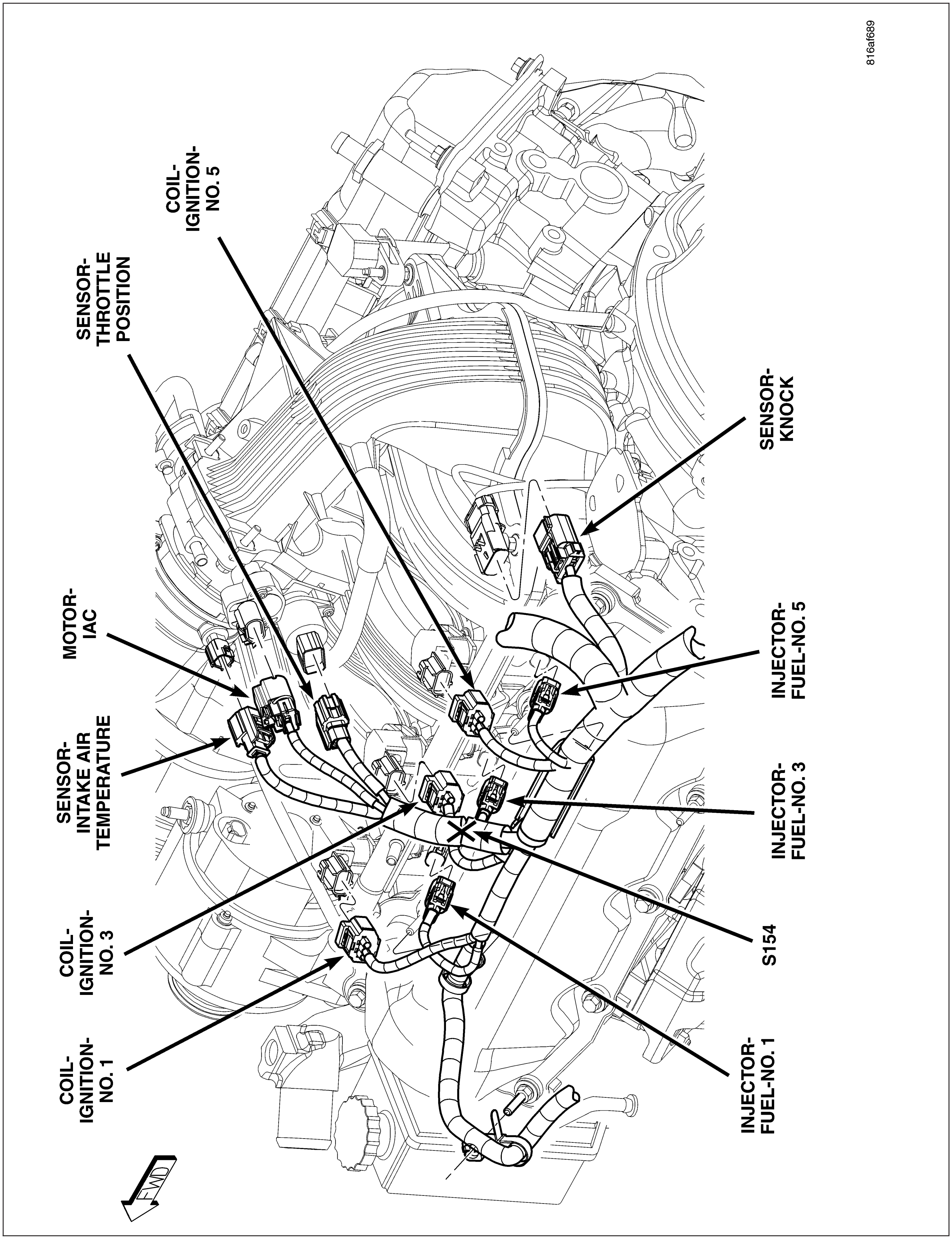



*Fig. 1 LEFT SIDE ENGINE 3.7L*

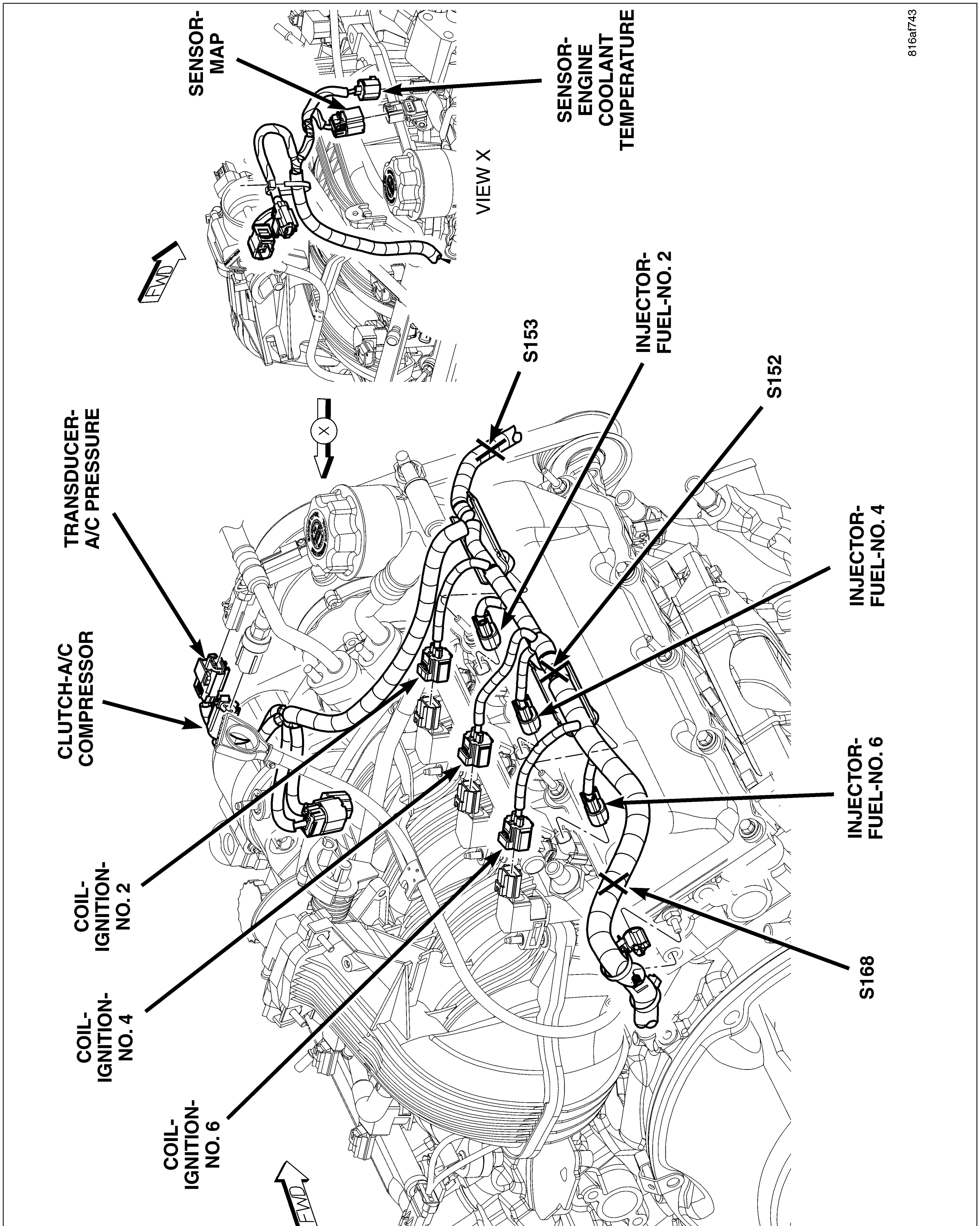



*Fig. 2 RIGHT SIDE ENGINE 3.7L*

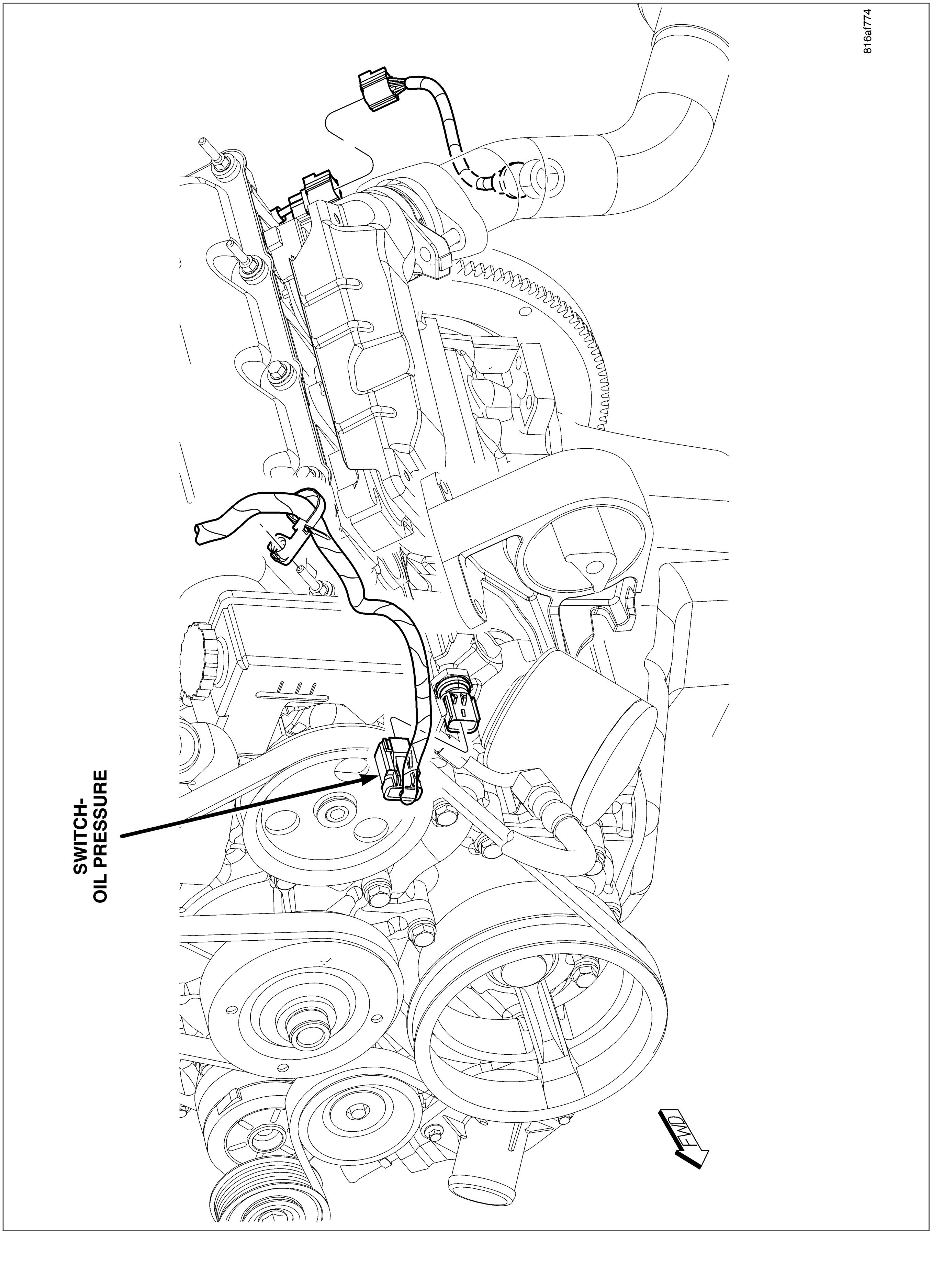



Fig. 3 LOWER LEFT ENGINE 3.7L

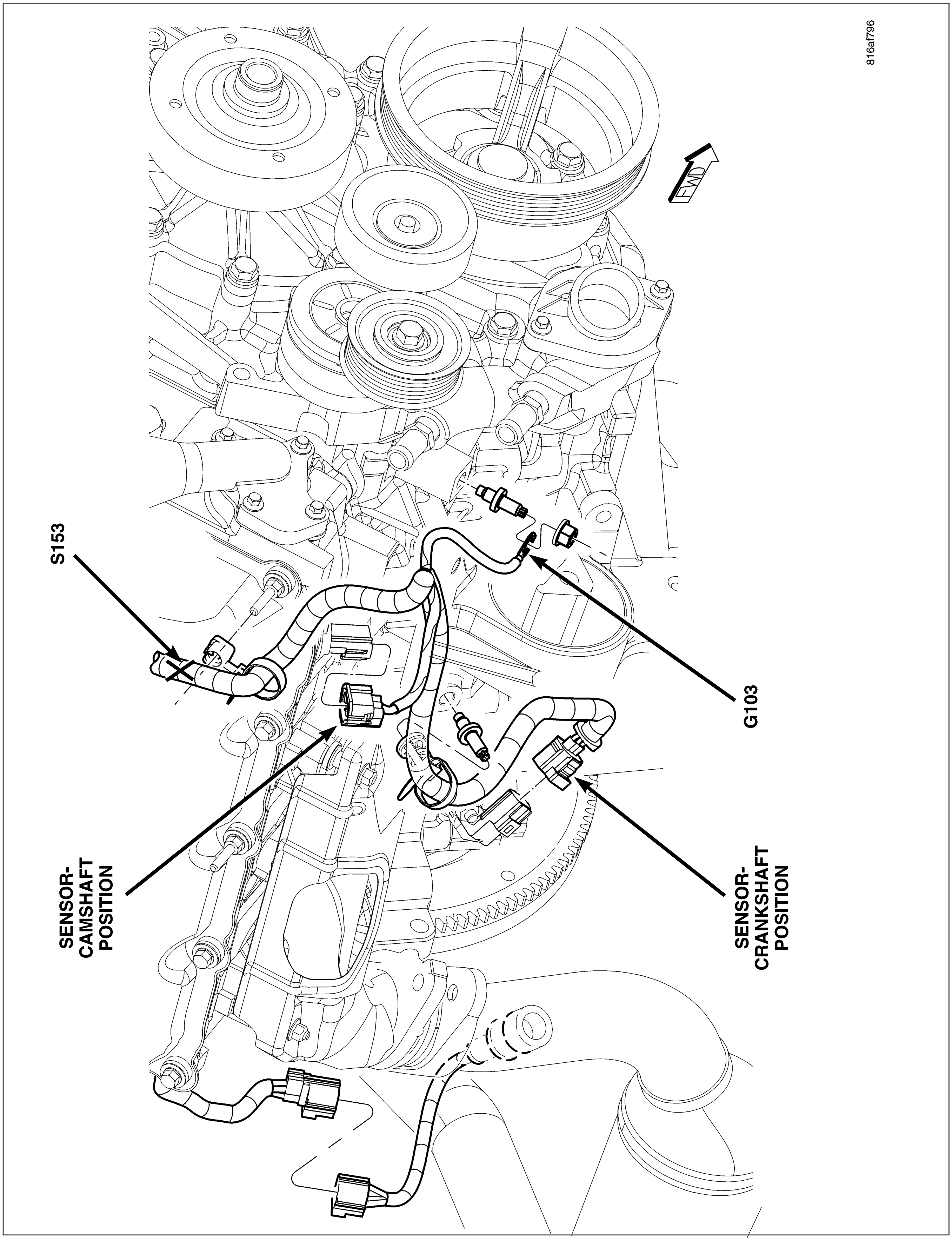



*Fig. 4 LOWER RIGHT ENGINE 3.7L*

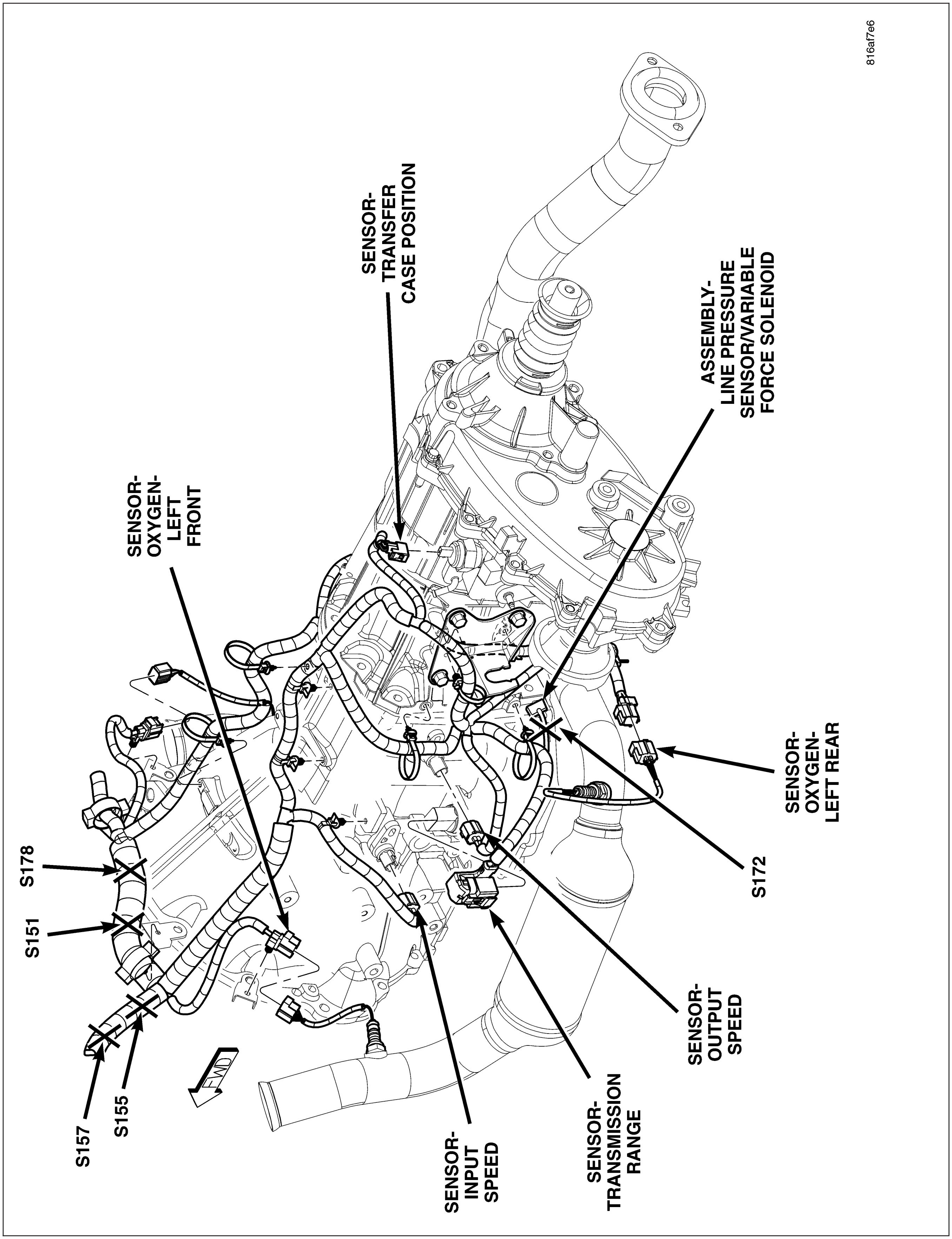



*Fig. 5 LEFT SIDE TRANSMISSION 3.7L*

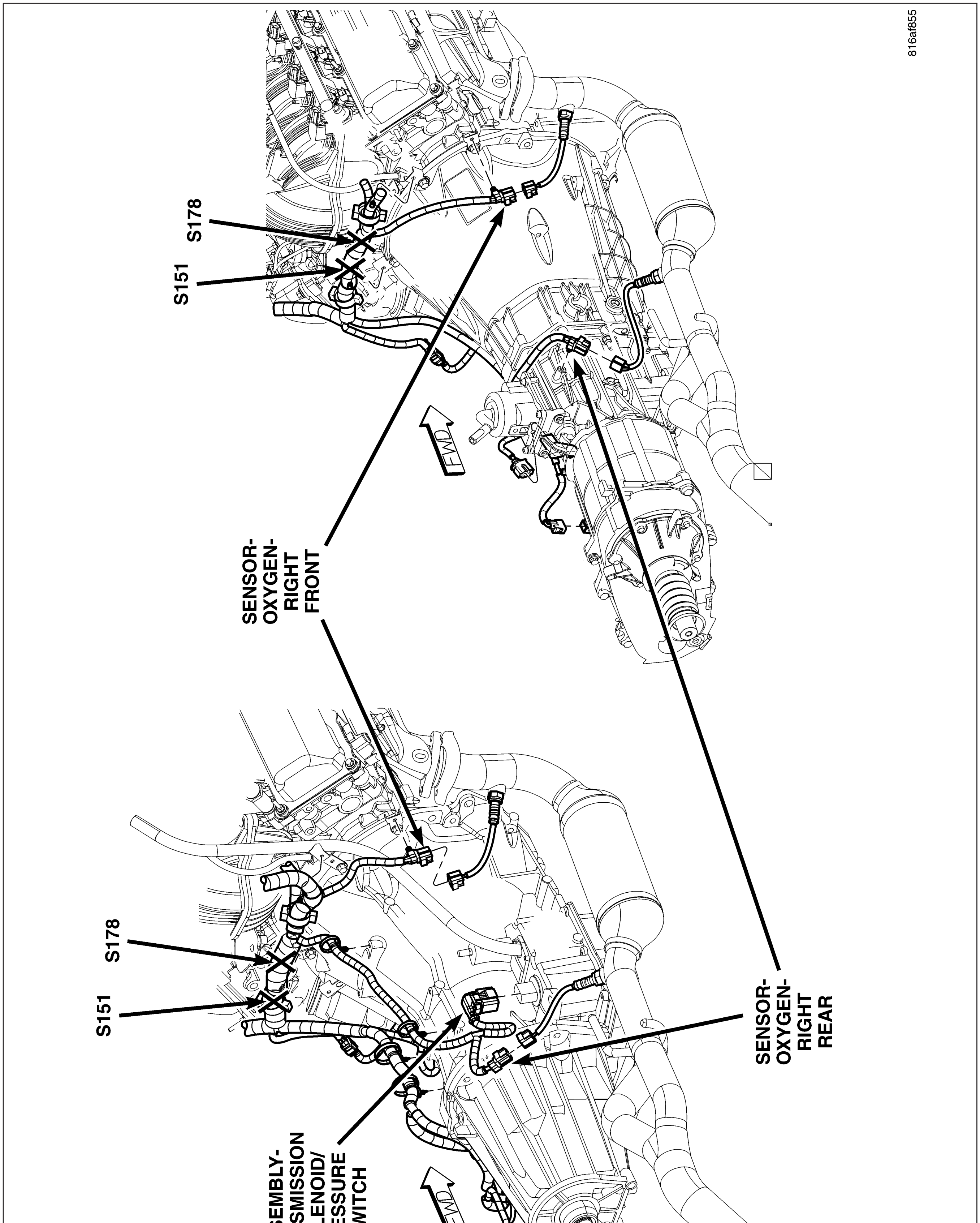



*Fig. 6 RIGHT SIDE TRANSMISSION 3.7L*

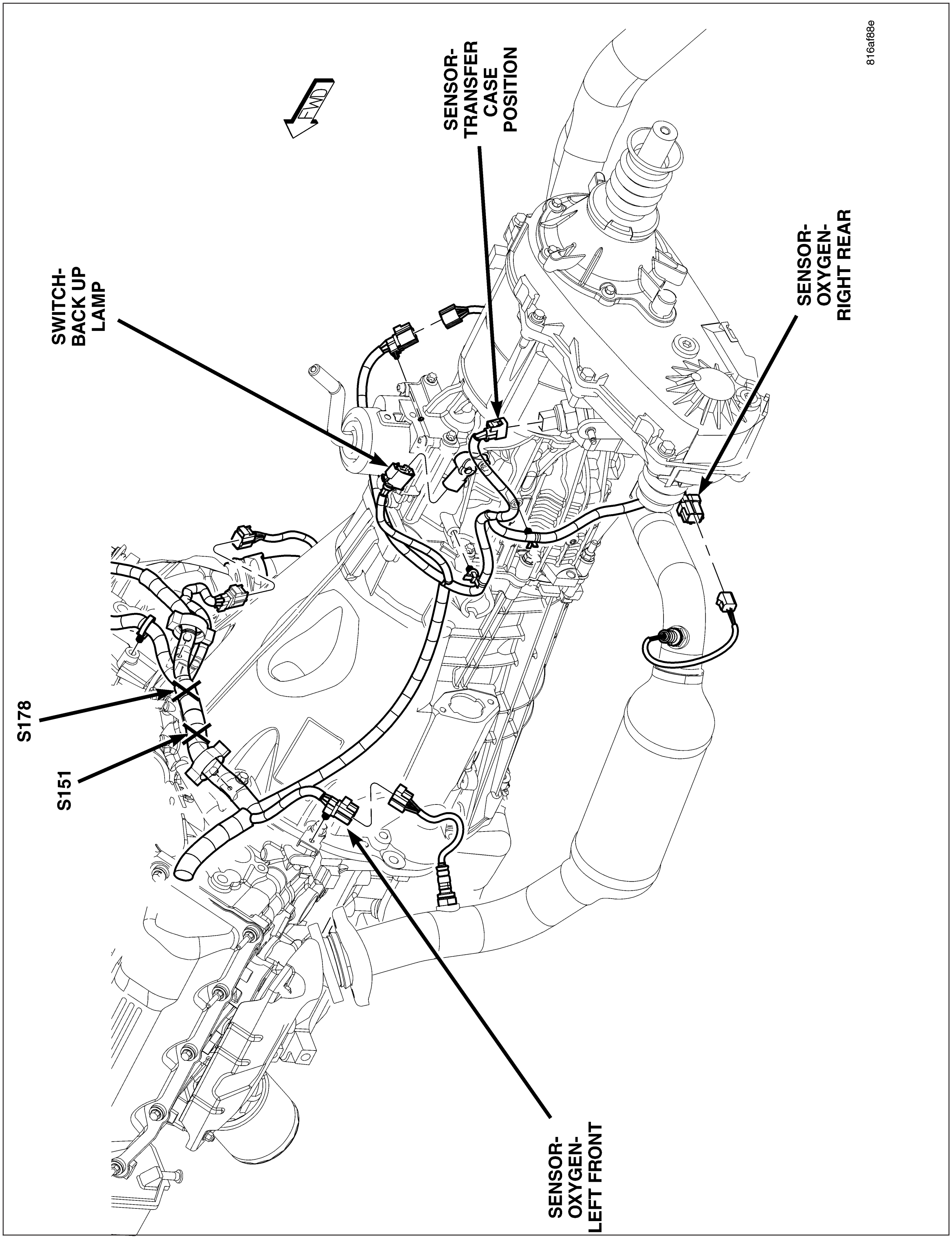



*Fig. 7 MANUAL TRANSMISSION 3.7L*

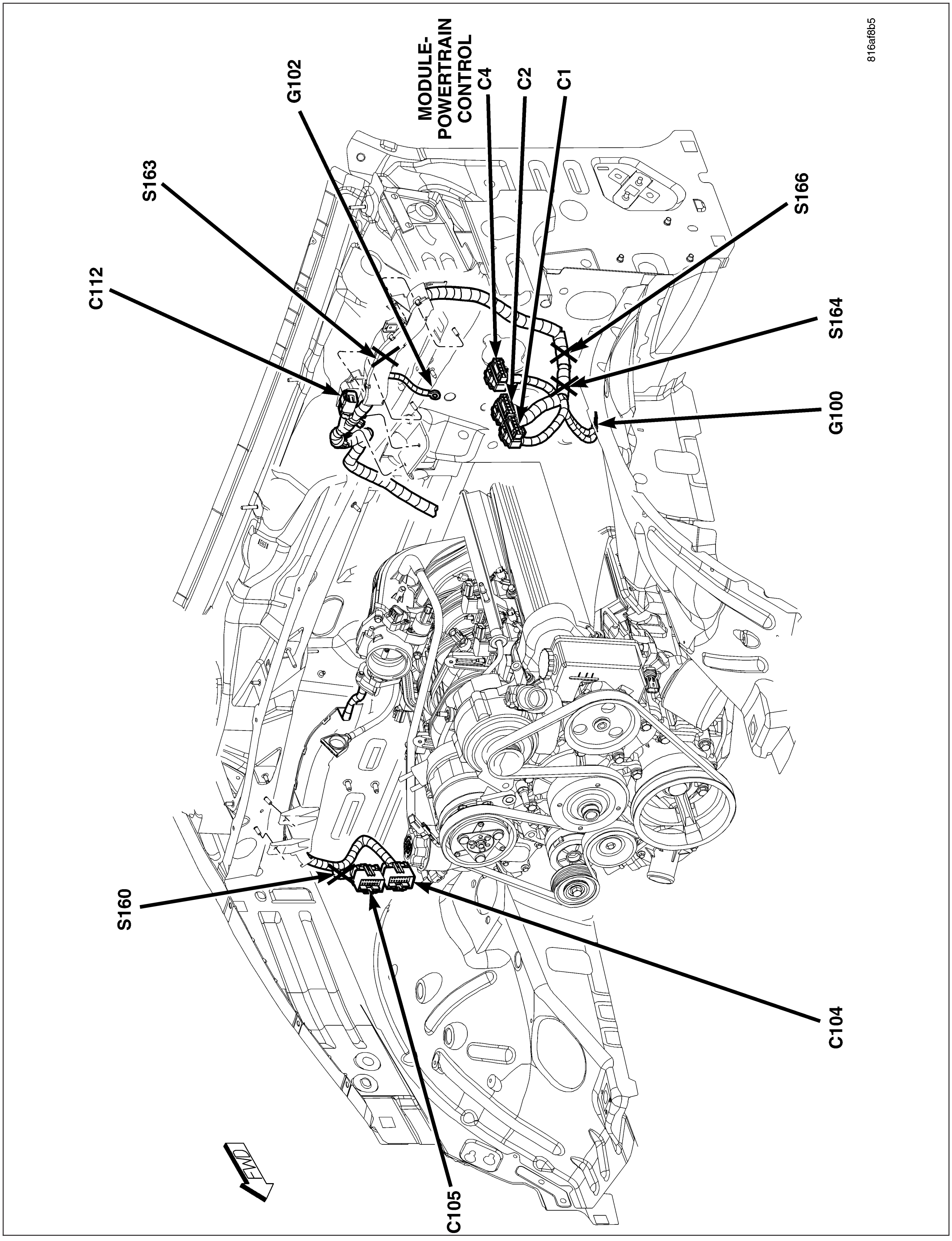



*Fig. 8 RIGHT SIDE ENGINE COMPARTMENT 3.7L*

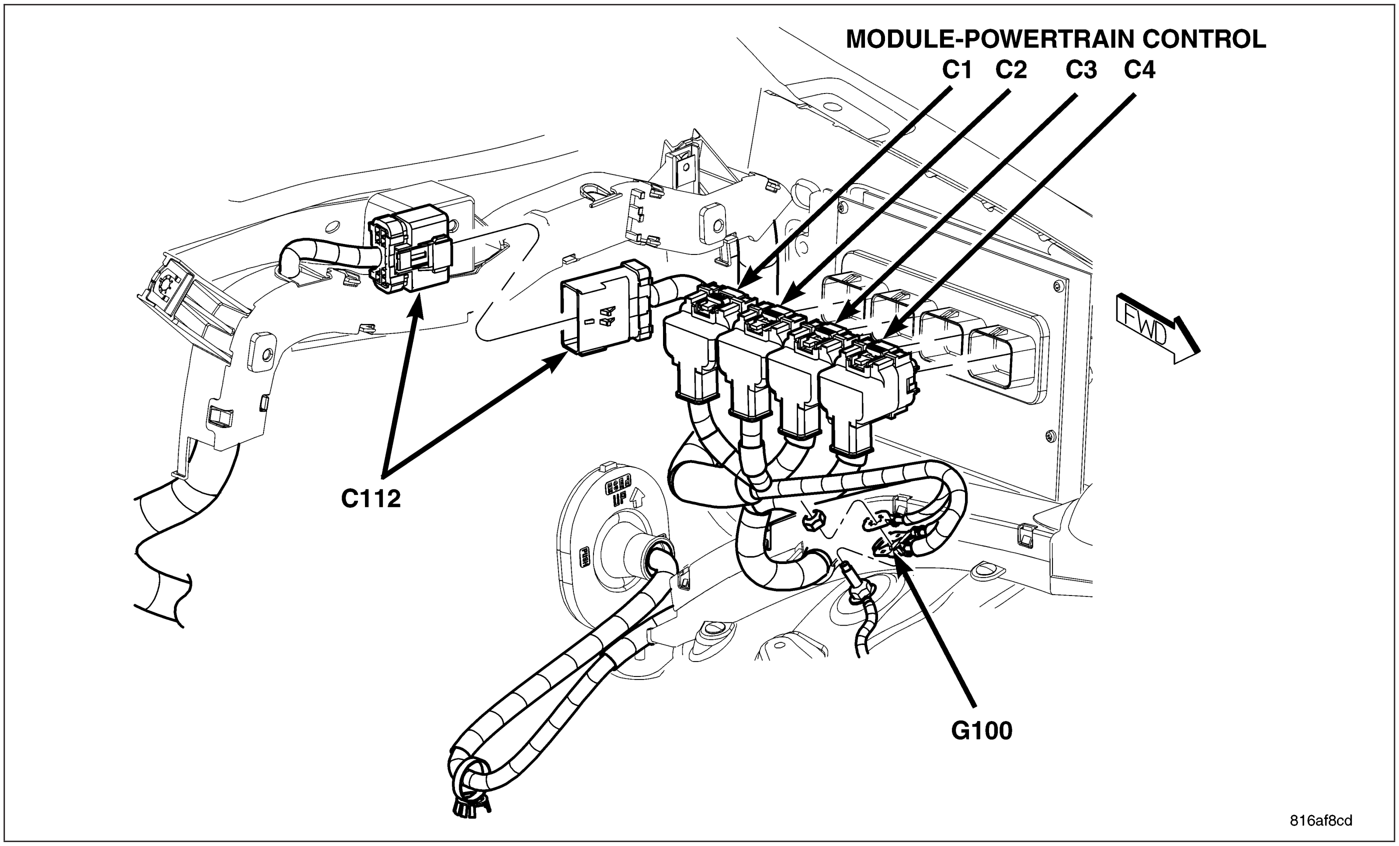



*Fig. 9 LEFT SIDE ENGINE COMPARTMENT 3.7L*

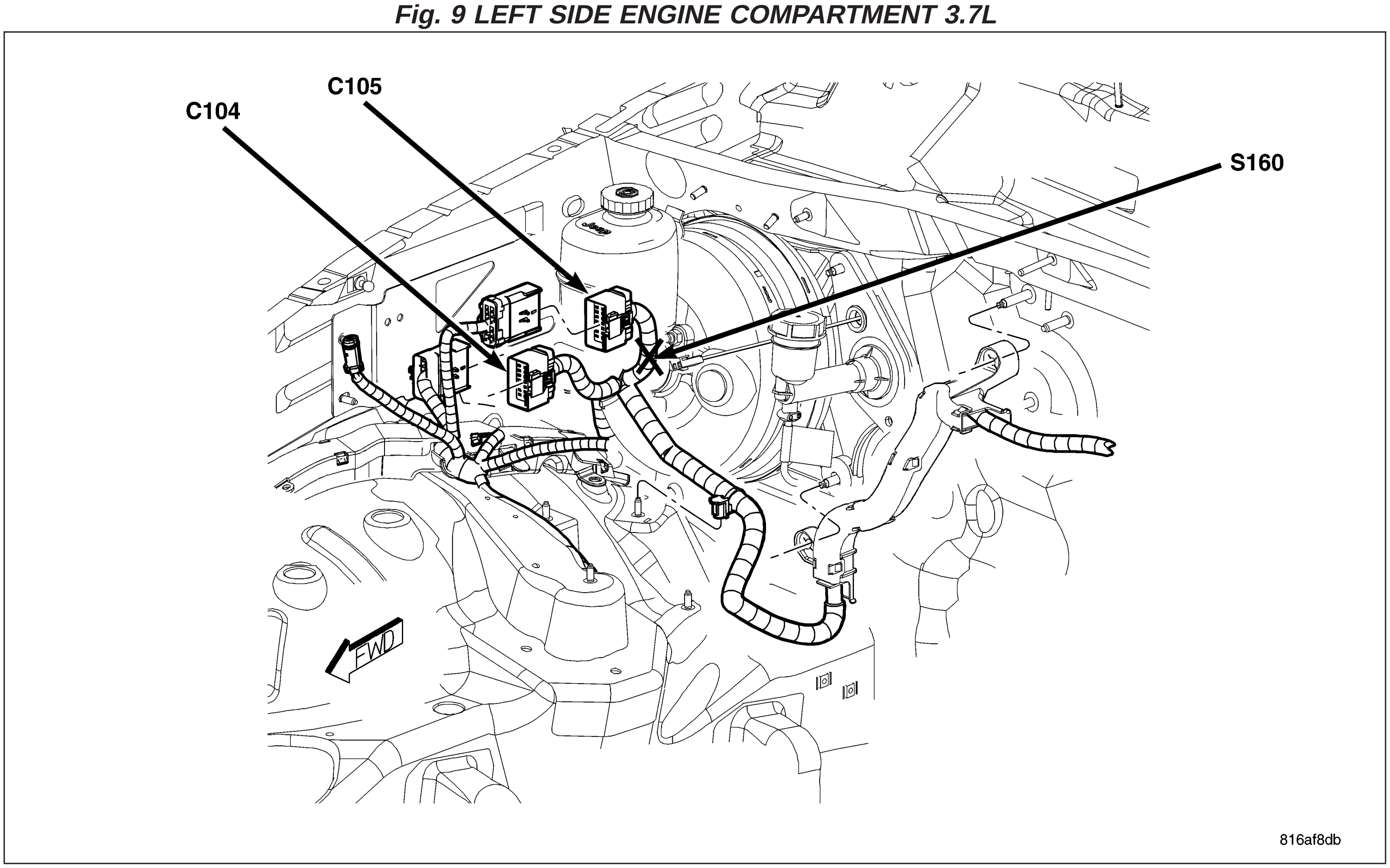



*Fig. 10 RIGHT SIDE ENGINE COMPARTMENT 3.7L RHD*

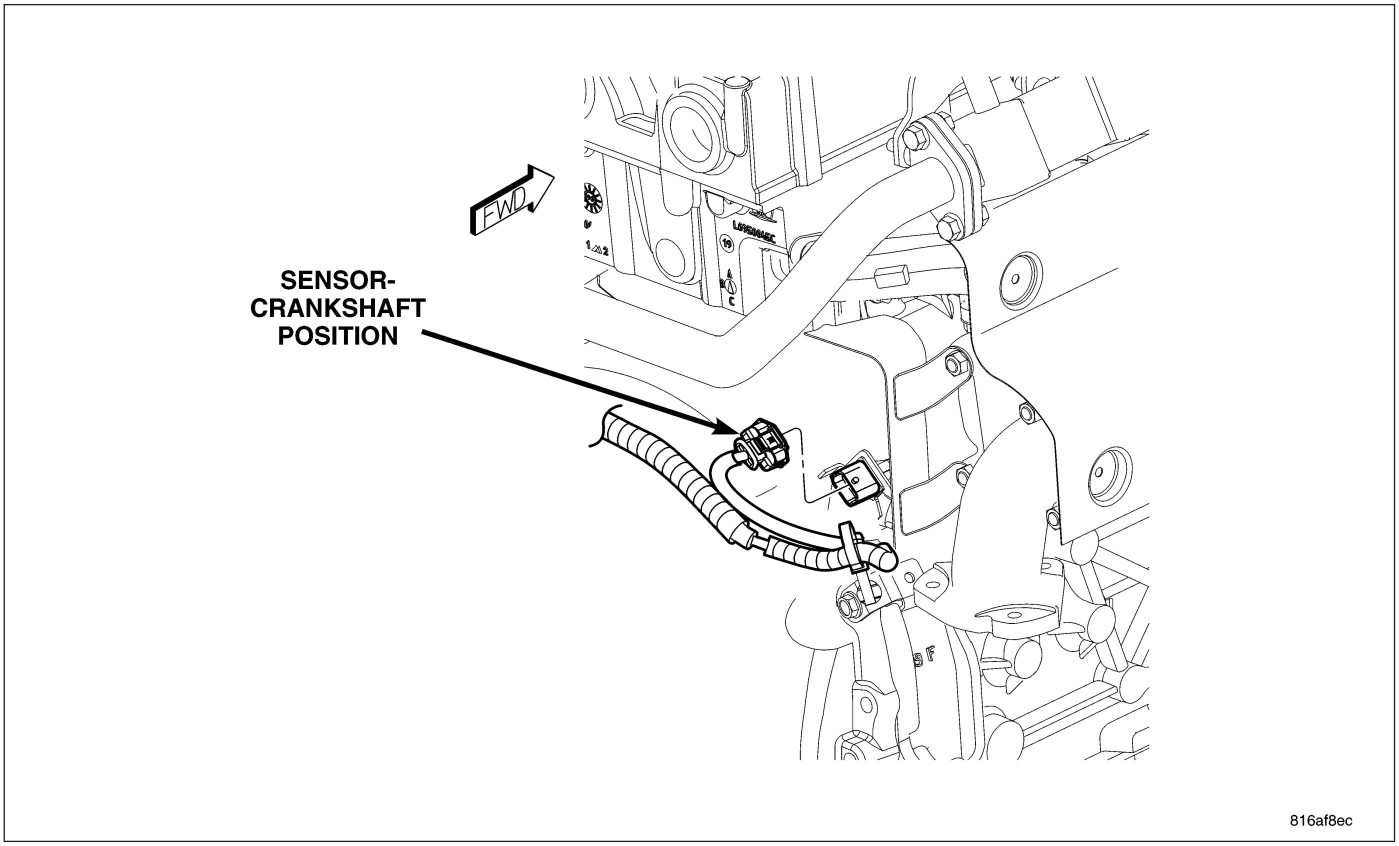



*Fig. 11 DIESEL ENGINE*

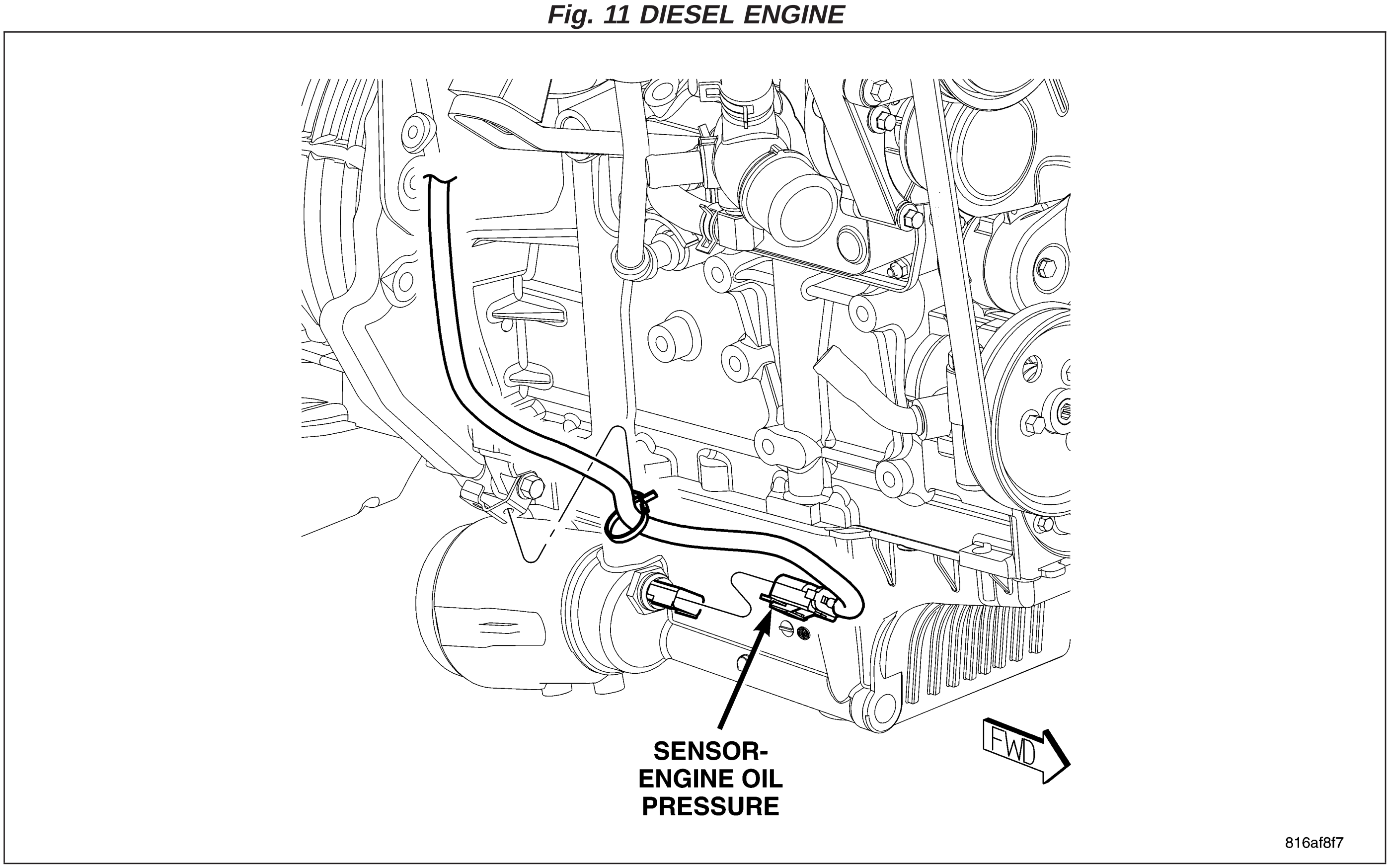



*Fig. 12 LOWER RIGHT FRONT DIESEL ENGINE*

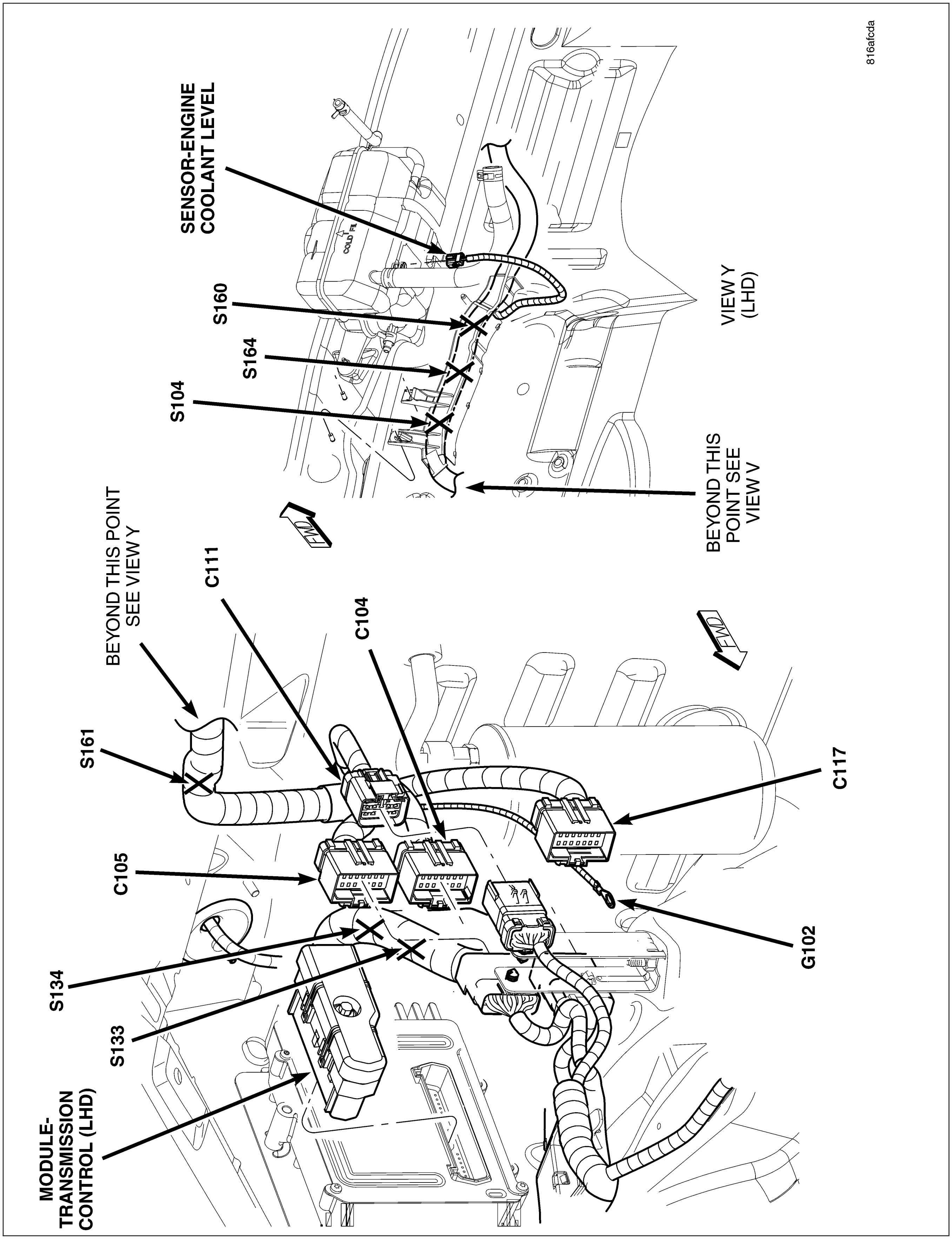



*Fig. 13 DIESEL ENGINE COMPARTMENT*

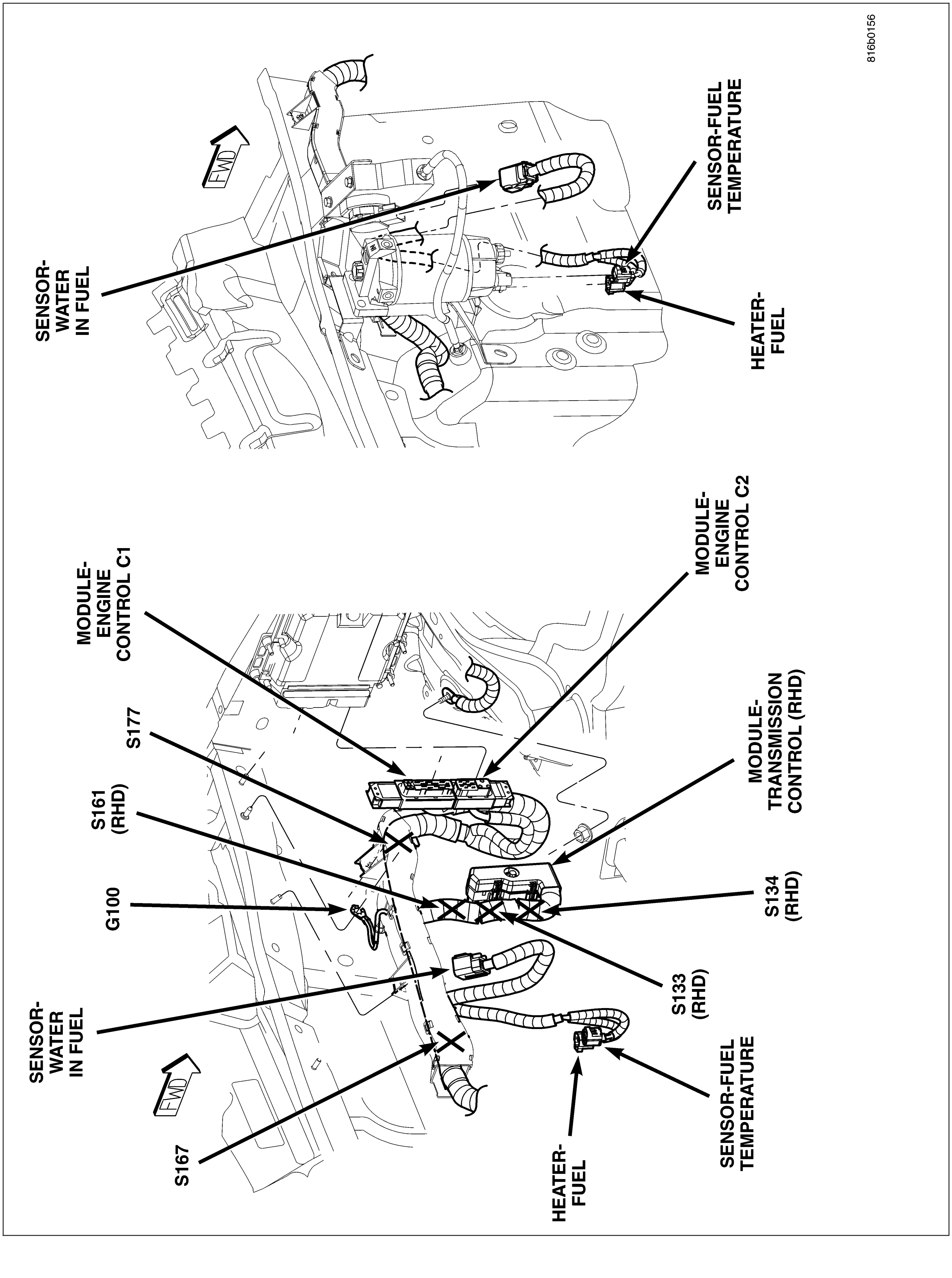



Fig. 14 DIESEL ENGINE COMPARTMENT

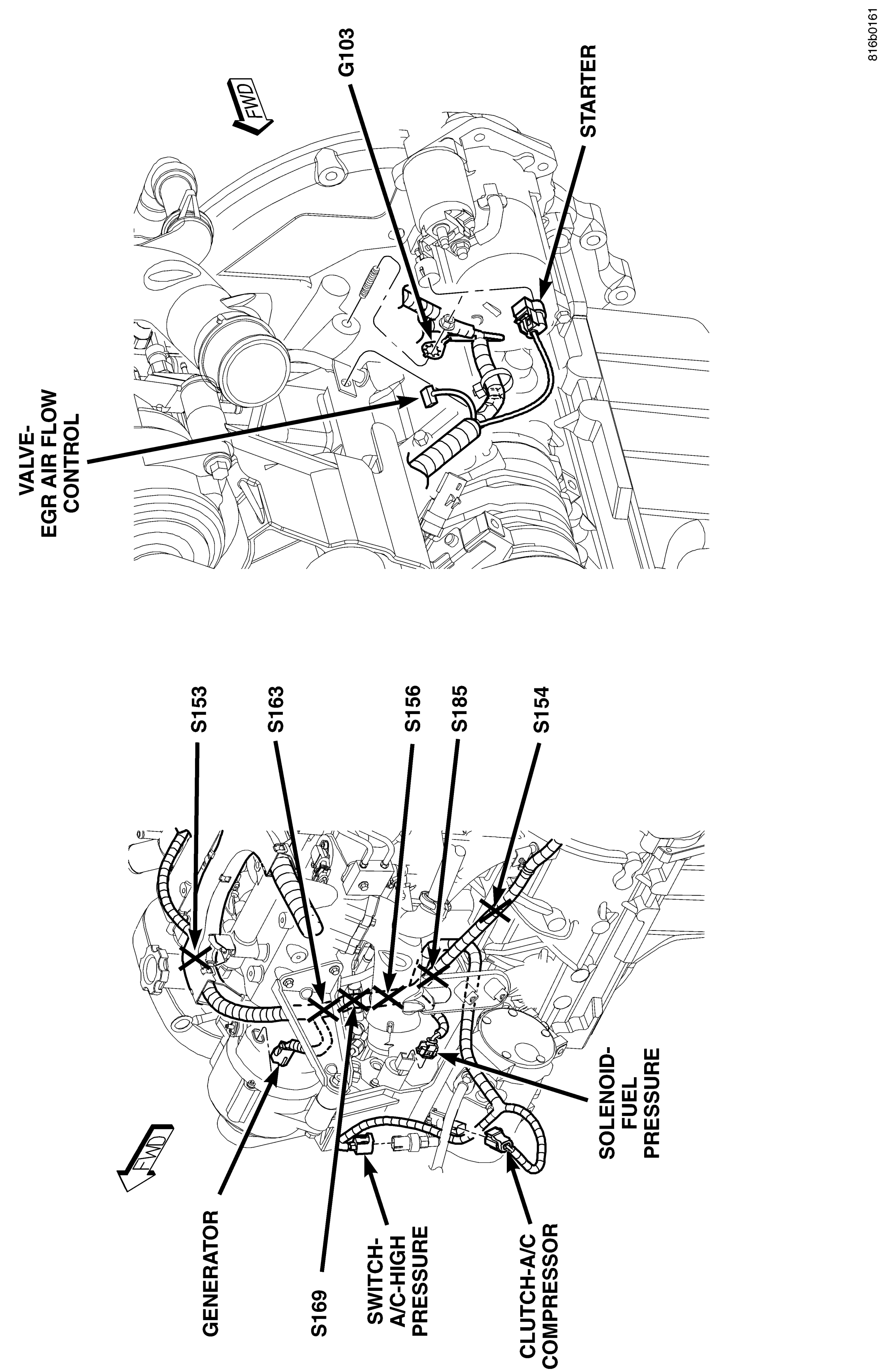



*Fig. 15 LEFT SIDE DIESEL ENGINE*

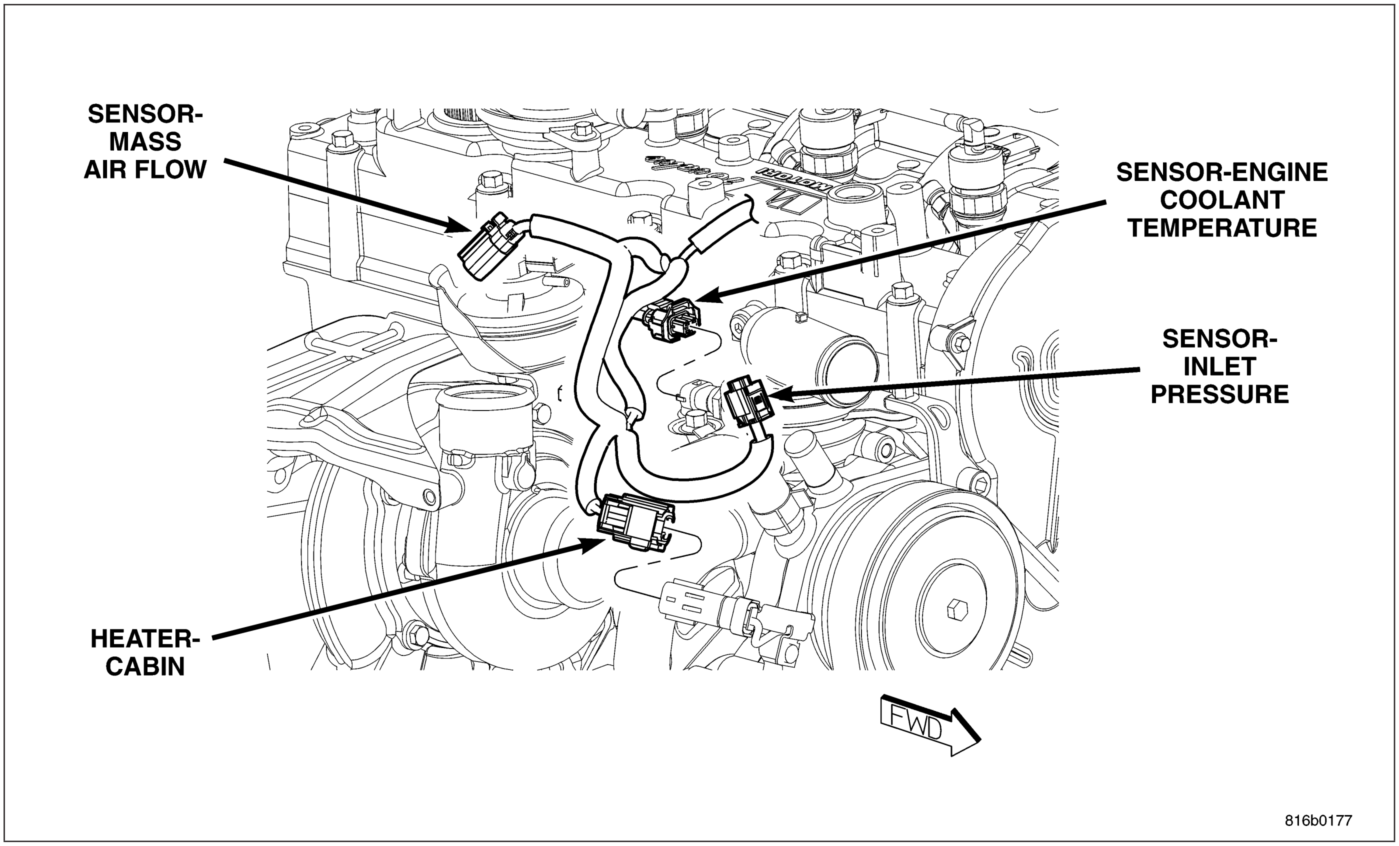



*Fig. 16 FRONT DIESEL ENGINE*

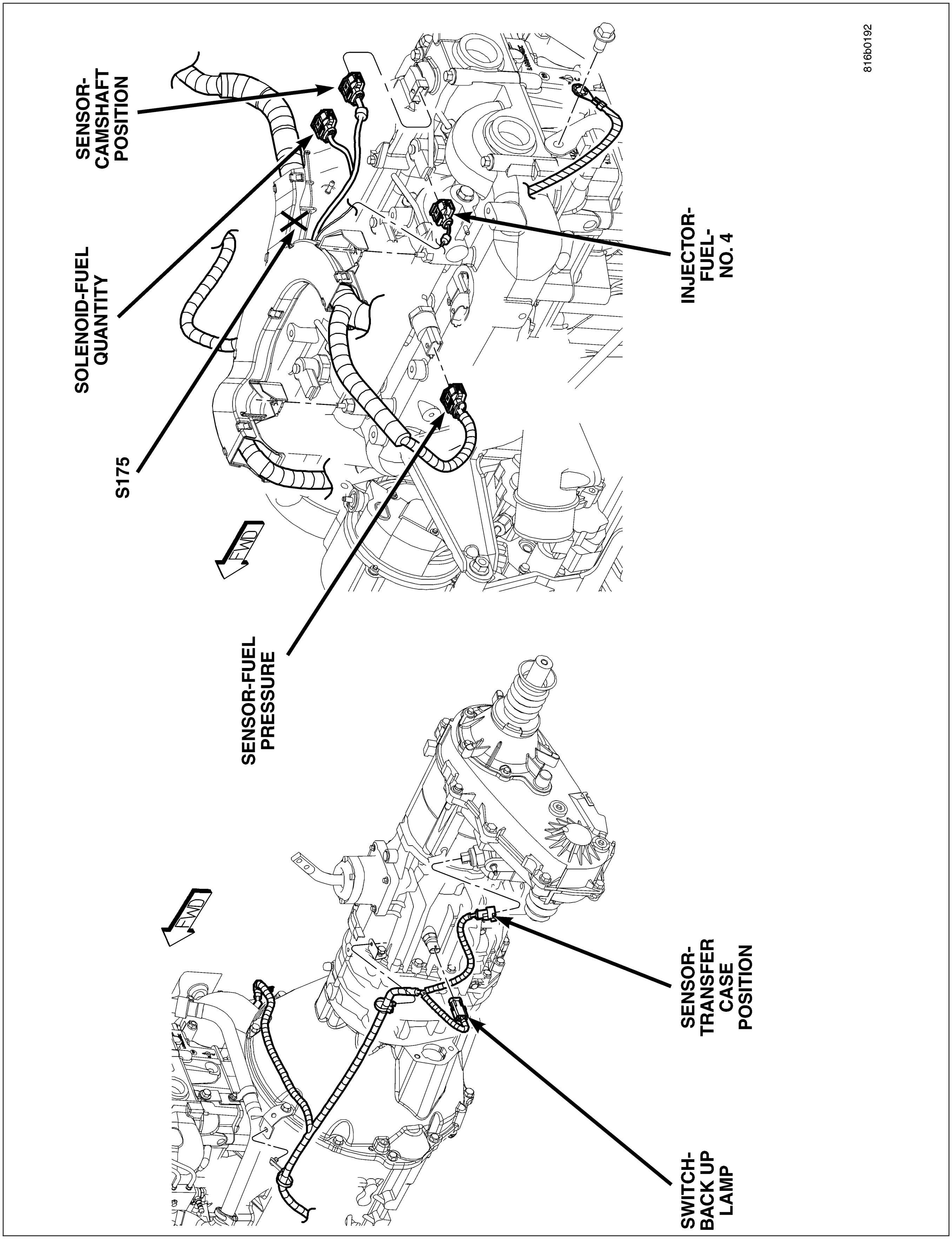



Fig. 17 REAR DIESEL ENGINE

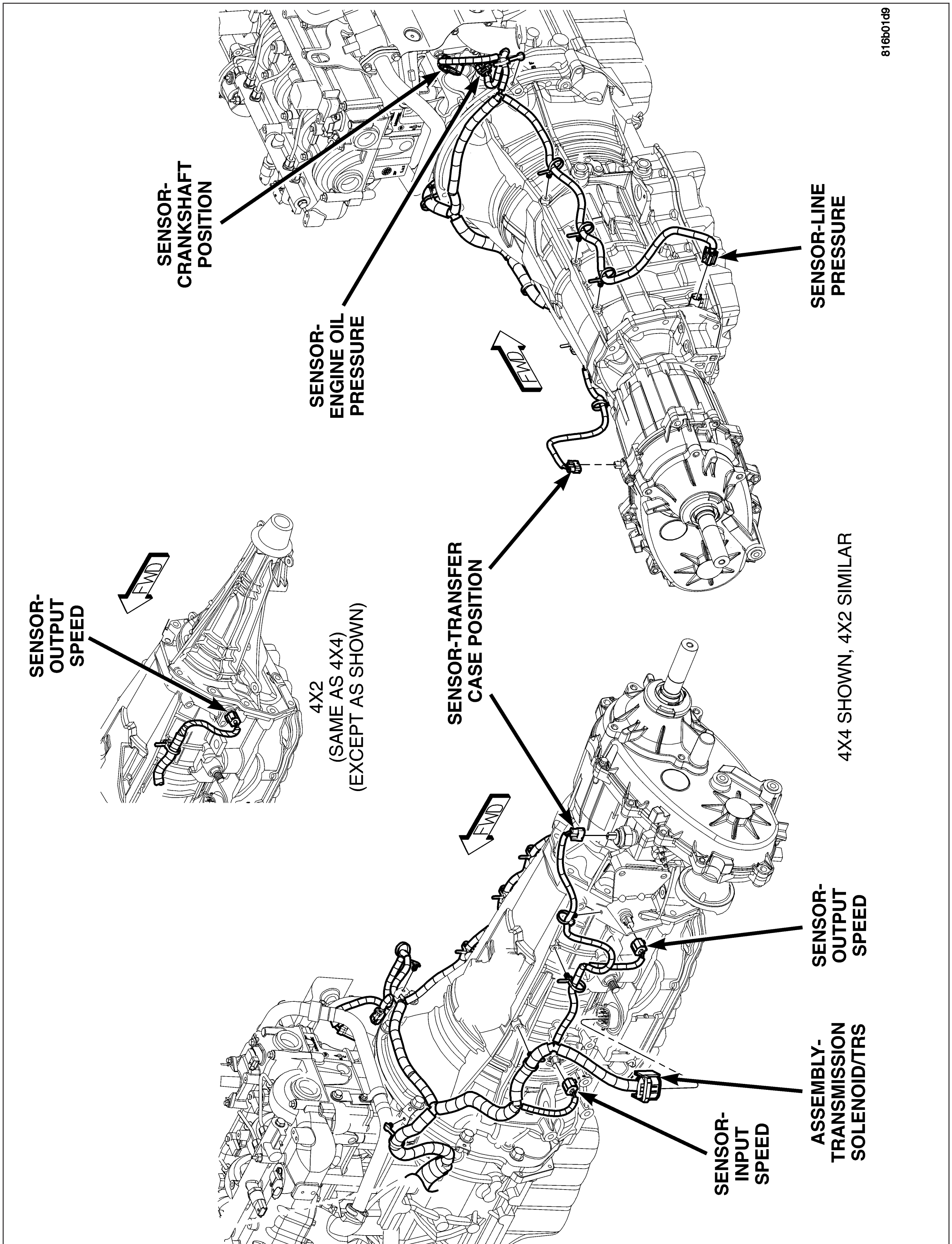



*Fig. 18 TRANSMISSION*

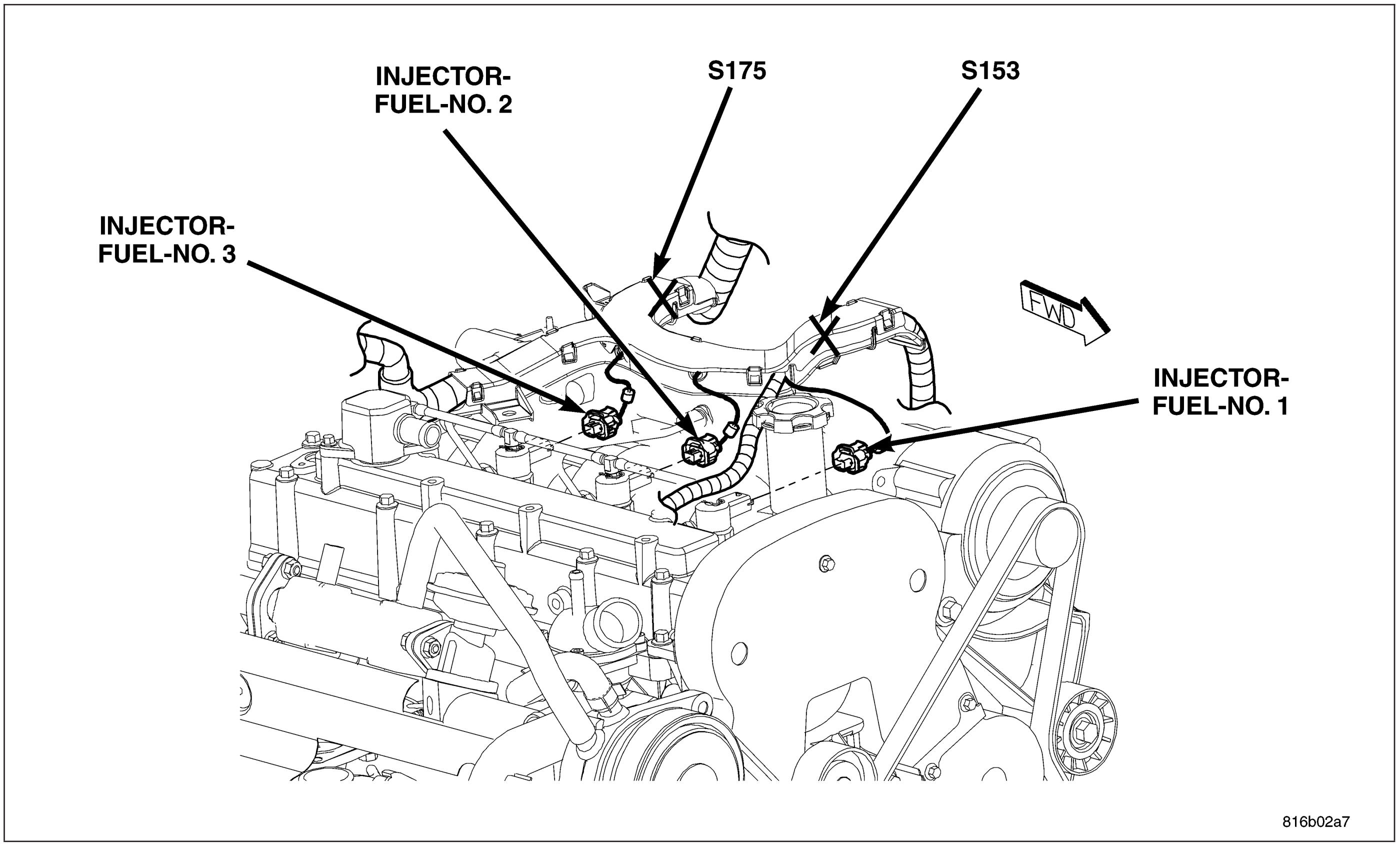



*Fig. 19 TOP DIESEL ENGINE*

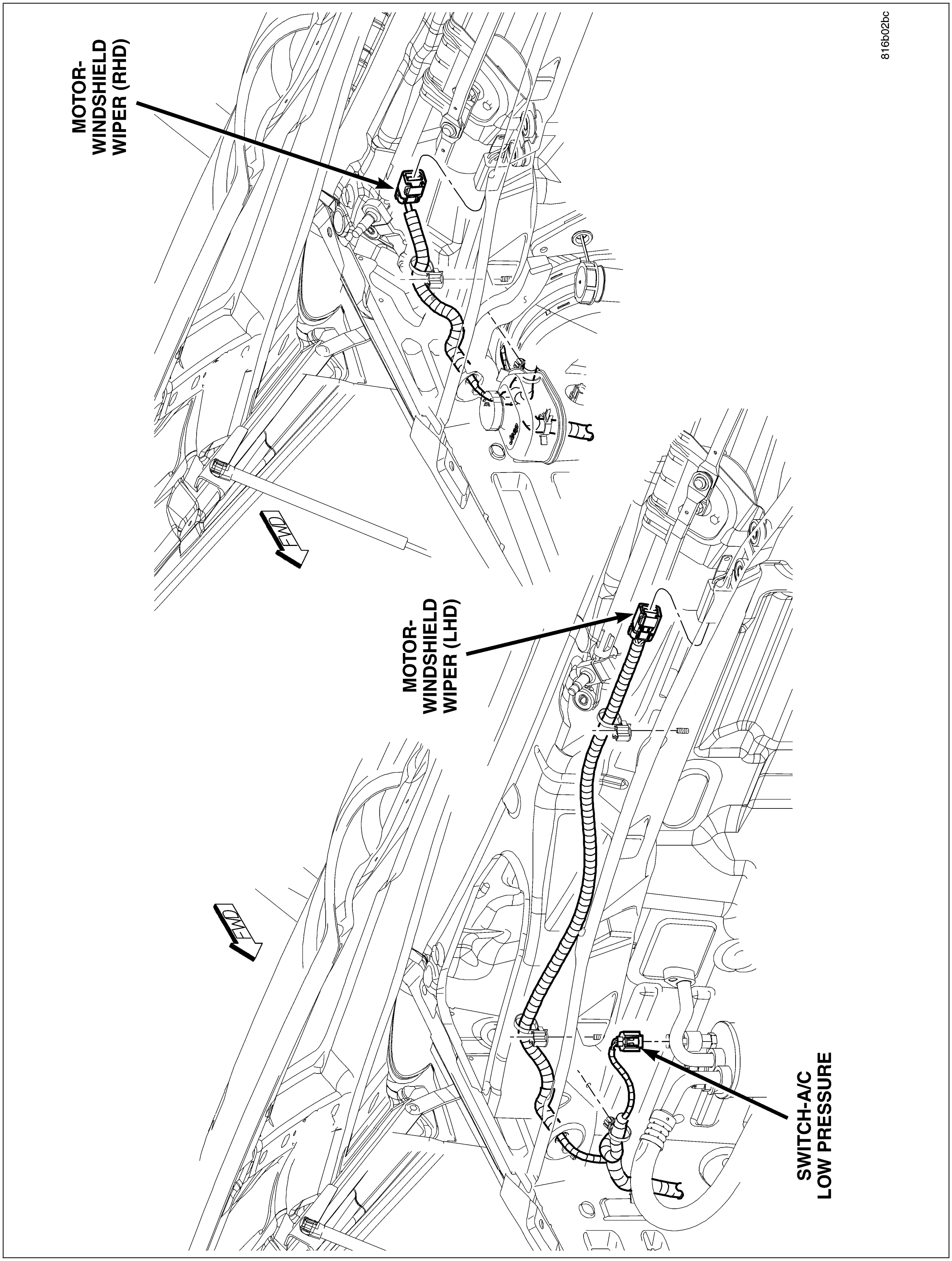



*Fig. 20 LEFT SIDE ENGINE COMPARTMENT*

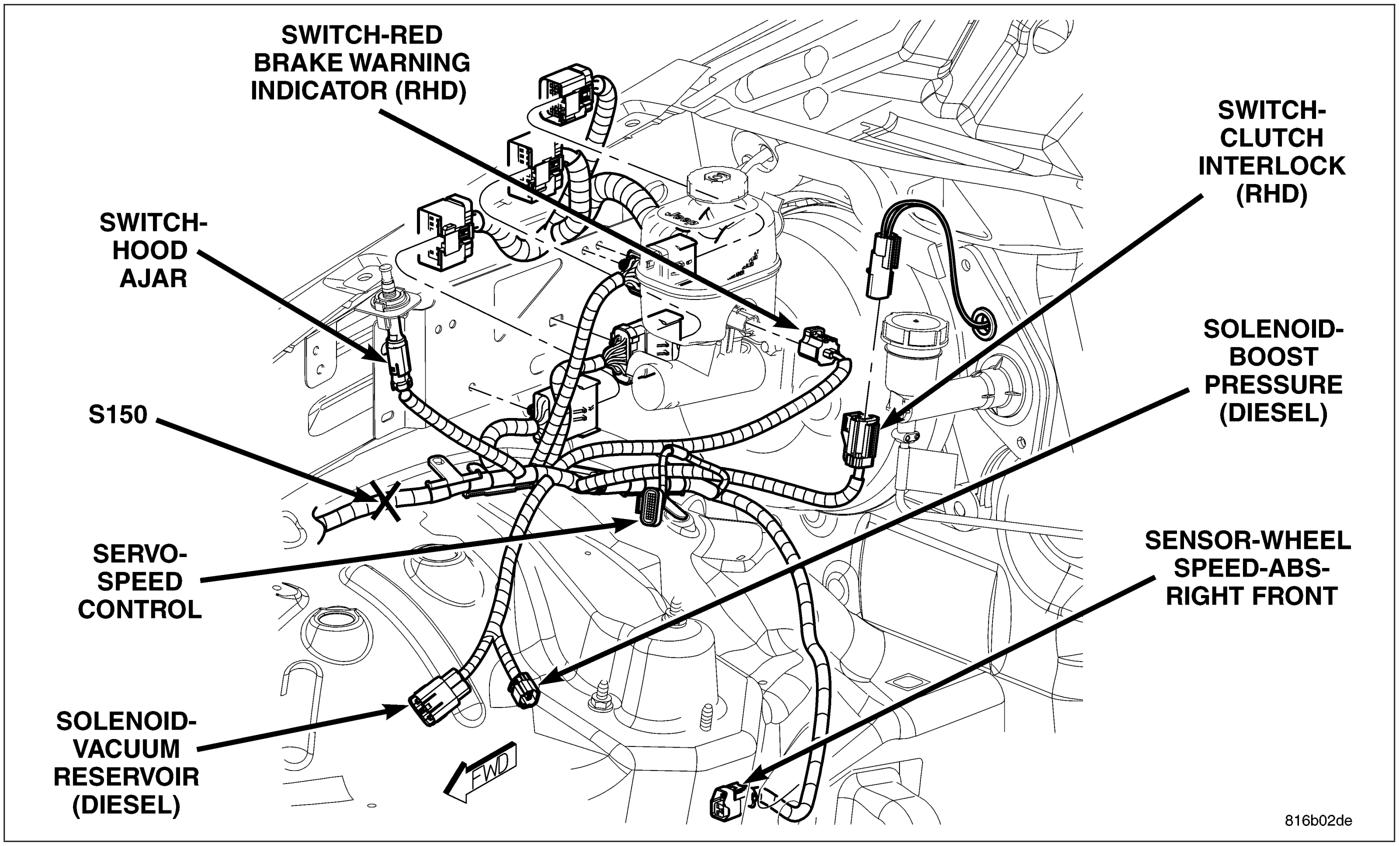



*Fig. 21 RIGHT SIDE ENGINE COMPARTMENT*

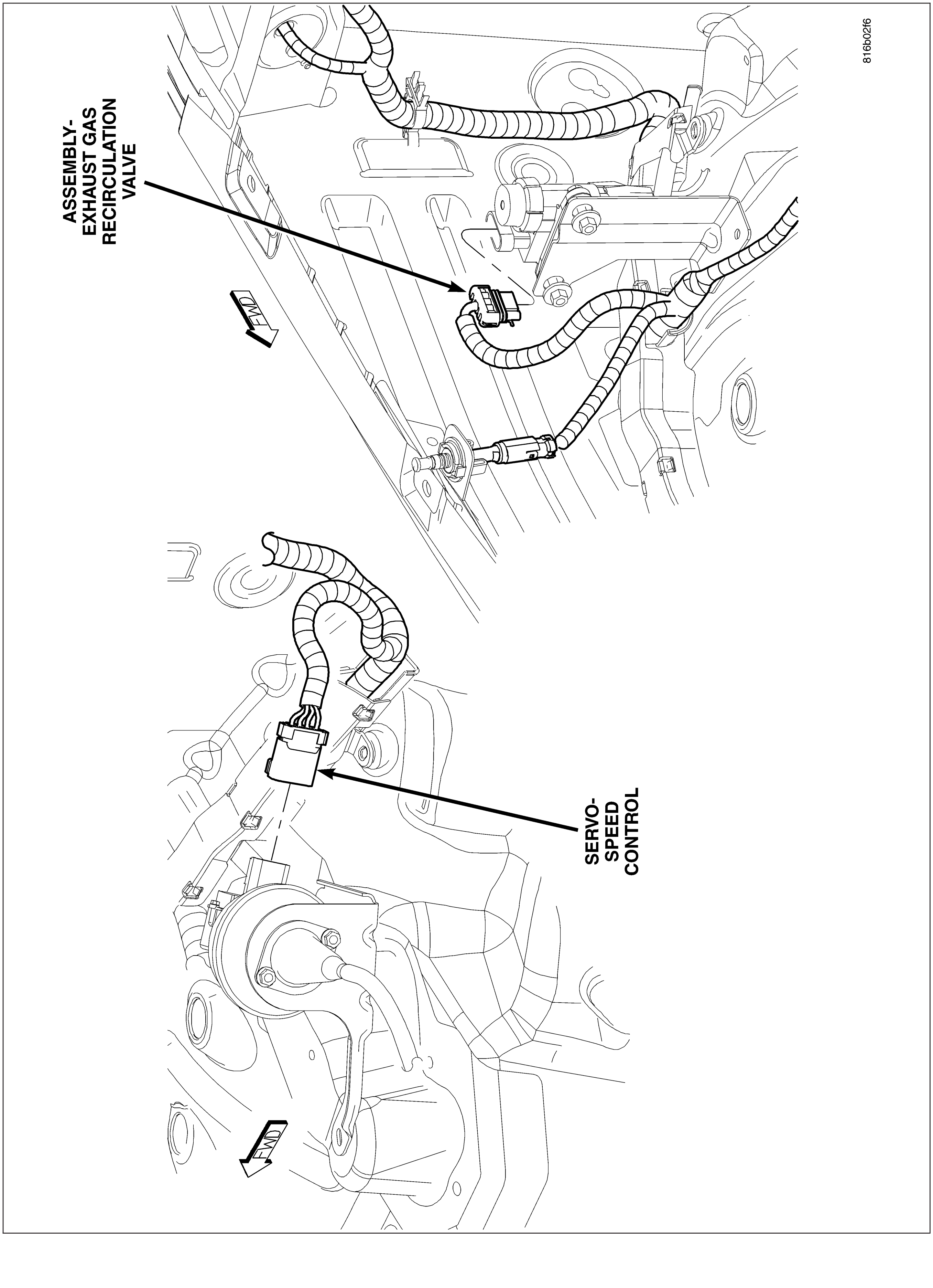



*Fig. 22 ENGINE COMPARTMENT*

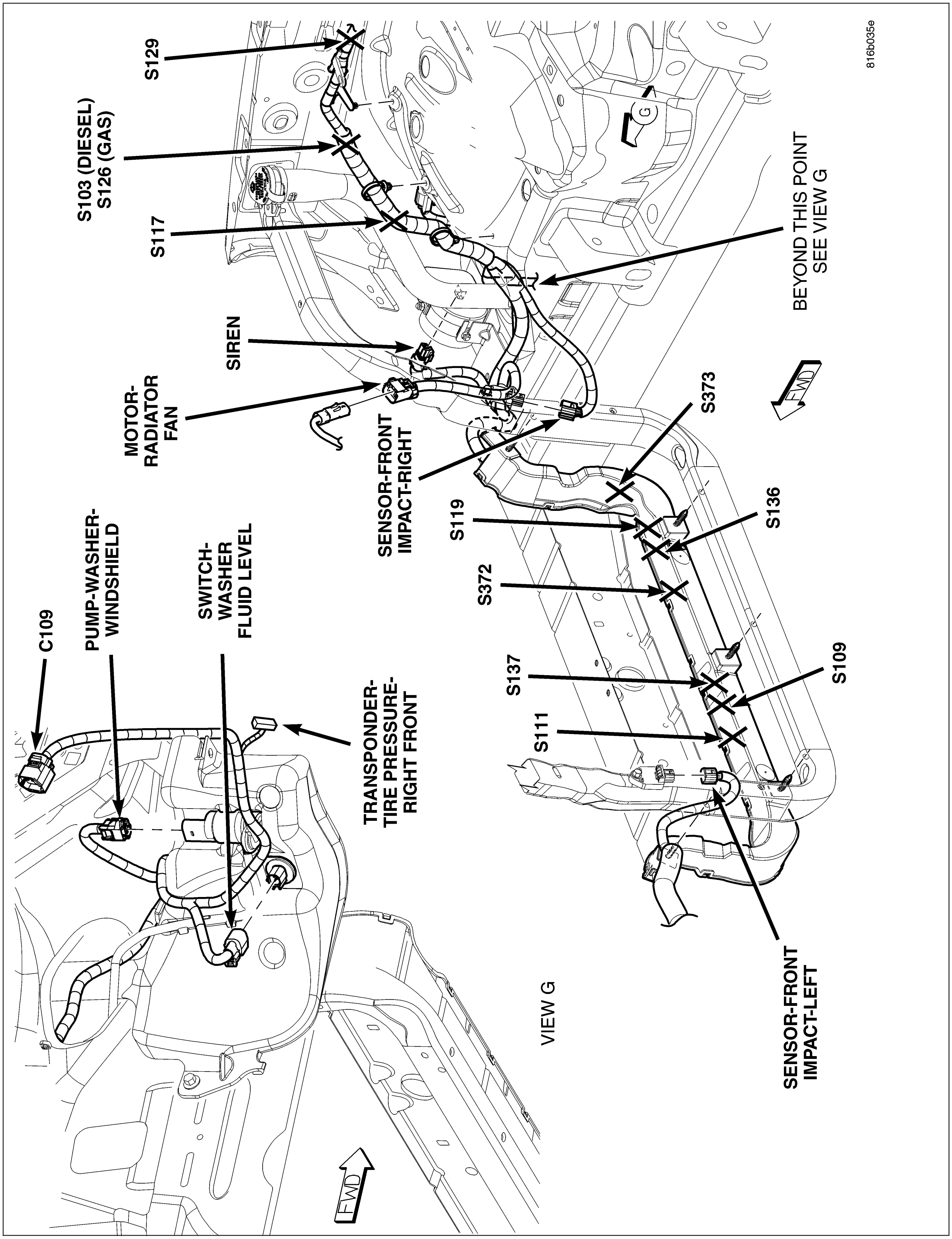



*Fig. 23 ENGINE COMPARTMENT*

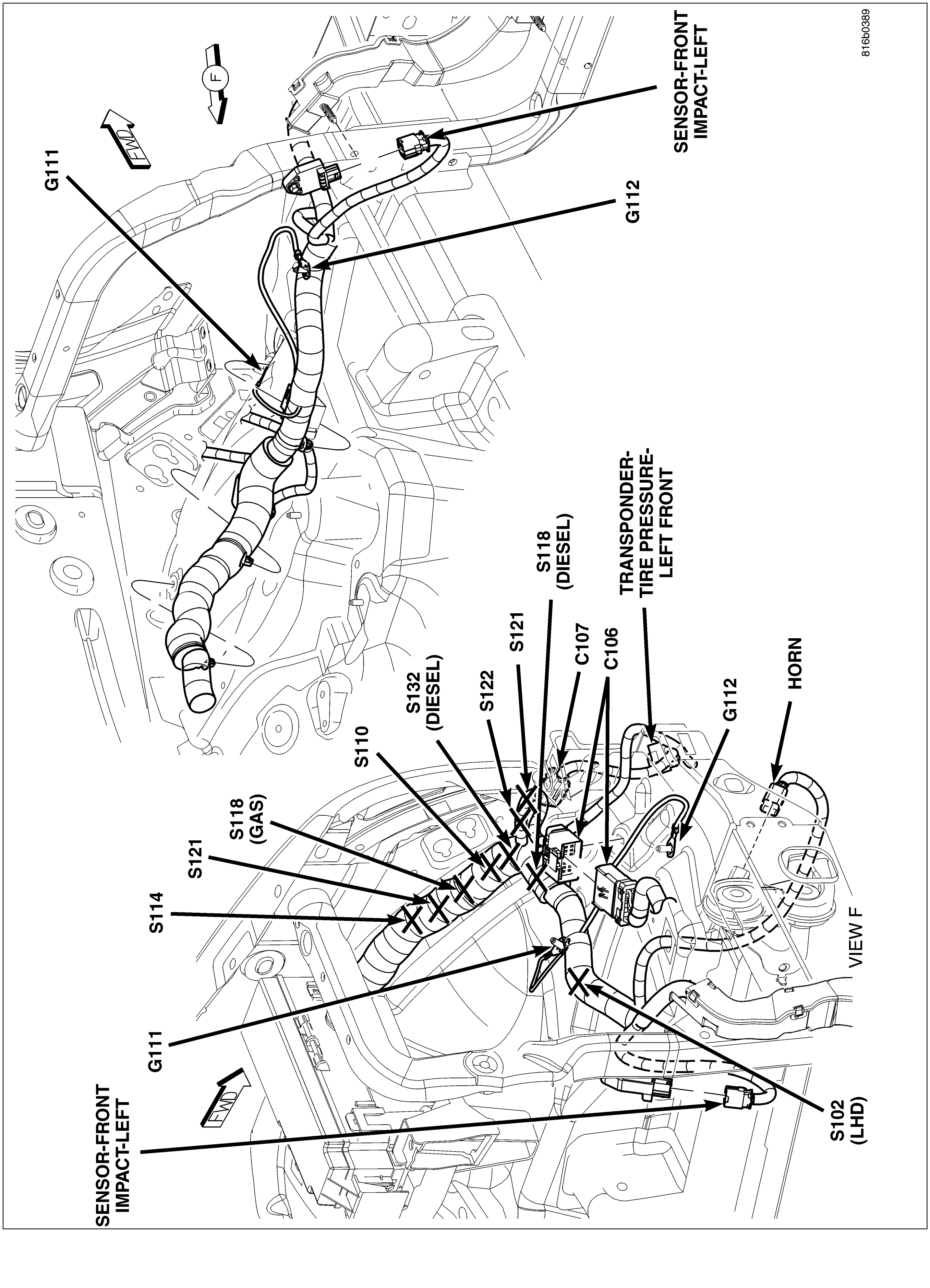



*Fig. 24 FRONT ENGINE COMPARTMENT*

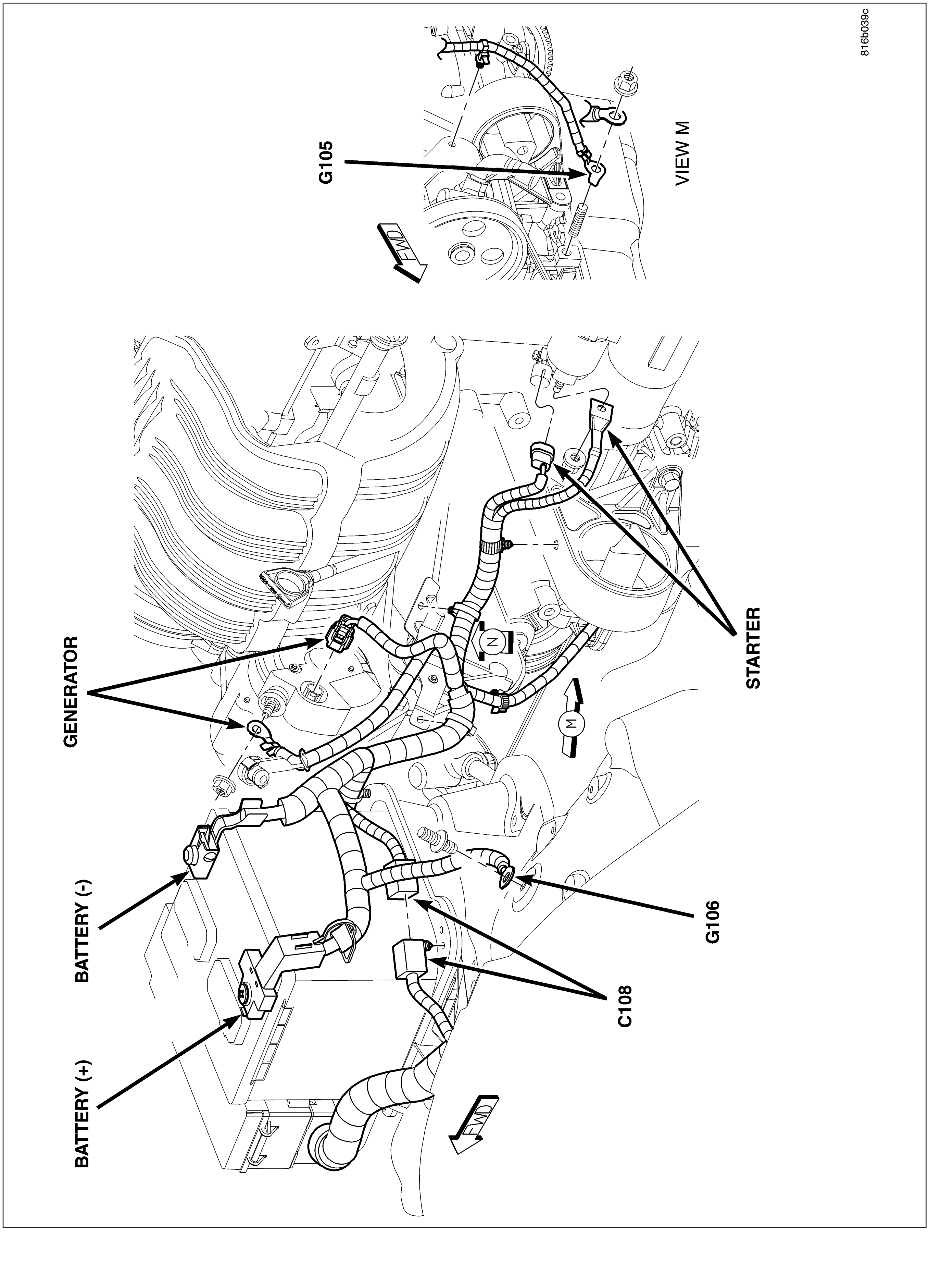



*Fig. 25 LEFT FRONT ENGINE COMPARTMENT*

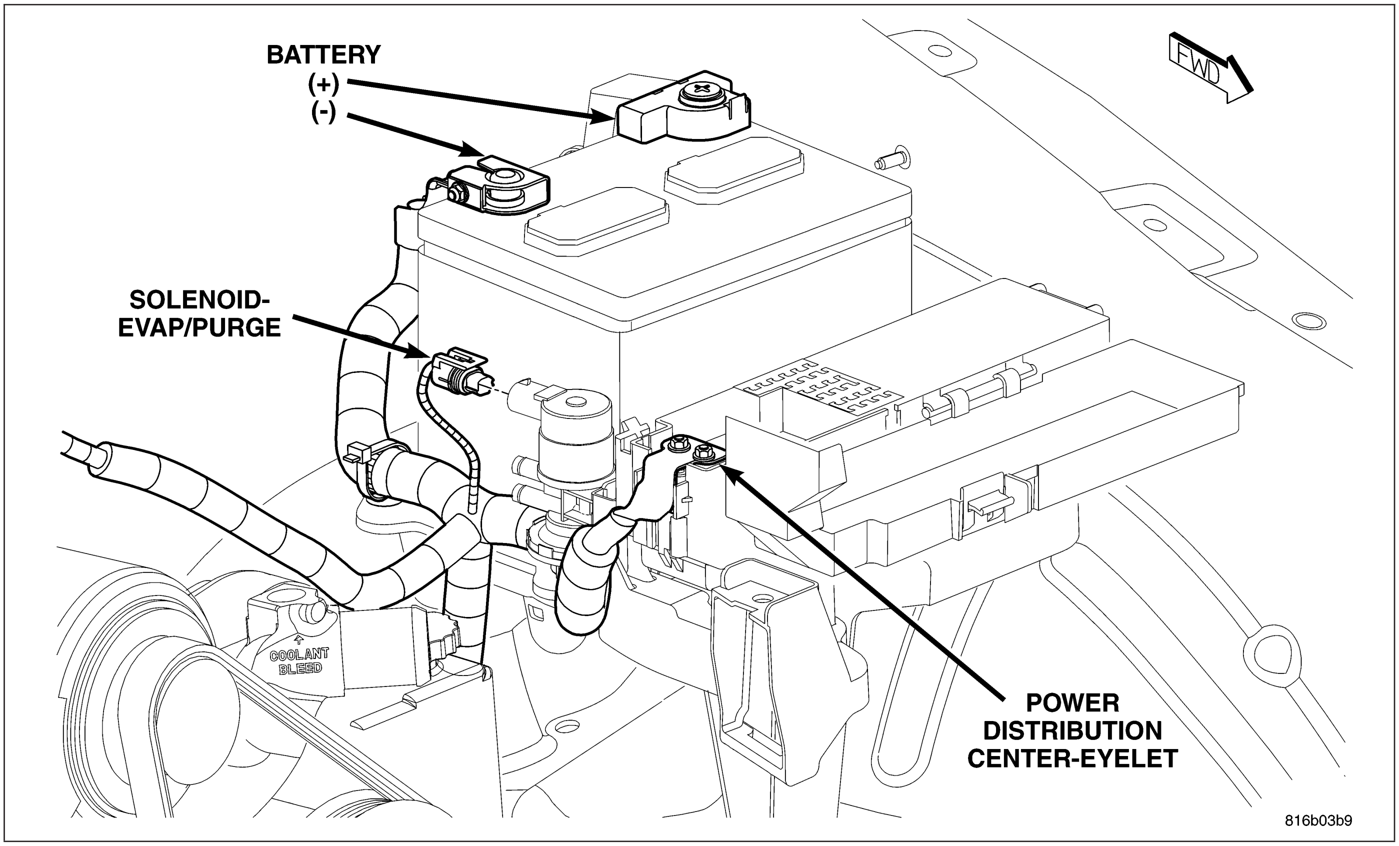



*Fig. 26 LEFT ENGINE COMPARTMENT (GAS)*

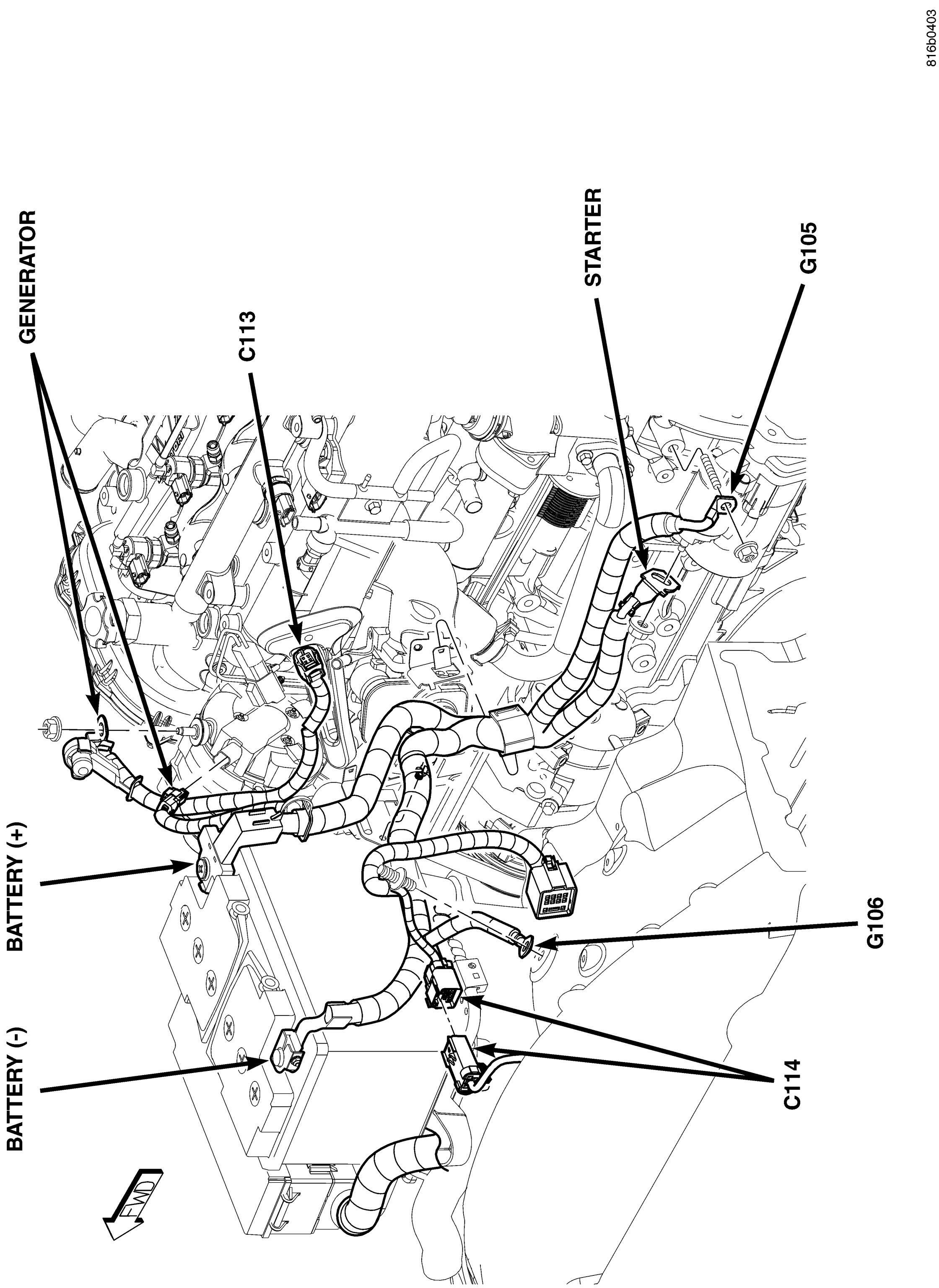



*Fig. 27 LEFT FRONT ENGINE COMPARTMENT (DIESEL)*

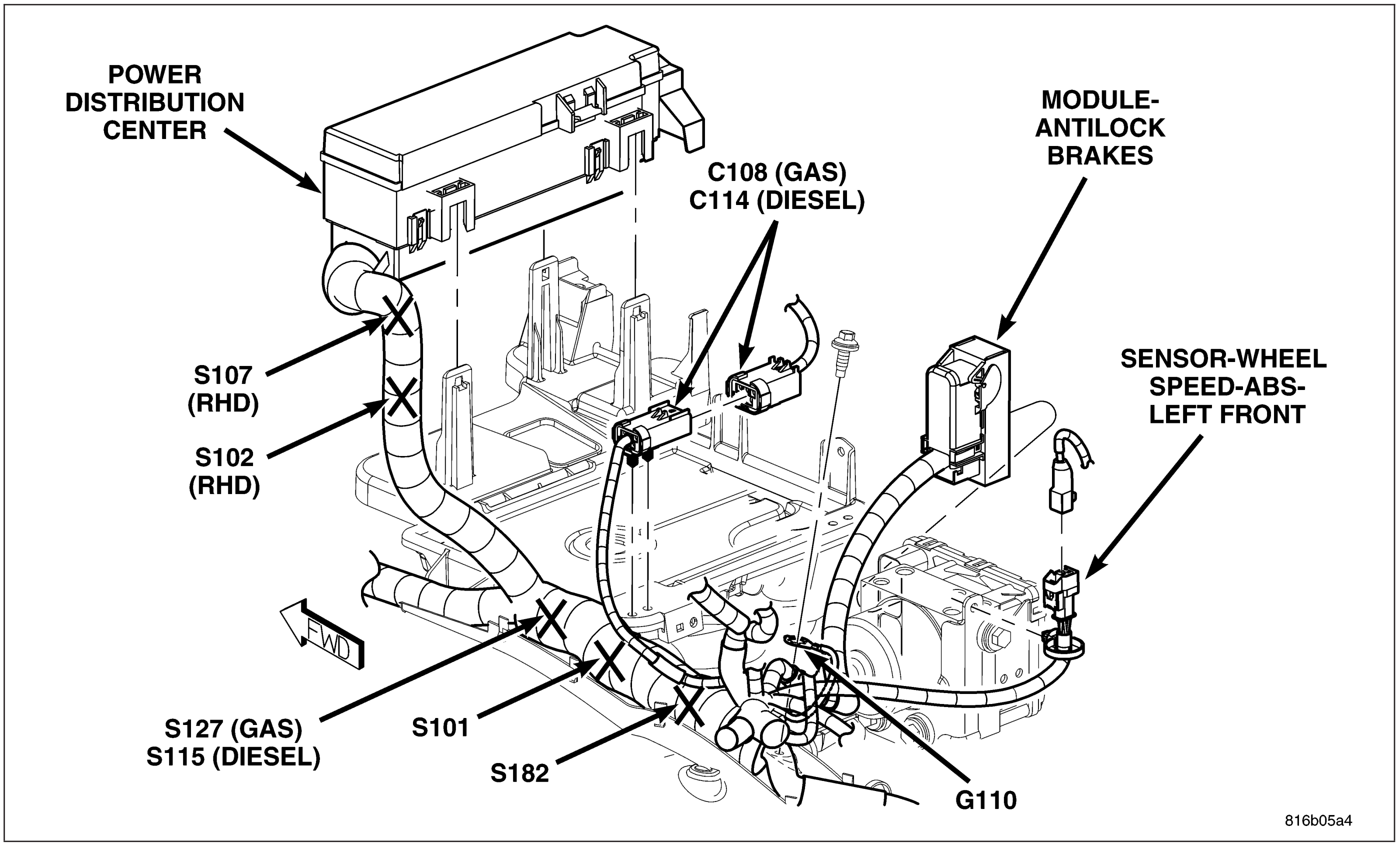



*Fig. 28 LEFT SIDE ENGINE COMPARTMENT*

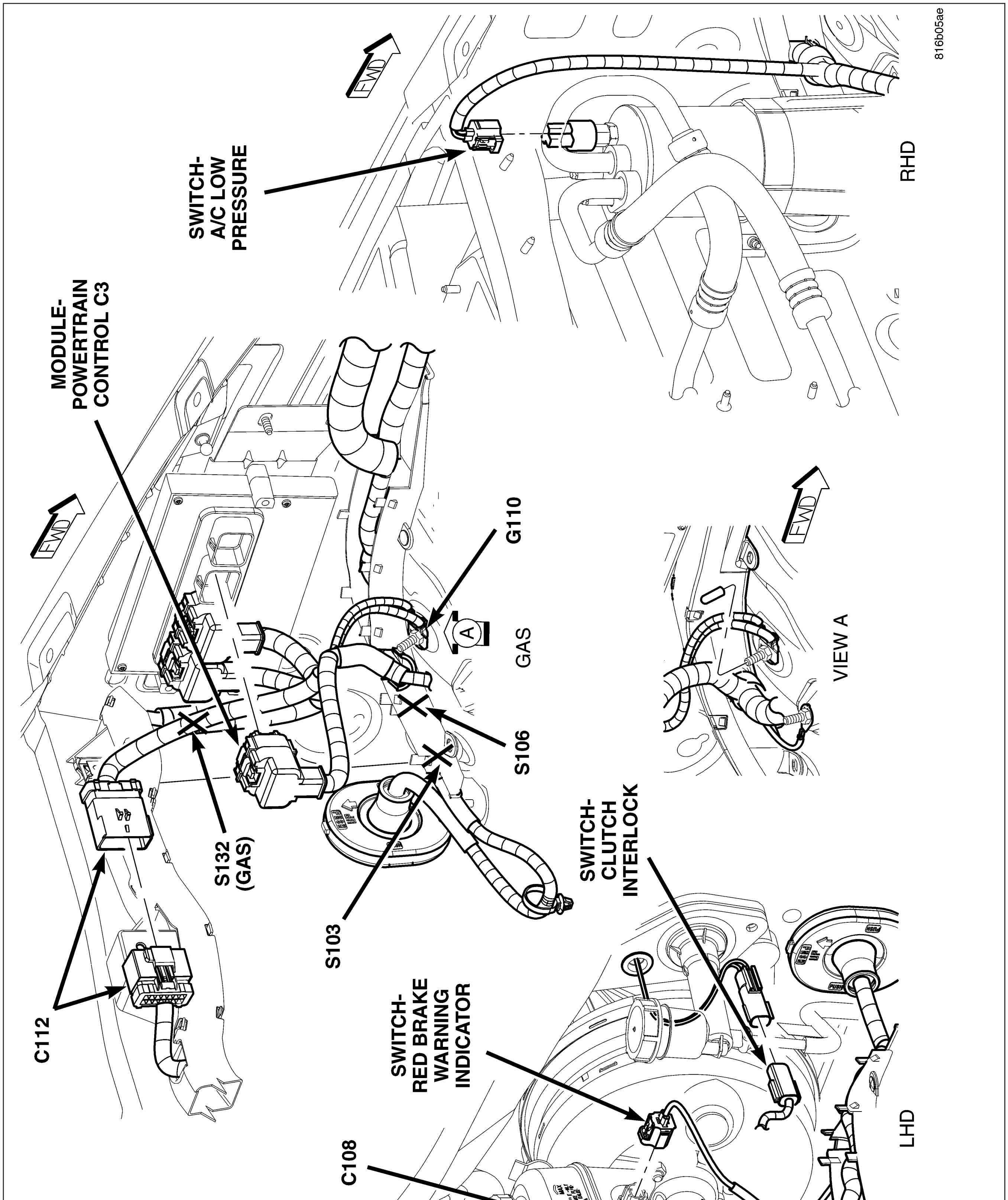



*Fig. 29 REAR ENGINE COMPARTMENT*

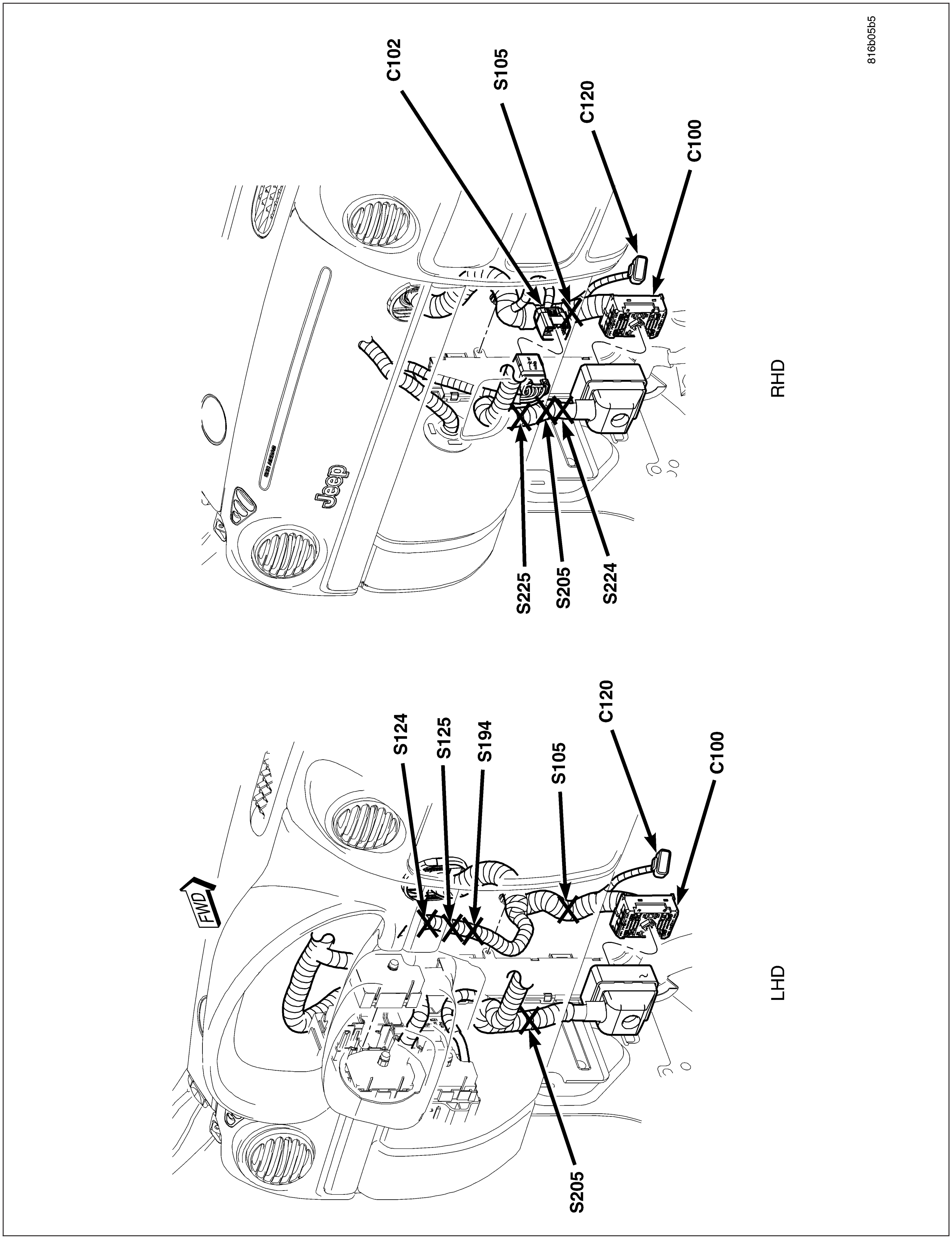



*Fig. 30 ENGINE TO INSTRUMENT PANEL*

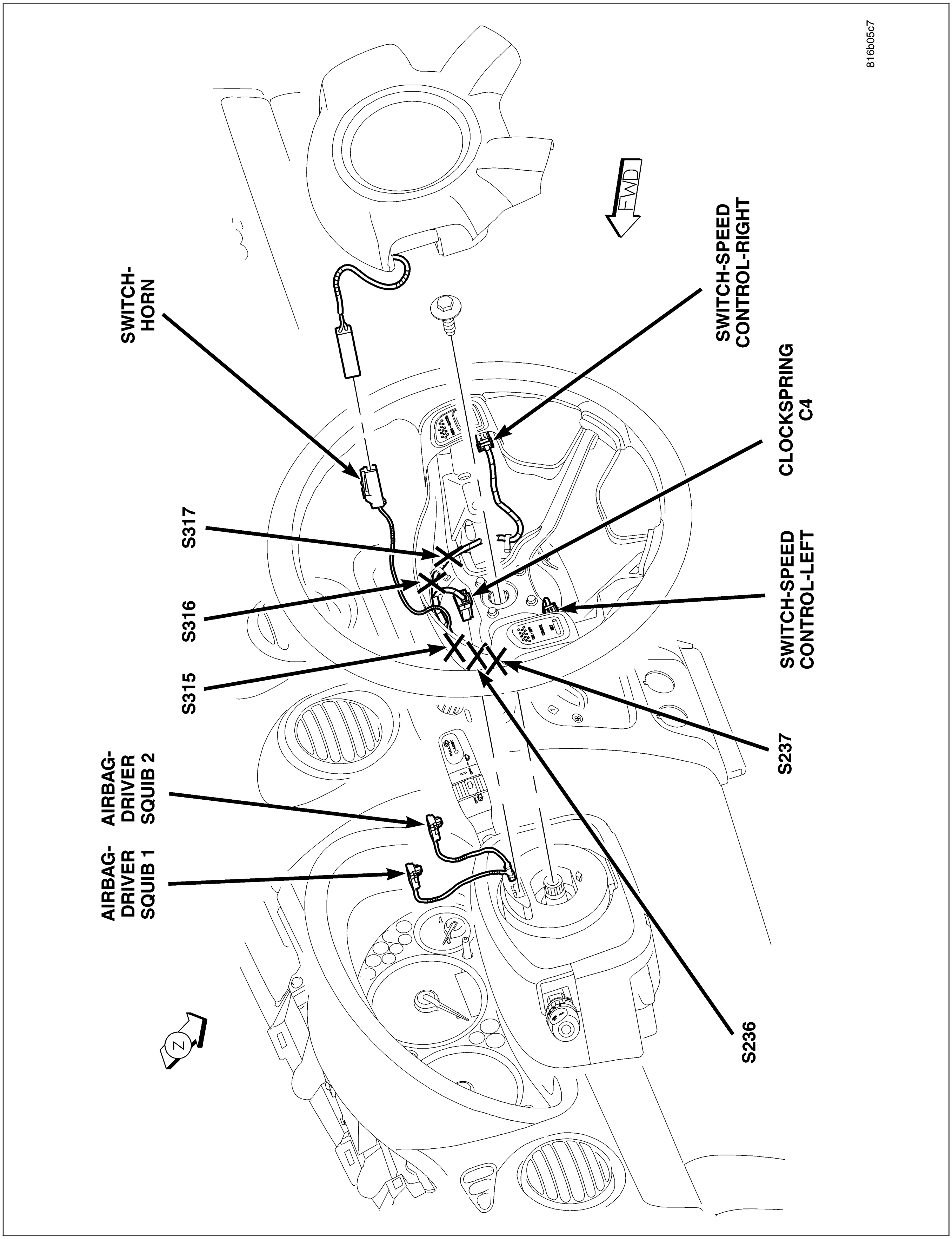



*Fig. 31 STEERING WHEEL*

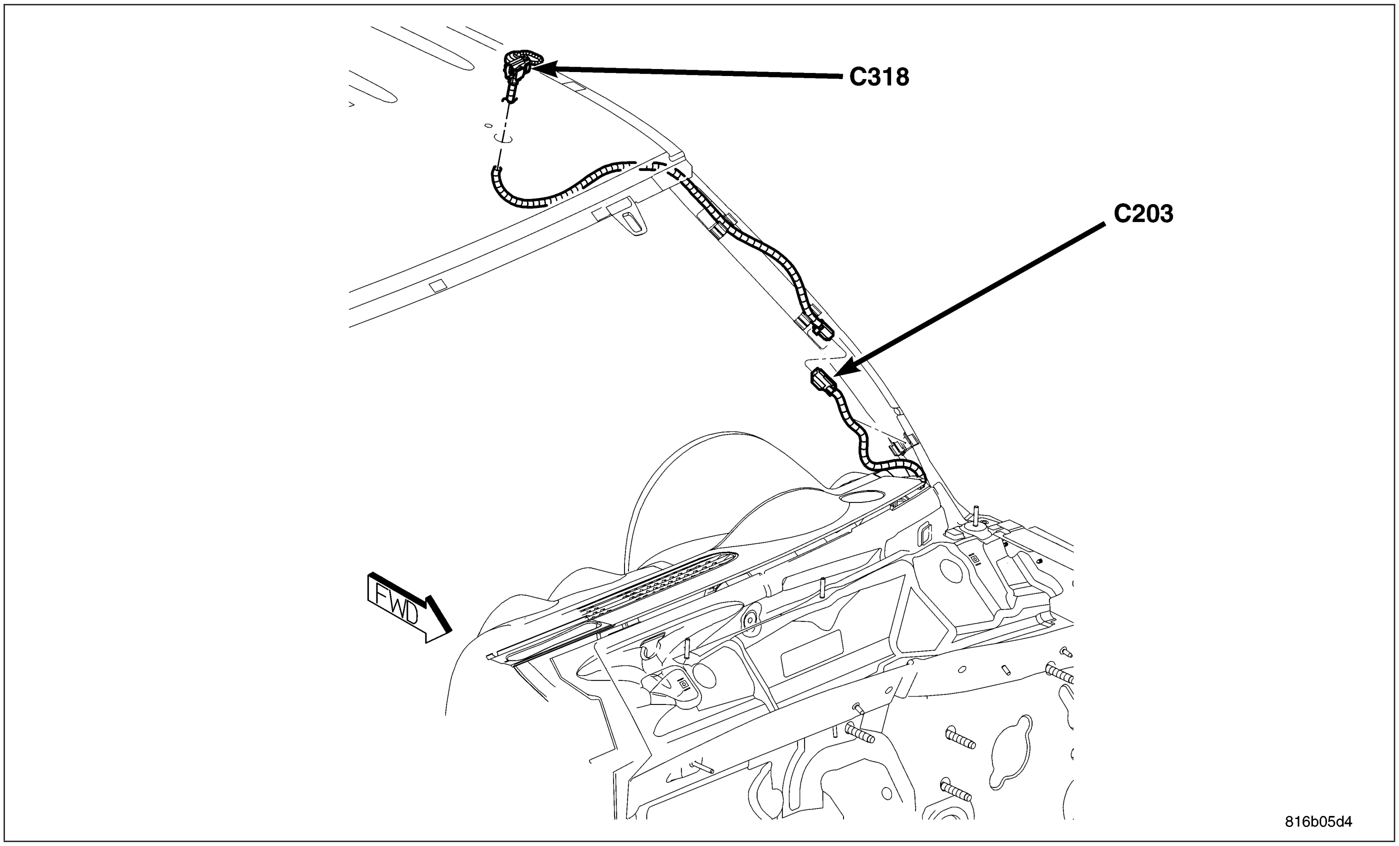



*Fig. 32 LEFT A POST*

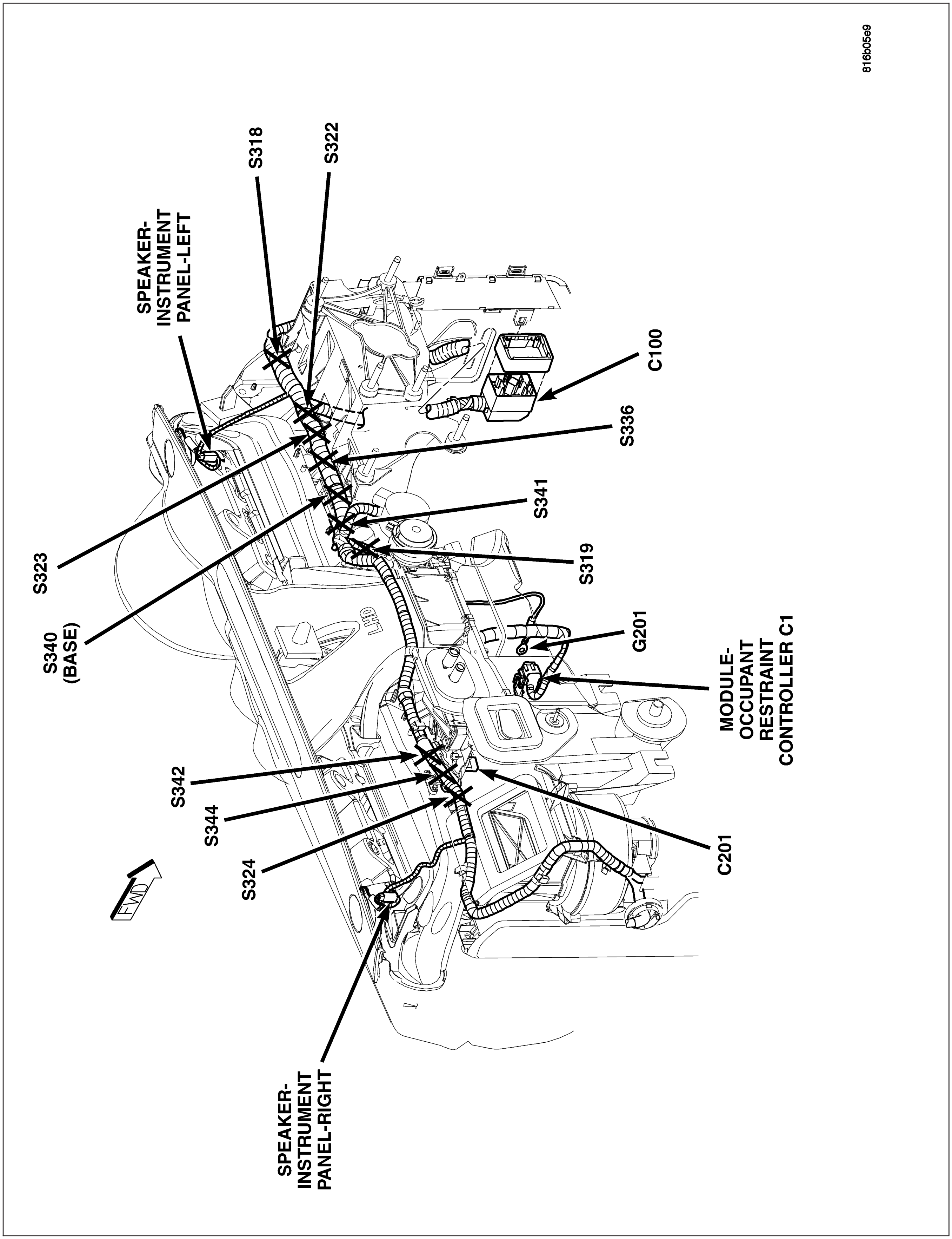



Fig. 33 INSTRUMENT PANEL LHD

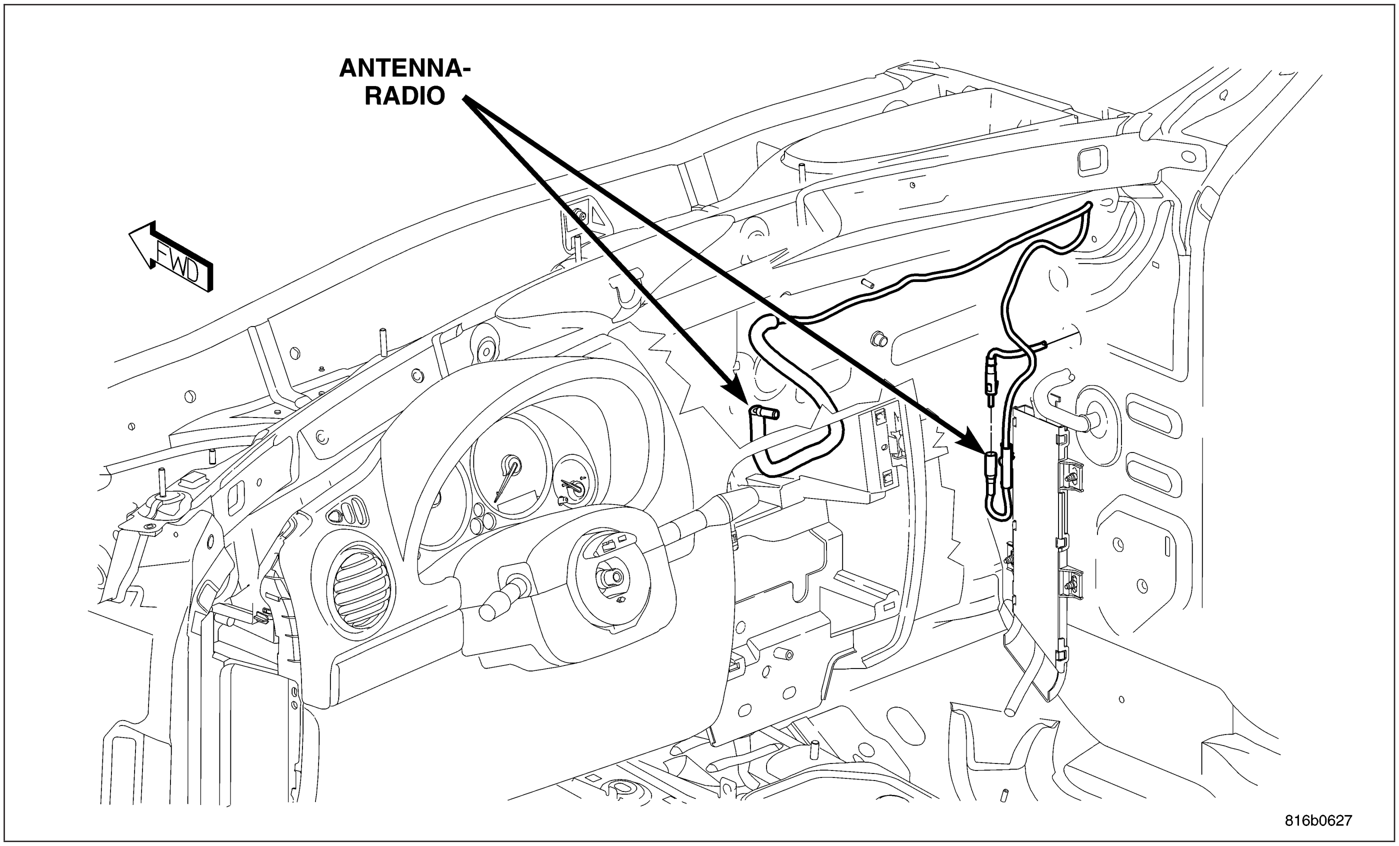



Fig. 34 RIGHT INSTRUMENT PANEL (EXCEPT EXPORT)

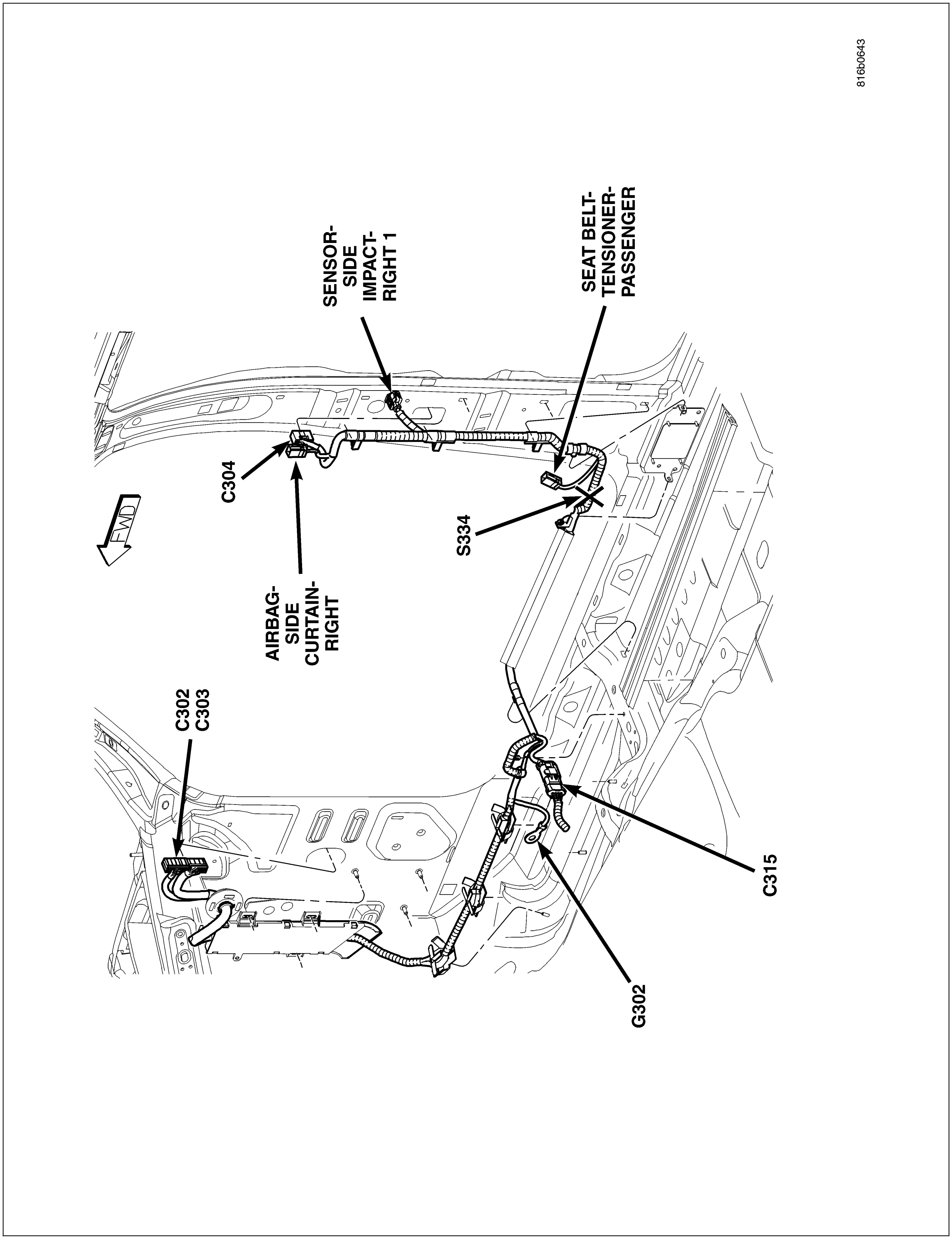



Fig. 35 RIGHT FRONT BODY LHD

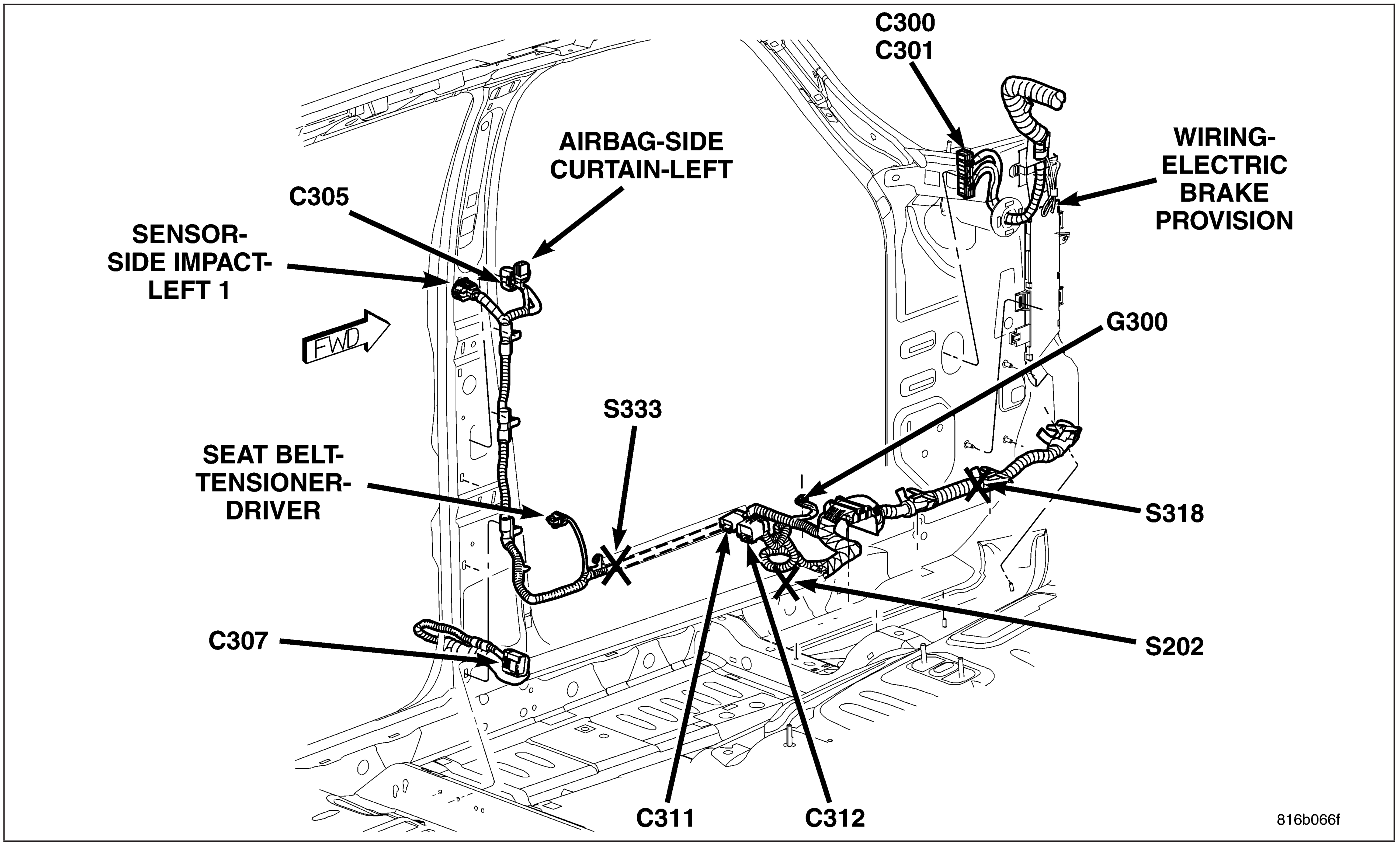



*Fig. 36 LEFT FRONT BODY LHD*

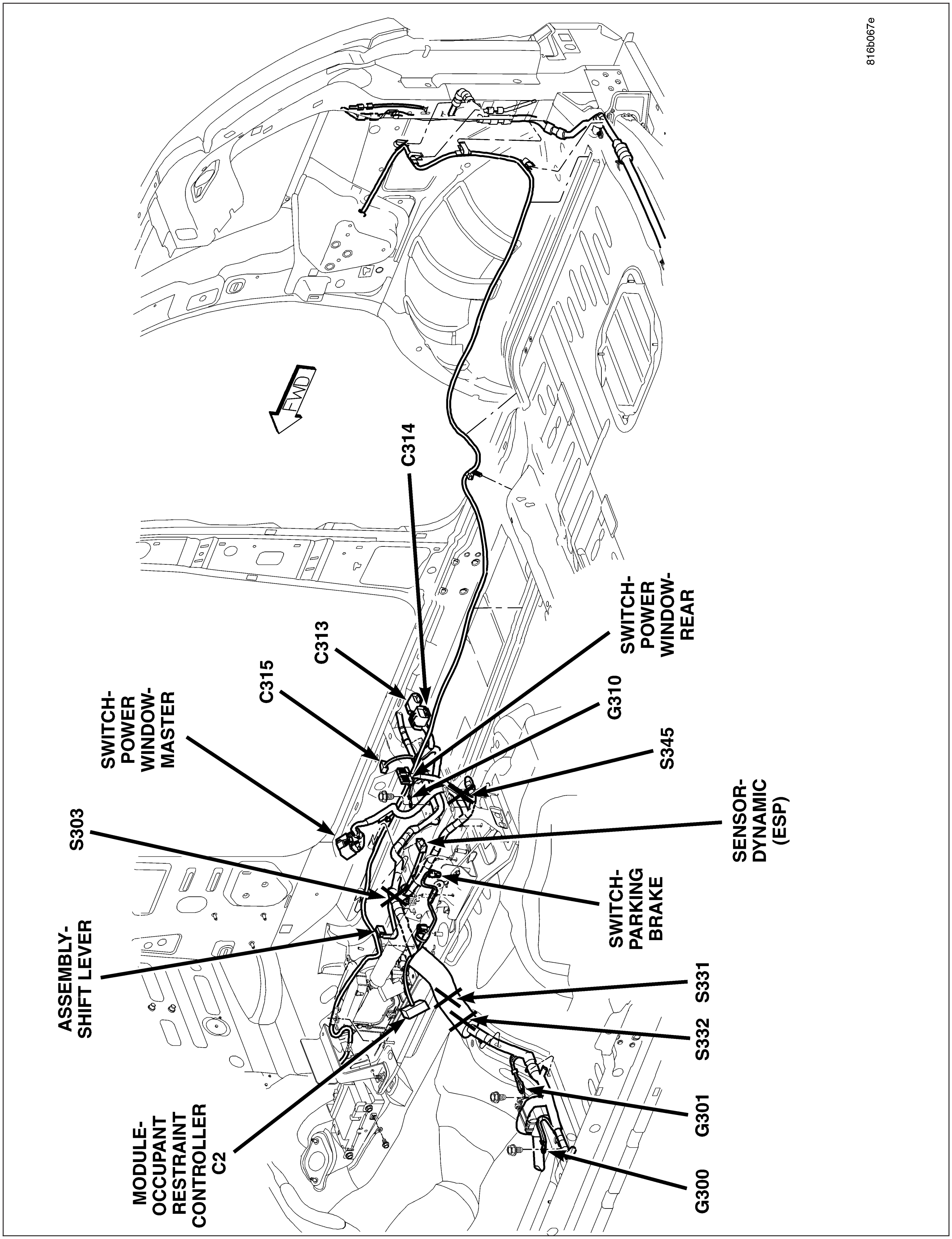



*Fig. 37 RIGHT FRONT BODY LHD*

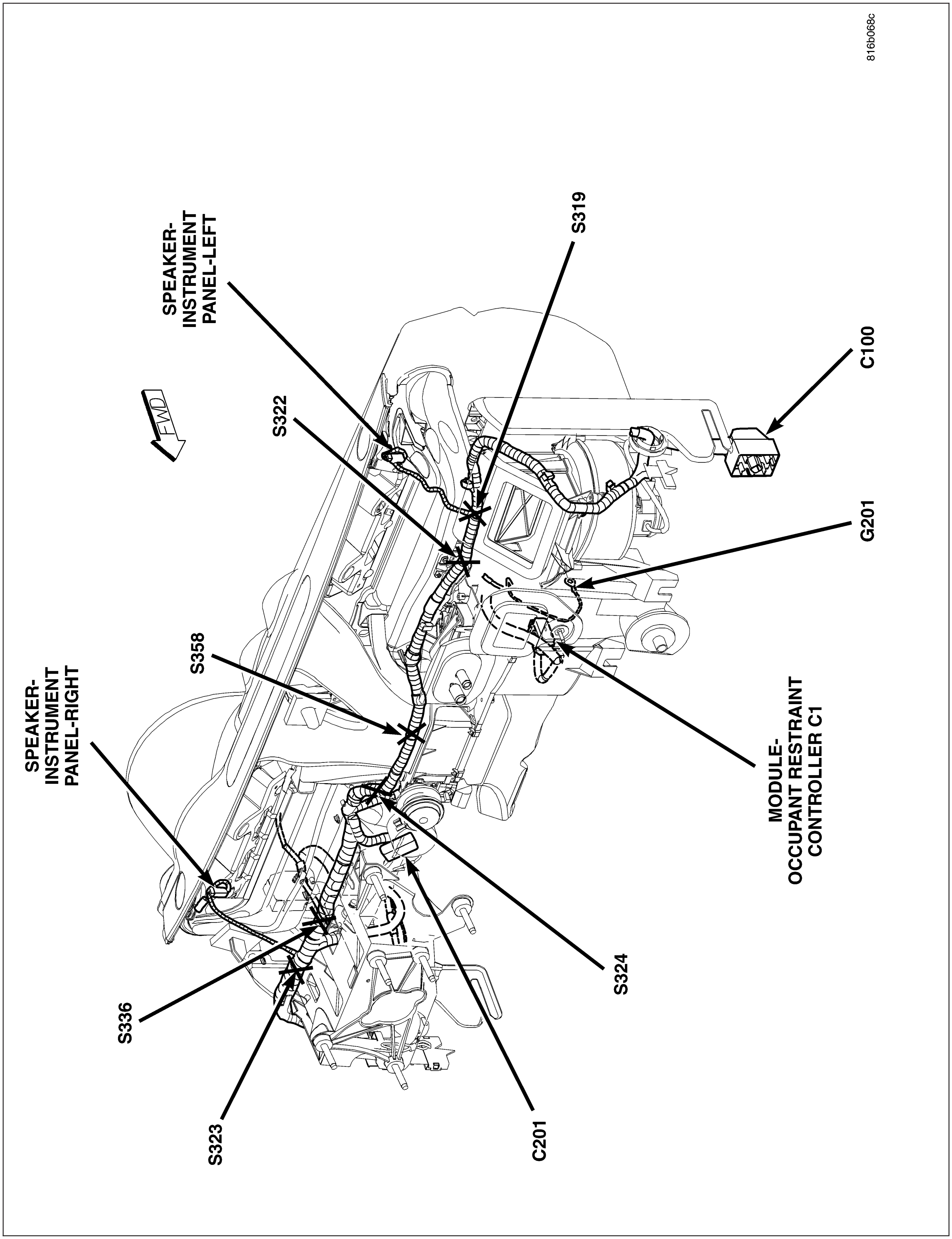



*Fig. 38 INSTRUMENT PANEL RHD*

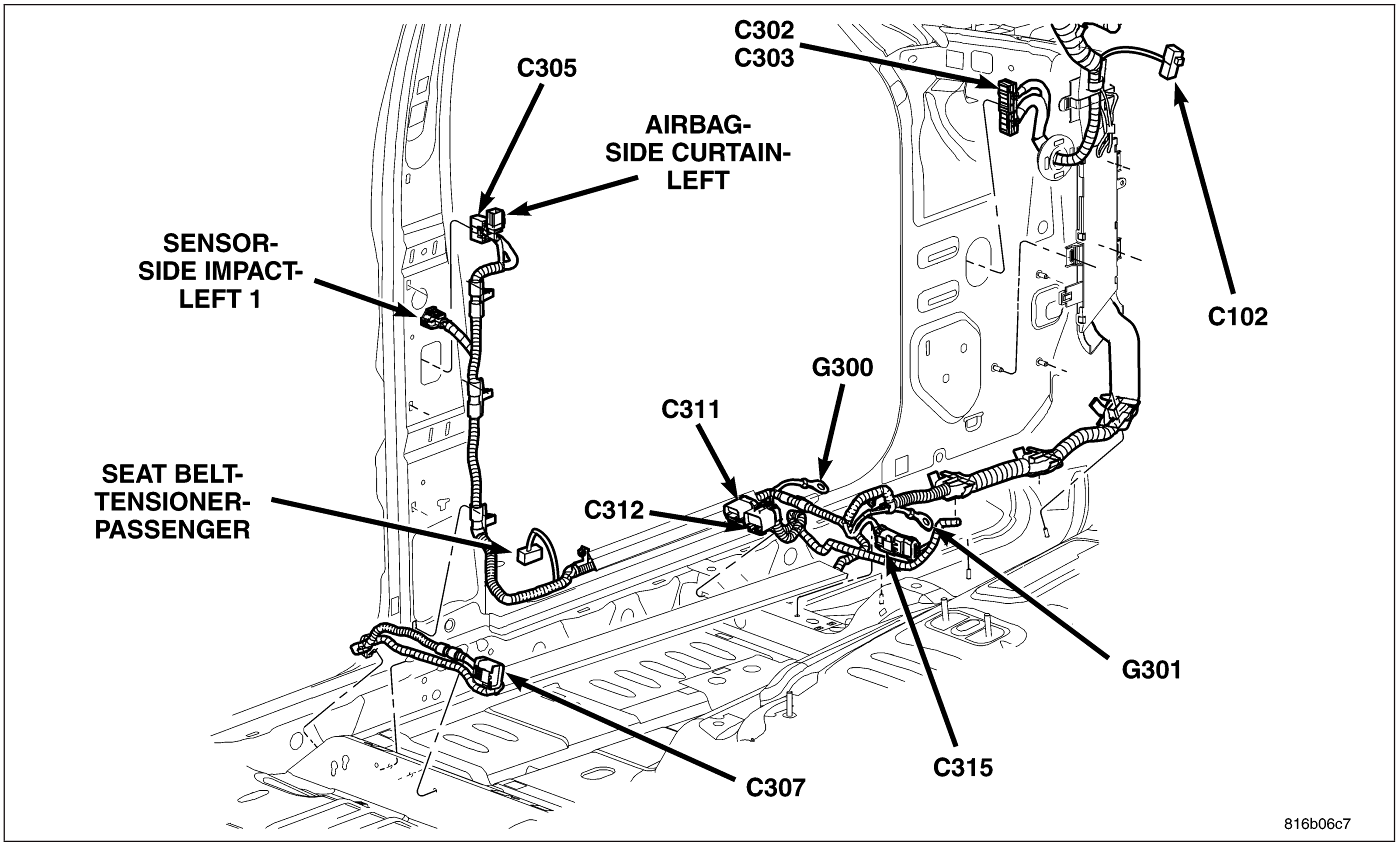



*Fig. 39 LEFT FRONT BODY RHD*

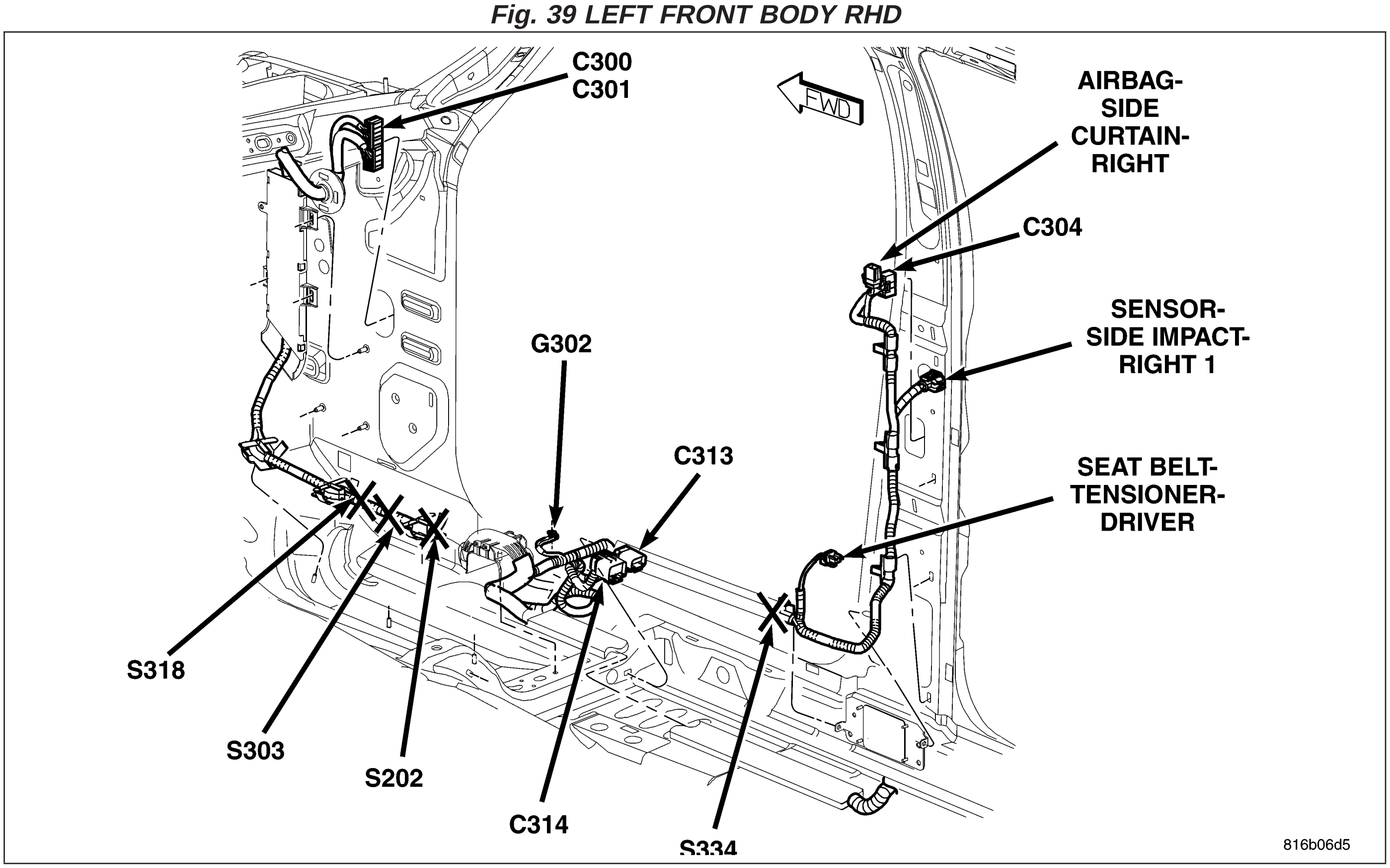



*Fig. 40 RIGHT FRONT BODY RHD*

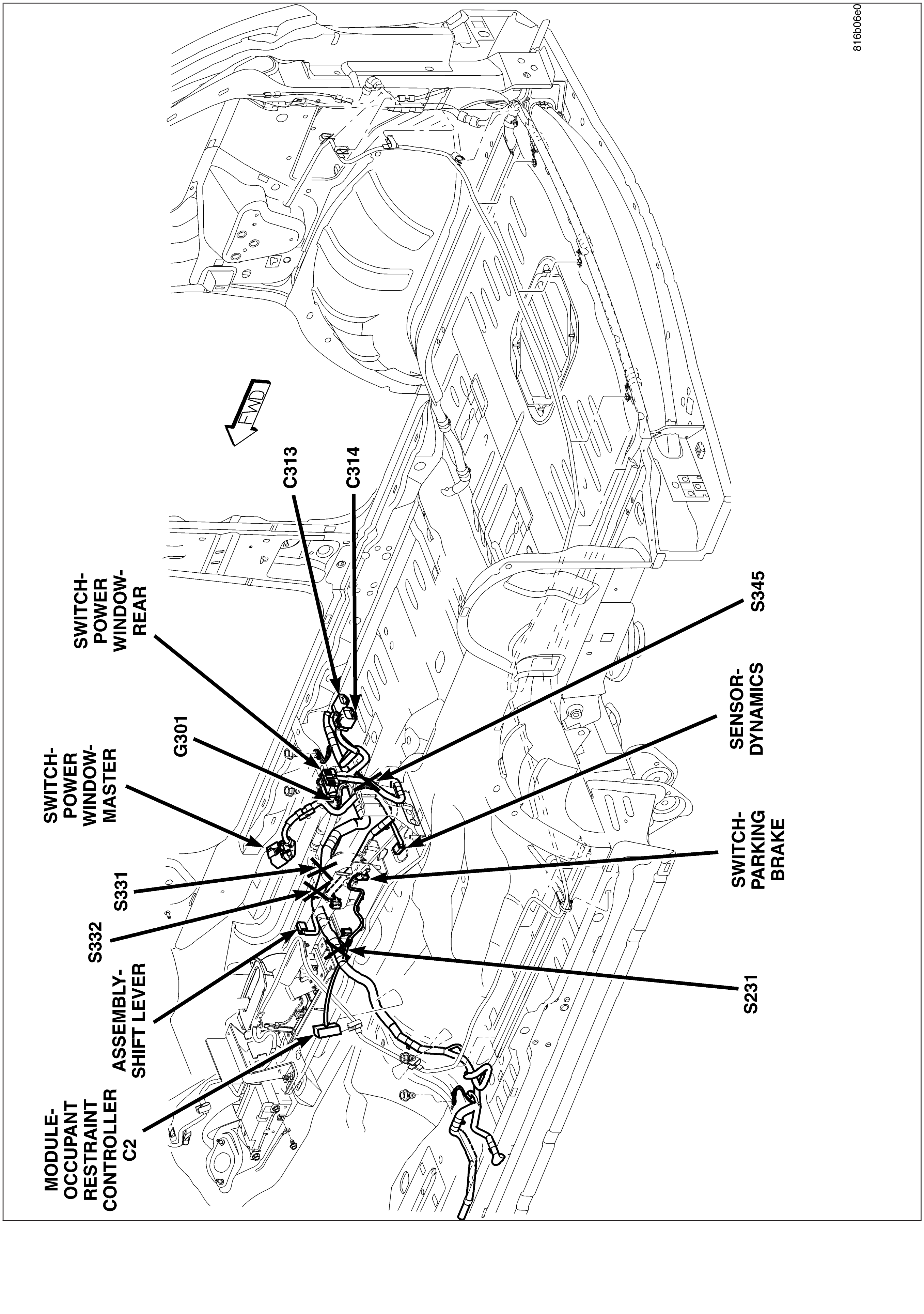



Fig. 41 RIGHT FRONT BODY RHD

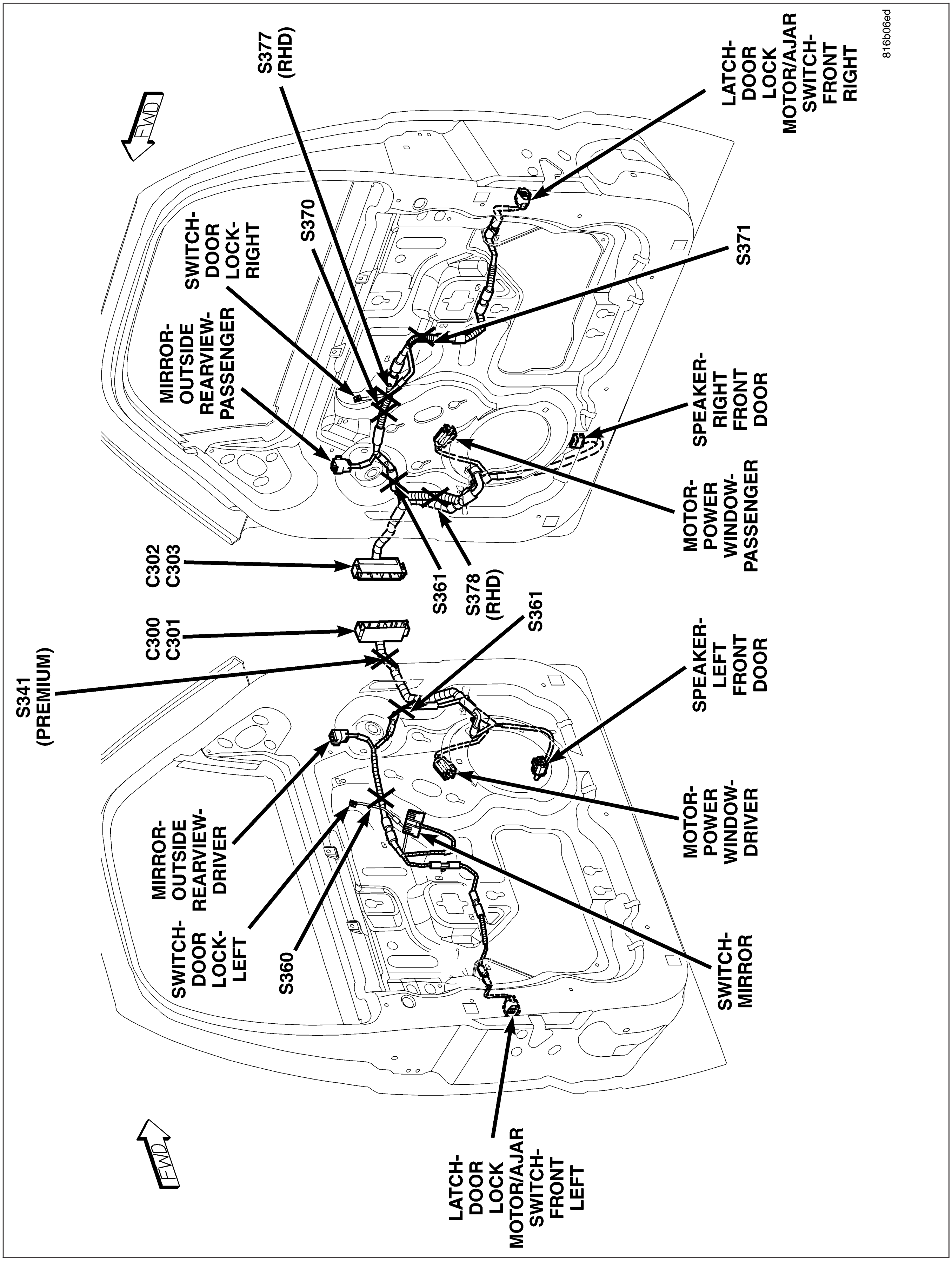



Fig. 42 FRONT DOORS

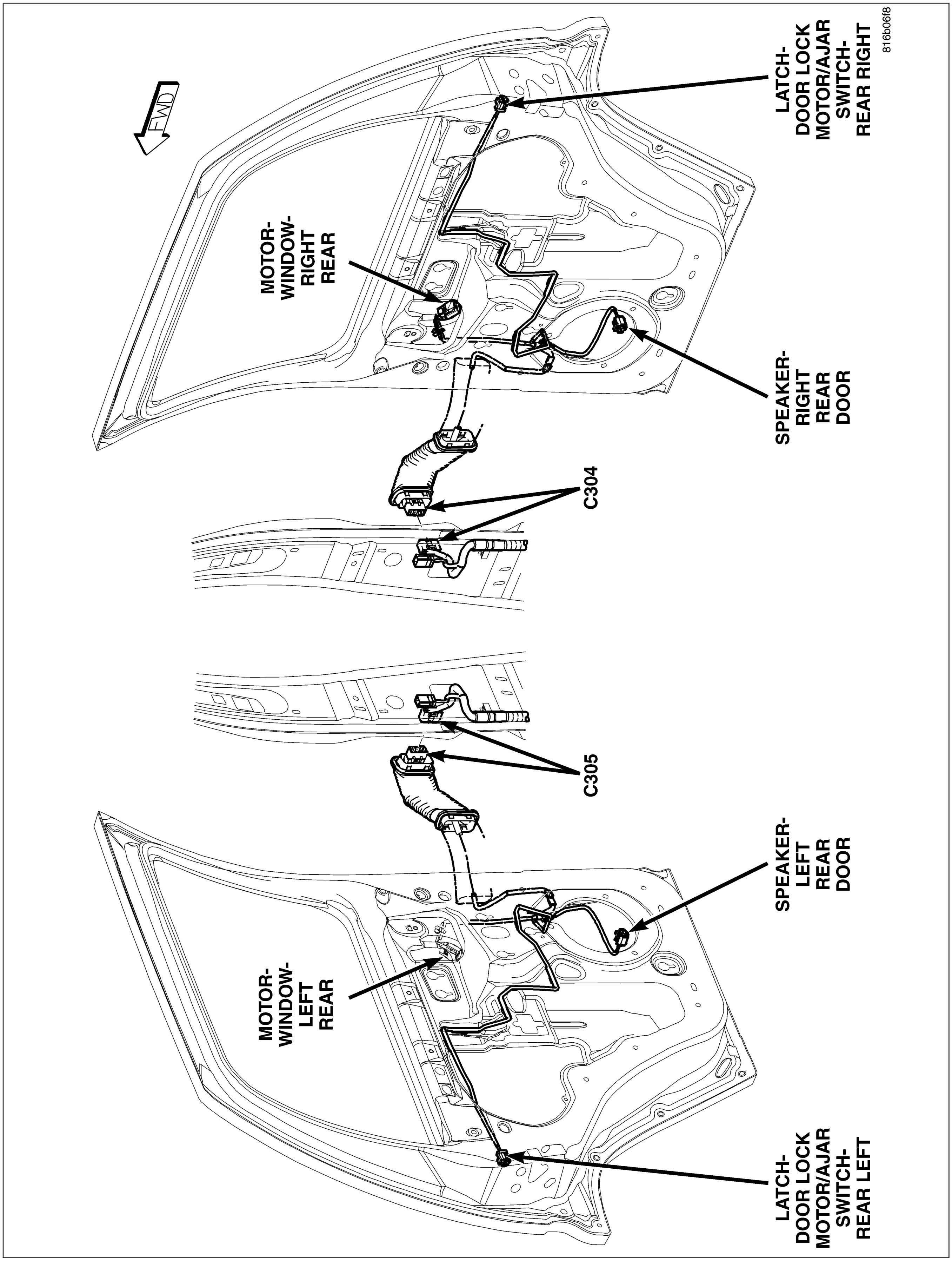



*Fig. 43 REAR DOORS*

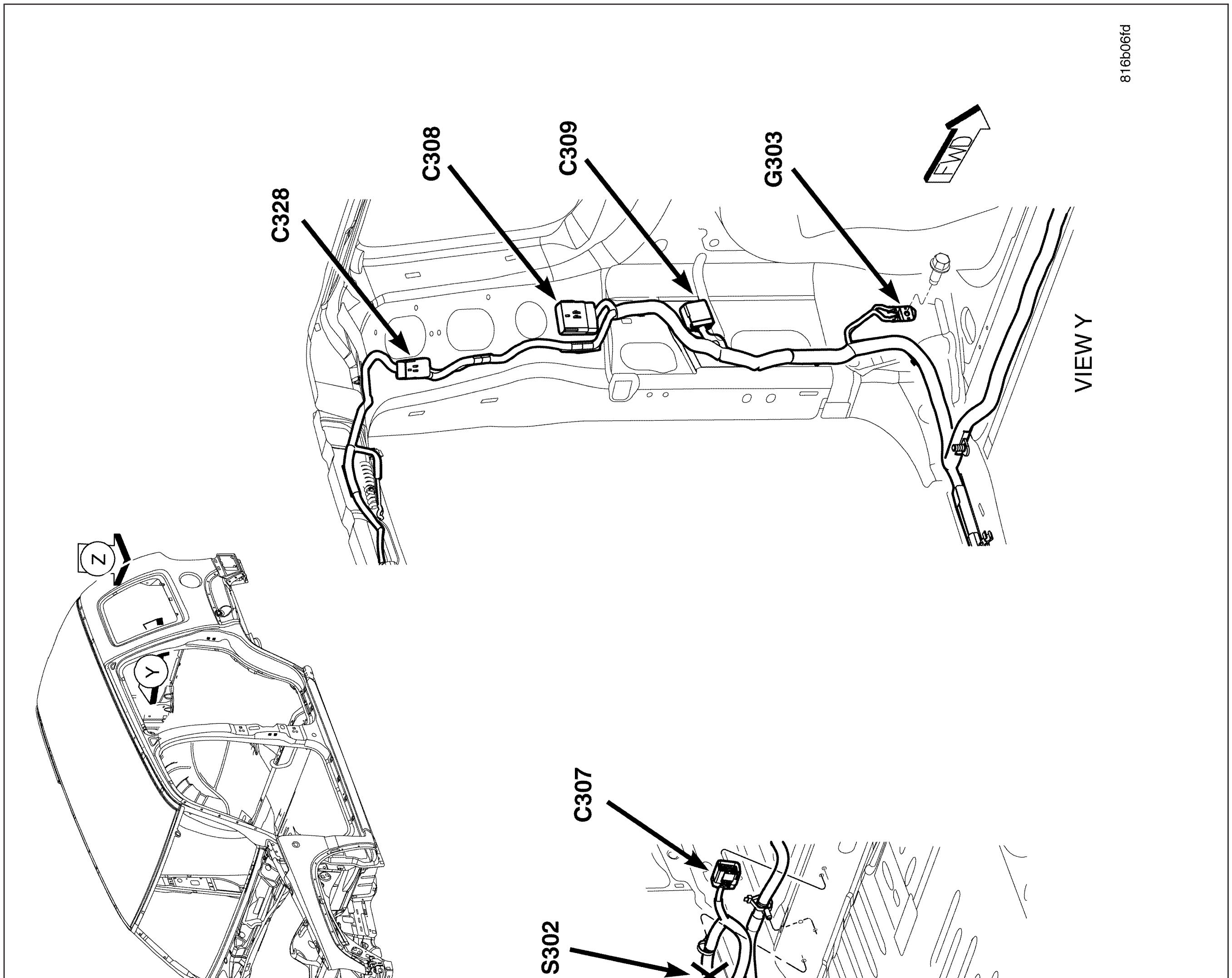



*Fig. 44 LEFT REAR BODY*

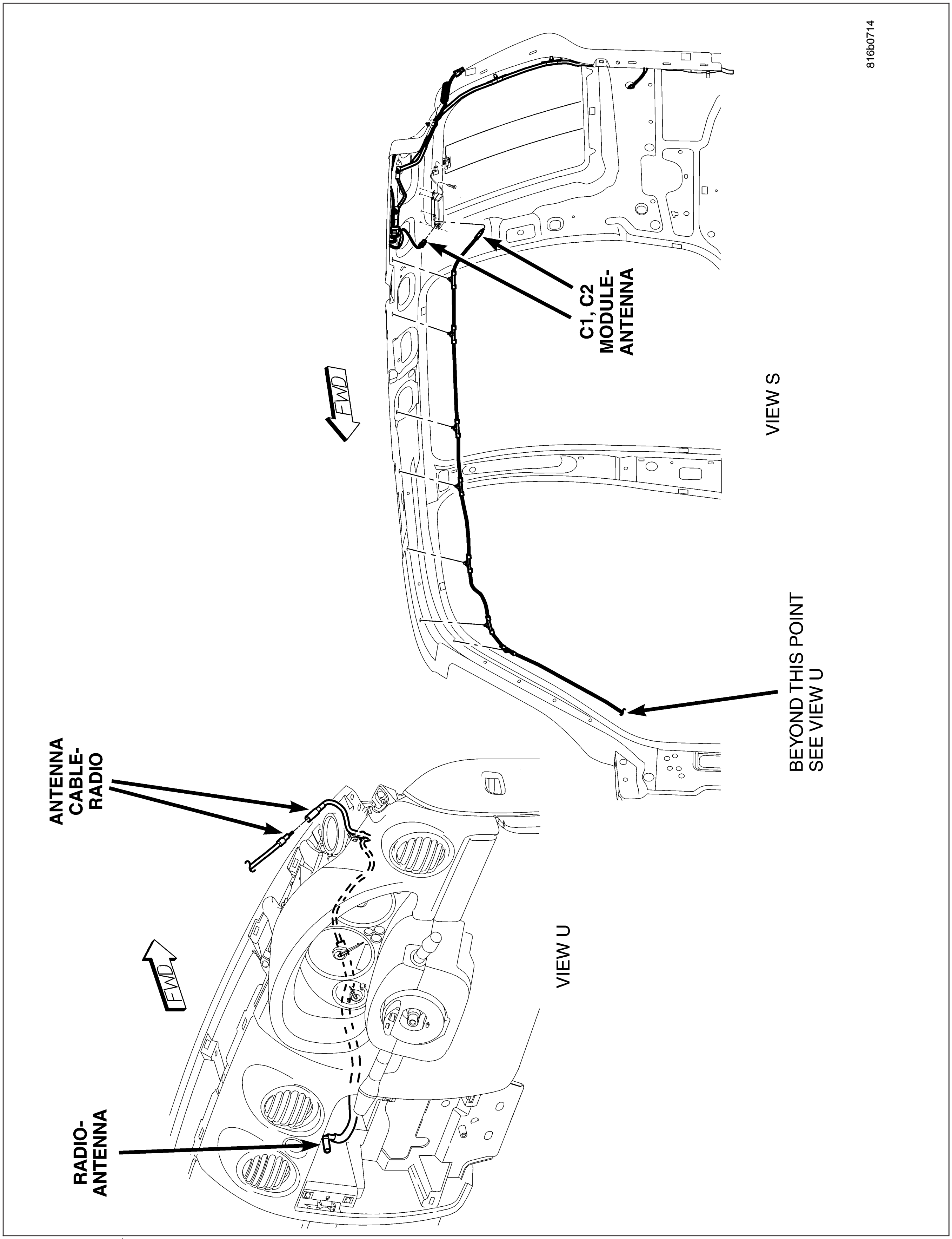



*Fig. 45 RADIO ANTENNA (EXPORT)*

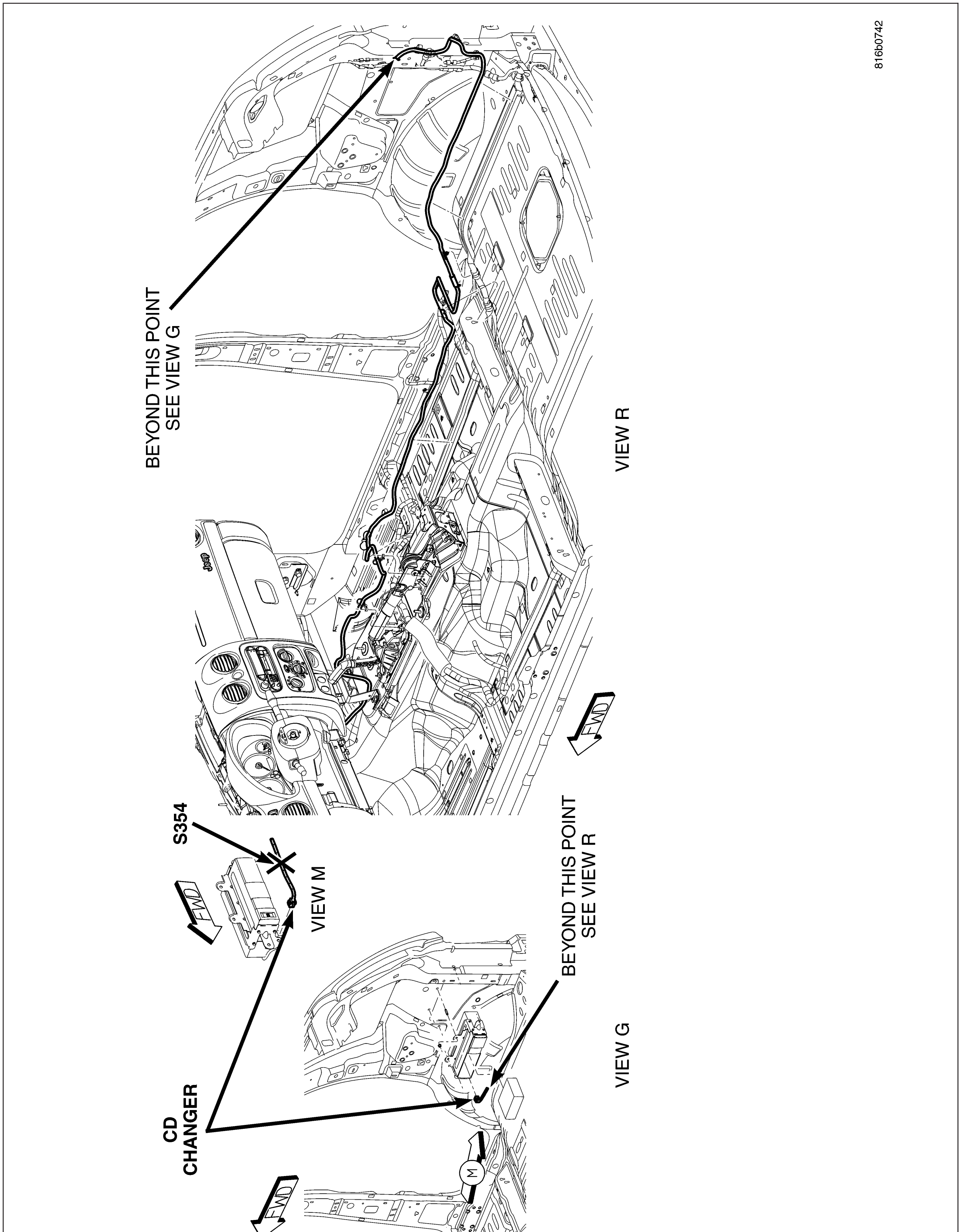



*Fig. 46 CD CHANGER AND CABLE*

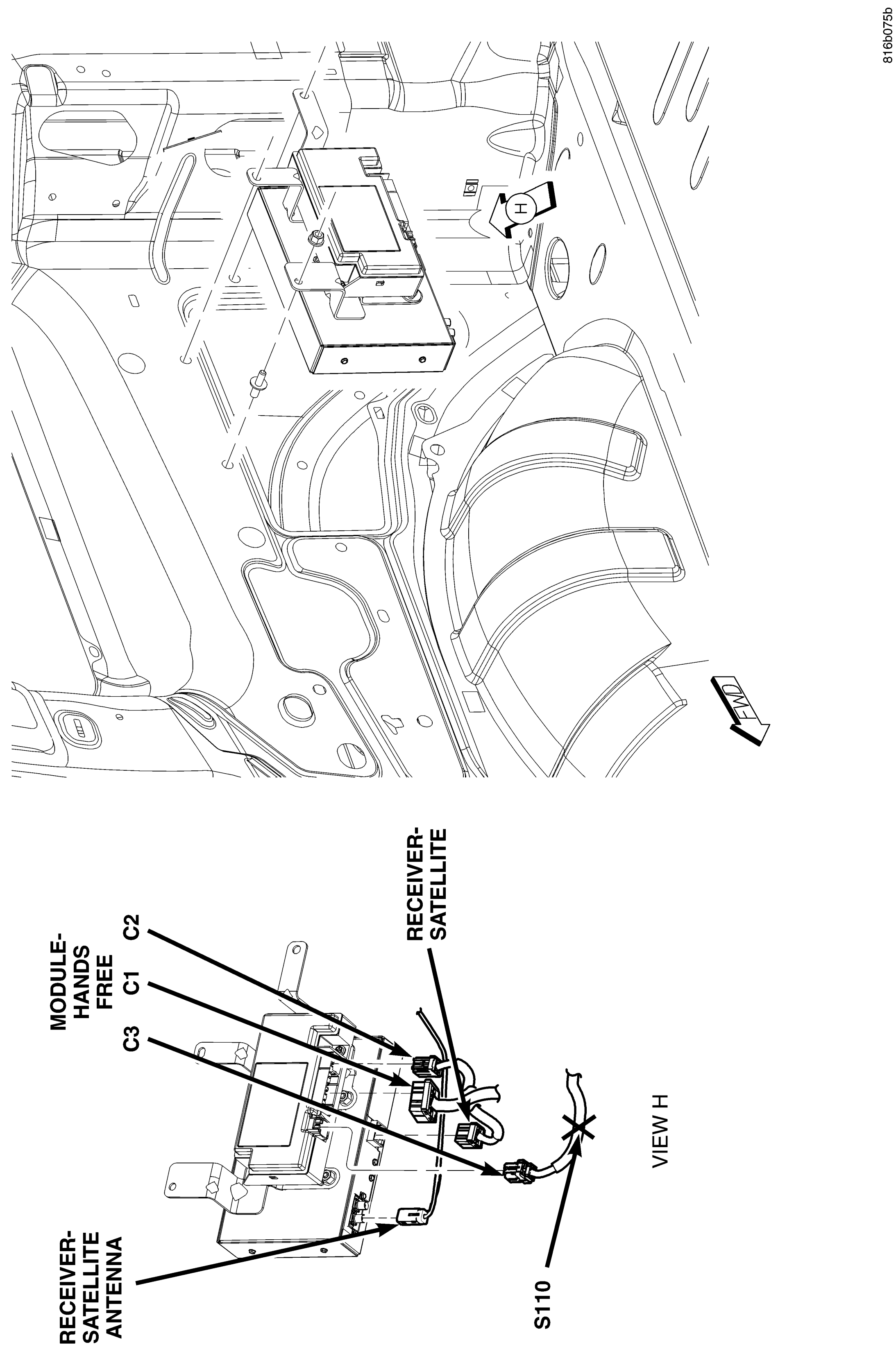



*Fig. 47 RIGHT REAR BODY LOWER CORNER*

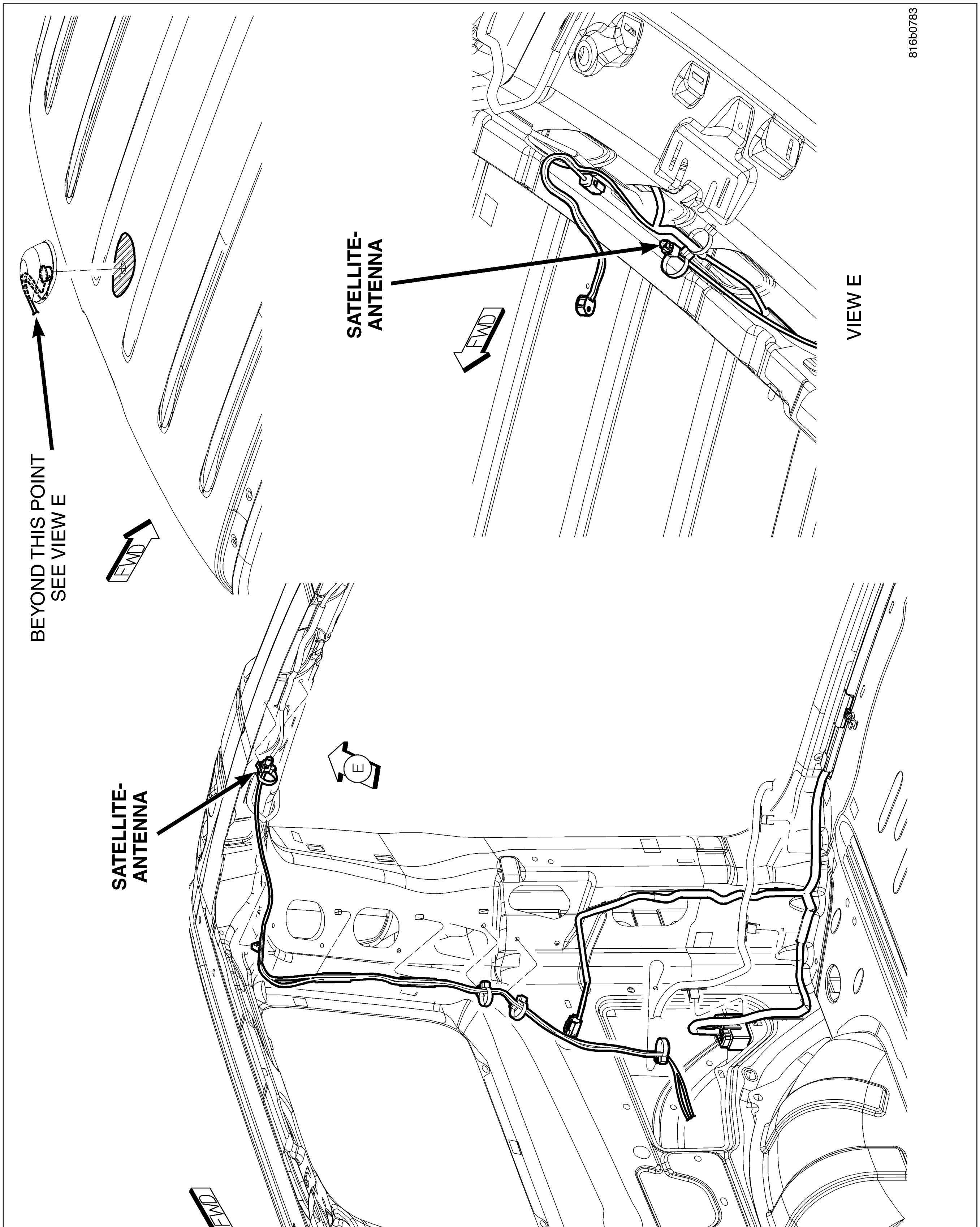



*Fig. 48 RIGHT REAR BODY UPPER CORNER*

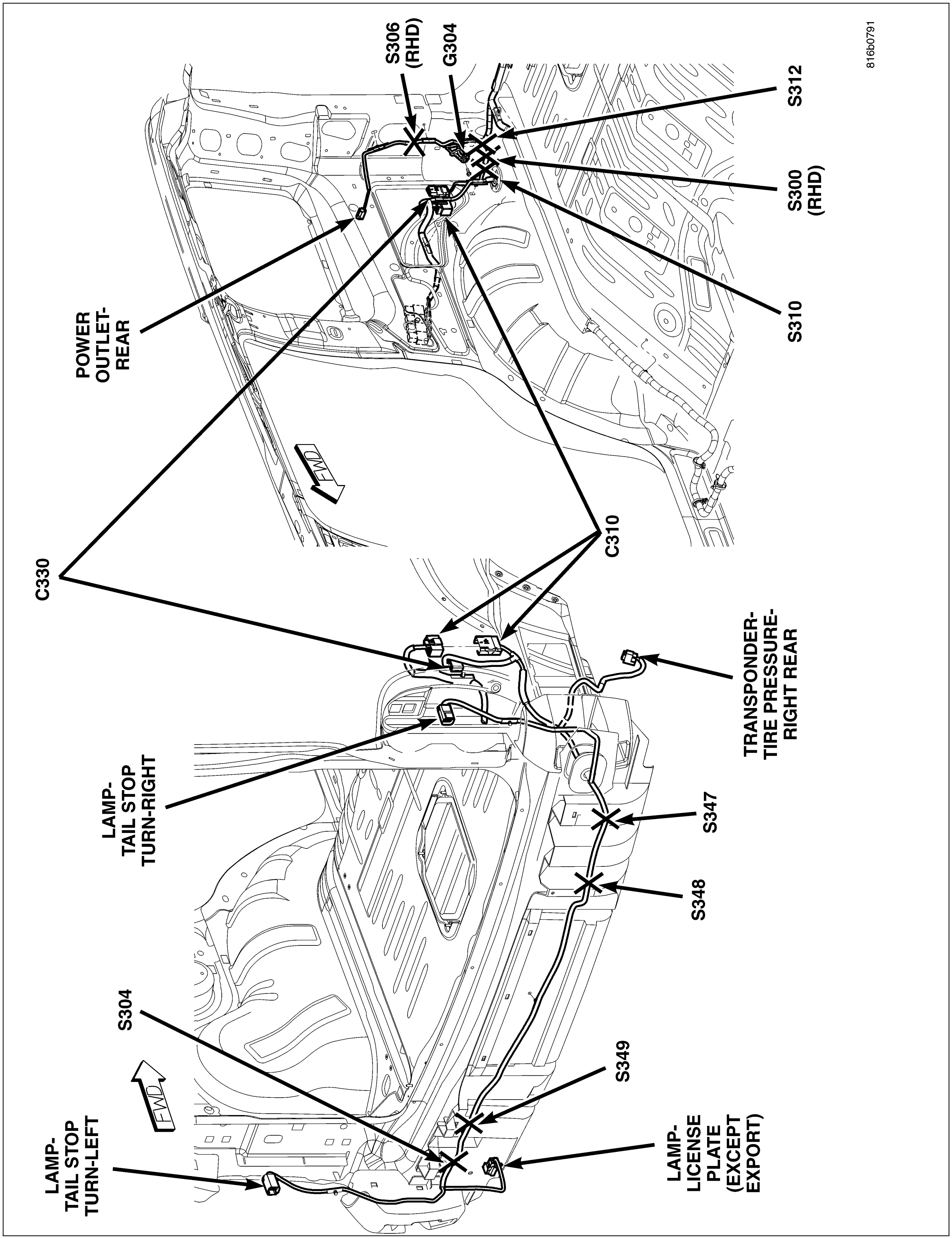



*Fig. 49 REAR BODY*

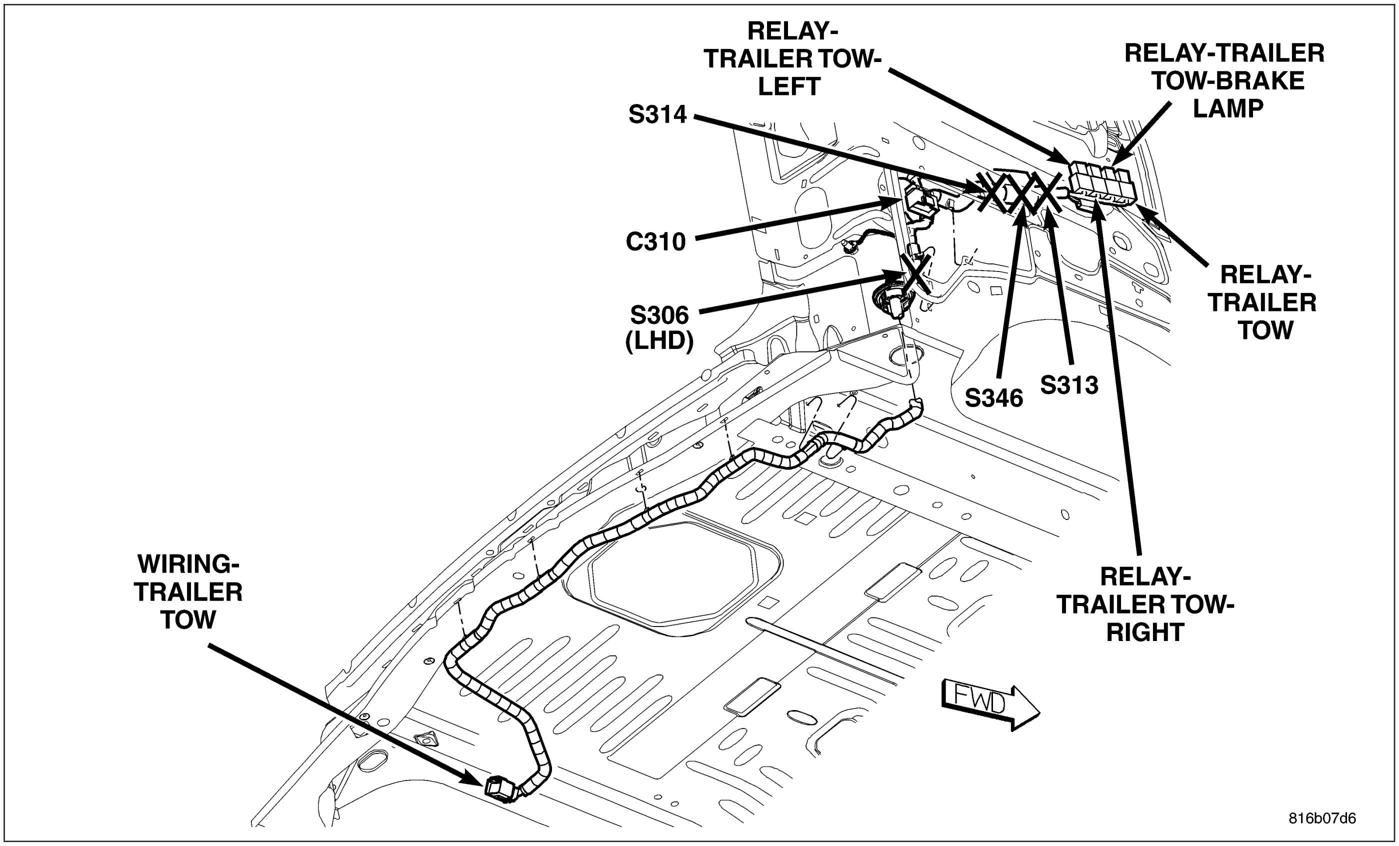



*Fig. 50 TRAILER TOW CONNECTORS*

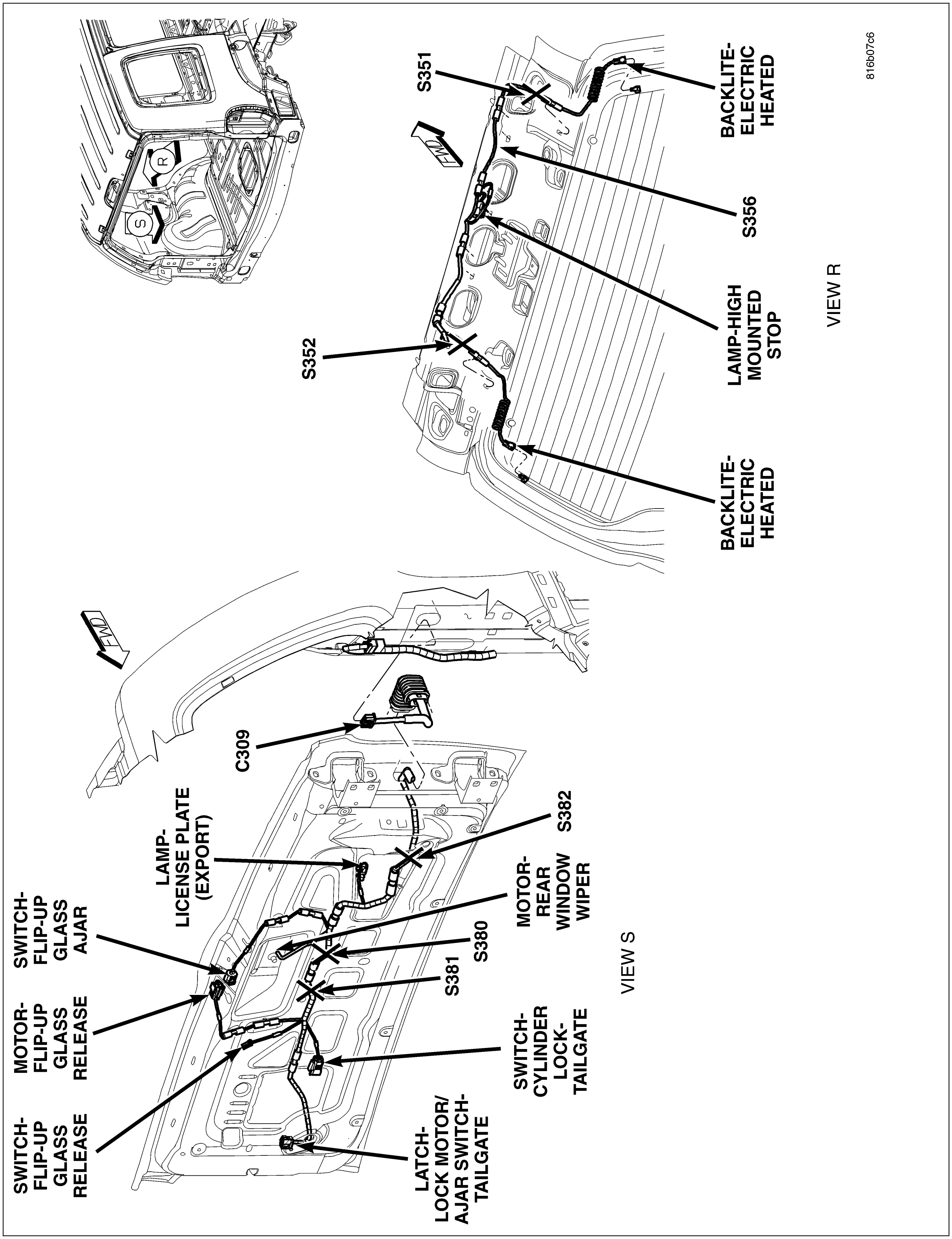



*Fig. 51 TAILGATE*

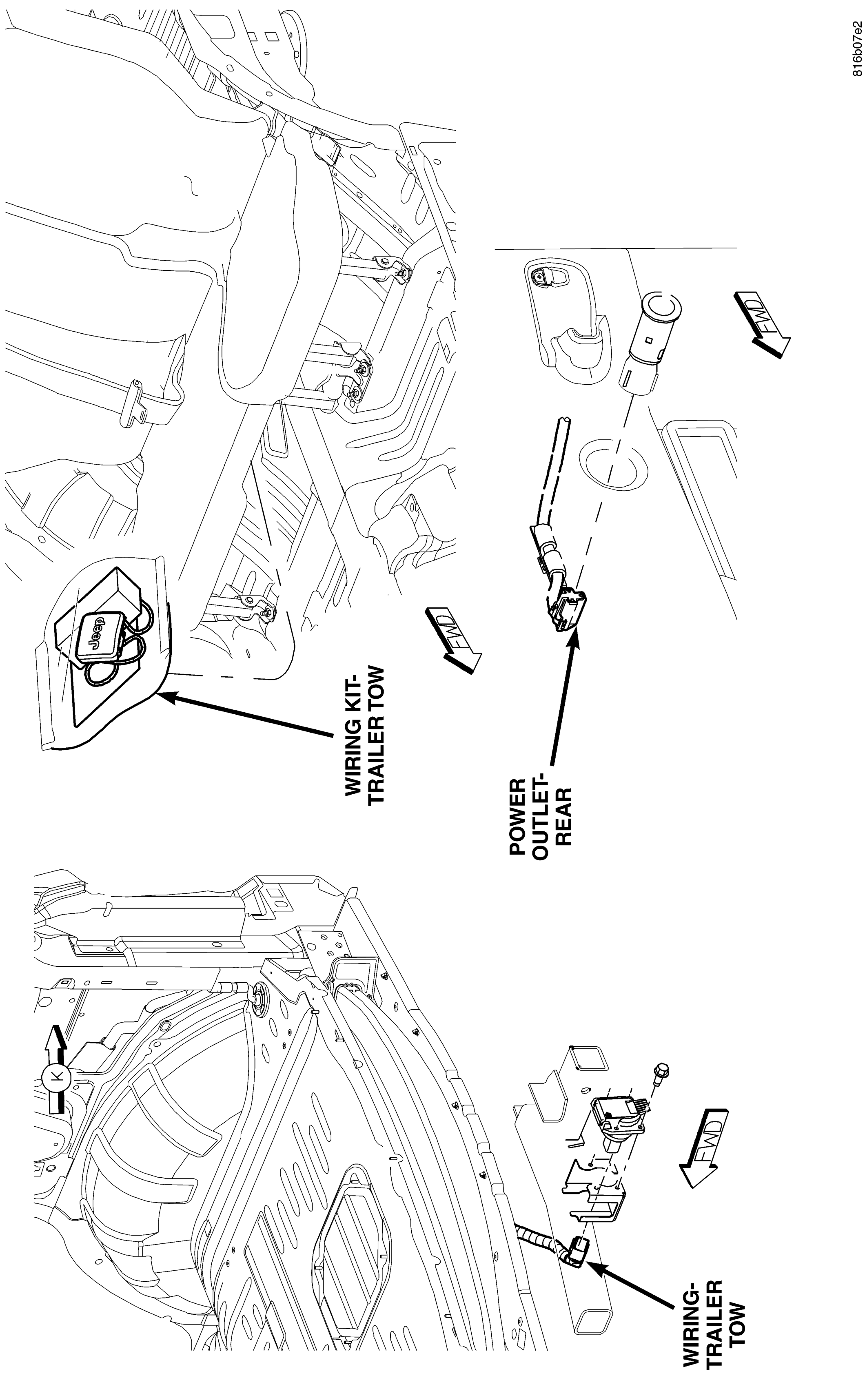



*Fig. 52 REAR BODY*

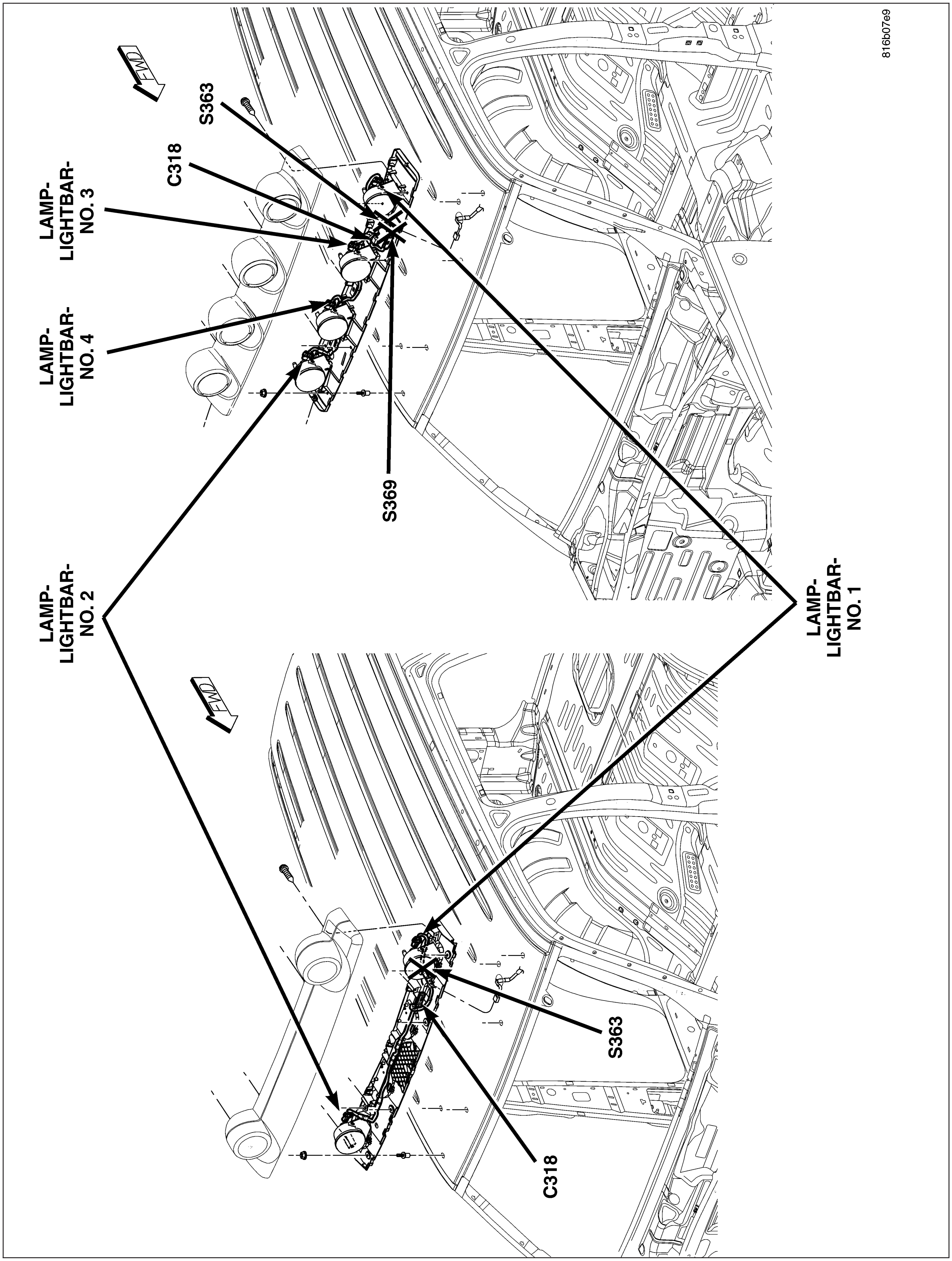



*Fig. 53 ROOF LIGHT BAR*

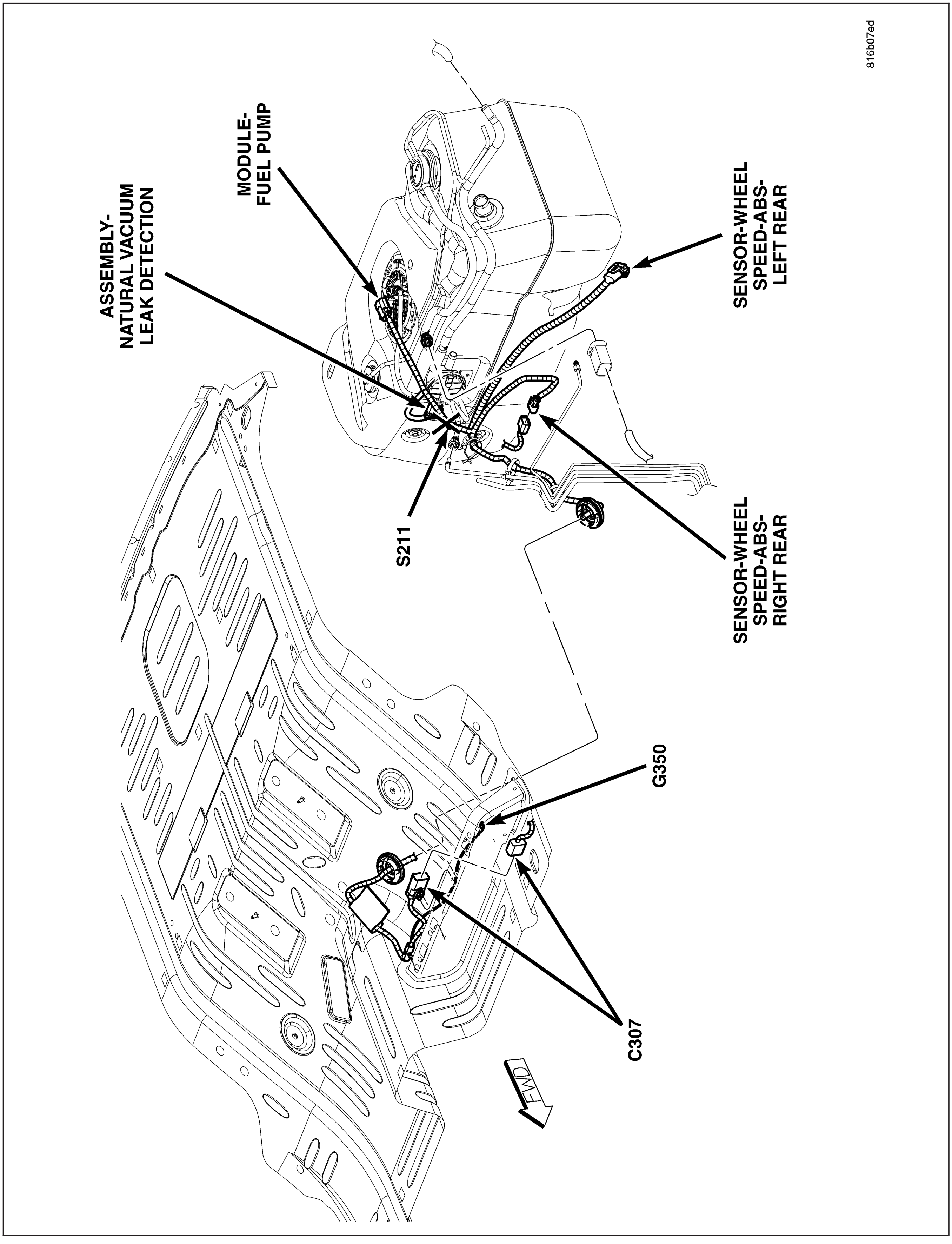



*Fig. 54 FUEL TANK*

# 8W-97 POWER DISTRIBUTION

## TABLE OF CONTENTS

# POWER DISTRIBUTION

## DESCRIPTION

This group covers the various standard and optional power distribution components used on this model. The power distribution system for this vehicle consists of the following components:

- Power Distribution Center (PDC)
- Junction Block (JB)
- Cigar Lighter Outlet
- Power Outlets

The power distribution system also incorporates various types of circuit control and protection features, including:

- Automatic resetting circuit breakers
- Blade-type fuses
- Bus bars
- Cartridge fuses
- Circuit splice blocks
- Fusible link
- ISO Standard and Micro-Relays

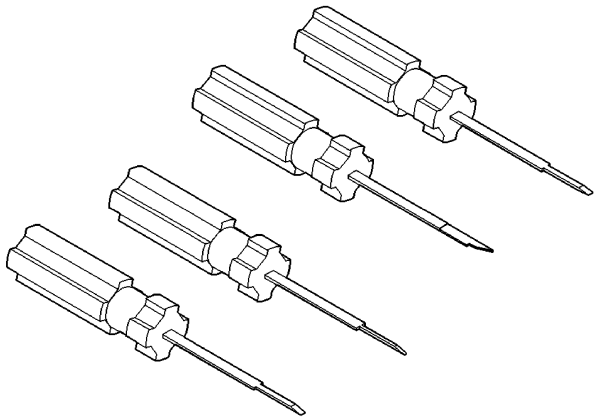
Following are general descriptions of the major components in the power distribution system. See the owner's manual in the vehicle glove box for more information on the features and use of all of the power distribution system components. Refer to Wiring Diagrams for complete circuit diagrams.

## OPERATION

The power distribution system for this vehicle is designed to provide safe, reliable, and centralized distribution points for the electrical current required to operate all of the standard and optional factory-installed electrical and electronic powertrain, chassis, safety, security, comfort and convenience systems. At the same time, the power distribution system was designed to provide ready access to these electrical distribution points for the vehicle technician to use when conducting diagnosis and repair of faulty circuits. The power distribution system can also prove useful for the sourcing of additional electrical circuits that may be required to provide the electrical current needed to operate accessories that the vehicle owner may choose to have installed in the aftermarket.

## SPECIAL TOOLS

## TERMINAL PICK KIT 6680



*Terminal Pick Kit 6680*

# CIGAR LIGHTER OUTLET

## DESCRIPTION

Some models are equipped with a cigar lighter outlet installed in the instrument panel. The cigar lighter outlet is located near the bottom of the instrument panel center stack area, below the heater and air conditioner controls. The cigar lighter outlet is secured by a snap fit within the center lower bezel.

The cigar lighter outlet, plastic cap and the knob and heating element unit are available for service replacement. These components cannot be repaired and, if faulty or damaged, they must be replaced.

## OPERATION

The cigar lighter consists of two major components: a knob and heating element unit, and the cigar lighter base or outlet shell. The receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The cigar lighter receives battery voltage from a fuse in the junction block when the ignition switch is in the Accessory or Run positions.

The cigar lighter knob and heating element are encased within a spring-loaded housing, which also features a sliding protective heat shield. When the knob and heating element are inserted in the outlet shell, the heating element resistor coil is grounded through its housing to the outlet shell. If the cigar lighter knob is pushed inward, the heat shield slides up toward the knob exposing the heating element, and the heating element extends from the housing toward the insulated contact in the bottom of the outlet shell.

Two small spring-clip retainers are located on either side of the insulated contact inside the bottom of the outlet shell. These clips engage and hold the heating element against the insulated contact long enough for the resistor coil to heat up. When the heating element is engaged with the contact, battery current can flow through the resistor coil to ground, causing the resistor coil to heat.

When the resistor coil becomes sufficiently heated, excess heat radiates from the heating element causing the spring-clips to expand. Once the spring-clips expand far enough to release the heating element, the spring-loaded housing forces the knob and heating element to pop back outward to their relaxed position. When the cigar lighter knob and element are pulled out of the outlet shell, the protective heat shield slides downward on the housing so that the heating element is recessed and shielded around its circumference for safety.

## DIAGNOSIS AND TESTING - CIGAR LIGHTER OUTLET

For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in Wiring Diagrams.

1. Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
2. Turn the ignition switch to the Run position. Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open or short as required.
3. Remove the cigar lighter knob and element from the cigar lighter outlet shell. Check for continuity between the inside circumference of the cigar lighter outlet shell and a good ground. there should be continuity. If OK, go to Step 4. If not OK, go to Step 5.
4. Turn the ignition switch to the Run position. Check for battery voltage at the insulated contact located at the back of the cigar lighter outlet shell. If OK, replace the faulty cigar lighter knob and element. If not OK, go to Step 5.
5. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the instrument panel center lower bezel. Check for continuity between the ground circuit cavity of the cigar lighter wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.
6. Connect the battery negative cable. Turn the ignition switch to the Accessory or Run positions. Check for battery voltage at the fused B(+) circuit cavity of the cigar lighter wire harness connector. If OK, replace the faulty cigar lighter outlet. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

# IOD FUSE

## DESCRIPTION

All vehicles are equipped with an Ignition-Off Draw (IOD) fuse that is disconnected within the Junction Block when the vehicle is shipped from the factory. Dealer personnel are to reconnect the IOD fuse in the junction block as part of the preparation procedures performed just prior to new vehicle delivery.

On left hand drive vehicles, the left end of the instrument panel cover has a snap-fit fuse access panel that can be removed to provide service access to the fuses in the junction block. On right hand drive vehicles the junction block is mounted on the right hand side of the instrument panel. A finger recess is molded into the access panel for easy removal. An adhesive-backed fuse layout map is secured to the instrument panel side of the access panel to ensure proper fuse identification. The IOD fuse is a 15 ampere mini blade-type fuse, located in fuse cavity # 34. The fuse is secured within a White molded plastic fuse holder and puller unit that serves both as a tool for disconnecting and reconnecting the fuse in its junction block cavity, and as a fuse holder that conveniently stores the fuse in the same junction block cavity after it has been disconnected.

### CIRCUITS INCLUDED WITH IOD FUSE

- Cluster
- Body Control Module
- Diagnostic Connector
- Map Lamps
- Glove Box Lamp
- Courtesy Lamps
- Compass Mini-Trip Computer
- Radio

## OPERATION

The term ignition-off draw identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. The IOD fuse feeds the memory and sleep mode functions for some of the electronic modules in the vehicle as well as various other accessories that require battery current when the ignition switch is in the Off position. The only reason the IOD fuse is disconnected is to reduce the normal IOD of the vehicle electrical system during new vehicle transportation and pre-delivery storage to reduce battery depletion, while still allowing vehicle operation so that the vehicle can be loaded, unloaded and moved as needed by both vehicle transportation company and dealer personnel.

The IOD fuse is disconnected from JB fuse cavity # 34 when the vehicle is shipped from the assembly plant. Dealer personnel must reconnect the IOD fuse when the vehicle is being prepared for delivery in order to restore full electrical system operation. Once the vehicle is prepared for delivery, the IOD function of this fuse becomes transparent and the fuse that has been assigned the IOD designation becomes only another Fused B(+) circuit fuse.

The IOD fuse can be used by the vehicle owner as a convenient means of reducing battery depletion when a vehicle is to be stored for periods not to exceed about thirty days. However, it must be remembered that disconnecting the IOD fuse will not eliminate IOD, but only reduce this normal condition. If a vehicle will be stored for more than about thirty days, the battery negative cable should be disconnected to eliminate normal IOD; and, the battery should be tested and recharged at regular intervals during the vehicle storage period to prevent the battery from becoming discharged or damaged.

## REMOVAL

The Ignition-Off Draw (IOD) fuse is disconnected from Junction Block fuse cavity # 34 when the vehicle is shipped from the assembly plant. Dealer personnel must reconnect the IOD fuse when the vehicle is being prepared for delivery in order to restore full electrical system operation.

1. Turn the ignition switch to the Off position.
2. Remove the fuse access panel by unsnapping it from the outboard end of the instrument panel.
3. Grasp the outer tabs of the IOD fuse holder unit in fuse cavity # 34 of the Junction Block between the thumb and forefinger and pull the unit firmly outward.
4. Install the fuse access panel by snapping it onto the outboard end of the instrument panel.

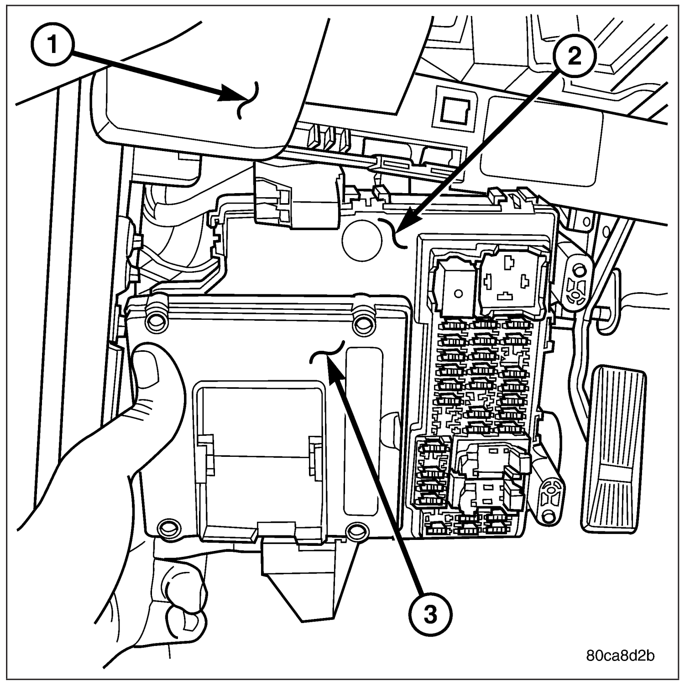
## INSTALLATION

1. Turn the ignition switch to the Off position.
2. To install the IOD fuse, use a thumb to press the IOD fuse holder unit in fuse cavity # 34 firmly into the junction block.
3. Install the fuse access panel by snapping it onto the left outboard end of the instrument panel.

# JUNCTION BLOCK

## DESCRIPTION

**NOTE: Left hand drive shown, right hand drive similar.**




An electrical Junction Block (2) is concealed behind the left outboard end of the instrument panel (1) on left hand drive vehicles. On right hand drive vehicles the Junction Block is concealed behind the right outboard end of the instrument panel. The junction block simplifies and centralizes numerous electrical components and distributes electrical current to many of the accessory systems throughout the vehicle. It also eliminates the need for numerous splice connections and serves in place of a bulkhead connector between many of the engine compartment, instrument panel, and body wire harnesses. The junction block houses up to thirty-nine mini blade-type fuses, up to three blade-type automatic resetting circuit breakers, up to three International Standards Organization (ISO) relays and up to eleven International Standards Organization (ISO) micro-relays.

The junction block (2) also provides the mounting location for the Body Control Module (BCM) (3) and Remote Keyless Entry (RKE) Module. Refer to the Electronic Control Modules section of the manual for more information on these two modules. The BCM is secured to the junction block assembly with four screws and multiple electrical connectors. The RKE module is mounted on the BCM via a single built-in electrical connector. With the junction block in its normal mounting location the BCM and RKE module are not accessible.

The molded plastic junction block housing has two integral mounting bosses that are secured with two screws to the left instrument panel end bracket on left hand drive. Additionally, upper and lower mounting brackets are attached to the junction block. These brackets are also secured to the instrument panel with two screws. On right hand drive vehicles, the junction block is secured to the right instrument panel end bracket on right hand drive. The left or right instrument panel end caps have snap-fit fuse access panels that can be removed for service of the junction block mounted fuses, daytime running lamp or high beam headlamp relays. A fuse puller and spare fuse holders are located on the back of the fuse access cover, as well as an adhesive-backed fuse layout map to ensure proper fuse identification. Refer to the owners manual or Wiring section of this manual for detailed component location and/or identification.

The junction block unit cannot be repaired and is only serviced as an assembly. If any internal circuit or the junction block housing is faulty or damaged, the entire junction block unit must be replaced.

## OPERATION

All of the circuits entering and exiting the junction block do so through wire harness connectors or the body control module which is mounted directly to the junction block underneath the instrument panel. These components are connected to the junction block through integral connector receptacles molded into the junction block housing. Internal connection of all of the junction block circuits is accomplished by an intricate combination of hard wiring and bus bars. Refer to **Wiring Diagrams** for the location of complete junction block circuit diagrams.

## DIAGNOSIS AND TESTING - JUNCTION BLOCK

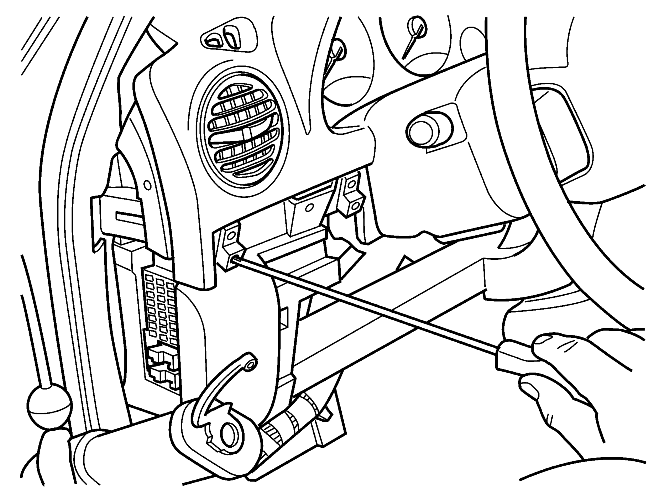
The junction block does not incorporate any self diagnostic capability. Most of the electrical circuits incorporated into the vehicle must pass through the junction block at one point or another. The most efficient means of diagnosing a suspected junction block problem involves a simple continuity tester or ohm meter. Using the Wiring Diagrams as a guide trace the problem circuit to the proper junction block cavity and test all circuits in the effected circuit for proper continuity. A open or high resistance circuit is a sign of a problem. Some other possible junction block problems to look for are:

- Loose fuse receptacle terminals.
- Loose relay / circuit breaker receptacle terminals.
- Bent or distorted electrical circuit pins.
- Incorrect size fuse installed in junction block fuse cavity.
- Dark areas identifying a source of excess heat.
- Defective fuse, relay or circuit breaker installed in junction block cavity.

## REMOVAL

## REMOVAL - LHD

**NOTE: On models equipped with a manual transmission, depress the clutch pedal to remove the Junction Block from under the instrument panel.**


80c9c623

The following junction block removal procedure is for Left Hand Drive (LHD) vehicles only.

1. Disconnect and isolate the negative battery cable.
2. Remove the left end cap from the instrument panel.
3. Unsnap and remove the left outboard trim bezel from the instrument panel. Located just to the left of the steering column.
4. Remove the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).
5. Remove the left cowl trim panel from the vehicle (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - REMOVAL).
6. Remove the courtesy lamp from under the left side of the instrument panel. This will allow sufficient room to remove the junction block from under the instrument panel.
7. Working through the steering column opening cover, remove the three bulkhead and two body controller electrical connectors from the junction block assembly.
8. Detach instrument panel wire harness from the lower channel on the instrument panel. This will allow sufficient room to remove the junction block from under the instrument panel.
9. Remove the four junction block retaining screws and remove the junction block from under the instrument panel.

## REMOVAL - RHD

The following junction block removal procedure applies to Right Hand Drive (RHD) vehicles only.

1. Disconnect and isolate the negative battery cable.
2. Remove the right end cap from the instrument panel.
3. Unsnap and remove the right outboard trim bezel from the instrument panel. Located just to the right of the steering column.
4. Remove the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

5. Remove the right cowl trim panel from the vehicle (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - REMOVAL).
6. Remove the courtesy lamp from under the right side of the instrument panel. This will allow sufficient room to remove the junction block from under the instrument panel.
7. Working through the steering column opening cover, remove the three bulkhead and two body controller electrical connectors from the junction block assembly.
8. Remove the two ground wires from the right lower kick panel area. Located directly behind the kick trim panel. This will allow sufficient room to remove the junction block from under the instrument panel.
9. Remove the upper and forward most (in relation to the vehicle) group of relays from the junction block. This will allow sufficient room to remove the junction block from under the instrument panel.
10. Remove the four junction block retaining screws and remove the junction block from under the instrument panel. It will be necessary to position the under instrument panel wire harness out of the way to remove the junction block.

## INSTALLATION

## INSTALLATION - LHD

**NOTE: On vehicles equipped with a manual transmission, it will be helpful to depress the clutch pedal when installing the Junction Block under the instrument panel.**

1. Position the junction block and install the four junction block retaining screws.
2. Install instrument panel wire harness on the lower channel of the instrument panel.
3. Working through the steering column opening cover, install the three bulkhead and two body controller electrical connectors on the junction block assembly.
4. Install the courtesy lamp under the left side of the instrument panel.
5. Install the left cowl trim panel on the vehicle (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - REMOVAL).
6. Install the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).
7. Install the left outboard trim bezel on the instrument panel.
8. Install the left end cap on the instrument panel.
9. Connect the negative battery cable.

## INSTALLATION - RHD

1. Position the junction block and install the four junction block retaining screws.
2. Install the upper and forward most group of relays in the junction block.
3. Install the two ground wires on the right lower kick panel area.
4. Working through the steering column opening cover, install the three bulkhead and two body controller electrical connectors on the junction block assembly.
5. Install the courtesy lamp under the right side of the instrument panel.
6. Install the right cowl trim panel on the vehicle (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - INSTALLATION).
7. Install the steering column opening cover (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).
8. Install the right outboard trim bezel on the instrument panel.
9. Install the right end cap on the instrument panel.
10. Connect the negative battery cable.

# POWER DISTRIBUTION CENTER

## DESCRIPTION

All of the electrical current distributed throughout this vehicle is directed through the standard equipment Power Distribution Center (PDC). The molded plastic PDC housing is located in the left front corner of the engine compartment, between the battery and the grille. The PDC houses up to fifteen maxi-type cartridge fuses, which replace all in-line fusible links, except for the fusible link between the PDC and alternator. The PDC also houses up to thirteen blade-type mini fuses, and up to twelve International Standards Organization (ISO) relays (four standard-type and eight micro-type).

The PDC housing is secured in the engine compartment at three points. Integral mounts on both sides of the PDC housing engage and latch to stanchions that are integral to the molded plastic battery tray. The PDC is integral to the headlamp and dash wire harness, which exits from the bottom of the PDC housing. The PDC housing has a molded plastic cover that includes an integral latch at the front and pivot hooks at the back that snap over a hinge pin on the rear of the PDC housing. The PDC cover is easily opened or removed for service access and has a convenient fuse and relay layout map integral to the inside surface of the cover to ensure proper component identification. A fuse puller is also stored on the inside of the PDC cover.

The PDC cover, the PDC housing lower cover, the PDC relay wedges, the PDC mini fuse wedge, the PDC relay cassettes and the PDC B(+) terminal stud module are available for service replacement. The PDC main housing unit, the cartridge fuse wedges and the bus bars cannot be repaired and are only serviced as a unit with the headlamp and dash wire harness. If the PDC main housing unit, cartridge fuse wedge or the bus bars are faulty or damaged, the headlamp and dash wire harness unit must be replaced.

## OPERATION

All of the current from the battery and the alternator output enters the PDC through two cables and a single two-holed eyelet that is secured with nuts to the two PDC B(+) terminal studs just inside the inboard end of the PDC housing. The PDC cover is unlatched and opened to access the battery and alternator output connection B(+) terminal studs, the fuses or the relays. Internal connection of all of the PDC circuits is accomplished by an intricate combination of hard wiring and bus bars. Refer to **Power Distribution** in Wiring Diagrams for the location of complete PDC circuit diagrams.

## REMOVAL

The Power Distribution Center (PDC) main housing unit, the PDC cartridge fuse wedge and the PDC bus bars cannot be repaired and are only serviced as a unit with the headlamp and dash wire harness. If the PDC main housing unit, the cartridge fuse wedges or the bus bars are faulty or damaged, the entire PDC and headlamp and dash wire harness unit must be replaced.

1. Disconnect and isolate the battery negative cable.
2. Disconnect each of the headlamp and dash wire harness connectors. Refer to **Connector Locations** in Wiring Diagrams for the location of more information on the right headlamp and dash wire harness connector locations.
3. Remove all of the fasteners that secure each of the headlamp and dash wire harness ground eyelets to the vehicle body and chassis components. Refer to **Connector Locations** in Wiring Diagrams for the location of more information on the ground eyelet locations.
4. Disengage each of the retainers that secure the headlamp and dash wire harness to the vehicle body and chassis components. Refer to **Connector Locations** in Wiring Diagrams for the location of more information on the headlamp and dash wire harness retainer locations.
5. Unlatch and open the PDC cover.
6. Remove the two nuts that secure the two-holed eyelet of the battery wire harness PDC take outs to the PDC B(+) terminal studs.
7. Remove the battery wire harness PDC take out eyelet from the B(+) terminal studs.
8. Disengage the latches on the PDC housing mounts from the tabs on the PDC mounting stanchions of the battery tray, and pull the PDC housing upward to disengage the mounts from the stanchions.
9. Remove the PDC and the headlamp and dash wire harness from the engine compartment as a unit.

# DISASSEMBLY

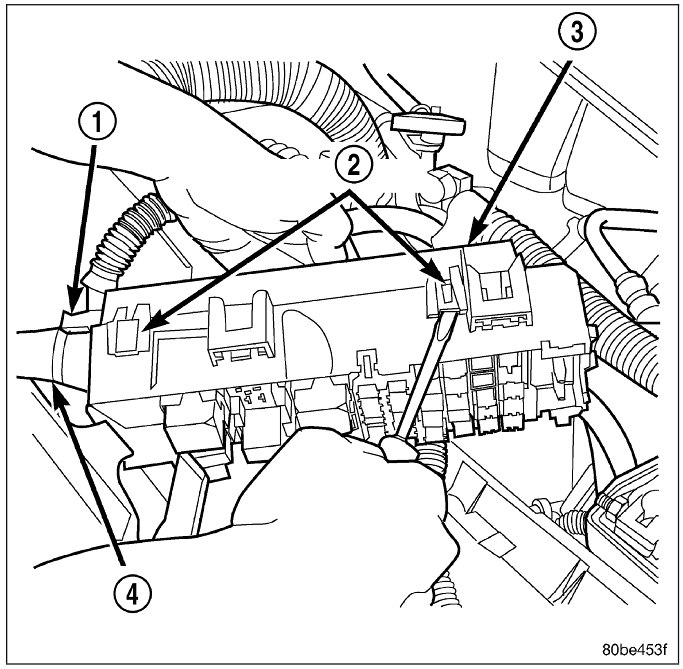
## POWER DISTRIBUTION CENTER DISASSEMBLY

### PDC HOUSING LOWER COVER

#### REMOVAL

The Power Distribution Center (PDC) cover, the PDC housing lower cover, the PDC relay wedges, the PDC mini fuse wedge, the PDC relay cassettes and the PDC B(+) terminal stud module are available for service replacement. The PDC cover can be simply unlatched and removed from the PDC housing without the PDC being removed or disassembled. Service of the remaining PDC components requires that the PDC be removed from its mounting and disassembled. Refer to **Wiring Repair** in Wiring Diagrams for the location of the wiring repair procedures.

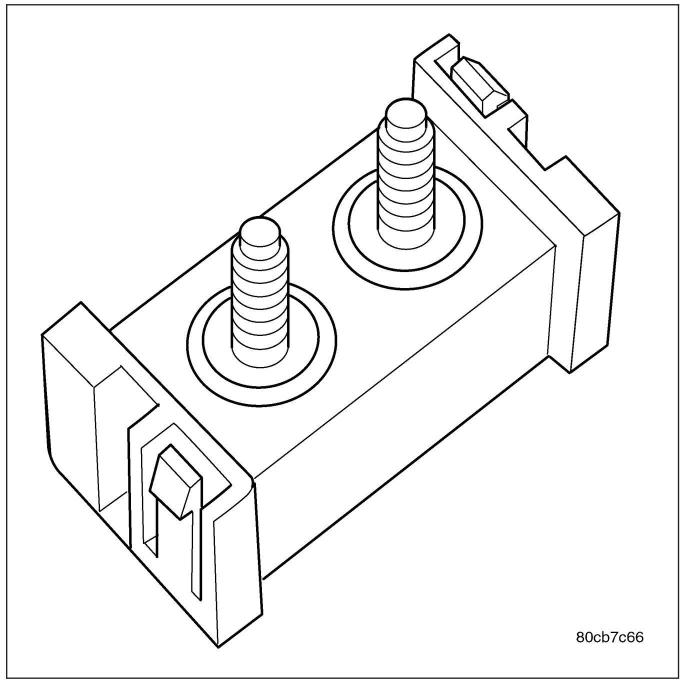
1. Unlatch and remove the cover from the PDC.
2. Remove the two nuts that secure the two-holed eyelet of the battery wire harness PDC take out to the B(+) terminal studs near the inboard end of the PDC.
3. Remove the battery wire harness PDC take out eyelet from the two PDC B(+) terminal studs.
4. Disengage the latches on the PDC housing mounts from the tabs on the PDC mounting stanchions on the battery tray, and pull the PDC housing upward to disengage the mounts from the stanchions.
5. Where the headlamp and dash wire harness exits the PDC, remove the tape that secures the wire harness to the trough formation on the PDC housing lower cover.
6. Using a trim stick or another suitable wide flat-bladed tool, gently pry the latches (2) on each side of the PDC housing that secure the housing lower cover (3) to the PDC and remove the housing lower cover.



## PDC B+ TERMINAL MODULE

### REMOVAL

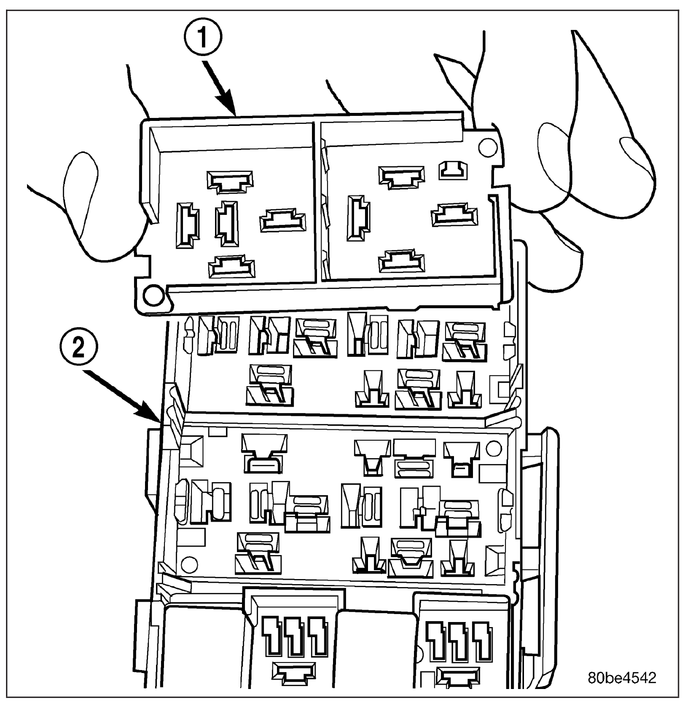
1. Remove the PDC housing lower cover.
2. From the top of the PDC housing, use a small screwdriver or a terminal pick tool (Special Tool Kit 6680) to release the two latches that secure the B(+) terminal module in the PDC.
3. Gently and evenly press the two B(+) terminal studs down through the bus bar in the PDC.
4. From the bottom of the PDC housing, remove the B(+) terminal module from the PDC.




## PDC RELAY WEDGE

### REMOVAL

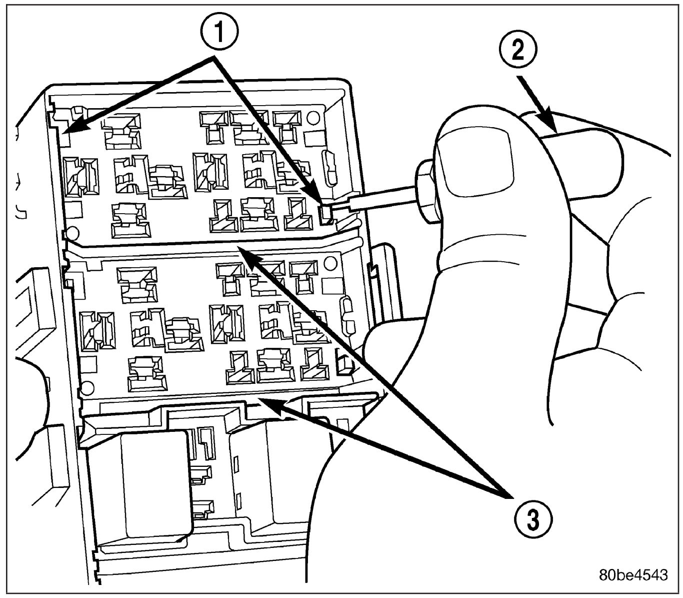
1. Remove the PDC housing lower cover.
2. Remove each of the relays from the PDC relay wedge (1) to be removed.
3. From the bottom of the PDC housing, use a small screwdriver or a terminal pick tool (Special Tool Kit 6680) to release the two latches (yellow) that secure the relay wedge (1) to the PDC relay cassette (2).
4. From the top of the PDC housing, remove the relay wedge (1) from the PDC relay cassette (2).



## PDC RELAY CASSETTE

### REMOVAL

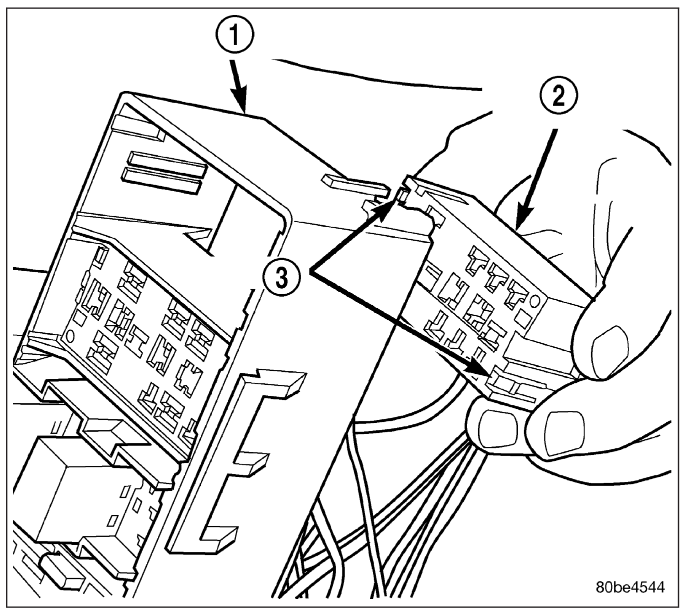
**CAUTION: Do not remove the wiring and terminals from the terminal cavities of the faulty PDC relay cassette at this time. Refer to the Assembly procedure that follows for the proper procedures for transferring the wiring and terminals to the replacement PDC relay cassette.**




1. Remove the relay wedge from the PDC relay cassette to be removed.

**NOTE: It may be necessary to remove relay cassettes that are not being serviced from the PDC housing in order to obtain sufficient clearance to access the faulty relay cassette. The same service procedure is repeated as necessary to remove each of the interfering relay wedges and relay cassettes from the PDC housing.**

2. From the top of the PDC housing, use a small screwdriver or a terminal pick tool (2) (Special Tool Kit 6680) to release the two latches (1) that secure the relay cassette (3) in the PDC.
3. Gently and evenly press the relay cassette (3) down through the PDC housing.
4. From the bottom of the PDC housing (1), remove the relay cassette (2) from the PDC.



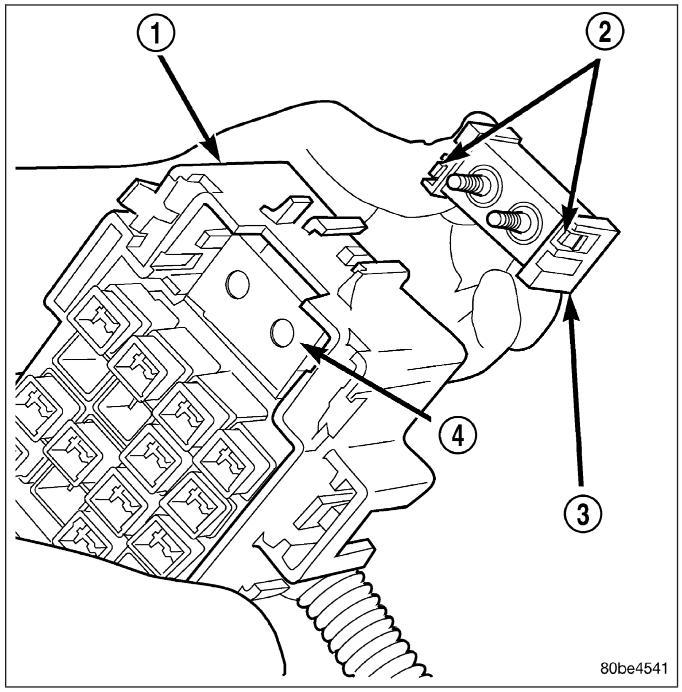
# ASSEMBLY

## POWER DISTRIBUTION CENTER ASSEMBLY

### PDC B(+) TERMINAL MODULE

#### INSTALLATION

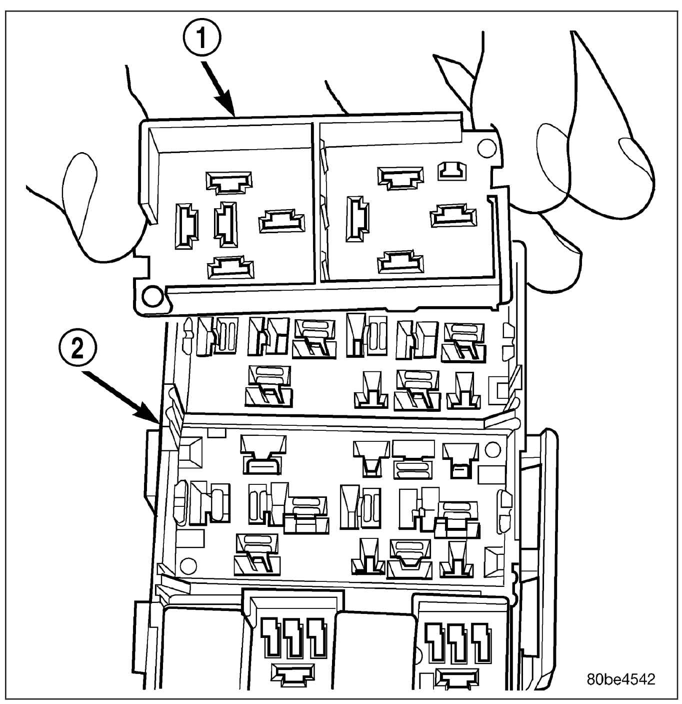
1. From the bottom of the PDC housing (1) , align and insert the B(+) terminal module (3) into the PDC.
2. From the bottom of the PDC housing (1) , align and insert the two studs of the PDC B(+) terminal module (3) through the bus bar (4) in the PDC.
3. From the bottom of the PDC housing (1) , press the B(+) terminal module (3) gently and evenly into the PDC until both of the latches (2) are fully engaged.
4. Install the PDC housing lower cover.




### RELAY WEDGE

#### INSTALLATION

1. From the top of the PDC housing (2), align and insert the PDC relay wedge (1) latch arms into the correct cavities in the relay cassette.
2. Gently and evenly press the PDC relay wedge (1) down into the relay cassette until both of the latches are fully engaged.
3. Install each of the removed relays into the proper cavities of the PDC relay wedge (1).
4. Install the PDC housing lower cover.

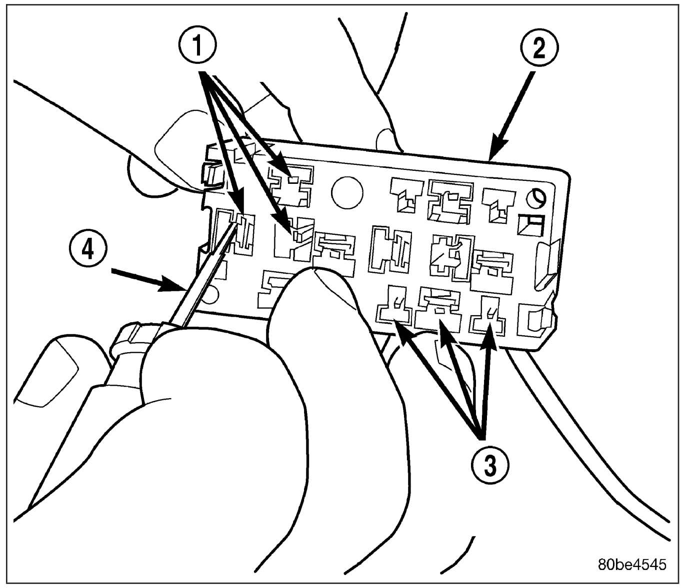


## RELAY CASSETTE

### INSTALLATION

1. Move the faulty PDC relay cassette with its wiring away from the bottom of the PDC housing far enough to allow the replacement relay cassette to be installed into the PDC.
2. Using the faulty relay cassette as a guide, be certain that the replacement relay cassette is correctly oriented before installing it into the PDC housing.
3. From the bottom of the PDC housing, align and insert the replacement relay cassette into the PDC. Press the relay cassette up into the PDC until both of the latches are fully engaged.

**CAUTION: Proper care must be taken to be certain that the wiring and terminals from the faulty PDC relay cassette are installed in the correct terminal cavities of the replacement relay cassette. To prevent mistakes it is recommended that the wiring and terminals be removed from the faulty relay cassette one cavity at a time, repaired or spliced as necessary, then installed securely into the correct cavity of the replacement relay cassette. If you are not absolutely certain into which cavity a terminal should be installed, refer to Power Distribution in the index of this service manual for the location of complete circuit diagrams covering the PDC.**




4. While pulling gently on the wire from the bottom of the faulty PDC relay cassette (2), use a terminal pick tool (4)(Special Tool Kit 6680) from the top of the relay cassette to release the latch (3) that secures the terminal in the relay cassette terminal cavity (1).
5. From the bottom of the faulty PDC relay cassette (2), remove the wire and terminal from the relay cassette terminal cavity (1).
6. Make all necessary repairs and splices to the wire for the removed terminal. Refer to **Wiring Repair** in Wiring Diagrams for the location of the wiring repair procedures.
7. From the bottom of the PDC housing, align and insert the removed wire and terminal into the correct terminal cavity of the replacement relay cassette. Push the wire and terminal up into the relay cassette terminal cavity until it is fully engaged by the latch.
8. Repeat Step 4, Step 5, Step 6 and Step 7 one wire and terminal at a time until each of the wires and terminals have been transferred from the faulty PDC relay cassette into the replacement relay cassette.
9. Install the PDC relay wedge into the replacement PDC relay cassette.

## PDC LOWER COVER

### INSTALLATION

1. Align the PDC housing lower cover on the bottom of the PDC.
2. Evenly press the lower cover into place until latches are fully engaged.
3. Where the headlamp and dash harness enters the PDC, tape the harness securely to the trough formation on the PDC lower cover.
4. Install the PDC in its mounting location on the battery support.
5. Install the battery wire harness over the two PDC B+ terminal studs. Torque the nuts to 11.3 N·m (100 in. lbs.).
6. Install the battery. Refer to the Battery section for the procedure.
7. Install the PDC cover.

## INSTALLATION

The Power Distribution Center (PDC) main housing unit, the PDC fuse wedges, the PDC mini fuse wedge and the PDC bus bars cannot be repaired and are only serviced as a unit with the right headlamp and dash wire harness. If the PDC main housing unit, the fuse wedges or the bus bars are faulty or damaged, the entire PDC and right headlamp and dash wire harness unit must be replaced.

1. Position the PDC and the headlamp and dash wire harness unit in the engine compartment.
2. Engage the PDC housing mounts with the stanchions of the battery tray and push the unit downward until the mount latches fully engage the mounting tabs on the stanchions.
3. Install the two-holed eyelet of the battery wire harness PDC take outs onto the two PDC B(+) terminal studs.
4. Install and tighten the nuts that secure the eyelet of the battery wire harness PDC take outs to the B(+) terminal studs. Tighten the nuts to 11.3 N·m (100 in. lbs.).
5. Engage each of the retainers that secure the headlamp and dash wire harness to the vehicle body and chassis components. Refer to **Connector Locations** in Wiring Diagrams for the location of more information on the headlamp and dash wire harness retainer locations.
6. Install all of the fasteners that secure each of the headlamp and dash wire harness ground eyelets to the vehicle body and chassis components. Refer to **Connector Locations** in Wiring Diagrams for the location of more information on the ground eyelet locations.
7. Reconnect each of the headlamp and dash wire harness connectors. Refer to **Connector Locations** in Wiring Diagrams for the location of more information on the headlamp and dash wire harness connector locations. For connectors secured with bolts, tighten the screws to 4.3 N·m (38 in. lbs.).
8. Reconnect the battery negative cable.

# POWER OUTLET

## DESCRIPTION

One power outlet is installed in the vehicle. It is located in the right rear quarter trim panel. The power outlet base is secured by a snap fit within the trim panel. A plastic protective cap snaps into the power outlet base when the power outlet is not being used, and hangs from the power outlet base mount by an integral bail strap while the power outlet is in use.

The power outlet receptacle unit and the accessory power outlet protective cap are available for service. The power outlet receptacle cannot be repaired and, if faulty or damaged, it must be replaced.

## OPERATION

The power outlet base or receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The power outlet receives battery voltage from a fuse in the Junction Block at all times.

While the power outlet is very similar to a cigar lighter base unit, it does not include the two small spring-clip retainers inside the bottom of the receptacle shell that are used to secure the cigar lighter heating element to the insulated contact.

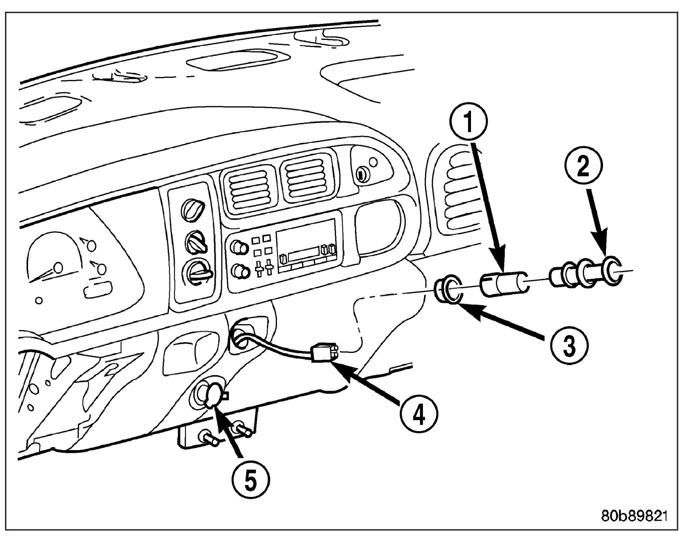
## DIAGNOSIS AND TESTING - POWER OUTLET

For complete circuit diagrams, refer to **Power Outlet** in Wiring Diagrams.

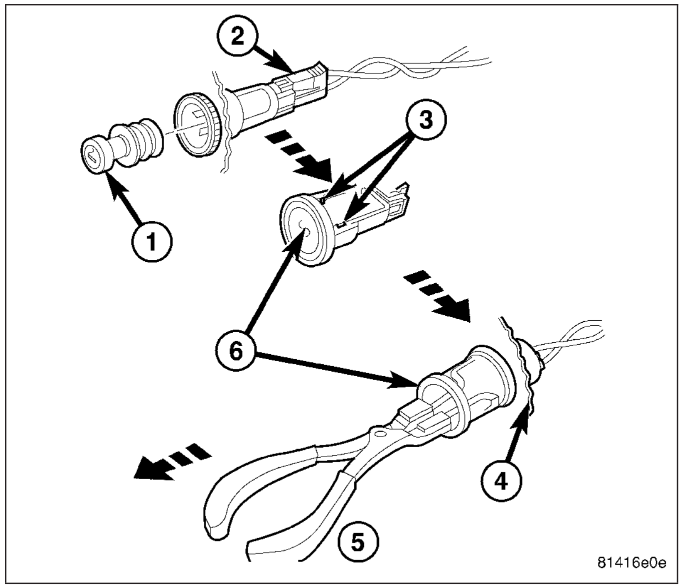
1. Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
2. Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the battery as required.
3. Remove the plastic protective cap from the power outlet receptacle. Check for continuity between the inside circumference of the power outlet receptacle and a good ground. There should be continuity. If OK, go to Step 4. If not OK, go to Step 5.
4. Check for battery voltage at the insulated contact located at the back of the power outlet receptacle. If not OK, go to Step 5.
5. Disconnect and isolate the battery negative cable. Remove the power outlet receptacle from the instrument panel. Disconnect the wire harness connector from the power outlet receptacle. Check for continuity between the ground circuit cavity of the power outlet wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.
6. Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the power outlet wire harness connector. If OK, replace the faulty power outlet receptacle. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

## REMOVAL

1. Disconnect and isolate the battery negative cable.
2. Pull the cigar lighter knob and element (2) out of the cigar lighter receptacle base (1), or unsnap the protective cap from the power outlet receptacle base (5).
3. Look inside the cigar lighter or power outlet receptacle base and note the position of the rectangular retaining bosses of the mount that secures the receptacle base to the instrument panel.



4. Insert a pair of external snap ring pliers (5) into the cigar lighter or power outlet receptacle base (6) and engage the tips of the pliers with the retaining bosses (3) of the mount.
5. Squeeze the pliers to disengage the mount retaining bosses from the receptacle base and, using a gentle rocking motion, pull the pliers and the receptacle base out of the mount.
6. Pull the receptacle base away from the instrument panel (4) far enough to access the instrument panel wire harness connector (2).
7. Disconnect the instrument panel wire harness connector (2) from the cigar lighter or power outlet receptacle base (6).
8. Remove the cigar lighter or power outlet mount from the instrument panel.



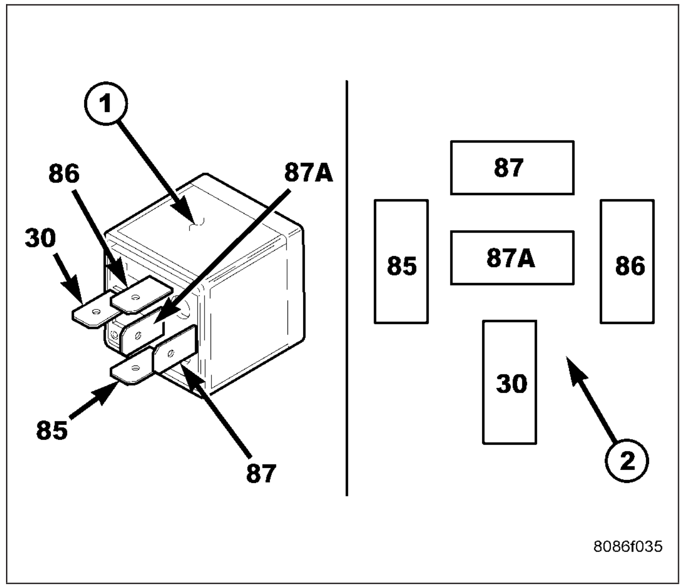

## INSTALLATION

1. Reconnect the instrument panel wire harness connector to the cigar lighter or power outlet receptacle base connector receptacle.
2. Install the cigar lighter or power outlet mount into the instrument panel.
3. Align the splines on the outside of the cigar lighter or power outlet receptacle base connector receptacle with the grooves on the inside of the mount.
4. Press firmly on the cigar lighter or power outlet receptacle base until the retaining bosses of the mount are fully engaged in their receptacles.
5. Install the cigar lighter knob and element into the cigar lighter receptacle base, or the protective cap into the power outlet receptacle base.
6. Reconnect the battery negative cable.

# RELAY

## DESCRIPTION

A relay is an electromechanical device that switches fused battery current to a electrical component when the ignition switch is turned to the Accessory or Run positions, or when controlled by a electronic module. The relays are located in the junction block or power distribution center.




The relay is a International Standards Organization (ISO) relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions.

A relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

## OPERATION

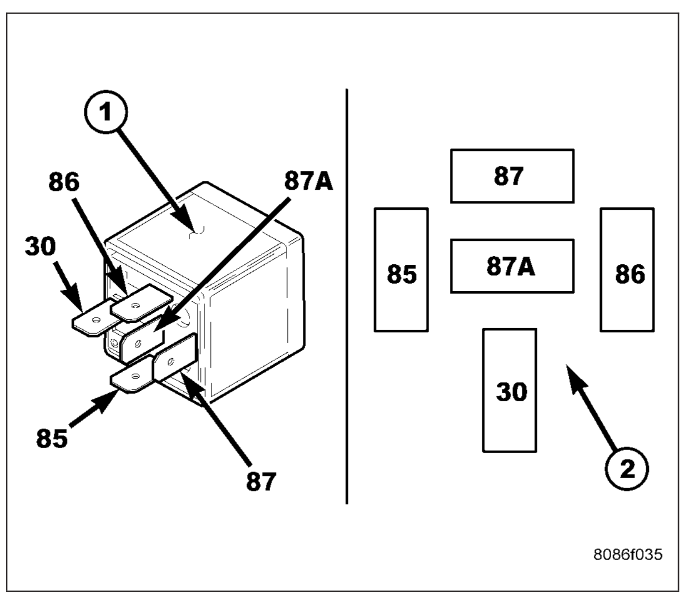
The ISO relay consists of an electromagnetic coil, a resistor and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

## DIAGNOSIS AND TESTING - RELAY

The relays are located in the junction block or power distribution center. For complete circuit diagrams, refer to **Wiring Diagrams**.

1. Remove the relay from its mounting location.
2. A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.
3. Resistance between terminals 85 and 86 (electromagnet) should be 60.7 - 80.3 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.
4. Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, perform the Relay Circuit Test that follows. If not OK, replace the faulty relay.



## DIAGNOSIS & TESTING - RELAY CIRCUIT TEST

1. The relay common feed terminal cavity (30) of the junction block or power distribution center is connected to battery voltage and should be hot at all times. Check for battery voltage at the fused B(+) circuit cavity in the junction block receptacle for the relay. If OK, go to Step 2. If not OK, repair the fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.
2. The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.
3. The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the fused B(+) fuse in the junction block that feeds the accessory when the relay is energized by the ignition switch. There should be continuity between the junction block cavity for relay terminal 87 and the fused B(+) fuse in the junction block at all times. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.
4. The coil ground terminal (85) is connected to the electromagnet in the relay. It receives battery feed to energize the relay when the ignition switch is in the Accessory or Run positions. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (acc/run) circuit cavity for relay terminal 85 in the junction block receptacle for the relay. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (acc/run) circuit to the ignition switch as required.
5. The coil battery terminal (86) is connected to the electromagnet in the relay. The junction block cavity for this terminal should have continuity to ground at all times. If not OK, repair the open ground circuit to ground as required.

## REMOVAL

1. Disconnect and isolate the negative battery cable.
2. Remove the relay by grasping it firmly and pulling it straight out from its receptacle. A slight back and fourth rocking motion may help the removal process.

## INSTALLATION

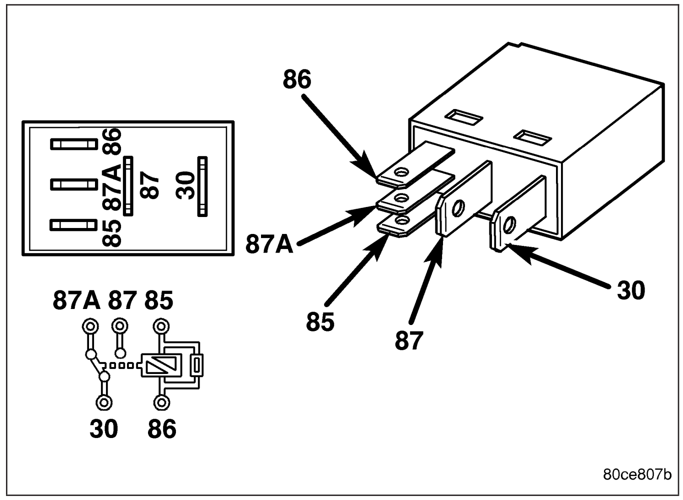
1. Position the relay to the proper receptacle.
2. Align the relay terminals with the terminal cavities in the receptacle.
3. Push firmly and evenly on the top of the relay until the terminals are fully seated in the terminal cavities in the receptacle.
4. Connect the negative battery cable.

# MICRO-RELAY

## DESCRIPTION

A micro-relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs by five integral male spade-type terminals that extend from the bottom of the relay base.

Relays cannot be adjusted or repaired and, if faulty or damaged, the unit must be replaced.




## OPERATION

A micro-relay is an electromechanical switch that uses a low current input from one source to control a high current output to another device. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. A resistor is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

## DIAGNOSIS AND TESTING - MICRO-RELAY

1. Remove the relay from its mounting location.
2. A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.
3. Resistance between terminals 85 and 86 (electromagnet) should be 67.5 - 82.5 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.
4. Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, reinstall the relay and use a DRBIII® scan tool to perform further testing. Refer to the appropriate diagnostic information.

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

## REMOVAL

1. Disconnect and isolate the negative battery cable.
2. Remove the relay by grasping it firmly and pulling it straight out from its receptacle. A slight back and fourth rocking motion may help the removal process.

## INSTALLATION

1. Align the micro-relay terminals with the terminal cavities in the receptacle.
2. Push firmly and evenly on the top of the relay until the terminals are fully seated in the terminal cavities in the receptacle.
3. Connect the battery negative cable.

# ENGINE

## TABLE OF CONTENTS



## ENGINE ELECTRICAL DIAGNOSTICS

### TABLE OF CONTENTS

# ENGINE ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

# PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

## Diagnostic Test

### 1. NO RESPONSE

Make sure the scan tool will communicate with the appropriate modules.

**Are you currently experiencing a NO RESPONSE condition?**

**Yes** >> The NO RESPONSE condition must be properly diagnosed before continuing.
Refer to the appropriate BUS Communication test in Section 8 ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS.

**No** >> Go To 2

### 2. NO START

**Is the customer complaint a NO START condition?**

**Yes** >> Check the vehicle for any NO START related PCM DTCs or Vehicle Theft Security related DTCs.
If no Theft related DTCs are present, refer to the Non DTC Diagnostic Procedures that relate to Fuel and Starting.

**No** >> Go To 3

### 3. VEHICLE HISTORY AND TSB(s)

Continue by reading PCM DTCs and record the related Freeze Frame data if any DTCs are present.

Whether or not any DTCs are present you will want to check the following items which may assist in repairing the customers complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any TSBs related to the customer's complaint or DTCs.

If a TSB applies, follow the instructions per the TSB.

**Choose the following scenario that best applies.**

**The TSB repaired the customers complaint.**
Testing complete.

**A DTC is present, no TSB applies, or the TSB didn't repair the customers complaint.**
Go To 4

**No DTCs are present.**
Refer to the INTERMITTENT CONDITION Diagnostic Procedure.

### 4. WIRE HARNESS INSPECTION

Clear the DTCs.

Attempt to duplicate the customer complaint.

Whether the customer complaint can be duplicated or not, make a quick wire harness inspection related to the DTCs that were previously cleared.

Check the Powertrain Control Module connectors, the suspected component connection, in-line connectors, wire harness splices, PCM power and ground circuits, and any related fuses.

If the DTCs are fuel or air related, check the fuel level and quality.

**Were any repairs made that fixed the customer's complaint?**

**Yes** >> Testing complete.

**No** >> Refer to the diagnostic test procedure related to the DTC.

## INTERMITTENT CONDITION

| POSSIBLE CAUSES |
|---|
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. INTERMITTENT CONDITION

**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.**

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Refer to any Technical Service Bulletins (TSBs) that may apply.

Review the scan tool Freeze Frame information. If possible, try to duplicate the conditions under which the DTC set.

With the engine running at normal operating temperature, monitor the scan tool parameters related to the DTC while wiggling the wire harness. Look for parameter values to change and/or a DTC to set.

Turn the ignition off.

Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

Perform a voltage drop test on the related circuits between the suspected inoperative component and the PCM.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Inspect and clean all PCM, engine, and chassis grounds that are related to the most current DTC.

If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits.

For any Relay DTCs, actuate the Relay with the scan tool and wiggle the related wire harness to try to interrupt the actuation.

For intermittent Evaporative Emission trouble codes perform a visual and physical inspection of the related parts including hoses and the Fuel Filler cap.

For intermittent Misfire DTCs check for restrictions in the Intake and Exhaust system, proper installation of Sensors, vacuum leaks, and binding components that are run by the accessory drive belt.

Use the scan tool to perform a System Test if one applies to failing component.

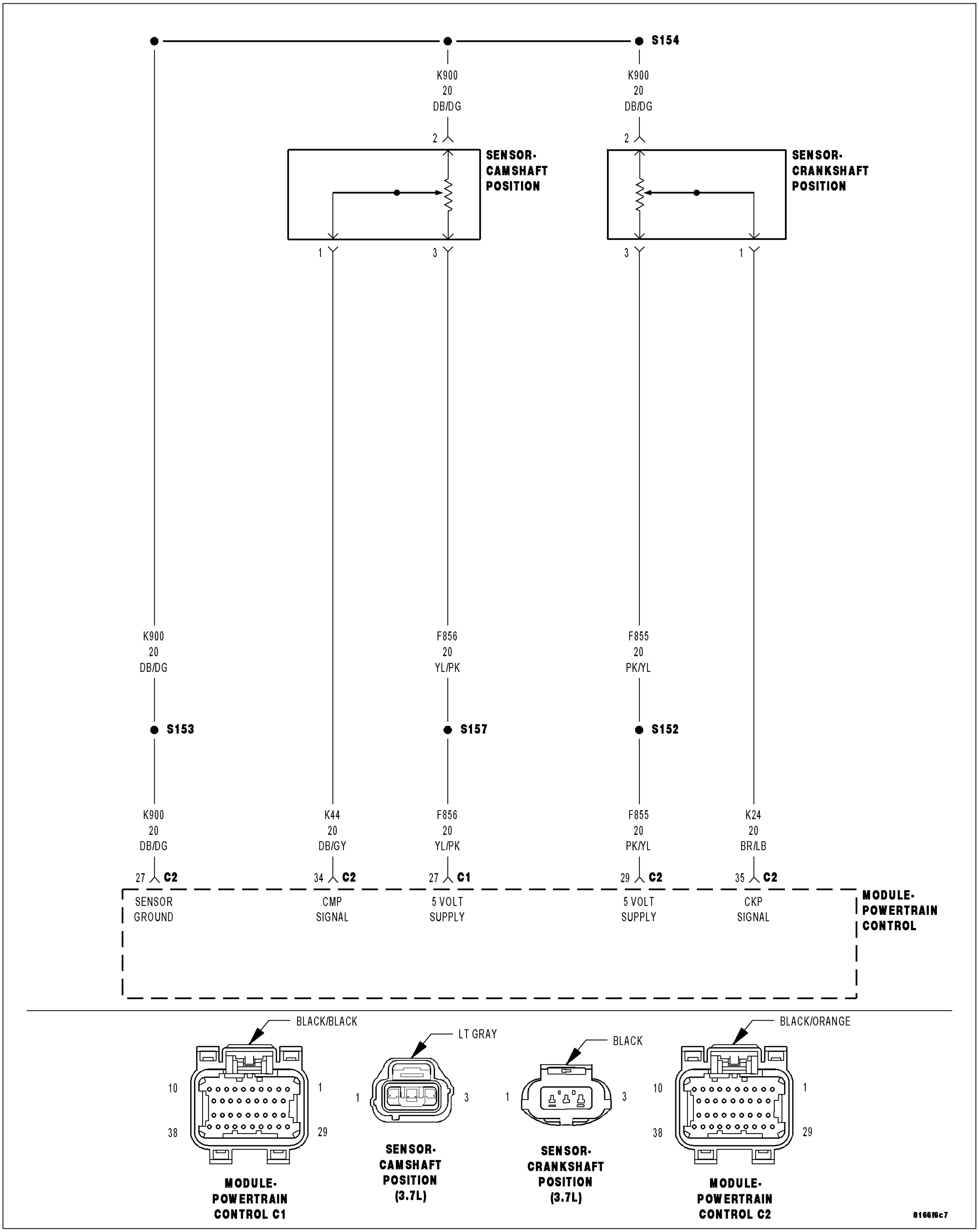
A co-pilot, data recorder, and/or lab scope should be used to help diagnose intermittent conditions.

**Were any problems found during the above inspections?**

**Yes** >> Perform the necessary repairs.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine cranking and Engine running
- **Set Condition:**
  Powertrain Control Module detects an error when the camshaft position is out of phase with the crankshaft position. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| ERRATIC CAM POSITION SENSOR SIGNAL |
| CAMSHAFT POSITION SENSOR TONE WHEEL/PULSE RING |
| ERRATIC CRANKSHAFT POSITION SENSOR SIGNAL |
| CRANKSHAFT POSITION SENSOR TONE WHEEL/PULSE RING |
| CAMSHAFT POSITION SENSOR |
| CRANKSHAFT POSITION SENSOR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

With the scan tool clear the DTC(s).

Start the engine and run until operating temp is reached. (Closed Loop)

If the DTC does not reset it may be necessary to test drive the vehicle.

**Does the P0016 return?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. CHECKING THE CMP SIGNAL WITH A LAB SCOPE

With a lab scope, backprobe the (K44) CMP Signal circuit at the CMP Sensor harness connector.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Start the engine.

Observe the lab scope screen.

**Are there any irregular or missing signals?**

**Yes** >> Go To 3

**No** >> Go To 6

## 3. CMP WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to their proper specification.

Refer to any TSBs that may apply.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. TONE WHEEL/PULSE RING INSPECTION

Remove the Camshaft Position Sensor.

Inspect the Tone Wheel/Pulse Ring for damage, foreign material, or excessive movement.

**Were any problems found?**

**Yes** >> Repair or replace the Tone Wheel/Pulse Ring as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CAMSHAFT POSITION SENSOR

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Camshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. ERRATIC CMP SIGNAL

Turn the ignition off.

Remove the lab scope probe.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Ignition on, engine not running.

With scan tool, erase DTCs.

Start the engine.

Gently tap on and wiggle the Cam Position Sensor.

Ignition on, engine not running.

Inspect the Sensor connector and harness connector, and inspect the PCM connector and harness connector for loose, bent, corroded, or pushed out pins/terminals.

Inspect the related wire harness and the splices in the CMP circuit.

**Does the P0016 return?**

**Yes** >> Repair the wiring/connector concerns as needed or replace the Camshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CHECKING THE CKP SIGNAL WITH A LAB SCOPE

Turn the ignition off.

With a lab scope, backprobe the (K24) CKP Signal circuit at the CKP harness connector.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Start the engine.

Observe the lab scope screen.

**Are there any irregular or missing signals?**

**Yes** >> Go To 8

**No** >> Go To 11

## 8. CKP WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to their proper specification.

Refer to any TSBs that may apply.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. TONE WHEEL/FLEX PLATE INSPECTION

Remove the Crankshaft Position Sensor.

Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement.

**Were any problems found?**

**Yes** >> Repair or replace the Tone Wheel/Flex Plate as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 10

## 10. CRANKSHAFT POSITION SENSOR

Remove the Crankshaft Position Sensor.

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Crankshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

## 11. ERRATIC CKP SIGNAL

**NOTE: The conditions that set this DTC are not present at this time. The following test may help in identifying the intermittent condition.**

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Start the engine.

Gently tap on and wiggle the Crank Position Sensor.

Turn the ignition off.

Inspect the Sensor connector and harness connector, and inspect the PCM connector and harness connector for loose, bent, corroded, or pushed out pins/terminals.

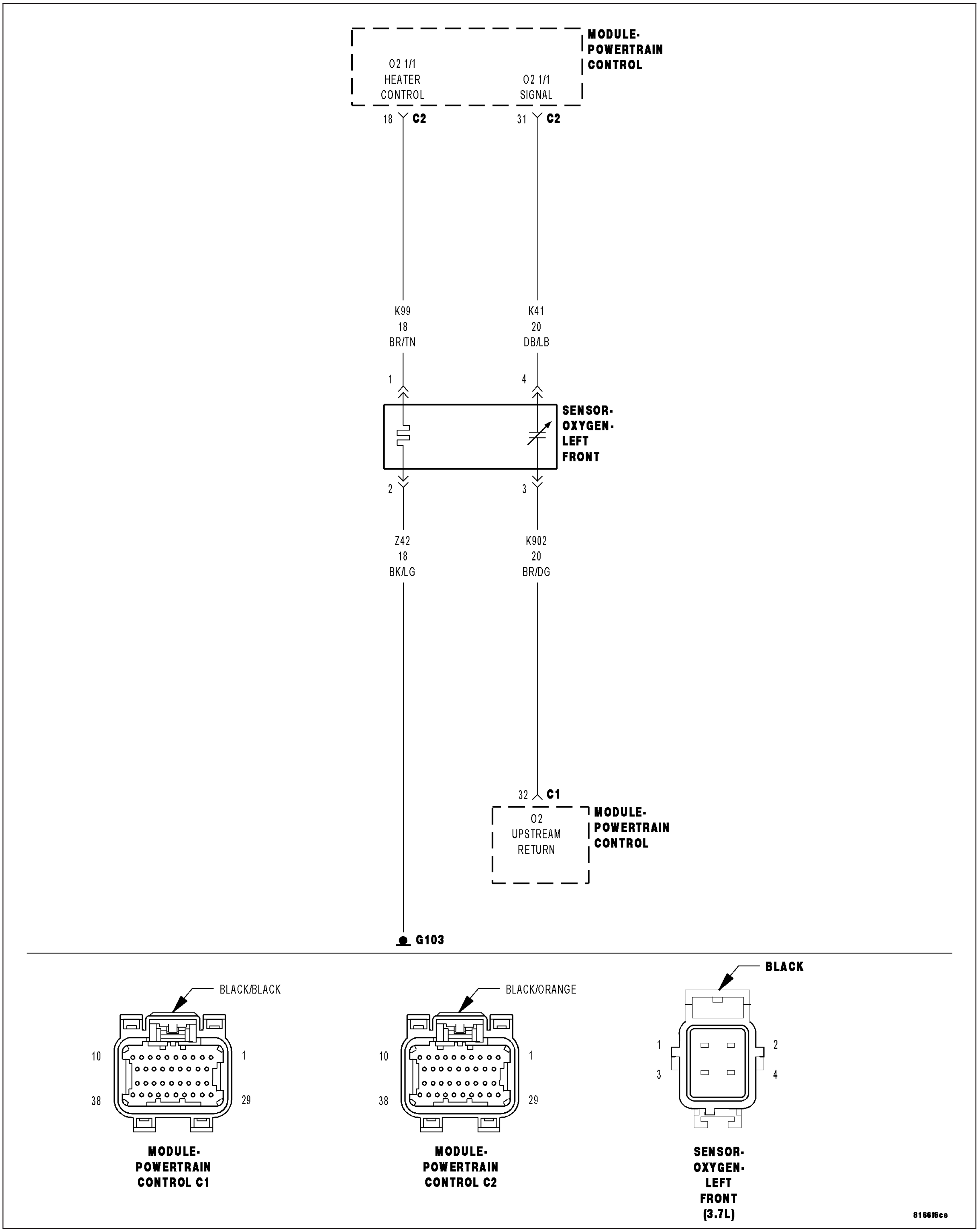
Inspect the related wire harness and the splices in the CKP circuits.

**Were any problems found?**

**Yes** >> Repair the wiring/connector concerns as needed or replace the Crankshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is powered.
- **Set Condition:**
  Desired state does not match Actual state. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K99) O2 SENSOR 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

**NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.**

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

**Does the O2 Sensor voltage stay above 4.5 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. O2 HEATER ELEMENT

Turn the ignition off.

**NOTE: Allow the O2 Sensor to cool down to room temperature.**

Disconnect the 1/1 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the Heater Control terminal and the Heater ground terminal at the component.

**NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.**

**Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?**

**Yes** >> Go To 3

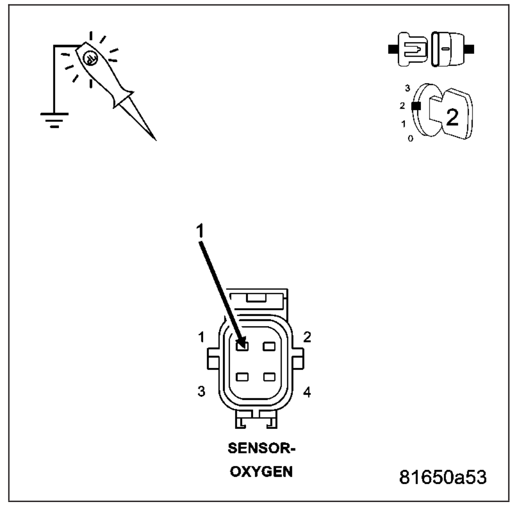
**No** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. O2 SENSOR

Ignition on, engine not running.

With a scan tool, actuate the O2 1/1 Heater Test with the O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.




**Does the test light illuminate brightly and flash on and off during the actuation?**

**Yes** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

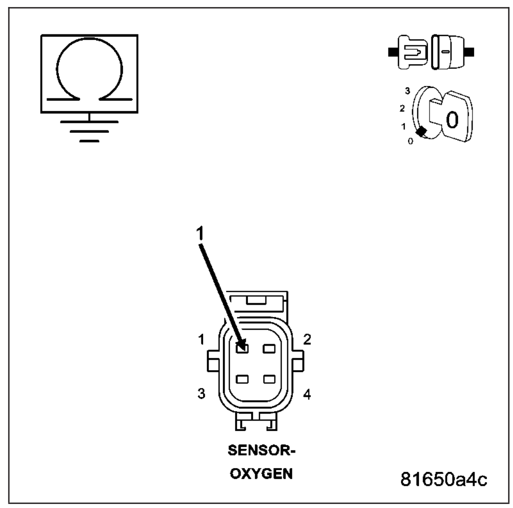
**No** >> Go To 4

## 4. (K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short to ground in the (K99) O2 1/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

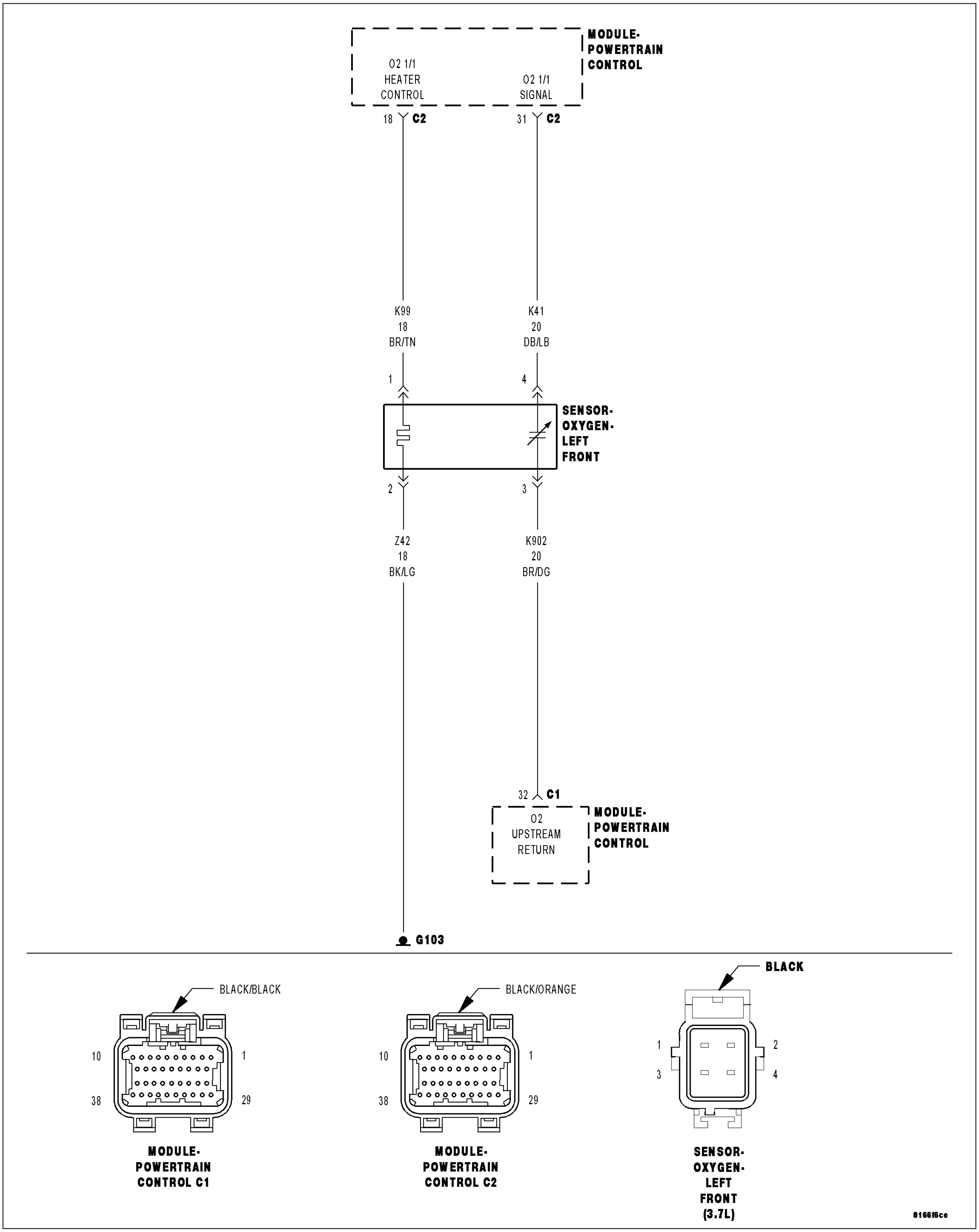
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.
- **Set Condition:**
  Desired state does not equal Actual state. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN |
| (Z42) O2 1/1 HEATER GROUND CIRCUIT OPEN |
| (K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, check DTC's

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. O2 HEATER ELEMENT

Turn the ignition off.

**NOTE: Allow the O2 Sensor to cool down to room temperature.**

Disconnect the 1/1 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element between the O2 Heater Control terminal and the O2 Heater ground terminal at the component.

**NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.**

**Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?**

**Yes** >> Go To 3

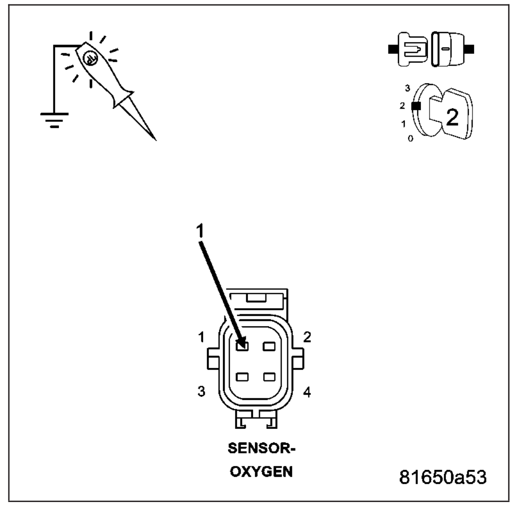
**No** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. (K99) O2 1/1 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

With a scan tool, actuate the O2 1/1 Heater Test with the Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.




**Does the test light illuminate brightly and flash on and off during the actuation?**

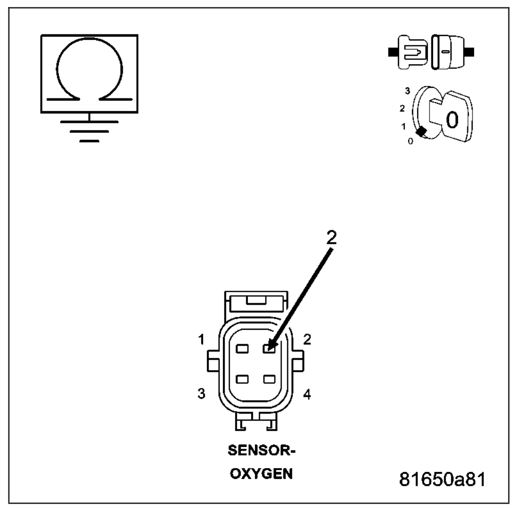
**Yes** >> Go To 4

**No** >> Go To 5

## 4. (Z42) O2 HEATER GROUND CIRCUIT OPEN

Turn the ignition off.

Measure the resistance between an engine ground and the (Z42) O2 1/1 Heater ground circuit in the O2 Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Repair the open in the (Z42) O2 1/1 Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

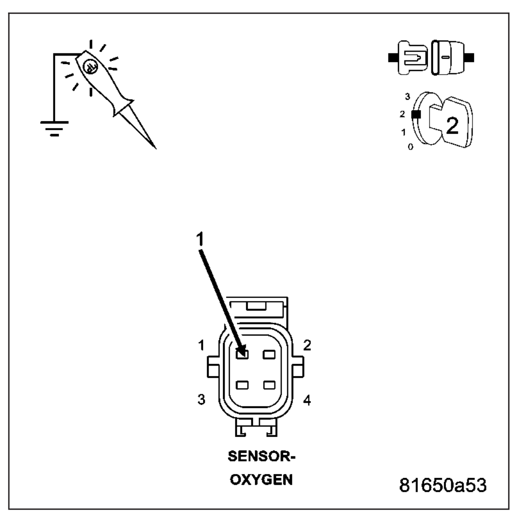
## 5. (K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Repair the short to battery voltage in the (K99) O2 1/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

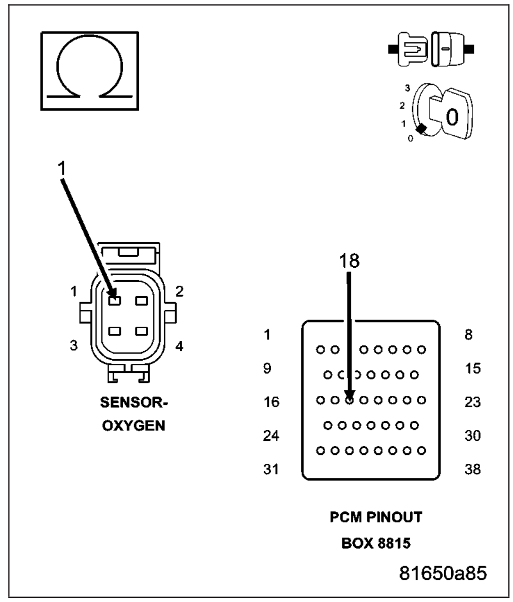
**No** >> Go To 6

## 6. (K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K99) O2 1/1 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K99) O2 1/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

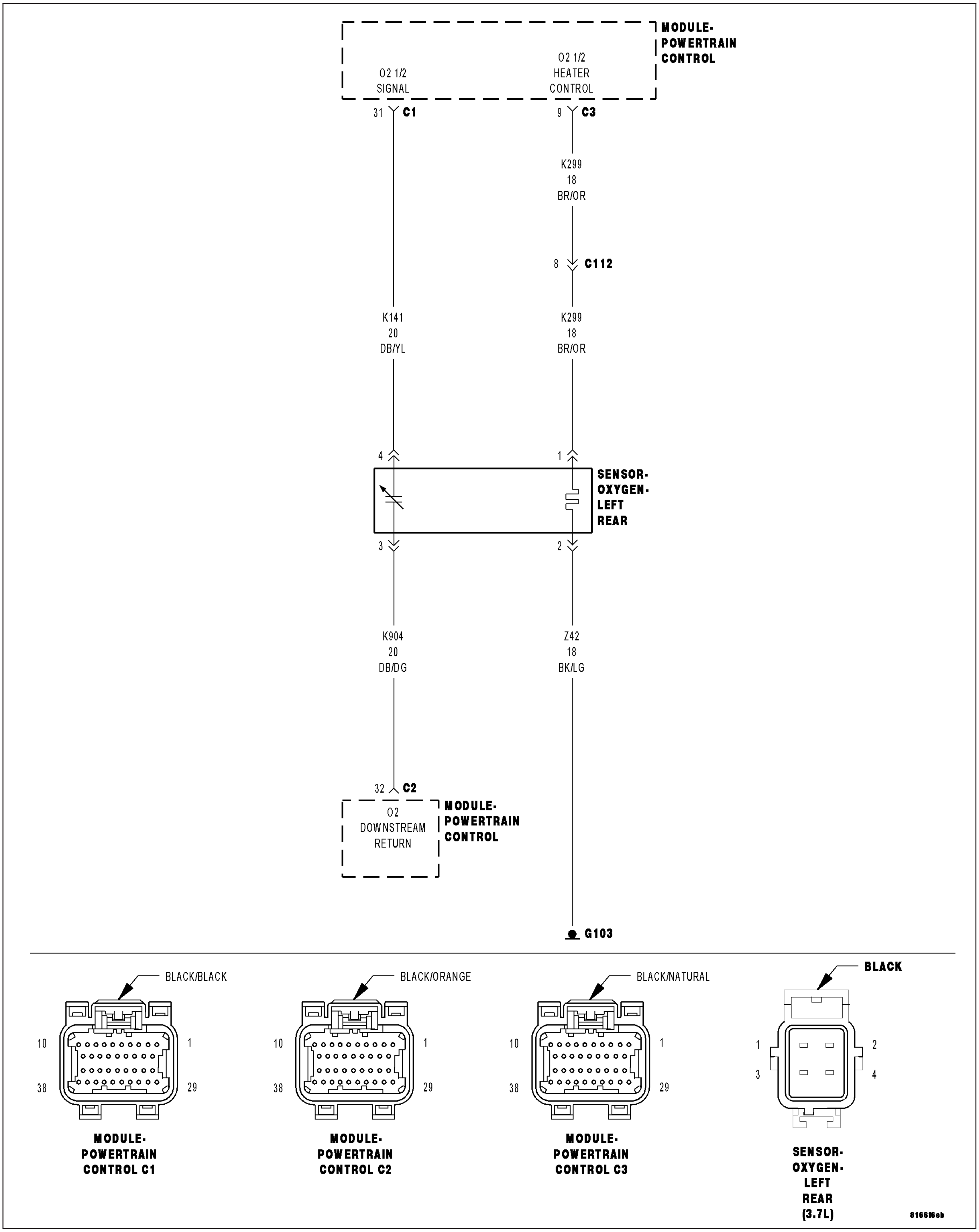
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K299) O2 1/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

**NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.**

Ignition on, engine not running.

With a scan tool, actuate the O2 1/2 Heater Test.

With the scan tool, monitor 1/2 O2 Sensor voltage for at least 2 minutes.

**Does the O2 Sensor voltage stay above 4.5 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. O2 HEATER ELEMENT

Turn the ignition off.

**NOTE: Allow the O2 Sensor to cool down to room temperature.**

Disconnect the 1/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the O2 Heater ground terminal at the component.

**NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.**

**Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?**

**Yes** >> Go To 3

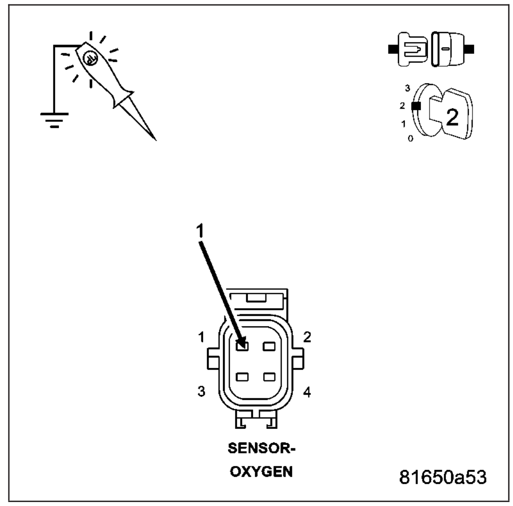
**No** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. O2 SENSOR

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test with the 1/2 O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.




**Does the test light illuminate brightly and flash on and off during the actuation?**

**Yes** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

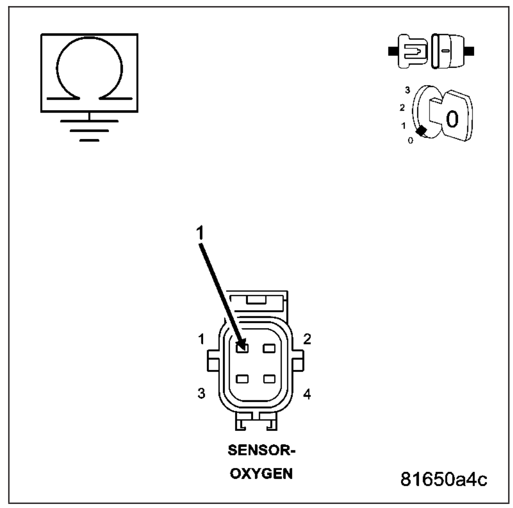
**No** >> Go To 4

## 4. (K299) O2 1/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short to ground in the (K299) O2 1/2 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

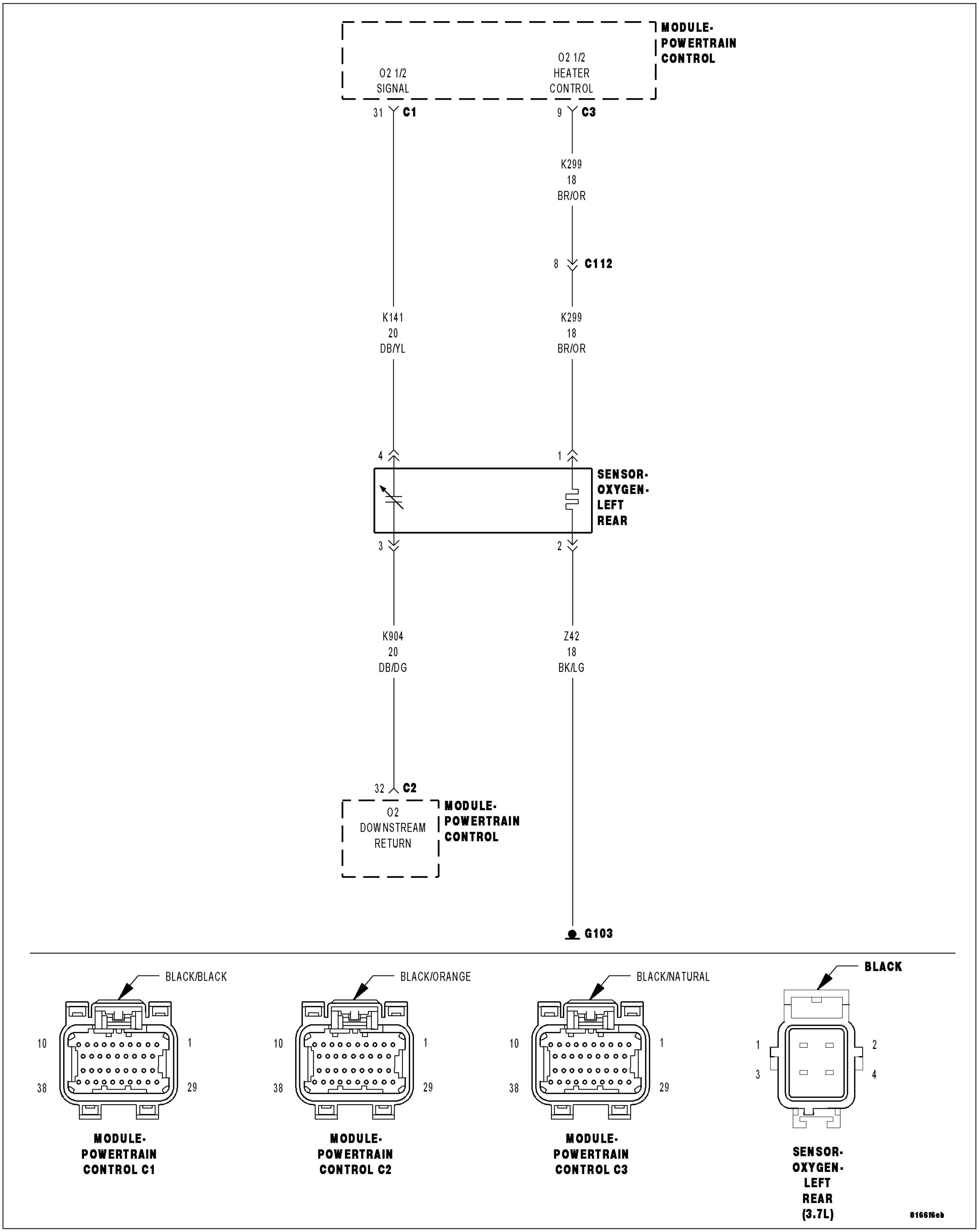
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.
- **Set Condition:**
  Desired state does not equal Actual state. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN |
| (Z42) O2 1/2 HEATER GROUND CIRCUIT OPEN |
| (K299) O2 SENSOR 1/2 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC's.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. O2 HEATER ELEMENT

Turn the ignition off.

**NOTE: Allow the O2 Sensor to cool down to room temperature.**
Disconnect the 1/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the Heater Control terminal and the Heater ground terminal at the component.

**NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.**

**Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?**

**Yes** >> Go To 3

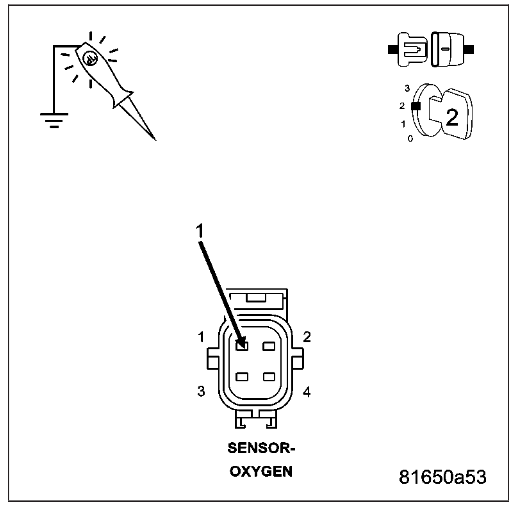
**No** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. (K299) O2 1/2 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

With a scan tool, actuate the O2 1/2 Heater Test with the O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.




**Does the test light illuminate brightly and flash on and off during the actuation?**

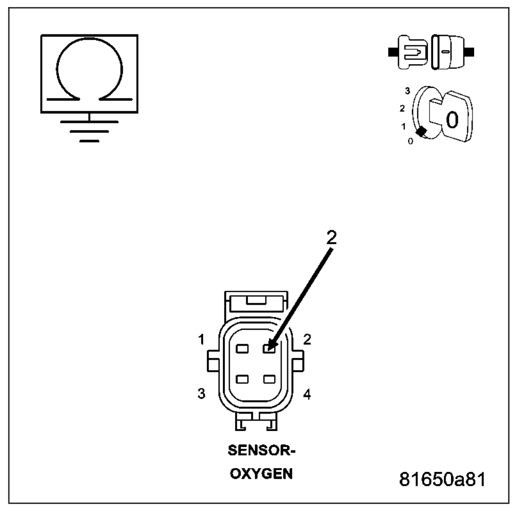
**Yes** >> Go To 4

**No** >> Go To 5

## 4. (Z42) O2 HEATER GROUND CIRCUIT OPEN

Turn the ignition off.

Measure the resistance between an engine ground and the (Z42) O2 1/2 Heater ground circuit in the O2 Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the O2 Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Repair the open in the (Z42) O2 1/2 Heater ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

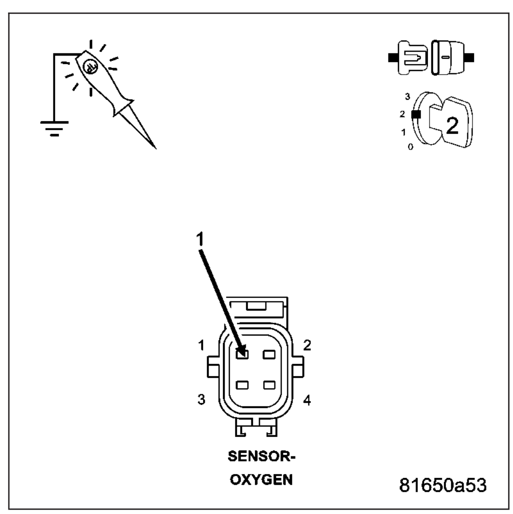
## 5. (K299) O2 1/2 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Using a 12-volt test light connect to ground, probe the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.




**Does the test light illuminate brightly?**

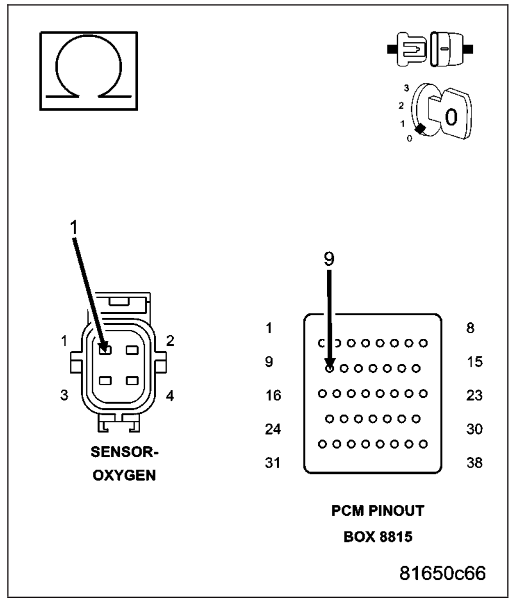
**Yes** >> Repair the short to battery voltage in the (K299) O2 1/2 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.




**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K299) O2 1/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K299) O2 1/2 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

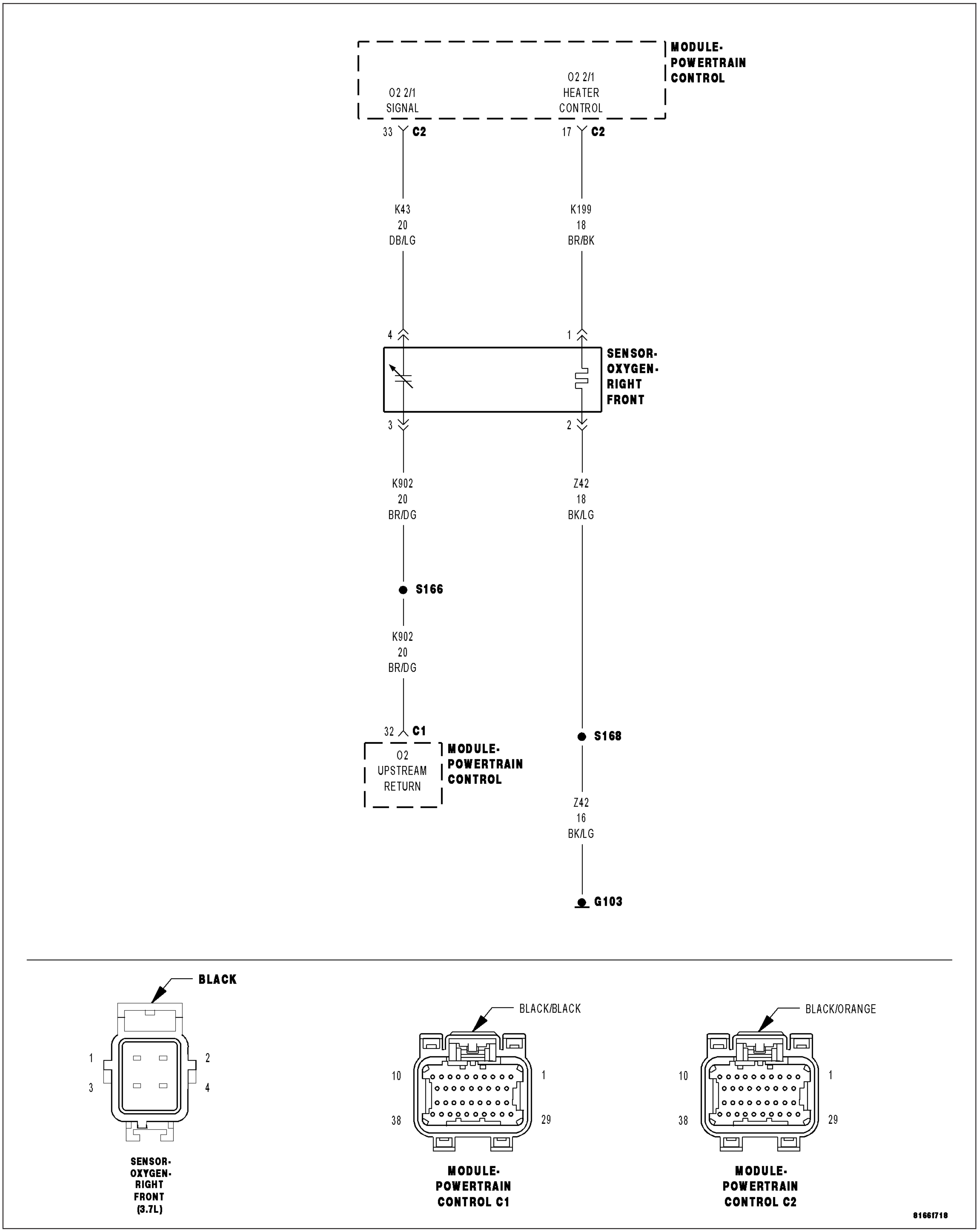
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

**NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.**

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With a scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

**Does the O2 Sensor voltage stay above 4.5 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. O2 HEATER ELEMENT

Turn the ignition off.

**NOTE: Allow the O2 Sensor to cool down to room temperature.**

Disconnect the 2/1 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the Heater Control terminal and the Heater ground terminal at the component.

**NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.**

**Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?**

**Yes** >> Go To 3

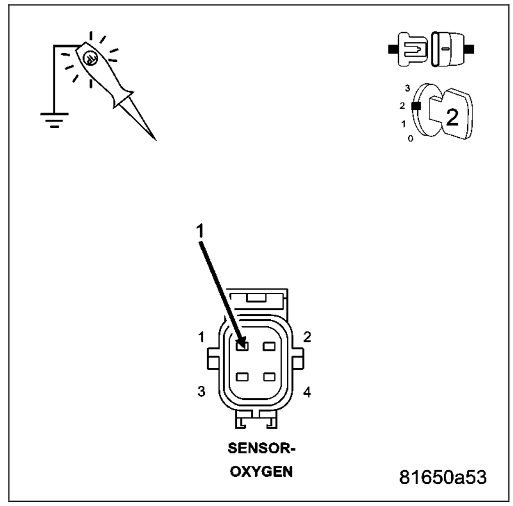
**No** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. O2 SENSOR

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test with the O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.




**Does the test light illuminate brightly and flash on and off during the actuation?**

**Yes** >> Replace the O2 Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

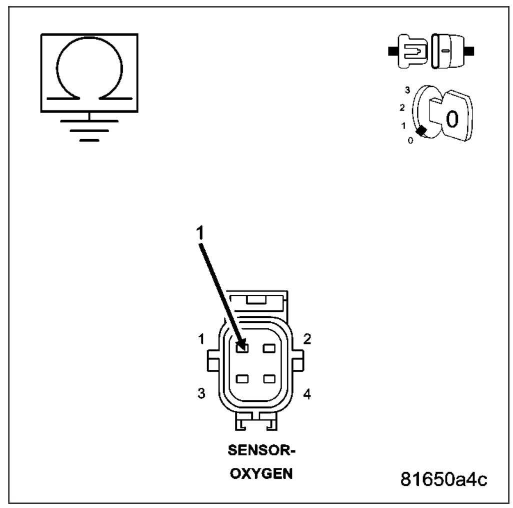
**No** >> Go To 4

## 4. (K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short to ground in the (K199) O2 2/1 Sensor Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

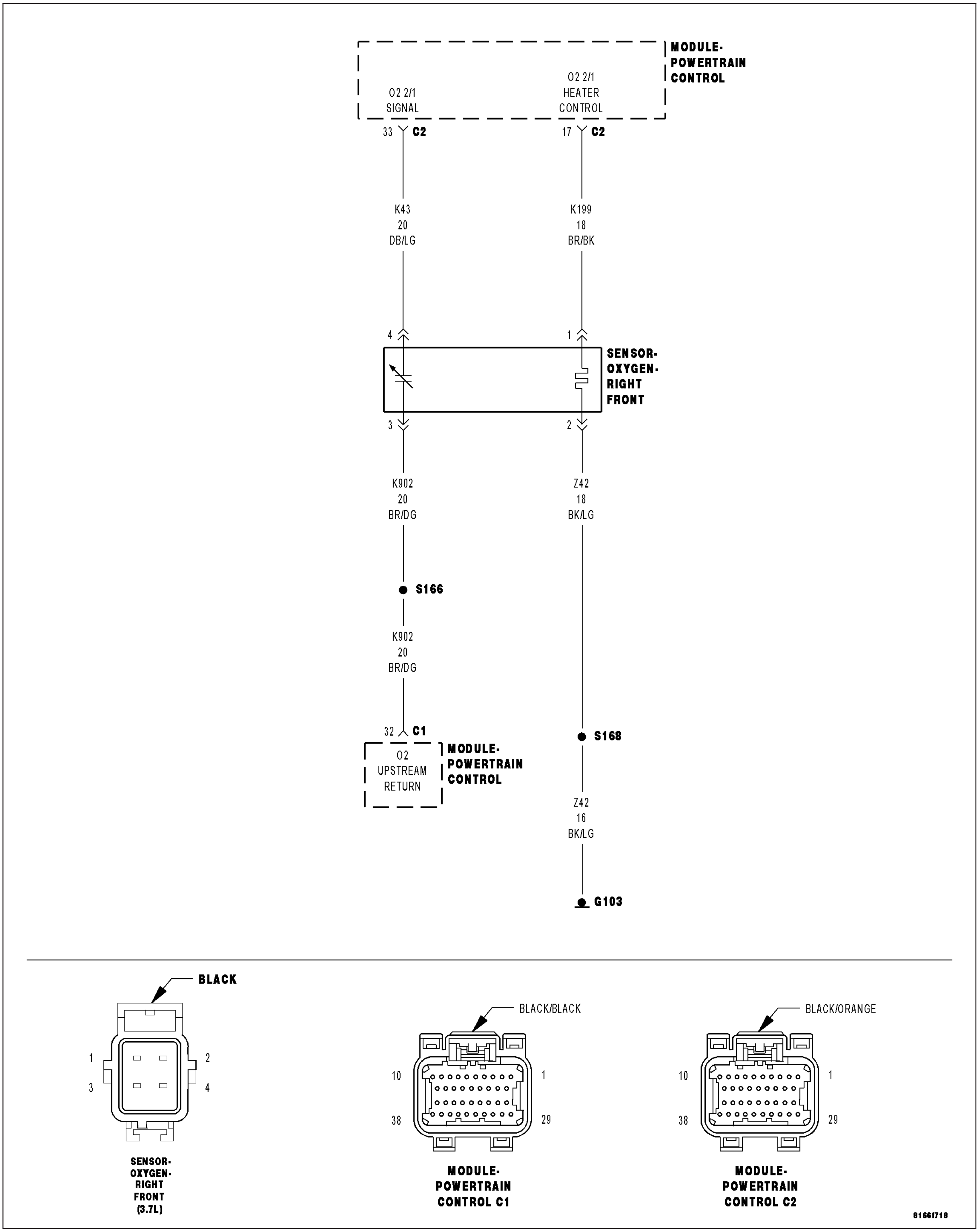
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.
- **Set Condition:**
  Desired state does not equal Actual state. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN |
| (Z42) O2 2/1 HEATER GROUND CIRCUIT OPEN |
| (K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC's.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. O2 HEATER ELEMENT

Turn the ignition off.

**NOTE: Allow the O2 Sensor to cool down to room temperature.**

Disconnect the 2/1 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the Heater ground terminal at the component connector.

**NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.**

**Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?**

**Yes** >> Go To 3

**No** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. (K199) O2 2/1 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

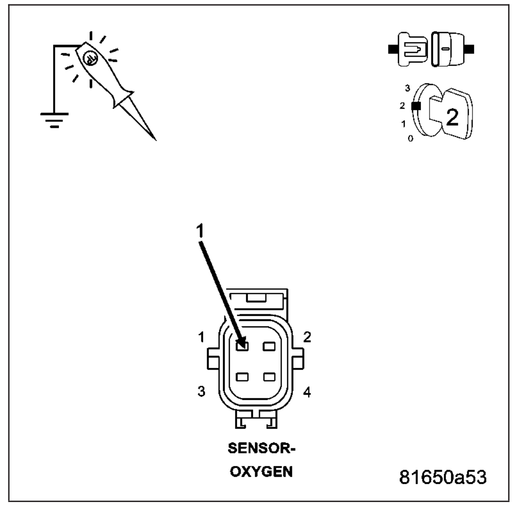
With the scan tool, actuate the O2 Heater Test with the Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

**Does the test light illuminate brightly and flash on and off during the actuation?**

**Yes** >> Go To 4

**No** >> Go To 5




## 4. (Z42) O2 2/1 HEATER GROUND CIRCUIT OPEN

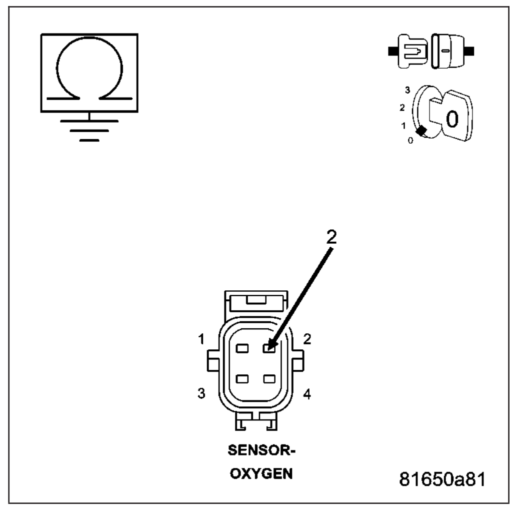
Turn the ignition off.

Measure the resistance between an engine ground and the (Z42) O2 2/1 Heater ground circuit in the O2 Sensor harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Repair the open in the (Z42) O2 2/1 Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




## 5. (K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

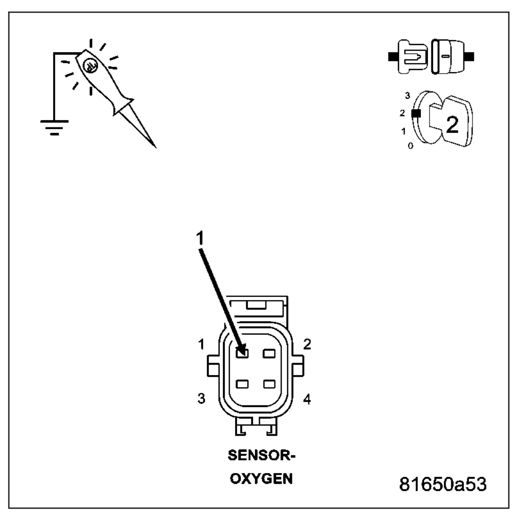
Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

**Does the test light illuminate?**

**Yes** >> Repair the short to battery voltage in the (K199) O2 2/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

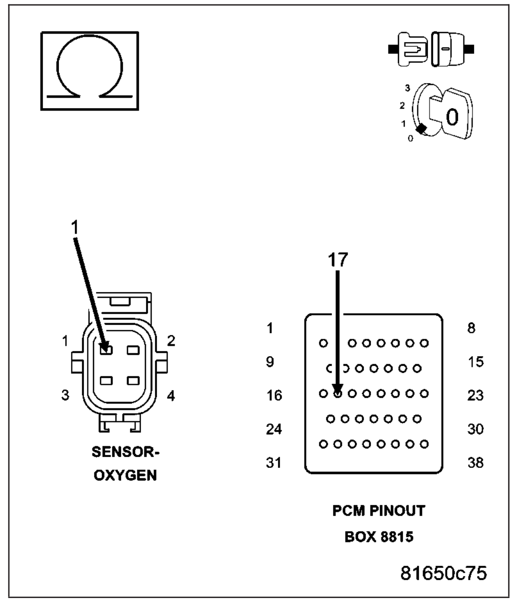


## 6. (K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K199) O2 2/1 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K199) O2 2/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

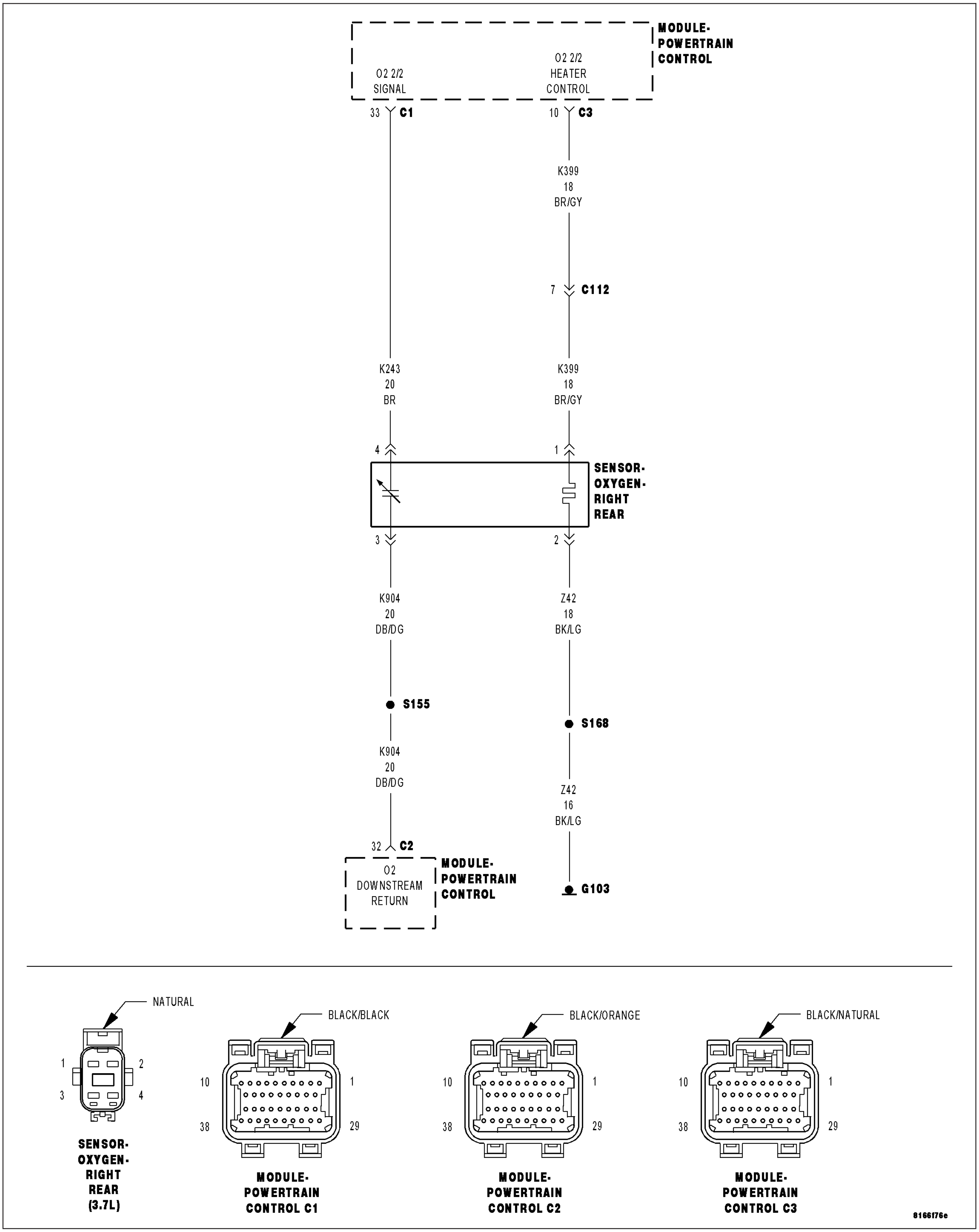
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0057-O2 SENSOR 2/2 HEATER CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

**NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.**

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 2/2 O2 Sensor voltage for at least 2 minutes.

**Does the O2 Sensor voltage stay above 4.5 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. O2 HEATER ELEMENT

Turn the ignition off.

**NOTE: Allow the O2 Sensor to cool down to room temperature.**

Disconnect the 2/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the O2 Heater ground terminal in the component connector.

**NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.**

**Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?**

**Yes** >> Go To 3

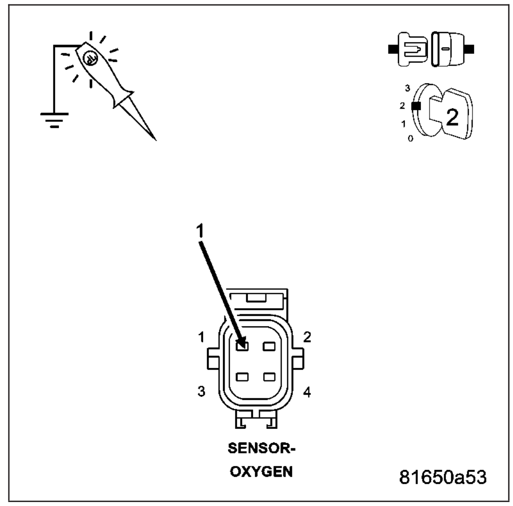
**No** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. O2 SENSOR

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test with the O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K399) O2 2/2 Heater Control circuit in the O2 Sensor harness connector.




**Does the test light illuminate brightly and flash on and off during the actuation?**

**Yes** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

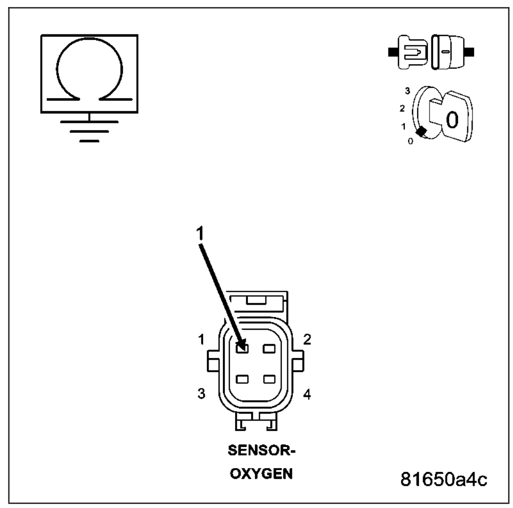
**No** >> Go To 4

## 4. (K399) O2 2/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K399) O2 2/2 Heater Control circuit in the O2 Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short to ground in the (K399) O2 2/2 Sensor Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

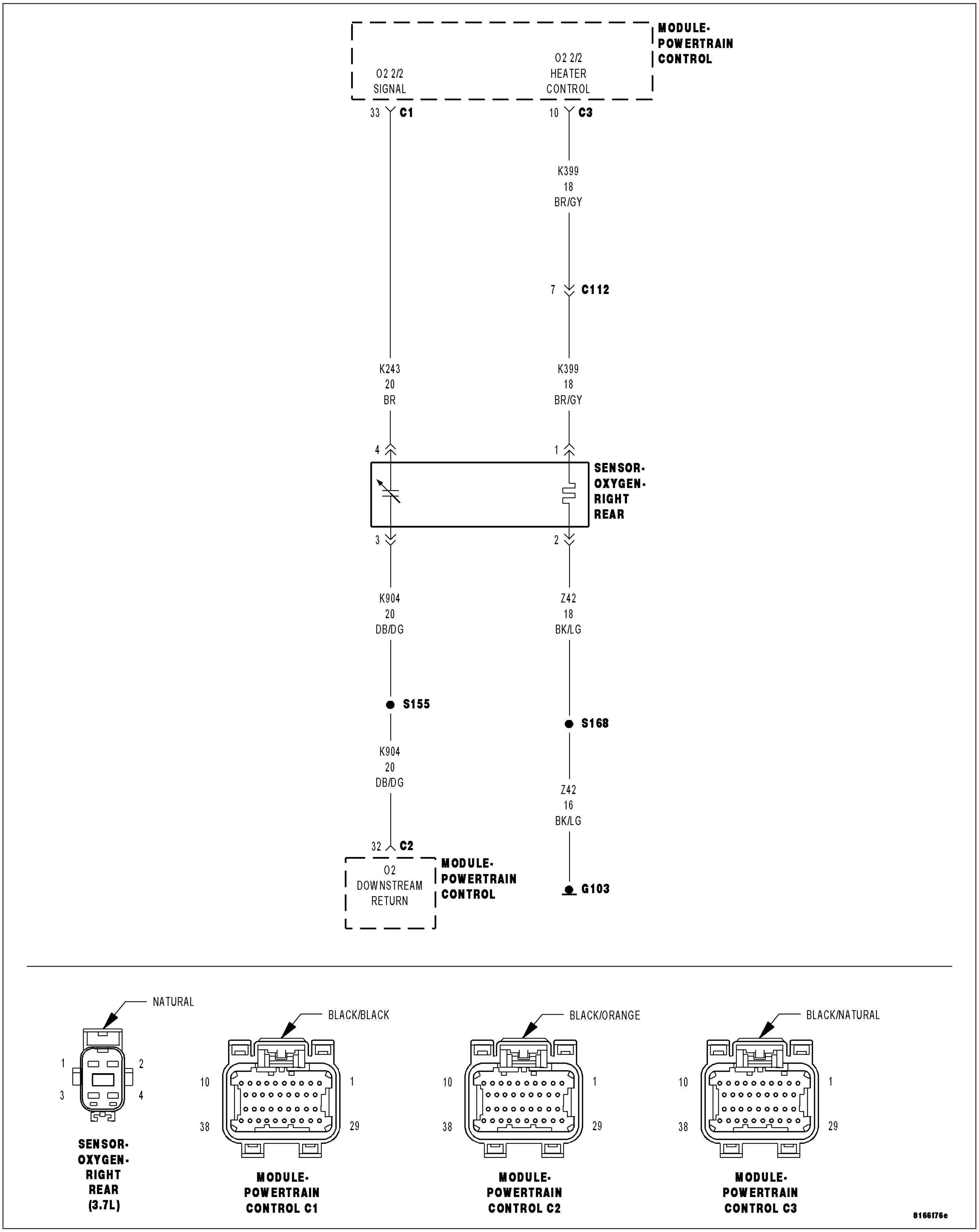
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.
- **Set Condition:**
  Desired state does not equal Actual state. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN |
| (Z42) O2 2/2 HEATER GROUND CIRCUIT OPEN |
| (K399) O2 2/2 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC's.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. O2 HEATER ELEMENT

Turn the ignition off.

**NOTE: Allow the O2 Sensor to cool down to room temperature.**

Disconnect the 2/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the O2 Heater ground terminal in the component connector.

**NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.**

**Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?**

**Yes** >> Go To 3

**No** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. (K399) O2 2/2 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

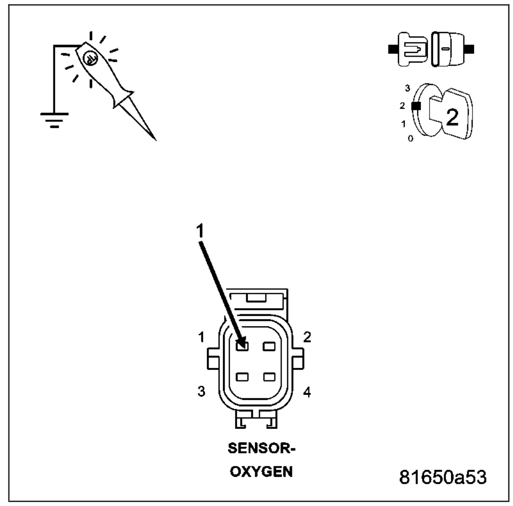
With a scan tool, actuate the O2 2/2 Heater Test with the Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K399) O2 2/2 Heater Control circuit in the O2 Sensor harness connector.

**Does the test light illuminate brightly and flash on and off during the actuation?**

**Yes** >> Go To 4

**No** >> Go To 5




## 4. (Z42) O2 HEATER GROUND CIRCUIT OPEN

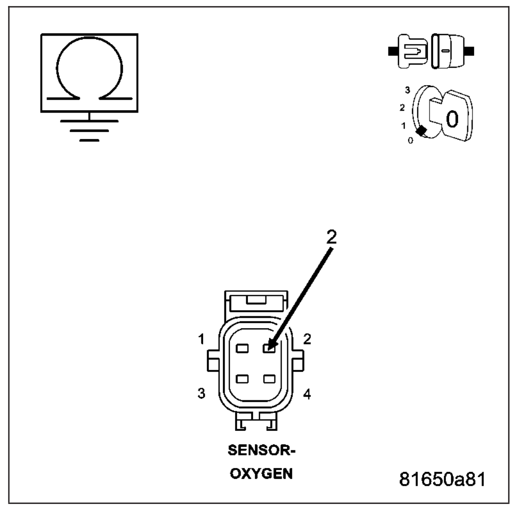
Turn the ignition off.

Measure the resistance between an engine ground and the (Z42) O2 2/2 Heater ground circuit in the O2 Sensor harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Repair the open in the (Z42) O2 2/2 Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




## 5. (K399) O2 2/2 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

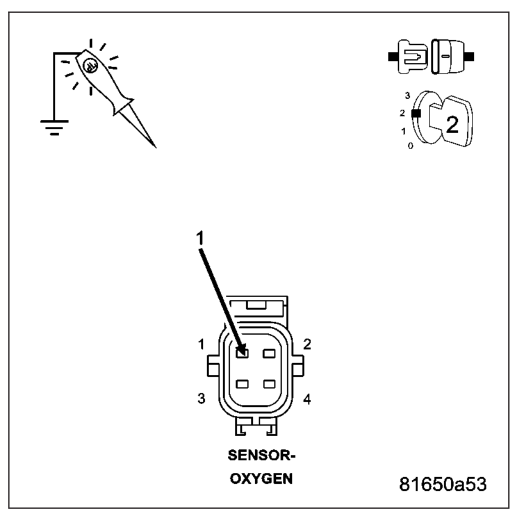
Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (K399) O2 Heater 2/2 Control circuit in the O2 Sensor harness connector.

**Does the test light illuminate?**

**Yes** >> Repair the short to battery voltage in the (K399) O2 2/2 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

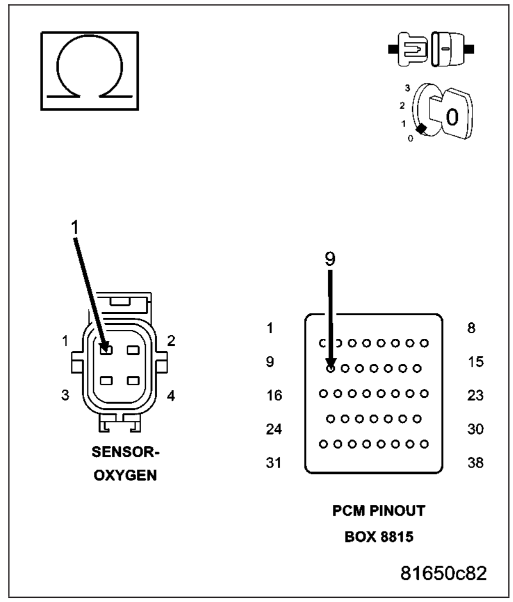


## 6. (K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K399) O2 2/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K399) O2 2/2 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION

For a complete wiring diagram **Refer to Section 8W**.

### Theory of Operation

This DTC sets when an unexpected high intake manifold air flow condition exists that can lead to increased engine speed and puts the NGC into a High Air flow Protection limiting mode. The High Air flow Protection feature includes RPM limits for when a Throttle and/or MAP sensor limp-in fault is present.

- **When Monitored:**
  During all drive modes.
- **Set Condition:**
  If vacuum drops below 1.5″Hg with engine RPM greater than 2000 RPM and closed throttle. This fault can set due to a TPS/MAP sensor failure. It will set much faster than the TPS/MAP fault can mature. If there is not an obvious large intake leak, suspect a TPS/MAP fault. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| VACUUM LEAK |
| RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT |
| (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND |
| RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT |
| (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| RESISTANCE IN THE (K22) TP SENSOR NO.1 SIGNAL CIRCUIT |
| (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND |
| RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT |
| MAP SENSOR |
| THROTTLE POSITION SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

### Diagnostic Test

#### 1. ACTIVE DTC

**NOTE: Diagnose any TP Sensor or MAP Sensor component DTCs before continuing.**

**NOTE: If the P0501 - No Vehicle Speed Signal is set long with this DTC, refer to the P0501 diagnostics before continuing.**

**NOTE: The throttle plate and linkage should be free from binding and carbon build up.**

**NOTE: Make sure the throttle plate is at the idle position.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. VACUUM LEAK

**NOTE: This code is enabled on engines with a plastic intake manifold and is intended to shut down the engine if a large crack occurs.**

**NOTE: A large vacuum leak is most likely the cause of this DTC.**

Inspect the Intake Manifold for leaks and cracks.

Inspect the Power Brake Booster for any vacuum leaks.

Inspect the PCV system for proper operation and vacuum leaks.

Inspect the throttle plate to see if it is bent and will close entirely, if it is bent it may need to be replaced.

Inspect the MAP Sensor for proper installation.

Verify the engine is free from any mechanical failures.

**Were any vacuum leaks found?**

**Yes** >> Repair the vacuum leak as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE) x

**No** >> Go To 3

## 3. MAP SENSOR OPERATION

Start the engine.

With a scan tool, monitor the MAP Sensor voltage.

Snap the throttle.

**Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at wide open throttle?**

**Yes** >> Go To 4

**No** >> Go To 11

## 4. TP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage while slowly pressing the throttle pedal from closed to wide open throttle.

**Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

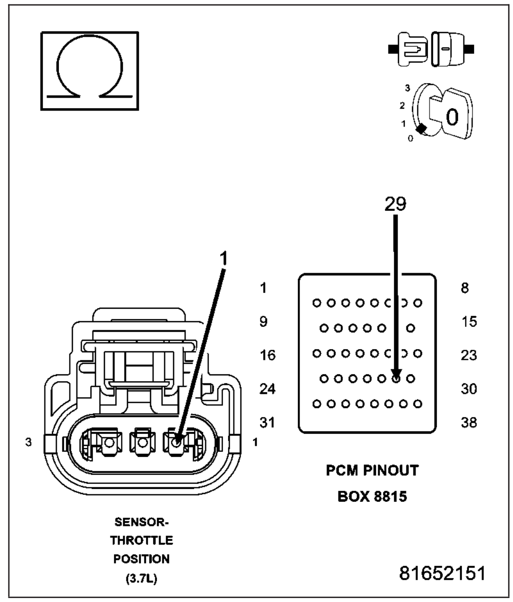
Turn the ignition off.

Disconnect the TP Sensor harness connector.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (F855) 5-volt Supply circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

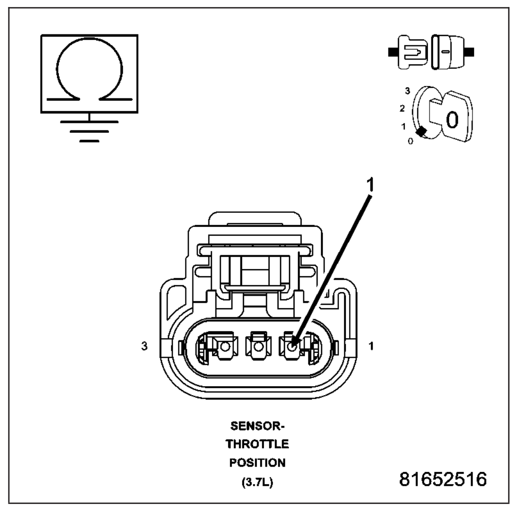
**Yes** >> Go To 6

**No** >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit in the TP Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

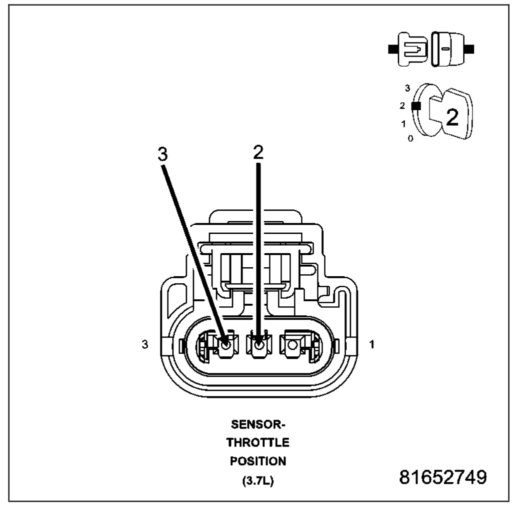
## 7. THROTTLE POSITION SENSOR

Connect the PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage.

Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.




**Does the TP Sensor voltage change from approximately 4.9 volts to below 0.5 of a volt with the jumper wire installed?**

**Yes** >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

**NOTE: Remove the jumper wire before continuing.**

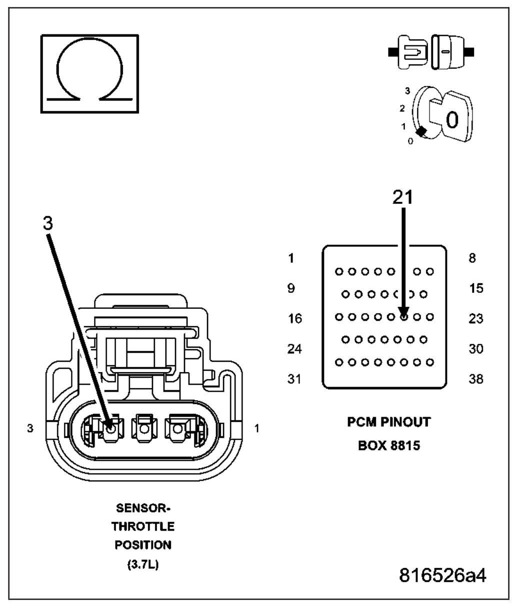
## 8. EXCESSIVE RESISTANCE IN THE (K22) TP NO.1 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.



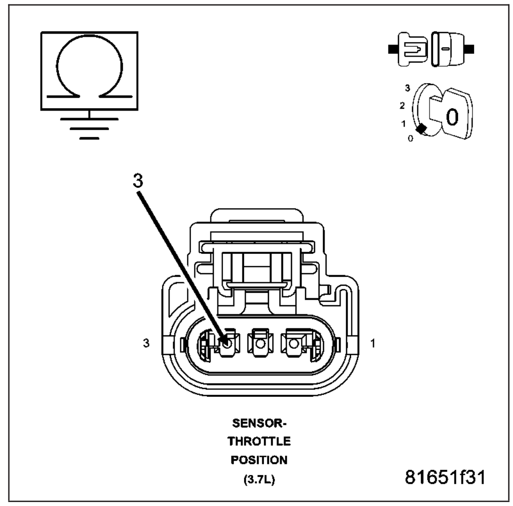

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 9

**No** >> Repair the excessive resistance in the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 9. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit.

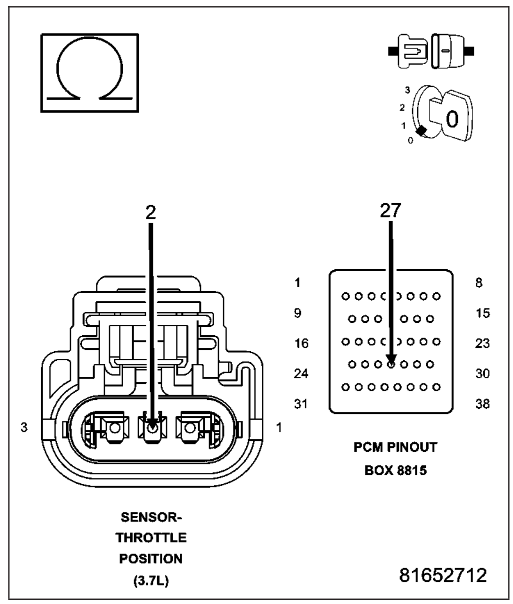
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 10

## 10. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K900) Sensor ground circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 17

**No** >> Repair the excessive resistance in the (K900) Sensor ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 11. EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

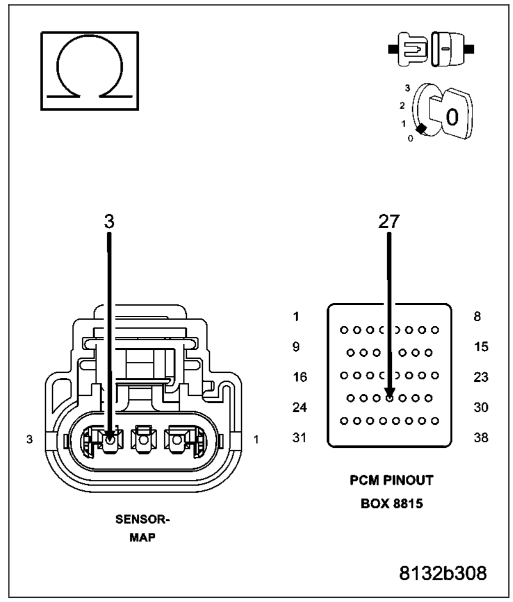
Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Disconnect the C1 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

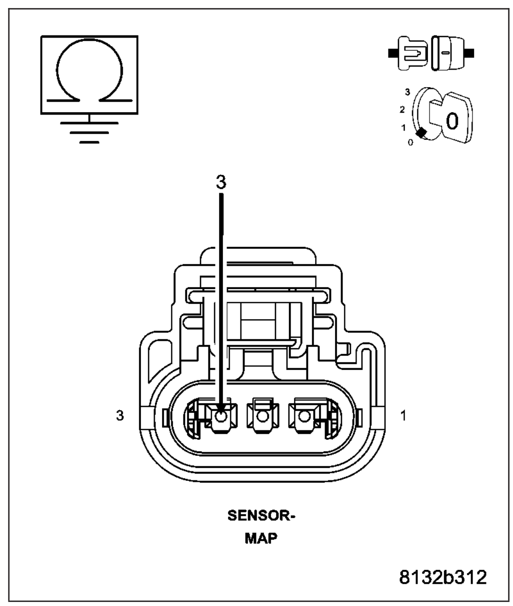
**Yes** >> Go To 12

**No** >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.




**Is the resistance above 100k ohms?**

**Yes** >> Go To 13

**No** >> Repair the short to ground in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 13. MAP SENSOR

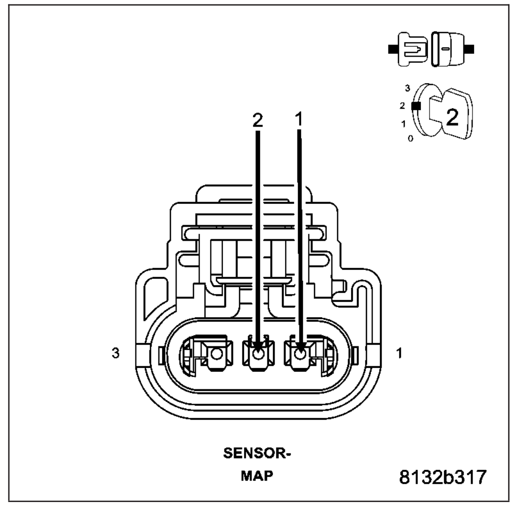
Turn the ignition off.

Connect the C1 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit.




**Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 of a volt with the jumper wire installed?**

**Yes** >> Replace the MAP Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

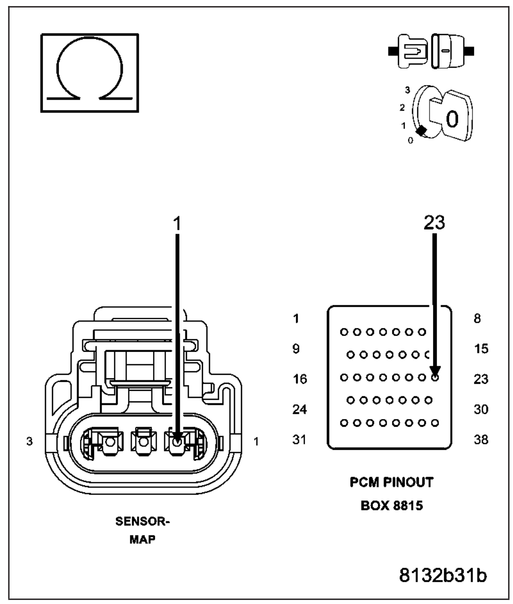
**No** >> Go To 14

**NOTE: Remove the jumper wire before continuing.**

## 14. EXCESSIVE RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.




**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

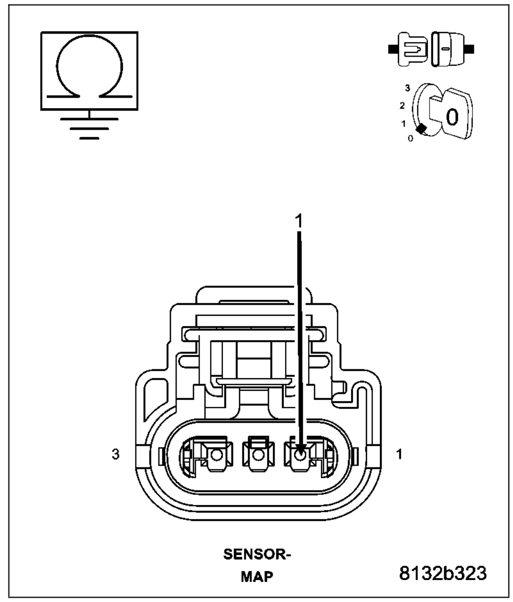
**Yes** >> Go To 15

**No** >> Repair the excessive resistance in the (K1) MAP Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 15. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.




**Is the resistance below 100 ohms?**

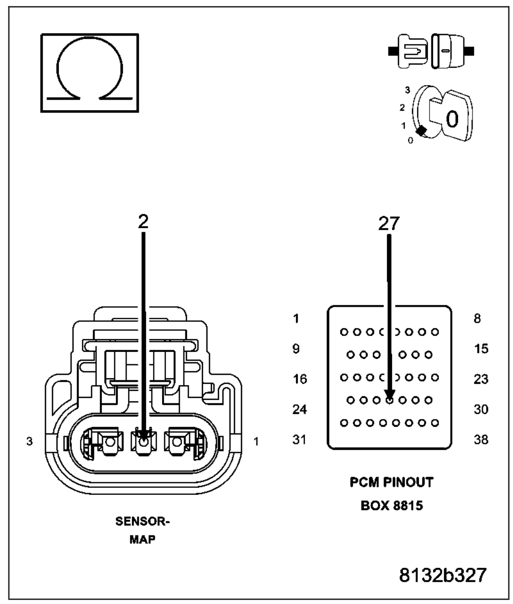
**Yes** >> Repair the short to ground in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 17

**No** >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 17. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

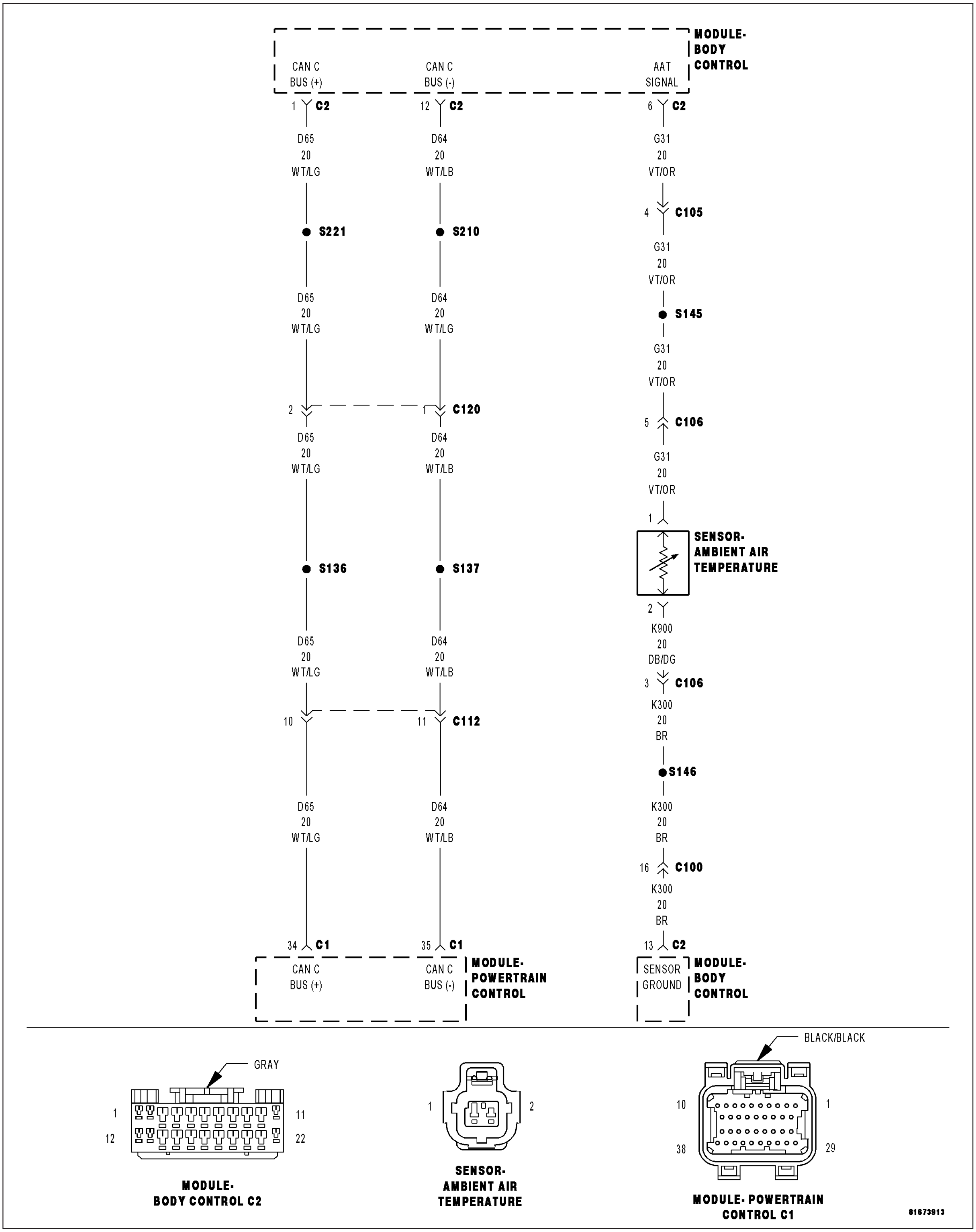
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE



## Theory of Operation

Ambient Air Temperature Sensor performance looks at the outputs of three temperature sensors and compare them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If the engine coolant and intake air temperature sensors agree and the ambient air temperature does not agree, the ambient air temperature sensor is declared as irrational.

- **When Monitored:**
  Engine off time is greater than 480 minutes. Ambient temperature is greater than 4 deg C (38 deg F).
- **Set Condition:**
  After a calibrated amount of cool down time the BCM compares the ECT Sensor, IAT Sensor, and the Ambient Air Temp Sensor values. If the IAT Sensor value is not within –10 deg C (18 deg F) of the other two temperature sensors. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (G31) AAT SIGNAL CIRCUIT OPEN |
| (K300) SENSOR GROUND CIRCUIT OPEN |
| (G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND |
| (G31) AAT SIGNAL CIRCUIT SHORTED TO THE (K300) SENSOR GROUND CIRCUIT |
| AMBIENT AIR TEMPERATURE SENSOR |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| BCM |
| BCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Diagnose any CAN C Bus communication DTC's before continuing.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. (G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

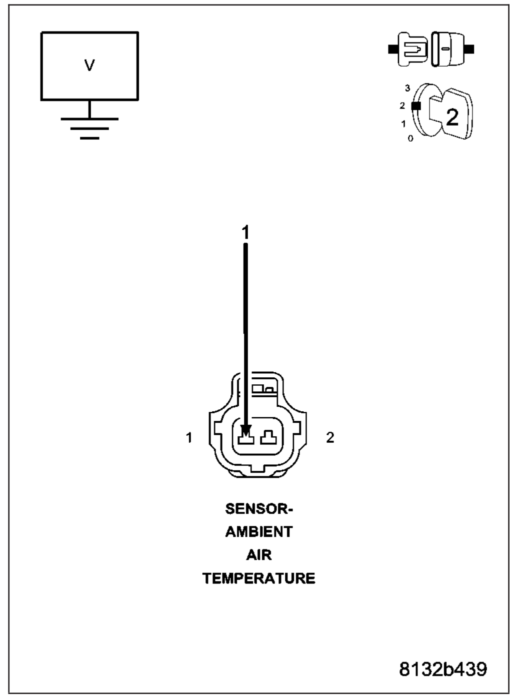
Disconnect the C2 BCM harness connector.

Disconnect the AAT Sensor harness connector.

**NOTE: Visually inspect both the component and the BCM connectors. Look for damaged, partially broken wires, and backed out or corroded terminals.**

Ignition on, engine not running.

Measure the voltage on the (G31) AAT Signal circuit in the AAT Sensor harness connector.




**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to voltage in the (G31) AAT Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. AAT SENSOR VOLTAGE ABOVE 4.6 VOLTS

Turn the ignition off.

Connect the C2 BCM harness connector.

Ignition on, engine not running.

With a scan tool, read the AAT voltage.

**Is the voltage above 4.6 volts?**

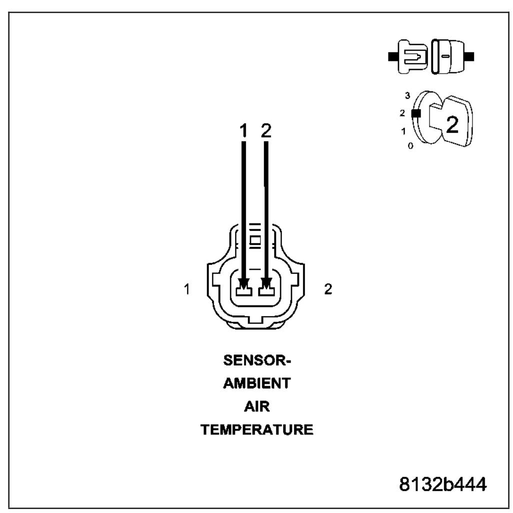
**Yes** >> Go To 4

**No** >> Go To 7

## 4. AAT SENSOR

Connect a jumper wire between the (G31) AAT Signal circuit and the (K300) Sensor ground circuit in the AAT Sensor harness connector.

With a scan tool, read the AAT voltage.




**Is the voltage below 1.0 volt with the jumper wire installed?**

**Yes** >> Replace the AAT Sensor. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

**NOTE: Remove the jumper wire before continuing.**

## 5. (G31) AAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

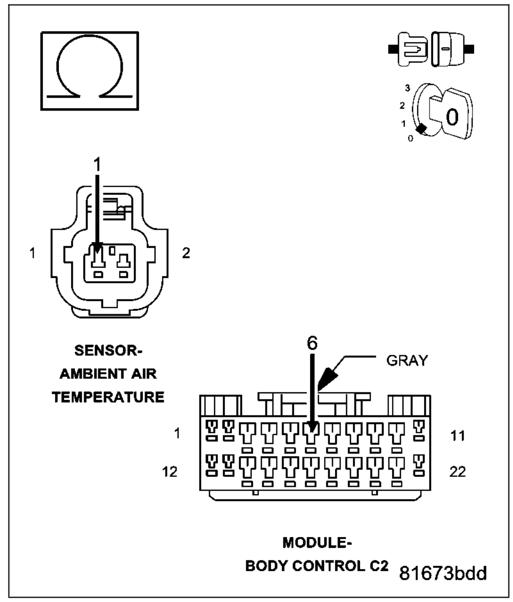
Disconnect the C2 BCM harness connector.

Measure the resistance of the (G31) AAT Signal circuit from the AAT Sensor harness connector to the C2 BCM harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (G31) AAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



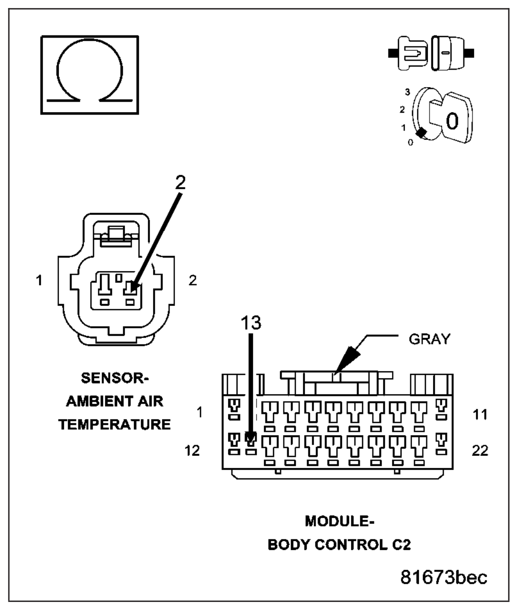

## 6. (K300) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K300) Sensor ground circuit from the AAT Sensor harness connector to the C2 BCM harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 9

**No** >> Repair the open in the (K300) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

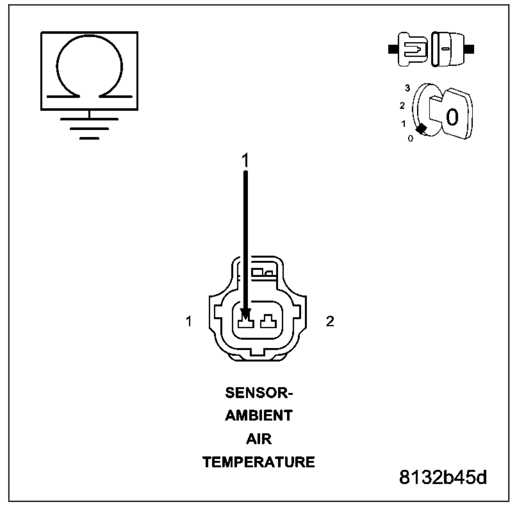


## 7. (G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 BCM harness connector.

Measure the resistance between ground and the (G31) AAT Signal circuit in the AAT Sensor harness connector.




**Is the resistance below 100 ohms?**

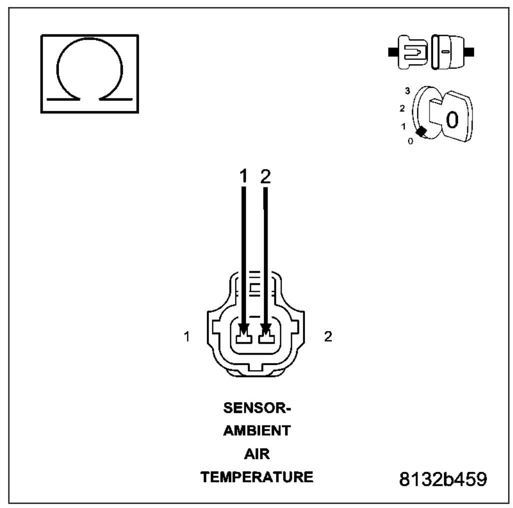
**Yes** >> Repair the short to ground in the (G31) AAT Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. (G31) AAT SIGNAL CIRCUIT SHORTED TO THE (K300) SENSOR GROUND CIRCUIT

Measure the resistance between the (G31) AAT Signal circuit and the (K300) Sensor ground circuit in the AAT Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K300) Sensor ground circuit and the (G31) AAT Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

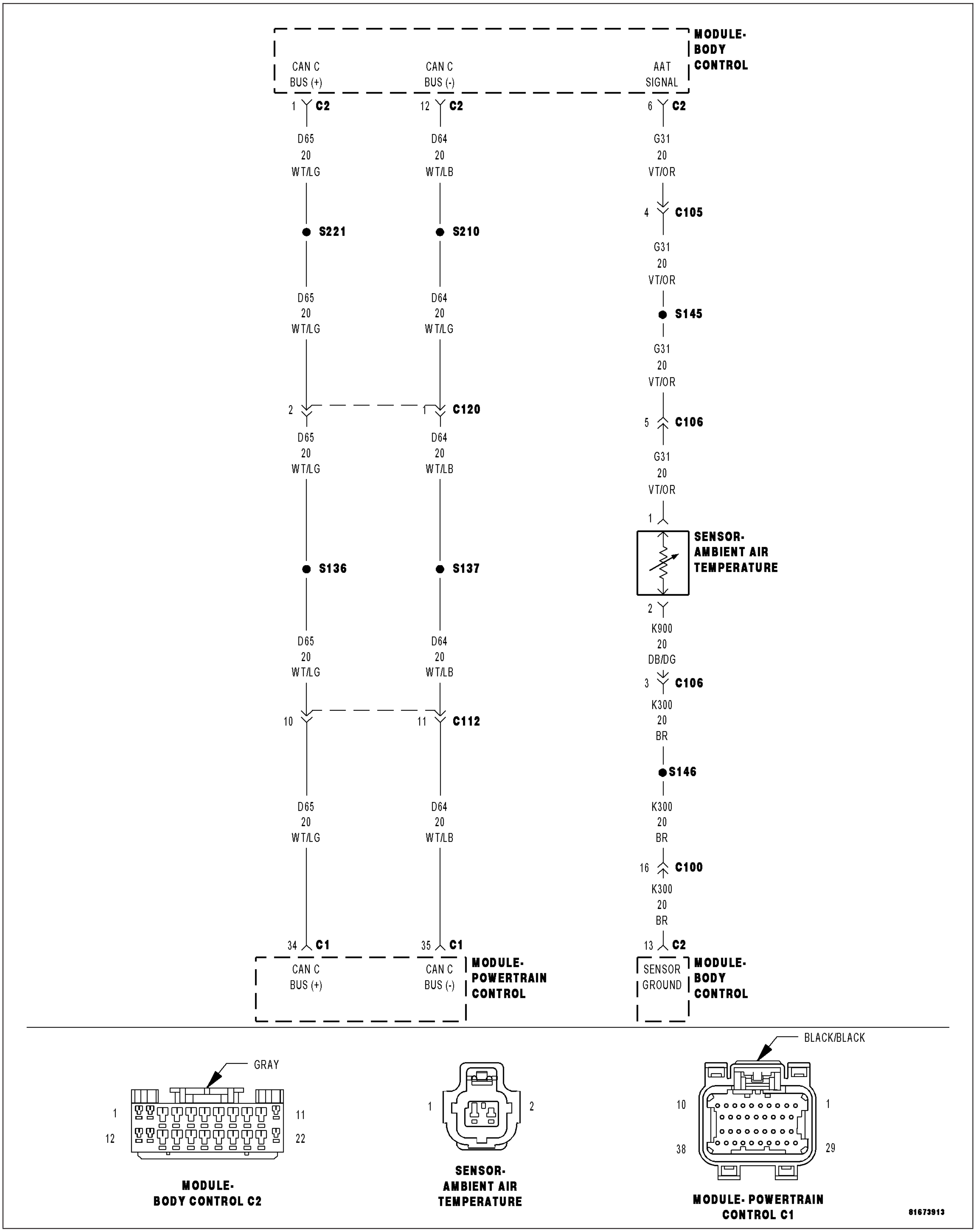
**Yes** >> Repair as necessary.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Body Control Module per Service Information.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## P0072-AMBIENT AIR TEMPERATURE SENSOR CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The ignition key on.
- **Set Condition:**
  Ambient Temperature Sensor is less than 0.078 of a volt at the BCM for 4.8 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND |
| (G31) ATT SIGNAL CIRCUIT SHORTED TO THE (K300) SENSOR GROUND CIRCUIT |
| AMBIENT AIR TEMPERATURE SENSOR |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| BCM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. AAT SENSOR VOLTAGE BELOW 0.078 OF A VOLT

**NOTE: Diagnose any CAN C Bus Communication DTCs before continuing.**
Ignition on, engine not running.
With a scan tool, read the Ambient Air Temperature Sensor voltage.

**Is the voltage below 0.078 of a volt?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. CHECKING AAT SENSOR

Turn the ignition off.
Disconnect the Ambient Air Temperature Sensor harness connector.
Ignition on, engine not running.
With a scan tool, read the AAT Sensor voltage.

**Is the voltage above 4.6 volts?**

**Yes** >> Replace the Ambient Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

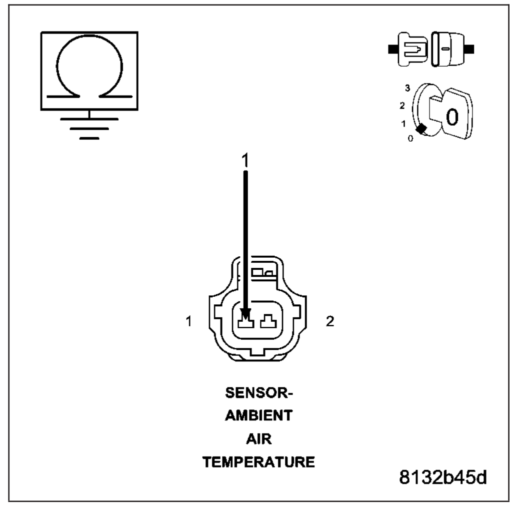
**No** >> Go To 3

## 3. (G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 BCM harness connector.

Measure the resistance between ground and the (G31) AAT Signal circuit in the AAT Sensor harness connector.



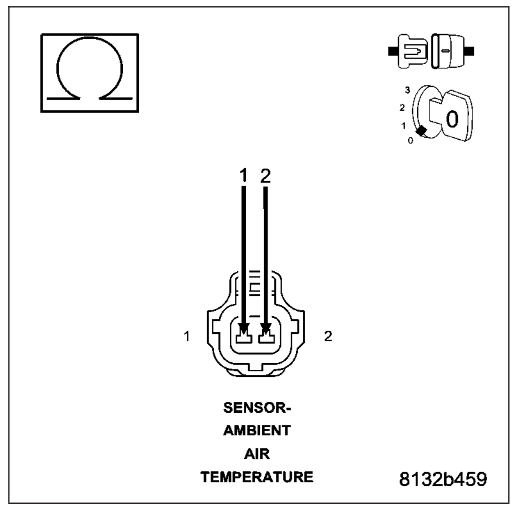

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (G31) AAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (G31) AAT SIGNAL CIRCUIT SHORTED TO THE (K300) SENSOR GROUND CIRCUIT

Measure the resistance between the (K300) Sensor ground circuit and the (G31) AAT Signal circuit in the AAT Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K300) Sensor ground circuit and the (G31) AAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

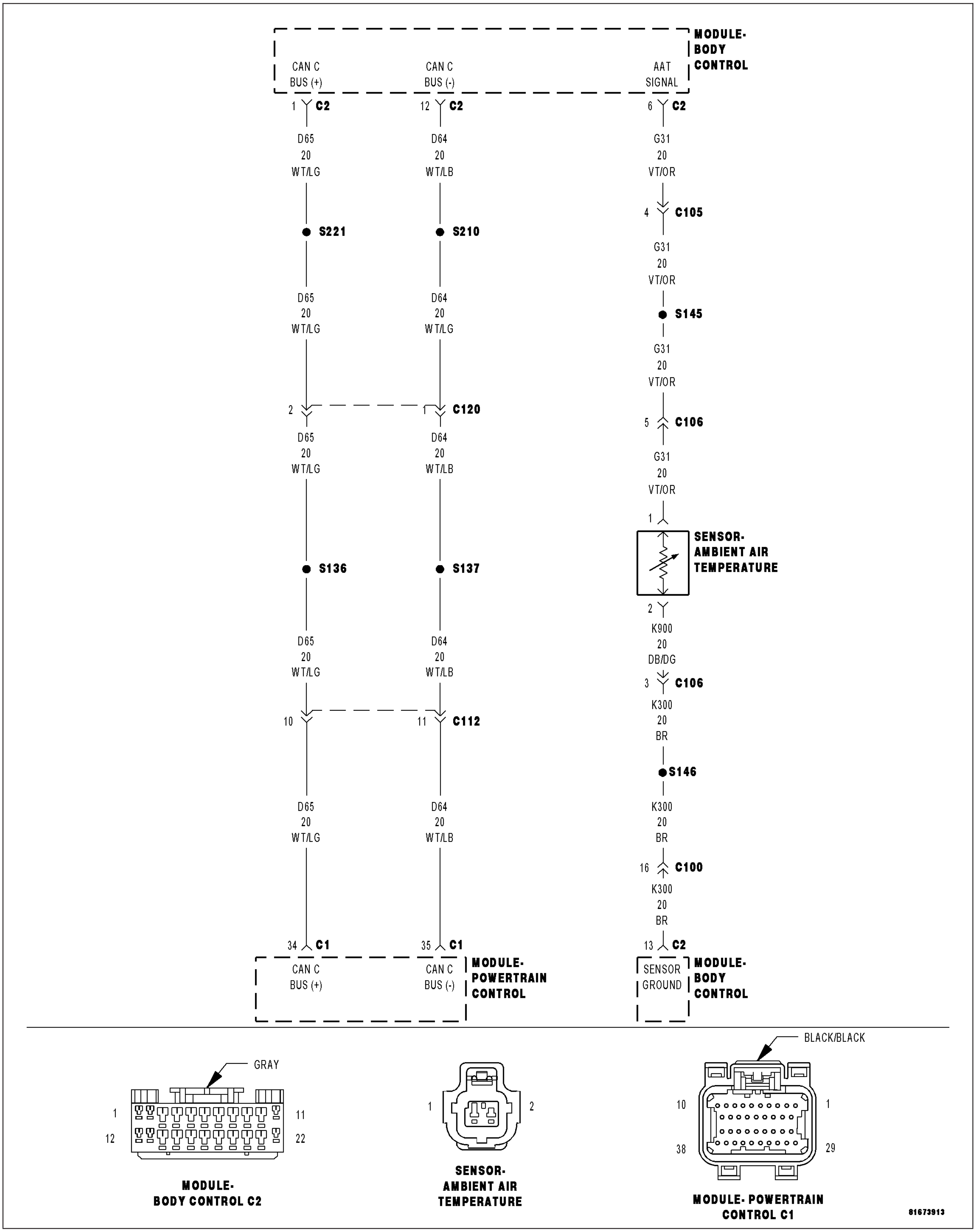
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and program the Body Control Module per Service Information.
Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## P0073–AMBIENT AIR TEMPERATURE SENSOR CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts.
- **Set Condition:**
  The Ambient Temperature Sensor voltage is greater than 4.94 volts at the PCM for 4.8 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (G31) AAT SIGNAL CIRCUIT OPEN |
| (K300) SENSOR GROUND CIRCUIT OPEN |
| AMBIENT AIR TEMPERATURE SENSOR |
| CAN C BUS CIRCUIT OPEN OR SHORTED |
| BCM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. AAT SENSOR VOLTAGE ABOVE 4.94 VOLTS

**NOTE: Diagnose any CAN C Bus Communication DTCs before continuing.**

Ignition on, engine not running.

With a scan tool, read the Ambient Air Temperature Sensor voltage.

**Is the voltage above 4.94 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. AAT SENSOR

Turn the ignition off.

Disconnect the Ambient Air Temperature Sensor harness connector.

Connect a jumper wire between the (G31) AAT Signal circuit and the (K300) Sensor ground circuit in the AAT Sensor harness connector.

Ignition on, engine not running.

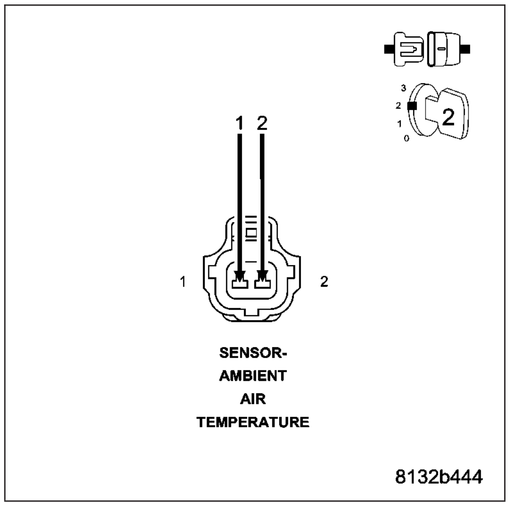
With a scan tool, read AAT Sensor voltage.

**Is the voltage below 1.0 volt with the jumper wire installed?**

**Yes** >> Replace the Ambient Air Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

**NOTE: Remove the jumper wire before continuing.**



## 3. (G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 BCM harness connector.

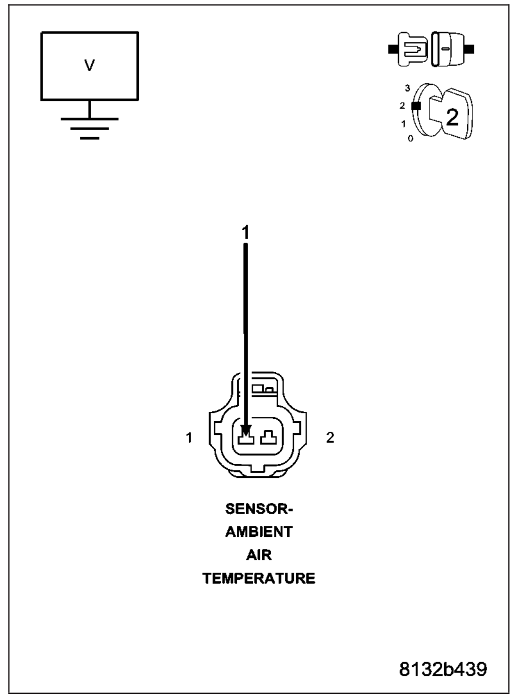
Ignition on, engine not running.

Measure the voltage on the (G31) AAT Signal circuit in the AAT Sensor harness connector.

**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (G31) AAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4




## 4. (G31) AAT SIGNAL CIRCUIT OPEN

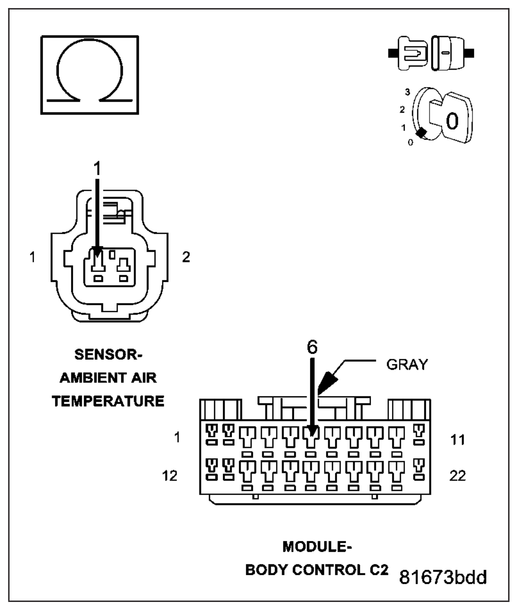
Turn the ignition off.

Measure the resistance of the (G31) AAT Signal circuit from the AAT Sensor harness connector to the C2 BCM harness connector.

**Is the resistance below 5.0 ohms?**

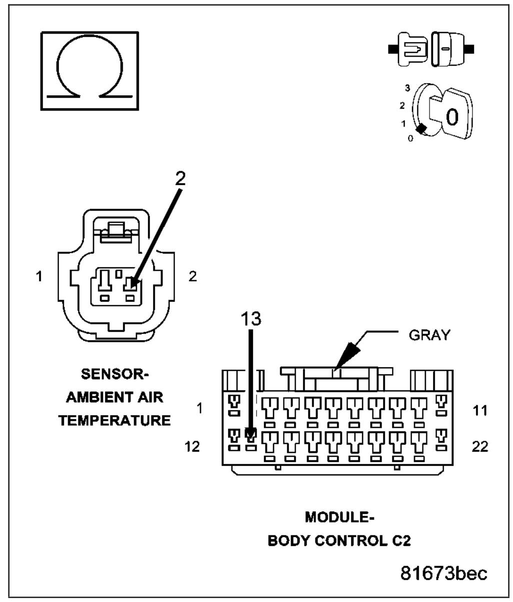
**Yes** >> Go To 5

**No** >> Repair the open in the (G31) AAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



## 5. (K300) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K300) Sensor ground circuit from the AAT Sensor harness connector to the C2 BCM harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K300) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

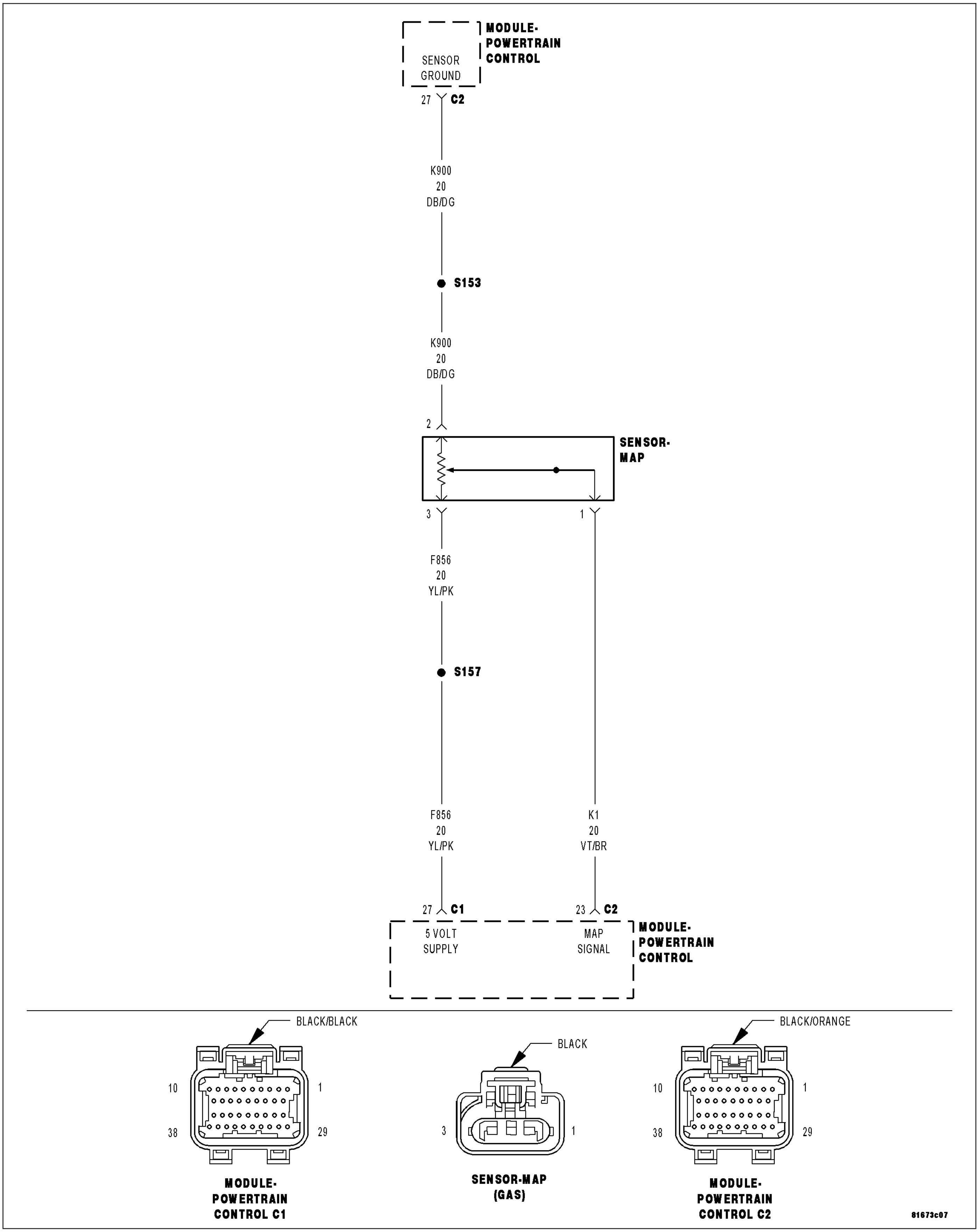
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace the Body Control Module per Service Information.
Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine speed between 600 and 3500 RPM. Battery voltage greater than 10.37 volts.
- **Set Condition:**
  The MAP sensor signal voltage is below 0.08 of a volt for 3.0 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (F856) 5-VOLT SUPPLY CIRCUIT OPEN |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND |
| (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT |
| MAP SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. MAP SENSOR VOLTAGE BELOW 0.08 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the MAP Sensor voltage.

**Is the voltage below 0.08 of a volt?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

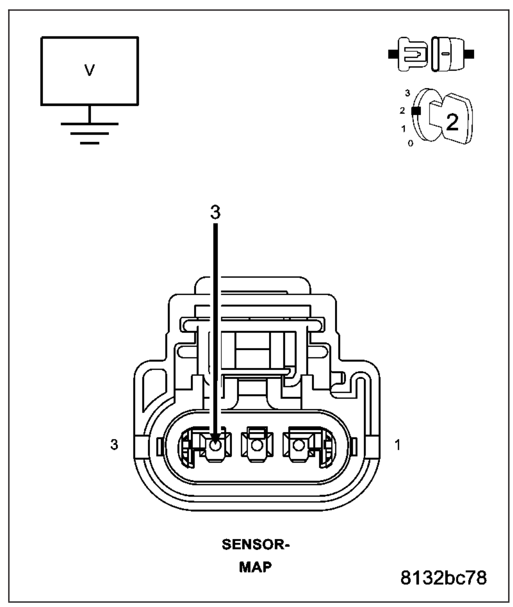
### 2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.




**Is the voltage between 4.5 to 5.2 volts?**

**Yes** >> Go To 3

**No** >> Go To 6

## 3. MAP SENSOR

With a scan tool, monitor the MAP Sensor voltage with the Sensor harness connector disconnected.

**Is the voltage above 4.5 volts?**

**Yes** >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

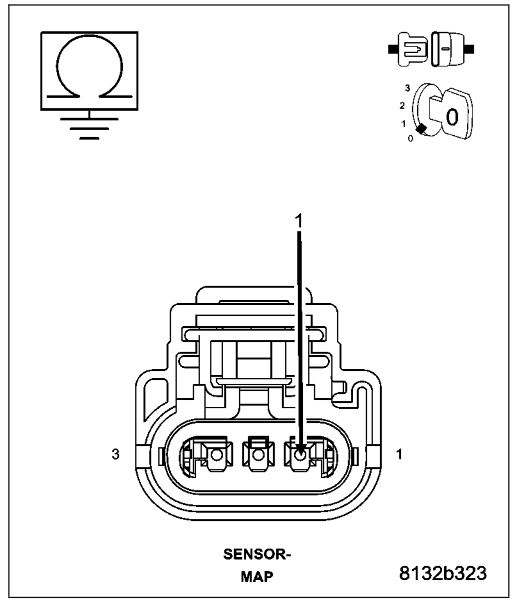
**No** >> Go To 4

## 4. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.



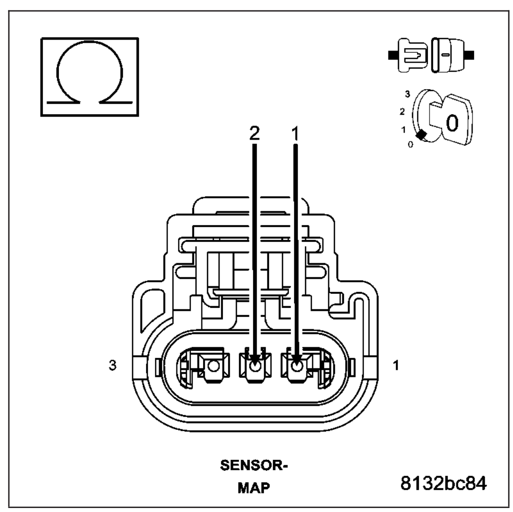

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the MAP Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (K900) Sensor ground and the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

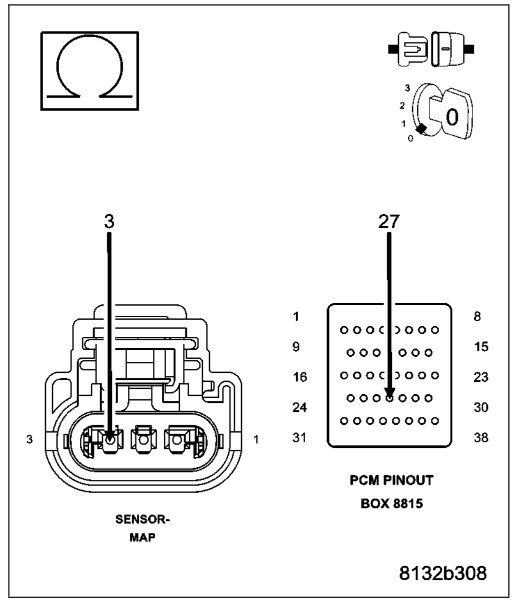
## 6. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

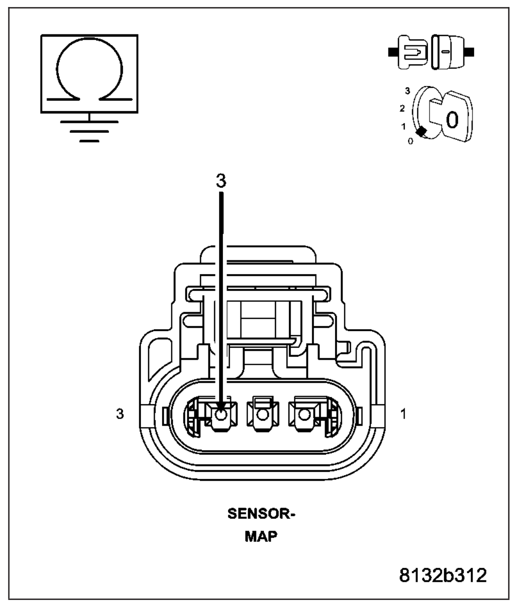
**Yes** >> Go To 7

**No** >> Repair the open in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

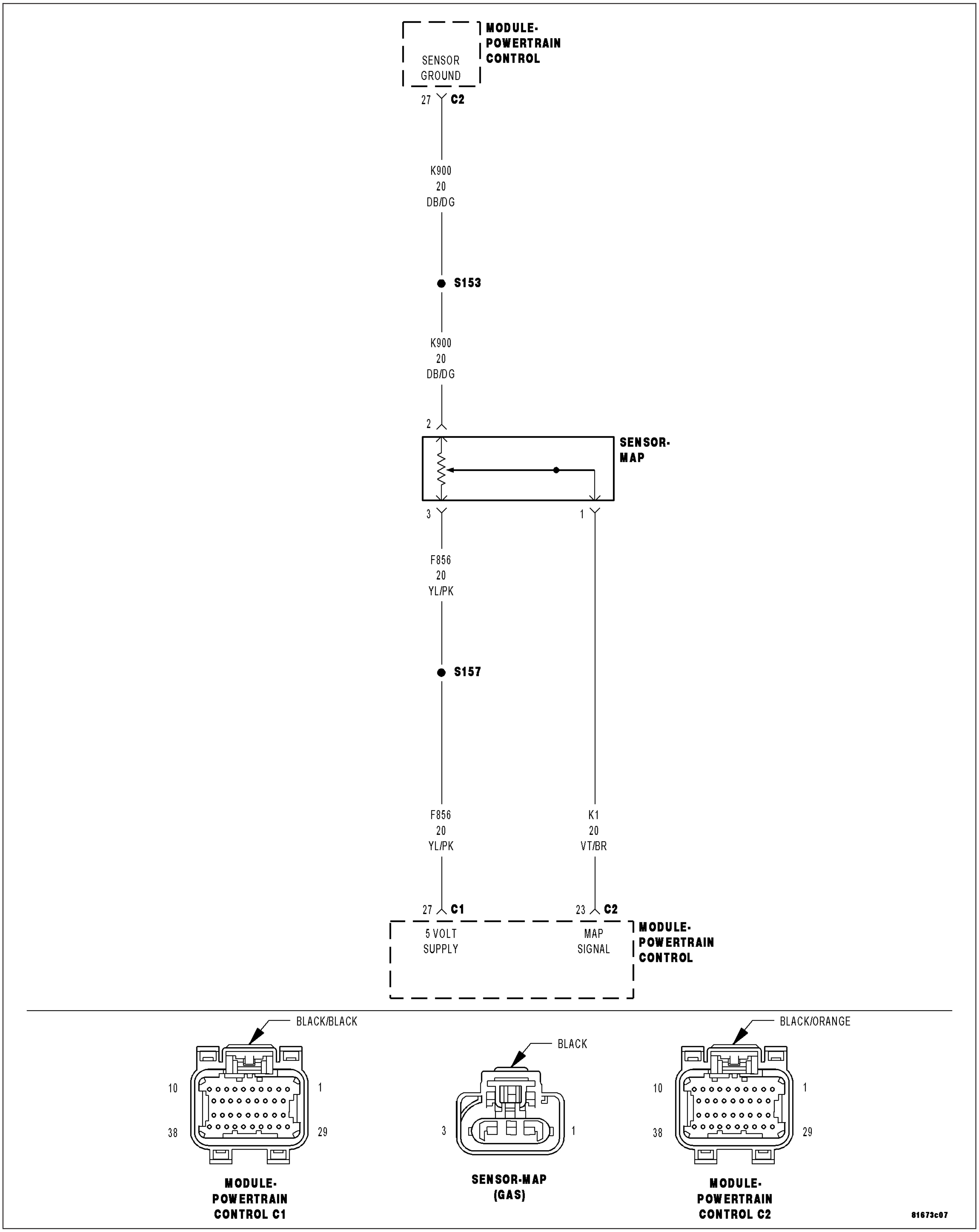
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine speed between 600 to 3500 RPM. Battery voltage greater than 10.37 volts.
- **Set Condition:**
  The MAP sensor signal voltage is greater than 4.92 volts for 3.0 seconds. One trip fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K1) MAP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K1) MAP SIGNAL CIRCUIT OPEN |
| (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT |
| (K900) SENSOR GROUND CIRCUIT OPEN |
| MAP SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. MAP SENSOR VOLTAGE ABOVE 4.92 VOLTS

Start the engine.

With a scan tool, read the MAP Sensor voltage.

**Is the voltage above 4.92 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. MAP SENSOR

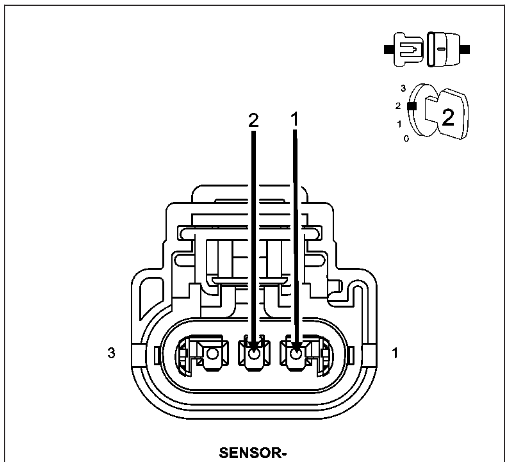
Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.



8132b317

**Is the voltage below 1.0 volt with the jumper wire installed?**

**Yes** >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

**NOTE: Remove the jumper wire before continuing.**

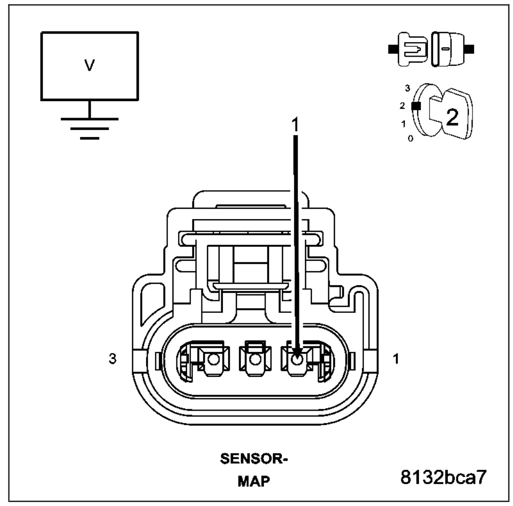
## 3. (K1) MAP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K1) MAP Signal circuit in the MAP Sensor harness connector.




**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

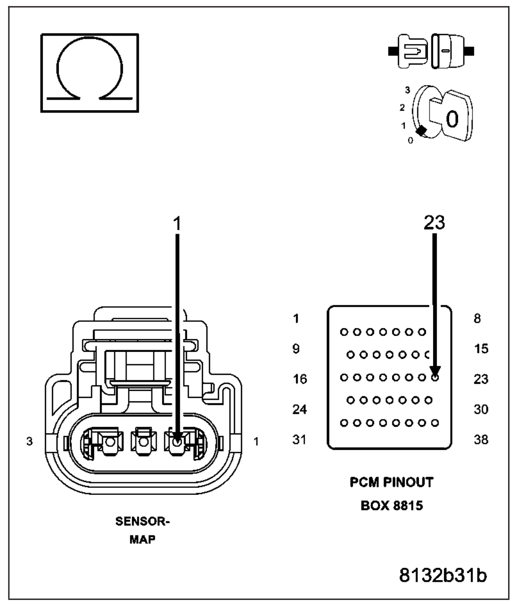
**No** >> Go To 4

## 4. (K1) MAP SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

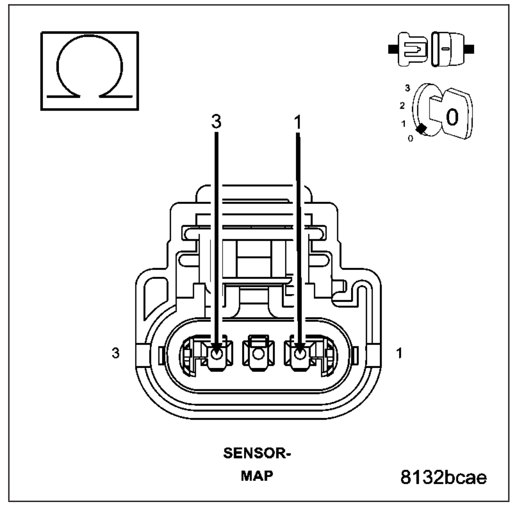
**Yes** >> Go To 5

**No** >> Repair the open in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Disconnect the C1 PCM harness connector.

Measure the resistance between the (K1) MAP Signal circuit and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



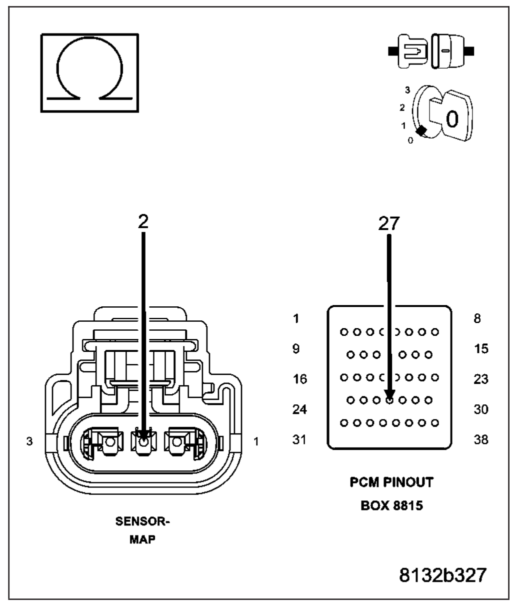

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (F856) 5-volt Supply circuit and the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

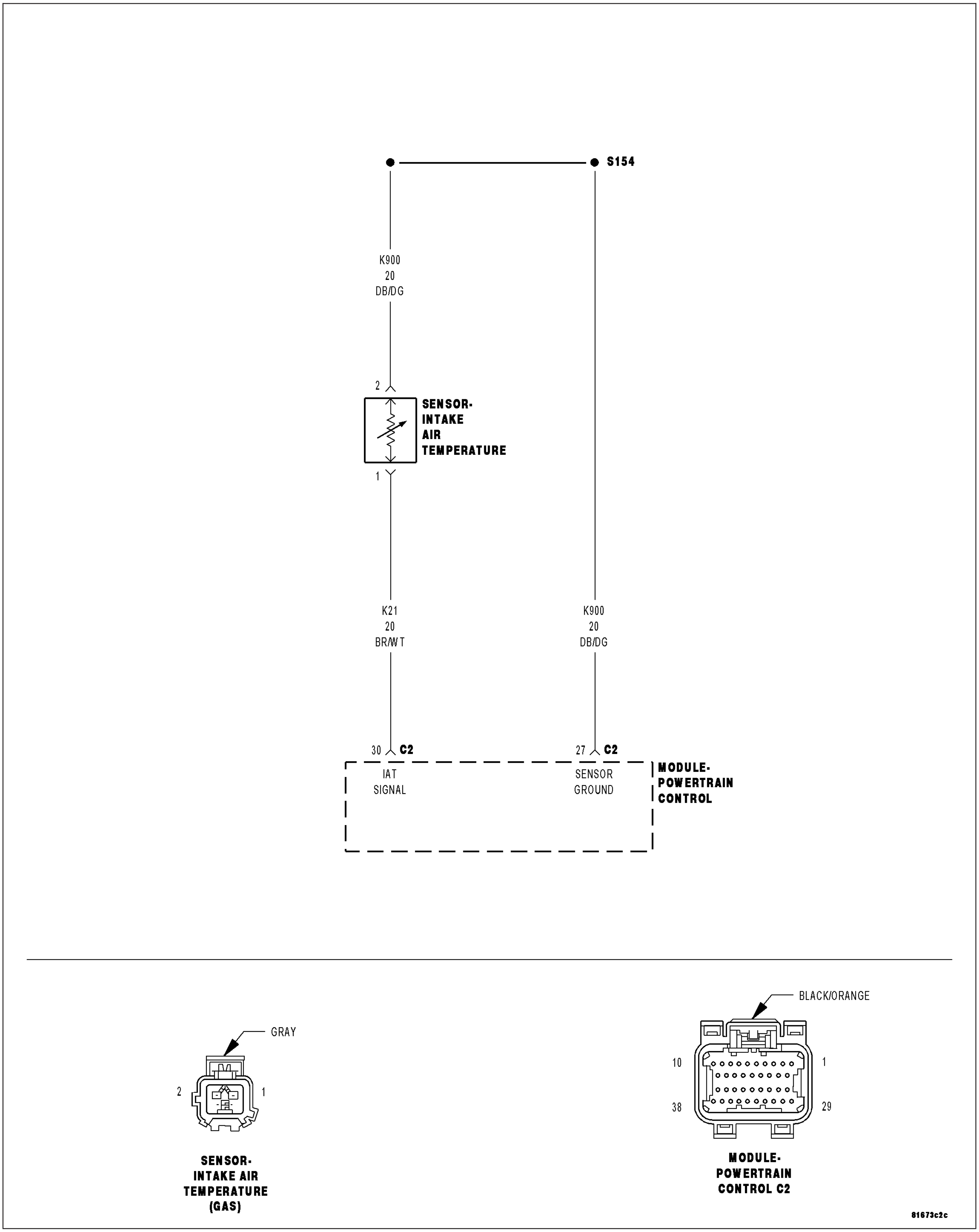
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

Intake Air Temperature Sensor performance looks at the outputs of three temperature sensors and compare them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If the engine coolant and ambient air temperature sensors agree and the intake air temperature does not agree, the intake air temperature sensor is declared as irrational.

- **When Monitored:**
  The engine off time is greater than 480 minutes. Ambient Temperature if greater than 4 deg C (38 deg F).
- **Set Condition:**
  After a calibrated amount of cool down time the PCM compares the ECT Sensor, IAT Sensor, and the Ambient Air Temp Sensor values. If the IAT Sensor value is not within -10 deg C (18 deg F) of the other two temperature sensors. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K21) IAT SIGNAL CIRCUIT OPEN |
| (K900) SENSOR GROUND CIRCUIT OPEN |
| (K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND |
| (K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT |
| INTAKE AIR TEMPERATURE SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

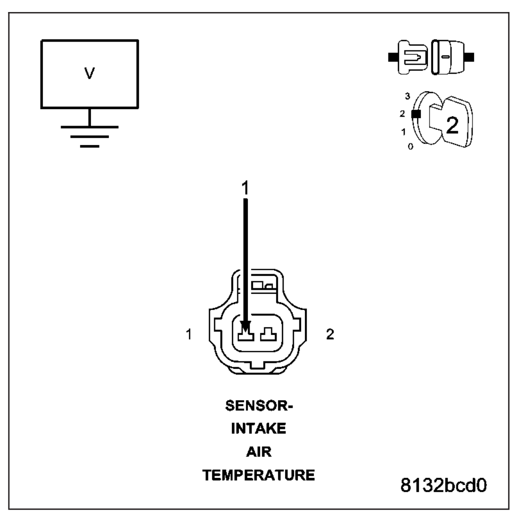
Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect the IAT Sensor harness connector.

**NOTE: Visually inspect both the component and the PCM connectors. Look for damaged, partially broken wires, and backed out or corroded terminals.**

Ignition on, engine not running.



Measure the voltage on the (K21) IAT Signal circuit in the IAT Sensor harness connector.

**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K21) IAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. IAT SENSOR VOLTAGE ABOVE 4.6 VOLTS

Turn the ignition off.

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, read the IAT voltage.

**Is the voltage above 4.6 volts?**

**Yes** >> Go To 4

**No** >> Go To 7

## 4. IAT SENSOR

Connect a jumper wire between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

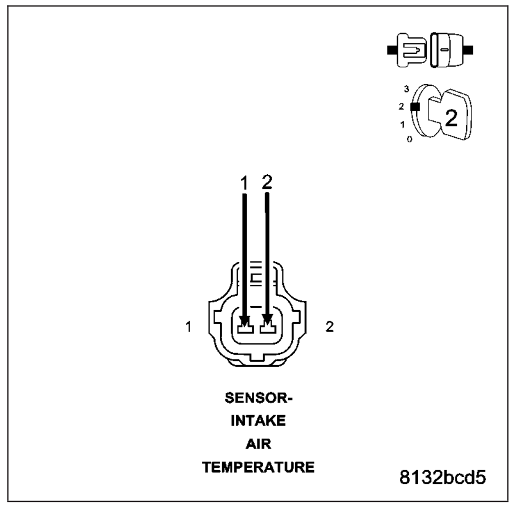
With a scan tool, read the IAT voltage.

**Is the voltage below 1.0 volt with the jumper wire installed?**

**Yes** >> Replace the IAT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

**NOTE: Remove the jumper wire before continuing.**



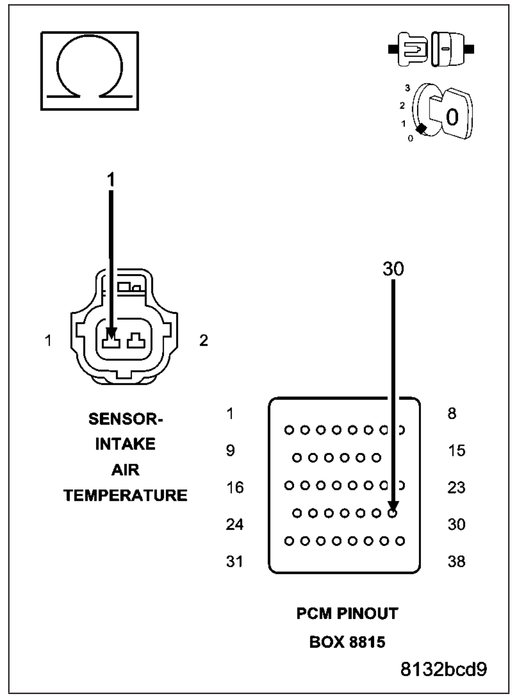
## 5. (K21) IAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K21) IAT Signal circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

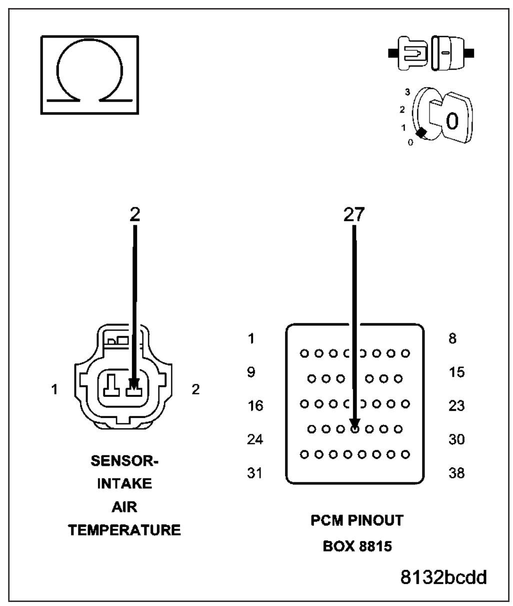
**Yes** >> Go To 6

**No** >> Repair the open in the (K21) IAT Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

## 6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 9

**No** >> Repair the open in the (K900) Sensor ground circuit.

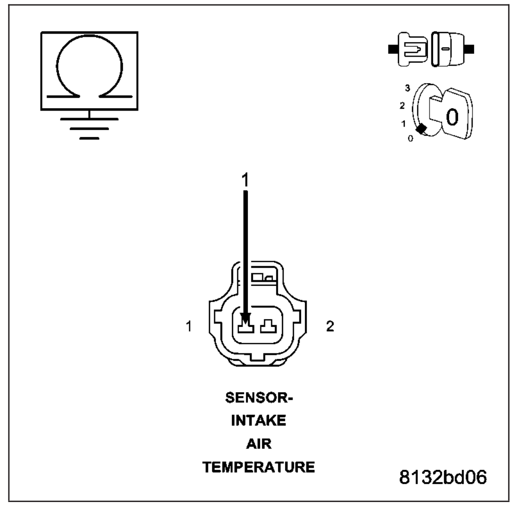
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. (K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K21) IAT Signal circuit in the IAT Sensor harness connector.



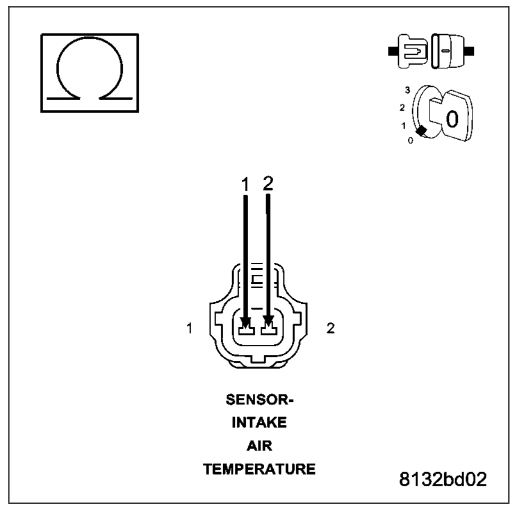

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K21) IAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. (K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K900) Sensor ground circuit and the (K21) IAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

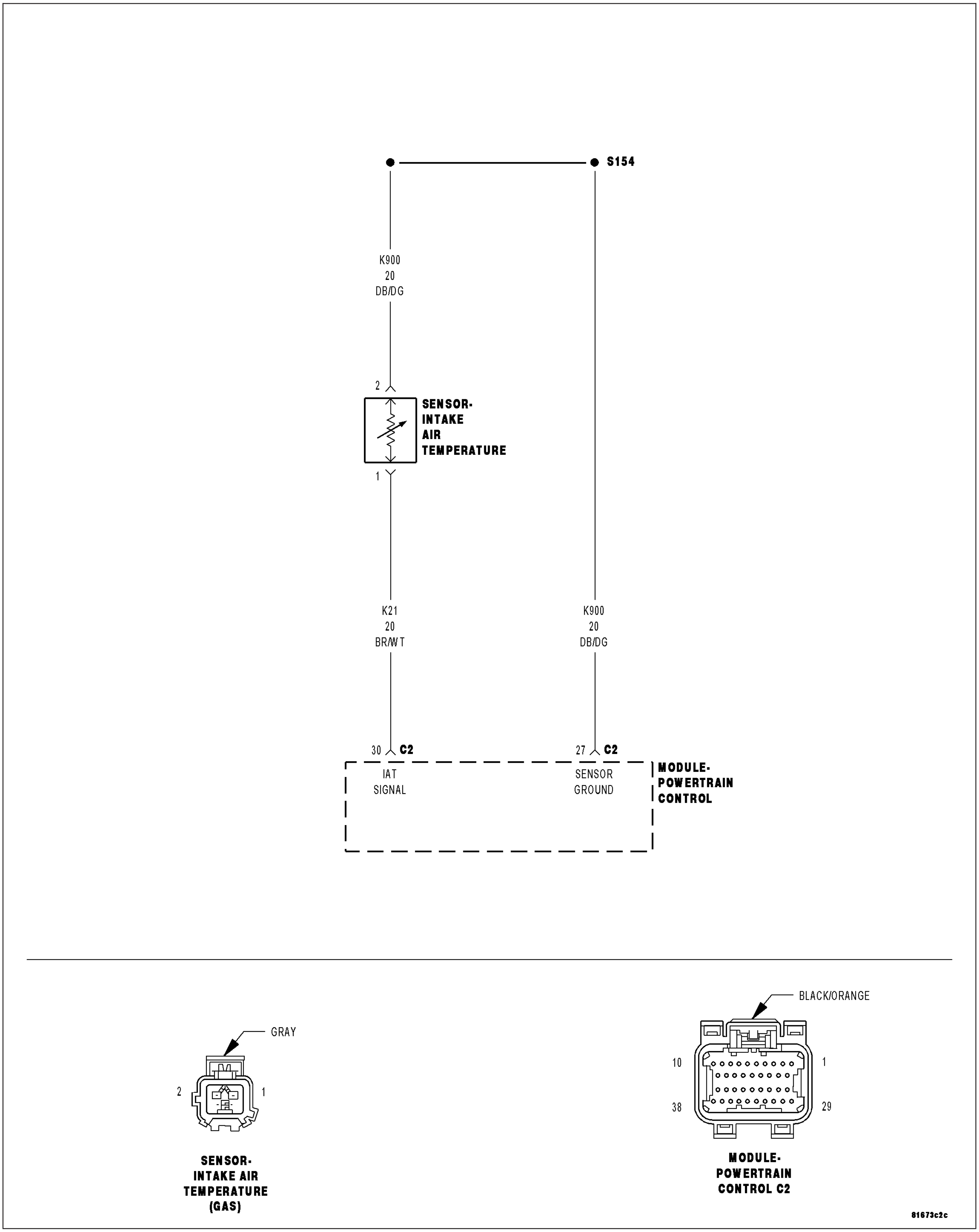
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0112-INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  When the Inlet Air Temp Sensor Signal circuit voltage is less than .078 volt for more than 2.8 seconds. One trip failure. Three good trips to clear the MIL.

| Possible Causes |
| --- |
| (K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND |
| (K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT |
| INTAKE AIR TEMPERATURE SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. IAT SENSOR VOLTAGE BELOW 0.078 OF A VOLT

Ignition on, engine not running.
With a scan tool, read the IAT voltage.

**Is the voltage below 0.078 of a volt?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. IAT SENSOR

Turn the ignition off.
Disconnect the IAT Sensor harness connector.
Ignition on, engine not running.
With a scan tool, read IAT voltage.

**Is the voltage above 0.05 of a volt?**

**Yes** >> Replace the Intake Air Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

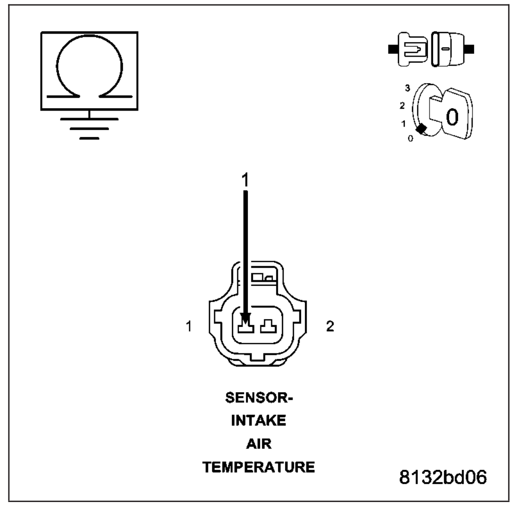
Measure the resistance between ground and the (K21) IAT Signal circuit in the IAT Sensor harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K21) IAT Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4




## 4. (K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

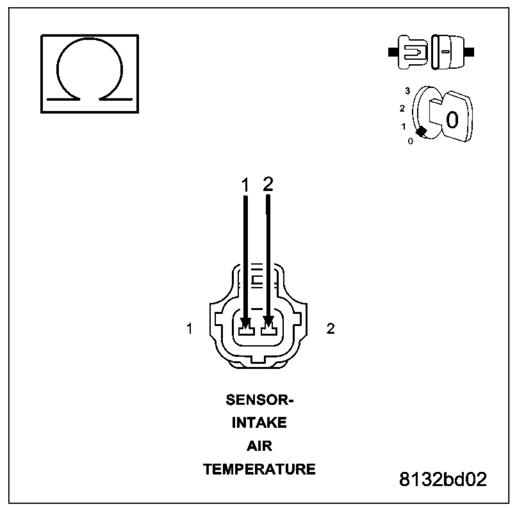
Measure the resistance between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (K900) Sensor ground circuit and the (K21) IAT Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5




## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

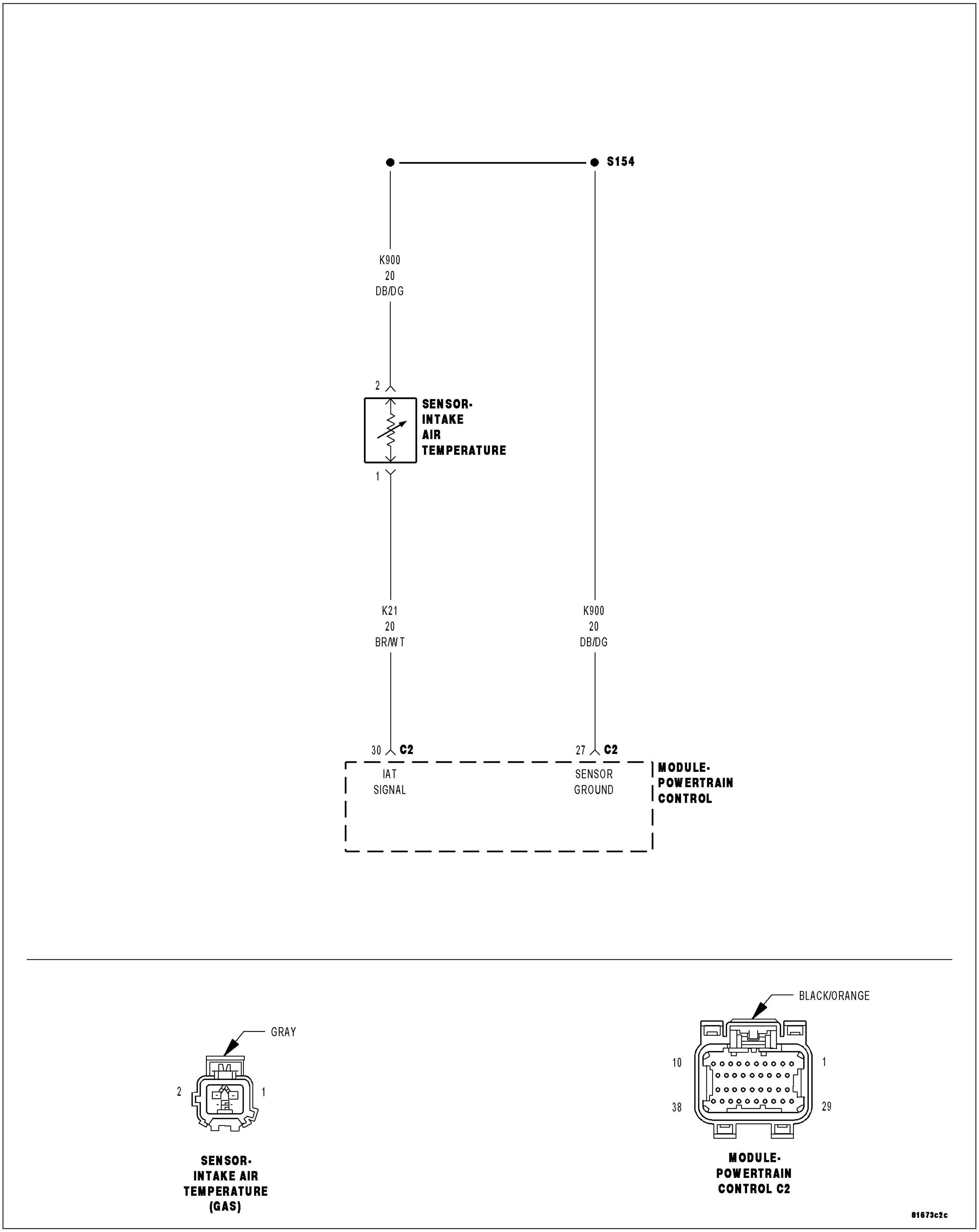
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Intake Air Temperature (IAT) sensor circuit voltage at the PCM goes above 4.98 volts for 2.8 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K21) IAT SIGNAL CIRCUIT OPEN |
| (K900) SENSOR GROUND CIRCUIT OPEN |
| IAT SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. IAT SENSOR VOLTAGE ABOVE 4.98 VOLTS

Ignition on, engine not running.

With a scan tool, read the Intake Air Temperature Sensor voltage.

**Is the voltage above 4.98 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. IAT SENSOR

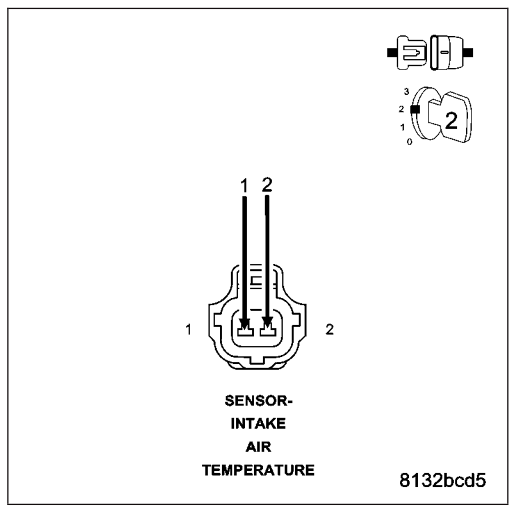
Turn the ignition off.

Disconnect the Intake Air Temperature Sensor harness connector.

Connect a jumper wire between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

Ignition on, engine not running.

With a scan tool, read the IAT Sensor voltage.




**Is the voltage below 1.0 volt with the jumper wire installed?**

**Yes** >> Replace the IAT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

**NOTE: Remove the jumper wire before continuing.**

## 3. (K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Ignition on, engine not running.

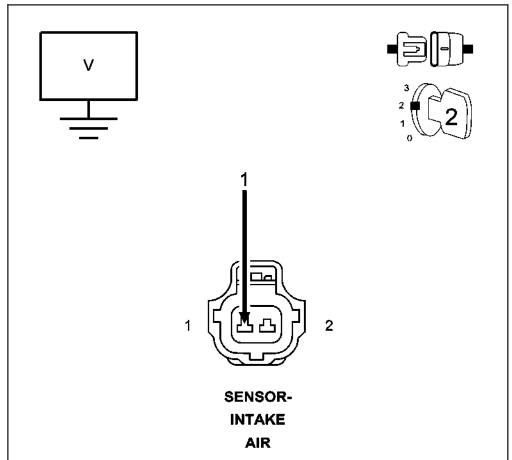
Measure the voltage on the (K21) IAT Signal circuit in the IAT Sensor harness connector.

**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K21) IAT Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4



8132bcd0

## 4. (K21) IAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

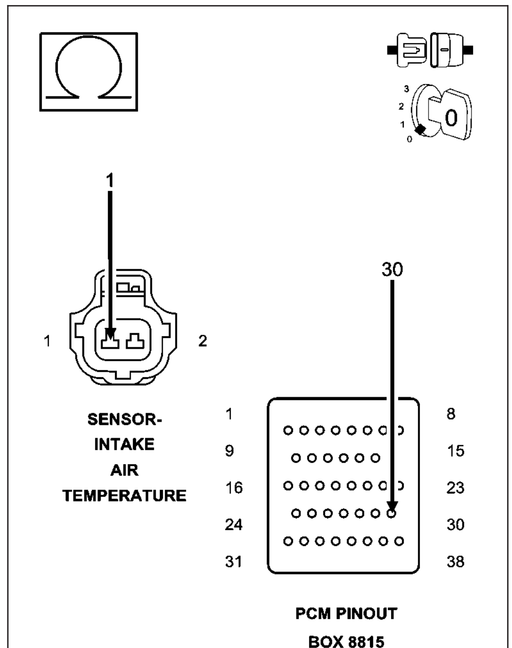
Measure the resistance of the (K21) IAT Signal circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the open in the (K21) IAT Signal circuit.

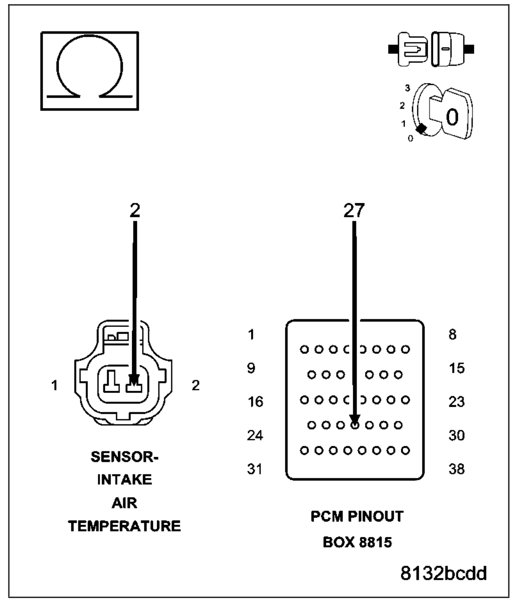
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8132bcd9

## 5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

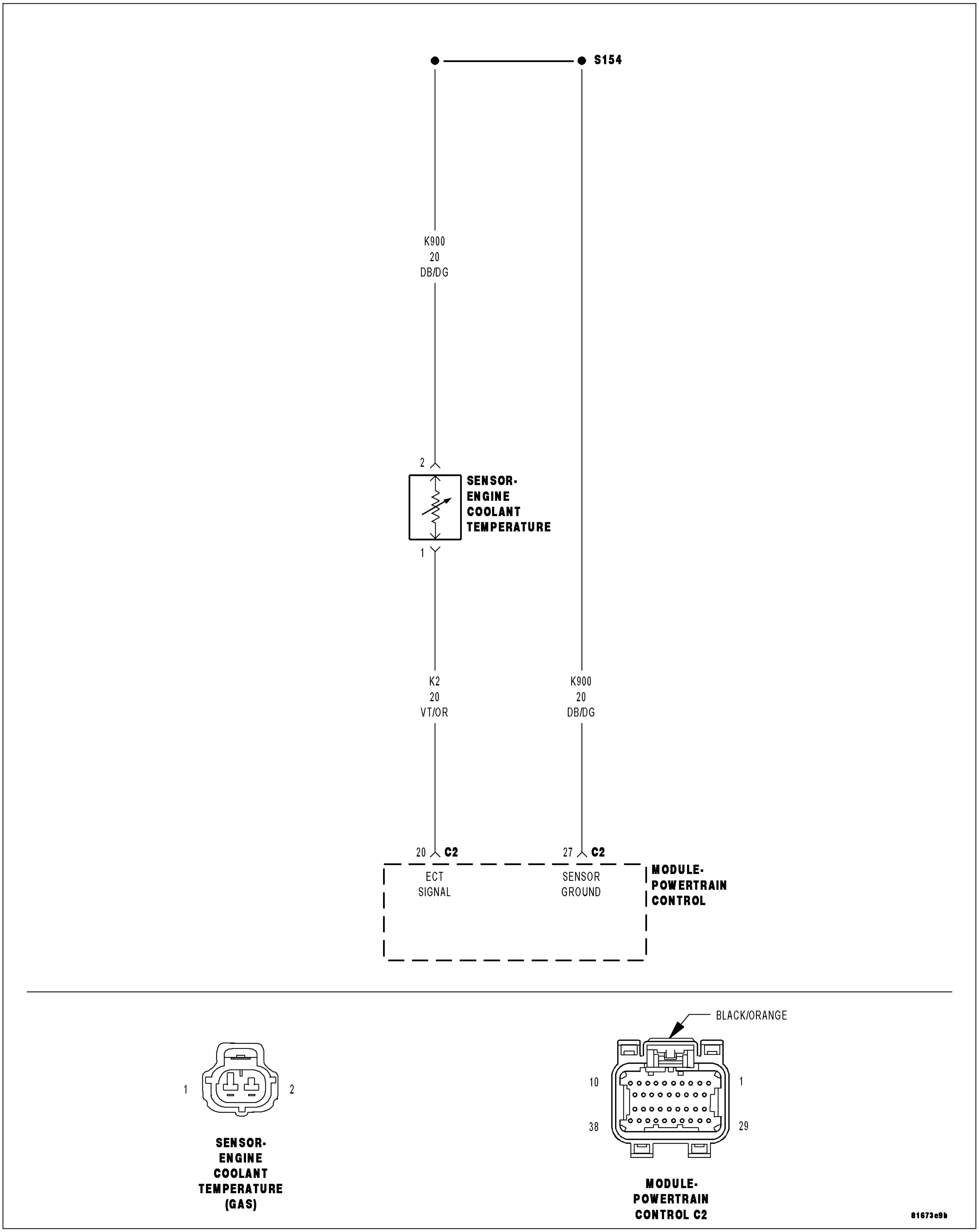
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

Engine Coolant Temperature Sensor performance looks at the outputs of three temperature sensors and compare them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If the intake air and ambient air temperature sensors agree and the intake air temperature does not agree, the intake air temperature sensor is declared as irrational.

- **When Monitored:**
  Engine off time is greater than 480 minutes. Ambient temperature is greater than 4 deg C (38 deg F).
- **Set Condition:**
  After a calibrated amount of cool down time the PCM compares the ECT Sensor, IAT Sensor, and the Ambient Air Temp Sensor values. If the IAT Sensor value is not within 10 deg C (18 deg F) of the other two temperature sensors. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K2) ECT SIGNAL CIRCUIT OPEN |
| (K900) SENSOR GROUND CIRCUIT OPEN |
| (K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND |
| (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT |
| ECT SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

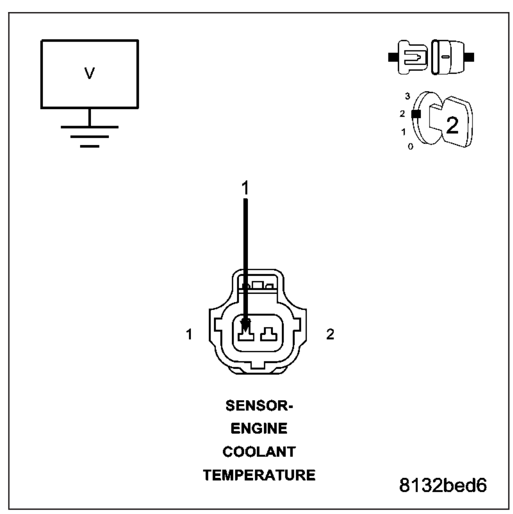
Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect the ECT Sensor harness connector.

**NOTE: Visually inspect both the component and the PCM connectors. Look for damaged, partially broken wires, and backed out or corroded terminals.**

Ignition on, engine not running.



Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.

**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. ECT SENSOR VOLTAGE ABOVE 4.6 VOLTS

Turn the ignition off.

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, read the ECT voltage.

**Is the voltage above 4.6 volts?**

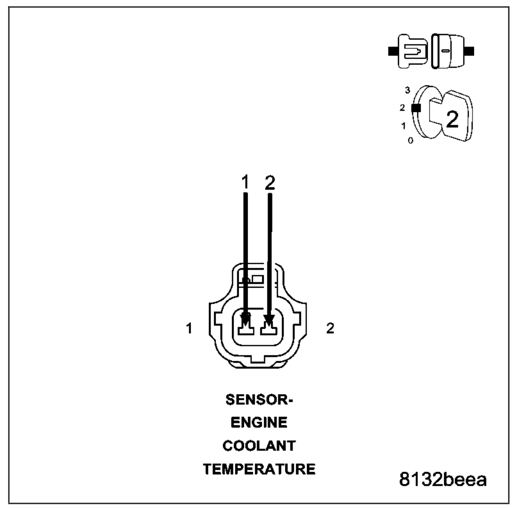
**Yes** >> Go To 4

**No** >> Go To 7

## 4. ECT SENSOR

Connect a jumper wire between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.

With a scan tool, read the ECT voltage.




**Is the voltage below 1.0 volt with the jumper wire installed?**

**Yes** >> Replace the ECT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

**NOTE: Remove the jumper wire before continuing.**

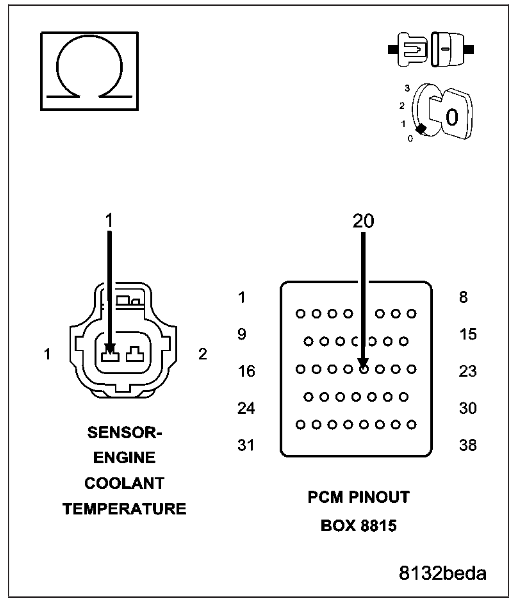
## 5. (K2) ECT SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K2) ECT Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.



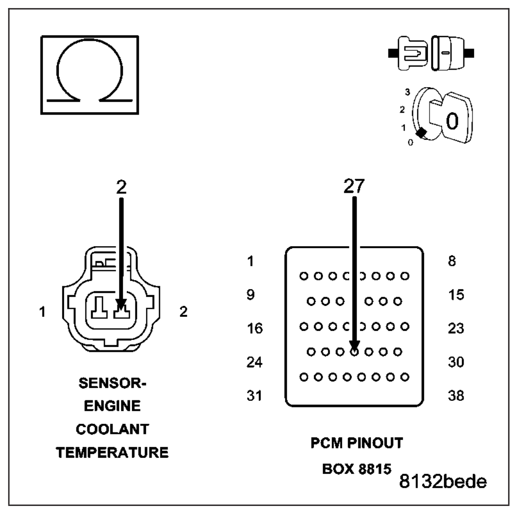

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 9

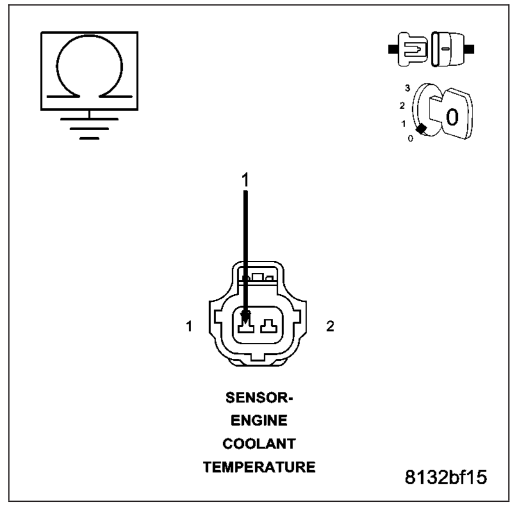
**No** >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. (K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.



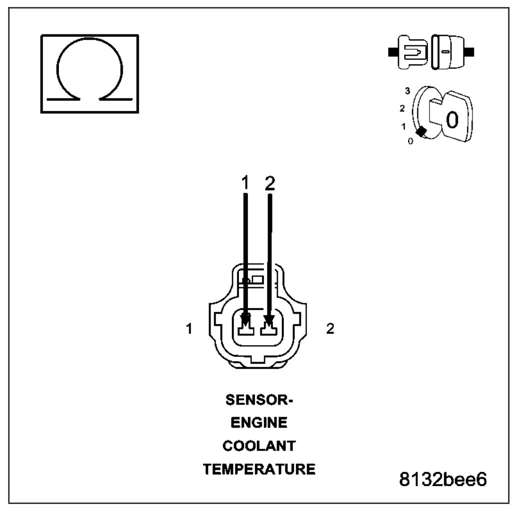

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

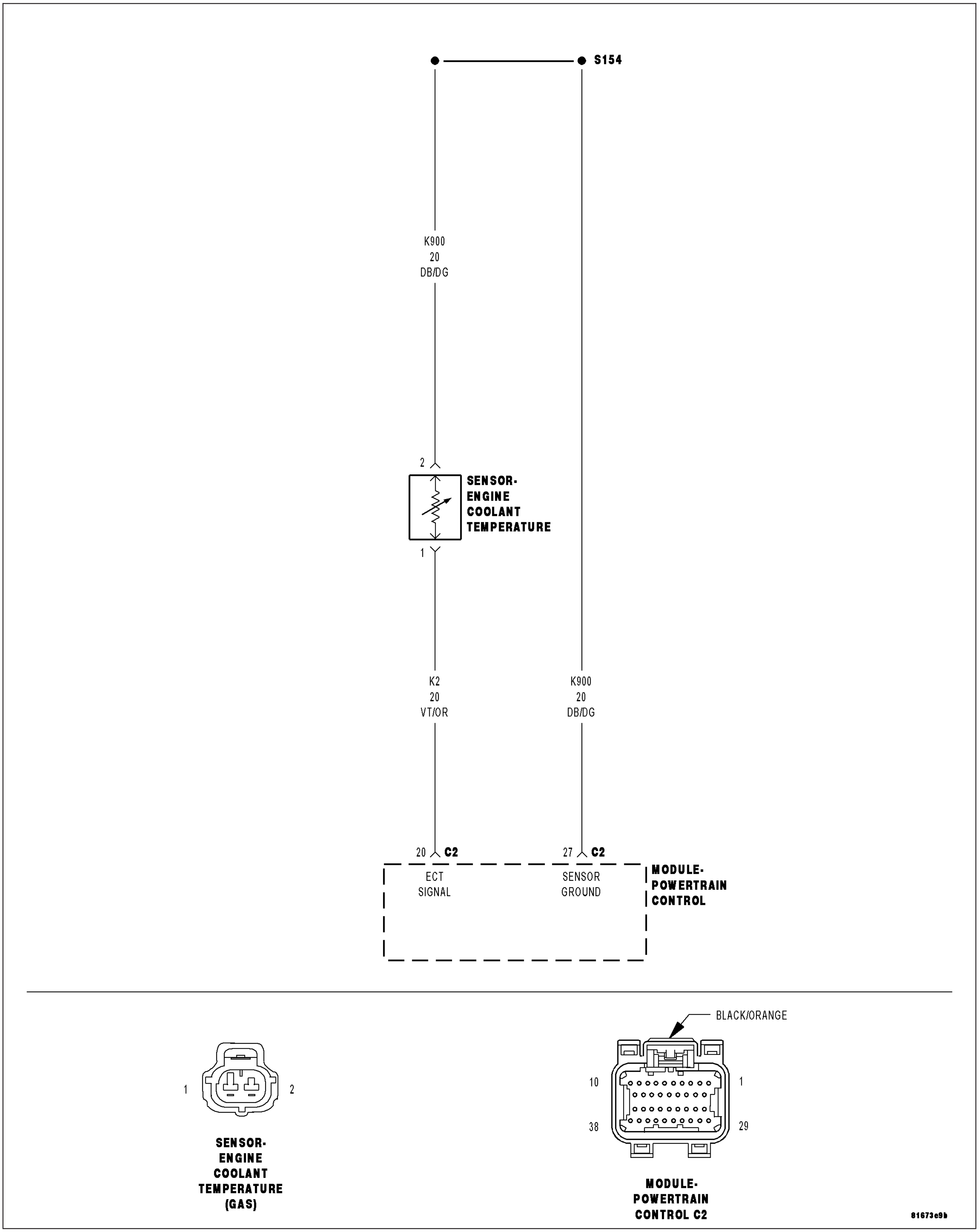
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The engine coolant temperature sensor is a negative temperature coefficient thermistor-type sensor whose resistance varies inversely with temperature. At cold temperatures the sensor resistance is high so the voltage is high. As the coolant temperature increases the resistance decreases and the voltage becomes low.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Engine Coolant Temperature (ECT) sensor circuit voltage at the PCM is less than 0.078 of a volt for more than 2.8 seconds. One Trip Fault. Three good trips to clear the MIL.

| Possible Causes |
|---|
| (K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND |
| (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT |
| ECT SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ECT SENSOR VOLTAGE BELOW 0.078 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the ECT voltage.

**Is the voltage below 0.078 of a volt?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. ECT SENSOR

Turn the ignition off.

Disconnect the ECT harness connector.

Ignition on, engine not running.

With a scan tool, read ECT voltage.

**Is the voltage above 1.0 volt?**

**Yes** >> Replace the ECT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

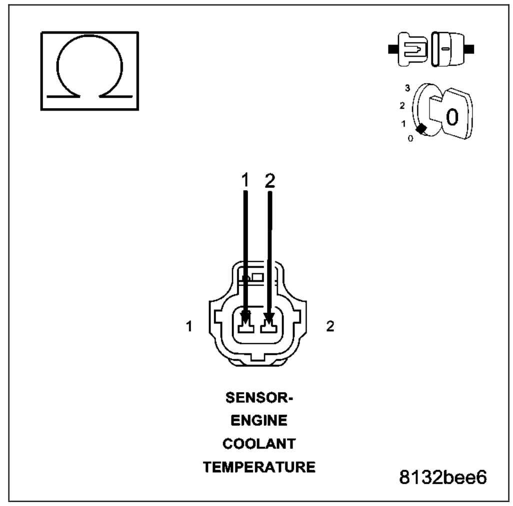
**No** >> Go To 3

## 3. (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit in the ECT Sensor harness connector.




**Is the resistance below 5.0 ohms?**

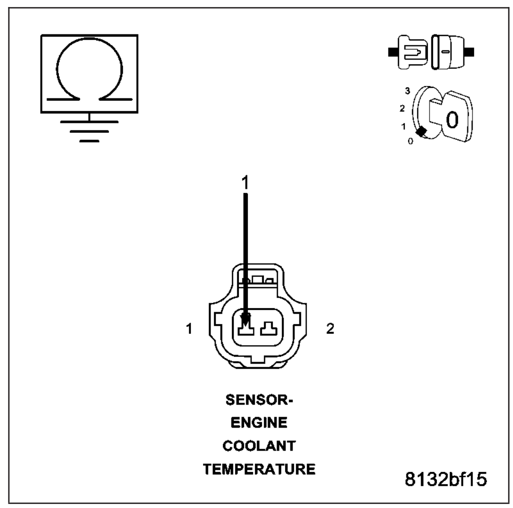
**Yes** >> Repair the short to between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (K2) ECT SIGNAL CIRCUIT SHORTED GROUND

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K2) ECT Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

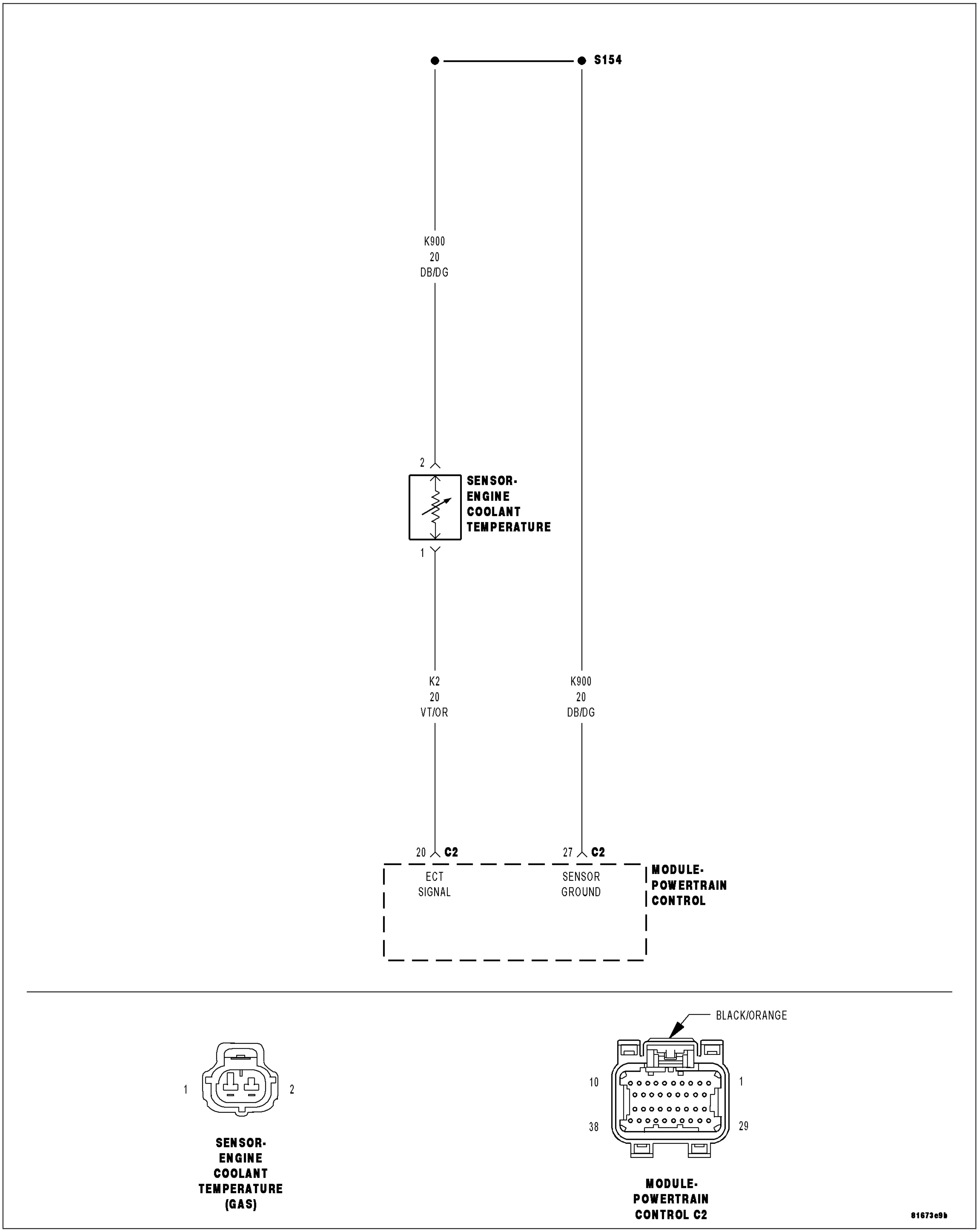
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The engine coolant temperature sensor is a negative temperature coefficient thermistor-type sensor whose resistance varies inversely with temperature. At cold temperatures the sensor resistance is high so the voltage is high. As the coolant temperature increases the resistance decreases and the voltage becomes low.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Engine Coolant Temperature (ECT) sensor circuit voltage at the PCM is greater than 4.98 volts for more than 2.8 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K2) ECT SIGNAL CIRCUIT OPEN |
| (K900) SENSOR GROUND CIRCUIT OPEN |
| ECT SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ECT SENSOR VOLTAGE ABOVE 4.98 VOLTS

Ignition on, engine not running.

With a scan tool, read the ECT voltage.

**Is the voltage above 4.98 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. ECT SENSOR

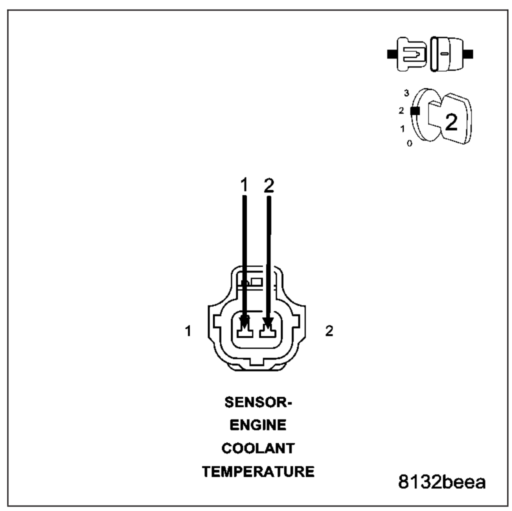
Turn the ignition off.

Disconnect the ECT harness connector.

Connect a jumper wire between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT harness connector.

Ignition on, engine not running.

With a scan tool, read ECT voltage.




**Is the voltage below 1.0 volt with the jumper wire installed?**

**Yes** >> Replace the ECT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

**NOTE: Remove the jumper wire before continuing.**

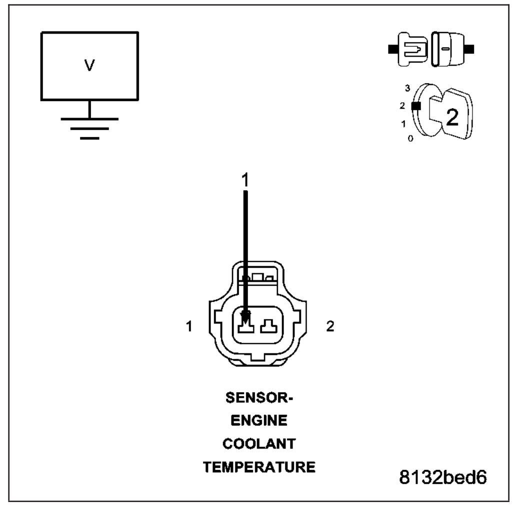
## 3. (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.




**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K2) ECT Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

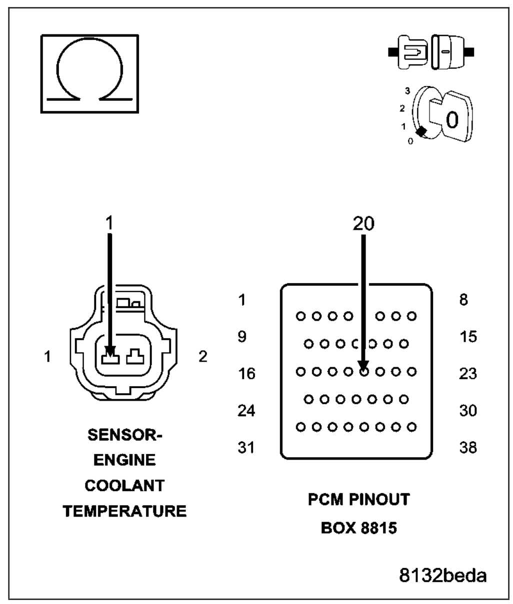
**No** >> Go To 4

## 4. (K2) ECT SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K2) ECT Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

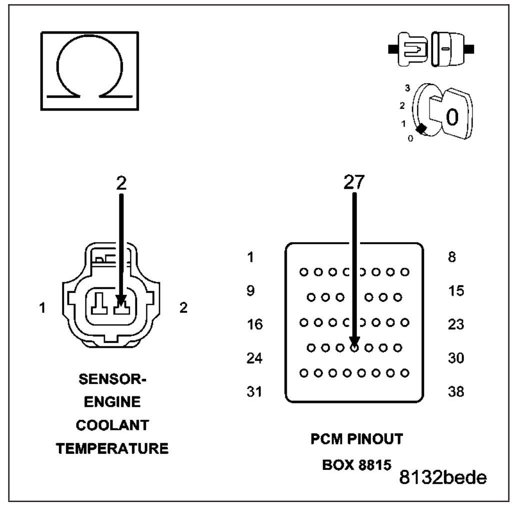
**Yes** >> Go To 5

**No** >> Repair the open in the (K2) ECT Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

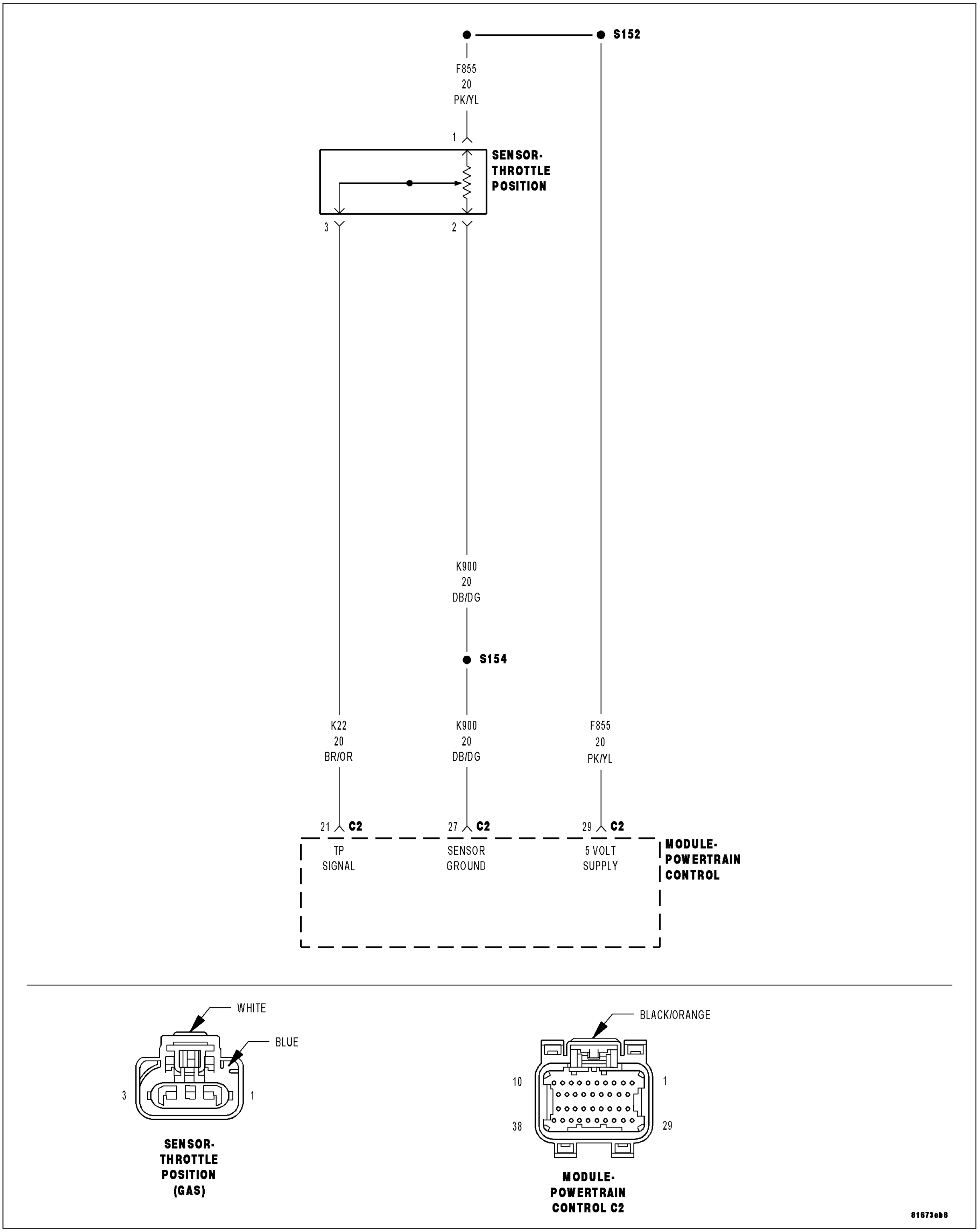
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  Throttle Position Sensor voltage at the PCM is less than 0.0978 of a volt for 1.3 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (F855) 5-VOLT SUPPLY CIRCUIT OPEN |
| (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND |
| (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT |
| THROTTLE POSITION SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. THROTTLE POSITION SENSOR VOLTAGE BELOW 0.098 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the TP Sensor voltage.

**Is the voltage below 0.098 of a volt?**

**Yes** >> Go To 2

**No** >> Go To 9

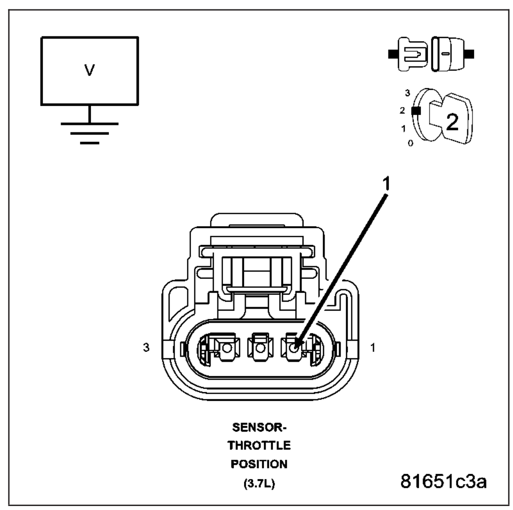
### 2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the TP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the TP Sensor harness connector.




**Is the voltage between 4.5 to 5.2 volts?**

**Yes** >> Go To 3

**No** >> Go To 6

### 3. THROTTLE POSITION SENSOR

With the a scan tool, monitor the TP Sensor voltage with the Sensor harness connector disconnected.

**Is the voltage above 4.5 volts?**

**Yes** >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

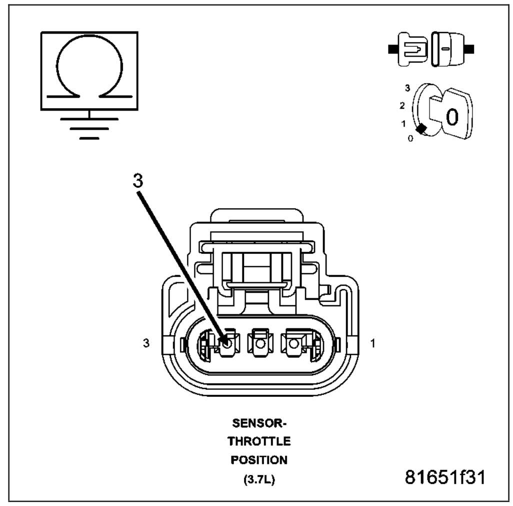
**No** >> Go To 4

## 4. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector.




**Is the resistance below 100 ohms?**

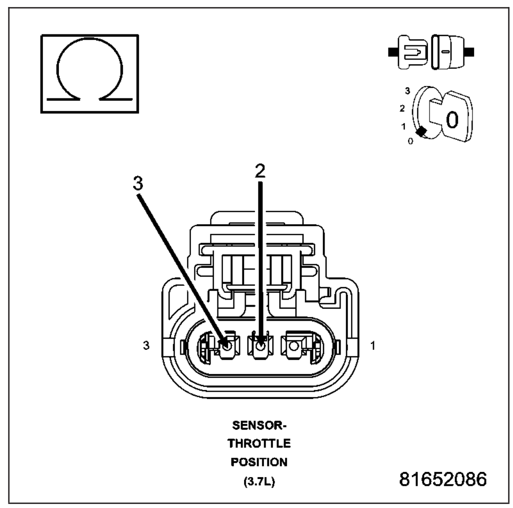
**Yes** >> Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the TP Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (K900) Sensor ground and the (K22) TP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

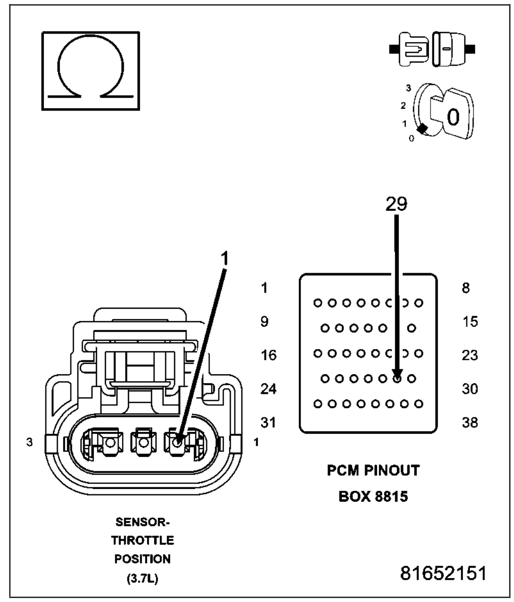
## 6. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (F855) 5-volt Supply circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.



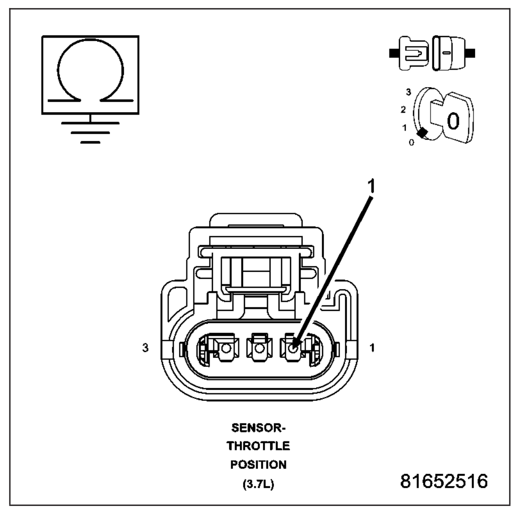

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the TP Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 9. THROTTLE POSITION SENSOR SWEEP

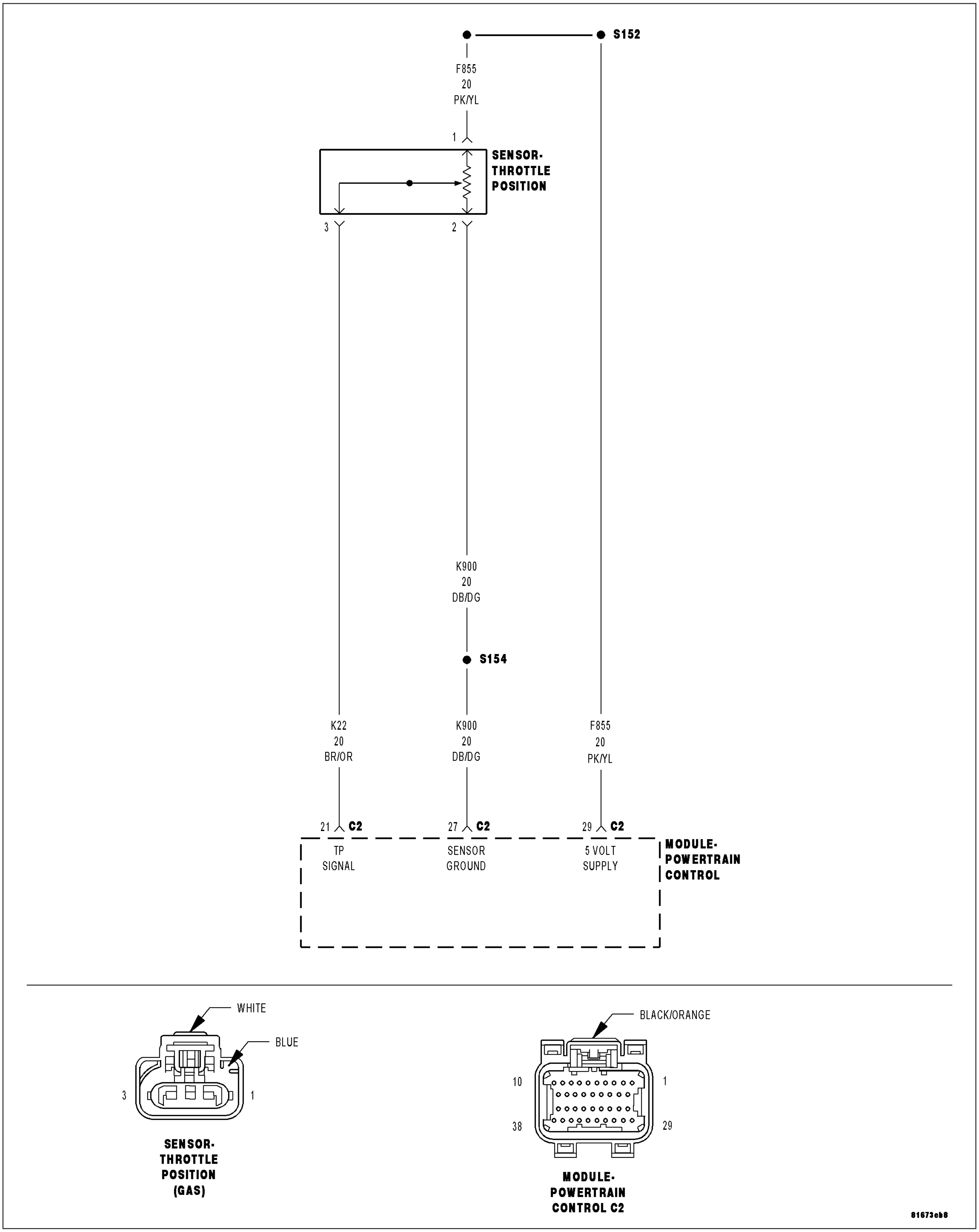
With a scan tool, monitor the Throttle Position Sensor voltage.
Slowly open the throttle from the idle position to the wide open throttle position.

**Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  Throttle Position Sensor voltage at the PCM is greater than 4.47 volts for 1.3 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K22) TP SENSOR NO.1 SIGNAL CIRCUIT OPEN |
| (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT |
| (K900) SENSOR GROUND CIRCUIT OPEN |
| THROTTLE POSITION SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. TP SENSOR VOLTAGE ABOVE 4.5 VOLTS

**NOTE: Make sure the throttle is fully closed and free from binding and carbon build up.**

Start the engine.

With a scan tool, read the TP Sensor voltage.

**Is the voltage above 4.5 volts?**

**Yes** >> Go To 2

**No** >> Go To 8

### 2. THROTTLE POSITION SENSOR

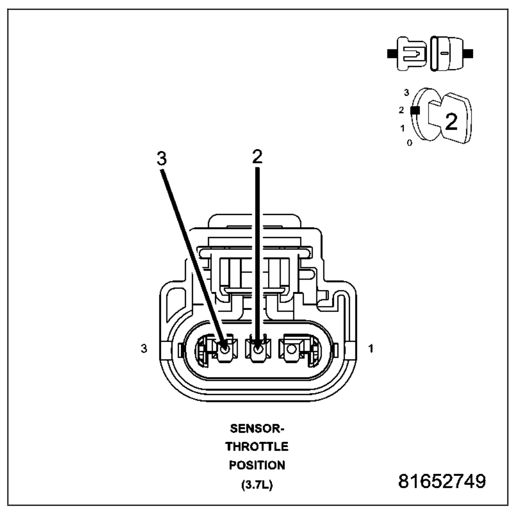
Turn the ignition off.

Disconnect the TP Sensor harness connector.

Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

With a scan tool, monitor the TP Sensor voltage.

Ignition on, engine not running.




**Is the voltage below 0.5 of a volt with the jumper wire installed?**

**Yes** >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

**NOTE: Remove the jumper wire before continuing.**

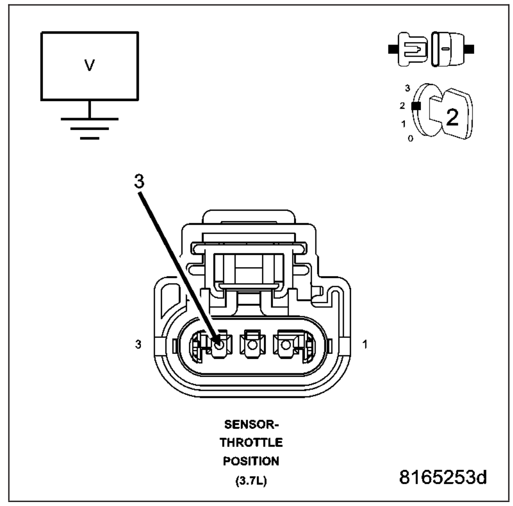
## 3. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector.




**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K22) TP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

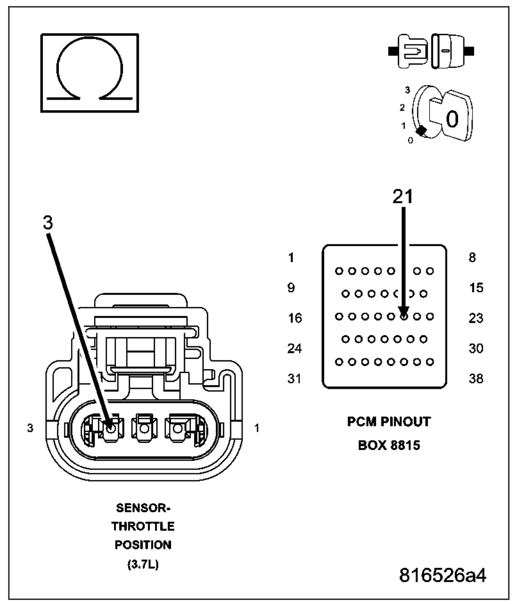
**No** >> Go To 4

## 4. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

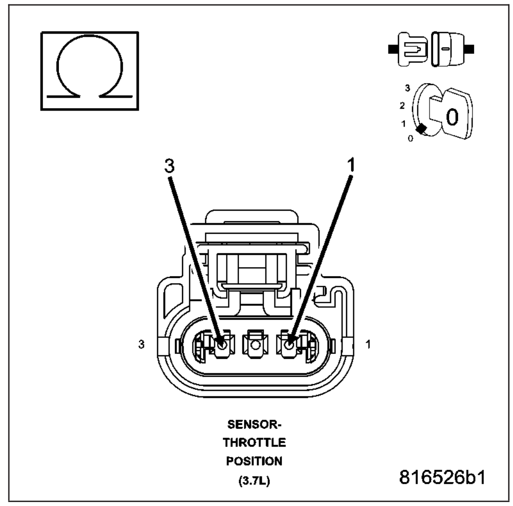
**Yes** >> Go To 5

**No** >> Repair the open in the (K22) TP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (F855) 5-volt Supply circuit in the TP Sensor harness connector.



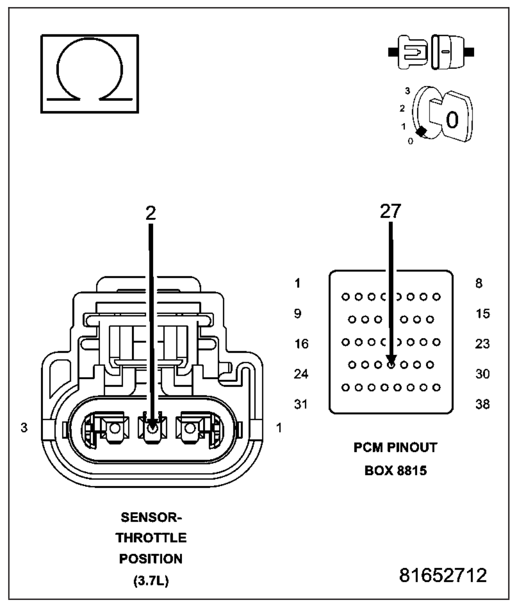

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (F855) 5-volt Supply circuit and the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 8. THROTTLE POSITION SENSOR SWEEP

With a scan tool, monitor the Throttle Position Sensor voltage.

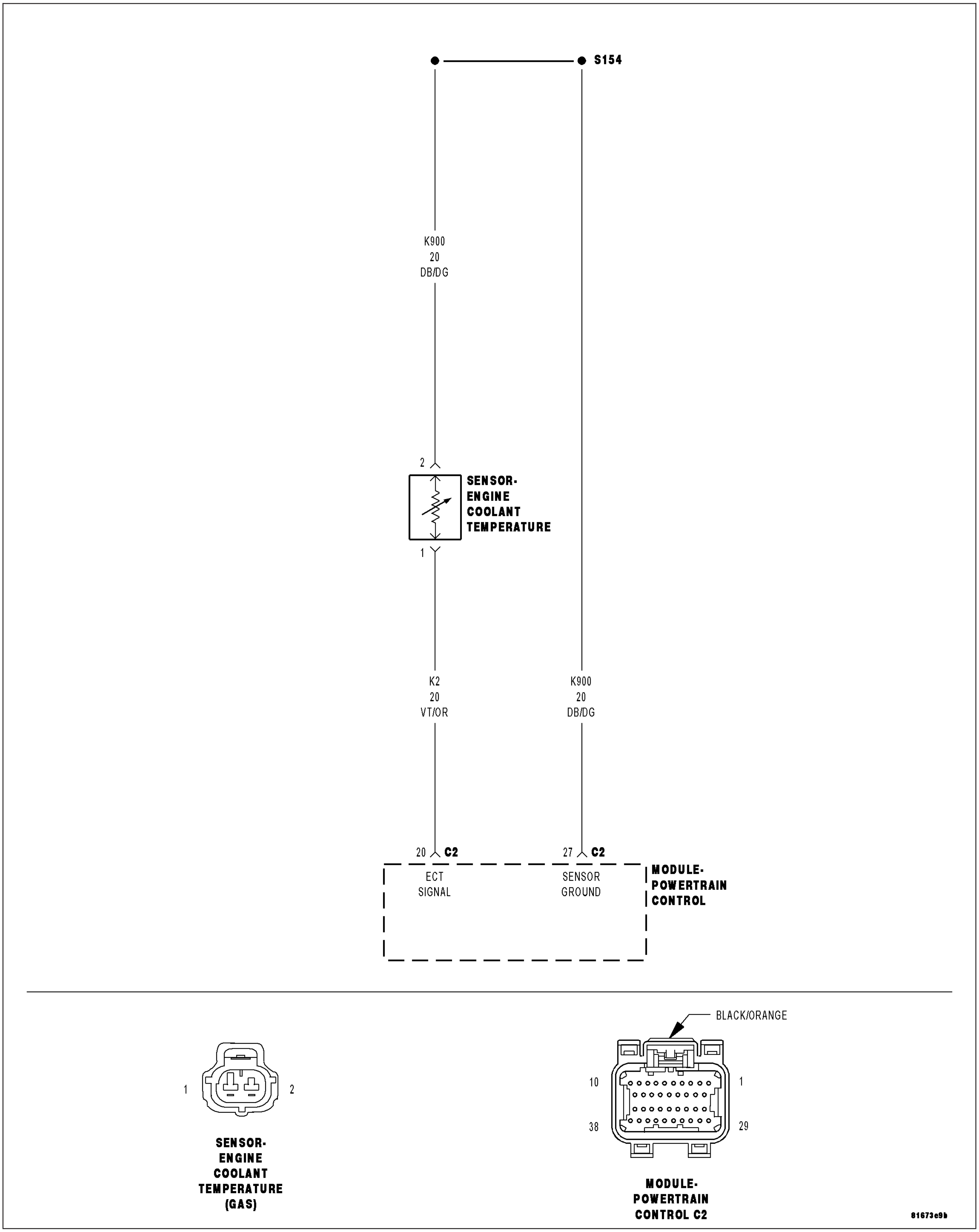
Slowly open the throttle from the idle position to the wide open throttle position.

**Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The engine coolant temperature sensor is a negative temperature coefficient thermistor-type sensor whose resistance varies inversely with temperature. At cold temperatures the sensor resistance is high so the voltage is high. As the coolant temperature increases the resistance decreases and the voltage becomes low. The INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL determines if the engine coolant temperature will reach the closed loop fueling control temperature limit in a regulated time after start.

- **When Monitored:**
  With battery voltage greater than 10.4 volts and after engine is started.
- **Set Condition:**
  The engine temperature does not go above -10°C (15°F). Failure time depends on start-up coolant temperature and ambient temperature. (i.e. 2 minutes for a start temp of -10°C (15°F) or up to 10 minutes for a vehicle with a start-up temp of -28°C (5°F). Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| LOW COOLANT LEVEL |
| THERMOSTAT |
| ECT SENSOR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. CHECKING COOLANT LEVEL AND CONDITION

Ignition on, engine not running.

With a scan tool, read DTCs.

**NOTE: If a Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.**

**NOTE: Inspect the ECT terminals and related PCM terminals. Make sure the terminals are free from corrosion and damage.**

**NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.**

**NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.**

**WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Extreme burns or scalding may result. Failure to follow these instructions can result in personal injury or death. Allow the engine to cool before opening the cooling system.**

Inspect the coolant system for proper level and condition.

**Is the coolant level and condition OK?**

**Yes** >> Go To 2

**No** >> Inspect the vehicle for a coolant leak, make the appropriate repairs, and add the correct amount of coolant.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. THERMOSTAT OPERATION

**NOTE: This test works best if performed on a cold engine (cold soak)**

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

**NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.**

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

**NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tool Eng Coolant Tmp Deg values should stay relatively close to each other.**

Using the appropriate service information, determine the proper opening temperature of the thermostat.

**Did the thermostat open at the proper temperature?**

**Yes** >> Go To 3

**No** >> Replace the thermostat.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. ECT SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

**NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.**

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

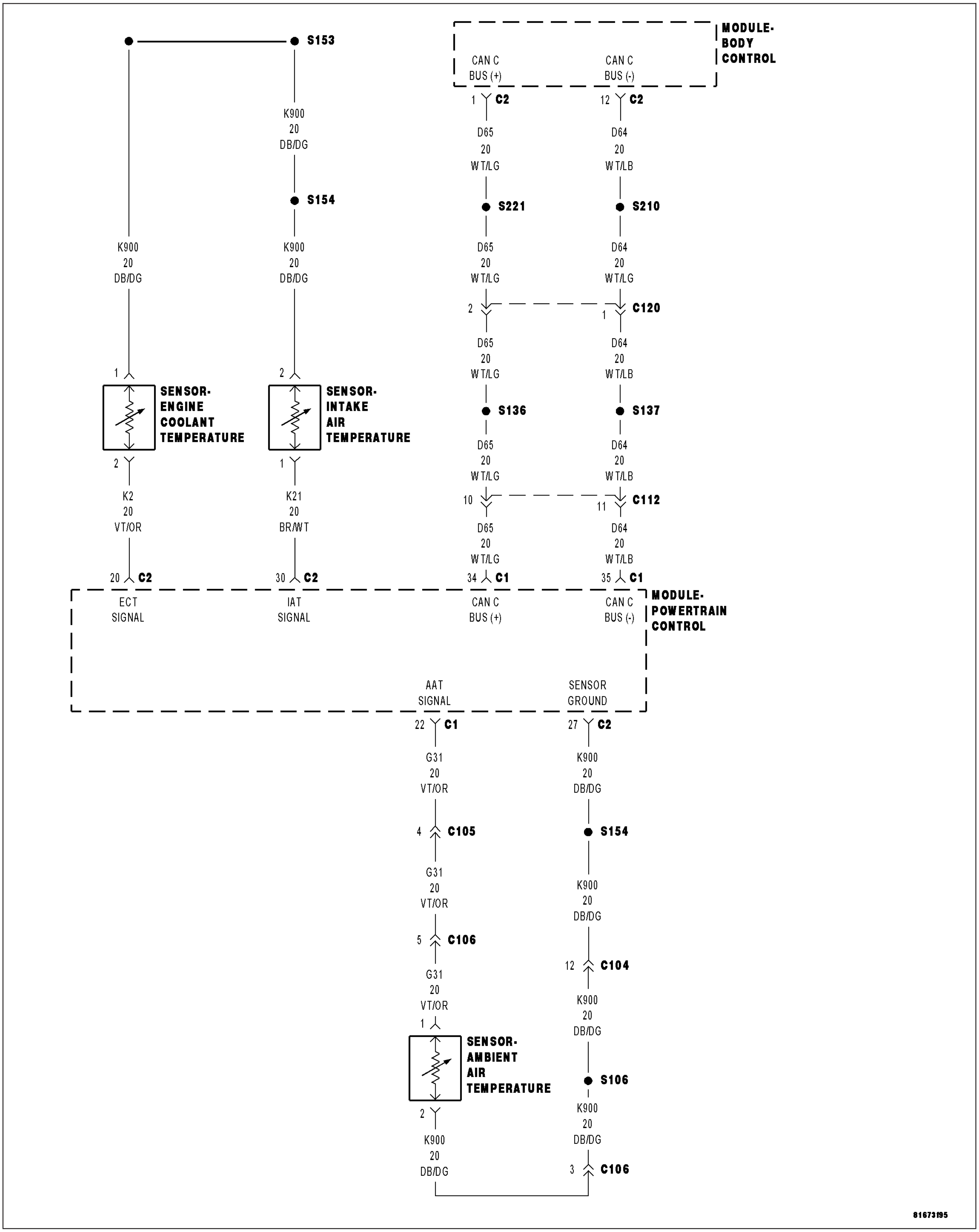
**NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tools Eng Coolant Tmp Deg value should stay relatively close to each other.**

**Is the thermometer reading relatively close to the scan tool ECT reading?**

**Yes** >> Test Complete.

**No** >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0128-THERMOSTAT RATIONALITY




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The PCM predicts what the engine coolant temperature should be, based on the engine coolant temperature at start-up, ambient temperature and how the vehicle is subsequently driven. The predicted engine coolant temperature is compared to the Engine Coolant Temperature Sensor reading. The error between the two is calculated and integrated with respect to time. When the Thermostat diagnostic runs, the integrated error is compared to a calibrated threshold and pass/fail is determined. Separate pass and fail thresholds are used in order to improve accuracy of the diagnostic.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The PCM predicts a coolant temperature value that it will compare to the actual coolant temperature. A significant difference results in an error. Two Trip Fault. Three good trips to turn off the MILD.

| Possible Causes |
|---|
| LOW COOLANT LEVEL |
| THERMOSTAT OPERATION |
| SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| TEMPERATURE SENSOR |
| SIGNAL CIRCUIT OPEN |
| SENSOR GROUND CIRCUIT OPEN |
| SIGNAL CIRCUIT SHORTED TO GROUND |
| SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT |
| OTHER POSSIBLE CAUSES |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: If any ECT, AAT, CRANK, or CAM sensor DTC's have set along with P0128, diagnose them before continuing.**

**NOTE: Make sure that the Pinion Factor has been programmed correctly into the PCM.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. LOW COOLANT LEVEL

**NOTE: If a Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.**

**NOTE: Inspect the ECT terminals and related PCM terminals. Make sure the terminals are free from corrosion and damage.**

**NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.**

**NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.**

**WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Failure to follow these instructions can result in personal injury including extreme burns, scalding, or death. Allow the engine to cool before opening the cooling system.**

Check the coolant system to make sure that the coolant is in good condition and at the proper level.

**Is the coolant level and condition OK?**

**Yes** >> Go To 3

**No** >> Inspect the vehicle for a coolant leak and add the necessary amount of coolant.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. THERMOSTAT OPERATION

**NOTE: This test works best if performed on a cold engine (cold soak).**

Ignition on, engine not running.

With a scan tool, read the ECT Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

**NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.**

Start the Engine.

During engine warm-up, monitor the ECT Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

**NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tool, ECT Temperature value should stay relatively close to each other.**

Using the appropriate service information, determine the proper opening temperature of the thermostat.

**Did the thermostat open at the proper temperature?**

**Yes** >> Go To 4

**No** >> Replace the thermostat.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. AMBIENT AIR TEMP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read and record the AAT Sensor Temperature value.

Using the DRB Temperature Probe #CH7050, or an equivalent temperature measuring tool, measure the ambient air temperature near the AAT Sensor.

**Is the AAT Sensor value with -15°C (5°F) of the temperature probe reading?**

**Yes** >> Go To 5

**No** >> Go To 7

## 5. ECT SENSOR OPERATION

**WARNING: Make sure the engine cooling system is cool before removing the pressure cap or any hose. The cooling system is pressurized when hot. Failure to follow these instructions can result in personal injury including extreme burns, scalding, or death.**

With a scan tool, read and record the ECT Sensor Temperature value.

Use the DRB Temperature Probe #CH7050, or an equivalent temperature measuring tool, measure the engine coolant temperature.

**Is the ECT Sensor value with -15°C (5°F) of the temperature probe reading?**

**Yes** >> Go To 6

**No** >> Go To 7

## 6. OTHER POSSIBLE CAUSES

Inspect the Temperature Sensors for any physical damage.

Inspect the engine coolant. Make sure the coolant is at the proper level. Refer to the Service Information COOLING.

Make sure the Temperature Sensors are properly installed.

Make sure the CMP and CKP sensors are installed properly. Check the connectors for any signs of damage.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Refer to any Technical Service Bulletins (TSBs) that may apply.

With the engine running at normal operating temperature, monitor the Temperature sensor parameters while wiggling the wire harness. Look for parameter values to change.

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Inspect and clean all PCM, engine, and chassis grounds.

**Were any problems found during the above inspections?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Test Complete.

## 7. SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

**NOTE: Visually inspect both the component and the PCM connectors. Look for damage, partially broken wires and backed out or corroded terminals**

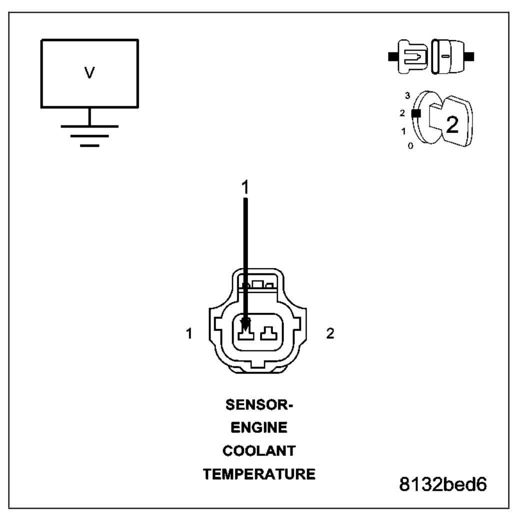
Turn the ignition off.

Disconnect the applicable Temperature Sensor harness connector.

Disconnect the C2 PCM harness connector.

Disconnect the C2 BCM harness connector if the vehicle is equipped with the Electronic Stability Program (ESP).

Ignition on, engine not running.

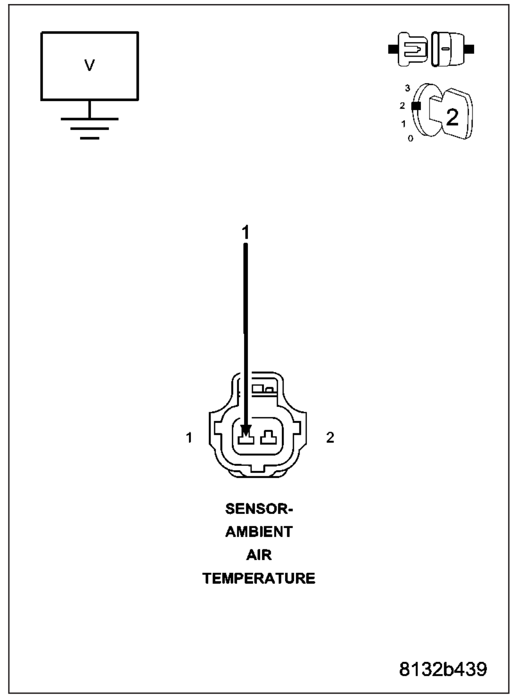


Measure the voltage on the (K2) ECT Signal circuit and the (G31) AAT Signal circuit at the appropriate Temperature Sensor harness connector.

**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8




## 8. TEMPERATURE SENSOR

Turn the ignition off.

Connect the C2 PCM harness connector.

Connect the C2 BCM harness connector if the vehicle is equipped with ESP.

Connect a jumper wire across the ECT and AAT Sensor harness connectors.

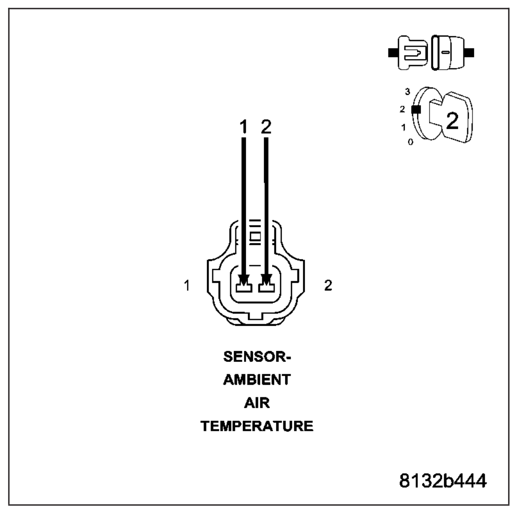
Ignition on, engine not running.

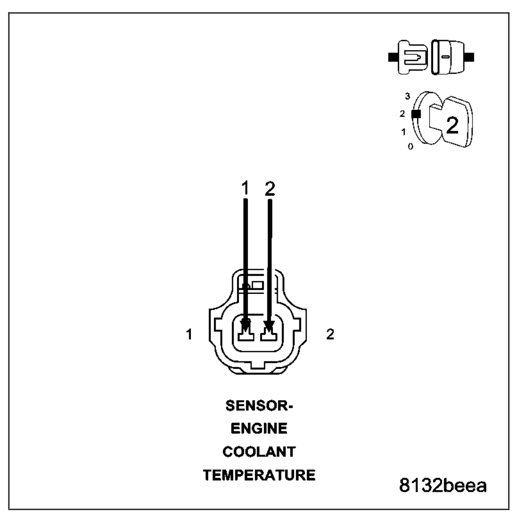
With a scan tool, read the Temperature Sensor voltage.

**Does the voltage start at 5.0 volts and drop below 1.0 volt when the jumper wire is installed?**

**Yes** >> Replace the appropriate Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9



**NOTE: Disconnect the jumper wire before continuing.**

## 9. SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K2) ECT Sensor Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

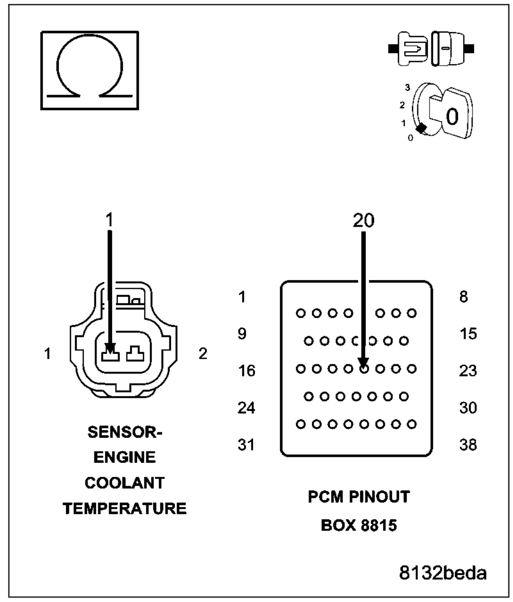
Measure the resistance of the (G31) AAT Sensor Signal circuit from the AAT Sensor harness connector to the appropriate terminal of special tool #8815.

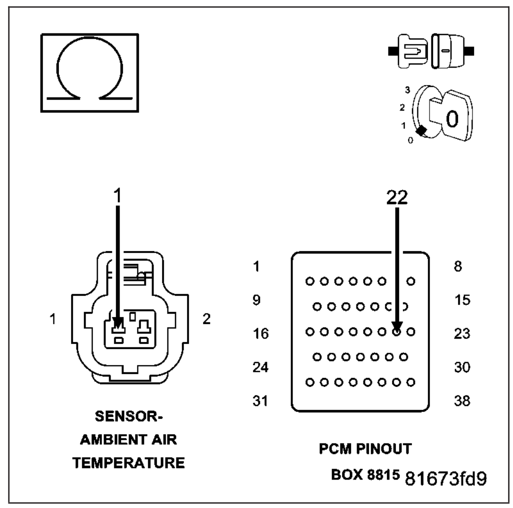
**Is the resistance below 5.0 ohms?**

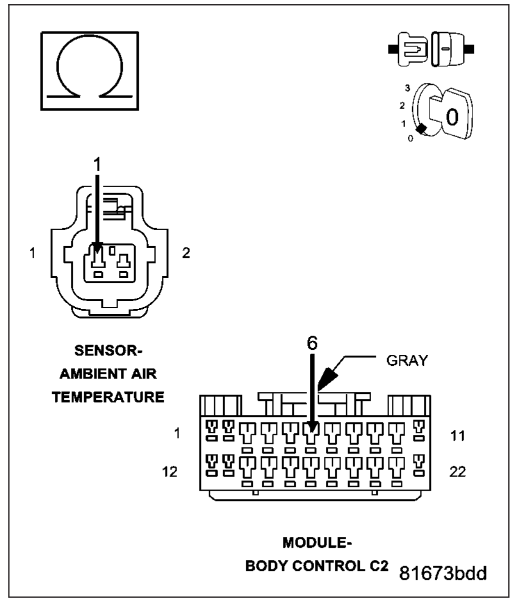
**Yes** >> Go To 10

**No** >> Repair the open in the Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)






## 10. SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the appropriate Temperature Sensor harness connector to the appropriate terminal of special tool #8815.

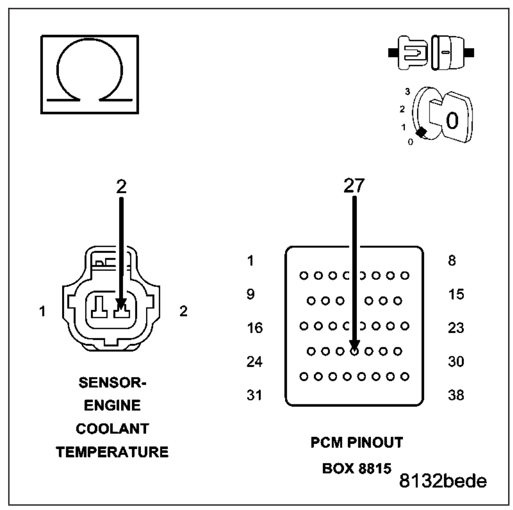
Measure the resistance of the (K300) Sensor ground circuit from AAT Sensor harness connector to the C2 BCM harness connector for ESP equipped vehicles.

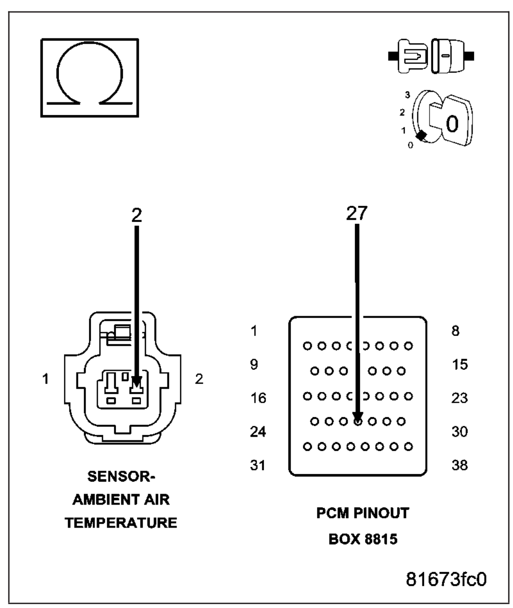
**Is the resistance below 5.0 ohms?**

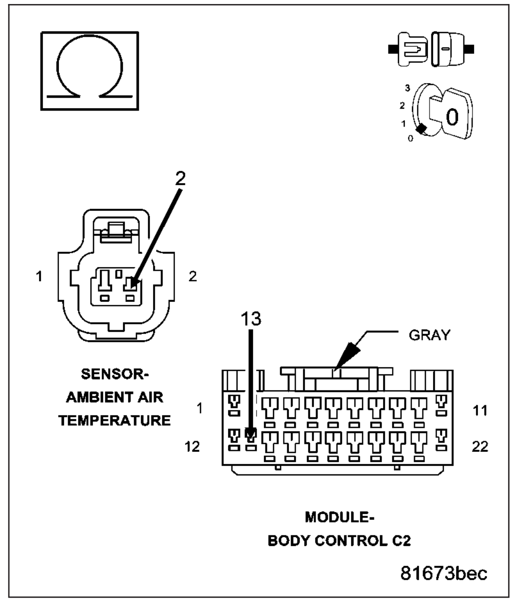
**Yes** >> Go To 11

**No** >> Repair the open in the Sensor ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





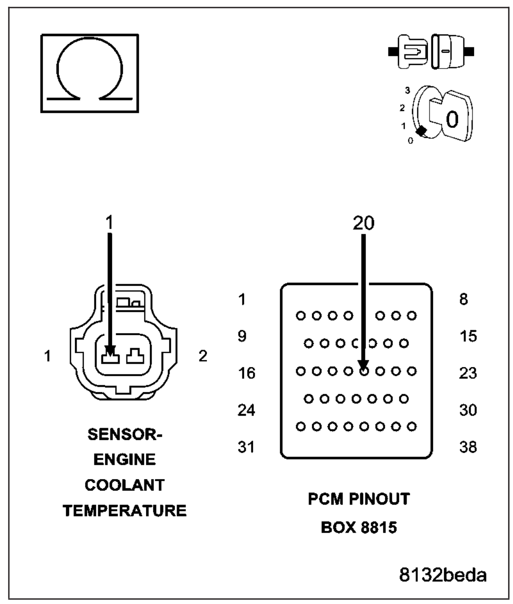

## 11. SIGNAL CIRCUIT SHORTED TO GROUND

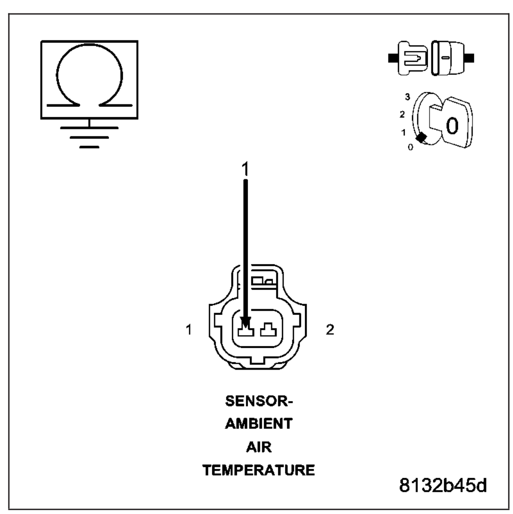
Measure the resistance between ground and the Sensor Signal circuit in the Temperature Sensor harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 12



## 12. SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT

Measure the resistance between the Signal circuit and the (K900) Sensor ground circuit in the (K2) ECT Sensor harness connector.

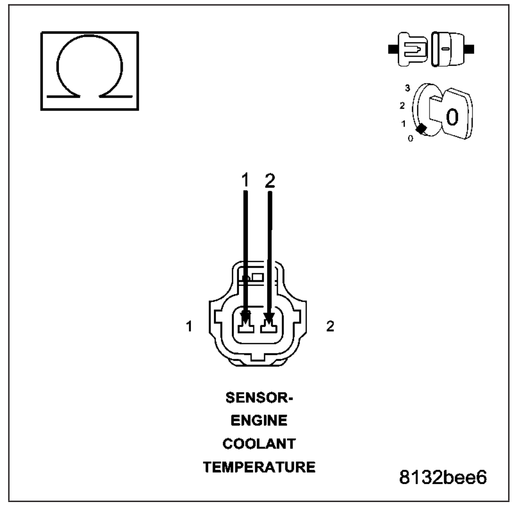
Measure the resistance between the Signal circuit and the Sensor ground circuit in the (G31) AAT Sensor harness connector.

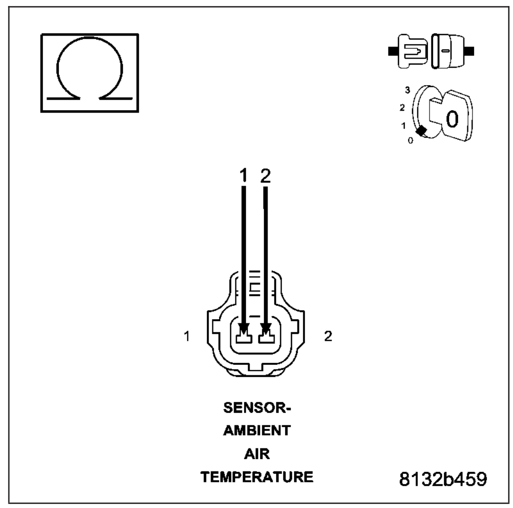
**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the Sensor ground circuit and the Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13




## 13. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

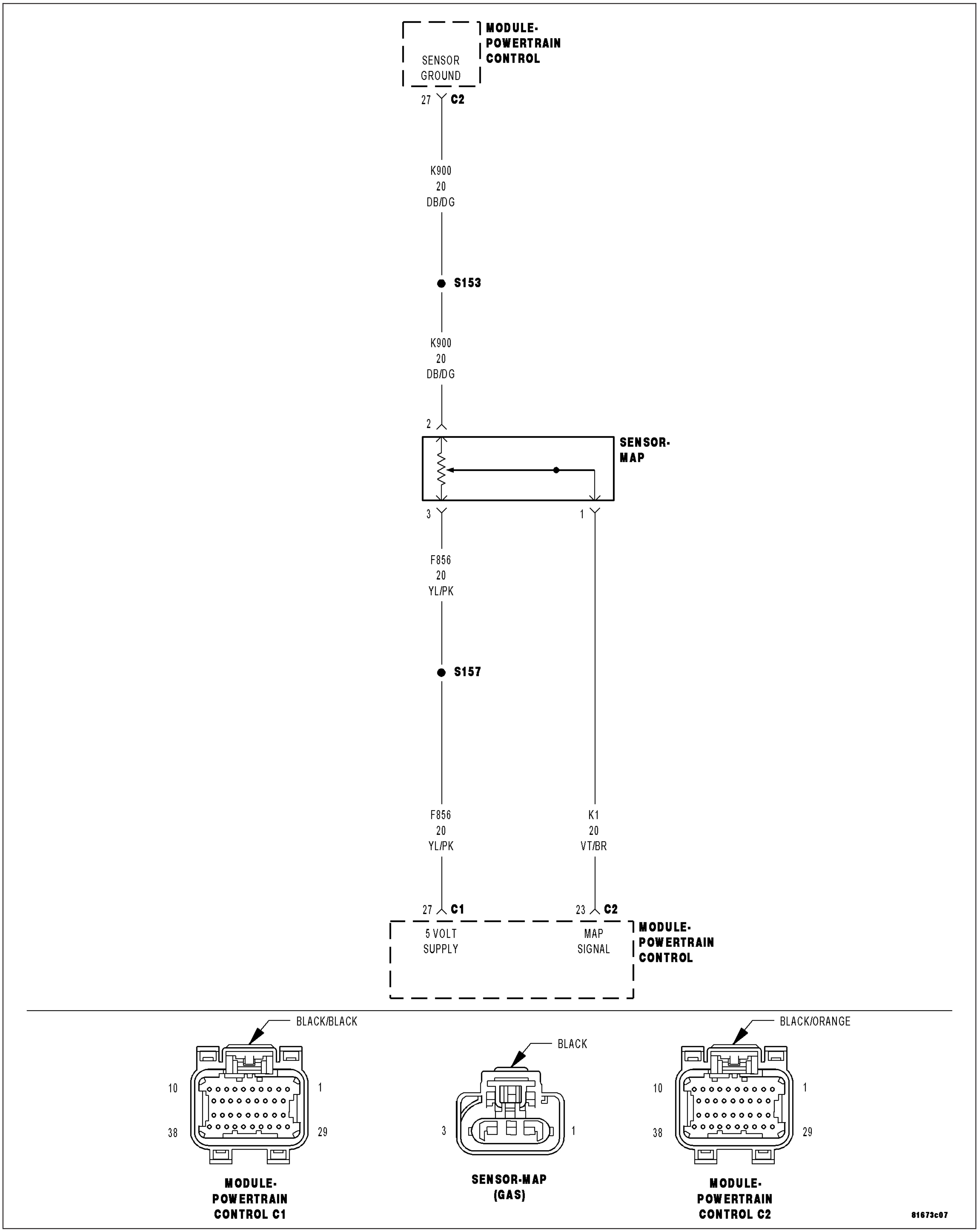
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on. No Cam or Crank signal within 75 ms. Engine speed less than 250 RPM.
- **Set Condition:**
  The PCM senses the voltage from the MAP sensor to be less than 2.2 volts but above 0.04 of a volt for 300 milliseconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (F856) 5-VOLT SUPPLY CIRCUIT OPEN |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| (K1) MAP SIGNAL CIRCUIT OPEN |
| (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND |
| (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT |
| MAP SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time.**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

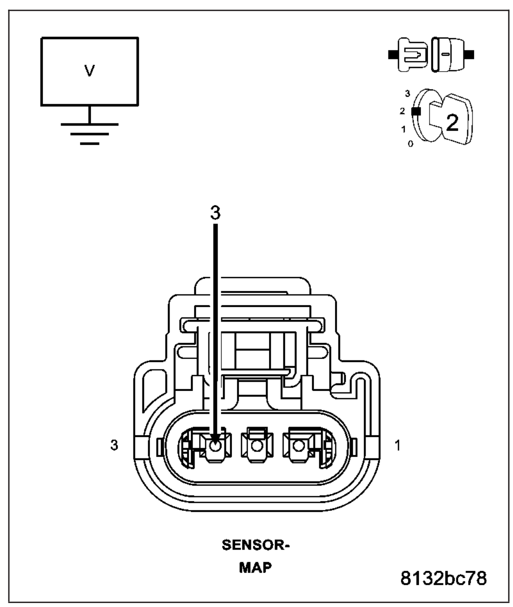
### 2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.




**Is the voltage between 4.5 to 5.2 volts?**

**Yes** >> Go To 3

**No** >> Go To 7

## 3. MAP SENSOR

With a scan tool, monitor the MAP Sensor voltage with the Sensor harness connector disconnected.

**Is the voltage above 2.2 volts?**

**Yes** >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

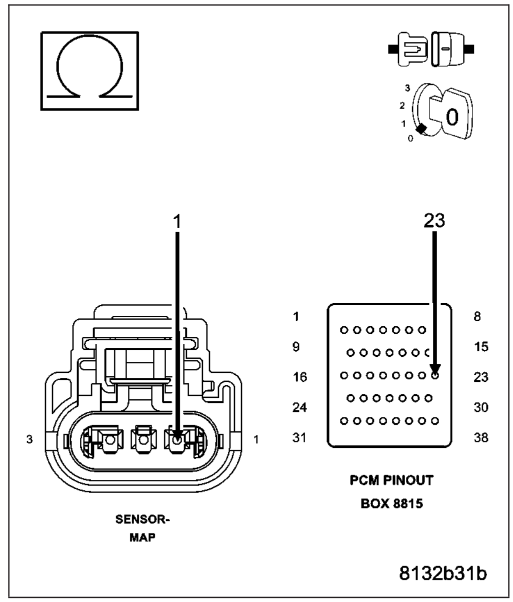
## 4. (K1) MAP SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



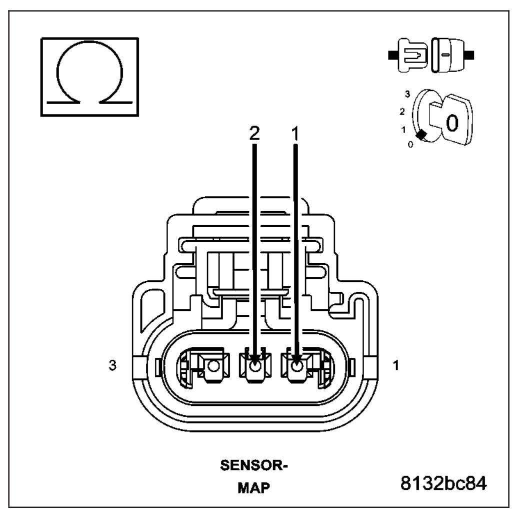

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the open in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K900) Sensor ground circuit and the (K1) MAP Signal circuit in the MAP Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K900) Sensor ground circuit and the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

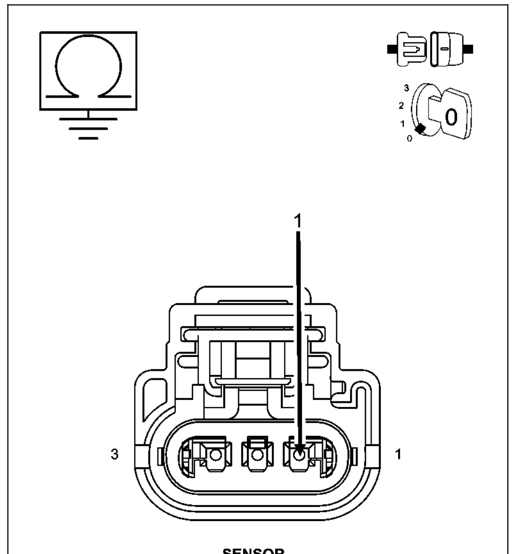
## 6. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 10



8132b323

## 7. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

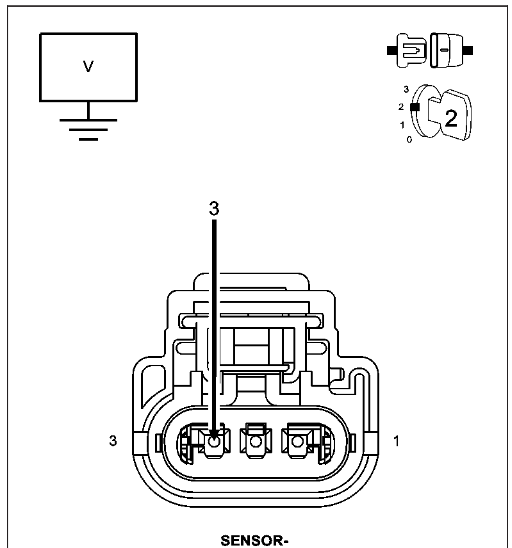
Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8



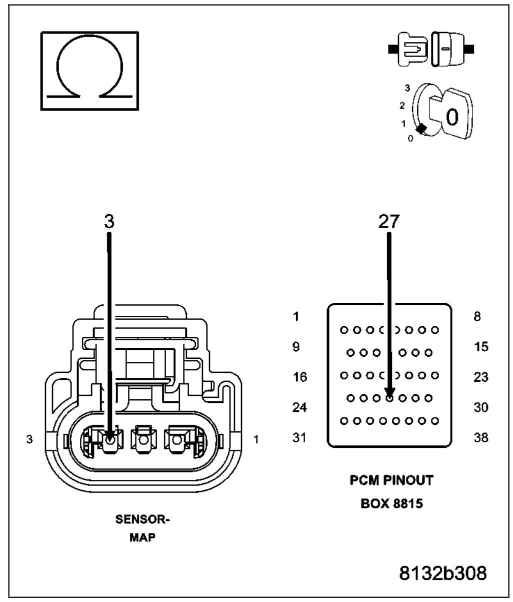
8132bc78

## 8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

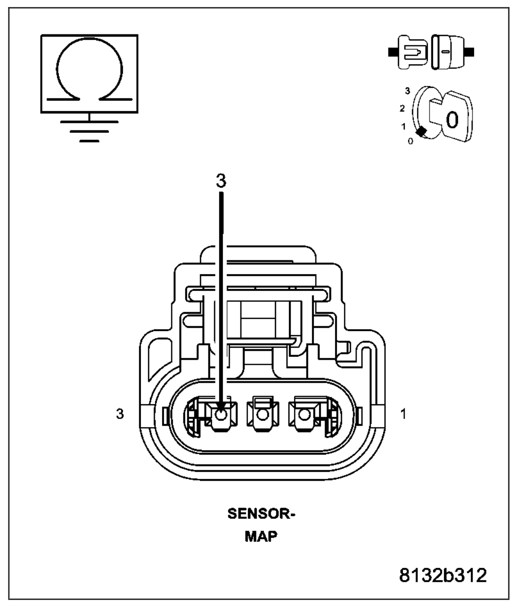
**Yes** >> Go To 9

**No** >> Repair the open in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 9. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 10

## 10. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

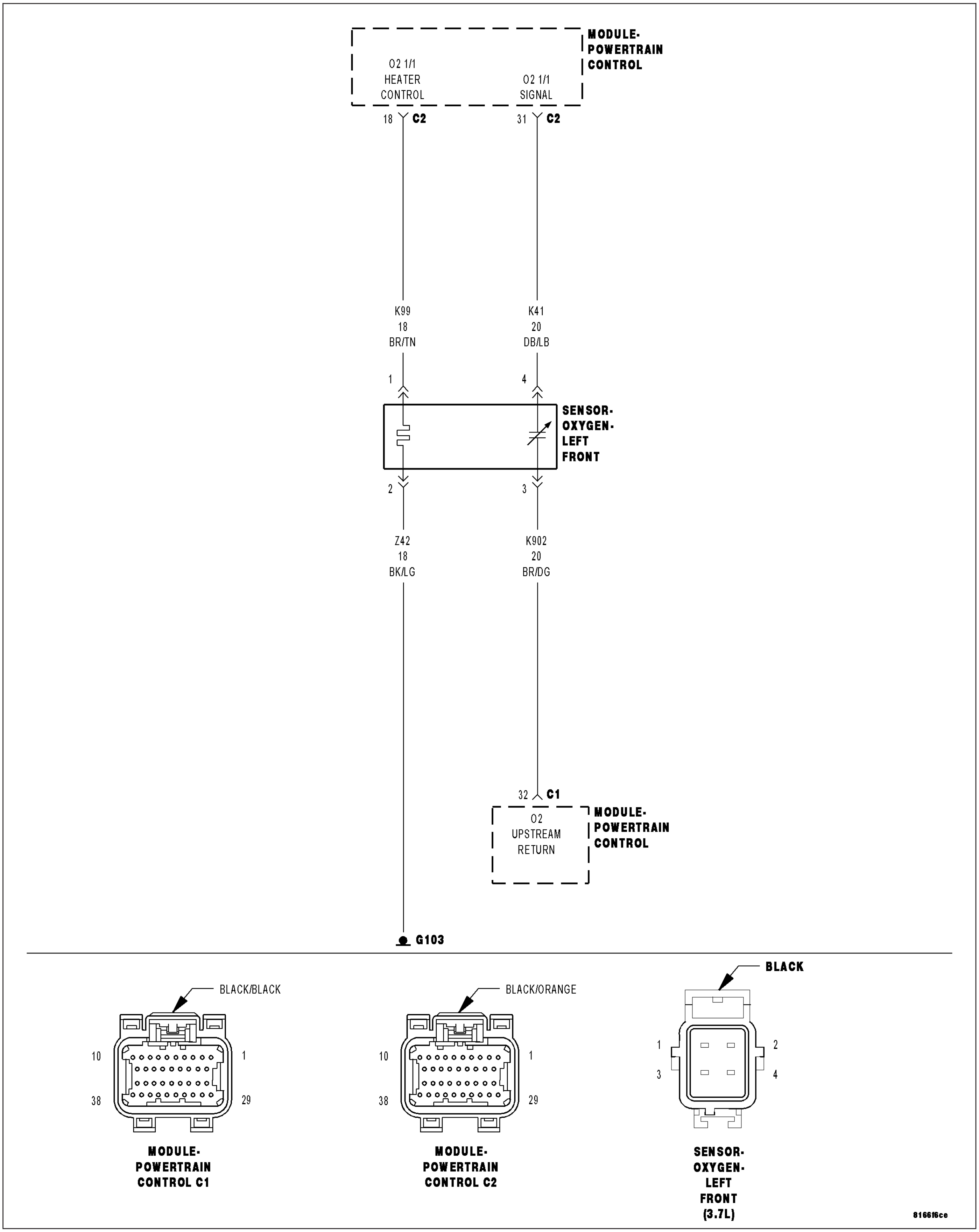
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0131-O2 SENSOR 1/1 CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251°C (484°F) with battery voltage greater 10.4 volts.
- **Set Condition:**
  The oxygen sensor signal voltage is below 2.5196 volts for 6 seconds after starting engine. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND |
| (K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO GROUND |
| (K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT |
| (K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO THE (Z42) O2 1/1 HEATER GROUND CIRCUIT |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR BELOW 2.52 VOLTS

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 1/1 O2 Sensor voltage.

**Is the voltage below 2.52 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the 1/1 O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the O2 Sensor voltage.

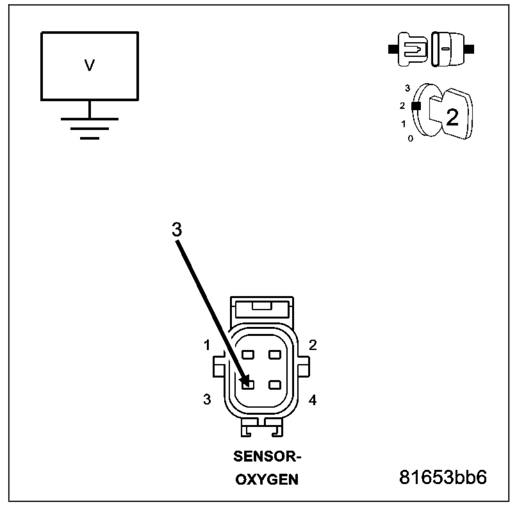
**Is the 1/1 O2 Sensor voltage above 4.8 volts?**

**Yes** >> Go To 3

**No** >> Go To 5

## 3. O2 SENSOR

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.




**Is the voltage at 2.5 volts?**

**Yes** >> Replace the O2 Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

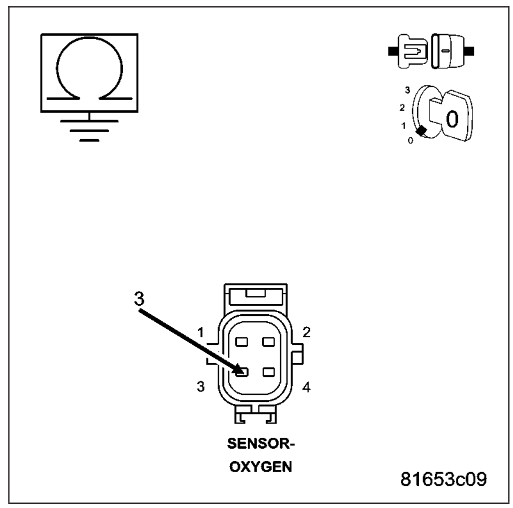
**No** >> Go To 4

## 4. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K902) O2 Return Upstream circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

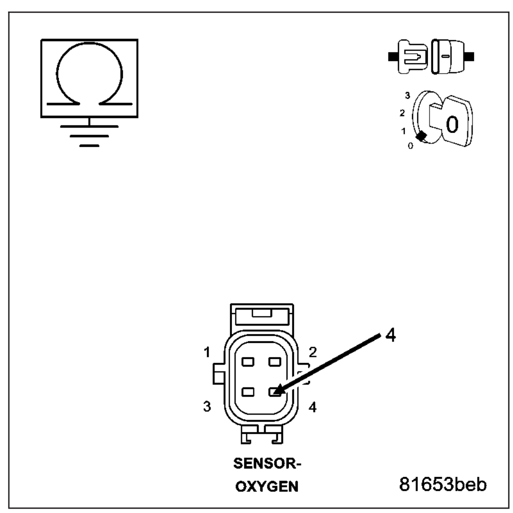
**No** >> Go To 8

## 5. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

Measure the resistance between ground and the (K41) O2 Sensor 1/1 Signal circuit in the O2 Sensor harness connector.




**Is the resistance below 100 ohms?**

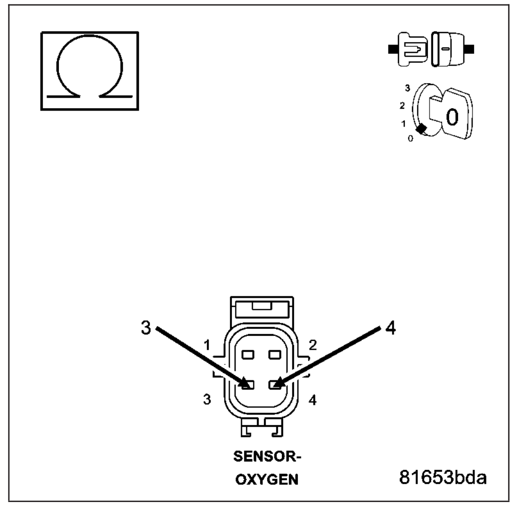
**Yes** >> Repair the short to ground in the (K41) O2 Sensor 1/1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT

Measure the resistance between the (K41) O2 Sensor 1/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.



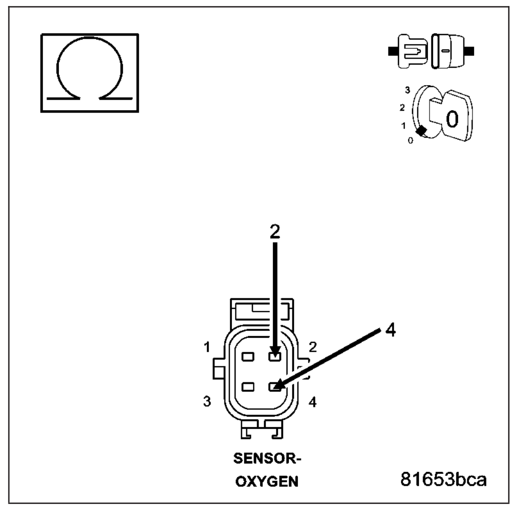

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (K902) O2 Return Upstream circuit and the (K41) O2 Sensor 1/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO THE (Z42) O2 1/1 HEATER GROUND CIRCUIT

Measure the resistance between the (K41) O2 Sensor 1/1 Signal circuit and the (Z42) O2 1/1 Heater ground circuit in the O2 Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (Z42) O2 1/1 Heater ground circuit and the (K41) O2 Sensor 1/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

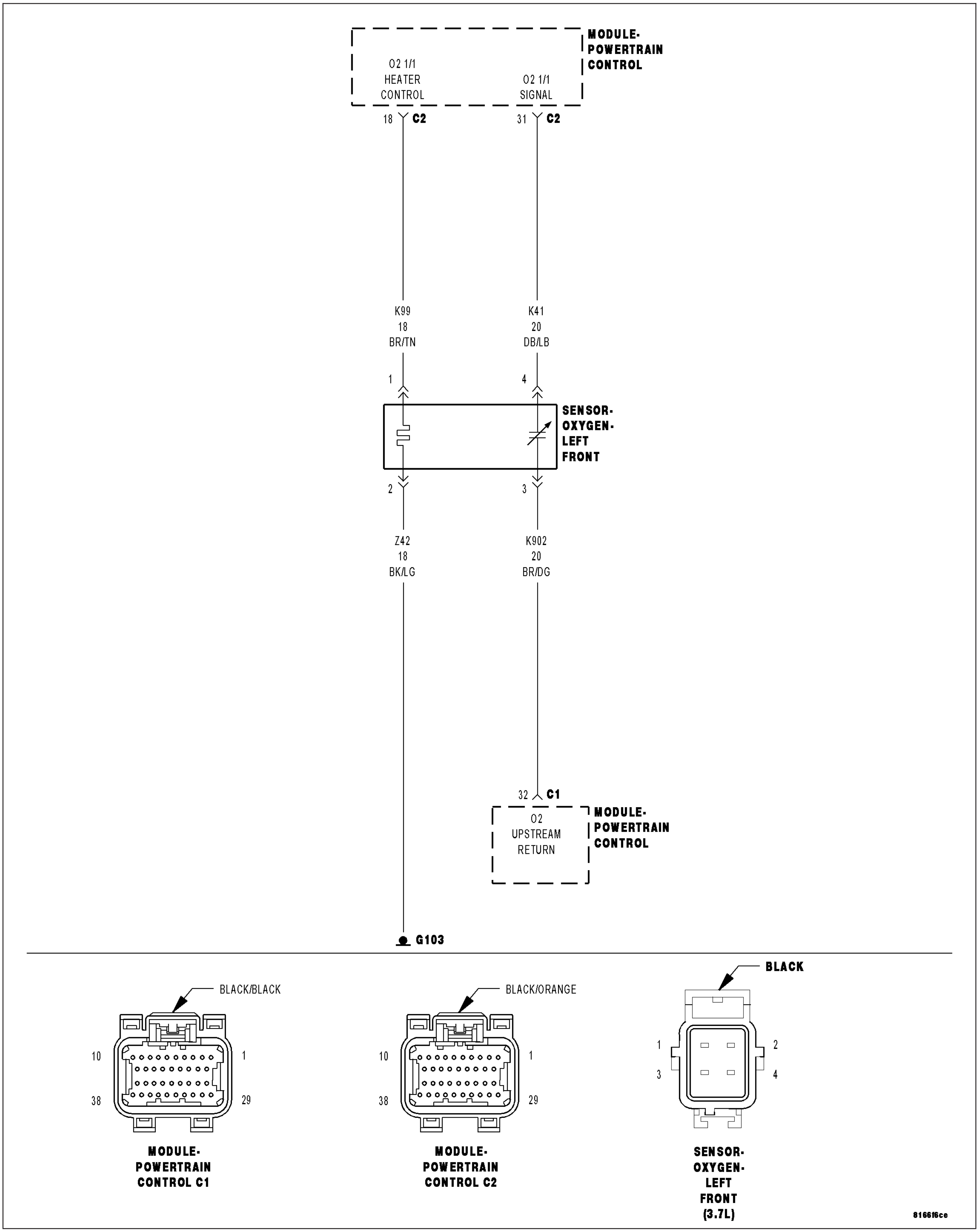
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0132-O2 SENSOR 1/1 CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  O2 Sensor Heater Temperature is greater than 496°C (925°F) and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Oxygen Sensor voltage is above 3.99 volts for 40 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K902) O2 UPSTREAM RETURN CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K41) O2 1/1 SIGNAL CIRCUIT OPEN |
| (K902) O2 UPSTREAM RETURN CIRCUIT OPEN |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR ABOVE 3.99 VOLTS

**NOTE: When only one O2 Sensor is shorted to voltage, the scan tool will display all O2 Sensor voltage readings at approximately 5.0 volts. When diagnosing this DTC, only diagnose the O2 Sensor that set the DTC.**

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 1/1 O2 Sensor voltage.

**Is the voltage above 3.9 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Start the engine and allow the engine to idle.

Disconnect the 1/1 O2 Sensor harness connector.

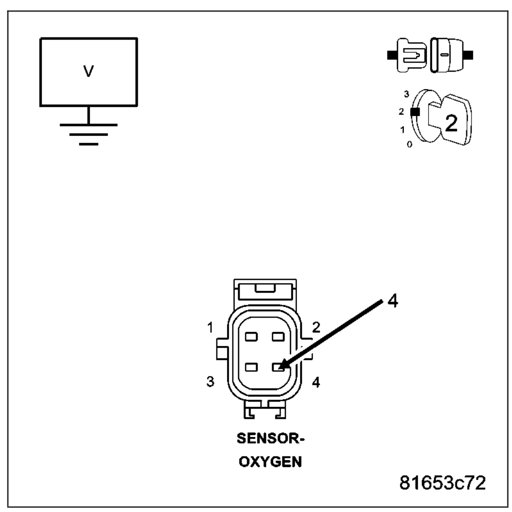
Measure the voltage on the (K41) O2 Sensor 1/1 Signal circuit in the 1/1 O2 Sensor harness connector.

**NOTE: Measure the voltage in reference to ground, not the (K902) O2 Upstream Return circuit.**

**Is the voltage above 5.2 volts?**

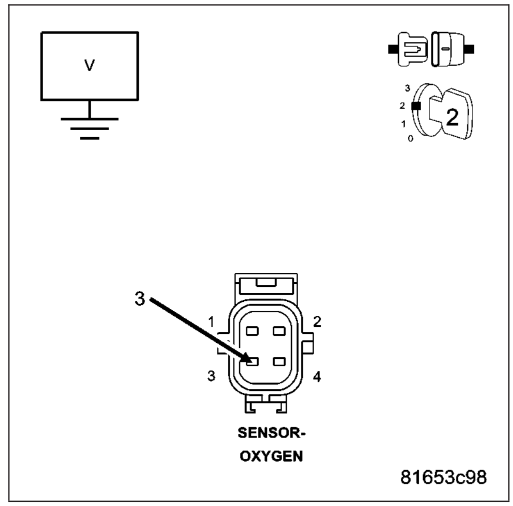
**Yes** >> Repair the short to battery voltage in the (K41) O2 Sensor 1/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3



81653c72

## 3. (K902) O2 UPSTREAM RETURN CIRCUIT SHORTED TO BATTERY VOLTAGE




Turn the ignition off.

Disconnect the C1 PCM harness connector.

Ignition on, engine not running.

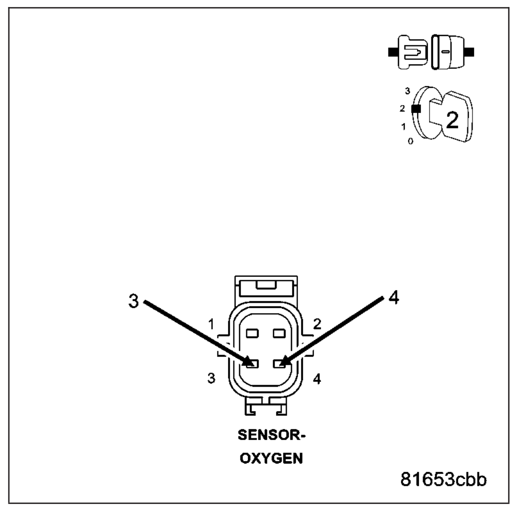
Measure the voltage on the (K902) O2 Upstream Return circuit in the 1/1 O2 Sensor harness connector.

**Is there any voltage present?**

**Yes** >> Repair the short to battery voltage in the (K902) O2 Upstream Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. 1/1 O2 SENSOR




Turn the ignition off.

Connect the C1 PCM harness connector.

Connect a jumper wire between the (K41) O2 1/1 Signal circuit and the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the 1/1 O2 Sensor voltage.

**Is the voltage between 2.3 and 2.7 volts with the jumper wire installed?**

**Yes** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

**NOTE: Remove the jumper wire before continuing.**

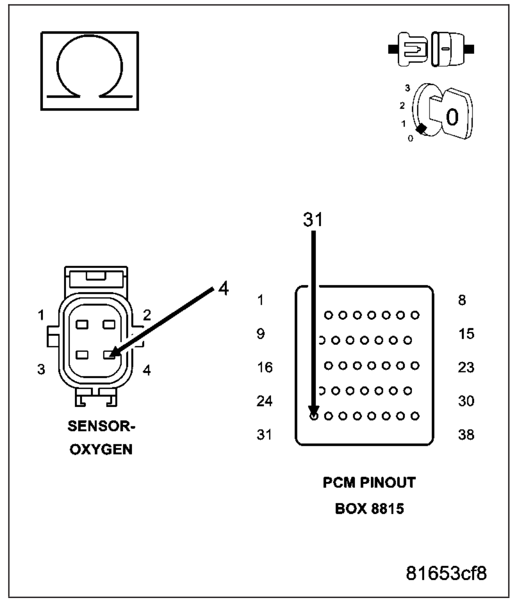
## 5. (K41) O2 1/1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K41) O2 1/1 Signal circuit from the 1/1 O2 Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

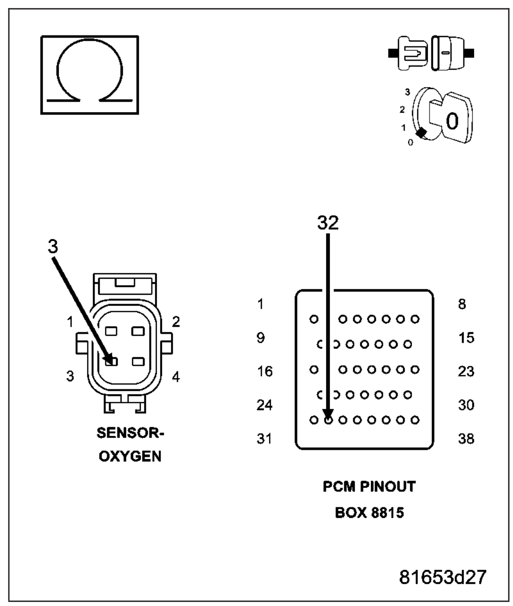
**Yes** >> Go To 6

**No** >> Repair the open in the (K41) O2 1/1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (K902) O2 UPSTREAM RETURN CIRCUIT OPEN

Measure the resistance of the (K902) O2 Upstream Return circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K902) O2 Upstream Return circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

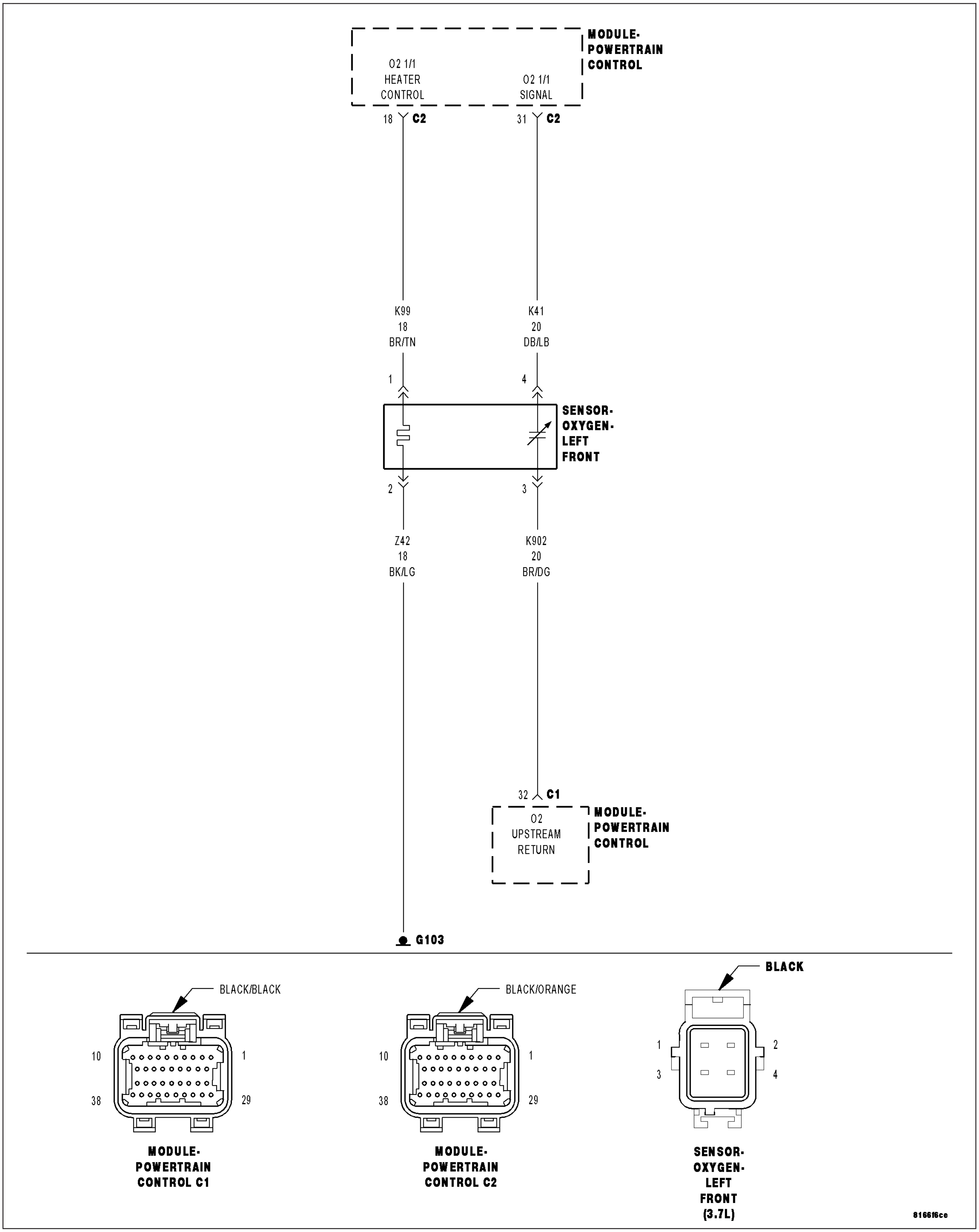
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0133-O2 SENSOR 1/1 SLOW RESPONSE




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

For an aged O2 sensor , the response rate to the air/fuel change is slower than when it was new. The O2 sensor tends to move less with the same air/fuel changes in a given time frame. Therefore by observing the activity of voltage readings from the upstream O2 sensor, the quality of the O2 sensor can be detected.

- **When Monitored:**
  Vehicle is started and driven between 20 and 55 MPH with the Throttle open for a minimum of 120 seconds. Coolant greater than 70°C (158°F). Catalytic Converter Temp greater than 600°C (1112°F) and EVAP Purge is active.
- **Set Condition:**
  O2 Sensor response is too slow for a calibrated amount of time. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EXHAUST LEAK |
| (K41) O2 1/1 SIGNAL CIRCUIT |
| (K902) O2 RETURN UPSTREAM CIRCUIT |
| O2 SENSOR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.**
Ignition on, engine not running.

**NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.**
With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. EXHAUST LEAK

Start the engine.

Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Turn the ignition off.

If a leak is heard but unable to be located, it may be necessary to use special tool Miller Tool #8404A Evaporative Emissions Leak Detector (EELD) on the exhaust system to find leaks.

Connect the SMOKE supply tip (black hose) to the exhaust cone adapter (if equipped) and place it into the tail pipe.

Set the smoke/air control switch to SMOKE.

Press the remote smoke/air start button.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view, release the remote smoke/air start button, and use the ultraviolet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

Be sure to check the exhaust manifold to cylinder head connection for leaks.

**Are there any exhaust leaks?**

**Yes** >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

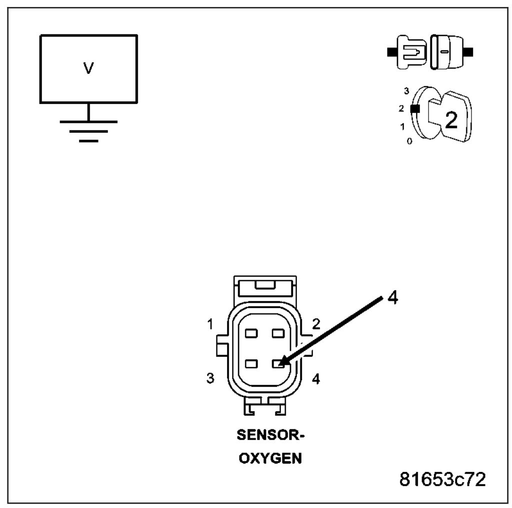
## 3. (K41) O2 1/1 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 1/1 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K41) O2 1/1 Signal circuit in the O2 Sensor harness connector.



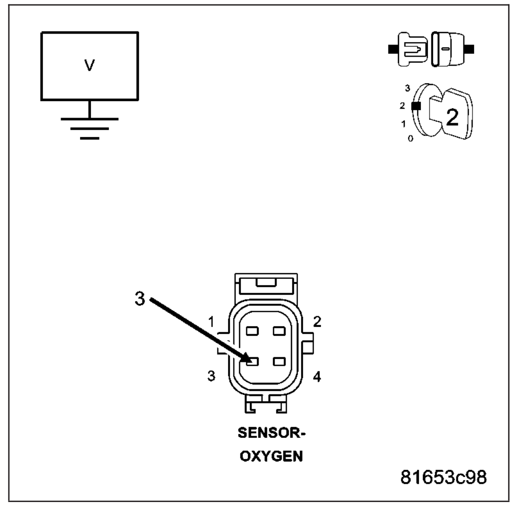

**Is the voltage approximately 5.0 volts?**

**Yes** >> Go To 4

**No** >> Check the (K41) O2 1/1 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (K902) O2 RETURN UPSTREAM CIRCUIT

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.




**Is the voltage at 2.5 volts?**

**Yes** >> Check the (K902) O2 Return Upstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. O2 SENSOR

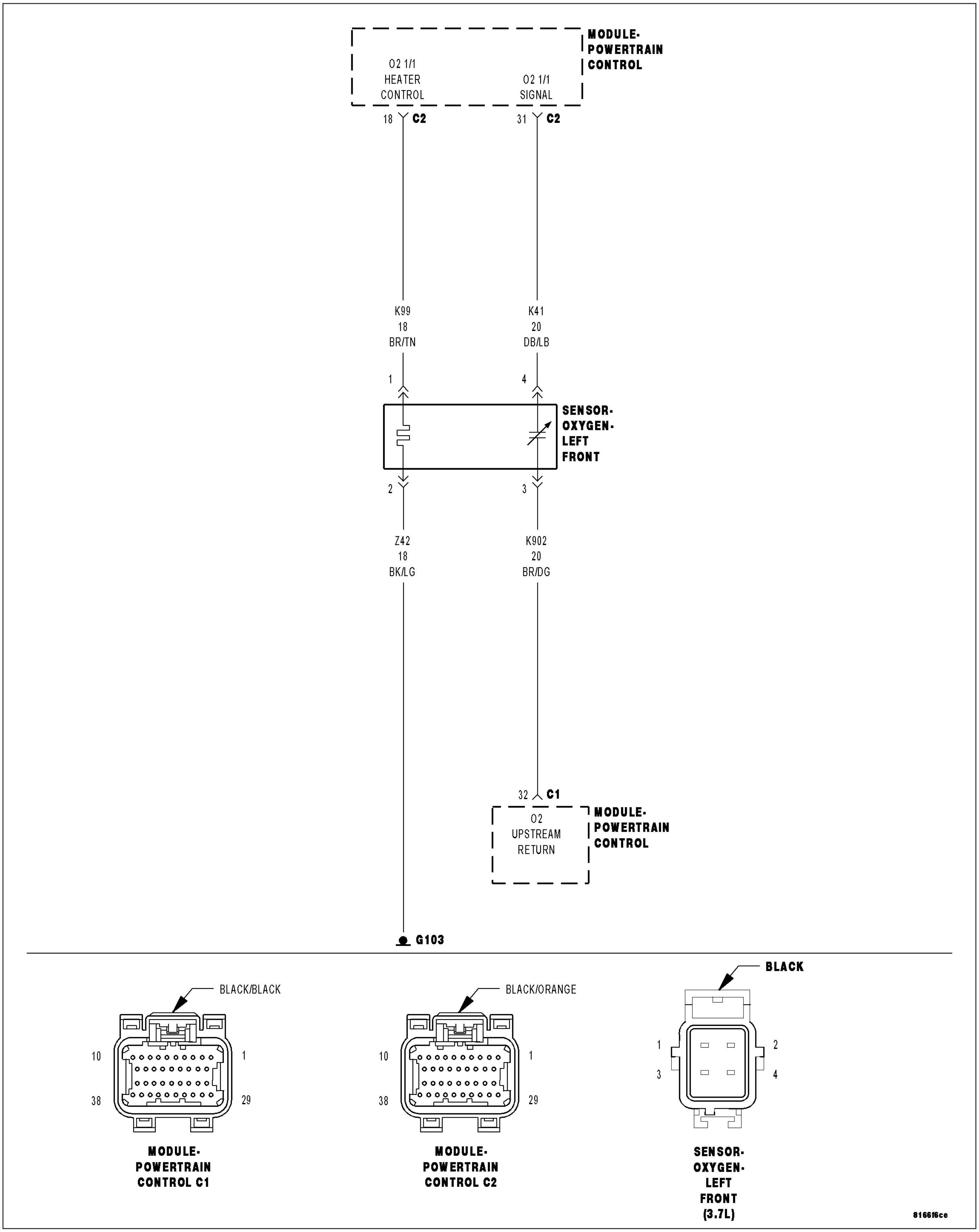
**If there are no possible causes remaining, view repair.**

**Repair**

Replace the O2 Sensor

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0135-O2 SENSOR 1/1 HEATER PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.
- **Set Condition:**
  No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN |
| (Z42) O2 1/1 HEATER GROUND CIRCUIT OPEN |
| O2 SENSOR HEATER ELEMENT |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

**NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.**

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

**Does the voltage stay above 4.5 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

**NOTE: Allow the O2 sensor to cool down to room temperature.**

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the 1/1 O2 Sensor connector between the O2 Heater Control terminal and the Heater ground terminal.

**NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.**

**Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?**

**Yes** >> Go To 3

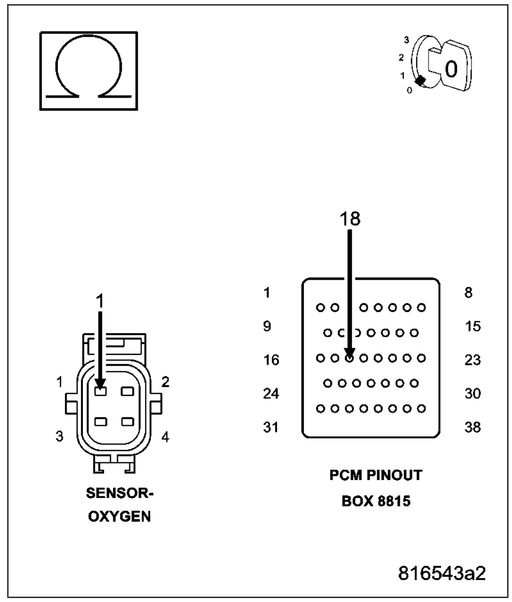
**No** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. (K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K99) O2 1/1 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 0.5 of an ohm?**

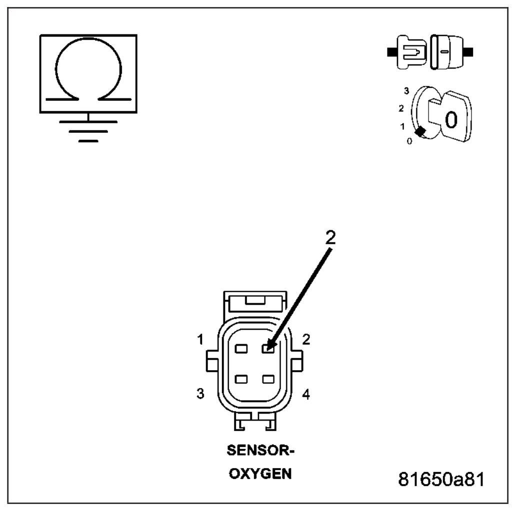
**Yes** >> Go To 4

**No** >> Repair the excessive resistance in the (K99) O2 1/1 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

## 4. (Z42) O2 1/1 HEATER GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z42) O2 1/1 Heater ground circuit in the O2 Sensor harness connector.




**Is the resistance below 0.5 of an ohm?**

**Yes** >> Go To 5

**No** >> Repair the excessive resistance in the (Z42) O2 1/1 Heater ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

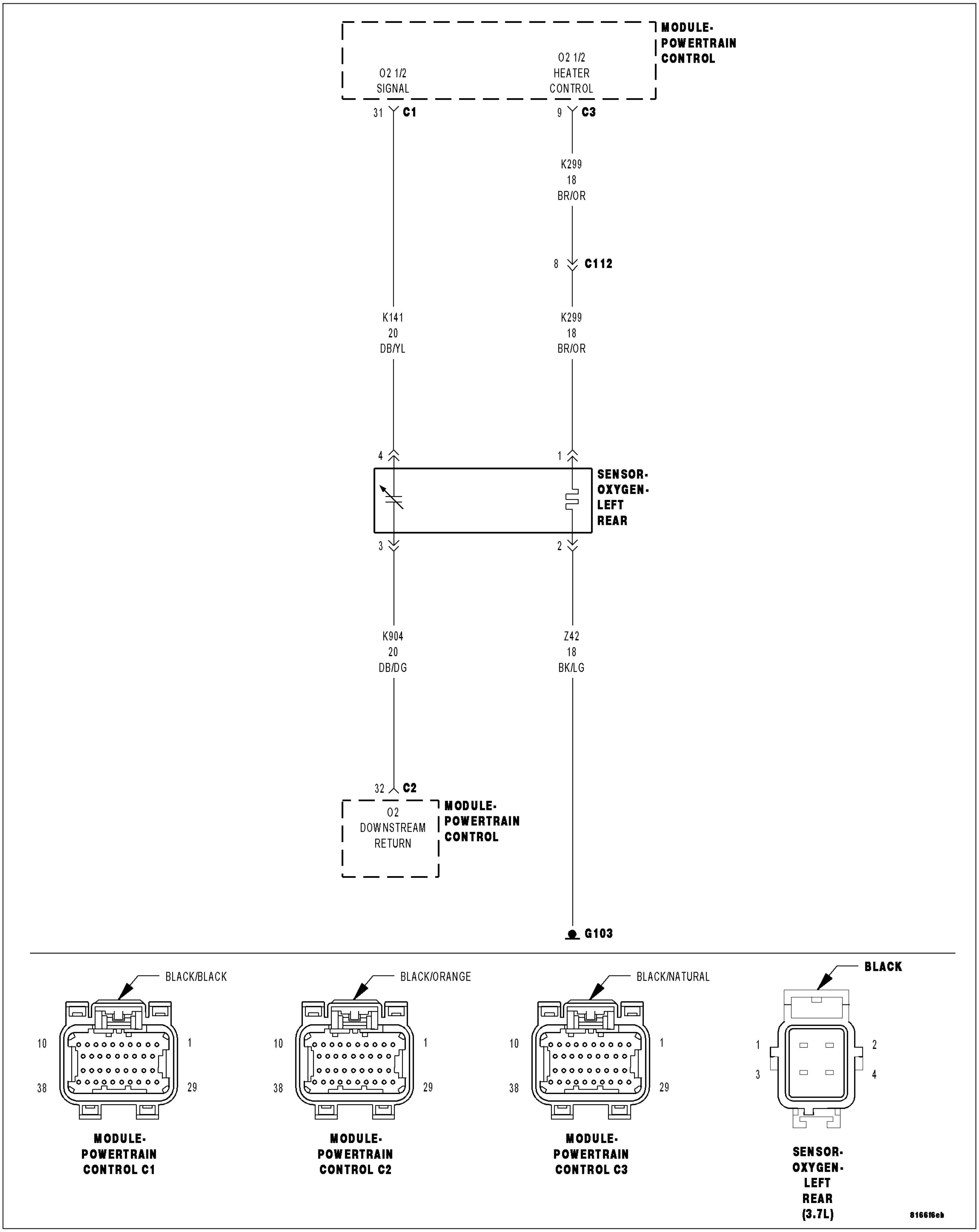
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0137-O2 SENSOR 1/2 CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251°C (484°F) with battery voltage greater 10.99 volts.
- **Set Condition:**
  The oxygen sensor signal voltage is below 2.5196 volts for 6 seconds after starting engine. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K904) O2 DOWNSTREAM RETURN CIRCUIT SHORTED TO GROUND |
| (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO GROUND |
| (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 DOWNSTREAM RETURN CIRCUIT |
| (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (Z42) O2 1/2 HEATER GROUND CIRCUIT |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR BELOW 2.52 VOLTS

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 1/2 O2 Sensor voltage.

**Is the voltage below 2.52 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (K141) O2 1/2 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the 1/2 O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the 1/2 O2 Sensor voltage.

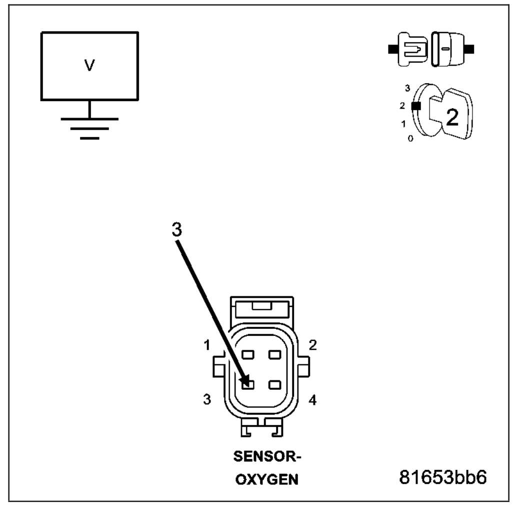
**Is the O2 Sensor voltage above 4.8 volts?**

**Yes** >> Go To 3

**No** >> Go To 5

## 3. O2 SENSOR

Measure the voltage on the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.




**Is the voltage at 2.5 volts?**

**Yes** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

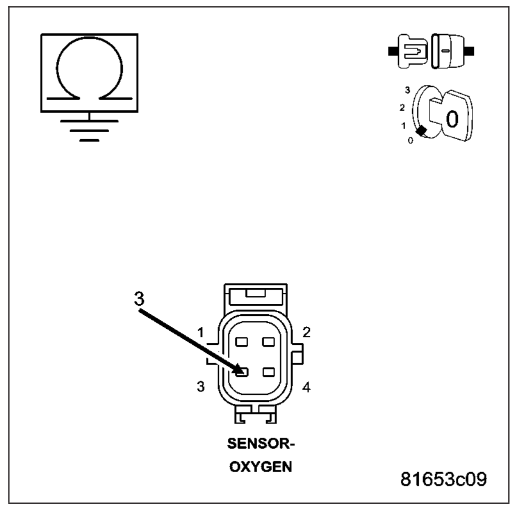
**No** >> Go To 4

## 4. (K904) O2 DOWNSTREAM RETURN CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K904) O2 Downstream Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

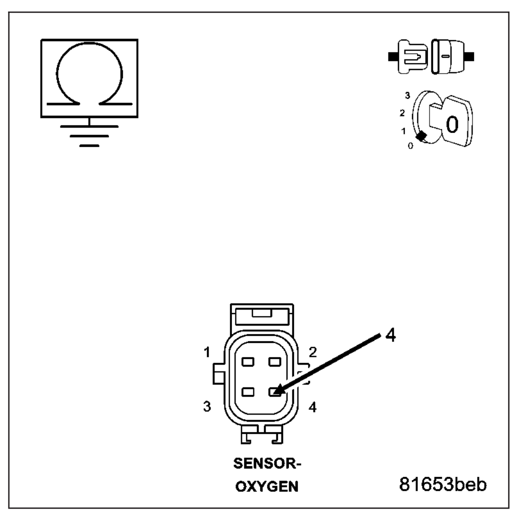
**No** >> Go To 8

## 5. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

Measure the resistance between ground and the (K141) O2 1/2 Signal circuit in the O2 Sensor harness connector.



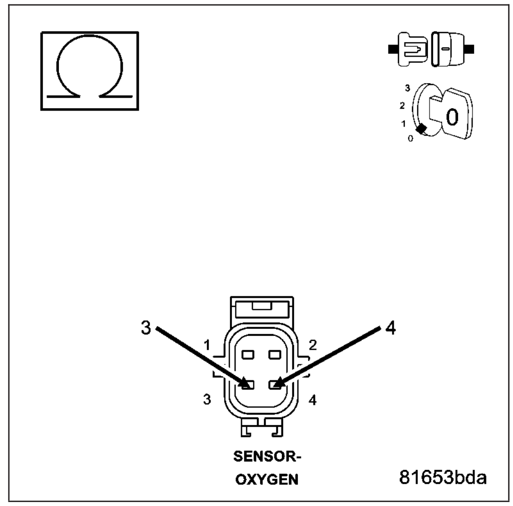

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K141) O2 1/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 DOWNSTREAM RETURN CIRCUIT

Measure the resistance between the (K141) O2 1/2 Signal circuit and the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.




**Is the resistance below 100 ohms?**

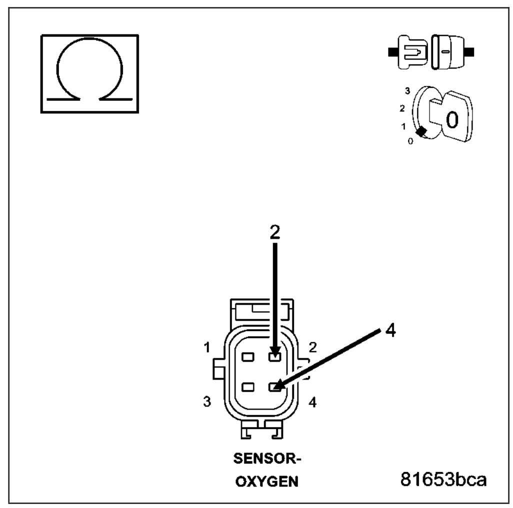
**Yes** >> Repair the short between the (K904) O2 Downstream Return circuit and the (K141) O2 1/2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (Z42) O2 1/2 HEATER GROUND CIRCUIT

Measure the resistance between the (K141) O2 1/2 Signal circuit and the (Z42) O2 1/2 Heater ground circuit in the O2 Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (Z42) O2 1/2 Heater ground circuit and the (K141) O2 1/2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

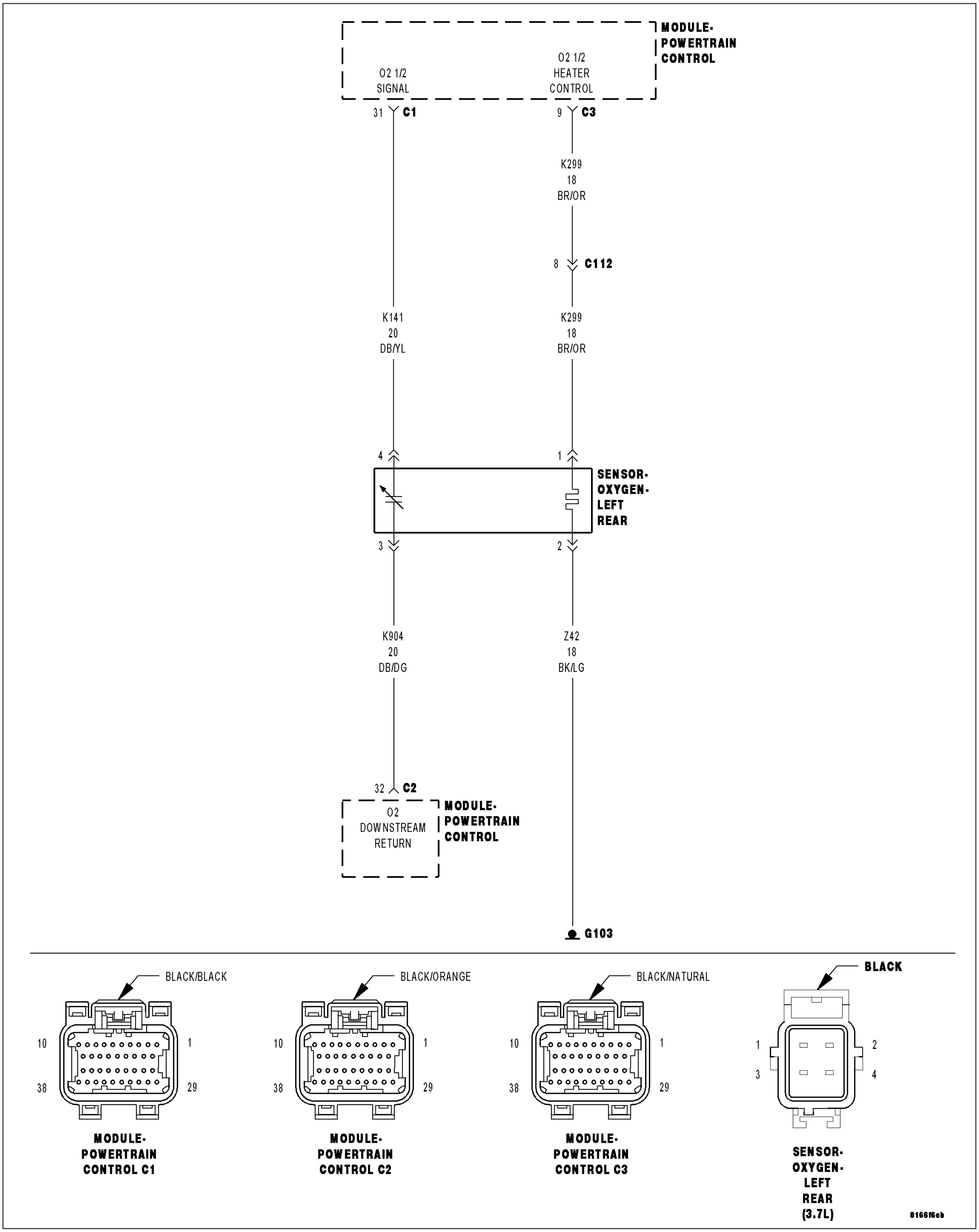
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0138-O2 SENSOR 1/2 CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  O2 Sensor Heater Temperature is greater than 496°C (925°F) and battery voltage greater than 10.99 volts.
- **Set Condition:**
  The Oxygen Sensor voltage is above 3.99 volts for 40 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K904) O2 DOWNSTREAM RETURN CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K141) O2 1/2 SENSOR SIGNAL CIRCUIT OPEN |
| (K904) O2 DOWNSTREAM RETURN CIRCUIT OPEN |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR ABOVE 3.7 VOLTS

**NOTE: When only one O2 Sensor is shorted to voltage, the scan tool will display all O2 Sensor voltage readings at approximately 5.0 volts. When diagnosing this DTC, only diagnose the O2 Sensor that set the DTC.**

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 1/2 O2 Sensor voltage.

**Is the voltage above 3.7 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Start the engine and allow the engine to idle.

Disconnect the 1/2 O2 Sensor harness connector.

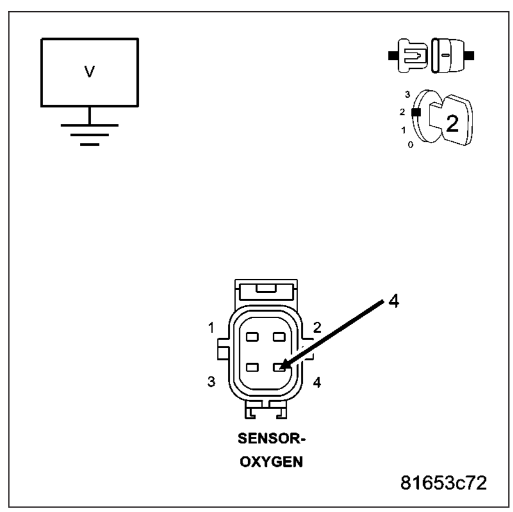
Measure the voltage on the (K141) O2 Sensor 1/2 Signal circuit in the O2 Sensor harness connector.

**NOTE: Measure the voltage in reference to ground, not the (K904) O2 Downstream Return circuit.**

**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K141) O2 Sensor 1/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3



## 3. (K904) O2 DOWNSTREAM RETURN CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

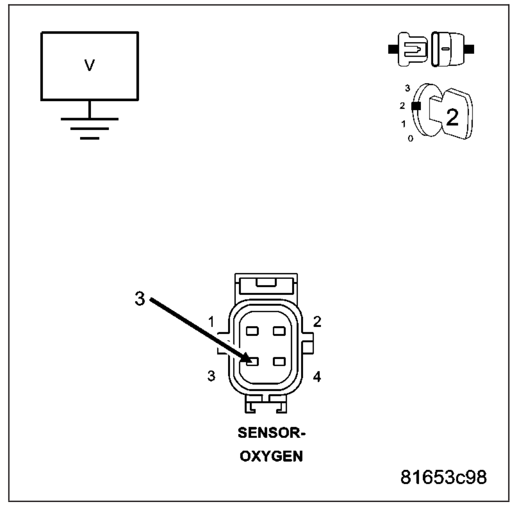
Ignition on, engine not running.

Measure the voltage on the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.

**Is there any voltage present?**

**Yes** >> Repair the short to battery voltage in the (K904) O2 Downstream Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4




## 4. O2 SENSOR

Turn the ignition off.

Connect the C2 PCM harness connector.

Connect a jumper wire between the (K141) O2 1/2 Signal circuit and the (K904) O2 Downstream Return circuit in the 1/2 O2 Sensor harness connector.

Ignition on, engine not running.

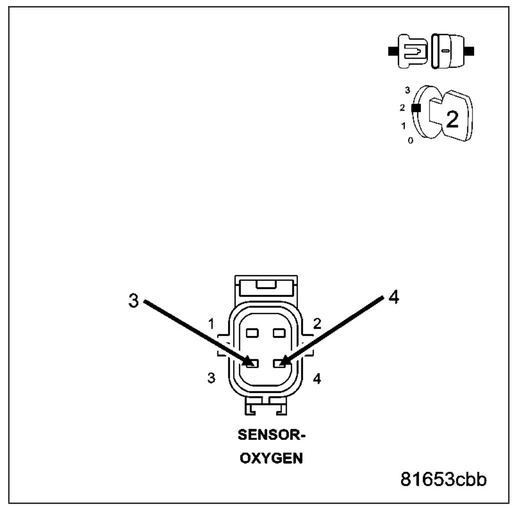
With a scan tool, monitor the 1/2 O2 Sensor voltage.

**Is the voltage between 2.3 and 2.7 volts with the jumper wire installed?**

**Yes** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

**NOTE: Remove the jumper wire before continuing.**



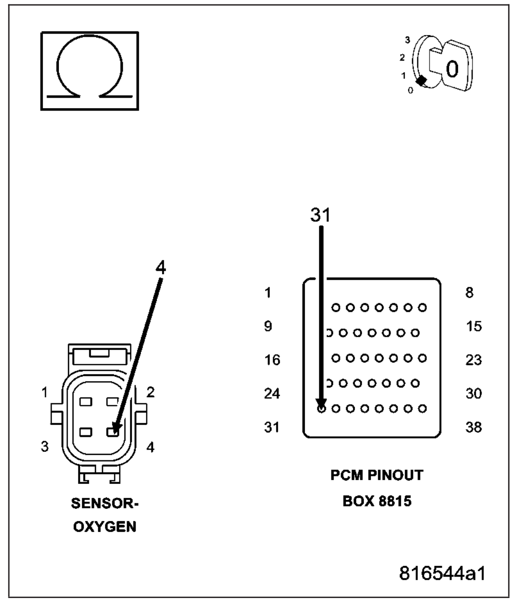
## 5. (K141) O2 1/2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K141) O2 1/2 Signal circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.



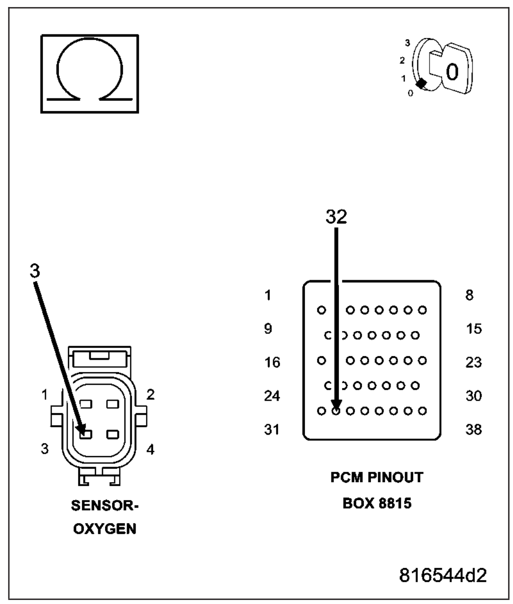

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K141) O2 1/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (K904) O2 DOWNSTREAM RETURN CIRCUIT OPEN

Measure the resistance of the (K904) O2 Downstream Return circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K904) O2 Downstream Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

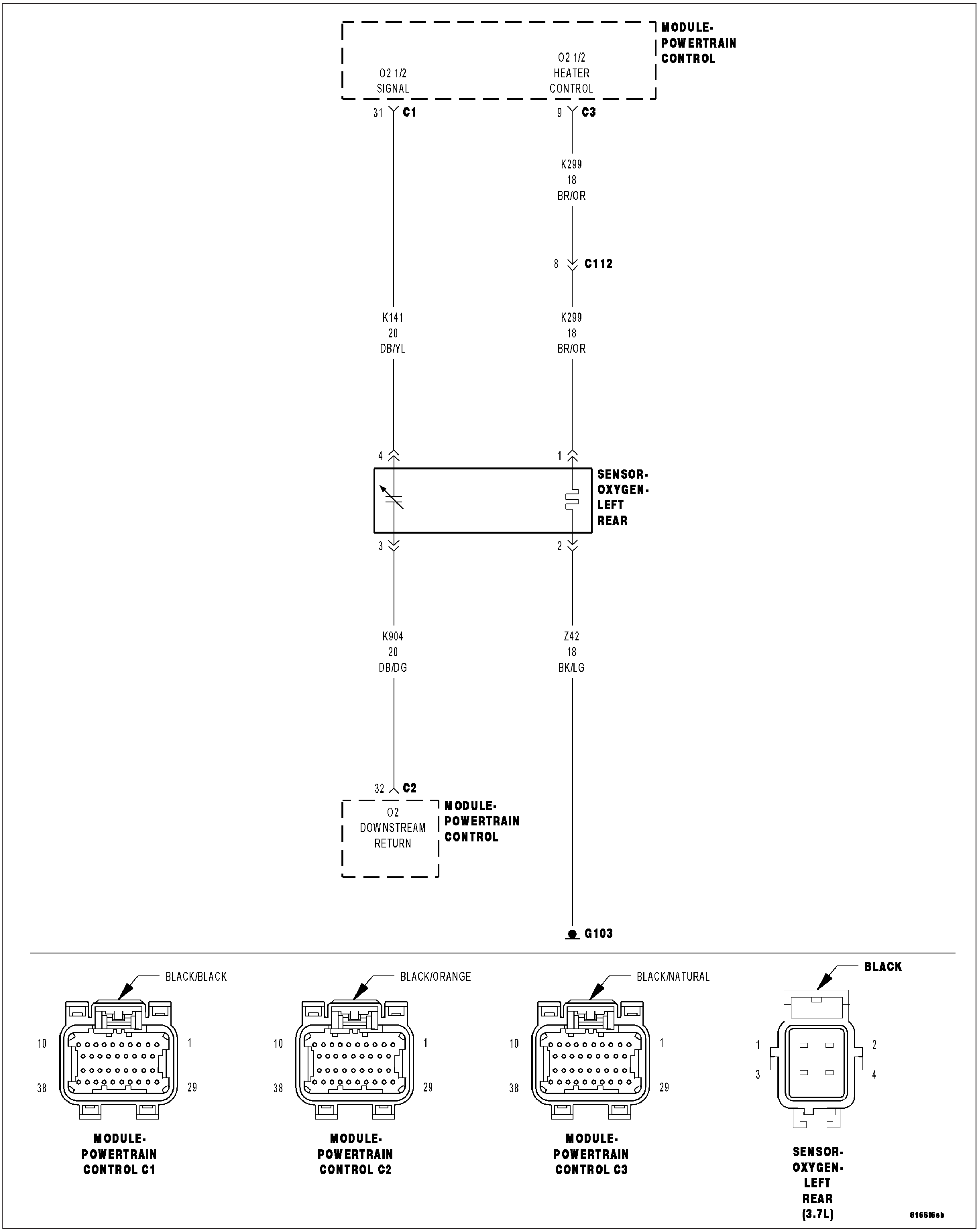
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0139-O2 SENSOR 1/2 SLOW RESPONSE




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The downstream O2 Sensor is located in the exhaust path behind the catalytic converter, is monitored for proper response to assure optimum catalytic converter efficiency. The downstream O2 response monitor is intended to diagnose a downstream O2 sensor that is not moving or stuck in a voltage window and to insure accurate information for catalyst monitor diagnosis.

- **When Monitored:**
  Vehicle is started and driven between 20 and 55 MPH with the Throttle open for a minimum of 120 seconds. Coolant greater than 70°C (158°F). Catalytic Converter Temp greater than 600°C (1112°F) and EVAP Purge is active.
- **Set Condition:**
  The oxygen sensor signal voltage switches less than 16 times from lean to rich within 20 seconds during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EXHAUST LEAK |
| (K141) O2 1/2 SIGNAL CIRCUIT |
| (K904) O2 DOWNSTREAM RETURN CIRCUIT |
| O2 SENSOR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.**
Ignition on, engine not running.

**NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.**
With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. EXHAUST LEAK

Start the engine.
Inspect the exhaust system for leaks between the engine and the O2 Sensors.

**Are there any exhaust leaks?**

**Yes** >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

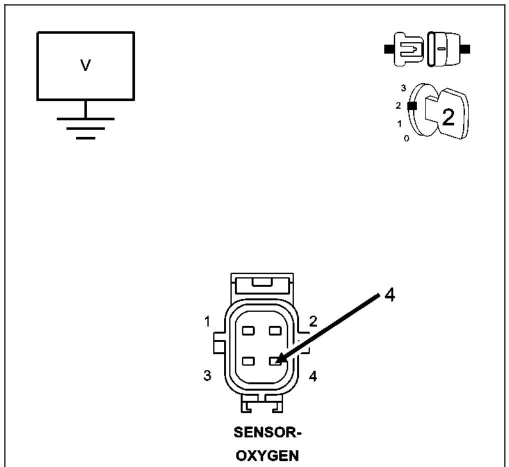
## 3. (K141) O2 1/2 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 1/2 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K141) O2 1/2 Signal circuit in the O2 Sensor harness connector.



81653c72

**Is the voltage approximately 5.0 volts?**

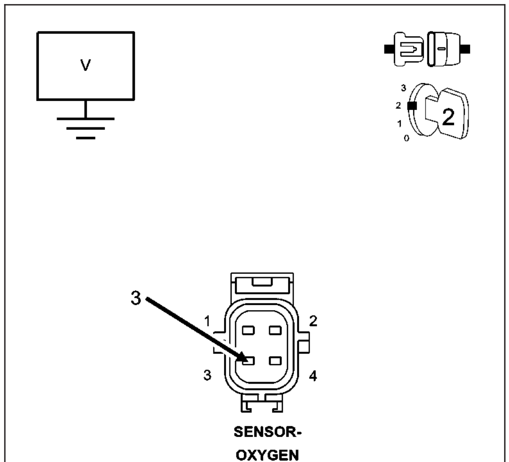
**Yes** >> Go To 4

**No** >> Check the (K141) O2 1/2 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (K904) O2 DOWNSTREAM RETURN CIRCUIT

Measure the voltage on the (K904) O2 Downstream Return circuit in the 1/2 O2 Sensor harness connector.



81653c98

**Is the voltage at 2.5 volts?**

**Yes** >> Check the (K904) O2 Downstream Return circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. O2 SENSOR

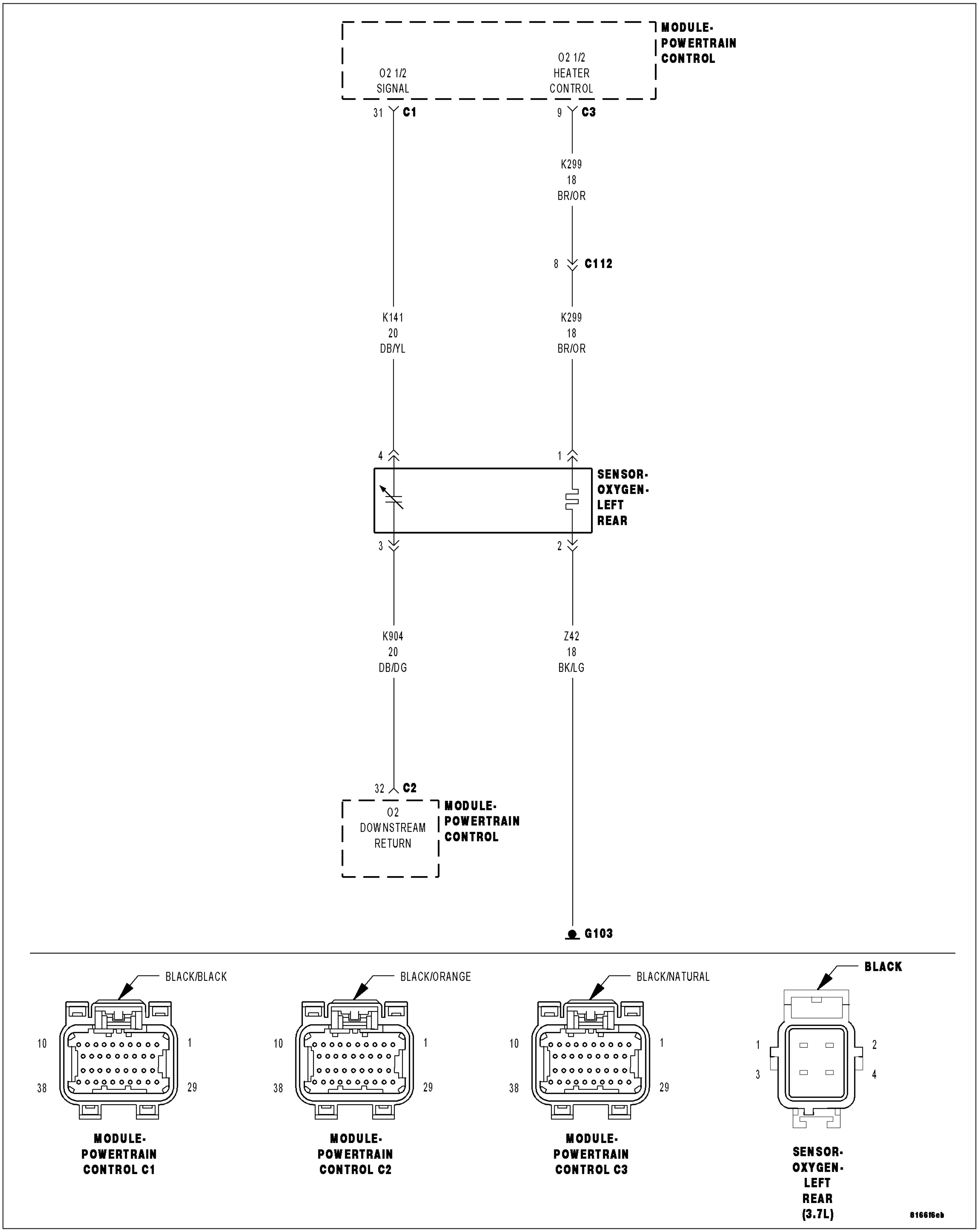
**If there are no possible causes remaining, view repair.**

**Repair**

Replace the O2 Sensor

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0141-O2 SENSOR 1/2 HEATER PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.
- **Set Condition:**
  No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN |
| (Z42) O2 HEATER GROUND CIRCUIT OPEN |
| O2 SENSOR HEATER ELEMENT |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

**NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.**

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 1/2 O2 Sensor voltage for at least 2 minutes.

**Does the voltage stay above 4.5 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

**NOTE: Allow the O2 sensor to cool down to room temperature.**

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the O2 Sensor connector between the O2 Heater Control terminal and the Heater ground terminal.

**NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.**

**Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?**

**Yes** >> Go To 3

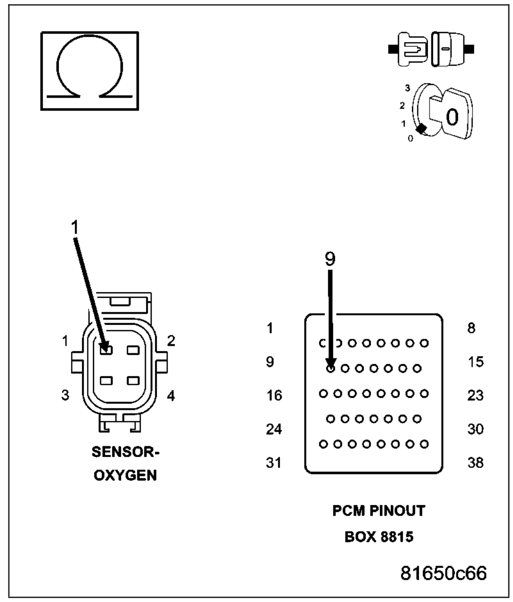
**No** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. (K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K299) O2 1/2 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 0.5 of an ohm?**

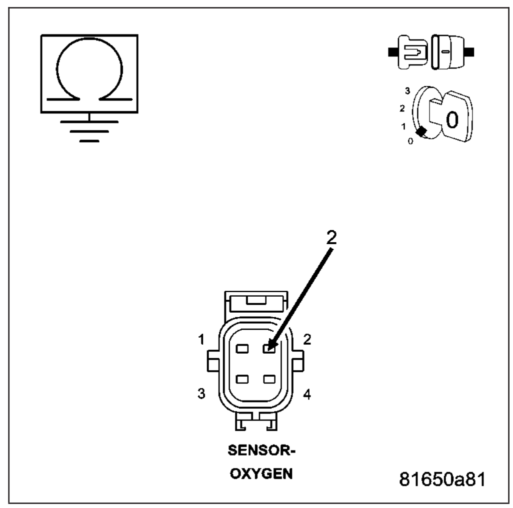
**Yes** >> Go To 4

**No** >> Repair the excessive resistance in the (K299) O2 1/2 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (Z42) O2 1/2 HEATER GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z42) O2 1/2 Heater ground circuit in the O2 Sensor harness connector.




**Is the resistance below 0.5 of an ohm?**

**Yes** >> Go To 5

**No** >> Repair the excessive resistance in the (Z42) O2 1/2 Heater ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

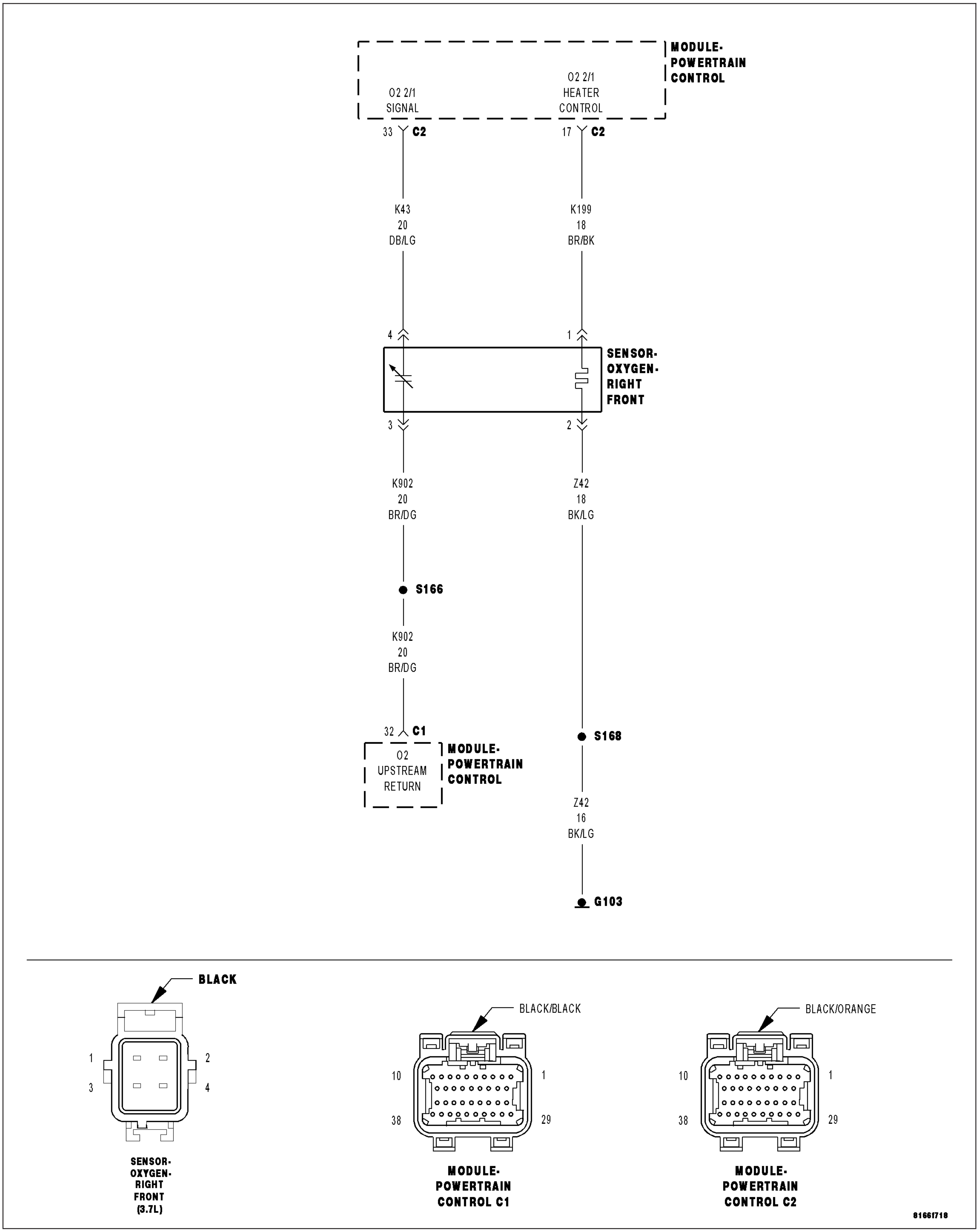
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0151-O2 SENSOR 2/1 CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251°C (484°F) with battery voltage greater 10.99 volts.
- **Set Condition:**
  The oxygen sensor signal voltage is below 2.5196 volts for 6 seconds after starting engine. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (K902) O2 UPSTREAM RETURN CIRCUIT SHORTED TO GROUND |
| (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO GROUND |
| (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 UPSTREAM RETURN CIRCUIT |
| (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (Z42) HEATER GROUND CIRCUIT |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR BELOW 2.52 VOLTS

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 2/1 O2 Sensor voltage.

**Is the voltage below 2.52 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (K43) O2 2/1 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the 2/1 O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the 2/1 O2 Sensor voltage.

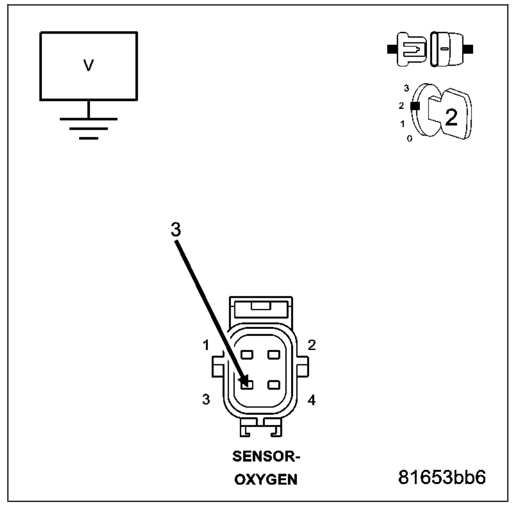
**Is the O2 Sensor voltage above 4.8 volts?**

**Yes** >> Go To 3

**No** >> Go To 5

## 3. O2 SENSOR

Measure the voltage on the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.




**Is the voltage at 2.5 volts?**

**Yes** >> Replace the 2/1 O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

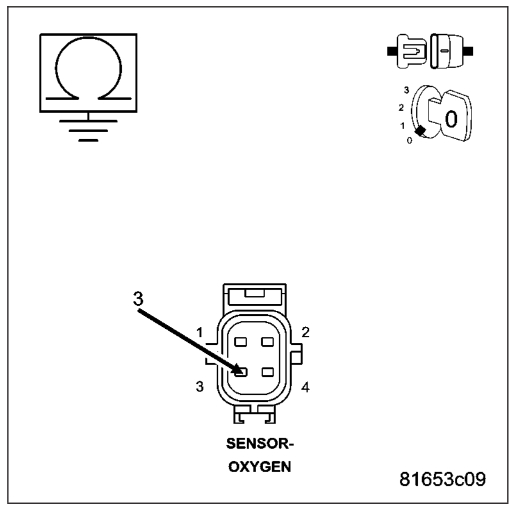
**No** >> Go To 4

## 4. (K902) O2 UPSTREAM RETURN CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K902) O2 Upstream Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

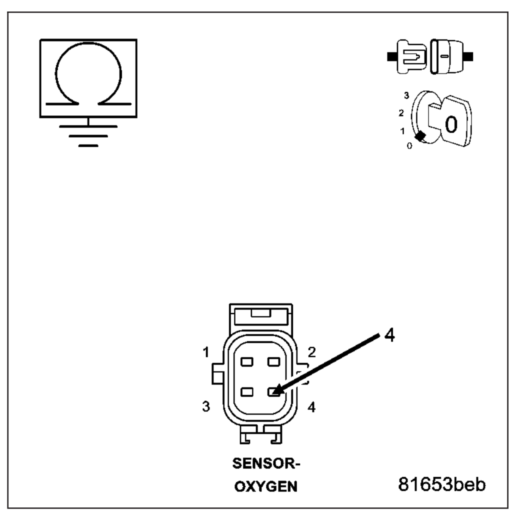
**No** >> Go To 8

## 5. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

Measure the resistance between ground and the (K43) O2 2/1 Signal circuit in the O2 Sensor harness connector.



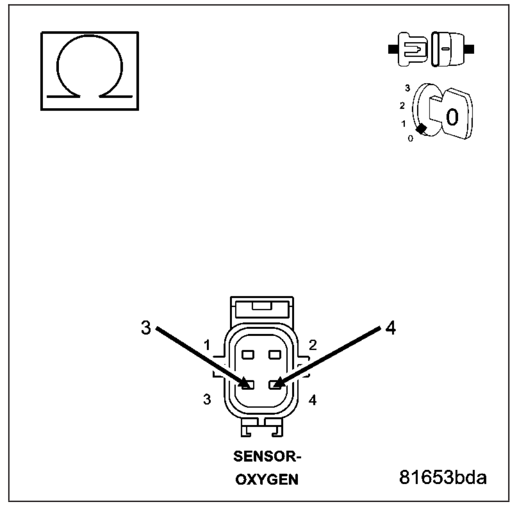

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K43) O2 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 UPSTREAM RETURN CIRCUIT

Measure the resistance between the (K43) O2 2/1 Signal circuit and the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.



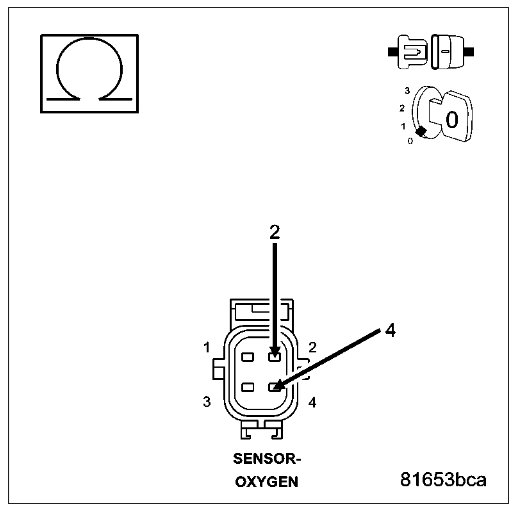

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (K902) O2 Upstream Return circuit and the (K43) O2 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (Z42) HEATER GROUND CIRCUIT

Measure the resistance between the (K43) O2 2/1 Signal circuit and the (Z42) O2 Heater ground circuit in the O2 Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (Z42) O2 Heater ground circuit and the (K43) O2 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

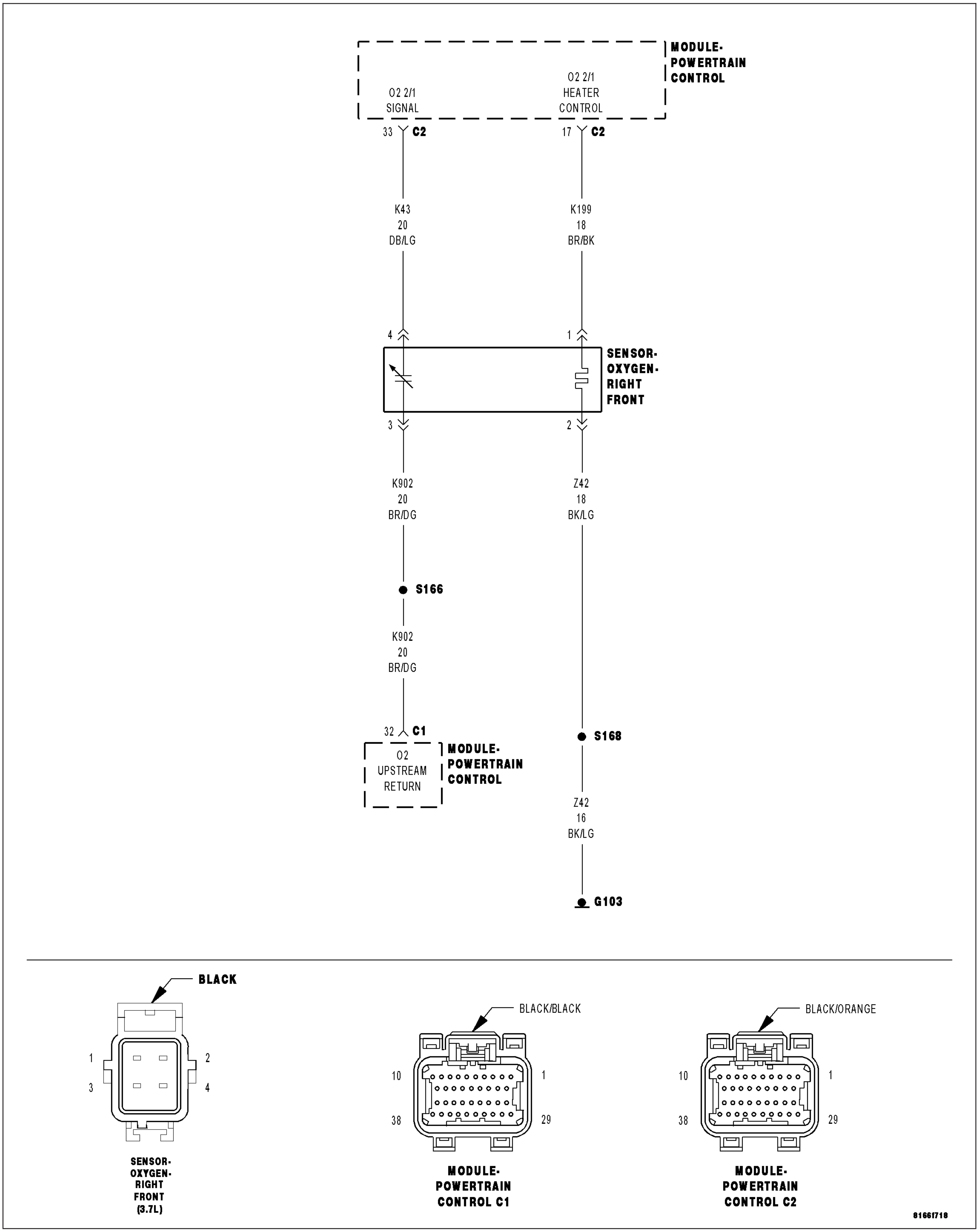
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0152-O2 SENSOR 2/1 CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  O2 Sensor Heater Temperature is greater than 496°C (925°F) and battery voltage greater than 10.99 volts.
- **Set Condition:**
  The Oxygen Sensor voltage is above 3.99 volts for 40 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K902) O2 UPSTREAM RETURN CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K43) O2 2/1 SIGNAL CIRCUIT OPEN |
| (K902) O2 UPSTREAM RETURN CIRCUIT OPEN |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR ABOVE 3.99 VOLTS

**NOTE: When only one O2 Sensor is shorted to voltage, the scan tool will display all O2 Sensor voltage readings at approximately 5.0 volts. When diagnosing this DTC, only diagnose the O2 Sensor that set the DTC.**

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 2/1 O2 Sensor voltage.

**Is the voltage above 3.99 volts?**

**Yes** >> Go To 2

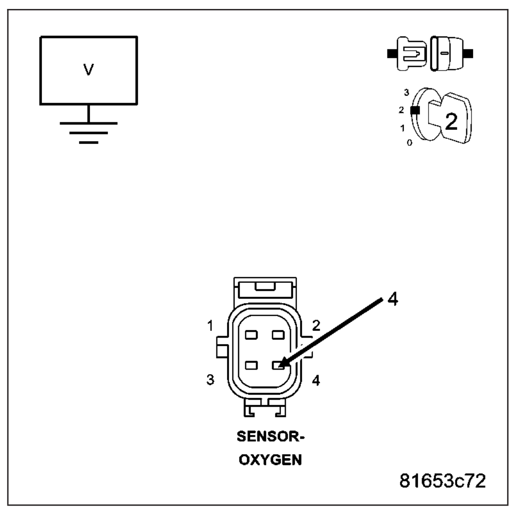
**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Start the engine and allow the engine to idle.

Disconnect the 2/1 O2 Sensor harness connector.

Measure the voltage on the (K43) O2 Sensor 2/1 Signal circuit in the 2/1 O2 Sensor harness connector.




**NOTE: Measure the voltage in reference to ground, not the (K902) O2 Upstream Return circuit.**

**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K43) O2 Sensor 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (K902) O2 UPSTREAM RETURN CIRCUIT SHORTED TO BATTERY VOLTAGE

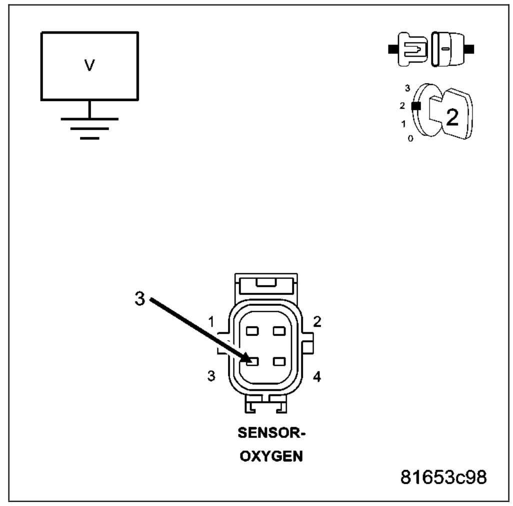
Turn the ignition off.

Disconnect the C1 PCM harness connector.

**WARNING: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Ignition on, engine not running.

Measure the voltage on the (K902) O2 Upstream Return circuit in the 2/1 O2 Sensor harness connector.




**Is there any voltage present?**

**Yes** >> Repair the short to battery voltage in the (K902) O2 Upstream Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. O2 SENSOR

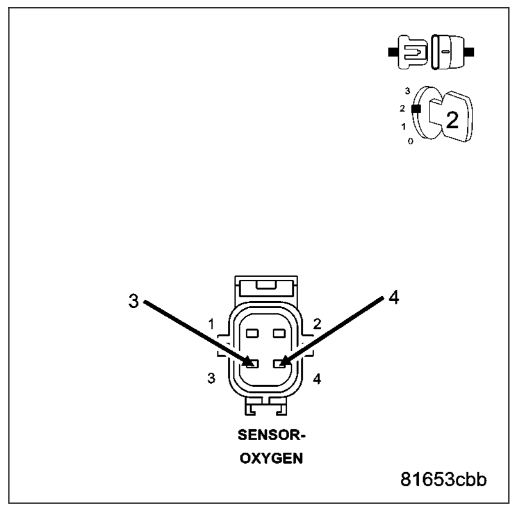
Turn the ignition off.

Connect the C1 PCM harness connector.

Connect a jumper wire between the (K43) O2 2/1 Signal circuit and the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the 2/1 O2 Sensor voltage.




**Is the voltage between 2.3 and 2.7 volts with the jumper wire in place?**

**Yes** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

**NOTE: Remove the jumper wire before continuing.**

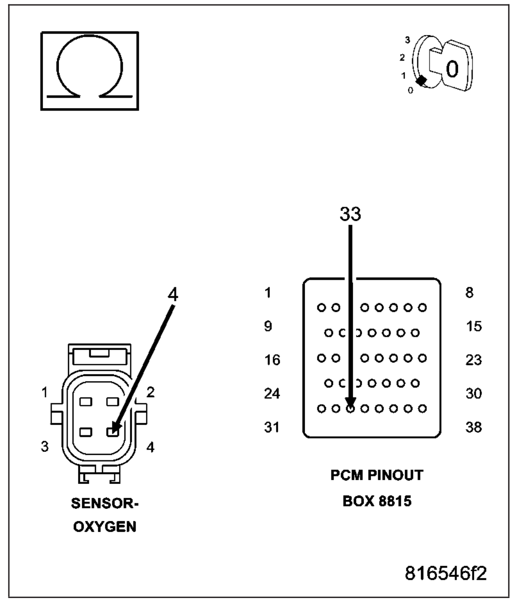
## 5. (K43) O2 2/1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K43) O2 2/1 Signal circuit from the 2/1 O2 Sensor harness connector to the appropriate terminal of special tool #8815.



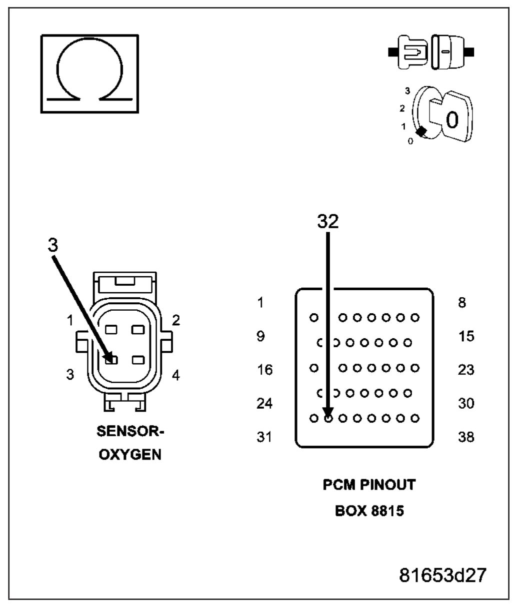

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K43) O2 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (K902) O2 UPSTREAM RETURN CIRCUIT OPEN

Measure the resistance of the (K902) O2 Upstream Return circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K902) O2 Upstream Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

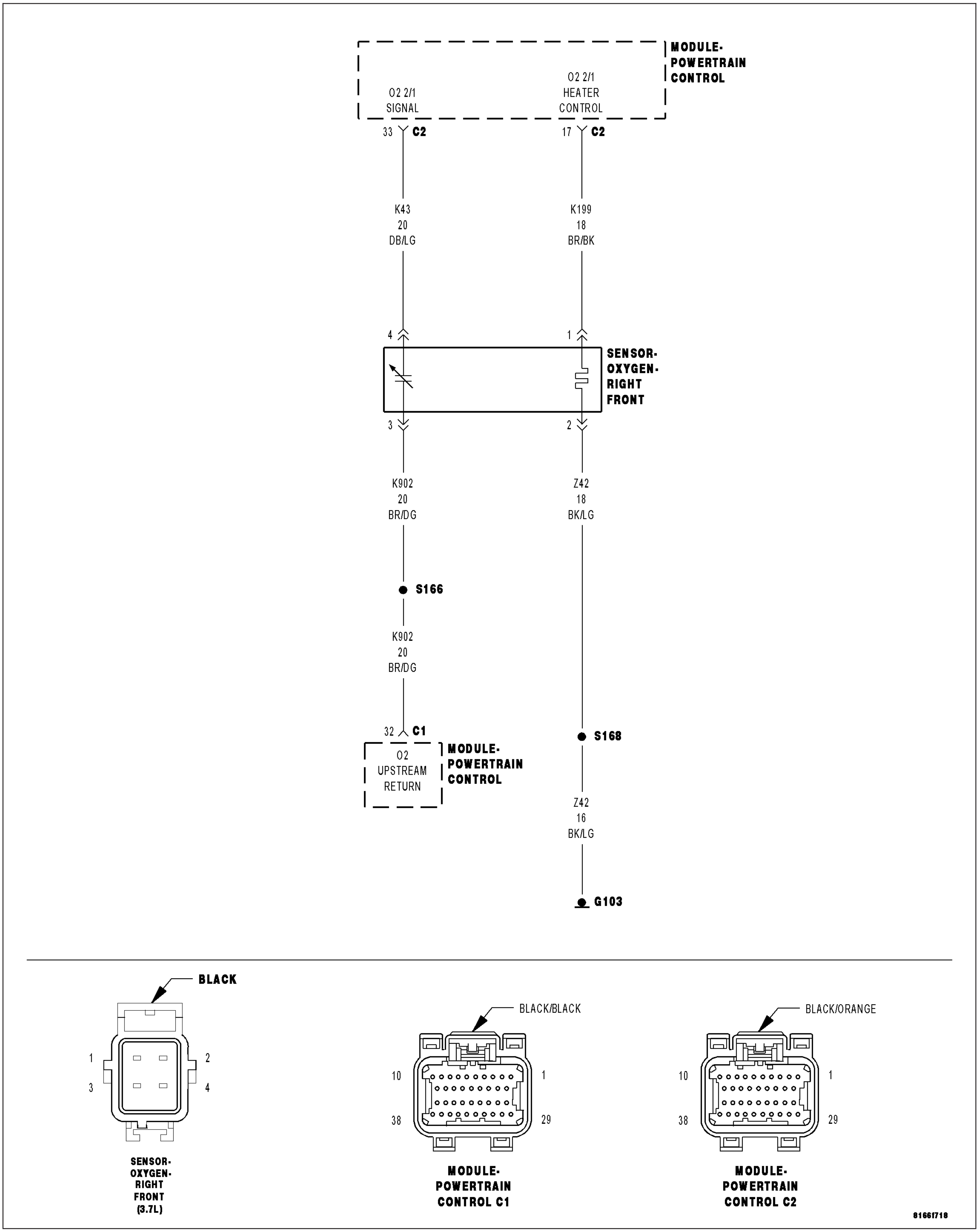
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0153-O2 SENSOR 2/1 SLOW RESPONSE




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

For an aged O2 sensor , the response rate to the air/fuel change is slower than when it was new. The O2 sensor tends to move less with the same air/fuel changes in a given time frame. Therefore by observing the activity of voltage readings from the upstream O2 sensor, the quality of the O2 sensor can be detected.

- **When Monitored:**
  Vehicle is started and driven between 20 and 55 MPH with the Throttle open for a minimum of 120 seconds. Coolant greater than 70°C (158°F). Catalytic Converter Temp greater than 600°C (1112°F) and EVAP Purge is active.
- **Set Condition:**
  O2 Sensor response is too slow for a calibrated amount of time. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EXHAUST LEAK |
| (K43) O2 2/1 SIGNAL CIRCUIT |
| (K902) O2 UPSTREAM RETURN CIRCUIT |
| O2 SENSOR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.**
Ignition on, engine not running.

**NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.**
With a scan tool, read DTCs and record the related Freeze Frame data.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. EXHAUST LEAK

Start the engine.

Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Turn the ignition off.

If a leak is heard but unable to be located, it may be necessary to use special tool Miller Tool #8404A Evaporative Emissions Leak Detector (EELD) on the exhaust system to find leaks.

Connect the SMOKE supply tip (black hose) to the exhaust cone adapter (if equipped) and place it into the tail pipe.

Set the smoke/air control switch to SMOKE.

Press the remote smoke/air start button.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view, release the remote smoke/air start button, and use the ultraviolet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

Be sure to check the exhaust manifold to cylinder head connection for leaks.

**Are there any exhaust leaks?**

**Yes** >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

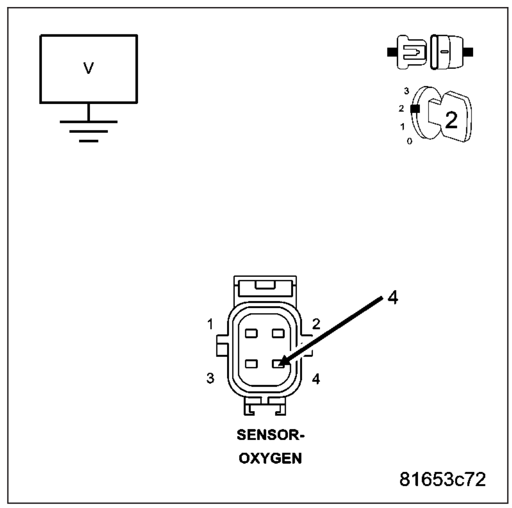
## 3. (K43) O2 2/1 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K43) O2 2/1 Signal circuit in the O2 Sensor harness connector.



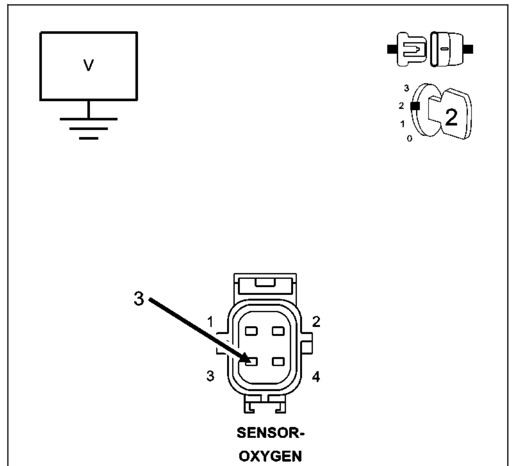

**Is the voltage approximately 5.0 volts?**

**Yes** >> Go To 4

**No** >> Check the (K43) O2 2/1 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (K902) O2 UPSTREAM RETURN CIRCUIT

Measure the voltage on the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.



81653c98

**Is the voltage at 2.5 volts?**

**Yes** >> Check the (K902) O2 Upstream Return circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. O2 SENSOR

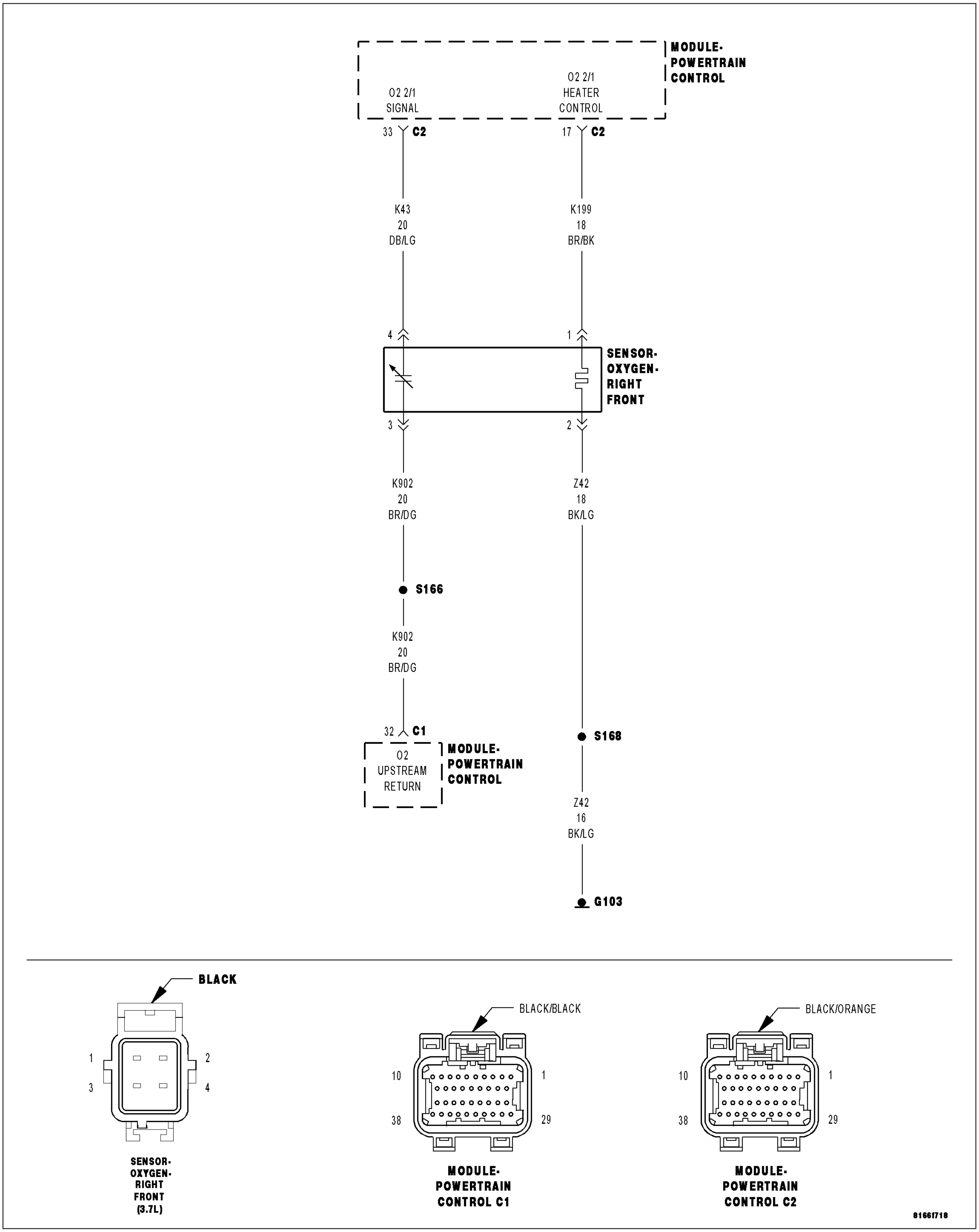
**If there are no possible causes remaining, view repair.**

**Repair**

Replace the O2 Sensor

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0155-O2 SENSOR 2/1 HEATER PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.
- **Set Condition:**
  No sensor output is received when the PCM powers up the sensor heater for more than 50 seconds. Two trip fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN |
| (Z42) O2 HEATER GROUND CIRCUIT OPEN |
| O2 SENSOR HEATER ELEMENT |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

**NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.**

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

**Does the voltage stay above 4.5 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

**NOTE: Allow the O2 sensor to cool down to room temperature.**

Disconnect the 2/1 O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the O2 Sensor connector between the O2 Heater Control terminal and the O2 Heater ground terminal.

**NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.**

**Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?**

**Yes** >> Go To 3

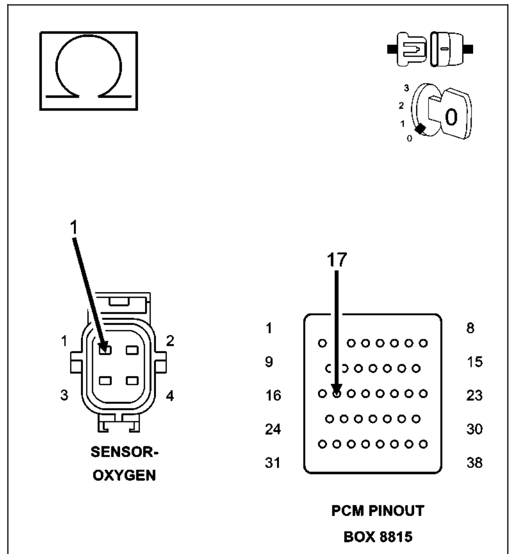
**No** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. (K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K199) O2 2/1 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.



81650c75

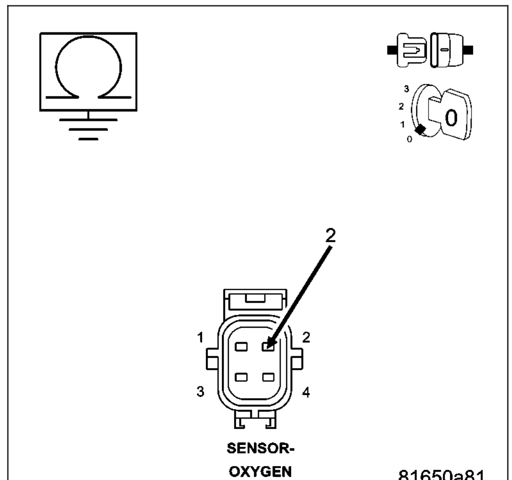
**Is the resistance below 0.5 of an ohm?**

**Yes** >> Go To 4

**No** >> Repair the excessive resistance in the (K199) O2 2/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (Z42) O2 SENSOR HEATER GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z42) O2 Heater ground circuit in the O2 Sensor harness connector.



81650a81

**Is the resistance below 0.5 of an ohm?**

**Yes** >> Go To 5

**No** >> Repair the excessive resistance in the (Z42) O2 Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

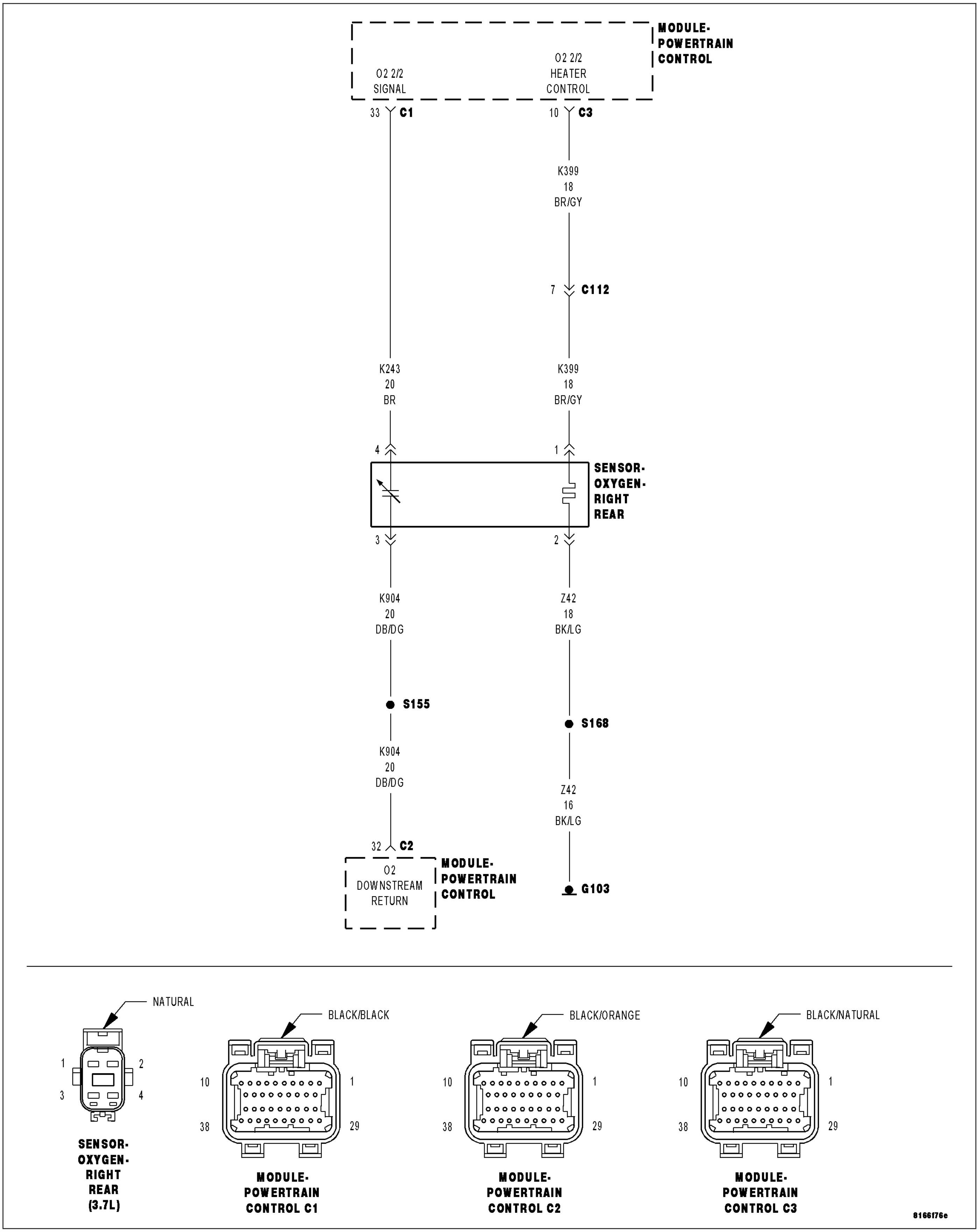
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0157-O2 SENSOR 2/2 CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251°C (484°F) with battery voltage greater 10.99 volts.
- **Set Condition:**
  The oxygen sensor signal voltage is below 2.5196 volts for 6 seconds after starting engine. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K904) O2 DOWNSTREAM RETURN CIRCUIT SHORTED TO GROUND |
| (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO GROUND |
| (K243) O2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 DOWNSTREAM RETURN CIRCUIT |
| (K243) O2 SIGNAL CIRCUIT SHORTED TO THE (Z42) O2 2/2 HEATER GROUND CIRCUIT |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR BELOW 2.52 VOLTS

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 2/2 O2 Sensor voltage.

**Is the voltage below 2.52 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (K243) O2 2/2 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the 2/2 O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the 2/2 O2 Sensor voltage.

**Is the O2 Sensor voltage above 4.8 volts?**

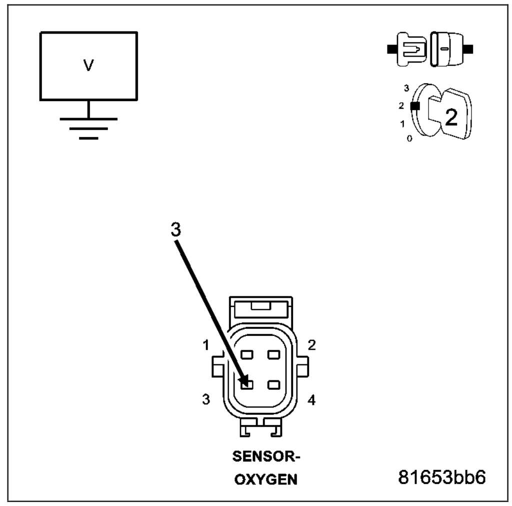
**Yes** >> Go To 3

**No** >> Go To 5

## 3. O2 SENSOR

Measure the voltage on the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.

**Is the voltage at 2.5 volts?**




**Yes** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

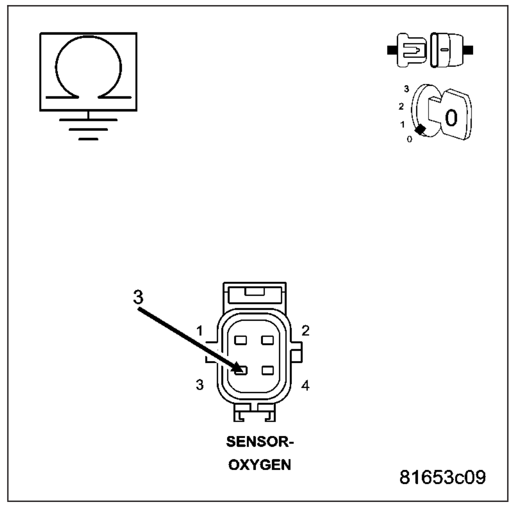
## 4. (K904) O2 DOWNSTREAM RETURN CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.

**Is the resistance below 100 ohms?**




**Yes** >> Repair the short to ground in the (K904) O2 Downstream Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

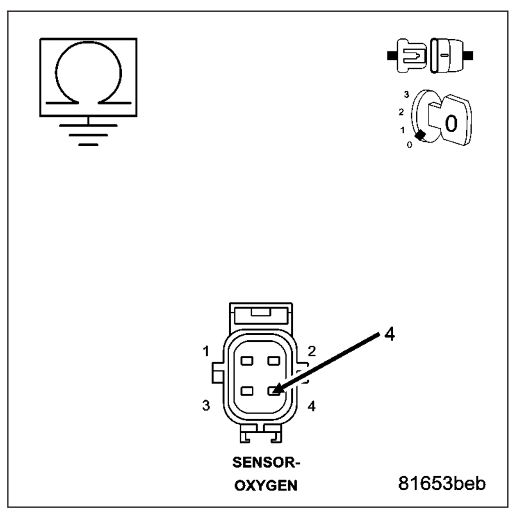
## 5. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

Measure the resistance between ground and the (K243) O2 2/2 Signal circuit in the O2 Sensor harness connector.

**Is the resistance below 100 ohms?**

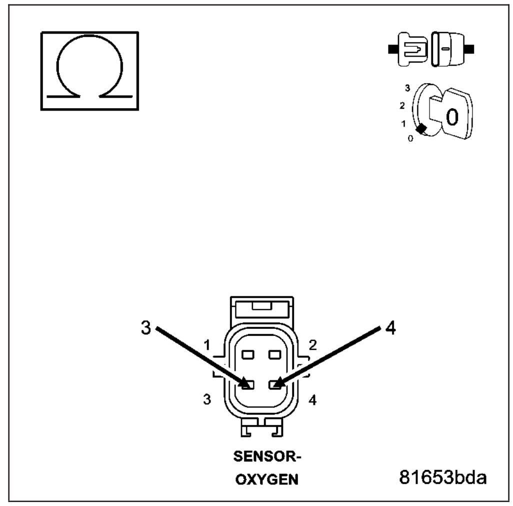



**Yes** >> Repair the short to ground in the (K243) O2 2/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 DOWNSTREAM RETURN CIRCUIT

Measure the resistance between the (K243) O2 2/2 Signal circuit and the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.




**Is the resistance below 100 ohms?**

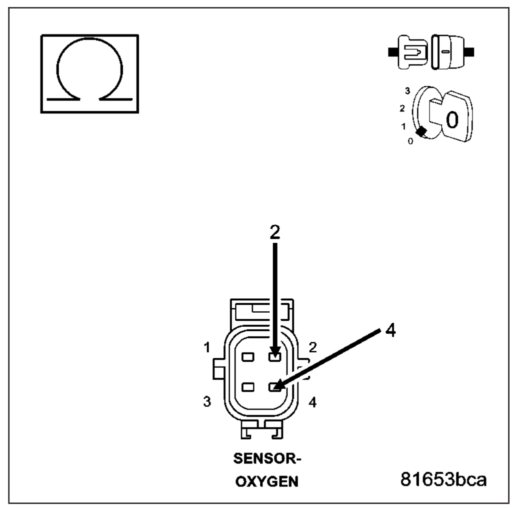
**Yes** >> Repair the short between the (K904) O2 Downstream Return circuit and the (K243) O2 2/2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO THE (Z42) O2 2/2 HEATER GROUND CIRCUIT

Measure the resistance between the (K243) O2 2/2 Signal circuit and the (Z42) O2 2/2 Heater ground circuit in the O2 Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (Z42) O2 2/2 Heater ground circuit and the (K243) O2 2/2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

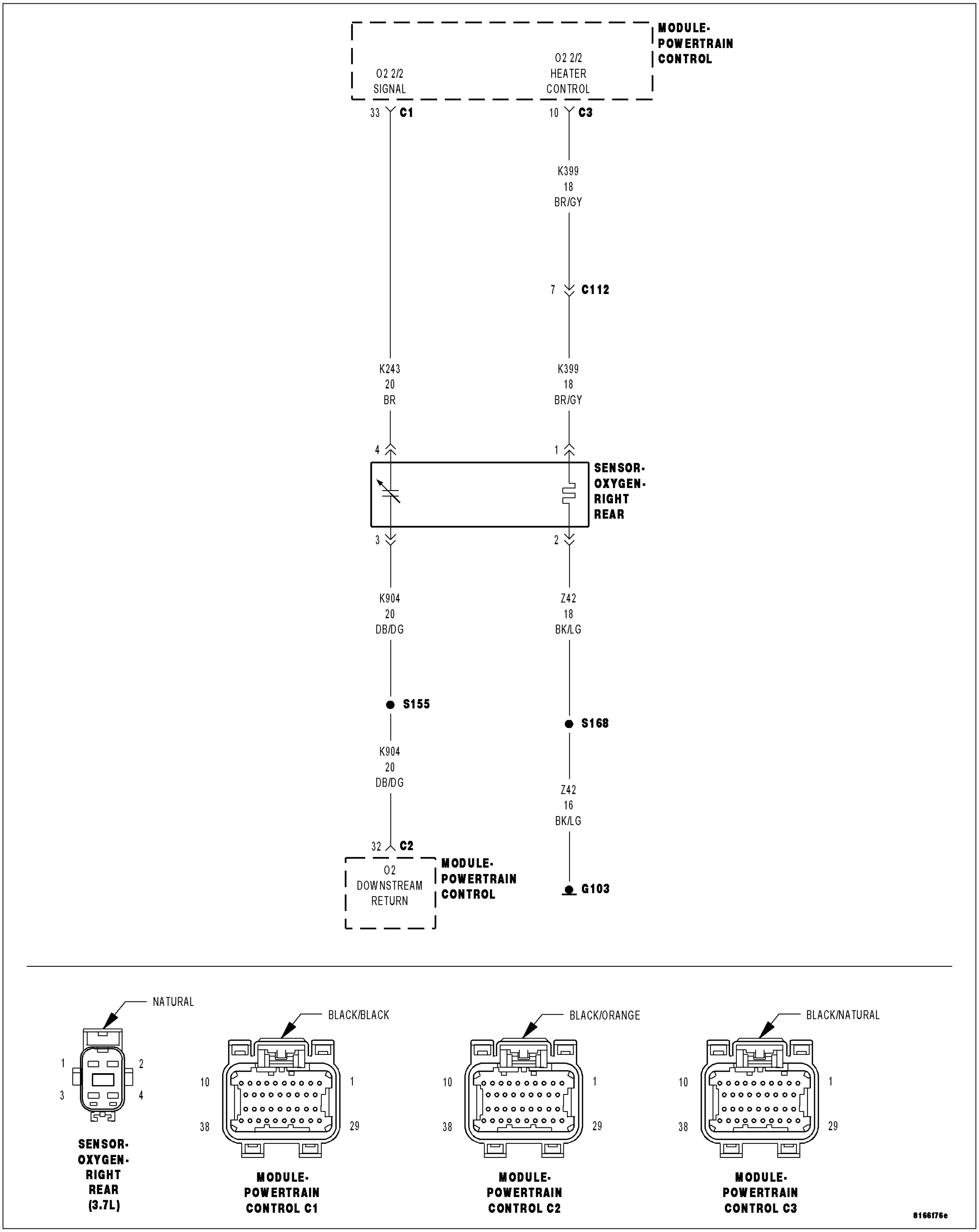
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0158-O2 SENSOR 2/2 CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  O2 Sensor Heater Temperature is greater than 496°C (925°F) and battery voltage greater than 10.99 volts.
- **Set Condition:**
  The Oxygen Sensor voltage is above 3.99 volts for 40 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K904) O2 DOWNSTREAM RETURN CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K243) O2 2/2 SIGNAL CIRCUIT OPEN |
| (K904) O2 DOWNSTREAM RETURN CIRCUIT OPEN |
| O2 SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. O2 SENSOR ABOVE 3.99 VOLTS

**NOTE: When only one O2 Sensor is shorted to voltage, the scan tool will display all O2 Sensor voltage readings at approximately 5.0 volts. When diagnosing this DTC, only diagnose the O2 Sensor that set the DTC.**

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 2/2 O2 Sensor voltage.

**Is the voltage above 3.99 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Start the engine and allow the engine to idle.

Disconnect the 2/2 O2 Sensor harness connector.

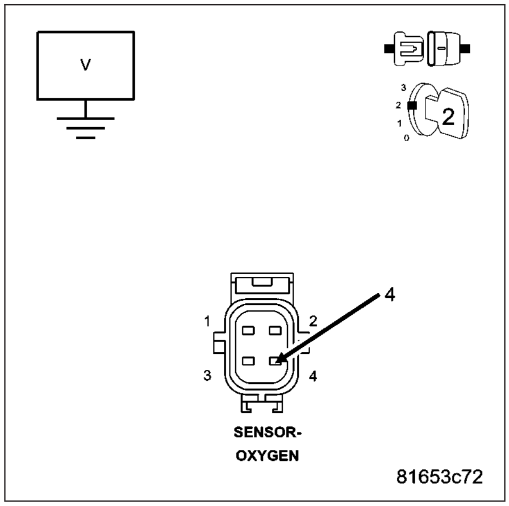
Measure the voltage on the (K243) O2 Sensor 2/2 Signal circuit in the O2 Sensor harness connector.

**NOTE: Measure the voltage in reference to ground, not the (K904) O2 Downstream Return circuit.**

**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K243) O2 Sensor 2/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3



81653c72

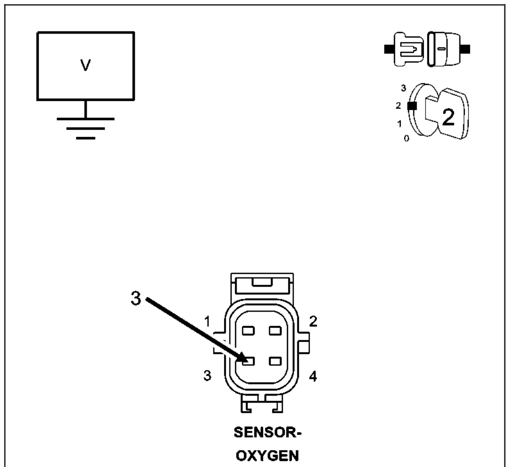
## 3. (K904) O2 DOWNSTREAM RETURN CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K904) O2 Downstream Return circuit in the 2/2 O2 Sensor harness connector.



81653c98

**Is there any voltage present?**

**Yes** >> Repair the short to battery voltage in the (K904) O2 Downstream Return circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. O2 SENSOR

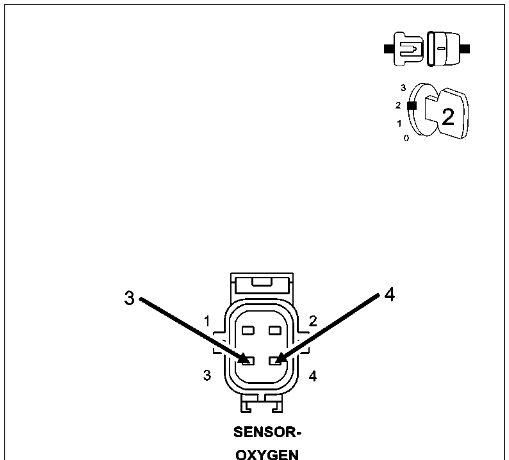
Turn the ignition off.

Connect the C2 PCM harness connector.

Connect a jumper wire between the (K243) O2 2/2 Signal circuit and the (K904) O2 Downstream Return circuit in the 2/2 O2 Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the 2/2 O2 Sensor voltage.



81653cbb

**Is the voltage between 2.3 and 2.7 volts with the jumper wire installed?**

**Yes** >> Replace the O2 Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

**NOTE: Remove the jumper wire before continuing.**

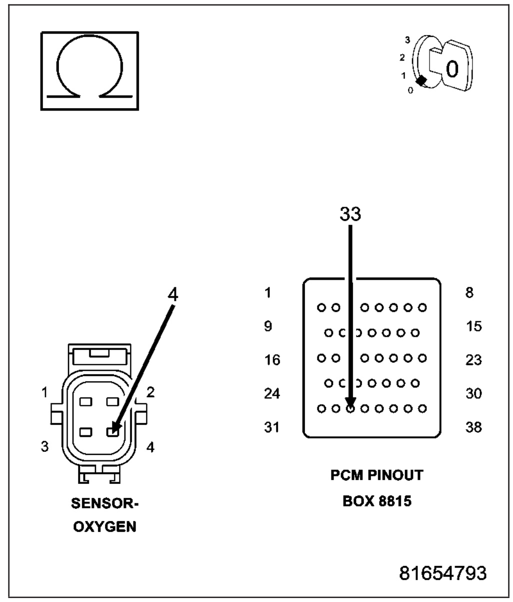
## 5. (K243) O2 2/2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K243) O2 2/2 Signal circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.



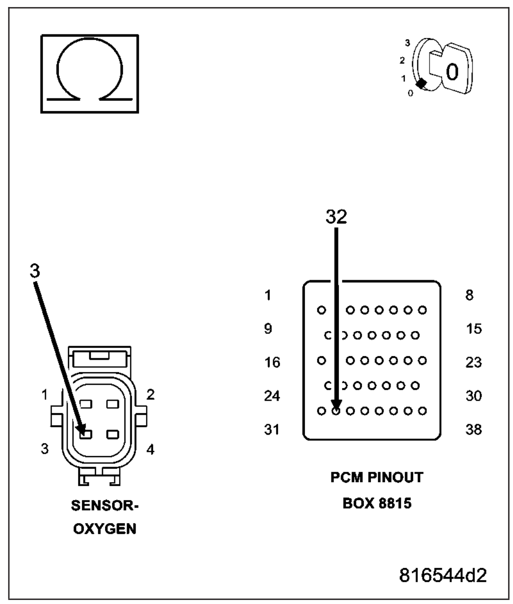

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K243) O2 2/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (K904) O2 DOWNSTREAM RETURN CIRCUIT OPEN

Measure the resistance of the (K904) O2 Downstream Return circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K904) O2 Downstream Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

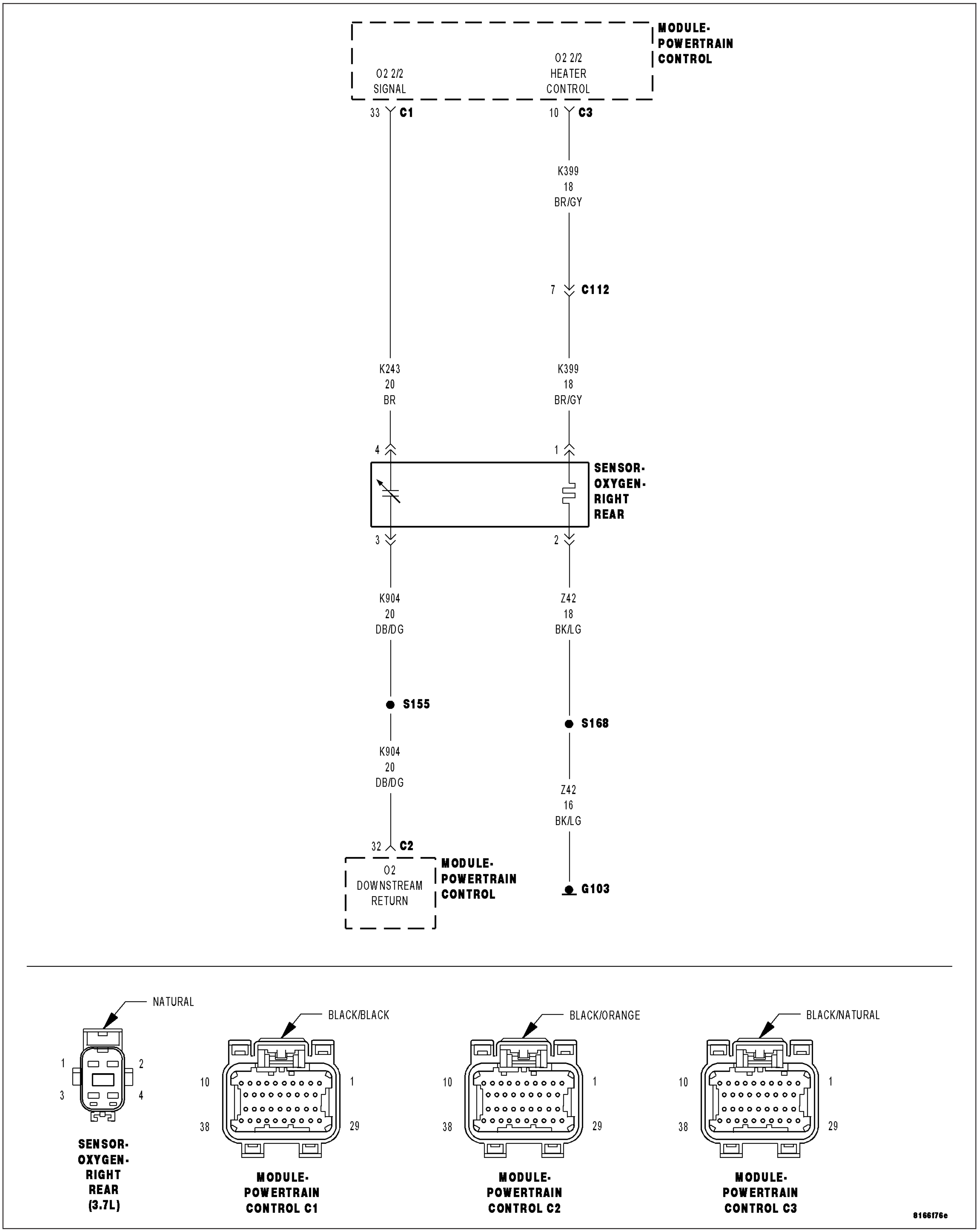
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0159-O2 SENSOR 2/2 SLOW RESPONSE




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The downstream O2 Sensor is located in the exhaust path behind the catalytic converter, is monitored for proper response to assure optimum catalytic converter efficiency. The downstream O2 response monitor is intended to diagnose a downstream O2 sensor that is not moving or stuck in a voltage window and to insure accurate information for catalyst monitor diagnosis.

- **When Monitored:**
  Vehicle is started and driven between 20 and 55 MPH with the Throttle open for a minimum of 120 seconds. Coolant greater than 70°C (158°F). Catalytic Converter Temp greater than 600°C (1112°F) and EVAP Purge is active.
- **Set Condition:**
  The oxygen sensor signal voltage switches less than 16 times from lean to rich within 20 seconds during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EXHAUST LEAK |
| (K243) O2 2/2 SIGNAL CIRCUIT |
| (K904) O2 DOWNSTREAM RETURN CIRCUIT |
| O2 SENSOR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.**
Ignition on, engine not running.

**NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.**
With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. EXHAUST LEAK

Start the engine.

Inspect the exhaust system for leaks between the engine and the O2 Sensors.

**Are there any exhaust leaks?**

**Yes** >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

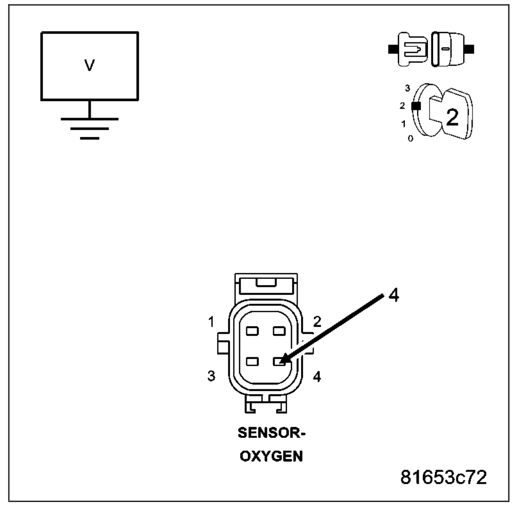
## 3. (K243) O2 2/2 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 2/2 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K243) O2 2/2 Signal circuit in the O2 Sensor harness connector.




**Is the voltage approximately 5.0 volts?**

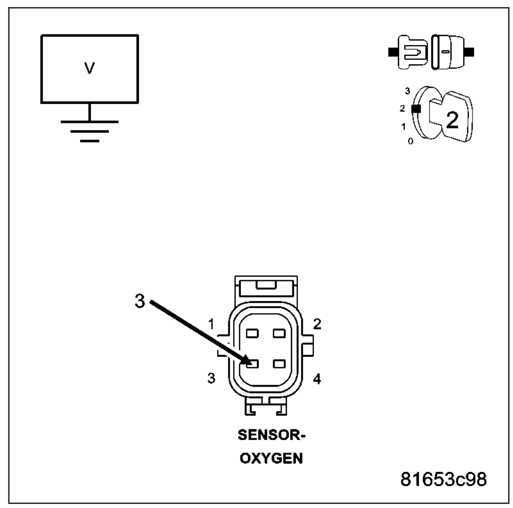
**Yes** >> Go To 4

**No** >> Check the (K243) O2 2/2 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (K904) O2 DOWNSTREAM RETURN CIRCUIT

Measure the voltage on the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.




**Is the voltage at 2.5 volts?**

**Yes** >> Check the (K904) O2 Downstream Return circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. O2 SENSOR

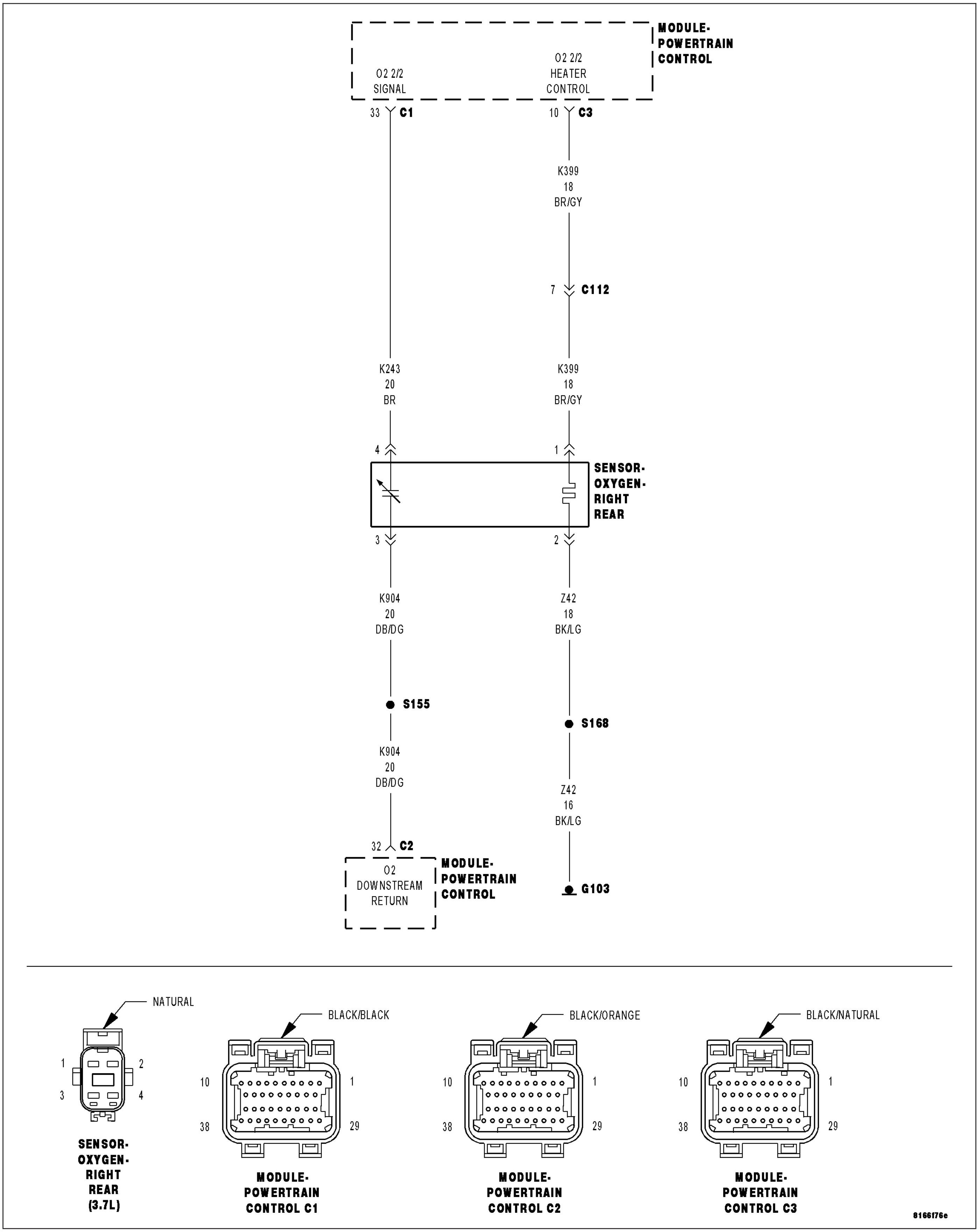
**If there are no possible causes remaining, view repair.**

**Repair**

Replace the O2 Sensor

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0161-O2 SENSOR 2/2 HEATER PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.
- **Set Condition:**
  No sensor output is received when the PCM powers up the sensor heater for more than 50 seconds. Two trip fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN |
| (Z42) O2 2/2 HEATER GROUND CIRCUIT OPEN |
| O2 SENSOR HEATER ELEMENT |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.**

## Diagnostic Test

### 1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

**NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.**

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With a scan tool, monitor 2/2 O2 Sensor voltage for at least 2 minutes.

**Does the voltage stay above 4.5 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

**NOTE: Allow the O2 sensor to cool down to room temperature.**

Disconnect the 2/2 O2 Sensor harness connector.

Measure the resistance of the 2/2 O2 Heater Element, between the O2 Heater Control terminal and the O2 Heater ground terminal in the O2 Sensor connector.

**NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.**

**Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?**

**Yes** >> Go To 3

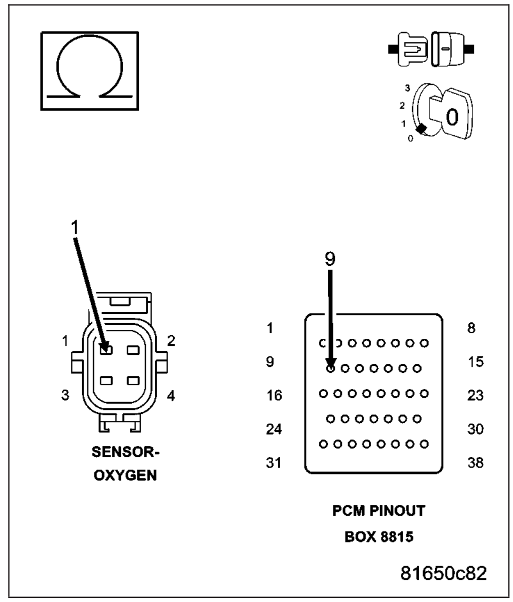
**No** >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. (K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K399) O2 2/2 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 0.5 of an ohm?**

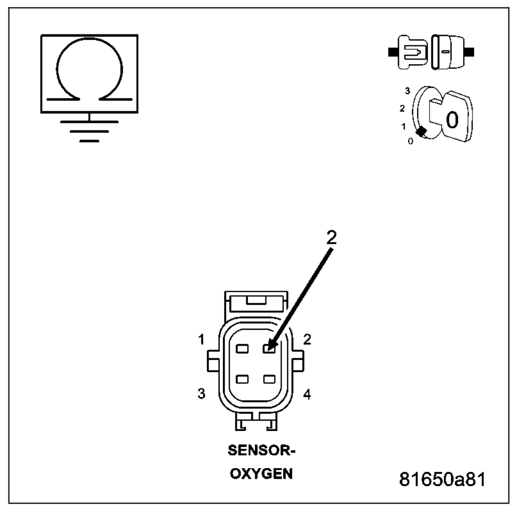
**Yes** >> Go To 4

**No** >> Repair the excessive resistance in the (K399) O2 2/2 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (Z42) O2 2/2 HEATER GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z42) O2 2/2 Heater ground circuit in the O2 Sensor harness connector.




**Is the resistance below 0.5 of an ohm?**

**Yes** >> Go To 5

**No** >> Repair the excessive resistance in the (Z42) O2 2/2 Heater ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

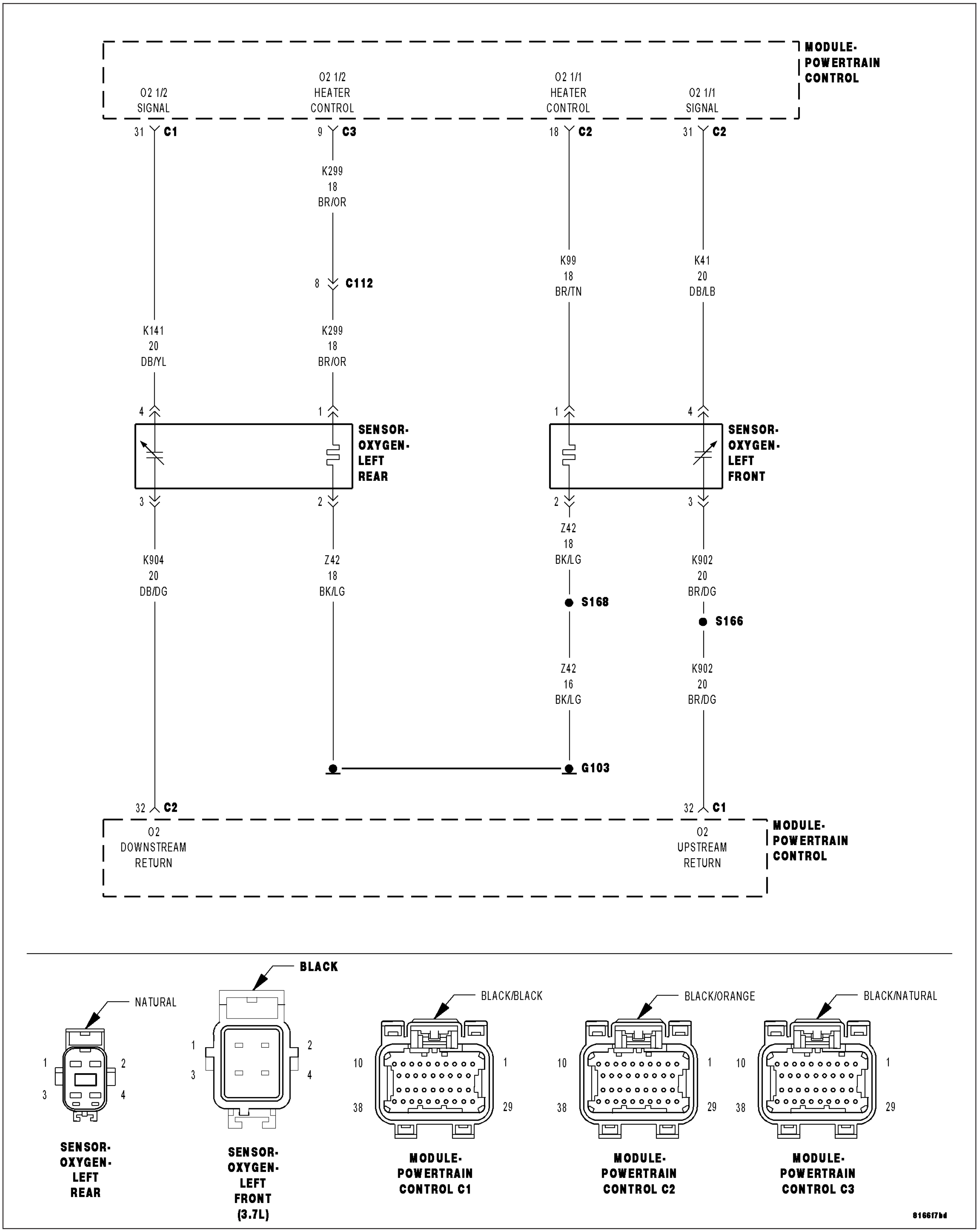
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0171-FUEL SYSTEM 1/1 LEAN




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL

| Possible Causes |
|---|
| RESTRICTED FUEL SUPPLY LINE |
| FUEL PUMP INLET STRAINER PLUGGED |
| FUEL PUMP MODULE |
| O2 SIGNAL CIRCUIT |
| O2 RETURN CIRCUIT |
| O2 SENSOR HEATER OPERATION |
| O2 SENSOR |
| MAP SENSOR OPERATION |
| ECT SENSOR OPERATION |
| ENGINE MECHANICAL PROBLEM |
| FUEL FILTER/PRESSURE REGULATOR (HIGH) |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Diagnose all other trouble codes before continuing.

**NOTE: Check for contaminants that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. CHECKING FUEL PRESSURE

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Turn the ignition off.

**Choose a conclusion that best matches your fuel pressure reading.**

**Within Specification**

Go To 3

**Above Specification**

Replace the fuel filter/pressure regulator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**Below Specification**

Go To 12

**CAUTION: Stop All Actuations.**

## 3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

**NOTE: If one of the O2 Sensor's Signal or Return circuit is shorted to ground the scan tool will display all O2 Sensor voltage readings low. The O2 Sensor that is shorted to ground will display a voltage reading near or at 0 volts.**

**NOTE: If one of the O2 Sensor Signal or Return circuits are shorted to voltage, the scan tool will display all O2 Sensor voltage readings high.**

**NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.**

With a scan tool, monitor all of the O2 Sensor voltage readings.

**Is the voltage switching between 2.5 and 3.4 volts for all the O2 Sensors?**

**Yes** >> Go To 4

**No** >> Go To 8

## 4. 1/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

**NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.**

Ignition on, engine not running.

With a scan tool, actuate the 1/1 O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

**Does the voltage stay above 4.5 volts?**

**Yes** >> Replace the 1/1 O2 Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

**NOTE: If engine will not idle, maintain a constant RPM above idle.**

With the scan tool, read the MAP Sensor vacuum value.

**Is the scan tool reading within 1″ of the Vacuum Gauge reading?**

**Yes** >> Go To 6

**No** >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. ECT SENSOR OPERATION

**NOTE: For this test to be valid, the thermostat must be operating correctly.**

**NOTE: This test works best if performed on a cold engine (cold soak)**

Ignition on, engine not running.

With a scan tool, read the Engine Coolant Temperature (ECT) Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

**NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.**

Start the Engine.

During engine warm-up, monitor the ECT Sensor value. The temperature value change should be a smooth transition from start up to normal operating temperature 82°C (180°F). The value should reach at least 82°C (180°F).

**Did the ECT value increase smoothly and did it reach at least 180°F (82°C)?**

**Yes** >> Go To 7

**No** >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. ENGINE MECHANICAL PROBLEM

Turn the ignition off.

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11

## 8. 1/1 O2 SENSOR

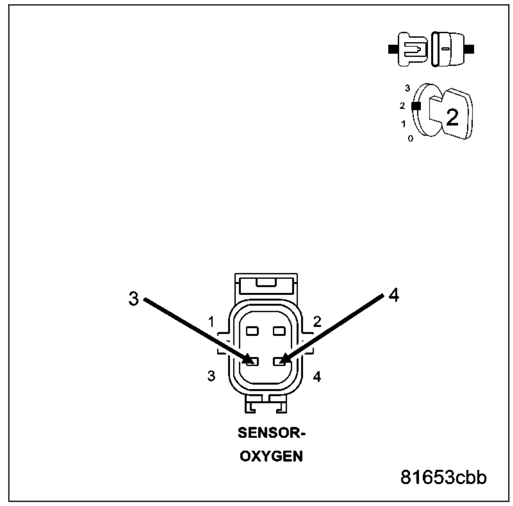
Ignition on, engine not running.

Disconnect the 1/1 O2 Sensor harness connector.

With a scan tool, monitor the 1/1 O2 Sensor voltage.

O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

Connect a jumper wire between the (K41) Signal circuit and the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.




**NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.**

**Did the O2 Sensor voltage change from 5.0 volts to 2.5 volts with the jumper wire installed?**

**Yes** >> Replace the O2 Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

**NOTE: Remove the jumper wire before continuing.**

## 9. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT

With a scan tool, monitor the 1/1 O2 Sensor voltage reading with the jumper wire removed.

**NOTE: The scan tool will display all O2 Sensor voltage readings approximately 5.0 volts when only one O2 Sensor's Signal circuit is shorted to voltage.**

**NOTE: The scan tool will display one O2 Sensor voltage close to zero and the others will read lower than normal when one O2 Sensor Signal circuit contains excessive resistance.**

**Is the voltage above 4.8 volts?**

**Yes** >> Go To 10

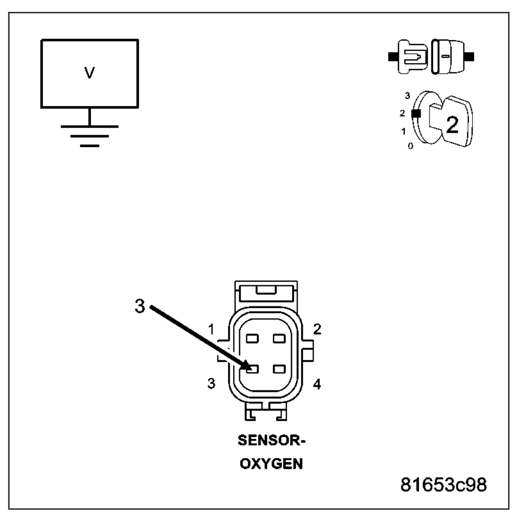
**No** >> Check the (K41) O2 Sensor 1/1 Signal circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 10. (K902) O2 UPSTREAM RETURN CIRCUIT

Disconnect the 1/1 O2 Sensor harness connector.

Measure the voltage on the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.




**Is the voltage at 2.5 volts?**

**Yes** >> Go To 11

**No** >> Check the O2 Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertriain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 11. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 12. RESTRICTED FUEL SUPPLY LINE

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special 5/16 fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module.

Attach a fuel pressure test gauge to the T fitting on tool #6539.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**CAUTION: Stop All Actuations.**

**Is the fuel pressure within specification?**

**Yes** >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. FUEL PUMP INLET STRAINER

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.**

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

**Is the Fuel Inlet Strainer plugged?**

**Yes** >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 14

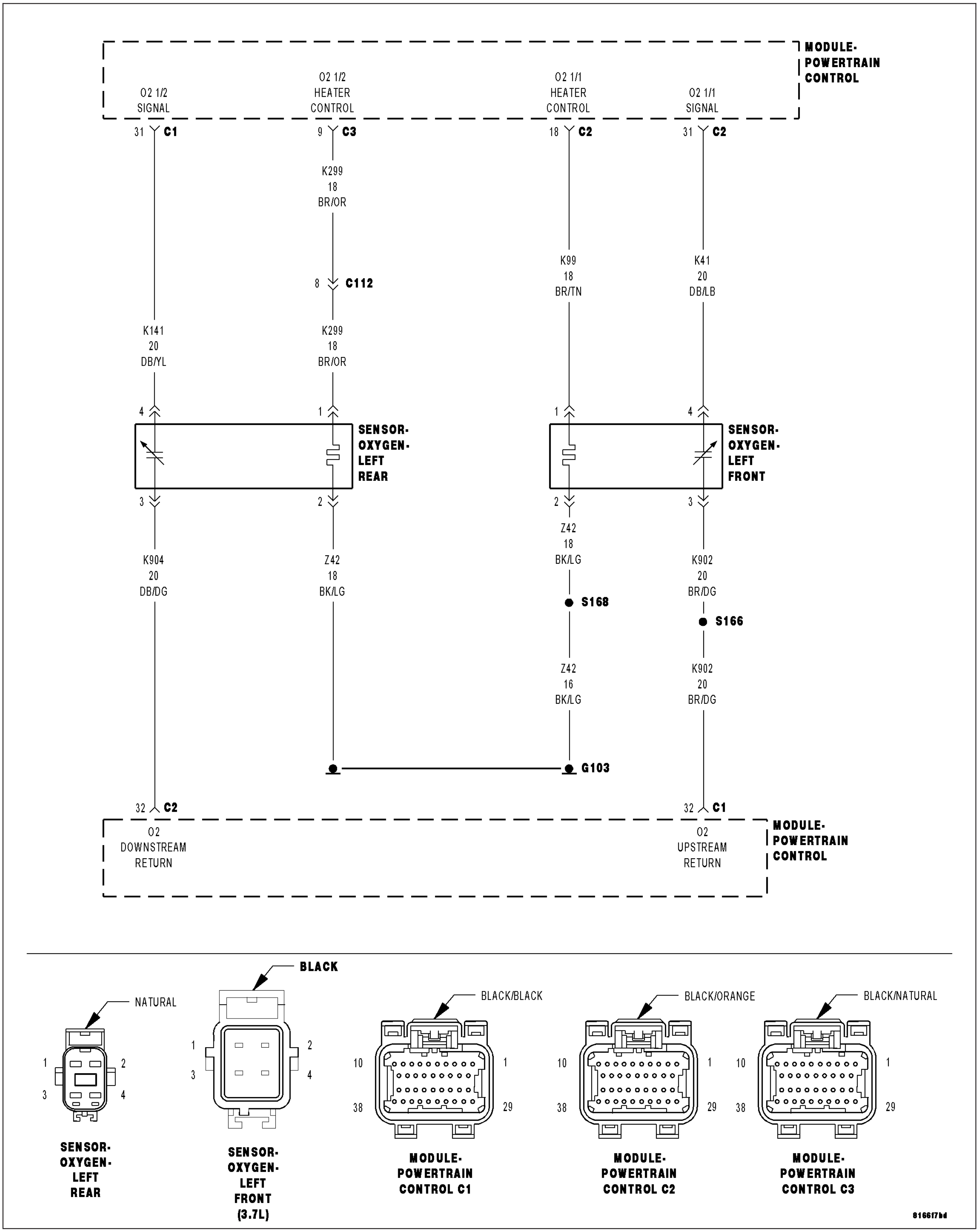
## 14. FUEL PUMP MODULE

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0172-FUEL SYSTEM 1/1 RICH




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulse width according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

| **Possible Causes** |
|---|
| O2 SENSOR HEATER OPERATION |
| EVAP PURGE SOLENOID OPERATION |
| O2 SIGNAL CIRCUIT |
| O2 RETURN CIRCUIT |
| O2 SENSOR |
| MAP SENSOR |
| ECT SENSOR |
| ENGINE MECHANICAL PROBLEM |
| FUEL FILTER/PRESSURE REGULATOR (HIGH) |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Check for contaminates that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. CHECKING FUEL PRESSURE

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Turn the ignition off.

**Choose a conclusion that best matches your fuel pressure reading.**

**Within Specification**

Go To 3

**Above Specification**

Replace the fuel filter/pressure regulator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**CAUTION: Stop All Actuations.**

## 3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

**NOTE: If one of the O2 Sensors Signal or Return circuit is shorted to ground or voltage, all the other O2 Sensor voltage readings will be affected.**

**NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.**

With the scan tool, monitor the 1/1 O2 Sensor voltage reading.

**Is the voltage switching between 2.5 and 3.4 volts?**

**Yes** >> Go To 4

**No** >> Go To 9

## 4. 1/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

**NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.**

Ignition on, engine not running.

With the scan tool, perform the 1/1 O2 Heater Test.

With the scan tool, monitor the O2 Sensor voltage while performing the Heater test for at least 2 minutes.

**Does the voltage stay above 4.5 volts during the Heater test?**

**Yes** >> Replace the O2 Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

**NOTE: If engine will not idle, maintain a constant RPM above idle.**

With a scan tool, read the MAP Sensor vacuum value.

**Is the scan tool reading within 1″ of the Vacuum Gauge reading?**

**Yes** >> Go To 6

**No** >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Remove the vacuum gauge before continuing.**

## 6. ECT SENSOR OPERATION

**NOTE: For this test to be valid, the thermostat must be operating correctly.**

**NOTE: This test works best if performed on a cold engine (cold soak)**

Ignition on, engine not running.

With a scan tool, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

**NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.**

Start the Engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F).

**Did the ECT value increase smoothly and reach at least 180°F (82°C)?**

**Yes** >> Go To 7

**No** >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. EVAP PURGE SOLENOID OPERATION

Turn the ignition off.

Disconnect the hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port on the component side.

**Did the Evap Purge Solenoid hold vacuum?**

**Yes** >> Go To 8

**No** >> Replace the EVAP Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Connect the vacuum hoses before continuing.**

## 8. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from restrictions.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 12

## 9. 1/1 O2 SENSOR

**NOTE: Perform the following test on the O2 Sensors whose voltage was not switching properly in the previous step.**

Ignition on, engine not running.

Disconnect the 1/1 O2 Sensor harness connector.

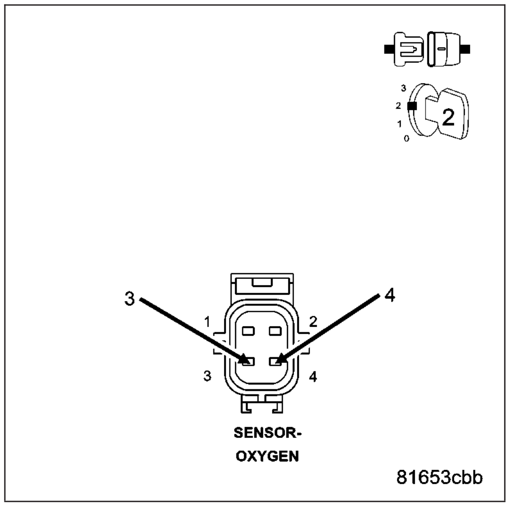
With a scan tool, monitor the 1/1 O2 Sensor voltage.

O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

Connect a jumper wire between the (K41) O2 Sensor 1/1 Signal circuit and the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.

**NOTE: The voltage should drop from 5.0 volts down to 2.5 volts with the jumper wire connected.**

**Did the O2 Sensor voltage drop from 5 volts to 2.5 volts when the jumper wire was installed?**

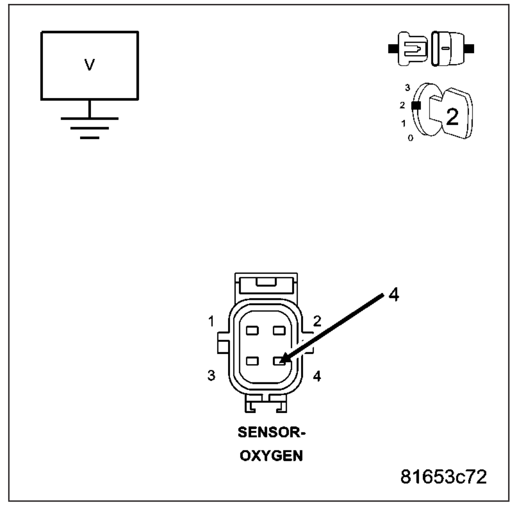



**Yes** >> Replace the 1/1 O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 10

**NOTE: Remove the jumper wire before continuing.**

## 10. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT




**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Start the engine.

Measure the voltage on the (K41) O2 Sensor 1/1 Signal circuit in the O2 Sensor harness connector.

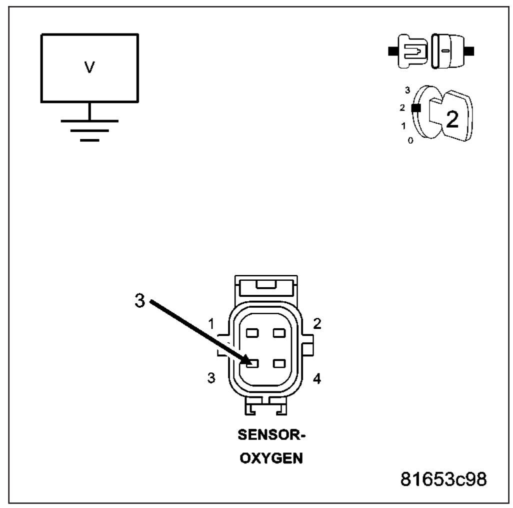
**Is the voltage above 4.8 volts?**

**Yes** >> Check the (K41) O2 Sensor 1/1 Signal circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11

## 11. (K902) O2 SENSOR UPSTREAM RETURN CIRCUIT




Engine still running.

Measure the voltage on the (K902) O2 Upstream Return circuit in the 1/1 O2 Sensor harness connector.

**Is the voltage at 2.5 volts?**

**Yes** >> Go To 12

**No** >> Check the (K902) O2 Upstream Return circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Turn the ignition off before continuing.**

## 12. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

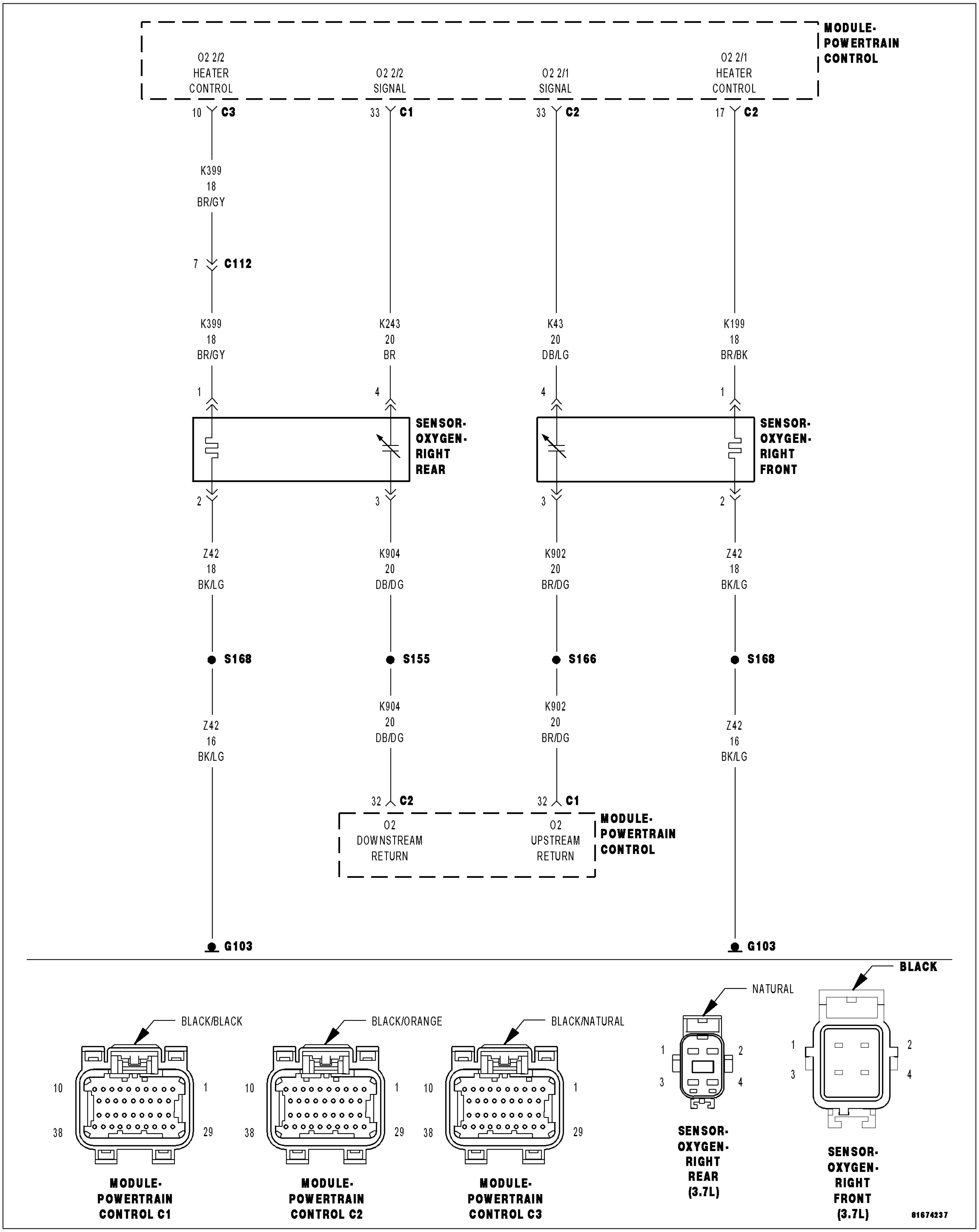
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0174-FUEL SYSTEM 2/1 LEAN




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulse width according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| RESTRICTED FUEL SUPPLY LINE |
| FUEL PUMP INLET STRAINER PLUGGED |
| FUEL PUMP MODULE |
| O2 SIGNAL CIRCUIT |
| O2 RETURN CIRCUIT |
| O2 SENSOR HEATER OPERATION |
| O2 SENSOR |
| MAP SENSOR OPERATION |
| ECT SENSOR OPERATION |
| ENGINE MECHANICAL PROBLEM |
| FUEL FILTER/PRESSURE REGULATOR (HIGH) |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Diagnose all other trouble codes before continuing.

**NOTE: Check for contaminants that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. CHECKING FUEL PRESSURE

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Turn the ignition off.

**Choose a conclusion that best matches your fuel pressure reading.**

**Within Specification**

Go To 3

**Above Specification**

Replace the fuel filter/pressure regulator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**Below Specification**

Go To 12

**CAUTION: Stop All Actuations.**

## 3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

**NOTE: If one of the O2 Sensor's Signal or Return circuit is shorted to ground the scan tool will display all O2 Sensor voltage readings low. The O2 Sensor that is shorted to ground will display a voltage reading near or at 0 volts.**

**NOTE: If one of the O2 Sensor Signal or Return circuits are shorted to voltage, the scan tool will display all O2 Sensor voltage readings high.**

**NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.**

With the scan tool, monitor the 2/1 O2 Sensor voltage reading.

**Is the voltage switching between 2.5 and 3.4 volts?**

**Yes** >> Go To 4

**No** >> Go To 8

## 4. 2/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

**NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.**

**NOTE: Perform the following test on all O2 Sensors.**

Ignition on, engine not running.

With a scan tool, actuate the 2/1 O2 Heater Test.

With the scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

**Does the voltage stay above 4.5 volts?**

**Yes** >> Replace the 2/1 O2 Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

**NOTE: If engine will not idle, maintain a constant RPM above idle.**

With the scan tool, read the MAP Sensor vacuum value.

**Is the scan tool reading within 1″ of the Vacuum Gauge reading?**

**Yes** >> Go To 6

**No** >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. ECT SENSOR OPERATION

**NOTE: For this test to be valid, the thermostat must be operating correctly.**

**NOTE: This test works best if performed on a cold engine (cold soak).**

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature (ECT) Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

**NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.**

Start the Engine.

During engine warm-up, monitor the ECT Sensor value. The temperature value change should be a smooth transition from start up to normal operating temperature 82°C (180°F). The value should reach at least 82°C (180°F).

**Did the ECT value increase smoothly and did it reach at least 180°F (82°C)?**

**Yes** >> Go To 7

**No** >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. ENGINE MECHANICAL PROBLEM

Turn the ignition off.

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11

## 8. O2 SENSOR

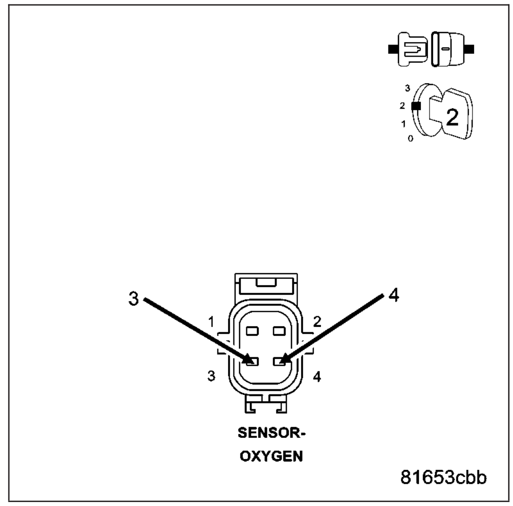
Ignition on, engine not running.

Disconnect the 2/1 O2 Sensor harness connector.

With the scan tool, monitor the 2/1 O2 Sensor voltage.

O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

Connect a jumper wire between the (K43) O2 Sensor 2/1 Signal circuit and the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.




**NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.**

**Did the O2 Sensor voltage change from 5.0 volts to 2.5 volts when the jumper wire was installed?**

**Yes** >> Replace the 2/1 O2 Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

**NOTE: Remove the jumper wire before continuing.**

## 9. O2 SENSOR SIGNAL CIRCUIT

With the scan tool, monitor all the O2 Sensor voltage reading with the jumper wire removed.

**NOTE: The scan tool will display all O2 Sensor voltage readings approximately 5.0 volts when only one O2 Sensor's Signal circuit is shorted to voltage.**

**NOTE: The scan tool will display one O2 Sensor voltage close to zero and the others will read lower than normal when one O2 Sensor Signal circuit contains excessive resistance.**

**Is the voltage above 4.8 volts?**

**Yes** >> Go To 10

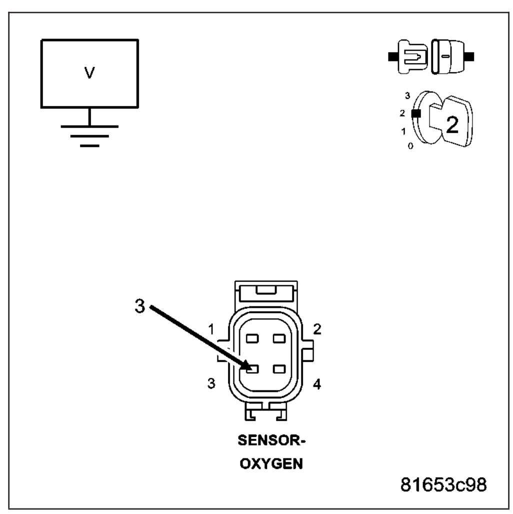
**No** >> Check all the O2 Signal circuits for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 10. (K902) O2 UPSTREAM RETURN CIRCUIT

Disconnect the 2/1 O2 Sensor harness connector.

Measure the voltage on the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.




**Is the voltage at 2.5 volts?**

**Yes** >> Go To 11

**No** >> Check the (K902) O2 Upstream Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 11. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 12. RESTRICTED FUEL SUPPLY LINE

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special 5/16 fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module.

Attach a fuel pressure test gauge to the T fitting on tool #6539.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**CAUTION: Stop All Actuations.**

**Is the fuel pressure within specification?**

**Yes** >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. FUEL PUMP INLET STRAINER

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.**

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

**Is the Fuel Inlet Strainer plugged?**

**Yes** >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 14

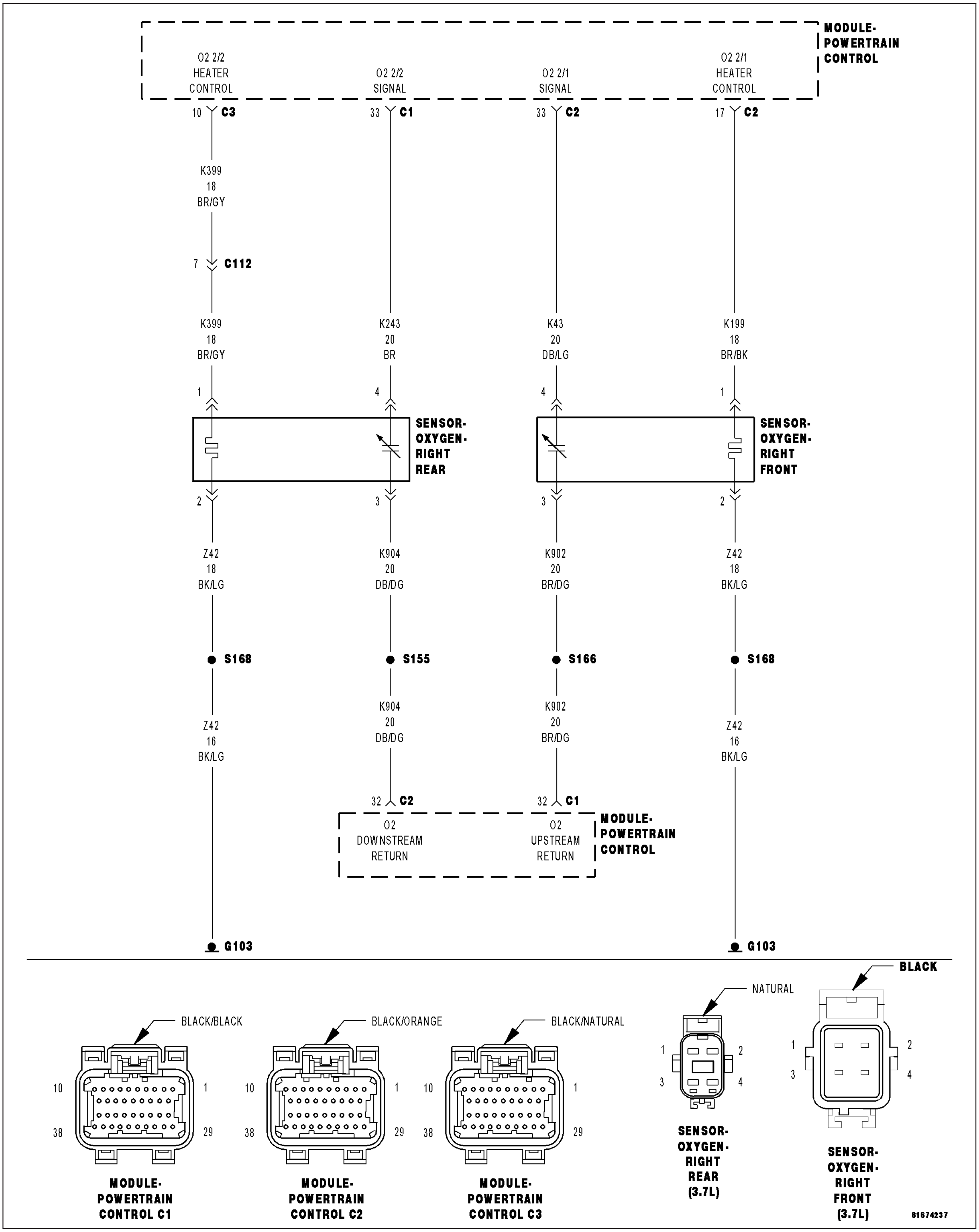
## 14. FUEL PUMP MODULE

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0175-FUEL SYSTEM 2/1 RICH




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulse width according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| O2 SENSOR HEATER OPERATION |
| EVAP PURGE SOLENOID OPERATION |
| O2 SIGNAL CIRCUIT |
| O2 RETURN CIRCUIT |
| O2 SENSOR |
| MAP SENSOR |
| ECT SENSOR |
| ENGINE MECHANICAL PROBLEM |
| FUEL FILTER/PRESSURE REGULATOR (HIGH) |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Check for contaminates that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. CHECKING FUEL PRESSURE

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Turn the ignition off.

**Choose a conclusion that best matches your fuel pressure reading.**

**Within Specification**

Go To 3

**Above Specification**

Replace the fuel filter/pressure regulator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**CAUTION: Stop All Actuations.**

## 3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

**NOTE: If one of the O2 Sensors Signal or Return circuit is shorted to ground or voltage, all the other O2 Sensor voltage readings will be affected.**

**NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.**

With the scan tool, monitor the 2/1 O2 Sensor voltage reading.

**Is the voltage switching between 2.5 and 3.4 volts?**

**Yes** >> Go To 4

**No** >> Go To 9

## 4. 2/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

**NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.**

Ignition on, engine not running.

With the scan tool, perform the 2/1 O2 Heater Test for each O2 Sensor.

With the scan tool, monitor the 2/1 O2 Sensor voltage while performing the Heater test for at least 2 minutes.

**Does the voltage stay above 4.5 volts for each Sensor?**

**Yes** >> Replace the 2/1 O2 Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

**NOTE: If engine will not idle, maintain a constant RPM above idle.**

With the scan tool, read the MAP Sensor vacuum value.

**Is the scan tool reading within 1″ of the Vacuum Gauge reading?**

**Yes** >> Go To 6

**No** >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Remove the vacuum gauge before continuing.**

## 6. ECT SENSOR OPERATION

**NOTE: For this test to be valid, the thermostat must be operating correctly.**

**NOTE: This test works best if performed on a cold engine (cold soak).**

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

**NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.**

Start the Engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F).

**Did the ECT value increase smoothly and reach at least 180°F (82°C)?**

**Yes** >> Go To 7

**No** >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. EVAP PURGE SOLENOID OPERATION

Turn the ignition off.

Disconnect the hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port on the component side.

**Did the Evap Purge Solenoid hold vacuum?**

**Yes** >> Go To 8

**No** >> Replace the EVAP Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Connect the vacuum hoses before continuing.**

## 8. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from restrictions.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 12

## 9. 2/1 O2 SENSOR

Ignition on, engine not running.

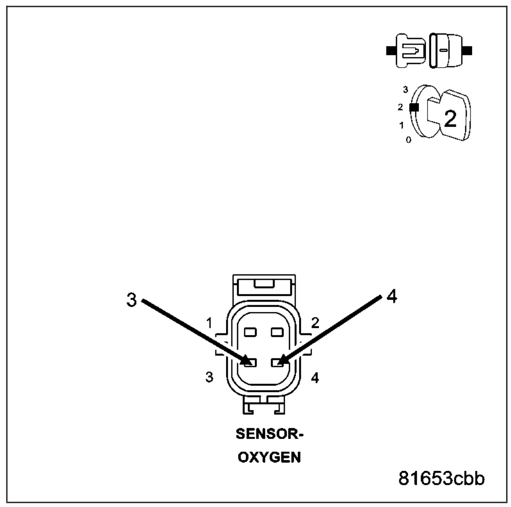
Disconnect the 2/1 O2 Sensor harness connector.

With the scan tool, monitor the 2/1 O2 Sensor voltage.

O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

Connect a jumper wire between the (K43) O2 Sensor 2/1 Signal circuit and the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.

**NOTE: The voltage should drop from 5.0 volts down to 2.5 volts with the jumper wire connected.**




**Did the O2 Sensor voltage drop from 5 volts to 2.5 volts when the jumper wire was installed?**

**Yes** >> Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 10

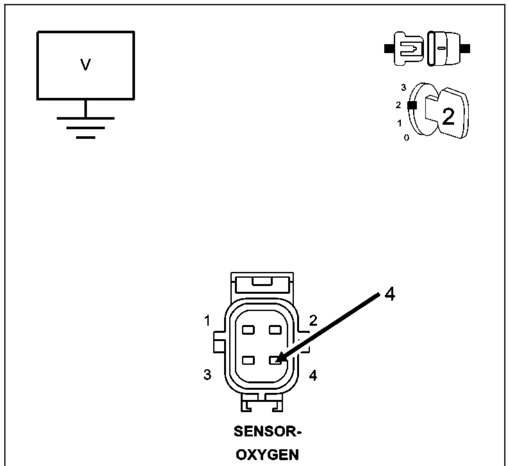
**NOTE: Remove the jumper wire before continuing.**

## 10. O2 SENSOR SIGNAL CIRCUIT

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Start the engine.

Measure the voltage on the (K43) O2 Sensor 2/1 Signal circuit in the O2 Sensor harness connector.



81653c72

**Is the voltage above 4.8 volts?**

**Yes** >> Check the (K43) O2 Sensor 2/1 Signal circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

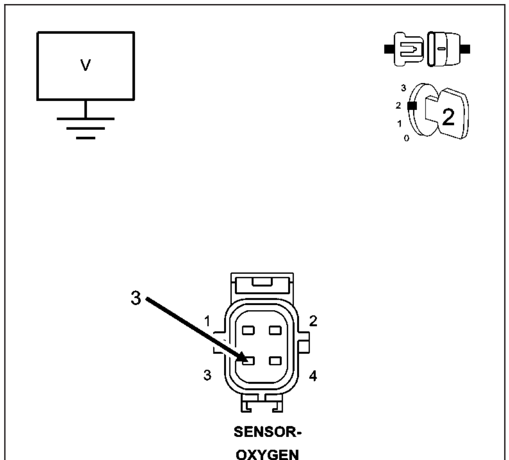
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11

## 11. (K902) O2 SENSOR UPSTREAM RETURN CIRCUIT

Engine still running.

Measure the voltage on the (K902) O2 Upstream Return circuit in the O2 Sensor harness connector.



81653c98

**Is the voltage at 2.5 volts?**

**Yes** >> Go To 12

**No** >> Check the (K902) O2 Upstream Return circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

**NOTE: Turn the ignition off before continuing.**

## 12. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

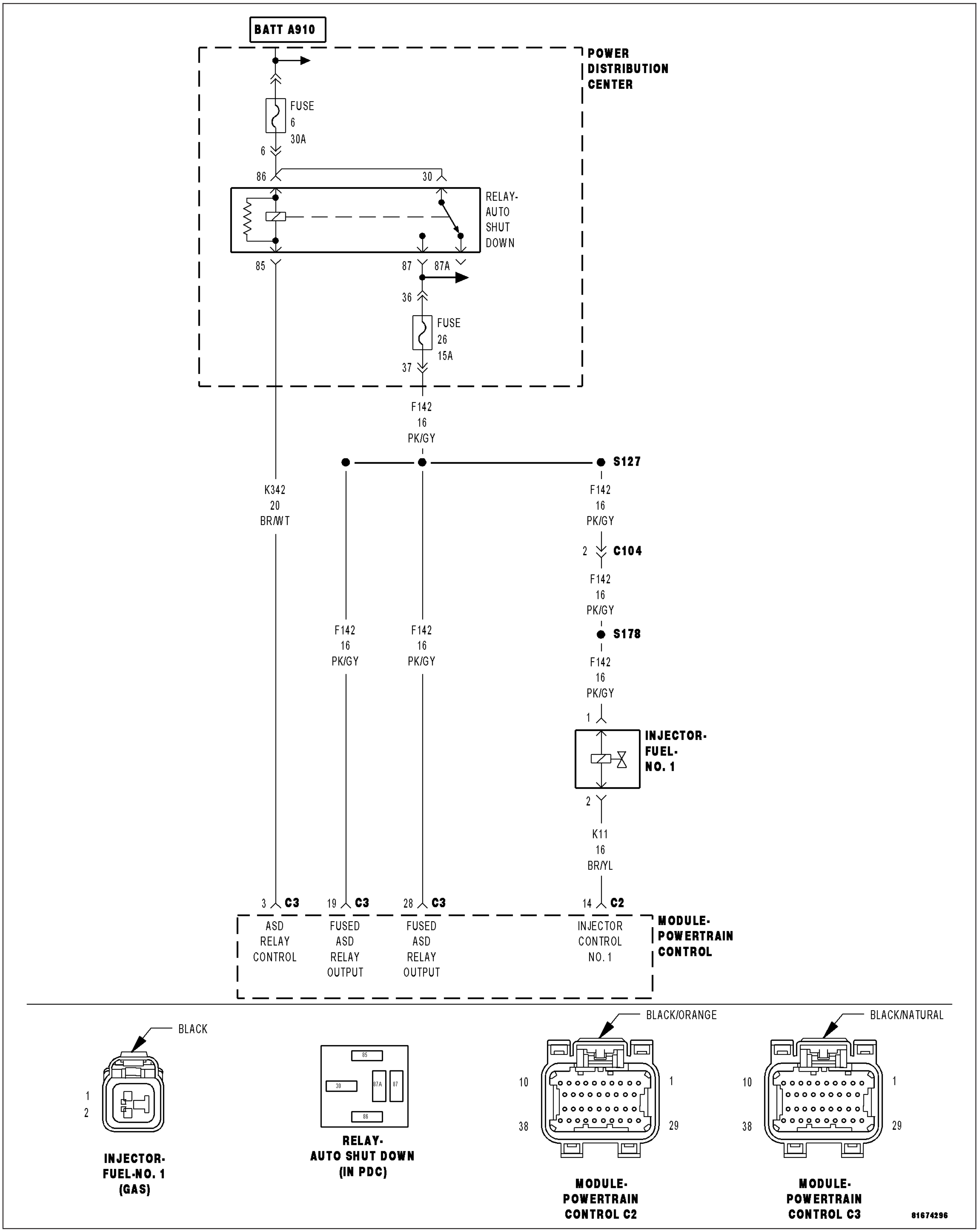
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0201-FUEL INJECTOR 1 CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off for more than 3.2 seconds. One trip fault. Three good trips to clear the MIL.

| Possible Causes |
|---|
| (F142) ASD RELAY OUTPUT CIRCUIT |
| (K11) INJECTOR CONTROL NO.1 CIRCUIT OPEN |
| (K11) INJECTOR CONTROL NO.1 CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

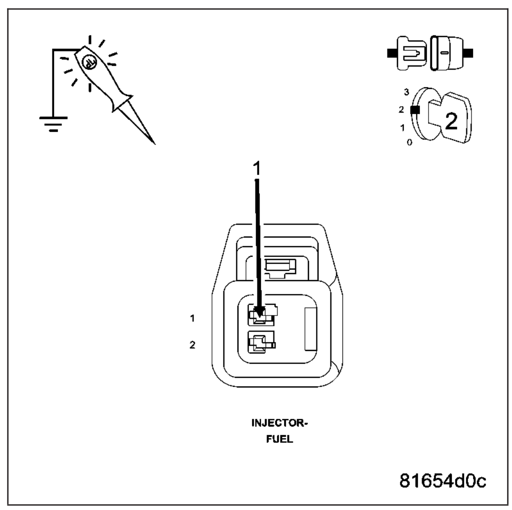
**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (F142) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.
Disconnect the No.1 Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, backprobe the (F142) ASD Relay Output circuit in the Fuel Injector harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

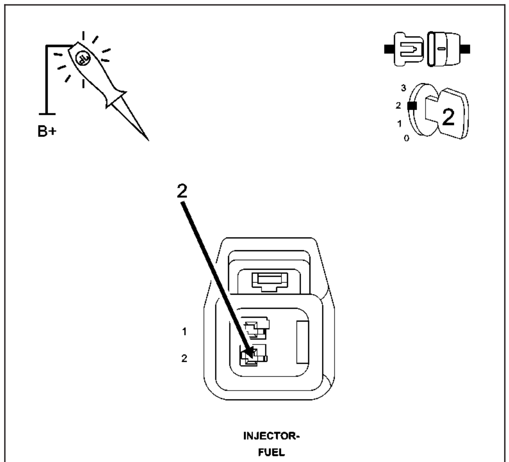
**No** >> Repair the excessive resistance or short to ground in the (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, backprobe the (K11) Injector Control No.1 circuit.

With the scan tool, actuate the Fuel Injector.

**What is the state of the test light during the actuation?**



81654d1d

**Brightly Blinking.**

Replace the Fuel Injector.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**ON Constantly.**

Go To 4

**OFF Constantly.**

Go To 5

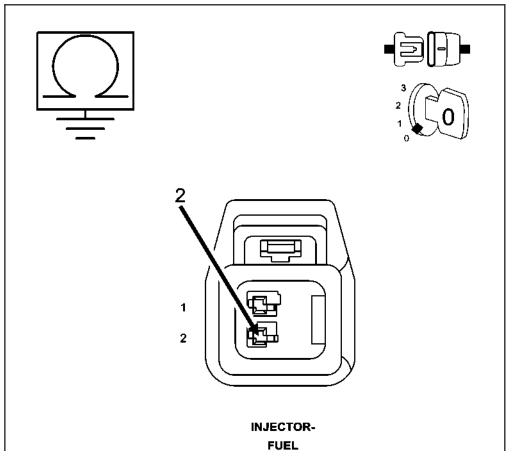
## 4. (K11) INJECTOR CONTROL NO.1 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K11) Injector Control No.1 circuit in the Injector harness connector.

**Is the resistance below 100 ohms?**



81654d74

**Yes** >> Repair the short to ground in the (K11) Injector Control No.1 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

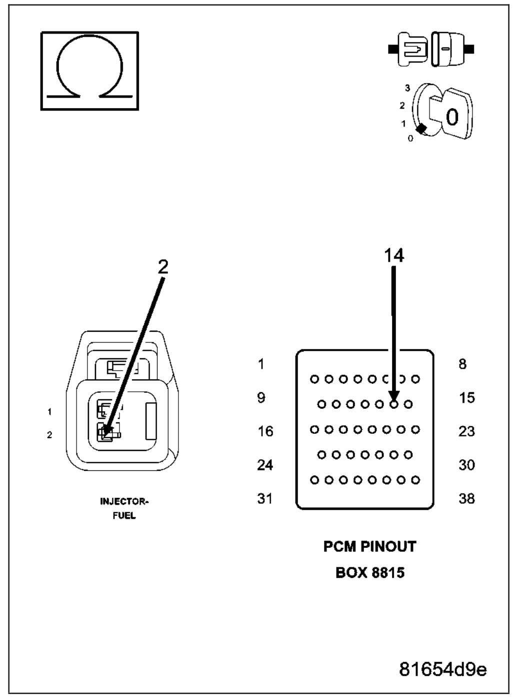
## 5. (K11) INJECTOR CONTROL NO.1 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K11) Injector Control No.1 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K11) Injector Control No.1 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

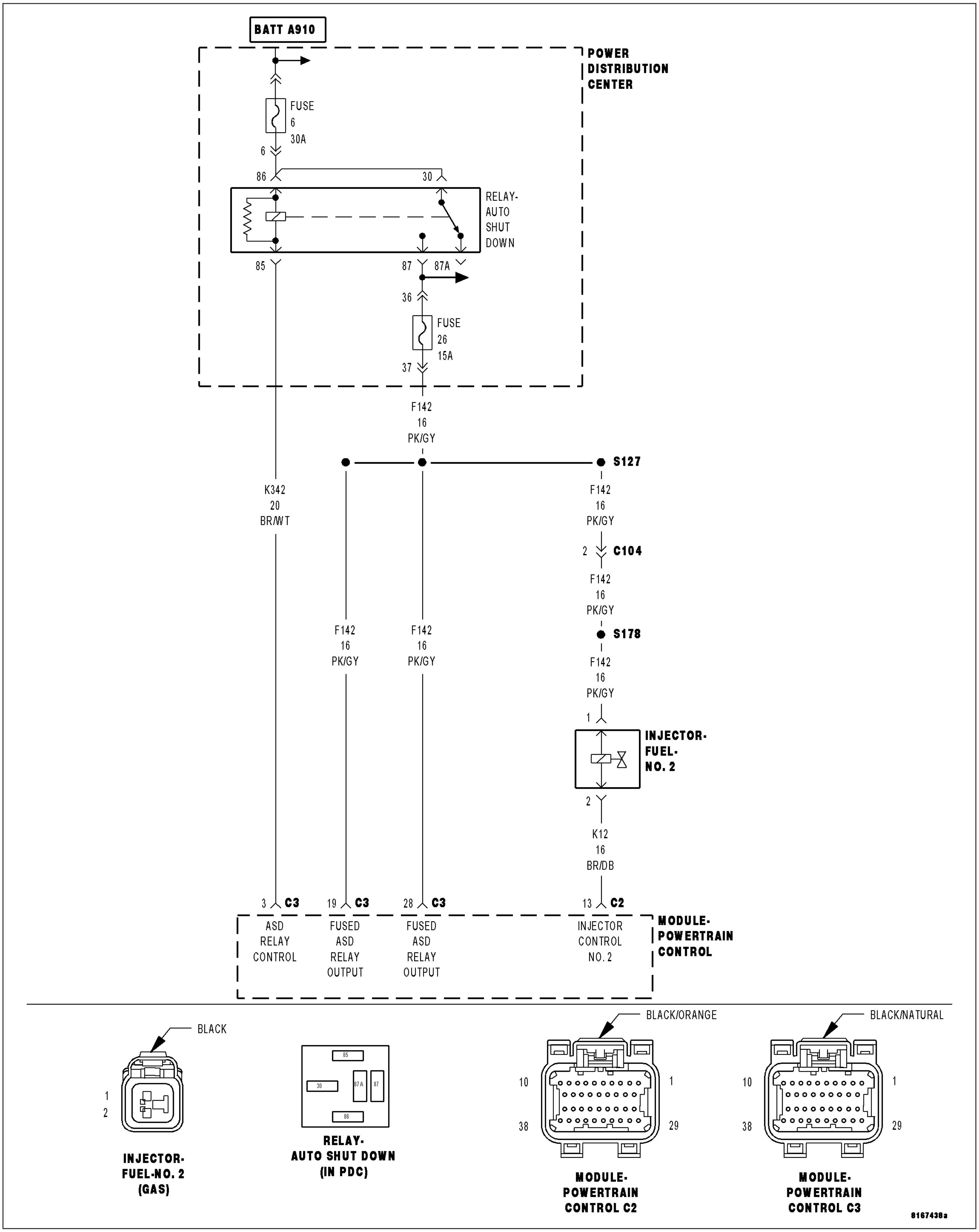
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0202-FUEL INJECTOR 2 CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off for more than 3.2 seconds. One trip fault. Three good trips to clear the MIL.

| Possible Causes |
|---|
| (F142) ASD RELAY OUTPUT CIRCUIT |
| (K12) INJECTOR CONTROL NO.2 CIRCUIT OPEN |
| (K12) INJECTOR CONTROL NO.2 CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (F142) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.2 Fuel Injector harness connector.

Ignition on, engine not running.

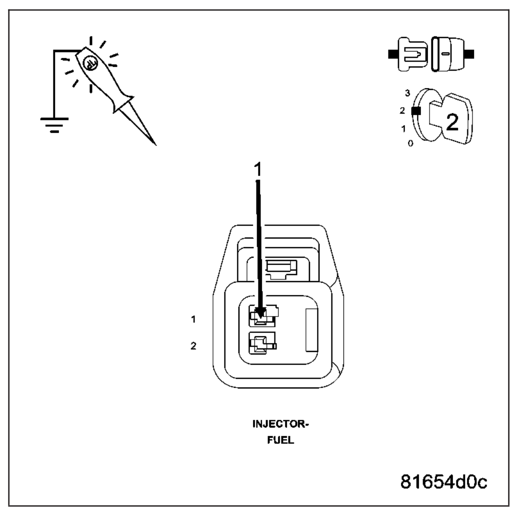
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, backprobe the (F142) ASD Relay Output circuit in the No.2 Fuel Injector harness connector.

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the excessive resistance or short to ground in the (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

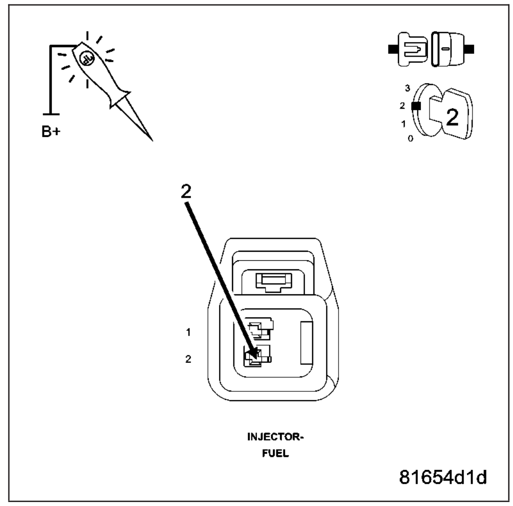


## 3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, backprobe the (K12) Injector Control No.2 circuit.

With the scan tool, actuate the No.2 Fuel Injector.

**What is the state of the test light during the actuation?**




**Brightly Blinking.**

Replace the Fuel Injector.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**ON Constantly.**

Go To 4

**OFF Constantly.**

Go To 5

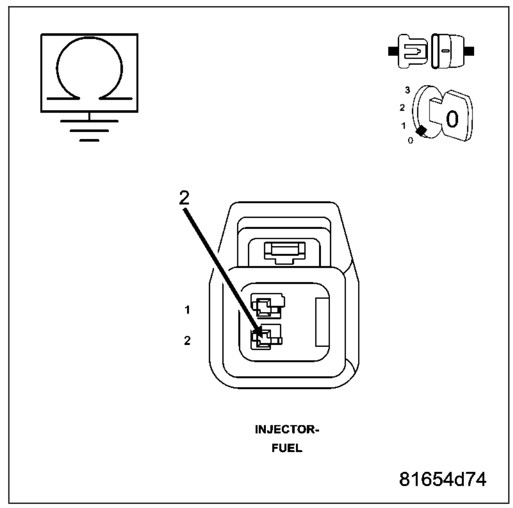
## 4. (K12) INJECTOR CONTROL NO.2 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K12) Injector Control No.2 circuit in the Injector harness connector.

**Is the resistance below 100 ohms?**




**Yes** >> Repair the short to ground in the (K12) Injector Control No.2 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

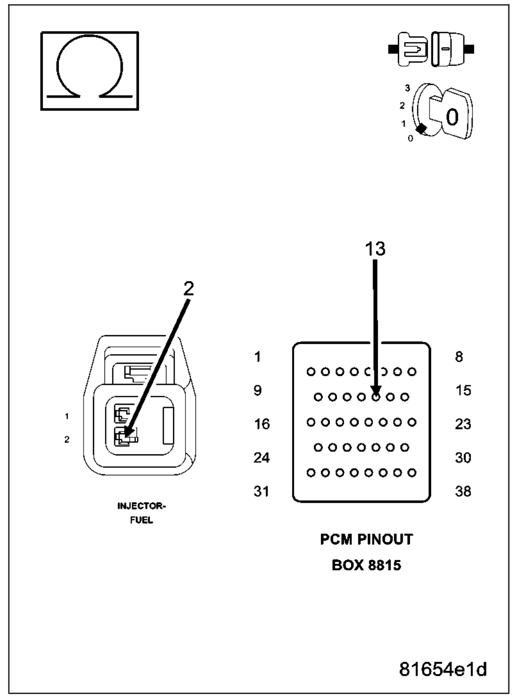
## 5. (K12) INJECTOR CONTROL NO.2 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K12) Injector Control No.2 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K12) Injector Control No.2 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

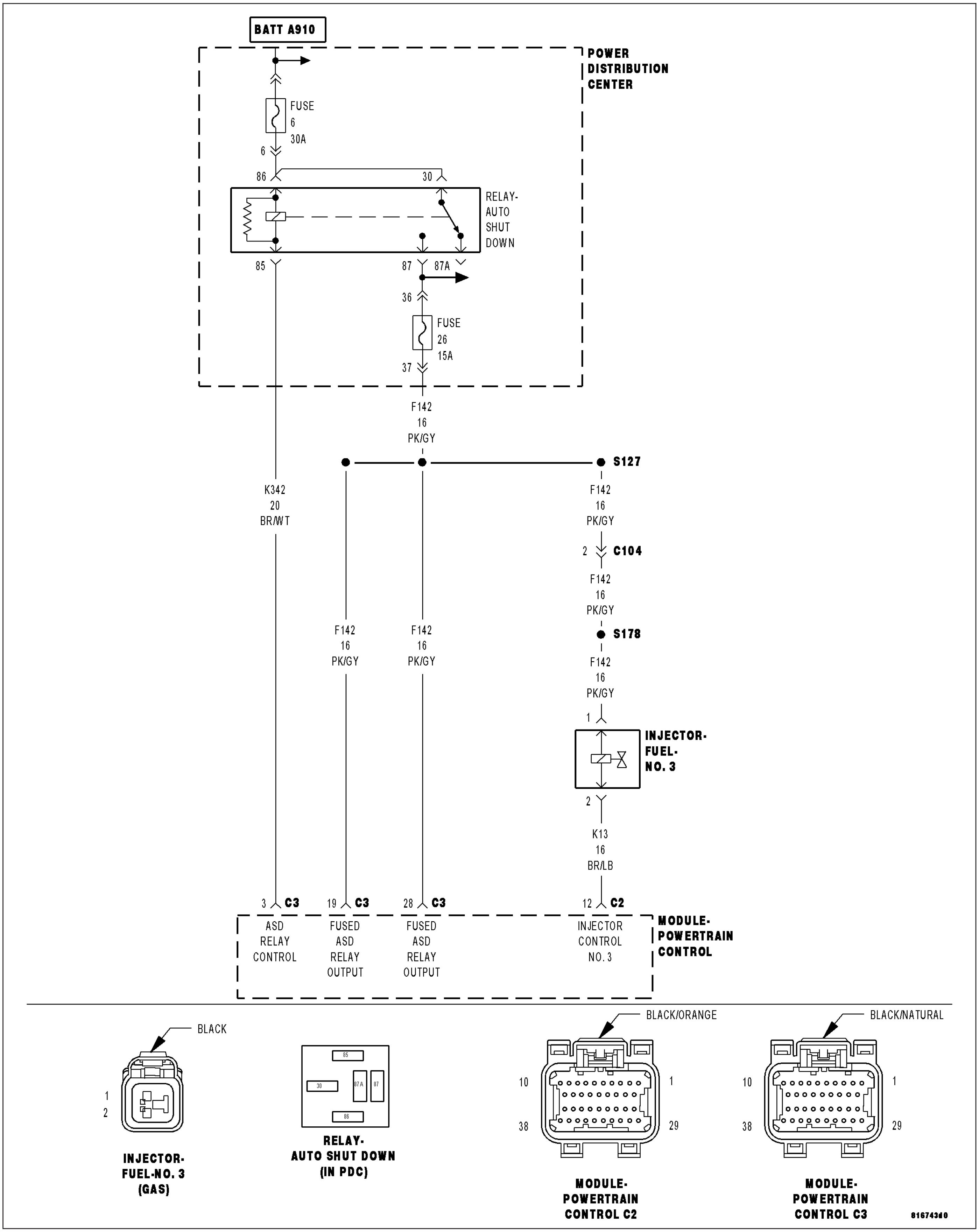
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0203-FUEL INJECTOR 3 CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off for more than 3.2 seconds. One trip fault. Three good trips to clear the MIL.

| Possible Causes |
|---|
| (F142) ASD RELAY OUTPUT CIRCUIT |
| (K13) INJECTOR CONTROL NO.3 CIRCUIT OPEN |
| (K13) INJECTOR CONTROL NO.3 CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (F142) ASD RELAY OUTPUT CIRCUIT

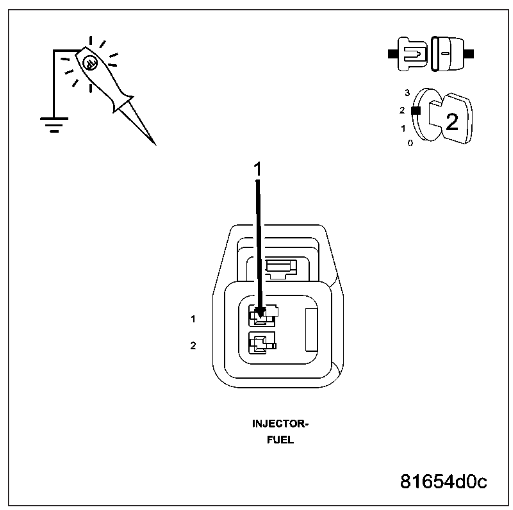
Turn the ignition off.

Disconnect the No.3 Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, backprobe the (F142) ASD Relay Output circuit in the No.3 Fuel Injector harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

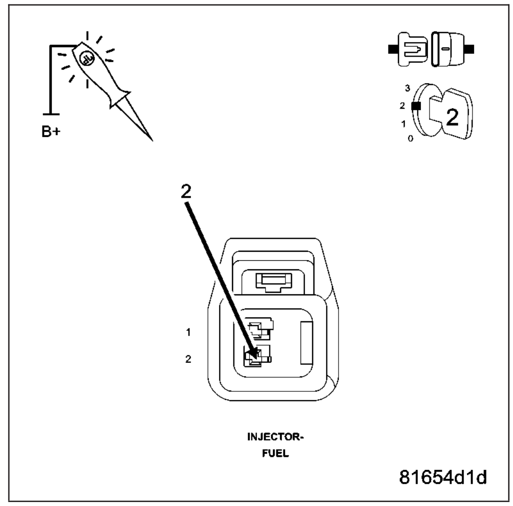
**No** >> Repair the excessive resistance or short to ground in the (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, backprobe the (K13) Injector Control No.3 circuit.

With the scan tool, actuate the No.3 Fuel Injector.

**What is the state of the test light during the actuation?**




**Brightly Blinking.**

Replace the Fuel Injector.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE

**ON Constantly.**

Go To 4

**OFF Constantly.**

Go To 5

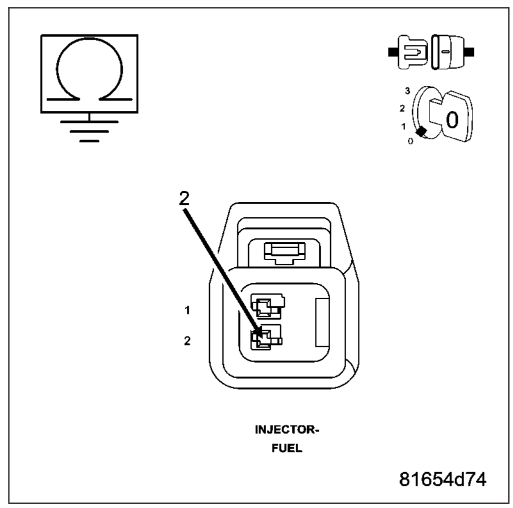
## 4. (K13) INJECTOR CONTROL NO.3 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K13) Injector Control No.3 circuit in the Injector harness connector.

**Is the resistance below 100 ohms?**




**Yes** >> Repair the short to ground in the (K13) Injector Control No.3 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

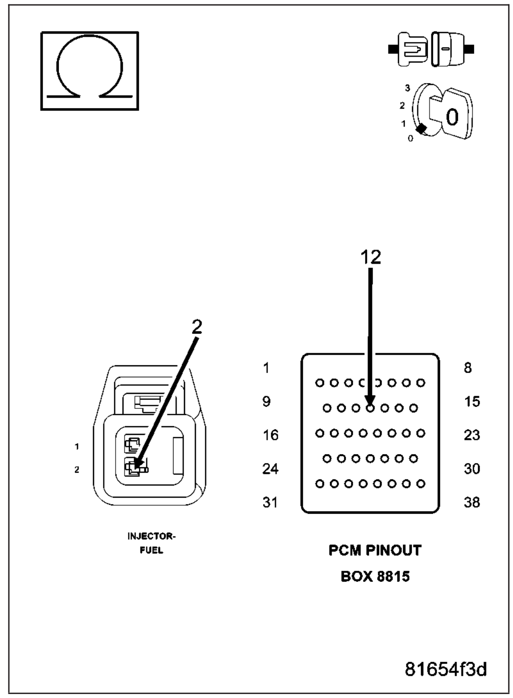
## 5. (K13) INJECTOR CONTROL NO.3 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K13) Injector Control No.3 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K13) Injector Control No.3 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

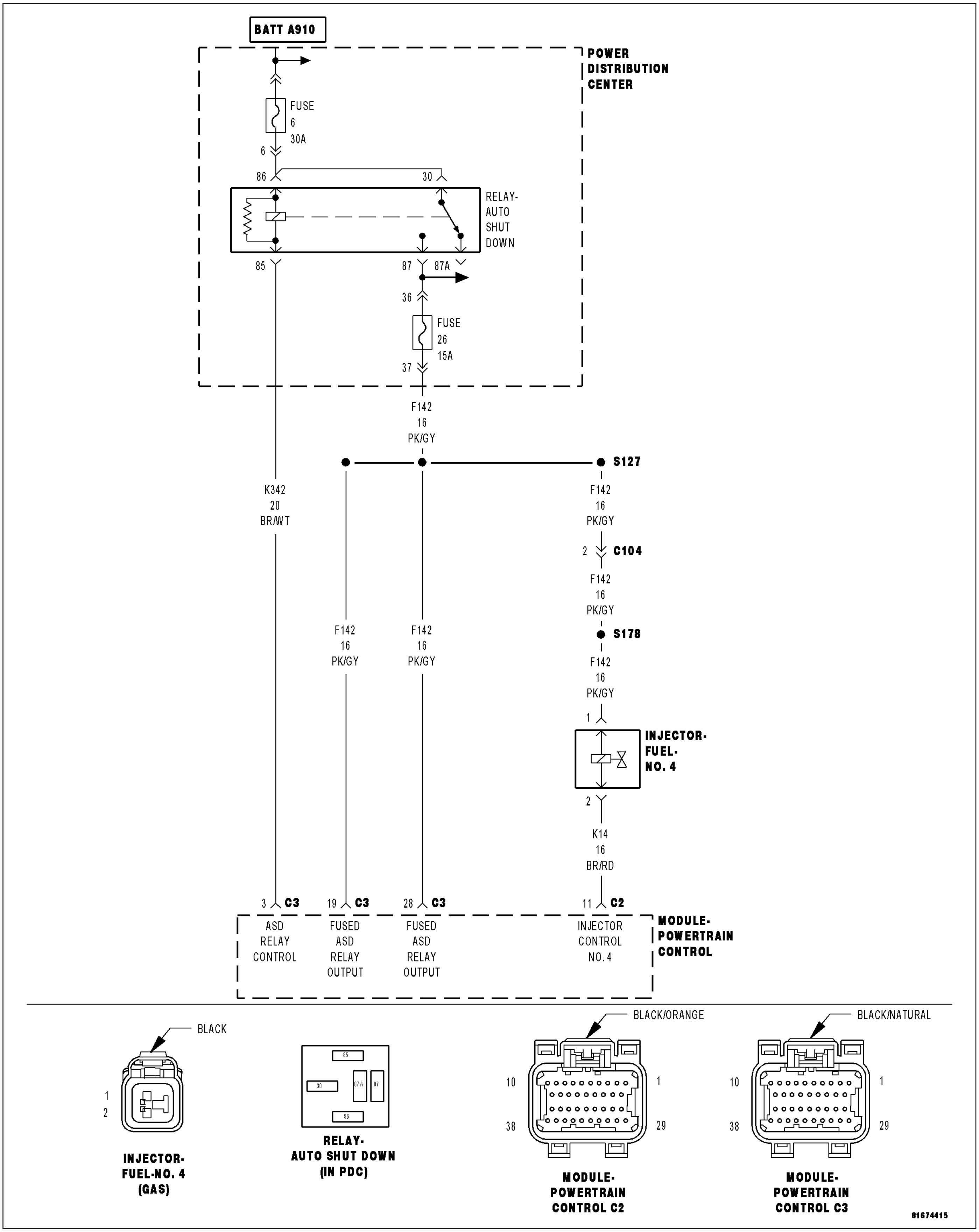
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0204-FUEL INJECTOR 4 CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off for more than 3.2 seconds. One trip fault. Three good trips to clear the MIL.

| Possible Causes |
|---|
| (F142) ASD RELAY OUTPUT CIRCUIT |
| (K14) INJECTOR CONTROL NO.4 CIRCUIT OPEN |
| (K14) INJECTOR CONTROL NO.4 CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (F142) ASD RELAY OUTPUT CIRCUIT

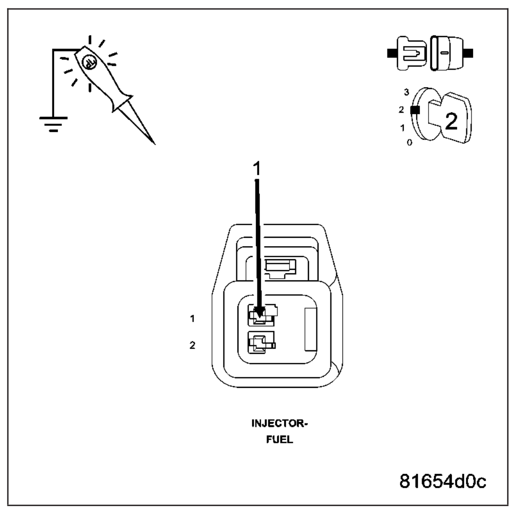
Turn the ignition off.

Disconnect the No.4 Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, backprobe the (F142) ASD Relay Output circuit in the No.4 Fuel Injector harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

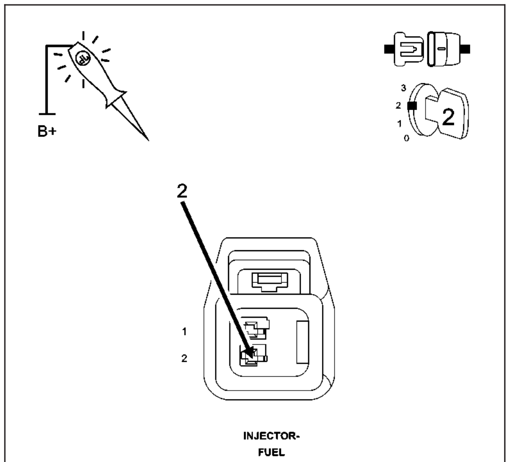
**No** >> Repair the excessive resistance or short to ground in the (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, backprobe the (K14) Injector Control No.4 circuit.

With the scan tool, actuate the No.4 Fuel Injector.

**What is the state of the test light during the actuation?**




81654d1d

**Brightly Blinking.**

Replace the Fuel Injector.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**ON Constantly.**

Go To 4

**OFF Constantly.**

Go To 5

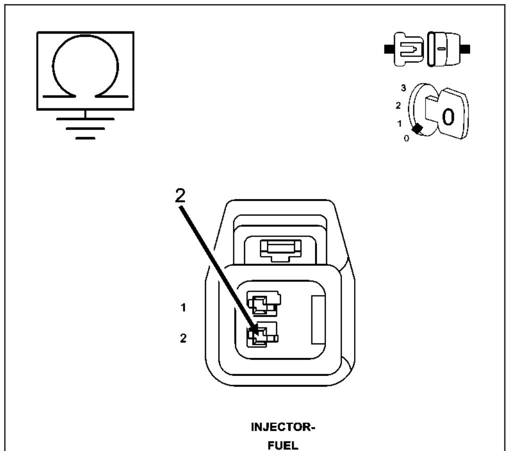
## 4. (K14) INJECTOR CONTROL NO.4 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K14) Injector Control No.4 circuit in the Injector harness connector.

**Is the resistance below 100 ohms?**




81654d74

**Yes** >> Repair the short to ground in the (K14) Injector Control No.4 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

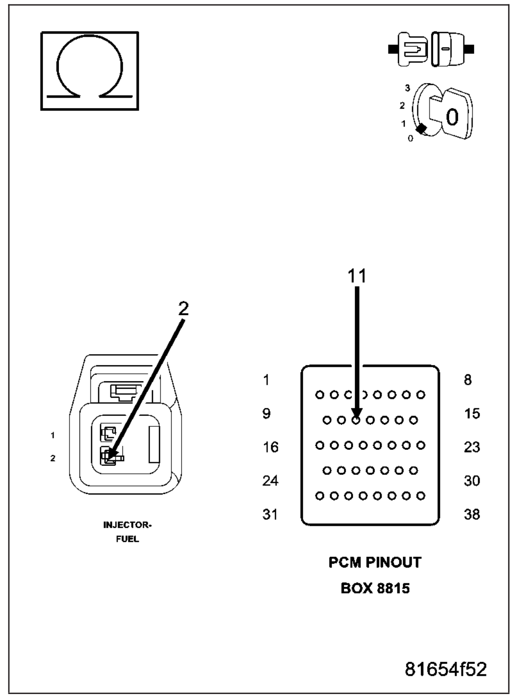
## 5. (K14) INJECTOR CONTROL NO.4 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K14) Injector Control No.4 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K14) Injector Control No.4 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

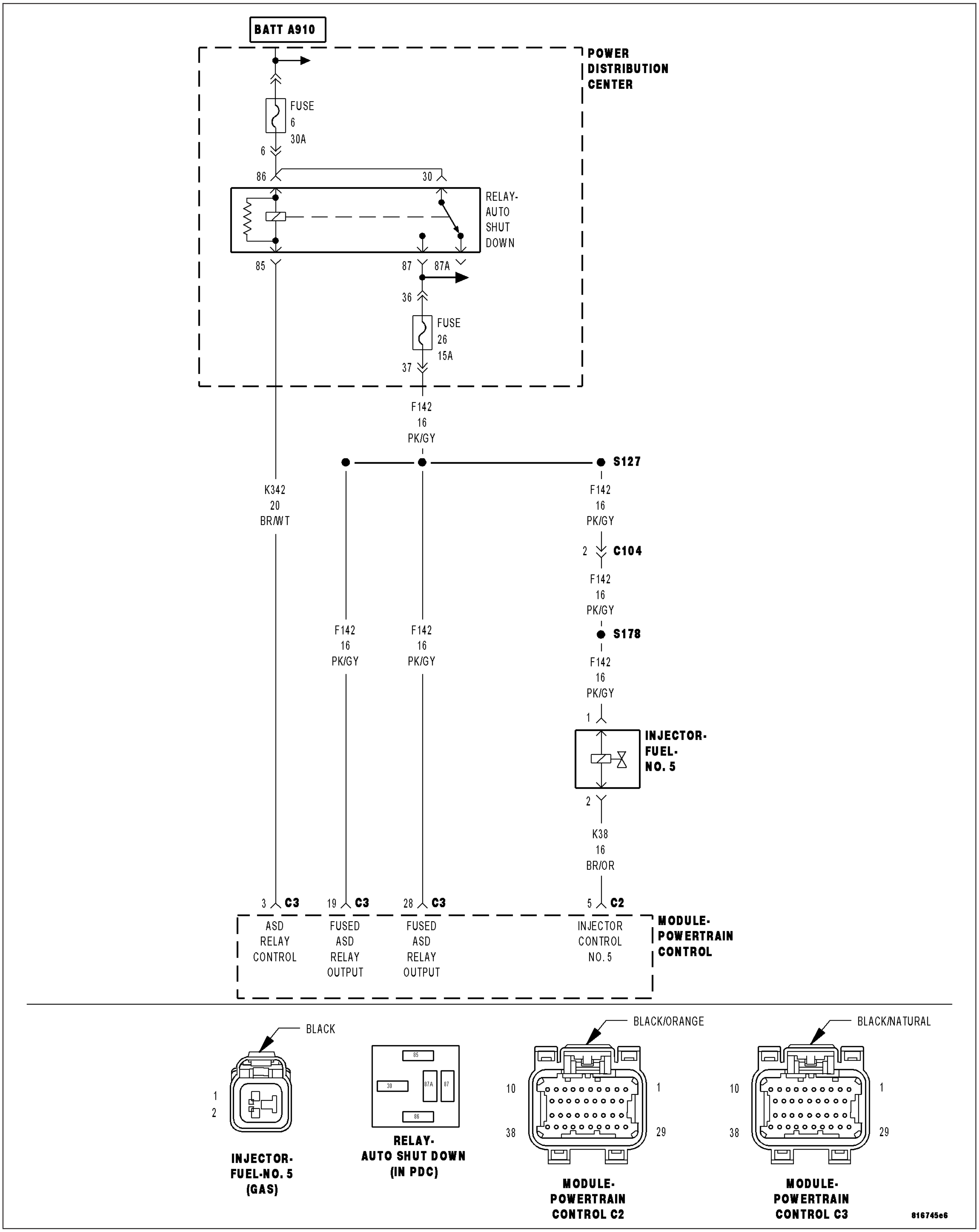
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0205-FUEL INJECTOR 5 CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off for more than 3.2 seconds. One trip fault. Three good trips to clear the MIL.

| Possible Causes |
|---|
| (F142) ASD RELAY OUTPUT CIRCUIT |
| (K38) INJECTOR CONTROL NO.5 CIRCUIT OPEN |
| (K38) INJECTOR CONTROL NO.5 CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (F142) ASD RELAY OUTPUT CIRCUIT

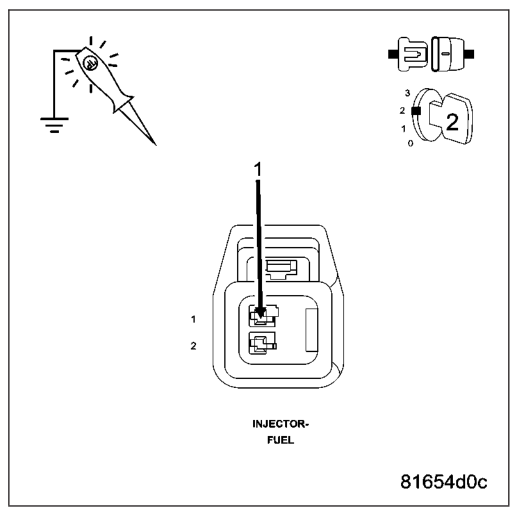
Turn the ignition off.

Disconnect the No.5 Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, backprobe the (F142) ASD Relay Output circuit in the No.5 Fuel Injector harness connector.




**Does the test light illuminate brightly?**

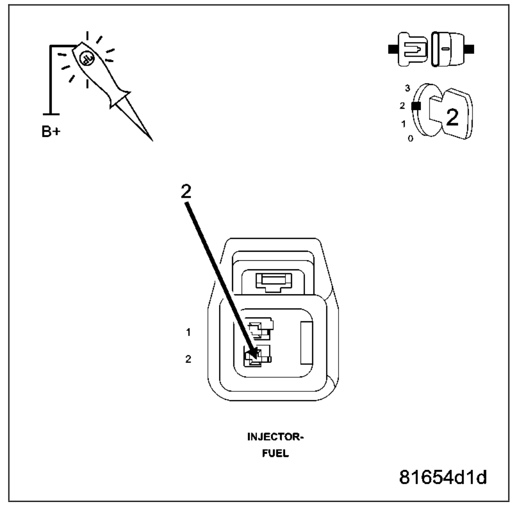
**Yes** >> Go To 3

**No** >> Repair the excessive resistance or short to ground in the (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, backprobe the (K38) Injector Control No.5 circuit.

With the scan tool, actuate the No.5 Fuel Injector.




**What is the state of the test light during the actuation?**

**Brightly Blinking.**

Replace the Fuel Injector.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**ON Constantly.**

Go To 4

**OFF Constantly.**

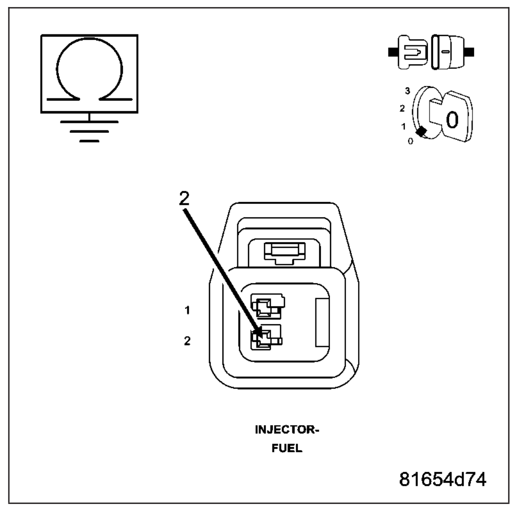
Go To 5

## 4. (K38) INJECTOR CONTROL NO.5 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K38) Injector Control No.5 circuit in the Injector harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K38) Injector Control No.5 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

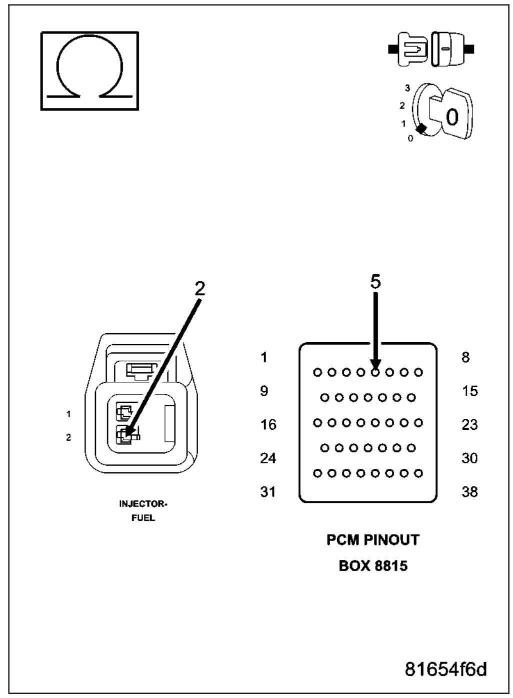
## 5. (K38) INJECTOR CONTROL NO.5 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K38) Injector Control No.5 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K38) Injector Control No.5 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

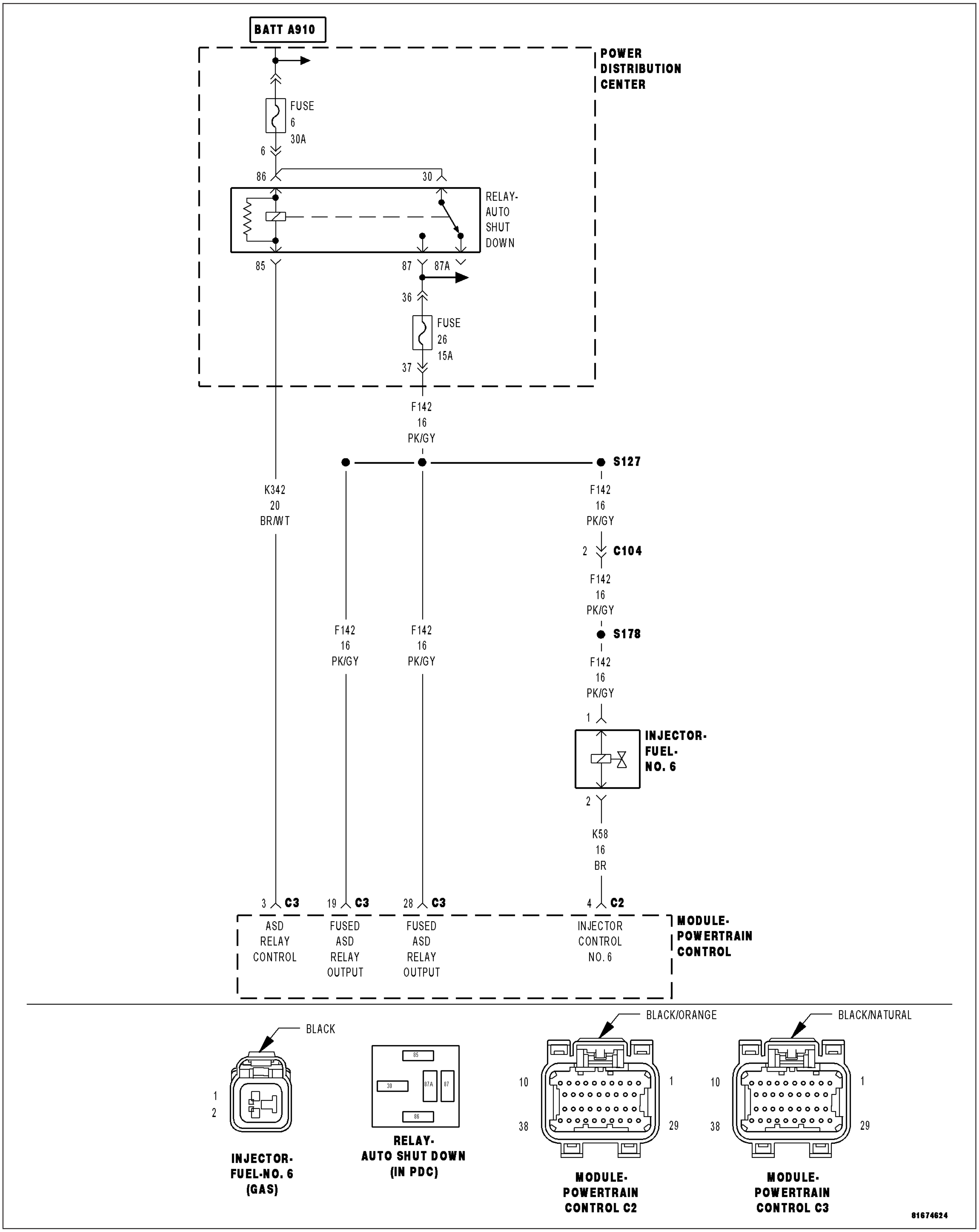
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0206-FUEL INJECTOR 6 CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off for more than 3.2 seconds. One trip fault. Three good trips to clear the MIL.

| Possible Causes |
|---|
| (F142) ASD RELAY OUTPUT CIRCUIT |
| (K58) INJECTOR CONTROL NO.6 CIRCUIT OPEN |
| (K58) INJECTOR CONTROL NO.6 CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (F142) ASD RELAY OUTPUT CIRCUIT

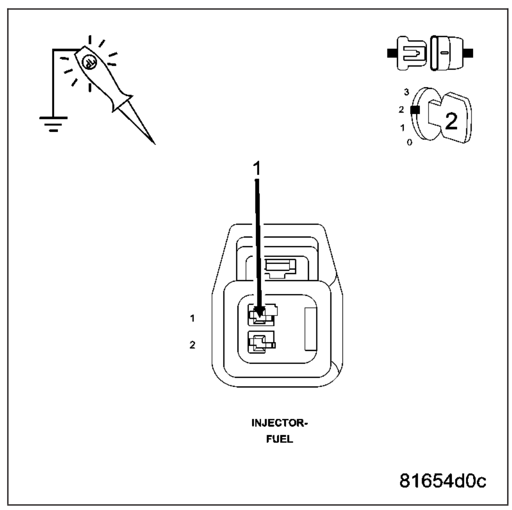
Turn the ignition off.

Disconnect the No.6 Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, backprobe the (F142) ASD Relay Output circuit in the No.6 Fuel Injector harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

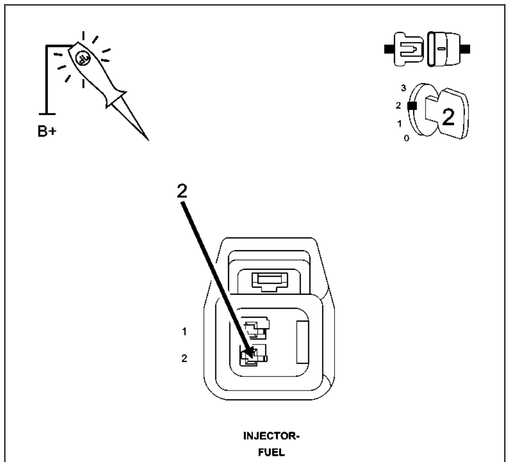
**No** >> Repair the excessive resistance or short to ground in the (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, backprobe the (K58) Injector Control No.6 circuit.

With the scan tool, actuate the No.6 Fuel Injector.

**What is the state of the test light during the actuation?**



81654d1d

**Brightly Blinking.**

Replace the Fuel Injector.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**ON Constantly.**

Go To 4

**OFF Constantly.**

Go To 5

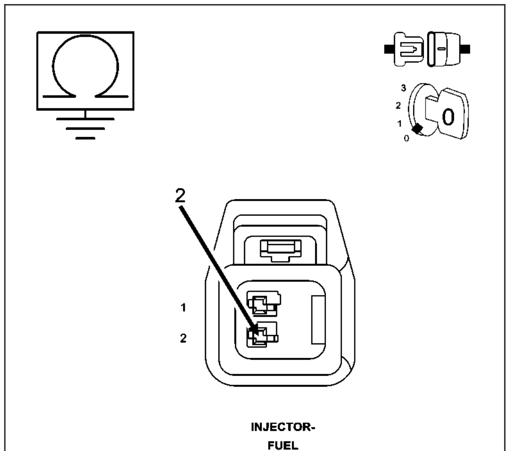
## 4. (K58) INJECTOR CONTROL NO.6 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K58) Injector Control No.6 circuit in the Injector harness connector.

**Is the resistance below 100 ohms?**



81654d74

**Yes** >> Repair the short to ground in the (K58) Injector Control No.6 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

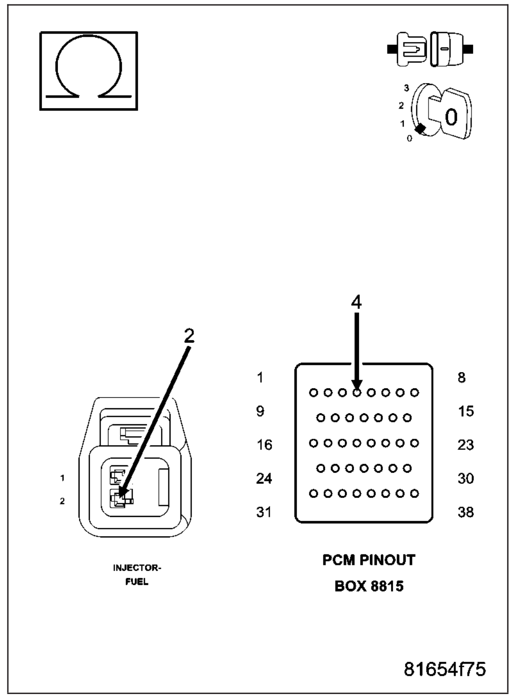
## 5. (K58) INJECTOR CONTROL NO.6 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K58) Injector Control No.6 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K58) Injector Control No.6 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0300-MULTIPLE CYLINDER MISFIRE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (F142) AND (A142) ASD RELAY OUTPUT CIRCUITS |
| INJECTOR CONTROL CIRCUIT |
| COIL CONTROL CIRCUIT |
| IGNITION WIRE |
| SPARK PLUG |
| IGNITION COIL |
| FUEL PUMP INLET STRAINER PLUGGED |
| RESTRICTED FUEL SUPPLY LINE |
| FUEL PUMP MODULE |
| FUEL PRESSURE LEAK DOWN |
| FUEL INJECTOR |
| ENGINE MECHANICAL PROBLEM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. CYLINDER MIS-FIRE CONDITION ACTIVE

**NOTE: Check for any TSB's that apply to a Misfire condition. Review the vehicle repair history for any misfire condition repairs that have been performed.**

Star the engine.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

**Is there a misfire present?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. VISUAL INSPECTION

**NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.**

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting

- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (A142) AND (F142) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Ignition Coil harness connector of the misfiring cylinders.

Disconnect the Fuel Injector harness connector of the misfiring cylinders.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Ignition Coil harness connector and the (F142) ASD Relay Output circuit in the Fuel Injector harness connector, while the relay is actuating.

**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the excessive resistance or short to ground in the (A142) or (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. IGNITION SYSTEM OPERATION

Turn the ignition off.

Connect the Ignition Coil harness connectors.

Remove the Ignition Coils.

Leave the Fuel Injector harness connector of the cylinder being tested disconnected.

Install a spark tester on the Ignition Coil.

While cranking the engine observe the spark coming from the spark tester.

**NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.**

**Is good spark present?**

**Yes** >> Go To 5

**No** >> Go To 14

**NOTE: Connect the Fuel Injector harness connector before continuing.**

## 5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

**NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.**

**Does the Spark Plug have any problems?**

**Yes** >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. FUEL PRESSURE CHECK

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Choose a conclusion that best matches your fuel pressure reading.**

**Within Specification**
Go To 7

**Below Specification**
Go To 12

**Above Specification**
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. FUEL PRESSURE LEAK DOWN

**NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair /replace as necessary.**

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death**

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

**NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

**NOTE: The pressure should not fall below 241 KPa (35 psi)**

**Does the gauge fall below the listed specification?**

**Yes** >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. FUEL INJECTOR OPERATION

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

**CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.**

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector for the cylinder that indicated the misfire.

Monitor the fuel pressure gauge.

**Does the fuel pressure gauge indicate a drop in fuel pressure?**

**Yes** >> Go To 9

**No** >> Go To 10

**NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.**

## 9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

CAM LOBES - must not be worn excessively

CYLINDER LEAKAGE TEST - must be within specifications

VALVE SPRINGS - cannot be weak or broken

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 17

## 10. FUEL INJECTOR

Turn the ignition off.

Disconnect the Fuel Injector harness connector of the misfiring cylinder.

Ignition on, engine not running.

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

With the scan tool, erase DTCs.

Using a 12-volt test light connected to 12-volts, probe the Injector Control circuit.

With the scan tool, actuate the Fuel Injector.

**Does the test light blink/flicker?**

**Yes** >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11

## 11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.

Disconnect the Fuel Injector harness connector.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Check the Injector Control circuit for an open, short to ground, and short to voltage.

**Was a problem found with the Injector Control circuit?**

**Yes** >> Repair the excessive resistance or short in the Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 17

## 12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Is the fuel pressure within specification?**

**Yes** >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. FUEL PUMP INLET STRAINER

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

**Is the Fuel Inlet Strainer plugged?**

**Yes** >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is operating properly. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 14. IGNITION WIRE

**NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.**
Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

**Is the resistance below 10K ohms?**

**Yes** >> Go To 15

**No** >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay or ASD Relay.

Using a 12-volt test light connected to 12-volts, probe the Ignition Coil Control circuit.

Crank the engine for 5 second while observing the test light.

**NOTE: The primary resistance of the 3.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).**

**Does the test light brightly blink/flicker?**

**Yes** >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. COIL CONTROL CIRCUIT

Turn the ignition off.

Disconnect the Ignition Coil harness connector.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**
Check the Coil Control circuit for an open, short to ground, and short to voltage.

**Was a problem found with the Coil Control circuit?**

**Yes** >> Repair the Coil Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 17

## 17. PCM

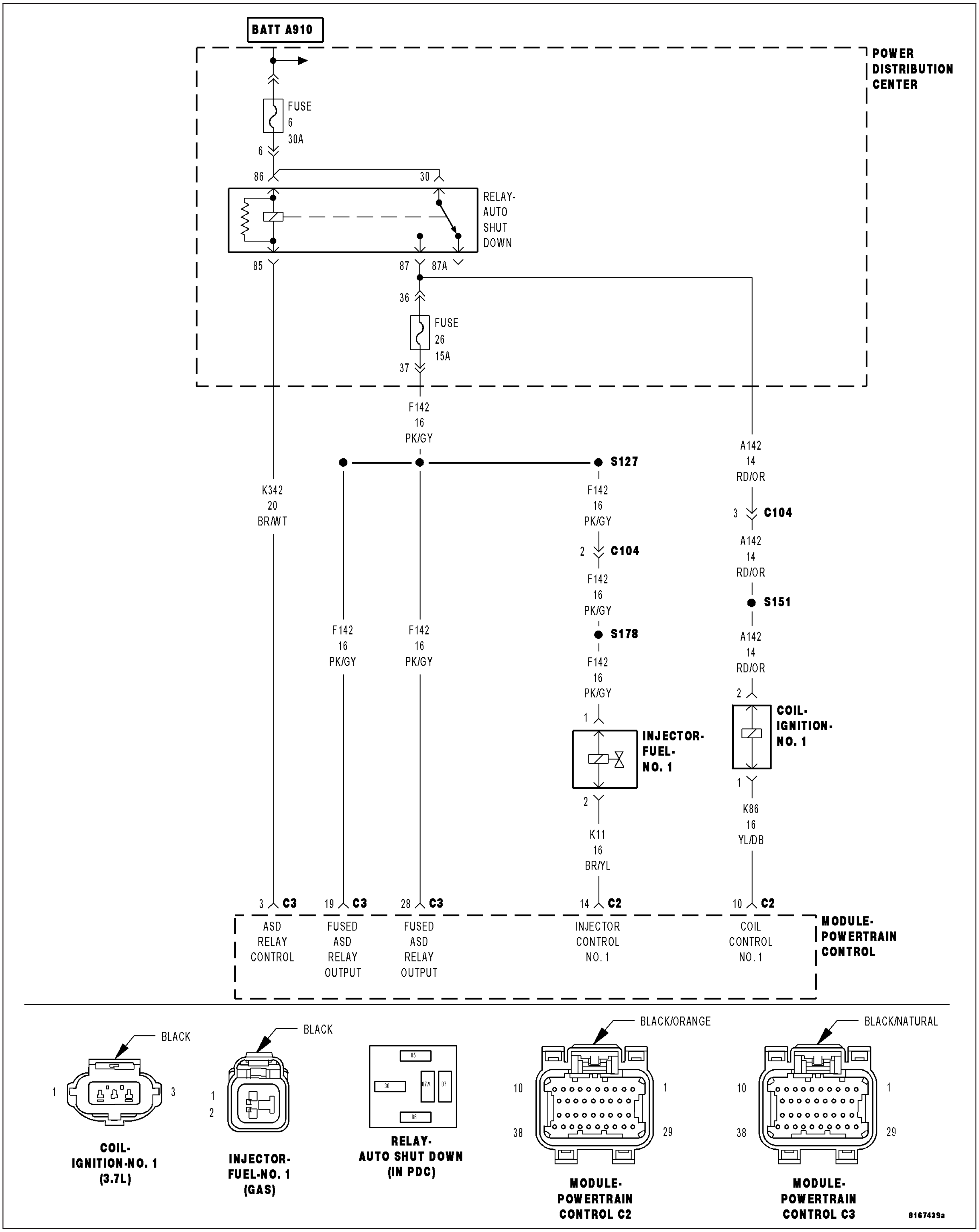
**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0301-CYLINDER 1 MISFIRE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (A142) AND (F142) ASD RELAY OUTPUT CIRCUIT |
| (K11) INJECTOR CONTROL NO.1 CIRCUIT |
| (K86) COIL CONTROL NO.1 CIRCUIT |
| IGNITION WIRE |
| SPARK PLUG |
| IGNITION COIL |
| FUEL PUMP INLET STRAINER PLUGGED |
| RESTRICTED FUEL SUPPLY LINE |
| FUEL PUMP MODULE |
| FUEL PRESSURE LEAK DOWN |
| FUEL INJECTOR |
| ENGINE MECHANICAL PROBLEM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

**Is there a misfire present at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. VISUAL INSPECTION

**NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.**

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.

- Internal engine component failures.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (A142) AND (F142) ASD RELAY OUTPUT CIRCUITS

Turn the ignition off.

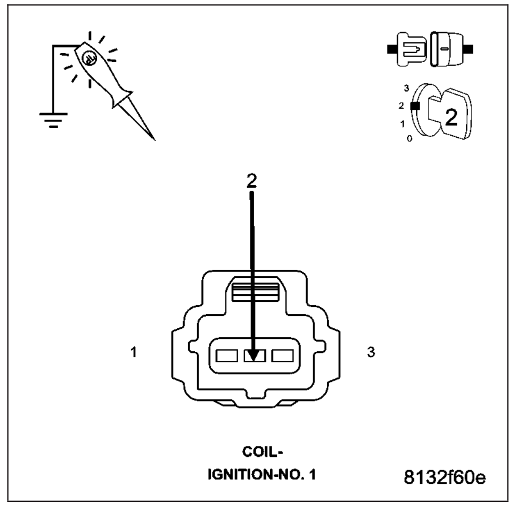
Disconnect the Ignition Coil No.1 harness connector.

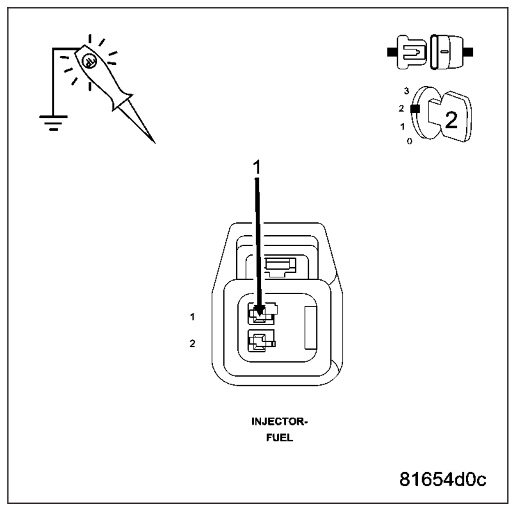
Disconnect the Fuel Injector No.1 harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Ignition Coil harness connector and the (F142) ASD Relay Output circuit in the Fuel Injector harness connector, while the relay is actuating.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the excessive resistance or short to ground in the (A142) or (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. IGNITION SYSTEM OPERATION

Turn the ignition off.

Connect the Ignition Coil No.1 harness connector.

Remove the Ignition Coil.

Leave the Fuel Injector harness connector of the cylinder being tested disconnected.

Install a spark tester on the Ignition Coil.

While cranking the engine observe the spark coming from the spark tester.

**NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.**

**Is good spark present?**

**Yes** >> Go To 5

**No** >> Go To 14

**NOTE: Connect the Fuel Injector harness connector before continuing.**

## 5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

**NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.**

**Were any of the above conditions present?**

**Yes** >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. FUEL PRESSURE CHECK

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Choose a conclusion that best matches your fuel pressure reading.**

**Within Specification**
Go To 7

**Below Specification**
Go To 12

**Above Specification**
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. FUEL PRESSURE LEAK DOWN

**NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.**

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death**

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

**NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

**NOTE: The pressure should not fall below 241 KPa (35 psi).**

**Does the gauge fall below the listed specification?**

**Yes** >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. FUEL INJECTOR OPERATION

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

**CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.**

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.1 Fuel Injector.

Monitor the fuel pressure gauge.

**Does the fuel pressure gauge indicate a drop in fuel pressure?**

**Yes** >> Go To 9

**No** >> Go To 10

**NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.**

## 9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

CAM LOBES - must not be worn excessively

CYLINDER LEAKAGE TEST - must be within specifications

VALVE SPRINGS - cannot be weak or broken

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 10. FUEL INJECTOR

Turn the ignition off.

Disconnect the No.1 Fuel Injector harness connector.

Ignition on, engine not running.

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

With the scan tool, erase DTCs.

Using a 12-volt test light connected to 12-volts, probe the (K11) Injector Control No.1 circuit.

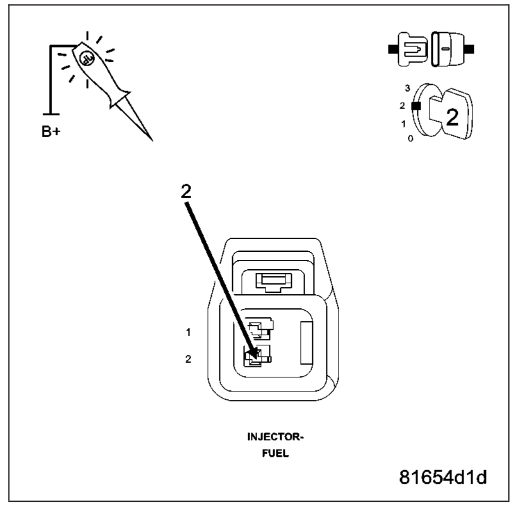
With the scan tool, actuate the Fuel Injector.

**Does the test light blink/flicker?**

**Yes** >> Replace the Fuel Injector.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11




## 11. (K11) INJECTOR CONTROL NO.1 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

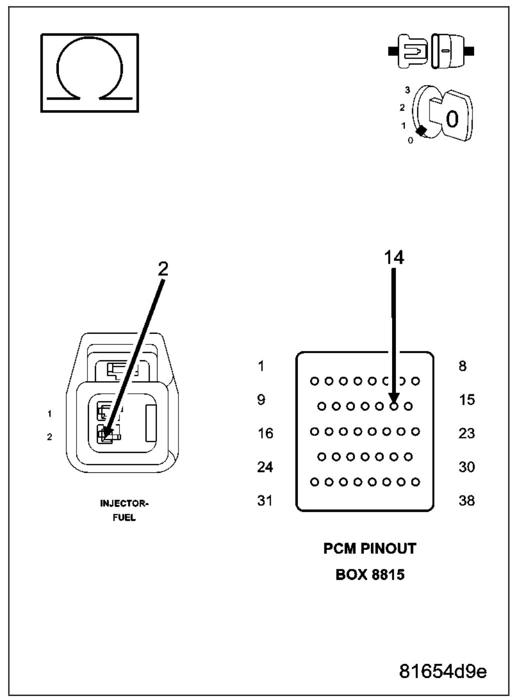
Check the (K11) Injector Control No.1 circuit for an open, short to ground, and short to voltage.

**Was a problem found with the (K11) Injector Control No.1 circuit?**

**Yes** >> Repair the excessive resistance or short in the (K11) Injector Control No.1 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

**No** >> Go To 16




## 12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Is the fuel pressure within specification?**

**Yes** >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. FUEL PUMP INLET STRAINER

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

**Is the Fuel Inlet Strainer plugged?**

**Yes** >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is operating properly. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 14. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K86) Coil Control No.1 circuit.

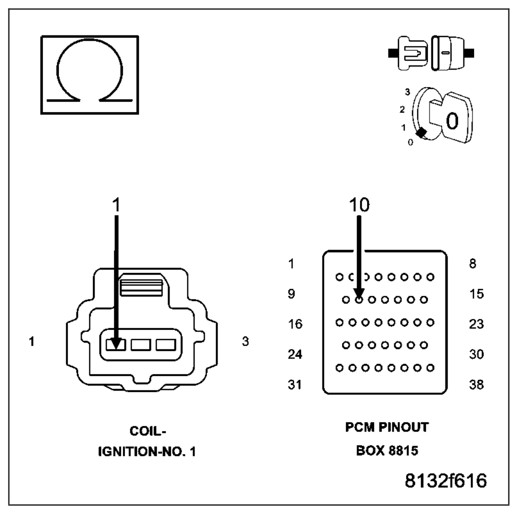
Crank the engine for 5 second while observing the test light.

**NOTE: The primary resistance of the 3.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).**

**Does the test light brightly blink/flicker?**

**Yes** >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 15



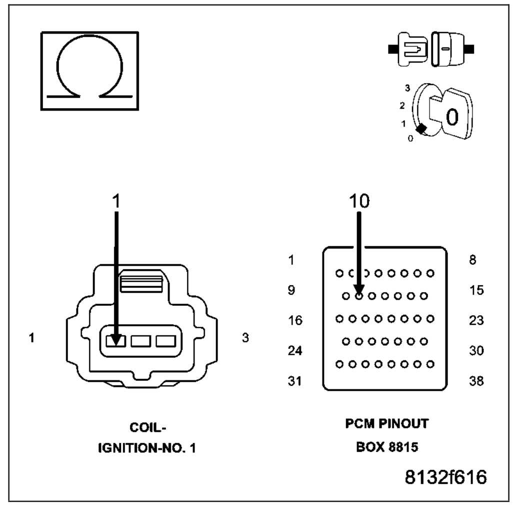
## 15. (K86) COIL CONTROL NO.1 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Check the (K86) Coil Control No.1 circuit for an open, short to ground, and short to voltage.




**Was a problem found with the (K86) Coil Control No.1 circuit?**

**Yes** >> Repair the (K86) Coil Control No.1 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

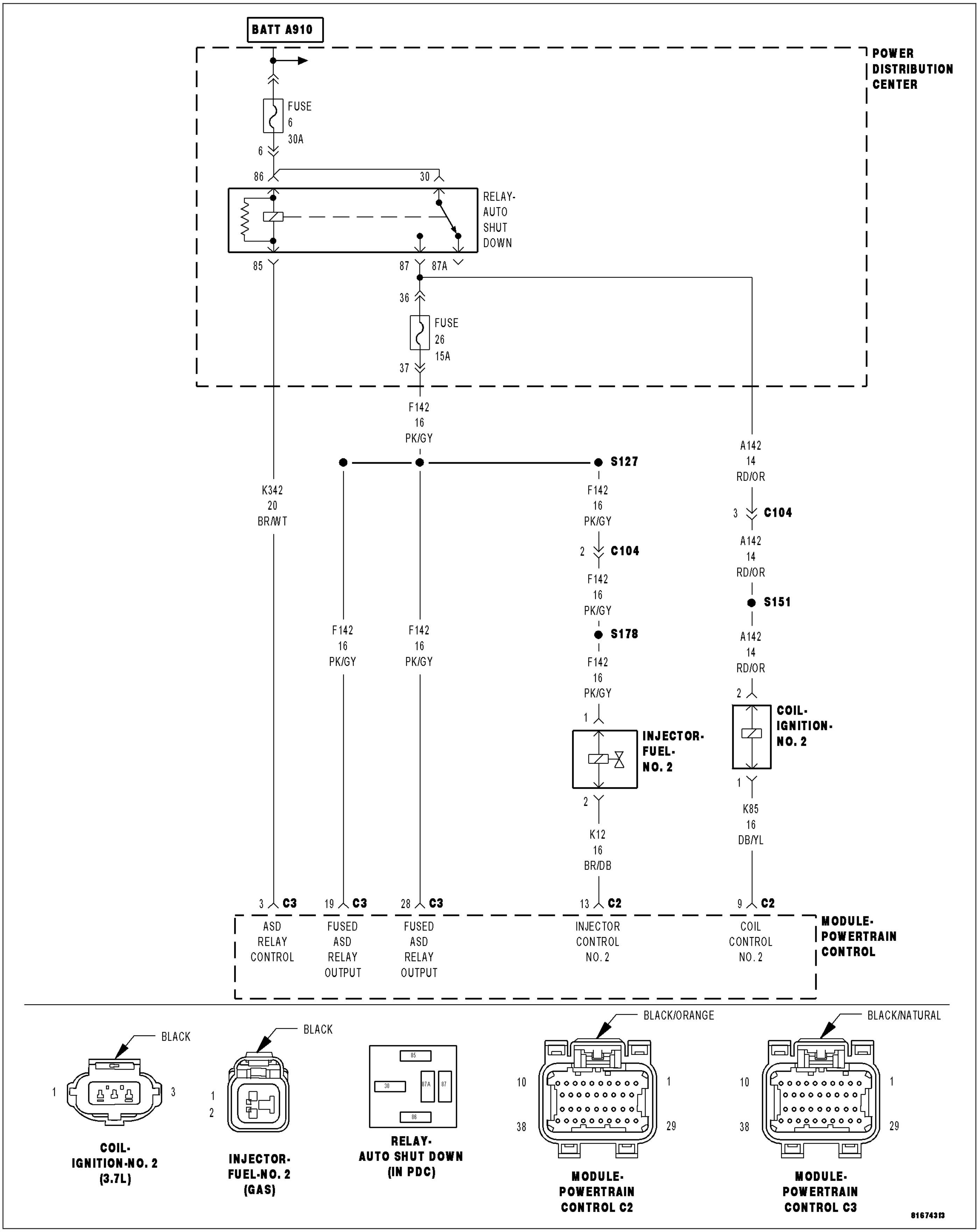
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0302-CYLINDER 2 MISFIRE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (A142) AND (F142) ASD RELAY OUTPUT CIRCUIT |
| (K12) INJECTOR CONTROL NO.2 CIRCUIT |
| (K85) COIL CONTROL NO.2 CIRCUIT |
| IGNITION WIRE |
| SPARK PLUG |
| IGNITION COIL |
| FUEL PUMP INLET STRAINER PLUGGED |
| RESTRICTED FUEL SUPPLY LINE |
| FUEL PUMP MODULE |
| FUEL PRESSURE LEAK DOWN |
| FUEL INJECTOR |
| ENGINE MECHANICAL PROBLEM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with the scan tool.

**Is there a misfire present?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. VISUAL INSPECTION

**NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.**

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.

- Internal engine component failures.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (A142) AND (F142) ASD RELAY OUTPUT CIRCUITS

Turn the ignition off.

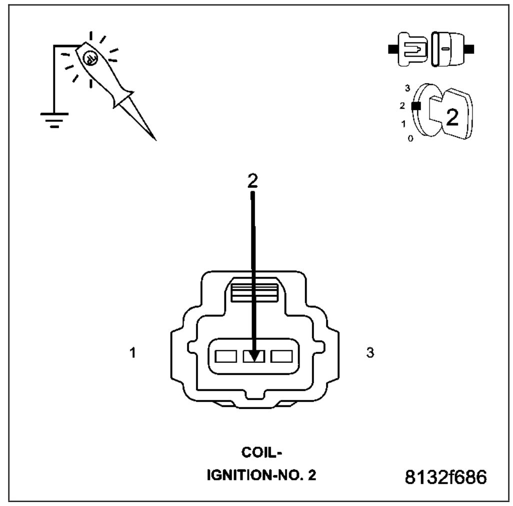
Disconnect the Ignition Coil No.2 harness connector.

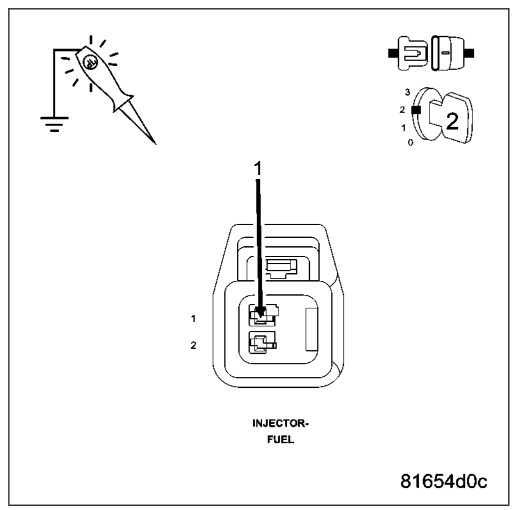
Disconnect the Fuel Injector No.2 harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Ignition Coil harness connector and (F142) ASD Relay Output circiut in the Fuel Injector harness connector, while the relay is actuating.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the excessive resistance or short to ground in the (A142) or (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. IGNITION SYSTEM OPERATION

Turn the ignition off.

Connect the Ignition Coil No.2 harness connector.

Remove the Ignition Coil.

Leave the Fuel Injector harness connector of the cylinder being tested disconnected.

Install a spark tester on the Ignition Coil.

While cranking the engine observe the spark coming from the spark tester.

**NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.**

**Is good spark present?**

**Yes** >> Go To 5

**No** >> Go To 14

**NOTE: Connect the Fuel Injector harness connector before continuing.**

## 5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

**NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.**

**Were any of the above conditions present?**

**Yes** >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. FUEL PRESSURE CHECK

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Choose a conclusion that best matches your fuel pressure reading.**

**Within Specification**
Go To 7

**Below Specification**
Go To 12

**Above Specification**
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. FUEL PRESSURE LEAK DOWN

**NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.**

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

**NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

**NOTE: The pressure should not fall below 241 KPa (35 psi)**

**Does the gauge fall below the listed specification?**

**Yes** >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. FUEL INJECTOR OPERATION

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

**CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.**

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using scan tool, actuate the No.2 Fuel Injector.

Monitor the fuel pressure gauge.

**Does the fuel pressure gauge indicate a drop in fuel pressure?**

**Yes** >> Go To 9

**No** >> Go To 10

**NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.**

## 9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

CAM LOBES - must not be worn excessively

CYLINDER LEAKAGE TEST - must be within specifications

VALVE SPRINGS - cannot be weak or broken

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 10. FUEL INJECTOR

Turn the ignition off.

Disconnect the No.2 Fuel Injector harness connector.

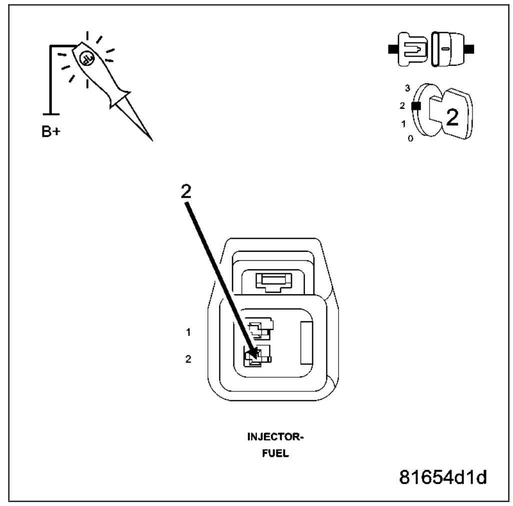
Ignition on, engine not running.

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

With the scan tool, erase DTCs.

Using a 12-volt test light connected to 12-volts, probe the (K12) Injector Control No.2 circuit.

With the scan tool, actuate the Fuel Injector.




**Does the test light blink/flicker?**

**Yes** >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11

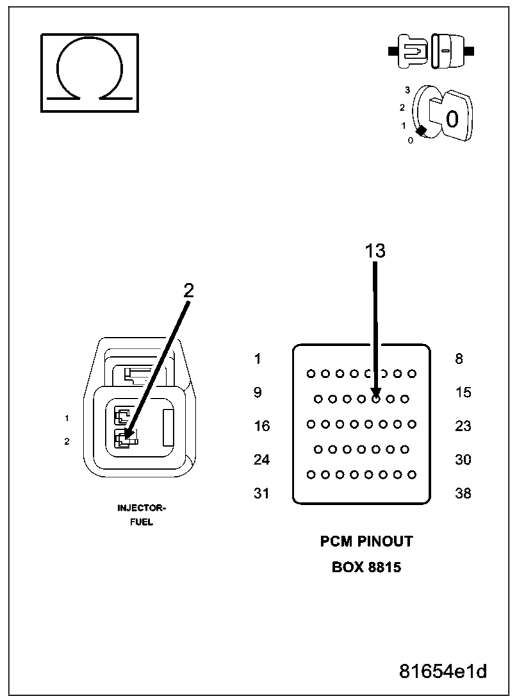
## 11. (K12) INJECTOR CONTROL NO.2 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Check the (K12) Injector Control No.2 circuit for an open, short to ground, and short to voltage.




**Was a problem found with the (K12) Injector Control No.2 circuit?**

**Yes** >> Repair the excessive resistance or short in the (K12) Injector Control No.2 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Is the fuel pressure within specification?**

**Yes** >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. FUEL PUMP INLET STRAINER

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

**Is the Fuel Inlet Strainer plugged?**

**Yes** >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Ensure the ground circuit is operating properly. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

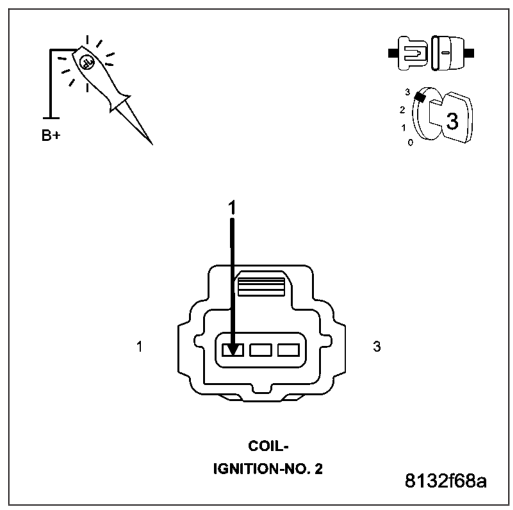
## 14. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K85) Coil Control No.2 circuit.

Crank the engine for 5 second while observing the test light.




**NOTE: The primary resistance of the 3.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).**

**Does the test light brightly blink/flicker?**

**Yes** >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 15

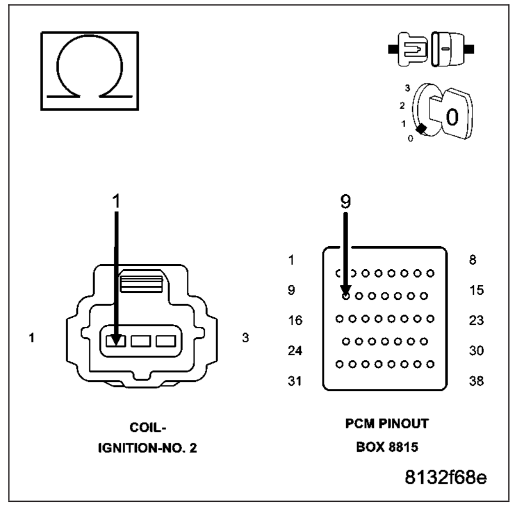
## 15. (K85) COIL CONTROL NO.2 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Check the (K85) Coil Control No.2 circuit for an open, short to ground, and short to voltage.




**Was a problem found with the (K85) Coil Control No.2 circuit?**

**Yes** >> Repair the (K85) Coil Control No.2 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

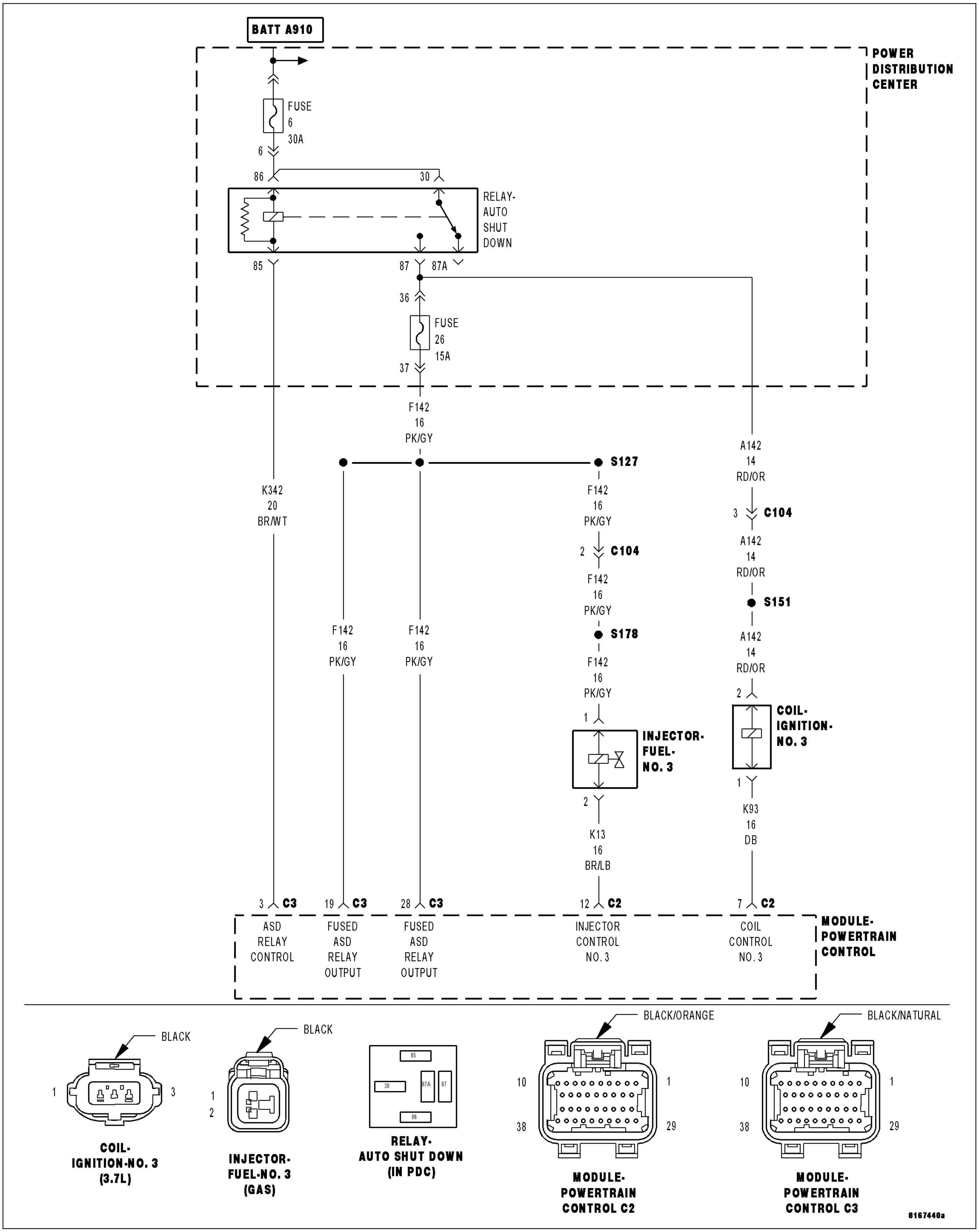
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0303-CYLINDER 3 MISFIRE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (A142) AND (F142) ASD RELAY OUTPUT CIRCUIT |
| (K13) INJECTOR CONTROL NO.3 CIRCUIT |
| (K93) COIL CONTROL NO.3 CIRCUIT |
| IGNITION WIRE |
| SPARK PLUG |
| IGNITION COIL |
| FUEL PUMP INLET STRAINER PLUGGED |
| RESTRICTED FUEL SUPPLY LINE |
| FUEL PUMP MODULE |
| FUEL PRESSURE LEAK DOWN |
| FUEL INJECTOR |
| ENGINE MECHANICAL PROBLEM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with the scan tool.

**Is there a misfire present at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. VISUAL INSPECTION

**NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.**

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.

- Internal engine component failures.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (A142) AND (F142) ASD RELAY OUTPUT CIRCUITS

Turn the ignition off.

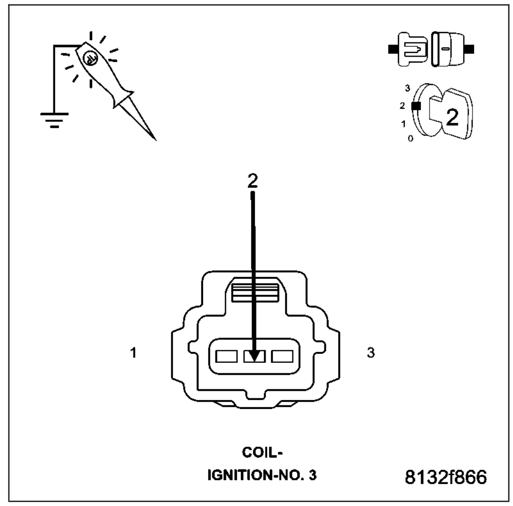
Disconnect the No.3 Ignition Coil harness connector.

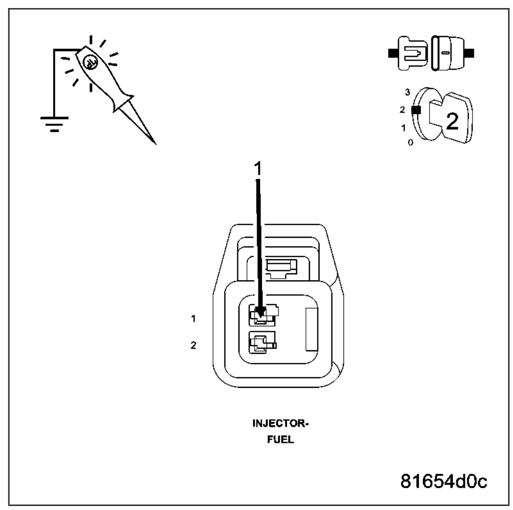
Disconnect the No.3 Fuel Injector harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Ignition Coil harness connector and (F142) ASD Relay Output circuit in the Fuel Injector harness connector, while the relay is actuating.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the excessive resistance or short to ground in the (A142) or (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. IGNITION SYSTEM OPERATION

Turn the ignition off.

Connect the Ignition Coil No.3 harness connector.

Remove the Ignition Coil.

Leave the Fuel Injector harness connector of the cylinder being tested disconnected.

Install a spark tester on the Ignition Coil.

While cranking the engine observe the spark coming from the spark tester.

**NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.**

**Is good spark present?**

**Yes** >> Go To 5

**No** >> Go To 14

**NOTE: Connect the Fuel Injector harness connector before continuing.**

## 5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

**NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.**

**Were any of the above conditions present?**

**Yes** >> Replace the Spark Plug.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. FUEL PRESSURE CHECK

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Choose a conclusion that best matches your fuel pressure reading.**

**Within Specification**

Go To 7

**Below Specification**

Go To 12

**Above Specification**

Replace the fuel filter/pressure regulator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. FUEL PRESSURE LEAK DOWN

**NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.**

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death**

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

**NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

**NOTE: The pressure should not fall below 241 KPa (35 psi).**

**Does the gauge fall below the listed specification?**

**Yes** >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. FUEL INJECTOR OPERATION

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

**CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.**

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using a scan tool, actuate the No.3 Fuel Injector.

Monitor the fuel pressure gauge.

**Does the fuel pressure gauge indicate a drop in fuel pressure?**

**Yes** >> Go To 9

**No** >> Go To 10

**NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.**

## 9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

CAM LOBES - must not be worn excessively

CYLINDER LEAKAGE TEST - must be within specifications

VALVE SPRINGS - cannot be weak or broken

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 10. FUEL INJECTOR

Turn the ignition off.

Disconnect the No.3 Fuel Injector harness connector.

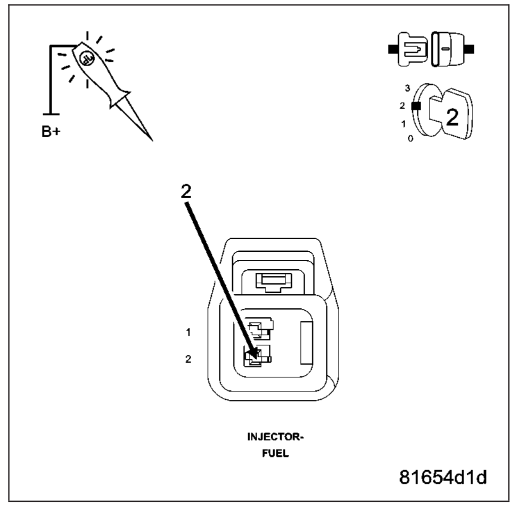
Ignition on, engine not running.

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

With the scan tool, erase DTCs.

Using a 12-volt test light connected to 12-volts, probe the (K13) Injector Control No.3 circuit.

With the scan tool, actuate the Fuel Injector.




**Does the test light blink/flicker?**

**Yes** >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11

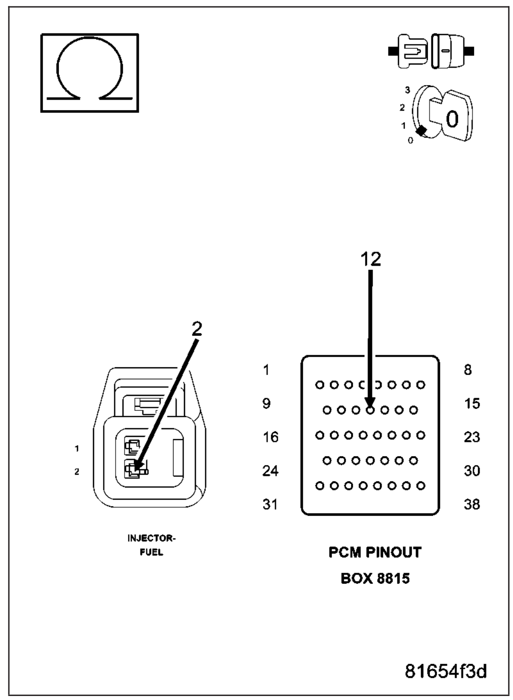
## 11. (K13) INJECTOR CONTROL NO.3 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Check the (K13) Injector Control No.3 circuit for an open, short to ground, and short to voltage.




**Was a problem found with the (K13) Injector Control No.3 circuit?**

**Yes** >> Repair the excessive resistance or short in the (K13) Injector Control No.3 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Is the fuel pressure within specification?**

**Yes** >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. FUEL PUMP INLET STRAINER

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

**Is the Fuel Inlet Strainer plugged?**

**Yes** >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is operating properly. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 14. IGNITION COIL

Disconnect the No.3 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K93) Coil Control No.3 circuit.

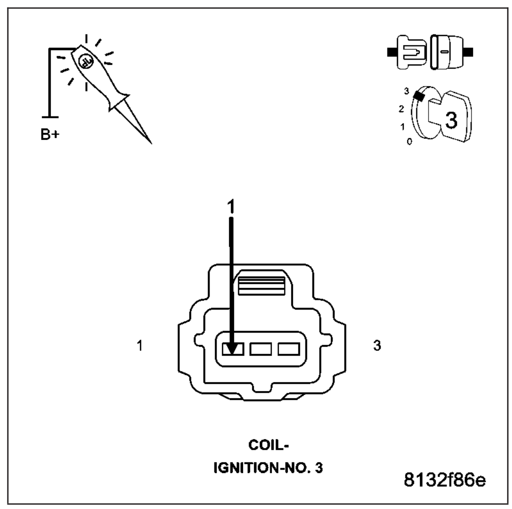
Crank the engine for 5 second while observing the test light.

**NOTE: The primary resistance of the 3.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).**

**Does the test light brightly blink/flicker?**

**Yes** >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 15




## 15. (K93) COIL CONTROL NO.3 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Check the (K93) Coil Control No.3 circuit for an open, short to ground, and short to voltage.

**Was a problem found with the (K93) Coil Control No.3 circuit?**

**Yes** >> Repair the (K93) Coil Control No.3 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

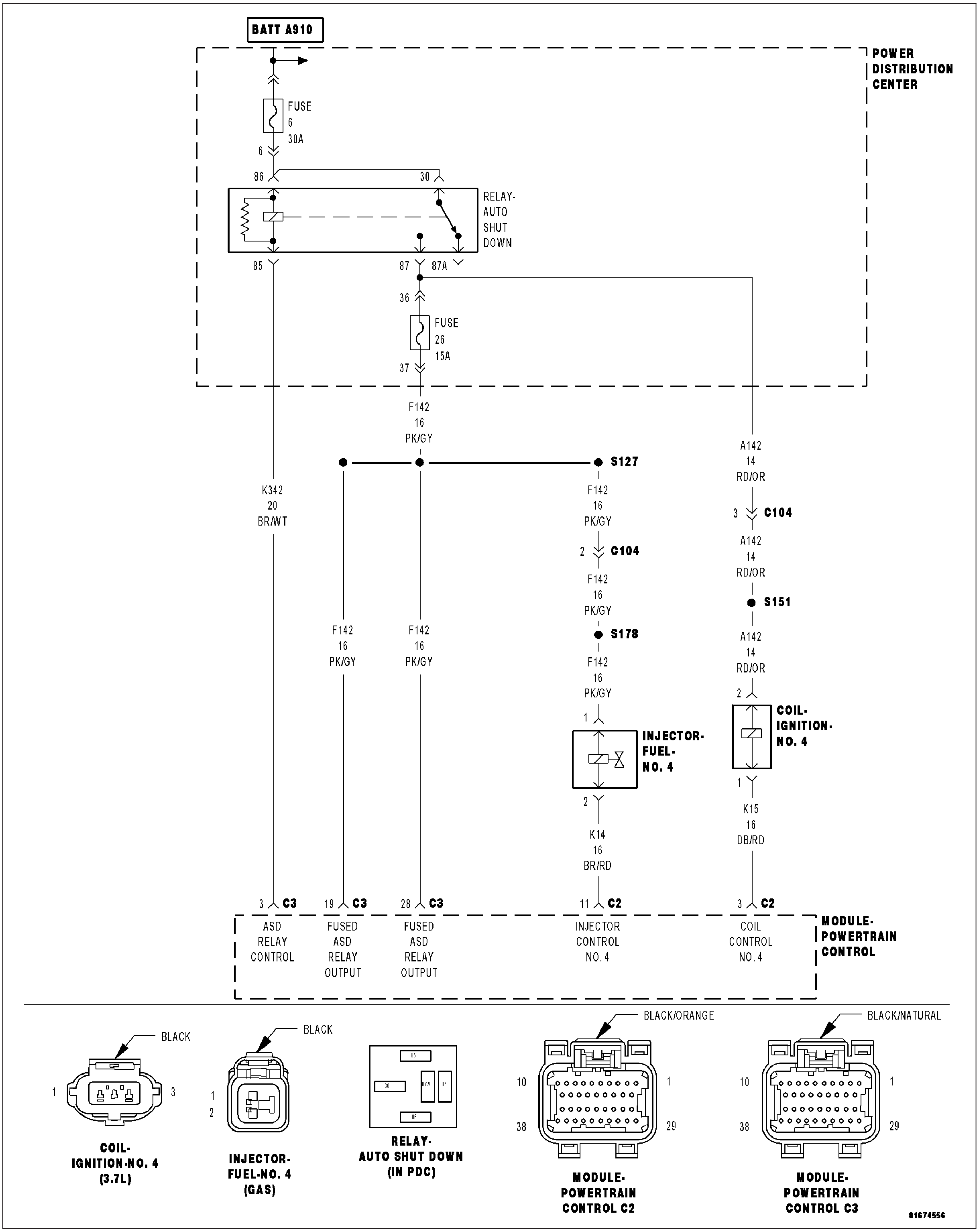
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P0304-CYLINDER 4 MISFIRE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (A142) AND (F142) ASD RELAY OUTPUT CIRCUIT |
| (K14) INJECTOR CONTROL NO.4 CIRCUIT |
| (K15) COIL CONTROL NO.4 CIRCUIT |
| IGNITION WIRE |
| SPARK PLUG |
| IGNITION COIL |
| FUEL PUMP INLET STRAINER PLUGGED |
| RESTRICTED FUEL SUPPLY LINE |
| FUEL PUMP MODULE |
| FUEL PRESSURE LEAK DOWN |
| FUEL INJECTOR |
| ENGINE MECHANICAL PROBLEM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with the scan tool.

**Is there a misfire present at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. VISUAL INSPECTION

**NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.**

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.

- Internal engine component failures.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (A142) AND (F142) ASD RELAY OUTPUT CIRCUITS

Turn the ignition off.

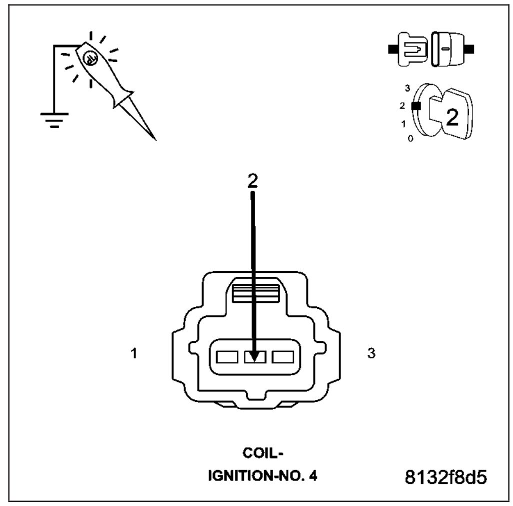
Disconnect the No.4 Ignition Coil harness connector.

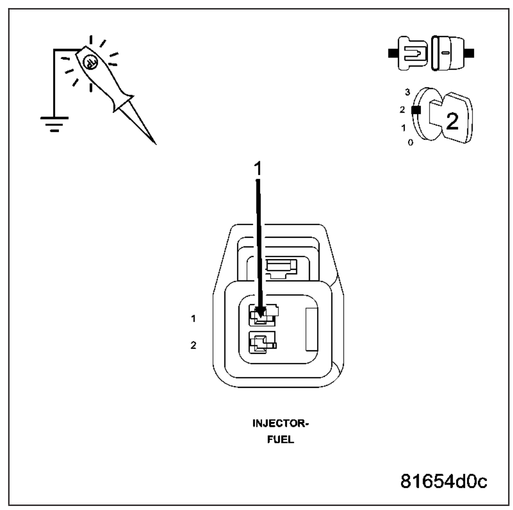
Disconnect the No.4 Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Ignition Coil harness connector and the (F142) ASD Relay Output circuit in the Fuel Injector harness connector, while the relay is actuating.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the excessive resistance or short to ground in the (A142) or (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. IGNITION SYSTEM OPERATION

Turn the ignition off.

Connect the No.4 Ignition Coil harness connector.

Remove the No.4 Ignition Coil.

Leave the Fuel Injector harness connector of the cylinder being tested disconnected.

Install a spark tester on the Ignition Coil.

While cranking the engine observe the spark coming from the spark tester.

**NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.**

**Is good spark present?**

**Yes** >> Go To 5

**No** >> Go To 14

**NOTE: Connect the Fuel Injector harness connector before continuing.**

## 5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

**NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.**

**Were any of the above conditions present?**

**Yes** >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. FUEL PRESSURE CHECK

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Choose a conclusion that best matches your fuel pressure reading.**

**Within Specification**
Go To 7

**Below Specification**
Go To 12

**Above Specification**
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. FUEL PRESSURE LEAK DOWN

**NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.**

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death**

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

**NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

**NOTE: The pressure should not fall below 241 KPa (35 psi)**

**Does the gauge fall below the listed specification?**

**Yes** >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. FUEL INJECTOR OPERATION

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

**CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.**

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.4 Fuel Injector.

Monitor the fuel pressure gauge.

**Does the fuel pressure gauge indicate a drop in fuel pressure?**

**Yes** >> Go To 9

**No** >> Go To 10

**NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.**

## 9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

CAM LOBES - must not be worn excessively

CYLINDER LEAKAGE TEST - must be within specifications

VALVE SPRINGS - cannot be weak or broken

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 10. FUEL INJECTOR

Turn the ignition off.

Disconnect the No.4 Fuel Injector harness connector.

Ignition on, engine not running.

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

With the scan tool, erase DTCs.

Using a 12-volt test light connected to 12-volts, probe the (K14) Injector Control No.4 circuit.

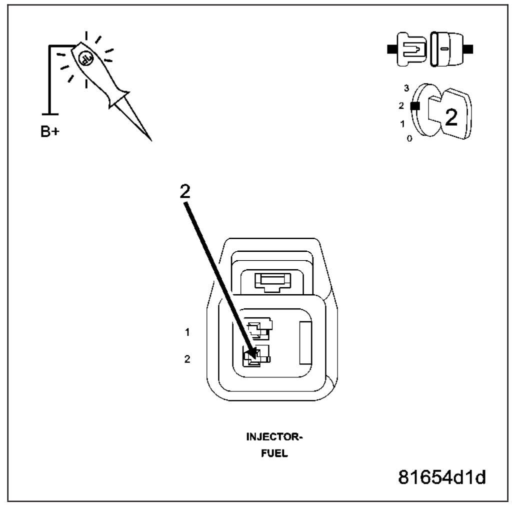
With the scan tool, actuate the Fuel Injector.

**Does the test light blink/flicker?**

**Yes** >> Replace the Fuel Injector.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11




## 11. (K14) INJECTOR CONTROL NO.4 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

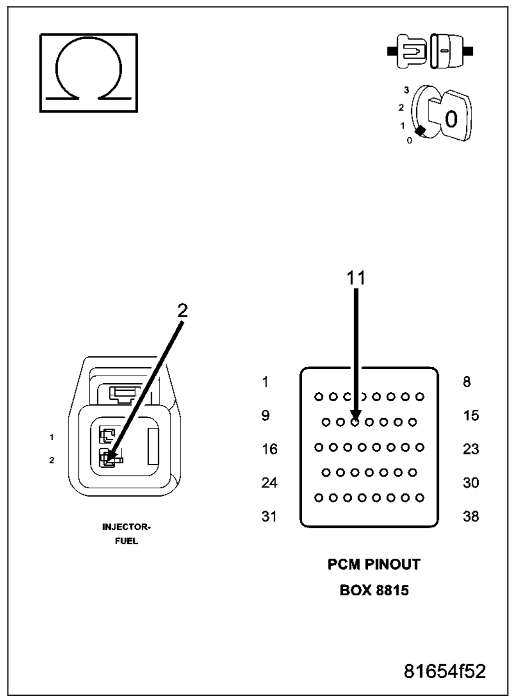
Check the (K14) Injector Control No.4 circuit for an open, short to ground, and short to voltage.

**Was a problem found with the (K14) Injector Control No.4 circuit?**

**Yes** >> Repair the excessive resistance or short in the (K14) Injector Control No.4 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16




## 12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Is the fuel pressure within specification?**

**Yes** >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. FUEL PUMP INLET STRAINER

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

**Is the Fuel Inlet Strainer plugged?**

**Yes** >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is operating properly. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 14. IGNITION COIL

Disconnect the No.4 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K15) Coil Control No.4 circuit.

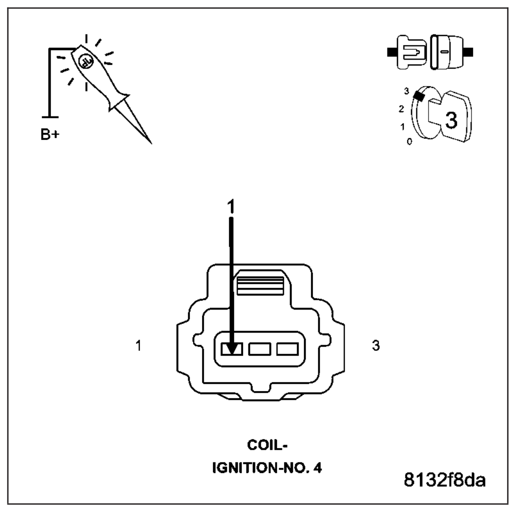
Crank the engine for 5 second while observing the test light.

**NOTE: The primary resistance of the 3.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).**

**Does the test light brightly blink/flicker?**

**Yes** >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 15



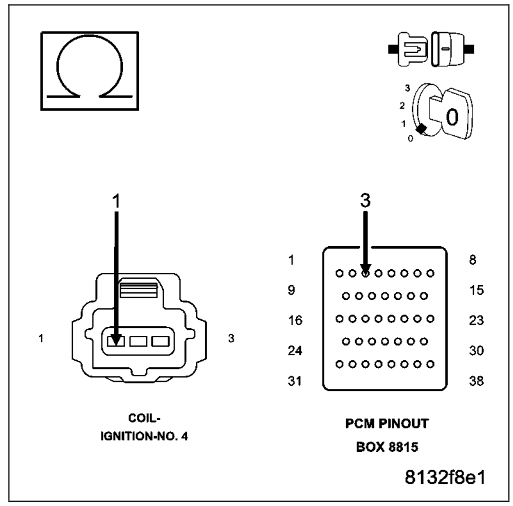
## 15. (K15) COIL CONTROL NO.4 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Check the (K15) Coil Control No.4 circuit for an open, short to ground, and short to voltage.




**Was a problem found with the (K15) Coil Control No.4 circuit?**

**Yes** >> Repair the (K15) Coil Control No.4 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

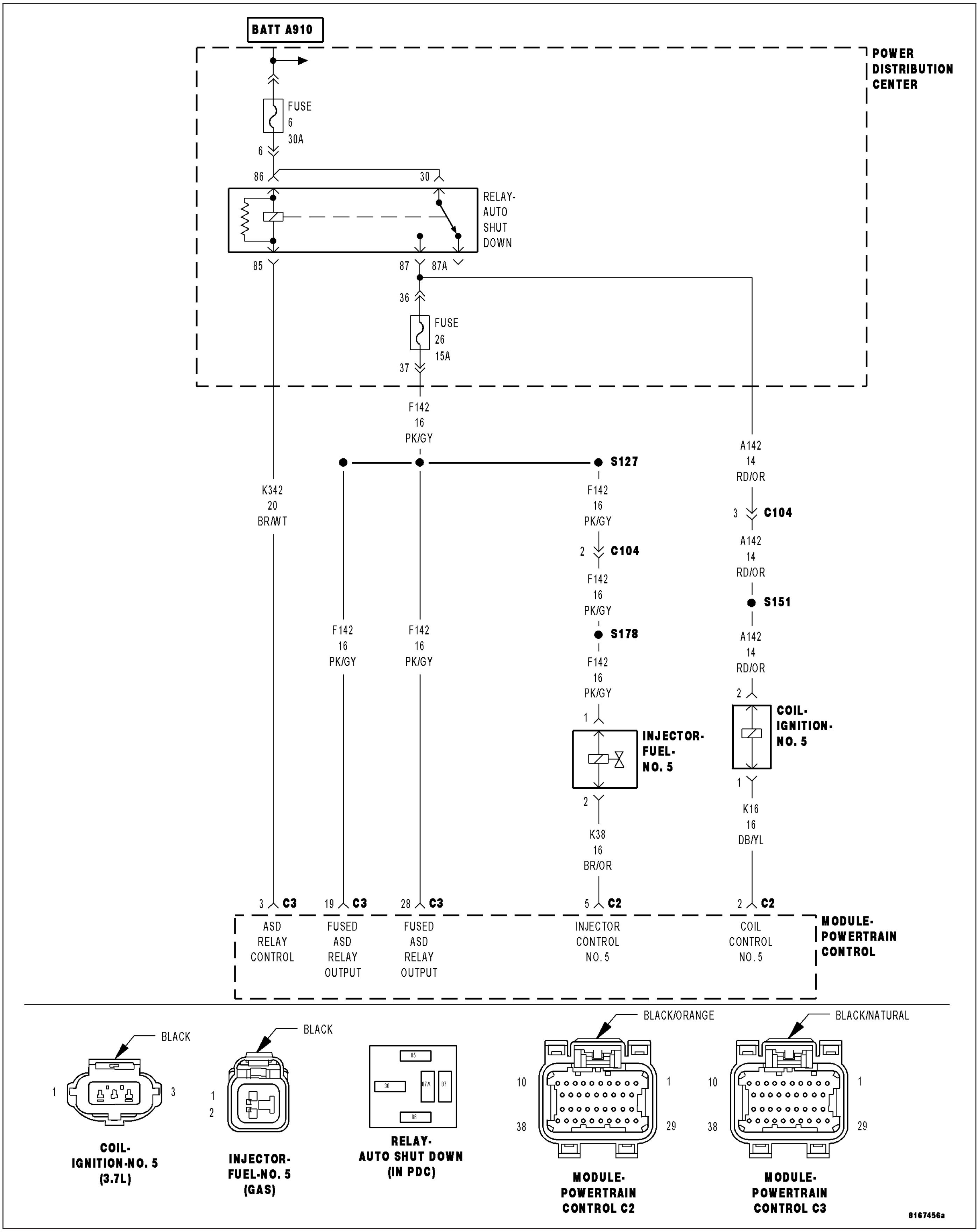
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0305-CYLINDER 5 MISFIRE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (A142) AND (F142) ASD RELAY OUTPUT CIRCUIT |
| (K38) INJECTOR CONTROL NO.5 CIRCUIT |
| (K16) COIL CONTROL NO.5 CIRCUIT |
| IGNITION WIRE |
| SPARK PLUG |
| IGNITION COIL |
| FUEL PUMP INLET STRAINER PLUGGED |
| RESTRICTED FUEL SUPPLY LINE |
| FUEL PUMP MODULE |
| FUEL PRESSURE LEAK DOWN |
| FUEL INJECTOR |
| ENGINE MECHANICAL PROBLEM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with a scan tool.

**Is there a misfire present at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. VISUAL INSPECTION

**NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.**

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.

- Internal engine component failures.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (A142) AND (F142) ASD RELAY OUTPUT CIRCUITS

Turn the ignition off.

Disconnect the No.5 Ignition Coil harness connector.

Disconnect the No.5 Fuel Injector harness connector.

Ignition on, engine not running.

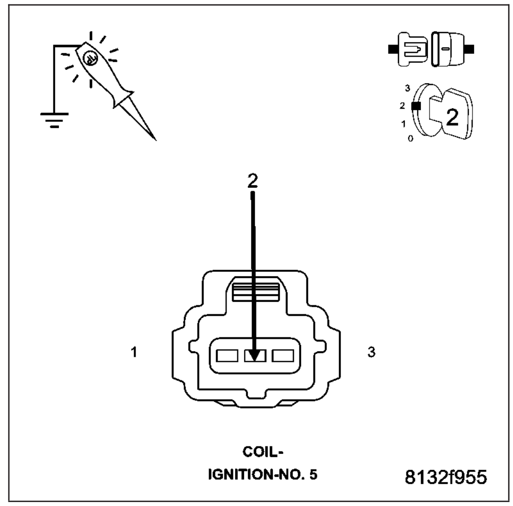
With the scan tool, actuate the ASD Relay.

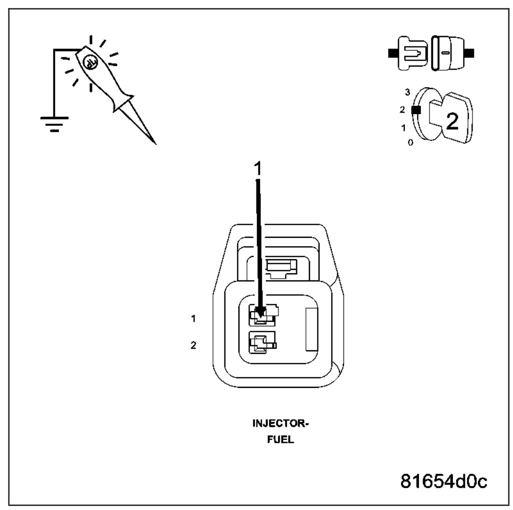
Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Ignition Coil harness connector and the (F142) ASD Relay Output circuit in the Fuel Injector harness connector, while the relay is actuating.

**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the excessive resistance or short to ground in the (A142) or (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




## 4. IGNITION SYSTEM OPERATION

Turn the ignition off.

Connect the Ignition Coil No.5 harness connector.

Remove the Ignition Coil.

Leave the Fuel Injector harness connector of the cylinder being tested disconnected.

Install a spark tester on the Ignition Coil.

While cranking the engine observe the spark coming from the spark tester.

**NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.**

**Is good spark present?**

**Yes** >> Go To 5

**No** >> Go To 14

**NOTE: Connect the Fuel Injector harness connector before continuing.**

## 5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

**NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.**

**Were any of the above conditions present?**

**Yes** >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. FUEL PRESSURE CHECK

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Choose a conclusion that best matches your fuel pressure reading.**

**Within Specification**
Go To 7

**Below Specification**
Go To 12

**Above Specification**
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. FUEL PRESSURE LEAK DOWN

**NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.**

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

**NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

**NOTE: The pressure should not fall below 241 KPa (35 psi).**

**Does the gauge fall below the listed specification?**

**Yes** >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. FUEL INJECTOR OPERATION

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

**CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.**

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.5 Fuel Injector.

Monitor the fuel pressure gauge.

**Does the fuel pressure gauge indicate a drop in fuel pressure?**

**Yes** >> Go To 9

**No** >> Go To 10

**NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.**

## 9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

CAM LOBES - must not be worn excessively

CYLINDER LEAKAGE TEST - must be within specifications

VALVE SPRINGS - cannot be weak or broken

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 10. FUEL INJECTOR

Turn the ignition off.

Disconnect the No.5 Fuel Injector harness connector.

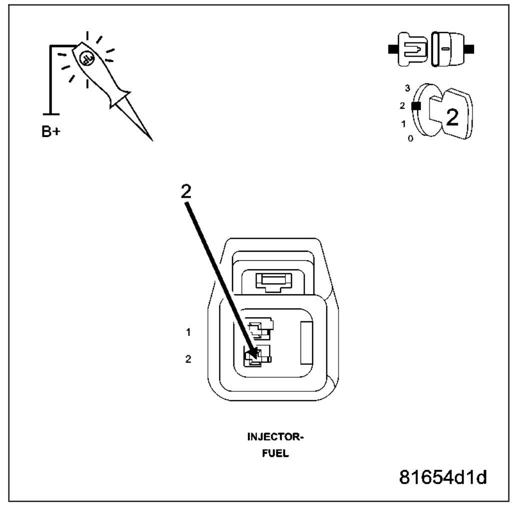
Ignition on, engine not running.

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

With the scan tool, erase DTCs.

Using a 12-volt test light connected to 12-volts, probe the (K38) Injector Control No.5 circuit.

With the scan tool, actuate the Fuel Injector.




**Does the test light blink/flicker?**

**Yes** >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11

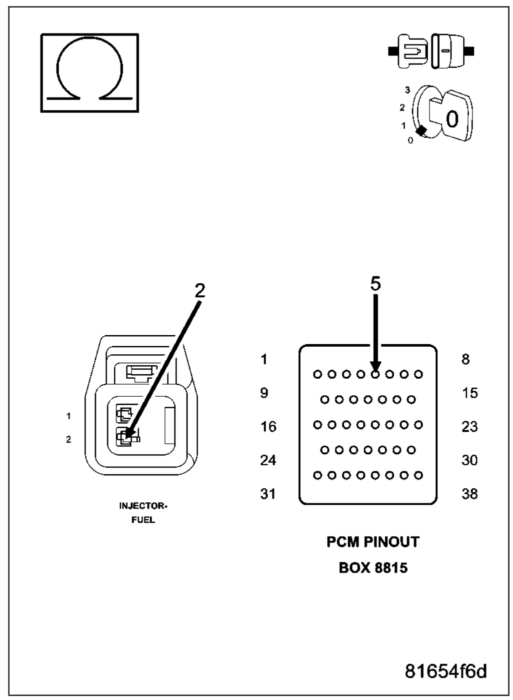
## 11. (K38) INJECTOR CONTROL NO.5 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Check the (K38) Injector Control No.5 circuit for an open, short to ground, and short to voltage.




**Was a problem found with the (K38) Injector Control No.5 circuit?**

**Yes** >> Repair the excessive resistance or short in the (K38) Injector Control No.5 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Is the fuel pressure within specification?**

**Yes** >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. FUEL PUMP INLET STRAINER

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

**Is the Fuel Inlet Strainer plugged?**

**Yes** >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is operating properly. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 14. IGNITION COIL

Disconnect the No.5 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K16) Coil Control No.5 circuit.

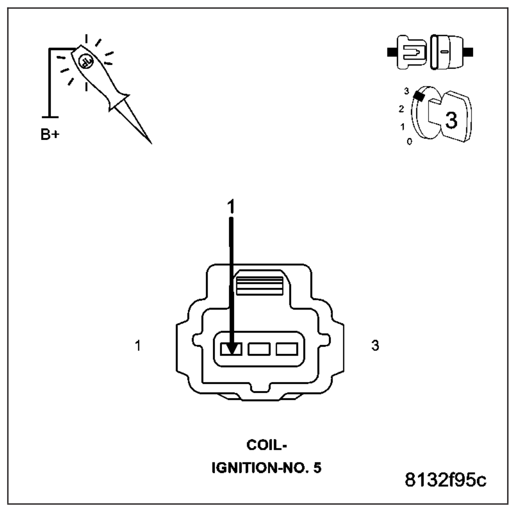
Crank the engine for 5 second while observing the test light.

**NOTE: The primary resistance of the 3.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).**

**Does the test light brightly blink/flicker?**

**Yes** >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 15



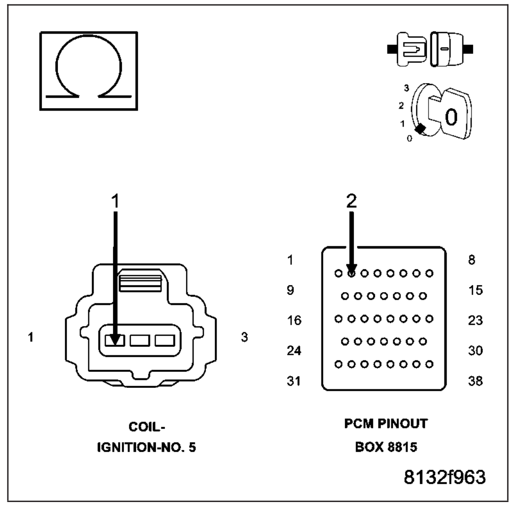
## 15. (K16) COIL CONTROL NO.5 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Check the (K16) Coil Control No.5 circuit for an open, short to ground, and short to voltage.




**Was a problem found with the (K16) Coil Control No.5 circuit?**

**Yes** >> Repair the (K16) Coil Control No.5 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

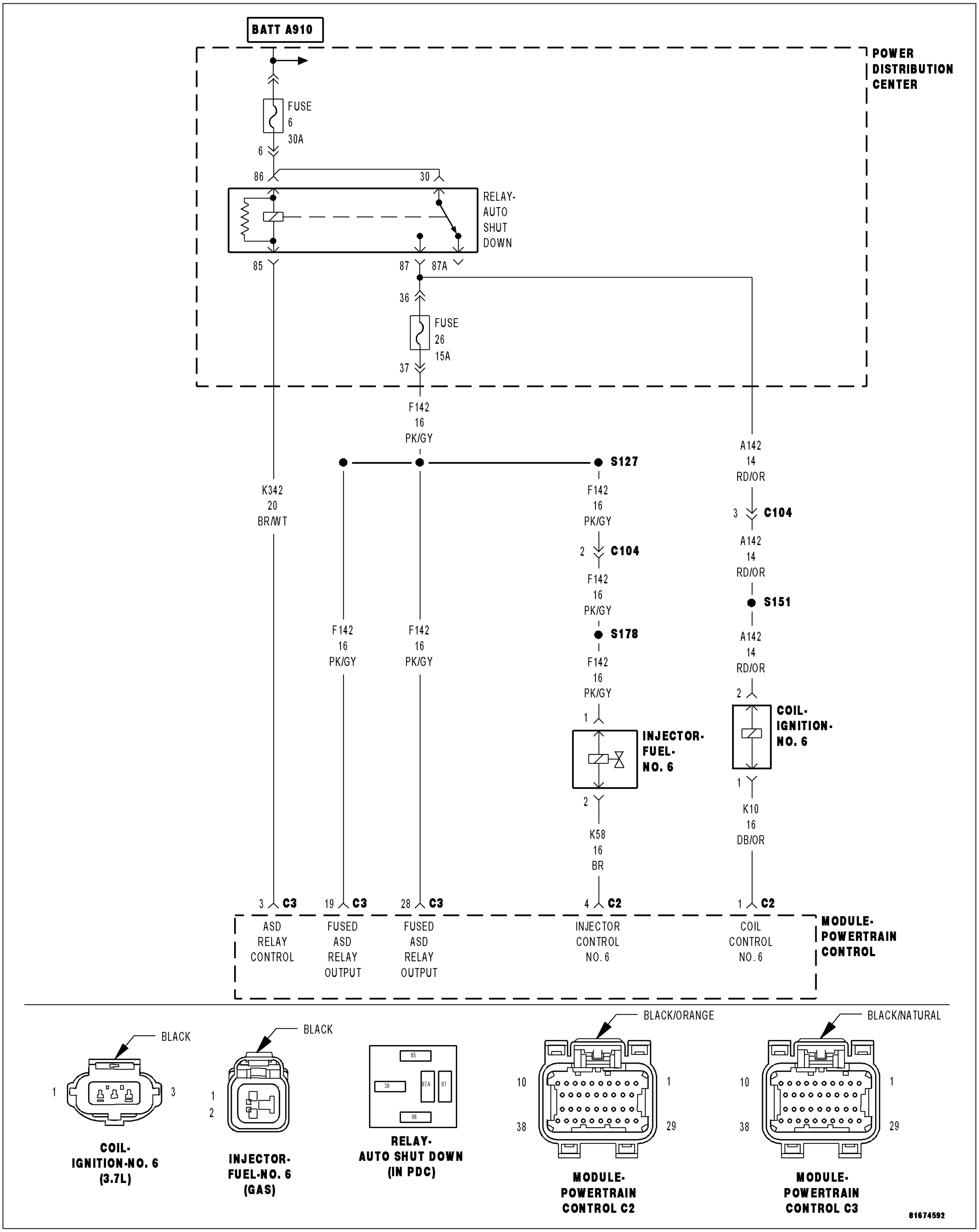
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0306-CYLINDER 6 MISFIRE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  The threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard or in some cases 1%. It is always a two trip fault above the calibrated RPM. It takes 1 soft fail to set a malfunction and two trips to set the MIL. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (A142) AND (F142) ASD RELAY OUTPUT CIRCUIT |
| (K58) INJECTOR CONTROL NO.6 CIRCUIT |
| (K10) COIL CONTROL NO.6 CIRCUIT |
| IGNITION WIRE |
| SPARK PLUG |
| IGNITION COIL |
| FUEL PUMP INLET STRAINER PLUGGED |
| RESTRICTED FUEL SUPPLY LINE |
| FUEL PUMP MODULE |
| FUEL PRESSURE LEAK DOWN |
| FUEL INJECTOR |
| ENGINE MECHANICAL PROBLEM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with a scan tool.

**Is there a misfire present at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. VISUAL INSPECTION

**NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.**

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.

- Internal engine component failures.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (A142) AND (F142) ASD RELAY OUTPUT CIRCUITS

Turn the ignition off.

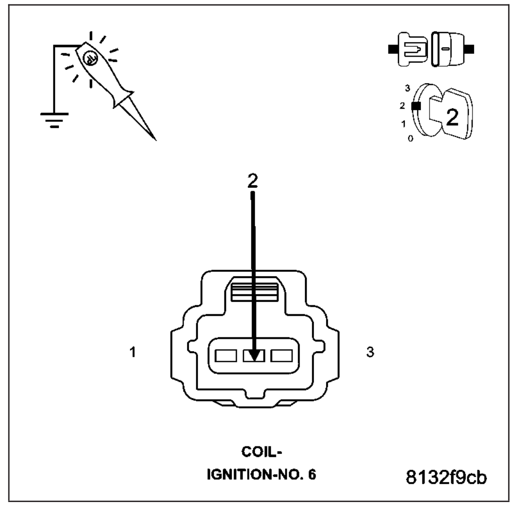
Disconnect the No.6 Ignition Coil harness connector.

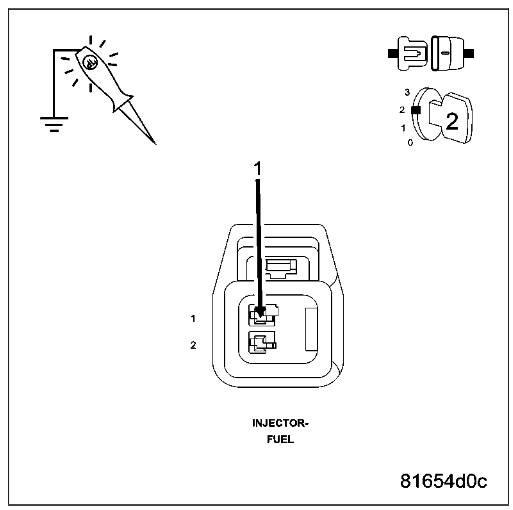
Disconnect the No.6 Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Ignition Coil harness connector and the (F142) ASD Relay Output circuit in the Fuel Injector harness connector, while the relay is actuating.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the excessive resistance or short to ground in the (A142) or (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. IGNITION SYSTEM OPERATION

Turn the ignition off.

Connect the Ignition Coil No.6 harness connector.

Remove the Ignition Coil.

Leave the Fuel Injector harness connector of the cylinder being tested disconnected.

Install a spark tester on the Ignition Coil.

While cranking the engine observe the spark coming from the spark tester.

**NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.**

**Is good spark present?**

**Yes** >> Go To 5

**No** >> Go To 14

**NOTE: Connect the Fuel Injector harness connector before continuing.**

## 5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

**NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.**

**Were any of the above conditions present?**

**Yes** >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. FUEL PRESSURE CHECK

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

**Choose a conclusion that best matches your fuel pressure reading.**

**Within Specification**
Go To 7

**Below Specification**
Go To 12

**Above Specification**
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

## 7. FUEL PRESSURE LEAK DOWN

**NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.**

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death**

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

**NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

**NOTE: The pressure should not fall below 241 KPa (35 psi).**

**Does the gauge fall below the listed specification?**

**Yes** >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. FUEL INJECTOR OPERATION

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

**CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.**

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.6 Fuel Injector.

Monitor the fuel pressure gauge.

**Does the fuel pressure gauge indicate a drop in fuel pressure?**

**Yes** >> Go To 9

**No** >> Go To 10

**NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.**

## 9. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

CAM LOBES - must not be worn excessively

CYLINDER LEAKAGE TEST - must be within specifications

VALVE SPRINGS - cannot be weak or broken

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 10. FUEL INJECTOR

Turn the ignition off.

Disconnect the No.6 Fuel Injector harness connector.

Ignition on, engine not running.

**NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.**

With the scan tool, erase DTCs.

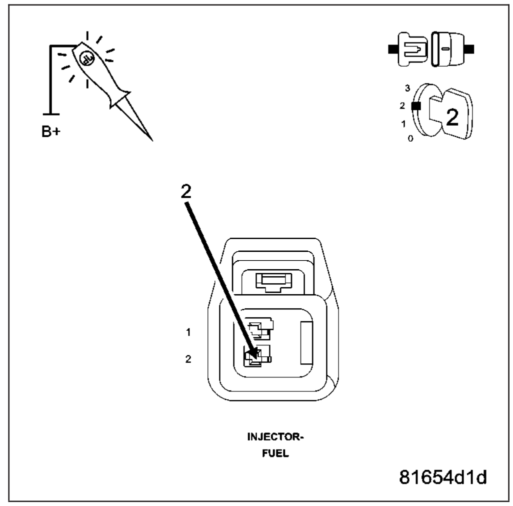
Using a 12-volt test light connected to 12-volts, probe the (K58) Injector Control No.6 circuit.

With the scan tool, actuate the Fuel Injector.

**Does the test light blink/flicker?**

**Yes** >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11




## 11. (K58) INJECTOR CONTROL NO.6 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

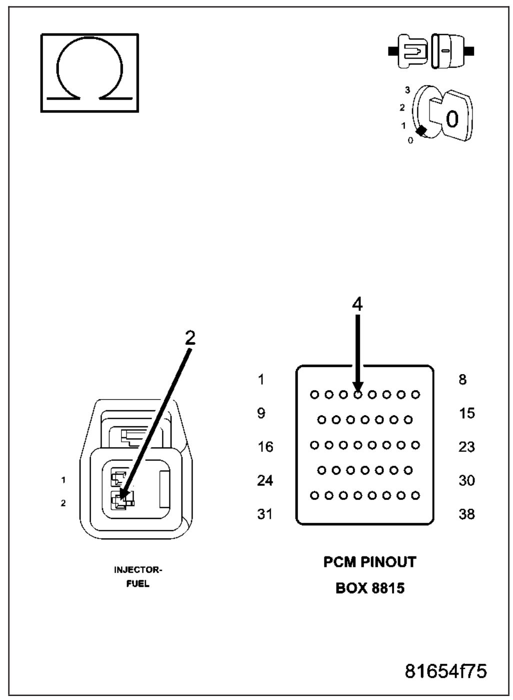
**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Check the (K58) Injector Control No.6 circuit for an open, short to ground, and short to voltage.

**Was a problem found with the (K58) Injector Control No.6 circuit?**

**Yes** >> Repair the excessive resistance or short in the (K58) Injector Control No.6 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16




## 12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Is the fuel pressure within specification?**

**Yes** >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. FUEL PUMP INLET STRAINER

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

**Is the Fuel Inlet Strainer plugged?**

**Yes** >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is operating properly. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 14. IGNITION COIL

Disconnect the No.6 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K10) Coil Control No.6 circuit.

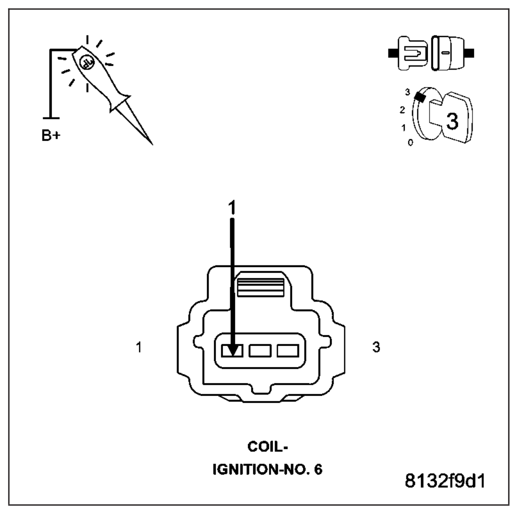
Crank the engine for 5 second while observing the test light.

**NOTE: The primary resistance of the 3.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).**

**Does the test light brightly blink/flicker?**

**Yes** >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

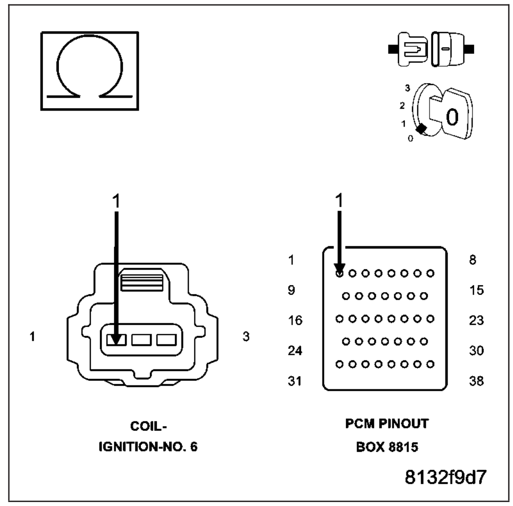
**No** >> Go To 15



## 15. (K10) COIL CONTROL NO.6 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.




**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Check the (K10) Coil Control No.6 circuit for an open, short to ground, and short to voltage.

**Was a problem found with the (K10) Coil Control No.6 circuit?**

**Yes** >> Repair the (K10) Coil Control No.6 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

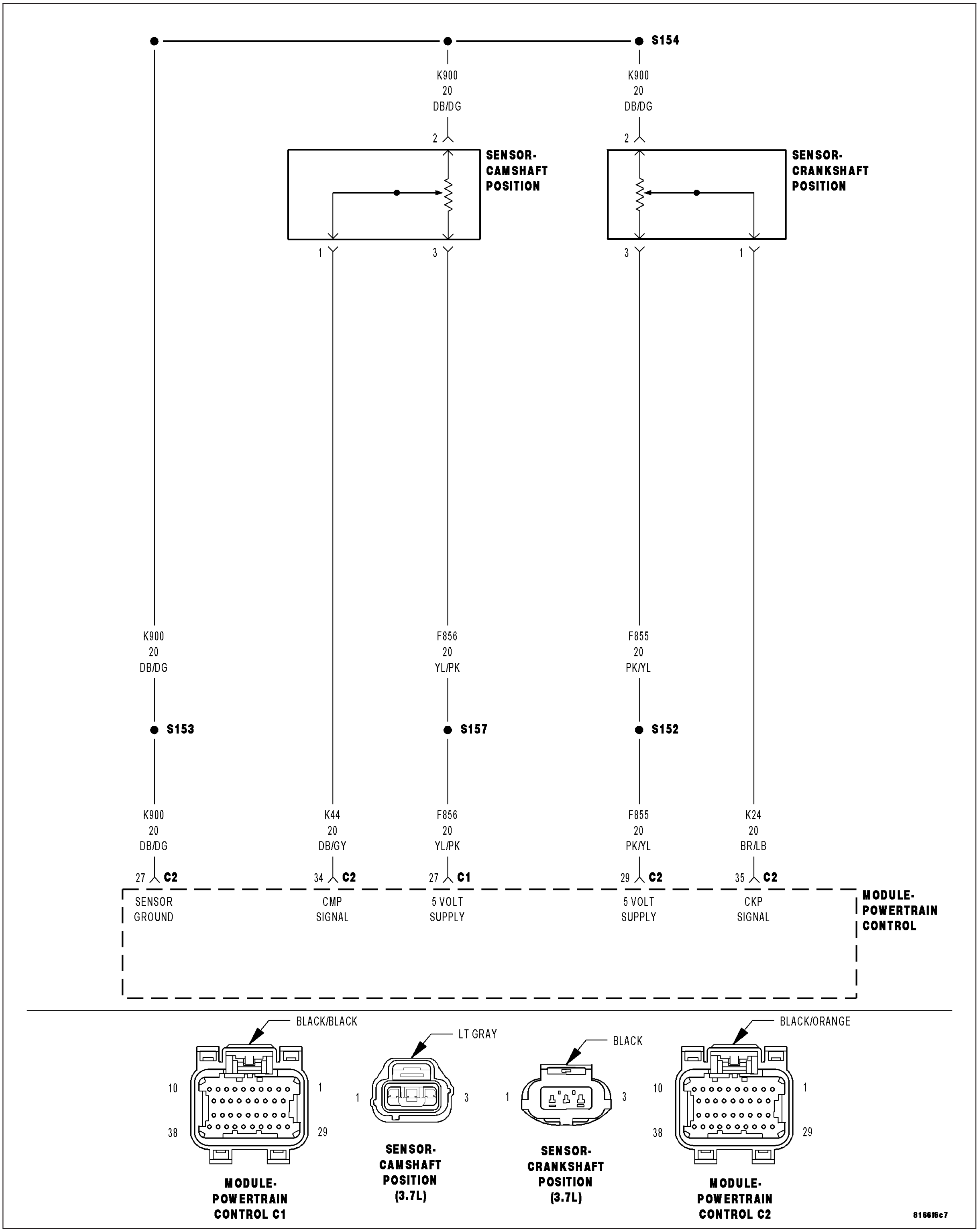
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0315-NO CRANK SENSOR LEARNED




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Under closed throttle decel and A/C off. ECT above 75°C (167°F). Engine start time is greater than 50 seconds.
- **Set Condition:**
  One of the CKP sensor target windows has more than 2.86% variance from the reference. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| TONE WHEEL/PULSE RING |
| WIRE HARNESS |
| CRANKSHAFT POSITION SENSOR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, clear DTCs, PCM battery disconnect to reset the PCM.

Start the engine.

If the MIL has not yet illuminated, test drive the vehicle to try to get the code to reset.

**Does the code reset while cranking or during the test drive?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the CKP wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the CKP wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor is properly installed and the mounting bolt(s) are torqued to the proper specification.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

### 3. TONE WHEEL/FLEX PLATE INSPECTION

Remove the Crankshaft Position Sensor.

Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement.

**Were any problems found?**

**Yes** >> Repair or replace the Tone Wheel/Flex Plate as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CRANKSHAFT POSITION SENSOR

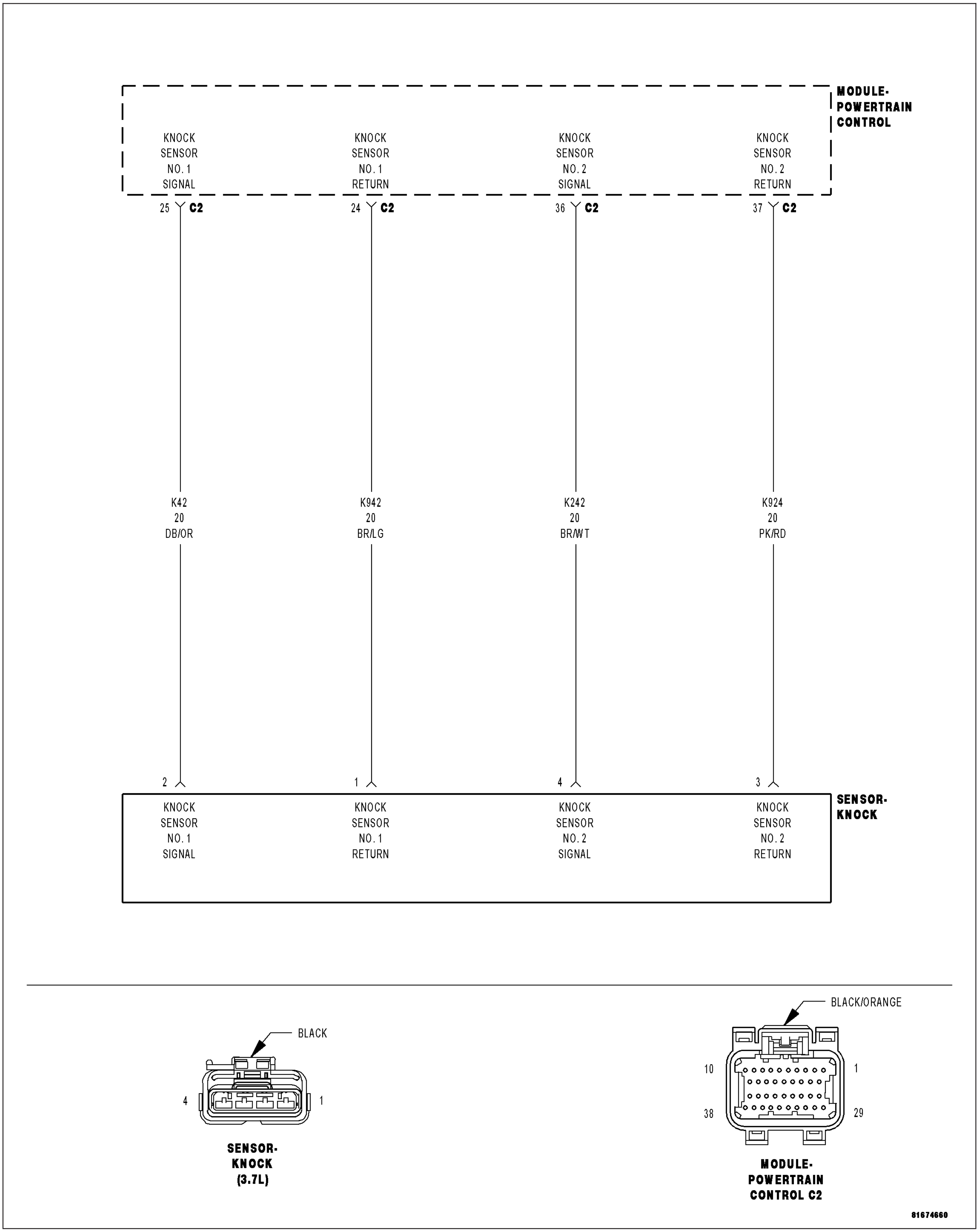
**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Crankshaft Position Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0325-KNOCK SENSOR 1 CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

Knock is the spontaneous auto-ignition of the remaining fuel/air mixture in the engine combustion chamber that occurs after normal combustion has started. It can occur under extreme vehicle operating conditions such as high engine temperature, high MAP, low humidity, and heavy loads to the engine. Knock is caused by excessive spark advance for the given engine operating conditions. Severe, continuous knock may be caused by carbon deposits, bad gasoline, and/or low octane fuel. Avoiding light audible knock is important for customer satisfaction while preventing excessive knock is important to protect engine components. The output voltage from the knock circuit represents the strength of the engine knock and is read by the engine controller. The knock system output voltage is not zero due to engine background noise, even when knock is not present. When the engine is operated under high load conditions where knock is possible, the knock voltage is tested to decide if it exceeds the knock voltage threshold. Knock has occurred when the knock voltage is at or above this knock threshold. When knock is detected a calibrated short term knock spark retard to be subtracted from the spark advance is calculated. The amount of retarded spark advance is based off a calibrated severity of the knock event. This retarded spark advance is used in the next ignition event to prevent further knock events. If knock continues, an additional amount of short term spark advance retard is added. When knock stops, short term knock spark retard is eliminated, the long term knock spark retard is reduced by a calibrated amount to recover some previously retarded spark advance. This decreases spark retard to improve engine performance.

- **When Monitored:**
  This monitor runs above 2000 rpm, under open throttle conditions. The Knock diagnostic does not run at idle or during decelerations. The high voltage test runs all the times the engine is running.
- **Set Condition:**
  The High voltage fault will set at 4.8 volts. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT OPEN |
| (K942) KNOCK SENSOR NO.1 RETURN CIRCUIT OPEN |
| (K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K942) KNOCK SENSOR NO.1 RETURN CIRCUIT |
| (K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND |
| KNOCK SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. (K42) KNOCK SENSOR NO.1 SIGNAL SHORTED TO BATTERY VOLTAGE

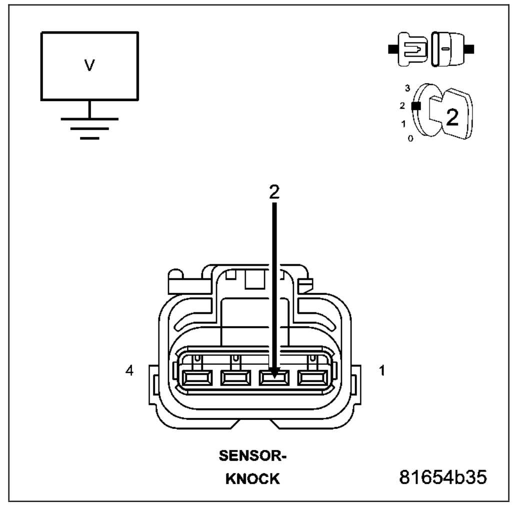
Turn the ignition off.

Disconnect the Knock Sensor harness connector.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K42) Knock Sensor No.1 Signal circuit in the Knock Sensor harness connector.




**Is the voltage above 1.5 volts at idle and above 0.3 of a volt above 2000 RPM?**

**Yes** >> Repair the short to battery voltage in the (K42) Knock Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

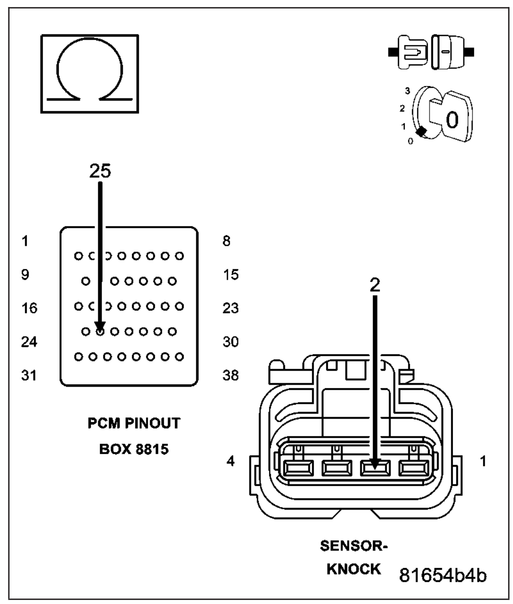
**No** >> Go To 3

## 3. (K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K42) Knock Sensor No.1 Signal circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the open in the (K42) Knock Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (K942) KNOCK SENSOR NO.1 RETURN CIRCUIT OPEN

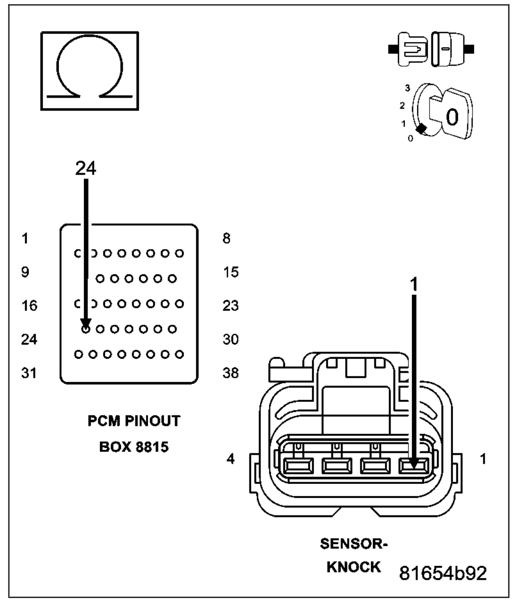
Measure the resistance of the (K942) Knock Sensor No.1 Return circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the open in the (K942) Knock Sensor No.1 Return circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




## 5. (K42) KNOCK SENSOR NO.1 SIGNAL SHORTED TO THE (K942) KNOCK SENSOR NO.1 RETURN CIRCUIT

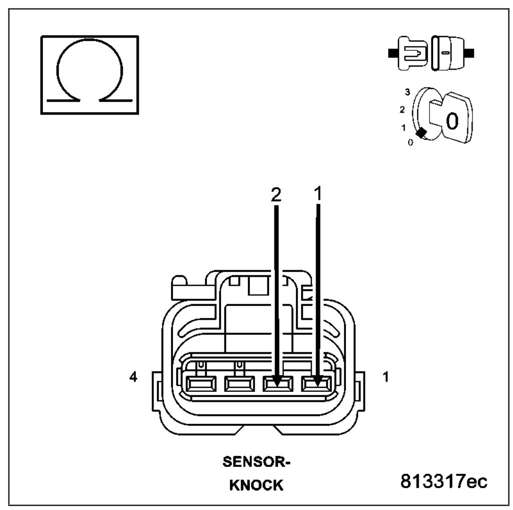
Measure the resistance between the (K42) Knock Sensor No.1 Signal circuit and the (K942) Knock Sensor No.1 Return circuit in the Knock Sensor harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (K42) Knock Sensor No.1 Signal circuit and the (K942) Knock Sensor No.1 Return circuit.

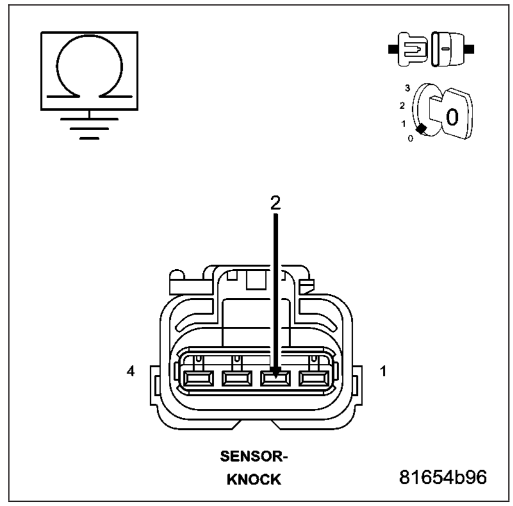
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6



## 6. (K42) KNOCK SENSOR NO.1 SIGNAL SHORTED TO GROUND

Measure the resistance between ground and the (K42) Knock Sensor No.1 Signal circuit in the Knock Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K42) Knock Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. KNOCK SENSOR

Replace the Knock Sensor.

Ignition on, engine not running.

With the scan tool, erase DTC.

Attempt to operate the vehicle using the information noted in the Freeze Frame.

With the scan tool, read DTCs.

**Does the scan tool display the DTC that was previously erased?**

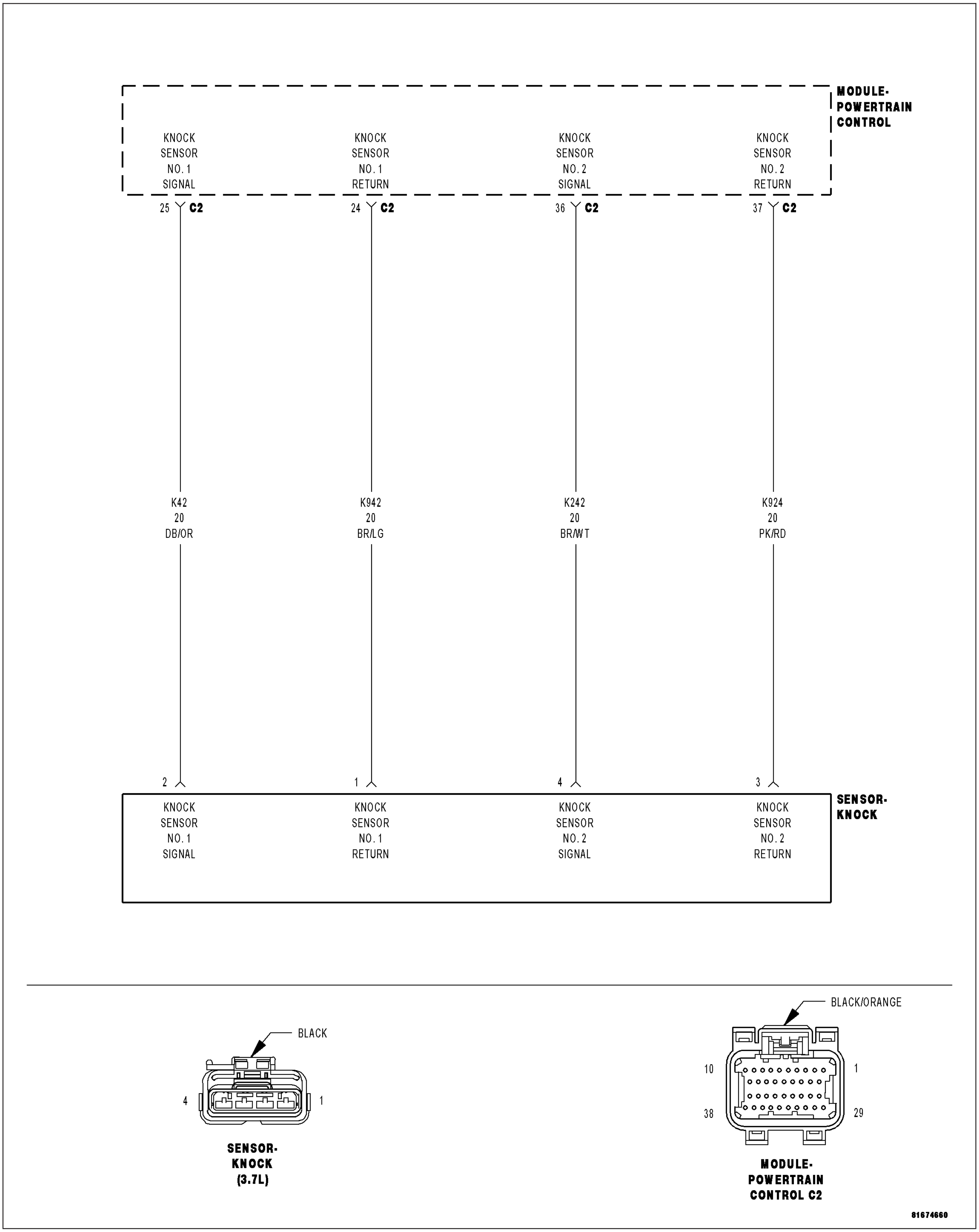
**Yes** >>

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary. Replace and program the Powertrain Control Module per Service Information.**

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0330-KNOCK SENSOR 2 CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

Knock is the spontaneous auto-ignition of the remaining fuel/air mixture in the engine combustion chamber that occurs after normal combustion has started. It can occur under extreme vehicle operating conditions such as high engine temperature, high MAP, low humidity, and heavy loads to the engine. Knock is caused by excessive spark advance for the given engine operating conditions. Severe, continuous knock may be caused by carbon deposits, bad gasoline, and/or low octane fuel. Avoiding light audible knock is important for customer satisfaction while preventing excessive knock is important to protect engine components. The output voltage from the knock circuit represents the strength of the engine knock and is read by the engine controller. The knock system output voltage is not zero due to engine background noise, even when knock is not present. When the engine is operated under high load conditions where knock is possible, the knock voltage is tested to decide if it exceeds the knock voltage threshold. Knock has occurred when the knock voltage is at or above this knock threshold. When knock is detected a calibrated short term knock spark retard to be subtracted from the spark advance is calculated. The amount of retarded spark advance is based off a calibrated severity of the knock event. This retarded spark advance is used in the next ignition event to prevent further knock events. If knock continues, an additional amount of short term spark advance retard is added. When knock stops, short term knock spark retard is eliminated, the long term knock spark retard is reduced by a calibrated amount to recover some previously retarded spark advance. This decreases spark retard to improve engine performance.

- **When Monitored:**
  This monitor runs above 2000 rpm, under open throttle conditions. The Knock diagnostic does not run at idle or during decelerations. The high voltage test runs all the times the engine is running.
- **Set Condition:**
  The High voltage fault will set at 4.8 volts. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT OPEN |
| (K924) KNOCK SENSOR NO.2 RETURN CIRCUIT OPEN |
| (K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO THE (K924) KNOCK SENSOR NO.2 RETURN CIRCUIT |
| (K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO GROUND |
| KNOCK SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. (K242) KNOCK SENSOR NO.2 SIGNAL SHORTED TO BATTERY VOLTAGE

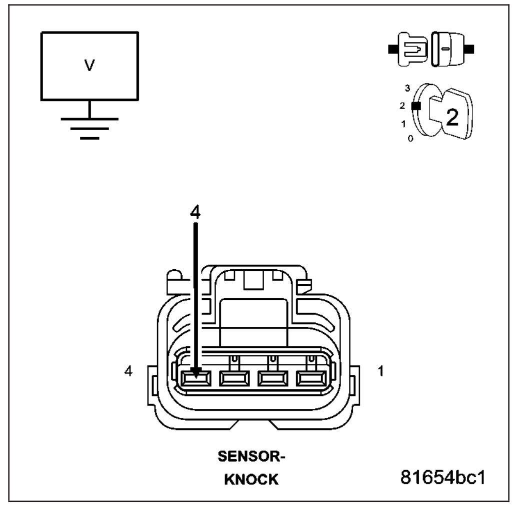
Turn the ignition off.

Disconnect the No.2 Knock Sensor harness connector.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K242) Knock Sensor No.2 Signal circuit in the Knock Sensor harness connector.




**Is the voltage above 1.5 volts at idle and above 0.3 of a volt above 2000 RPM?**

**Yes** >> Repair the short to battery voltage in the (K242) Knock Sensor No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

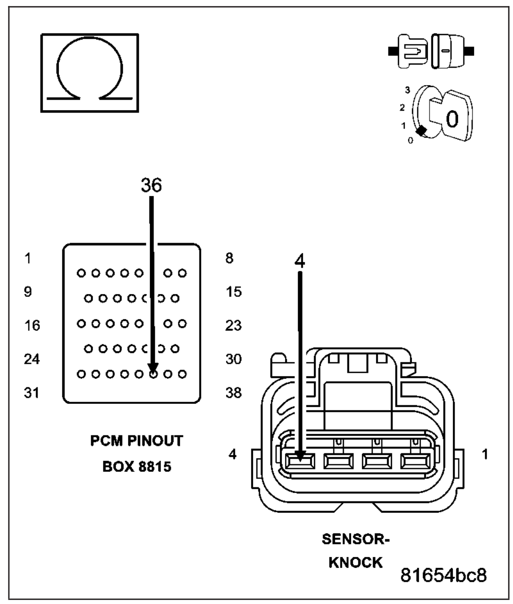
**No** >> Go To 3

## 3. (K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K242) Knock Sensor No.2 Signal circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

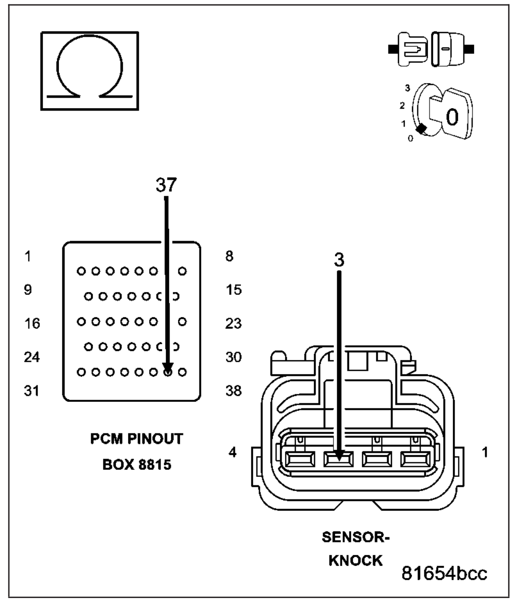
**Yes** >> Go To 4

**No** >> Repair the open in the (K242) Knock Sensor No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (K924) KNOCK SENSOR NO.2 RETURN CIRCUIT OPEN

Measure the resistance of the (K924) Knock Sensor No.2 Return circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

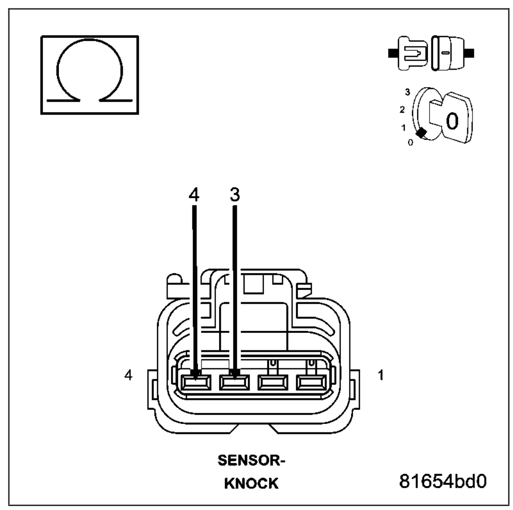
**Yes** >> Go To 5

**No** >> Repair the open in the (K924) Knock Sensor No.2 Return circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (K242) KNOCK SENSOR NO.2 SIGNAL SHORTED TO THE (K924) KNOCK SENSOR NO.2 RETURN CIRCUIT

Measure the resistance between the (K242) Knock Sensor No.2 Signal circuit and the (K924) Knock Sensor No.2 Return circuit in the Knock Sensor harness connector.




**Is the resistance below 100 ohms?**

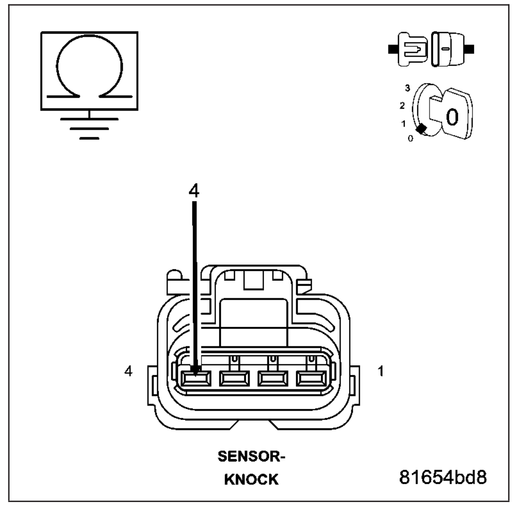
**Yes** >> Repair the short between the (K242) Knock Sensor No.2 Signal circuit and the (K924) Knock Sensor No.2 Return circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (K242) KNOCK SENSOR NO.2 SIGNAL SHORTED TO GROUND

Measure the resistance between ground and the (K242) Knock Sensor No.2 Signal circuit in the Knock Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K242) Knock Sensor No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. KNOCK SENSOR

Replace the Knock Sensor.

Ignition on, engine not running.

With the scan tool, erase DTC.

Attempt to operate the vehicle using the information noted in the Freeze Frame.

With the scan tool, read DTCs.

**Does the scan tool display the DTC that was previously erased?**

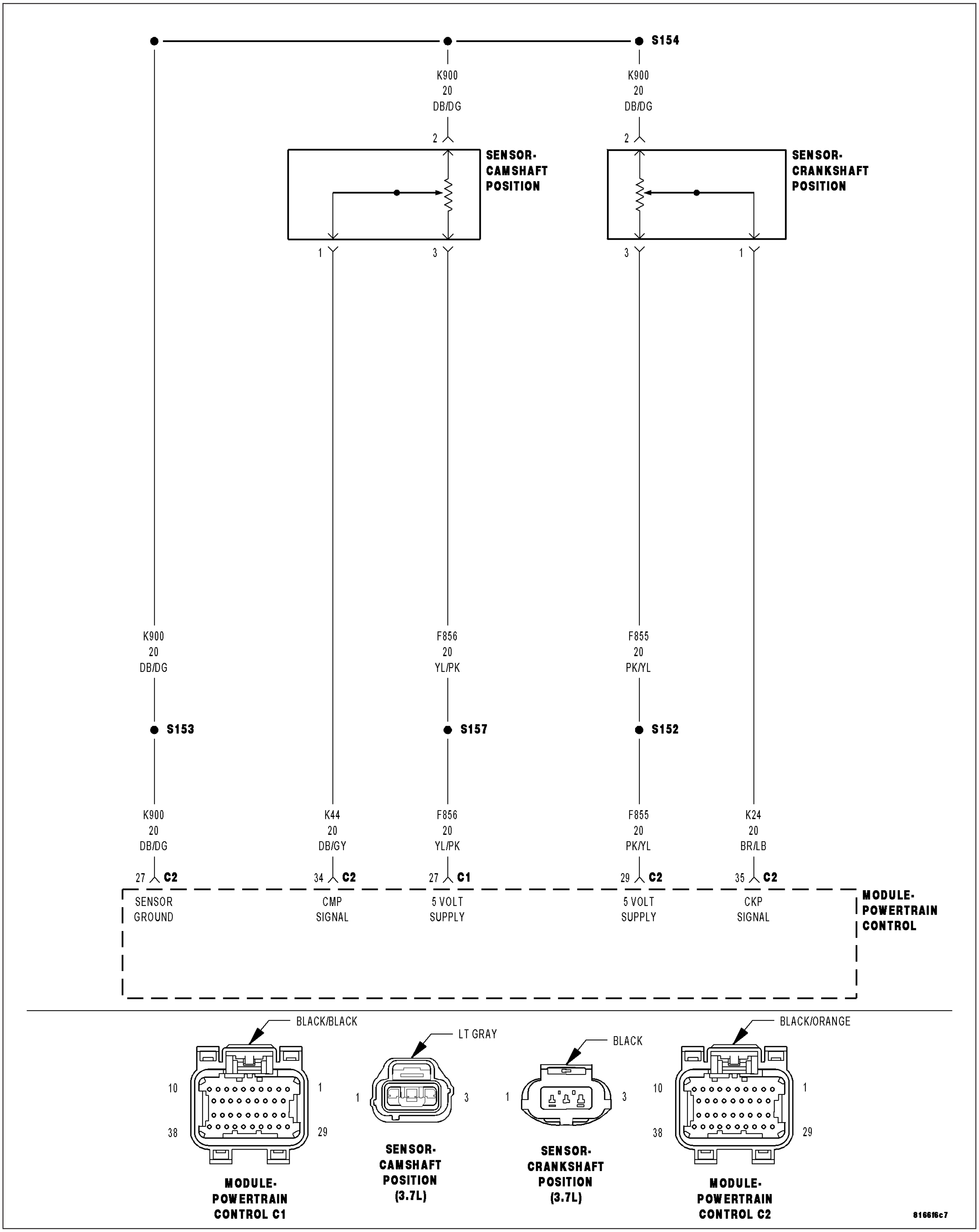
**Yes** >>

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary. Replace and program the Powertrain Control Module per Service Information.**

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0335-CRANKSHAFT POSITION SENSOR CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine cranking.
- **Set Condition:**
  No CKP signal is present during engine cranking, and at least 8 camshaft position sensor signals have occurred within 8 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (F855) 5-VOLT SUPPLY CIRCUIT OPEN |
| (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| (K24) CKP SIGNAL CIRCUIT OPEN |
| (K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K24) CKP SIGNAL CIRCUIT SHORTED GROUND |
| (K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT |
| (K900) SENSOR GROUND CIRCUIT OPEN |
| CRANKSHAFT POSITION SENSOR |
| CAMSHAFT POSITION SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Crank the engine.

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Go To 14

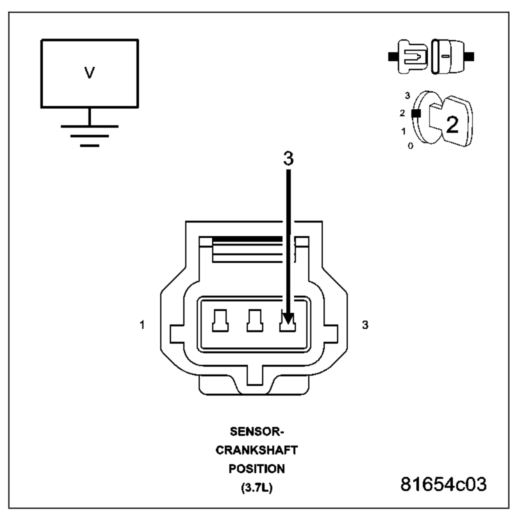
### 2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the CKP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.




**Is the voltage between 4.5 and 5.2 volts?**

**Yes** >> Go To 3

**No** >> Go To 10

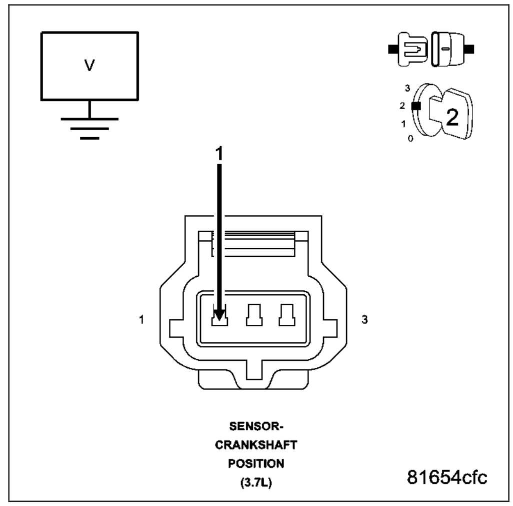
## 3. (K24) CKP SIGNAL CIRCUIT

Measure the voltage on the (K24) CKP Signal circuit in the CKP Sensor harness connector.

**Is the voltage between 4.5 and 5.0 volts?**

**Yes** >> Go To 4

**No** >> Go To 7




## 4. (K900) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

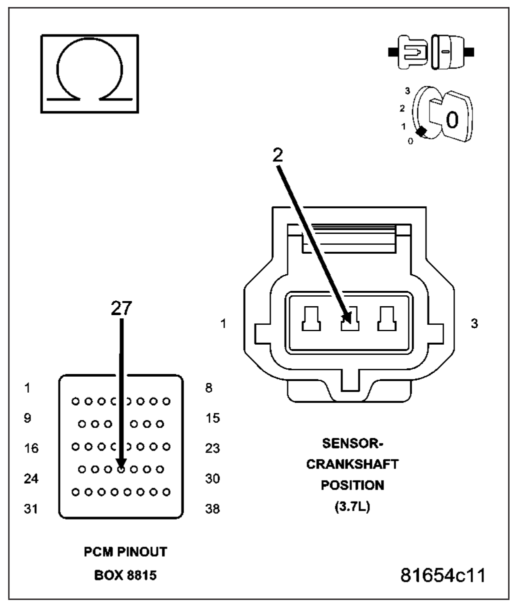
Measure the resistance of the (K900) Sensor ground circuit from the CKP Sensor harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

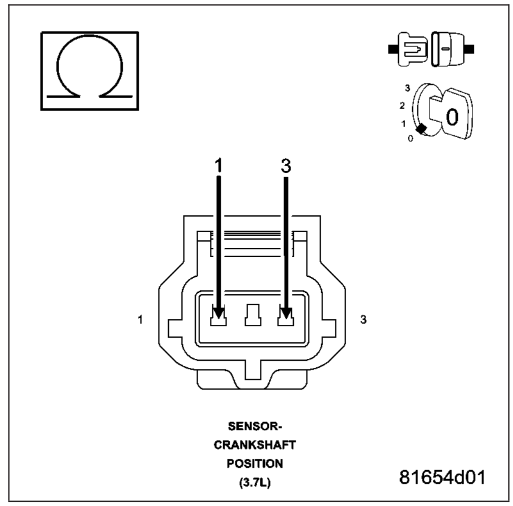
**No** >> Repair the open in the (K900) Sensor ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



## 5. (K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K24) CKP Signal circuit and the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K24) CKP Signal circuit and the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CRANKSHAFT POSITION SENSOR

**NOTE: Inspect the slots on the flywheel for damage. If a problem is found repair as necessary.**

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Crankshaft Position Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

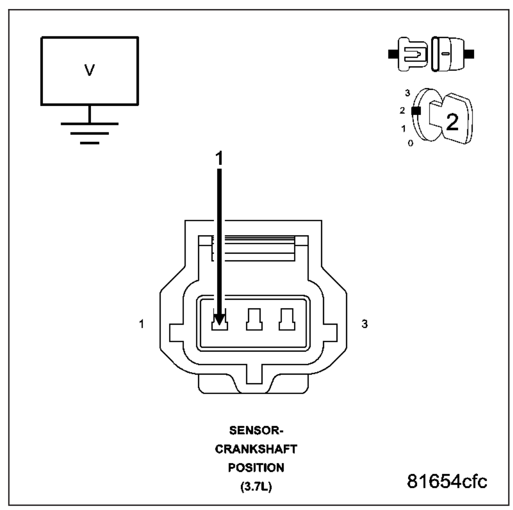
## 7. (K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K24) CKP Signal circuit in the CKP Sensor harness connector.



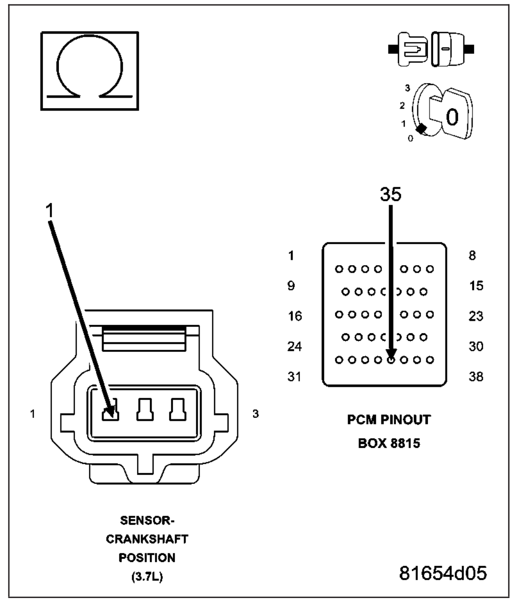

**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K24) CKP Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. (K24) CKP SIGNAL CIRCUIT OPEN




Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

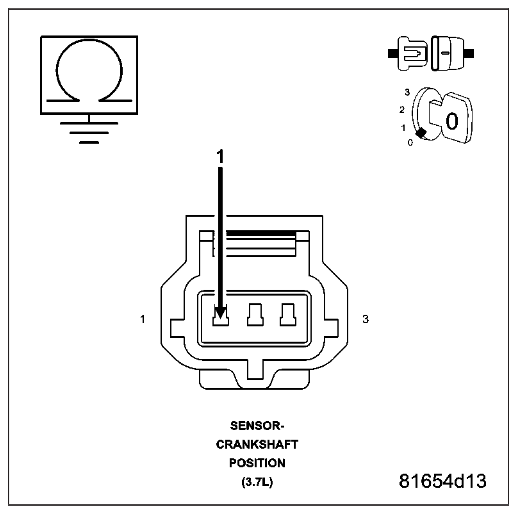
Measure the resistance of the (K24) CKP Signal circuit from the CKP Sensor harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 9

**No** >> Repair the open in the (K24) CKP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 9. (K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND




Measure the resistance between ground and the (K24) CKP Signal circuit in the CKP Sensor harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short to ground in the (K24) CKP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13

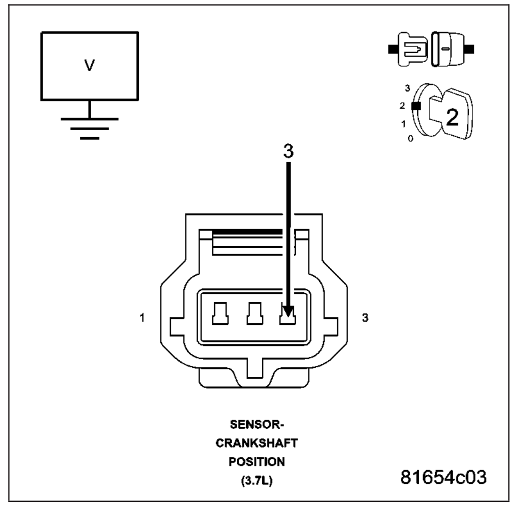
## 10. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.




**Is the voltage above 5.5 volts?**

**Yes** >> Repair the short to battery voltage in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

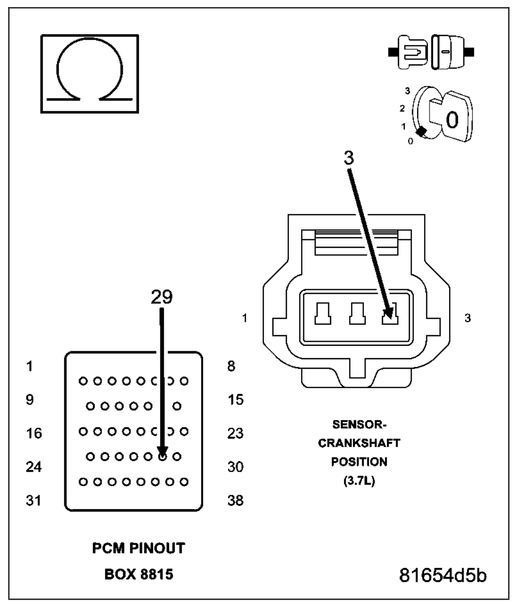
**No** >> Go To 11

## 11. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (F855) 5-volt Supply circuit from the CKP Sensor harness connector to the appropriate terminal of special tool #8815.



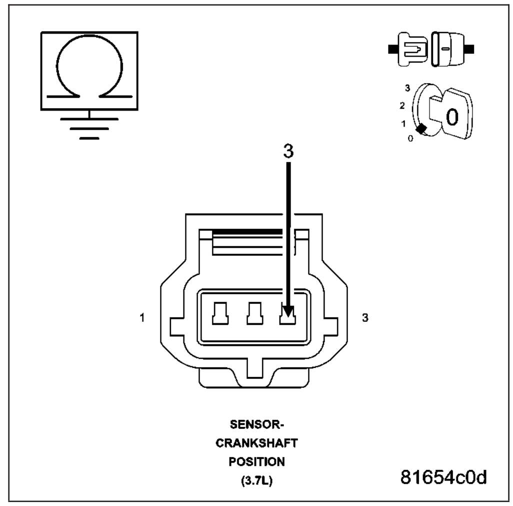

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 12

**No** >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 12. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 14. ERRATIC CKP SENSOR SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harnessconnector.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crank Position Sensor.

Observe the lab scope screen.

Look for any pulses generated by the CKP Sensor.

Allow the engine to idle.

Observe the lab scope screen.

**Did the CKP Sensor generate any erratic pulses?**

**Yes** >> Inspect the related wire harness and replace the Crankshaft Position Sensor if no wiring problems were found.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 15

## 15. ERRATIC CMP SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the CMP harness connector.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Cam Position Sensor.

Observe the lab scope screen.

Look for any pulses generated by the CMP Sensor.

Allow the engine to idle.

Observe the lab scope screen.

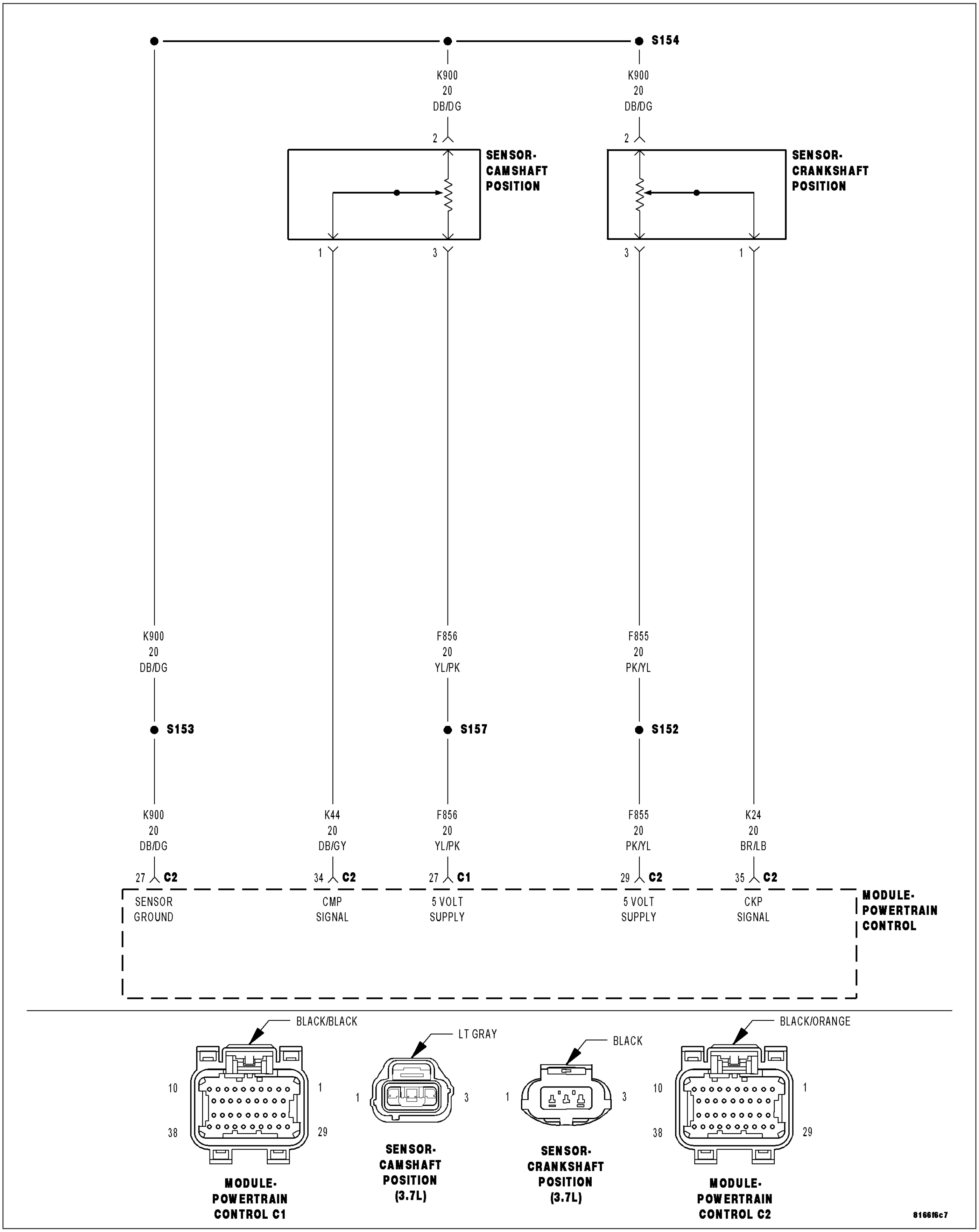
**Did the CMP Sensor generate any pulses?**

**Yes** >> Inspect the related wire harness and replace the Camshaft Position Sensor if no wiring problems were found.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Test Complete.

# P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While cranking the engine and with the engine running.
- **Set Condition:**
  When the CKP Sensor failure counter reaches 20. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (F855) 5-VOLT SUPPLY CIRCUIT OPEN |
| (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| (K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K24) CKP SIGNAL CIRCUIT OPEN |
| (K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND |
| (K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT |
| CRANKSHAFT POSITION SENSOR |
| TONE WHEEL/PULSE RING |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. CHECKING CRANKSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the Sensor harness connector.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Ignition on, engine not running.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

**Are there any irregular or missing signals?**

**Yes** >> Go To 3

**No** >> Go To 8

## 3. WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wire harness including the ground circuit. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to the proper specification.

Refer to any TSBs that may apply.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (F855) 5-VOLT SUPPLY CIRCUIT OPEN OR SHORTED TO GROUND

Disconnect the CKP Sensor connector.

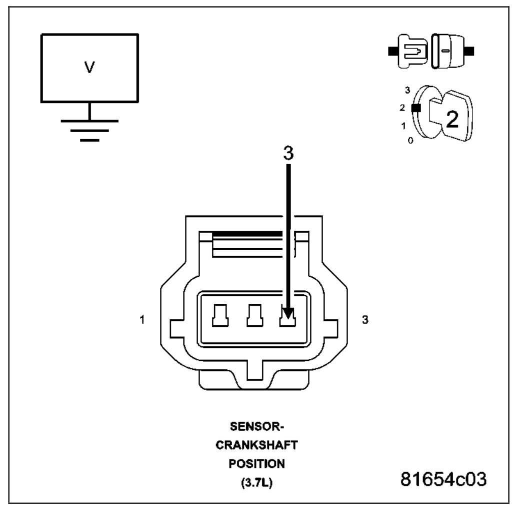
Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the Sensor harness connector.

**Is the voltage between 4.5 and 5.2 volts?**

**Yes** >> Go To 5

**No** >> Repair the open or short to ground in the (F855) 5-volt Supply circuit. Use Miller special tool #8815 when checking for an open circuit to prevent PCM harness connector terminal damage.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




## 5. TONE WHEEL/FLEX PLATE INSPECTION

Turn the ignition off.

Carefully disconnect the Negative Battery (Ground) cable.

Remove the Crankshaft Position Sensor.

Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement.

**Were any problems found?**

**Yes** >> Repair or replace the Tone Wheel/Flex Plate as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECKING CAMSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

Install the CKP Sensor and connect the battery cable.

**NOTE: An intermittent condition in the Cam Position Sensor can cause the P0339 to set.**

With the a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the Sensor harness connector.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Cam Position Sensor.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

**Are there any irregular or missing signals?**

**Yes** >> Replace the Cam Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CRANKSHAFT POSITION SENSOR

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Crankshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 8. (K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

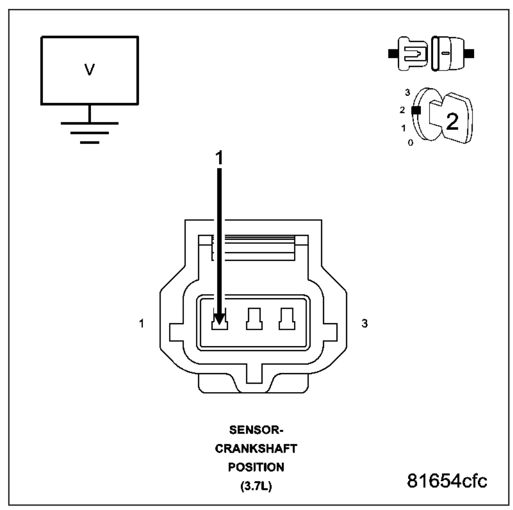
Disconnect the C2 PCM harness connector.

Disconnect the CKP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K24) CKP Signal circuit in the Sensor harness connector.

Wiggle the related wire harness while taking this measurement.




**Is the voltage above 1 volt?**

**Yes** >> Repair the short to battery voltage in the (K24) CKP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. (K24) CKP SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance in the (K24) CKP Signal circuit from the CKP harness connector to the appropriate terminal of special tool #8815.

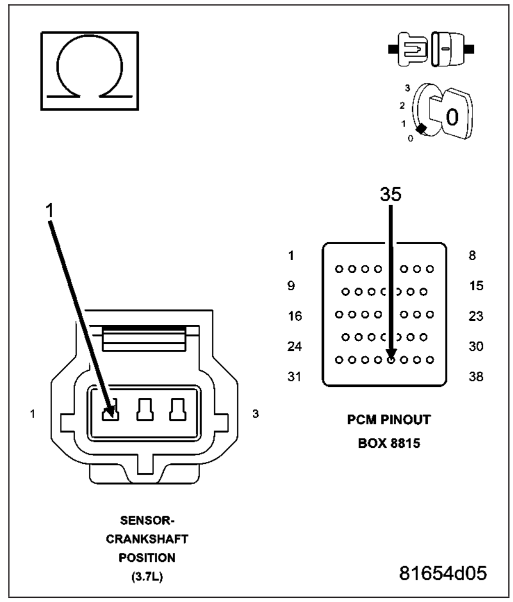
Wiggle the wire harness while taking this measurement.

**Is the resistance below 1.0 ohm?**

**Yes** >> Go To 10

**No** >> Repair the excessive resistance in the (K24) CKP Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




## 10. (K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K24) CKP Signal circuit in the CKP Sensor harness connector.

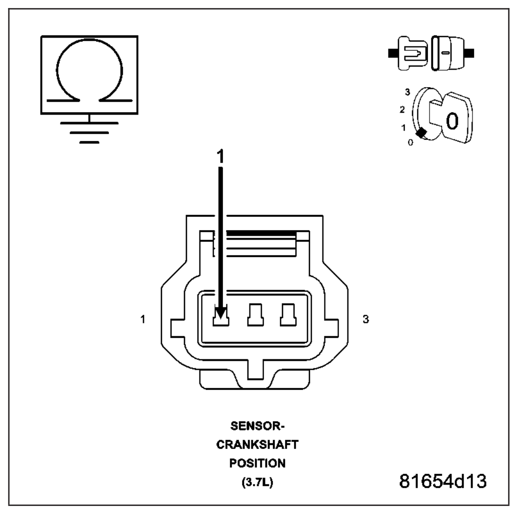
Wiggle the related wire harness while monitoring the resistance value.

**Does the resistance ever go below 100 ohms?**

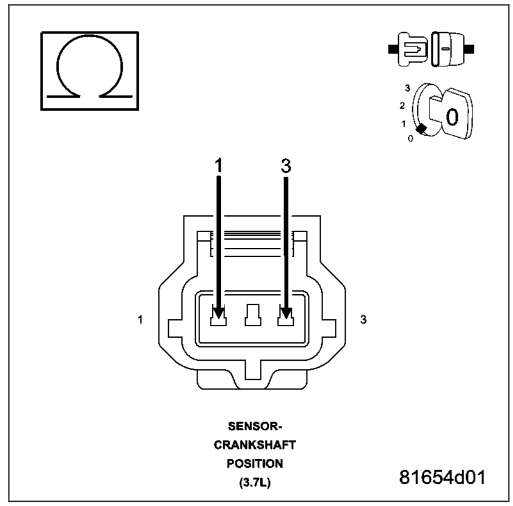
**Yes** >> Repair the short to ground in the (K24) Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11



## 11. (K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT




Measure the resistance between the (F855) 5-volt Supply circuit and the (K24) CKP Signal circuit in the CKP harness connector.

Wiggle the related wire harness while taking this measurement.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (F855) 5-volt Supply circuit and the (K24) CKP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 12

## 12. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

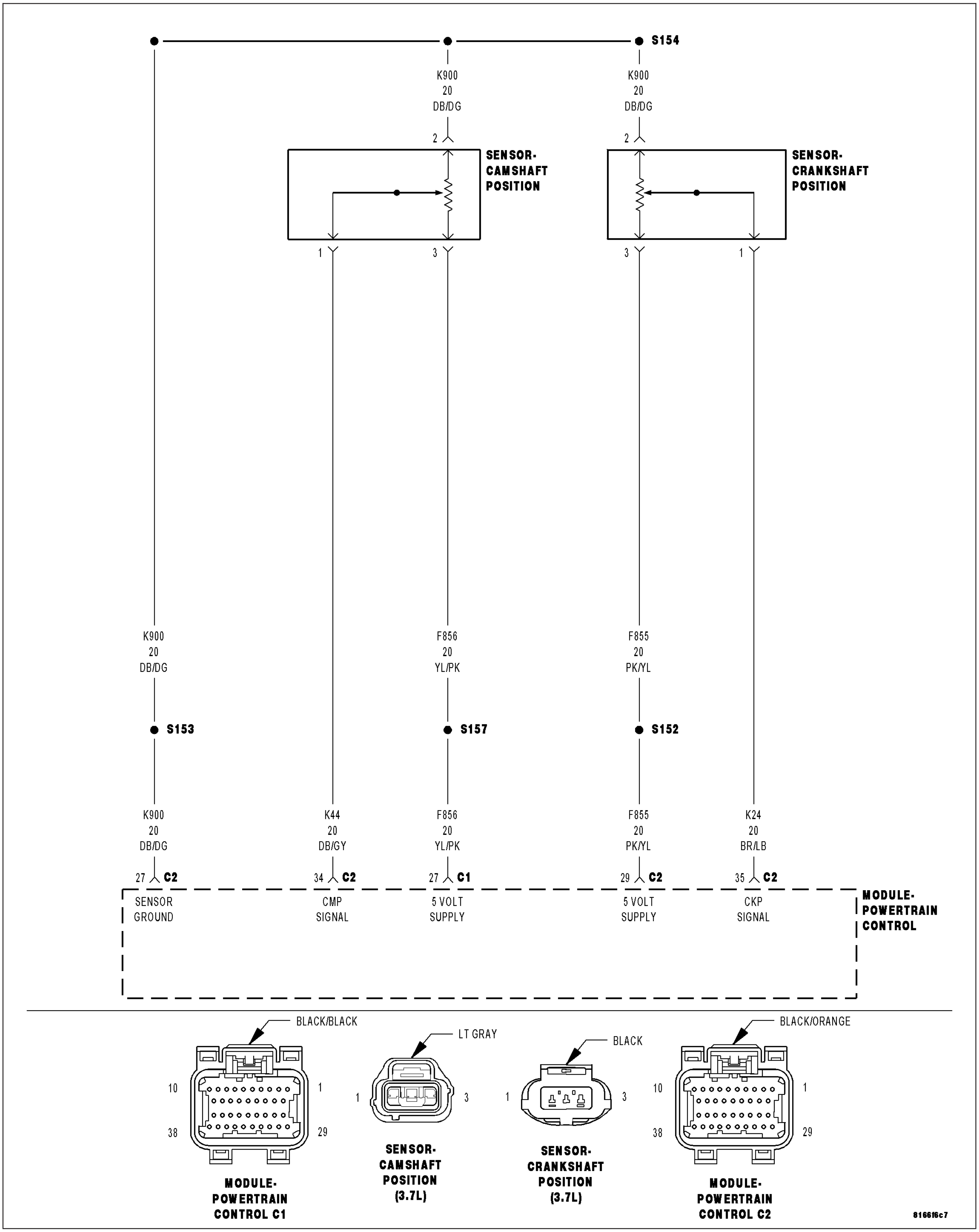
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0340-CAMSHAFT POSITION SENSOR CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During engine cranking and with the engine running. Battery voltage greater than 10 volts.
- **Set Condition:**
  At least 5 seconds or 2.5 engine revolutions have elapsed with crankshaft position sensor signals present but no camshaft position sensor signal. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (F856) 5-VOLT SUPPLY CIRCUIT OPEN |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| (K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K44) CMP SIGNAL CIRCUIT OPEN |
| (K44) CMP SIGNAL CIRCUIT SHORTED GROUND |
| (K44) CMP SIGNAL SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT |
| (K900) SENSOR GROUND CIRCUIT OPEN |
| CAMSHAFT POSITION SENSOR |
| CRANKSHAFT POSITION SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Crank the engine.

Ignition on, engine not running.

With a scan tool read the DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Go To 14

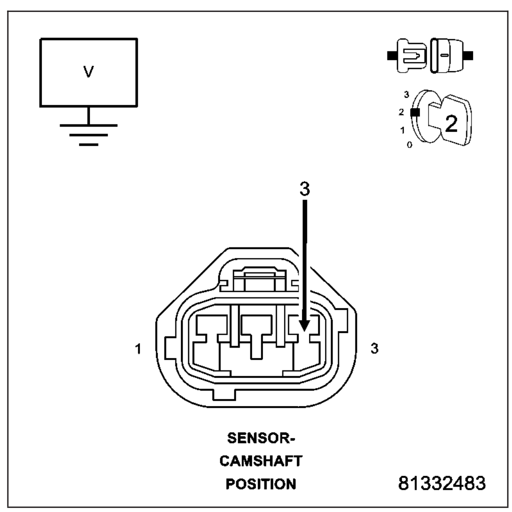
### 2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.




**Is the voltage between 4.5 and 5.2 volts?**

**Yes** >> Go To 3

**No** >> Go To 10

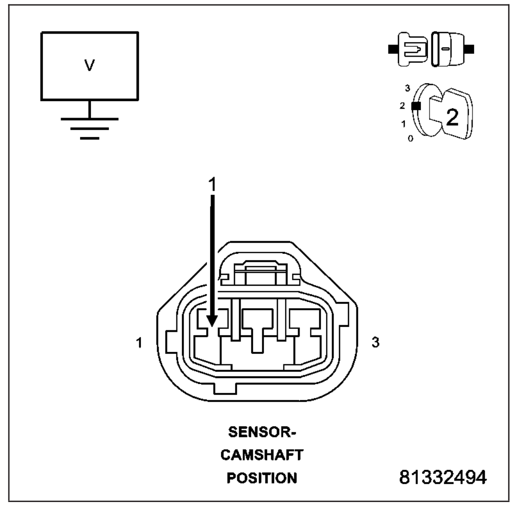
## 3. (K44) CMP SIGNAL CIRCUIT

Measure the voltage on the (K44) CMP Signal circuit in the CMP Sensor harness connector.

**Is the voltage between 4.5 and 5.0 volts?**

**Yes** >> Go To 4

**No** >> Go To 7




## 4. (K900) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

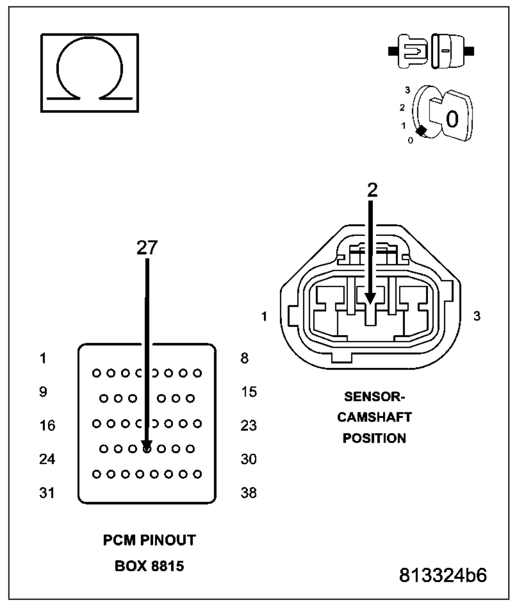
Measure the resistance of the (K900) Sensor ground circuit from the CMP Sensor harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

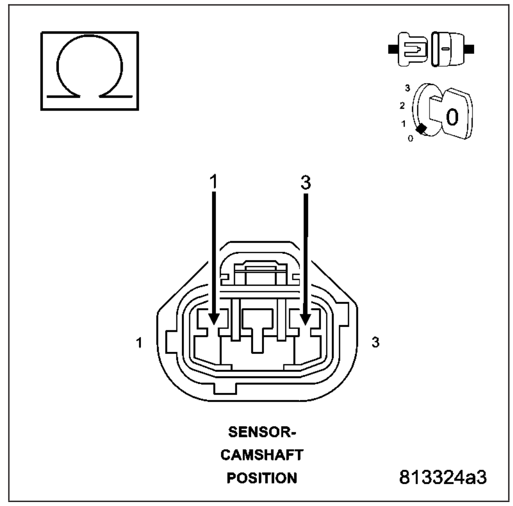
**No** >> Repair the open in the (K900) Sensor ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



## 5. (K44) CMP SIGNAL SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K44) CMP Signal circuit and the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K44) CMP Signal circuit and the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CAMSHAFT POSITION SENSOR

**NOTE: Inspect the Camshaft sprocket for damage per the Service Information. If a problem is found repair as necessary.**

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Camshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

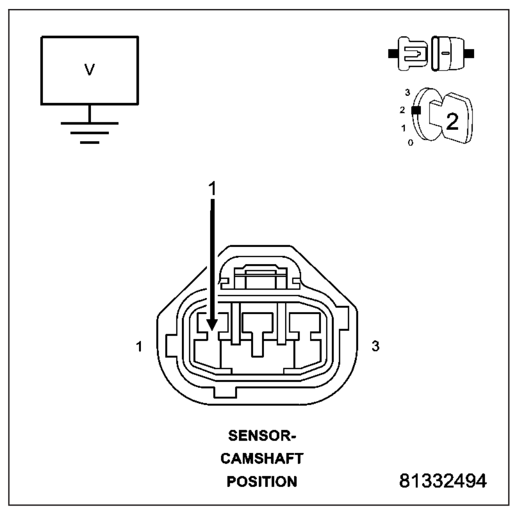
## 7. (K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K44) CMP Signal circuit in the CMP Sensor harness connector.




**Is the voltage above 0 volts?**

**Yes** >> Repair the short to battery voltage in the (K44) CMP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

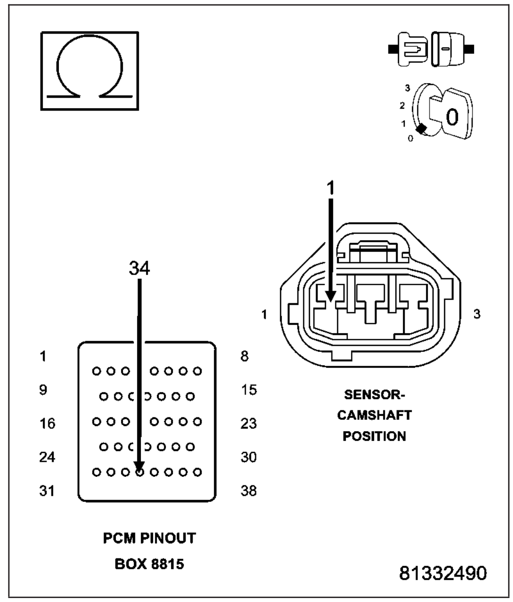
**No** >> Go To 8

## 8. (K44) CMP SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K44) CMP Signal circuit from the CMP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

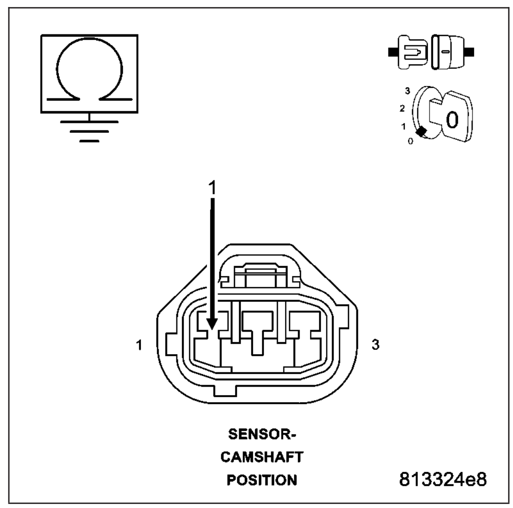
**Yes** >> Go To 9

**No** >> Repair the open in the (K44) CMP Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 9. (K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Signal circuit in the CMP Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K44) CMP Signal circuit

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 10

## 10. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

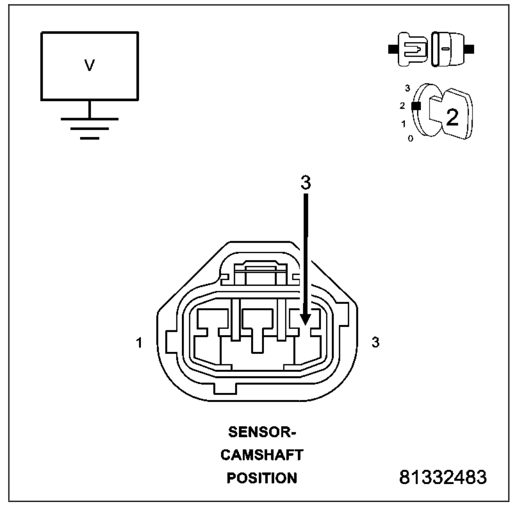
Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.

**Is the voltage above 0 volts?**

**Yes** >> Repair the short to battery voltage in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11




## 11. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

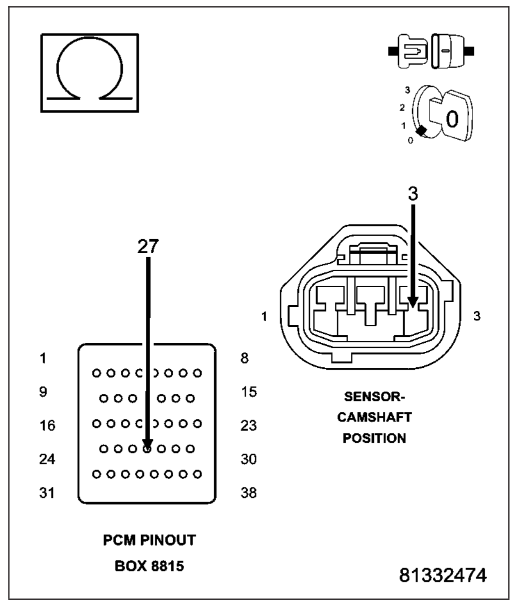
**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (F856) 5-volt Supply circuit between the CMP Sensor harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

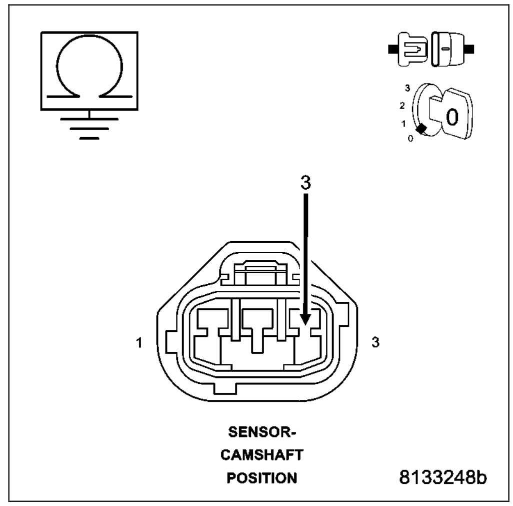
**Yes** >> Go To 12

**No** >> Repair the open in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



## 12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 14. ERRATIC CMP SIGNAL

With a lab scope probe and the Miller special tool #6801, back probe the (K44) CMP Signal circuit in the CMP harness connector.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap the Camshaft Position Sensor.

Observe the lab scope screen.

Allow the engine to idle.

Observe the lab scope screen.

**Did the CMP Sensor generate any erratic pulses?**

**Yes** >> Replace the Camshaft Position Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 15

## 15. ERRATIC CKP SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crankshaft Position Sensor.

Observe the lab scope screen.

Allow the engine to idle.

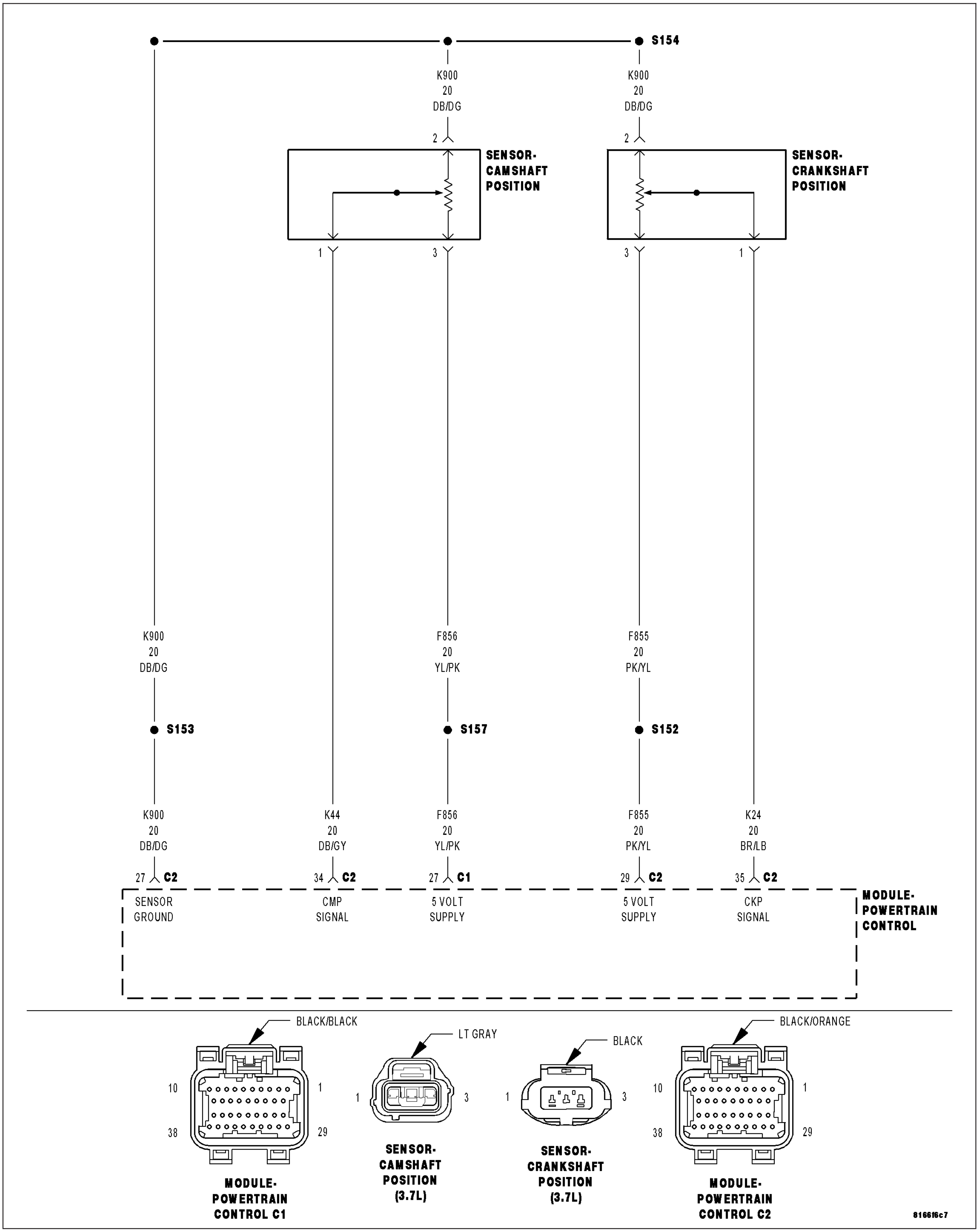
Observe the lab scope screen.

**Did the CKP Sensor generate any erratic pulses?**

**Yes** >> Replace the Crankshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0344-CAMSHAFT POSITION SENSOR INTERMITTENT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While cranking the engine and engine running.
- **Set Condition:**
  When the failure counter reaches 20. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (F856) 5-VOLT SUPPLY CIRCUIT OPEN |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| (K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K44) CMP SIGNAL CIRCUIT OPEN |
| (K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND |
| (K44) CMP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT |
| TONE WHEEL/PULSE RING |
| CAMSHAFT POSITION SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. CHECKING CAMSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the CMP harness connector.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Ignition on, engine not running.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

**Are there any irregular or missing signals?**

**Yes** >> Go To 3

**No** >> Go To 8

## 3. WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wire harness including the ground circuit. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to the proper specification.

Refer to any TSBs that may apply.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

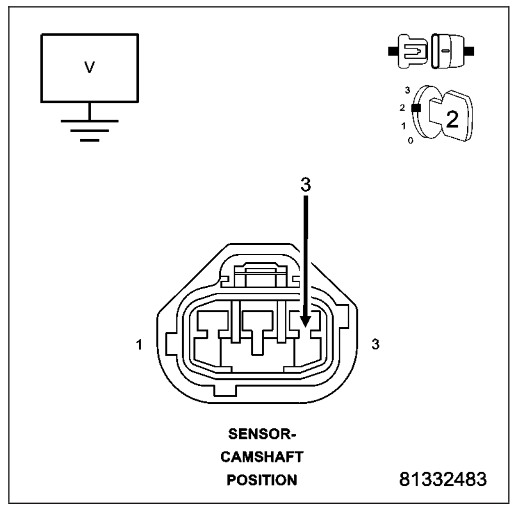
**No** >> Go To 4

## 4. (F856) 5-VOLT SUPPLY CIRCUIT OPEN OR SHORTED TO GROUND

Disconnect the CMP Sensor connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the CMP harness connector.




**Is the voltage between 4.5 and 5.2 volts?**

**Yes** >> Go To 5

**No** >> Repair the open or short to ground in the (F856) 5-volt Supply circuit. Use Miller special tool #8815 when checking for an open circuit to prevent PCM harness connector terminal damage.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. TONE WHEEL/PULSE RING INSPECTION

Turn the ignition off.

Carefully disconnect the Battery Ground cable.

Remove the Camshaft Position Sensor.

Inspect the Tone Wheel/Pulse Ring for damage, foreign material, or excessive movement.

**Were any problems found?**

**Yes** >> Repair or replace the Tone Wheel/Pulse Ring as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECKING CRANKSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

**NOTE: An intermittent condition in the Crank Position Sensor can cause the P0344 to set.**

Install the CMP Sensor and connect the Battery cable.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crank Position Sensor.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

**Are there any irregular or missing signals?**

**Yes** >> Replace the Crank Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CAMSHAFT POSITION SENSOR

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Camshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 8. (K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the CMP Sensor connector.

Disconnect the C1 and C2 PCM harness connectors.

Ignition on, engine not running.

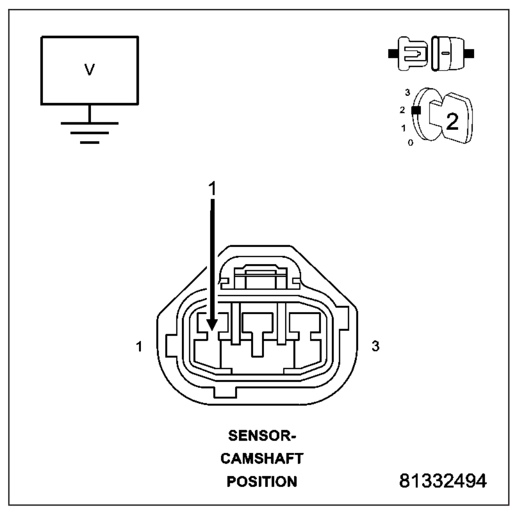
Measure the voltage on the (K44) CMP Signal circuit.

Wiggle the related wire harness while taking this measurement.

**Does the voltage ever increase above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K44) CMP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9



## 9. (K44) CMP SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance in the (K44) CMP Signal circuit from the CMP harness connector to the appropriate terminal of special tool #8815.

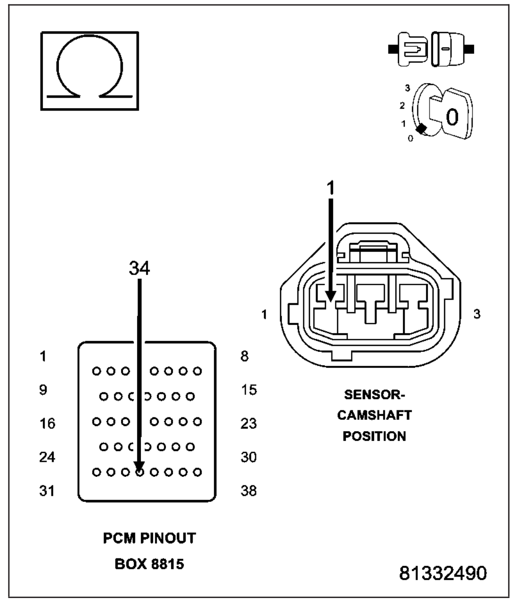
Wiggle the related wire harness while taking this measurement.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 10

**No** >> Repair the excessive resistance in the (K44) CMP Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




## 10. (K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Signal circuit in the CMP Sensor harness connector.

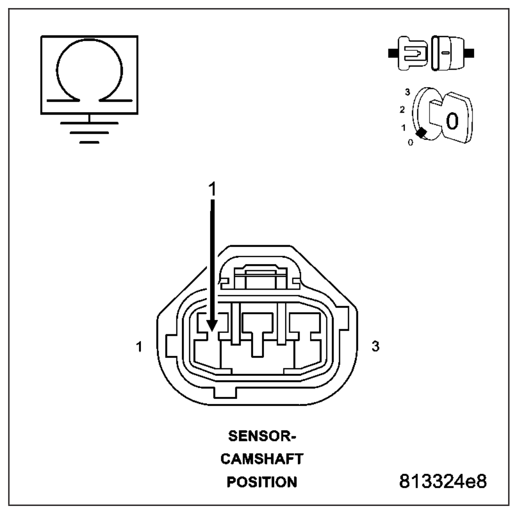
Wiggle the related wire harness while monitoring the resistance value.

**Does the resistance ever go below 100 ohms?**

**Yes** >> Repair the short to ground in the (K44) CMP Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11



## 11. (K44) CMP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

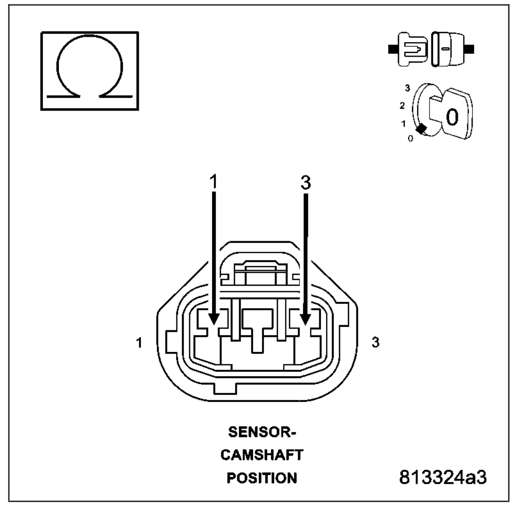
Measure the resistance between the (F856) 5-volt Supply circuit and the (K44) CMP Signal circuit in the CMP harness connector.

Wiggle the related wire harness while taking this measurement.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (F856) 5-volt Supply circuit and the (K44) CMP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 12




## 12. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

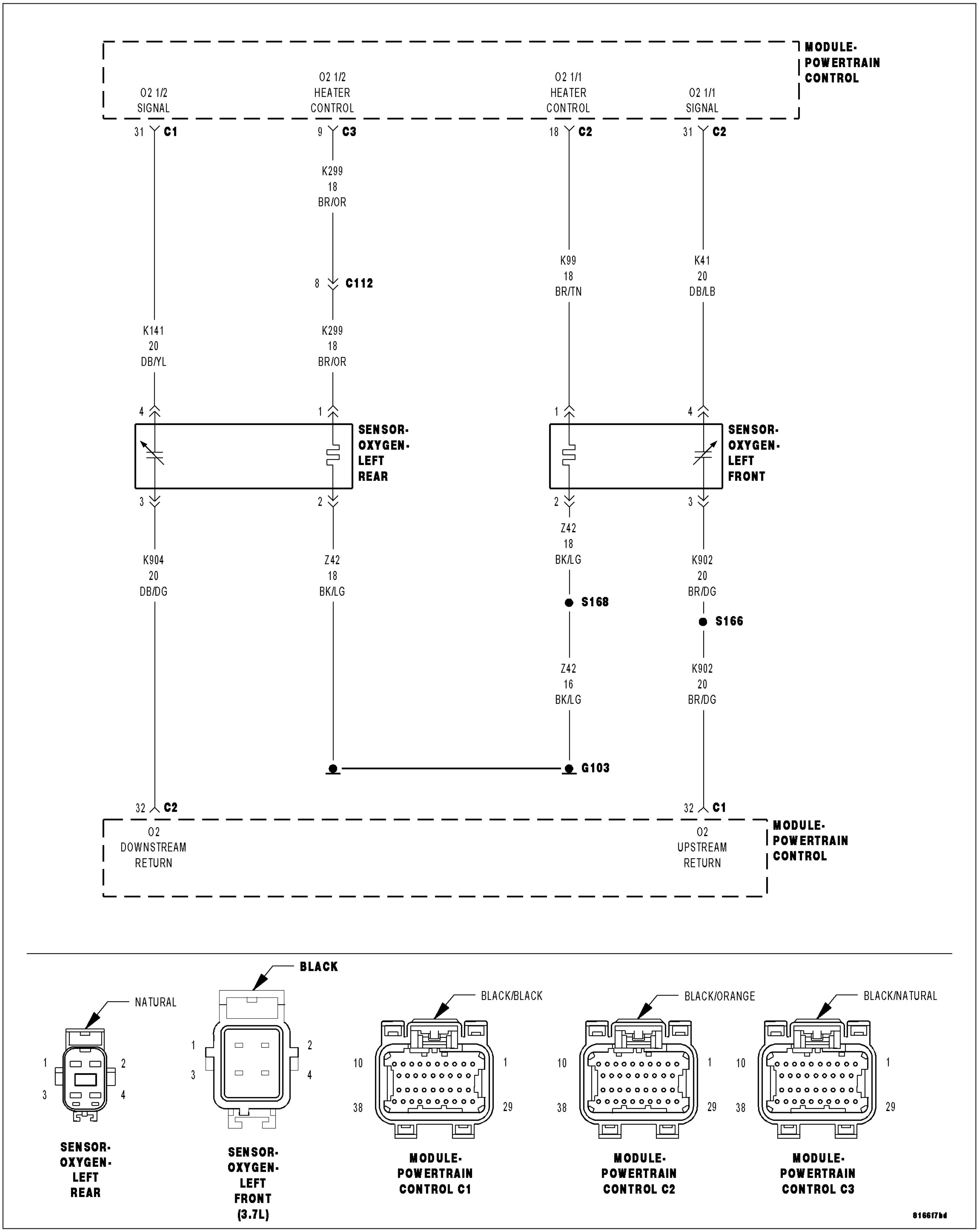
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0420-CATALYST 1/1 EFFICIENCY




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The State of Change (SOC) catalyst monitor uses the signals from both the upstream and downstream O2 sensors to detect aging of the catalyst. Based on the fact that when a catalyst ages, it loses some of its Oxygen Storage Capacity (OSC). As a result, part of the untreated exhaust gases can breakthrough the catalyst and causes the downstream O2 sensor to deviate from its neutral (Stoichiometric) position. By observing the activities in the downstream O2 signal, the degradation level of catalyst can be detected. In general, the higher the downstream O2 sensor SOC value, the more exhaust gas breakthrough and the lower the OSC of the catalytic converter.

- **When Monitored:**
  The monitor will run at between 1400 and 2300 RPM. It also runs between 40 and 70 KPA.
- **Set Condition:**
  If the final State of Change index is within the calibrated fail threshold. Two trip fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EXHAUST LEAK |
| ENGINE MECHANICAL CONDITION |
| AGING O2 SENSOR |
| CATALYTIC CONVERTER |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set. Review the repair history of the vehicle before continuing.**

**NOTE: If an O2 Sensor DTC set along with the Catalytic Converter Efficiency DTC diagnose the O2 Sensor DTC(s) before continuing.**

**NOTE: Check for contaminants that may have damaged the O2 Sensor and Catalytic Converter: contaminated fuel, unapproved silicone, oil and coolant, repair necessary.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. VISUALLY INSPECT CATALYTIC CONVERTER

Inspect the Catalytic Converter for the following damage.

Damage Catalytic Converter, dents or holes.

Severe discoloration caused by overheating the Catalytic Converter.

Catalytic Converter broke internally.

Inspect both ends of the converter, inlet and outlet.

Leaking Catalytic Converter.

**Were any problems found?**

**Yes** >> Replace the Catalytic Converter. Repair the condition that may have caused the failure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. EXHAUST LEAK

Start the engine.

Inspect the exhaust for leaks between the engine and the 1/1 O2 Sensor.

Inspect the exhaust for leaks between the engine and the 1/2 O2 Sensor.

Turn the ignition off.

If a leak is heard but unable to be located, it may be necessary to use special tool Miller Tool #8404A Evaporative Emissions Leak Detector (EELD) on the exhaust system to find leaks.

Connect the SMOKE supply tip (black hose) to the exhaust cone adapter (if equipped) and place it into the tail pipe.

Set the smoke/air control switch to SMOKE.

Press the remote smoke/air start button.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view, release the remote smoke/air start button, and use the ultraviolet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

Be sure to check the exhaust manifold to cylinder head connection for leaks.

**Are there any exhaust leaks?**

**Yes** >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. ENGINE MECHANICAL CONDITION

Check the exhaust for excessive smoke caused by an internal problem in the engine.

**Is an engine mechanical condition present?**

**Yes** >> Repair the engine mechanical condition as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. AGING O2 SENSOR

A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set.

Review the vehicles repair history.

**Has the rear O2 Sensor been replaced without replacing the front O2 Sensor?**

**Yes** >> Replace the Front O2 Sensor as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

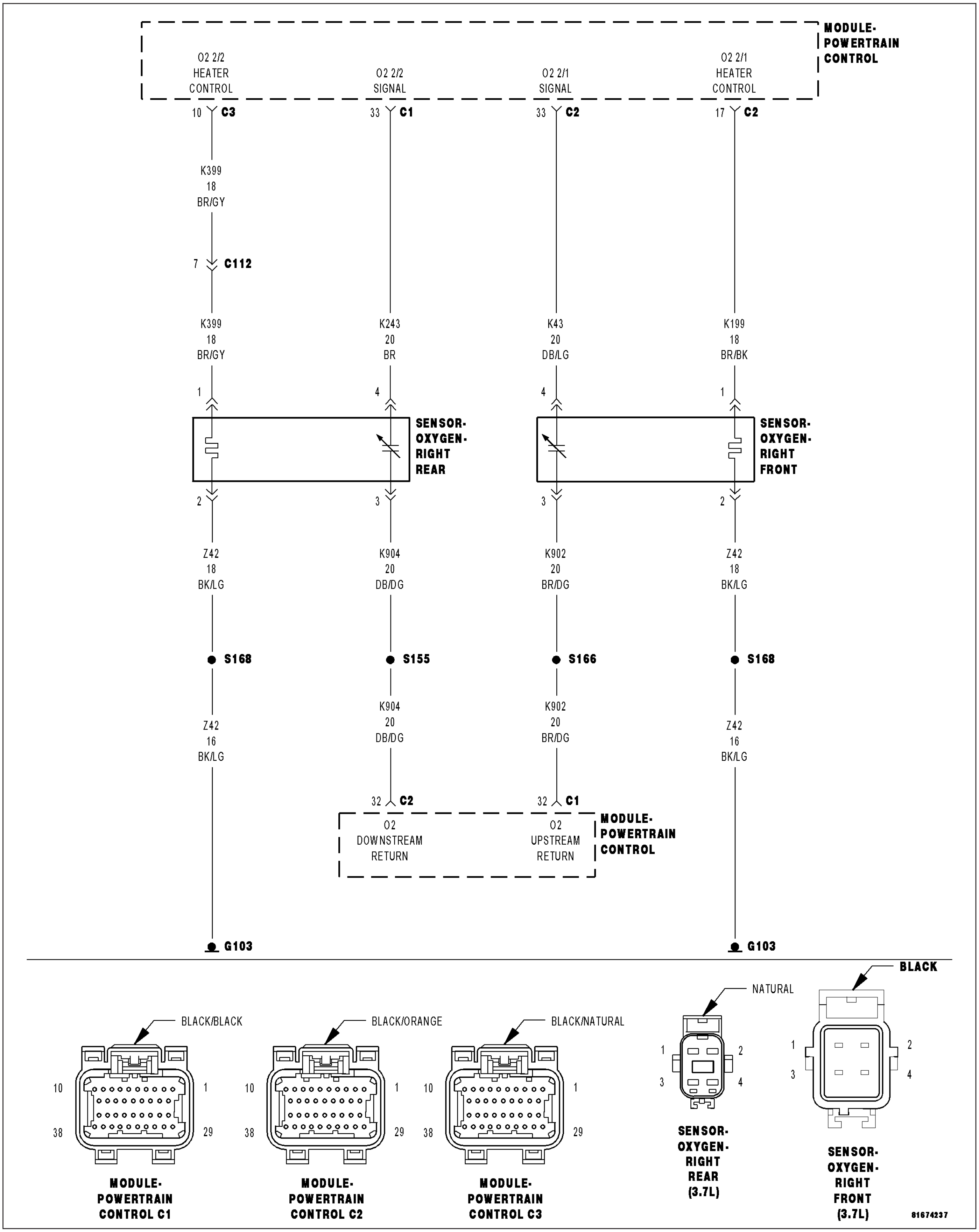
## 6. CATALYTIC CONVERTER

**If there are no possible cause remaining, view repair.**

**Repair**

Replace the Catalytic Converter.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0430-CATALYST 2/1 EFFICIENCY




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The State of Change (SOC) catalyst monitor uses the signals from both the upstream and downstream O2 sensors to detect aging of the catalyst. Based on the fact that when a catalyst ages, it loses some of its Oxygen Storage Capacity (OSC). As a result, part of the untreated exhaust gases can breakthrough the catalyst and causes the downstream O2 sensor to deviate from its neutral (Stoichiometric) position. By observing the activities in the downstream O2 signal, the degradation level of catalyst can be detected. In general, the higher the downstream O2 sensor SOC value, the more exhaust gas breakthrough and the lower the OSC of the catalytic converter.

- **When Monitored:**
  The monitor will run at between 1400 and 2300 RPM. It also runs between 40 and 70 KPA.
- **Set Condition:**
  If the final State of Change index is within the calibrated fail threshold. Two trip fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EXHAUST LEAK |
| ENGINE MECHANICAL CONDITION |
| AGING O2 SENSOR |
| CATALYTIC CONVERTER |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set. Review the repair history of the vehicle before continuing.**

**NOTE: If an O2 Sensor DTC set along with the Catalytic Converter Efficiency DTC diagnose the O2 Sensor DTC(s) before continuing.**

**NOTE: Check for contaminants that may have damaged the O2 Sensor and Catalytic Converter: contaminated fuel, unapproved silicone, oil and coolant, repair necessary.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. VISUALLY INSPECT CATALYTIC CONVERTER

Inspect the Catalytic Converter for the following damage.

Damage Catalytic Converter, dents or holes.

Severe discoloration caused by overheating the Catalytic Converter.

Catalytic Converter broke internally.

Inspect both ends of the converter, inlet and outlet.

Leaking Catalytic Converter.

**Were any problems found?**

**Yes** >> Replace the Catalytic Converter. Repair the condition that may have caused the failure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. EXHAUST LEAK

Start the engine.

Inspect the exhaust for leaks between the engine and the 2/1 O2 Sensor.

Inspect the exhaust for leaks between the engine and the 2/2 O2 Sensor.

Turn the ignition off.

If a leak is heard but unable to be located, it may be necessary to use special tool Miller Tool #8404A Evaporative Emissions Leak Detector (EELD) on the exhaust system to find leaks.

Connect the SMOKE supply tip (black hose) to the exhaust cone adapter (if equipped) and place it into the tail pipe.

Set the smoke/air control switch to SMOKE.

Press the remote smoke/air start button.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view, release the remote smoke/air start button, and use the ultraviolet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

Be sure to check the exhaust manifold to cylinder head connection for leaks.

**Are there any exhaust leaks?**

**Yes** >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. ENGINE MECHANICAL CONDITION

Check the exhaust for excessive smoke caused by an internal problem in the engine.

**Is an engine mechanical condition present?**

**Yes** >> Repair the engine mechanical condition as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. AGING O2 SENSOR

A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set.

Review the vehicles repair history.

**Has the rear O2 Sensor been replaced without replacing the front O2 Sensor?**

**Yes** >> Replace the 2/1 O2 Sensor as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

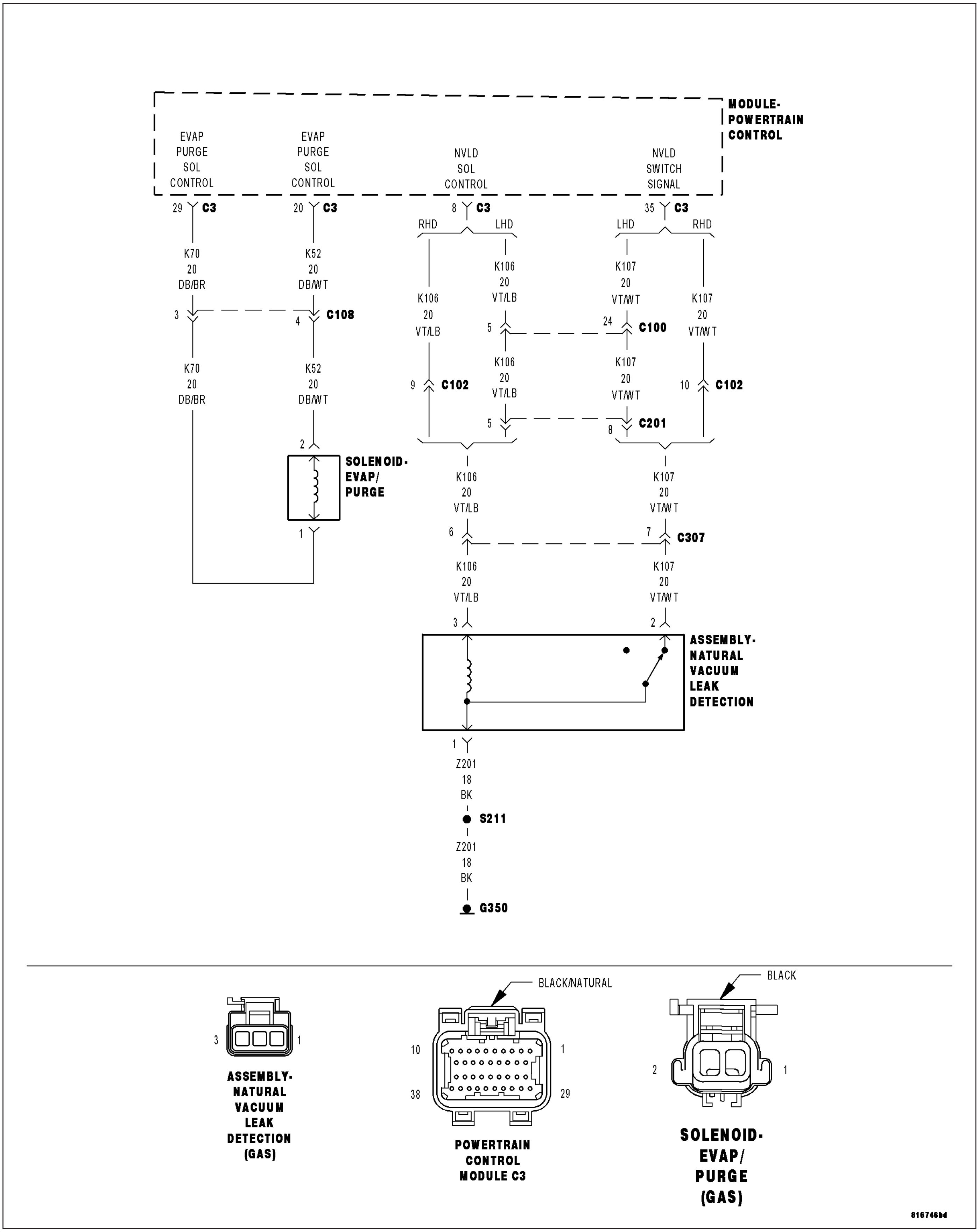
## 6. CATALYTIC CONVERTER

**If there are no possible cause remaining, view repair.**

**Repair**

Replace the Catalytic Converter.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0440-GENERAL EVAP SYSTEM FAILURE




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The theory behind the Natural Vacuum Leak Detection (NVLD) is adherence to the Ideal Gas Law. Pressure in a sealed vessel will change linearly as a function of the temperature of the gas in the vessel. Even small leaks will allow the pressure in the vessel to come to equilibrium with the atmospheric pressure. The General Evap test runs by commanding purge flow during the leak size test and evaluates the NVLD vacuum switch.

- **When Monitored:**
  Engine running after a cold start. Fuel Level greater than 12%. Fuel level below 88%. No NVLD switch during previous eng off time. No NVLD switch close during leak size purge draw. Ambient Temperature between 4°C and 32°C (39°F and 89°F).
- **Set Condition:**
  The PCM does not see the NVLD switch close during the medium/large leak test. The PCM then will increase the vacuum supply to the EVAP system by increasing flow through the EVAP Purge valve. If the switch does not close with an increase in vacuum an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EVAP PURGE SOLENOID VACUUM SUPPLY |
| (Z201) GROUND CIRCUIT OPEN |
| (K107) NVLD SWITCH SIGNAL CIRCUIT OPEN |
| EVAPORATIVE EMISSION LEAK DETECTION |
| NVLD ASSEMBLY |
| EVAP PURGE SOLENOID |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTCs are present.

Whether or not any DTCs are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTCs.

If a service bulletin applies, follow the instructions per the service bulletin.

**Choose the following scenario that best applies.**

**The service bulletin repaired the customer's complaint.**
Testing complete.

**A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.**
Go To 2

## 2. ACTIVE DTC

**NOTE: If any of the following DTCs are set (P0443, P0452, P0453, P0498, or P0499) diagnose them first before continuing with P0440.**

**NOTE: A loose gas cap could have caused this DTC to set. Make sure the gas cap is tight and in good condition.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 3

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. VISUAL AND PHYSICAL INSPECTION

Turn the ignition off.

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the following conditions:

- Hoses disconnected or left off
- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap left off or bad gasket seal

**Were any of the above conditions found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. EVAP VACUUM SUPPLY HOSE INSPECTION

Carefully inspect the Evap Purge Solenoid vacuum supply hose for proper routing.

Check for a pinched or plugged hose from the throttle body or intake manifold to the Purge Solenoid.

Make sure the vacuum port at the throttle body or intake manifold is free from any blockage.

**Were any problems found?**

**Yes** >> Repair the vacuum supply, hose/tube as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECKING EVAP PURGE SOLENOID FUNCTIONALITY

**NOTE: To continue testing you will need Miller Tool #8404 Evaporative Emission Leak Detector (EELD).**

**WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases, Keep the test area well ventilated.**

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Connect the SMOKE supply tip (black hose) to the “CAN” port on the Evap Purge Solenoid.

Set the smoke/air control switch to SMOKE.

While still holding the remote smoke/air start button, check to see if smoke is exiting the purge valve. This indicates that there is a leak internal to the purge valve.

**Is smoke visible from the EVAP Purge Solenoid?**

**Yes** >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECKING EVAP PURGE SOLENOID FUNCTIONALITY

**NOTE: This is an optional method of checking the purge valve for leaks if the EELD is unavailable.**

Disconnect the Smoke supply tip from the vacuum supply hoses at the EVAP Purge Solenoid.

Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ side of the EVAP Purge Solenoid.

Observe the vacuum gauge for at least 15 seconds.

**Does the EVAP Purge Solenoid hold vacuum?**

**Yes** >> Go To 7

**No** >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. NVLD SWITCH OPERATION

**CAUTION: Do not attempt to probe the NVLD Terminals to diagnose the switch function. This may damage the switch and disable the NVLD component. Follow procedures outlined in the service manual for NVLD switch testing using a scan tool.**

Connect the previously disconnected vacuum hose.

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the NVLD FORCED MONITOR TEST.

Monitor the NVLD Switch state.

**NOTE: As the test runs, the NVLD Switch should go from an OPEN state to a CLOSED state and then return to OPEN when the test is complete This may take up to 10 minutes.**

**Did the NVLD Switch operate as described above?**

**Yes** >> Test complete.

**No** >> Go To 8

## 8. VERIFY NVLD SWITCH OPERATION

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the NVLD FORCED MONITOR TEST for a second time.

While the NVLD FORCED MONITOR TEST is running, open/remove the gas cap.

Monitor the NVLD Switch state.

**Did the NVLD Switch go from OPEN to CLOSED?**

**Yes** >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. VERIFY EVAPORATIVE EMISSION LEAK

**WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.**

Turn the ignition off.

To continue testing you will need Miller Tool #8404 Evaporative Emission Leak Detector (EELD).

**NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.**

Connect the red power lead of EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the EVAP Canister.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the .040 orifice on the tester's control panel.

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute.

Install the service port adapter #8404-14 on the vehicle's service port (if equipped) or install the #8404-ADP into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

**Is the indicator ball above the red flag?**

**Yes** >> Go To 10

**No** >> Go To 11

## 10. EVAPORATIVE EMISSION LEAK DETECTION

**NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may aid diagnosis also.**

Remove the Air supply hose from the service port or the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

**NOTE: The flow meter indicator ball will not move at this point.**

Press the remote smoke/air start button.

**NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.**

**NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.**

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that are left behind by the smoke.

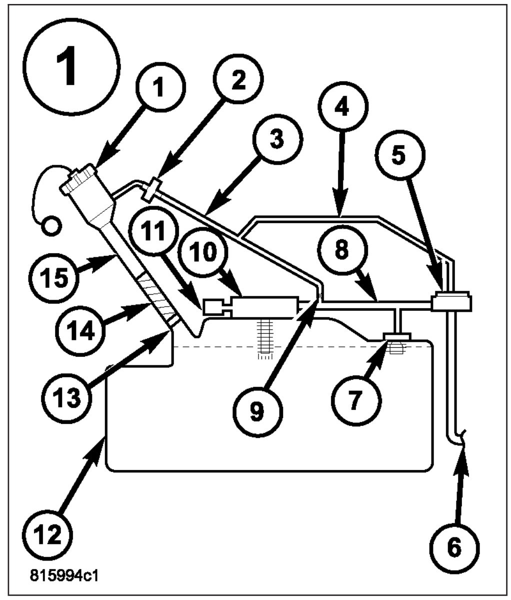
The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

**NOTE: The EVAP System is divided into three zones. A leak from any of these zones can cause this DTC to set. The lists below specify the possible leak points in that specific zone. For further assistance see the Zone Identification Charts below.**

---

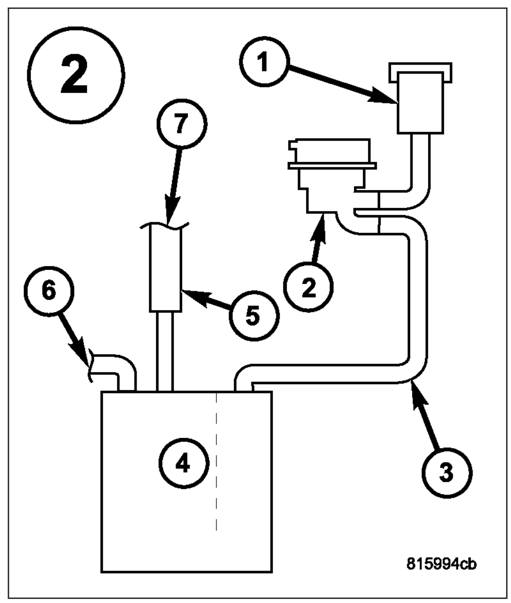
- ZONE 1

1 Fuel Cap
2 Recirculation Check Valve.
3 Vapor Recirculation Line.
4 Signal Vapor Line for FVM.
5 Flow Management Valve.
6 Fuel Tank to Canister Vapor Line connection.
7 Fuel Tank Vent (Check Valve).
8 Vapor Line to Canister.
9 Flow Control Orifice.
10 Control Valve.
11 Liquid Trap.
12 Fuel Tank.
13 Check valve.
14 Fuel Fill Tube to Tank connector.
15 Fuel Fill Tube
Damaged or disconnected EVAP system components.




- ZONE 2

1 Filter.
2 NVLD.
3 Canister Vent Line.
4 Evap Canister.
5 Chassis Purge Valve.
6 Fuel Tank to Canister Vapor Line connection.
7 Evap Purge connection.




- ZONE 3

1 Evap Purge Vacuum Line.
2 Connection to Chassis Line.
3 Connection to Canister.
4 Chassis Purge Line.
5 Evap Purge Vacuum Line.
6 Connection to Evap Purge Harness.
7 Chassis Evap Purge Line connection to Engine Vacuum.
8 Evap Purge Valve.
9 Service Port.

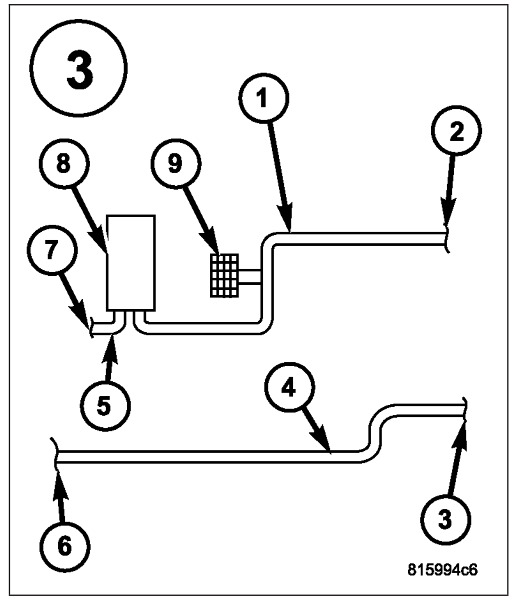
**NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke or dye may or may not be visible. Introducing smoke into the filtered side of the canister may assist in locating the leak.**

**Was a leak found?**

**Yes** >> Repair or replace the leaking component as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 11

## 11. NVLD ASSEMBLY




Turn the ignition off.

Disconnect the NVLD electrical harness connector.

Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

Connect a jumper wire between the (K107) NVLD Switch Signal circuit and the (Z201) Ground circuit in the NVLD electrical harness connector.

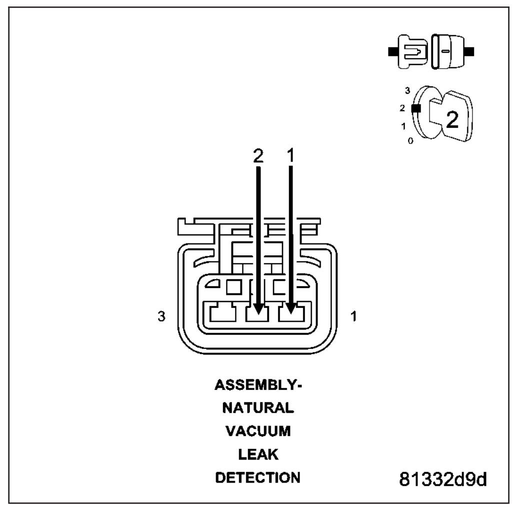
Monitor the NVLD Switch state on the scan tool.

**Does the Switch change from OPEN to CLOSED when the jumper wire is installed?**

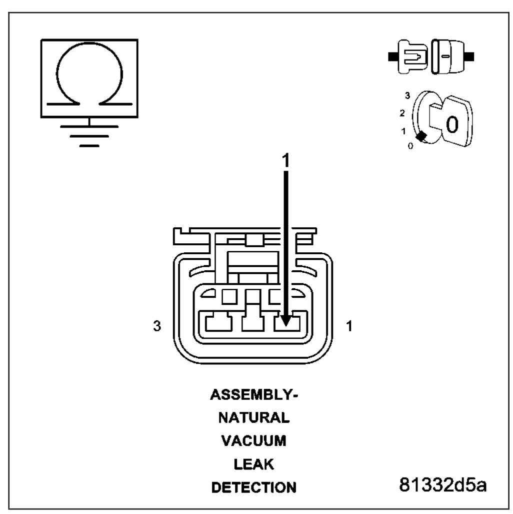
**Yes** >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 12

**NOTE: Remove the jumper wire before continuing.**




## 12. (Z201) GROUND CIRCUIT OPEN




Turn the ignition off.

Measure the resistance between the (Z201) Ground circuit and ground.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 13

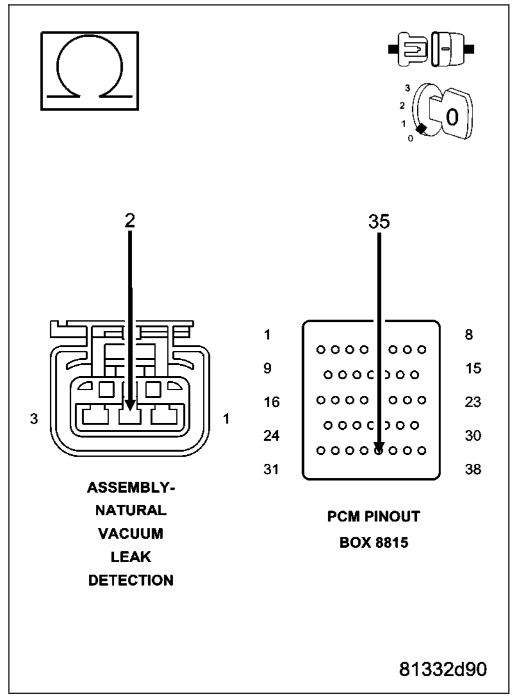
**No** >> Repair the open in the (Z201) Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE).

## 13. (K107) NVLD SWITCH SIGNAL CIRCUIT OPEN

Disconnect the PCM harness connectors.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K107) NVLD Switch Signal circuit from the NVLD electrical harness connector to the appropriate terminal of the special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 14

**No** >> Repair the open in the (K107) Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 14. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

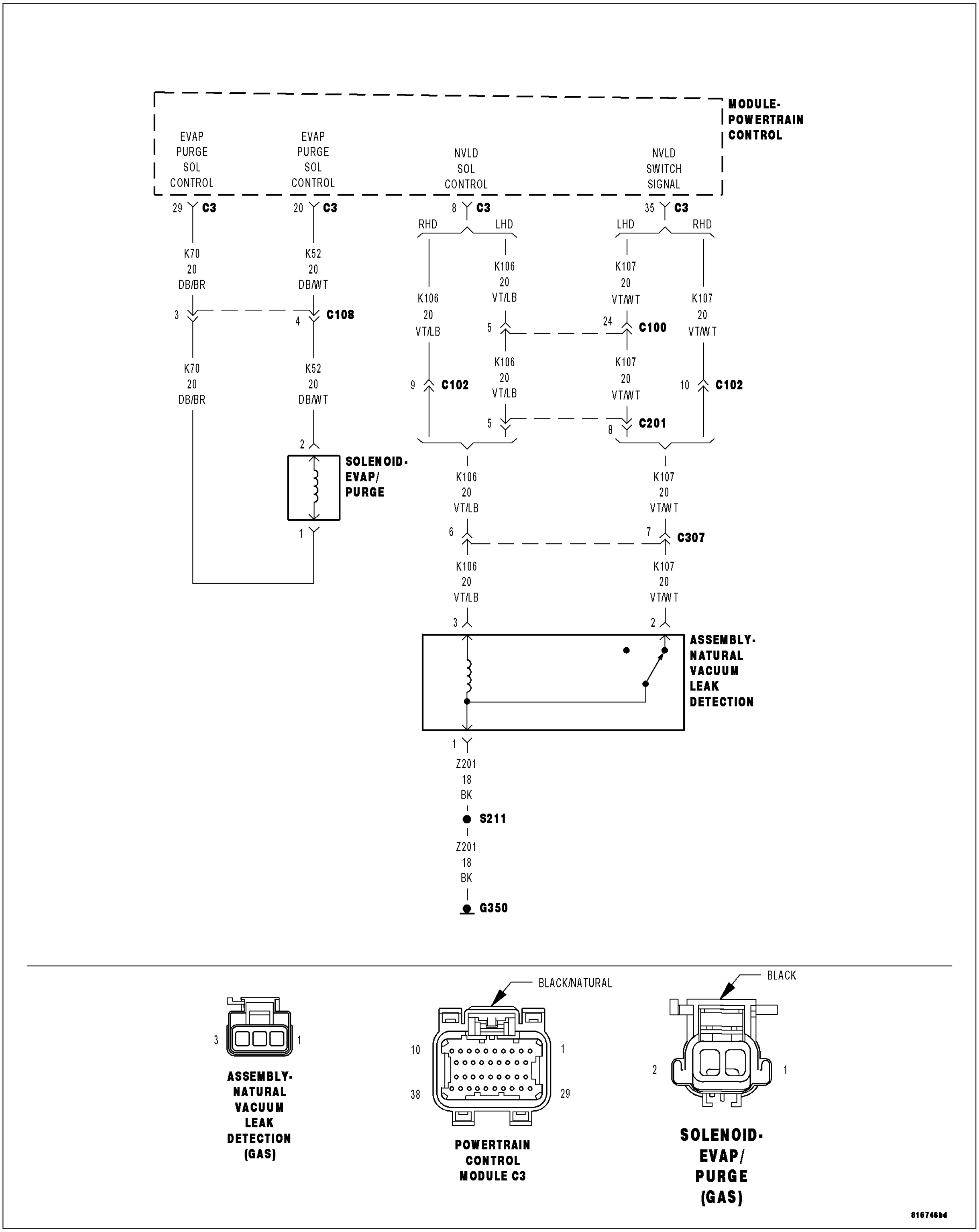
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0441-EVAP PURGE SYSTEM PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Cold start test. Engine Running. Small Leak Test Passed.
- **Set Condition:**
  The PCM activates the EVAP Purge solenoid gradually increases to maximum flow. During flow, the PCM looks for the NVLD switch to close. If the PCM does not see the NVLD switch close at maximum flow an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| EVAP PURGE SOLENOID VACUUM SUPPLY |
| EVAP PURGE SOLENOID |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTCs are present.

Whether or not any DTCs are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTCs.

If a service bulletin applies, follow the instructions per the service bulletin.

**Choose the following scenario that best applies.**

**The service bulletin repaired the customer's complaint.**
Testing complete.

**A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.**
Go To 2

### 2. ACTIVE DTC

**NOTE: If any of the following DTCs are set (P0443, P0452, P0453, P0498, or P0499) diagnose them first before continuing with P0441.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 3

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. CHECKING EVAP PURGE SOLENOID FUNCTIONALITY

**NOTE: After disconnecting the Evap Purge vacuum connections, inspect the lines and solenoid for any signs of contamination or foreign materials.**

Using a hand vacuum pump, apply 10 in Hg to ″CAN″ side of the EVAP Purge Solenoid.

Ignition on, engine not running.

Observe the vacuum gauge.

With the scan tool, actuate the EVAP Purge Solenoid.

**Does the vacuum drop when the solenoid is actuated?**

**Yes** >> Go To 4

**No** >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Remove the vacuum pump before continuing.**

## 4. EVAP VACUUM SUPPLY HOSE INSPECTION

Turn the ignition off.

Carefully inspect the Evap Purge Solenoid vacuum supply hose for proper routing.

Check for a pinched or plugged hose from the throttle body or intake manifold to the Purge Solenoid.

Inspect the vacuum port at the throttle body or intake manifold for any damage or plugging.

**Were any problems found?**

**Yes** >> Repair the vacuum supply hose/tube as necessary.
Perform the POWERTRAIN VERIFICATION TEST.

**No** >> Go To 5
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. NVLD SWITCH OPERATION

**CAUTION: Do not attempt to probe the NVLD Terminals to diagnose the switch function. This may damage the switch and disable the NVLD component. Follow procedures outlined in the service manual for NVLD switch testing using a scan tool.**

Connect the previously disconnected vacuum hose.

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the NVLD FORCED MONITOR TEST.

Monitor the NVLD Switch state.

**NOTE: As the test runs, the NVLD Switch should go from an OPEN state to a CLOSED state and then return to OPEN when the test is complete This may take up to 10 minutes.**

**Did the NVLD Switch operate as described above?**

**Yes** >> Test complete.

**No** >> Go To 6

## 6. VERIFY NVLD SWITCH OPERATION

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the NVLD FORCED MONITOR TEST for a second time.

While the NVLD FORCED MONITOR TEST is running, open/remove the gas cap.

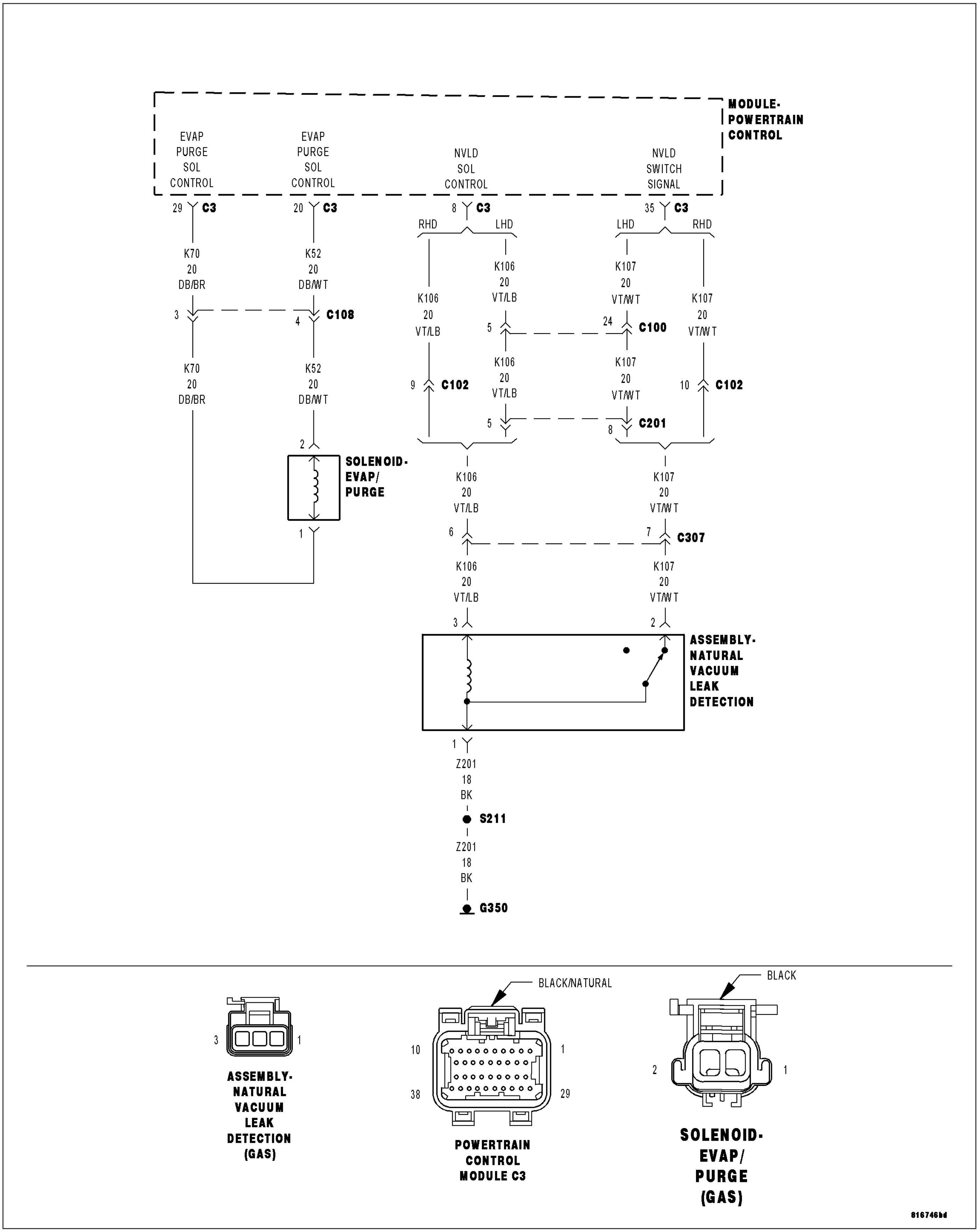
Monitor the NVLD Switch state.

**Did the NVLD Switch go from OPEN to CLOSED?**

**Yes** >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Test complete.

## P0443-EVAP PURGE SOLENOID CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The ignition on or engine running. Battery voltage greater than 10 volts.
- **Set Condition:**
  The PCM will set a trouble code if the actual state of the solenoid does not match the intended state for more than 4.4 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K52) EVAP PURGE CONTROL CIRCUIT OPEN |
| (K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| (K70) EVAP PURGE SOLENOID SIGNAL CIRCUIT OPEN |
| (K70) EVAP PURGE SOLENOID SIGNAL CIRCUIT SHORTED TO GROUND |
| EVAP PURGE SOLENOID |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTCs are present.

Whether or not any DTCs are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTCs.

If a service bulletin applies, follow the instructions per the service bulletin.

**Choose the following scenario that best applies.**

**The service bulletin repaired the customer's complaint.**
Testing complete.

**A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.**
Go To 2

### 2. ACTIVE DTC

Ignition on, engine not running.

With the scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 3

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. EVAP PURGE SOLENOID OPERATION

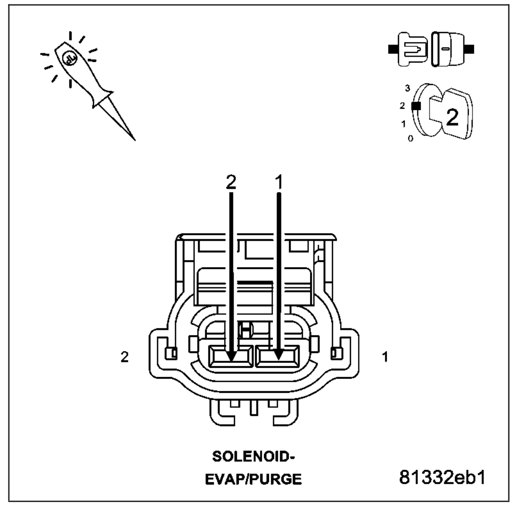
Turn the ignition off.

Disconnect the EVAP Purge Solenoid harness connector.

Ignition on, engine not running.

Using a 12-volt test light, jump across the (K52) Evap Purge Solenoid Control circuit and (K70) Evap Purge Solenoid Signal circuit in the EVAP Purge Solenoid harness connector.

With a scan tool, actuate the EVAP Purge Solenoid.




**Does the test light flash on and off?**

**Yes** >> Replace the EVAP Purge Solenoid.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

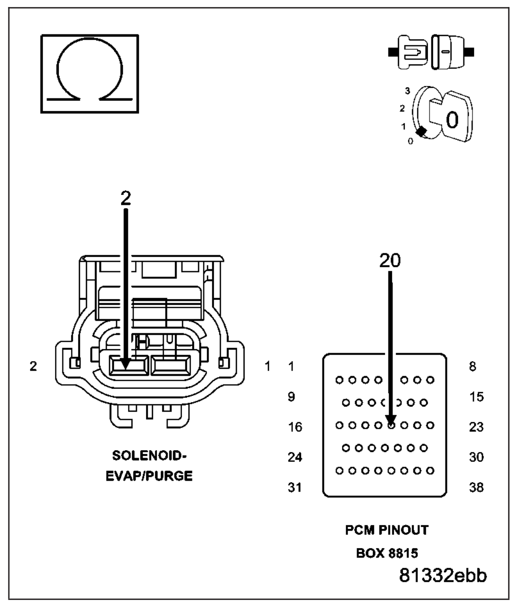
## 4. (K52) EVAP PURGE SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K52) Evap Purge Solenoid Control circuit from the Evap Purge Solenoid harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the open in the (K52) EVAP Purge Solenoid Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

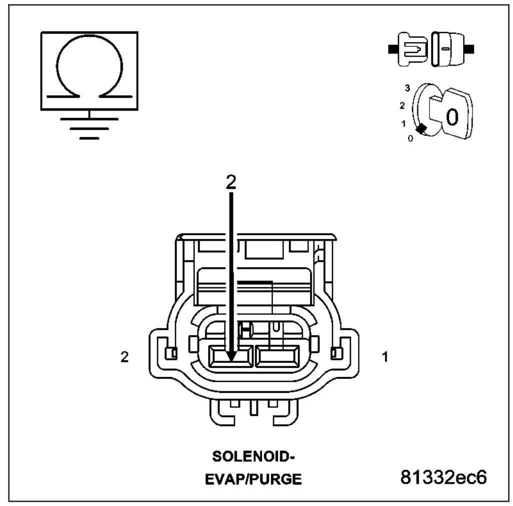
## 5. (K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K52) Evap Purge Solenoid Control circuit in the Evap Purge Solenoid harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K52) EVAP Purge Solenoid Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6




## 6. (K70) EVAP PURGE SOLENOID SIGNAL CIRCUIT OPEN

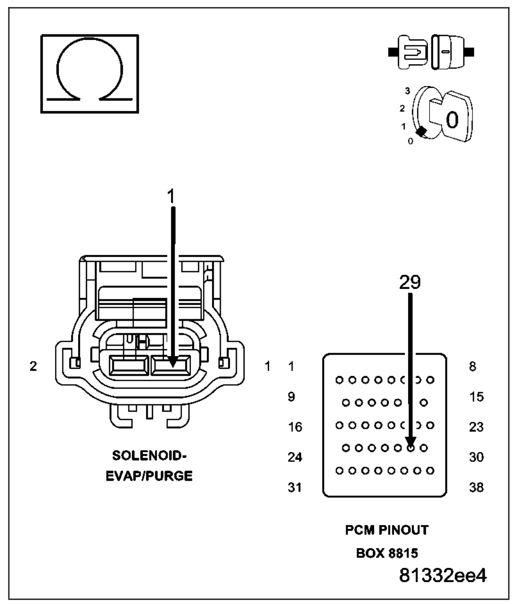
**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K70) Evap Purge Solenoid Signal circuit from the EVAP Purge Solenoid harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

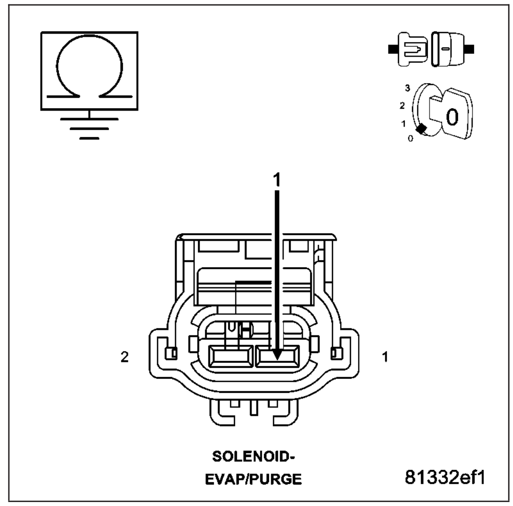
**Yes** >> Go To 7

**No** >> Repair the open in the (K70) Evap Purge Solenoid Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



## 7. (K70) EVAP PURGE SOLENOID SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K70) Evap Purge Solenoid Signal circuit in the Evap Purge Solenoid harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K70) Evap Purge Solenoid Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

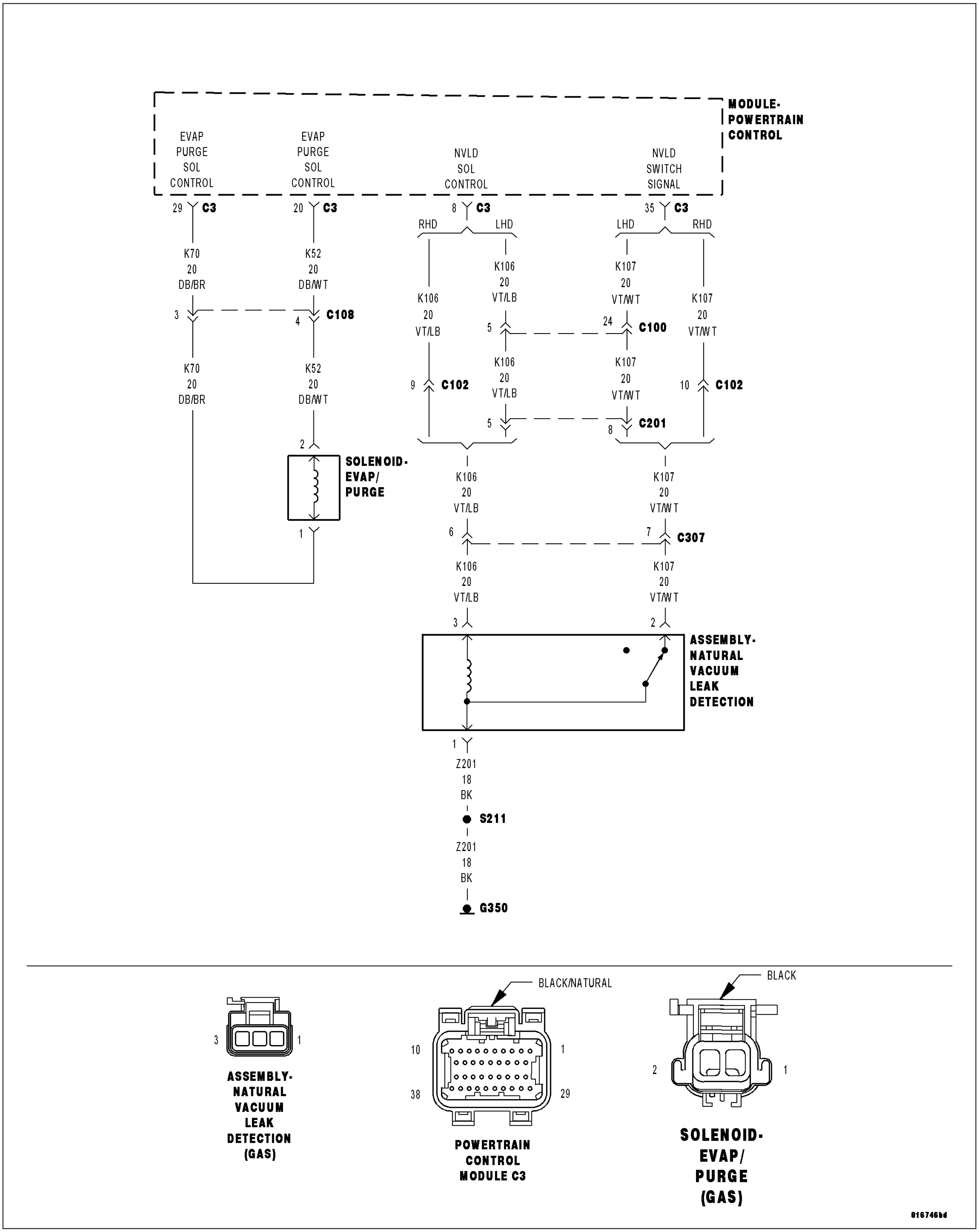
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0452-NVLD PRESSURE SWITCH STUCK CLOSED




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Immediately after the engine has been started.
- **Set Condition:**
  The PCM activates the NLVD Solenoid. If PCM does not see NVLD switch open an error is detected. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| (K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO GROUND |
| NVLD ASSEMBLY |
| EVAP PURGE SOLENOID |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTCs are present.

Whether or not any DTCs are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTCs.

If a service bulletin applies, follow the instructions per the service bulletin.

**Choose the following scenario that best applies.**

**The service bulletin repaired the customer's complaint.**
Testing complete.

**A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.**
Go To 2

### 2. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 3

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. EVAP PURGE SOLENOID OPERATION

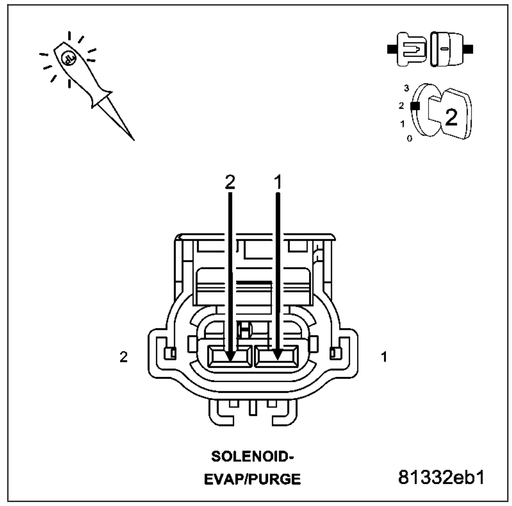
Turn the ignition off.

Disconnect the EVAP Purge Solenoid harness connector.

Ignition on, engine not running.

Using a 12-volt test light, jump across the Evap Purge Solenoid harness connector.

With the scan tool, actuate the EVAP Purge Solenoid.




**Does the test light flash on and off?**

**Yes** >> Go To 4

**No** >> Go To 8

## 4. EVAP PURGE SOLENOID LEAKS/STUCK OPEN

Turn the ignition off.

Connect the Evap Purge Solenoid harness connector.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

**NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.**

Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ of the EVAP Purge Solenoid.

**NOTE: Monitor the vacuum gauge for at least 15 seconds.**

**Does the EVAP Purge Solenoid hold vacuum?**

**Yes** >> Go To 5

**No** >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. NVLD SWITCH OPERATION

Ignition on, engine not running.

Using the scan tool, monitor the NVLD Switch State with the vacuum pump still installed and holding vacuum.

**Does the scan tool display the NVLD state OPEN?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

**NOTE: Remove the vacuum pump and connect the vacuum hose before continuing.**

## 6. NVLD ASSEMBLY

Disconnect the NVLD electrical connector.

**Does the Switch change from CLOSED to OPEN?**

**Yes** >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

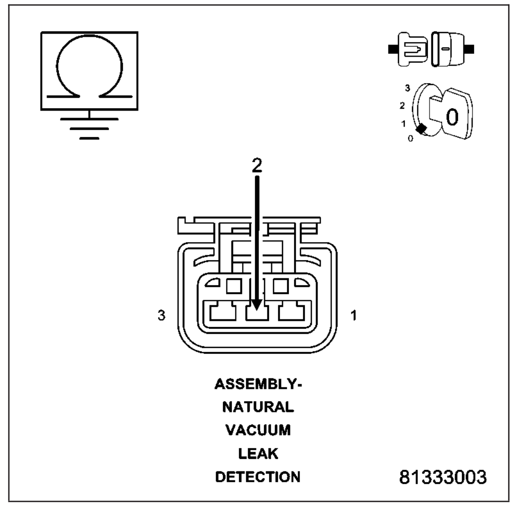
**No** >> Go To 7

## 7. (K107) SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K107) NVLD Switch Signal circuit in the NVLD Assembly harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K107) NVLD Switch Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

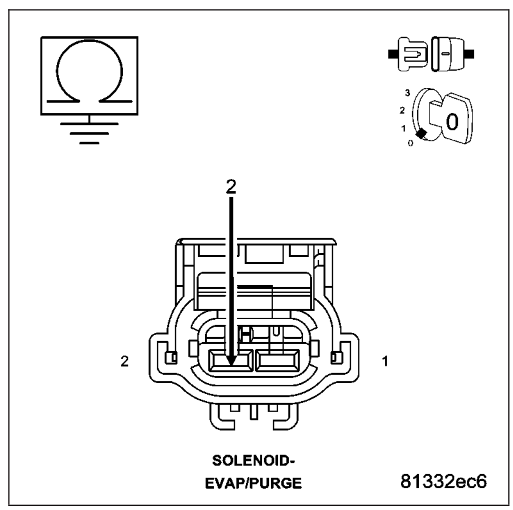
**No** >> Go To 9

## 8. (K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K52) Evap Purge Solenoid Control circuit in the EVAP Purge Solenoid harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K52) Evap Purge Sol Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

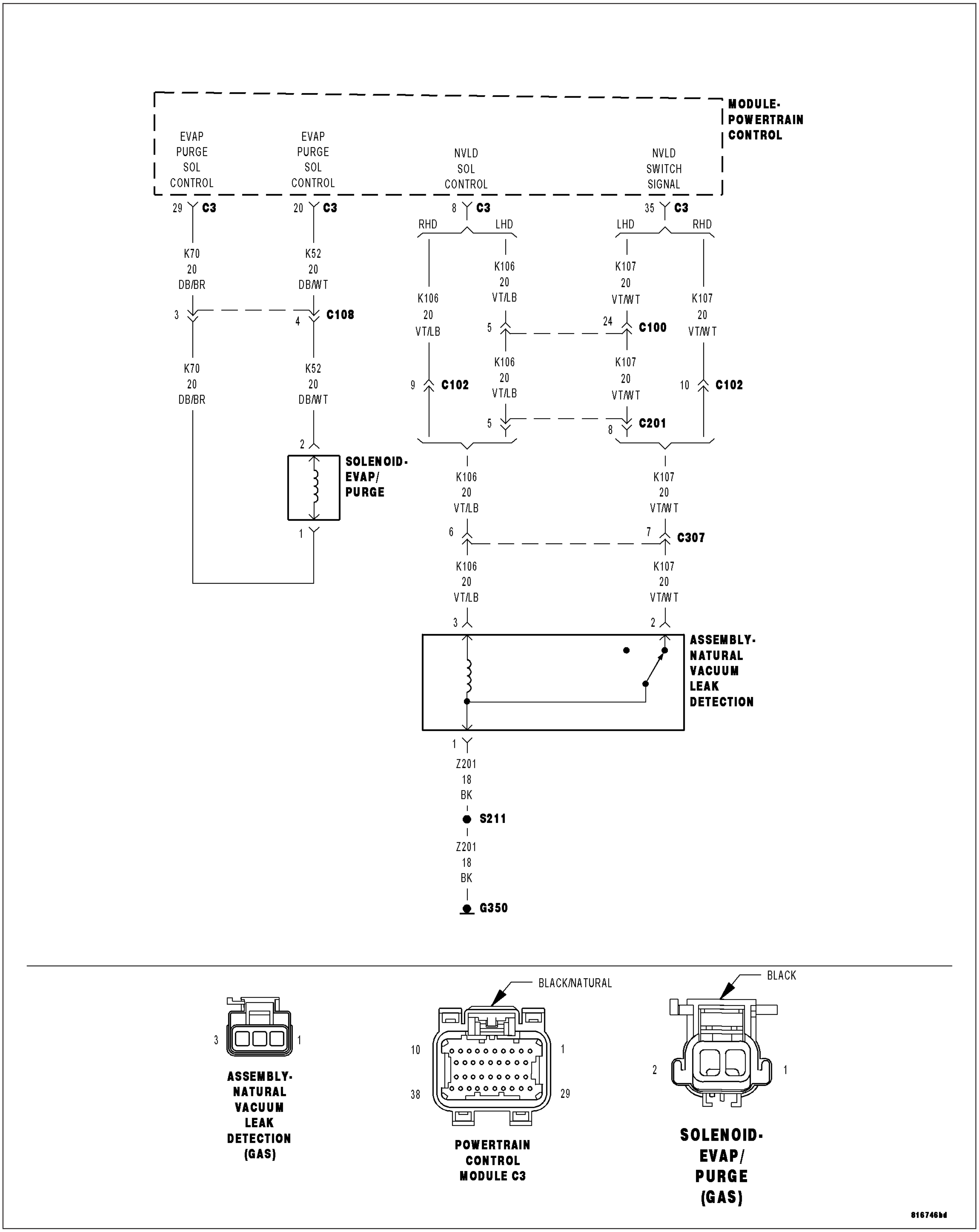
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0453-NVLD PRESSURE SWITCH STUCK OPEN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  If the PCM does not see the NVLD switch close during test an error is detected. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K107) NVLD SWITCH SIGNAL CIRCUIT OPEN |
| (K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO THE (K106) NVLD SOLENOID CONTROL CIRCUIT |
| (Z201) GROUND CIRCUIT OPEN |
| NVLD ASSEMBLY |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. NVLD SWITCH OPERATION

Start the engine.

Allow the engine to idle.

Using a scan tool, perform the NVLD FORCED MONITOR TEST.

Monitor the NVLD Switch state.

**NOTE: As the test runs, the NVLD Switch should go from an OPEN state to a CLOSED state and then return to OPEN when the test is complete.**

**Did the NVLD Switch operate as described above?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. NVLD ASSEMBLY

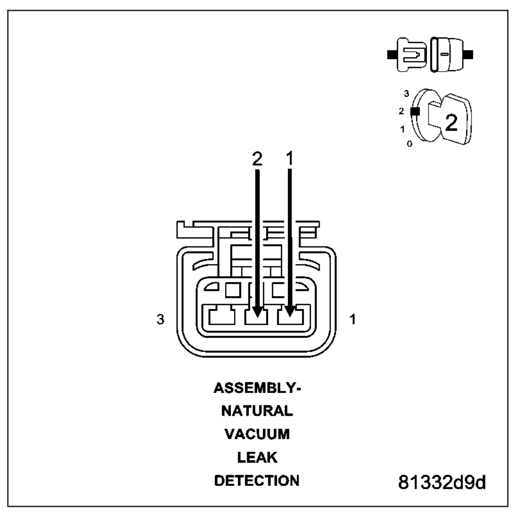
Turn the ignition off.

Disconnect the NVLD electrical harness connector.

Ignition on, engine not running.

Monitor the NVLD Switch state on the scan tool.

Connect a jumper wire between the (K107) NVLD Switch Signal circuit and the (Z201) Ground circuit in the NVLD harness connector.




**Does the Switch change from OPEN to CLOSED with the jumper wire installed?**

**Yes** >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

**NOTE: Remove the jumper wire before continuing.**

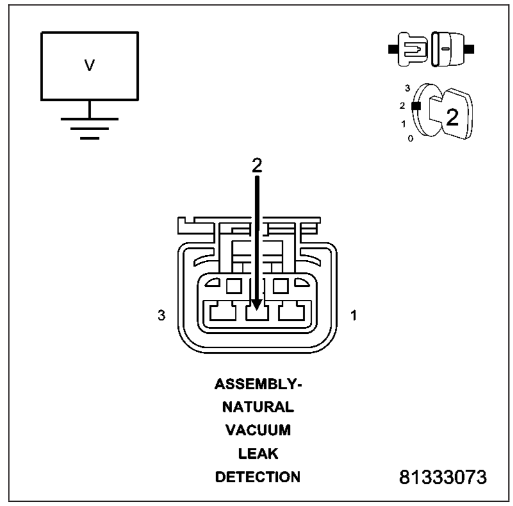
## 3. (K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K107) NVLD Switch Signal circuit in the NVLD electrical harness connector.




**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K107) NVLD Switch Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

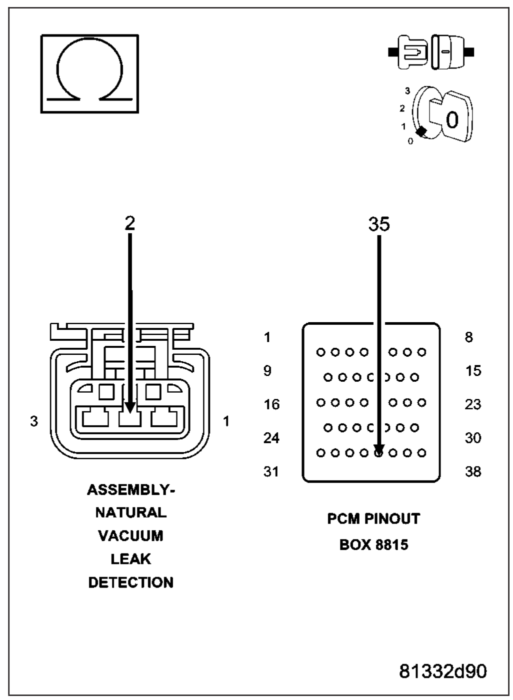
**No** >> Go To 4

## 4. (K107) NVLD SWITCH SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K107) NVLD Switch Signal circuit from the NVLD electrical harness connector to the appropriate terminal of special tool # 8815.



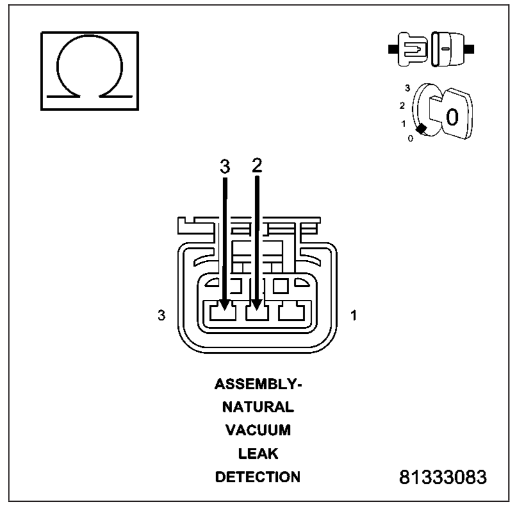

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the open in the (K107) NVLD Switch Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO THE (K106) NVLD SOLENOID CONTROL CIRCUIT

Measure the resistance between the (K107) NVLD Switch Signal circuit and the (K106) NVLD Solenoid Control circuit in the NVLD electrical harness connector.




**Is the resistance below 5.0 ohms?**

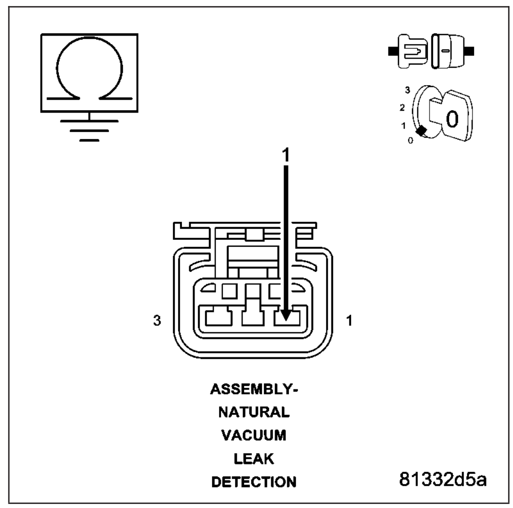
**Yes** >> Repair the short between the (K107) NVLD Switch Signal circuit and the (K106) NVLD Solenoid Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (Z201) GROUND CIRCUIT OPEN

Measure the resistance between the (Z201) Ground circuit and ground.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (Z201) Ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

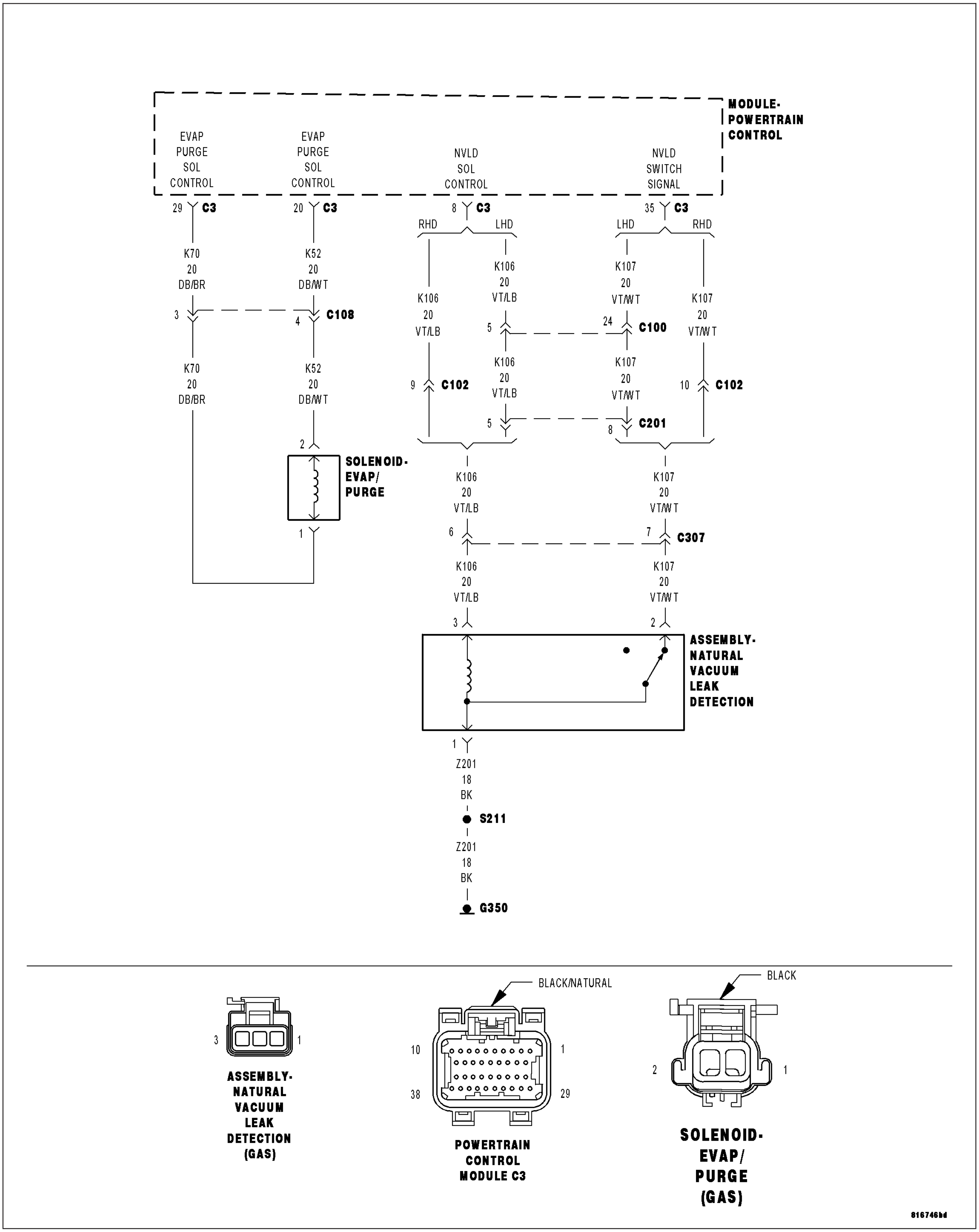
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0455-EVAP PURGE SYSTEM LARGE LEAK




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The theory behind the Natural Vacuum Leak Detection (NVLD) is adherence to the Ideal Gas Law. Pressure in a sealed vessel will change linearly as a function of the temperature of the gas in the vessel. Even small leaks will allow the pressure in the vessel to come to equilibrium with the atmospheric pressure. After key-off and a calibrated amount of time, cool down from operating temperatures or diurnal ambient temperature the system pressure will force the system to go negative or draw a vacuum if there is no leak. When the vacuum level reaches 1” H2O (0.25 KPA) the NVLD vacuum switch closes. This sends a signal to the NGC freezing a timer and registering a pass. If a switch closure is not detected an assessment of leak size will be made.

- **When Monitored:**
  Engine Running. Cold start test. Fuel Level greater than 12%. Ambient Temperature between 4°C and 32°C (39°F and 89°F) Close Loop fuel system. Test runs when small leak test is maturing.
- **Set Condition:**
  The PCM activates the EVAP Purge Solenoid to pull the EVAP system into a vacuum to close the NVLD switch. Once the NVLD switch is closed, the PCM turns the EVAP Purge solenoid off to seal the EVAP system. If the NVLD switch reopens before the calibrated amount of time for a Large leak an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EVAP PURGE SYSTEM LEAK |
| EVAP PURGE SOLENOID |
| NVLD SWITCH |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTCs are present.

Whether or not any DTCs are present you will want to check the following items which may assist in repairing the customer’s complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer’s current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer’s complaint or DTCs.

If a service bulletin applies, follow the instructions per the service bulletin.

**Choose the following scenario that best applies.**

**The service bulletin repaired the customer’s complaint.**
Testing complete.

**A DTC is present, no service bulletins apply, or the service bulletin didn’t repair the customer’s complaint.**
Go To 2

## 2. ACTIVE DTC

Check for any related TSBs before continuing.

**NOTE: Since a hot vehicle can conceal a leak, it is best to perform this test at room temperature.**

**NOTE: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Make sure the gas cap meets OEM specifications.**

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data.

**Is the DTC active at this time?**

**Yes** >> Go To 3

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. VISUAL AND PHYSICAL INSPECTION

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the follow conditions:

- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap gasket seal

**Were any of the above conditions found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

**WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.**

**NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.**

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

**NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.**

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

**Is the indicator ball above the red flag?**

**Yes** >> Go To 5

**No** >> Refer to the Freeze Frame data recorded in step 1. If the data indicates that the vehicle was in motion when the DTC was set, verify that all hoses are properly connected.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. EVAPORATIVE EMISSION LEAK DETECTION

**NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may aid diagnosis also.**

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

**NOTE: The flow meter indicator ball will not move in the smoke mode.**

Press the remote smoke/air start button.

**NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.**

**NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.**

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

**NOTE: The EVAP System is divided into three zones. A leak from any of these zones can cause this DTC to set. The lists below specify the possible leak points in that specific zone. For further assistance see the Zone Identification Charts below.**

- ZONE 1

1 Fuel Cap

2 Recirculation Check Valve.

3 Vapor Recirculation Line.

4 Signal Vapor Line for FVM.

5 Flow Management Valve.

6 Fuel Tank to Canister Vapor Line connection.

7 Fuel Tank Vent (Check Valve).

8 Vapor Line to Canister.

9 Flow Control Orifice.

10 Control Valve.

11 Liquid Trap.

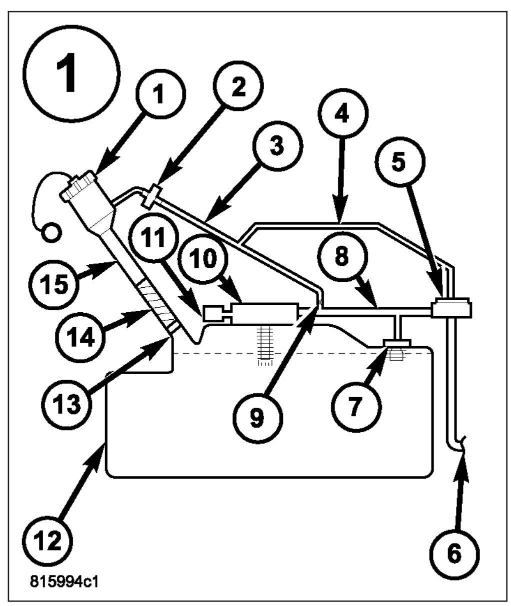
12 Fuel Tank.

13 Check valve.

14 Fuel Fill Tube to Tank connector.

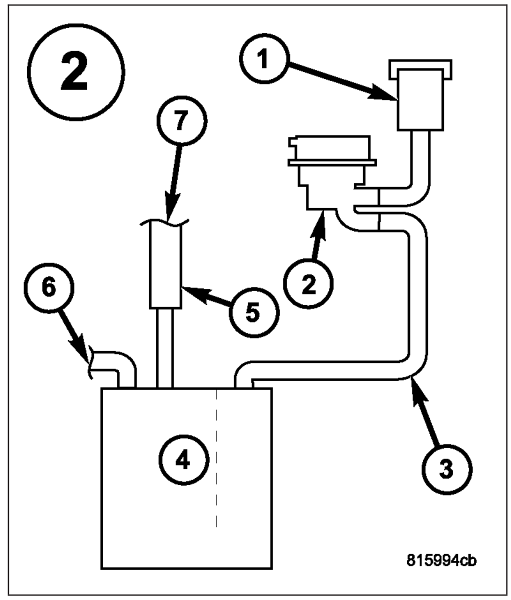
15 Fuel Fill Tube

Damaged or disconnected EVAP system components.



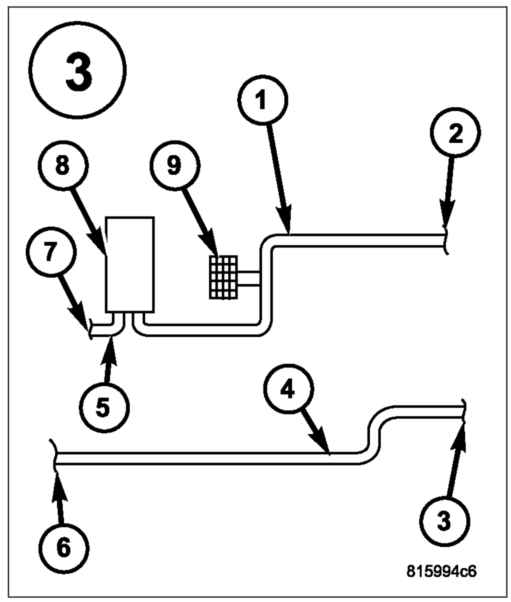
- ZONE 2

1 Filter.
2 NVLD.
3 Canister Vent Line.
4 Evap Canister.
5 Chassis Purge Valve.
6 Fuel Tank to Canister Vapor Line connection.
7 Evap Purge connection.




- ZONE 3

1 Evap Purge Vacuum Line.
2 Connection to Chassis Line.
3 Connection to Canister.
4 Chassis Purge Line.
5 Evap Purge Vacuum Line.
6 Connection to Evap Purge Harness.
7 Chassis Evap Purge Line connection to Engine Vacuum.
8 Evap Purge Valve.
9 Service Port.




**NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.**

**Was a leak found at the gas cap?**

**Yes** >> Go To 6

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 6. LEAK AT GAS CAP

Remove the SMOKE supply tip (black hose) from the service port (if equipped) or to the #8404–ADP adapter.

Install gas cap adapter, Miller Tool #8382 (1/4 turn cap) or #6922 (screw cap) and #8399* (secondary seal depressor) and repeat test 5.

**Was a leak found at the gas cap adapter?**

**Yes** >> Replace the Fuel Filler tube assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace the gas cap.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. EVAP PURGE SOLENOID OPERATION

**NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.**

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Press the remote smoke/air start button on the EELD.

While holding the remote smoke/air start button, check to see if smoke is exiting the purge valve. This indicates that there is a leak internal to the purge valve.

**NOTE: Below is an optional method of checking the purge valve for leaks if the EELD is unavailable.**

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in HG to the “CAN” of the Evap Purge Solenoid.

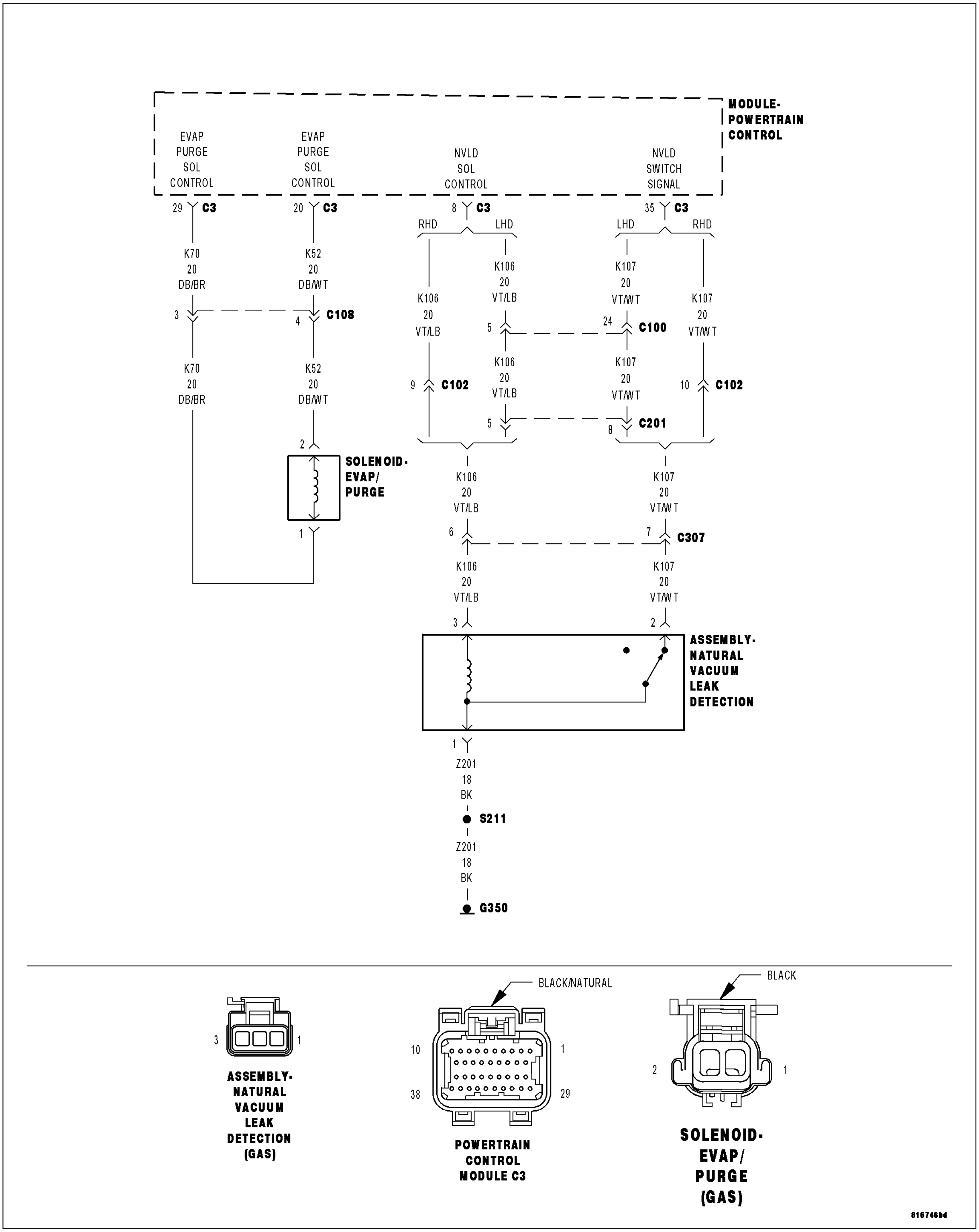
Monitor the vacuum gauge for at least 15 seconds.

**Is smoke visible from the EVAP Purge Solenoid if using the EELD, or not hold a vacuum?**

**Yes** >> Replace the NVLD.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0456-EVAP PURGE SYSTEM SMALL LEAK




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The theory behind the Natural Vacuum Leak Detection (NVLD) is adherence to the Ideal Gas Law. Pressure in a sealed vessel will change linearly as a function of the temperature of the gas in the vessel. Even small leaks will allow the pressure in the vessel to come to equilibrium with the atmospheric pressure. After key-off and a calibrated amount of time, cool down from operating temperatures or diurnal ambient temperature the system pressure will force the system to go negative or draw a vacuum if there is no leak. When the vacuum level reaches 1” H2O (0.25 KPA) the NVLD vacuum switch closes. This sends a signal to the NGC freezing a timer and registering a pass. If a switch closure is not detected an assessment of leak size will be made.

- **When Monitored:**
  Ignition off. Fuel Level less than 88%. Ambient Temperature between 4°C and 43°C (39°F and 109°F) Close Loop fuel system.
- **Set Condition:**
  Due to temperature changes, a vacuum is created in the fuel tank and EVAP system. With the EVAP system sealed, the PCM monitors the NVLD switch. If the NVLD switch does not close within a calibrated time allowance, an error is detected by the PCM. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EVAP PURGE SYSTEM LEAK |
| EVAP PURGE SOLENOID |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTCs are present.

Whether or not any DTCs are present you will want to check the following items which may assist in repairing the customer’s complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer’s current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer’s complaint or DTCs.

If a service bulletin applies, follow the instructions per the service bulletin.

**Choose the following scenario that best applies.**

**The service bulletin repaired the customer’s complaint.**
Testing complete.

**A DTC is present, no service bulletins apply, or the service bulletin didn’t repair the customer’s complaint.**
Go To 2

## 2. ACTIVE DTC

**NOTE: Since a hot vehicle can conceal a leak, it is best to perform this test at room temperature.**

**NOTE: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Make sure the gas cap meets OEM specifications.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 3

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. VISUAL AND PHYSICAL INSPECTION

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the follow conditions:

- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap gasket seal

**Were any of the above conditions found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

**WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.**

**NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.**

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

**NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.**

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

**Is the indicator ball above the red flag?**

**Yes** >> Go To 5

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. EVAPORATIVE EMISSION LEAK DETECTION

**NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may also aid diagnosis.**

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

**NOTE: The flow meter indicator ball will not move in the smoke mode.**

Press the remote smoke/air start button.

**NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.**

**NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.**

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

**NOTE: The EVAP System is divided into three zones. A leak from any of these zones can cause this DTC to set. The lists below specify the possible leak points in that specific zone. For further assistance see the Zone Identification Charts below.**

---

- ZONE 1

1 Fuel Cap

2 Recirculation Check Valve.

3 Vapor Recirculation Line.

4 Signal Vapor Line for FVM.

5 Flow Management Valve.

6 Fuel Tank to Canister Vapor Line connection.

7 Fuel Tank Vent (Check Valve).

8 Vapor Line to Canister.

9 Flow Control Orifice.

10 Control Valve.

11 Liquid Trap.

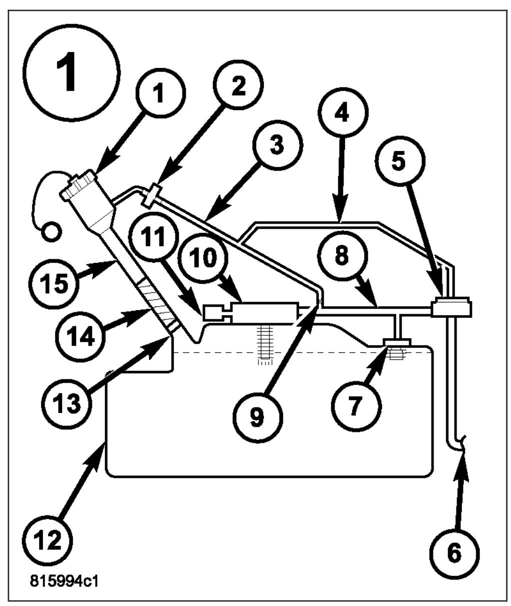
12 Fuel Tank.

13 Check valve.

14 Fuel Fill Tube to Tank connector.

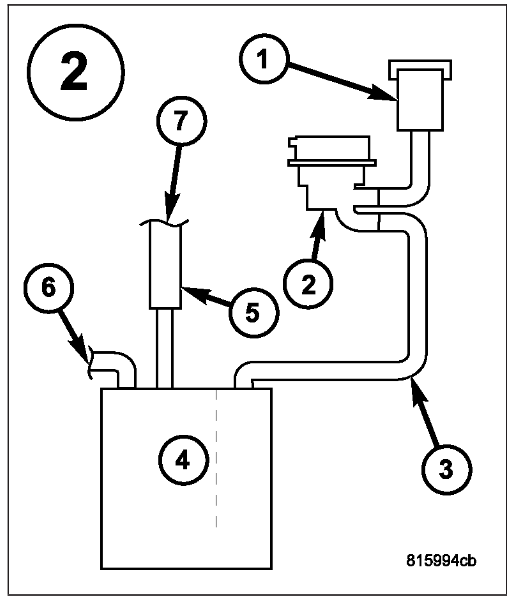
15 Fuel Fill Tube

Damaged or disconnected EVAP system components.



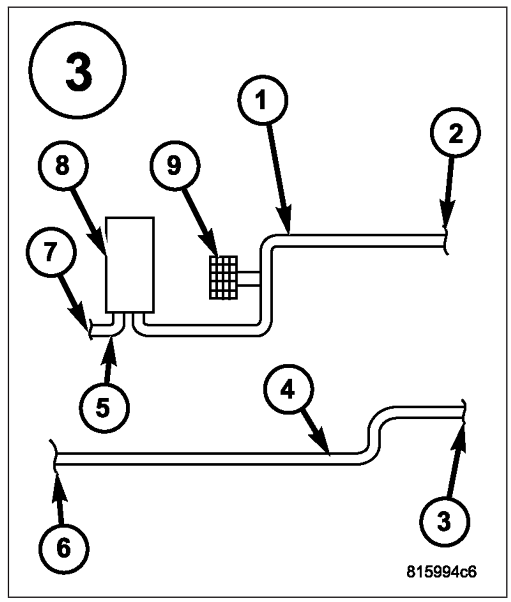
- ZONE 2

1 Filter.
2 NVLD.
3 Canister Vent Line.
4 Evap Canister.
5 Chassis Purge Valve.
6 Fuel Tank to Canister Vapor Line connection.
7 Evap Purge connection.




- ZONE 3

1 Evap Purge Vacuum Line.
2 Connection to Chassis Line.
3 Connection to Canister.
4 Chassis Purge Line.
5 Evap Purge Vacuum Line.
6 Connection to Evap Purge Harness.
7 Chassis Evap Purge Line connection to Engine Vacuum.
8 Evap Purge Valve.
9 Service Port.




**NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.**

**Was a leak found?**

**Yes** >> Go To 6

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 6. LEAK AT GAS CAP

Remove the SMOKE supply tip (black hose) from the service port (if equipped) or to the #8404–ADP adapter.

Install gas cap adapter, Miller Tool #8382 (1/4 turn cap) or #6922 (screw cap) and #8399* (secondary seal depressor) and repeat test 5.

**Was a leak found at the gas cap adapter?**

**Yes** >> Replace the Fuel Filler tube assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace the gas cap.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. EVAP PURGE SOLENOID OPERATION

**NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.**

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Press the remote smoke/air start button on the EELD.

While holding the remote smoke/air start button, check to see if smoke is exiting the purge valve. This indicates that there is a leak internal to the purge valve.

**NOTE: Below is an optional method of checking the purge valve for leaks if the EELD is unavailable.**

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in HG to the “CAN” of the Evap Purge Solenoid.

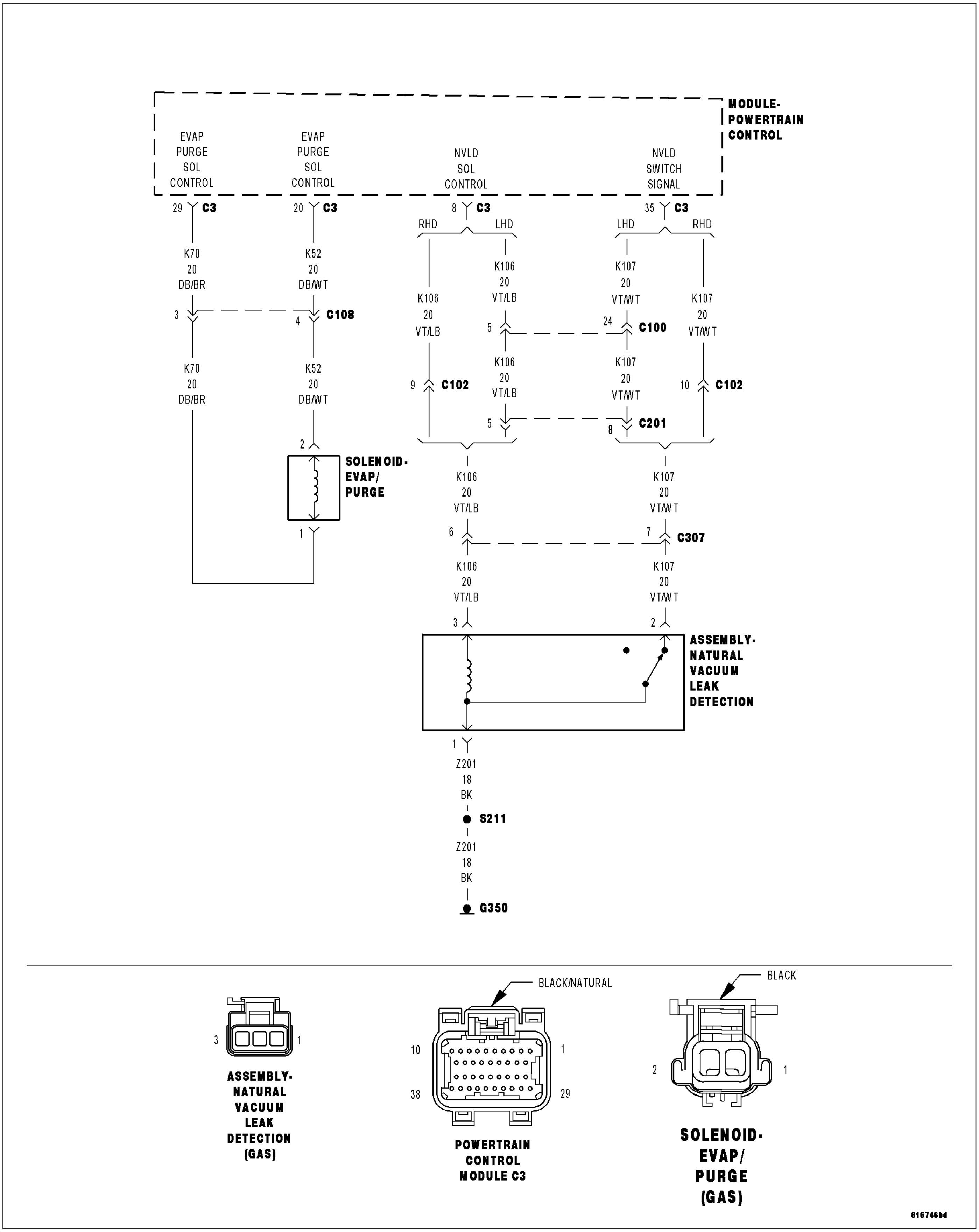
**NOTE: Monitor the vacuum gauge for at least 15 seconds.**

**Is smoke visible from the EVAP Purge Solenoid if using the EELD, or not hold a vacuum?**

**Yes** >> Replace the NVLD.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0457-LOOSE FUEL CAP




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

Fuel level is recorded when the ignition key is turned off and is compared to the fuel level when the ignition key is turned back on. The PCM recognizes an increase in fuel level and will fail the Medium leak test because the fuel cap is broken or not installed properly. GAS CAP will be displayed in odometer to inform the owner that the cap is off of loose.

- **When Monitored:**
  Ignition on. Ambient Temperature between 4°C and 32°C (39°F and 89°F) Close Loop fuel system. Test runs after the medium leak test is inconclusive and the PCM has sensed a fuel increase.
- **Set Condition:**
  The PCM activates the EVAP Purge Solenoid to pull the EVAP system into a vacuum to close the NVLD switch. Once the NVLD switch is closed, the PCM turns the EVAP Purge Solenoid off to seal the EVAP system. If the NVLD switch reopens before the calibrated amount of time after a fuel tank fill, an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| LOOSE OR MISSING FUEL CAP |
| FUEL FILL CAP |
| EVAP PURGE SYSTEM MEDIUM LEAK |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .**

## Diagnostic Test

### 1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTCs are present.

Whether or not any DTCs are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTCs.

If a service bulletin applies, follow the instructions per the service bulletin.

**Choose the following scenario that best applies.**

**The service bulletin repaired the customer's complaint.**
Testing complete.

**A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.**
Go To 2.

### 2. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 3.

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. LOOSE OR MISSING FUEL FILL CAP

Inspect the fuel fill cap.

Inspect the cap for any abnormal defects.

**Was the cap off, missing, or broken?**

**Yes** >> Properly install the fuel fill cap and proceed to step.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4.

## 4. NVLD SERVICE TEST

With the scan tool perform the NVLD Service Test.

**Does the NVLD Service Test pass?**

**Yes** >> Test complete.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

**WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.**

**NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.**

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

**NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.**

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

**Is the indicator ball above the red flag?**

**Yes** >> Go To 6.

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. EVAPORATIVE EMISSION LEAK DETECTION

**NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may also aid diagnosis.**

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

**NOTE: The flow meter indicator ball will not move in the smoke mode.**

Press the remote smoke/air start button.

**NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.**

**NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.**

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

**NOTE: The EVAP System is divided into three zones. A leak from any of these zones can cause this DTC to set. The lists below specify the possible leak points in that specific zone. For further assistance see the Zone Identification Charts below.**

- ZONE 1

1 Fuel Cap

2 Recirculation Check Valve.

3 Vapor Recirculation Line.

4 Signal Vapor Line for FVM.

5 Flow Management Valve.

6 Fuel Tank to Canister Vapor Line connection.

7 Fuel Tank Vent (Check Valve).

8 Vapor Line to Canister.

9 Flow Control Orifice.

10 Control Valve.

11 Liquid Trap.

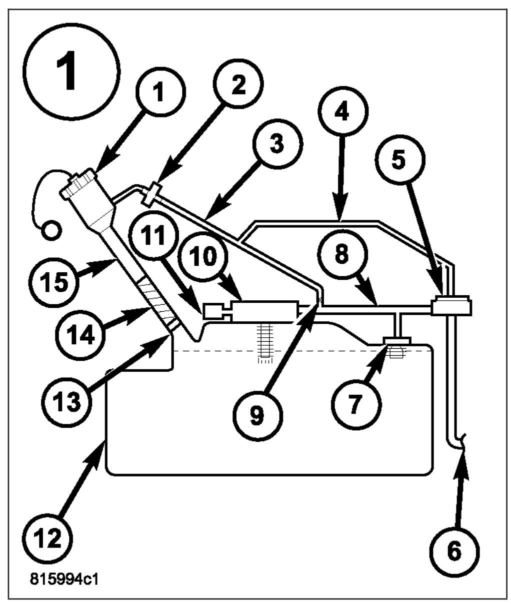
12 Fuel Tank.

13 Check valve.

14 Fuel Fill Tube to Tank connector.

15 Fuel Fill Tube

Damaged or disconnected EVAP system components.




- ZONE 2

1 Filter.

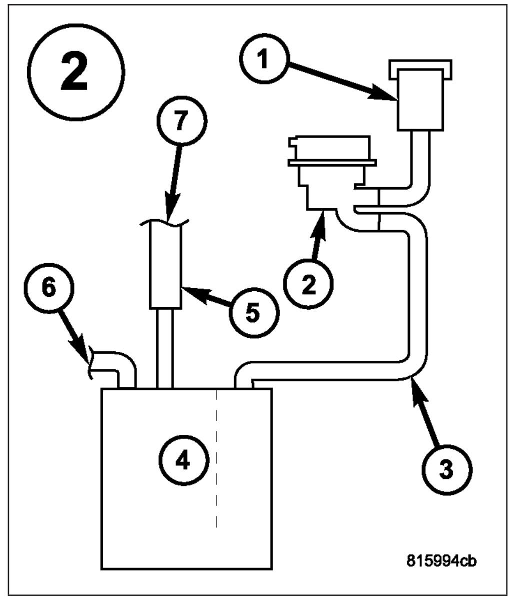
2 NVLD.

3 Canister Vent Line.

4 Evap Canister.

5 Chassis Purge Valve.

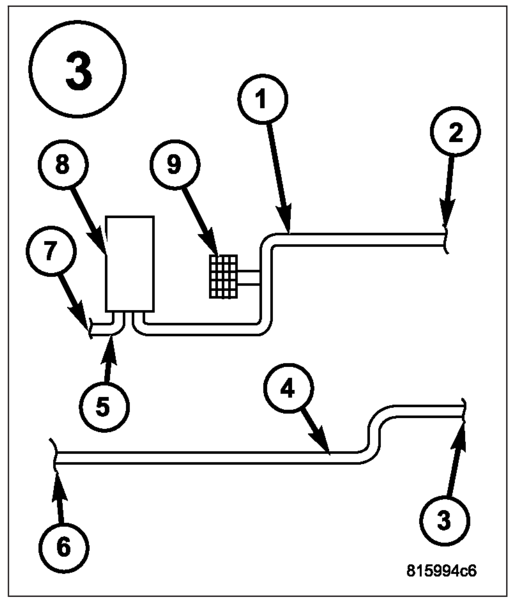
6 Fuel Tank to Canister Vapor Line connection.
7 Evap Purge connection.




---

- ZONE 3

1 Evap Purge Vacuum Line.
2 Connection to Chassis Line.
3 Connection to Canister.
4 Chassis Purge Line.
5 Evap Purge Vacuum Line.
6 Connection to Evap Purge Harness.
7 Chassis Evap Purge Line connection to Engine Vacuum.
8 Evap Purge Valve.
9 Service Port.




**NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.**

**Was a leak found?**

**Yes** >> Go To 7.

**No** >> Go To 8.

## 7. LEAK AT GAS CAP

Remove the SMOKE supply tip (black hose) from the service port (if equipped) or to the #8404–ADP adapter.

Install gas cap adapter, Miller Tool #8382 (1/4 turn cap) or #6922 (screw cap) and #8399* (secondary seal depressor) and repeat test 5.

**Was a leak found at the gas cap adapter?**

**Yes** >> Replace the Fuel Filler tube assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace the gas cap.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 8. EVAP PURGE SOLENOID OPERATION

**NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.**

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Press the remote smoke/air start button on the EELD.

While holding the remote smoke/air start button, check to see if smoke is exiting the purge valve. This indicates that there is a leak internal to the purge valve.

**NOTE: Below is an optional method of checking the purge valve for leaks if the EELD is unavailable.**

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in HG to the “CAN” of the Evap Purge Solenoid.

**NOTE: Monitor the vacuum gauge for at least 15 seconds.**

**Is smoke visible from the EVAP Purge Solenoid if using the EELD, or not hold a vacuum?**

**Yes** >> Go To 9.

**No** >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 9. NVLD SWITCH OPERATION

Reconnect all vacuum hoses.

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the NVLD FORCED MONITOR TEST.

Monitor the NVLD Switch.

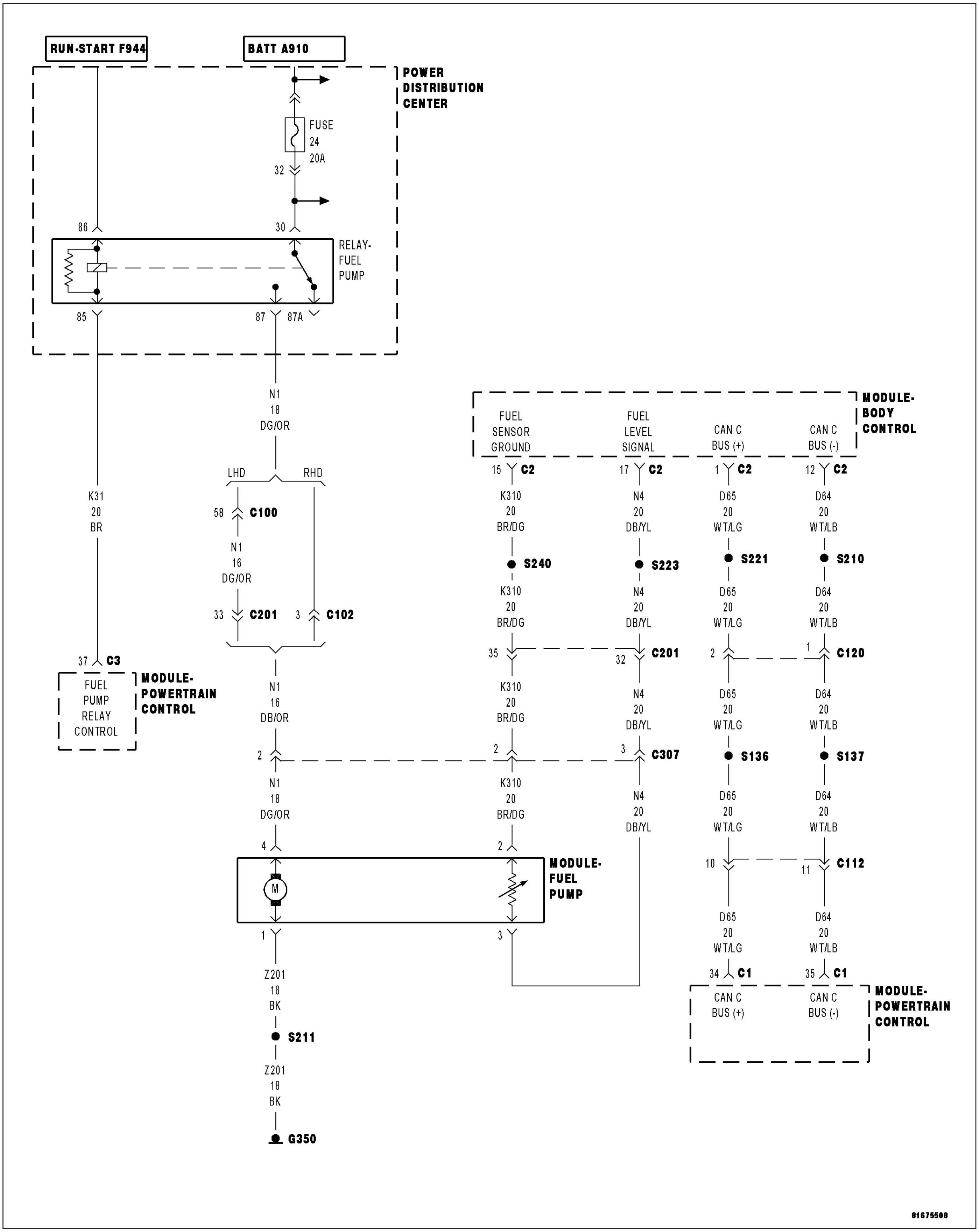
**NOTE: As the test runs, the NVLD Switch should go from an OPEN state to CLOSED. After the vacuum is released form the EVAP system the Switch state will return to OPEN.**

**Did the NVLD Switch operate as described above?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0461-FUEL LEVEL SENSOR 1 PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The fuel level rationality will set a fault for a fuel level reading that does not change over an accumulated mileage threshold to keep stuck high or stuck low fuel levels from disabling OBD monitors. If the vehicle is fitted with a saddle tank fuel system this feature includes diagnostics for both of the sending units and diagnostics for a siphon tube that has become disconnected or plugged. The power up test looks to see a large enough fuel level voltage change from the last key-off to the following engine run. The engine run test looks to see a fuel level voltage change over an accumulated mileage.

- **When Monitored:**
  TEST No.1: With the ignition on, the fuel level is compared to the previous key down after a 20 second delay. TEST No.2: The PCM monitors the fuel level at ignition on.
- **Set Condition:**
  TEST No.1: If the PCM does not see a difference in fuel level of greater than 0.1 volt the test will fail. TEST No.2: If the PCM does not see a change in the fuel level of .1765 over a set amount of miles the test will fail. Two trip fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN |
| (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND |
| (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K310) SENSOR GROUND CIRCUIT |
| (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| (K310) SENSOR GROUND CIRCUIT OPEN |
| FUEL TANK |
| FUEL LEVEL SENSOR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Diagnose any CAN C Bus communication DTCs before continuing.**

**NOTE: Diagnose P0462 or P0463 first, if set along with P0461.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. VISUALLY INSPECT FUEL TANK

Visually inspect the Fuel Tank for damage that may restrict the Fuel Sending Unit float from moving.

**Is the Fuel Tank OK?**

**Yes** >> Go To 3

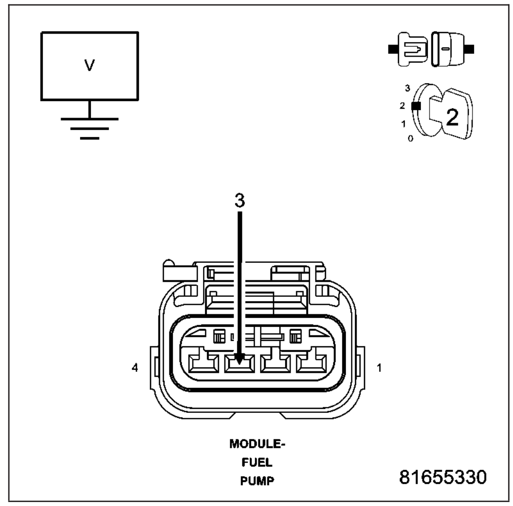
**No** >> Replace the Fuel Tank as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO VOLTAGE

Disconnect the Fuel Pump Module harness connector.

Ignition on, engine not running.

Measure the voltage on the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.




**Is the voltage above 0.5 of a volt?**

**Yes** >> Repair the short to voltage in the (N4) Fuel Level Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

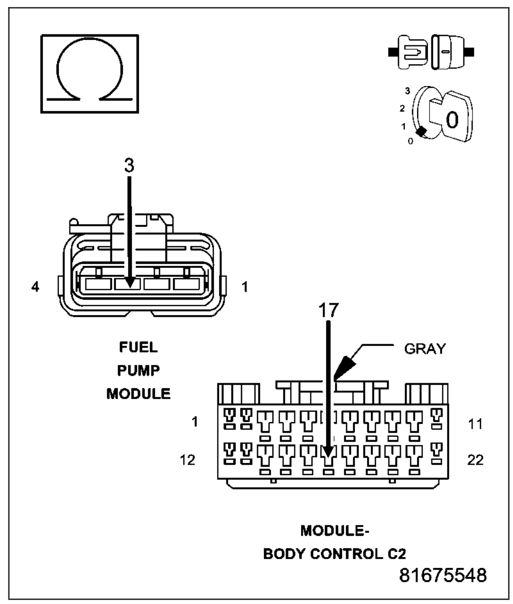
**No** >> Go To 4

## 4. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 BCM harness connector.

Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the C2 BCM harness connector.




**Is the resistance below 5.0 ohms?**

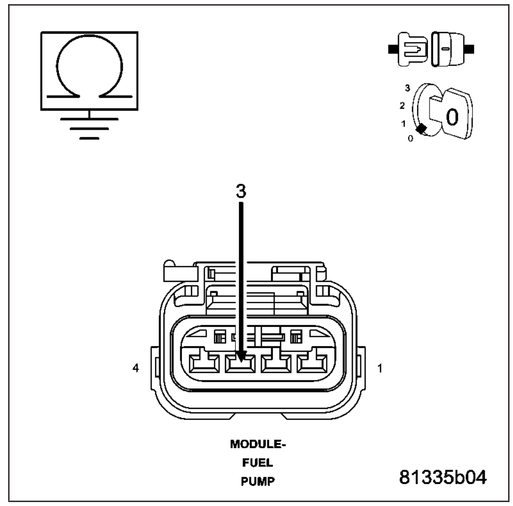
**Yes** >> Go To 5

**No** >> Repair the open in the (N4) Fuel Level Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.




**Is the resistance below 100 ohms?**

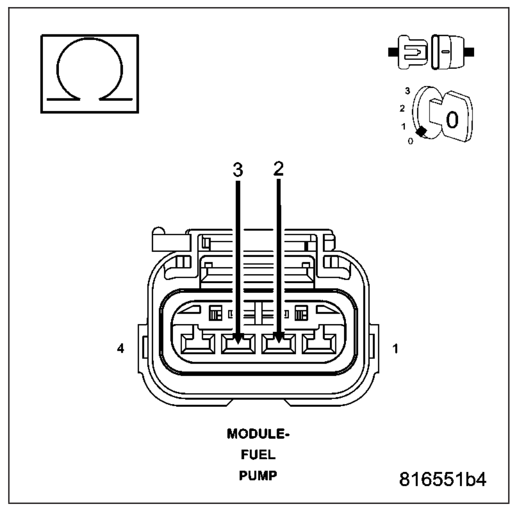
**Yes** >> Repair the short to ground in the (N4) Fuel Level Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K310) SENSOR GROUND CIRCUIT

Measure the resistance between the (K310) Sensor ground circuit and the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.




**Is the resistance below 100 ohms?**

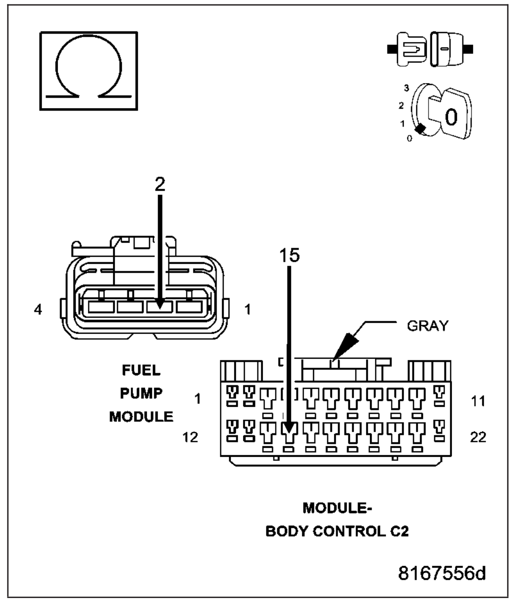
**Yes** >> Repair the short between the (K310) Sensor ground circuit and the (N4) Fuel Level Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. (K310) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K310) Sensor ground circuit from the Fuel Pump Module harness connector to the C2 BCM harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 8

**No** >> Repair the open in the (K310) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 8. INTERNAL INSPECTION OF THE FUEL TANK

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Remove the Fuel Tank per Service Information.

Remove the Fuel Pump Module.

Visually inspect the inside of the Fuel Tank for any obstructions or deformities.

Inspect the Fuel Pump Module Float arm for damage.

**Were any problems found?**

**Yes** >> Repair or replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

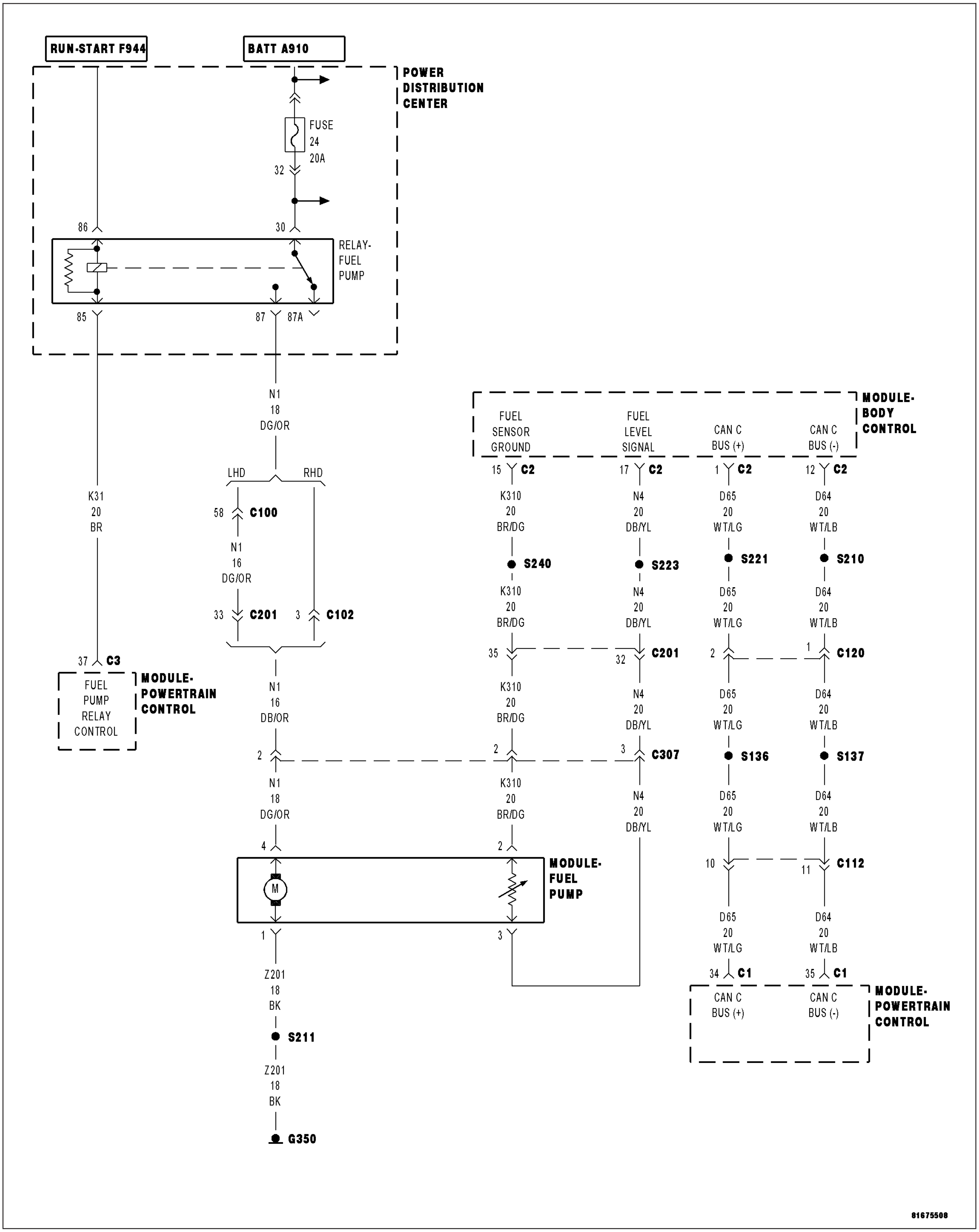
## 9. FUEL LEVEL SENSOR

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Fuel Level Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P0462-FUEL LEVEL SENSOR 1 CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The fuel level sensor signal voltage goes below 0.4 of a volt for more than 4.4 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND |
| (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K310) SENSOR GROUND CIRCUIT |
| FUEL LEVEL SENSOR |
| CAN C BUS CIRCUIT OPEN OR SHORTED |
| BCM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).**

## Diagnostic Test

### 1. FUEL LEVEL SENSOR VOLTAGE BELOW 0.4 OF A VOLT

**NOTE: Diagnose all CAN C communication DTCs before continuing.**
Ignition on, engine not running.

With the scan tool, read the Fuel Level Sensor voltage.

**Is the Fuel Level Sensor voltage below 0.4 of a volt?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. FUEL LEVEL SENSOR

Turn the ignition off.

Disconnect the Fuel Pump Module harness connector.

Ignition on, engine not running.

With the scan tool, read the Fuel Level Sensor voltage.

**Did the Fuel Level Sensor voltage change from below 0.4 of a volt to above 4.0 volts?**

**Yes** >> Replace the Fuel Level Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

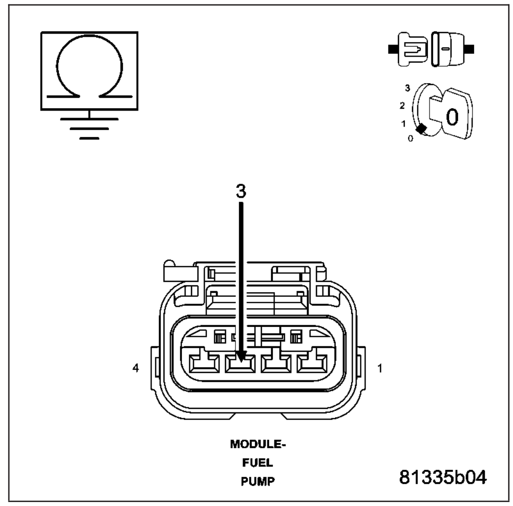
**No** >> Go To 3

## 3. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 BCM harness connector.

Measure the resistance between ground and the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.




**Is the resistance below 100 ohms?**

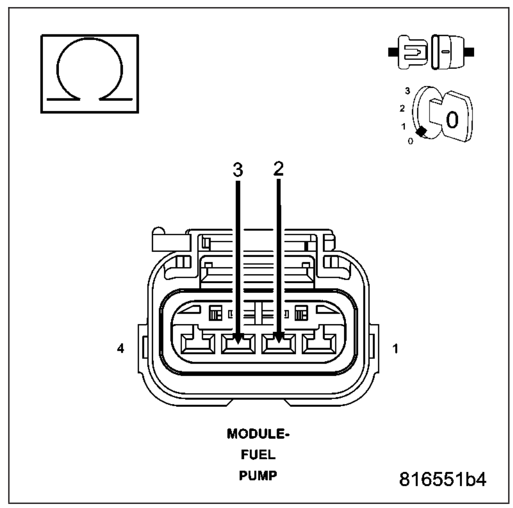
**Yes** >> Repair the short to ground in the (N4) Fuel Level Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K310) SENSOR GROUND CIRCUIT

Measure the resistance between the (N4) Fuel Level Signal circuit and the (K310) Sensor ground circuit in the Fuel Pump Module harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K310) Sensor ground circuit and the (N4) Fuel Level Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

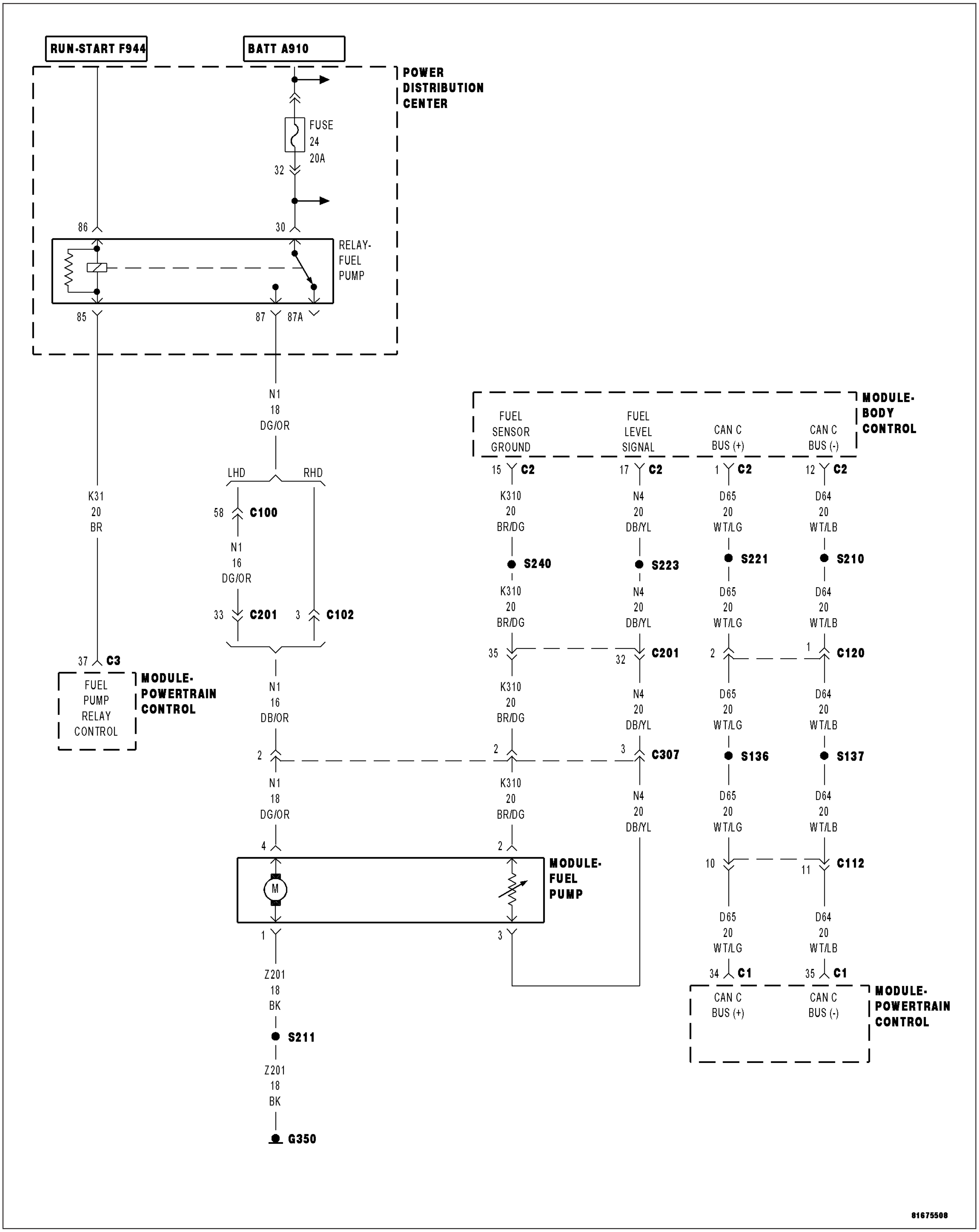
**Yes** >> Repair as necessary.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and program the Body Control Module per Service Information.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The fuel level sensor signal voltage at the PCM goes above 4.9 volts for more than 90 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN |
| (K310) SENSOR GROUND CIRCUIT OPEN |
| FUEL LEVEL SENSOR |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| BCM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. FUEL LEVEL SENSOR VOLTS ABOVE 4.9 VOLTS

**NOTE: Diagnose and CAN C Bus communication DTCs before continuing.**

Ignition on, engine not running.

With a scan tool, read the Fuel Level Sensor voltage.

**Is the Fuel Level Sensor voltage above 4.9 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. FUEL LEVEL SENSOR

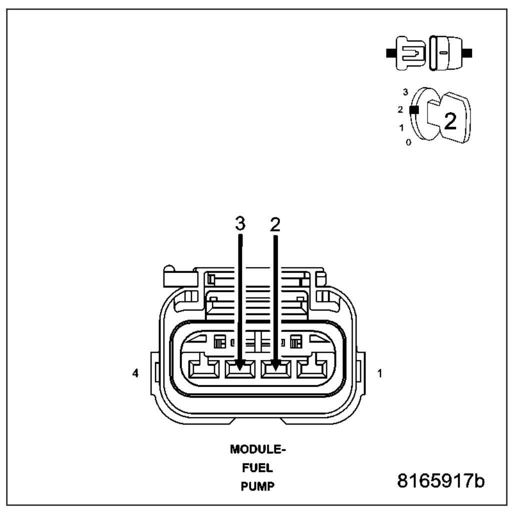
Turn the ignition off.

Disconnect the Fuel Pump Module electrical harness connector.

Ignition on, engine not running.

Connect a jumper wire between the (N4) Fuel Level Signal circuit and the (K310) Sensor ground circuit in the Fuel Pump Module harness connector.

With the scan tool, read the Fuel Level Sensor voltage.




**Did the Fuel Level Sensor voltage change from above 4.8 volts to below 0.4 of a volt with the jumper wire installed?**

**Yes** >> Replace the Fuel Level Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

**NOTE: Remove the jumper wire before continuing.**

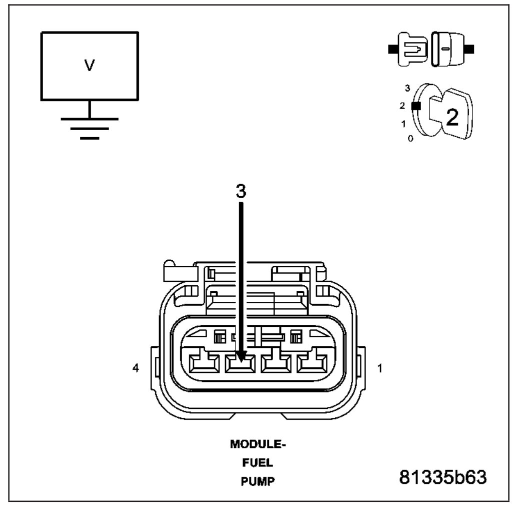
## 3. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 BCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.




**Is the voltage above 5.2 volts?**

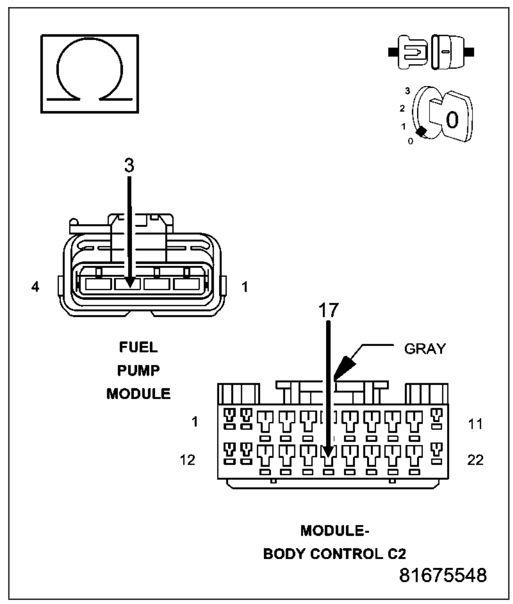
**Yes** >> Repair the short to battery voltage in the (N4) Fuel Level Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the C2 BCM harness connector.



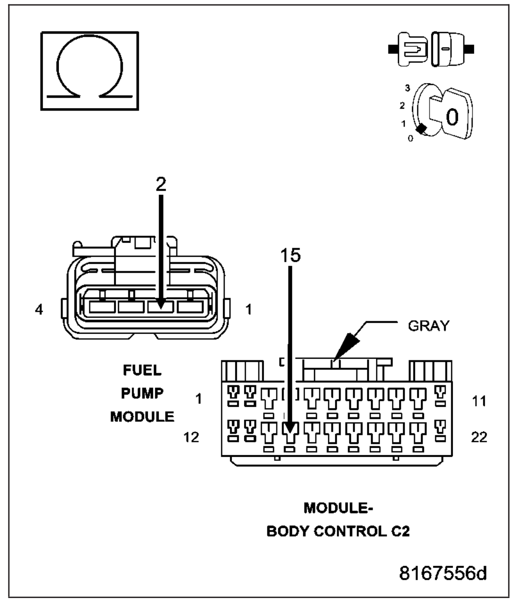

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the open in the (N4) Fuel Level Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (K310) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K310) Sensor ground circuit from the Fuel Pump Module harness connector to the C2 BCM harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K310) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

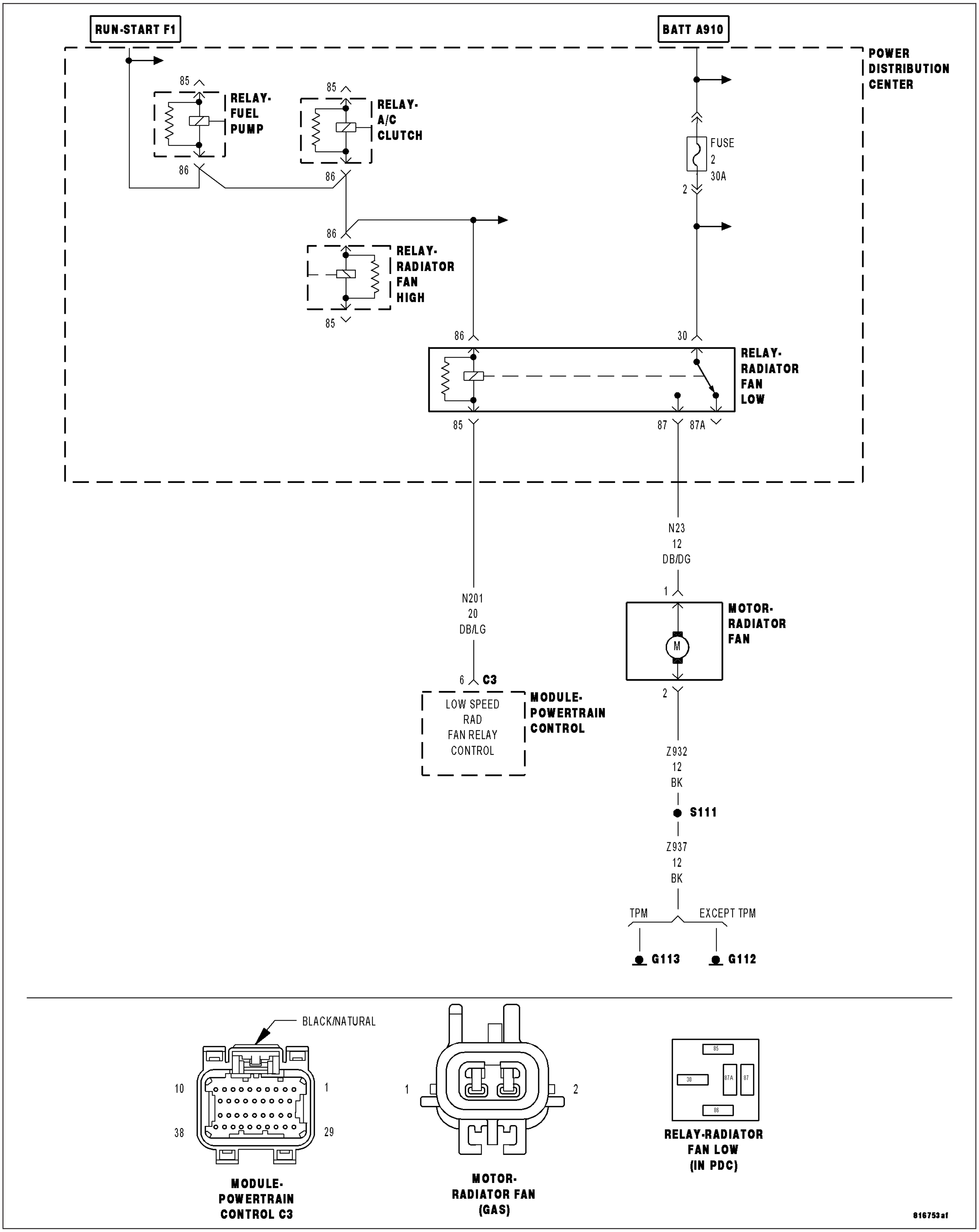
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and program the Body Control Module per Service Information.
Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## P0480-COOLING FAN 1 CONTROL CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts.
- **Set Condition:**
  An open or shorted circuit is detected in the radiator fan relay control circuit for more than 2.7 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| INTERNAL (A16) FUSED B+ CIRCUIT |
| INTERNAL (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT |
| (N201) COOOLING FAN NO.1 RELAY CONTROL CIRCUIT OPEN |
| (N201) COOOLING FAN NO.1 RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| LOW SPEED RADIATOR FAN RELAY |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. LOW SPEED RADIATOR FAN RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the Low Speed Radiator Fan Relay.

**Is the Cooling Fan Relay operating?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

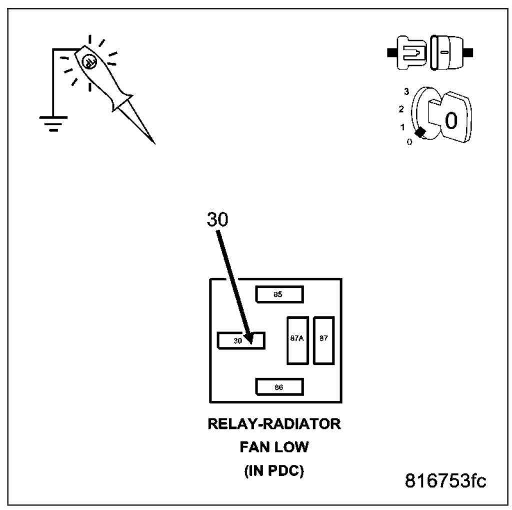
**No** >> Go To 2

### 2. (A16) FUSED B+ CIRCUIT

Turn the ignition off.

Remove the Low Speed Radiator Fan Relay.

Using a 12-volt test light connected to ground, probe the (A16) Fused B+ circuit.




**Does the test light illuminate brightly?**

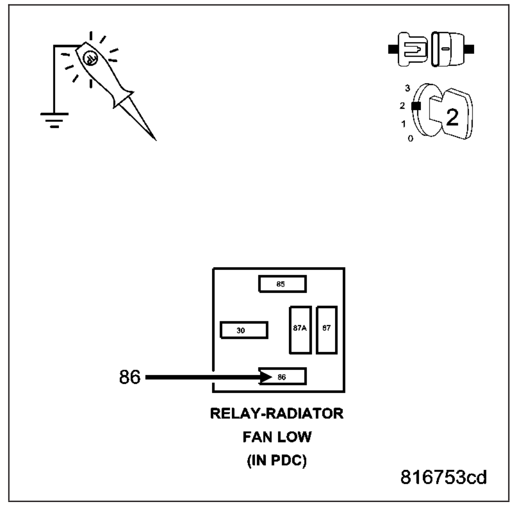
**Yes** >> Go To 3

**No** >> Repair the open or short to ground in the (A16) Fused B+ circuit. Inspect the related fuse and repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (F1) Fused Ignition Switch Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the open or short to ground in the (F1) Fused Ignition Output circuit. Inspect the related fuse and repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. LOW SPEED RADIATOR FAN RELAY RESISTANCE

Turn the ignition off.

Measure the resistance of the Low Speed Radiator Fan Relay Coil.

**Is the resistance between 60 to 80 ohms?**

**Yes** >> Go To 5

**No** >> Replace the Low Speed Radiator Fan Relay.

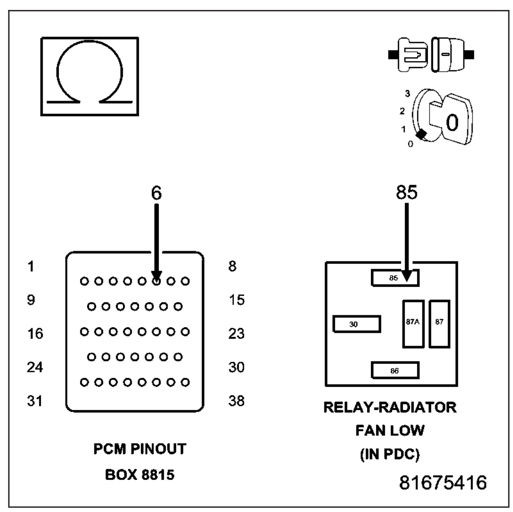
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (N201) COOLING FAN NO.1 CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis**

Measure the resistance of the (N201) Cooling Fan No.1 Relay Control circuit from the Relay to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

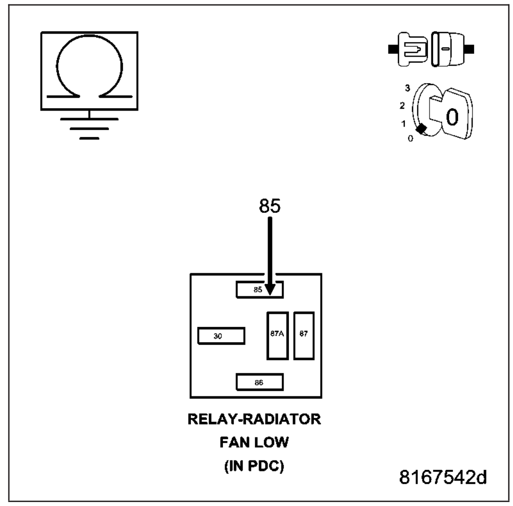
**Yes** >> Go To 6

**No** >> Repair the open in the (N201) Cooing Fan No.1 Relay Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (N201) COOLING FAN NO.1 CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (N201) Cooling Fan No.1 Relay Control circuit at the Relay connection.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (N201) Cooling Fan No.1 Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

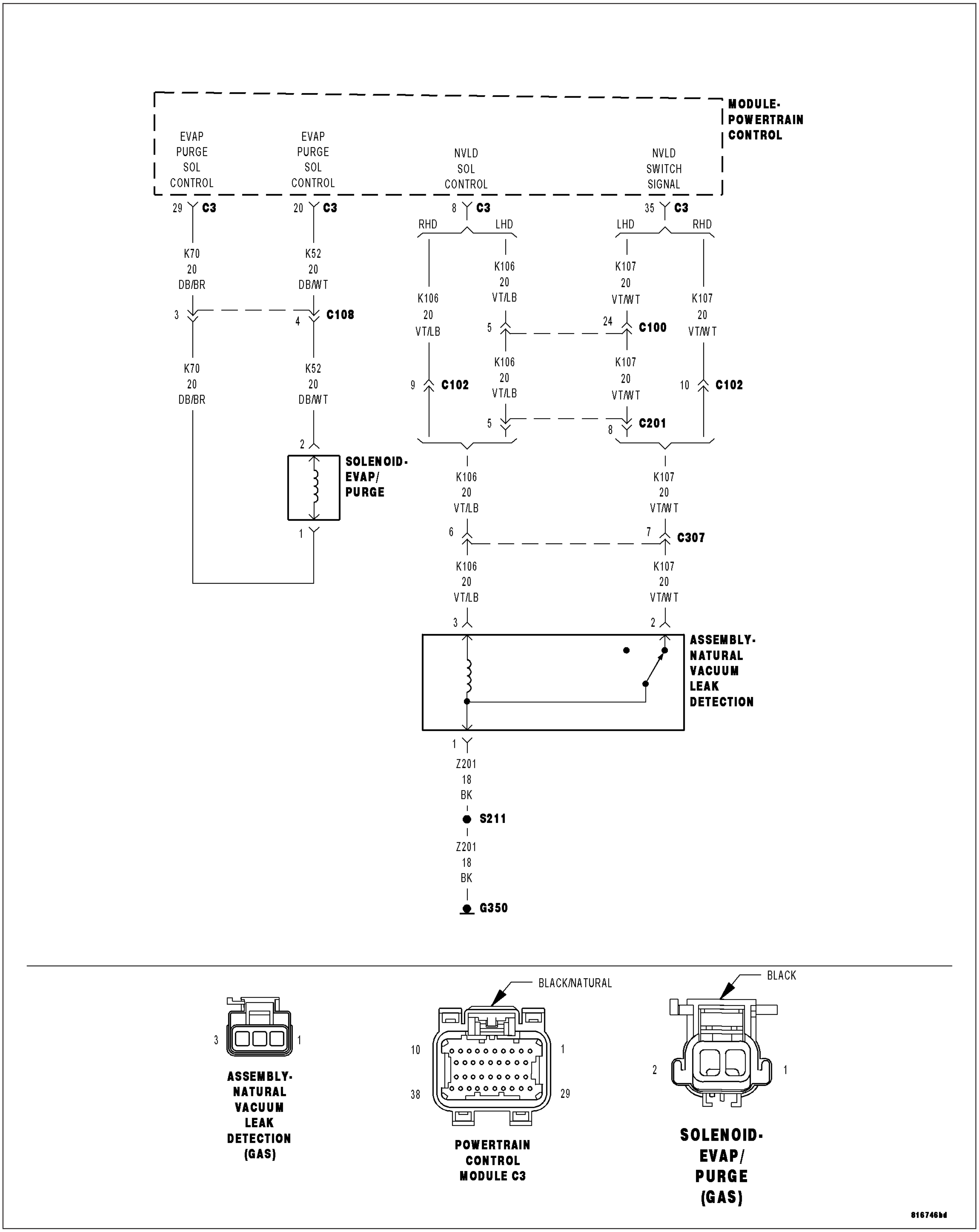
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0498-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The PCM detects a short in the NVLD Canister vent solenoid circuits for more than 5 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (K106) NVLD SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| NVLD ASSEMBLY |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTCs are present.

Whether or not any DTCs are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTCs.

If a service bulletin applies, follow the instructions per the service bulletin.

**Choose the following scenario that best applies.**

**The service bulletin repaired the customer's complaint.**
Testing complete.

**A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.**
Go To 2.

### 2. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 3

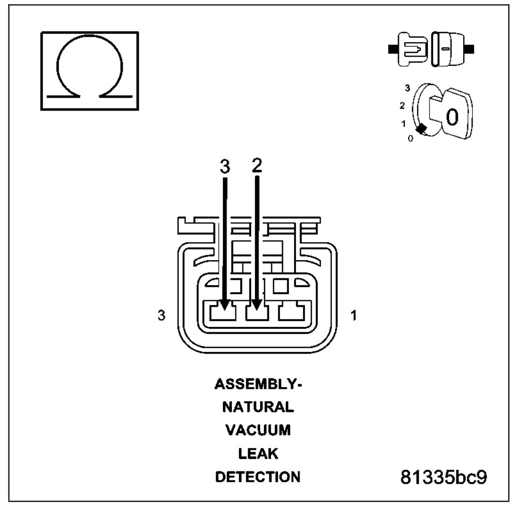
**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. NVLD SOLENOID

Turn the ignition off.

Disconnect the NVLD electrical harness connector.

Measure the resistance of the NVLD Solenoid Coil.




**Is the resistance between 7.5 to 8.5 ohms?**

**Yes** >> Go To 4

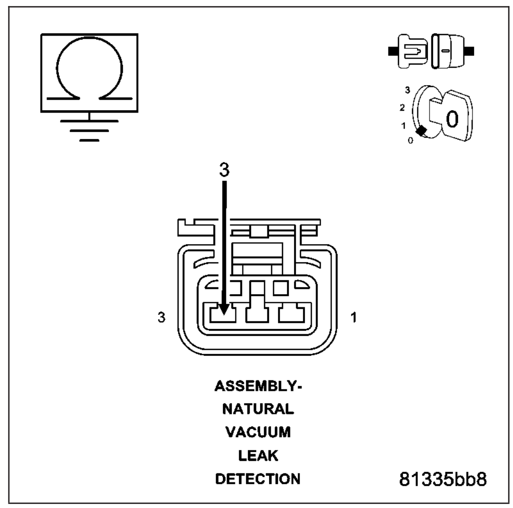
**No** >> Replace the NVLD Assembly.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (K106) NVLD SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K106) NVLD Solenoid Control circuit in the NVLD electrical harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K106) NVLD Solenoid Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

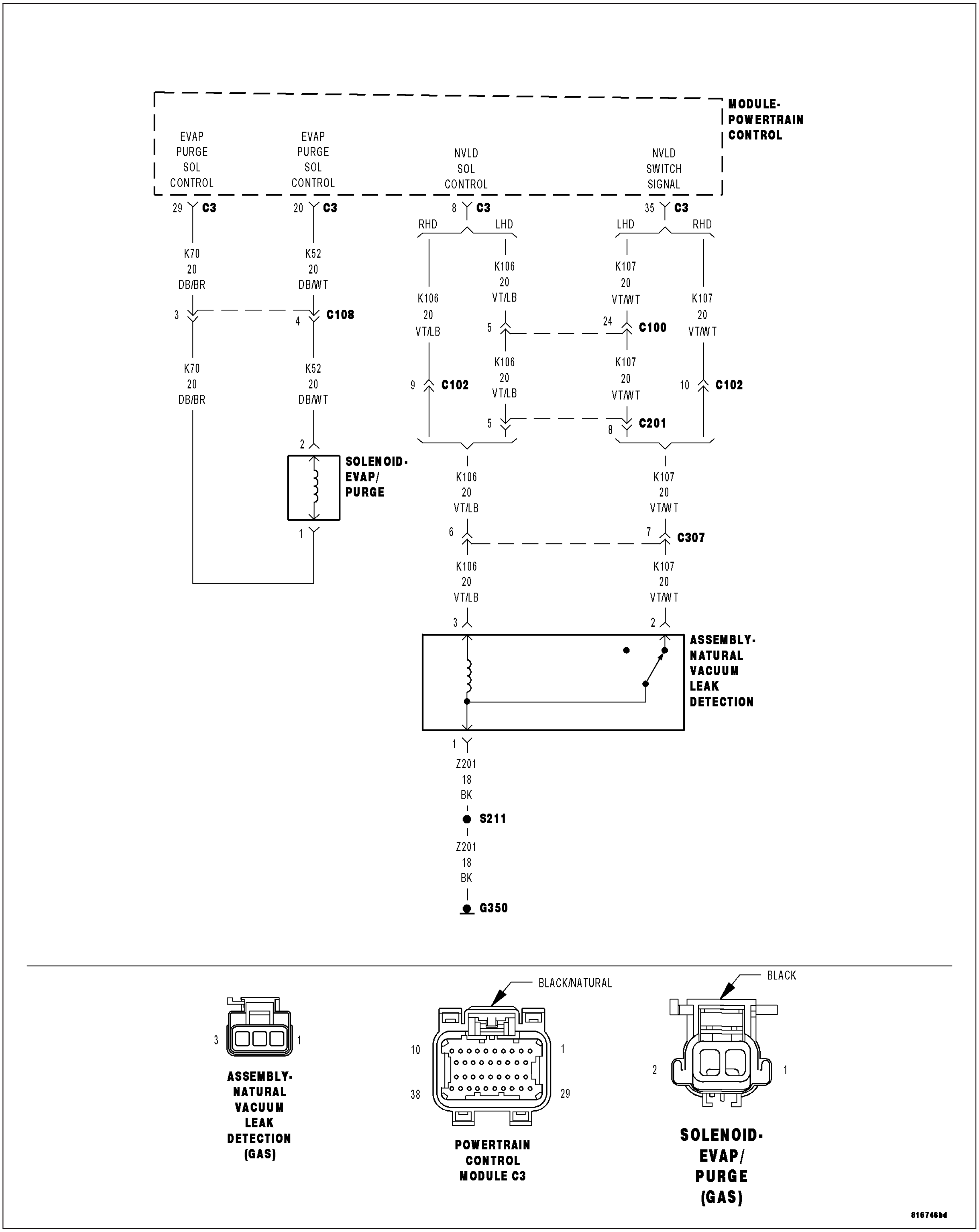
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0499-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The PCM detects an open in the NVLD Canister vent solenoid circuits for more than 9.375 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (K106) NVLD SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K106) NVLD SOLENOID CONTROL CIRCUIT OPEN |
| (Z201) GROUND CIRCUIT OPEN |
| NVLD SOLENOID |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTCs are present.

Whether or not any DTCs are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTCs.

If a service bulletin applies, follow the instructions per the service bulletin.

**Choose the following scenario that best applies.**

**The service bulletin repaired the customer's complaint.**
Testing complete.

**A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.**
Go To 2.

### 2. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 3

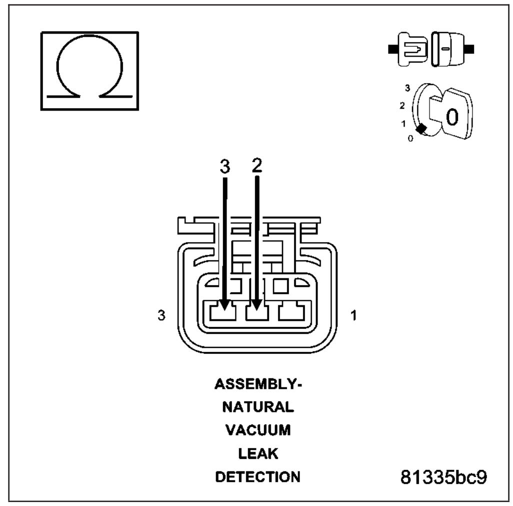
**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. NVLD SOLENOID

Turn the ignition off.

Disconnect the NVLD Assembly harness connector.

Measure the resistance of the NVLD Solenoid coil.




**Is the resistance between 7.5 to 8.5 ohms?**

**Yes** >> Go To 4

**No** >> Replace the NVLD Assembly.

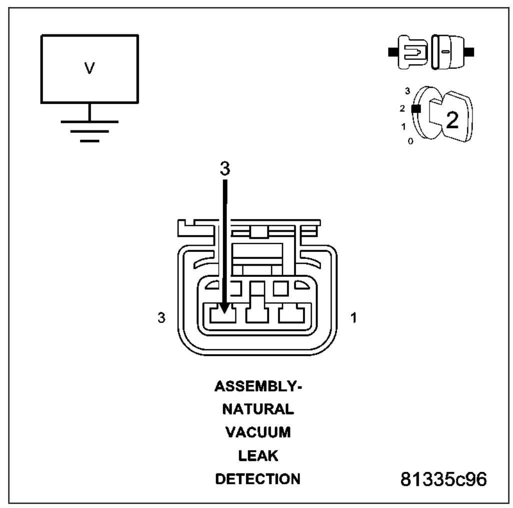
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (K106) NVLD SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Disconnect the C3 PCM harness connector.

Take this measurement with the Ignition in the off (lock) position and in the Ignition on, engine off position.

Measure the voltage on the (K106) NVLD Solenoid Control circuit in the NVLD Assembly harness connector.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the short to battery voltage in the (K106) NVLD Solenoid Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

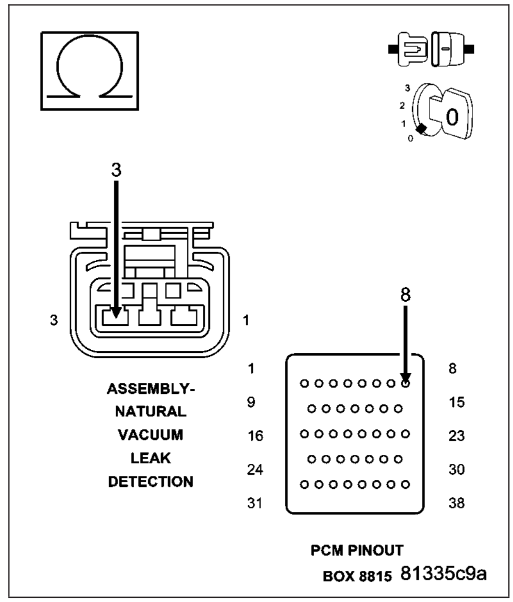
**No** >> Go To 5

## 5. (K106) NVLD SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K106) NVLD Solenoid Control circuit from the NVLD Assembly harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

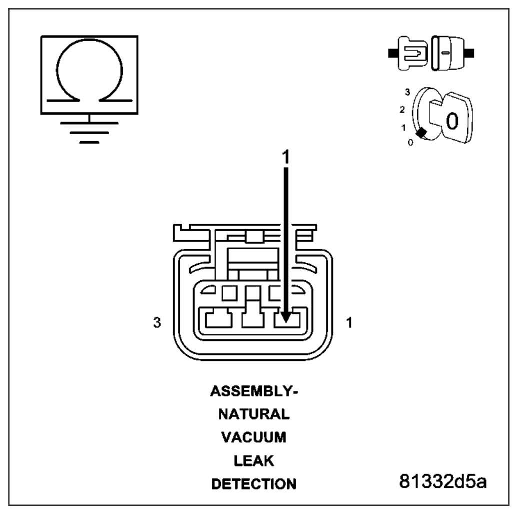
**Yes** >> Go To 6

**No** >> Repair the open in the (K106) NVLD Solenoid Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (Z201) GROUND CIRCUIT OPEN

Measure the resistance between the (Z201) Ground circuit and ground.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (Z201) Ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P0501-VEHICLE SPEED SENSOR 1 PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The vehicle speed sensor rationality is a continuous test that monitors the vehicle speed sensor for lack of activity. The rationality will not run if a limp-in exists for MAP, Throttle Position, and Engine Coolant Temperature. If vehicle speed sensor is below a minimum threshold for a period of time after the vehicle is operated at a sufficient load, a failure will be indicated.

- **When Monitored:**
  With the engine running, transmission not in park or neutral, brakes not applied, and engine rpm greater than 1500.
- **Set Condition:**
  This code will set if no vehicle speed signal is received from the ABS Module up to 120 seconds for 2 consecutive trips. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (B22) VEHICLE SPEED SIGNAL OPEN |
| (B22) VEHICLE SPEED SIGNAL SHORT TO GROUND |
| TIRE CIRCUMFERENCE |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. VISUAL INSPECTION

**NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.**

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.

Check tire pressure of all the tires.

Check tire wear on all the tires.

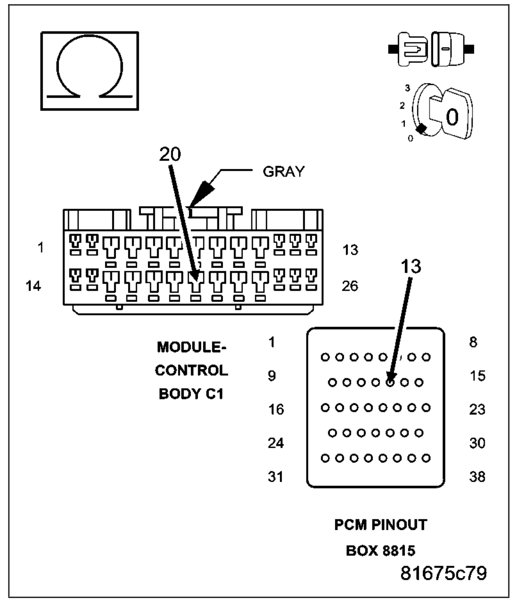
Ask the customer what the road and driving conditions were like when the fault set.

**Were any problems found?**

**Yes** >> Repair as necessary. If the code set during a front OR rear wheel spin condition, no repair is necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. (B22) VEHICLE SPEED SIGNAL CIRCUIT OPEN




Disconnect the C1 BCM harness connector.

Disconnect the C1 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (B22) Vehicle Speed Sensor Signal circuit from the C1 BCM harness connector to the appropriate terminal of special tool #8815.

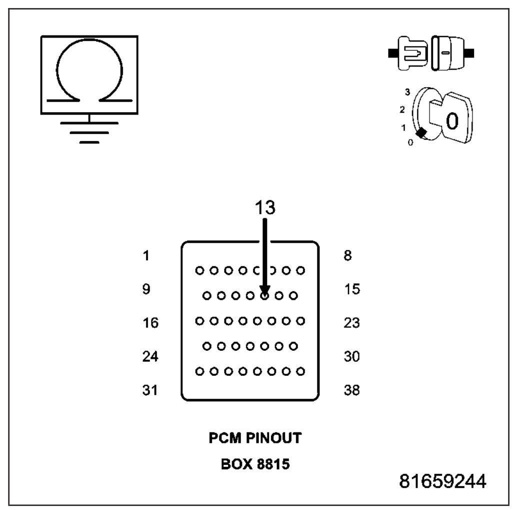
**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the open in the (B22) Vehicle Speed Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (B22) VEHICLE SPEED SIGNAL CIRCUIT SHORTED TO GROUND




Measure the resistance between ground and the (B22) Vehicle Speed Sensor Signal circuit connector at the appropriate terminal of special tool #8815.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (B22) Vehicle Speed Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

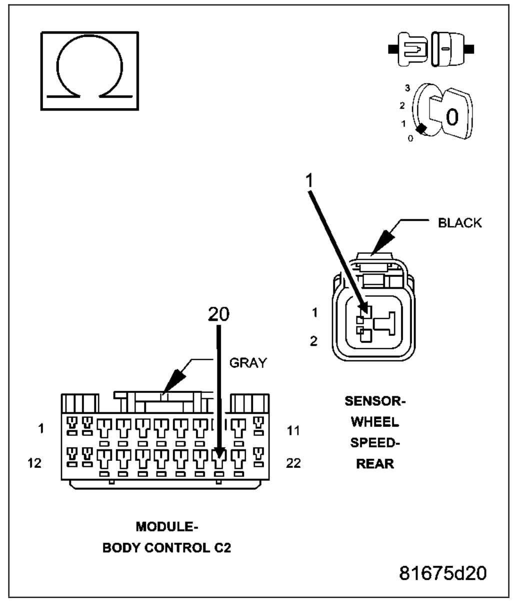
**No** >> Go To 5

## 5. (F512) VEHICLE SPEED SENSOR SUPPLY CIRCUIT OPEN

Disconnect the C2 BCM harness connector.

Disconnect the Vehicle Speed Sensor harness connector.

Measure the resistance of the (F512) Vehicle Speed Sensor Supply circuit from the Vehicle Speed Sensor harness connector to the C2 BCM harness connector.




**Is the resistance above 5.0 ohms?**

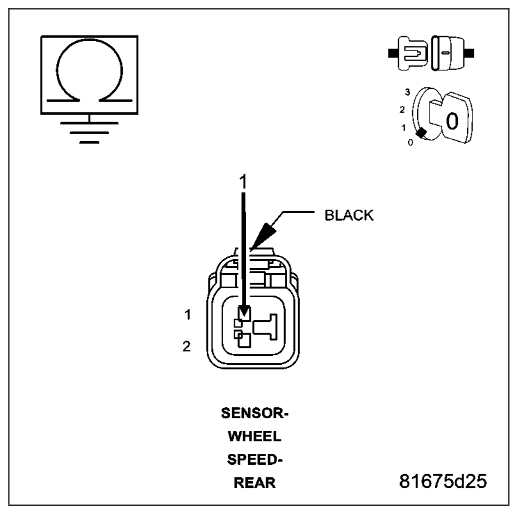
**Yes** >> Repair the open in the (F512) Vehicle Speed Sensor Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (F512) VEHICLE SPEED SENSOR SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F512) Vehicle Speed Sensor Supply circuit at the Vehicle Speed Sensor harness connector.




**Is the resistance below 100 ohms?**

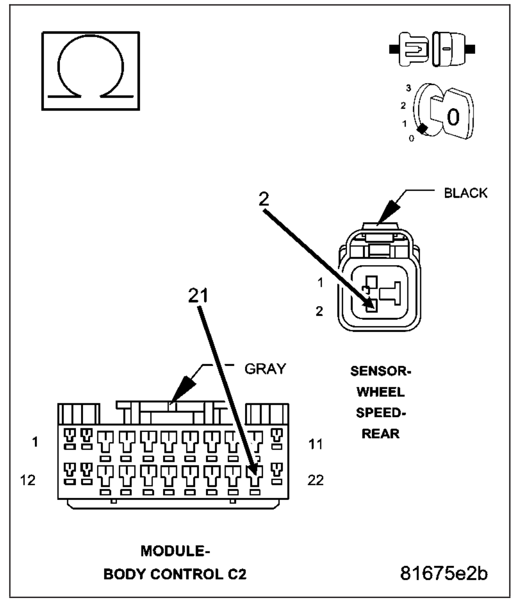
**Yes** >> Repair the short to ground in the (F512) Vehicle Speed Sensor Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. (B12) VEHICLE SPEED SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the (B12) Vehicle Speed Sensor Signal circuit from the Vehicle Speed Sensor harness connector to the C2 BCM harness connector.



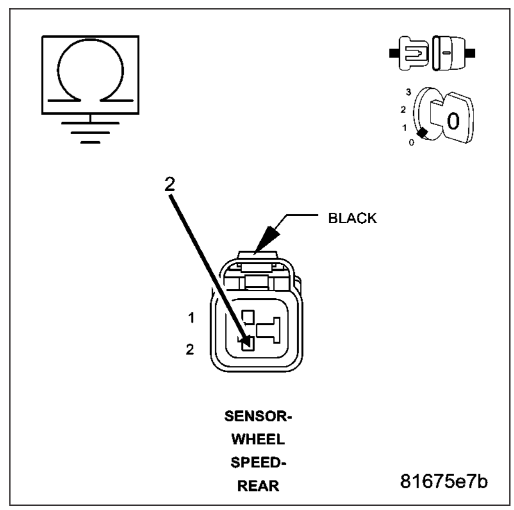

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the open in the (B12) Vehicle Speed Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. (B12) VEHICLE SPEED SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (B12) Vehicle Speed Sensor Signal circuit at the Vehicle Speed Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (B12) Vehicle Speed Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

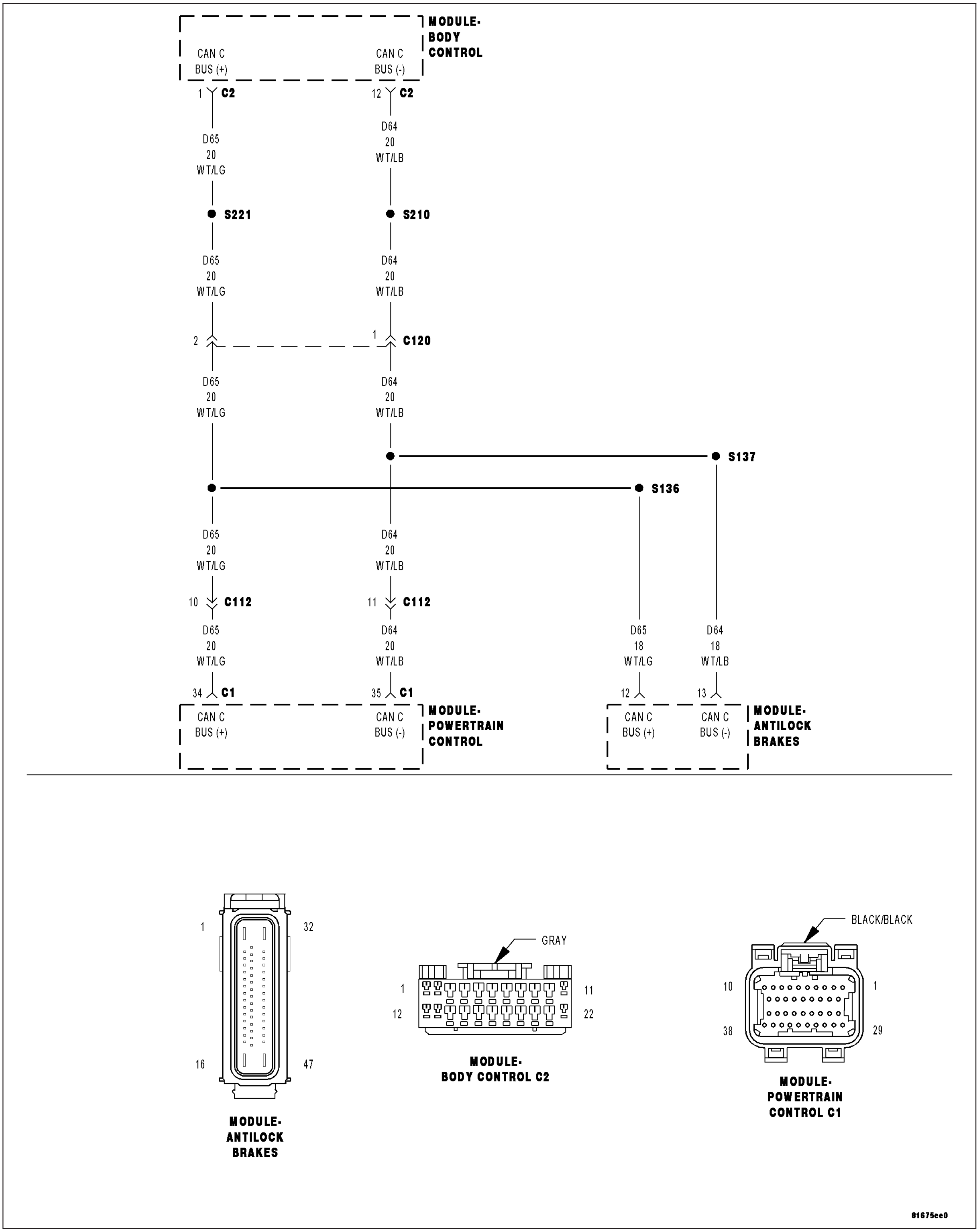
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0503-VEHICLE SPEED SENSOR 1 ERRATIC




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The vehicle speed sensor rationality is a continuous test that monitors the vehicle speed sensor for lack of activity. The rationality will not run if a limp-in exists for MAP, Throttle Position, and Engine Coolant Temperature. If vehicle speed sensor is below a minimum threshold for a period of time after the vehicle is operated at a sufficient load, a failure will be indicated.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts. Transmission in Drive or Reverse.
- **Set Condition:**
  This code will set if no vehicle speed signal is received from the ABS Module up to 120 seconds for 2 consecutive trips. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| ACTIVE BUS OR COMMUNICATION DTCS |
| TIRE CIRCUMFERENCE |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

**NOTE: Check for any Bus Communication DTCs. If no Bus or Communication DTCs are set, check for active DTCs stored in the Anti-Lock Brake Module. Any bus or communication DTCs or VSS DTCs in the Anti-Lock Brake Module must be properly diagnosed before continuing.**

With a scan tool, read DTCs and record the related Freeze Frame data.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. VISUAL INSPECTION

**NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.**

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.

Check tire pressure of all the tires.

Check tire wear on all the tires.

Ask the customer what the road and driving conditions were like when the fault set.

**Were any problems found?**

**Yes** >> Repair as necessary. If the code set during a front OR rear wheel spin condition, no repair is necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0506-IDLE SPEED PERFORMANCE LOWER THAN EXCEPTED

For a complete wiring diagram **Refer to Section 8W**.

### Theory of Operation

**The objective of the Idle “Speed Rationality is to monitor the ability to achieve and maintain a steady idle condition. The monitor will judge the functionality of the idle speed control system by monitoring RPM during idle. If RPM does not come within a calibrated band of target idle speed, a timer is started. If the timer reaches its maximum threshold without any sign of the RPM trending towards control, a soft failure is generated.**

- **When Monitored:**
  With the engine running at idle, MAF <250 mg/tdc, air temp >-17.8°C (0°F) and <-7°C (19.4°F) enable after coolant temp >70°C (158°F) or air temp >-7°C (19.4°F), coolant temp >-7°C (19.4°F) <130°C (266°F), canister purge <100% duty cycle, and no VSS, MAF/MAP, ECT, TPS, ETC, CRK Sensor DTCs nor any fuel system or injector DTCs.
- **Set Condition:**
  Engine speed is 100 RPM or more below idle speed for 7 seconds. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| AIR INDUCTION SYSTEM |
| THROTTLE BODY |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

### Diagnostic Test

#### 1. ACTIVE DTC

**NOTE: If any other DTCs are present, they must be diagnosed and repaired before continuing this test.**
Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

#### 2. AIR INDUCTION SYSTEM

Inspect the Air Induction System for the following problems.

Restrictions: Dirty Air Cleaner, Foreign material trap in the air intake tube, etc.

Leaks: Air Intake tube connection, Air Cleaner housing, etc.

**Were any problems found?**

**Yes** >> Repair or replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. THROTTLE BODY OPERATION

Inspect the throttle body for carbon build up, other restrictions, and a bent throttle plate using a straight edge.

If the throttle plate does not close entirely it may be bent and needs to be replaced.

Verify that the throttle cable between the Accelerator Pedal and Throttle Body is not binding.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

**Were any problems found?**

**Yes** >> Repair or replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P0507-IDLE SPEED PERFORMANCE HIGHER THAN EXCEPTED

For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The objective of the Idle “Speed Rationality is to monitor the ability to achieve and maintain a steady idle condition. The monitor will judge the functionality of the idle speed control system by monitoring RPM during idle. If RPM does not come within a calibrated band of target idle speed, a timer is started. If the timer reaches its maximum threshold without any sign of the RPM trending towards control, a soft failure is generated.

- **When Monitored:**
  With the engine running at idle, MAF <250 mg/tdc, air temp >-17.8°C (0°F) and <-7°C (19.4°F) enable after coolant temp >70°C (158°F) or air temp >-7°C (19.4°F), coolant temp >-7°C (19.4°F) <130°C (266°F), canister purge <100% duty cycle, and no VSS, MAF/MAP, ECT, TPS, ETC, CRK Sensor DTCs nor any fuel system or injector DTCs.
- **Set Condition:**
  Engine speed is 200 RPM or more above idle speed for 7 seconds. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| AIR INDUCTION SYSTEM |
| VACUUM LEAKS |
| THROTTLE BODY |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: If any other DTCs are present, they must be diagnosed and repaired before continuing this test.**
Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. AIR INDUCTION SYSTEM

Inspect the Air Induction System for the following problems.

Restrictions: Dirty Air Cleaner, Foreign material trap in the air intake tube, etc.

Leaks: Air Intake tube connection, Air Cleaner housing, etc.

**Were any problems found?**

**Yes** >> Repair or replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. VACUUM LEAKS

Start the engine.

Inspect the vehicle for external vacuum leaks.

Inspect the engine for internal leaks.

**Were any vacuum leaks found?**

**Yes** >> Repair the vacuum leak as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. THROTTLE BODY OPERATION

Inspect the throttle body for carbon build up, other restrictions, and a bent throttle plate using a straight edge.

If the throttle plate does not close entirely it may be bent and needs to be replaced.

Verify that the throttle cable between the Accelerator Pedal and Throttle Body is not binding.

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

While the vehicle is running, lightly tap on IAC Motor, with your hand, and listen for the idle to fluctuate.

**Were any problems found?**

**Yes** >> Repair or replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

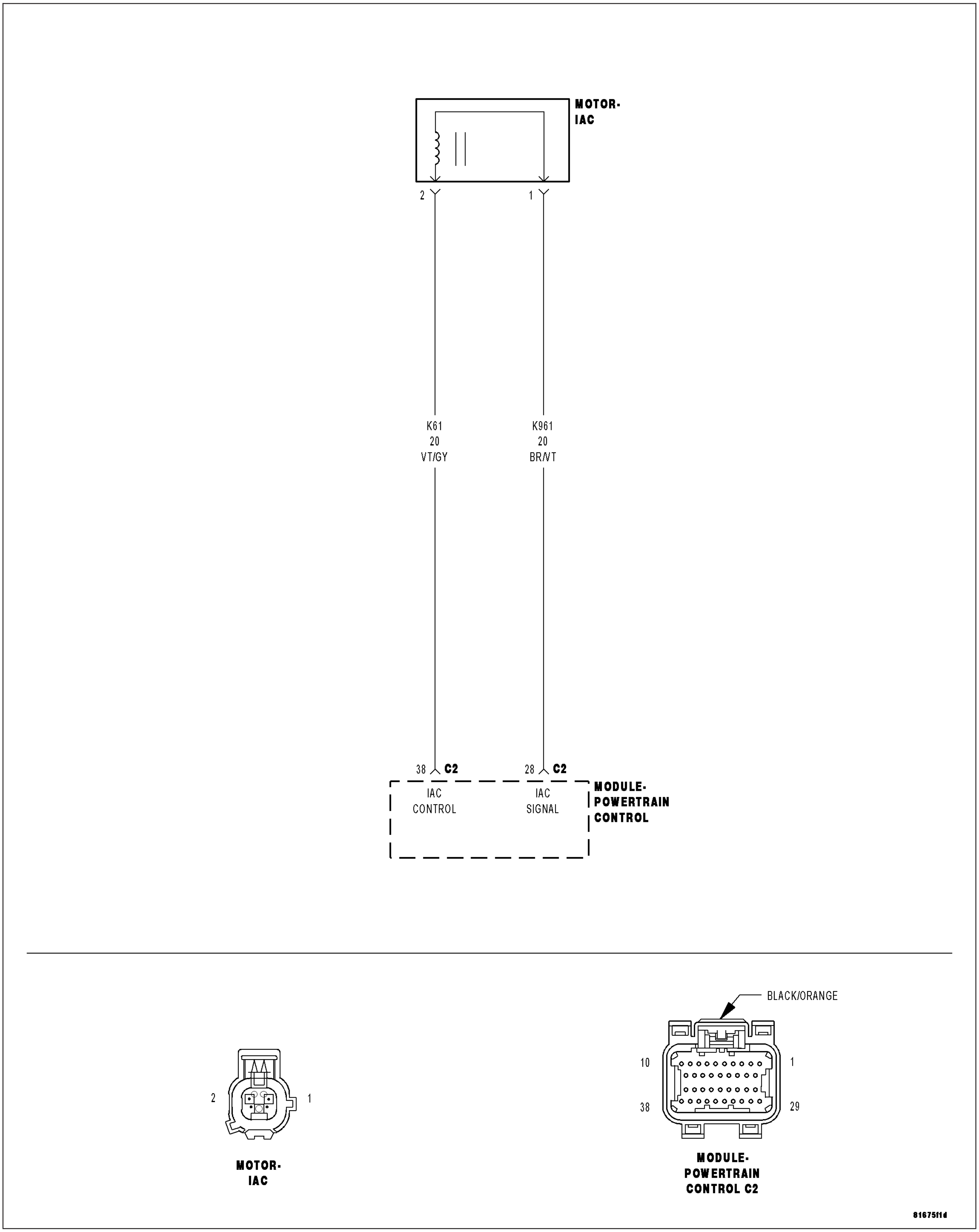
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0508-IDLE AIR CONTROL VALVE SENSE CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running. Battery voltage greater than 10 volts. IAC motor operating.
- **Set Condition:**
  The PCM senses a short to ground or battery voltage on any of the Linear Idle Air Control (LIAC) control circuits for 2.75 seconds while the IAC motor is active. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K61) IAC CONTROL CIRCUIT SHORTED TO GROUND |
| (K961) IAC SIGNAL CIRCUIT OPEN |
| (K961) IAC SIGNAL CIRCUIT SHORTED TO GROUND |
| (K61) IAC CONTROL CIRCUIT OPEN |
| IAC MOTOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. IAC MOTOR OPERATION

**NOTE: If the engine will not idle, maintain an engine speed between 800 and 1500 RPM.**
Start the engine.
Allow the engine to idle.
With a scan tool, read the IAC Current.

**Is the IAC Current below 146 mA?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. IAC MOTOR

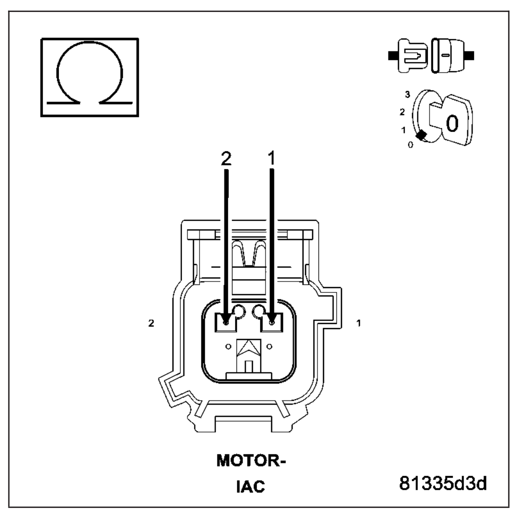
Turn the ignition off.
Disconnect the IAC Motor harness connector.
Remove the IAC Motor.

**NOTE: Inspect the IAC air passages for restrictions and damage to the IAC valve.**
Measure the resistance across the IAC Motor pin terminals (component).

**Is the resistance 9.7 +/- 1.0 ohms?**

**Yes** >> Go To 3

**No** >> Replace the IAC Motor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

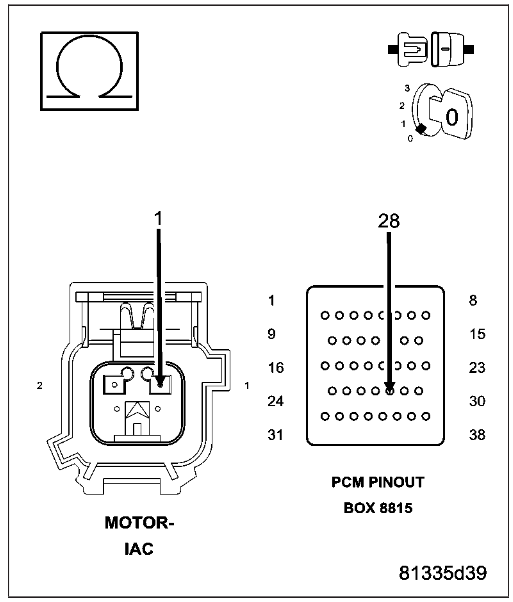


## 3. (K961) IAC SIGNAL CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K961) IAC Signal circuit from the IAC Motor harness connector to the appropriate terminal of special tool #8815.



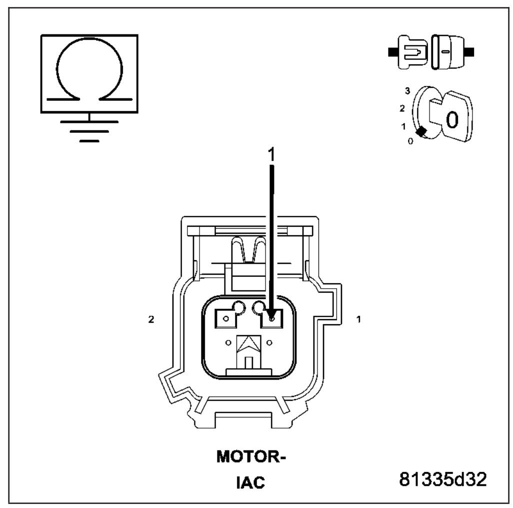

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the open in the (K961) IAC Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (K961) IAC SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K961) IAC Signal circuit in the IAC Motor harness connector.



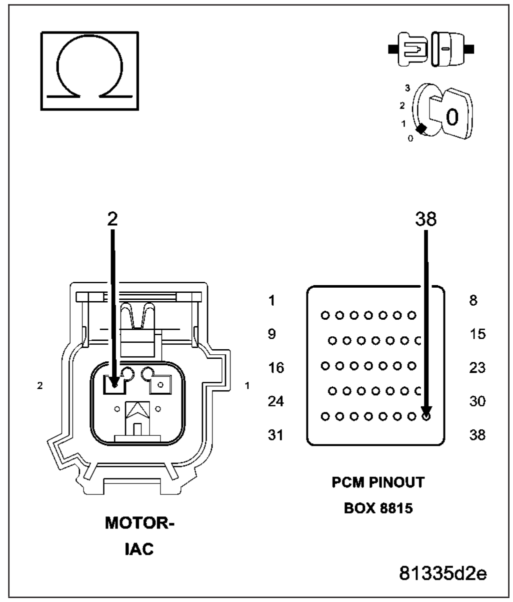

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K961) IAC Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (K61) IAC CONTROL CIRCUIT OPEN

Measure the resistance of the (K61) IAC Control circuit from the IAC Motor harness connector to the appropriate terminal of special tool #8815.



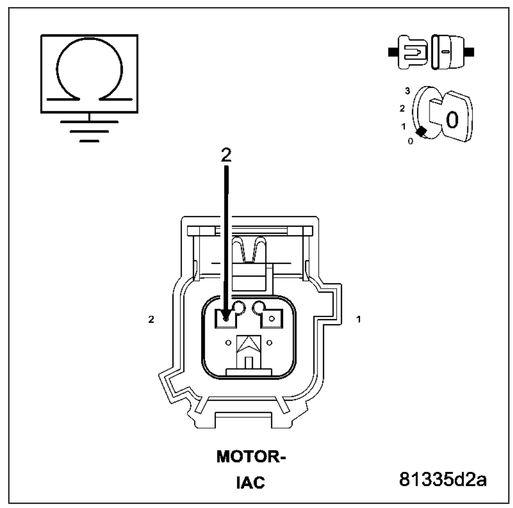

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (K61) IAC Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (K61) IAC CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K61) IAC Control circuit in the IAC Motor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K61) IAC Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

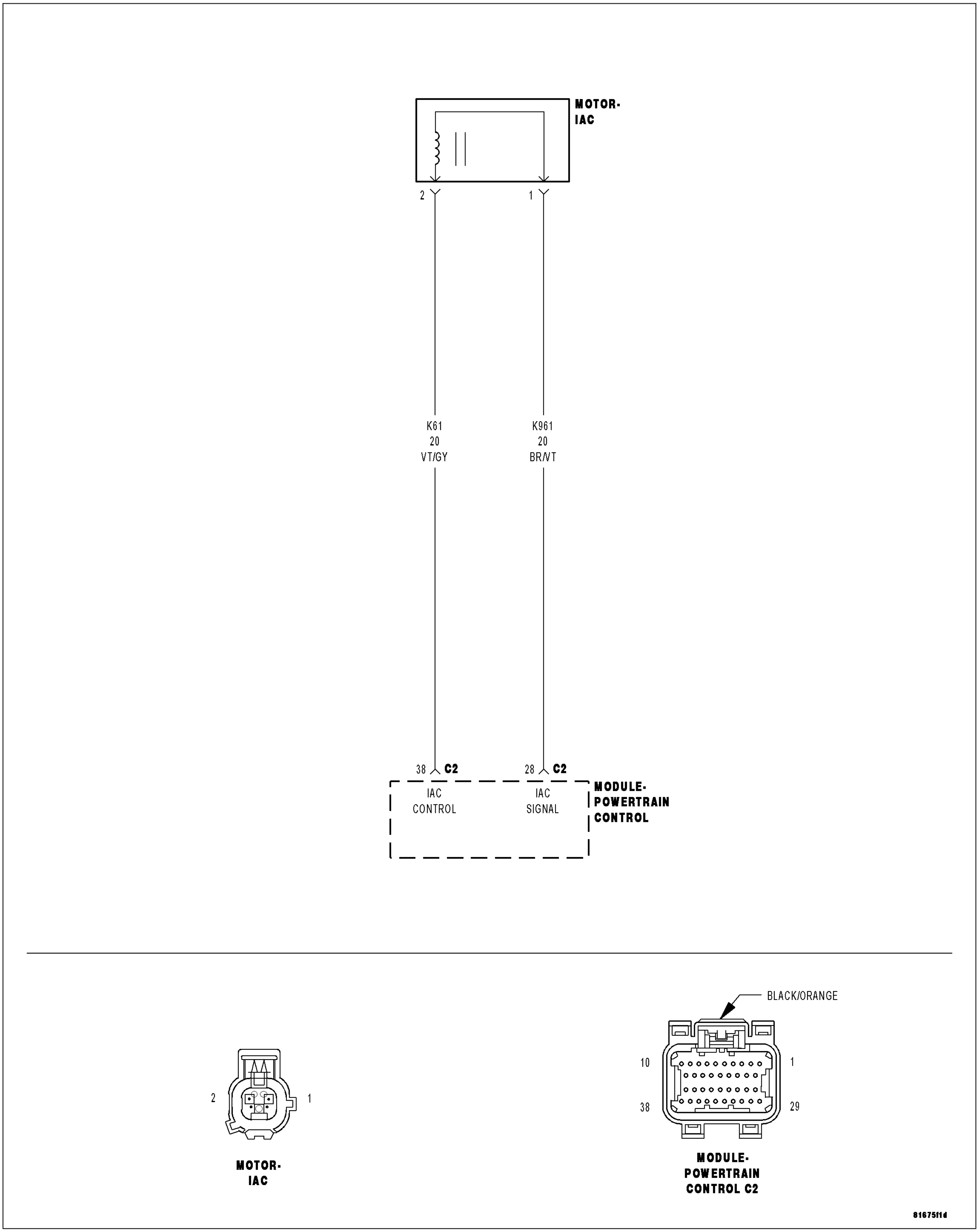
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0509-IDLE AIR CONTROL VALVE SENSE CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running. Battery voltage greater than 10 volts. IAC motor operating.
- **Set Condition:**
  The PCM senses a short to ground or battery voltage on any of the Linear Idle Air Control (LIAC) control circuits for 2.75 seconds while the IAC motor is active. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (K961) IAC RETURN CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K61) IAC CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K61) IAC CONTROL CIRCUIT SHORTED TO THE (K961) IAC RETURN CIRCUIT |
| IAC MOTOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. IAC MOTOR OPERATION

**NOTE: If the engine will not idle, maintain an engine speed between 800 and 1500 RPM.**

Start the engine.

Allow the engine to idle.

With a scan tool, read the IAC Current.

**Is the IAC Current above 999 mA?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. IAC MOTOR

Turn the ignition off.

Disconnect the IAC Motor harness connector.

With the scan tool, monitor the IAC Current.

Ignition on, engine not running.

**Does the scan tool display IAC Current at 0 mA?**

**Yes** >> Replace the IAC Motor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

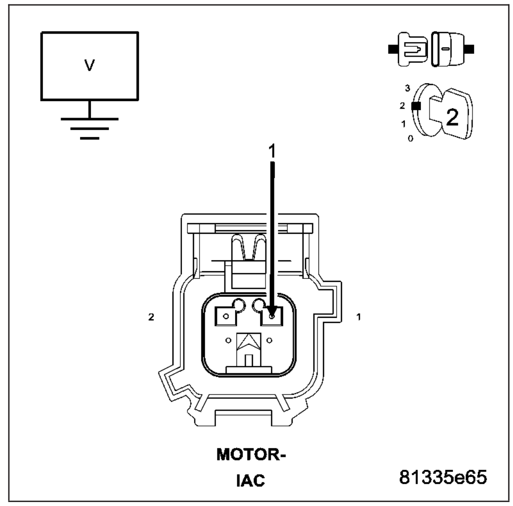
## 3. (K961) IAC SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K961) IAC Signal circuit in the IAC Motor harness connector.




**Is the voltage above 0.5 of a volt?**

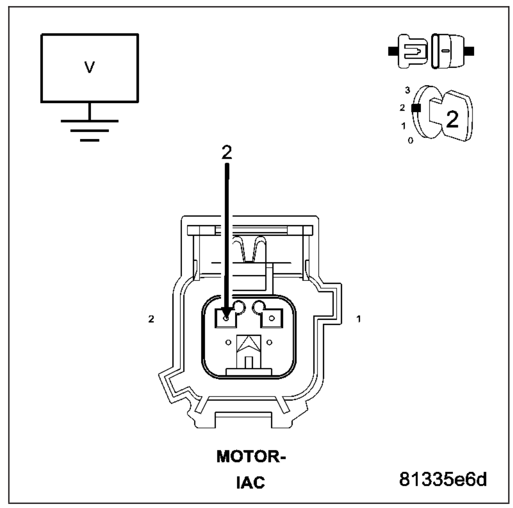
**Yes** >> Repair the short to battery voltage in the (K961) IAC Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (K61) IAC CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Measure the voltage on the (K61) IAC Control circuit in the IAC Motor harness connector.



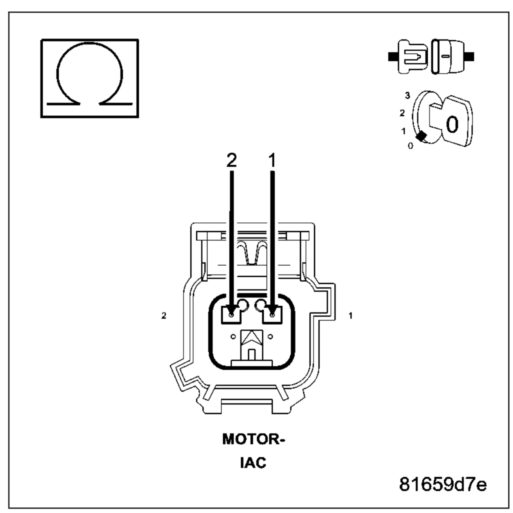

**Is the voltage above 0.5 of a volt?**

**Yes** >> Repair the short to battery voltage in the (K61) IAC Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (K61) IAC CONTROL CIRCUIT SHORTED TO THE (K961) IAC RETURN CIRCUIT

Measure the resistance across the (K961) IAC Signal circuit and the (K61) IAC Control circuit in the IAC Motor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K961) IAC Signal circuit and the (K61) IAC Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0513-INVALID SKIM KEY

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM detects an invalid SKIM key. One Trip Fault.

| Possible Causes |
|---|
| INCORRECT VIN PROGRAMMED IN THE PCM |
| NO COMMUNICATION WITH SKIM |
| NO VIN PROGRAMMED IN THE PCM |
| IGNITION KEY |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With the scan tool, read the PCM DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Go To 6

### 2. NO COMMUNICATION WITH SKIM

With the scan tool, attempt to communicate with the SKIM.

**Can the scan tool communicate with the SKIM?**

**Yes** >> Go To 3

**No** >> Refer to Section 8 - Electrical VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS and perform the appropriate Diagnostic Procedure.
Perform the SKIM VERIFICATION.

### 3. SKIM TROUBLE CODES SET

With the scan tool, check for SKIM DTCs.

**Are any DTCs present in the SKIM?**

**Yes** >> Refer to Section 8 - Electrical VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS and perform the appropriate Diagnostic Procedure.
Perform the SKIM VERIFICATION.

**No** >> Go To 4

## 4. VIN PROGRAMMED INTO PCM

With the scan tool, display the VIN that is programmed in the PCM.

**Has a VIN been programmed into the PCM?**

**Yes** >> Go To 5

**No** >> Program the correct VIN into the PCM and retest.
Perform the SKIM VERIFICATION.

## 5. PCM

Turn the ignition off.

Replace and program the SKIM per Service Information.

Ignition on, engine not running.

With the scan tool, erase all SKIM and PCM DTCs.

Attempt to start and idle the engine.

With the scan tool, read the PCM DTCs.

**Does the scan tool display this code?**

**Yes** >>

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary. Replace and program the Powertrain Control Module per Service Information.**

Perform the SKIM VERIFICATION.

**No** >> Test Complete.

## 6. IGNITION KEY

**NOTE: You must obtain the SKIM pin number.**

**NOTE: This DTC could have been set if the SKIM harness connector was disconnected, or if the SKIM was replaced recently.**

**NOTE: All keys that the customer uses for this vehicle must be tested to verify they are operating properly.**

Ignition on, engine not running.

Verify the correct VIN is programmed into the PCM and SKIM.

Turn the ignition off.

With the next customer key turn the ignition key on and crank the engine to start.

With the scan tool, read the PCM DTCs. Look for P0513.

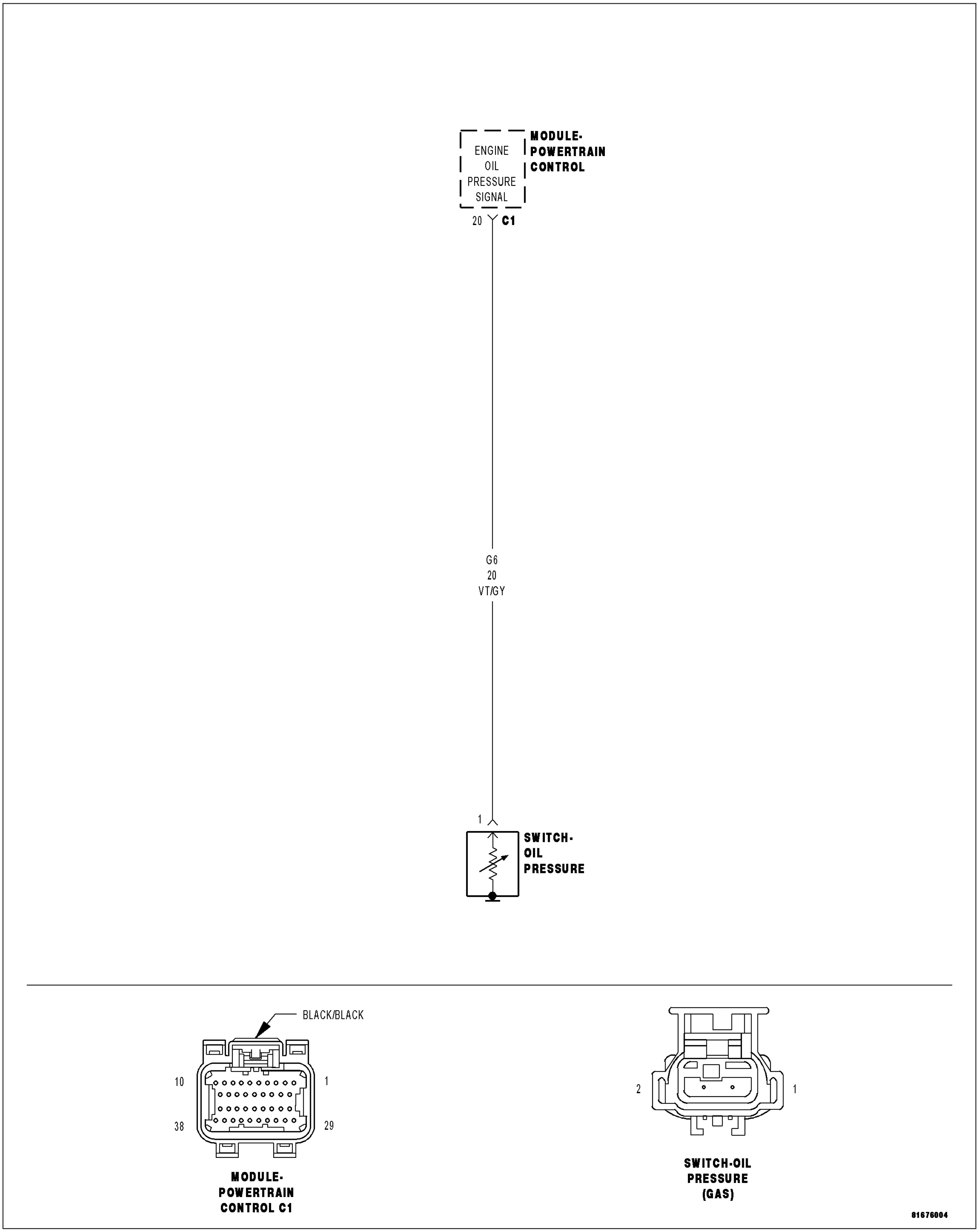
**Is the DTC P0513 still active?**

**Yes** >> Replace the Ignition Key.
Perform the SKIM VERIFICATION.

**No** >> Test Complete.

**NOTE: If this DTC cannot be reset, it could have been an actual theft attempt.**

## P0522-OIL PRESSURE TOO LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on and battery voltage above 10.4 volts.
- **Set Condition:**
  The oil pressure sensor voltage at PCM goes below 0.1 of a volt for 0.5 of a second. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (G6) OIL PRESSURE SIGNAL CIRCUIT OPEN |
| (G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND |
| OIL PRESSURE SWITCH |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. OIL PRESSURE SWITCH

Turn the ignition off.

Disconnect the Oil Pressure Switch harness connector.

Ignition on, engine not running.

Connect a jumper wire to the (G6) Oil Pressure Signal circuit in the Sensor harness connector.

With the scan tool monitor the Oil Pressure Switch state.

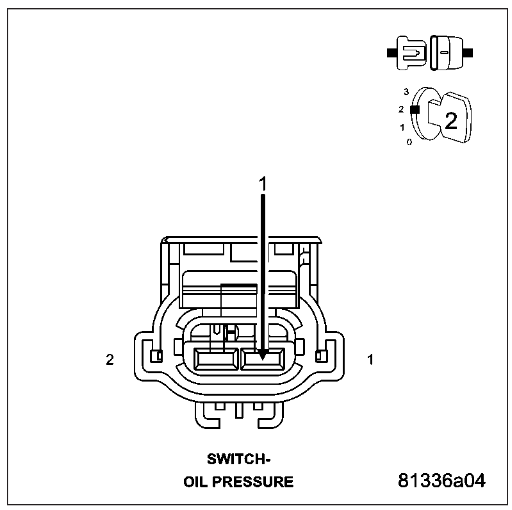
Touch the other end of the jumper wire to a known good Ground several times.

**Did the Oil Pressure Switch state change from High to Low when connecting and disconnecting the jumper wire to ground?**

**Yes** >> Replace the Oil Pressure Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

**NOTE: Remove the jumper wire before continuing.**



## 3. (G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Ignition on, engine not running.

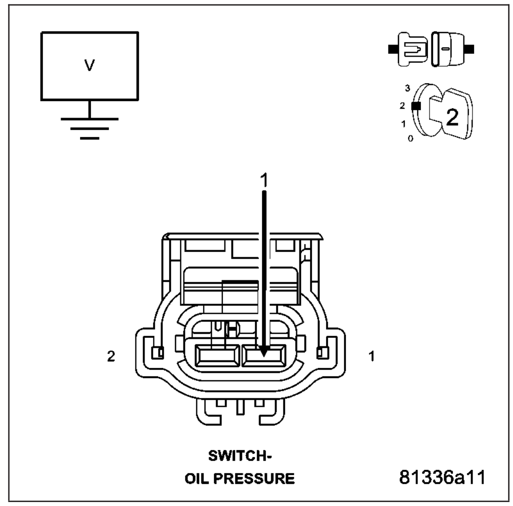
Measure the voltage on the (G6) Oil Pressure Signal circuit in the Switch harness connector.

**Is the voltage above 0 volts?**

**Yes** >> Repair the short to battery voltage on the (G6) Oil Pressure Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4




## 4. (G6) OIL PRESSURE SWITCH SIGNAL CIRCUIT OPEN

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

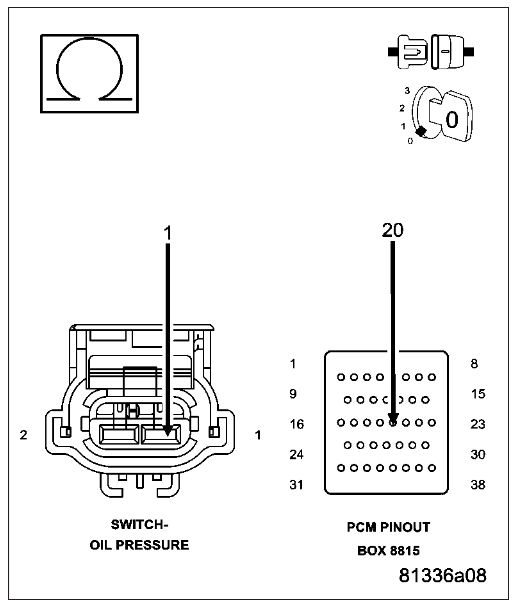
Measure the resistance of the (G6) Oil Pressure Signal circuit from the Oil Pressure Switch harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

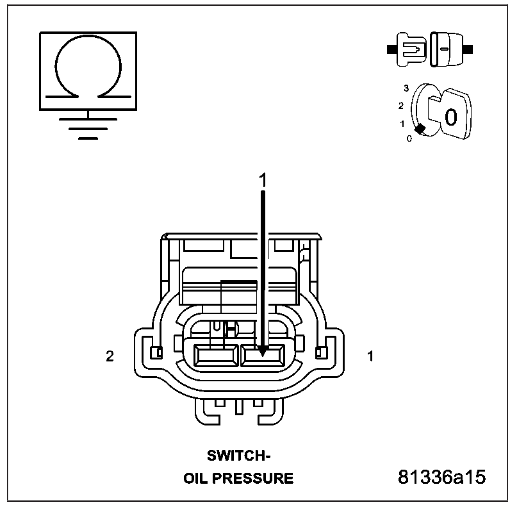
**No** >> Repair the open in the (G6) Oil Pressure Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



## 5. (G6) SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (G6) Oil Pressure Signal circuit in the Switch connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (G6) Oil Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

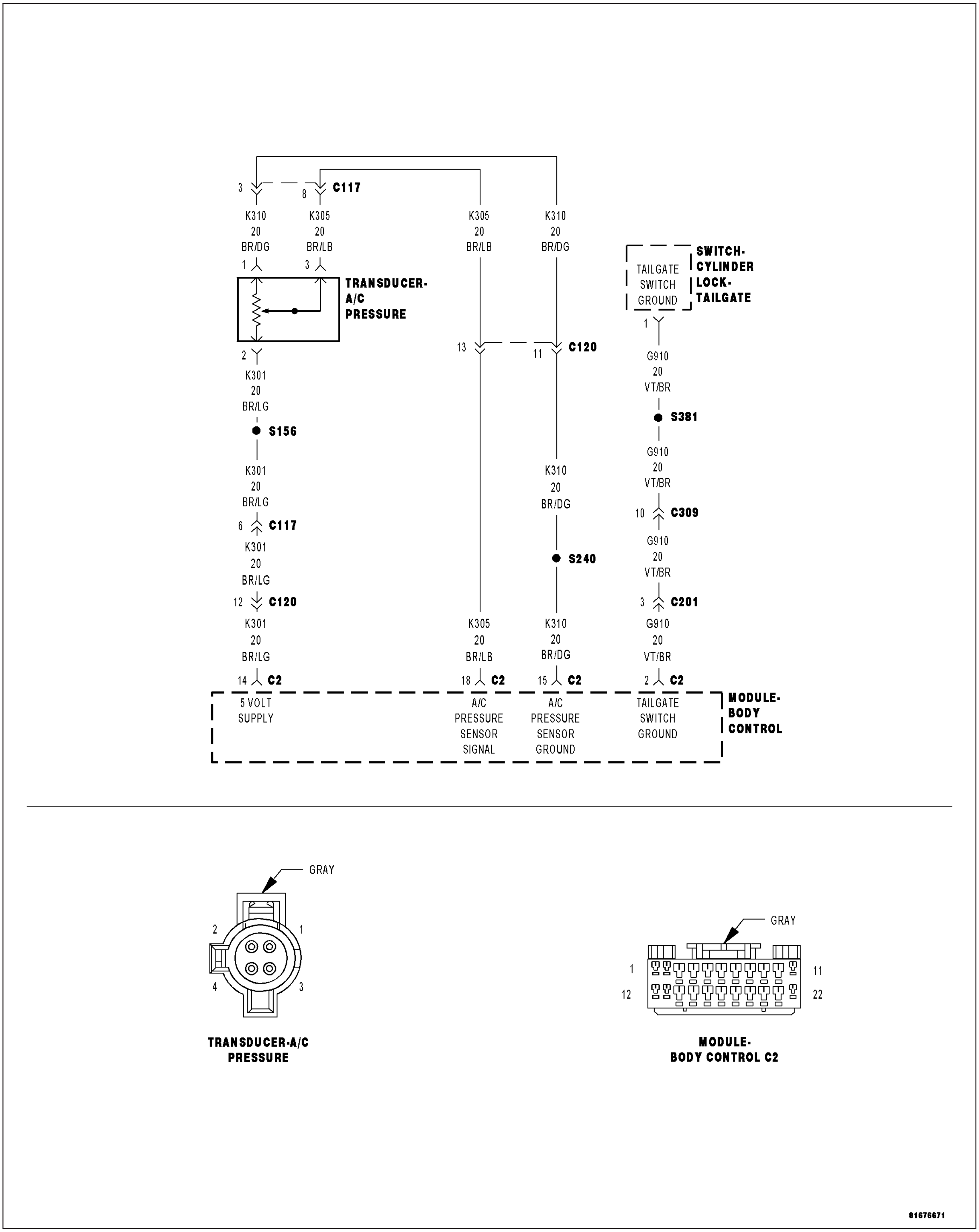
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0532-A/C PRESSURE SENSOR CIRCUIT LOW (ESP)




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running, AC is learned, and AC Clutch Relay energized.
- **Set Condition:**
  The A/C pressure sensor signal voltage at the PCM goes below 0.58 of a volt for 2.6 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (K301) 5-VOLT SUPPLY CIRCUIT OPEN |
| (K301) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| A/C PRESSURE TRANSDUCER |
| (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND |
| (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (K310) SENSOR GROUND CIRCUIT |
| CAN C BUS CIRCUIT OPEN OR SHORTED |
| BCM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. A/C PRESSURE TRANSDUCER VOLTAGE BELOW 0.6 OF A VOLT

**NOTE: Diagnose any CAN C Bus communication DTC's before continuing.**

**NOTE: Make sure the A/C refrigerant System is properly charged per Service Information.**

Start the engine.

With a scan tool, read the A/C Pressure Sensor voltage.

**Is the voltage below 0.6 of a volt?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

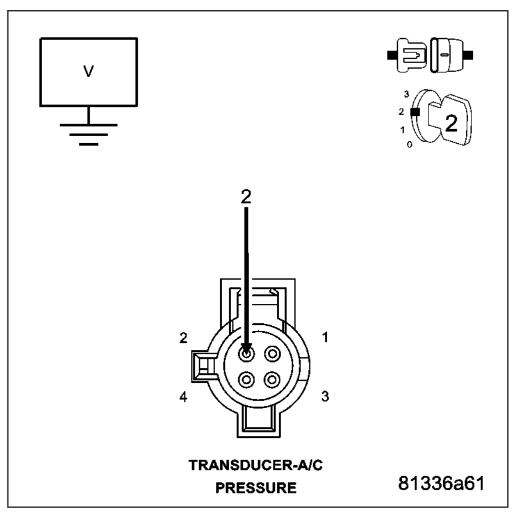
### 2. (K301) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the A/C Pressure Transducer harness connector.

Ignition on, engine not running.

Measure the voltage on the (K301) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.




**Is the voltage between 4.5 to 5.2 volts?**

**Yes** >> Go To 3

**No** >> Go To 6

## 3. A/C PRESSURE TRANSDUCER

With the scan tool, monitor the A/C Pressure Transducer voltage.

**Is the voltage above 0.6 of a volt?**

**Yes** >> Replace the A/C Pressure Transducer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

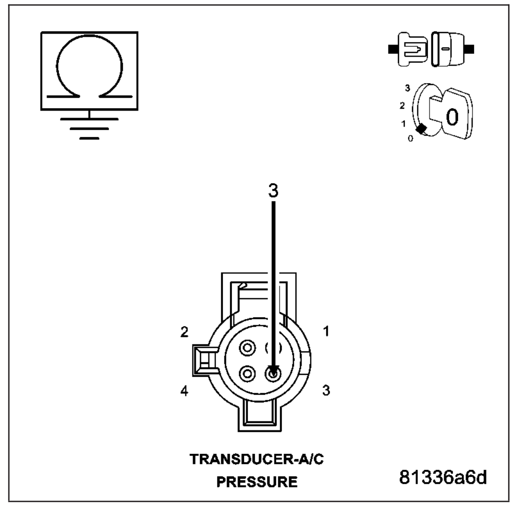
Disconnect the C2 BCM harness connector.

Measure the resistance between ground and the (C18) A/C Pressure Signal circuit in the A/C Pressure Transducer harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (C18) A/C Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5



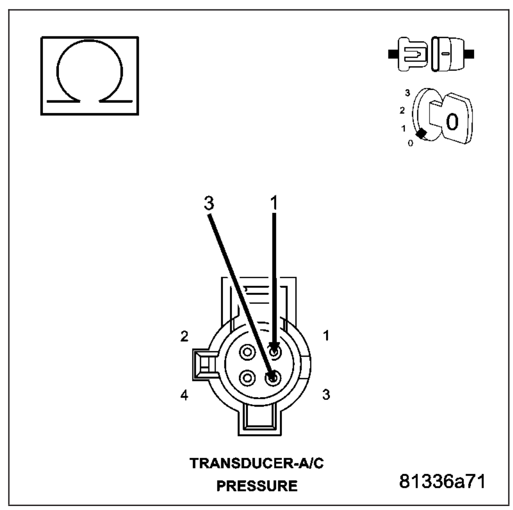

## 5. (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (K310) SENSOR GROUND CIRCUIT

Measure the resistance between the (C18) A/C Pressure Signal circuit and the (K310) Sensor ground circuit in the A/C Pressure Transducer harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short between the (K310) Sensor ground circuit and the (C18) A/C Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8



## 6. (K301) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 BCM harness connector.

Measure the resistance of the (K301) 5-volt Supply circuit from the A/C Pressure Transducer harness connector to the C2 BCM harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K301) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. (K301) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

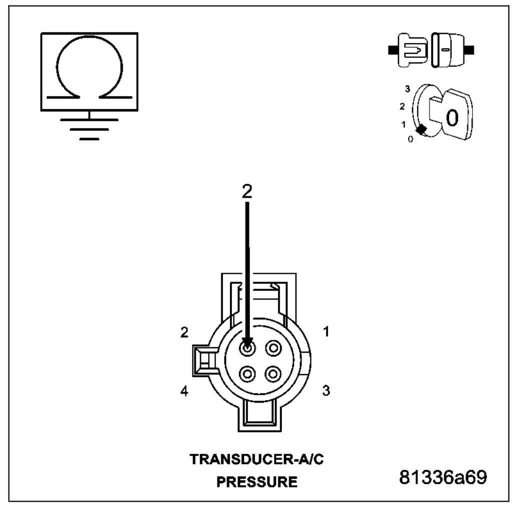
Measure the resistance between ground and the (K301) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K301) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8




## 8. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

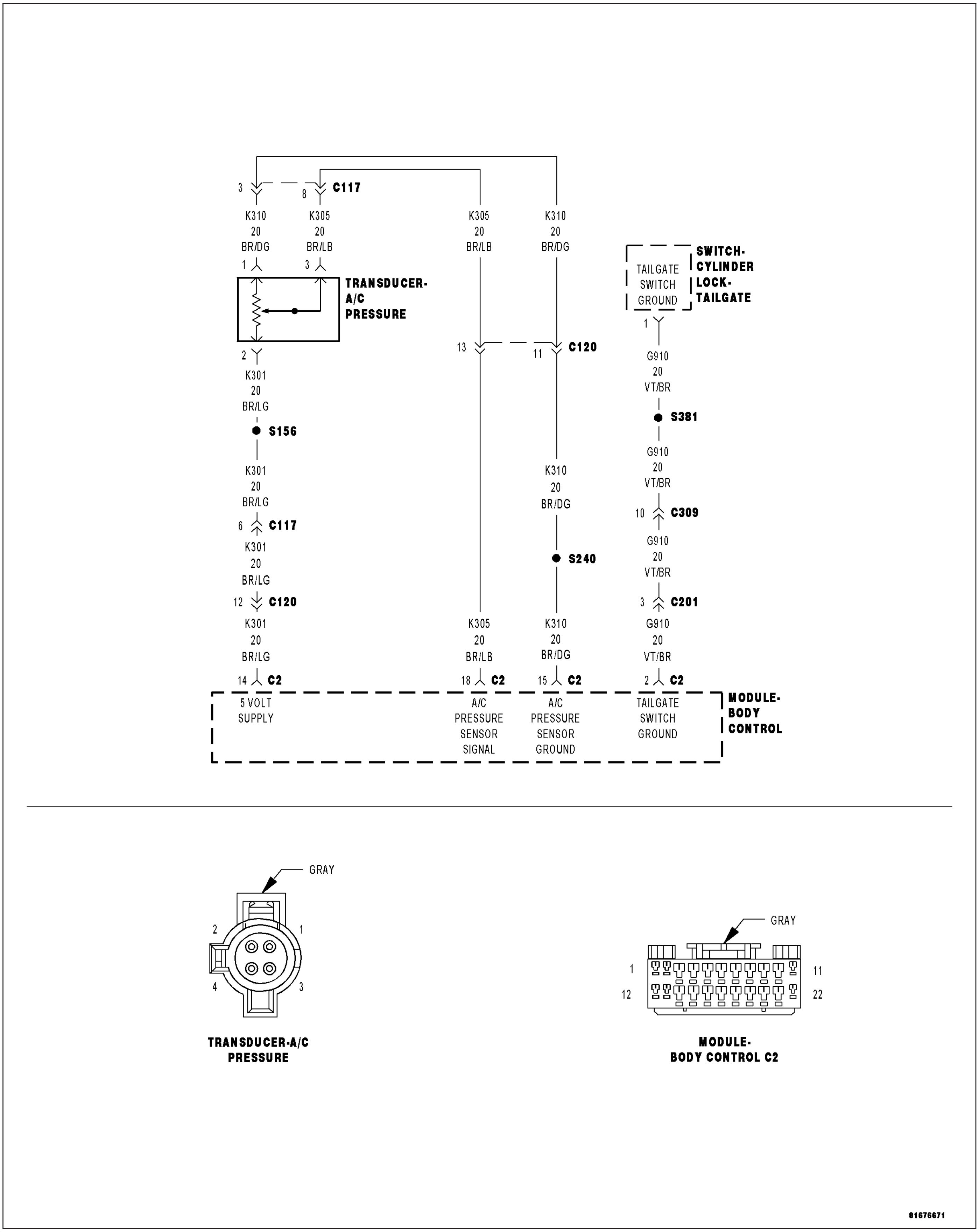
**Yes** >> Repair as necessary.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and program the Body Control Module per Service Information.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## P0533-A/C PRESSURE SENSOR CIRCUIT HIGH (ESP)




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and the AC Clutch Relay energized.
- **Set Condition:**
  The A/C pressure transducer signal at the PCM goes above 4.92 volts for more than 2.6 seconds. One trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (C18) A/C PRESSURE SIGNAL CIRCUIT OPEN |
| (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (K301) 5-VOLT SUPPLY CIRCUIT |
| (K310) SENSOR GROUND CIRCUIT OPEN |
| A/C PRESSURE TRANSDUCER |
| CAN C BUS CIRCUIT OPEN OR SHORTED |
| BCM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. A/C PRESSURE TRANSDUCER VOLTAGE ABOVE 4.9 VOLTS

**NOTE: Diagnose any CAN C Bus Communication DTCs before continuing.**

**NOTE: Make sure the A/C refrigerant System is properly charged per Service Information.**

Start the engine.

With a scan tool, read the A/C Pressure Sensor voltage.

**Is the voltage above 4.9 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. A/C PRESSURE TRANSDUCER

Turn the ignition off.

Disconnect the A/C Pressure Transducer harness connector.

Connect a jumper wire between the (C18) A/C Pressure Signal circuit and the (K310) Sensor ground circuit in the Transducer harness connector.

Ignition on, engine not running.

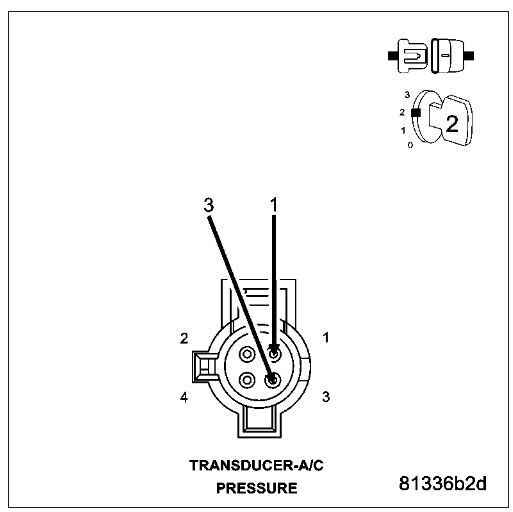
With the scan tool, monitor the A/C Pressure Transducer voltage.

**Is the voltage below 1.0 volt with the jumper wire installed?**

**Yes** >> Replace the A/C Pressure Transducer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

**NOTE: Remove the jumper wire before continuing.**



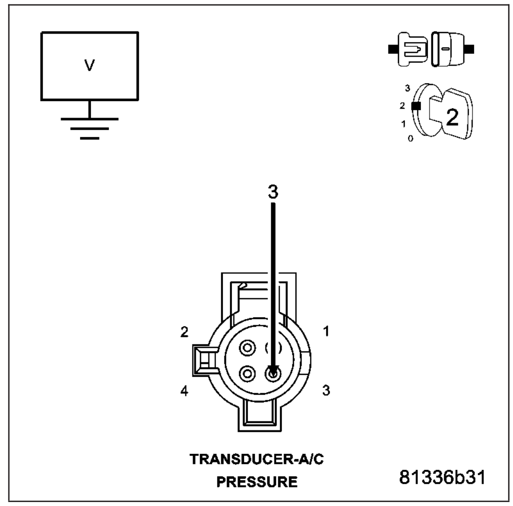
## 3. (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 BCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (C18) A/C Pressure Signal circuit in the A/C Pressure Transducer harness connector.




**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (C18) A/C Pressure Signal circuit.

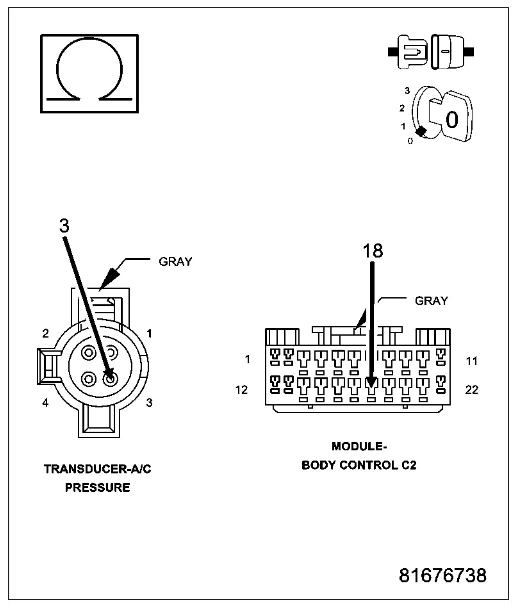
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (C18) A/C PRESSURE SIGNAL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (C18) A/C Pressure Signal circuit from the A/C Pressure Transducer harness connector to the C2 BCM harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the open in the (C18) A/C Pressure Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (K301) 5-VOLT SUPPLY CIRCUIT

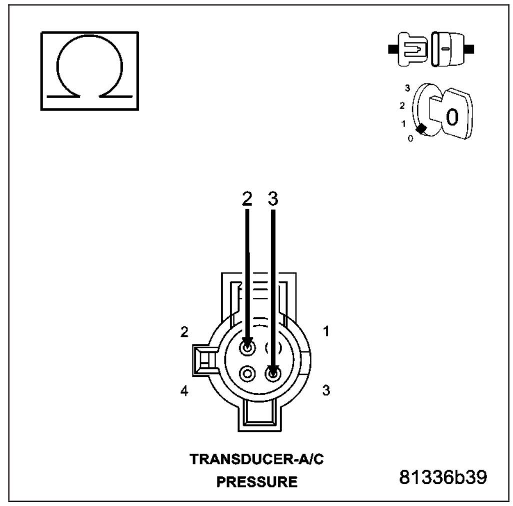
Measure the resistance between the (C18) A/C Pressure Signal circuit and the (K301) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K301) 5-volt Supply circuit and the (C18) A/C Pressure Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6




## 6. (K310) SENSOR GROUND CIRCUIT OPEN

Disconnect the C2 BCM harness connector.

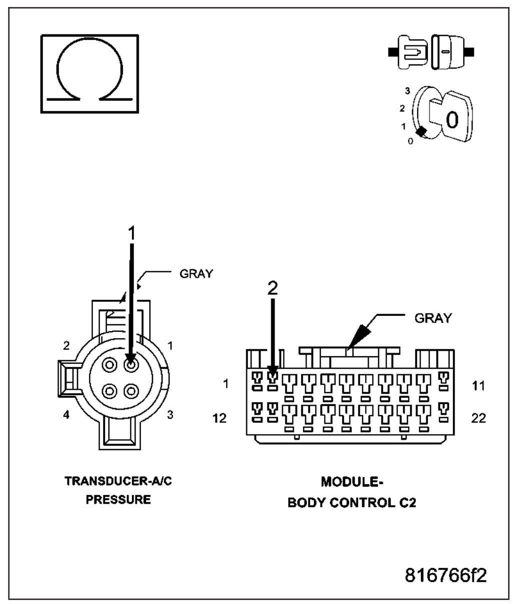
Measure the resistance of the (K310) Sensor ground circuit from the A/C Pressure Sensor harness connector to the C2 BCM harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K310) Sensor ground circuit

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




## 7. BCM

**NOTE: Before continuing, check the BCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

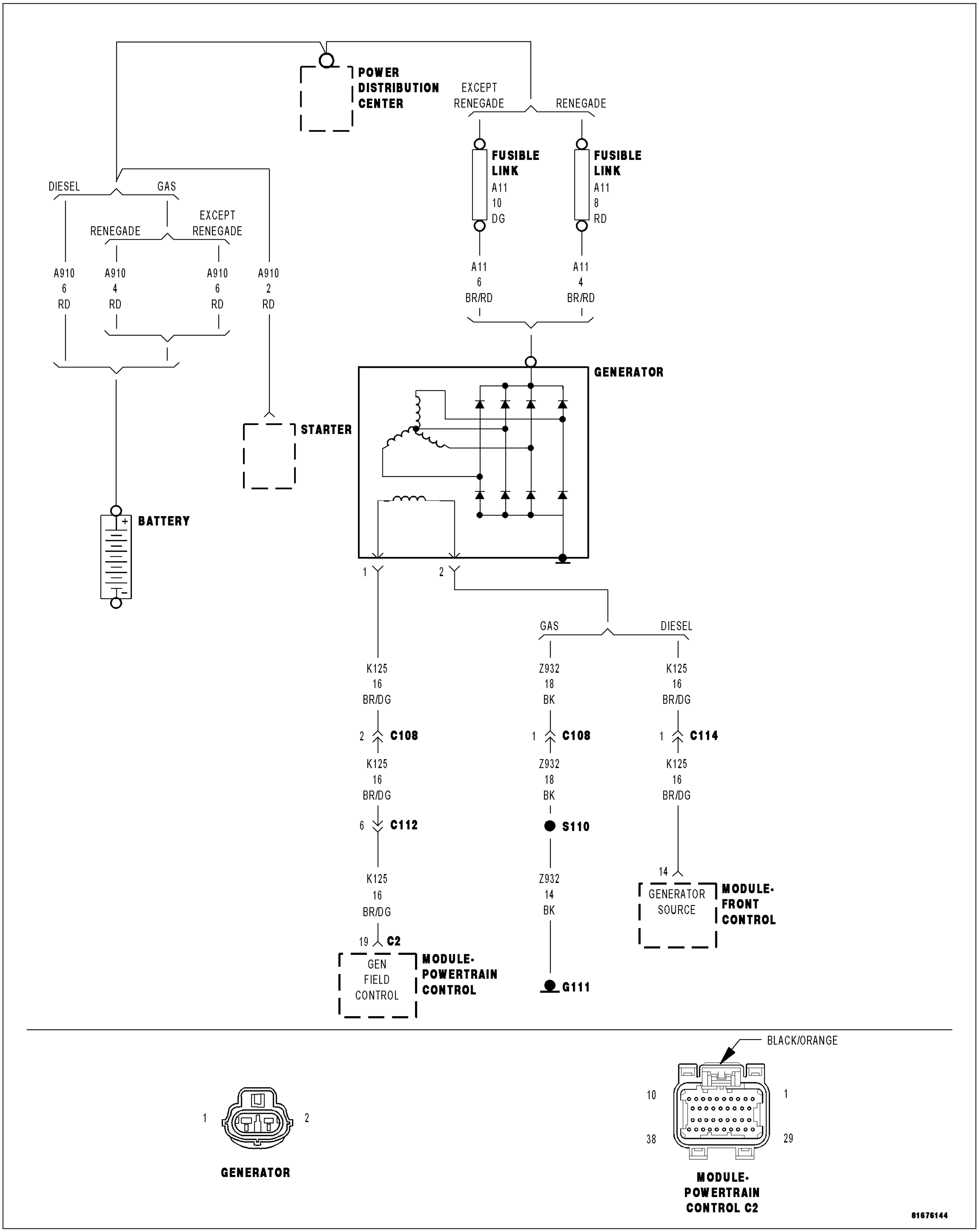
**Yes** >> Repair as necessary.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

**No** >> Replace and program the Body Control Module per Service Information.

Perform the BODY VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE)

## P0562-BATTERY VOLTAGE LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The engine running. The engine speed greater than 1000 RPM.
- **Set Condition:**
  Battery voltage is 1 volt less than desired voltage for a set period of time. One Trip Fault.

| Possible Causes |
|---|
| RESISTANCE IN THE (A1) BATTERY POSITIVE CIRCUIT |
| RESISTANCE IN THE GENERATOR CASE GROUND |
| (K125) GENERATOR FIELD CONTROL CIRCUIT OPEN |
| (K125) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND |
| OPEN FUSE LINK |
| (Z932) GROUND CIRCUIT OPEN |
| GENERATOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester, test the Battery before continuing.**

**NOTE: Inspect the vehicle for after market accessories that may exceed the Generator System output.**
Turn the ignition off.

**NOTE: Make sure the generator drive belt is in good operating condition.**

**NOTE: Inspect the fuses in the IPM. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.**
Ignition on, engine not running.

With the scan tool, read DTCs.

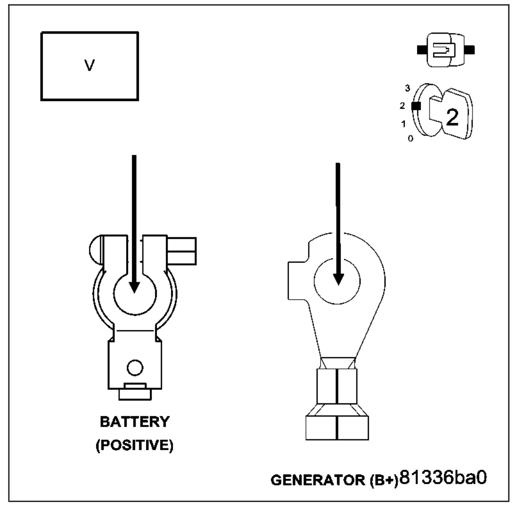
**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. (A1) B+ CIRCUIT HIGH RESISTANCE

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**




**NOTE: Make sure all wires are clear of the engine's moving parts.**

Measure the voltage between the (A1) B+ Terminal at the Generator and the Battery + Post.

Start the engine.

**Is the voltage above 0.4 of a volt?**

**Yes** >> Repair the excessive resistance in the (A1) B+ circuit between the Generator and Battery.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. GENERATOR CASE GROUND HIGH RESISTANCE

Ignition on, engine not running.

Start the engine.

Allow the engine to reach normal operating temperature.

**NOTE: Make sure all wires are clear of the engine's moving parts.**

Measure the voltage between the Generator case and Battery ground post.

**Is the voltage above 0.1 of a volt?**

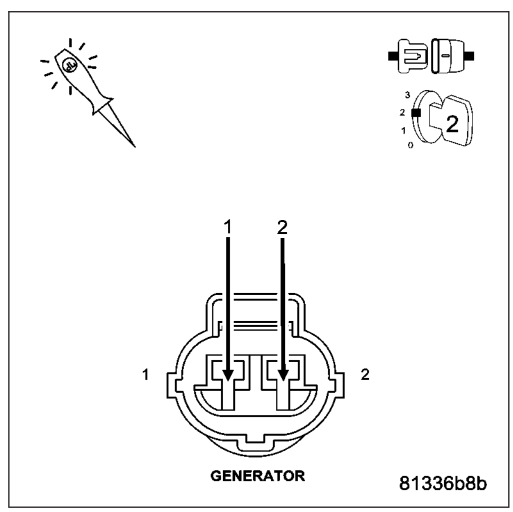
**Yes** >> Repair excessive resistance in the Generator Ground between the Generator Case and Battery ground side.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. GENERATOR OPERATION

Turn the ignition off.




Disconnect the Generator Field harness connector.

Using a 12-volt test light, jump it across the Generator Field harness connector.

Ignition on, engine not running.

With the scan tool, actuate the Gen Field Control circuit.

**Does the test light illuminate brightly and flash on and off?**

**Yes** >> Replace the Generator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

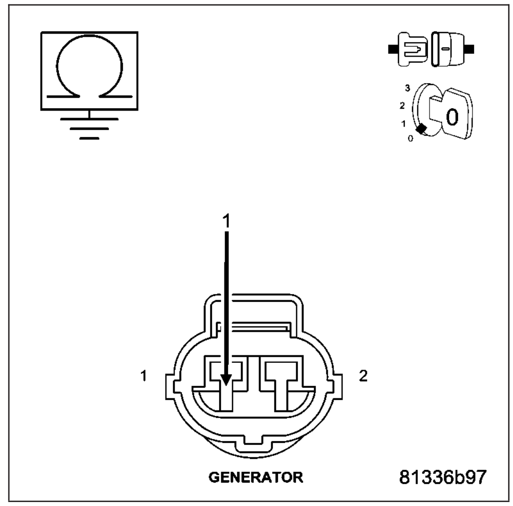
**No** >> Go To 5

## 5. (K125) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K125) Gen Field Control circuit in the Generator Field harness connector.




**Is the resistance below 100 ohms?**

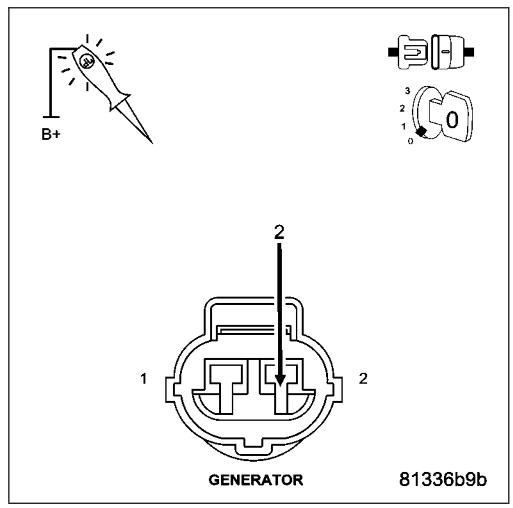
**Yes** >> Repair the short to ground in the (K125) Gen Field Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (Z932) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, probe the (Z932) Ground circuit in the Generator Field harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 7

**No** >> Repair the open in the (Z932) Ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. (K125) GENERATOR FIELD CONTROL CIRCUIT OPEN

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K125) Gen Field Control circuit from the Generator harness connector to the appropriate terminal of the special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 8

**No** >> Repair the open in the (K125) Gen Field Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 8. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

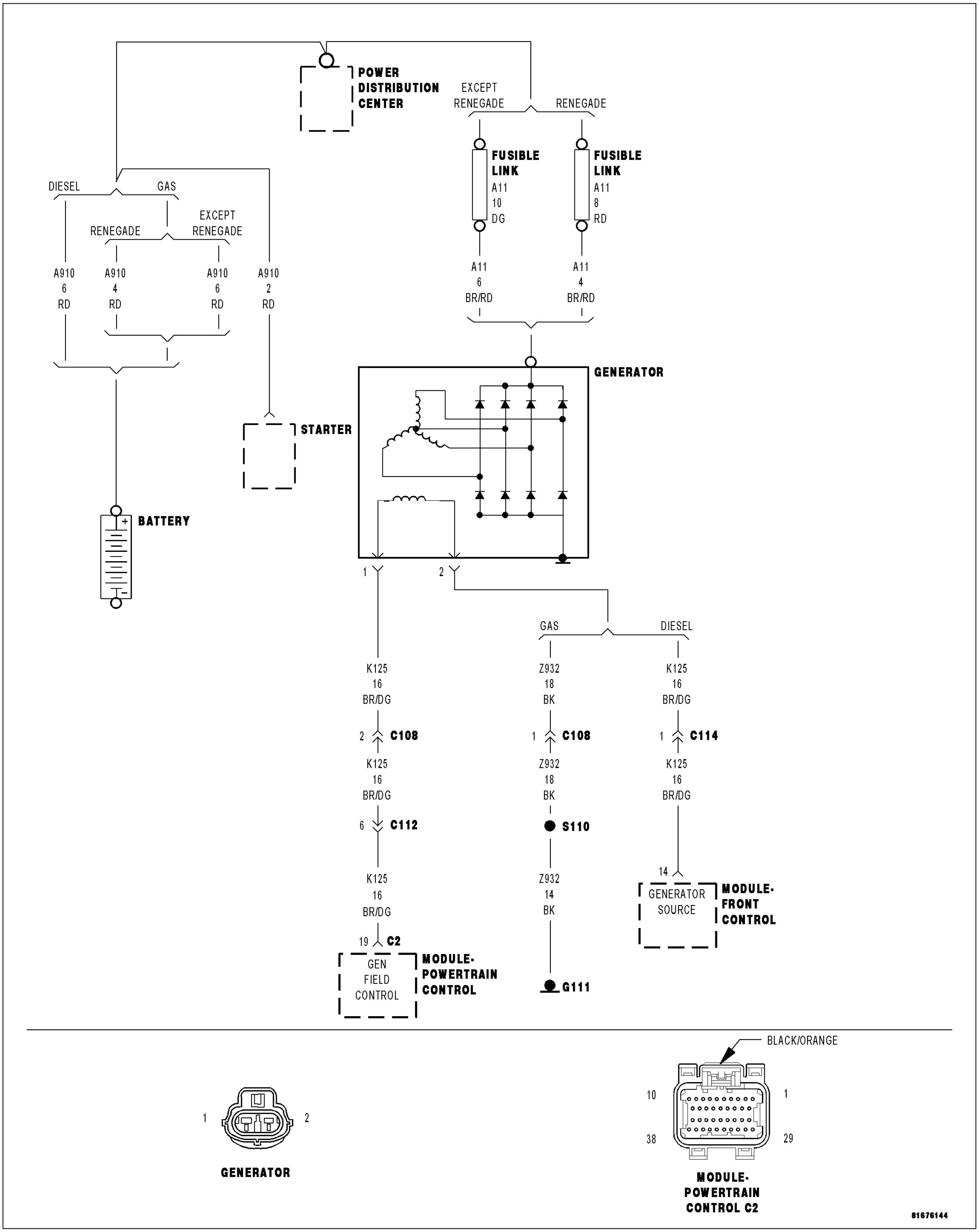
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0563-BATTERY VOLTAGE HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Engine RPM greater than 1000 RPM. With no other charging system codes set.
- **Set Condition:**
  Battery voltage is 1 volt greater than desired voltage for more than 10 seconds. Battery voltage greater than 15.75 volts. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (K125) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| GENERATOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester, test the Battery before continuing.**

**NOTE: Inspect the vehicle for after market accessories that may exceed the Generator System output.**
Turn the ignition off.

**NOTE: Make sure the generator drive belt is in good operating condition.**

**NOTE: Inspect the fuses in the IPM. If a fuse is open use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.**
Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. GENERATOR OPERATION

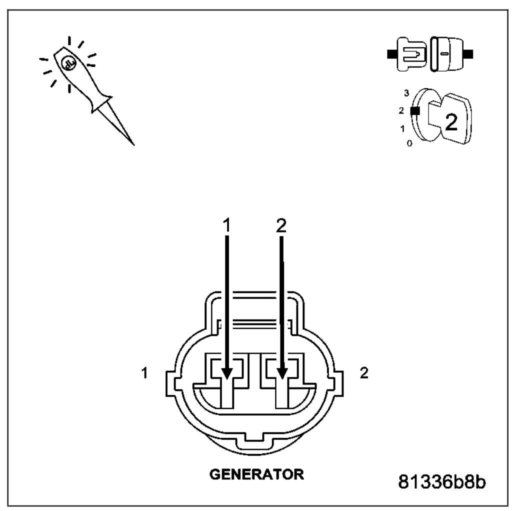
Turn the ignition off.

Disconnect the Generator Field harness connector.

Using a 12-volt test light, jump across the Generator Field harness connector.

Ignition on, engine not running.

With the scan tool, actuate the Generator Field Driver.




**Does the test light illuminate brightly and flash on and off?**

**Yes** >> Replace the Generator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

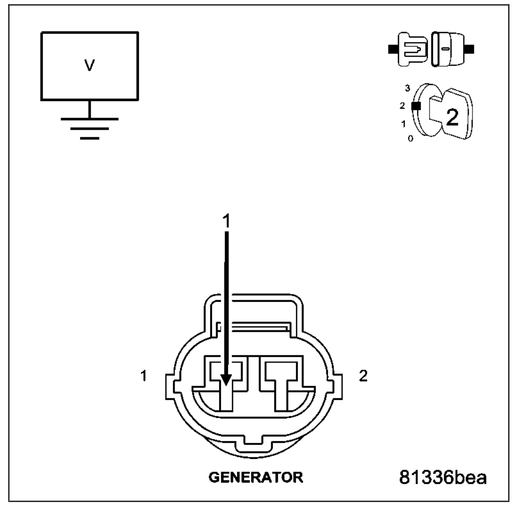
## 3. (K125) FIELD CIRCUIT SHORTED BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K125) Gen Field Control circuit at the Generator Field harness connector.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the short to battery voltage in the (K125) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

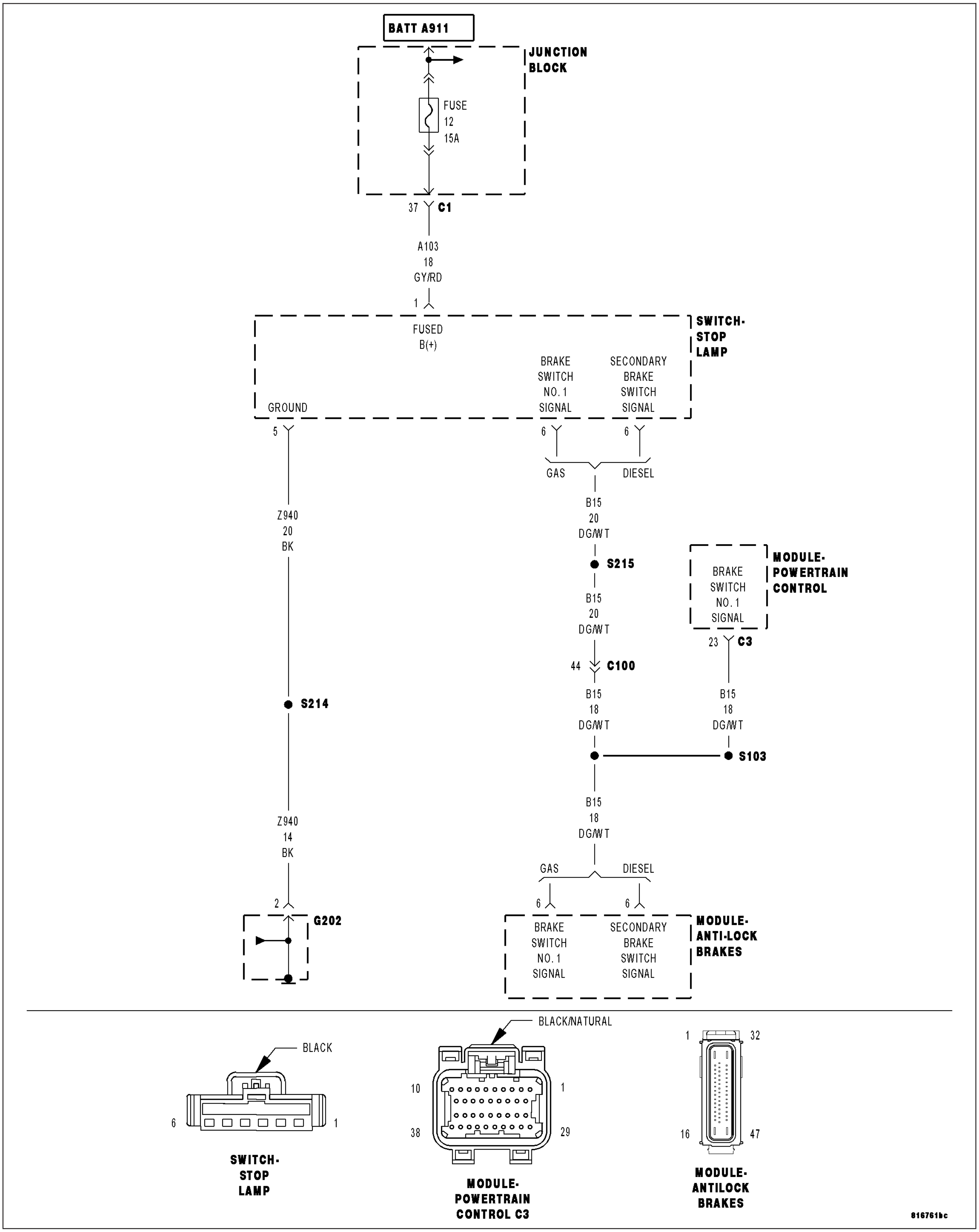
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0571-BRAKE SWITCH 1 PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The brake switch rationality checks both failure modes of the brake switch. The brake switch stuck on test checks for a high vehicle speed condition where the brake switch is unexpectedly depressed. The brake switch stuck off test checks for repeated vehicle stop maneuvers without the brake switch depressed.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  If the output of Brake Switch No.1 to the PCM looks like it is not applied, while Brake Lamp Switch Output circuit is applied the fault will mature in 60ms. Two Trip Fault.

| Possible Causes |
|---|
| (B15) BRAKE SWITCH NO.1 SIGNAL SHORTED TO GROUND |
| (Z940) GROUND CIRCUIT OPEN |
| STOP LAMP SWITCH |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Make sure the Stop Lamp Switch is properly adjusted before continuing.**

**NOTE: Make sure the Stop Lamp Switch is properly wired, such as (B15) Brake Switch No.1 and (L50) Brake Lamp Switch Output circuit are not switched at the harness connector.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (B15) BRAKE SWITCH NO.1 SIGNAL SHORTED TO GROUND

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

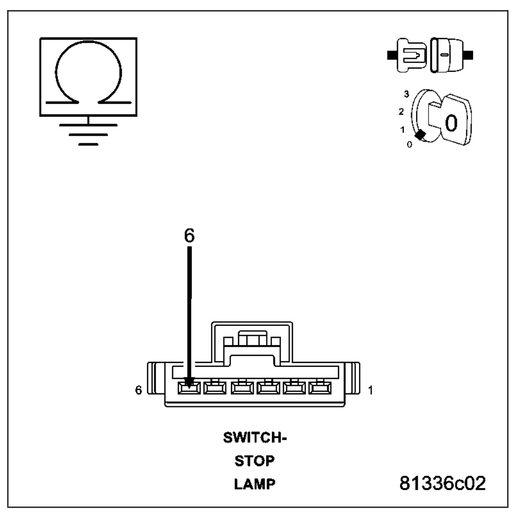
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (B15) Brake Switch No.1 Signal circuit in the Stop Lamp Switch harness connector.

**Is the resistance below 100 ohms?**

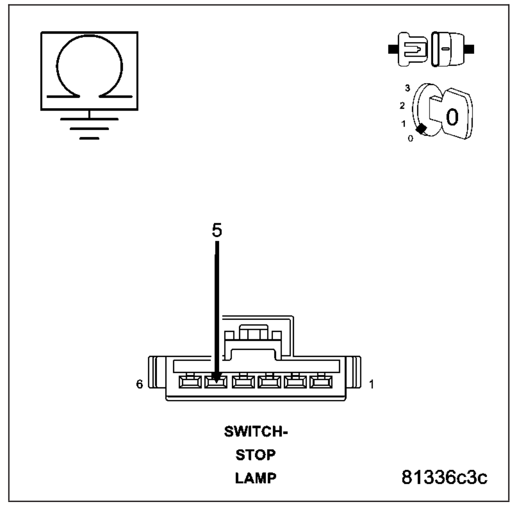
**Yes** >> Repair the short to ground in the (B15) Brake Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3



## 3. (Z940) GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z940) Ground circuit in the Stop Lamp Switch harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the open in the (Z940) Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. STOP LAMP SWITCH

Measure the resistance between the (Z940) Ground circuit terminal and the (B15) Brake Switch No.1 Signal terminal in the Stop Lamp Switch.

Apply and release the brake pedal while monitoring the ohmmeter.

**Does the resistance change from below 5.0 ohms to an open circuit for one or both of the measurements taken?**

**Yes** >> Go To 5

**No** >> Replace the Stop Lamp Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

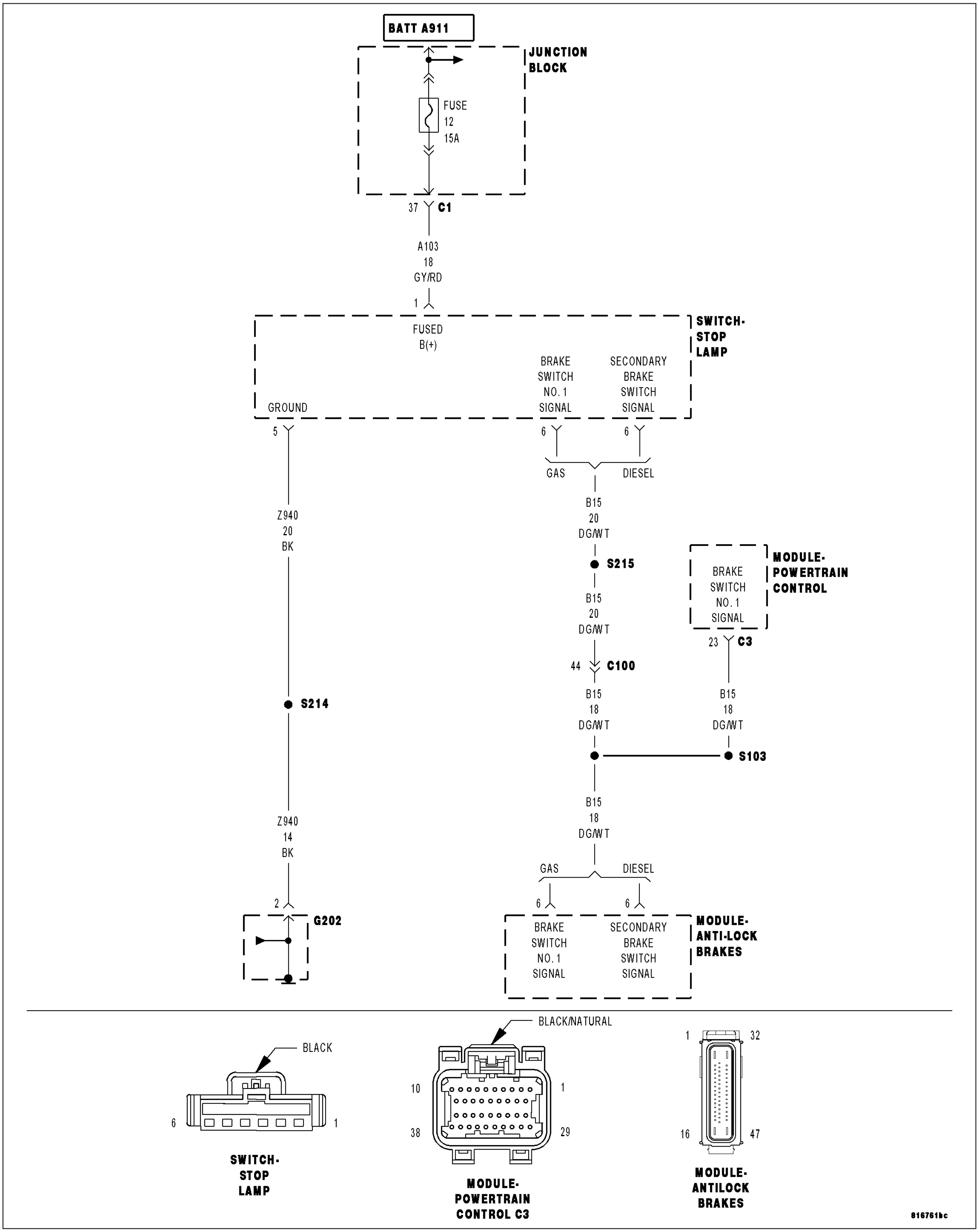
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0572-BRAKE SWITCH 1 STUCK ON




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes Brake Switch No.1 is mechanically stuck in the low/on position. Two Trip Fault. Three Global Good Trips to Clear.

| Possible Causes |
|---|
| (B15) BRAKE SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND |
| STOP LAMP SWITCH |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Verify battery voltage is greater than 10 volts.**
With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. STOP LAMP SWITCH

Turn the ignition off.

Remove the Stop Lamp Switch and disconnect the harness connector.

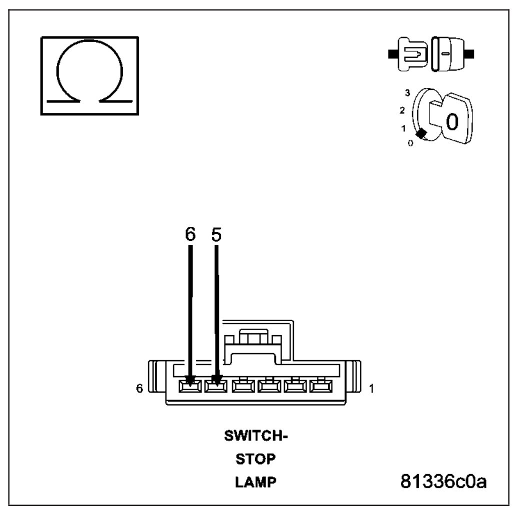
Measure the resistance between the (Z940) Ground circuit terminal and the (B15) Brake Switch No.1 Signal terminal in the Stop Lamp Switch.

Apply and release the brake pedal plunger while monitoring the ohmmeter.

**Does the resistance change from below 5.0 ohms to an open circuit?**

**Yes** >> Go To 3

**No** >> Replace the Stop Lamp Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

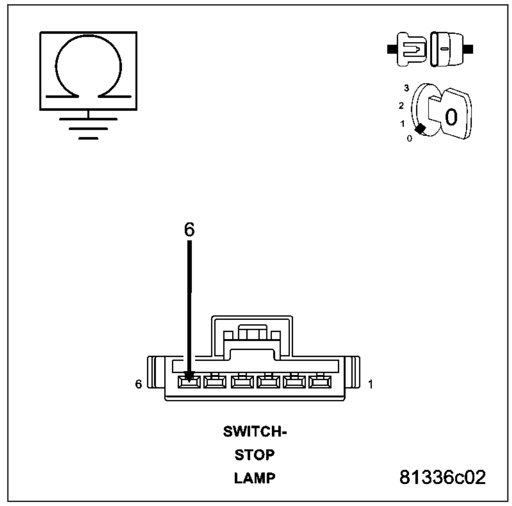


## 3. (B15) BRAKE SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (B15) Brake Switch No.1 Signal circuit in the Stop Lamp Switch harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (B15) Brake Switch No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

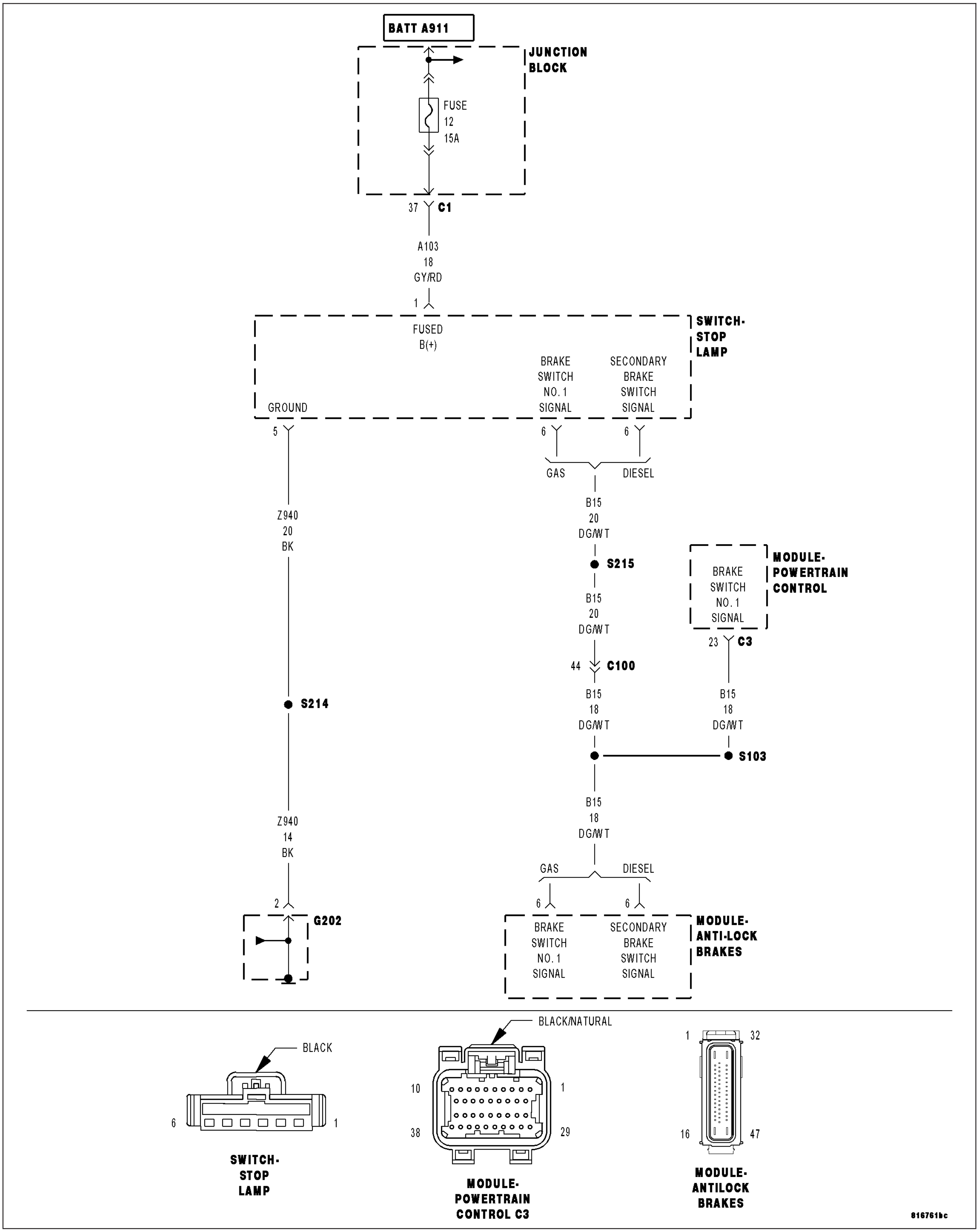
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0573-BRAKE SWITCH 1 STUCK OFF




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes Brake Switch No.1 is stuck in the high/off position. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (B15) BRAKE SWITCH NO.1 SIGNAL CIRCUIT OPEN |
| (Z940) GROUND CIRCUIT OPEN |
| STOP LAMP SWITCH |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. STOP LAMP SWITCH

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

Measure the resistance between the (Z940) Ground circuit terminal and the (B15) Brake Switch No.1 Signal circuit terminal in the Stop Lamp Switch.

Apply and release the brake pedal while monitoring the ohmmeter.

**Does the resistance change from below 5.0 ohms to an open circuit?**

**Yes** >> Go To 3

**No** >> Replace the Stop Lamp Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

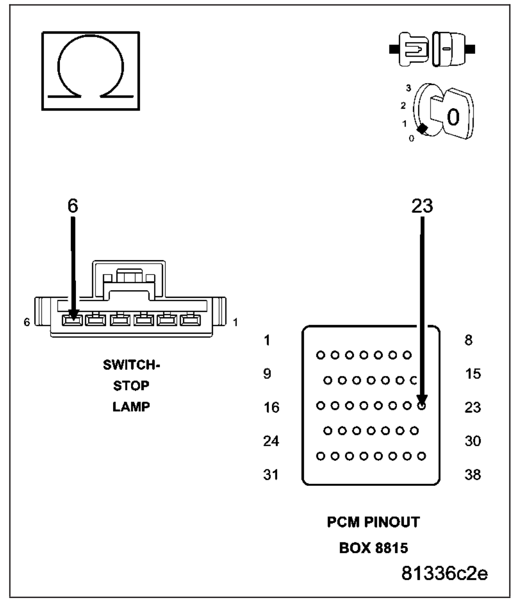
## 3. (B15) BRAKE SWITCH NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (B15) Brake Switch No.1 Signal circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

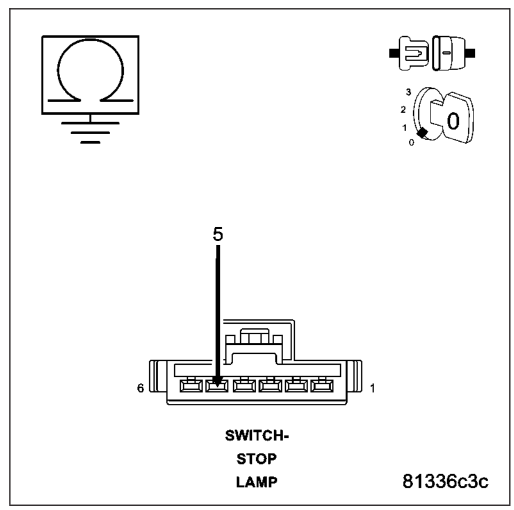
**Yes** >> Go To 4

**No** >> Repair the open in the (B15) Brake Switch No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (Z940) GROUND CIRCUIT OPEN

Measure the resistance between the (Z940) Ground circuit and ground in the Stop Lamp Switch harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the open in the (Z940) Ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

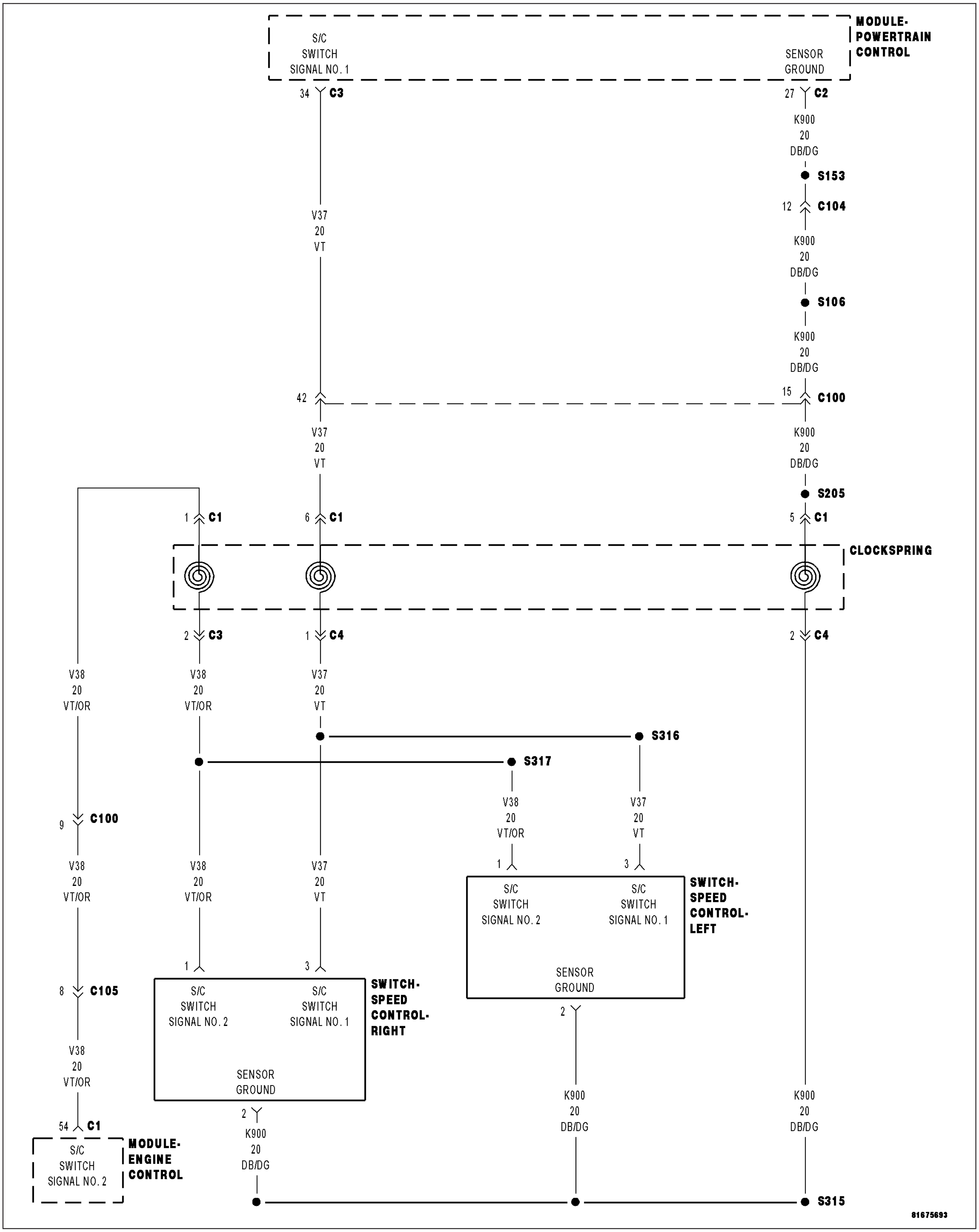
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on. Battery voltage above 10 volts.
- **Set Condition:**
  When switch voltage is less than 0.43 of a volt for 18.4 seconds. One trip fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (V37) S/C SIGNAL NO.1 CIRCUIT SHORTED TO GROUND |
| (V37) S/C SIGNAL NO.1 CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT |
| CLOCKSPRING |
| SPEED CONTROL ON/OFF SWITCH |
| SPEED CONTROL RESUME/ACCEL SWITCH |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. SPEED CONTROL SWITCH VOLTAGE LOW

**NOTE: Do not press any of the Speed Control Switch buttons.**
Ignition on, engine not running.
With a scan tool, read the Speed Control voltage.

**Is the Speed Control voltage below 1.0 volt?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. SPEED CONTROL ON/OFF SWITCH

Ignition on, engine not running.
With the scan tool, monitor the Speed Control Switch voltage.
Disconnect the Speed Control On/Off Switch harness connector per Service Information.

**Did the voltage change to above 4.7 volts?**

**Yes** >> Replace the Speed Control On/Off Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

### 3. SPEED CONTROL RESUME/ACCEL SWITCH

With the scan tool, monitor the Speed Control Switch voltage.
Disconnect the Speed Control Resume/Accel Switch harness connector.

**Did the voltage change to above 4.7 volts?**

**Yes** >> Replace the Speed Control Resume/Accel Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CLOCKSPRING

Turn the ignition off.

Disconnect the clockspring 6-way harness connector (instrument panel wiring side) per Service Information.

Ignition on, engine not running.

With the scan tool, read the S/C Switch voltage.

**Did the S/C Switch volts change to 5.0 volts?**

**Yes** >> Replace the Clockspring.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (V37) S/C NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

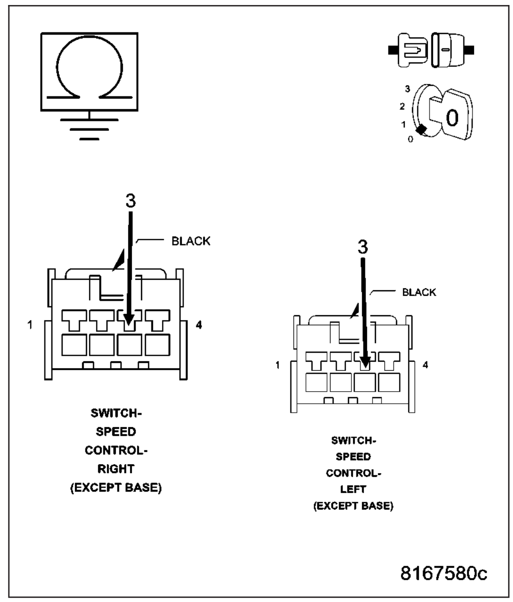
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (V37) S/C Signal circuit in the Switch harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (V37) S/C Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6



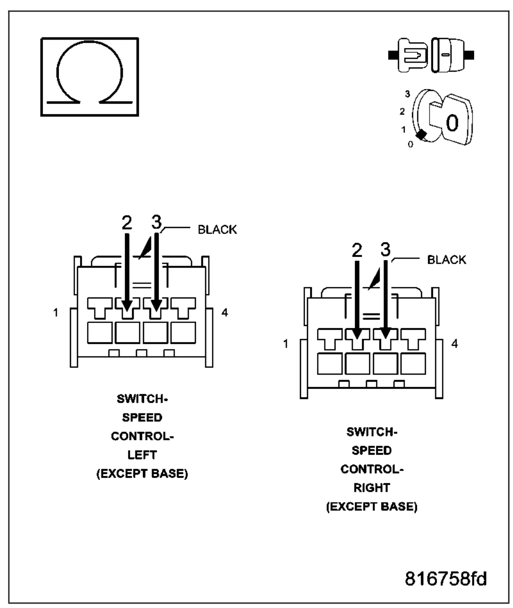

## 6. (V37) S/C SIGNAL NO.1 CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K900) Sensor ground circuit and the (V37) S/C Signal No.1 circuit in the Speed Control Switch.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (V37) S/C Signal No.1 circuit and the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7



## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

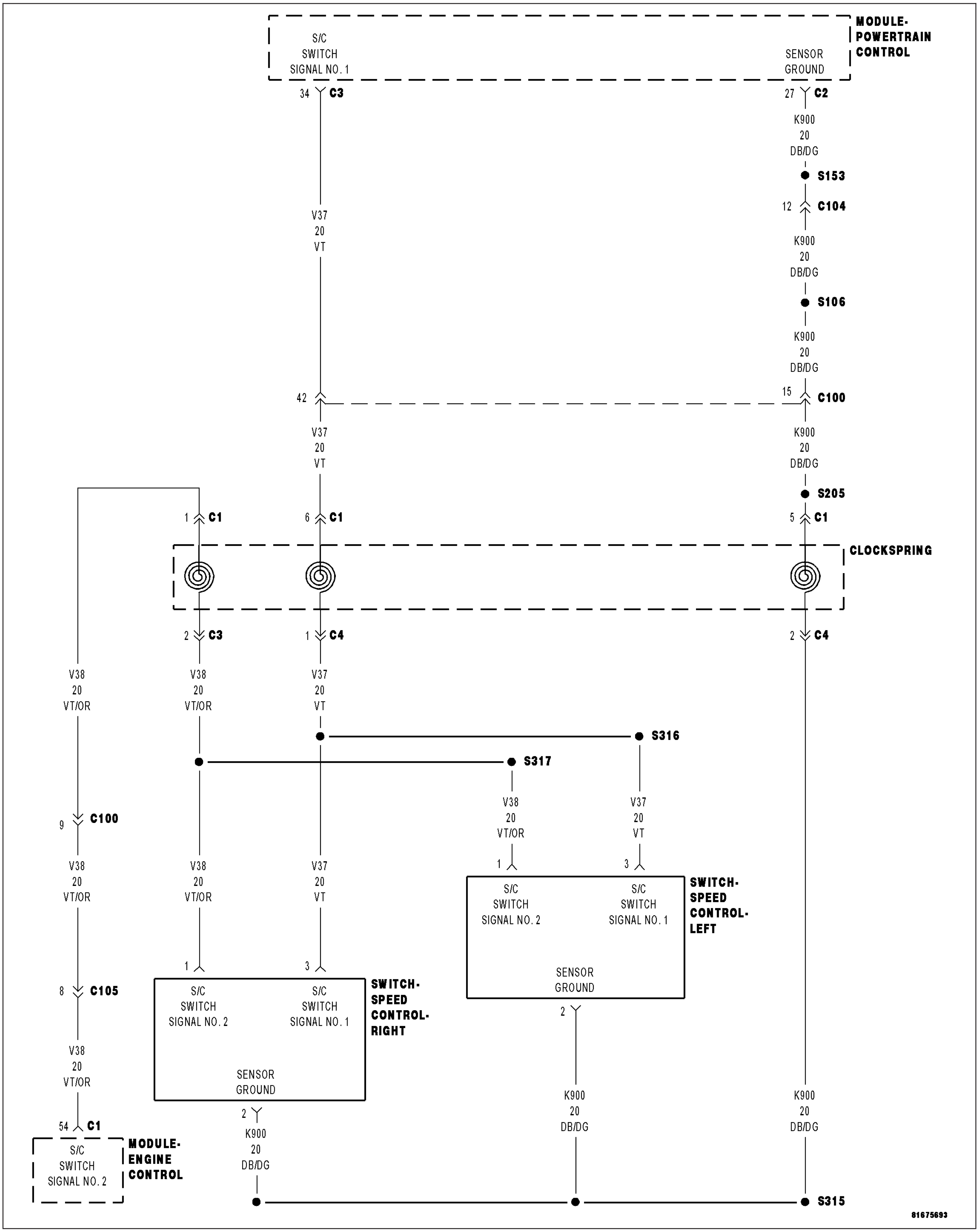
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on. Battery voltage above 10 volts.
- **Set Condition:**
  The PCM detects an open or short to voltage in the Speed Control Switch Signal circuit for more than 18.4 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING |
| (K900) SENSOR GROUND CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING |
| (K900) SENSOR GROUND CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH |
| (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH |
| CLOCKSPRING |
| SPEED CONTROL SWITCH |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. SPEED CONTROL SWITCH VOLTAGE HIGH

**NOTE: Do not press any of the Speed Control Switch buttons.**
Ignition on, engine not running.
With a scan tool, read the Speed Control voltage.

**Is the Speed Control voltage above 4.8 volts?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. SPEED CONTROL SWITCHES

Turn the ignition off.
Remove the Speed Control Switches from the steering wheel.
Measure the resistance across each Speed Control Switch.
Monitor the ohmmeter while pressing each function button on each switch.
Resume/Accel - 15.4 kohms
Cancel - 1.24 kohms
Coast - 2.94 kohms
On/Off - 0.47 kohms
Set - 5.49 kohms

**Does the function on the Speed Control Switches have the correct resistance value?**

**Yes** >> Go To 3

**No** >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. CLOCKSPRING

Disconnect the upper and lower 6-way clockspring harness connector per Service Information.

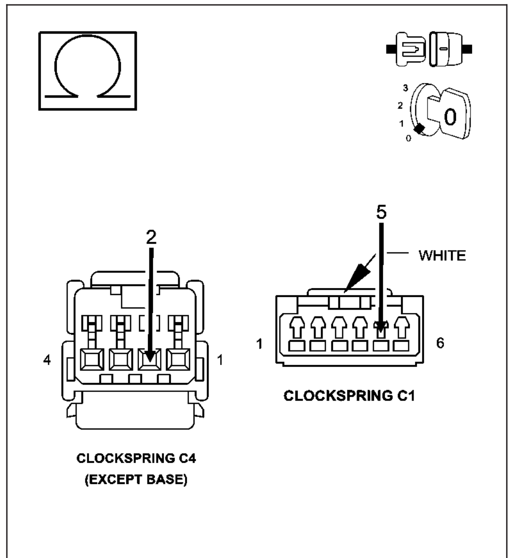
Measure the resistance of the (K900) Sensor ground circuit between the C4 and C1 clockspring connectors.

Measure the resistance of the (V37) S/C Switch No.1 Signal circuit between the C4 and C1 clockspring connectors.

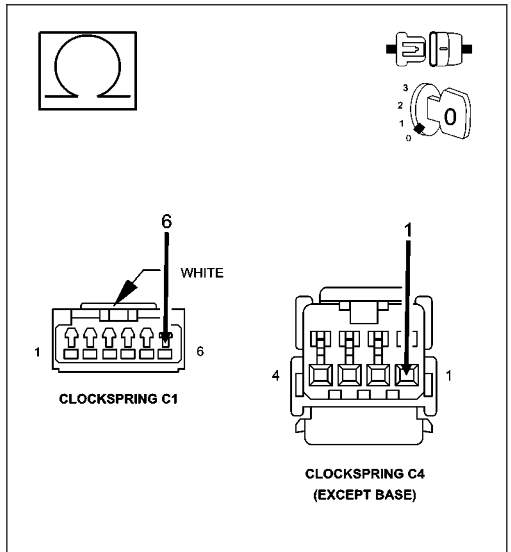
**Was the resistance above 5.0 ohms for either circuit?**

**Yes** >> Replace the clockspring.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

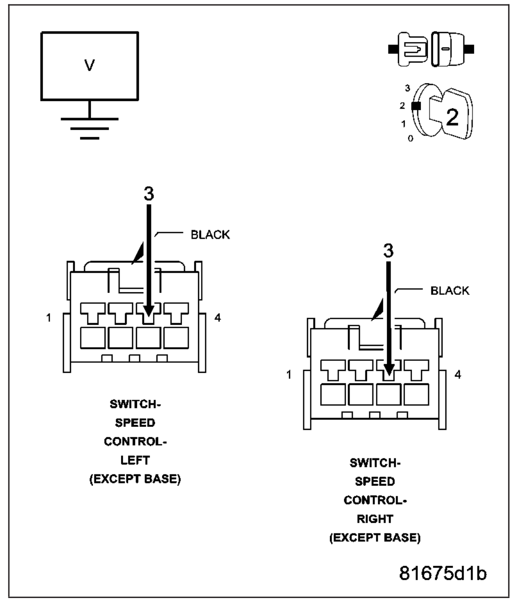


81675cce



81675ceb

## 4. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE




Connect the Clockspring harness connectors per Service Information.

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.

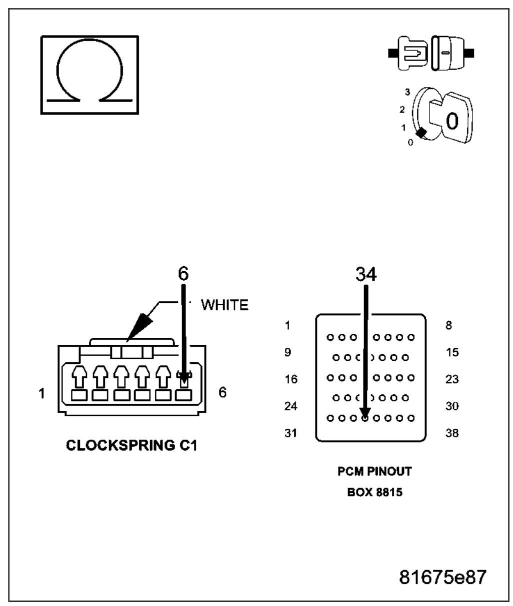
**Is the voltage above 5.3 volts?**

**Yes** >> Repair the short to battery voltage in the (V37) S/C Switch No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING




Turn the ignition off.

Disconnect the C4 and C1 Clockspring harness connectors per Service Information.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (V37) S/C Switch No.1 Signal circuit from the C1 Clockspring harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

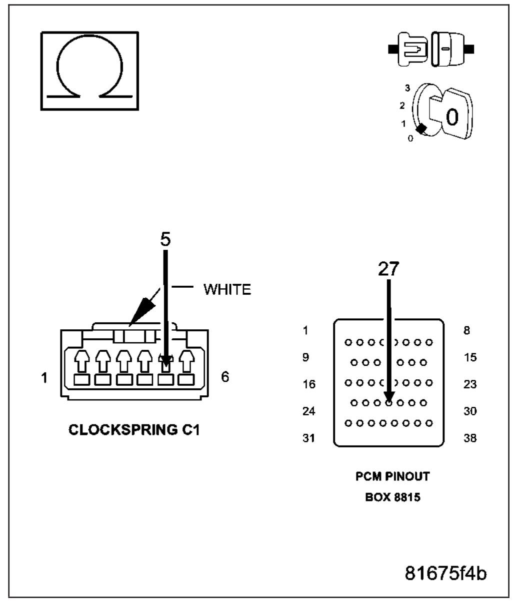
**No** >> Repair the open in the (V37) S/C Switch No.1 Signal circuit between the PCM and Clockspring.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (K900) SENSOR GROUND CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING

**Disconnect the C2 PCM harness connector.**

Measure the resistance of the (K900) Sensor ground circuit from the C1 Clockspring harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

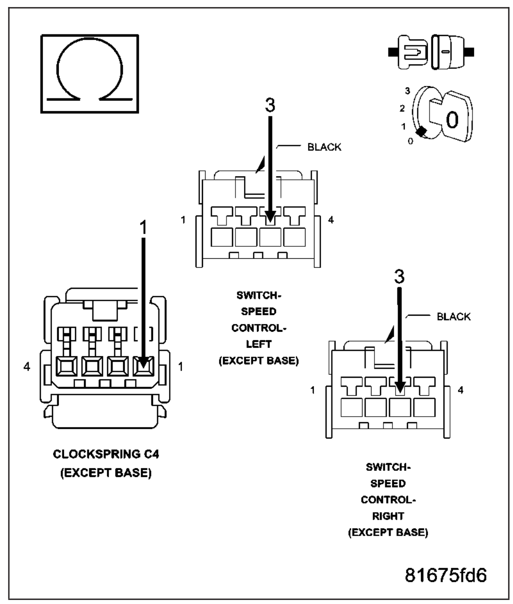
**Yes** >> Go To 7

**No** >> Repair the open (K900) Sensor ground circuit between the PCM and Clockspring.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH

Measure the resistance of the (V37) S/C Switch No.1 Signal circuit from the C4 Clockspring harness connector to the left and right S/C Switch harness connectors.




**Is the resistance below 5.0 ohms from each switch?**

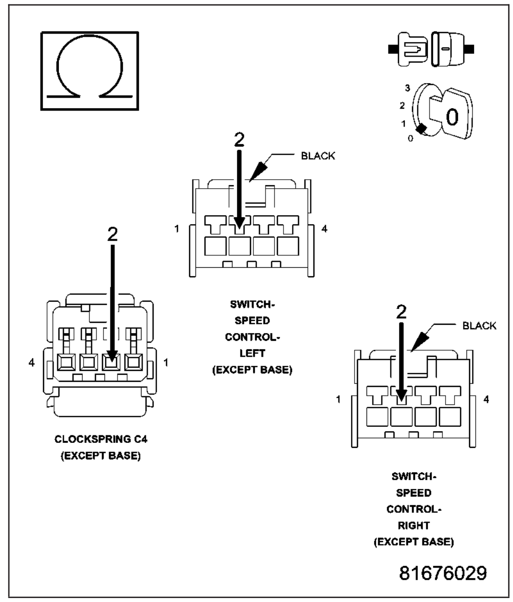
**Yes** >> Go To 8

**No** >> Repair the open in the (V37) S/C Switch No.1 Signal circuit, Clockspring to S/C Switch.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 8. (K900) SENSOR GROUND CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH

Measure the resistance of the (K900) Sensor ground circuit from the left and right S/C Switch harness connectors to the C4 Clockspring harness connector.




**Is the resistance below 5.0 ohms from each switch?**

**Yes** >> Go To 9

**No** >> Repair the open in the (K900) Sensor ground circuit between the Clockspring and S/C Switch.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 9. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

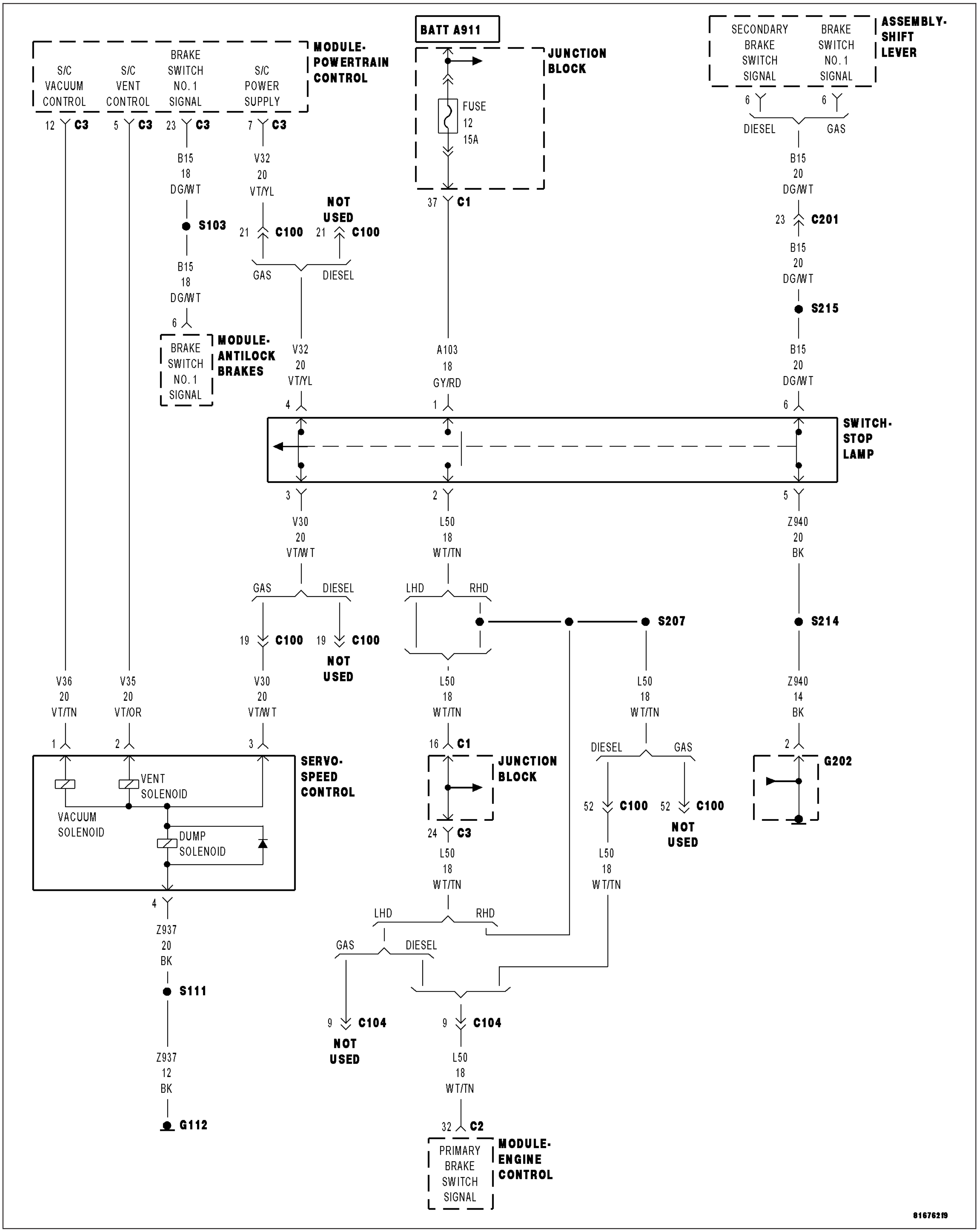
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts. Cruise is learned and powered and the brake is not pressed.
- **Set Condition:**
  An open or shorted condition detected in the Speed control vac solenoid control circuit for more than 0.325 of a second. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (V36) S/C VACUUM SOL CONTROL CIRCUIT SHORTED TO GROUND |
| (V36) S/C VACUUM SOL CONTROL CIRCUIT OPEN |
| SPEED CONTROL VACUUM SOLENOID |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. SPEED CONTROL VACUUM CONTROL

Ignition on, engine not running.

**NOTE: If this code is setting on a vehicle that doesn't have a S/C Servo, flash the correct code into the PCM or the wrong PCM may have previously been installed.**

With the scan tool, actuate the Speed Control Vacuum Solenoid and note operation.

**Does the Speed Control Vacuum Solenoid actuate properly?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. SPEED CONTROL VACUUM SOLENOID

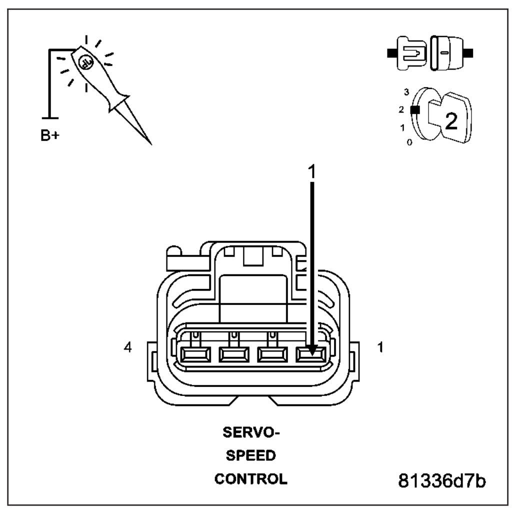
Turn the ignition off.

Disconnect the S/C Servo harness connector.

Ignition on, engine not running.

With the scan tool, actuate the S/C Vacuum Solenoid.

Using a 12-volt test light connected to ground, probe the (V36) S/C Vacuum control circuit.




**Does the test light illuminate brightly and flash?**

**Yes** >> Replace the Speed Control Servo.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

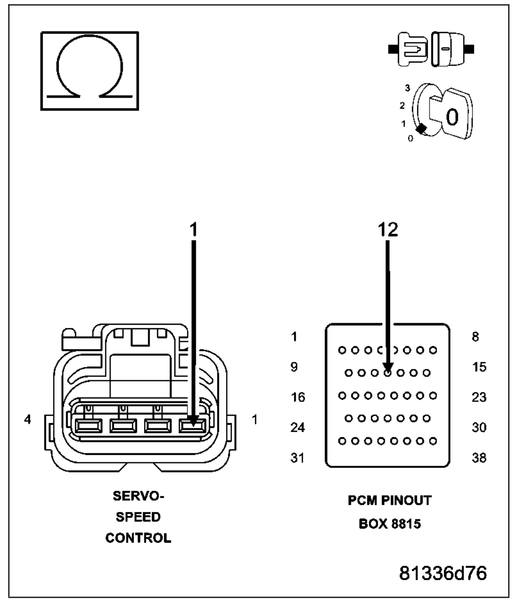
## 3. (V36) VACUUM SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (V36) S/C Vacuum Control in the Speed Control Servo harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

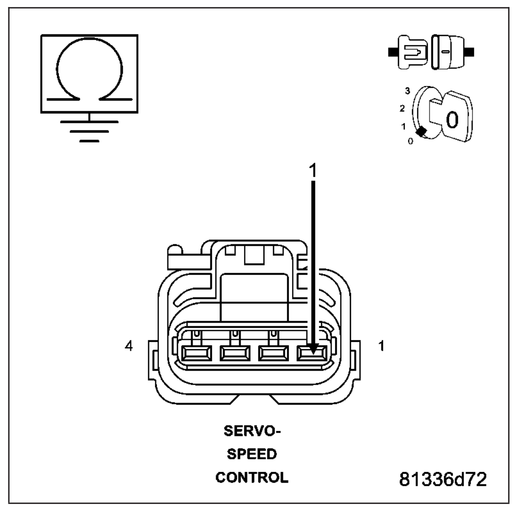
**Yes** >> Go To 4

**No** >> Repair the excessive resistance in the (V36) S/C Vacuum Sol Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (V36) S/C VACUUM SOL CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V36) S/C Vacuum Control circuit in the Speed Control Servo harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (V36) S/C Vacuum Sol Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

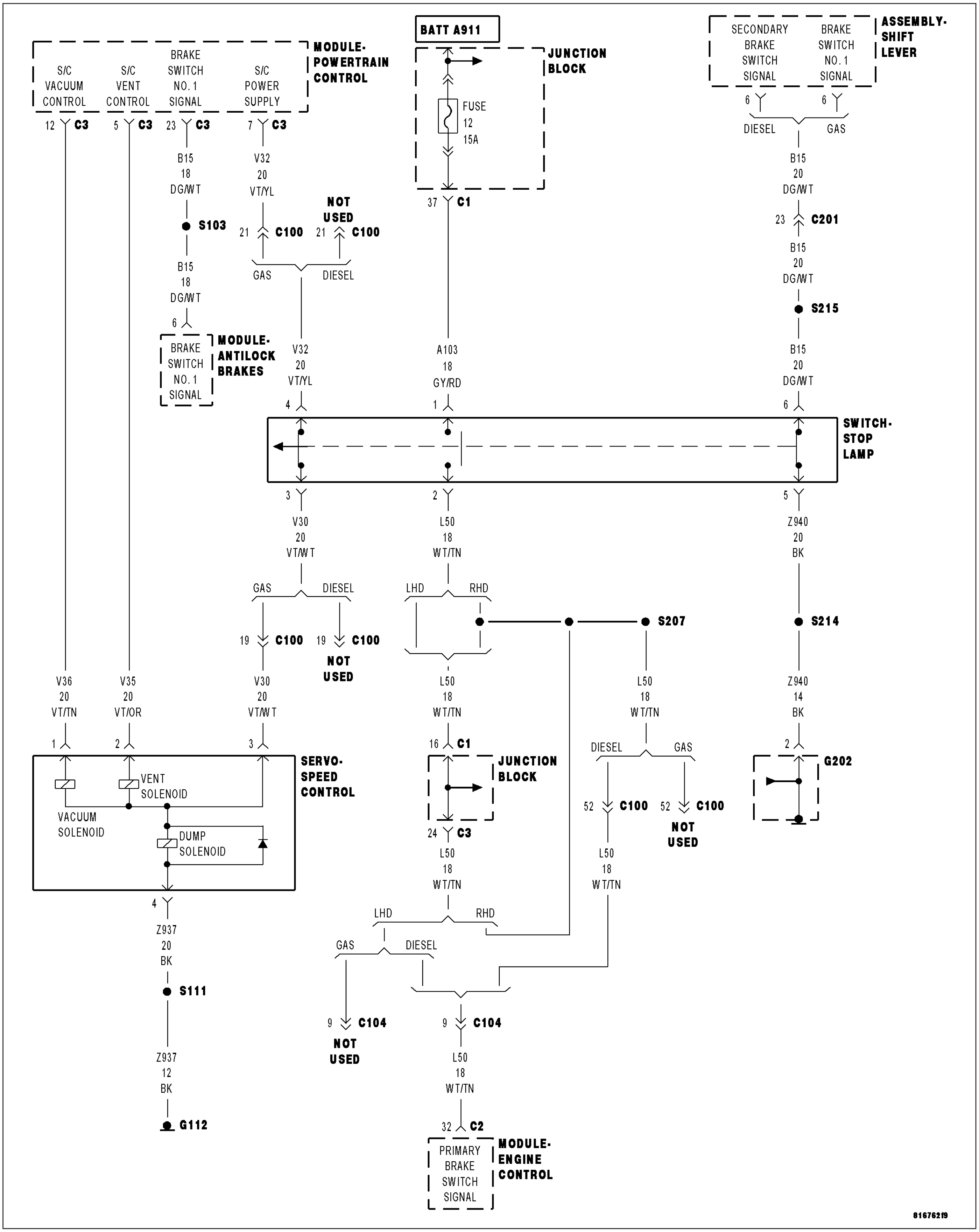
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0586-SPEED CONTROL VENT CONTROL CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running, the speed control switched on and the brake is not pressed..
- **Set Condition:**
  The PCM detects an open or short to voltage in the Speed Control Vent Control circuit for more than 0.325 of a second. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (V35) S/C VENT SOL CONTROL CIRCUIT OPEN |
| (V35) S/C VENT SOL CONTROL CIRCUIT SHORTED TO GROUND |
| SPEED CONTROL VENT SOLENOID |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .**

## Diagnostic Test

### 1. SPEED CONTROL VENT CONTROL

**NOTE: If this code is setting on a vehicle that doesn't have a S/C Servo, flash the correct code into the PCM or the wrong PCM may have previously been installed.**

Ignition on, engine not running.

With the scan tool, actuate the Speed Control Vent Solenoid and note operation.

**Does the Speed Control Vent Solenoid actuate properly?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. SPEED CONTROL VENT SOLENOID

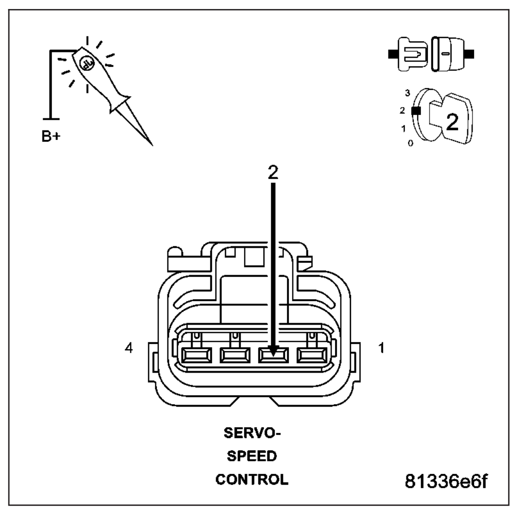
Turn the ignition off.

Disconnect the Speed Control Servo harness connector.

Ignition on, engine not running.

With the scan tool, actuate the Speed Control Vent Solenoid.

Using a 12-volt test light connected to ground, probe the (V35) S/C Vent Solenoid Control circuit in the Speed Control Servo harness connector.




**Does the test light illuminate brightly and flash?**

**Yes** >> Replace the Speed Control Servo.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

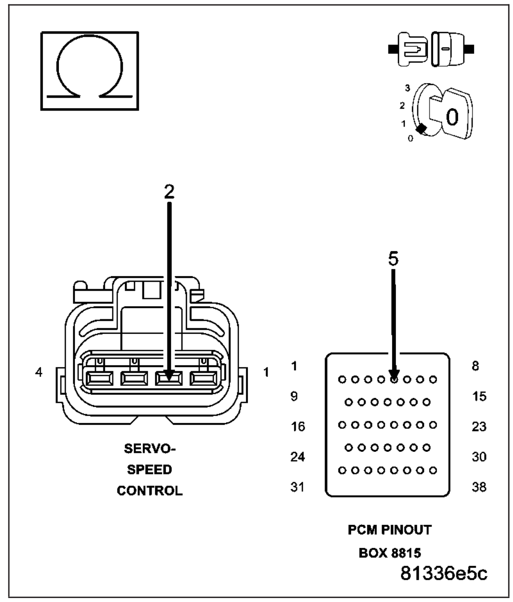
## 3. (V35) VENT CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (V35) S/C Vent Control circuit from the Speed Control Servo harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

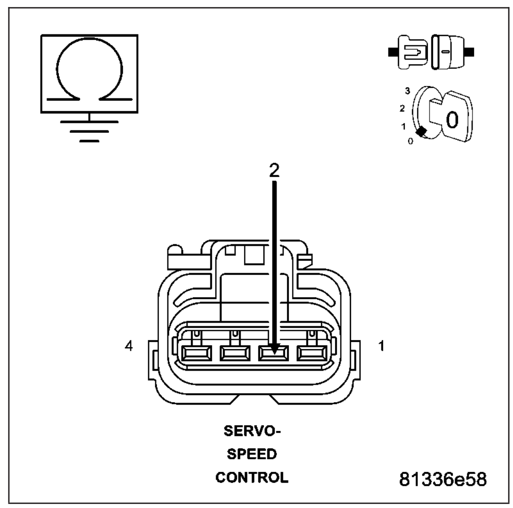
**Yes** >> Go To 4

**No** >> Repair the excessive resistance in the (V35) S/C Vent Sol Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (V35) VENT SOL CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V35) S/C Vent Solenoid Control circuit in the Speed Control Servo harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (V35) S/C Vent Sol Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

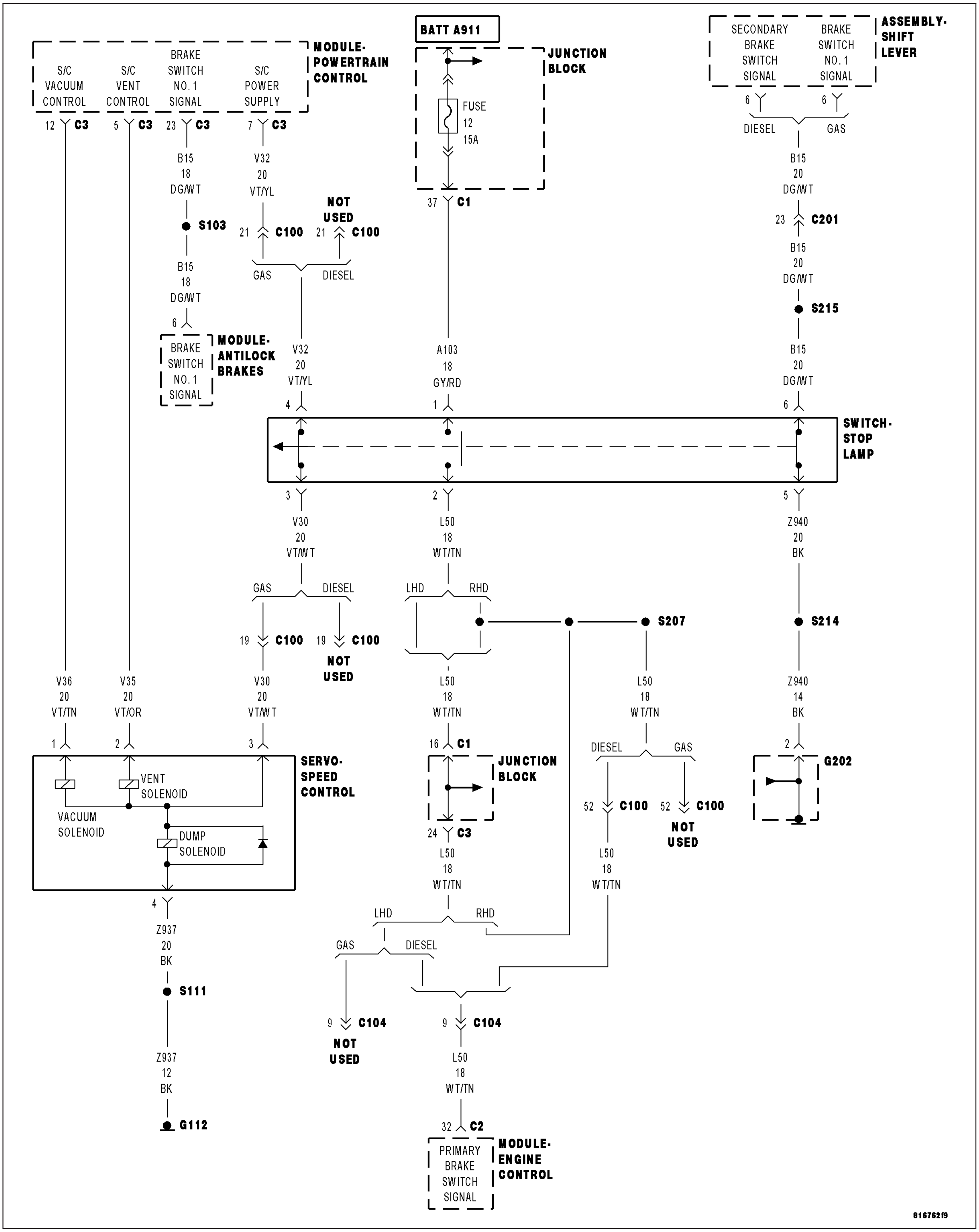
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on. The speed control switched on and the brake pedal is not pressed.
- **Set Condition:**
  The speed control power supply circuit is either open or shorted to ground for more than 2.6 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (V32) S/C SUPPLY CIRCUIT OPEN |
| (V32) S/C SUPPLY CIRCUIT SHORTED TO GROUND |
| (V30) S/C BRAKE SWITCH OUTPUT CIRCUIT OPEN |
| (V30) S/C BRAKE SWITCH OUTPUT CIRCUIT SHORTED TO GROUND |
| STOP LAMP SWITCH |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: If this code is setting on a vehicle that doesn't have a S/C Servo, flash the correct code into the PCM or the wrong PCM may have previously been installed.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (V32) S/C SUPPLY CIRCUIT

Turn the ignition off.

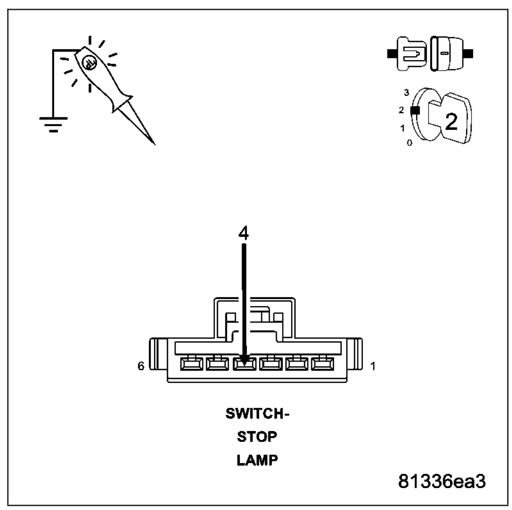
Disconnect the Stop Lamp Switch harness connector.

Using a 12-volt test light connected to ground, probe the (V32) S/C Supply circuit in the Switch harness connector while holding the Cruise Switch in the ON position.

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Go To 7



## 3. STOP LAMP SWITCH

Disconnect and remove the Stop Lamp Switch.

Measure the resistance across the (V32) S/C Supply circuit terminal and the (V30) S/C Brake Switch Output circuit terminal in the Stop Lamp Switch.

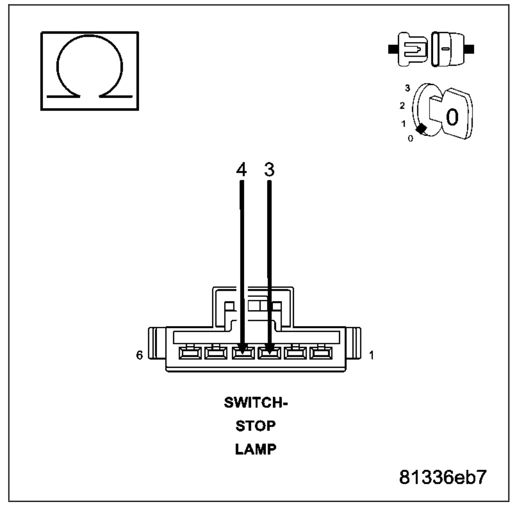
Push the Plunger of the Switch in and let it out.

**Does the resistance change from below 5.0 ohms to an open circuit?**

**Yes** >> Go To 4

**No** >> Replace the Stop Lamp Switch.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




## 4. (V30) S/C BRAKE SWITCH OUTPUT

Turn the ignition off.

Connect the Stop Lamp Switch harness connector and install the Switch.

Disconnect the Speed Control Servo harness connector.

Ignition on, engine not running.

**NOTE: It is necessary to PRESS and HOLD the Speed Control Switch in the ON position while checking for voltage.**

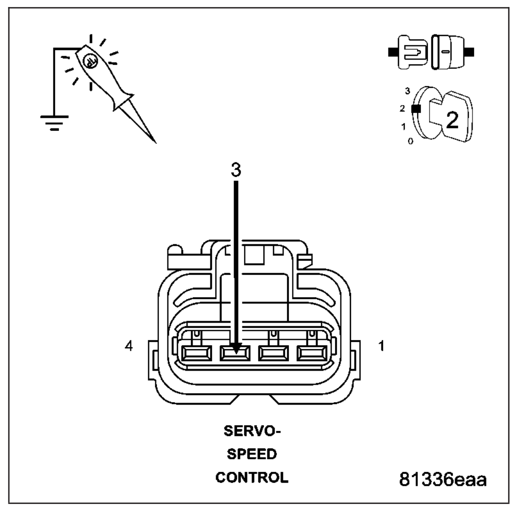
Using a 12-volt test light connected to ground, probe the (V30) S/C Brake Switch Output circuit in the Servo Harness connector.

**Does the test light illuminate brightly?**

**Yes** >> Replace the S/C Servo.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5




## 5. (V30) S/C BRAKE SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Brake Lamp Switch harness connector.

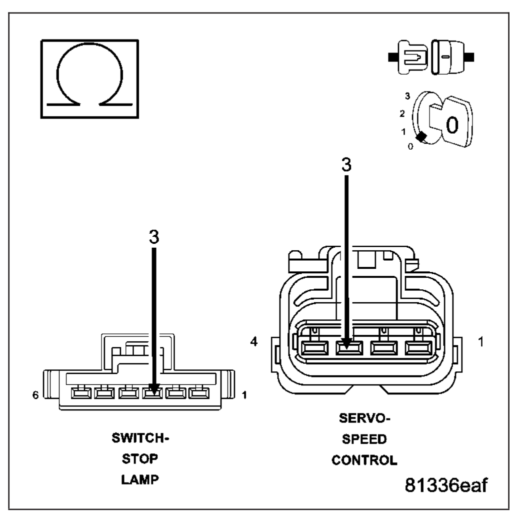
Measure the resistance of the (V30) S/C Brake Switch Output circuit from the Stop Lamp Switch harness connector to the S/C Servo harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the excessive resistance in the (V30) S/C Brake Switch Output circuit.

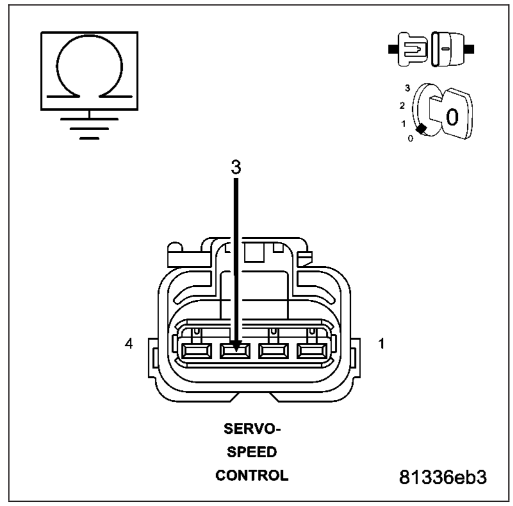
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6



## 6. (V30) S/C BRAKE SWITCH OUTPUT CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V30) S/C Brake Switch Output circuit in the Speed Control Servo harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (V30) S/C Brake Switch Output circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

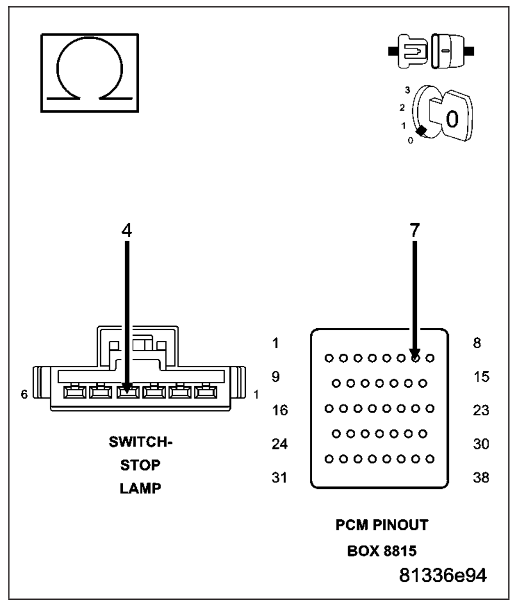
## 7. (V32) S/C SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (V32) S/C Supply circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.




**Is the resistance above 5.0 ohms?**

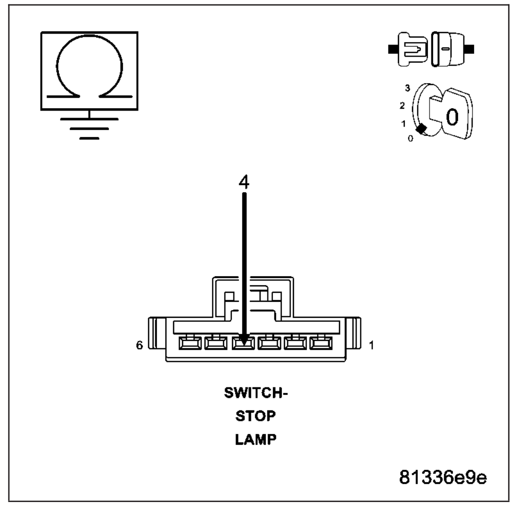
**Yes** >> Repair the open in the (V32) S/C Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. (V32) S/C SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V32) S/C Supply circuit in the Stop Lamp Switch harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (V32) S/C Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0600-SERIAL COMMUNICATION LINK

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Internal Bus communication failure between processors. One Trip Fault. Three Global Good Trips to Clear.

| Possible Causes |
|---|
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. PCM

**NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.**

**The Powertrain Control Module is reporting internal errors, view repair to continue.**

**Repair**

Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0601-INTERNAL MEMORY CHECKSUM INVALID

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Internal checksum for software failed, does not match calculated value. One Trip Fault, Three Good Trips to clear.

| Possible Causes |
|---|
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. PCM

**NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.**

**The Powertrain Control Module is reporting internal errors, view repair to continue.**

**Repair**

Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0606-INTERNAL ECM PROCESSOR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  When the PCM recognizes an internal failure to communicate with the ECM or the CMP and CKP Sensor count periods are too short. One trip fault. ETC light is flashing.

| Possible Causes |
|---|
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. PCM

**NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.**

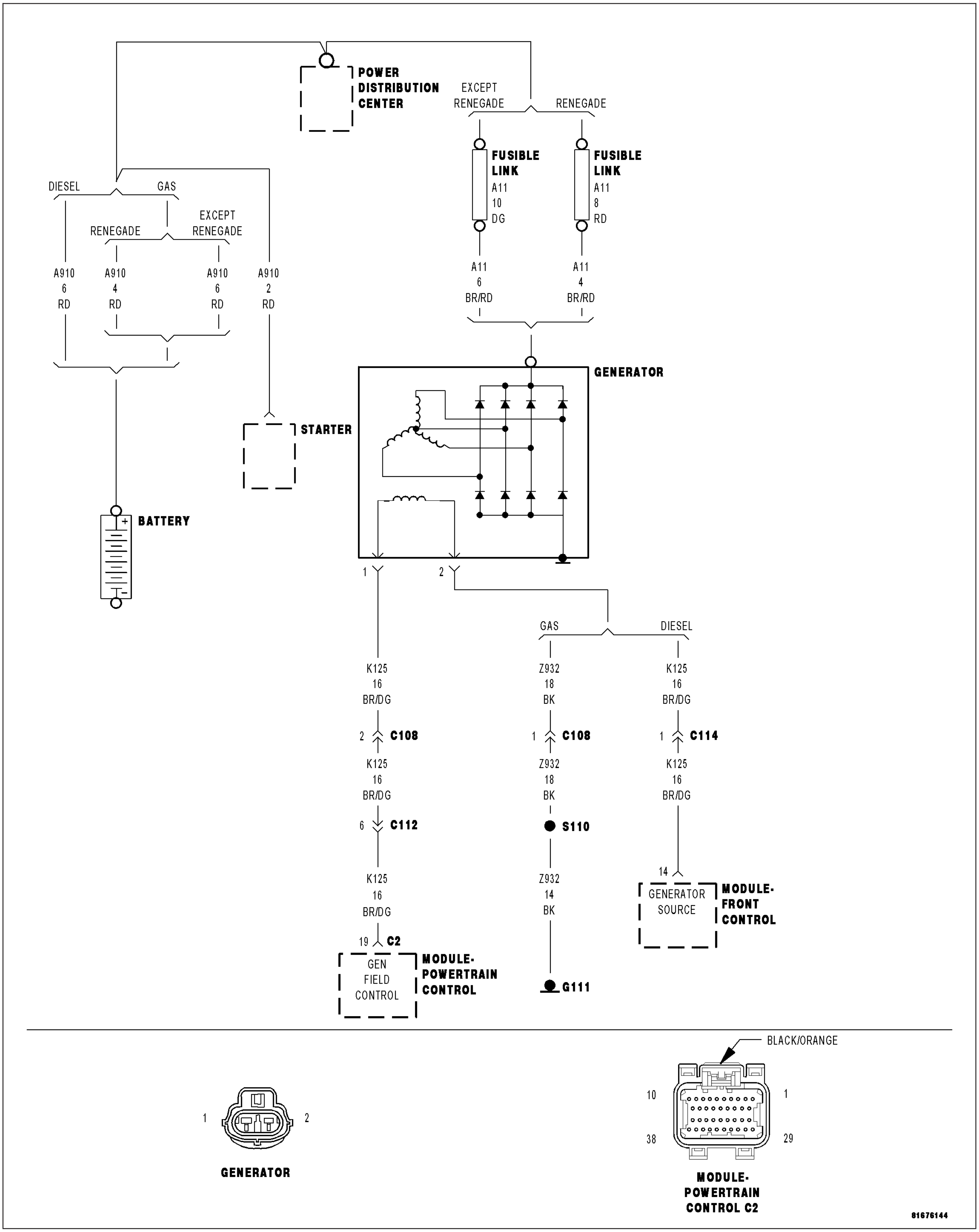
**The Powertrain Control Module is reporting internal errors, view repair to continue.**

**Repair**

Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0622-GENERATOR FIELD CONTROL CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Engine running.
- **Set Condition:**
  When the PCM tries to regulate the generator field with no result during monitoring for more than 2.7 seconds. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (K125) GEN FIELD CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K125) GEN FIELD CONTROL CIRCUIT OPEN |
| (K125) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND |
| (Z932) GROUND CIRCUIT OPEN |
| GENERATOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. GENERATOR OPERATION

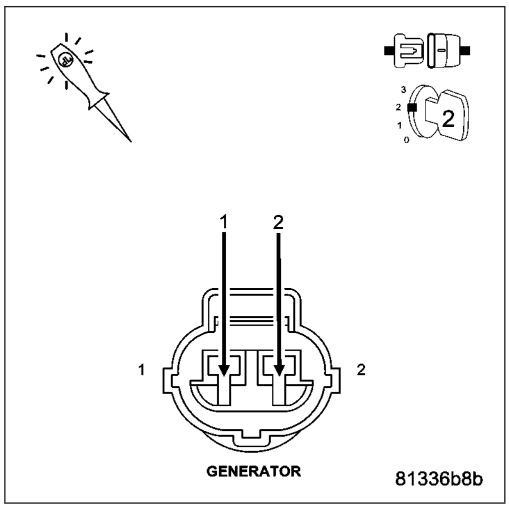
Turn the ignition off.

Disconnect the Generator Field harness connector.

Using a 12-volt test light, jump it across the Generator Field harness connector.

Ignition on, engine not running.

With the scan tool, actuate the Generator Field Control circuit.




**Does the test light illuminate brightly and flash on and off?**

**Yes** >> Replace the Generator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

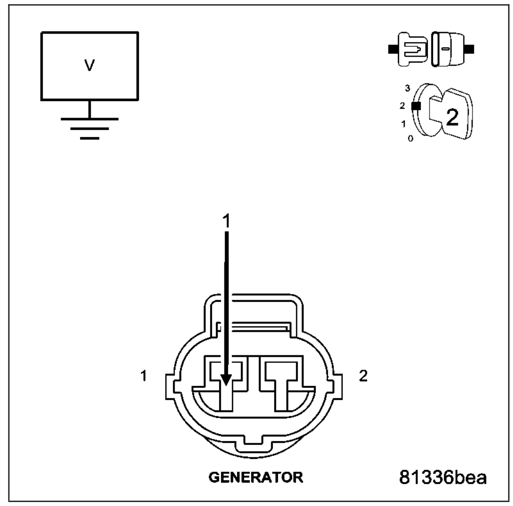
## 3. (K125) GEN FIELD CIRCUIT SHORTED BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K125) Gen Field Control circuit in the Generator Field harness connector.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the short to battery voltage in the (K125) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

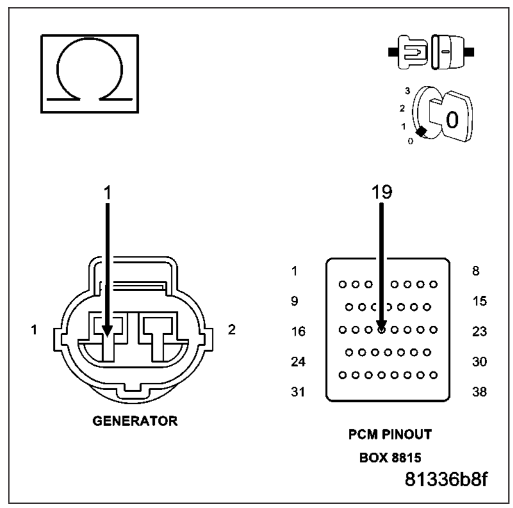
**No** >> Go To 4

## 4. (K125) GEN FIELD CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K125) Gen Field Control circuit from the Generator Field harness connector to appropriate terminal of the special tool #8815.



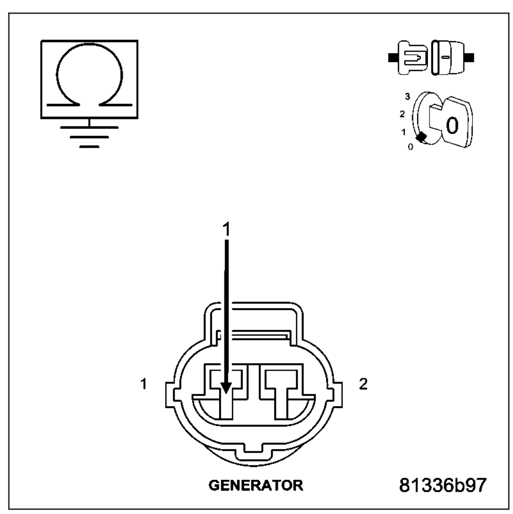

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the open in the (K125) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (K125) GEN FIELD CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K125) Gen Field Control circuit in the Generator Field harness connector.



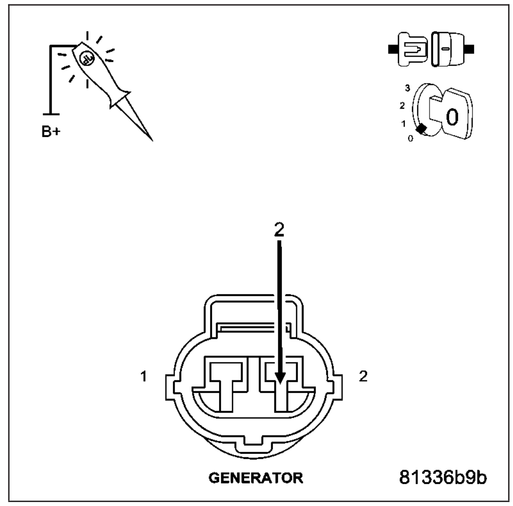

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K125) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (Z932) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to battery voltage, probe the (Z932) Ground circuit in the Gen Field harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 7

**No** >> Repair the open in the (Z932) Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

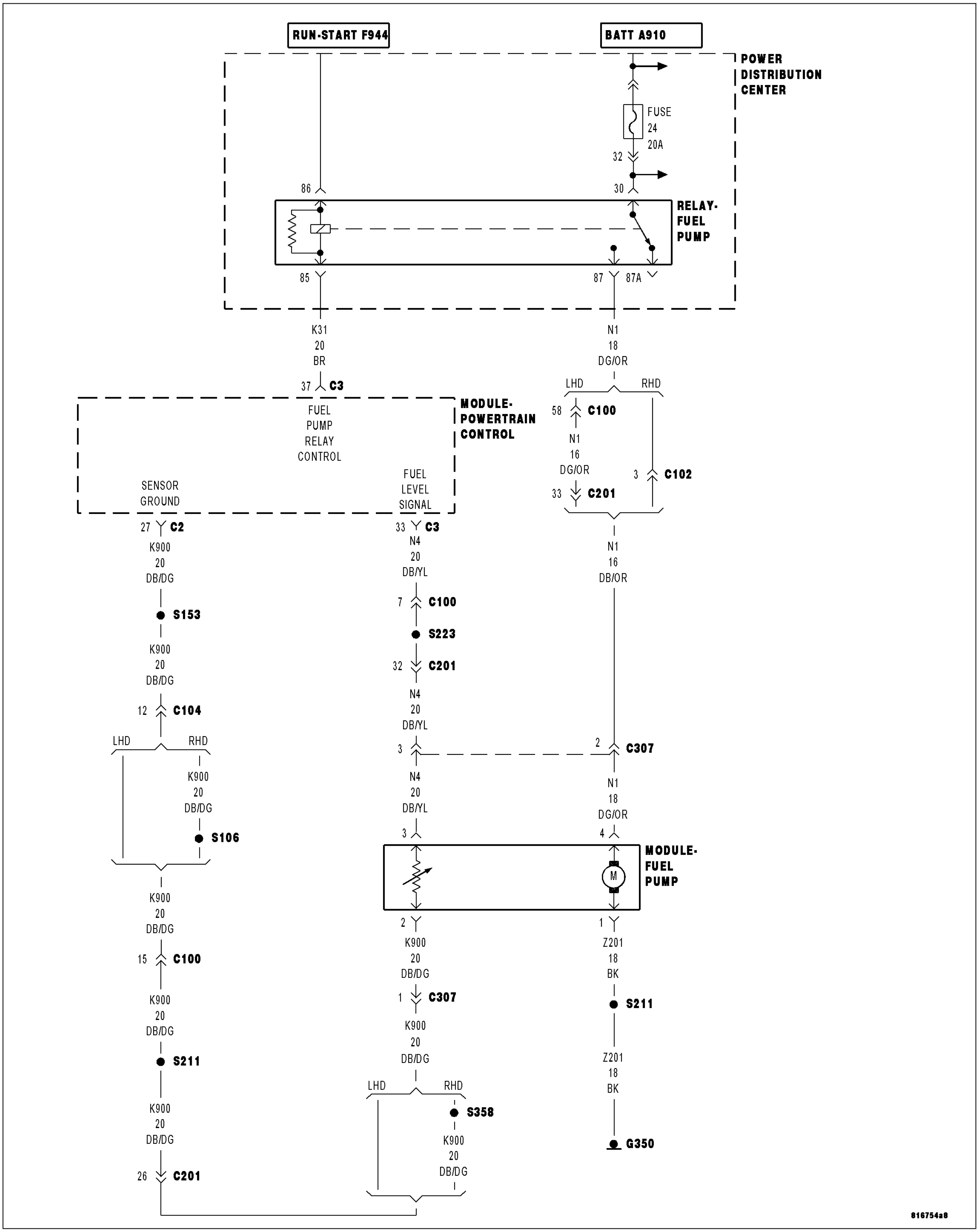
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0627-FUEL PUMP CONTROL CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts and the ASD sense switch is on.
- **Set Condition:**
  Actual Fuel Pump Relay state is not equal to desired state. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT |
| INTERNAL FUSED B+ CIRCUIT |
| (K31) FUEL PUMP RELAY CONTROL CIRCUIT |
| (K31) FUEL PUMP RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL PUMP RELAY |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. FUEL PUMP RELAY OPERATION

Ignition on, engine not running.
With a scan tool, actuate the Fuel Pump Relay.

**Is the Fuel Pump Relay operating?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. FUEL PUMP RELAY

Turn the ignition off.
Remove the Fuel Pump Relay from the IPM.
Measure the resistance of the Fuel Pump Relay Coil.

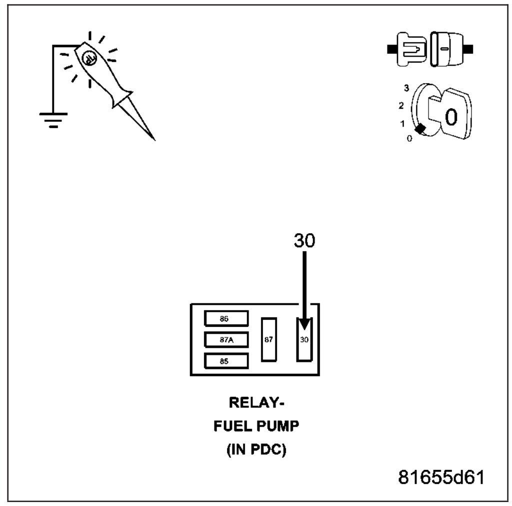
**Is the resistance between 70 to 90 ohms?**

**Yes** >> Go To 3

**No** >> Replace the Fuel Pump Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. FUSED B+ CIRCUIT

Using a 12-volt test light connected to ground, probe the Fused B+ circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

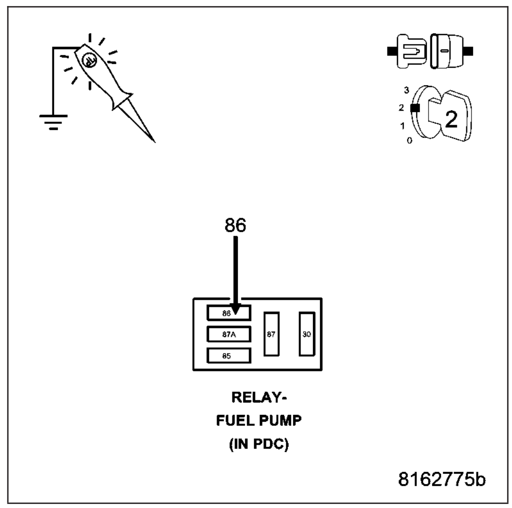
**No** >> Repair the open or short to ground in the Fused B+ circuit. Inspect the related fuse and repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (F1) Fused Ignition Switch Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 5

**No** >> Repair the open or short to ground in the (F1) Fused Ignition Switch Output circuit. Inspect the related fuse and repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

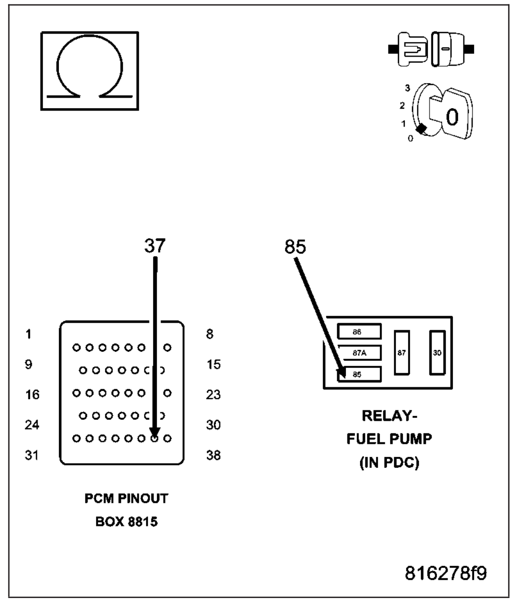
## 5. (K31) FUEL PUMP CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K31) Fuel Pump Relay Control circuit from the PDC to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

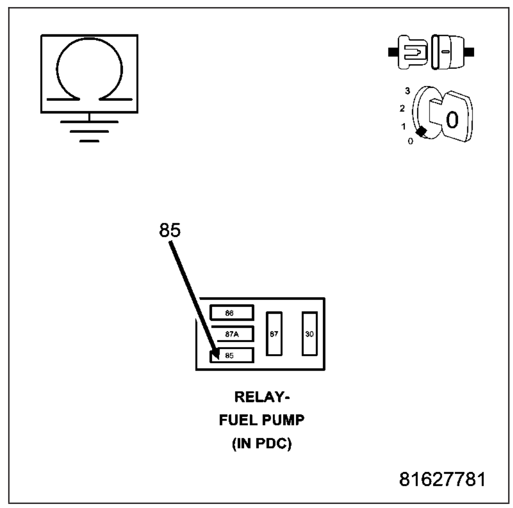
**Yes** >> Go To 6

**No** >> Repair the open in the (K31) Fuel Pump Relay Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (K31) FUEL PUMP CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K31) Fuel Pump Relay Control circuit in the PDC.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K31) Fuel Pump Relay Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0630-VIN NOT PROGRAMMED IN PCM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At initialization.
- **Set Condition:**
  The VIN has not been programmed into the PCM. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| PROGRAMMING VIN INTO PCM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. PROGRAMMING VIN INTO THE PCM

Ignition on, engine not running.

Using the scan tool, program VIN into the PCM.

Start the engine.

**NOTE: If the engine will not start, crank the engine over for 15 seconds. Crank at least 2 times with the ignition switch returning to the off position each time.**

Allow the engine to reach normal operating temperature.

With the scan tool, read DTCs.

**Does the DTC reset?**

**Yes** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> The VIN has been successfully programmed into the PCM. Test is complete.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P0632-ODOMETER NOT PROGRAMMED IN PCM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  Odometer is not programed into the PCM. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| PROGRAMMING MILEAGE INTO THE PCM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. PROGRAMMING MILEAGE INTO THE PCM

Ignition on, engine not running.
With the scan tool, erase DTCs.
Using a scan tool, program the mileage into the PCM.
Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read DTCs.

**Does the DTC reset?**

**Yes** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> The mileage has been successfully programmed into the PCM. Test is complete.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0633-SKIM KEY NOT PROGRAMMED IN PCM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The SKIM Key information has not been programmed into the PCM. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| PROGRAMMING SKIM KEY INTO THE PCM |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. PROGRAMMING SKIM KEY INTO THE PCM

Ignition on, engine not running.

With a scan tool, erase DTCs.

Using the scan tool, program the SKIM Key information into the PCM.

Start the engine.

**NOTE: If the engine will not start, crank the engine over for 15 seconds. Crank at least 2 times with the ignition switch returning to the off position each time.**

Allow the engine to reach normal operating temperature.

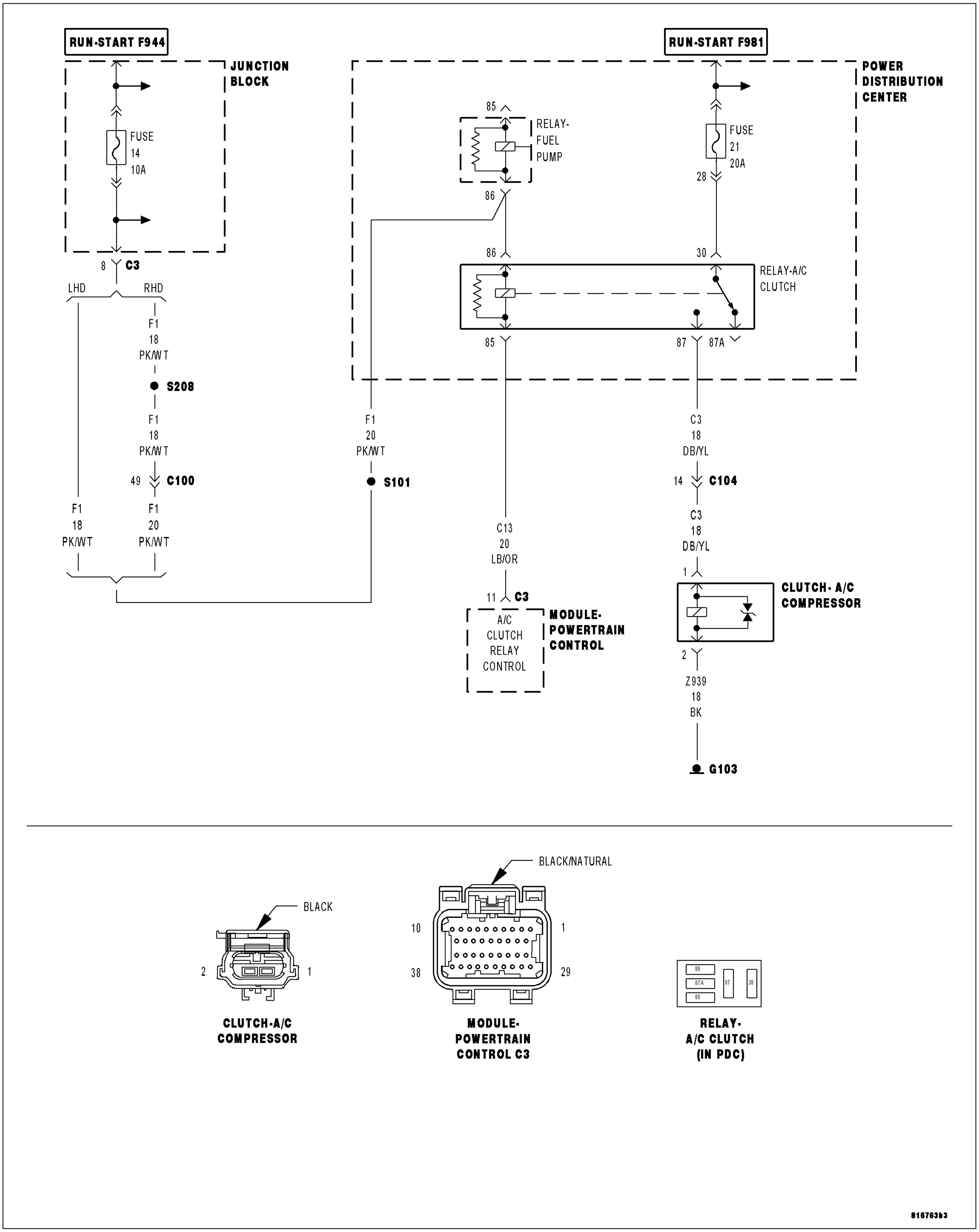
With the scan tool, read DTCs.

**Does the DTC reset?**

**Yes** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> The SKIM KEY information has been successfully programmed into the PCM. Test is complete.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P0645-A/C CLUTCH CONTROL CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts. A/C Switch on.
- **Set Condition:**
  An open or shorted condition is detected in the A/C clutch control circuit. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT |
| FUSED B+ CIRCUIT |
| (C13) A/C CLUTCH RELAY CONTROL CIRCUIT OPEN |
| (C13) A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| A/C CLUTCH RELAY |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. A/C CLUTCH RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the A/C Clutch Relay.

**Is the A/C Clutch Relay operating?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. A/C CLUTCH RELAY RESISTANCE

Turn the ignition off.

Remove the A/C Clutch Relay from the PDC.

Measure the resistance of the A/C Clutch Relay Coil.

**Is the resistance between 60 to 80 ohms?**

**Yes** >> Go To 3

**No** >> Replace the A/C Clutch Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. FUSED B+ CIRCUIT

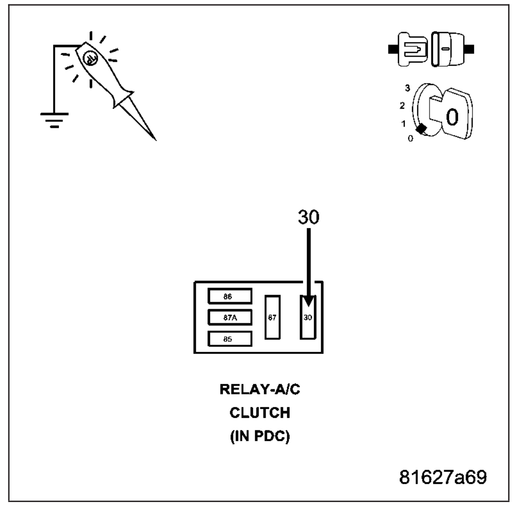
Using a 12-volt test light connected to ground, probe the Fused B+ circuit in the connection.

**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the open or short to ground in the Fused B+ circuit. Check and replace any open fuses.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




## 4. (F1) FUSED IGNITION SWITCH OUTPUT CIRCUIT

Ignition on, engine not running.

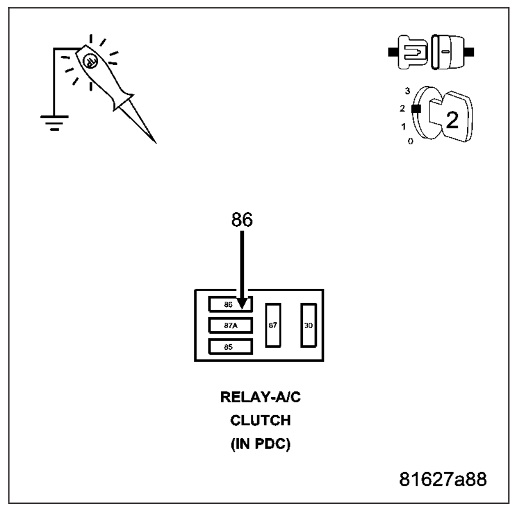
Using a 12-volt test light connected to ground, probe the (F1) Fused Ignition Switch Output circuit in the connection.

**Does the test light illuminate brightly?**

**Yes** >> Go To 5

**No** >> Repair the open or short to ground in the (F1) Fused Ignition Switch Output circuit. Check and replace any open fuses.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



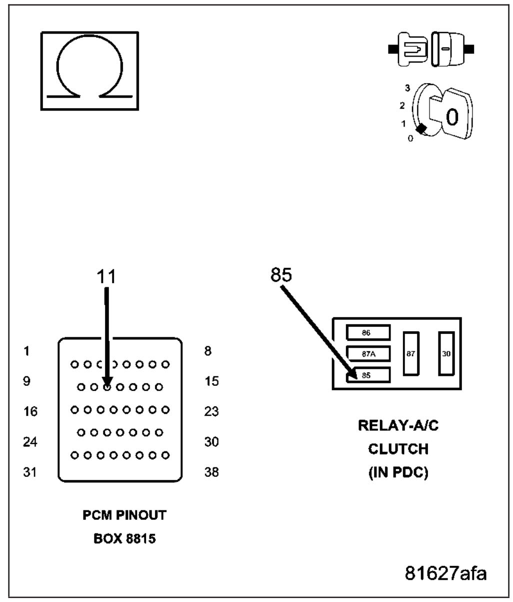
## 5. (C13) A/C CLUTCH RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (C13) A/C Clutch Relay Control circuit from the relay connection to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

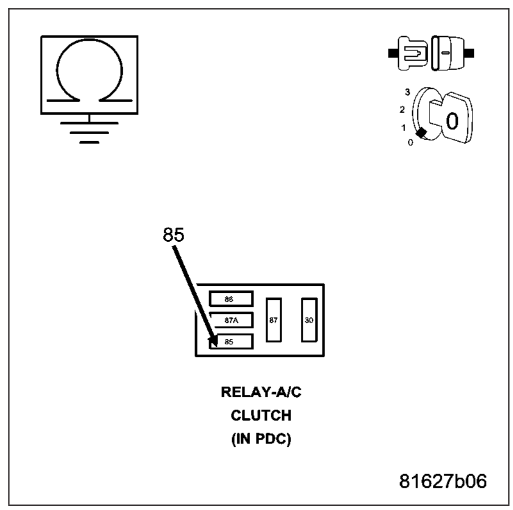
**Yes** >> Go To 6

**No** >> Repair the open in the (C13) A/C Clutch Relay Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (C13) A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (C13) A/C Clutch Relay Control circuit at the PDC.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short to ground in the (C13) A/C Relay Clutch Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

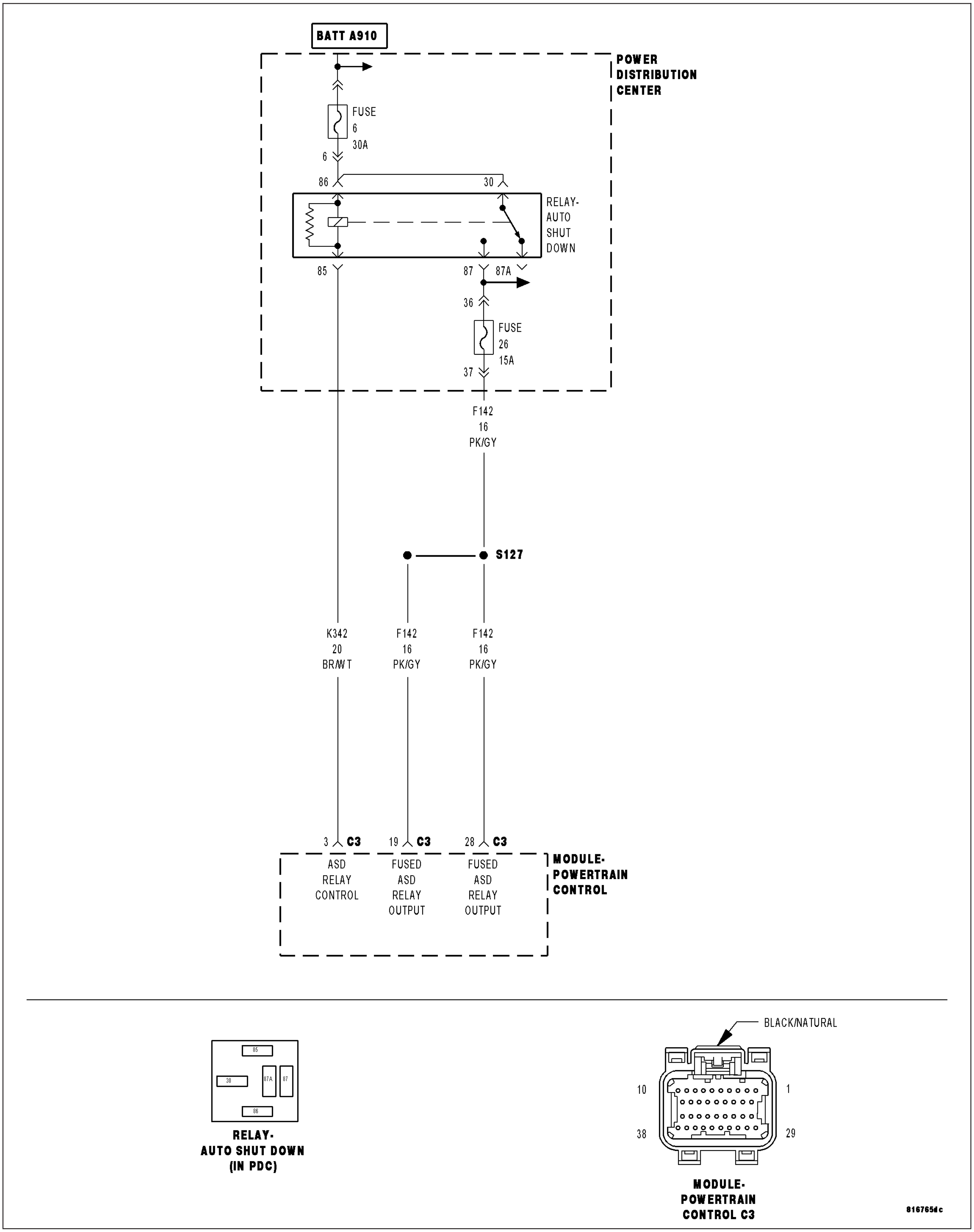
**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0685-AUTO SHUTDOWN CONTROL CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on. Battery voltage above 10 volts.
- **Set Condition:**
  The actual ASD state is not equal to the desired ASD state. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| INTERNAL FUSED B+ CIRCUITS |
| (K342) ASD RELAY CONTROL CIRCUIT OPEN |
| (K342) ASD RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| ASD RELAY |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ASD RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

**Is the ASD Relay operating?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. INTERNAL FUSED B+ CIRCUITS

Turn the ignition off.

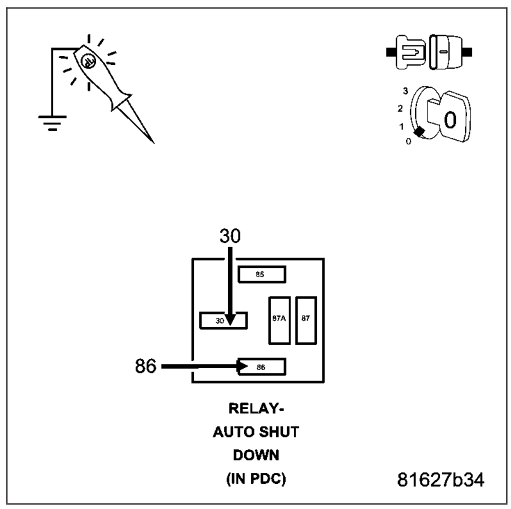
Remove the ASD Relay from the PDC.

Using a 12-volt test light connected to ground, probe the Internal Fused B+ circuits in the IPM.

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the open or short to ground in the Internal Fused B+ circuits. Inspect and replace any open fuses.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




### 3. ASD RELAY

Measure the resistance of the ASD Relay Coil.

**Is the resistance between 60 to 80 ohms?**

**Yes** >> Go To 4

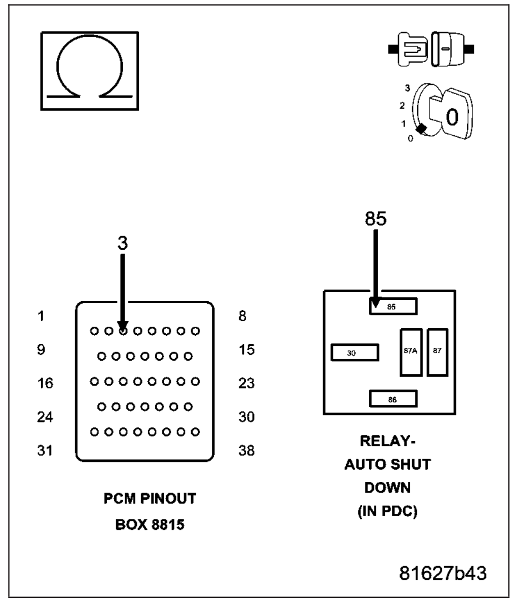
**No** >> Replace the ASD Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (K342) ASD RELAY CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K342) ASD Relay Control circuit from the PDC to the appropriate terminals of special tool #8815.



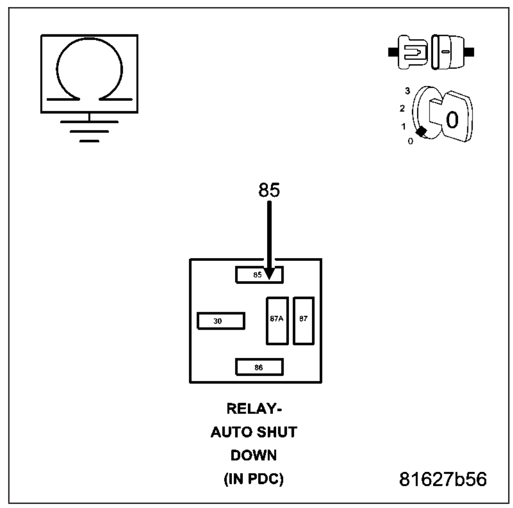

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the open in the (K342) ASD Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. (K342) ASD RELAY CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K342) ASD Relay Control circuit in the PDC.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K342) ASD Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

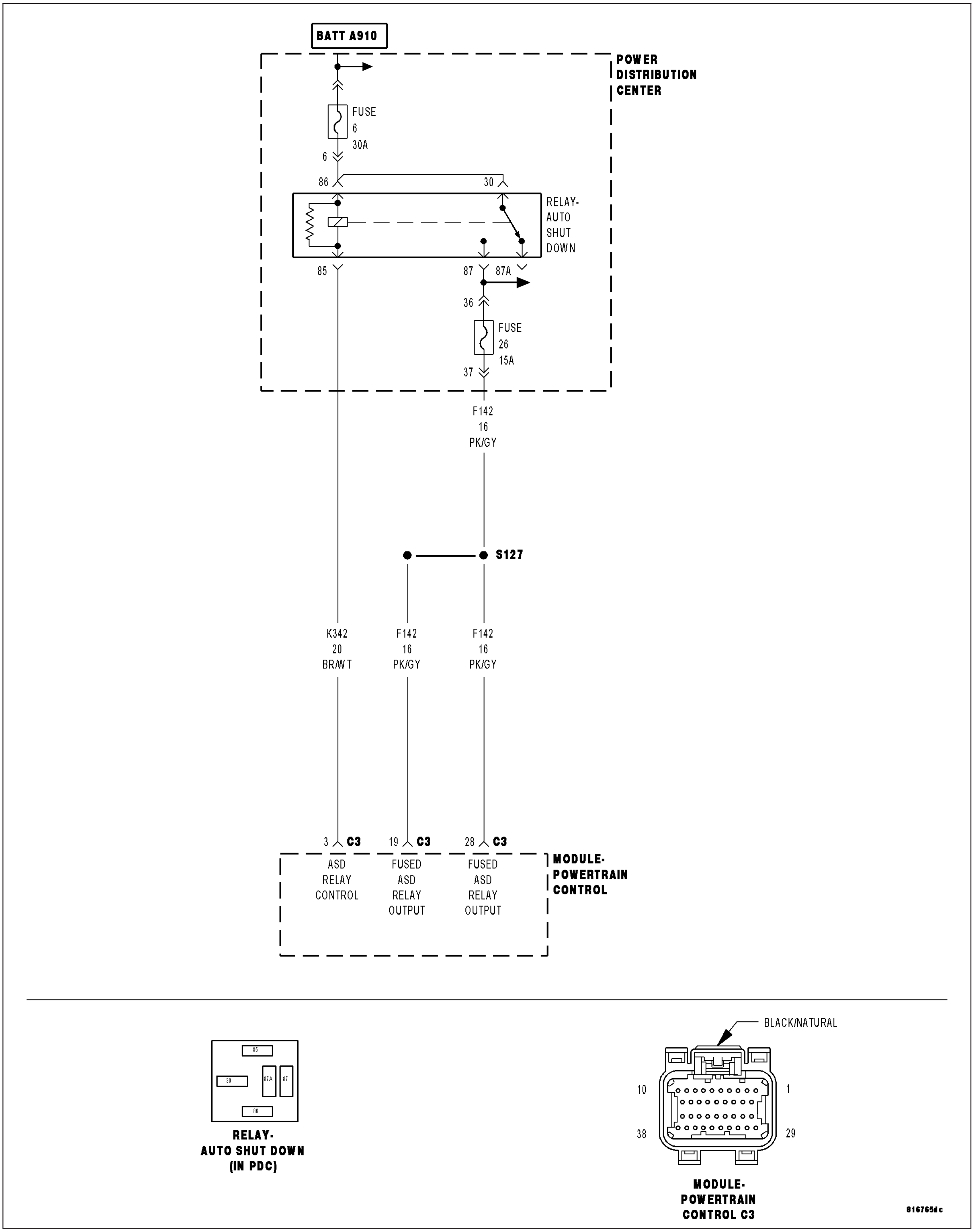
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0688-AUTO SHUTDOWN SENSE CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition key on. Battery voltage greater than 10 volts.
- **Set Condition:**
  No voltage sensed at the PCM when the ASD relay is energized. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| INTERNAL FUSED B+ CIRCUITS |
| (F142) ASD RELAY OUTPUT CIRCUIT OPEN |
| ASD RELAY |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. VERIFY ASD DTC

**NOTE: Diagnose P0685 - Auto Shutdown Relay Control Circuit first if it set along with this DTC.**
With a scan tool, erase the DTC.

Attempt to start the engine. If the engine will not start, crank the engine for at least 15 seconds. It may be necessary to repeat several times.

**Does the DTC reset?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. ENGINE OPERATION

Attempt to start the engine.

**Does the engine start?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. (F142) ASD RELAY OUTPUT CIRCUIT OPEN

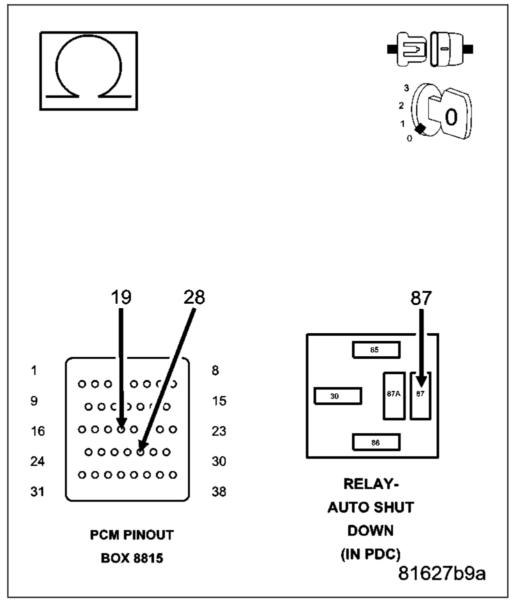
Turn the ignition off.

Remove the ASD Relay.

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (F142) ASD Relay Output circuit from the Relay connection to the appropriate terminals of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. ASD RELAY

Turn the ignition off.

Install a substitute relay in place of the ASD Relay.

Ignition on, engine not running.

With a scan tool, erase DTCs.

Attempt to start the engine.

With a scan tool, read DTCs.

**Does the DTC reset?**

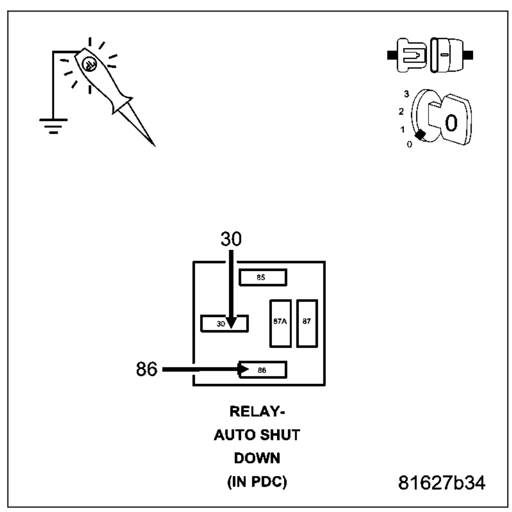
**Yes** >> Go To 5

**No** >> Replace the ASD Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. INTERNAL FUSED B+ CIRCUITS

Turn the ignition off.

Using a 12-volt test light connected to ground, probe the Internal Fused B+ circuits at the Relay connection.




**Does the test light illuminate brightly?**

**Yes** >> Go To 6

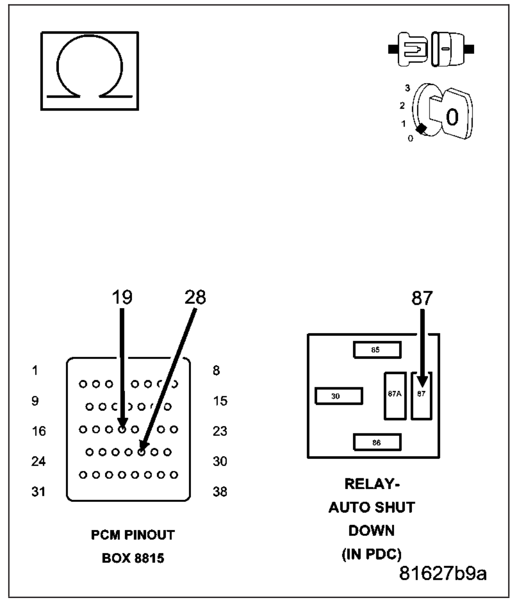
**No** >> Repair the open or short to ground in the Internal Fused B+ circuits. Inspect the related fuse and repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (F142) ASD RELAY OUTPUT CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (F142) ASD Relay Output circuit from the Relay connection to the appropriate terminals of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (F142) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P0700-TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  An active DTC is stored in the TCM. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| DTC PRESENT IN THE TRANSMISSION CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. DTC PRESENT IN EATX CONTROLLER

This is an informational DTC letting you know that a DTC(s) is stored in the Transmission Control Module.

Erase this DTC from the PCM after all Transmission DTC(s) have been repaired.

Using a scan tool, read the Transmission Controller DTC and refer to the Transmission Category and perform the appropriate symptom.

**PCM Diagnostic Information complete.**

**Continue**

Test Complete.

# P0850-PARK/NEUTRAL SWITCH PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The Park Neutral switch rationality test is enabled only for vehicles equipped with a 4/5 speed automatic transmission. This diagnostic checks if the park/neutral switch is incorrectly stuck in the neutral position during driving conditions by comparing Vehicle Speed, Engine Speed, Throttle Position, and Pressure Ratio to the fail thresholds and by looking at the state of the Park/Neutral Switch. The stuck in drive condition is not explicitly checked as the starter relay does not energize and therefore render the vehicle inoperable.

- **When Monitored:**
  Continuously with the transmission in Park, Neutral, or Drive and NOT in Limp-in mode.
- **Set Condition:**
  This code will set if the PCM detects an incorrect Park/Neutral switch state for a given mode of vehicle operation. One trip fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| TRS (T41) SENSE (P/N SENSE) CIRCUIT OPEN |
| TRS (T41) SENSE (P/N SENSE) CIRCUIT SHORTED TO GROUND |
| TRANSMISSION RANGE SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. P/N & D/R NOT IN CORRECT POSITION

**NOTE: Check the TCM for DTCs, if P0706 is set in the TCM diagnose the TCM code before continuing.**
Ignition on, engine not running.

With the scan tool, read the Park/Neutral Position Switch input state.

While moving the gear selector through all gear positions (Park to 1 and back to Park), monitor the scan tool display.

**Did the scan tool display show P/N and D/R in the correct gear positions?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. TRS (T41) SENSE (P/N SENSE) CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Disconnect the Transmission Range Sensor harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**
Measure the resistance of the TRS (T41) Sense (P/N Sense) circuit from the TRS harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 3

**No** >> Repair the open in the TRS (T41) Sense (P/N Sense) circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. TRS (T41) SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the TRS (T41) Sense (P/N Sense) circuit at the TRS harness connector.

**Is the resistance above 100k ohms?**

**Yes** >> Go To 4

**No** >> Repair the short to ground in the TRS (T41) Sense (P/N Sense) circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. TRANSMISSION RANGE SENSOR

Measure the resistance between ground and the (T41) TRS Sense (P/N Sense) circuit while moving the gear selector through each gear in the TRS connector.

**NOTE: The circuit is grounded in Park and Neutral and open in the other positions.**

**Did the resistance change from above 100 kohms (open) to below 10.0 ohms (grounded)?**

**Yes** >> Go To 5

**No** >> Replace the Transmission Range Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

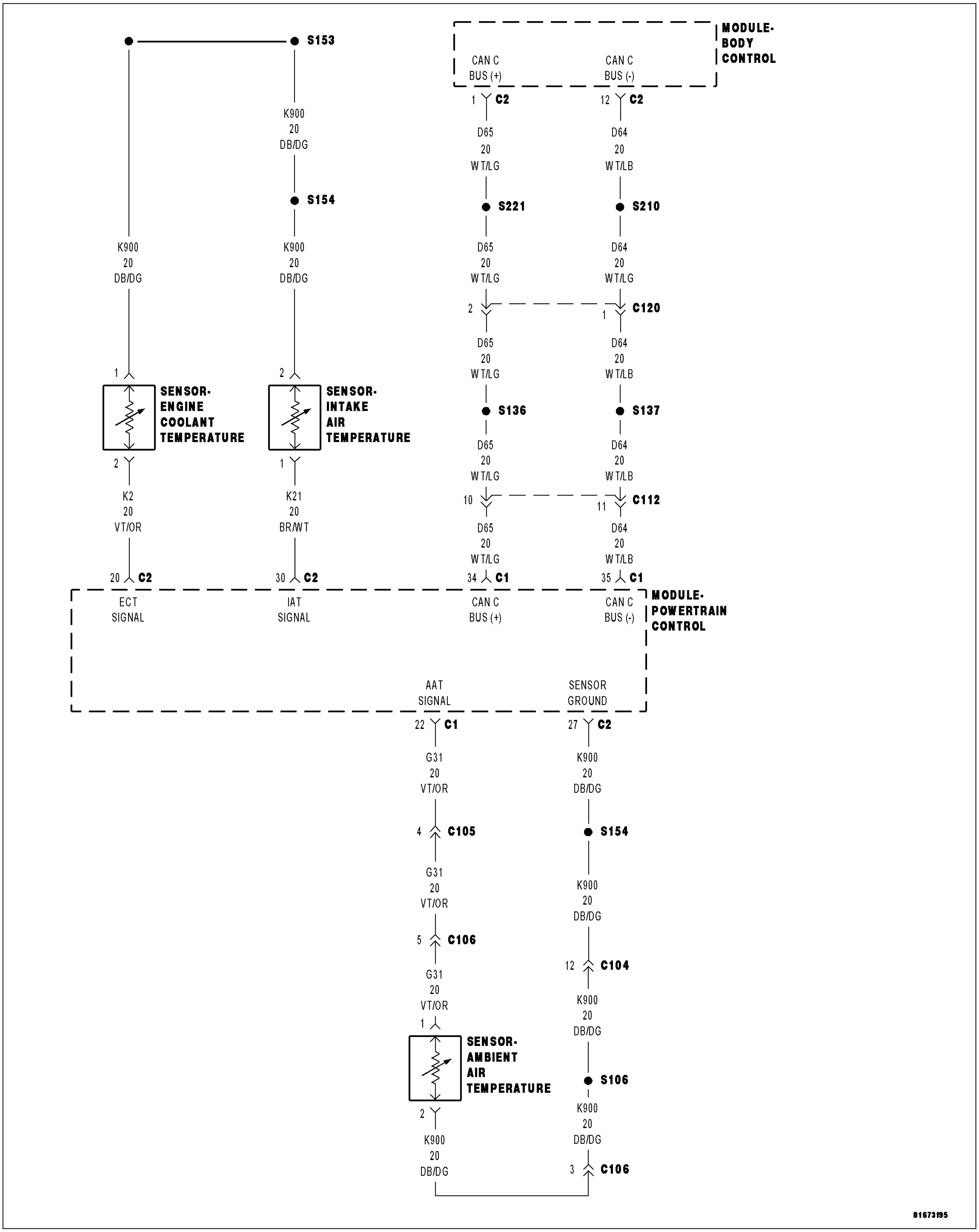
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P1115-GENERAL TEMPERATURE RATIONALITY




For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The General Temperature Rationality looks at the outputs of the three temperature sensors and compare them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If two sensors agree but not the third, the third sensor is declared as irrational. If all three sensors are irrational the General Temperature Sensor Rationality is failed.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Ambient Air, Engine Coolant, and Intake Air Temp sensor inputs are compared under cold start conditions. After start up the temp readings are monitored. If two of the three readings agree and the third doesn't, a DTC is stored. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EXCESSIVE RESISTANCE IN THE SENSOR SIGNAL CIRCUIT |
| EXCESSIVE RESISTANCE IN THE SENSOR GROUND CIRCUIT |
| TEMPERATURE SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Diagnose all CAN C Bus Communication DTCs before continuing**

Ignition on, engine not running.

With a scan tool, read the DTCs.

**NOTE: All ECT, Intake Air, and Ambient Air Temperature Sensor codes must be diagnosed and repaired before continuing.**

**NOTE: In cold weather, this DTC could be set by a high powered block heater and no repair would be required.**

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. TEMPERATURE SENSOR CIRCUIT

With a scan tool, read the ECT, Ambient Air Temp, and Intake Air Temp Sensor temp values.

Start the engine.

Allow the engine to reach normal operating temperature while monitoring the three Sensor temperature values.

**Is the temperature for each of the Sensors increasing properly?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. TEMPERATURE SENSOR

Ignition on, engine not running.

Disconnect the suspected faulty sensor.

Connect a jumper wire between the Sensor Signal circuit and the Sensor ground circuit.

With the scan tool, read the voltage of the suspected Sensor.

**Did the voltage reading start at 4.8 to 5.0 volts and decrease to 0 volts when the jumper wire was installed?**

**Yes** >> Replace the faulty Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

**NOTE: Remove the jumper wire before continuing.**

## 4. EXCESSIVE RESISTANCE IN THE TEMPERATURE SENSOR SIGNAL CIRCUIT

**NOTE: If the vehicle is equipped with ESP the AAT Sensor Signal circuit is a direct feed to the C2 BCM circuit. The PCM receives AAT Sensor Signal input over the CAN C Bus circuit. If the vehicle is not equipped with ESP, the AAT Sensor is a direct feed to the PCM.**

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

Disconnect the C2 BCM harness connector for ESP equipped vehicles.

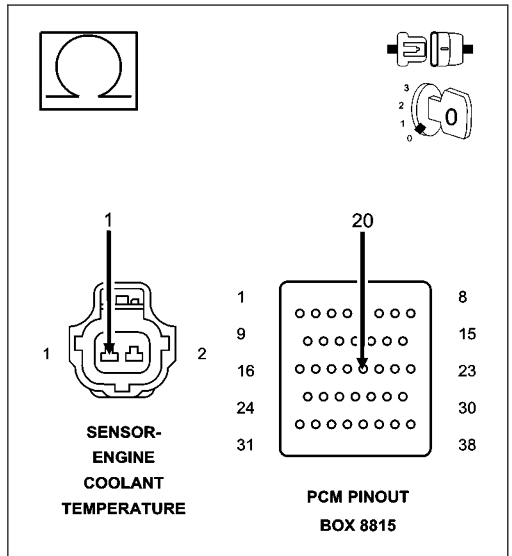
**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the Sensor Signal circuit from the Sensor harness connector to the appropriate terminal of special tool #8815 or the C2 BCM harness connector.

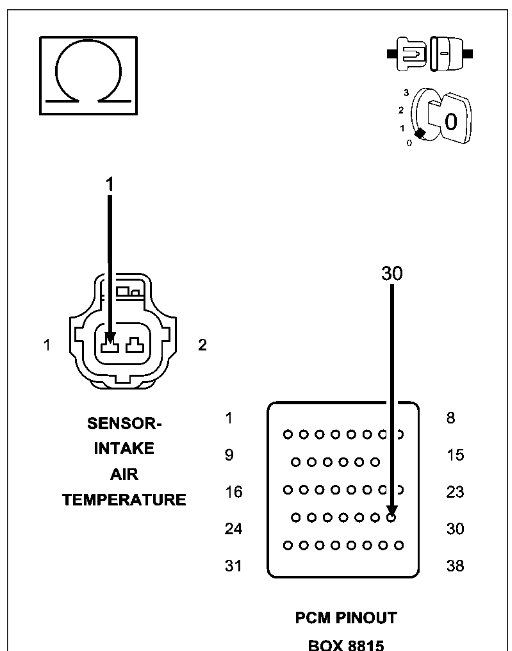
**Is the resistance above 5.0 ohms.**

**Yes** >> Repair the excessive resistance in the Temperature Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

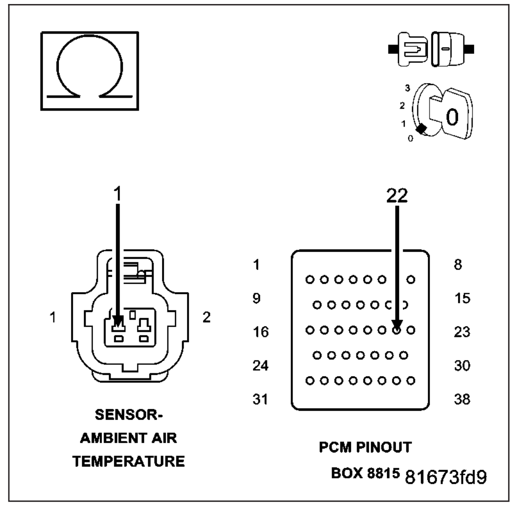
**No** >> Go To 5

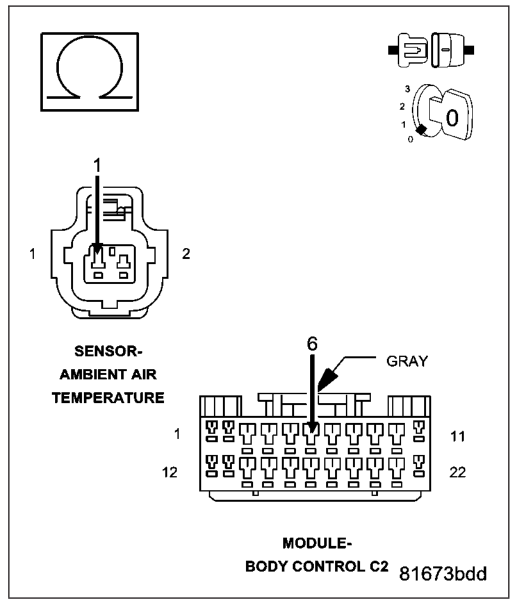


8132beda



8132bcd9


1
22
1
2
1
9
16
24
31
8
15
23
30
38
SENSOR-
AMBIENT AIR
TEMPERATURE
PCM PINOUT
BOX 8815
81673fd9


1
1
2
SENSOR-
AMBIENT AIR
TEMPERATURE
6
GRAY
1
11
12
22
MODULE-
BODY CONTROL C2
81673bdd

## 5. EXCESSIVE RESISTANCE IN THE SENSOR GROUND CIRCUIT

**NOTE: On ESP equipped vehicles the AAT Sensor ground circuit is at the C2 BCM harness connector.**

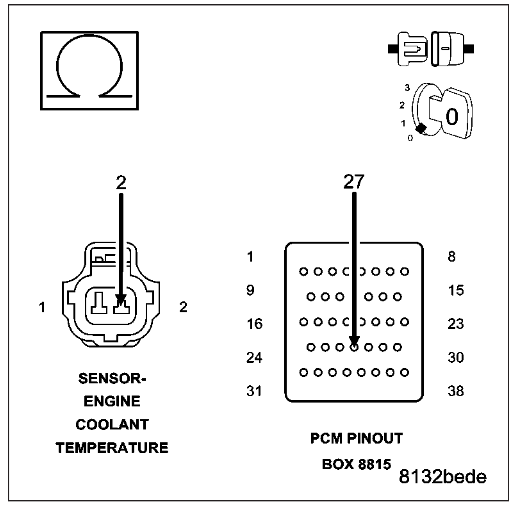
Measure the resistance of the Sensor ground circuit from the Sensor harness connector to the appropriate terminal of special tool #8815 or the C2 BCM harness connector on ESP vehicles.

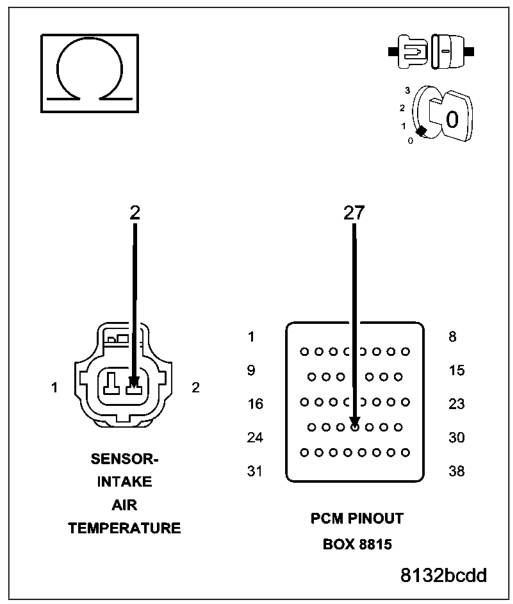
**Is the resistance above 5.0 ohms.**

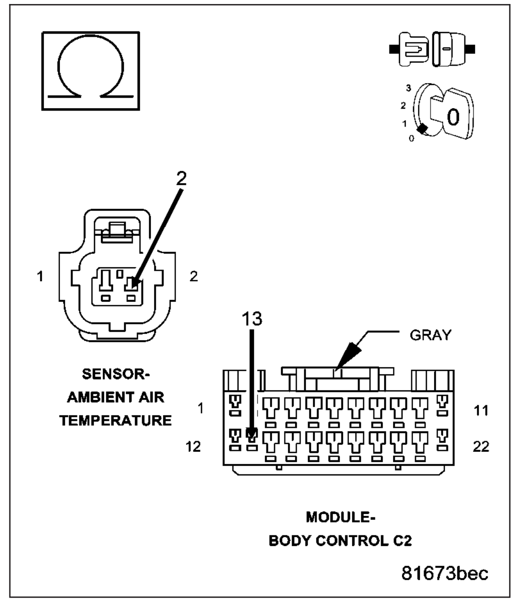
**Yes** >> Repair the excessive resistance in the Sensor ground circuit.

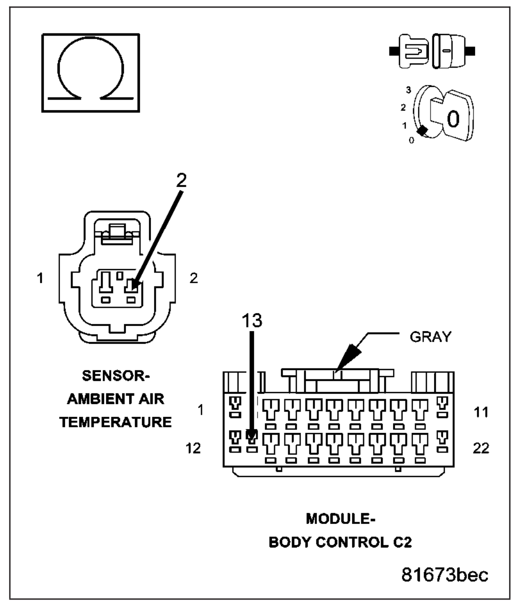
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 6






## 6. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

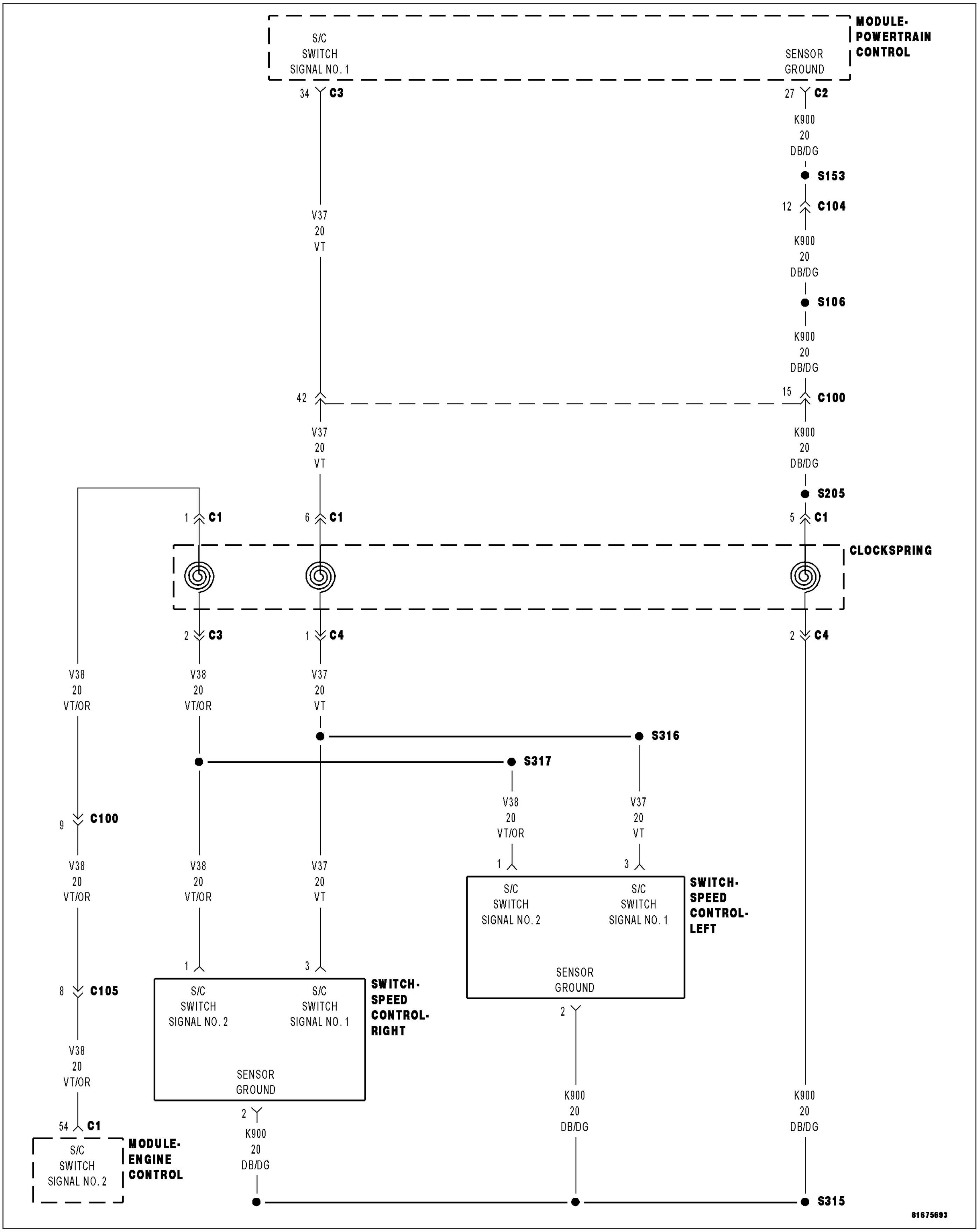
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P1593-SPEED CONTROL SWITCH 1 STUCK




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  S/C Switch No.1 is mechanically stuck in the On/Off, Resume/Accel, or Set position for too long. One trip fault.

| **Possible Causes** |
|---|
| (V37) S/C SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (V37) S/C SIGNAL CIRCUIT OPEN |
| (K900) SENSOR GROUND OPEN |
| (V37) S/C SIGNAL CIRCUIT SHORTED TO GROUND |
| (V37) S/C SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND |
| SPEED CONTROL SWITCH |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. SPEED CONTROL SWITCH STATUS

Start the engine.
With a scan tool, monitor each which function for the Speed Control Switches.
Press and release each Speed Control Button.
- Resume/Accel
- Cancel
- Decel (Coast)
- On/Off
- Set

**Does each switch function change status when pressing each switch?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. SPEED CONTROL SWITCHES

Turn the ignition off.
Disconnect and remove the Speed Control Switches from the steering wheel per Service Information.
Measure the resistance across each Speed Control Switch.
Monitor the ohmmeter while pressing each function button on each switch.
Resume/Accel - 15.4 kohms
Cancel - 1.24 kohms
Coast - 2.94 kohms
On/Off -0.47 kohms
Set - 5.49 kohms

**Does the function on the Speed Control Switches have the correct resistance value?**

**Yes** >> Go To 3

**No** >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

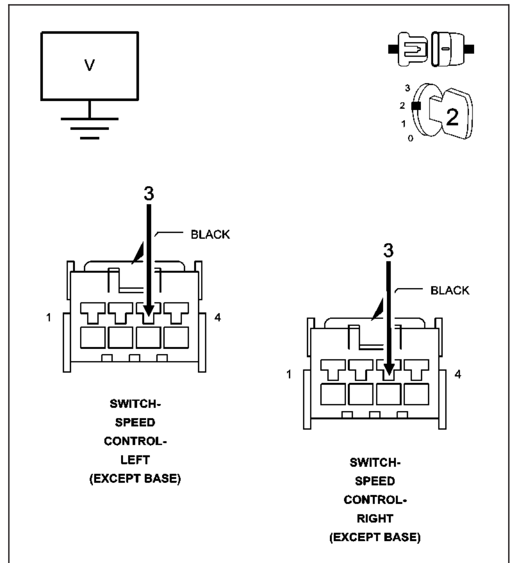
Measure the voltage of the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.

**Is the voltage above 5.0 volts?**

**Yes** >> Repair the short to battery voltage in the (V37) S/C Signal No.1 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4




81675d1b

## 4. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN

**NOTE: The measurement must be taken from both Speed Control Switch harness connectors.**

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

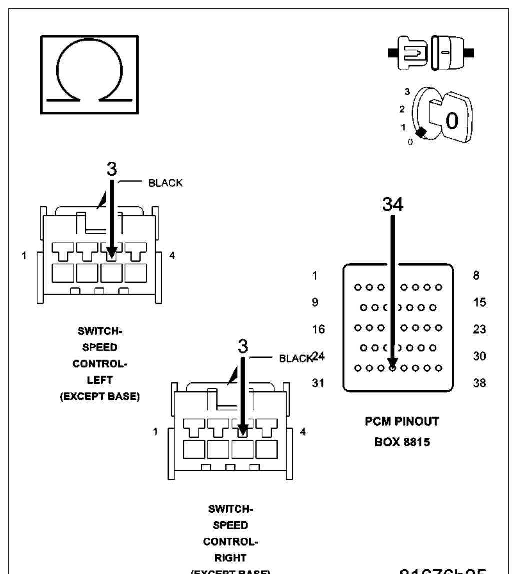
Measure the resistance of the (V37) S/C Switch No.1 Signal circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the open in the (V37) S/C Switch No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



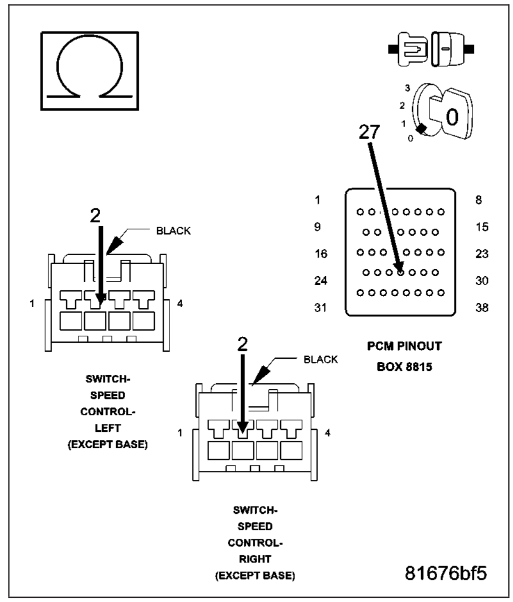

81676b25

## 5. (K900) SENSOR GROUND CIRCUIT OPEN

**NOTE: The measurement must be taken from both Speed Control Switch harness connectors.**

Disconnect the C2 PCM harness connector.

Measure the resistance of the (K900) Sensor ground circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms for both measurements?**

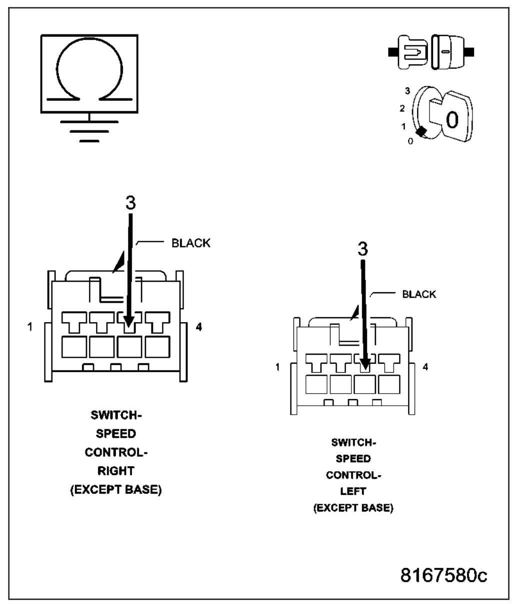
**Yes** >> Go To 6

**No** >> Repair the open in the (K900) Sensor ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.




**Is the resistance below 100 ohms?**

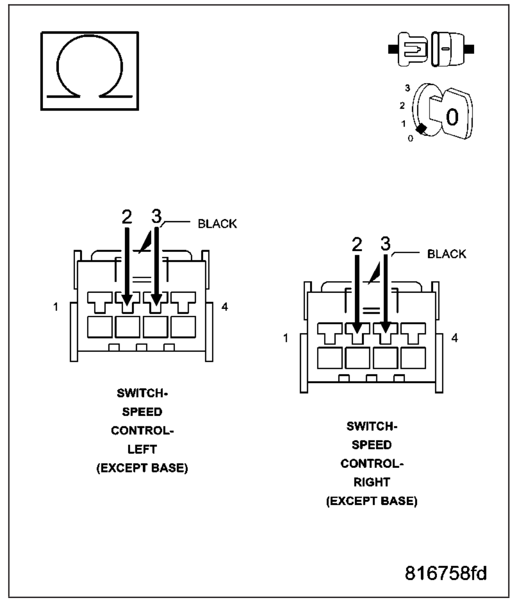
**Yes** >> Repair the short to ground in the (V37) S/C Switch No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (V37) S/C Switch No.1 Signal circuit and the (K900) Sensor ground circuit in the Speed Control harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (V37) S/C Switch No.1 Signal circuit and the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P1602–PCM NOT PROGRAMMED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  The PCM has not been programmed.

| Possible Causes |
|---|
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. PCM PROGRAMMED

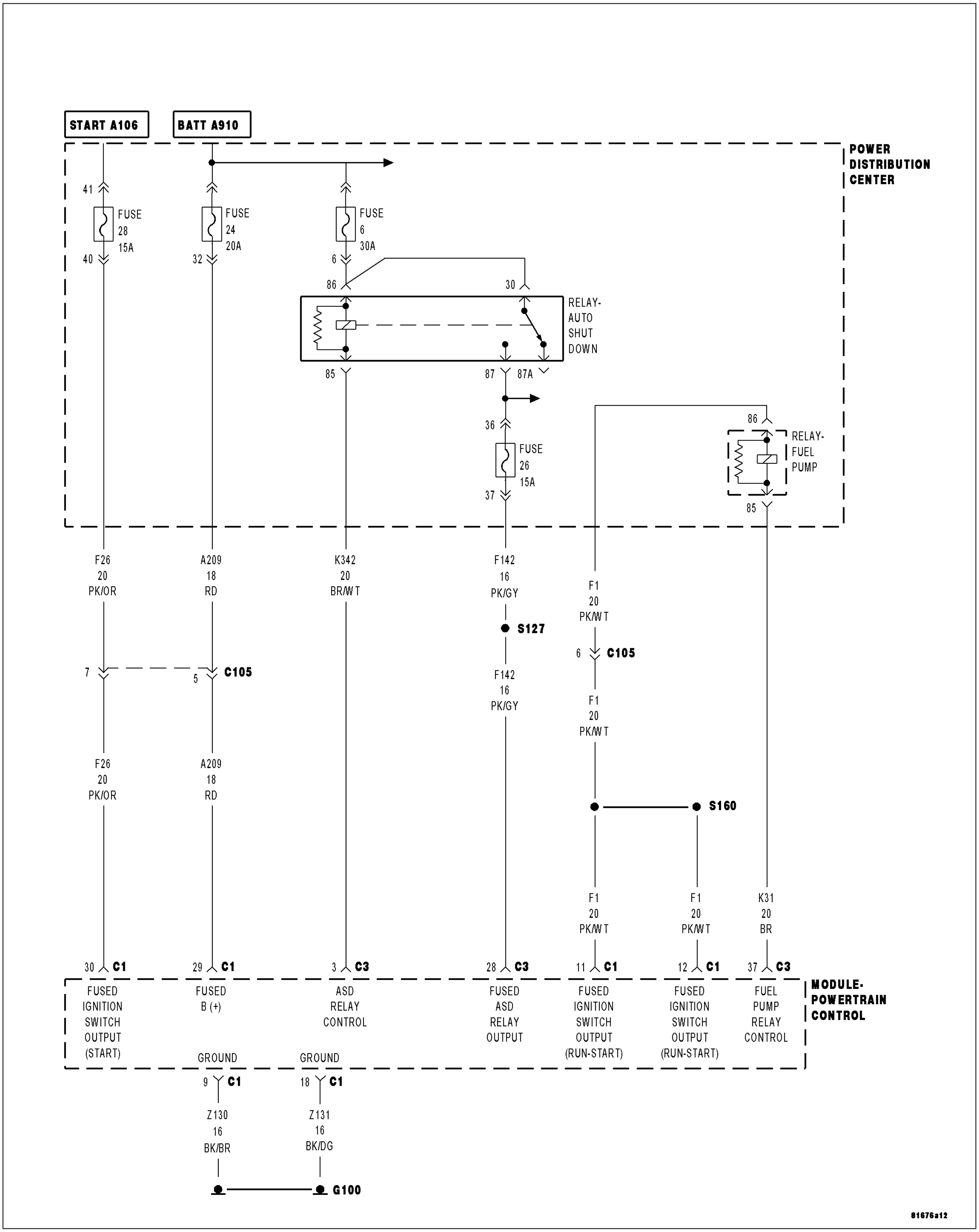
Ignition on, engine not running.
With a scan tool, erase DTCs.
With a scan tool program the PCM.
Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read DTCs.

**Does the DTC reset?**

**Yes** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> The PCM has been successfully programmed. Test is complete.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P1603-PCM INTERNAL DUAL-PORT RAM COMMUNICATION FAILURE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Internal PCM failure detected. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (F1) AND (F26) PCM FUSED IGNITION SWITCH CIRCUIT |
| PCM INTERNAL |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. PCM IGNITION CIRCUITS

Turn the ignition off.

Disconnect the C1 PCM harness connector.

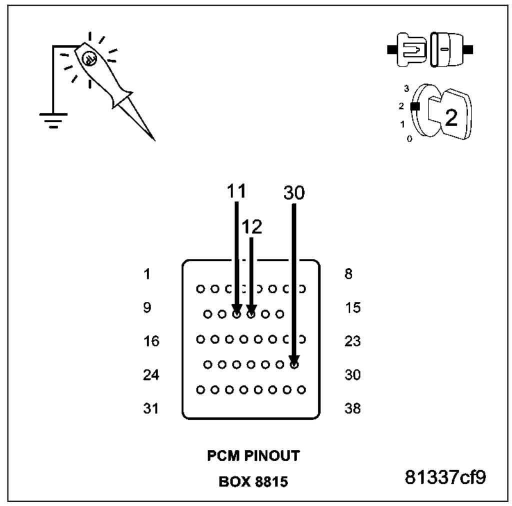
Ignition on, engine not running.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

With a 12-volt test light connected to ground and with special tool #8815 installed, probe the (F1) and (F26) Fused Ignition Switch circuits.

Perform the above check with the Ignition key in the off lock position, Ignition on, engine not running position, and during cranking.

Wiggle the related wire harness while probing the special tool with the test light to try to interrupt the circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 2

**No** >> Repair the open or excessive resistance in the (F1) and (F26) Fused Ignition Switch (Off, Run, Start) circuits. Inspect the related fuse, if the fuse is open check the circuits for a short to ground.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. PCM

The Powertrain Control Module is reporting internal errors.

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

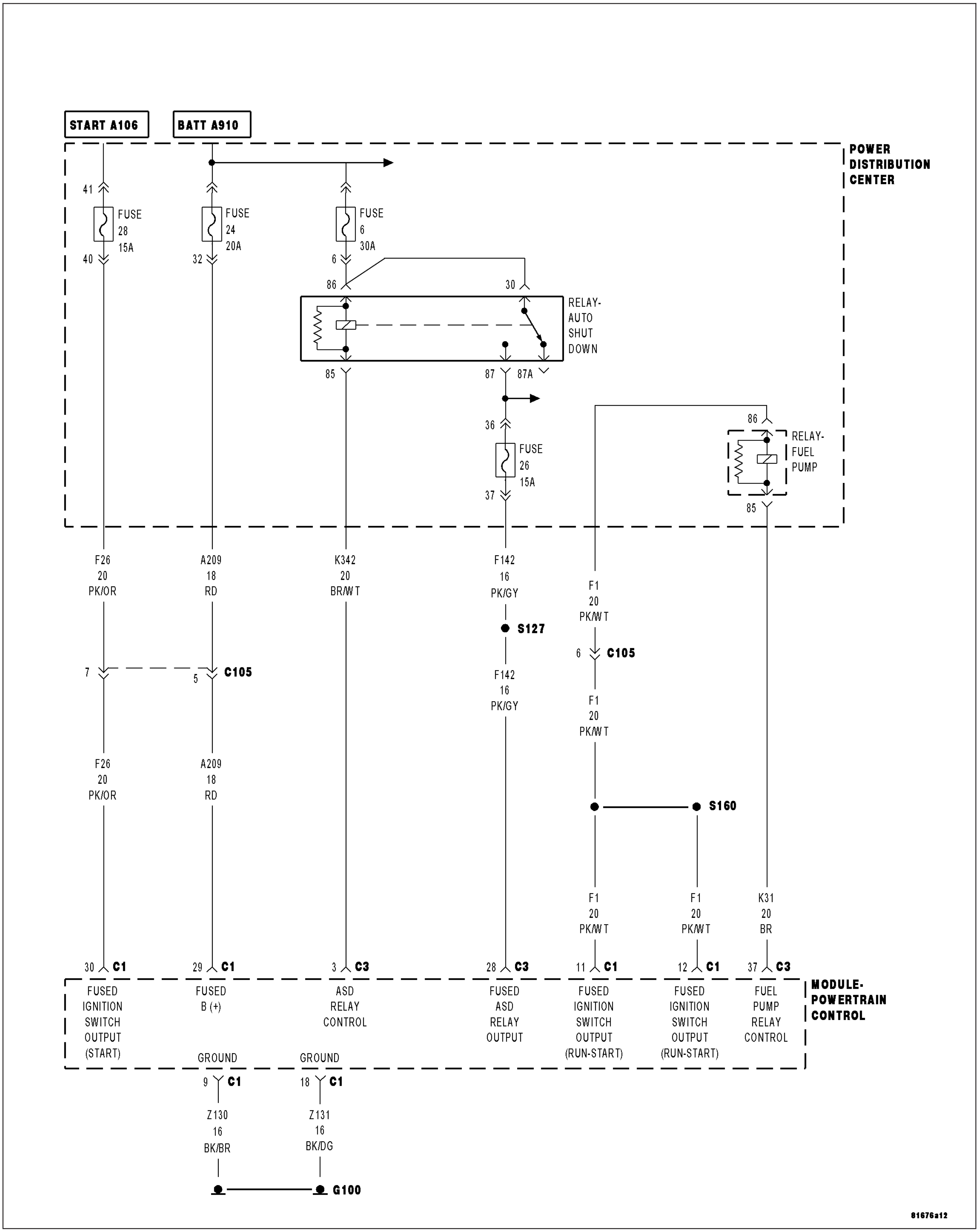
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P1604-PCM INTERNAL DUAL-PORT RAM READ/WRITE INTEGRITY FAILURE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Internal PCM failure detected. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (F1) AND (F26) PCM FUSED IGNITION SWITCH CIRCUIT |
| PCM INTERNAL |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. PCM IGNITION CIRCUITS

Turn the ignition off.

Disconnect the C1 PCM harness connector.

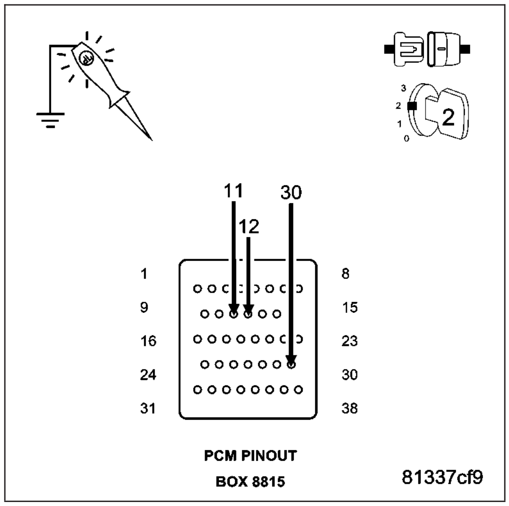
Ignition on, engine not running.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

With a 12-volt test light connected to ground and with special tool #8815 installed, probe the (F1) and (F26) Fused Ignition Switch circuits.

Perform the above check with the Ignition key in the off lock position, Ignition on, engine not running position, and during cranking.

Wiggle the related wire harness while probing the special tool with the test light to try to interrupt the circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 2

**No** >> Repair the open or excessive resistance in the (F1) and (F26) Fused Ignition Switch (Off, Run, Start) circuits. Inspect the related fuse, if the fuse is open check the circuits for a short to ground.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. PCM

The Powertrain Control Module is reporting internal errors.

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

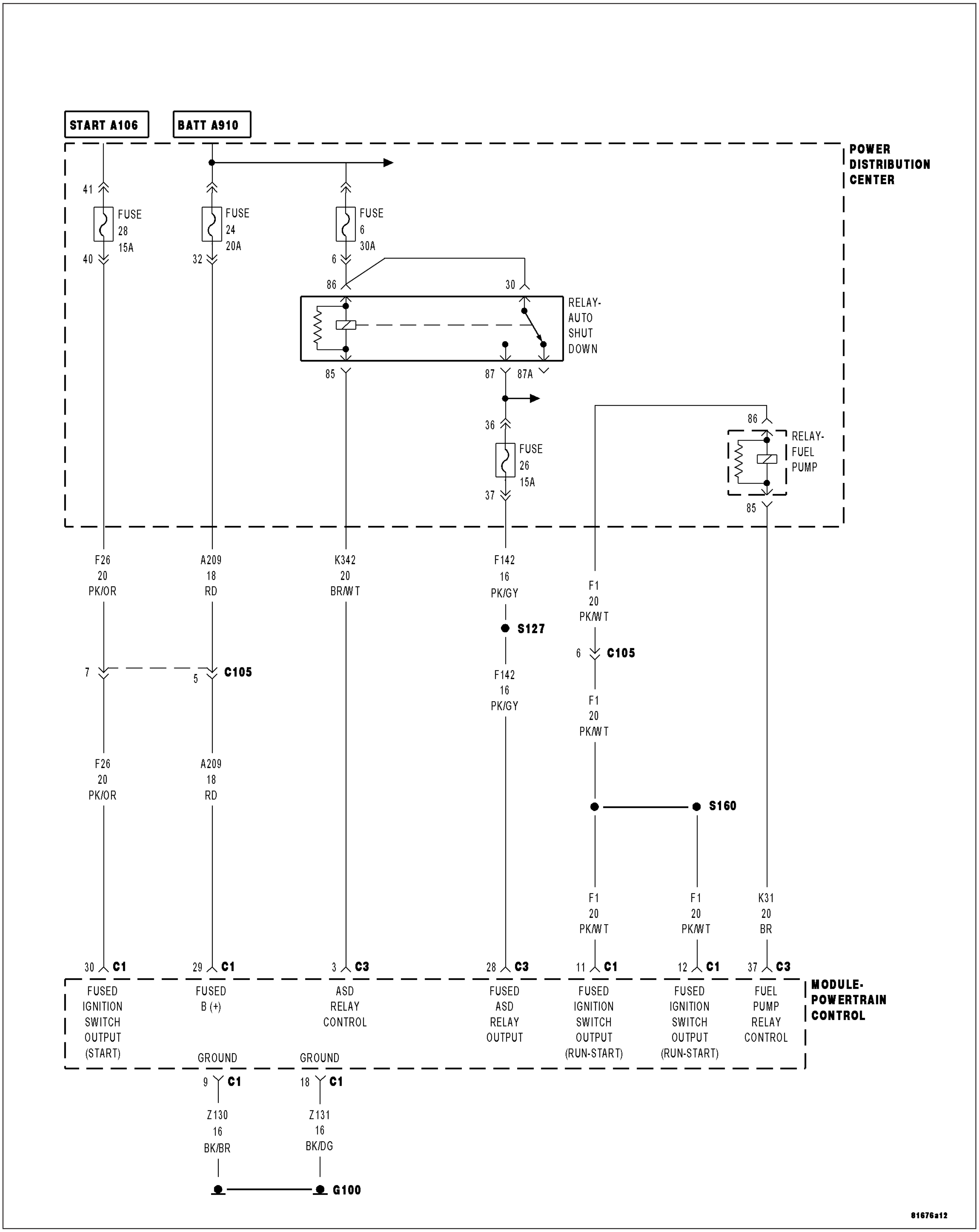
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P1607-PCM INTERNAL SHUTDOWN TIMER RATIONALITY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Internal PCM failure detected. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (F1) AND (F26) PCM FUSED IGNITION SWITCH CIRCUIT |
| PCM INTERNAL |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. PCM IGNITION CIRCUITS

Turn the ignition off.

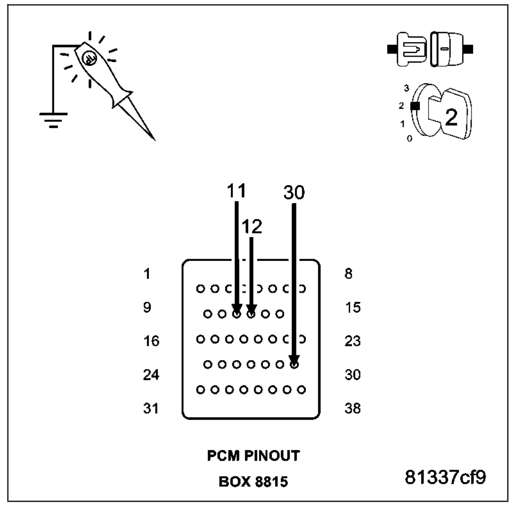
Disconnect the C1 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

With a 12-volt test light connected to ground and with special tool #8815 installed, probe the (F1) and (F26) Fused Ignition Switch circuits.

Perform the above check with the Ignition key in the off lock position, Ignition on, engine not running position, and during cranking.

Wiggle the related wire harness while probing the special tool with the test light to try to interrupt the circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 2

**No** >> Repair the open or excessive resistance in the (F1) and (F26) Fused Ignition Switch (Off, Run, Start) circuits. Inspect the related fuse, if the fuse is open check the circuits for a short to ground.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. PCM

The Powertrain Control Module is reporting internal errors.

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P1696-EEPROM MEMORY WRITE DENIED/INVALID

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on.
- **Set Condition:**
  An attempt to program/write to the internal EEPROM failed, Also checks at powerdown. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. SCAN TOOL DISPLAYS A WRITE FAILURE

With a scan tool, perform the SRI Memory Test.

**Does scan tool display Write Failure?**

**Yes** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. SCAN TOOL DISPLAYS A WRITE REFUSED

With the a scan tool, perform the SRI Memory Test.

**Does the scan tool display Write Refused?**

**Yes** >> Go To 3

**No** >> Go To 4

### 3. PCM REFUSED 2ND TEST

With a scan tool, perform the SRI Memory Test a third time.

**NOTE: Retest the SRI Memory two more times.**

**Does the scan tool display Write Refused again?**

**Yes** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Test Complete.

### 4. SCAN TOOL DISPLAYS SRI MILEAGE INVALID

With a scan tool, perform the SRI Memory Test.

**Does the scan tool display SRI Mileage Invalid?**

**Yes** >> Update the mileage and retest the SRI Memory.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. COMPARE SRI MILEAGE WITH ODOMETER

Compare the SRI Mileage stored with the Instrument Panel Odometer.

**Is the mileage within the specified range displayed on the scan tool?**

**Yes** >> Test Complete.

**No** >> Update the mileage and retest the SRI Memory.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P1697-EMR (SRI) MILEAGE NOT STORED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on.
- **Set Condition:**
  An attempt to program/write to the internal EEPROM failed, Also checks at powerdown. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. SCAN TOOL DISPLAYS A WRITE FAILURE

With a scan tool, perform the SRI Memory Test.

**Does scan tool display Write Failure?**

**Yes** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. SCAN TOOL DISPLAYS A WRITE REFUSED

With the a scan tool, perform the SRI Memory Test.

**Does the scan tool display Write Refused?**

**Yes** >> Go To 3

**No** >> Go To 4

### 3. PCM REFUSED 2ND TEST

With a scan tool, perform the SRI Memory Test a third time.

**NOTE: Retest the SRI Memory two more times.**

**Does the scan tool display Write Refused again?**

**Yes** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Test Complete.

### 4. SCAN TOOL DISPLAYS SRI MILEAGE INVALID

With a scan tool, perform the SRI Memory Test.

**Does the scan tool display SRI Mileage Invalid?**

**Yes** >> Update the mileage and retest the SRI Memory.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. COMPARE SRI MILEAGE WITH ODOMETER

Compare the SRI Mileage stored with the Instrument Panel Odometer.

**Is the mileage within the specified range displayed on the scan tool?**

**Yes** >> Test Complete.

**No** >> Update the mileage and retest the SRI Memory.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# P2074-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During all drive modes
- **Set Condition:**
  If vacuum drops below 1.5″Hg with engine RPM greater than 2000 RPM and closed throttle. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| VACUUM LEAK |
| RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT |
| (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND |
| RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT |
| (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| RESISTANCE IN THE (K22) TP SENSOR NO.1 SIGNAL CIRCUIT |
| (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND |
| RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT |
| MAP SENSOR |
| THROTTLE POSITION SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Diagnose any TP Sensor or MAP Sensor component DTCs before continuing.**

**NOTE: If the P0501 - No Vehicle Speed Signal is set long with this DTC, refer to the P0501 diagnostics before continuing.**

**NOTE: The throttle plate and linkage should be free from binding and carbon build up.**

**NOTE: Make sure the throttle plate is at the idle position.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. VACUUM LEAK

**NOTE: This code is enabled on engines with a plastic intake manifold and is intended to shut down the engine if a large crack occurs.**

**NOTE: A large vacuum leak is most likely the cause of this DTC.**

Inspect the Intake Manifold for leaks and cracks.

Inspect the Power Brake Booster for any vacuum leaks.

Inspect the PCV system for proper operation and vacuum leaks.

Inspect the throttle plate to see if it is bent and will close entirely, if it is bent it may need to be replaced.

Inspect the MAP Sensor for proper installation.

Verify the engine is free from any mechanical failures.

**Were any vacuum leaks found?**

**Yes** >> Repair the vacuum leak as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. MAP SENSOR OPERATION

Start the engine.

With a scan tool, monitor the MAP Sensor voltage.

Snap the throttle.

**Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at wide open throttle?**

**Yes** >> Go To 4

**No** >> Go To 11

## 4. TP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage while slowly pressing the throttle pedal from closed to wide open throttle.

**Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?**

**Yes** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

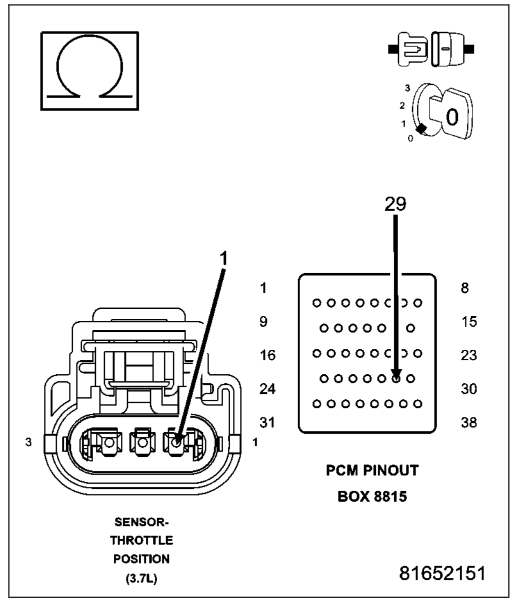
Turn the ignition off.

Disconnect the TP Sensor harness connector.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (F855) 5-volt Supply circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

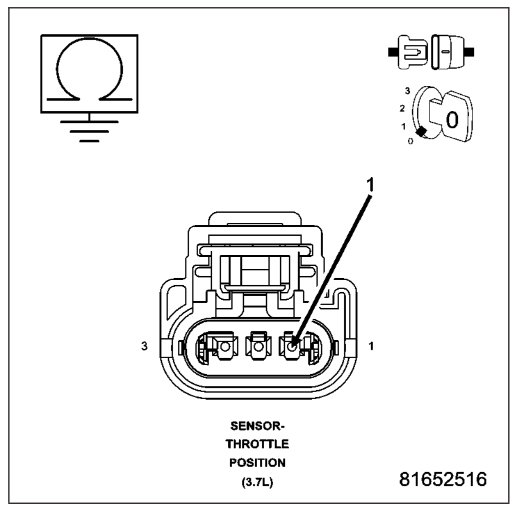
**Yes** >> Go To 6

**No** >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit in the TP Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

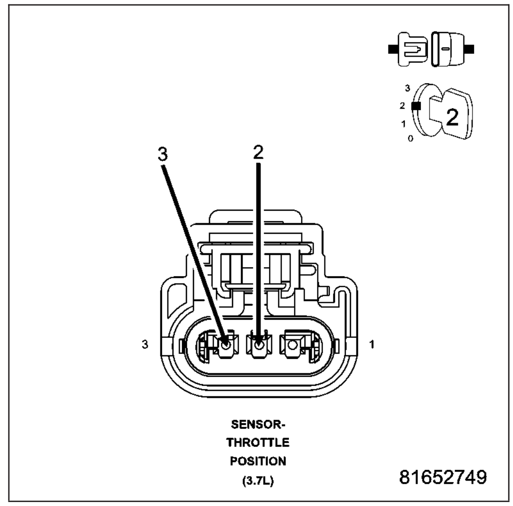
## 7. THROTTLE POSITION SENSOR

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage.

Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.




**Does the TP Sensor voltage change from approximately 4.9 volts to below 0.5 of a volt with the jumper wire installed?**

**Yes** >> Replace the Throttle Position Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

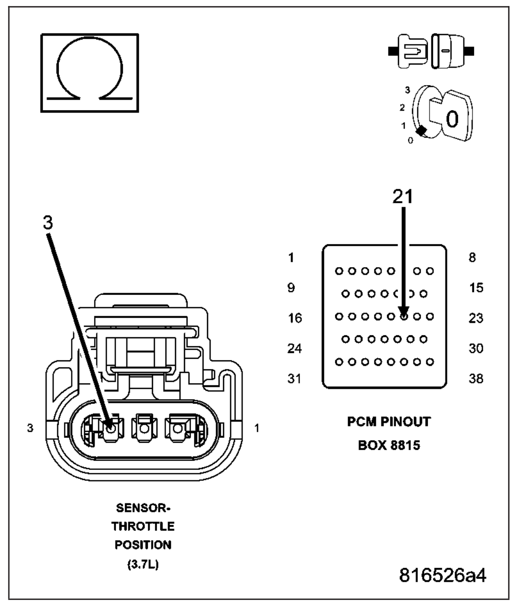
**No** >> Go To 8

**NOTE: Remove the jumper wire before continuing.**

## 8. EXCESSIVE RESISTANCE IN THE (K22) TP NO.1 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.




**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

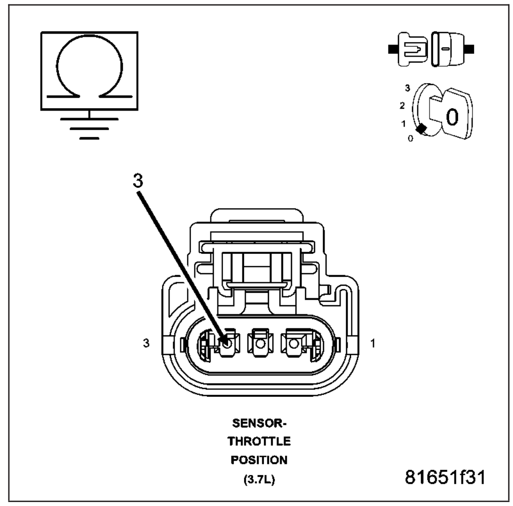
**Yes** >> Go To 9

**No** >> Repair the excessive resistance in the (K22) TP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 9. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit.

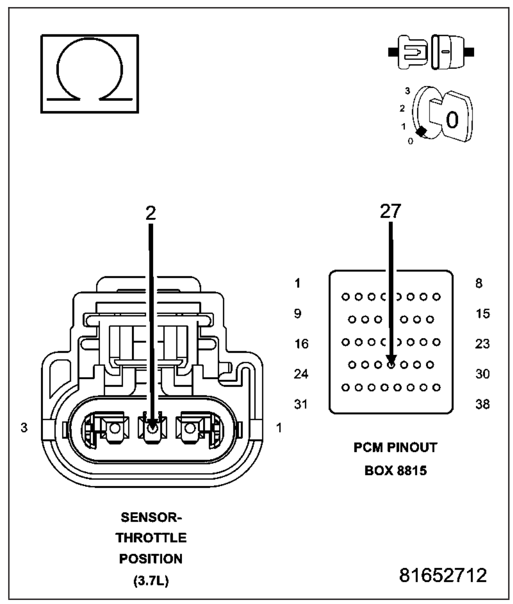
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 10

## 10. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K900) Sensor ground circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 17

**No** >> Repair the excessive resistance in the (K900) Sensor ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 11. EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

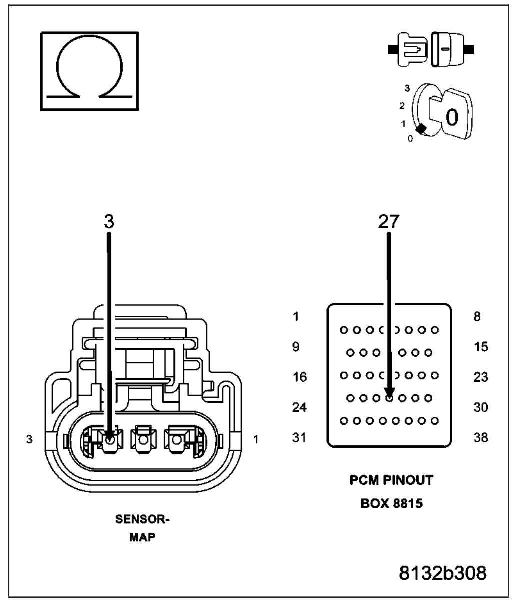
Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Disconnect the C1 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

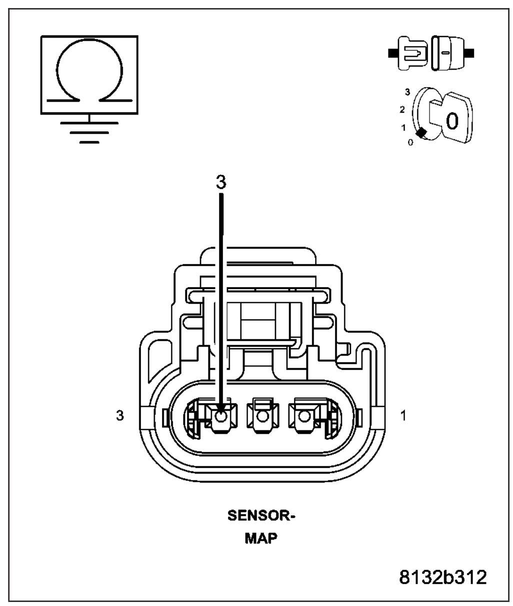
**Yes** >> Go To 12

**No** >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.




**Is the resistance above 100k ohms?**

**Yes** >> Go To 13

**No** >> Repair the short to ground in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 13. MAP SENSOR

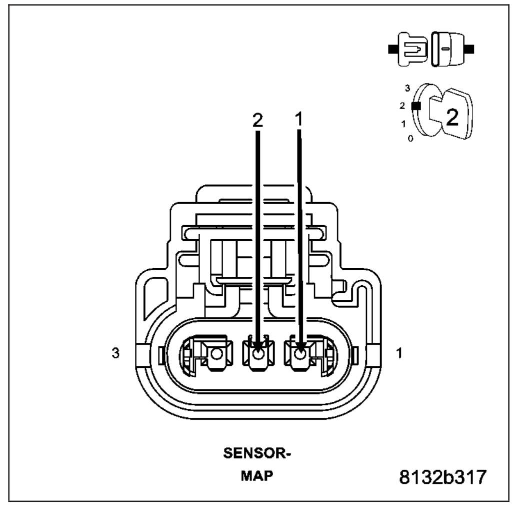
Turn the ignition off.

Connect the C1 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit.




**Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 of a volt with the jumper wire installed?**

**Yes** >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

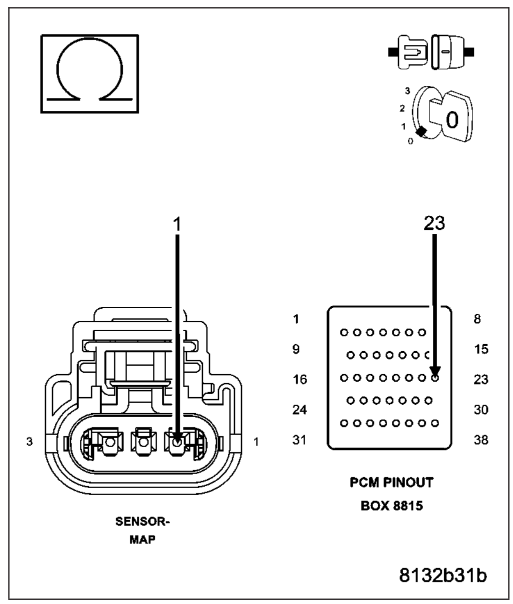
**No** >> Go To 14

**NOTE: Remove the jumper wire before continuing.**

## 14. EXCESSIVE RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.




**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

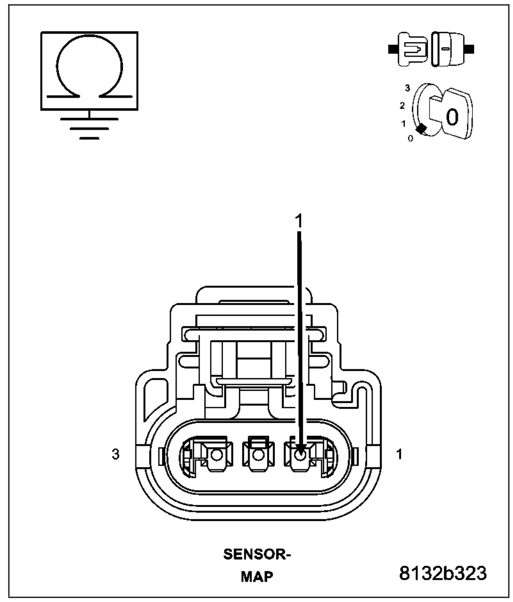
**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 15

**No** >> Repair the excessive resistance in the (K1) MAP Signal circuit
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 15. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.




**Is the resistance below 100 ohms?**

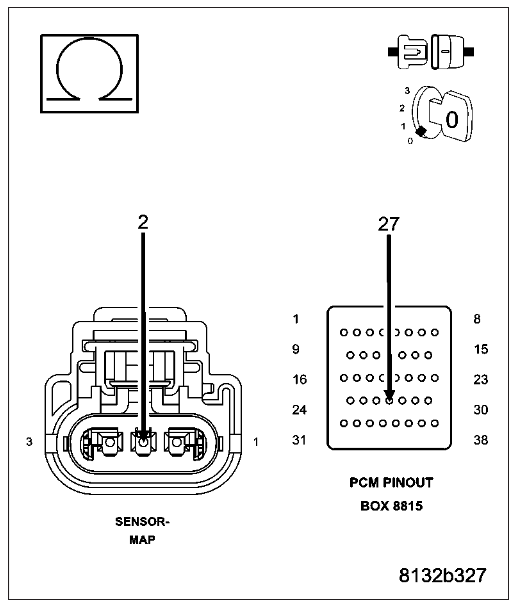
**Yes** >> Repair the short to ground in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 17

**No** >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 17. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

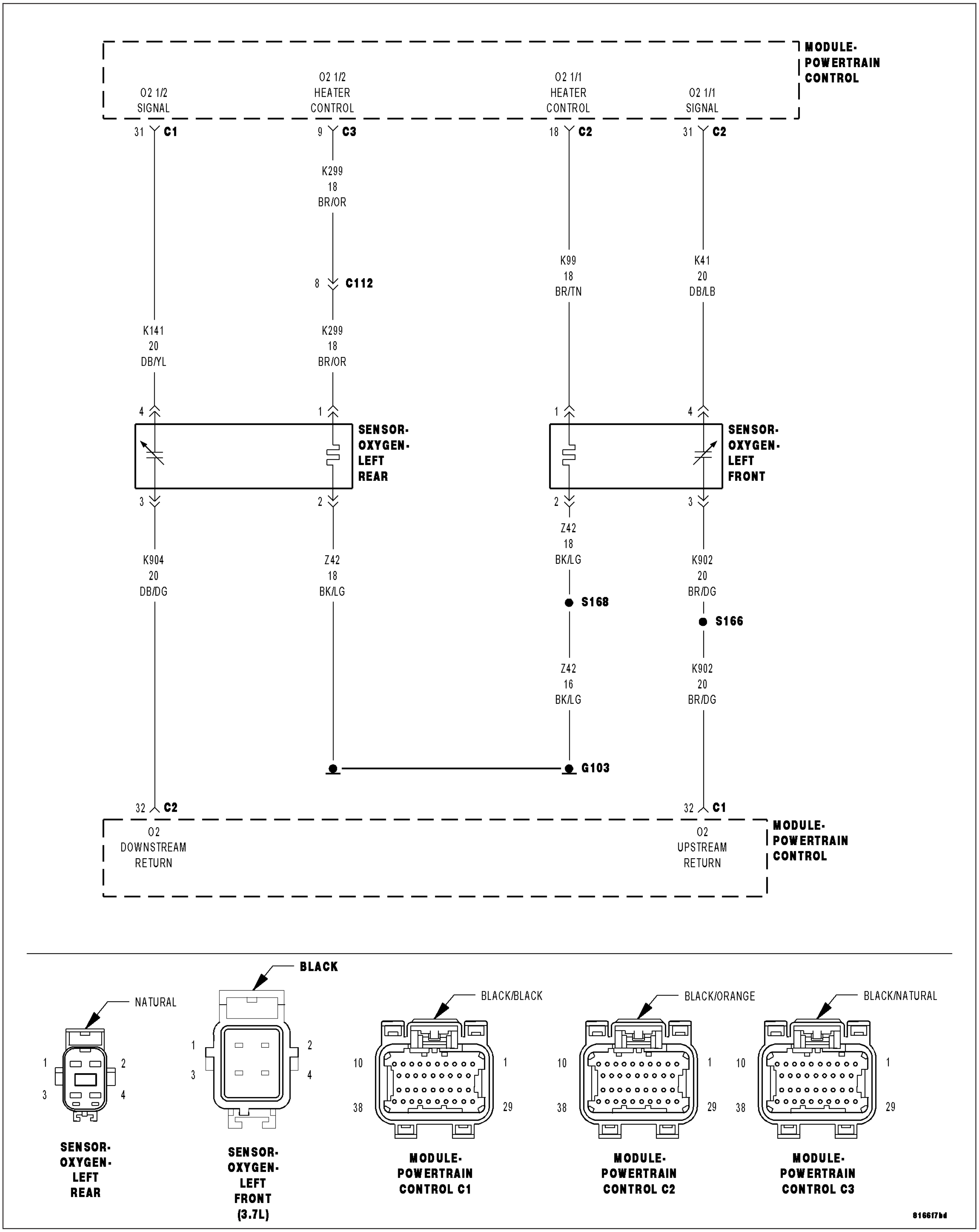
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above (-7°C) 20°F, altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive as well as a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EXHAUST LEAK |
| ENGINE MECHANICAL PROBLEM |
| 1/2 O2 SENSOR |
| (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT |
| (K299) O2 1/2 HEATER CONTROL CIRCUIT |
| (K904) O2 DOWNSTREAM RETURN CIRCUIT |
| FUEL CONTAMINATION |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Check the vehicle repair history. If the 1/2 O2 has been replace make sure that the O2 sensor was properly installed and meets OEM specification.**

**NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. EXHAUST LEAK

Turn the ignition off.

**WARNING: To avoid personal injury from the exhaust system being hot, allow the exhaust to cool down to a safe temperature before performing a physical inspection. Failure to follow these instructions can result in personal injury or death.**

Visually and Physically inspect the for holes, cracks, and blockage in the exhaust system.

**Is the exhaust system is good condition?**

**Yes** >> Go To 3

**No** >> Repair or Replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. O2 SENSOR

Ignition on, engine not running.

Disconnect the 1/2 O2 Sensor harness connector.

With the scan tool, monitor the 1/2 O2 Sensor voltage.

The O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

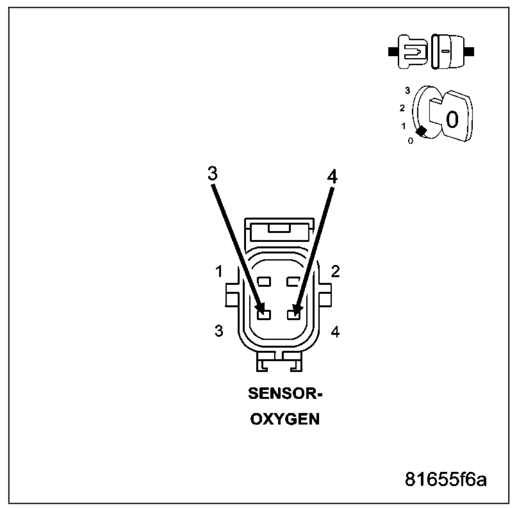
Using a jumper wire, jump the (K141) O2 Sensor 1/2 Signal circuit to the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.

**NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.**

**Did the O2 Sensor volts change from 5.0 volts to 2.5 volts?**

**Yes** >> Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5



## 5. (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT

Remove the jump wire.

Ignition on, engine not running.

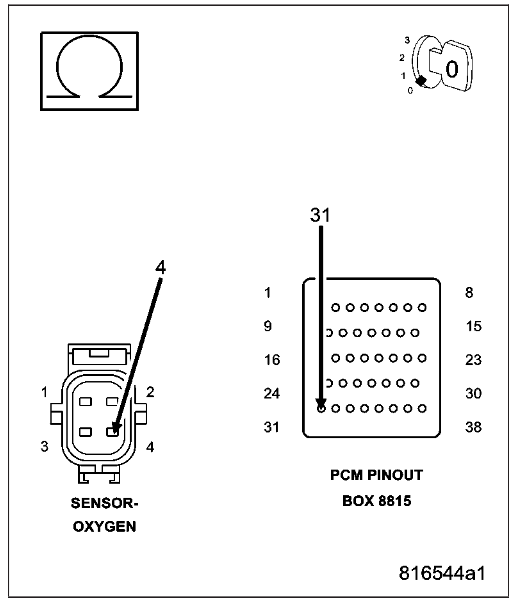
With the scan tool, monitor the 1/2 O2 Sensor voltage.

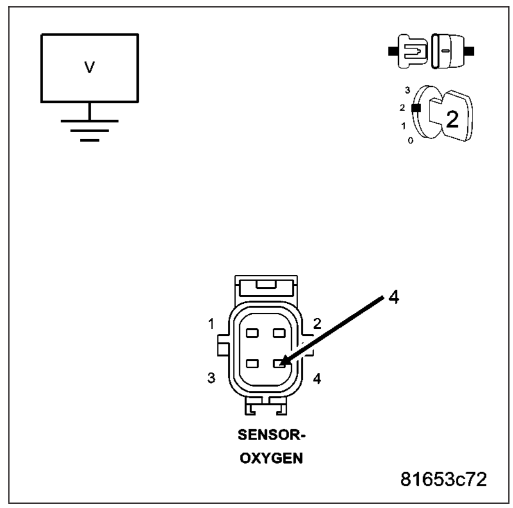
**Is the voltage above 4.8 volts?**

**Yes** >> Go To 6

**No** >> Check the (K141) O2 Sensor 1/2 Signal circuit for an open or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




## 6. (K299) O2 SENSOR 1/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

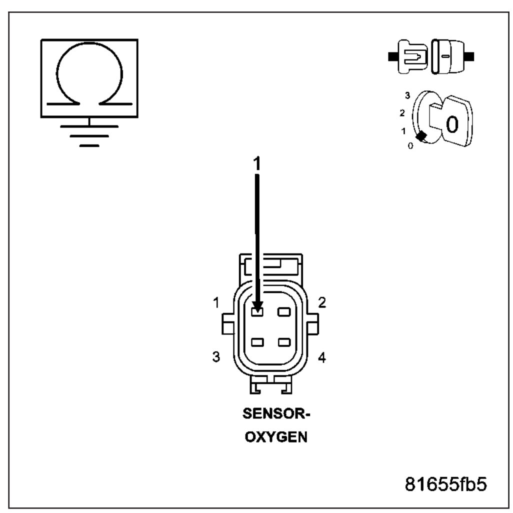
Measure the resistance between ground and the (K299) O2 Sensor 1/2 Heater Control circuit from the O2 Sensor harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short to ground in the (K299) O2 Sensor 1/2 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7



## 7. (K904) O2 DOWNSTREAM RETURN CIRCUIT

Measure the voltage on the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.

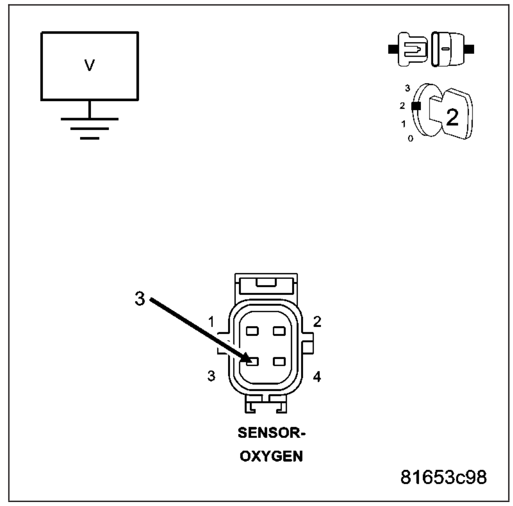
**Is the voltage at 2.5 volts?**

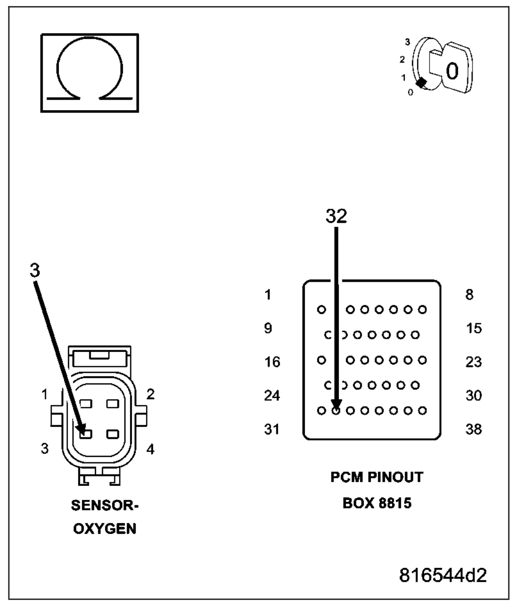
**Yes** >> Check the fuel system for contaminants.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

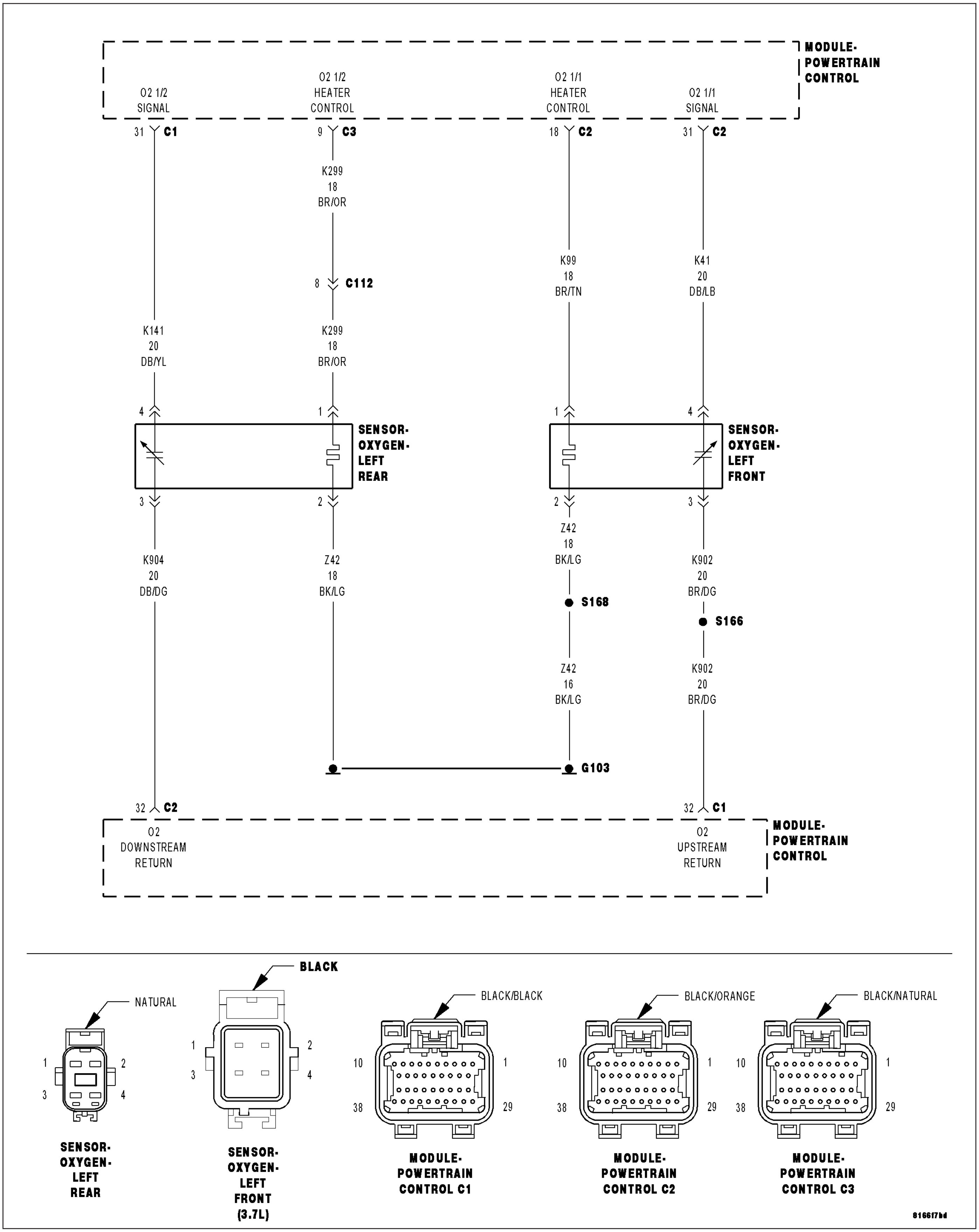
**No** >> Check the (K904) O2 Downstream Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



## P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above (-7°C) 20°F, altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive as well as a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates, and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EXHAUST LEAK |
| ENGINE MECHANICAL PROBLEM |
| 1/2 O2 SENSOR |
| (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT |
| (K299) O2 HEATER 1/2 CONTROL CIRCUIT |
| (K904) O2 DOWNSTREAM RETURN CIRCUIT |
| FUEL CONTAMINATION |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Check the vehicle repair history. If the 1/2 O2 has been replace make sure that the O2 sensor was properly installed and meets OEM specification.**

**NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil, and coolant.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. EXHAUST LEAK

Turn the ignition off.

**WARNING: To avoid personal injury from the exhaust system being hot, allow the exhaust to cool down to a safe temperature before performing a physical inspection. Failure to follow these instructions can result in personal injury or death.**

Visually and Physically inspect the for holes, cracks, and blockage in the exhaust system.

**Is the exhaust system is good condition?**

**Yes** >> Go To 3

**No** >> Repair or Replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems

AIR INDUCTION SYSTEM - must be free from leaks.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. O2 SENSOR

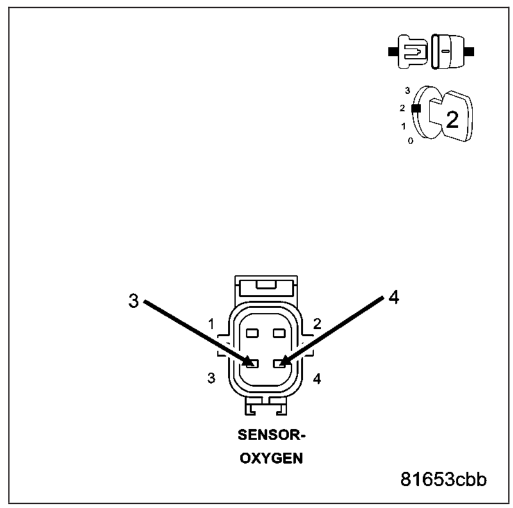
Ignition on, engine not running.

Disconnect the 1/2 O2 Sensor harness connector.

With the scan tool, monitor the 1/2 O2 Sensor voltage.

The O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

Using a jumper wire, jump the (K141) O2 Sensor 1/2 Signal circuit to the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.




**NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.**

**Did the O2 Sensor volts change from 5.0 volts to 2.5 volts?**

**Yes** >> Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT

Remove the jump wire.

Ignition on, engine not running.

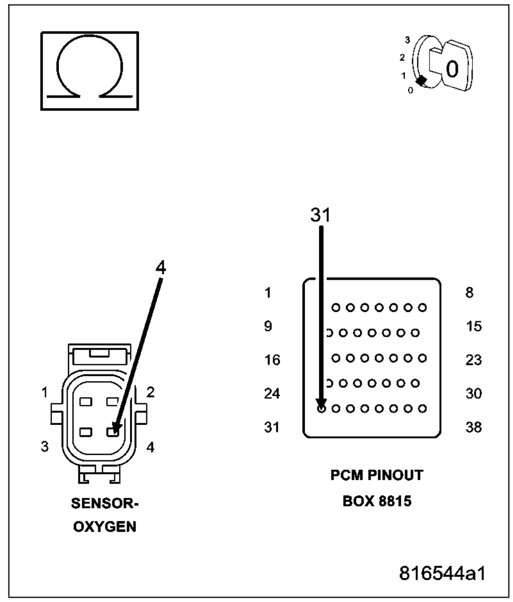
With the scan tool, monitor the 1/2 O2 Sensor voltage.

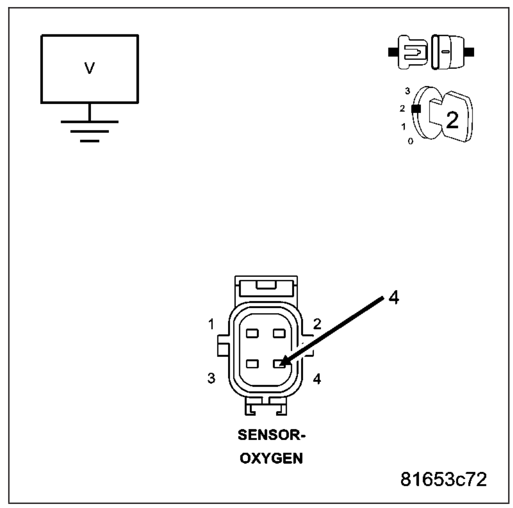
**Is the voltage above 4.8 volts?**

**Yes** >> Go To 6

**No** >> Check the (K141) O2 Sensor 1/2 Signal circuit for an open or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

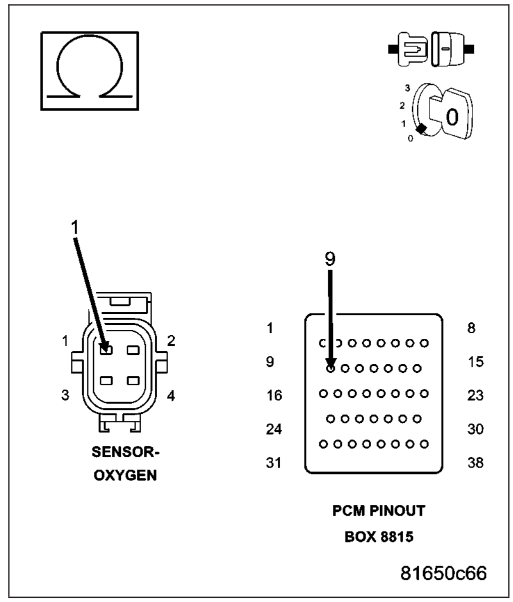


## 6. (K299) O2 SENSOR 1/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (K299) O2 Sensor 1/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

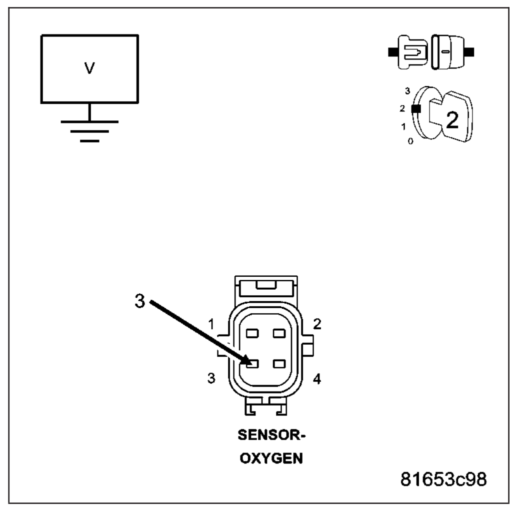
**Yes** >> Go To 7

**No** >> Repair the open in the (K299) O2 Sensor 1/2 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. (K904) O2 DOWN STREAM RETURN CIRCUIT

Measure the voltage on the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.



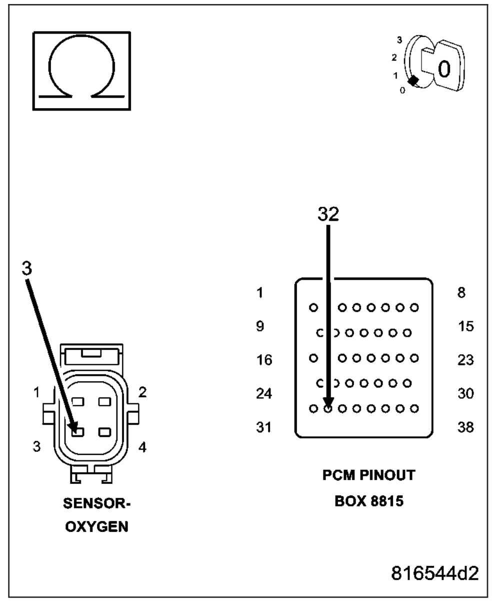

**Is the voltage at 2.5 volts?**

**Yes** >> Check the fuel system for contaminants.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

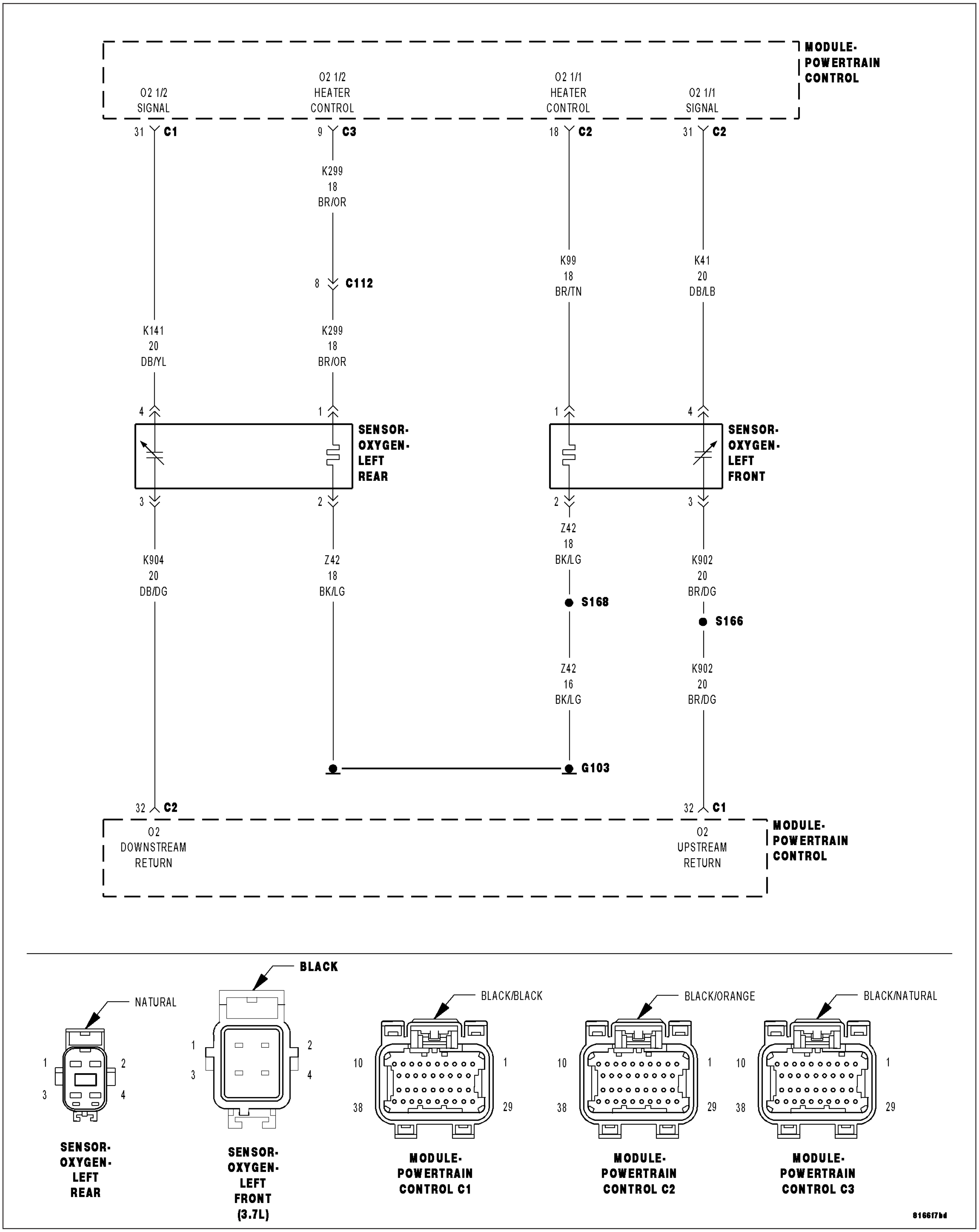
**No** >> Check the (K904) O2 Downstream Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



0
32
3
1
8
9
15
16
23
24
30
31
38
1
2
3
4
PCM PINOUT
BOX 8815
SENSOR-
OXYGEN
816544d2

## P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above (-7°C) 20°F, altitude below 8500 ft and fuel level greater than 15%.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates, and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EXHAUST LEAK |
| ENGINE MECHANICAL PROBLEM |
| 2/2 O2 SENSOR |
| (K243) O2 2/2 SIGNAL CIRCUIT |
| (K399) O2 HEATER 2/2 CONTROL CIRCUIT |
| (K904) O2 DOWNSTREAM RETURN CIRCUIT |
| FUEL CONTAMINATION |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Check the vehicle repair history. If the 2/2 O2 has been replace make sure that the O2 sensor was properly installed and meets OEM specification.**

**NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil, and coolant.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. EXHAUST LEAK

Turn the ignition off.

**WARNING: To avoid personal injury from the exhaust system being hot, allow the exhaust to cool down to a safe temperature before performing a physical inspection. Failure to follow these instructions can result in personal injury or death.**

Visually and Physically inspect the for holes, cracks, and blockage in the exhaust system.

**Is the exhaust system is good condition?**

**Yes** >> Go To 3

**No** >> Repair or Replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. O2 SENSOR

Ignition on, engine not running.

Disconnect the 2/2 O2 Sensor harness connector.

With the scan tool, monitor the 2/2 O2 Sensor voltage.

The O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

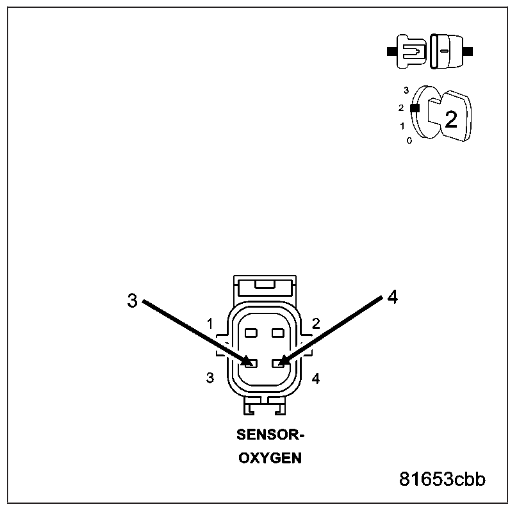
Using a jumper wire, jump the (K243) O2 Sensor 2/2 Signal circuit to the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.

**NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.**

**Did the O2 Sensor volts change from 5.0 volts to 2.5 volts?**

**Yes** >> Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

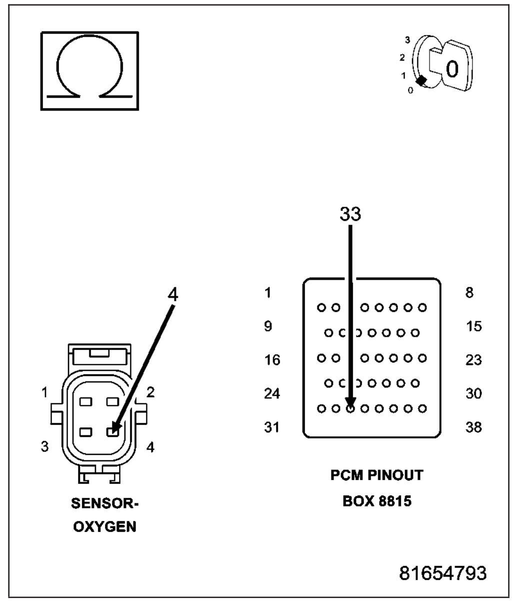


## 5. (K243) O2 SENSOR 2/2 SIGNAL CIRCUIT

Remove the jump wire.

Ignition on, engine not running.

With the scan tool, monitor the O2 Sensor voltage.

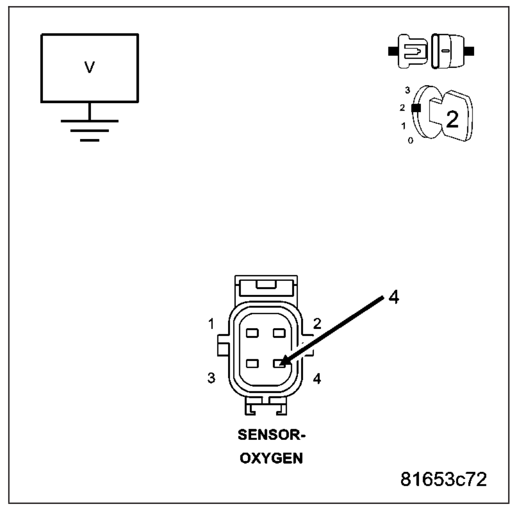



**Is the voltage above 4.8 volts?**

**Yes** >> Go To 6

**No** >> Check the (K243) O2 Sensor 2/2 Signal circuit for a open or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

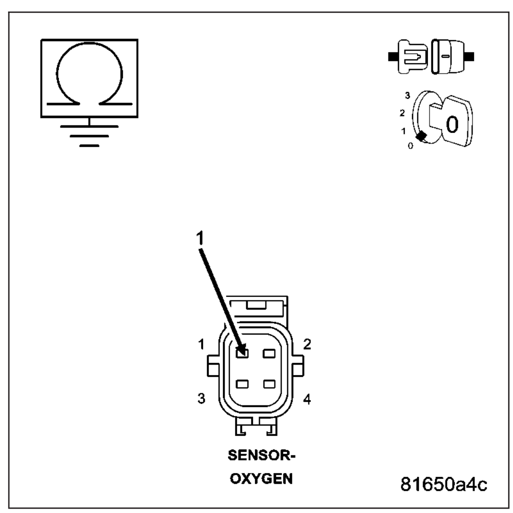
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)




## 6. (K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (K399) O2 Sensor 2/2 Heater Control circuit in the O2 Sensor harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short to ground in the (K399) O2 Sensor 2/2 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. (K904) O2 DOWNSTREAM RETURN CIRCUIT

Measure the voltage on the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.

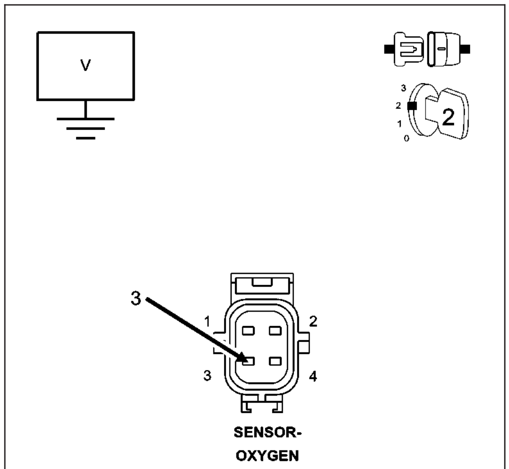
**Is the voltage at 2.5 volts?**

**Yes** >> Check the fuel system for contaminants.

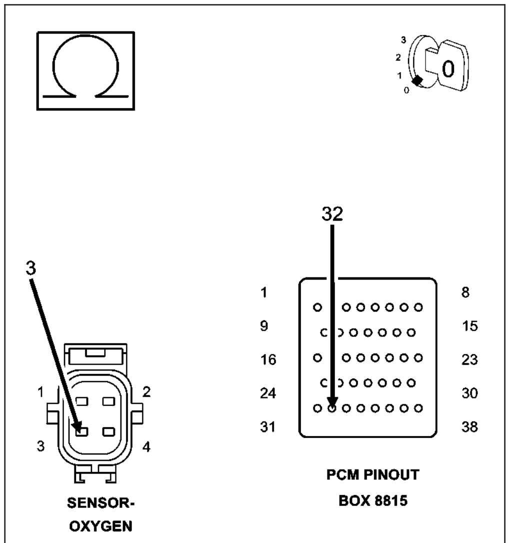
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Check the (K904) O2 Downstream Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

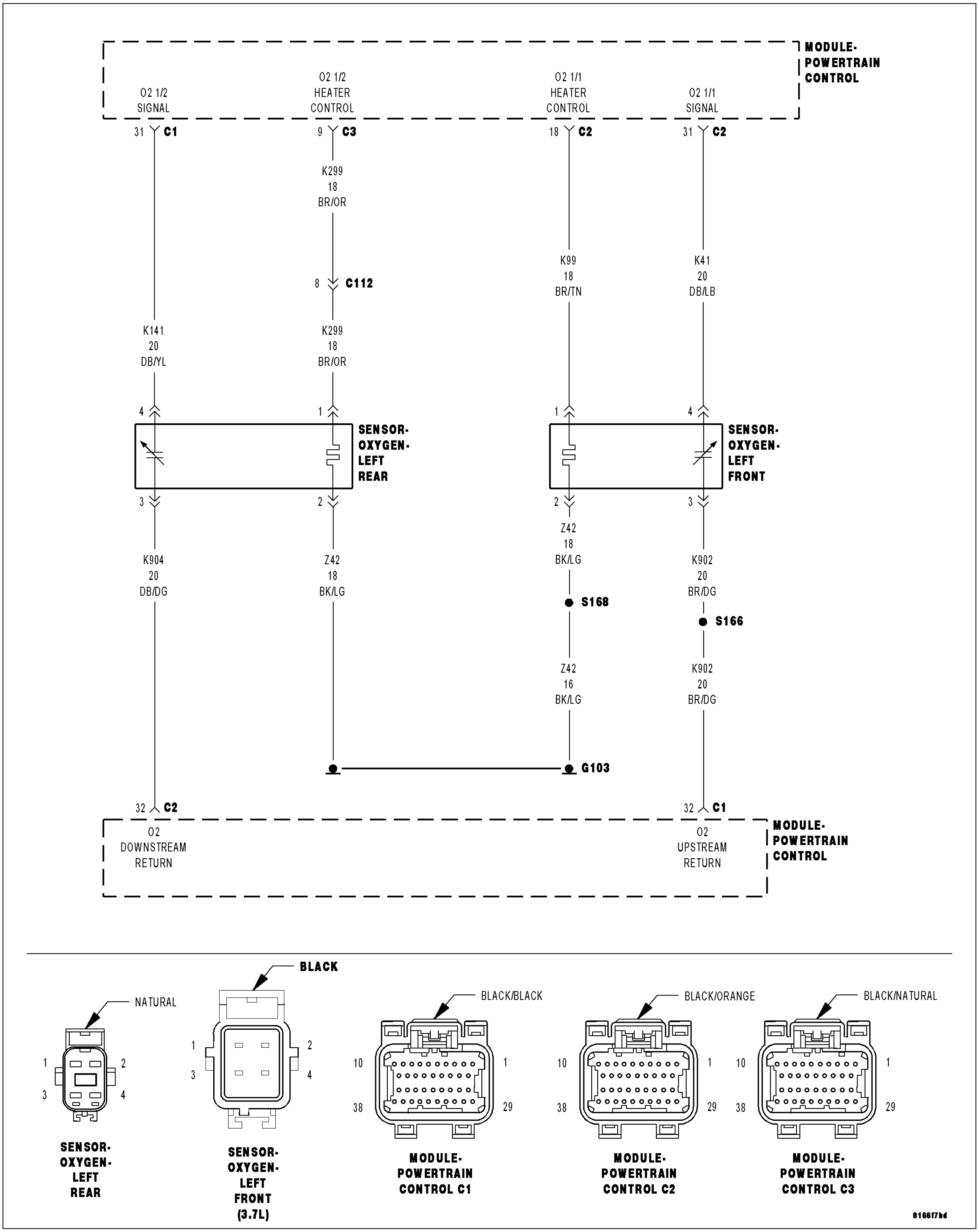


81653c98



816544d2

## P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above (-7°C) 20°F, altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive as well as a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
| --- |
| EXHAUST LEAK |
| ENGINE MECHANICAL PROBLEM |
| 2/2 O2 SENSOR |
| (K342) O2 SENSOR 2/2 SIGNAL CIRCUIT |
| (K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT |
| (K904) O2 DOWNSTREAM RETURN CIRCUIT |
| FUEL CONTAMINATION |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Check the vehicle repair history. If the 2/2 O2 has been replace make sure that the O2 sensor was properly installed and meets OEM specification.**

**NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.**

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. EXHAUST LEAK

Turn the ignition off.

**WARNING: To avoid personal injury from the exhaust system being hot, allow the exhaust to cool down to a safe temperature before performing a physical inspection. Failure to follow these instructions can result in personal injury or death.**

Visually and Physically inspect the for holes, cracks and blockage in the exhaust system.

**Is the exhaust system is good condition?**

**Yes** >> Go To 3

**No** >> Repair or Replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. O2 SENSOR

Ignition on, engine not running.

Disconnect the 2/2 O2 Sensor harness connector.

With the scan tool, monitor the 2/2 O2 Sensor voltage.

The O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

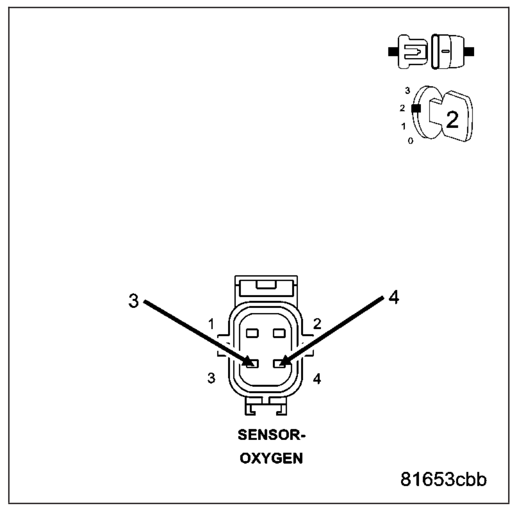
Using a jumper wire, jump the (K243) O2 Signal 2/2 circuit to the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.

**NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.**

**Did the O2 Sensor volts change from 5.0 volts to 2.5 volts?**

**Yes** >> Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5



## 5. (K243) O2 SENSOR 2/2 SIGNAL CIRCUIT

Remove the jump wire.

Ignition on, engine not running.

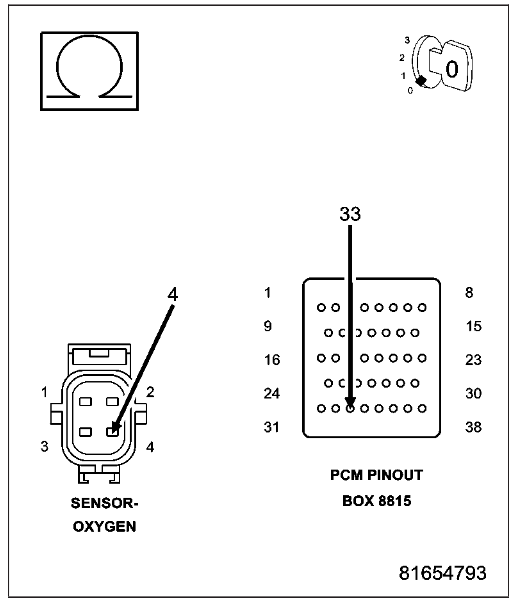
With the scan tool, monitor the 2/2 O2 Sensor voltage.

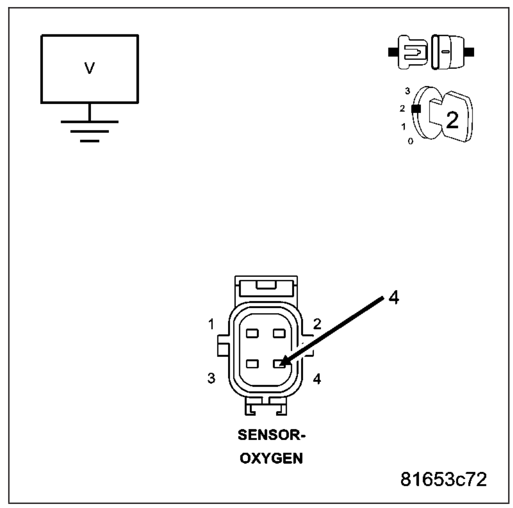
**Is the voltage above 4.8 volts?**

**Yes** >> Check the (K243) O2 Sensor 2/2 Signal circuit for an open or short to battery voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

**No** >> Go To 6

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



## 6. (K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

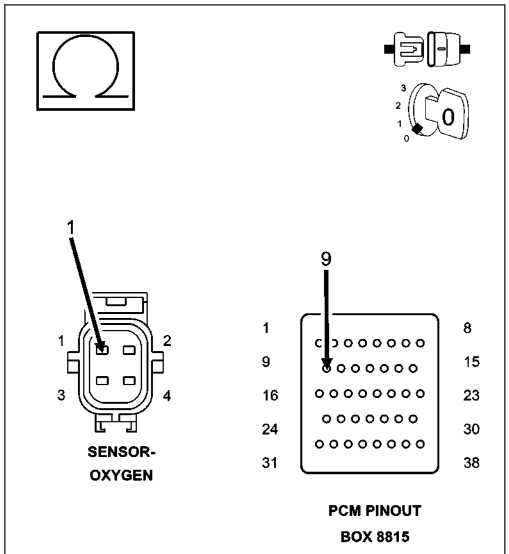
Measure the resistance of the (K399) O2 Sensor 2/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Repair the open in the (K399) O2 Sensor 2/2 Heater Control circuit.



81650c82

## 7. (K904) O2 DOWNSTREAM RETURN CIRCUIT

Measure the voltage on the (K904) O2 Downstream Return circuit in the O2 Sensor harness connector.

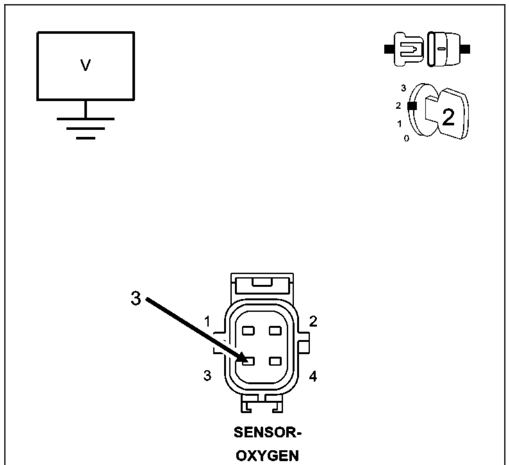
**Is the voltage at 2.5 volts?**

**Yes** >> Check the fuel system for contaminants.

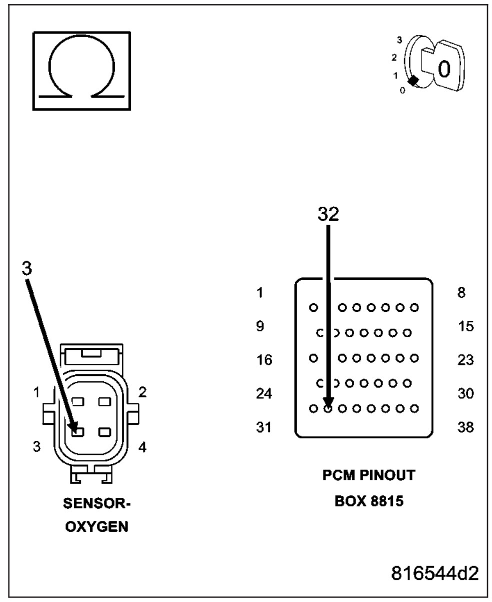
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Check the (K904) O2 Downstream Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



81653c98


32
3
1
8
9
15
16
23
24
30
31
38
1
2
3
4
SENSOR-
OXYGEN
PCM PINOUT
BOX 8815
816544d2

## P2181-COOLING SYSTEM PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on, Engine running, and no ECT DTCs present.
- **Set Condition:**
  PCM recognizes that the ECT has failed its self coherence test. The coolant temp should only change at a certain rate, if this rate is too slow or too fast this fault will set. Two trip fault. Three good trips to clear MIL.

| Possible Causes |
|---|
| LOW COOLANT LEVEL |
| (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE |
| (K2) ECT SIGNAL CIRCUIT OPEN |
| (K900) SENSOR GROUND CIRCUIT OPEN |
| (K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND |
| (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT |
| THERMOSTAT |
| ECT SENSOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

### Diagnostic Test

#### 1. ACTIVE DTC

Ignition on, engine not running.

**NOTE: If this code sets during extreme ambient temperatures, improper installation of a block heater could be the cause of this DTC.**

With a scan tool, read DTCs.

Diagnose all other ECT and Cooling System codes before continuing.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

#### 2. LOW COOLANT LEVEL

**NOTE: If a Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.**

**NOTE: Inspect the ECT terminals and related PCM terminals. Ensure the terminals are free from corrosion and damage.**

**NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.**

**NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.**

**NOTE: Need to make sure that that no Cooling System DTCs are set or changes that would make the warm up much slower or much faster: broken water pump can set this, addition of aftermarket auxiliary cooler can set this DTC.**

**WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Failure to follow these instructions can result in personal injury or death. Allow the engine to cool before opening the cooling system.**

Inspect the coolant system for proper level and condition.

**Is the coolant level and condition OK?**

**Yes** >> Go To 3

**No** >> Inspect the vehicle for a coolant leak and add the necessary amount of coolant.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. THERMOSTAT

**NOTE: This test works best if performed on a cold engine (cold soak).**

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

**NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.**

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

**NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the Eng Coolant Tmp Deg on the scan tool should stay relatively close to each other.**

Using the appropriate service information, determine the proper opening temperature of the thermostat.

**Did the thermostat open at the proper temperature?**

**Yes** >> Go To 4

**No** >> Replace the thermostat.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. ECT SENSOR

Connect a jumper between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.

Turn the ignition off.

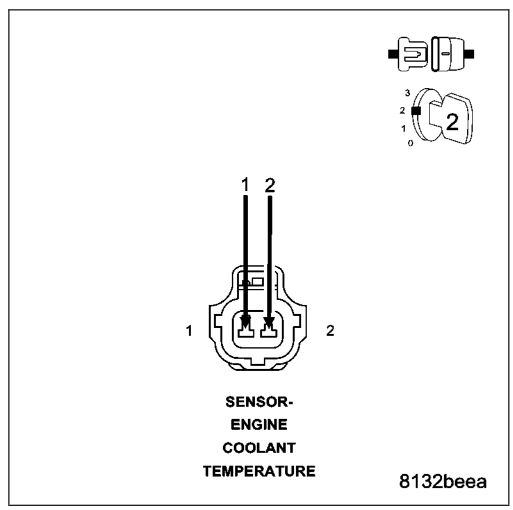
Disconnect the ECT Sensor harness connector.

With a scan tool, read the ECT voltage.

**Is the voltage below 1.0 volt?**

**Yes** >> Replace the ECT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5



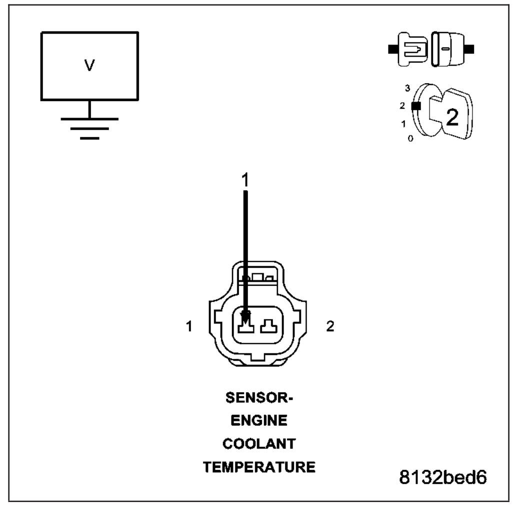
## 5. (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.




**Is the voltage above 5.2 volts?**

**Yes** >> Repair the short to battery voltage in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

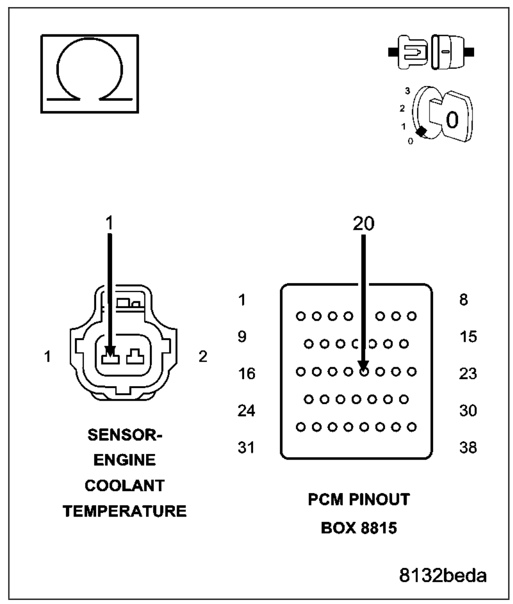
**No** >> Go To 6

## 6. (K2) ECT SIGNAL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K2) ECT Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

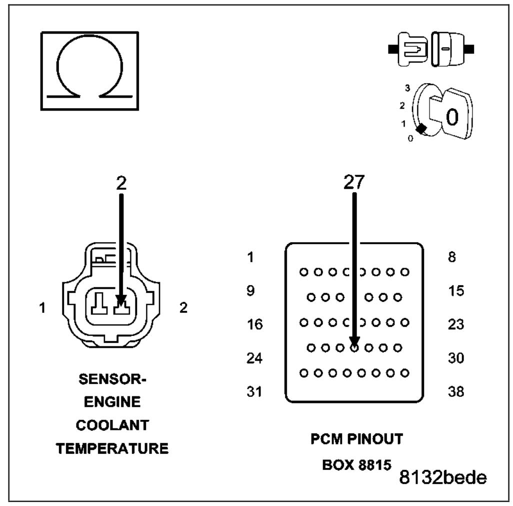
## 7. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 8

**No** >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



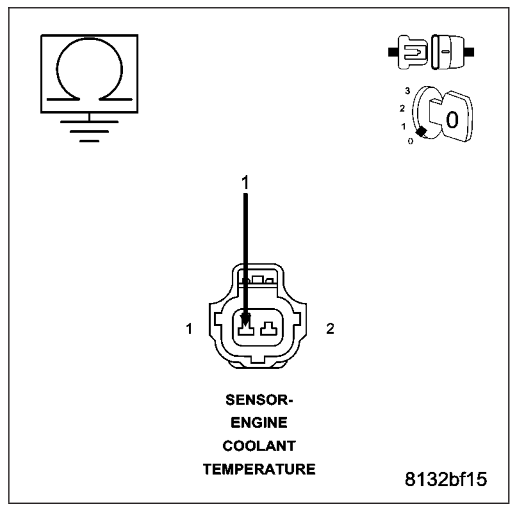

## 8. (K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9



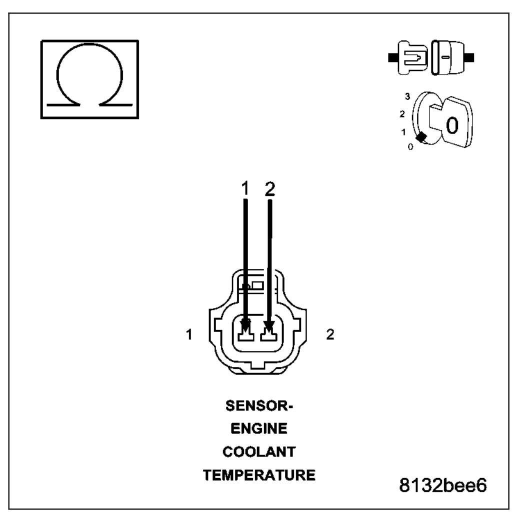

## 9. (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the short between the (K900) Sensor ground and the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 10



## 10. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

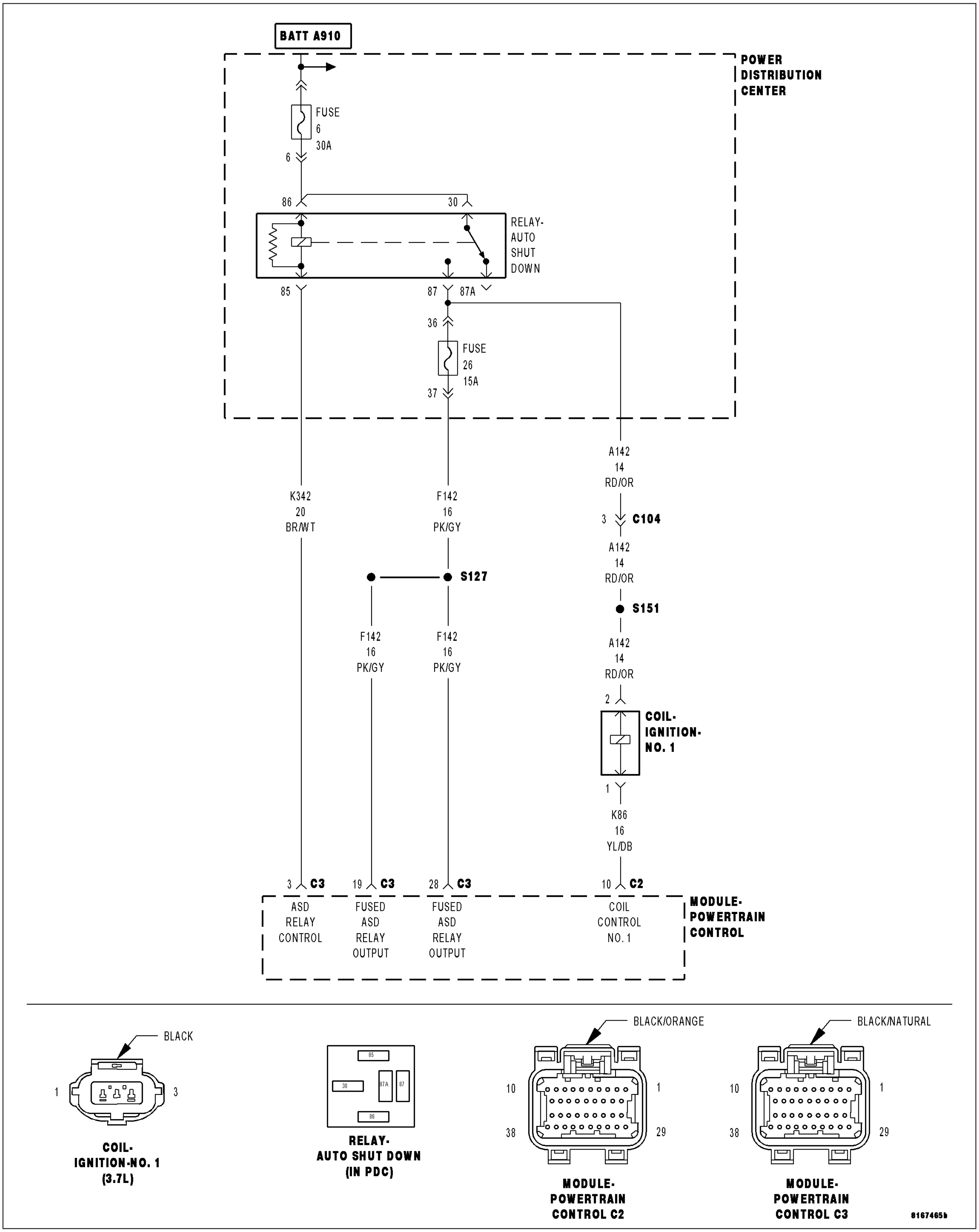
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P2302-IGNITION COIL 1 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (A142) ASD RELAY OUTPUT CIRCUIT |
| (K86) COIL CONTROL NO.1 CIRCUIT OPEN |
| (K86) COIL CONTROL NO.1 CIRCUIT SHORTED TO GROUND |
| COIL ON PLUG |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (A142) ASD RELAY OUTPUT CIRCUIT

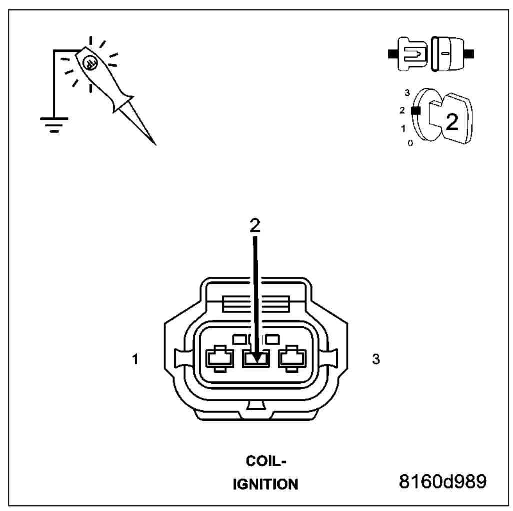
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Coil on Plug harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the open or short to ground in the (A142) ASD Relay Output circuit between the PDC and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Stop All Actuations.**

## 3. COIL ON PLUG RESISTANCE

Turn the ignition off.

**NOTE: The following resistance measurement should be taken at 70°-80° F.**

Measure the resistance of the Coil on Plug.

3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

**Is the resistance within the given specification for the Ignition Coil being tested?**

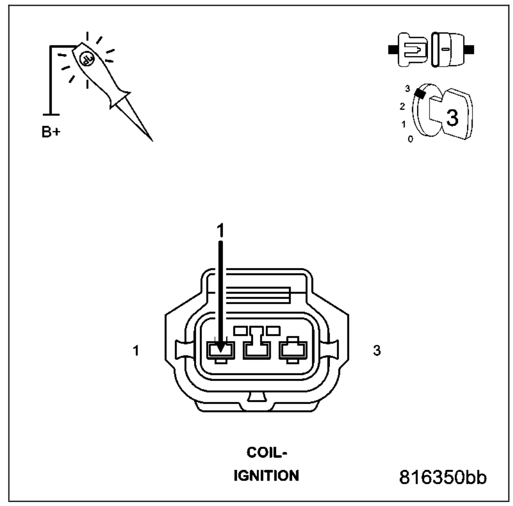
**Yes** >> Go To 4

**No** >> Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K86) Coil Control No.1 circuit.

Crank the engine for 5 seconds while observing the test light.




**What is the condition of the test light while cranking the engine?**

**Brightly blinking.**
Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**ON constantly.**
Go To 5

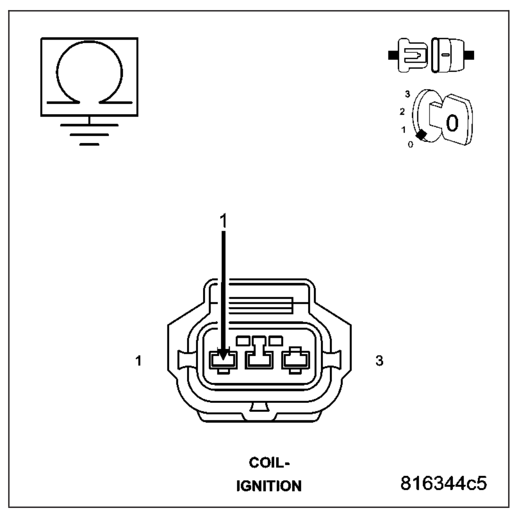
**OFF constantly.**
Go To 6

## 5. (K86) COIL CONTROL NO.1 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K86) Coil Control No.1 circuit in the Coil on Plug harness connector.

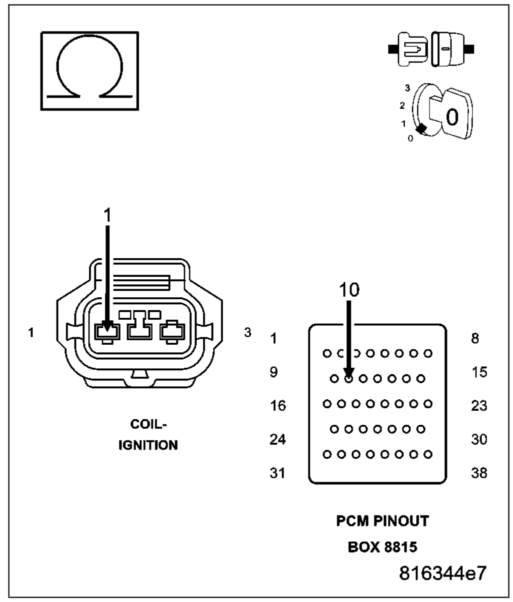



**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K86) Coil Control No.1 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 6. (K86) COIL CONTROL NO.1 CIRCUIT OPEN




Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K86) Coil Control No.1 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K86) Coil Control No.1 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

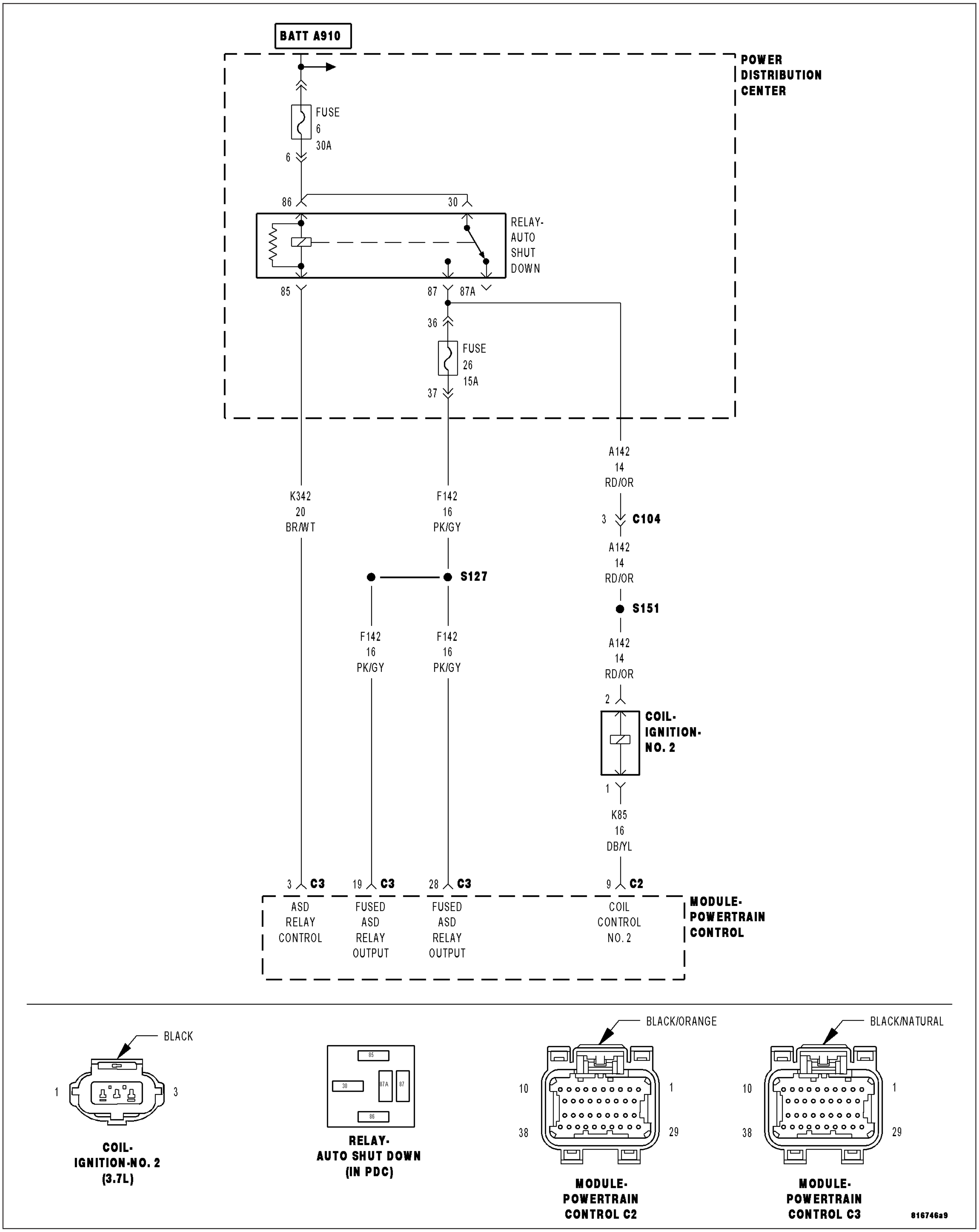
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P2305-IGNITION COIL 2 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (A142) ASD RELAY OUTPUT CIRCUIT |
| (K85) COIL CONTROL NO.2 CIRCUIT OPEN |
| (K85) COIL CONTROL NO.2 CIRCUIT SHORTED TO GROUND |
| COIL ON PLUG |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (A142) ASD RELAY OUTPUT CIRCUIT

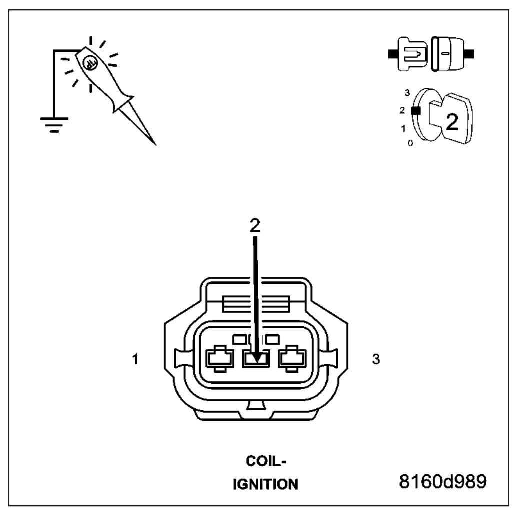
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Coil on Plug harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the open or short to ground in the (A142) ASD Relay Output circuit between the PDC and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Stop All Actuations.**

## 3. COIL ON PLUG RESISTANCE

Turn the ignition off.

**NOTE: The following resistance measurement should be taken at 70°-80° F.**

Measure the resistance of the Coil on Plug.

3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

**Is the resistance within the given specification for the Ignition Coil being tested?**

**Yes** >> Go To 4

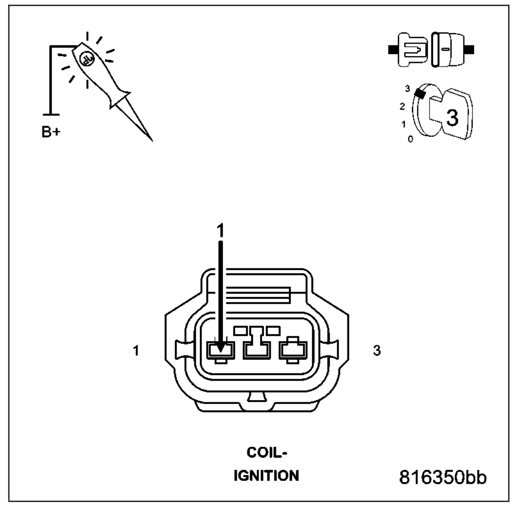
**No** >> Replace the Coil on plug.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K85) Coil Control No.2 circuit.

Crank the engine for 5 seconds while observing the test light.




**What is the state of the test light while cranking the engine?**

**Brightly blinking.**

Replace the Coil on plug.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**ON constantly.**

Go To 5

**OFF constantly.**

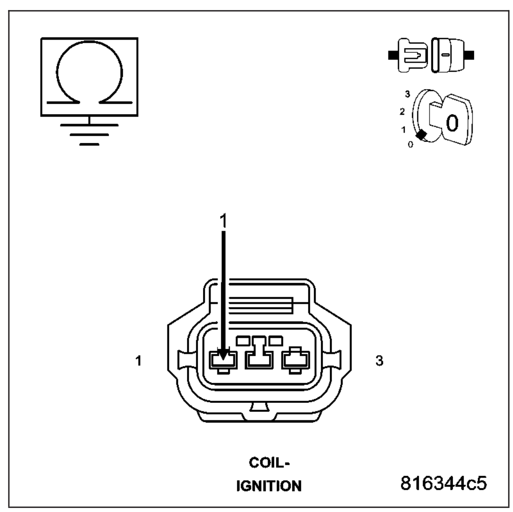
Go To 6

## 5. (K85) COIL CONTROL NO.2 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K85) Coil Control No.2 circuit in the Coil on Plug harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K85) Coil Control No.2 circuit.

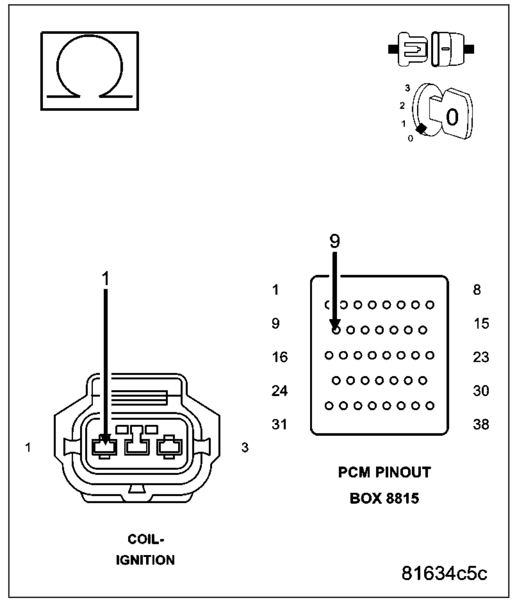
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 6. (K85) COIL CONTROL NO.2 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.




**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K85) Coil Control No.2 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K85) Coil Control No.2 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

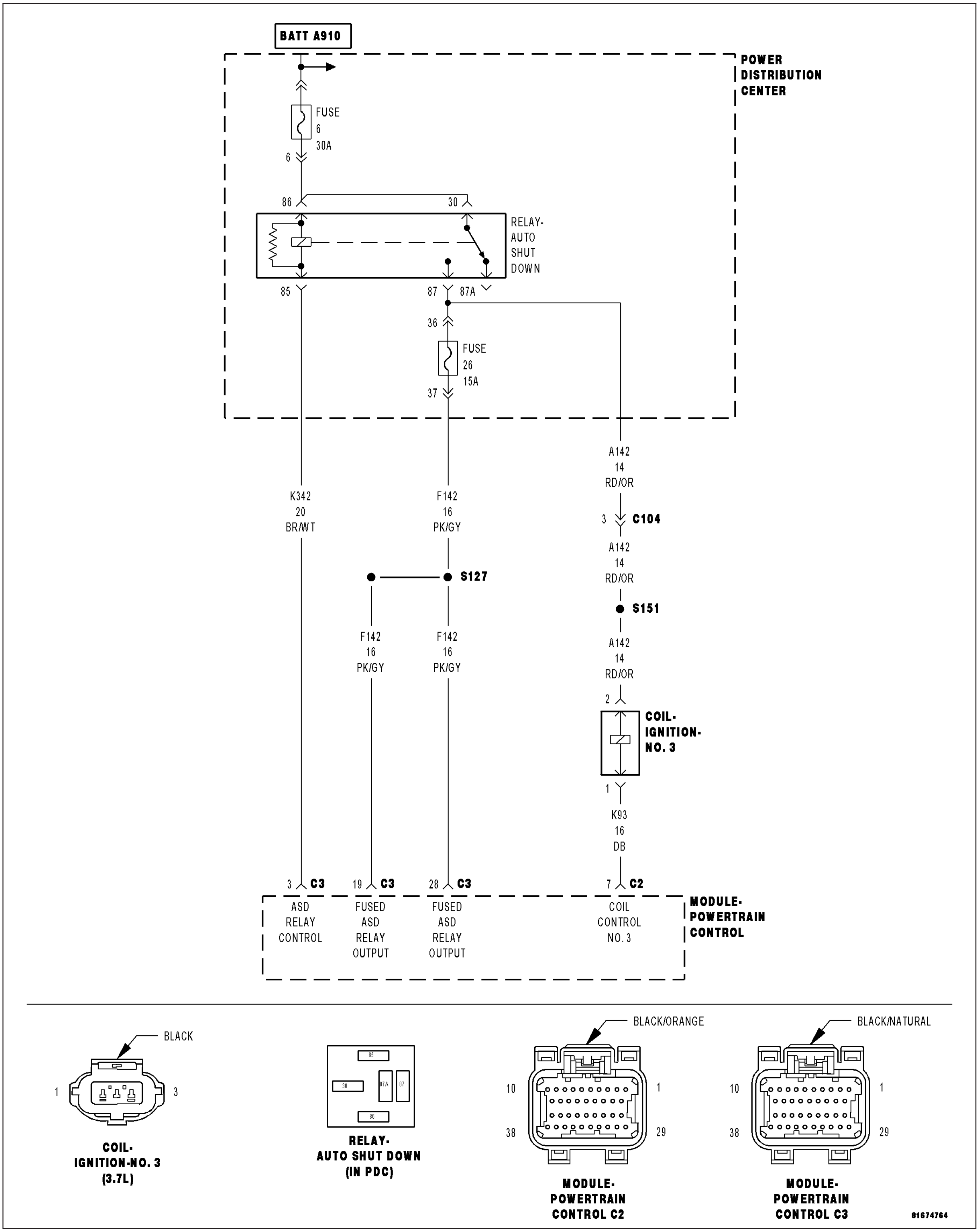
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P2308-IGNITION COIL 3 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (A142) ASD RELAY OUTPUT CIRCUIT |
| (K93) COIL CONTROL NO.3 CIRCUIT OPEN |
| (K93) COIL CONTROL NO.3 CIRCUIT SHORTED TO GROUND |
| COIL ON PLUG |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (A142) ASD RELAY OUTPUT CIRCUIT

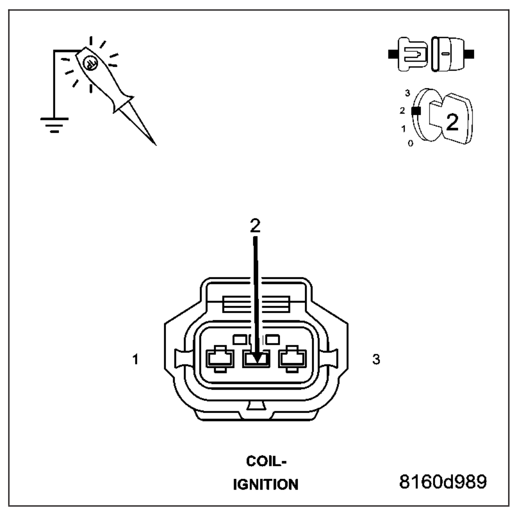
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Coil on Plug harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the open or short to ground in the (A142) ASD Relay Output circuit between the PDC and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Stop All Actuations.**

## 3. COIL ON PLUG RESISTANCE

Turn the ignition off.

**NOTE: The following resistance measurement should be taken at 70°-80° F.**

Measure the resistance of the Coil on Plug.

3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

**Is the resistance within the given specification for the Ignition Coil being tested?**

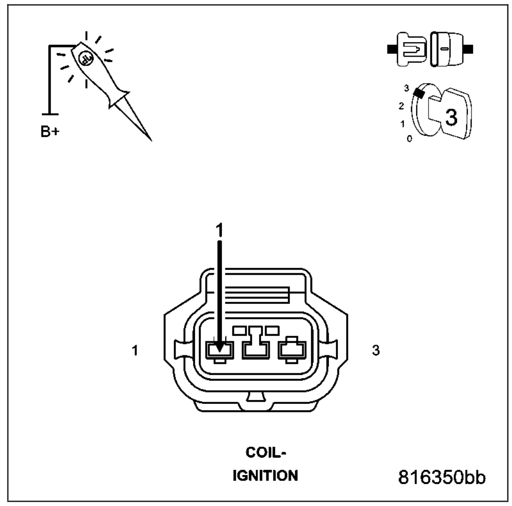
**Yes** >> Go To 4

**No** >> Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K93) Coil Control No.3 circuit.

Crank the engine for 5 seconds while observing the test light.




**What is the state of the test light while cranking the engine?**

**Brightly blinking.**
Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**ON constantly.**
Go To 5

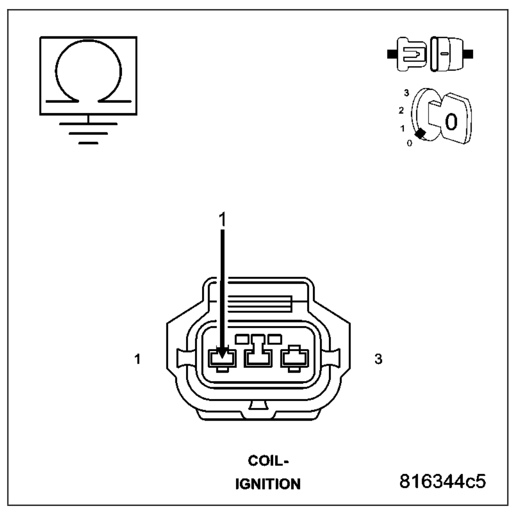
**OFF constantly.**
Go To 6

## 5. (K93) COIL CONTROL NO.3 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K93) Coil Control No.3 circuit in the Coil on Plug harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K93) Coil Control No.3 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

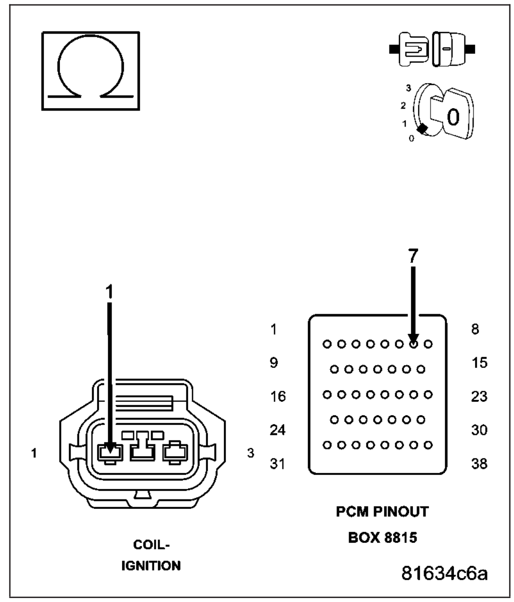
## 6. (K93) COIL CONTROL NO.3 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K93) Coil Control No.3 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K93) Coil Control No.3 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

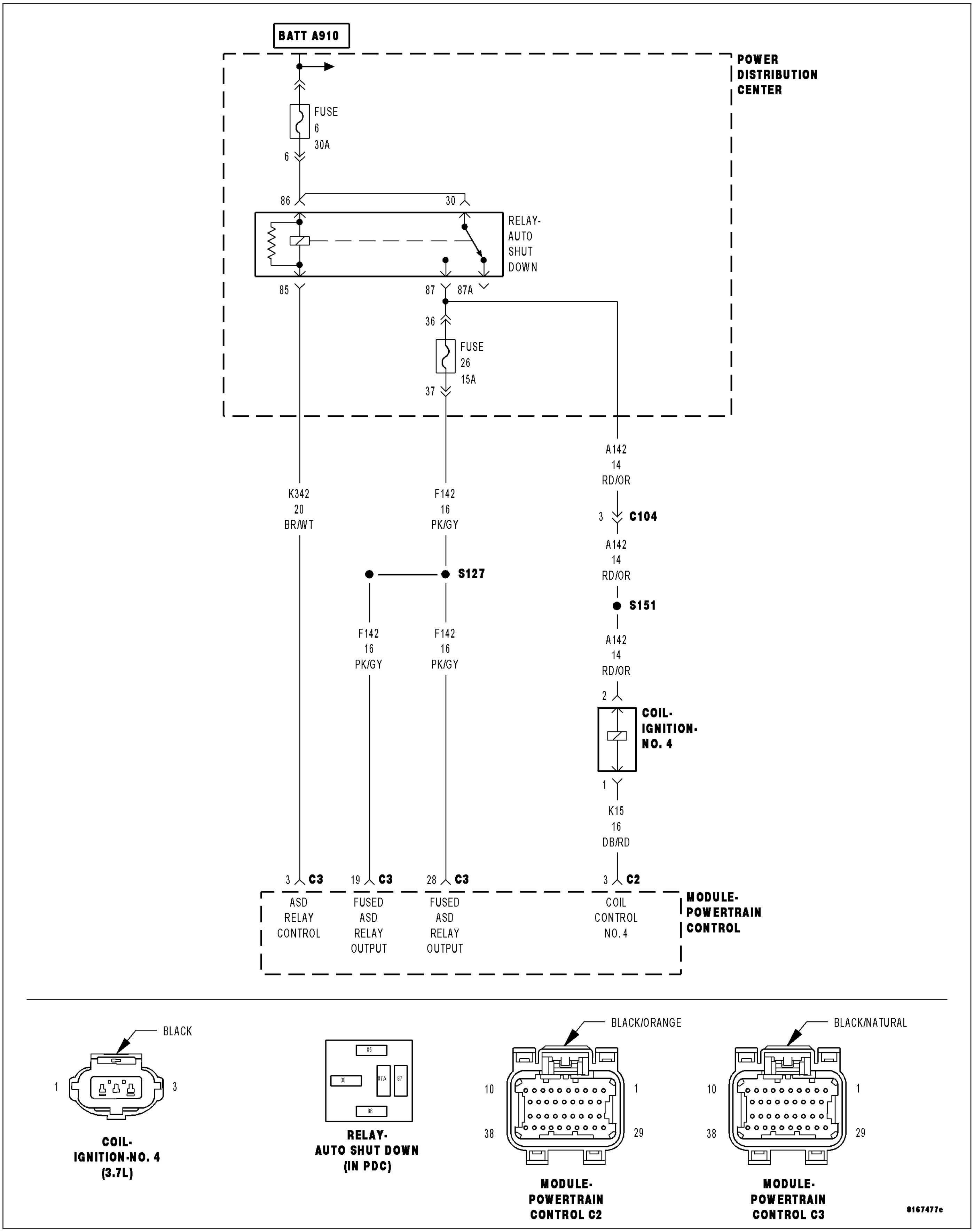
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P2311-IGNITION COIL 4 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (A142) ASD RELAY OUTPUT CIRCUIT |
| (K15) COIL CONTROL NO.4 CIRCUIT OPEN |
| (K15) COIL CONTROL NO.4 CIRCUIT SHORTED TO GROUND |
| COIL ON PLUG |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (A142) ASD RELAY OUTPUT CIRCUIT

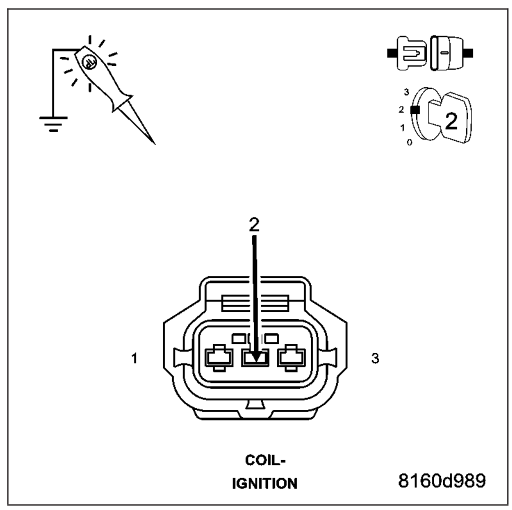
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Coil on Plug harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the open or short to ground in the (A142) ASD Relay Output circuit between the PDC and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Stop All Actuations.**

## 3. COIL ON PLUG RESISTANCE

Turn the ignition off.

**NOTE: The following resistance measurement should be taken at 70°-80° F.**

Measure the resistance of the Coil on Plug.

3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

**Is the resistance within the given specification for the Ignition Coil being tested?**

**Yes** >> Go To 4

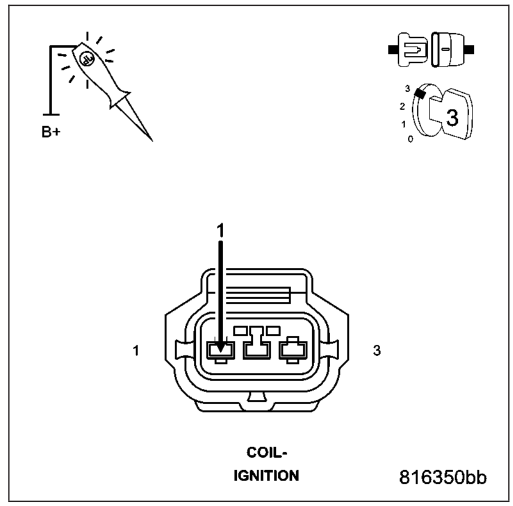
**No** >> Replace the Coil on plug.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K15) Coil Control No.4 circuit.

Crank the engine for 5 seconds while observing the test light.




**What is the state of the test light while cranking the engine?**

**Brightly blinking.**

Replace the Coil on plug.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**ON constantly.**

Go To 5

**OFF constantly.**

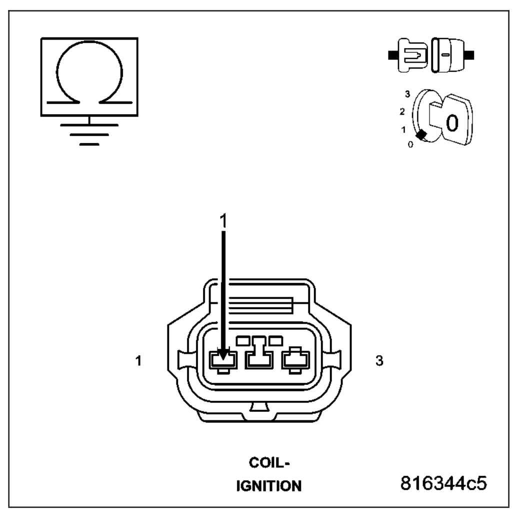
Go To 6

## 5. (K15) COIL CONTROL NO.4 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K15) Coil Control No.4 circuit in the Coil on Plug harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K15) Coil Control No.4 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

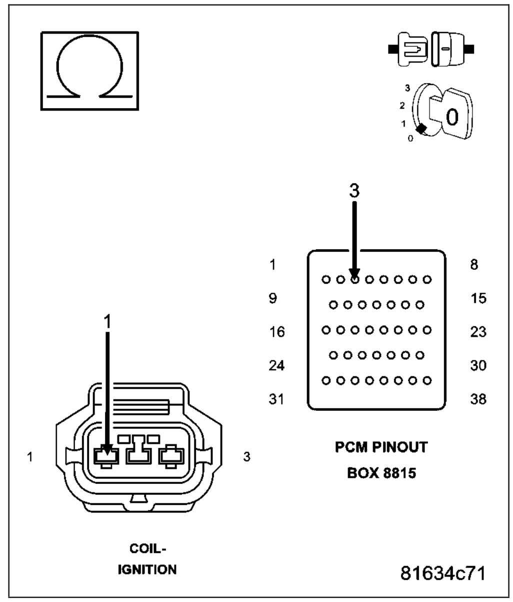
## 6. (K15) COIL CONTROL NO.4 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K15) Coil Control No.4 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K15) Coil Control No.4 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

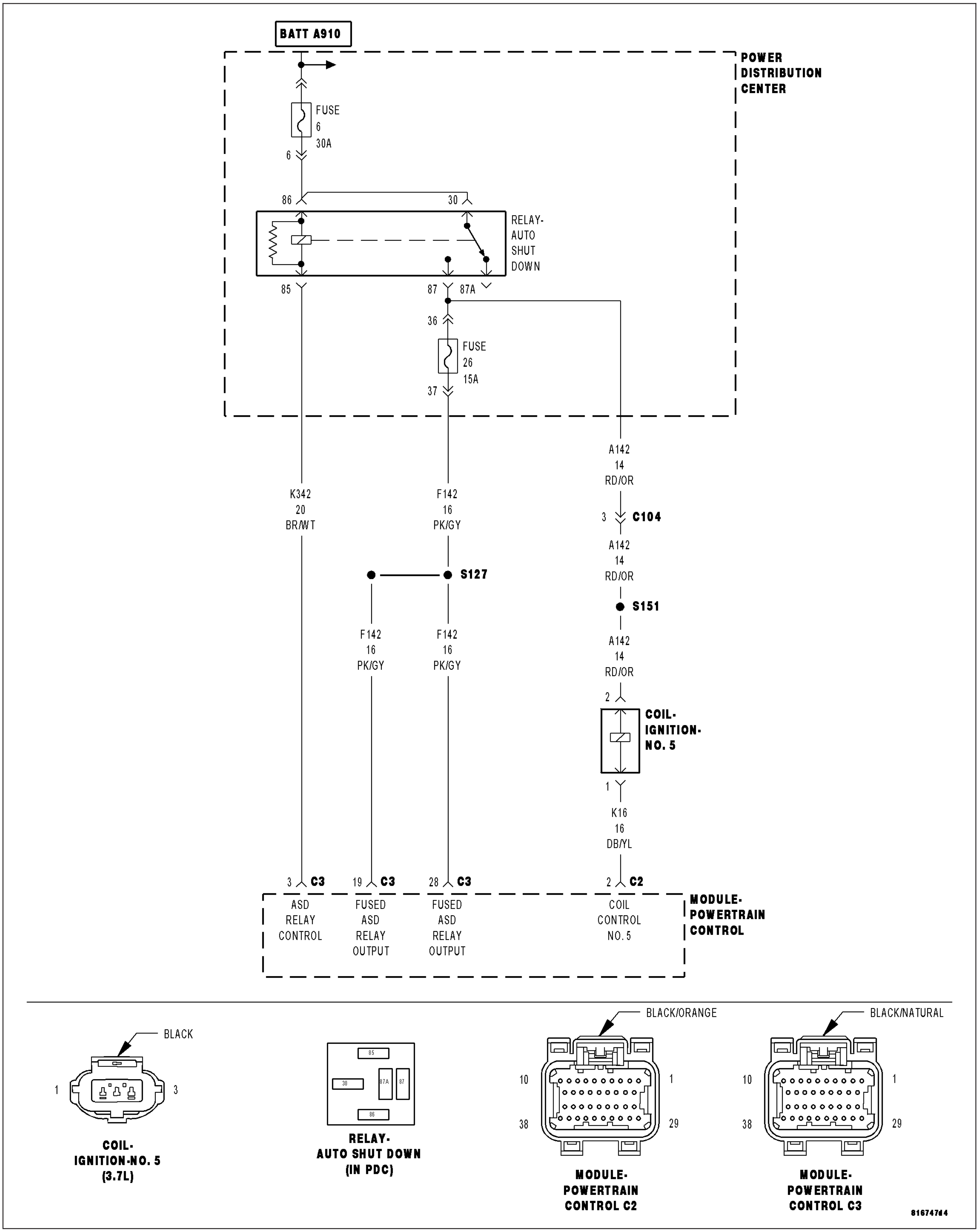
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P2314-IGNITION COIL 5 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (A142) ASD RELAY OUTPUT CIRCUIT |
| (K16) COIL CONTROL NO.5 CIRCUIT OPEN |
| (K16) COIL CONTROL NO.5 CIRCUIT SHORTED TO GROUND |
| COIL ON PLUG |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (A142) ASD RELAY OUTPUT CIRCUIT

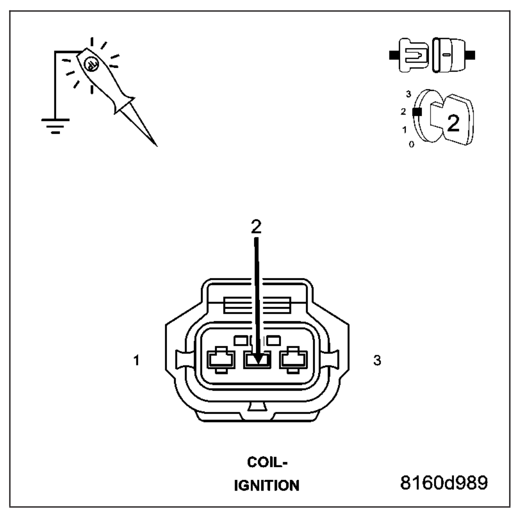
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Coil on Plug harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the open or short to ground in the (A142) ASD Relay Output circuit between the PDC and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Stop All Actuations.**

## 3. COIL ON PLUG RESISTANCE

Turn the ignition off.

**NOTE: The following resistance measurement should be taken at 70°-80° F.**

Measure the resistance of the Coil on Plug.

3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

**Is the resistance within the given specification for the Ignition Coil being tested?**

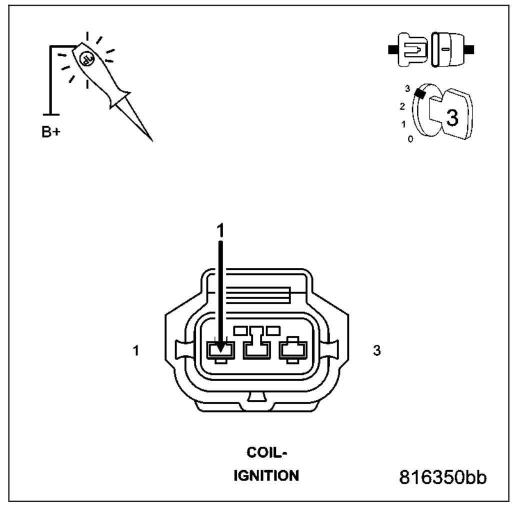
**Yes** >> Go To 4

**No** >> Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K16) Coil Control No.5 circuit.

Crank the engine for 5 seconds while observing the test light.




**What is the state of the test light while cranking the engine?**

**Brightly blinking.**
Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**ON constantly.**
Go To 5

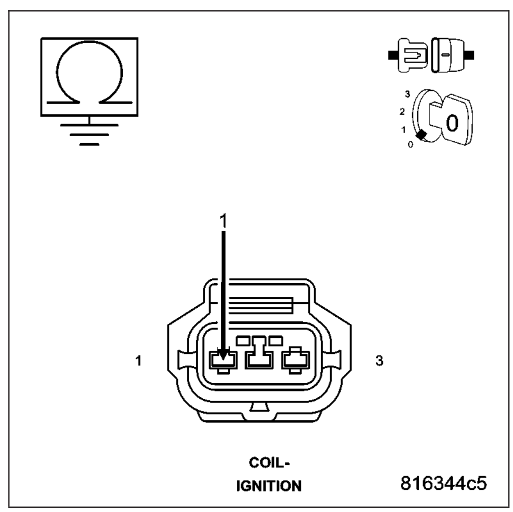
**OFF constantly.**
Go To 6

## 5. (K16) COIL CONTROL NO.5 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K16) Coil Control No.5 circuit in the Coil on Plug harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K16) Coil Control No.5 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

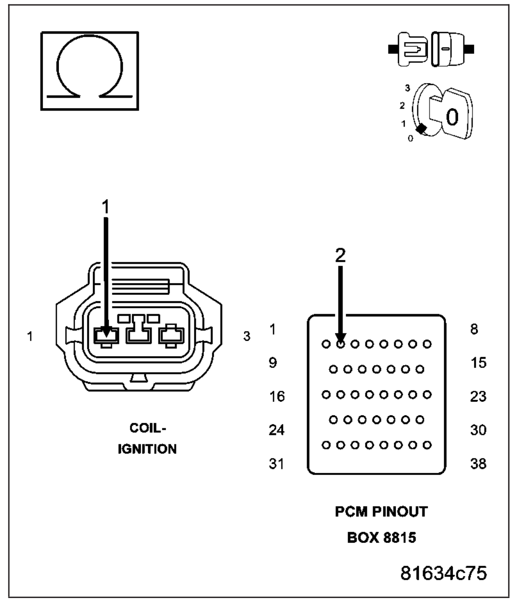
## 6. (K16) COIL CONTROL NO.5 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K16) Coil Control No.5 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K16) Coil Control No.5 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

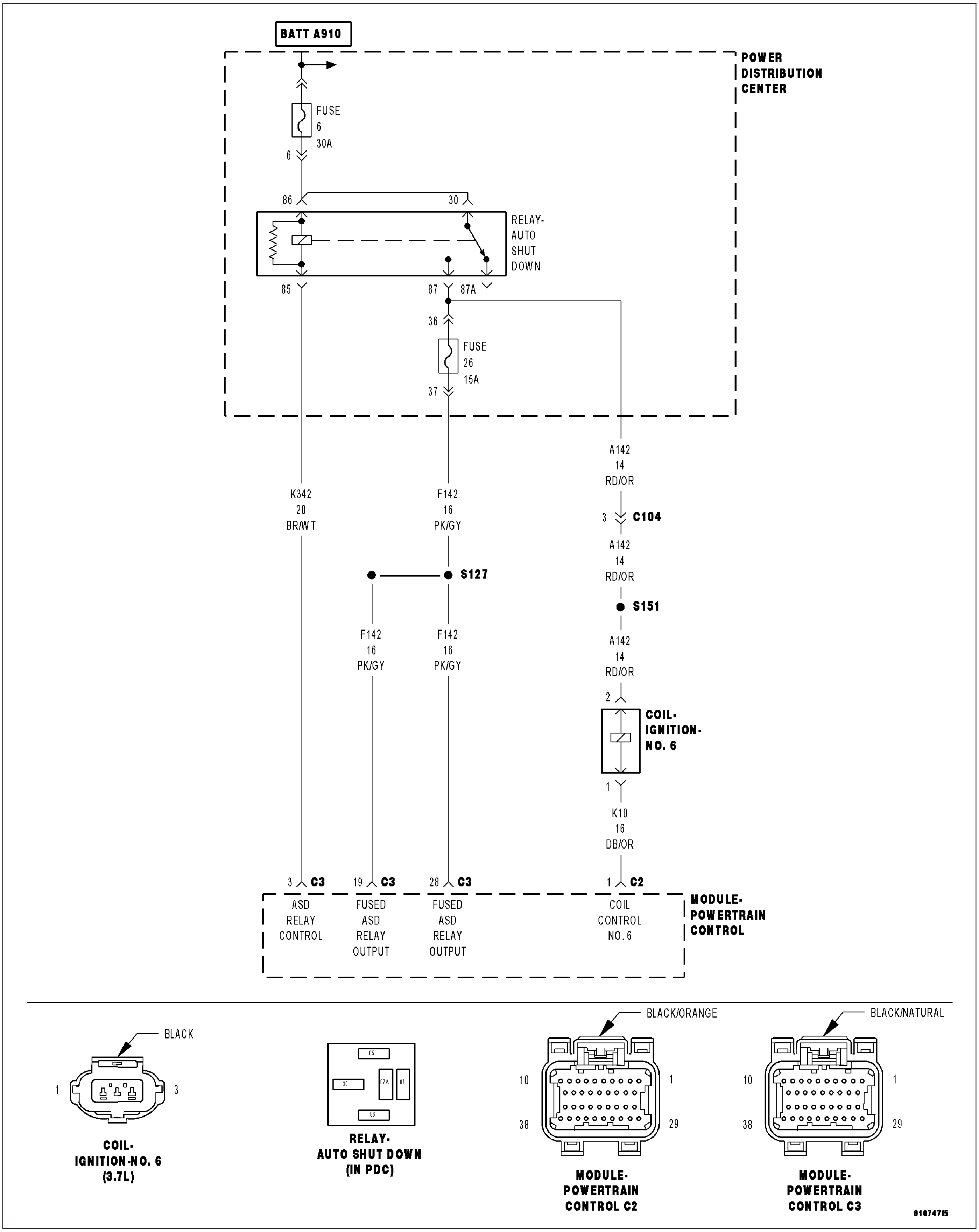
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P2317-IGNITION COIL 6 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| (A142) ASD RELAY OUTPUT CIRCUIT |
| (K10) COIL CONTROL NO.6 CIRCUIT OPEN |
| (K10) COIL CONTROL NO.6 CIRCUIT SHORTED TO GROUND |
| COIL ON PLUG |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (A142) ASD RELAY OUTPUT CIRCUIT

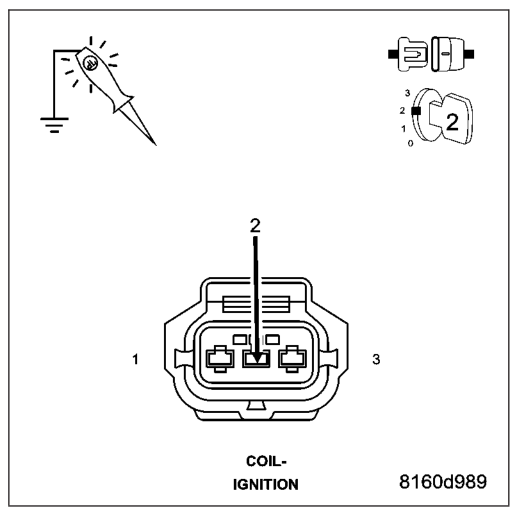
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (A142) ASD Relay Output circuit in the Coil on Plug harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the open or short to ground in the (A142) ASD Relay Output circuit between the PDC and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**NOTE: Stop All Actuations.**

## 3. COIL ON PLUG RESISTANCE

Turn the ignition off.

**NOTE: The following resistance measurement should be taken at 70°-80° F.**

Measure the resistance of the Coil on Plug.

3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

**Is the resistance within the given specification for the Ignition Coil being tested?**

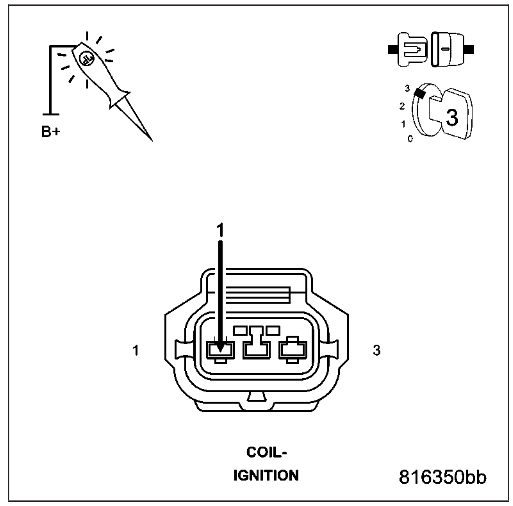
**Yes** >> Go To 4

**No** >> Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K10) Coil Control No.6 circuit.

Crank the engine for 5 seconds while observing the test light.




**What is the state of the test light while cranking the engine?**

**Brightly blinking.**
Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**ON constantly.**
Go To 5

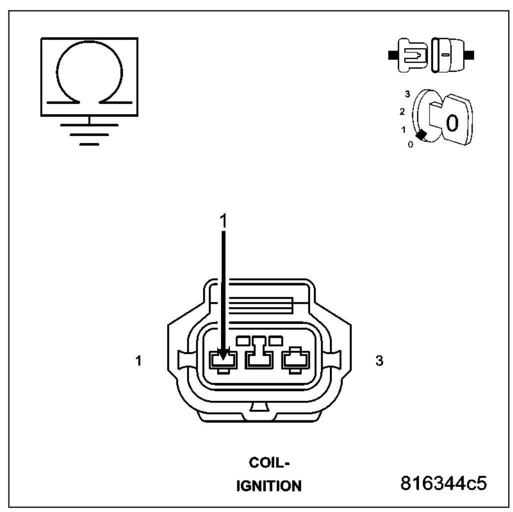
**OFF constantly.**
Go To 6

## 5. (K10) COIL CONTROL NO.6 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K10) Coil Control No.6 circuit in the Coil on Plug harness connector.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K10) Coil Control No.6 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

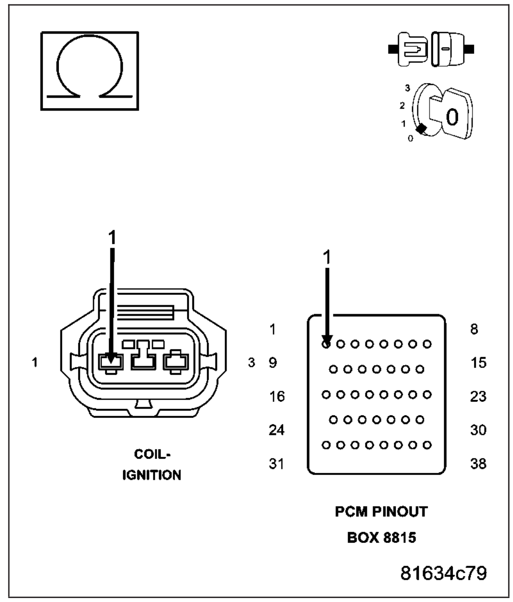
## 6. (K10) COIL CONTROL NO.6 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connectors.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K10) Coil Control No.6 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K10) Coil Control No.6 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

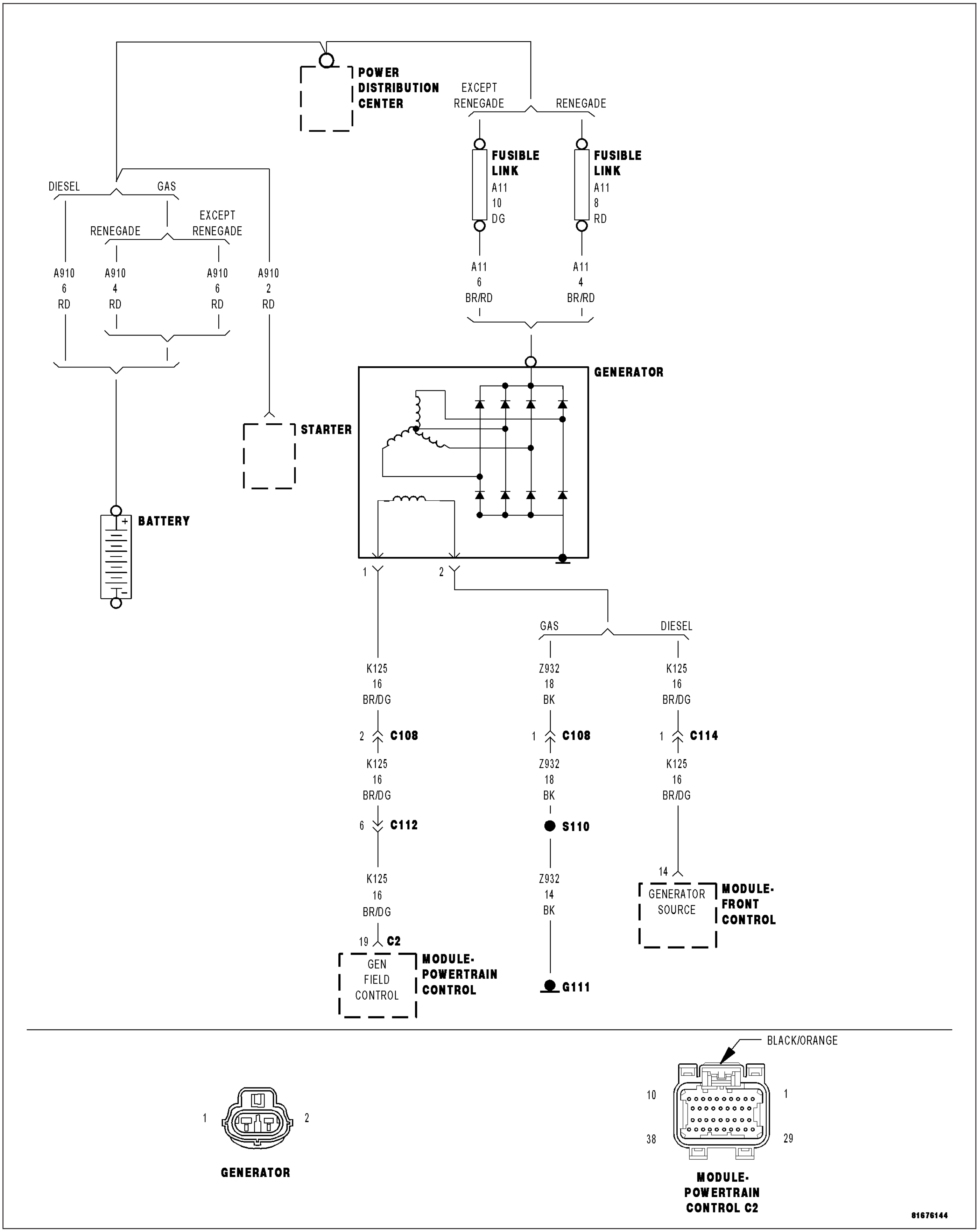
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## P2503-CHARGING SYSTEM OUTPUT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The engine running. The engine speed greater than 1157 RPM.
- **Set Condition:**
  The battery sensed voltage is 1 volt below the charging goal for 13.47 seconds. The PCM senses the battery voltage turns off the field driver and senses the battery voltage again. If the voltages are the same, the code is set. One Trip Fault. Three good trips to turn off the MIL.

| Possible Causes |
|---|
| EXCESSIVE RESISTANCE IN THE BATTERY POSITIVE CIRCUIT |
| EXCESSIVE RESISTANCE IN THE CASE GROUND |
| (K125) GEN FIELD CONTROL CIRCUIT SHORTED TO VOLTAGE |
| (K125) GEN FIELD CONTROL CIRCUIT OPEN |
| (K125) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND |
| (Z932) GEN GROUND CIRCUIT OPEN |
| GENERATOR |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Diagnostic Test

### 1. ACTIVE DTC

**NOTE: Inspect the vehicle for aftermarket accessories that may exceed the Generator System output.**
Ignition on, engine not running.

**NOTE: The battery must be fully charged.**

**NOTE: The Generator belt tension and condition must be checked before continuing.**
With a scan tool, read DTCs.
Start the engine.
Allow the idle to stabilize.
Ignition on, engine not running.
With the scan tool, read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 2. FUSED B+ CIRCUIT HIGH RESISTANCE

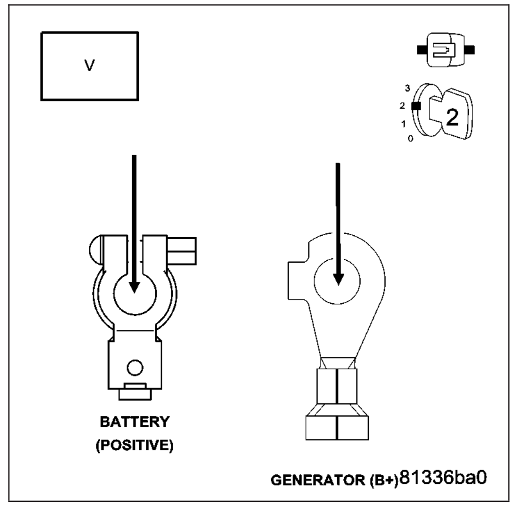
**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Ignition on, engine not running.

**NOTE: Make sure all wires are clear of the engine's moving parts.**

Measure the voltage between the Generator B+ Output Terminal and the Battery+ Post.

Start the engine.




**Is the voltage above 0.4 of a volt?**

**Yes** >> Repair the excessive resistance in the battery positive circuit between the Generator and Battery.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. EXCESSIVE RESISTANCE IN THE CASE GROUND

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

Start the engine.

Warm the engine to operating temperature.

**NOTE: Make sure all wires are clear of the engine's moving parts.**

Measure the voltage between the Generator Case and Battery ground post.

**Is the voltage above 0.1 of a volt?**

**Yes** >> Repair the excessive resistance in the Generator Case Ground.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. GENERATOR OPERATION

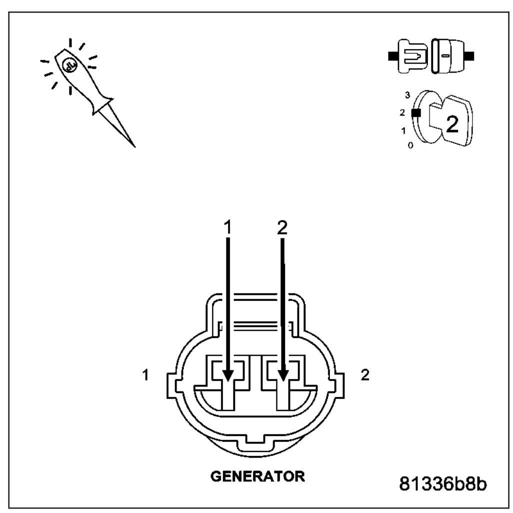
Turn the ignition off.

Disconnect the Generator Field harness connector.

Using a 12-volt test light, jump across the Generator Field harness connector.

Ignition on, engine not running.

With a scan tool, actuate the Generator Field Driver.




**Does the test light illuminate brightly and flash on and off?**

**Yes** >> Replace the Generator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

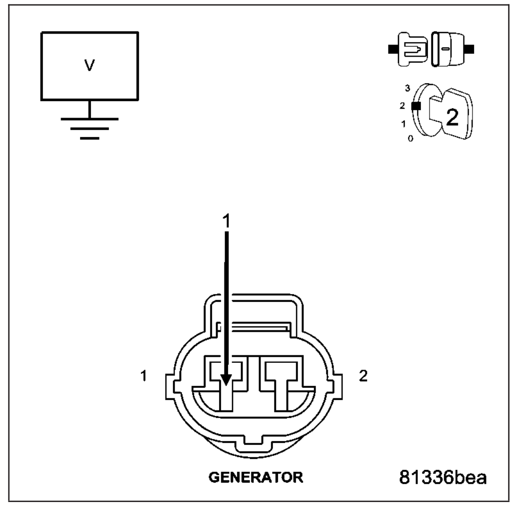
## 5. (K125) GEN FIELD CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K125) Gen Field Control circuit in the Generator Field harness connector.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the short to battery voltage in the (K125) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

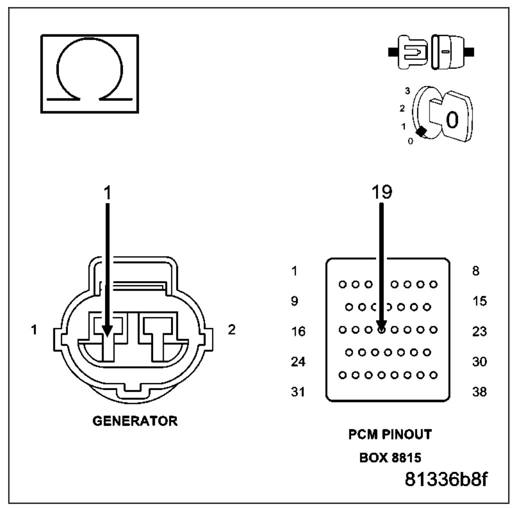
**No** >> Go To 6

## 6. (K125) FIELD CONTROL CIRCUIT OPEN

Turn the ignition off.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (K125) Gen Field Control circuit from the Generator Field harness connector to the appropriate terminal of special tool #8815.



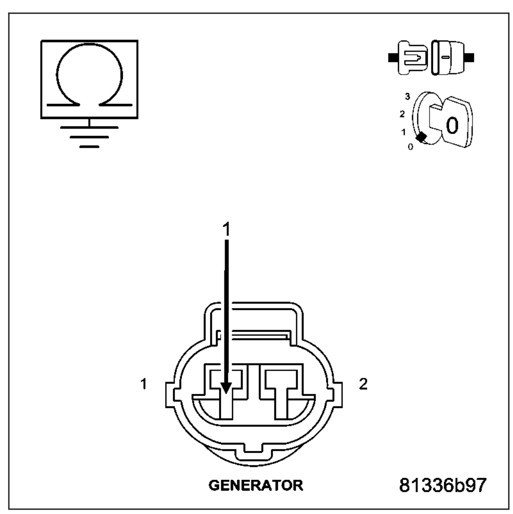

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the open in the (K125) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. (K125) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K125) Gen Field Control circuit in the Generator Field harness connector.



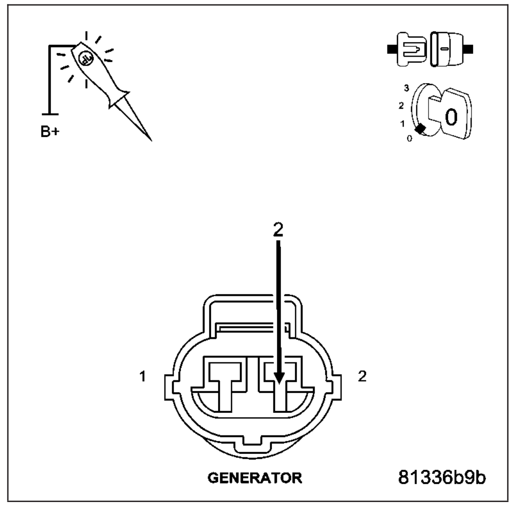

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (K125) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. (Z932) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to battery voltage, probe the (Z932) Ground circuit in the Generator Field harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 9

**No** >> Repair the open in the (Z932) Generator Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 9. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## U0001–CAN C BUS

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects a short in either CAN C Bus circuit.

Perform CAN C Bus Communication Failure diagnostic test procedure. **(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)**.

## U0101–LOST COMMUNICATION WITH TCM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
- **Set Condition:**
  If the Anti-Lock Brakes Module fails to receive bus messages from the TCM for approximately 500 ms.

| Possible Causes |
|---|
| DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| TCM POWER AND GROUND |
| TCM |
| ANTI-LOCK BRAKES MODULE |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**
Turn the ignition on.

With the scan tool, read active DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Perform the Stored Lost Communication test procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

**No** >> Go To 3

### 3. VERIFY THAT THE TCM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the TCM is active on the bus.

**Is the TCM active on the bus?**

**Yes** >> Go To 4

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs "Logged Against" the TCM?**

**Yes** >> Replace/update the TCM in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace the Anti-Lock Brakes Module in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## U0121-LOST COMMUNICATION WITH ANTI-LOCK BRAKE MODULE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
- **Set Condition:**
  If the PCM fails to receive bus messages from the ABS M for approximately 500 ms.

| Possible Causes |
|---|
| DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| ABS POWER AND GROUND |
| ABS |
| PCM |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**
Turn the ignition on.

With the scan tool, read active DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Perform the Stored Lost Communication test procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

**No** >> Go To 3

### 3. VERIFY THAT THE ABS IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the ABS is active on the bus.

**Is the ABS active on the bus?**

**Yes** >> Go To 4

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs “Logged Against” the ABS?**

**Yes** >> Replace/update the ABS in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace the PCM in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## U0140-LOST COMMUNICATION WITH BODY CONTROL MODULE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
- **Set Condition:**
  If the PCM fails to receive bus messages from the BCM for approximately 500 ms.

| Possible Causes |
|---|
| DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| BCM POWER AND GROUND |
| BCM |
| PCM |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**
Turn the ignition on.

With the scan tool, read active DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Perform the Stored Lost Communication test procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

**No** >> Go To 3

### 3. VERIFY THAT THE BCM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the BCM is active on the bus.

**Is the BCM active on the bus?**

**Yes** >> Go To 4

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs “Logged Against” the BCM?**

**Yes** >> Replace/update the BCM in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace the PCM in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## U0155-LOST COMMUNICATION WITH CLUSTER

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
- **Set Condition:**
  If the PCM fails to receive bus messages from the Cluster for approximately 500 ms.

| Possible Causes |
|---|
| DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| CLUSTER POWER AND GROUND |
| CLUSTER |
| PCM |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**
Turn the ignition on.

With the scan tool, read active DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Perform the Stored Lost Communication test procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

**No** >> Go To 3

### 3. VERIFY THAT THE CLUSTER IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the Cluster is active on the bus.

**Is the Cluster active on the bus?**

**Yes** >> Go To 4

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs “Logged Against” the CLUSTER?**

**Yes** >> Replace/update the Cluster in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace the PCM in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## U0168-LOST COMMUNICATION WITH SKIM/SKREEM (WCM)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  - With the ignition on
  - Battery voltage between 10 and 16 volts
  - IOD fuse installed
- **Set Condition:**
  If the PCM fails to receive bus messages from the SKREEM (WCM) for approximately 500 ms.

| Possible Causes |
|---|
| DTCS RELATED TO BATTERY VOLTAGE, IGNITION, OR VIN MESSAGES |
| CAN C BUS CIRCUITS OPEN OR SHORTED |
| SKREEM (WCM) POWER AND GROUND |
| SKREEM (WCM) |
| PCM |

## Diagnostic Test

### 1. VERIFY DTC IS ACTIVE

**NOTE: Ensure the IOD fuse is installed and battery voltage is between 10 and 16 volts before proceeding.**
Turn the ignition on.

With the scan tool, read active DTCs.

**Is this DTC active?**

**Yes** >> Go To 2

**No** >> Perform the Stored Lost Communication test procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING).

### 2. CHECK FOR ANY OF THE FOLLOWING ACTIVE DTCS

With the scan tool, read all active DTCs from all CAN C Bus modules.

**NOTE: Check for CAN C hardware electrical, VIN Missing/Mismatch, battery or ignition related DTCs.**

**Does the scan tool display any active DTCs to the conditions listed above?**

**Yes** >> Diagnose and repair the DTC(s). Refer to the Table of Contents in the applicable Section.

**No** >> Go To 3

### 3. VERIFY THAT THE SKREEM (WCM) IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the SKREEM (WCM) is active on the bus.

**Is the SKREEM (WCM) active on the bus?**

**Yes** >> Go To 4

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

## 4. CHECK FOR ADDITIONAL COMMUNICATION RELATED DTCS

With the scan tool, select Network View and select Advanced.

**Is there more than one module with active DTCs "Logged Against" the SKREEM (WCM)?**

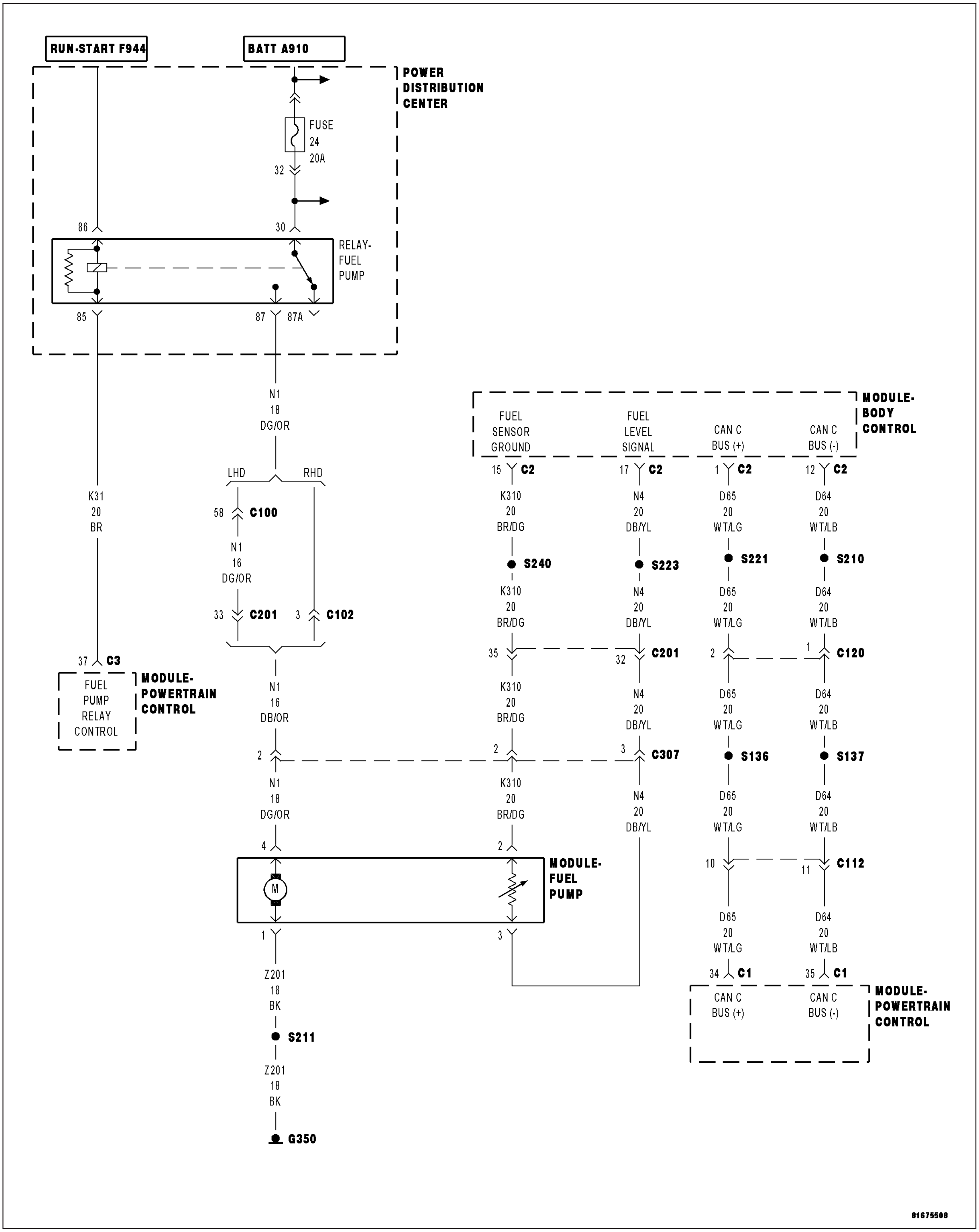
**Yes** >> Replace/update the SKREEM (WCM) in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> Replace the PCM in accordance with the service information.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

## U110C-NO FUEL LEVEL BUS MESSAGE RECEIVED




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM does not receive a fuel level signal from the BCM over the CAN C circuit. The circuit is constantly monitored. One Trip fault.

| Possible Causes |
|---|
| CAN C BUS CIRCUIT OPEN OR SHORTED |
| BODY CONTROL MODULE |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .**

## Theory of Operation

The BCM sends the fuel level signal the NGC over the CAN C bus circuit.

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool read Powertrain DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. U0140-LOST COMMUNICATION WITH BODY CONTROL MODULE ALSO ACTIVE

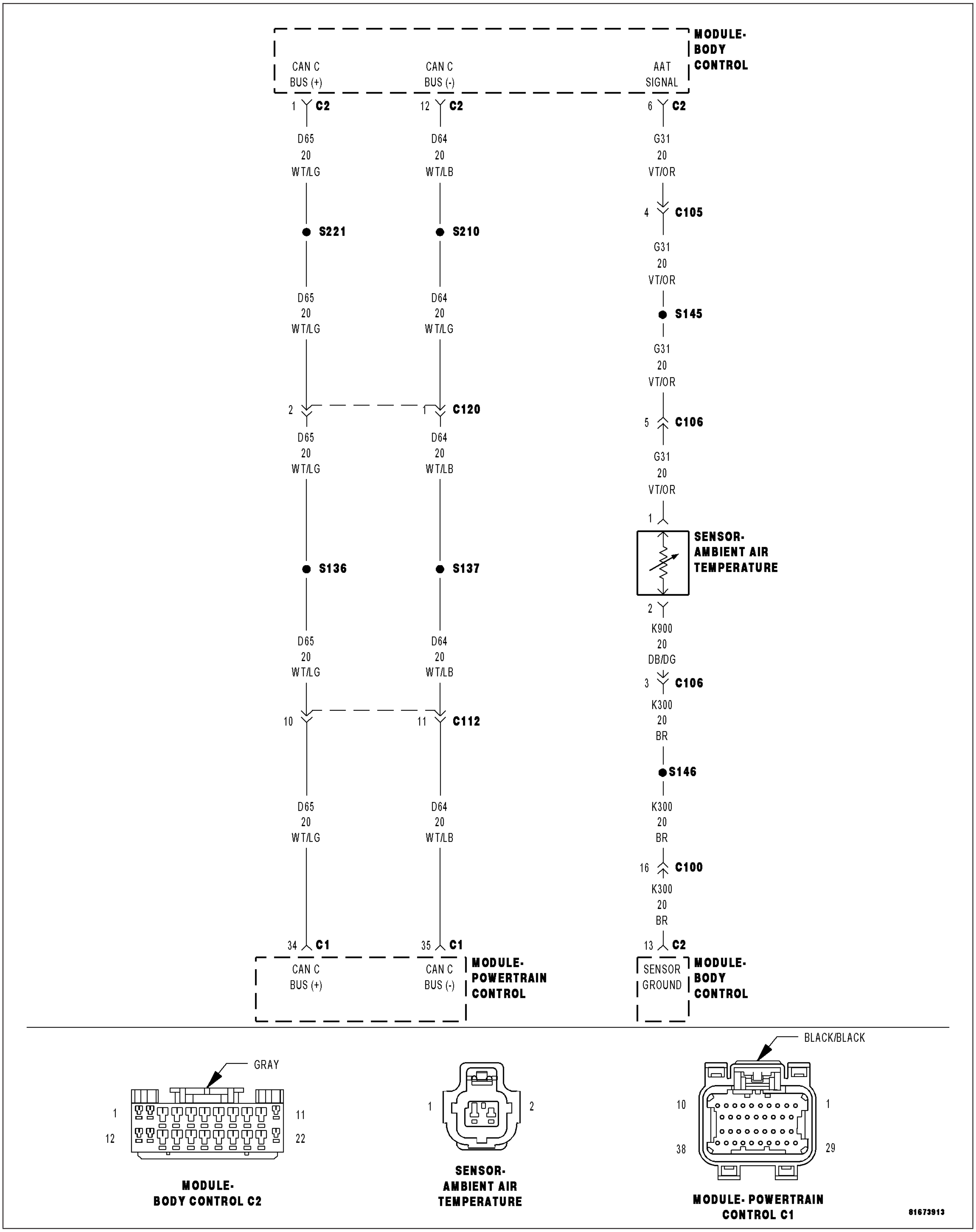
With the scan tool read DTCs.

**Is the U0140-LOST COMMUNICATION WITH BODY CONTROL MODULE also set?**

**Yes** >> Follow the diagnostics for U0140-LOST COMMUNICATION WITH BODY CONTROL MODULE
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## U110E-LOST AMBIENT TEMPERATURE MESSAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM doesn't receive the ambient temperature signal over the CAN C bus from the BCM. The circuit is continuously monitored.

| Possible Causes |
| --- |
| CAN C BUS CIRCUIT OPEN OR SHORTED |
| BODY CONTROL MODULE |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Theory of Operation

The ambient temperature sensor signal is a direct input to the BCM. The BCM sends the PCM the ambient temperature signal over the CAN C bus.

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With the scan tool read Powertrain DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. U0140-LOST COMMUNICATION WITH BODY CONTROL MODULE ALSO ACTIVE

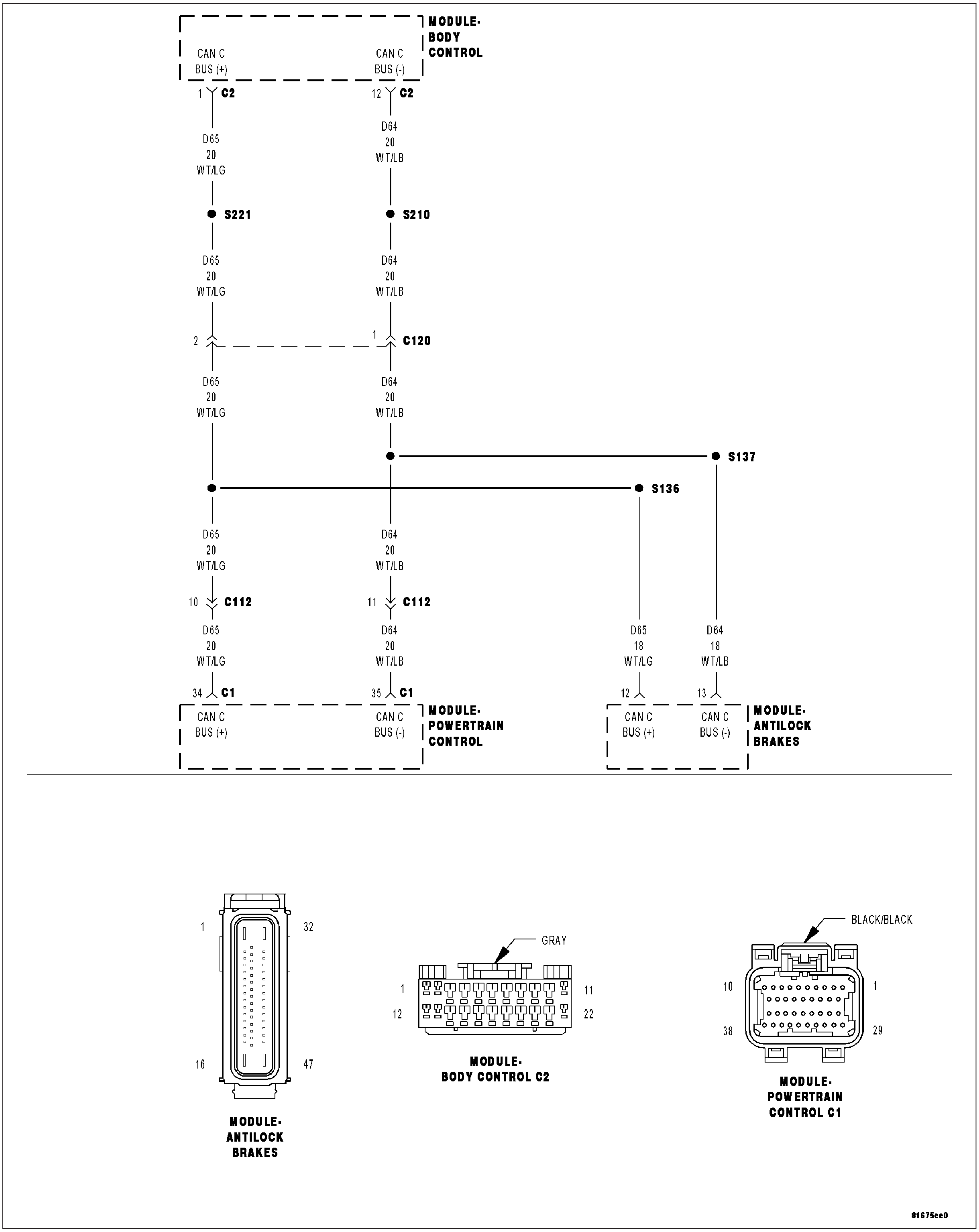
With the scan tool read DTCs.

**Is the U0140-NO BUS MESSAGE RECEIVED FROM THE BCM also set?**

**Yes** >> Follow the diagnostics for U0140-LOST COMMUNICATION WITH BODY CONTROL MODULE
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## U1110-LOST VEHICLE SPEED MESSAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM doesn’t receive a vehicle speed signal from the Anti-lock brake Module over the CAN C bus.

| Possible Causes |
|---|
| CAN C BUS CIRCUIT OPEN OR SHORTED |
| ANTI-LOCK BRAKE MODULE |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .**

## Theory of Operation

The PCM receives the vehicle speed signal over the CAN C bus from the Anti-lock Brake Module.

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool read Powertrain DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. U0121-LOST COMMUNICATION WITH ABS MODULE ALSO SET

With the scan tool continue reading DTCs.

**Is the U0121-LOST COMMUNICATION WITH ABS MODULE also set?**

**Yes** >> Follow the diagnostics for U0121-LOST COMMUNICATION WITH ABS MODULE
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## U1113-LOST A/C PRESSURE MESSAGE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM doesn't receive the a/c pressure signal over the CAN C bus from the BCM. The circuit is continuously monitored.

| Possible Causes |
|---|
| CAN C BUS CIRCUIT OPEN OR SHORTED |
| BODY CONTROL MODULE |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

### Theory of Operation

The A/C Pressure Transducer signal is a direct input to the BCM. The BCM sends the PCM the A/C Pressure Transducer signal over the CAN C bus.

### Diagnostic Test

#### 1. ACTIVE DTC

Ignition on, engine not running.

With the scan tool read Powertrain DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

#### 2. U0141-LOST COMMUNICATION WITH BODY CONTROL MODULE ALSO ACTIVE

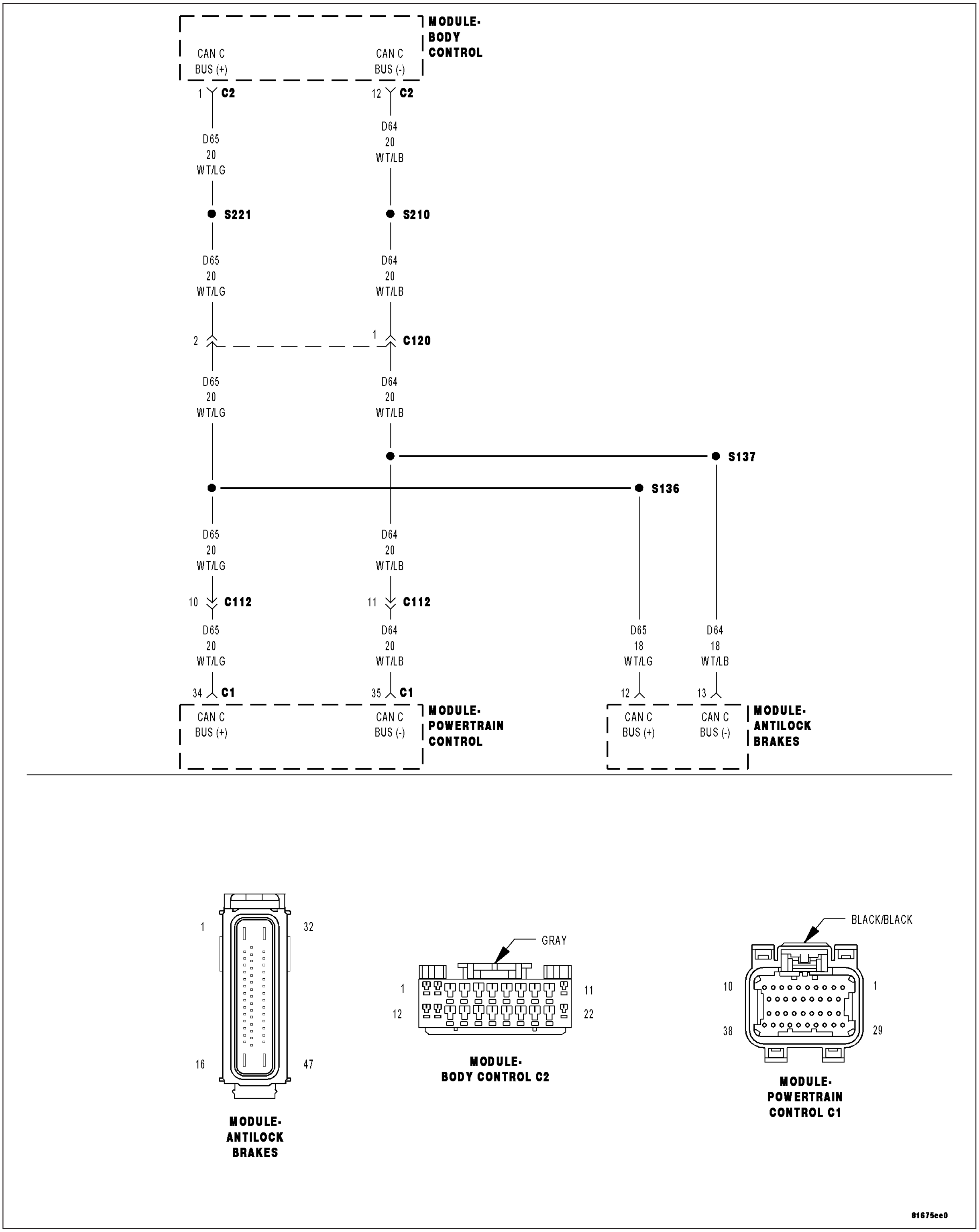
With the scan tool read DTCs.

**Is the U0141-NO BUS MESSAGE RECEIVED FROM THEBCM also set?**

**Yes** >> Follow the diagnostics for U0140-LOST COMMUNICATION WITH BODY CONTROL MODULE
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## U1120-LOST WHEEL DISTANCE MESSAGE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM doesn't receive a wheel distance message from the Anti-lock brake Module or BCM (NON-ABS) over the CAN C bus.

| Possible Causes |
| --- |
| CAN C BUS CIRCUIT OPEN OR SHORTED |
| ANTI-LOCK BRAKE MODULE |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Theory of Operation

The PCM receives the vehicle speed signal over the CAN C bus from the Anti-lock Brake Module or BCM (NON-ABS).

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With the scan tool read Powertrain DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. U0121-LOST COMMUNICATION WITH ABS MODULE/P0140–LOST COMMUNICATION WITH BCM ALSO SET

**NOTE: If the vehicle is not equipped with ABS the VSS signal will come from the BCM.**

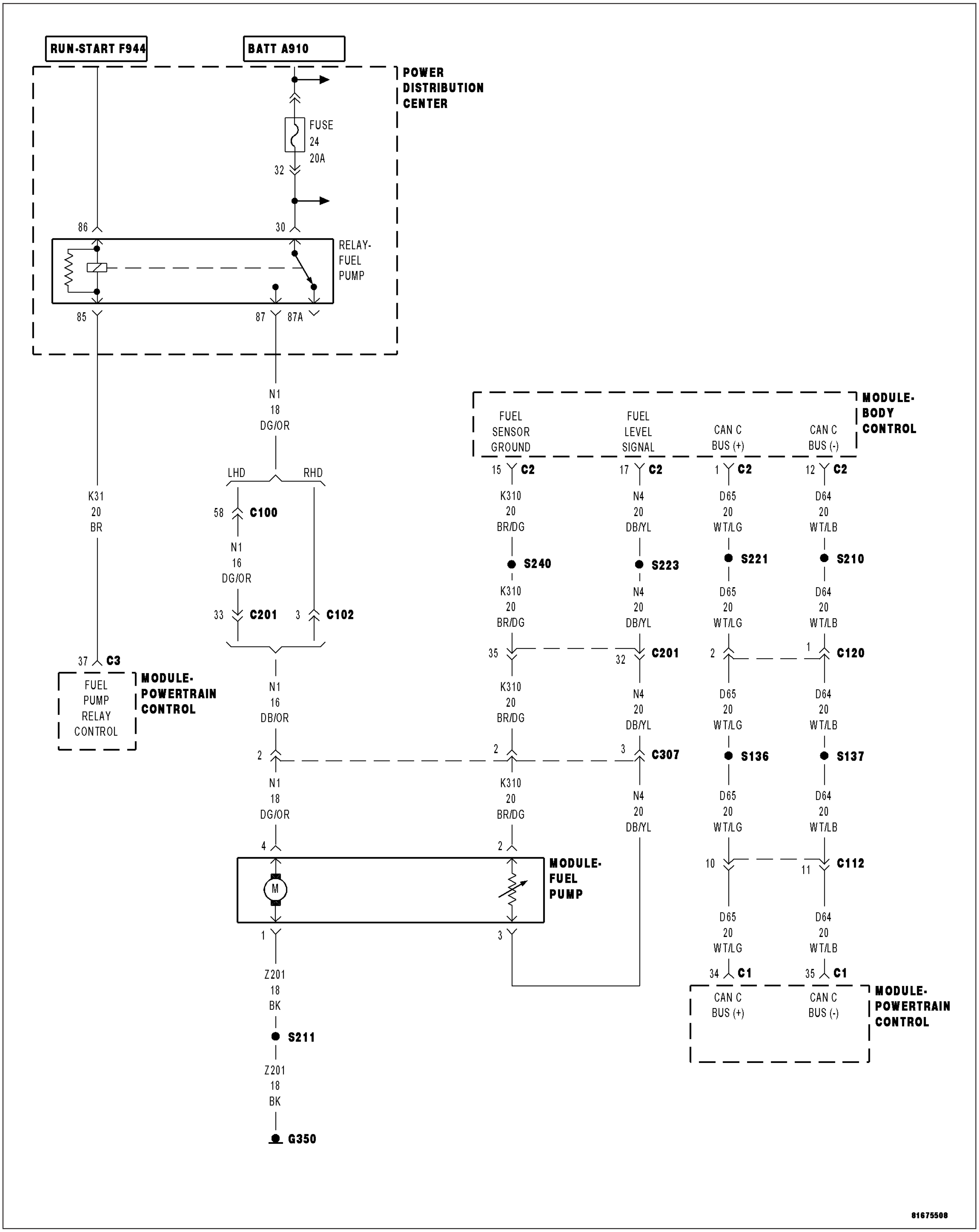
With the scan tool, read the appropriate module for DTCs.

**Is the U0121-LOST COMMUNICATION WITH ABS MODULE/P0140–Lost Communicate With BCM also set?**

**Yes** >> Perform the appropriate diagnostic test. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## U1411-IMPLAUSIBLE FUEL VOLUME SIGNAL RECEIVED




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The fuel volume message the PCM is receiving is implausible. The circuit is continuously monitored.

| Possible Causes |
| --- |
| CAN C OPEN OR SHORTED |
| BODY CONTROL MODULE |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Theory of Operation

The BCM has to send the PCM a fuel volume signal over CAN C. The signal the BCM sends over CAN C is implausible.

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool read DTCs.

**Is the DTC active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. CAN C BUS DTCS ALSO ACTIVE

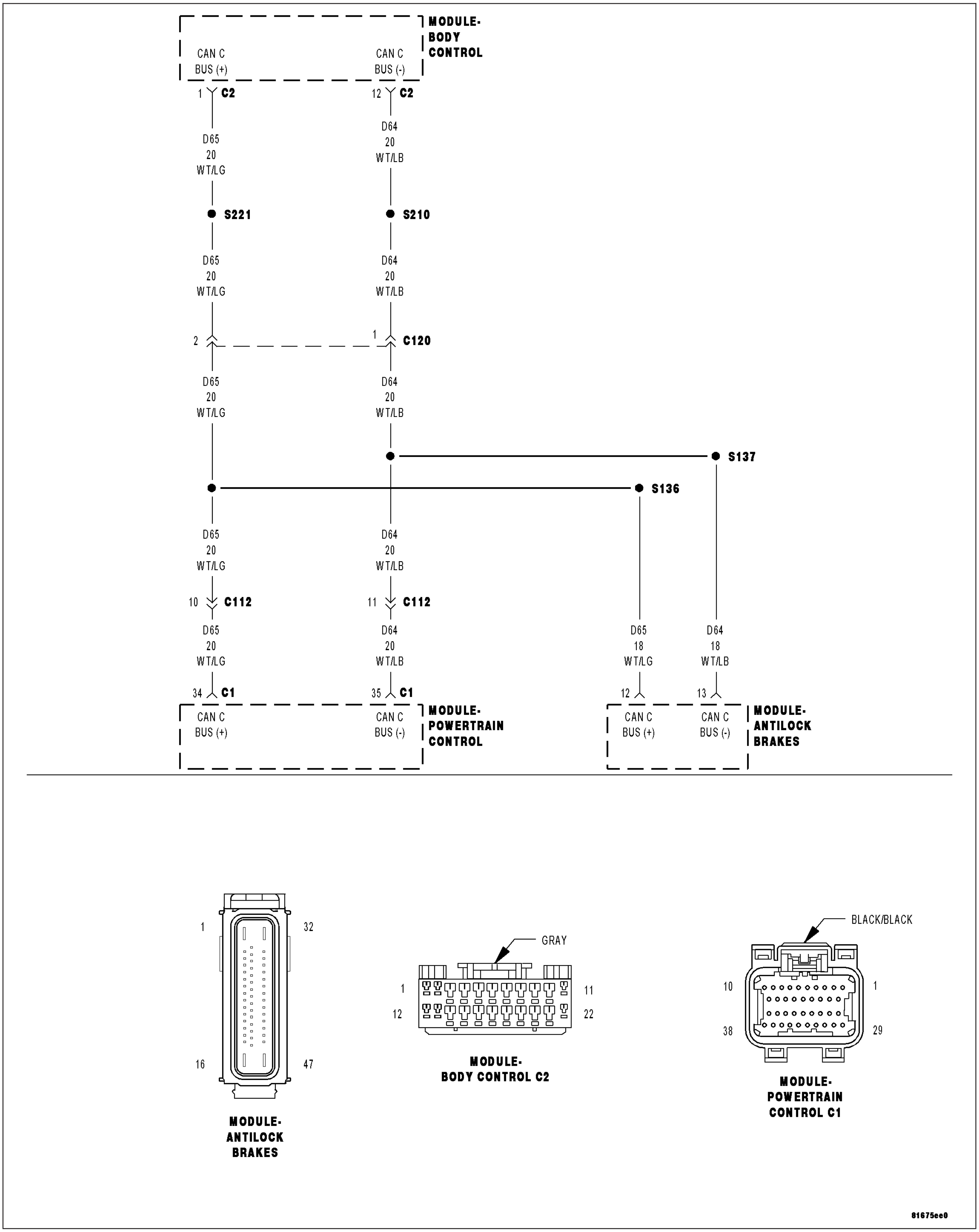
With a scan tool check for DTCs in the BCM.

**Are any CAN C related DTCs active at this time?**

**Yes** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for the appropriate diagnostic procedures.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## U1412-IMPLAUSIBLE VEHICLE SPEED SIGNAL RECEIVED




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM gets an implausible signal over the CAN C circuit from the ABS Module. The circuit is continuously monitored.

| Possible Causes |
|---|
| CAN C BUS CIRCUIT SHORTED |
| CAN C BUS CIRCUIT OPEN |
| ABS MODULE |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Theory of Operation

The ABS Module sends vehicle speed information over the CAN C Bus circuit to the PCM.

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the U1412-IMPLAUSIBLE VEHICLE SPEED SIGNAL RECEIVED active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

### 2. U0001-NO COMMUNICATION ON THE CAN C BUS CIRCUIT IS ACTIVE

Continue reading DTCs.

**Is the U0001-NO COMMUNICATION ON THE CAN C BUS CIRCUIT ACTIVE at this time?**

**Yes** >> Refer to the Diagnostic Procedure for the U0001-NO COMMUNICATION ON THE CAN C BUS CIRCUIT.

**No** >> Go To 3

### 3. ABS MODULE IS ACTIVE ON THE CAN C BUS

With the scan tool, select ECU View.

Verify that the ABS Module active on the bus.

**Is the ABS Module active on the bus?**

**Yes** >> Go To 4

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic procedures.

Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

## 4. ACTIVE DTCS IN THE BCM

With the scan tool, select ECU View and select BCM.

Withe the scan tool, read active DTCs.

**Is the U0001-NO COMMUNICATION ON THE CAN C BUS CIRCUIT ACTIVE in the BCM at this time?**

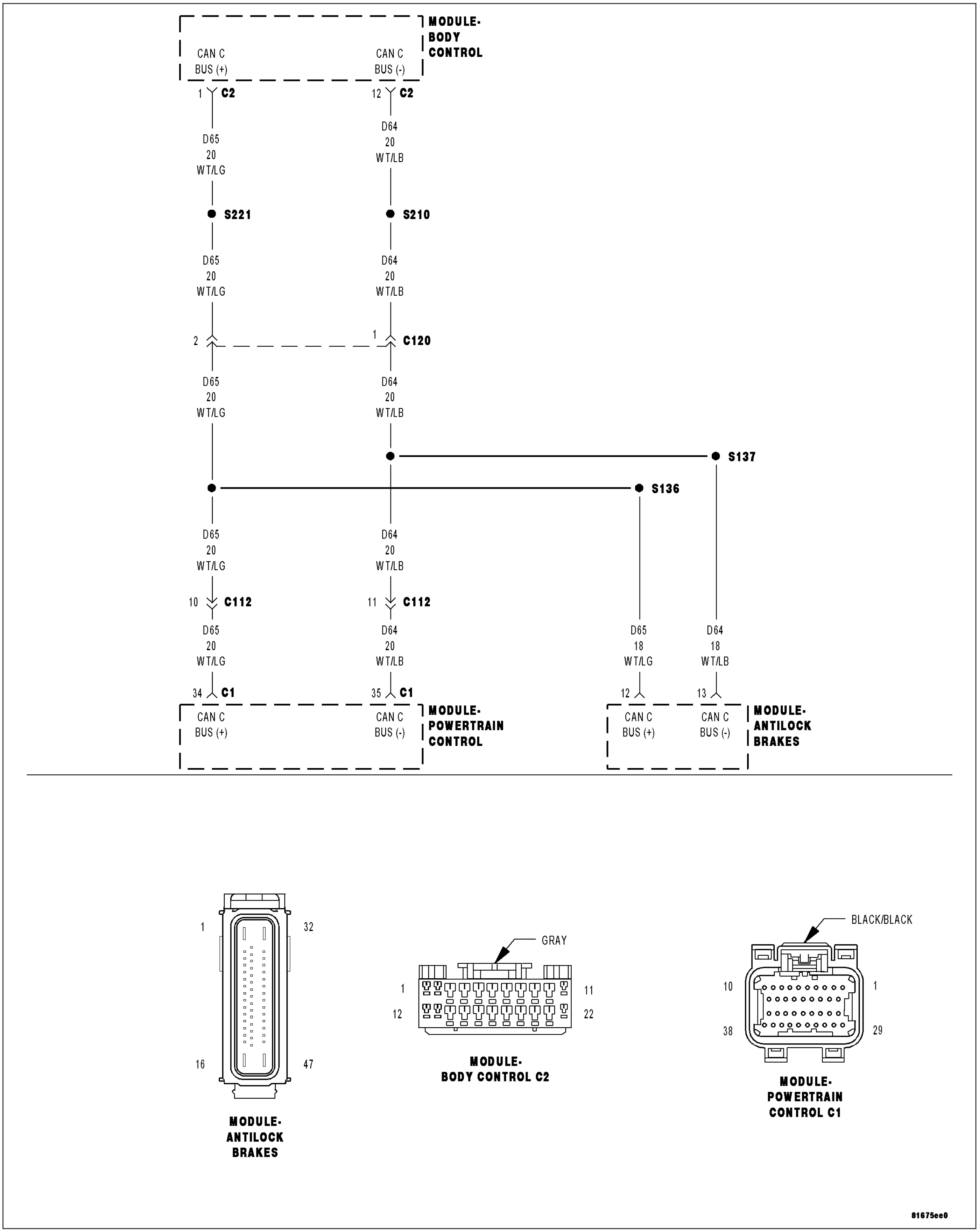
**Yes** >> Replace the ABS Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

**No** >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

## U1417-IMPLAUSIBLE LEFT WHEEL DISTANCE SIGNAL RECEIVED




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM gets an implausible signal over the CAN C circuit from the ABS Module. The circuit is continuously monitored.

| Possible Causes |
|---|
| VEHICLE SPEED SENSOR FAULT ACTIVE IN ANTI-LOCK BRAKE MODULE |
| CAN C BUS CIRCUIT SHORTED |
| CAN C BUS CIRCUIT OPEN |
| ABS MODULE |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Theory of Operation

The ABS Module sends an implausible distance signal over the CAN C Bus circuit to the PCM.

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

**Is the U1417-IMPLAUSIBLE LEFT WHEEL DISTANCE SIGNAL RECEIVED active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. ABS MODULE IS ACTIVE ON THE CAN C BUS

With the scan tool, select ECU View.
Verify that the ABS Module active on the bus.

**Is the ABS Module active on the bus?**

**Yes** >> Go To 3

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic procedures.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

### 3. DTCS STORED OR ACTIVE IN THE ABS MODULE

Check for DTCs in the ABS Module.

**Are any DTCs active or stored in the ABS Module?**

**Yes** >> Refer to section 5 - BRAKES - ABS ELECTRICAL DIAGNOSTICS and perform the diagnostics for the DTCs in the ABS Module.
Perform ABS VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

**No** >> Go to 4

## 4. ACTIVE DTCS IN THE BCM

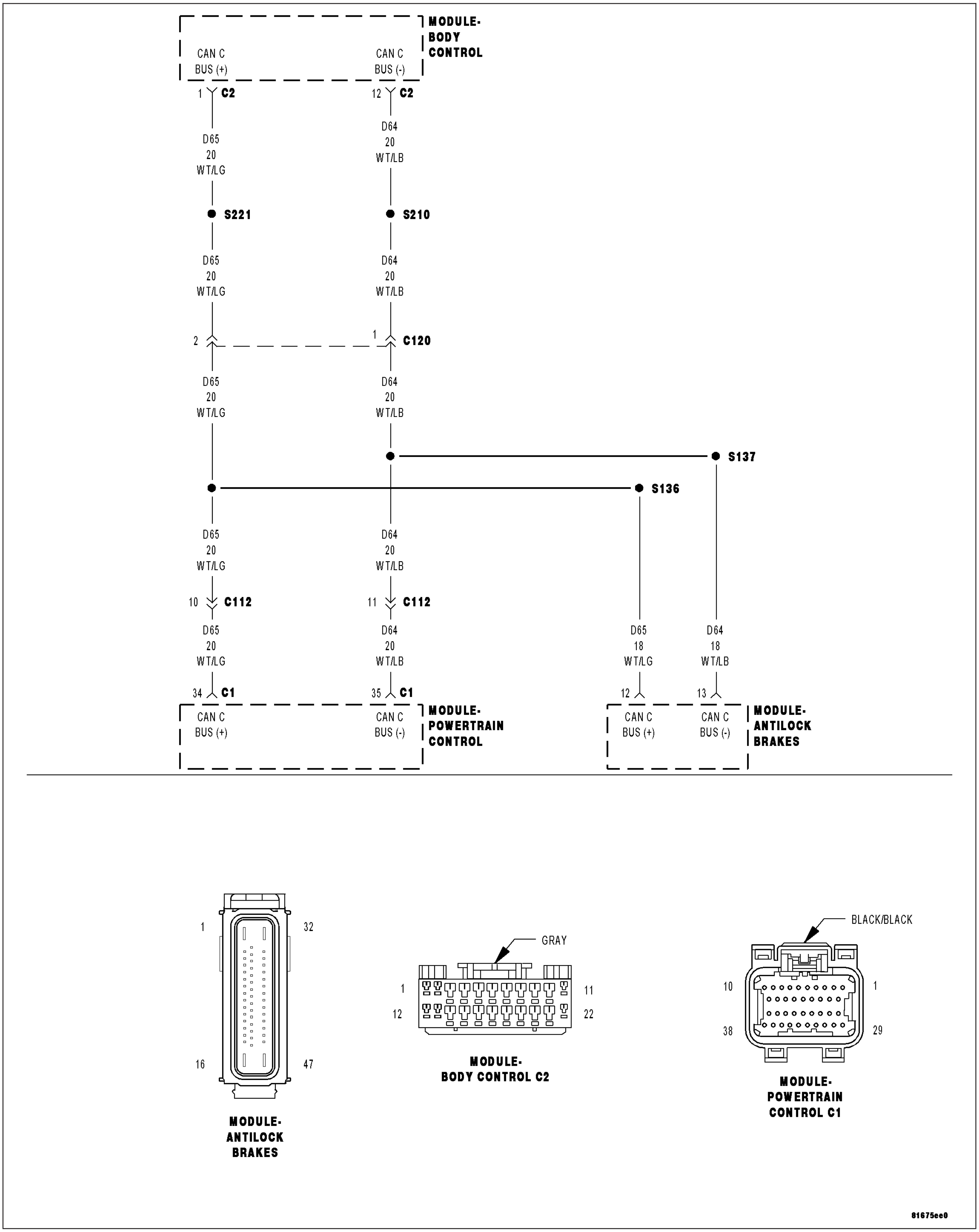
With the scan tool, select ECU View and select BCM.
Withe the scan tool, read active DTCs.

**Are any Communication DTCs active in the BCM relating to the ABS System?**

**Yes** >> Replace the ABS Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## U1418-IMPLAUSIBLE RIGHT WHEEL DISTANCE SIGNAL RECEIVED




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM gets an implausible signal over the CAN C circuit from the ABS Module. The circuit is continuously monitored.

| Possible Causes |
|---|
| VEHICLE SPEED SENSOR FAULT ACTIVE IN ANTI-LOCK BRAKE MODULE |
| CAN C BUS CIRCUIT SHORTED |
| CAN C BUS CIRCUIT OPEN |
| ABS MODULE |
| PCM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).**

## Theory of Operation

The ABS Module sends an implausible distance signal over the CAN C Bus circuit to the PCM.

## Diagnostic Test

### 1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

**Is the U1418-IMPLAUSIBLE RIGHT WHEEL DISTANCE SIGNAL RECEIVED active at this time?**

**Yes** >> Go To 2

**No** >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. ABS MODULE IS ACTIVE ON THE CAN C BUS

With the scan tool, select ECU View.

Verify that the ABS Module active on the bus.

**Is the ABS Module active on the bus?**

**Yes** >> Go To 3

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response diagnostic procedures.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

### 3. DTCS STORED OR ACTIVE IN THE ABS MODULE

Check for DTCs in the ABS Module.

**Are any DTCs active or stored in the ABS Module?**

**Yes** >> Refer to section 5 - BRAKES - ABS ELECTRICAL DIAGNOSTICS and perform the diagnostics for the DTCs in the ABS Module.
Perform ABS VERIFICATION TEST – VER 1 (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/FRONT CONTROL MODULE - DIAGNOSIS AND TESTING)

**No** >> Go to 4

## 4. ACTIVE DTCS IN THE BCM

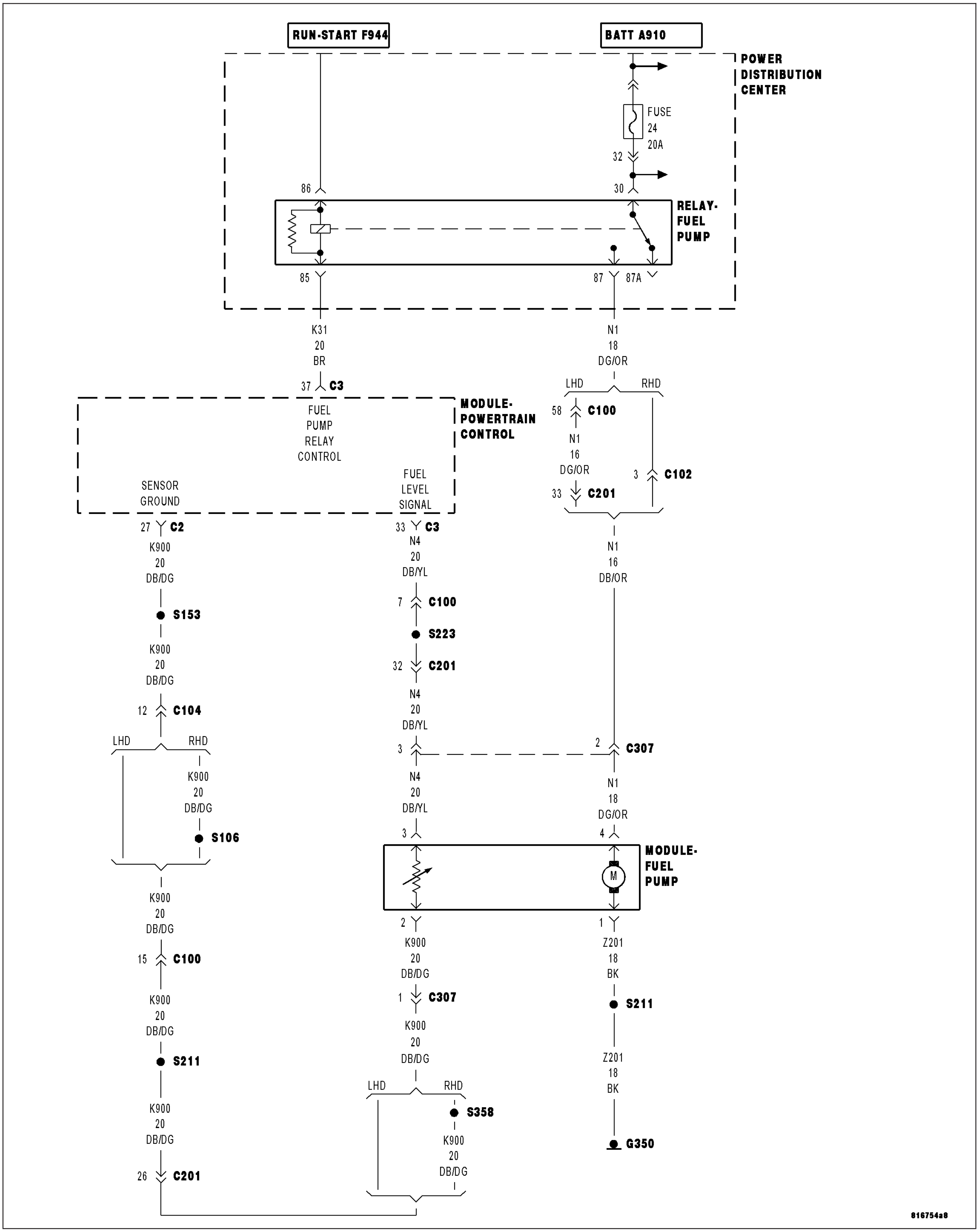
With the scan tool, select ECU View and select BCM.
Withe the scan tool, read active DTCs.

**Are any Communication DTCs active in the BCM relating to the ABS System?**

**Yes** >> Replace the ABS Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## *CHECKING THE FUEL DELIVERY SYSTEM




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| RESTRICTED FUEL SUPPLY LINE |
| FUEL PUMP INLET STRAINER PLUGGED |
| (N1) FUEL PUMP RELAY OUTPUT CIRCUIT OPEN |
| FUEL PUMP RELAY |
| FUEL PUMP |

## Diagnostic Test

### 1. FUEL PUMP OPERATION

Ignition on, engine not running.

With a scan tool, actuate the Fuel System test.

**NOTE: It may be necessary to use a mechanics stethoscope in the next step.**
Listen for fuel pump operation at the fuel tank.

**Does the Fuel Pump operate?**

**Yes** >> Go To 2

**No** >> Go To 5

**CAUTION: Stop All Actuations.**

### 2. FUEL PRESSURE

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**
Install a fuel pressure gauge at the engine.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Choose a conclusion that best matches your fuel pressure reading.**

**Below Specification**
Go To 3

**Within Specification**
Test Complete.

**Above Specification**
Replace the fuel filter/fuel pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**CAUTION: Stop All Actuations.**

### 3. RESTRICTED FUEL SUPPLY LINE

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.**
Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) or #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Is the fuel pressure within specification now?**

**Yes** >> Repair/replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

**CAUTION: Stop All Actuations.**

## 4. CHECKING FUEL INLET STRAINER

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

**Is the Fuel Inlet Strainer plugged?**

**Yes** >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

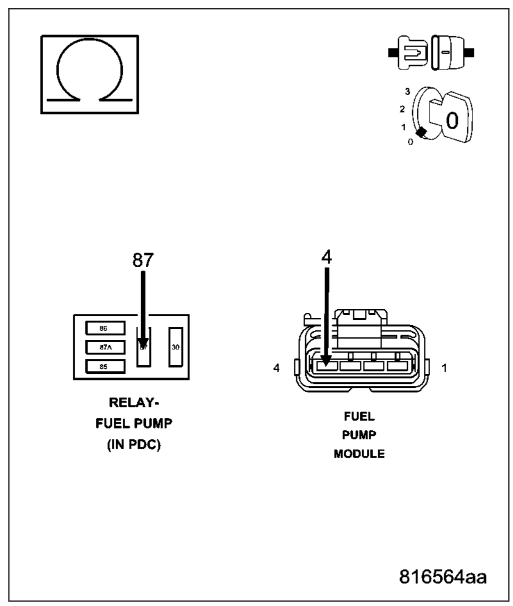
## 5. (N1) FUEL PUMP RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Remove the Fuel Pump Relay from the PDC.

Disconnect the Fuel Pump Module harness connector.

Measure the resistance of the (N1) Fuel Pump Relay Output circuit from the relay connector to the fuel pump module connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Fuel Pump Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Repair the open in the (N1) Fuel Pump Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# *HARD START FUEL SYSTEM

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| FUEL CONTAMINATION |
| RESTRICTED FUEL SUPPLY LINE |
| FUEL PUMP INLET STRAINER PLUGGED |
| FUEL PUMP MODULE |
| FUEL INJECTOR(S) |

## Diagnostic Test

### 1. CHECKING FUEL PRESSURE

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install a fuel pressure gauge at the engine.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Choose a conclusion that best matches your fuel pressure reading.**

**Below Specification**
Go To 2

**Within Specification**
Go To 4

### 2. RESTRICTED FUEL SUPPLY LINE

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Raise vehicle on hoist, and disconnect the fuel supply line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

**NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

**Is the fuel pressure within specification?**

**Yes** >> Visually and physically inspect the fuel supply lines between the fuel tank and the fuel rail. Repair/replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECKING THE FUEL INLET STRAINER

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

**Is the Fuel Inlet Strainer plugged?**

**Yes** >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. FUEL PUMP MODULE

**NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.**

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

**NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

**NOTE: The pressure should not fall below 241 KPa (35 psi)**

**Does the fuel pressure drop?**

**Yes** >> Replace Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. FUEL INJECTOR(S)

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Remove special tool #C4390.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

**NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Move special tool #C4390, Hose Clamp Pliers, from between the fuel pressure gauge and the engine to between the fuel pressure gauge and fuel pump module.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

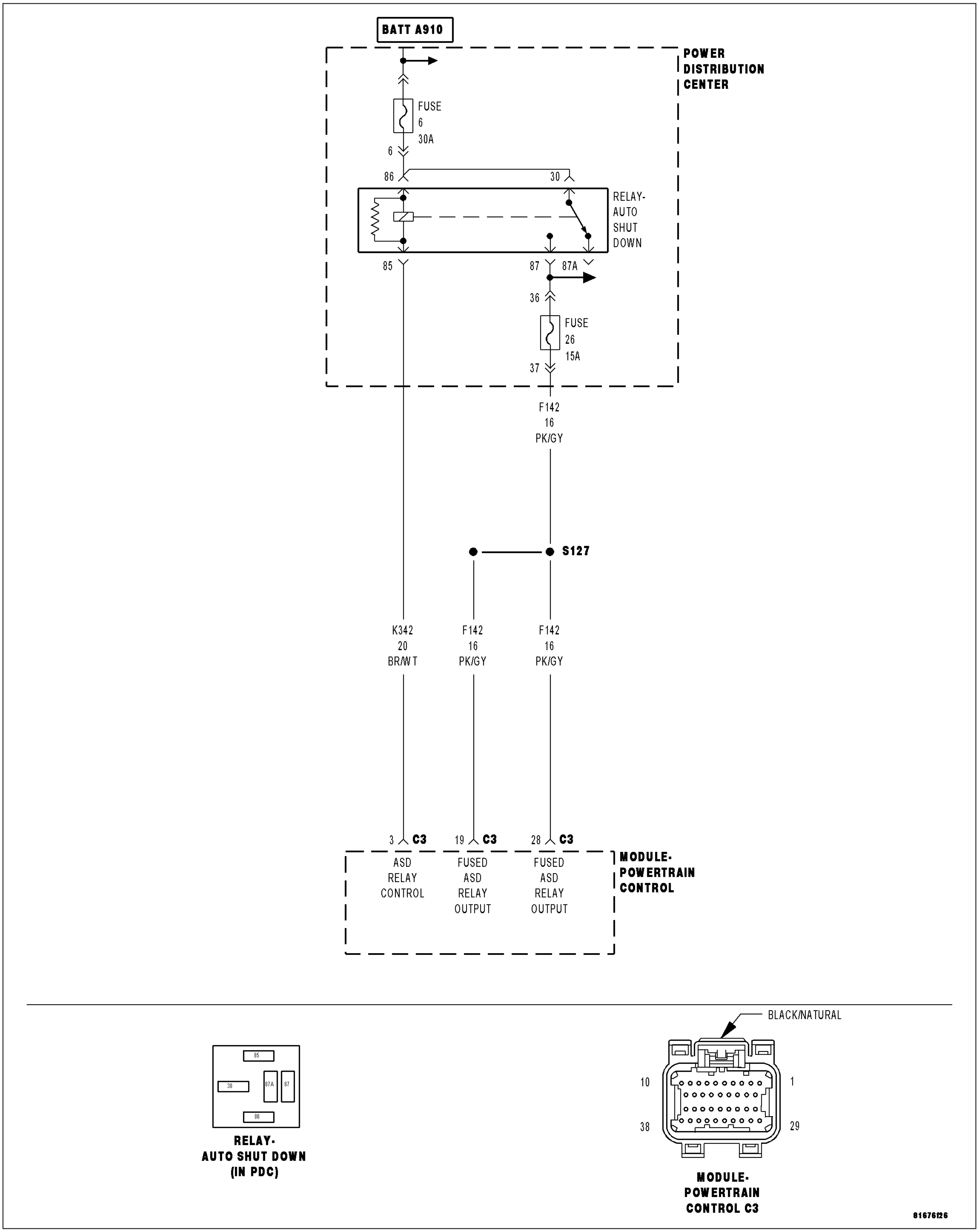
**NOTE: The pressure should not fall below 241 KPa (35 psi)**

**Does the fuel pressure drop?**

**Yes** >> Replace the leaking fuel injectors.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Check the fuel for contaminants.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# *ENGINE CRANKS BUT DOES NOT START




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| NO START PRE-TEST |
| POWERTRAIN FUSES OPEN |
| SECONDARY INDICATORS PRESENT |
| ENGINE MECHANICAL PROBLEM |
| (F142) ASD RELAY OUTPUT CIRCUIT OPEN |
| FUEL CONTAMINATION |

## Diagnostic Test

### 1. NO START PRE-TEST

**NOTE: The following list of items must be checked before continuing with any no start tests.**

The battery must be fully charged and in good condition. A low charged battery may produce invalid test results. If the battery is low, charge the battery and then attempt to start the vehicle by cranking the engine for 15 seconds, 3 consecutive times.

This will allow any DTCs to set that may have been erased due to a dead battery.

Try to communicate with PCM if not able to communicate check fuses.

Make sure the Powers and Ground to the PCM are OK.

Make sure the PCM communicates with the scan tool and that there are no DTCs stored in the PCM memory. If the PCM reports a No Response condition, refer to section 8 Electrical Electronic Control Module Electrical Diagnostics for the proper tests.

Read the PCM DTCs with the scan tool. If any DTCs are present, they must be repaired before continuing with any other No Start diagnostic tests. Refer to the Table of Contents for the related P-code that is reported by the PCM.

Make sure that the Bus is functional. Attempt to communicate with the Instrument Cluster and VTSS, If you are unable to establish communications refer to 8 Electrical Electronic Control Module Electrical Diagnostics for the proper Diagnostic procedures.

The Sentry Key Immobilizer System must be operating properly. Check for proper communication with the scan tool and check for DTCs that may be stored in the Sentry Key Immobilizer Module (SKREEM). Repair the DTC(s) before continuing.

If no DTCs are found, using the scan tool, select Clear PCM (BATT Disconnect).

Crank the engine several times. Using the scan tool, read DTCs. If a DTC is present perform the DTC diagnostics before continuing.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. OPEN FUSE

Check for any open fuses in the IPM or Junction Block that may be related to the No Start condition.

**Are any of the fuses open?**

**Yes** >> Replace the open fuse and check the related circuit(s) for a short to ground.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. SECONDARY INDICATORS PRESENT

Ignition on, engine not running.

With the scan tool, under DTCs & Related Functions, read the Secondary Indicators while cranking the engine.

**Are there any Secondary Indicators present while cranking the engine?**

**Yes** >> Refer to the Engine Electrical Diagnostics group and perform the tests related to the secondary indicator that is reported by the scan tool.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. POSSIBLE MECHANICAL PROBLEMS

Check for any of the following conditions/mechanical problems.

ENGINE VALVE TIMING - must be within specifications, check for broken timing components

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

**Are there any engine mechanical problems?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (F142) ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

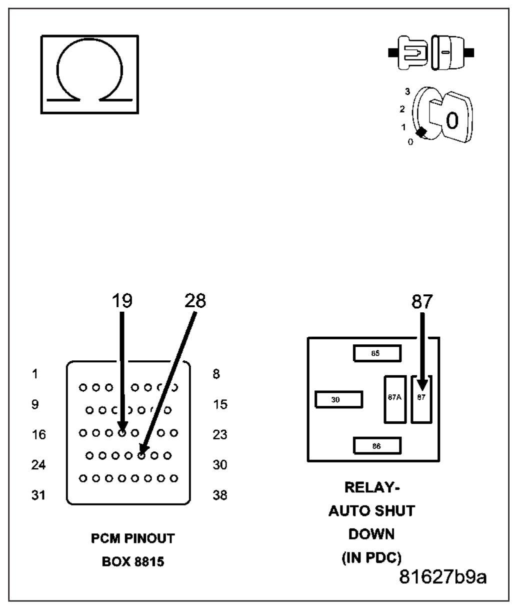
Remove the ASD relay from the PDC.

Disconnect the C3 PCM harness connector.

Verify the ASD Relay is getting voltage on the Fused B+ circuits before continuing.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the ASD Relay Output circuit from the ASD Relay connector to the appropriate terminals of special tool #8815, Ignition coil, and the fuel injectors.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the open in the (F142) ) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. FUEL PUMP DELIVERY

Verify that the Fuel tank is not empty before continuing.

Follow the diagnostics for Checking Fuel Delivery in Section 9 Engine Electrical Diagnostic section of this manual.

**Was the No Start condition solved after following the above diagnostic test?**

**Yes** >> Test Complete.

**No** >> Check for contamination/water in the fuel. Make sure the fuel being used in this vehicle meets manufactures Fuel Requirement, refer to the service manual.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# *FUEL PRESSURE LEAK DOWN

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| FAULTY FUEL PUMP MODULE |
| FUEL INJECTOR(S) |

## Diagnostic Test

### 1. FUEL PUMP MODULE

**NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.**

Turn the ignition off.

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

**NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

**NOTE: The pressure should not fall below 241 KPa (35 psi)**

**Does the fuel pressure drop?**

**Yes** >> Replace Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. FUEL INJECTOR(S)

**WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.**

Remove special tool #C4390.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

**NOTE: NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).**

Move special tool #C4390, Hose Clamp Pliers, from between the fuel pressure gauge and the engine to between the fuel pressure gauge and fuel pump module.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

**NOTE: The pressure should not fall below 241 KPa (35 psi)**

**Does the fuel pressure drop?**

**Yes** >> Replace the leaking fuel injectors.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Test Complete.

## *NO CRANK CONDITION

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| MECHANICAL CONDITION |
| BATTERY CIRCUIT RESISTANCE TOO HIGH |
| FUSED IGNITION SWITCH OUTPUT CIRCUITS |
| FUSED B+ CIRCUIT OPEN |
| (T752) STARTER RELAY CONTROL CIRCUIT OPEN |
| (T750) STARTER RELAY OUTPUT CIRCUIT OPEN |
| TRANSMISSION RANGE SENSOR |
| STARTER RELAY |
| STARTER |

### Diagnostic Test

#### 1. MECHANICAL CONDITION

**NOTE: Verify the battery is fully charged and capable of passing a load test before continuing.**

**WARNING: Make sure the battery is disconnected, then wait two minutes before proceeding. Failure to do so may result in personal injury or possible death.**

Turn the engine over by hand to make sure the engine is not seized.

**Is the engine able to turn over?**

**Yes** >> Go To 2

**No** >> Repair the mechanical condition preventing the starter motor from cranking.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

#### 2. TRANSMISSION RANGE SENSOR

Turn the ignition off.

Disconnect the TRS harness connectors.

Move the Gear selector through all gear positions, from Park to 1st and back.

While moving the gear selector through each gear, measure the resistance between ground and the TRS (T41) Sense (P/NSense) circuit at the TRS connector.

**NOTE: The circuit is grounded in Park and Neutral and open in the other positions.**

**Did the resistance change from above 100 kohms (open) to below 10.0 ohms (grounded) ?**

**Yes** >> Go To 3

**No** >> Replace the Transmission Range Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. EXCESSIVE RESISTANCE IN THE BATTERY CIRCUIT

Turn the ignition off.

Check the Battery Cables for excessive resistance using the service information procedure.

**Did either Battery Cable have a voltage drop greater than 0.2 of a volt?**

**Yes** >> Repair the excessive resistance in the Battery circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. STARTER RELAY

Turn ignition off.

Remove the Starter Relay from PDC.

Install a known good Relay.

**Will the Starter Motor crank with the new relay?**

**Yes** >> Replace the Starter Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. INTERNAL FUSED IGNITION SWITCH OUTPUT CIRCUIT

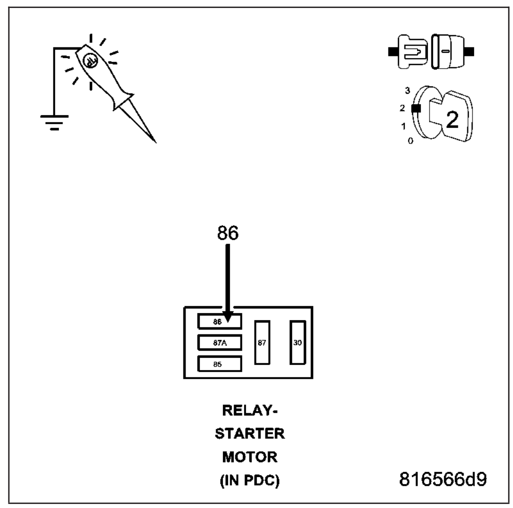
Turn the ignition off.

Remove the Starter Relay from the PDC.

Ignition on, engine not running.

Using a 12-volt test light, probe the Internal Fused Ignition Switch Output circuit in the Starter Relay connector.

While observing 12-volt test light, hold ignition key in the start position.




**Does the test light illuminate brightly?**

**Yes** >> Go To 6

**No** >> Repair the excessive resistance in the (F924) Fused Ignition Switch Output circuit. Inspect related fuses and repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

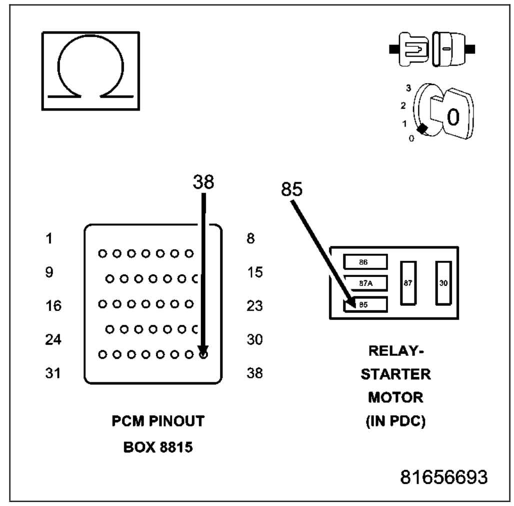
## 6. (T752) STARTER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the Starter Relay from the PDC.

Disconnect the C3 PCM harness connector.

Measure the resistance in the (T752) Starter Relay Control circuit from the Relay terminal to the appropriate terminals of special tool #8815.




**Is the resistance below 5.0 ohms?**

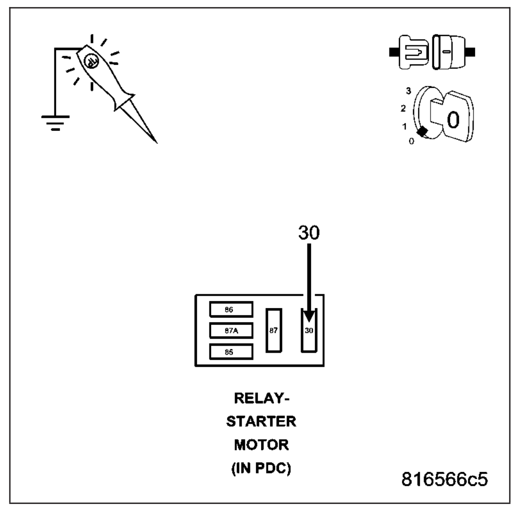
**Yes** >> Go To 7

**No** >> Repair the open in the (T752) Starter Relay Control circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 7. INTERNAL FUSED B+ CIRCUIT OPEN

Turn the ignition off.

Using a 12-volt test light connected to ground, probe the Internal Fused B+ circuit at the Starter Relay terminal.




**Does the test light illuminate brightly?**

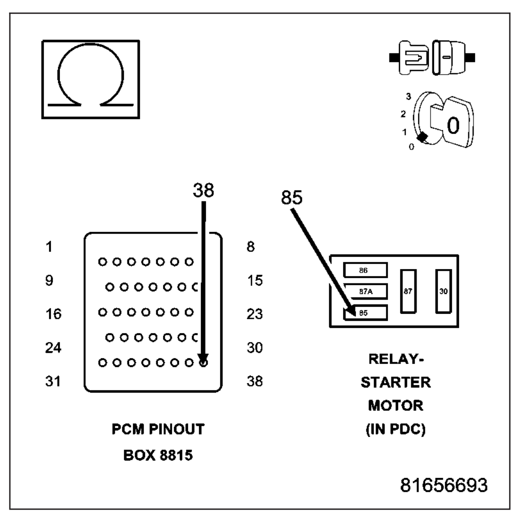
**Yes** >> Go To 8

**No** >> Repair the excessive resistance in the Internal Fused B+ circuit. Inspect related fuses and repair as necessary. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 8. (T750) STARTER RELAY OUTPUT CIRCUIT OPEN

Disconnect the Starter Relay Output connector from the Starter Solenoid.

Measure the resistance of the (T750) Starter Relay Output circuit between the Relay and the Solenoid harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 9

**No** >> Repair the open in the (T750) Starter Relay Output circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 9. STARTER

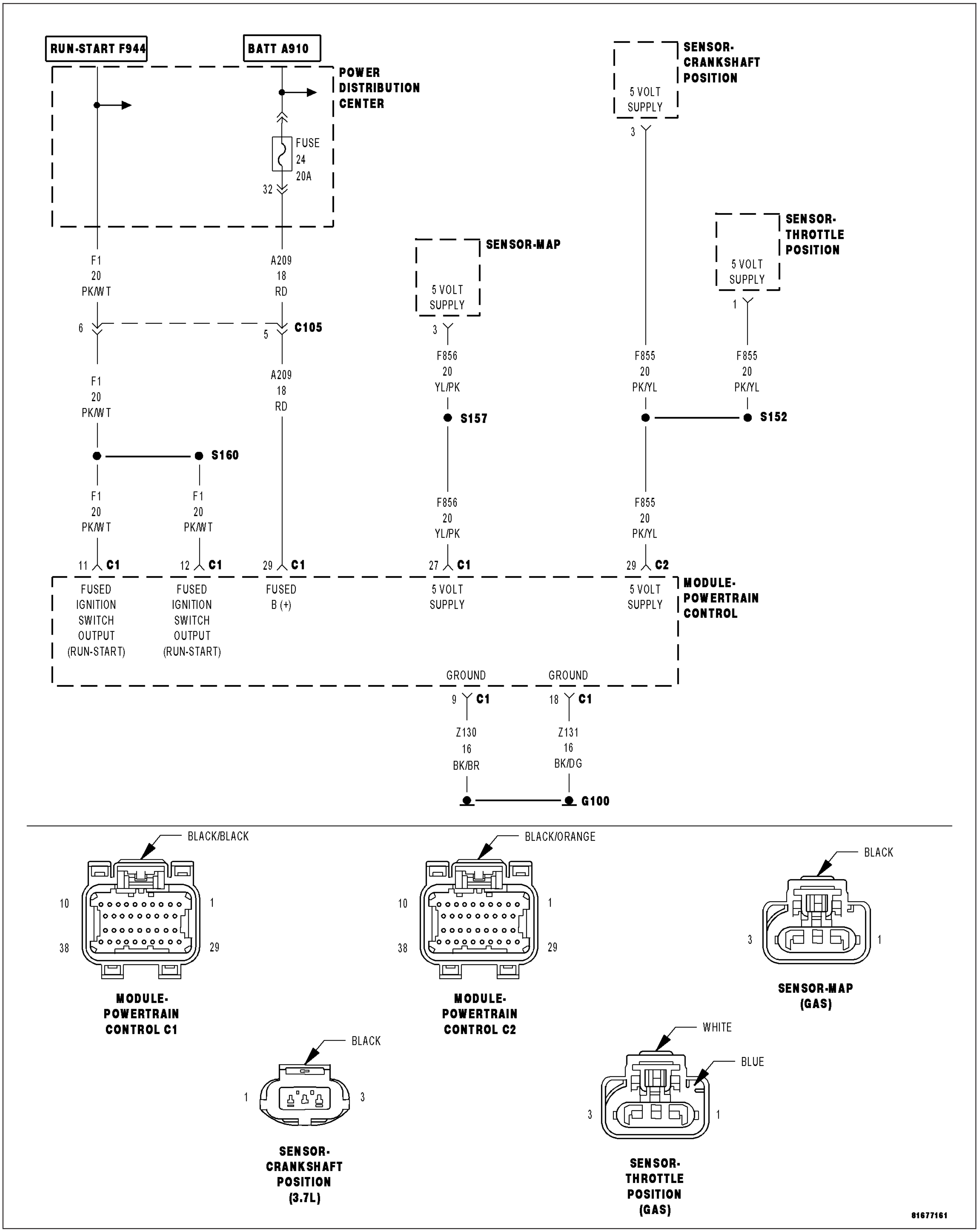
**If there are no other possible causes remaining, review repair.**

**Repair**

Replace the Starter.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## *NO RESPONSE WITH A NO START CONDITION




For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| (A209) PCM FUSED B+ CIRCUIT |
| PCM NO RESPONSE |
| (F1) (F26) PCM FUSED IGNITION SWITCH OUTPUT CIRCUITS |
| (Z130) (Z131) PCM GROUND CIRCUITS |
| CRANKSHAFT POSITION SENSOR |
| (F855) 5-VOLT SENSOR OPEN/SHORTED |
| (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| PCM |

## Diagnostic Test

### 1. (A209) PCM FUSED B+ CIRCUIT

**NOTE: The scan tool and cable must be operating properly for the results of this test to be valid.**

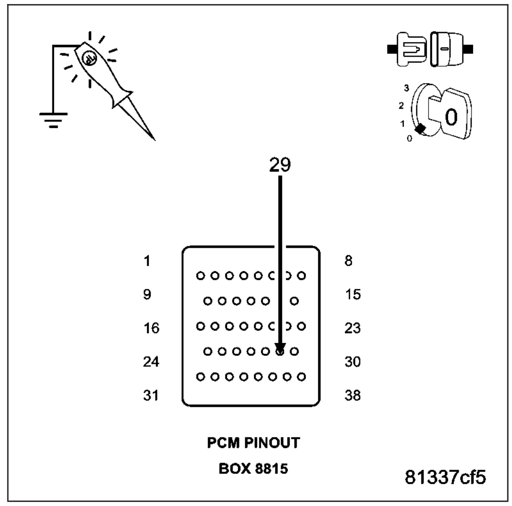
**NOTE: Make sure the ignition switch was on while trying to communicate with the PCM.**

Turn the ignition off.

Disconnect the C1 PCM harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Using a 12-volt test light connected to ground, probe the appropriate terminal of special tool #8815.




**Does the test light illuminate brightly?**

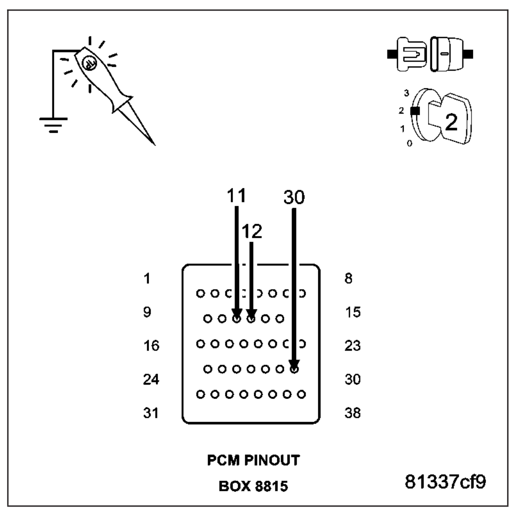
**Yes** >> Go To 2

**No** >> Repair the open or short to ground in the (A209) Fused B+ circuit. Inspect and replace fuses as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

### 2. (F1) (F26) PCM FUSED IGNITION SWITCH CIRCUITS

Using a 12-volt test light connected to ground, probe the PCM Fused Ignition Switch Output circuit in the appropriate terminals of special tool #8815.




**Does the test light illuminate brightly?**

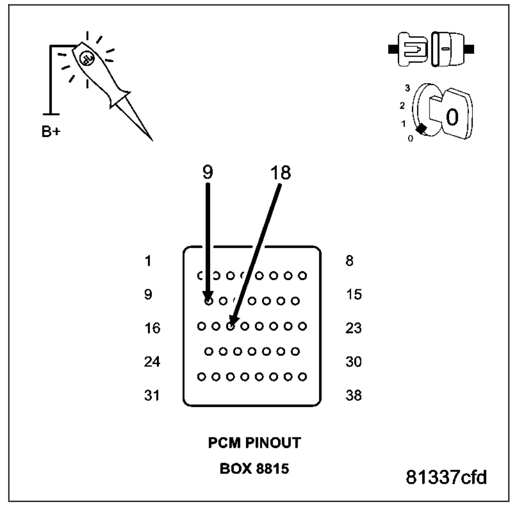
**Yes** >> Go To 3

**No** >> Repair the (F1) and (F26) Ignition Switch Output circuits. Inspect and replace fuses as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 3. (Z130) (Z131) PCM GROUND CIRCUITS

Using a 12-volt test light connected to battery voltage, probe the (Z130) and (Z131) PCM ground circuits in the appropriate terminals of special tool #8815.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the PCM ground circuits.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. (F855) 5-VOLT SUPPLY CIRCUIT

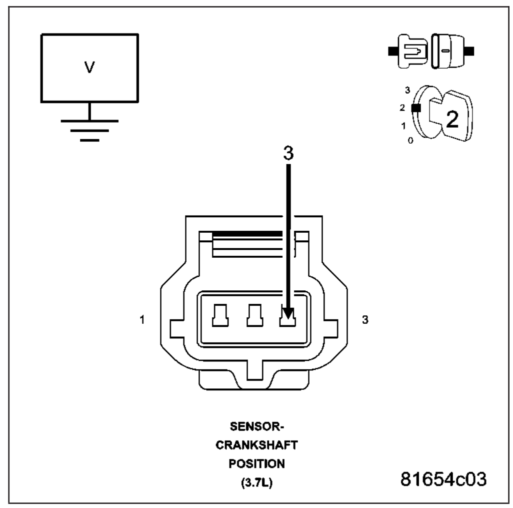
Turn the ignition off.

Connect the C1 PCM harness connector.

Disconnect the Crankshaft Position Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit.




**Is the voltage between 4.5 and 5.2 volts?**

**Yes** >> Go To 5

**No** >> Go To 6

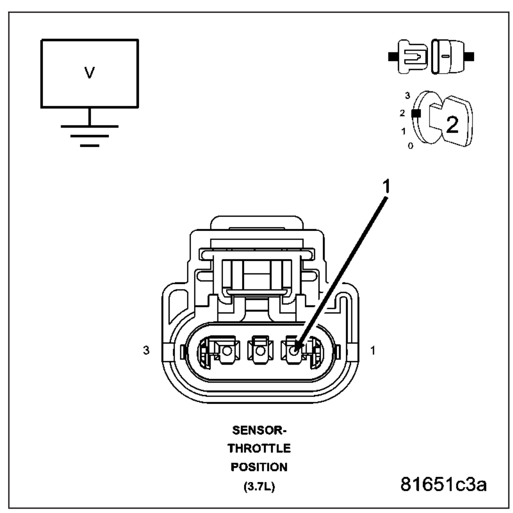
## 5. CKP SENSOR

Turn the ignition off.

Disconnect the TP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the TP Sensor harness connector.




**Is the voltage between 4.5 and 5.2 volts?**

**Yes** >> If communication is available with a PCM on a like vehicle, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace the Crankshaft Position Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. (F855) 5-VOLT SENSOR OPEN/SHORTED

Turn the ignition off.

Disconnect the TP Sensor/Throttle Body harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit.

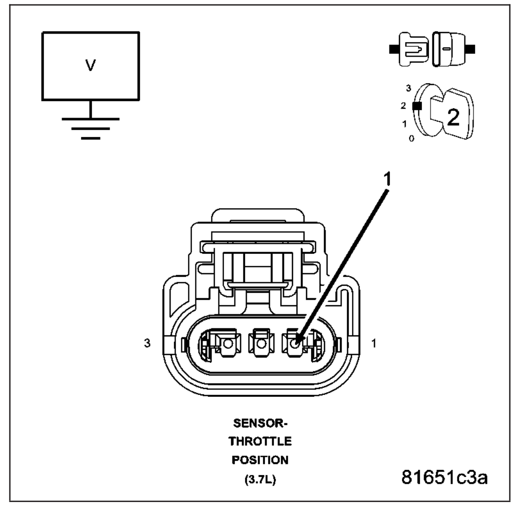
Disconnect all the sensors that use the (F855) 5-volt Supply circuit.

**Did the voltage return to 4.5 to 5.2 volts when disconnecting any of the sensors.**

**Yes** >> Replace the sensor that is pulling down the (F855) 5-volt supply.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7




## 7. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect C2 PCM harness connector.

Disconnect all the sensors that share the (F855) 5-volt Supply circuit.

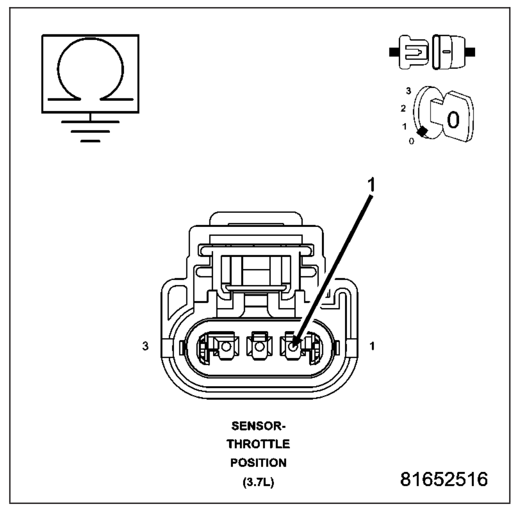
Measure the resistance between ground and the (F855) 5-volt Supply circuit at one of the sensor harness connectors.

**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

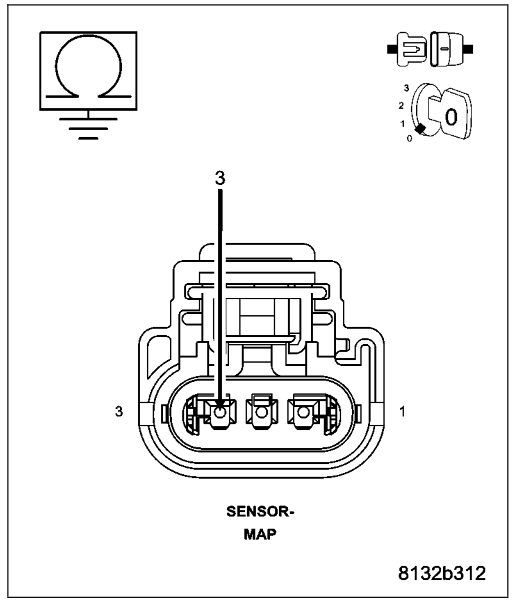
**No** >> Go To 8



## 8. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Disconnect all the sensors that share the (F856) 5-volt Supply circuit.

Measure the resistance between ground and the (F856) 5-volt Supply circuit at one of the sensor harness connectors.




**Is the resistance below 100 ohms?**

**Yes** >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. PCM

**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.**

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## *START AND STALL CONDITION

For a complete wiring diagram **Refer to Section 8W**.

| Possible Causes |
|---|
| CURRENT PCM DTCS |
| CURRENT SKIM DTCS |
| THROTTLE POSITION SENSOR SWEEP |
| TP SENSOR NO.1 VOLTAGE GREATER THAN 0.92 VOLTS WITH THROTTLE CLOSED |
| ECT SENSOR |
| OTHER POSSIBLE CAUSES FOR START AND STALL CONDITON |
| FUEL CONTAMINATION |

## Diagnostic Test

### 1. CHECKING DTCS

Ignition on, engine not running.

With a scan tool, read DTCs.

**Are any DTCs present?**

**Yes** >> Refer to the appropriate Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST.

**No** >> Go To 2

### 2. CHECKING SKIM DTCS

**NOTE: If you are unable to communicate with the SKIM/SKREEM, refer to the VEHICLE THEFT AND SECURITY ELECTRICAL DIAGNOSTICS in Section 8 and perform the appropriate diagnostics.**

With the scan tool, read the SKIM codes.

**Are there any SKIM DTCs?**

**Yes** >> Refer to the Sentry Key Vehicle Theft Security Electrical Diagnostics in Section 8.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 3

### 3. TP SENSOR SWEEP

Ignition on, engine not running.

With the scan tool read TP Sensor voltage.

While monitoring the scan tool, slowly open and close the Throttle.

**Was the voltage change smooth?**

**Yes** >> Go To 4

**No** >> Replace the Throttle Position Sensor per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 4. TP SENSOR NO.1 VOLTAGE GREATER THAN 0.92 VOLTS WITH THROTTLE CLOSED

With the scan tool, read Throttle Position Sensor No.1 voltage.

Throttle must be against its stop.

**Is the voltage 0.92 or less with the Throttle closed?**

**Yes** >> Go To 5

**No** >> Check for a binding throttle condition. If OK, replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 5. ECT SENSOR OPERATION

**NOTE: For this test to be valid, the thermostat must be operating correctly.**

**NOTE: This test works best if performed on a cold engine (cold soaked).**

**NOTE: If the vehicle was allowed to sit over night with no engine start, coolant temperature should be near ambient temperatures.**

Ignition on, engine not running.

With the scan tool, read the ECT value.

**NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.**

Start the engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temperature value change should be a smooth transition from start up to normal operating temp 82° C (180° F). The value should reach at least 82° C (180° F).

**Did the Engine Temperature value increase smoothly and did it reach at least 82° C (180° F)?**

**Yes** >> Go To 6

**No** >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

## 6. OTHER POSSIBLE CAUSES OF START AND STALL CONDITION

The following additional items should be checked as a possible cause for a start and stall condition.

Refer to any Technical Service Bulletins (TSBs) that may apply to the symptom.

The exhaust system must be free of any restrictions.

The engine compression must be within specifications.

The engine valve timing must be within specifications.

The engine must be free from vacuum leaks.

The throttle body must be free of carbon buildup and dirt.

**Do any of the above conditions exist?**

**Yes** >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. FUEL PUMP DELIVERY

Verify that the Fuel tank is not empty before continuing.

Follow the diagnostics for Checking Fuel Delivery in this manual.

**Was the No Start condition solved after following the above diagnostic test?**

**Yes** >> Test Complete.

**No** >> Check for contamination/water in the fuel. Make sure the fuel being used in this vehicle meets manufactures Fuel Requirement, refer to the service manual.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

# STANDARD PROCEDURE

# POWERTRAIN VERIFICATION TEST

For a complete wiring diagram **Refer to Section 8W**.

## Diagnostic Test

### 1. SELECTING THE PROPER VERIFICATION TEST

**The following verification test are for different repairs. Select the appropriate Verification test for the repair that has been completed.**

**Speed Control repair**
Go To 2

**Charging System repair**
Go To 3

**NVLD System repair**
Go To 4

**All other repairs**
Go To 5

### 2. POWERTRAIN VERIFICATION TEST 1

**NOTE: 1. If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.**

**NOTE: 2. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.**

**NOTE: 3. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.**

**NOTE: 4. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information. Using the scan tool, program the Secret Key information into the PCM using the PCM replaced function under the WCM menu.**

5. Inspect the vehicle to make sure that all engine components are properly installed and connected.
6. Connect the scan tool to the data link connector and erase all codes.
7. Turn the speed control ON (if equipped, cruise light will be on).
8. Depress and release the SET Switch when the vehicle speed is greater than 35 MPH. The speed control should engage and hold the selected speed.
9. Press and hold the RESUME/ACCEL Switch. The vehicle speed should increase by at least 2 MPH.
10. Press and hold the COAST switch. The vehicle speed should decrease.
11. Using caution, press and release the brake pedal. The speed control should disengage.
12. Bring the vehicle speed back up to 35 MPH.
13. Press the RESUME/ACCEL switch. The speed control should resume the previously set speed.
14. Hold down the SET switch. The vehicle should decelerate.
15. Make sure vehicle speed is greater than 35 mph and release the SET Switch. The vehicle should adjust and set a new vehicle speed.
16. Press and release the CANCEL switch. The speed control should disengage.
17. Bring the vehicle speed back up above 35 mph and engage speed control.
18. Turn the Speed Control Off. (Cruise light will be off). The speed control should disengage.

**NOTE: OVERSHOOT/UNDERSHOOT FOLLOWING SPEED CONTROL SET.**

19. If the vehicle operator repeatedly presses and releases the SET button with their foot off of the accelerator (referred to as ″lift foot set″), the vehicle may accelerate and exceed the desired set speed by up to 5 mph (8 km/h).
20. It may also decelerate to less than the desired set speed, before finally achieving the desired set speed.
21. The Speed Control System has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths.
22. When the speed control is set with the vehicles operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts accordingly.

23. If the ″lift foot sets″ are continually used, a speed control overshoot/undershoot condition will develop.

24. To ″unlearn″ the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed using the accelerator pedal (not decelerating or accelerating).

25. Then turn the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds.

26. This procedure must be performed approximately 10-15 times to completely unlearn the overshoot/undershoot condition.

**Did the Speed Control pass the above test?**

**Yes** >> Repair is complete.

**No** >> Check for any related Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

## 3. POWERTRAIN VERIFICATION TEST 2

1. If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly has been replaced use a scan tool to perform the ETC RELEARN function.

**NOTE: 2. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.**

**NOTE: 3. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.**

**NOTE: 4. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information. Using the scan tool, program the Secret Key information into the PCM using the PCM replaced function under the WCM menu.**

5. Inspect the vehicle to make sure that all components related to the repair are properly installed and connected.

6. With the scan tool, clear DTCs.

7. Perform generator output test. Refer to the appropriate service information as necessary.

8. Start the engine and set engine speed to 2000 RPM for at least thirty seconds.

9. Cycle the ignition key off and on.

10. With the scan tool, read the DTCs.

**Are any DTCs or symptoms remaining?**

**Yes** >> Check for any Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

**No** >> Repair is complete.

## 4. POWERTRAIN VERIFICATION TEST 3

1. Install the Miller Tool #8404 Evaporative Emission Leak Detector (EELD) according to the instructions in the previous DTC table.

2. Set the smoke/air control switch to AIR.

3. Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

4. Press the remote smoke/air start button.

5. Position the red flag on the air flow meter so it is aligned with the indicator ball.

6. When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size of leak indicated by the DTC set in the PCM.

7. Install the service port adapter #8404-14 on the vehicle's service port.

8. Connect the Air supply hose from the EELD to the vehicle.

9. Press the remote button to activate AIR flow.

**NOTE: 10. Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.**

11. Compare the flow meter indicator ball reading to the red flag.

12. ABOVE the red flag indicates a leak present.

13. BELOW the red flag indicates a sealed system.

**NOTE: If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.**

14. If the indicator ball shows a leak present, perform the smoke test indicated in the previous test and identify the leak and repair. Perform this verification test when the repair is complete.

**Did the indicator ball indicate the a leak is present?**

**Yes** >> Repeat the DTC test to identify the leak and repair.

**No** >> Repair is complete.

## 5. POWERTRAIN VERIFICATION TEST 4

**NOTE: 1. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.**

**NOTE: 2. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.**

**NOTE: 3. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information. Using the scan tool, program the Secret Key information into the PCM using the PCM replaced function under the WCM menu.**

**NOTE: 4. If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.**

**NOTE: 5. When replacing an O2 Sensor, the PCM RAM memory must be cleared, either by disconnecting the PCM C1 connector or momentarily disconnecting the Battery negative terminal.**

6. The NGC learns the characteristics of each O2 heater element and these old values should be cleared when installing a new O2 sensor. The customer may experience driveability issues if this is not performed.

7. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.

8. Connect the scan tool to the data link connector.

9. Make sure the fuel tank has at least a quarter tank of fuel. Turn off all accessories.

10. If the Catalyst was replaced, with the scan tool go to the Miscellaneous Menu Option ″Catalyst Replaced″ and press enter.

11. If a Comprehensive Component DTC was repaired, perform steps 12 - 14. If a Major OBDII Monitor DTC was repaired skip those steps and continue verification.

12. After the ignition has been off for at least 10 seconds, restart the vehicle and run 2 minutes.

13. With the scan tool, monitor the appropriate pre-test enabling conditions until all conditions have been met. Once the conditions have been met, switch screen to the appropriate OBDII monitor, (Audible beeps when the monitor is running).

14. If the repaired OBDII trouble code has reset or was seen in the monitor while on the road test, the repair is not complete. Check for any related technical service bulletins or flash updates and return to Engine Electrical Diagnostic List.

15. If the conditions cannot be duplicated, erase all DTCs with the Scan tool.

16. If another DTC has set, return to the Engine Electrical Diagnostic List and follow the path specified for that DTC.

**Did the OBDII Monitor run successfully and has the Good Trip Counter changed to one or more?**

**Yes** >> Repair is complete.

**No** >> Check for any related Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

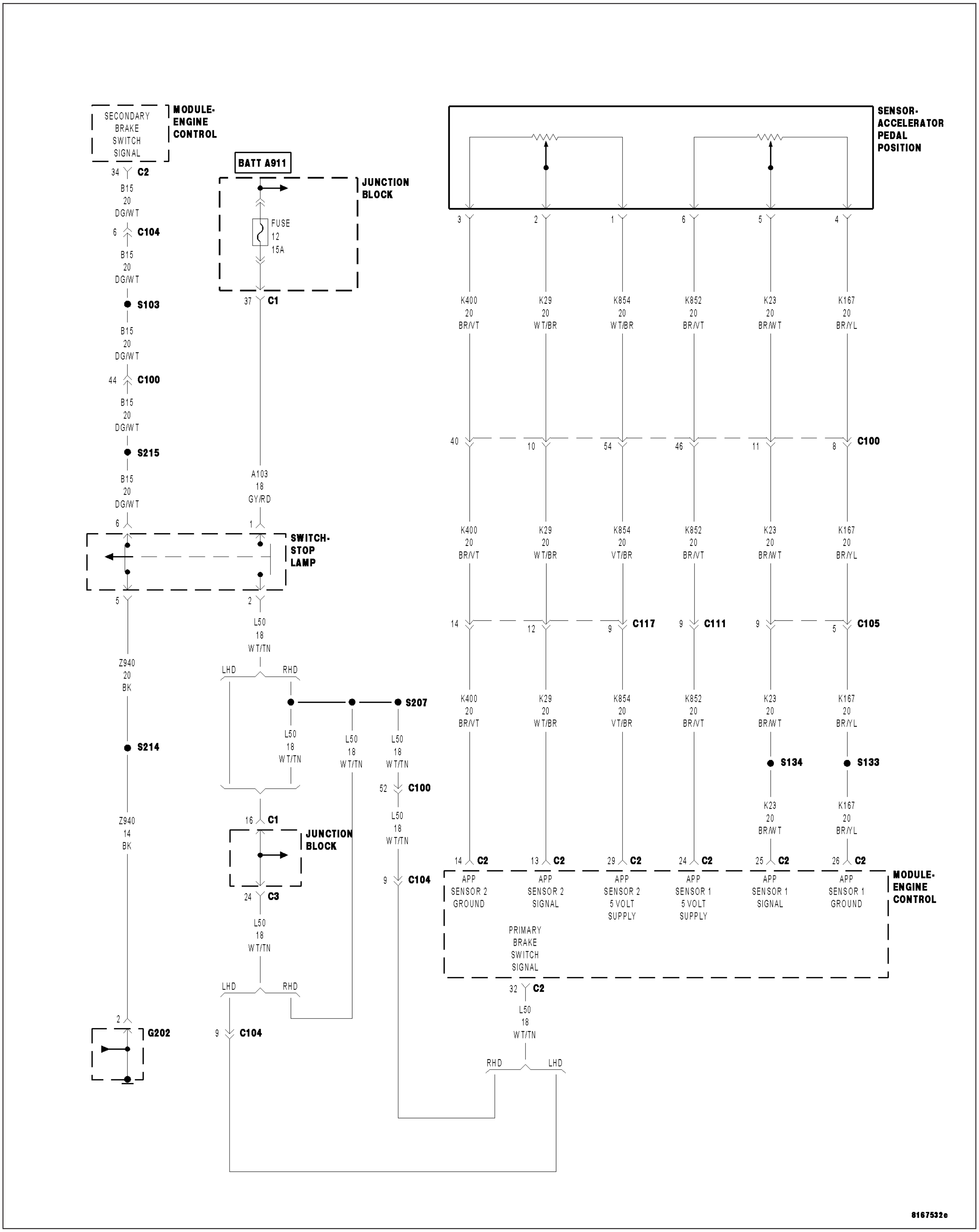
# ENGINE DIESEL DIAG

## TABLE OF CONTENTS

# ENGINE DIESEL DIAG

## DIAGNOSIS AND TESTING

# *CHECKING THE ACCELERATOR PEDAL POSITION SENSOR CALIBRATION




For a complete wiring diagram **Refer to Section 8W**

## Theory of Operation

The Accelerator Pedal Position Sensor (APP) is a device that contains 2 separate potentiometer type sensors. Each sensor has its own 5-volt supply circuit, sensor ground circuit and signal circuit.

The APP Sensor 2 signal should always be approximately 1/2 the voltage of the APP Sensor 1 signal.

| Possible Causes |
|---|
| APP SENSOR OPERATION |
| APP SENSOR CIRCUIT 1 HIGH RESISTANCE |
| APP SENSOR CIRCUIT 2 HIGH RESISTANCE |

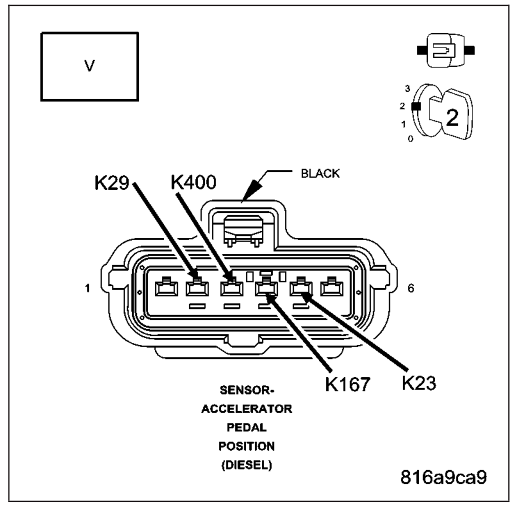
## Diagnostic Test

### 1. APP SENSOR IDLE VOLTAGE

Inspect the Accelerator Pedal Position Sensor for proper travel from the rest position to the fully depressed position.

Turn the ignition on.

With the accelerator pedal in the rest position, use a voltmeter to back-probe the (K23) Accelerator Pedal Position Sensor 1 and the (K29) Accelerator Pedal Position Sensor 2 Signal circuits at the Accelerator Pedal Position Sensor harness connector with the accelerator pedal in the at rest position.




**Is the voltage between 0.42 and 0.51 volt for sensor 1 and 0.19 and 0.28 volt for sensor 2?**

**Yes** >> Go To 2

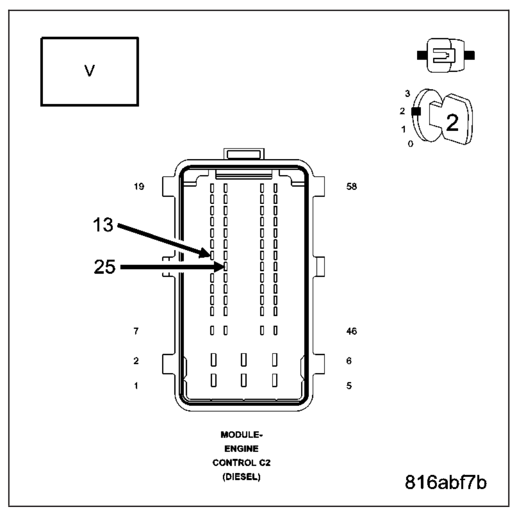
**No** >> Check the wiring and connectors related to the Accelerator Pedal Position Sensor. If OK, replace the Accelerator Pedal Position Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

### 2. APP SENSOR

While back probing, measure the voltage of the (K23) Accelerator Pedal Position Sensor Signal 1 and (K29) Accelerator Pedal Position Sensor Signal 2 circuits at the ECM.

Monitor the voltmeter while slowly pressing the accelerator pedal completely down.




**Did the voltage for both sensors increase smoothly with pedal travel?**

**Yes** >> Go To 3

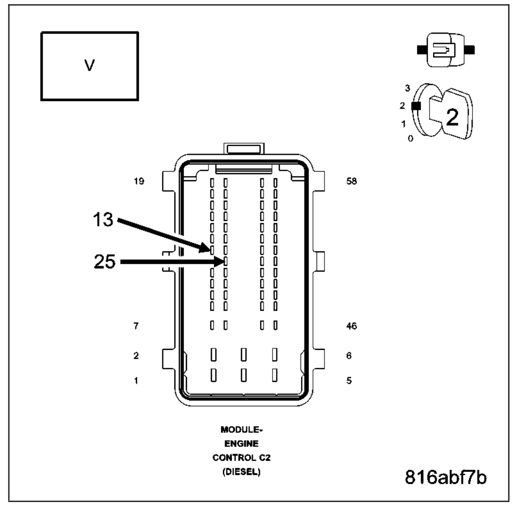
**No** >> Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. APP SENSOR WIDE OPEN THROTTLE VOLTAGE

Using a voltmeter backprobe the Accelerator Pedal Position Sensor harness connector and read the voltage for (K23) Accelerator Pedal Position Sensor 1 and (K29) Accelerator Pedal Position Sensor 2 Signal circuits.

Fully depress the accelerator pedal.



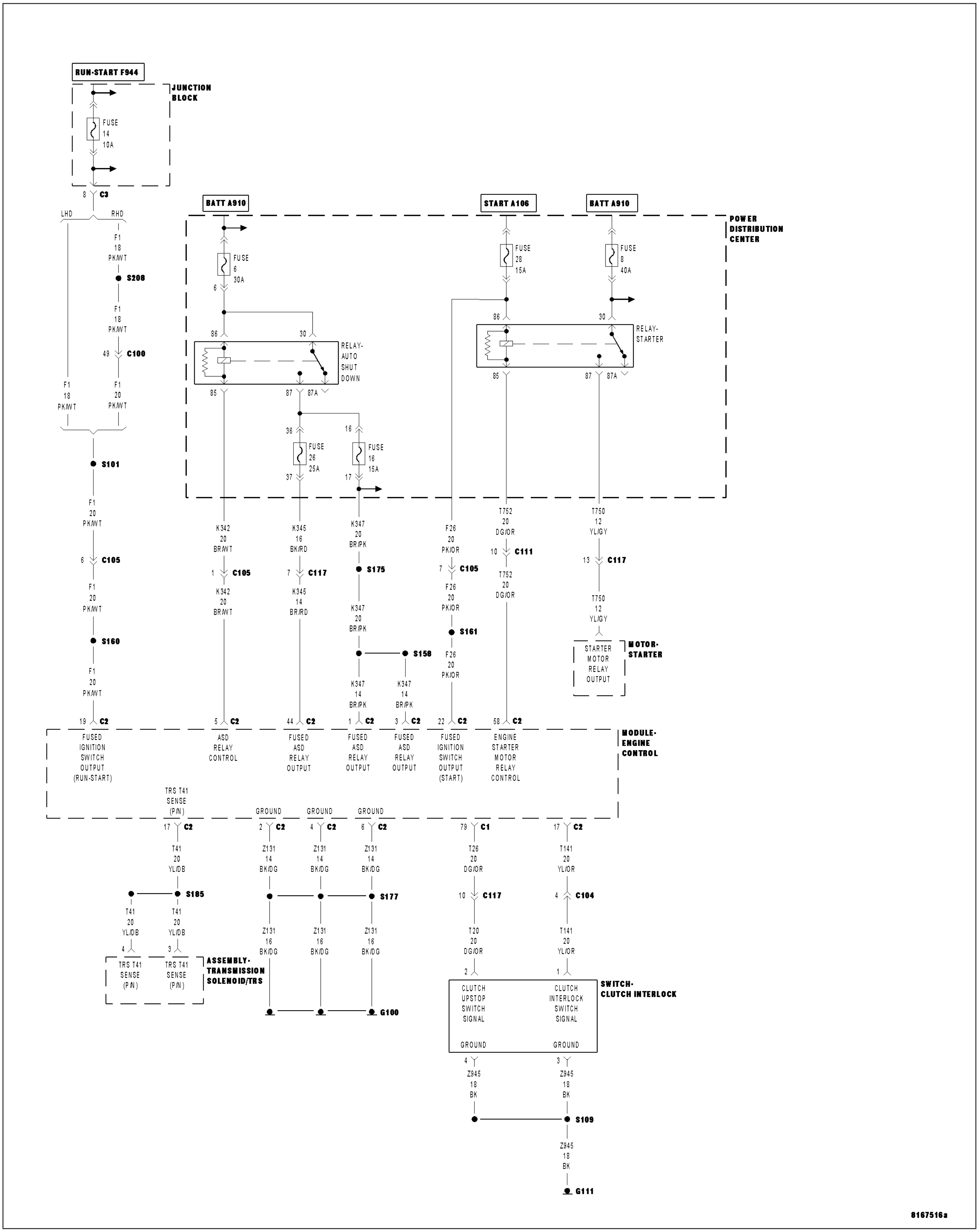

**Is the voltage between 4.45 and 4.75 volts for #1 and 2.15 and 2.45 volts for #2?**

**Yes** >> Test Complete.

**No** >> Check the wiring and connectors related to the APP Sensor. If OK, replace the Accelerator Pedal Position Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# *CHECKING THE ECM POWER AND GROUND CIRCUITS




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| (K342) ASD RELAY CONTROL CIRCUIT OPEN |
| (K347) ASD RELAY OUTPUT CIRCUIT(S) OPEN |
| (Z131) ECM GROUND CIRCUIT(S) OPEN |
| FUSED ASD RELAY BATTERY SUPPLY CIRCUIT OPEN |
| (F26)<br>FUSED IGNITION SWITCH (START) OUTPUT CIRCUIT OPEN |
| (F1) FUSED IGNITION SWITCH (START/RUN) OUTPUT CIRCUIT OPEN |
| SUBSTITUTE ASD RELAY |
| (K342) ASD RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE |

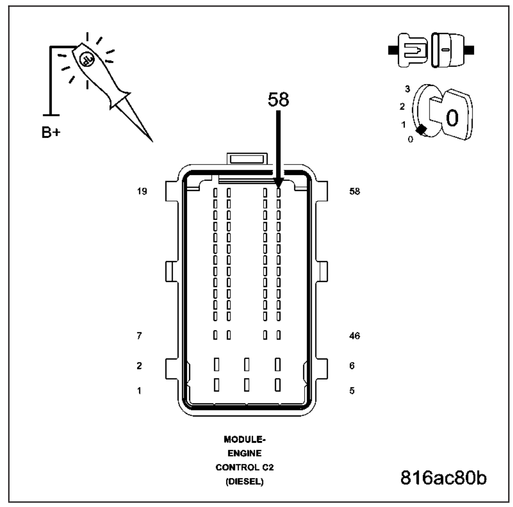
## Diagnostic Test

### 1. ECM GROUND CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Using a 12-volt test light connected to 12-volts, check each of the ECM ground circuits in ECM harness connector C2 cavities 2, 4 and 6.




**Did the test light illuminate for each cavity?**

**Yes** >> Go To 2

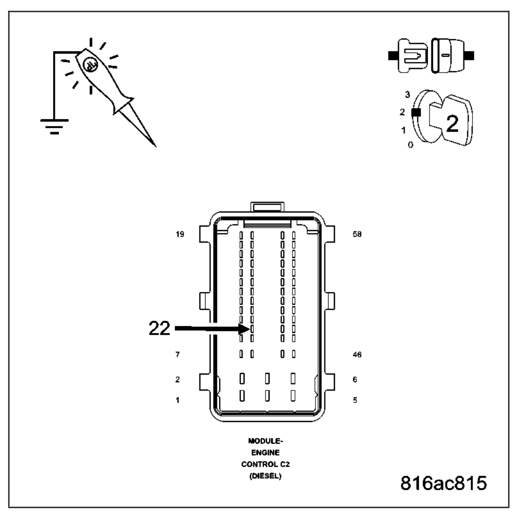
**No** >> Repair the ECM Ground circuit(s) for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

### 2. FUSED IGNITION SWITCH START OUTPUT CIRCUIT OPEN

Turn the ignition to the Start position.

Using a 12-volt test light connected to ground, check the Fused Ignition Switch (Start) Output circuit in ECM harness connector C2 cavity 22.




**Is the test light on?**

**Yes** >> Go To 3

**No** >> Repair the Fused Ignition Switch (Start) Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. FUSED IGNITION SWITCH START/RUN OUTPUT CIRCUIT OPEN

Using a 12-volt test light connected to ground, check the Fused Ignition Switch (Start Run Output circuit in ECM harness connector C2 cavity 19.

Turn the ignition to the Run position.

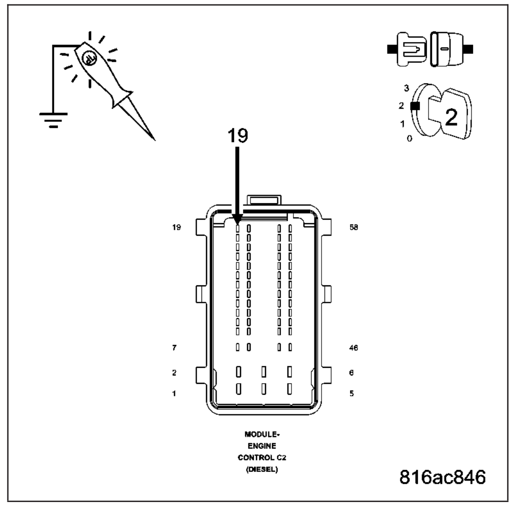
Using a 12-volt test light connected to ground, check the Fused Ignition Switch (Start/Run) Output circuit in ECM harness connector C2 cavity 19.

**Is the test light on for both ignition switch positions?**

**Yes** >> Go To 4

**No** >> Repair the Fused Ignition Switch (Start/Run) Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 4. CHECKING THE ASD RELAY SYSTEM

Turn the ignition off.

Connect a jumper wire between ground and the ASD Relay Control circuit in ECM C2 harness connector cavity 44.

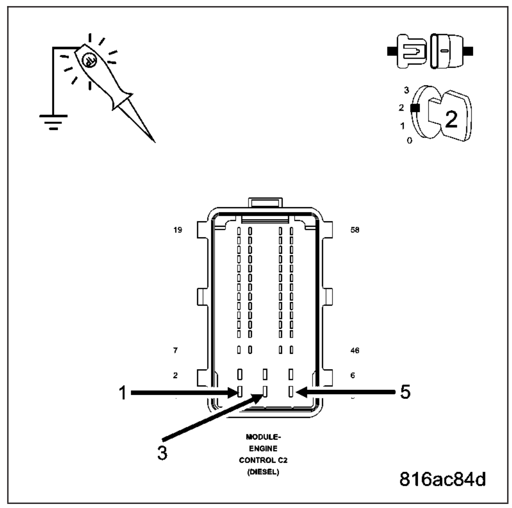
Turn the ignition on.

Using a 12-volt test light connected to ground, check the Fused ASD Relay Output circuits at the ECM C2 harness connector cavities 1, 3 and 5.

**Does the test light illuminate brightly for each circuit?**

**Yes** >> Test Complete.

**No** >> Go To 5




## 5. FUSED ASD RELAY BATTERY SUPPLY CIRCUIT OPEN

Turn the ignition off.

Remove the ASD Relay from the PDC.

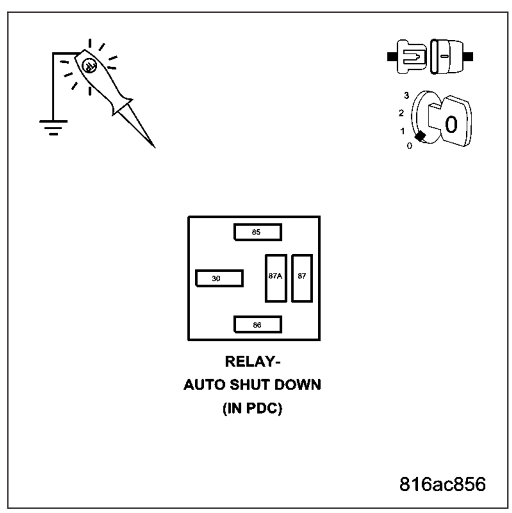
Using a 12-volt test light connected to ground, check both Fused ASD Relay Battery Supply circuits in ASD Relay connector.

**Is the test light on?**

**Yes** >> Go To 6

**No** >> Repair the Fused ASD Relay Battery Supply circuit(s) for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 6. ASD RELAY OUTPUT CIRCUIT OPEN

Connect a jumper wire between cavity 30 and cavity 87 in the ASD Relay connector.

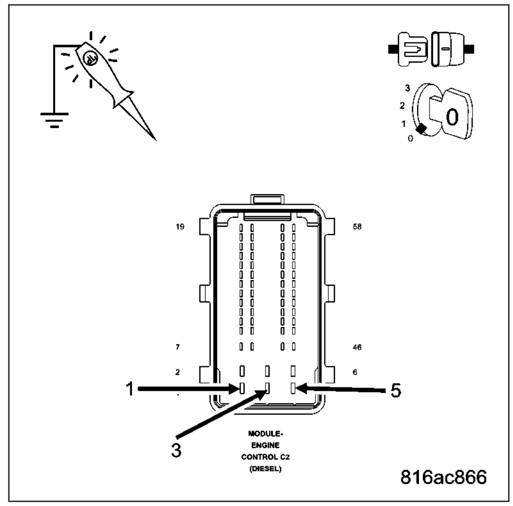
Using a 12-volt test light connected to ground, check the ASD Relay Output circuit in ECM harness connector C2 cavities 1, 3 and 5.

**Did the test light illuminate for each circuit?**

**Yes** >> Go To 7

**No** >> Repair the ASD Relay Output circuit(s) for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 7. ASD RELAY

Install a substitute relay in place of the ASD Relay.

Connect a jumper wire between ground and the ASD Relay Control circuit in ECM C2 harness connector cavity 44.

Turn the ignition on.

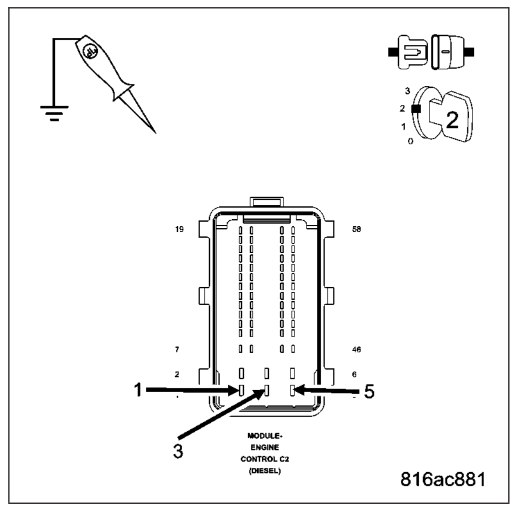
Using a 12-volt test light connected to ground, check the Fused ASD Relay Output circuits at the ECM C2 harness connector cavities 1, 3 and 5.

**Did the test light illuminate brightly for each circuit?**

**Yes** >> Replace the ASD Relay.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8




## 8. ASD RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the ASD Relay from the PDC.

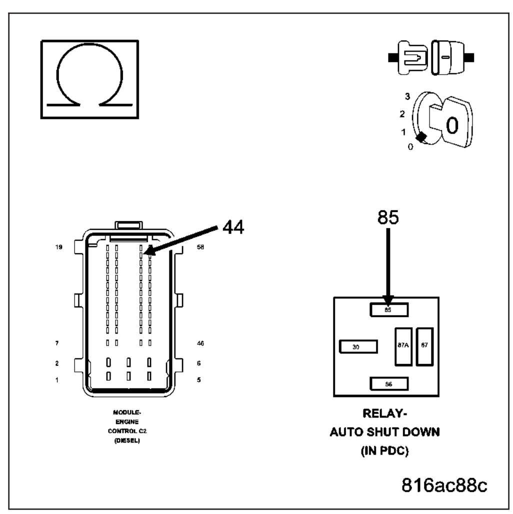
Measure the resistance of the ASD Relay Control circuit between the PDC connector and the ECM harness connector.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 9

**No** >> Repair the ASD Relay Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 9. ASD RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector in the PDC.

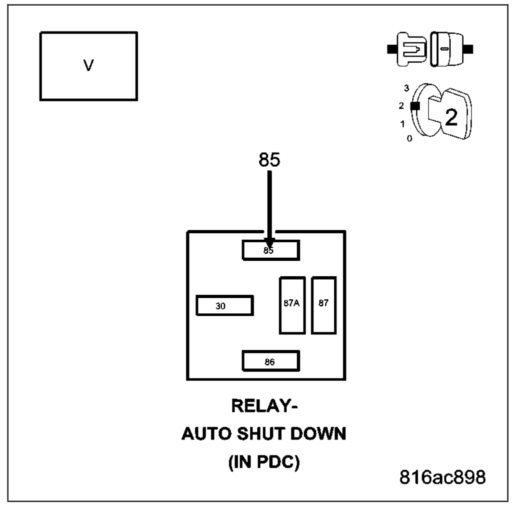
Turn the ignition on.

Measure the voltage on the ASD Relay Control circuit.

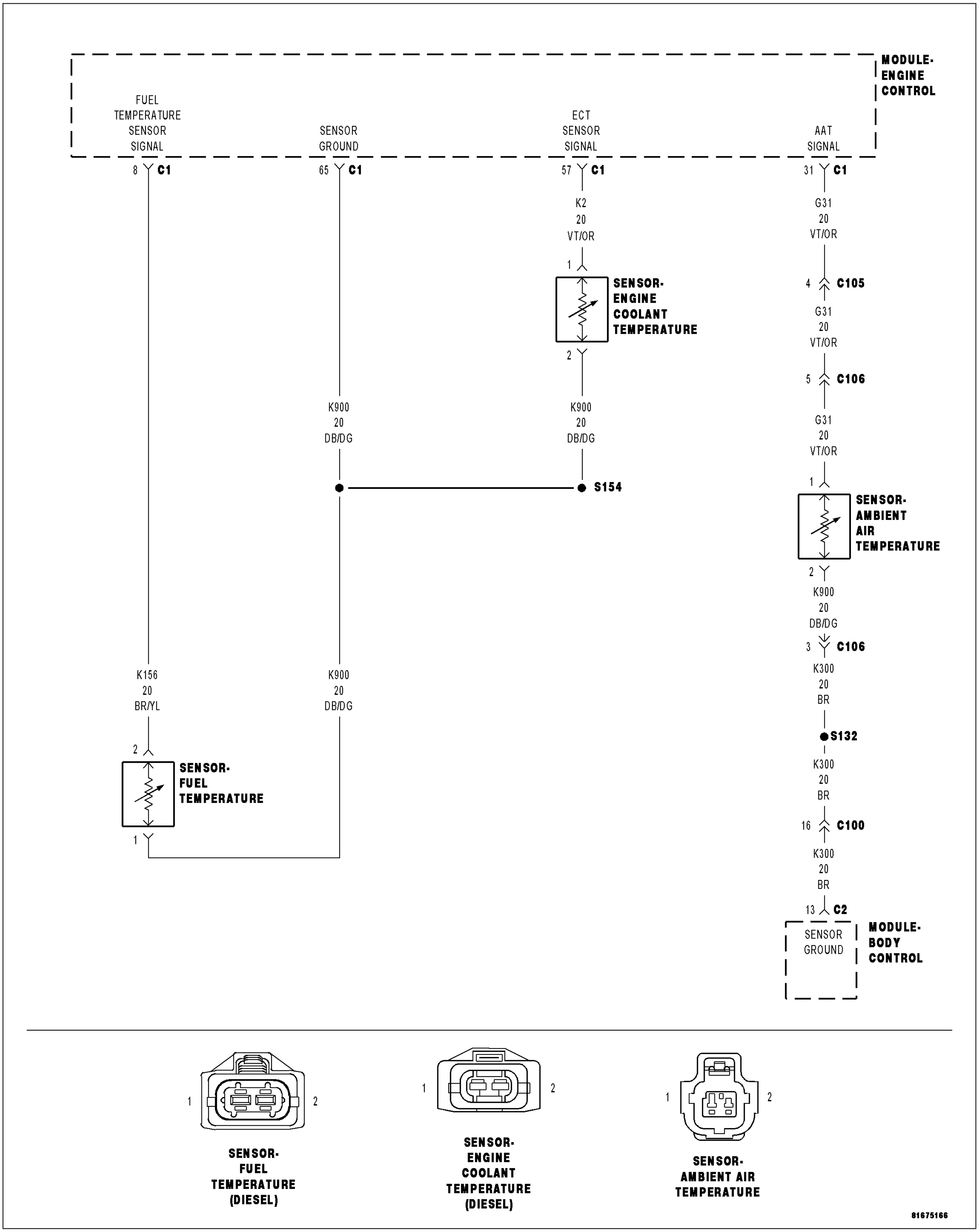
**Is the voltage above 1.0 volt?**

**Yes** >> Repair the ASD Relay Control circuit for a short to voltage. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.



## *CHECKING THE ENGINE COOLANT TEMPERATURE SENSOR CALIBRATION




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
| --- |
| ECT SENSOR - COLD |
| ECT SENSOR - HOT |

## Diagnostic Test

### 1. ECT SENSOR - COLD

**NOTE: The thermostat must be operating correctly for this test to be valid.**

Using the scan tool read and note the engine coolant temperature.

Using a temperature probe, measure the engine block temperature near the ECT Sensor.

**NOTE: The engine temperature should be below 50°C (120°F).**

**Are the readings within 7°C (13°F) of each other?**

**Yes** >> Go To 2

**No** >> Check the wiring and connectors associated with the ECT Sensor for corrosion, damage or other problems. Repair as necessary. If wiring and connectors are o.k., replace the Engine Coolant Temperature Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

### 2. ECT SENSOR - HOT

**NOTE: The thermostat must be operating correctly for this test to be valid.**

Start the engine and bring the engine to operating temperature (thermostat open).

Turn the engine off and wait 10 minutes to allow the engine temperature to stabilize.

Using a temperature probe, measure the engine block temperature near the ECT Sensor.

Using the Scan Tool, read the engine coolant temperature.

**Are the readings within 7°C (13°F) of each other?**

**Yes** >> Test Complete.

**No** >> Check the wiring and connectors associated with the ECT Sensor for corrosion, damage or other problems. Repair as necessary. If wiring and connectors are o.k., replace the Engine Coolant Temperature Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## *CHECKING THE ENGINE MECHANICAL SYSTEMS

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE MECHANICAL SYSTEMS |

## Diagnostic Test

### 1. CHECKING ENGINE MECHANICAL

**NOTE: The following items should be checked as a possible cause of a Driveability or No-Start problem.**

**WARNING: Do not attempt to remove or separate high pressure fuel line. Attempting to do so could result in severe bodily injury or death.**

Engine Valve Timing - must be within specification

Engine Compression - must be within specifications

Camshaft Lobes - check for abnormal wear

Camshaft Position Sensor - check the camshaft position sensor tooth for debris and deterioration

Crankshaft Position Sensor - check the crankshaft tone wheel for debris and deterioration

Engine Exhaust System - must be free of any restriction

Engine Drive Sprocket - must be properly positioned

Vacuum System - must operate properly and be free of any vacuum leaks

Fuel - must have adequate supply and must be free of contamination (ie. debris, water and gasoline)

Fuel Injectors - must not be plugged or restricted

Fuel Lift Pump - must operate properly (where applicable)

Fuel Injection Pump - must be producing the correct output volume and pressure

Inspect the Fuel Lines, Fuel Filter and Fuel Pressure Relief Valve for signs of restriction and leaks

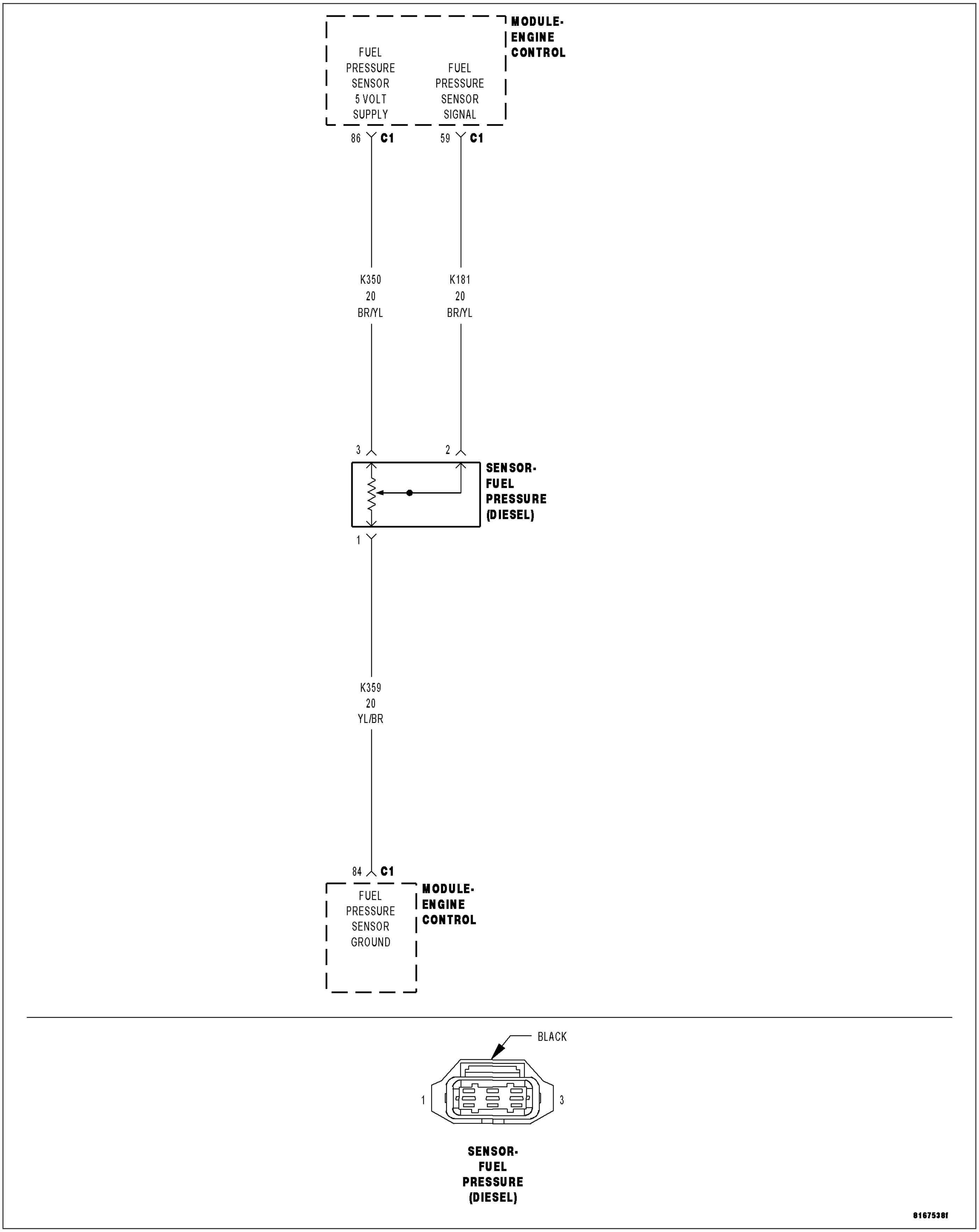
**NOTE: Check for any Technical Service Bulletins that may relate to the problem.**

**Are there any problems evident?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## *CHECKING THE FUEL PRESSURE SENSOR CIRCUITS




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
| --- |
| OPEN CIRCUITS |

## Diagnostic Test

### 1. OPEN CIRCUITS

Turn the ignition off.

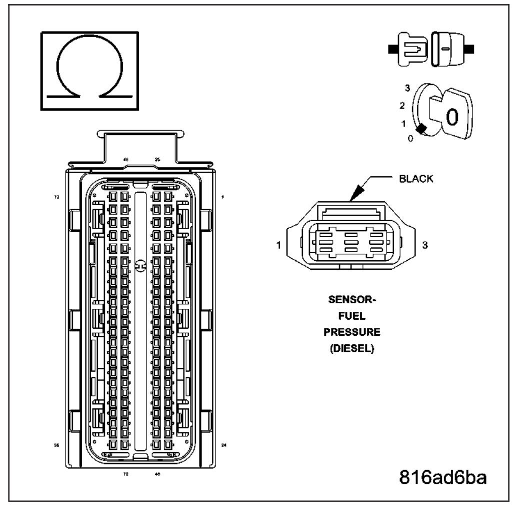
Disconnect the Fuel Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Repair as necessary.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Repair as necessary.

Measure the resistance of each of the three Fuel Pressure Sensor circuits between the ECM harness connector and the Fuel Pressure Sensor harness connector.



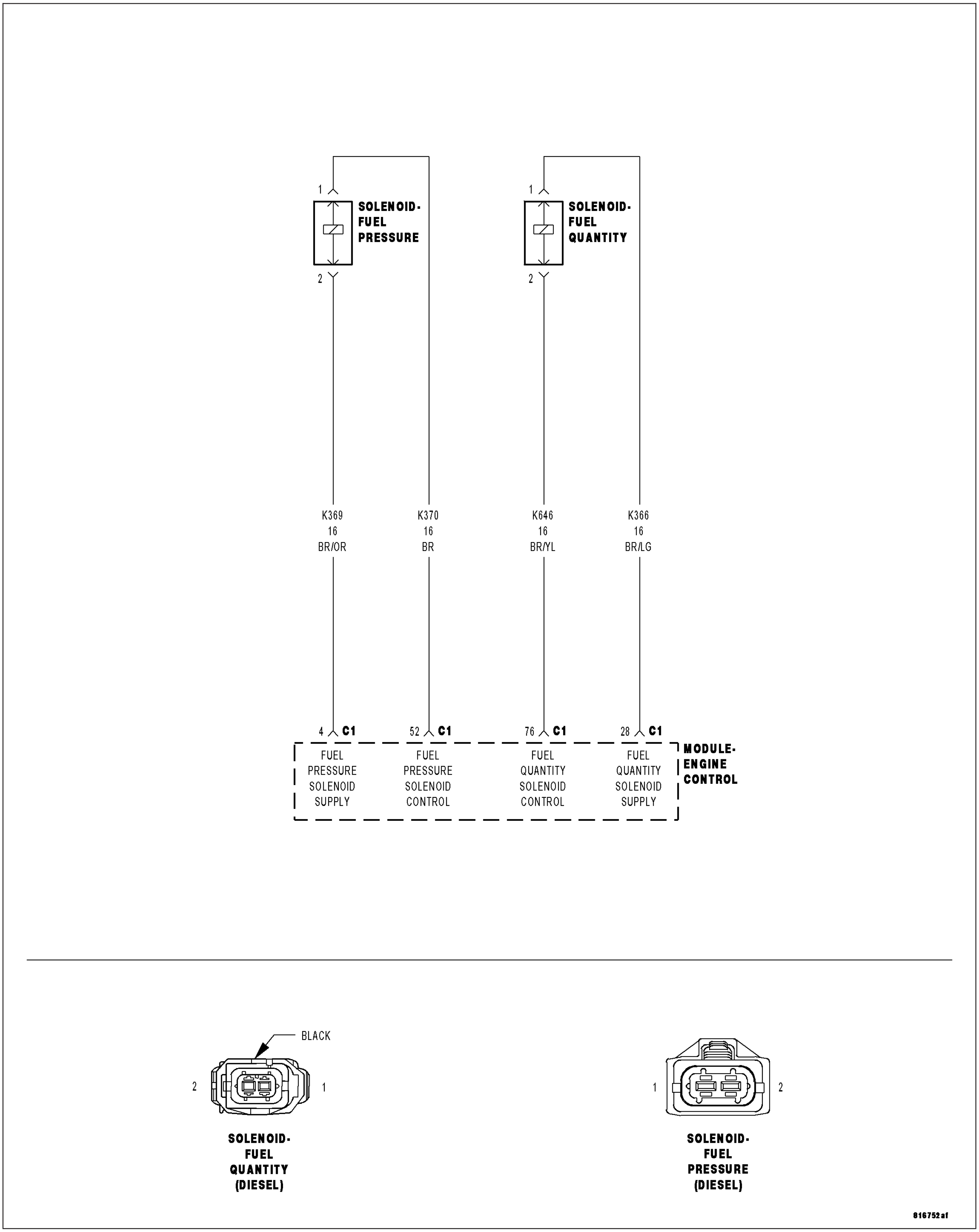

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Test Complete.

**No** >> Repair open circuit(s) as necessary.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## *CHECKING THE FUEL PRESSURE SOLENOID CIRCUITS




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| FUEL PRESSURE SOLENOID RESISTANCE |
| OPEN CIRCUITS |

## Diagnostic Test

### 1. OPEN CIRCUITS

Turn the ignition off.

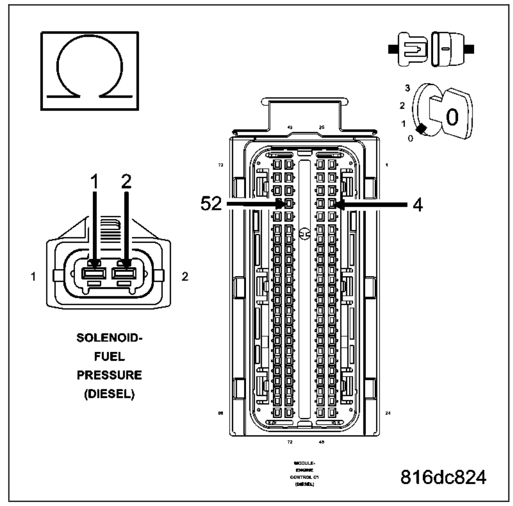
Disconnect the Fuel Pressure Solenoid harness connector.

Disconnect the ECM harness connectors.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Repair as necessary.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Repair as necessary.

Measure the resistance of both Fuel Pressure Solenoid circuits between the ECM harness connector and the Fuel Pressure Solenoid harness connector.



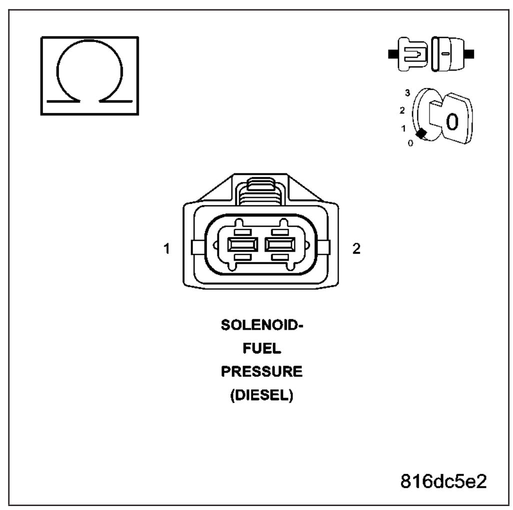

**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 2

**No** >> Repair open circuit(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

### 2. FUEL PRESSURE SOLENOID RESISTANCE

Measure the resistance of the Fuel Pressure Solenoid.

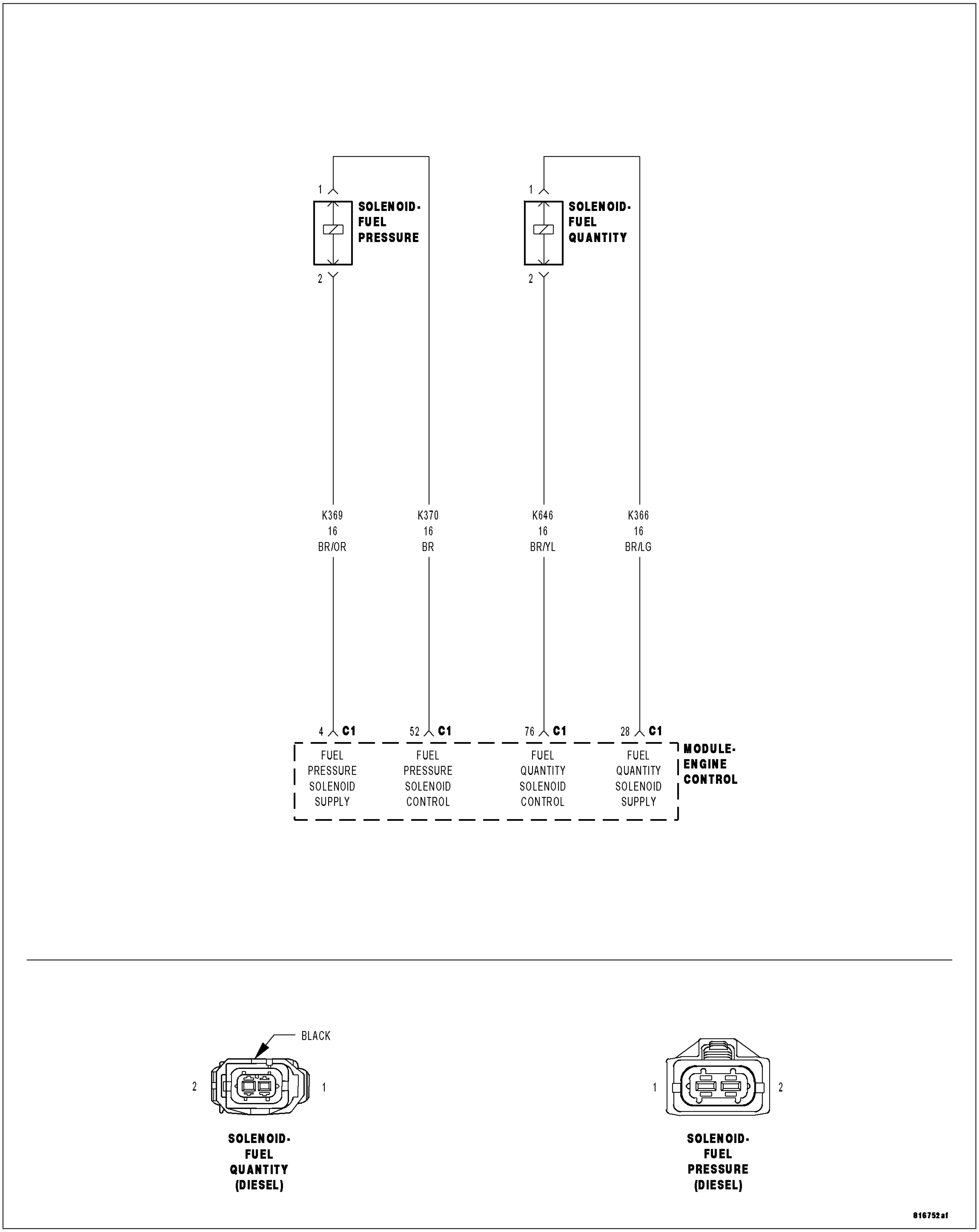



**Is the resistance between 3.5 and 5.5 ohms?**

**Yes** >> Test Complete.

**No** >> Replace the Fuel Pressure Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# *CHECKING THE FUEL QUANTITY SOLENOID CIRCUITS




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| OPEN CIRCUITS |

## Diagnostic Test

### 1. OPEN CIRCUITS

Turn the ignition off.

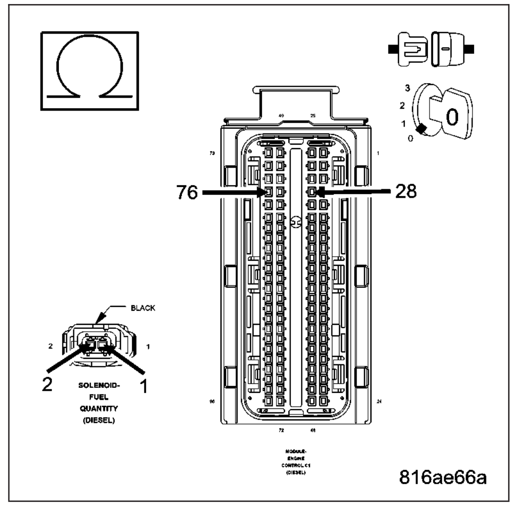
Disconnect the Fuel Quantity Solenoid harness connector.

Disconnect the ECM harness connectors.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Repair as necessary.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals. Repair as necessary.

Measure the resistance of both Fuel Quantity Solenoid circuits between the ECM harness connector and the Fuel Quantity Solenoid harness connector.



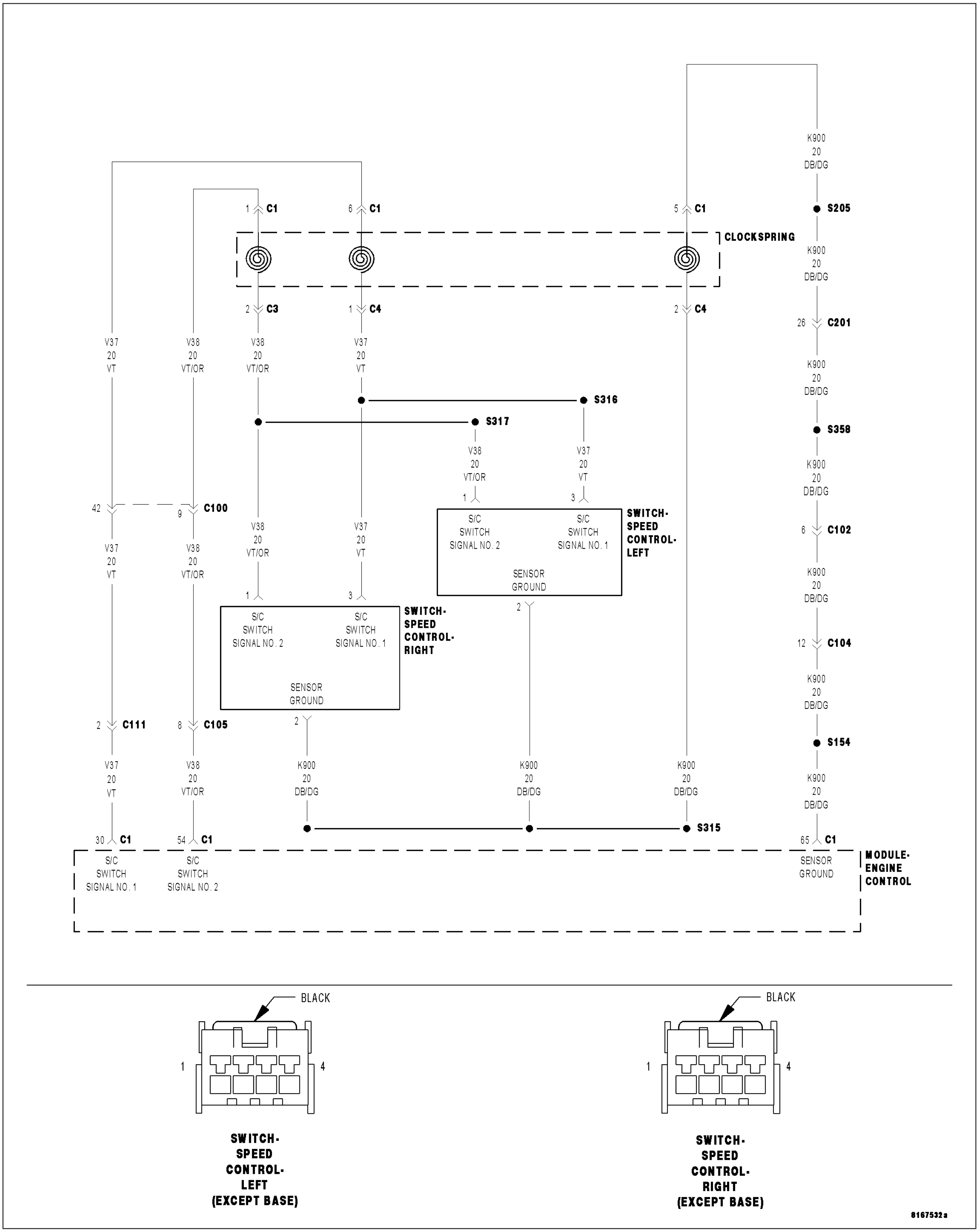

**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Test Complete.

**No** >> Repair open circuit(s) as necessary.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# *CHECKING THE SPEED CONTROL OPERATION




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
| --- |
| BRAKE SWITCH SIGNAL |
| CHECKING CRUISE SWITCHES |
| CHECKING THE ECM FOR DTC'S |
| ENGINE CONTROL MODULE |
| VSS SIGNAL |

## Diagnostic Test

### 1. CHECKING THE ECM FOR DTC'S

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any ECM DTCs present?**

**Yes** >> Refer to symptom list for problems related to the ECM DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CHECKING CRUISE SWITCHES

Start the engine.

With the scan tool, read the S/C Switch #1 volts.

Observe the cruise switch volts on the scan tool while pressing and holding each cruise button separately.

**NOTE: Pressing each cruise button should result in the following voltages: ON/OFF 0.78v - 0.98, SET 3.26 - 3.46v, RESUME/ACCEL 3.93 - 4.13v, CANCEL 1.67 - 1.87v, COAST 2.64 - 2.84v, No Button Pressed 4.44 - 4.64v**

With the scan tool, read the S/C Switch #2 volts.

Observe the cruise switch volts on the scan tool while pressing and holding each cruise button separately.

**NOTE: Pressing each cruise button should result in the following voltages: ON/OFF 3.62 - 3.82v, SET 1.25 - 1.45v, RESUME/ACCEL 2.13 - 2.33v, CANCEL 2.93 - 3.13v, COAST 0.78 - 0.98v, No Button Pressed 4.44 - 4.64v**

**Does each switch provide the correct voltage?**

**Yes** >> Go To 3

**No** >> Check S/C Switch signal and Ground circuits. If o.k., replace the S/C Switches.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

### 3. VERIFY S/C OPERATION

**NOTE: Prior to testing the speed control operation, ensure the Learn Speed Control feature has been performed on the ECM.**

Test drive the vehicle above 60 km/h (35 MPH).

Attempt to Set the Speed Control.

**Does the Speed Control function properly?**

**Yes** >> Test Complete.

**No** >> Go To 4

## 4. VSS SIGNAL

With the scan tool, read Vehicle Speed.

Have an assistant drive the vehicle while you are observing the Vehicle Speed on the scan tool.

While observing vehicle speed on the scan tool, note any rapid changes (signal dropouts) in the reading that do not correspond with actual vehicle speed.

**Is the scan tool displaying an accurate vehicle speed?**

**Yes** >> Go To 5

**No** >> Refer to symptom list for problems related to the Vehicle Speed Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. BRAKE SWITCH SIGNAL

With the scan tool in Inputs/Outputs, read the Primary and Secondary brake switch states while pressing and releasing the Brake Pedal several times.

**Did the scan tool indicate the correct brake pedal state when pressing and releasing the Brake Pedal?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Refer to symptom list for problems related to Brake Switch Signal.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## CHECKING THE HIGH-SIDE FUEL SYSTEM

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| SCAN TOOL TESTS |
| FUEL PRESSURE SOLENOID |
| FUEL PRESSURE SOLENOID RETURN VOLUME TEST |
| FUEL PUMP |
| FUEL SYSTEM LEAK |
| INJECTOR RETURN VOLUME TEST |

### Diagnostic Test

#### 1. CHECKING FUEL PRESSURE

**NOTE: The Low/Supply Side Fuel System must be working properly for this test to be valid. Refer to the Service Information and Perform the Low/Supply Side Fuel System Test before continuing.**
Turn the ignition on.

**NOTE: This test requires two people. One person to test drive the vehicle while a technician observes the scan tool readings**
With the scan tool, read and compare the Fuel Pressure (PSI) with the Fuel Pressure Desired/Setpoint (PSI) while test driving the vehicle under various load conditions such as idle, hard acceleration, cruise and deceleration.

**NOTE: The Fuel Pressure reading should follow (trail) closely to the Fuel Pressure Desired/Setpoint reading.**

**Does the Fuel Pressure reading follow closely to the Fuel Pressure Desired/Setpoint reading?**

**Yes** >> Test Complete.

**No** >> Go To 2

#### 2. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**
Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 spi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL PRESSURE SOLENOID

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. SCAN TOOL TESTS

Turn the engine off.

Turn the ignition on.

With the scan tool, select Engine, System Tests and perform the following tests:

- Injector Fuel Correction Test.
- Cylinder Balance test.
- Compression Test.

**Were any problems found?**

**Yes** >> Diagnose and/or repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. INJECTOR RETURN VOLUME TEST

Refer the Service Information and perform the Injector Return Volume Test.

**Did the Injectors pass the Return Volume Test?**

**Yes** >> Go To 7

**No** >> Refer to the Service Information and replace injector(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. FUEL PRESSURE SOLENOID RETURN VOLUME TEST

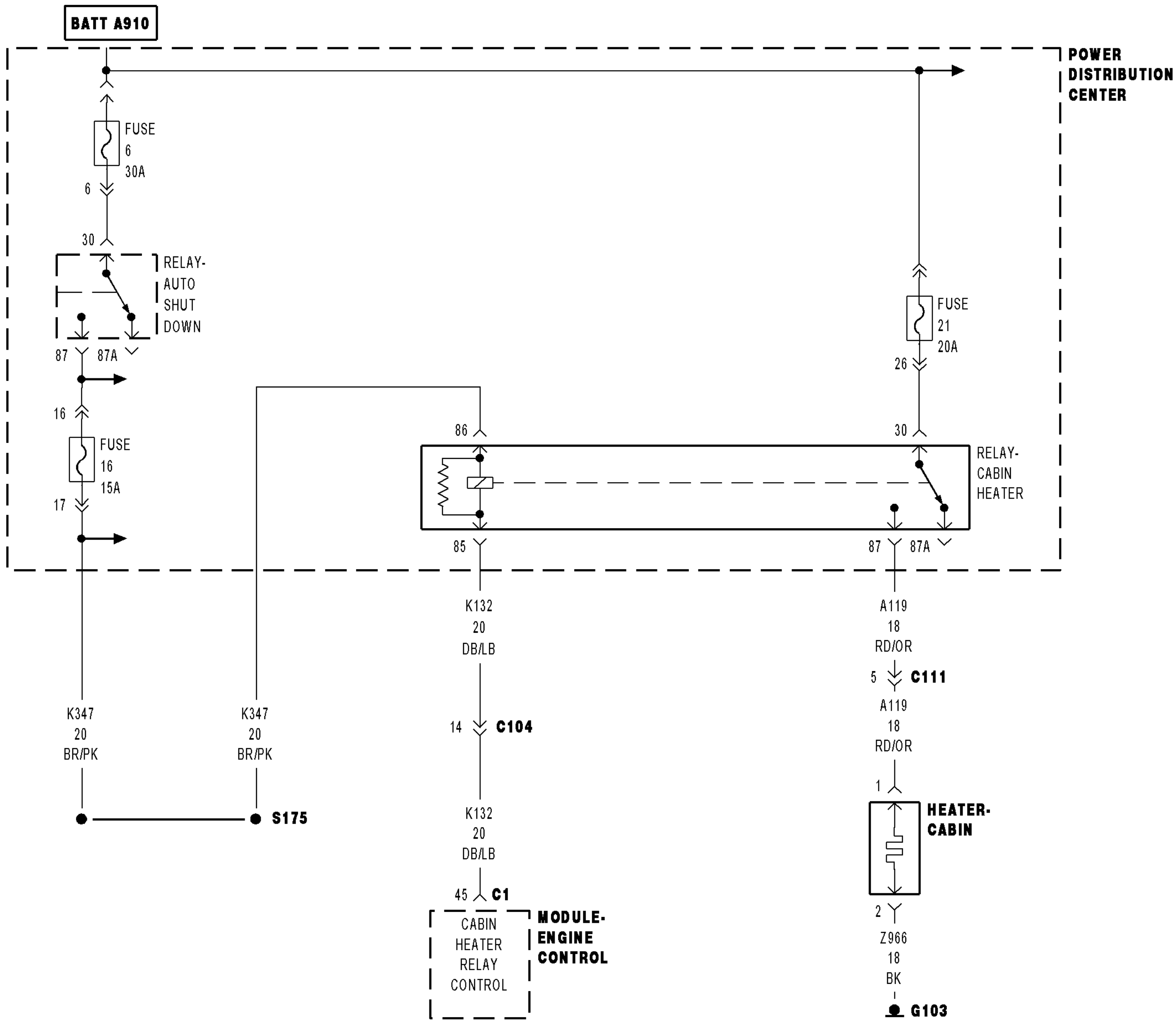
Refer the Service Information and perform the Fuel Pressure Solenoid Return Volume Test.

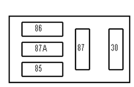
**Did the Fuel Pressure Solenoid pass the Return Volume Test?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the Service Information and replace the Fuel Pressure Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## *CHECKING THE VISCOUS/CABIN HEATER RELAY




RELAY-CABIN HEATER (DIESEL) (IN PDC)

816b02a3

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| FUSED B+ CIRCUIT OPEN |
| (K132) CABIN HEATER RELAY OUTPUT CIRCUIT SHORTED TO VOLTAGE |
| (K347) CABIN HEATER RELAY OUTPUT CIRCUIT SHORTED TO GROUND |
| (A119) CABIN HEATER RELAY OUTPUT CIRCUIT OPEN |
| CABIN HEATER RELAY |

## Diagnostic Test

### 1. VISCOUS/CABIN HEATER RELAY ACTUATOR TEST

Turn the ignition on.

With the scan tool, actuate the Viscous/Cabin Heater Relay.

**Is the Cabin Heater Relay clicking during the actuator test?**

**Yes** >> Test Complete.

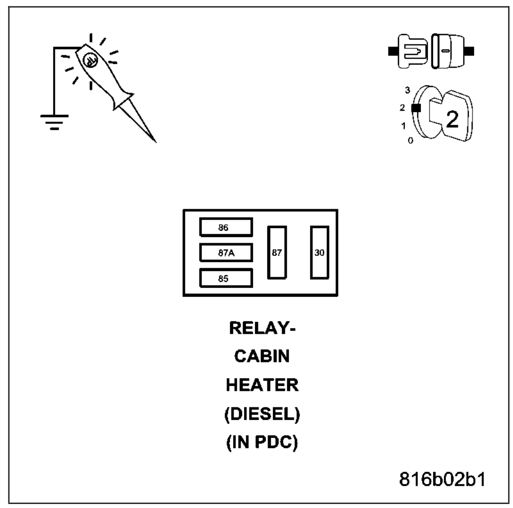
**No** >> Go To 2

### 2. FUSED B+ CIRCUIT OPEN

**NOTE: If the Cabin Heater Relay fuse or fuselink is open, refer to the system schematics for all circuits that are powered by the Cabin Heater Relay fuse or fuselink to determine the cause of the blown fuse/fuselink.**

Remove the Cabin Heater Relay.

Using a 12-volt test light connected to ground, probe the Fused B+ circuit in the (cavity 30) Cabin Heater Relay connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the Fused B+ (Fuse/Fuselink) circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

### 3. CABIN HEATER RELAY OUTPUT CIRCUIT SHORTED TO VOLTAGE

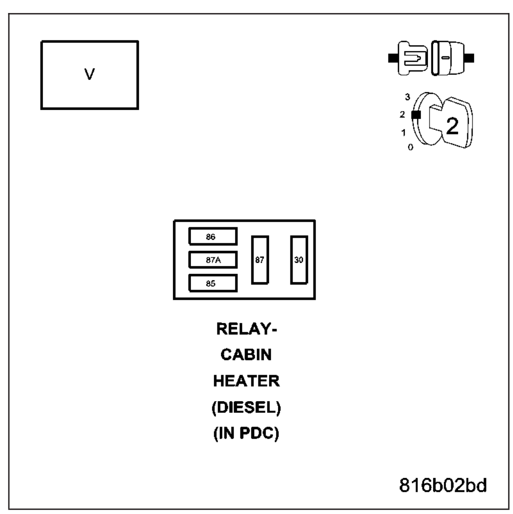
Turn the ignition off.

Disconnect the Cabin Heater harness connector.

Remove the Cabin Heater Relay.

Turn the ignition on.

Measure the voltage on the (cavity 87) Cabin Heater Relay Output circuit.



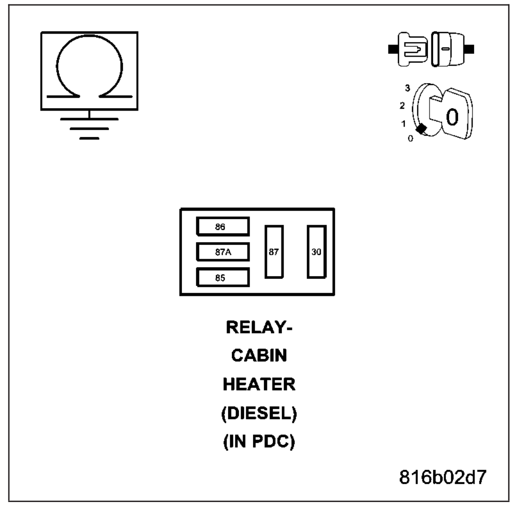

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the (A119) Cabin Heater Relay Output circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. CABIN HEATER RELAY OUTPUT CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (cavity 87) Cabin Heater Relay Output circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

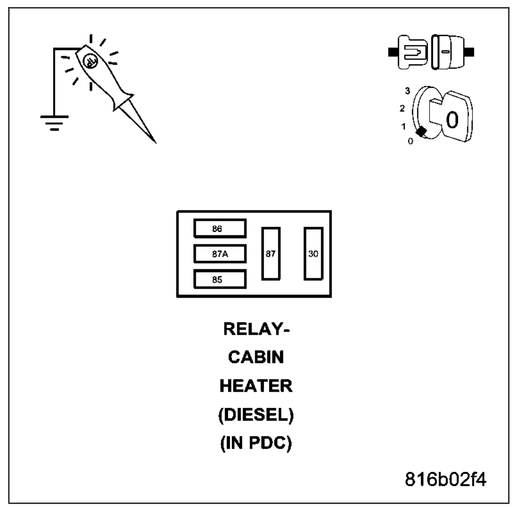
**No** >> Repair the (K132) Cabin Heater Relay Output circuit for a short to ground. Inspect the fuse or fuselink and replace as necessary.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. CABIN HEATER RELAY OUTPUT CIRCUIT OPEN

Connect a jumper wire across Cabin Heater Relay connector (cavities 30 and 87).

Using a 12-volt test light connected to ground, check the (A119) Cabin Heater Relay Output circuit in the Cabin Heater harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 6

**No** >> Repair the (A119) Cabin Heater Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. CABIN HEATER RELAY

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Cabin Heater Relay.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## *ENGINE CRANKS BUT WILL NOT START

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| CAMSHAFT POSITION SENSOR SIGNAL PROBLEM |
| CRANKSHAFT POSITION SENSOR SIGNAL PROBLEM |
| ECM CODES PRESENT |
| ECT SENSOR |
| ENGINE CONTROL MODULE |
| ENGINE DRIVE BELT/CHAIN |
| FUEL PRESSURE - CRANKING |
| FUEL SUPPLY CONTAMINATION |
| FUEL SYSTEM RESTRICTION |
| GLOW PLUGS |
| SKIM CODES PRESENT |

## Diagnostic Test

### 1. ECM CODES PRESENT

**NOTE: The ECM must have proper power and ground connections for the following tests to be valid. Refer to Checking the ECM Power and Grounds in the symptom list.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Does the scan tool display any ECM DTCs?**

**Yes** >> Refer to symptom list for problems related to ECM DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. SKIM CODES PRESENT

Turn the ignition on.

With the scan tool, read the SKIM DTCs.

**Does the scan tool display any SKIM DTCs?**

**Yes** >> Refer to symptom list for problems related to SKIM DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

### 3. ECT SENSOR

Using a temperature probe, check the vehicle temperature near the ECT Sensor.

Turn the ignition on.

With the scan tool in Sensors, read the ECT Sensor temperature.

Compare the temperature probe reading with the scan tool reading.

**Are the two readings within 10°C of each other?**

**Yes** >> Go To 4

**No** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. GLOW PLUGS

**NOTE: Prior to performing this test, be sure to check the Glow Plug Relay operation. Refer to CHECKING GLOW PLUG OPERATION for the related symptom(s).**

Refer to the Service Information and check the Glow Plugs for proper operation.

**Are the Glow Plugs operating properly?**

**Yes** >> Go To 5

**No** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. FUEL SYSTEM RESTRICTION

Inspect the fuel system lines for restrictions, leaks or other problems.

**NOTE: Refer to the Service Information to ensure that the fuel system is properly primed. An unprimed system or excessive air in the supply system will cause a no-start condition.**

**Is there any evidence of problems?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. CAMSHAFT POSITION SENSOR SIGNAL PROBLEM

Turn the ignition off.

Attempt to start the engine, if the engine will not start, crank the engine for several seconds while monitoring the scan tool.

With the scan tool, read the Cam Position Sensor RPM.

**Does the scan tool display a steady CMP Sensor RPM approximately one half the speed of Engine RPM?**

**Yes** >> Go To 7

**No** >> Using the Service Information, check the wiring and connectors related to the CMP Sensor. If o.k., replace the CMP Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CRANKSHAFT POSITION SENSOR SIGNAL PROBLEM

Turn the ignition off.

Attempt to start the engine, if the engine will not start, crank the engine for several seconds while monitoring the scan tool.

With the scan tool in Sensors, read the Engine RPM.

**Does the scan tool display a steady CKP Sensor RPM approximately double the speed of the CMP RPM?**

**Yes** >> Go To 8

**No** >> Using the Service Information, check the wiring and connectors related to the CKP Sensor. If o.k., replace the CKP Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 8. FUEL PRESSURE - CRANKING

Turn the ignition on.

With the scan tool, read the Fuel Pressure Sensor signal while cranking the engine for 15 seconds.

**NOTE: Fuel pressure should increase above 3400 psi (240 bar) after only a few seconds of cranking.**

**Does the fuel pressure increase above 3500 psi (240 bar) after a few seconds of cranking?**

**Yes** >> Go To 9

**No** >> refer to Symptom CHECKING THE HIGH-SIDE PRESSURE.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 9. FUEL CONTAMINATION

Refer to the Service Information and inspect the fuel supply for contamination.

**Is the fuel contaminated?**

**Yes** >> Refer to the Service Information to remove and replace fuel throughout the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. ENGINE DRIVE BELT/CHAIN

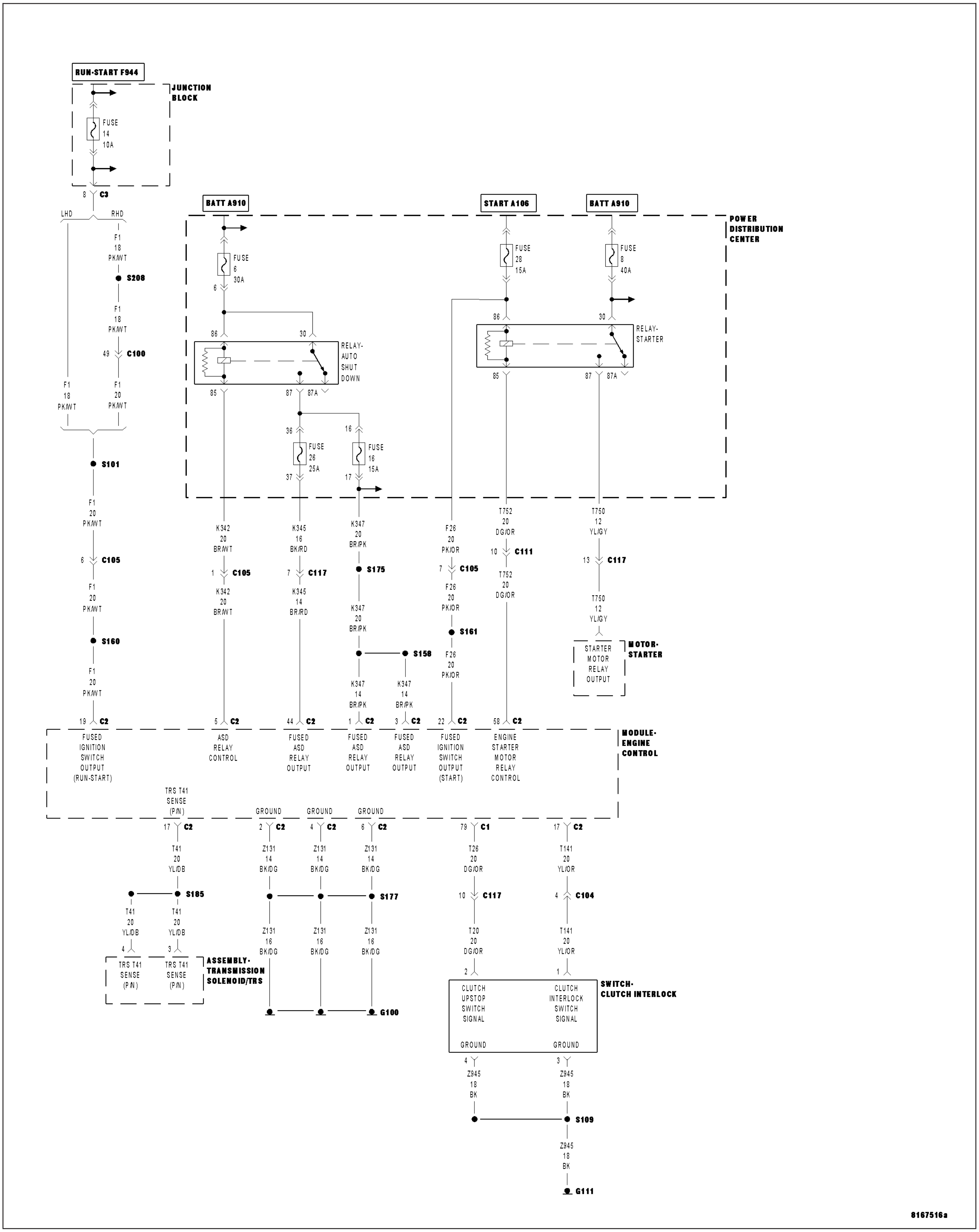
Refer to the Service Information to ensure the Engine Drive Belt/Chain is installed correctly and the camshaft and crankshaft gears are timed correctly.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# *ENGINE WILL NOT CRANK




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| BATTERY CABLE HIGH RESISTANCE |
| BATTERY CABLES |
| CLUTCH INTERLOCK SWITCH |
| CLUTCH INTERLOCK SWITCH OUTPUT CIRCUIT |
| IGNITION SWITCH START OUTPUT CIRCUIT OPEN |
| MECHANICAL PROBLEM |
| OPEN FUSED BATTERY (+) CIRCUIT |
| OPEN IGNITION SWITCH START OUTPUT |
| P/N SWITCH |
| P/N SWITCH CIRCUIT OPEN |
| P/N SWITCH GROUND CIRCUIT OPEN |
| SKIM CODES PRESENT |
| STARTER MOTOR |
| STARTER RELAY |
| STARTER RELAY |
| STARTER RELAY GROUND CIRCUIT OPEN |
| STARTER RELAY OUTPUT CIRCUIT OPEN |

## Diagnostic Test

### 1. BATTERY CABLES

Turn the ignition off.

**NOTE: The battery must be fully charged before diagnosing a no crank condition.**
Inspect the battery cables for corrosion, looseness or other problems.

**Is there evidence of problems?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. SKIM CODES PRESENT

Turn the ignition on.
With the scan tool, read the SKIM DTCs.

**Does the scan tool display any SKIM DTCs?**

**Yes** >> Refer to symptom list for problems related to SKIM.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. AUTOMATIC OR MANUAL TRANSMISSION

**Is the vehicle equipped with an automatic transmission?**

**Yes** >> Go To 4

**No** >> Go To 9

## 4. CHECKING STARTER OPERATION

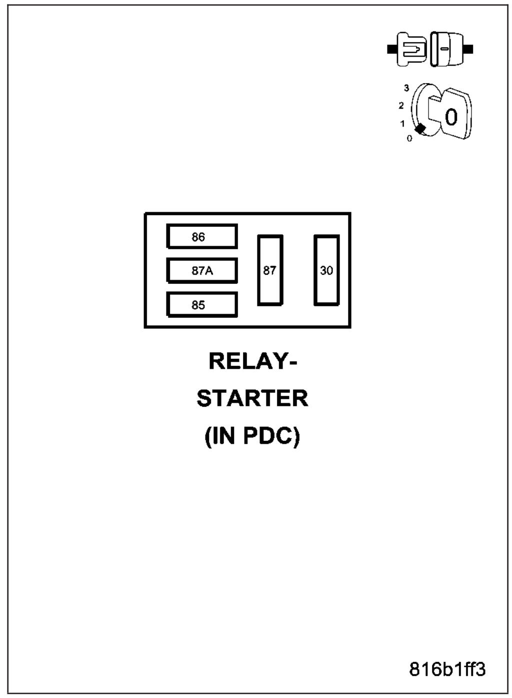
Turn the ignition off.

Remove the Starter Relay from the PDC.

**WARNING: THE TRANSMISSION MUST BE IN PARK/NEUTRAL AND THE PARK BRAKE MUST BE SET FOR THIS TEST.**

**WARNING: THE ENGINE MAY CRANK IN THE NEXT STEP. WHEN THE ENGINE IS CRANKING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.**

Momentarily jumper Starter Relay connector cavities 30 and 87 in the PDC connector.




**Did the engine crank?**

**Yes** >> Go To 5

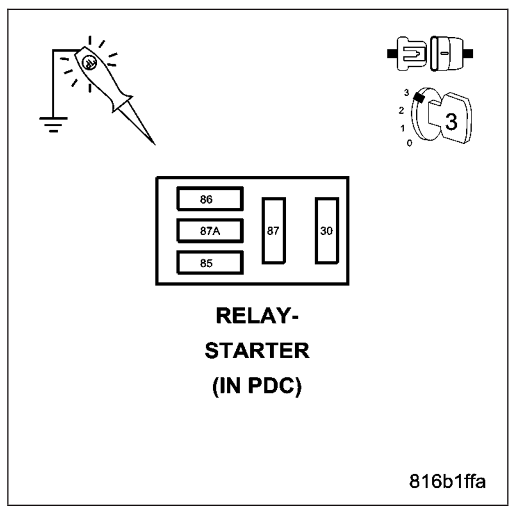
**No** >> Go To 14

## 5. OPEN IGNITION SW START CIRCUIT

Place the transmission in Park or Neutral.

Remove the Starter Relay from the PDC.

Using a 12-volt test light connected to ground, check the Ignition Switch Start Output circuit while turning the ignition switch to the START position.




**Does the test light illuminate with the ignition switch in the START position?**

**Yes** >> Go To 6

**No** >> Repair the Ignition Switch Start Output circuit between the Starter Relay and the ECM for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

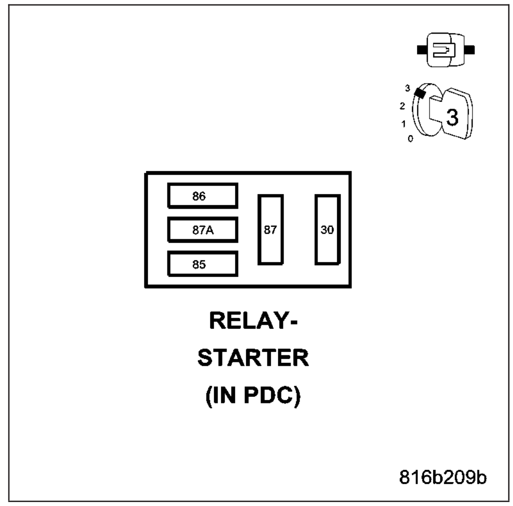
## 6. STARTER RELAY

Turn the ignition off.
Remove the Starter Relay from the PDC.
Install a substitute relay in place of the Starter Relay.
Attempt to start the engine.

**Does the engine crank?**

**Yes** >> Replace the Starter Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7




## 7. TRS SWITCH

Use the scan tool to monitor the status of the Transmission Range Switch (TRS).
Shift the vehicle from park to neutral.

**Does the TRS status change?**

**Yes** >> Go To 8

**No** >> Replace the TRS in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

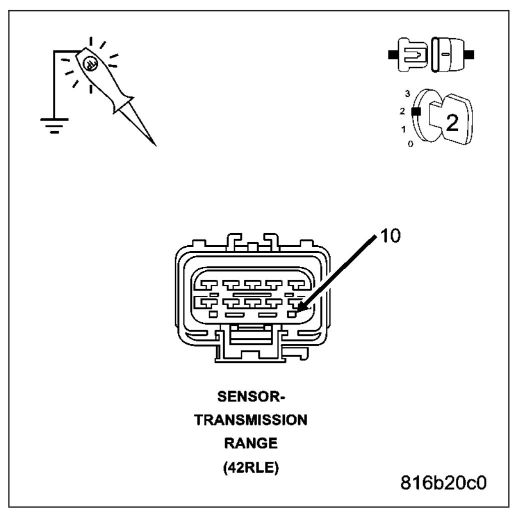
## 8. TRS CIRCUIT OPEN/SHORT

Turn the ignition off.
Disconnect the TRS harness connector.
Turn the ignition on.
Using a 12-volt test light connected to ground, check the (T41) TRS sense circuit.

**Does the test light illuminate brightly?**

**Yes** >> Repair the (T41) Switch Sense circuit between the (T41) TRS Switch and the (cavity B17) ECM.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the P/N Switch Ground circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 9. CHECKING STARTER OPERATION

Turn the ignition off.

Remove the Starter Relay from the PDC.

**WARNING: THE TRANSMISSION MUST BE IN NEUTRAL AND THE PARK BRAKE MUST BE SET FOR THIS TEST.**

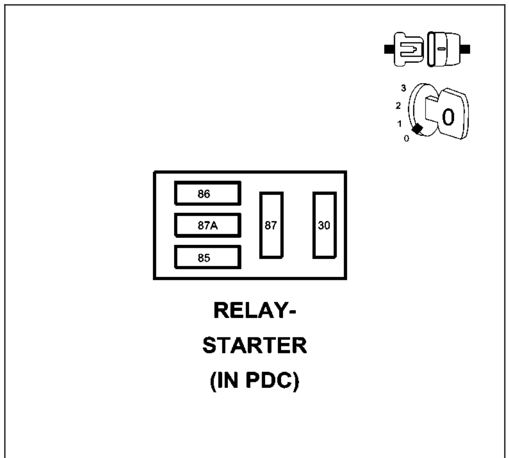
**WARNING: THE ENGINE MAY CRANK IN THE NEXT STEP. WHEN THE ENGINE IS CRANKING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.**

Momentarily jumper Starter Relay connector cavities 30 and 87 in the PDC connector.

**Did the engine crank?**

**Yes** >> Go To 10

**No** >> Go To 14



816b20da

## 10. OPEN IGNITION SW START CIRCUIT

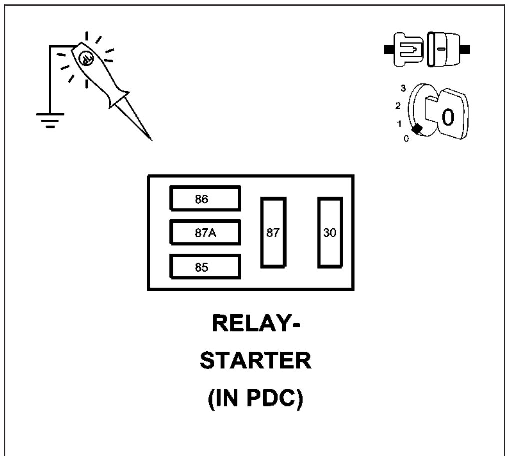
Remove the Starter Relay from the PDC.

Using a 12-volt test light connected to ground, check the (Cavity 86) Ignition Switch Start Output circuit while fully depressing the clutch pedal and turning the ignition switch to the START position.

**Does the test light illuminate with the ignition switch in the START position?**

**Yes** >> Go To 11

**No** >> Go To 12



816b21e1

## 11. STARTER RELAY

Turn the ignition off.

Remove the Starter Relay from the PDC.

Install a substitute relay in place of the Starter Relay.

Attempt to start the engine.

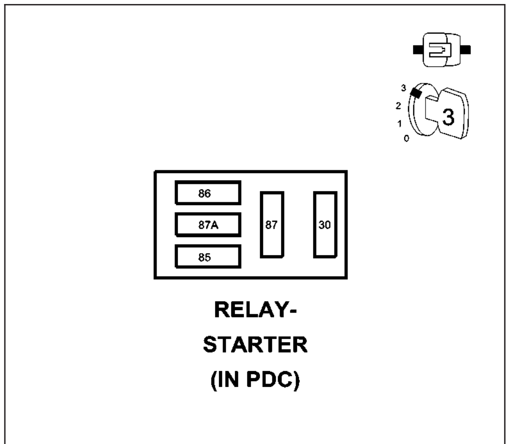
**Does the engine crank?**

**Yes** >> Replace the Starter Relay.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Starter Relay Ground Circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



816b21e9

## 12. CLUTCH INTERLOCK SWITCH

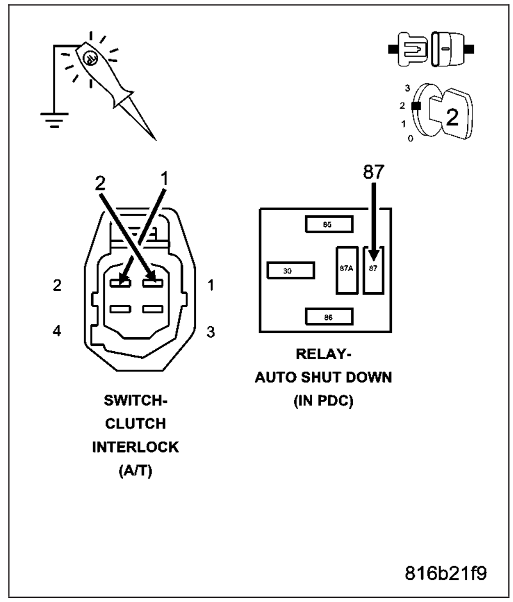
Turn the ignition off.

Remove the Starter Relay from the PDC.

Disconnect the Clutch Interlock Switch harness connector.

Connect a jumper wire across the Clutch Interlock Switch harness connector.

Using a 12-volt test light connected to ground, check the Ignition Switch Start Output circuit at the Starter Relay connector in the PDC and turning the ignition switch to the Start position.




**Does the test light illuminate with the ignition switch in the Start position?**

**Yes** >> Replace the Clutch Interlock Switch.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 13

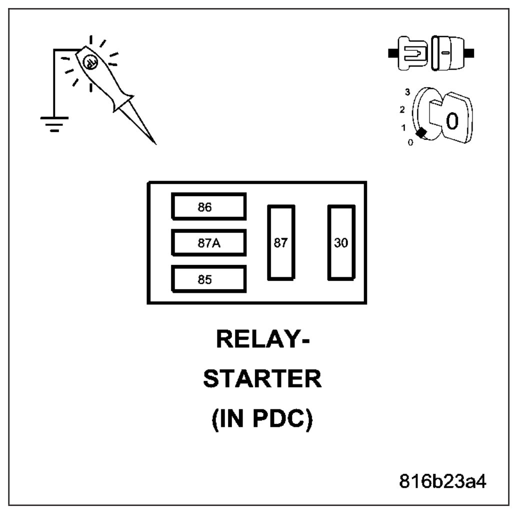
## 13. CLUTCH INTERLOCK SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Clutch Interlock Switch harness connector.

Remove the Starter Relay from the PDC.

Measure the resistance of the Clutch Interlock Switch Output circuit between the PDC and the Clutch Interlock Switch harness connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Repair the Ignition Switch Start Output circuit to the Clutch Interlock Switch.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

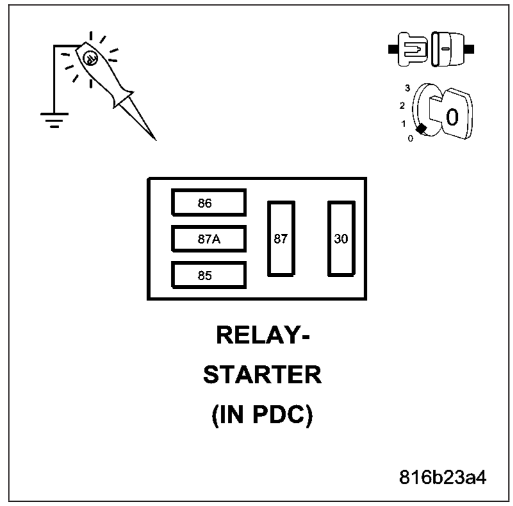
**No** >> Repair the Clutch Interlock Switch Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 14. OPEN FUSED BATTERY (+) CIRCUIT

Remove the Starter Relay from the PDC.

Using a 12-volt test light connected to ground, check the (cavity 30) Fused B+ circuit in the Starter Relay connector in the PDC.




**Is the test light on?**

**Yes** >> Go To 15

**No** >> Repair the Fused B(+) circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 15. STARTER RELAY OUTPUT CIRCUIT OPEN

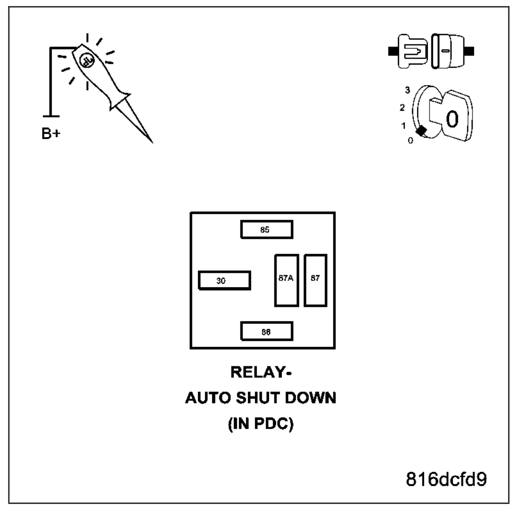
Turn the ignition off.

Remove the Starter Relay from the PDC.

Disconnect the Starter Relay Output wire from the Starter Solenoid.

Connect the Starter Relay Output wire (at the Starter) to ground.

Using a 12-volt test light connected to 12-volts, check the Starter Relay Output circuit at the Starter Relay connector in the PDC.




**Does the test light illuminate brightly?**

**Yes** >> Go To 16

**No** >> Repair the Starter Relay Output circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 16. BATTERY CABLE HIGH RESISTANCE

Using the Service Information, check the battery cables for high resistance.

**Did either battery cable have a voltage drop greater than 0.2 volts?**

**Yes** >> Replace the battery cable(s).
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 17

## 17. MECHANICAL PROBLEM

Turn the ignition off.

Attempt to manually rotate the crankshaft 360°.

**Is the crankshaft able to rotate 360°?**

**Yes** >> Replace the Starter Motor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the engine mechanical problem.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## *LACK OF ENGINE POWER

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| BOOST CONTROL VACUUM SUPPLY |
| CHECK FOR ECM DTCS |
| CHECKING ECM POWER AND GROUNDS |
| CHECKING FOR AIR LEAKS |
| CHECKING THE FUEL DELIVERY SYSTEM |
| SCAN TOOL TESTS |
| ENGINE DRIVE BELT/CHAIN |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |
| TURBOCHARGER |

### Diagnostic Test

#### 1. CHECKING FOR ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any DTCs present?**

**Yes** >> Refer to symptom list for problems related to this DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

#### 2. CHECKING BOOST PRESSURE

**NOTE: This test requires two people. One person to test drive the vehicle while a technician observes the scan tool readings**

With the scan tool, read and compare the Boost Pressure (PSI) with the Boost Pressure Desired/Setpoint (PSI) while test driving the vehicle under various load conditions such as idle, hard acceleration, cruise and deceleration.

**NOTE: The Boost Pressure reading should directionally follow (trail) the Boost Pressure Desired/Setpoint reading.**

**Does the Boost Pressure reading follow the Boost Pressure Desired/Setpoint reading?**

**Yes** >> Go To 3

**No** >> Go To 15

## 3. CHECK POWER AND GROUNDS

Refer to the symptom list and perform the Checking the ECM Power and Ground test.

**Were any problem found with the ECM powers and grounds?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. CHECKING FUEL PRESSURE

**NOTE: This test requires two people. One person to test drive the vehicle while a technician observes the scan tool readings**

With the scan tool, read and compare the Fuel Pressure (PSI) with the Fuel Pressure Desired/Setpoint (PSI) while test driving the vehicle under various load conditions such as idle, hard acceleration, cruise and deceleration.

**NOTE: The Fuel Pressure reading should follow (trail) closely to the Fuel Pressure Desired/Setpoint reading.**

**Does the Fuel Pressure reading follow closely to the Fuel Pressure Desired/Setpoint reading?**

**Yes** >> Go To 5

**No** >> Go To 7

## 5. SCAN TOOL TESTS

With the scan tool, select Engine, System Tests and perform the following tests:

- Injector Fuel Correction Test.
- Cylinder Balance test.
- Compression Test.

**Were any problems found?**

**Yes** >> Diagnose and/or repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this symptom to occur.**

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 7. FUEL SYSTEM LEAK

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 spi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. FUEL PRESSURE SOLENOID

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 11

## 11. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this symptom. A sticking injector will cause the engine to miss fire and emit excessive black smoke from the exhaust system.**

Start and idle the engine.

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. ENGINE DRIVE BELT/CHAIN

Refer to the Service Information to ensure the Engine Drive Belt/Chain is installed correctly and the camshaft and crankshaft gears are timed correctly.

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 13

## 13. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 14

**No** >> Test Complete.

## 14. FUEL QUANTITY SOLENOID

Turn the ignition off.

Replace the Fuel Quantity Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 15. CHECKING FOR AIR LEAKS

**NOTE: Inspect all air intake and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause a poor performance/lack of power symptom.**

Turn the ignition off.

Remove the Inlet Pressure Sensor.

Connect smoke machine 84-04 to the Inlet Pressure Sensor port in the intake duct and begin injecting smoke into the intake system.

Observe all intake system components for evidence of smoke leakage.

**Is there evidence of smoke leakage?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 16

## 16. BOOST CONTROL VACUUM SUPPLY

Refer to symptom Checking The Boost Control Vacuum Supply in the Driveability category.

**Is the boost control vacuum supply system o.k.?**

**Yes** >> Using the Service Information, replace the Turbocharger assembly.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair boost system vacuum supply as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## B10B3-VISCOUS/CABIN HEATER RELAY CONTROL OPEN CIRCUIT

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| VISCOUS/CABIN HEATER RLY |
| VISCOUS/CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| VISCOUS/CABIN HEATER RELAY CONTROL CIRCUIT OPEN |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the Viscous/Cabin Heater Relay.

**Does the relay cycle on and off during the actuation?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Remove the Viscous/Cabin Heater Relay from the PDC.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit.

**Did the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

### 3. VISCOUS/CABIN HEATER RELAY

Turn the ignition off.

Install a substitute relay in place of the Viscous/Cabin Heater Relay

Turn the ignition on.

With the scan tool, actuate the Viscous/Cabin Heater Relay.

**Does the relay cycle on and off during the actuation?**

**Yes** >> Replace the Viscous/Cabin Heater Relay Fan Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. VISCOUS/CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Remove the Viscous/Cabin Heater Relay from the PDC.
Disconnect the ECM harness connectors.
Measure the resistance between ground and the Viscous/Cabin Heater Relay Control circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Viscous/Cabin Heater Relay Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. VISCOUS/CABIN HEATER RELAY CONTROL CIRCUIT OPEN

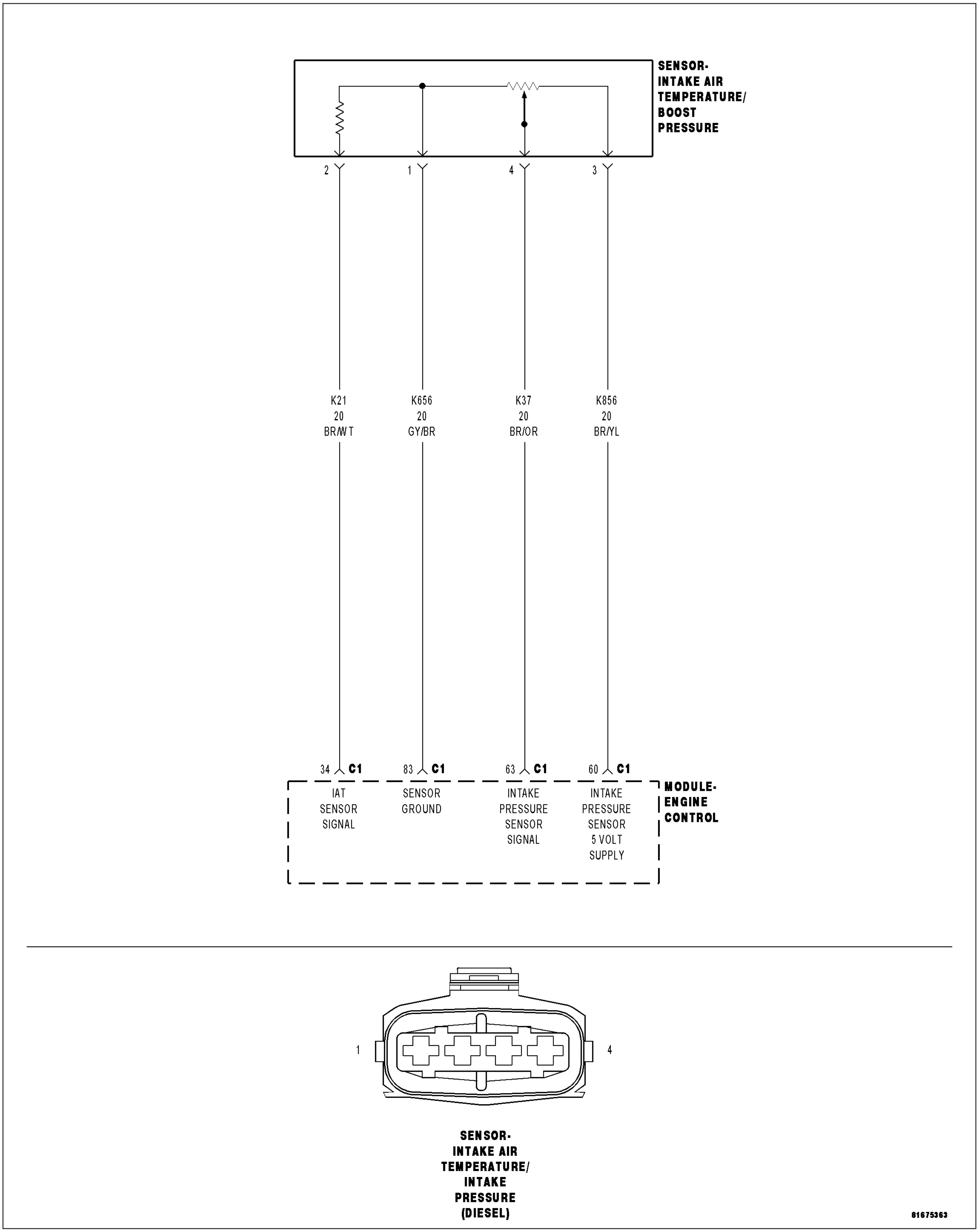
Turn the ignition off.
Remove the Viscous/Cabin Heater Relay from the PDC.
Disconnect the ECM harness connectors.
Measure the resistance of the Viscous/Cabin Heater Relay Control circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Viscous/Cabin Heater Relay Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P009A-INTAKE AIR TEMP/ AMBIENT AIR TEMP PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
| --- |
| AAT SENSOR - COLD |
| AAT SENSOR - HOT |
| CHECKING CONNECTORS |
| IAT SENSOR - COLD |
| IAT SENSOR - HOT |
| INTERMITTENT CONDITION |

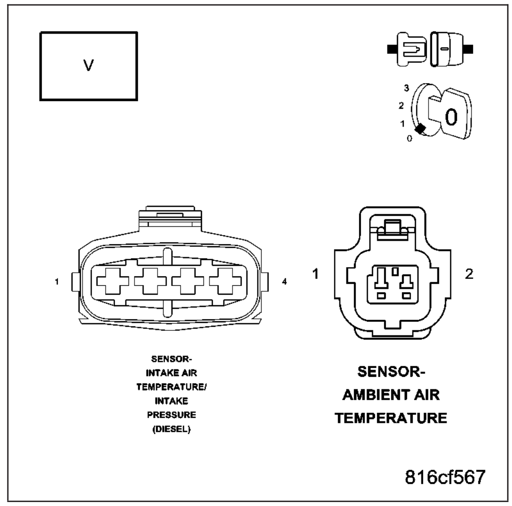
## Diagnostic Test

### 1. CHECKING CONNECTORS

Turn the ignition off.

Disconnect the IAT and AAT Sensor harness connectors.

Inspect both connectors for poor terminal contact, corrosion, damage or other problems.




**Is there any evidence of connector problems?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. IAT SENSOR - COLD

**NOTE: Allow the engine to completely cool to ambient temperature.**

With the scan tool, read and note the engine coolant temperature.

With the scan tool, read the Intake Air Temperature and compare it to the engine coolant temperature reading.

**Are the readings within 7°C (13°F) of each other?**

**Yes** >> Go To 3

**No** >> Check the wiring and connectors associated with the IAT Sensor for corrosion, damage or other problems. Repair as necessary. If wiring and connectors are o.k., replace the Intake Air Temperature Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

### 3. AAT SENSOR - COLD

**NOTE: Allow the engine to completely cool to ambient temperature.**

With the scan tool, read and note the engine coolant temperature.

With the scan tool, read the Ambient Air Temperature and compare it to the engine coolant temperature reading.

**Are the readings within 7°C (13°F) of each other?**

**Yes** >> Go To 4

**No** >> Check the wiring and connectors associated with the AAT Sensor for corrosion, damage or other problems. Repair as necessary. If wiring and connectors are o.k., replace the Ambient Air Temperature Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. IAT SENSOR - HOT

Start the engine and bring the engine to operating temperature (thermostat open).

Turn the engine off and wait 10 minutes to allow the engine temperature to stabilize.

With the scan tool, read and note the engine coolant temperature.

With the scan tool, read the Intake Air Temperature.

**Are the readings within 7°C (13°F) of each other?**

**Yes** >> Go To 5

**No** >> Check the wiring and connectors associated with the IAT Sensor for corrosion, damage or other problems. Repair as necessary. If wiring and connectors are o.k., replace the Intake Air Temperature Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. AAT SENSOR - HOT

Start the engine and bring the engine to operating temperature (thermostat open).

With the scan tool, read the Ambient Air Temperature.

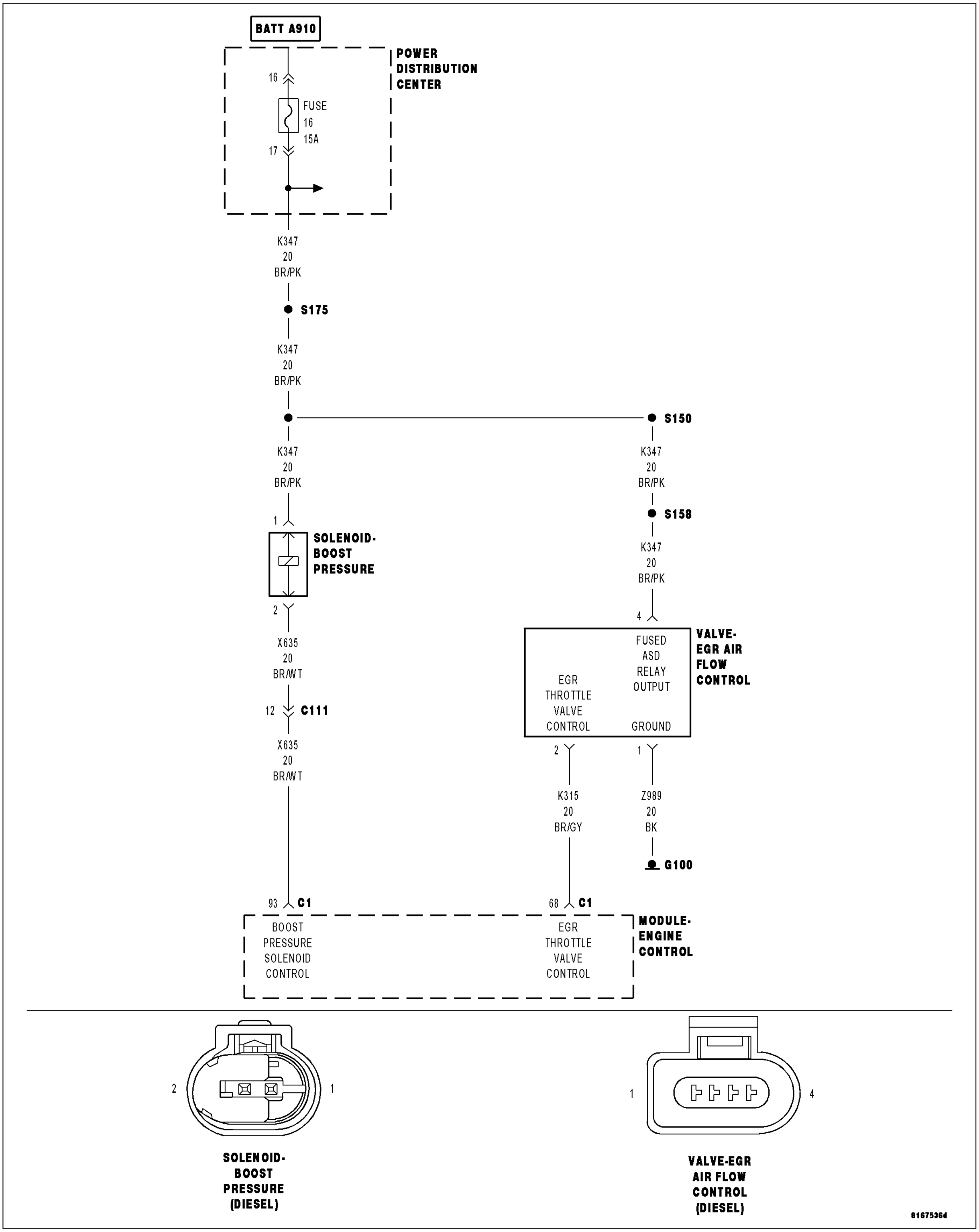
**Is the Ambient Temperature Sensor reading correct outside temperature?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Check the wiring and connectors associated with the AAT Sensor for corrosion, damage or other problems. Repair as necessary. If wiring and connectors are o.k., replace the Ambient Air Temperature Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0045-BOOST PRESSURE SOLENOID OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Boost Pressure Solenoid command off.
- **Set Condition:**
  The ECM does not detect voltage on the Boost Pressure Solenoid Control circuit.

| **Possible Causes** |
| --- |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| BP SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| BP SOLENOID CONTROL CIRCUIT OPEN |
| BOOST PRESSURE SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**Are the ECM power and ground circuits are functioning properly?.**

**Yes** >> Go To 3

**No** >> Repair the ECM power and ground circuits. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

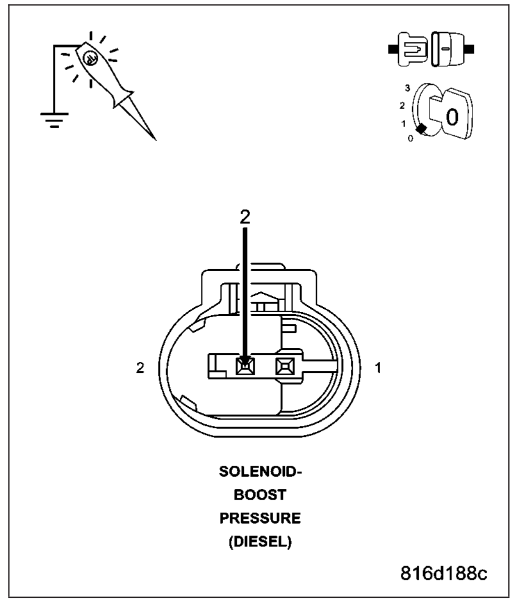
## 3. ASD OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the BP Solenoid harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit at the BP Solenoid harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the ASD Relay Output circuit for an open.

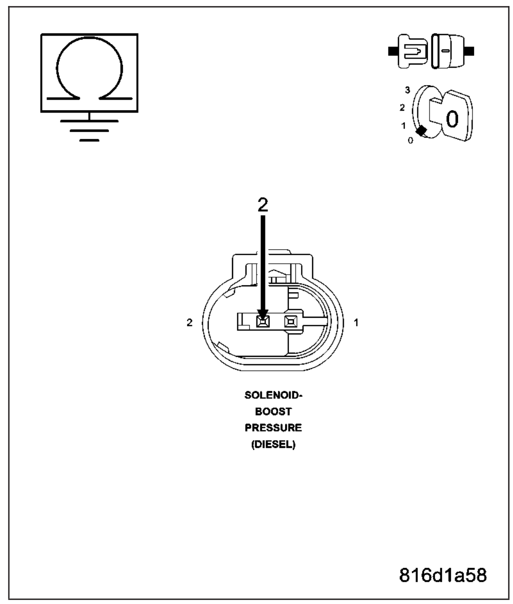
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. BP SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the BP Solenoid Control circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the BP Solenoid Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

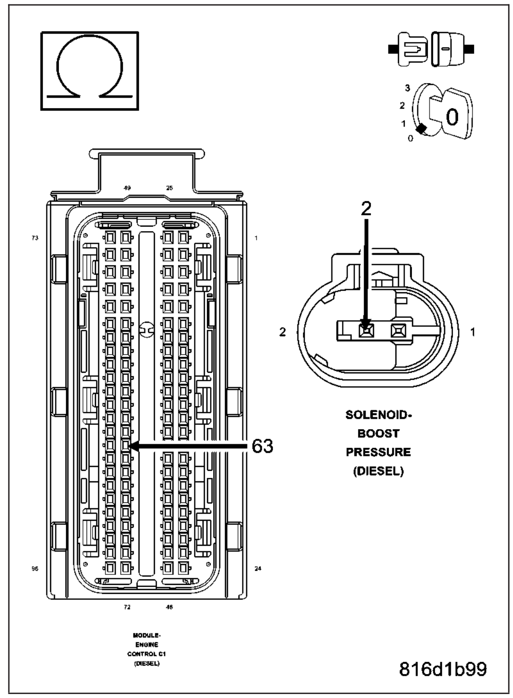
## 5. BP SOLENOID CONTROL CIRCUIT OPEN

Measure the resistance of the BP Solenoid Control circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the BP Solenoid Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 6. BOOST PRESSURE SOLENOID

Turn the ignition off.

Install a substitute BP Solenoid in place of the vehicle's BP Solenoid.

**NOTE: Ensure the ECM and BP Solenoid harness connectors are connected.**

Turn the ignition on.

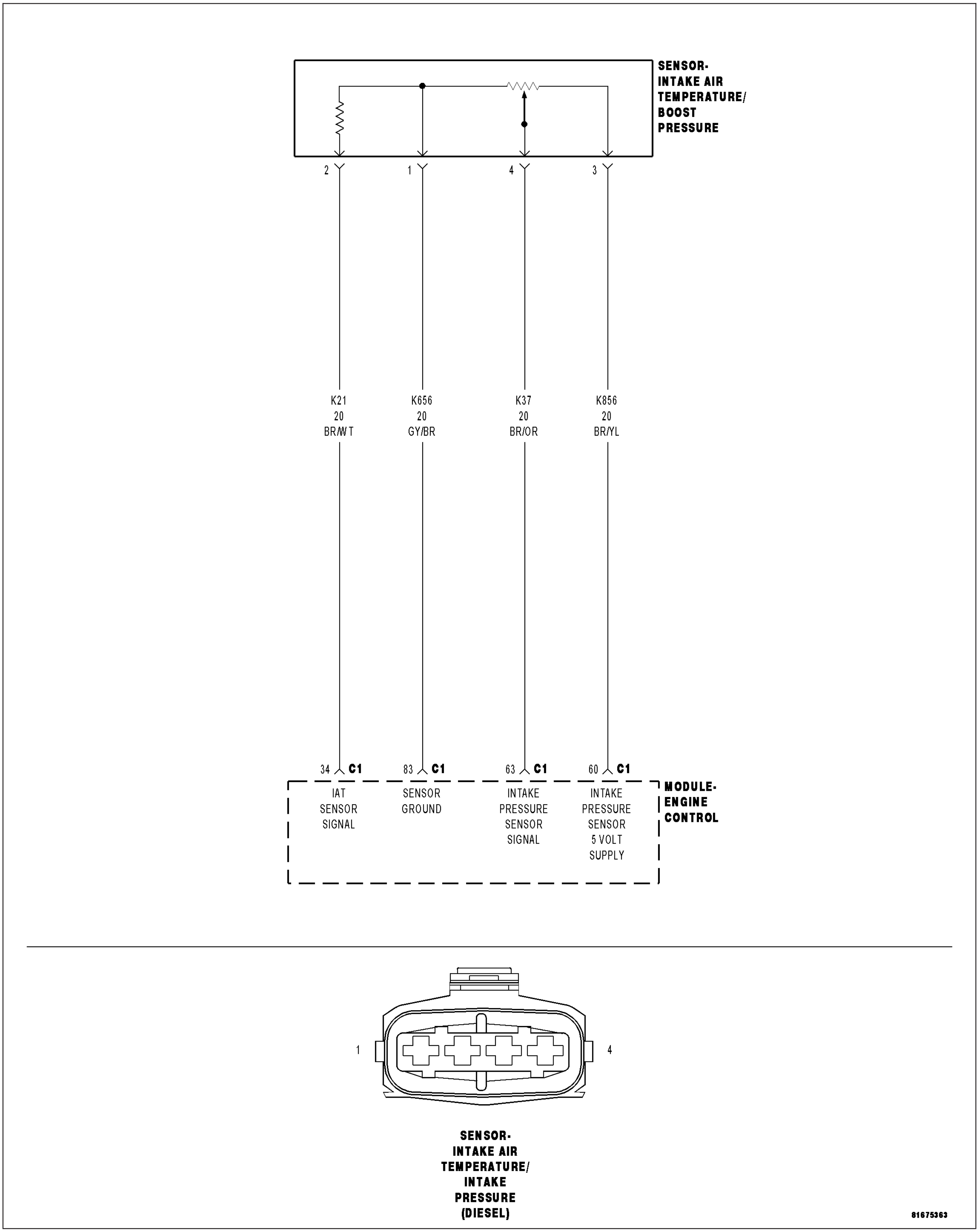
With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Boost Pressure Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0045-BOOST PRESSURE SOLENOID EXCESSIVE CURRENT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Boost Pressure Solenoid command on.
- **Set Condition:**
  The ECM detects excessive current on the Boost Pressure Solenoid Control circuit.

| Possible Causes |
| --- |
| BOOST PRESSURE SOLENOID |
| BP SOLENOID CONTROL SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE - INTERNAL SHORT TO VOLTAGE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. BP SOLENOID CONTROL SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the BP Solenoid harness connector.

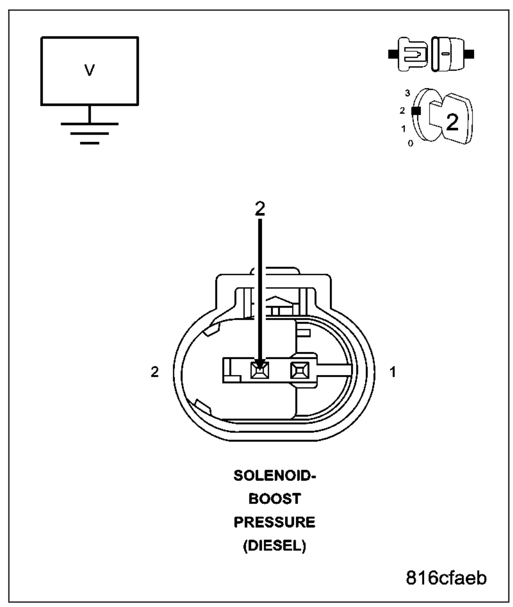
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the BP Solenoid Control circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Go To 3

**No** >> Repair the BP Solenoid Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. BOOST PRESSURE SOLENOID

Turn the ignition off.

Disconnect the BP Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

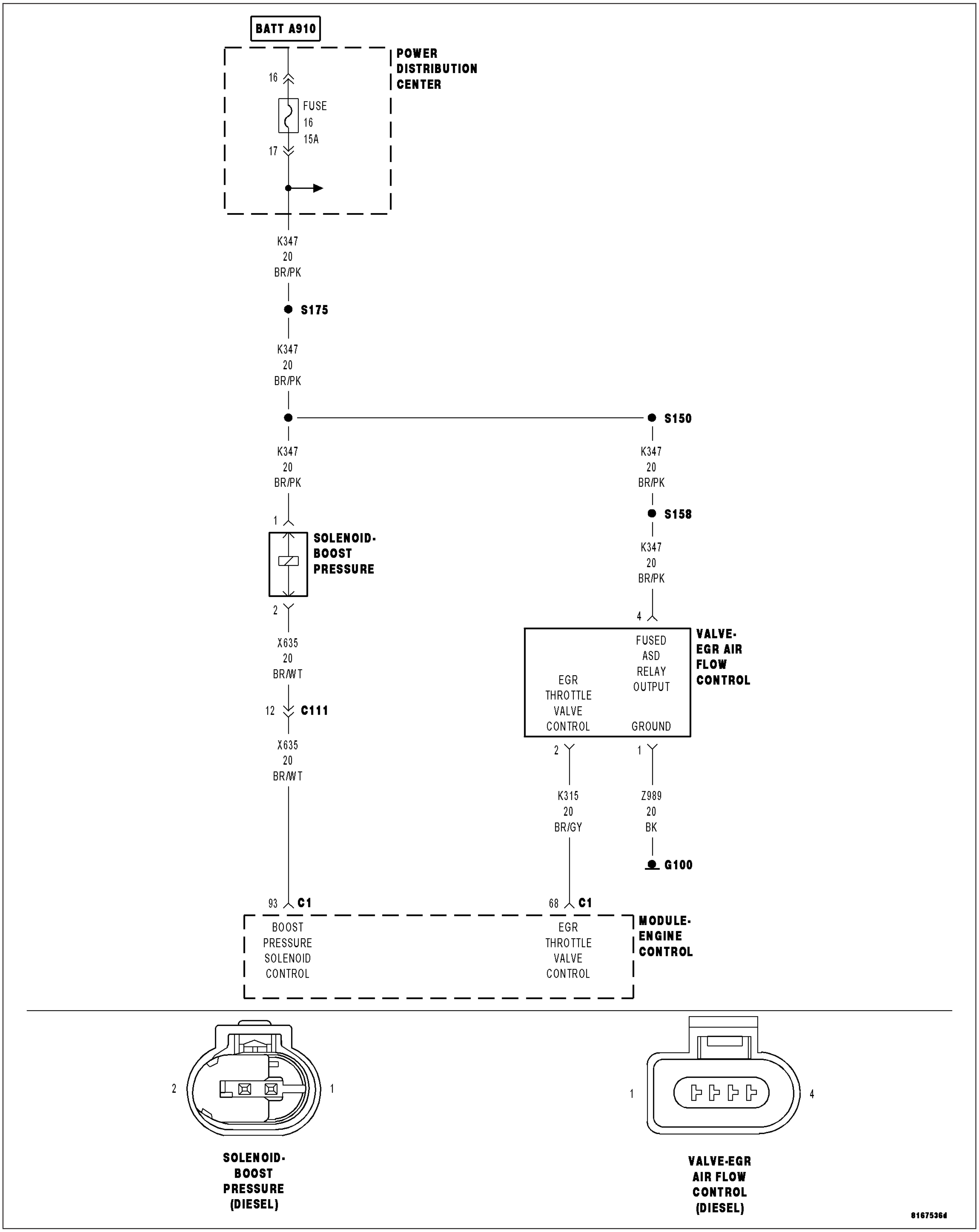
Monitor the scan tool for ECM DTCs.

**Does the scan tool display P0045 BOOST PRESSURE SOLENOID OPEN CIRCUIT?**

**Yes** >> Replace the Boost Pressure Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0047-TURBOCHARGER BOOST PRESSURE SOLENOID SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Boost Pressure Solenoid command off.
- **Set Condition:**
  The Engine Control Module (ECM) detects that the (X653) Boost Pressure Solenoid Control circuit is shorted to ground for 5.3 seconds.

| Possible Causes |
|---|
| (X653) BOOST PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| (X653) BOOST PRESSURE SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE |
| BOOST PRESSURE SOLENOID |
| ENGINE CONTROL MODULE (ECM) |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)**

## Diagnostic Test

### 1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Boost Pressure Solenoid.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

**Is the status Active for this DTC?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

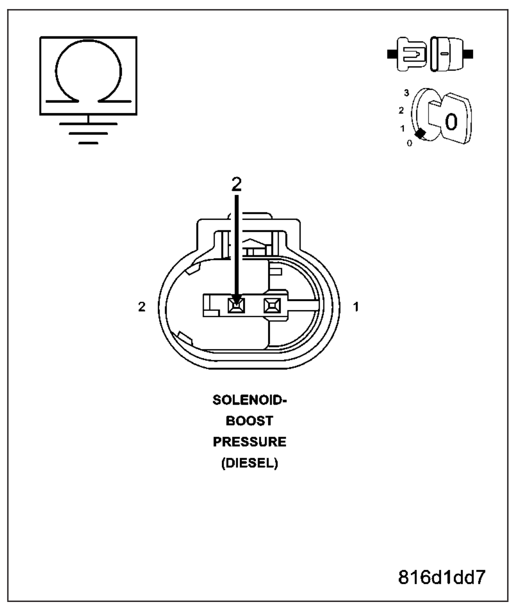
### 2. (X653) BOOST PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Boost Pressure Solenoid connector.

Disconnect the Engine Control Module (ECM) connector.

Measure the resistance between ground and the (X653) Boost Pressure Solenoid Control circuit in the Boost Pressure Solenoid harness connector.



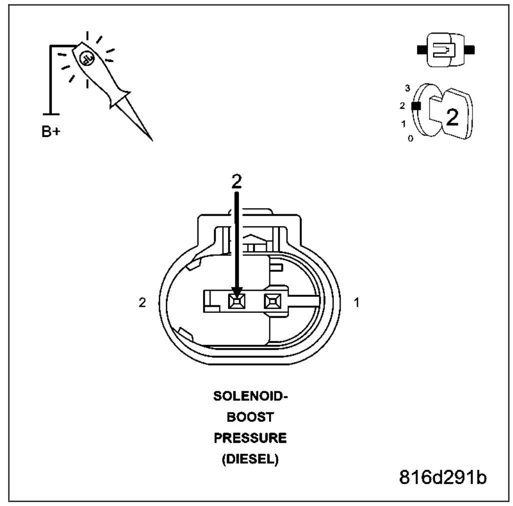

**Is the resistance below 1000 ohms?**

**Yes** >> Repair the (X653) Boost Pressure Solenoid Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go to 3

## 3. BOOST PRESSURE SOLENOID




Connect the Engine Control Module (ECM) connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, actuate the Boost Pressure Solenoid to 100%.

Using a 12 volt test light connected to 12 volts, check the (X653) Boost Pressure Solenoid Control circuit in the Boost Pressure Solenoid harness connector.

**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

**NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when checking the circuit.**

With the scan tool, actuate the Boost Pressure Solenoid to 0%.

Using a 12 volt test light connected to 12 volts, check the (X653) Boost Pressure Solenoid Control circuit in the Boost Pressure Solenoid harness connector.

**NOTE: The test light should not be illuminated.**

**NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when checking the circuit.**

**Is the test light illuminated and bright with the actuation at 100% and not illuminated with the actuation at 0%?**

**Yes** >> Replace the Boost Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go to 4

## 4. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Boost Pressure Solenoid and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

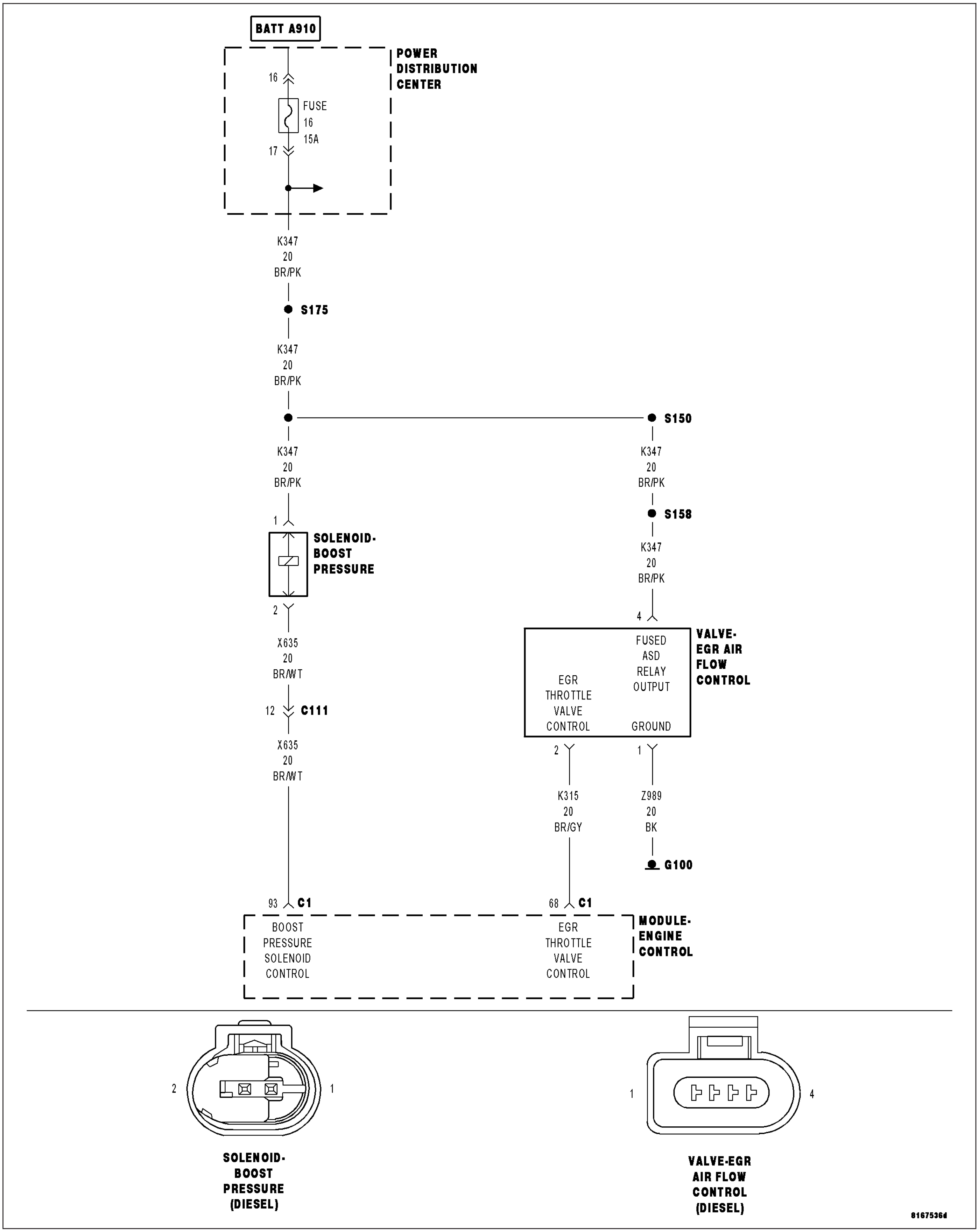
Refer to any Technical Service Bulletins that may apply.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Engine Control Module (ECM) in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0048-TURBOCHARGER BOOST CONTROL CIRCUIT SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Boost Pressure Servo Motor command on.
- **Set Condition:**
  The Engine Control Module (ECM) detects that the (X653) Boost Pressure Servo Motor Control circuit is shorted to voltage for 2.0 seconds.

| Possible Causes |
| --- |
| (X635) BOOST PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE |
| (X635) BOOST PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO THE (K347) FUSED ASD RELAY OUTPUT CIRCUIT |
| BOOST PRESSURE SOLENOID |
| ENGINE CONTROL MODULE (ECM) |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)**

## Diagnostic Test

### 1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Boost Pressure Solenoid.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

**Is the status Active for this DTC?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. (X635) BOOST PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Boost Pressure Solenoid connector.

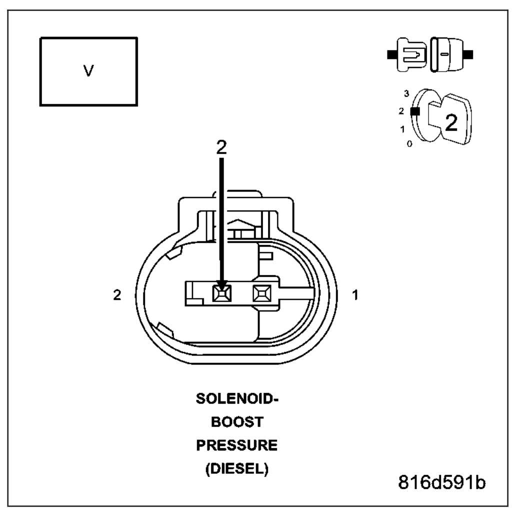
Disconnect the Engine Control Module (ECM) connector.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (X635) Boost Pressure Solenoid Control circuit in the Boost Pressure Solenoid harness connector.




**Is there any voltage present?**

**Yes** >> Repair the (X635) Boost Pressure Solenoid Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go to 3

## 3. (X653) BOOST PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO THE (K343) FUSED ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

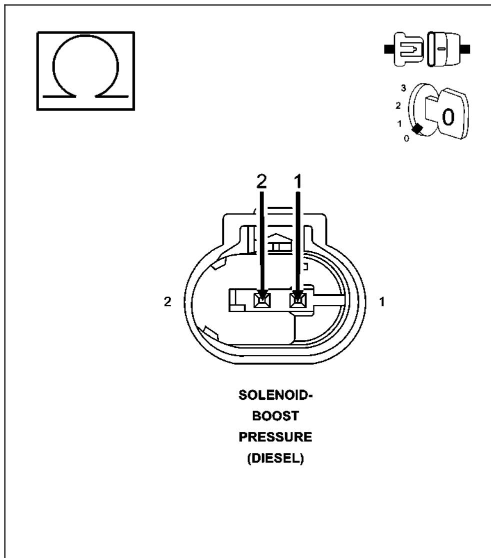
Measure the resistance between the (X635) Boost Pressure Solenoid Control circuit and the (K347) Fused ASD Relay Output circuit in the Boost Pressure Solenoid harness connector.

**Is the resistance above 1000 ohms?**

**Yes** >> Go to 4

**No** >> Repair the (X635) Boost Pressure Solenoid Control circuit for a short to the (K347) Fused ASD Relay Output circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




816d592a

## 4. BOOST PRESSURE SOLENOID

Connect the Engine Control Module (ECM) connector.

Turn the ignition on.

With the scan tool, Clear DTCs.

With the scan tool, actuate the Boost Pressure Solenoid to 100%.

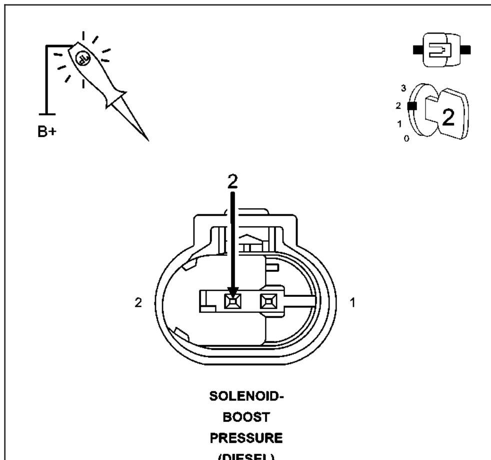
Using a 12 volt test light connected to 12 volts, check the (X635) Boost Pressure Solenoid Control circuit in the Boost Pressure Solenoid harness connector.

**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

**NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when checking the circuit.**

With the scan tool, actuate the Boost Pressure Solenoid to 0%.

Using a 12 volt test light connected to 12 volts, check the (X653) Boost Pressure Solenoid Control circuit in the Boost Pressure Solenoid harness connector.




816d291b

**NOTE: The test light should not be illuminated.**

**NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when checking the circuit.**

**Is the test light illuminated and bright with the actuation at 100% and not illuminated with the actuation at 0%?**

**Yes** >> Replace the Boost Pressure Solenoid in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go to 5

## 5. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Boost Pressure Solenoid and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

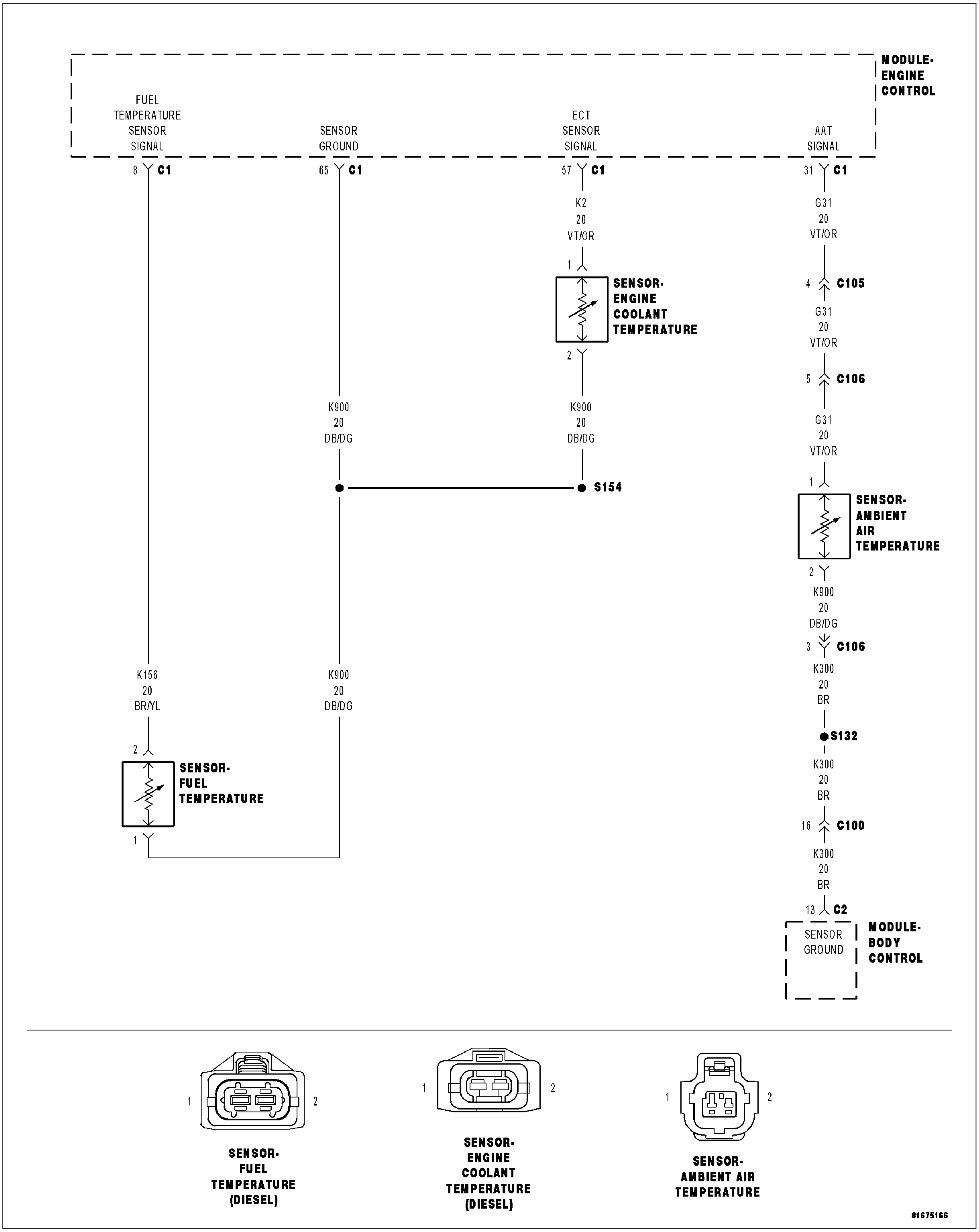
Refer to any Technical Service Bulletins that may apply.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Engine Control Module (ECM) in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0070-AMBIENT AIR TEMPERATURE SIGNAL VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Ambient Air Temperature Sensor signal is above 4.82 volts for 0.5 second.

| Possible Causes |
|---|
| AMBIENT AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| AMBIENT AIR TEMP SENSOR GROUND CIRCUIT OPEN |
| AMBIENT AIR TEMP SENSOR SIGNAL CIRCUIT OPEN |
| AMBIENT TEMPERATURE SENSOR |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off for 10 seconds.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. AMBIENT AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Ambient Air Temperature Sensor harness connector.

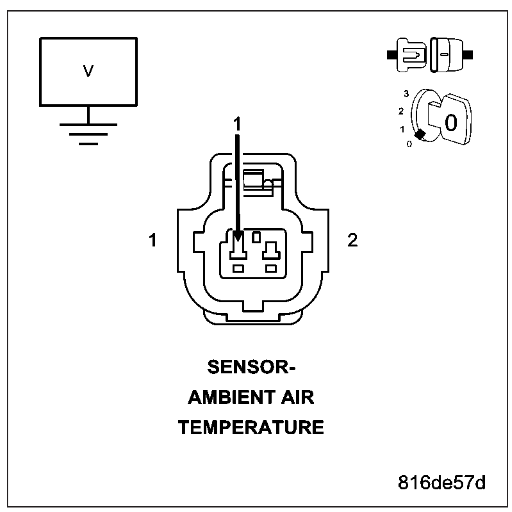
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage on the Ambient Air Temperature Sensor Signal circuit.



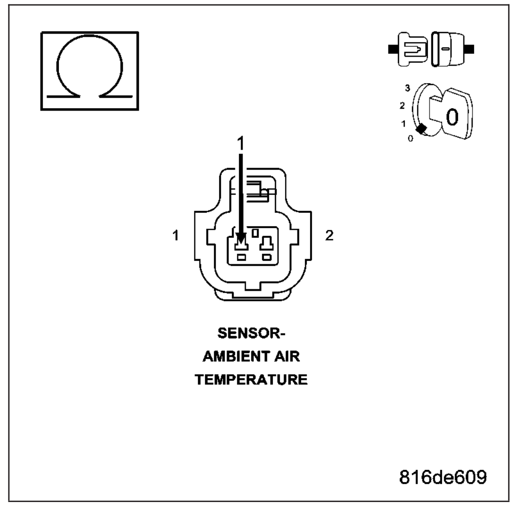

**NOTE: Remove the jumper wire.**

**Is the voltage below 1.0 volt?**

**Yes** >> Go To 3

**No** >> Repair the Ambient Air Temperature Sensor Signal circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. AMBIENT AIR TEMP SENSOR SIGNAL CIRCUIT OPEN




Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Ambient Air Temperature Sensor harness connector.

Measure the resistance of the Ambient Air Temperature Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Ambient Air Temperature Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. AMBIENT TEMPERATURE SENSOR

Turn the ignition off.

Disconnect the Ambient Temperature Sensor harness connector.

Connect a jumper wire between the Ambient Temperature Sensor Signal and Sensor Ground circuits in the Ambient Temperature Sensor harness connector.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

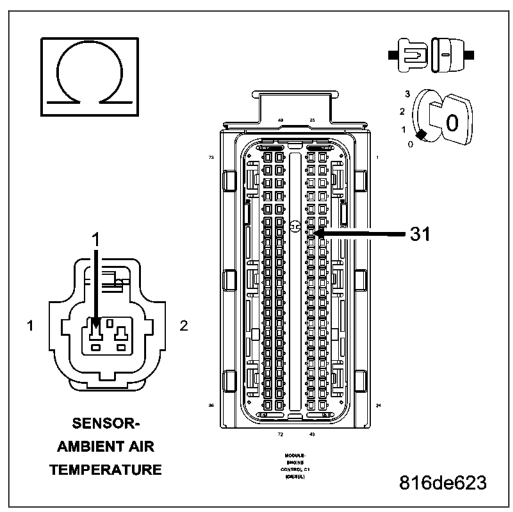
**Does the scan tool display P0070 AMB TEMP. SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW?**

**Yes** >> Replace the Ambient Temperature Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. AMBIENT TEMP SENSOR GROUND CIRCUIT OPEN




Turn the ignition off.

Disconnect the Ambient temperature Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between the ECM harness connector and the Ambient Temperature Sensor harness connector.

**Is the resistance below 10.0 ohms?**

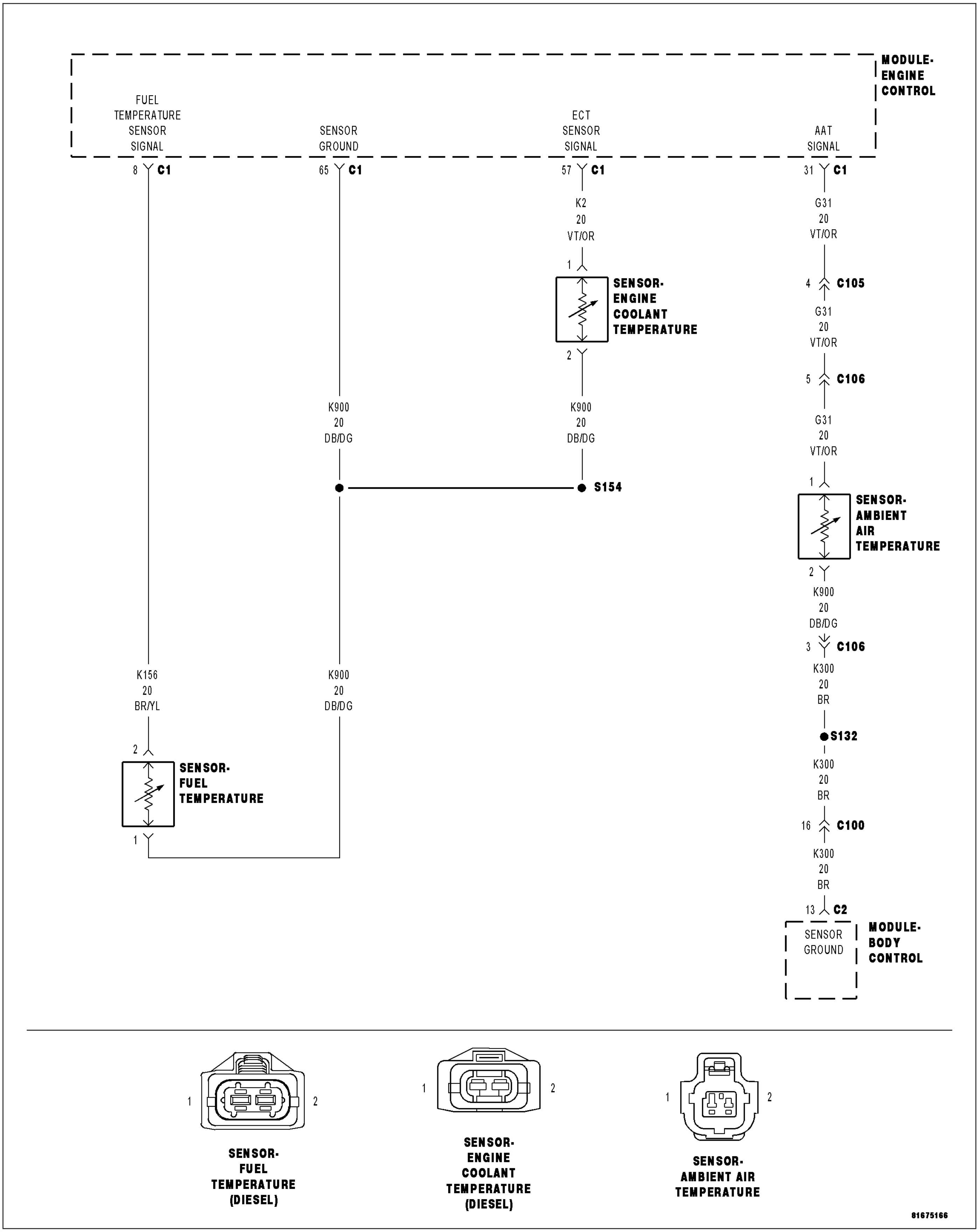
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Ambient Air Temperature Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0070-AMBIENT AIR TEMPERATURE SIGNAL VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Ambient Air Temperature Sensor signal is below 0.068 volt.

| Possible Causes |
|---|
| AMBIENT AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| AMBIENT AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND |
| AMBINET TEMPERATURE SENSOR |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs for at least 2 minutes.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. AMBIENT TEMPERATURE SENSOR

Turn the ignition off.

Disconnect the Ambient Temperature Sensor harness connector.

Turn the ignition on.

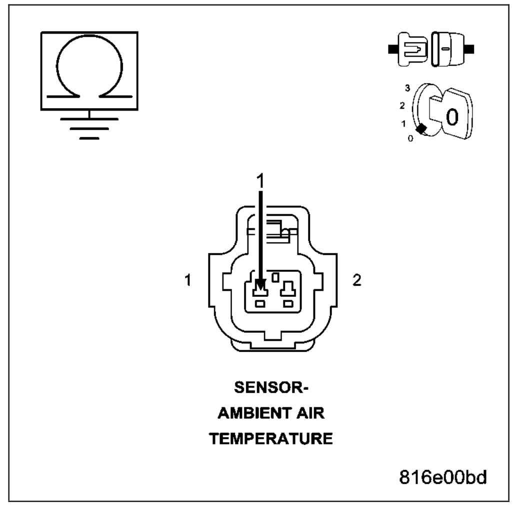
Monitor the scan tool for ECM DTCs for at least 2 minutes.

**Does the scan tool display P0070 AMB TEMP SENSOR SIGNAL VOLTAGE TOO HIGH?**

**Yes** >> Replace the Ambient Temperature Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. AMBIENT AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND




Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Ambient Air Temperature Sensor harness connector.

Measure the resistance between ground and the Ambient Air Temperature Sensor Signal circuit.

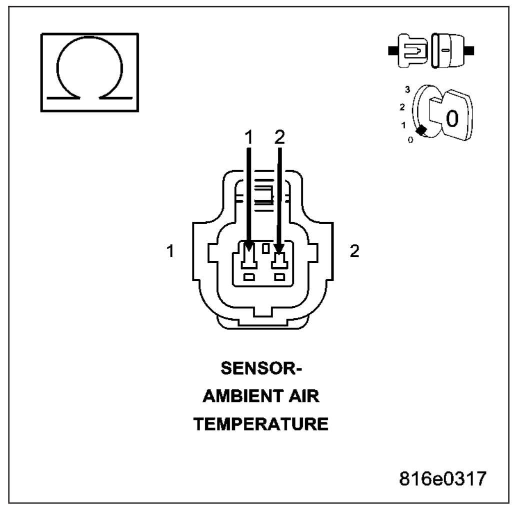
**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Ambient Air Temperature Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. AMBIENT AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND




Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Ambient Air temperature Sensor harness connector.

Measure the resistance between the Ambient Air Temperature Sensor Signal circuit and the Sensor Ground circuit.

**Is the resistance above 1000 ohms?**

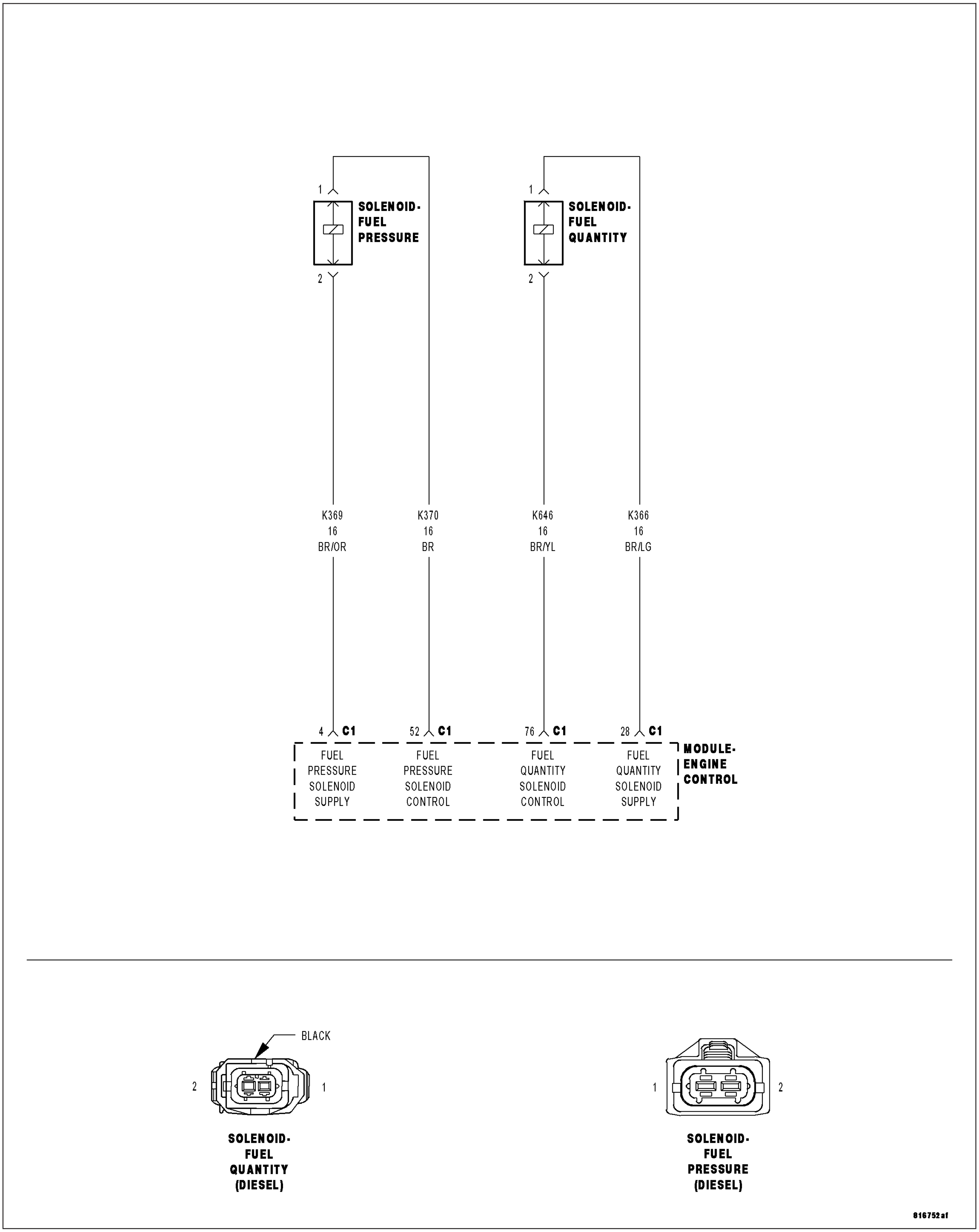
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Ambient Air Temperature Sensor Signal circuit for a short to the Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0087-FUEL RAIL PRESSURE MALFUNCTION PRESSURE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail pressure is too low for a given engine speed.

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM CONCERNS |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |

## Diagnostic Test

### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.**

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Refer to the Service Information and inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. ATTEMPT TO START ENGINE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 6

**No** >> Go To 11

## 6. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. FUEL PRESSURE SOLENOID

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.**

Start and idle the engine.

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 11. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 13

**No** >> Test Complete.

## 13. FUEL QUANTITY SOLENOID

Turn the ignition off.

Replace the Fuel Quantity Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

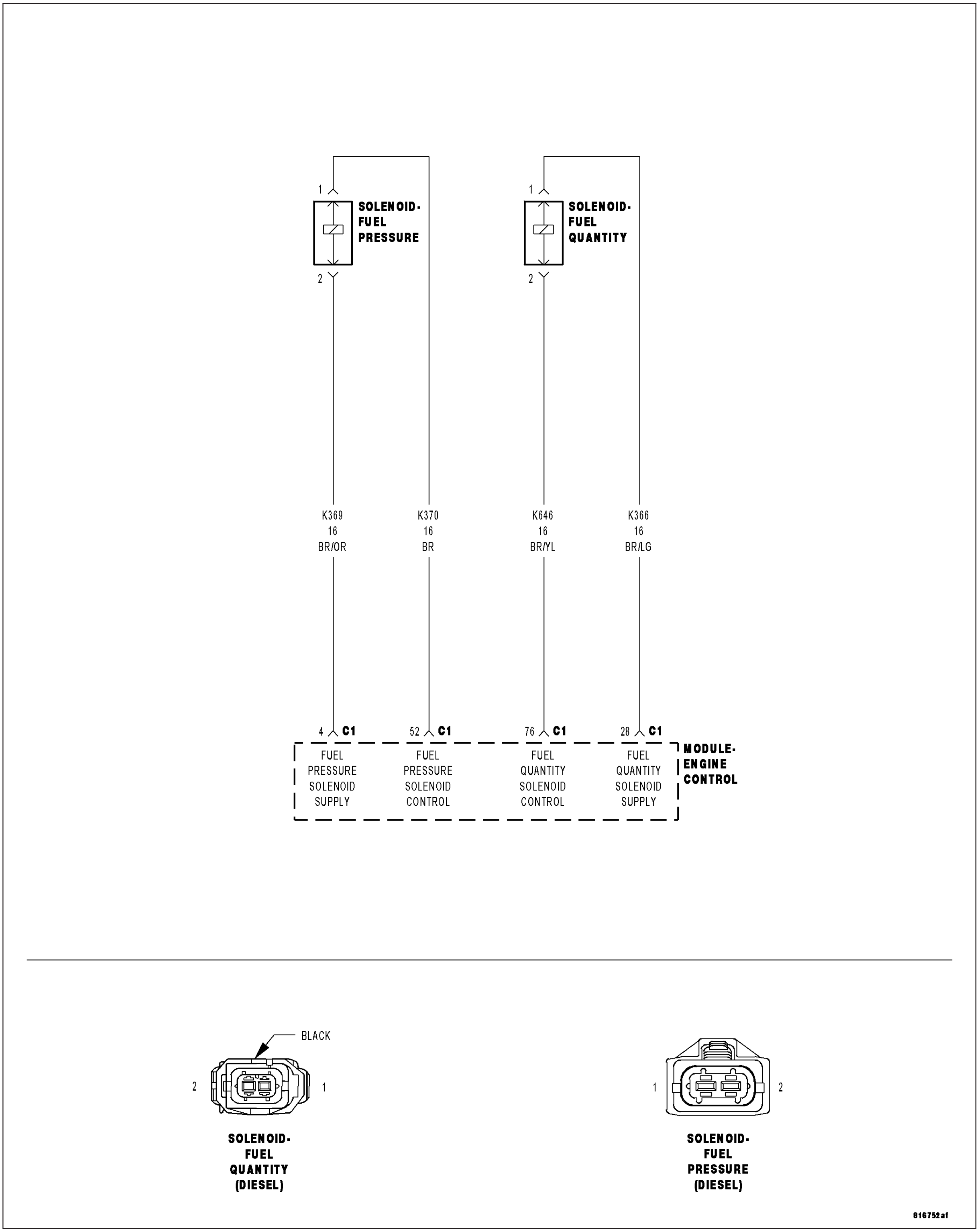
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P0088-FUEL RAIL PRESSURE TOO HIGH




For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail pressure is too high for a given engine speed and load.

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |
| INTERMITTENT DTC |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)**

## Diagnostic Test

### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM VERIFICATION TEST.

**No** >> Go To 2

### 2. CURRENT DTC

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.**

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 5

## 5. FUEL PRESSURE SENSOR CALIBRATION

Turn the ignition on.

With the scan tool, read the Fuel Pressure Sensor volts.

**Does the scan tool display between 0.45 and 0.55 volts for the Fuel Pressure Sensor?**

**Yes** >> Go To 6

**No** >> Check the Fuel Pressure Sensor wiring and connectors for corrosion or poor terminal contact that could cause high resistance. repair as necessary. If wiring and connectors are o.k., replace the Fuel Pressure Sensor.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 6. ATTEMPT TO START ENGINE

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 7

**No** >> Go To 12

## 7. CHECKING FOR AIR IN FUEL SYSTEM

With the scan tool in Sensors, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 8

## 8. FUEL PRESSURE SOLENOID

With the scan tool, compare the Fuel Pressure Setpoint with the actual Fuel Pressure.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by the actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does the actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure Setpoint?**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 9

## 9. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 10

## 10. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.**

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 11

## 11. FUEL PRESSURE SOLENOID

Turn the ignition off.
Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Test Complete.

## 12. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 13

## 13. FUEL PRESSURE SOLENOID

Turn the ignition off.
Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 14

**No** >> Test Complete.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 14. FUEL QUANTITY SOLENOID

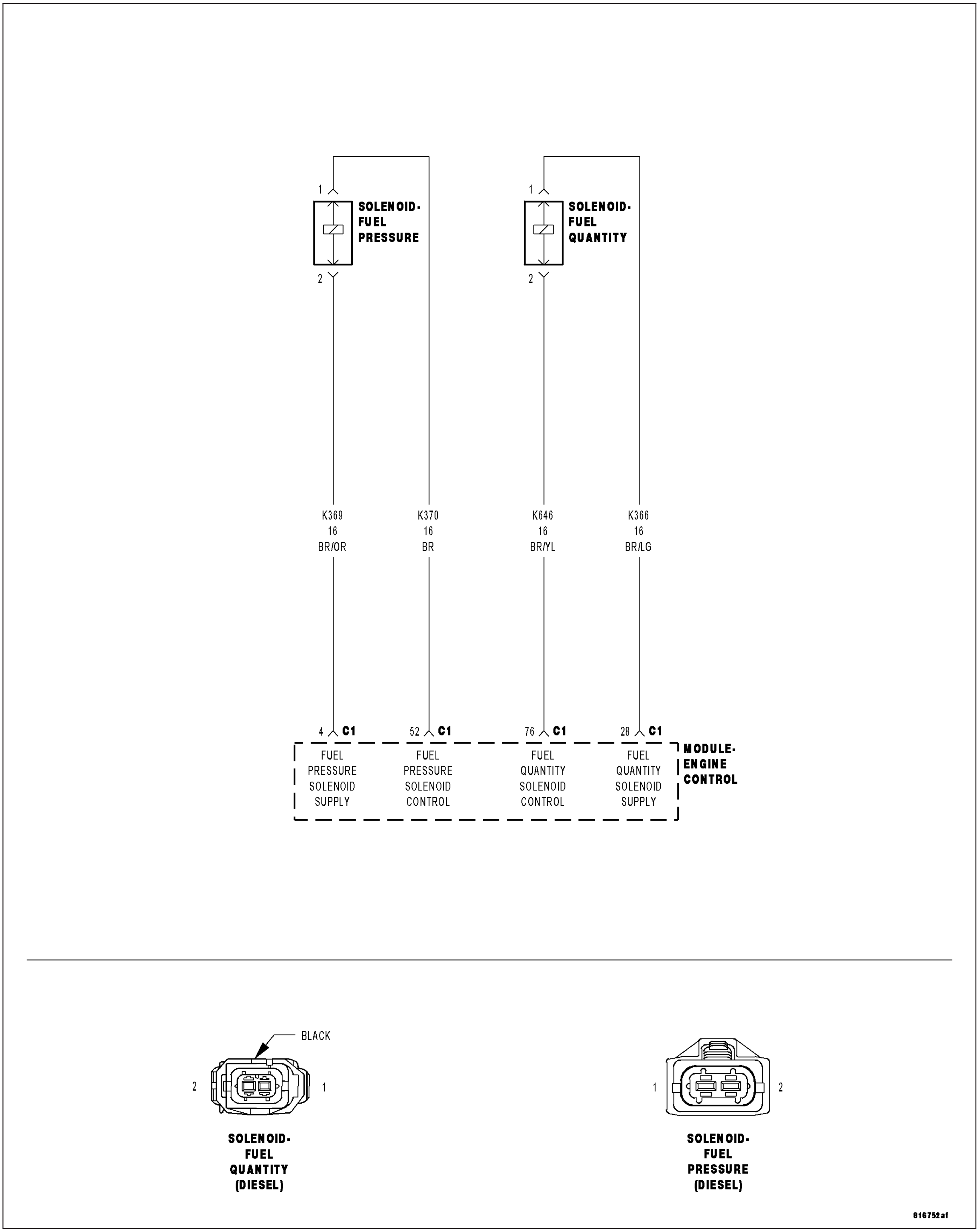
Turn the ignition off.
Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Test Complete.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## P0089-FUEL PRESSURE 1 CONTROL PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Fuel Pressure Solenoid command on.
- **Set Condition:**
  The Engine Control Module (ECM) detects that the (K370) Fuel Pressure Solenoid Control circuit voltage is implausible for 0.28 seconds.

| **Possible Causes** |
|---|
| (K369) FUEL PRESSURE SOLENOID SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE |
| (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE |
| (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE |
| FUEL PRESSURE SOLENOID |
| ENGINE CONTROL MODULE (ECM) |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)**

## Diagnostic Test

### 1. DTC IS ACTIVE

Ignition on, engine not running.

With the scan tool, Clear DTCs in the Engine Control Module (ECM).

With the scan tool, actuate the Fuel Pressure Solenoid.

Monitor the scan tool for at least two minutes.

With the scan tool, select View DTCs.

**Is the status Active for this DTC?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. (K369) FUEL PRESSURE SOLENOID SUPPLY CIRCUIT OPEN OR HIGH RESISTANCE

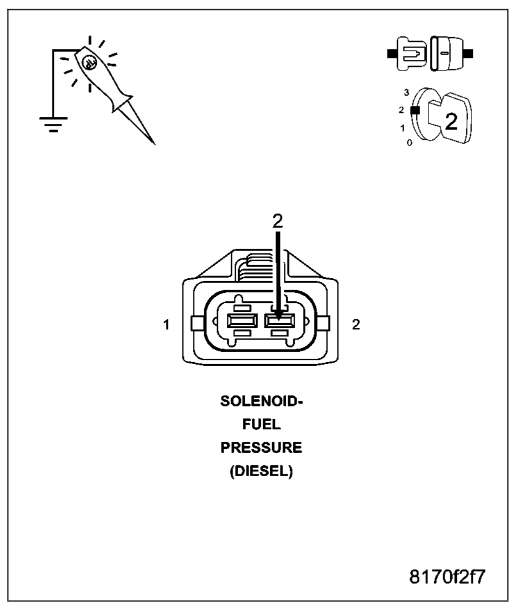
Turn the ignition off.

Disconnect the Fuel Pressure Solenoid connector.

Turn the ignition on.

With the scan tool, actuate the Fuel Pressure Solenoid.

Using a 12 volt test light connected to ground, check the (K369) Fuel Pressure Solenoid Supply circuit in the Fuel Pressure Solenoid harness connector.




**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

**Is the test light illuminated and bright?**

**Yes** >> Go to 3

**No** >> Repair the (K369) Fuel Pressure Solenoid Supply circuit for an open circuit or high resistance.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

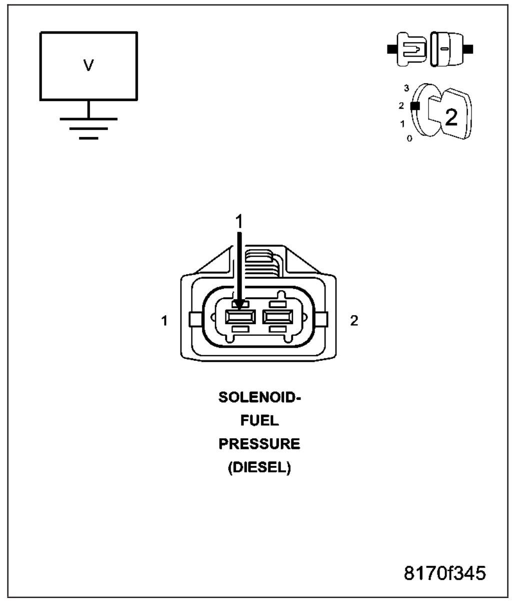
Disconnect the Engine Control Module (ECM) connector.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay Connector.

Turn the ignition on.

Measure the voltage of the (K370) Fuel Pressure Solenoid Control circuit in the Fuel Pressure Solenoid harness connector.




**Is there any voltage present?**

**Yes** >> Repair the (K370) Fuel Pressure Solenoid Control circuit for a short to voltage.

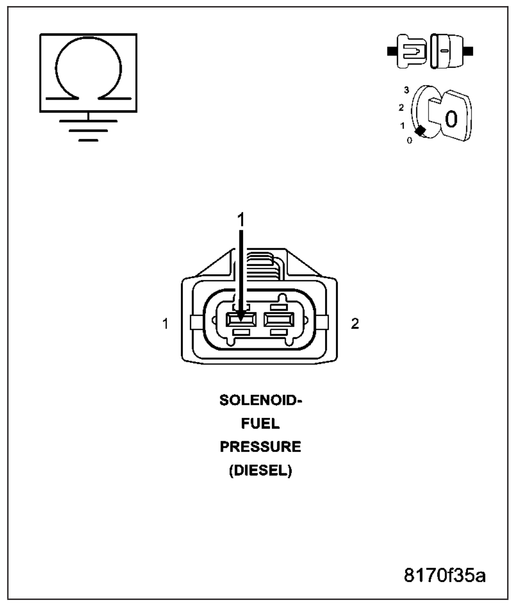
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go to 4

## 4. (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (K370) Fuel Pressure Solenoid Control circuit in the Fuel Pressure Solenoid harness connector.




**Is the resistance below 1000 ohms?**

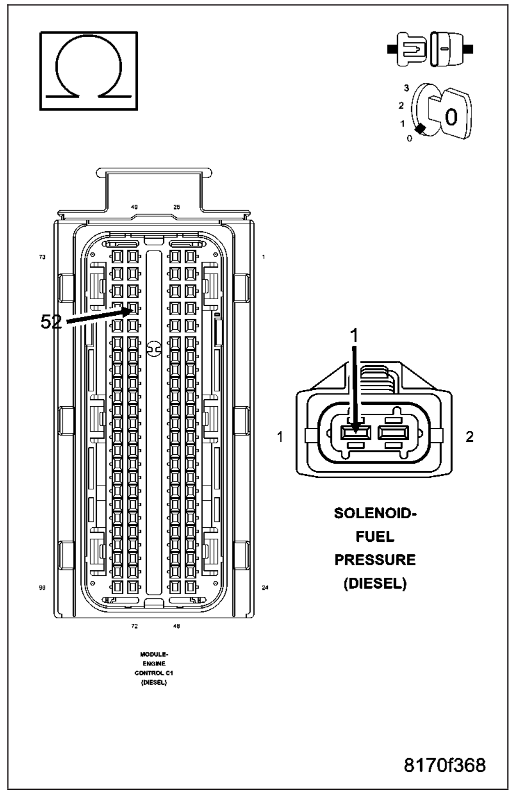
**Yes** >> Repair the (K370) Fuel Pressure Solenoid Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go to 5

## 5. (K370) FUEL PRESSURE SOLENOID CONTROL CIRCUIT OPEN OR HIGH RESISTANCE

Measure the resistance of the (K370) Fuel Pressure Solenoid Control circuit between the Fuel Pressure Solenoid harness connector and the Engine Control Module (ECM) harness connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go to 6

**No** >> Repair the (K370) Fuel Pressure Solenoid Control circuit for an open circuit or high resistance.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. FUEL PRESSURE SOLENOID

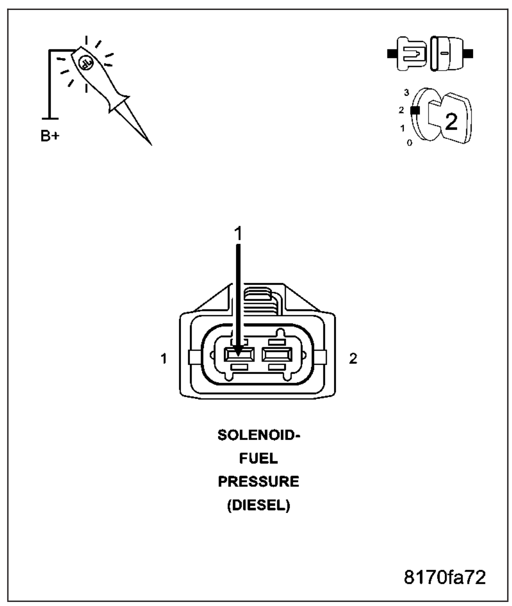
Connect the Engine Control Module (ECM) connector.

Remove the jumper wire and install the ASD Relay.

Turn the ignition on.

With the scan tool, actuate the Fuel Pressure Solenoid to 100%.

Using a 12 volt test light connected to 12 volts, check the (K370) Fuel Pressure Solenoid Control circuit in the Fuel Pressure Solenoid harness connector.




**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

**NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when checking the circuit.**

With the scan tool, actuate the Fuel Pressure Solenoid to 0%.

Using a 12 volt test light connected to 12 volts, check the (K370) Fuel Pressure Solenoid Control circuit in the Fuel Pressure Solenoid harness connector.

**NOTE: The test light should not be illuminated.**

**NOTE: The circuit will remain actuated by the controller for 30 seconds. Be certain the actuation is active when checking the circuit.**

**Is the test light illuminated and bright with the actuation at 100% and not illuminated with the actuation at 0%?**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go to 7

## 7. ENGINE CONTROL MODULE (ECM)

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Fuel Pressure Solenoid and the Engine Control Module (ECM).

Look for any chafed, pierced, pinched, or partially broken wires.

Look for broken, bent, pushed out or corroded terminals.

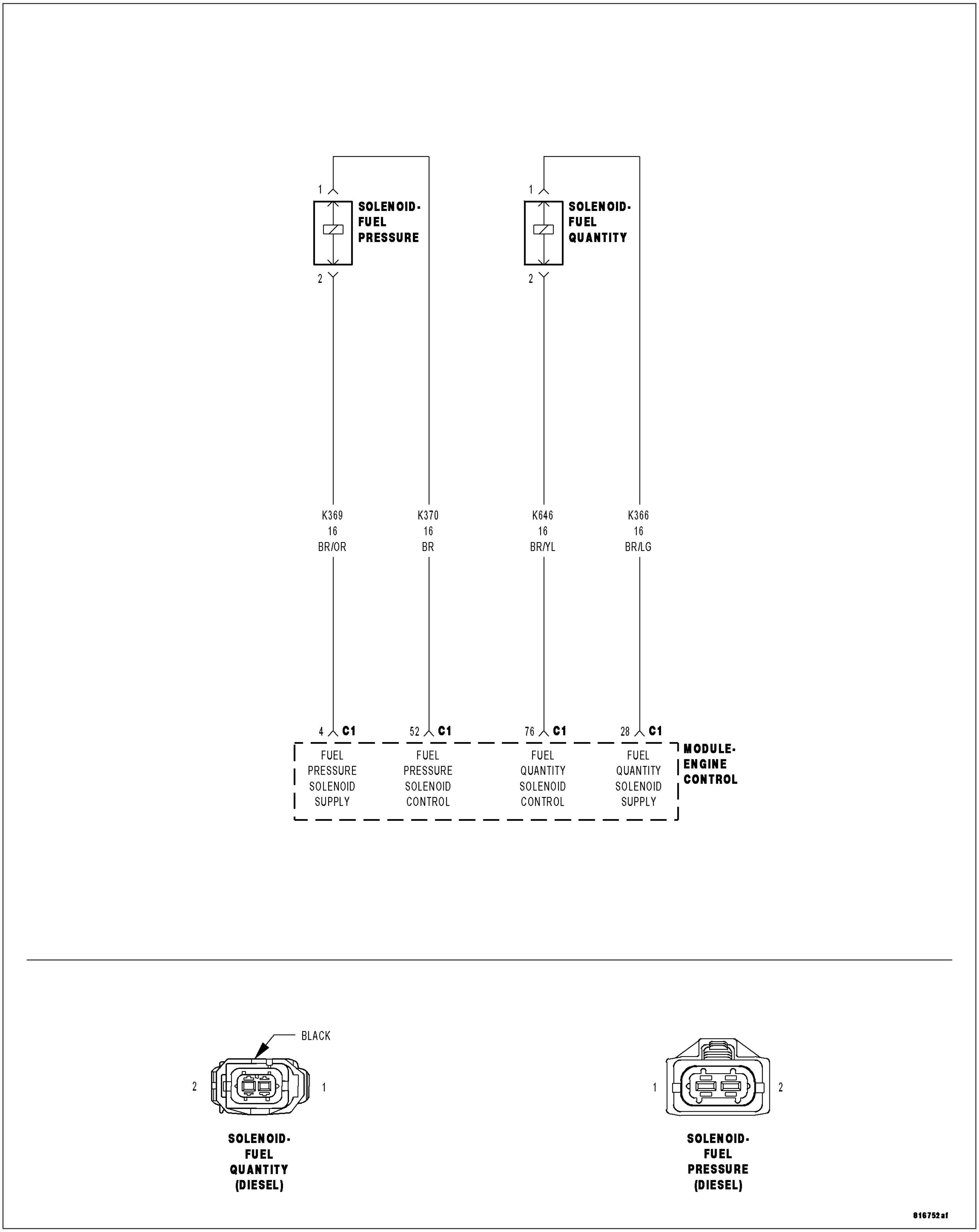
Refer to any Technical Service Bulletins that may apply.

**Were any problems found?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Engine Control Module (ECM) in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0090-FUEL QUANTITY SOLENOID OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Fuel Quantity Solenoid command off.
- **Set Condition:**
  The ECM detects an open in the Fuel Quantity Solenoid circuit.

| Possible Causes |
|---|
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL QUANTITY SOLENOID OPEN CIRCUIT(S) |
| FUEL QUANTITY SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. VERIFY CURRENT DTC

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

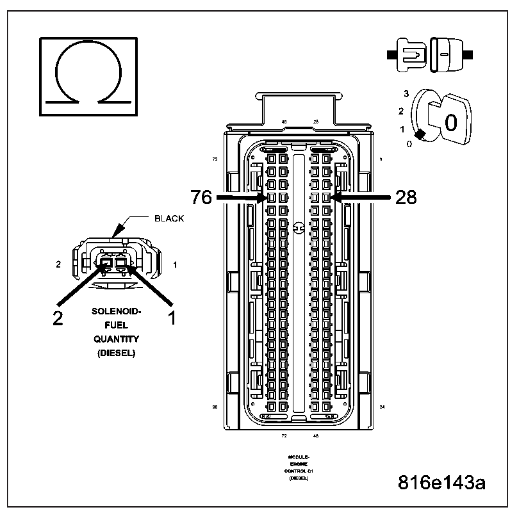
### 3. FUEL QUANTITY SOLENOID CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Quantity Solenoid harness connector.

Measure the resistance of each of the Fuel Quantity Solenoid circuits between the ECM harness connector and the Fuel Quantity Solenoid harness connector.



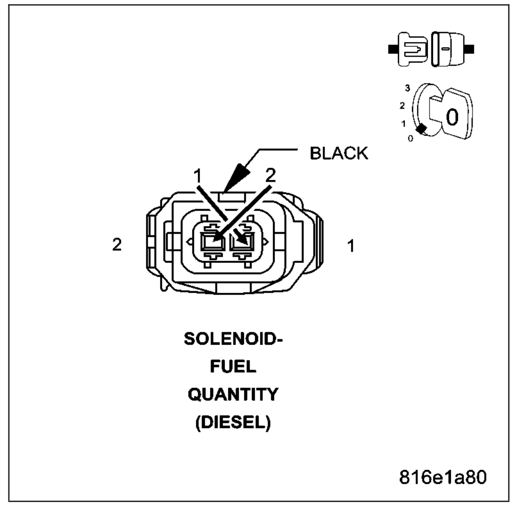

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 4

**No** >> Repair the circuit(s) that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL QUANTITY SOLENOID




Turn the ignition off.

Disconnect the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0090-FUEL QUANTITY SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

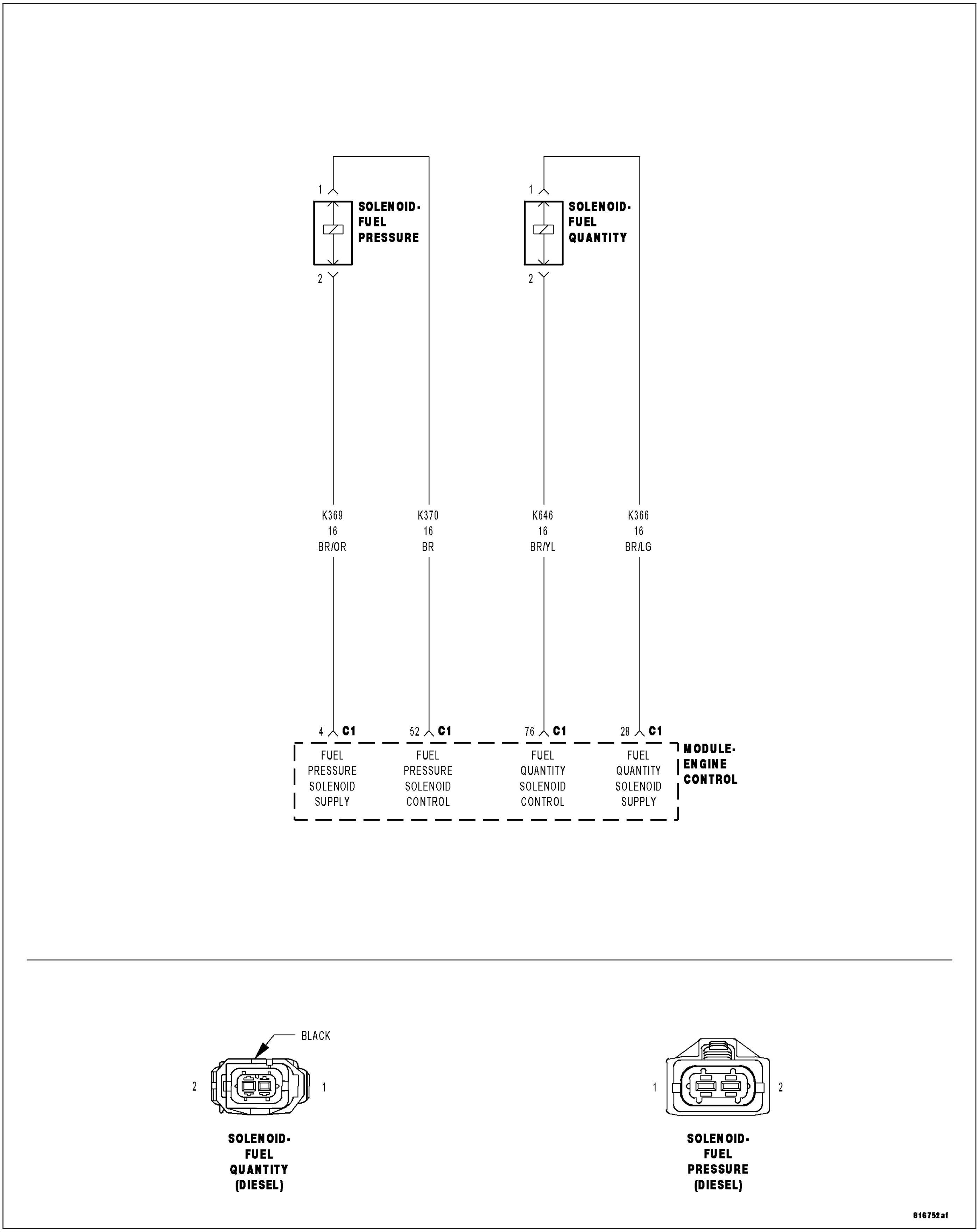
**NOTE: The scan tool should display P0092-FUEL QUANTITY SOLENOID SHORT CIRCUIT.**

**Does the scan tool display the appropriate DTC for each condition?**

**Yes** >> Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0091-FUEL QUANTITY SOLENOID SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Fuel Quantity Solenoid command off.
- **Set Condition:**
  The ECM detects an open in the Fuel Quantity Solenoid circuit.

| Possible Causes |
|---|
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL QUANTITY SOLENOID OPEN CIRCUIT(S) |
| FUEL QUANTITY SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. VERIFY CURRENT DTC

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL QUANTITY SOLENOID CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Quantity Solenoid harness connector.

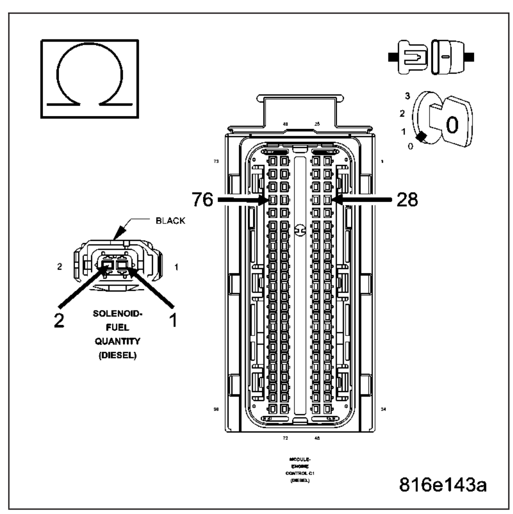
Measure the resistance of each of the Fuel Quantity Solenoid circuits between the ECM harness connector and the Fuel Quantity Solenoid harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 4

**No** >> Repair the circuit(s) that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 4. FUEL QUANTITY SOLENOID

Turn the ignition off.

Disconnect the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0090-FUEL QUANTITY SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

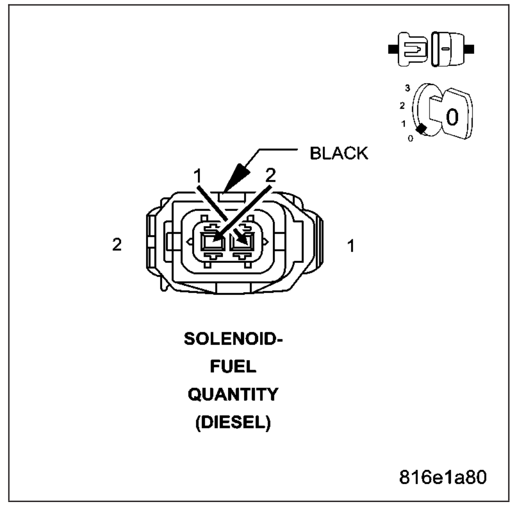
Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0092-FUEL QUANTITY SOLENOID SHORT CIRCUIT.**

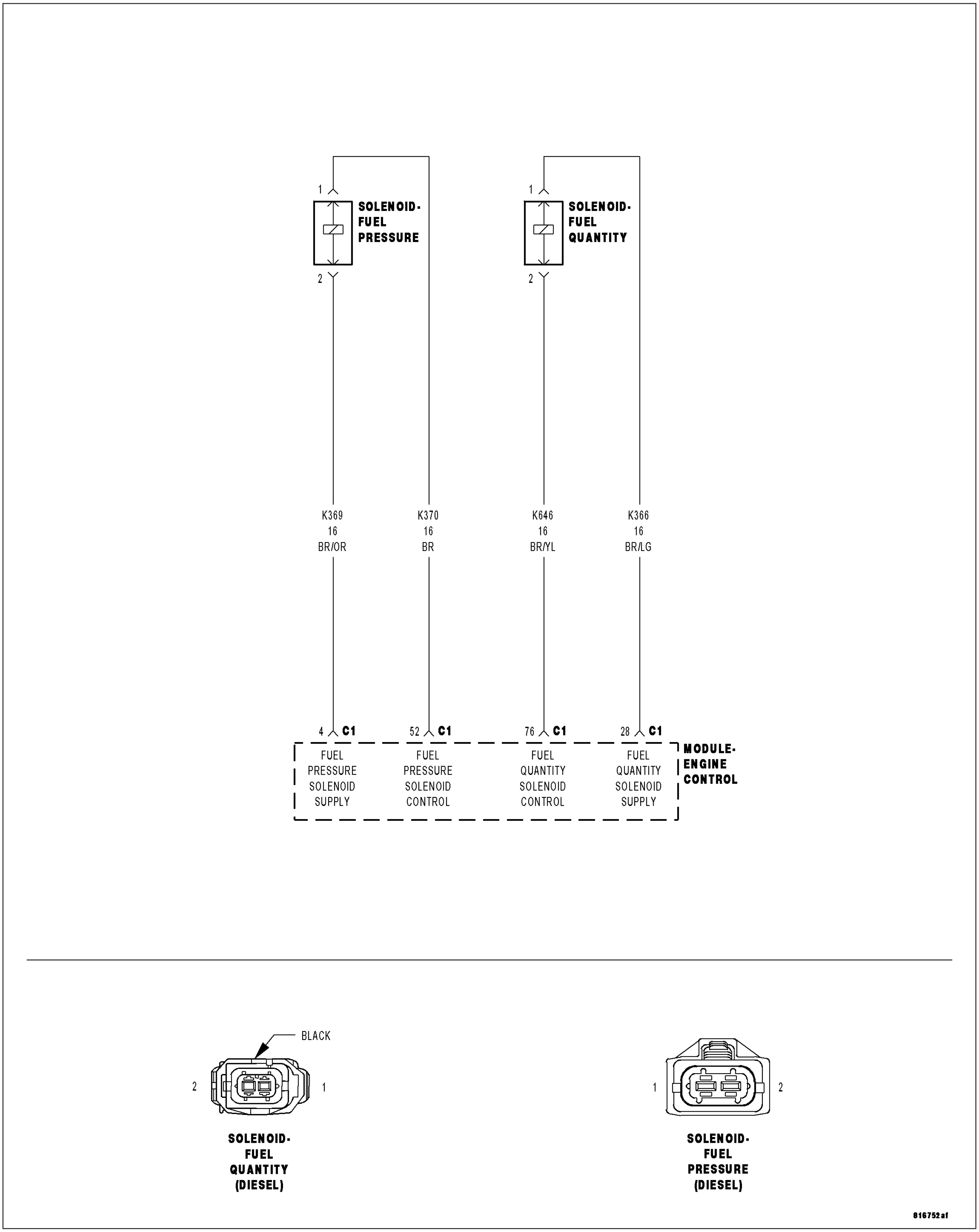



**Does the scan tool display the appropriate DTC for each condition?**

**Yes** >> Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0092-FUEL QUANTITY SOLENOID SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Fuel Quantity Solenoid command on.
- **Set Condition:**
  The ECM detects excessive current in the Fuel Quantity Solenoid circuit.

| Possible Causes |
|---|
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL QUANTITY SOLENOID OPEN CIRCUIT(S) |
| FUEL QUANTITY SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. VERIFY CURRENT DTC

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

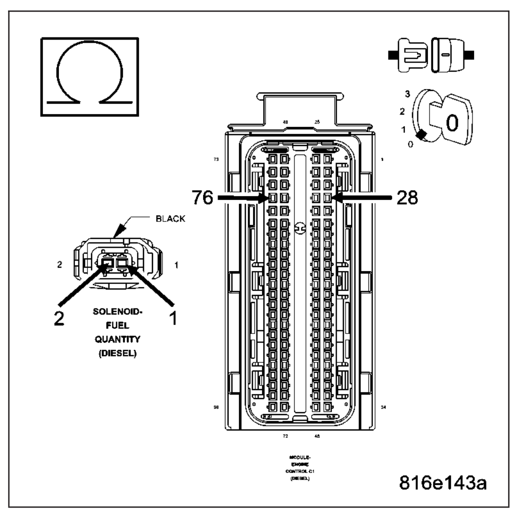
### 3. FUEL QUANTITY SOLENOID CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Quantity Solenoid harness connector.

Measure the resistance of each of the Fuel Quantity Solenoid circuits between the ECM harness connector and the Fuel Quantity Solenoid harness connector.



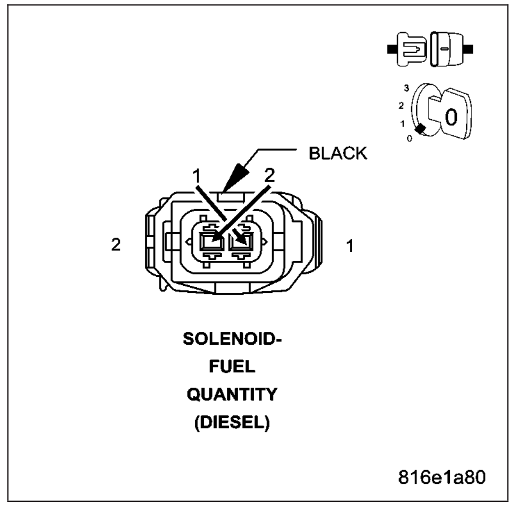

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 4

**No** >> Repair the circuit(s) that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL QUANTITY SOLENOID




Turn the ignition off.

Disconnect the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0090 FUEL QUANTITY SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

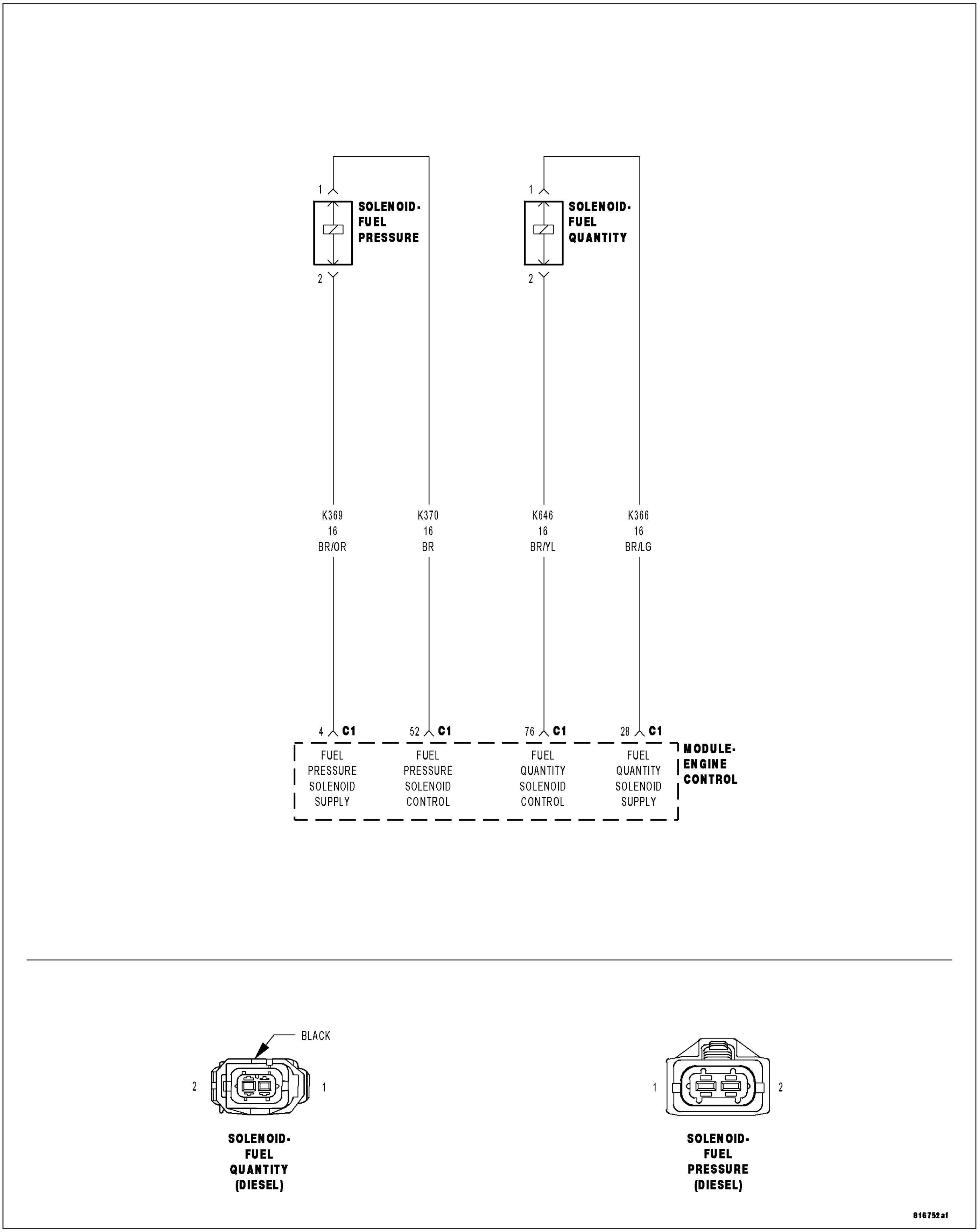
**NOTE: The scan tool should display P0092-FUEL QUANTITY SOLENOID SHORT CIRCUIT.**

**Does the scan tool display the appropriate DTC for each condition?**

**Yes** >> Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0093 - FUEL RAIL PRESSURE MALFUNCTION POSITIVE PRESSURE DEVIATION




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  When the engine is running.
- **Set Condition:**
  The signal from the fuel pressure sensor indicates the actual fuel pressure is above the fuel pressure setpoint.

| Possible Causes |
|---|
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL QUANTITY SOLENOID OPEN CIRCUIT(S) |
| INTERMITTENT CONDITION |
| FUEL QUANTITY SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. VERIFY CURRENT DTC

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle. With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

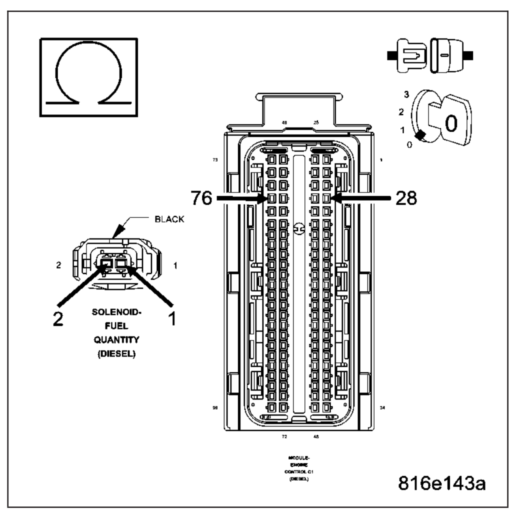
### 3. FUEL QUANTITY SOLENOID CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Quantity Solenoid harness connector.

Measure the resistance of each of the Fuel Quantity Solenoid circuits between the ECM harness connector and the Fuel Quantity Solenoid harness connector.



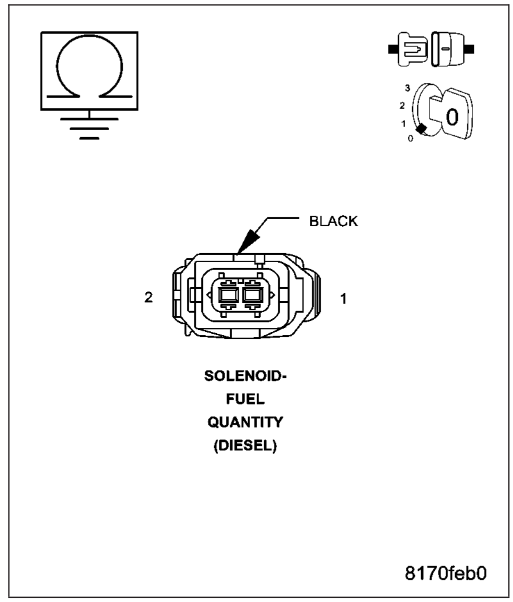

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 4

**No** >> Repair the circuit(s) that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO GROUND




Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Quantity Solenoid harness connector.

Measure the resistance between ground and each of the Fuel Quantity Solenoid circuits.

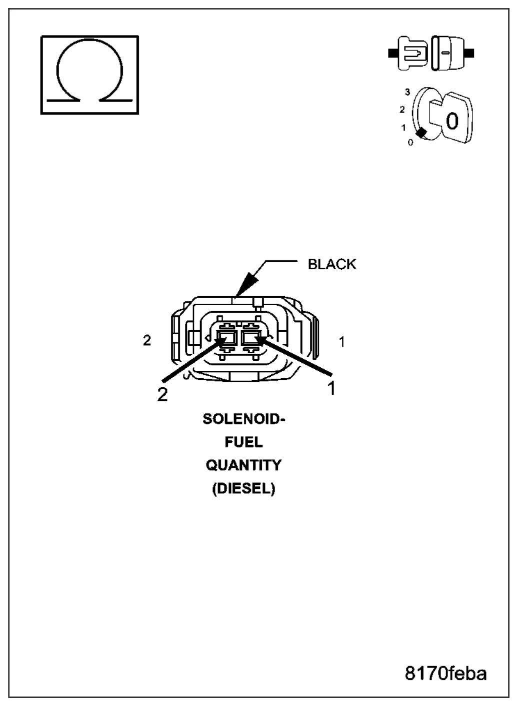
**Is the resistance above 1000 ohms for each measurement?**

**Yes** >> Go To 5

**No** >> Repair the circuit(s) that measured below 1000 ohms for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TOGETHER




Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Quantity Solenoid harness connector.

Measure the resistance between the Fuel Quantity Solenoid circuits.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Fuel Quantity Solenoid circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

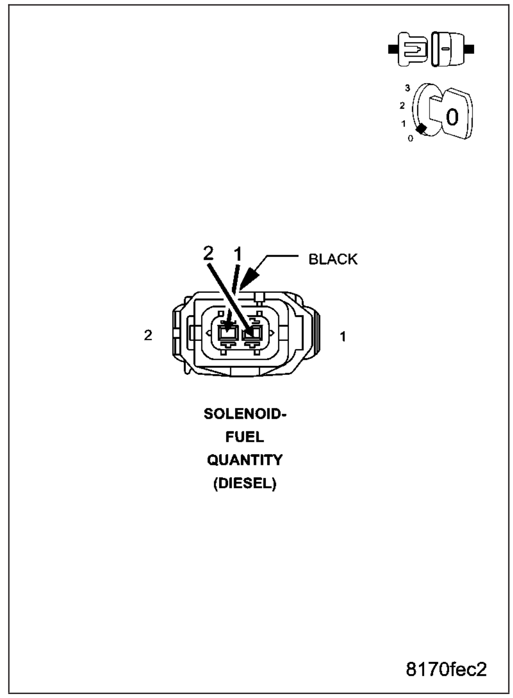
Disconnect the Fuel Quantity Solenoid harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage each of the Fuel Quantity Solenoid circuits.




**Is the voltage below 1.0 volt for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the circuit(s) that measured above 1.0 volts for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. FUEL QUANTITY SOLENOID

Turn the ignition off.

Disconnect the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0090-FUEL QUANTITY SOLENOID OPEN CIRCUIT.**

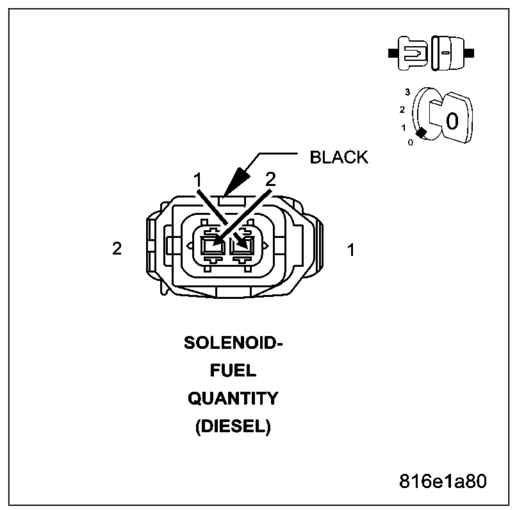
Turn the ignition off.

Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.




**NOTE: The scan tool should display P0092-FUEL QUANTITY SOLENOID SHORT CIRCUIT.**

**Does the scan tool display the appropriate DTC for each condition?**

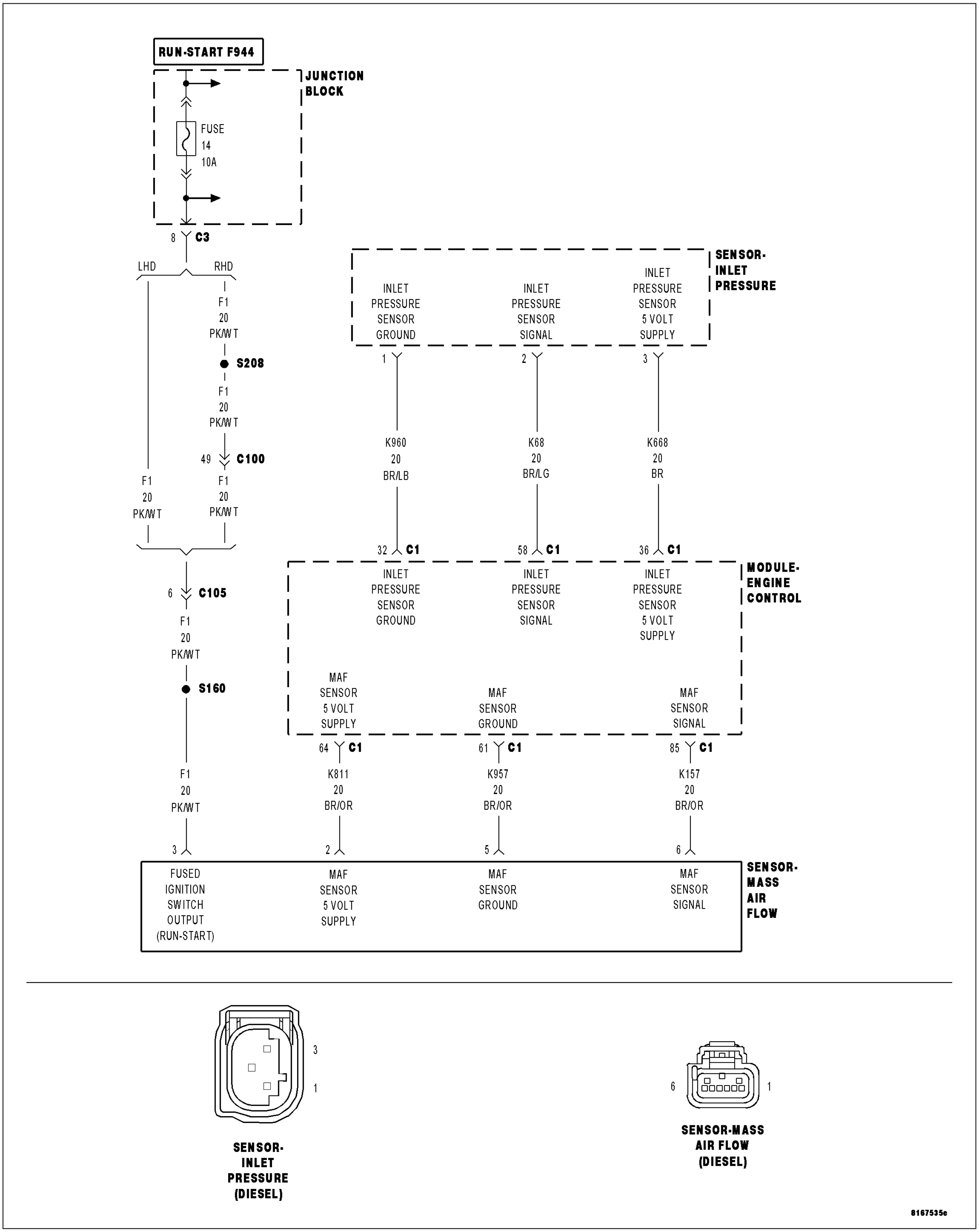
**Yes** >> Replace the Fuel Quantity Solenoid in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0100-MAF SENSOR SIGNAL VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Engine speed is between 500 and 5000 rpm.
- **Set Condition:**
  The Mass Air Flow Sensor signal is above 800 kg/h for 0.5 seconds.

| Possible Causes |
|---|
| ASD RELAY OUTPUT CIRCUIT OPEN |
| ECM - 5-VOLT SUPPLY CIRCUIT |
| MAF SENSOR GROUND OPEN |
| MASS AIRFLOW SENSOR |
| MAF SENSOR 5 VOLT SUPPLY CIRCUIT OPEN |
| MAF SENSOR SIGNAL CIRCUIT OPEN |
| MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO THE MAF SENSOR GROUND CIRCUIT |
| MAF SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| ECM SENSOR GROUND CIRCUIT OPEN |
| MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| MAF SENSOR SIGNAL CIRCUIT SHORTED TO THE MAF SENSOR GROUND CIRCUIT |
| MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| MAF SENSOR CIRCUIT SHORTED TO VOLTAGE |
| ECM - MAF SENSOR SIGNAL CIRCUIT |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: Inspect the turbocharger inlet tube between the MAF Sensor and the turbocharger for damage, restriction or poor connection. Any of these conditions can cause a MAF Plausibility DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the scan tool display a Mass Air Flow Sensor DTC?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 2. VERIFY SENSOR 5 VOLT SUPPLY

**NOTE: A malfunctioning EGR system can cause this DTC to set. Refer to symptom Checking the EGR System in the Driveability category to check EGR system operation.**

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

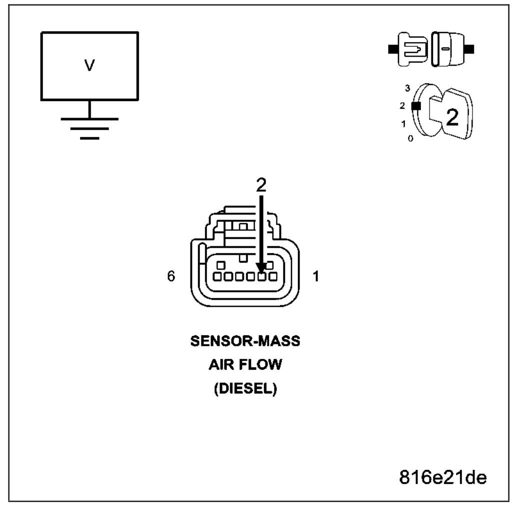
Turn the ignition on.

Measure the voltage of the MAF Sensor 5 Volt Supply circuit in MAF Sensor harness connector.

**Is the voltage between 4.8 and 5.2 volts?**

**Yes** >> Go To 3

**No** >> Go To 11




## 3. MAF SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

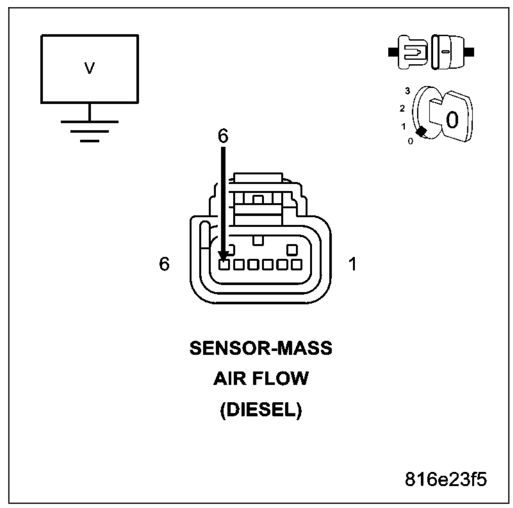
Turn the ignition on.

Measure the voltage of the MAF Sensor Signal circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the MAF Sensor Signal circuit for a short to voltage. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4




## 4. MAF SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

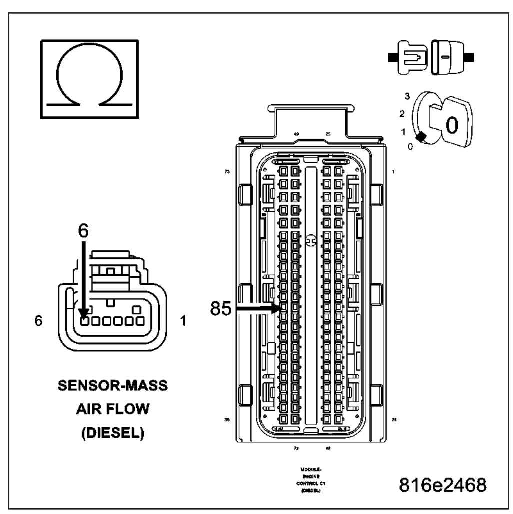
Disconnect the ECM harness connectors.

Measure the resistance of the MAF Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the MAF Sensor Signal circuit for an open Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 5. MAF SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

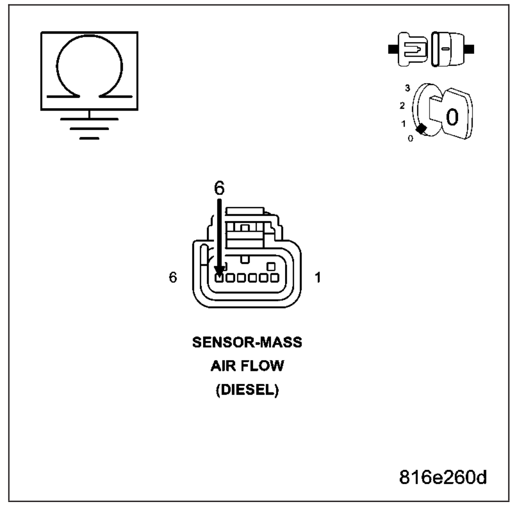
Disconnect the ECM harness connectors.

Measure the resistance between ground and the MAF Sensor Signal circuit.

**Is the resistance below 1000 ohms?**

**Yes** >> Repair the MAF Sensor Signal circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6




## 6. MAF SENSOR SIGNAL CIRCUIT SHORTED TO THE MAF SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

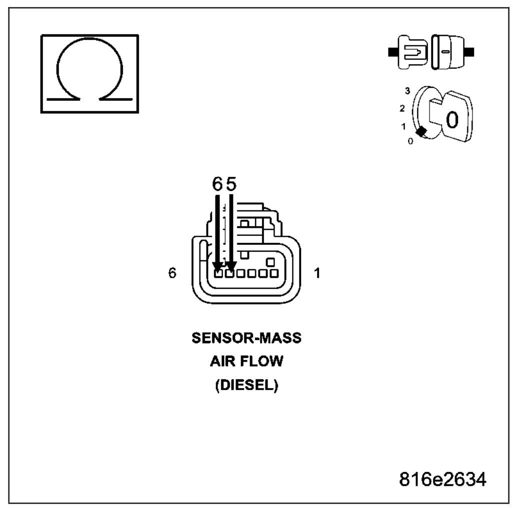
Disconnect the ECM harness connectors.

Measure the resistance between the MAF Sensor Signal circuit and the MAF Sensor Ground circuit at of the MAF Sensor harness connector.

**Is the resistance below 1000 ohms?**

**Yes** >> Repair the MAF Sensor Signal for a short to MAF Sensor Ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7




## 7. VERIFY MAF SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Connect a jumper wire between MAF Sensor Signal circuit and the 5-volt supply circuit at the MAF Sensor harness connector.

Turn the ignition on.

With the scan tool, read the MAF VOLTS.

**Does the scan tool display between 4.0 and 5.5 volts?**

**Yes** >> Go To 8

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

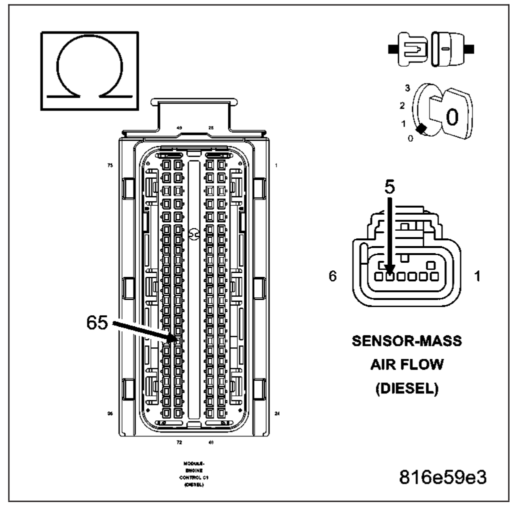
## 8. MAF SENSOR GROUND OPEN

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the MAF Sensor Ground circuit between the MAF Sensor and the ECM.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 9

**No** >> Repair the MAF Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

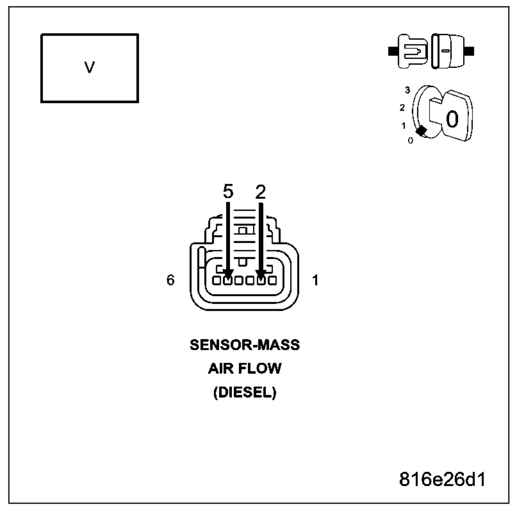
## 9. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Turn the ignition on.

Measure the voltage between the 5-volt Supply circuit and the MAF Sensor Ground circuit at the MAF Sensor harness connector.




**Is the voltage above 4.5 volts?**

**Yes** >> Go To 10

**No** >> Replace and program the ECM in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 10. ASD RELAY OUTPUT CIRCUIT OPEN

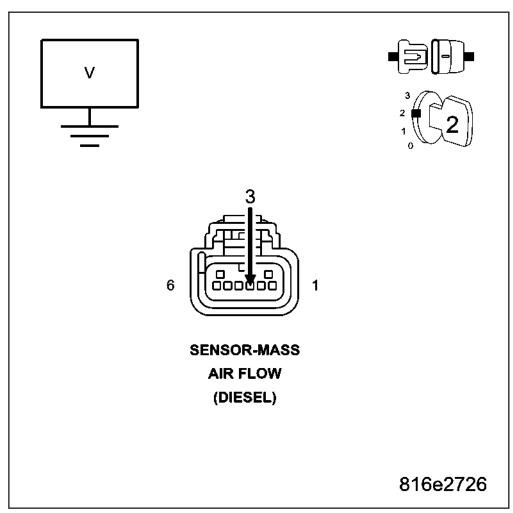
Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Turn the ignition on.

With the scan tool, actuate the ASD Relay.

Measure the voltage of the 12-volt Supply circuit at the MAF Sensor harness connector.




**Is the voltage above 10.0 volts?**

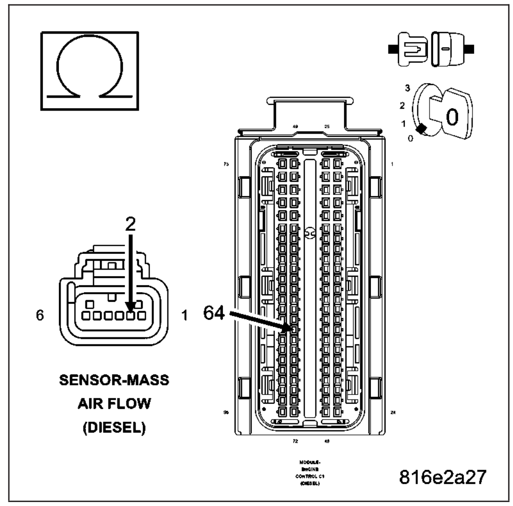
**Yes** >> Replace the MAF Sensor.

Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Repair the ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 11. MAF SENSOR 5 VOLT SUPPLY CIRCUIT OPEN




Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the MAF Sensor 5 Volt Supply circuit.

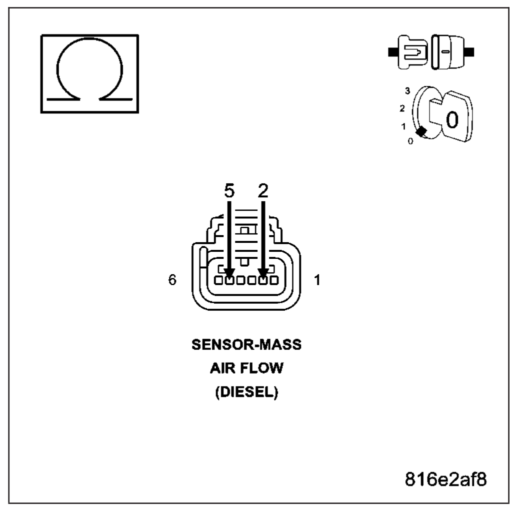
**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 12

**No** >> Repair the MAF Sensor 5 Volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 12. MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO THE MAF SENSOR GROUND CIRCUIT




Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the MAF Sensor 5 Volt Supply circuit and the MAF Sensor Ground circuit at the MAF Sensor harness connector.

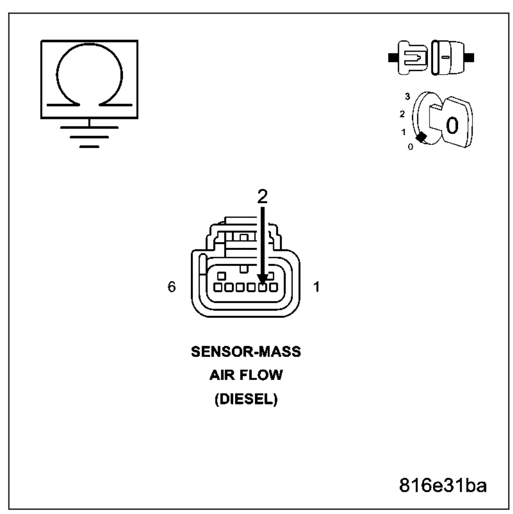
**Is the resistance above 1000 ohms?**

**Yes** >> Go To 13

**No** >> Repair the MAF Sensor 5 Volt Supply circuit for a short to the MAF Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 13. MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND




Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the MAF Sensor 5 Volt Supply circuit at the MAF harness connector.

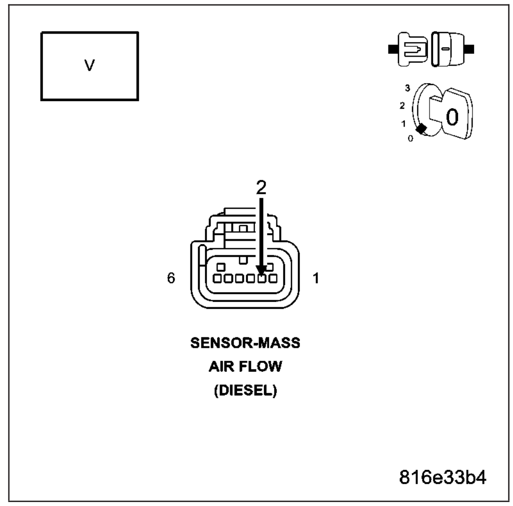
**Is the resistance below 1000 ohms?**

**Yes** >> Repair the MAF Sensor 5 Volt Supply circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 14

## 14. MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the MAF Sensor 5 Volt Supply circuit in the ECM harness connector.

**Is the voltage above 1.0 volt?**

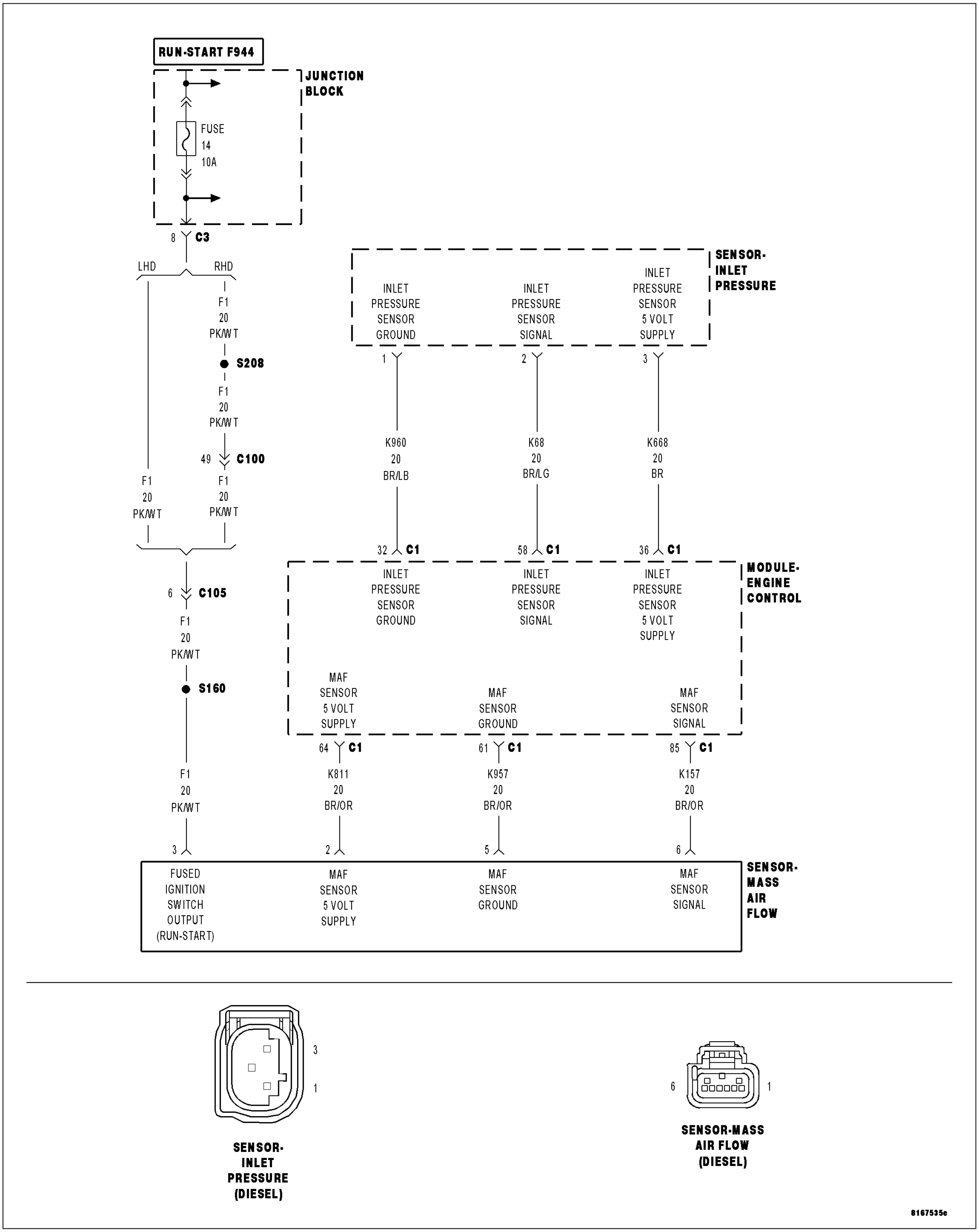
**Yes** >> Repair the MAF Sensor 5 Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0100-MAF SENSOR SIGNAL VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Engine speed is between 500 and 5000 rpm.
- **Set Condition:**
  The Mass Air Flow Sensor signal is above 800 kg/h for 0.5 seconds.

| Possible Causes |
| --- |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| ECM - 5-VOLT SUPPLY CIRCUIT |
| MAF SENSOR GROUND OPEN |
| MASS AIRFLOW SENSOR |
| MAF SENSOR 5 VOLT SUPPLY CIRCUIT OPEN |
| MAF SENSOR SIGNAL CIRCUIT OPEN |
| MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO THE MAF SENSOR GROUND CIRCUIT |
| MAF SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| ECM SENSOR GROUND CIRCUIT OPEN |
| MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| MAF SENSOR SIGNAL CIRCUIT SHORTED TO THE MAF SENSOR GROUND CIRCUIT |
| MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| MAF SENSOR CIRCUIT SHORTED TO VOLTAGE |
| ECM - MAF SENSOR SIGNAL CIRCUIT |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: Inspect the turbocharger inlet tube between the MAF Sensor and the turbocharger for damage, restriction or poor connection. Any of these conditions can cause a MAF Plausibility DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the scan tool display a Mass Air Flow Sensor DTC?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 2. VERIFY SENSOR 5 VOLT SUPPLY

**NOTE: A malfunctioning EGR system can cause this DTC to set. Refer to symptom Checking the EGR System in the Driveability category to check EGR system operation.**

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

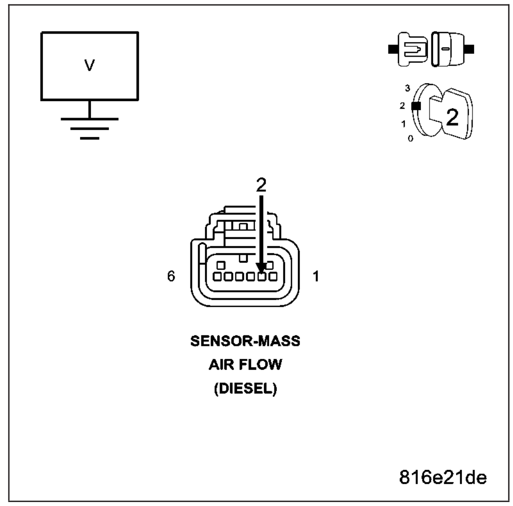
Turn the ignition on.

Measure the voltage of the MAF Sensor 5 Volt Supply circuit in MAF Sensor harness connector.

**Is the voltage between 4.8 and 5.2 volts?**

**Yes** >> Go To 3

**No** >> Go To 11




## 3. MAF SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

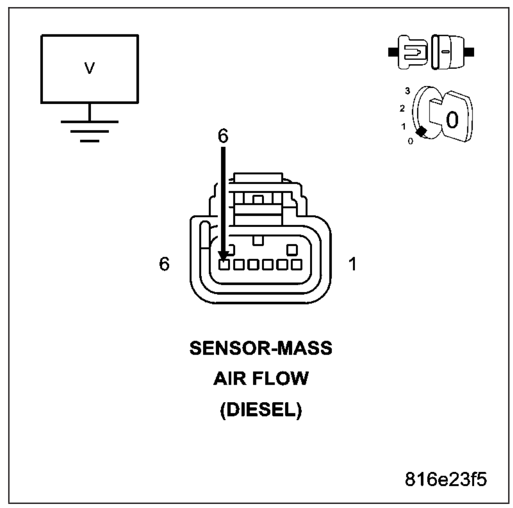
Turn the ignition on.

Measure the voltage of the MAF Sensor Signal circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the MAF Sensor Signal circuit for a short to voltage. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4




## 4. MAF SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

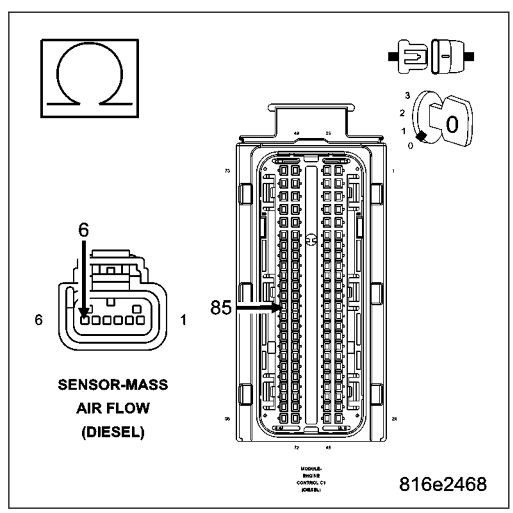
Disconnect the ECM harness connectors.

Measure the resistance of the MAF Sensor Signal circuit.

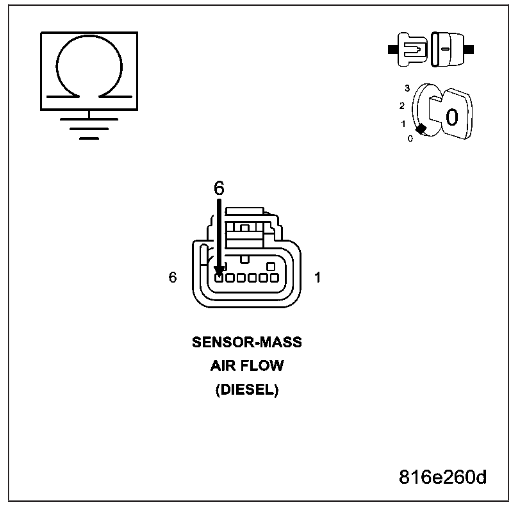
**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the MAF Sensor Signal circuit for an open Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 5. MAF SENSOR SIGNAL CIRCUIT SHORTED TO GROUND




Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

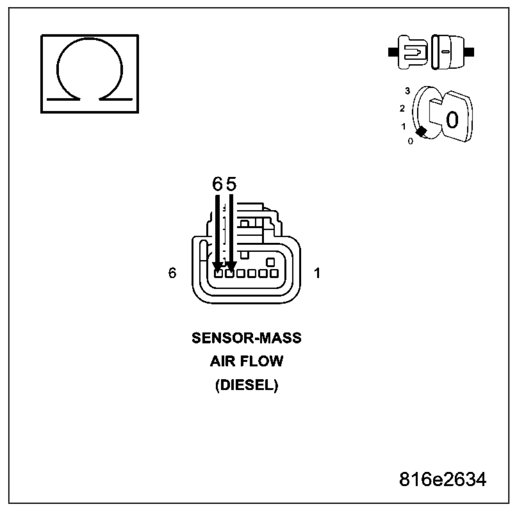
Measure the resistance between ground and the MAF Sensor Signal circuit.

**Is the resistance below 1000 ohms?**

**Yes** >> Repair the MAF Sensor Signal circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. MAF SENSOR SIGNAL CIRCUIT SHORTED TO THE MAF SENSOR GROUND CIRCUIT




Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the MAF Sensor Signal circuit and the MAF Sensor Ground circuit at of the MAF Sensor harness connector.

**Is the resistance below 1000 ohms?**

**Yes** >> Repair the MAF Sensor Signal for a short to MAF Sensor Ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. VERIFY MAF SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Connect a jumper wire between MAF Sensor Signal circuit and the 5-volt supply circuit at the MAF Sensor harness connector.

Turn the ignition on.

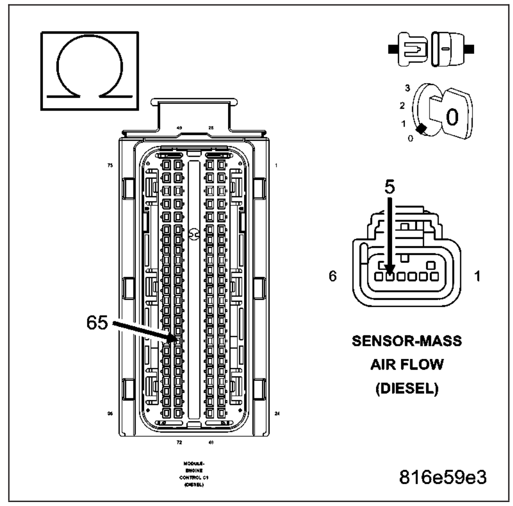
With the scan tool, read the MAF VOLTS.

**Does the scan tool display between 4.0 and 5.5 volts?**

**Yes** >> Go To 8

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 8. MAF SENSOR GROUND OPEN




Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the MAF Sensor Ground circuit between the MAF Sensor and the ECM.

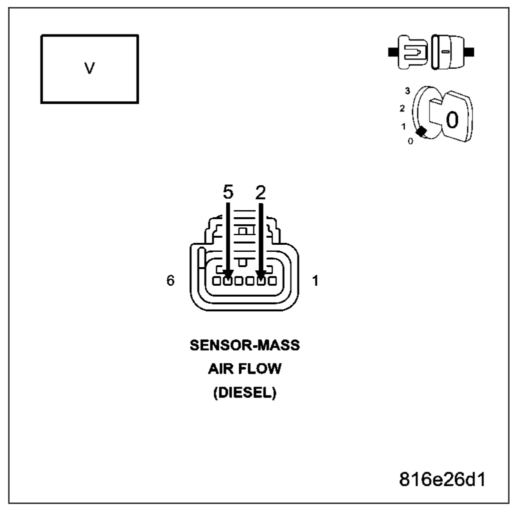
**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 9

**No** >> Repair the MAF Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 9. ECM - SENSOR GROUND OPEN




Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Turn the ignition on.

Measure the voltage between the 5-volt Supply circuit and the MAF Sensor Ground circuit at the MAF Sensor harness connector.

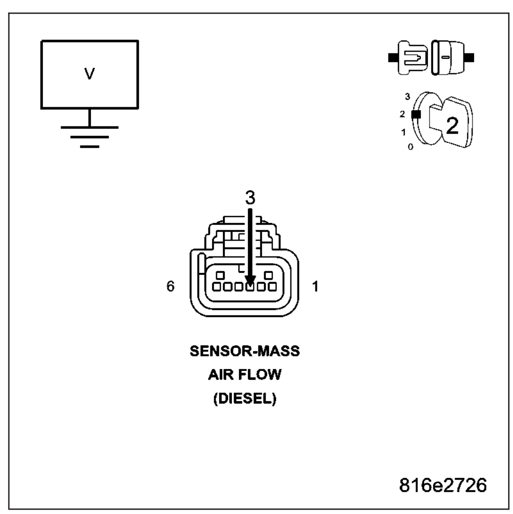
**Is the voltage above 4.5 volts?**

**Yes** >> Go To 10

**No** >> Replace and program the ECM in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 10. ASD RELAY OUTPUT CIRCUIT OPEN




Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Turn the ignition on.

With the scan tool, actuate the ASD Relay.

Measure the voltage of the 12-volt Supply circuit at the MAF Sensor harness connector.

**Is the voltage above 10.0 volts?**

**Yes** >> Replace the MAF Sensor.

Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Repair the ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

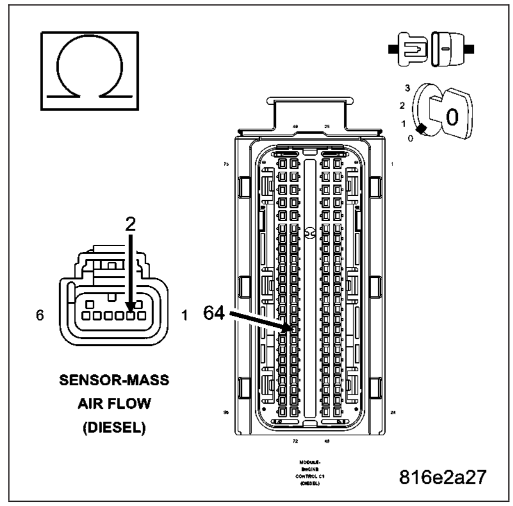
## 11. MAF SENSOR 5 VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the MAF Sensor 5 Volt Supply circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 12

**No** >> Repair the MAF Sensor 5 Volt Supply circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

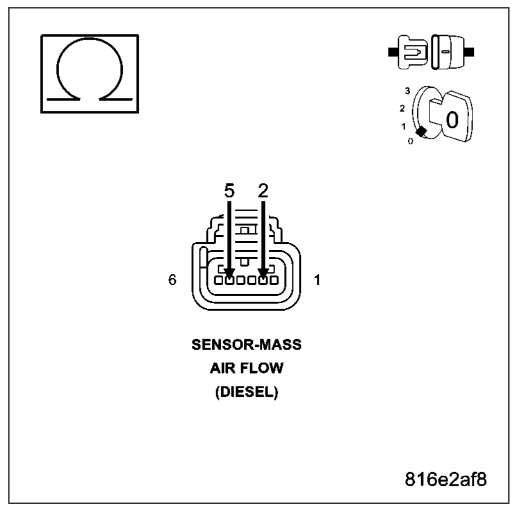
## 12. MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO THE MAF SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the MAF Sensor 5 Volt Supply circuit and the MAF Sensor Ground circuit at the MAF Sensor harness connector.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 13

**No** >> Repair the MAF Sensor 5 Volt Supply circuit for a short to the MAF Sensor Ground circuit.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

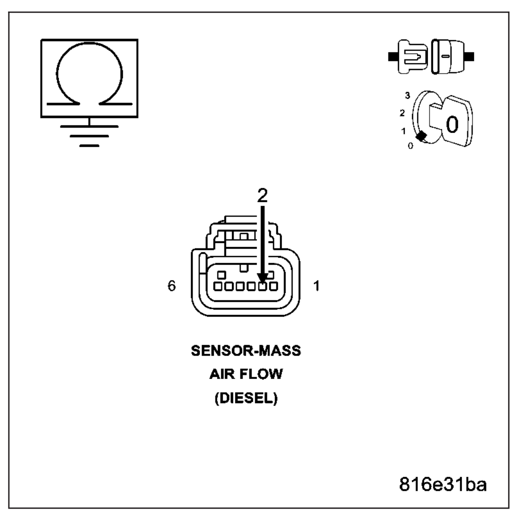
## 13. MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the MAF Sensor 5 Volt Supply circuit at the MAF harness connector.

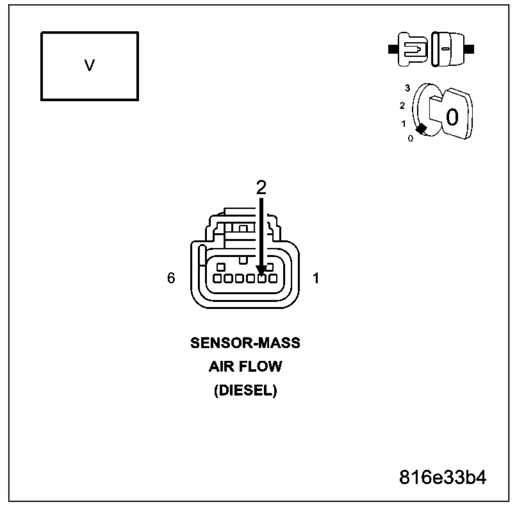



**Is the resistance below 1000 ohms?**

**Yes** >> Repair the MAF Sensor 5 Volt Supply circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 14

## 14. MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the MAF Sensor 5 Volt Supply circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the MAF Sensor 5 Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0101-MAF SENSOR SIGNAL NEGATIVE DEVIATION

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Engine temperature between 59.9°C and 99.9°C. Intake Air Temperature reading is steady. Atmospheric pressure below 1500 hpa. Boost pressure is between 750 hpa and 2400 hpa.
- **Set Condition:**
  The MAF Sensor reading is below the calibrated map value for more than 2.0 seconds.

| Possible Causes |
|---|
| AIR FILTER |
| AIR RESTRICTION |
| CHECKING FOR AIR LEAKS |
| EGR VALVE |
| MASS AIRFLOW SENSOR |
| INTERMITTENT CONDITION |

### Diagnostic Test

#### 1. VERIFY ACTIVE DTC

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: Inspect all air intake and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the scan tool display a Mass Air Flow Sensor DTC?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

#### 2. AIR FILTER

Turn the ignition off.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause air flow restriction.

**Were any of these problems found?**

**Yes** >> Replace the Air Filter element.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. AIR RESTRICTION

**NOTE: Inspect all air intake, crankcase vent and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

**NOTE: Inspect the exhaust system and related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

Turn the ignition off.

Inspect the intake system, exhaust system and related tubes and connections.

**Were any problems found?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. CHECKING FOR AIR LEAKS

Turn the ignition off.

Remove the Inlet Pressure Sensor.

Connect smoke machine 84-04 to the Inlet Pressure Sensor port in the intake duct and begin injecting smoke into the intake system.

Observe all intake system components for evidence of smoke leakage.

**Is there evidence of smoke leakage?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. EGR VALVE

Turn the ignition off.

**NOTE: An EGR Valve that is stuck partially open can cause this DTC to set. Hard starting, rough running and black smoke from the tailpipe are signs of an EGR Valve that is stuck open.**

While starting and test driving the vehicle, observe for the conditions mentioned in the note above.

**Does the vehicle exhibit these conditions?**

**Yes** >> Replace the EGR Valve.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the MAF Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0101-MAF SENSOR SIGNAL POSITIVE DEVIATION

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Engine temperature between 59.9°C and 99.9°C. Intake Air Temperature reading is steady. Atmospheric pressure below 1500 hpa. Boost pressure is between 750 hpa and 2400 hpa.
- **Set Condition:**
  The MAF Sensor reading is above the calibrated map value for more than 2.0 seconds.

| Possible Causes |
|---|
| AIR FILTER |
| AIR RESTRICTION |
| CHECKING FOR AIR LEAKS |
| EGR VALVE |
| MASS AIRFLOW SENSOR |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: Inspect all air intake and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the scan tool display a Mass Air Flow Sensor DTC?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. AIR FILTER

Turn the ignition off.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause air flow restriction.

**Were any of these problems found?**

**Yes** >> Replace the Air Filter element.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. AIR RESTRICTION

**NOTE: Inspect all air intake, crankcase vent and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

**NOTE: Inspect the exhaust system and related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

Turn the ignition off.

Inspect the intake system, exhaust system and related tubes and connections.

**Were any problems found?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. CHECKING FOR AIR LEAKS

Turn the ignition off.

Remove the Inlet Pressure Sensor.

Connect smoke machine 84-04 to the Inlet Pressure Sensor port in the intake duct and begin injecting smoke into the intake system.

Observe all intake system components for evidence of smoke leakage.

**Is there evidence of smoke leakage?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. EGR VALVE

Turn the ignition off.

**NOTE: An EGR Valve that is stuck partially open can cause this DTC to set. Hard starting, rough running and black smoke from the tailpipe are signs of an EGR Valve that is stuck open.**

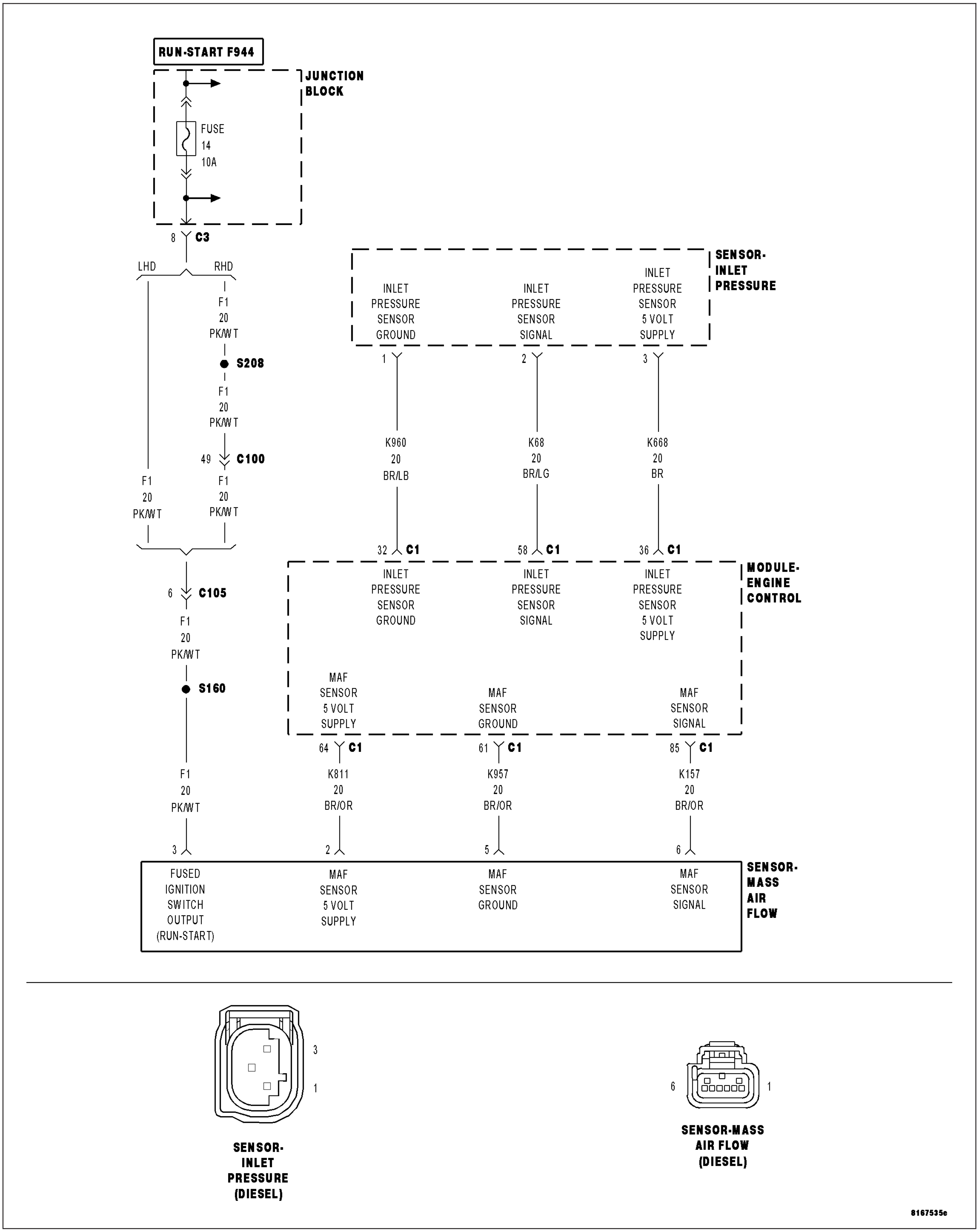
While starting and test driving the vehicle, observe for the conditions mentioned in the note above.

**Does the vehicle exhibit these conditions?**

**Yes** >> Replace the EGR Valve.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the MAF Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0105-INLET PRESSURE SENSOR SIGNAL PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on. No other IAT DTC's present in the ECM. Engine speed below 800 rpm.
- **Set Condition:**
  The difference between the Inlet Pressure Sensor signal and the Atmospheric Pressure Sensor signal is 3500 hpa for 5.0 seconds.

| Possible Causes |
|---|
| AIR FILTER |
| AIR RESTRICTION |
| INTERMITTENT CONDITION |
| HIGH RESISTANCE IN THE INLET PRESSURE SENSOR SIGNAL CIRCUIT |
| HIGH RESISTANCE IN THE INLET PRESSURE SENSOR GROUND CIRCUIT |
| HIGH RESISTANCE IN THE INLET PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT |
| INLET PRESSURE SENSOR |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off, wait 30 seconds.

Test drive the vehicle.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. AIR FILTER

Turn the ignition off.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause air flow restriction.

**Were any of these problems found?**

**Yes** >> Replace the Air Filter element.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. AIR RESTRICTION

**NOTE: Inspect all air intake and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

Inspect all air intake and turbocharger related tubes and connections.

**were any problems found?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. HIGH RESISTANCE IN THE INLET PRESSURE SENSOR SIGNAL CIRCUIT

Disconnect the Inlet Pressure Sensor harness connector.

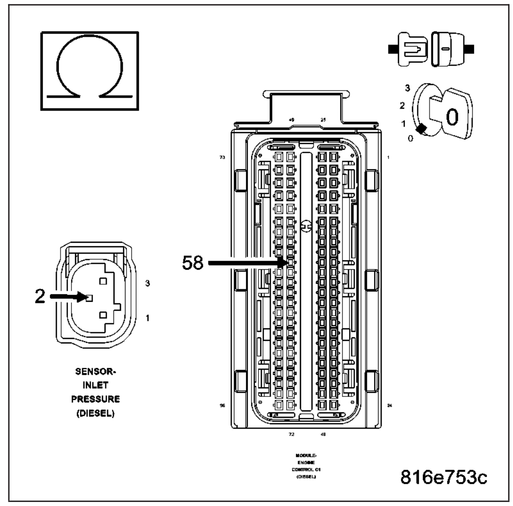
Disconnect the ECM harness connectors.

Measure the resistance of the Inlet Pressure Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Inlet Pressure Sensor Signal circuit for high resistance.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



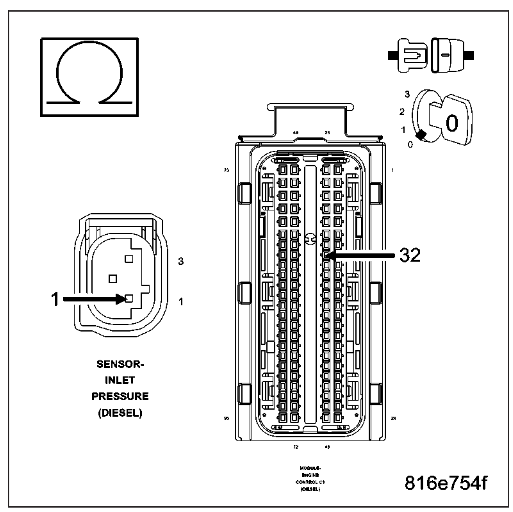

## 5. HIGH RESISTANCE IN THE INLET PRESSURE SENSOR GROUND CIRCUIT

Measure the resistance of the Inlet Pressure Sensor Ground circuit.

**Is the resistance below 10.0 ohms?**

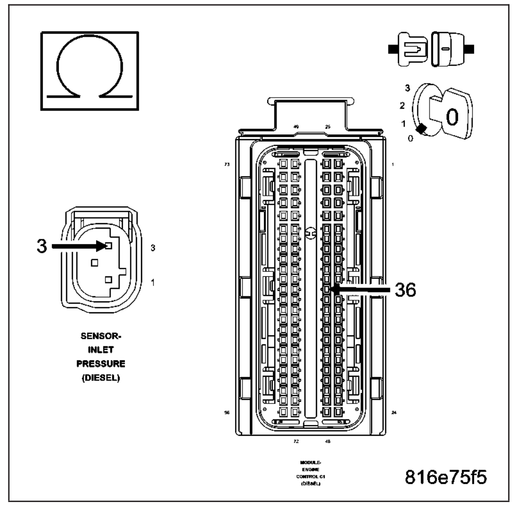
**Yes** >> Go To 6

**No** >> Repair the Inlet Pressure Sensor Ground circuit for high resistance.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 6. INLET PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT HIGH RESISTANCE

Measure the resistance of the Inlet Pressure Sensor 5-volt Supply circuit.




**Is the resistance below 10.0 ohms?**

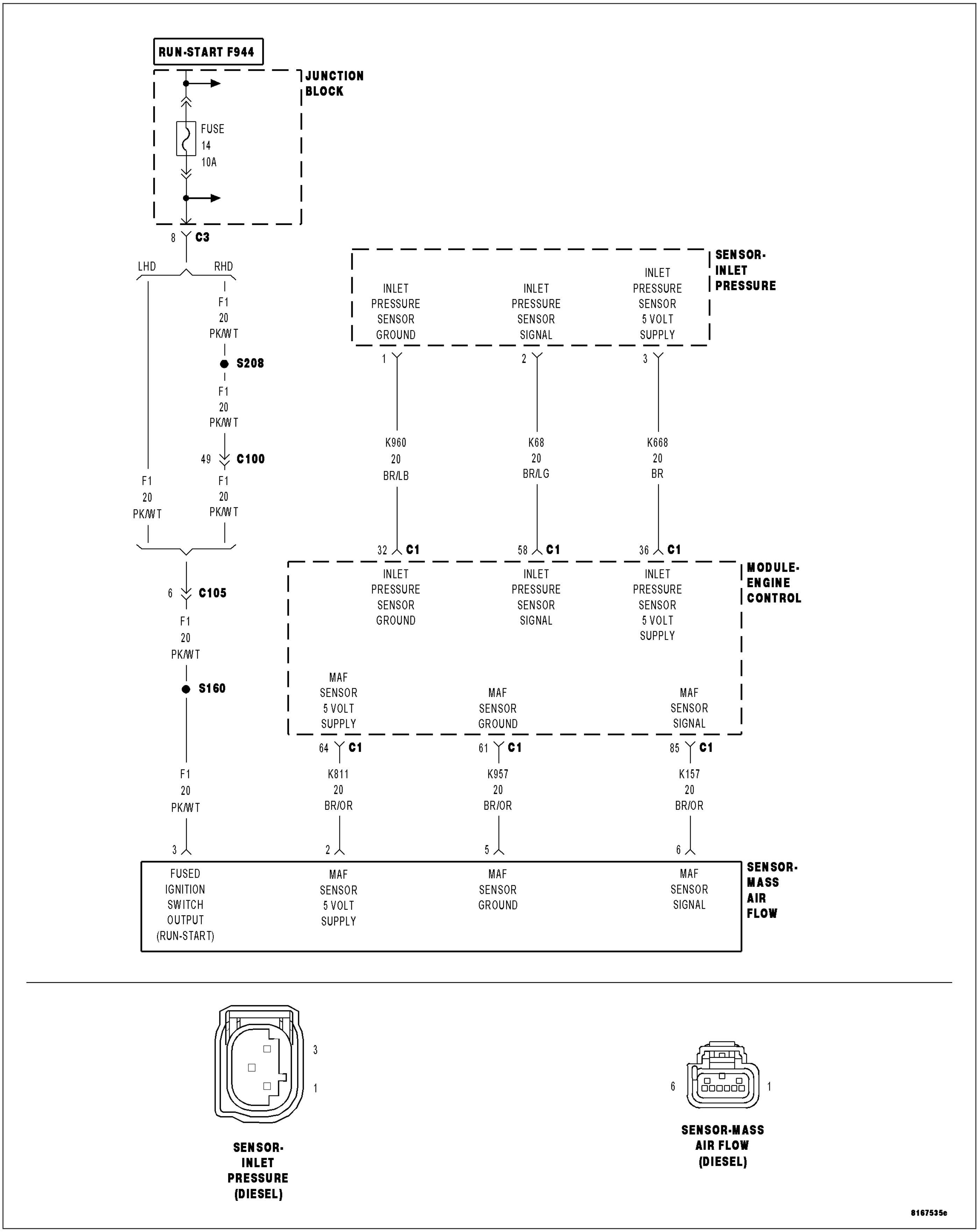
**Yes** >> Replace the Inlet Pressure Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Inlet Pressure Sensor 5 Volt Supply circuit for high resistance.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0105-INLET PRESSURE SENSOR SIGNAL VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Inlet Pressure Sensor signal is above 4.75 volts for 2.0 seconds.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| INLET PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE |
| INLET PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| INLET PRESSURE SENSOR GROUND CIRCUIT OPEN |
| INLET PRESSURE SENSOR |
| ENGINE CONTROL MODULE (INTERNAL) |
| ENGINE CONTROL MODULE (SENSOR SIGNAL SHORTED TO VOLTAGE) |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Ensure all turbocharger inlet and outlet tubes are connected properly, without damage and restriction before continuing with this test.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Cycle the ignition key on and off several times, leaving the key on for at least 10 seconds at a time.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

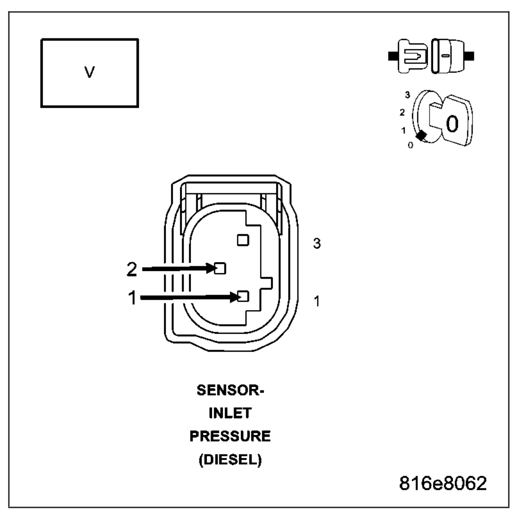
### 2. MEASURE THE INLET PRESSURE SENSOR SIGNAL CIRCUIT VOLTAGE

Turn the ignition off.

Disconnect the Inlet Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage between ground and the Inlet Pressure Sensor Signal circuit.

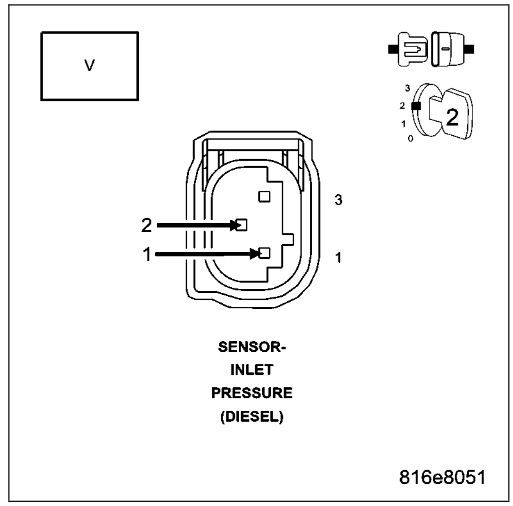



**Is the voltage above 1.0 volt?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. INLET PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the Inlet Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage between ground and the Inlet Pressure Sensor Signal circuit.

**Is the voltage above 1.0 volt?**

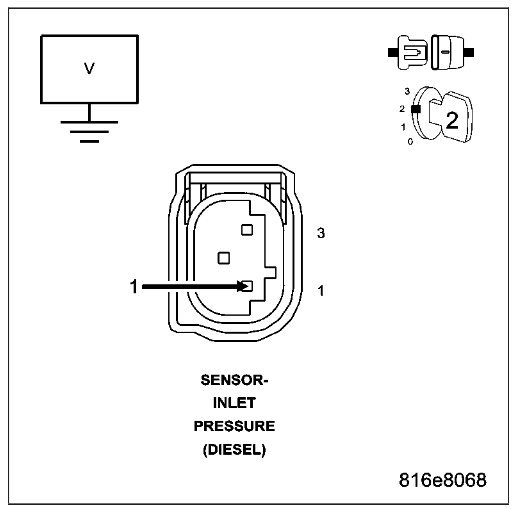
**Yes** >> Repair the Inlet Pressure Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. INLET PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the Inlet Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage between ground and the Inlet Pressure Sensor Ground circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Inlet Pressure Sensor Ground circuit for a short to voltage. The ECM will need to be checked for proper operation before the repair is completed. A short to voltage on a ground circuit can damage the ECM.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. INLET PRESSURE SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Inlet Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

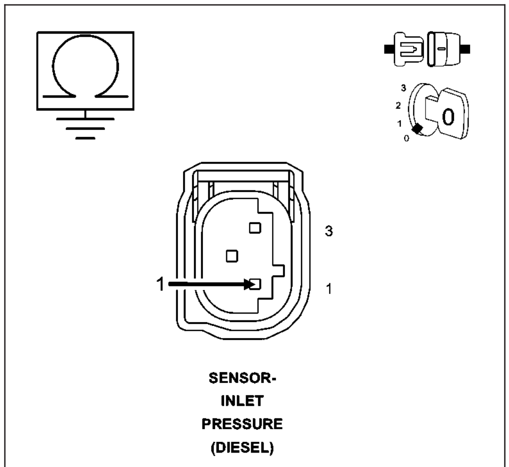
Measure the resistance of the Inlet Pressure Sensor Ground circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Inlet Pressure Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



816e836e

## 6. INLET PRESSURE SENSOR

Turn the ignition off.

**NOTE: Ensure all harness connectors are connected.**

Turn the ignition on.

Measure the voltage of the Inlet Pressure Sensor Signal circuit by back probing ECM harness connector.

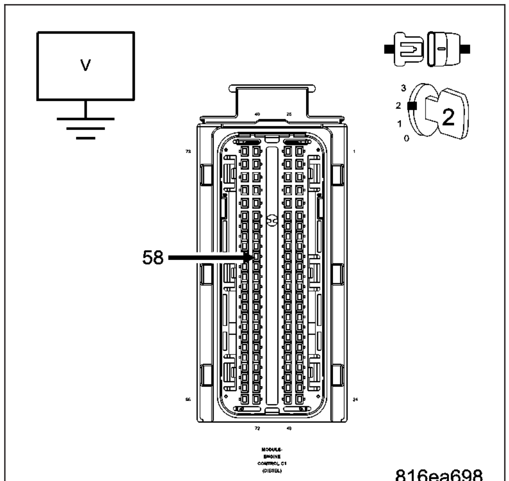
**Is the voltage above 4.85 volts?**

**Yes** >> Replace the Inlet Pressure Sensor.

Perform ROAD TEST VERIFICATION - VER-2.

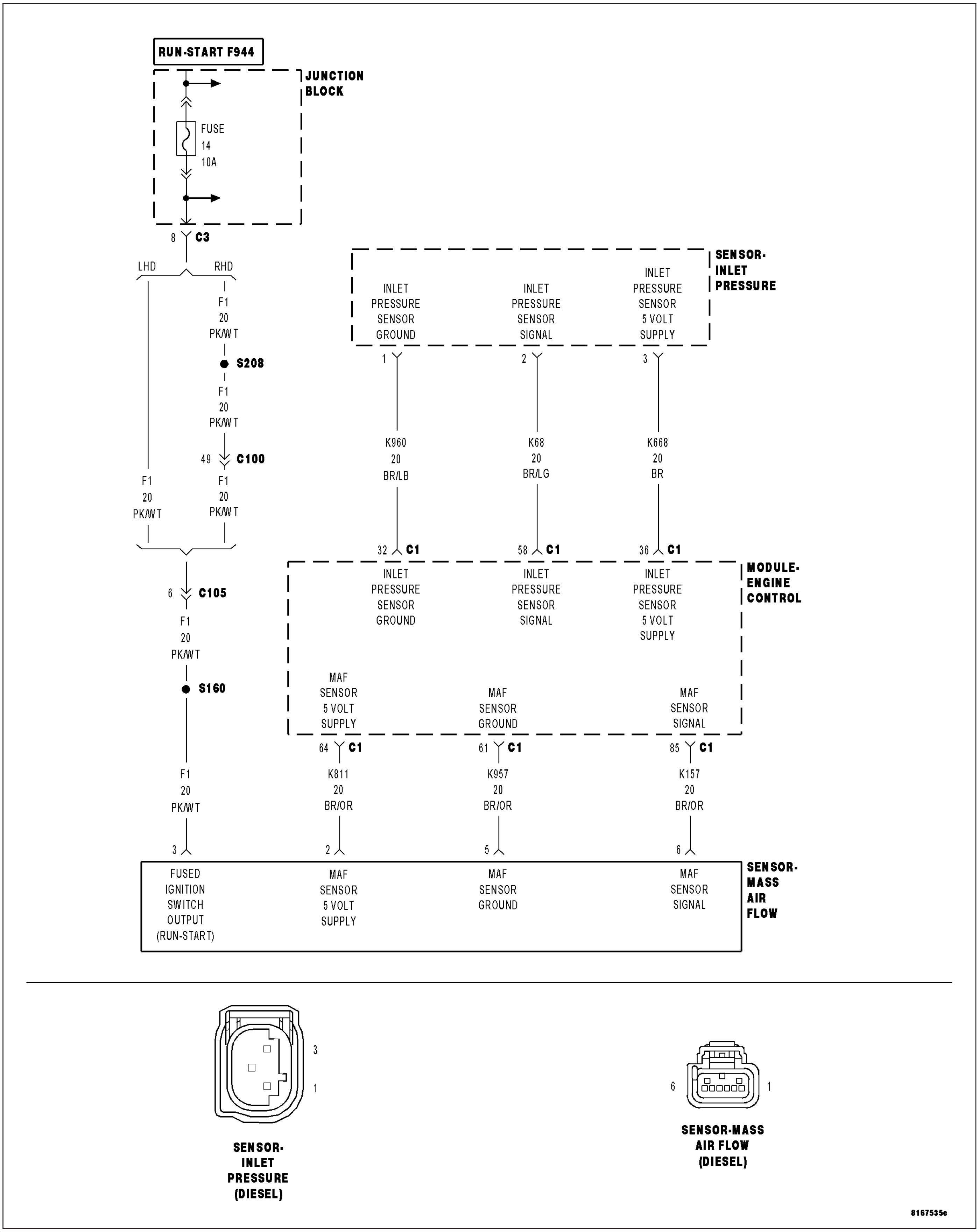
**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



816ea698

## P0105-INLET PRESSURE SENSOR SIGNAL VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Inlet Pressure Sensor signal is below 0.25 volt for 2.0 seconds.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| INLET PRESSURE SENSOR 5 VOLT SUPPLY |
| INLET PRESSURE SENSOR |
| INLET PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| INLET PRESSURE SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER |
| ENGINE CONTROL MODULE |
| INLET PRESSURE SENSOR SIGNAL CIRCUIT OPEN |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Ensure all turbocharger inlet and outlet tubes are connected properly, without damage and restriction before continuing with this test.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Cycle the ignition key on and off several times, leaving the key on for at least 10 seconds at a time.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. INLET PRESSURE SENSOR 5 VOLT SUPPLY VOLTAGE

Turn the ignition off.

Disconnect the Inlet Pressure Sensor harness connector.

Turn the ignition on.

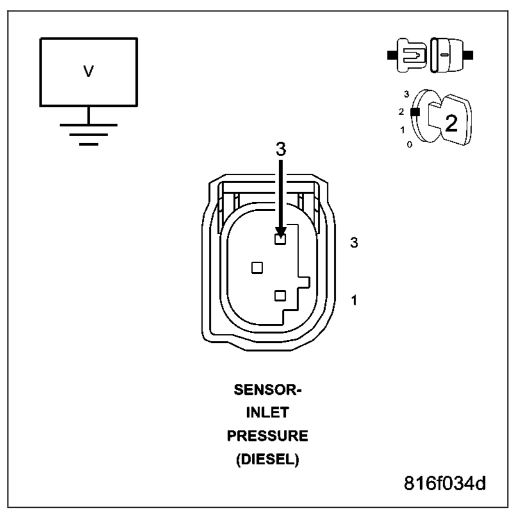
Measure the voltage between ground and the Inlet Pressure Sensor 5 Volt Supply circuit.

**Is the voltage above 4.8 volts?**

**Yes** >> Go To 3

**No** >> Repair the Inlet Pressure Sensor 5 Volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



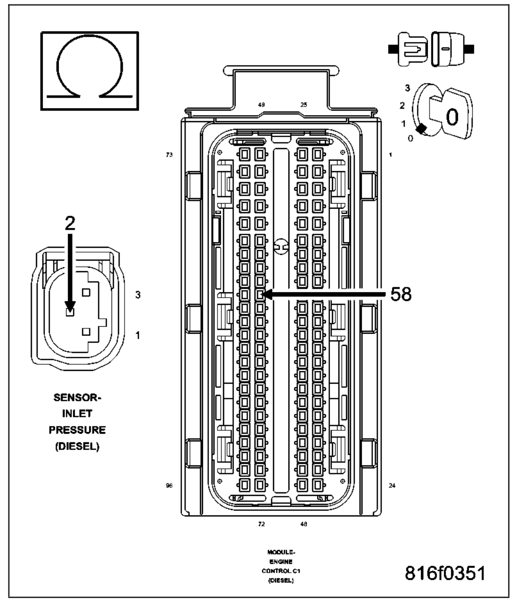
## 3. INLET PRESSURE SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Inlet Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Inlet Pressure Sensor Signal circuit.




**Is the resistance below 10.0 ohms?**

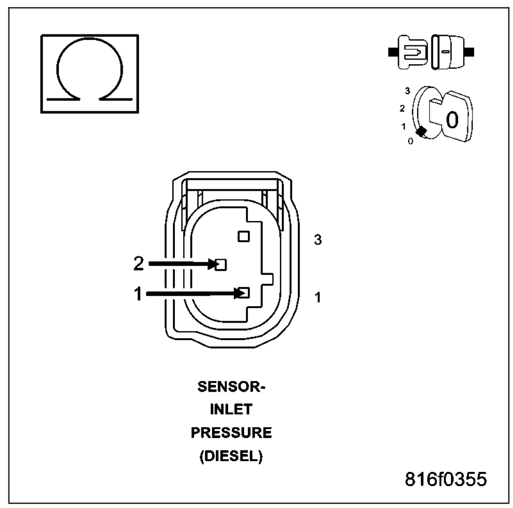
**Yes** >> Go To 4

**No** >> Repair the Inlet Pressure Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. INLET PRESSURE SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER

Measure the resistance between the Inlet Pressure Sensor Signal circuit and Inlet Pressure Sensor Ground circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Inlet Pressure Sensor Signal circuit for a short to the Inlet Pressure Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. INLET PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

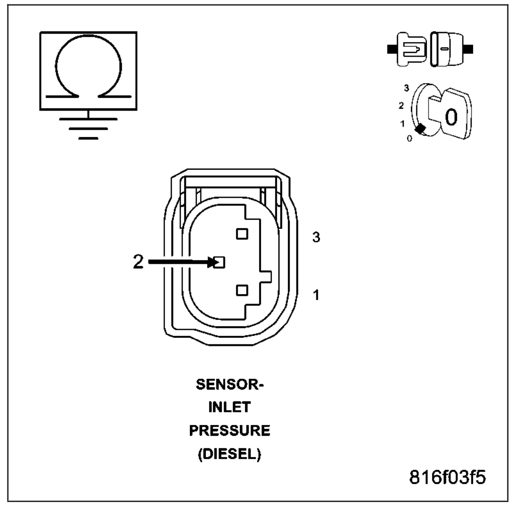
Measure the resistance between ground and the Inlet Pressure Sensor Signal circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Inlet Pressure Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 6. INLET PRESSURE SENSOR

Connect a jumper wire between the Inlet Pressure Sensor Signal and Inlet Pressure Sensor 5 Volt Supply circuits.

With the scan tool, read the Inlet Pressure Sensor voltage.

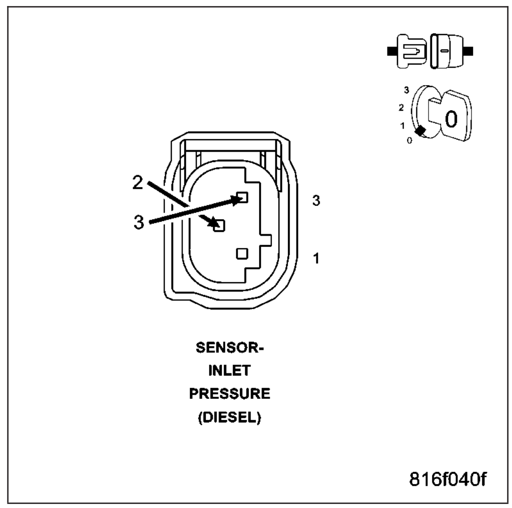
**Is the voltage above 4.5 volts?**

**Yes** >> Replace the Inlet Pressure Sensor.

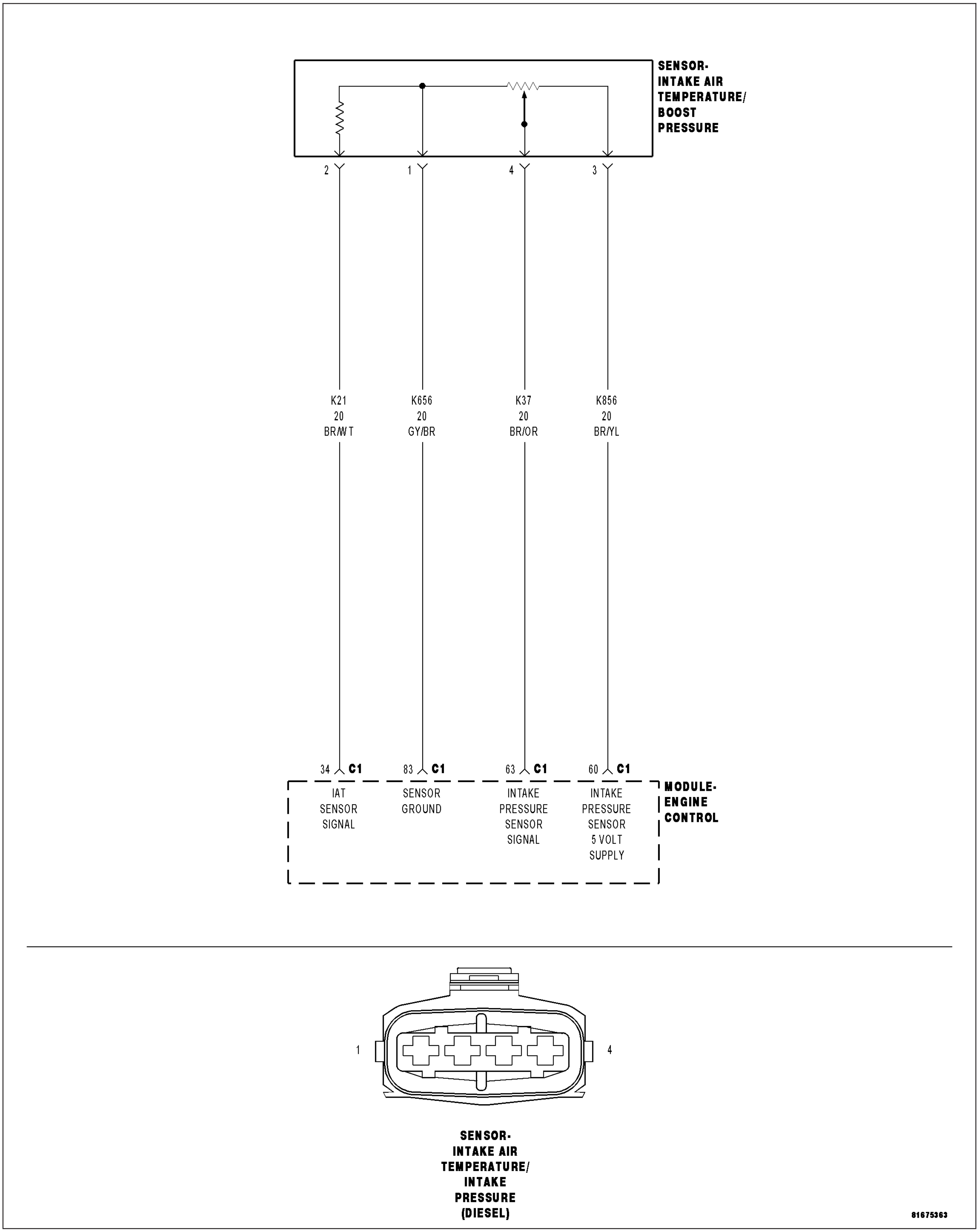
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



# P0110-INTAKE AIR TEMP SENSOR SIGNAL VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Intake Air Temperature Sensor signal is above 4.95 volts.

| Possible Causes |
|---|
| INTAKE AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND CIRCUIT OPEN |
| INTAKE AIR TEMP SENSOR SIGNAL CIRCUIT OPEN |
| BOOST PRESSURE/IAT SENSOR |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off for 10 seconds.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. INTAKE AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Boost Pressure/IAT Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage on the IAT Sensor Signal circuit.

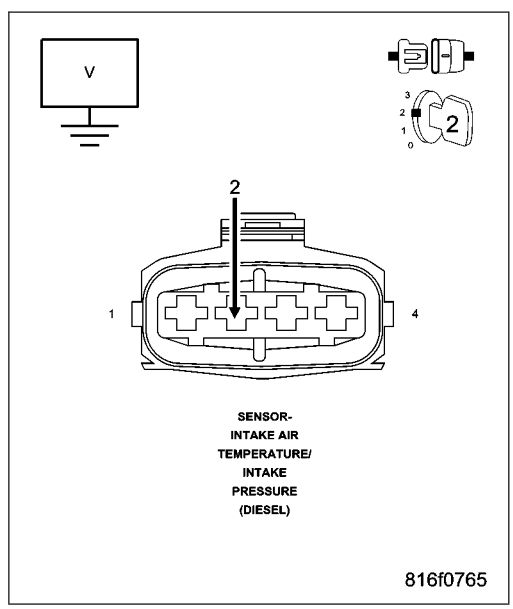
**NOTE: Remove the jumper wire.**

**Is the voltage below 1.0 volt?**

**Yes** >> Go To 3

**No** >> Repair the Intake Air Temperature Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



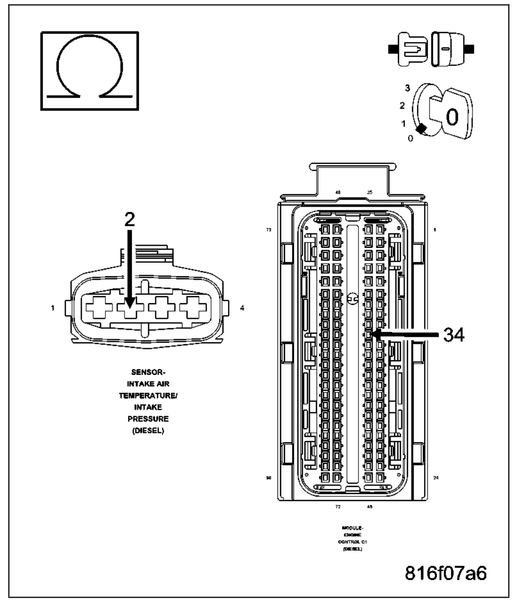
## 3. INTAKE AIR TEMP SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Boost Pressure/IAT Sensor harness connector.

Measure the resistance of the Intake Air Temperature Sensor Signal circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Intake Air Temperature Sensor Signal circuit for an open.

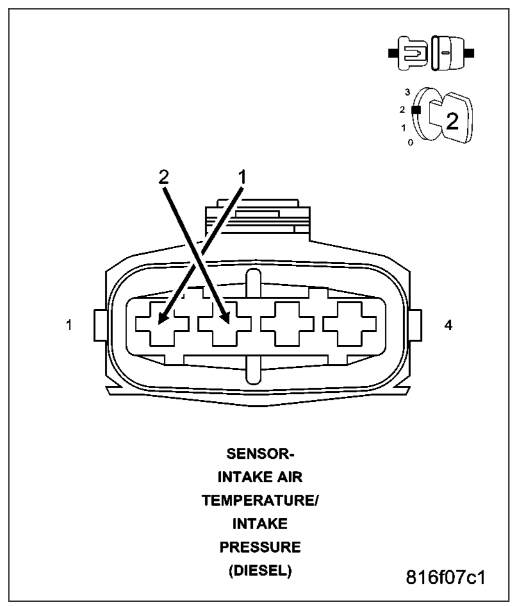
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. BOOST PRESSURE/IAT SENSOR

Connect a jumper wire between the IAT Sensor Signal and Sensor Ground circuits in the Boost Pressure/IAT Sensor harness connector.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.




**Does the scan tool display P0110 INTAKE AIR TEMP. SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW?**

**Yes** >> Replace the Boost Pressure/Intake Air Temperature Sensor.

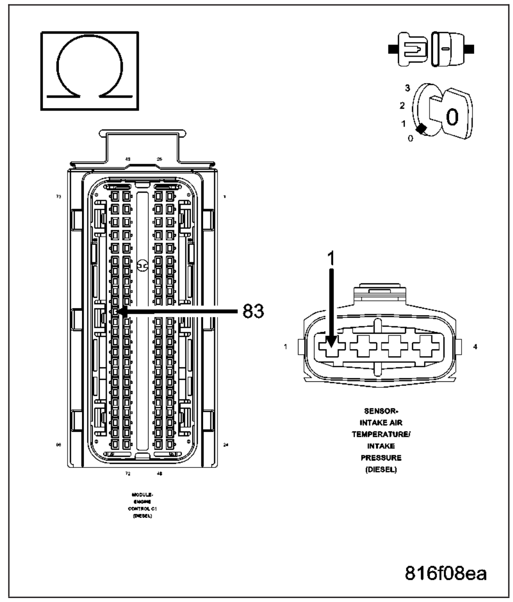
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the Sensor Ground circuit between the ECM harness connector and the Boost Pressure Sensor harness connector.




**Is the resistance below 10.0 ohms?**

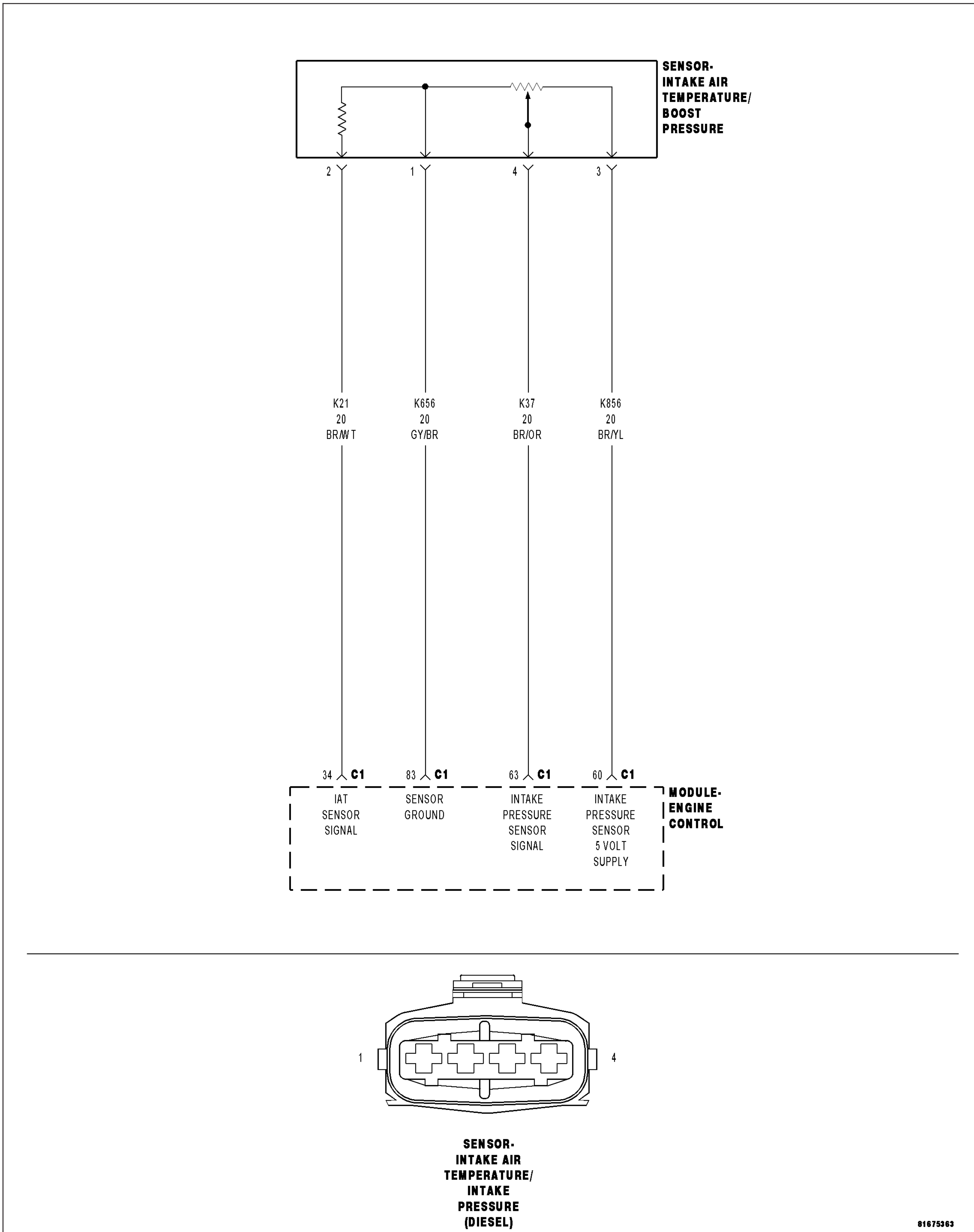
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0110-INTAKE AIR TEMP SENSOR SIGNAL VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Intake Air Temperature Sensor signal is below 0.45 volt.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| INTAKE AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| INTAKE AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND |
| BOOST PRESSURE/IAT SENSOR |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs for at least 2 minutes.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. BOOST PRESSURE/IAT SENSOR

Turn the ignition off.

Disconnect the Boost Pressure/IAT Sensor harness connector.

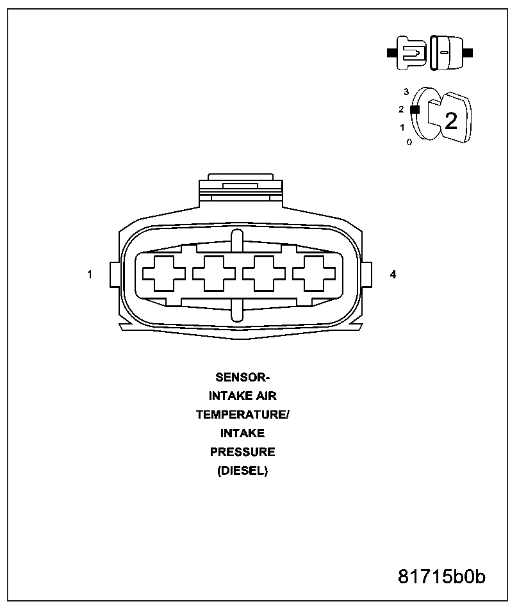
Turn the ignition on.

Monitor the scan tool for ECM DTCs for at least 2 minutes.

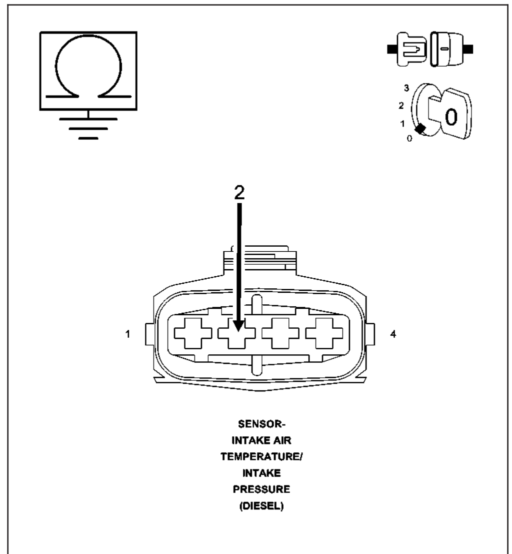
**Does the scan tool display P0110 INTAKE AIR TEMP SIGNAL VOLTAGE TOO HIGH?**

**Yes** >> Replace the Boost Pressure/Intake Air Temperature Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3



## 3. INTAKE AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND



81715a10

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Boost Pressure/IAT Sensor harness connector.

Measure the resistance between ground and the Intake Air Temperature Sensor Signal circuit.

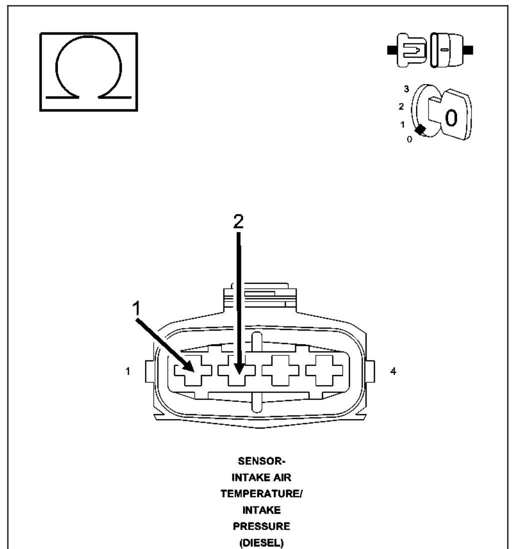
**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Intake Air Temperature Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. INTAKE AIR TEMP SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND



81715a17

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Boost Pressure/IAT Sensor harness connector.

Measure the resistance between the Intake Air Temperature Sensor Signal circuit and the Sensor Ground circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Intake Air Temperature Sensor Signal circuit for a short to the Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. ENGINE CONTROL MODULE

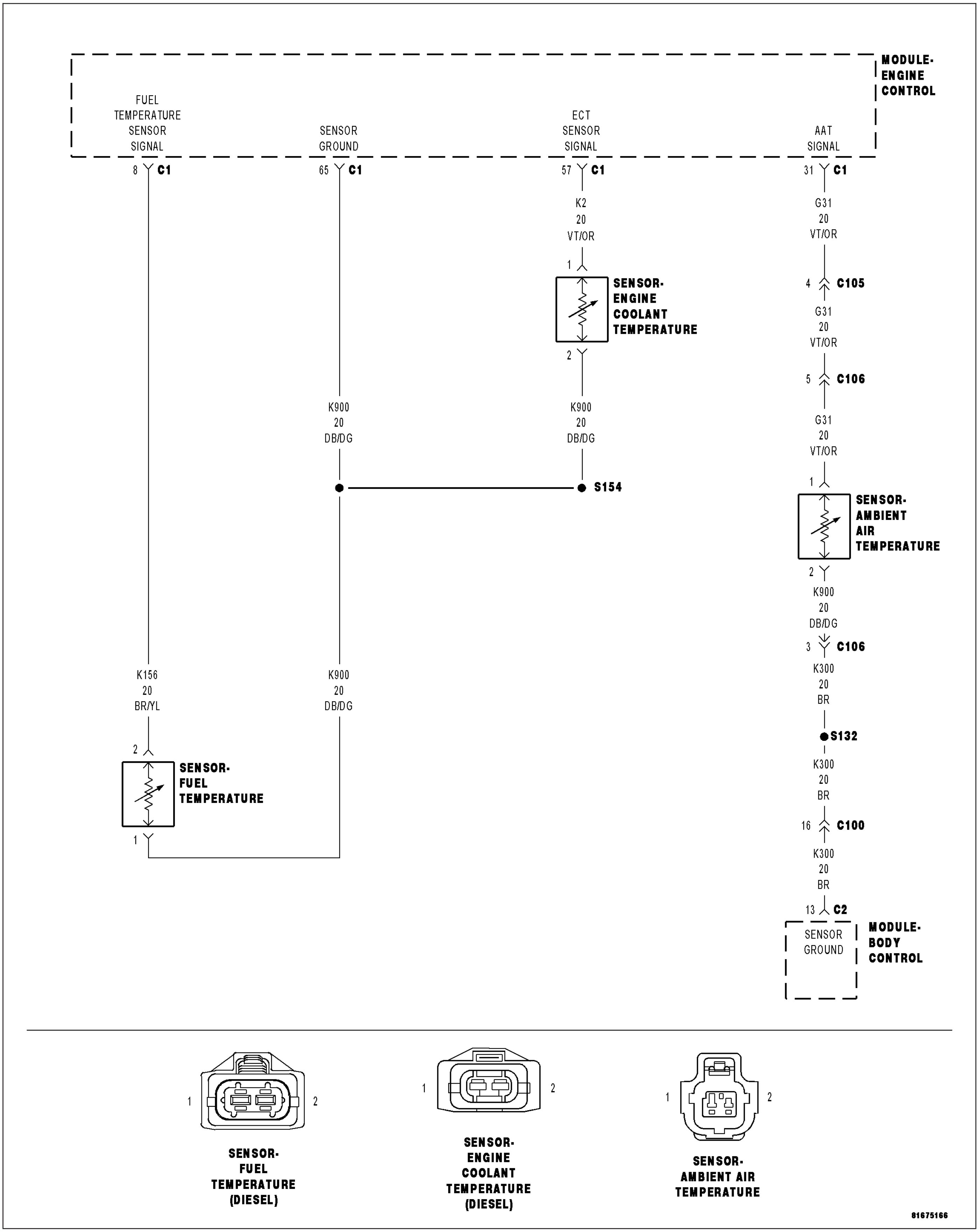
**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0115-ENGINE COOLANT TEMP SENSOR SIGNAL VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Engine Coolant Temperature Sensor signal is above 4.95 volts.

| Possible Causes |
|---|
| ECM ECT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND CIRCUIT OPEN |
| ECT SENSOR |
| ECT SENSOR SIGNAL CIRCUIT OPEN |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If multiple DTCs are present, the most likely cause is a 5-Volt Supply or Sensor Ground circuit shorted to voltage or ground. Refer to the Service Information Wiring section for circuits that would affect multiple DTCs.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, monitor the Engine Coolant Temperature (ECT) Sensor voltage.

**Is the ECT Sensor voltage above 4.8 volts?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. ECT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECT Sensor harness connector.

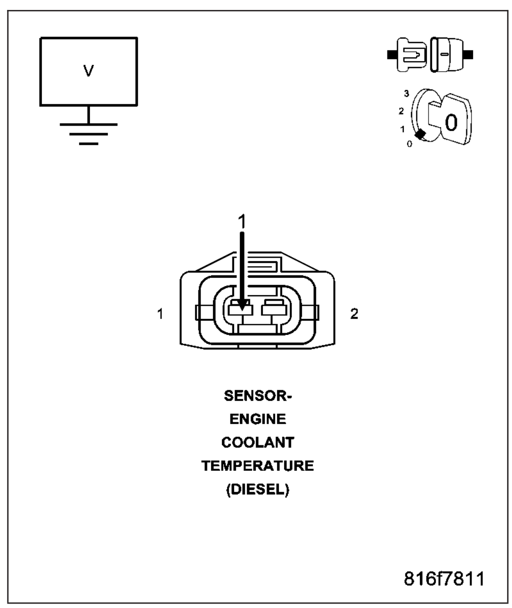
Turn the ignition on.

Measure the voltage on the ECT Sensor Signal circuit.

**Is the voltage above 5.5 volts?**

**Yes** >> Repair the ECT Sensor Signal circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3



## 3. ECT SENSOR

Turn the ignition off.

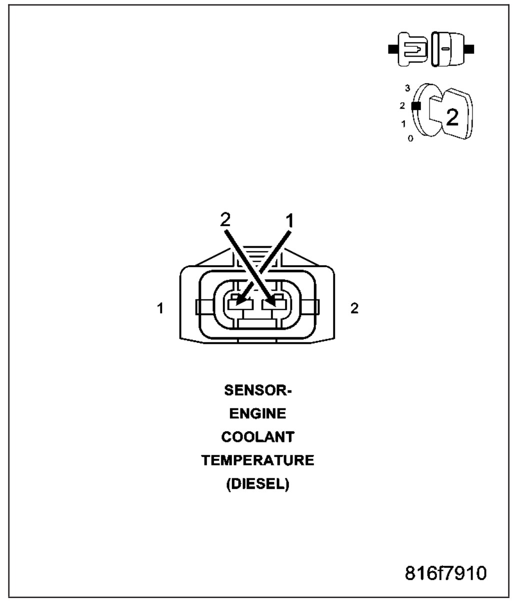
Disconnect the ECT Sensor harness connector.

Connect a jumper wire between the ECT Sensor harness connector cavities.

Turn the ignition on.

With the scan tool, read the ECT Sensor voltage.

**Is the voltage below 1.0 volt?**




**Yes** >> Replace the ECT Sensor in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. SENSOR GROUND CIRCUIT OPEN

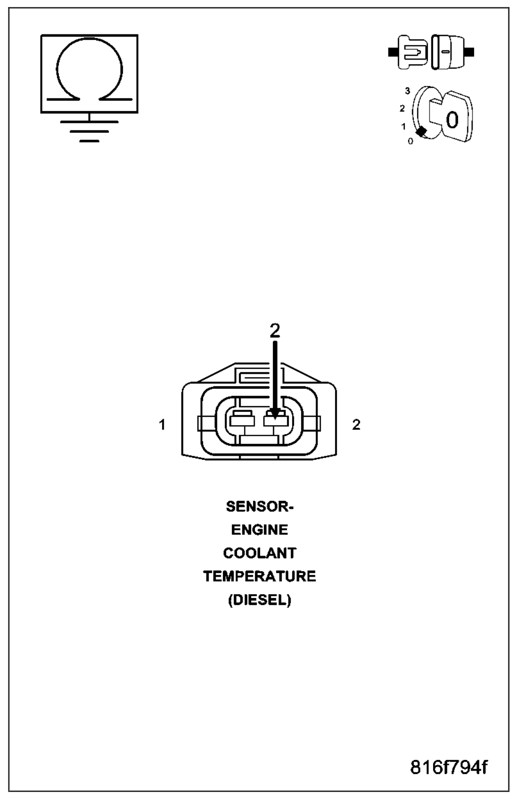
Turn the ignition off.

Disconnect the ECT Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit.

**Is the resistance below 10.0 ohms?**




**Yes** >> Go To 5

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

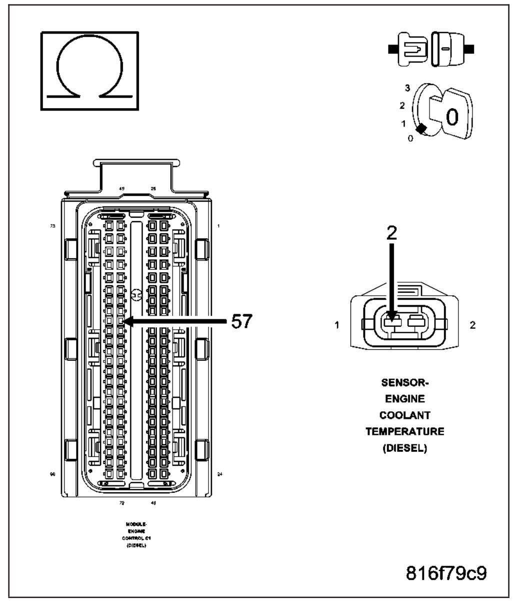
## 5. ECT SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the ECT Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the ECT Sensor Signal circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



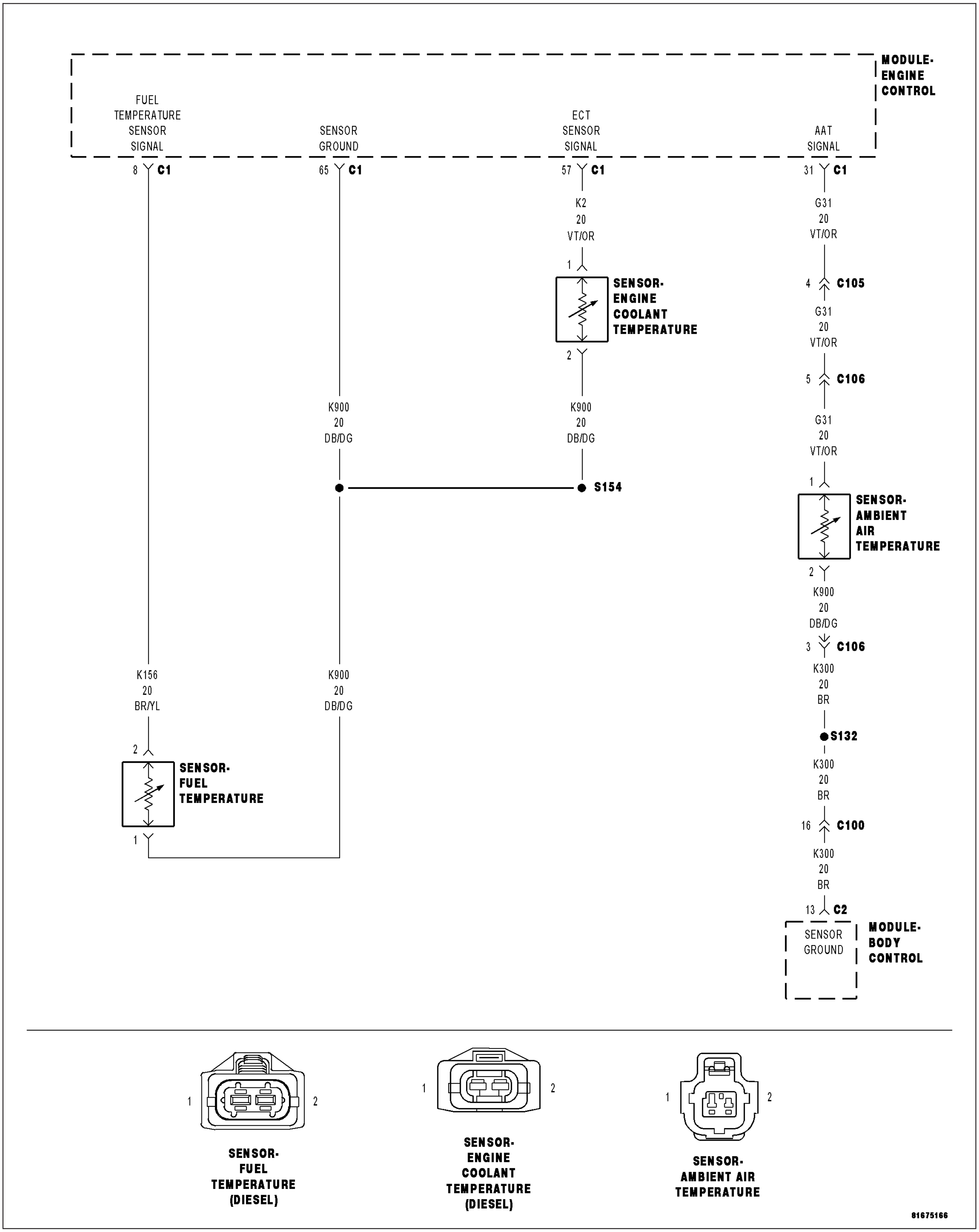

## 6. ENGINE CONTROL MODULE

**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0115-ENGINE COOLANT TEMP SENSOR SIGNAL VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Engine Coolant Temperature Sensor signal is below 0.12 volt.

| Possible Causes |
|---|
| ECT SENSOR |
| ECT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| ECT SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, monitor the Engine Coolant Temperature (ECT) Sensor voltage.

**Is the ECT Sensor voltage below 0.25 volt?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. ECT SENSOR

Turn the ignition off.

Disconnect the ECT Sensor harness connector.

Turn the ignition on.

With the scan tool, read the ECT Sensor voltage.

**Is the voltage above 4.0 volts?**

**Yes** >> Replace the ECT Sensor in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

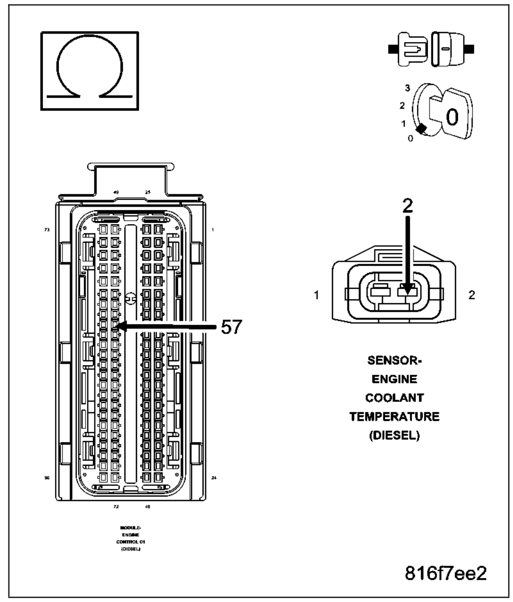
## 3. ECT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the ECT Sensor harness connector.

Measure the resistance between ground and the ECT Sensor Signal circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

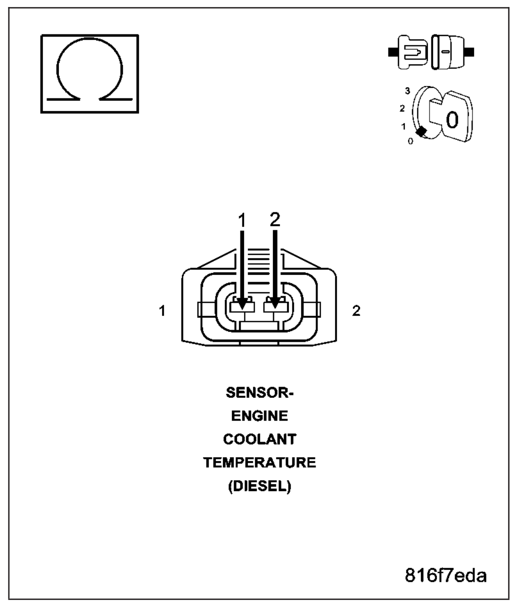
**No** >> Repair the ECT Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. ECT SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Measure the resistance between the ECT Sensor Signal circuit and Sensor Ground circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the ECT Sensor Signal and Ground circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. ENGINE CONTROL MODULE

**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0128-ENGINE COOLANT TEMP SENSOR ENGINE IS COLD TOO LONG

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  When the engine temperature is below 34.0°C.

| Possible Causes |
|---|
| ENGINE COLD TOO LONG |

## Diagnostic Test

### 1. CHECK COOLING SYSTEM PERFORMANCE

**NOTE: The best way to diagnose this DTC is to allow the vehicle to remain outside overnight in order to have a completely cold soaked engine.**

**NOTE: Extremely cold outside ambient temperatures may cause this DTC to set.**

Verify that the coolant level is correct.

Start the engine.

With the scan tool, set the engine RPM to 1500 and allow the engine to warm up for 10-15 minutes.

With the scan tool, monitor the Engine Coolant Temperature value during the warm up cycle. Make sure the transition of temperature change is smooth.

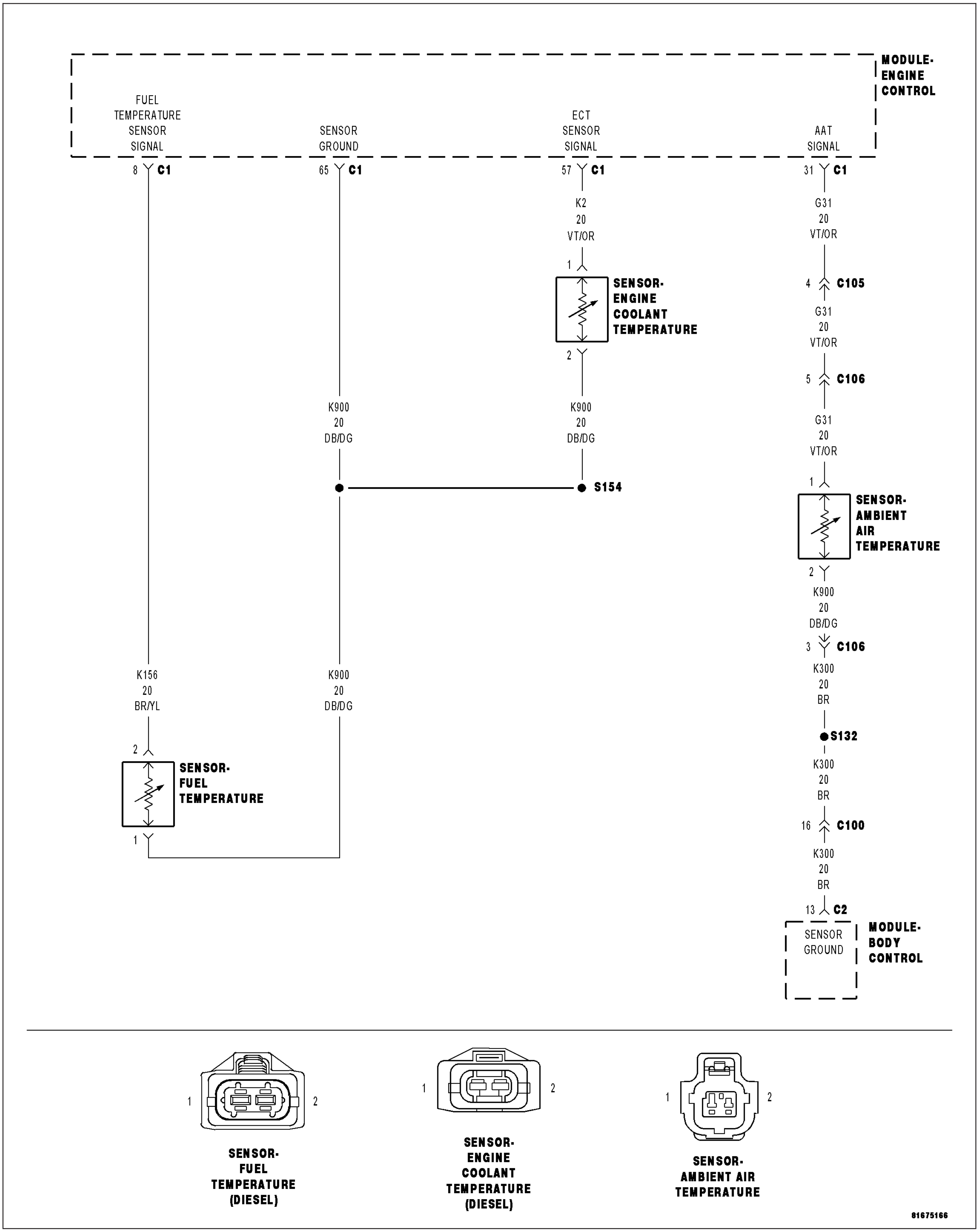
**Did the engine temperature reach a minimum of 80° C (176° F)?**

**Yes** >> Test Complete.

**No** >> Refer to the Service Information for cooling system performance diagnosis. The most probable cause is a Thermostat problem. Also, refer to any related TSBs.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0180-FUEL TEMPERATURE SENSOR SIGNAL VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Fuel Temperature Sensor signal is above 4.95 volts for 0.5 seconds.

| Possible Causes |
|---|
| FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND CIRCUIT OPEN |
| FUEL TEMPERATURE SENSOR |
| FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If multiple DTCs are present, the most likely cause is a 5-Volt Supply or Sensor Ground circuit shorted to voltage or ground. Refer to the Service Information Wiring section for circuits that would affect multiple DTCs.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, monitor the Fuel Temperature Sensor voltage.

**Is the Fuel Temperature Sensor voltage above 4.80 volts?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Fuel Temperature Sensor harness connector.

Turn the ignition on.

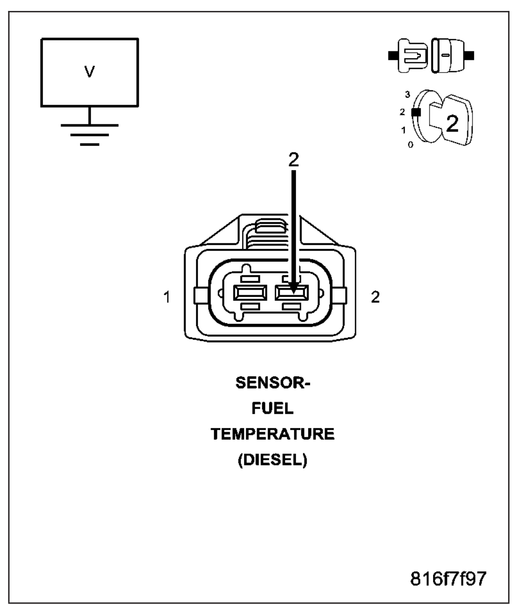
Measure the voltage on the Fuel Temperature Sensor Signal circuit.

**Is the voltage above 5.5 volts?**

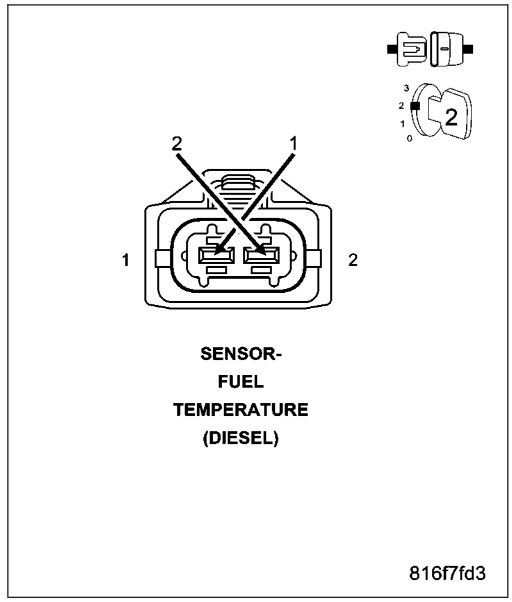
**Yes** >> Repair the Fuel Temperature Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3



## 3. FUEL TEMPERATURE SENSOR




Turn the ignition off.

Disconnect the Fuel Temperature Sensor harness connector.

Connect a jumper wire between the Fuel Temperature Sensor harness connector cavities.

Turn the ignition on.

With the scan tool, read the Fuel Temperature Sensor voltage.

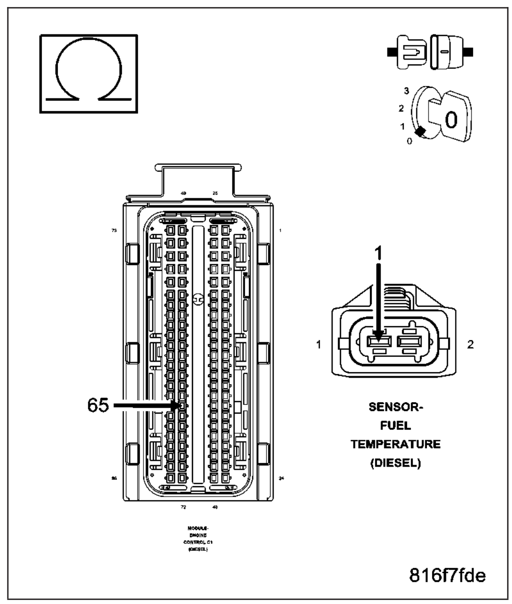
**Is the voltage below 1.0 volt?**

**Yes** >> Replace the Fuel Temperature Sensor in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. SENSOR GROUND CIRCUIT OPEN




Turn the ignition off.

Disconnect the Fuel Temperature Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

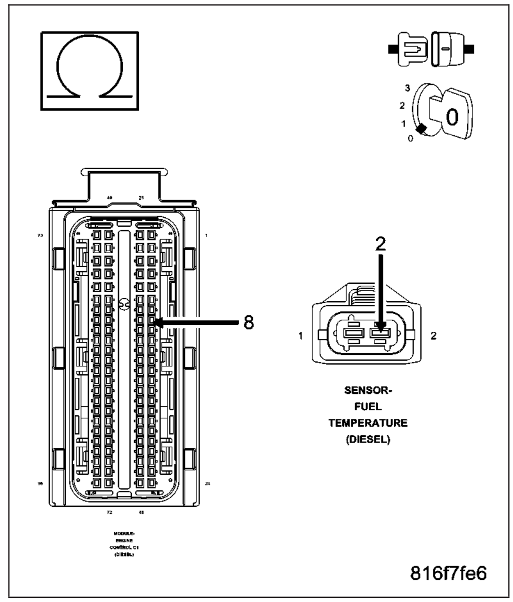
## 5. FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Temperature Sensor harness connector.

Measure the resistance of the Fuel Temperature Sensor Signal circuit.




**Is the resistance below 10.0 ohms?**

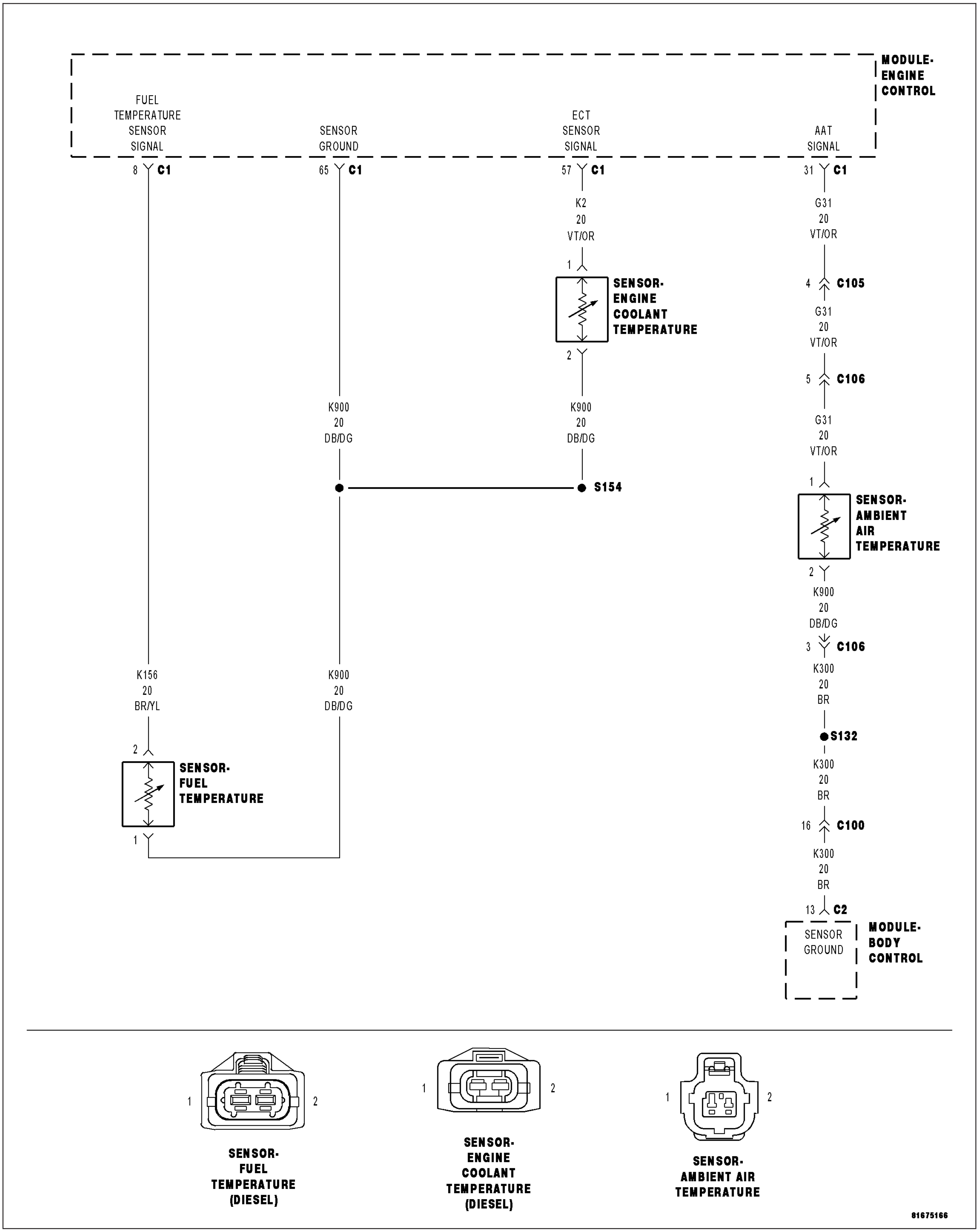
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Fuel Temperature Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0180-FUEL TEMPERATURE SENSOR SIGNAL VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Fuel Temperature Sensor signal is below 0.12 volt for 0.5 seconds.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| FUEL TEMPERATURE SENSOR |
| FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| FUEL TEMPERATURE SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, monitor the Fuel Temperature Sensor voltage.

**Is the Fuel Temperature Sensor voltage below 0.20 volt?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. FUEL TEMPERATURE SENSOR

Turn the ignition off.

Disconnect the Fuel Temperature Sensor harness connector.

Turn the ignition on.

With the scan tool, read the Fuel Temperature Sensor voltage.

**Is the voltage above 4.0 volts?**

**Yes** >> Replace the Fuel Temperature Sensor in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> 3

## 3. FUEL TEMPERATURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Temperature Sensor harness connector.

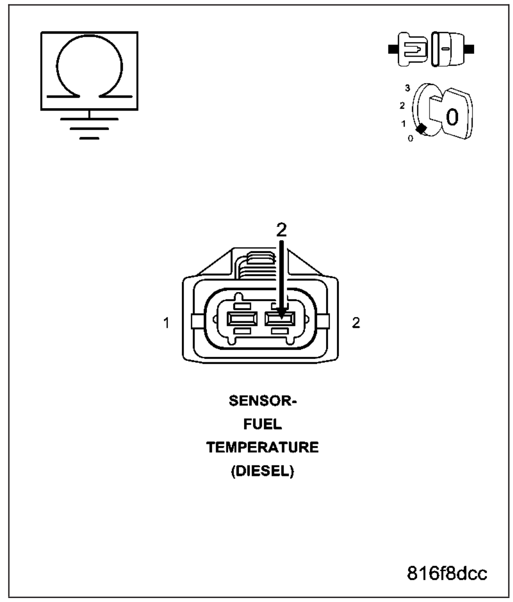
Measure the resistance between ground and the Fuel temperature Sensor Signal circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Fuel Temperature Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 4. FUEL TEMPERATURE SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Temperature Sensor harness connector.

Measure the resistance between the Fuel Temperature Sensor Signal circuit and Sensor Ground circuit.

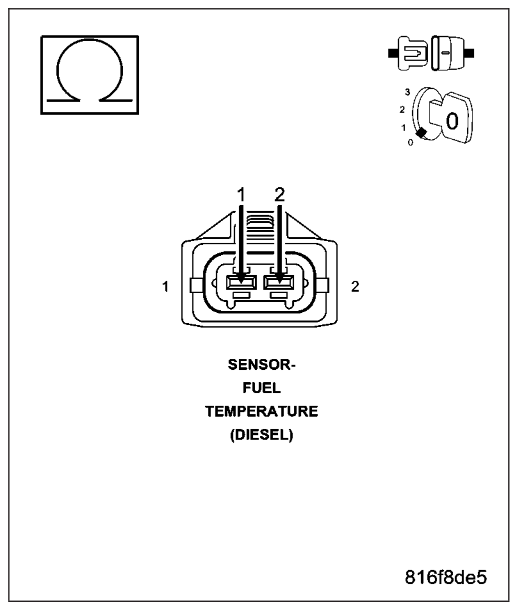
**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

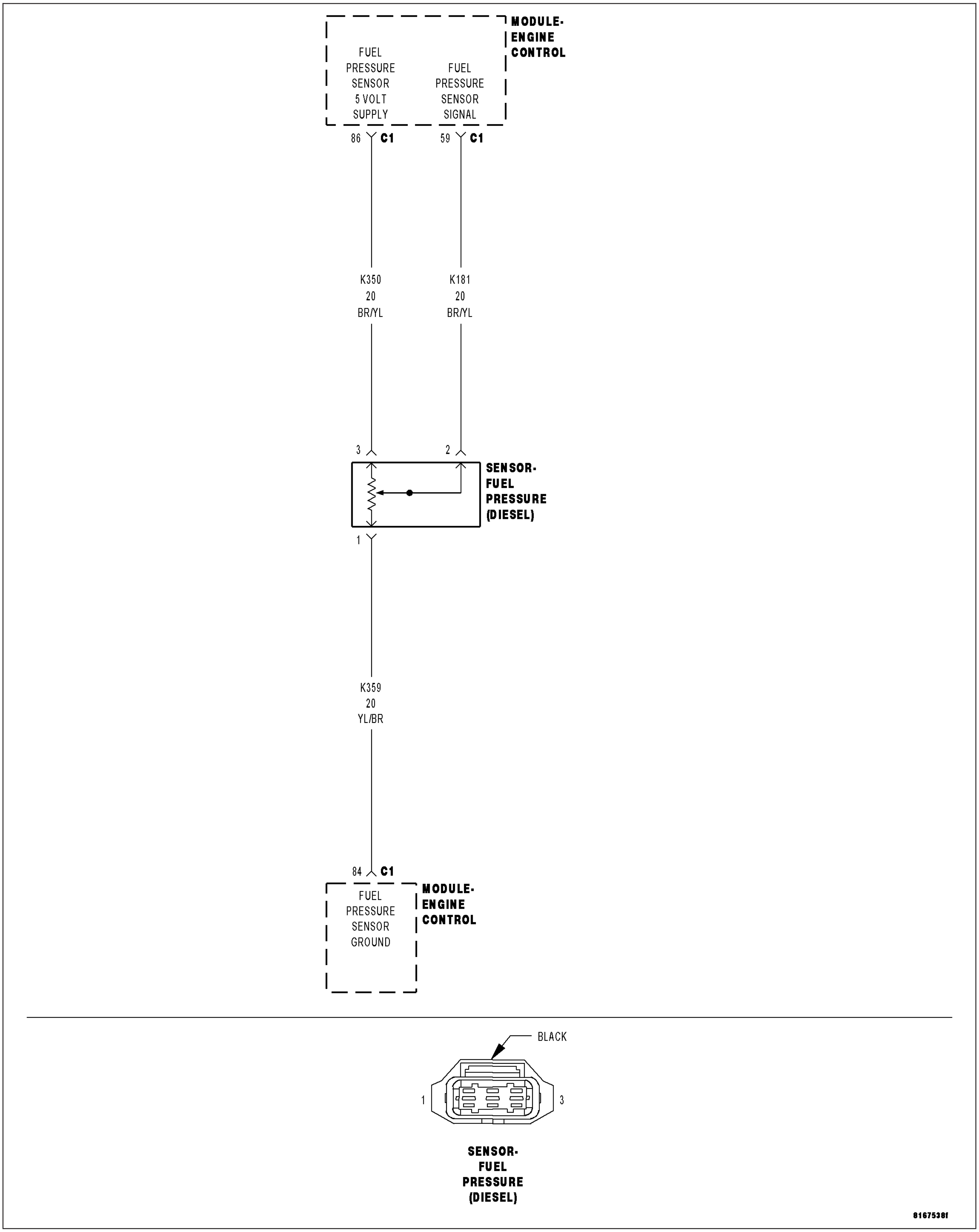
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Fuel Temperature Sensor Signal and Ground circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## P0190-FUEL PRESS SENSOR SIGNAL VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Fuel Rail Pressure Sensor signal voltage is above 4.8 volts.

| Possible Causes |
|---|
| ECM - FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| ECM - FUEL PRESSURE SENSOR SIGNAL OPEN |
| FUEL PRESSURE SENSOR SIGNAL CIRCUIT OPEN |
| FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND CIRCUIT OPEN |
| FUEL PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT OPEN |
| FUEL PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE |
| FUEL PRESSURE SENSOR |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**WARNING: THE FUEL INJECTION PUMP SUPPLIES HIGH-PRESSURE FUEL TO EACH INDIVIDUAL INJECTOR THROUGH HIGH-PRESSURE FUEL LINES. FUEL UNDER HIGH PRESSURE CAN PENETRATE SKIN AND CAUSE PERSONAL INJURY. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING.**

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Cycle the ignition key on and off several times, leaving the key on for at least 10 seconds at a time.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

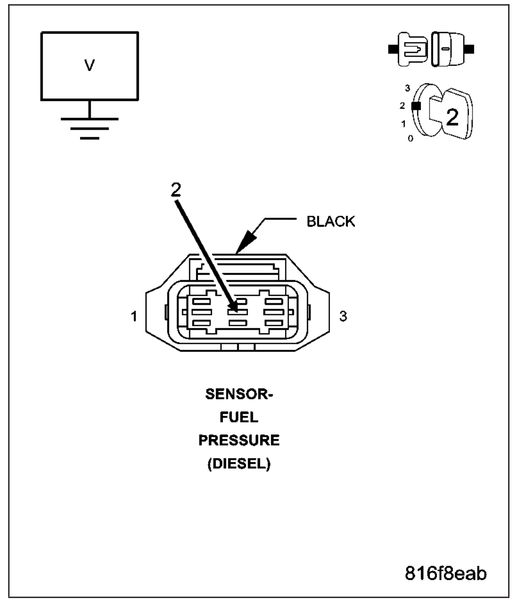
## 2. CHECK FUEL PRESSURE SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the Fuel Pressure Sensor Signal circuit.




**Select the appropriate voltage reading.**

**Voltage is above 5.5 volts.**
Go To 3

**Voltage is between 4.7 and 5.4 volts.**
Go To 4

**Voltage is below 4.7 volts.**
Go To 9

## 3. FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

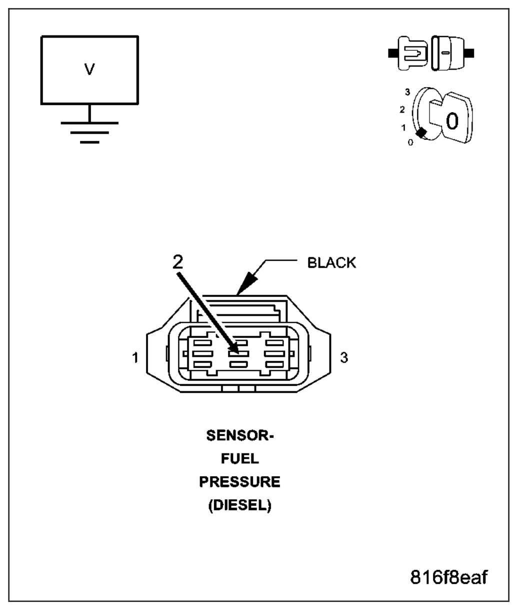
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Fuel Pressure Sensor Signal circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Fuel Pressure Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL PRESSURE SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

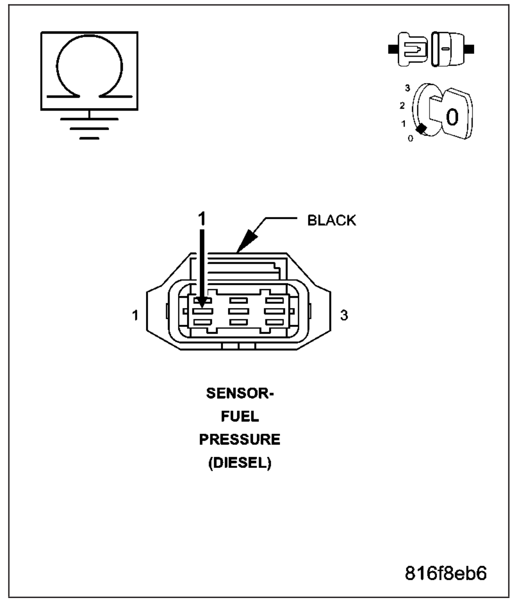
Measure the resistance of the Fuel Pressure Sensor Ground circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Fuel Pressure Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 5. FUEL PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

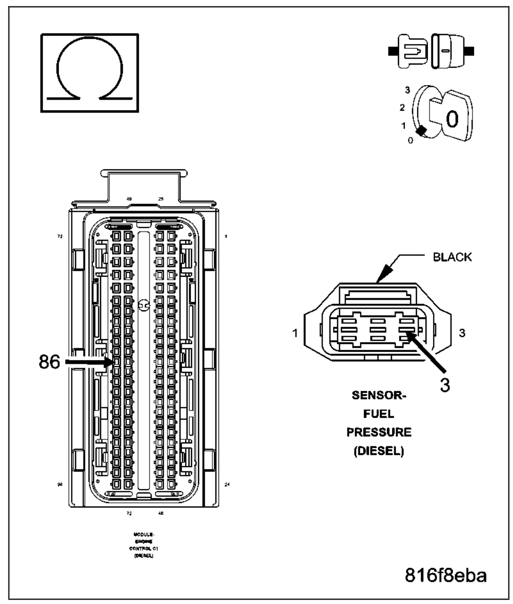
Measure the resistance of the Fuel Pressure Sensor 5-Volt Supply circuit.

**Is the resistance below 10.0 ohms?**

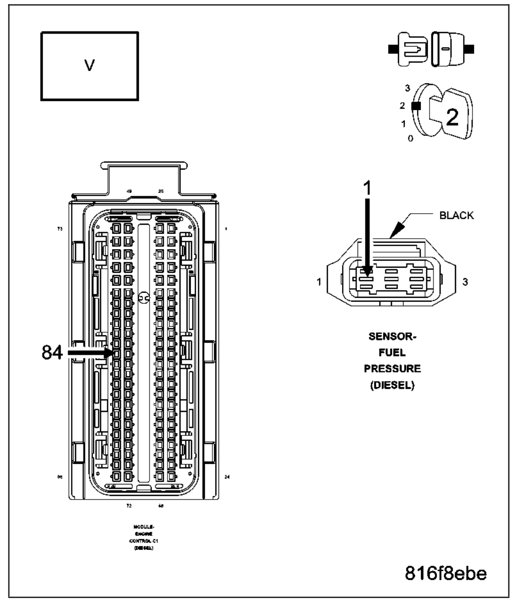
**Yes** >> Go To 6

**No** >> Repair the Fuel Pressure Sensor 5-volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 6. FUEL PRESSURE SENSOR GROUND CKT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Fuel Pressure Sensor Ground circuit at the Fuel Pressure Sensor and ECM harness connectors.

**NOTE: If the Fuel Pressure Sensor Ground circuit had a short to voltage on it, the ECM could be damaged. Retest the Fuel Pressure Sensor circuit.**

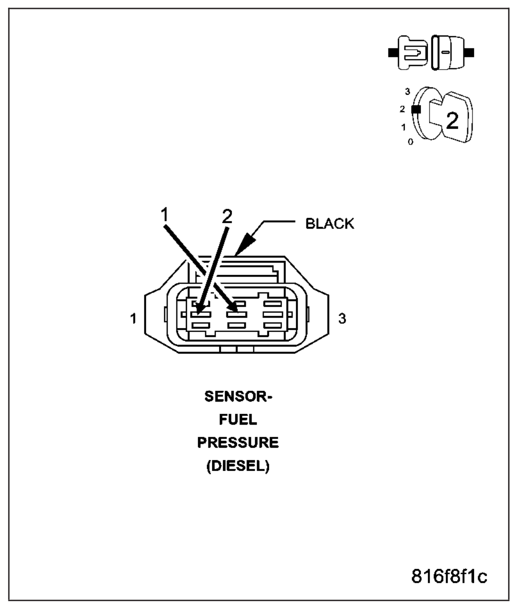
**Is the voltage above 1.0 volt at either connector?**

**Yes** >> Repair the Fuel Pressure Sensor Ground circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. FUEL PRESSURE SENSOR




Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

Connect a jumper wire between the Fuel Pressure Sensor Signal circuit and the Fuel Pressure Sensor Ground circuit in the Fuel Pressure Sensor harness connector.

Turn the ignition on and monitor the scan tool for DTCs.

**Is DTC P0190 FUEL PRESS SENSOR CIRCUIT MALF SIGNAL VOLTAGE TOO LOW present?**

**Yes** >> Replace the Fuel Pressure Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. ENGINE CONTROL MODULE

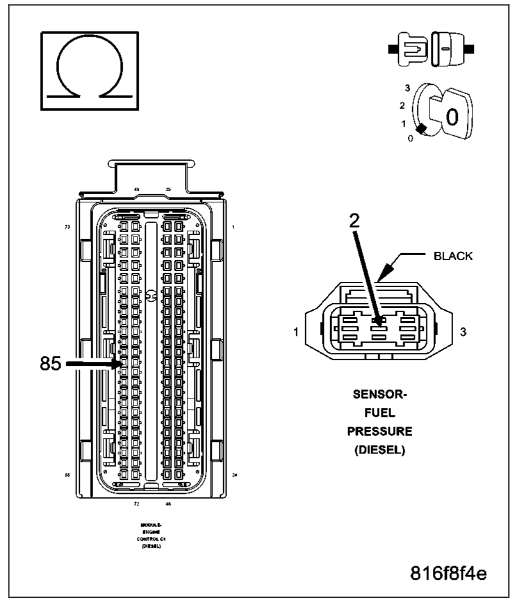
**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 9. FUEL PRESSURE SENSOR SIGNAL CIRCUIT OPEN




Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Fuel Pressure Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

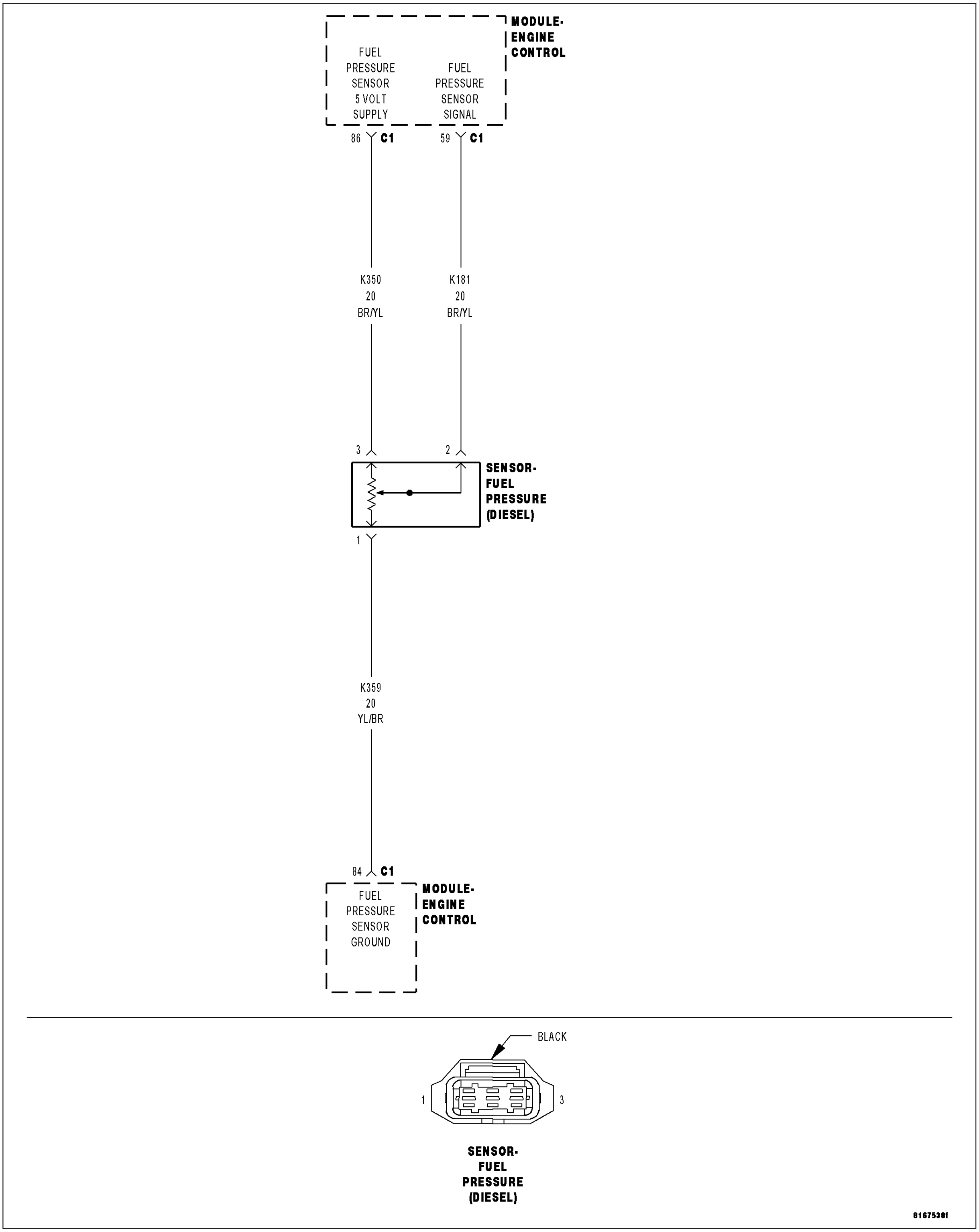
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Fuel Pressure Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0190-FUEL PRESS SENSOR SIGNAL VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Fuel Rail Pressure Sensor signal voltage is below 0.2 volt.

| Possible Causes |
|---|
| FUEL PRESSURE SENSOR |
| FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND |
| ECM - FUEL PRESSURE SENSOR SIGNAL SHORTED TO GROUND |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**WARNING: THE FUEL INJECTION PUMP SUPPLIES HIGH-PRESSURE FUEL TO EACH INDIVIDUAL INJECTOR THROUGH HIGH-PRESSURE FUEL LINES. FUEL UNDER HIGH PRESSURE CAN PENETRATE SKIN AND CAUSE PERSONAL INJURY. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Cycle the ignition key on and off several times, leaving the key on for at least 10 seconds at a time.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

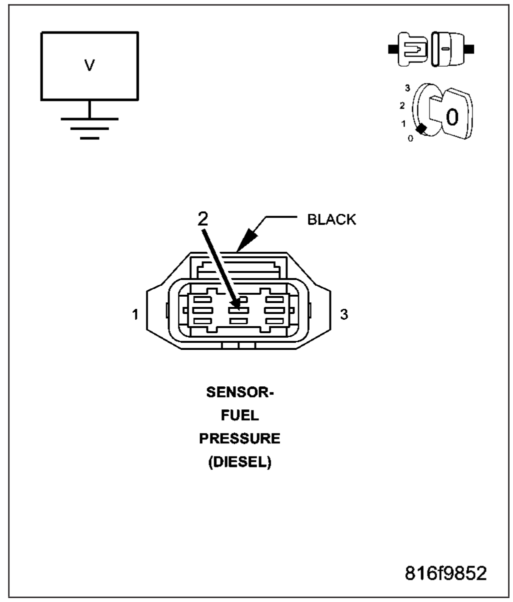
## 2. FUEL PRESSURE SENSOR

Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the Fuel Pressure Sensor Signal circuit.




**Is the voltage between 4.7 and 5.3 volts?**

**Yes** >> Replace the Fuel Pressure Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

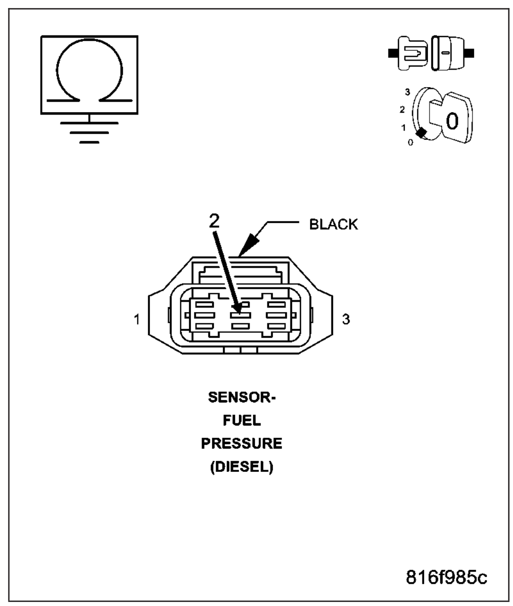
## 3. FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Fuel Pressure Sensor Signal circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Fuel Pressure Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

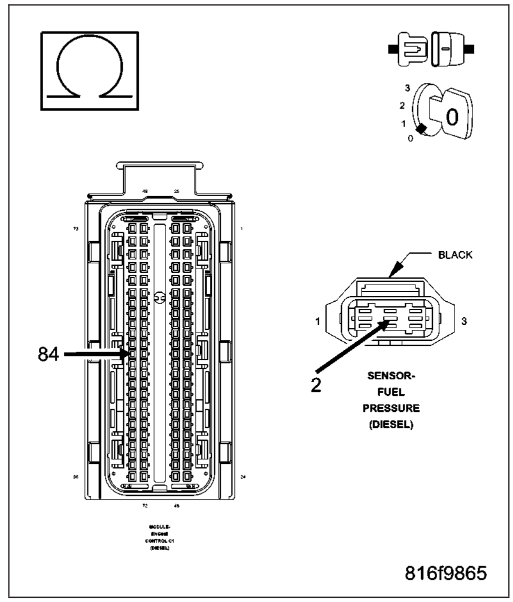
## 4. FUEL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND

Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the Fuel Pressure Sensor Ground circuit and the Fuel Pressure Sensor Signal circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Fuel Pressure Sensor Signal circuit for a short to the Fuel Pressure Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. ECM - SHORT TO GROUND

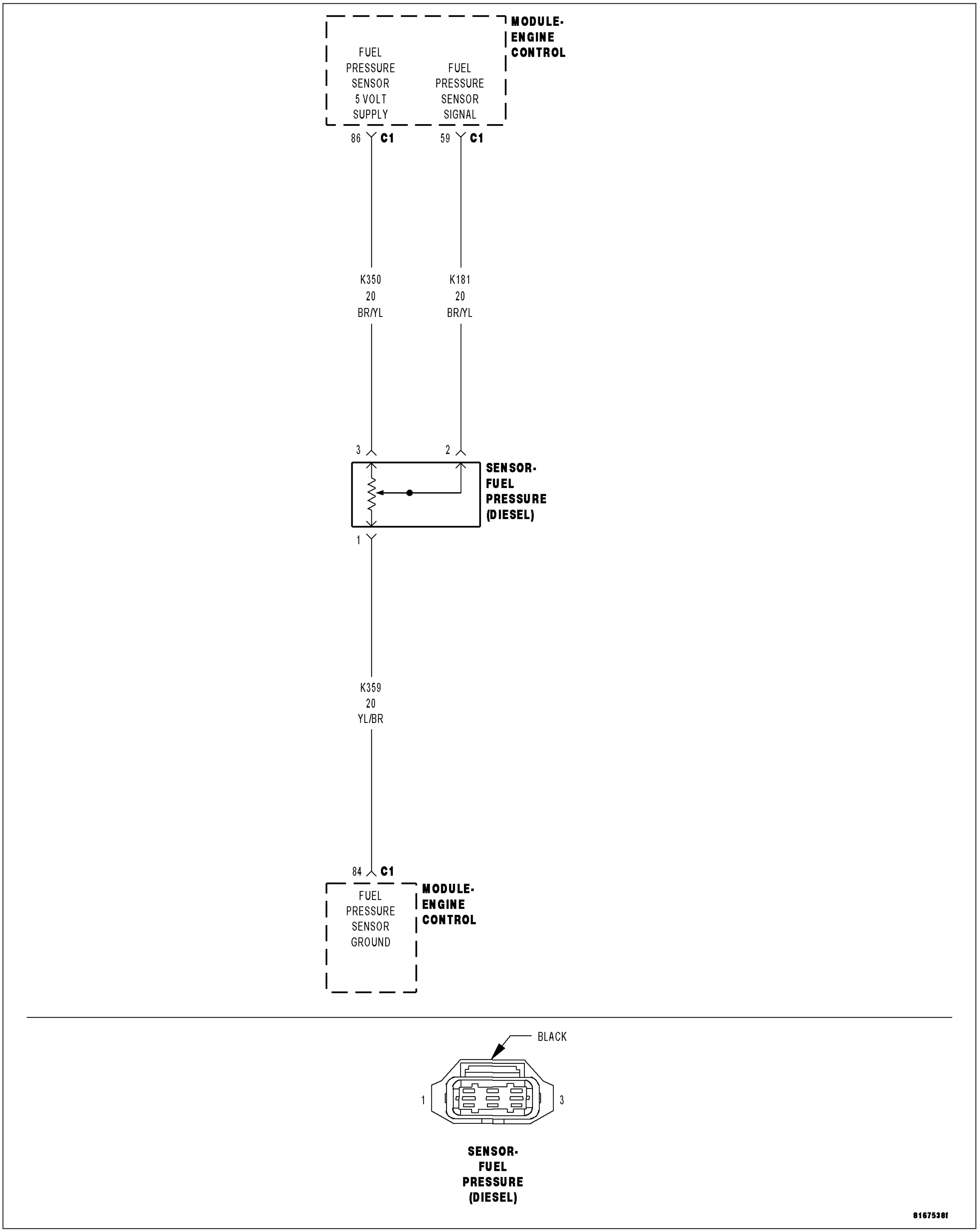
**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0191-FUEL PRESS SENSOR AFTERRUN NEGATIVE PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  At ignition shut off during Afterrun.
- **Set Condition:**
  The Fuel Pressure Sensor signal is below 0.298 volt for 1.0 second.

| Possible Causes |
|---|
| FUEL PRESSURE SENSOR |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. FUEL PRESSURE SENSOR

**NOTE: This code can be caused by an intermittent problem in the wiring and connectors to the Fuel Pressure Sensor. Inspect the Fuel Pressure Sensor harness connector and associated wiring for signs of poor terminal contact.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

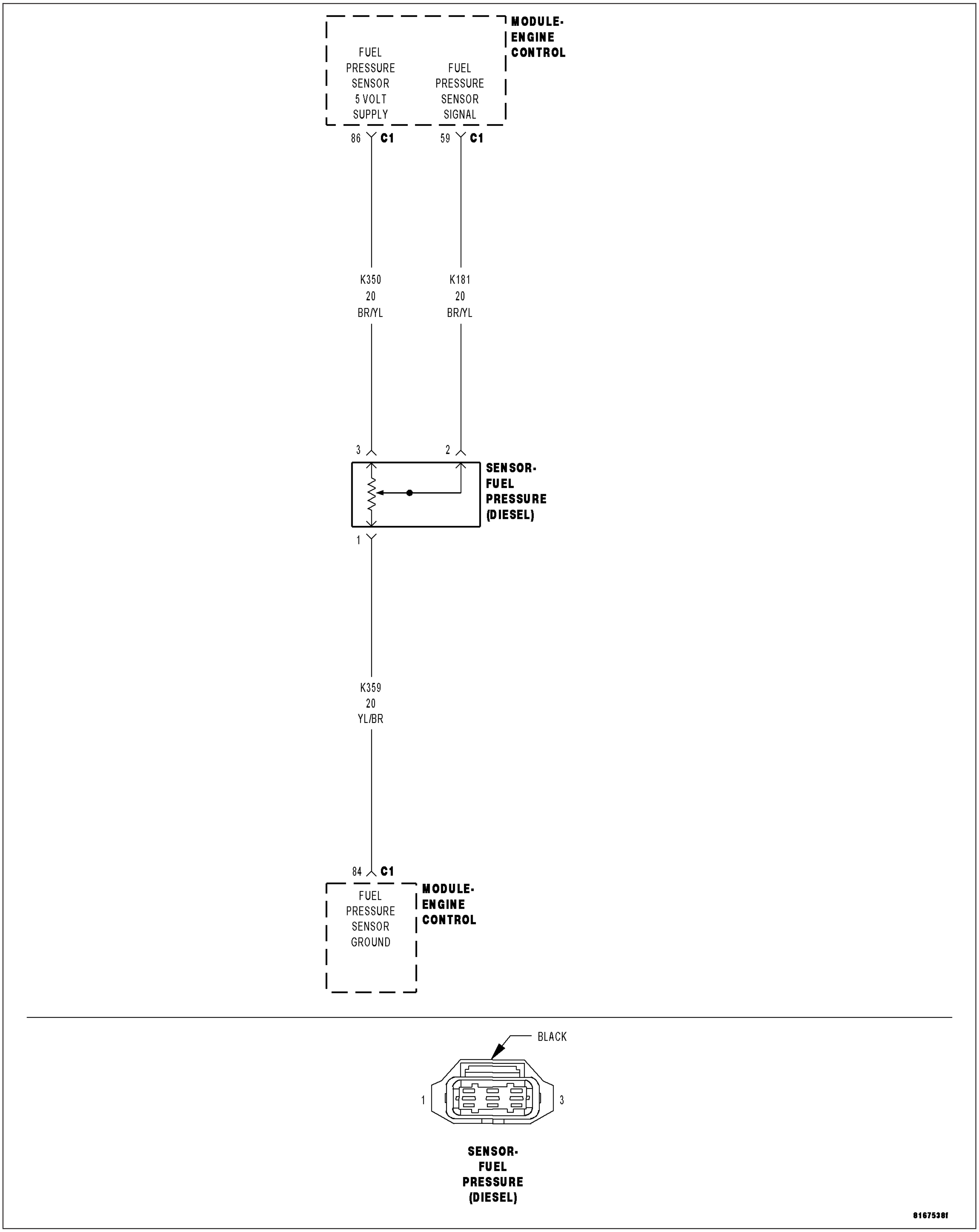
Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle. With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pressure Sensor in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## P0191-FUEL PRESS SENSOR AFTERRUN POSITIVE PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  At ignition shut off during Afterrun.
- **Set Condition:**
  The Fuel Pressure Sensor signal is above 0.698 volt for 1.0 second.

| Possible Causes |
|---|
| FUEL PRESSURE SENSOR |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. FUEL PRESSURE SENSOR

**NOTE: This code can be caused by an intermittent problem in the wiring and connectors to the Fuel Pressure Sensor. Inspect the Fuel Pressure Sensor harness connector and associated wiring for signs of poor terminal contact.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

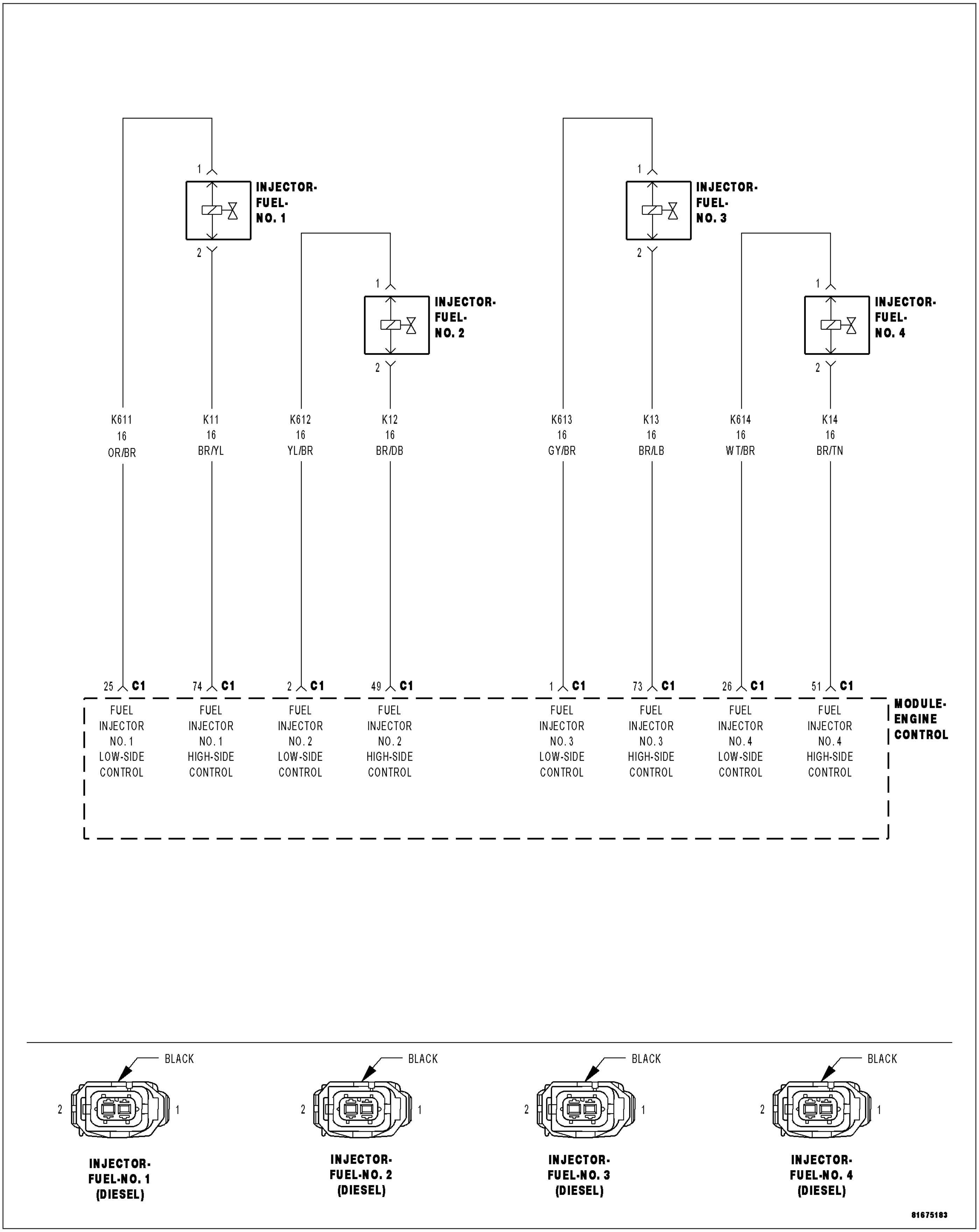
Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle. With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pressure Sensor in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## P0201-CYLINDER 1-INJECTOR CIRCUIT LOAD DROP




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM detects an incorrect rate of current decrease after injection occurs.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

## 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

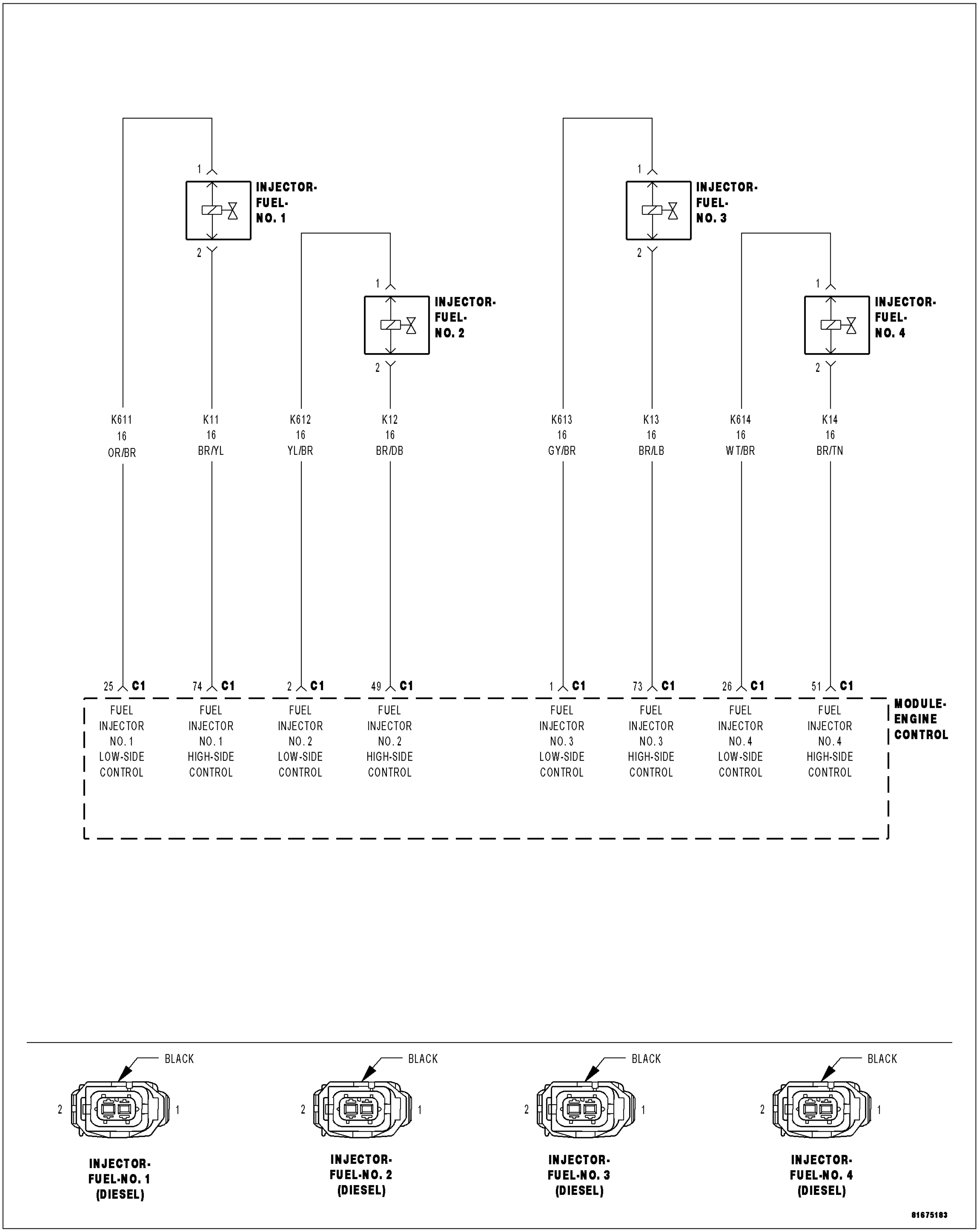
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0201-CYLINDER 1-INJECTOR CIRCUIT CURRENT DECREASE




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

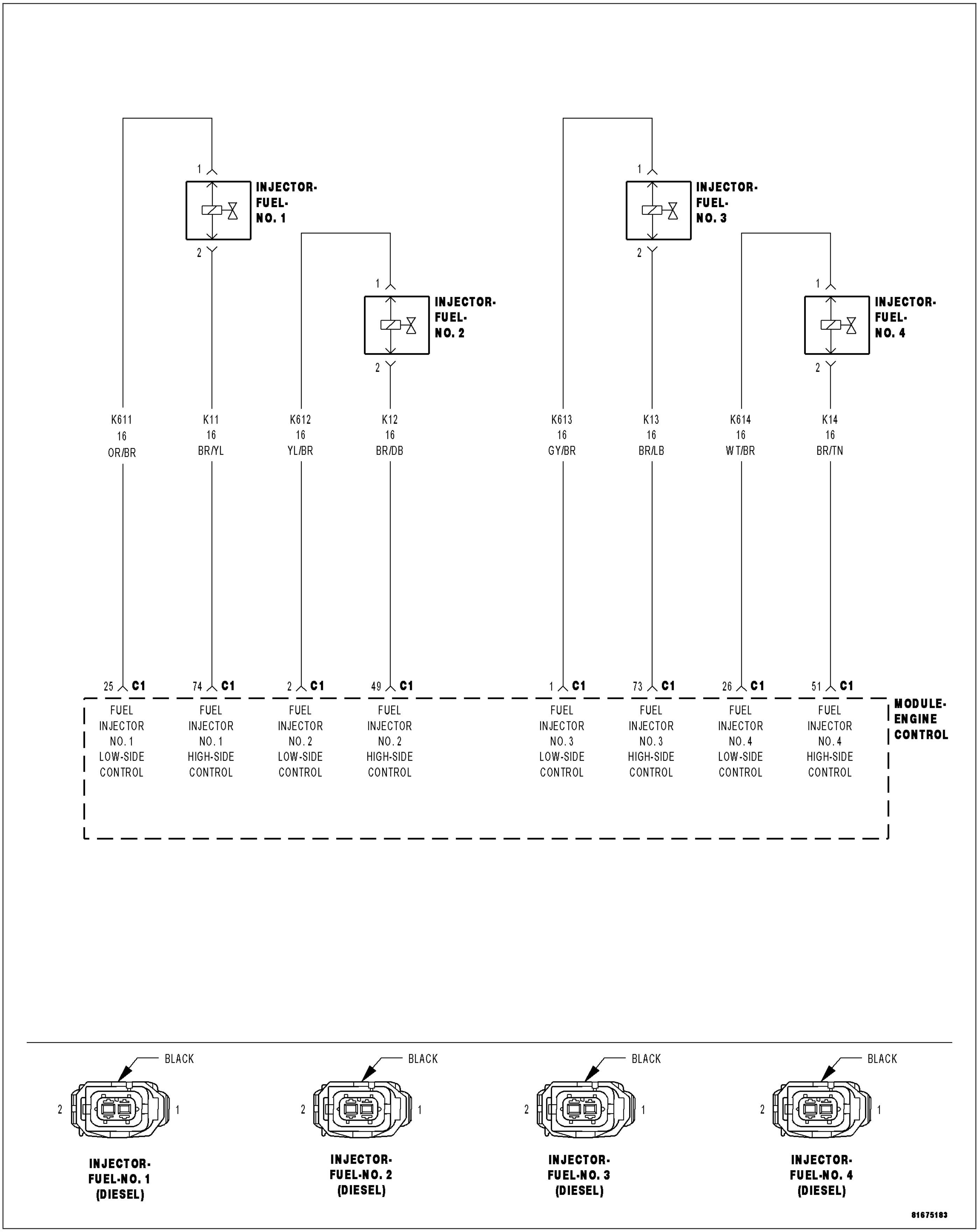
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0201-CYLINDER 1-INJECTOR OVERCURRENT LOW SIDE




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

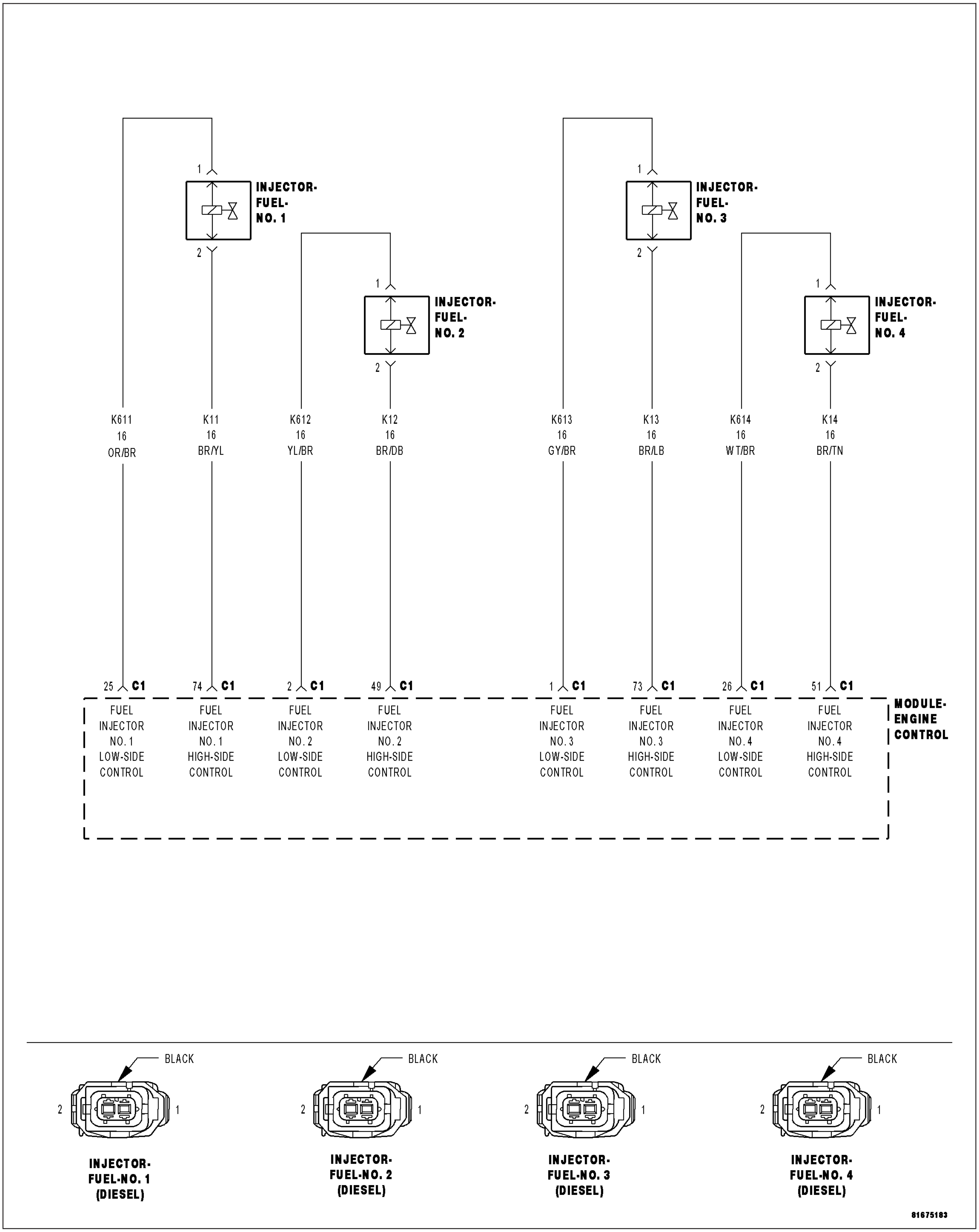
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0201-CYLINDER 1-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

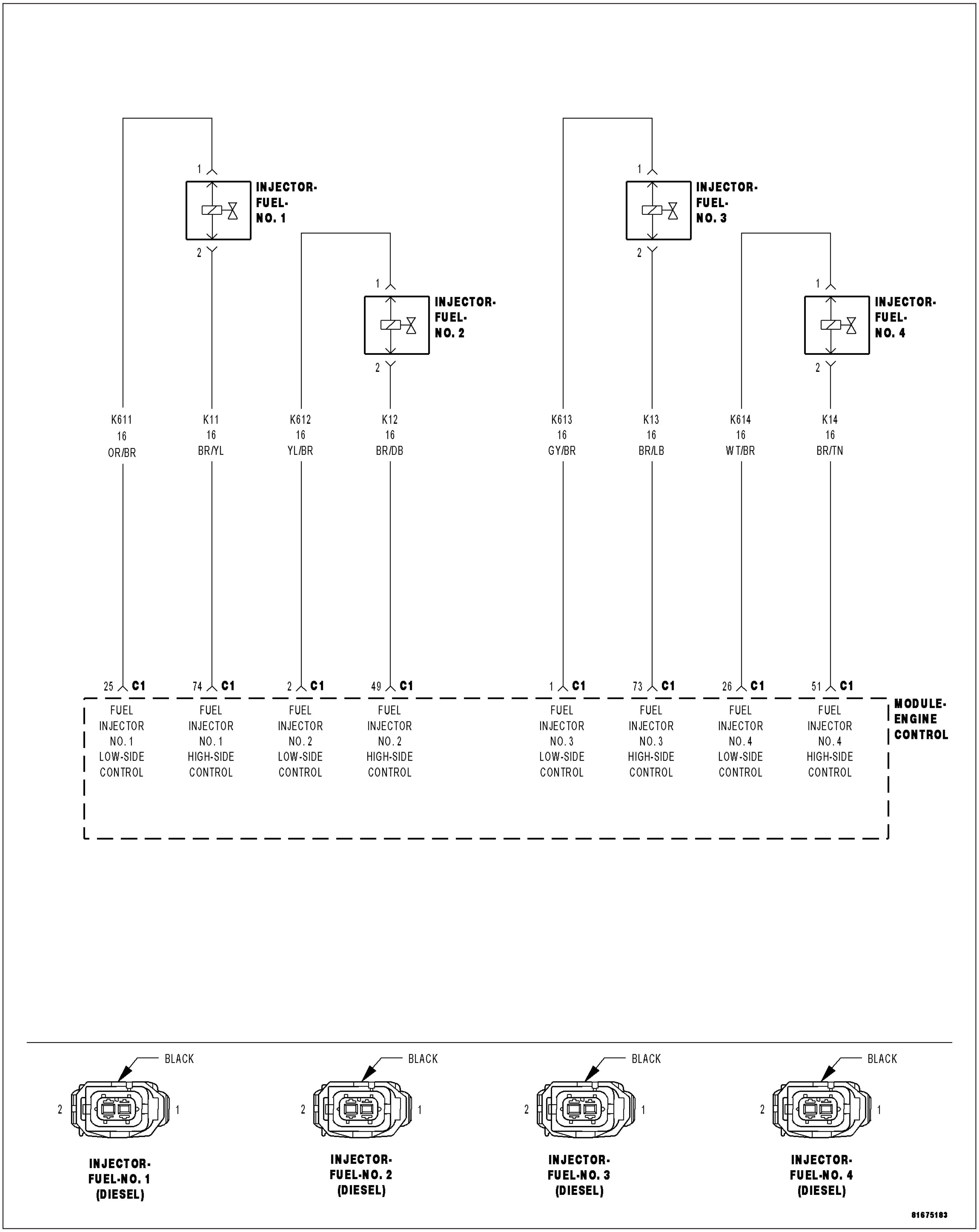
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0202-CYLINDER 2-INJECTOR CIRCUIT CURRENT DECREASE




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM detects an incorrect rate of current decrease after injection occurs.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC’s including this DTC to set.**

**NOTE: Check the ECM for other DTC’s. If other DTC’s are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

## 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect all of the Cylinder Fuel Injector harness connectors.
Disconnect the ECM harness connectors.
Remove the ASD Relay from the PDC.
Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
Turn the ignition on.
Measure the voltage of each Fuel Injector High-Side Control circuit.
Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the ECM harness connectors.
Disconnect all of the Fuel Injector harness connectors.
Measure the resistance between ground and each Fuel Injector High-Side Control circuits.
Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.
Disconnect the ECM harness connectors.
Disconnect all of the Cylinder Fuel Injector harness connectors.
Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.
Disconnect the ECM harness connectors.
Disconnect all of the Cylinder Fuel Injector harness connectors.
Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

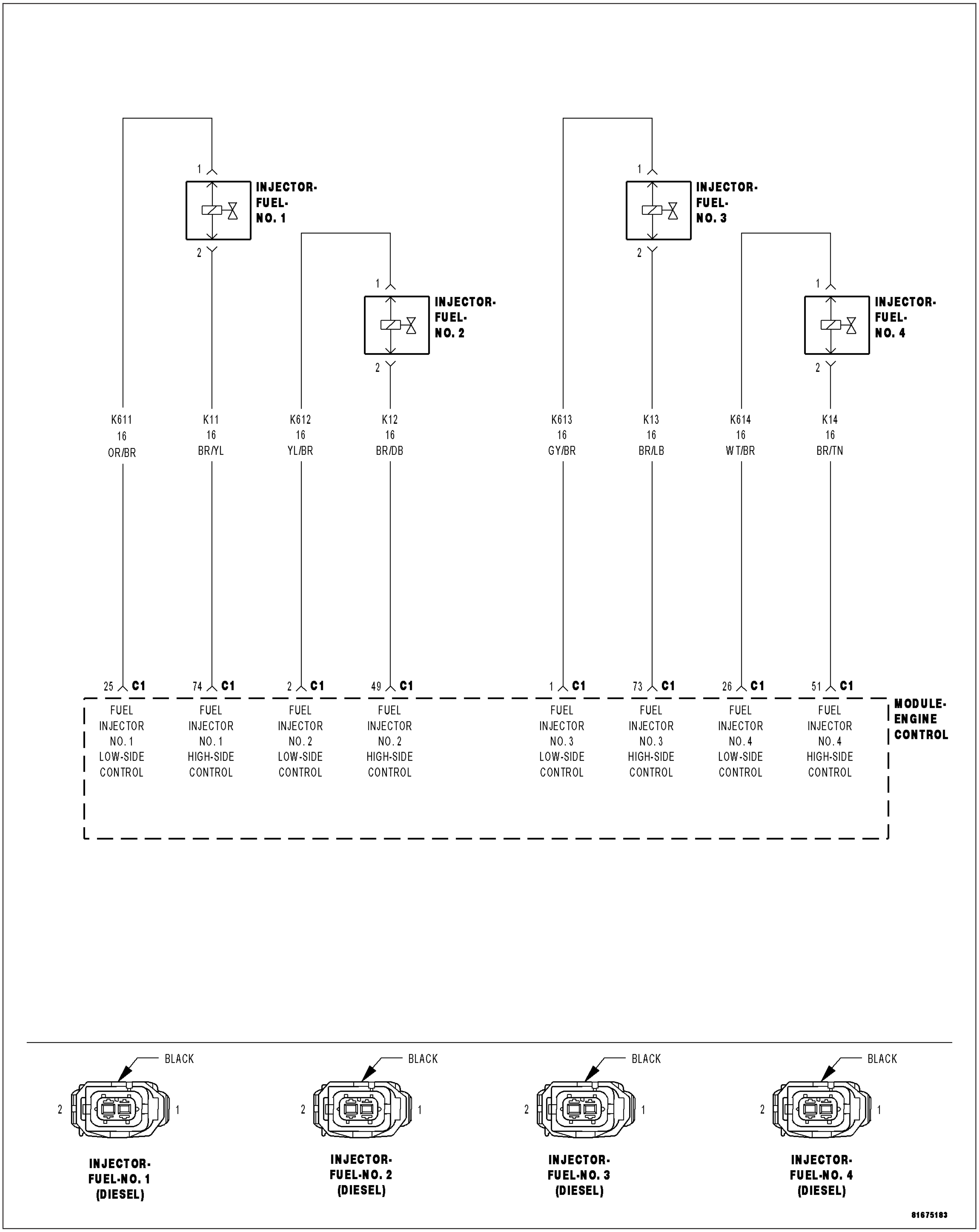
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0202-CYLINDER 2-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

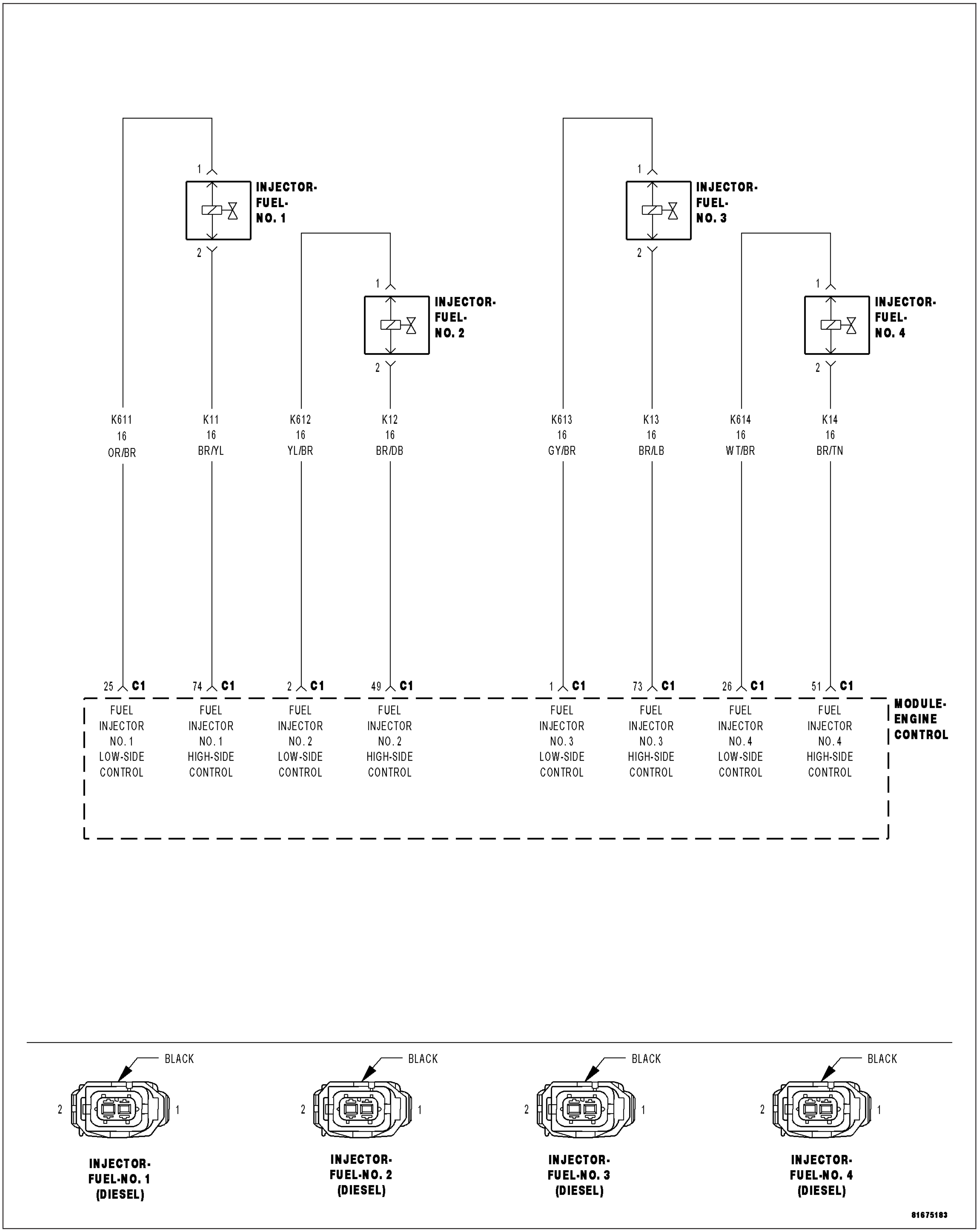
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0202-CYLINDER 2-INJECTOR CIRCUIT OVERCURRENT LOW SIDE




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
| --- |
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

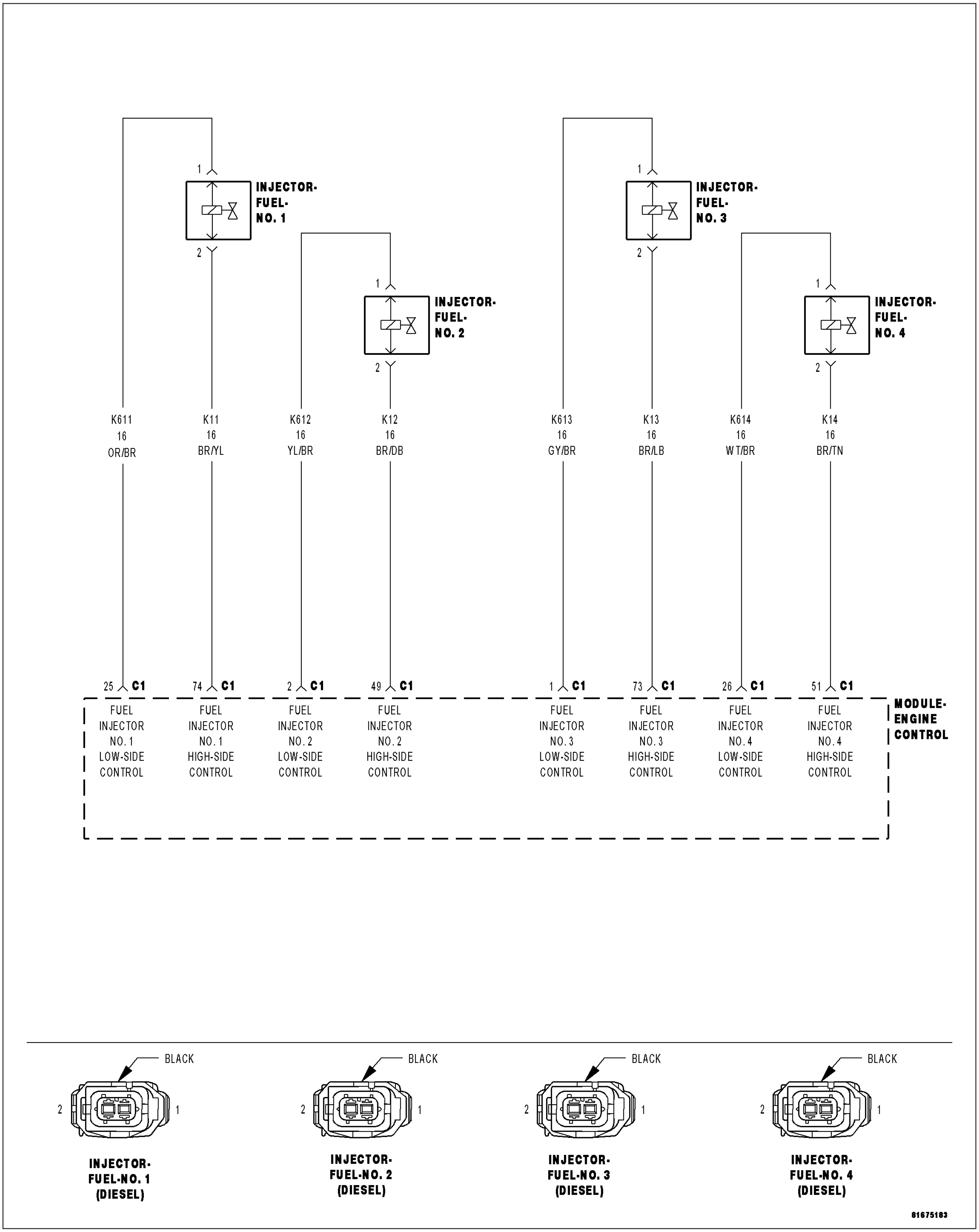
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0202-CYLINDER 2-INJECTOR CIRCUIT LOAD DROP




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
| --- |
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

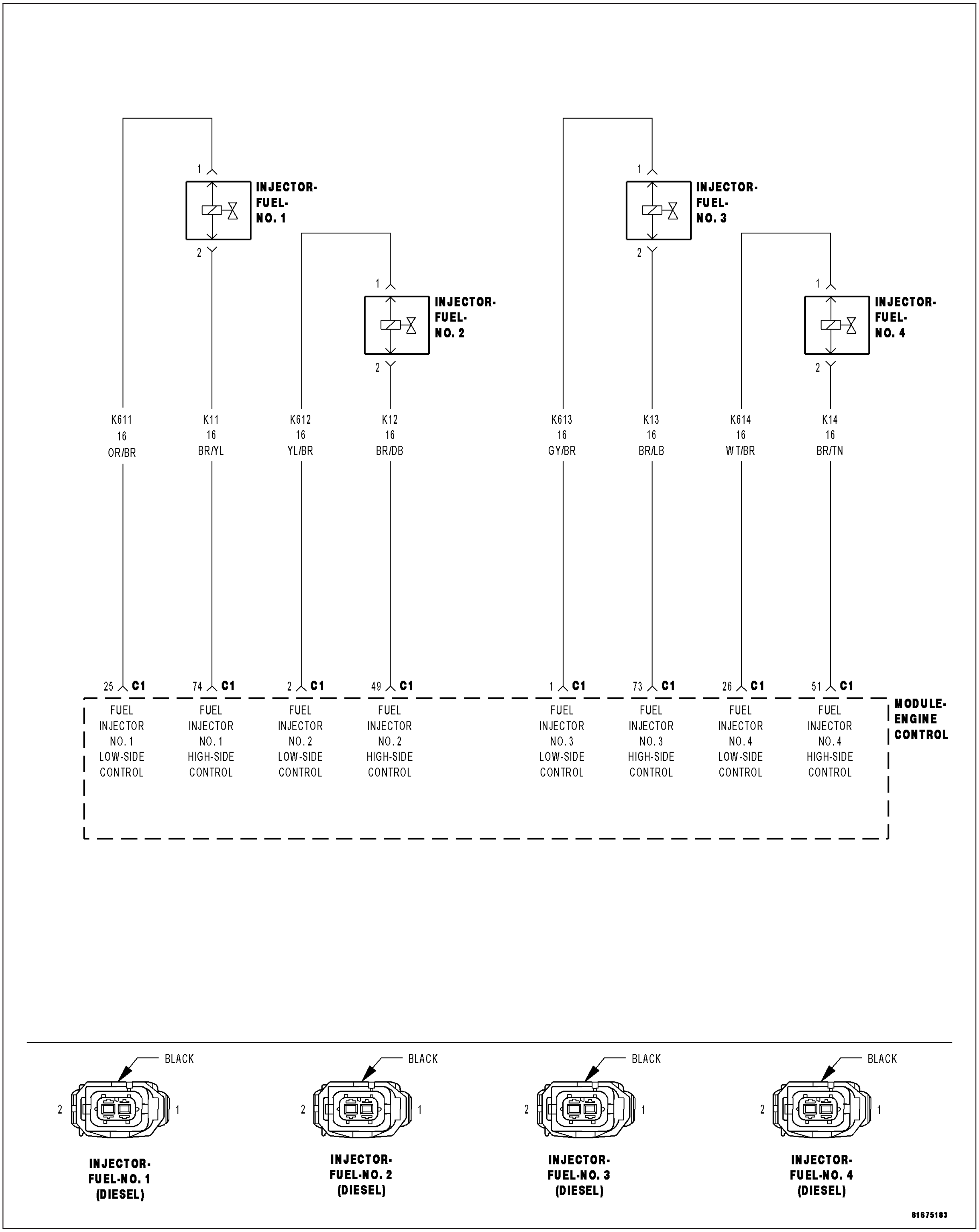
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0201-CYLINDER 1-INJECTOR CIRCUIT CURRENT DECREASE




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

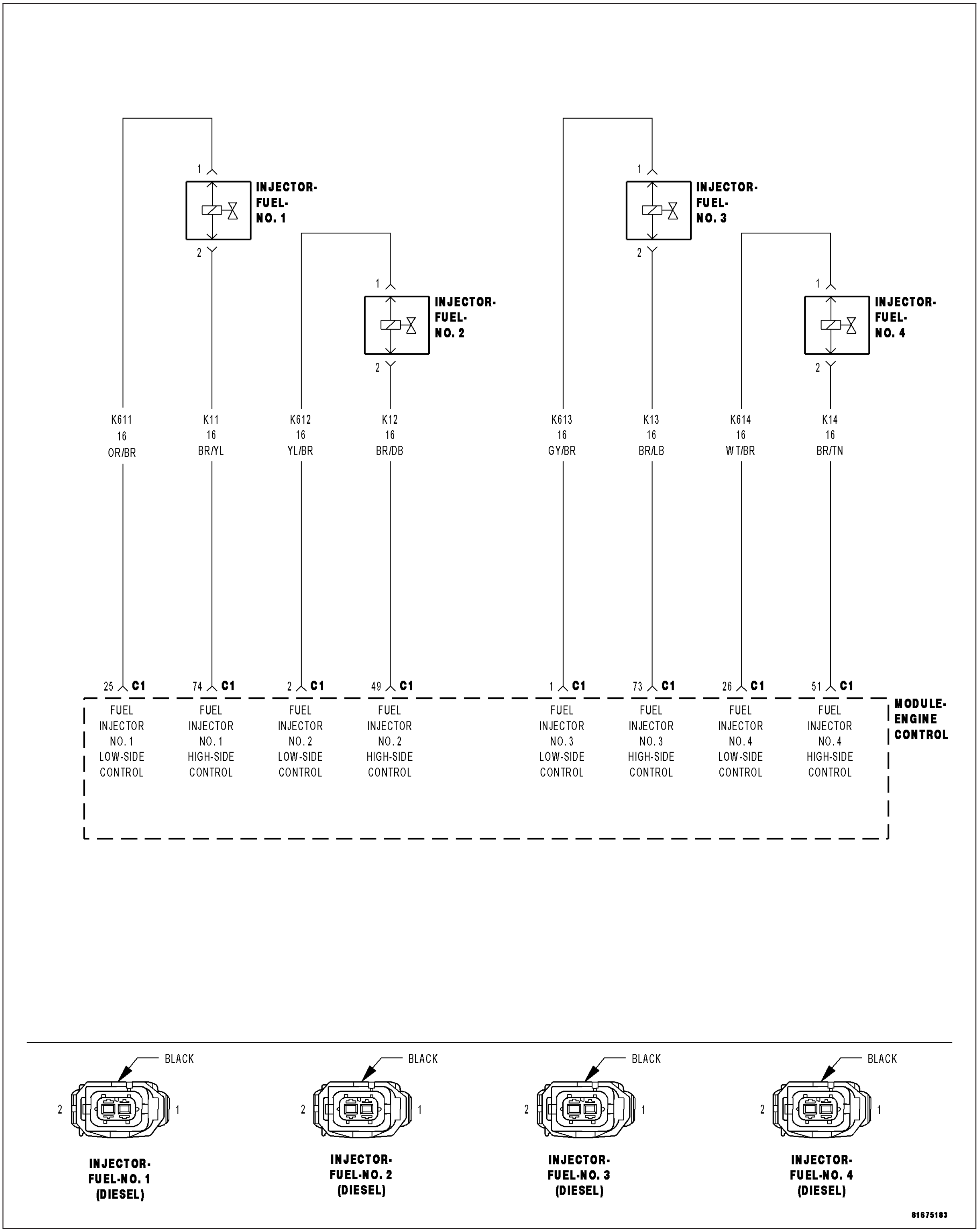
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0203-CYLINDER 3-INJECTOR CIRCUIT OVERCURRENT LOW SIDE




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
| --- |
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

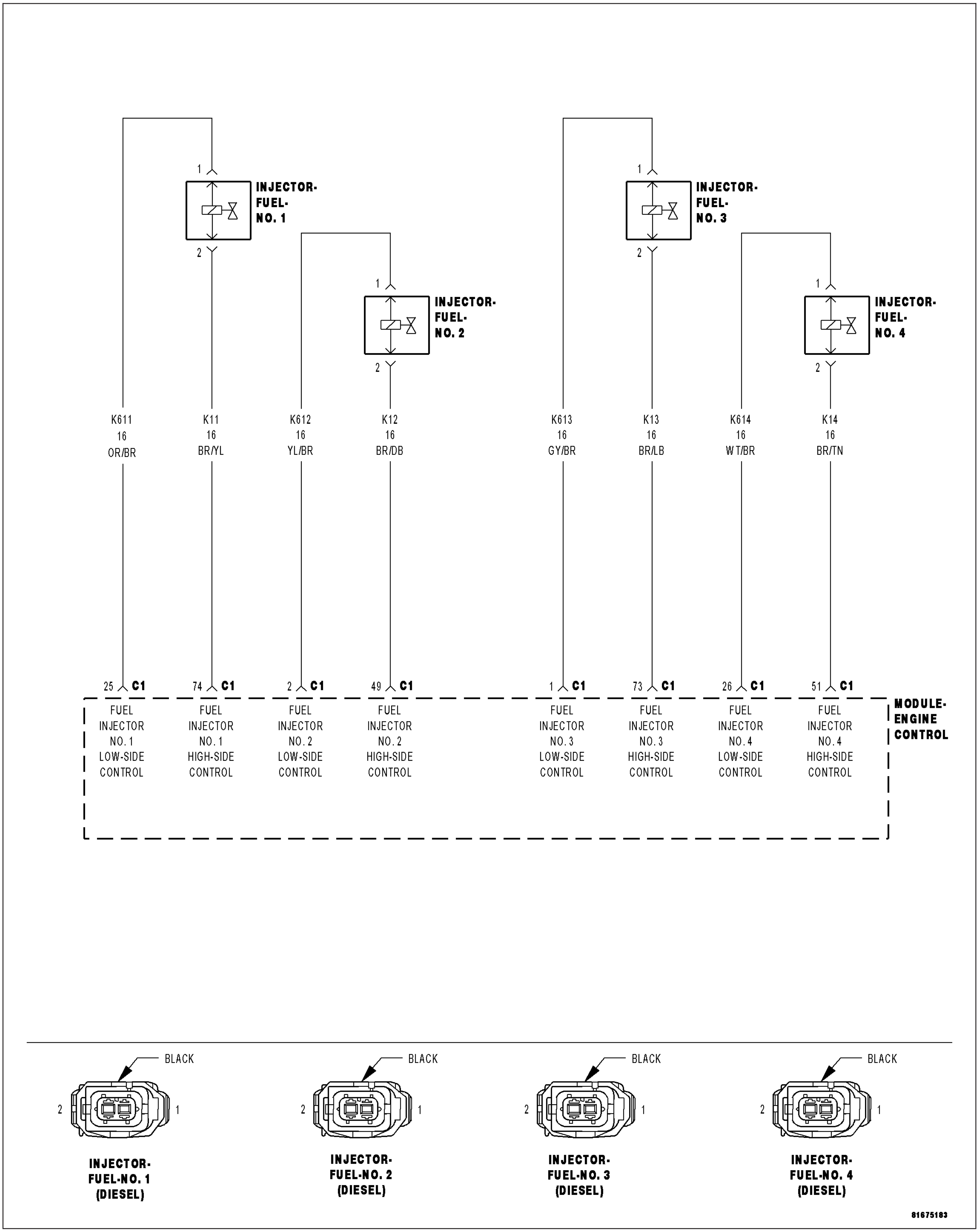
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0203-CYLINDER 3-INJECTOR CIRCUIT OVERCURRENT LOW SIDE




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

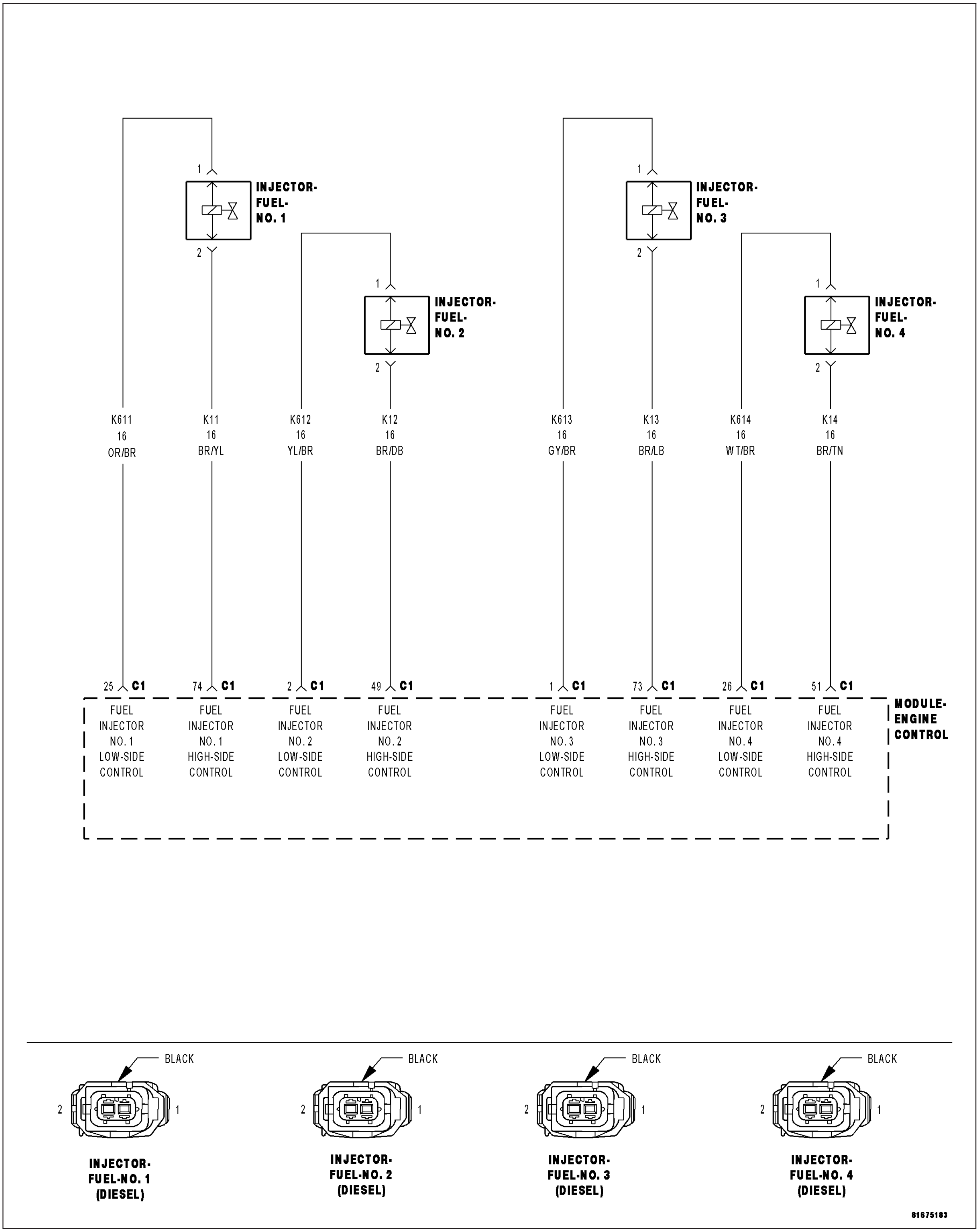
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0203-CYLINDER 3-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

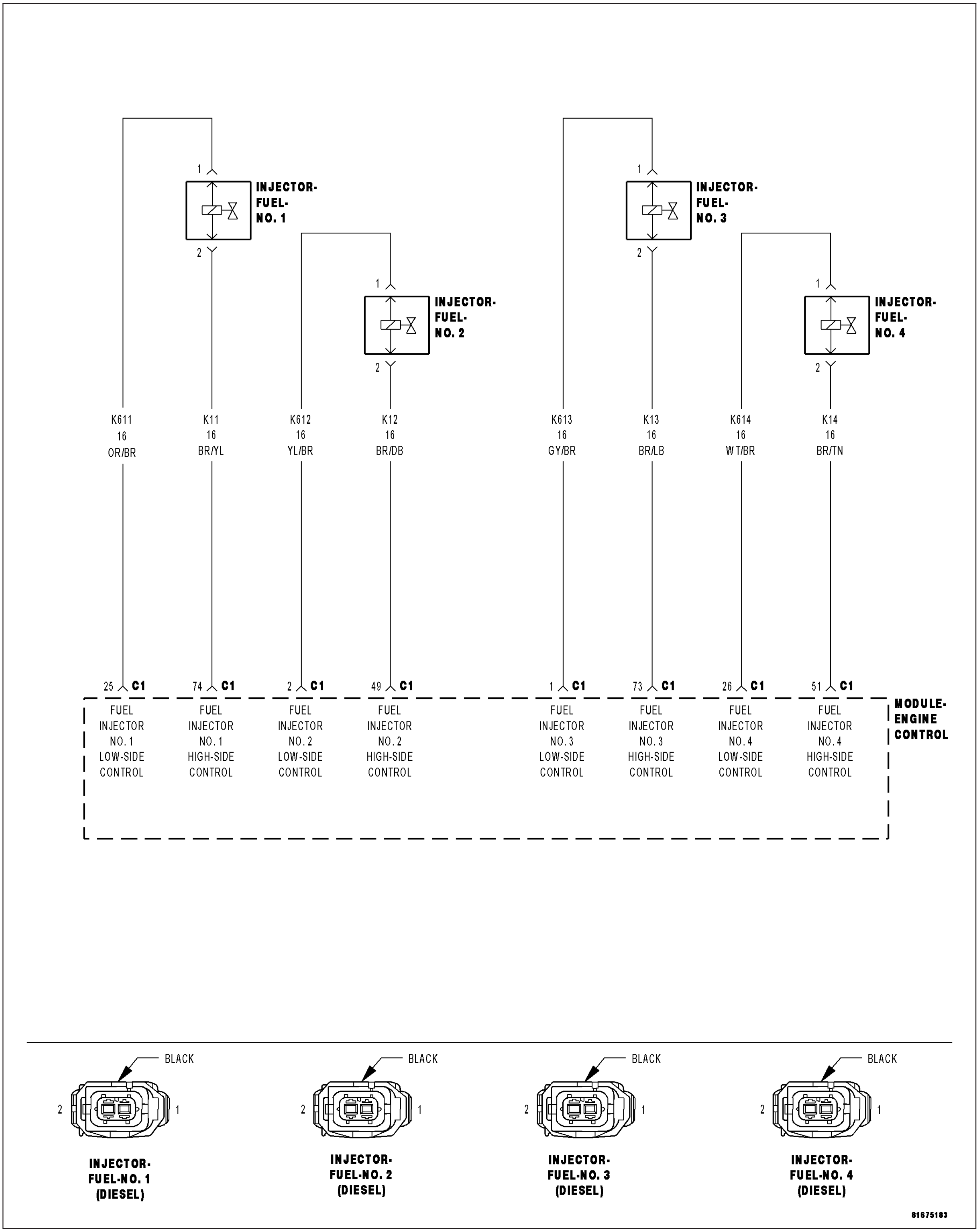
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0204-CYLINDER 4-INJECTOR CIRCUIT CURRENT DECREASE




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

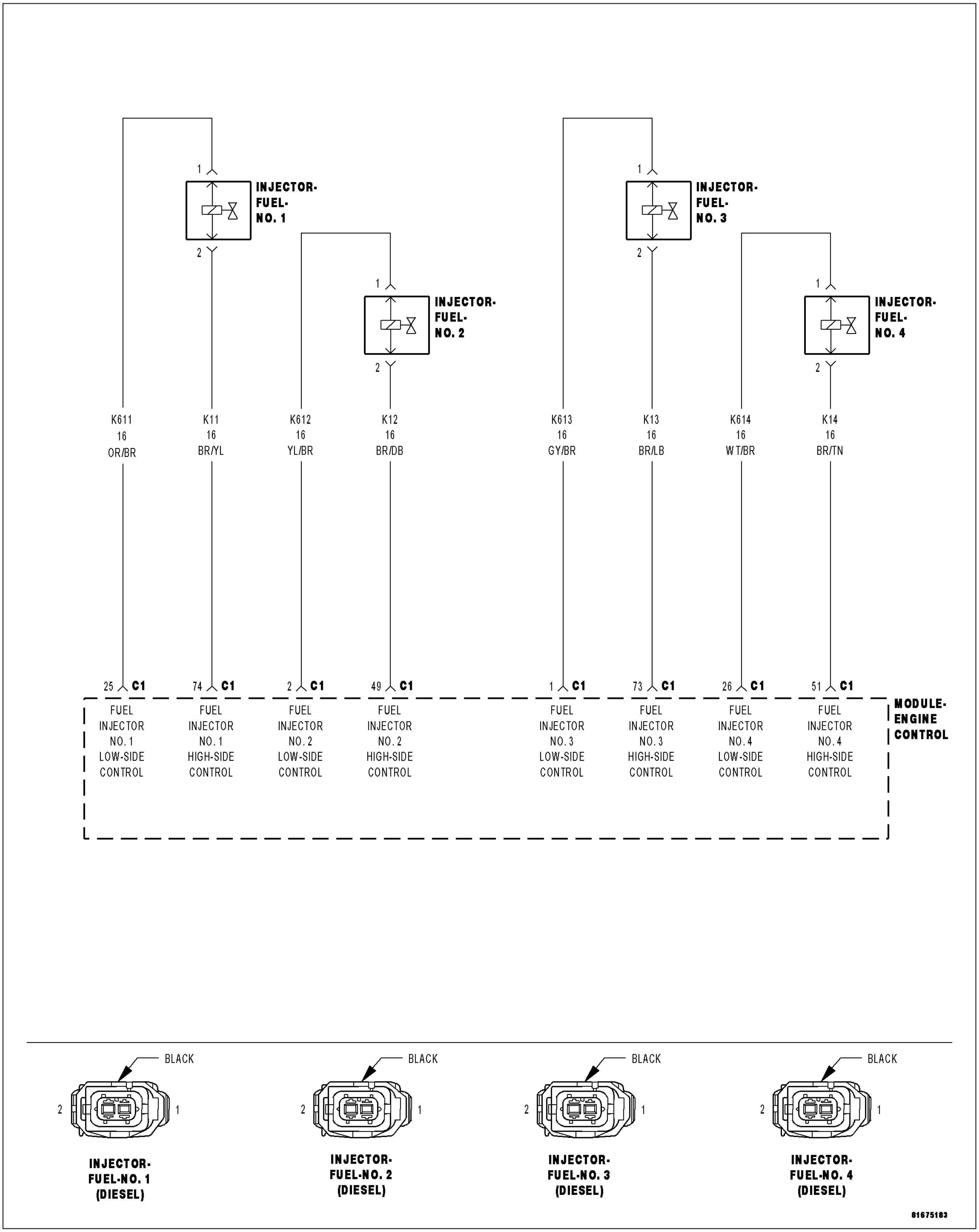
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0204-CYLINDER 4-INJECTOR CIRCUIT LOAD DROP




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

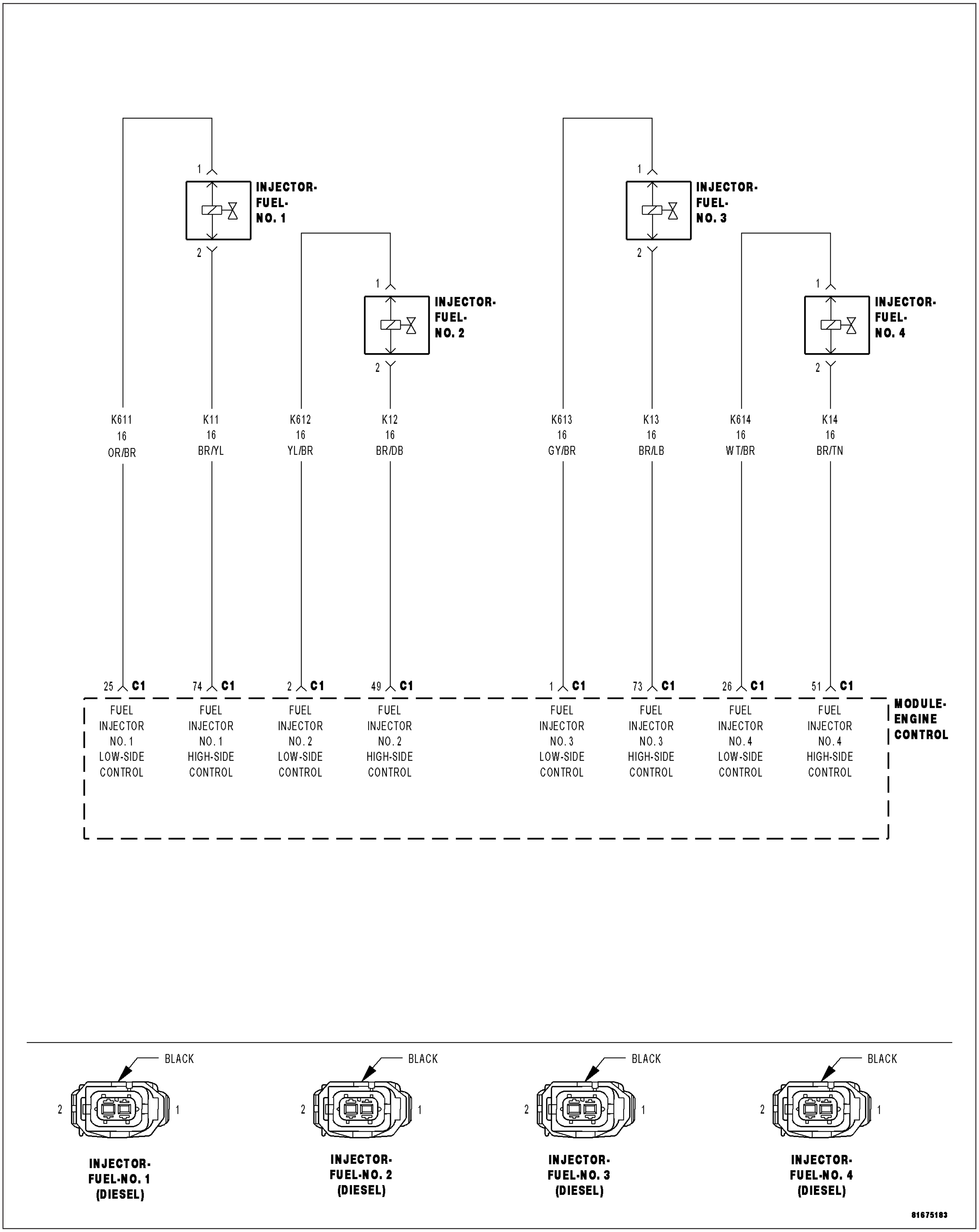
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0204-CYLINDER 4-INJECTOR CIRCUIT OVERCURRENT HIGH SIDE




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

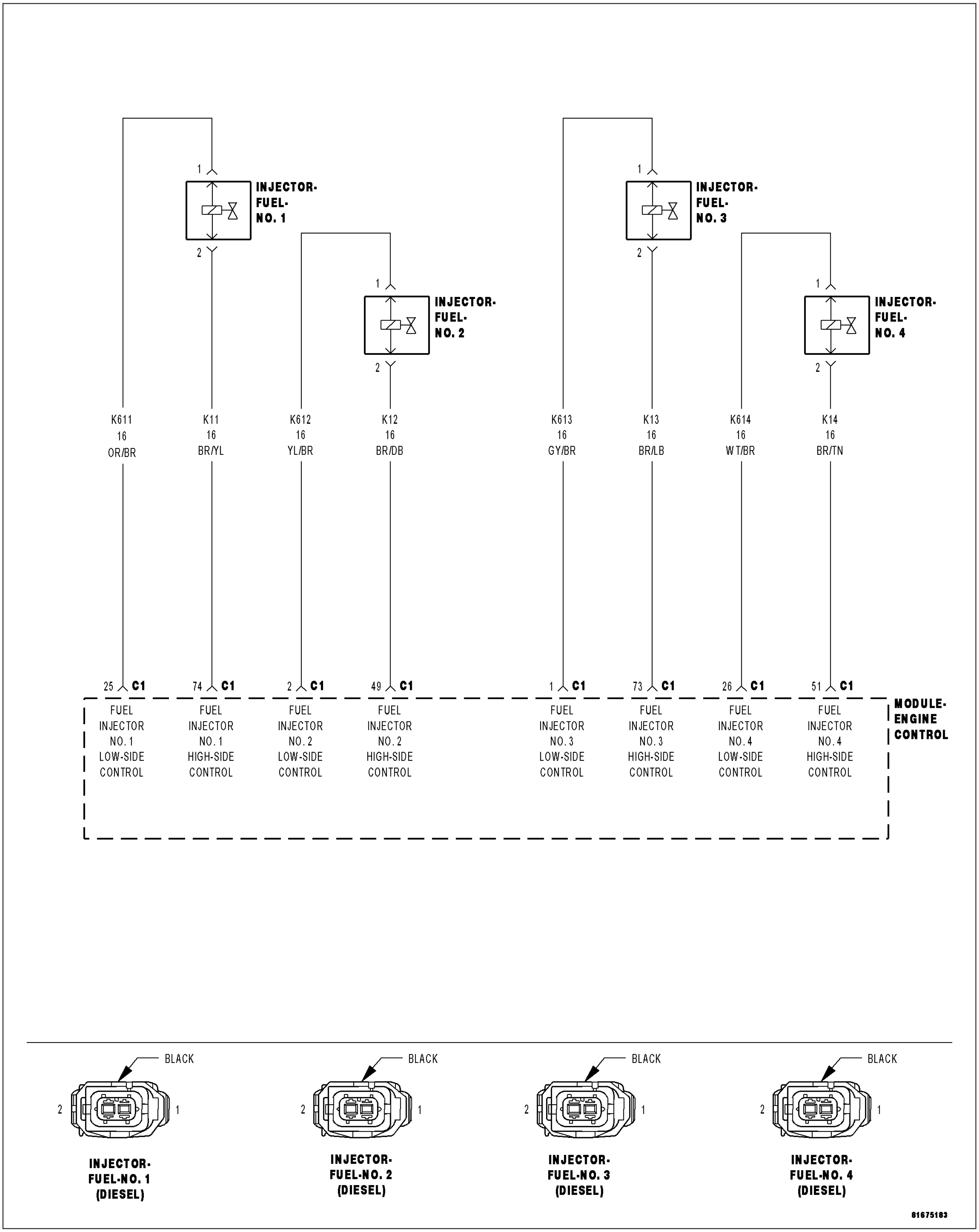
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0204-CYLINDER 4-INJECTOR CIRCUIT OVERCURRENT LOW SIDE




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

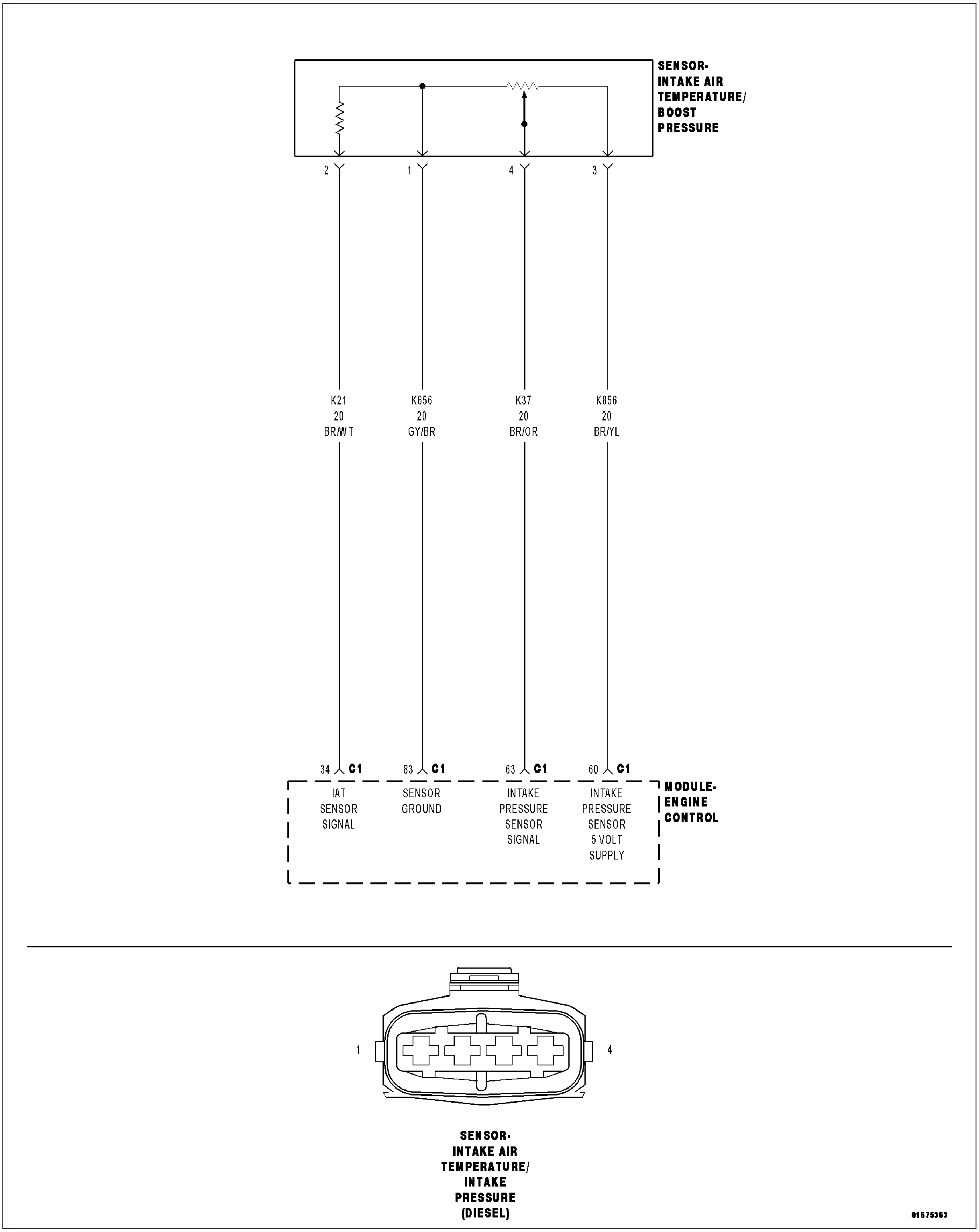
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0234-BOOST PRESSURE SENSOR NEGATIVE DEVIATION




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The Boost Pressure Sensor indicates actual turbocharger boost is less than the ECM setpoint.

| Possible Causes |
| --- |
| AIR FILTER |
| AIR RESTRICTION |
| AIR LEAKS |
| BOOST CONTROL VACUUM SUPPLY |
| BOOST PRESSURE ACTUATOR |
| TURBOCHARGER |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Ensure all turbocharger inlet and outlet tubes are connected properly, without damage and restriction before continuing with this test.**

**NOTE: If DTC P0401 or P0402 is present with this DTC, diagnose P0401 or P0402 before diagnosing this DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle.

Monitor the scan tool for ECM DTCs.

**NOTE: A clogged Boost Pressure Solenoid Air Filter can cause this DTC to set. Inspect this filter and replace as necessary before continuing with this test.**

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Test Complete.

### 2. AIR FILTER

Turn the ignition off.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause air flow restriction.

**Were any of these problems found?**

**Yes** >> Replace the Air Filter element.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. AIR RESTRICTION

**NOTE: Inspect all air intake and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

Turn the ignition off.

Inspect all air intake, crankcase vent and turbocharger related tubes and connections.

**Were any problems found?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. CHECKING THE BOOST CONTROL VACUUM SUPPLY

Refer to symptom Checking The Boost Control Vacuum Supply to check the turbocharger vacuum supply system.

**Were any problems found?**

**Yes** >> Repair as necessary
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. CHECKING FOR AIR LEAKS

Turn the ignition off.

Remove the Inlet Pressure Sensor.

Connect smoke machine 84-04 to the Inlet Pressure Sensor port in the intake duct and begin injecting smoke into the intake system.

Observe all intake system components for evidence of smoke leakage.

**Is there evidence of smoke leakage?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. BOOST PRESSURE ACTUATOR

Turn the ignition off.

Replace the Boost Pressure Actuator in accordance with the Service Information.

**NOTE: Ensure the ECM and Boost Pressure Actuator harness connectors are connected.**

Test drive the vehicle.

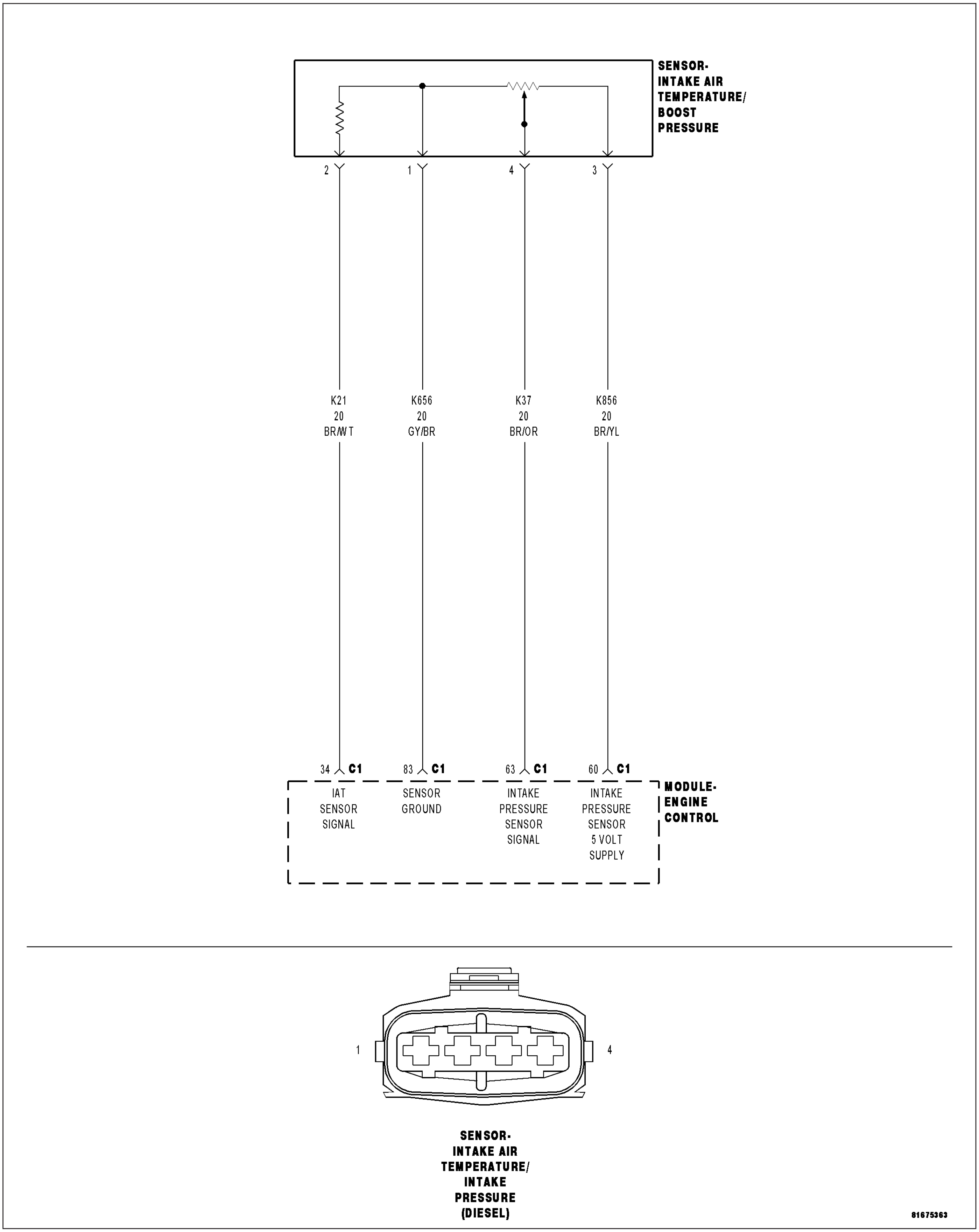
With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

**Yes** >> Replace the Turbocharger assembly in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Boost Pressure Actuator.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0235-BOOST PRESSURE SENSOR PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine speed below 850 rpm. No other Boost Pressure Sensor DTC's. No Atmospheric Pressure Sensor DTC's.
- **Set Condition:**
  The Boost Pressure Sensor signal differs from the Atmospheric Pressure Sensor signal by 150 hpa or greater for at least 2.0 seconds.

| Possible Causes |
|---|
| HIGH RESISTANCE IN THE BOOST PRESSURE SENSOR SIGNAL CIRCUIT |
| HIGH RESISTANCE IN THE BOOST PRESSURE SENSOR GROUND CIRCUIT |
| HIGH RESISTANCE IN THE BOOST PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT |
| BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off, wait 30 seconds, then start and idle the engine for at least 30 seconds.

**NOTE: Engine idle speed must be below 870 RPM.**

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 2. HIGH RESISTANCE IN THE BOOST PRESSURE SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the Boost Pressure/IAT Sensor harness connector.

Disconnect the ECM harness connectors.

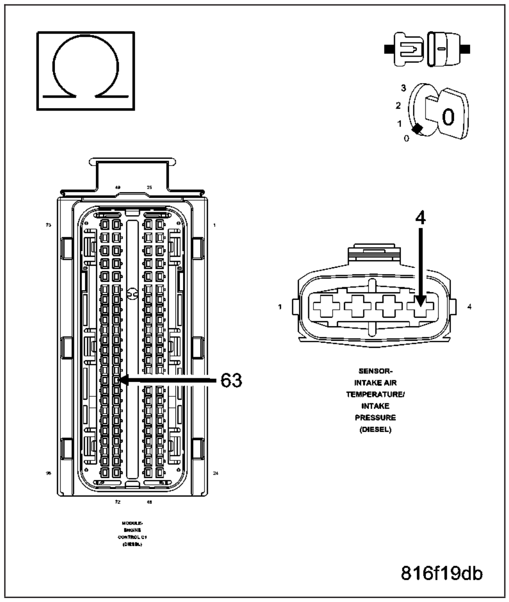
Measure the resistance of the Boost Pressure Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 3

**No** >> Repair the Boost Pressure Sensor Signal circuit for high resistance.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 3. HIGH RESISTANCE IN THE BOOST PRESSURE SENSOR GROUND CIRCUIT

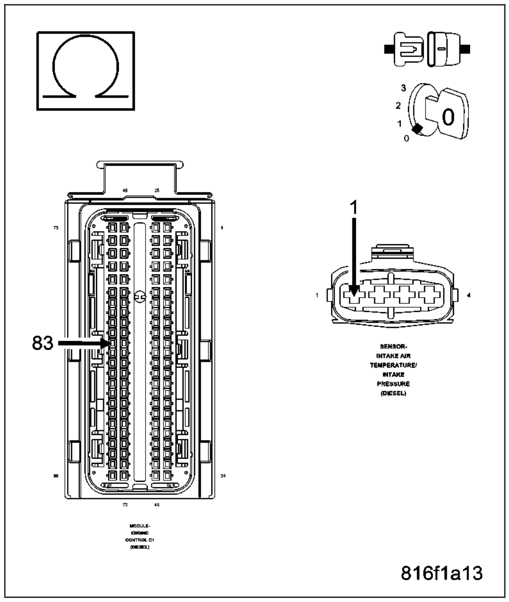
Measure the resistance of the Sensor Ground circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 4

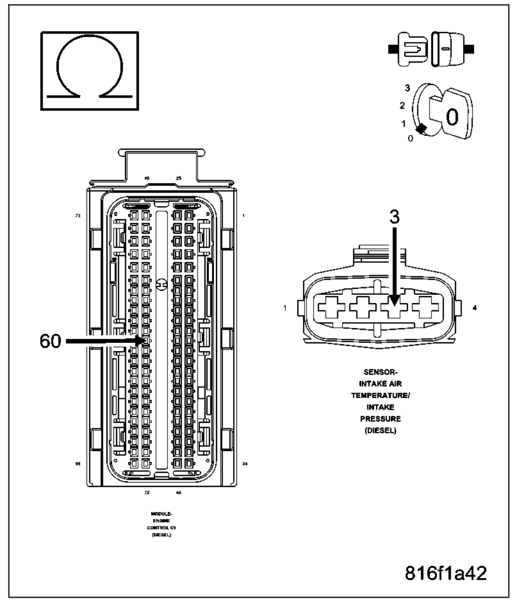
**No** >> Repair the Boost Pressure Sensor Ground circuit for high resistance.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 4. HIGH RESISTANCE IN THE BOOST PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT

Measure the resistance of the Boost Pressure Sensor 5-Volt Supply circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Boost Pressure Sensor 5-Volt Supply circuit for high resistance.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR

Replace the Boost Pressure/Intake Air Temperature Sensor.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle, pausing several times to cycle the ignition.

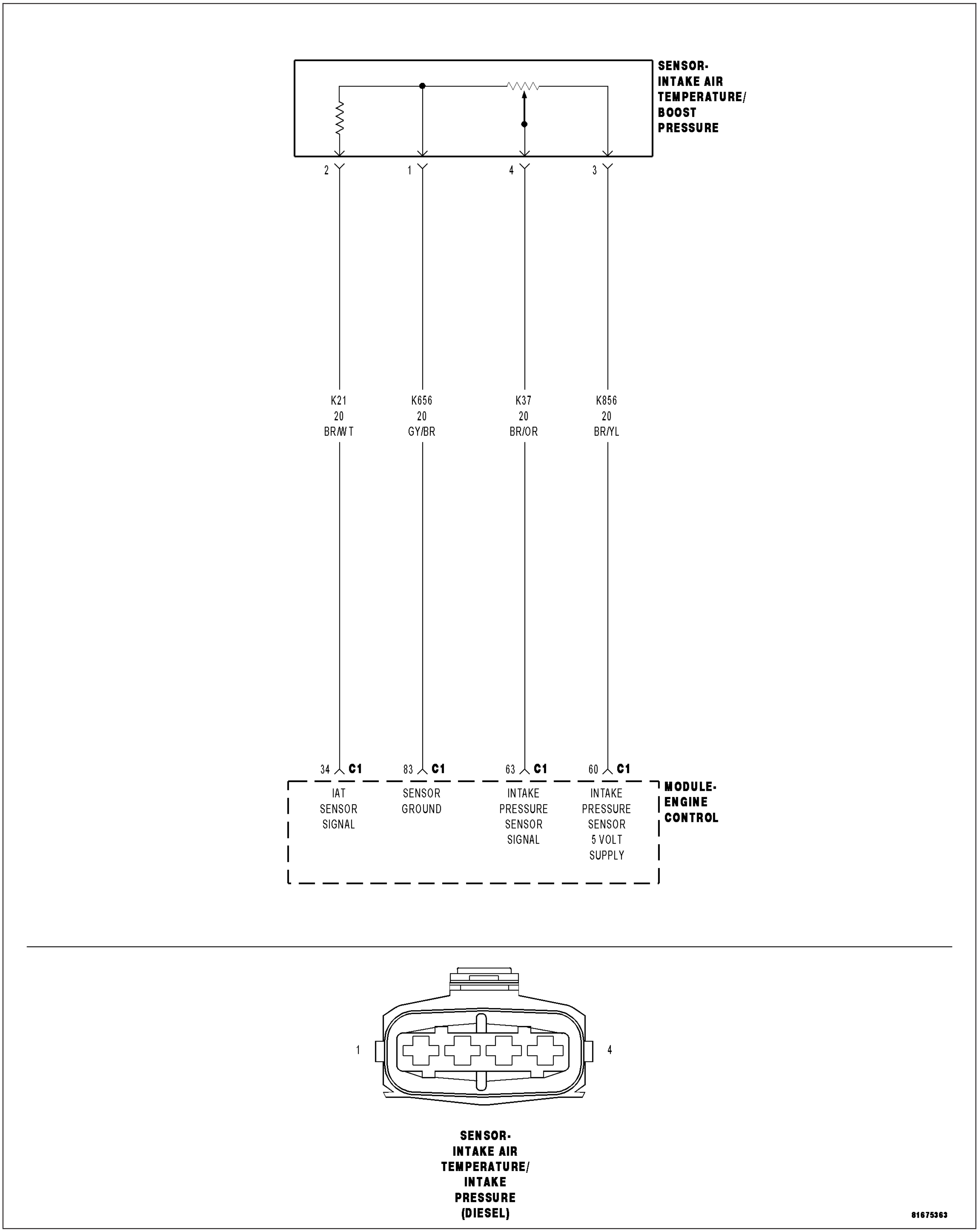
Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0235-BOOST PRESSURE SENSOR SIGNAL VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Boost Pressure Sensor signal voltage is above 4.79 volts for 0.5 seconds.

| Possible Causes |
| --- |
| BOOST PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE |
| BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| BOOST PRESSURE SENSOR GROUND CIRCUIT OPEN |
| BOOST PRESSURE SENSOR |
| POOR CONNECTOR TERMINAL CONTACT |
| ENGINE CONTROL MODULE (INTERNAL) |
| ENGINE CONTROL MODULE (SENSOR SIGNAL SHORTED TO VOLTAGE) |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**NOTE: If a P0234 or P0299 DTC is present with this DTC, diagnose P0234 or P0299 DTC before continuing.**

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Ensure all turbocharger inlet and outlet tubes are connected properly, without damage and restriction before continuing with this test. Also ensure the wastegate actuator and actuator rod are attached and functioning properly.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Cycle the ignition key on and off several times, leaving the key on for at least 10 seconds at a time.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 2. MEASURE THE BOOST PRESSURE SENSOR SIGNAL CIRCUIT VOLTAGE

Turn the ignition off.

Disconnect the Boost Pressure Sensor harness connector.

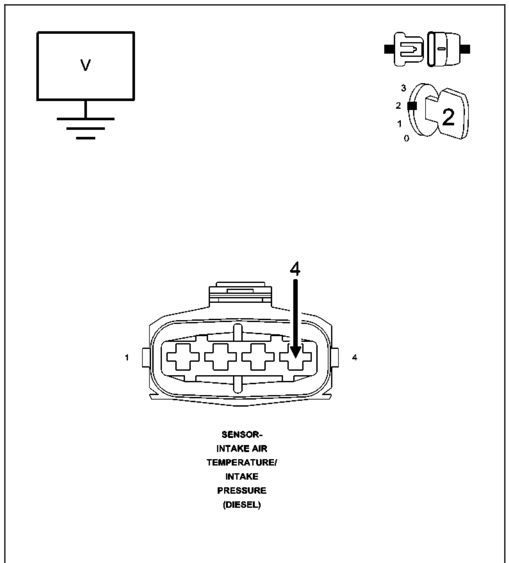
Turn the ignition on.

Measure the voltage between ground and the Boost Pressure Sensor Signal circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Go To 3

**No** >> Go To 4




81701fbb

## 3. BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage between ground and the Boost Pressure Sensor Signal circuit.

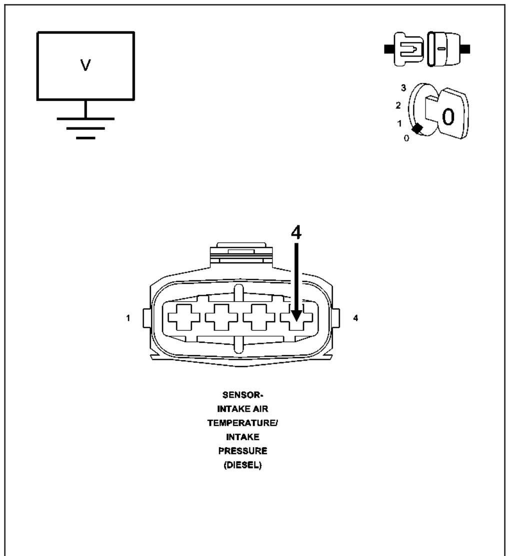
**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Boost Pressure Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



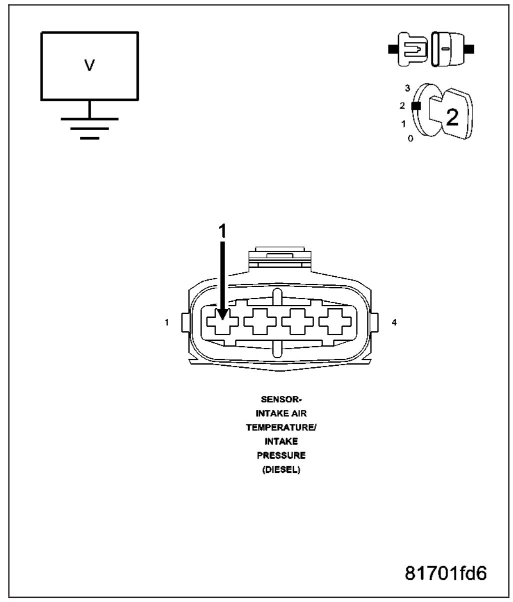

81701fc6

## 4. BOOST PRESSURE SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between ground and the Boost Pressure Sensor Ground circuit.

**NOTE: If the Sensor Ground circuit had a short to voltage on it, the ECM could be damaged. Retest the Fuel Pressure Sensor circuit.**

**Is the voltage above 1.0 volt?**




**Yes** >> Repair the Boost Pressure Sensor Ground circuit for a short to voltage. The ECM will need to be checked for proper operation before the repair is completed. A short to voltage on a ground circuit can damage the ECM.

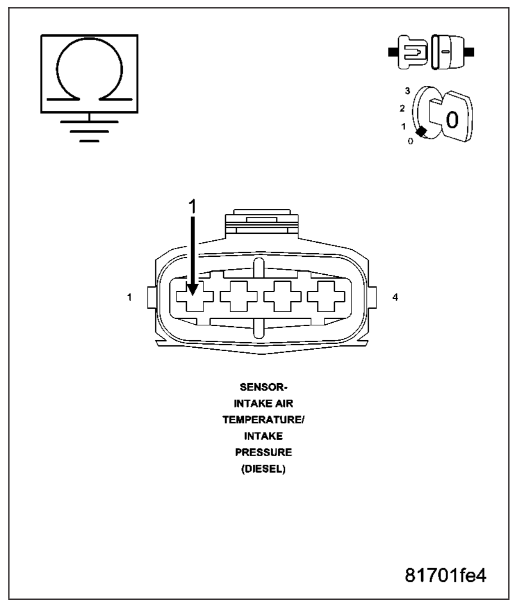
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. BOOST PRESSURE SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the Sensor Ground circuit.

**Is the resistance below 10.0 ohms?**




**Yes** >> Go To 6

**No** >> Repair the Boost Pressure Sensor Ground circuit for an open.

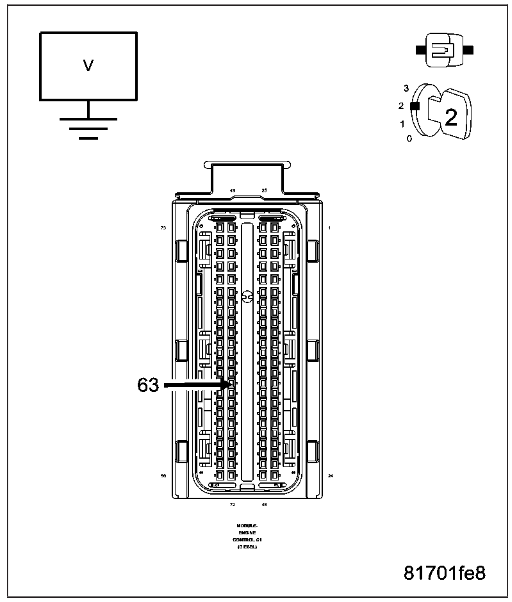
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. BOOST PRESSURE SENSOR

**NOTE: Ensure all harness connectors are connected.**

Turn the ignition on.

Measure the voltage of the Boost Pressure Sensor Signal circuit by back probing ECM harness connector C1, cavity 63.




**Is the voltage above 4.85 volts?**

**Yes** >> Replace the Boost Pressure Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. POOR CONNECTOR TERMINAL CONTACT

Turn the ignition on.

With the scan tool, read ECM DTCs.

With the scan tool, erase ECM DTCs.

**Did this DTC set again?**

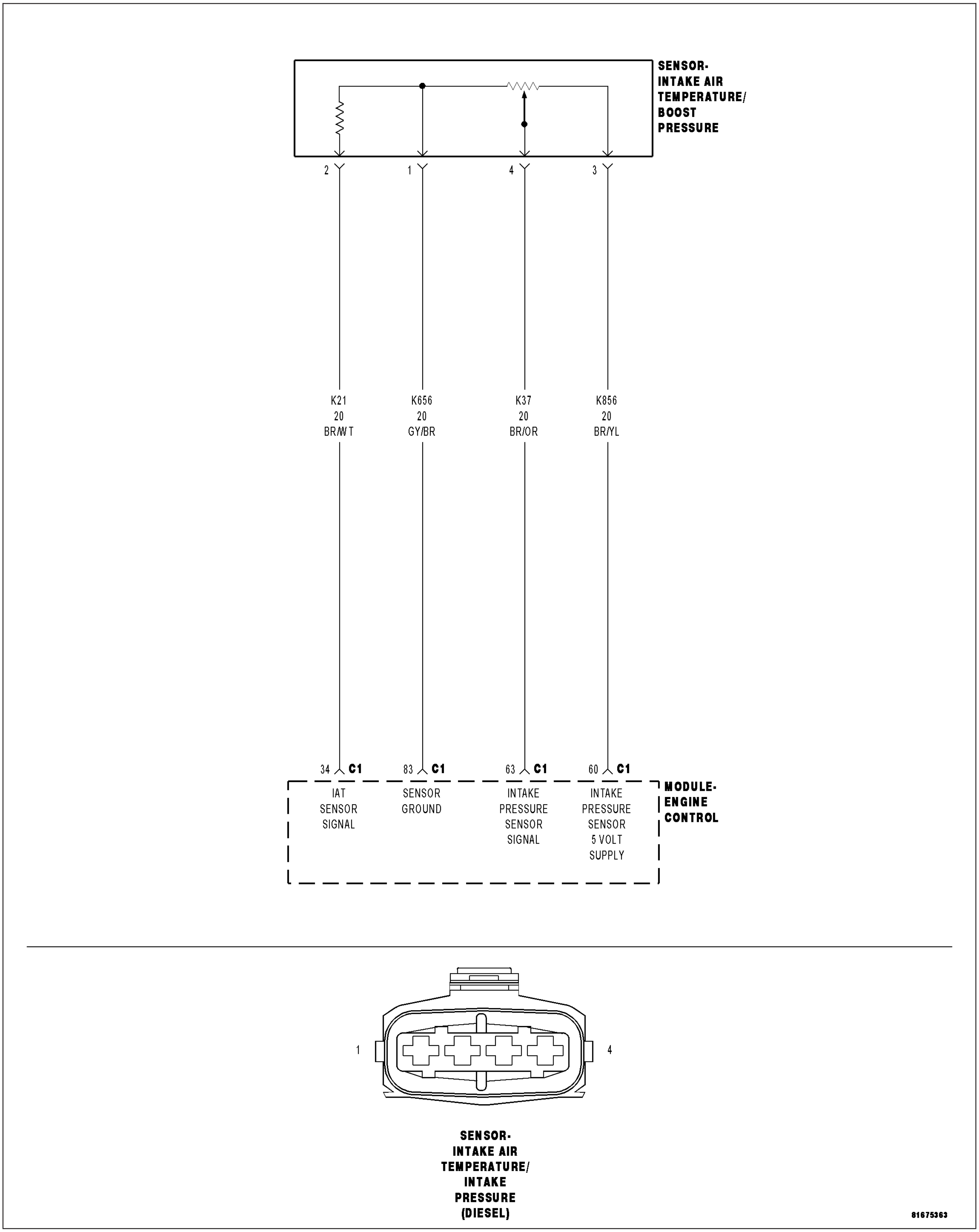
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Ensure good terminal contact between the Boost Pressure Sensor harness connector and the sensor. The repair is complete.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0235-BOOST PRESSURE SENSOR SIGNAL VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Boost Pressure Sensor signal voltage is below 0.29 volt for 0.5 seconds.

| Possible Causes |
| --- |
| BOOST PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT OPEN |
| BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR |
| BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| BOOST PRESSURE SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER |
| BOOST PRESSURE SENSOR SIGNAL CIRCUIT OPEN |
| ENGINE CONTROL MODULE |

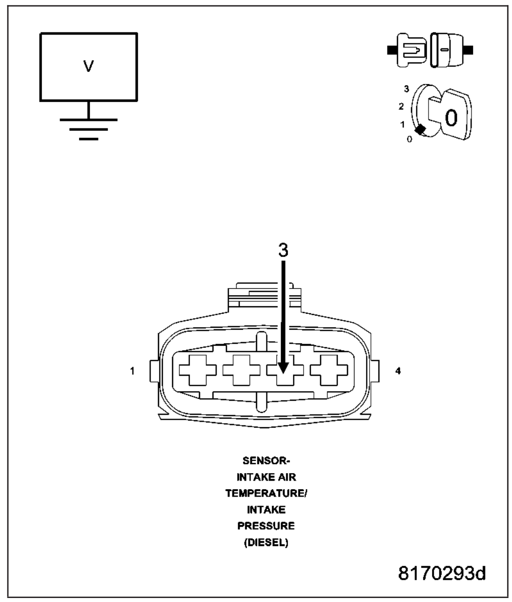
## Diagnostic Test

### 1. READ THE BOOST PRESSURE SENSOR VOLTAGE ON THE SCAN TOOL

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

Turn the ignition on.

With the scan tool, read the Boost Pressure Sensor voltage.




**Is the voltage below 0.2 volt?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 2. SENSOR REFERENCE VOLTAGE B CIRCUIT OPEN

Turn the ignition off.

Disconnect the Boost Pressure/IAT Sensor harness connector.

Turn the ignition on.

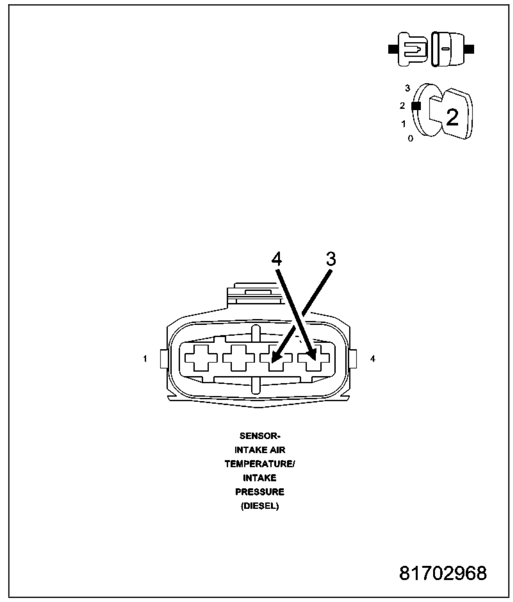
Measure the voltage between ground and the Boost Pressure Sensor 5-Volt Supply circuit.

**Is the voltage above 4.9 volts?**

**Yes** >> Go To 3

**No** >> Repair the Boost Pressure Sensor 5-Volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 3. BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR

Turn the ignition off.

Disconnect the Boost Pressure/IAT Sensor harness connector.

Turn the ignition on.

Connect a jumper wire between the Boost Pressure Sensor Signal and Boost Pressure Sensor 5-Volt Supply circuits.

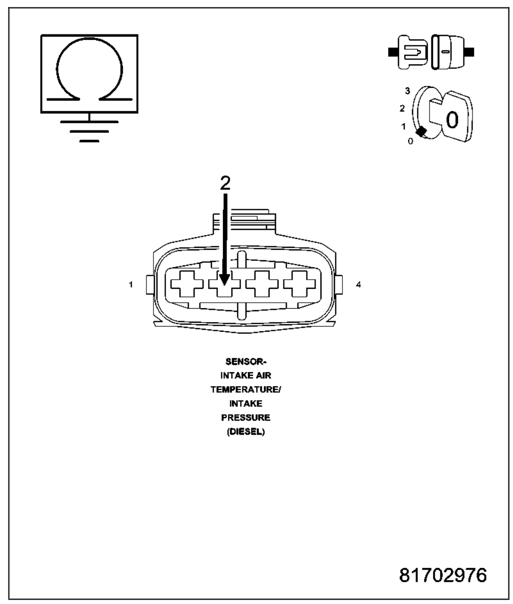
With the scan tool, read the Boost Pressure Sensor voltage.

**Is the Boost Pressure Sensor voltage above 4.5 volts?**

**Yes** >> Replace the Boost Pressure/Intake Air Temperature Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4



## 4. BOOST PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

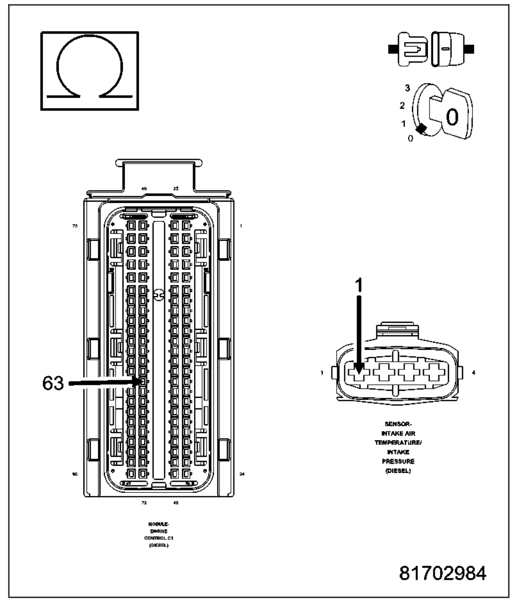
Measure the resistance between ground and the Boost Pressure Sensor Signal circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Boost Pressure Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 5. BOOST PRESSURE SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER

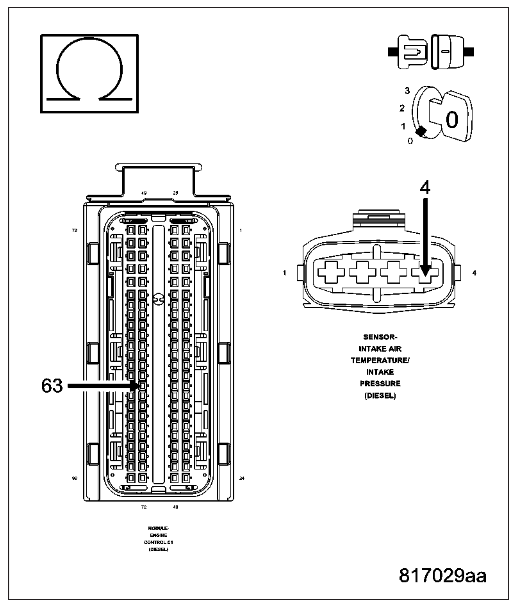
Measure the resistance between the Boost Pressure Sensor Signal circuit and Sensor Ground circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

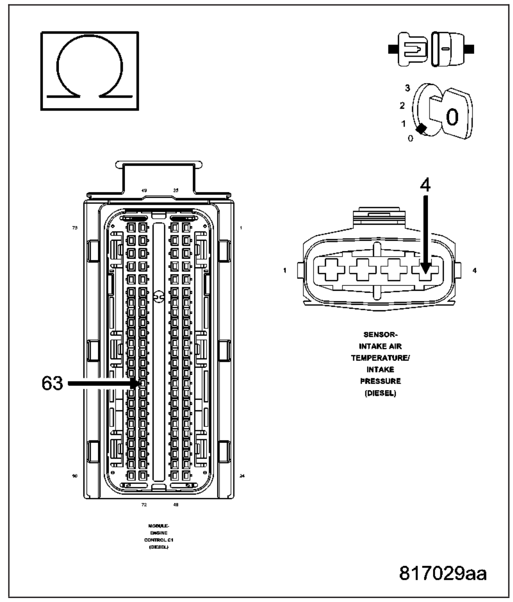
**No** >> Repair the Boost Pressure Sensor Signal circuit for a short to the Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 6. BOOST PRESSURE SENSOR SIGNAL CIRCUIT OPEN

Measure the resistance of the Boost Pressure Sensor Signal circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the Boost Pressure Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. ENGINE CONTROL MODULE

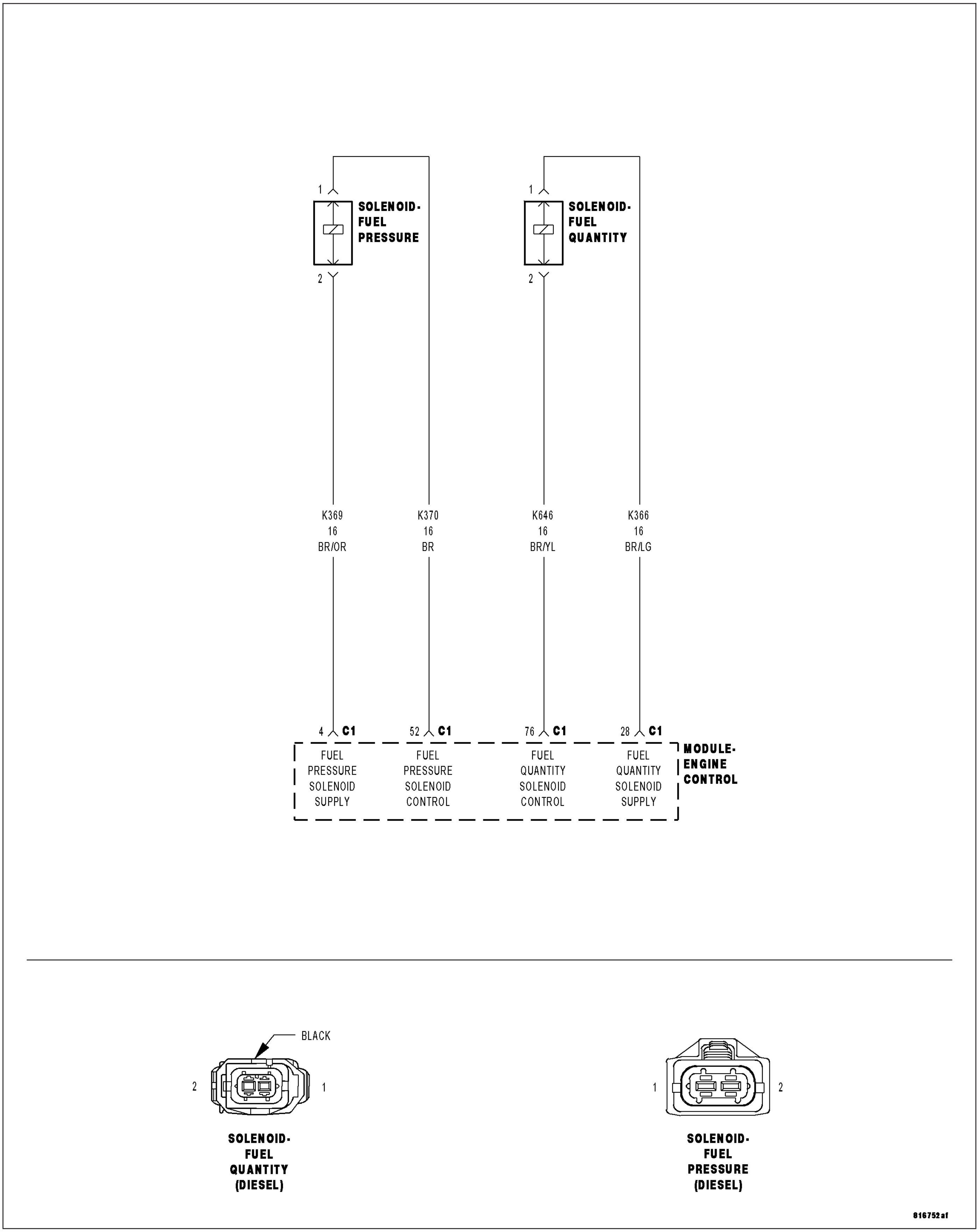
**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0251-FUEL QUANTITY SOLENOID OPEN OR SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an open or excessive current on the Fuel Quantity Solenoid circuit.

| Possible Causes |
|---|
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL QUANTITY SOLENOID OPEN CIRCUIT(S) |
| FUEL QUANTITY SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. VERIFY CURRENT DTC

Turn the ignition on.
With the scan tool, erase ECM DTCs.
Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

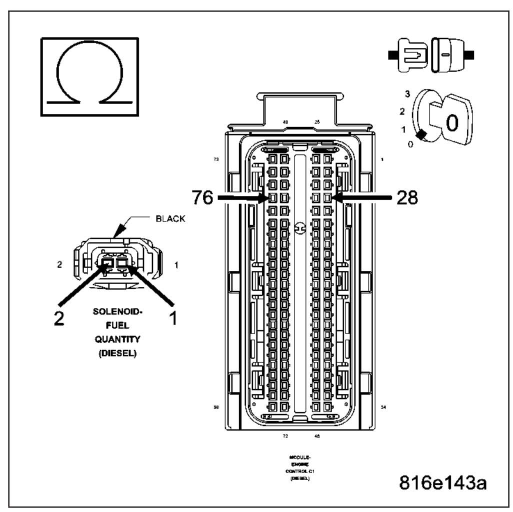
**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL QUANTITY SOLENOID CIRCUIT(S) OPEN

Turn the ignition off.
Disconnect the ECM harness connectors.
Disconnect the Fuel Quantity Solenoid harness connector.
Measure the resistance of each of the Fuel Quantity Solenoid circuits between the ECM harness connector and the Fuel Quantity Solenoid harness connector.




**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 4

**No** >> Repair the circuit(s) that measured above 10.0 ohms for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL QUANTITY SOLENOID

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0251-FUEL QUANTITY SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

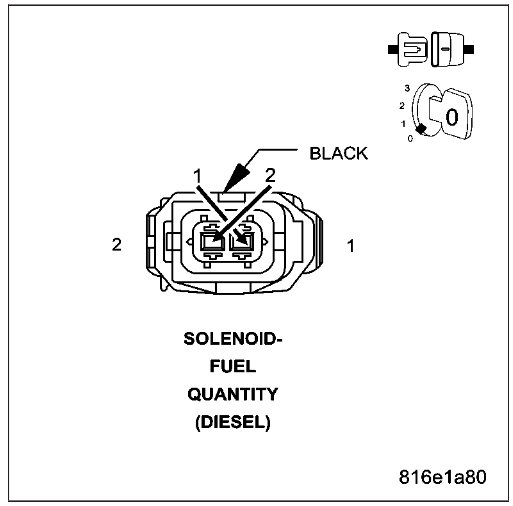
Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0251-FUEL QUANTITY SOLENOID SHORT CIRCUIT.**

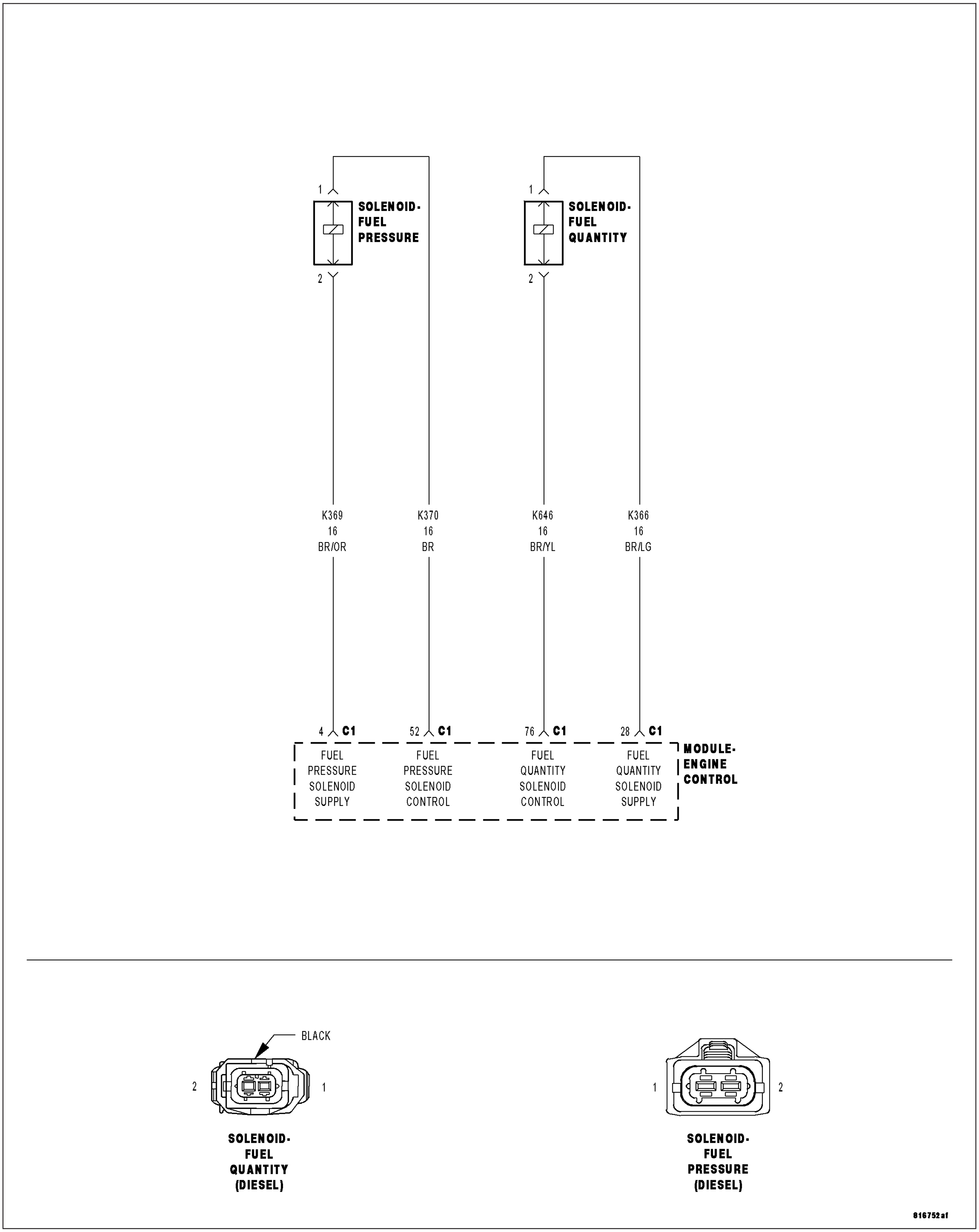



**Does the scan tool display the appropriate DTC for each condition?**

**Yes** >> Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0252-FUEL QUANTITY SOLENOID CIRCUIT MALFUNCTION




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Fuel Quantity Solenoid command on.
- **Set Condition:**
  The ECM detects excessive current on the Fuel Quantity Solenoid circuit.

| Possible Causes |
| --- |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL QUANTITY SOLENOID OPEN CIRCUIT(S) |
| INTERMITTENT CONDITION |
| FUEL QUANTITY SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. VERIFY CURRENT DTC

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL QUANTITY SOLENOID CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Quantity Solenoid harness connector.

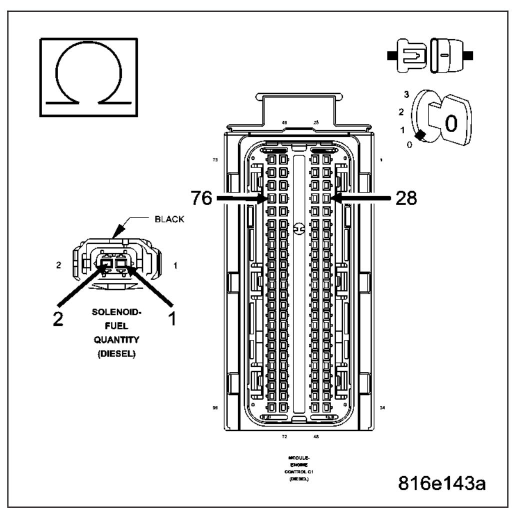
Measure the resistance of each of the Fuel Quantity Solenoid circuits between the ECM harness connector and the Fuel Quantity Solenoid harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 4

**No** >> Repair the circuit(s) that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



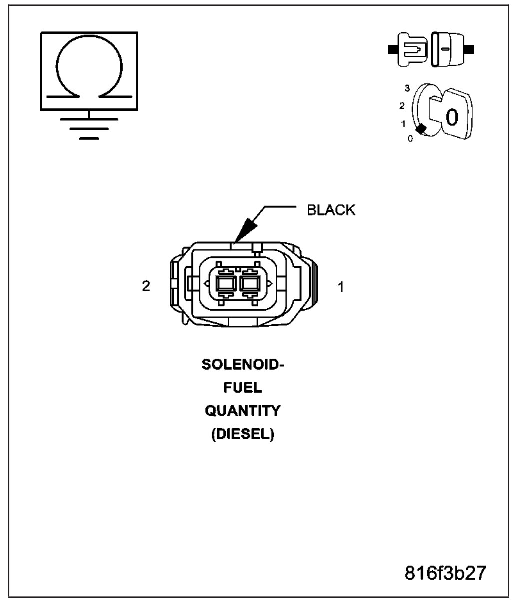
## 4. FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Quantity Solenoid harness connector.

Measure the resistance between ground and each of the Fuel Quantity Solenoid circuits.




**Is the resistance above 1000 ohms for each measurement?**

**Yes** >> Go To 5

**No** >> Repair the circuit(s) that measured below 1000 ohms for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

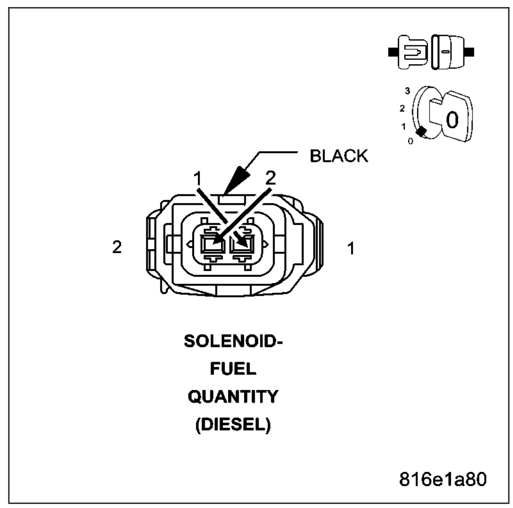
## 5. FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Quantity Solenoid harness connector.

Measure the resistance between the Fuel Quantity Solenoid circuits.



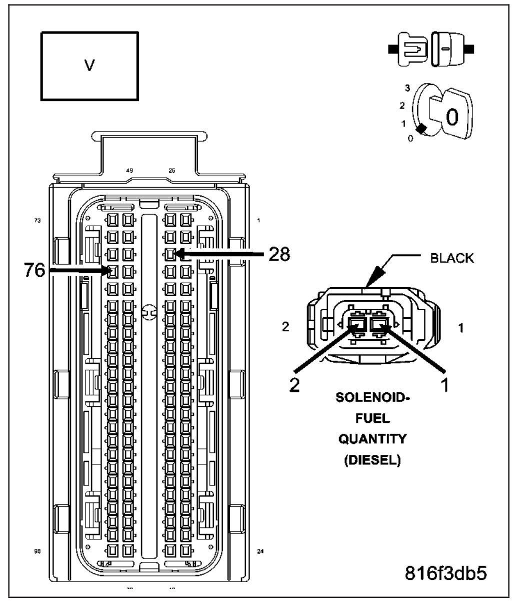

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Fuel Quantity Solenoid circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Quantity Solenoid harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage each of the Fuel Quantity Solenoid circuits.

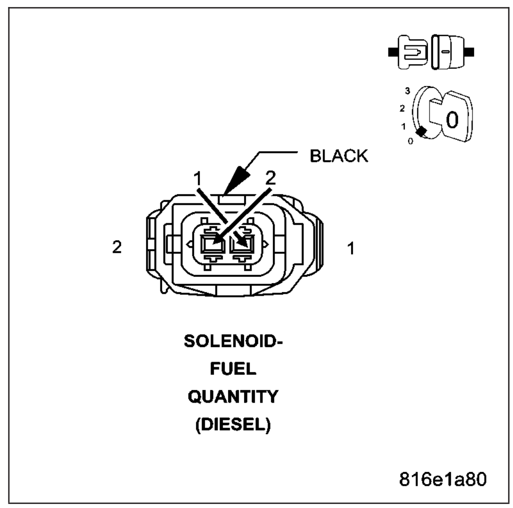
**Is the voltage below 1.0 volt for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the circuit(s) that measured above 1.0 volts for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. FUEL QUANTITY SOLENOID




Turn the ignition off.

Disconnect the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0090-FUEL QUANTITY SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0092-FUEL QUANTITY SOLENOID SHORT CIRCUIT.**

**Does the scan tool display the appropriate DTC for each condition?**

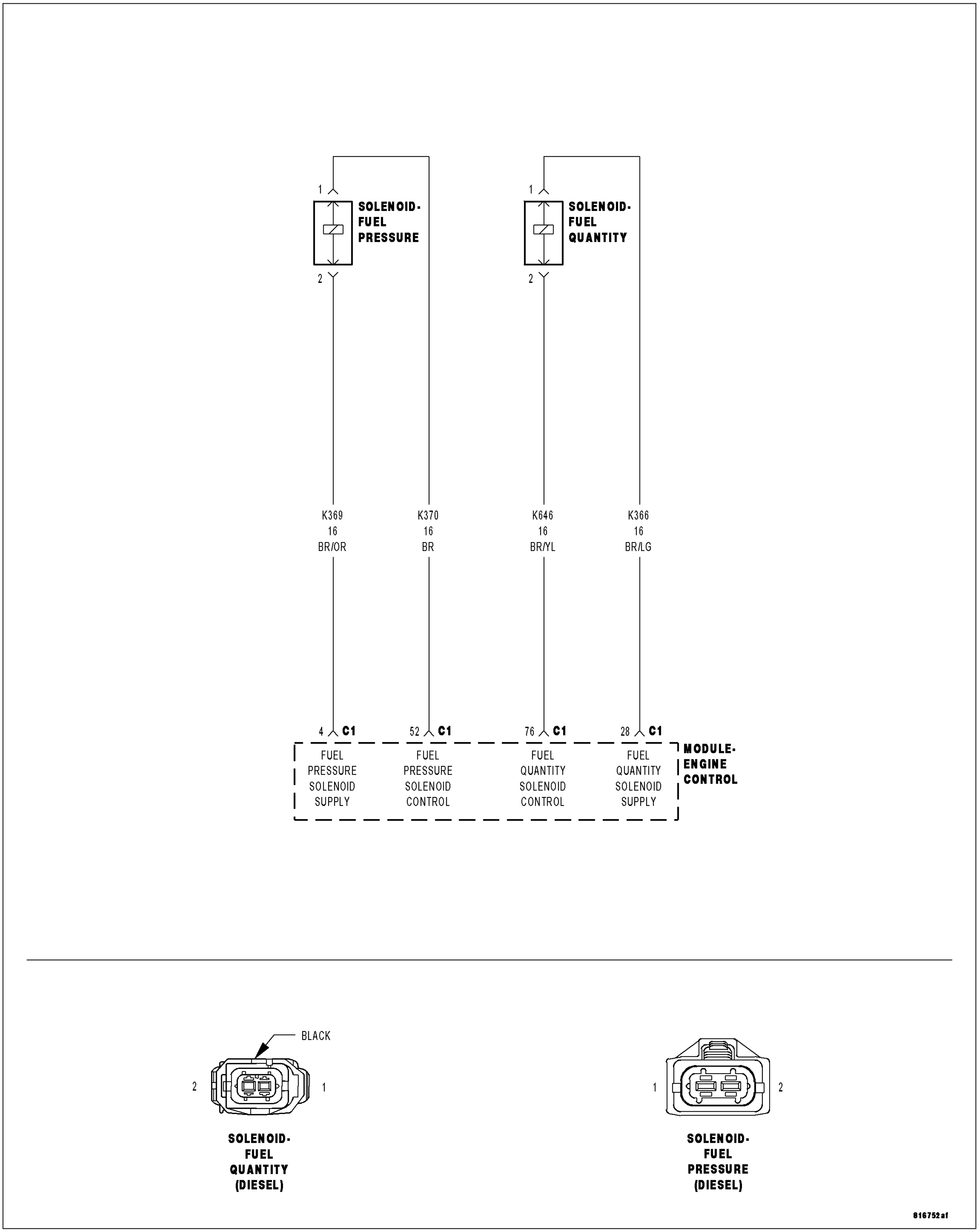
**Yes** >> Replace the Fuel Quantity Solenoid in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0253-FUEL QUANTITY SOLENOID SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Fuel Quantity Solenoid command off.
- **Set Condition:**
  The ECM detects a short to ground on the Fuel Quantity Solenoid circuit.

| Possible Causes |
|---|
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL QUANTITY SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. VERIFY CURRENT DTC

Turn the ignition on.
With the scan tool, erase ECM DTCs.
Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

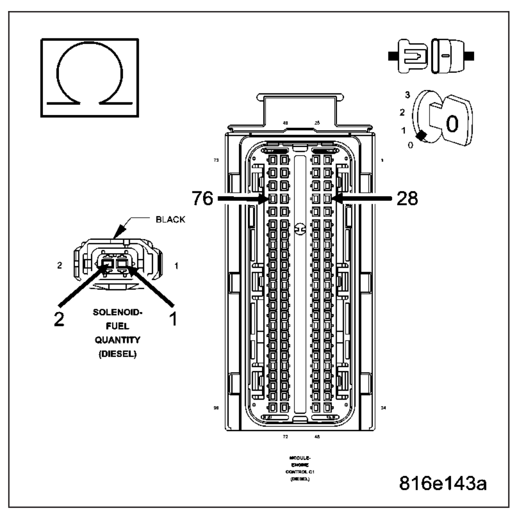
**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO GROUND

Turn the ignition off.
Disconnect the ECM harness connectors.
Disconnect the Fuel Quantity Solenoid harness connector.
Measure the resistance between ground and each of the Fuel Quantity Solenoid circuits.




**Is the resistance above 1000 ohms for each measurement?**

**Yes** >> Go To 4

**No** >> Repair the circuit(s) that measured below 1000 ohms for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL QUANTITY SOLENOID

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0252-FUEL QUANTITY SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

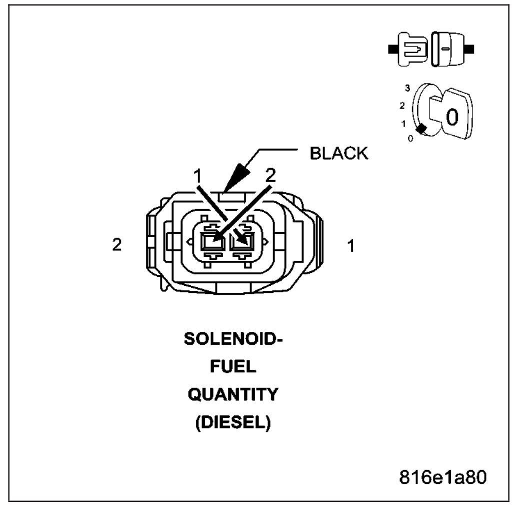
Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0252-FUEL QUANTITY SOLENOID SHORT CIRCUIT.**

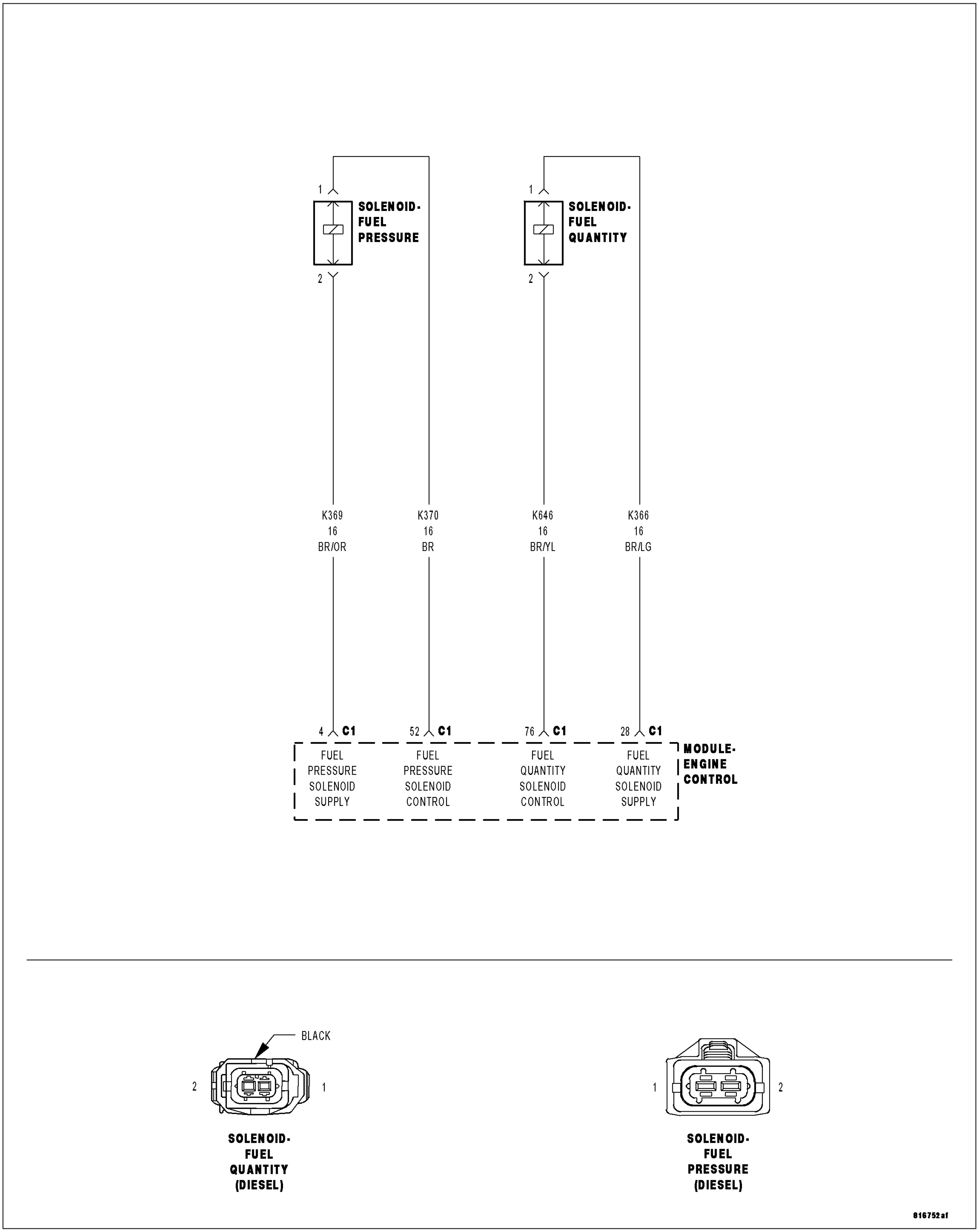



**Does the scan tool display the appropriate DTC for each condition?**

**Yes** >> Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0254-FUEL QUANTITY SOLENOID SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Fuel Quantity Solenoid command on.
- **Set Condition:**
  The ECM detects excessive current on the Fuel Quantity Solenoid circuit.

| Possible Causes |
|---|
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL QUANTITY SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. VERIFY CURRENT DTC

Turn the ignition on.
With the scan tool, erase ECM DTCs.
Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

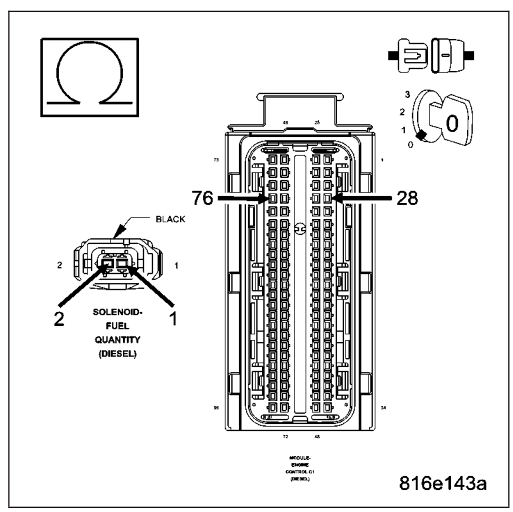
**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TOGETHER

Turn the ignition off.
Disconnect the ECM harness connectors.
Disconnect the Fuel Quantity Solenoid harness connector.
Measure the resistance between the Fuel Quantity Solenoid circuits.

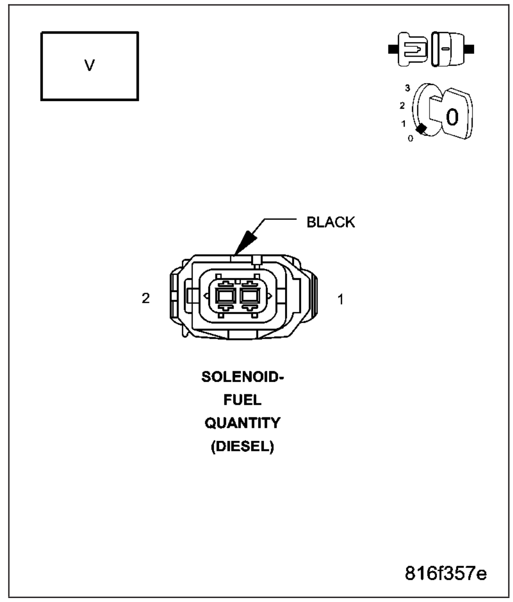



**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Fuel Quantity Solenoid circuits for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL QUANTITY SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Quantity Solenoid harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

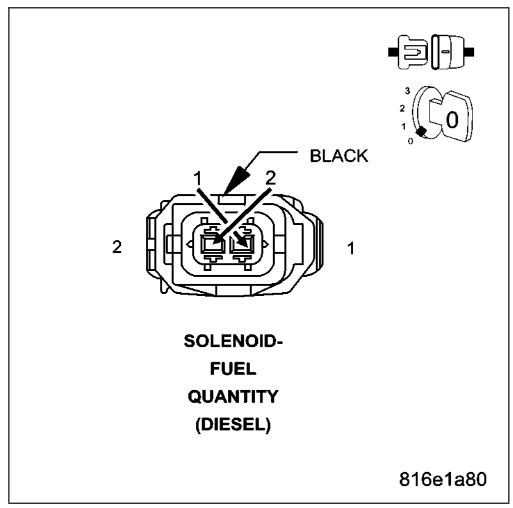
Measure the voltage each of the Fuel Quantity Solenoid circuits.

**Is the voltage below 1.0 volt for each measurement?**

**Yes** >> Go To 5

**No** >> Repair the circuit(s) that measured above 1.0 volts for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. FUEL QUANTITY SOLENOID




Turn the ignition off.

Disconnect the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0090-FUEL QUANTITY SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Quantity Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P0092-FUEL QUANTITY SOLENOID SHORT CIRCUIT.**

**Does the scan tool display the appropriate DTC for each condition?**

**Yes** >> Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0299-BOOST PRESSURE SENSOR POSITIVE DEVIATION

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The Boost Pressure Sensor indicates actual turbocharger boost is greater than the ECM setpoint.

| Possible Causes |
|---|
| AIR FILTER |
| AIR RESTRICTION |
| CHECKING FOR AIR LEAKS |
| CHECKING THE BOOST CONTROL VACUUM SUPPLY |
| BOOST PRESSURE ACTUATOR |
| TURBOCHARGER |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Ensure all turbocharger inlet and outlet tubes are connected properly, without damage and restriction before continuing with this test.**

**NOTE: If DTC P0401 or P0402 is present with this DTC, diagnose P0401 or P0402 before diagnosing this DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle.

Monitor the scan tool for ECM DTCs.

**NOTE: A clogged Boost Pressure Solenoid Air Filter can cause this DTC to set. Inspect this filter and replace as necessary before continuing with this test.**

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Test Complete.

### 2. AIR FILTER

Turn the ignition off.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause air flow restriction.

**Were any of these problems found?**

**Yes** >> Replace the Air Filter element.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. AIR RESTRICTION

**NOTE: Inspect all air intake and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

Turn the ignition off.

Inspect all air intake, crankcase vent and turbocharger related tubes and connections.

**Were any problems found?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. CHECKING THE BOOST CONTROL VACUUM SUPPLY

Turn the ignition off.

Refer to symptom Checking The Boost Control Vacuum Supply to check the turbocharger vacuum supply system.

**Were any problems found?**

**Yes** >> Repair as necessary
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. CHECKING FOR AIR LEAKS

Turn the ignition off.

Remove the Inlet Pressure Sensor.

Connect smoke machine 84-04 to the Inlet Pressure Sensor port in the intake duct and begin injecting smoke into the intake system.

Observe all intake system components for evidence of smoke leakage.

**Is there evidence of smoke leakage?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. BOOST PRESSURE ACTUATOR

Turn the ignition off.

Replace the Boost Pressure Actuator in accordance with the Service Information.

**NOTE: Ensure the ECM and Boost Pressure Actuator harness connectors are connected.**

Test drive the vehicle.

With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

**Yes** >> Replace the Turbocharger assembly in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Boost Pressure Actuator.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0300-MISFIRE DETECTED

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM detects multiple misfires from one or more cylinders.

| Possible Causes |
|---|
| ENGINE COMPRESSION |
| FUEL INJECTOR QUANTITY |
| FUEL SUPPLY CONTAMINATION |
| INJECTOR LEAKAGE |
| INTERMITTENT CONDITION |

### Diagnostic Test

#### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

With the scan tool, erase ECM DTCs.

Test drive the vehicle and attempt to duplicate the problem.

With the scan tool, read ECM DTC's.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

#### 2. FUEL CONTAMINATION

Refer to the Service Information and inspect the fuel supply for contamination.

**Is the fuel contaminated?**

**Yes** >> Refer to the Service Information to remove and replace fuel throughout the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

#### 3. ENGINE COMPRESSION

Turn the ignition off.

With the scan tool, perform the Cylinder Compression Test.

**Is the cylinder compression within specification for all cylinders?**

**Yes** >> Go To 4

**No** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL INJECTOR QUANTITY

Turn the ignition off.
With the scan tool, perform the Injector Quantity Test.

**Is the Injector Quantity within specification for all cylinders?**

**Yes** >> Go To 5

**No** >> Repair or replace as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. FUEL INJECTOR LEAKAGE

Turn the ignition off.
Perform the INJECTOR LEAKAGE TEST in accordance with the Service Information.

**Were any problems found?**

**Yes** >> Repair or replace as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P0301-MISFIRE DETECTED CYLINDER #1

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM detects multiple misfires from cylinder #1.

| Possible Causes |
|---|
| ENGINE COMPRESSION |
| FUEL INJECTOR QUANTITY |
| FUEL SUPPLY CONTAMINATION |
| INJECTOR LEAKAGE |
| INTERMITTENT CONDITION |

### Diagnostic Test

#### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

With the scan tool, erase ECM DTCs.

Test drive the vehicle and attempt to duplicate the problem.

With the scan tool, read ECM DTC's.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

#### 2. FUEL CONTAMINATION

Refer to the Service Information and inspect the fuel supply for contamination.

**Is the fuel contaminated?**

**Yes** >> Refer to the Service Information to remove and replace fuel throughout the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

#### 3. ENGINE COMPRESSION

Turn the ignition off.

With the scan tool, perform the Cylinder Compression Test.

**Is the cylinder compression within specification for all cylinders?**

**Yes** >> Go To 4

**No** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL INJECTOR QUANTITY

Turn the ignition off.
With the scan tool, perform the Injector Quantity Test.

**Is the Injector Quantity within specification for all cylinders?**

**Yes** >> Go To 5

**No** >> Repair or replace as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. FUEL INJECTOR LEAKAGE

Turn the ignition off.
Perform the INJECTOR LEAKAGE TEST in accordance with the Service Information.

**Were any problems found?**

**Yes** >> Repair or replace as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P0302-MISFIRE DETECTED CYLINDER #2

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM detects multiple misfires from cylinder #2.

| Possible Causes |
|---|
| ENGINE COMPRESSION |
| FUEL INJECTOR QUANTITY |
| FUEL SUPPLY CONTAMINATION |
| INJECTOR LEAKAGE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

With the scan tool, erase ECM DTCs.

Test drive the vehicle and attempt to duplicate the problem.

With the scan tool, read ECM DTC's.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. FUEL CONTAMINATION

Refer to the Service Information and inspect the fuel supply for contamination.

**Is the fuel contaminated?**

**Yes** >> Refer to the Service Information to remove and replace fuel throughout the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

### 3. ENGINE COMPRESSION

Turn the ignition off.

With the scan tool, perform the Cylinder Compression Test.

**Is the cylinder compression within specification for all cylinders?**

**Yes** >> Go To 4

**No** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL INJECTOR QUANTITY

Turn the ignition off.
With the scan tool, perform the Injector Quantity Test.

**Is the Injector Quantity within specification for all cylinders?**

**Yes** >> Go To 5

**No** >> Repair or replace as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. FUEL INJECTOR LEAKAGE

Turn the ignition off.
Perform the INJECTOR LEAKAGE TEST in accordance with the Service Information.

**Were any problems found?**

**Yes** >> Repair or replace as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P0303-MISFIRE DETECTED CYLINDER #3

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM detects multiple misfires from cylinder #3.

| Possible Causes |
|---|
| ENGINE COMPRESSION |
| FUEL INJECTOR QUANTITY |
| FUEL SUPPLY CONTAMINATION |
| INJECTOR LEAKAGE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

With the scan tool, erase ECM DTCs.

Test drive the vehicle and attempt to duplicate the problem.

With the scan tool, read ECM DTC's.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. FUEL CONTAMINATION

Refer to the Service Information and inspect the fuel supply for contamination.

**Is the fuel contaminated?**

**Yes** >> Refer to the Service Information to remove and replace fuel throughout the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

### 3. ENGINE COMPRESSION

Turn the ignition off.

With the scan tool, perform the Cylinder Compression Test.

**Is the cylinder compression within specification for all cylinders?**

**Yes** >> Go To 4

**No** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL INJECTOR QUANTITY

Turn the ignition off.

With the scan tool, perform the Injector Quantity Test.

**Is the Injector Quantity within specification for all cylinders?**

**Yes** >> Go To 5

**No** >> Repair or replace as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. FUEL INJECTOR LEAKAGE

Turn the ignition off.

Perform the INJECTOR LEAKAGE TEST in accordance with the Service Information.

**Were any problems found?**

**Yes** >> Repair or replace as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P0304-MISFIRE DETECTED CYLINDER #4

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM detects multiple misfires from cylinder #4.

| Possible Causes |
| --- |
| ENGINE COMPRESSION |
| FUEL INJECTOR QUANTITY |
| FUEL SUPPLY CONTAMINATION |
| INJECTOR LEAKAGE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

With the scan tool, erase ECM DTCs.

Test drive the vehicle and attempt to duplicate the problem.

With the scan tool, read ECM DTC's.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. FUEL CONTAMINATION

Refer to the Service Information and inspect the fuel supply for contamination.

**Is the fuel contaminated?**

**Yes** >> Refer to the Service Information to remove and replace fuel throughout the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

### 3. ENGINE COMPRESSION

Turn the ignition off.

With the scan tool, perform the Cylinder Compression Test.

**Is the cylinder compression within specification for all cylinders?**

**Yes** >> Go To 4

**No** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL INJECTOR QUANTITY

Turn the ignition off.
With the scan tool, perform the Injector Quantity Test.

**Is the Injector Quantity within specification for all cylinders?**

**Yes** >> Go To 5

**No** >> Repair or replace as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. FUEL INJECTOR LEAKAGE

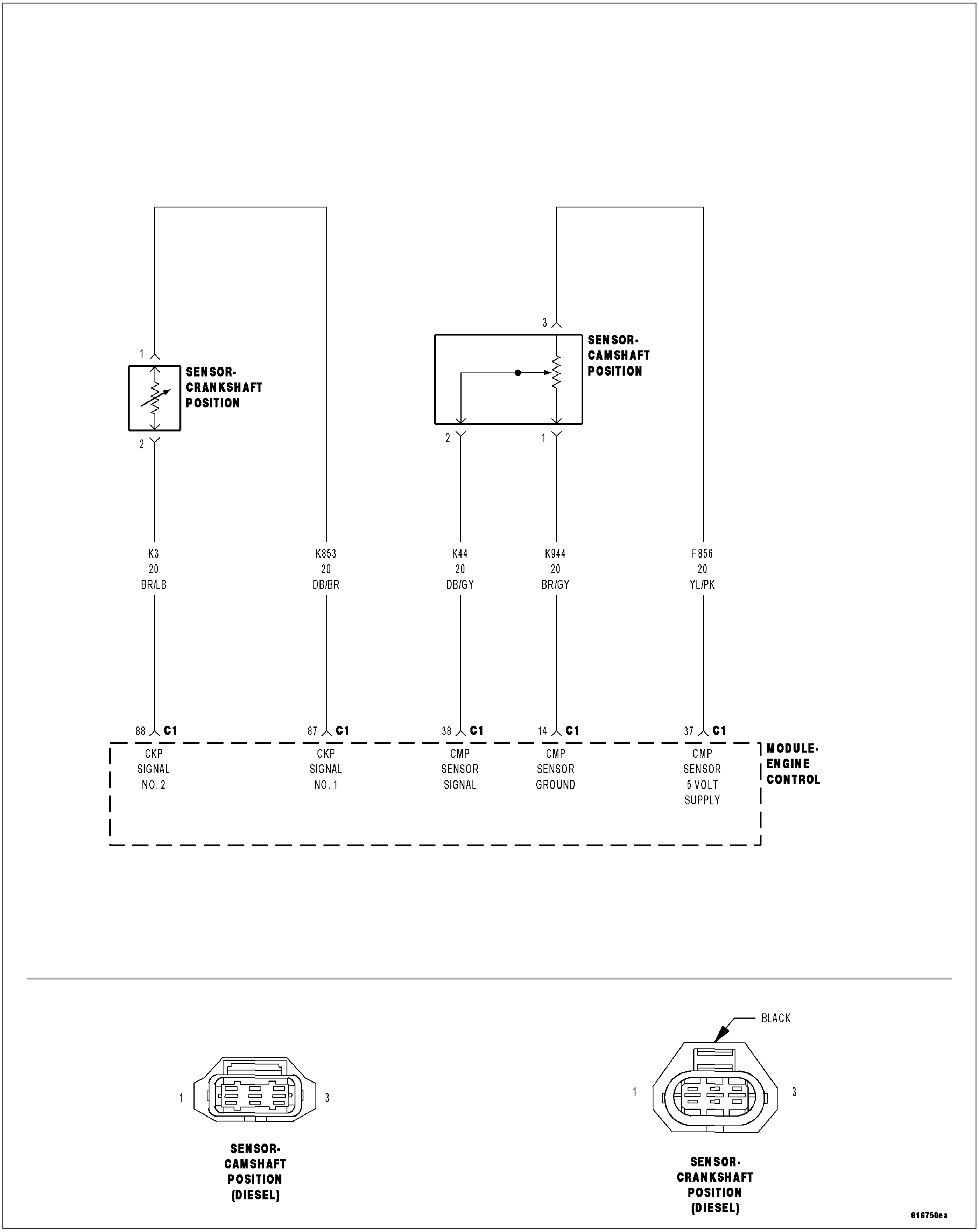
Turn the ignition off.
Perform the INJECTOR LEAKAGE TEST in accordance with the Service Information.

**Were any problems found?**

**Yes** >> Repair or replace as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

# P0335-CRANKSHAFT POSITION SENSOR CIRCUIT INCORRECT OR MISSING SIGNAL



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine speed between 20 and 6000 rpm.
- **Set Condition:**
  The ECM does not receive a Crankshaft Position Sensor signal or receives an incorrect signal.

| Possible Causes |
| --- |
| CRANKSHAFT POSITION SENSOR |
| INTERMITTENT CONDITION |
| (K853, K3) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT(S) SHORTED TO GROUND |
| (K853, K3) CKP SENSOR CIRCUITS SHORTED TOGETHER |
| (K853, K3) CKP SENSOR SIGNAL CIRCUITS OPEN |
| (K853, K3) CKP SENSOR SIGNAL CIRCUIT(S) SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. ATTEMPT TO START THE ENGINE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Attempt to start the engine.

**Did the engine start?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. (K853, K3) CKP SENSOR SIGNAL CIRCUITS SHORTED TO GROUND

Turn the ignition off.

Disconnect the CKP Sensor harness connector.

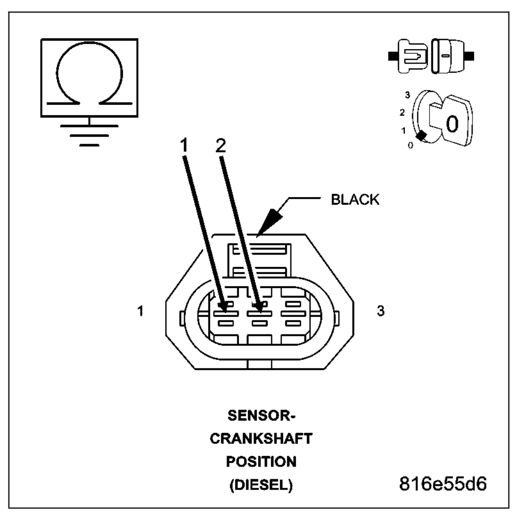
Disconnect the ECM harness connectors.

Measure the resistance between ground and both of the CKP Sensor Signal circuits.

**Is the resistance above 1000 ohms for both measurements?**

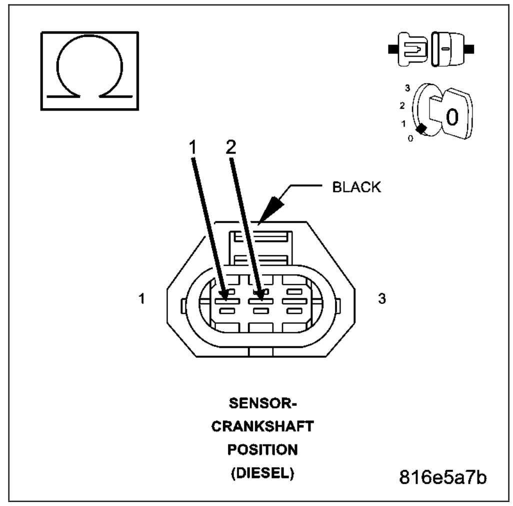
**Yes** >> Go To 3

**No** >> Repair the CKP Sensor Signal circuit(s) for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 3. (K853, K3) CKP SENSOR CIRCUITS SHORTED TOGETHER

Measure the resistance between the CKP Sensor Signal circuits.



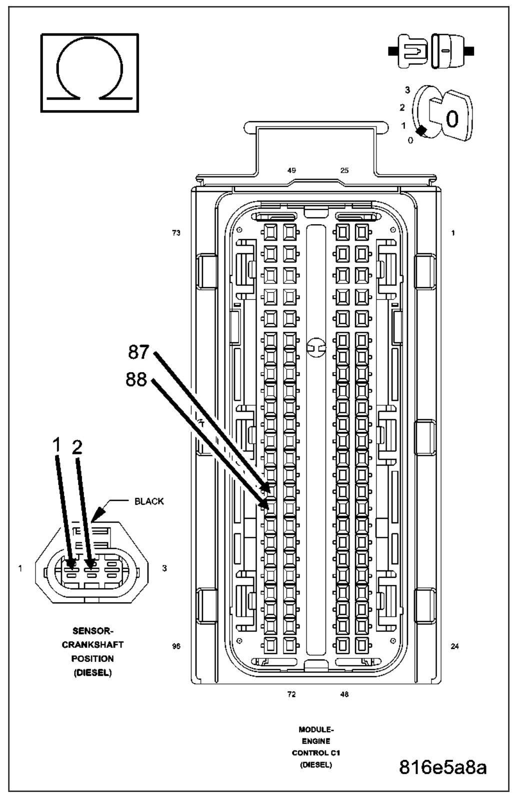

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the CKP Sensor Signal circuits for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. (K853, K3) CKP SENSOR SIGNAL CIRCUIT(S) OPEN

Measure the resistance of CKP Sensor Signal circuits between CKP Sensor harness connector and ECM harness connector.

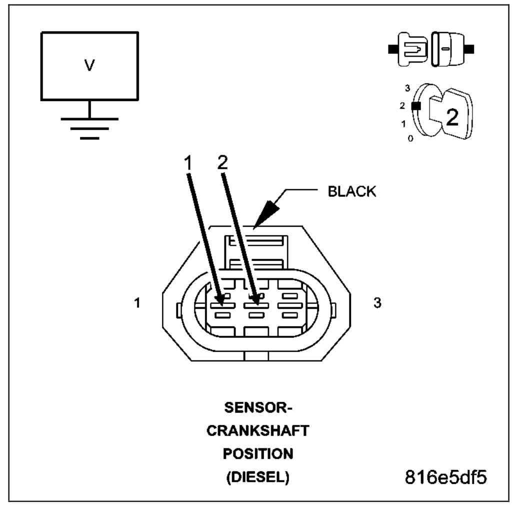



**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the CKP Sensor Signal circuit(s) for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. (K853, K3) CKP SENSOR SIGNAL CIRCUIT(S) SHORTED TO VOLTAGE




Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of both CKP Sensor Signal circuits.

**Is the voltage below 1.0 volt for both measurements?**

**Yes** >> Go To 6

**No** >> Repair the CKP Sensor Signal circuit(s) for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. CRANKSHAFT POSITION SENSOR

Turn the ignition off.

Use a lab scope, backprobe both of the CKP Sensor Signal circuits at the ECM harness connector.

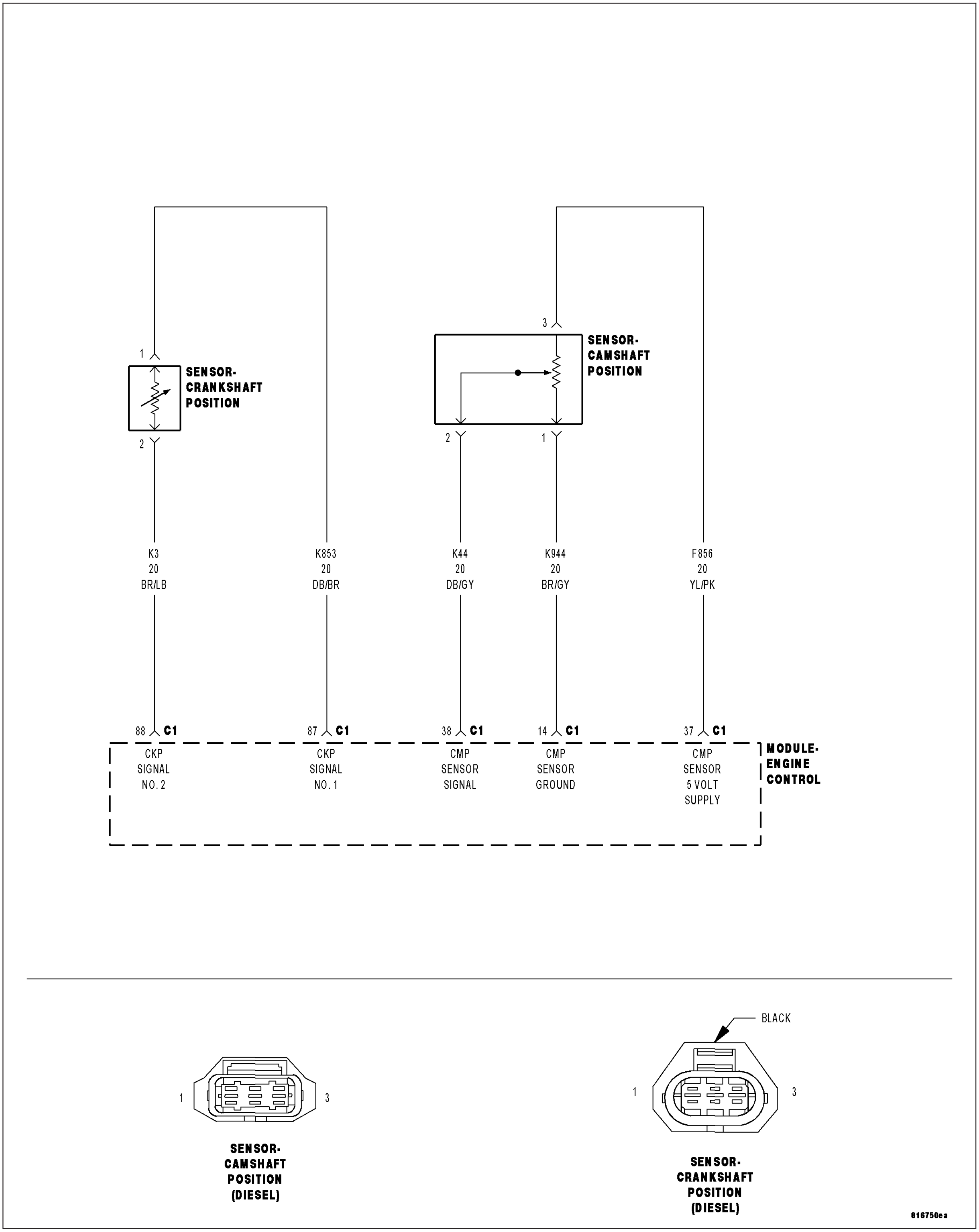
Start the engine, if the engine will not start, crank the engine for several seconds while monitoring the scan tool.

**Does the lab scope display a steady clean CKP Signal pattern for each circuit?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Crankshaft Position Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0339-CRANKSHAFT POSITION SENSOR CIRCUIT INTERMITTENT INCORRECT OR MISSING SIGNAL



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine speed between 20 and 6000 rpm.
- **Set Condition:**
  The ECM does not receive a Crankshaft Position Sensor signal or receives an incorrect signal.

| Possible Causes |
|---|
| CRANKSHAFT POSITION SENSOR |
| INTERMITTENT CONDITION |
| (K853, K3) CRANKSHAFT POSITION SENSOR SIGNAL CIRCUIT(S) SHORTED TO GROUND |
| (K853, K3) CKP SENSOR CIRCUITS SHORTED TOGETHER |
| (K853, K3) CKP SENSOR SIGNAL CIRCUITS OPEN |
| (K853, K3) CKP SENSOR SIGNAL CIRCUIT(S) SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. ATTEMPT TO START THE ENGINE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Attempt to start the engine.

**Did the engine start?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. (K853, K3) CKP SENSOR SIGNAL CIRCUITS SHORTED TO GROUND

Turn the ignition off.

Disconnect the CKP Sensor harness connector.

Disconnect the ECM harness connectors.

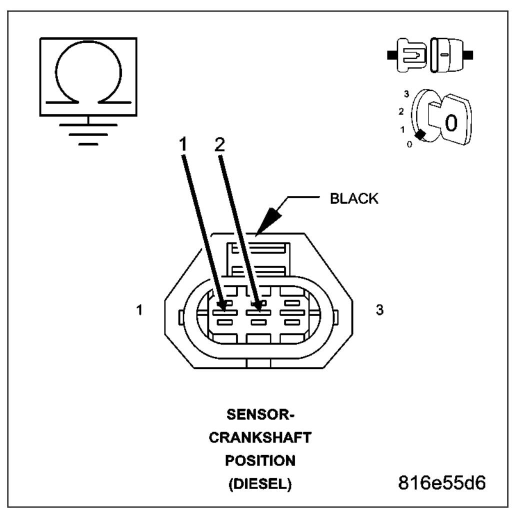
Measure the resistance between ground and both of the CKP Sensor Signal circuits.

**Is the resistance above 1000 ohms for both measurements?**

**Yes** >> Go To 3

**No** >> Repair the CKP Sensor Signal circuit(s) for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



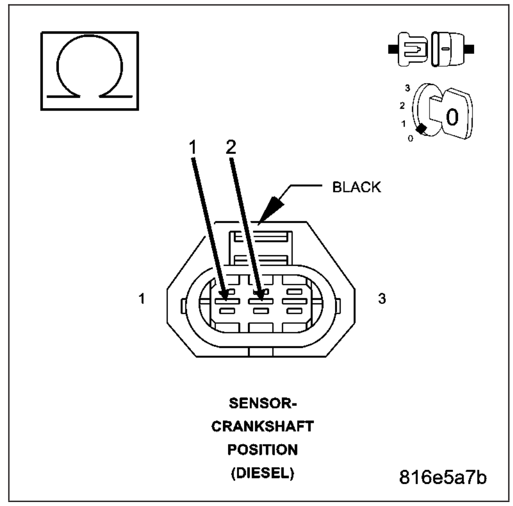
## 3. (K853, K3) CKP SENSOR CIRCUITS SHORTED TOGETHER

Measure the resistance between the CKP Sensor Signal circuits.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the CKP Sensor Signal circuits for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



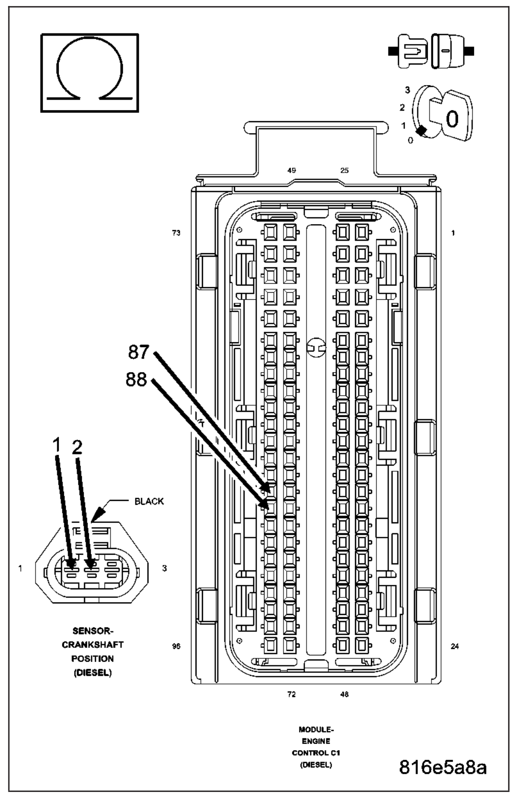

## 4. (K853, K3) CKP SENSOR SIGNAL CIRCUIT(S) OPEN

Measure the resistance of CKP Sensor Signal circuits between CKP Sensor harness connector and ECM harness connector.

**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the CKP Sensor Signal circuit(s) for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 5. (K853, K3) CKP SENSOR SIGNAL CIRCUIT(S) SHORTED TO VOLTAGE

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

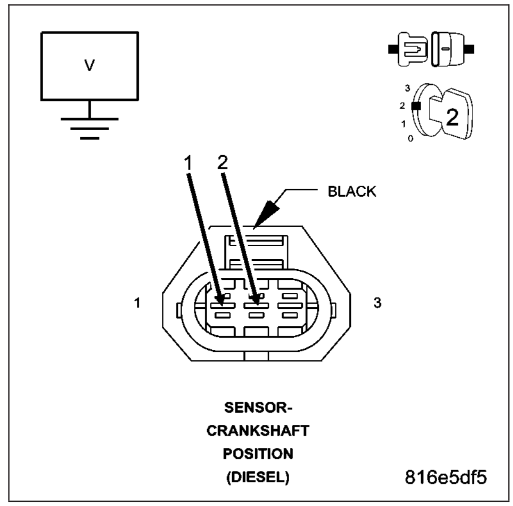
Measure the voltage of both CKP Sensor Signal circuits.

**Is the voltage below 1.0 volt for both measurements?**

**Yes** >> Go To 6

**No** >> Repair the CKP Sensor Signal circuit(s) for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 6. CRANKSHAFT POSITION SENSOR

Turn the ignition off.

Using the lab scope, backprobe both of the CKP Sensor Signal circuits at the ECM harness connector.

Start the engine, if the engine will not start, crank the engine for several seconds while monitoring the scan tool.

**Does the lab scope display a steady clean CKP Signal pattern for each circuit?**

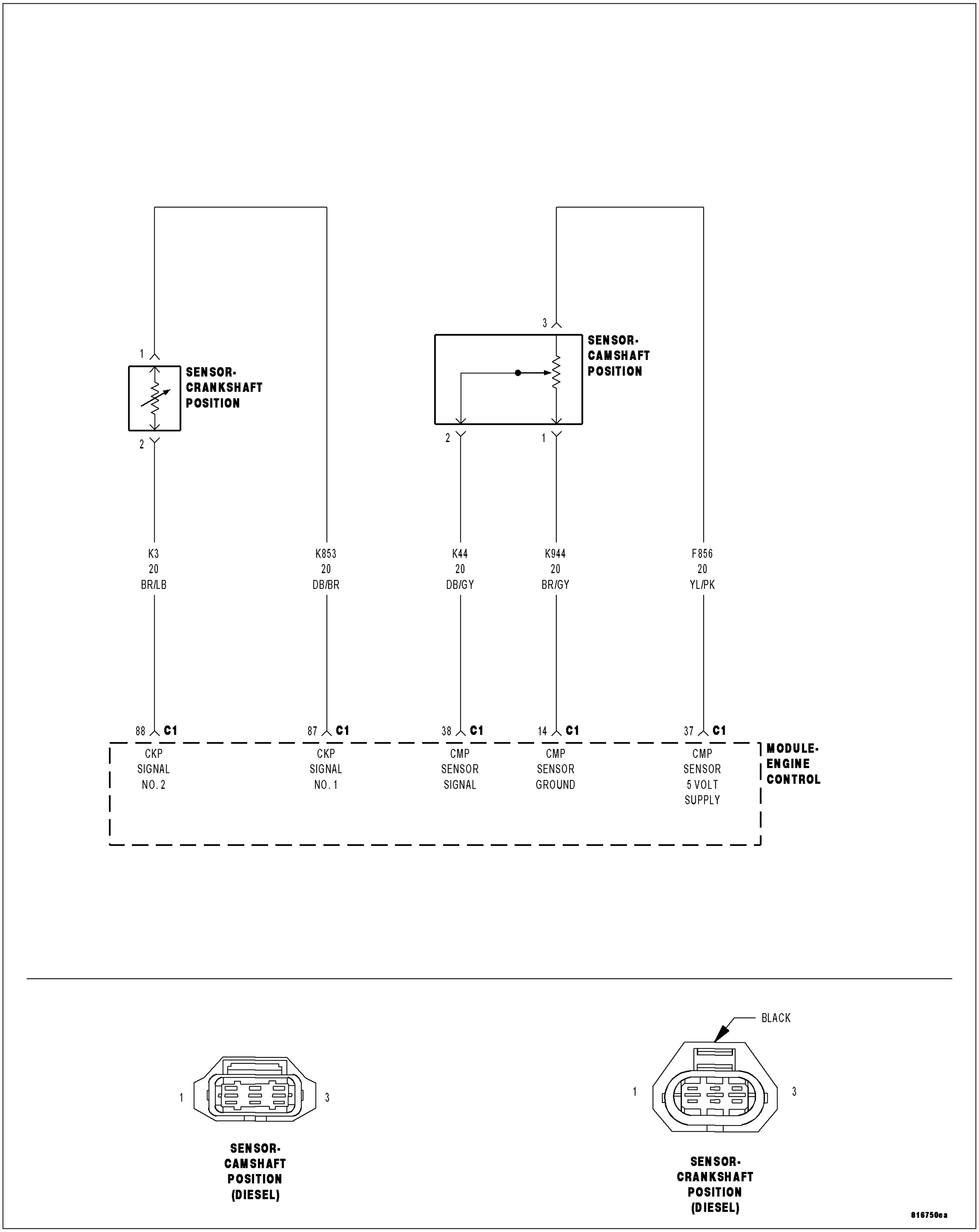
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Crankshaft Position Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0340-CAMSHAFT POSITION SENSOR CIRCUIT MISSING SIGNAL




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine speed between 20 and 6000 rpm.
- **Set Condition:**
  The ECM does not receive a Camshaft Position Sensor signal.

| **Possible Causes** |
|---|
| INTERMITTENT CONDITION |
| CHECKING (K44) CAMSHAFT SENSOR SIGNAL CIRCUIT |
| (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| CHECKING (F856) 5-VOLT SUPPLY CIRCUIT |
| (K944) SENSOR GROUND CIRCUIT OPEN |
| ECM SENSOR GROUND CIRCUIT OPEN |
| DAMAGED CMP SENSOR OR CAMSHAFT |
| CAMSHAFT POSITION SENSOR |
| (F856) 5-VOLT SUPPLY CIRCUIT OPEN |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K944) SENSOR GROUND CIRCUIT |
| (K44) CMP SENSOR SIGNAL CIRCUIT OPEN |
| (K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| (K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO (K944) SENSOR GROUND CIRCUIT |
| ECM |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: The Timing Belt/Chain must be correctly installed and operational before diagnosis can be made. Refer to the Service Information to ensure the timing belt is properly installed.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine cranking the engine for at least 7 seconds.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Go To 2

## 2. TEST DRIVE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

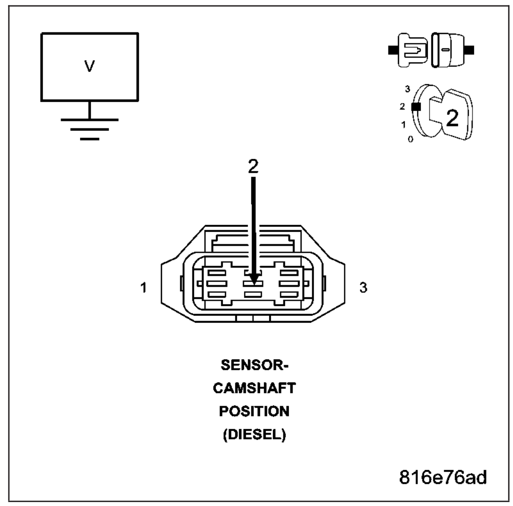
## 3. CHECKING CAMSHAFT POSITION SENSOR SIGNAL CKT

Turn the ignition off.

Disconnect the Camshaft Position Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K44) CMP Sensor Signal circuit.




**Select the appropriate voltage reading.**

**Voltage is above 5.4 volts.**
Go To 4

**Voltage is between 4.7 and 5.4 volts.**
Go To 5

**Voltage is below 4.7 volts.**
Go To 13

## 4. (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the Camshaft Position Sensor harness connector.

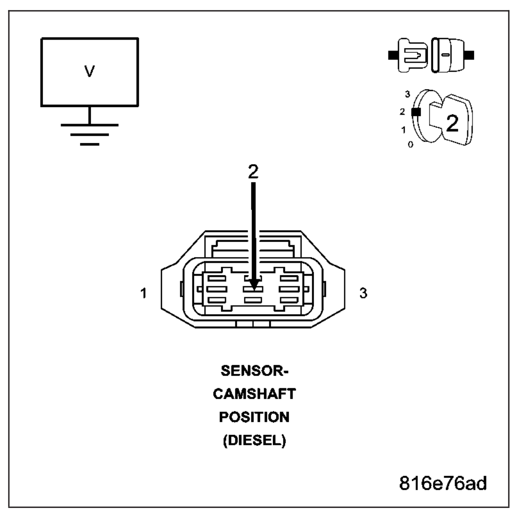
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the (K44) CMP Position Sensor Signal circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the (K44) Camshaft Position Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. CHECKING (F856) 5-VOLT SUPPLY CIRCUIT

Disconnect the ECM harness connectors.

Measure the voltage of the (F856) CMP Sensor 5-Volt Supply circuit.

**Select the appropriate voltage reading.**

**Voltage is above 5.4 volts.**

Repair the (F856) CMP 5-Volt Supply circuit for a short to voltage.

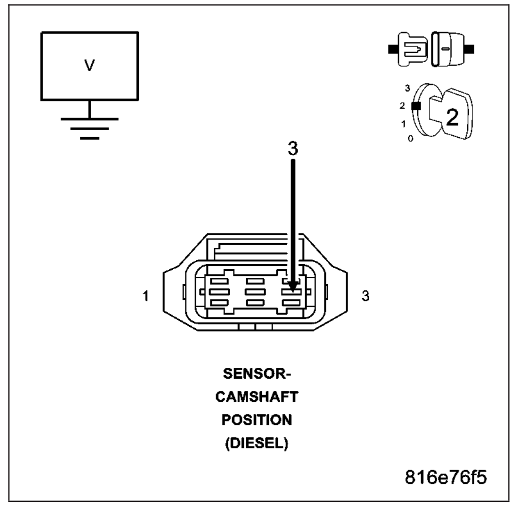
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**Voltage is between 4.7 and 5.4 volts.**

Go To 6

**Voltage is below 4.7 volts.**

Go To 10




## 6. (K944) SENSOR GND CKT OPEN

Turn the ignition off.

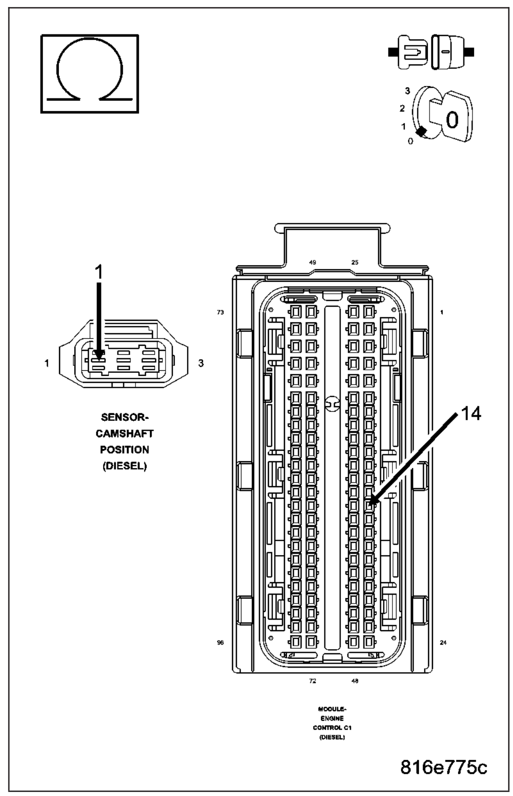
Measure the resistance of the (K944) Sensor Ground circuit between the CMP Sensor harness connector and the ECM C1 harness connector.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the (K944) Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 7. ECM - SENSOR GROUND CIRCUIT OPEN

Connect ECM harness connectors.

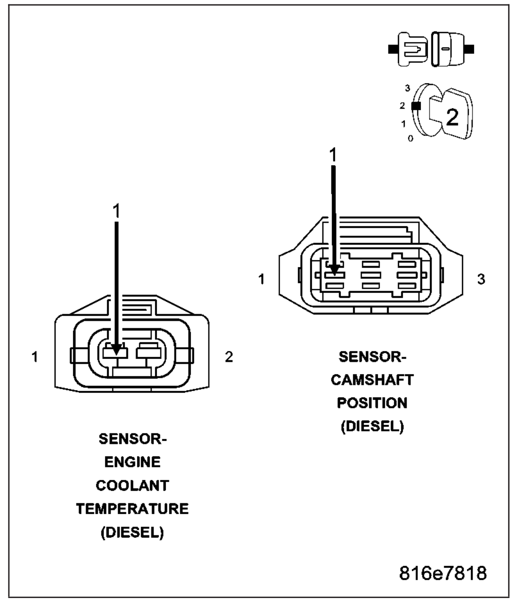
Turn the ignition on.

Disconnect the ECT Sensor harness connector.

Connect one end of a jumper wire to the (K2) ECT Sensor signal circuit in the ECT Sensor harness connector.

Connect the other end of the jumper wire to the (K944) Sensor Ground circuit in the Camshaft Position Sensor harness connector.

With the scan tool, read the Engine Coolant Temp volts.




**Is the voltage below 0.5 volt?**

**Yes** >> Go To 8

**No** >> Replace and program the ECM in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 8. DAMAGED CMP SENSOR OR CAMSHAFT

Turn the ignition off.

Connect ECT Sensor harness connector.

Remove the CMP Sensor.

Inspect the CMP Sensor for conditions such as loose mounting screws, damage, or cracks.

Inspect the camshaft for conditions such as damage, debris or cracked teeth.

**Is there any evidence of these conditions?**

**Yes** >> Repair as necessary.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. CAMSHAFT POSITION SENSOR

Install and connect CMP Sensor.

With the lab scope lead, backprobe the (K44) CMP Signal circuit.

While observing the display, crank the engine.

**Does the scan tool display an uninterrupted digital signal (square wave)?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

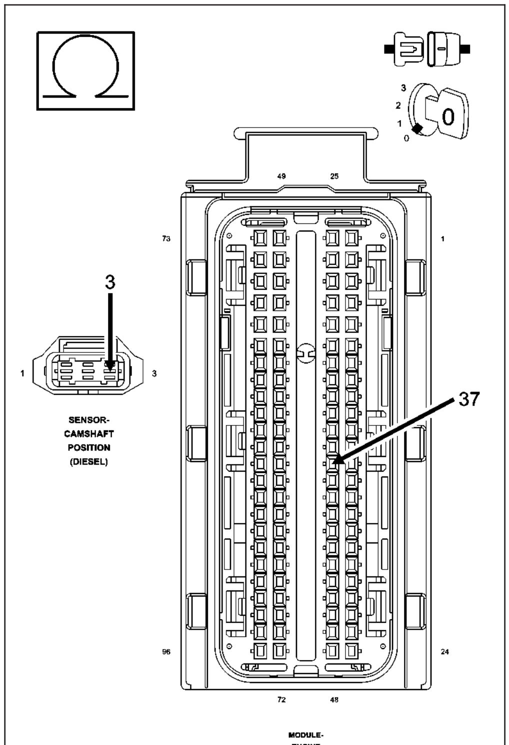
**No** >> Replace the Camshaft Position Sensor in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 10. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (F856) 5-Volt Supply circuit between the CMP harness connector and the ECM C1 harness connector..




816e78f2

**Is the resistance below 10.0 ohms?**

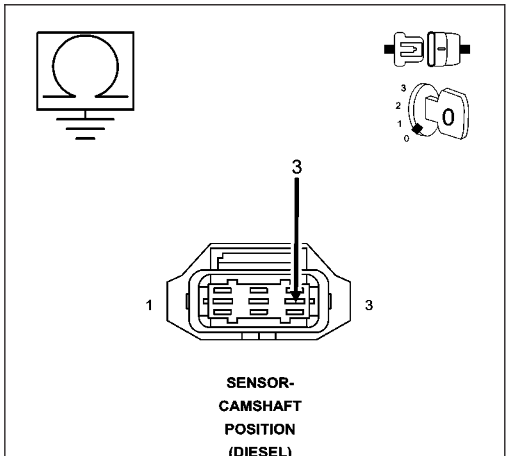
**Yes** >> Go To 11

**No** >> Repair the (F856) 5-Volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 11. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the CMP Sensor 5-Volt Supply circuit.




816e792d

**Is the resistance above 1000 ohms?**

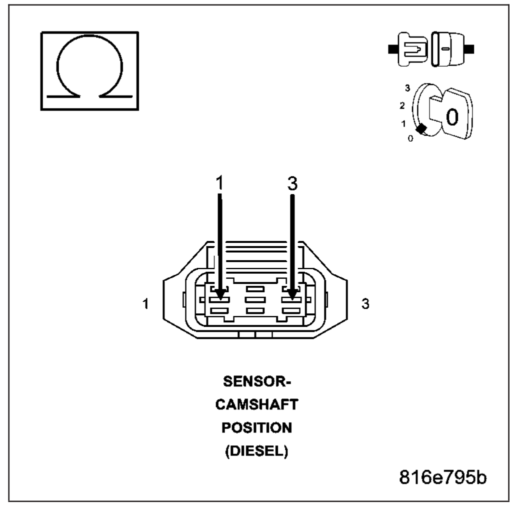
**Yes** >> Go To 12

**No** >> Repair the (F856) CMP Sensor 5-Volt Supply circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K944) SENSOR GROUND CIRCUIT

Measure the resistance between the (F856) CMP Sensor 5-Volt Supply circuit and the (K944) Sensor Ground circuit at the CMP Sensor harness connector.




**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the (F856) CMP Sensor 5-Volt Supply and (K944) Sensor Ground circuits for a short together.

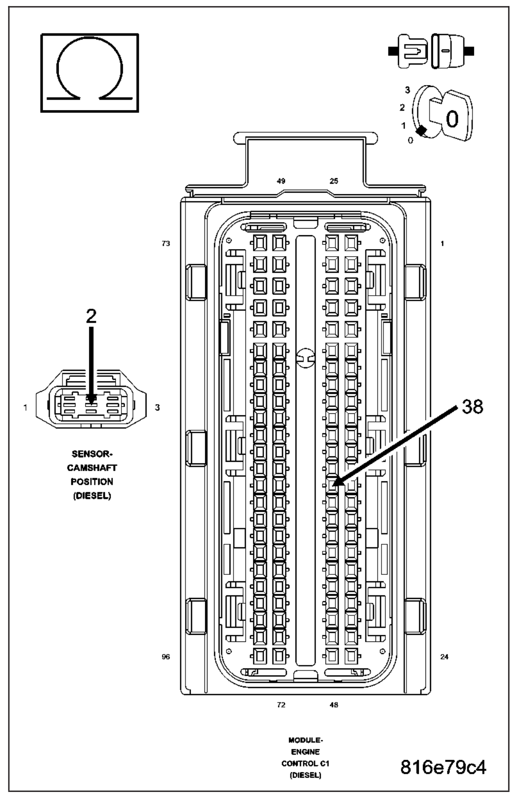
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 13. (K44) CMP SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Measure the resistance of the (K44) CMP Sensor Signal circuit.




**Is the resistance below 10.0 ohms?**

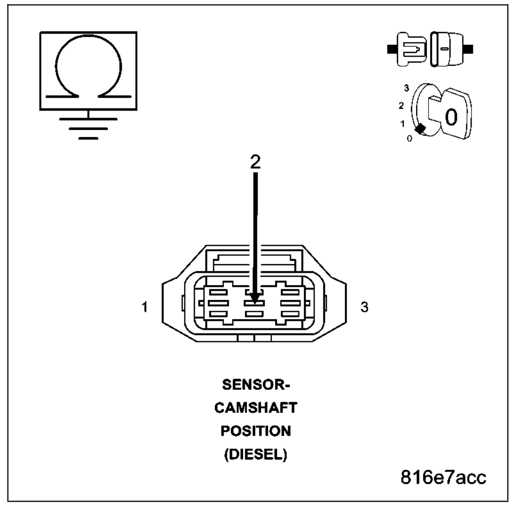
**Yes** >> Go To 14

**No** >> Repair the CMP Sensor Signal circuit for an open

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 14. (K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Sensor Signal circuit.




**Is the resistance below 1000 ohms?**

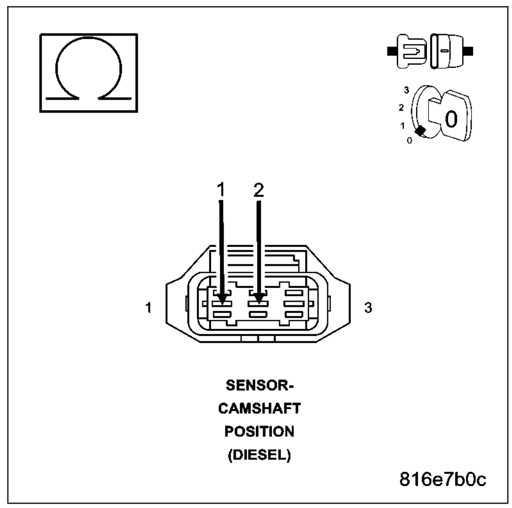
**Yes** >> Repair the (K44) CMP Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 15

## 15. (K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO THE (K944) SENSOR GROUND CIRCUIT

Measure the resistance between the (K44) CMP Sensor Signal circuit and (K944) Sensor Ground circuit at the CMP Sensor harness connector.




**Is the resistance below 1000 ohms?**

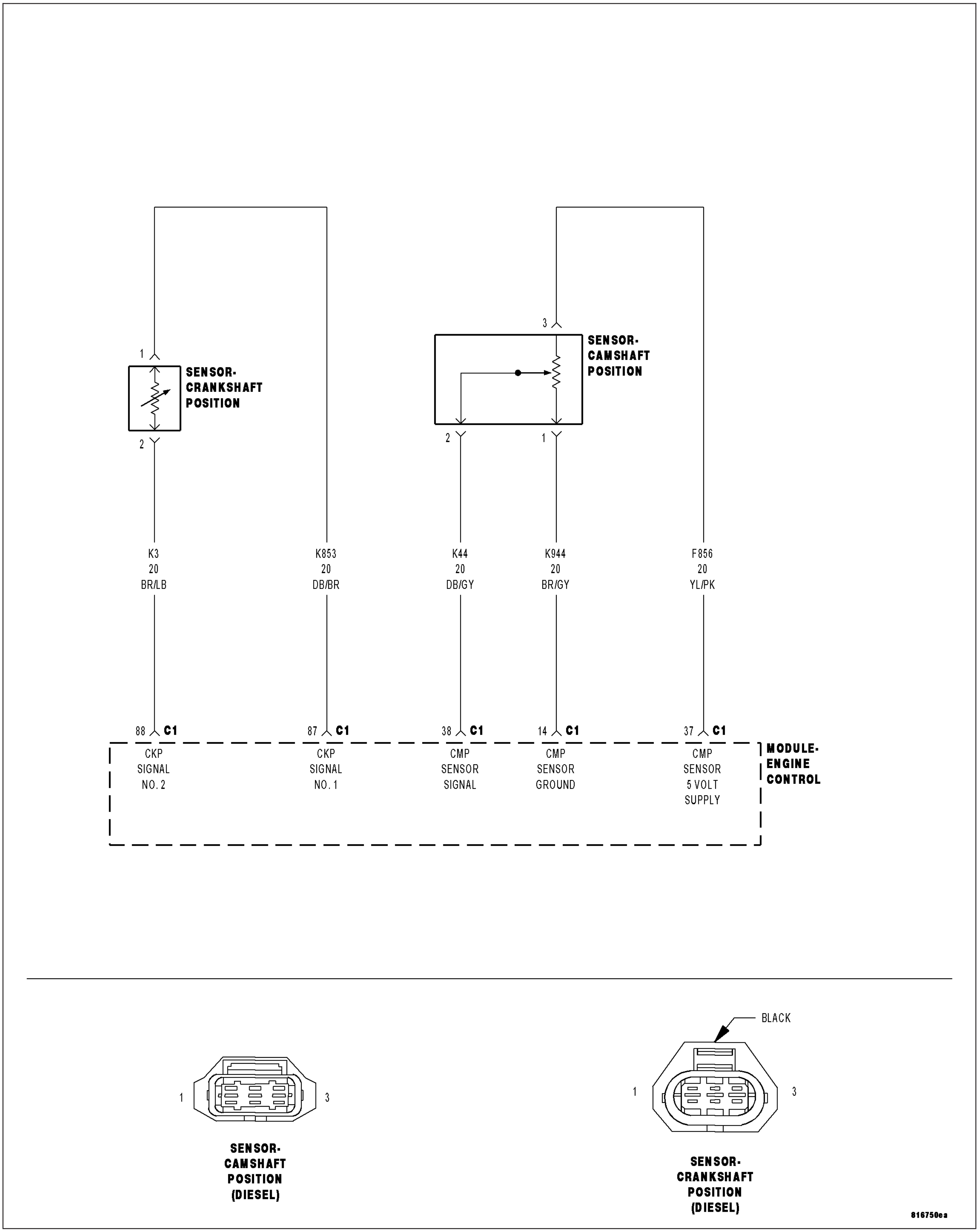
**Yes** >> Repair the (K44) CMP Sensor Signal and (K944) Sensor Ground circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0340-CAMSHAFT POSITION SENSOR CIRCUIT MISSING SIGNAL PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine speed between 20 and 6000 rpm.
- **Set Condition:**
  The ECM does not receive a Camshaft Position Sensor signal.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| CHECKING (K44) CAMSHAFT SENSOR SIGNAL CIRCUIT |
| (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| CHECKING (F856) 5-VOLT SUPPLY CIRCUIT |
| (K944) SENSOR GROUND CIRCUIT OPEN |
| ECM SENSOR GROUND CIRCUIT OPEN |
| DAMAGED CMP SENSOR OR CAMSHAFT |
| CAMSHAFT POSITION SENSOR |
| (F856) 5-VOLT SUPPLY CIRCUIT OPEN |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K944) SENSOR GROUND CIRCUIT |
| (K44) CMP SENSOR SIGNAL CIRCUIT OPEN |
| (K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| (K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO (K944) SENSOR GROUND CIRCUIT |
| ECM |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: The Timing Belt/Chain must be correctly installed and operational before diagnosis can be made. Refer to the Service Information to ensure the timing belt is properly installed.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine cranking the engine for at least 7 seconds.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Go To 2

## 2. TEST DRIVE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

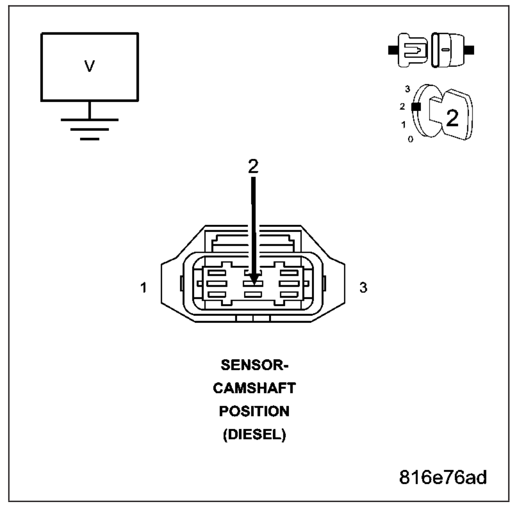
## 3. CHECKING CAMSHAFT POSITION SENSOR SIGNAL CKT

Turn the ignition off.

Disconnect the Camshaft Position Sensor harness connector.

Turn the ignition on.

Measure the voltage of the (K44) CMP Sensor Signal circuit.




**Select the appropriate voltage reading.**

**Voltage is above 5.4 volts.**
Go To 4

**Voltage is between 4.7 and 5.4 volts.**
Go To 5

**Voltage is below 4.7 volts.**
Go To 13

## 4. (K44) CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the Camshaft Position Sensor harness connector.

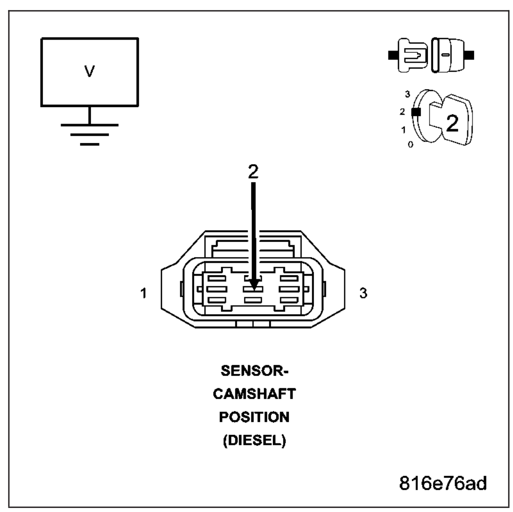
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the (K44) CMP Position Sensor Signal circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

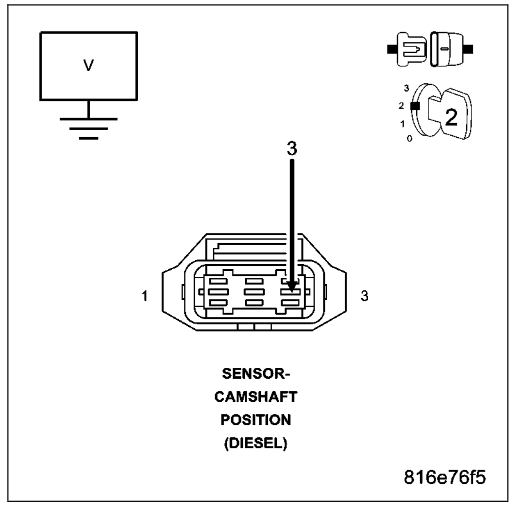
**No** >> Repair the (K44) Camshaft Position Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. CHECKING (F856) 5-VOLT SUPPLY CIRCUIT

Disconnect the ECM harness connectors.

Measure the voltage of the (F856) CMP Sensor 5-Volt Supply circuit.




**Select the appropriate voltage reading.**

**Voltage is above 5.4 volts.**
Repair the (F856) CMP 5-Volt Supply circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

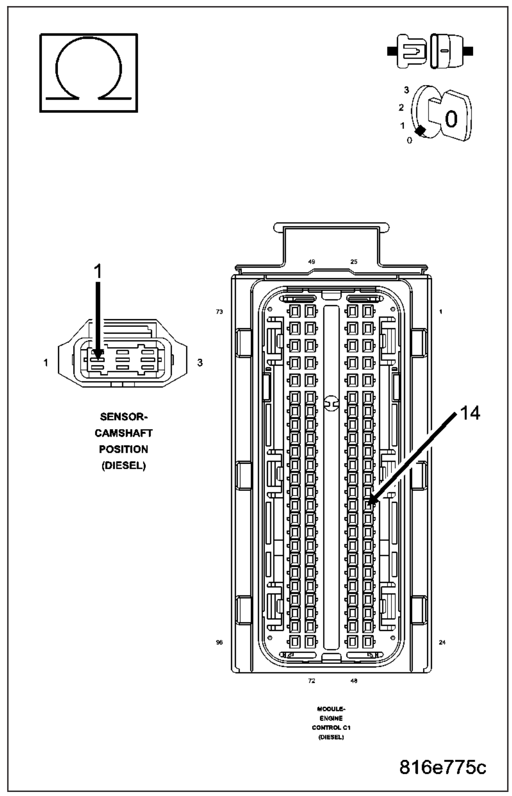
**Voltage is between 4.7 and 5.4 volts.**
Go To 6

**Voltage is below 4.7 volts.**
Go To 10

## 6. (K944) SENSOR GND CKT OPEN

Turn the ignition off.

Measure the resistance of the (K944) Sensor Ground circuit between the CMP Sensor harness connector and the ECM C1 harness connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the (K944) Sensor Ground circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. ECM - SENSOR GROUND CIRCUIT OPEN

Connect ECM harness connectors.

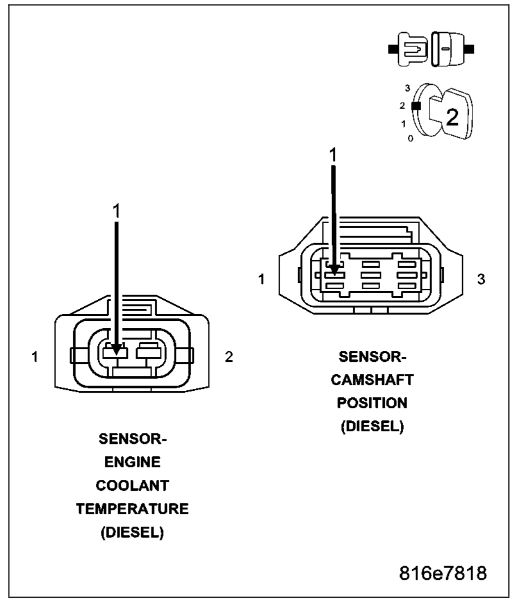
Turn the ignition on.

Disconnect the ECT Sensor harness connector.

Connect one end of a jumper wire to the (K2) ECT Sensor signal circuit in the ECT Sensor harness connector.

Connect the other end of the jumper wire to the (K944) Sensor Ground circuit in the Camshaft Position Sensor harness connector.

With the scan tool, read the Engine Coolant Temp volts.




**Is the voltage below 0.5 volt?**

**Yes** >> Go To 8

**No** >> Replace and program the ECM in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 8. DAMAGED CMP SENSOR OR CAMSHAFT

Turn the ignition off.

Connect ECT Sensor harness connector.

Remove the CMP Sensor.

Inspect the CMP Sensor for conditions such as loose mounting screws, damage, or cracks.

Inspect the camshaft for conditions such as damage, debris or cracked teeth.

**Is there any evidence of these conditions?**

**Yes** >> Repair as necessary.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. CAMSHAFT POSITION SENSOR

Install and connect CMP Sensor.

With the lab scope lead, backprobe the (K44) CMP Signal circuit.

While observing the display, crank the engine.

**Does the scan tool display an uninterrupted digital signal (square wave)?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

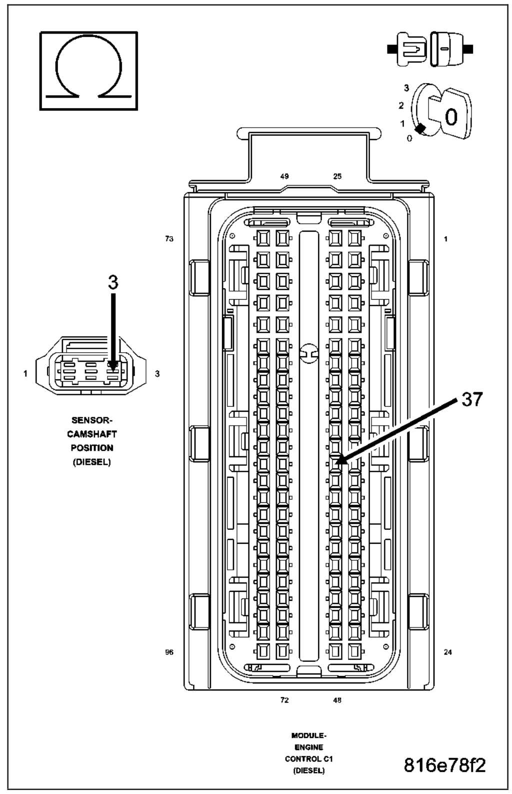
**No** >> Replace the Camshaft Position Sensor in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 10. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (F856) 5-Volt Supply circuit between the CMP harness connector and the ECM C1 harness connector..




**Is the resistance below 10.0 ohms?**

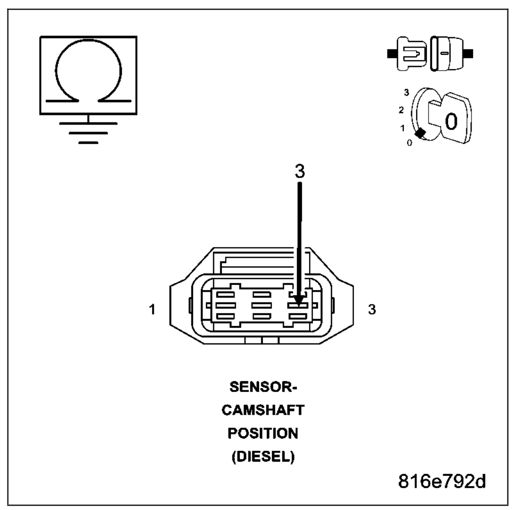
**Yes** >> Go To 11

**No** >> Repair the (F856) 5-Volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 11. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the CMP Sensor 5-Volt Supply circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 12

**No** >> Repair the (F856) CMP Sensor 5-Volt Supply circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K944) SENSOR GROUND CIRCUIT

Measure the resistance between the (F856) CMP Sensor 5-Volt Supply circuit and the (K944) Sensor Ground circuit at the CMP Sensor harness connector.

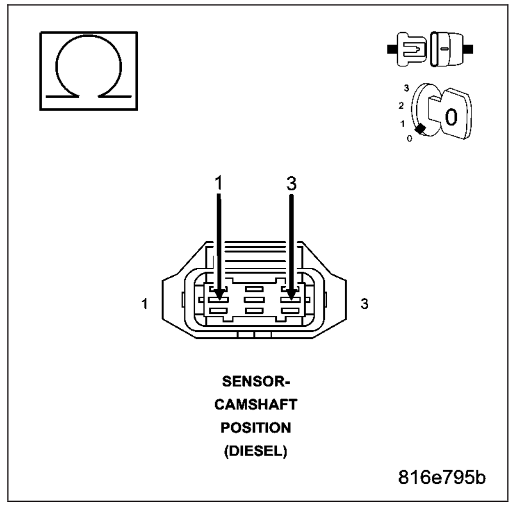
**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the (F856) CMP Sensor 5-Volt Supply and (K944) Sensor Ground circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 13. (K44) CMP SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

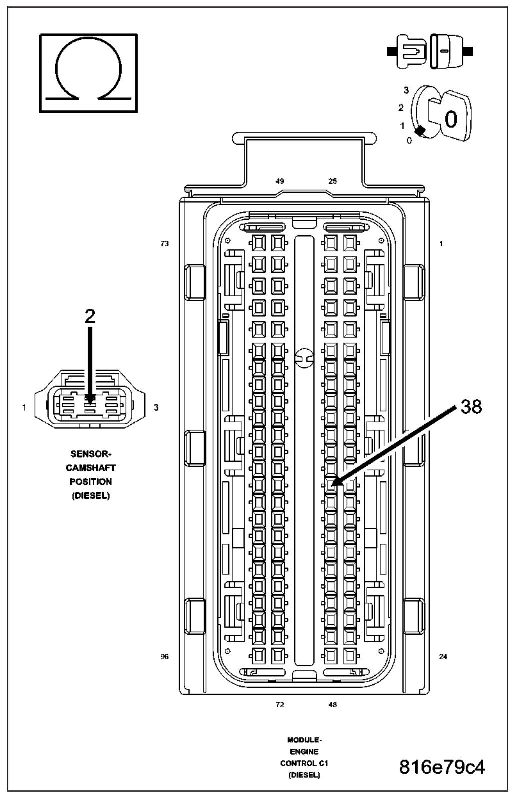
Measure the resistance of the (K44) CMP Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 14

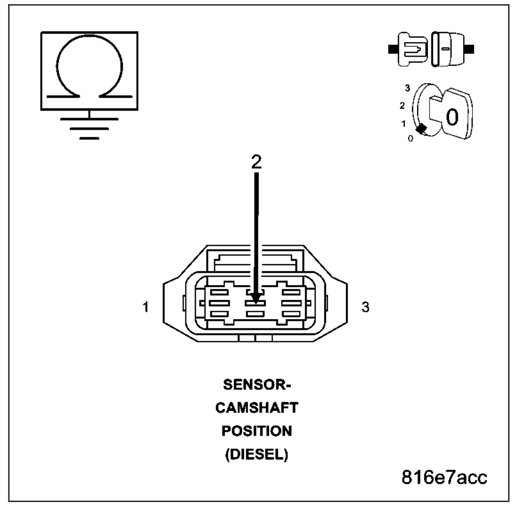
**No** >> Repair the CMP Sensor Signal circuit for an open

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 14. (K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Sensor Signal circuit.




**Is the resistance below 1000 ohms?**

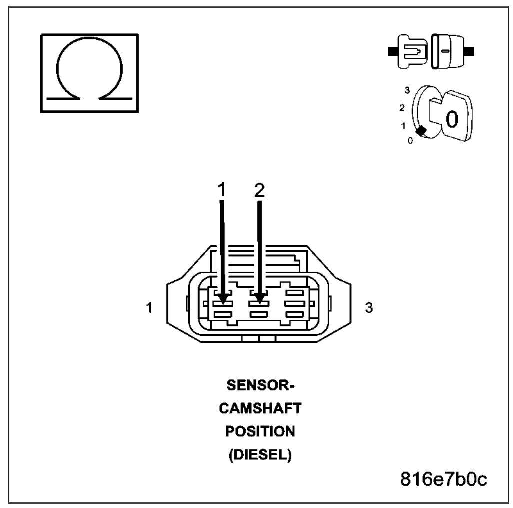
**Yes** >> Repair the (K44) CMP Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 15

## 15. (K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO THE (K944) SENSOR GROUND CIRCUIT

Measure the resistance between the (K44) CMP Sensor Signal circuit and (K944) Sensor Ground circuit at the CMP Sensor harness connector.




**Is the resistance below 1000 ohms?**

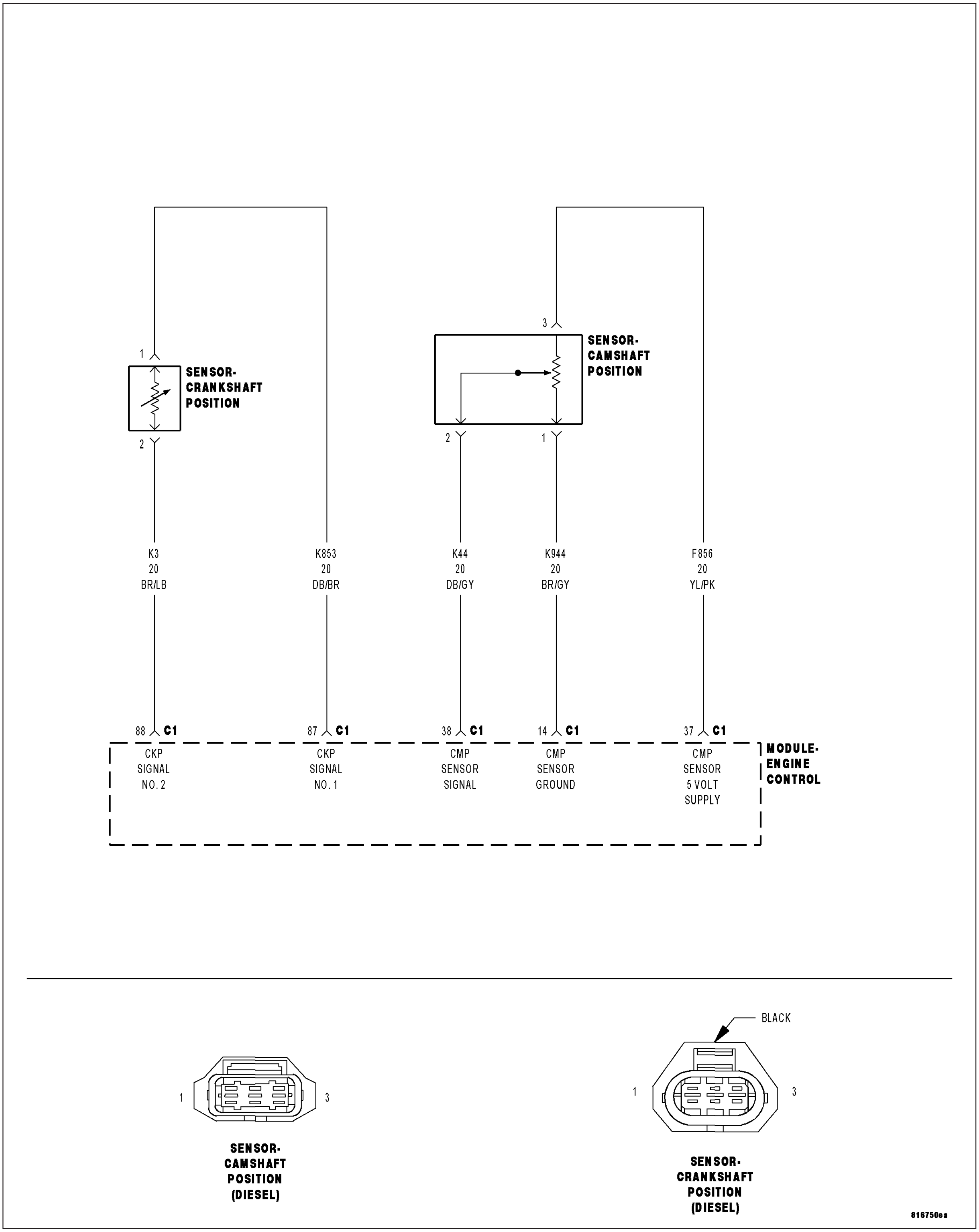
**Yes** >> Repair the (K44) CMP Sensor Signal and (K944) Sensor Ground circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0344-CAMSHAFT POSITION SENSOR INTERMITTENT OR MISSING SIGNAL




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine speed between 20 and 6000 rpm.
- **Set Condition:**
  The ECM does not receive a Camshaft Position Sensor signal.

| Possible Causes |
|---|
| 5-VOLT SUPPLY CIRCUIT OPEN |
| CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| CHECKING 5-VOLT SUPPLY CIRCUIT |
| DAMAGED CMP SENSOR OR CAMSHAFT |
| ECM |
| ECM |
| ECM - CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND CIRCUIT OPEN |
| INTERMITTENT CONDITION |
| CMP SENSOR SIGNAL CIRCUIT OPEN |
| 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| CMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| CMASHAFT POSITION SENSOR |
| ECM SENSOR GROUND CIRCUIT OPEN |
| 5-VOLT SUPPLY CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT |
| CMP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: The Timing Belt/Chain must be correctly installed and operational before diagnosis can be made. Refer to the Service Information to ensure the timing belt is properly installed.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine cranking the engine for at least 7 seconds.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Go To 2

## 2. TEST DRIVE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

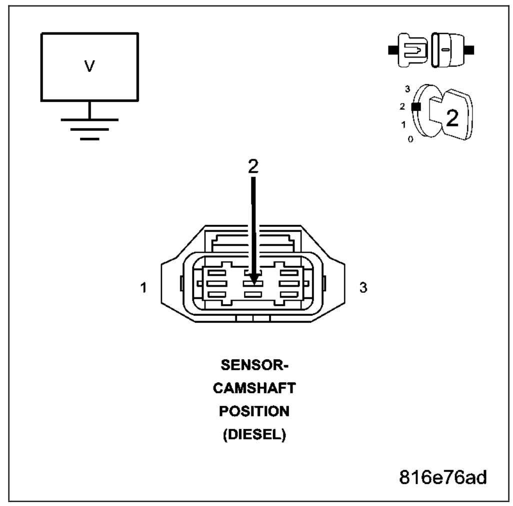
## 3. CHECKING CAMSHAFT POSITION SENSOR SIGNAL CKT

Turn the ignition off.

Disconnect the Camshaft Position Sensor harness connector.

Turn the ignition on.

Measure the voltage of the CMP Sensor Signal circuit.




**Select the appropriate voltage reading.**

**Voltage is above 5.4 volts.**
Go To 4

**Voltage is between 4.7 and 5.4 volts.**
Go To 5

**Voltage is below 4.7 volts.**
Go To 13

## 4. CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the Camshaft Position Sensor harness connector.

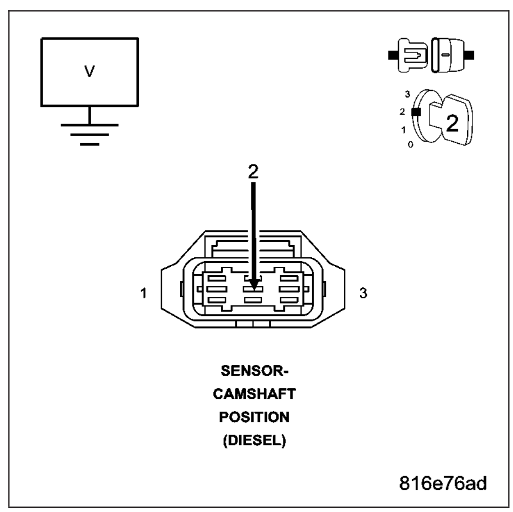
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the CMP Position Sensor Signal circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Camshaft Position Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

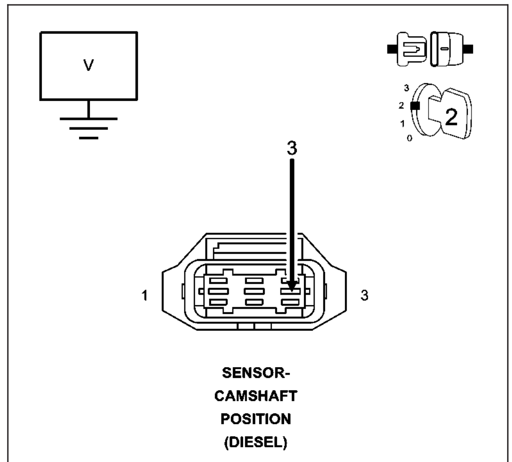
## 5. CHECKING 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Camshaft Position Sensor harness connector.

Turn the ignition on.

Measure the voltage of the CMP Sensor 5-Volt Supply circuit.



816e76f5

**Select the appropriate voltage reading.**

**Voltage is above 5.4 volts.**

Repair the CMP 5-Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**Voltage is between 4.7 and 5.4 volts.**

Go To 6

**Voltage is below 4.7 volts.**

Go To 10

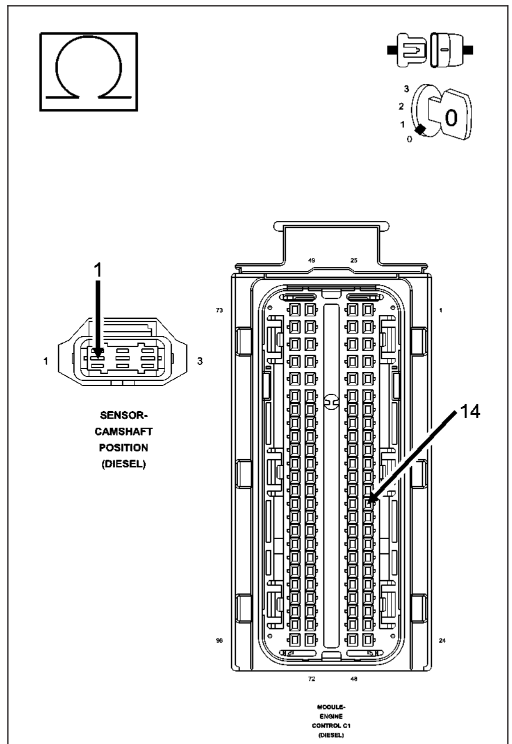
## 6. SENSOR GND CKT OPEN

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between the CMP Sensor harness connector and the ECM harness connector.



816e775c

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. ECM - SENSOR GROUND CIRCUIT OPEN

Turn the ignition on.

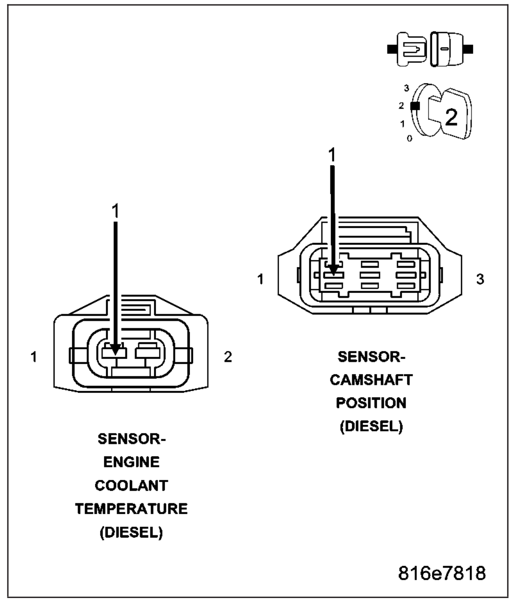
Disconnect the ECT Sensor harness connector.

Disconnect the Camshaft Position Sensor harness connector.

Connect one end of a jumper wire to the ECT Sensor signal circuit in the ECT Sensor harness connector.

Connect the other end of the jumper wire to the Sensor Ground circuit in the Camshaft Position Sensor harness connector.

With the scan tool read the Engine Coolant Temp volts.




**Is the voltage below 0.5 volt?**

**Yes** >> Go To 8

**No** >> Replace and program the ECM in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 8. DAMAGED CMP SENSOR OR CAMSHAFT

Turn the ignition off.

Remove the CMP Sensor.

Inspect the CMP Sensor for conditions such as loose mounting screws, damage, or cracks.

Inspect the camshaft for conditions such as damage, debris or cracked teeth.

**Is there any evidence of these conditions?**

**Yes** >> Repair as necessary.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. CAMSHAFT POSITION SENSOR

Turn the ignition off.

With the lab scope lead, backprobe the CMP Signal circuit.

While observing the lab scope display, crank the engine.

**NOTE: The lab scope should display a digital signal (square wave) similar to that shown in Charts and Graphs.**

**Does the lab scope display an uninterrupted digital signal (square wave)?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Camshaft Position Sensor in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

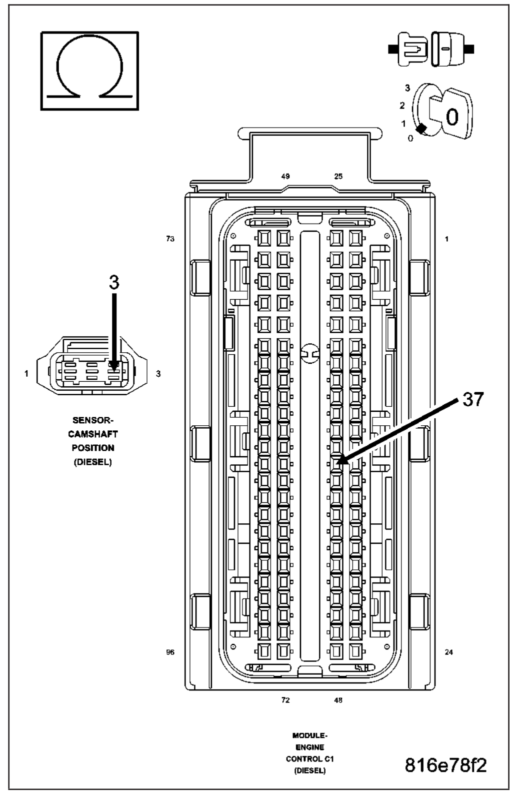
## 10. 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the CMP Sensor harness connector.

Measure the resistance of the 5-Volt Supply circuit between the ECM harness connector and the CMP Sensor harness connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 11

**No** >> Repair the 5-Volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

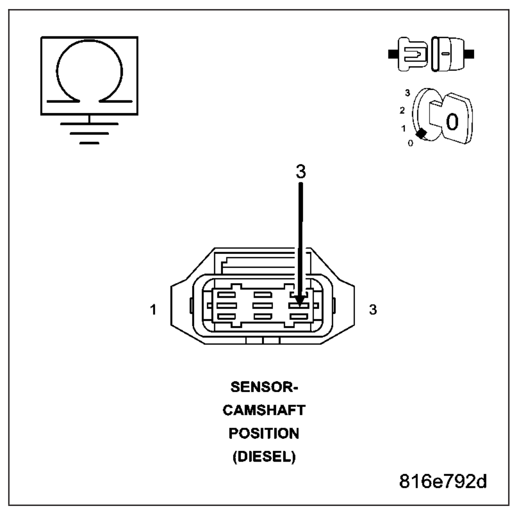
## 11. 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the CMP Sensor 5-Volt Supply circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 12

**No** >> Repair the CMP Sensor 5-Volt Supply circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

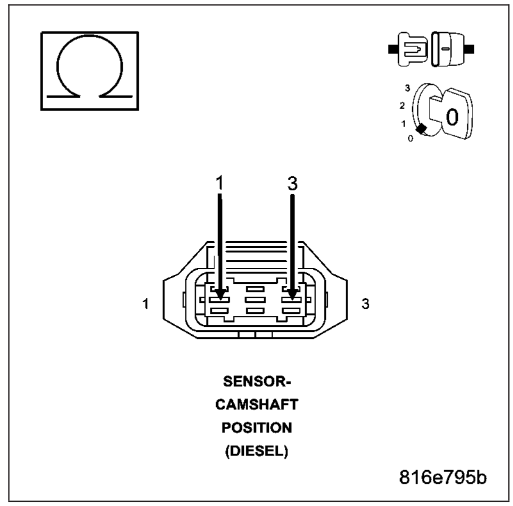
## 12. 5-VOLT SUPPLY CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the CMP Sensor 5-Volt Supply circuit and the Sensor Ground circuit at the CMP Sensor harness connector.




**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the CMP Sensor 5-Volt Supply and Sensor Ground circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

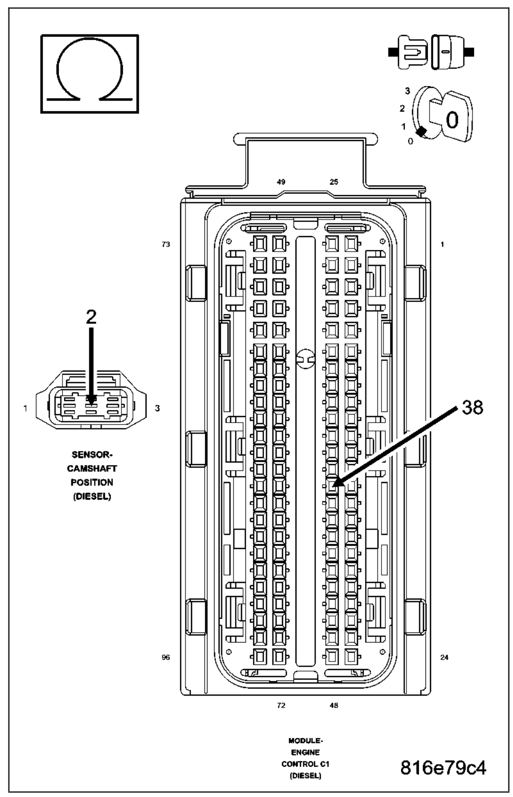
## 13. CMP SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the CMP Sensor Signal circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 14

**No** >> Repair the CMP Sensor Signal circuit for an open

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 14. CMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the ECM harness connectors.

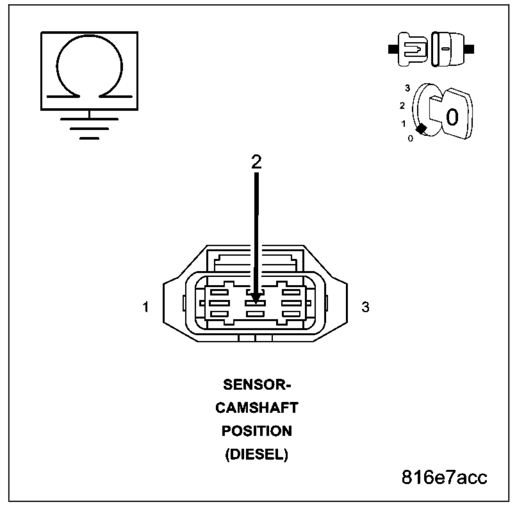
Measure the resistance between ground and the CMP Sensor Signal circuit.

**Is the resistance below 1000 ohms?**

**Yes** >> Repair the CMP Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 15




## 15. CMP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the CMP Sensor Signal circuit and the Sensor Ground circuit at the CMP Sensor harness connector.

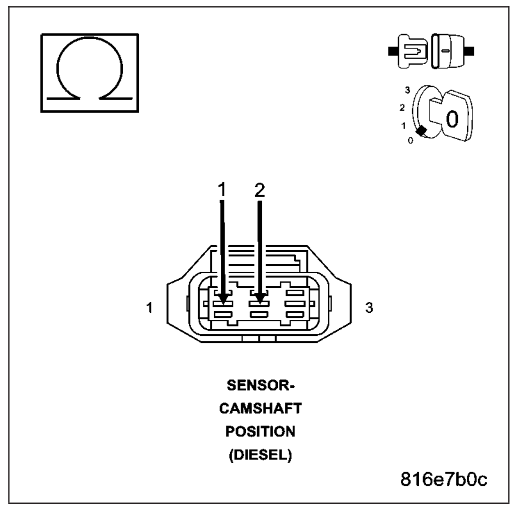
**Is the resistance below 1000 ohms?**

**Yes** >> Repair the CMP Sensor Signal and Sensor Ground circuits for a short together.

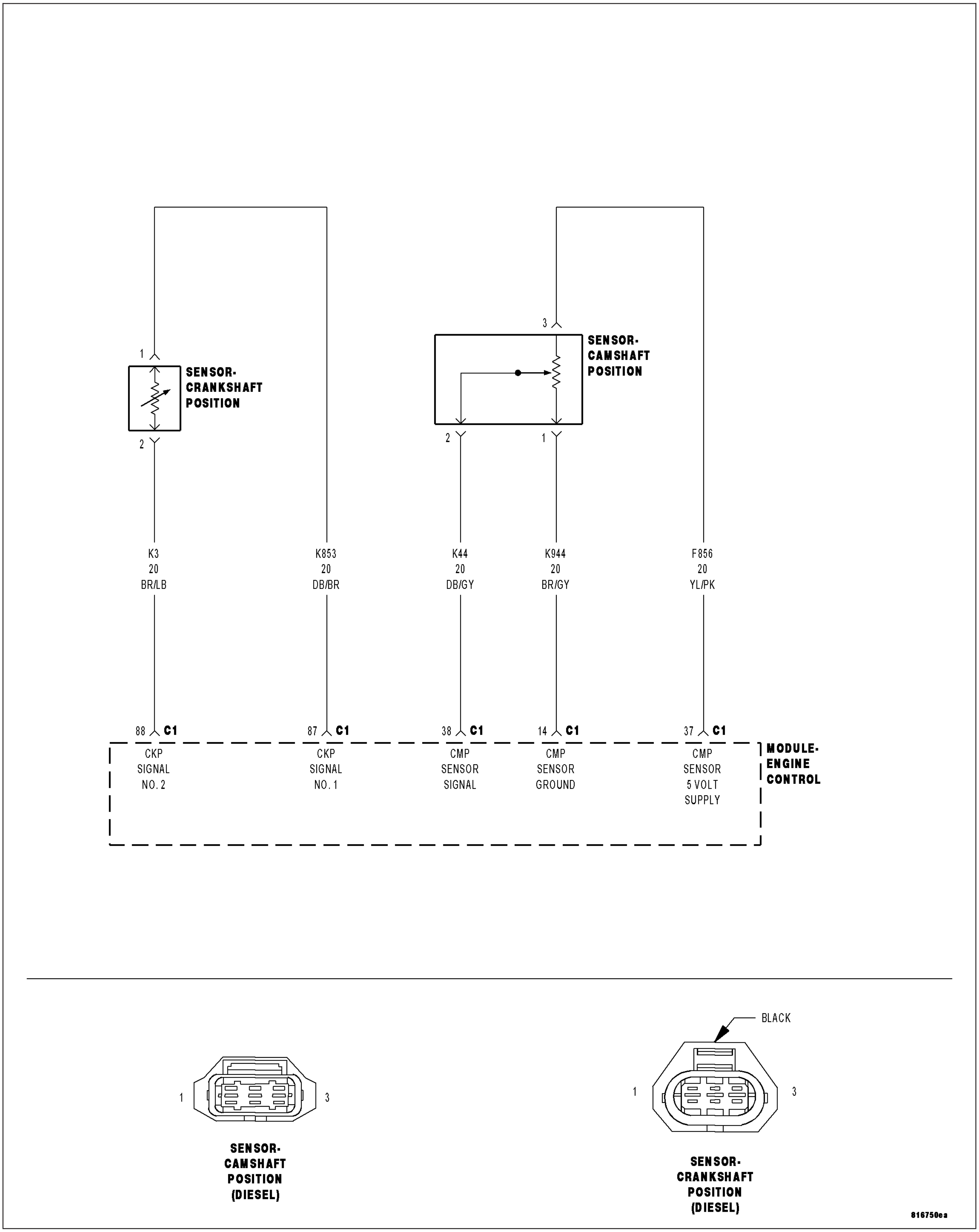
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



# P0344-CAMSHAFT POSITION SENSOR INTERMITTENT SIGNAL PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine speed between 20 and 6000 rpm.
- **Set Condition:**
  The ECM does not receive a Camshaft Position Sensor signal.

| **Possible Causes** |
|---|
| 5-VOLT SUPPLY CIRCUIT OPEN |
| CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| CHECKING 5-VOLT SUPPLY CIRCUIT |
| DAMAGED CMP SENSOR OR CAMSHAFT |
| ECM |
| ECM |
| ECM - CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND CIRCUIT OPEN |
| INTERMITTENT CONDITION |
| CMP SENSOR SIGNAL CIRCUIT OPEN |
| 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| CMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| CMASHAFT POSITION SENSOR |
| ECM SENSOR GROUND CIRCUIT OPEN |
| 5-VOLT SUPPLY CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT |
| CMP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: The Timing Belt/Chain must be correctly installed and operational before diagnosis can be made. Refer to the Service Information to ensure the timing belt is properly installed.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine cranking the engine for at least 7 seconds.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Go To 2

## 2. TEST DRIVE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

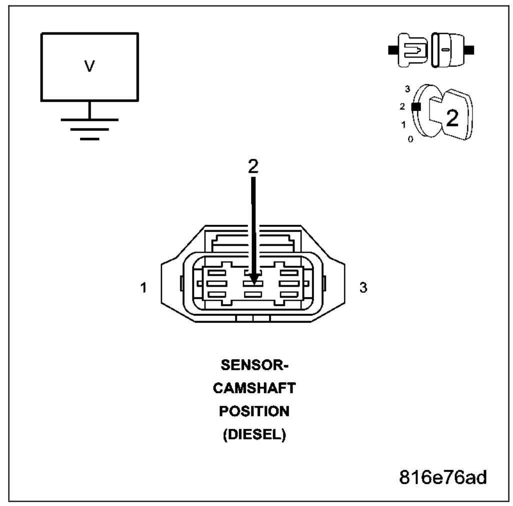
## 3. CHECKING CAMSHAFT POSITION SENSOR SIGNAL CKT

Turn the ignition off.

Disconnect the Camshaft Position Sensor harness connector.

Turn the ignition on.

Measure the voltage of the CMP Sensor Signal circuit.




**Select the appropriate voltage reading.**

**Voltage is above 5.4 volts.**
Go To 4

**Voltage is between 4.7 and 5.4 volts.**
Go To 5

**Voltage is below 4.7 volts.**
Go To 13

## 4. CAMSHAFT POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the Camshaft Position Sensor harness connector.

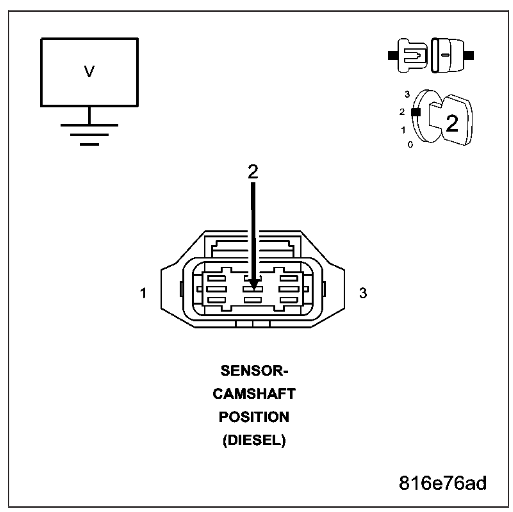
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the CMP Position Sensor Signal circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Camshaft Position Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

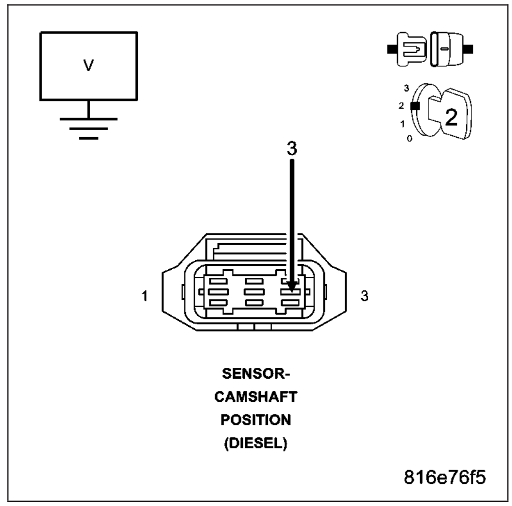
## 5. CHECKING 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Camshaft Position Sensor harness connector.

Turn the ignition on.

Measure the voltage of the CMP Sensor 5-Volt Supply circuit.




**Select the appropriate voltage reading.**

**Voltage is above 5.4 volts.**

Repair the CMP 5-Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**Voltage is between 4.7 and 5.4 volts.**

Go To 6

**Voltage is below 4.7 volts.**

Go To 10

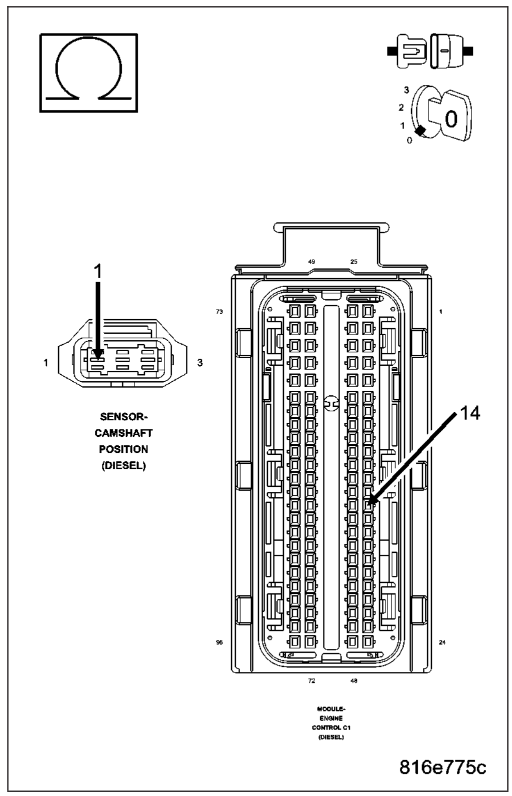
## 6. SENSOR GND CKT OPEN

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between the CMP Sensor harness connector and the ECM harness connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. ECM - SENSOR GROUND CIRCUIT OPEN

Turn the ignition on.

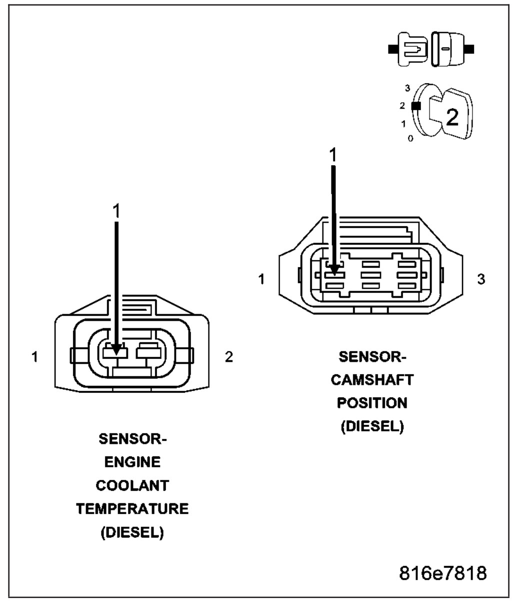
Disconnect the ECT Sensor harness connector.

Disconnect the Camshaft Position Sensor harness connector.

Connect one end of a jumper wire to the ECT Sensor signal circuit in the ECT Sensor harness connector.

Connect the other end of the jumper wire to the Sensor Ground circuit in the Camshaft Position Sensor harness connector.

With the scan tool read the Engine Coolant Temp volts.




**Is the voltage below 0.5 volt?**

**Yes** >> Go To 8

**No** >> Replace and program the ECM in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 8. DAMAGED CMP SENSOR OR CAMSHAFT

Turn the ignition off.

Remove the CMP Sensor.

Inspect the CMP Sensor for conditions such as loose mounting screws, damage, or cracks.

Inspect the camshaft for conditions such as damage, debris or cracked teeth.

**Is there any evidence of these conditions?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. CAMSHAFT POSITION SENSOR

Turn the ignition off.

With the ab scope lead, backprobe the CMP Signal circuit.

While observing the lab scope display, crank the engine.

**Does the lab scope display an uninterrupted digital signal (square wave)?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Camshaft Position Sensor in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 10. 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the CMP Sensor harness connector.

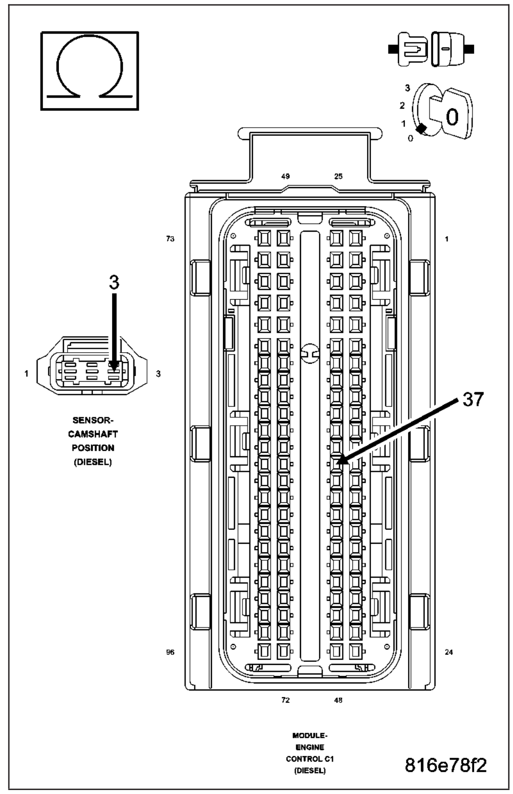
Measure the resistance of the 5-Volt Supply circuit between the ECM harness connector and the CMP Sensor harness connector.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 11

**No** >> Repair the 5-Volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 11. 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the ECM harness connectors.

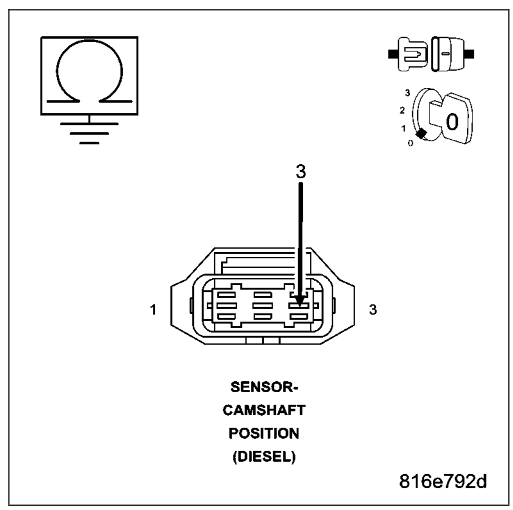
Measure the resistance between ground and the CMP Sensor 5-Volt Supply circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 12

**No** >> Repair the CMP Sensor 5-Volt Supply circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



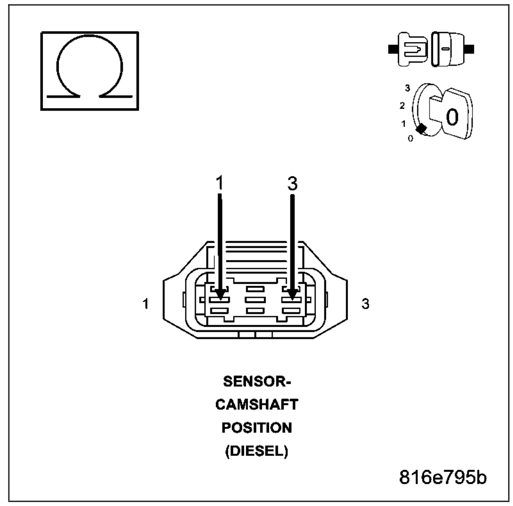
## 12. 5-VOLT SUPPLY CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the CMP Sensor 5-Volt Supply circuit and the Sensor Ground circuit at the CMP Sensor harness connector.




**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the CMP Sensor 5-Volt Supply and Sensor Ground circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

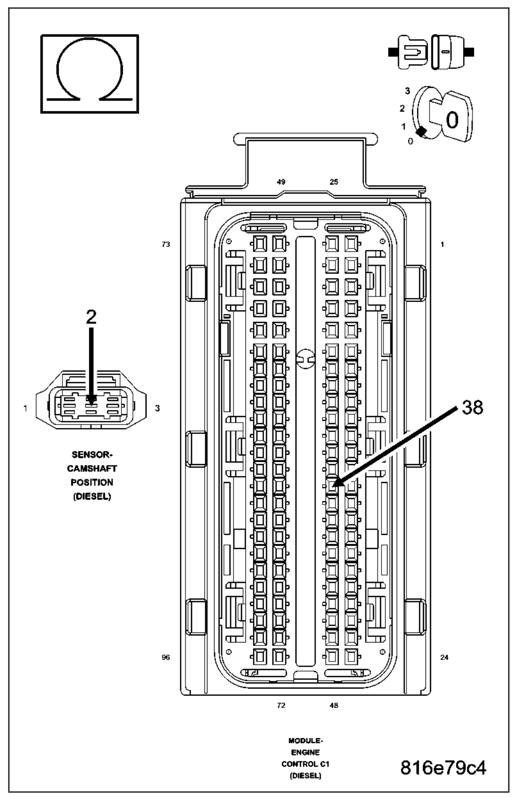
## 13. CMP SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the CMP Sensor Signal circuit.



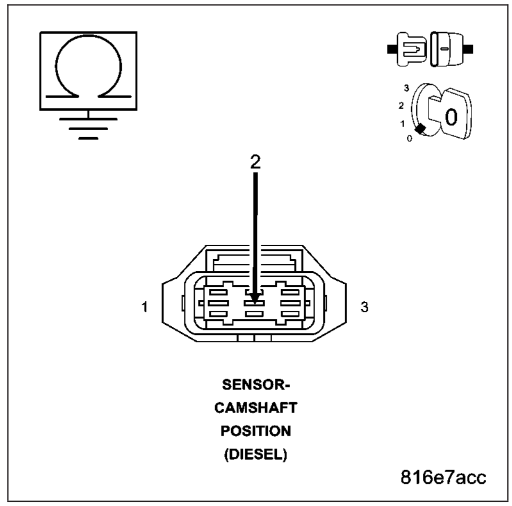

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 14

**No** >> Repair the CMP Sensor Signal circuit for an open

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 14. CMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND




Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the CMP Sensor Signal circuit.

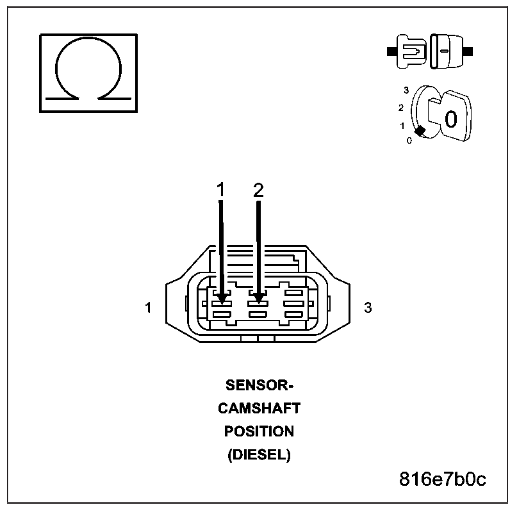
**Is the resistance below 1000 ohms?**

**Yes** >> Repair the CMP Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 15

## 15. CMP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT




Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the CMP Sensor Signal circuit and the Sensor Ground circuit at the CMP Sensor harness connector.

**Is the resistance below 1000 ohms?**

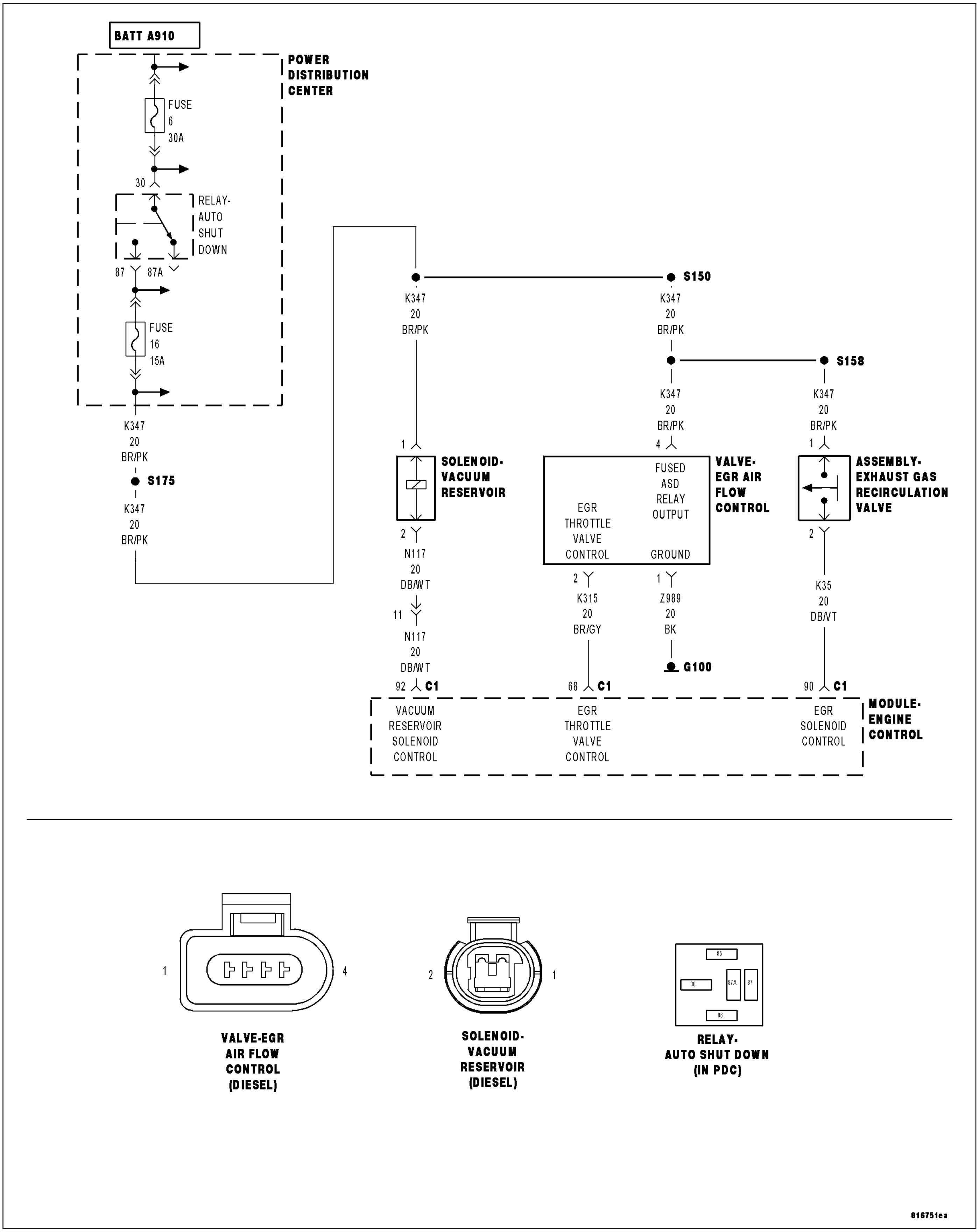
**Yes** >> Repair the CMP Sensor Signal and Sensor Ground circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0401-EGR SOLENOID CIRCUIT NEGATIVE DEVIATION




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM detects EGR flow is less than the requested flow.

| Possible Causes |
|---|
| AIR FILTER |
| AIR RESTRICTION |
| CHECKING FOR AIR LEAKS |
| EGR VALVE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle and monitor the scan tool for ECM DTCs.

**NOTE: If there are any Mass Air Flow DTC's, diagnose the MAF DTC's before continuing EGR diagnostics.**

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. AIR FILTER

Turn the ignition off.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause air flow restriction.

**Were any of these problems found?**

**Yes** >> Replace the Air Filter element.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

### 3. AIR RESTRICTION

**NOTE: Inspect all air intake, crankcase vent and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

**NOTE: Inspect the exhaust system and related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

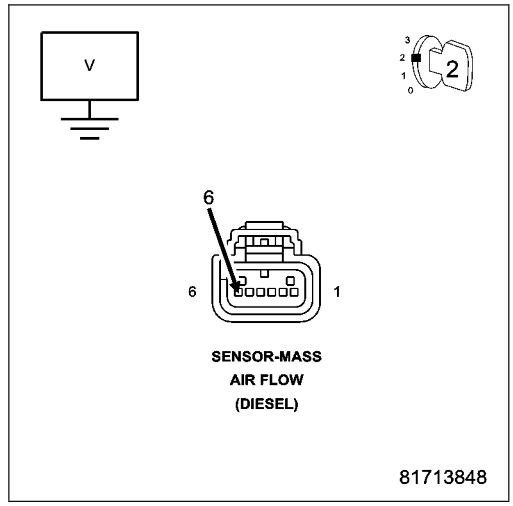
Inspect the intake system, exhaust system and related tubes and connections.

**Were any problems found?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. EGR ACTUATION - IDLE




**NOTE: Inspect the complete exhaust system for restriction. Restrictions in the exhaust system can cause improper EGR flow. Repair as necessary**

Start engine.

Allow the engine to idle until the engine reaches operating temperature.

While back probing, measure the MAF Sensor Signal circuit at the MAF Sensor harness connector.

With the scan tool, perform the EGR Actuator with the engine idling.

**NOTE: The MAF reading should change by at least 0.23 volts during EGR actuation**

Note the MAF readings.

**Does the MAF reading switch a minimum of 0.23 volt during EGR actuation?**

**Yes** >> Go To 5

**No** >> Go To 6

## 5. EGR ACTUATION - 1000 RPM

While back probing, measure the MAF Sensor Signal circuit at the MAF Sensor harness connector.

With the scan tool, perform the EGR Actuator with the engine speed at 1000 rpm.

**NOTE: The MAF reading should change by at least 0.30 volts during EGR actuation**

Note the MAF readings.

**Does the MAF reading switch a minimum of 0.30 volt during EGR actuation?**

**Yes** >> Test Complete.

**No** >> Go To 6

## 6. CHECKING FOR AIR LEAKS

Turn the ignition off.

Remove the Inlet Pressure Sensor.

Connect smoke machine 84-04 to the Inlet Pressure Sensor port in the intake duct and begin injecting smoke into the intake system.

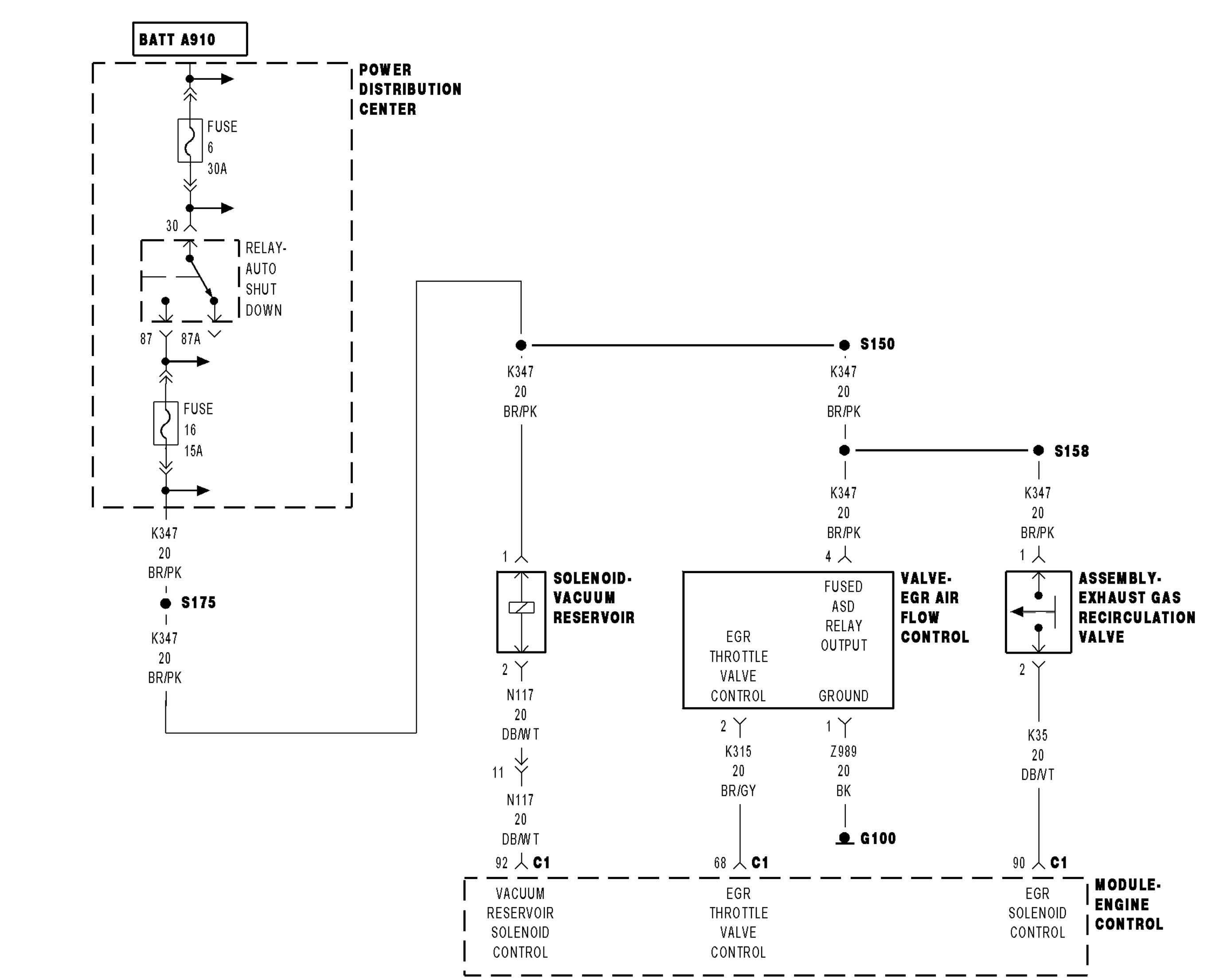
Observe all intake system components for evidence of smoke leakage.

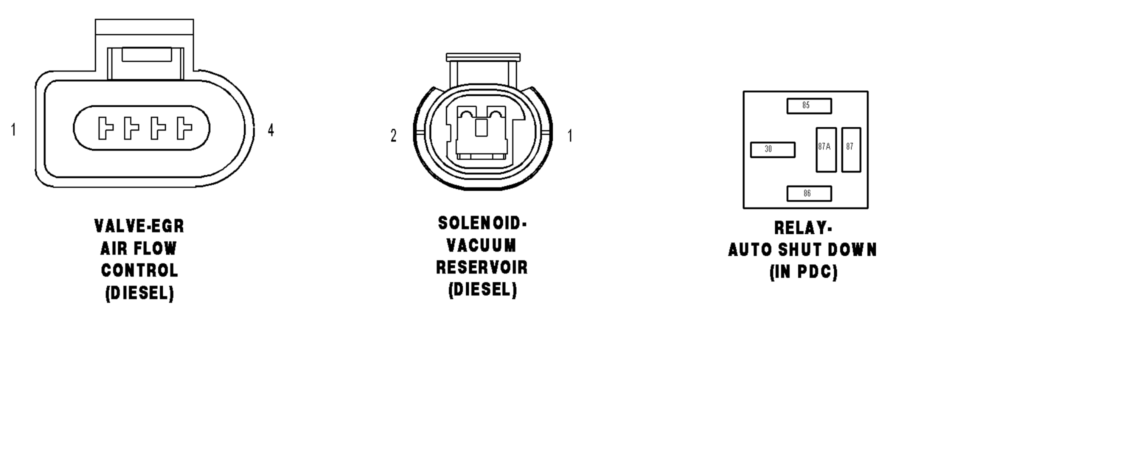
**Is there evidence of smoke leakage?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the EGR Valve.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0402-EGR SOLENOID CIRCUIT POSITIVE DEVIATION




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM detects EGR flow is more than the requested flow.

| Possible Causes |
|---|
| AIR FILTER |
| AIR RESTRICTION |
| CHECKING FOR AIR LEAKS |
| EGR VALVE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle and monitor the scan tool for ECM DTCs.

**NOTE: If there are any Mass Air Flow DTC's, diagnose the MAF DTC's before continuing EGR diagnostics.**

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. AIR FILTER

Turn the ignition off.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause air flow restriction.

**Were any of these problems found?**

**Yes** >> Replace the Air Filter element.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

### 3. AIR RESTRICTION

**NOTE: Inspect all air intake, crankcase vent and turbocharger related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

**NOTE: Inspect the exhaust system and related tubes for damage, restriction or poor connection. Any of these conditions can cause a this DTC to set.**

Inspect the intake system, exhaust system and related tubes and connections.

**Were any problems found?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. EGR ACTUATION - IDLE

**NOTE: Inspect the complete exhaust system for restriction. Restrictions in the exhaust system can cause improper EGR flow. Repair as necessary**

Start engine.

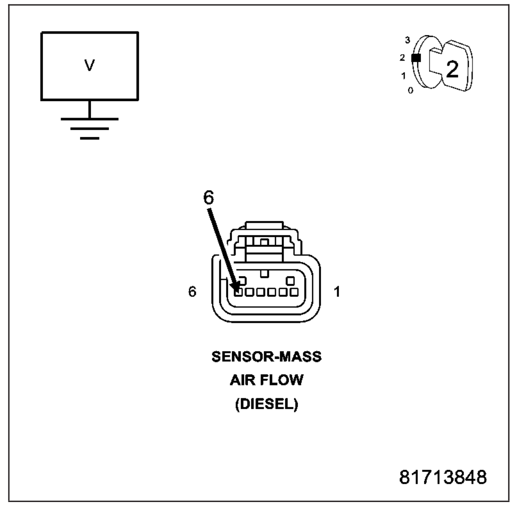
Allow the engine to idle until the engine reaches operating temperature.

While back probing, measure the MAF Sensor Signal circuit at the MAF Sensor harness connector.

With the scan tool, perform the EGR Actuator with the engine idling.

**NOTE: The MAF reading should change by at least 0.23 volts during EGR actuation**

Note the MAF readings.




**Does the MAF reading switch a minimum of 0.23 volt during EGR actuation?**

**Yes** >> Go To 5

**No** >> Go To 6

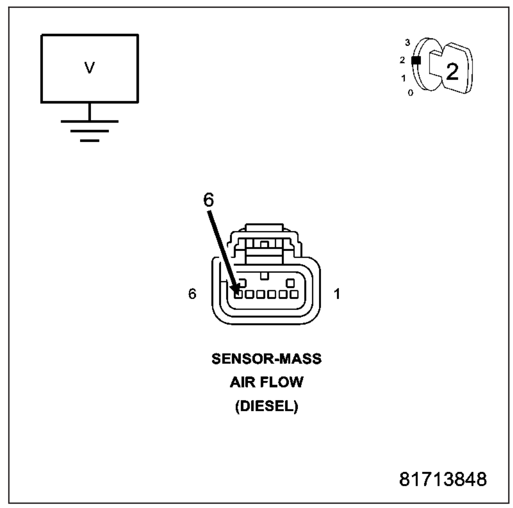
## 5. EGR ACTUATION - 1000 RPM

While back probing, measure the MAF Sensor Signal circuit at the MAF Sensor harness connector.

With the scan tool, perform the EGR Actuator with the engine speed at 1000 rpm.

**NOTE: The MAF reading should change by at least 0.30 volts during EGR actuation**

Note the MAF readings.




**Does the MAF reading switch a minimum of 0.30 volt during EGR actuation?**

**Yes** >> Test Complete.

**No** >> Go To 6

## 6. CHECKING FOR AIR LEAKS

Turn the ignition off.

Remove the Inlet Pressure Sensor.

Connect smoke machine 84-04 to the Inlet Pressure Sensor port in the intake duct and begin injecting smoke into the intake system.

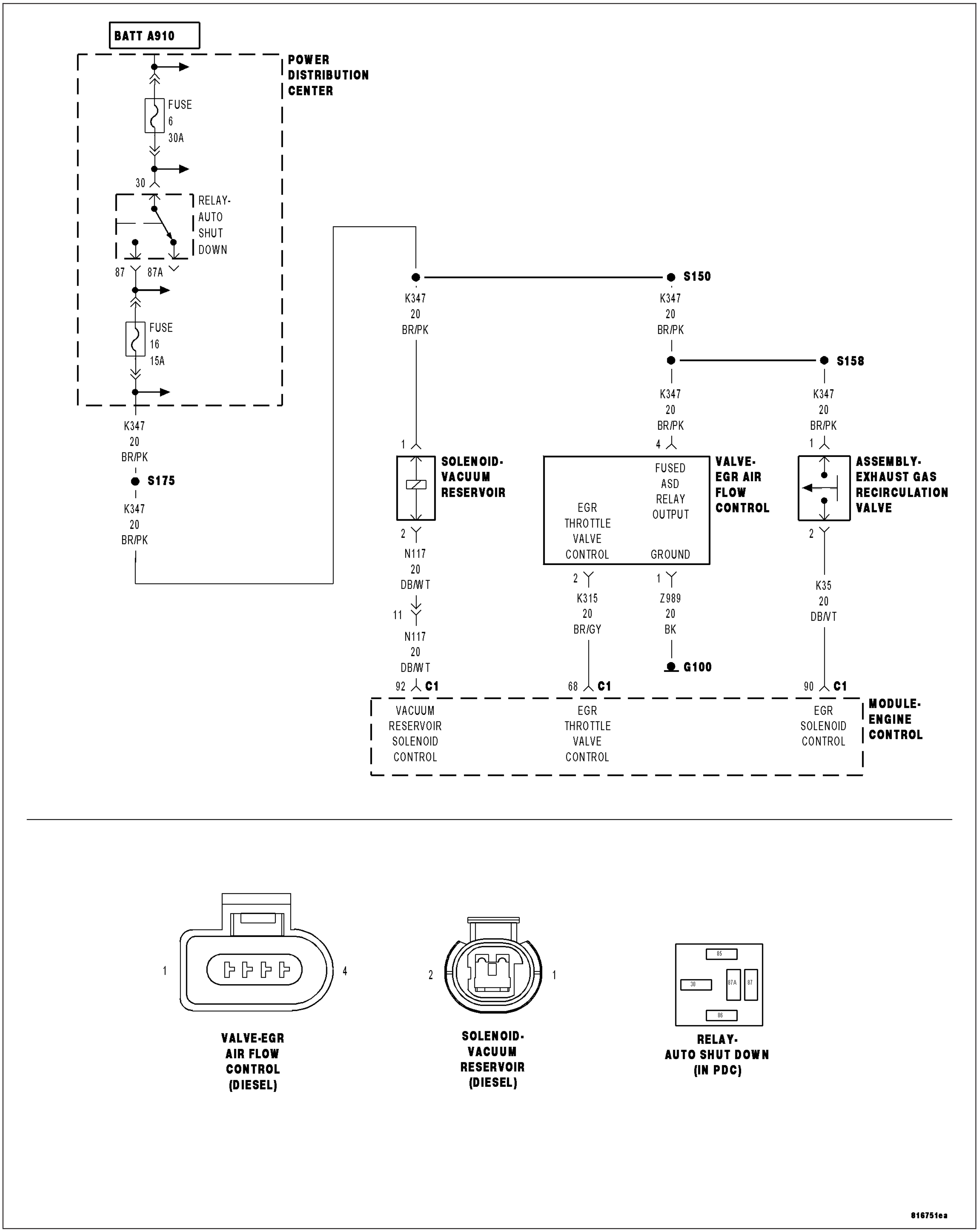
Observe all intake system components for evidence of smoke leakage.

**Is there evidence of smoke leakage?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the EGR Valve.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0403-EGR SOLENOID CIRCUIT EXCESSIVE CURRENT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM EGR Solenoid command on.
- **Set Condition:**
  The ECM detects excessive current on the EGR Solenoid Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| EGR SOLENOID |
| (K35) EGR SOLENOID CONTROL SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE - INTERNAL SHORT TO VOLTAGE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle and monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. EGR SOLENOID

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**Does the scan tool display P0403 EGR OPEN CIRCUIT?**

**Yes** >> Replace the EGR Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. (K35) EGR SOLENOID CONTROL SHORTED TO VOLTAGE

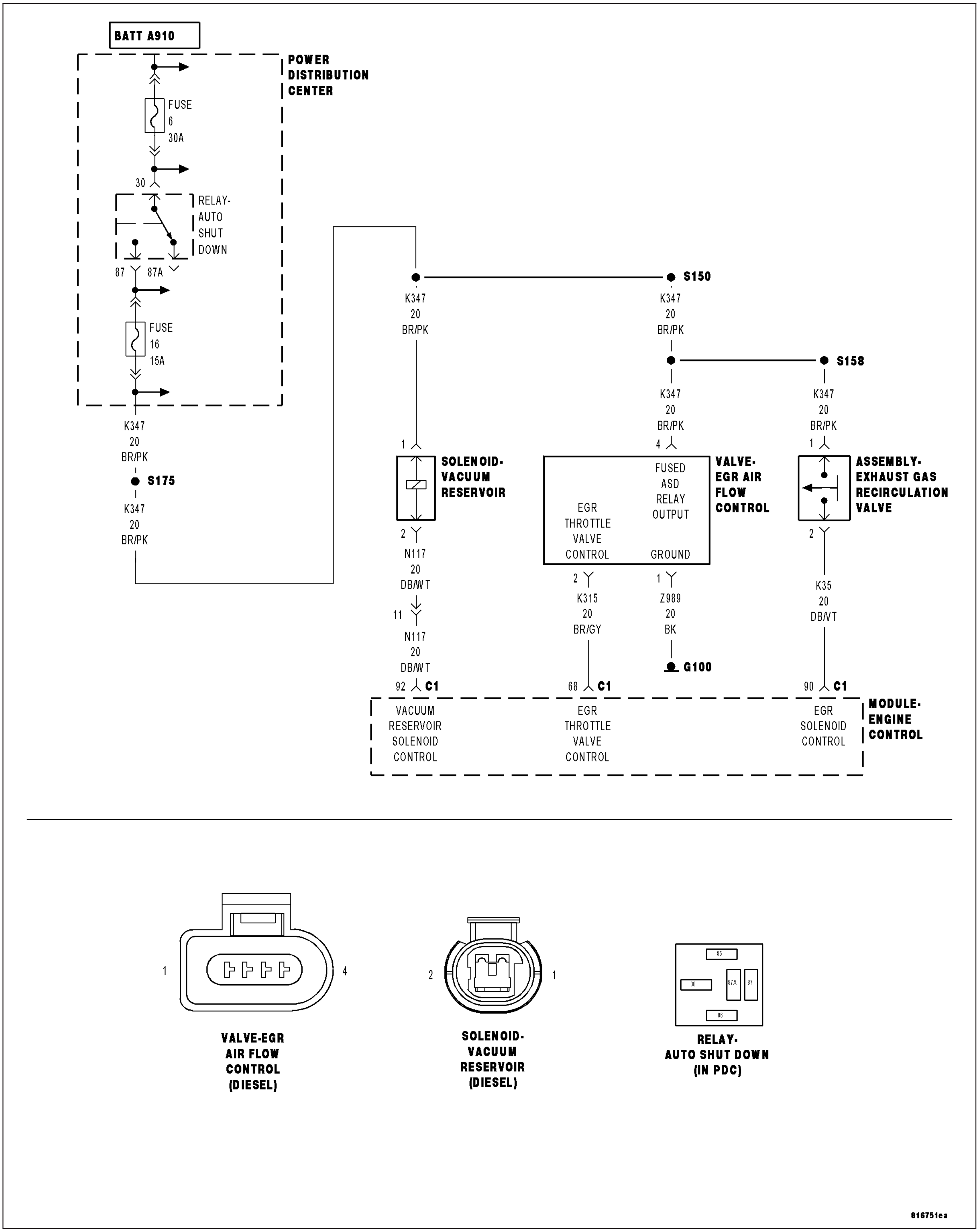
Turn the ignition off.
Disconnect the EGR Solenoid harness connector.
Disconnect the ECM harness connectors.
Remove the ASD Relay from the PDC.
Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
Turn the ignition on.
Measure the voltage of the (K35) EGR Solenoid Control circuit.

**Is the voltage below 0.5 volt?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the (K35) EGR Solenoid Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0403-EGR SOLENOID CIRCUIT OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM EGR Solenoid command off.
- **Set Condition:**
  The ECM does not detect voltage on the EGR Solenoid Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| (K35) EGR SOLENOID CONTROL CIRCUIT OPEN |
| EGR SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles, turning the ignition off for at least 10 seconds between each ignition cycle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

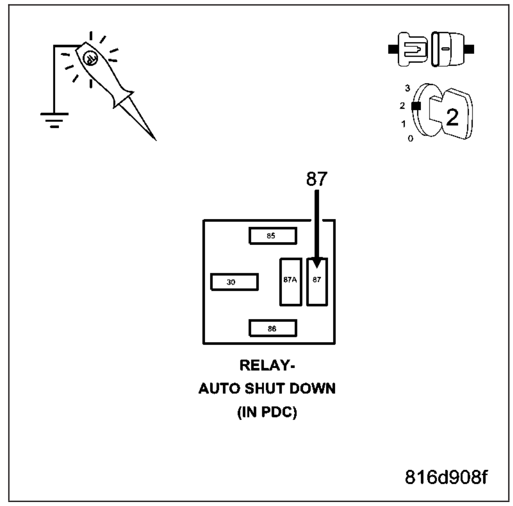
## 3. ASD OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the ASD Relay Output circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the (K35) EGR Solenoid Control circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (K35) EGR Solenoid Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. (K35) EGR SOLENOID CONTROL CIRCUIT OPEN

Measure the resistance of the (K35) EGR Solenoid Control circuit between the EGR Solenoid harness connector and the ECM C1 harness connector.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the (K35) EGR Solenoid Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. EGR SOLENOID

Install a substitute EGR Solenoid in place of the vehicle's EGR Solenoid.

**NOTE: Ensure the ECM and EGR Solenoid harness connectors are connected.**

Turn the ignition on.

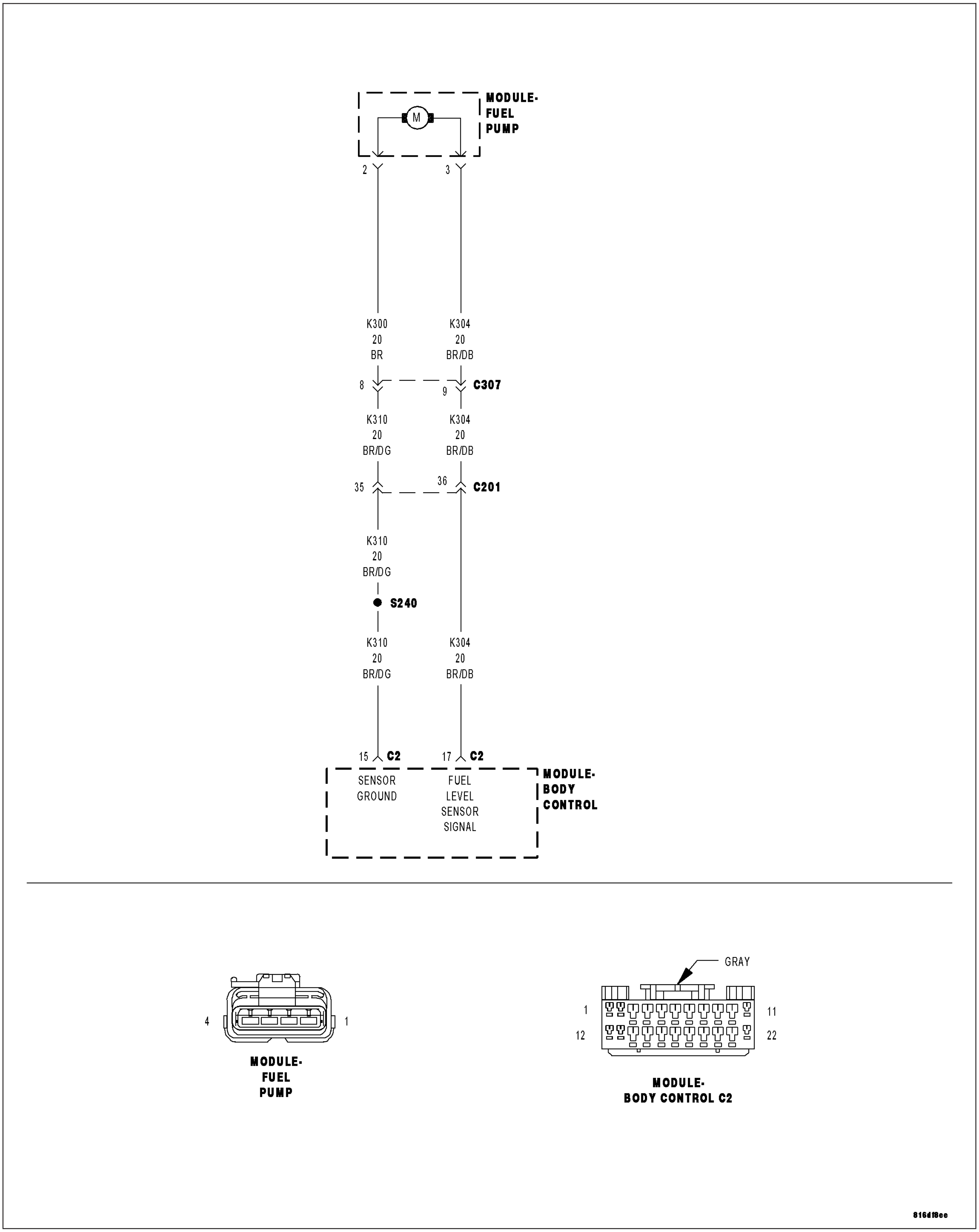
With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the EGR Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0460-FUEL LEVEL SENSOR CIRCUIT SIGNAL VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Fuel Level Sensor signal voltage is above 4.51 volts for 1.0 seconds.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| (K304) FUEL LEVEL SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| (K304) FUEL LEVEL SENSOR SIGNAL CIRCUIT OPEN |
| (K300) FUEL LEVEL SENSOR GROUND CIRCUIT OPEN |
| FUEL PUMP MODULE |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. (K304) FUEL LEVEL SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the BCM harness connectors.

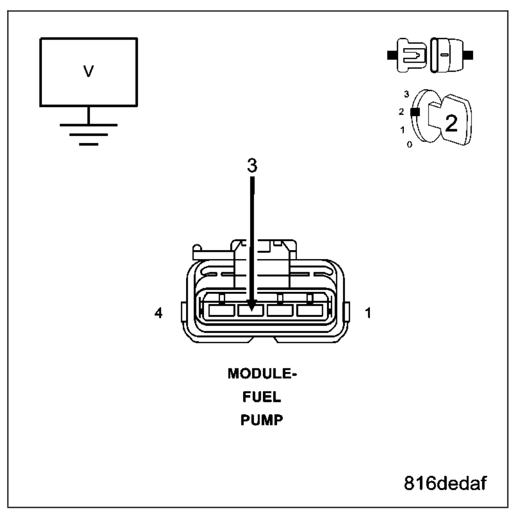
Disconnect the Fuel Pump Module harness connector.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage on the (K304) Fuel Level Sensor Signal circuit.




**Is the voltage below 0.5 volt?**

**Yes** >> Go To 3

**No** >> Repair the (K304) Fuel Level Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. (K304) FUEL LEVEL SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

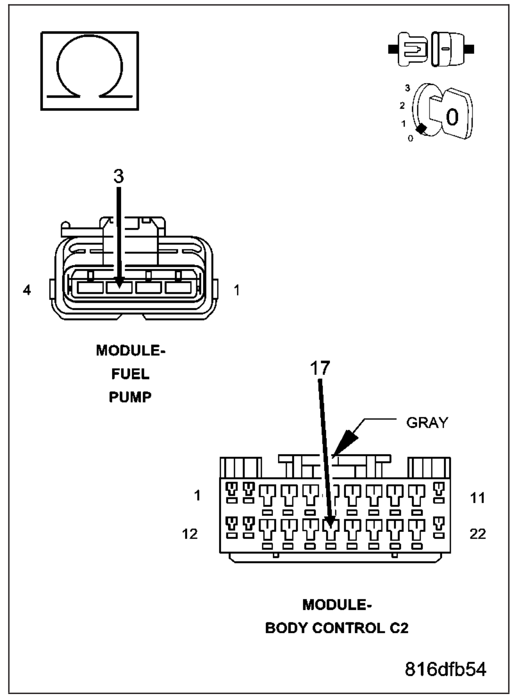
Measure the resistance of the (K304) Fuel Level Sensor Signal circuit from the Fuel Pump Module harness connector to the BCM harness connector.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the (K304) Fuel Level Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 4. FUEL LEVEL SENSOR GROUND CIRCUIT OPEN

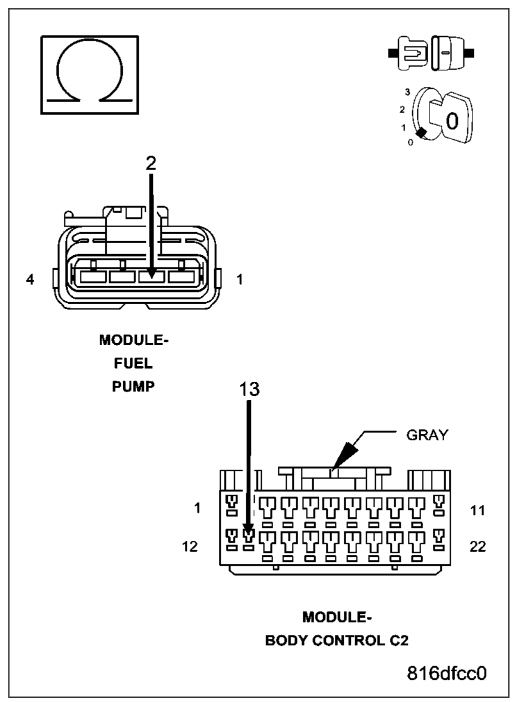
Measure the resistance of the (K300) Fuel Level Sensor Ground circuit from the Fuel Pump Module harness connector to the BCM harness connector.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (K300) Fuel Level Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 5. FUEL LEVEL SENSOR

Turn the ignition on.

With the scan tool, read and record the Fuel Level Sensor voltage.

**NOTE: The Fuel Level Sensor voltage should be 5.0 ± 0.3 volts with the sensor harness connector disconnected.**

Connect a jumper wire across the Fuel Level Sensor Signal circuit and Sensor Ground circuit at the Fuel Pump Module harness connector.

With the scan tool, read the Fuel Level Sensor voltage.

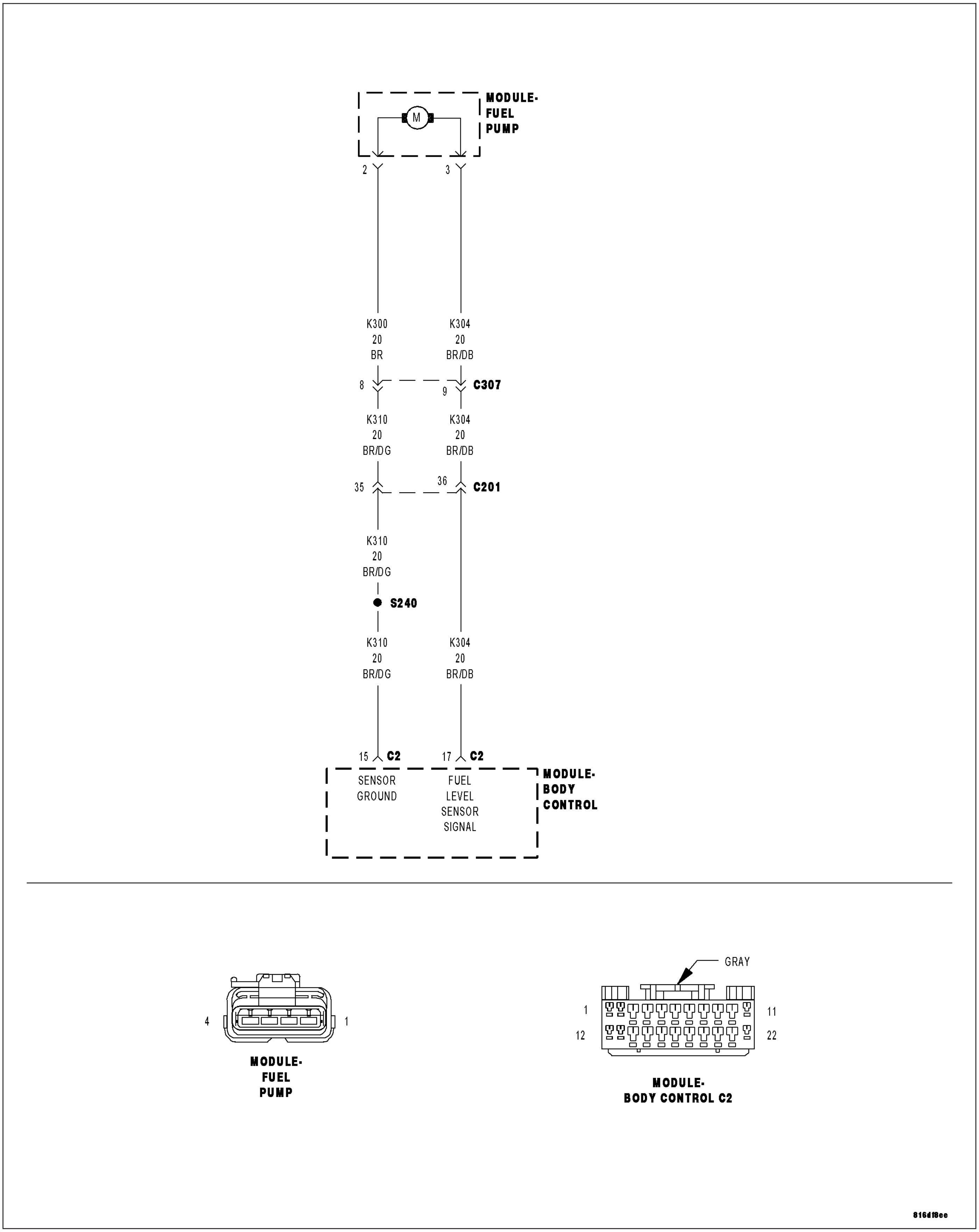
**NOTE: The Fuel Level Sensor voltage should be less then 1.0 volt with the jumper wire connected.**

**Are the voltage readings the expected voltages?**

**Yes** >> Replace the Fuel Pump Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Body Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0460-FUEL LEVEL SENSOR CIRCUIT SIGNAL VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Fuel Level Sensor signal voltage is below 0.19 volt for 1.0 second.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| FUEL PUMP MODULE |
| (K304) FUEL LEVEL SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| FUEL LEVEL SENSOR SIGNAL AND GROUND CIRCUIT SHORTED TOGETHER |
| BODY CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. FUEL LEVEL SENSOR

Turn the ignition off.

Disconnect the Fuel Level Sensor harness connector.

Turn the ignition on.

With the scan tool, read the Fuel Level Sensor voltage.

**Is the voltage above 4.8 volts?**

**Yes** >> Replace the Fuel Level Sensor in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. (K304) FUEL LEVEL SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the Fuel Pump Module harness connector.

Measure the resistance between ground and the (K304) Fuel Level Sensor Signal circuit at the Fuel Pump Module connector.

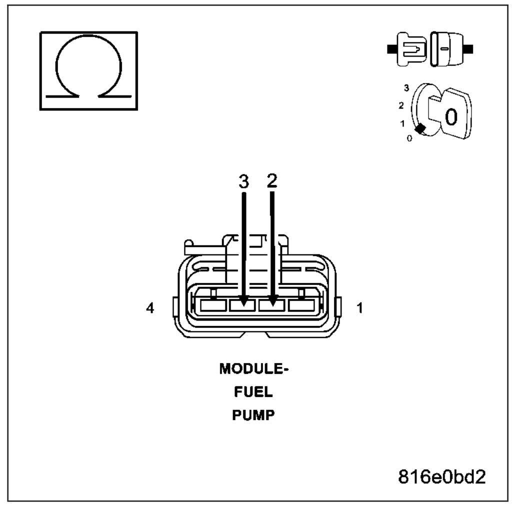
**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the (K304) Fuel Level Sensor Signal circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. (K304) FUEL LEVEL SENSOR SIGNAL AND (K300) GROUND CIRCUIT SHORTED TOGETHER

Measure the resistance between the (K304) Fuel Level Sensor Signal circuit and (K300) Sensor Ground circuit.

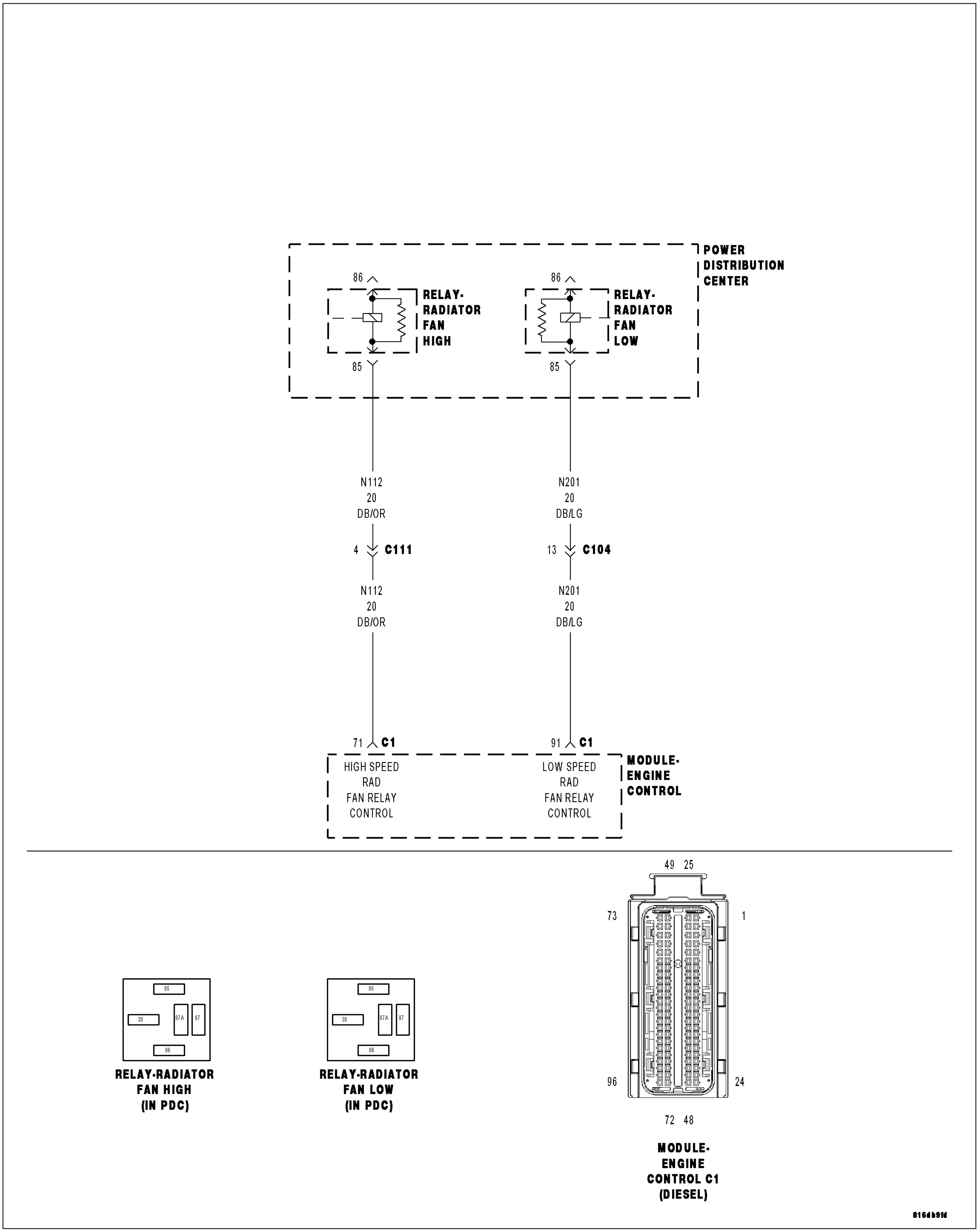



**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the (K304) Fuel Level Sensor Signal and (K300) Ground circuit for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0480-FAN 1 CONTROL CIRCUIT EXCESSIVE CURRENT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Low Speed Rad Fan Relay command on.
- **Set Condition:**
  The ECM detects excessive current on the Low Speed Rad Fan Relay Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| LOW SPEED RADIATOR FAN RELAY |
| (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the Low Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. LOW SPEED RADIATOR FAN RELAY

Turn the ignition off.

Install a know good relay in place of the Low Speed Radiator Fan Relay.

Turn the ignition on.

With the scan tool, actuate the Low Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Replace the Low Speed Radiator Fan Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

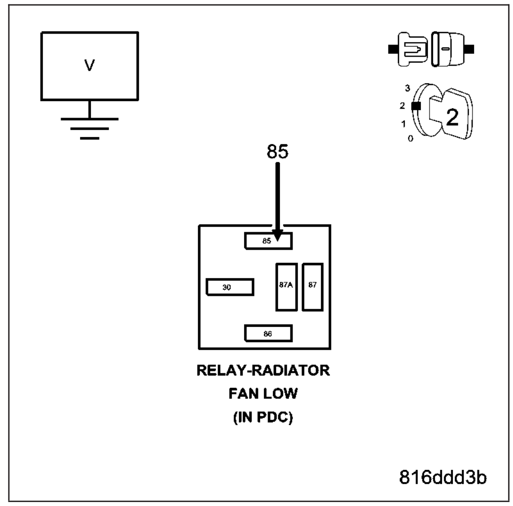
Remove the Low Speed Radiator Fan Relay from the PDC.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of (N201) Low Speed Radiator Fan Control circuit.




**Is the voltage below 1.0 volt?**

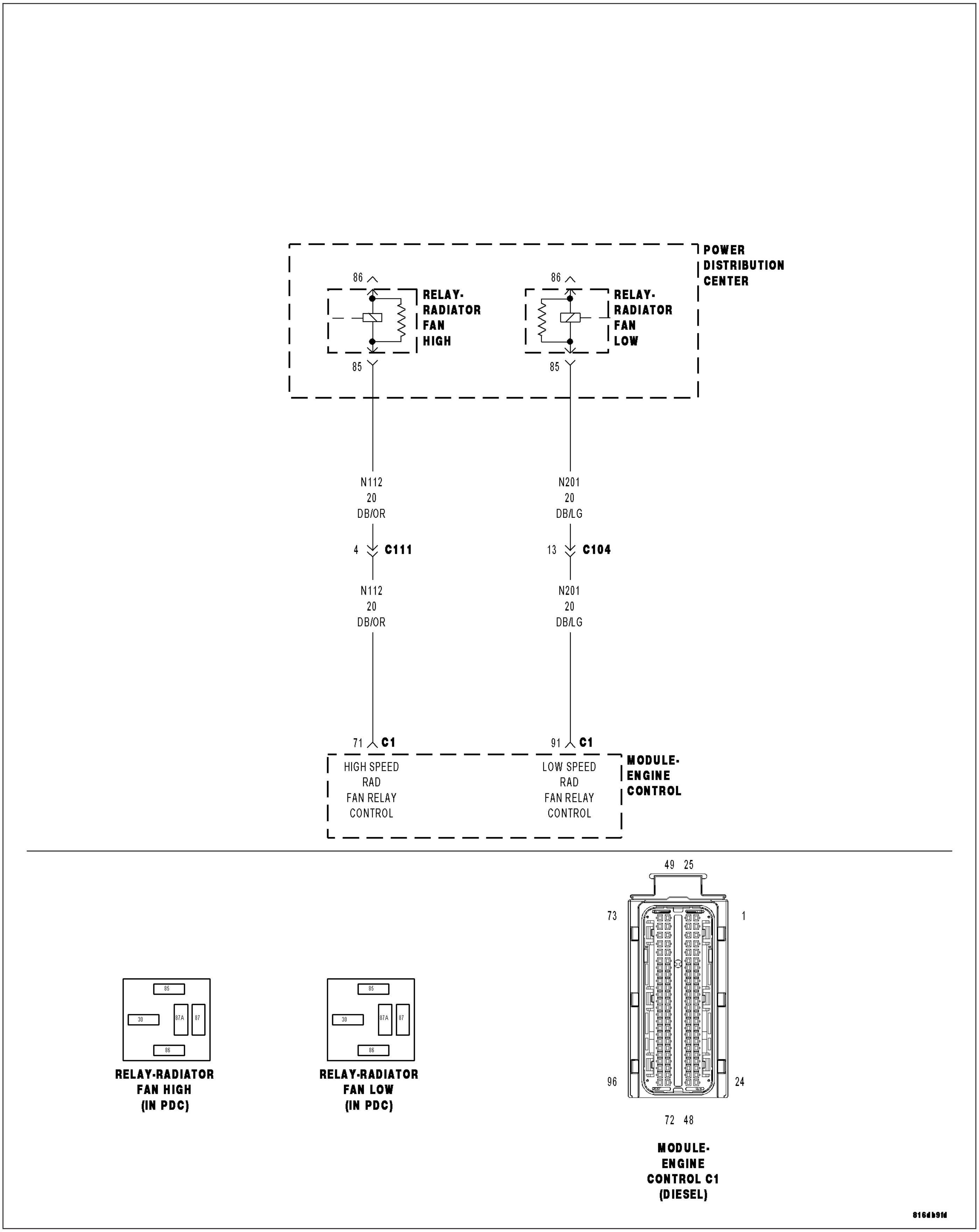
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the (N201) Low Speed Radiator Fan Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0480-FAN 1 CONTROL CIRCUIT OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Low Speed Rad Fan Relay command off.
- **Set Condition:**
  The ECM does not detect voltage on the Low Speed Rad Fan Relay Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| LOW SPEED RADIATOR FAN RELAY |
| (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO GROUND |
| (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT OPEN |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the Low Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Remove the Low Speed Radiator Fan Relay from the PDC.

Turn the ignition on.

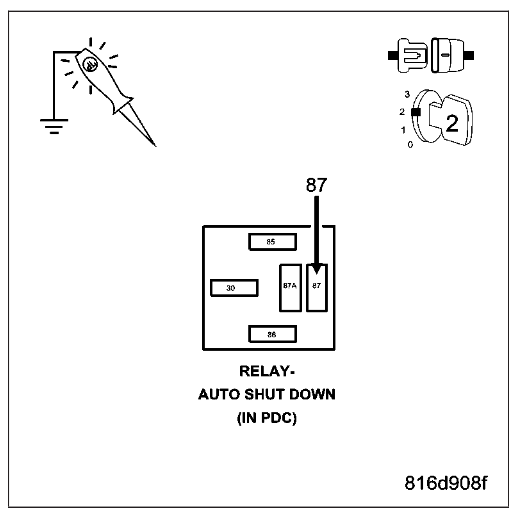
Using a 12-volt test light connected to ground, check the ASD Relay Output circuit.

**Did the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 3. LOW SPEED RADIATOR FAN RELAY

Turn the ignition off.

Install a known good relay in place of the Low Speed Radiator Fan Relay.

Turn the ignition on.

With the scan tool, actuate the Low Speed Rad Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Replace the Low Speed Radiator Fan Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the Low Speed Radiator Fan Relay from the PDC.

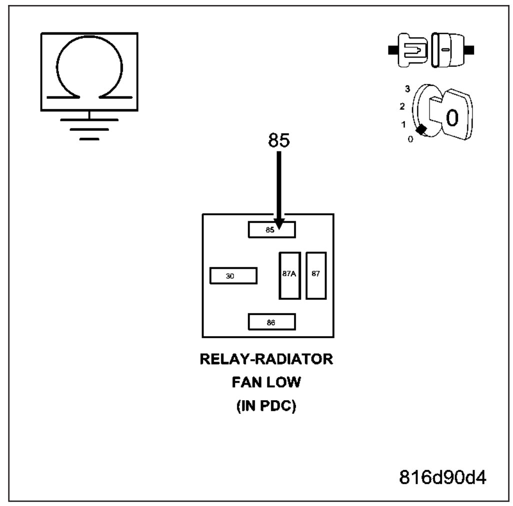
Disconnect the ECM C1 harness connectors.

Measure the resistance between ground and the (N201) Low Speed Radiator Fan Control circuit at the PDC.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (N201) Low Speed Radiator Fan Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



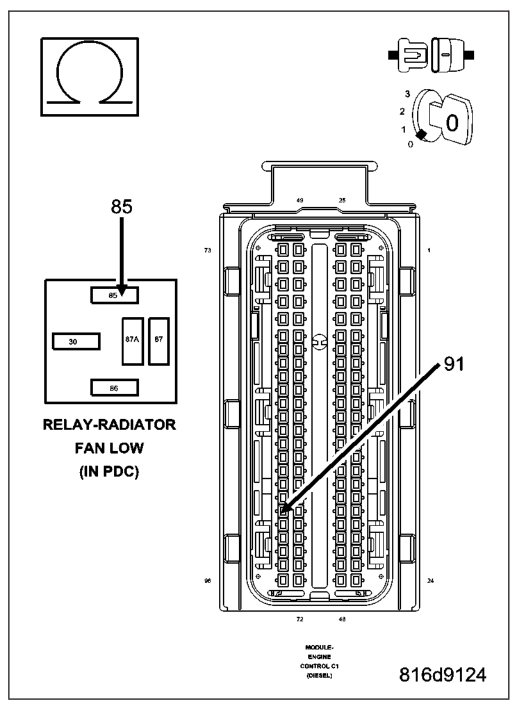

## 5. (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT OPEN

Measure the resistance of the (N201) Low Speed Radiator Fan Control circuit between the PDC and the ECM C1 harness connector.

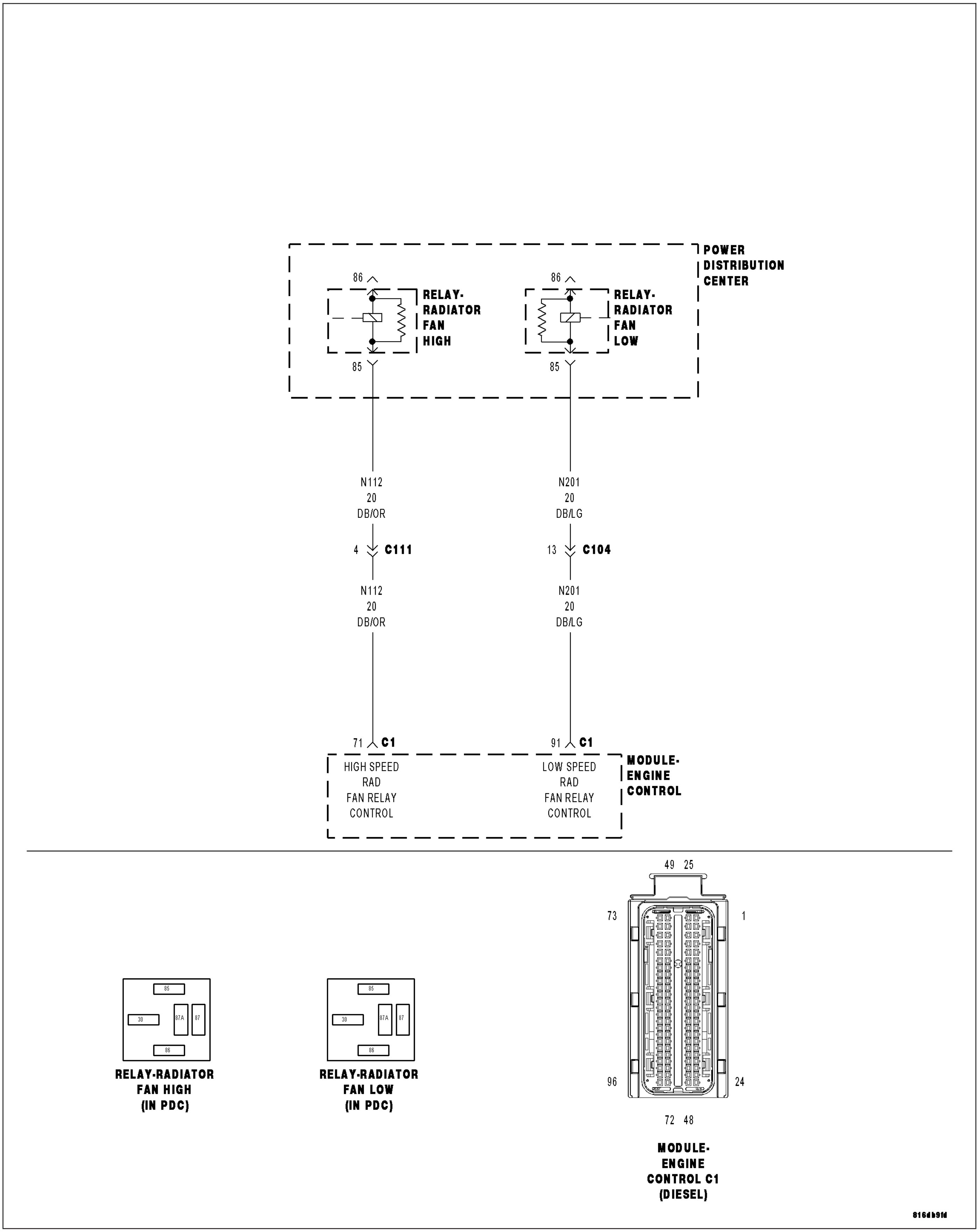
**Is the resistance below 10.0 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Low Speed Radiator Fan Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## P0480-FAN 1 CONTROL CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Low Speed Rad Fan Relay command off.
- **Set Condition:**
  The ECM detects a short to ground on the Low Speed Rad Fan Relay Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| LOW SPEED RADIATOR FAN RELAY |
| (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO GROUND |
| (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT OPEN |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the Low Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

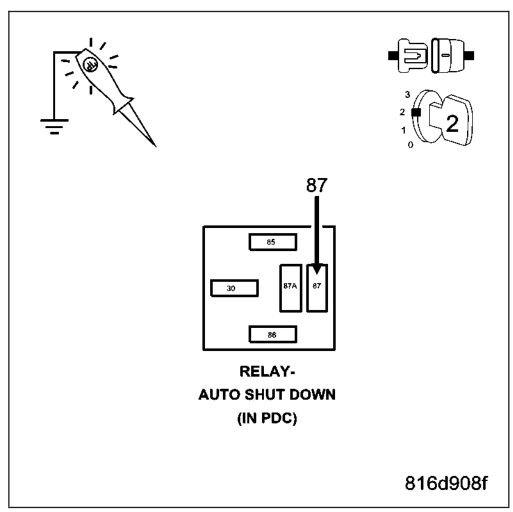
### 2. ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Remove the Low Speed Radiator Fan Relay from the PDC.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit.




**Did the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. LOW SPEED RADIATOR FAN RELAY

Turn the ignition off.

Install a substitute relay in place of the Low Speed Radiator Fan Relay.

Turn the ignition on.

With the scan tool, actuate the Low Speed Rad Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Replace the Low Speed Radiator Fan Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the Low Speed Radiator Fan Relay from the PDC.

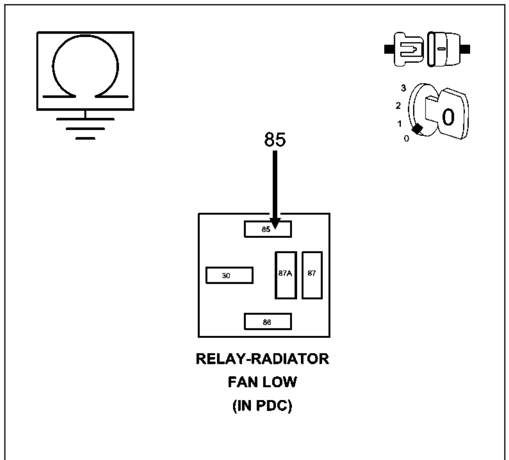
Disconnect the ECM C1 harness connectors.

Measure the resistance between ground and the (N201) Low Speed Radiator Fan Control circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (N201) Low Speed Radiator Fan Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




816d90d4

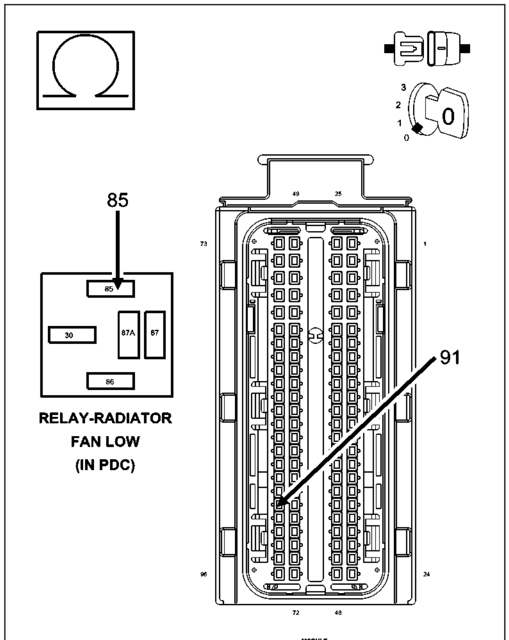
## 5. (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT OPEN

Measure the resistance of the (N201) Low Speed Radiator Fan Control circuit between the PDC and the ECM C1 harness connector.

**Is the resistance below 10.0 ohms?**

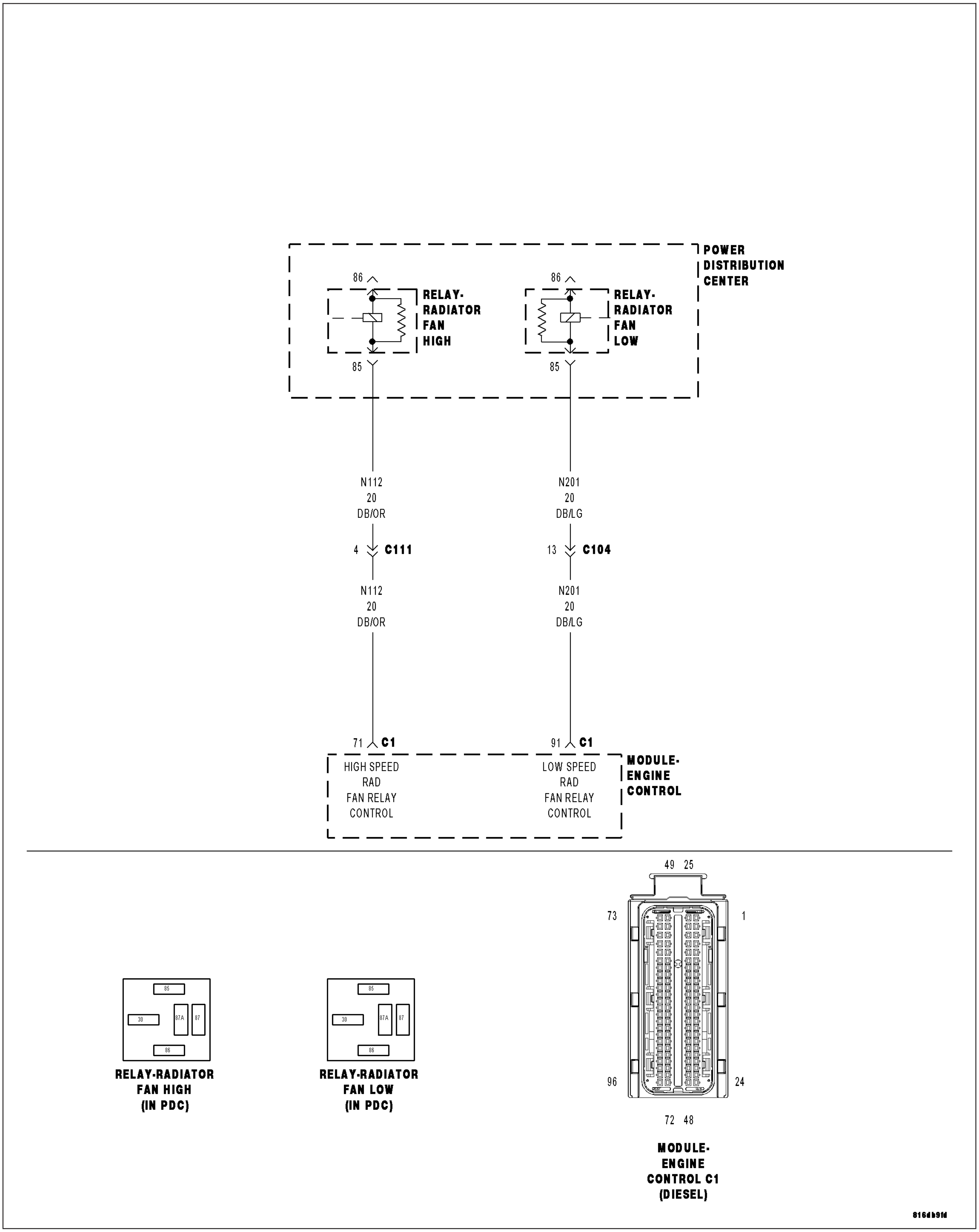
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the (N201) Low Speed Radiator Fan Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




816d9124

## P0480-FAN 1 CONTROL CIRCUIT SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Low Speed Rad Fan Relay command on.
- **Set Condition:**
  The ECM detects excessive current on the Low Speed Rad Fan Relay Control circuit.

| Possible Causes |
| --- |
| INTERMITTENT CONDITION |
| LOW SPEED RADIATOR FAN RELAY |
| (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the Low Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. LOW SPEED RADIATOR FAN RELAY

Turn the ignition off.

Install a know good relay in place of the Low Speed Radiator Fan Relay.

Turn the ignition on.

With the scan tool, actuate the Low Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Replace the Low Speed Radiator Fan Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO VOLTAGE

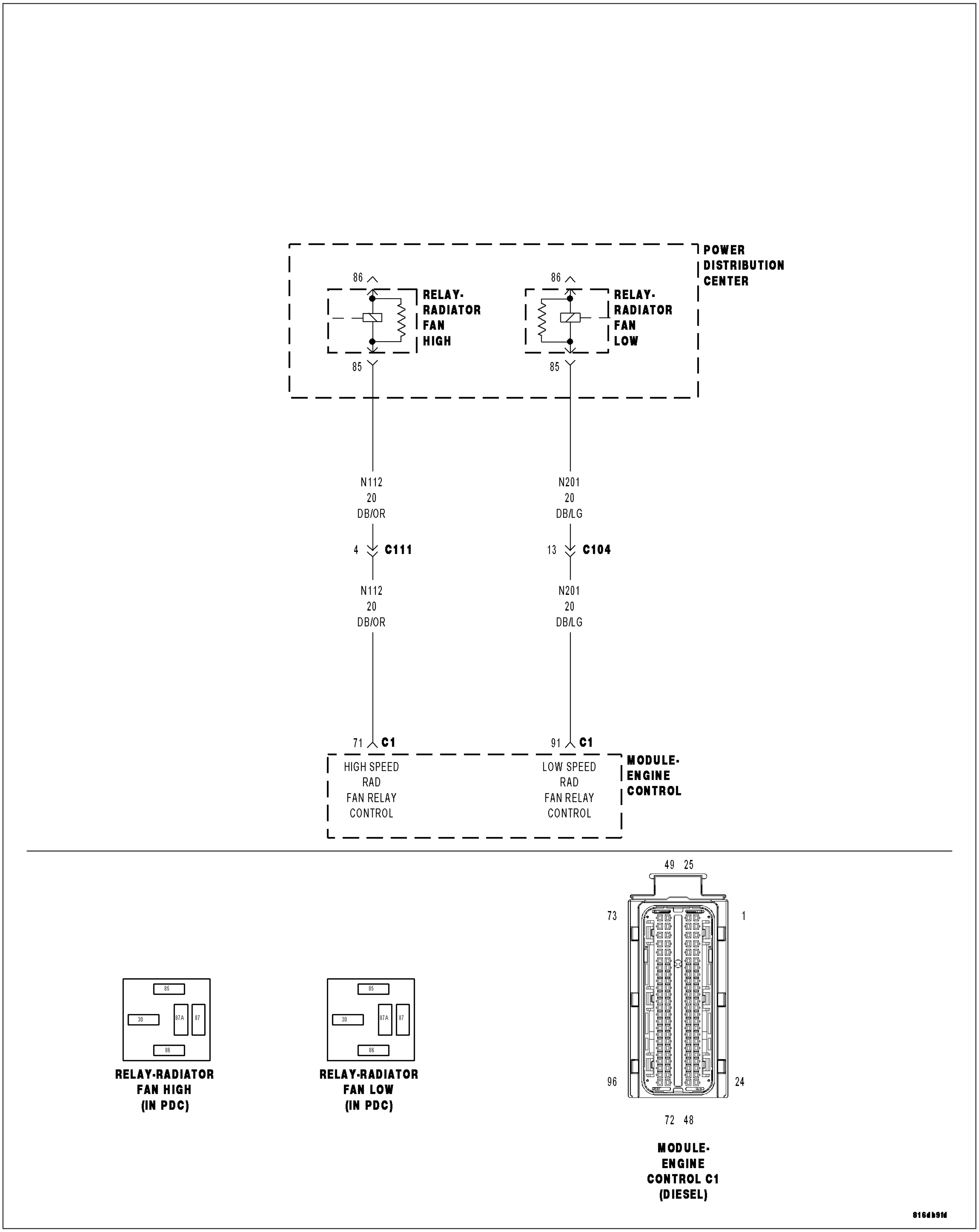
Turn the ignition off.
Disconnect the ECM harness connectors.
Remove the Low Speed Radiator Fan Relay from the PDC.
Remove the ASD Relay from the PDC.
Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
Turn the ignition on.
Measure the voltage of (N201) Low Speed Radiator Fan Control circuit.

**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the (N201) Low Speed Radiator Fan Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0481-FAN 2 CONTROL CIRCUIT EXCESSIVE CURRENT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM High Speed Rad Fan Relay command on.
- **Set Condition:**
  The ECM detects excessive current on the Low Speed Rad Fan Relay Control circuit.

| Possible Causes |
| --- |
| INTERMITTENT CONDITION |
| LOW SPEED RADIATOR FAN RELAY |
| (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the Low Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. LOW SPEED RADIATOR FAN RELAY

Turn the ignition off.

Install a know good relay in place of the Low Speed Radiator Fan Relay.

Turn the ignition on.

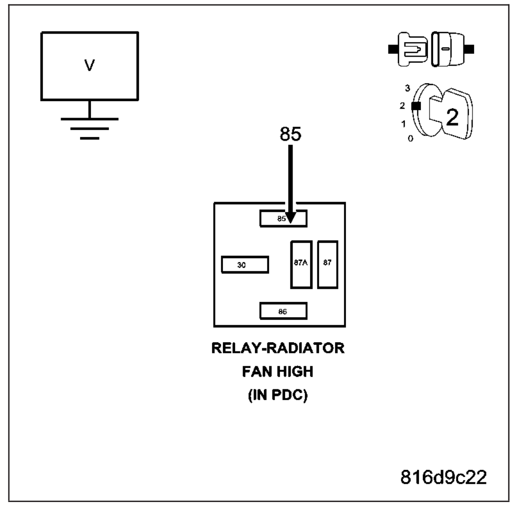
With the scan tool, actuate the Low Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Replace the Low Speed Radiator Fan Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the Low Speed Radiator Fan Relay from the PDC.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of (N201) Low Speed Radiator Fan Control circuit.

**Is the voltage below 1.0 volt?**

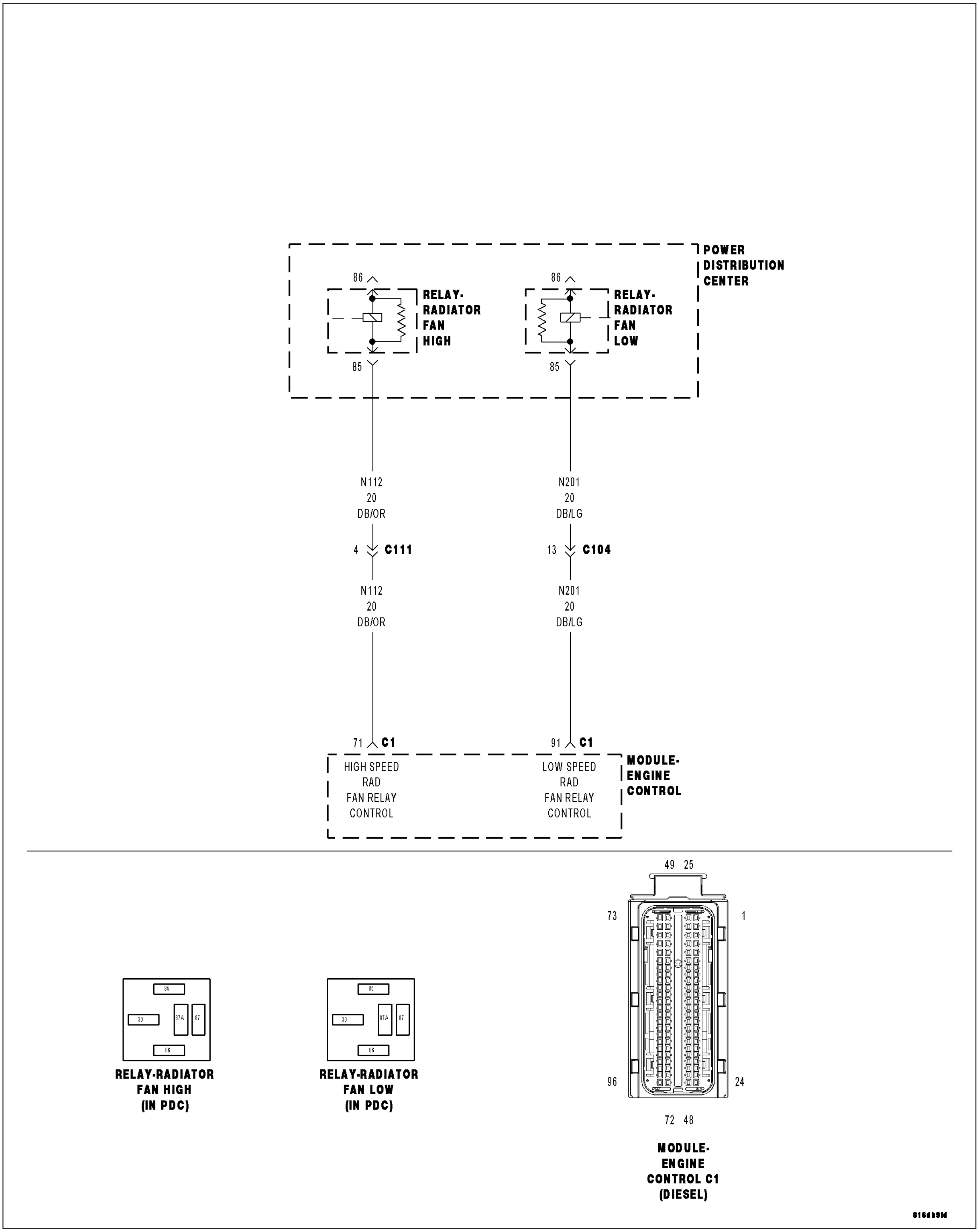
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the (N201) Low Speed Radiator Fan Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0481-FAN 2 CONTROL CIRCUIT OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Low Speed Rad Fan Relay command off.
- **Set Condition:**
  The ECM does not detect voltage on the Low Speed Rad Fan Relay Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| LOW SPEED RADIATOR FAN RELAY |
| (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO GROUND |
| (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT OPEN |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the DRB at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the Low Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Remove the Low Speed Radiator Fan Relay from the PDC.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit.

**Did the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

### 3. LOW SPEED RADIATOR FAN RELAY

Turn the ignition off.

Install a known good relay in place of the Low Speed Radiator Fan Relay.

Turn the ignition on.

With the scan tool, actuate the Low Speed Rad Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Replace the Low Speed Radiator Fan Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

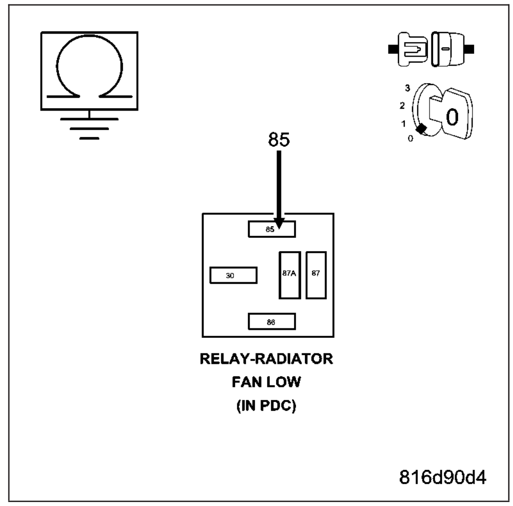
## 4. (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the Low Speed Radiator Fan Relay from the PDC.

Disconnect the ECM C1 harness connectors.

Measure the resistance between ground and the (N201) Low Speed Radiator Fan Control circuit at the PDC.




**Is the resistance above 1000 ohms?**

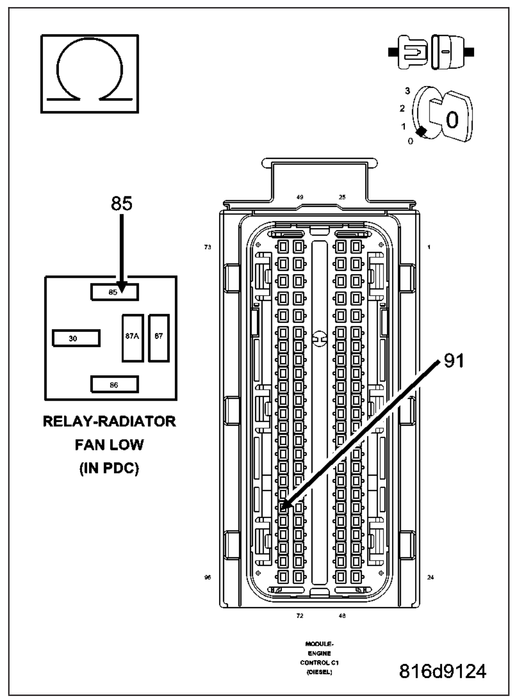
**Yes** >> Go To 5

**No** >> Repair the (N201) Low Speed Radiator Fan Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. (N201) LOW SPEED RADIATOR FAN CONTROL CIRCUIT OPEN

Measure the resistance of the (N201) Low Speed Radiator Fan Control circuit between the PDC and the ECM C1 harness connector.




**Is the resistance below 10.0 ohms?**

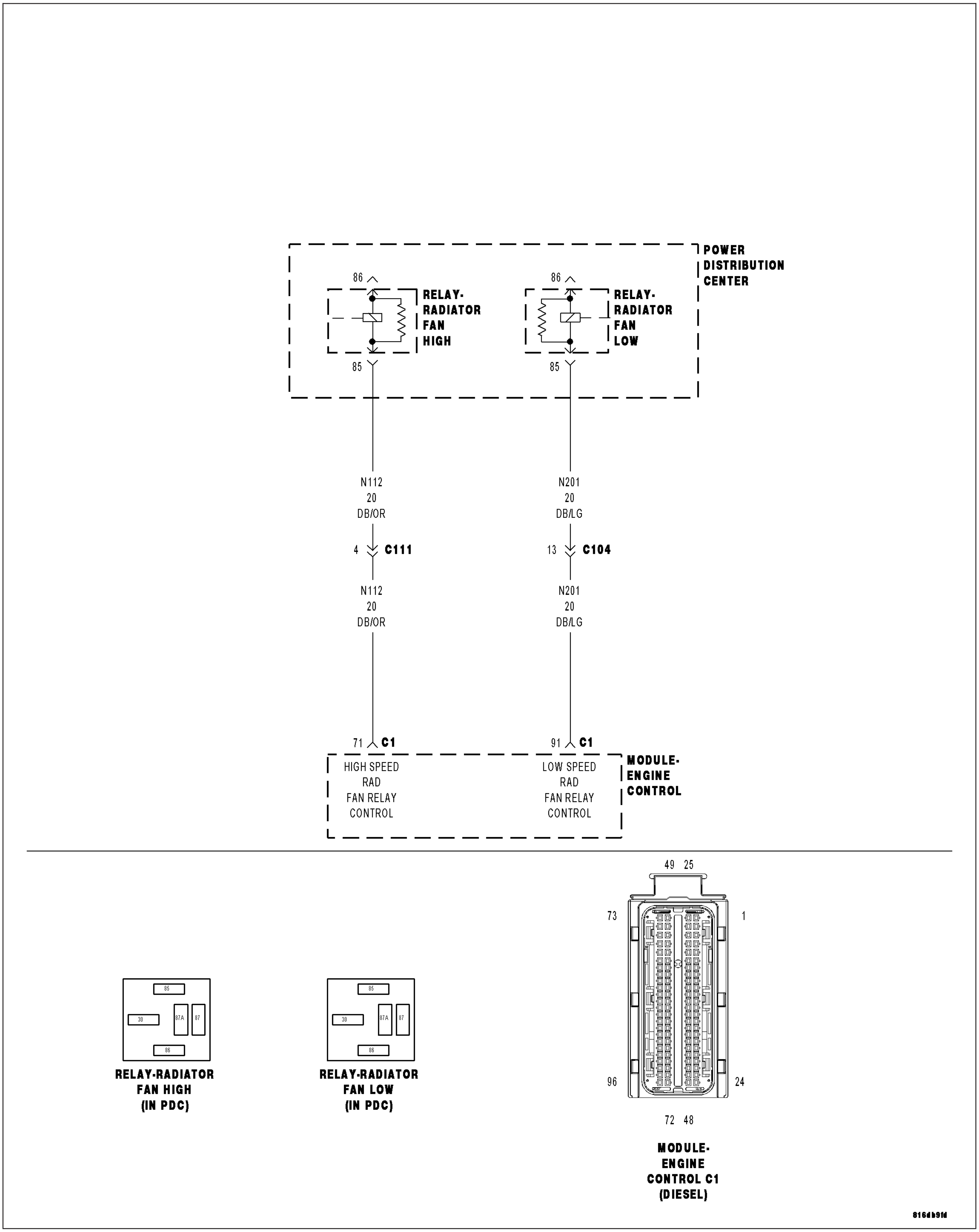
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Low Speed Radiator Fan Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0481-FAN 2 CONTROL CIRCUIT SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM High Speed Rad Fan Relay command on.
- **Set Condition:**
  The ECM detects a short circuit on the High Speed Rad Fan Relay Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| HIGH SPEED RADIATOR FAN RELAY |
| (N112) HIGH SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the High Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. HIGH SPEED RADIATOR FAN RELAY

Turn the ignition off.

Install a known good relay in place of the High Speed Radiator Fan Relay.

Turn the ignition on.

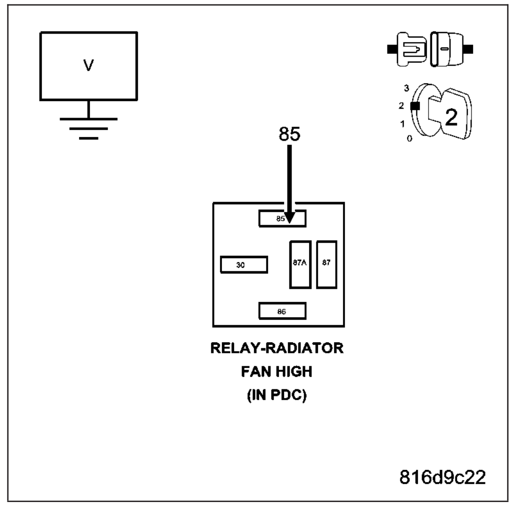
With the scan tool, actuate the High Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Replace High Speed Radiator Fan Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. (N112) HIGH SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the High Speed Radiator Fan Relay from the PDC.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of (N112) High Speed Radiator Fan Control circuit.

**Is the voltage below 1.0 volt?**

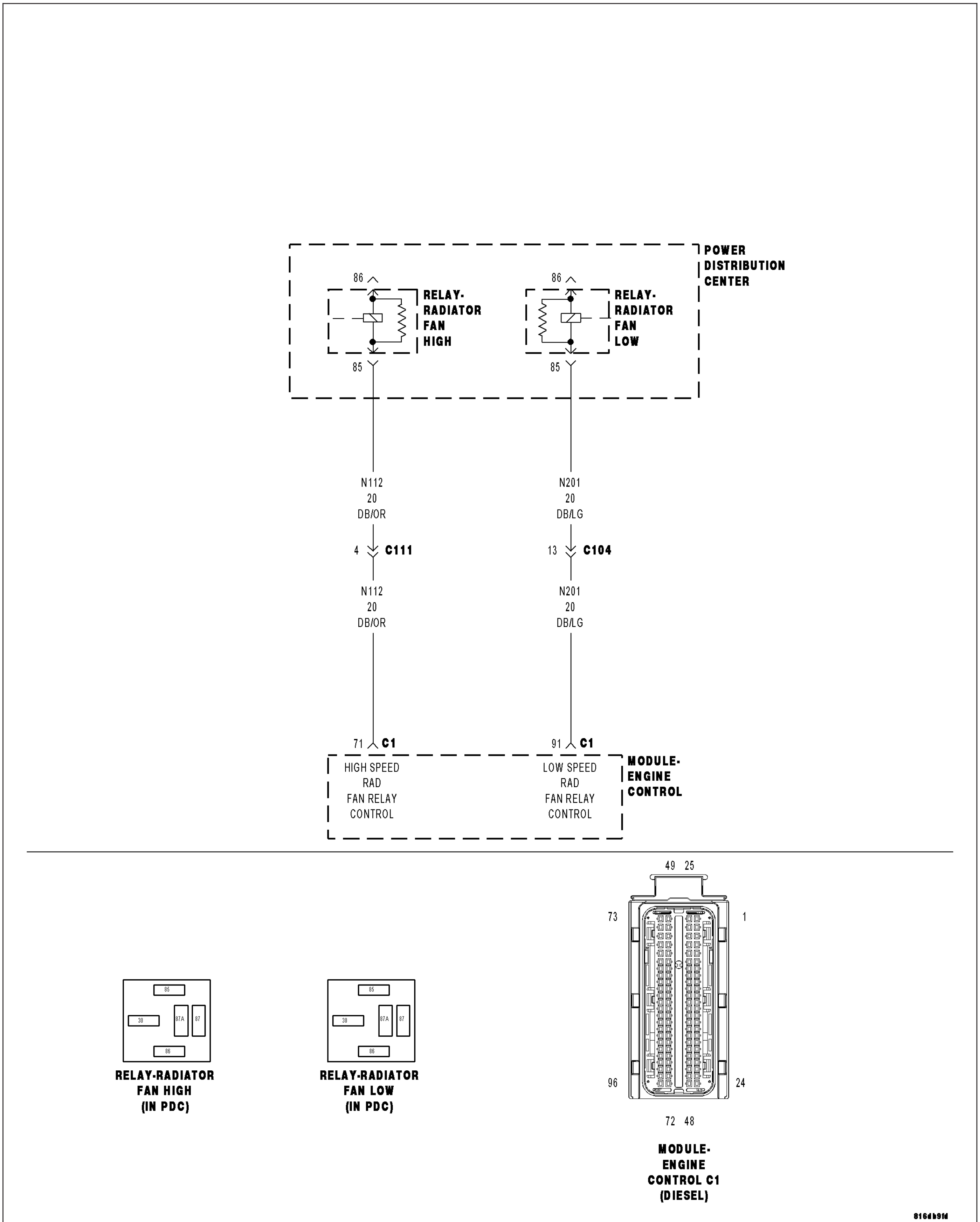
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair (N112) High Speed Radiator Fan Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0481-FAN 2 CONTROL CIRCUIT SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM High Speed Rad Fan Relay command on.
- **Set Condition:**
  The ECM detects a short circuit on the High Speed Rad Fan Relay Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| HIGH SPEED RADIATOR FAN RELAY |
| (N112) HIGH SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the High Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. HIGH SPEED RADIATOR FAN RELAY

Turn the ignition off.

Install a known good relay in place of the High Speed Radiator Fan Relay.

Turn the ignition on.

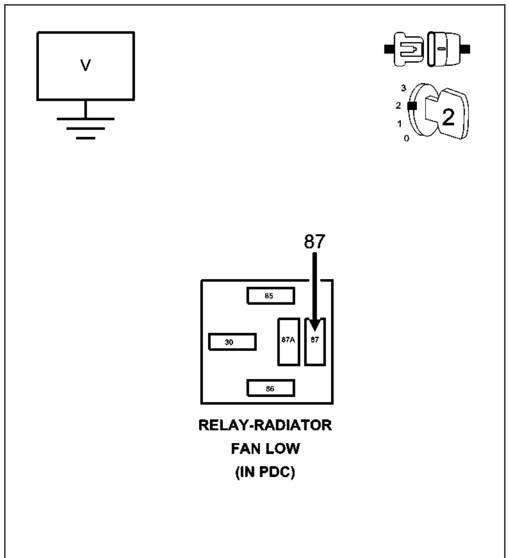
With the scan tool, actuate the High Speed Radiator Fan Relay.

**Does the Radiator Fan cycle on and off?**

**Yes** >> Replace High Speed Radiator Fan Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. (N112) HIGH SPEED RADIATOR FAN CONTROL CIRCUIT SHORTED TO VOLTAGE



816d7741

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the High Speed Radiator Fan Relay from the PDC.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of (N112) High Speed Radiator Fan Control circuit.

**Is the voltage below 1.0 volt?**

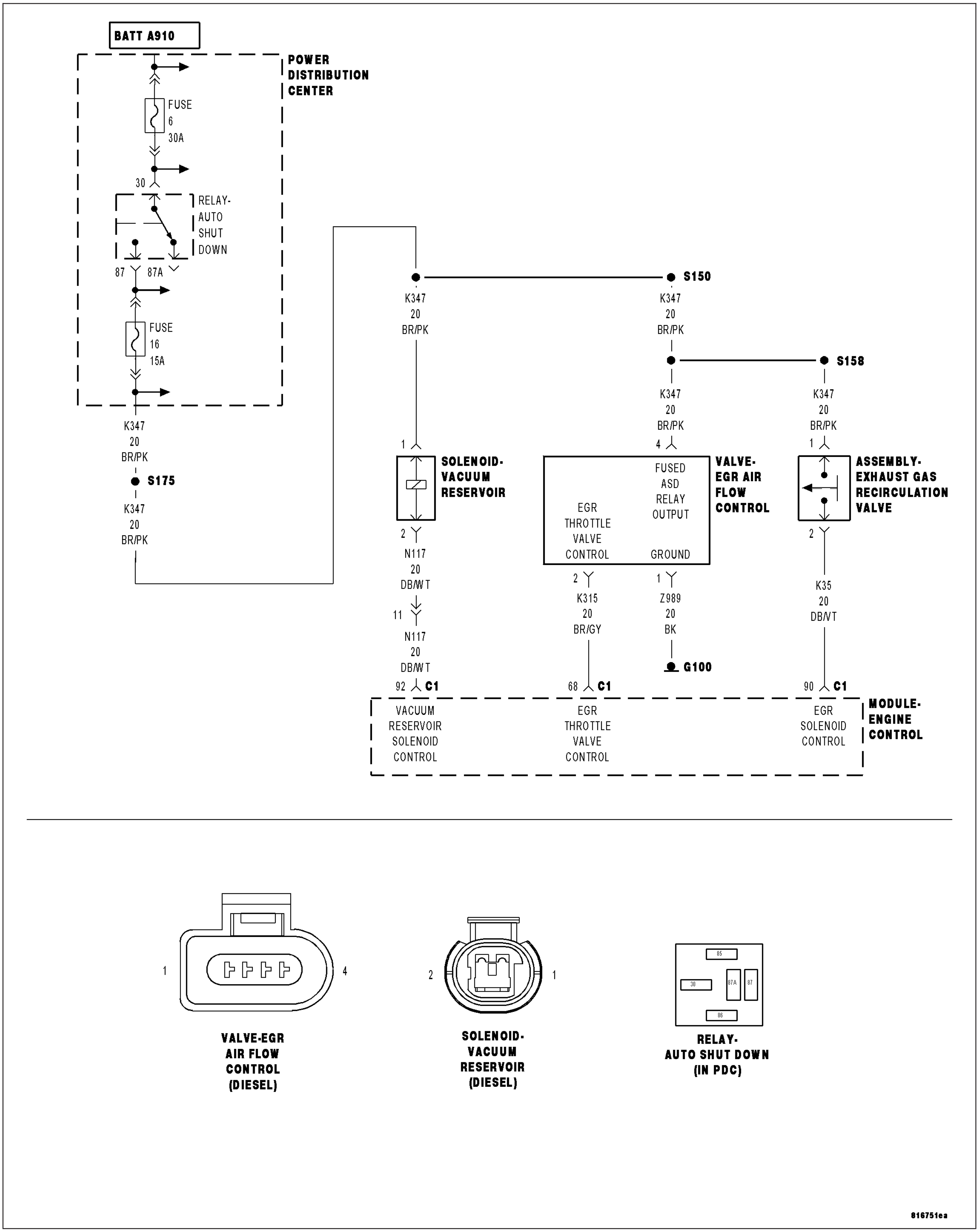
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair (N112) High Speed Radiator Fan Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0489-EGR SOLENOID CIRCUIT SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM EGR Solenoid command on.
- **Set Condition:**
  The ECM detects excessive current on the EGR Solenoid Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| (K35) EGR SOLENOID CONTROL CIRCUIT OPEN |
| EGR SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles, turning the ignition off for at least 10 seconds between each ignition cycle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

## 3. ASD OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Turn the ignition on.

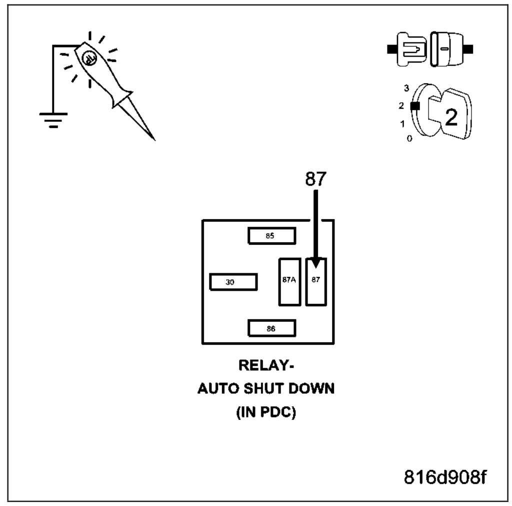
Using a 12-volt test light connected to ground, check the ASD Relay Output circuit.

**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 4. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and (K35) EGR Solenoid Control circuit at EGR Solenoid harness connector.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair (K35) EGR Solenoid Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. (K35) EGR SOLENOID CONTROL CIRCUIT OPEN

Measure the resistance of (K35) EGR Solenoid Control circuit between EGR Solenoid harness connector and ECM C1 harness connector.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair (K35) EGR Solenoid Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. EGR SOLENOID

Install a substitute EGR Solenoid in place of the vehicle's EGR Solenoid.

**NOTE: Ensure the ECM and EGR Solenoid harness connectors are connected.**

Turn the ignition on.

With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

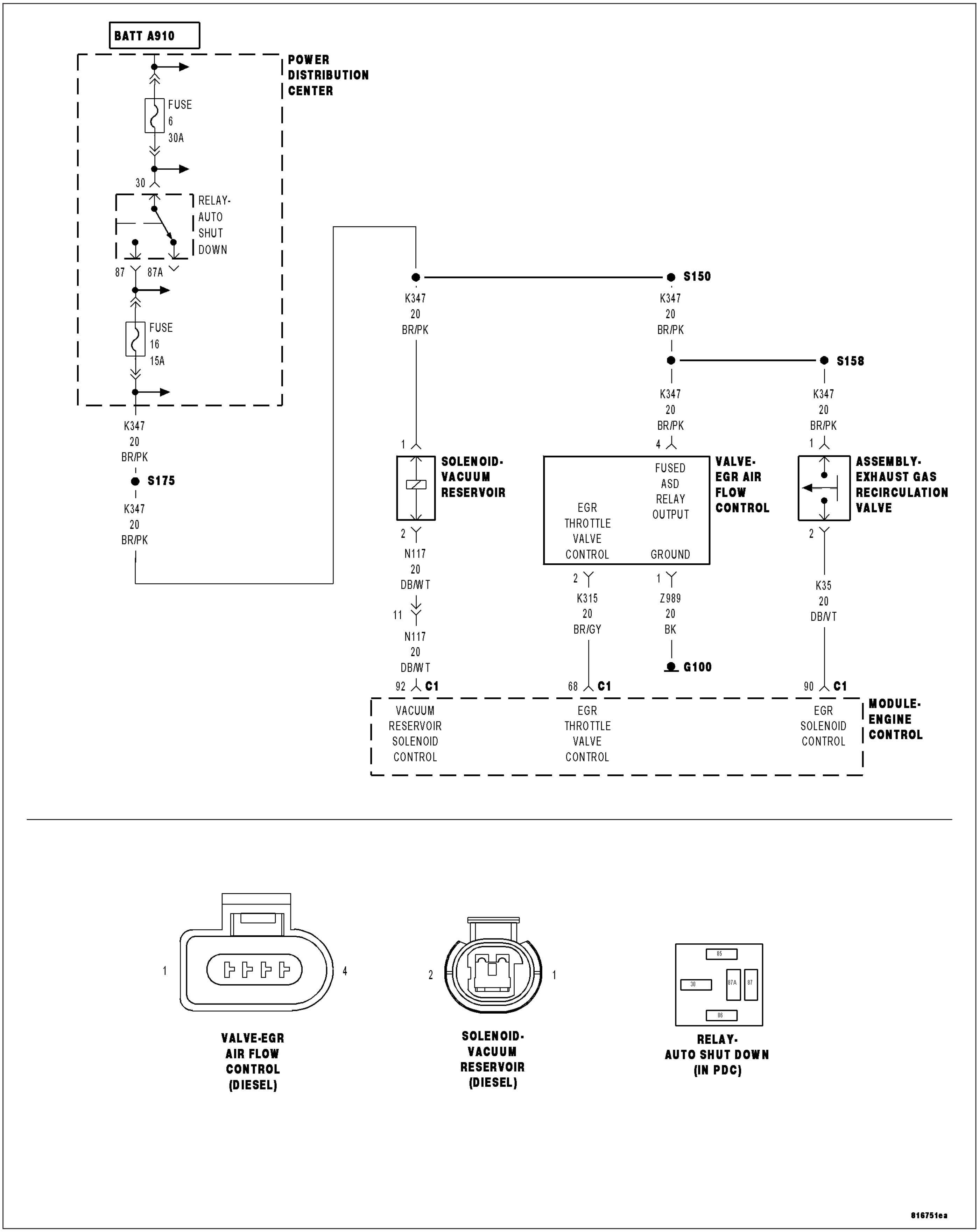
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the EGR Solenoid.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0490-EGR SOLENOID CIRCUIT SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM EGR Solenoid command on.
- **Set Condition:**
  The ECM detects excessive current on the EGR Solenoid Control circuit.

| Possible Causes |
| --- |
| INTERMITTENT CONDITION |
| (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE |
| EGR SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles, turning the ignition off for at least 10 seconds between each ignition cycle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. EGR SOLENOID CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Remove the EGR Solenoid from the PDC.

Disconnect the ECM harness connector.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the EGR Solenoid Control circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the EGR Solenoid Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. EGR SOLENOID

Install a substitute EGR Solenoid in place of the vehicle's EGR Solenoid.

**NOTE: Ensure the ECM and EGR Solenoid harness connectors are connected.**

Turn the ignition on.

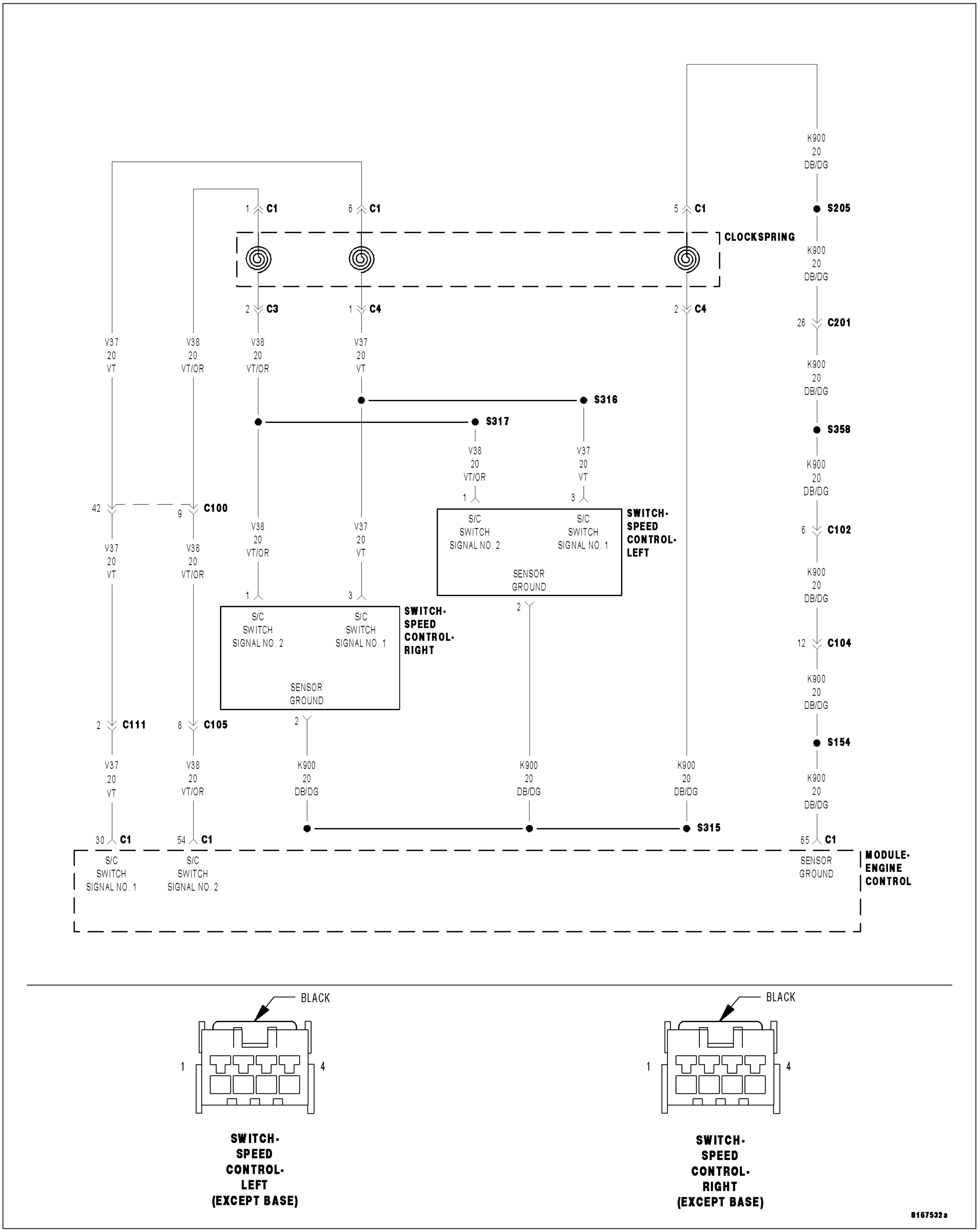
With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the EGR Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0501-VEHICLE SPEED SENSOR PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Engine temperature above 10.0°C. Battery voltage above 11.0 volts Transmission in drive gear. Brake Switch off (brakes not applied). Varying engine speed and load (indicating vehicle motion).
- **Set Condition:**
  The vehicle speed message to the ECM indicates 0 mph when the ECM monitoring condition indicate that vehicle speed should be above 0 mph.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| CHECK FOR RELATED CONTROLLER ANTILOCK BRAKES DTCS |
| CHECK FOR RELATED TRANSMISSION CONTROL MODULE DTCS |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM displays multiple CAN Bus related DTC's, check the CAN Bus circuits at the ECM harness connector for proper connection before continuing with this test.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTC's.

**Does the scan tool display this DTC?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECK FOR RELATED CAB DTCS

Turn the ignition on.

With the scan tool, check for Controller Antilock Brakes DTCs.

**NOTE: The ECM Receives vehicle speed messages via CAB Bus from the ABS module. An interruption on the CAN Bus can cause this fault to set.**

**Are any related CAB DTCs present?**

**Yes** >> Refer to symptom list for problems related to CAB DTCs before continuing.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. CHECK FOR RELATED TCM DTCS

**NOTE: The TCM Receives vehicle speed messages via CAB Bus from the ABS module. An interruption on the CAN Bus can cause this fault to set.**

Turn the ignition on.

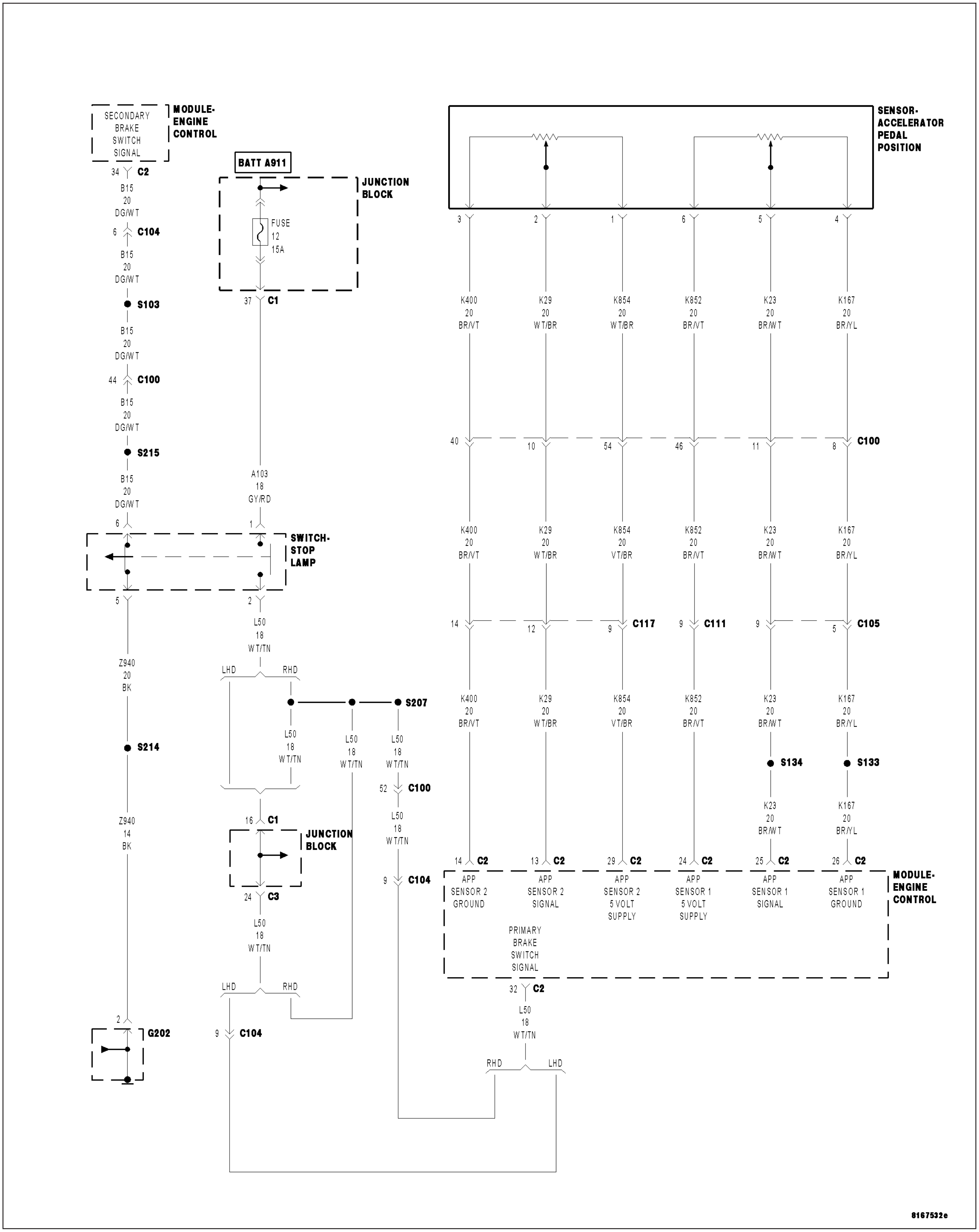
With the scan tool, check the TCM for DTCs.

**Are any ABS CAN Bus Message or Vehicle Speed related TCM DTCs present?**

**Yes** >> Replace the CAB in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0504-BRAKE SWITCH SIGNAL CIRCUITS PLAUSIBILITY WITH REDUNDANT CONTACT



For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Primary Brake Switch Signal and Secondary Brake Switch Signal inputs to the ECM do not agree.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| BRAKE LAMP SWITCH - SENSE CKT OPEN |
| BRAKE LAMP SWITCH FUSED B+ CIRCUIT OPEN |
| BRAKE SWITCH SENSE CIRCUIT SHORTED TO GROUND |
| BRAKE LAMP SWITCH - OUTPUT OPEN |
| BRAKE SWITCH SENSE CIRCUIT OPEN |
| BRAKE SWITCH SENSE GROUND CIRCUIT OPEN |
| BRAKE LAMP SWITCH OUTPUT CIRCUIT SHORTED TO VOLTAGE |
| BRAKE LAMP SWITCH OUTPUT CIRCUIT OPEN |
| ENGINE CONTROL MODULE - BRAKE SWITCH SENSE |
| ENGINE CONTROL MODULE - INTERNAL |
| ENGINE CONTROL MODULE - PRIMARY BRAKE SIGNAL |

## Diagnostic Test

### 1. CHECK THE PRIMARY BRAKE SWITCH STATUS WITH THE SCAN TOOL

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

While observing the PRIMARY BRAKE SWITCH status on the scan tool display, press and release the brake pedal several times.

**Does the scan tool display PRIMARY BRAKE SWITCH: PRESSED and RELEASED for the appropriate pedal position?**

**Yes** >> Go To 2

**No** >> Go To 10

### 2. CHECK THE SECONDARY BRAKE SWITCH STATUS WITH THE SCAN TOOL

Turn the ignition on.

While observing the SECONDARY BRAKE SWITCH status on the scan tool display, press and release the brake pedal several times.

**Does the scan tool display SECONDARY BRAKE SWITCH: PRESSED and RELEASED for the appropriate pedal position**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 3

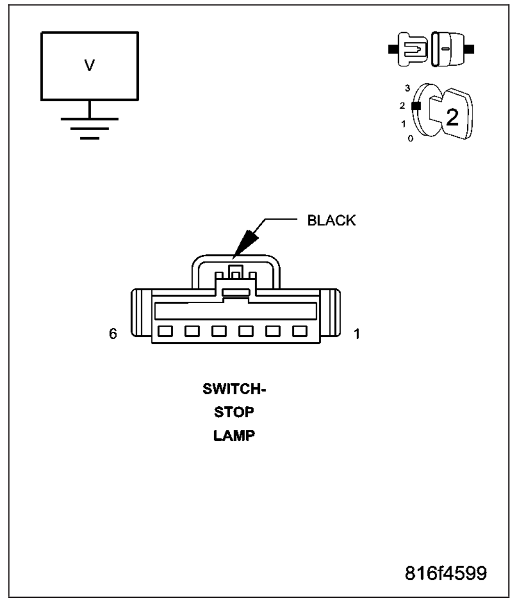
## 3. BRAKE SWITCH SENSE CIRCUIT VOLTAGE

Turn the ignition off.

Disconnect the Brake Lamp Switch harness connector.

Turn the ignition on.

Measure the voltage between the Brake Switch Sense circuit and ground.




**Is the voltage above 9.0 volts?**

**Yes** >> Go To 4

**No** >> Go To 7

## 4. BRAKE LAMP SWITCH - SENSE CKT OPEN

Disconnect the Brake Lamp Switch harness connector.

Turn the ignition on.

While monitoring the SECONDARY BRAKE SWITCH status with the scan tool, connect a jumper wire between ground and the Secondary Brake Switch Sense circuit.

**Does the scan tool display change from PRESSED to RELEASED?**

**Yes** >> Adjust or replace the Brake Lamp Switch in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

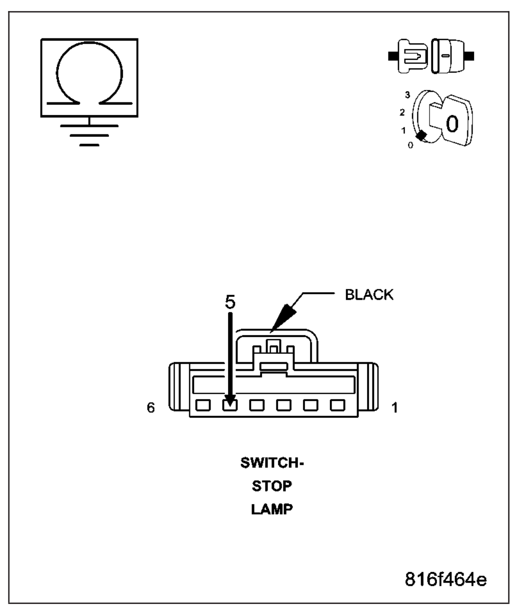
**No** >> Go To 5

## 5. BRAKE SWITCH SENSE GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Brake Lamp Switch harness connector.

Measure the resistance between ground and the Secondary Brake Switch Ground circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Brake Switch Sense Ground circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. ENGINE CONTROL MODULE - INTERNAL

**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Engine Control Module in accordance with the Service Information. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

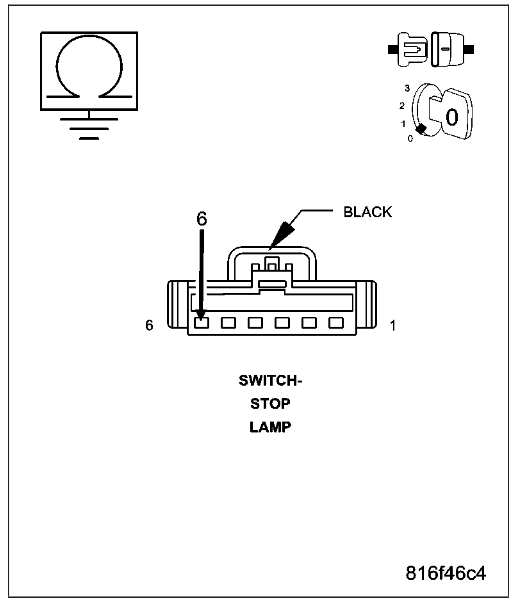
## 7. BRAKE SWITCH SENSE CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Brake Lamp Switch harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Brake Switch Sense circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 8

**No** >> Repair the Brake Switch Sense circuit for a short to ground. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

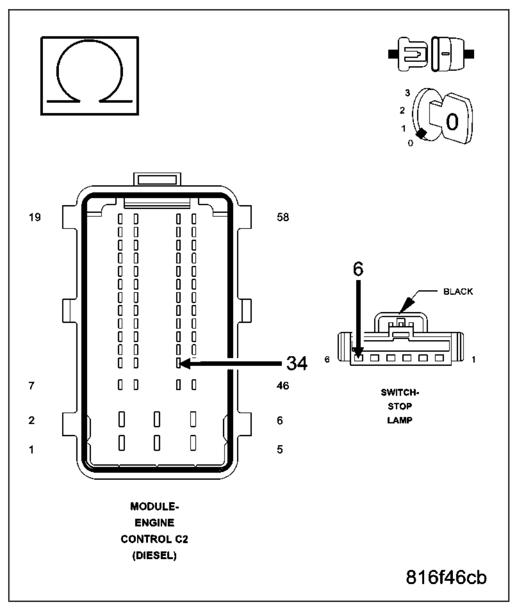
## 8. BRAKE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off.

Disconnect the Brake Lamp Switch harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Brake Switch Sense circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 9

**No** >> Repair the Brake Switch Sense circuit for an open. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 9. ENGINE CONTROL MODULE - SECONDARY BRAKE SIGNAL

**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Engine Control Module in accordance with the Service Information.

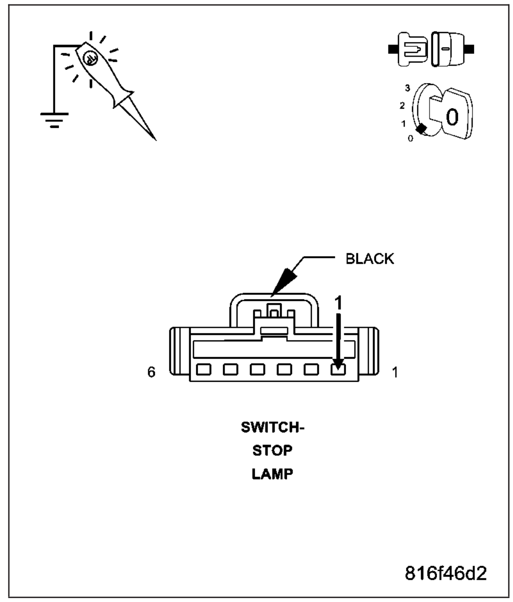
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 10. BRAKE LAMP SWITCH FUSED B+ CIRCUIT OPEN

Disconnect the Brake Lamp Switch harness connector.

Using a 12-volt test light connected to ground, check the Fused B+ circuit.

**Does the test light illuminate brightly?**




**Yes** >> Go To 11

**No** >> Repair the Brake Lamp Switch Fused B+ circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 11. BRAKE LAMP SWITCH - PRIMARY OPEN

Disconnect the Brake Lamp Switch harness connector.

Turn the ignition on.

While monitoring the PRIM BRAKE SWITCH status with the Scan Tool, connect a jumper wire between the Brake Lamp Switch Output circuit and the Fused B(+) circuit.

**Does the scan tool display change from RELEASED to PRESSED?**

**Yes** >> Adjust or replace the Brake Lamp Switch in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. BRAKE LAMP SWITCH OUTPUT CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Brake Lamp Switch harness connector.

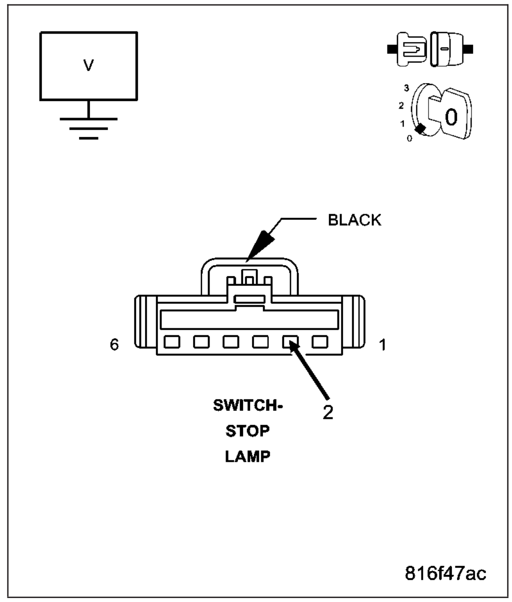
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage between the Brake Lamp Switch Output circuit and ground.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Brake Lamp Switch Output circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 13

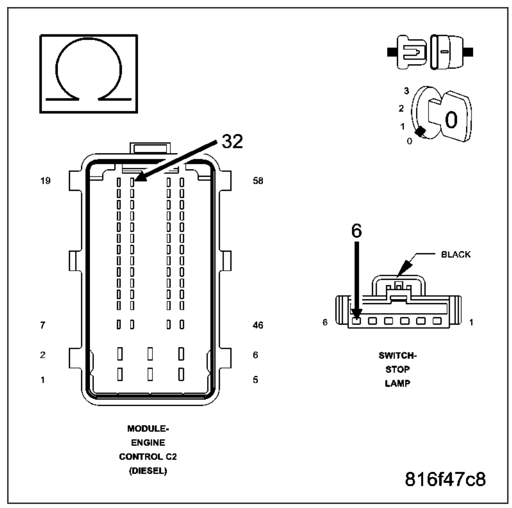
## 13. BRAKE LAMP SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Brake Lamp Switch harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Brake Lamp Switch Output circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Brake Lamp Switch Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0513-SKIM SYSTEM INVALID KEY CODE RECEIVED

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an internal mismatch of the secret key code when performing an internal EEPROM check.

| Possible Causes |
|---|
| SKIM |
| INTERMITTENT CONDITION |
| CHECK FOR SKIM COMMUNICATION AND DTCS |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR SKIM COMMUNICATION AND DTCS

Turn the ignition on.

With the scan tool, check for Sentry Key Immobilizer Module communication and DTCs.

**Are any SKIS problems or DTCs present?**

**Yes** >> Refer to symptom list for problems related to SKIM Communication and DTCs before continuing. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CHECK FOR ECM DTCS

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition on and off several times pausing 10 seconds between each key cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. SKIM

Replace and program the SKIM in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Turn the ignition on and off several times pausing for 10 seconds between key cycles.
With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The test is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0513-SKIM SYSTEM READ ACCESS TO EEPROM FAILURE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an internal EEPROM fault.

| Possible Causes |
| --- |
| SKIM |
| INTERMITTENT CONDITION |
| CHECK FOR SKIM COMMUNICATION AND DTCS |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR SKIM COMMUNICATION AND DTCS

Turn the ignition on.

With the scan tool, check for Sentry Key Immobilizer Module communication and DTCs.

**Are any SKIS problems or DTCs present?**

**Yes** >> Refer to symptom list for problems related to SKIM Communication and DTCs before continuing. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CHECK FOR ECM DTCS

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition on and off several times pausing 10 seconds between each key cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. SKIM

Replace and program the SKIM in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Turn the ignition on and off several times pausing for 10 seconds between key cycles.
With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The test is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0513-SKIM SYSTEM WRITE ACCESS TO EEPROM FAILURE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an internal EEPROM fault.

| Possible Causes |
|---|
| SKIM |
| INTERMITTENT CONDITION |
| CHECK FOR SKIM COMMUNICATION AND DTCS |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR SKIM COMMUNICATION AND DTCS

Turn the ignition on.

With the scan tool, check for Sentry Key Immobilizer Module communication and DTCs.

**Are any SKIS problems or DTCs present?**

**Yes** >> Refer to symptom list for problems related to SKIM Communication and DTCs before continuing. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CHECK FOR ECM DTCS

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition on and off several times pausing 10 seconds between each key cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. SKIM

Replace and program the SKIM in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Turn the ignition on and off several times pausing for 10 seconds between key cycles.
With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The test is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0513-SKIM SYSTEM WRITE ACCESS TO EEPROM FAILURE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an internal EEPROM fault.

| Possible Causes |
|---|
| SKIM |
| INTERMITTENT CONDITION |
| CHECK FOR SKIM COMMUNICATION AND DTCS |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR SKIM COMMUNICATION AND DTCS

Turn the ignition on.

With the scan tool, check for Sentry Key Immobilizer Module communication and DTCs.

**Are any SKIS problems or DTCs present?**

**Yes** >> Refer to symptom list for problems related to SKIM Communication and DTCs before continuing. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CHECK FOR ECM DTCS

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition on and off several times pausing 10 seconds between each key cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. SKIM

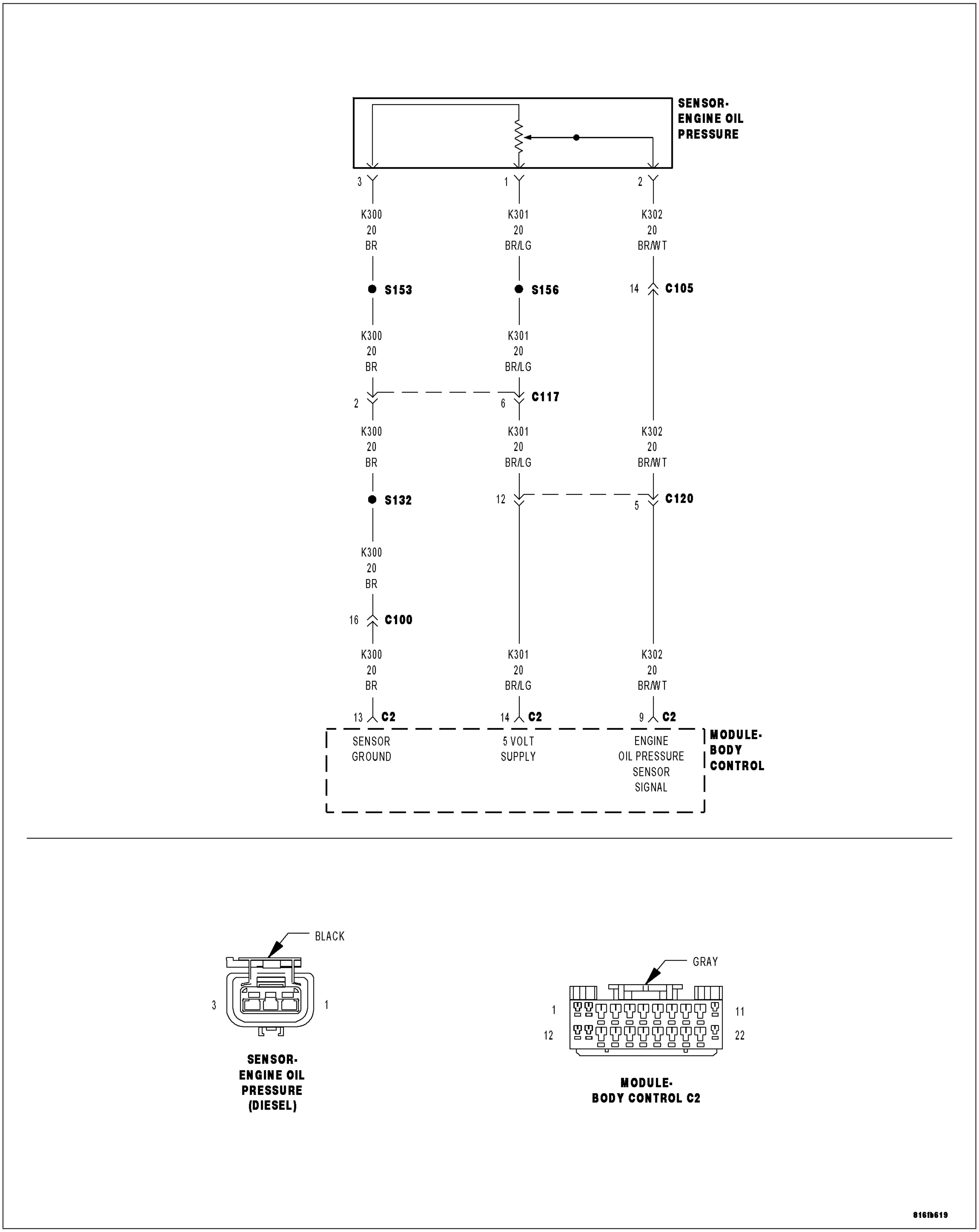
Replace and program the SKIM in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Turn the ignition on and off several times pausing for 10 seconds between key cycles.
With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The test is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0520- OIL PRESS SENSOR CIRCUIT MALF PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  At engine start-up.
- **Set Condition:**
  The oil pressure signal is below 0.19 volts for 8 seconds after engine start-up.

| Possible Causes |
|---|
| 5-VOLT SUPPLY CIRCUIT OPEN |
| BCM - OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| BCM - OIL PRESSURE SENSOR SIGNAL SHORT TO GROUND |
| MECHANICAL PROBLEM |
| OIL PRESSURE SENSOR FAILURE |
| OIL PRESSURE SENSOR SIGNAL CIRCUIT OPEN |
| OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND |
| OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND CIRCUIT OPEN |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, letting the engine run for at least 30 seconds at a time.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. MECHANICAL PROBLEM

Refer to the Service Information and perform the Oil Pressure Test.

**Is the oil pressure within specification?**

**Yes** >> Go To 3

**No** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

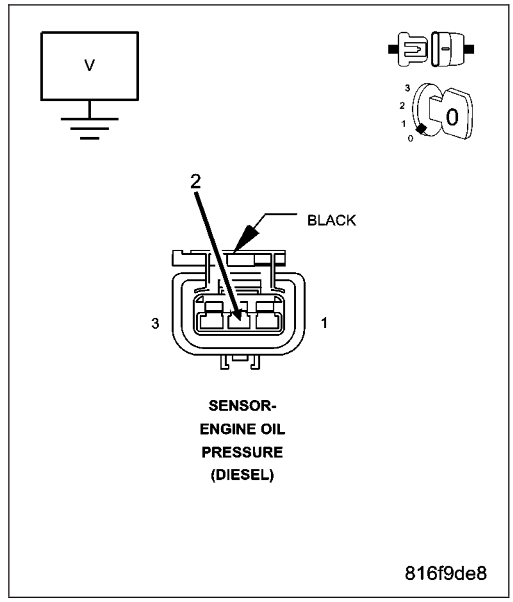
## 3. CHECKING OP SENSOR SIGNAL CKT

Turn the ignition off.

Disconnect the Oil Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the Oil Pressure Sensor Signal circuit.




**Select the appropriate voltage reading.**

**Voltage is above 5.5 volts.**
Go To 4

**Voltage is between 4.7 and 5.4 volts.**
Go To 5

**Voltage is below 4.7 volts.**
Go To 7

## 4. OP SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the Oil Pressure Sensor harness connector.

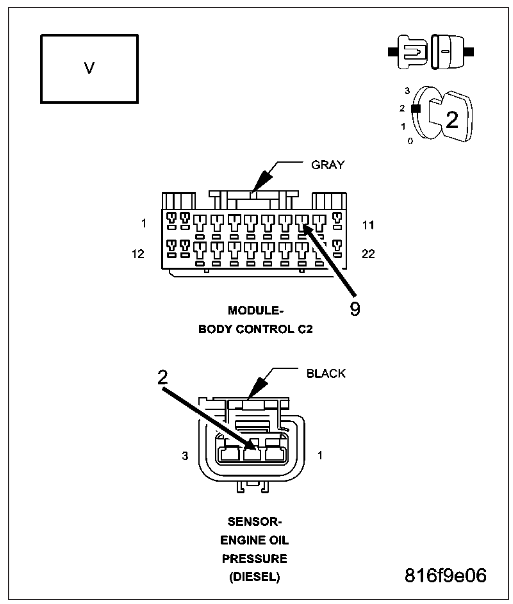
Disconnect the BCM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Oil Pressure Sensor Signal circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Oil Pressure Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the Oil Pressure Sensor harness connector.

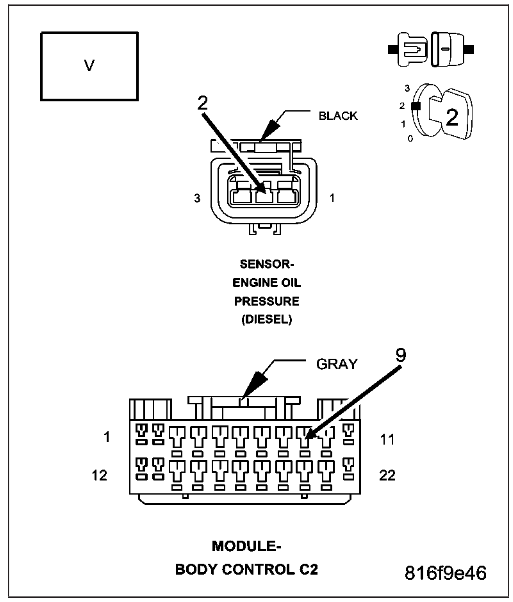
Measure the resistance of the 5-Volt Supply circuit between the BCM harness connector and the Oil Pressure Sensor harness connector.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 6

**No** >> Repair the 5-Volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 6. SENSOR GROUND CKT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the Oil Pressure Sensor harness connector.

Measure the resistance of the Sensor Ground circuit.

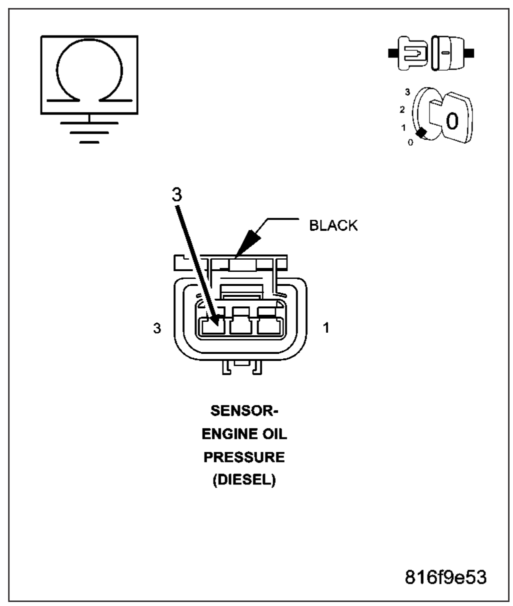
**Is the resistance below 10.0 ohms?**

**Yes** >> Replace the Oil Pressure Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 7. OP SENSOR SIGNAL CKT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the Oil Pressure Sensor harness connector.

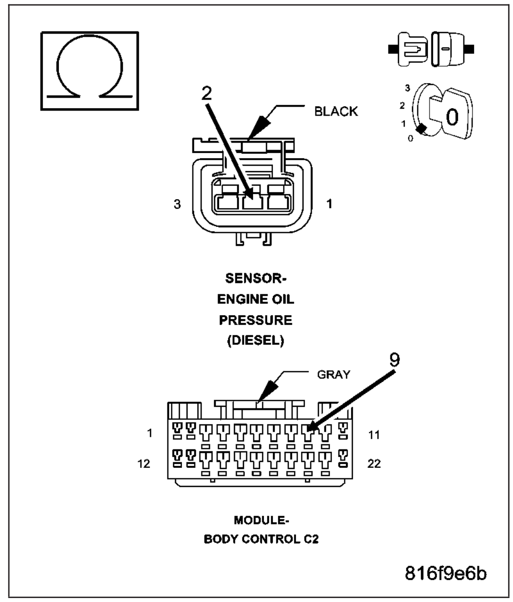
Measure the resistance of the Oil Pressure Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 8

**No** >> Repair the Oil Pressure Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 8. OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the Oil Pressure Sensor harness connector.

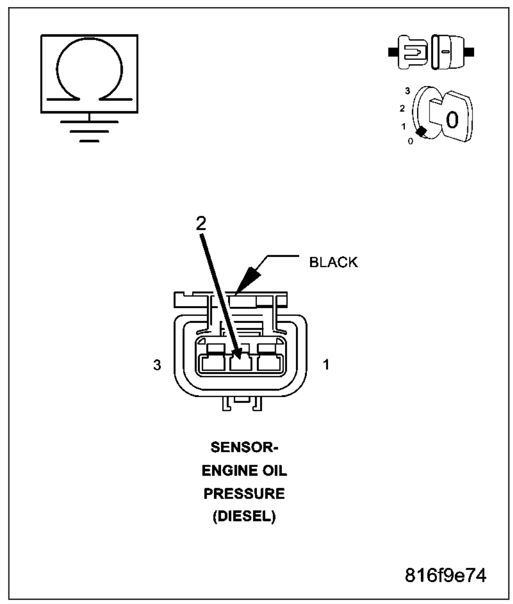
Measure the resistance between ground and the Oil Pressure Sensor Signal circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 9

**No** >> Repair the Oil Pressure Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



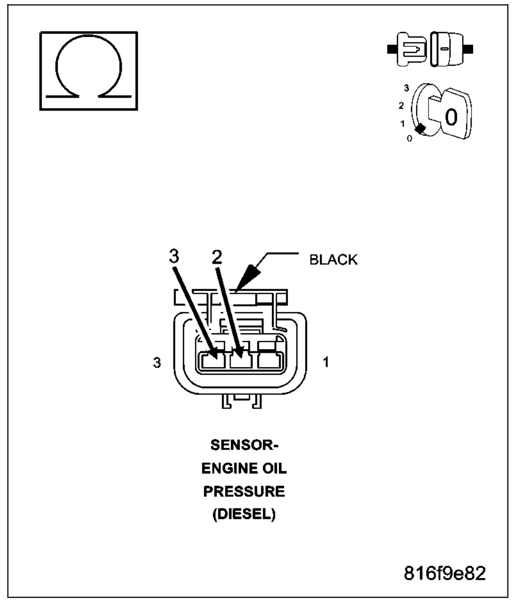
## 9. OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the Oil Pressure Sensor harness connector.

Measure the resistance between Sensor Ground and the Oil Pressure Sensor Signal circuit.




**Is the resistance above 1000 ohms?**

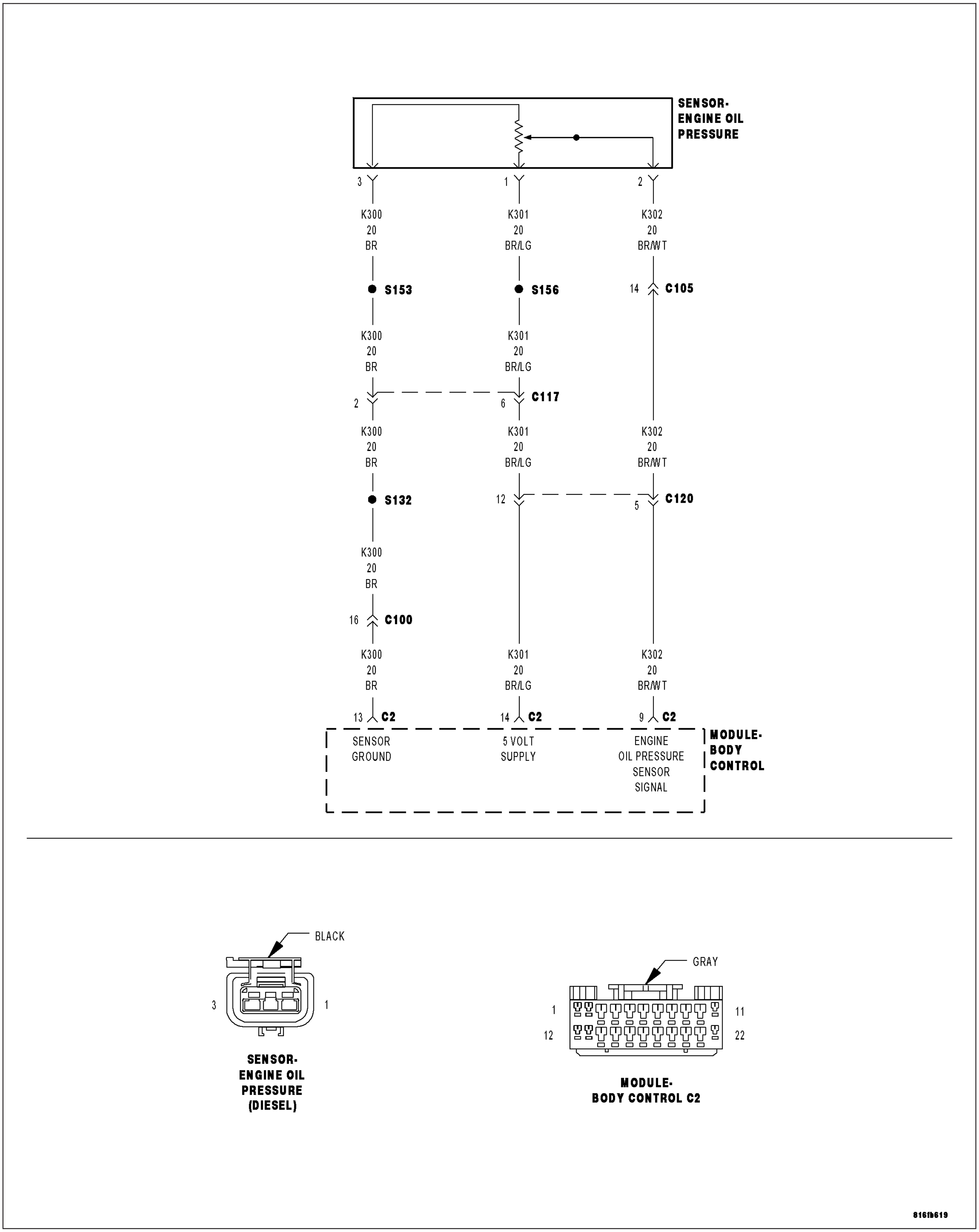
**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Oil Pressure Sensor Signal circuit for a short to the Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0520-OIL PRESS SENSOR CKT MALF SIGNAL VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The Oil Pressure Sensor signal is above 4.8 volts for 0.5 second.

| Possible Causes |
|---|
| ENGINE OIL PRESSURE SENSOR |
| BCM - OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| BCM - OIL PRESSURE SENSOR SIGNAL OPEN |
| OIL PRESSURE SENSOR SIGNAL CIRCUIT OPEN |
| OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND CIRCUIT OPEN |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR CURRENT DTC

**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, letting the engine run for at least 30 seconds at a time.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

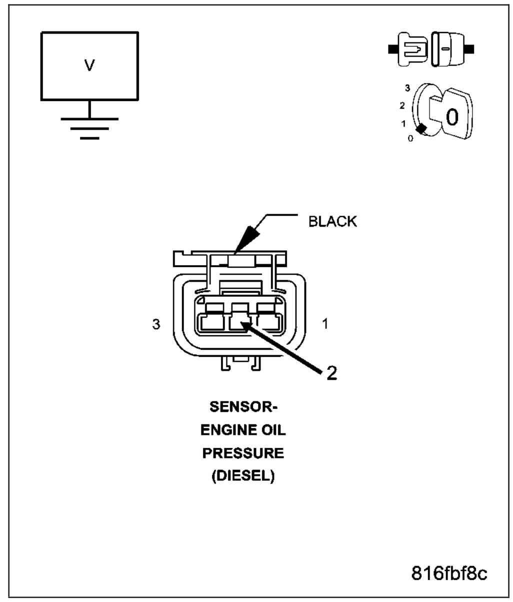
## 2. CHECK OIL PRESSURE SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the Oil Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the Oil Pressure Sensor Signal circuit.




**Select the appropriate voltage reading.**

**Voltage is above 5.5 volts.**
Go To 3

**Voltage is between 4.7 and 5.4 volts.**
Go To 4

**Voltage is below 4.7 volts.**
Go To 5

## 3. OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Oil Pressure Sensor harness connector.

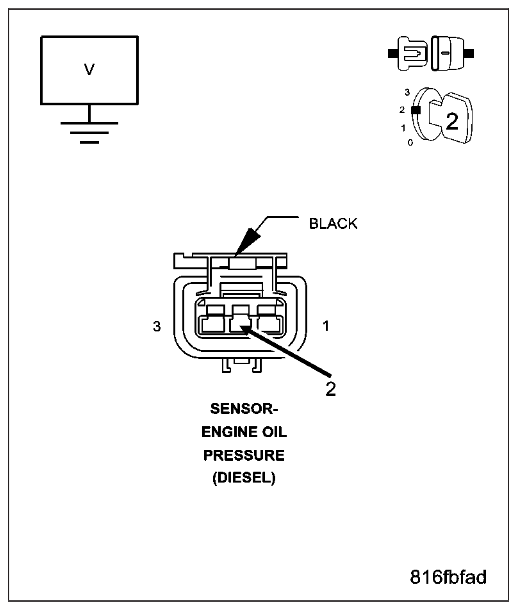
Disconnect the BCM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Oil Pressure Sensor Signal circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Oil Pressure Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

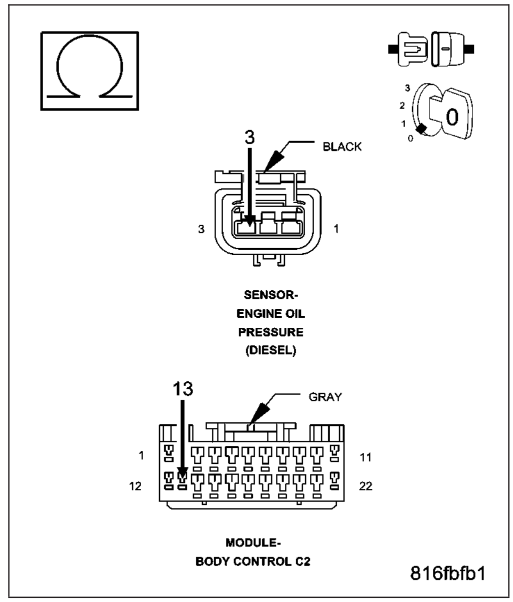
## 4. SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the Oil Pressure Sensor harness connector.

Measure the resistance of the Sensor Ground circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Replace the Engine Oil Pressure Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

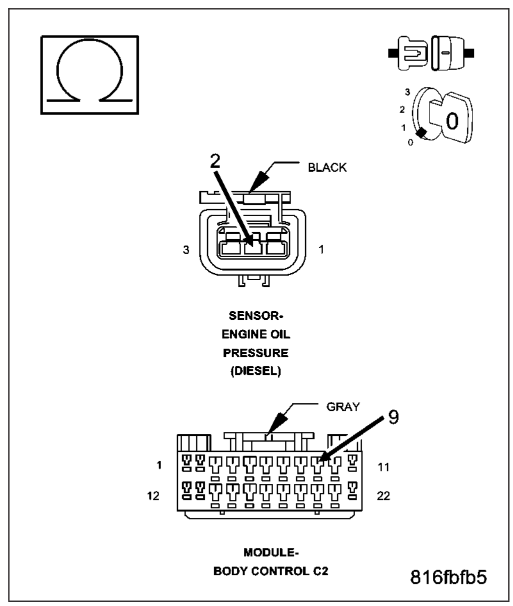
## 5. OIL PRESSURE SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the Oil Pressure Sensor harness connector.

Measure the resistance of the Oil Pressure Sensor Signal circuit.




**Is the resistance below 10.0 ohms?**

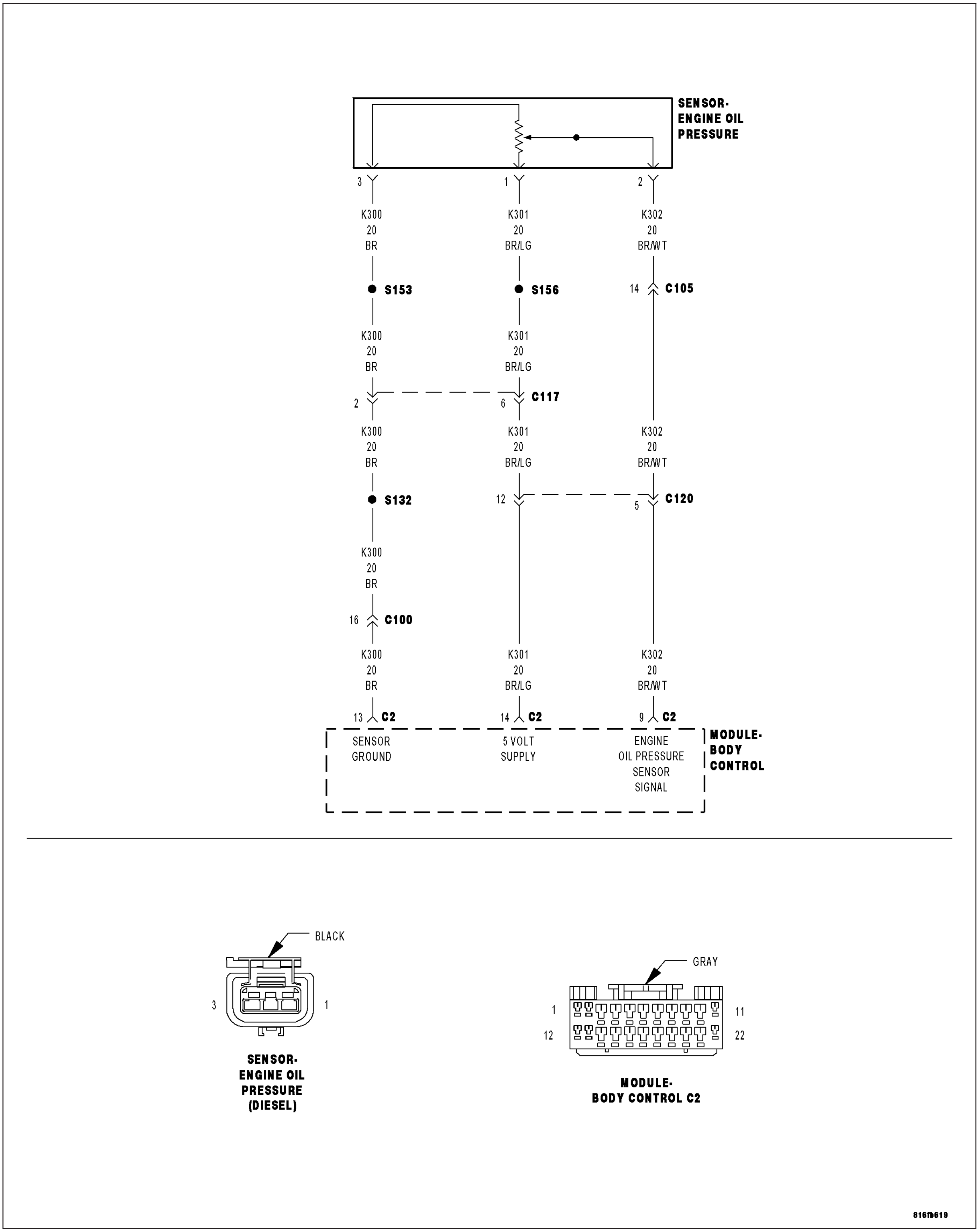
**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Oil Pressure Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0520-OIL PRESS SENSOR CKT MALF SIGNAL VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The Oil Pressure Sensor signal is below 0.19 volt for 0.5 seconds.

| Possible Causes |
| --- |
| ENGINE OIL PRESSURE SENSOR |
| BCM - OIL PRESSURE SENSOR SIGNAL SHORT TO GROUND |
| OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 10 seconds between run cycles.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. ENGINE OIL PRESSURE SENSOR

Turn the ignition off.

Disconnect the Oil Pressure Sensor harness connector.

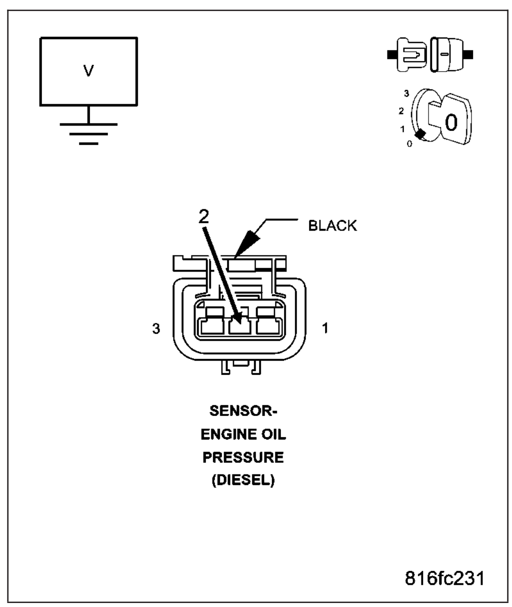
Measure the voltage of the Oil Pressure Sensor Signal circuit.

**Is the voltage between 4.7 and 5.3 volts?**

**Yes** >> Replace the Engine Oil Pressure Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3



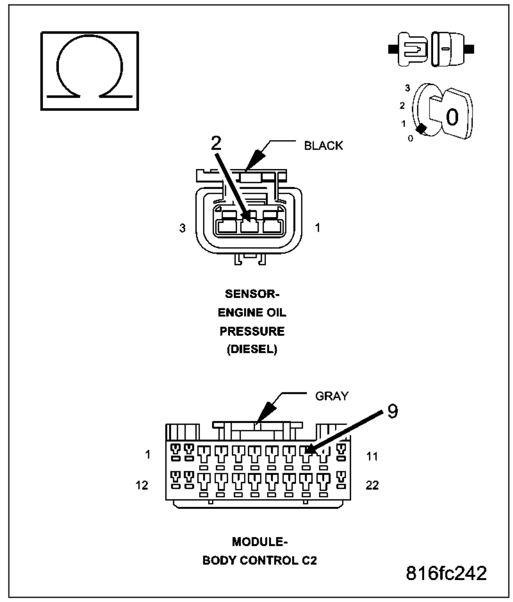
## 3. OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the Oil Pressure Sensor harness connector.

Measure the resistance between ground and the Oil Pressure Sensor Signal circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Oil Pressure Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

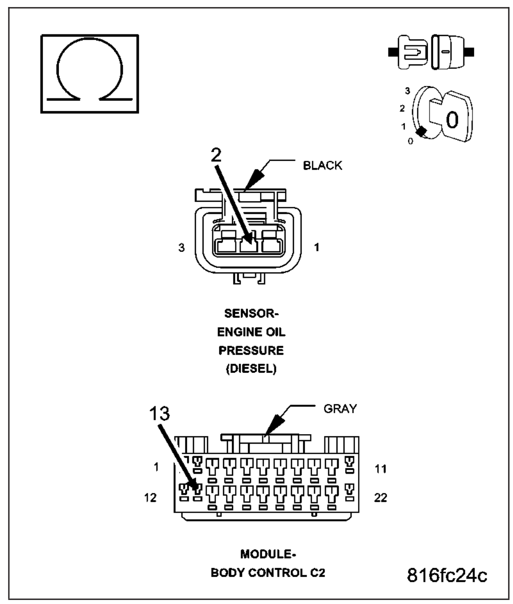
## 4. OIL PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the Oil Pressure Sensor harness connector.

Measure the resistance between Sensor Ground and the Oil Pressure Sensor Signal circuit.




**Is the resistance above 1000 ohms?**

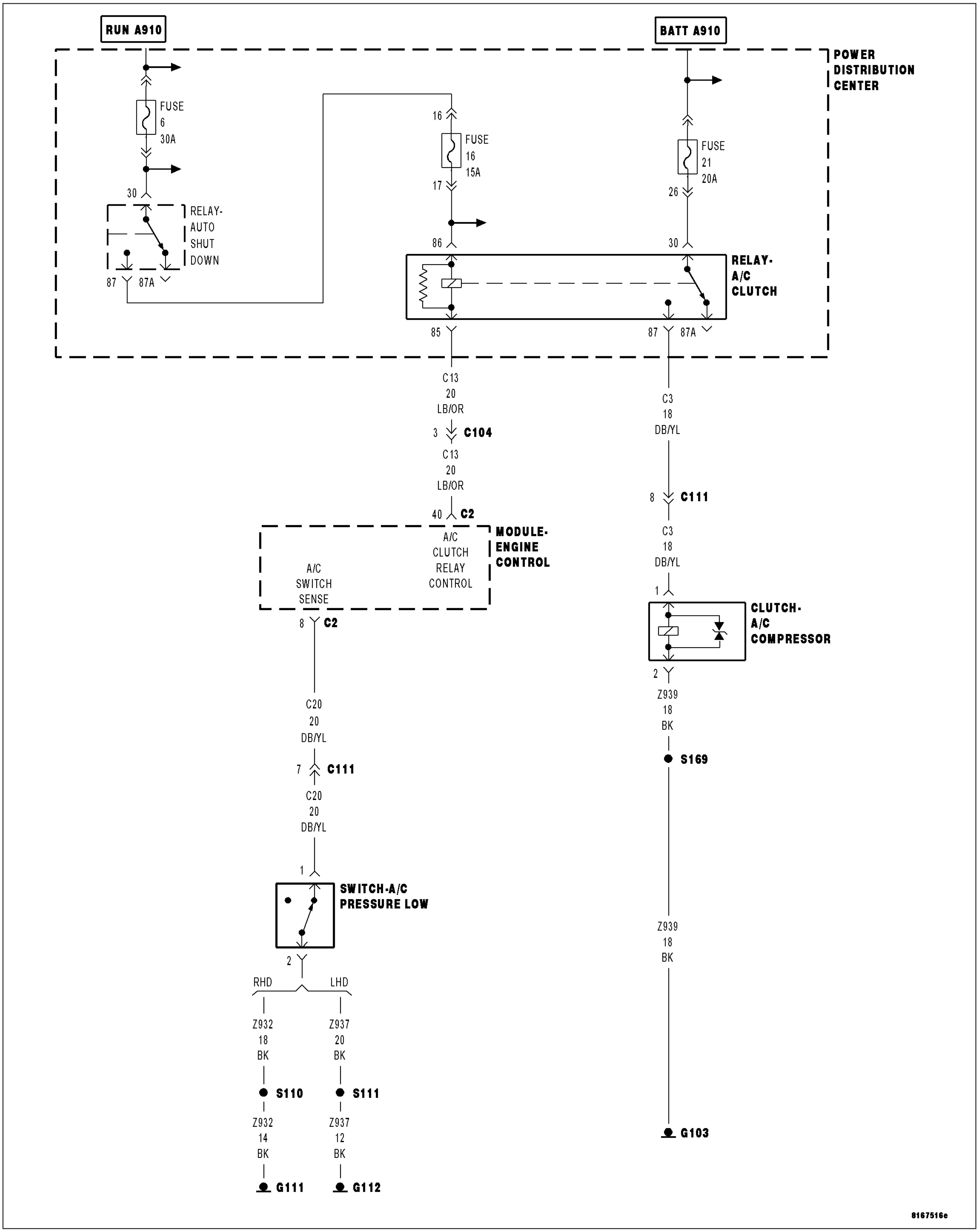
**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Oil Pressure Sensor Signal circuit for a short to Sensor Ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0530- A/C PRESS SENSOR CIRCUIT MALF PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  An error occurs with the A/C pressure CAN bus message from the Body Control Module to the Engine Control Module.

| Possible Causes |
|---|
| 5-VOLT SUPPLY CIRCUIT OPEN |
| BCM - A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| BCM - A/C PRESSURE SENSOR SIGNAL SHORT TO GROUND |
| A/C PRESSURE SENSOR FAILURE |
| A/C PRESSURE SENSOR SIGNAL CIRCUIT OPEN |
| A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND |
| A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND CIRCUIT OPEN |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, letting the engine run for at least 30 seconds at a time.

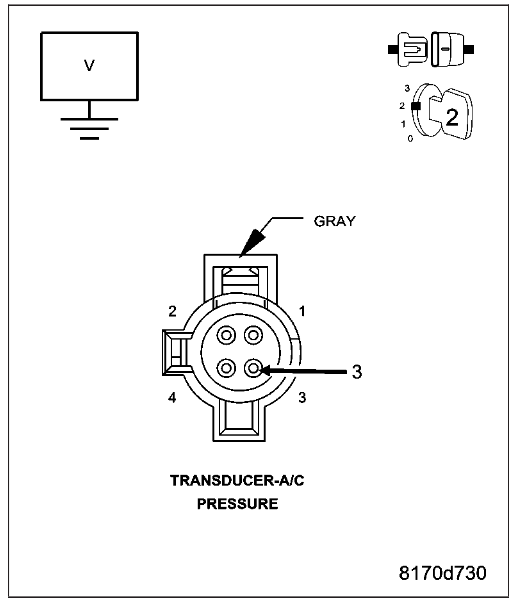
With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 2. CHECKING A/C SENSOR SIGNAL CKT




Turn the ignition off.

Disconnect the A/C Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the A/C Pressure Sensor Signal circuit.

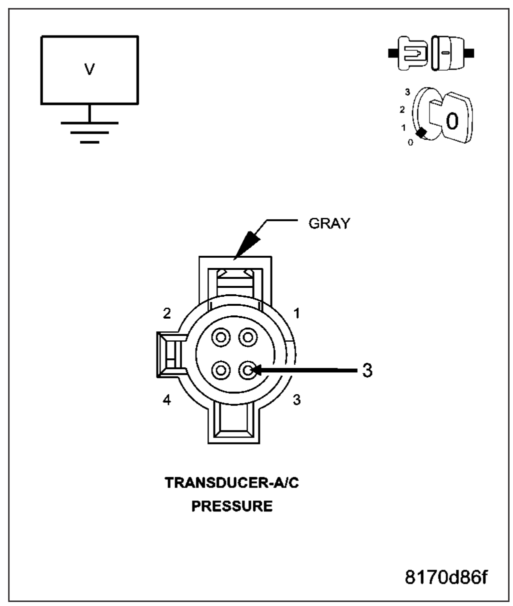
**Select the appropriate voltage reading.**

**Voltage is above 5.5 volts.**
Go To 3

**Voltage is between 4.7 and 5.4 volts.**
Go To 4

**Voltage is below 4.7 volts.**
Go To 6

## 3. A/C SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE




Turn the ignition off.

Disconnect the A/C Pressure Sensor harness connector.

Disconnect the BCM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the A/C Pressure Sensor Signal circuit.

**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the A/C Pressure Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

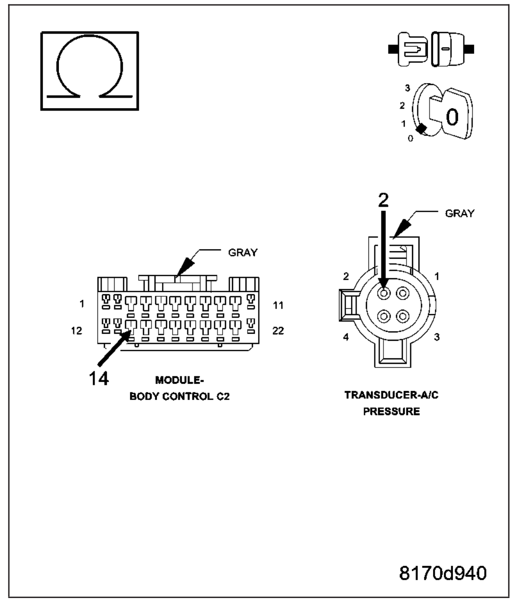
## 4. 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance of the 5-Volt Supply circuit between the BCM harness connector and the A/C Pressure Sensor harness connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the 5-Volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

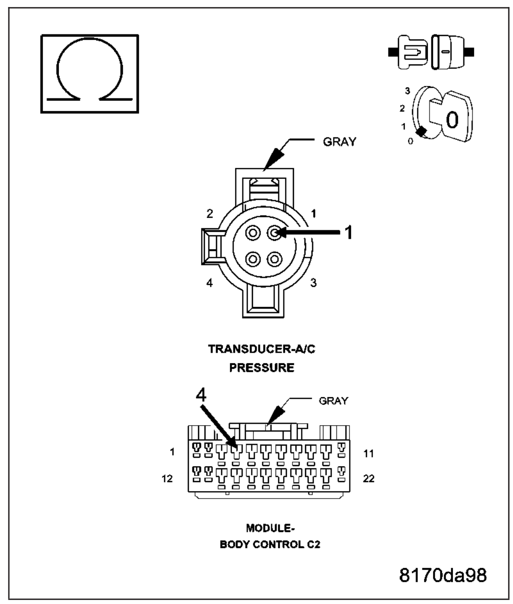
## 5. SENSOR GROUND CKT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance of the Sensor Ground circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Replace the A/C Pressure Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

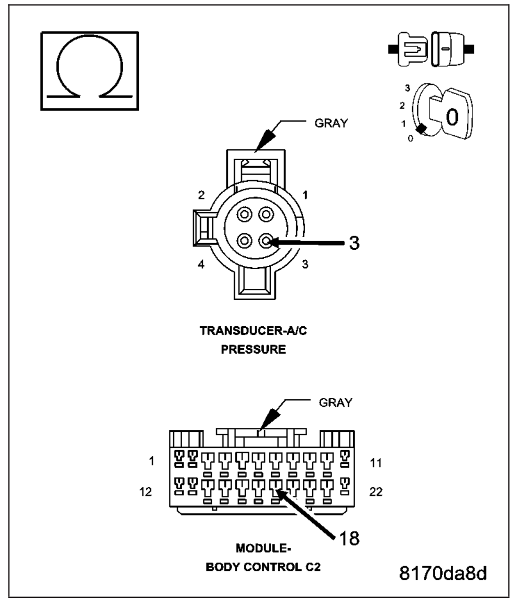
## 6. A/C SENSOR SIGNAL CKT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance of the A/C Pressure Sensor Signal circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the A/C Pressure Sensor Signal circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

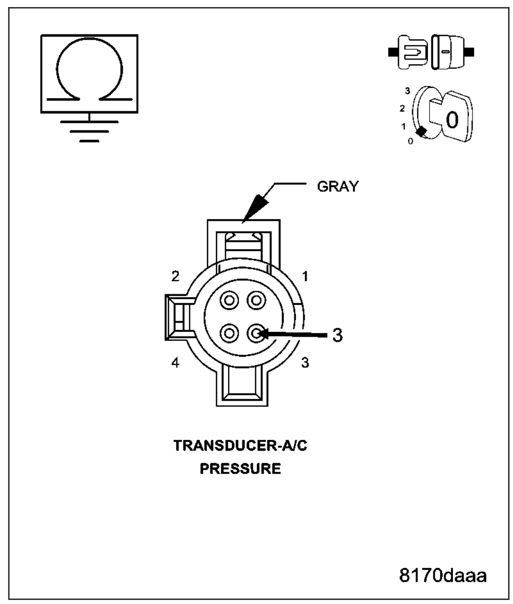
## 7. A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance between ground and the A/C Pressure Sensor Signal circuit.

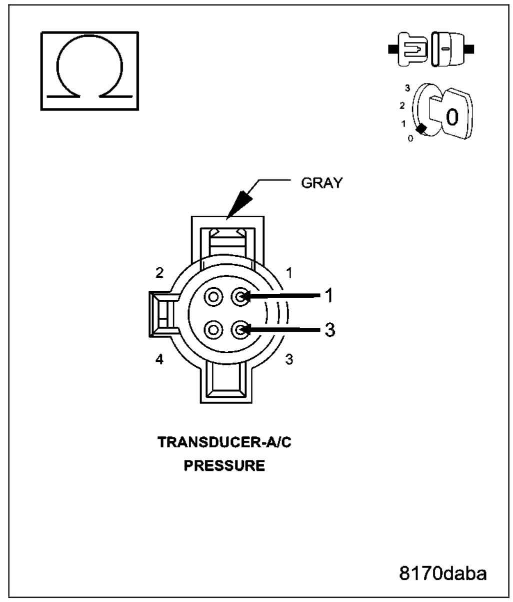



**Is the resistance above 1000 ohms?**

**Yes** >> Go To 8

**No** >> Repair the A/C Pressure Sensor Signal circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 8. A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND




Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance between Sensor Ground and the A/C Pressure Sensor Signal circuit.

**Is the resistance above 1000 ohms?**

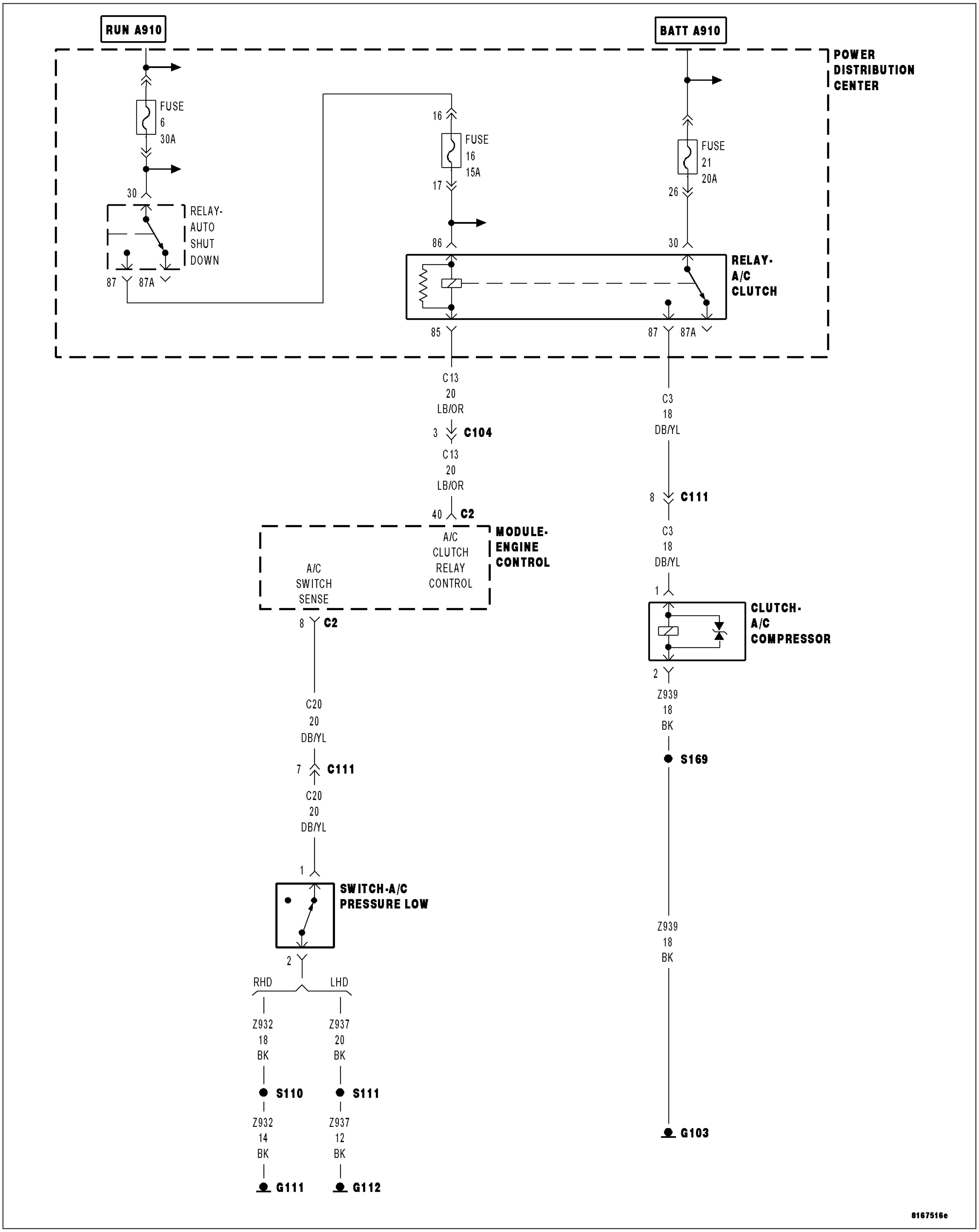
**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform the BCM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the A/C Pressure Sensor Signal circuit for a short to the Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0530- A/C PRESS SENSOR CIRCUIT VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The A/C Pressure Sensor Signal is below 0.06 volt for 0.6 second.

| Possible Causes |
| --- |
| 5-VOLT SUPPLY CIRCUIT OPEN |
| BCM - A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| BCM - A/C PRESSURE SENSOR SIGNAL SHORT TO GROUND |
| A/C PRESSURE SENSOR FAILURE |
| A/C PRESSURE SENSOR SIGNAL CIRCUIT OPEN |
| A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND |
| A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND CIRCUIT OPEN |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, letting the engine run for at least 30 seconds at a time.

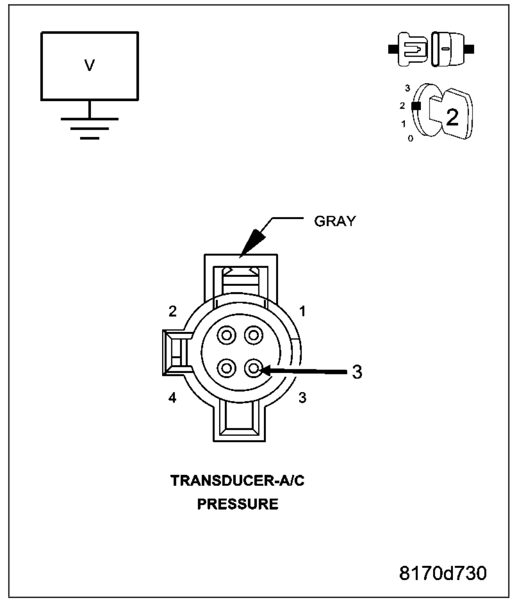
With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 2. CHECKING A/C SENSOR SIGNAL CKT




Turn the ignition off.

Disconnect the A/C Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the A/C Pressure Sensor Signal circuit.

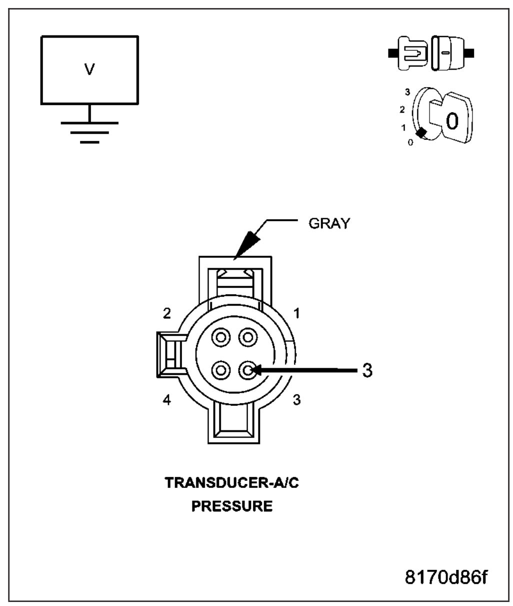
**Select the appropriate voltage reading.**

**Voltage is above 5.5 volts.**
Go To 3

**Voltage is between 4.7 and 5.4 volts.**
Go To 4

**Voltage is below 4.7 volts.**
Go To 6

## 3. A/C SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE




Turn the ignition off.

Disconnect the A/C Pressure Sensor harness connector.

Disconnect the BCM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the A/C Pressure Sensor Signal circuit.

**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the A/C Pressure Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

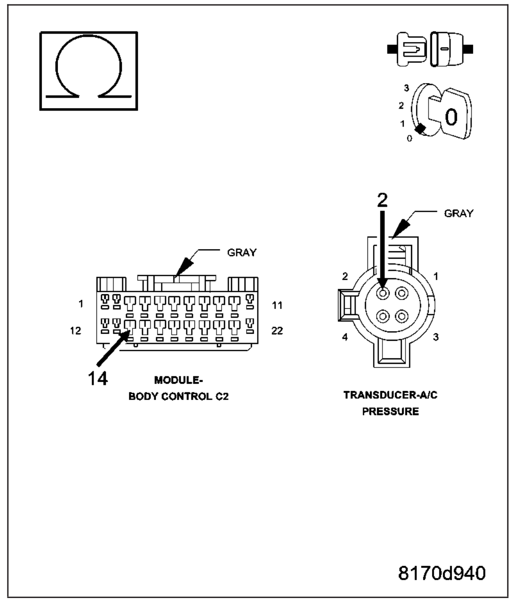
## 4. 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance of the 5-Volt Supply circuit between the BCM harness connector and the A/C Pressure Sensor harness connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the 5-Volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

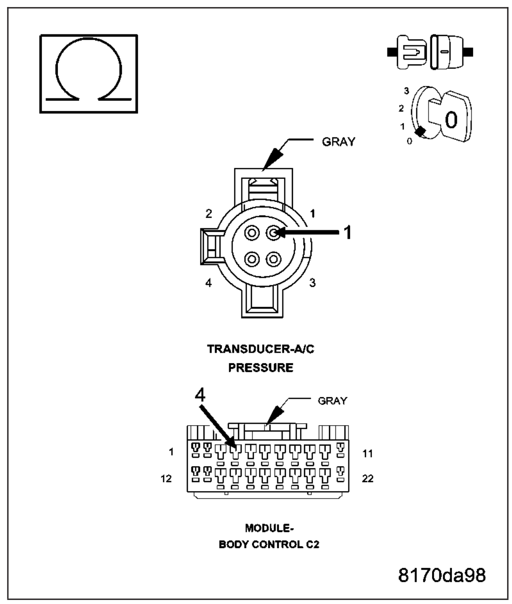
## 5. SENSOR GROUND CKT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance of the Sensor Ground circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Replace the A/C Pressure Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

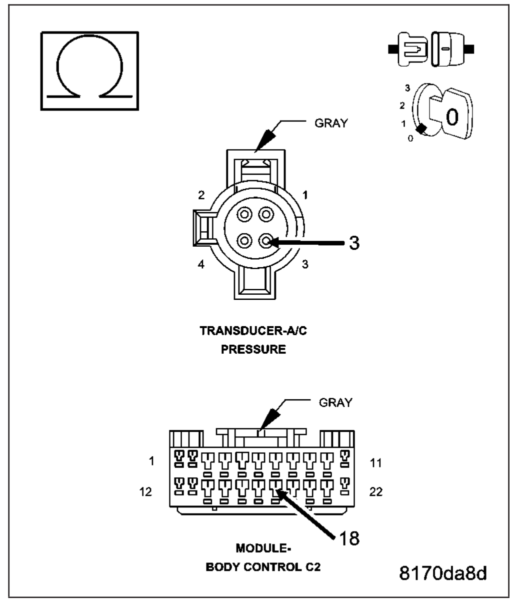
## 6. A/C SENSOR SIGNAL CKT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance of the A/C Pressure Sensor Signal circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the A/C Pressure Sensor Signal circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

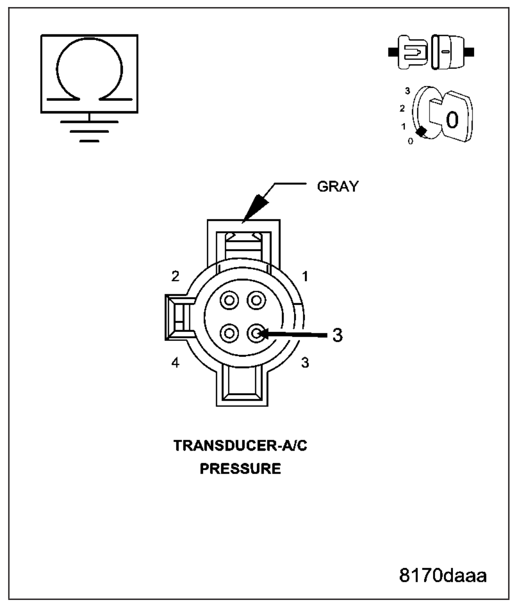
## 7. A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance between ground and the A/C Pressure Sensor Signal circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 8

**No** >> Repair the A/C Pressure Sensor Signal circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

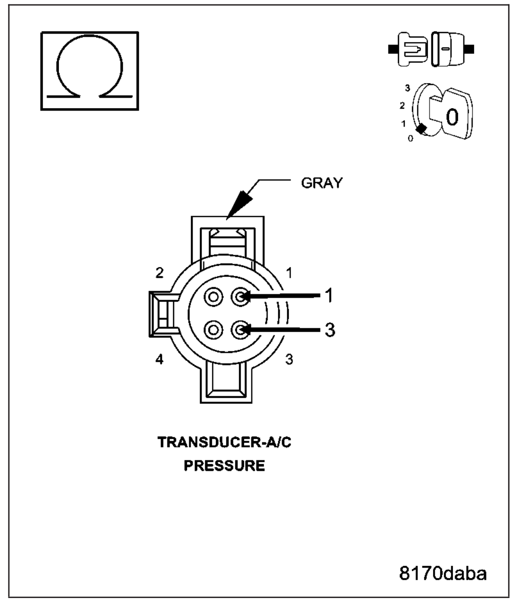
## 8. A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance between Sensor Ground and the A/C Pressure Sensor Signal circuit.




**Is the resistance above 1000 ohms?**

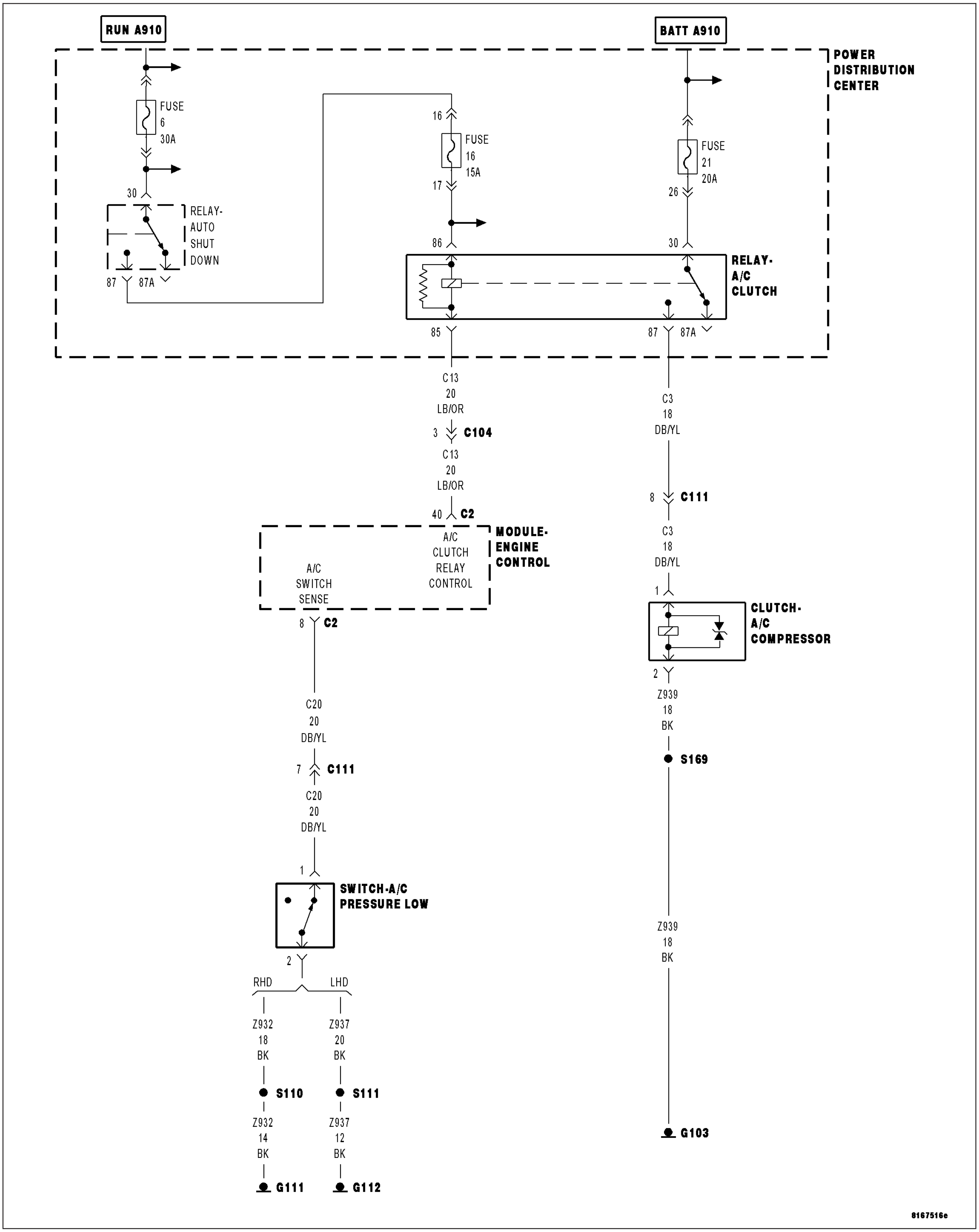
**Yes** >> Replace and program the Body Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the A/C Pressure Sensor Signal circuit for a short to the Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0530- A/C PRESS SENSOR CIRCUIT VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The A/C Pressure Sensor Signal is above 4.74 volts for 0.6 second.

| Possible Causes |
|---|
| 5-VOLT SUPPLY CIRCUIT OPEN |
| BCM - A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| BCM - A/C PRESSURE SENSOR SIGNAL SHORT TO GROUND |
| A/C PRESSURE SENSOR FAILURE |
| A/C PRESSURE SENSOR SIGNAL CIRCUIT OPEN |
| A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND |
| A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND CIRCUIT OPEN |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**NOTE: If DTC P0641 or P0651 is present with this DTC, diagnose DTCs P0641 and P0651 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, letting the engine run for at least 30 seconds at a time.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

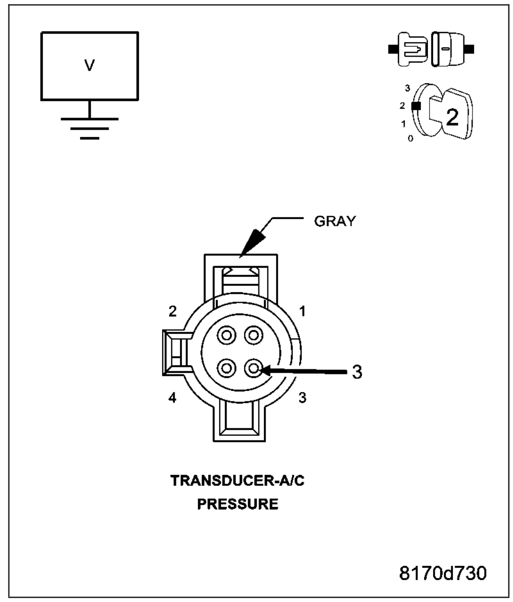
## 2. CHECKING A/C SENSOR SIGNAL CKT

Turn the ignition off.

Disconnect the A/C Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the A/C Pressure Sensor Signal circuit.




**Select the appropriate voltage reading.**

**Voltage is above 5.5 volts.**
Go To 3

**Voltage is between 4.7 and 5.4 volts.**
Go To 4

**Voltage is below 4.7 volts.**
Go To 6

## 3. A/C SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the A/C Pressure Sensor harness connector.

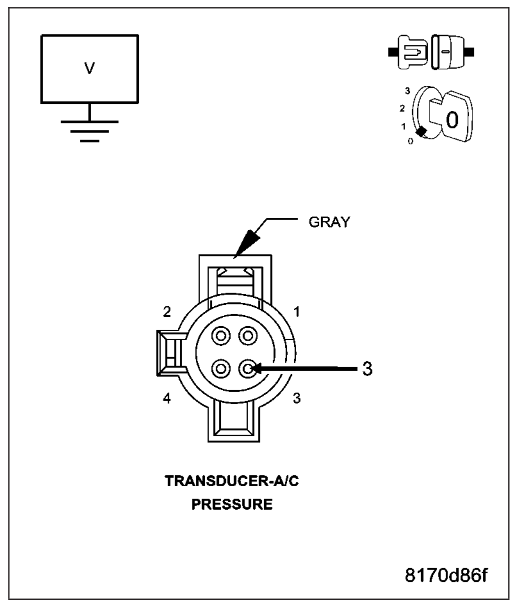
Disconnect the BCM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the A/C Pressure Sensor Signal circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the body Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the A/C Pressure Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

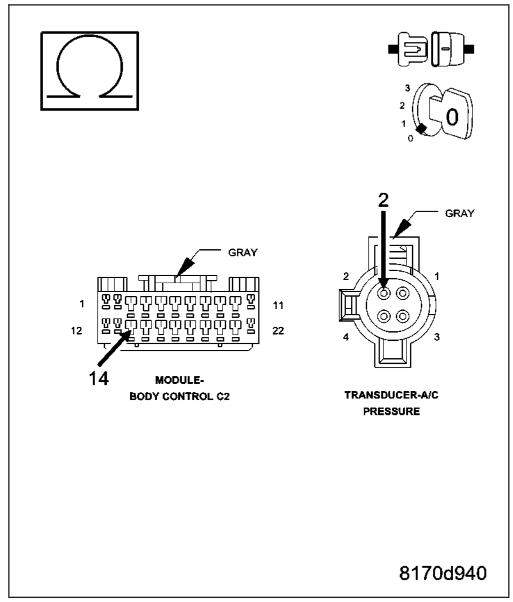
## 4. 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance of the 5-Volt Supply circuit between the BCM harness connector and the A/C Pressure Sensor harness connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the 5-Volt Supply circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

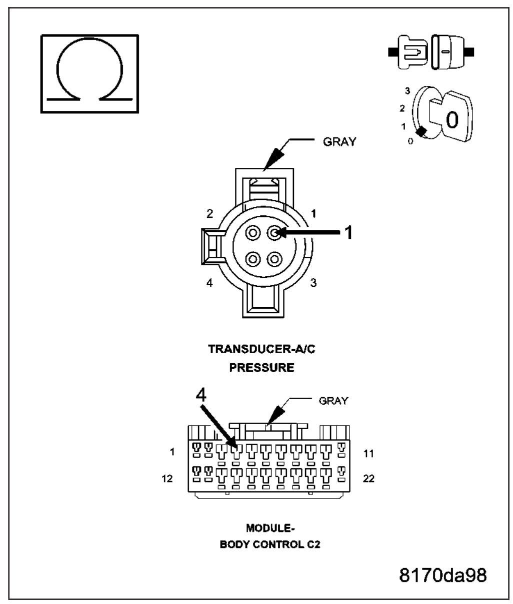
## 5. SENSOR GROUND CKT OPEN

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance of the Sensor Ground circuit.

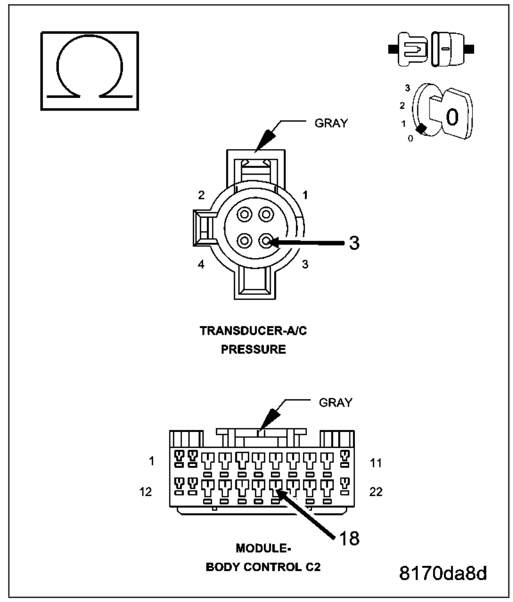



**Is the resistance below 10.0 ohms?**

**Yes** >> Replace the A/C Pressure Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Sensor Ground circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. A/C SENSOR SIGNAL CKT OPEN




Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance of the A/C Pressure Sensor Signal circuit.

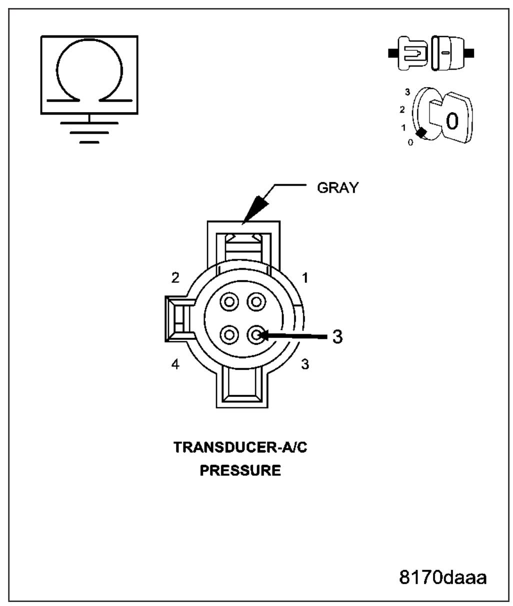
**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the A/C Pressure Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO GROUND




Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance between ground and the A/C Pressure Sensor Signal circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 8

**No** >> Repair the A/C Pressure Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 8. A/C PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO SENSOR GROUND

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the A/C Pressure Sensor harness connector.

Measure the resistance between Sensor Ground and the A/C Pressure Sensor Signal circuit.

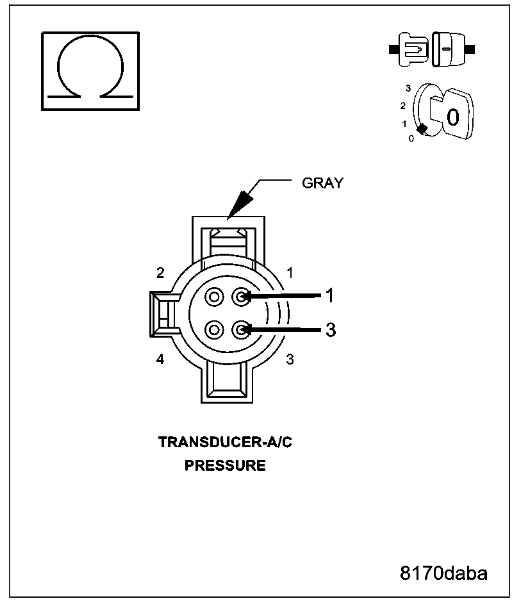
**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the body Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the A/C Pressure Sensor Signal circuit for a short to the Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## P0560-ECM VOLTAGE TOO HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on or the engine running.
- **Set Condition:**

| Possible Causes |
|---|
| CHECKING ECM POWER AND GROUNDS |
| ECM |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

**NOTE: This DTC may be caused by a charging system problem. Refer to the Service Information and verify proper charging system operation before continuing.**

Test drive the vehicle.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECK POWER AND GROUNDS

Refer to the symptom list and perform the Checking the ECM Power and Ground test.

**Were any problem found with the ECM powers and grounds?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0560-ECM VOLTAGE TOO LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on or the engine running.
- **Set Condition:**

| Possible Causes |
|---|
| CHECKING ECM POWER AND GROUNDS |
| ECM |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

**NOTE: This DTC may be caused by a charging system problem. Refer to the Service Information and verify proper charging system operation before continuing.**

Test drive the vehicle.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECK POWER AND GROUNDS

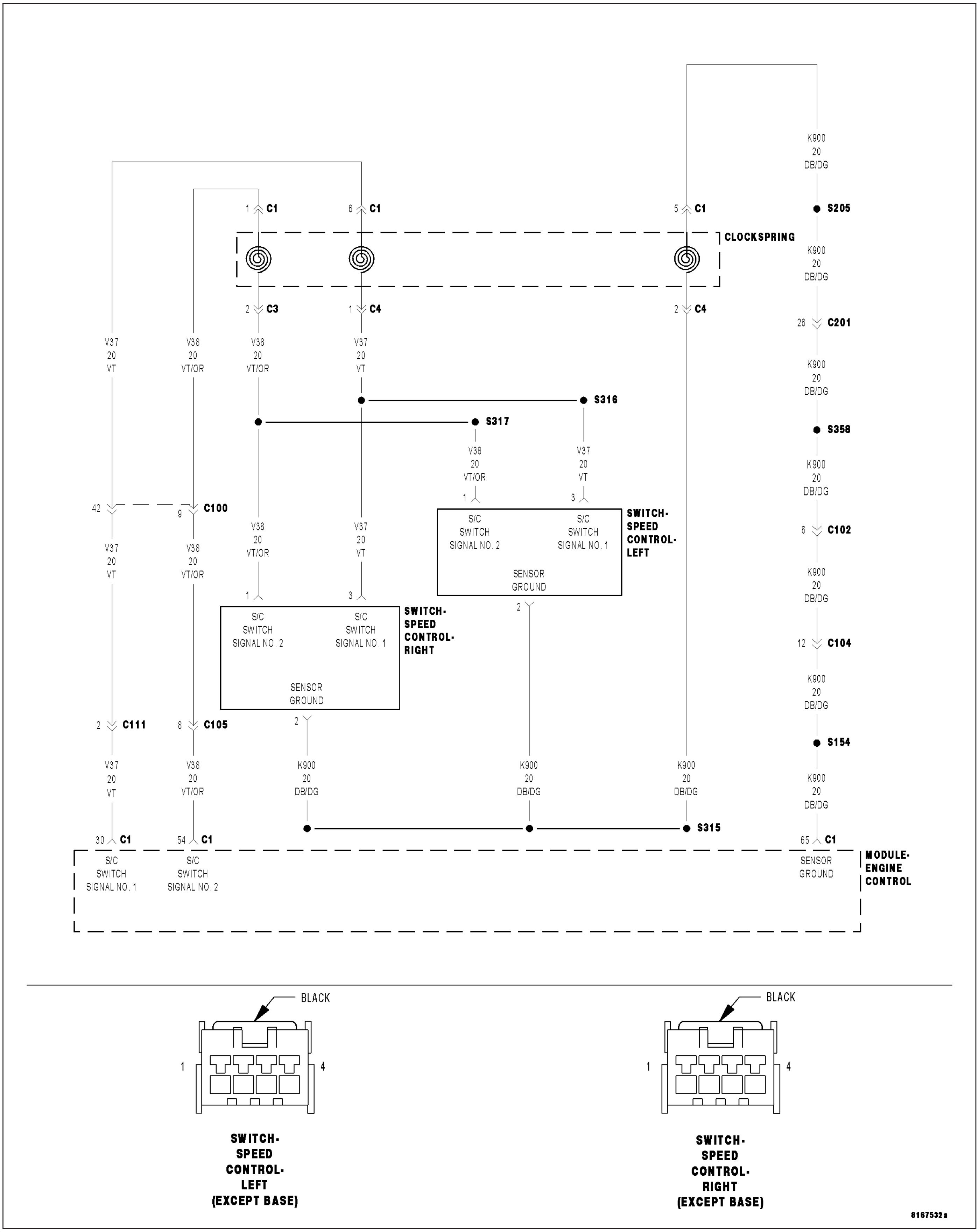
Refer to the symptom list and perform the Checking the ECM Power and Ground test.

**Were any problem found with the ECM powers and grounds?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0564-S/C SWITCH #1 SIGNAL CIRCUIT PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition switch on and no other S/C Switch DTC's present.
- **Set Condition:**
  The S/C Switch #1 signal voltage is not within a valid switch signal range.

| Possible Causes |
| --- |
| ECM - S/C SIGNAL CIRCUIT OPEN |
| ECM - S/C SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT SHORT TO GROUND |
| S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND OPEN |
| SPEED CONTROL SWITCHES |

## Diagnostic Test

### 1. VERIFY S/C SWITCH SIGNAL CIRCUIT VOLTAGE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

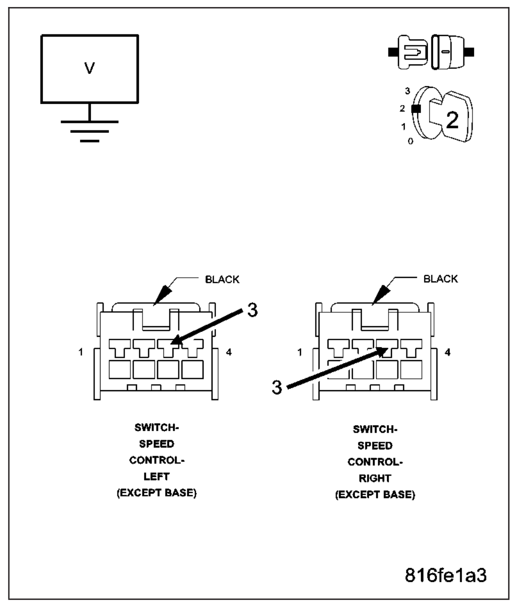
**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition off.

Disconnect the harness connectors from both S/C Switches.

Turn the ignition on.

Measure the voltage of the S/C Switch #1 Signal circuit at both S/C Switch harness connectors.




**Select the appropriate voltage reading.**

**4.5 to 5.5 volts at both connectors.**
Go To 2

**4.5 to 5.5 volts at only one connector.**
Repair the S/C Switch Signal circuit that measured below 4.5 volts for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**Below 4.5 volts at both connectors.**
Go To 4

**Above 5.5 volts for either measurement.**
Go To 6

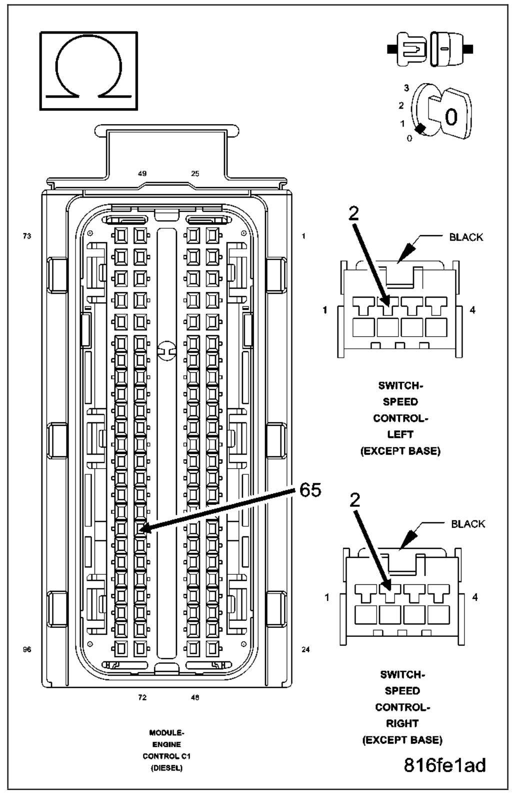
## 2. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between each S/C Switch harness connector and the ECM harness connector.




**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 3

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

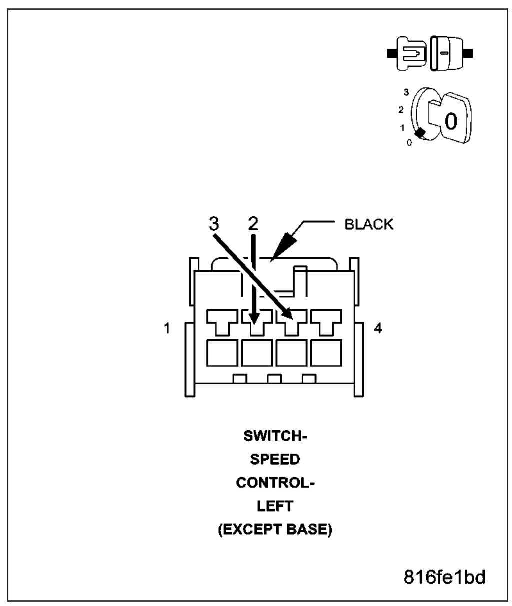
## 3. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect one of the S/C Switch harness connectors.

With the scan tool, read the S/C Switch Voltage.

While monitoring the scan tool, connect a jumper wire between the S/C Switch #1 Signal circuit and the Sensor Ground circuit in the S/C Switch harness connector.




**Does the scan tool display below 0.1 volt with the jumper wire connected?**

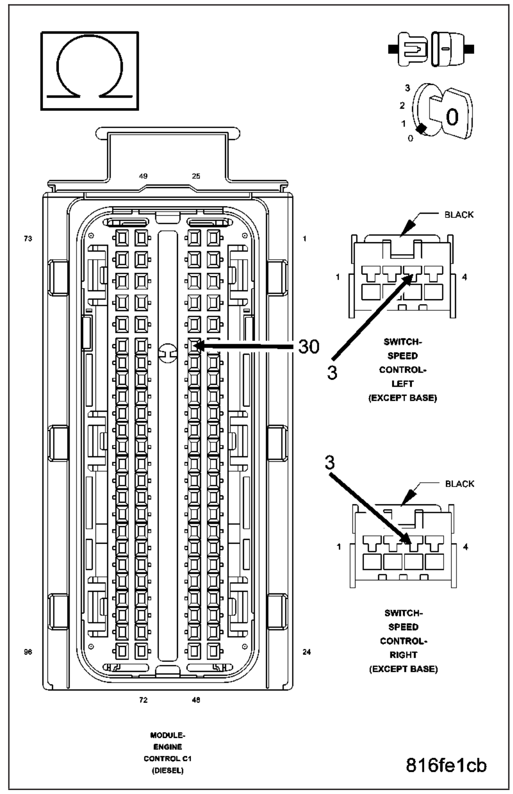
**Yes** >> Replace the Speed Control Switches.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. S/C SWITCH #1 SIGNAL CIRCUIT OPEN




Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between the S/C Switch #1 Signal circuit between both S/C Switch harness connectors and the ECM harness connector.

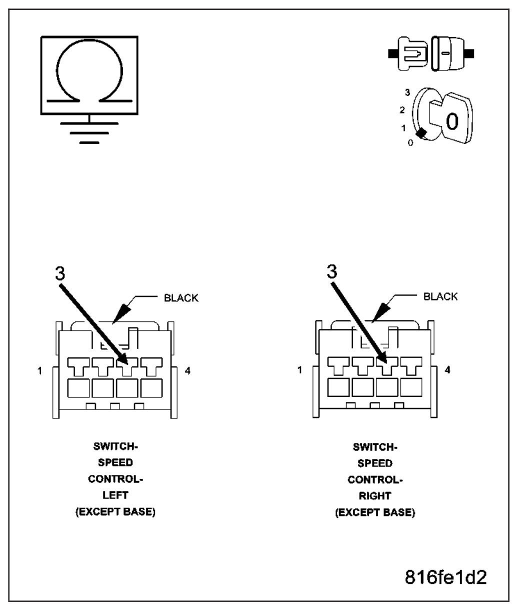
**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the S/C Switch #1 Signal circuit that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. S/C SWITCH #1 SIGNAL CIRCUIT SHORT TO GROUND




Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the S/C Switch #1 Signal circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the S/C Switch #1 Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. S/C SWITCH #1 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

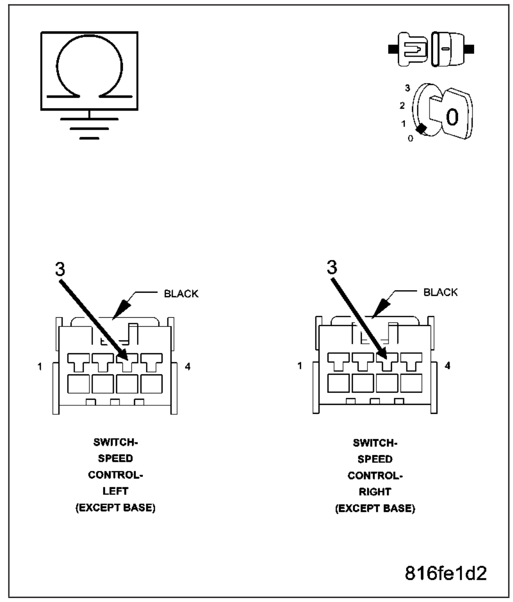
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the S/C Switch #1 Signal circuit.




**Is the voltage above 1.0 volt?**

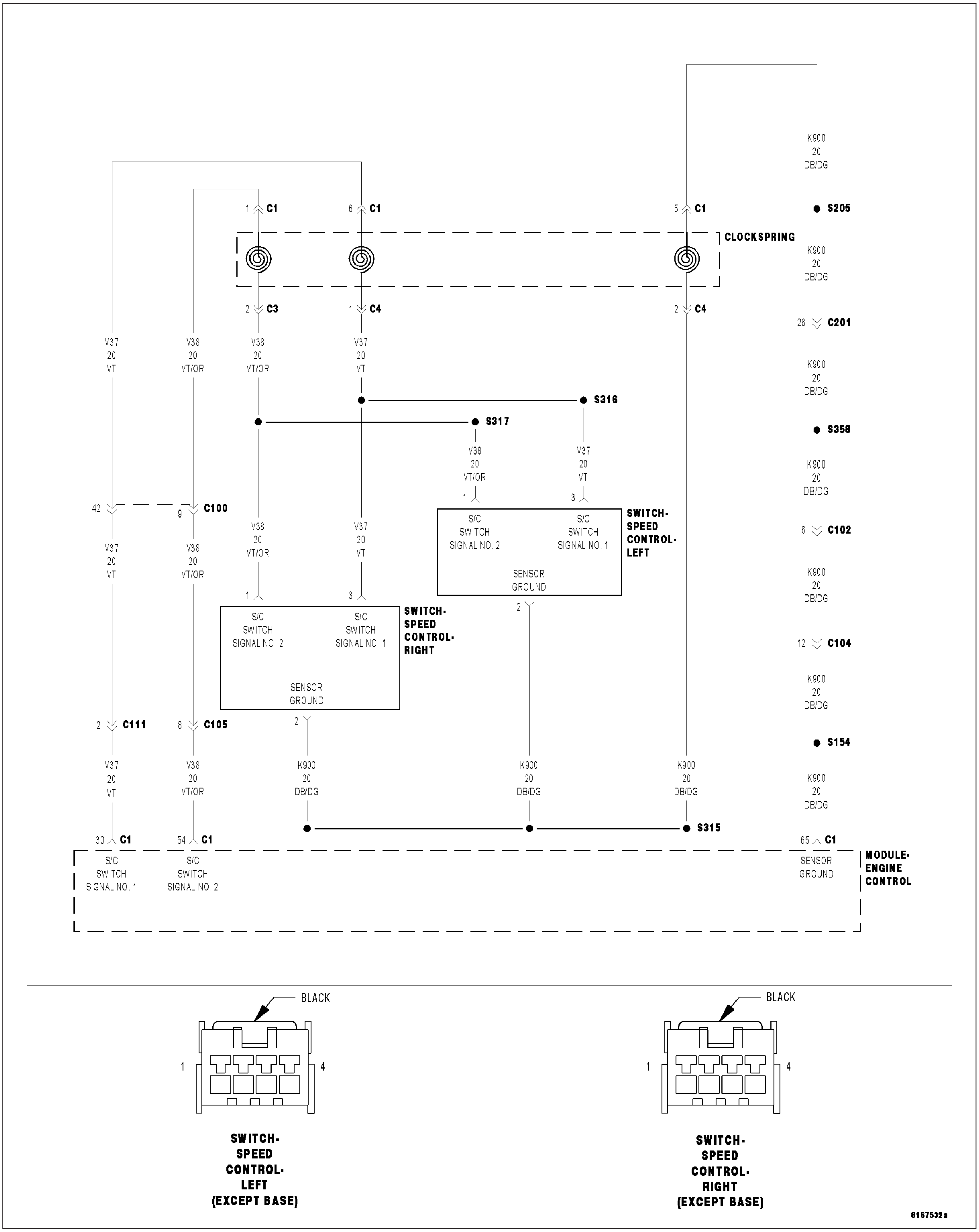
**Yes** >> Repair the S/C Switch #1 Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0564-S/C SWITCH #1 SIGNAL CIRCUIT VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The S/C Switch #1 Signal is above 4.90 volts for 1.0 second.

| Possible Causes |
|---|
| ECM - S/C SIGNAL CIRCUIT OPEN |
| ECM - S/C SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT SHORT TO GROUND |
| S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND OPEN |
| SPEED CONTROL SWITCHES |

## Diagnostic Test

### 1. VERIFY S/C SWITCH SIGNAL CIRCUIT VOLTAGE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

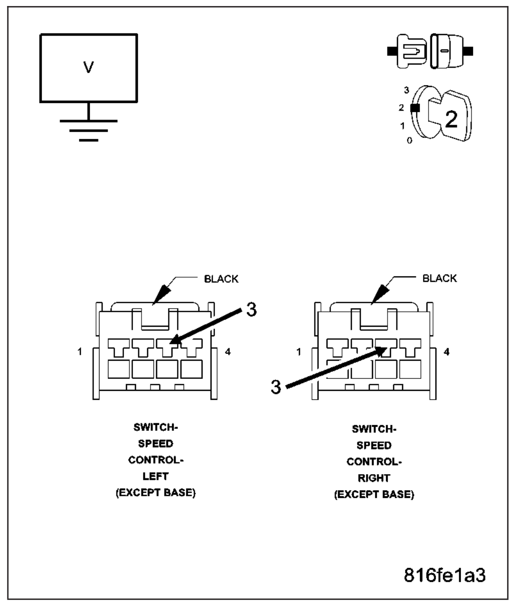
**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition off.

Disconnect the harness connectors from both S/C Switches.

Turn the ignition on.

Measure the voltage of the S/C Switch #1 Signal circuit at both S/C Switch harness connectors.




**Select the appropriate voltage reading.**

**4.5 to 5.5 volts at both connectors.**
Go To 2

**4.5 to 5.5 volts at only one connector.**
Repair the S/C Switch Signal circuit that measured below 4.5 volts for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**Below 4.5 volts at both connectors.**
Go To 4

**Above 5.5 volts for either measurement.**
Go To 6

## 2. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

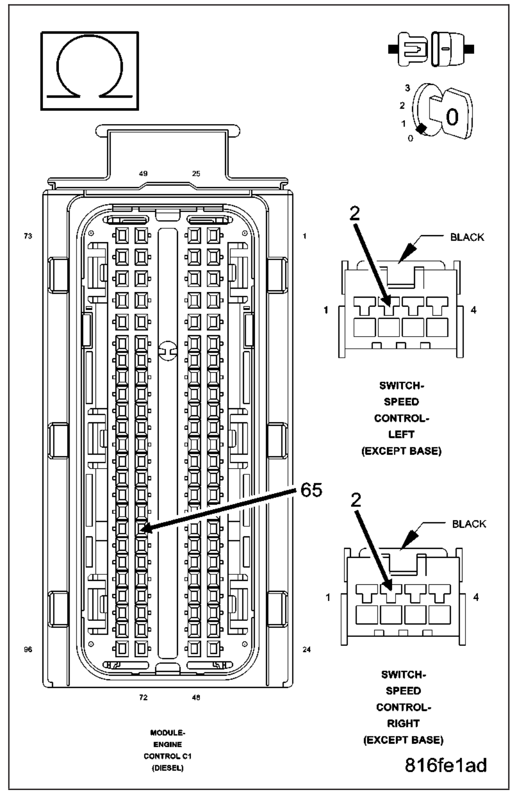
Measure the resistance of the Sensor Ground circuit between each S/C Switch harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 3

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 3. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect one of the S/C Switch harness connectors.

With the scan tool, read the S/C Switch Voltage.

While monitoring the scan tool, connect a jumper wire between the S/C Switch #1 Signal circuit and the Sensor Ground circuit in the S/C Switch harness connector.

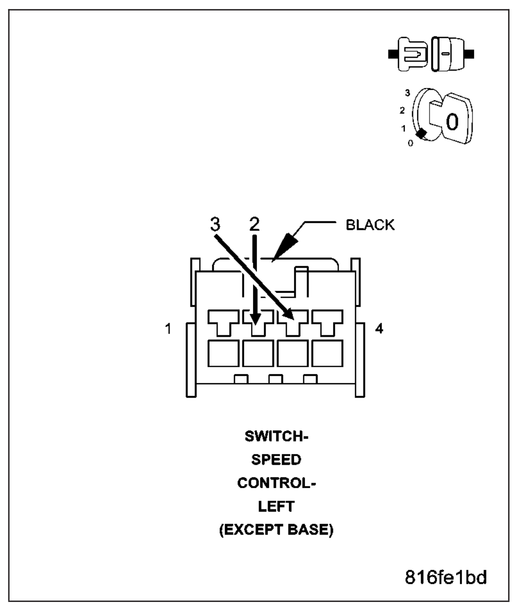
**Does the scan tool display below 0.1 volt with the jumper wire connected?**

**Yes** >> Replace the Speed Control Switches.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



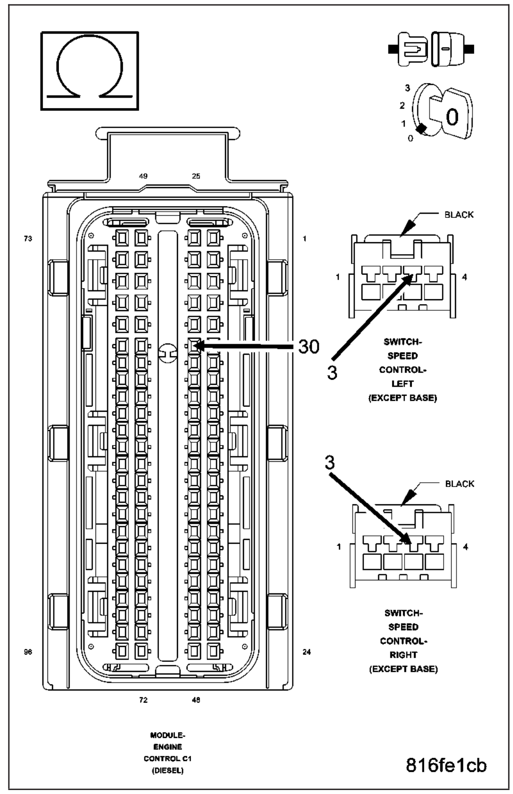
## 4. S/C SWITCH #1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between the S/C Switch #1 Signal circuit between both S/C Switch harness connectors and the ECM harness connector.




**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the S/C Switch #1 Signal circuit that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

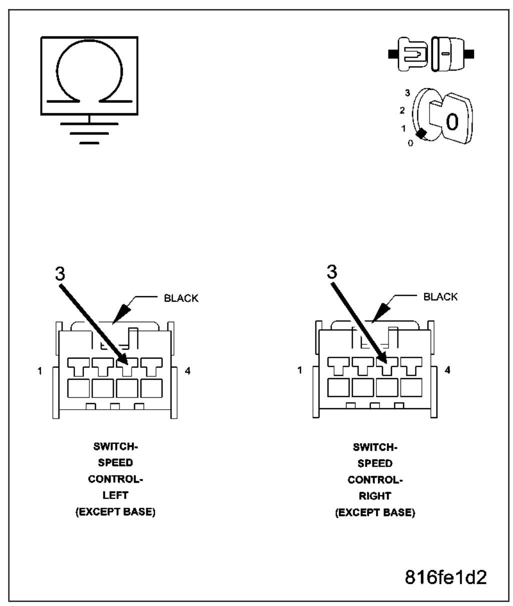
## 5. S/C SWITCH #1 SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the S/C Switch #1 Signal circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the S/C Switch #1 Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. S/C SWITCH #1 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

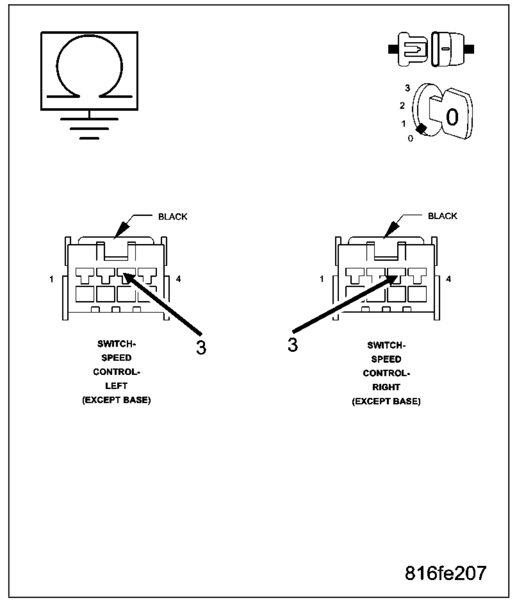
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the S/C Switch #1 Signal circuit.




**Is the voltage above 1.0 volt?**

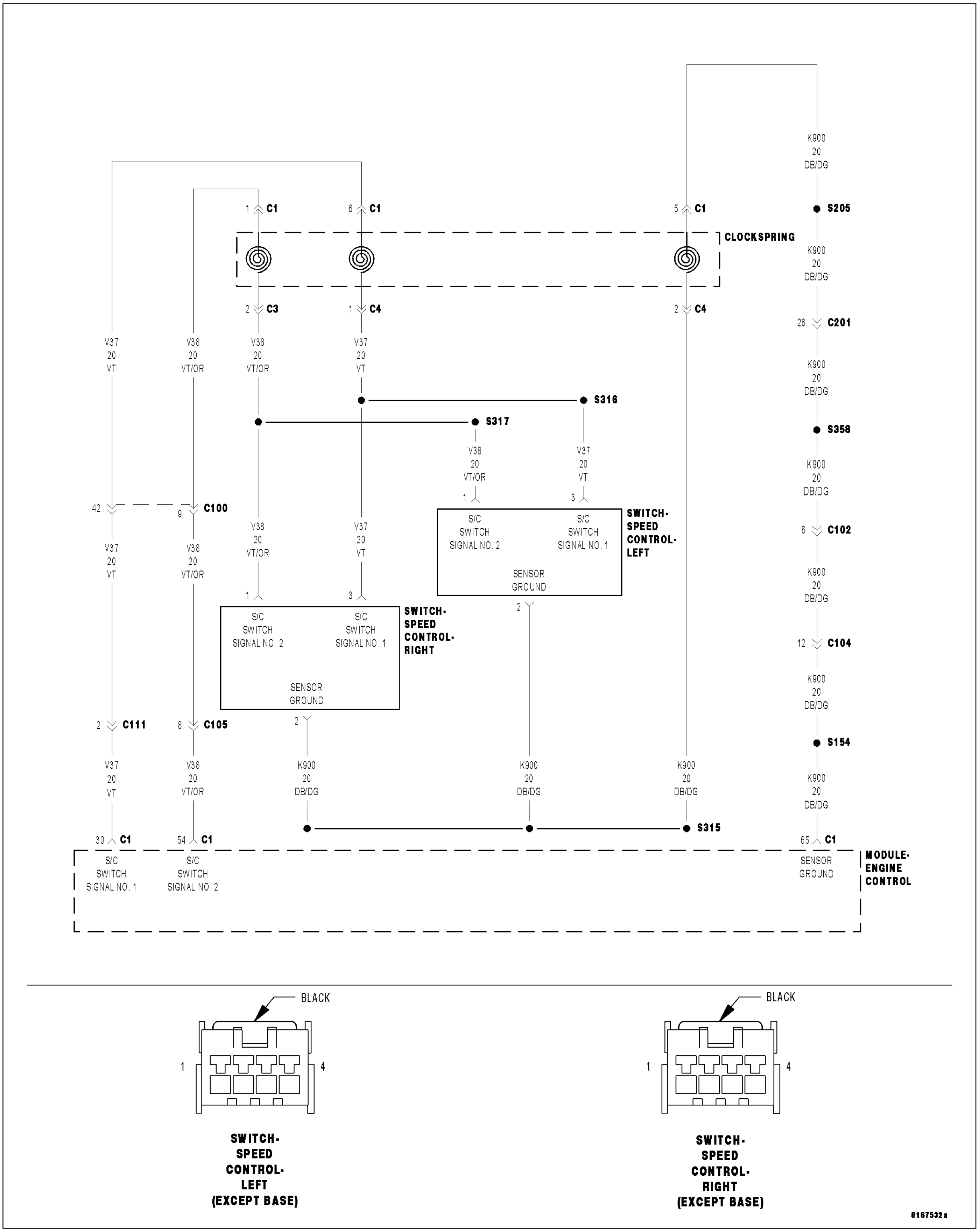
**Yes** >> Repair the S/C Switch #1 Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0564-S/C SWITCH #1 SIGNAL CIRCUIT VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The S/C Switch #1 Signal is below 0.60 volt for 1.0 second.

| Possible Causes |
|---|
| ECM - S/C SIGNAL CIRCUIT OPEN |
| ECM - S/C SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT SHORT TO GROUND |
| S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND OPEN |
| SPEED CONTROL SWITCHES |

## Diagnostic Test

### 1. VERIFY S/C SWITCH SIGNAL CIRCUIT VOLTAGE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

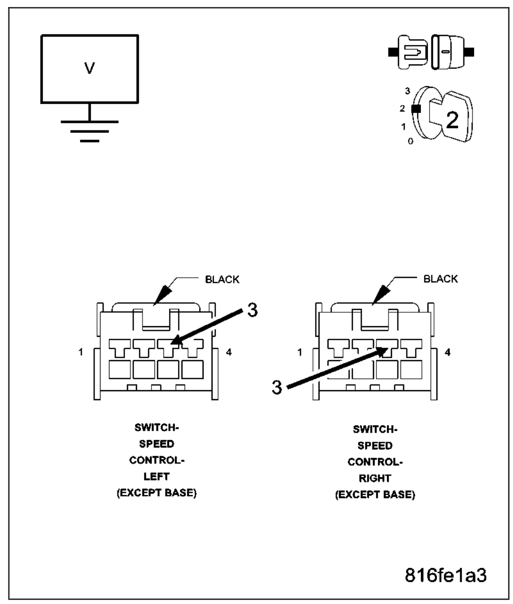
**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition off.

Disconnect the harness connectors from both S/C Switches.

Turn the ignition on.

Measure the voltage of the S/C Switch #1 Signal circuit at both S/C Switch harness connectors.




**Select the appropriate voltage reading.**

**4.5 to 5.5 volts at both connectors.**
Go To 2

**4.5 to 5.5 volts at only one connector.**
Repair the S/C Switch Signal circuit that measured below 4.5 volts for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**Below 4.5 volts at both connectors.**
Go To 4

**Above 5.5 volts for either measurement.**
Go To 6

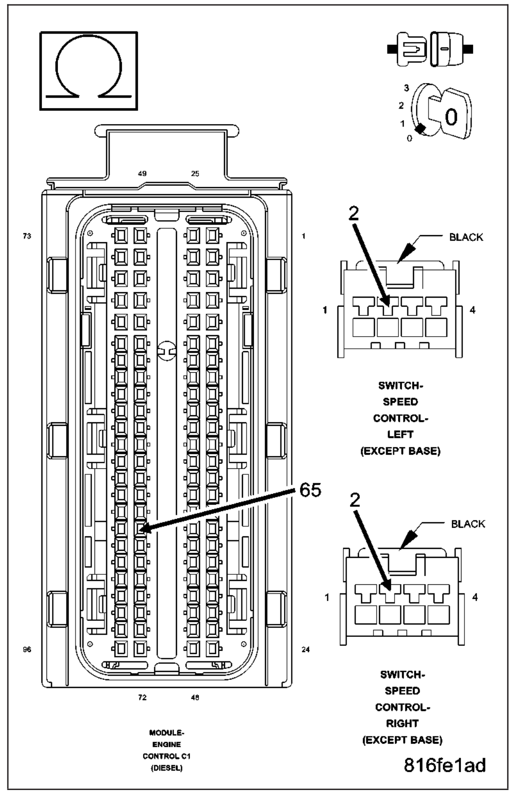
## 2. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between each S/C Switch harness connector and the ECM harness connector.




**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 3

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

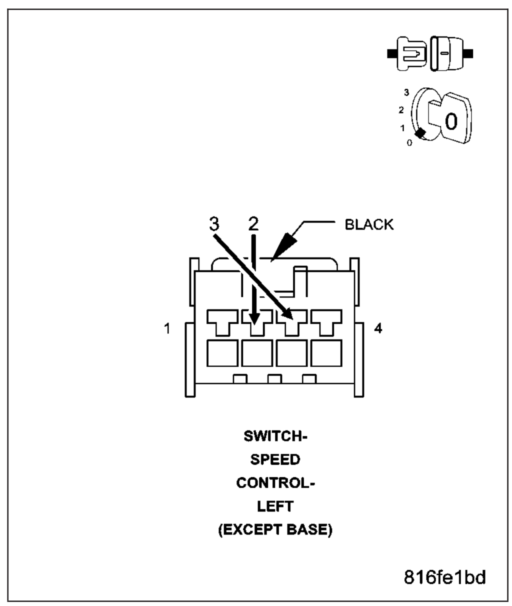
## 3. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect one of the S/C Switch harness connectors.

With the scan tool, read the S/C Switch Voltage.

While monitoring the scan tool, connect a jumper wire between the S/C Switch #1 Signal circuit and the Sensor Ground circuit in the S/C Switch harness connector.




**Does the scan tool display below 0.1 volt with the jumper wire connected?**

**Yes** >> Replace the Speed Control Switches.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. S/C SWITCH #1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

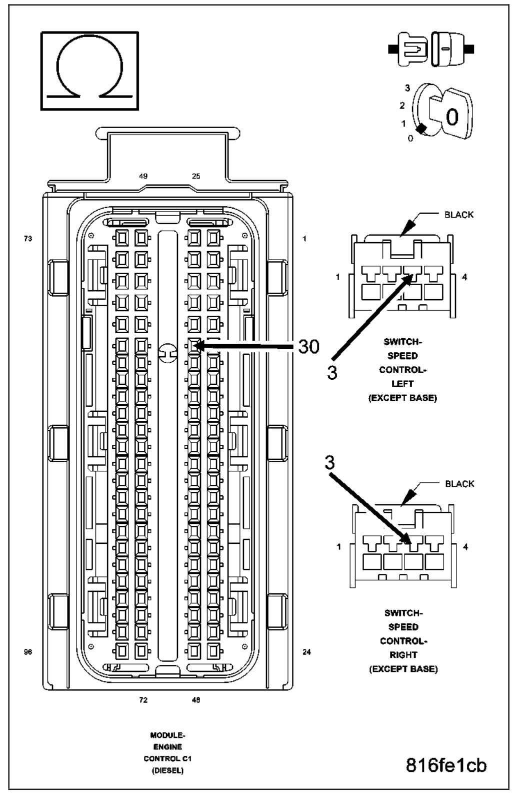
Measure the resistance between the S/C Switch #1 Signal circuit between both S/C Switch harness connectors and the ECM harness connector.

**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the S/C Switch #1 Signal circuit that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 5. S/C SWITCH #1 SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the S/C Switch #1 Signal circuit.

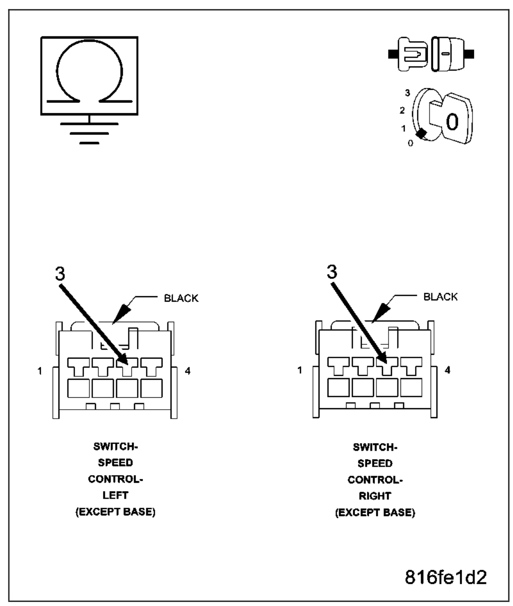
**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the S/C Switch #1 Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 6. S/C SWITCH #1 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

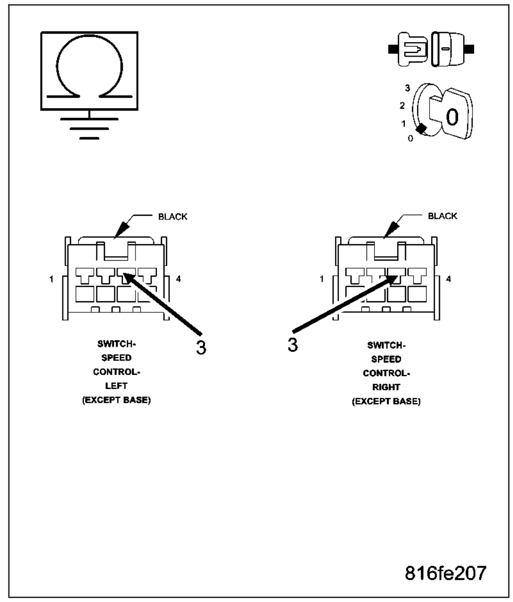
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the S/C Switch #1 Signal circuit.




**Is the voltage above 1.0 volt?**

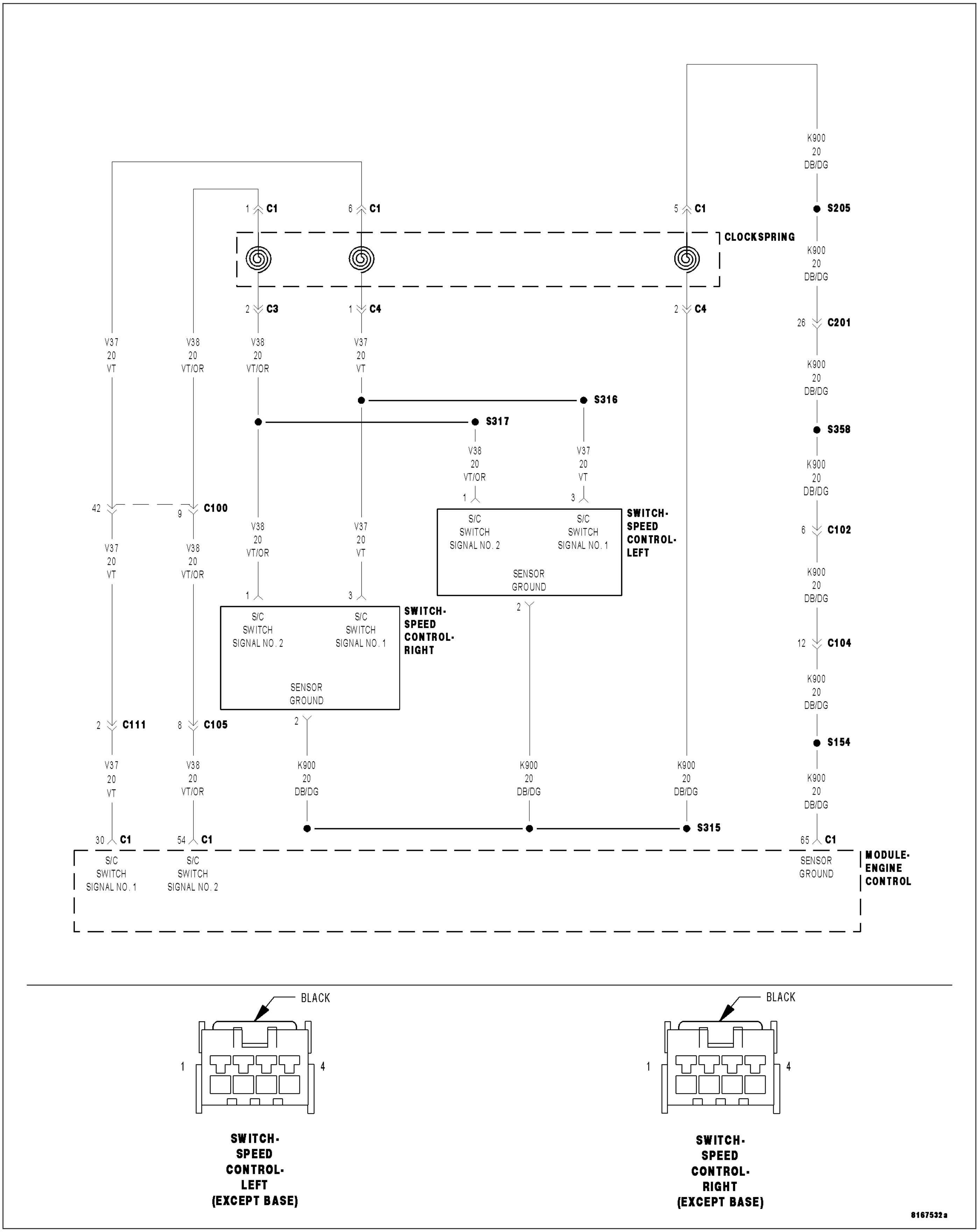
**Yes** >> Repair the S/C Switch #1 Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0564-S/C SWITCH #1 SIGNAL CIRCUIT STUCK SWITCH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The S/C Switch #1 Signal indicates that a switch is pressed for more than 1 minute.

| Possible Causes |
|---|
| ECM - S/C SIGNAL CIRCUIT OPEN |
| ECM - S/C SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT SHORT TO GROUND |
| S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND OPEN |
| SPEED CONTROL SWITCHES |

## Diagnostic Test

### 1. VERIFY S/C SWITCH SIGNAL CIRCUIT VOLTAGE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

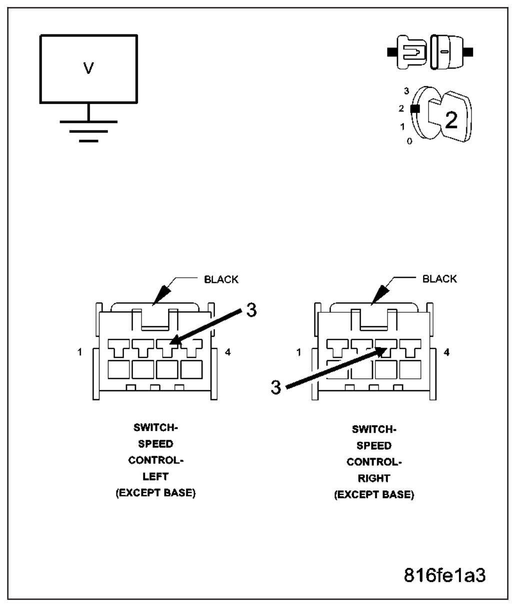
**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition off.

Disconnect the harness connectors from both S/C Switches.

Turn the ignition on.

Measure the voltage of the S/C Switch #1 Signal circuit at both S/C Switch harness connectors.




**Select the appropriate voltage reading.**

**4.5 to 5.5 volts at both connectors.**
Go To 2

**4.5 to 5.5 volts at only one connector.**
Repair the S/C Switch Signal circuit that measured below 4.5 volts for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**Below 4.5 volts at both connectors.**
Go To 4

**Above 5.5 volts for either measurement.**
Go To 6

## 2. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

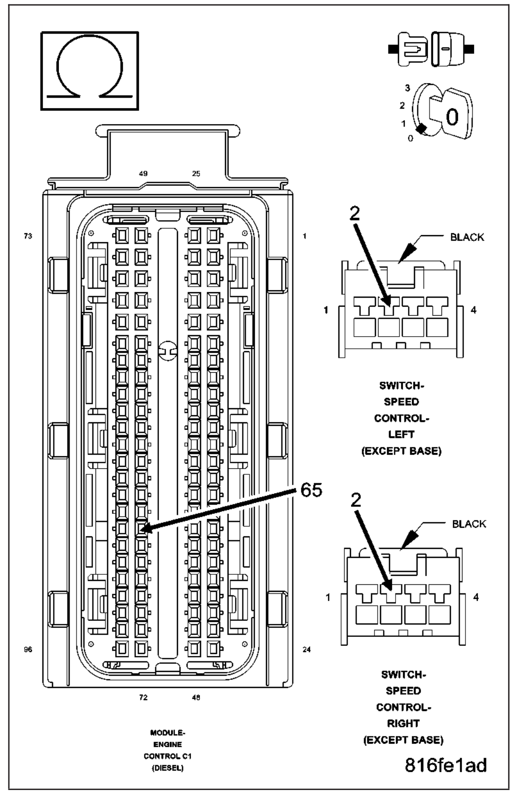
Measure the resistance of the Sensor Ground circuit between each S/C Switch harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 3

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 3. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect one of the S/C Switch harness connectors.

With the scan tool, read the S/C Switch Voltage.

While monitoring the scan tool, connect a jumper wire between the S/C Switch #1 Signal circuit and the Sensor Ground circuit in the S/C Switch harness connector.

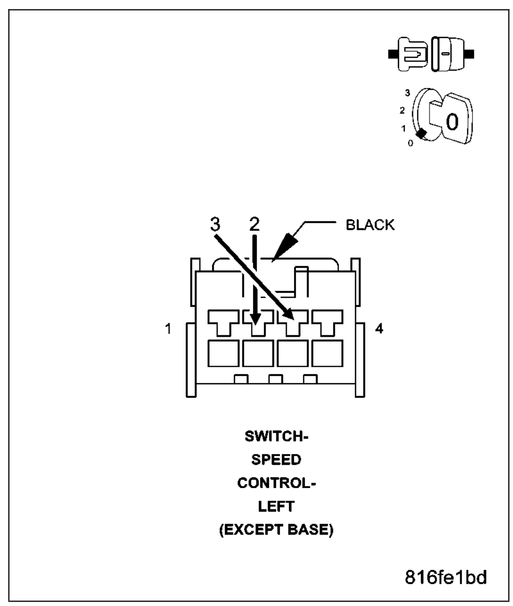
**Does the scan tool display below 0.1 volt with the jumper wire connected?**

**Yes** >> Replace the Speed Control Switches.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 4. S/C SWITCH #1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

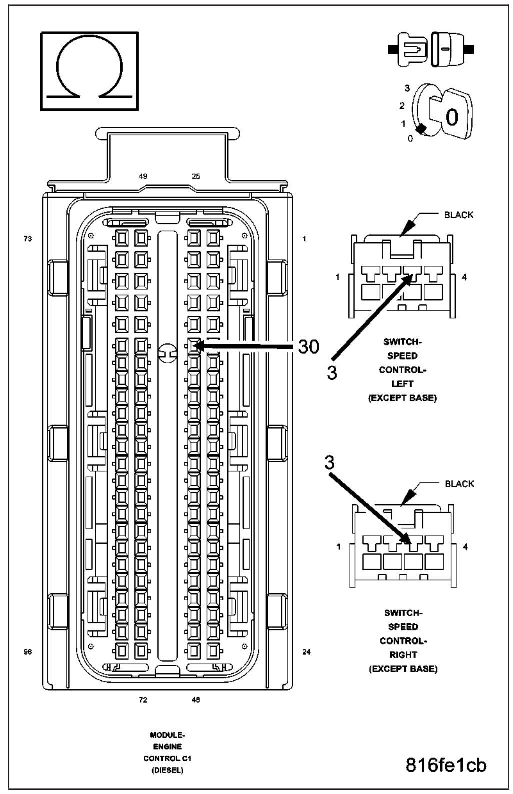
Measure the resistance between the S/C Switch #1 Signal circuit between both S/C Switch harness connectors and the ECM harness connector.

**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the S/C Switch #1 Signal circuit that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 5. S/C SWITCH #1 SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the S/C Switch #1 Signal circuit.

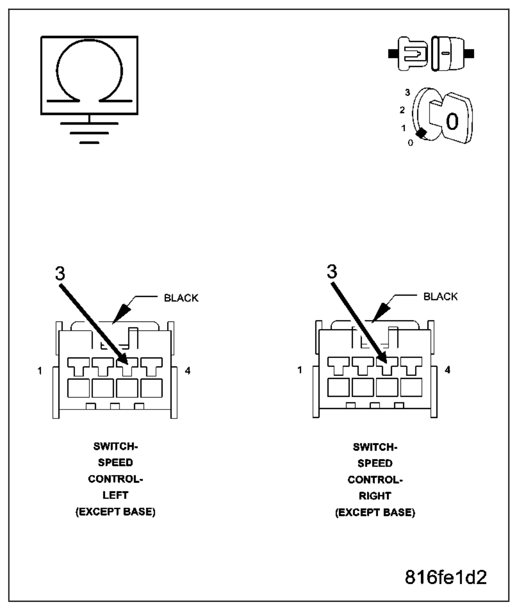
**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the S/C Switch #1 Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 6. S/C SWITCH #1 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

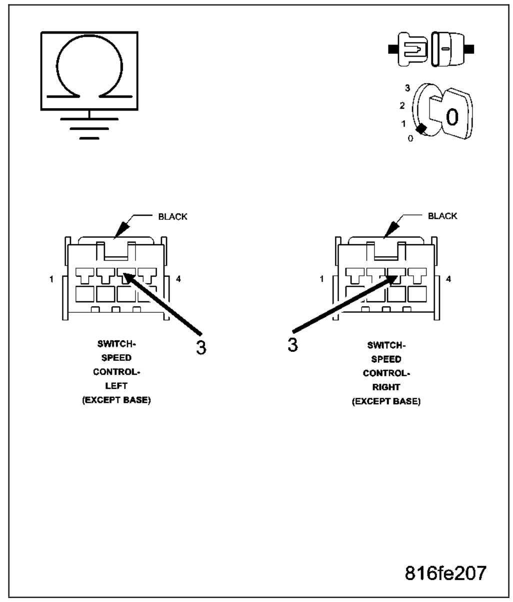
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the S/C Switch #1 Signal circuit.




**Is the voltage above 1.0 volt?**

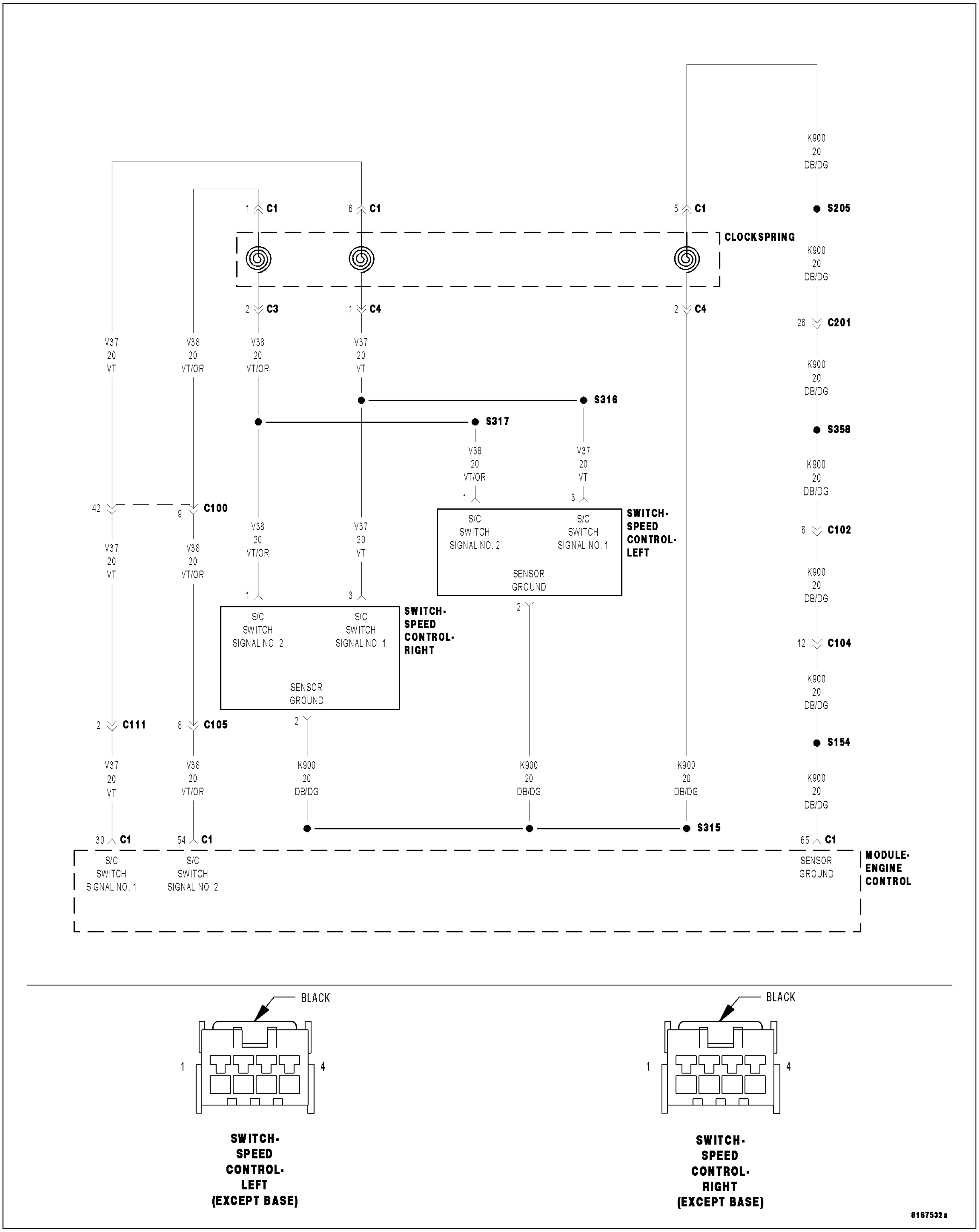
**Yes** >> Repair the S/C Switch #1 Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0585-S/C SWITCH PLAUSIBILITY BETWEEN SWITCH #1 AND #2




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects a discrepency between S/C Switch #1 and S/C Switch #2 signals for 10.0 seconds.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| HIGH RESISTANCE IN THE S/C SWITCH SIGNAL CIRCUIT |
| HIGH RESISTANCE IN THE S/C SWITCH GROUND CIRCUIT |
| S/C SWITCHES |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle and activate the Speed Control.

At some point during the test drive, press each of the S/C Switch buttons.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

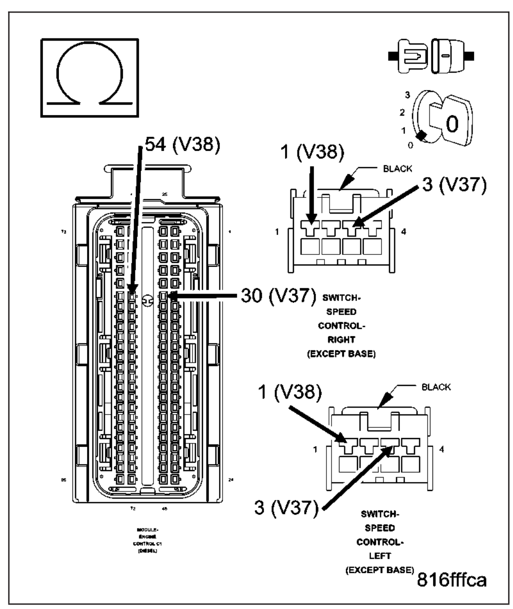
### 2. HIGH RESISTANCE IN THE S/C SWITCH SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the S/C Switch #1 Signal circuit and the S/C Switch #2 Signal circuit between each S/C Switch harness connector and the ECM harness connector.




**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 3

**No** >> Repair the S/C Switch Signal circuit(s) for high resistance.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

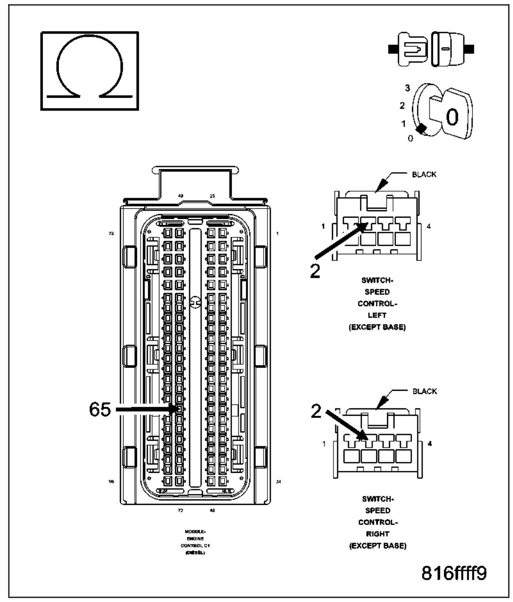
## 3. HIGH RESISTANCE IN THE SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between each S/C Switch harness connector and the ECM harness connector.




**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 4

**No** >> Repair the S/C Switch Ground circuit for high resistance.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. S/C SWITCHES

Turn the ignition off.

Replace the S/C Switches.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle and activate the Speed Control.

At some point during the test drive, press each of the S/C Switch buttons.

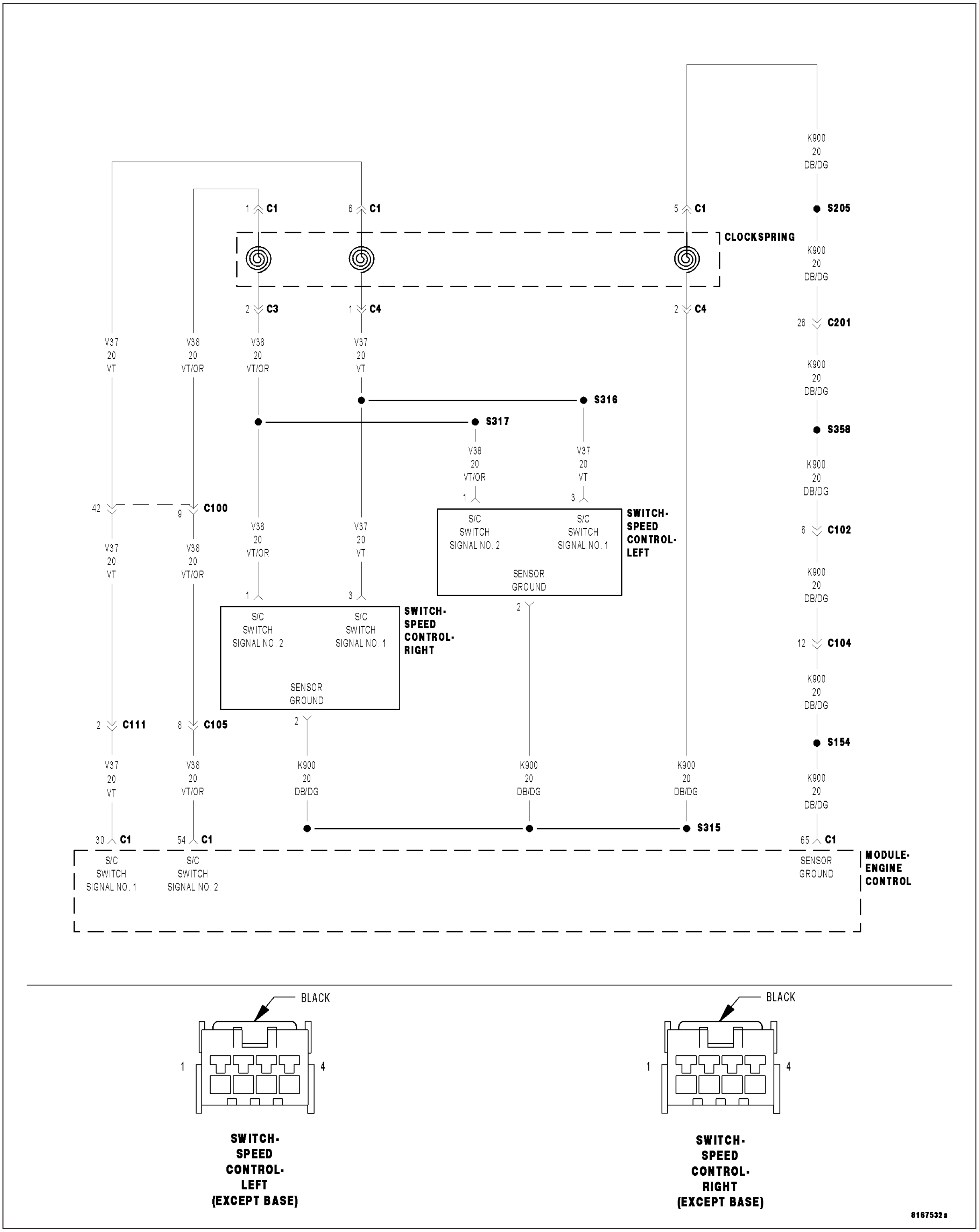
Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0589-S/C SWITCH #2 SIGNAL CIRCUIT PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition switch on and no other S/C Switch DTC's present.
- **Set Condition:**
  The S/C Switch #2 signal voltage is not within a valid switch signal range.

| Possible Causes |
|---|
| ECM - S/C SIGNAL CIRCUIT OPEN |
| ECM - S/C SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT SHORT TO GROUND |
| S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND OPEN |
| SPEED CONTROL SWITCHES |

## Diagnostic Test

### 1. VERIFY S/C SWITCH SIGNAL CIRCUIT VOLTAGE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

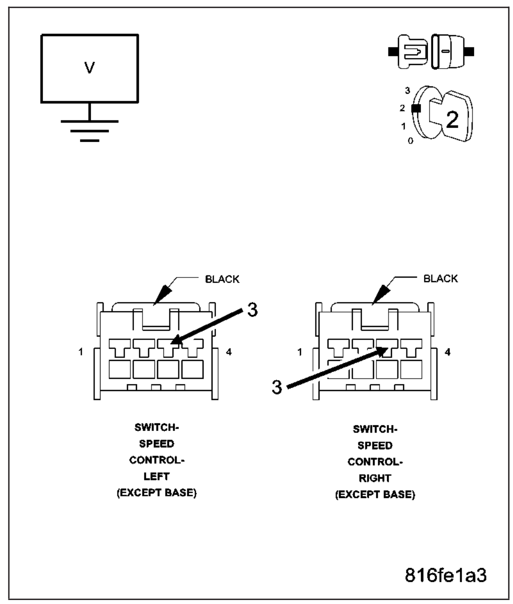
**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition off.

Disconnect the harness connectors from both S/C Switches.

Turn the ignition on.

Measure the voltage of the S/C Switch #2 Signal circuit at both S/C Switch harness connectors.




**Select the appropriate voltage reading.**

**4.5 to 5.5 volts at both connectors.**
Go To 2

**4.5 to 5.5 volts at only one connector.**
Repair the S/C Switch Signal circuit that measured below 4.5 volts for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**Below 4.5 volts at both connectors.**
Go To 4

**Above 5.5 volts for either measurement.**
Go To 6

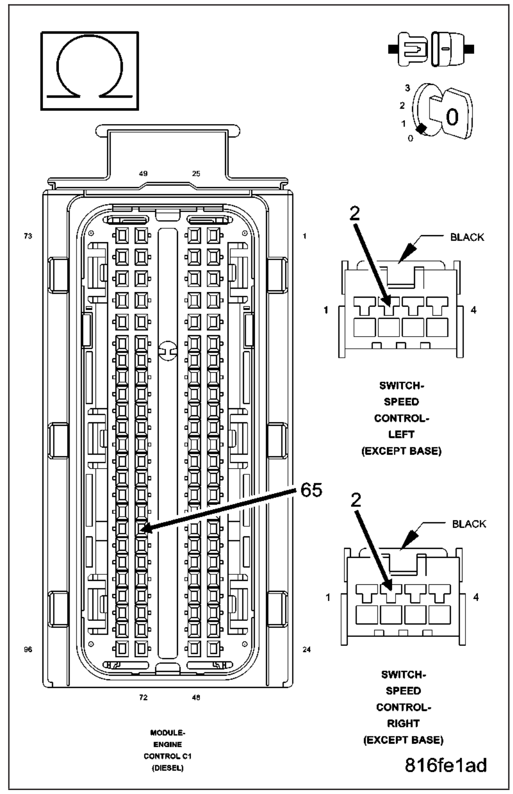
## 2. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between each S/C Switch harness connector and the ECM harness connector.




**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 3

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

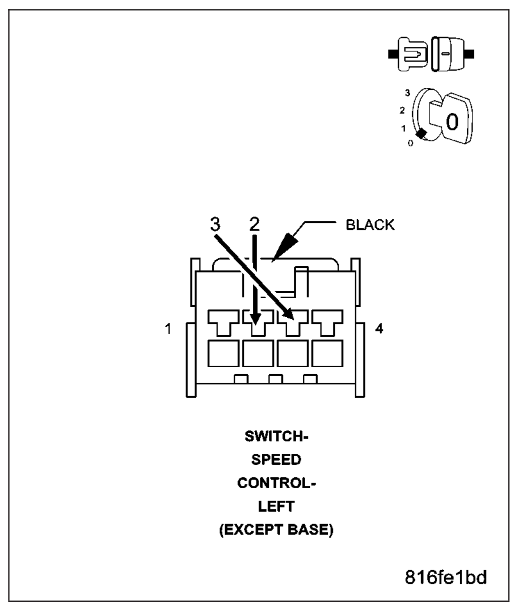
## 3. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect one of the S/C Switch harness connectors.

With the scan tool, read the S/C Switch Voltage.

While monitoring the scan tool, connect a jumper wire between the S/C Switch #2 Signal circuit and the Sensor Ground circuit in the S/C Switch harness connector.




**Does the scan tool display below 0.1 volt with the jumper wire connected?**

**Yes** >> Replace the Speed Control Switches.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. S/C SWITCH #2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

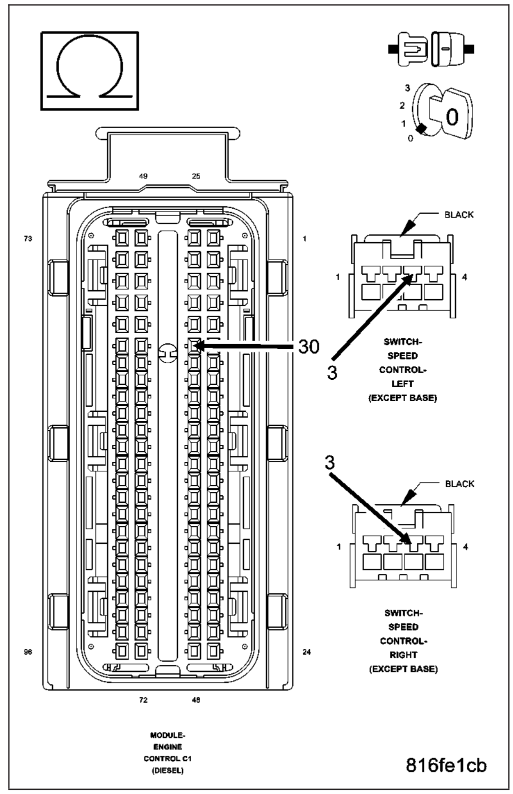
Measure the resistance between the S/C Switch #2 Signal circuit between both S/C Switch harness connectors and the ECM harness connector.

**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the S/C Switch #2 Signal circuit that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 5. S/C SWITCH #2 SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the S/C Switch #2 Signal circuit.

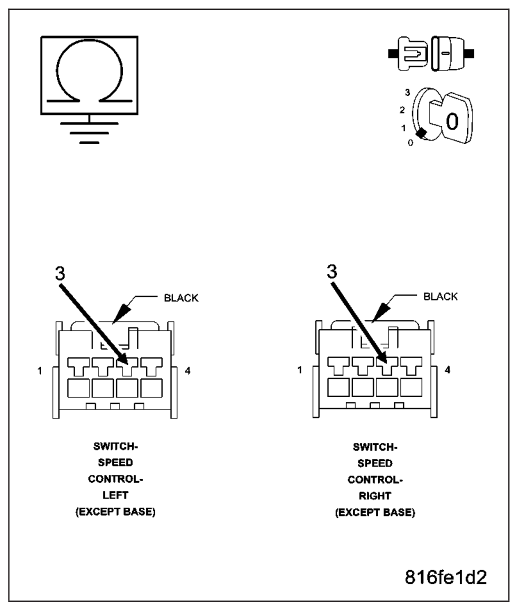
**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the S/C Switch #2 Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 6. S/C SWITCH #2 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

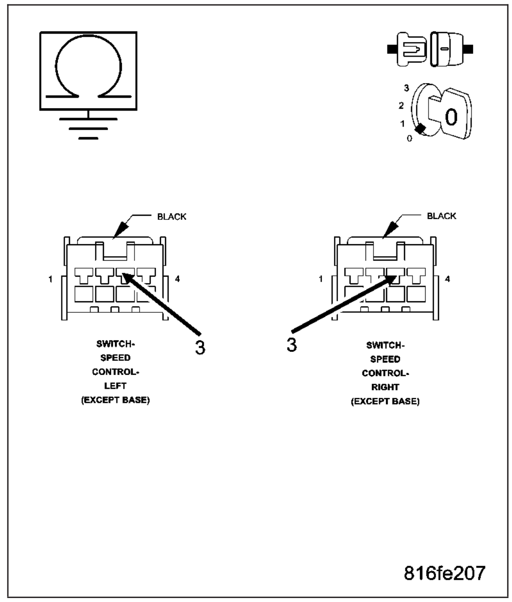
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the S/C Switch #2 Signal circuit.




**Is the voltage above 1.0 volt?**

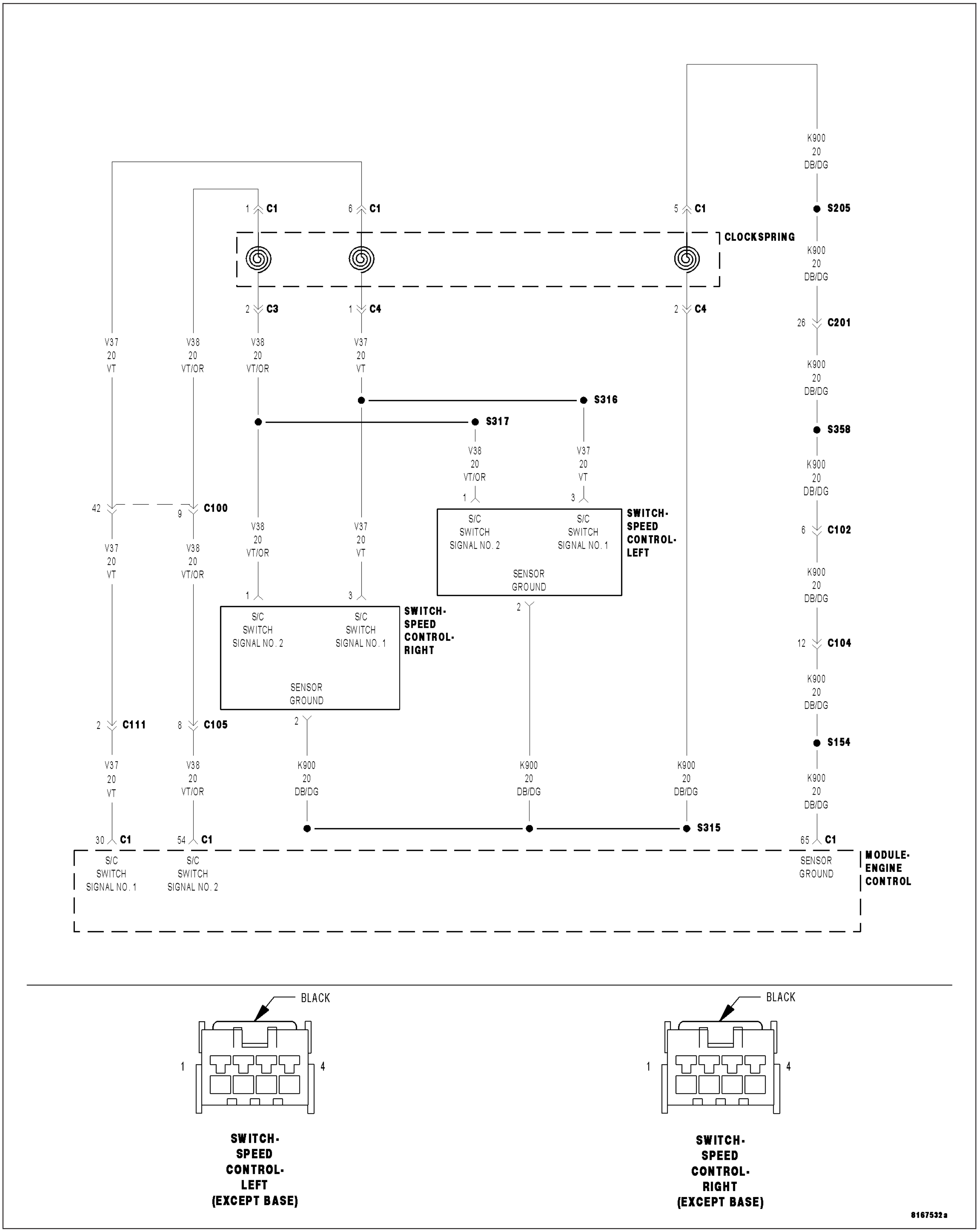
**Yes** >> Repair the S/C Switch #2 Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0589-S/C SWITCH #2 SIGNAL CIRCUIT VOLTAGE TOO HIGH



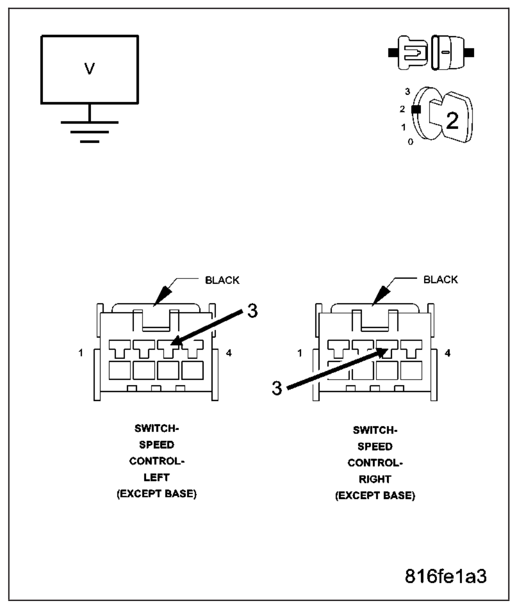

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The S/C Switch #2 Signal is above 4.80 volts for 1.0 second.

| Possible Causes |
|---|
| ECM - S/C SIGNAL CIRCUIT OPEN |
| ECM - S/C SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT SHORT TO GROUND |
| S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND OPEN |
| SPEED CONTROL SWITCHES |

## Diagnostic Test

### 1. VERIFY S/C SWITCH SIGNAL CIRCUIT VOLTAGE




**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition off.

Disconnect the harness connectors from both S/C Switches.

Turn the ignition on.

Measure the voltage of the S/C Switch #2 Signal circuit at both S/C Switch harness connectors.

**Select the appropriate voltage reading.**

**4.5 to 5.5 volts at both connectors.**
Go To 2

**4.5 to 5.5 volts at only one connector.**
Repair the S/C Switch Signal circuit that measured below 4.5 volts for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**Below 4.5 volts at both connectors.**
Go To 4

**Above 5.5 volts for either measurement.**
Go To 6

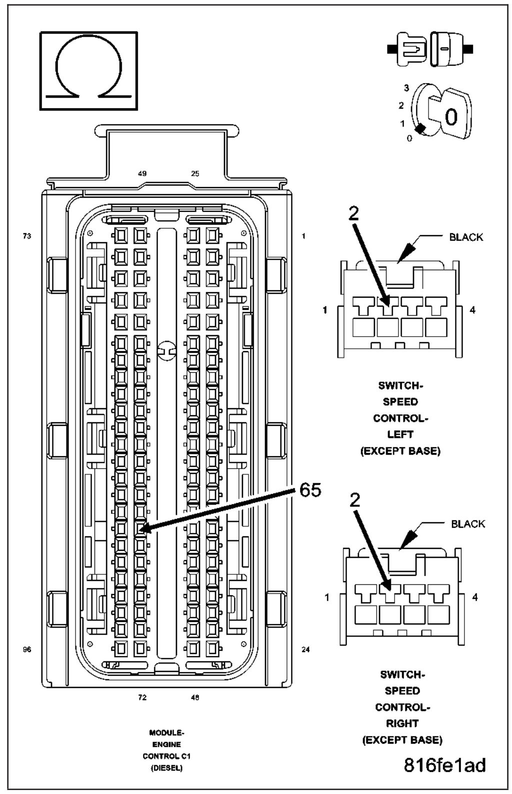
## 2. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between each S/C Switch harness connector and the ECM harness connector.




**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 3

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

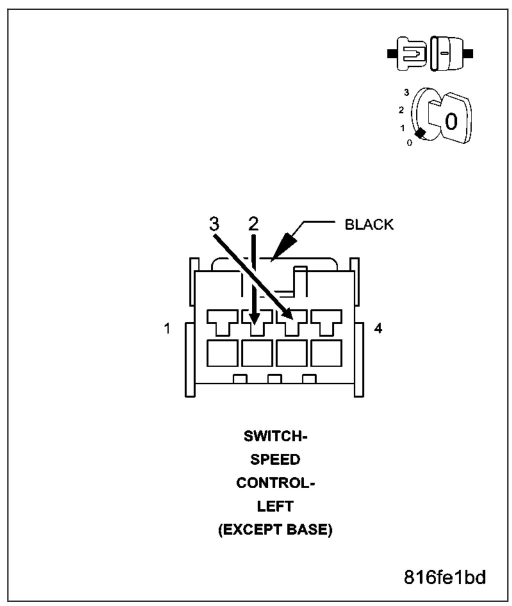
## 3. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect one of the S/C Switch harness connectors.

With the scan tool, read the S/C Switch Voltage.

While monitoring the scan tool, connect a jumper wire between the S/C Switch #2 Signal circuit and the Sensor Ground circuit in the S/C Switch harness connector.




**Does the scan tool display below 0.1 volt with the jumper wire connected?**

**Yes** >> Replace the Speed Control Switches.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. S/C SWITCH #2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

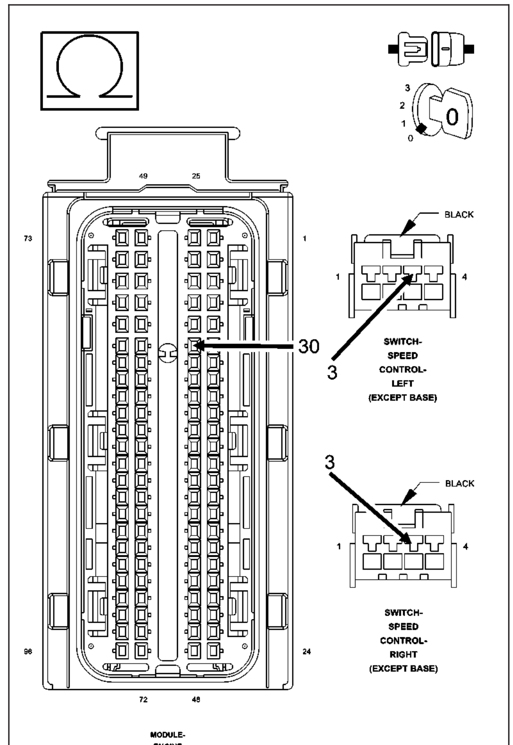
Measure the resistance between the S/C Switch #2 Signal circuit between both S/C Switch harness connectors and the ECM harness connector.

**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the S/C Switch #2 Signal circuit that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



816fe1cb

## 5. S/C SWITCH #2 SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the S/C Switch #2 Signal circuit.

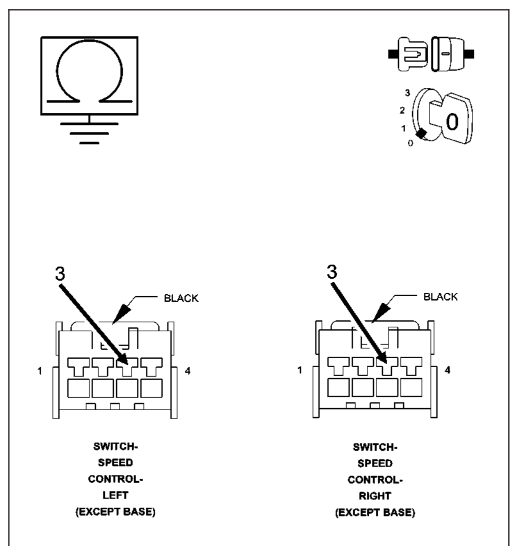
**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

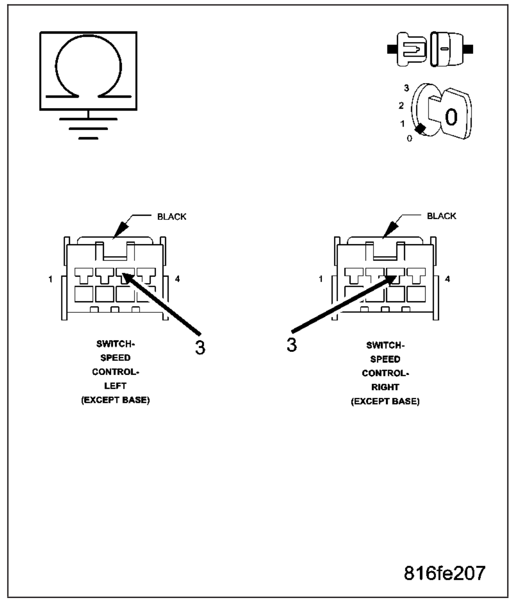
**No** >> Repair the S/C Switch #2 Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



816fe1d2

## 6. S/C SWITCH #2 SIGNAL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the S/C Switch #2 Signal circuit.

**Is the voltage above 1.0 volt?**

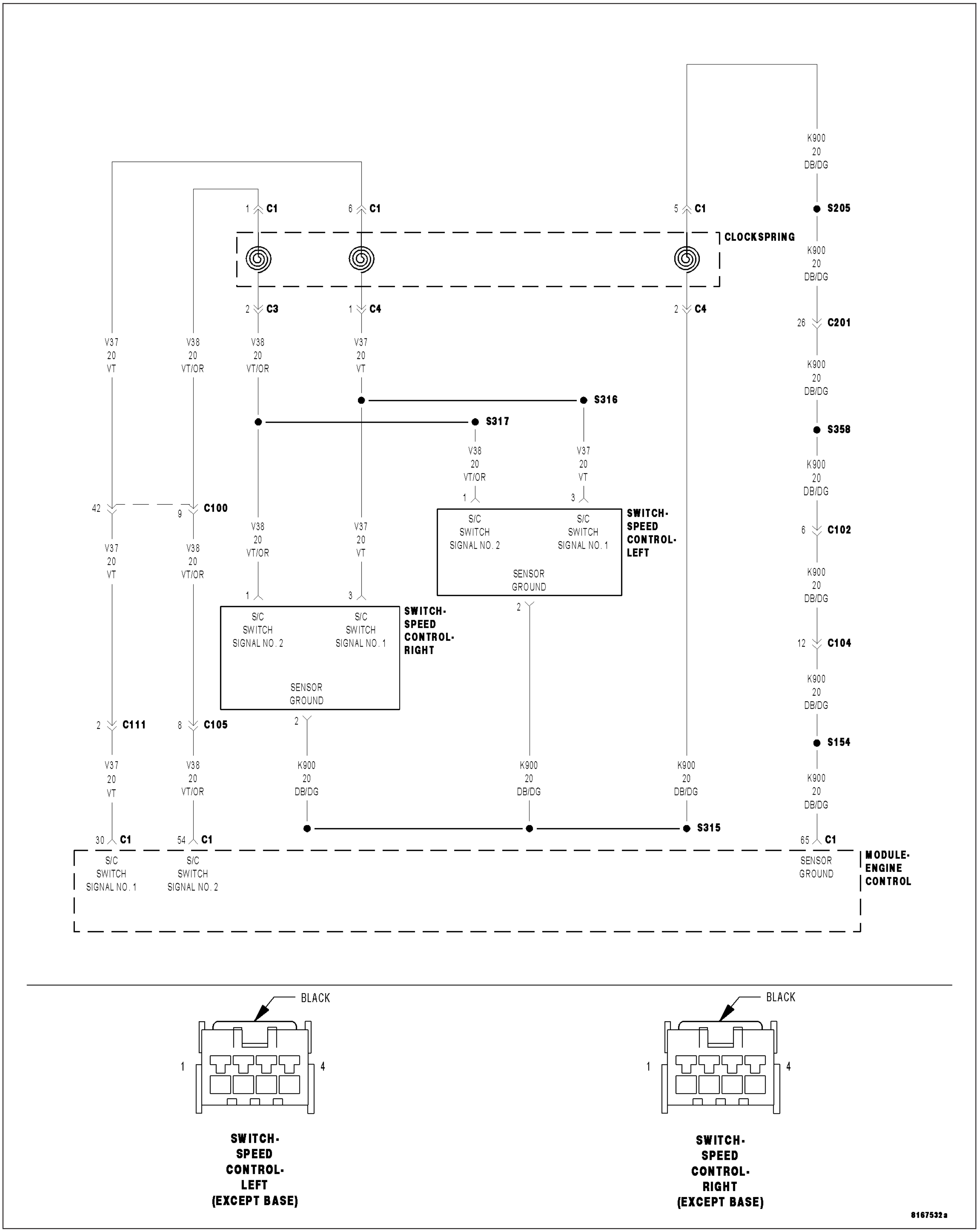
**Yes** >> Repair the S/C Switch #2 Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0589-S/C SWITCH #2 SIGNAL CIRCUIT VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The S/C Switch #2 Signal is below 0.60 volt for 1.0 second.

| Possible Causes |
|---|
| ECM - S/C SIGNAL CIRCUIT OPEN |
| ECM - S/C SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT SHORT TO GROUND |
| S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND OPEN |
| SPEED CONTROL SWITCHES |

## Diagnostic Test

### 1. VERIFY S/C SWITCH SIGNAL CIRCUIT VOLTAGE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the DRB at the same time the DTC is displayed.**

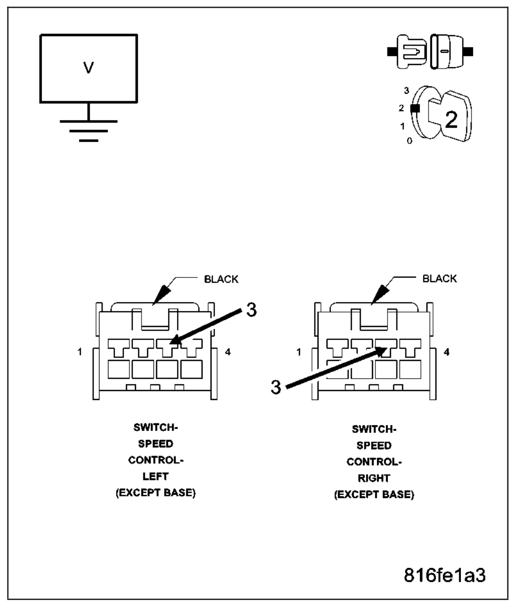
**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition off.

Disconnect the harness connectors from both S/C Switches.

Turn the ignition on.

Measure the voltage of the S/C Switch #2 Signal circuit at both S/C Switch harness connectors.




**Select the appropriate voltage reading.**

**4.5 to 5.5 volts at both connectors.**
Go To 2

**4.5 to 5.5 volts at only one connector.**
Repair the S/C Switch Signal circuit that measured below 4.5 volts for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**Below 4.5 volts at both connectors.**
Go To 4

**Above 5.5 volts for either measurement.**
Go To 6

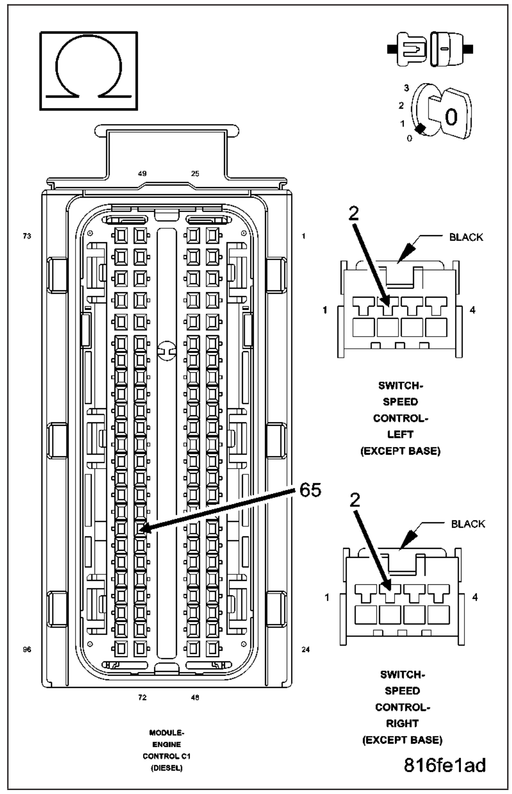
## 2. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between each S/C Switch harness connector and the ECM harness connector.




**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 3

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

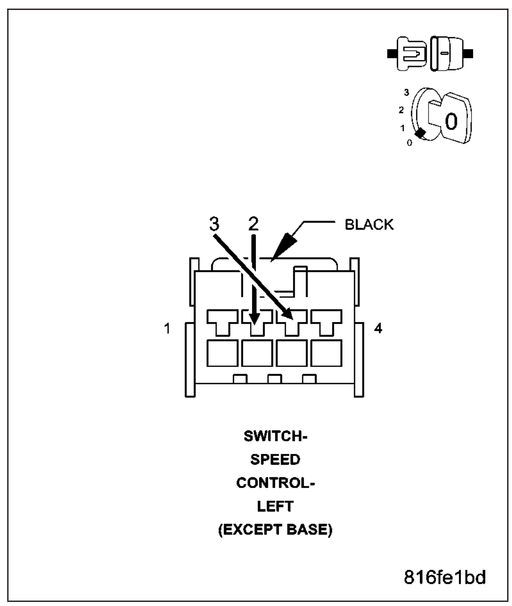
## 3. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect one of the S/C Switch harness connectors.

With the scan tool, read the S/C Switch Voltage.

While monitoring the scan tool, connect a jumper wire between the S/C Switch #2 Signal circuit and the Sensor Ground circuit in the S/C Switch harness connector.




**Does the scan tool display below 0.1 volt with the jumper wire connected?**

**Yes** >> Replace the Speed Control Switches.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

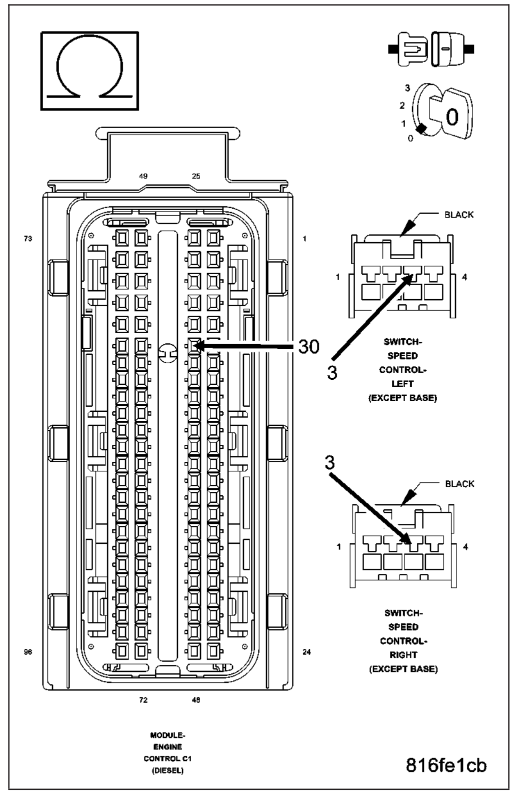
## 4. S/C SWITCH #2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between the S/C Switch #2 Signal circuit between both S/C Switch harness connectors and the ECM harness connector.




**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the S/C Switch #2 Signal circuit that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

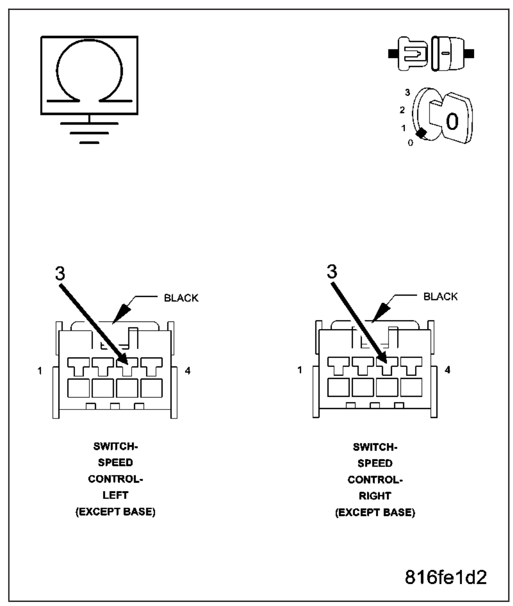
## 5. S/C SWITCH #2 SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the S/C Switch #2 Signal circuit.




**Is the resistance above 1000 ohms?**

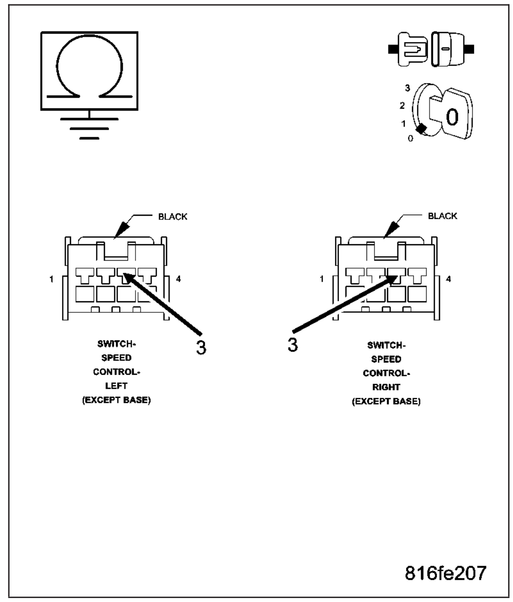
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the S/C Switch #2 Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. S/C SWITCH #2 SIGNAL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the S/C Switch #2 Signal circuit.

**Is the voltage above 1.0 volt?**

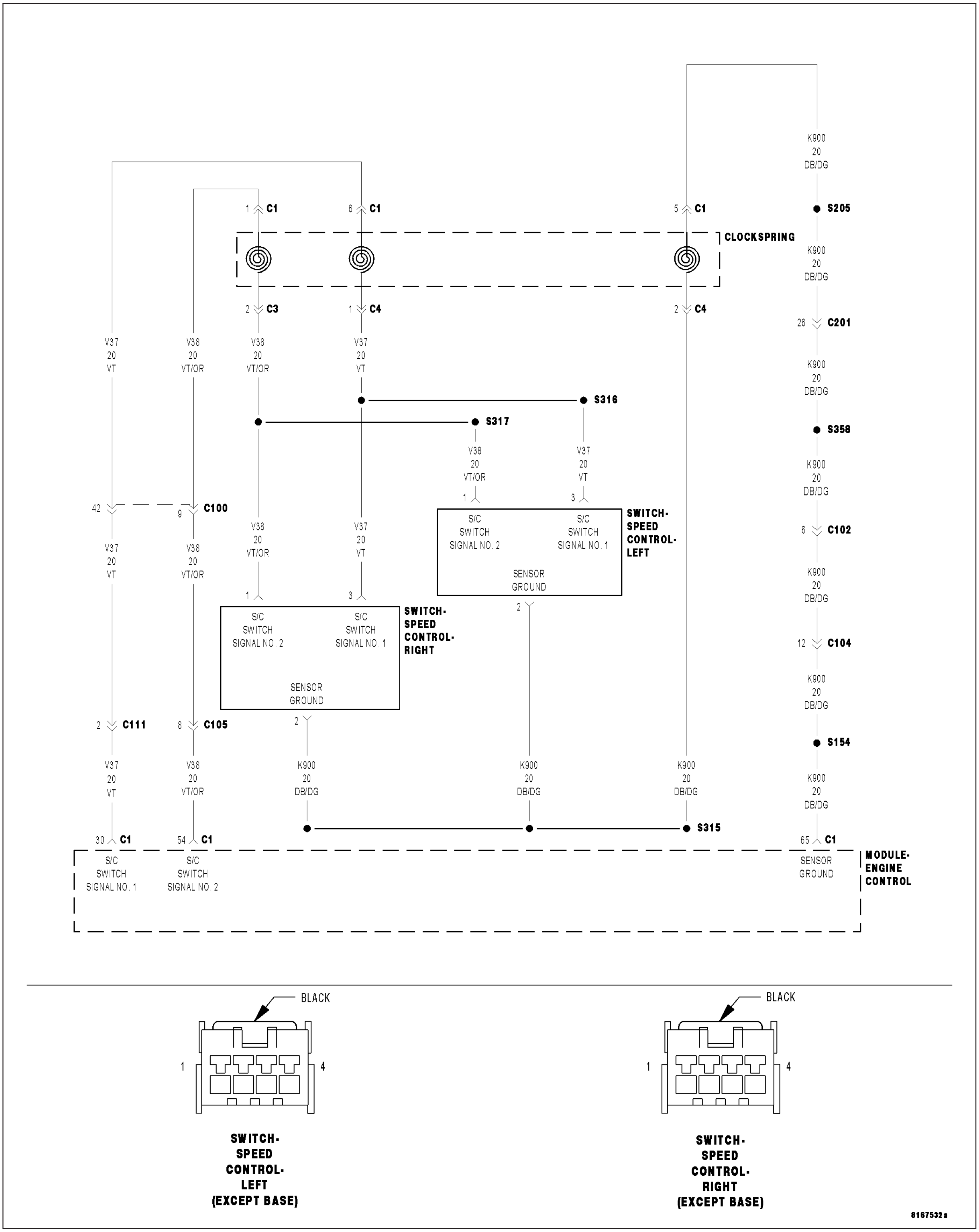
**Yes** >> Repair the S/C Switch #2 Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0589-S/C SWITCH #2 SIGNAL CIRCUIT STUCK SWITCH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The S/C Switch #2 Signal indicates that a switch is pressed for more than 1 minute.

| Possible Causes |
|---|
| ECM - S/C SIGNAL CIRCUIT OPEN |
| ECM - S/C SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT OPEN |
| S/C SWITCH SIGNAL CIRCUIT SHORT TO GROUND |
| S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| SENSOR GROUND OPEN |
| SPEED CONTROL SWITCHES |

## Diagnostic Test

### 1. VERIFY S/C SWITCH SIGNAL CIRCUIT VOLTAGE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

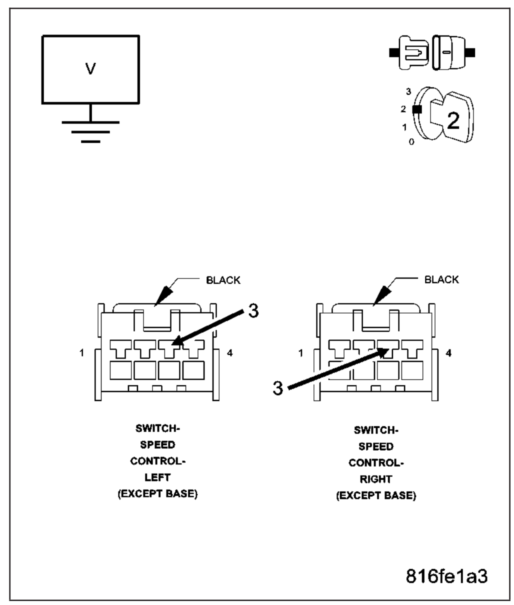
**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition off.

Disconnect the harness connectors from both S/C Switches.

Turn the ignition on.

Measure the voltage of the S/C Switch #2 Signal circuit at both S/C Switch harness connectors.




**Select the appropriate voltage reading.**

**4.5 to 5.5 volts at both connectors.**
Go To 2

**4.5 to 5.5 volts at only one connector.**
Repair the S/C Switch Signal circuit that measured below 4.5 volts for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**Below 4.5 volts at both connectors.**
Go To 4

**Above 5.5 volts for either measurement.**
Go To 6

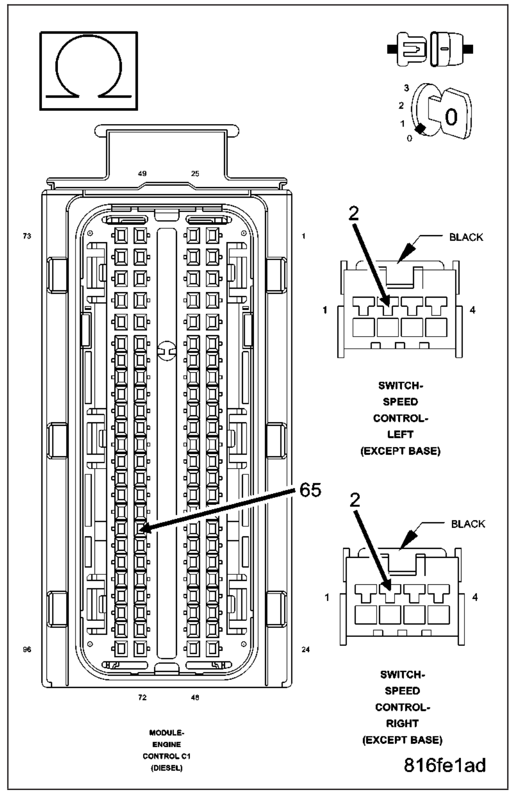
## 2. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between each S/C Switch harness connector and the ECM harness connector.




**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 3

**No** >> Repair the Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

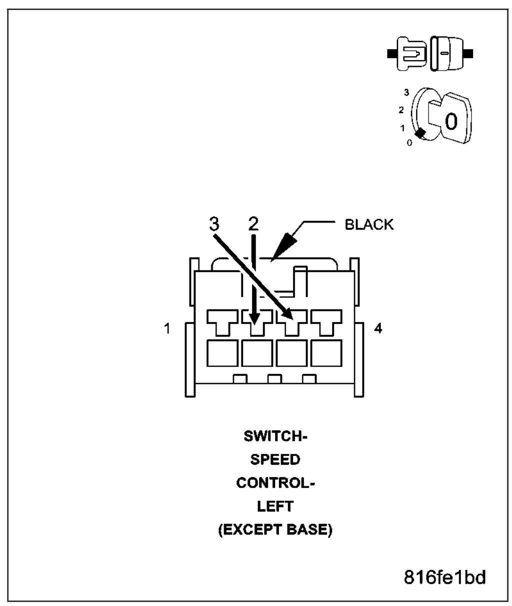
## 3. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect one of the S/C Switch harness connectors.

With the scan tool, read the S/C Switch Voltage.

While monitoring the scan tool, connect a jumper wire between the S/C Switch #2 Signal circuit and the Sensor Ground circuit in the S/C Switch harness connector.




**Does the scan tool display below 0.1 volt with the jumper wire connected?**

**Yes** >> Replace the Speed Control Switches.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. S/C SWITCH #2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

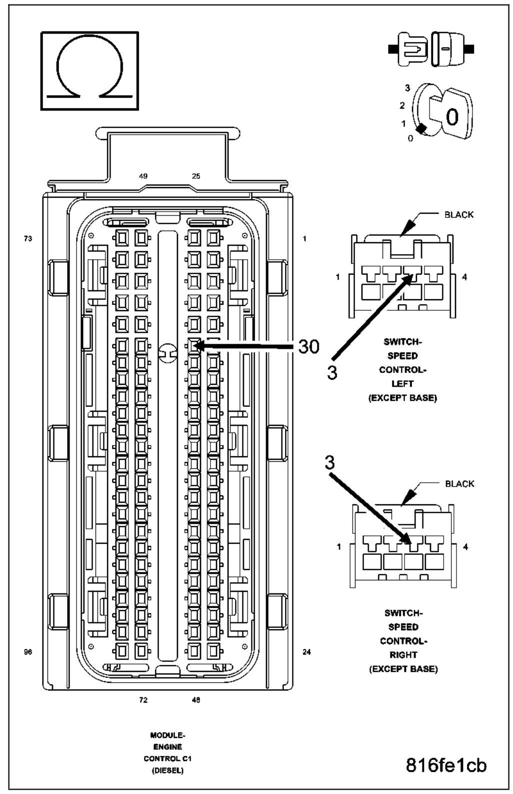
Measure the resistance between the S/C Switch #2 Signal circuit between both S/C Switch harness connectors and the ECM harness connector.

**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the S/C Switch #2 Signal circuit that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 5. S/C SWITCH #2 SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the S/C Switch #2 Signal circuit.

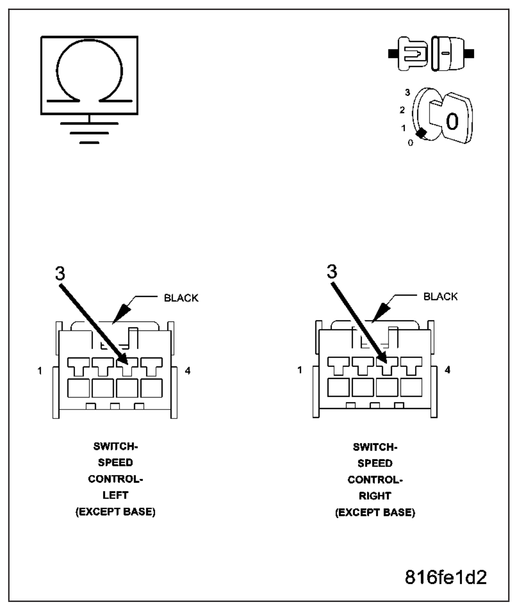
**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

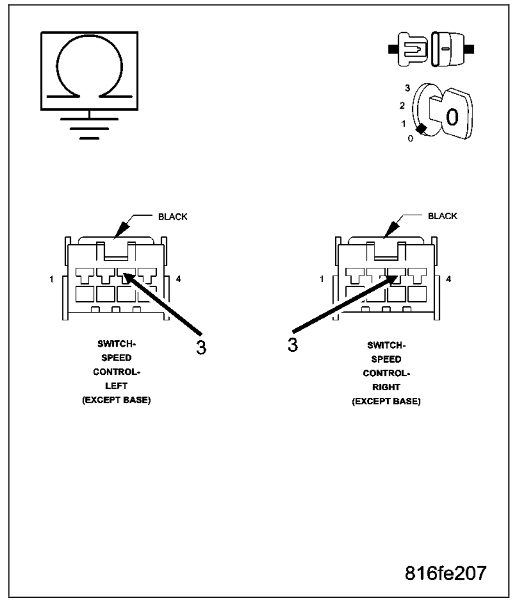
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the S/C Switch #2 Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 6. S/C SWITCH #2 SIGNAL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect both S/C Switch harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the S/C Switch #2 Signal circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the S/C Switch #2 Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0600-ECM COMMUNICATION ERROR

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an internal failure.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. ENGINE CONTROL MODULE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: If there are other DTC's set with this DTC repair other DTC's before continuing with this diagnostic procedure.**

**NOTE: This code can be caused by an intermittent problem in the wiring and connectors to the Engine Control Module. Inspect the Engine Control Module harness connector and associated wiring for signs of poor terminal contact.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## P0602-ECM INVALID CODE WORD

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an internal failure.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. ENGINE CONTROL MODULE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: If there are other DTC's set with this DTC repair other DTC's before continuing with this diagnostic procedure.**

**NOTE: This code can be caused by an intermittent problem in the wiring and connectors to the Engine Control Module. Inspect the Engine Control Module harness connector and associated wiring for signs of poor terminal contact.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## P0606-ECM DEVIATION ERROR

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an internal failure.

| Possible Causes |
| --- |
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. ENGINE CONTROL MODULE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: If there are other DTC's set with this DTC repair other DTC's before continuing with this diagnostic procedure.**

**NOTE: This code can be caused by an intermittent problem in the wiring and connectors to the Engine Control Module. Inspect the Engine Control Module harness connector and associated wiring for signs of poor terminal contact.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle. With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## P0606-ECM CHECKSUM ERROR

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an internal failure.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. ENGINE CONTROL MODULE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: If there are other DTC's set with this DTC repair other DTC's before continuing with this diagnostic procedure.**

**NOTE: This code can be caused by an intermittent problem in the wiring and connectors to the Engine Control Module. Inspect the Engine Control Module harness connector and associated wiring for signs of poor terminal contact.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle. With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## P0606-ECM INTERNAL ERROR

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an internal failure.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. ENGINE CONTROL MODULE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: If there are other DTC's set with this DTC repair other DTC's before continuing with this diagnostic procedure.**

**NOTE: This code can be caused by an intermittent problem in the wiring and connectors to the Engine Control Module. Inspect the Engine Control Module harness connector and associated wiring for signs of poor terminal contact.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## P0610-AUTOMATIC TRANSMISSION CODED AS MANUAL TRANSMISSION

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an automatic transmission when it has been programmed for a manual transmission.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| VERIFY ECM PROGRAMMING |

## Diagnostic Test

### 1. VERIFY ECM PROGRAMMING

Turn the Ignition on.

With the scan tool, erase the ECM DTCs.

With the scan tool, verify that the ECM is properly coded for the options and components that the vehicle is equipped with.

**NOTE: Reprogram the ECM with correct information if necessary.**

Start and idle the engine.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0610-MANUAL TRANSMISSION CODED AS AUTOMATIC TRANSMISSION

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an automatic transmission when it has been programmed for a manual transmission.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| VERIFY ECM PROGRAMMING |

## Diagnostic Test

### 1. VERIFY ECM PROGRAMMING

Turn the Ignition on.

With the scan tool, erase the ECM DTCs.

With the scan tool, verify that the ECM is properly coded for the options and components that the vehicle is equipped with.

**NOTE: Reprogram the ECM with correct information if necessary.**

Start and idle the engine.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0600-ECM COMMUNICATION ERROR

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an internal failure.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |

### Diagnostic Test

#### 1. ENGINE CONTROL MODULE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: If there are other DTC's set with this DTC repair other DTC's before continuing with this diagnostic procedure.**

**NOTE: This code can be caused by an intermittent problem in the wiring and connectors to the Engine Control Module. Inspect the Engine Control Module harness connector and associated wiring for signs of poor terminal contact.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

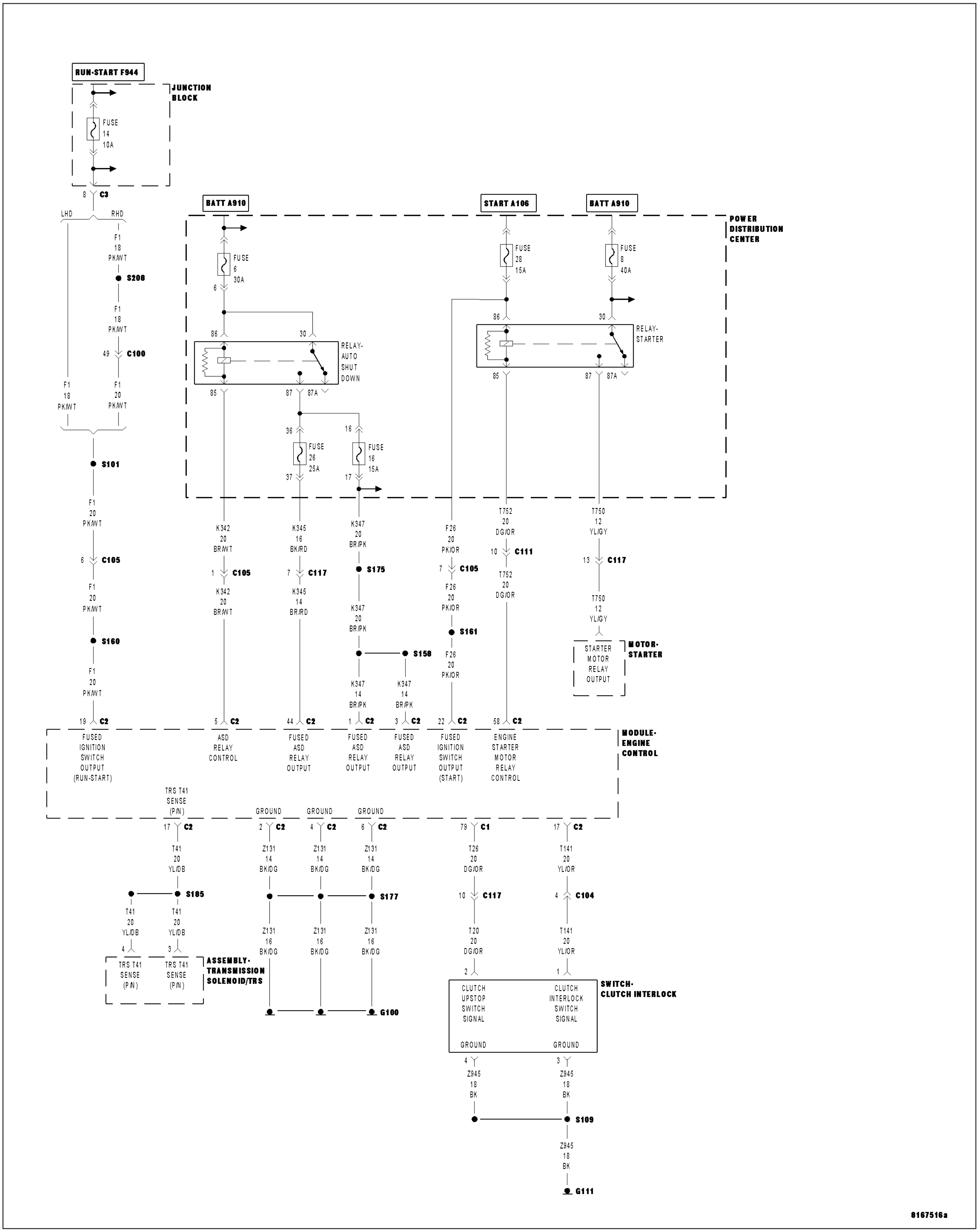
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

# P0615-STARTER RELAY CIRCUIT EXCESSIVE CURRENT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Starter Relay command on.
- **Set Condition:**
  The ECM detects excessive current on the Starter Relay Control circuit for 0.2 seconds.

| Possible Causes |
| --- |
| INTERMITTENT CONDITION |
| STARTER RELAY |
| IGNITION SWITCH START OUTPUT OPEN |
| STARTER RELAY CONTROL CIRCUIT OPEN |
| STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CLEAR CODE AND CHECK IF THE DTC RESETS

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Attempt to start the engine several times, pausing for at least 10 seconds between each attempt.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. STARTER RELAY

Turn the ignition off.

Install a substitute relay in place of the Starter Relay.

Turn the ignition on.

With the scan tool, erase DTCs.

Attempt to start the engine several times, pausing for at least 10 seconds between each attempt.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 3

**No** >> Replace the Starter Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. IGNITION SWITCH START OUTPUT CIRCUIT OPEN

Turn the ignition off.

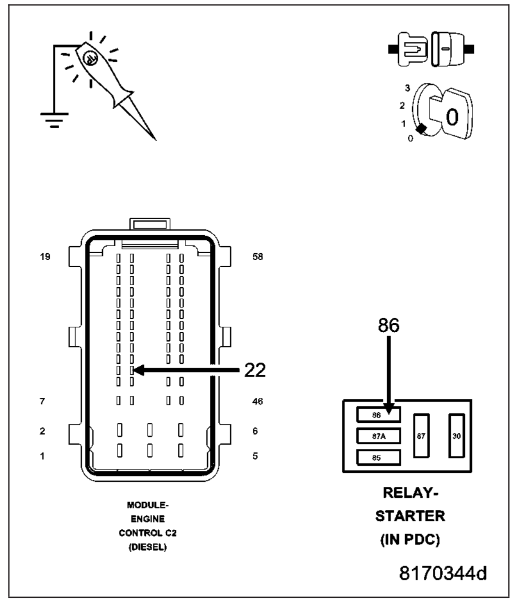
Remove the Starter Relay from the PDC.

Disconnect the ECM harness connectors.

Turn the Ignition Switch to the Start position.

Using a 12-volt test light connected to ground, check the Ignition Switch Start Output circuit at the Starter Relay connector in the PDC.

Using a 12-volt test light connected to ground, check the Ignition Switch Start Output circuit at the ECM C2 harness connector cavity 22.




**Does the test light illuminate brightly for both circuit checks?**

**Yes** >> Go To 4

**No** >> Repair the Ignition Switch Start Output circuit for an open. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

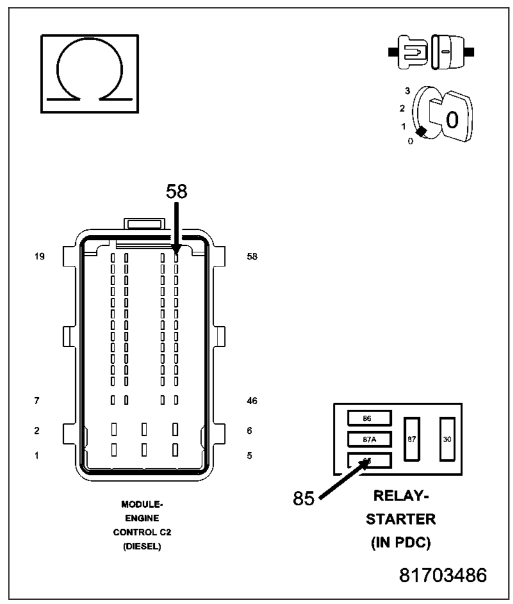
## 4. STARTER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the Starter Relay from the PDC.

Disconnect the ECM harness connectors.

Measure the resistance of the Starter Relay Control circuit between the ECM harness connector and the PDC connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Starter Relay Control circuit for an open. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the Starter Relay from the PDC.

Disconnect the ECM harness connectors.

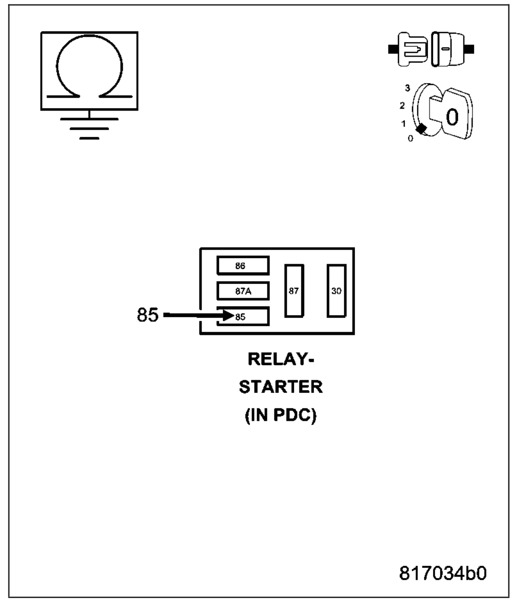
Measure the resistance between ground and the Starter Relay Control circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Starter Relay Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 6. STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Remove the Starter Relay.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Starter Relay Control circuit.

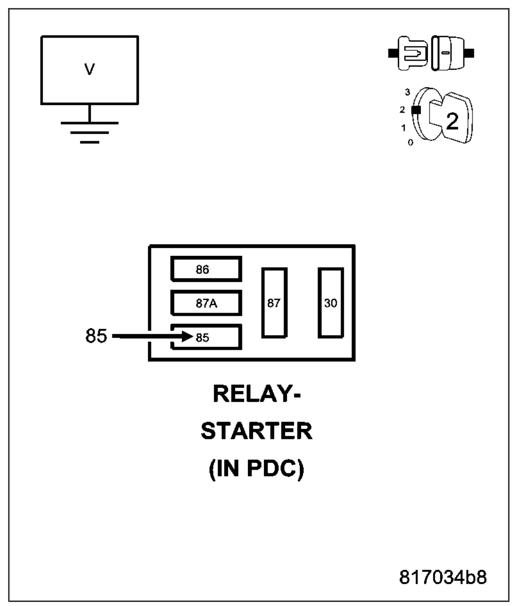
**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

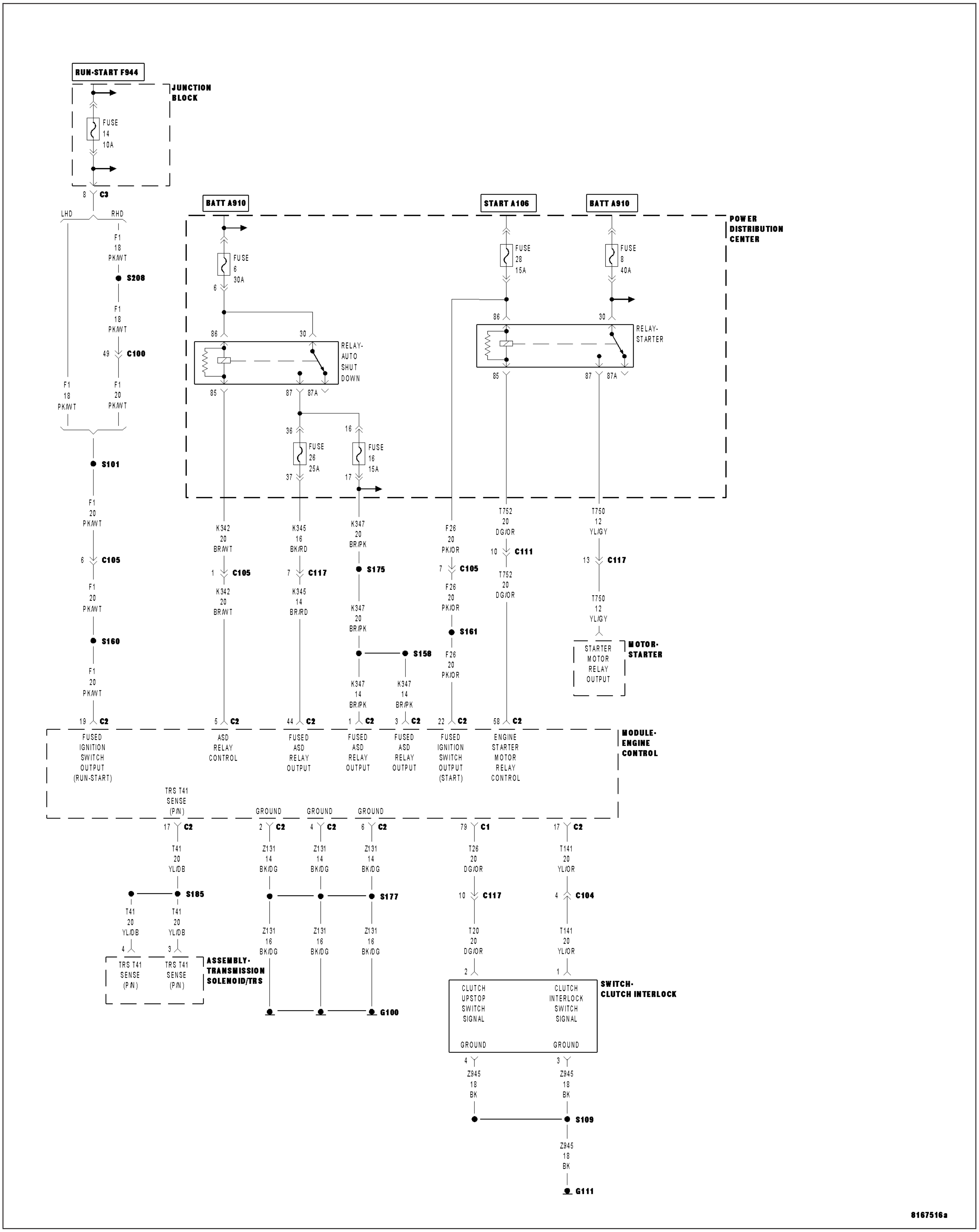
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Starter Relay Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



# P0615-STARTER RELAY CIRCUIT OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Starter Relay command off.
- **Set Condition:**
  The ECM does not detect voltage on the Starter Relay Control circuit for 0.2 second.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| STARTER RELAY |
| IGNITION SWITCH START OUTPUT OPEN |
| STARTER RELAY CONTROL CIRCUIT OPEN |
| STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CLEAR CODE AND CHECK IF THE DTC RESETS

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Attempt to start the engine several times, pausing for at least 10 seconds between each attempt.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 2. STARTER RELAY

Turn the ignition off.

Install a substitute relay in place of the Starter Relay.

Turn the ignition on.

With the scan tool, erase DTCs.

Attempt to start the engine several times, pausing for at least 10 seconds between each attempt.

Turn the ignition on.

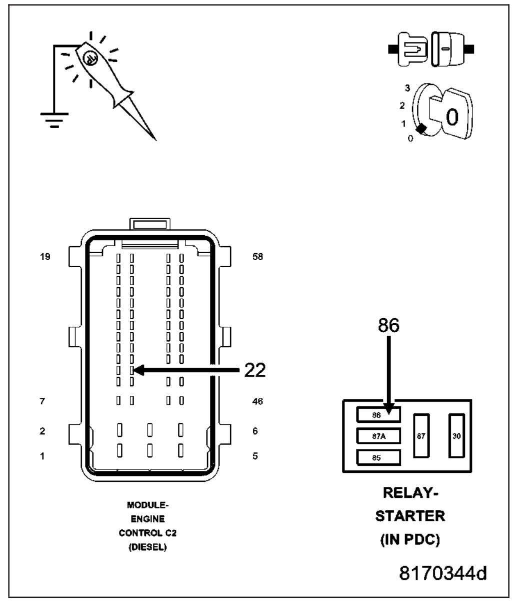
With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 3

**No** >> Replace the Starter Relay.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 3. IGNITION SWITCH START OUTPUT CIRCUIT OPEN

Turn the ignition off.

Remove the Starter Relay from the PDC.

Disconnect the ECM harness connectors.

Turn the Ignition Switch to the Start position.

Using a 12-volt test light connected to ground, check the Ignition Switch Start Output circuit at the Starter Relay connector in the PDC.

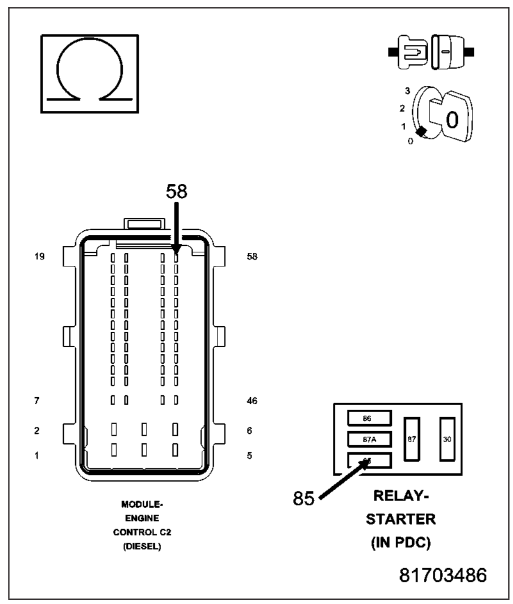
Using a 12-volt test light connected to ground, check the Ignition Switch Start Output circuit at the ECM C2 harness connector cavity 22.

**Does the test light illuminate brightly for both circuit checks?**

**Yes** >> Go To 4

**No** >> Repair the Ignition Switch Start Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



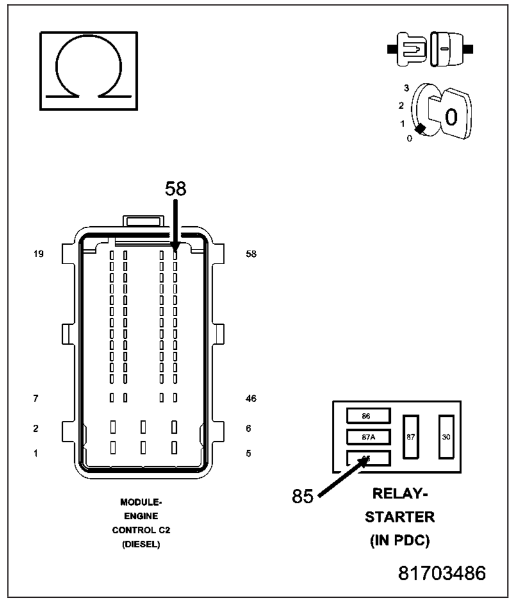
## 4. STARTER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the Starter Relay from the PDC.

Disconnect the ECM harness connectors.

Measure the resistance of the Starter Relay Control circuit between the ECM harness connector and the PDC connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Starter Relay Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

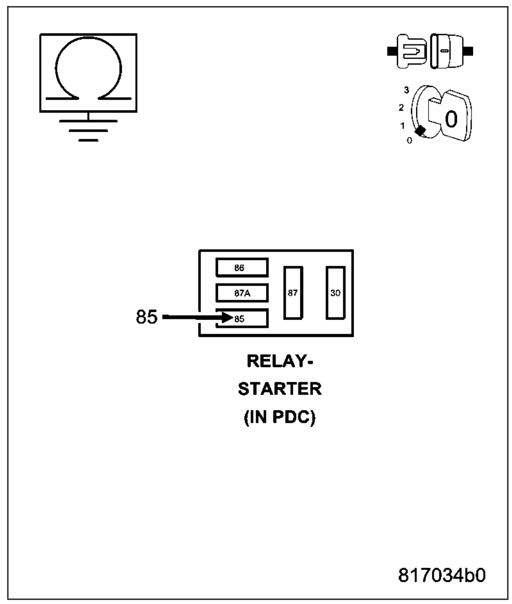
## 5. STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the Starter Relay from the PDC.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Starter Relay Control circuit.



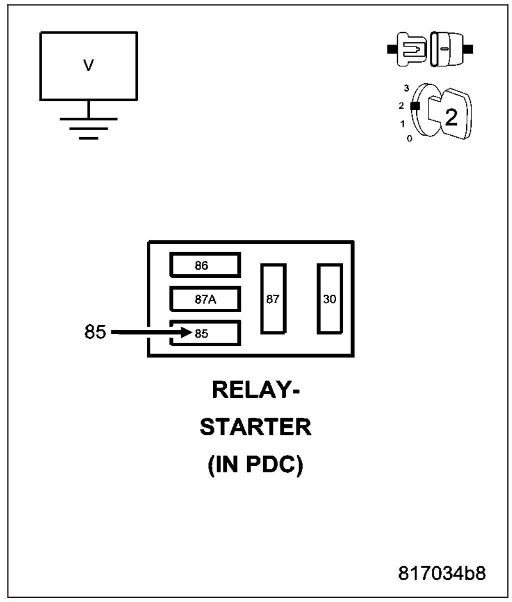

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Starter Relay Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Remove the Starter Relay.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Starter Relay Control circuit.

**Is the voltage below 1.0 volt?**

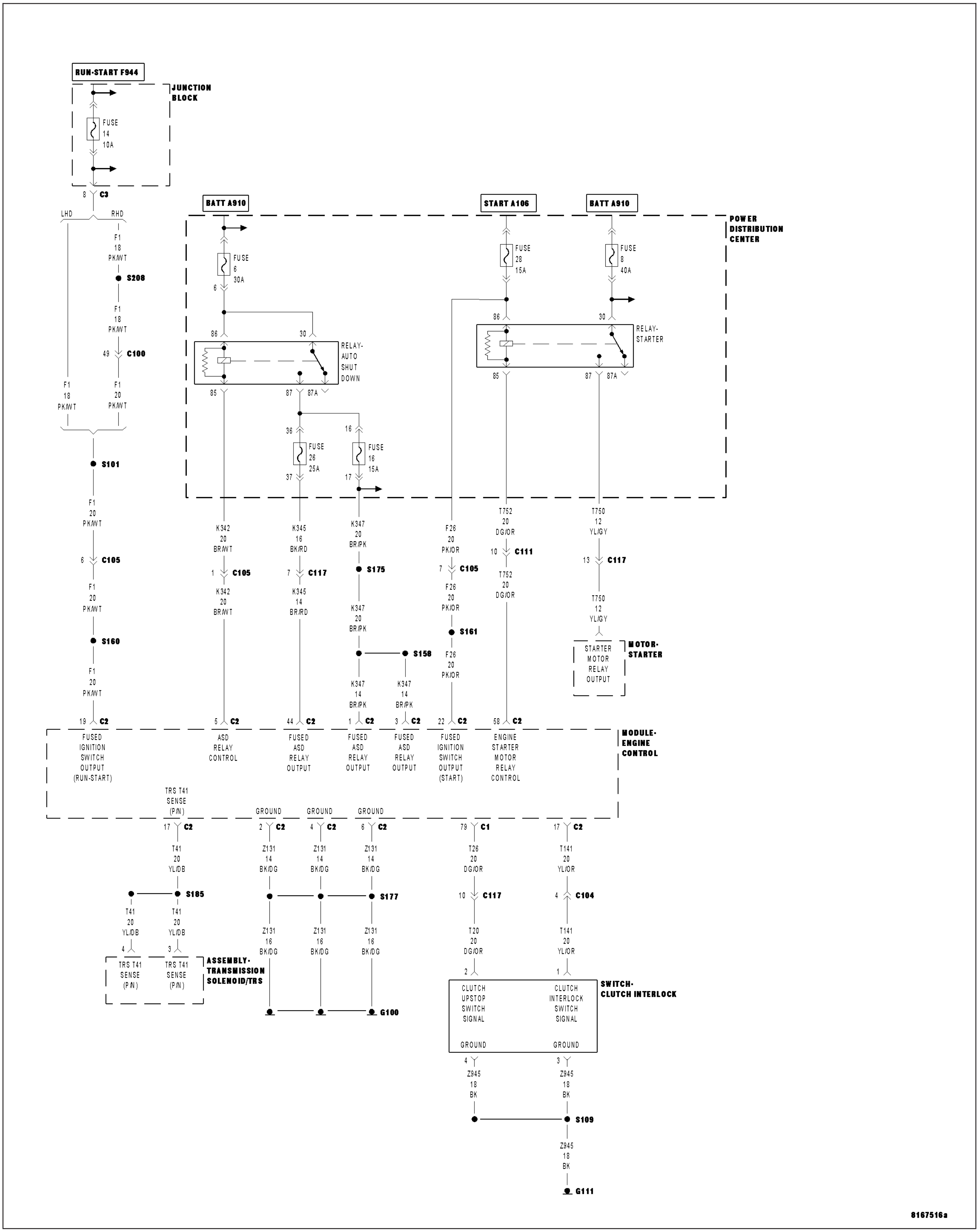
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Starter Relay Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0616-STARTER RELAY CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Starter Relay command off.
- **Set Condition:**
  The ECM detects a short to ground on the Starter Relay Control circuit for 0.05 seconds.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| STARTER RELAY |
| IGNITION SWITCH START OUTPUT OPEN |
| STARTER RELAY CONTROL CIRCUIT OPEN |
| STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CLEAR CODE AND CHECK IF THE DTC RESETS

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Attempt to start the engine several times, pausing for at least 10 seconds between each attempt.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. STARTER RELAY

Turn the ignition off.

Install a substitute relay in place of the Starter Relay.

Turn the ignition on.

With the scan tool, erase DTCs.

Attempt to start the engine several times, pausing for at least 10 seconds between each attempt.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 3

**No** >> Replace the Starter Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. IGNITION SWITCH START OUTPUT CIRCUIT OPEN

Turn the ignition off.

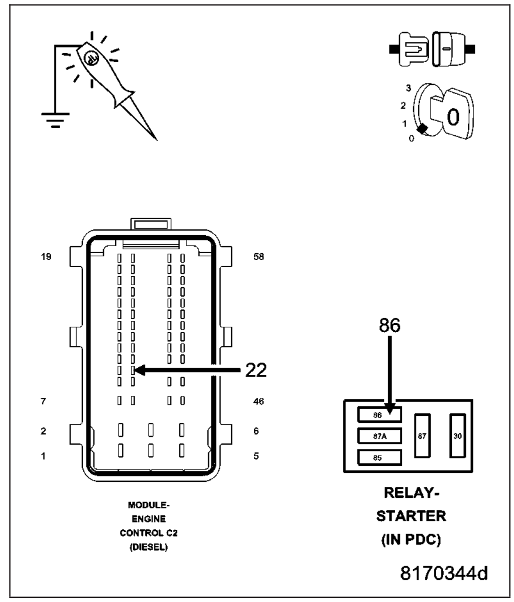
Remove the Starter Relay from the PDC.

Disconnect the ECM harness connectors.

Turn the Ignition Switch to the Start position.

Using a 12-volt test light connected to ground, check the Ignition Switch Start Output circuit at the Starter Relay connector in the PDC.

Using a 12-volt test light connected to ground, check the Ignition Switch Start Output circuit at the ECM C2 harness connector cavity 22.




**Does the test light illuminate brightly for both circuit checks?**

**Yes** >> Go To 4

**No** >> Repair the Ignition Switch Start Output circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

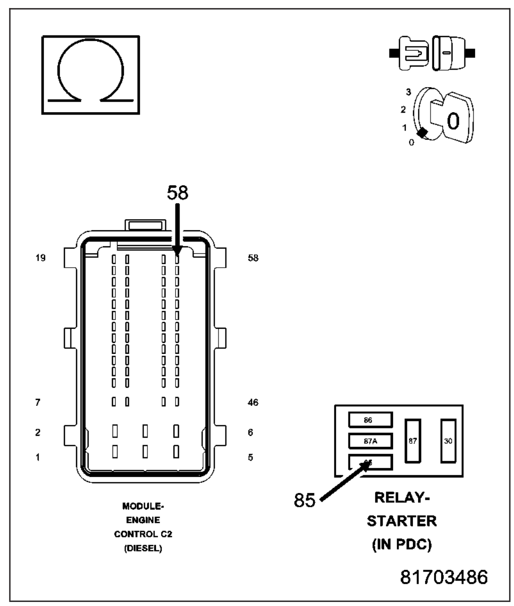
## 4. STARTER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the Starter Relay from the PDC.

Disconnect the ECM harness connectors.

Measure the resistance of the Starter Relay Control circuit between the ECM harness connector and the PDC connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Starter Relay Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the Starter Relay from the PDC.

Disconnect the ECM harness connectors.

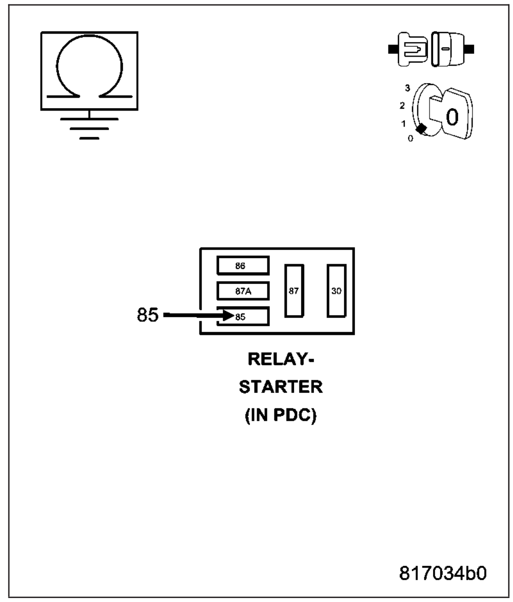
Measure the resistance between ground and the Starter Relay Control circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Starter Relay Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 6. STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Remove the Starter Relay.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Starter Relay Control circuit.

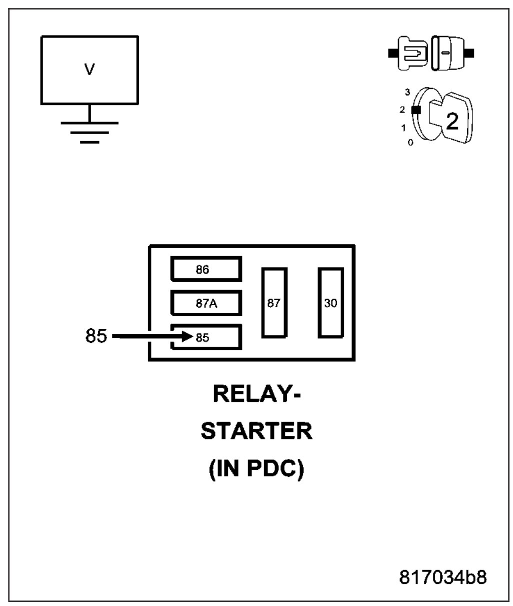
**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

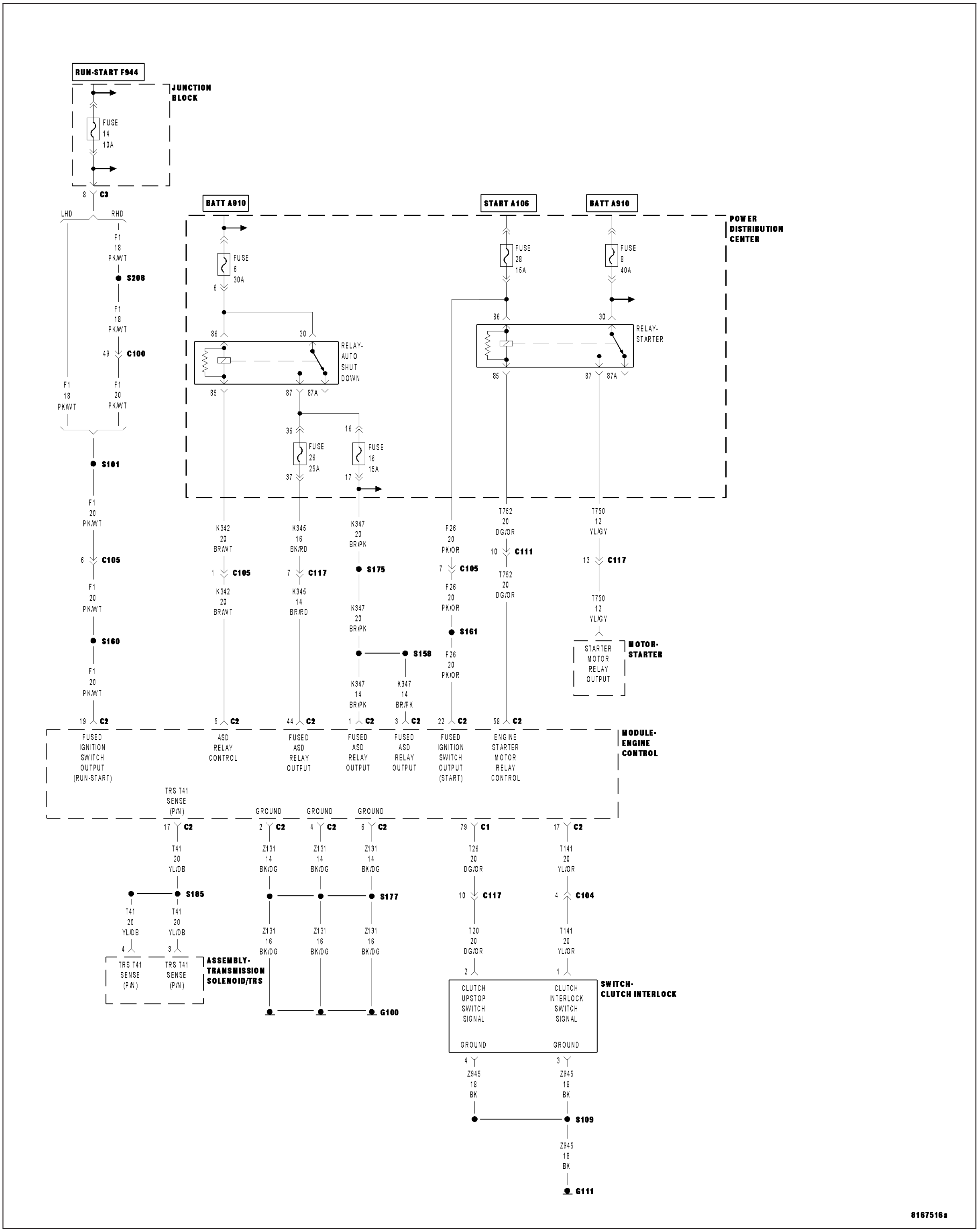
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Starter Relay Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## P0617-STARTER RELAY CIRCUIT SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Starter Relay command on.
- **Set Condition:**
  The ECM detects excessive current on the Starter Relay Control circuit for 0.2 second.

| Possible Causes |
| --- |
| INTERMITTENT CONDITION |
| STARTER RELAY |
| IGNITION SWITCH START OUTPUT OPEN |
| STARTER RELAY CONTROL CIRCUIT OPEN |
| STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CLEAR CODE AND CHECK IF THE DTC RESETS

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Attempt to start the engine several times, pausing for at least 10 seconds between each attempt.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. STARTER RELAY

Turn the ignition off.

Install a substitute relay in place of the Starter Relay.

Turn the ignition on.

With the scan tool, erase DTCs.

Attempt to start the engine several times, pausing for at least 10 seconds between each attempt.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 3

**No** >> Replace the Starter Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. IGNITION SWITCH START OUTPUT CIRCUIT OPEN

Turn the ignition off.

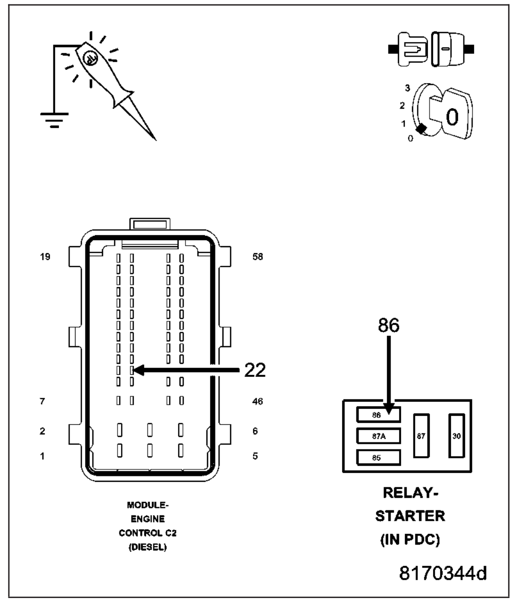
Remove the Starter Relay from the PDC.

Disconnect the ECM harness connectors.

Turn the Ignition Switch to the Start position.

Using a 12-volt test light connected to ground, check the Ignition Switch Start Output circuit at the Starter Relay connector in the PDC.

Using a 12-volt test light connected to ground, check the Ignition Switch Start Output circuit at the ECM C2 harness connector cavity 22.




**Does the test light illuminate brightly for both circuit checks?**

**Yes** >> Go To 4

**No** >> Repair the Ignition Switch Start Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

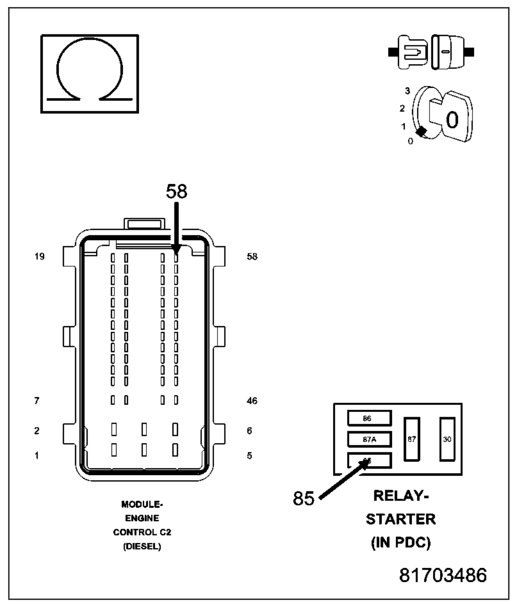
## 4. STARTER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the Starter Relay from the PDC.

Disconnect the ECM harness connectors.

Measure the resistance of the Starter Relay Control circuit between the ECM harness connector and the PDC connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Starter Relay Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

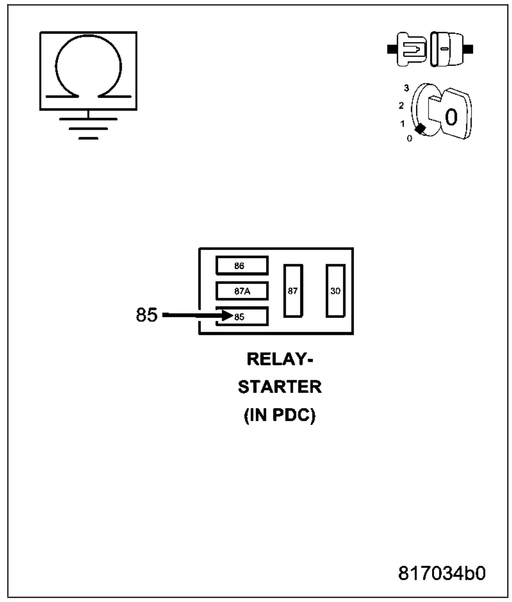
## 5. STARTER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the Starter Relay from the PDC.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Starter Relay Control circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Starter Relay Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. STARTER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Remove the Starter Relay.

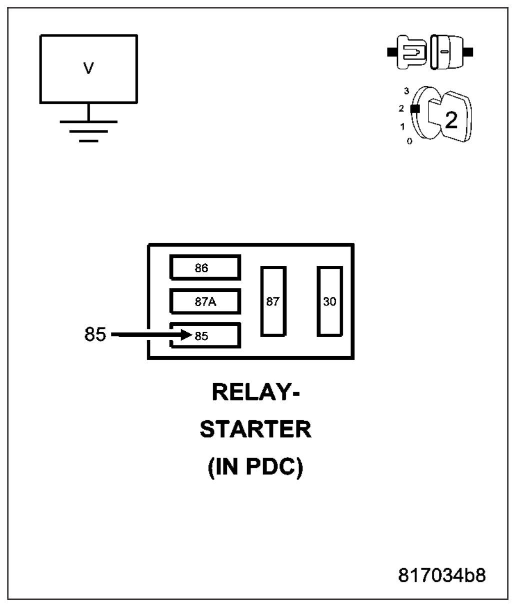
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Starter Relay Control circuit.




**Is the voltage below 1.0 volt?**

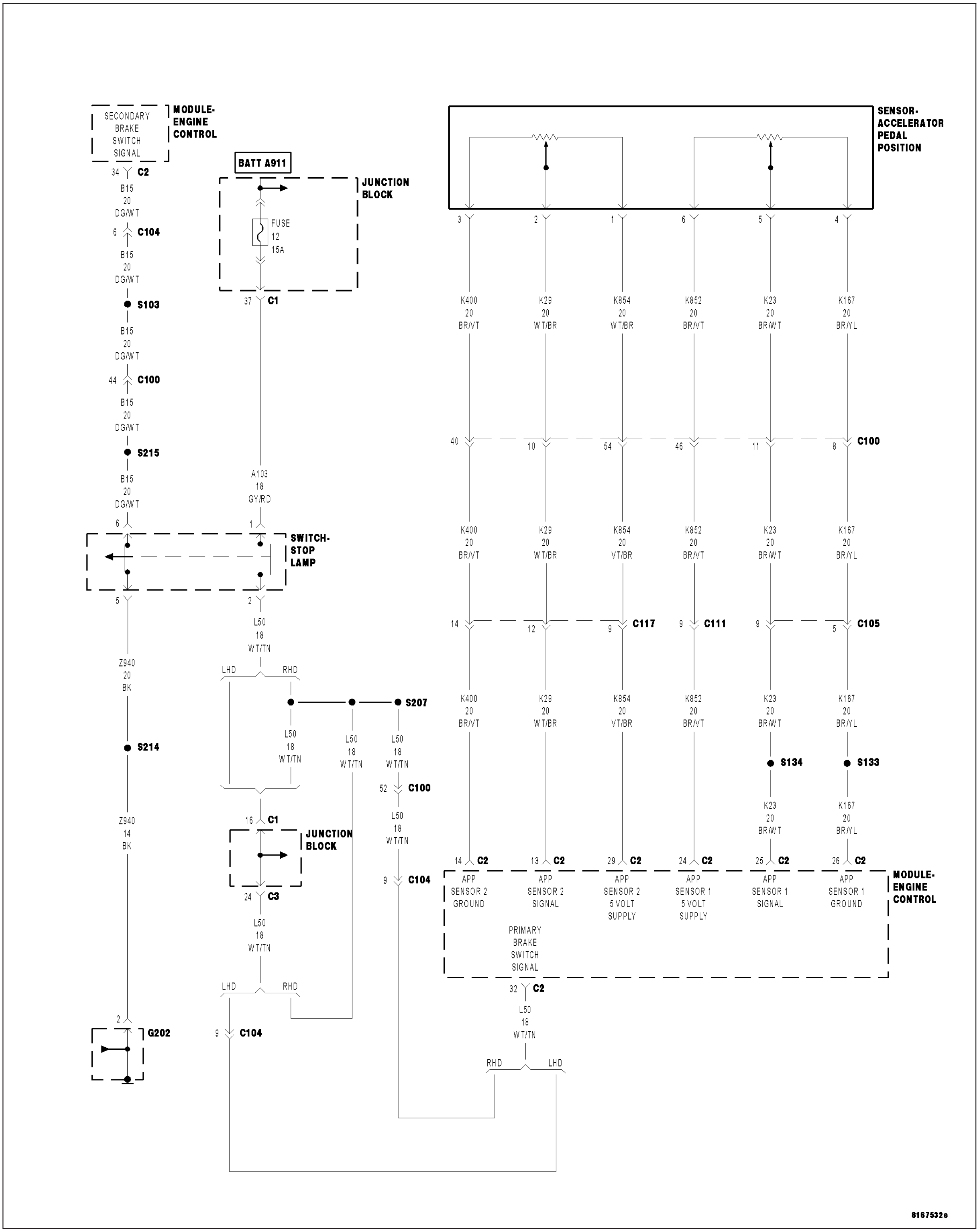
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Starter Relay Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0641-SENSOR SUPPLY 1 VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects a short to voltage for 0.1 second on the Sensor Supply #1 circuit which supplies 5-volts to the CMP Sensor and the APP Sensor #1.

| Possible Causes |
|---|
| WIRING INSPECTION |
| APP SENSOR #1 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| CMP SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off for 10 seconds.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> Go To 4

### 2. APP #1 SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Accelerator Pedal Position Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage on the Accelerator Pedal Position Sensor #1 5-Volt Supply circuit.

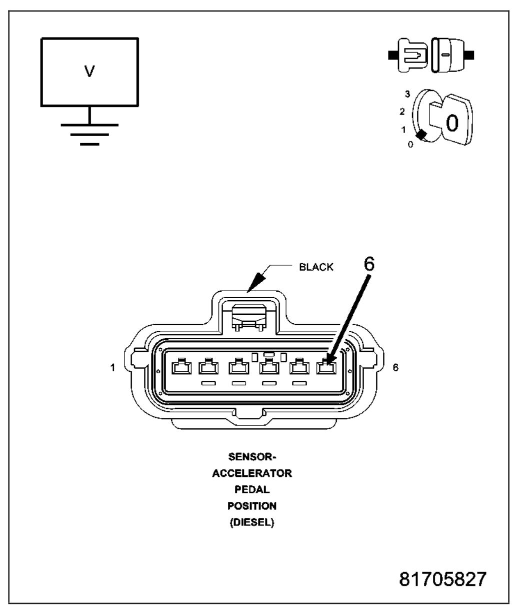
**NOTE: Remove the jumper wire and reinstall the ASD Relay.**

**Is the voltage below 1.0 volt?**

**Yes** >> Go To 3

**No** >> Repair the APP #1 5-Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 3. CMP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Camshaft Position Sensor harness connector.

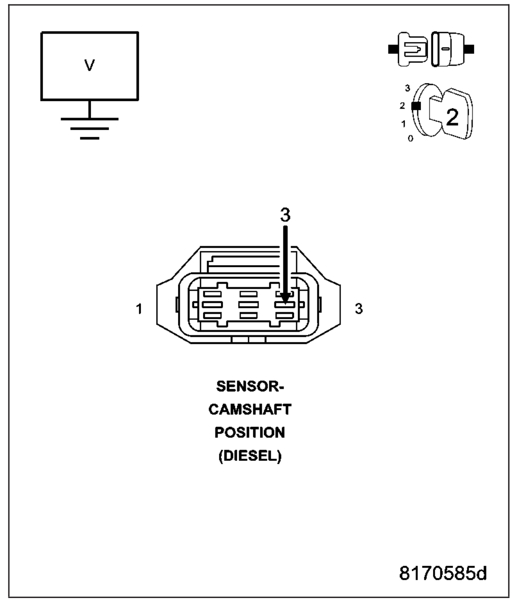
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage on the Camshaft Position Sensor 5-Volt Supply circuit.




**NOTE: Remove the jumper wire and reinstall the ASD Relay.**

**Is the voltage below 1.0 volt?**

**Yes** >> Go To 4

**No** >> Repair the CMP Sensor 5-Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. WIRING INSPECTION

Turn the ignition off.

Inspect the CMP Sensor 5-Volt supply circuit between the CMP harness connector and the ECM harness connector for possible shorts to other circuits.

Inspect the APP Sensor #1 5-Volt supply circuit between the APP Sensor harness connector and the ECM harness connector for possible shorts to other circuits.

**Were any problems found?**

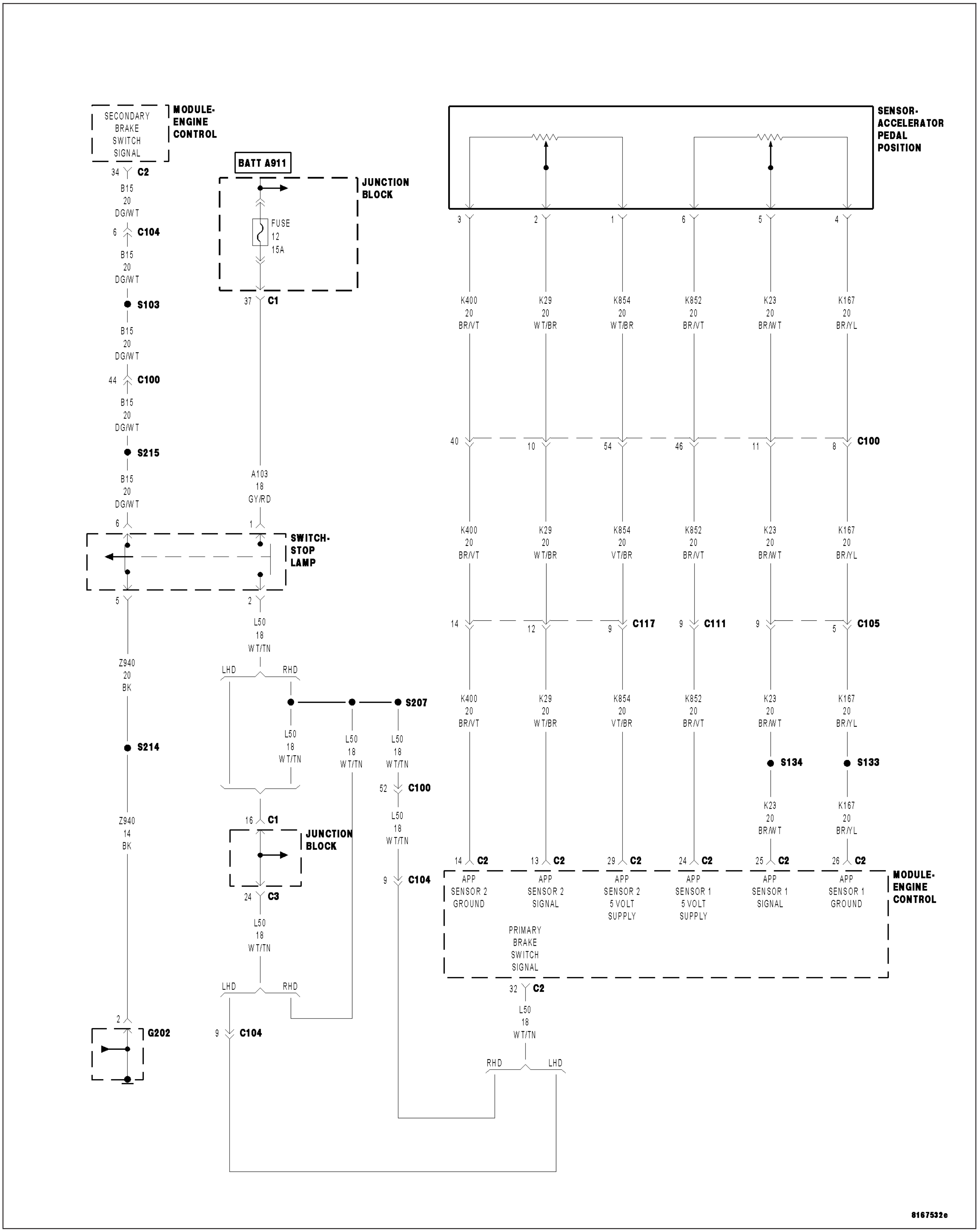
**Yes** >> Repair shorted circuit as necessary.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0641-SENSOR SUPPLY 1 VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects low voltage on the Sensor Supply #1 circuit which supplies 5-volts to the CMP Sensor and the APP Sensor #1.

| Possible Causes |
|---|
| WIRING INSPECTION |
| INTERMITTENT CONDITION |
| 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| ACCELERATOR PEDAL POSITION SENSOR |
| CAMSHAFT POSITION SENSOR |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CAMSHAFT POSITION SENSOR SHORTED TO GROUND

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

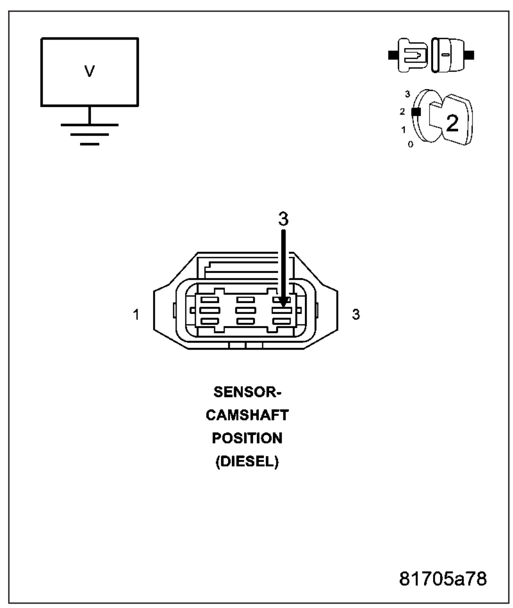
Turn the ignition on.

Measure the voltage of the CMP Sensor 5-Volt Supply circuit.

**Is the voltage above 4.6 volts?**

**Yes** >> Replace the Camshaft Position Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3



## 3. ACCELERATOR PEDAL POSITION SENSOR SHORTED TO GROUND

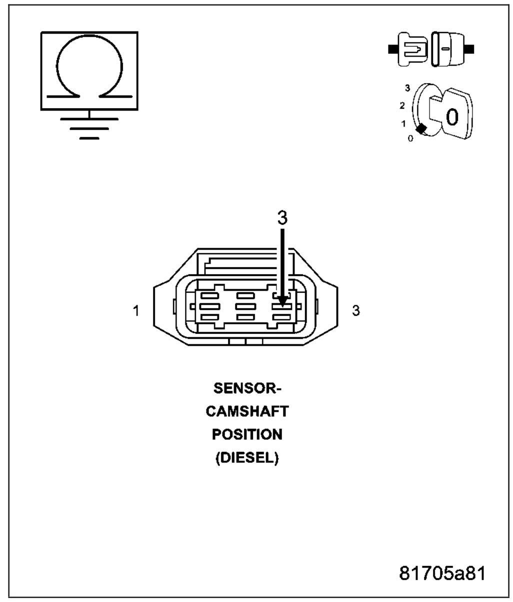
Ensure all connectors are reconnected.

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Turn the ignition on.

Measure the voltage of the APP Sensor #1 5-Volt Supply circuit.




**Is the voltage above 4.6 volts?**

**Yes** >> Replace the Accelerator Pedal Position Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

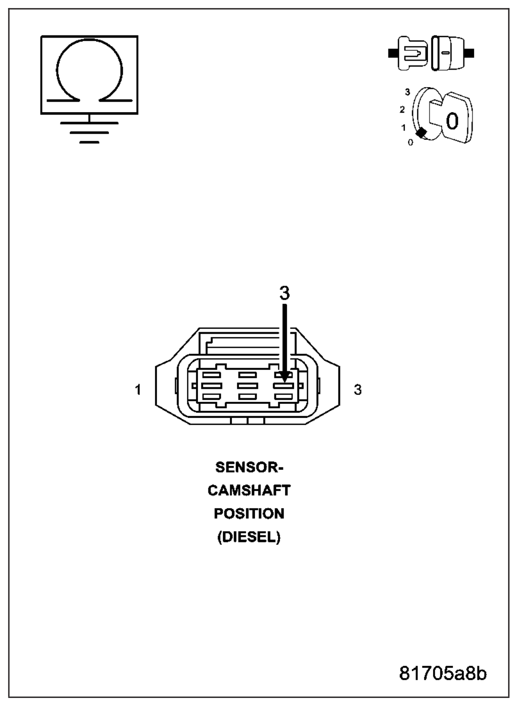
Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the CMP Sensor 5-Volt Supply circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the 5-Volt Supply circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. WIRING INSPECTION

Turn the ignition off.

Inspect the CMP Sensor 5-Volt supply circuit between the CMP harness connector and the ECM harness connector for possible shorts to other circuits.

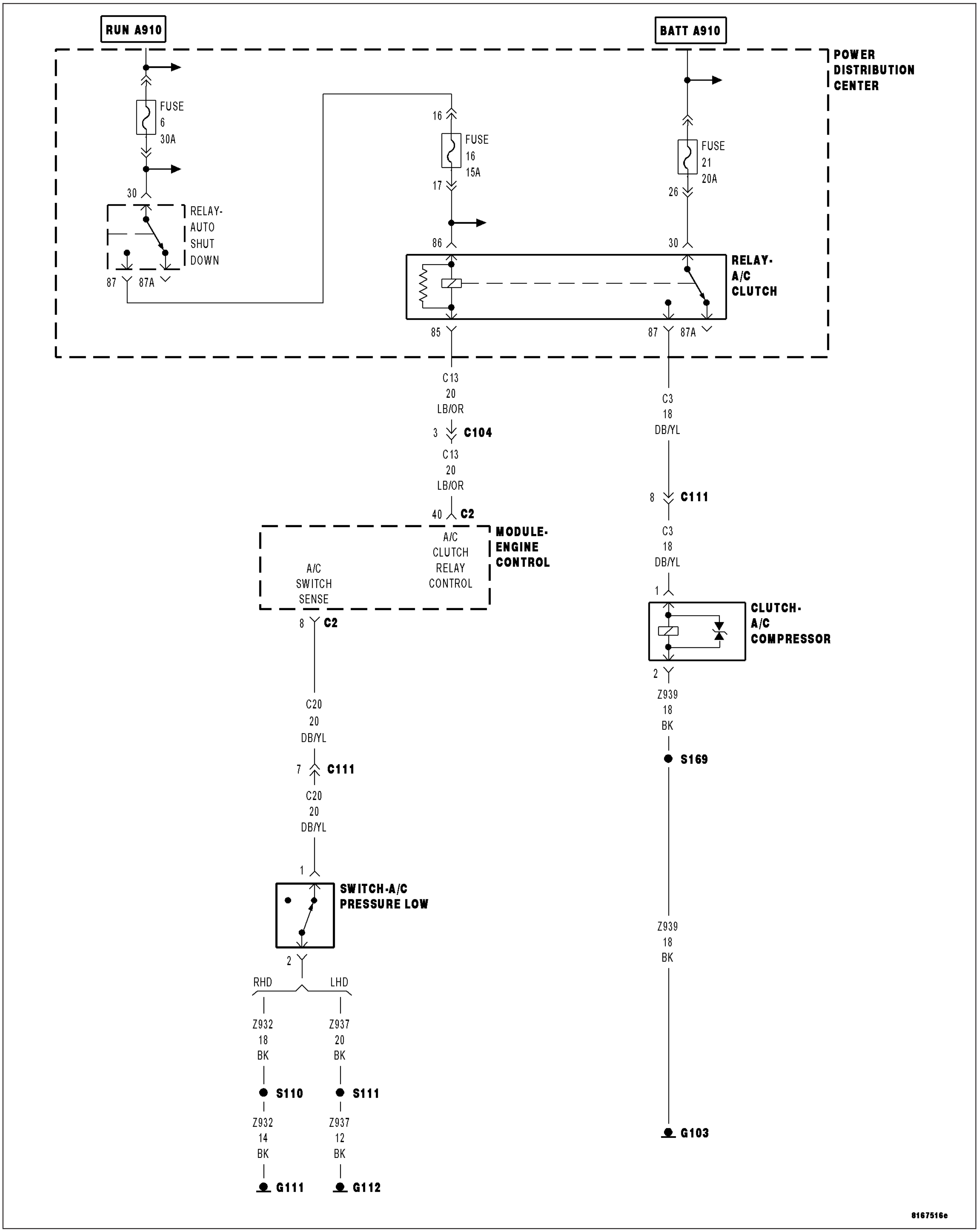
Inspect the APP Sensor #1 5-Volt supply circuit between the APP Sensor harness connector and the ECM harness connector for possible shorts to other circuits.

**Were any problems found?**

**Yes** >> Repair shorted circuit as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0645-A/C CLUTCH RELAY CIRCUIT EXCESSIVE CURRENT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM A/C Clutch Relay command on.
- **Set Condition:**
  The ECM detects excessive current on the A/C Clutch Relay Control circuit for 0.5 second.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| A/C CLUTCH RELAY |
| A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE |
| ECM |

## Diagnostic Test

### 1. A/C CLUTCH RELAY OPERATION

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the A/C Clutch Relay.

**Is the A/C Clutch Relay clicking?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. A/C CLUTCH RELAY

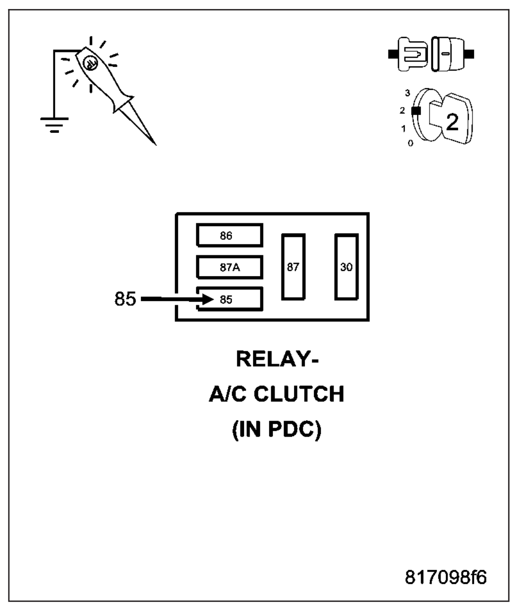
Turn the ignition off.

Remove the A/C Clutch Relay from the PDC.

Turn the ignition on.

Using a 12-volt test light connected to 12-volts, probe the A/C Clutch Relay Control circuit in the PDC.

With the scan tool, actuate the A/C Clutch Relay.




**Does the test light cycle on and off?**

**Yes** >> Replace the A/C Clutch Relay.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Remove the A/C Clutch Relay from the PDC.

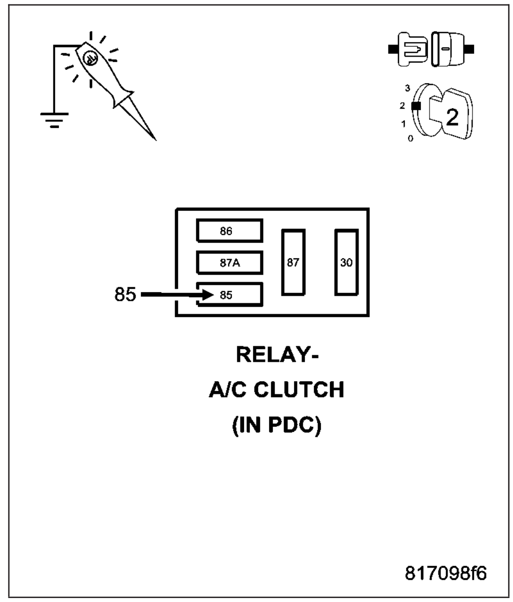
Disconnect the ECM harness connector.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the A/C Clutch Relay Control circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the A/C Clutch Relay Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. ECM

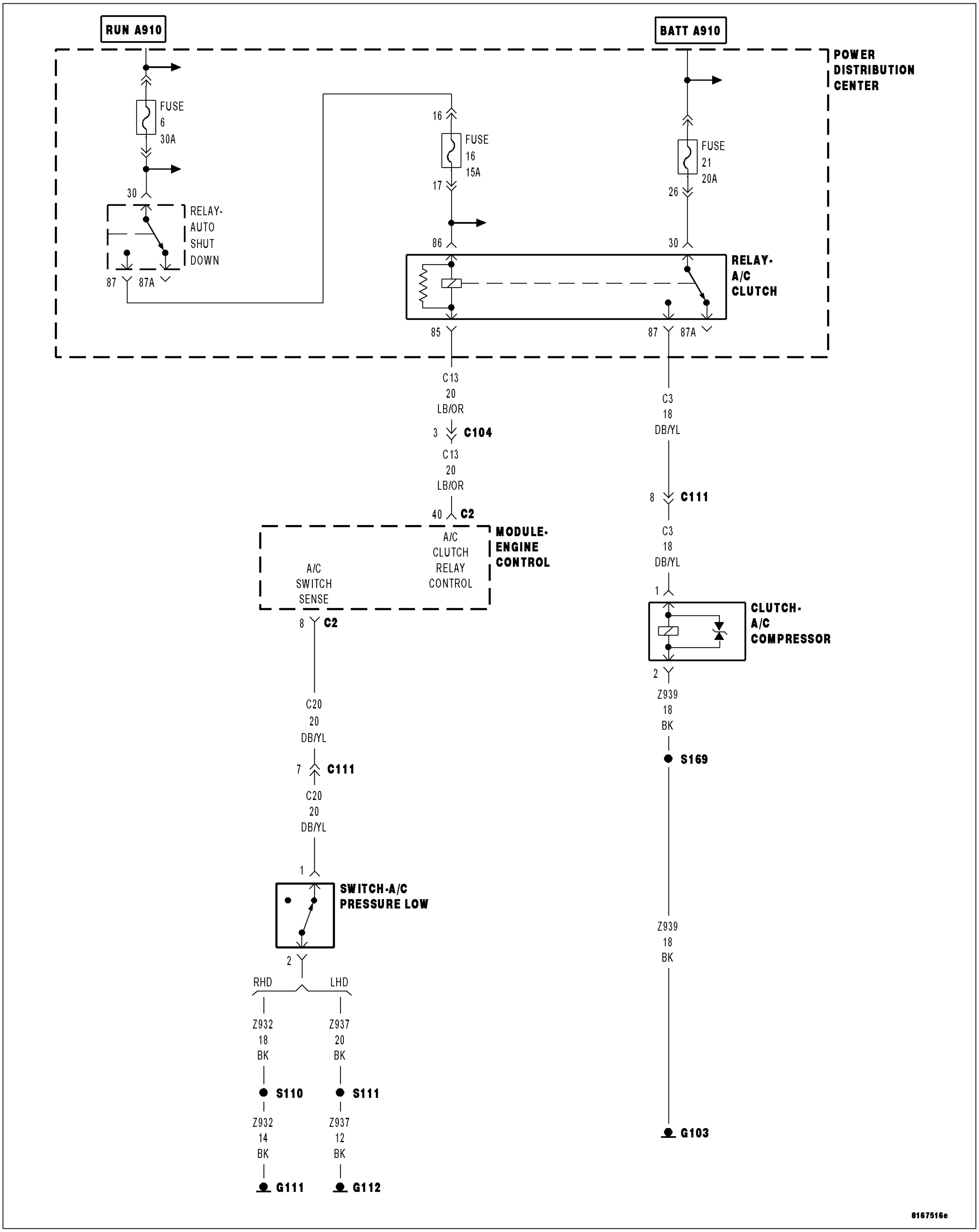
**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0645-A/C CLUTCH RELAY CIRCUIT OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM A/C Clutch Relay command off.
- **Set Condition:**
  The ECM does not detect voltage on the A/C Clutch Relay Control circuit for 0.5 second.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| FUSED ASD RELAY OUTPUT CIRCUIT OPEN |
| A/C CLUTCH RELAY |
| A/C CLUTCH RELAY CONTROL CKT OPEN |
| A/C CLUTCH RELAY CONTROL CIRCUIT SHORT TO GROUND |
| ECM |

## Diagnostic Test

### 1. A/C CLUTCH RELAY OPERATION

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the A/C Clutch Relay.

**Is the A/C Clutch Relay clicking?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. FUSED ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Remove the A/C Clutch Relay from the PDC.

Turn the ignition on.

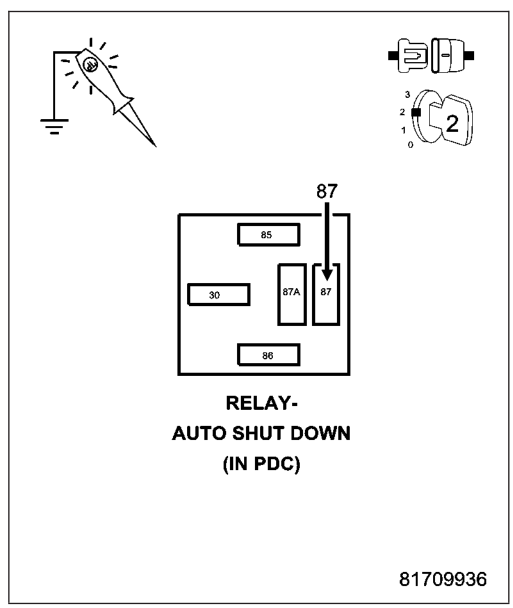
Using a 12-volt test light connected to ground, probe the Fused ASD Relay Output circuit in the PDC.

**Does the test light illuminate?**

**Yes** >> Go To 3

**No** >> Repair the Fused ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 3. A/C CLUTCH RELAY

Turn the ignition off.

Remove the A/C Clutch Relay from the PDC.

Turn the ignition on.

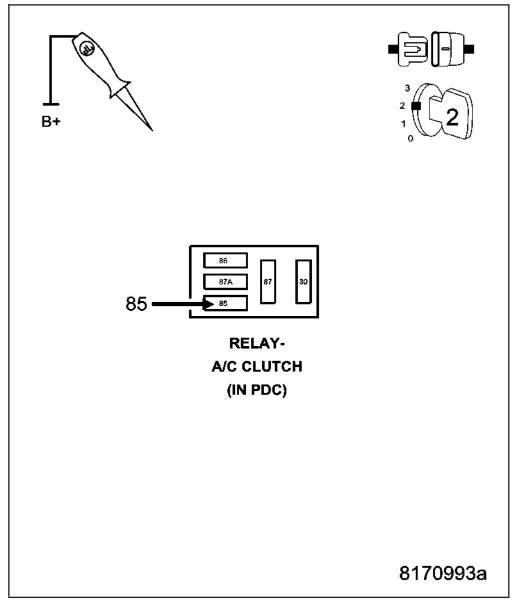
Using a 12-volt test light connected to 12-volts, probe the A/C Clutch Relay Control circuit in the PDC.

With the scan tool, actuate the A/C Clutch Relay.

**Does the test light cycle on and off?**

**Yes** >> Replace the A/C Clutch Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4




## 4. A/C CLUTCH RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the A/C Clutch Relay from the PDC.

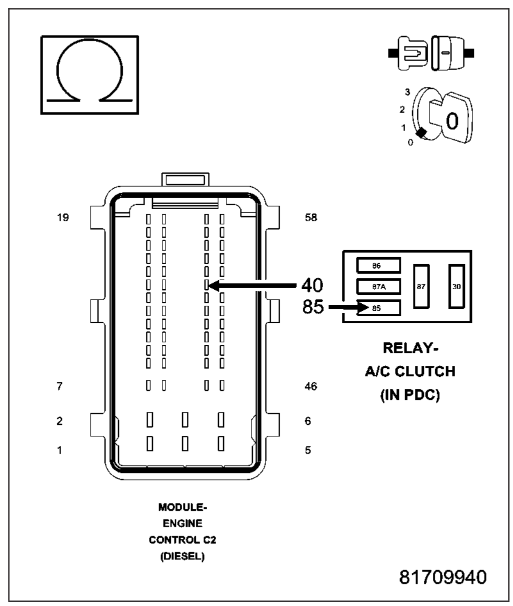
Disconnect the ECM harness connector.

Measure the resistance of the A/C Clutch Relay Control circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the A/C Clutch Relay Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



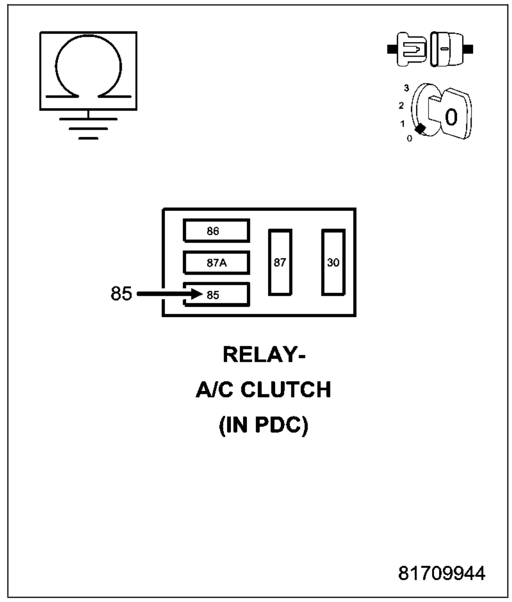
## 5. A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the A/C Clutch Relay from the PDC.

Disconnect the ECM harness connector.

Measure the resistance between ground and the A/C Clutch Relay Control circuit.




**Is the resistance below 1000 ohms?**

**Yes** >> Repair the A/C Clutch Relay Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. ECM

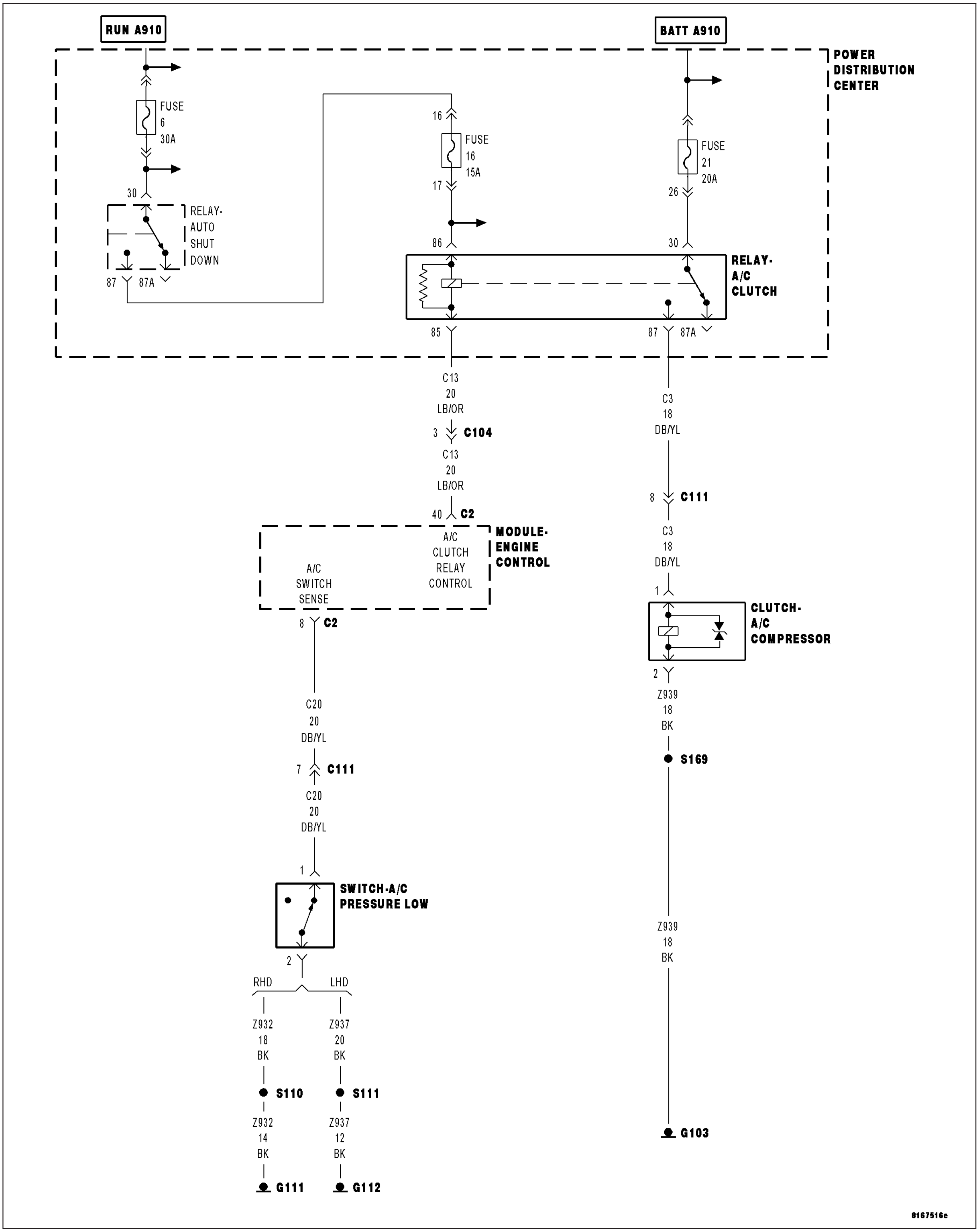
**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0645-A/C CLUTCH RELAY CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM A/C Clutch Relay command off.
- **Set Condition:**
  The ECM does not detect voltage on the A/C Clutch Relay Control circuit for 0.5 second.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| FUSED ASD RELAY OUTPUT CIRCUIT OPEN |
| A/C CLUTCH RELAY |
| A/C CLUTCH RELAY CONTROL CKT OPEN |
| A/C CLUTCH RELAY CONTROL CIRCUIT SHORT TO GROUND |
| ECM |

## Diagnostic Test

### 1. A/C CLUTCH RELAY OPERATION

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the A/C Clutch Relay.

**Is the A/C Clutch Relay clicking?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

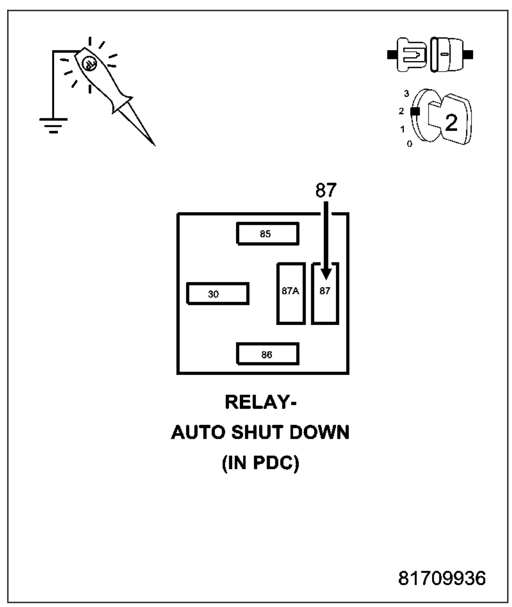
### 2. FUSED ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Remove the A/C Clutch Relay from the PDC.

Turn the ignition on.

Using a 12-volt test light connected to ground, probe the Fused ASD Relay Output circuit in the PDC.



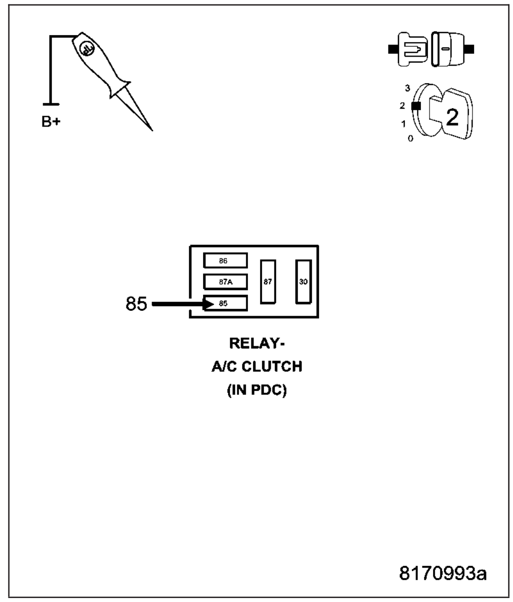

**Does the test light illuminate?**

**Yes** >> Go To 3

**No** >> Repair the Fused ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. A/C CLUTCH RELAY




Turn the ignition off.

Remove the A/C Clutch Relay from the PDC.

Turn the ignition on.

Using a 12-volt test light connected to 12-volts, probe the A/C Clutch Relay Control circuit in the PDC.

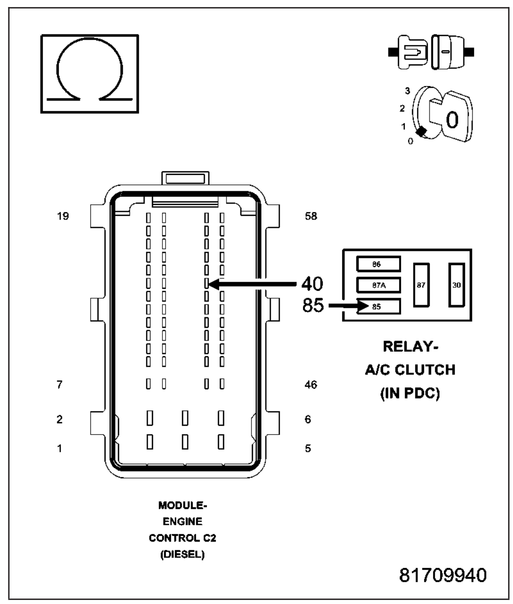
With the scan tool, actuate the A/C Clutch Relay.

**Does the test light cycle on and off?**

**Yes** >> Replace the A/C Clutch Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. A/C CLUTCH RELAY CONTROL CIRCUIT OPEN




Turn the ignition off.

Remove the A/C Clutch Relay from the PDC.

Disconnect the ECM harness connector.

Measure the resistance of the A/C Clutch Relay Control circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the A/C Clutch Relay Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

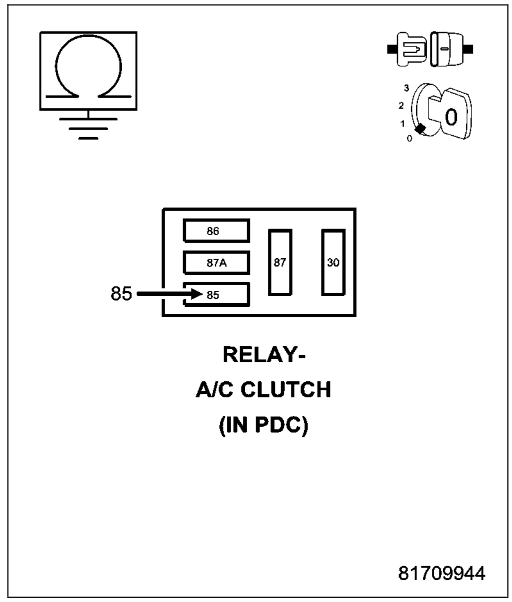
## 5. A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the A/C Clutch Relay from the PDC.

Disconnect the ECM harness connector.

Measure the resistance between ground and the A/C Clutch Relay Control circuit.




**Is the resistance below 1000 ohms?**

**Yes** >> Repair the A/C Clutch Relay Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. ECM

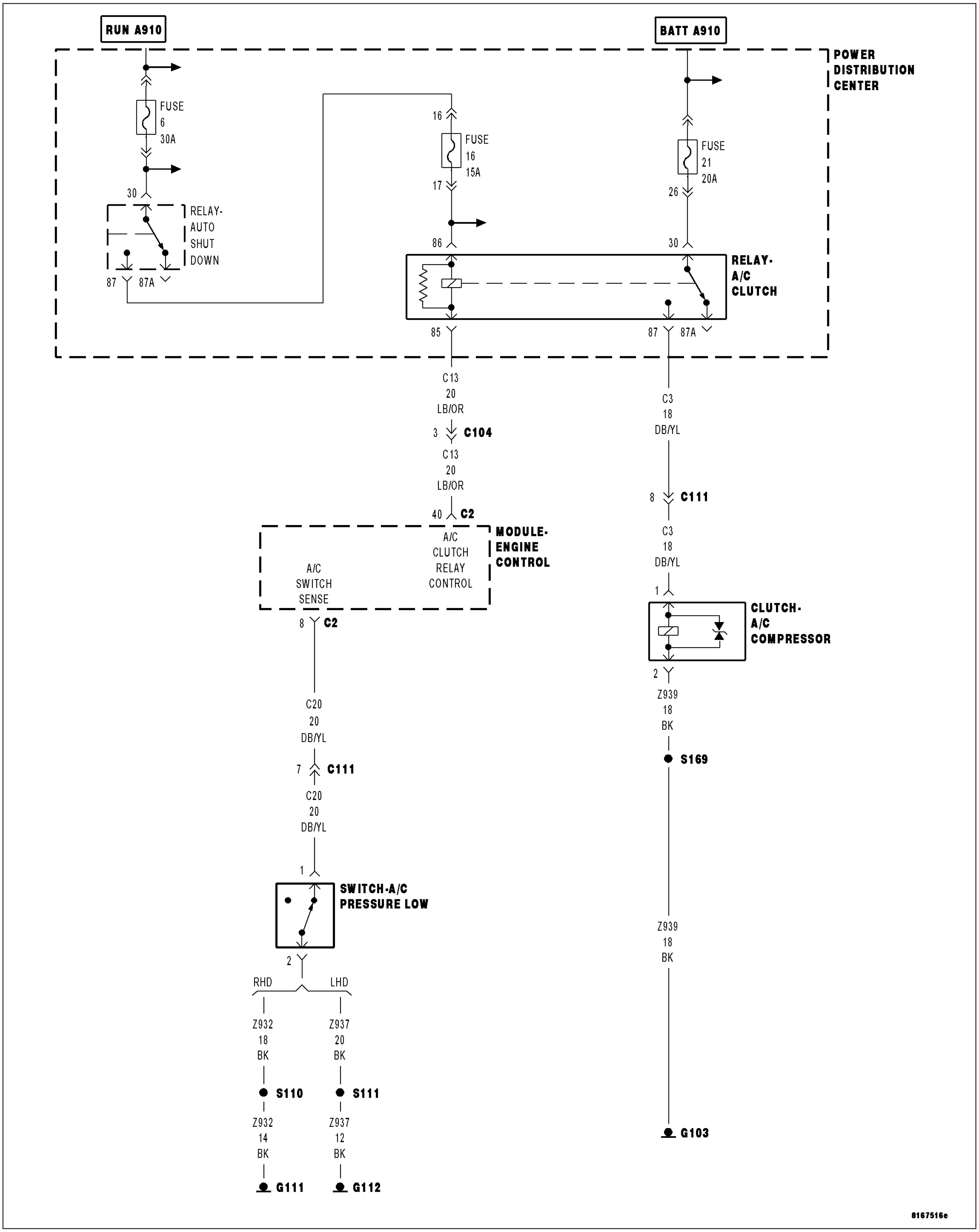
**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0645-A/C CLUTCH RELAY SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM A/C Clutch Relay command on.
- **Set Condition:**
  The ECM detects a short to voltage on the A/C Clutch Relay Control circuit for 0.5 second.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| A/C CLUTCH RELAY |
| A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE |
| ECM |

## Diagnostic Test

### 1. A/C CLUTCH RELAY OPERATION

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the A/C Clutch Relay.

**Is the A/C Clutch Relay clicking?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. A/C CLUTCH RELAY

Turn the ignition off.

Remove the A/C Clutch Relay from the PDC.

Turn the ignition on.

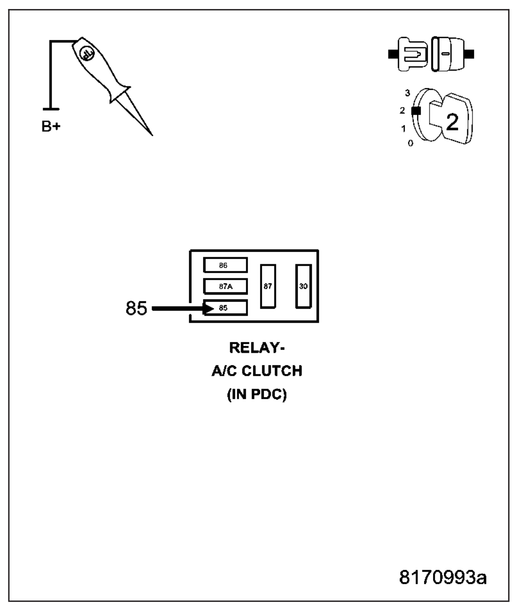
Using a 12-volt test light connected to 12-volts, probe the A/C Clutch Relay Control circuit in the PDC.

With the scan tool, actuate the A/C Clutch Relay.

**Does the test light cycle on and off?**

**Yes** >> Replace the A/C Clutch Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3



## 3. A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Remove the A/C Clutch Relay from the PDC.
Disconnect the ECM harness connector.
Remove the ASD Relay from the PDC.
Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
Turn the ignition on.
Measure the voltage of the A/C Clutch Relay Control circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the A/C Clutch Relay Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

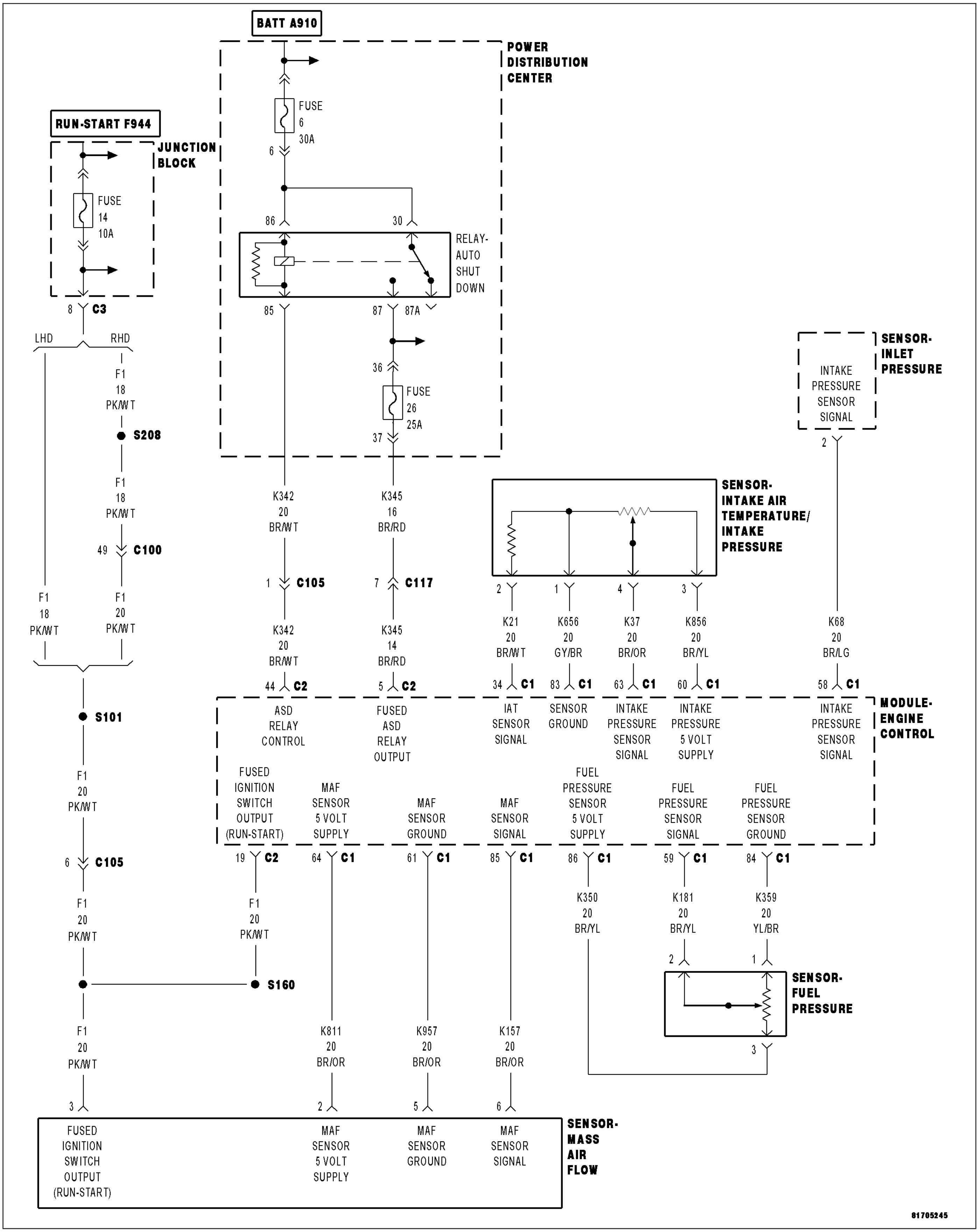
## 4. ECM

**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0651-SENSOR SUPPLY 2 VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects a short to voltage for 0.1 second on the Sensor Supply #2 circuit which supplies 5-volts to the MAF Sensor, Fuel Pressure Sensor and Boost Pressure Sensor.

| Possible Causes |
|---|
| WIRING INSPECTION |
| INTERMITTENT CONDITION |
| BOOST PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |
| FUEL PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| MAF SENSOR |
| MAF SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off for 10 seconds.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. FUEL PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

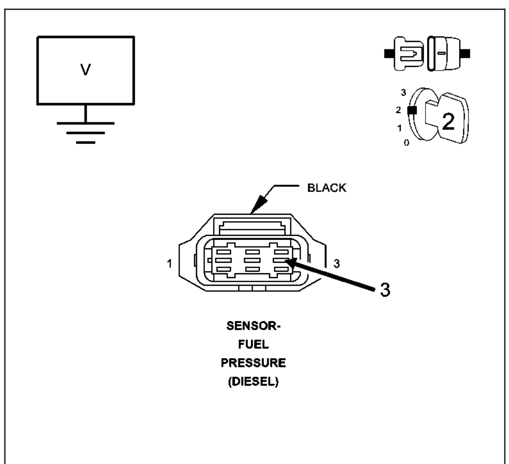
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage on the Fuel Pressure Sensor 5-Volt Supply circuit.



81706bb9

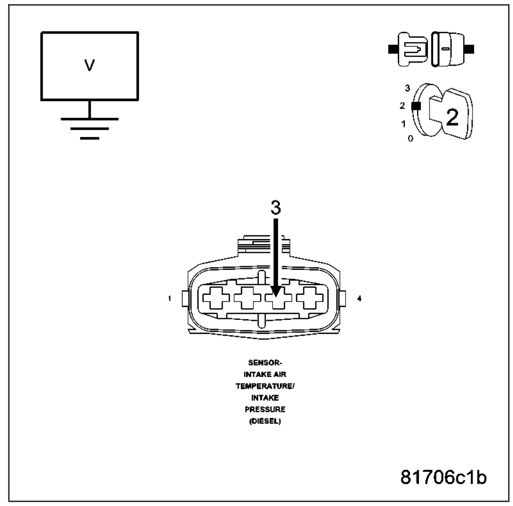
**NOTE: Remove the jumper wire and reinstall the ASD Relay.**

**Is the voltage below 1.0 volt?**

**Yes** >> Go To 3

**No** >> Repair the Fuel Pressure Sensor 5-Volt Supply circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. BOOST PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the Boost Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage on the Boost Pressure Sensor 5-Volt Supply circuit.

**NOTE: Remove the jumper wire and reinstall the ASD Relay.**

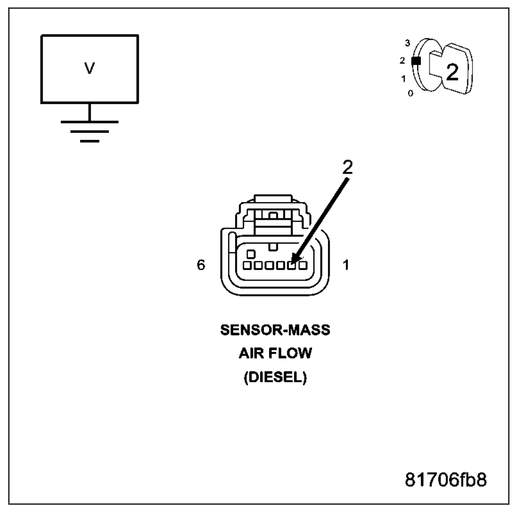
**Is the voltage below 1.0 volt?**

**Yes** >> Go To 4

**No** >> Repair the Boost Pressure Sensor 5-Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. MAF SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE




Turn the ignition on.

While back probing the MAF Sensor harness connector, measure the voltage of the MAF Sensor 5-Volt Supply circuit.

**Is the voltage below 5.5 volts?**

**Yes** >> Go To 6

**No** >> Go To 5

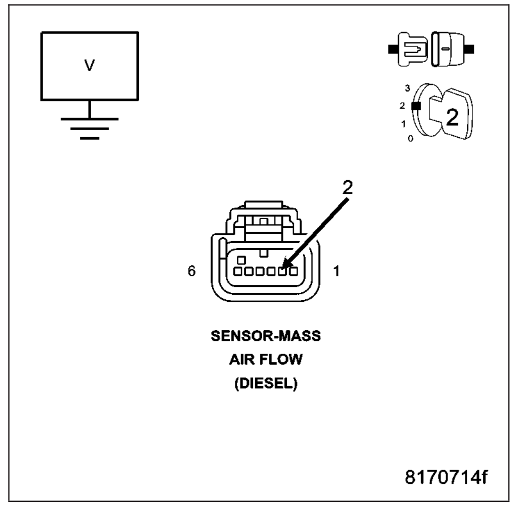
## 5. MAF SENSOR

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Turn the ignition on.

Measure the voltage on the MAF Sensor 5-Volt Supply circuit at the MAF Sensor harness connector.




**Is the voltage below 5.5 volt?**

**Yes** >> Replace the MAF Sensor
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. WIRING INSPECTION

Turn the ignition off.

Inspect the Boost Pressure Sensor 5-Volt supply circuit between the Boost Pressure Sensor harness connector and the ECM harness connector for possible shorts to other circuits.

Inspect the Fuel Pressure Sensor 5-Volt supply circuit between the Fuel Pressure Sensor harness connector and the ECM harness connector for possible shorts to other circuits.

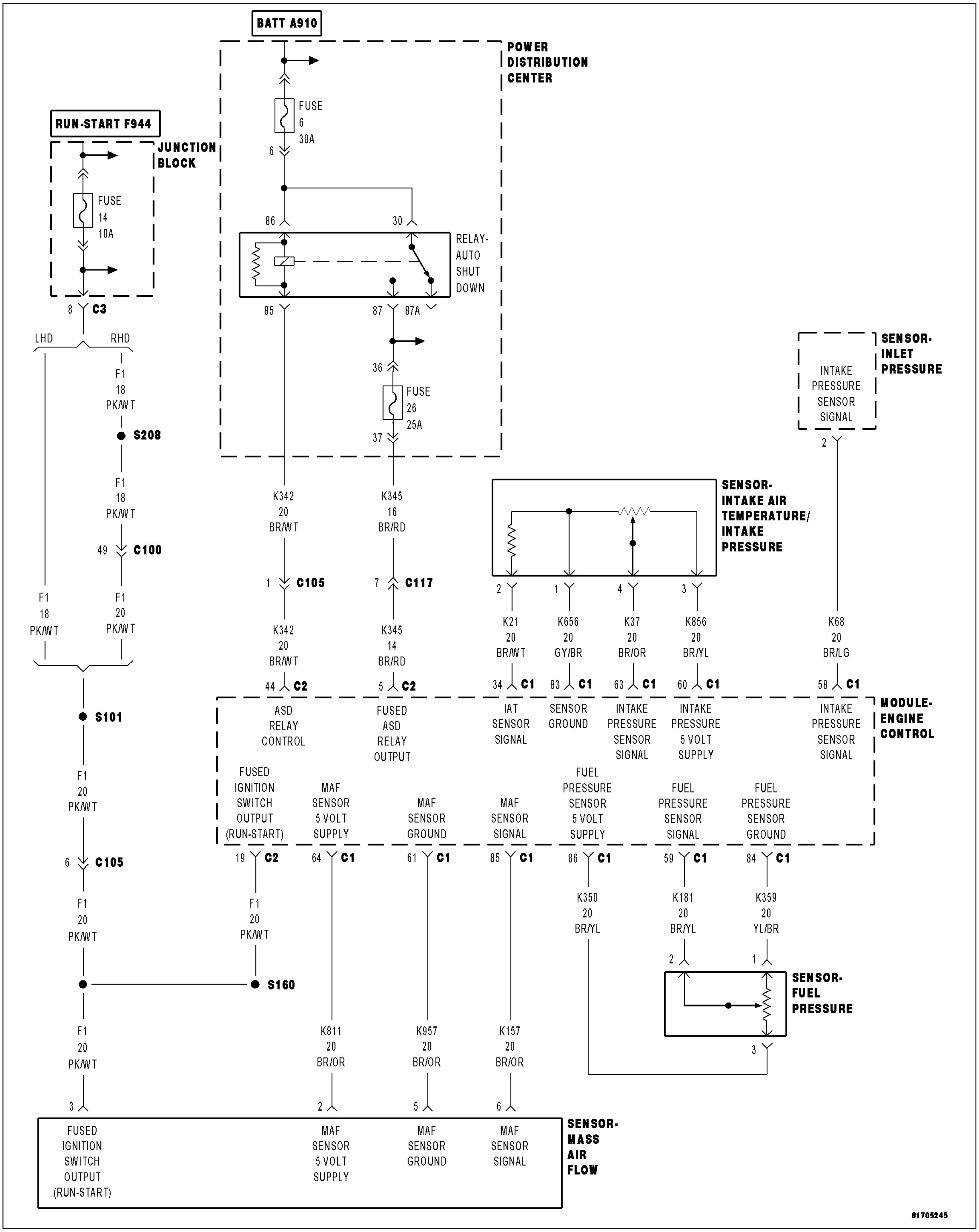
Inspect the MAF Sensor 5-Volt supply circuit between the MAF Sensor harness connector and the ECM harness connector for possible shorts to other circuits.

**Were any problems found?**

**Yes** >> Repair shorted circuit as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0651-SENSOR SUPPLY 2 VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects a low voltage for 0.1 second on the Sensor Supply #2 circuit which supplies 5-volts to the MAF Sensor, Fuel Pressure Sensor and Boost Pressure Sensor.

| Possible Causes |
|---|
| WIRING INSPECTION |
| INTERMITTENT CONDITION |
| 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| BOOST PRESSURE SENSOR |
| FUEL PRESSURE SENSOR |
| MAF SENSOR |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off for 10 seconds.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

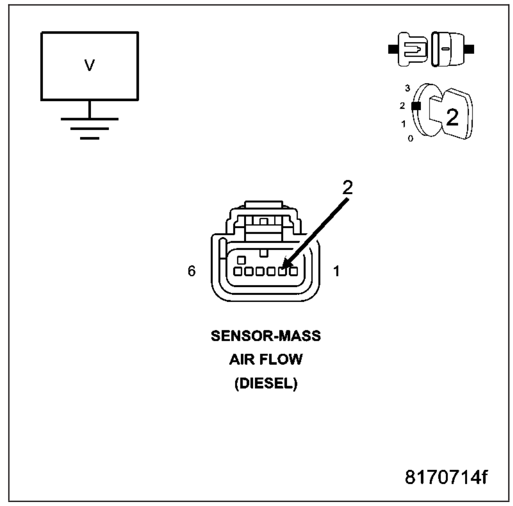
## 2. MASS AIR FLOW SENSOR SHORTED TO GROUND

Turn the ignition off.

Disconnect the MAF Sensor harness connector.

Turn the ignition on.

Measure the voltage of the MAF Sensor 5-Volt Supply circuit.




**Is the voltage above 4.6 volts?**

**Yes** >> Replace the Mass Air Flow Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

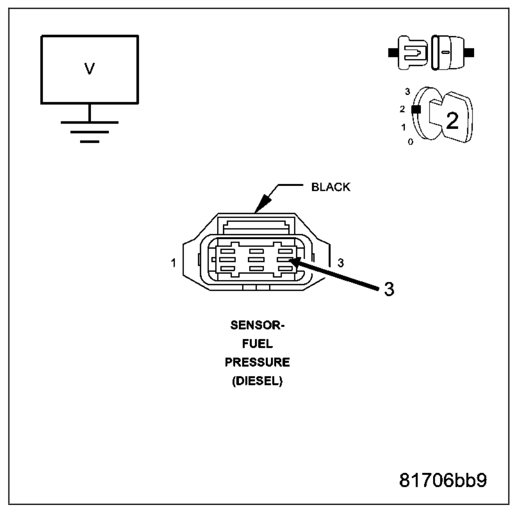
## 3. FUEL PRESSURE SENSOR SHORTED TO GROUND

Turn the ignition off.

Disconnect the Fuel Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the Fuel Pressure Sensor 5-Volt Supply circuit.

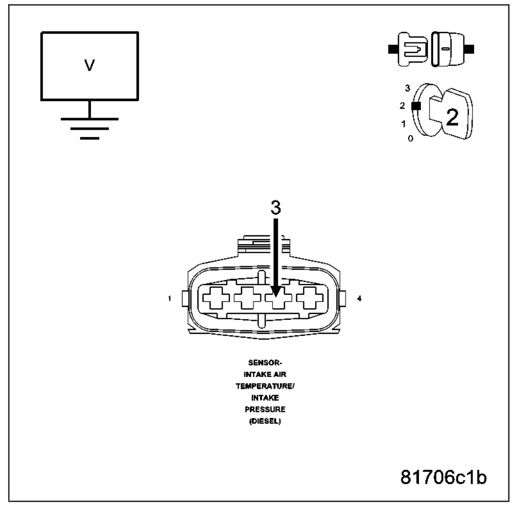



**Is the voltage above 4.6 volts?**

**Yes** >> Replace the Fuel Pressure Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. BOOST PRESSURE SENSOR SHORTED TO GROUND




Ensure all connectors are reconnected.

Turn the ignition off.

Disconnect the Boost Pressure Sensor harness connector.

Turn the ignition on.

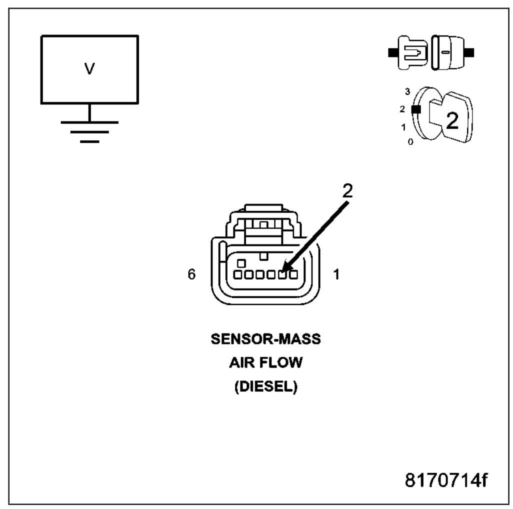
Measure the voltage of the Boost Pressure Sensor 5-Volt Supply circuit.

**Is the voltage above 4.6 volts?**

**Yes** >> Replace the Boost Pressure Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND




Turn the ignition off.

Disconnect the Boost Pressure Sensor harness connector.

Disconnect the Fuel Pressure Sensor harness connector.

Disconnect the Mass Air Flow Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Mass Air Flow Sensor 5-Volt Supply circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the 5-Volt Supply circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. WIRING INSPECTION

Turn the ignition off.

Inspect the Boost Pressure Sensor 5-Volt supply circuit between the Boost Pressure Sensor harness connector and the ECM harness connector for possible shorts to other circuits.

Inspect the Mass Air Flow Sensor #1 5-Volt supply circuit between the Mass Air Flow Sensor harness connector and the ECM harness connector for possible shorts to other circuits.

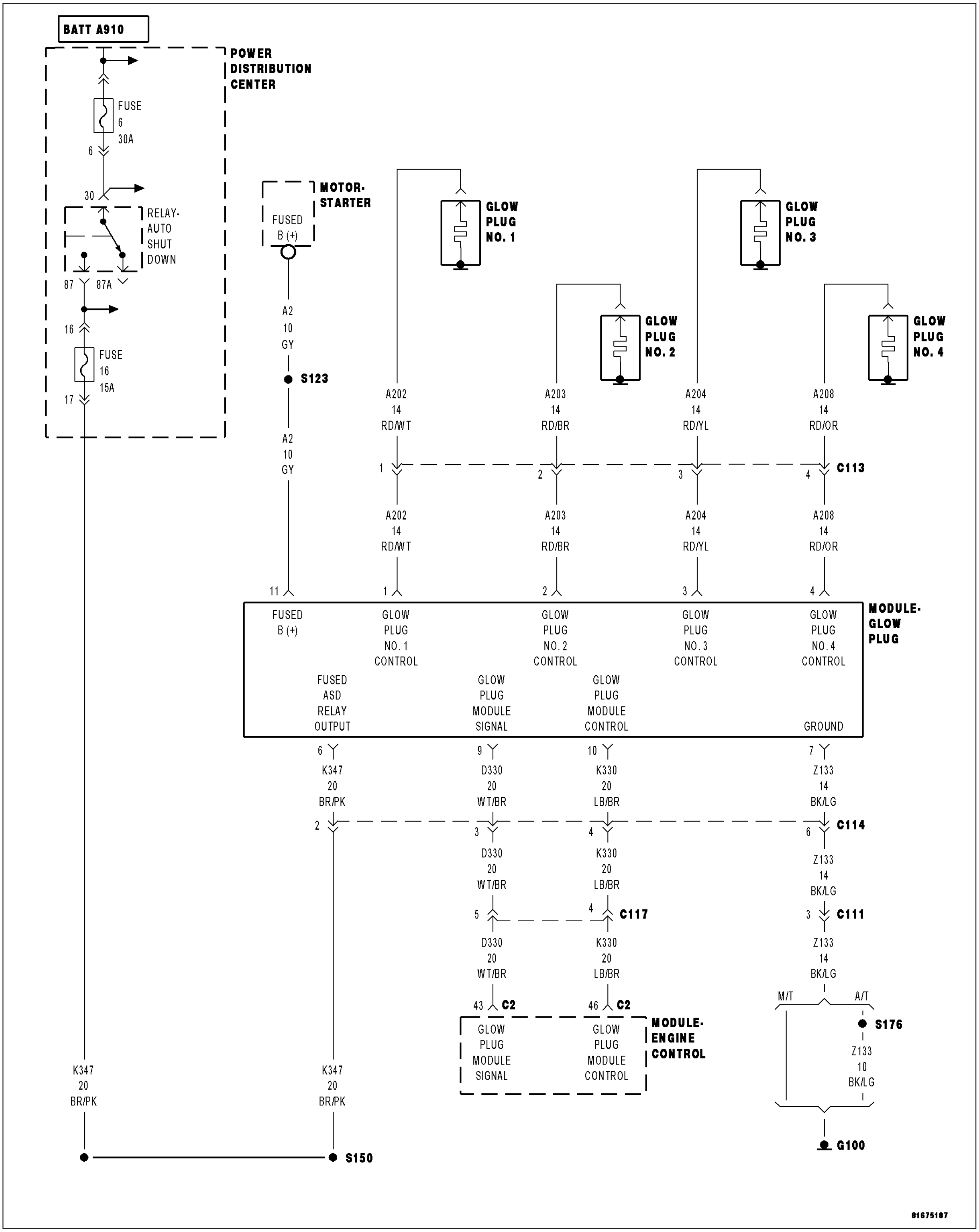
Inspect the Fuel Pressure Sensor 5-Volt supply circuit between the Fuel Pressure Sensor harness connector and the ECM harness connector for possible shorts to other circuits.

**Were any problems found?**

**Yes** >> Repair shorted circuit as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0670-GLOW PLUG CONTROLLER CIRCUIT MALFUNCTION




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects a malfunction on the Glow Plug Module Signal or Glow Plug Module Control circuit.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| GLOW PLUG MODULE |
| GLOW PLUG MODULE SIGNAL/CONTROL CIRCUIT OPEN |
| GLOW PLUG MODULE SIGNAL/CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG MODULE SIGNAL/CONTROL CIRCUIT SHORTED TO VOLTAGE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

Turn the ignition on and wait at least 90 seconds.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. GLOW PLUG MODULE SIG/CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Glow Plug Module Signal circuit.

Measure the resistance of the Glow Plug Module Control circuit.

**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 3

**No** >> Repair the Glow Plug Module circuit(s) that measured above 10.0 ohms for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. GLOW PLUG MODULE SIG/CONTROLCIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the Glow Plug Module harness connectors.
Disconnect the ECM harness connectors.
Measure the resistance between ground and the Glow Plug Module Signal circuit.
Measure the resistance between ground and the Glow Plug Module Control circuit.

**Is the resistance above 1000 ohms for both measurements?**

**Yes** >> Go To 4

**No** >> Repair the Glow Plug Module circuit(s) that measured below 1000 ohms for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. GLOW PLUG MODULE SIG/CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Glow Plug Module harness connectors.
Disconnect the ECM harness connectors.
Remove the ASD Relay.
Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
Measure the voltage of the Glow Plug Module Signal circuit.
Measure the voltage of the Glow Plug Module Control circuit.

**Is the voltage below 1.0 volt for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the Glow Plug Module circuit(s) that measured above 1.0 volt for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG CONTROL MODULE

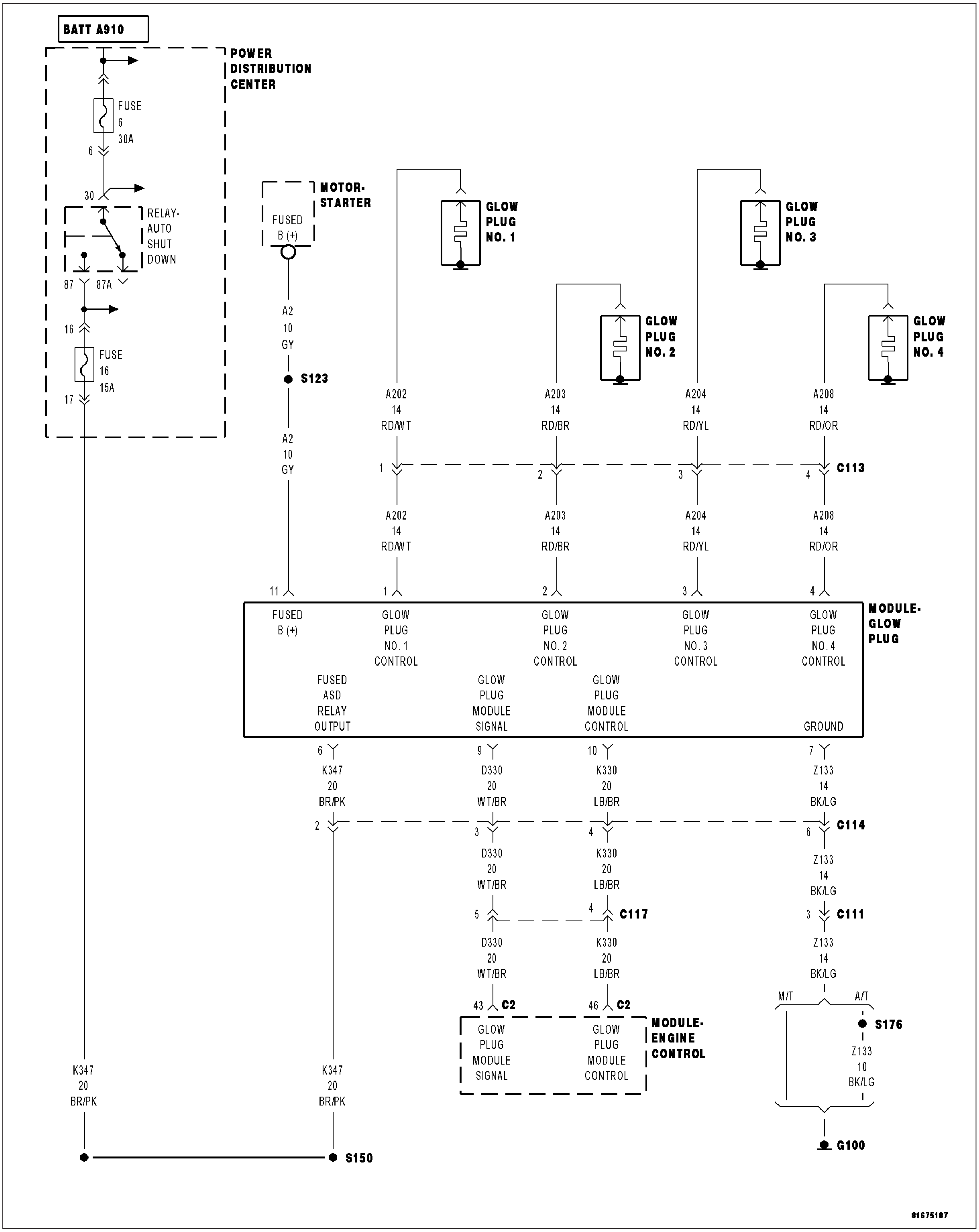
Turn the ignition off.
Replace the Glow Plug Module in accordance with the Service Information.
Reconnect all connectors.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P0671-GLOW PLUG 1 PLUG SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Glow Plug Module Glow Plug command on.
- **Set Condition:**
  The ECM detects a short circuit on a Glow Plug Control circuit.

| Possible Causes |
|---|
| GLOW PLUG |
| GLOW PLUG CONTROL CIRCUIT OPEN |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE |
| GLOW PLUG MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. GLOW PLUG CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Measure the resistance of each Glow Plug Control circuit.

**Is the resistance below 10.0 ohms for each circuit?**

**Yes** >> Go To 3

**No** >> Repair the appropriate Glow Plug Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect each Glow Plug harness connector.
Disconnect the Glow Plug Module harness connector.
Measure the resistance between ground and each Glow Plug Control circuit.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the appropriate Glow Plug Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect each Glow Plug harness connector.
Disconnect the Glow Plug Module harness connector.
Turn the ignition on.
Measure the voltage of each Glow Plug Control circuit.

**Is the voltage below 1.0 volt for each circuit?**

**Yes** >> Go To 5

**No** >> Repair the appropriate Glow Plug Control circuit for a short to voltage
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG

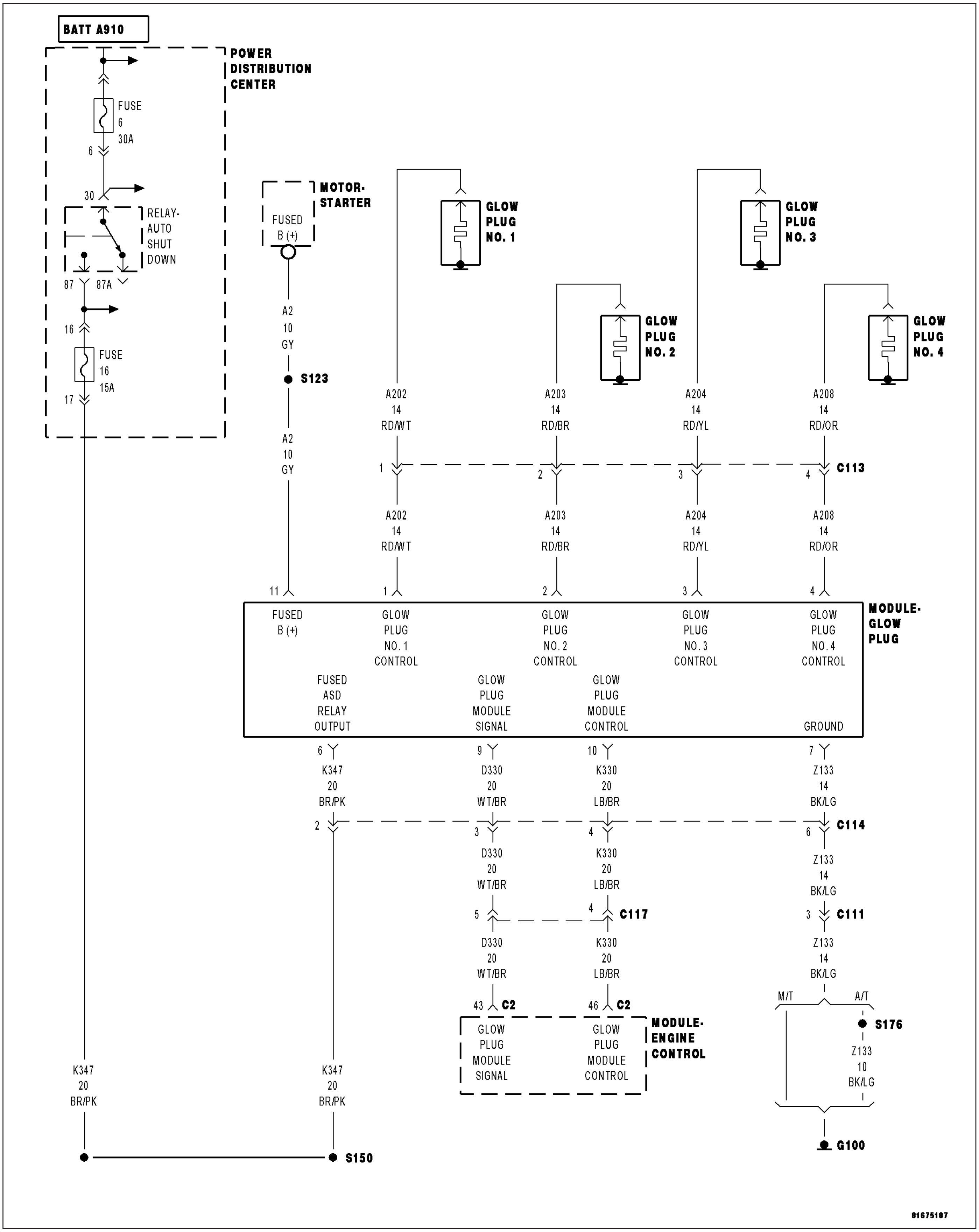
Turn the ignition off.
With the scan tool, erase ECM DTCs.
Refer to the Service Information and perform the Glow Plug Test on each Glow plug.

**Did each Glow Plug pass the test?**

**Yes** >> Replace the Glow Plug Module.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the appropriate Glow Plug in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0671-GLOW PLUG 1 PLUG FAILURE




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Glow Plug Module Glow Plug command on.
- **Set Condition:**
  The ECM detects a malfunction with a Glow Plug or a Glow Plug Control circuit.

| Possible Causes |
|---|
| GLOW PLUG |
| GLOW PLUG CONTROL CIRCUIT OPEN |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE |
| GLOW PLUG MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. GLOW PLUG CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Measure the resistance of each Glow Plug Control circuit.

**Is the resistance below 10.0 ohms for each circuit?**

**Yes** >> Go To 3

**No** >> Repair the appropriate Glow Plug Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Measure the resistance between ground and each Glow Plug Control circuit.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the appropriate Glow Plug Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Turn the ignition on.

Measure the voltage of each Glow Plug Control circuit.

**Is the voltage below 1.0 volt for each circuit?**

**Yes** >> Go To 5

**No** >> Repair the appropriate Glow Plug Control circuit for a short to voltage
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG

Turn the ignition off.

With the scan tool, erase ECM DTCs.

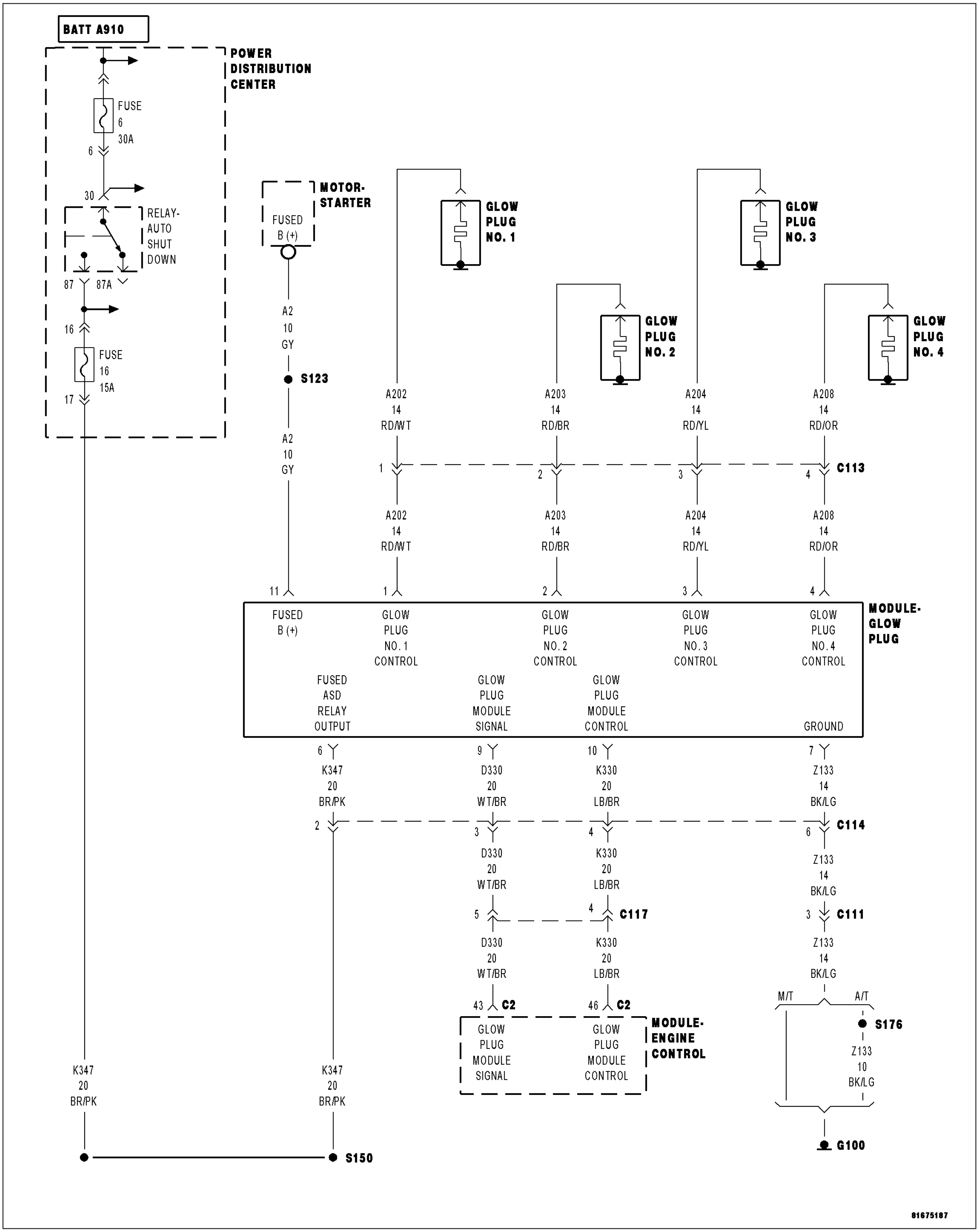
Refer to the Service Information and perform the Glow Plug Test on each Glow plug.

**Did each Glow Plug pass the test?**

**Yes** >> Replace the Glow Plug Module.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the appropriate Glow Plug in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0672-GLOW PLUG 2 PLUG FAILURE




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Glow Plug Module Glow Plug command on.
- **Set Condition:**
  The ECM detects a malfunction with a Glow Plug or a Glow Plug Control circuit.

| Possible Causes |
|---|
| GLOW PLUG |
| GLOW PLUG CONTROL CIRCUIT OPEN |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE |
| GLOW PLUG MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. GLOW PLUG CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Measure the resistance of each Glow Plug Control circuit.

**Is the resistance below 10.0 ohms for each circuit?**

**Yes** >> Go To 3

**No** >> Repair the appropriate Glow Plug Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect each Glow Plug harness connector.
Disconnect the Glow Plug Module harness connector.
Measure the resistance between ground and each Glow Plug Control circuit.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the appropriate Glow Plug Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect each Glow Plug harness connector.
Disconnect the Glow Plug Module harness connector.
Turn the ignition on.
Measure the voltage of each Glow Plug Control circuit.

**Is the voltage below 1.0 volt for each circuit?**

**Yes** >> Go To 5

**No** >> Repair the appropriate Glow Plug Control circuit for a short to voltage
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG

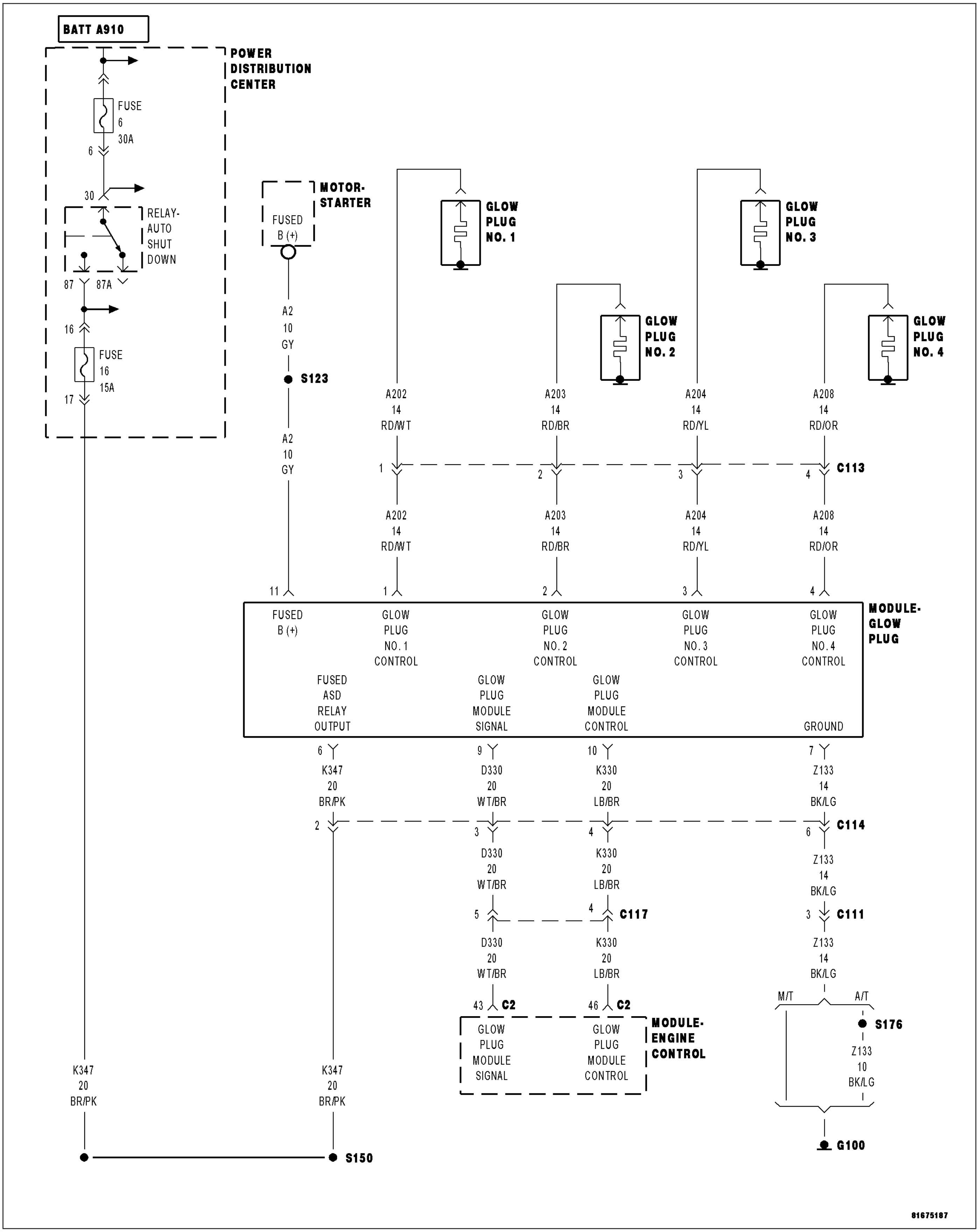
Turn the ignition off.
With the scan tool, erase ECM DTCs.
Refer to the Service Information and perform the Glow Plug Test on each Glow plug.

**Did each Glow Plug pass the test?**

**Yes** >> Replace the Glow Plug Module.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the appropriate Glow Plug in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0672-GLOW PLUG 2 PLUG SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Glow Plug Module Glow Plug command on.
- **Set Condition:**
  The ECM detects a short circuit on a Glow Plug Control circuit.

| Possible Causes |
|---|
| GLOW PLUG |
| GLOW PLUG CONTROL CIRCUIT OPEN |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE |
| GLOW PLUG MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. GLOW PLUG CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Measure the resistance of each Glow Plug Control circuit.

**Is the resistance below 10.0 ohms for each circuit?**

**Yes** >> Go To 3

**No** >> Repair the appropriate Glow Plug Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Measure the resistance between ground and each Glow Plug Control circuit.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the appropriate Glow Plug Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Turn the ignition on.

Measure the voltage of each Glow Plug Control circuit.

**Is the voltage below 1.0 volt for each circuit?**

**Yes** >> Go To 5

**No** >> Repair the appropriate Glow Plug Control circuit for a short to voltage
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG

Turn the ignition off.

With the scan tool, erase ECM DTCs.

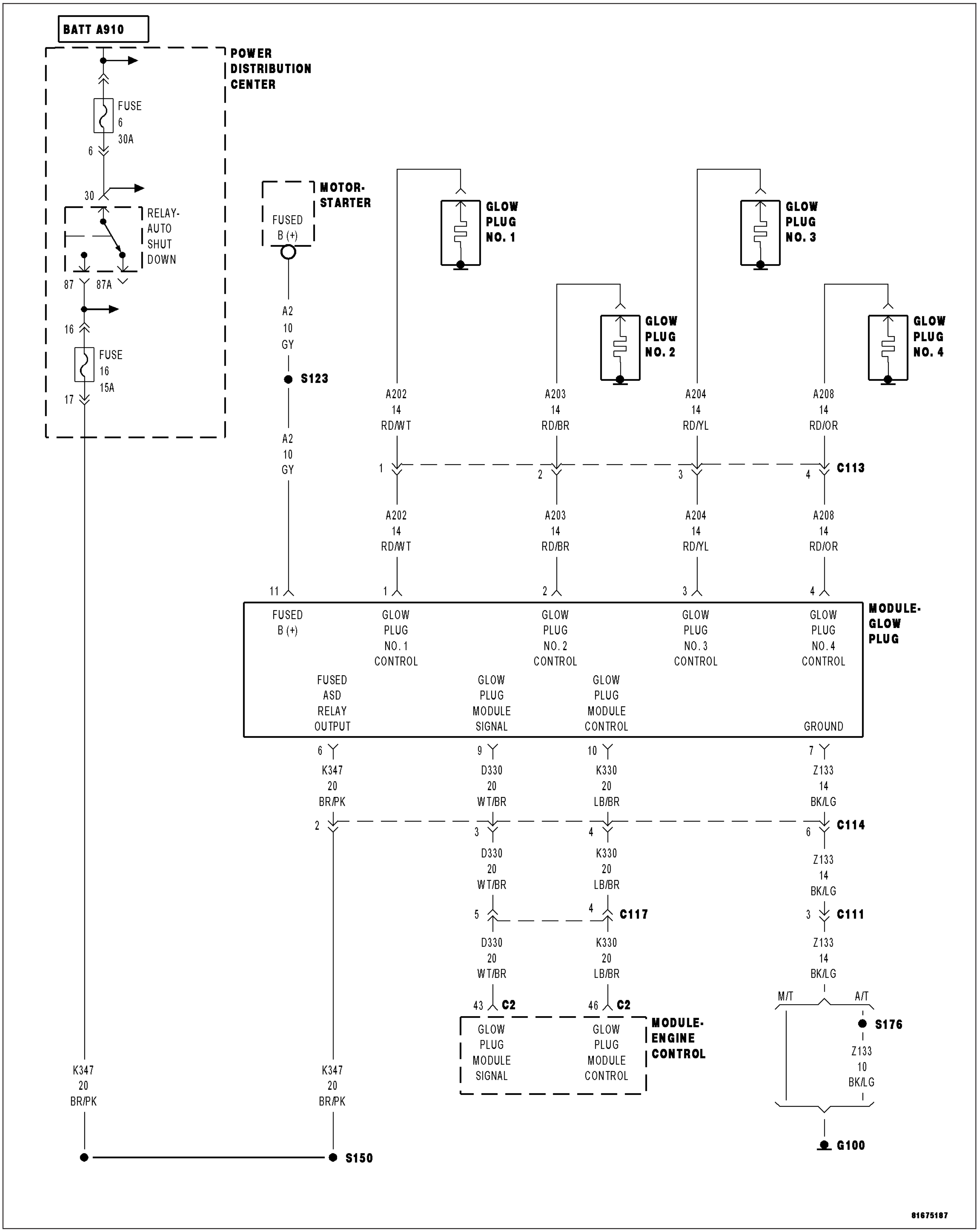
Refer to the Service Information and perform the Glow Plug Test on each Glow plug.

**Did each Glow Plug pass the test?**

**Yes** >> Replace the Glow Plug Module.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the appropriate Glow Plug in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0673-GLOW PLUG 3 PLUG FAILURE




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Glow Plug Module Glow Plug command on.
- **Set Condition:**
  The ECM detects a malfunction with a Glow Plug or a Glow Plug Control circuit.

| Possible Causes |
|---|
| GLOW PLUG |
| GLOW PLUG CONTROL CIRCUIT OPEN |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE |
| GLOW PLUG MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. GLOW PLUG CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Measure the resistance of each Glow Plug Control circuit.

**Is the resistance below 10.0 ohms for each circuit?**

**Yes** >> Go To 3

**No** >> Repair the appropriate Glow Plug Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Measure the resistance between ground and each Glow Plug Control circuit.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the appropriate Glow Plug Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Turn the ignition on.

Measure the voltage of each Glow Plug Control circuit.

**Is the voltage below 1.0 volt for each circuit?**

**Yes** >> Go To 5

**No** >> Repair the appropriate Glow Plug Control circuit for a short to voltage
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG

Turn the ignition off.

With the scan tool, erase ECM DTCs.

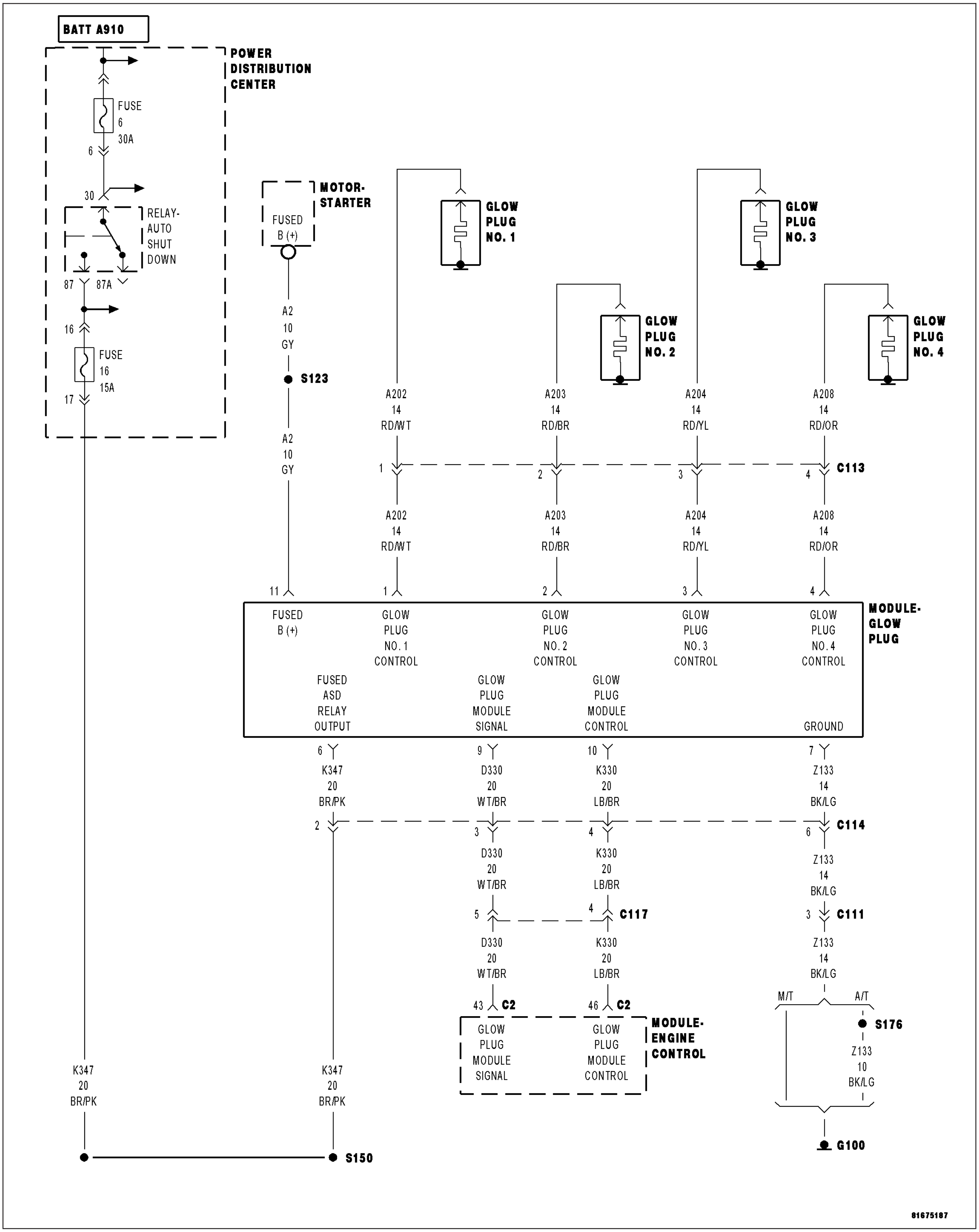
Refer to the Service Information and perform the Glow Plug Test on each Glow plug.

**Did each Glow Plug pass the test?**

**Yes** >> Replace the Glow Plug Module.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the appropriate Glow Plug in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0673-GLOW PLUG 3 SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Glow Plug Module Glow Plug command on.
- **Set Condition:**
  The ECM detects a short circuit on a Glow Plug Control circuit.

| Possible Causes |
|---|
| GLOW PLUG |
| GLOW PLUG CONTROL CIRCUIT OPEN |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE |
| GLOW PLUG MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. GLOW PLUG CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Measure the resistance of each Glow Plug Control circuit.

**Is the resistance below 10.0 ohms for each circuit?**

**Yes** >> Go To 3

**No** >> Repair the appropriate Glow Plug Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect each Glow Plug harness connector.
Disconnect the Glow Plug Module harness connector.
Measure the resistance between ground and each Glow Plug Control circuit.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the appropriate Glow Plug Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect each Glow Plug harness connector.
Disconnect the Glow Plug Module harness connector.
Turn the ignition on.
Measure the voltage of each Glow Plug Control circuit.

**Is the voltage below 1.0 volt for each circuit?**

**Yes** >> Go To 5

**No** >> Repair the appropriate Glow Plug Control circuit for a short to voltage
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG

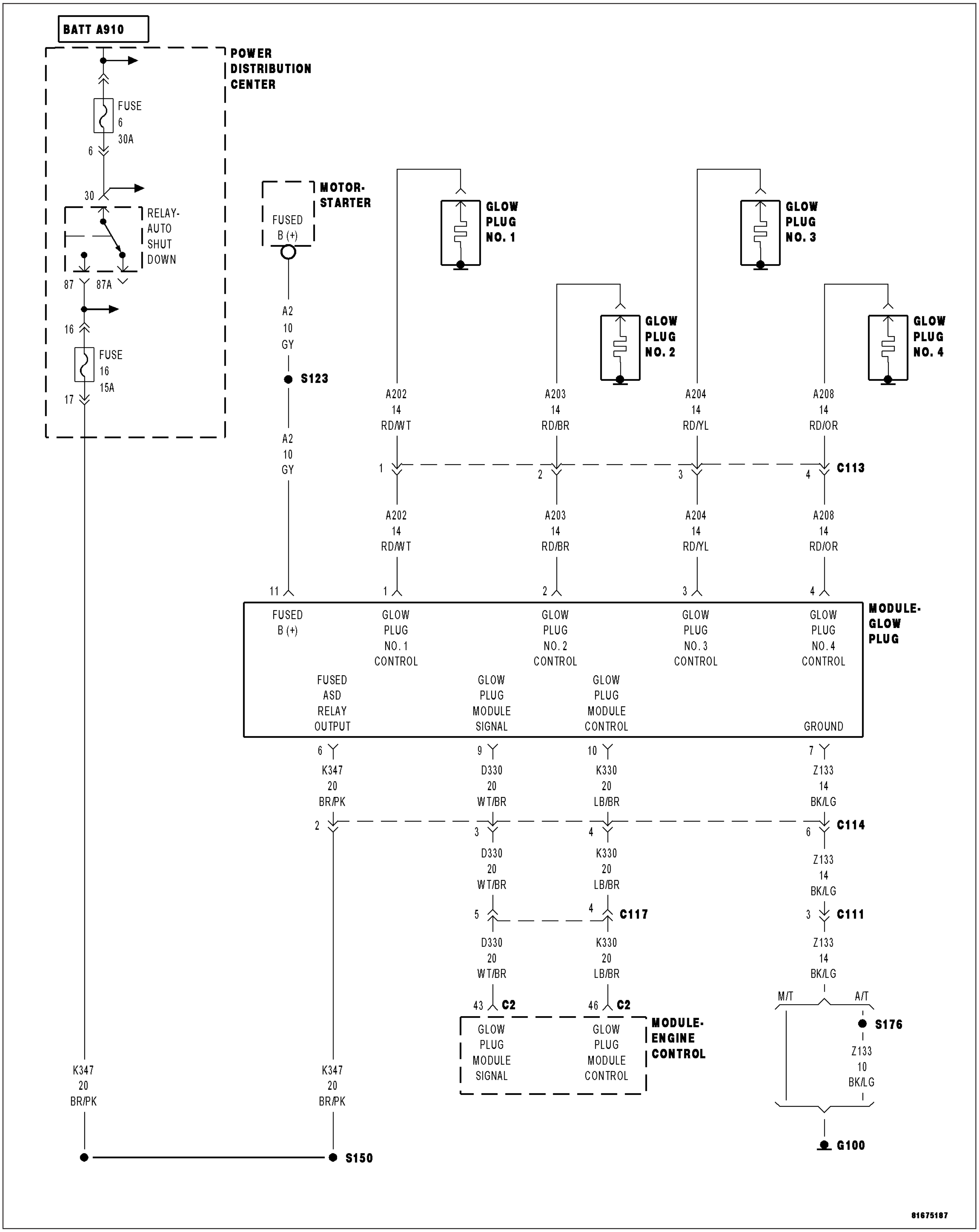
Turn the ignition off.
With the scan tool, erase ECM DTCs.
Refer to the Service Information and perform the Glow Plug Test on each Glow plug.

**Did each Glow Plug pass the test?**

**Yes** >> Replace the Glow Plug Module.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the appropriate Glow Plug in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0674-GLOW PLUG 4 SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Glow Plug Module Glow Plug command on.
- **Set Condition:**
  The ECM detects a short circuit on a Glow Plug Control circuit.

| Possible Causes |
|---|
| GLOW PLUG |
| GLOW PLUG CONTROL CIRCUIT OPEN |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE |
| GLOW PLUG MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. GLOW PLUG CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Measure the resistance of each Glow Plug Control circuit.

**Is the resistance below 10.0 ohms for each circuit?**

**Yes** >> Go To 3

**No** >> Repair the appropriate Glow Plug Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect each Glow Plug harness connector.
Disconnect the Glow Plug Module harness connector.
Measure the resistance between ground and each Glow Plug Control circuit.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the appropriate Glow Plug Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect each Glow Plug harness connector.
Disconnect the Glow Plug Module harness connector.
Turn the ignition on.
Measure the voltage of each Glow Plug Control circuit.

**Is the voltage below 1.0 volt for each circuit?**

**Yes** >> Go To 5

**No** >> Repair the appropriate Glow Plug Control circuit for a short to voltage
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG

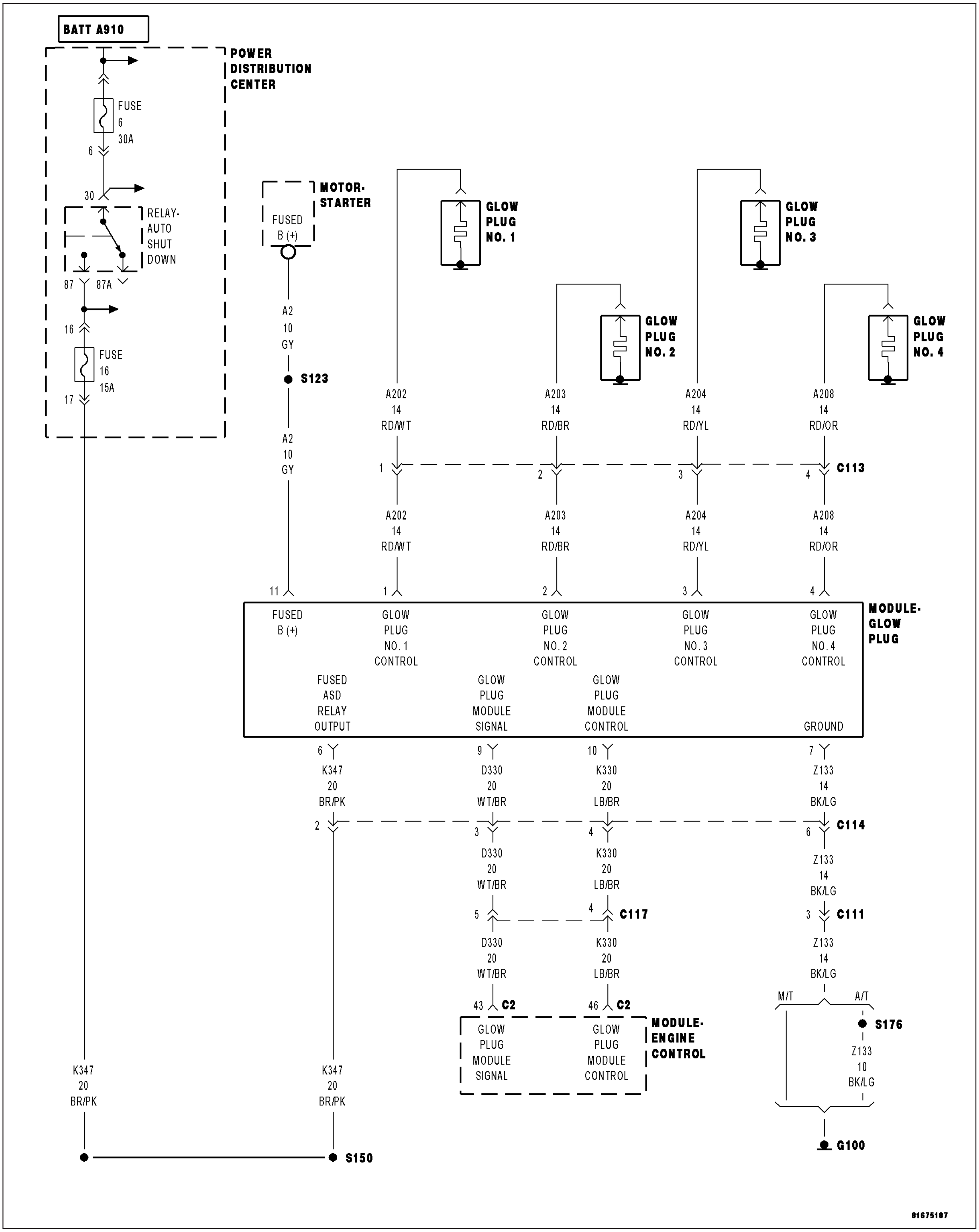
Turn the ignition off.
With the scan tool, erase ECM DTCs.
Refer to the Service Information and perform the Glow Plug Test on each Glow plug.

**Did each Glow Plug pass the test?**

**Yes** >> Replace the Glow Plug Module.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the appropriate Glow Plug in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0674-GLOW PLUG 4 PLUG FAILURE




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Glow Plug Module Glow Plug command on.
- **Set Condition:**
  The ECM detects a malfunction with a Glow Plug or a Glow Plug Control circuit.

| Possible Causes |
|---|
| GLOW PLUG |
| GLOW PLUG CONTROL CIRCUIT OPEN |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE |
| GLOW PLUG MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles leaving the ignition on for at least 10 seconds then off for 10 seconds.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. GLOW PLUG CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect each Glow Plug harness connector.

Disconnect the Glow Plug Module harness connector.

Measure the resistance of each Glow Plug Control circuit.

**Is the resistance below 10.0 ohms for each circuit?**

**Yes** >> Go To 3

**No** >> Repair the appropriate Glow Plug Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. GLOW PLUG CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect each Glow Plug harness connector.
Disconnect the Glow Plug Module harness connector.
Measure the resistance between ground and each Glow Plug Control circuit.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the appropriate Glow Plug Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. GLOW PLUG CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect each Glow Plug harness connector.
Disconnect the Glow Plug Module harness connector.
Turn the ignition on.
Measure the voltage of each Glow Plug Control circuit.

**Is the voltage below 1.0 volt for each circuit?**

**Yes** >> Go To 5

**No** >> Repair the appropriate Glow Plug Control circuit for a short to voltage
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG

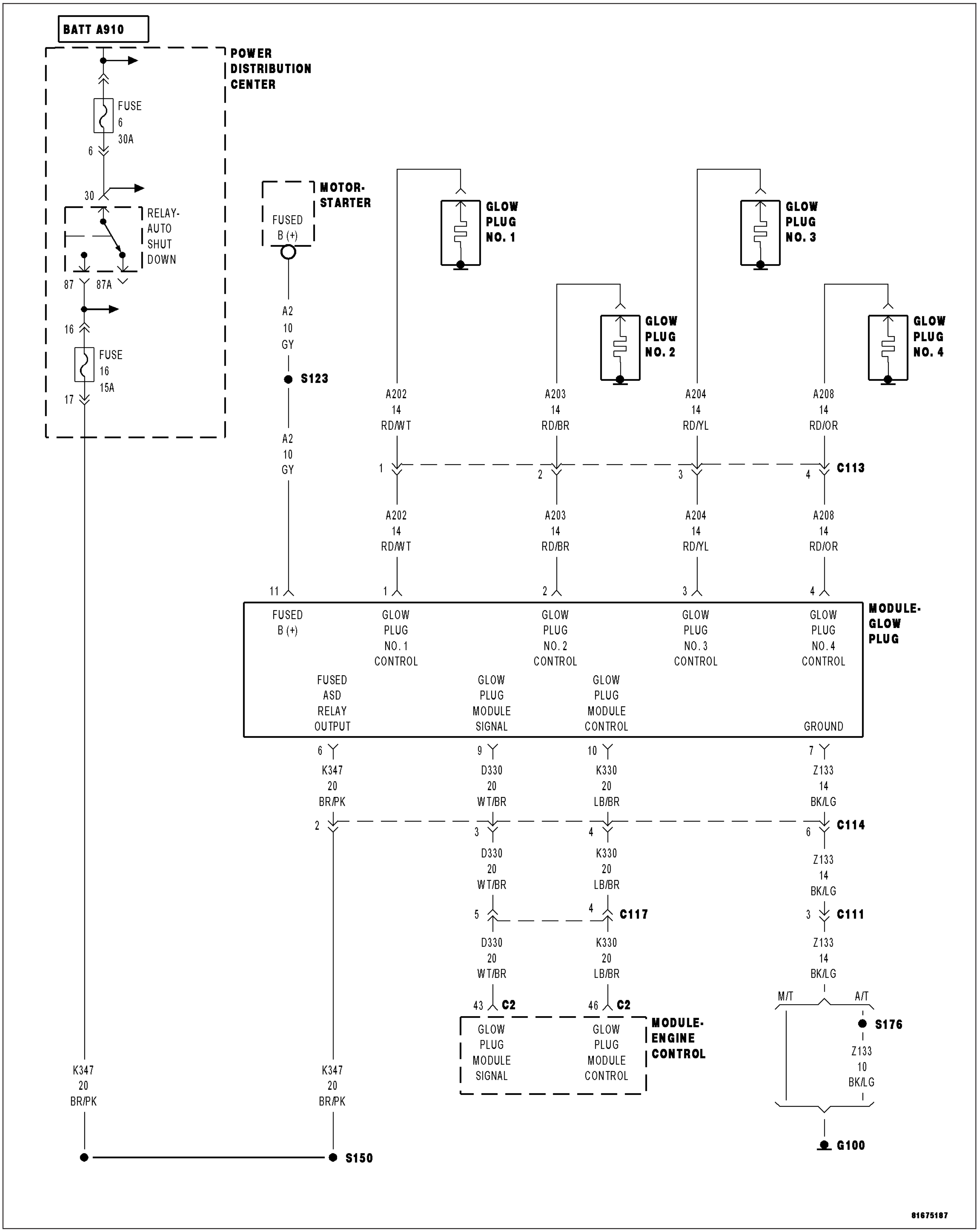
Turn the ignition off.
With the scan tool, erase ECM DTCs.
Refer to the Service Information and perform the Glow Plug Test on each Glow plug.

**Did each Glow Plug pass the test?**

**Yes** >> Replace the Glow Plug Module.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the appropriate Glow Plug in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0683-GLOW PLUG MODULE SIGNAL CIRCUIT MALFUNCTION




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects a malfunction on the Glow Plug Module Signal or Glow Plug Module Control circuit.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| GLOW PLUG MODULE |
| GLOW PLUG MODULE SIGNAL/CONTROL CIRCUIT OPEN |
| GLOW PLUG MODULE SIGNAL/CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG MODULE SIGNAL/CONTROL CIRCUIT SHORTED TO VOLTAGE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

Turn the ignition on and wait at least 90 seconds.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. GLOW PLUG MODULE SIG/CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Glow Plug Module Signal circuit.

Measure the resistance of the Glow Plug Module Control circuit.

**Is the resistance below 10.0 ohms for both measurements?**

**Yes** >> Go To 3

**No** >> Repair the Glow Plug Module circuit(s) that measured above 10.0 ohms for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. GLOW PLUG MODULE SIG/CONTROLCIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the Glow Plug Module harness connectors.
Disconnect the ECM harness connectors.
Measure the resistance between ground and the Glow Plug Module Signal circuit.
Measure the resistance between ground and the Glow Plug Module Control circuit.

**Is the resistance above 1000 ohms for both measurements?**

**Yes** >> Go To 4

**No** >> Repair the Glow Plug Module circuit(s) that measured below 1000 ohms for a short to ground. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. GLOW PLUG MODULE SIG/CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the Glow Plug Module harness connectors.
Disconnect the ECM harness connectors.
Remove the ASD Relay.
Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.
Measure the voltage of the Glow Plug Module Signal circuit.
Measure the voltage of the Glow Plug Module Control circuit.

**Is the voltage below 1.0 volt for both measurements?**

**Yes** >> Go To 5

**No** >> Repair the Glow Plug Module circuit(s) that measured above 1.0 volt for a short to voltage. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG CONTROL MODULE

Turn the ignition off.
Replace the Glow Plug Module in accordance with the Service Information.
Reconnect all connectors.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P0685-ASD RELAY CONTROL CIRCUIT SHUTS OFF TOO EARLY

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  During after-run.
- **Set Condition:**
  The internal ECM timer determines that the ASD Relay has shut off before the AFTER-RUN mode of operation has been completed.

| Possible Causes |
|---|
| CHECK FOR OTHER DTCS |
| INTERMITTENT CONDITION |
| SUBSTITUTE ASD RELAY |
| ASD RELAY CONTROL CIRCUIT OPEN INTERMITTENTLY |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR OTHER DTCS

Turn the ignition on.

With the scan tool, check for additional DTCs.

**Are other DTCs present?**

**Yes** >> Refer to the Symptom List for diagnosis of the other DTCs before continuing.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CLEAR CODE AND CHECK IF THE DTC RESETS

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition key cycles, pausing for at least 20 seconds between each cycle.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. ASD RELAY

Turn the ignition off.
Install a substitute relay in place of the ASD Relay.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Perform several ignition key cycles, pausing for at least 10 seconds between each cycle.
Turn the ignition on.
With the scan tool, read ECM DTCs.

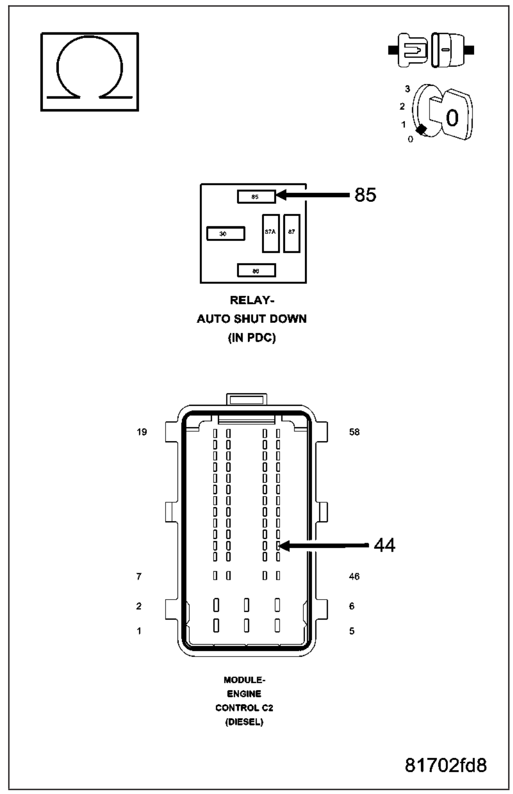
**Did this DTC set again?**

**Yes** >> Go To 4

**No** >> Replace the ASD Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. ASD RELAY CONTROL CIRCUIT OPEN INTERMITTENTLY

Turn the ignition off.
Remove the ASD Relay from the PDC.
Disconnect the ECM harness connectors.
Measure the resistance of the ASD Relay Control circuit while wiggling the wiring harness and connectors between the ECM and the PDC.




**Was the resistance above 10.0 ohms at any time while wiggling the wiring harness and connectors?**

**Yes** >> Repair the ASD Relay Control circuit for an intermittent open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P0685-ASD RELAY CONTROL CIRCUIT SHUTS OFF TOO LATE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  During after-run.
- **Set Condition:**
  The internal ECM timer determines that the ASD Relay did not shut off after the AFTER-RUN mode of operation has been completed.

| Possible Causes |
|---|
| CHECK FOR OTHER DTCS |
| INTERMITTENT CONDITION |
| SUBSTITUTE ASD RELAY |
| ASD RELAY CONTROL CIRCUIT OPEN INTERMITTENTLY |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR OTHER DTCS

Turn the ignition on.

With the scan tool, check for additional DTCs.

**Are other DTCs present?**

**Yes** >> Refer to the Symptom List for diagnosis of the other DTCs before continuing.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CLEAR CODE AND CHECK IF THE DTC RESETS

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition key cycles, pausing for at least 20 seconds between each cycle.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. ASD RELAY

Turn the ignition off.
Install a substitute relay in place of the ASD Relay.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Perform several ignition key cycles, pausing for at least 10 seconds between each cycle.
Turn the ignition on.
With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 4

**No** >> Replace the ASD Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

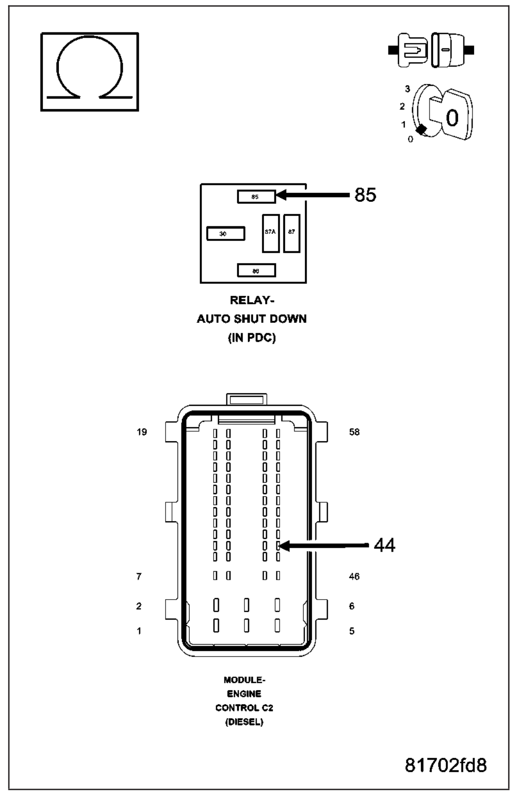
## 4. ASD RELAY CONTROL CIRCUIT OPEN INTERMITTENTLY

Turn the ignition off.
Remove the ASD Relay from the PDC.
Disconnect the ECM harness connectors.
Measure the resistance of the ASD Relay Control circuit while wiggling the wiring harness and connectors between the ECM and the PDC.

**Was the resistance above 10.0 ohms at any time while wiggling the wiring harness and connectors?**

**Yes** >> Repair the ASD Relay Control circuit for an intermittent open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



# P0686-ECM VOLTAGE ERROR LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on or the engine running.
- **Set Condition:**
  The ECM detects low battery voltage.

| Possible Causes |
| --- |
| CHECKING ECM POWER AND GROUNDS |
| ECM |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

**NOTE: This DTC may be caused by a charging system problem. Refer to the Service Information and verify proper charging system operation before continuing.**

Test drive the vehicle.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECK POWER AND GROUNDS

Refer to the symptom list and perform the Checking the ECM Power and Ground test.

**Were any problem found with the ECM powers and grounds?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0687-ECM VOLTAGE ERROR HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on or the engine running.
- **Set Condition:**
  The ECM detects high battery voltage.

| Possible Causes |
|---|
| CHECKING ECM POWER AND GROUNDS |
| ECM |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

**NOTE: This DTC may be caused by a charging system problem. Refer to the Service Information and verify proper charging system operation before continuing.**

Test drive the vehicle.

Turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECK POWER AND GROUNDS

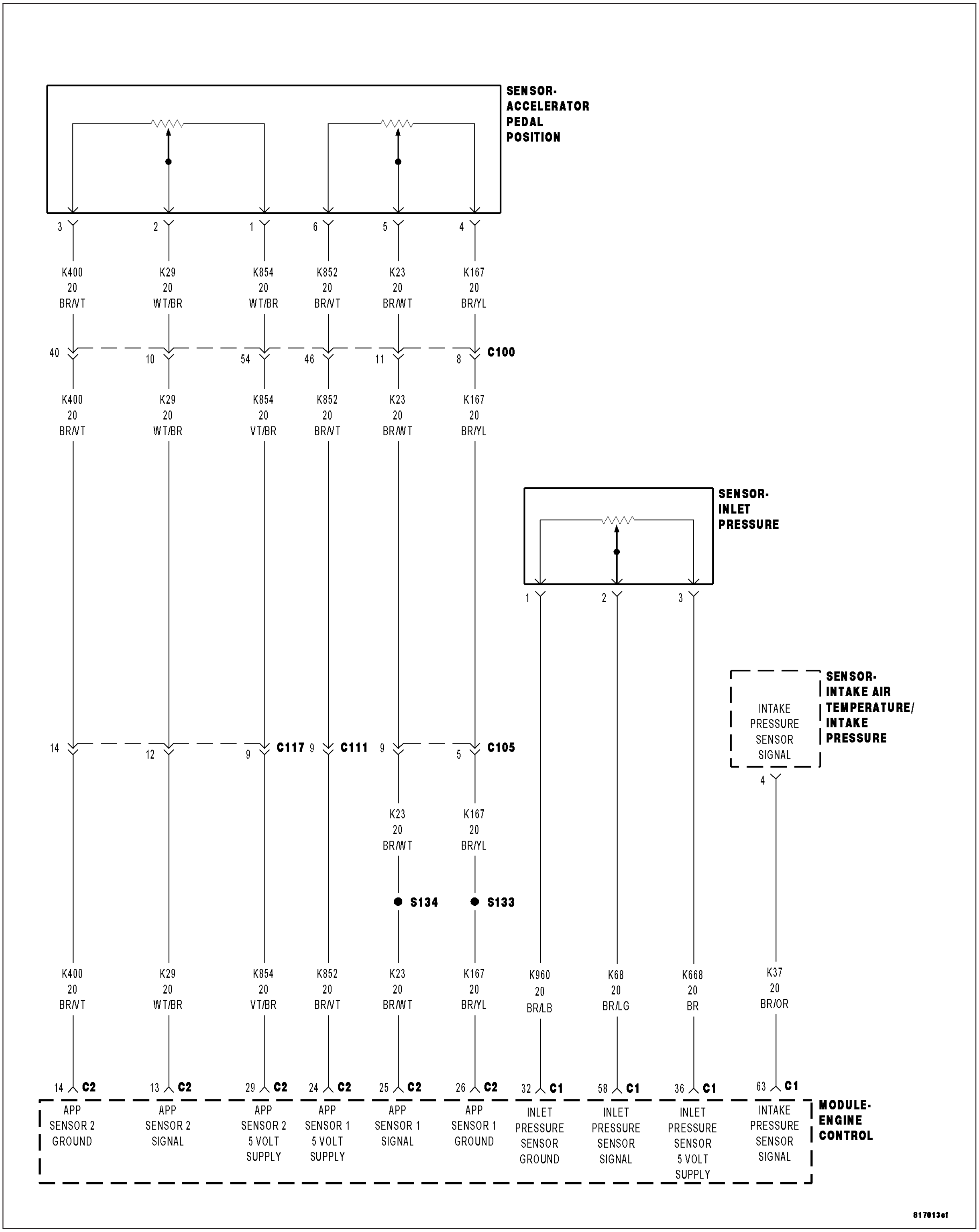
Refer to the symptom list and perform the Checking the ECM Power and Ground test.

**Were any problem found with the ECM powers and grounds?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0697-SENSOR SUPPLY 3 VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects low voltage for 0.1 second on the Sensor Supply #3 circuit which supplies 5-volts to the Inlet Pressure Sensor and the APP Sensor #2.

| Possible Causes |
|---|
| WIRING INSPECTION |
| INTERMITTENT CONDITION |
| 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| ACCELERATOR PEDAL POSITION SENSOR |
| INLET PRESSURE SENSOR |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off for 10 seconds.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. ACCELERATOR PEDAL POSITION SENSOR SHORTED TO GROUND

Ensure all connectors are reconnected.

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Turn the ignition on.

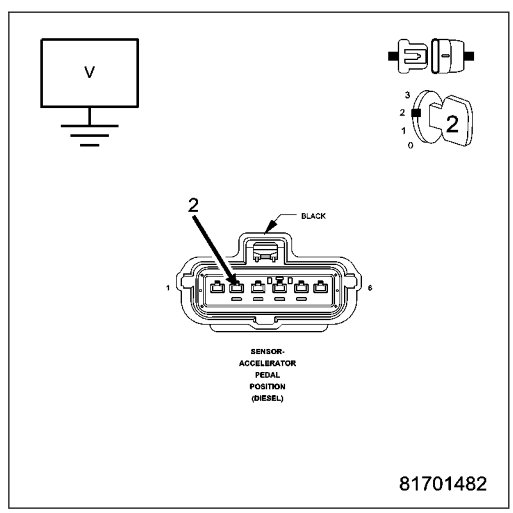
Measure the voltage of the APP Sensor #2 5-Volt Supply circuit.

**Is the voltage below 4.6 volts?**

**Yes** >> Replace the Accelerator Pedal Position Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3



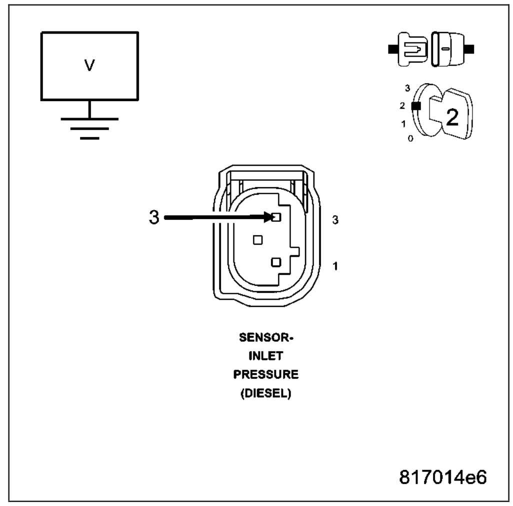
## 3. INLET PRESSURE SENSOR SHORTED TO GROUND

Turn the ignition off.

Disconnect the Inlet Pressure Sensor harness connector.

Turn the ignition on.

Measure the voltage of the Inlet Pressure Sensor 5-Volt Supply circuit.




**Is the voltage below 4.6 volts?**

**Yes** >> Replace the Inlet Pressure Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

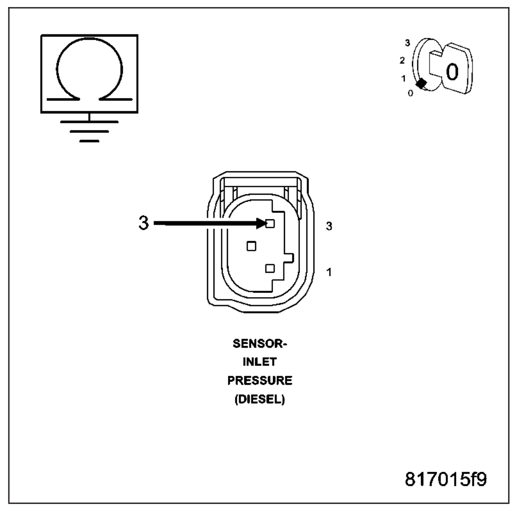
Turn the ignition off.

Disconnect the Inlet Pressure Sensor harness connector.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Inlet Pressure Sensor 5-Volt Supply circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the 5-Volt Supply circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. WIRING INSPECTION

Turn the ignition off.

Inspect the Inlet Pressure Sensor 5-Volt supply circuit between the Inlet Pressure Sensor harness connector and the ECM harness connector for possible shorts to other circuits.

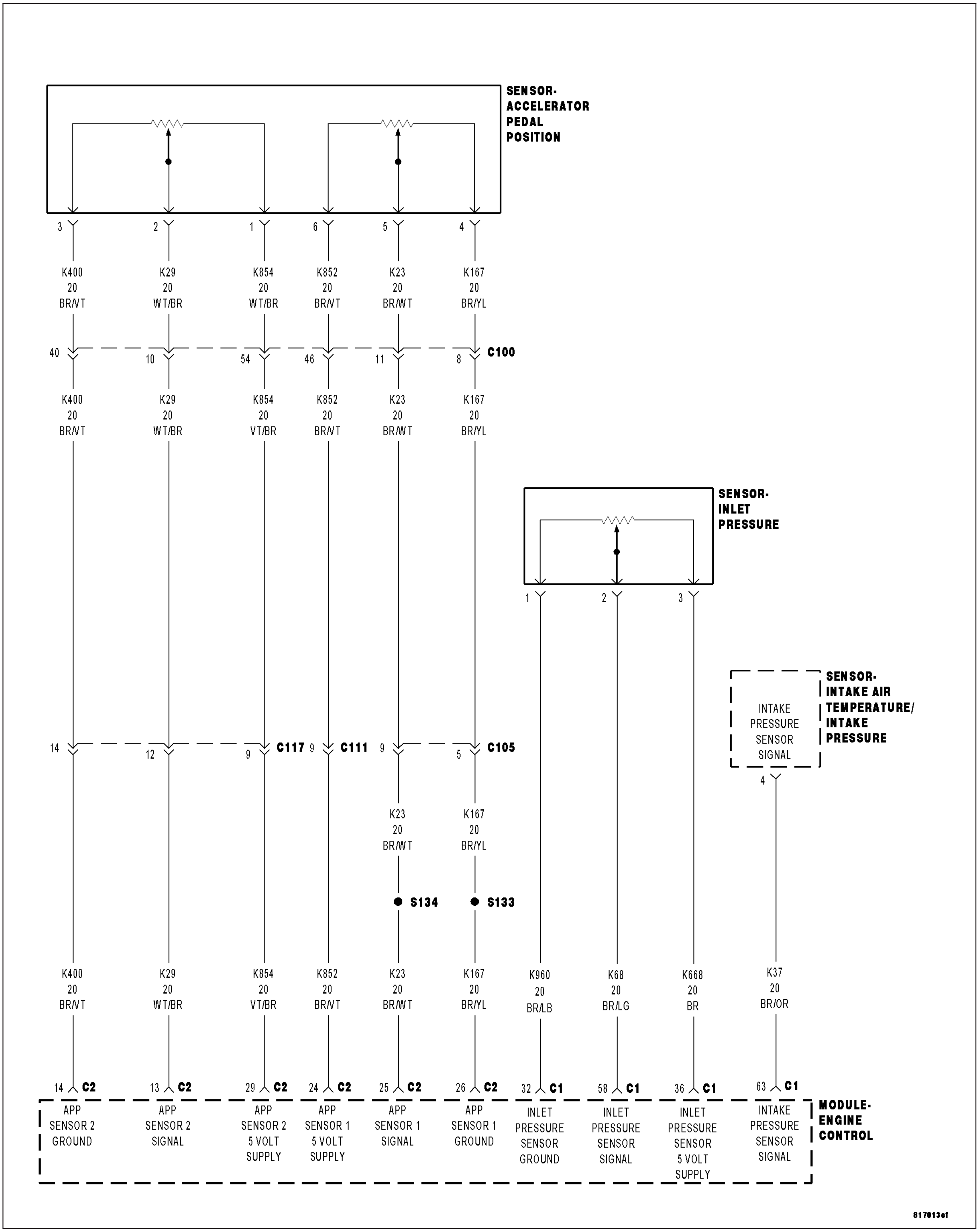
Inspect the APP Sensor #1 5-Volt supply circuit between the APP Sensor harness connector and the ECM harness connector for possible shorts to other circuits.

**Were any problems found?**

**Yes** >> Repair shorted circuit as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0697-SENSOR SUPPLY 3 VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects a short to voltage for 0.1 second on the Sensor Supply #3 circuit which supplies 5-volts to the Inlet Pressure Sensor and the APP Sensor #2.

| Possible Causes |
|---|
| WIRING INSPECTION |
| INTERMITTENT CONDITION |
| APP SENSOR #2 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |
| INLET PRESSURE SENSOR 5 VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off for 10 seconds.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

**Did this DTC reset?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. APP #2 SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Accelerator Pedal Position Sensor harness connector.

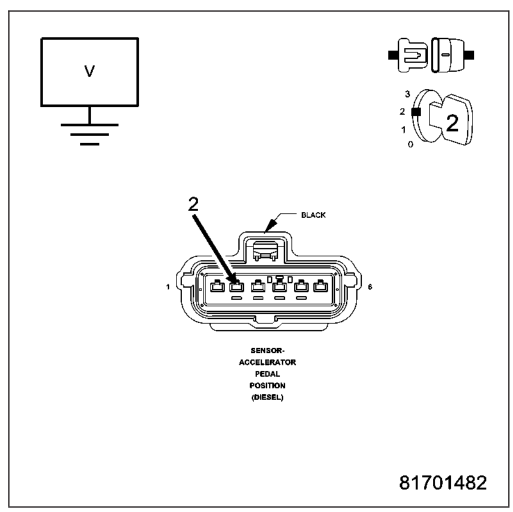
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage on the Accelerator Pedal Position Sensor #2 5-Volt Supply circuit.




**NOTE: Remove the jumper wire and reinstall the ASD Relay.**

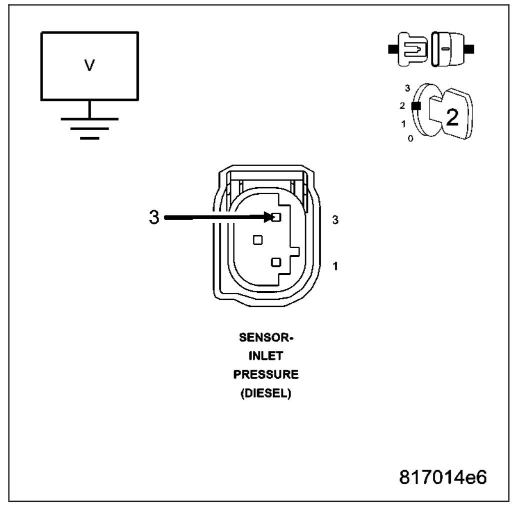
**Is the voltage below 1.0 volt?**

**Yes** >> Go To 3

**No** >> Repair the APP #2 5-Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. INLET PRESSURE SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the Inlet Pressure Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage on the Inlet Pressure Sensor 5-Volt Supply circuit.

**NOTE: Remove the jumper wire and reinstall the ASD Relay.**

**Is the voltage below 1.0 volt?**

**Yes** >> Go To 4

**No** >> Repair the Inlet Pressure Sensor 5-Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. WIRING INSPECTION

Turn the ignition off.

Inspect the Inlet Pressure Sensor 5-Volt supply circuit between the Inlet Pressure Sensor harness connector and the ECM harness connector for possible shorts to other circuits.

Inspect the APP Sensor #2 5-Volt supply circuit between the APP Sensor harness connector and the ECM harness connector for possible shorts to other circuits.

**Were any problems found?**

**Yes** >> Repair shorted circuit as necessary.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P0700-TCM DTC

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM recieves a CAN Bus message indicating the presence of a DTC in the TCM.

| Possible Causes |
|---|
| VERIFY CURRENT DTC |

## Diagnostic Test

### 1. VERIFY CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: This code was set in the ECM by the Transmission Control Module to indicate a transmission fault. Diagnosis of transmission faults should be done using the Transmission Diagnostic Information.**

**NOTE: When repairs have been completed, the ECM and TCM must have codes cleared.**

Turn the ignition on.

With the scan tool, erase ECM DTCs only.

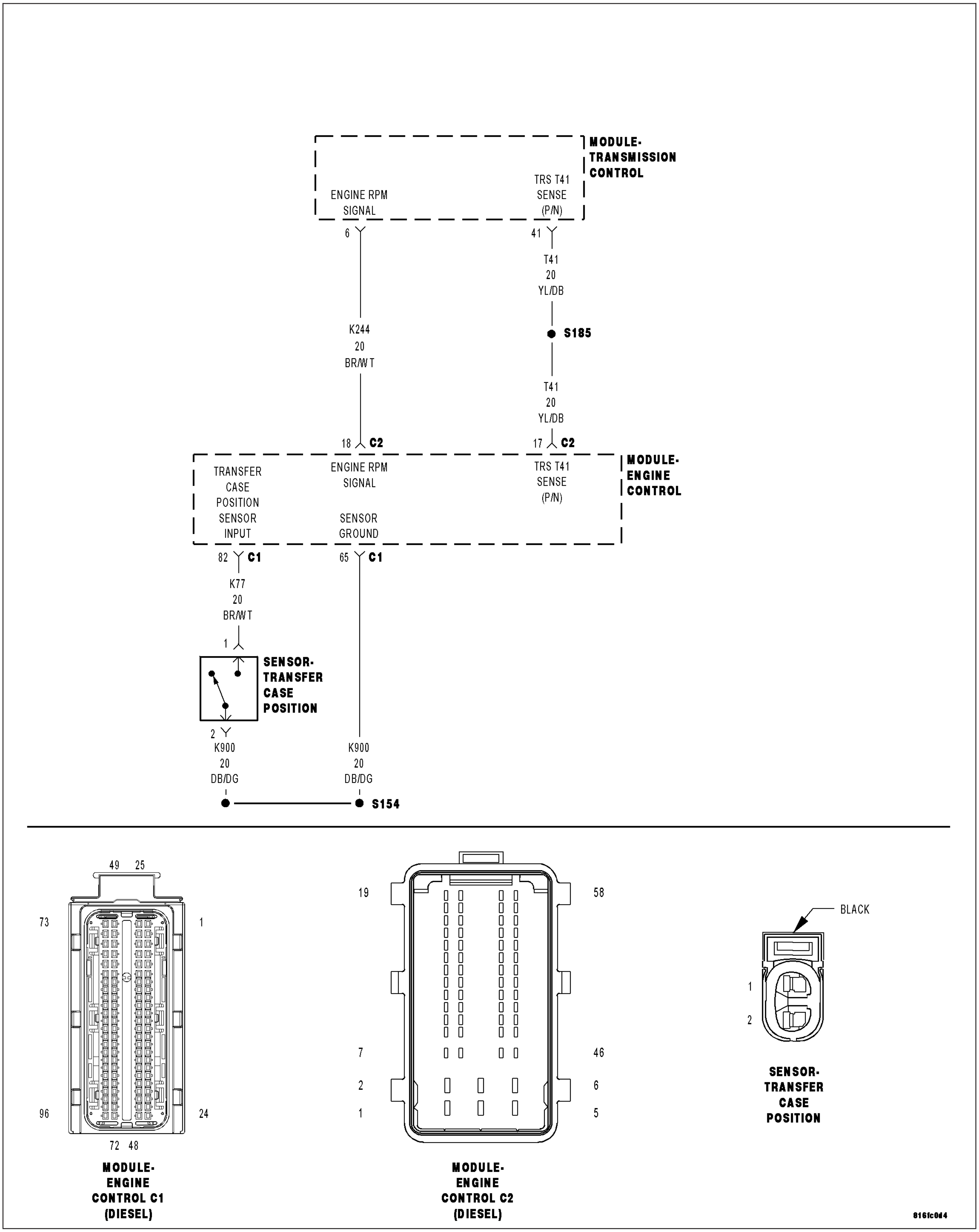
With the scan tool, read ECM DTCs.

**Are there any TCM DTCs present in the ECM?**

**Yes** >> Refer to Transmission Diagnostic Information for the related symptom(s).
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P0836-TRANSFER CASE POSITION SENSOR PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on. No other T-Case Position Sensor DTC's present.
- **Set Condition:**
  The ECM detects a voltage signal from the transfer case switch that does not fall into a valid switch position voltage range.

| Possible Causes |
|---|
| TRANSFER CASE POSITION SENSOR |
| INTERMITTENT WIRING AND CONNECTORS |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT OPEN |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO GROUND |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO SENSOR GROUND CIRCUIT |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: The vehicle speedometer must be operational for the result of this test to be valid.**

With the scan tool, record and erase DTCs.

Start the engine and cycle the Transfer Case through all positions.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 2

**No** >> Go To 7

### 2. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

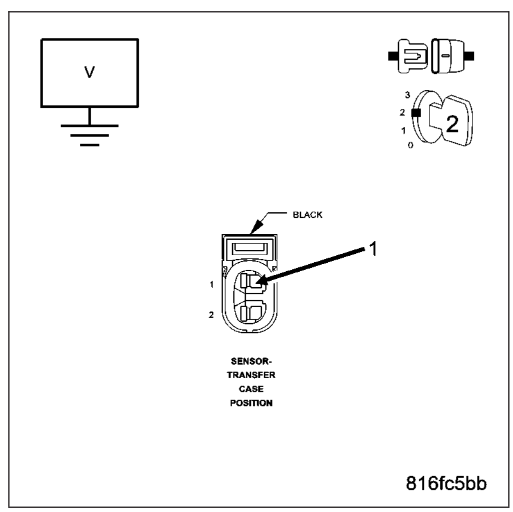
Disconnect the Transfer Case Position Sensor harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavities 30 and 87 of the ASD Relay connector in the PDC.

Turn the ignition on.

Measure the voltage of the Transfer Case Position Sensor Signal circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Transfer Case Position Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

Disconnect the Transfer Case Position Sensor harness connector.

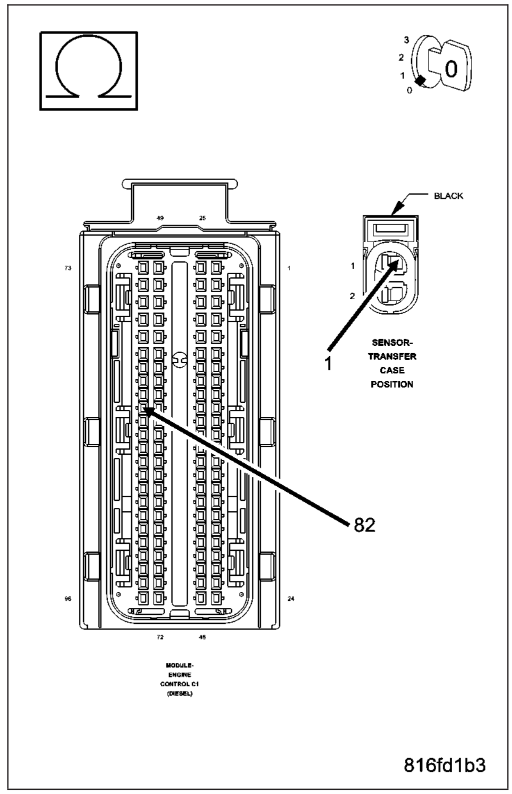
Measure the resistance of the Transfer Case Position Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Transfer Case Position Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 4. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

Disconnect the Transfer Case Position Sensor harness connector.

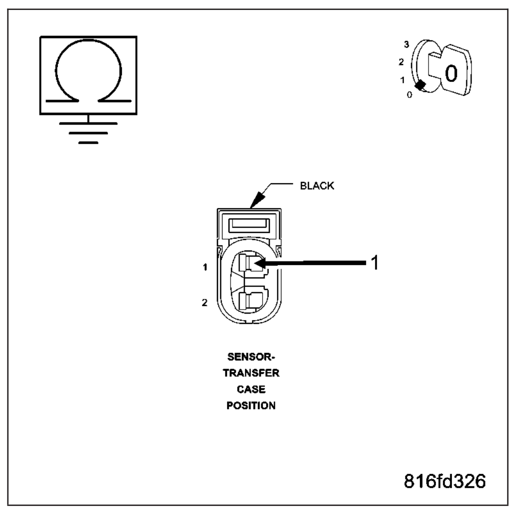
Measure the resistance between ground and the Transfer Case Position Sensor Signal circuit.

**Is the resistance below 1000.0 ohms?**

**Yes** >> Repair the Transfer Case Position Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5



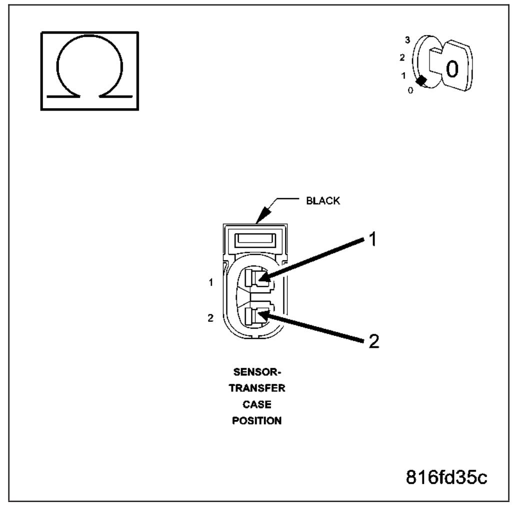
## 5. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO SENSOR RETURN CIRCUIT

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

Disconnect the Transfer Case Position Sensor harness connector.

Measure the resistance between the Transfer Case Position Sensor circuit and the Sensor Ground circuit.




**Is the resistance below 1000.0 ohms?**

**Yes** >> Repair the Transfer Case Position Sensor Signal circuit for a short to the Sensor Ground circuit.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. TRANSFER CASE POSITION SENSOR

Reconnect the ECM harness connectors.

Reconnect the Transfer Case Position Sensor harness connector.

Turn the ignition on.

With the scan tool read the T-case Sensor

Observe the T-case volts on the scan tool while moving the transfer case selector lever in each of the transfer case positions.

**NOTE: When shifting the transfer case selector to each position, the Sensor voltage should result in the following voltages: 2WD 2.64 - 2.80, 4WD Part Time 1.96 - 2.12, 4WD Full Time 1.39 - 1.55, Neutral 0.80 - 0.96, 4WD Low 0.21 - 0.37,**

**Does each position provide the correct voltage?**

**Yes** >> Replace and program the ECM in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Transfer Case Position Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

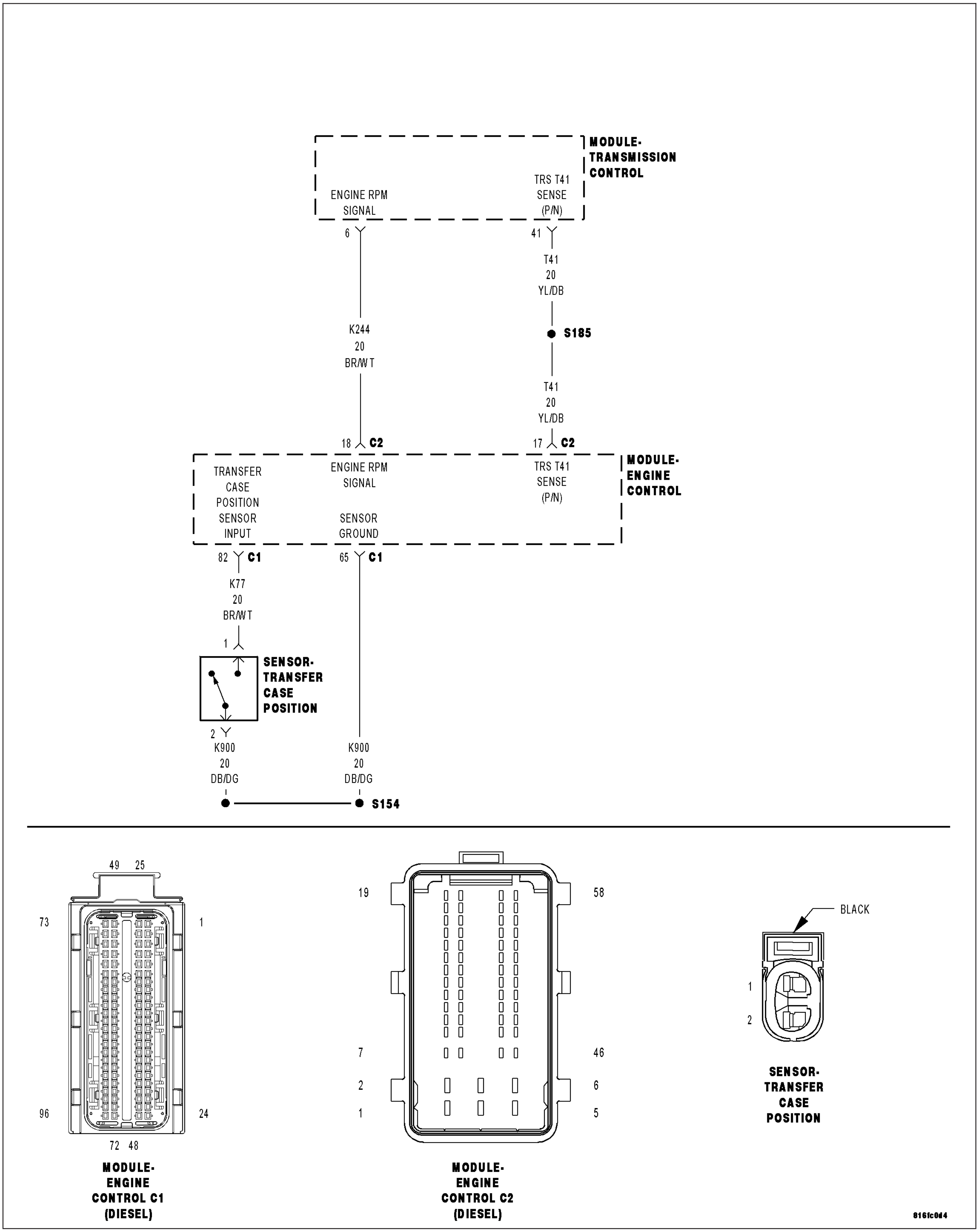
Wiggle the wiring while checking for shorts and open circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P0836-TRANSFER CASE POSITION SIGNAL VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on. No other T-Case Position Sensor DTC's present.
- **Set Condition:**
  The Transfer Case Position Sensor Signal is below 0.14 for 0.5 second.

| Possible Causes |
|---|
| TRANSFER CASE POSITION SENSOR |
| INTERMITTENT WIRING AND CONNECTORS |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT OPEN |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO GROUND |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO SENSOR GROUND CIRCUIT |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the DRB at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: The vehicle speedometer must be operational for the result of this test to be valid.**

With the DRBIII®, record and erase DTCs.

Start the engine and cycle the Transfer Case through all positions.

With the DRBIII®, read the ECM DTCs.

**Does the DRBIII® display this DTC?**

**Yes** >> Go To 2

**No** >> Go To 7

### 2. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

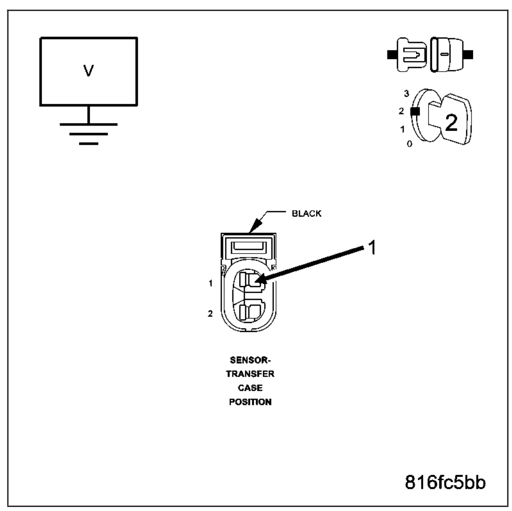
Disconnect the Transfer Case Position Sensor harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavities 30 and 87 of the ASD Relay connector in the PDC.

Turn the ignition on.

Measure the voltage of the Transfer Case Position Sensor Signal circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Transfer Case Position Sensor Signal circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

Disconnect the Transfer Case Position Sensor harness connector.

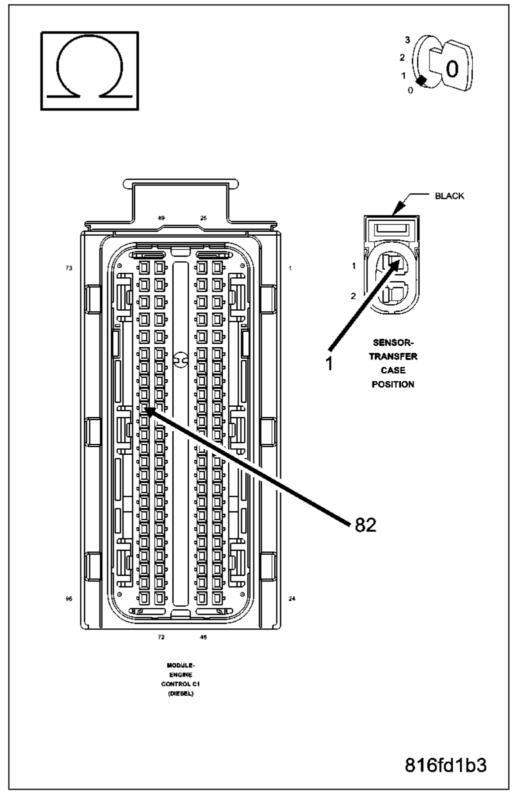
Measure the resistance of the Transfer Case Position Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Transfer Case Position Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 4. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

Disconnect the Transfer Case Position Sensor harness connector.

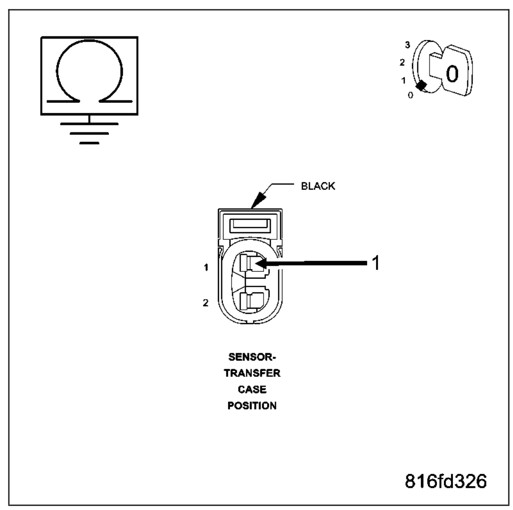
Measure the resistance between ground and the Transfer Case Position Sensor Signal circuit.

**Is the resistance below 1000.0 ohms?**

**Yes** >> Repair the Transfer Case Position Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5



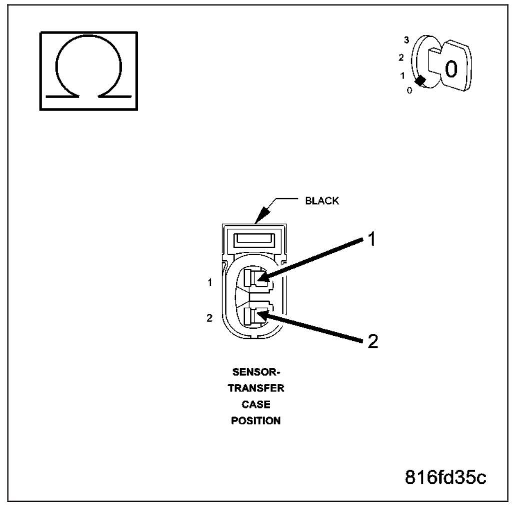
## 5. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO SENSOR RETURN CIRCUIT

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

Disconnect the Transfer Case Position Sensor harness connector.

Measure the resistance between the Transfer Case Position Sensor circuit and the Sensor Ground circuit.




**Is the resistance below 1000.0 ohms?**

**Yes** >> Repair the Transfer Case Position Sensor Signal circuit for a short to the Sensor Ground circuit.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. TRANSFER CASE POSITION SENSOR

Reconnect the ECM harness connectors.

Reconnect the Transfer Case Position Sensor harness connector.

Turn the ignition on.

With the DRBIII® read the T-case Sensor

Observe the T-case volts on the DRB while moving the transfer case selector lever in each of the transfer case positions.

**NOTE: When shifting the transfer case selector to each position, the Sensor voltage should result in the following voltages: 2WD 2.64 - 2.80, 4WD Part Time 1.96 - 2.12, 4WD Full Time 1.39 - 1.55, Neutral 0.80 - 0.96, 4WD Low 0.21 - 0.37,**

**Does each position provide the correct voltage?**

**Yes** >> Replace and program the ECM in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Transfer Case Position Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

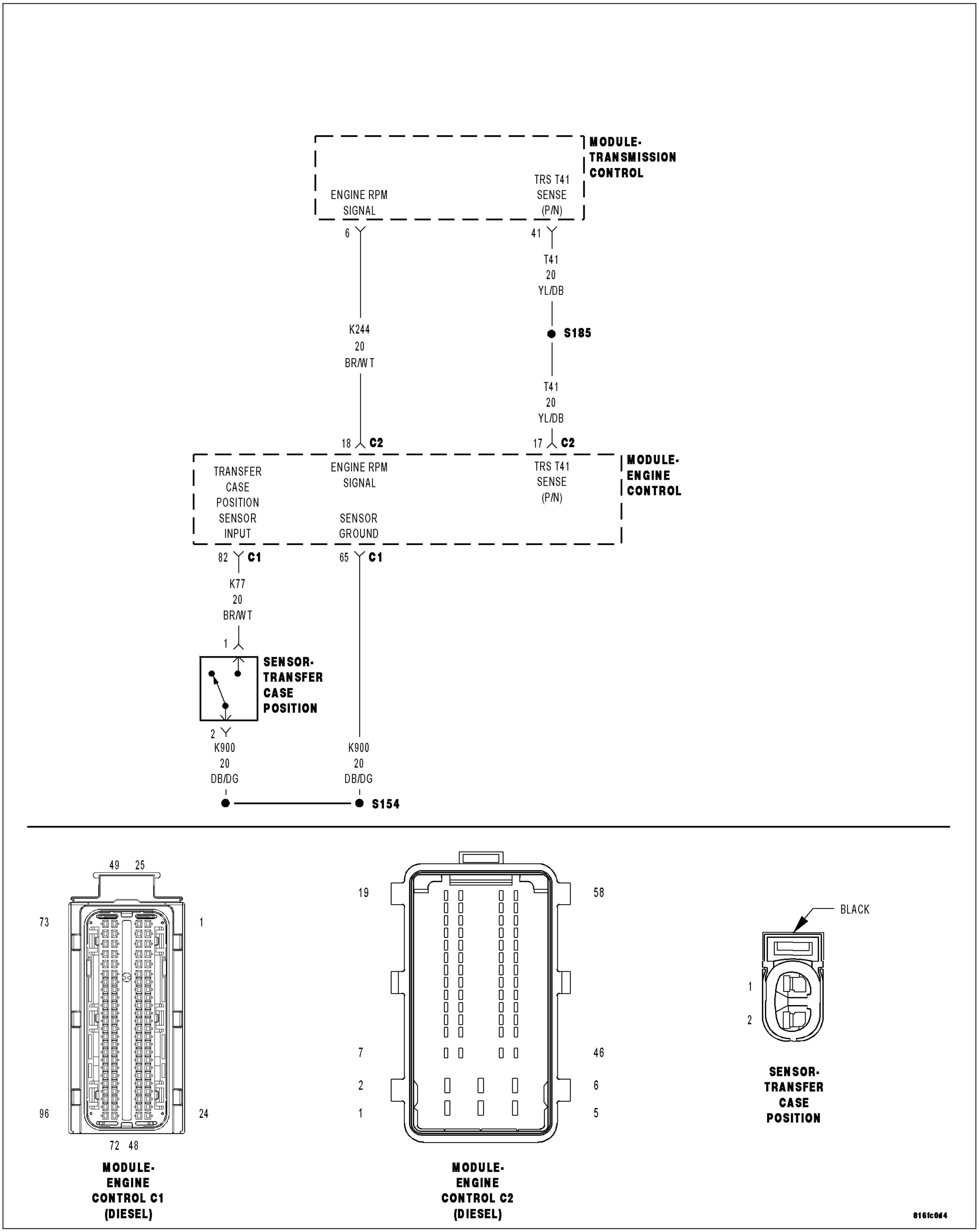
Wiggle the wiring while checking for shorts and open circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

# P0836-TRANSFER CASE POSITION SENSOR PLAUSIBILITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on. No other T-Case Position Sensor DTC's present.
- **Set Condition:**
  The ECM detects a voltage signal from the transfer case switch that does not fall into a valid switch position voltage range.

| Possible Causes |
|---|
| TRANSFER CASE POSITION SENSOR |
| INTERMITTENT WIRING AND CONNECTORS |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT OPEN |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO GROUND |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO SENSOR GROUND CIRCUIT |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the DRB at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: The vehicle speedometer must be operational for the result of this test to be valid.**

With the scan tool, record and erase DTCs.

Start the engine and cycle the Transfer Case through all positions.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 2

**No** >> Go To 7

### 2. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

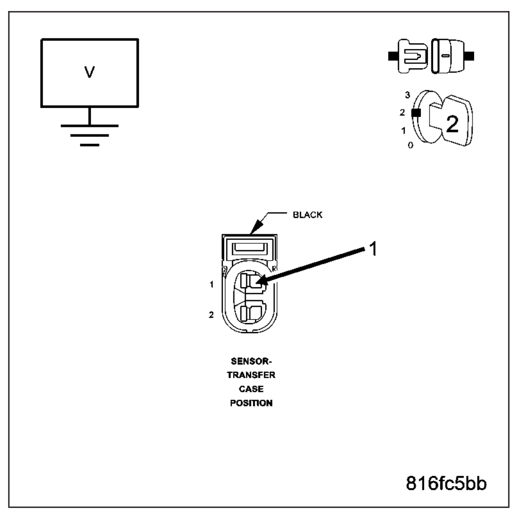
Disconnect the Transfer Case Position Sensor harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavities 30 and 87 of the ASD Relay connector in the PDC.

Turn the ignition on.

Measure the voltage of the Transfer Case Position Sensor Signal circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Transfer Case Position Sensor Signal circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

Disconnect the Transfer Case Position Sensor harness connector.

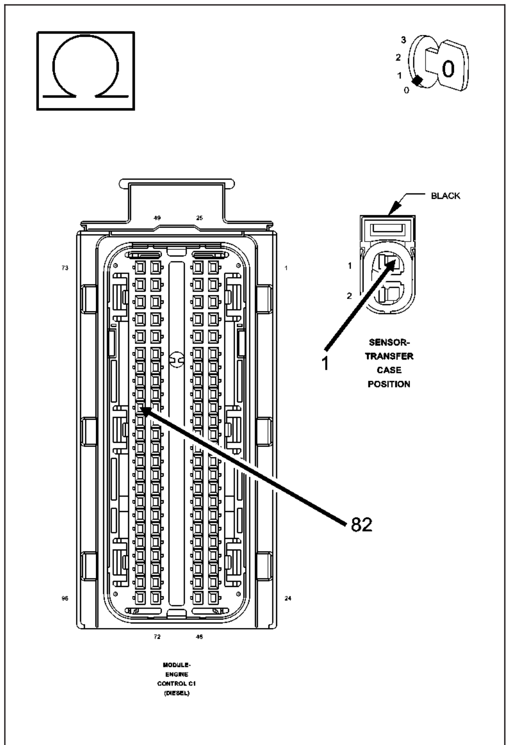
Measure the resistance of the Transfer Case Position Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Transfer Case Position Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



816fd1b3

## 4. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

Disconnect the Transfer Case Position Sensor harness connector.

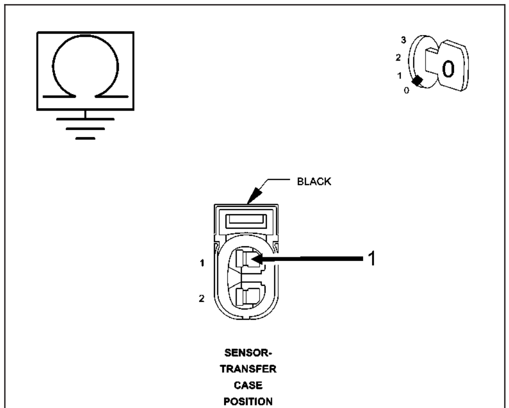
Measure the resistance between ground and the Transfer Case Position Sensor Signal circuit.

**Is the resistance below 1000.0 ohms?**

**Yes** >> Repair the Transfer Case Position Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5



816fd326

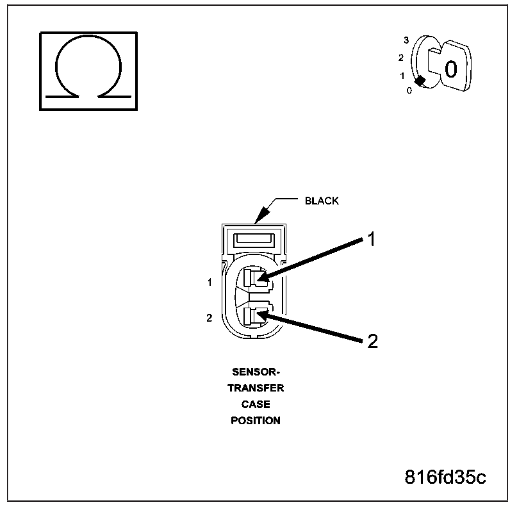
## 5. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO SENSOR RETURN CIRCUIT

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

Disconnect the Transfer Case Position Sensor harness connector.

Measure the resistance between the Transfer Case Position Sensor circuit and the Sensor Ground circuit.




**Is the resistance below 1000.0 ohms?**

**Yes** >> Repair the Transfer Case Position Sensor Signal circuit for a short to the Sensor Ground circuit.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. TRANSFER CASE POSITION SENSOR

Reconnect the ECM harness connectors.

Reconnect the Transfer Case Position Sensor harness connector.

Turn the ignition on.

Use the scan tool to read the T-case Sensor voltage.

Observe the T-case volts on the scan tool while moving the transfer case selector lever in each of the transfer case positions.

**NOTE: When shifting the transfer case selector to each position, the Sensor voltage should result in the following voltages: 2WD 2.64 - 2.80, 4WD Part Time 1.96 - 2.12, 4WD Full Time 1.39 - 1.55, Neutral 0.80 - 0.96, 4WD Low 0.21 - 0.37,**

**Does each position provide the correct voltage?**

**Yes** >> Replace and program the ECM in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Transfer Case Position Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

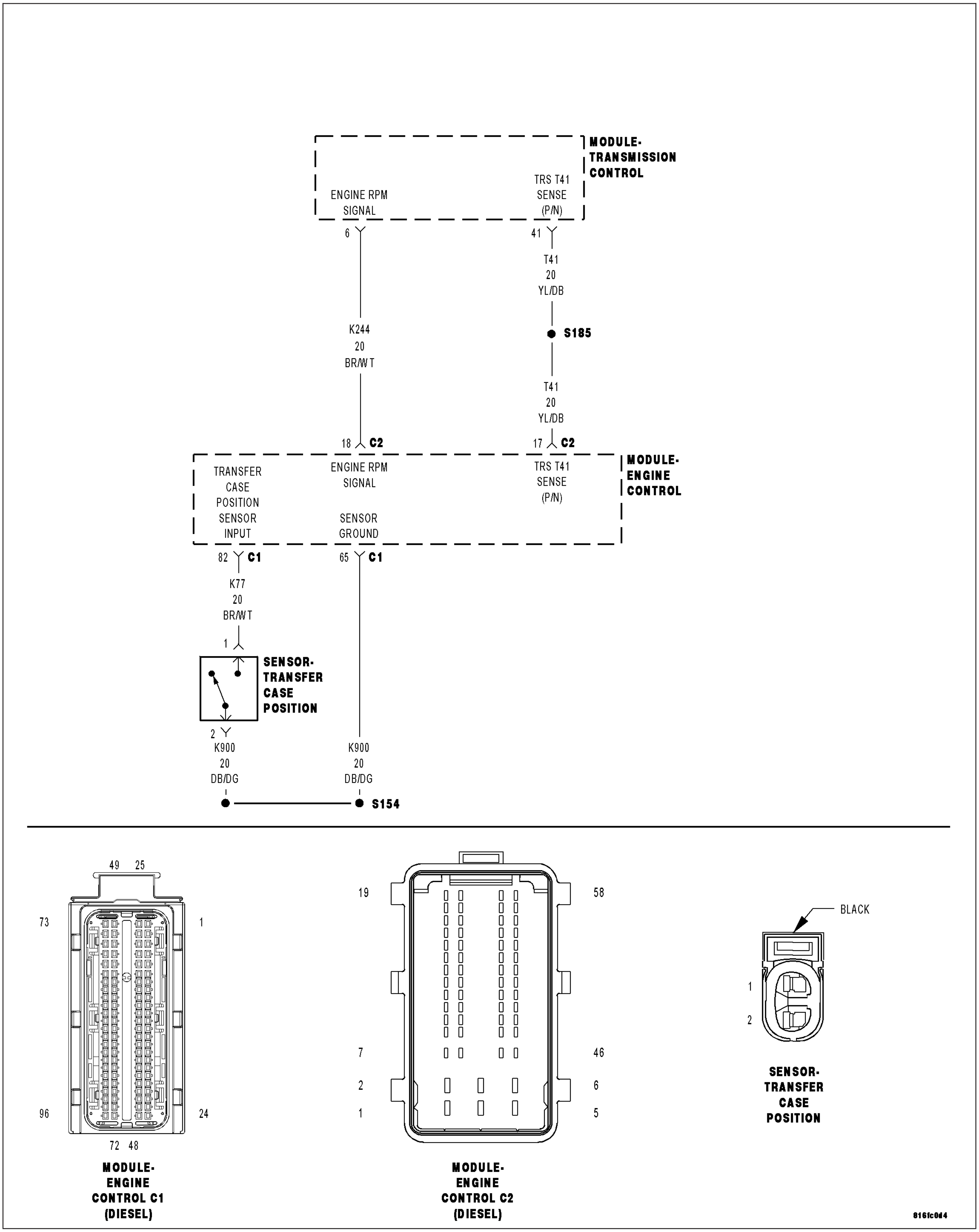
Wiggle the wiring while checking for shorts and open circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P0836-TRANSFER CASE POSITION SENSOR SIGNAL VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on. No other T-Case Position Sensor DTC's present.
- **Set Condition:**
  The Transfer Case Position Sensor Signal is above 4.8 volts for 0.5 second.

| Possible Causes |
|---|
| TRANSFER CASE POSITION SENSOR |
| INTERMITTENT WIRING AND CONNECTORS |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT OPEN |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO GROUND |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE |
| TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO SENSOR GROUND CIRCUIT |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECKING FOR CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the DRB at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: The vehicle speedometer must be operational for the result of this test to be valid.**

With the scan tool, record and erase DTCs.

Start the engine and cycle the Transfer Case through all positions.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 2

**No** >> Go To 7

### 2. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

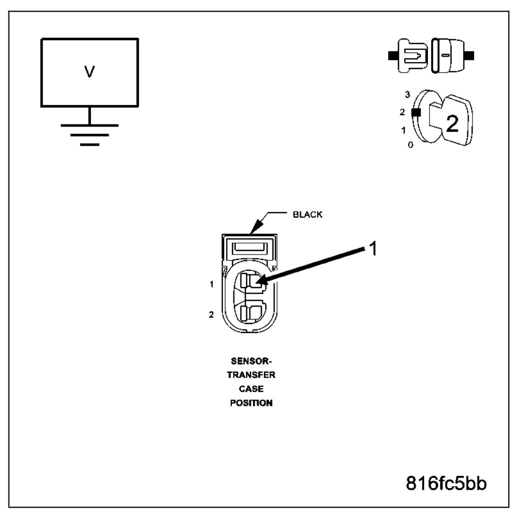
Disconnect the Transfer Case Position Sensor harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavities 30 and 87 of the ASD Relay connector in the PDC.

Turn the ignition on.

Measure the voltage of the Transfer Case Position Sensor Signal circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Transfer Case Position Sensor Signal circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

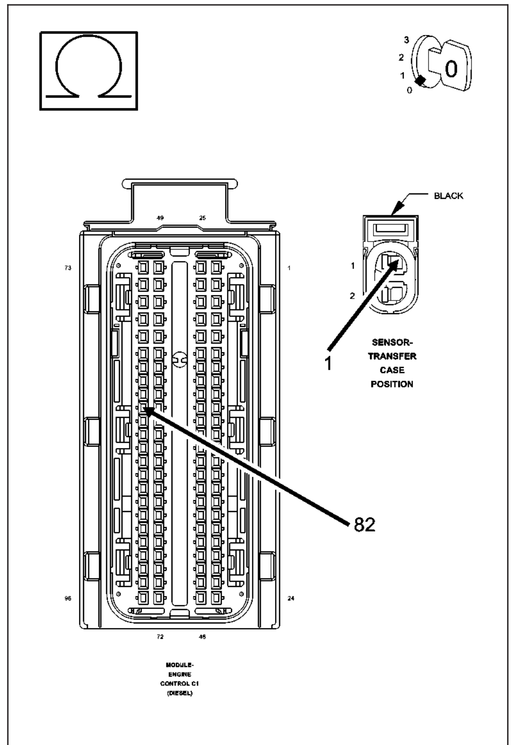
## 3. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

Disconnect the Transfer Case Position Sensor harness connector.

Measure the resistance of the Transfer Case Position Sensor Signal circuit.



816fd1b3

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Transfer Case Position Sensor Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

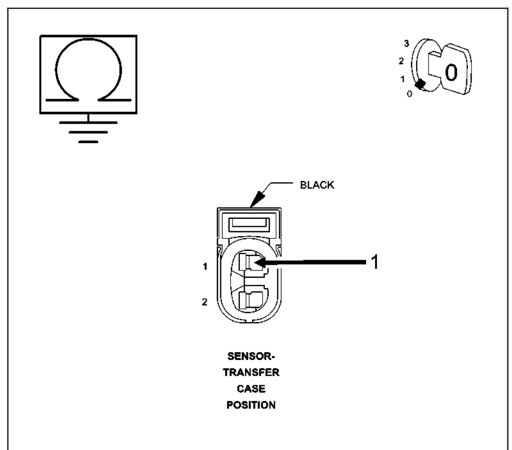
## 4. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

Disconnect the Transfer Case Position Sensor harness connector.

Measure the resistance between ground and the Transfer Case Position Sensor Signal circuit.



816fd326

**Is the resistance below 1000.0 ohms?**

**Yes** >> Repair the Transfer Case Position Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

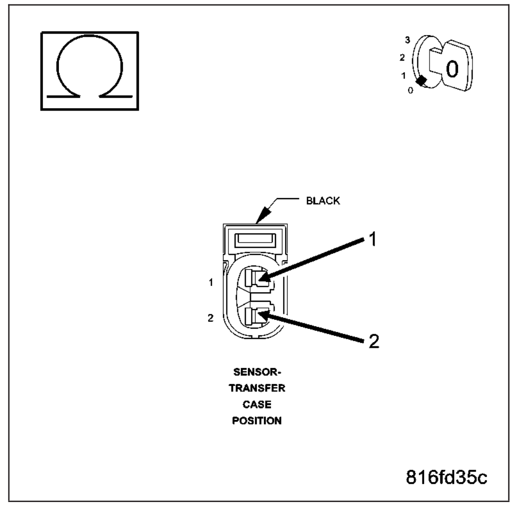
## 5. TRANSFER CASE POSITION SENSOR SIGNAL CIRCUIT SHORT TO SENSOR RETURN CIRCUIT

Turn the ignition off to the lock position.

Disconnect the ECM harness connectors.

Disconnect the Transfer Case Position Sensor harness connector.

Measure the resistance between the Transfer Case Position Sensor circuit and the Sensor Ground circuit.




**Is the resistance below 1000.0 ohms?**

**Yes** >> Repair the Transfer Case Position Sensor Signal circuit for a short to the Sensor Ground circuit.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. TRANSFER CASE POSITION SENSOR

Turn the ignition on.

With the scan tool read the T-case Sensor

Observe the T-case volts on the scan tool while moving the transfer case selector lever in each of the transfer case positions.

**NOTE: When shifting the transfer case selector to each position, the Sensor voltage should result in the following voltages: 2WD 2.64 - 2.80, 4WD Part Time 1.96 - 2.12, 4WD Full Time 1.39 - 1.55, Neutral 0.80 - 0.96, 4WD Low 0.21 - 0.37,**

**Does each position provide the correct voltage?**

**Yes** >> Replace and program the ECM in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Transfer Case Position Sensor.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

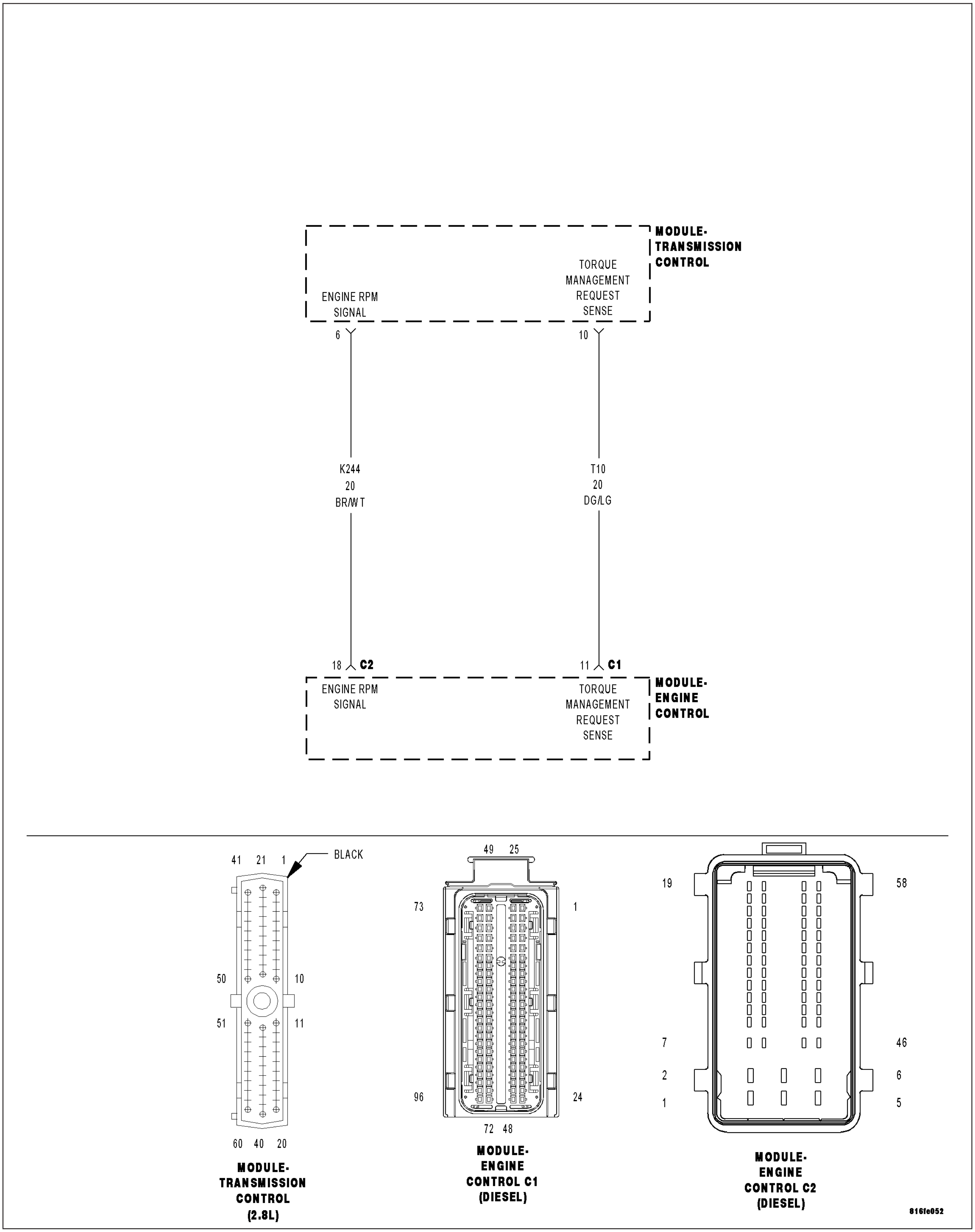
Wiggle the wiring while checking for shorts and open circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P0864-TCM TORQUE REDUCTION SIGNAL ERROR




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM detects a malfunction on the Torque Management Request Signal circuit.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| TORQUE MANAGEMENT REQUEST SIGNAL CIRCUIT OPEN |
| TORQUE MANAGEMENT REQUEST SIGNAL CIRCUIT SHORTED TO GROUND |
| TORQUE MANAGEMENT REQUEST SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| TRANSMISSION CONTROL MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECKING THE TORQUE MANAGEMENT REQUEST SIGNAL

Turn the ignition off.

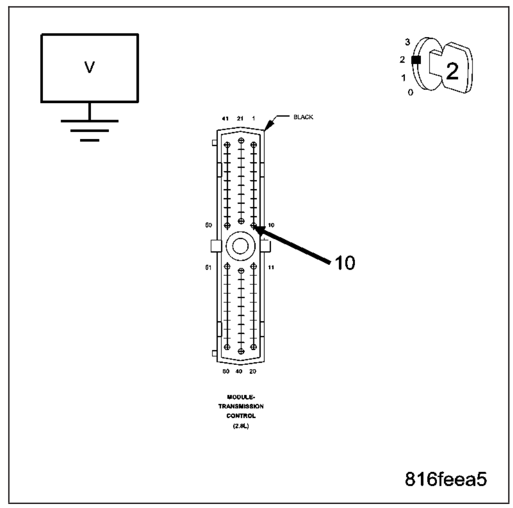
Disconnect the TCM harness connectors.

Turn the ignition on.

Measure the voltage of the Torque Management Request Signal circuit at the TCM harness connector.

While monitoring the voltmeter wiggle the Torque Management Signal wiring and connectors between the ECM and TCM harness connectors.

**Is the voltage steady between 4.5 and 5.5 volts while wiggling the wiring and connectors?**




**Yes** >> Go To 2

**No** >> Go To 3

### 2. TRANSMISSION CONTROL MODULE

Turn the ignition off.

Reconnect all connectors.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle.

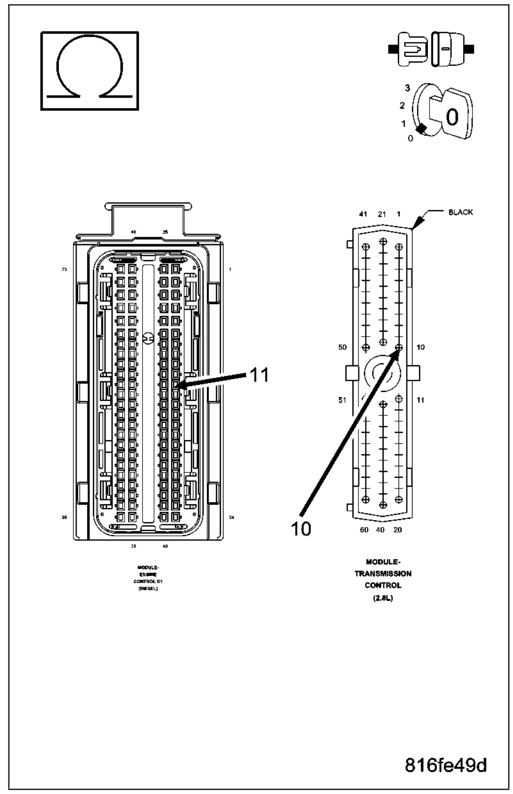
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Transmission Control Module in accordance with the Service Information. Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 3. TORQUE MANAGEMENT REQUEST SIGNAL CIRCUIT OPEN




Turn the ignition off.

Disconnect the TCM harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Torque Management Request Signal circuit.

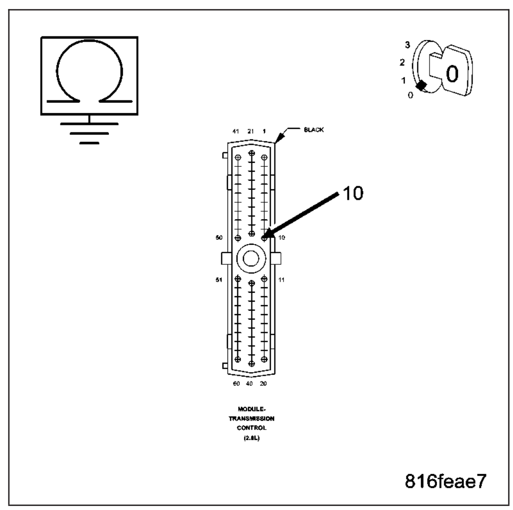
**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Torque Management Request Signal circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. TORQUE MANAGEMENT REQUEST SIGNAL CIRCUIT SHORTED TO GROUND




Turn the ignition off.

Disconnect the TCM harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Torque Management Request Signal circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Torque Management Request Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. TORQUE MANAGEMENT REQUEST SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

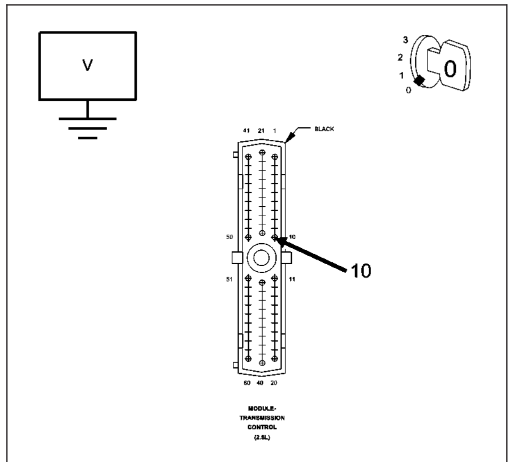
Disconnect the TCM harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Measure the voltage of the Torque Management Request Signal circuit.



816fec20

**Is the voltage below 1.0 volt?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Torque Management Request Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1001-IGNITION KEY OFF TIMER PERFORMANCE - TOO FAST

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
| --- |
| BODY CONTROL MODULE |
| BODY CONTROL MODULE POWER AND GROUNDS |
| CHECKING FOR OTHER DTCS |
| CHECKING THE ECT OPERATION |
| IGNITION SWITCH |
| INTERMITTENT CONDITION |

### Diagnostic Test

#### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition on key cycles turning the ignition off for 10 seconds between cycles.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

#### 2. CHECKING FOR OTHER DTCS

Turn the ignition on.

Does the scan tool display all FCM and BCM DTC's.

**NOTE: Any ECM communication related DTC's in the FCM or BCM must be diagnosed and corrected before continuing to diagnose this DTC.**

**Are there any ECM communication related DTC's in the FCM or BCM?**

**Yes** >> Refer to the Symptom List and repair communication DTC's before continuing.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. CHECKING THE ECT OPERATION

Refer to symptom Checking the ECT Sensor and verify proper ECT Sensor operation.

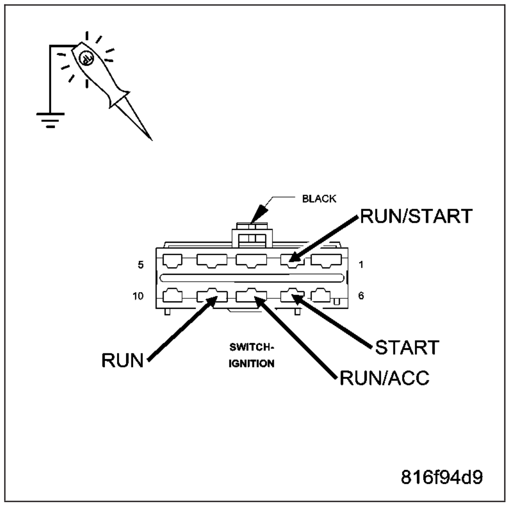
**Is the ECT Sensor operating correctly?**

**Yes** >> Go To 4

**No** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. IGNITION SWITCH

Refer to the Wiring Information and verify proper ignition switch operation. Turn the ignition key to each position and verifying correct voltage output by back probing the corresponding ignition switch harness connector cavity.




**Is the Ignition Switch functioning properly?**

**Yes** >> Go To 5

**No** >> Repair or replace Ignition Switch, wiring or connectors as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. VERIFY THAT THE BCM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the BCM is active on the bus.

**Is the BCM active on the bus?**

**Yes** >> The condition that caused the code to set is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

## P1002-IGNITION KEY OFF TIMER PERFORMANCE - TOO SLOW

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| BODY CONTROL MODULE |
| BODY CONTROL MODULE POWER AND GROUNDS |
| CHECKING FOR OTHER DTCS |
| CHECKING THE ECT OPERATION |
| IGNITION SWITCH |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition on key cycles turning the ignition off for 10 seconds between cycles.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

Turn the ignition on.

Does the scan tool display all FCM and BCM DTC’s.

**NOTE: Any ECM communication related DTC’s in the FCM or BCM must be diagnosed and corrected before continuing to diagnose this DTC.**

**Are there any ECM communication related DTC’s in the FCM or BCM?**

**Yes** >> Refer to the Symptom List and repair communication DTC’s before continuing.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. CHECKING THE ECT OPERATION

Refer to symptom Checking the ECT Sensor and verify proper ECT Sensor operation.

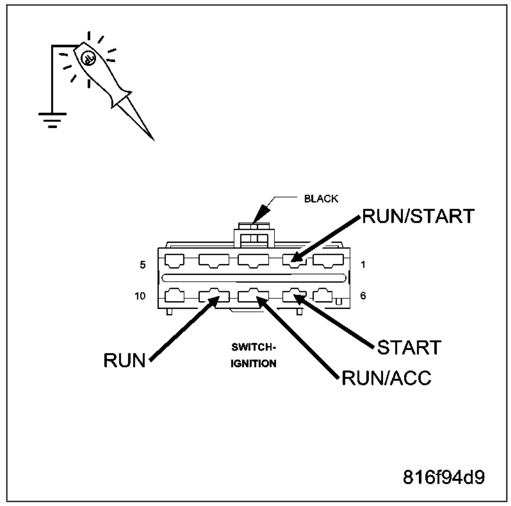
**Is the ECT Sensor operating correctly?**

**Yes** >> Go To 4

**No** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. IGNITION SWITCH

Refer to the Wiring Information and verify proper ignition switch operation. Turn the ignition key to each position and verifying correct voltage output at each ignition switch harness connector cavity.




**Is the Ignition Switch functioning properly?**

**Yes** >> Go To 5

**No** >> Repair or replace Ignition Switch, wiring or connectors as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. VERIFY THAT THE BCM IS ACTIVE ON THE BUS

With the scan tool, select ECU View.

Verify that the BCM is active on the bus.

**Is the BCM active on the bus?**

**Yes** >> The condition that caused the code to set is not present at this time. Using the wiring diagram/schematic as a guide, inspect the wiring for chafed, pierced, pinched, and partially broken wires and the wiring harness connectors for broken, bent, pushed out, and corroded terminals.
Perform BODY VERIFICATION TEST – VER 1. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE).

**No** >> (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for No Response related diagnostic procedures.

## P1101-ACM CRASH SIGNAL RECIEVED

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
| --- |
| ACM WIRING FAULT |

## Diagnostic Test

### 1. CLEAR DTC

**NOTE: This DTC indicates that the vehicle safety system has deployed the airbag(s).**

Turn the ignition on.

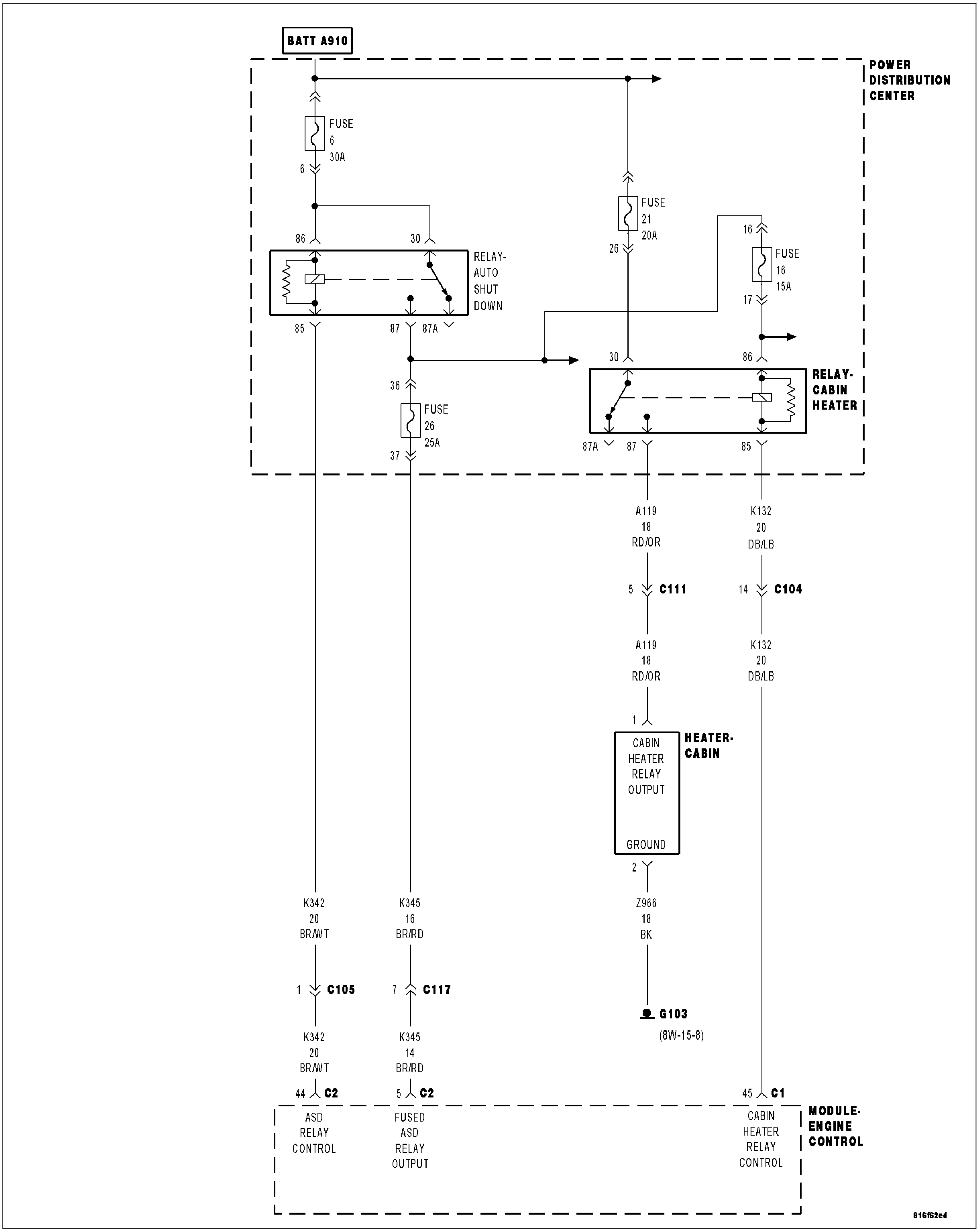
With the scan tool, erase ECM DTCs.

**NOTE: If this DTC sets again inspect the ACM Signal circuit between the ECM harness connector and the ACM harness connector for an intermittent short to ground.**

**View repair.**

**Yes** >> Test complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1102-VISCOUS/CABIN HEATER RELAY EXCESSIVE CURRENT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Viscous/Cabin Heater Relay command on.
- **Set Condition:**
  The ECM detects excessive current on the Viscous/Cabin Heater Relay Control circuit for 0.5 second.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| CABIN HEATER RELAY |
| CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE |
| CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| CABIN HEATER RELAY CONTROL CIRCUIT OPEN |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CABIN HEATER RELAY CLICKING

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the Viscous/Cabin Heater Relay.

**Is the Cabin Heater Relay clicking?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

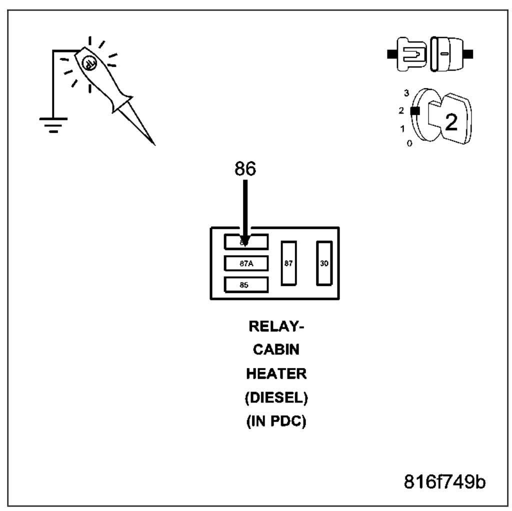
### 2. ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Cabin Heater Relay from the PDC.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit at the Cabin Heater Relay connector in the PDC.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. CABIN HEATER RELAY

Turn the ignition off.
Install a substitute relay in place of the Cabin Heater Relay.
Turn the ignition on.
With the scan tool, actuate the Viscous/Cabin Heater Relay for at least 20 seconds.
With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 4

**No** >> Replace the Cabin Heater Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

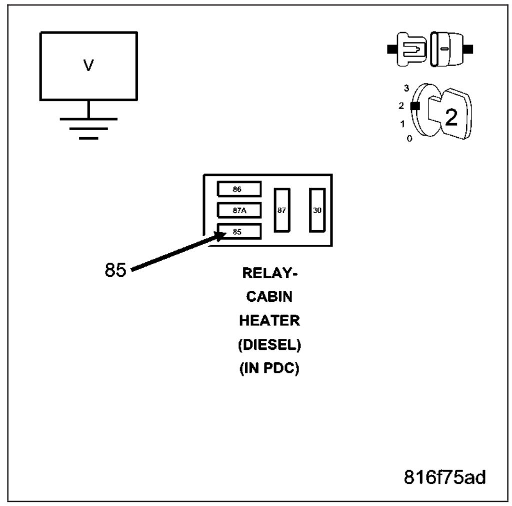
## 4. CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.
Disconnect the ECM harness connectors.
Remove the Cabin Heater Relay.
Remove the ASD Relay from the PDC.
Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector in the PDC.
Turn the ignition on.
Measure the voltage on the Cabin Heater Relay Control circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Cabin Heater Relay Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5



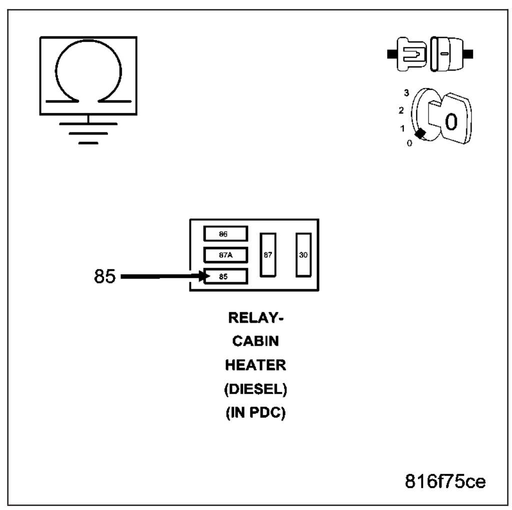

## 5. CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Remove the Cabin Heater Relay from the PDC.
Disconnect the ECM harness connectors.
Measure the resistance between ground and the Cabin Heater Relay Control circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Cabin Heater Relay Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



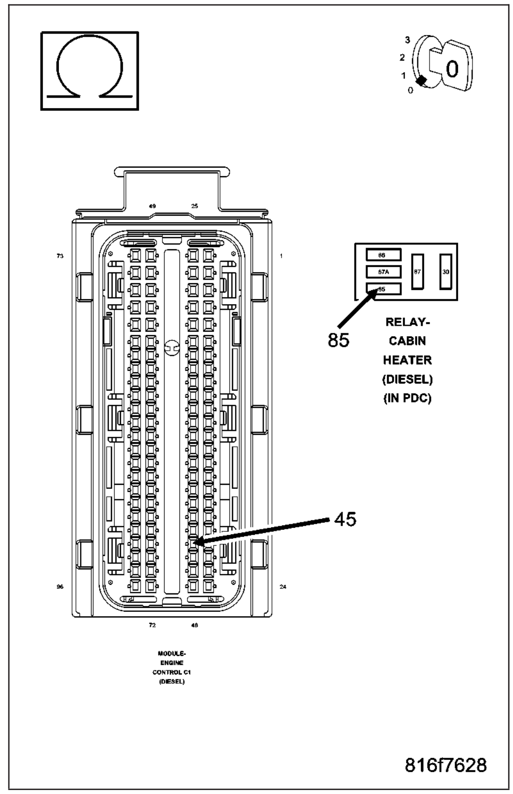
## 6. CABIN HEATER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the Cabin Heater Relay from the PDC.

Disconnect the ECM harness connectors.

Measure the resistance of the Cabin Heater Relay Control circuit.




**Is the resistance below 10.0 ohms?**

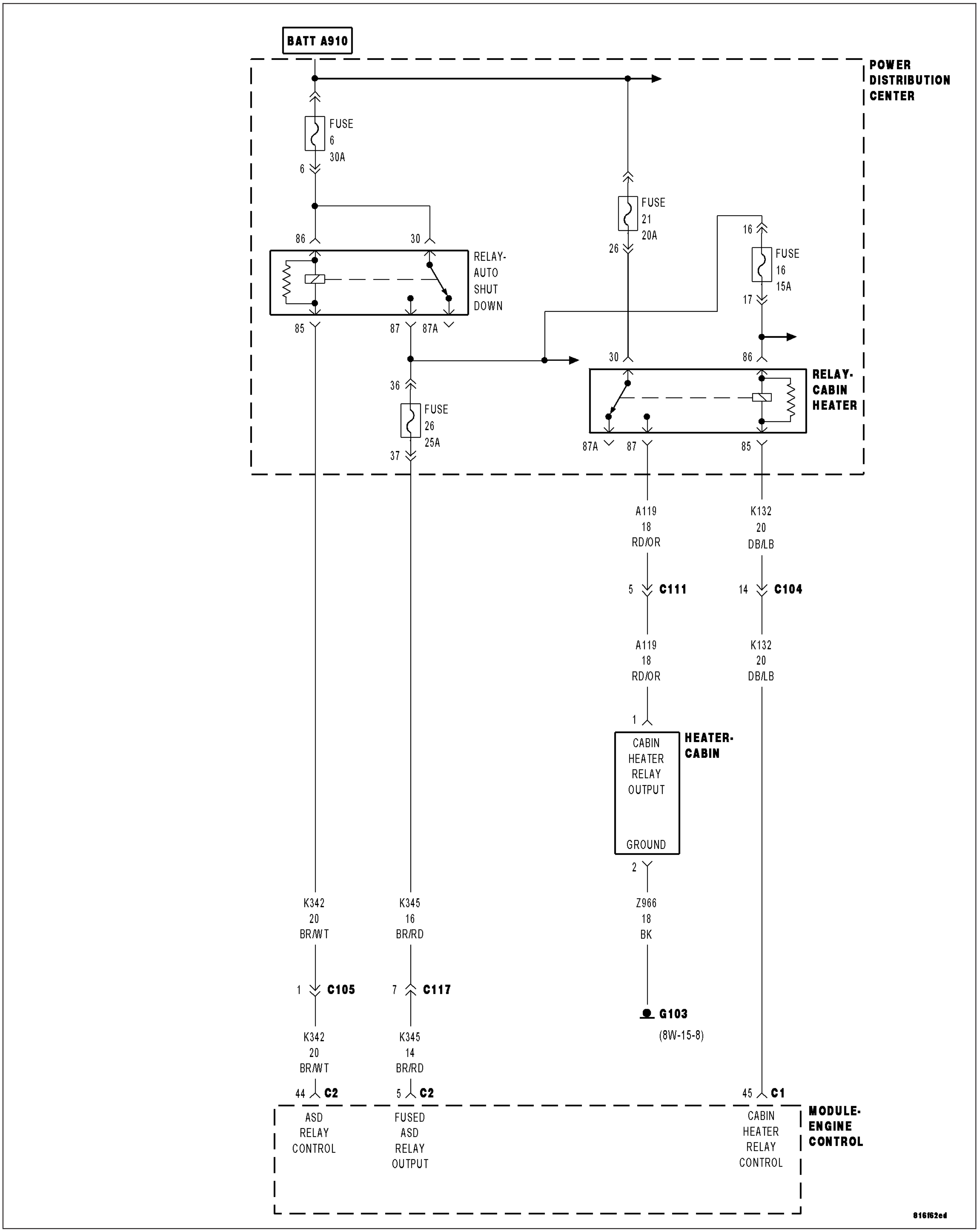
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Cabin Heater Relay Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1102-VISCOUS/CABIN HEATER RELAY OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Viscous/Cabin Heater Relay command off.
- **Set Condition:**
  The ECM detects an open on the Viscous/Cabin Heater Relay Control circuit for 0.5 second.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| CABIN HEATER RELAY |
| CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE |
| CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| CABIN HEATER RELAY CONTROL CIRCUIT OPEN |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CABIN HEATER RELAY CLICKING

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the Viscous/Cabin Heater Relay.

**Is the Cabin Heater Relay clicking?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Cabin Heater Relay from the PDC.

Turn the ignition on.

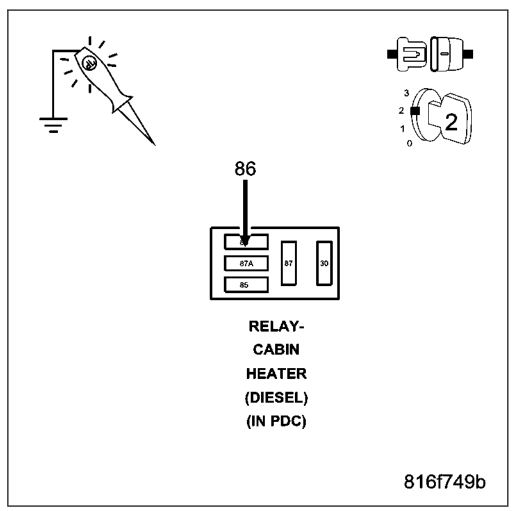
Using a 12-volt test light connected to ground, check the ASD Relay Output circuit at the Cabin Heater Relay connector in the PDC.

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 3. CABIN HEATER RELAY

Turn the ignition off.

Install a substitute relay in place of the Cabin Heater Relay.

Turn the ignition on.

With the scan tool, actuate the Viscous/Cabin Heater Relay for at least 20 seconds.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 4

**No** >> Replace the Cabin Heater Relay.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

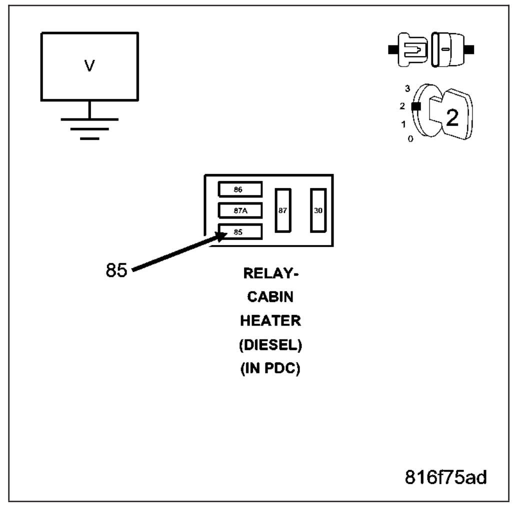
Remove the Cabin Heater Relay.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector in the PDC.

Turn the ignition on.

Measure the voltage on the Cabin Heater Relay Control circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Cabin Heater Relay Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

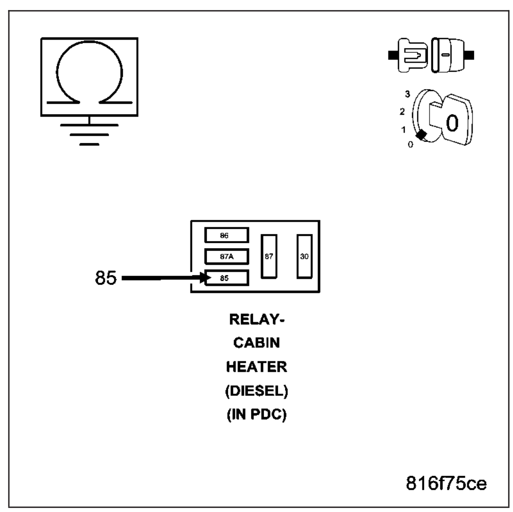
## 5. CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the Cabin Heater Relay from the PDC.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Cabin Heater Relay Control circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Cabin Heater Relay Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

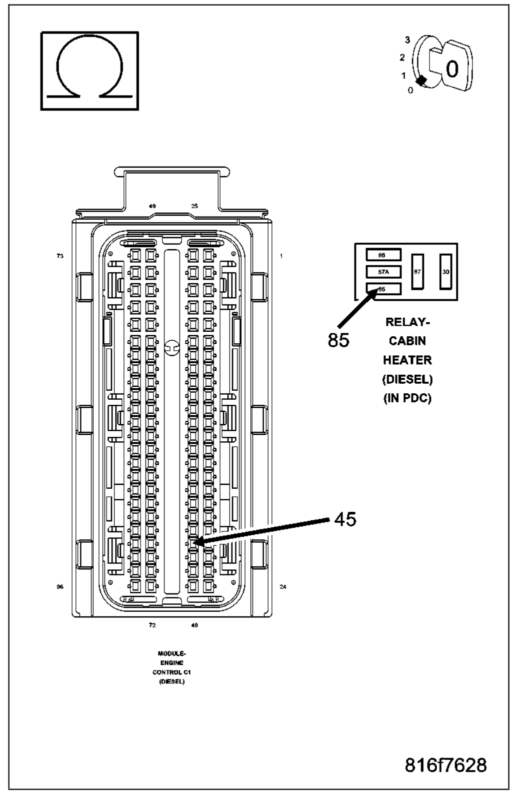
## 6. CABIN HEATER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the Cabin Heater Relay from the PDC.

Disconnect the ECM harness connectors.

Measure the resistance of the Cabin Heater Relay Control circuit.




**Is the resistance below 10.0 ohms?**

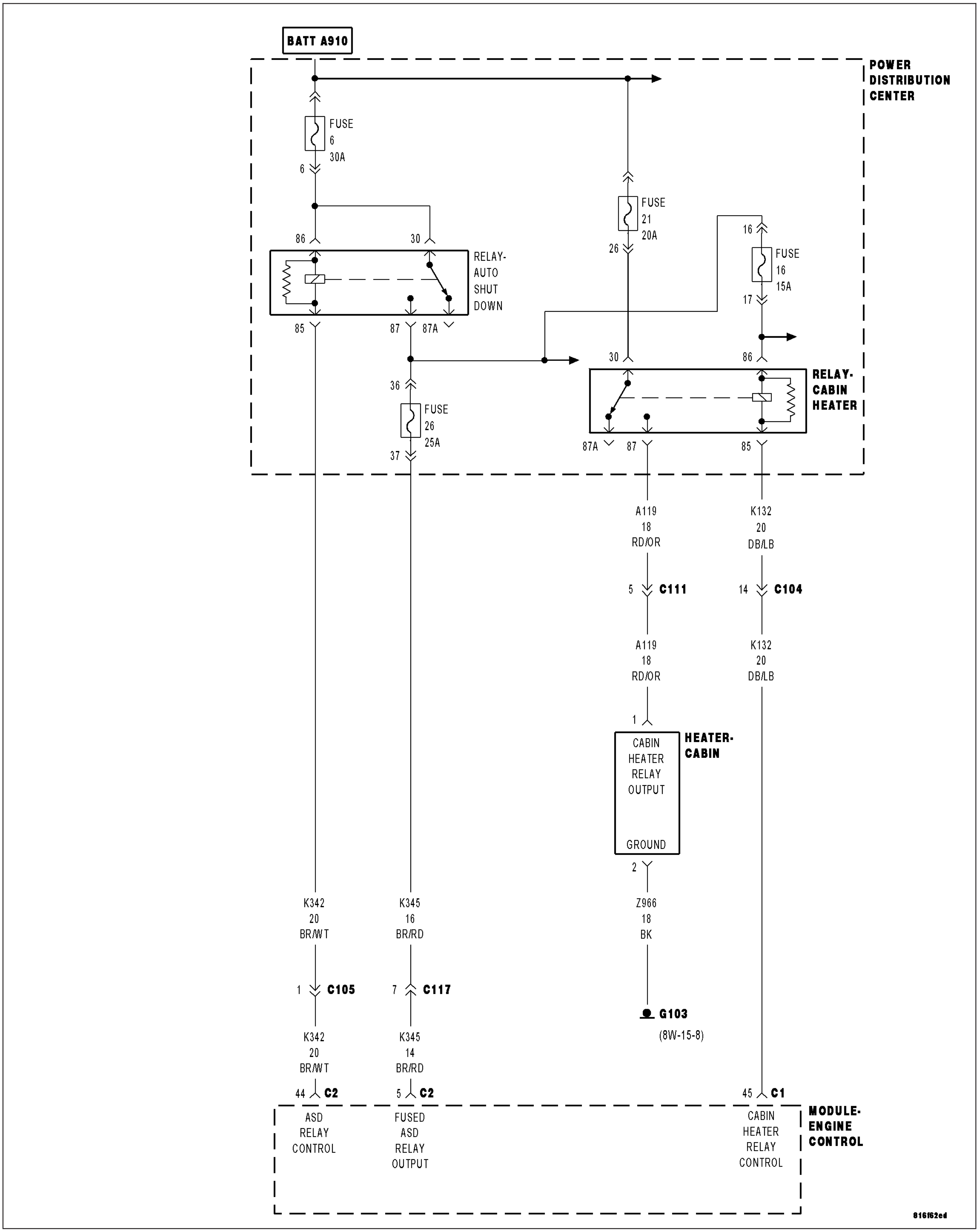
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Cabin Heater Relay Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1102-VISCOUS/CABIN HEATER RELAY SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Viscous/Cabin Heater Relay command on.
- **Set Condition:**
  The ECM detects excessive current on the Viscous/Cabin Heater Relay Control circuit for 0.5 second.

| Possible Causes |
| --- |
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| CABIN HEATER RELAY |
| CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE |
| CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| CABIN HEATER RELAY CONTROL CIRCUIT OPEN |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CABIN HEATER RELAY CLICKING

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the Viscous/Cabin Heater Relay.

**Is the Cabin Heater Relay clicking?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

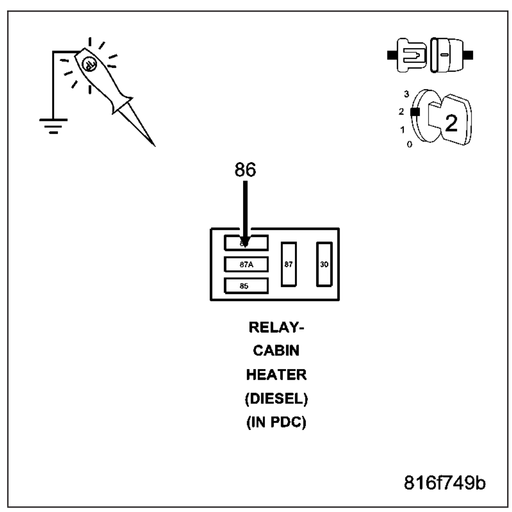
### 2. ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Cabin Heater Relay from the PDC.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit at the Cabin Heater Relay connector in the PDC.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. CABIN HEATER RELAY

Turn the ignition off.

Install a substitute relay in place of the Cabin Heater Relay.

Turn the ignition on.

With the scan tool, actuate the Viscous/Cabin Heater Relay for at least 20 seconds.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 4

**No** >> Replace the Cabin Heater Relay.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the Cabin Heater Relay.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector in the PDC.

Turn the ignition on.

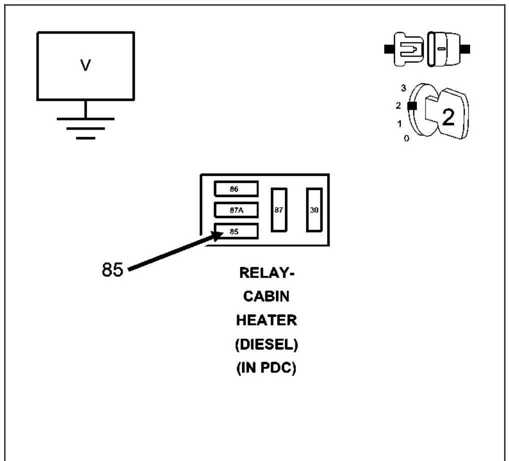
Measure the voltage on the Cabin Heater Relay Control circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Cabin Heater Relay Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5




816f75ad

## 5. CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the Cabin Heater Relay from the PDC.

Disconnect the ECM harness connectors.

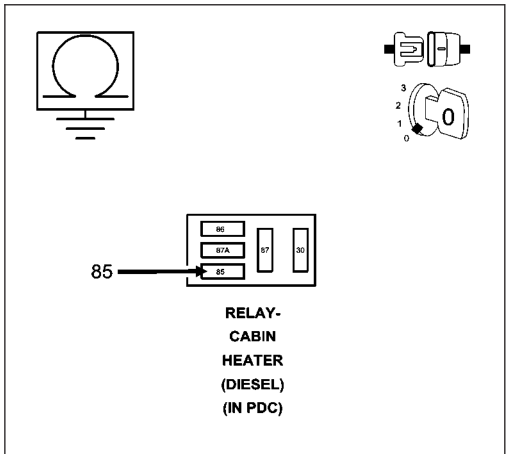
Measure the resistance between ground and the Cabin Heater Relay Control circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Cabin Heater Relay Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




816f75ce

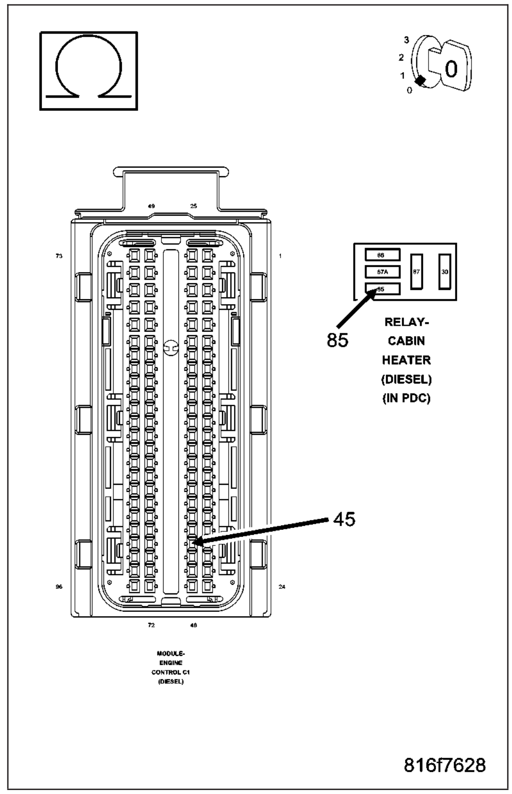
## 6. CABIN HEATER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the Cabin Heater Relay from the PDC.

Disconnect the ECM harness connectors.

Measure the resistance of the Cabin Heater Relay Control circuit.




**Is the resistance below 10.0 ohms?**

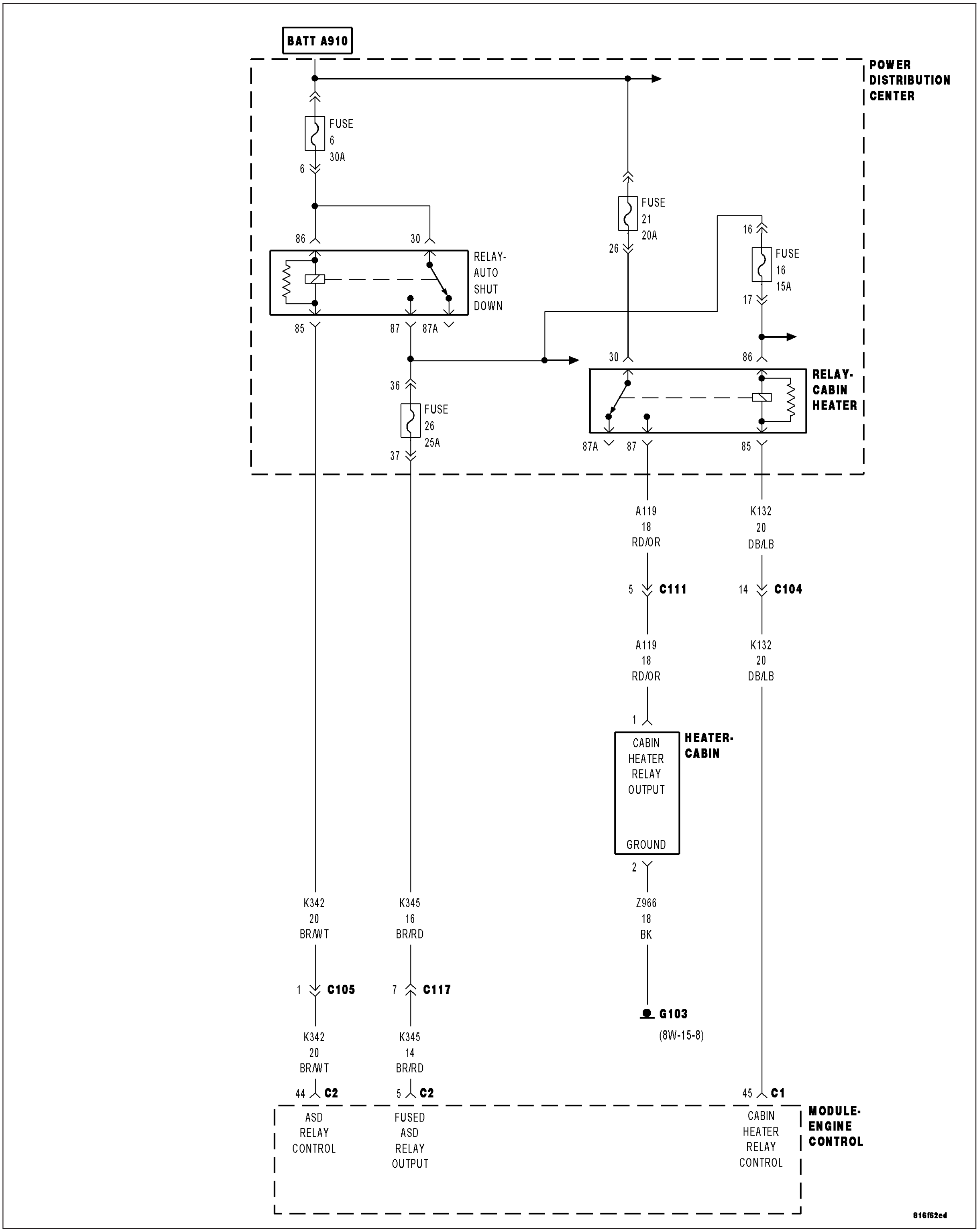
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Cabin Heater Relay Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1102-VISCOUS/CABIN HEATER RELAY SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Viscous/Cabin Heater Relay command off.
- **Set Condition:**
  The ECM detects a short to ground on the Viscous/Cabin Heater Relay Control circuit for 0.5 seconds.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| CABIN HEATER RELAY |
| CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE |
| CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND |
| CABIN HEATER RELAY CONTROL CIRCUIT OPEN |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CABIN HEATER RELAY CLICKING

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, actuate the Viscous/Cabin Heater Relay.

**Is the Cabin Heater Relay clicking?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Cabin Heater Relay from the PDC.

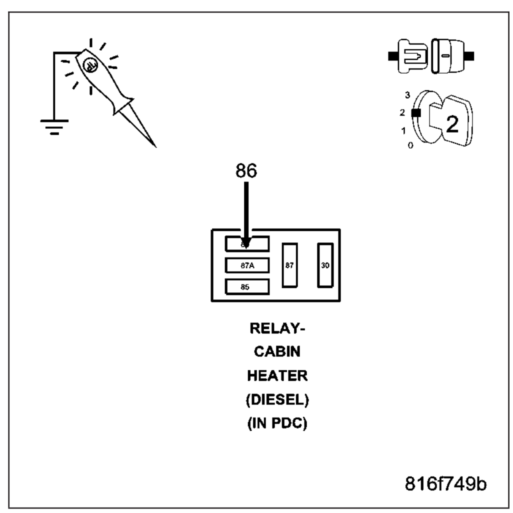
Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit at the Cabin Heater Relay connector in the PDC.

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 3. CABIN HEATER RELAY

Turn the ignition off.

Install a substitute relay in place of the Cabin Heater Relay.

Turn the ignition on.

With the scan tool, actuate the Viscous/Cabin Heater Relay for at least 20 seconds.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 4

**No** >> Replace the Cabin Heater Relay.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

Remove the Cabin Heater Relay.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector in the PDC.

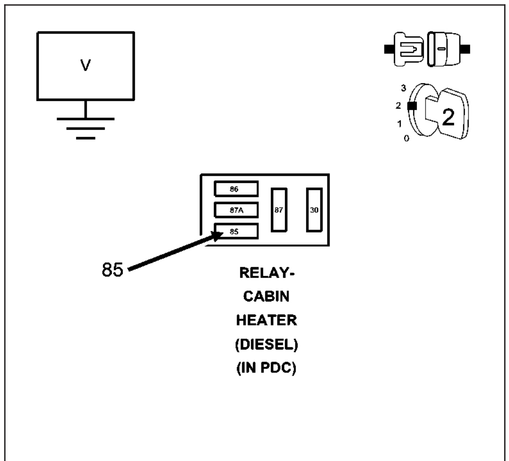
Turn the ignition on.

Measure the voltage on the Cabin Heater Relay Control circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Cabin Heater Relay Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5



816f75ad

## 5. CABIN HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Remove the Cabin Heater Relay from the PDC.

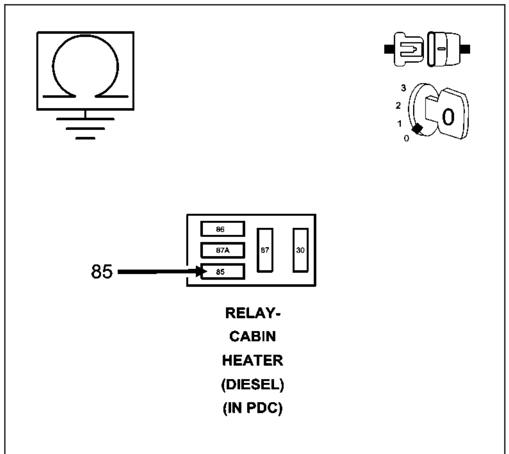
Disconnect the ECM harness connectors.

Measure the resistance between ground and the Cabin Heater Relay Control circuit.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Cabin Heater Relay Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



816f75ce

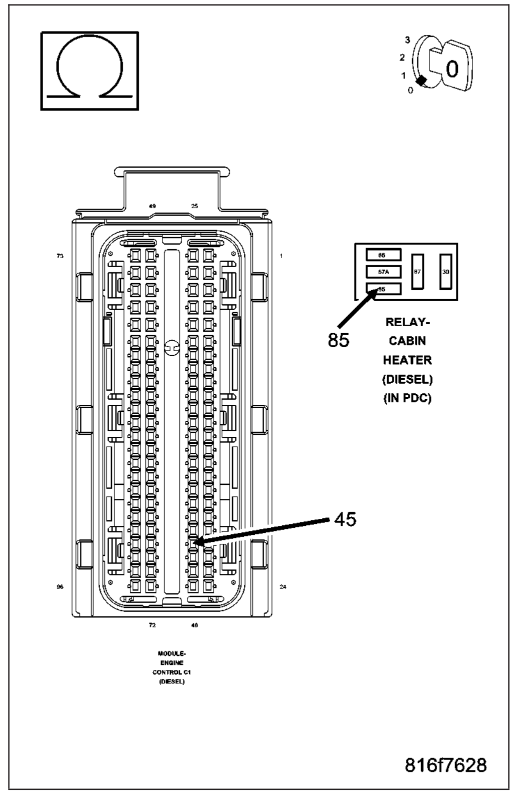
## 6. CABIN HEATER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the Cabin Heater Relay from the PDC.

Disconnect the ECM harness connectors.

Measure the resistance of the Cabin Heater Relay Control circuit.




**Is the resistance below 10.0 ohms?**

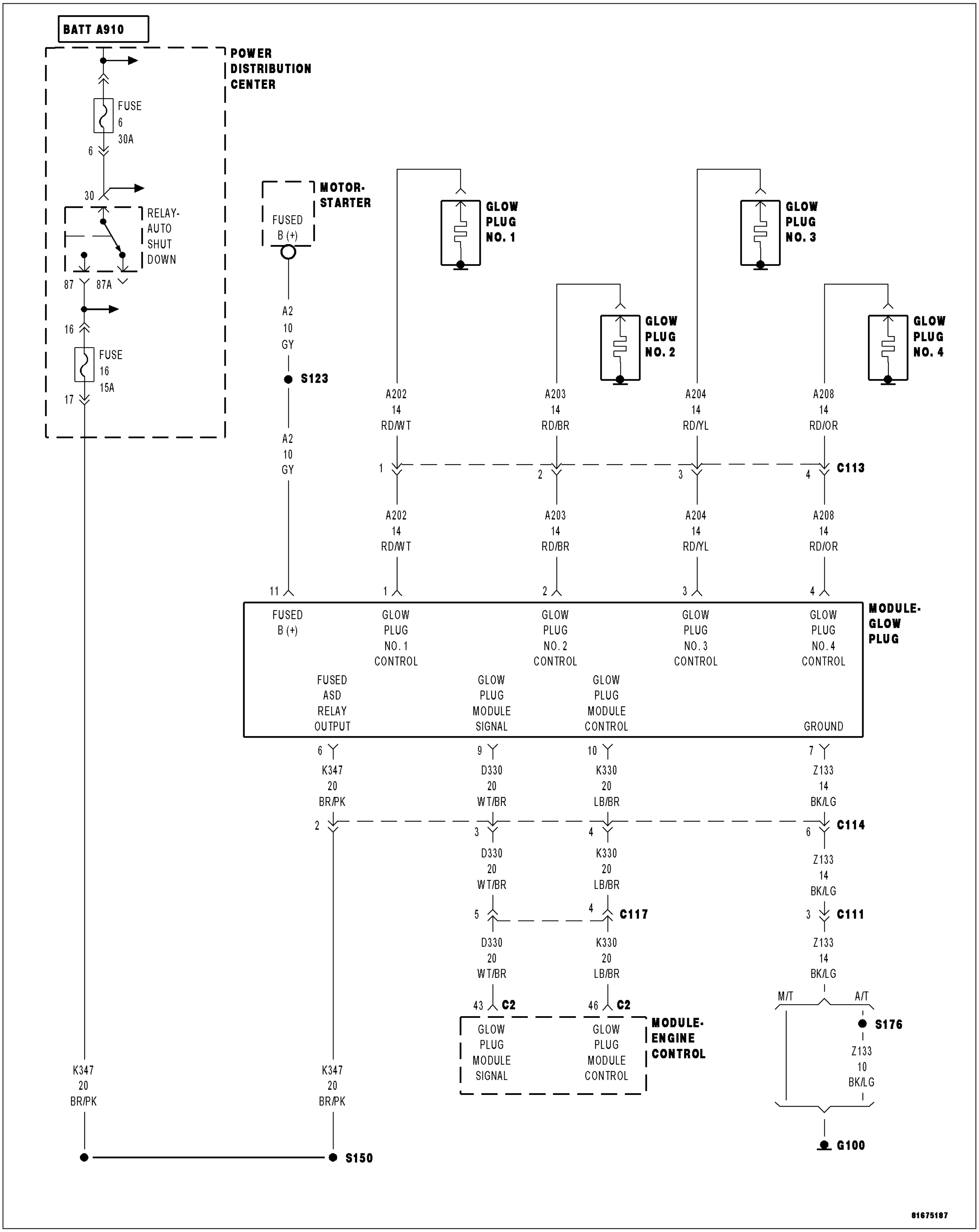
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Cabin Heater Relay Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P1131-GLOW PLUG MODULE VOLTAGE SUPPLY




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| BATTERY SUPPLY CIRCUIT OPEN |
| GROUND CIRCUIT OPEN |
| INTERMITTENT CONDITION |
| GLOW PLUG CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off for 10 seconds.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

Repeat this test several times.

**Did this DTC set again?**

**Yes** >> Go To 2

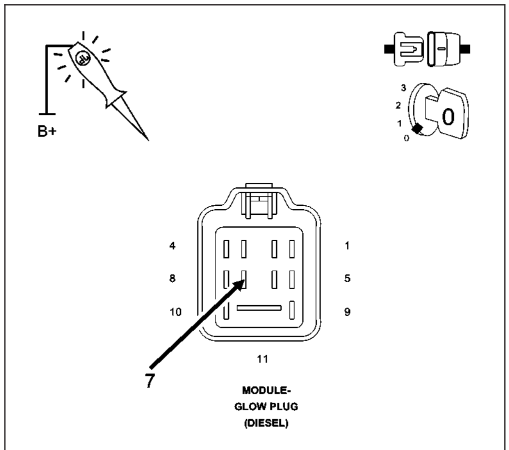
**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Glow Plug Control Module harness connector.

Using a 12-volt test light connected to 12-volts, check the Ground circuit at the Glow Plug Control Module harness connector.




816f4647

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the Glow Plug Control Module Ground circuit for an open.

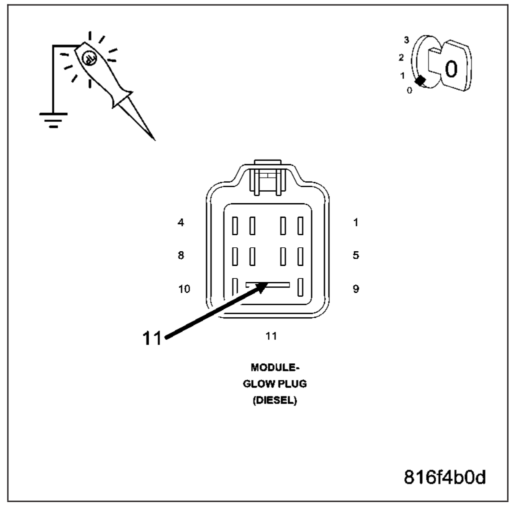
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. BATTERY SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the Glow Plug Control Module harness connector.

Using a 12-volt test light connected to ground, check the Battery Supply circuit at the Glow Plug Control Module harness connector.




**Does the test light illuminate brightly?**

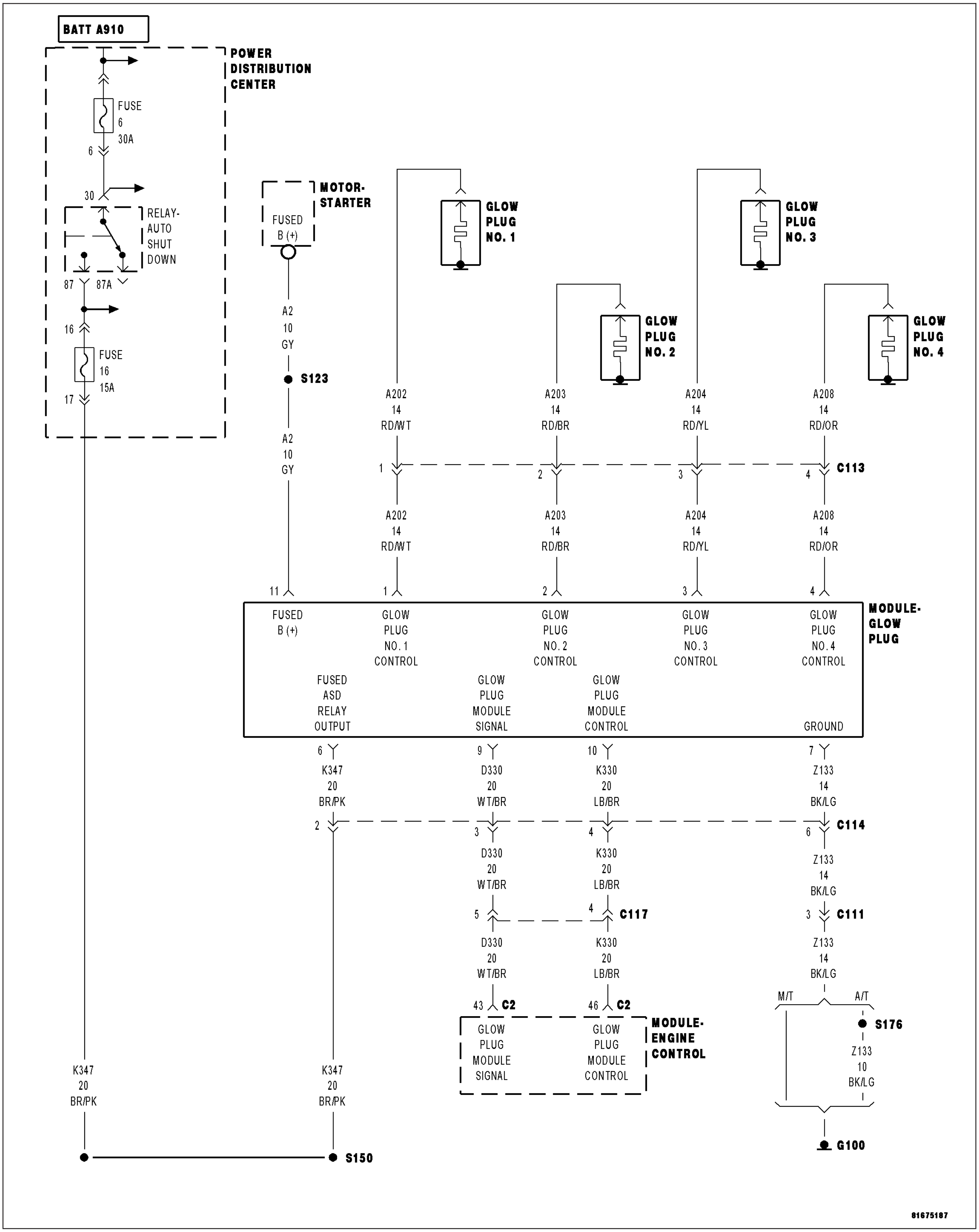
**Yes** >> Replace the Glow Plug Control Module.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Glow Plug Control Module Battery Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1131-GLOW PLUG MODULE INTERNAL FAULT




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| BATTERY SUPPLY CIRCUIT OPEN |
| GROUND CIRCUIT OPEN |
| INTERMITTENT CONDITION |
| GLOW PLUG CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off for 10 seconds.

Turn the ignition on.

Monitor the scan tool for ECM DTCs.

Repeat this test several times.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the Glow Plug Control Module harness connector.

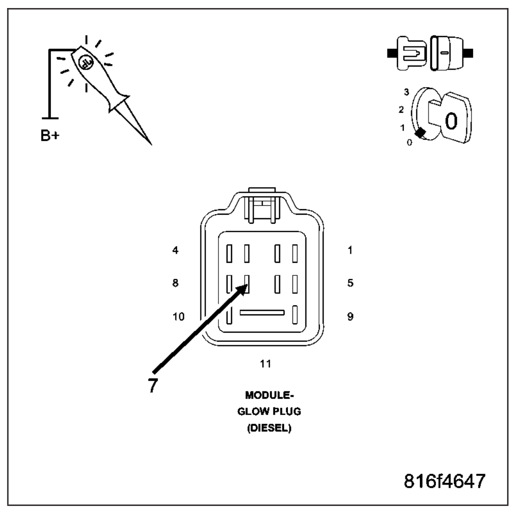
Using a 12-volt test light connected to 12-volts, check the Ground circuit at the Glow Plug Control Module harness connector.

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the Glow Plug Control Module Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

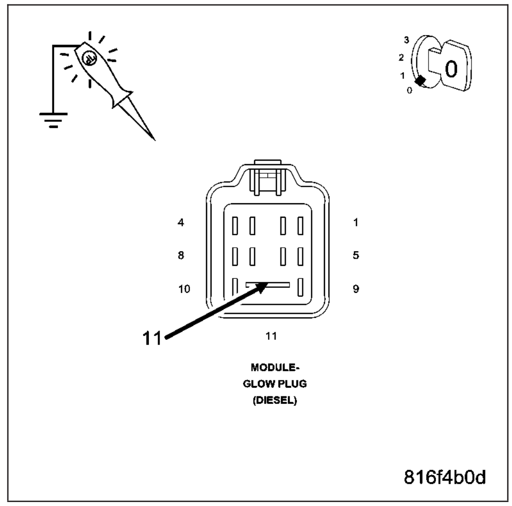


## 3. BATTERY SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the Glow Plug Control Module harness connector.

Using a 12-volt test light connected to ground, check the Battery Supply circuit at the Glow Plug Control Module harness connector.




**Does the test light illuminate brightly?**

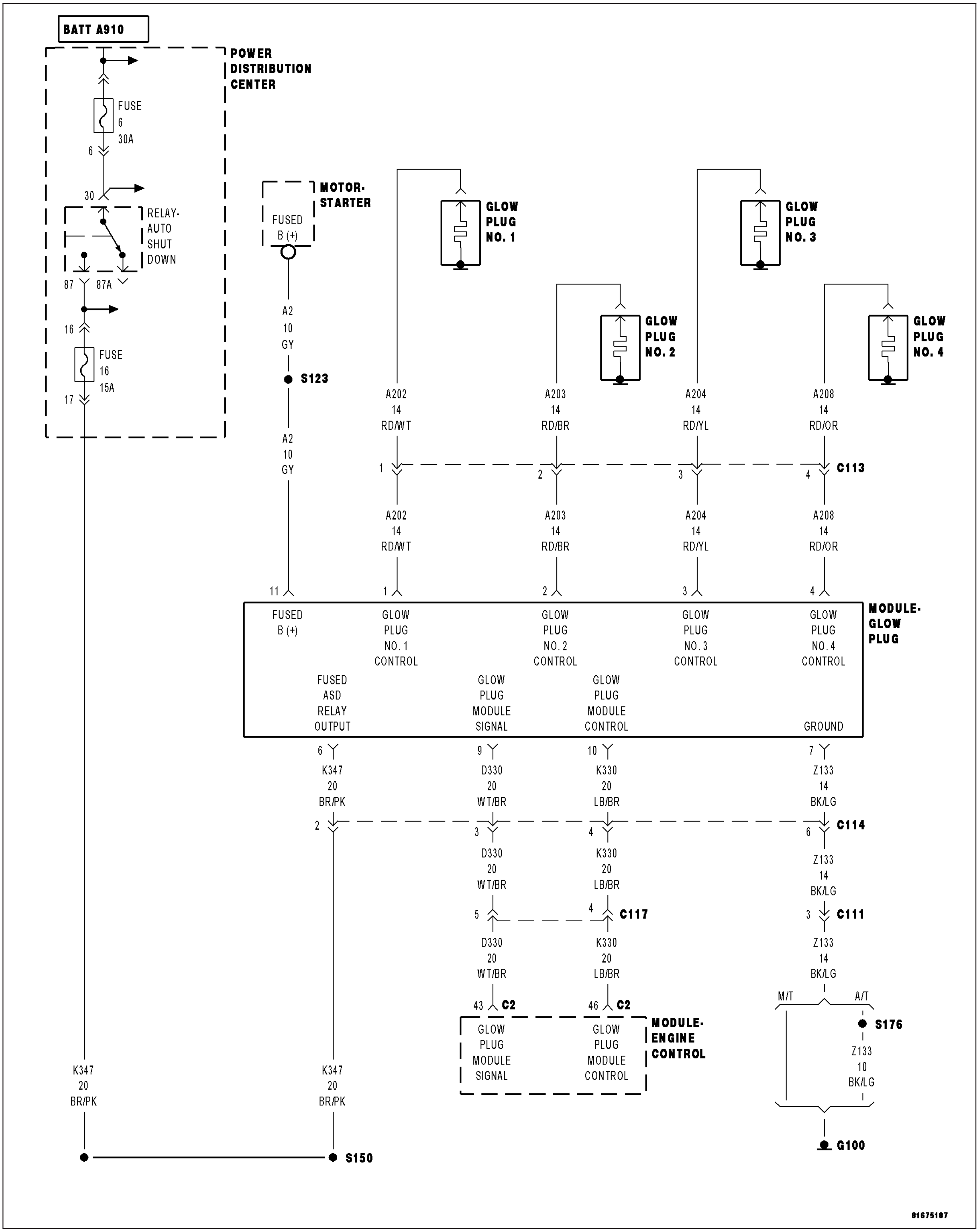
**Yes** >> Replace the Glow Plug Control Module.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Glow Plug Control Module Battery Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P1135-GLOW PLUG MODULE CONTROL CIRCUIT EXCESSIVE CURRENT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Glow Plug Module command on.
- **Set Condition:**
  The ECM detects excessive current on the Glow Plug Module Control circuit.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| GLOW PLUG MODULE |
| GLOW PLUG MODULE CONTROL CIRCUIT OPEN |
| GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO VOLTAGE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

Turn the ignition on and wait at least 90 seconds.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

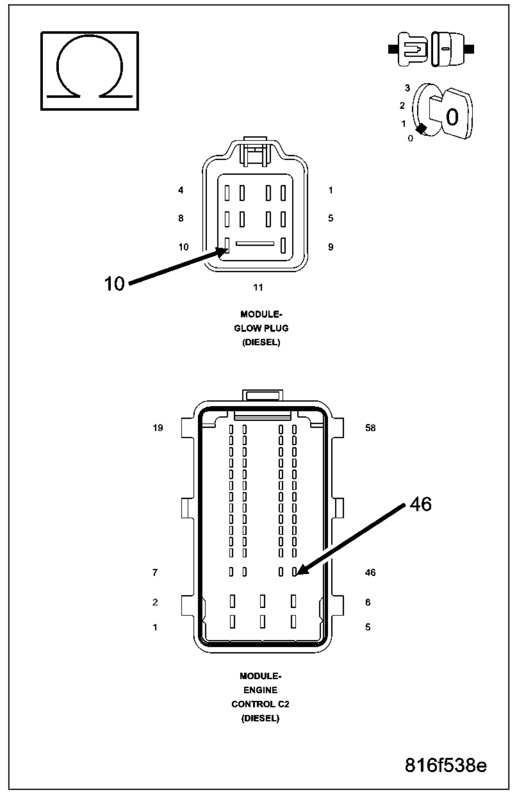
## 2. GLOW PLUG MODULE CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Glow Plug Module Control circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 3

**No** >> Repair the Glow Plug Module Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

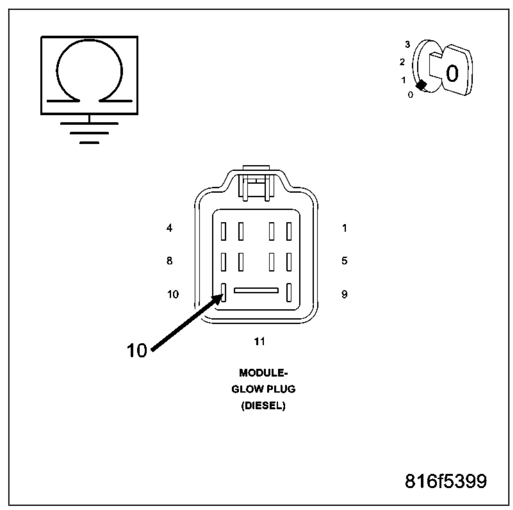
## 3. GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Glow Plug Module Control circuit.



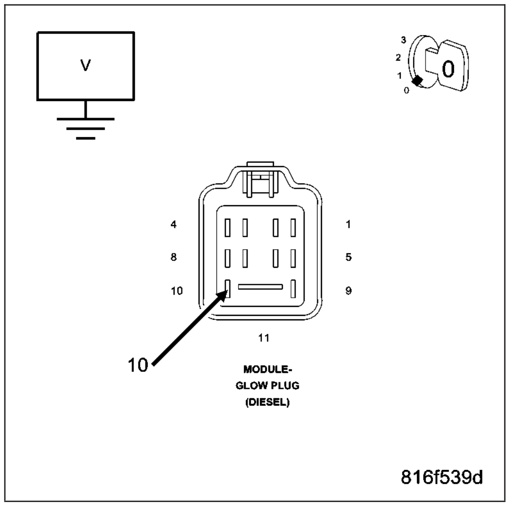

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Glow Plug Module Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Measure the voltage of the Glow Plug Module Control circuit.

**Is the voltage below 1.0 volt?**

**Yes** >> Go To 5

**No** >> Repair the Glow Plug Module Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG CONTROL MODULE

Turn the ignition off.

Replace the Glow Plug Module in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

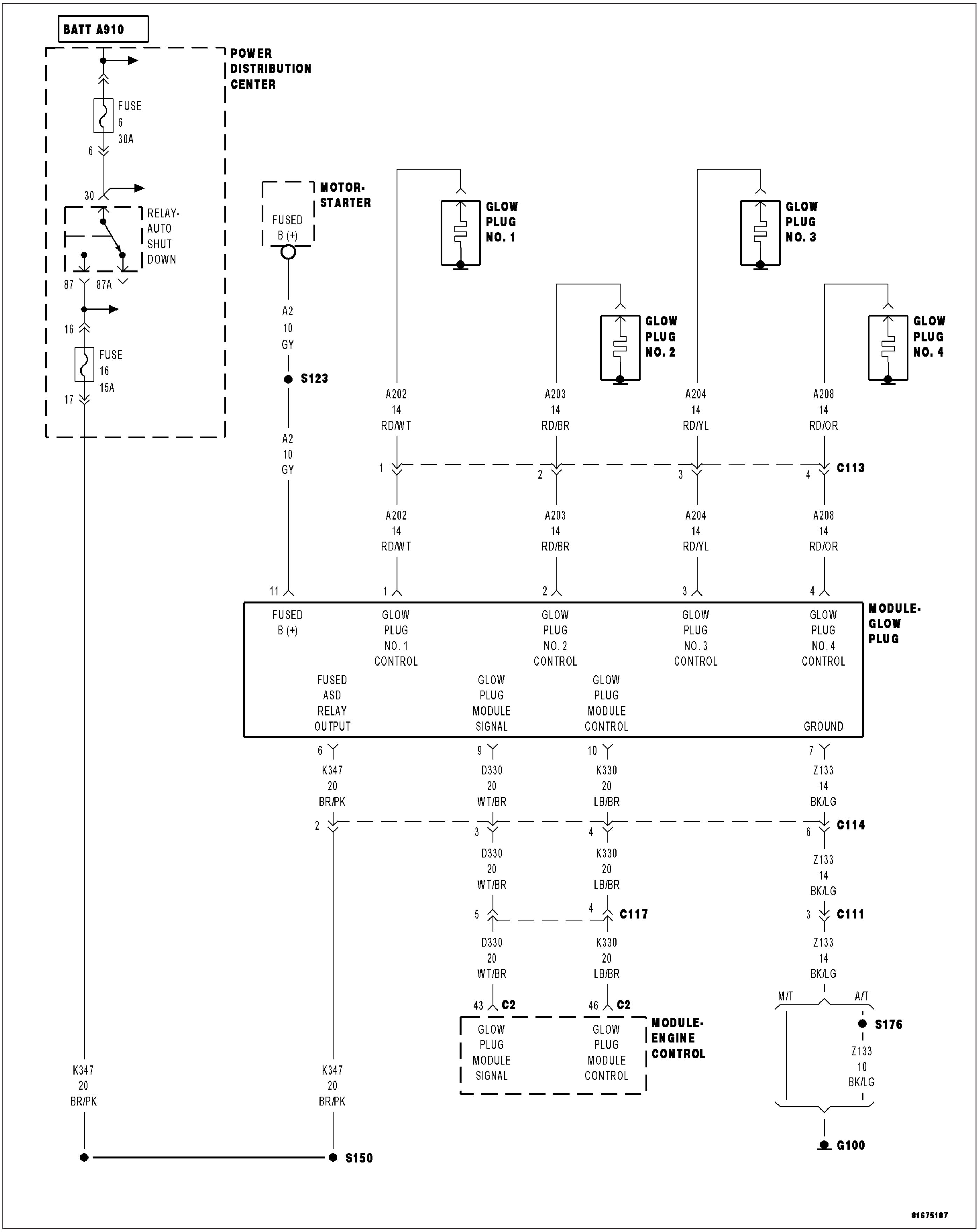
**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

# P1135-GLOW PLUG MODULE CONTROL CIRCUIT OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Glow Plug Module command off.
- **Set Condition:**
  The ECM does not detect voltage on the Glow Plug Module Control circuit.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| GLOW PLUG MODULE |
| GLOW PLUG MODULE CONTROL CIRCUIT OPEN |
| GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO VOLTAGE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

Turn the ignition on and wait at least 90 seconds.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

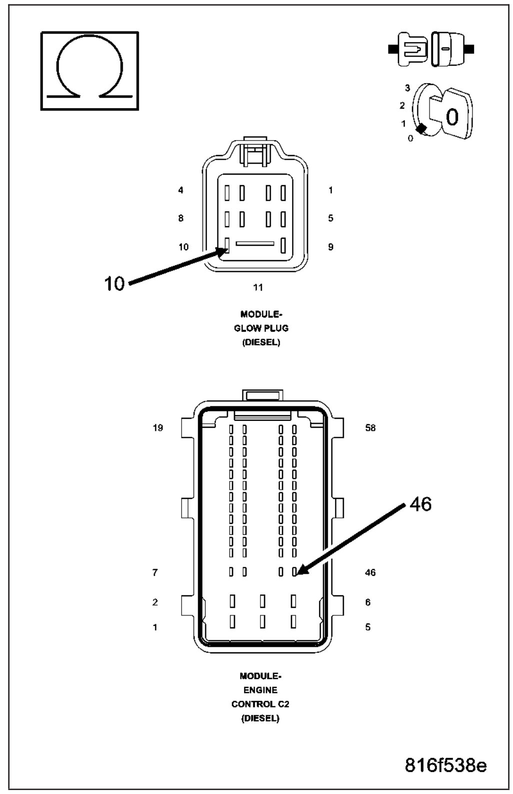
## 2. GLOW PLUG MODULE CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Glow Plug Module Control circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 3

**No** >> Repair the Glow Plug Module Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

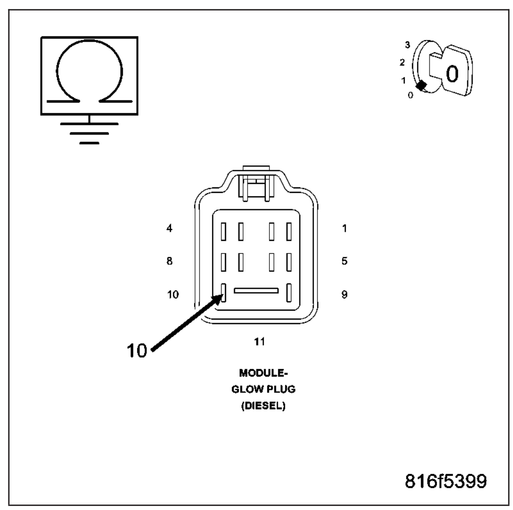
## 3. GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Glow Plug Module Control circuit.



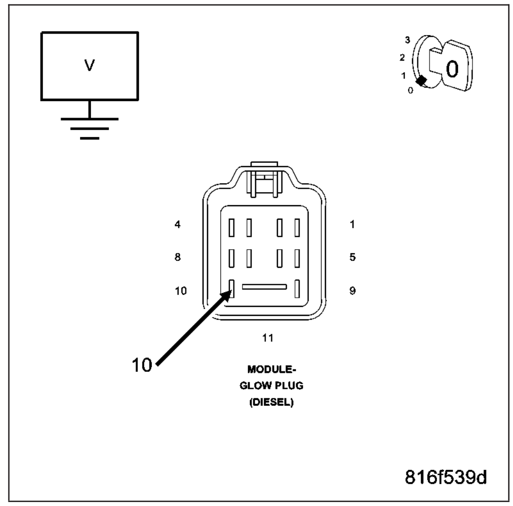

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Glow Plug Module Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Measure the voltage of the Glow Plug Module Control circuit.

**Is the voltage below 1.0 volt?**

**Yes** >> Go To 5

**No** >> Repair the Glow Plug Module Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG CONTROL MODULE

Turn the ignition off.

Replace the Glow Plug Module in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

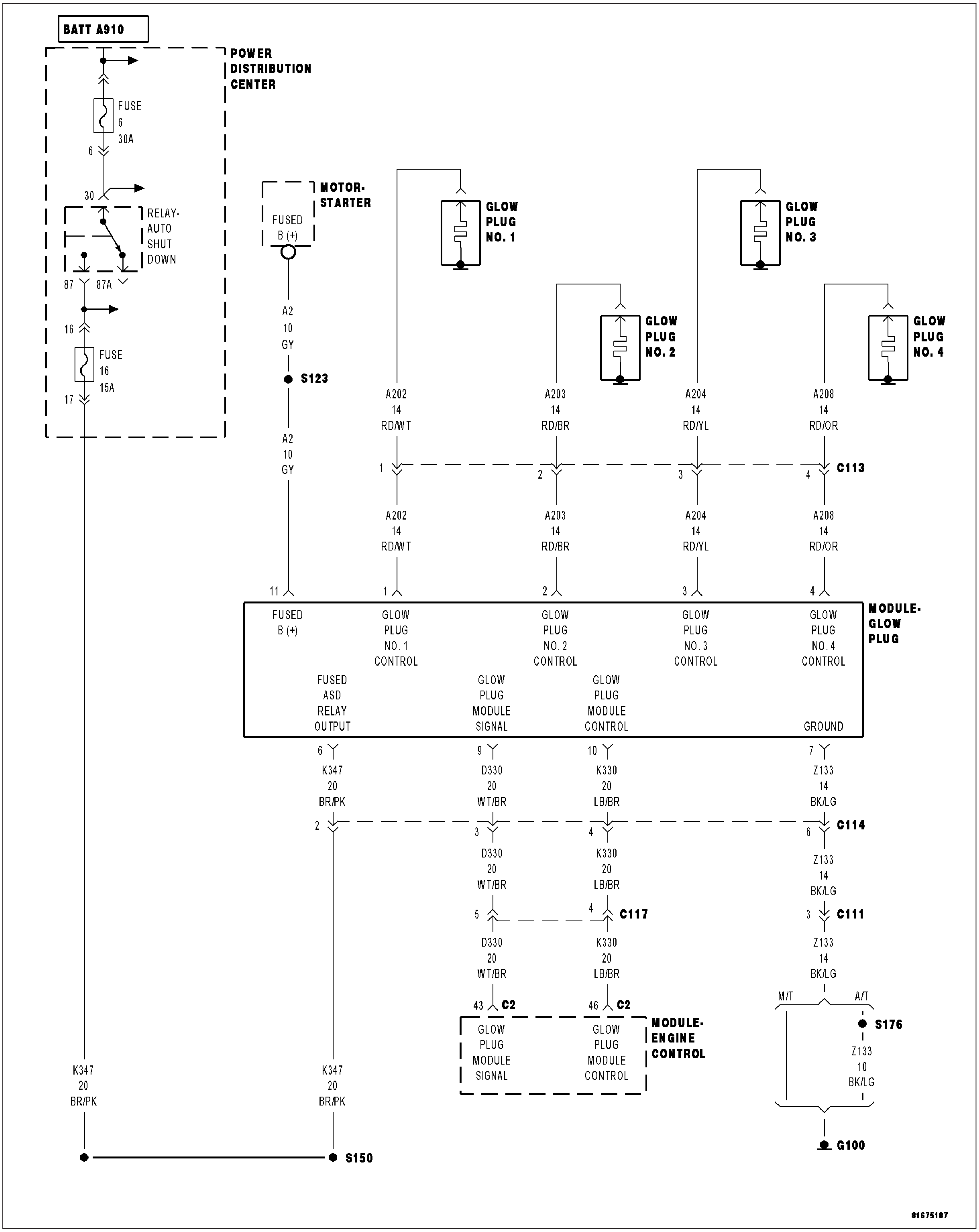
**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P1135-GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Glow Plug Module command off.
- **Set Condition:**
  The ECM detects a short to ground on the Glow Plug Module Control circuit.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| GLOW PLUG MODULE |
| GLOW PLUG MODULE CONTROL CIRCUIT OPEN |
| GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO VOLTAGE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

Turn the ignition on and wait at least 90 seconds.

With the DRB, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 2. GLOW PLUG MODULE CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

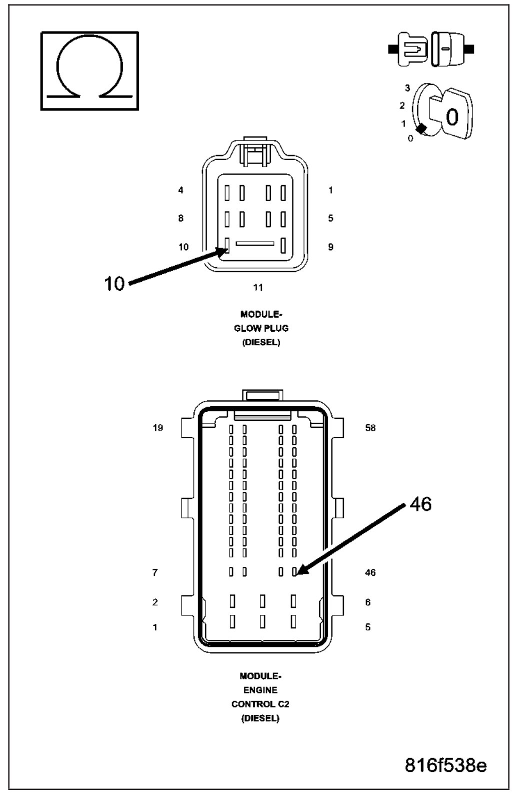
Measure the resistance of the Glow Plug Module Control circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 3

**No** >> Repair the Glow Plug Module Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 3. GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

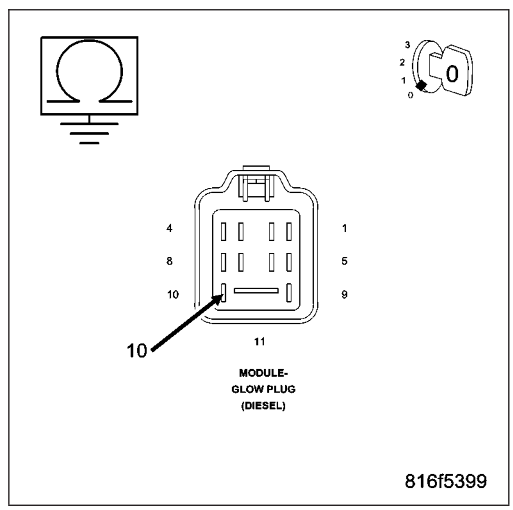
Measure the resistance between ground and the Glow Plug Module Control circuit.

**Is the resistance above 1000 ohms?**

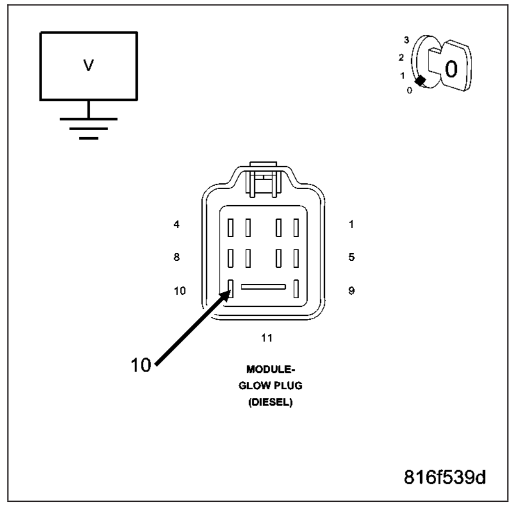
**Yes** >> Go To 4

**No** >> Repair the Glow Plug Module Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 4. GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Measure the voltage of the Glow Plug Module Control circuit.

**Is the voltage below 1.0 volt?**

**Yes** >> Go To 5

**No** >> Repair the Glow Plug Module Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG CONTROL MODULE

Turn the ignition off.

Replace the Glow Plug Module in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

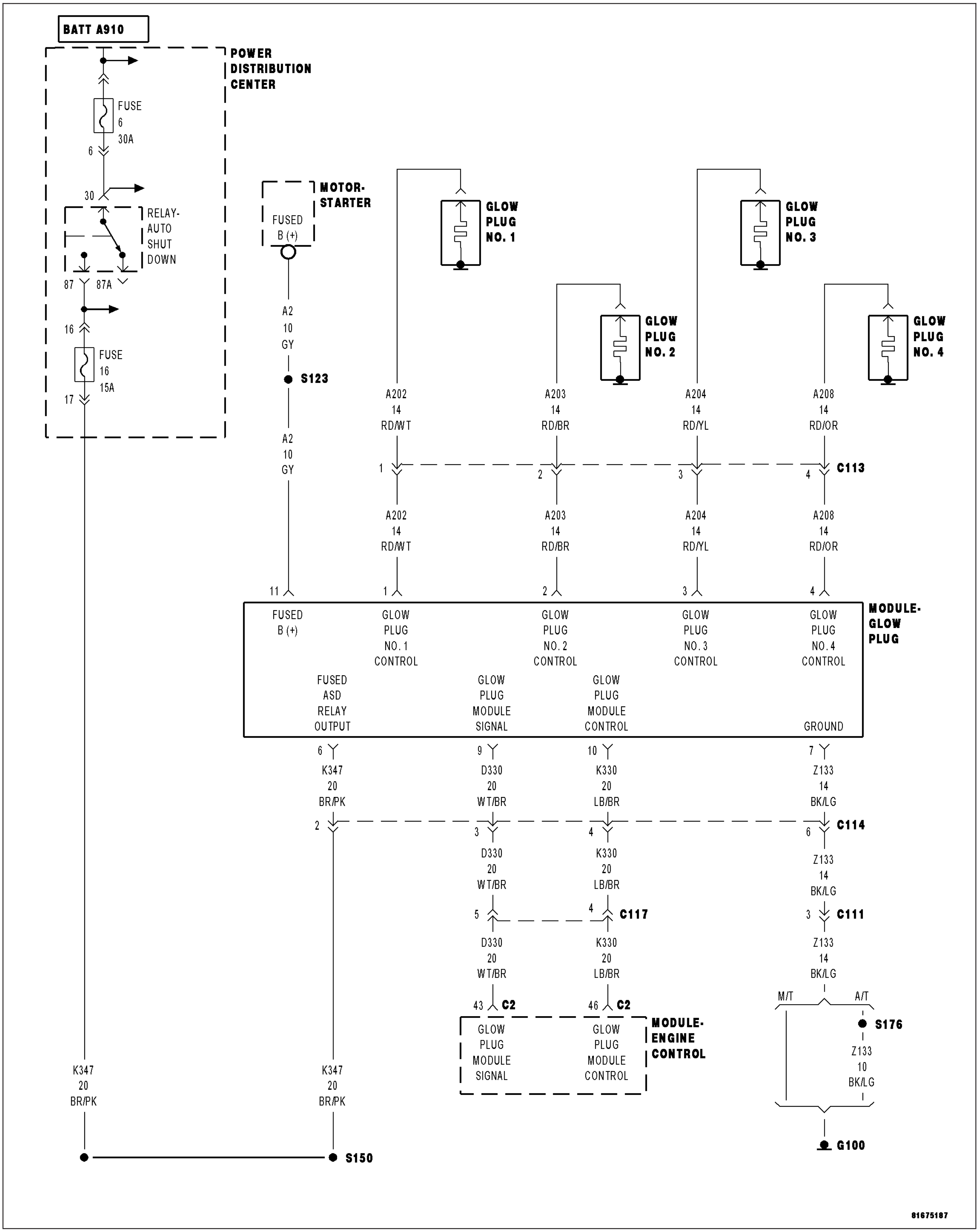
**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P1135-GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO VOLTAGE




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the Glow Plug Module command on.
- **Set Condition:**
  The ECM detects a short to voltage on the Glow Plug Module Control circuit.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| GLOW PLUG MODULE |
| GLOW PLUG MODULE CONTROL CIRCUIT OPEN |
| GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND |
| GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO VOLTAGE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

Turn the ignition on and wait at least 90 seconds.

With the DRB, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

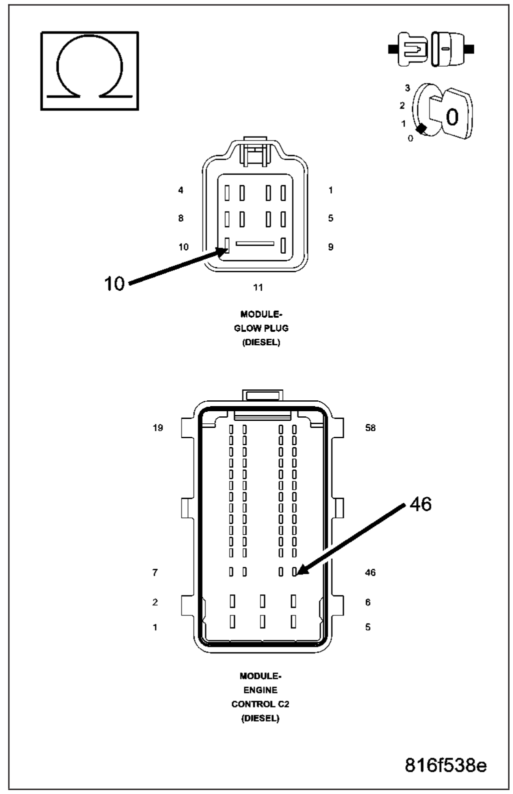
## 2. GLOW PLUG MODULE CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance of the Glow Plug Module Control circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 3

**No** >> Repair the Glow Plug Module Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

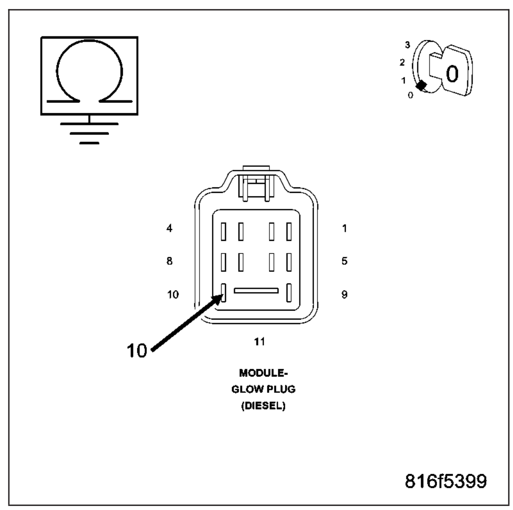
## 3. GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Glow Plug Module Control circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Glow Plug Module Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. GLOW PLUG MODULE CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

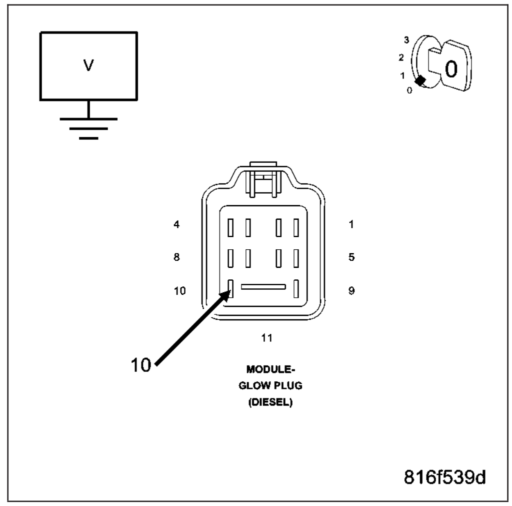
Disconnect the Glow Plug Module harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Measure the voltage of the Glow Plug Module Control circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Go To 5

**No** >> Repair the Glow Plug Module Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. GLOW PLUG CONTROL MODULE

Turn the ignition off.

Replace the Glow Plug Module in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P0600-ECM RECOVERY

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. ENGINE CONTROL MODULE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: If there are other DTC's set with this DTC repair other DTC's before continuing with this diagnostic procedure.**

**NOTE: This code can be caused by an intermittent problem in the wiring and connectors to the Engine Control Module. Inspect the Engine Control Module harness connector and associated wiring for signs of poor terminal contact.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

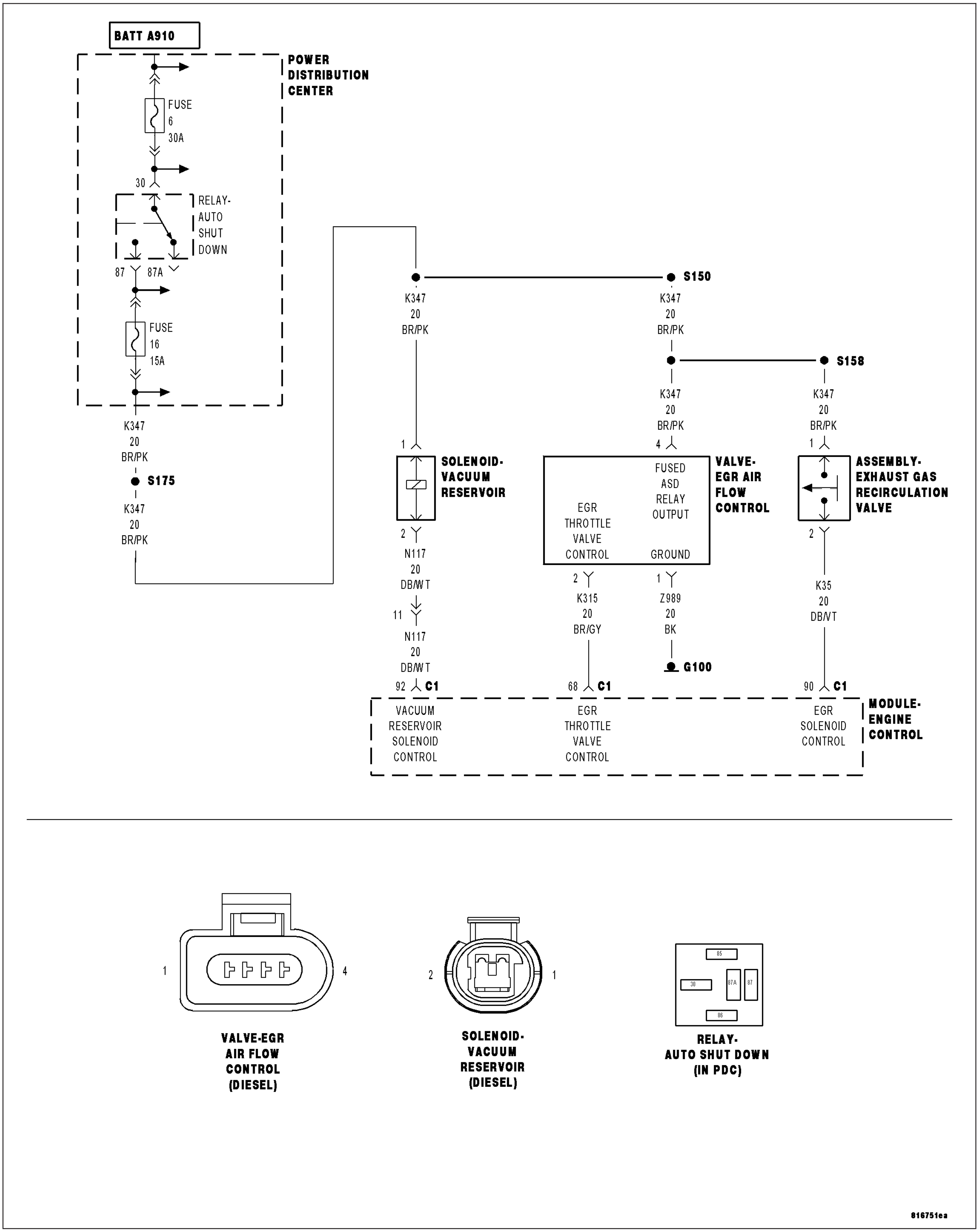
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

# P1140-VACUUM RESERVOIR SOLENOID OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Vacuum Reservoir Solenoid command off.
- **Set Condition:**
  The ECM does not detect voltage on the Vacuum Reservoir Solenoid Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| VR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| VR SOLENOID CONTROL CIRCUIT OPEN |
| VACUUM RESERVOIR SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, turning the ignition off for at least 10 seconds between engine run cycles.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

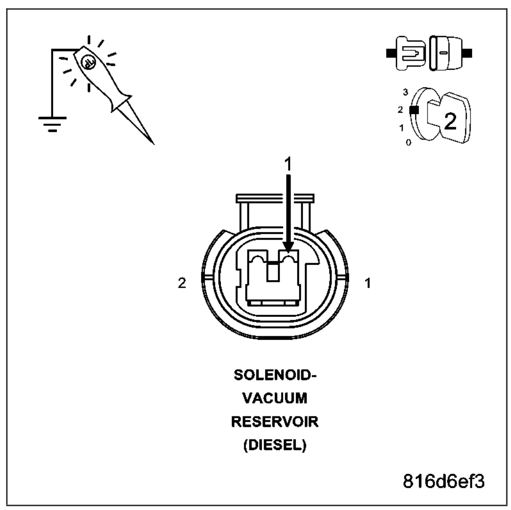
### 2. ASD OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit at the Vacuum Reservoir Solenoid harness connector.

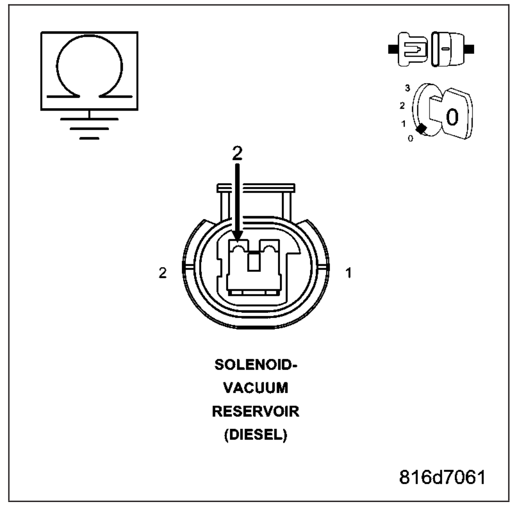



**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND




Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Vacuum Reservoir Solenoid Control circuit.

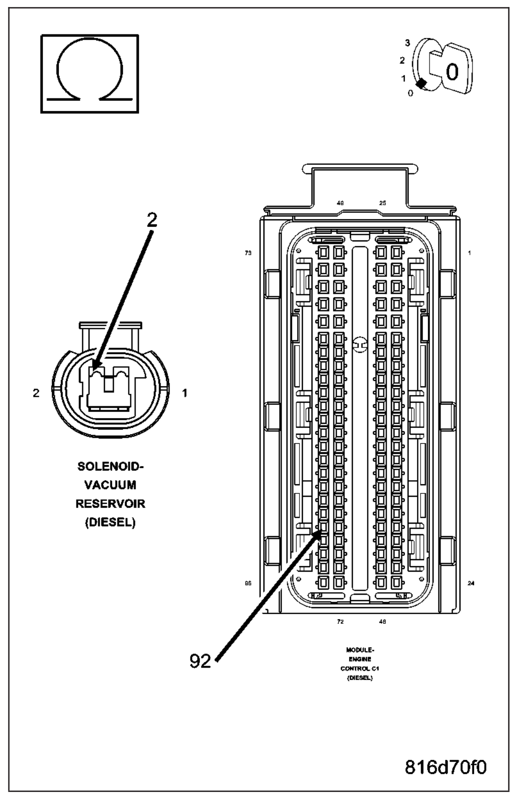
**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT OPEN




Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Vacuum Reservoir Solenoid Control circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Vacuum reservoir Solenoid Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. VACUUM RESERVOIR SOLENOID

Turn the ignition off.

Install a substitute Vacuum Reservoir Solenoid in place of the vehicle's Vacuum Reservoir Solenoid.

**NOTE: Ensure the ECM and Vacuum Reservoir Solenoid harness connectors are connected.**

Turn the ignition on.

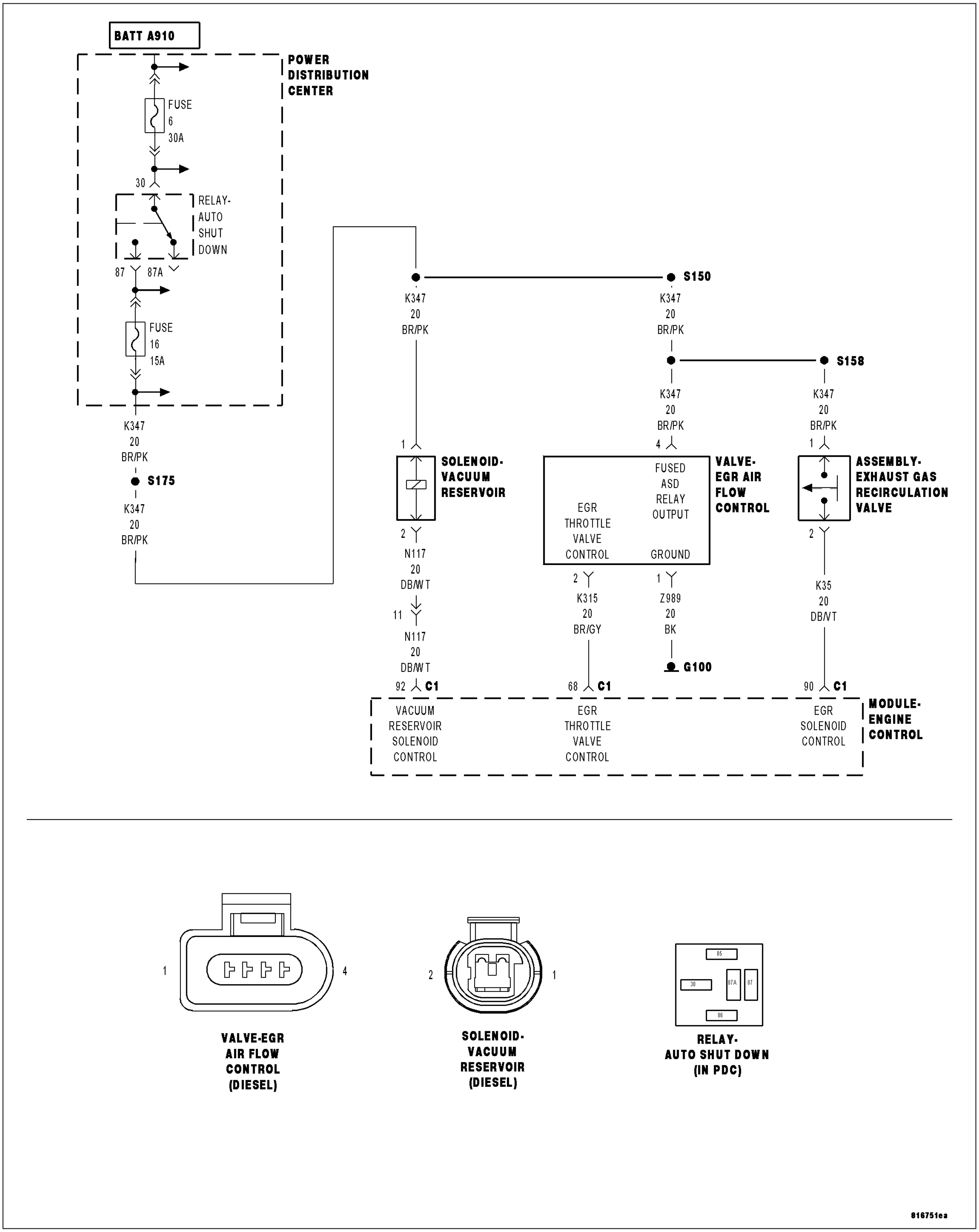
With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Vacuum Reservoir Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1140-VACUUM RESERVOIR SOLENOID SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Vacuum Reservoir Solenoid command on.
- **Set Condition:**
  The ECM detects excessive current on the Vacuum Reservoir Solenoid Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| VACUUM RESERVOIR SOLENOID |
| VR SOLENOID CONTROL SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE - INTERNAL SHORT TO VOLTAGE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, turning the ignition off for at least 10 seconds between engine run cycles.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. VR SOLENOID CONTROL SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

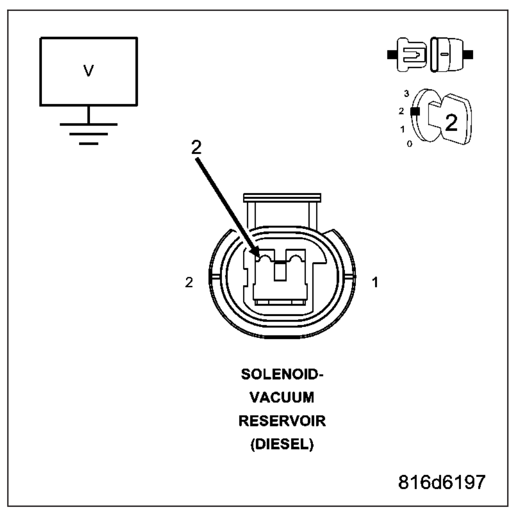
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Vacuum Reservoir Solenoid Control circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Go To 3

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. VR SOLENOID

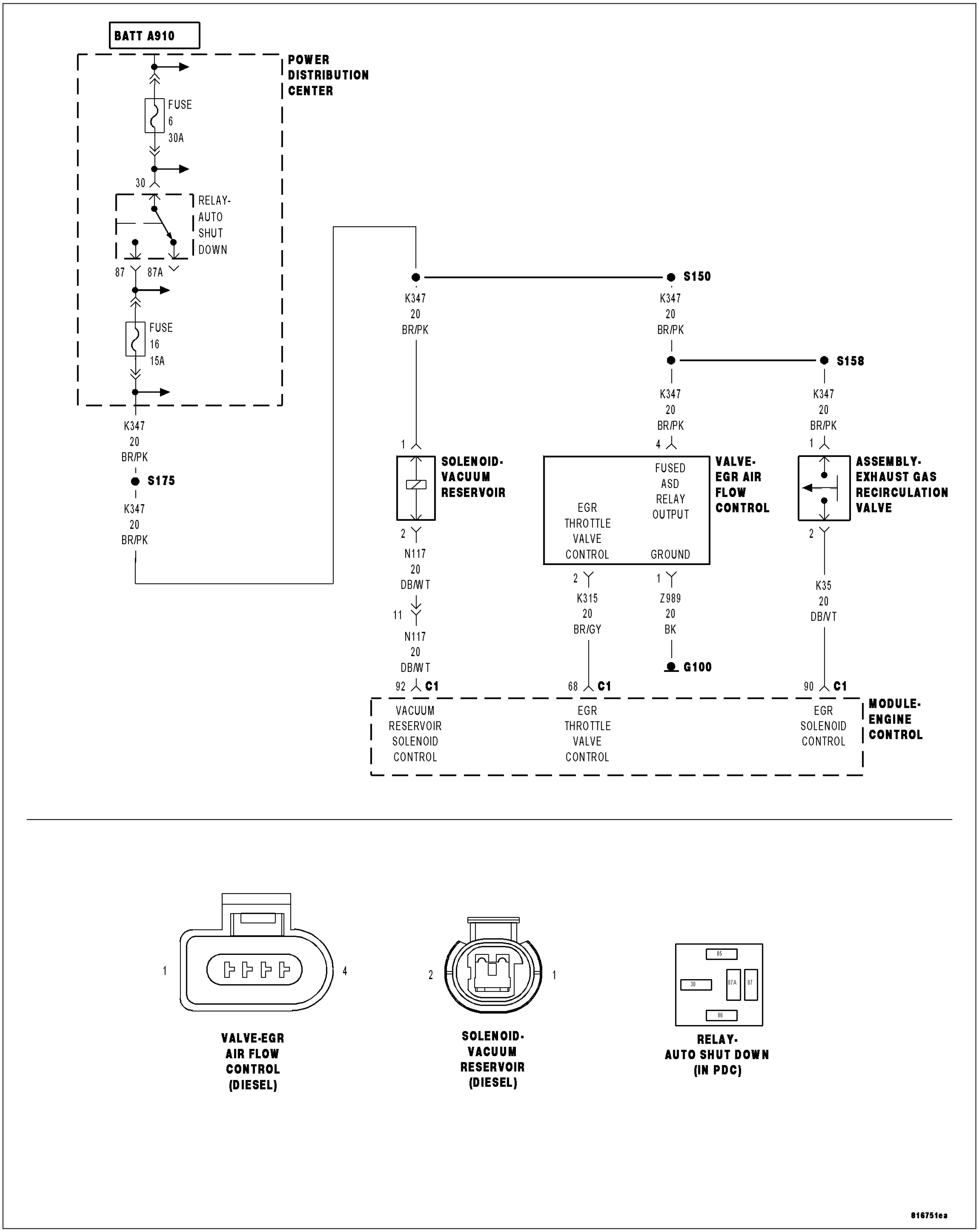
Turn the ignition off.
Disconnect the Vacuum Reservoir Solenoid harness connector.
Turn the ignition on.
With the scan tool, erase ECM DTCs.
Monitor the scan tool for ECM DTCs.

**Does the scan tool display P1250 VACUUM RESERVOIR SOLENOID OPEN CIRCUIT?**

**Yes** >> Replace the Vacuum Reservoir Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1140-VACUUM RESERVOIR SOLENOID CIRCUIT SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Vacuum Reservoir Solenoid command off.
- **Set Condition:**
  The ECM detects a short to ground on the Vacuum Reservoir Solenoid Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| VR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| VR SOLENOID CONTROL CIRCUIT OPEN |
| VACUUM RESERVOIR SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, turning the ignition off for at least 10 seconds between engine run cycles.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

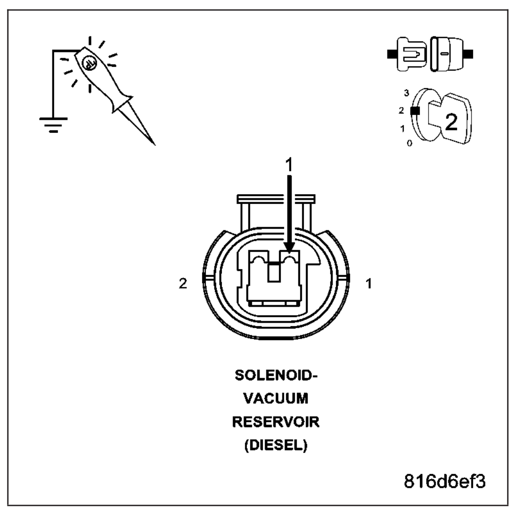
### 2. ASD OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit at the Vacuum Reservoir Solenoid harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

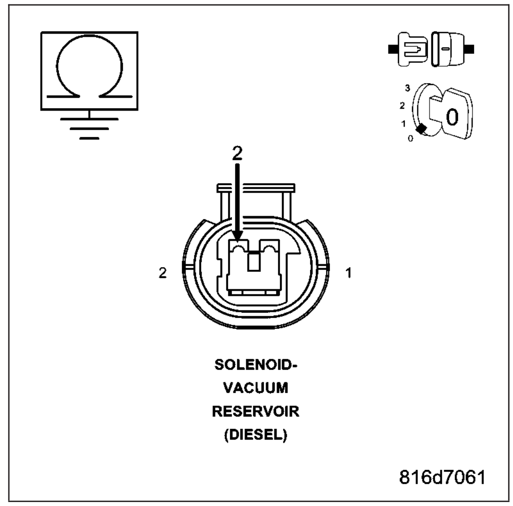
## 3. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Vacuum Reservoir Solenoid Control circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

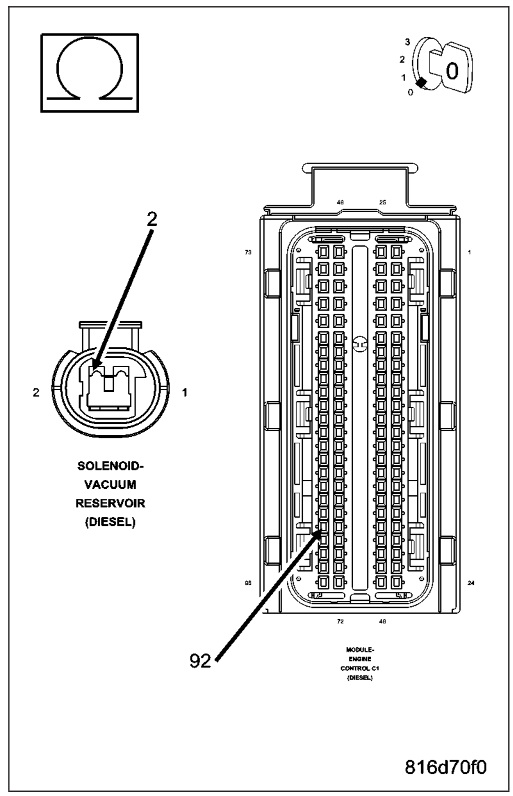
## 4. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Vacuum Reservoir Solenoid Control circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Vacuum reservoir Solenoid Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. VACUUM RESERVOIR SOLENOID

Turn the ignition off.

Install a substitute Vacuum Reservoir Solenoid in place of the vehicle's Vacuum Reservoir Solenoid.

**NOTE: Ensure the ECM and Vacuum Reservoir Solenoid harness connectors are connected.**

Turn the ignition on.

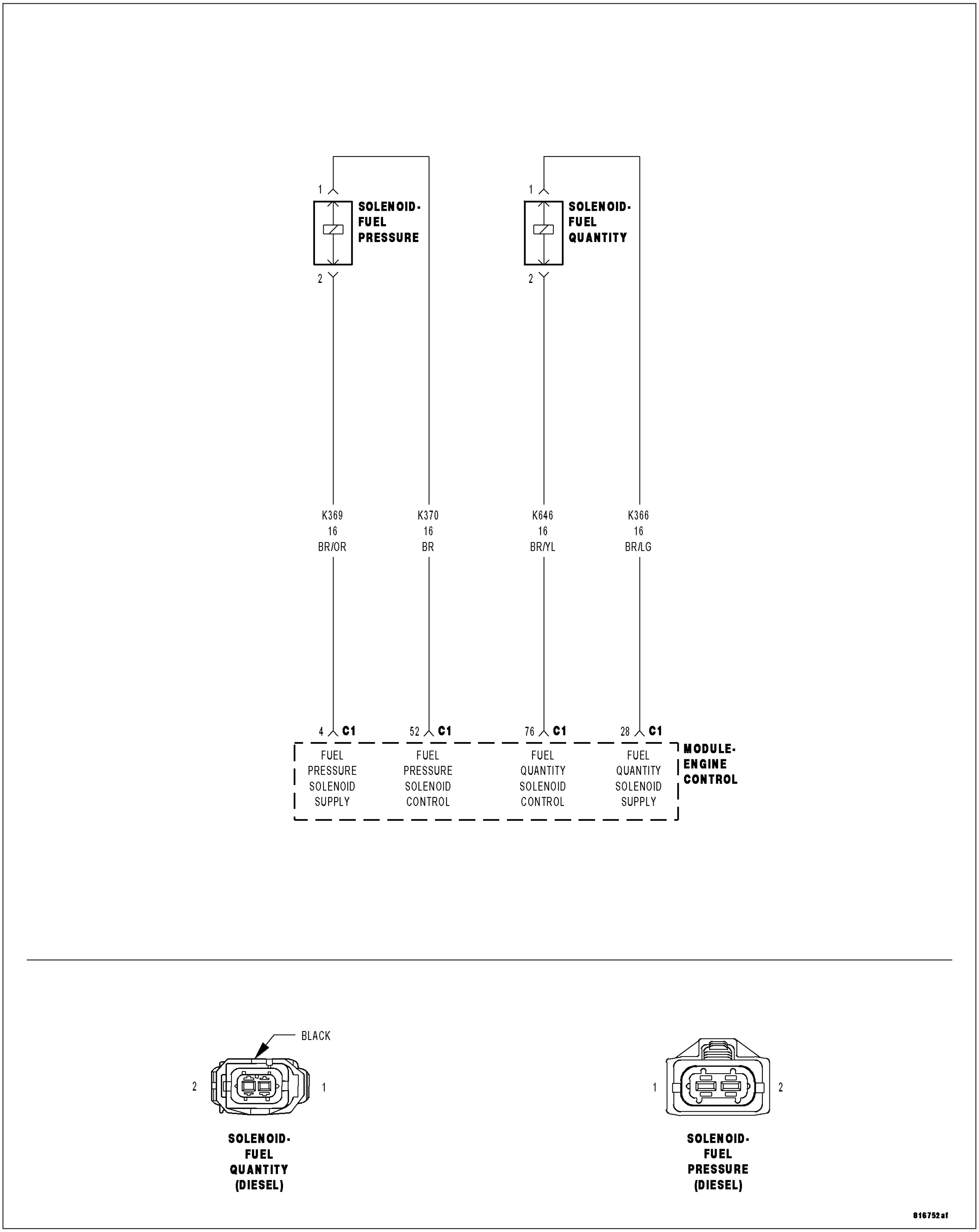
With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Vacuum Reservoir Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1142-FUEL PRESSURE SOLENOID OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Fuel Pressure Solenoid command off.
- **Set Condition:**
  The ECM does not detect voltage on the Fuel Pressure Solenoid Control circuit for 0.28 second.

| Possible Causes |
|---|
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL PRESSURE SOLENOID OPEN CIRCUIT(S) |
| INTERMITTENT CONDITION |
| FUEL PRESSURE SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the DRB at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the DRB, erase ECM DTCs.

Start the engine several times, turning the ignition off for at least 30 seconds between each run cycle.

Monitor the DRB for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

## 3. FUEL PRESSURE SOLENOID CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

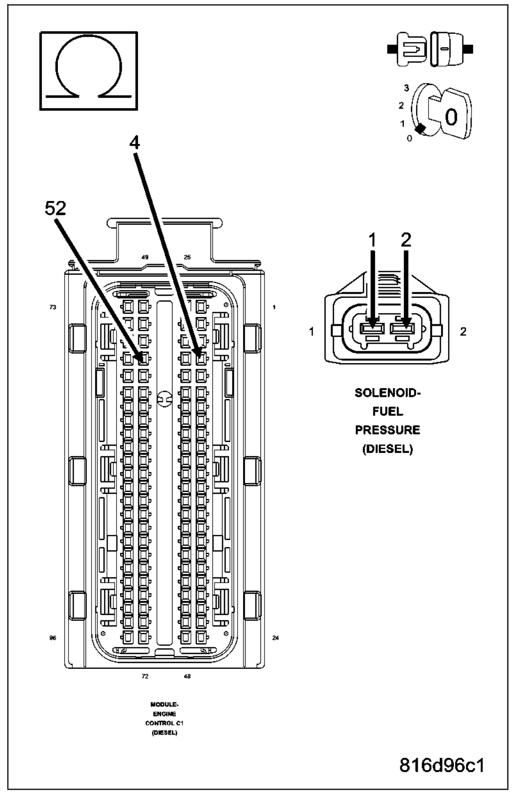
Measure the resistance of each of the Fuel Pressure Solenoid circuits between the ECM harness connector and the Fuel Pressure Solenoid harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 4

**No** >> Repair the circuit(s) that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 4. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

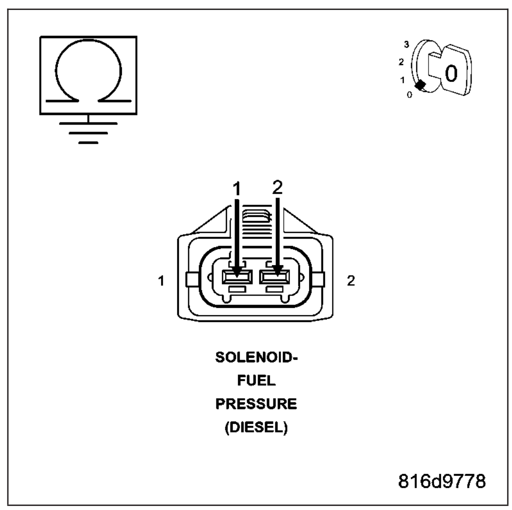
Measure the resistance between ground and each of the Fuel Pressure Solenoid circuits.

**Is the resistance above 1000 ohms for each measurement?**

**Yes** >> Go To 5

**No** >> Repair the circuit(s) that measured below 1000 ohms for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



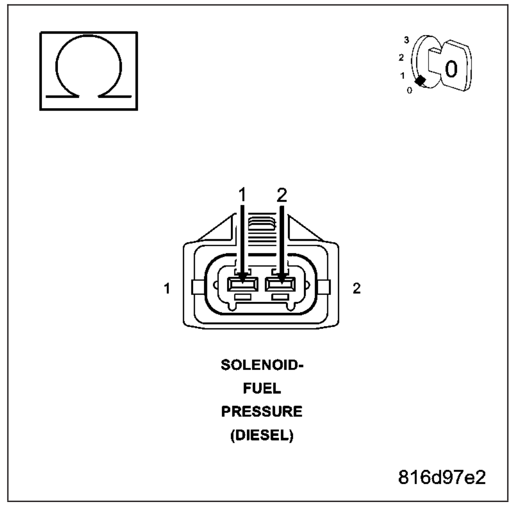
## 5. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

Measure the resistance between the Fuel Pressure Solenoid circuits.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Fuel Pressure Solenoid circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

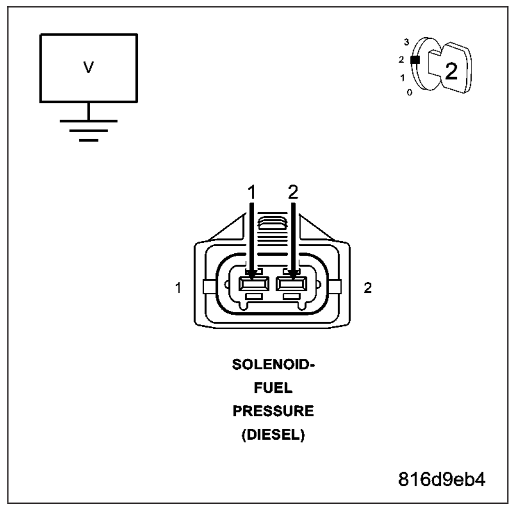
Disconnect the Fuel Pressure Solenoid harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage each of the Fuel Pressure Solenoid circuits.




**Is the voltage below 1.0 volt for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the circuit(s) that measured above 1.0 volts for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. FUEL PRESSURE SOLENOID

Turn the ignition off.

Disconnect the Fuel Pressure Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P2294-FUEL PRESSURE SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Pressure Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

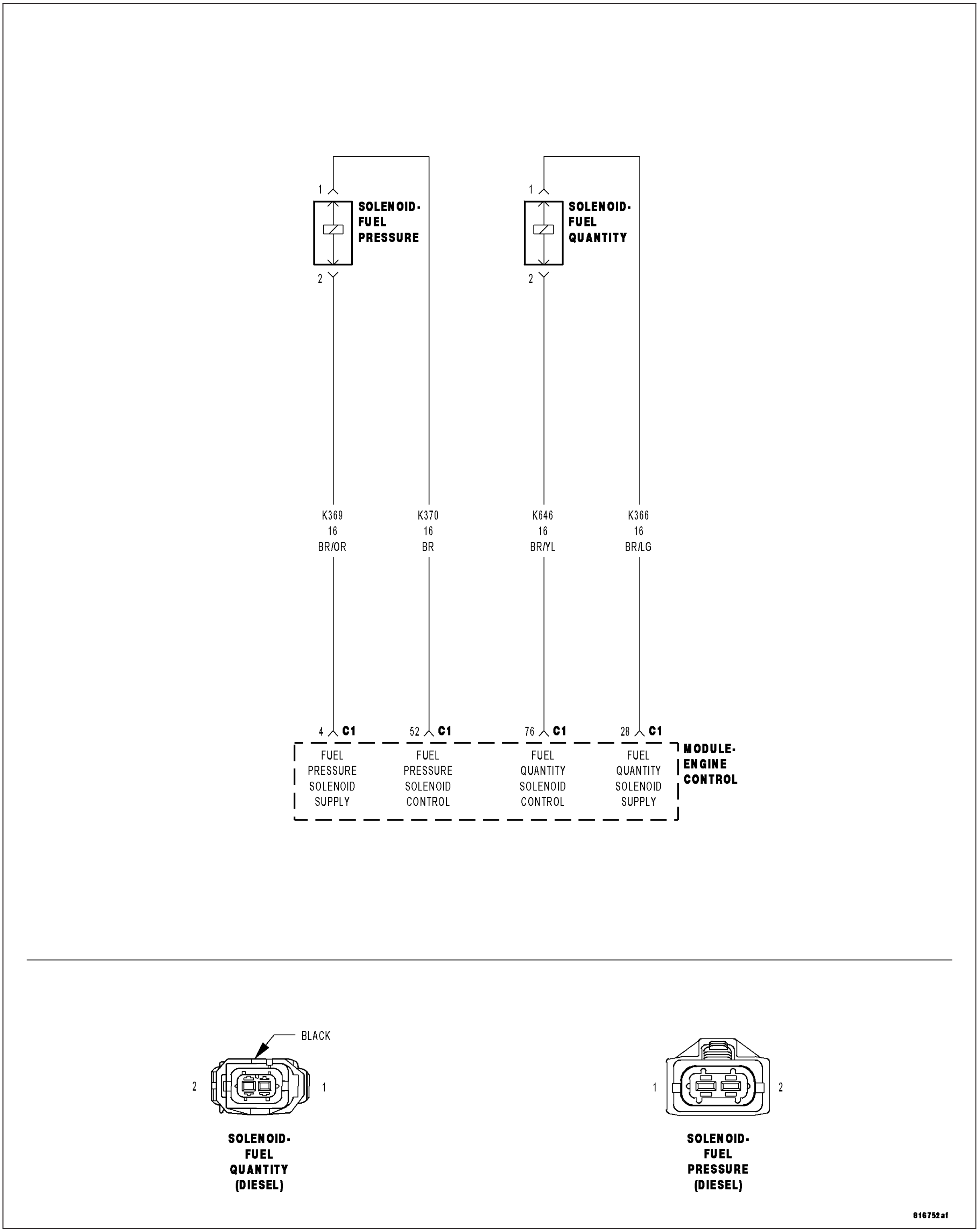
**NOTE: The scan tool should display P2296-FUEL PRESSURE SOLENOID SHORT CIRCUIT.**

**Does the scan tool display the appropriate DTC for each condition?**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1142-FUEL PRESSURE SOLENOID SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Fuel Pressure Solenoid command off.
- **Set Condition:**
  The ECM detects a short to ground on the Fuel Pressure Solenoid Control circuit.

| Possible Causes |
|---|
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL PRESSURE SOLENOID OPEN CIRCUIT(S) |
| INTERMITTENT CONDITION |
| FUEL PRESSURE SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, turning the ignition off for at least 30 seconds between each run cycle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

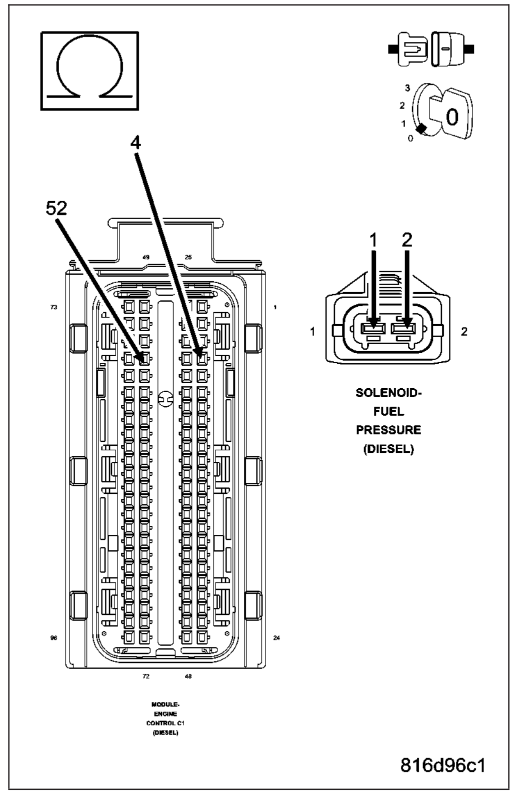
## 3. FUEL PRESSURE SOLENOID CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

Measure the resistance of each of the Fuel Pressure Solenoid circuits between the ECM harness connector and the Fuel Pressure Solenoid harness connector.




**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 4

**No** >> Repair the circuit(s) that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

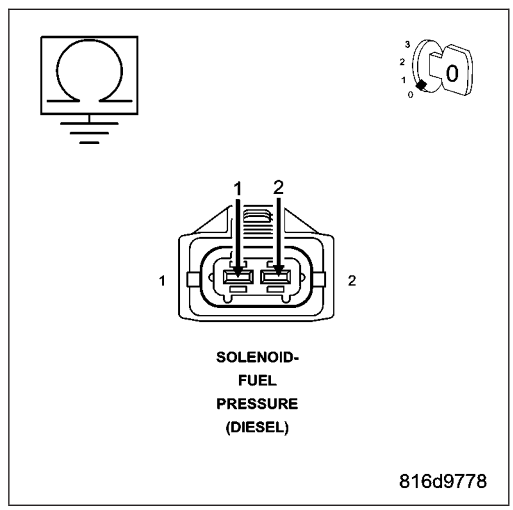
## 4. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

Measure the resistance between ground and each of the Fuel Pressure Solenoid circuits.




**Is the resistance above 1000 ohms for each measurement?**

**Yes** >> Go To 5

**No** >> Repair the circuit(s) that measured below 1000 ohms for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

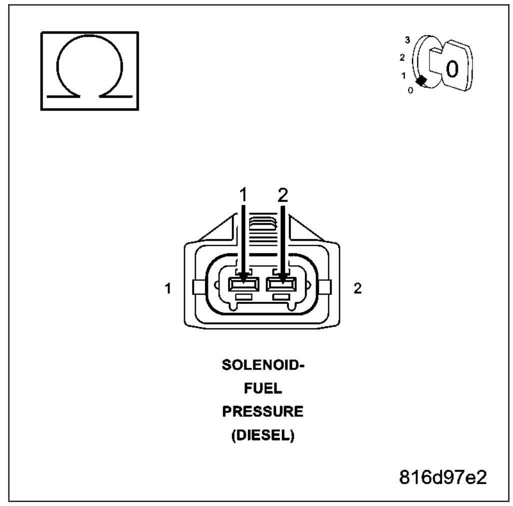
## 5. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

Measure the resistance between the Fuel Pressure Solenoid circuits.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Fuel Pressure Solenoid circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

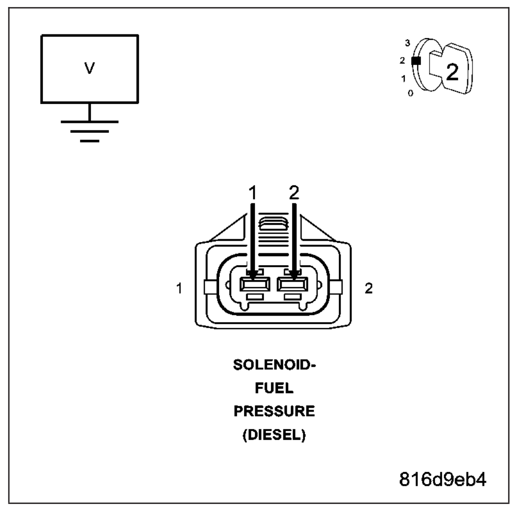
Disconnect the Fuel Pressure Solenoid harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage each of the Fuel Pressure Solenoid circuits.




**Is the voltage below 1.0 volt for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the circuit(s) that measured above 1.0 volts for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. FUEL PRESSURE SOLENOID

Turn the ignition off.

Disconnect the Fuel Pressure Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P2294-FUEL PRESSURE SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Pressure Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

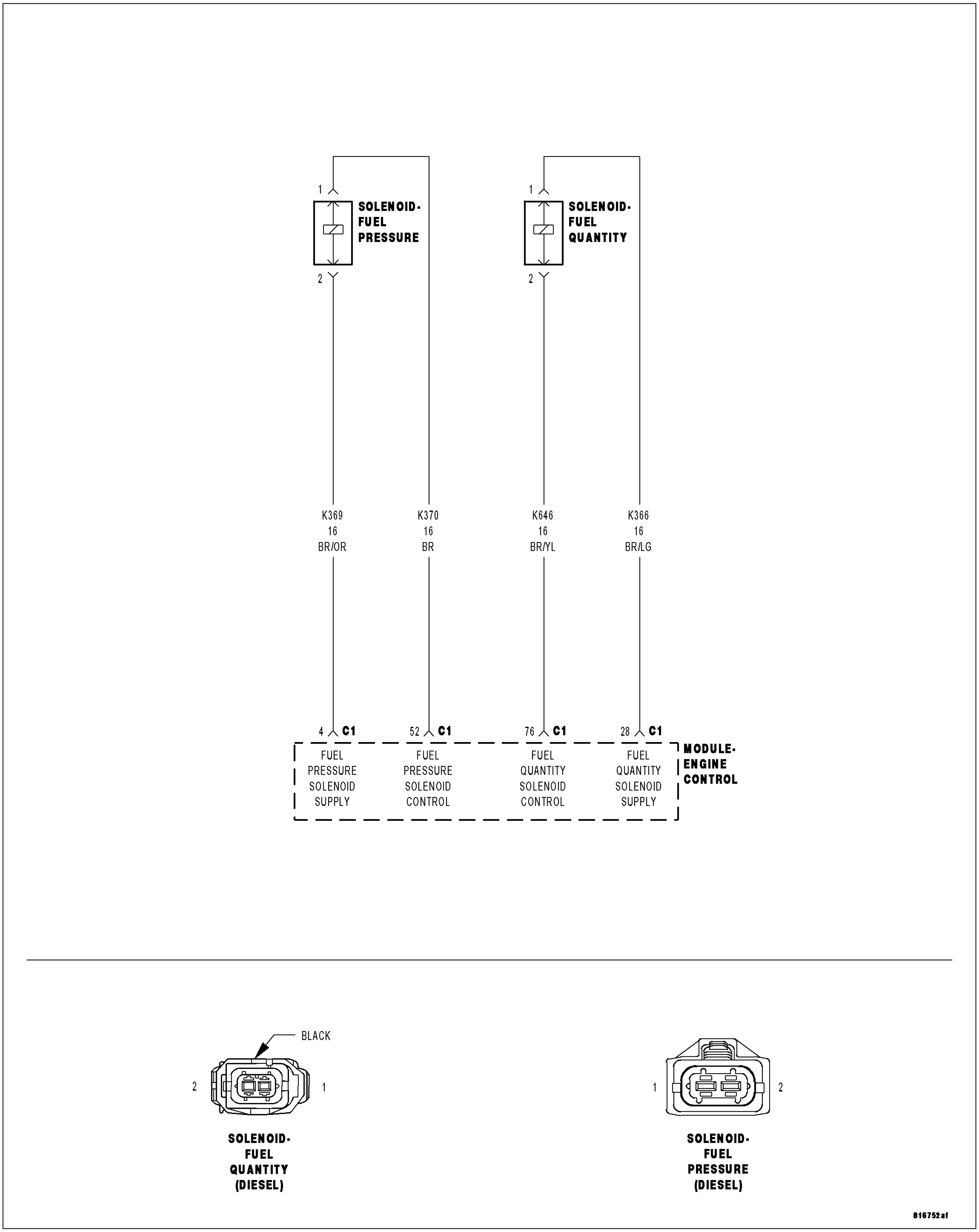
**NOTE: The scan tool should display P2296-FUEL PRESSURE SOLENOID SHORT CIRCUIT.**

**Does the DRB display the appropriate DTC for each condition?**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1142-FUEL PRESSURE SOLENOID SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Fuel Pressure Solenoid command on.
- **Set Condition:**
  The ECM detects excessive current on the Fuel Pressure Solenoid Control circuit for 0.28 second.

| Possible Causes |
| --- |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL PRESSURE SOLENOID OPEN CIRCUIT(S) |
| INTERMITTENT CONDITION |
| FUEL PRESSURE SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, turning the ignition off for at least 30 seconds between each run cycle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

## 3. FUEL PRESSURE SOLENOID CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

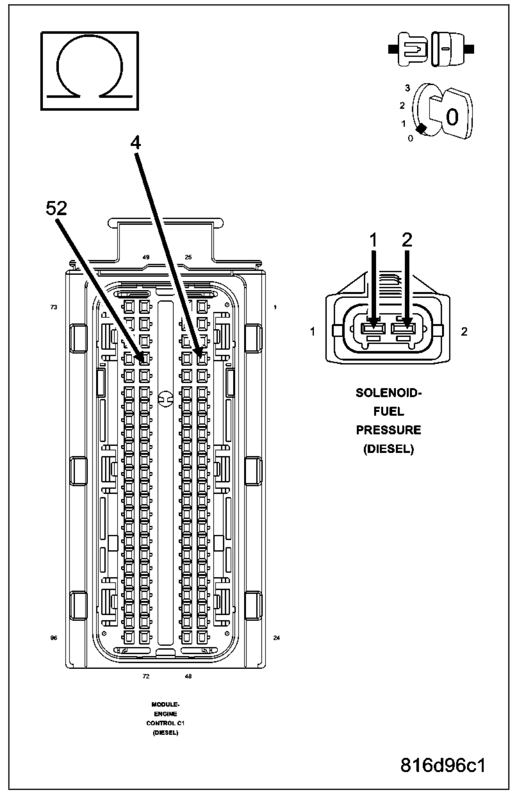
Measure the resistance of each of the Fuel Pressure Solenoid circuits between the ECM harness connector and the Fuel Pressure Solenoid harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 4

**No** >> Repair the circuit(s) that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 4. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

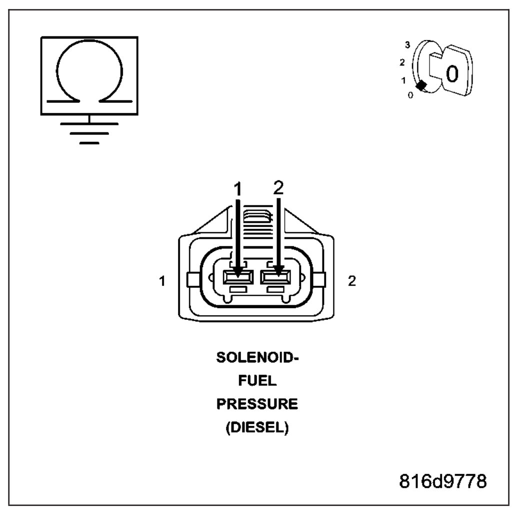
Measure the resistance between ground and each of the Fuel Pressure Solenoid circuits.

**Is the resistance above 1000 ohms for each measurement?**

**Yes** >> Go To 5

**No** >> Repair the circuit(s) that measured below 1000 ohms for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



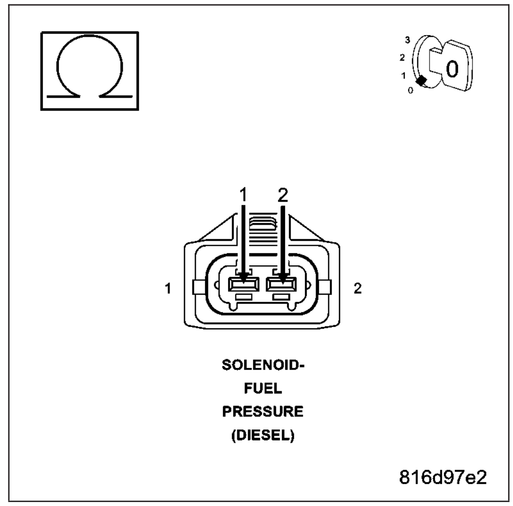
## 5. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

Measure the resistance between the Fuel Pressure Solenoid circuits.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Fuel Pressure Solenoid circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

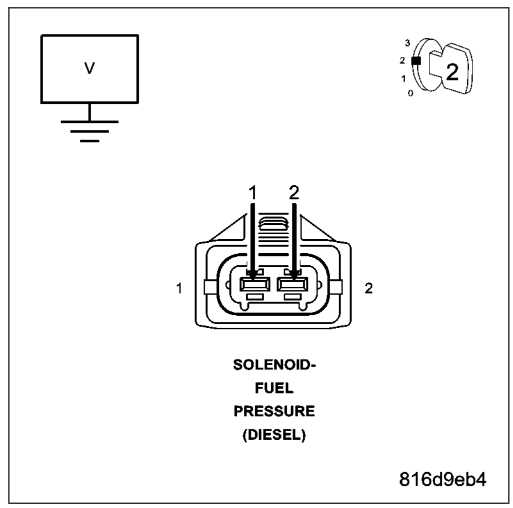
Disconnect the Fuel Pressure Solenoid harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage each of the Fuel Pressure Solenoid circuits.




**Is the voltage below 1.0 volt for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the circuit(s) that measured above 1.0 volts for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. FUEL PRESSURE SOLENOID

Turn the ignition off.

Disconnect the Fuel Pressure Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P2294-FUEL PRESSURE SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Pressure Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P2296-FUEL PRESSURE SOLENOID SHORT CIRCUIT.**

**Does the scan tool display the appropriate DTC for each condition?**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1143-FUEL RAIL PRESSURE MALFUNCTION POSITIVE PRESSURE DEVIATION

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail pressure is too high for a given engine speed/load.

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM CONCERNS |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |

## Diagnostic Test

### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.**

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Refer to the Service Information and inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. ATTEMPT TO START ENGINE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 6

**No** >> Go To 11

## 6. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. FUEL PRESSURE SOLENOID

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to missfire and emit excessive black smoke from the exhaust system.**

Start and idle the engine.

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 11. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. FUEL PRESSURE SOLENOID

Turn the ignition off.
Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 13

**No** >> Test Complete.

## 13. FUEL QUANTITY SOLENOID

Turn the ignition off.
Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P1144-FUEL RAIL PRESSURE MALFUNCTION POSITIVE VOLUME DEVIATION

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail volume is too high for a given engine speed/load.

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM CONCERNS |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |

### Diagnostic Test

#### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

#### 2. CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.**

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Refer to the Service Information and inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. ATTEMPT TO START ENGINE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 6

**No** >> Go To 11

## 6. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. FUEL PRESSURE SOLENOID

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to missfire and emit excessive black smoke from the exhaust system.**

Start and idle the engine.

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 11. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. FUEL PRESSURE SOLENOID

Turn the ignition off.
Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 13

**No** >> Test Complete.

## 13. FUEL QUANTITY SOLENOID

Turn the ignition off.
Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P1145– FUEL RAIL PRESSURE MALFUNCTION NEGATIVE PRESSURE DEVIATION

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail pressure is too low for a given engine speed/load.

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM CONCERNS |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |

### Diagnostic Test

#### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

#### 2. CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosene kerosine can cause this DTC to set.**

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Refer to the Service Information and inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. ATTEMPT TO START ENGINE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 6

**No** >> Go To 11

## 6. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. FUEL PRESSURE SOLENOID

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.**

Start and idle the engine.

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 11. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 13

**No** >> Test Complete.

## 13. FUEL QUANTITY SOLENOID

Turn the ignition off.

Replace the Fuel Quantity Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P1148-FUEL RAIL PRESSURE MALFUNCTION PRESSURE DROP IN OVERRUN

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail pressure is incorrect at engine shutdown.

| Possible Causes |
| --- |
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM CONCERNS |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |

## Diagnostic Test

### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.**

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Refer to the Service Information and inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. ATTEMPT TO START ENGINE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 6

**No** >> Go To 11

## 6. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. FUEL PRESSURE SOLENOID

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to missfire and emit excessive black smoke from the exhaust system.**

Start and idle the engine.

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 11. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 13

**No** >> Test Complete.

## 13. FUEL QUANTITY SOLENOID

Turn the ignition off.

Replace the Fuel Quantity Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P1151-FUEL RAIL PRESSURE MALFUNCTION MAXIMUM POSITIVE DEVIATION

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail pressure is too high for a given engine speed/load.

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM CONCERNS |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |

## Diagnostic Test

### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.**

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Refer to the Service Information and inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. ATTEMPT TO START ENGINE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 6

**No** >> Go To 11

## 6. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. FUEL PRESSURE SOLENOID

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.**

Start and idle the engine.

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 11. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 13

**No** >> Test Complete.

## 13. FUEL QUANTITY SOLENOID

Turn the ignition off.

Replace the Fuel Quantity Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P1152-FUEL RAIL PRESSURE MALFUNCTION POSITIVE DEV FUEL PRESS SOL SETPOINT

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail pressure is too high for a given engine speed/load.

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM CONCERNS |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |

### Diagnostic Test

#### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

#### 2. CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.**

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Refer to the Service Information and inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. ATTEMPT TO START ENGINE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 6

**No** >> Go To 11

## 6. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. FUEL PRESSURE SOLENOID

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.**

Start and idle the engine.

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. FUEL PRESSURE SOLENOID

Turn the ignition off.
Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 11. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. FUEL PRESSURE SOLENOID

Turn the ignition off.
Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 13

**No** >> Test Complete.

## 13. FUEL QUANTITY SOLENOID

Turn the ignition off.
Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

# P1153-FUEL RAIL PRESSURE MALFUNCTION NEGATIVE DEV FUEL PRESS SOL SETPOINT

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail pressure is too low for a given engine speed/load.

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM CONCERNS |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |

## Diagnostic Test

### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.**

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Refer to the Service Information and inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. ATTEMPT TO START ENGINE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 6

**No** >> Go To 11

## 6. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. FUEL PRESSURE SOLENOID

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.**

Start and idle the engine.

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. FUEL PRESSURE SOLENOID

Turn the ignition off.
Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 11. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. FUEL PRESSURE SOLENOID

Turn the ignition off.
Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 13

**No** >> Test Complete.

## 13. FUEL QUANTITY SOLENOID

Turn the ignition off.
Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P1154-FUEL RAIL PRESSURE MALFUNCTION RAIL PRESSURE IS TOO LOW

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail pressure is too low for a given engine speed/load.

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM CONCERNS |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |

### Diagnostic Test

#### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

#### 2. CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.**

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Refer to the Service Information and inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. ATTEMPT TO START ENGINE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 6

**No** >> Go To 11

## 6. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. FUEL PRESSURE SOLENOID

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.**
Start and idle the engine.

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 11. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 13

**No** >> Test Complete.

## 13. FUEL QUANTITY SOLENOID

Turn the ignition off.

Replace the Fuel Quantity Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P1155-FUEL RAIL PRESSURE MALFUNCTION RAIL PRESSURE IS TOO HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail pressure is too high for a given engine speed/load.

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM CONCERNS |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |

## Diagnostic Test

### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.**

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Refer to the Service Information and inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. ATTEMPT TO START ENGINE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 6

**No** >> Go To 11

## 6. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. FUEL PRESSURE SOLENOID

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.**

Start and idle the engine.

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 11. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 13

**No** >> Test Complete.

## 13. FUEL QUANTITY SOLENOID

Turn the ignition off.

Replace the Fuel Quantity Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P1156-FUEL RAIL PRESSURE MALFUNCTION PLAUSIBILITY

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail pressure is fluxuating out of the calibrated setpoint range.

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM CONCERNS |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |

## Diagnostic Test

### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. CURRENT DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.**

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Refer to the Service Information and inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. ATTEMPT TO START ENGINE

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 6

**No** >> Go To 11

## 6. CHECKING FOR AIR IN FUEL SYSTEM

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. FUEL PRESSURE SOLENOID

Start the engine.

With the scan tool, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by Actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8

## 8. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 9

## 9. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.**

Start and idle the engine.

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 10

## 10. FUEL PRESSURE SOLENOID

Turn the ignition off.

Replace the Fuel Pressure Solenoid in accordance with the Service Information.

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 11. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. FUEL PRESSURE SOLENOID

Turn the ignition off.
Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 13

**No** >> Test Complete.

## 13. FUEL QUANTITY SOLENOID

Turn the ignition off.
Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## P1159-IMPROPER START ATTEMPT

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Vehicle speed is below 3 km/h.
- **Set Condition:**
  The ECM detects engine speed above 100 rpm without activating the starter relay control.

| Possible Causes |
|---|
| VERIFY ACTIVE DTC |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: This DTC indicates that engine rotation has occurred without an ignition switch Start input. This can occurred when an attempt to start the vehicle using a push start method.**

**NOTE: Consult with the customer to determine if a push start has been attempted.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P1160-IGN VOLTAGE

For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| CHECK THE ECM POWER AND GROUNDS |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. VERIFY CURRENT DTC

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECK POWER AND GROUNDS

Refer to symptom Checking the ECM Power and Grounds.

**Are the ECM Power and Ground circuits o.k.?**

**Yes** >> Replace the ECM in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1169- ECM A/D CONVERTER ERROR

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an internal failure.

| Possible Causes |
|---|
| CHECKING FOR INJECTOR CODES |
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECKING FOR INJECTOR CODES

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Does the scan tool display any Injector Cylinder DTC?**

**Yes** >> Repair Fuel Injector related DTC's before continuing.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. ENGINE CONTROL MODULE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: This DTC indicates an internal ECM problem.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## P1167-CAPACITOR VOLTAGE 1

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine cranking or running.
- **Set Condition:**
  The ECM detects a capacitor voltage problem during injector actuation.

| Possible Causes |
|---|
| CHECKING FOR INJECTOR CODES |
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECKING FOR INJECTOR CODES

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Does the scan tool display any Injector Cylinder DTC?**

**Yes** >> Repair Fuel Injector related DTC's before continuing.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. ENGINE CONTROL MODULE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: This DTC indicates an internal ECM problem.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

# P1167-CAPACITOR VOLTAGE 1

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine cranking or running.
- **Set Condition:**
  The ECM detects a capacitor voltage problem during injector actuation.

| Possible Causes |
|---|
| CHECKING FOR INJECTOR CODES |
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. CHECKING FOR INJECTOR CODES

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Does the scan tool display any Injector Cylinder DTC?**

**Yes** >> Repair Fuel Injector related DTC's before continuing.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 2

### 2. ENGINE CONTROL MODULE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: This DTC indicates an internal ECM problem.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

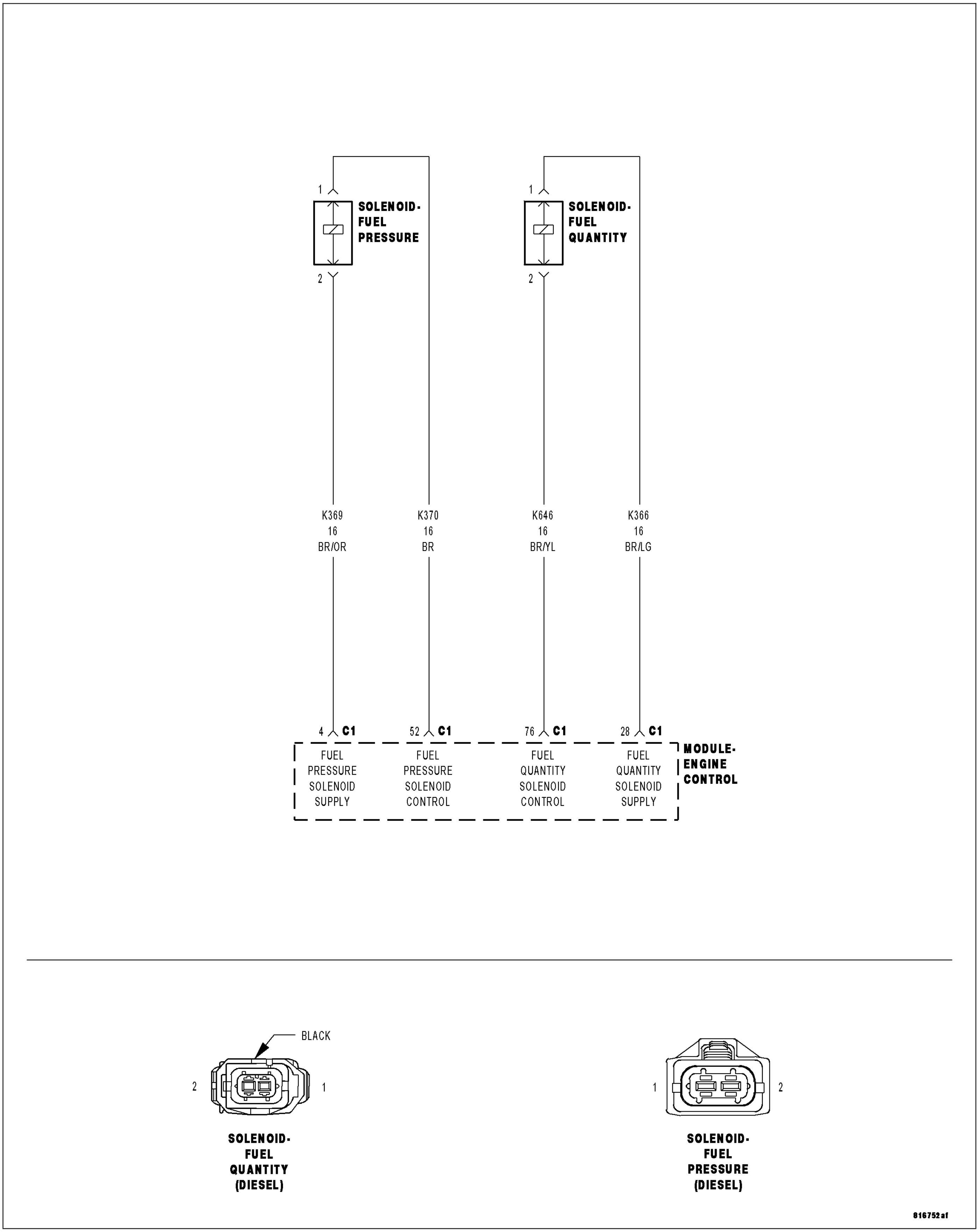
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## P1202-FUEL SYSTEM OVER PRESSURE — STUCK REGULATOR




For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the engine running.
- **Set Condition:**
  The ECM determines that the fuel rail pressure is too high for a given engine speed and load.

| Possible Causes |
|---|
| AIR IN FUEL SYSTEM |
| FUEL DELIVERY SYSTEM |
| FUEL INJECTOR(S) |
| FUEL PRESSURE SOLENOID |
| FUEL PUMP |
| FUEL SYSTEM CONTAMINATION |
| FUEL SYSTEM LEAK |
| INTERMITTENT DTC |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)**

## Diagnostic Test

### 1. CHECKING FOR OTHER ECM DTCS

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, read the ECM DTCs.

**Are there any other DTCs present?**

**Yes** >> Refer to symptom list for problems related to the DTC other than this DTC.
Perform the ECM VERIFICATION TEST.

**No** >> Go To 2

### 2. CURRENT DTC

**NOTE: Refer to the Service Information and perform the Air Bleed Procedure before continuing diagnosis.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

**NOTE: Driving the vehicle up and down steep hills or rapid cornering with a low fuel level can cause this DTC to set. Verify with customer if Low Fuel Light was illuminated when fault occurred.**

Test drive the vehicle under various load and speed conditions to attempt to duplicate the fault.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 3. FUEL SYSTEM LEAK

Turn the ignition off.

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the entire fuel system for leakage.

**Is there any evidence of leakage?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 4

## 4. FUEL SYSTEM CONTAMINATION

**NOTE: Mixing any other fuels such as gasoline or kerosine can cause this DTC to set.**

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Inspect the fuel system for contamination.

**Is the fuel contaminated?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 5

## 5. FUEL PRESSURE SENSOR CALIBRATION

Turn the ignition on.

With the scan tool, read the Fuel Pressure Sensor volts.

**Does the scan tool display between 0.45 and 0.55 volts for the Fuel Pressure Sensor?**

**Yes** >> Go To 6

**No** >> Check the Fuel Pressure Sensor wiring and connectors for corrosion or poor terminal contact that could cause high resistance. repair as necessary. If wiring and connectors are o.k., replace the Fuel Pressure Sensor.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 6. ATTEMPT TO START ENGINE

With the scan tool, erase the ECM DTCs.

Attempt to start the engine.

**Does the engine start and idle?**

**Yes** >> Go To 7

**No** >> Go To 12

## 7. CHECKING FOR AIR IN FUEL SYSTEM

With the scan tool in Sensors, compare the Fuel Pressure Setpoint with the Actual Fuel Pressure readings.

**NOTE: If there is air in the fuel system, the Actual Fuel Pressure will oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint.**

**Does Actual Fuel Pressure oscillate more than 100 psi above and/or below the Fuel Pressure Setpoint?**

**Yes** >> Refer to the Service Information to purge air from the fuel system.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 8

## 8. FUEL PRESSURE SOLENOID

With the scan tool, compare the Fuel Pressure Setpoint with the actual Fuel Pressure.

**NOTE: A sticking Fuel Pressure Solenoid is indicated by the actual Fuel Pressure gradually dropping below the Fuel Pressure Setpoint then suddenly increasing (spiking) above the Fuel Pressure Setpoint.**

**Does the actual Fuel Pressure gradually decrease then suddenly increase (spike) above the Fuel Pressure Setpoint?**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 9

## 9. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 10

## 10. FUEL INJECTOR(S)

**NOTE: An injector that sticks open can cause this DTC. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.**

**Does the engine exhibit the symptoms described in the above note?**

**Yes** >> Using the Service Information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 11

## 11. FUEL PRESSURE SOLENOID

Turn the ignition off.
Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Test Complete.

## 12. CHECKING FUEL DELIVERY SYSTEM

Refer to the appropriate Service Information and refer to Diagnosis and Testing Fuel Delivery System table.

**NOTE: The following is a list of problems that can cause fuel pressure to deviate from specification: restricted fuel filter or fuel lines, failed fuel pressure solenoid, air in fuel system, failed fuel sending unit, contaminated fuel, faulty injector.**

**Were there any problems with the Fuel Delivery System?**

**Yes** >> Repair as necessary in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 13

## 13. FUEL PRESSURE SOLENOID

Turn the ignition off.
Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Does the ECM display this DTC?**

**Yes** >> Go To 14

**No** >> Test Complete.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 14. FUEL QUANTITY SOLENOID

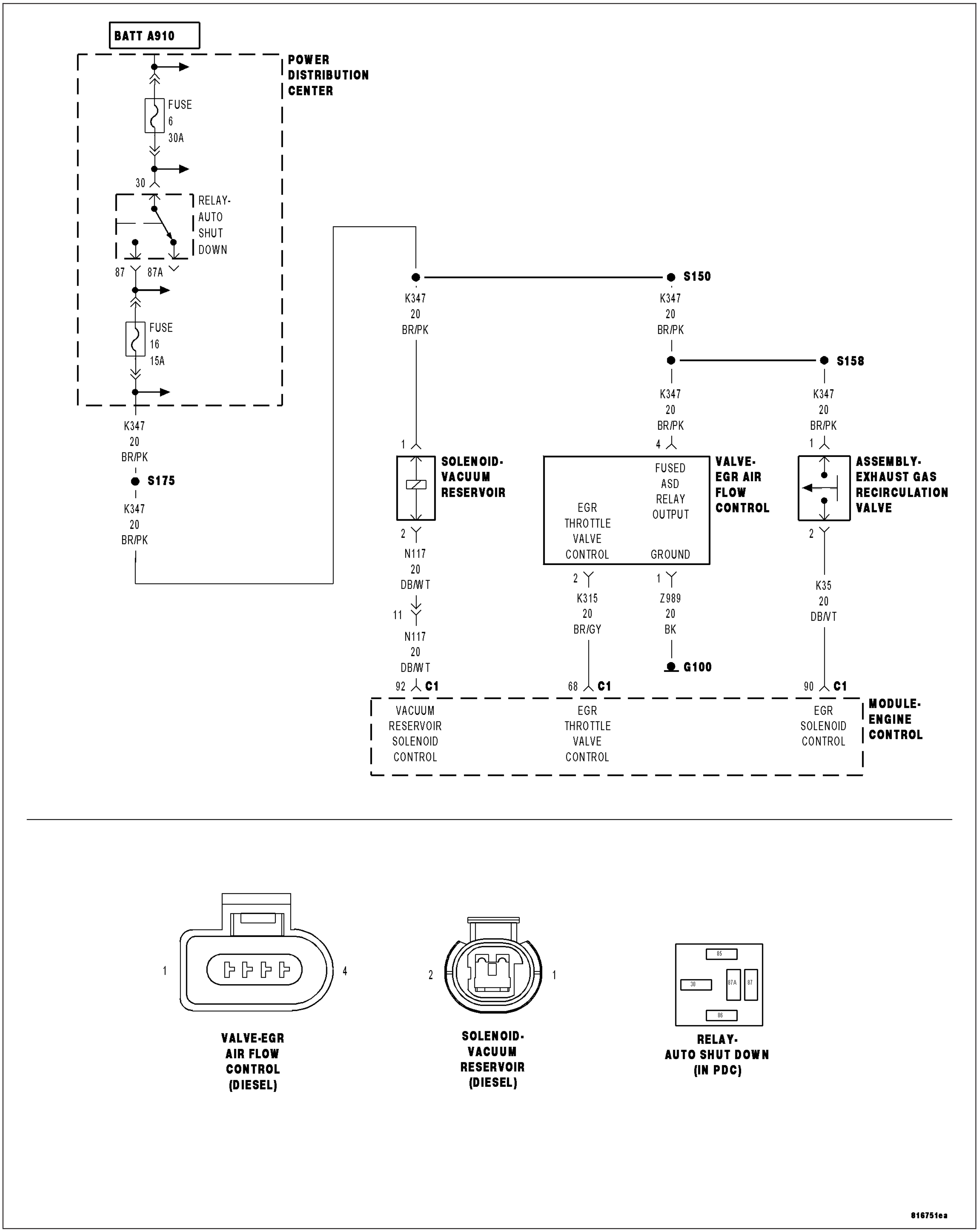
Turn the ignition off.
Replace the Fuel Quantity Solenoid in accordance with the Service Information.
Turn the ignition on.
With the scan tool, erase the ECM DTCs.
Attempt to start and test drive the vehicle.
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace the Fuel Pump in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Test Complete.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## P1250-VACUUM RESERVOIR SOLENOID OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Vacuum Reservoir Solenoid command off.
- **Set Condition:**
  The ECM does not detect voltage on the Vacuum Reservoir Solenoid Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| VACUUM RESERVOIR SOLENOID CONTROL SHORTED TO VOLTAGE |
| VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT OPEN |
| VACUUM RESERVOIR SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: IfINTERMITTENT CONDITIONe ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles, turning the ignition off for at least 10 seconds between each ignition cycle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC’s including this DTC to set.**

**NOTE: Check the ECM for other DTC’s. If other DTC’s are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

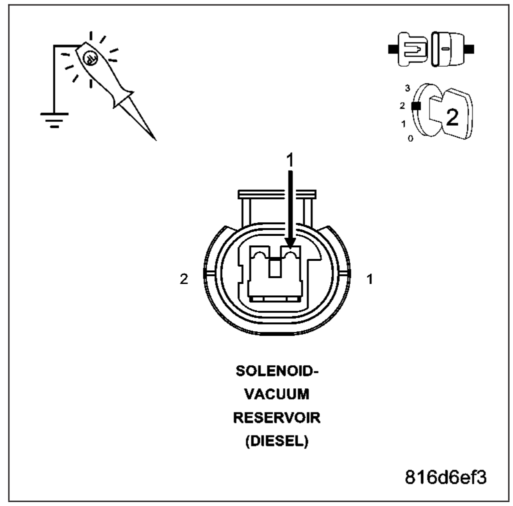
## 3. ASD OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. VACUUM RESERVOIR SOLENOID CONTROL SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

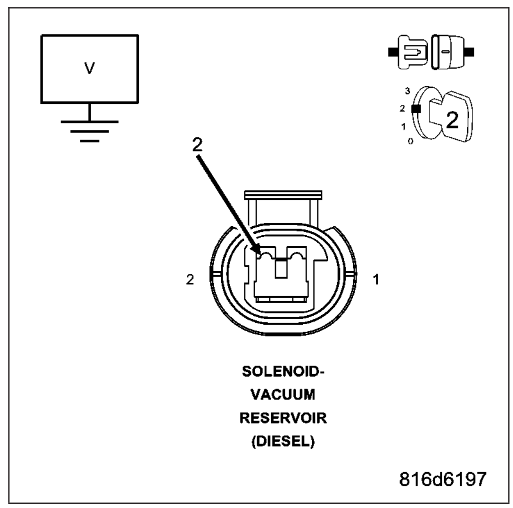
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Vacuum Reservoir Solenoid Control circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Go To 5

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

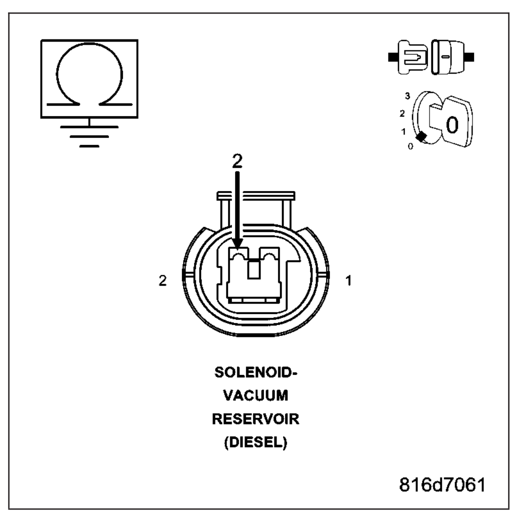
## 5. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Vacuum Reservoir Solenoid Control circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

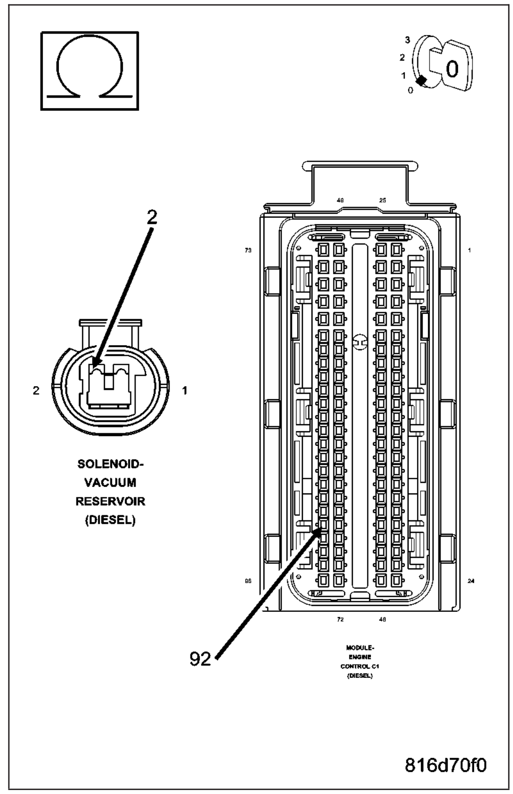
## 6. VACUUM RESERVIOR SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Vacuum Reservoir Solenoid Control circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CHECK THE VACUUM RESERVOIR SOLENOID

Turn the ignition off.

Install a substitute Vacuum Reservoir Solenoid in place of the vehicle's Vacuum reservoir Solenoid.

**NOTE: Ensure the ECM and Vacuum Reservoir Solenoid harness connectors are connected.**

Turn the ignition on.

With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

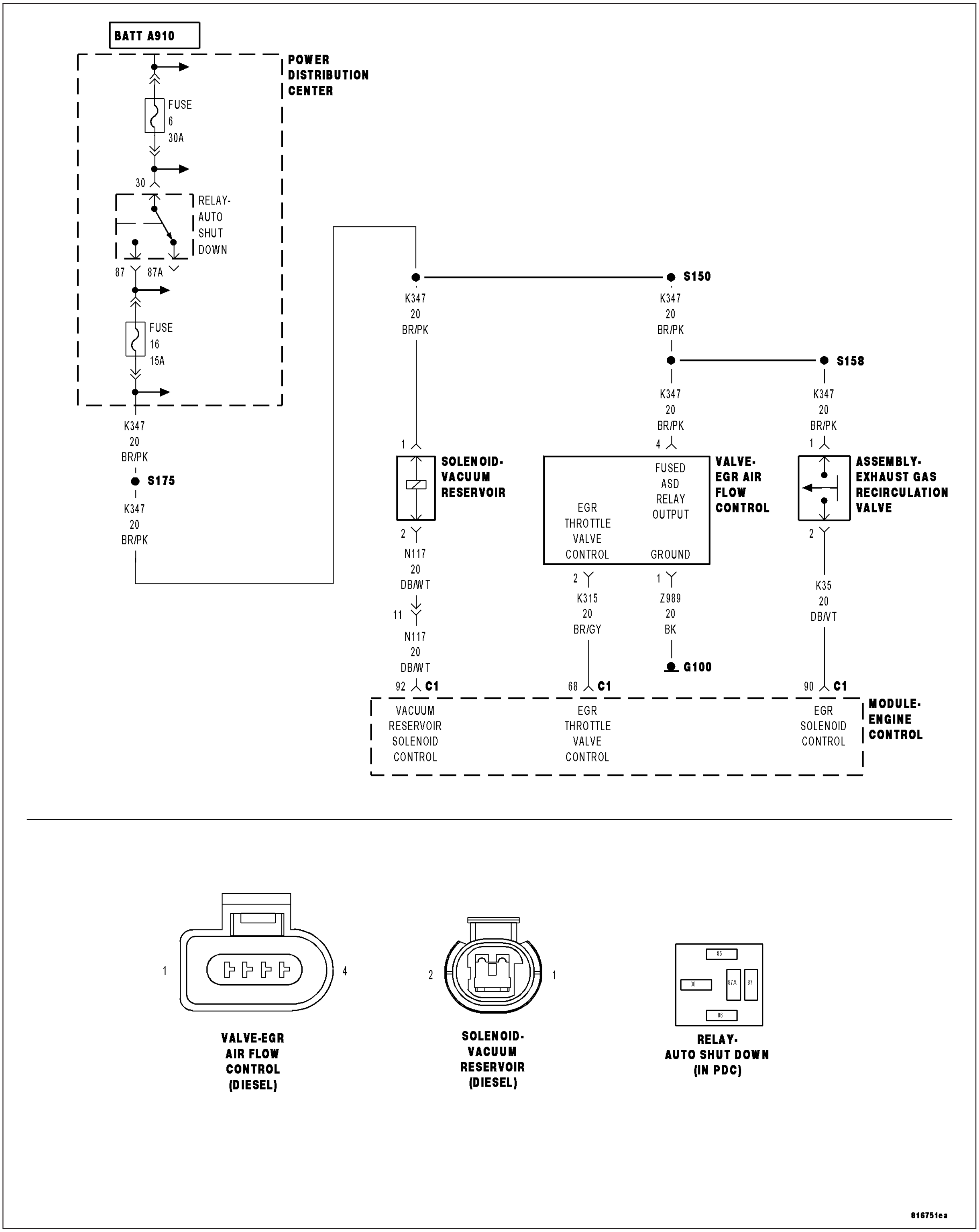
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Vacuum Reservoir Solenoid.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P1251-VACUUM RESERVOIR SOLENOID SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Vacuum Reservoir Solenoid command off.
- **Set Condition:**
  The ECM detects a short to ground on the Vacuum Reservoir Solenoid Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| VACUUM RESERVOIR SOLENOID CONTROL SHORTED TO VOLTAGE |
| VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT OPEN |
| VACUUM RESERVOIR SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: IfINTERMITTENT CONDITIONe ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles, turning the ignition off for at least 10 seconds between each ignition cycle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

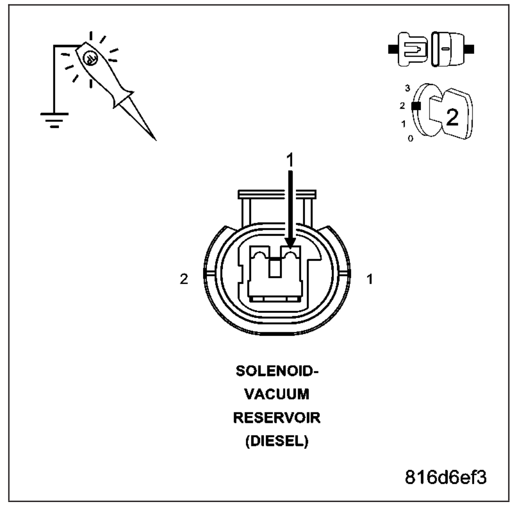
## 3. ASD OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. VACUUM RESERVOIR SOLENOID CONTROL SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

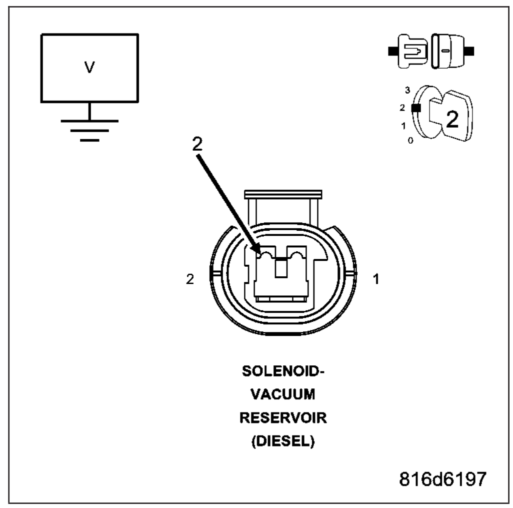
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Vacuum Reservoir Solenoid Control circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Go To 5

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

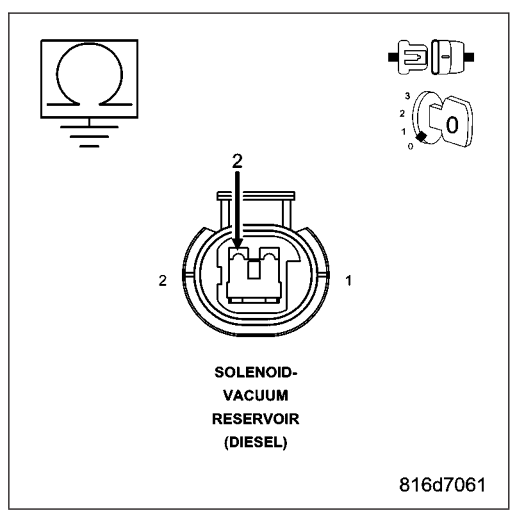
## 5. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Vacuum Reservoir Solenoid Control circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

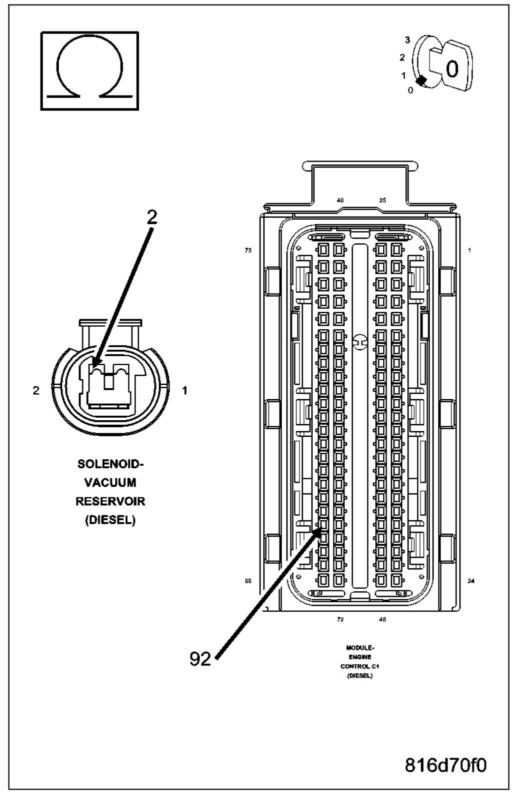
## 6. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Vacuum Reservoir Solenoid Control circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. VACUUM RESERVOIR SOLENOID

Turn the ignition off.

Install a substitute Vacuum Reservoir Solenoid in place of the vehicle's Vacuum reservoir Solenoid.

**NOTE: Ensure the ECM and Vacuum Reservoir Solenoid harness connectors are connected.**

Turn the ignition on.

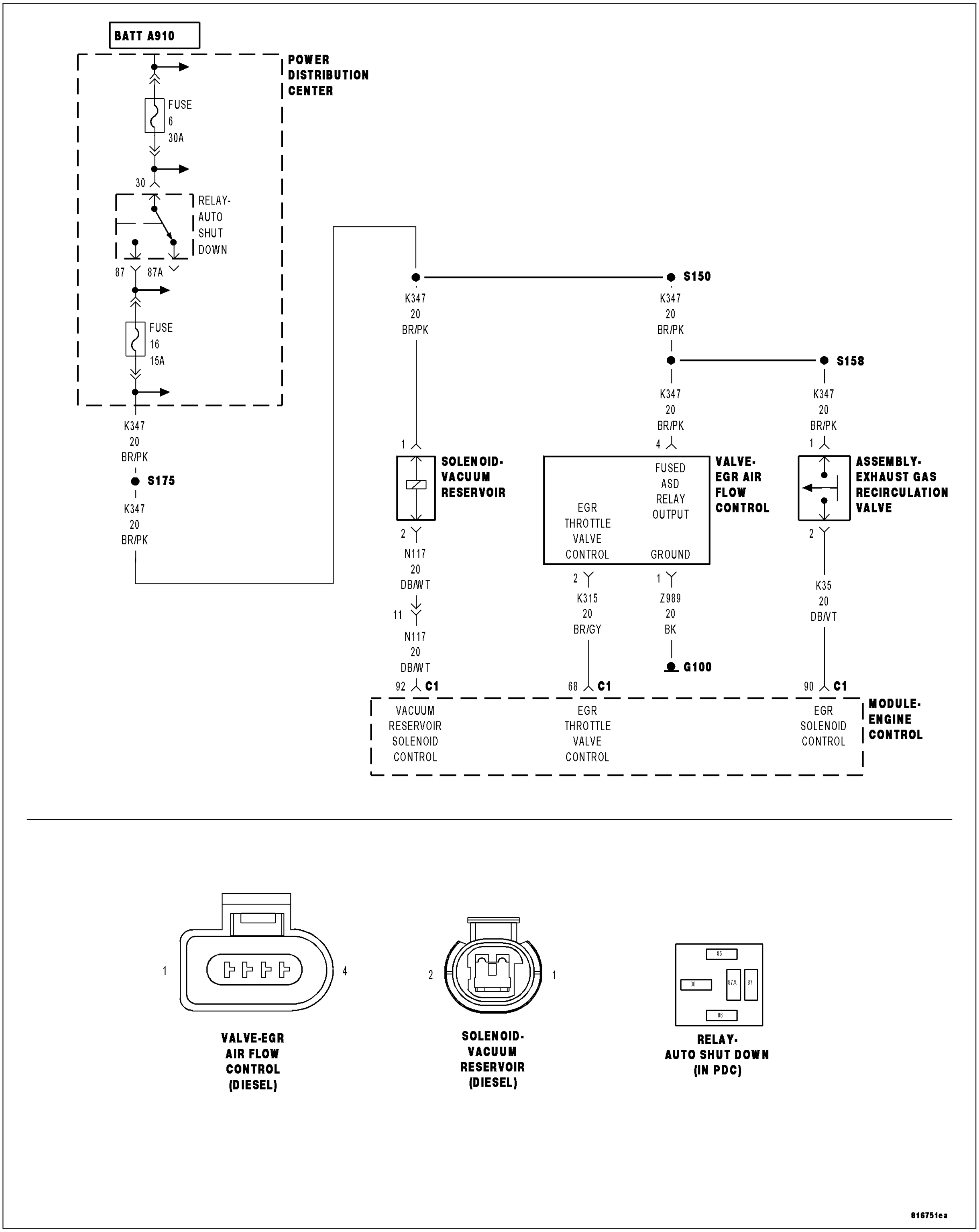
With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Vacuum Reservoir Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P1252-VACUUM RESERVOIR SOLENOID SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Vacuum Reservoir Solenoid command on.
- **Set Condition:**
  The ECM detects a short to voltage on the Vacuum Reservoir Solenoid Control circuit.

| Possible Causes |
| --- |
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| VACUUM RESERVOIR SOLENOID CONTROL SHORTED TO VOLTAGE |
| VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT OPEN |
| VACUUM RESERVOIR SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: IfINTERMITTENT CONDITIONe ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several ignition cycles, turning the ignition off for at least 10 seconds between each ignition cycle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

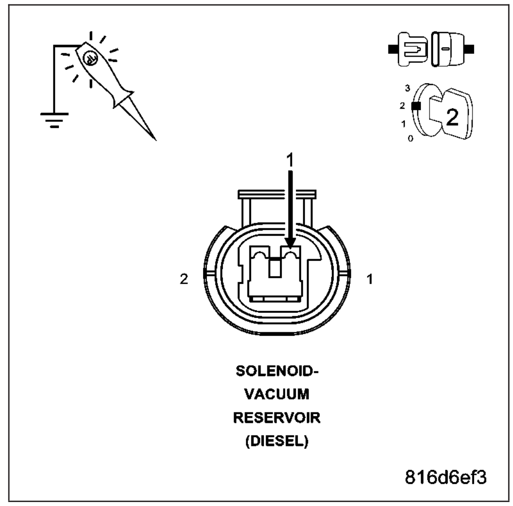
## 3. ASD OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. VACUUM RESERVOIR SOLENOID CONTROL SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

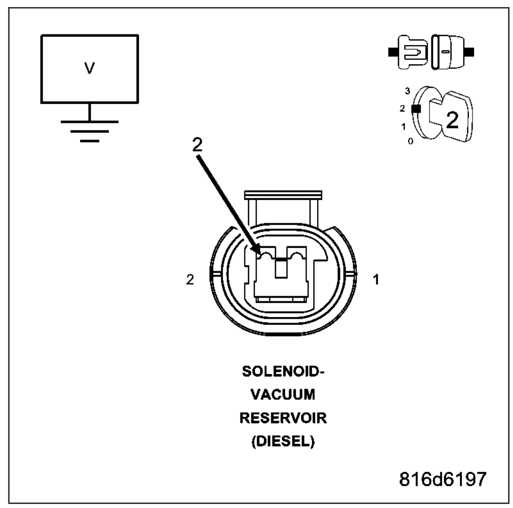
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Vacuum Reservoir Solenoid Control circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Go To 5

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

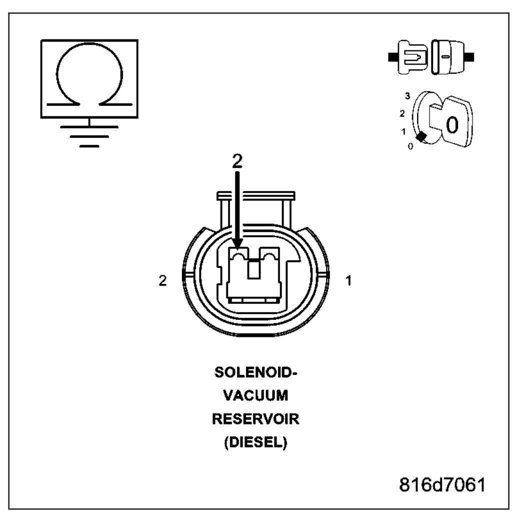
## 5. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Vacuum Reservoir Solenoid Control circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

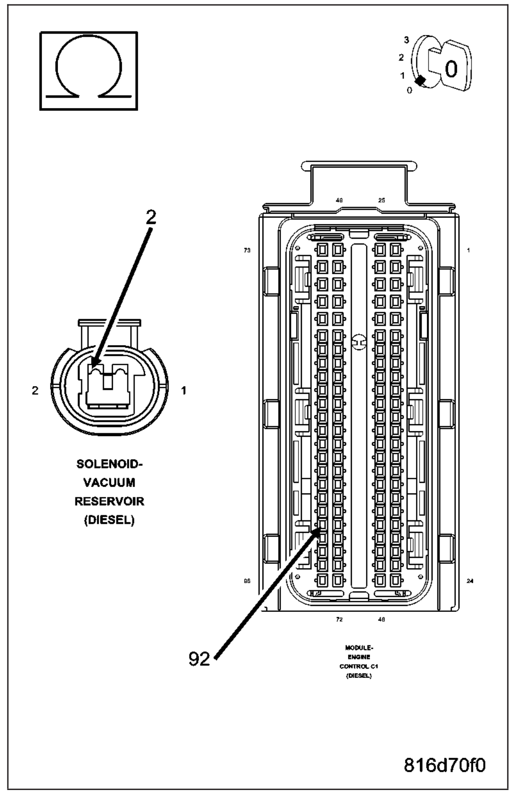
Measure the resistance of the Vacuum Reservoir Solenoid Control circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 7

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 7. VACUUM RESERVOIR SOLENOID

Turn the ignition off.

Install a substitute Vacuum Reservoir Solenoid in place of the vehicle's Vacuum reservoir Solenoid.

**NOTE: Ensure the ECM and Vacuum Reservoir Solenoid harness connectors are connected.**

Turn the ignition on.

With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

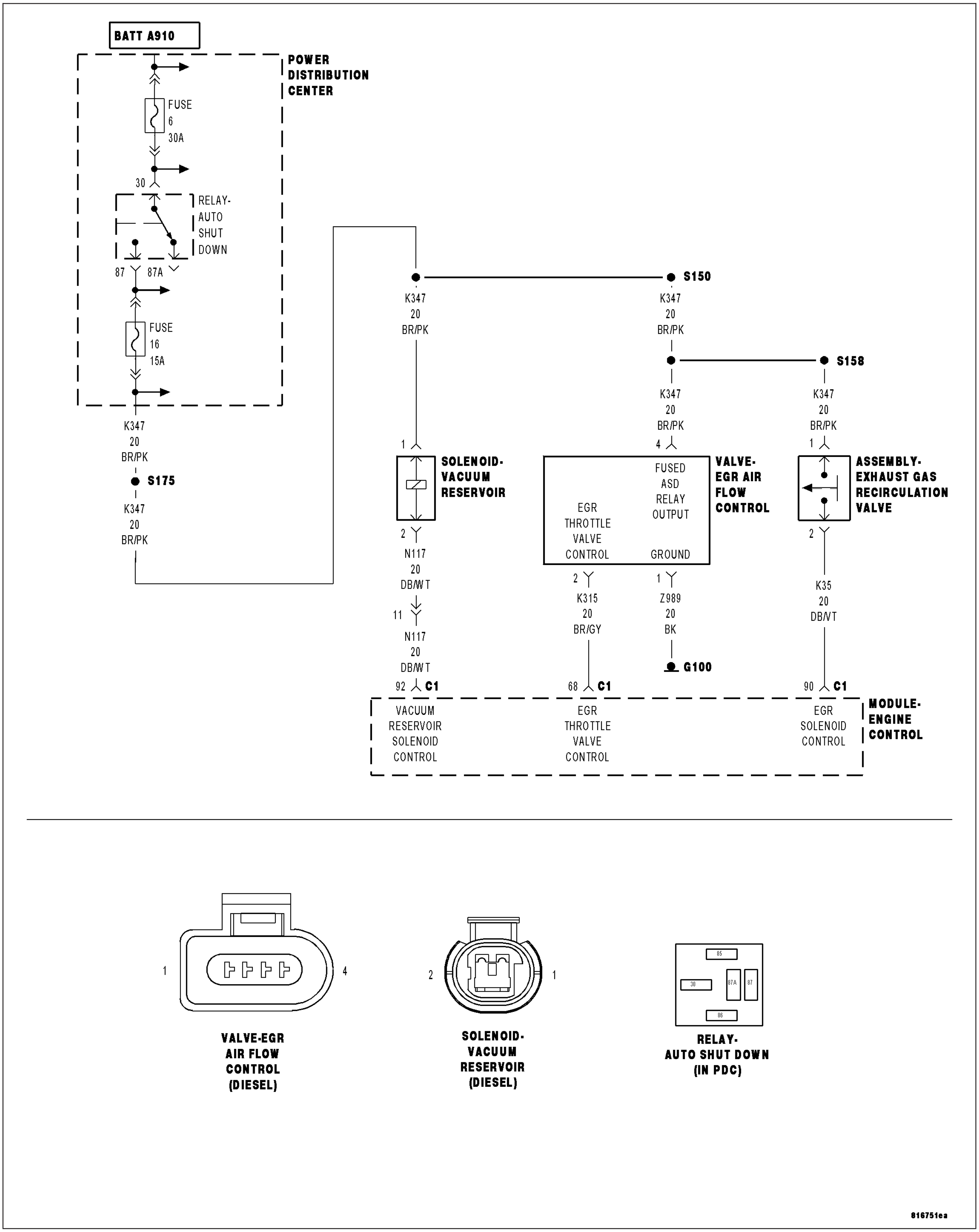
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Vacuum Reservoir Solenoid.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2101-EGR AIR FLOW CONTROL VALVE EXCESSIVE CURRENT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM EGR Air Flow Control Valve command on.
- **Set Condition:**
  The ECM detects excessive current on the EGR Air Flow Control Valve Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| EGR AIR FLOW CONTROL VALVE |
| EGR AIR FLOW CONTROL VALVE CONTROL SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE - INTERNAL SHORT TO VOLTAGE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle and monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. EGR AIR FLOW CONTROL VALVE

Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

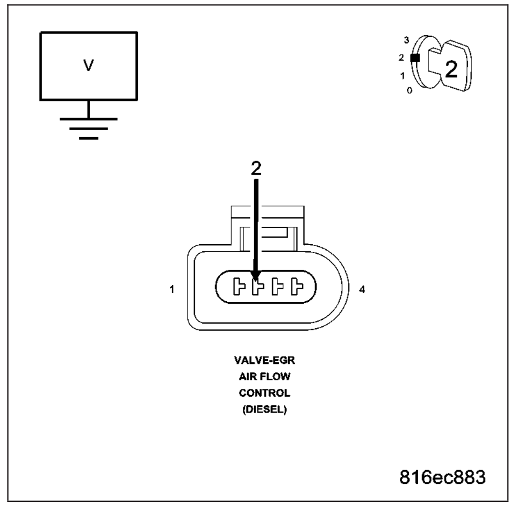
Monitor the scan tool for ECM DTCs.

**Does the scan tool display an EGR AIR FLOW CONTROL VALVE OPEN CIRCUIT dtc?**

**Yes** >> Replace the EGR Air Flow Control Valve.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. EGR AIR FLOW CONTROL VALVE SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the EGR Air Flow Control Valve Control circuit.

**Is the voltage below 1.0 volt?**

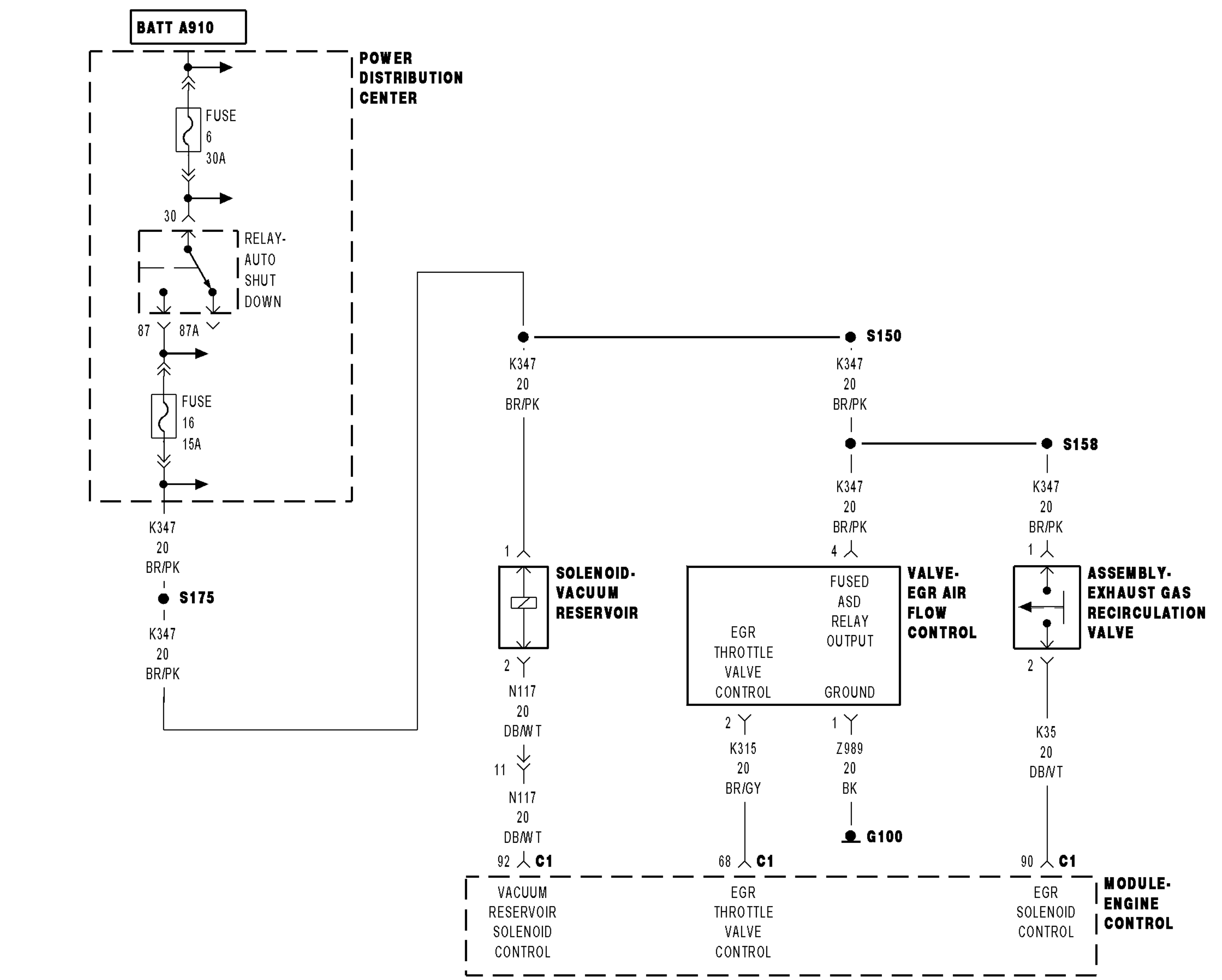
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

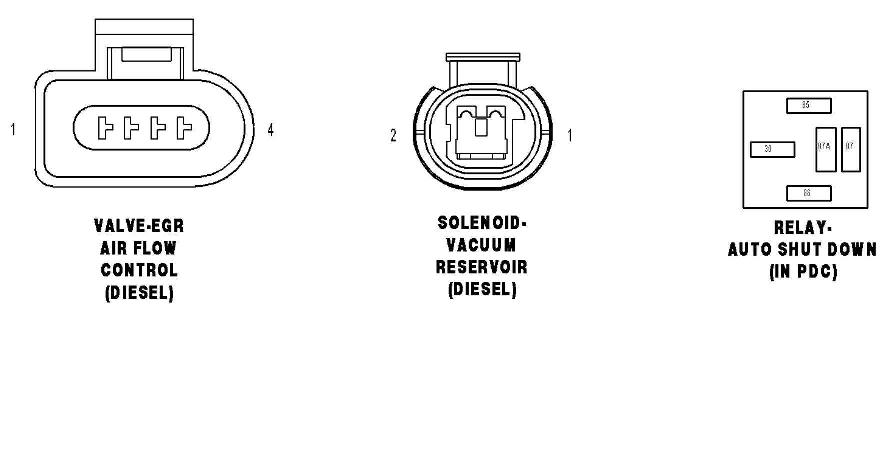
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the EGR Air Flow Control Valve Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2101-EGR AIR FLOW CONTROL VALVE OPEN CKT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM EGR Air Flow Control Valve command off.
- **Set Condition:**
  The ECM does not detect voltage on the EGR Air Flow Control Valve Control circuit.

| Possible Causes |
| --- |
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| EGR AIR FLOW CONTROL VALVE CIRCUIT SHORTED TO GROUND |
| EGR AIR FLOW CONTROL VALVE CIRCUIT OPEN |
| EGR AIR FLOW CONTROL VALVE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool , erase ECM DTCs.

Test drive the vehicle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

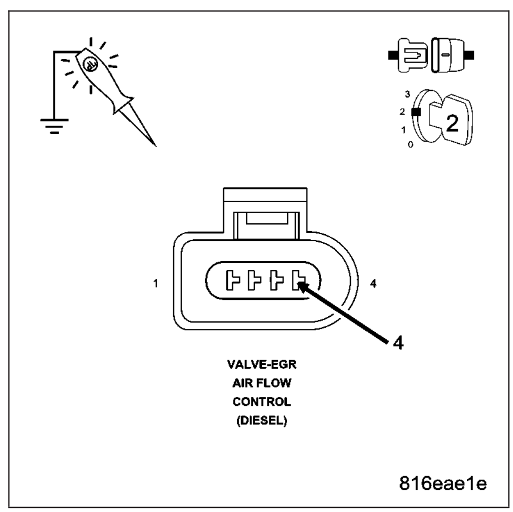
### 2. ASD OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit.



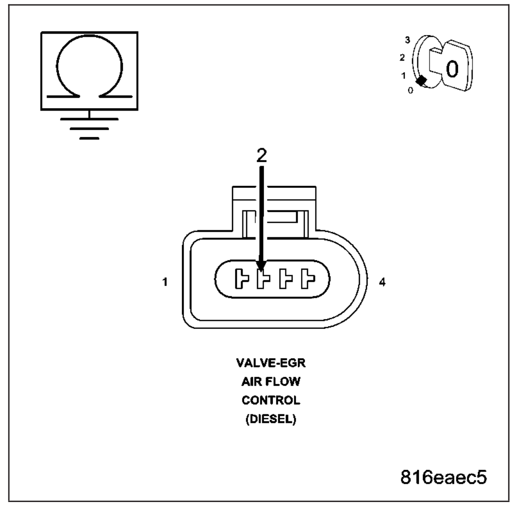

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. EGR AIR FLOW CONTROL VALVE SHORTED TO GROUND




Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the EGR Air Flow Control Valve Control circuit.

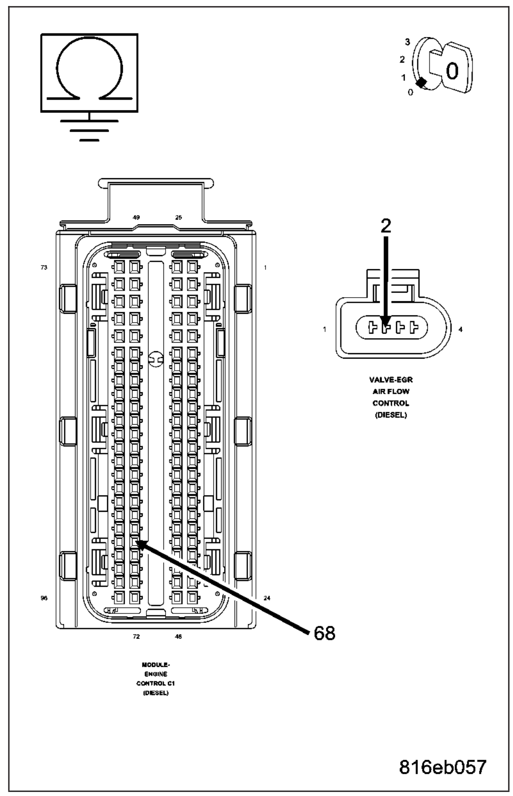
**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the EGR Air Flow Control Valve circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. EGR AIR FLOW CONTROL VALVE CIRCUIT OPEN




Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the EGR Air Flow Control Valve Control circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the EGR Air Flow Control Valve Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. EGR AIR FLOW CONTROL VALVE

Turn the ignition off.

Install a substitute EGR Air Flow Control Valve in place of the vehicle's EGR Air Flow Control Valve.

**NOTE: Ensure the ECM and EGR Air Flow Control Valve harness connectors are connected.**

Turn the ignition on.

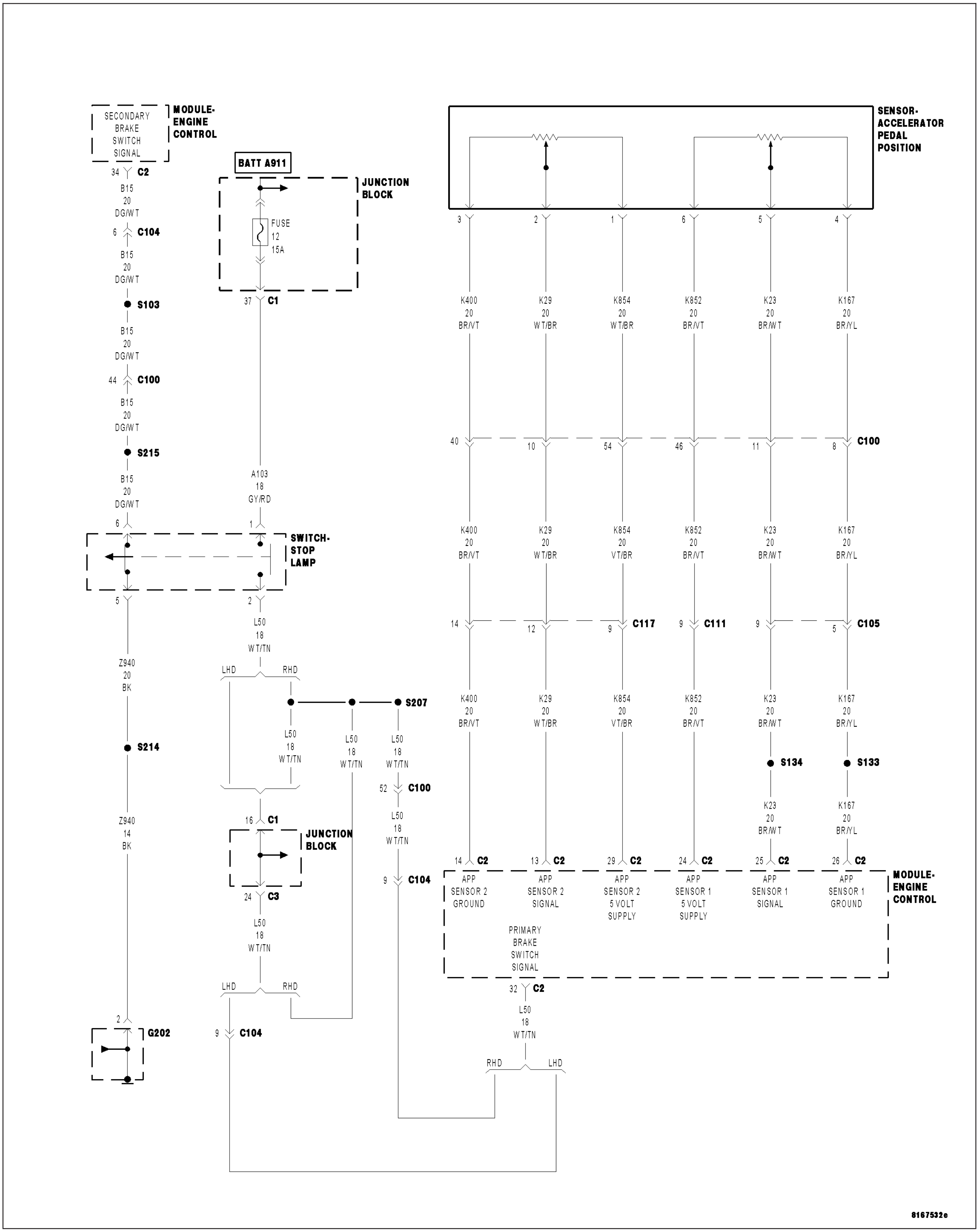
With the scan tool , check for this DTC to set again.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the EGR Air Flow Control Valve.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P2120-ACC PEDAL POSITION SENSOR 1 CKT PLAUSIBILITY



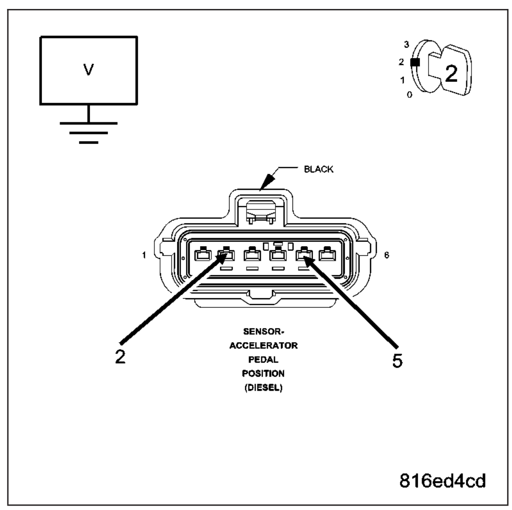

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  APP Sensor #1 and APP Sensor #2 signals do not agree.

| Possible Causes |
|---|
| ACCELERATOR PEDAL POSITION SENSOR |
| ECM - APP SENSOR 1 5-VOLT SUPPLY CIRCUIT |
| SENSOR GROUND OPEN (APP SENSOR) |
| INTERMITTENT CONDITION |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT OPEN |
| APP SENSOR SIGNAL CIRCUIT OPEN |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND |
| APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| VERIFY APP SENSOR OPERATION |
| APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| APP SENSOR CIRCUIT SHORTED TO VOLTAGE |
| APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE |
| ECM - APP SENSOR SIGNAL CIRCUIT |

## Diagnostic Test

### 1. APP SENSOR IDLE VOLTAGE




**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: The APP Sensor is a device that contains 2 separate potentiometer type sensors. Each sensor has its own 5-volt supply circuit, sensor ground circuit and signal circuit. The APP Sensor no longer incorporates a low-idle switch.**

**NOTE: The APP Sensor 2 signal should always be approximately 1/2 the voltage of the APP Sensor 1 signal.**

Inspect the APP Sensor for proper travel from the rest position to the fully depressed position.

Turn the ignition on.

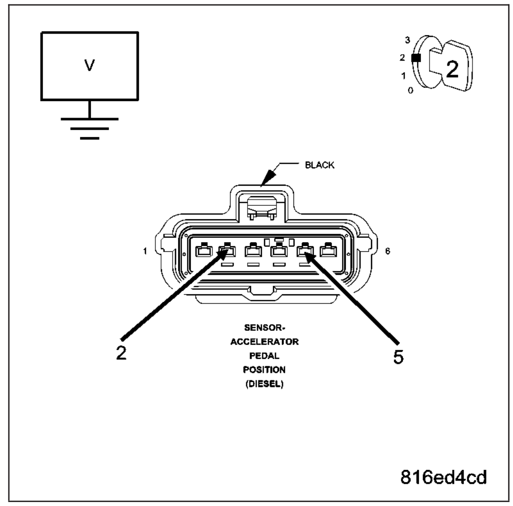
Using a voltmeter, backprobe the APP Sensor 1 and APP Sensor 2 Signal circuits at the APP Sensor harness connector with the accelerator pedal in the at rest position.

**Is the voltage between 0.42 and 0.51 volt for sensor 1 and 0.19 and 0.28 volt for sensor 2?**

**Yes** >> Go To 2

**No** >> Go To 4

## 2. APP SENSOR WIDE OPEN THROTTLE VOLTAGE




Turn the ignition on.

Fully depress the accelerator pedal.

Using a voltmeter backprobe the APP Sensor harness connector and read the voltage for APP Sensor 1 and APP Sensor 2 Signal circuits.

**Is the voltage between 4.45 and 4.75 volts for #1 and 2.15 and 2.45 volts for #2?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. VERIFY APP SENSOR OPERATION

Turn the ignition on.

With the scan tool, read the APP Sensor 1 and APP Sensor 2 percentages (%).

With the accelerator pedal in the idle position, slowly depress the accelerator pedal until the pedal is fully depressed.

**NOTE: The percentage readings for APP Sensors 1 and 2 should increase smoothly as the pedal is depressed.**

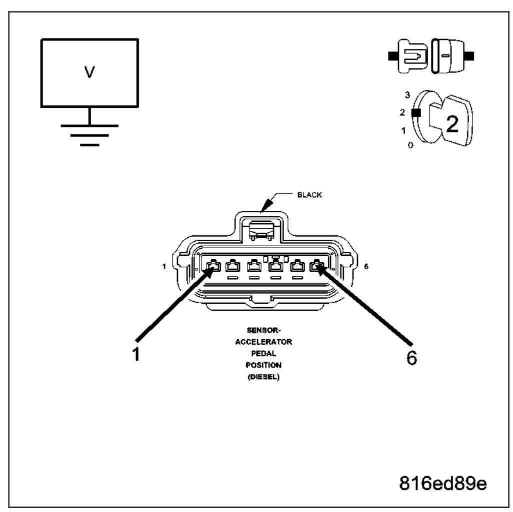
**NOTE: This test can also performed using a voltmeter by back probing each APP Sensor Signal circuit at the APP Sensor harness connector and observing the voltmeter for a smooth voltage change through the entire pedal travel.**

**Does the percentage (voltage) increase smoothly for both readings with the accelerator pedal travel?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. VERIFY 5-VOLT SUPPLY AND SENSOR REFERENCE VOLTAGE A CIRCUITS




**NOTE: Perform the rest of this diagnostic procedure on the individual APP Sensor Potentiometer (1 or 2) that did not display the correct voltages in the previous test.**

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Turn the ignition on.

Measure the voltage of the 5-Volt Supply circuit in the APP Sensor harness connector.

**Is the voltage between 4.7 and 5.3 volts?**

**Yes** >> Go To 5

**No** >> Go To 13

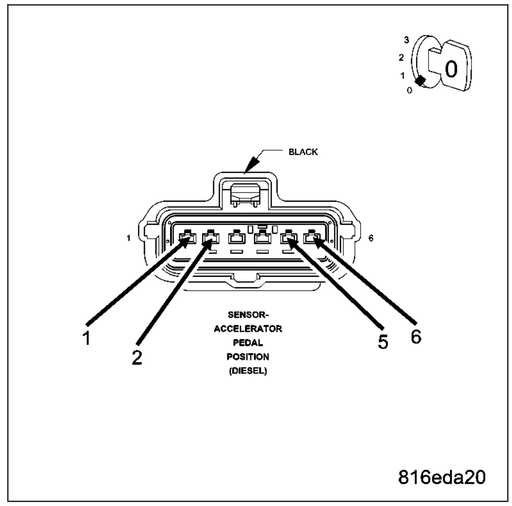
## 5. VERIFY APP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Connect a jumper wire between APP Sensor Signal circuit and the 5-volt supply circuit at the APP Sensor harness connector.

With the scan tool, read the PEDAL OUTPUT VOLTS.




**Does the scan tool display between 4.0 and 5.5 volts?**

**Yes** >> Go To 6

**No** >> Go To 9

## 6. APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

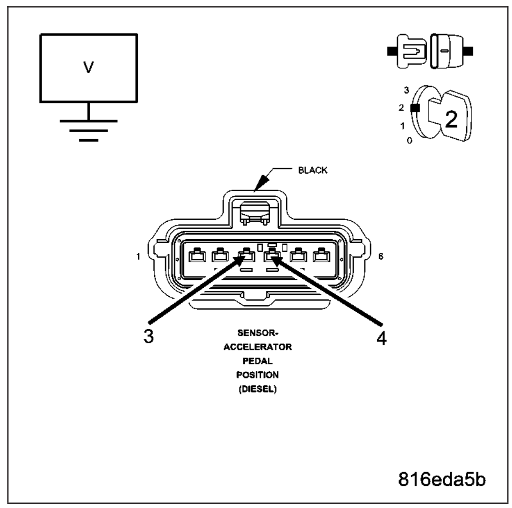
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the APP Sensor Ground circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the App Sensor Ground circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

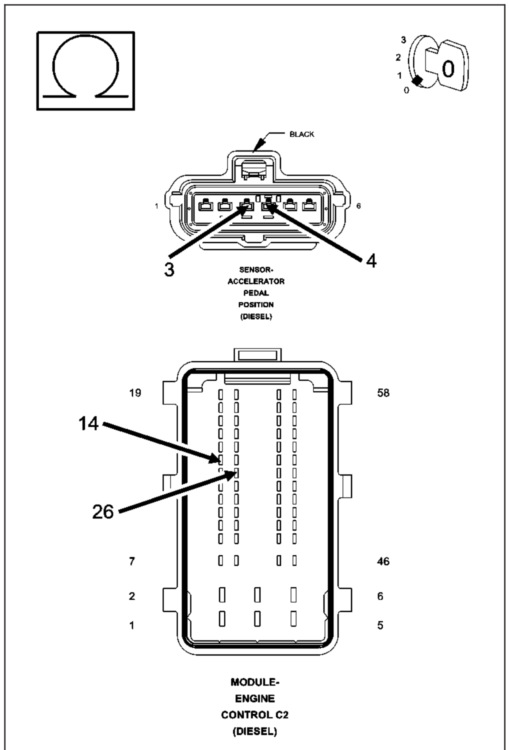
## 7. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between the APP Sensor and the ECM.



816edaa6

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 8

**No** >> Repair the APP Sensor Ground circuit for an open.

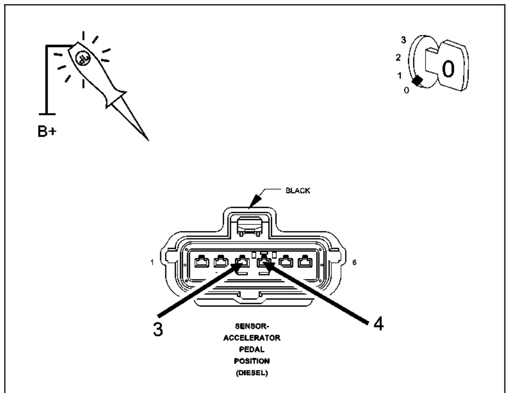
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 8. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Using a 12-volt test light connected to 12-volts, check the Sensor Ground circuit of the appropriate potentiometer.



816edb5c

**Does the test light illuminate brightly?**

**Yes** >> Replace the Accelerator Pedal Position Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

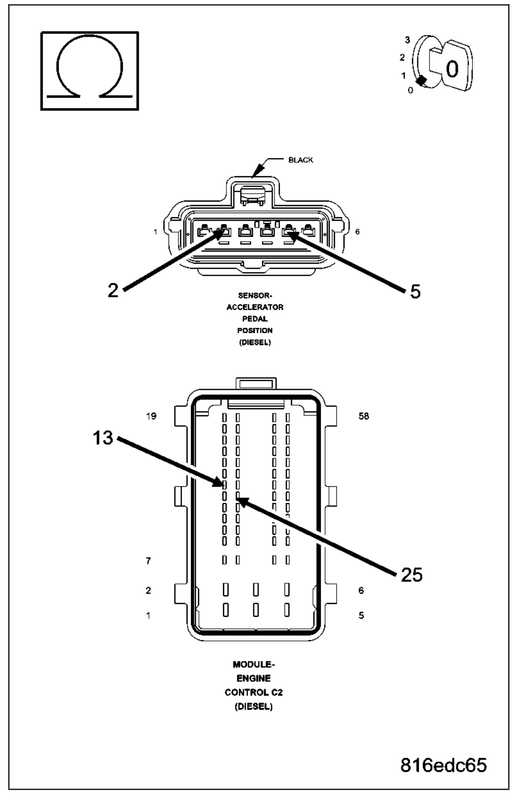
## 9. APP SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the APP Sensor Signal circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 10

**No** >> Repair the APP Sensor Signal circuit for an open

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

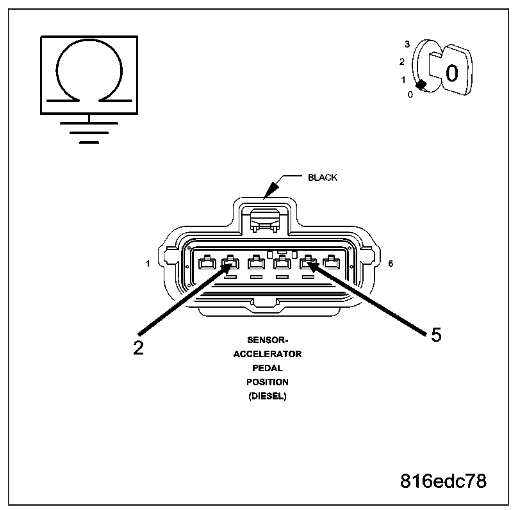
## 10. APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the APP Sensor Signal circuit.




**Is the resistance below 1000 ohms?**

**Yes** >> Repair the APP Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 11

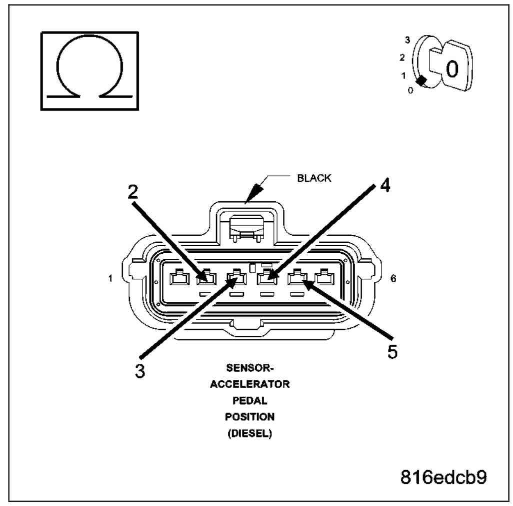
## 11. APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the APP Sensor Signal circuit and the Sensor Ground circuit at the APP Sensor harness connector.




**Is the resistance below 1000 ohms?**

**Yes** >> Repair the APP Sensor Signal and Sensor Ground circuits for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. APP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

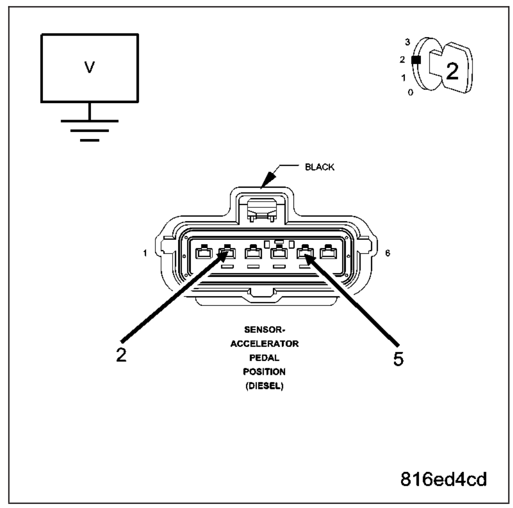
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the APP Sensor Signal circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the APP Sensor Signal circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

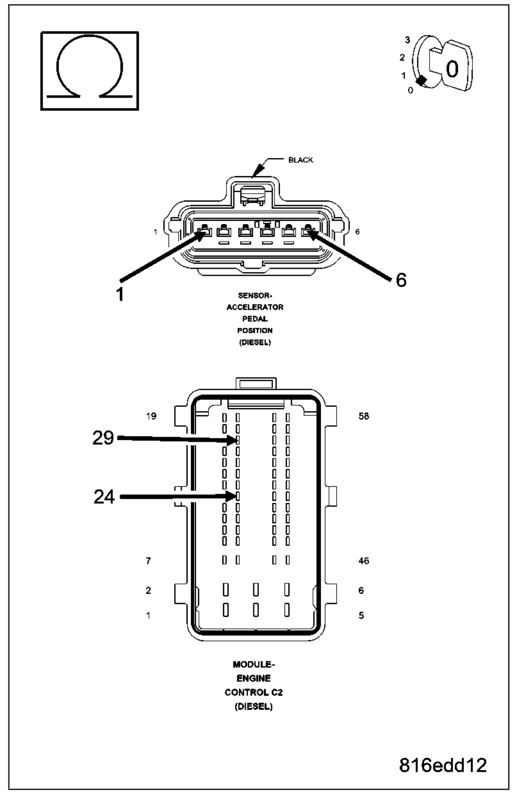
## 13. APP SENSOR 5-VOLT SUPPLY CIRCUITS OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Accelerator Pedal Position Sensor 5-volt Supply circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 14

**No** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

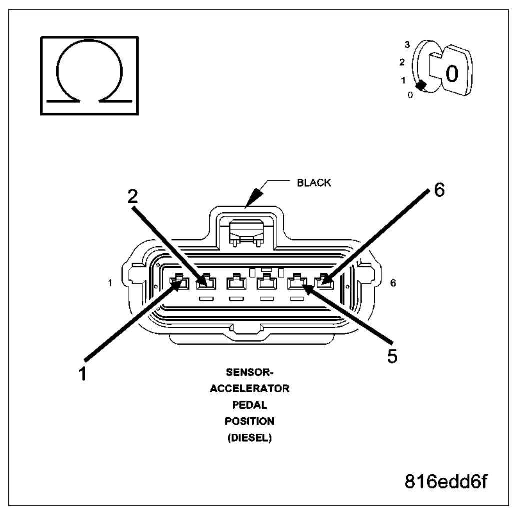
## 14. APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the Accelerator Pedal Position Sensor 5-Volt Supply circuit and both Sensor Ground circuits in the APP Sensor harness connector.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 15

**No** >> Repair the 5-Volt Supply circuit for a short to the Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

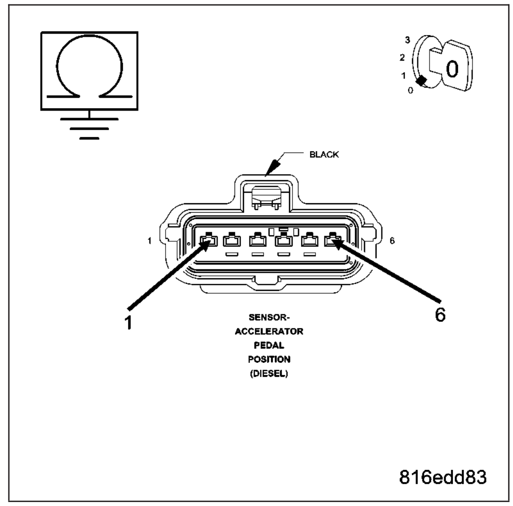
## 15. APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Accelerator Pedal Position Sensor 5-volt Supply circuit.




**Is the resistance below 1000 ohms?**

**Yes** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 16

## 16. APP SENSOR 5-VOLT SUPPLY SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

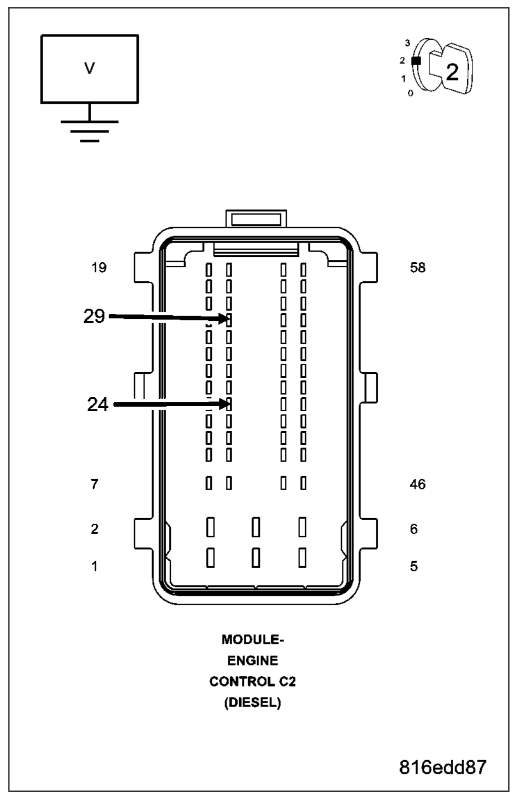
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Accelerator Pedal Position Sensor 5-Volt Supply circuit in the ECM harness connector.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to voltage.

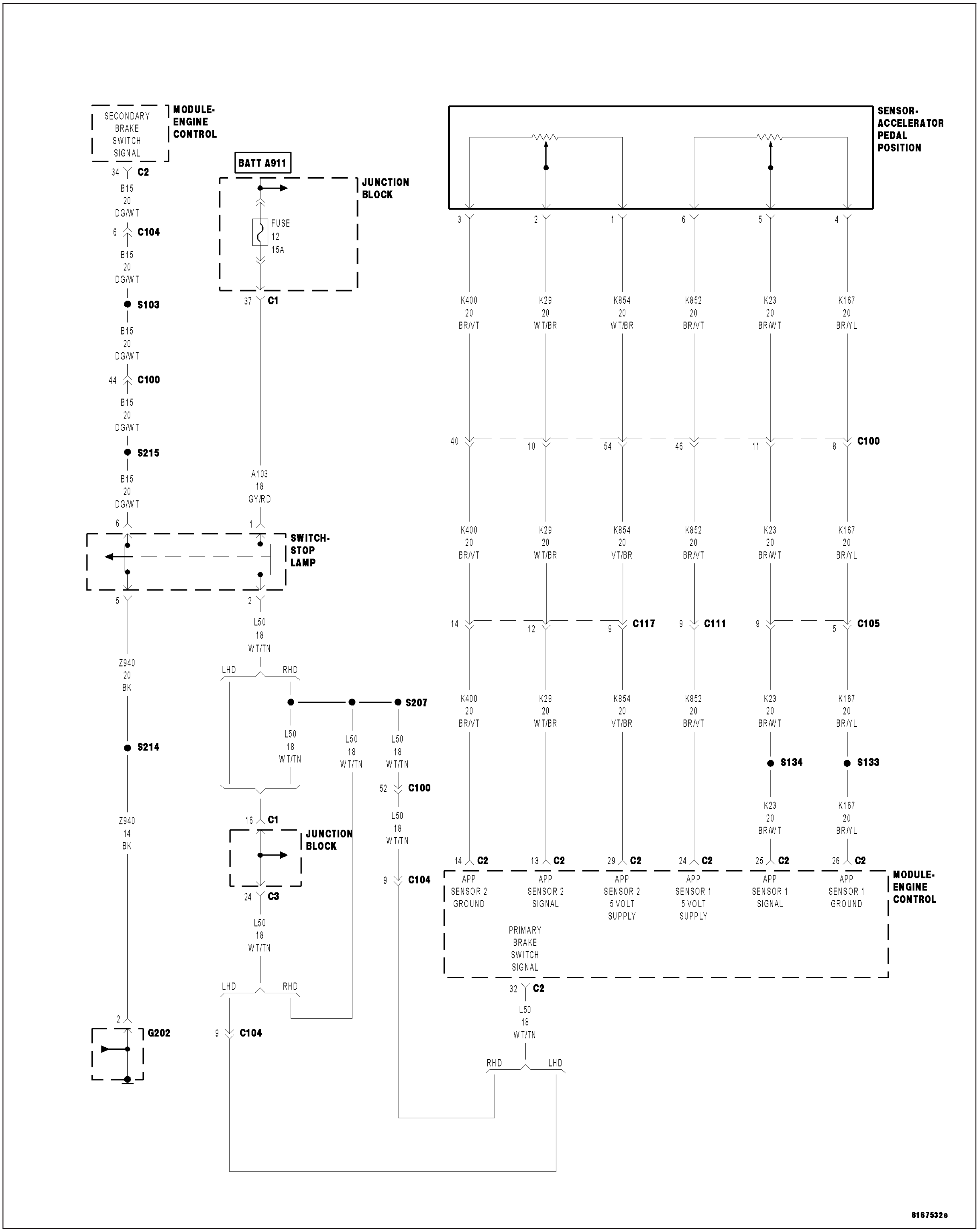
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Repair as necessary.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2120-ACC PEDAL POSITION SENSOR 1 CIRCUIT VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The APP Sensor #1 Signal circuit voltage is above 4.8 volts for 0.3 second.

| Possible Causes |
|---|
| ACCELERATOR PEDAL POSITION SENSOR |
| ECM - APP SENSOR 1 5-VOLT SUPPLY CIRCUIT |
| SENSOR GROUND OPEN (APP SENSOR) |
| INTERMITTENT CONDITION |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT OPEN |
| APP SENSOR SIGNAL CIRCUIT OPEN |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND |
| APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| VERIFY APP SENSOR OPERATION |
| APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| APP SENSOR CIRCUIT SHORTED TO VOLTAGE |
| APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE |
| ECM - APP SENSOR SIGNAL CIRCUIT |

## Diagnostic Test

### 1. APP SENSOR IDLE VOLTAGE

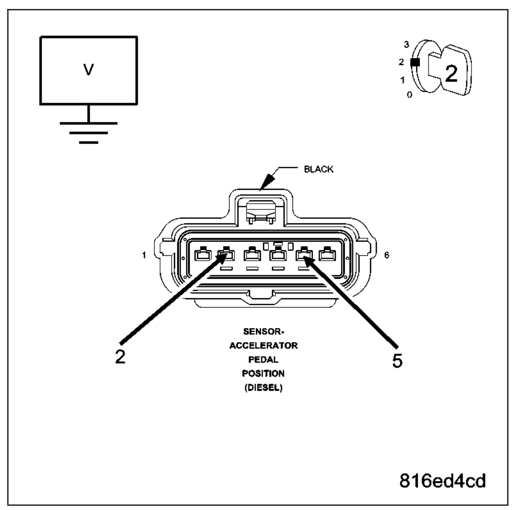
**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: The APP Sensor is a device that contains 2 separate potentiometer type sensors. Each sensor has its own 5-volt supply circuit, sensor ground circuit and signal circuit. The APP Sensor no longer incorporates a low-idle switch.**

**NOTE: The APP Sensor 2 signal should always be approximately 1/2 the voltage of the APP Sensor 1 signal.**




Inspect the APP Sensor for proper travel from the rest position to the fully depressed position.

Turn the ignition on.

Using a voltmeter, backprobe the APP Sensor 1 and APP Sensor 2 Signal circuits at the APP Sensor harness connector with the accelerator pedal in the at rest position.

**Is the voltage between 0.42 and 0.51 volt for sensor 1 and 0.19 and 0.28 volt for sensor 2?**

**Yes** >> Go To 2

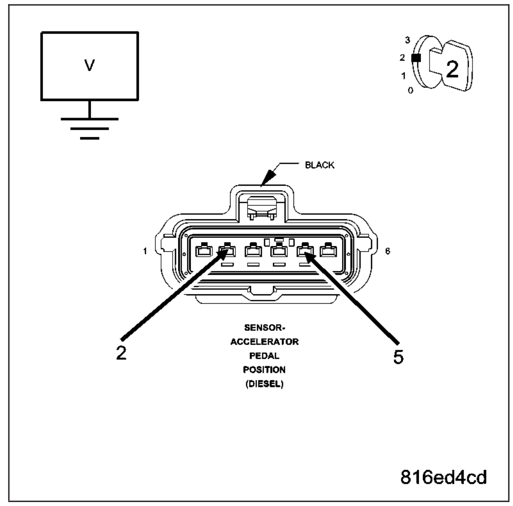
**No** >> Go To 4

## 2. APP SENSOR WIDE OPEN THROTTLE VOLTAGE

Turn the ignition on.

Fully depress the accelerator pedal.

Using a voltmeter backprobe the APP Sensor harness connector and read the voltage for APP Sensor 1 and APP Sensor 2 Signal circuits.




**Is the voltage between 4.45 and 4.75 volts for #1 and 2.15 and 2.45 volts for #2?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. VERIFY APP SENSOR OPERATION

Turn the ignition on.

With the scan tool, read the APP Sensor 1 and APP Sensor 2 percentages (%).

With the accelerator pedal in the idle position, slowly depress the accelerator pedal until the pedal is fully depressed.

**NOTE: The percentage readings for APP Sensors 1 and 2 should increase smoothly as the pedal is depressed.**

**NOTE: This test can also performed using a voltmeter by back probing each APP Sensor Signal circuit at the APP Sensor harness connector and observing the voltmeter for a smooth voltage change through the entire pedal travel.**

**Does the percentage (voltage) increase smoothly for both readings with the accelerator pedal travel?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.
Perform ROAD TEST VERIFICATION - VER-2.

## 4. VERIFY 5-VOLT SUPPLY AND SENSOR REFERENCE VOLTAGE A CIRCUITS

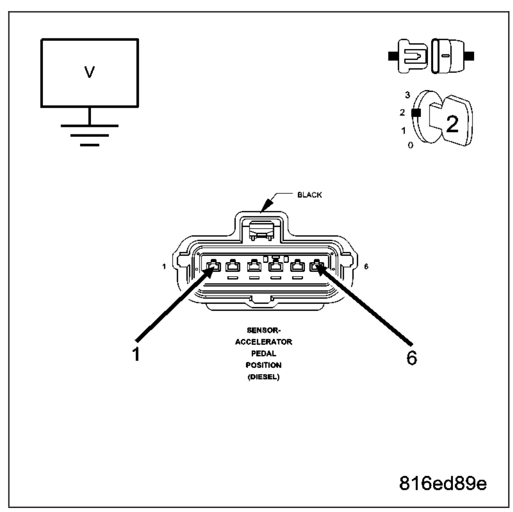
**NOTE: Perform the rest of this diagnostic procedure on the individual APP Sensor Potentiometer (1 or 2) that did not display the correct voltages in the previous test.**

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Turn the ignition on.

Measure the voltage of the 5-Volt Supply circuit in the APP Sensor harness connector.




**Is the voltage between 4.7 and 5.3 volts?**

**Yes** >> Go To 5

**No** >> Go To 13

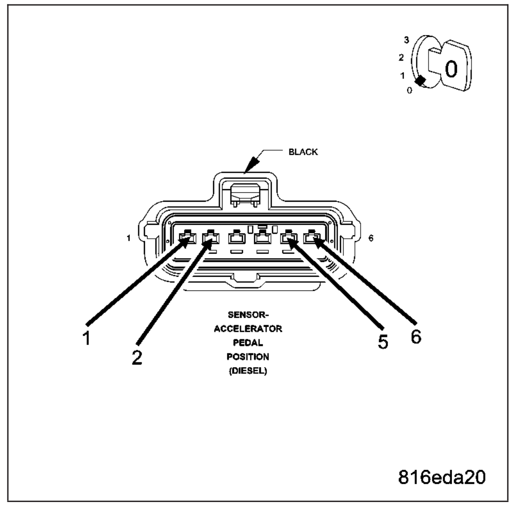
## 5. VERIFY APP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Connect a jumper wire between APP Sensor Signal circuit and the 5-volt supply circuit at the APP Sensor harness connector.

With the scan tool, read the PEDAL OUTPUT VOLTS.




**Does the scan tool display between 4.0 and 5.5 volts?**

**Yes** >> Go To 6

**No** >> Go To 9

## 6. APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

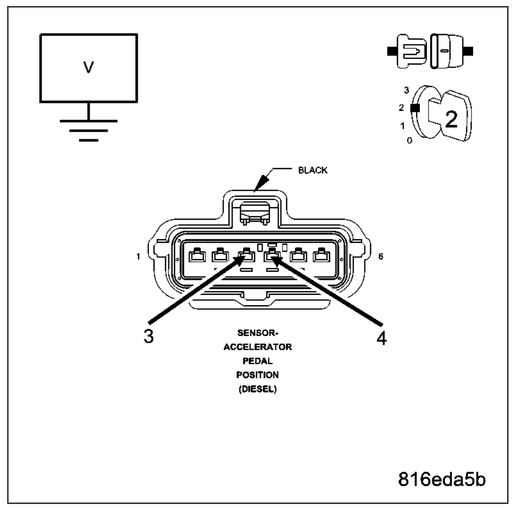
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the APP Sensor Ground circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the App Sensor Ground circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Go To 7

## 7. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

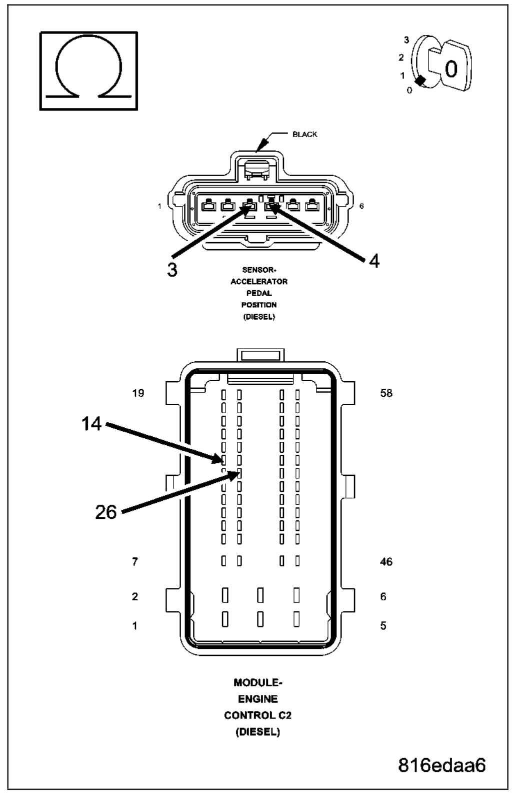
Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between the APP Sensor and the ECM.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 8

**No** >> Repair the APP Sensor Ground circuit for an open.
Perform ROAD TEST VERIFICATION - VER-2.




## 8. ECM - SENSOR GROUND OPEN

Turn the ignition off.

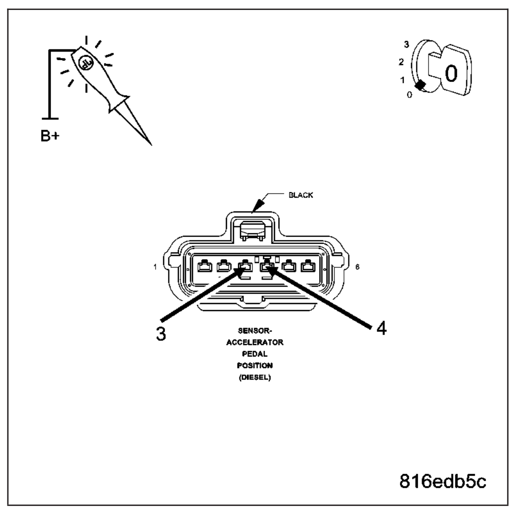
Disconnect the APP Sensor harness connector.

Using a 12-volt test light connected to 12-volts, check the Sensor Ground circuit of the appropriate potentiometer.

**Does the test light illuminate brightly?**

**Yes** >> Replace the Accelerator Pedal Position Sensor.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform ROAD TEST VERIFICATION - VER-2.



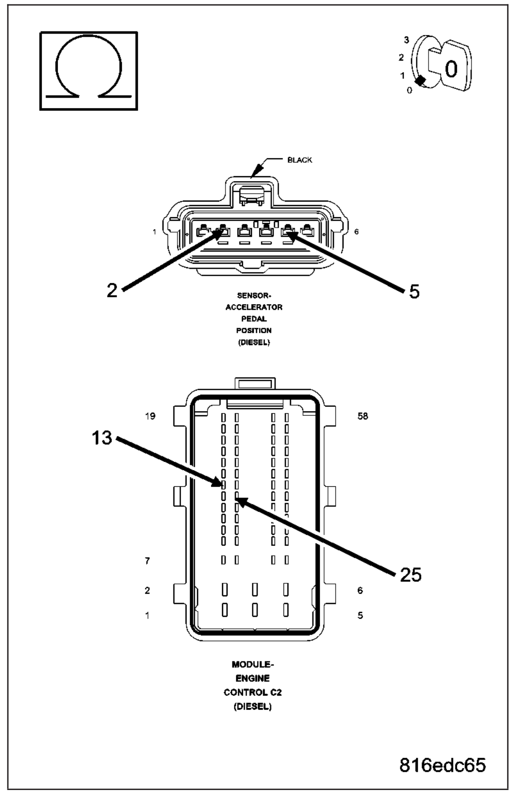
## 9. APP SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.
Disconnect the APP Sensor harness connector.
Disconnect the ECM harness connectors.
Measure the resistance of the APP Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 10

**No** >> Repair the APP Sensor Signal circuit for an open
Perform ROAD TEST VERIFICATION - VER-2.



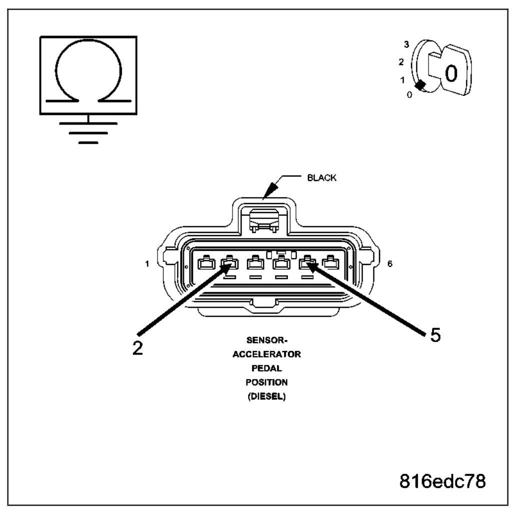

## 10. APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect the APP Sensor harness connector.
Disconnect the ECM harness connectors.
Measure the resistance between ground and the APP Sensor Signal circuit.

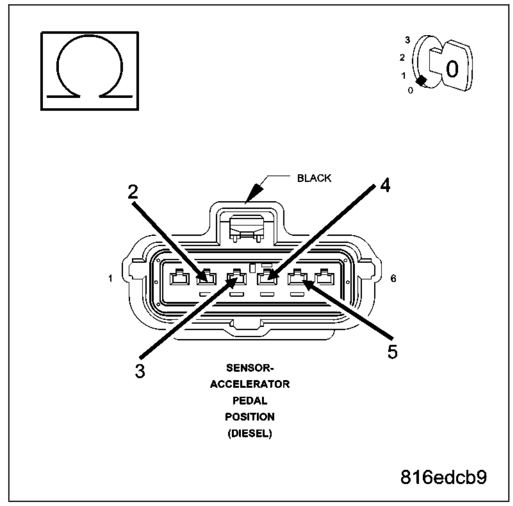
**Is the resistance below 1000 ohms?**

**Yes** >> Repair the APP Sensor Signal circuit for a short to ground.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Go To 11



## 11. APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT




Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

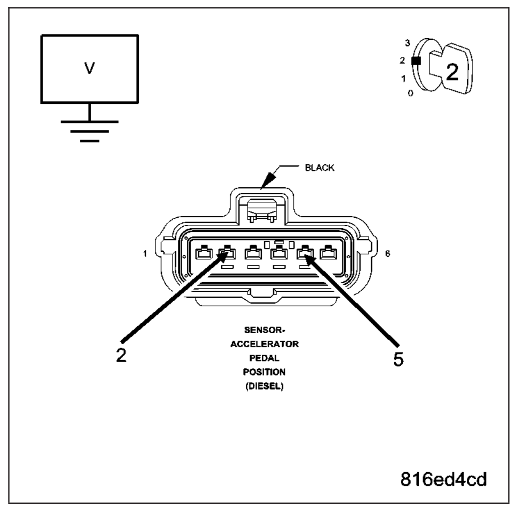
Measure the resistance between the APP Sensor Signal circuit and the Sensor Ground circuit at the APP Sensor harness connector.

**Is the resistance below 1000 ohms?**

**Yes** >> Repair the APP Sensor Signal and Sensor Ground circuits for a short together.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Go To 12

## 12. APP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the APP Sensor Signal circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the APP Sensor Signal circuit for a short to voltage.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform ROAD TEST VERIFICATION - VER-2.

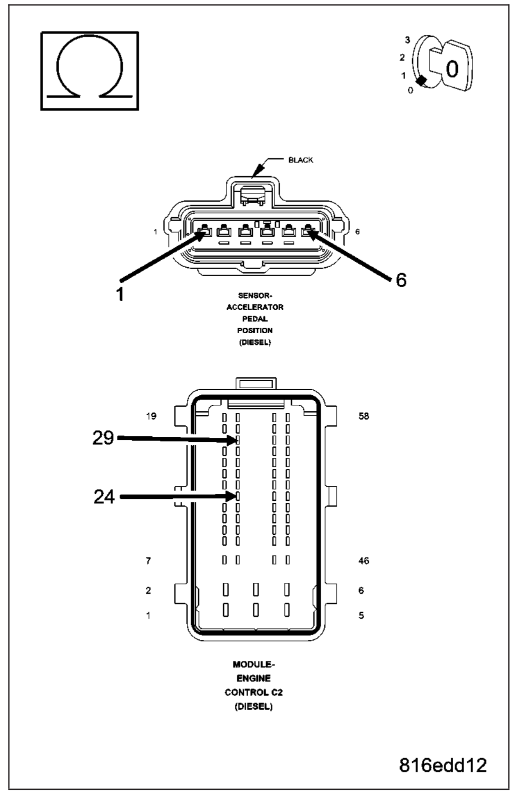
## 13. APP SENSOR 5-VOLT SUPPLY CIRCUITS OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Accelerator Pedal Position Sensor 5-volt Supply circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 14

**No** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for an open.
Perform ROAD TEST VERIFICATION - VER-2.

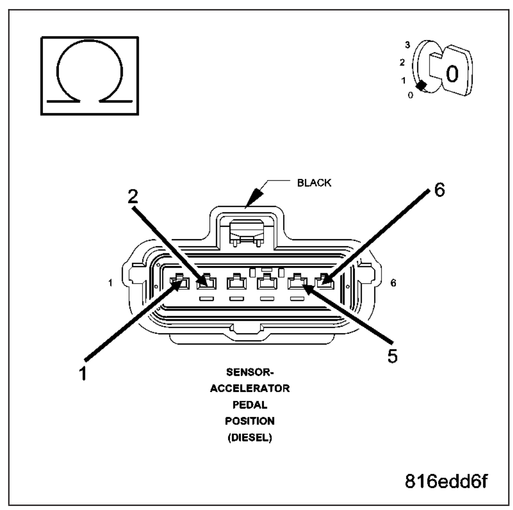
## 14. APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the Accelerator Pedal Position Sensor 5-Volt Supply circuit and both Sensor Ground circuits in the APP Sensor harness connector.

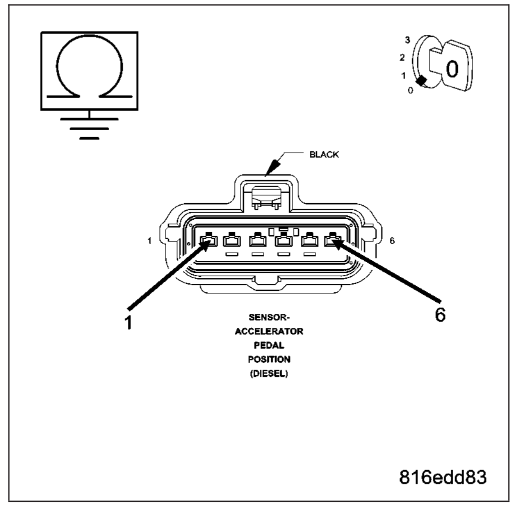



**Is the resistance above 1000 ohms?**

**Yes** >> Go To 15

**No** >> Repair the 5-Volt Supply circuit for a short to the Sensor Ground circuit.
Perform ROAD TEST VERIFICATION - VER-2.

## 15. APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND




Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Accelerator Pedal Position Sensor 5-volt Supply circuit.

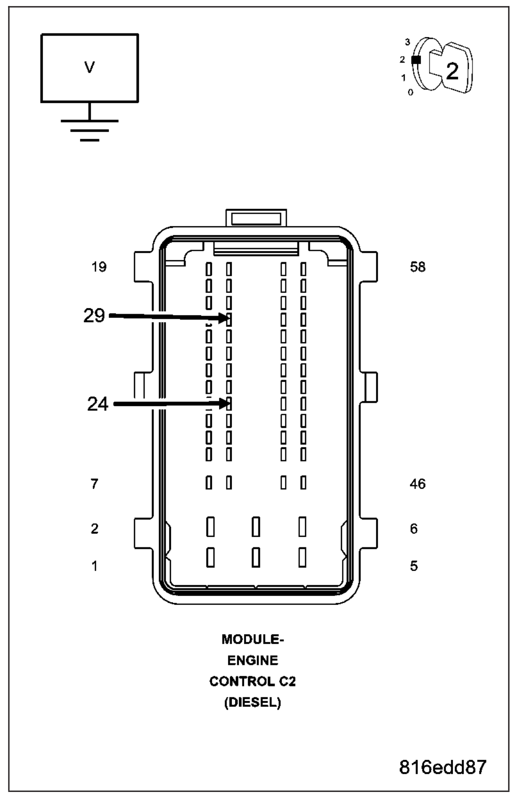
**Is the resistance below 1000 ohms?**

**Yes** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to ground.

Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Go To 16

## 16. APP SENSOR 5-VOLT SUPPLY SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Accelerator Pedal Position Sensor 5-Volt Supply circuit in the ECM harness connector.

**Is the voltage above 1.0 volt?**

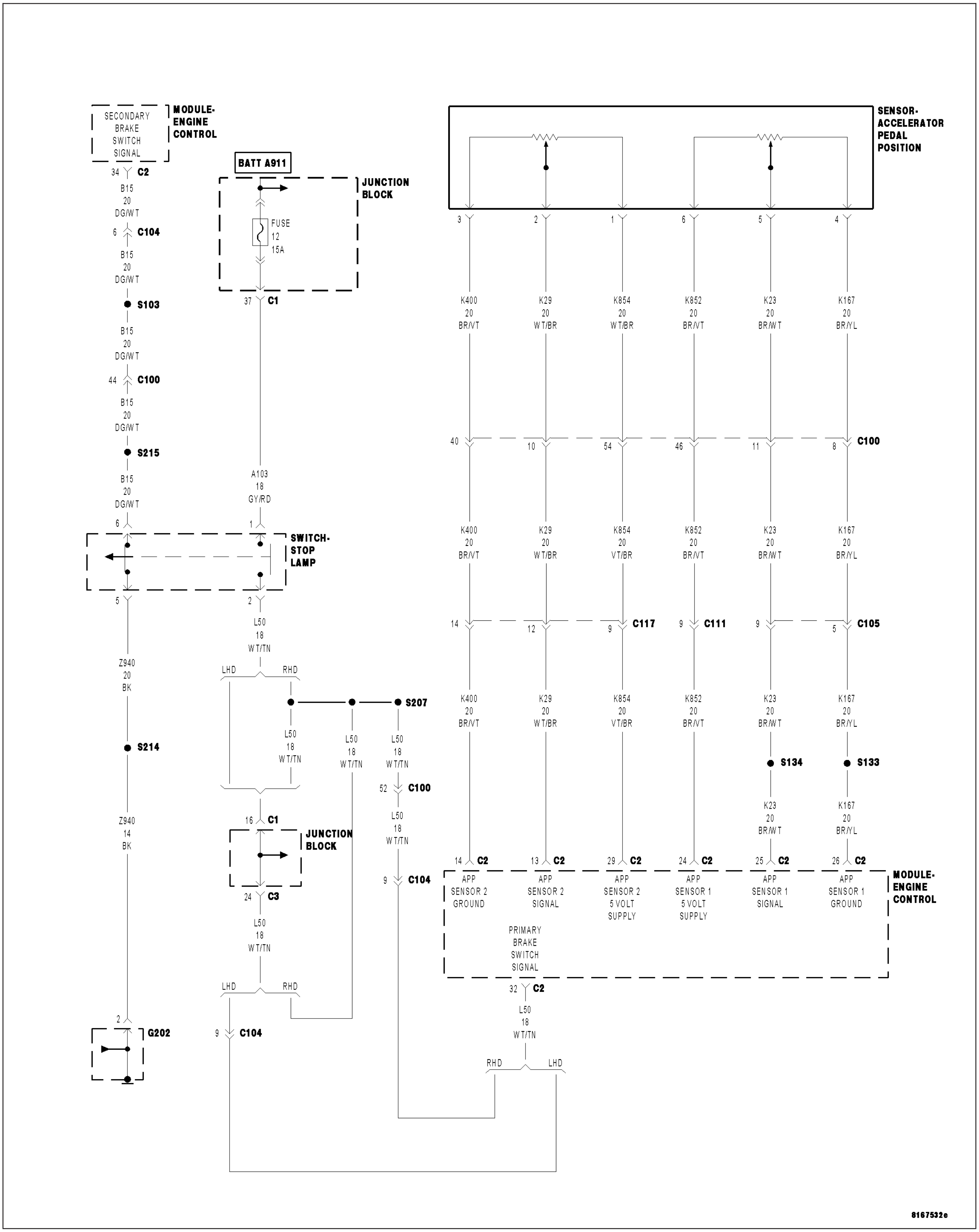
**Yes** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2120-ACC PEDAL POSITION SENSOR 1 CIRCUIT VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The APP Sensor #1 Signal circuit voltage is below 0.2 volt for 0.3 second.

| Possible Causes |
|---|
| ACCELERATOR PEDAL POSITION SENSOR |
| ECM - APP SENSOR 1 5-VOLT SUPPLY CIRCUIT |
| SENSOR GROUND OPEN (APP SENSOR) |
| INTERMITTENT CONDITION |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT OPEN |
| APP SENSOR SIGNAL CIRCUIT OPEN |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND |
| APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| VERIFY APP SENSOR OPERATION |
| APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| APP SENSOR CIRCUIT SHORTED TO VOLTAGE |
| APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE |
| ECM - APP SENSOR SIGNAL CIRCUIT |

## Diagnostic Test

### 1. APP SENSOR IDLE VOLTAGE

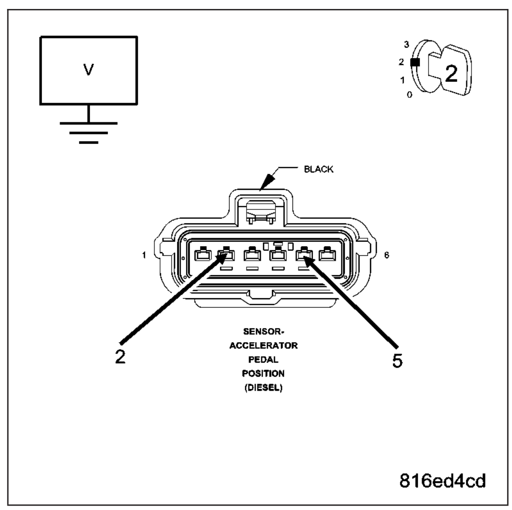
**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: The APP Sensor is a device that contains 2 separate potentiometer type sensors. Each sensor has its own 5-volt supply circuit, sensor ground circuit and signal circuit. The APP Sensor no longer incorporates a low-idle switch.**

**NOTE: The APP Sensor 2 signal should always be approximately 1/2 the voltage of the APP Sensor 1 signal.**




Inspect the APP Sensor for proper travel from the rest position to the fully depressed position.

Turn the ignition on.

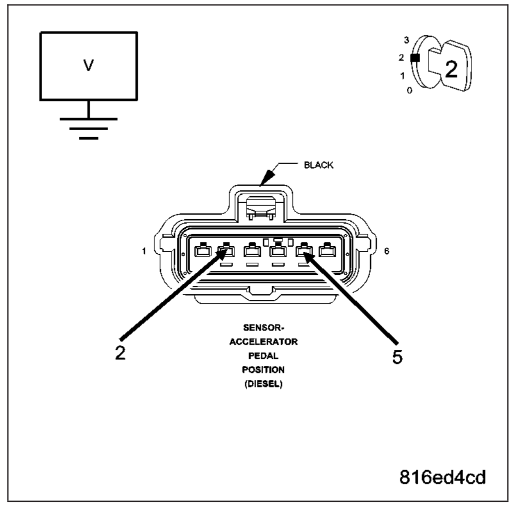
Using a voltmeter, backprobe the APP Sensor 1 and APP Sensor 2 Signal circuits at the APP Sensor harness connector with the accelerator pedal in the at rest position.

**Is the voltage between 0.42 and 0.51 volt for sensor 1 and 0.19 and 0.28 volt for sensor 2?**

**Yes** >> Go To 2

**No** >> Go To 4

## 2. APP SENSOR WIDE OPEN THROTTLE VOLTAGE




Turn the ignition on.

Fully depress the accelerator pedal.

Using a voltmeter backprobe the APP Sensor harness connector and read the voltage for APP Sensor 1 and APP Sensor 2 Signal circuits.

**Is the voltage between 4.45 and 4.75 volts for #1 and 2.15 and 2.45 volts for #2?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. VERIFY APP SENSOR OPERATION

Turn the ignition on.

With the scan tool, read the APP Sensor 1 and APP Sensor 2 percentages (%).

With the accelerator pedal in the idle position, slowly depress the accelerator pedal until the pedal is fully depressed.

**NOTE: The percentage readings for APP Sensors 1 and 2 should increase smoothly as the pedal is depressed.**

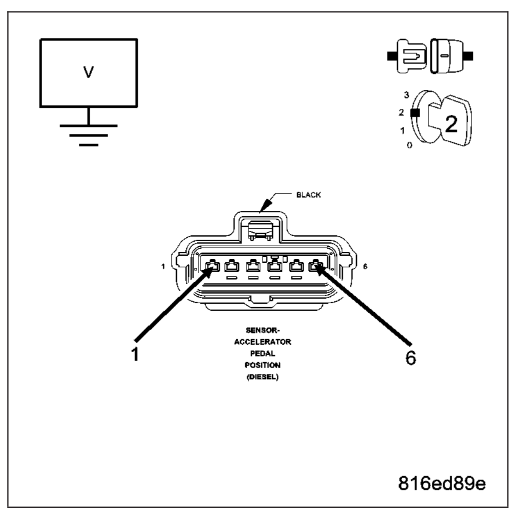
**NOTE: This test can also performed using a voltmeter by back probing each APP Sensor Signal circuit at the APP Sensor harness connector and observing the voltmeter for a smooth voltage change through the entire pedal travel.**

**Does the percentage (voltage) increase smoothly for both readings with the accelerator pedal travel?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.
Perform ROAD TEST VERIFICATION - VER-2.

## 4. VERIFY 5-VOLT SUPPLY AND SENSOR REFERENCE VOLTAGE A CIRCUITS




**NOTE: Perform the rest of this diagnostic procedure on the individual APP Sensor Potentiometer (1 or 2) that did not display the correct voltages in the previous test.**

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Turn the ignition on.

Measure the voltage of the 5-Volt Supply circuit in the APP Sensor harness connector.

**Is the voltage between 4.7 and 5.3 volts?**

**Yes** >> Go To 5

**No** >> Go To 13

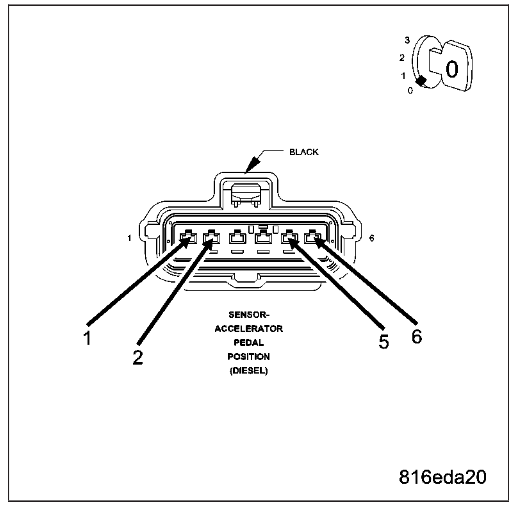
## 5. VERIFY APP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Connect a jumper wire between APP Sensor Signal circuit and the 5-volt supply circuit at the APP Sensor harness connector.

With the scan tool, read the PEDAL OUTPUT VOLTS.




**Does the scan tool display between 4.0 and 5.5 volts?**

**Yes** >> Go To 6

**No** >> Go To 9

## 6. APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

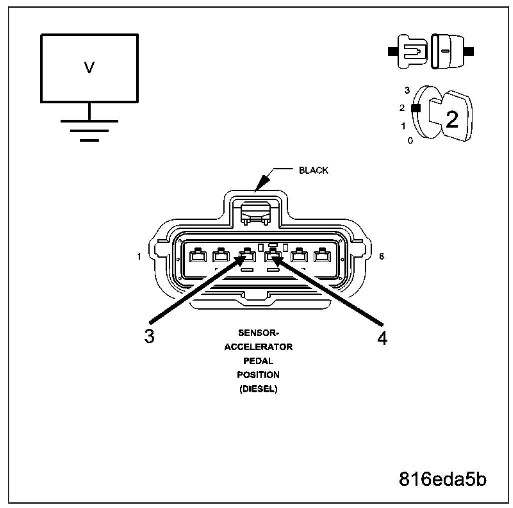
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the APP Sensor Ground circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the App Sensor Ground circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Go To 7

## 7. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

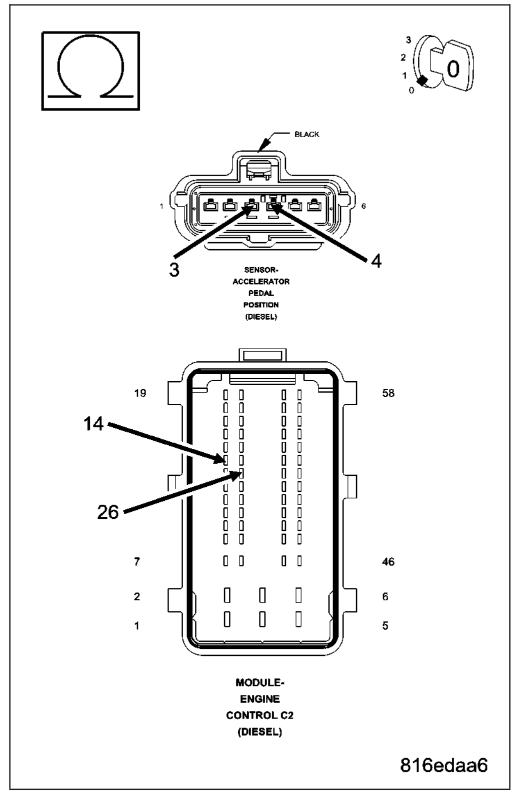
Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between the APP Sensor and the ECM.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 8

**No** >> Repair the APP Sensor Ground circuit for an open.
Perform ROAD TEST VERIFICATION - VER-2.




## 8. ECM - SENSOR GROUND OPEN

Turn the ignition off.

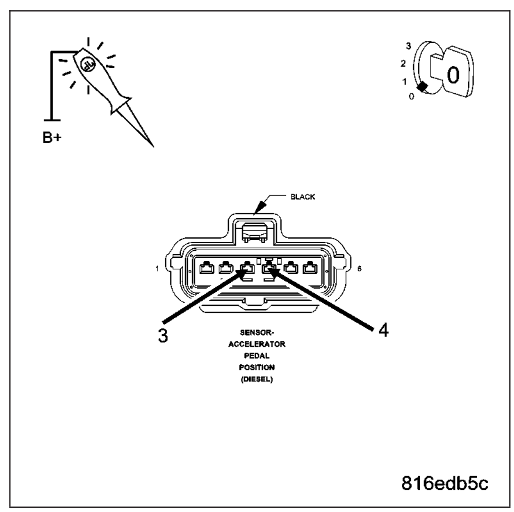
Disconnect the APP Sensor harness connector.

Using a 12-volt test light connected to 12-volts, check the Sensor Ground circuit of the appropriate potentiometer.

**Does the test light illuminate brightly?**

**Yes** >> Replace the Accelerator Pedal Position Sensor.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform ROAD TEST VERIFICATION - VER-2.



## 9. APP SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

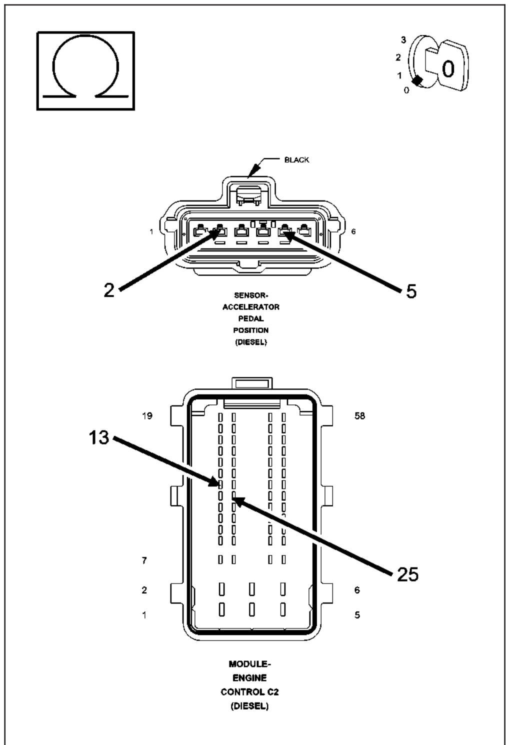
Disconnect the ECM harness connectors.

Measure the resistance of the APP Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 10

**No** >> Repair the APP Sensor Signal circuit for an open
Perform ROAD TEST VERIFICATION - VER-2.




816edc65

## 10. APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

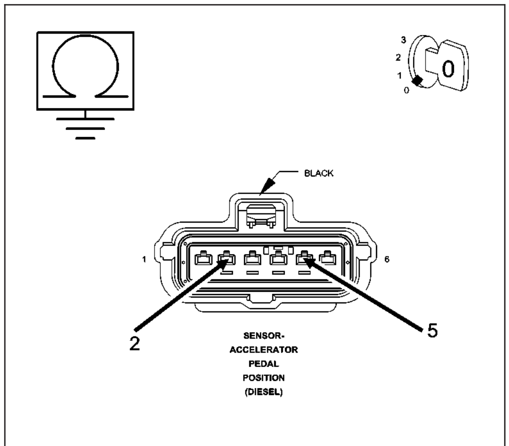
Disconnect the ECM harness connectors.

Measure the resistance between ground and the APP Sensor Signal circuit.

**Is the resistance below 1000 ohms?**

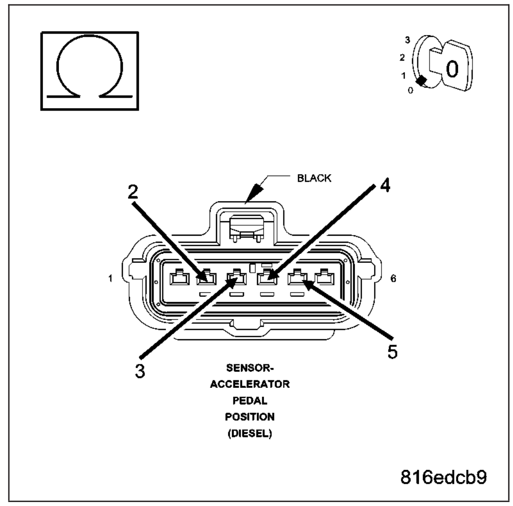
**Yes** >> Repair the APP Sensor Signal circuit for a short to ground.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Go To 11




816edc78

## 11. APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT




Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

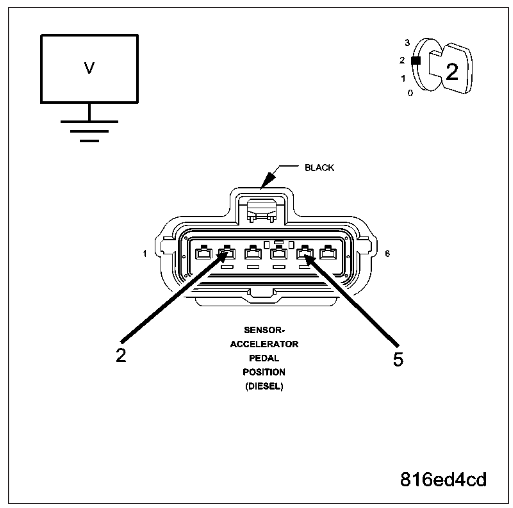
Measure the resistance between the APP Sensor Signal circuit and the Sensor Ground circuit at the APP Sensor harness connector.

**Is the resistance below 1000 ohms?**

**Yes** >> Repair the APP Sensor Signal and Sensor Ground circuits for a short together.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Go To 12

## 12. APP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the APP Sensor Signal circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the APP Sensor Signal circuit for a short to voltage.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform ROAD TEST VERIFICATION - VER-2.

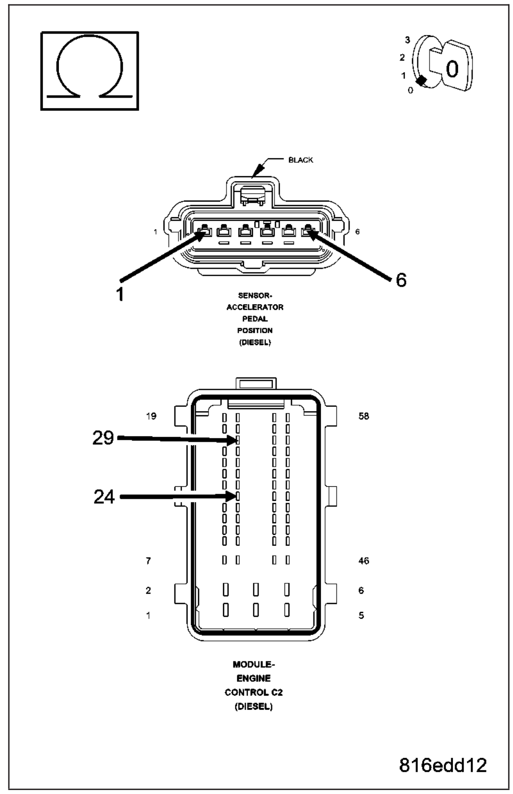
## 13. APP SENSOR 5-VOLT SUPPLY CIRCUITS OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Accelerator Pedal Position Sensor 5-volt Supply circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 14

**No** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for an open.

Perform ROAD TEST VERIFICATION - VER-2.

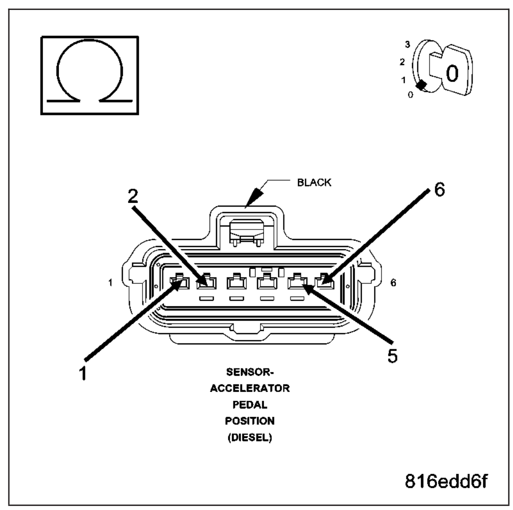
## 14. APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the Accelerator Pedal Position Sensor 5-Volt Supply circuit and both Sensor Ground circuits in the APP Sensor harness connector.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 15

**No** >> Repair the 5-Volt Supply circuit for a short to the Sensor Ground circuit.

Perform ROAD TEST VERIFICATION - VER-2.

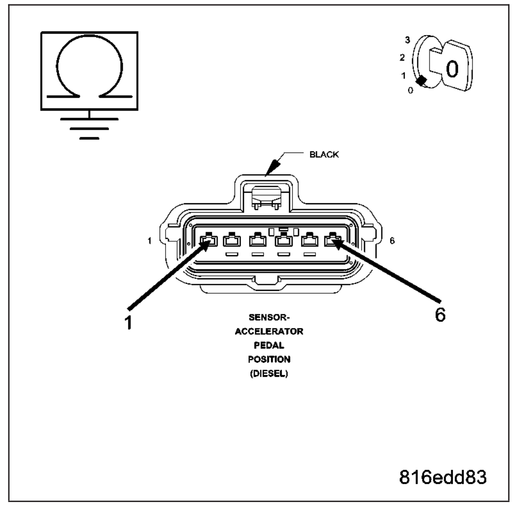
## 15. APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Accelerator Pedal Position Sensor 5-volt Supply circuit.




**Is the resistance below 1000 ohms?**

**Yes** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to ground.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Go To 16

## 16. APP SENSOR 5-VOLT SUPPLY SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

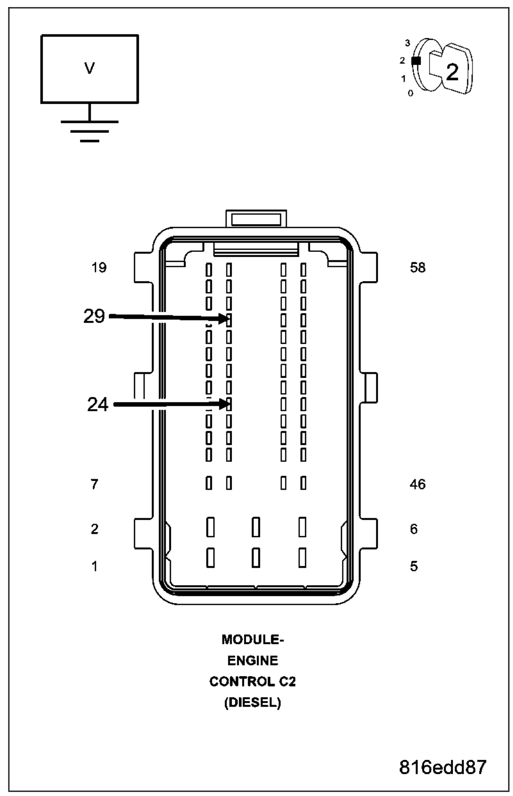
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Accelerator Pedal Position Sensor 5-Volt Supply circuit in the ECM harness connector.

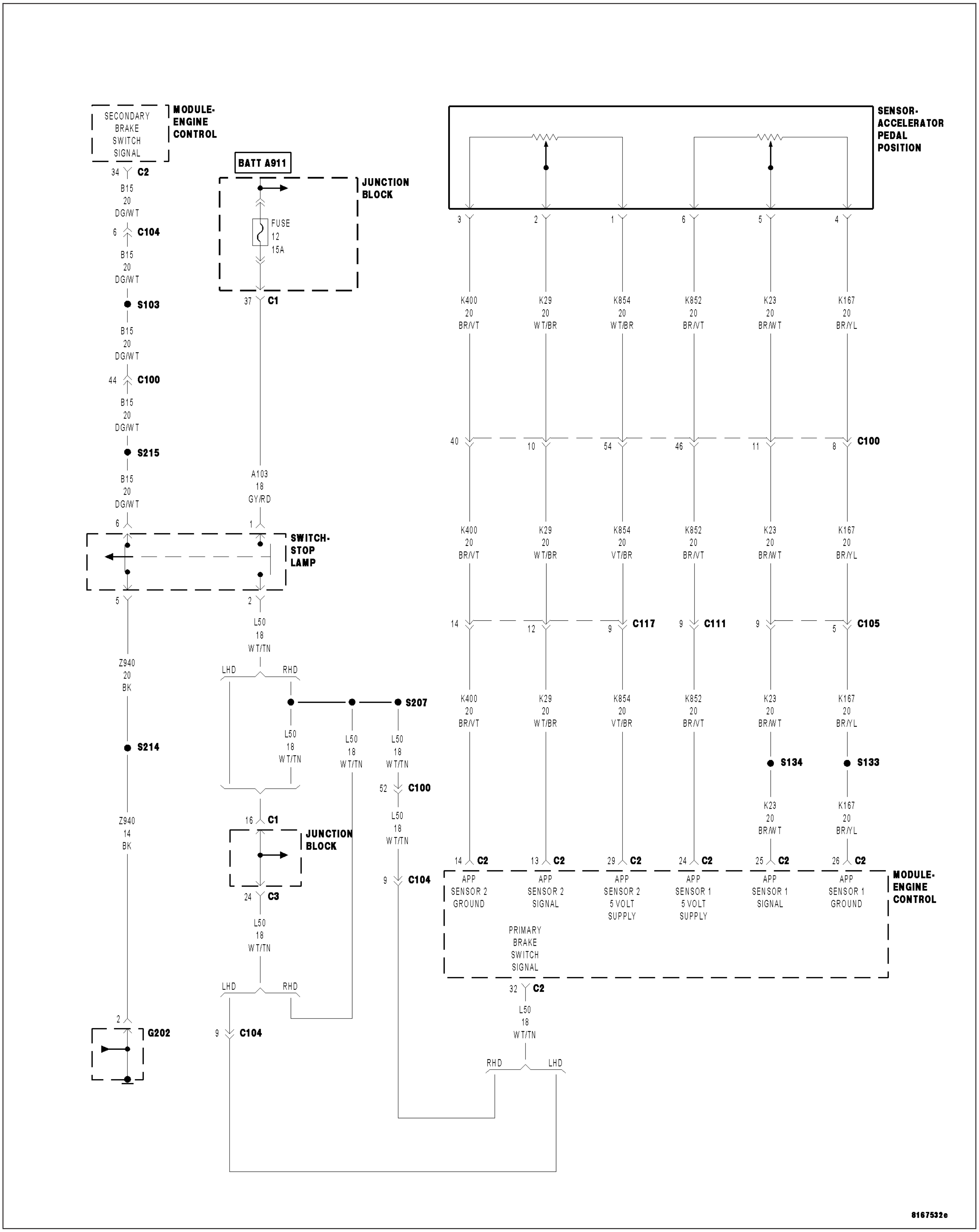



**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to voltage.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2125-ACC PEDAL POSITION SENSOR 2 CKT PLAUSIBILITY



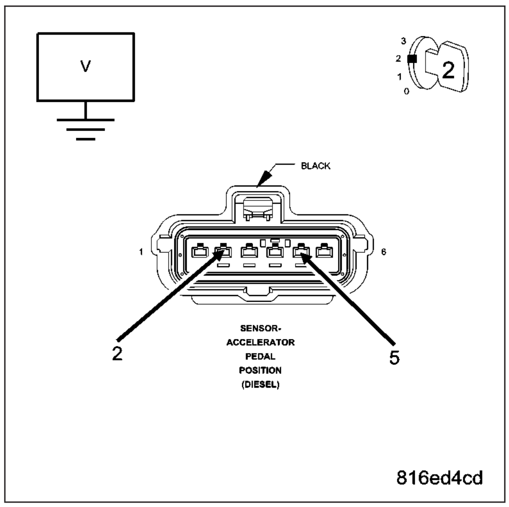

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  APP Sensor #1 and APP Sensor #2 signals do not agree.

| Possible Causes |
|---|
| ACCELERATOR PEDAL POSITION SENSOR |
| ECM - APP SENSOR 1 5-VOLT SUPPLY CIRCUIT |
| SENSOR GROUND OPEN (APP SENSOR) |
| INTERMITTENT CONDITION |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT OPEN |
| APP SENSOR SIGNAL CIRCUIT OPEN |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND |
| APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| VERIFY APP SENSOR OPERATION |
| APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| APP SENSOR CIRCUIT SHORTED TO VOLTAGE |
| APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE |
| ECM - APP SENSOR SIGNAL CIRCUIT |

## Diagnostic Test

### 1. APP SENSOR IDLE VOLTAGE




**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: The APP Sensor is a device that contains 2 separate potentiometer type sensors. Each sensor has its own 5-volt supply circuit, sensor ground circuit and signal circuit. The APP Sensor no longer incorporates a low-idle switch.**

**NOTE: The APP Sensor 2 signal should always be approximately 1/2 the voltage of the APP Sensor 1 signal.**

Inspect the APP Sensor for proper travel from the rest position to the fully depressed position.

Turn the ignition on.

Using a voltmeter, backprobe the APP Sensor 1 and APP Sensor 2 Signal circuits at the APP Sensor harness connector with the accelerator pedal in the at rest position.

**Is the voltage between 0.42 and 0.51 volt for sensor 1 and 0.19 and 0.28 volt for sensor 2?**

**Yes** >> Go To 2

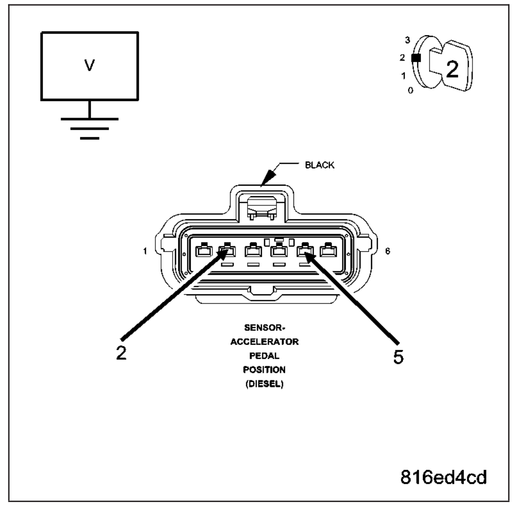
**No** >> Go To 4

## 2. APP SENSOR WIDE OPEN THROTTLE VOLTAGE

Turn the ignition on.

Fully depress the accelerator pedal.

Using a voltmeter backprobe the APP Sensor harness connector and read the voltage for APP Sensor 1 and APP Sensor 2 Signal circuits.




**Is the voltage between 4.45 and 4.75 volts for #1 and 2.15 and 2.45 volts for #2?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. VERIFY APP SENSOR OPERATION

Turn the ignition on.

With the scan tool, read the APP Sensor 1 and APP Sensor 2 percentages (%).

With the accelerator pedal in the idle position, slowly depress the accelerator pedal until the pedal is fully depressed.

**NOTE: The percentage readings for APP Sensors 1 and 2 should increase smoothly as the pedal is depressed.**

**NOTE: This test can also performed using a voltmeter by back probing each APP Sensor Signal circuit at the APP Sensor harness connector and observing the voltmeter for a smooth voltage change through the entire pedal travel.**

**Does the percentage (voltage) increase smoothly for both readings with the accelerator pedal travel?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.

Perform ROAD TEST VERIFICATION - VER-2.

## 4. VERIFY 5-VOLT SUPPLY AND SENSOR REFERENCE VOLTAGE A CIRCUITS

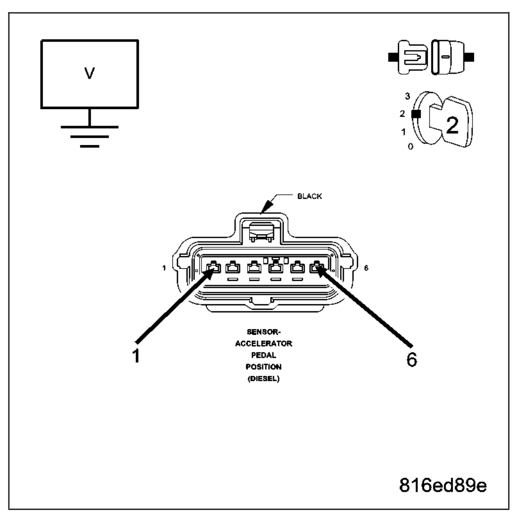
**NOTE: Perform the rest of this diagnostic procedure on the individual APP Sensor Potentiometer (1 or 2) that did not display the correct voltages in the previous test.**

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Turn the ignition on.

Measure the voltage of the 5-Volt Supply circuit in the APP Sensor harness connector.




**Is the voltage between 4.7 and 5.3 volts?**

**Yes** >> Go To 5

**No** >> Go To 13

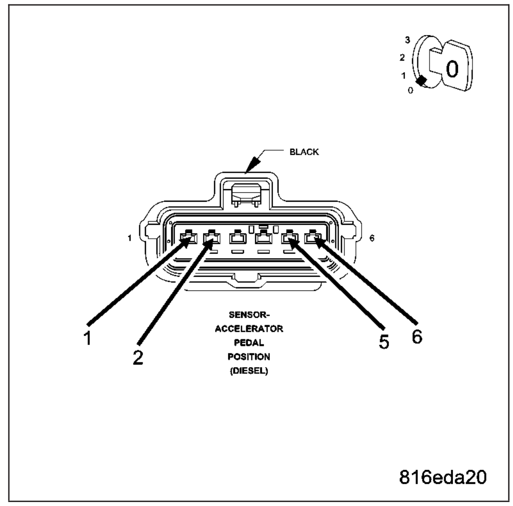
## 5. VERIFY APP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Connect a jumper wire between APP Sensor Signal circuit and the 5-volt supply circuit at the APP Sensor harness connector.

With the scan tool, read the PEDAL OUTPUT VOLTS.




**Does the scan tool display between 4.0 and 5.5 volts?**

**Yes** >> Go To 6

**No** >> Go To 9

## 6. APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

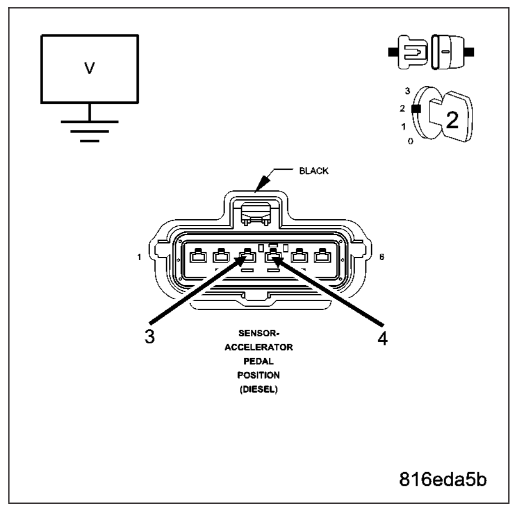
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the APP Sensor Ground circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the App Sensor Ground circuit for a short to voltage. Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Go To 7

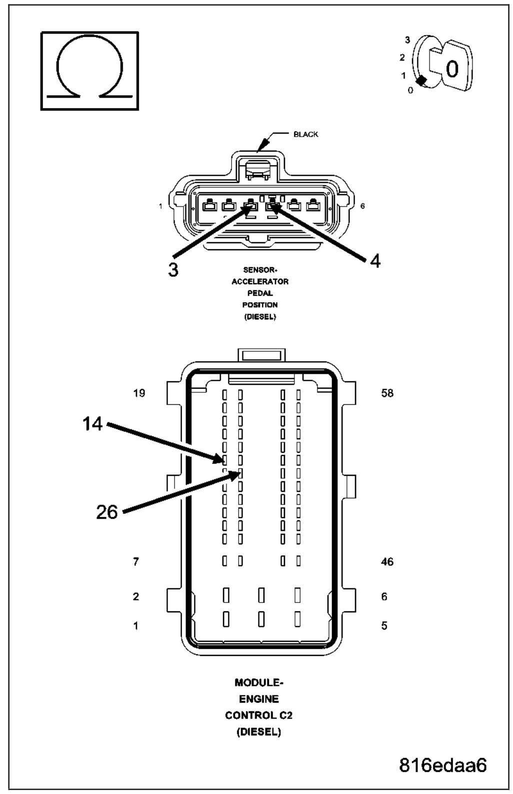
## 7. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between the APP Sensor and the ECM.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 8

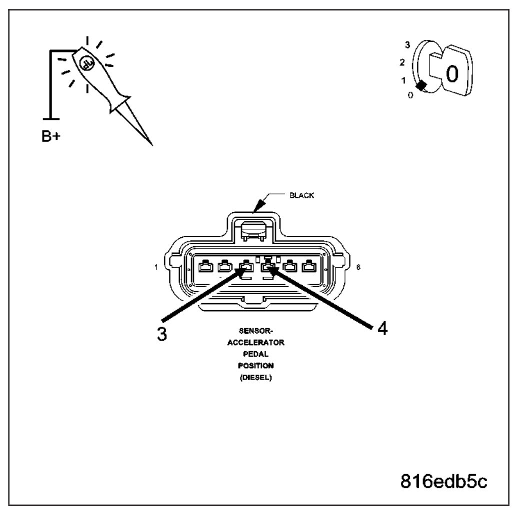
**No** >> Repair the APP Sensor Ground circuit for an open.
Perform ROAD TEST VERIFICATION - VER-2.

## 8. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Using a 12-volt test light connected to 12-volts, check the Sensor Ground circuit of the appropriate potentiometer.




**Does the test light illuminate brightly?**

**Yes** >> Replace the Accelerator Pedal Position Sensor.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform ROAD TEST VERIFICATION - VER-2.

## 9. APP SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

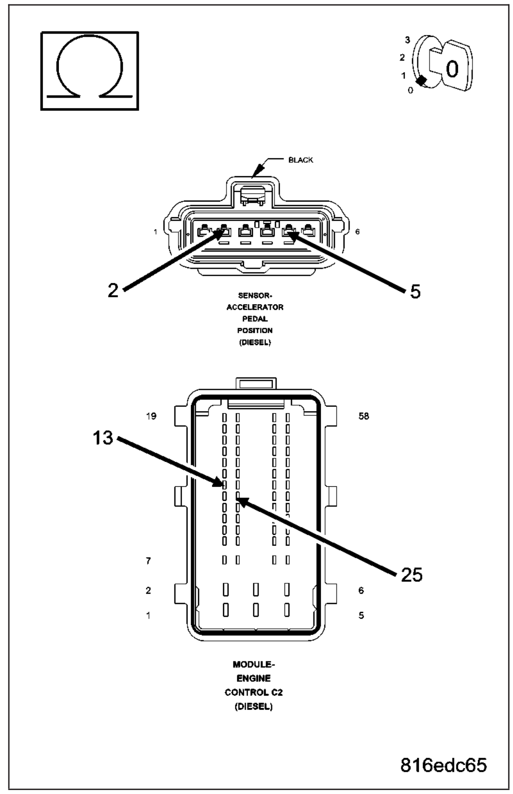
Disconnect the ECM harness connectors.

Measure the resistance of the APP Sensor Signal circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 10

**No** >> Repair the APP Sensor Signal circuit for an open Perform ROAD TEST VERIFICATION - VER-2.




## 10. APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

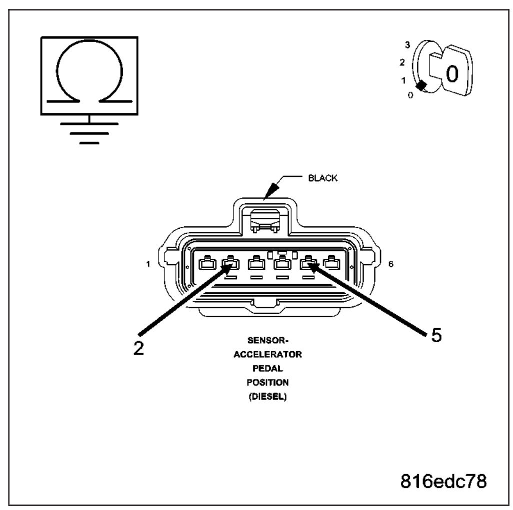
Disconnect the ECM harness connectors.

Measure the resistance between ground and the APP Sensor Signal circuit.

**Is the resistance below 1000 ohms?**

**Yes** >> Repair the APP Sensor Signal circuit for a short to ground. Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Go To 11



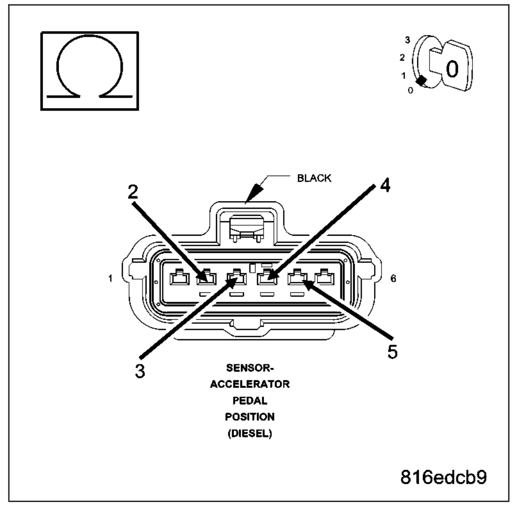
## 11. APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the APP Sensor Signal circuit and the Sensor Ground circuit at the APP Sensor harness connector.




**Is the resistance below 1000 ohms?**

**Yes** >> Repair the APP Sensor Signal and Sensor Ground circuits for a short together.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Go To 12

## 12. APP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

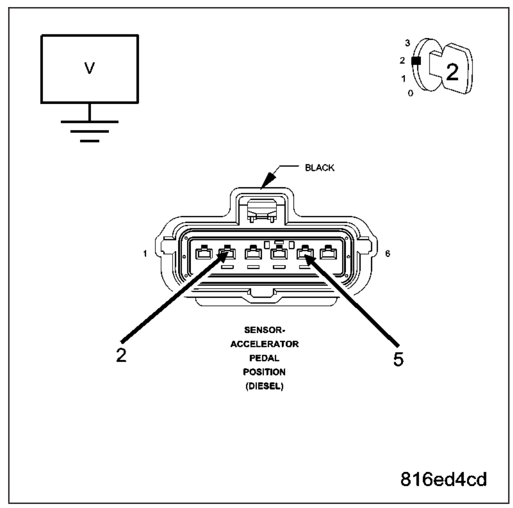
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the APP Sensor Signal circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the APP Sensor Signal circuit for a short to voltage.
Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform ROAD TEST VERIFICATION - VER-2.

## 13. APP SENSOR 5-VOLT SUPPLY CIRCUITS OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

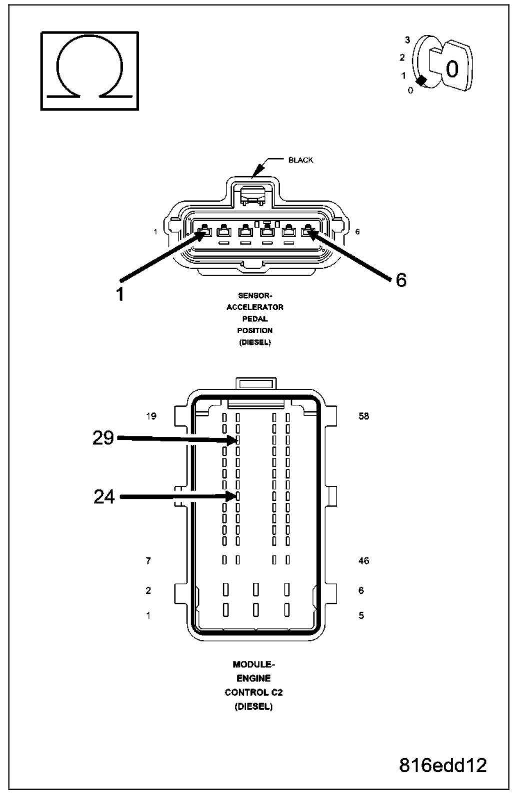
Measure the resistance of the Accelerator Pedal Position Sensor 5-volt Supply circuit.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 14

**No** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for an open.

Perform ROAD TEST VERIFICATION - VER-2.




## 14. APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

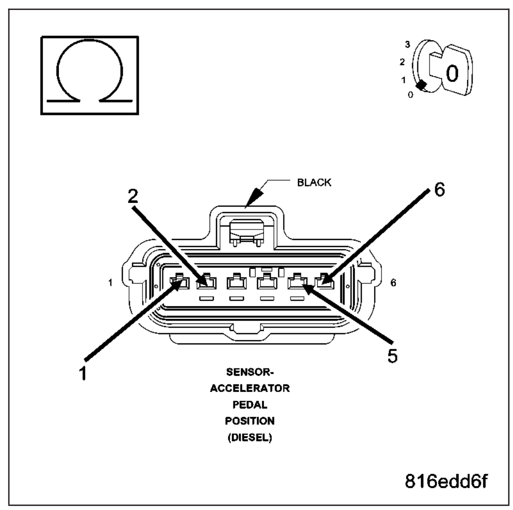
Measure the resistance between the Accelerator Pedal Position Sensor 5-Volt Supply circuit and both Sensor Ground circuits in the APP Sensor harness connector.

**Is the resistance above 1000 ohms?**

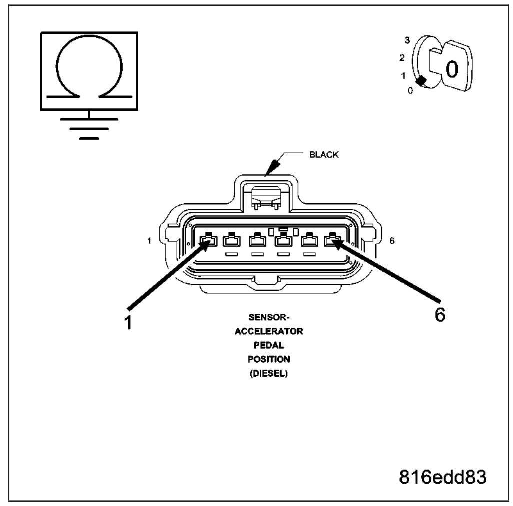
**Yes** >> Go To 15

**No** >> Repair the 5-Volt Supply circuit for a short to the Sensor Ground circuit.

Perform ROAD TEST VERIFICATION - VER-2.



## 15. APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND




Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Accelerator Pedal Position Sensor 5-volt Supply circuit.

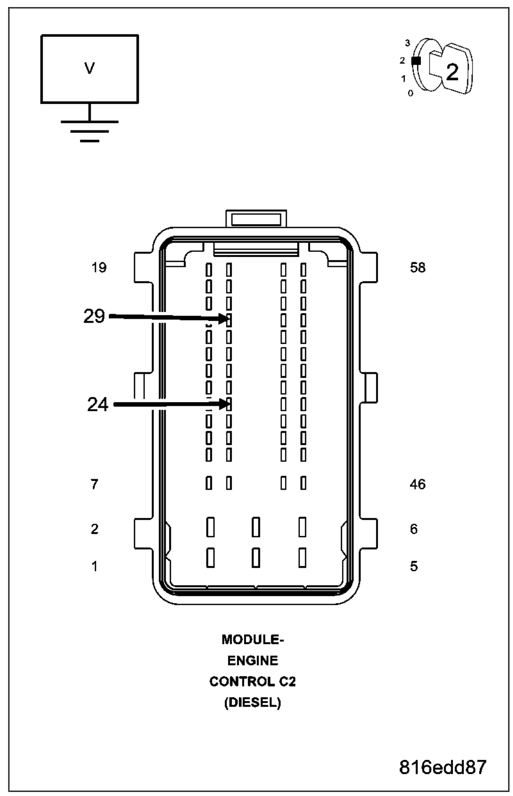
**Is the resistance below 1000 ohms?**

**Yes** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to ground.

Perform ROAD TEST VERIFICATION - VER-2.

**No** >> Go To 16

## 16. APP SENSOR 5-VOLT SUPPLY SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Accelerator Pedal Position Sensor 5-Volt Supply circuit in the ECM harness connector.

**Is the voltage above 1.0 volt?**

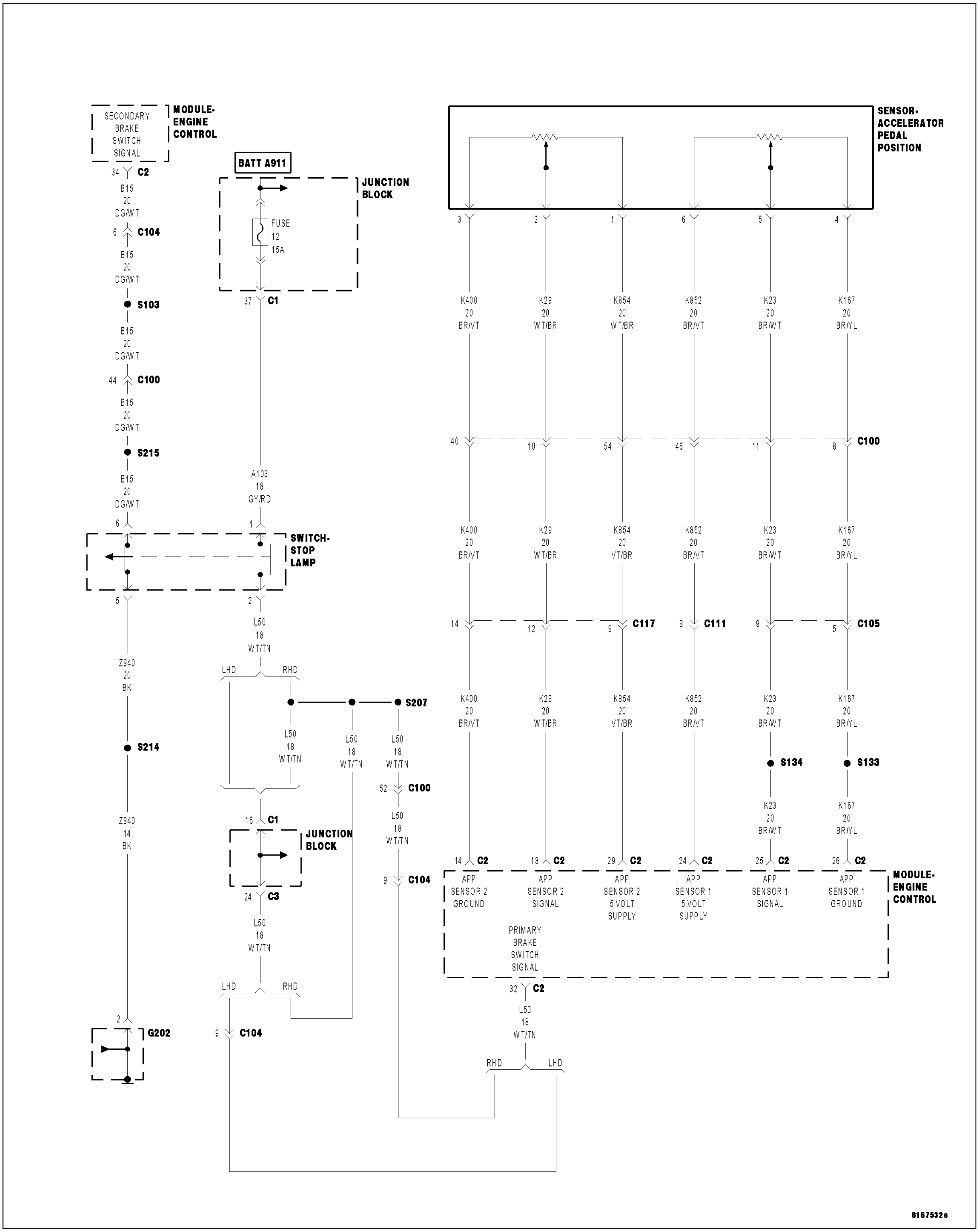
**Yes** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2125-ACC PEDAL POSITION SENSOR 2 SIGNAL VOLTAGE TOO HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The APP Sensor #2 Signal circuit voltage is above 2.5 volts for 0.3 second.

| Possible Causes |
|---|
| ACCELERATOR PEDAL POSITION SENSOR |
| ECM - APP SENSOR 1 5-VOLT SUPPLY CIRCUIT |
| SENSOR GROUND OPEN (APP SENSOR) |
| INTERMITTENT CONDITION |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT OPEN |
| APP SENSOR SIGNAL CIRCUIT OPEN |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND |
| APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| VERIFY APP SENSOR OPERATION |
| APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| APP SENSOR CIRCUIT SHORTED TO VOLTAGE |
| APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE |
| ECM - APP SENSOR SIGNAL CIRCUIT |

## Diagnostic Test

### 1. APP SENSOR IDLE VOLTAGE

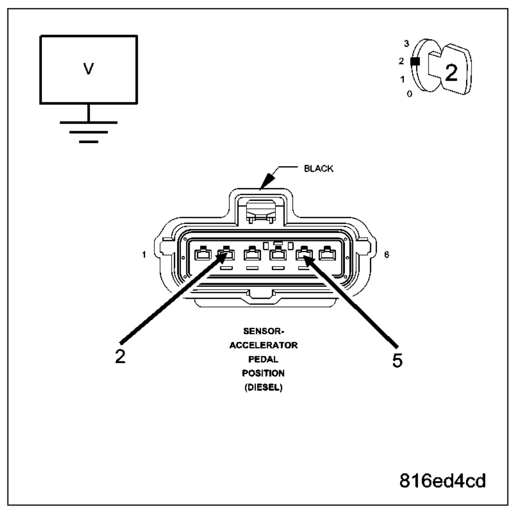
**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: The APP Sensor is a device that contains 2 separate potentiometer type sensors. Each sensor has its own 5-volt supply circuit, sensor ground circuit and signal circuit. The APP Sensor no longer incorporates a low-idle switch.**

**NOTE: The APP Sensor 2 signal should always be approximately 1/2 the voltage of the APP Sensor 1 signal.**




Inspect the APP Sensor for proper travel from the rest position to the fully depressed position.

Turn the ignition on.

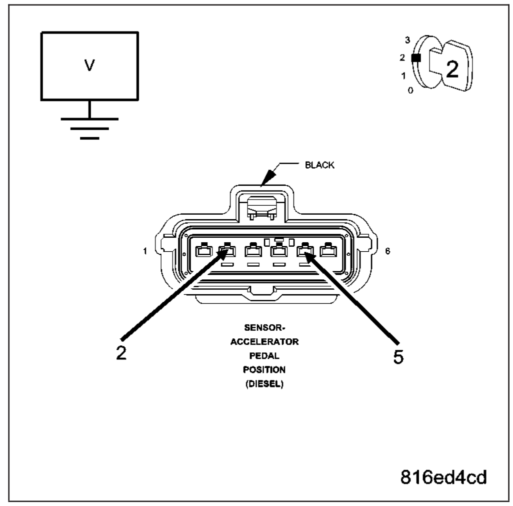
Using a voltmeter, backprobe the APP Sensor 1 and APP Sensor 2 Signal circuits at the APP Sensor harness connector with the accelerator pedal in the at rest position.

**Is the voltage between 0.42 and 0.51 volt for sensor 1 and 0.19 and 0.28 volt for sensor 2?**

**Yes** >> Go To 2

**No** >> Go To 4

## 2. APP SENSOR WIDE OPEN THROTTLE VOLTAGE




Turn the ignition on.

Fully depress the accelerator pedal.

Using a voltmeter backprobe the APP Sensor harness connector and read the voltage for APP Sensor 1 and APP Sensor 2 Signal circuits.

**Is the voltage between 4.45 and 4.75 volts for #1 and 2.15 and 2.45 volts for #2?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. VERIFY APP SENSOR OPERATION

Turn the ignition on.

With the scan tool, read the APP Sensor 1 and APP Sensor 2 percentages (%).

With the accelerator pedal in the idle position, slowly depress the accelerator pedal until the pedal is fully depressed.

**NOTE: The percentage readings for APP Sensors 1 and 2 should increase smoothly as the pedal is depressed.**

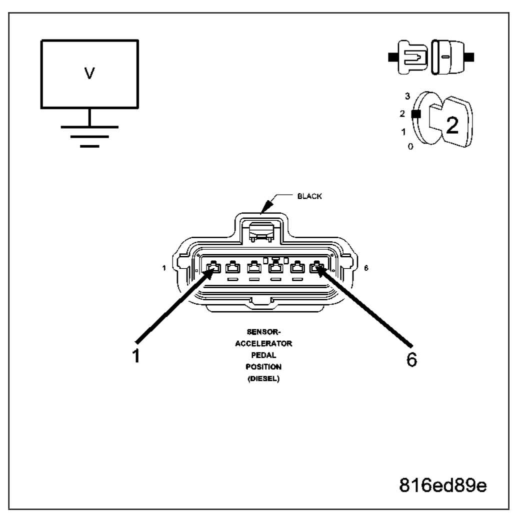
**NOTE: This test can also performed using a voltmeter by back probing each APP Sensor Signal circuit at the APP Sensor harness connector and observing the voltmeter for a smooth voltage change through the entire pedal travel.**

**Does the percentage (voltage) increase smoothly for both readings with the accelerator pedal travel?**

**Yes** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. VERIFY 5-VOLT SUPPLY AND SENSOR REFERENCE VOLTAGE A CIRCUITS




**NOTE: Perform the rest of this diagnostic procedure on the individual APP Sensor Potentiometer (1 or 2) that did not display the correct voltages in the previous test.**

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Turn the ignition on.

Measure the voltage of the 5-Volt Supply circuit in the APP Sensor harness connector.

**Is the voltage between 4.7 and 5.3 volts?**

**Yes** >> Go To 5

**No** >> Go To 13

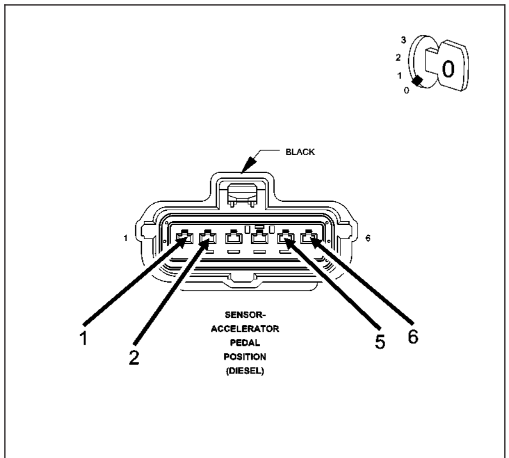
## 5. VERIFY APP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Connect a jumper wire between APP Sensor Signal circuit and the 5-volt supply circuit at the APP Sensor harness connector.

With the scan tool, read the PEDAL OUTPUT VOLTS.



816eda20

**Does the scan tool display between 4.0 and 5.5 volts?**

**Yes** >> Go To 6

**No** >> Go To 9

## 6. APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

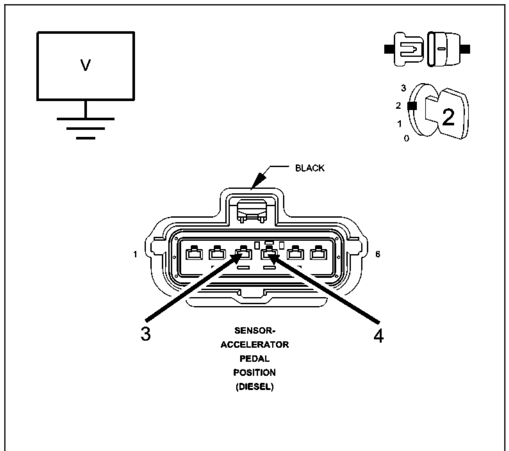
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the APP Sensor Ground circuit.



816eda5b

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the App Sensor Ground circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 7

## 7. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

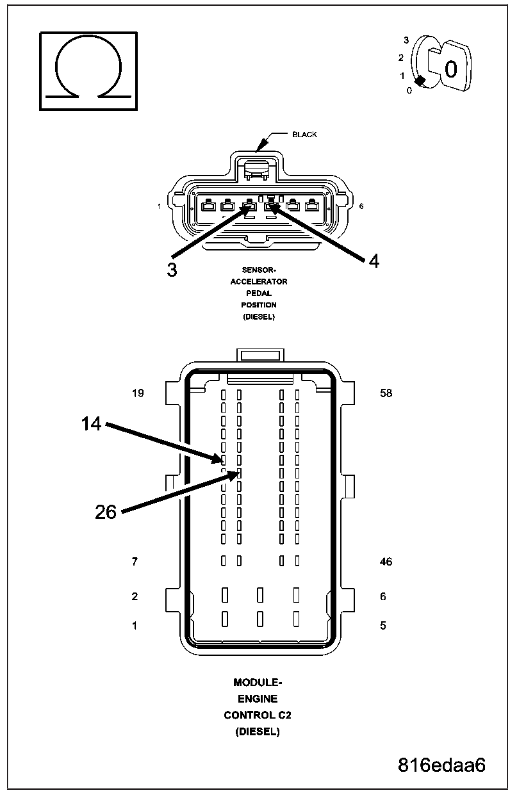
Measure the resistance of the Sensor Ground circuit between the APP Sensor and the ECM.

**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 8

**No** >> Repair the APP Sensor Ground circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 8. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Using a 12-volt test light connected to 12-volts, check the Sensor Ground circuit of the appropriate potentiometer.

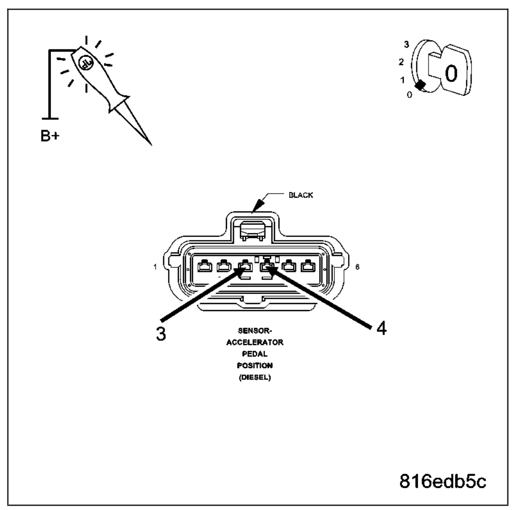
**Does the test light illuminate brightly?**

**Yes** >> Replace the Accelerator Pedal Position Sensor.

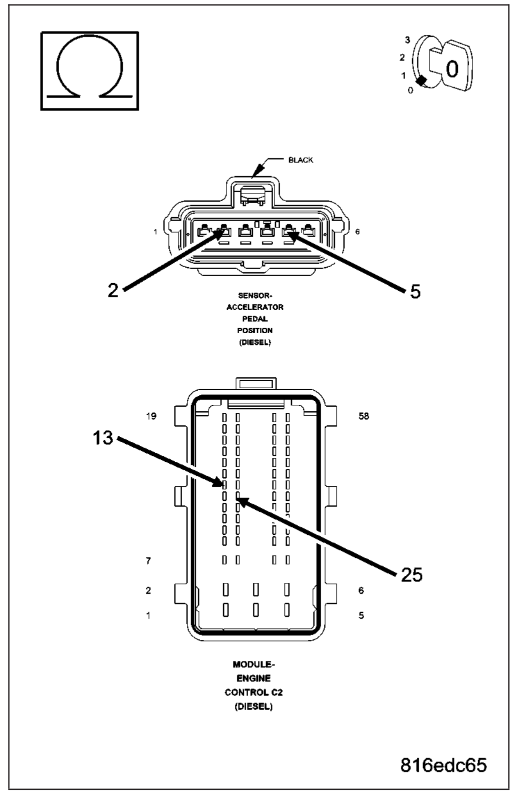
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



## 9. APP SENSOR SIGNAL CIRCUIT OPEN




Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the APP Sensor Signal circuit.

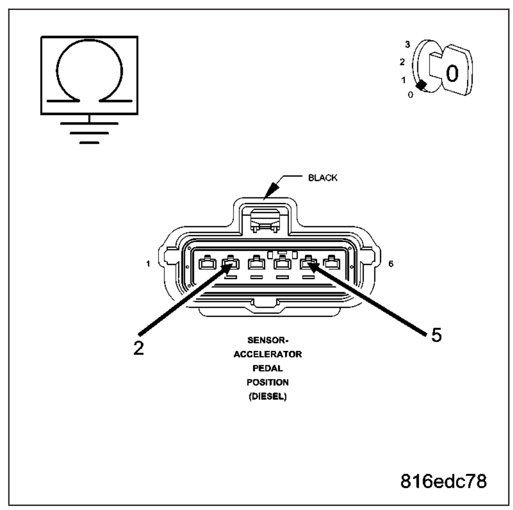
**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 10

**No** >> Repair the APP Sensor Signal circuit for an open

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 10. APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND




Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the APP Sensor Signal circuit.

**Is the resistance below 1000 ohms?**

**Yes** >> Repair the APP Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 11

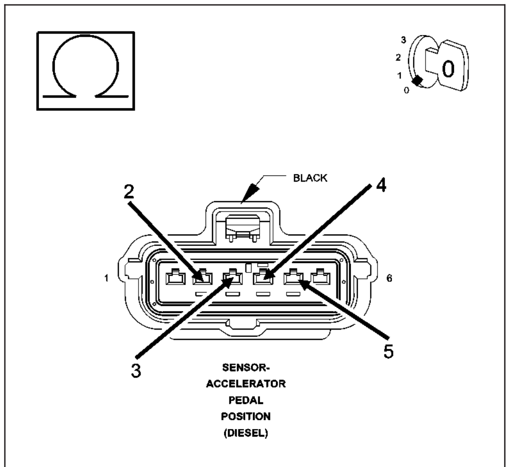
## 11. APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the APP Sensor Signal circuit and the Sensor Ground circuit at the APP Sensor harness connector.



816edcb9

**Is the resistance below 1000 ohms?**

**Yes** >> Repair the APP Sensor Signal and Sensor Ground circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

## 12. APP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

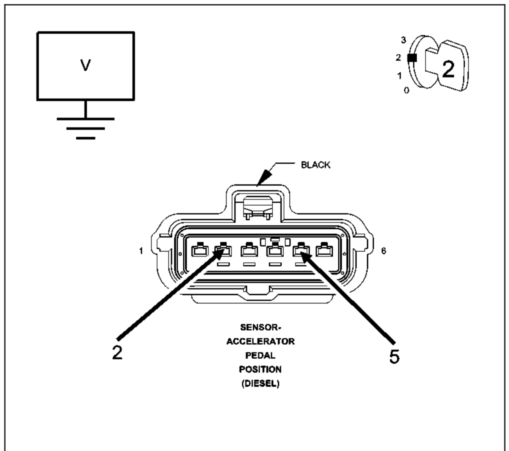
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the APP Sensor Signal circuit.



816ed4cd

**Is the voltage above 1.0 volt?**

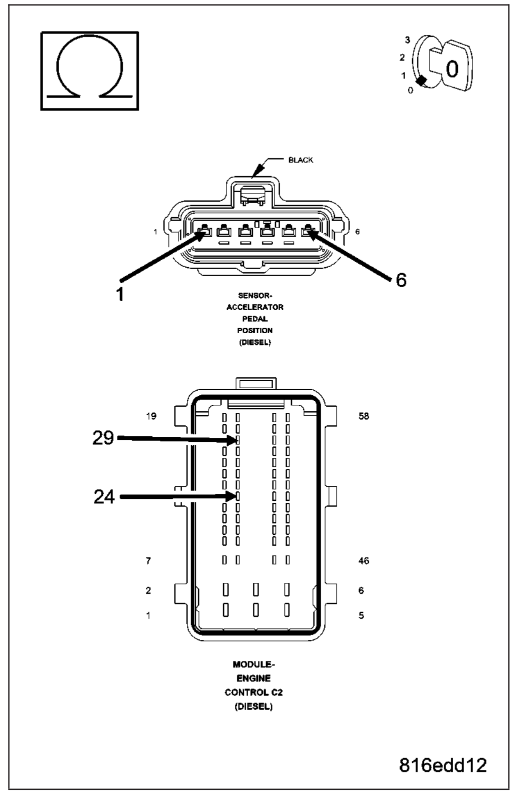
**Yes** >> Repair the APP Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 13. APP SENSOR 5-VOLT SUPPLY CIRCUITS OPEN




Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Accelerator Pedal Position Sensor 5-volt Supply circuit.

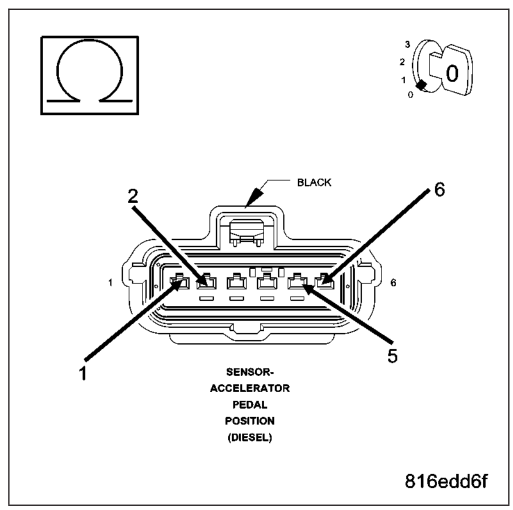
**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 14

**No** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 14. APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND




Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the Accelerator Pedal Position Sensor 5-Volt Supply circuit and both Sensor Ground circuits in the APP Sensor harness connector.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 15

**No** >> Repair the 5-Volt Supply circuit for a short to the Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 15. APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

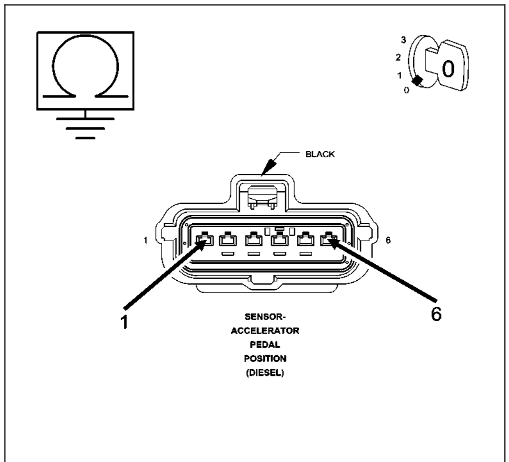
Measure the resistance between ground and the Accelerator Pedal Position Sensor 5-volt Supply circuit.

**Is the resistance below 1000 ohms?**

**Yes** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 16



816edd83

## 16. APP SENSOR 5-VOLT SUPPLY SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Accelerator Pedal Position Sensor 5-Volt Supply circuit in the ECM harness connector.

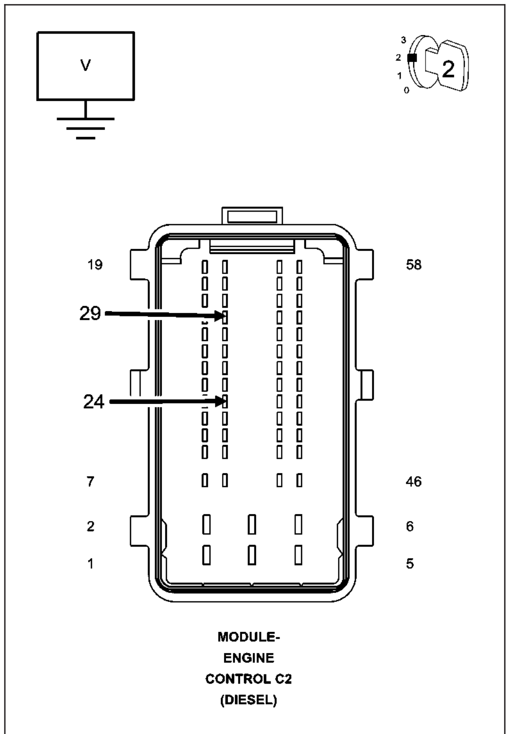
**Is the voltage above 1.0 volt?**

**Yes** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

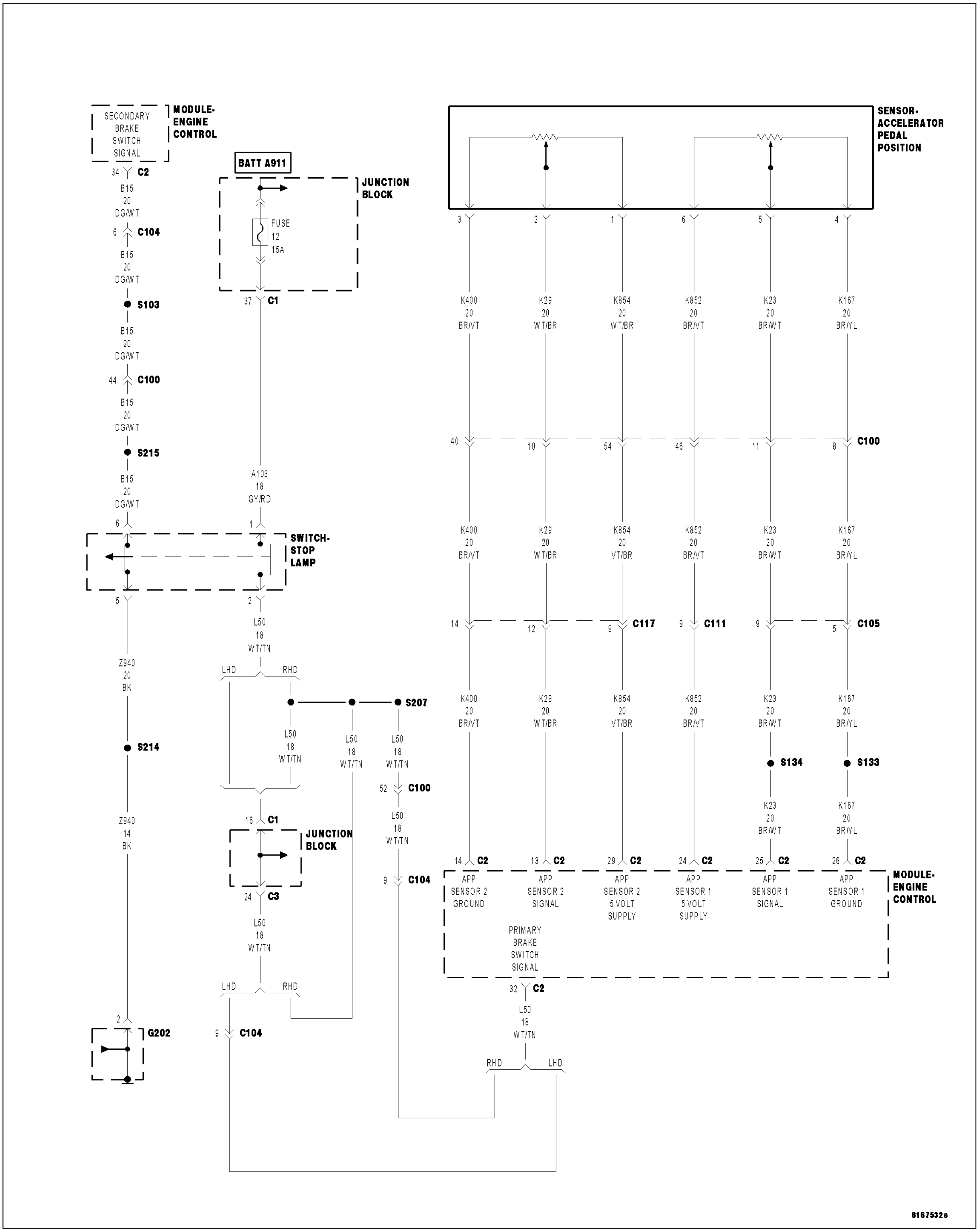
**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



816edd87

# P2125-ACC PEDAL POSITION SENSOR 2 SIGNAL VOLTAGE TOO LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The APP Sensor #2 Signal circuit voltage is below 0.097 volt for 0.3 second.

| Possible Causes |
|---|
| ACCELERATOR PEDAL POSITION SENSOR |
| ECM - APP SENSOR 1 5-VOLT SUPPLY CIRCUIT |
| SENSOR GROUND OPEN (APP SENSOR) |
| INTERMITTENT CONDITION |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT OPEN |
| APP SENSOR SIGNAL CIRCUIT OPEN |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND |
| APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND |
| VERIFY APP SENSOR OPERATION |
| APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT |
| APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE |
| ECM - SENSOR GROUND OPEN |
| APP SENSOR CIRCUIT SHORTED TO VOLTAGE |
| APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE |
| ECM - APP SENSOR SIGNAL CIRCUIT |

## Diagnostic Test

### 1. APP SENSOR IDLE VOLTAGE

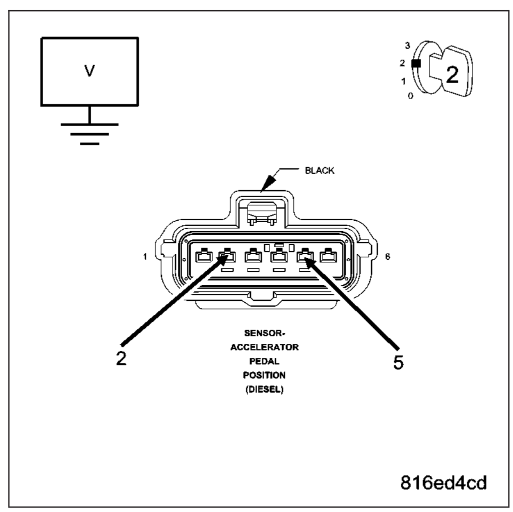
**NOTE: If DTC P0641, P0651 or P0697 is present with this DTC, diagnose DTCs P0641, P0651 or P0697 before diagnosing this DTC.**

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the DRB at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: The APP Sensor is a device that contains 2 separate potentiometer type sensors. Each sensor has its own 5-volt supply circuit, sensor ground circuit and signal circuit. The APP Sensor no longer incorporates a low-idle switch.**

**NOTE: The APP Sensor 2 signal should always be approximately 1/2 the voltage of the APP Sensor 1 signal.**




Inspect the APP Sensor for proper travel from the rest position to the fully depressed position.

Turn the ignition on.

Using a voltmeter, backprobe the APP Sensor 1 and APP Sensor 2 Signal circuits at the APP Sensor harness connector with the accelerator pedal in the at rest position.

**Is the voltage between 0.42 and 0.51 volt for sensor 1 and 0.19 and 0.28 volt for sensor 2?**

**Yes** >> Go To 2

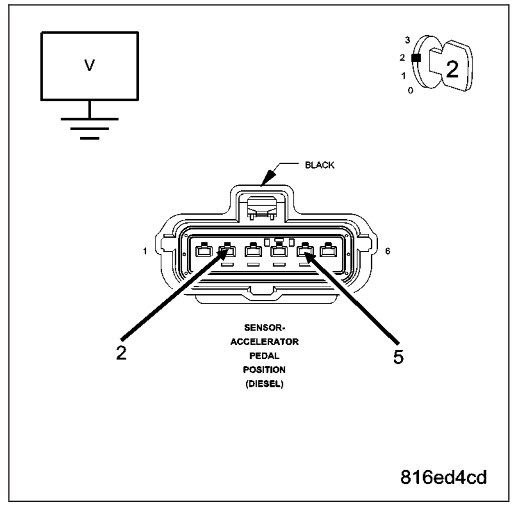
**No** >> Go To 5

## 2. APP SENSOR WIDE OPEN THROTTLE VOLTAGE

Turn the ignition on.

Fully depress the accelerator pedal.

Using a voltmeter backprobe the APP Sensor harness connector and read the voltage for APP Sensor 1 and APP Sensor 2 Signal circuits.




**Is the voltage between 4.45 and 4.75 volts for #1 and 2.15 and 2.45 volts for #2?**

**Yes** >> Go To 3

**No** >> Go To 5

## 3. VERIFY APP SENSOR OPERATION

Turn the ignition on.

With the DRB, read the APP Sensor 1 and APP Sensor 2 percentages (%).

With the accelerator pedal in the idle position, slowly depress the accelerator pedal until the pedal is fully depressed.

**NOTE: The percentage readings for APP Sensors 1 and 2 should increase smoothly as the pedal is depressed.**

**NOTE: This test can also performed using a voltmeter by back probing each APP Sensor Signal circuit at the APP Sensor harness connector and observing the voltmeter for a smooth voltage change through the entire pedal travel.**

**Does the percentage (voltage) increase smoothly for both readings with the accelerator pedal travel?**

**Yes** >> Go To 4

**No** >> Replace the Accelerator Pedal Position Sensor in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. INTERMITTENT CONDITION

**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.**

**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.**

With the engine running and at normal operating temperature, monitor the DRB parameters related to the DTC while wiggling the wiring harness. Look for parameter values to change and/or a DTC to set.

Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the conditions under which the DTC was set by slowly pressing and releasing the accelerator pedal several times.

Refer to any Technical Service Bulletins (TSB) that may apply.

Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wiring harness connectors. Look for broken, bent, pushed out, or corroded terminals.

**Were any of the above conditions present?**

**Yes** >> Repair as necessary.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Test Complete.

## 5. VERIFY 5-VOLT SUPPLY AND SENSOR REFERENCE VOLTAGE A CIRCUITS

**NOTE: Perform the rest of this diagnostic procedure on the individual APP Sensor Potentiometer (1 or 2) that did not display the correct voltages in the previous test.**

Turn the ignition off.

Disconnect the APP Sensor harness connector.

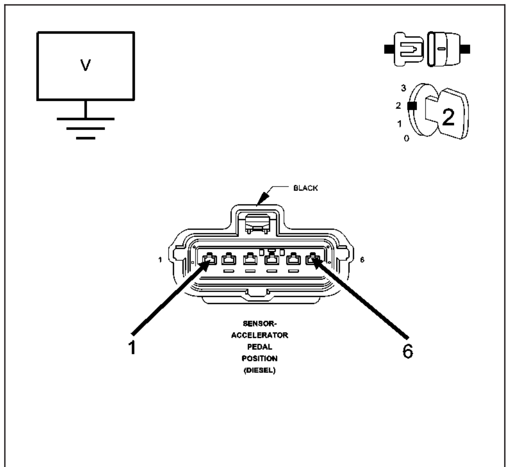
Turn the ignition on.

Measure the voltage of the 5-Volt Supply circuit in the APP Sensor harness connector.

**Is the voltage between 4.7 and 5.3 volts?**

**Yes** >> Go To 6

**No** >> Go To 14




816ed89e

## 6. VERIFY APP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

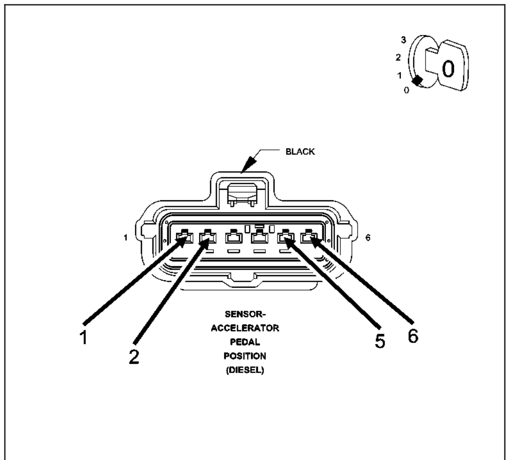
Connect a jumper wire between APP Sensor Signal circuit and the 5-volt supply circuit at the APP Sensor harness connector.

With the DRB, read the PEDAL OUTPUT VOLTS.

**Does the DRB display between 4.0 and 5.5 volts?**

**Yes** >> Go To 7

**No** >> Go To 10




816eda20

## 7. APP SENSOR GROUND CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

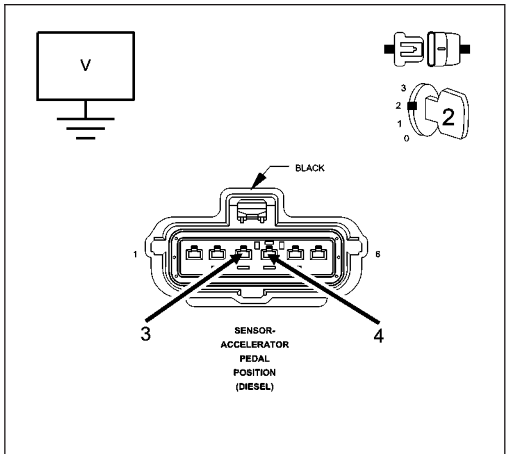
Turn the ignition on.

Measure the voltage of the APP Sensor Ground circuit.

**Is the voltage above 1.0 volt?**

**Yes** >> Repair the App Sensor Ground circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 8




816eda5b

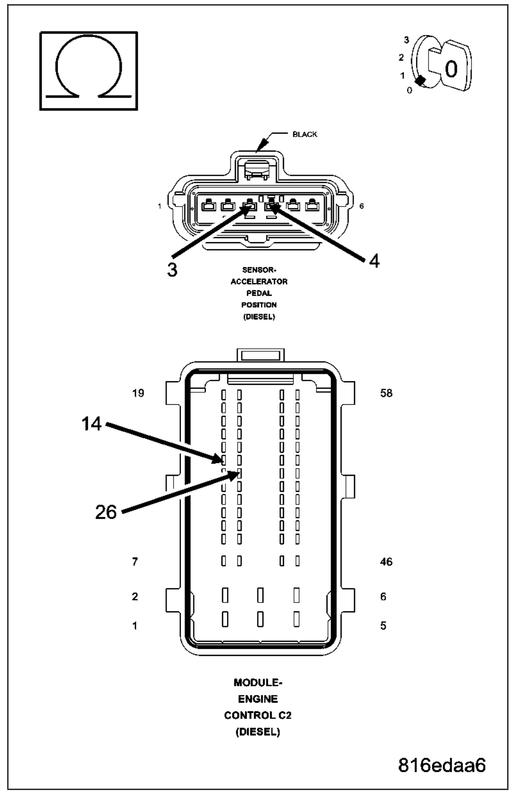
## 8. SENSOR GROUND OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Sensor Ground circuit between the APP Sensor and the ECM.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 9

**No** >> Repair the APP Sensor Ground circuit for an open.

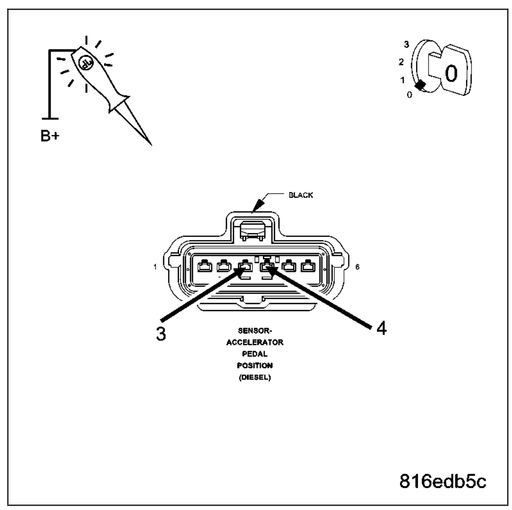
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 9. ECM - SENSOR GROUND OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Using a 12-volt test light connected to 12-volts, check the Sensor Ground circuit of the appropriate potentiometer.




**Does the test light illuminate brightly?**

**Yes** >> Replace the Accelerator Pedal Position Sensor.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

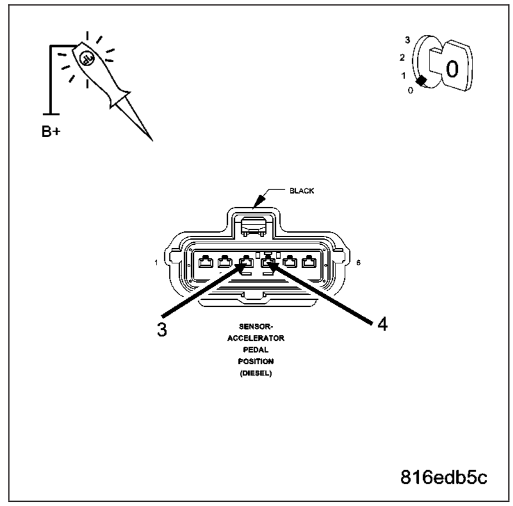
## 10. APP SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the APP Sensor Signal circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 11

**No** >> Repair the APP Sensor Signal circuit for an open
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

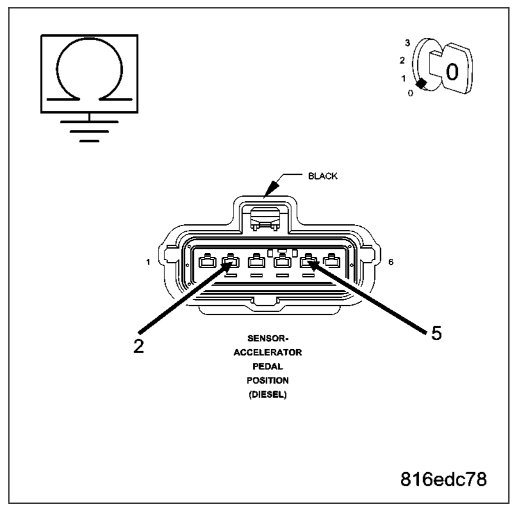
## 11. APP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the APP Sensor Signal circuit.




**Is the resistance below 1000 ohms?**

**Yes** >> Repair the APP Sensor Signal circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 12

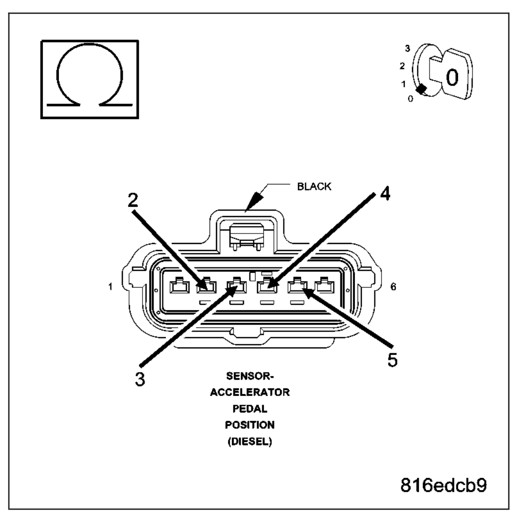
## 12. APP SENSOR SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the APP Sensor Signal circuit and the Sensor Ground circuit at the APP Sensor harness connector.




**Is the resistance below 1000 ohms?**

**Yes** >> Repair the APP Sensor Signal and Sensor Ground circuits for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 13

## 13. APP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

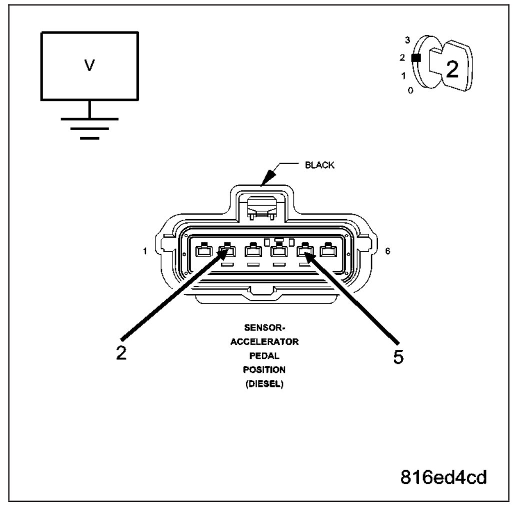
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the APP Sensor Signal circuit.




**Is the voltage above 1.0 volt?**

**Yes** >> Repair the APP Sensor Signal circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

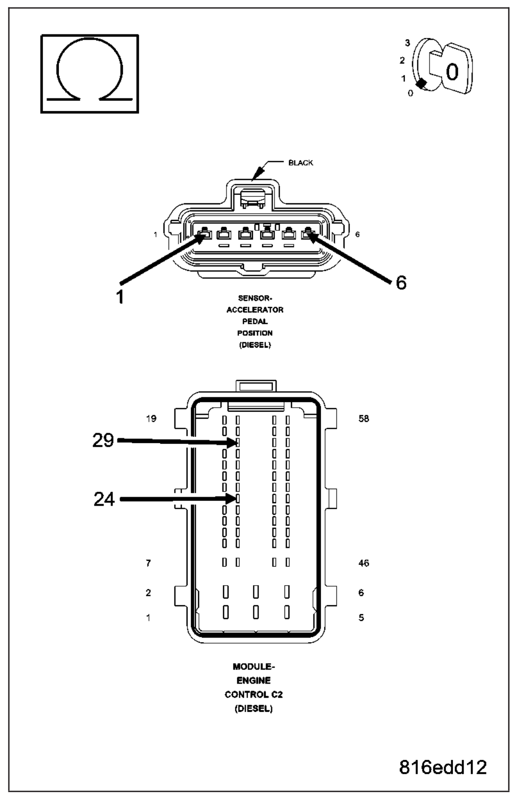
## 14. APP SENSOR 5-VOLT SUPPLY CIRCUITS OPEN

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Accelerator Pedal Position Sensor 5-volt Supply circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 15

**No** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

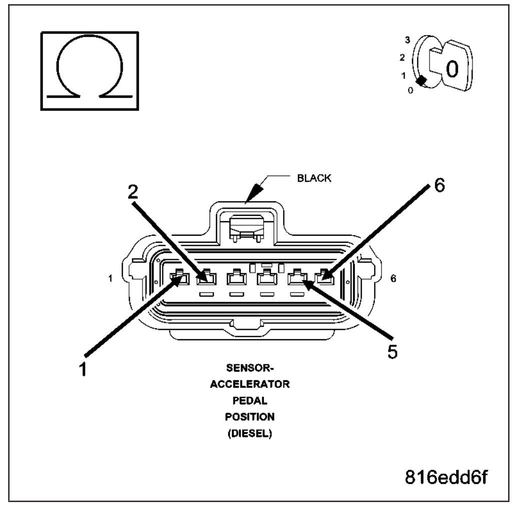
## 15. APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO SENSOR GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between the Accelerator Pedal Position Sensor 5-Volt Supply circuit and both Sensor Ground circuits in the APP Sensor harness connector.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 16

**No** >> Repair the 5-Volt Supply circuit for a short to the Sensor Ground circuit.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

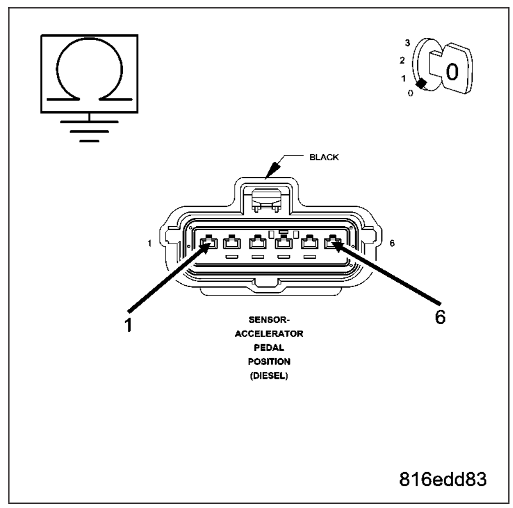
## 16. APP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Accelerator Pedal Position Sensor 5-volt Supply circuit.




**Is the resistance below 1000 ohms?**

**Yes** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 17

## 17. APP SENSOR 5-VOLT SUPPLY SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the APP Sensor harness connector.

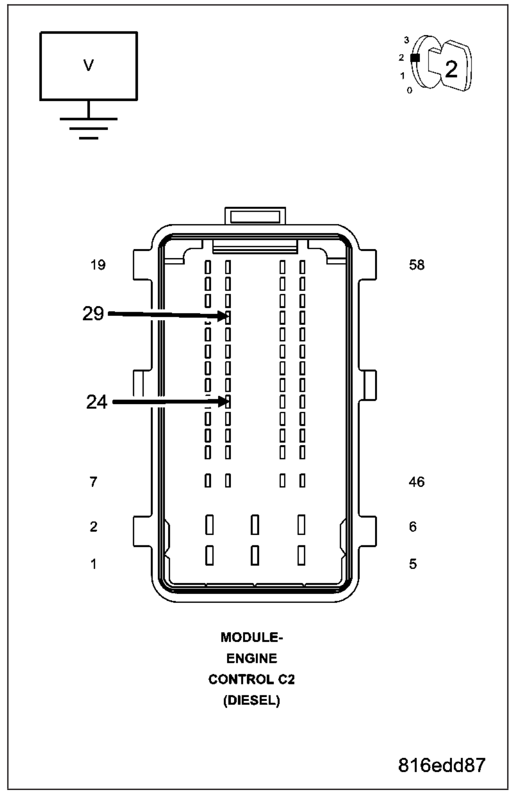
Disconnect the ECM harness connectors.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Accelerator Pedal Position Sensor 5-Volt Supply circuit in the ECM harness connector.




**Is the voltage above 1.0 volt?**

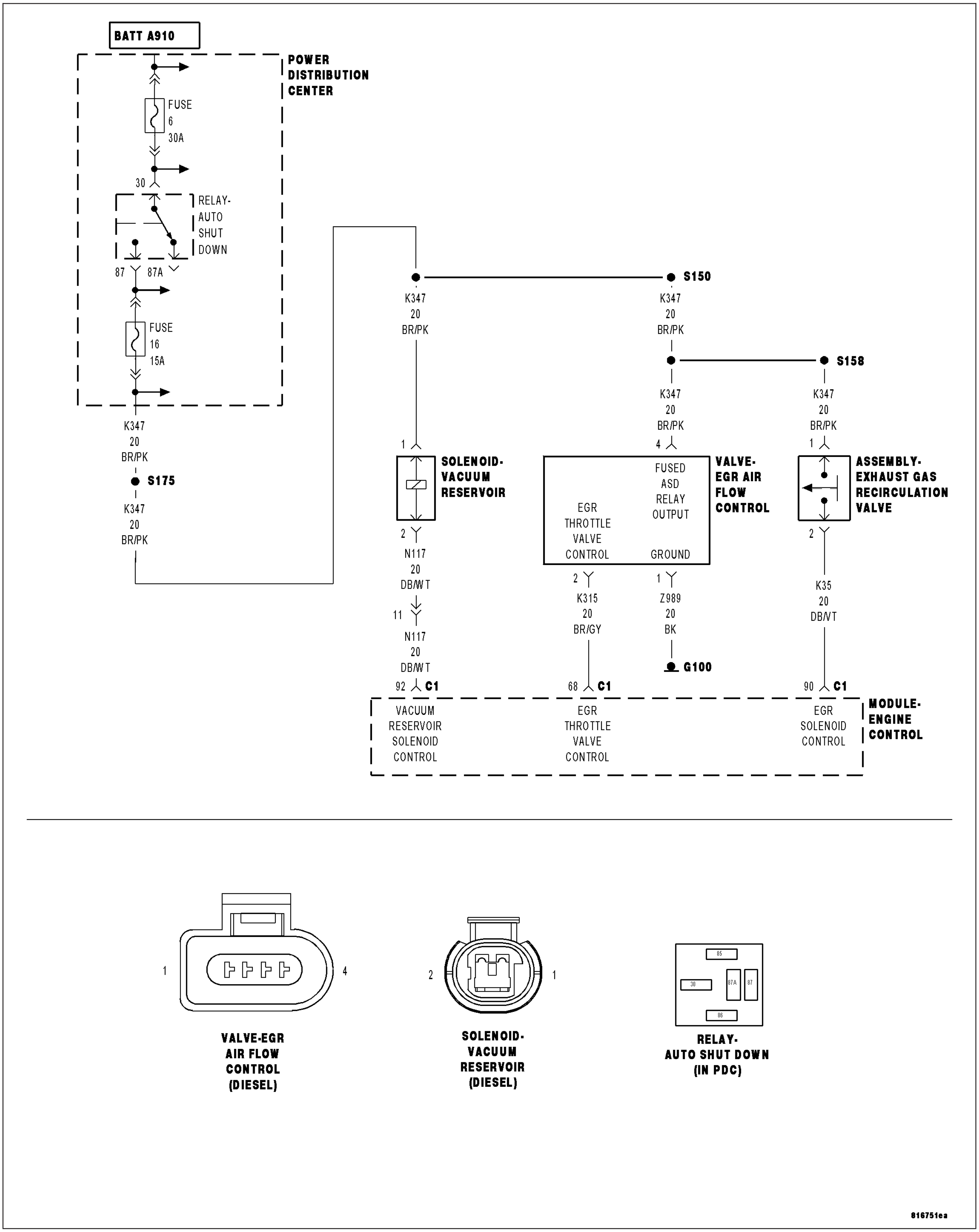
**Yes** >> Repair the Accelerator Pedal Position Sensor 5-Volt Supply circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2141-EGR AIR FLOW CONTROL VALVE SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM EGR Air Flow Control Valve command off.
- **Set Condition:**
  The ECM detect a short to ground on the EGR Air Flow Control Valve Control circuit for 0.5 second.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| EGR AIR FLOW CONTROL VALVE CIRCUIT SHORTED TO GROUND |
| EGR AIR FLOW CONTROL VALVE CIRCUIT OPEN |
| EGR AIR FLOW CONTROL VALVE |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the DRB at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the DRB, erase ECM DTCs.

Test drive the vehicle.

Monitor the DRB for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

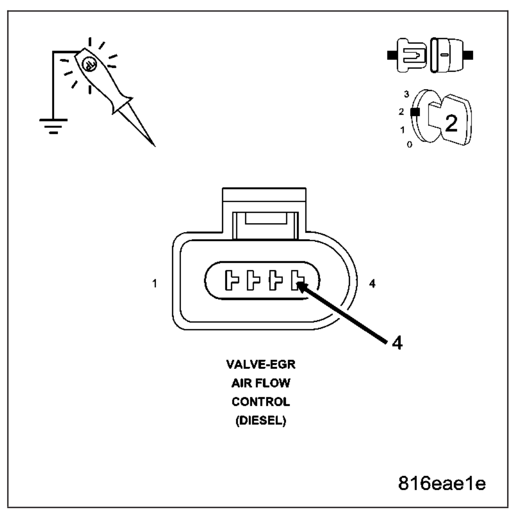
### 2. ASD OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

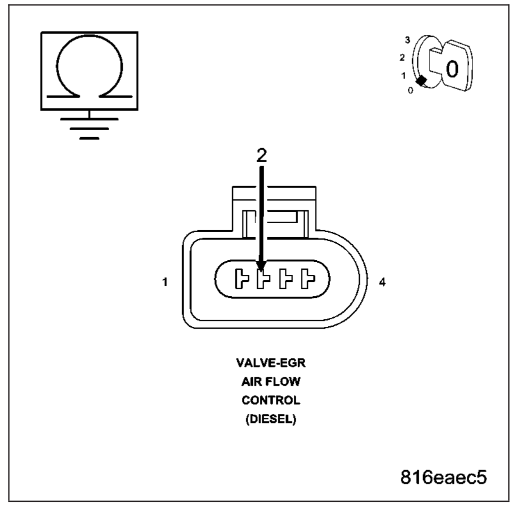
## 3. EGR AIR FLOW CONTROL VALVE SHORTED TO GROUND

Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the EGR Air Flow Control Valve Control circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the EGR Air Flow Control Valve circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

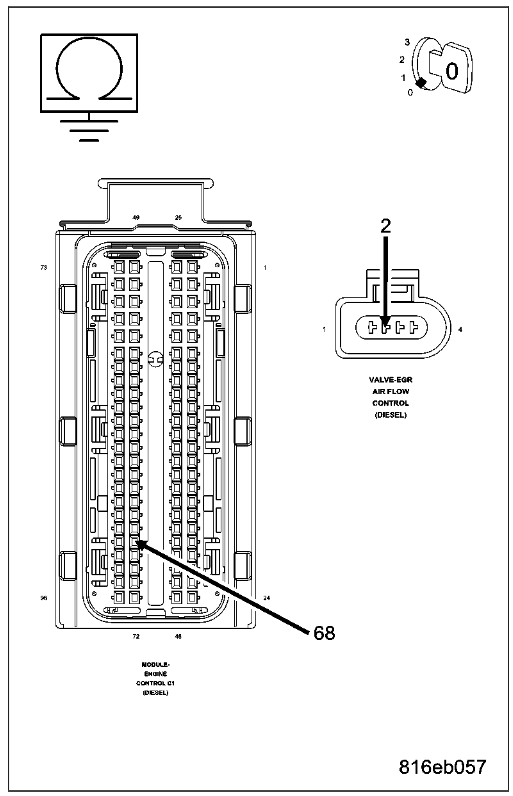
## 4. EGR AIR FLOW CONTROL VALVE CIRCUIT OPEN

Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the EGR Air Flow Control Valve Control circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the EGR Air Flow Control Valve Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. EGR AIR FLOW CONTROL VALVE

Turn the ignition off.

Install a substitute EGR Air Flow Control Valve in place of the vehicle's EGR Air Flow Control Valve.

**NOTE: Ensure the ECM and EGR Air Flow Control Valve harness connectors are connected.**

Turn the ignition on.

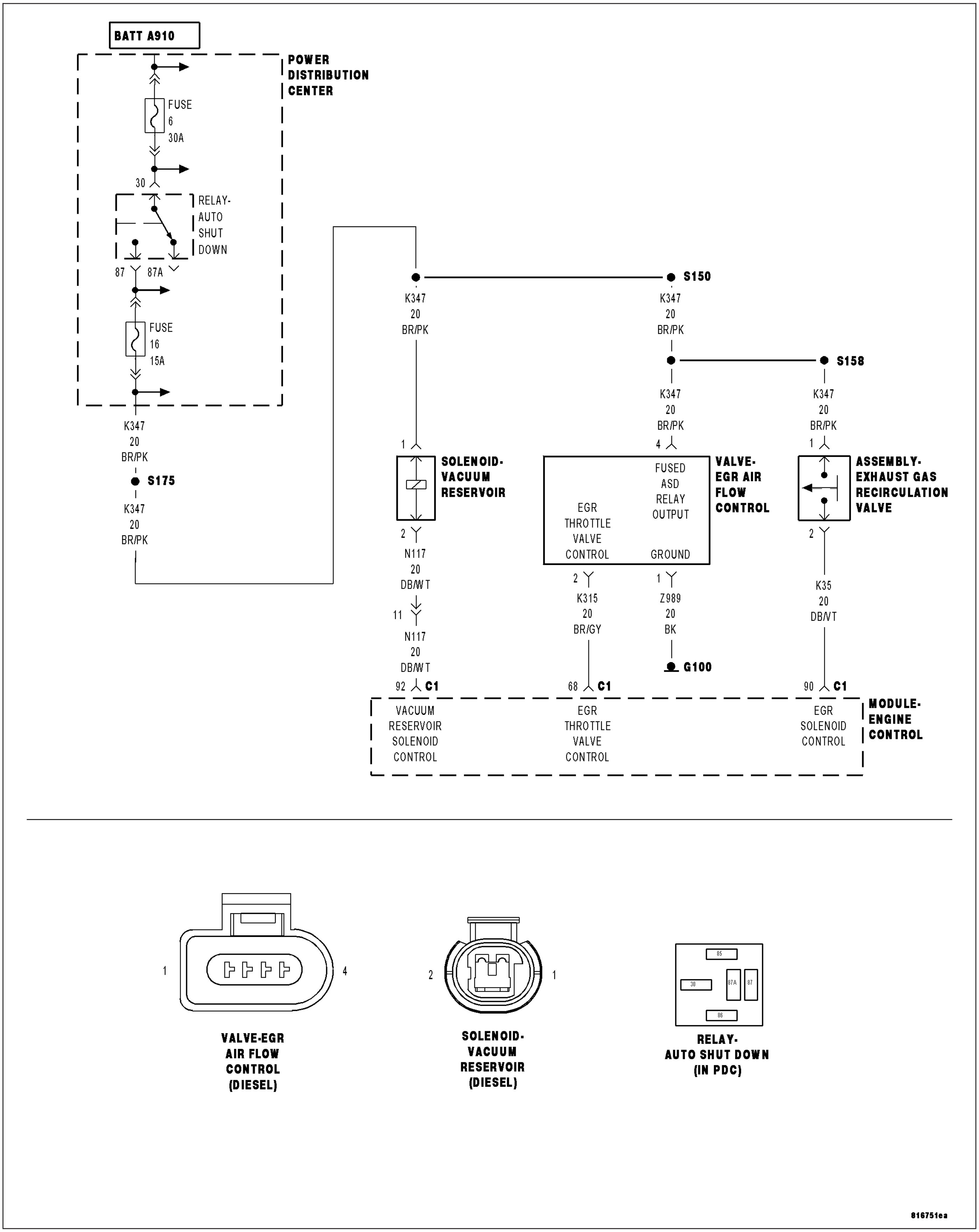
With the DRB, check for this DTC to set again.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the EGR Air Flow Control Valve.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2142-EGR AIR FLOW CONTROL VALVE SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM EGR Air Flow Control Valve command on.
- **Set Condition:**
  The ECM detects excessive current on the EGR Air Flow Control Valve Control circuit for 0.5 second.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| EGR AIR FLOW CONTROL VALVE |
| EGR AIR FLOW CONTROL VALVE CONTROL SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE - INTERNAL SHORT TO VOLTAGE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Test drive the vehicle and monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. EGR AIR FLOW CONTROL VALVE

Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

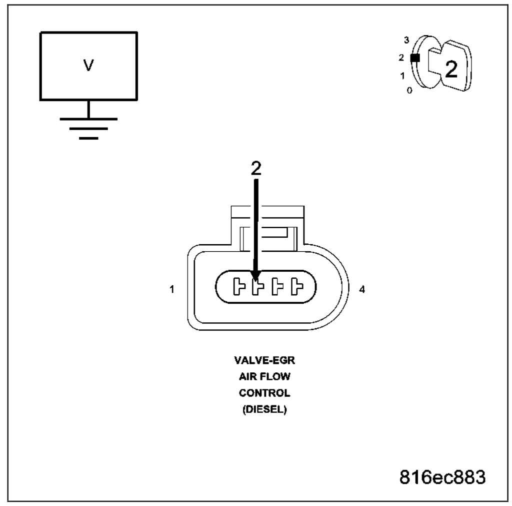
Monitor the scan tool for ECM DTCs.

**Does the scan tool display P1140 EGR AIR FLOW CONTROL VALVE OPEN CIRCUIT?**

**Yes** >> Replace the EGR Air Flow Control Valve.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

## 3. EGR AIR FLOW CONTROL VALVE SHORTED TO VOLTAGE




Turn the ignition off.

Disconnect the EGR Air Flow Control Valve harness connector.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the EGR Air Flow Control Valve Control circuit.

**Is the voltage below 1.0 volt?**

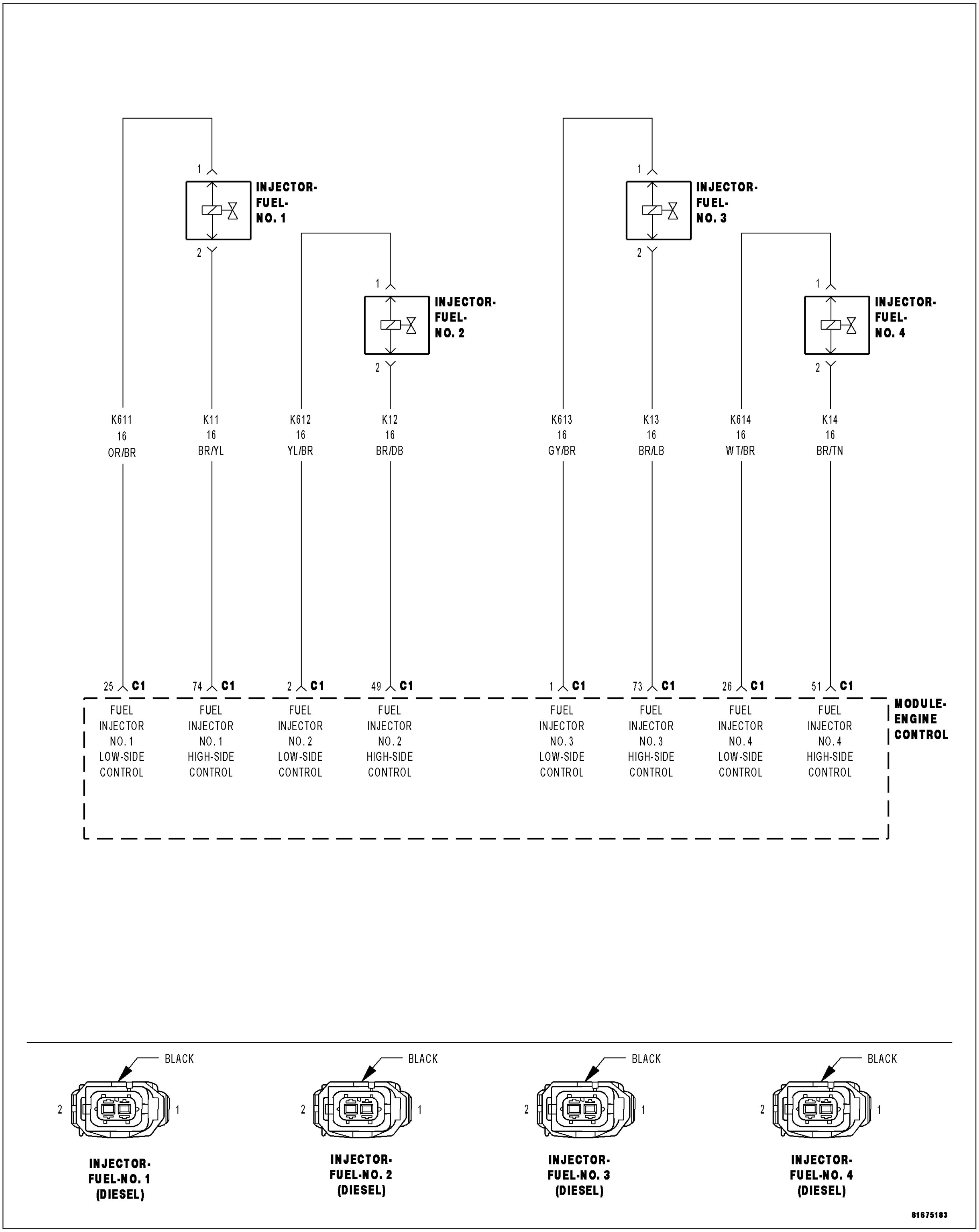
**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the EGR Air Flow Control Valve Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2147 INJECTOR BANK 1 OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

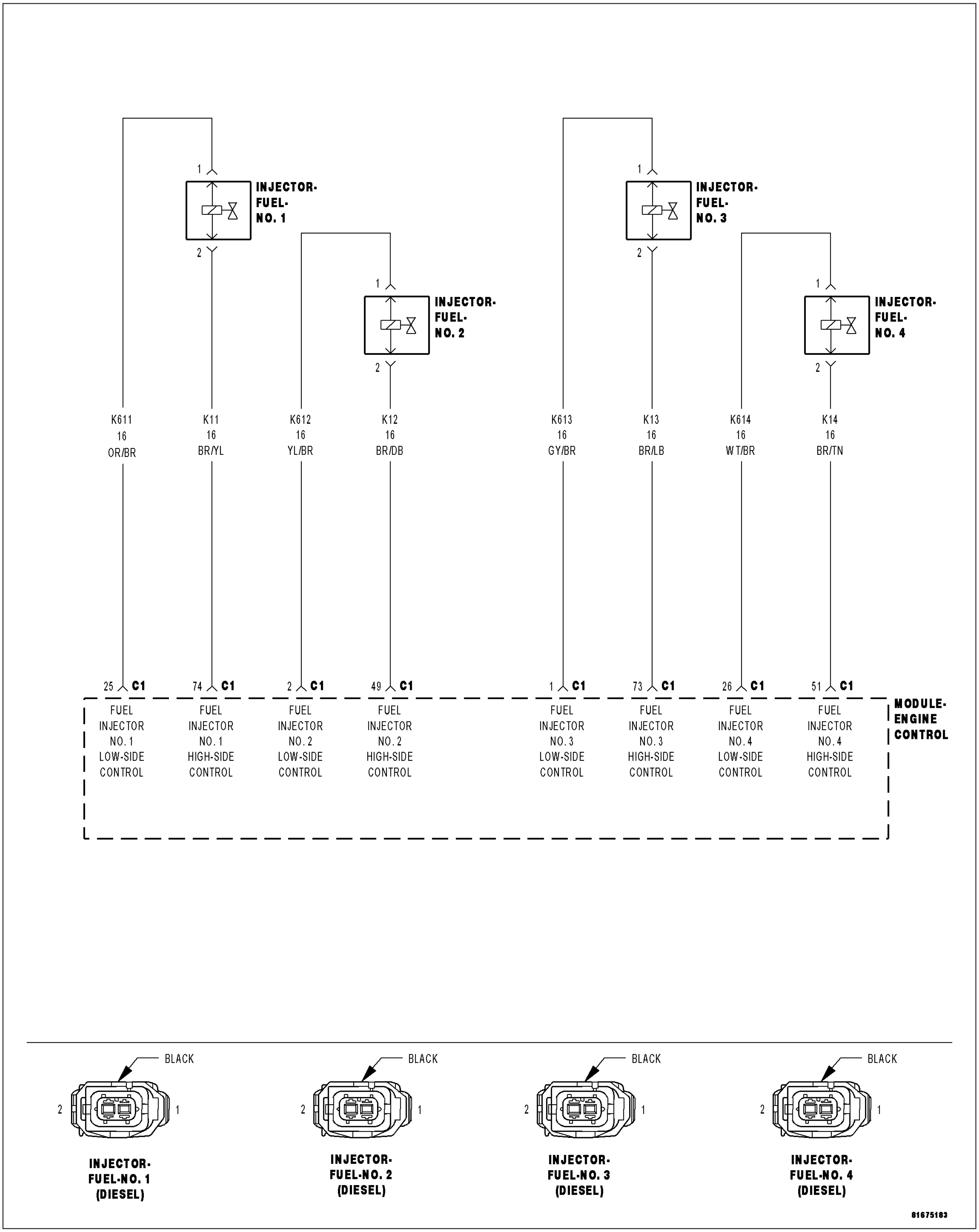
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2148-BANK 1-INJECTOR SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

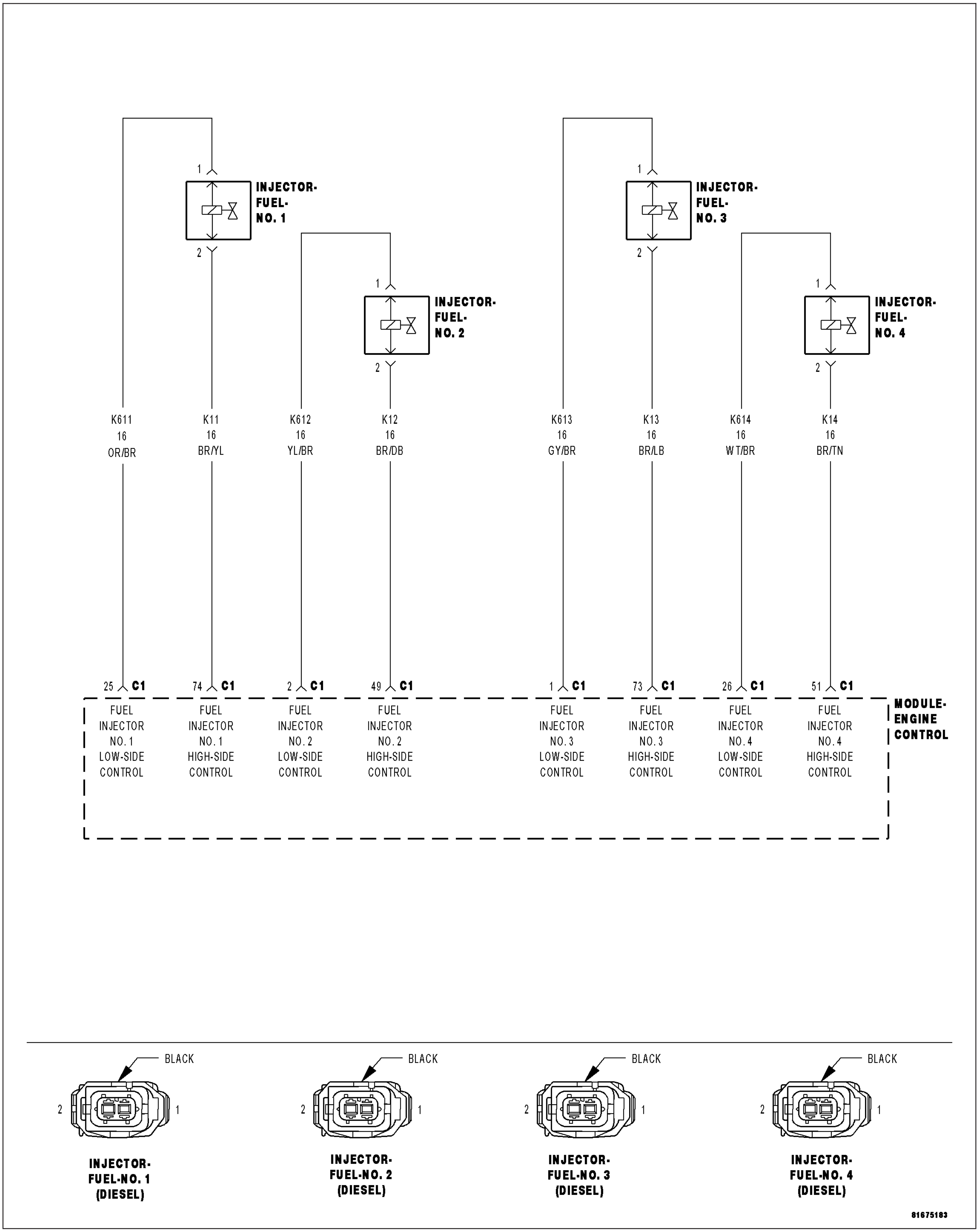
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2151-BANK 2- OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
| --- |
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

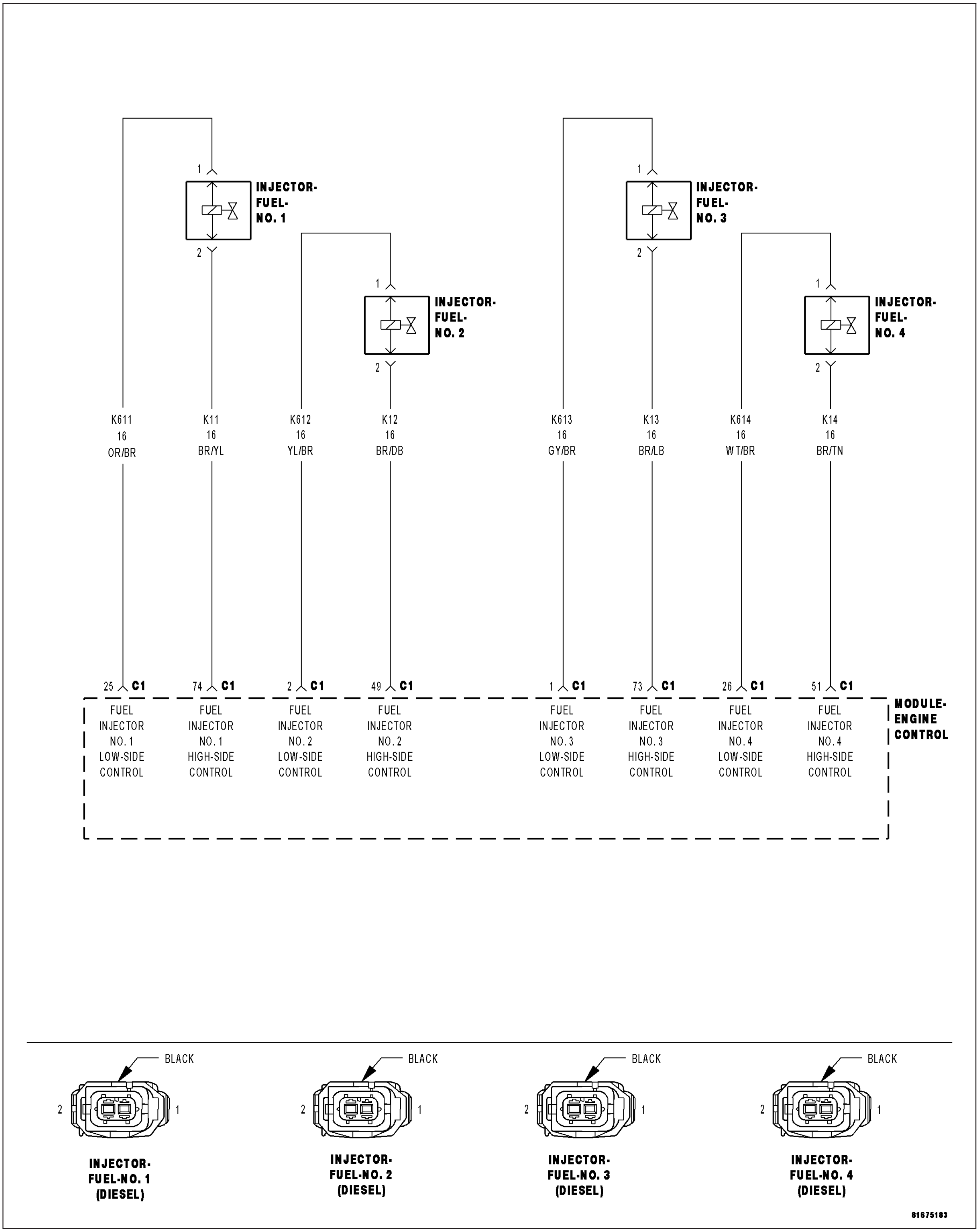
With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2151-BANK 2 SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

| Possible Causes |
| --- |
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE |
| FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND |
| FUEL INJECTOR CIRCUITS SHORTED TOGETHER |
| FUEL INJECTOR CONTROL CIRCUIT OPEN |
| FUEL INJECTOR |

## Diagnostic Test

### 1. VERIFY ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase the ECM DTCs.

Attempt to start the engine and test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**If the ECM power and ground circuits are functioning properly continue with this test.**

**Yes** >> Go To 3

### 3. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of each Fuel Injector High-Side Control circuit.

Measure the voltage of each Fuel Injector Low-Side Control circuit.

**Is the voltage above 1.0 volt for any of the measurements?**

**Yes** >> Repair the appropriate Fuel Injector Control circuit for a short to voltage.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 4

## 4. FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Fuel Injector harness connectors.

Measure the resistance between ground and each Fuel Injector High-Side Control circuits.

Measure the resistance between ground and each Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector Control circuit for a short to ground.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 5

## 5. FUEL INJECTOR CIRCUITS SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance between each of the Fuel Injector High-Side Control circuits and the Fuel Injector Low-Side Control circuits.

**Is the resistance below 1000 ohms for any of the measurements?**

**Yes** >> Repair the Fuel Injector circuits that measured below 1000 ohms for a short together.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 6

## 6. FUEL INJECTOR CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect all of the Cylinder Fuel Injector harness connectors.

Measure the resistance of each Fuel Injector High-Side and Low-Side Control circuits between its respective injector harness connector and the ECM harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the appropriate Fuel Injector Control circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. CYLINDER FUEL INJECTOR

Turn the ignition off.

Replace the appropriate Cylinder Fuel Injector (as indicated by the DTC) in accordance with the Service Information.

With the scan tool, erase the ECM DTCs.

Test drive the vehicle.

With the scan tool, read the ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> The repair is complete.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2226 BAROMETRIC PRESSURE CIRCUIT SIGNAL VOLTAGE TOO HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The ECM detects an internal failure.

| Possible Causes |
|---|
| ENGINE CONTROL MODULE |
| INTERMITTENT CONDITION |

## Diagnostic Test

### 1. ENGINE CONTROL MODULE

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**NOTE: If there are other DTC's set with this DTC repair other DTC's before continuing with this diagnostic procedure.**

**NOTE: This code can be caused by an intermittent problem in the wiring and connectors to the Engine Control Module. Inspect the Engine Control Module harness connector and associated wiring for signs of poor terminal contact.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Perform several engine run cycles, turning the ignition off for at least 20 seconds between each engine run cycle.

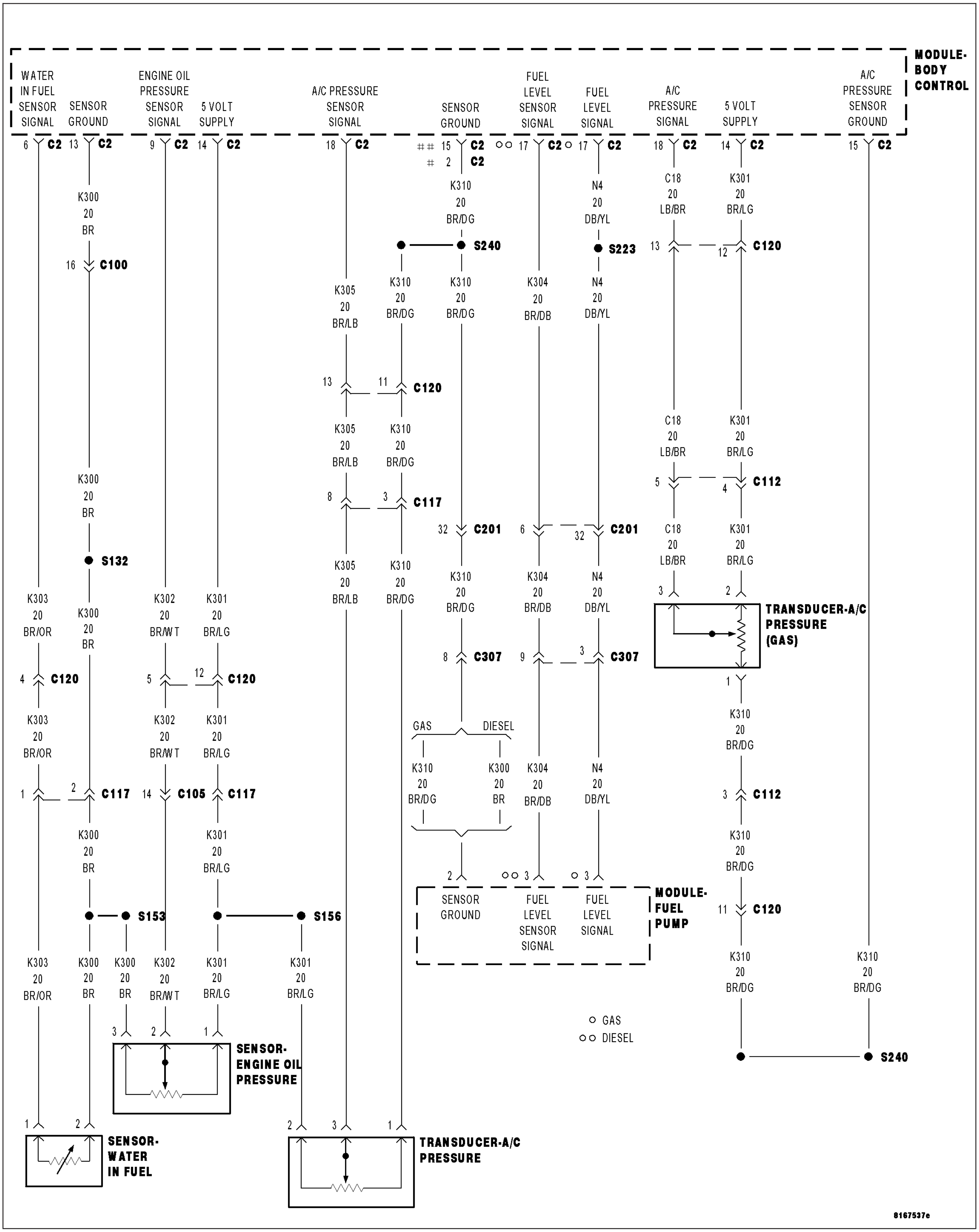
With the scan tool, read the ECM DTCs.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## P2264-WATER IN FUEL VOLTAGE ABOVE UPPER LIMIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Water In Fuel Sensor signal is above 4.99 volts for 0.2 second.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| WATER IN FUEL SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE |
| WATER IN FUEL SENSOR SIGNAL CIRCUIT OPEN |
| WATER IN FUEL SENSOR GROUND CIRCUIT OPEN |
| WATER IN FUEL SENSOR |
| FRONT CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. WATER IN FUEL SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the BCM C2 harness connector.

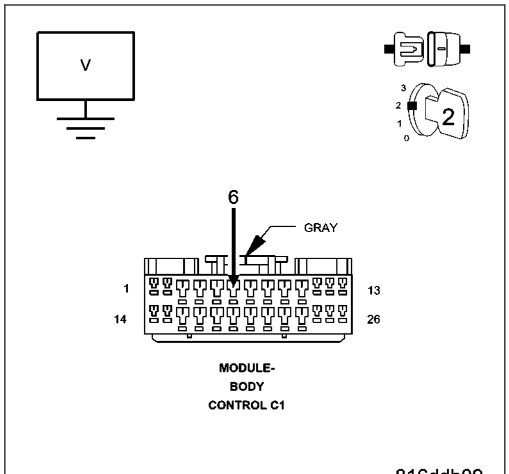
Disconnect the Water In Fuel Sensor harness connector.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage between ground and the Water In Fuel Sensor Signal circuit.



816ddb09

**Is the voltage below 0.5 volt?**

**Yes** >> Go To 3

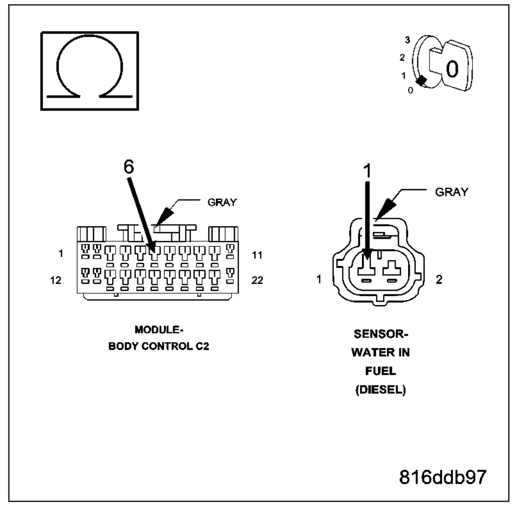
**No** >> Repair the Water In Fuel Sensor Signal circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. WATER IN FUEL SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the Water In Fuel Sensor Signal circuit between the Water In Fuel sensor harness connecto and the BCM C2 harness connector.




**Is the resistance below 10.0 ohms?**

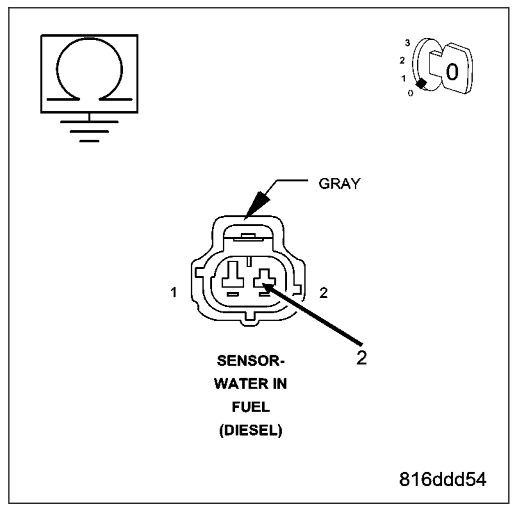
**Yes** >> Go To 4

**No** >> Repair the Water In Fuel Sensor Signal circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. WATER IN FUEL SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Measure the resistance between ground and the Water In Fuel Sensor Ground circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Water In Fuel Sensor Ground circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. WATER IN FUEL SENSOR

Turn the ignition off.

Disconnect the Water In Fuel Sensor harness connector.

Turn the ignition on.

With the scan tool, read and record the Water In Fuel Sensor voltage.

**NOTE: The Water In Fuel Sensor voltage should be 5.0 ± 0.3 volts with the sensor harness connector disconnected.**

Connect a jumper wire across the Water In Fuel Sensor harness connector.

With the scan tool, read the Water In Fuel Sensor voltage.

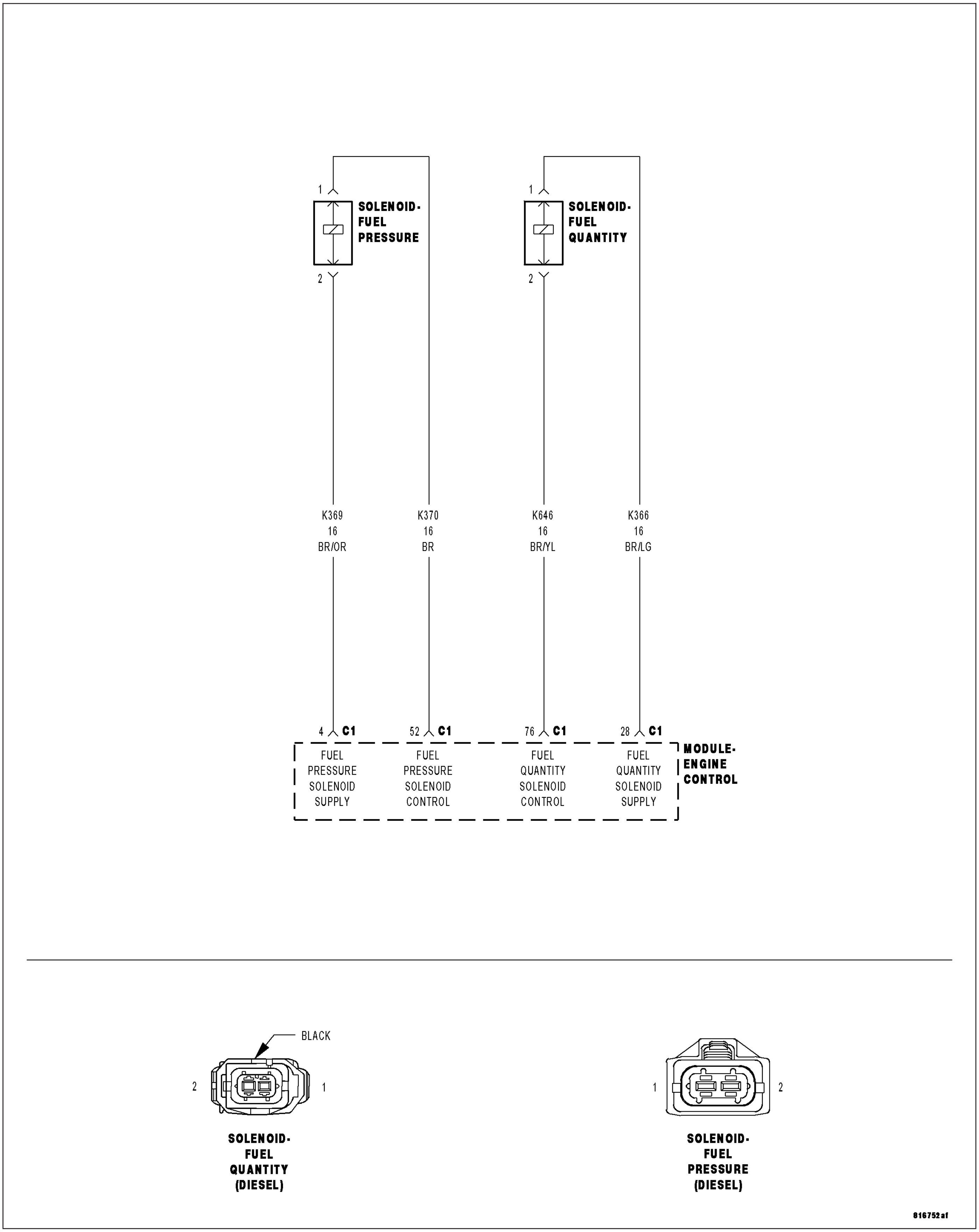
**NOTE: The Water In Fuel Sensor voltage should be less then 0.5 volt with the jumper wire connected.**

**Is the Water In Fuel voltage less than 0.5 volt?**

**Yes** >> Replace the Water In Fuel Sensor in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Front Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2294-FUEL PRESSURE SOLENOID OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Fuel Pressure Solenoid command off.
- **Set Condition:**
  The ECM does not detect voltage on the Fuel Pressure Solenoid Control circuit for 0.28 second.

| Possible Causes |
|---|
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL PRESSURE SOLENOID OPEN CIRCUIT(S) |
| INTERMITTENT CONDITION |
| FUEL PRESSURE SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, turning the ignition off for at least 30 seconds between each run cycle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**Are the ECM power and ground circuits functioning properly?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING THE ECM POWER AND GROUND CIRCUITS Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

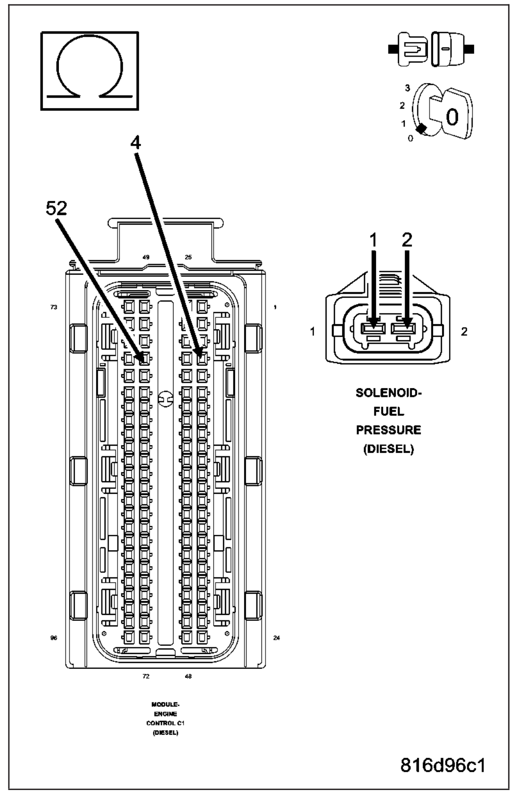
## 3. FUEL PRESSURE SOLENOID CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

Measure the resistance of each of the Fuel Pressure Solenoid circuits between the ECM harness connector and the Fuel Pressure Solenoid harness connector.




**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 4

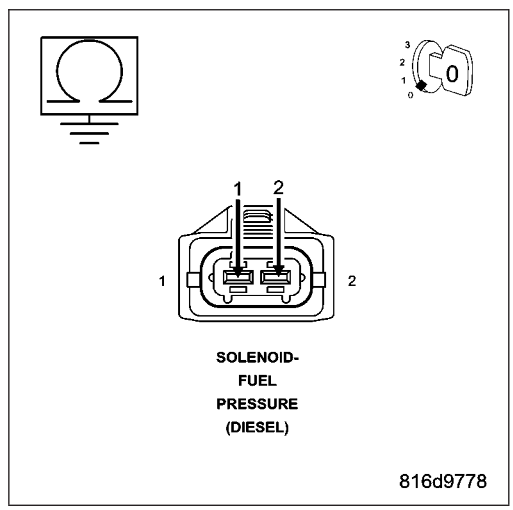
**No** >> Repair the circuit(s) that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and each of the Fuel Pressure Solenoid circuits.




**Is the resistance above 1000 ohms for each measurement?**

**Yes** >> Go To 5

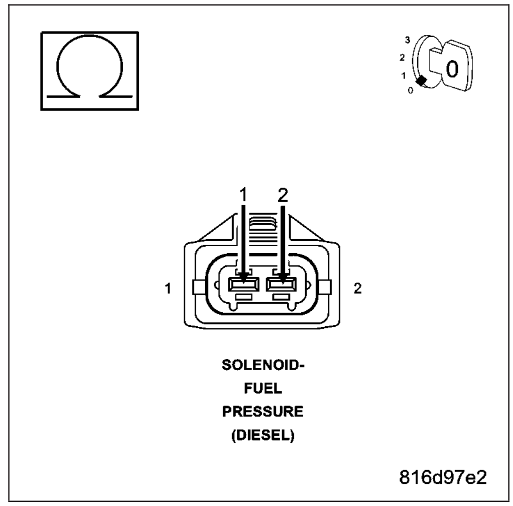
**No** >> Repair the circuit(s) that measured below 1000 ohms for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TOGETHER

Turn the ignition off.

Measure the resistance between the Fuel Pressure Solenoid circuits.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Fuel Pressure Solenoid circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE

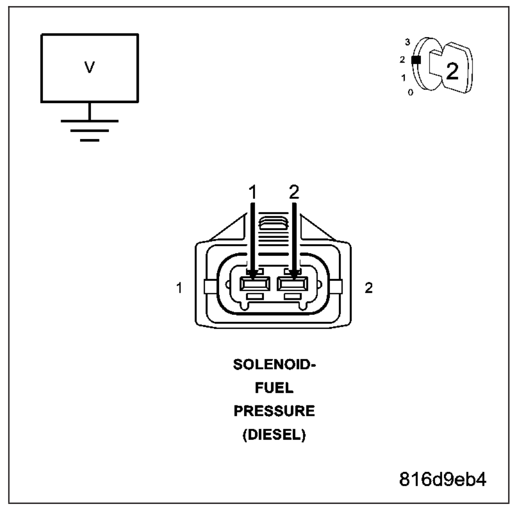
Turn the ignition off.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage each of the Fuel Pressure Solenoid circuits.




**Is the voltage below 1.0 volt for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the circuit(s) that measured above 1.0 volts for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. FUEL PRESSURE SOLENOID

Turn the ignition off.

Remove the jumper wire from the ASD relay connector.

Reinstall the ASD relay.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P2294-FUEL PRESSURE SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Pressure Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

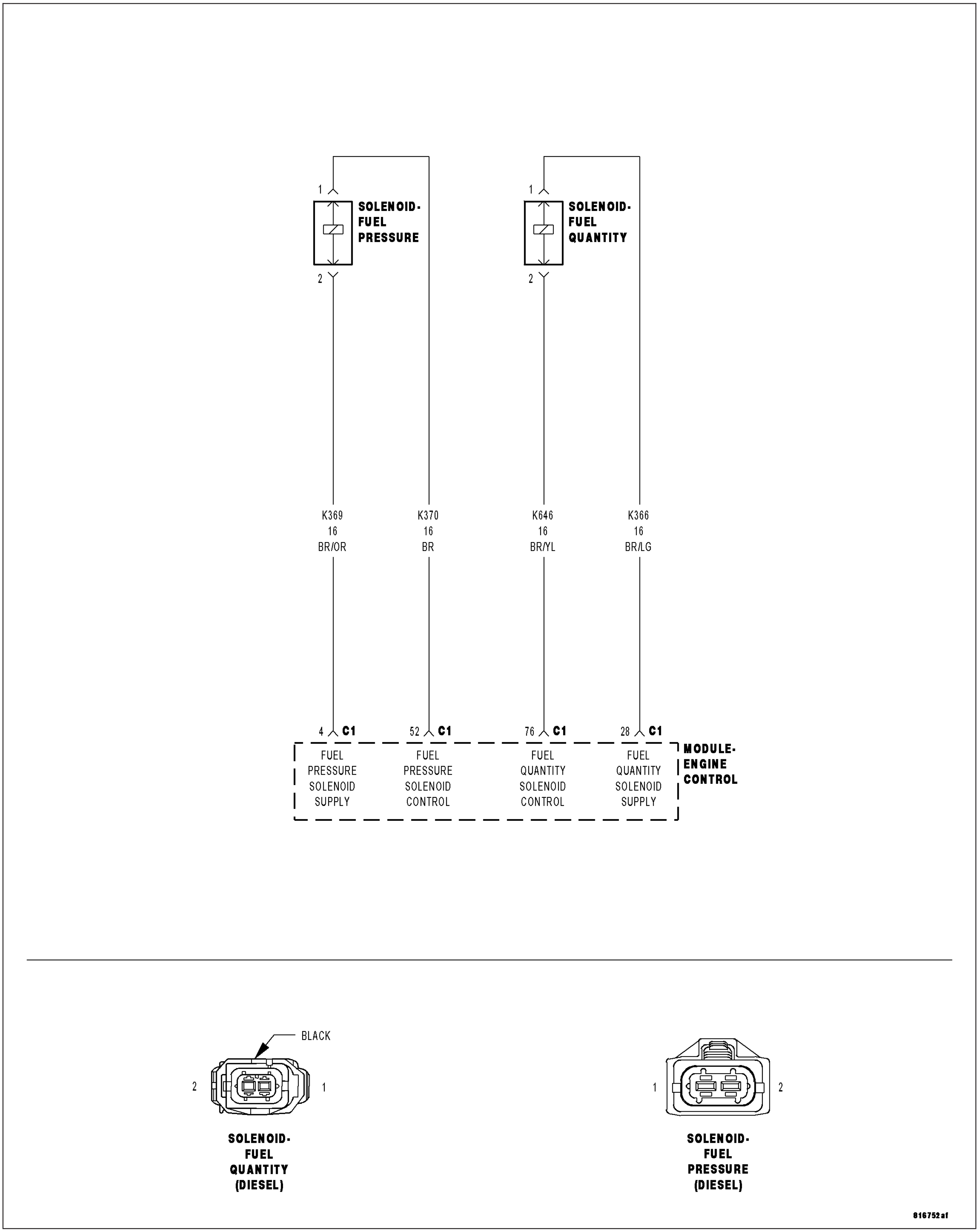
**NOTE: The scan tool should display P2296-FUEL PRESSURE SOLENOID SHORT CIRCUIT.**

**Does the scan tool display the appropriate DTC for each condition?**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2295-FUEL PRESSURE SOLENOID SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Fuel Pressure Solenoid command off.
- **Set Condition:**
  The ECM detects a short to ground on the Fuel Pressure Solenoid Control circuit for 0.22 second.

| Possible Causes |
|---|
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL PRESSURE SOLENOID OPEN CIRCUIT(S) |
| INTERMITTENT CONDITION |
| FUEL PRESSURE SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, turning the ignition off for at least 30 seconds between each run cycle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**Are the ECM power and ground circuits functioning properly?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING THE ECM POWER AND GROUND CIRCUITS Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

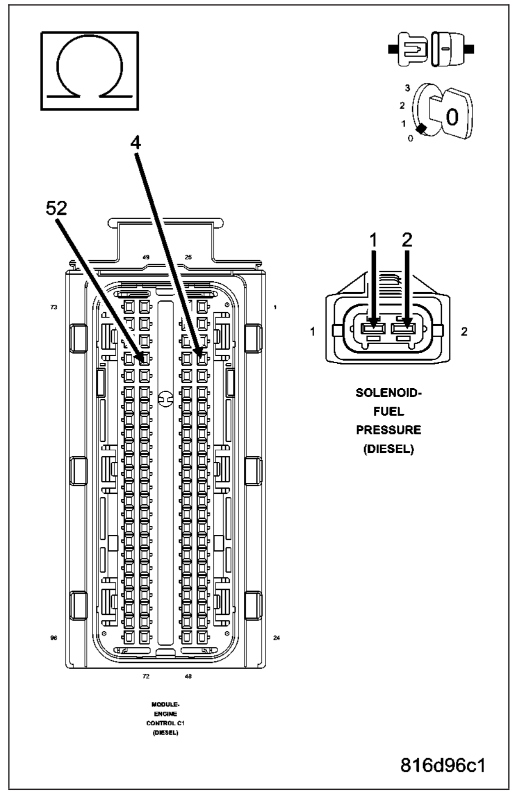
## 3. FUEL PRESSURE SOLENOID CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

Measure the resistance of each of the Fuel Pressure Solenoid circuits between the ECM harness connector and the Fuel Pressure Solenoid harness connector.




**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 4

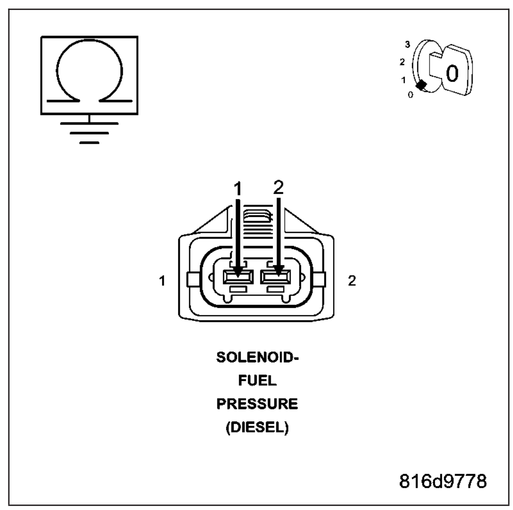
**No** >> Repair the circuit(s) that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and each of the Fuel Pressure Solenoid circuits.




**Is the resistance above 1000 ohms for each measurement?**

**Yes** >> Go To 5

**No** >> Repair the circuit(s) that measured below 1000 ohms for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TOGETHER

Turn the ignition off.

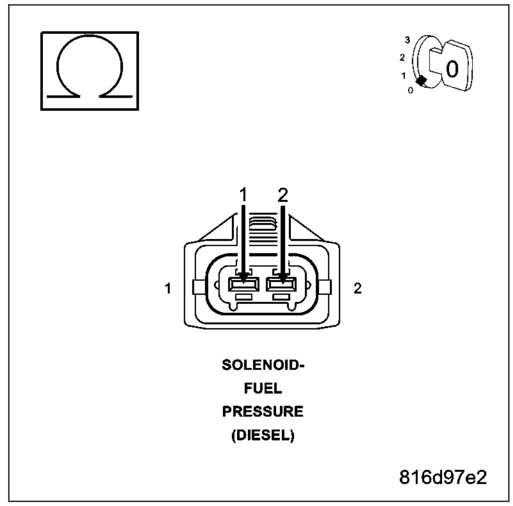
Measure the resistance between the Fuel Pressure Solenoid circuits.

**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Fuel Pressure Solenoid circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 6. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE

Turn the ignition off.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

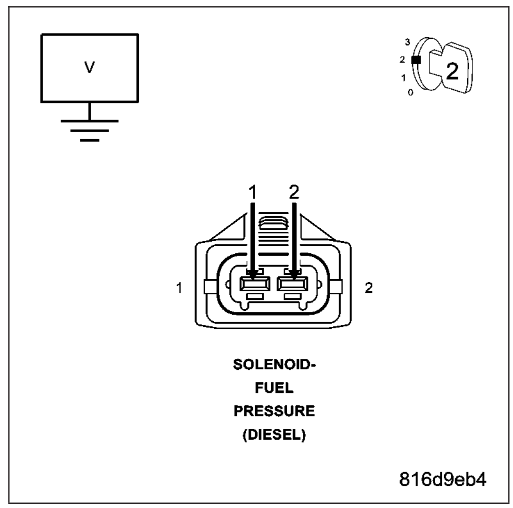
Measure the voltage each of the Fuel Pressure Solenoid circuits.

**Is the voltage below 1.0 volt for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the circuit(s) that measured above 1.0 volts for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 7. FUEL PRESSURE SOLENOID

Turn the ignition off.

Remove the jumper wire from the ASD relay connector.

Reinstall the ASD relay.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P2294-FUEL PRESSURE SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Pressure Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

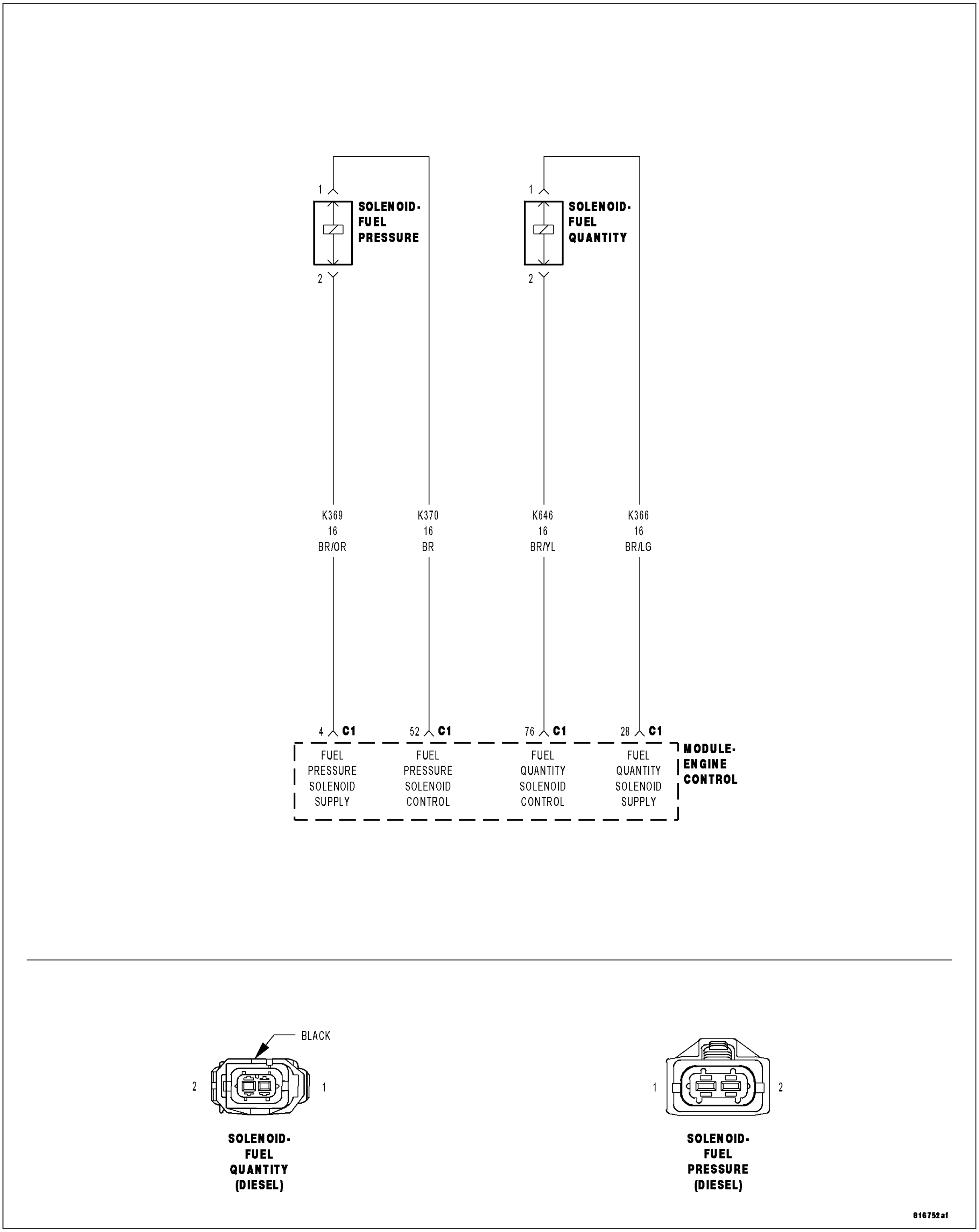
**NOTE: The scan tool should display P2296-FUEL PRESSURE SOLENOID SHORT CIRCUIT.**

**Does the scan tool display the appropriate DTC for each condition?**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2296-FUEL PRESSURE SOLENOID SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Fuel Pressure Solenoid command on.
- **Set Condition:**
  The ECM detects excessive current on the Fuel Pressure Solenoid Control circuit for 0.28 second.

| Possible Causes |
| --- |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO GROUND |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE |
| FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TOGETHER |
| FUEL PRESSURE SOLENOID OPEN CIRCUIT(S) |
| INTERMITTENT CONDITION |
| FUEL PRESSURE SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

**WARNING: HIGH-PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 23,200 PSI (1600 BAR). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS.**

**WARNING: FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, turning the ignition off for at least 30 seconds between each run cycle.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECKING FOR OTHER DTCS

**NOTE: An open ASD power supply to the ECM will cause multiple DTC's including this DTC to set.**

**NOTE: Check the ECM for other DTC's. If other DTC's are set with this DTC refer to the symptom list and perform the CHECKING THE ECM POWER AND GROUND CIRCUITS test before continuing.**

**Are the ECM power and ground circuits functioning properly?**

**Yes** >> Go To 3

**No** >> Refer to the *CHECKING THE ECM POWER AND GROUND CIRCUITS Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. FUEL PRESSURE SOLENOID CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

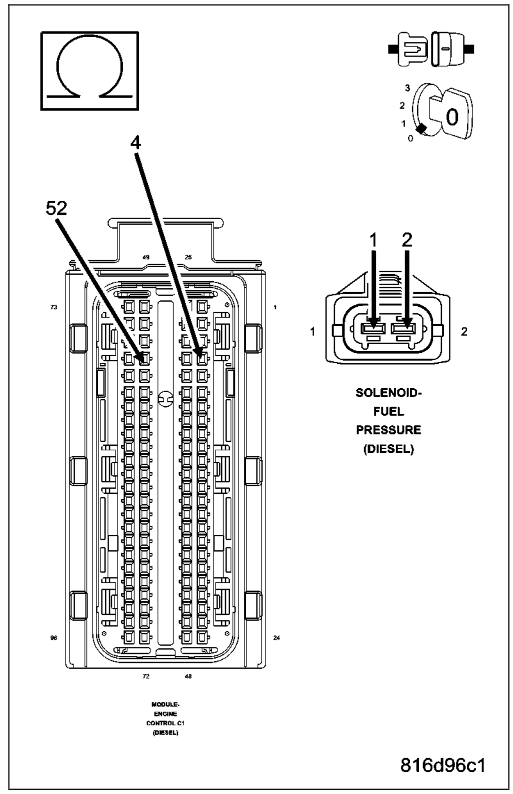
Measure the resistance of each of the Fuel Pressure Solenoid circuits between the ECM harness connector and the Fuel Pressure Solenoid harness connector.

**Is the resistance below 10.0 ohms for each measurement?**

**Yes** >> Go To 4

**No** >> Repair the circuit(s) that measured above 10.0 ohms for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).




## 4. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

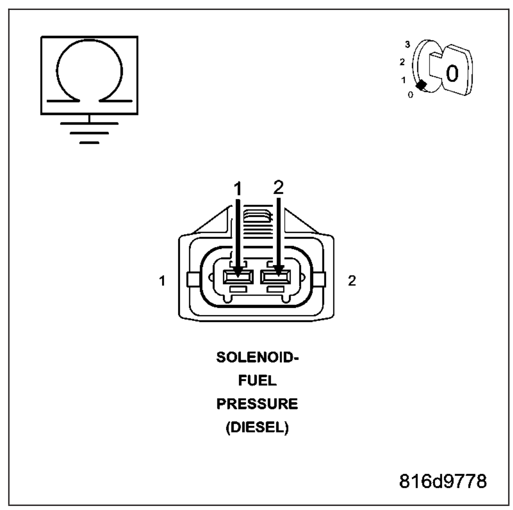
Measure the resistance between ground and each of the Fuel Pressure Solenoid circuits.

**Is the resistance above 1000 ohms for each measurement?**

**Yes** >> Go To 5

**No** >> Repair the circuit(s) that measured below 1000 ohms for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).



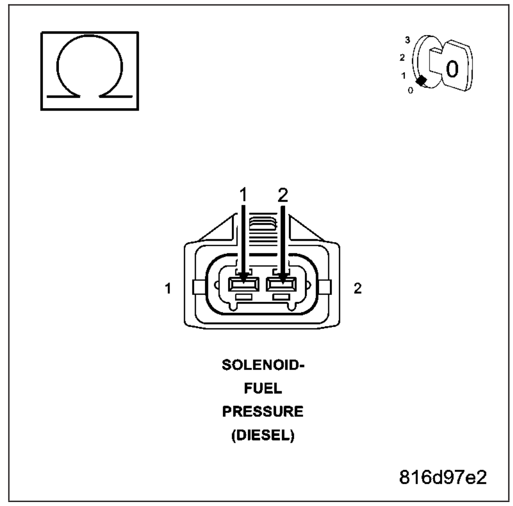
## 5. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TOGETHER

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure Solenoid harness connector.

Measure the resistance between the Fuel Pressure Solenoid circuits.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 6

**No** >> Repair the Fuel Pressure Solenoid circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 6. FUEL PRESSURE SOLENOID CIRCUIT(S) SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connectors.

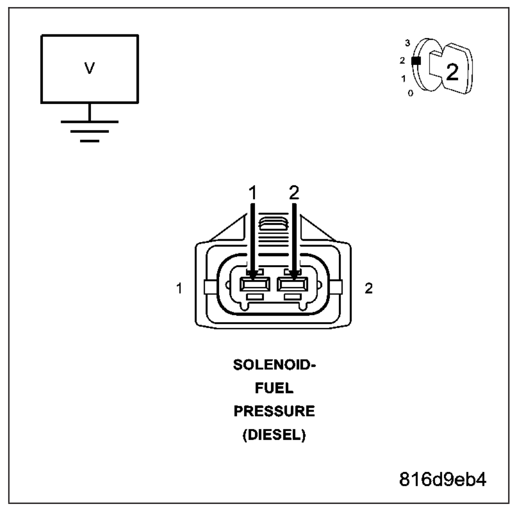
Disconnect the Fuel Pressure Solenoid harness connector.

Remove the ASD Relay.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage each of the Fuel Pressure Solenoid circuits.




**Is the voltage below 1.0 volt for each measurement?**

**Yes** >> Go To 7

**No** >> Repair the circuit(s) that measured above 1.0 volts for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 7. FUEL PRESSURE SOLENOID

Turn the ignition off.

Remove the jumper wire from the ASD relay connector.

Reinstall the ASD relay.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

**NOTE: The scan tool should display P2294-FUEL PRESSURE SOLENOID OPEN CIRCUIT.**

Turn the ignition off.

Connect a jumper wire between cavity 1 and cavity 2 of the Fuel Pressure Solenoid harness connector.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Monitor the scan tool for ECM DTCs.

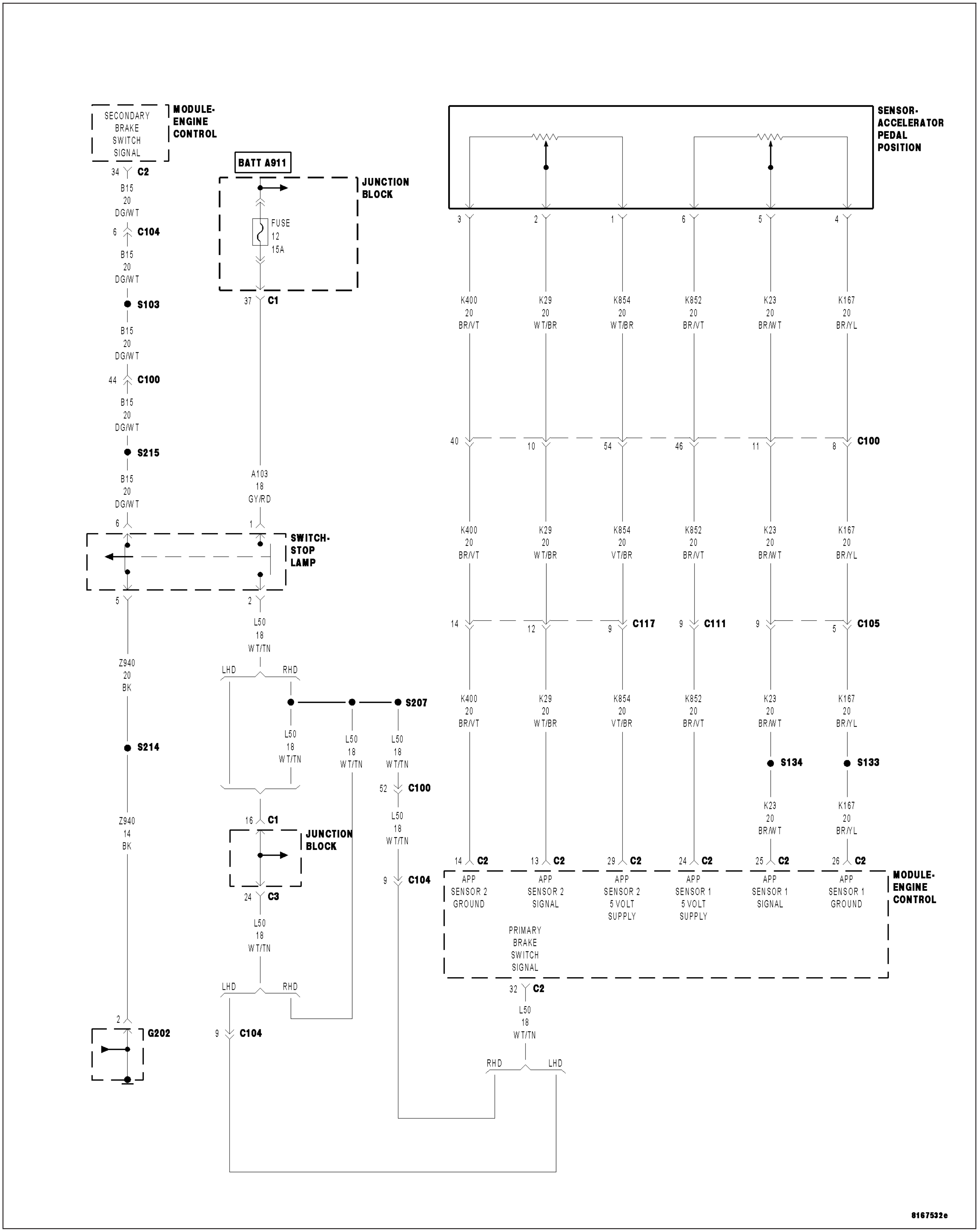
**NOTE: The scan tool should display P2296-FUEL PRESSURE SOLENOID SHORT CIRCUIT.**

**Does the scan tool display the appropriate DTC for each condition?**

**Yes** >> Replace the Fuel Pressure Solenoid in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

# P2299- BRAKE PEDAL POSITION/ACCELERATOR PEDAL POSITION INCOMPATIBLE



For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running (engine speed above 570 rpm). No other APP or Brake Signal DTC's. Vehicle speed above 3 km/h.
- **Set Condition:**
  The ECM detects a brake signal input (brakes applied) and Accelerator Pedal Position above 3% at the same time for 15.0 seconds.

| Possible Causes |
|---|
| ACCELERATOR PEDAL POSITION SENSOR |
| ACCELERATOR PEDAL OBSTRUCTION |
| BRAKE SWITCH ADJUSTMENT |
| BRAKE SWITCH |
| INTERMITTENT WIRING/CONNECTOR PROBLEM |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)**

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: This DTC may be set if the vehicle operator is "riding" the brake pedal (driving with both feet).**

With the scan tool, clear all ECM DTCs.

Test drive the vehicle performing several stop-and-go operations.

With the scan tool, view active ECM DTCs.

**Does the scan tool display this DTC?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. CHECK BRAKE SWITCH OPERATION

**NOTE: This DTC may be set if the Brake Switch is not properly adjusted. Check Brake Switch adjustment before continuing.**

Turn the ignition on.

With the scan tool, read the Primary and Secondary Brake Switch Input.

**Are the Primary and Secondary Brake Switch inputs operating properly?**

**Yes** >> Go To 3

**No** >> Refer to the Service Information Wiring to diagnose Brake Switch and/or Brake Switch wiring problem. Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 3. CHECK ACCELERATOR PEDAL MOVEMENT

Turn the ignition off.

Check the Accelerator Pedal for obstructions or other problem that could restrict pedal travel, cause binding or prohibit the pedal from traveling to the complete rest position.

**Were any of these problems found?**

**Yes** >> Repair or replace as necessary.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

**No** >> Go To 4

## 4. CHECK ACCELERATOR PEDAL POSITION SENSOR INPUT

Turn the ignition on.

**NOTE: The Accelerator Pedal must be at the complete rest position for this test. Ensure the pedal is at rest and free from any obstruction.**

With the scan tool, read the APP #1 and APP #2 percentages.

**Does the scan tool display below 2% for APP #1 and APP #2 percentages?**

**Yes** >> Go To 5

**No** >> Replace the Accelerator Pedal Position Sensor.
Perform the ECM Verification Test Ver. 1. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

## 5. INTERMITTENT APP SENSOR/BRAKE SWITCH

Turn the ignition on.

With the scan tool, read the APP #1 and APP #2 percentages

Fully depress and release the Accelerator Pedal several times.

With the scan tool, read the Primary and Secondary Brake Switch inputs.

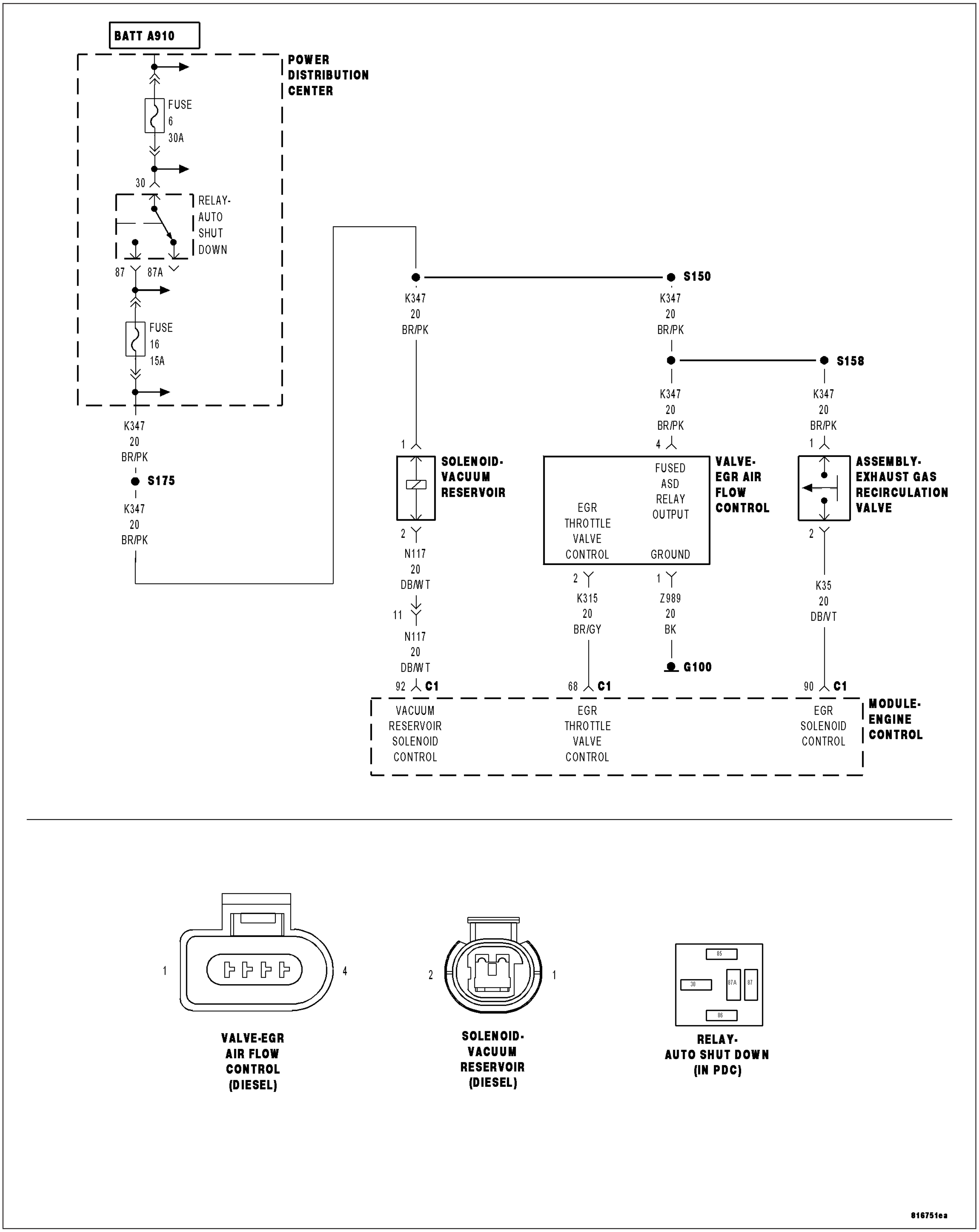
Fully depress and release the Brake Pedal several times.

**Were any problems found with the inputs during pedal actuation for the Brakes or Accelerator?**

**Yes** >> Repair or replace as necessary.

**No** >> Using the wiring diagrams check the connectors and wiring associated with the Accelerator Pedal Sensor and Brake Switch for damage, corrosion or other problems that could cause an intermittent DTC.

## P2525-VACUUM RESERVOIR SOLENOID OPEN CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Vacuum Reservoir Solenoid command off.
- **Set Condition:**
  The ECM does not detect voltage on the Vacuum Reservoir Solenoid Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| VR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| VR SOLENOID CONTROL CIRCUIT OPEN |
| VACUUM RESERVOIR SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, turning the ignition off for at least 10 seconds between engine run cycles.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

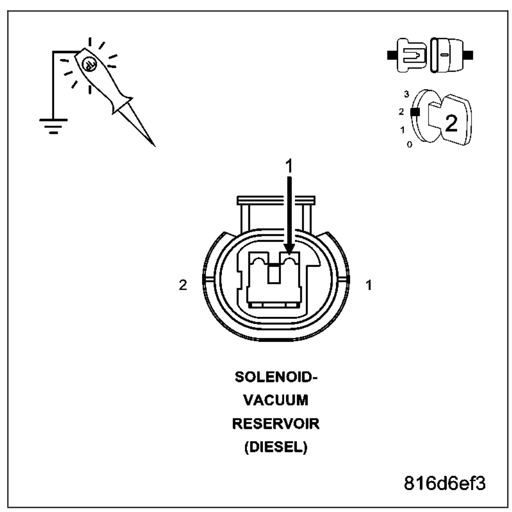
### 2. ASD OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit at the Vacuum Reservoir Solenoid harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the ASD Relay Output circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

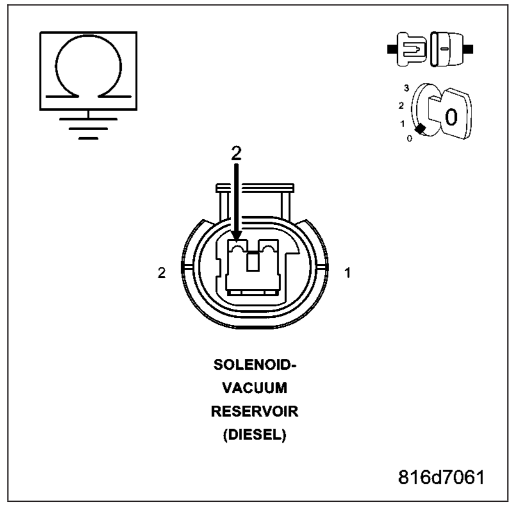
## 3. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Vacuum Reservoir Solenoid Control circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

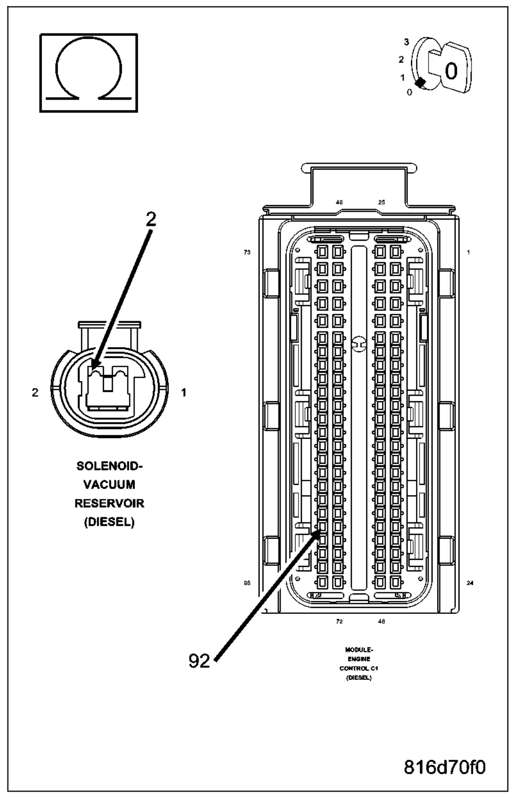
## 4. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Vacuum Reservoir Solenoid Control circuit.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Vacuum reservoir Solenoid Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. VACUUM RESERVOIR SOLENOID

Turn the ignition off.

Install a substitute Vacuum Reservoir Solenoid in place of the vehicle's Vacuum Reservoir Solenoid.

**NOTE: Ensure the ECM and Vacuum Reservoir Solenoid harness connectors are connected.**

Turn the ignition on.

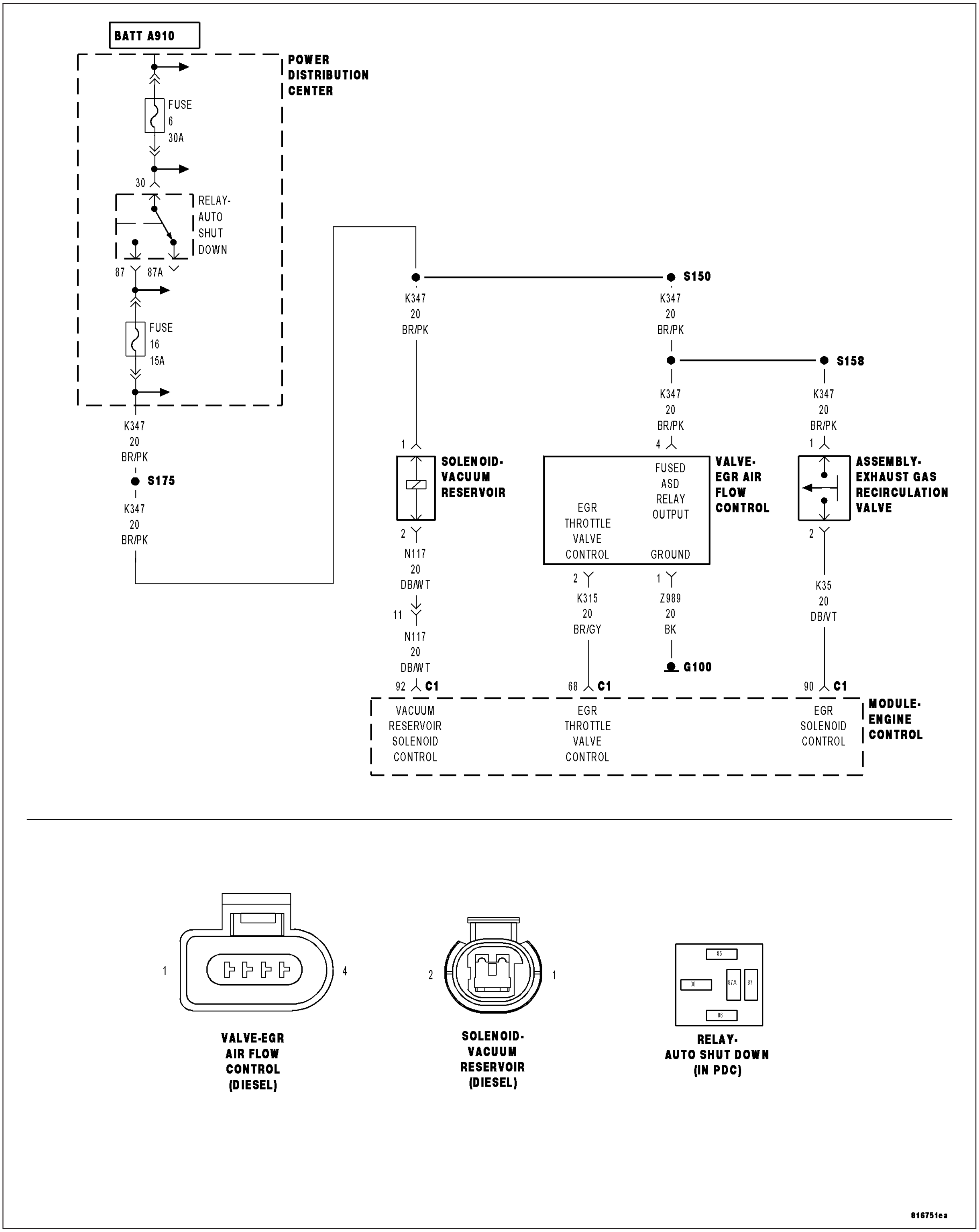
With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Vacuum Reservoir Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2527-VACUUM RESERVOIR SOLENOID SHORT TO GROUND




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Vacuum Reservoir Solenoid command off.
- **Set Condition:**
  The ECM detects a short to ground on the Vacuum Reservoir Solenoid Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| ASD RELAY OUTPUT CIRCUIT OPEN |
| VR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND |
| VR SOLENOID CONTROL CIRCUIT OPEN |
| VACUUM RESERVOIR SOLENOID |
| ENGINE CONTROL MODULE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, turning the ignition off for at least 10 seconds between engine run cycles.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

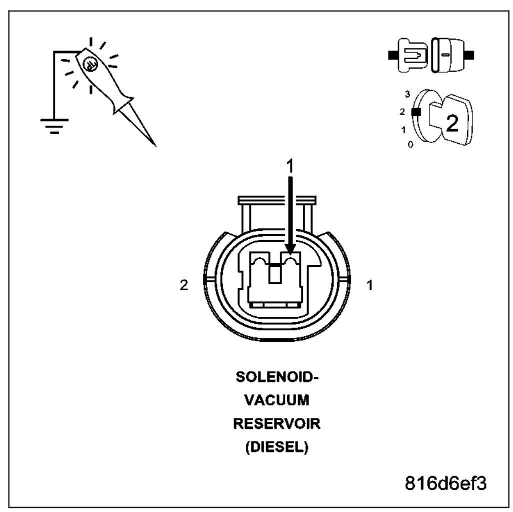
### 2. ASD OUTPUT CKT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the ASD Relay Output circuit at the Vacuum Reservoir Solenoid harness connector.




**Does the test light illuminate brightly?**

**Yes** >> Go To 3

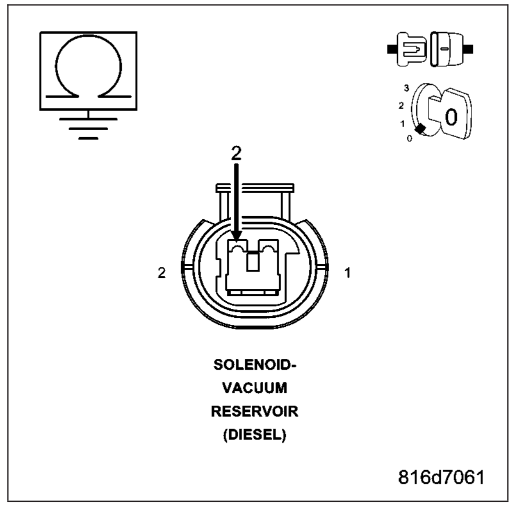
**No** >> Repair the ASD Relay Output circuit for an open.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connectors.

Measure the resistance between ground and the Vacuum Reservoir Solenoid Control circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Go To 4

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

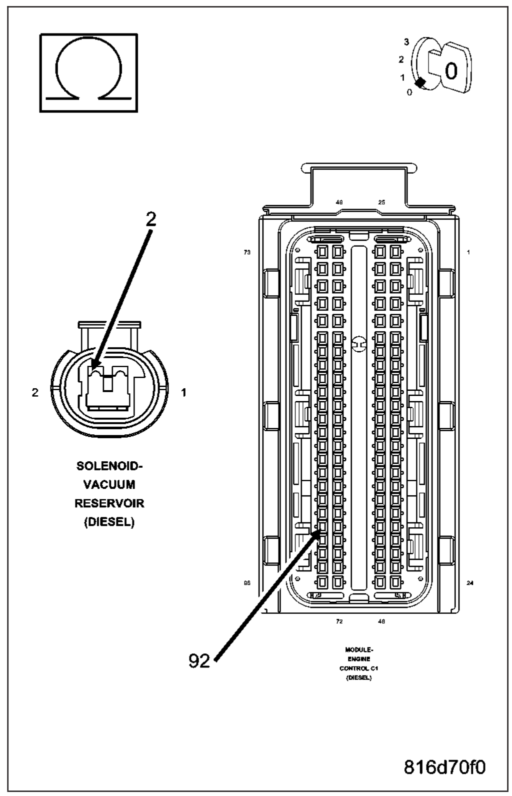
## 4. VACUUM RESERVOIR SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

Disconnect the ECM harness connectors.

Measure the resistance of the Vacuum Reservoir Solenoid Control circuit between the Vacuum Reservoir Solenoid connector and the ECM harness connector.




**Is the resistance below 10.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the Vacuum reservoir Solenoid Control circuit for an open.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 5. VACUUM RESERVOIR SOLENOID

Turn the ignition off.

Install a substitute Vacuum Reservoir Solenoid in place of the vehicle's Vacuum Reservoir Solenoid.

**NOTE: Ensure the ECM and Vacuum Reservoir Solenoid harness connectors are connected.**

Turn the ignition on.

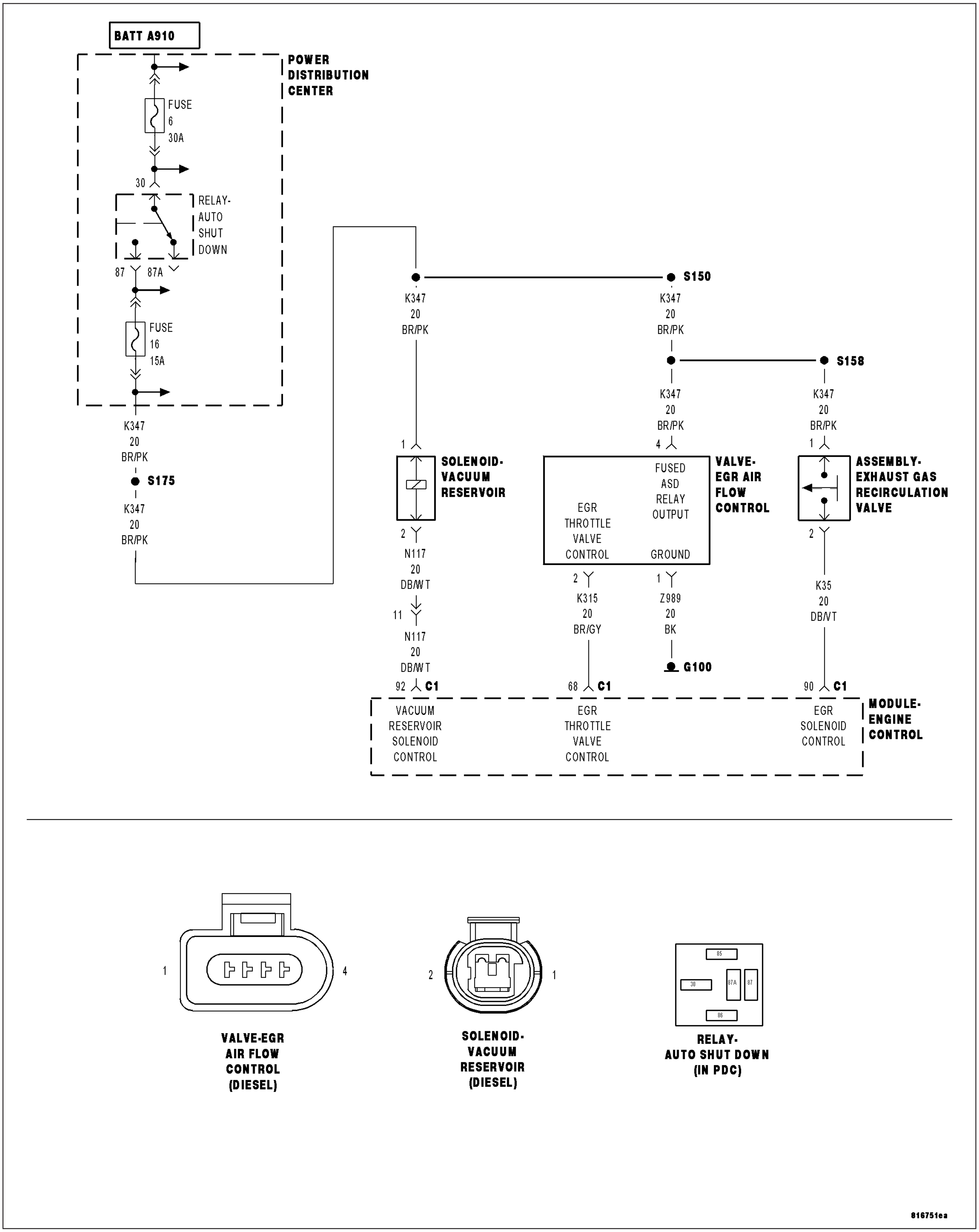
With the scan tool, check for this DTC to set again.

**Did this DTC set again?**

**Yes** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace the Vacuum Reservoir Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2528-VACUUM RESERVOIR SOLENOID SHORT CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on and the ECM Vacuum Reservoir Solenoid command on.
- **Set Condition:**
  The ECM detects excessive current on the Vacuum Reservoir Solenoid Control circuit.

| Possible Causes |
|---|
| INTERMITTENT CONDITION |
| VACUUM RESERVOIR SOLENOID |
| VR SOLENOID CONTROL SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE - INTERNAL SHORT TO VOLTAGE |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Start the engine several times, turning the ignition off for at least 10 seconds between engine run cycles.

Monitor the scan tool for ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. VR SOLENOID CONTROL SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Vacuum Reservoir Solenoid harness connector.

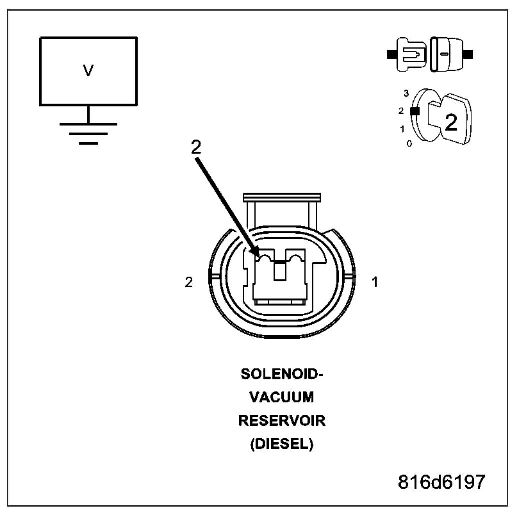
Disconnect the ECM harness connectors.

Remove the ASD Relay from the PDC.

Connect a jumper wire between cavity 30 and cavity 87 of the ASD Relay connector.

Turn the ignition on.

Measure the voltage of the Vacuum Reservoir Solenoid Control circuit.




**Is the voltage below 1.0 volt?**

**Yes** >> Go To 3

**No** >> Repair the Vacuum Reservoir Solenoid Control circuit for a short to voltage.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 3. VR SOLENOID

Turn the ignition off.

Turn the ignition on.

With the scan tool, erase ECM DTCs.

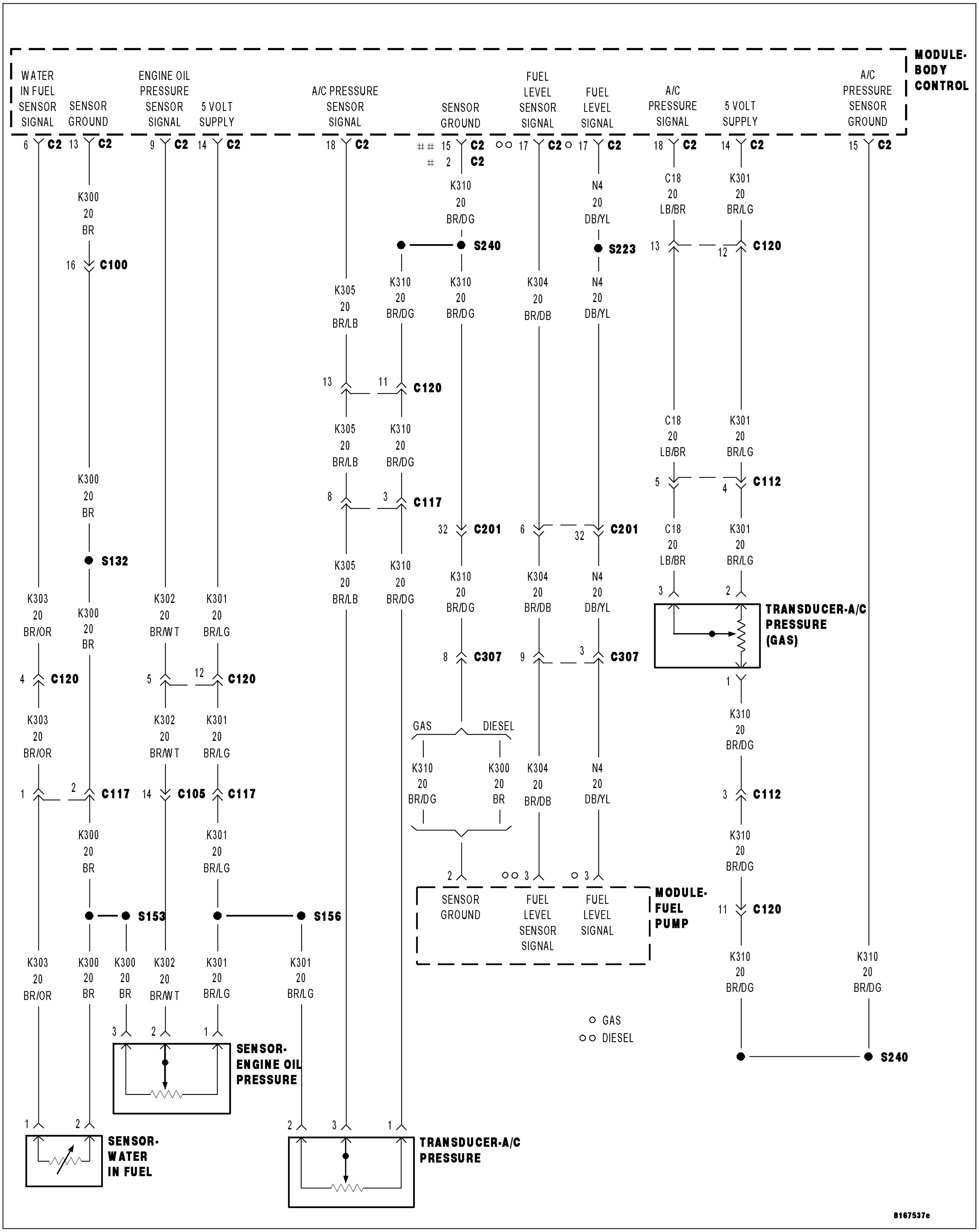
Monitor the scan tool for ECM DTCs.

**Does the scan tool display P1250 VACUUM RESERVOIR SOLENOID OPEN CIRCUIT?**

**Yes** >> Replace the Vacuum Reservoir Solenoid.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Replace and program the Engine Control Module in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## P2264-WATER IN FUEL VOLTAGE BELOW LOWER LIMIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The Water In Fuel Sensor signal is below 0.51 volts for 0.2 second.

| Possible Causes |
|---|
| WATER IN FUEL SENSOR |
| WATER IN FUEL SENSOR SIGNAL CIRCUIT SHORTED TO CHASSIS GROUND |
| WATER IN FUEL SENSOR SIGNAL CIRCUIT SHORTED TO WATER IN FUEL SENSOR GROUND |

## Diagnostic Test

### 1. CHECK FOR ACTIVE DTC

**NOTE: If the ECM detects and stores a DTC, the ECM also stores the engine/vehicle operating conditions under which the DTC was set. Some of these conditions are displayed on the scan tool at the same time the DTC is displayed.**

**NOTE: Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.**

Turn the ignition on.

With the scan tool, erase ECM DTCs.

Turn the ignition off, wait 10 seconds, then turn the ignition on.

With the scan tool, read ECM DTCs.

**Did this DTC set again?**

**Yes** >> Go To 2

**No** >> Refer to the *CHECKING FOR AN INTERMITTENT DTC Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

### 2. WATER IN FUEL SENSOR

Turn the ignition off.

Disconnect the Water In Fuel Sensor harness connector.

Turn the ignition on.

With the scan tool, read the Water In Fuel Sensor voltage.

**Is the voltage above 4.8 volts?**

**Yes** >> Replace the Water In Fuel Sensor in accordance with the Service Information.
Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Go To 3

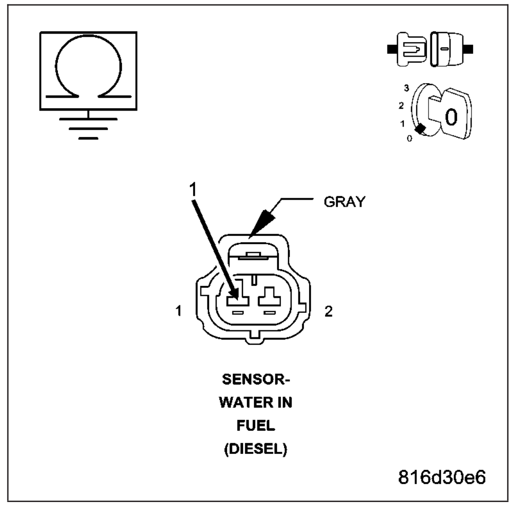
## 3. WATER IN FUEL SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the BCM harness connectors.

Disconnect the Water In Fuel Sensor harness connector.

Measure the resistance between ground and the Water In Fuel Sensor Signal circuit.




**Is the resistance above 1000 ohms?**

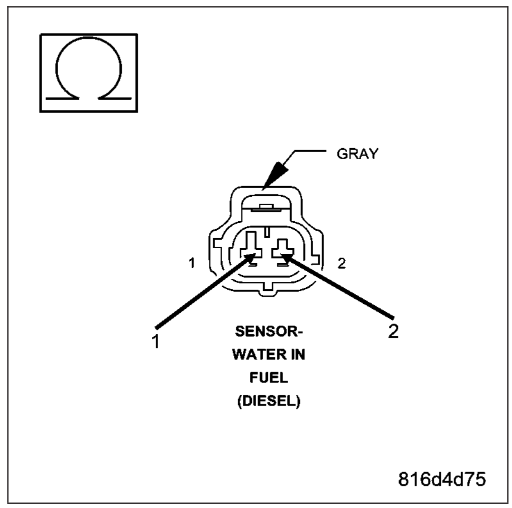
**Yes** >> Go To 4

**No** >> Repair the Water In Fuel Sensor Signal circuit for a short to ground.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## 4. WATER IN FUEL SENSOR SIGNAL AND GROUND CIRCUITS SHORTED TOGETHER

Measure the resistance between the Water In Fuel Sensor Signal circuit and Sensor Ground circuit.




**Is the resistance above 1000 ohms?**

**Yes** >> Replace and program the Front Control Module in accordance with the Service Information.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

**No** >> Repair the Water In Fuel Sensor Signal and Ground circuits for a short together.

Perform the ECM Verification Test Ver. 1 (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

## *INTERMITTENT DTC

For a complete wiring diagram **Refer to Section 8W**

## Diagnostic Test

### 1. INTERMITTENT DTC

**WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.**

The conditions necessary to set this DTC are not present at this time.

Review the scan tool environmental data. If possible, try to duplicate the conditions under which the DTC set.

If applicable, actuate the component with the scan tool.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change, the actuation to be interrupted, or for the DTC to reset during the wiggle test.

Refer to any Technical Service Bulletins (TSBs) that may apply.

Turn the ignition off.

Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

Perform a voltage drop test on the related circuits between the suspected component and the ECM.

Inspect and clean all ECM, engine, and chassis grounds that are related to the most current DTC.

If numerous trouble codes were set, use a schematic and inspect any common ground or supply circuits.

For intermittent Misfire DTCs check for restrictions in the Intake and Exhaust system, proper installation of Sensors, vacuum leaks, and binding components that are run by the accessory drive belt.

Use the scan tool to perform a System Test if one applies to the component.

A co-pilot, data recorder, and/or lab scope should be used to help diagnose intermittent conditions.

**Were any problems found during the above inspections?**

**Yes** >> Perform the necessary repairs.
Perform the ECM Verification Test Ver. 1.

**No** >> Test Complete.

# PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

For a complete wiring diagram **Refer to Section 8W**.

## Diagnostic Test

### 1. NO RESPONSE

**NOTE: For vehicle communication problems, use the scan tool to refer to the Network Review Screen. The screen depicts a high level view of the vehicle network. Fault and problem areas appear in red.**

**Does the scan tool display a Vehicle Network problem or NO RESPONSE condition?**

**Yes** >> Refer to the appropriate BUS Communication test in Section 8 ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS.

**No** >> Go To 2

### 2. NO START

**Does the vehicle have a NO START condition?**

**Yes** >> Check the vehicle for any DTC(s), including Vehicle Theft Security related DTC(s), that may cause a no-start condition.

If no DTC(s) are present that relate to a no-start condition, refer to the Non DTC Diagnostic Procedures that relate to Fuel and Starting.

**No** >> Go To 3

### 3. VEHICLE REPAIR HISTORY AND TSB(s)

Check the vehicle repair history for repairs that may relate to the current condition.

Inspect the vehicle for aftermarket accessories that may have been installed incorrectly.

Check for any TSB(s) related to the condition or DTC(s).

If a TSB applies, follow the procedure outlined in the TSB.

**Select the appropriate response for the condition that applies:**

**Performing a TSB procedure repaired the condition.**
Test Complete.

Perform the ECM Verification Test Ver. 1.

**A DTC is present, no TSB applies, or the TSB didn’t repair the condition.**
Go To 4

**No DTC(s) or conditions are present.**
Refer to the INTERMITTENT CONDITION Diagnostic Procedure.

### 4. VEHICLE INSPECTION

**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.**

Based on the diagnostic condition that applies, review the following list and perform any tests that relate to the condition:

If multiple DTCs are set in the ECM, review the wiring schematics for problems in any shared supply or ground circuits. Refer to the diagnostic procedure for Checking the ECM Power and Ground Circuits.

Inspect the air intake system and turbocharger related tubes for damage, restriction, or poor connection.

Inspect the exhaust system and related tubes for damage, restriction, or poor connection.

Remove and inspect the Air Filter for soiling or excessive dirt and debris which may cause an air flow restriction.

If the ECM detects and stores a DTC, the ECM also stores the environmental conditions under which the DTC was set.

Before erasing stored DTCs, record these conditions. Attempting to duplicate these conditions may assist when checking for an active DTC.

With the scan tool, Clear the stored DTC(s).

Attempt to duplicate the environmental conditions under which the DTC was set.

Review the DTC When Monitored and Set Conditions. If possible, try to duplicate the vehicle conditions under which the DTC conditions will be monitored. Operate the vehicle under those conditions.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the component and the module.

If the DTC(s) are fuel or air related, check the fuel level and quality.

**Were any repairs made that corrected the DTC or condition?**

**Yes** >> Test complete.
Perform the ECM Verification Test Ver. 1.

**No** >> Refer to the diagnostic test procedure related to the DTC.

## STANDARD PROCEDURE

# ECM VERIFICATION TEST

For a complete wiring diagram **Refer to Section 8W**.

## Diagnostic Test

### 1. SELECT THE PROPER VERIFICATION TEST

**Select the verification test for the repair that has been completed:**

**Speed Control repair**
Go To 2

**Charging System repair**
Go To 3

**No Start repair**
Go To 4

**DTC and all other repairs**
Go To 5

### 2. SPEED CONTROL VERIFICATION TEST

1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.

2. With the scan tool, erase all diagnostic trouble codes (DTCs).

3. Road test the vehicle at a speed above 60 km/h (35 MPH).

4. Turn the speed control ON/OFF switch on.

5. Depress and release the SET switch. If the speed control does not engage, the repair is not complete, continue with step 12.

6. Quickly depress and release the RESUME/ACCEL switch. If the vehicle speed does not increase by 3 km/h (2 MPH), the repair is not complete, continue with step 12.

7. Using caution, depress and release the brake pedal. If the speed control does not disengage, the repair is not complete, continue with step 12.

8. With the vehicle speed at least 60 km/h (35 MPH), depress the RESUME/ACCEL switch. If the speed control does not resume at the previously set speed, the repair is not complete, continue with step 12.

9. Hold down the COAST switch. If the vehicle does not decelerate, the repair is not complete, continue with step 12.

10. While still holding down the COAST switch, ensure the vehicle speed is at least 60 km/h (35 MPH) and release the COAST switch. If the vehicle does not adjust and set a new vehicle speed, the repair is not complete, continue with step 12.

11. With the speed control engaged, depress the ON/OFF switch. If the speed control does not disengage, the repair is not complete, continue with step 12.

12. If the vehicle did not successfully perform all of the previous steps, check for Technical Service Bulletins (TSBs) that pertain to this speed control problem and then, if necessary, return to the Symptom List.

13. If the vehicle successfully performed all of the previous steps, the speed control system is now functioning as designed. The repair is now complete.

**Are any DTCs or symptoms remaining?**

**Yes** >> Repair is not complete, refer to the appropriate diagnostic procedure.

**No** >> Repair is complete.

## 3. CHARGING SYSTEM VERIFICATION TEST

1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. With the scan tool, erase all diagnostic trouble codes (DTCs).
3. Start the engine.
4. Raise the engine speed to 2000 RPM for at least 30 seconds.
5. Allow the engine to idle.
6. Turn the ignition off for 20 seconds.
7. Turn the ignition on.
8. With the scan tool, read ECM DTCs.
9. If this DTC has set again, or another DTC has set, look for any Technical Service Bulletins (TSBs) that may relate to this condition. Return to the Symptom List if necessary.
10. If the charging system is functioning correctly and there are no DTCs, the repair is now complete.

**Are any DTCs or symptoms remaining?**

**Yes** >> Repair is not complete, refer to the appropriate diagnostic procedure.

**No** >> Repair is complete.

## 4. NO START VERIFICATION TEST

**NOTE: IMPORTANT! If the Engine Control Module or Sentry Key Immobilizer Module has been replaced, ensure the programming procedure for the module has been performed in accordance with the Service Information.**

2. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
3. Inspect the engine oil for contamination. If it is contaminated, change the oil and filter.
4. With the scan tool, erase all diagnostic trouble codes (DTCs).
5. Turn the ignition off for at least 10 seconds.
6. Attempt to start the engine.
7. If the engine is unable to start, look for any Technical Service Bulletins (TSBs) that may relate to this condition. Return to the Symptom List if necessary.
8. If the engine starts and continues to run, the repair is now complete.

**Are any DTCs or symptoms remaining?**

**Yes** >> Repair is not complete, refer to the appropriate diagnostic procedure.

**No** >> Repair is complete.

## 5. ROAD TEST VERIFICATION TEST

1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. If this verification procedure is being performed after a non-DTC test, perform steps 3 and 4. If not, proceed to step 5.
3. Check to see if the initial symptom still exists. If there are no trouble codes and the symptom no longer exists, the repair was successful and testing is now complete.
4. If the initial or another symptom exists, the repair is not complete. Check all pertinent Technical Service Bulletins (TSBs) and return to the Symptom List if necessary.
5. For previously read DTCs that have not been dealt with, return to the Symptom List and follow the diagnostic path for that DTC; otherwise, continue.
6. If the Engine Control Module (ECM) has been replaced, continue with step 9.
7. With the scan tool, erase all diagnostic trouble codes (DTCs), then disconnect the scan tool.
8. Turn the ignition off for at least 10 seconds.
9. If equipped with a Transfer Case Position Switch, perform step 10, otherwise, continue with step 11.
10. With the ignition switch on, place the Transfer Case Shift Lever in each gear position, stopping for 15 seconds in each position.
11. Road test the vehicle. For some of the road test, go at least 64 km/h (40 MPH). If this test is for an A/C Relay Control Circuit, drive the vehicle for at least 5 minutes with the A/C on.
12. At some point, stop the vehicle and turn the engine off for at least 10 seconds, then restart the engine and continue.
13. Upon completion of the road test, turn the engine off and check for DTCs with the scan tool.
14. If the repaired DTC has set again, the repair is not complete. Check for any pertinent Technical Service Bulletins (TSBs) and return to the Symptom List. If there are no DTCs, the repair was successful and is now complete.

**Are any DTCs or symptoms remaining?**

**Yes** >> Repair is not complete, refer to the appropriate diagnostic procedure.

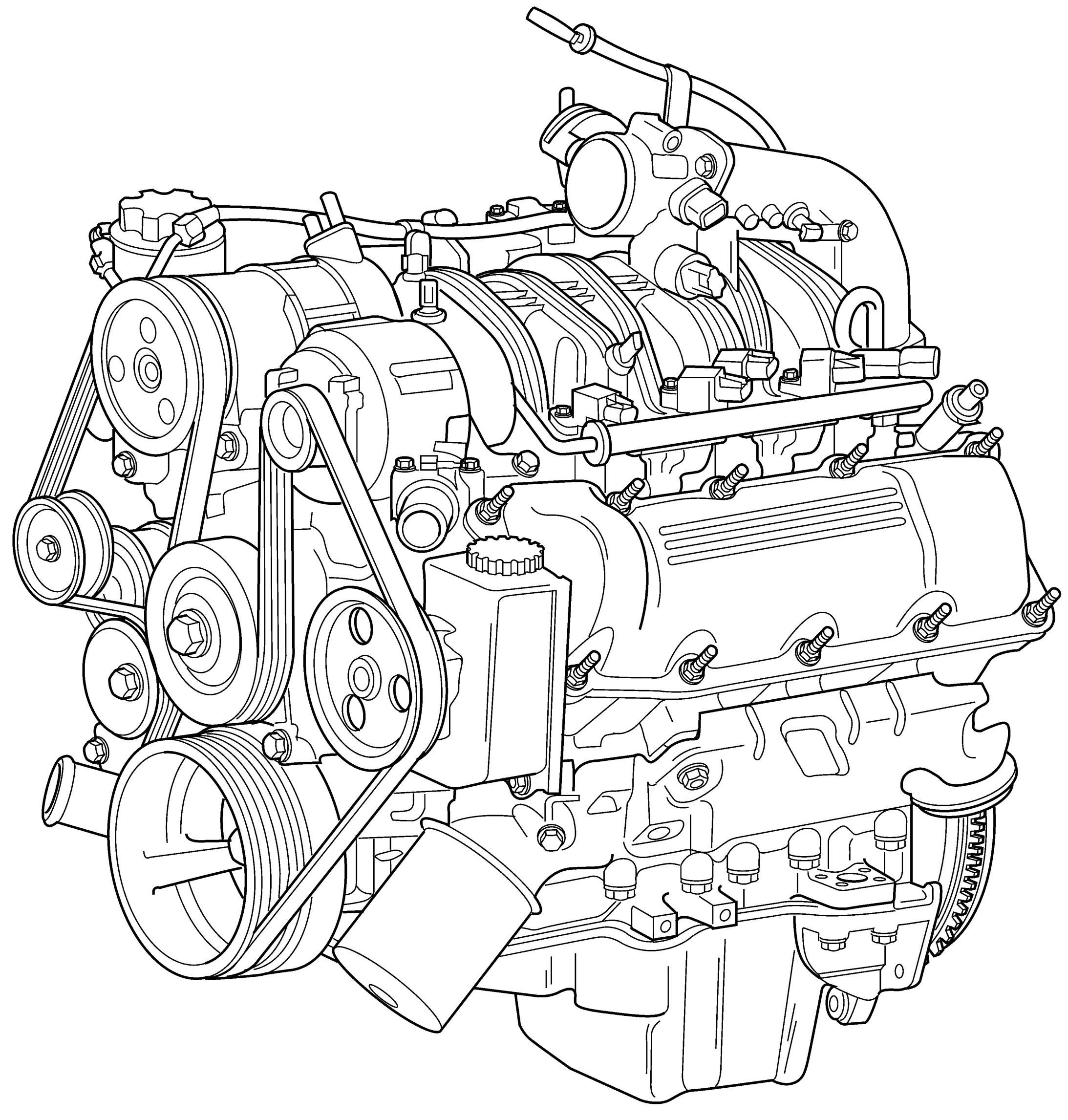
**No** >> Repair is complete.

# ENGINE - 3.7L

## TABLE OF CONTENTS

# ENGINE - 3.7L

## DESCRIPTION



80ccc15e

The 3.7 liter (226 CID) six-cylinder engine is an 90° single overhead camshaft engine. The cast iron cylinder block is made up of two different components; the first component is the cylinder bore and upper block, the second component is the bedplate that comprises the lower portion of the cylinder block and houses the lower half of the crankshaft main bearings. The cylinders are numbered from front to rear with the left bank being numbered 1,3, and 5 and the right bank being numbered 2,4, and 6. The firing order is 1–6–5–4–3–2. The engine serial number is located at the right front side of the engine block.

## DIAGNOSIS AND TESTING

## DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)—PERFORMANCE and (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)—MECHANICAL for possible causes and corrections of malfunctions. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DIAGNOSIS AND TESTING) and (Refer to 14 - FUEL SYSTEM/FUEL INJECTION - DIAGNOSIS AND TESTING) for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Cylinder Combustion Pressure Leakage Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Engine Cylinder Head Gasket Failure Diagnosis (Refer to 9 - ENGINE/CYLINDER HEAD - DIAGNOSIS AND TESTING).
- Intake Manifold Leakage Diagnosis (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - DIAGNOSIS AND TESTING).

## DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE

| CONDITION | POSSIBLE CAUSE | CORRECTION |
|---|---|---|
| ENGINE WILL NOT START | 1. Weak battery | 1. Charge or replace as necessary. |
| | 2. Corroded or loose battery connections. | 2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals. |
| | 3. Faulty starter. | 3. (Refer to 8 - ELECTRICAL/STARTING - DIAGNOSIS AND TESTING). |
| | 4. Faulty coil or control unit. | 4. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - REMOVAL). |
| | 5. Incorrect spark plug gap. | 5. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - CLEANING). |
| | 6. Incorrect right bank cam timing. | 6. Refer to engine timing in this section. |
| | 7. Dirt or water in fuel system. | 7. Clean system and replace fuel filter. |
| | 8. Faulty fuel pump, relay or wiring. | 8. Repair or replace as necessary. |
| | 9. Faulty cam or crank sensor | 9. Refer to Ignition system. |
| ENGINE STALLS OR ROUGH IDLE | 1. Vacuum leak. | 1. Inspect intake manifold and vacuum hoses, repair or replace as necessary. |
| | 2. Faulty crank position sensor | 2. Replace crank position sensor. |
| 3. Faulty coil. | 3. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - REMOVAL). | |
| 4. Incorrect cam timing. | 4. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE). | |

| CONDITION | POSSIBLE CAUSE | CORRECTION |
|---|---|---|
| ENGINE LOSS OF POWER | 1. Dirty or incorrectly gapped spark plugs. | 1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING). |
| | 2. Dirt or water in fuel system. | 2. Clean system and replace fuel filter. |
| | 3. Faulty fuel pump. | 3. (Refer to 14 - FUEL SYSTEM/ FUEL DELIVERY/FUEL PUMP - DIAGNOSIS AND TESTING). |
| | 4. Blown cylinder head gasket. | 4. Replace cylinder head gasket. |
| | 5. Low compression. | 5. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), repair as necessary. |
| | 6. Burned, warped or pitted valves. | 6. Replace as necessary. |
| | 7. Plugged or restricted exhaust system. | 7. Inspect and replace as necessary. |
| | 8. Faulty coil. | 8. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL). |
| | 9. Incorrect cam timing. | 9. Refer to Engine Timing in this section. |
| ENGINE MISSES ON ACCELERATION | 1. Spark plugs dirty or incorrectly gapped. | 1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING). |
| | 2. Dirt in fuel system. | 2. Clean fuel system. |
| | 3. Burned, warped or pitted valves. | 3. Replace as necessary. |
| | 4. Faulty coil. | 4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL). |
| ENGINE MISSES AT HIGH SPEED | 1. Spark plugs dirty or incorrectly gapped. | 1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING). |
| | 2. Faulty coil. | 2. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL). |
| | 3. Dirt or water in fuel system. | 3. Clean system and replace fuel filter. |

## DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL

| CONDITION | POSSIBLE CAUSES | CORRECTIONS |
|---|---|---|
| NOISY VALVES | 1. High or low oil level in crankcase. | 1. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS). |
| | 2. Thin or diluted oil. | 2. Change oil and filter. |
| | 3. Low oil pressure. | 3. Check oil pump, if Ok, check rod and main bearings for excessive wear. |
| | 4. Dirt in lash adjusters. | 4. Clean or replace as necessary. |
| | 5. Worn rocker arms. | 5. Replace as necessary. |
| | 6. Worn valve guides. | 6. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE). |
| | 7. Excessive runout of valve seats. | 7. Service valves and valve seats (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE) |
| ENGINE VIBRATION | 1. Counter Balance Shaft not timed properly | 1. Refer to Engine Timing in this section |
| CONNECTING ROD NOISE | 1. Insufficient oil supply. | 1. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS). |
| | 2. Low oil pressure. | 2. Check oil pump, if Ok, check rod and main bearings for excessive wear. |
| | 3. Thin or diluted oil. | 3. Change oil and filter. |
| | 4. Excessive bearing clearance. | 4. Replace as necessary. |
| | 5. Connecting rod journal out-of-round. | 5. Service or replace crankshaft. |
| | 6. Misaligned connecting rods. | 6. Replace bent connecting rods. |
| MAIN BEARING NOISE | 1. Insufficient oil supply. | 1. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS). |
| | 2. Low oil pressure. | 2. Check oil pump, if Ok, check rod and main bearings for excessive wear. |
| | 3. Thin or diluted oil. | 3. Change oil and filter. |
| | 4. Excessive bearing clearance. | 4. Replace as necessary. |
| | 5. Excessive end play. | 5. Check thrust washers for wear. |
| | 6. Crankshaft journal out-of round. | 6. Service or replace crankshaft. |
| | 7. Loose flywheel or torque converter. | 7. Tighten to correct torque |

## DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - LUBRICATION

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| OIL LEAKS | 1. Gaskets and O-Rings. | |
| | (a) Misaligned or damaged. | (a) Replace as necessary. |
| | (b) Loose fasteners, broken or porous metal parts. | (b) Tighten fasteners, Repair or replace metal parts. |
| | 2. Crankshaft rear seal | 2. Replace as necessary (Refer to 9 - ENGINE/ENGINE BLOCK/ CRANKSHAFT OIL SEAL - REAR - REMOVAL). |
| | 3. Crankshaft seal flange. Scratched, nicked or grooved. | 3. Polish or replace crankshaft. |
| | 4. Oil pan flange cracked. | 4. Replace oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL). |
| | 5. Timing chain cover seal damaged. | 5. Re-seal timing cover. |
| | 6. Scratched or damaged vibration damper hub. | 6. Polish or replace damper. |
| OIL PRESSURE DROP | 1. Low oil level. | 1. Check and correct oil level. |
| | 2. Faulty oil pressure sending unit. | 2. Replace sending unit (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE SENSOR/SWITCH - REMOVAL). |
| | 3. Low oil pressure. | 3. Check oil pump and bearing clearance. |
| | 4. Clogged oil filter. | 4. Replace oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL). |
| | 5. Worn oil pump. | 5. Replace oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL). |
| | 6. Thin or diluted oil. | 6. Change oil and filter. |
| | 7. Excessive bearing clearance. | 7. Replace as necessary. |
| | 8. Oil pump relief valve stuck. | 8. Replace oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL). |
| | 9. Oil pick up tube loose, damaged or clogged. | 9. Replace as necessary. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| OIL PUMPING AT RINGS; SPARK PLUGS FOULING | 1. Worn or damaged rings. | 1. Hone cylinder bores and replace rings. |
| | 2. Carbon in oil ring slots. | 2. Replace rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE). |
| | 3. Incorrect ring size installed. | 3. Replace rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE). |
| | 4. Worn valve guides. | 4. Ream guides and replace valves (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE). |
| | 5. Leaking valve guide seals. | 5. Replace valve guide seals. |

## DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

1. Clean the spark plug recesses with compressed air.
2. Remove the spark plugs.
3. Secure the throttle in the wide-open position.
4. Disable the fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DESCRIPTION).
5. Remove the ASD relay (Refer to 8 - ELECTRICAL/IGNITION CONTROL/AUTO SHUT DOWN RELAY - REMOVAL).
6. Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.
7. Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.
8. (Refer to 9 - ENGINE - SPECIFICATIONS) for the correct engine compression pressures.

## DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

1. Check the coolant level and fill as required. DO NOT install the radiator cap.
2. Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.
3. Remove the spark plugs.
4. Remove the oil filler cap.
5. Remove the air cleaner.
6. Calibrate the tester according to the manufacturer’s instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.
7. Perform the test procedures on each cylinder according to the tester manufacturer’s instructions. Set piston of cylinder to be tested at TDC compression,While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

**FOR EXAMPLE:** At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART .

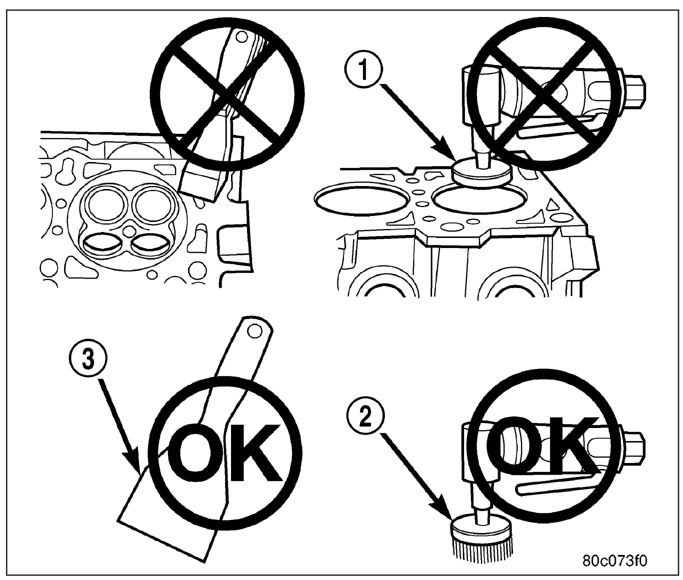
**CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART**

| CONDITION | POSSIBLE CAUSE | CORRECTION |
|---|---|---|
| AIR ESCAPES THROUGH THROTTLE BODY | Intake valve bent, burnt, or not seated properly | Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary. |
| AIR ESCAPES THROUGH TAILPIPE | Exhaust valve bent, burnt, or not seated properly | Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary. |
| AIR ESCAPES THROUGH RADIATOR | Head gasket leaking or cracked cylinder head or block | Remove cylinder head and inspect. Replace defective part |
| MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS | Head gasket leaking or crack in cylinder head or block between adjacent cylinders | Remove cylinder head and inspect. Replace gasket, head, or block as necessary |
| MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY | Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall | Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary |

## STANDARD PROCEDURE

## ENGINE GASKET SURFACE PREPARATION

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.




**Never** use the following to clean gasket surfaces:

- Metal scraper (3).
- Abrasive pad (1) or paper to clean cylinder block and head.
- High speed power tool (1) with an abrasive pad or a wire brush.

**NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.**

Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover
- Plastic or wood scraper.
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow).

**CAUTION: Excessive pressure or high RPM (beyond the recommended speed), can damage the sealing surfaces. The mild (white, 120 grit) bristle disc is recommended. If necessary, the medium (yellow, 80 grit) bristle disc may be used on cast iron surfaces with care.**

## STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS

**CAUTION: Be sure that the tapped holes maintain the original center line.**

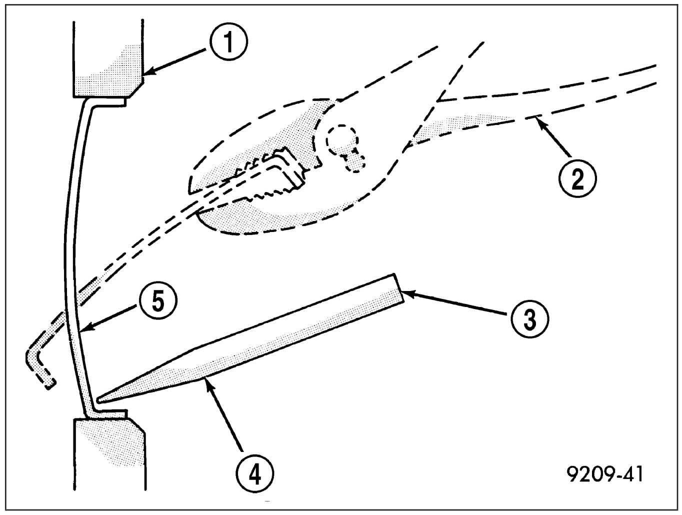
Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

## ENGINE CORE AND OIL GALLERY PLUGS

Using a blunt tool such as a drift and a hammer, strike the bottom edge of the cup plug (5). With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug.

**CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.**




Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 in.) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

## REMOVAL

1. Disconnect the battery negative cable.
2. Remove hood. Mark hood hinge location for reinstallation.
3. Remove air cleaner assembly.
4. Remove radiator core support bracket.
5. Remove fan shroud with electric fan assembly.
6. Remove mechanical cooling fan.
7. Remove drive belt.

**NOTE: It is NOT necessary to discharge the A/C system to remove the engine.**

8. Remove A/C compressor and secure away from engine with lines attached.
9. Remove generator and secure away from engine.

**NOTE: Do NOT remove the phenolic pulley from the P/S pump. It is not required for P/S pump removal.**

10. Remove power steering pump with lines attached and secure away from engine.
11. Drain cooling system.
12. Remove coolant bottle.
13. Disconnect the heater hoses from the engine.
14. Disconnect heater hoses from heater core and remove hose assembly.
15. Disconnect throttle and speed control cables.
16. Remove upper radiator hose from engine.
17. Remove lower radiator hose from engine.
18. Disconnect the engine to body ground straps at the left side of cowl.
19. Disconnect the engine wiring harness at the following points:
    - Intake air temperature (IAT) sensor
    - Fuel Injectors

- Throttle Position (TPS) Switch
- Idle Air Control (IAC) Motor
- Engine Oil Pressure Switch
- Engine Coolant Temperature (ECT) Sensor
- Manifold Absolute Pressure MAP) Sensor
- Camshaft Position (CMP) Sensor
- Coil Over Plugs
- Crankshaft Position Sensor

20. Remove coil over plugs.
21. Release fuel rail pressure.
22. Remove fuel rail and secure away from engine.

**NOTE: It is not necessary to release the quick connect fitting from the fuel supply line for engine removal.**

23. Remove the PCV hose.
24. Remove the breather hoses.
25. Remove the vacuum hose for the power brake booster.
26. Disconnect knock sensors.
27. Remove engine oil dipstick tube.
28. Remove intake manifold.
29. Install engine lift plate.

**NOTE: Recheck bolt torque for engine lift plate before removing engine.**

30. Secure the left and right engine wiring harnesses away from engine.
31. Raise vehicle.
32. Disconnect oxygen sensor wiring.
33. Disconnect crankshaft postion sensor.
34. Disconnect the engine block heater power cable, if equipped.
35. Disconnect the front propshaft at the front differential and secure out of way.

**NOTE: It is necessary to disconnect the front propshaft for access to the starter and left side exhaust flange.**

36. Remove the starter.
37. Remove the ground straps from the left and right side of the block.
38. Disconnect the right and left exhaust pipes at the manifolds and from the crossover, and remove from the vehicle.

**NOTE: The exhaust clamps at the manifolds cannot be reused. New clamps must be used or leaks may occur.**

**NOTE: For manual transmission vehicles, the transmission must be removed from the vehicle, before the engine can be removed. The manual transmission will contact the floorpan before the engine clears the motor mounts, so it must be removed.**

39. Remove the structural cover.
40. Remove torque convertor bolts, and mark location for reassembly.
41. Remove transmission bellhousing to engine bolts.
42. Loosen left and right engine mount thru bolts.

**NOTE: It is not necessary to completely remove engine mount thru bolts, for engine removal.**

43. Lower the vehicle.

44. Support the transmission with a suitable jack.
45. Connect a suitable engine hoist to the engine lift plate.
46. Remove engine from vehicle.

## INSTALLATION

1. Position the engine in the vehicle.
2. Install both left and right side engine mounts onto engine.
3. Raise the vehicle.
4. Install the transmission bellhousing to engine mounting bolts. Tighten the bolts to 41 N·m (30ft. lbs.).
5. Tighten the engine mount thru bolts.
6. Install the torque convertor bolts.
7. Connect the ground straps on the left and right side of the engine.
8. Install the starter.
9. Connect the crankshaft position sensor.
10. Install the engine block heater power cable, if equipped.

**CAUTION: The structural cover requires a specific torque sequence. Failure to follow this sequence may cause severe damage to the cover.**

11. Install the structural cover.

**NOTE: New clamps must be used on exhaust manifold flanges. Failure to use new clamps may result in exhaust leaks.**

12. Install the left and right exhaust pipes.
13. Connect the left and right oxygen sensors.
14. Lower vehicle.
15. Remove the engine lift plate.
16. Connect the knock sensors.
17. Connect the engine to body ground straps at the left side of the cowl.
18. Install the intake manifold.
19. Install the engine oil dipstick tube.
20. Install the power brake booster vacuum hose.
21. Install the breather hoses.
22. Install the PCV hose.
23. Install the fuel rail.
24. Install the coil over plugs.
25. Connect the engine wiring harness at the following points:
    - Intake air temperature (IAT) sensor
    - Fuel Injectors
    - Throttle Position (TPS) Switch
    - Idle Air Control (IAC) Motor
    - Engine Oil Pressure Switch
    - Engine Coolant Temperature (ECT) Sensor
    - Manifold Absolute Pressure MAP) Sensor
    - Camshaft Position (CMP) Sensor
    - Coil Over Plugs
    - Crankshaft Position Sensor
26. Connect lower radiator hose.
27. Connect upper radiator hose.
28. Connect throttle and speed control cables.

29. Install the heater hose assembly.
30. Install coolant recovery bottle.
31. Install the power steering pump.
32. Install the generator.
33. Install the A/C compressor.
34. Install the drive belt.
35. Install the mechanical cooling fan.
36. Install the fan shroud with the electric fan assembly.
37. Install the radiator core support bracket.
38. Install the air cleaner assembly.
39. Refill the engine cooling system.
40. Install the hood.
41. Check and fill engine oil.
42. Connect the battery negative cable.
43. Start the engine and check for leaks.

## SPECIFICATIONS

## TORQUE

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Camshaft | | | |
| Non - Oiled Sprocket Bolt | 122 | 90 | — |
| Bearing Cap Bolts | 11 | — | 100 |
| Counterbalance shaft retaining bolt | 28 | — | 250 |
| Timing Chain Cover—Bolts | 58 | 43 | — |
| Connecting Rod Cap—Bolts | 27 | 20 | — |
| | **PLUS 90° TURN** | | |
| Bed Plate—Bolts | Refer to Procedure | | |
| Crankshaft Damper—Bolt | 175 | 130 | — |
| Cylinder Head—Bolts | | | |
| M11 Bolts | Refer To Procedure | | |
| M8 Bolts | Refer To Procedure | | |
| Cylinder Head Cover—Bolts | 12 | — | 105 |
| Exhaust Manifold—Bolts | 25 | 18 | — |
| Exhaust Manifold Heat Shield—Nuts | 8 | — | 72 |
| | Then loosen 45° | | |
| Flexplate—Bolts | 95 | 70 | — |
| Engine Mount Bracket to Block—Bolts | 61 | 45 | — |
| Rear Mount to Transmission—Bolts | 46 | 34 | — |
| Generator Mounting—Bolts | | | |
| M10 Bolts | 54 | 40 | — |
| M8 Bolts | 28 | — | 250 |
| Intake Manifold—Bolts | 12 | — | 105 |
| | Refer to Procedure for | | |

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| | Tightening Sequence | | |
| Oil Pan—Bolts | 15 | — | 130 |
| Oil Pan—Drain Plug | 34 | 25 | — |
| Oil Pump—Bolts | 28 | — | 250 |
| Oil Pump Cover—Bolts | 12 | — | 105 |
| Oil Pickup Tube—Bolt and Nut | 28 | — | 250 |
| Oil Dipstick Tube to Engine Block—Bolt | 15 | — | 130 |
| Oil Fill Tube—Bolts | 12 | — | 105 |
| Timing Chain Guide—Bolts | 28 | — | 250 |
| Timing Chain Tensioner Arm—Bolt | 28 | — | 250 |
| Hydraulic Tensioner—Bolts | 28 | — | 250 |
| Timing Chain Primary Tensioner—Bolts | 28 | — | 250 |
| Timing Drive Idler Sprocket—Bolt | 34 | 25 | — |
| Thermostat Housing—Bolts | 12 | — | 105 |
| Water Pump—Bolts | 58 | 43 | — |

## SPECIFICATIONS - 3.7L ENGINE

### GENERAL SPECIFICATIONS

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| Type | 90° SOHC V6 12 Valve | |
| Number of Cylinders | 6 | |
| Firing Order | 1-6-5-4-3-2 | |
| Lead Cylinder | No. 1 Left Bank | |
| Compression Ratio | 9.6:1 | |
| Max. Variation Between Cylinders | 25% | |
| | **Metric** | **Standard** |
| Displacement | 3.7 Liters | 226 Cubic Inches |
| Bore | 93.0 mm | 3.66 in. |
| Stroke | 90.8 mm | 3.40 in. |
| Horsepower | 211 @ 5200 RPM | |
| Torque | 236ft. lbs.@4000 PRM | |
| Compression Pressure | 1172-1551 kPa | 170-225 psi |

### CYLINDER BLOCK

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | **Metric** | **Standard** |
| Bore Diameter | 93.013 ± .0075 mm | 3.6619 ± 0.0003 in. |
| Out of Round (MAX) | 0.076 mm | 0.003 in. |
| Taper (MAX) | 0.051 mm | 0.002 in. |

### PISTONS

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Diameter | 92.975 mm | 3.6605 in. |
| Weight | 365.0 grams | 12.87 oz |
| **Ring Groove Diameter** | | |
| No. 1 | 85.37 - 83.13 mm | 3.282 - 3.273 in |
| No. 2 | 82.833 - 83.033 mm | 3.261 - 3.310 in. |
| No. 3 | 83.88 - 84.08 mm | 3.302 - 3.310 in. |

### PISTON PINS

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Clearance In Piston | 0.006 - 0.015 mm | 0.0002 - 0.0005 in. |
| Diameter | 24.017 - 24.020 mm | 0.9455 - 0.9456 in. |

### PISTON RINGS

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| **Ring Gap** | | |
| Top Compression Ring | 0.20 - 0.36 mm | 0.0079 - 0.0142 in. |
| Second Compression Ring | 0.37 - 0.63 mm | 0.0146 - 0.0249 in. |
| Oil Control (Steel Rails) | 0.25 - 0.76 mm | 0.0099 - 0.30 in. |
| **Side Clearance** | | |
| Top Compression Ring | .051 - .094 mm | 0.0020 - 0.0037 in. |
| Second Compression Ring | 0.040 - 0.080 mm | 0.0016 - 0.0031 in. |
| Oil Ring (Steel Ring) | .019 - .229 mm | .0007 - .0091 in. |
| **Ring Width** | | |
| Top Compression Ring | 1.472 - 1.490 mm | 0.057 - 0.058 in. |
| Second Compression Ring | 1.472 - 1.490 mm | 0.057 - 0.058 in. |
| Oil Ring (Steel Rails) | 0.445 - 0.470 mm | 0.017 - 0.018 in. |

### CONNECTING RODS

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Bearing Clearance | 0.006 - 0.044 mm | 0.0002 - 0.0017 in. |
| Side Clearance | 0.10 - 0.35 mm | 0.004 - 0.0138 in. |
| Piston Pin Clearance | .015 - .028 mm | 0.0006 - 0.0011 in. |
| Bearing Bore Out of Round (MAX) | 0.004 mm | 0.0002 in. |
| Total Weight (Less Bearing) | 612 grams | 21.588 ounces |

#### CRANKSHAFT

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Main Bearing Journal Diameter | 63.488 - 63.512 mm | 2.4996 - 2.5005 in. |
| Bearing Clearance | 0.002 - 0.046 mm | 0.00008 - 0.0018 in. |
| Out of Round (MAX) | 0.005 mm | 0.0002 in. |
| Taper (MAX) | 0.006 mm | 0.0004 in. |
| End Play | 0.052 - 0.282 mm | 0.0021 - 0.0112 in. |
| End Play (MAX) | 0.282 mm | 0.0112 in. |
| Connecting Rod Journal Diameter | 57.908 - 57.892 mm | 2.2798 - 2.2792 in. |
| Bearing Clearance | 0.006 - 0.044 | 0.0002 - 0.0011 in. |
| Out of Round (MAX) | 0.005 mm | 0.0002 in. |
| Taper (MAX) | 0.006 mm | 0.0002 in. |

#### CAMSHAFT

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Bore Diameter | 26.02 - 26.04 mm | 1.0245 - 1.0252 in. |
| Bearing Journal Diameter | 25.975 - 25.995 mm | 1.0227 - 1.0235 in. |
| Bearing Clearance | 0.025 - 0.065 mm | 0.001 - 0.0026 in. |
| Bearing Clearance (MAX) | 0.065 mm | 0.0026 in. |
| End Play | .075 - .200 mm | 0.003 - 0.0079 in. |
| End Play (MAX) | .200 mm | 0.0079 in. |

#### VALVE TIMING

| DESCRIPTION | SPECIFICATION |
|---|---|
| **Intake** | |
| Opens (BTDC) | 5.6° |
| Closes (ATDC) | 240.1° |
| Duration | 245.7° |
| **Exhaust** | |
| Opens (BTDC) | 241.5° |
| Closes (ATDC) | 20.1° |
| Duration | 261.6° |
| Valve Overlap | 25.7° |

#### VALVES

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Face Angle | 45° - 45.5° | |
| Head Diameter | | |
| Intake | 48.52 - 48.78 mm | 1.9103 - 1.9205 in. |
| Exhaust | 36.87 - 37.13 mm | 1.4516 - 1.4618 in. |
| Length (Overall) | | |
| Intake | 113.45 - 114.21 mm | 4.4666 - 4.4965 in. |
| Exhaust | 114.92 - 115.68 mm | 4.5244 - 4.5543 in. |
| Stem Diameter | | |
| Intake | 6.931 - 6.957 mm | 0.2729 - 0.2739 in. |
| Exhaust | 6.902 - 6.928 mm | 0.2717 - 0.2728 in. |
| Stem-to-Guide Clearance | | |
| Intake | 0.018 - 0.069 mm | 0.0008 - 0.0028 in. |
| Exhaust | 0.047 - 0.098 mm | 0.0019 - 0.0039 in. |
| Max. Allowable Stem-to-Guide Clearance (Rocking Method) | | |
| Intake | 0.069 mm | 0.0028 in. |
| Exhaust | 0.098 mm | 0.0039 in. |
| Valve Lift (Zero Lash) | | |
| Intake | 12.00 mm | 0.472 in. |
| Exhaust | 12.00 mm | 0.472 in. |

**VALVE SPRING**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Free Length (Approx) | | |
| Intake | 48.18 mm | 1.896 in. |
| Exhaust - w/damper | 48.2 mm | 1.897 in. |
| Spring Force (Valve Closed) | | |
| Intake | 332.0 - 368.0 N @ 40.12 mm | 74.63 - 82.72 lbs. @ 1.5795 in. |
| Exhaust - (without damper) | 356 - 394 N @ 39.12 mm | 80.031 - 88.57 lbs. @ 1.54 in. |
| Spring Force (Valve Open) | | |
| Intake | 948.0 - 1038.0 N @ 28.12 mm | 213.2 - 233.8 lbs. @ 1.107 in. |
| Exhaust - without damper | 974 - 956 N @ 27.12 mm | 218.8 - 215.1 lbs. @ 1.067 in. |
| Number of Coils | | |
| Intake | 7.30 | |
| Exhaust | 7.15 | |
| Wire Diameter | | |
| Intake | 4.77 × 3.80mm | 0.1878 × 0.1496 in. |

| | | |
|---|---|---|
| Exhaust | 4.66 × 3.72mm | 0.1843 × .1464 in. |
| Installed Height (Spring Seat to Bottom of Retainer) | | |
| Nominal | | |
| Intake | 40.12 mm | 1.579 in. |
| Exhaust - w/damper | 40.12 mm | 1.579 in. |

**CYLINDER HEAD**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | **Metric** | **Standard** |
| Gasket Thickness (Compressed) | 0.7 mm | (0.0276 in.) |
| Valve Seat Angle | 44.5° - 45.0° | |
| Valve Seat Runout (MAX) | 0.051 mm | 0.002 in. |
| Valve Seat Width | | |
| Intake | 1.75 - 2.36 mm | 0.0698 - 0.0928 in. |
| Exhaust | 1.71 - 2.32 mm | 0.0673 - 0.0911 in. |
| Guide Bore Diameter (Std.) | 6.975 - 7.00 mm | 0.2747 - 0.2756 in. |
| Cylinder Head Warpage (Flatness) | 0.0508 mm | 0.002 in. |

**OIL PUMP**

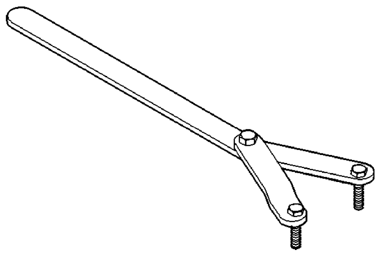
| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | **Metric** | **Standard** |
| Clearance Over Rotors/End Face (MAX) | 0.095 mm | 0.0038 in. |
| Cover Out - of -Flat (MAX) | 0.025 mm | 0.001 in. |
| Inner and Outer Rotor Thickness | 12.02 mm | 0.4731 in. |
| Outer Rotor to pocket (Diametral) clearance (MAX) | .235 mm | .0093 in. |
| Outer Rotor Diameter (MIN) | 85.925 mm | 0.400 in. |
| Tip Clearance Between Rotors (MAX) | 0.150 mm | 0.006 in. |

**OIL PRESSURE**

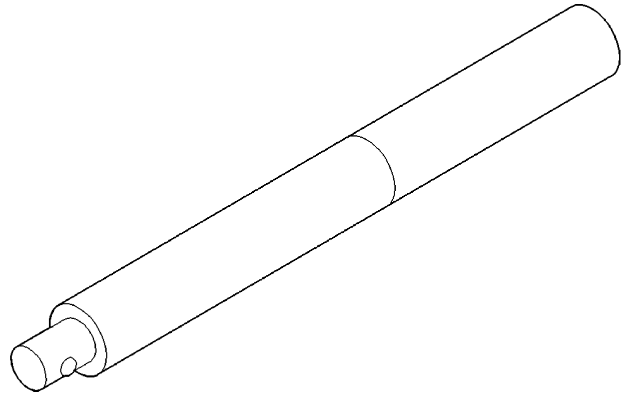
| SPECIFICATION | SPECIFICATION | |
|---|---|---|
| | **Metric** | **Standard** |
| At Curb Idle Speed (MIN)* | 25 kPa | 4 psi |
| @ 3000 rpm | 170 - 758 kPa | 25 - 110 psi |
| *** CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 rpm.** | | |

## SPECIAL TOOLS

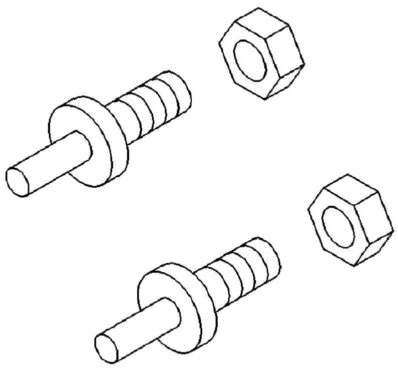
## 3.7L ENGINE



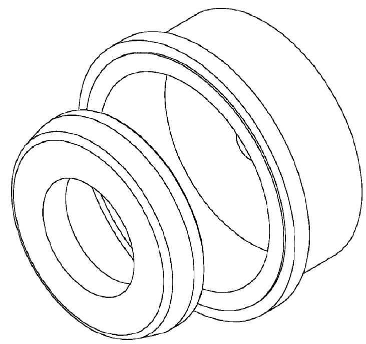
*Spanner Wrench 6958*



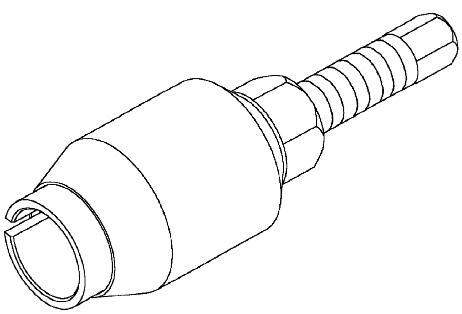
*Handle C-4171*



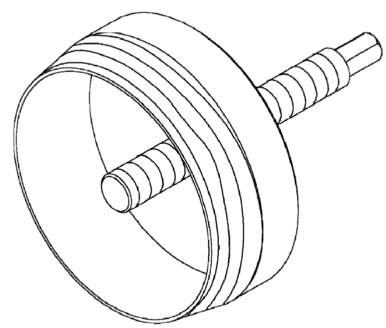
*Adapter Pins 8346*



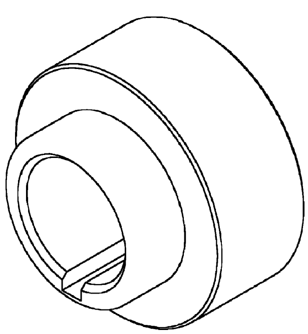
*Rear Crankshaft Seal Installer 8349*



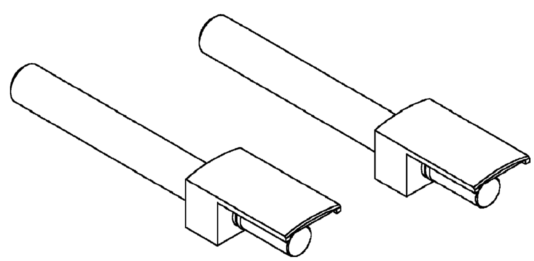
*Front Crankshaft Seal Remover 8511*



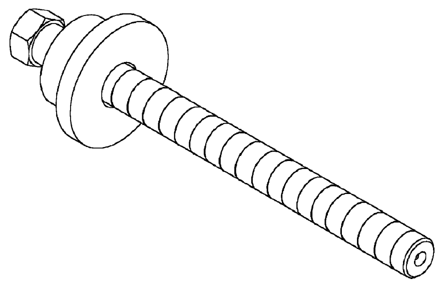
*Rear Crankshaft Seal Remover 8506*



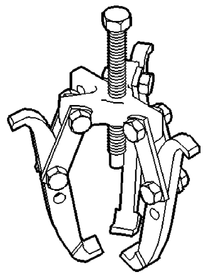
*Front Crankshaft Seal Installer 8348*



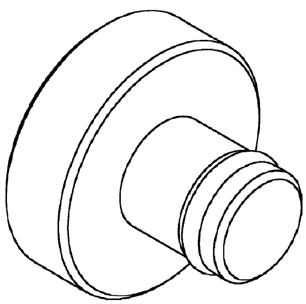
*Connecting Rod Guides 8507*



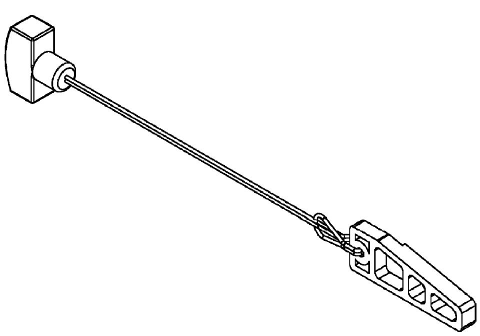
*Crankshaft Damper Installer 8512*



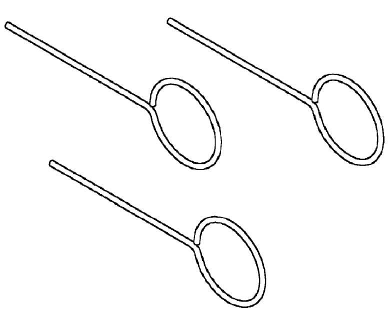
*Puller 1026*



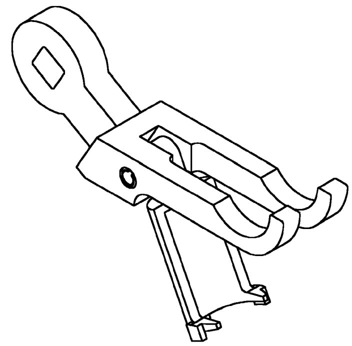
*Crankshaft Damper Removal Insert 8513*



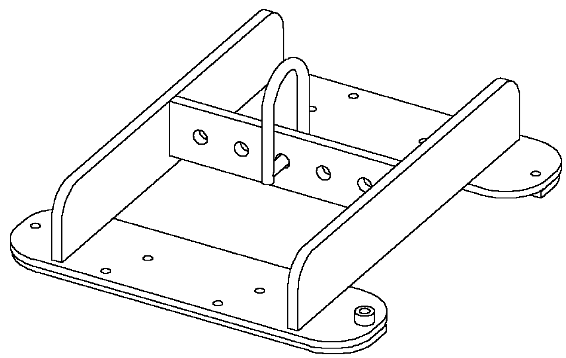
*Chain Tensioner Wedge 8379*



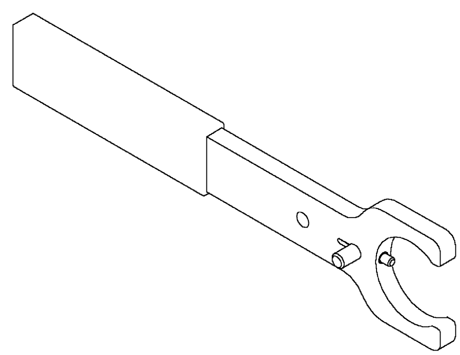
*Chain Tensioner Pins 8514*



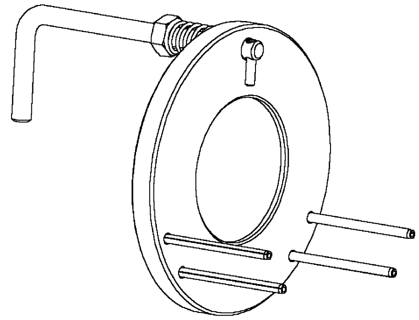
*VALVE SPRING COMPRESSOR 8426*



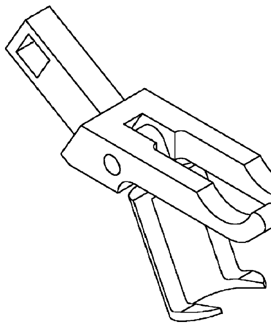
*ENGINE LIFTING FIXTURE 8427*



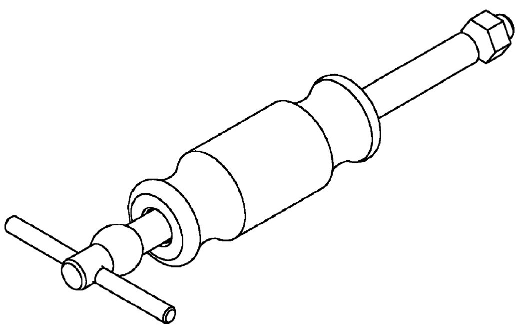
*CAMSHAFT HOLDER 8428*



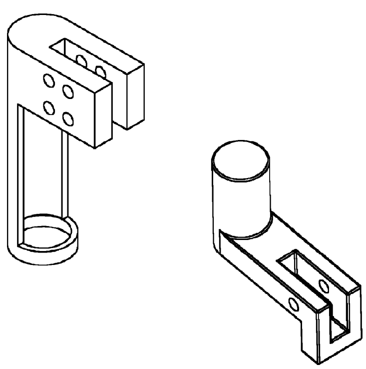
*HOLDER SECONDARY CAMSHAFT CHAIN 8429*



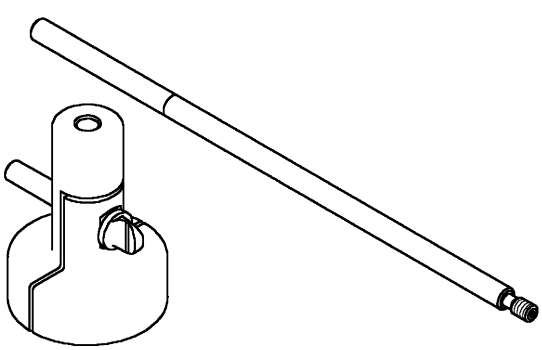
***Remover, Rocker Arm 8516***



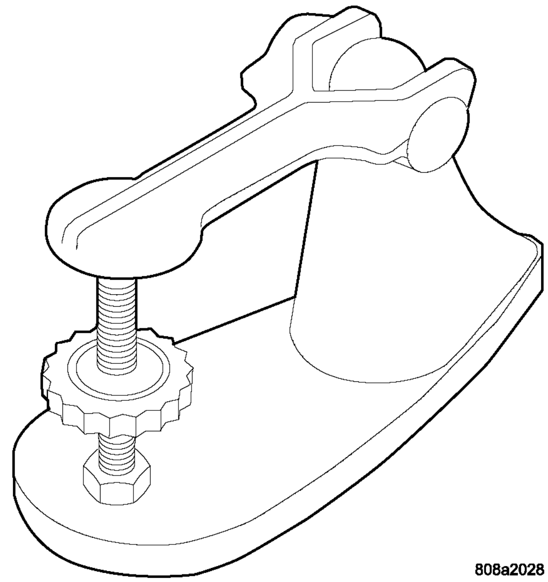
***Idler Shaft Remover 8517***



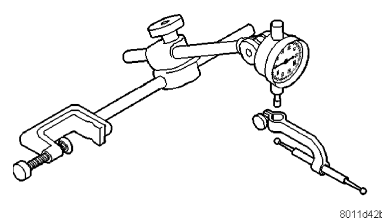
***Valve Spring Compressor Adapters 8519***



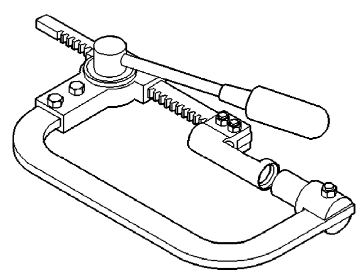
***INSTALLER - REMOVER - COUNTER BALANCE SHAFT 8641***



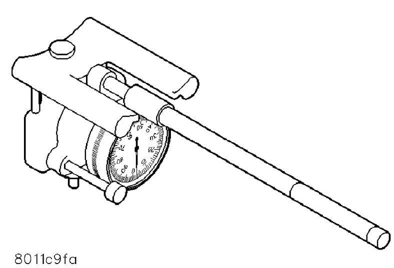

***Valve Spring Tester C-647***



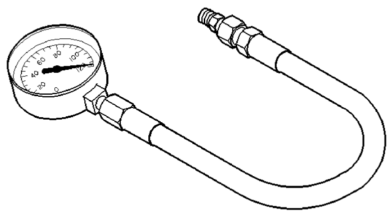

***Dial Indicator C-3339***



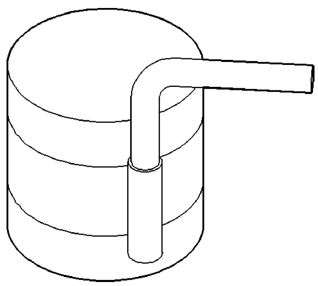
***COMPRESSOR VALVE SPRING C-3422-C***



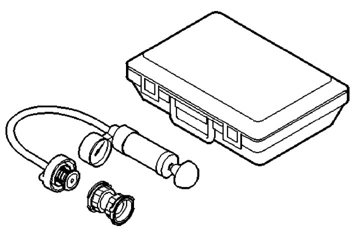

***Bore Size Indicator C-119***



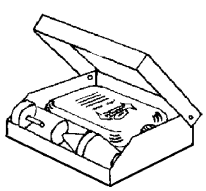
GAUGE OIL PRESSURE - C-3292



Piston Ring Compressor C-385



Pressure Tester Kit 7700



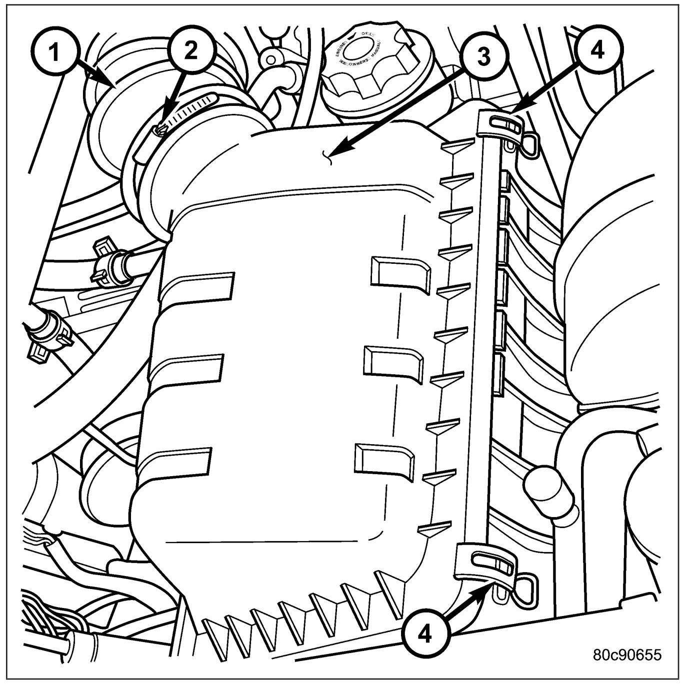
Bloc–Chek–Kit C-3685–A

# ELEMENT - AIR CLEANER

## REMOVAL - 3.7L

Housing removal is not necessary for element (filter) replacement.

1. Pry up spring clips (4) from front of housing cover (spring clips retain cover to housing).
2. Release housing cover from 4 locating tabs located on rear of housing, and remove cover.
3. Remove air cleaner element (filter) from housing.
4. Clean inside of housing before replacing element.




## INSTALLATION - 3.7L

1. Install element into housing.
2. Position housing cover into housing locating tabs.
3. Pry up spring clips and lock cover to housing.

If any air filter, air resonator, air intake tubes or air filter housing clamps had been loosened or removed, tighten them to 5 N·m (40 in. lbs.) torque.

# HEAD-CYLINDER-LEFT

## DESCRIPTION - VALVE GUIDES

The valve guides are made of powered metal and are pressed into the cylinder head. The guides are not replaceable or serviceable, and valve guide reaming is not recommended. If the guides are worn beyond acceptable limits, replace the cylinder heads.

## DIAGNOSIS AND TESTING

## DIAGNOSIS AND TESTING - HYDRAULIC LASH ADJUSTER

A tappet-like noise may be produced from several items. Check the following items.

1. Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.
2. Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.
3. Turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.
4. Low oil pressure.
5. The oil restrictor in cylinder head gasket or the oil passage to the cylinder head is plugged with debris.
6. Air ingested into oil due to broken or cracked oil pump pick up.
7. Worn valve guides.
8. Rocker arm ears contacting valve spring retainer.
9. Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.
10. Oil leak or excessive cam bore wear in cylinder head.
11. Faulty lash adjuster.
    a. Check lash adjusters for sponginess while installed in cylinder head and cam on camshaft at base circle. Depress part of rocker arm over adjuster. Normal adjusters should feel firm when pressed quickly. When pressed very slowly, lash adjusters should collapse.
    b. Remove suspected lash adjusters, and replace.
    c. Before installation, make sure adjusters are full of oil. This can be verified by little plunger travel when lash adjuster is depressed quickly.

## CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

### CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50 - 70% reduction in compression pressure.

## CYLINDER-TO-WATER JACKET LEAKAGE TEST

**WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.**

### VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

### COOLING SYSTEM TESTER METHOD

**WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).**

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

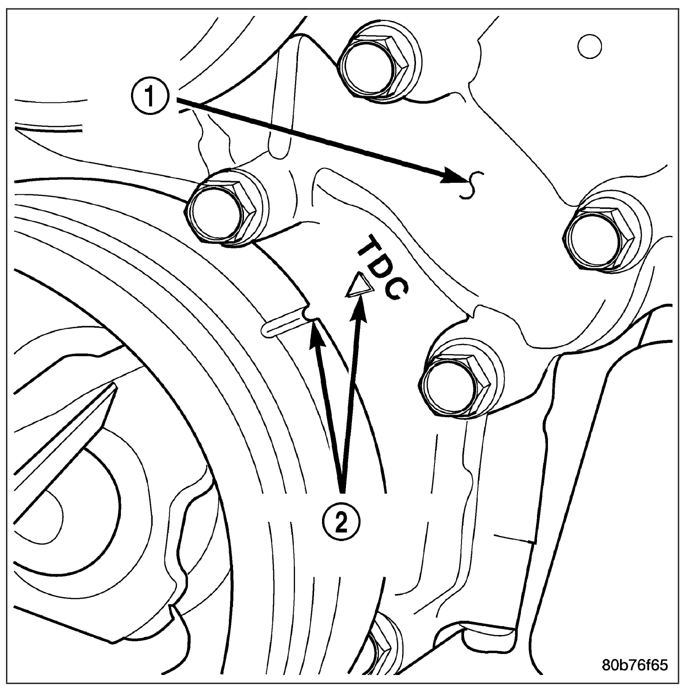
### CHEMICAL TEST METHOD

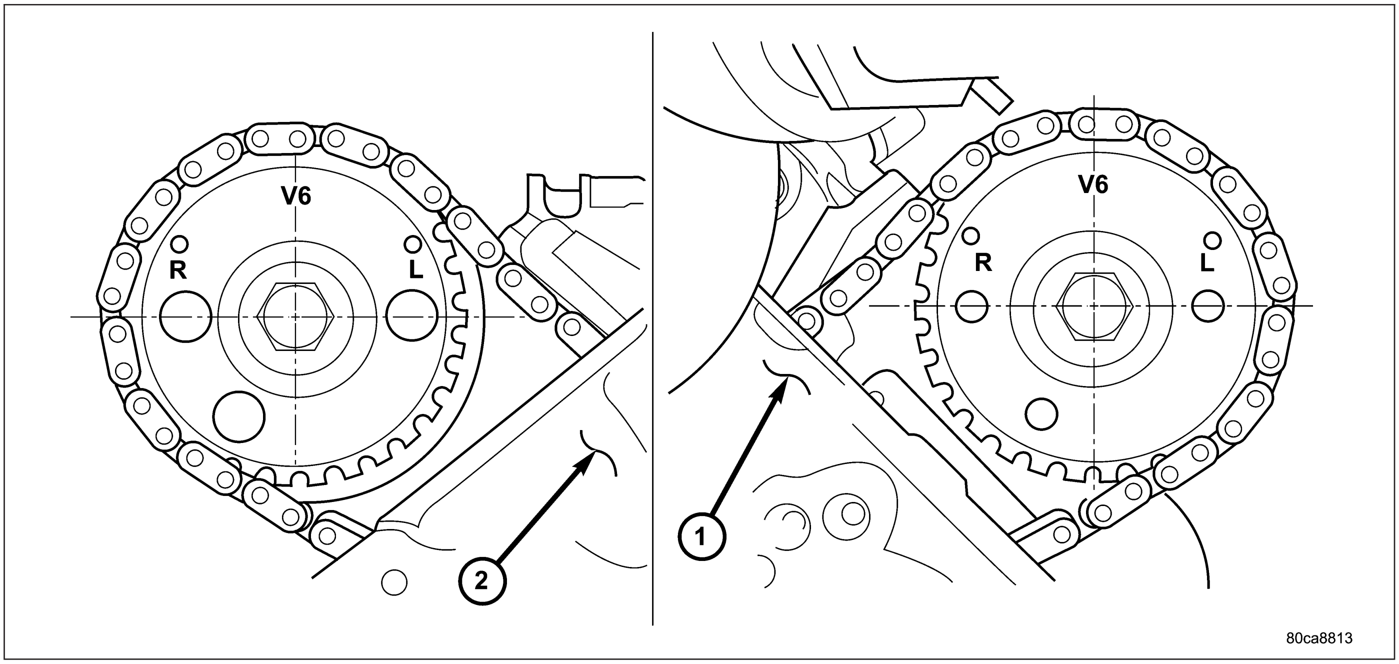
Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

## REMOVAL

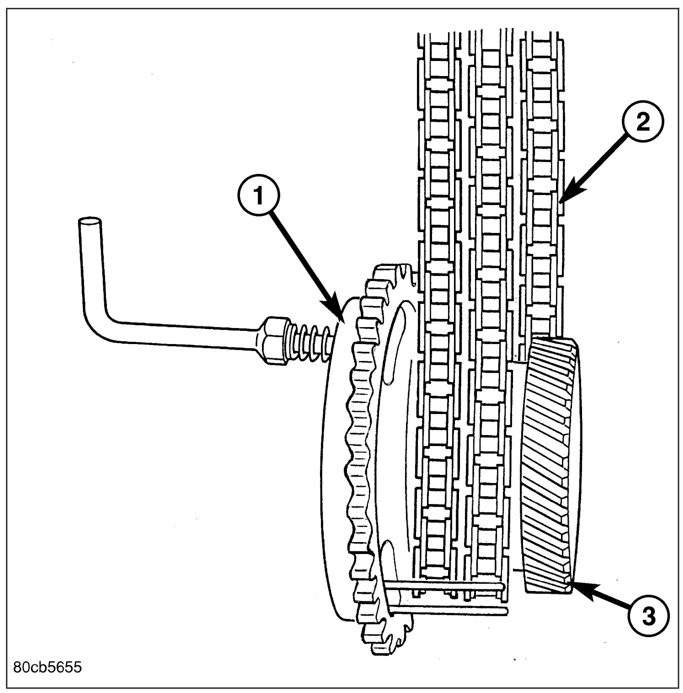
## REMOVAL LEFT CYLINDER HEAD

1. Disconnect the negative cable from the battery.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the left side exhaust manifold.
4. Drain the engine coolant. Refer to COOLING SYSTEM.
5. Lower the vehicle.
6. Remove the intake manifold. Refer to procedure in this section.
7. Remove the cylinder head cover. Refer to procedure in this section.
8. Remove the fan shroud and fan blade assembly. Refer to COOLING SYSTEM.
9. Remove accessory drive belt. Refer to COOLING SYSTEM.
10. Remove the power steering pump and set aside.
11. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (2).





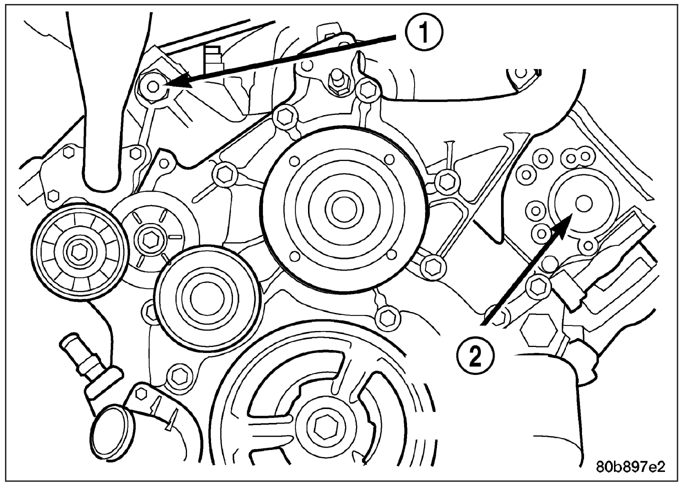

12. Verify the V6 mark on the camshaft sprocket is at the 12 o'clock position. Rotate the crankshaft one turn if necessary.
13. Remove the crankshaft damper. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL)
14. Remove the timing chain cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL)
15. Lock the secondary timing chains to the idler sprocket using Special Tool 8429 Timing Chain Holding Fixture (1).




**NOTE: Mark the secondary timing chain prior to removal to aid in installation.**

16. Mark the secondary timing chain, one link on each side of the V6 mark on the camshaft drive gear.
17. Remove the left side secondary chain tensioner.

18. Remove the cylinder head access plug (1) (2).
19. Remove the left side secondary chain guide.
20. Remove the retaining bolt and the camshaft drive gear.



80b897e2

**CAUTION: Do not allow the engine to rotate. Severe damage to the valve train can occur.**

**CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.**

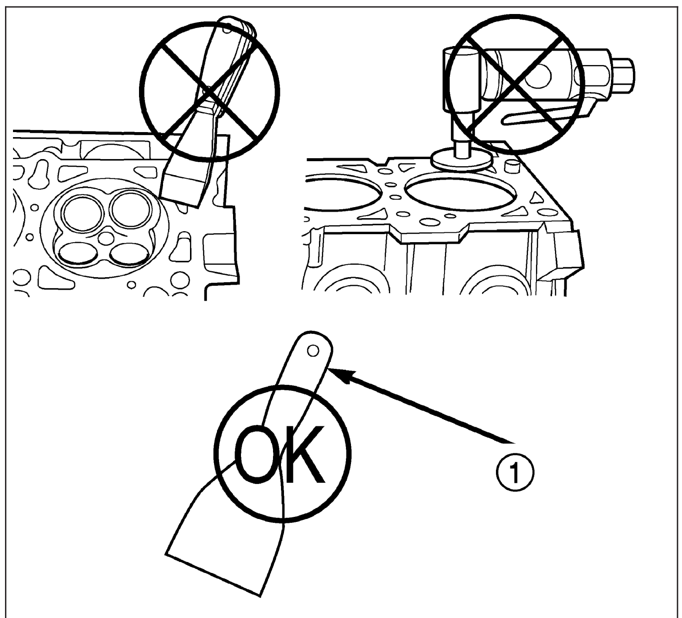
**NOTE: The cylinder head is attached to the cylinder block with twelve bolts.**

21. Remove the cylinder head retaining bolts.
22. Remove the cylinder head and gasket. Discard the gasket.

**CAUTION: Do not lay the cylinder head on its gasket sealing surface, due to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.**

## CLEANING

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components. (Refer to 9 - ENGINE - STANDARD PROCEDURE).



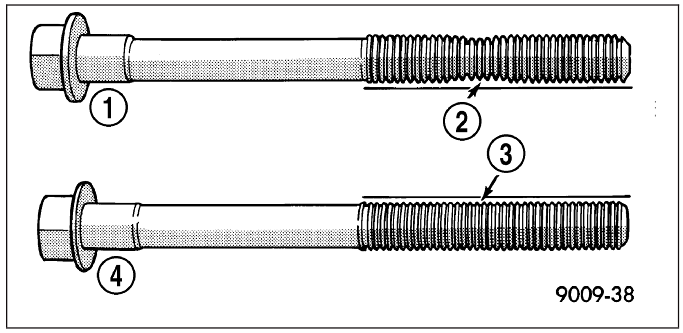
80b76eba

## INSTALLATION

## INSTALLATION LEFT CYLINDER HEAD

**NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts should be replaced.**

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale (1), the bolt should be replaced.

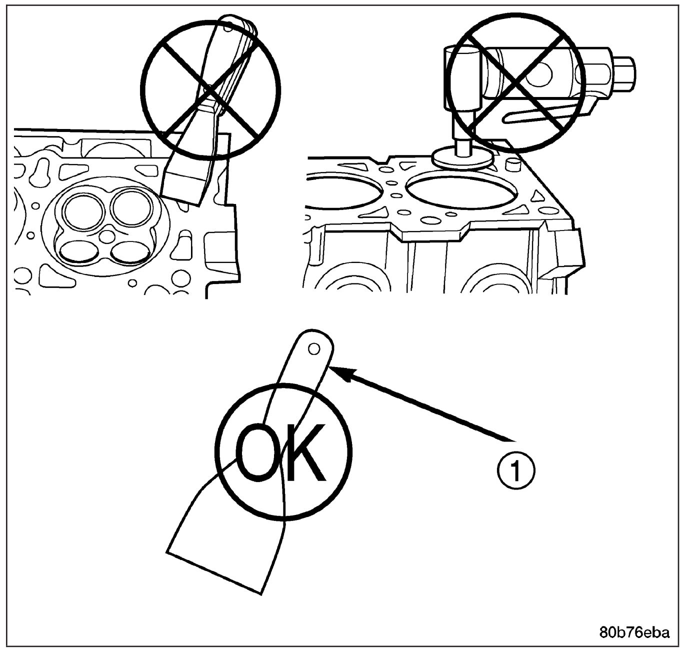



**CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper.**

1. Clean the cylinder head and cylinder block mating surfaces.
2. Position the new cylinder head gasket on the locating dowels.

**CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.**

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

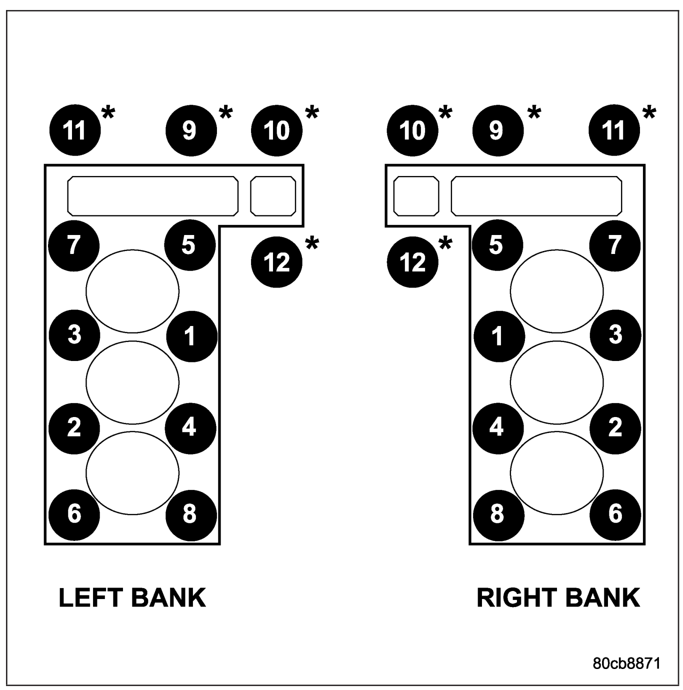



**NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.**

4. Lubricate the cylinder head bolt threads with clean engine oil and install the eight M11 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar® Lock and Seal Adhesive** then install the bolts.

**NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.**

6. Tighten the bolts in sequence using the following steps and torque values:
   - Step 1: Tighten bolts 1–8, 27 N·m (20 ft. lbs.).
   - Step 2: Verify that bolts 1–8, all reached 27 N·m (20 ft. lbs.), by repeating step-1 without loosening the bolts. Tighten bolts 9 thru 12 to 14 N·m (10 ft. lbs.).
   - Step 3: Tighten bolts 1–8, 90 degrees.



- Step 4: Tighten bolts 1–8, 90 degrees, again. Tighten bolts 9–12, 26 N·m (19 ft. lbs.)

7. Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V6 mark on the gear then using Special Tool 8428 Camshaft Wrench, position the gear onto the camshaft.

**CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torqueing of bolt resulting in bolt failure.**

8. Install the camshaft drive gear retaining bolt.
9. Install the left side secondary chain guide.
10. Install the cylinder head access plug.
11. Re-set and Install the left side secondary chain tensioner.
12. Remove Special Tool 8429.
13. Install the timing chain cover.
14. Install the crankshaft damper. Tighten damper bolt 175 N·m (130 Ft. Lbs.).
15. Install the power steering pump.
16. Install the fan blade assembly and fan shroud.
17. Install the cylinder head cover.
18. Install the intake manifold.
19. Refill the cooling system
20. Raise the vehicle.
21. Install the exhaust pipe onto the left exhaust manifold.
22. Lower the vehicle.
23. Connect the negative cable to the battery.
24. Start the engine and check for leaks.

# CAMSHAFT

## DESCRIPTION

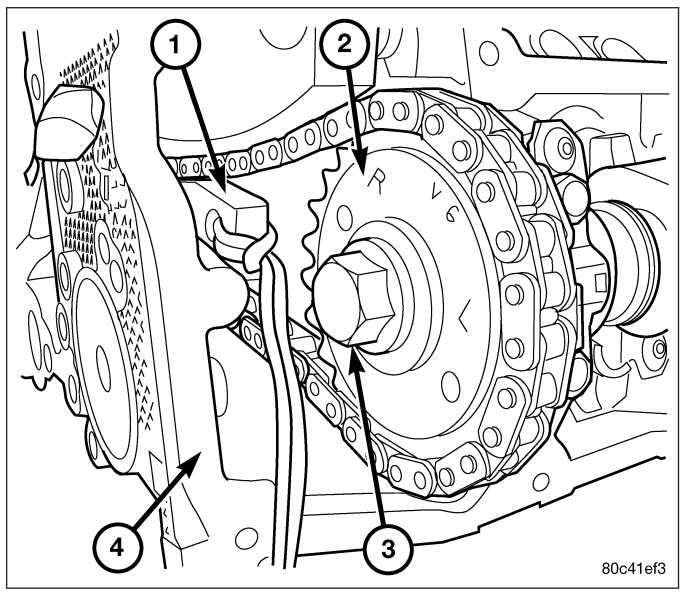
The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. Four bearing journals are machined into the camshaft. Camshaft end play is controlled by two thrust walls that border the nose piece journal.

## REMOVAL

**CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.**

**CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use Special Tool 8379 will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.**

1. Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Set engine to TDC cylinder #1, camshaft sprocket V6 marks at the 12 o'clock position.
3. Mark one link on the secondary timing chain on both sides of the V6 mark on the camshaft sprocket to aid in installation.




**CAUTION: Do not hold or pry on the camshaft target wheel (Located on the right side camshaft sprocket) for any reason, Severe damage will occur to the target wheel resulting in a vehicle no start condition.**

4. Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave the bolt snug against the sprocket.

**NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.**

**CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.**

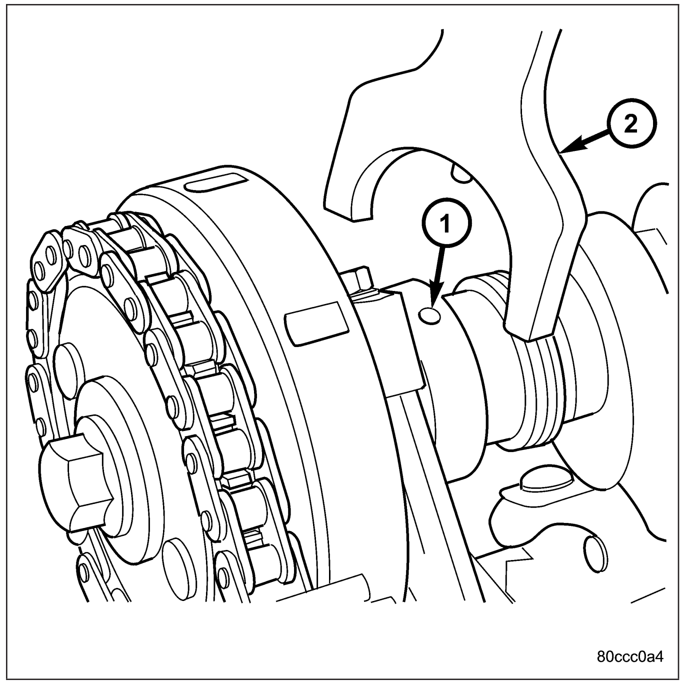
5. Position Special Tool 8379 timing chain wedge between the timing chain strands, tap the tool to securely wedge the timing chain against the tensioner arm and guide.

6. Hold the camshaft with Special Tool 8428 Camshaft Wrench , while removing the camshaft sprocket bolt and sprocket.
7. Using Special Tool 8428 Camshaft Wrench, gently allow the camshaft to rotate 5° clockwise until the camshaft is in the neutral position (no valve load).
8. Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

**CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.**

**NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.**

9. Remove the camshaft bearing caps and the camshaft.



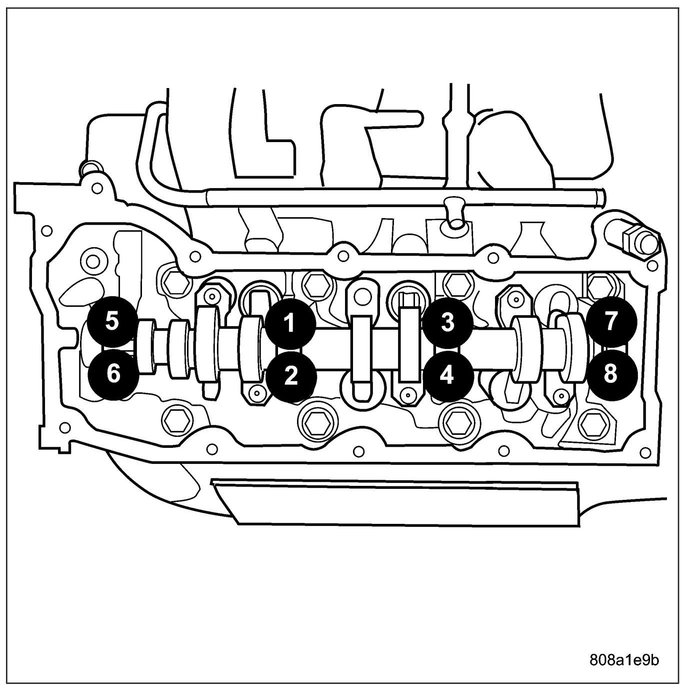

## INSTALLATION

1. Lubricate camshaft journals with clean engine oil.

**NOTE: Position the left side camshaft so that the camshaft sprocket dowel is near the 1 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.**

2. Position the camshaft into the cylinder head.
3. Install the camshaft bearing caps, hand tighten the retaining bolts.

**NOTE: Caps should be installed so that the stamped numbers on the caps are in numerical order, ( 1 thru 4 ) from the front to the rear of the engine. All caps should be installed so that the stamped arrows on the caps point toward the front of the engine.**




4. Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward.
5. Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.) .
6. Position the camshaft drive gear into the timing chain aligning the V6 mark between the two marked chain links (Two links marked during removal).
7. Using Special Tool 8428 Camshaft Wrench, rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft.

**CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.**

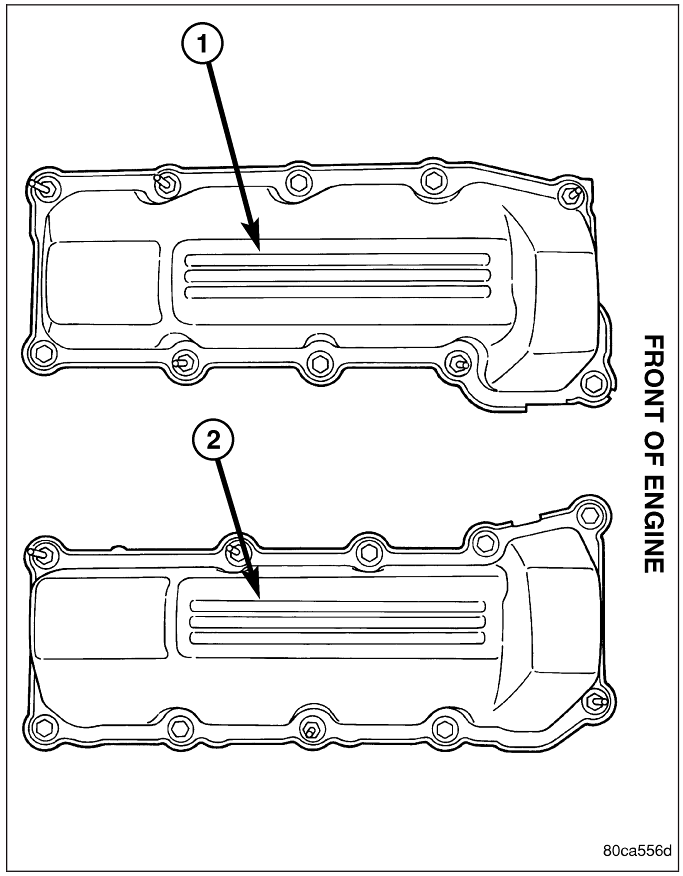
8. Remove excess oil from bolt, then install the camshaft sprocket retaining bolt and hand tighten.
9. Remove Special Tool 8379 timing chain wedge.

10. Using Special Tool 6958 spanner wrench with adapter pins 8346, torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).
11. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

# COVER-CYLINDER HEAD

## DESCRIPTION

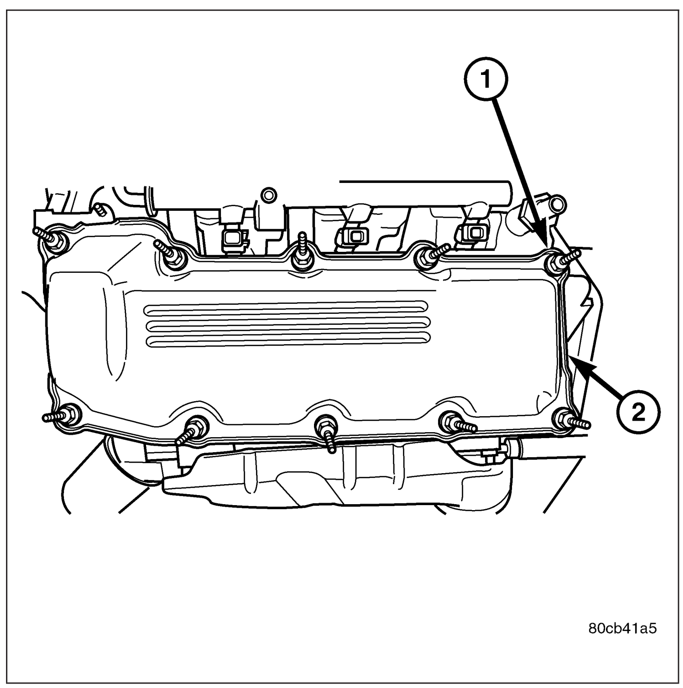
The cylinder head covers (1,2) are made of glass re-enforced thermoset plastic, and are not interchangable from side-to-side.




## REMOVAL

1. Disconnect negative cable from battery.
2. Remove the resonator assemble and air inlet hose.
3. Disconnect injector connectors and un-clip the injector harness.
4. Route injector harness in front of cylinder head cover.
5. Disconnect the left side breather tube and remove the breather tube.
6. Remove the cylinder head cover mounting bolts (1).
7. Remove cylinder head cover (1) and gasket.

**NOTE: The gasket may be used again, providing no cuts, tears, or deformation has occurred.**

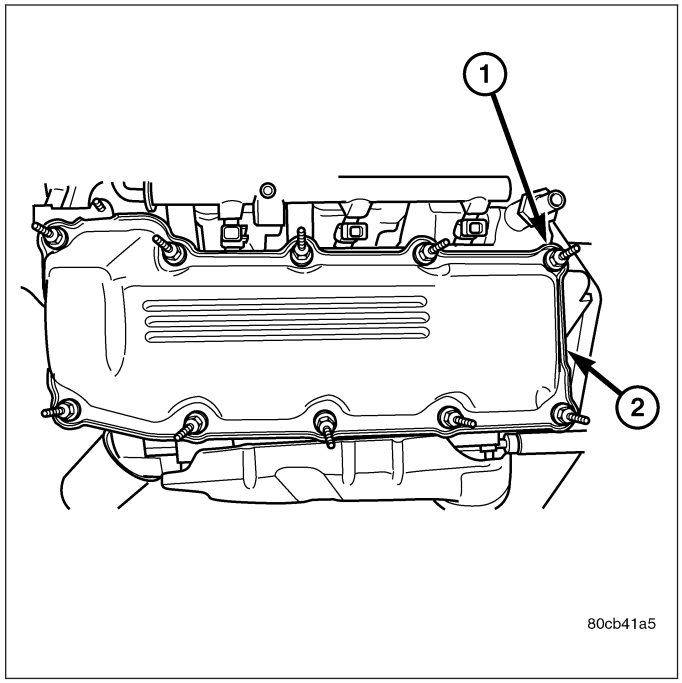


## INSTALLATION

**CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.**

**NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.**

1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Install cylinder head cover (2).
3. Tighten cylinder head cover bolts (1) and double ended studs to 12 N·m (105 in. lbs.).
4. Install left side breather and connect breather tube.
5. Connect injector electrical connectors and injector harness retaining clips.
6. Install the resonator and air inlet hose.
7. Connect negative cable to battery.



# VALVES & SEATS - INTAKE/EXHAUST

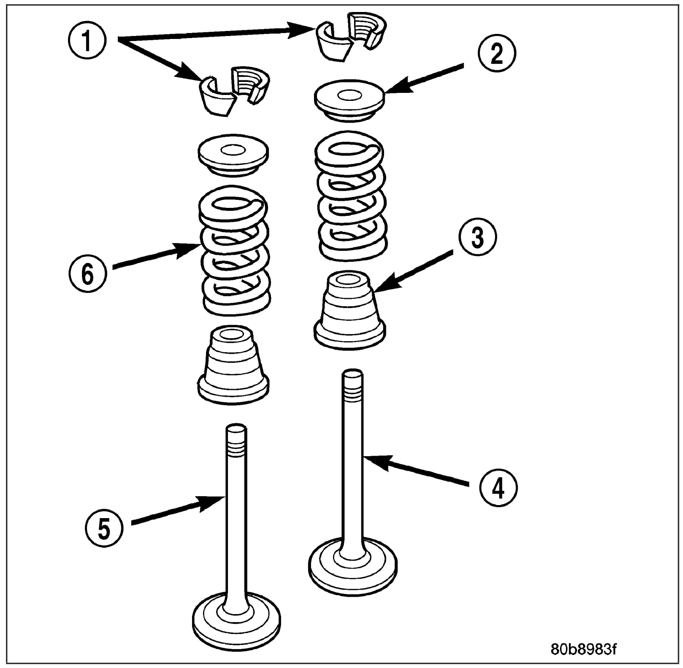
## DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

## STANDARD PROCEDURE - REFACING

**NOTE: Valve seats that are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise the cylinder head must be replaced.**

**NOTE: When refacing valves (4) and valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.**




1. Using a suitable dial indicator measure the center of the valve seat. Total run out must not exceed 0.051 mm (0.002 in).
2. Apply a small amount of Prussian blue to the valve seat, insert the valve into the cylinder head, while applying light pressure on the valve rotate the valve. Remove the valve and examine the valve face. If the blue is transferred below the top edge of the valve face, lower the valve seat using a 15 degree stone. If the blue is transferred to the bottom edge of the valve face, raise the valve seat using a 65 degree stone.
3. When the seat is properly positioned the width of the intake seat must be 1.75 - 2.36 mm (0.0689 - 0.0928 in.) and the exhaust seat must be 1.71 - 2.32 mm (0.0673 - 0.0911 in.).
4. Check the valve spring (6) installed height after refacing the valve and seat. The installed height for both intake and exhaust valve springs must not exceed 40.74 mm (1.6039 in.).
5. The valve seat and valve face must maintain a face angle of 44.5 - 45 ° angle.

## REMOVAL

**NOTE: The cylinder heads must be removed in order to perform this procedure.**

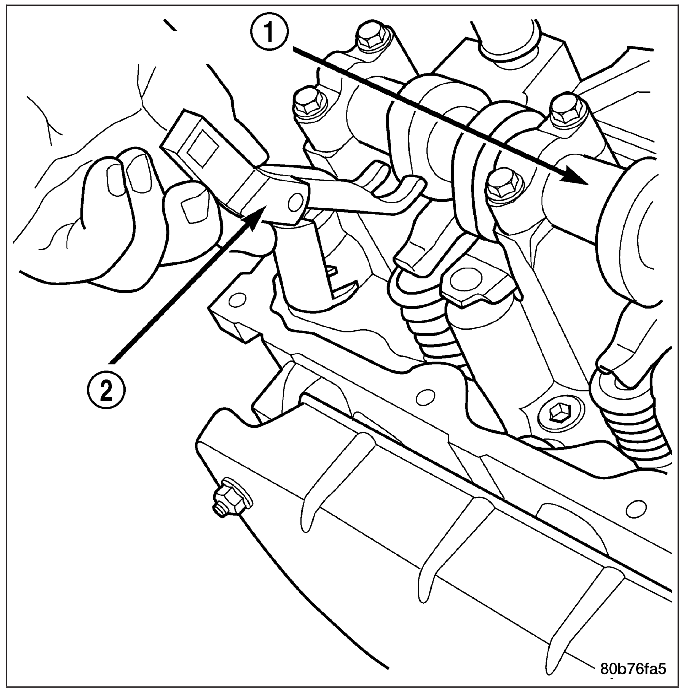
1. Remove rocker arms and lash adjusters (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).
2. Remove the camshaft bearing caps and the camshaft.

**NOTE: All valve springs and valves are removed in the same manner; this procedure only covers one valve and valve spring.**

3. Using Special Tool C-3422–B or C-3422–C Valve Spring Compressor and Special tool 8519 Adapter, compress the valve spring.

**NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.**

4. Remove the two spring retainer lock halves.




**NOTE: the valve spring is under tension use care when releasing the valve spring compressor.**

5. Remove the valve spring compressor.
6. Remove the spring retainer, and the spring.

**NOTE: Check for sharp edges on the keeper grooves. Remove any burrs from the valve stem before removing the valve from the cylinder head.**

7. Remove the valve from the cylinder head.

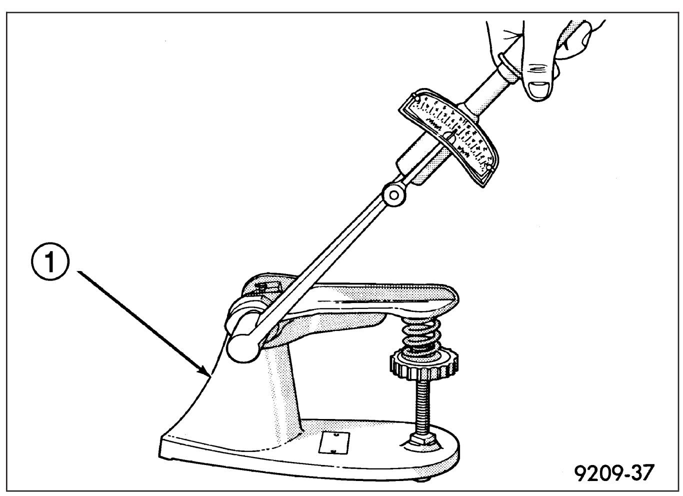
**NOTE: The valve stem seals are common between intake and exhaust.**

8. Remove the valve stem seal. Mark the valve for proper installation.

## TESTING VALVE SPRINGS

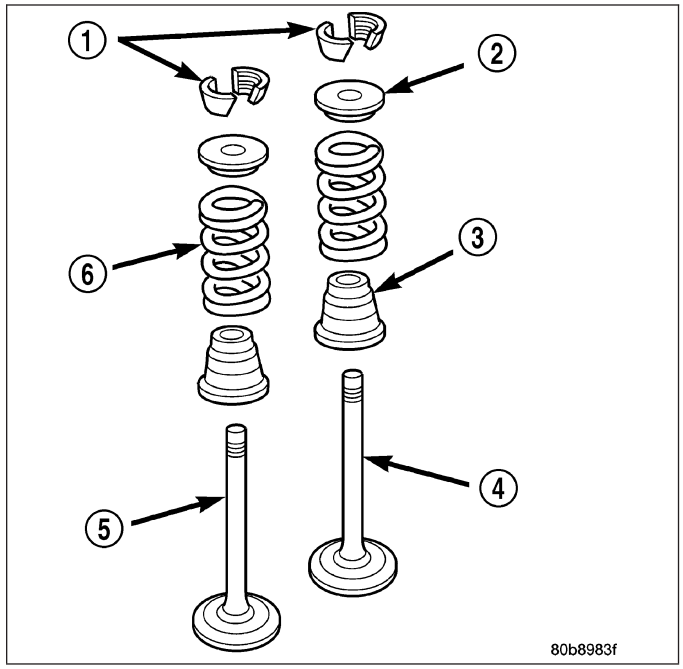
**NOTE: Whenever the valves are removed from the cylinder head it is recommended that the valve springs be inspected and tested for reuse.**

Inspect the valve springs for physical signs of wear or damage. Turn table of tool C-647 (1) until surface is in line with the 40.12 mm (1.579 in.) mark on the threaded stud and the zero mark on the front. Place spring over the stud on the table and lift compressing lever to set tone device. Pull on torque wrench until a Ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to Specifications Section to obtain specified height and allowable tensions. Replace any springs that do not meet specifications.

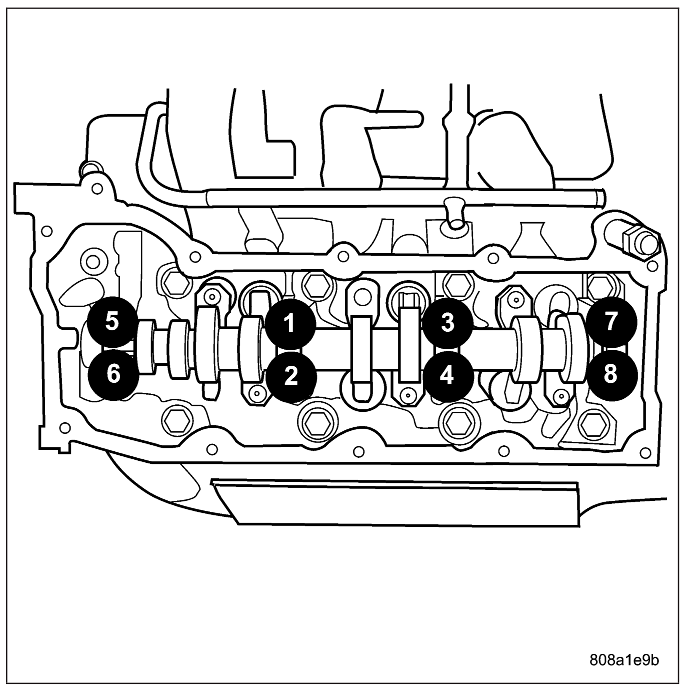


## INSTALLATION

1. coat the valve stem with clean engine oil and insert it into the cylinder head.
2. Install the valve stem seal. make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
3. Install the spring and the spring retainer.
4. Using the valve spring compressor, compress the spring and install the two valve spring retainer halves.
5. Release the valve spring compressor and make sure the two spring retainer halves and the spring retainer are fully seated.




6. lubricate the camshaft journal with clean engine oil then Position the camshaft (with the sprocket dowel on the left camshaft at 11 o'clock and the right camshaft at 12 o'clock), then position the camshaft bearing caps.
7. Install the camshaft bearing cap retaining bolts. Tighten the bolts 9-13 N·m (100 in. lbs.) in 1/2 turn increments in the sequence shown .
8. Position the hydraulic lash adjusters and rocker arms (Refer to 9 - ENGINE/CYLINDER HEAD/ ROCKER ARM / ADJUSTER ASSY - INSTALLATION).



# ARM-VALVE ROCKER

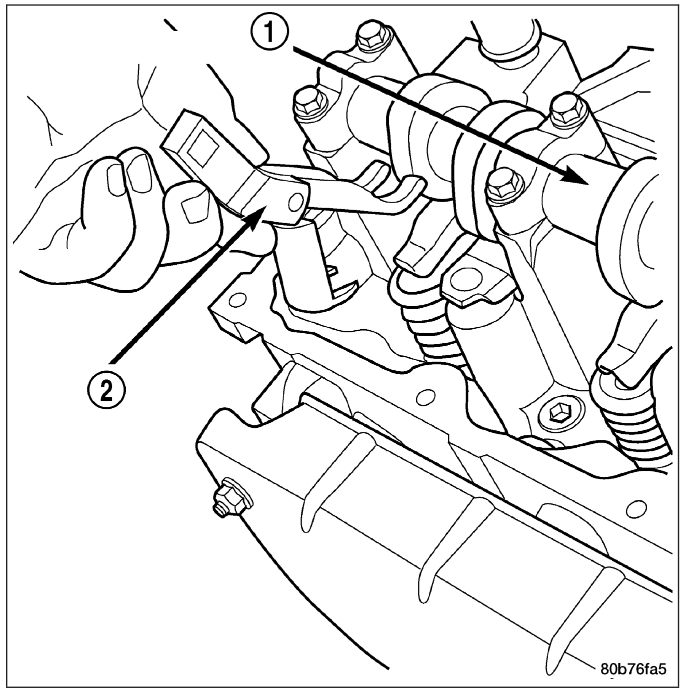
## DESCRIPTION

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate a 2.8 mm (0.11 inch) oil hole in the lash adjuster socket for roller and camshaft lubrication.

## REMOVAL

**NOTE: Disconnect the battery negative cable to prevent accidental starter engagement.**

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. For rocker arm removal on cylinder No. 4, Rotate the crankshaft until cylinder No. 1 is at BDC intake stroke.
3. For rocker arm removal on cylinder No. 1, Rotate the crankshaft until cylinder No. 1 is at BDC combustion stroke.
4. For rocker arm removal on cylinders No. 3 and No. 5, Rotate the crankshaft until cylinder No. 1 is at TDC exhaust stroke.
5. For rocker arm removal on cylinders No. 2 and No. 6, Rotate the crankshaft until cylinder No. 1 is at TDC ignition stroke.
6. Using special tool 8516 Rocker Arm Remover (2) , press downward on the valve spring, remove rocker arm.



# SEALS-VALVE GUIDE

## DESCRIPTION

The valve guide seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

# SPRINGS-VALVE

## DESCRIPTION

The valve springs are made from high strength chrome silicon steel. The springs are NOT common for intake and exhaust applications. The exhaust spring has an external damper. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

## REMOVAL

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Using Special Tool 8516 Valve Spring Compressor, remove the rocker arms and the hydraulic lash adjusters.
3. Remove the spark plug for the cylinder the valve spring and seal are to be removed from.
4. Apply shop air to the cylinder to hold the valves in place when the spring is removed.

**NOTE: All six valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.**

5. Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.

**NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.**

6. Remove the two spring retainer lock halves.

**NOTE: the valve spring is under tension use care when releasing the valve spring compressor.**

7. Remove the valve spring compressor.

**NOTE: The valve springs are NOT common between intake and exhaust.**

8. Remove the spring retainer, and the spring.
9. Remove the valve stem seal.

**NOTE: The valve stem seals are common between intake and exhaust.**

## INSTALLATION

**NOTE: All six valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.**

1. Apply shop air to the cylinder to hold the valves in place while the spring is installed.

**NOTE: The valve stem seals are common between intake and exhaust.**

2. Install the valve stem seal.

**NOTE: The valve springs are NOT common between intake and exhaust.**

3. Install the spring retainer, and the spring.
4. Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.
5. Install the two spring retainer lock halves.

**NOTE: the valve spring is under tension use care when releasing the valve spring compressor.**

6. Remove the valve spring compressor.
7. Disconnect the shop air to the cylinder.
8. Install the spark plug for the cylinder the valve spring and seal was installed on.

9. Using Special Tool 8516 Valve Spring Compressor, install the rocker arms and the hydraulic lash adjusters.
10. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

# HEAD-CYLINDER-RIGHT

## DESCRIPTION

## DESCRIPTION - CYLINDER HEAD

The cylinder heads are made of an aluminum alloy. The cylinder head features two valves per cylinder with pressed in powdered metal valve guides. The cylinder heads also provide enclosures for the timing chain drain, necessitating unique left and right cylinder heads.

## DESCRIPTION - VALVE GUIDES

The valve guides are made of powered metal and are pressed into the cylinder head. The guides are not replaceable or serviceable, and valve guide reaming is not recommended. If the guides are worn beyond acceptable limits, replace the cylinder heads.

## DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

## DIAGNOSIS AND TESTING

## DIAGNOSIS AND TESTING - HYDRAULIC LASH ADJUSTER

A tappet-like noise may be produced from several items. Check the following items.

1. Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.
2. Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.
3. Turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.
4. Low oil pressure.
5. The oil restrictor in cylinder head gasket or the oil passage to the cylinder head is plugged with debris.
6. Air ingested into oil due to broken or cracked oil pump pick up.
7. Worn valve guides.
8. Rocker arm ears contacting valve spring retainer.
9. Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.
10. Oil leak or excessive cam bore wear in cylinder head.
11. Faulty lash adjuster.
    a. Check lash adjusters for sponginess while installed in cylinder head and cam on camshaft at base circle. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.
    b. Remove suspected lash adjusters, and replace.
    c. Before installation, make sure adjusters are at least partially full of oil. This can be verified by little or no plunger travel when lash adjuster is depressed.

## DIAGNOSIS AND TESTING - CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

## CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50–70% reduction in compression pressure.

## CYLINDER-TO-WATER JACKET LEAKAGE TEST

**WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.**

### VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

### COOLING SYSTEM TESTER METHOD

**WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).**

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

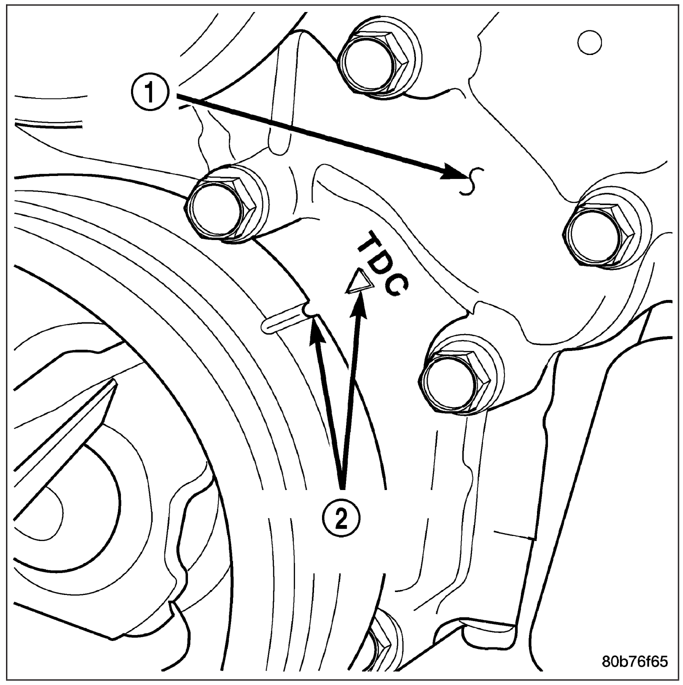
### CHEMICAL TEST METHOD

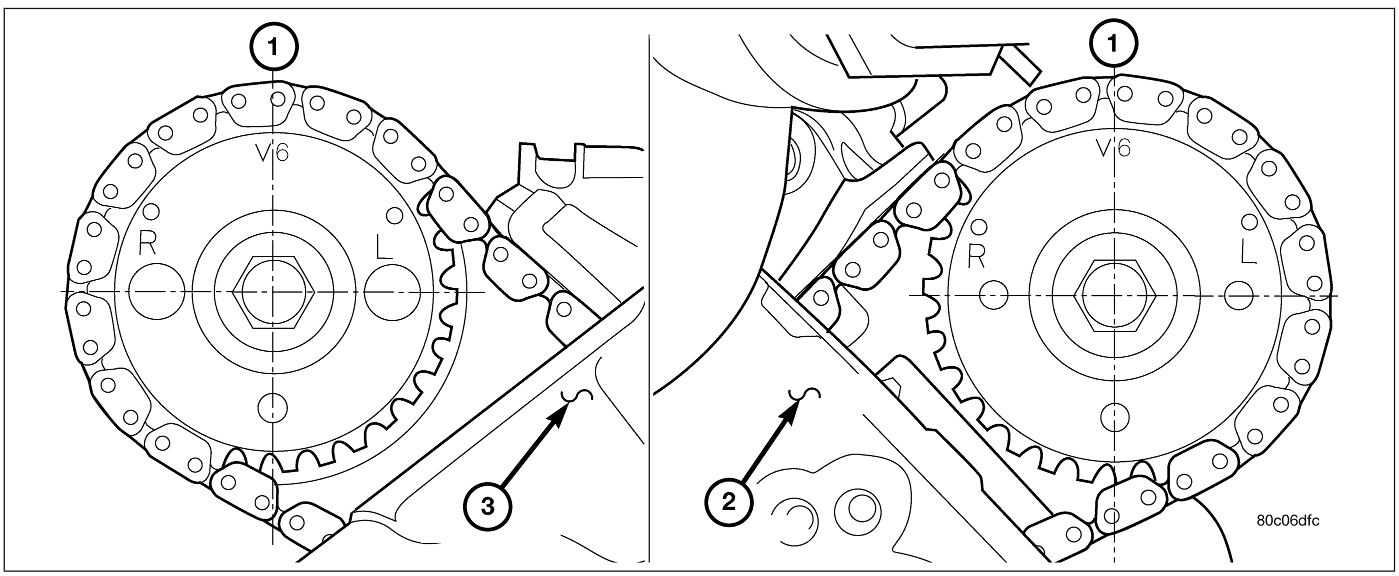
Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

## REMOVAL

## REMOVAL RIGHT CYLINDER HEAD

1. Disconnect battery negative cable.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the right side exhaust manifold.
4. Drain the engine coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Lower the vehicle.
6. Remove the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
7. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
8. Remove the fan shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
9. Remove oil fill housing from cylinder head.
10. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
11. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (2).



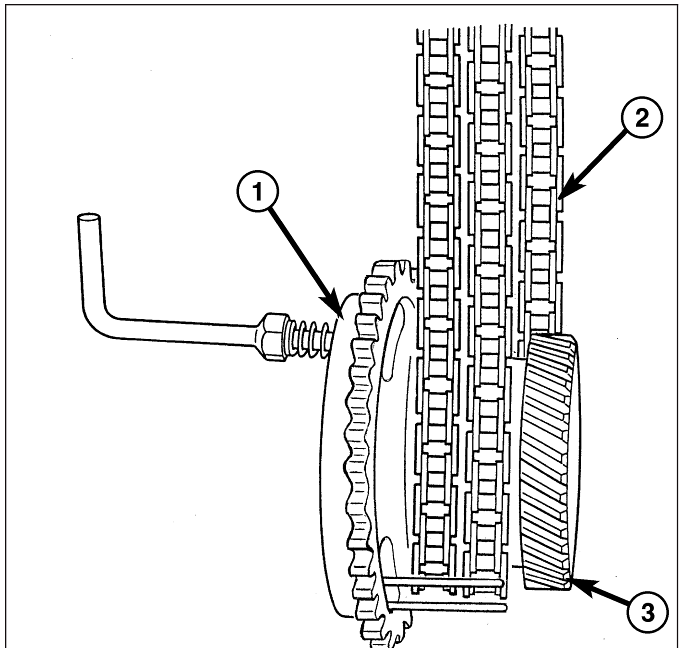




12. Verify the V6 mark on the camshaft sprocket is at the 12 o'clock position. Rotate the crankshaft one turn if necessary.
13. Remove the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
14. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

15. Lock the secondary timing chains to the idler sprocket using Special Tool 8429 Timing Chain Holding Fixture (1).

**NOTE: Mark the secondary timing chain prior to removal to aid in installation.**

16. Mark the secondary timing chain, one link on each side of the V6 mark on the camshaft drive gear.
17. Remove the right side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).



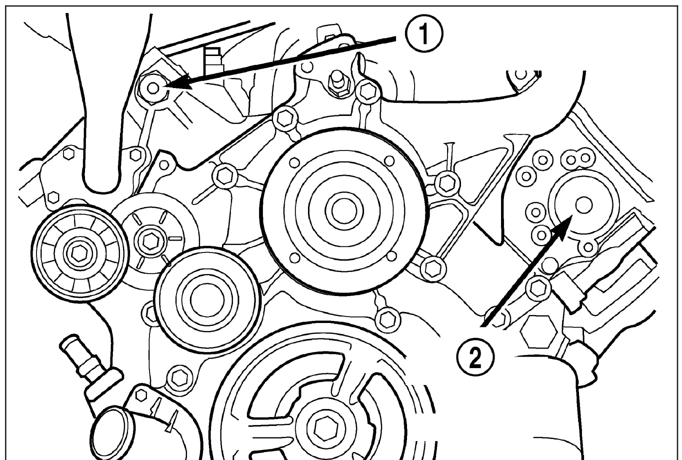
80cb5655

18. Remove the cylinder head access plug (1,2).
19. Remove the right side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

**CAUTION: The nut on the right side camshaft sprocket should not be removed for any reason, as the sprocket and camshaft sensor target wheel is serviced as an assembly. If the nut was removed, torque nut to 5 N·m (44 in. lbs.).**

20. Remove the retaining bolt and the camshaft drive gear.

**CAUTION: Do not allow the engine to rotate. severe damage to the valve train can occur.**



80b897e2

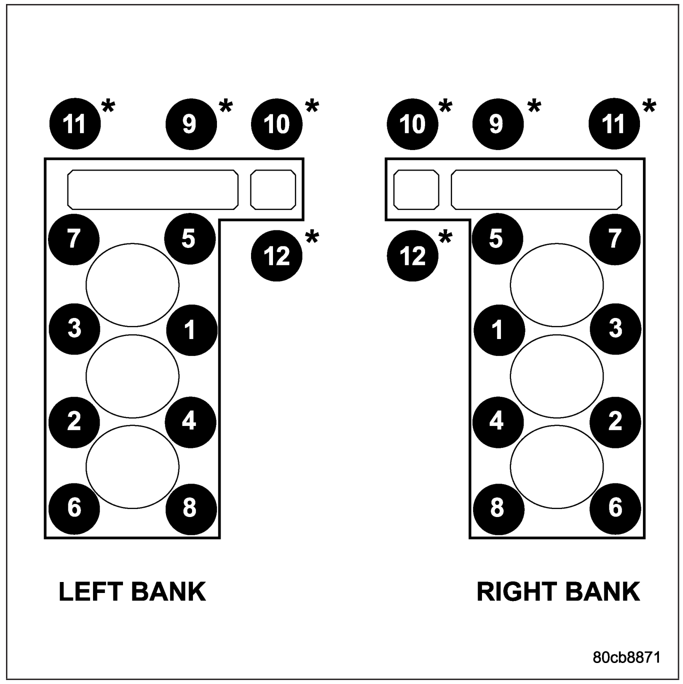
**CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.**

**CAUTION: Do not hold or pry on the camshaft target wheel for any reason. A damaged target wheel can result in a vehicle no start condition.**

**NOTE: The cylinder head is attached to the cylinder block with twelve bolts.**

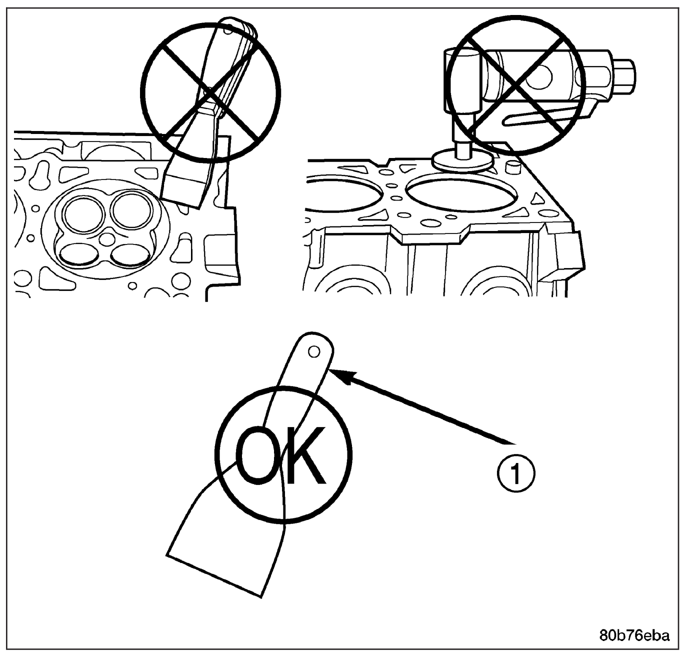
21. Remove the cylinder head retaining bolts.
22. Remove the cylinder head and gasket. Discard the gasket.

**CAUTION: Do not lay the cylinder head on its gasket sealing surface, do to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.**




## CLEANING

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components. (Refer to 9 - ENGINE - STANDARD PROCEDURE).




## INSPECTION

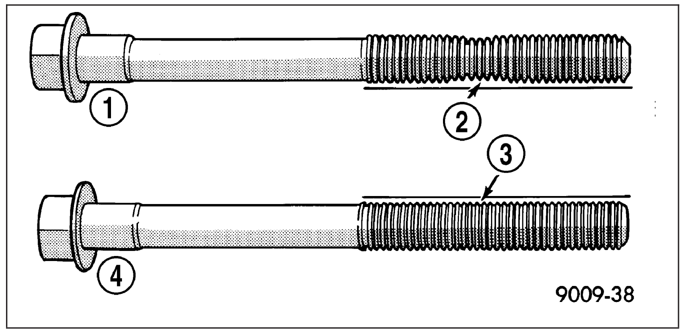
1. Inspect the cylinder head for out-of-flatness, using a straightedge and a feeler gauge. If measurements exceed 0.0508 mm (0.002 in.) replace the cylinder head.
2. Inspect the valve seats for damage. Service the valve seats as necessary.
3. Inspect the valve guides for wear, cracks or looseness. If either condition exist, replace the cylinder head.

# INSTALLATION

## INSTALLATION RIGHT CYLINDER HEAD

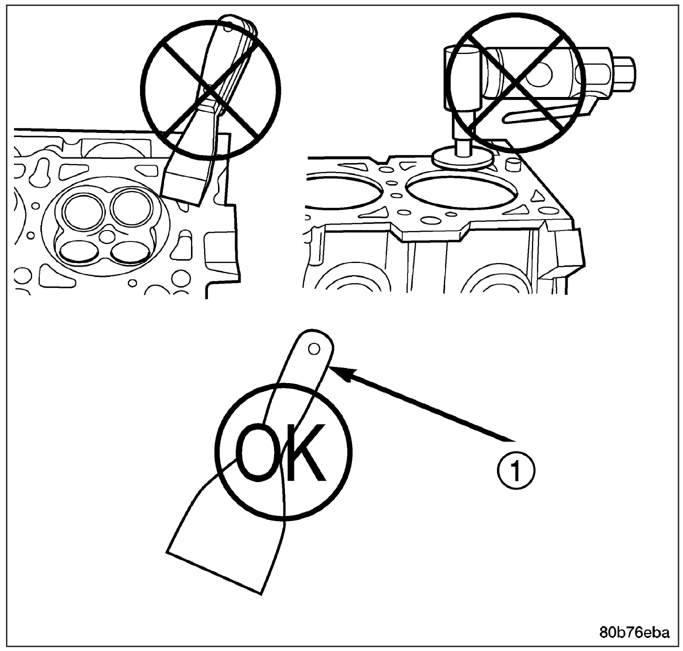
**NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down (2) the bolts should be replaced.**

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced.




**CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper (1).**

1. Clean the cylinder head and cylinder block mating surfaces.



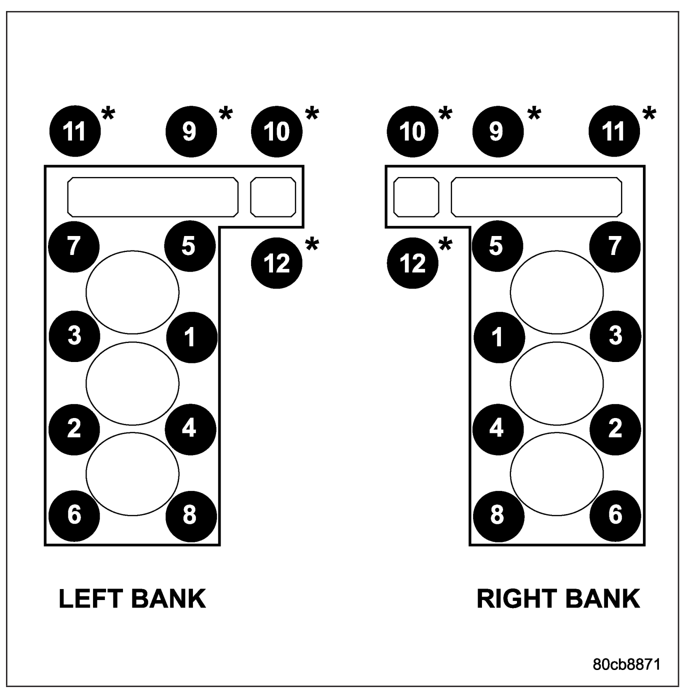

2. Position the new cylinder head gasket on the locating dowels.

**CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.**

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

**NOTE: The four M8 cylinder head mounting bolts (1) require sealant to be added to them before installing. Failure to do so may cause leaks.**

4. Lubricate the cylinder head bolt threads with clean engine oil and install the eight M10 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar Lock and Seal Adhesive** then install the bolts.




**NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.**

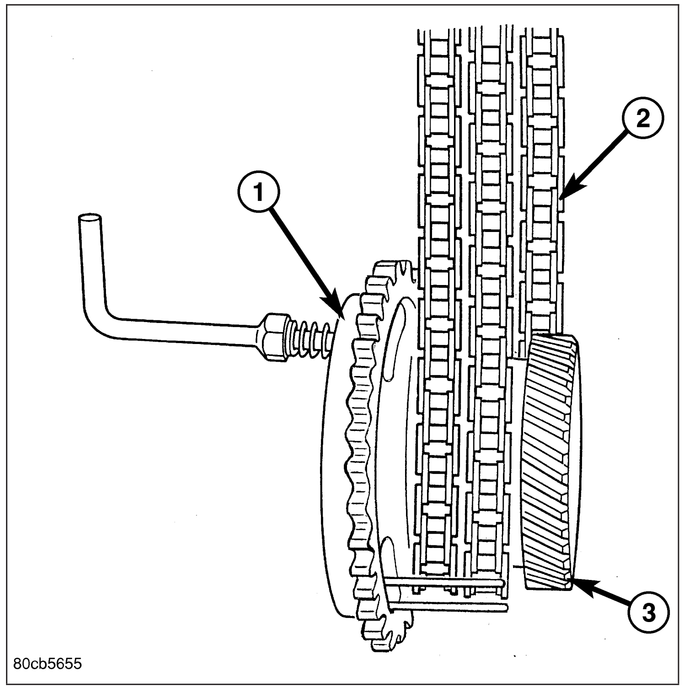
6. Tighten the bolts in sequence using the following steps and torque values :
   - Step 1: Tighten bolts 1-8, 27 N·m (20 ft. lbs.).
   - Step 2: Verify that bolts 1-8, all reached 27 N·m (20 ft. lbs.), by repeating step 1 without loosening the bolts. Tighten bolts 9 thru 12 to 14 N·m (10 ft. lbs.).
   - Step 3: Tighten bolts 1-8, 90 °.
   - Step 4: Tighten bolts 1-8, 90 °, again. Tighten bolts 9-12, 26 N·m (19 ft. lbs.)

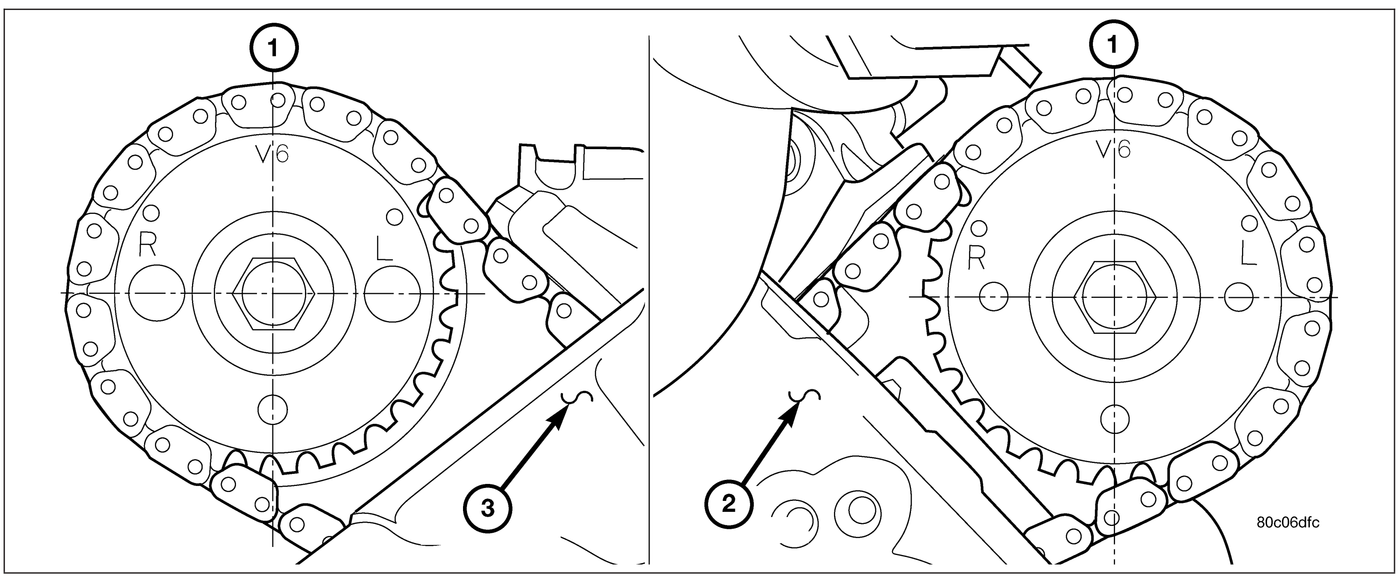
**CAUTION: The nut on the right side camshaft sprocket should not be removed for any reason, as the sprocket and camshaft sensor target wheel is serviced as an assembly. If the nut was removed, torque nut to 5 NM ( 60 in. lbs.).**

7. Position the secondary chain (2) onto the camshaft drive gear, making sure one marked chain link is on either side of the V6 mark (1) on the gear then using Special Tool 8428 Camshaft Wrench, position the gear onto the camshaft.

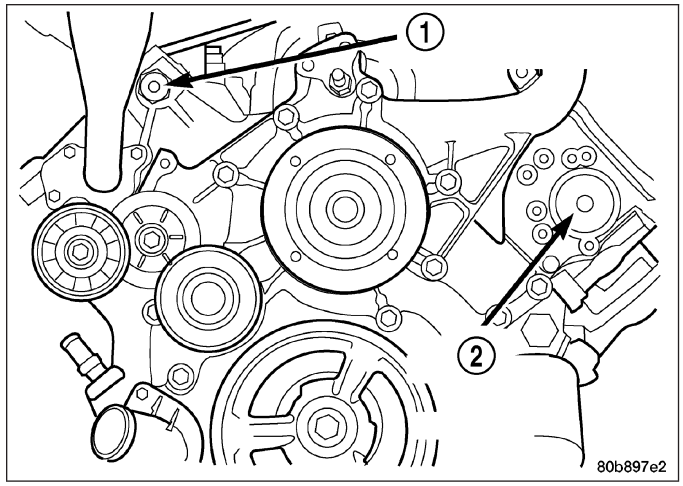
**CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torquing of bolt resulting in bolt failure.**

8. Install the camshaft drive gear retaining bolt.
9. Install the right side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/ CHAIN AND SPROCKETS - INSTALLATION).

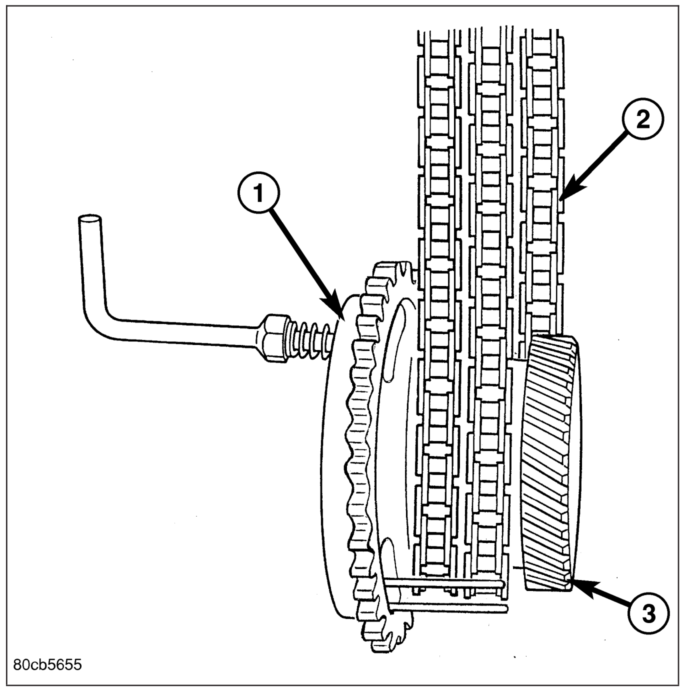


10. Install the cylinder head access plug (1,2).
11. Re-set and install the right side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/ TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).




12. Remove Special Tool 8429 (1).
13. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
14. Install the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION). Tighten damper bolt 175 N·m (130 Ft. Lbs.).
15. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
16. Install the fan shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
17. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
18. Install the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
19. Install oil fill housing onto cylinder head.
20. Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
21. Raise the vehicle.
22. Install the exhaust pipe onto the right exhaust manifold.
23. Lower the vehicle.
24. Reconnect battery negative cable.
25. Start the engine and check for leaks.

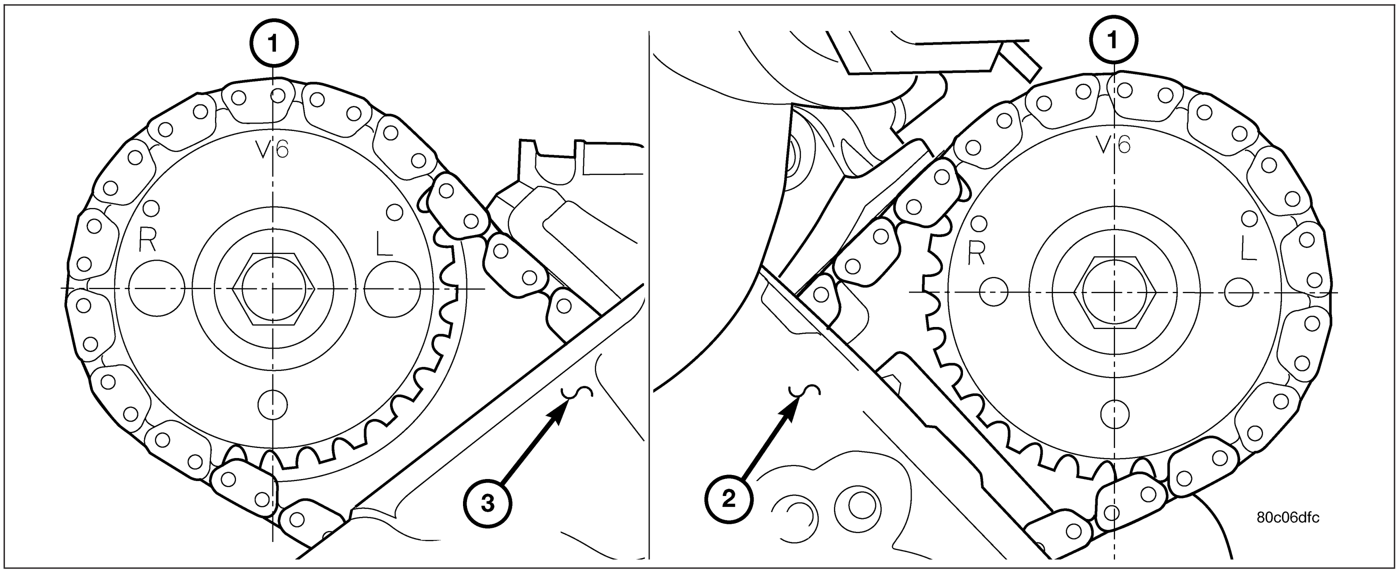


# CAMSHAFT

## DESCRIPTION

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. Four bearing journals are machined into the camshaft. Camshaft end play is controlled by two thrust walls that border the nose piece journal.

## REMOVAL



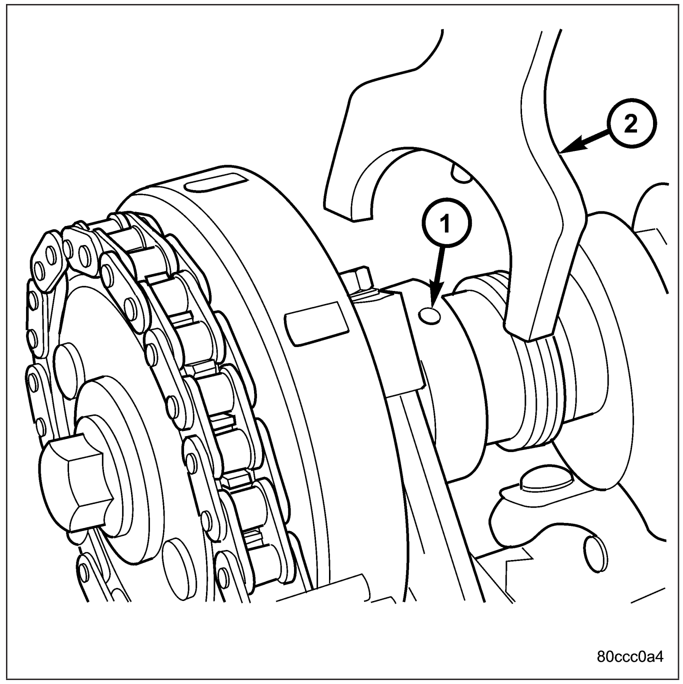

**CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.**

**CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use special tool 8379 will result in hydraulic tensioner ratchet over extension, Requiring timing chain cover removal to re-set the tensioner ratchet.**

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Set engine to TDC cylinder No. 1, camshaft sprocket V6 marks at the 12 o'clock position (1).
3. Mark one link on the secondary timing chain on both sides of the V6 mark on the camshaft sprocket to aid in installation.

**CAUTION: Do not hold or pry on the camshaft target wheel for any reason, Severe damage will occur to the target wheel. A damaged target wheel could cause a vehicle no start condition.**

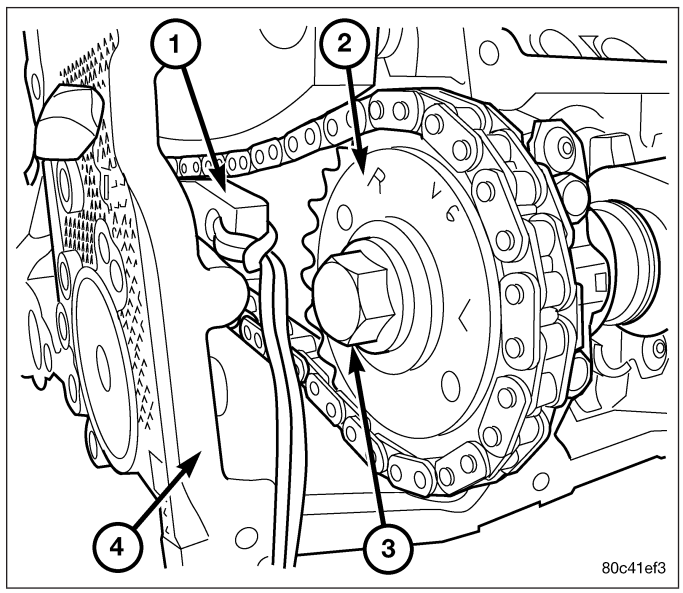
4. Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave bolt snug against sprocket.



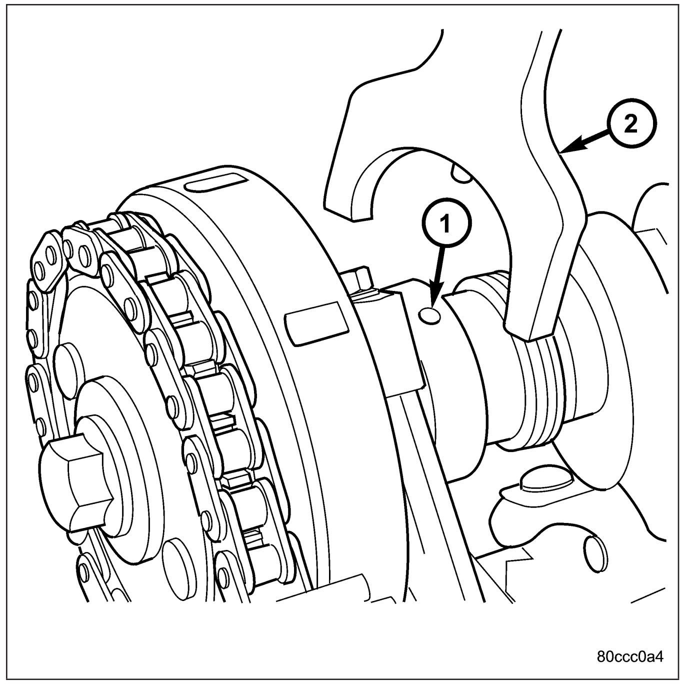

**NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.**

**CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.**

5. Position Special Tool 8379 timing chain wedge (1) between the timing chain strands. Tap the tool to securely wedge the timing chain against the tensioner arm and guide.



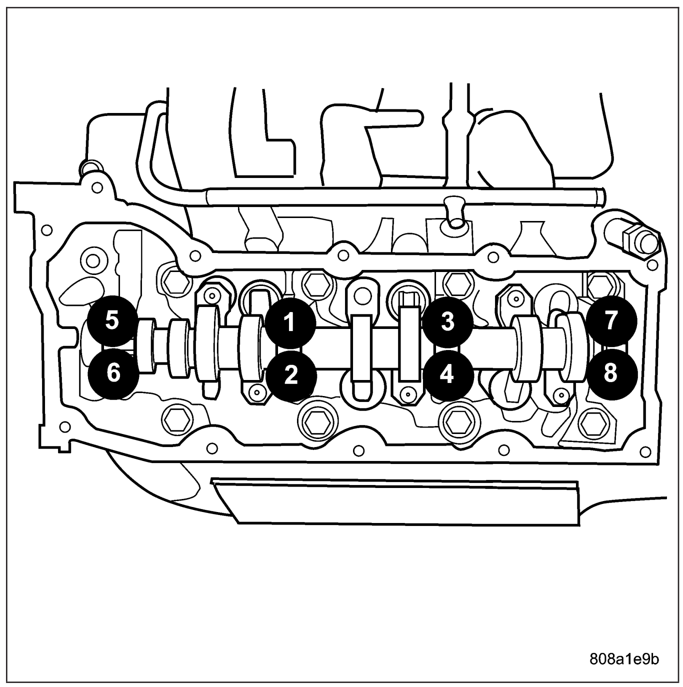
6. Remove the camshaft position sensor.
7. Hold the camshaft with Special Tool 8428 Camshaft Wrench (2), while removing the camshaft sprocket bolt and sprocket.




8. Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

**CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.**

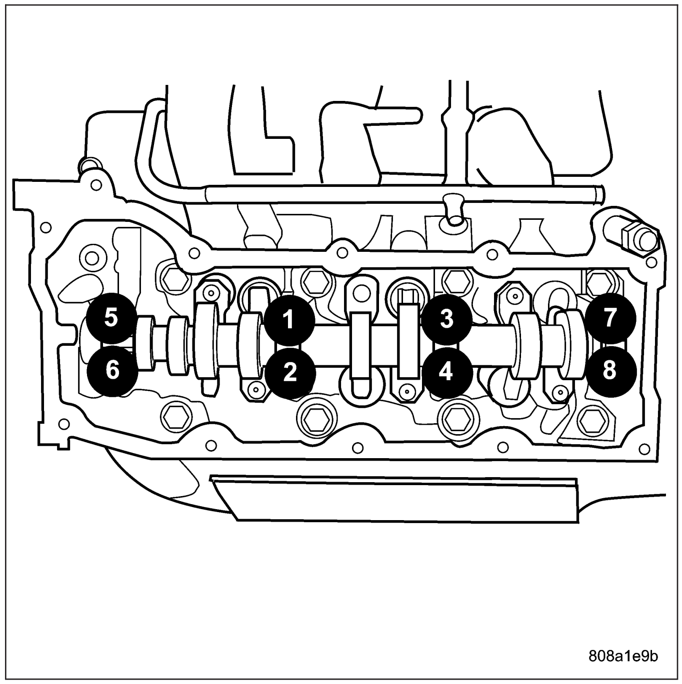
**NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.**




9. Remove the camshaft bearing caps and the camshaft.

## INSTALLATION

1. Lubricate camshaft journals with clean engine oil.

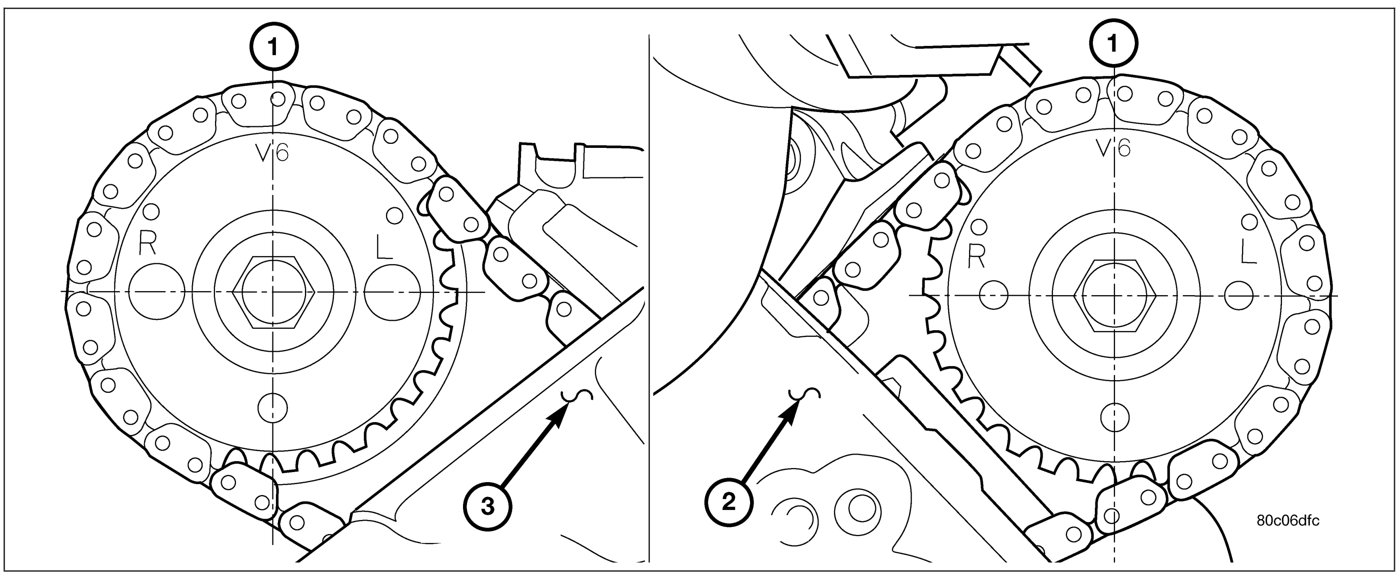



**NOTE: Position the right side camshaft so that the camshaft sprocket dowel is near the 10 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.**

2. Position the camshaft into the cylinder head.
3. Install the camshaft bearing caps, hand tighten the retaining bolts.

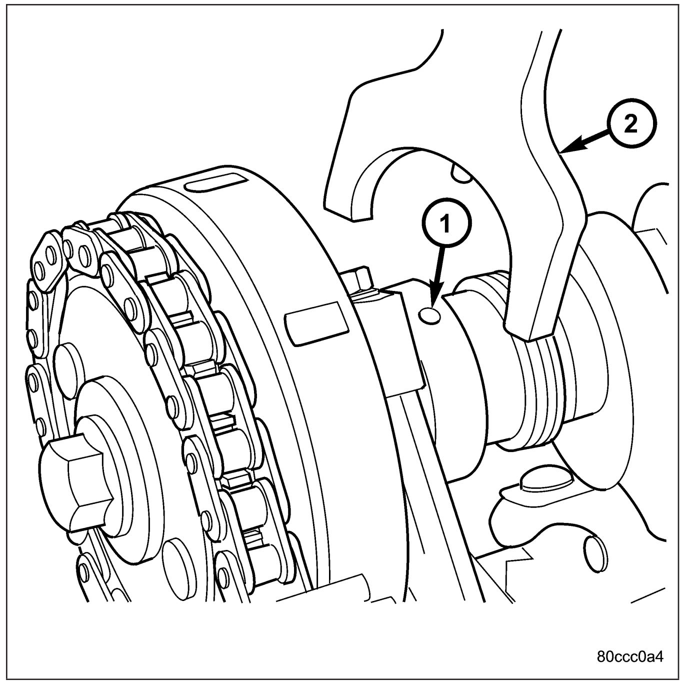
**NOTE: Caps should be installed so that the stamped numbers on the caps are in numerical order, ( 1 thru 4 ) from the front to the rear of the engine. All caps should be installed so that the stamped arrows on the caps point toward the front of the engine.**

4. Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward.
5. Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).




6. Position the camshaft drive gear into the timing chain aligning the V6 mark between the two marked chain links (Two links marked during removal) .

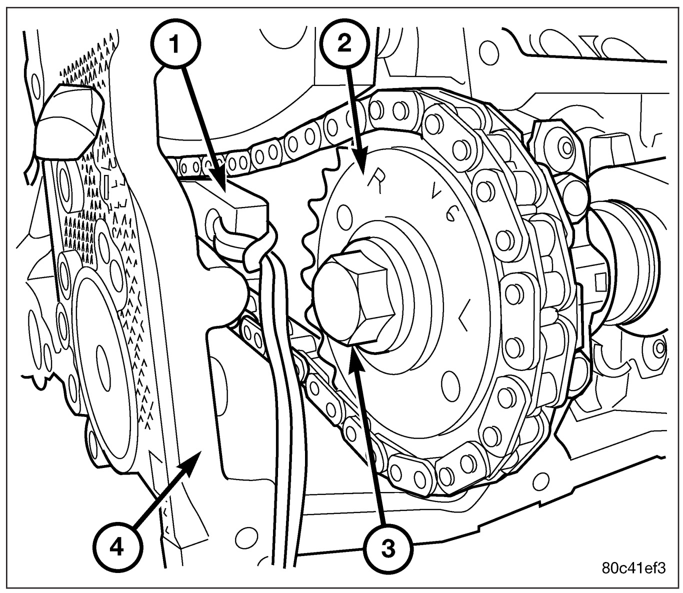
7. Using Special Tool 8428 Camshaft Wrench (2), rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft.




**CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.**

8. Remove excess oil from camshaft sprocket bolt, then install the camshaft sprocket retaining bolt and hand tighten.

9. Remove timing chain wedge special tool 8379 (1).
10. Using Special Tool 6958 spanner wrench with adapter pins 8346, torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).
11. Install the camshaft position sensor.
12. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).



# COVER - CYLINDER HEAD

## REMOVAL

1. Disconnect battery negative cable.
2. Remove air cleaner assembly, resonator assembly and air inlet hose.
3. Drain cooling system, below the level of the heater hoses (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
5. Remove air conditioning compressor retaining bolts and move compressor to the left.
6. Remove heater hoses.
7. Disconnect injector and ignition coil connectors.
8. Disconnect and remove positive crankcase ventilation (PCV) hose.
9. Remove oil fill tube.
10. Un-clip injector and ignition coil harness and move away from cylinder head cover.
11. Remove right rear breather tube and filter assembly.
12. Remove cylinder head cover retaining bolts.
13. Remove cylinder head cover.

## INSTALLATION

**CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.**

**NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.**

1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Tighten cylinder head cover bolts and double ended studs to 12 N·m (105 in. lbs).
3. Install right rear breather tube and filter assembly.
4. Connect injector, ignition coil electrical connectors and harness retaining clips.
5. Install the oil fill tube.
6. Install PCV hose.
7. Install heater hoses.
8. Install air conditioning compressor retaining bolts.
9. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
10. Fill Cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
11. Install air cleaner assembly, resonator assembly and air inlet hose.
12. Connect battery negative cable.

# VALVES & SEATS - INTAKE/EXHAUST

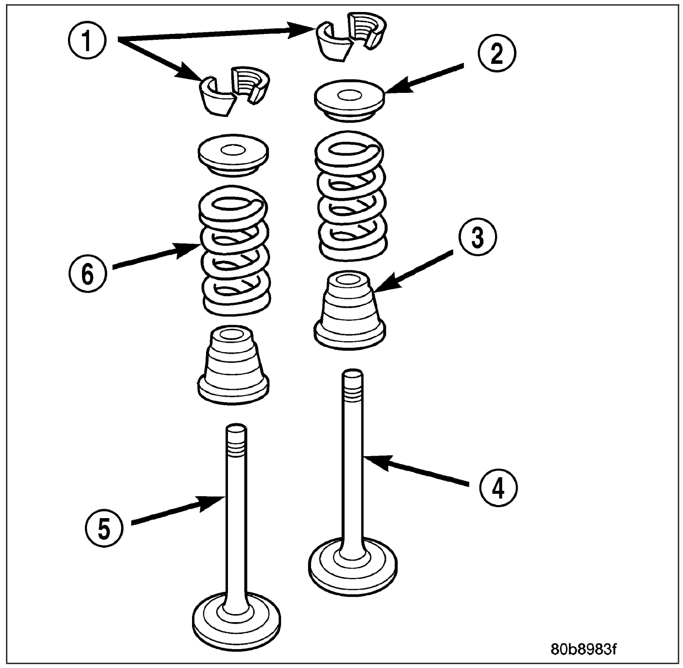
## DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

## STANDARD PROCEDURE - REFACING

**NOTE: Valve seats that are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise the cylinder head must be replaced.**

**NOTE: When refacing valves (4) and valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.**




1. Using a suitable dial indicator measure the center of the valve seat. Total run out must not exceed 0.051 mm (0.002 in).
2. Apply a small amount of Prussian blue to the valve seat, insert the valve into the cylinder head, while applying light pressure on the valve rotate the valve. Remove the valve and examine the valve face. If the blue is transferred below the top edge of the valve face, lower the valve seat using a 15 degree stone. If the blue is transferred to the bottom edge of the valve face, raise the valve seat using a 65 degree stone.
3. When the seat is properly positioned the width of the intake seat must be 1.75 - 2.36 mm (0.0689 - 0.0928 in.) and the exhaust seat must be 1.71 - 2.32 mm (0.0673 - 0.0911 in.).
4. Check the valve spring (6) installed height after refacing the valve and seat. The installed height for both intake and exhaust valve springs must not exceed 40.74 mm (1.6039 in.).
5. The valve seat and valve face must maintain a face angle of 44.5 - 45 ° angle.

## REMOVAL

**NOTE: The cylinder heads must be removed in order to perform this procedure.**

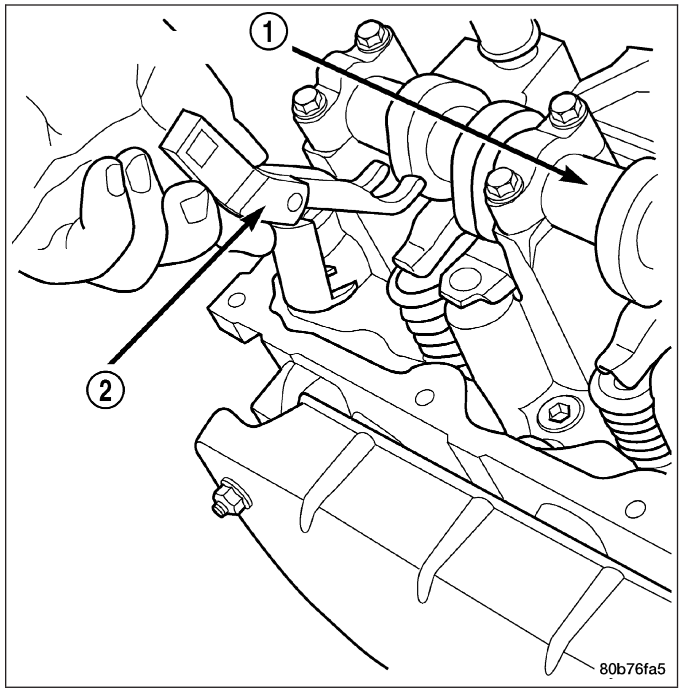
1. Remove rocker arms and lash adjusters (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).
2. Remove the camshaft bearing caps and the camshaft.

**NOTE: All valve springs and valves are removed in the same manner; this procedure only covers one valve and valve spring.**

3. Using Special Tool C-3422–B or C-3422–C Valve Spring Compressor and Special tool 8519 Adapter, compress the valve spring.

**NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.**

4. Remove the two spring retainer lock halves.




**NOTE: the valve spring is under tension use care when releasing the valve spring compressor.**

5. Remove the valve spring compressor.
6. Remove the spring retainer, and the spring.

**NOTE: Check for sharp edges on the keeper grooves. Remove any burrs from the valve stem before removing the valve from the cylinder head.**

7. Remove the valve from the cylinder head.

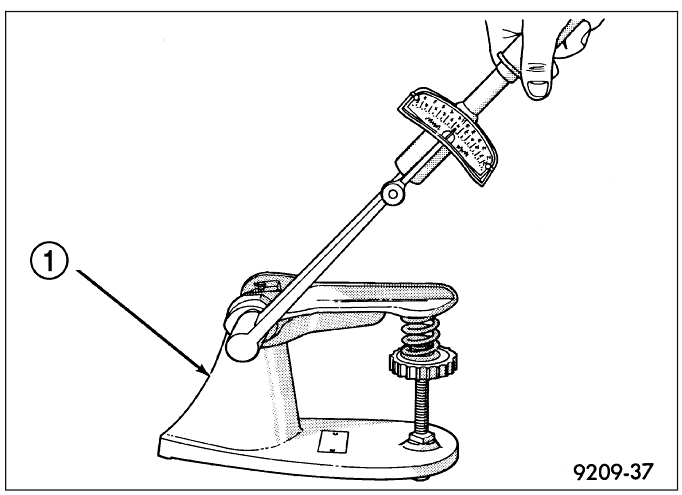
**NOTE: The valve stem seals are common between intake and exhaust.**

8. Remove the valve stem seal. Mark the valve for proper installation.

## TESTING VALVE SPRINGS

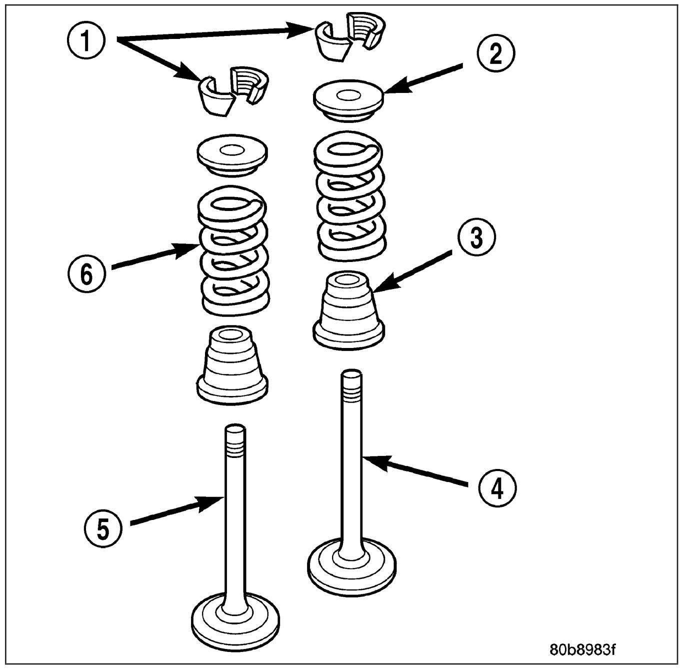
**NOTE: Whenever the valves are removed from the cylinder head it is recommended that the valve springs be inspected and tested for reuse.**

Inspect the valve springs for physical signs of wear or damage. Turn table of tool C-647 (1) until surface is in line with the 40.12 mm (1.579 in.) mark on the threaded stud and the zero mark on the front. Place spring over the stud on the table and lift compressing lever to set tone device. Pull on torque wrench until a Ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to Specifications Section to obtain specified height and allowable tensions. Replace any springs that do not meet specifications.

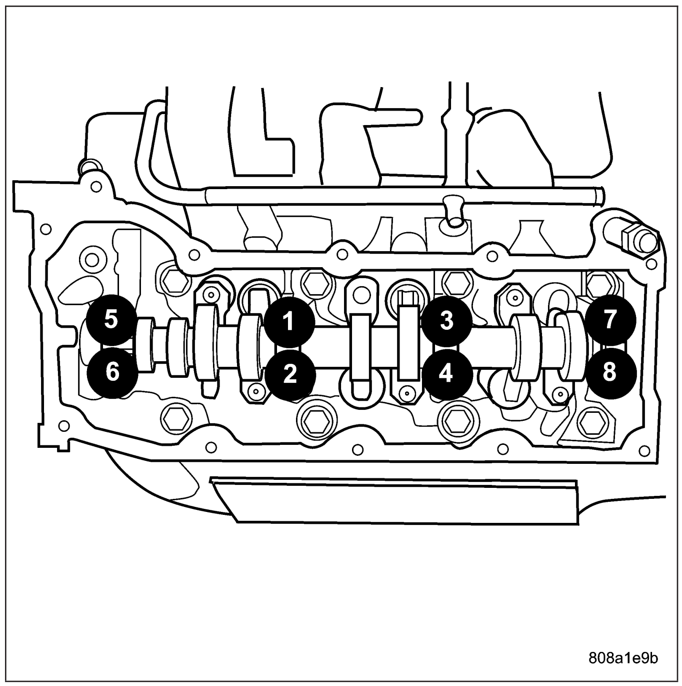


## INSTALLATION

1. coat the valve stem with clean engine oil and insert it into the cylinder head.
2. Install the valve stem seal. make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
3. Install the spring and the spring retainer.
4. Using the valve spring compressor, compress the spring and install the two valve spring retainer halves.
5. Release the valve spring compressor and make sure the two spring retainer halves and the spring retainer are fully seated.




6. lubricate the camshaft journal with clean engine oil then Position the camshaft (with the sprocket dowel on the left camshaft at 11 o'clock and the right camshaft at 12 o'clock), then position the camshaft bearing caps.
7. Install the camshaft bearing cap retaining bolts. Tighten the bolts 9-13 N·m (100 in. lbs.) in 1/2 turn increments in the sequence shown .
8. Position the hydraulic lash adjusters and rocker arms (Refer to 9 - ENGINE/CYLINDER HEAD/ ROCKER ARM / ADJUSTER ASSY - INSTALLATION).



# ROCKER ARM - VALVE

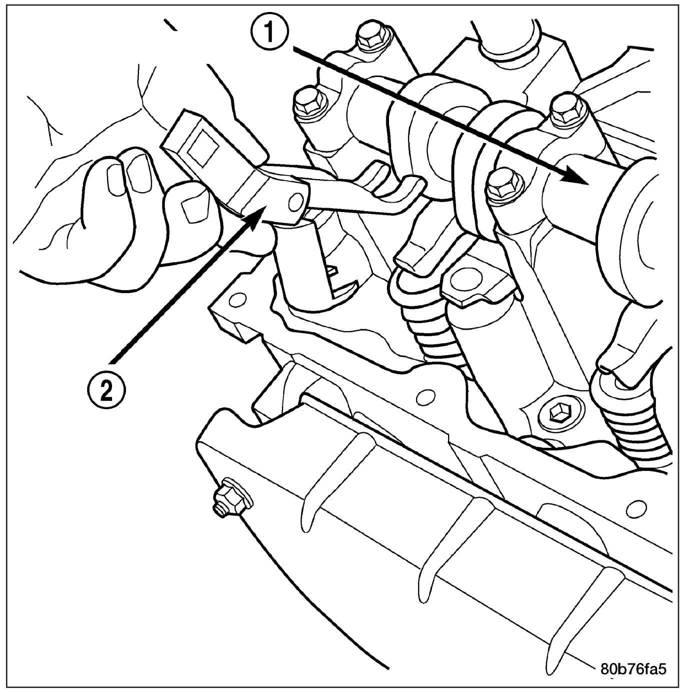
## DESCRIPTION

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate a 0.5 mm oil hole in the lash adjuster socket for roller and camshaft lubrication.

## REMOVAL

**NOTE: Disconnect the battery negative cable to prevent accidental starter engagement.**

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. For rocker arm removal on cylinder No. 4, Rotate the crankshaft until cylinder No. 1 is at BDC intake stroke.
3. For rocker arm removal on cylinder No. 1, Rotate the crankshaft until cylinder No. 1 is at BDC combustion stroke.
4. For rocker arm removal on cylinders No. 3 and No. 5, Rotate the crankshaft until cylinder No. 1 is at TDC exhaust stroke.
5. For rocker arm removal on cylinders No. 2 and No. 6, Rotate the crankshaft until cylinder No. 1 is at TDC ignition stroke.
6. Using special tool 8516 Rocker Arm Remover (2) , press downward on the valve spring, remove rocker arm.

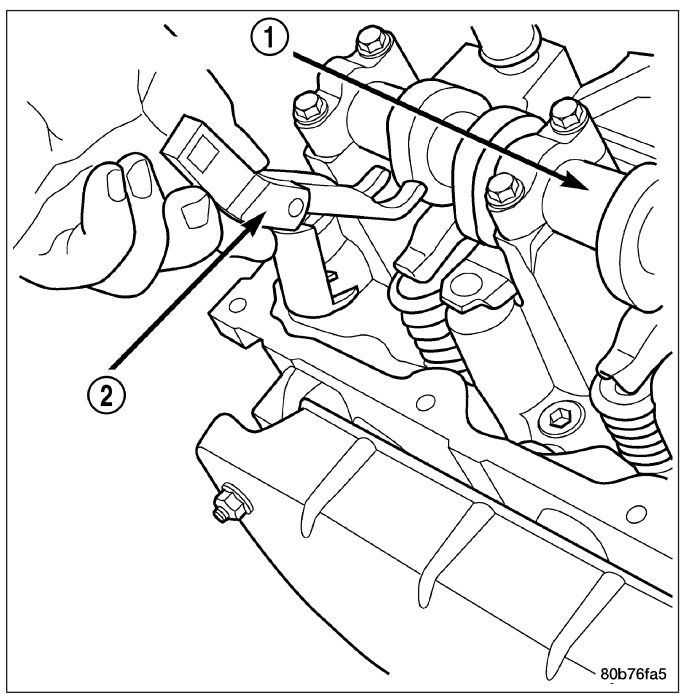



## INSTALLATION

**CAUTION: Make sure the rocker arms are installed with the concave pocket over the lash adjusters. Failure to do so may cause severe damage to the rocker arms and/or lash adjusters.**

**NOTE: Coat the rocker arms with clean engine oil prior to installation.**

1. For rocker arm installation on cylinders No. 4, Rotate the crankshaft until cylinder No. 1 is at BDC intake stroke.
2. For rocker arm installation on cylinder No. 1, Rotate the crankshaft until cylinder No. 1 is at BDC combustion stroke.
3. For rocker arm installation on cylinders No. 3 and No. 5, Rotate the crankshaft until cylinder No. 1 is at TDC exhaust stroke.
4. For rocker arm installation on cylinders No. 2 and No. 6, Rotate the crankshaft until cylinder No. 1 is at TDC ignition stroke.
5. Using special tool 8516 (2) press downward on the valve spring, install rocker arm.



6. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

# SEALS - VALVE GUIDE

## DESCRIPTION

The valve guide seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

# SPRINGS - VALVE

## DESCRIPTION

The valve springs are made from high strength chrome silicon steel. There are different springs for intake and exhaust applications. The exhaust spring has an external damper. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

## REMOVAL

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Using Special Tool 8516 Valve Spring Compressor, remove the rocker arms and the hydraulic lash adjusters.
3. Remove the spark plug for the cylinder the valve spring and seal are to be removed from.
4. Apply shop air to the cylinder to hold the valves in place when the spring is removed.

**NOTE: All six valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.**

5. Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.

**NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.**

6. Remove the two spring retainer lock halves.

**NOTE: the valve spring is under tension use care when releasing the valve spring compressor.**

7. Remove the valve spring compressor.

**NOTE: The valve springs are NOT common between intake and exhaust.**

8. Remove the spring retainer, and the spring.
9. Remove the valve stem seal.

**NOTE: The valve stem seals are common between intake and exhaust.**

## INSTALLATION

**NOTE: All six valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.**

1. Apply shop air to the cylinder to hold the valves in place while the spring is installed.

**NOTE: The valve stem seals are common between intake and exhaust.**

2. Install the valve stem seal.

**NOTE: The valve springs are NOT common between intake and exhaust.**

3. Install the spring retainer, and the spring.
4. Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.
5. Install the two spring retainer lock halves.

**NOTE: the valve spring is under tension use care when releasing the valve spring compressor.**

6. Remove the valve spring compressor.
7. Disconnect the shop air to the cylinder.
8. Install the spark plug for the cylinder the valve spring and seal was installed on.

9. Using Special Tool 8516 Valve Spring Compressor, install the rocker arms and the hydraulic lash adjusters.
10. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

# BLOCK-ENGINE

## DESCRIPTION

The cylinder block is made of cast iron. The block is a closed deck design with the left bank forward. To provide high rigidity and improved NVH an enhanced compacted graphite bedplate is bolted to the block. The block design allows coolant flow between the cylinders bores, and an internal coolant bypass to a single poppet inlet thermostat is included in the cast aluminum front cover.

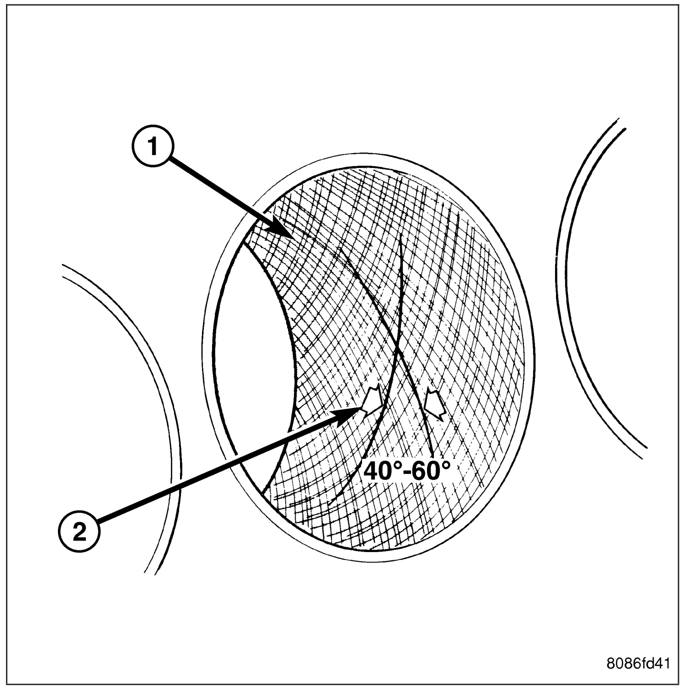
## STANDARD PROCEDURE - CYLINDER BORE HONING

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

1. Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

**CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.**

2. Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.




**CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.**

3. Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern (1). The hone marks should INTERSECT at 50° to 60° for proper seating of rings (2).
4. A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.
5. After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

## CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

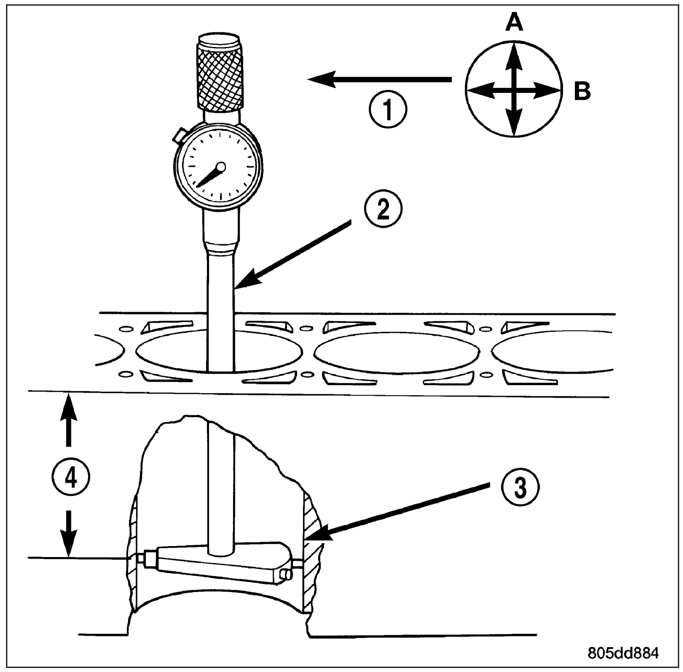
Use compressed air to clean out:

- The galley at the oil filter adaptor hole.
- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the plugs to 34 N·m (25 ft. lbs.) torque.

## INSPECTION

1. It is mandatory to use a dial bore gauge to measure each cylinder bore diameter. To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
2. Measure the inside diameter of the cylinder bore at three levels below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft and then take two additional reading.
3. Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.
4. Determine taper by subtracting the smaller diameter from the larger diameter.
5. Rotate measuring device 90° and repeat steps above.
6. Determine out-of-roundness by comparing the difference between each measurement.

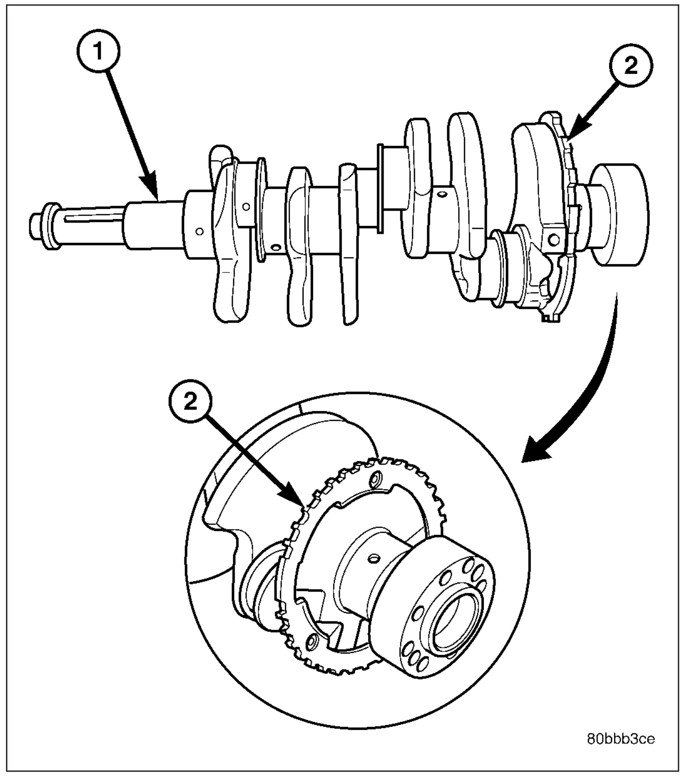



7. If cylinder bore taper does not exceed 0.025 mm (0.001 inch) and out-of-roundness does not exceed 0.015 mm (0.0006 inch), the cylinder bore can be honed. If the cylinder bore taper or out- of-round condition exceeds these maximum limits, the cylinder block must be replaced. A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

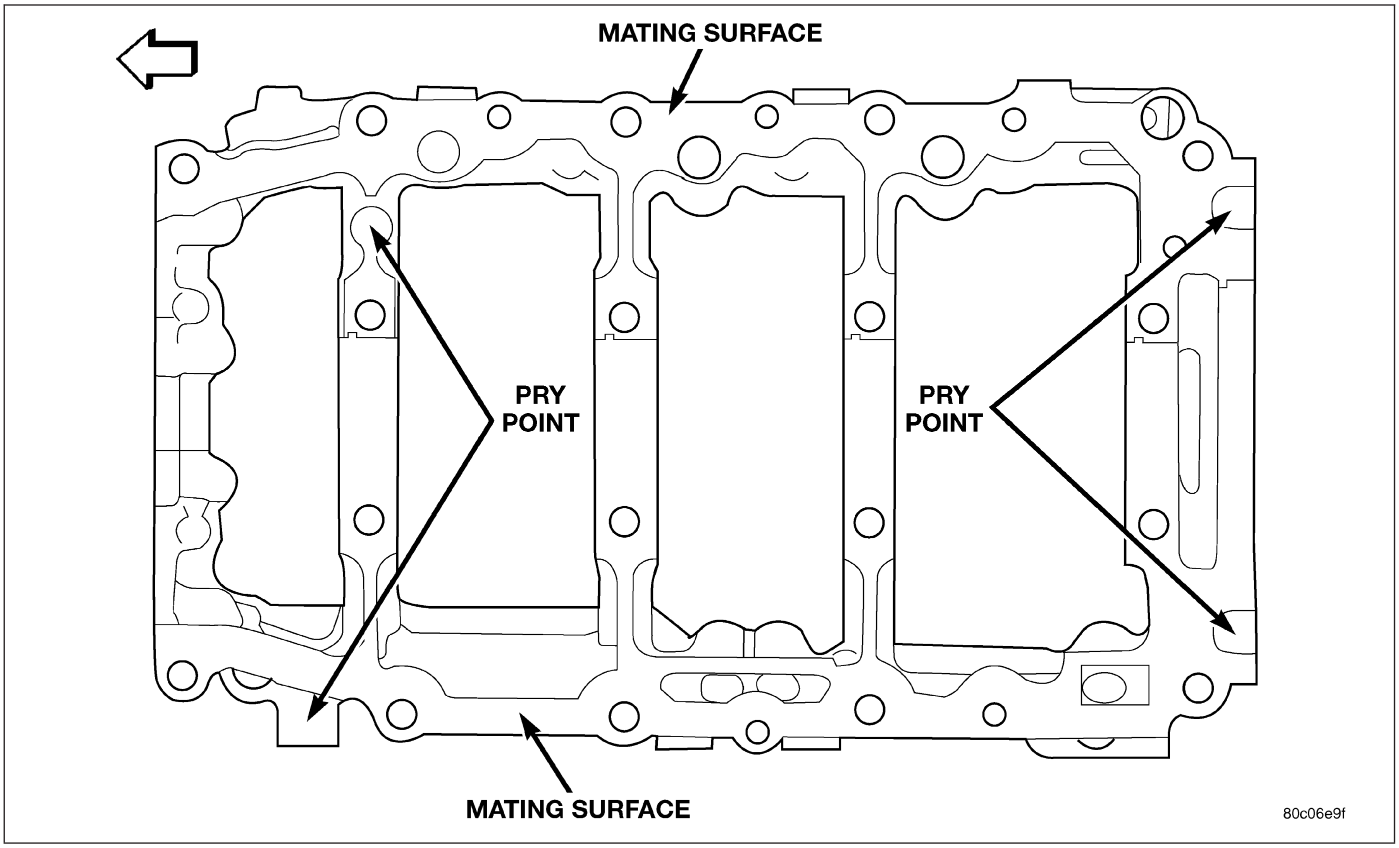
# CRANKSHAFT

## DESCRIPTION

The crankshaft is constructed of nodular cast iron. The crankshaft is a three throw split pin design with six counterweights for balancing purposes. The crankshaft is supported by four select fit main bearings with the number two serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The number six counterweight has provisions for crankshaft position sensor target wheel mounting. The select fit main bearing markings are located on the rear side of the target wheel. The crankshaft oil seals are one piece design. The front oil seal is retained in the timing chain cover, and the rear seal is pressed in to a bore formed by the cylinder block and the bedplate assembly.



## REMOVAL




**NOTE: To remove the crankshaft from the engine, the engine must be removed from the vehicle.**

1. Remove the engine (Refer to 9 - ENGINE - REMOVAL).
2. Remove the engine oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

**CAUTION: DO NOT pry on the oil pan gasket when removing the oil pan, The oil pan gasket is mounted to the cylinder block in three locations and will remain attached to block when removing oil pan. Gasket can not be removed with oil pan.**

3. Remove the bedplate mounting bolts. Note the location of the two stud bolts for installation.
4. Remove the connecting rods from the crankshaft.

**CAUTION: The bedplate to cylinder block mating surface is a critical sealing surface. Do not pry on or damage this surface in anyway.**

**NOTE: The bedplate contains the lower main bearing halves. Use care when handling bedplate as not to drop or damage bearing halves. Installing main bearing halves in the wrong position will cause severe damage to the crankshaft.**

**NOTE: The bedplate has pry points cast into it. Use these points only. The pry points are shown below.**

5. Carefully pry on the pry points to loosen the bedplate then remove the bedplate.

**CAUTION: When removing the crankshaft, use care not to damage bearing surfaces on the crankshaft.**

6. Remove the crankshaft.
7. Remove the crankshaft tone wheel.

## INSPECTION

**NOTE: Thoroughly inspect the connecting rod bearing bores and main bearing bores for scoring, blueing or severe scratches. Further disassembly may be required.**

If connecting rod bearing bores show damage, the cylinder heads must be removed to service the piston and rod assemblies. If the bedplate or the cylinder block main bearing bores show damage the engine must be replaced.

1. If required, remove the main bearing halves from the cylinder block and bedplate.
2. Thoroughly clean the bedplate to cylinder block sealing surfaces and main bearing bores. Remove all oil and sealant residue.
3. Inspect the bedplate main bearing bores for cracks, scoring or severe blueing. If either condition exists the engine must be replaced.
4. Inspect the crankshaft thrust washers for scoring, scratches, wear or blueing. If either condition exist replace the thrust washers.
5. Inspect the oil pan gasket/windage tray for splits, tears or cracks in the gasket sealing surfaces. Replace gasket as necessary.

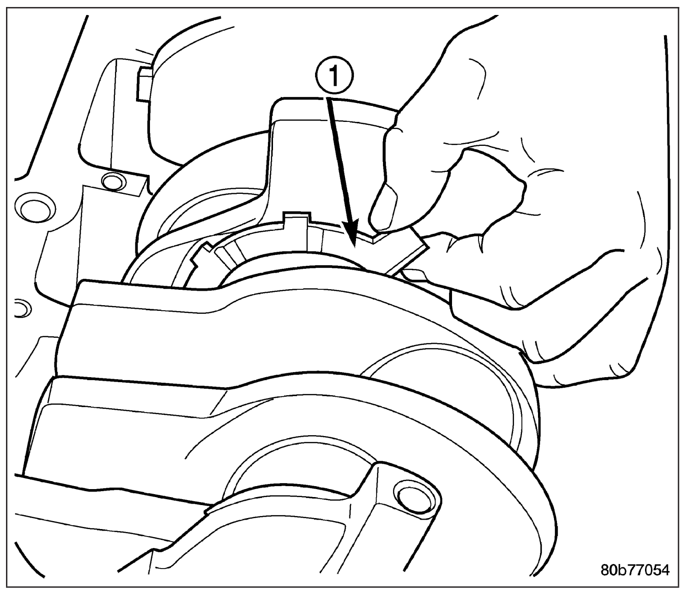
## INSTALLATION

**CAUTION: Main bearings are select fit. Refer to Crankshaft Main Bearings in this section for proper bearing selections.**

**CAUTION: When installing crankshaft, use care not to damage bearing surfaces on the crankshaft.**

**NOTE: Apply sealant to the tone wheel retaining screws prior to installation.**

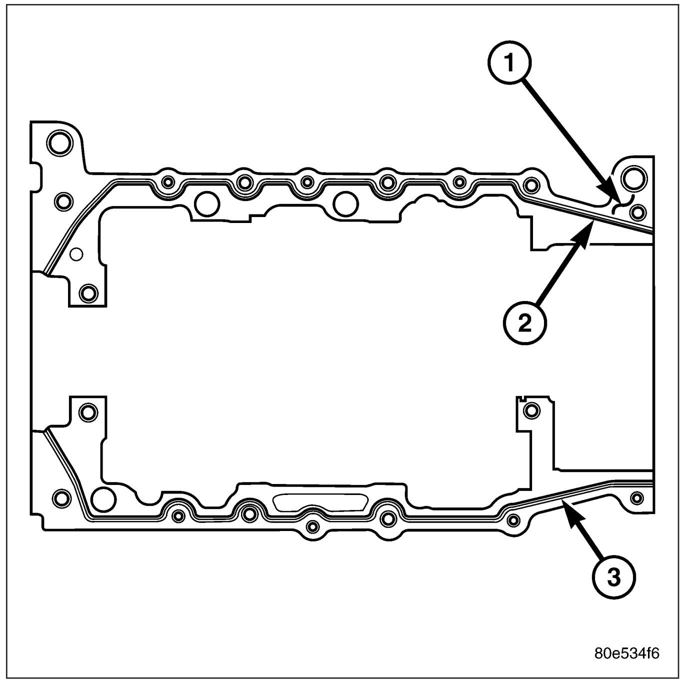
1. Lubricate upper main bearing halves with clean engine oil.
2. Install the crankshaft tone wheel. Torque the mounting screws to 15 N·m (11 ft. lbs.).
3. Position crankshaft in cylinder block.
4. Install the thrust washers (1).

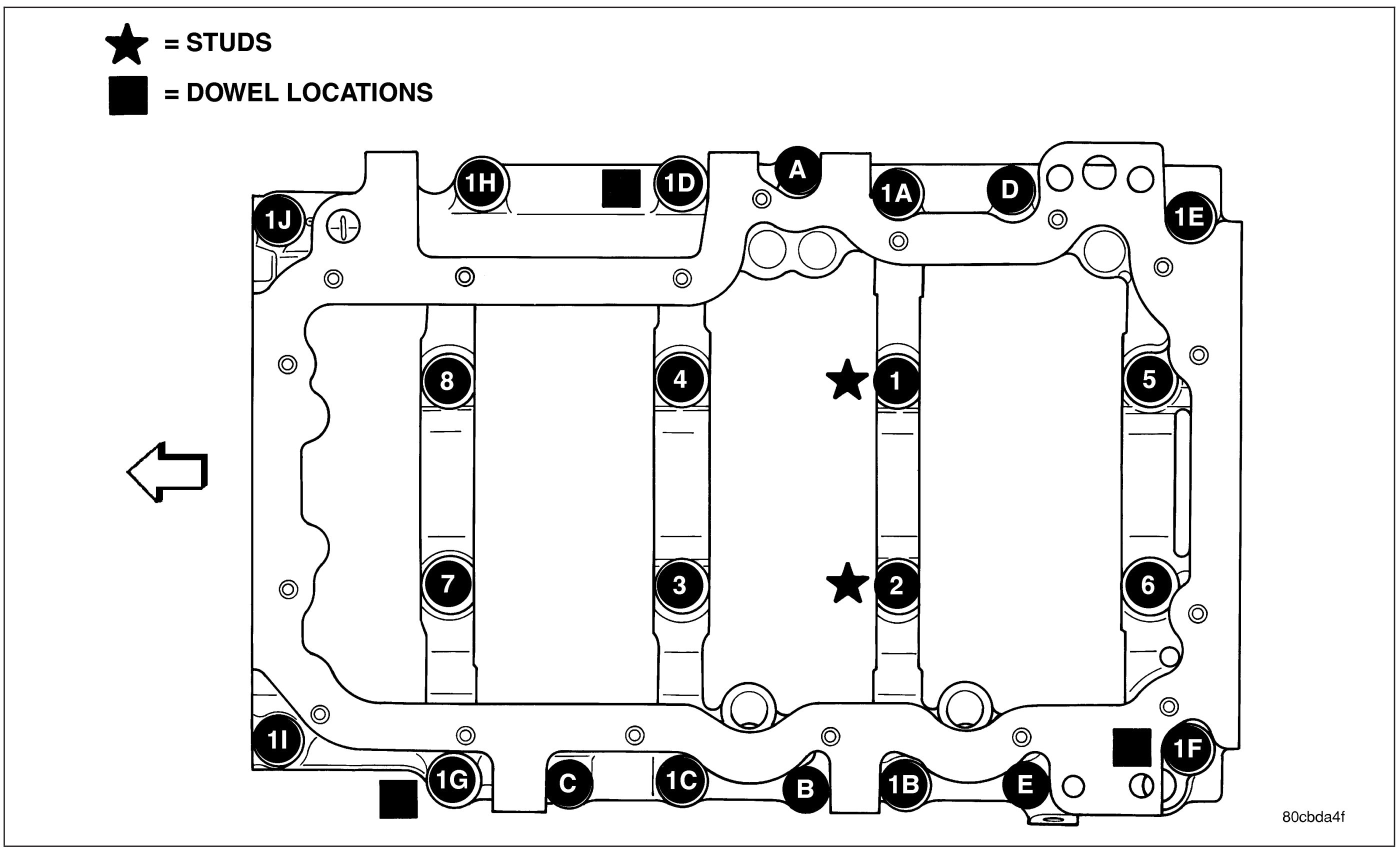


**CAUTION: The bedplate to cylinder block mating surface must be coated with Mopar® Engine RTV sealant prior to installation. Failure to do so will cause severe oil leaks.**

**NOTE: Make sure that the bedplate and cylinder block sealing surfaces are clean and free of oil or other contaminants. Contaminants on the sealing surfaces may cause main bearing distortion and/or oil leaks.**

5. Apply a 2.5mm (0.100 inch) bead of Mopar® Engine RTV sealant to the cylinder block-to-bedplate mating surface (2,3) as shown.




6. Coat the crankshaft main bearing journals with clean engine oil and position the bedplate onto the cylinder block.

**NOTE: Lubricate the bedplate retaining bolts with clean engine oil prior to installation.**

7. Install the bedplate retaining bolts, making sure to place the stud bolts in the correct location, Torque the bolts in the sequence shown.
   - Hand tighten bolts **1D,1G and 1F** until the bedplate contacts the block.
   - Tighten bolts **1A - 1J** to 54 N·m (40 ft. lbs.)
   - Tighten bolts **1 - 8** to 7 N·m (5 ft. lbs.)

- Turn bolts **1 - 8** an additional 90°.
- Tighten bolts **A - E** 27 N·m ( 20 ft. lbs.).

8. Measure crankshaft end play.
9. Install the connecting rods and measure side clearance (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - STANDARD PROCEDURE).
10. Install oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).
11. Install the engine (Refer to 9 - ENGINE - INSTALLATION).

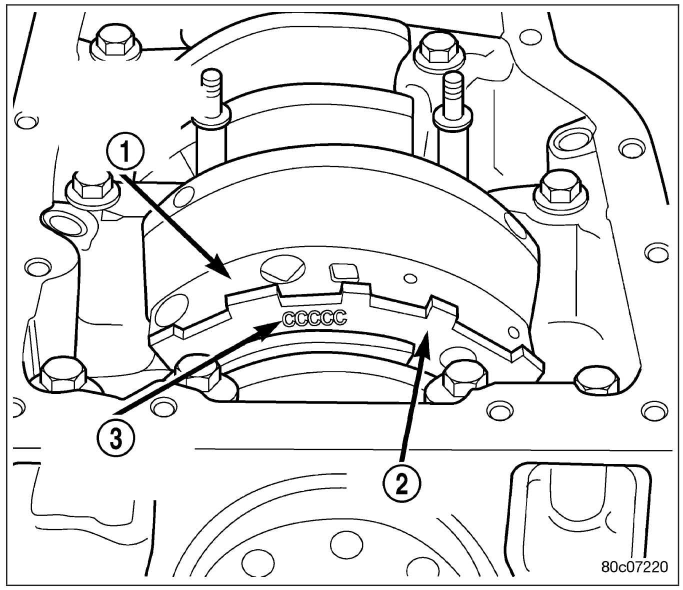
# BEARINGS-CRANKSHAFT MAIN

## STANDARD PROCEDURE

## MAIN BEARING FITTING

### SELECT FIT IDENTIFICATION

The main bearings are “select fit” to achieve proper oil clearances. For main bearing selection, the crankshaft position sensor target wheel (2) has grade identification marks stamped into it. These marks are read from left to right, corresponding with journal number 1, 2, 3, 4. The crankshaft position sensor target wheel is mounted to the number 6 counter weight (1) on the crankshaft.




### INSPECTION

Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.

### MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Remove the crankshaft from the cylinder block (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - REMOVAL).

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper is 0.008mm (0.0004 inch.) and maximum out of round is 0.005mm (0.002 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

Install the crankshaft into the cylinder block (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - INSPECTION).

Check crankshaft end play.

### CRANKSHAFT MAIN BEARING SELECTION

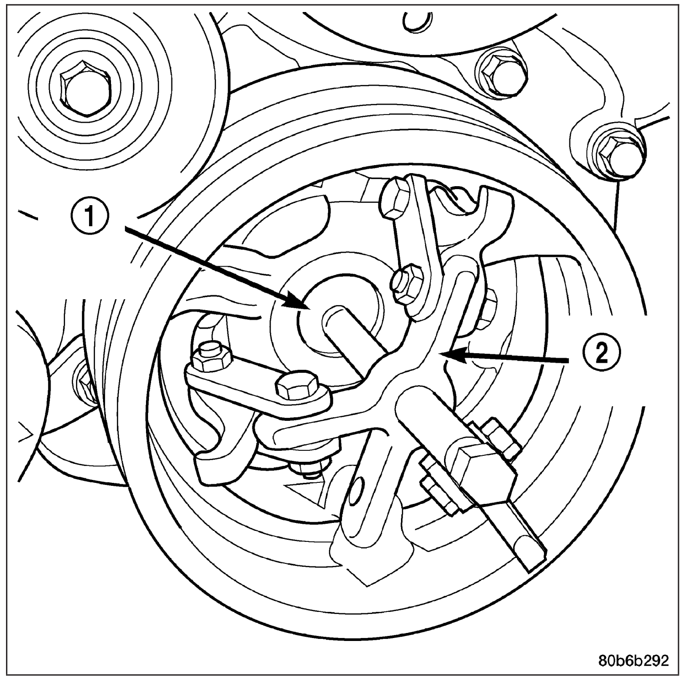
| Crankshaft Marking | JOURNAL SIZE<br>SIZE mm (in.) | |
|---|---|---|
| ″R″ Size | 63.488 - 63.496 mm<br>(2.4995 - 2.4998 in.) | |
| ″S″ Size | 63.496 - 63.500 mm (2.4998 - 2.4999 in.) | |
| ″T″ Size | 63.500 - 63.504 mm (2.4999 - 2.501 in.) | |
| ″U″ Size | 63.504 - 63.512 mm (2.5001 - 2.5004 in.) | |
| Bearing size | | |
| Bearing Code | Size | Application |
| Upper Bearing | | |
| **A** | .2.443 - 2.447 mm<br>(.0961 - .0963 in.) | Use with crankshaft size ″R″ |
| **B** | 2.439 - 2.443 mm<br>(0.960 - .0961 in.) | Use with crankshaft ″S, T″ |
| **C** | 2.435 - 2.439 mm<br>(.0958 - .0960 in.) | Use with crankshaft ″U″ |
| Lower Bearing Main ″1″ and ″4″ | | |
| ″1″ | 2.441 - 2.447 mm<br>(.0961 -.0963 in.) | Use with crankshaft ″R, S″ |
| ″2″ | 2.435 - 2.441 mm<br>(.0958 - .0962 in.) | Use with crankshaft ″T, U″ |
| Lower Main Bearing ″2″ and ″3″ | | |
| ″3″ | 2.429 - 2.435 mm<br>(.0956 - .0958 in.) | Use with crankshaft ″R, S″ |
| ″4″ | 2.423 - 2.429 mm<br>(.0953 - .0956 in.) | Use with crankshaft ″T, U″ |
| Bearing Clearances | | |
| Main ″1, 4″ | | |
| Crankshaft ″R″ | .004 - .034 mm ( .00015 - .0013 in.) | |
| Crankshaft ″S″ | .004 - .030 mm ( .00015 - .0011 in.) | |
| Crankshaft ″T″ | .006 - .032 mm (.0002 - .0012 in.) | |
| Crankshaft ″U″ | .002 - .032 mm (.00007 -. 0012 in.) | |
| Main ″2, 3″ | | |
| Crankshaft ″R″ | .016 - .046 mm (.0006 - .0018 in.) | |
| Crankshaft ″S″ | .016 - .042 mm (.00062 - .016 in.) | |
| Crankshaft ″T″ | .018 - .044 mm (.0007 - .0017 in.) | |
| Crankshaft ″U″ | .014 - .044 mm (.0005 - .0017 in.) | |

1. Service main bearings are available in four grades. The chart identifies the four service grades available.

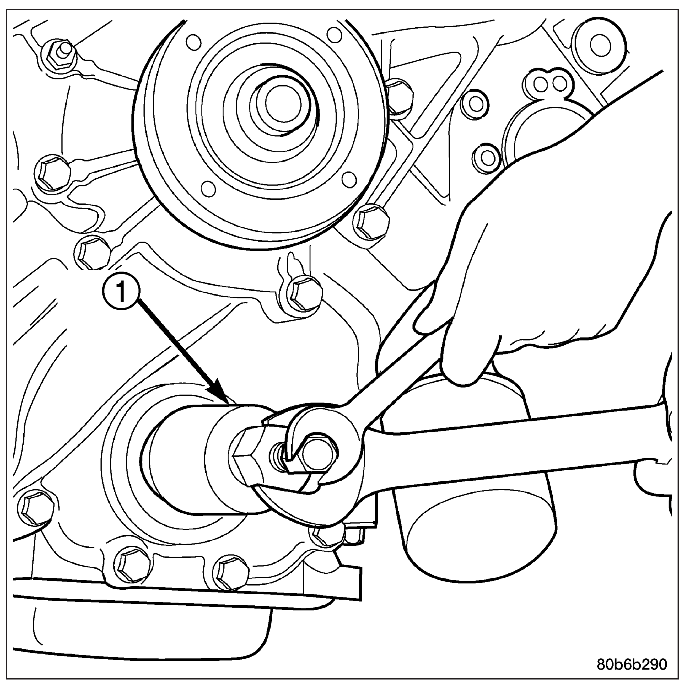
# SEAL-CRANKSHAFT OIL-FRONT

## REMOVAL

1. Disconnect negative cable from battery.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Remove A/C compressor mounting fasteners and set aside.
4. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Remove upper radiator hose.
6. Disconnect electrical connector for fan mounted inside radiator shroud.
7. Remove radiator shroud attaching fasteners.
8. Remove radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
9. Remove crankshaft damper bolt.
10. Remove damper using Special Tools 8513 Insert and 1026 Three Jaw Puller (2).

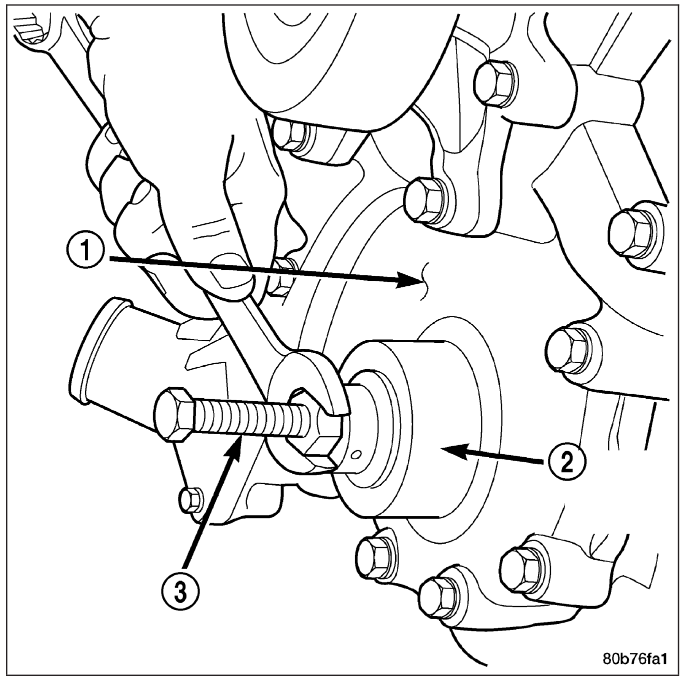



11. Using Special Tool 8511, remove crankshaft front seal (1) .



## INSTALLATION

**CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512, thoroughly clean the damper bore and the crankshaft nose before installing Damper.**




1. Using Special Tool 8348 (2) and 8512 (3), install crankshaft front seal.
2. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
3. Install radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
4. Install upper radiator hose.
5. Install A/C compressor and tighten fasteners to 54 N·m (40 ft. lbs.).
6. Install accessory drive belt refer (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
7. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
8. Connect negative cable to battery.

# SEAL-CRANKSHAFT OIL-REAR

## DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Engine, for proper repair procedures of these items.
4. If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

**CAUTION: Do not exceed 20.6 kPa (3 psi).**

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

**CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.**

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), under the Oil Leak row, for components inspections on possible causes and corrections.
7. After the oil leak root cause and appropriate corrective action have been identified, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).

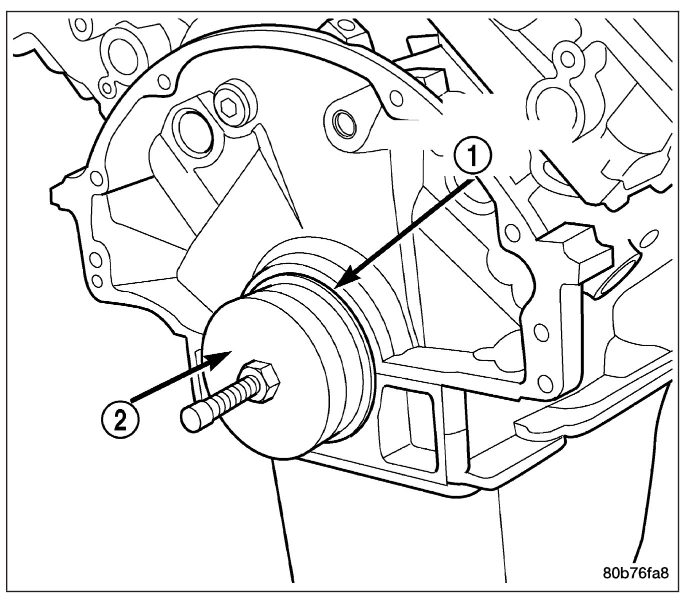
## REMOVAL

**NOTE: This procedure can be performed in vehicle.**

1. If being performed in vehicle, remove the transmission.
2. Remove the flexplate (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - REMOVAL).

**NOTE: The crankshaft oil seal CAN NOT be reused after removal.**

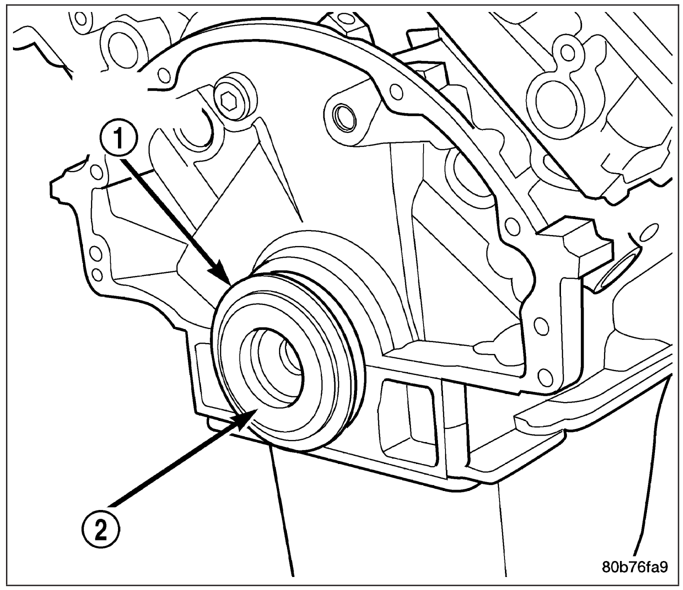
**NOTE: The crankshaft rear oil seal remover Special Tool 8506 must be installed deeply into the seal. Continue to tighten the removal tool into the seal until the tool can not be turned farther. Failure to install tool correctly the first time will cause tool to pull free of seal without removing seal from engine.**



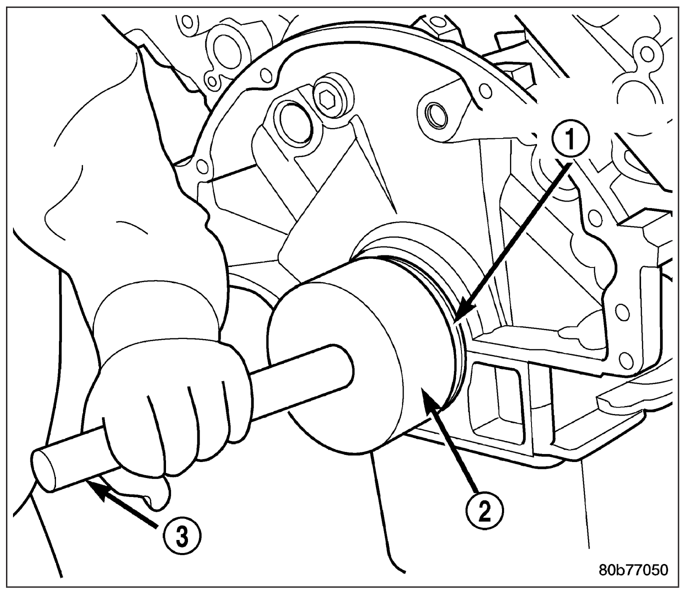

3. Using Special Tool 8506 (2), remove the crankshaft rear oil seal (1)

## INSTALLATION

1. Lubricate the crankshaft flange with engine oil.
2. Position the magnetic seal guide Special Tool 8349-2 onto the crankshaft rear face. Then position the crankshaft rear oil seal (1) onto the guide (2).




3. Using Special Tools 8349 Crankshaft Rear Oil Seal Installer (2) and C-4171 Driver Handle (3), with a hammer, tap the seal (1) into place. Continue to tap on the driver handle until the seal installer seats against the cylinder block crankshaft bore.
4. Install the flexplate.
5. Install the transmission.



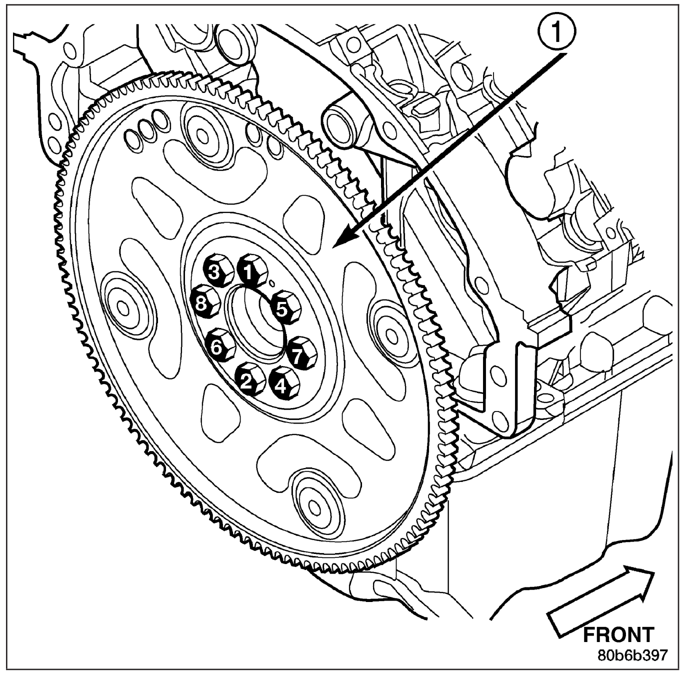
# PLATE-FLEX

## REMOVAL

1. Remove the transmission.
2. Remove the bolts and flexplate.

## INSTALLATION

1. Position the flexplate (1) onto the crankshaft and install the bolts hand tight.
2. Tighten the flexplate retaining bolts to 95 N·m (70 ft. lbs.) in the sequence shown.
3. Install the transmission.

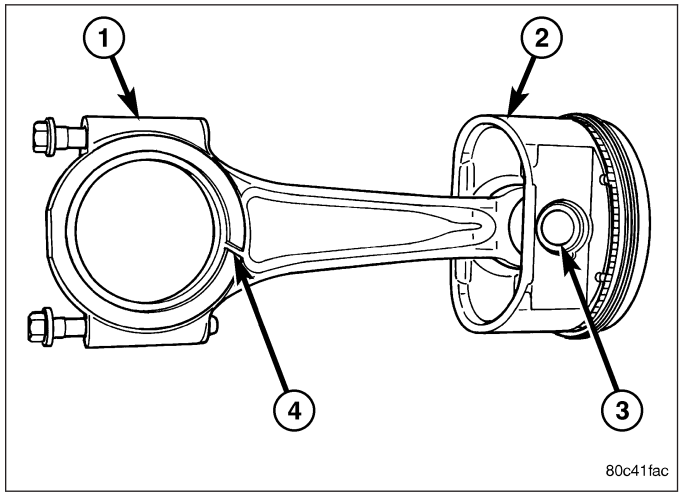


# ROD-PISTON AND CONNECTING

## DESCRIPTION

**CAUTION: Do not use a metal stamp to mark connecting rods as damage may result, instead use ink or a scratch awl.**

The pistons (2) are made of a high strength aluminum alloy. The connecting rods (1) are made of forged powdered metal, with a “fractured cap” design. A full floating piston pin is used to attach the piston to the connecting rod.



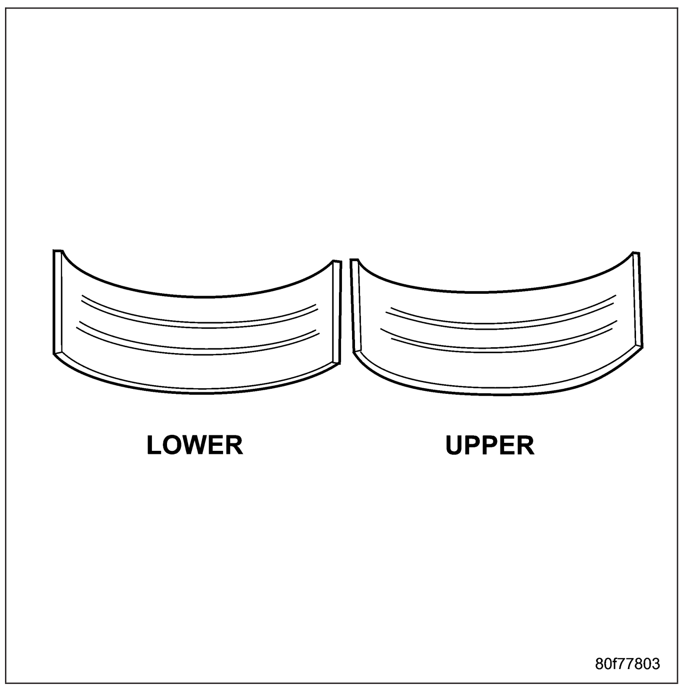

## STANDARD PROCEDURE

## CONNECTING ROD BEARING FITTING

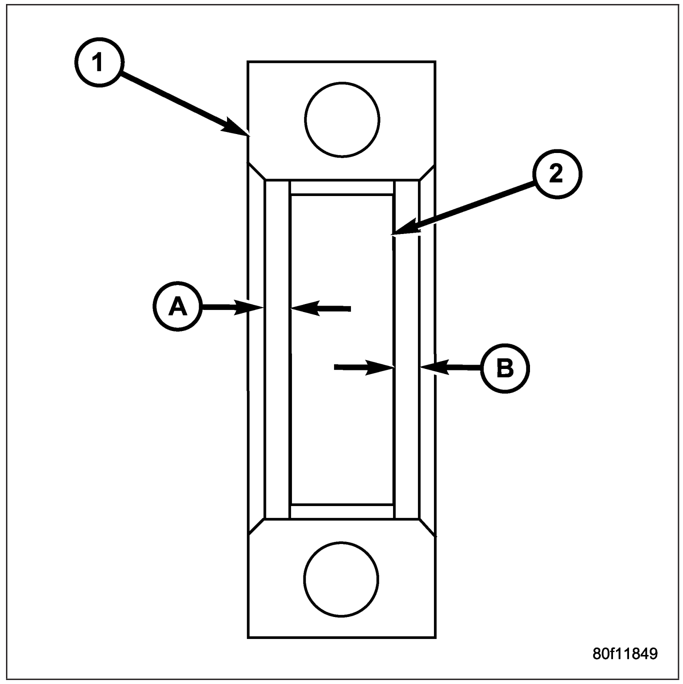
Inspect the connecting rod bearings for scoring. Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting. Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

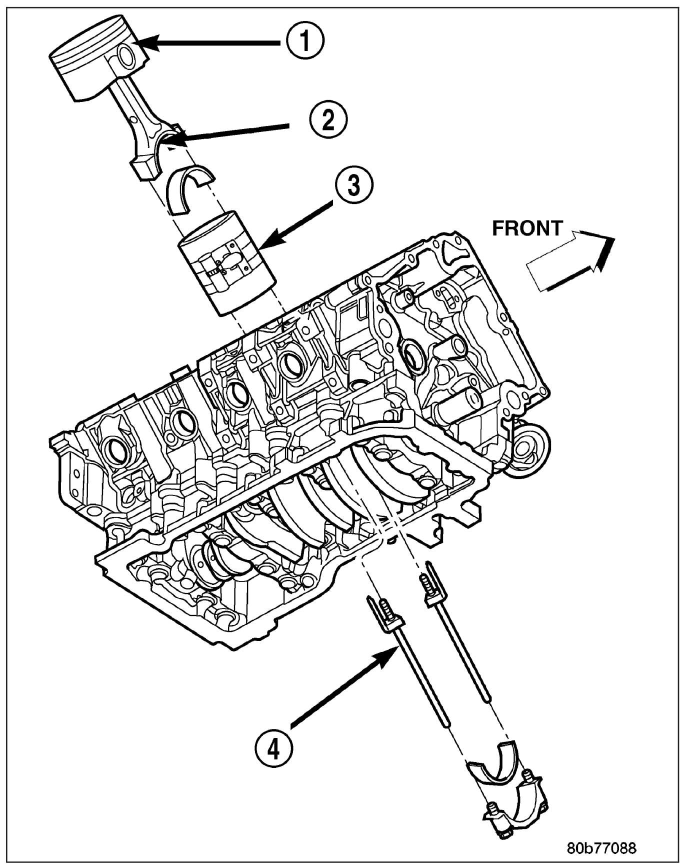
Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted connecting rods.



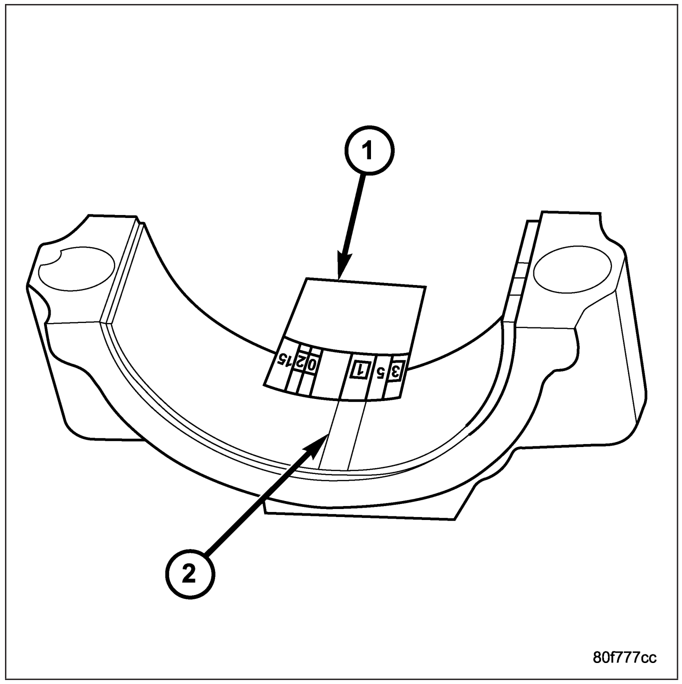
1. Wipe the oil from the connecting rod journal.
2. Lubricate the upper bearing insert and position in connecting rod. **Center bearing insert (2) in connecting rod (1)**




3. Use piston ring compressor (3) and Guide Pins Special Tool 8507 to install the rod and piston assemblies. The oil slinger slots in the rods must face front of the engine. The “F”'s near the piston wrist pin bore (1) should point to the front of the engine.



4. Install the lower bearing insert in the bearing cap. **Center bearing insert in connecting rod.**. The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.
5. Install bearing cap and connecting rod on the journal and tighten bolts to 27 N·m (20 ft. lbs.) plus a 90° turn. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.
6. Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (2). Refer to Engine Specifications for the proper clearance. **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**




7. If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage from crankshaft journal and bearing insert. Proceed with installation.

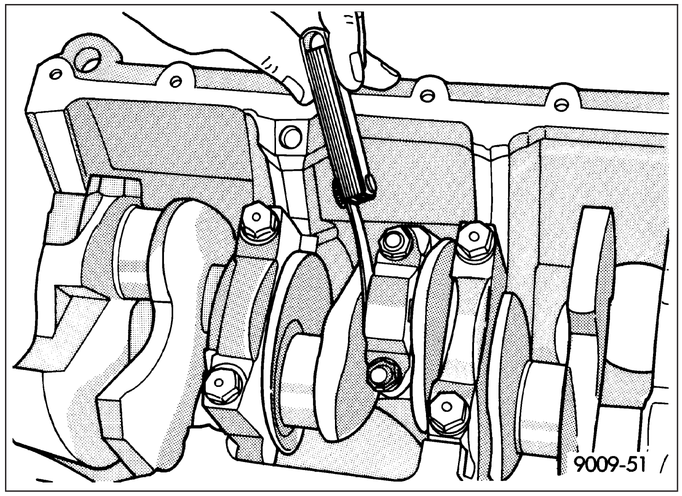
| Bearing Mark | SIZE | USED WITH JOURNAL SIZE |
|---|---|---|
| **.025 US** | .025 mm<br>(.001 in.) | 57.883-57.867 mm<br>(2.2788-2.2783 in.) |
| **Std.** | STANDARD | 57.908-57.892 mm<br>(2.2798-2.2792 in.) |
| **.250 US** | .250 mm<br>(.010 in.) | 57.658-57.646 mm<br>(2.2700-2.2695 in.) |

8. If bearing-to-journal clearance exceeds the specification, determin which services bearing set to use the bearing sizes are as follows:

**CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.**

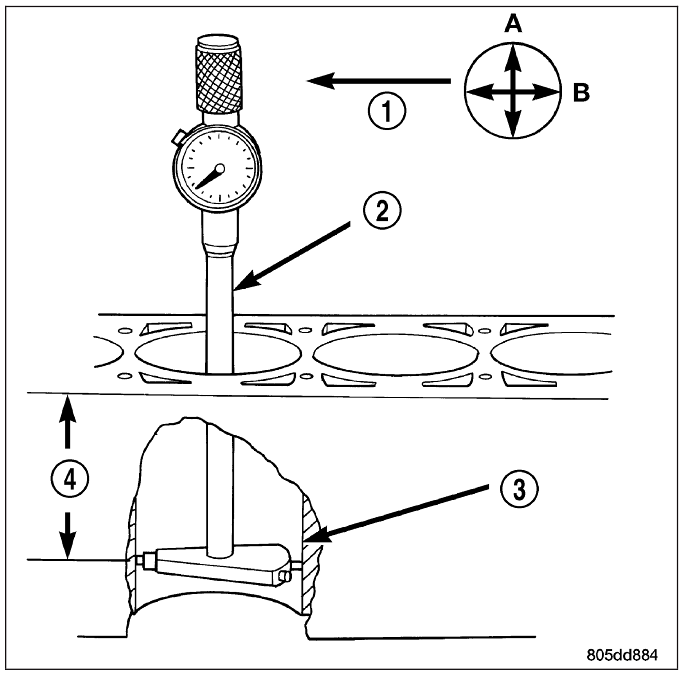
9. Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.
10. Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 27 N·m (20 ft. lbs.) plus a 90° turn.

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange. Refer to Engine Specifications for the proper clearance. Replace the connecting rod if the side clearance is not within specification.

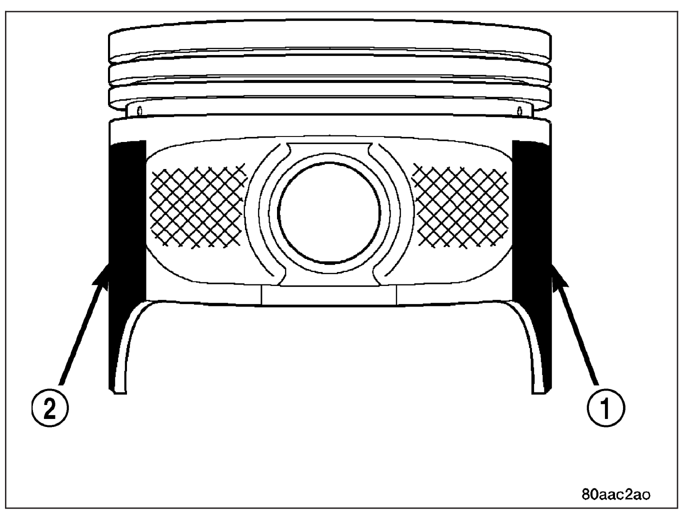



## STANDARD PROCEDURE - PISTON FITTING

1. To correctly select the proper size piston, a cylinder bore gauge (2), capable of reading in 0.003 mm ( .0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
2. Measure the inside diameter of the cylinder bore (3) at a point 38.0 mm (1.5 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B.




3. The coated pistons (1,2) will be serviced with the piston pin and connecting rod pre-assembled.
4. The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston (1,2) will not provide accurate results. Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.
5. Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.



## REMOVAL

1. Disconnect negative cable from battery.
2. Remove the following components:
   - Oil pan and gasket/windage tray (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
   - Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
   - Timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
   - Cylinder head(s) (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
3. If necessary, remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation.** Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so the each connecting rod is centered in cylinder bore.

**CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur**

**NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.**

4. Mark connecting rod and bearing cap positions using a permanent ink marker or scribe tool.

**CAUTION: Care must be taken not to damage the fractured rod and cap joint face surfaces, as engine damage may occur.**

5. Remove connecting rod cap. Install Special Tool 8507 Connecting Rod Guides into the connecting rod being removed. Remove piston from cylinder bore. Repeat this procedure for each piston being removed.

**CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur**

6. Immediately after piston and connecting rod removal, install bearing cap on the mating connecting rod to prevent damage to the fractured cap and rod surfaces.

## CLEANING

**CAUTION: DO NOT use a wire wheel or other abrasive cleaning devise to clean the pistons or connecting rods. The pistons have a Moly coating, this coating must not be damaged.**

1. Using a suitable cleaning solvent clean the pistons in warm water and towel dry.
2. Use a wood or plastic scraper to clean the ring land grooves.

**CAUTION: DO NOT remove the piston pin from the piston and connecting rod assembly.**

## INSPECTION

Check the connecting rod journal for excessive wear, taper and scoring (Refer to 9 - ENGINE/ENGINE BLOCK/CONNECTING ROD BEARINGS - STANDARD PROCEDURE).

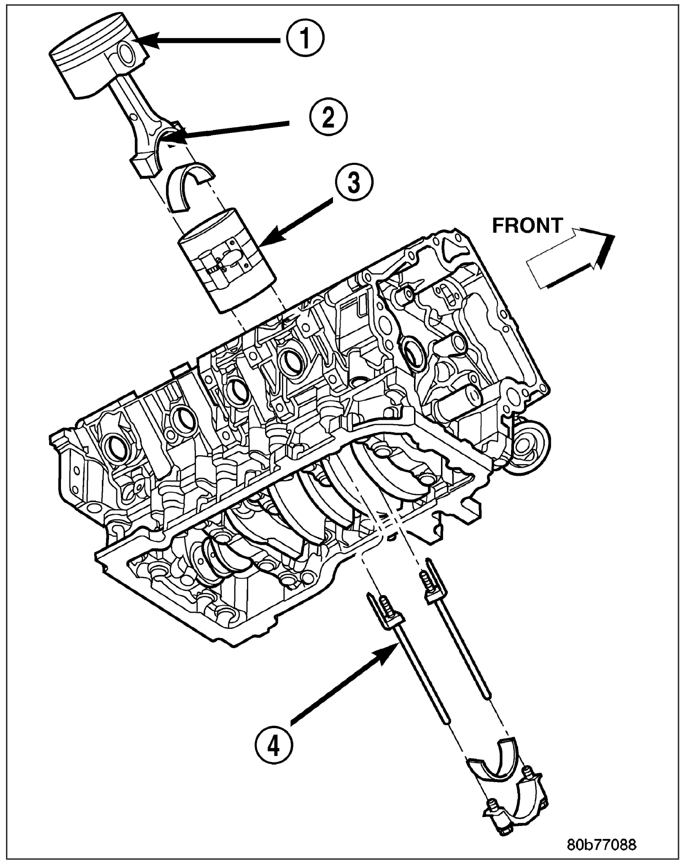
Check the connecting rod for signs of twist or bending.

Check the piston for taper and elliptical shape before it is fitted into the cylinder bore (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - STANDARD PROCEDURE).

Check the piston for scoring, or scraping marks in the piston skirts. Check the ring lands for cracks and/or deterioration.

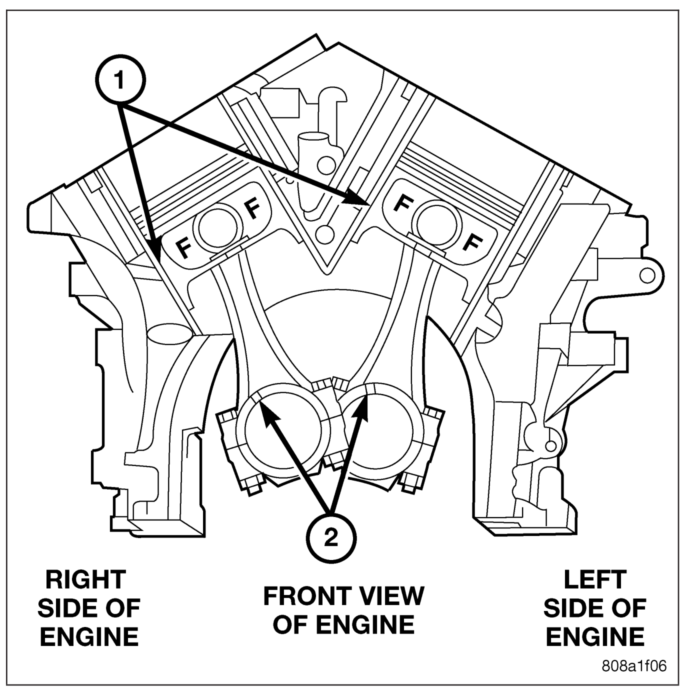
## INSTALLATION

1. Before installing piston and connecting rod assemblies into the bore, install the piston rings.
2. Immerse the piston head and rings in clean engine oil. Position a ring compressor over the piston and rings. Tighten ring compressor. **Ensure position of rings do not change during this operation.**
3. Position bearing onto connecting rod. Ensure that tabs in bearing shell aligns with slots in connecting rod. Verify that parting line of bearing is aligned with parting line of connecting rod.
4. Lubricate bearing surface with clean engine oil.
5. Install Special Tool 8507 Connecting Rod Guides (4) into connecting rod bolt threads.




6. The pistons are marked on the piston pin bore surface with an raised “F” indicating installation position. This mark must be pointing toward the front of engine on both cylinder banks. The connecting rod oil slinger slot (2) faces the front of the engine.
7. Wipe cylinder bore clean and lubricate with engine oil.
8. Rotate crankshaft until connecting rod journal is on the center of cylinder bore. Insert rod and piston into cylinder bore and carefully position connecting rod guides over crankshaft journal.
9. Tap piston down in cylinder bore using a hammer handle. While at the same time, guide connecting rod into position on rod journal.

**CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.**




10. Lubricate rod bolts and bearing surfaces with engine oil. Install connecting rod cap and bearing. Tighten bolts to 27 N·m (20 ft. lbs.) plus 90°.
11. Install the following components:
- Cylinder head(s). (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
- Timing chain and cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

- Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
- Oil pan and gasket/windage tray. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

12. Fill crankcase with proper engine oil to correct level.
13. Connect negative cable to battery.

# RINGS-PISTON

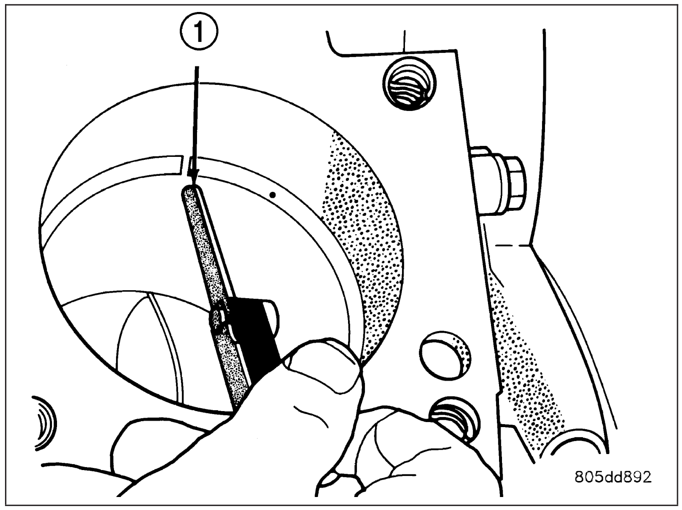
## STANDARD PROCEDURE - PISTON RING FITTING

Before reinstalling used rings or installing new rings, the ring clearances must be checked.

1. Wipe the cylinder bore clean.
2. Insert the ring in the cylinder bore.

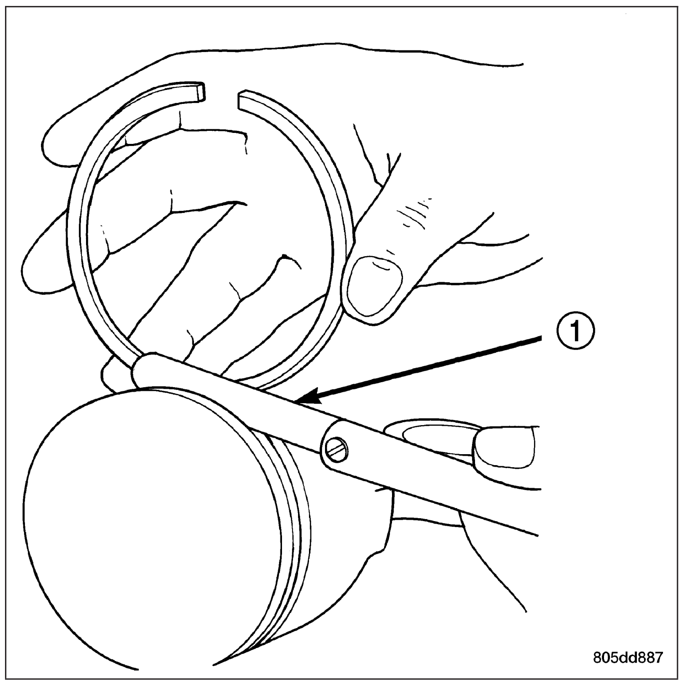
**NOTE: The ring gap measurement must be made with the ring positioned at least 12mm (0.50 inch.) from bottom of cylinder bore.**

3. Using a piston, to ensure that the ring is squared in the cylinder bore, slide the ring downward into the cylinder.
4. Using a feeler gauge (1) check the ring end gap. Replace any rings not within specification.




### PISTON RING SIDE CLEARANCE

**NOTE: Make sure the piston ring grooves are clean and free of nicks and burrs.**



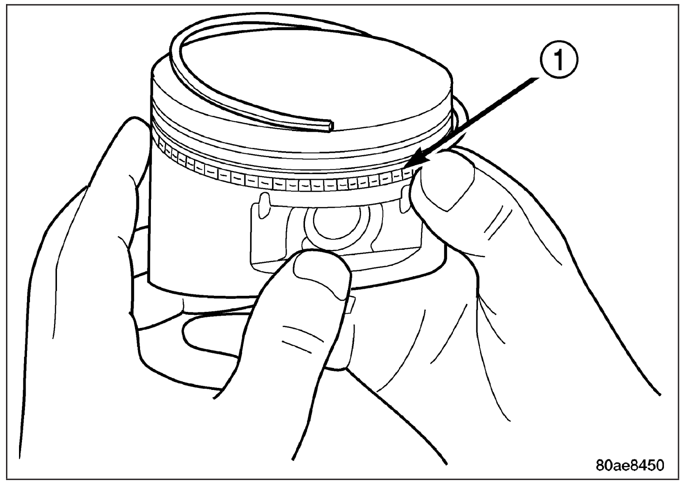

5. Measure the ring side clearance as shown make sure the feeler gauge (1) fits snugly between the ring land and the ring. Replace any ring not within specification.
6. Rotate the ring around the piston, the ring must rotate in the groove with out binding.

### PISTON RING SPECIFICATION CHART

| Ring Position | Groove Clearance | Maximum Clearance |
|---|---|---|
| Upper Ring | .051-.094 mm<br>(0.0020-.0037 in.) | 0.11 mm<br>(0.004 in.) |
| Intermediate Ring | 0.04-0.08 mm<br>(0.0016-0.0031 in.) | 0.10 mm<br>(0.004 in.) |
| Oil Control Ring | .019-.229 mm | .25 mm |

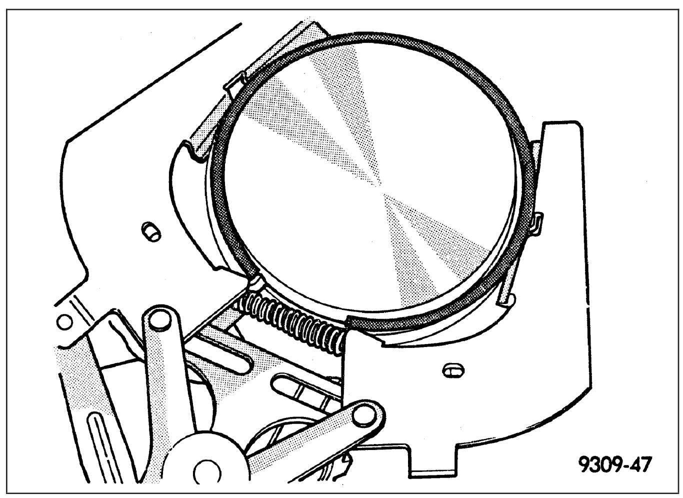
| Ring Position | Groove Clearance | Maximum Clearance |
|---|---|---|
| (Steel Rails) | (.0007-.0090 in.) | (0.010 in.) |
| **Ring Position** | **Ring Gap** | **Wear Limit** |
| Upper Ring | 0.20-0.36 mm<br>(0.0079-0.0142 in.) | 0.43 mm<br>(0.0017 in.) |
| Intermediate Ring | 0.37-0.63 mm<br>(0.0146-0.0249 in.) | 0.74 mm<br>(0.029 in.) |
| Oil Control Ring<br>(Steel Rail) | 0.025-0.76 mm<br>(0.0099- 0.03 in.) | 1.55 mm<br>(0.061 in.) |

7. The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.

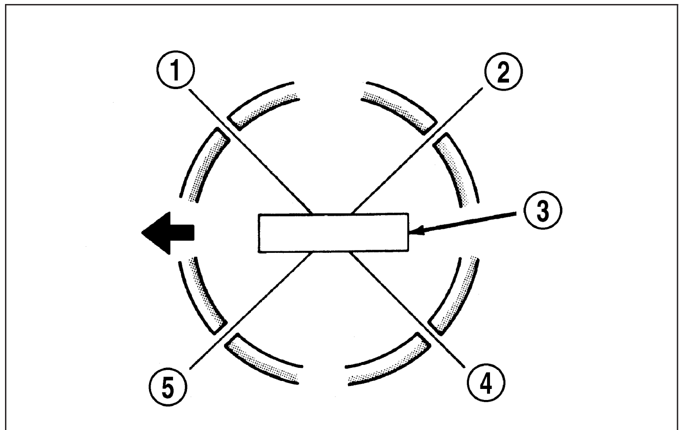



**NOTE: Piston rings are installed in the following order:**
- **Oil ring expander.**
- **Upper oil ring side rail.**
- **Lower oil ring side rail.**
- **No. 2 Intermediate piston ring.**
- **No. 1 Upper piston ring.**

8. Install the oil ring expander.
9. Install upper side rail (1) by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.
10. Install No. 2 intermediate piston ring using a piston ring installer.
11. Install No. 1 upper piston ring using a piston ring installer.



12. Position piston ring end gaps as shown. It is important that expander ring gap (5) is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.




RR09B48

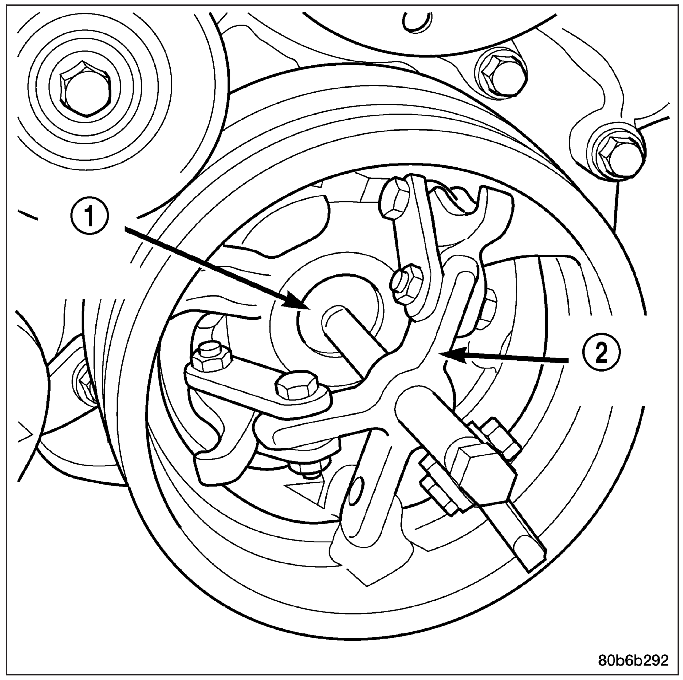
# DAMPER-CRANKSHAFT

## REMOVAL

1. Disconnect negative cable from battery.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

**NOTE: Transmission cooler line snaps into shroud lower right hand corner.**

3. Remove crankshaft damper bolt.
4. Remove damper using Special Tools 8513 Insert (1) and 1026 Three Jaw Puller (2).

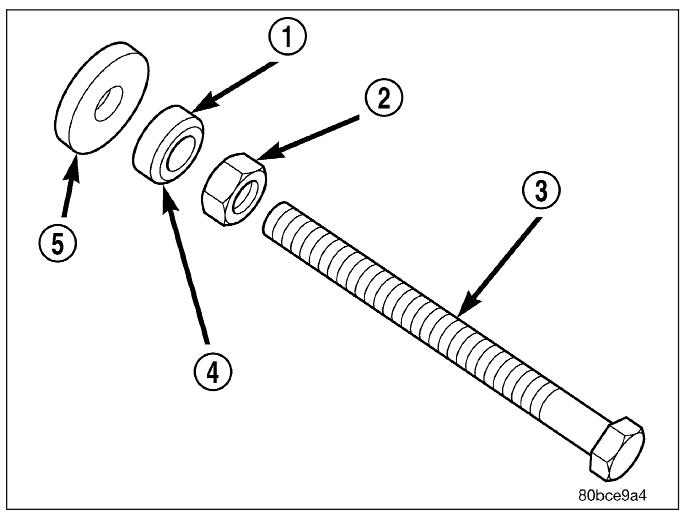



## INSTALLATION

**CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512, thoroughly clean the damper bore and the crankshaft nose before installing Damper.**

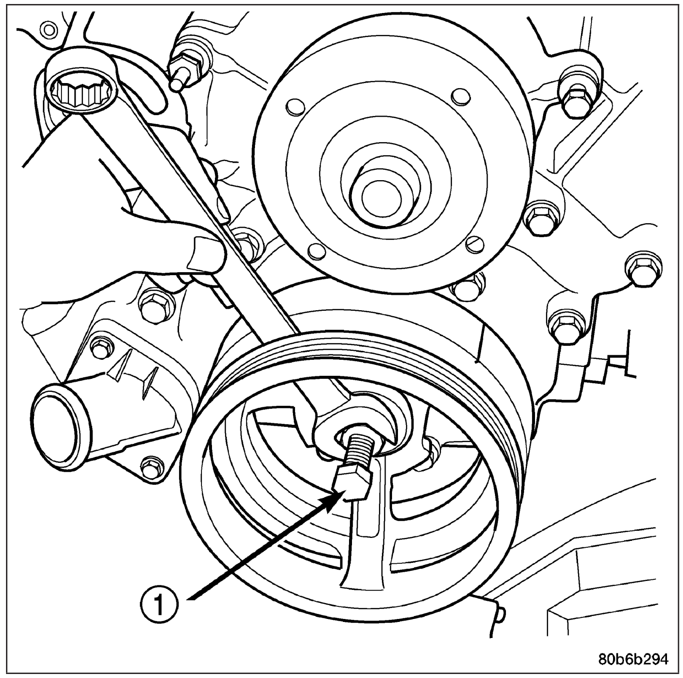
1. Align crankshaft damper slot with key in crankshaft. Slide damper onto crankshaft slightly.

**CAUTION: Special Tool 8512A, is assembled in a specific sequence. Failure to assemble this tool in this sequence can result in tool failure and severe damage to either the tool or the crankshaft.**




2. Assemble Special Tool 8512–A as follows, The nut is threaded onto the shaft first. Then the roller bearing (1) is placed onto the threaded rod (3) (The hardened bearing surface of the bearing **MUST** face the nut). Then the hardened washer slides onto the threaded rod. Once assembled coat the threaded rod's threads with Mopar® Nickel Anti-Seize or (Loctite No. 771).

3. Using Special Tool 8512A (1), press damper onto crankshaft.
4. Install then tighten crankshaft damper bolt to 175 N·m (130 ft. lbs.).
5. Install accessory drive belt (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
6. Connect negative cable to battery.



# COVER-STRUCTURAL

## DESCRIPTION

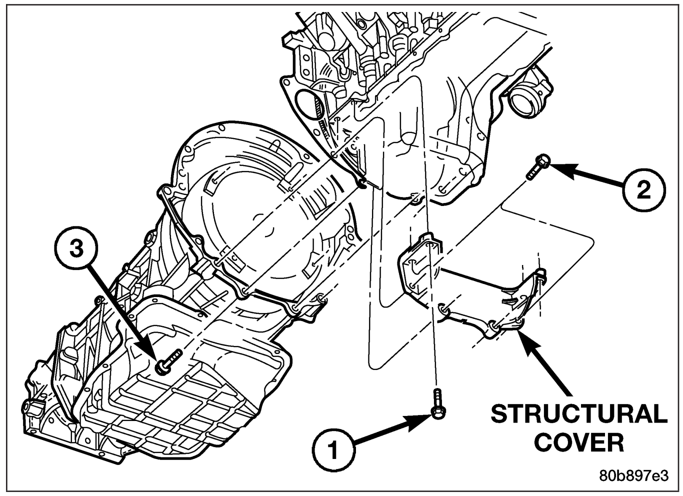
The structural dust cover is made of die cast aluminum and joins the lower half of the transmission bell housing to the engine bedplate.

## OPERATION

The structural cover provides additional powertrain stiffness and reduces noise and vibration.

## REMOVAL

1. Raise vehicle on hoist.
2. Remove the bolts (1) retaining structural cover.
3. Remove the structural cover.

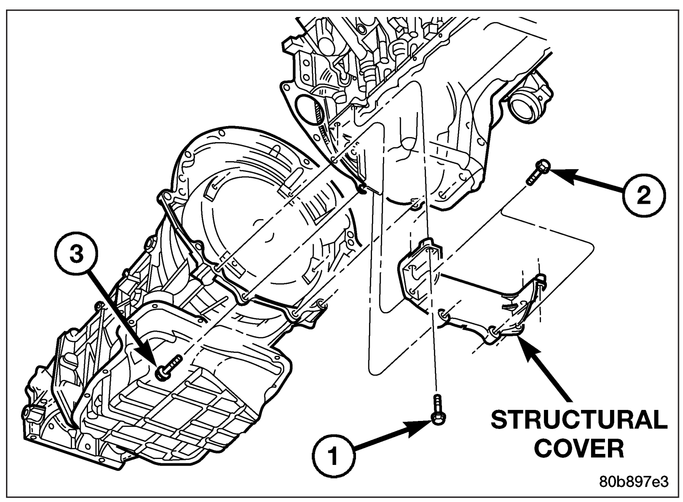



## INSTALLATION

**CAUTION: The structural cover must be installed as described in the following steps. Failure to do so will cause severe damage to the cover.**

1. Position the structural cover in the vehicle.
2. Install all bolts (1) retaining the cover-to-engine. DO NOT tighten the bolts at this time.
3. Install the cover-to-transmission bolts. Do NOT tighten at this time.

**CAUTION: The structural cover must be held tightly against both the engine and the transmission bell housing during tightening sequence. Failure to do so may cause damage to the cover.**




4. Starting with the two rear cover-to-engine bolts, tighten bolts (1) to 54 N·m (40 ft. lbs.), then tighten bolts (2) and (3) to 54 N·m ( 40 ft. lbs.) in the sequence shown.

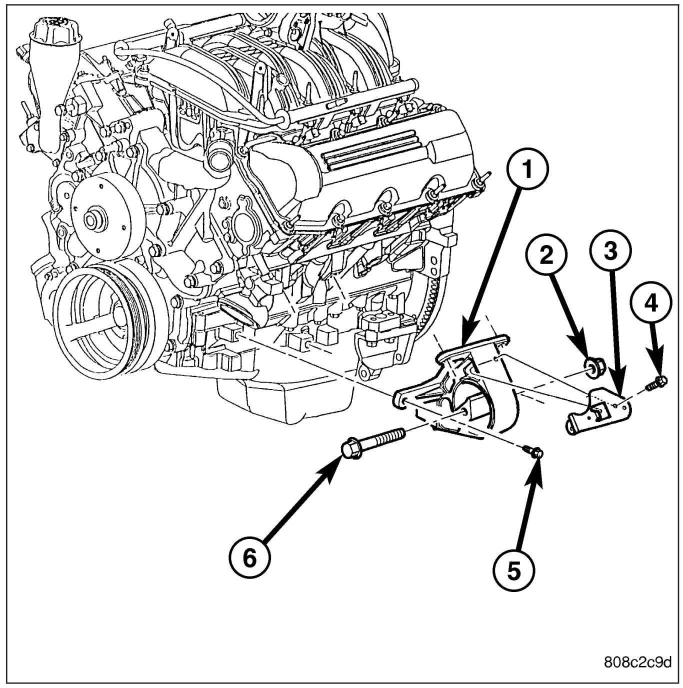
# MOUNT-FRONT

## REMOVAL

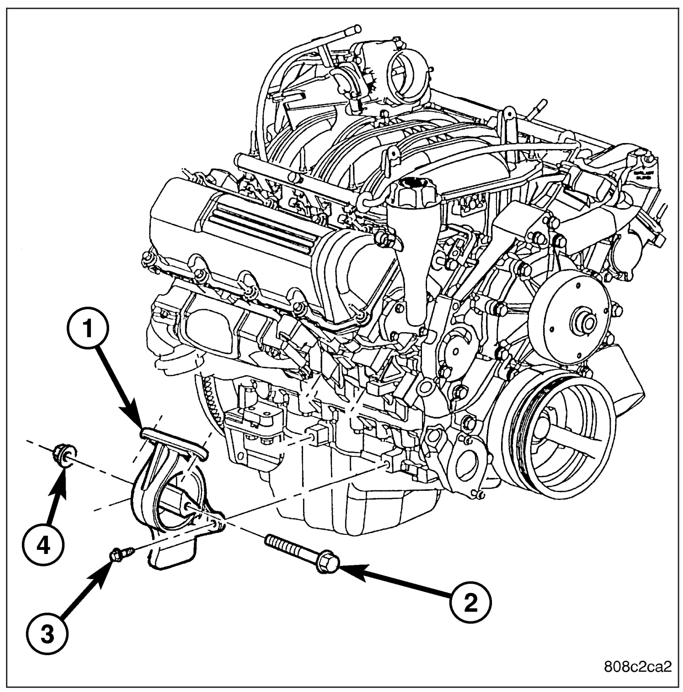
1. Disconnect the negative cable from the battery.

**CAUTION: Remove the fan blade, fan clutch and fan shroud before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.**

2. Remove the fan blade, fan clutch and fan shroud. Refer to COOLING SYSTEM for procedure.
3. Remove the engine oil filter.
4. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
5. Remove the four cylinder block-to-insulator mount bolts (5) and the nut from the engine insulator mount through bolt.




6. Using the jack, raise the engine high enough to remove the engine insulator mount thru bolt (2) and the insulator mount and.




## INSTALLATION

1. Position the insulator mount and install the insulator mount through bolt.
2. Lower the engine until the cylinder block-to-insulator mount bolts can be installed.
3. Remove the jack and block of wood.
4. Torque the cylinder block-to-insulator mount bolts to 61 N·m ( 45 ft. lbs.).
5. Install and torque the through bolt retaining nut to 61 N·m (45 ft. lbs.).
6. Install the fan blade, fan clutch and fan shroud.

# MOUNT-REAR

## REMOVAL

**NOTE: A resilient rubber cushion supports the transmission at the rear between the transmission extension housing and the rear support crossmember or skid plate.**

1. Disconnect negative cable from battery.
2. Raise the vehicle and support the transmission.
3. Remove the nuts holding the support cushion to the crossmember. Remove the crossmember.

### MANUAL TRANSMISSION

a. Remove the support cushion nuts and remove the cushion.

b. Remove the transmission support bracket bolts and remove the bracket from the transmission.

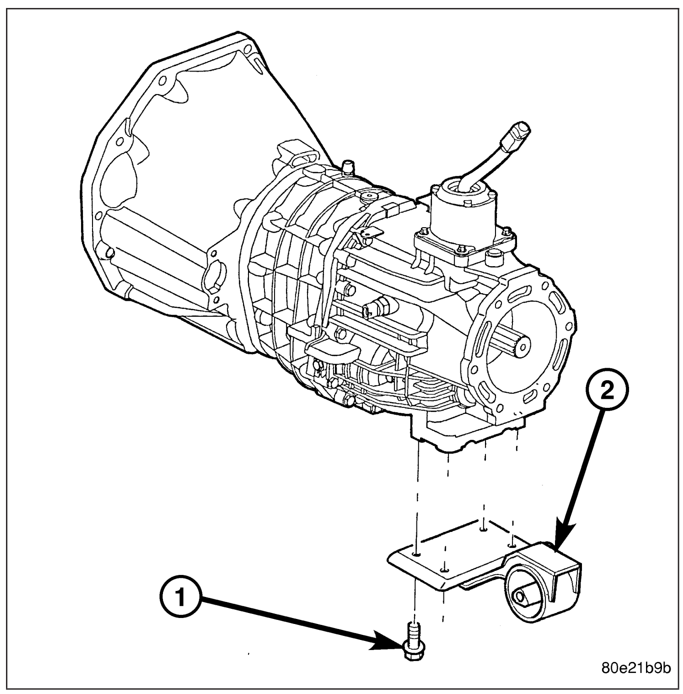
### AUTOMATIC TRANSMISSION

a. Remove the support cushion bolts and remove the cushion and the support bracket from the transmission (4WD) or from the adaptor bracket (2WD).

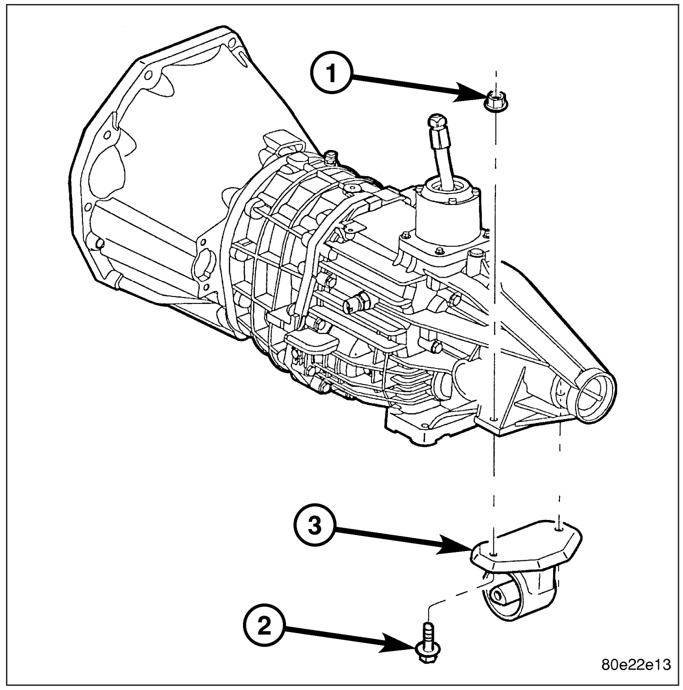
b. On 2WD vehicles, remove the bolts holding the transmission support adaptor bracket to the transmission. Remove the adaptor bracket.

## INSTALLATION

### MANUAL TRANSMISSION:

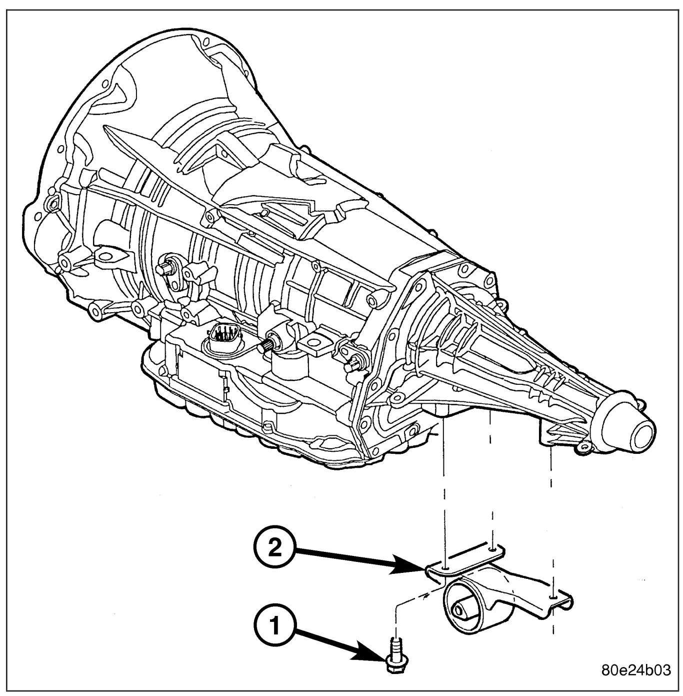


1. Install the transmission mount (1) to the transmissionor. Install the bolts (2) and tighten.

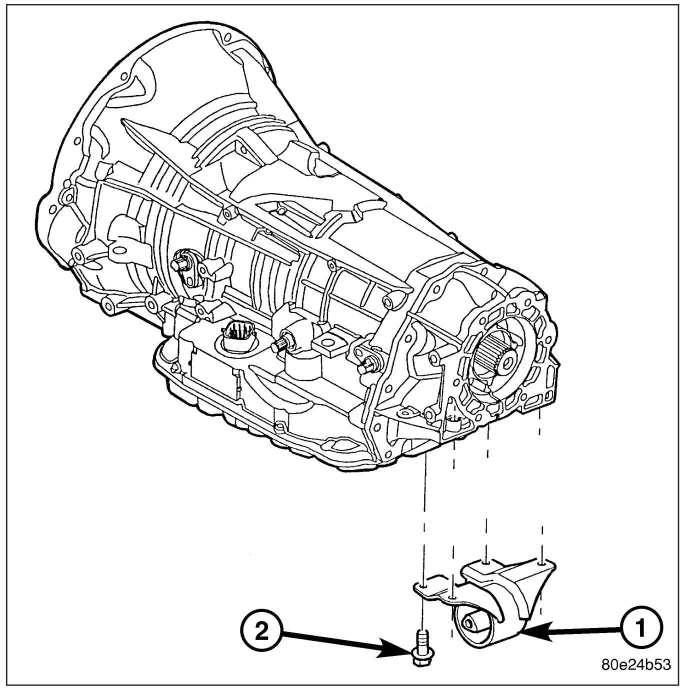



2. Position the crossmember in the vehicle. Install the crossmember to mount through bolt and nut.
3. Install crossmember-to-sill bolts and tighten to 41 N·m (30 ft. lbs.) torque.
4. Remove the transmission support.
5. Lower the vehicle.
6. Connect negative cable to battery.

## AUTOMATIC TRANSMISSION:



1. Install the transmission mount to transmission and. Install the bolts.
2. Position the crossmember in the vehicle. Install the crossmember to mount through bolt and nut.
3. Remove the transmission support.
4. Lower the vehicle.
5. Connect negative cable to battery.



# LUBRICATION

## DESCRIPTION

The lubrication system is a full flow filtration pressure feed type.

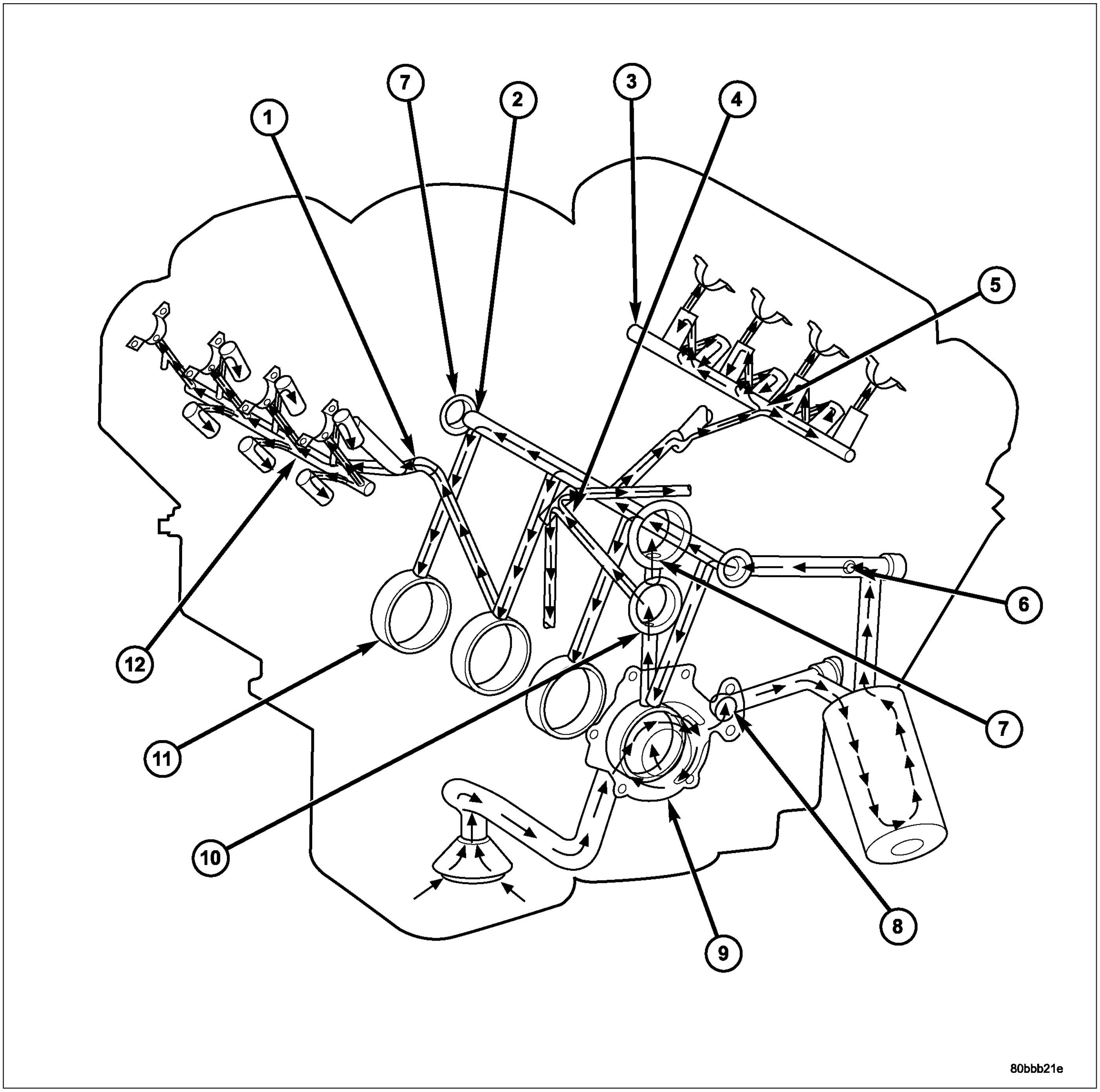
## OPERATION

**Engine Lubrication Flow Chart - Block: Table 1**

| FROM | TO |
|---|---|
| Oil Pickup Tube | Oil Pump |
| Oil Pump | Oil Filter |
| Oil Filter | Block Main Oil Gallery |
| Block Main Oil Gallery | 1. Crankshaft Main Journal<br>2. Left Cylinder Head*<br>3. Right Cylinder Head*<br>4. Counterbalance Shaft Rear Journal |
| Crankshaft Main Journals | Crankshaft Rod Journals |
| Crankshaft Number One Main Journal | 1. Front Timing Chain Idler Shaft<br>2. Counterbalance Shaft - Front Journal<br>3. Both Secondary Chain Tensioners |
| Left Cylinder Head | Refer to Engine Lubrication Flow Chart - Cylinder Heads: Table 2 |
| Right Cylinder Head | Refer to Engine Lubrication Flow Chart - Cylinder Heads: Table 2 |
| * The cylinder head gaskets have an oil restricter to control oil flow to the cylinder heads | |

**Engine Lubrication Flow Chart - Cylinder Heads: Table 2**

| FROM | TO |
|---|---|
| Cylinder Head Oil Port (in bolt hole) | Diagonal Cross Drilling to Main Oil Gallery |
| Main Oil Gallery (drilled through head from rear to front) | 1. Base of Camshaft Towers<br>2. Lash Adjuster Towers |
| Base of Camshaft Towers | Vertical Drilling Through Tower to Camshaft Bearings** |
| Lash Adjuster Towers | Diagonal Drillings to Hydraulic Lash Adjuster Pockets |
| ** The number three camshaft bearing journal feeds oil into the hollow camshaft tubes. Oil is routed to the intake lobes, which have oil passages drilled into them to lubricate the rocker arms. | |




Oil from the oil pan is pumped by a gerotor type oil pump (9) directly mounted to the crankshaft nose. Oil pressure is controlled by a relief valve mounted inside the oil pump housing.

The camshaft exhaust valve lobes and rocker arms are lubricated through a small hole in the rocker arm; oil flows through the lash adjuster then through the rocker arm and onto the camshaft lobe. Due to the orientation of the rocker arm, the camshaft intake lobes are not lubed in the same manner as the exhaust lobes. The intake lobes are lubed through internal passages in the camshaft. Oil flows through a bore in the No. 3 camshaft bearing bore, and as the camshaft turns, a hole in the camshaft aligns with the hole in the camshaft bore allowing engine oil to enter the camshaft tube. The oil then exits through 1.6mm (0.063 in.) holes drilled into the intake lobes, lubricating the lobes and the rocker arms.

# DIAGNOSIS AND TESTING

## DIAGNOSIS AND TESTING - ENGINE OIL LEAK

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.
2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.
3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.**If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method.

### Air Leak Detection Test Method

1. Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.
2. Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.
3. Attach an air hose with pressure gauge and regulator to the dipstick tube.

**CAUTION: Do not subject the engine assembly to more than 20.6 kPa (3 PSI) of test pressure.**

4. Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.
5. If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.
6. If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose.
7. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

## INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.
4. If no leaks are detected, pressurize the crankcase as outlined in the, Inspection (Engine oil Leaks in general)

**CAUTION: Do not exceed 20.6 kPa (3 psi).**

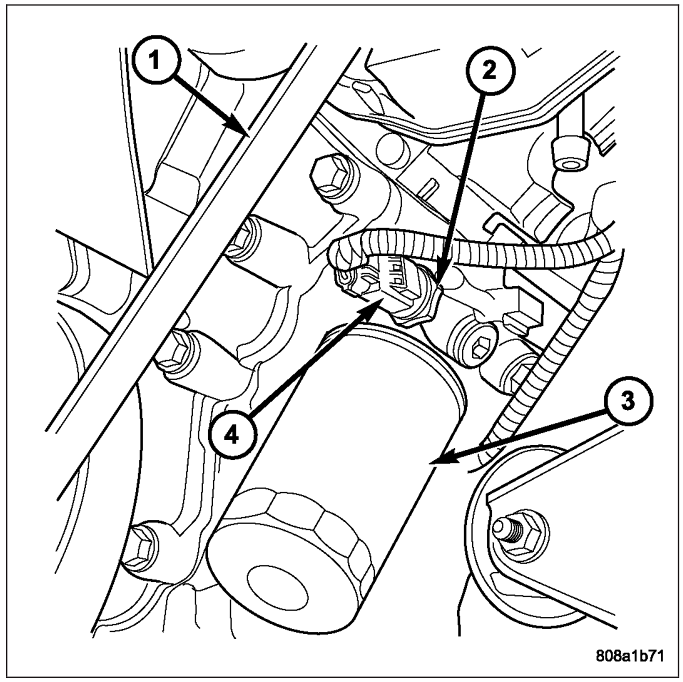
5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

**CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.**

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

## DIAGNOSIS AND TESTING - CHECKING ENGINE OIL PRESSURE

1. Remove oil pressure sending unit (2) and install gauge assembly C-3292.
2. Run engine until thermostat opens.
3. Oil Pressure:
   - Curb Idle - 25 kPa (4 psi) minimum
   - 3000 rpm - 170 - 758 kPa (25 - 110 psi)
4. If oil pressure is 0 at idle, shut off engine. Check for a clogged oil pick-up screen or a pressure relief valve stuck open.




## DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Engine, for proper repair procedures of these items.
4. If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

**CAUTION: Do not exceed 20.6 kPa (3 psi).**

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

**CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.**

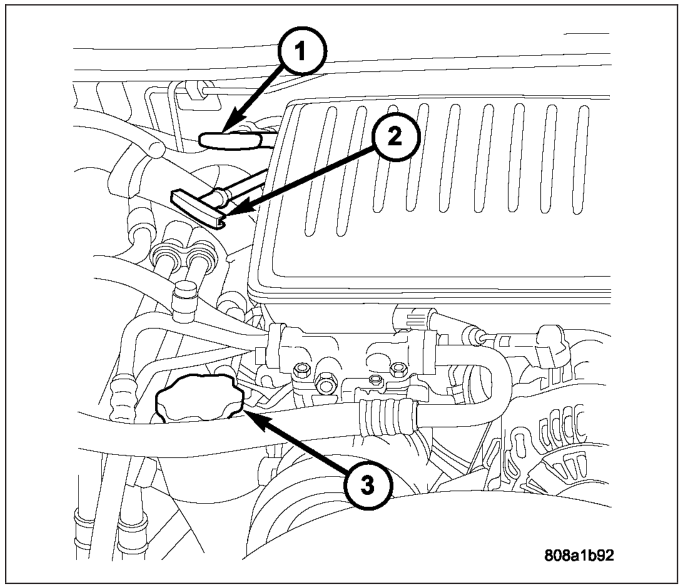
6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), under the Oil Leak row, for components inspections on possible causes and corrections.

7. After the oil leak root cause and appropriate corrective action have been identified, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).

# OIL

## STANDARD PROCEDURE - ENGINE OIL SERVICE

The engine oil level indicator (1) is located at the right rear of the engine on the 3.7L/4.7L engines.




## CRANKCASE OIL LEVEL INSPECTION

**CAUTION: Do not overfill crankcase with engine oil, pressure loss or oil foaming can result.**

Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about five minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

1. Position vehicle on level surface.
2. With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.
3. Wipe dipstick clean.
4. Install dipstick and verify it is seated in the tube.
5. Remove dipstick, with handle held above the tip, take oil level reading.
6. Add oil only if level is below the ADD mark on dipstick.

## ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Maintenance Schedules.

Run engine until achieving normal operating temperature.

1. Position the vehicle on a level surface and turn engine off.
2. Hoist and support vehicle on safety stands.
3. Remove oil fill cap.
4. Place a suitable drain pan under crankcase drain.
5. Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.
6. Install drain plug in crankcase.
7. Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.
8. Install oil fill cap.
9. Start engine and inspect for leaks.

10. Stop engine and inspect oil level.

**NOTE:**
**Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING at beginning of this section.**

# FILTER-ENGINE OIL

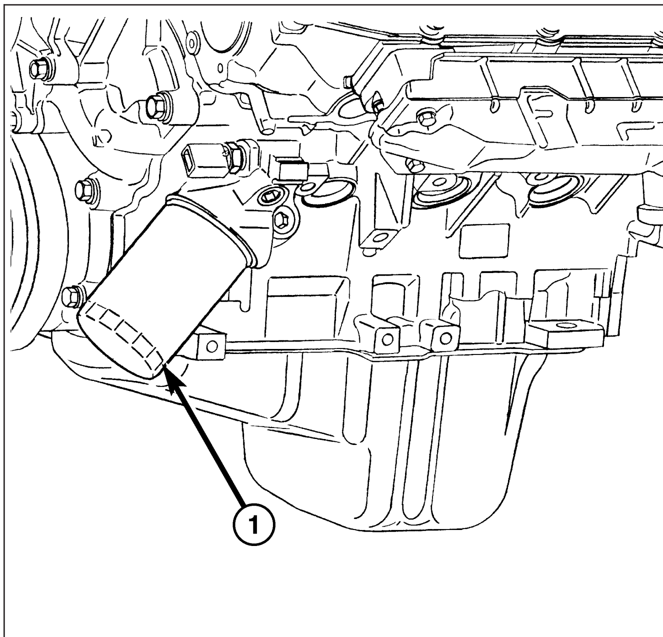
## REMOVAL

All engines are equipped with a high quality full-flow, disposable type oil filter. DaimlerChrysler Corporation recommends a Mopar® or equivalent oil filter be used.

1. Position a drain pan under the oil filter (1).
2. Using a suitable oil filter wrench loosen filter.
3. Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss.
4. When filter separates from cylinder block oil filter boss, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

**NOTE: Make sure filter gasket was removed with filter.**

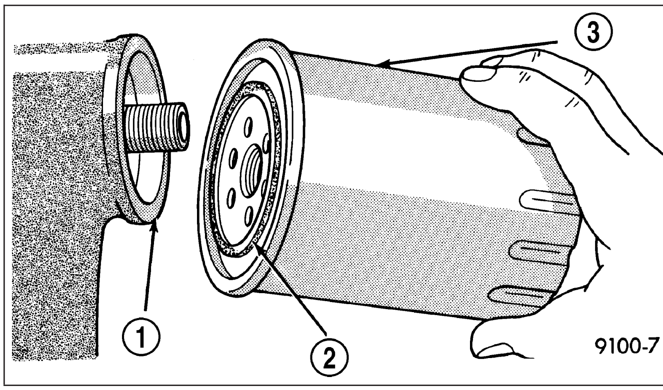
5. With a wiping cloth, clean the gasket sealing surface of oil and grime.




808a1b94

## INSTALLATION

1. Lightly lubricate oil filter gasket (2) with engine oil.
2. Thread filter (3) onto adapter nipple. When gasket makes contact with sealing surface, hand tighten filter one full turn, do not over tighten.
3. Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

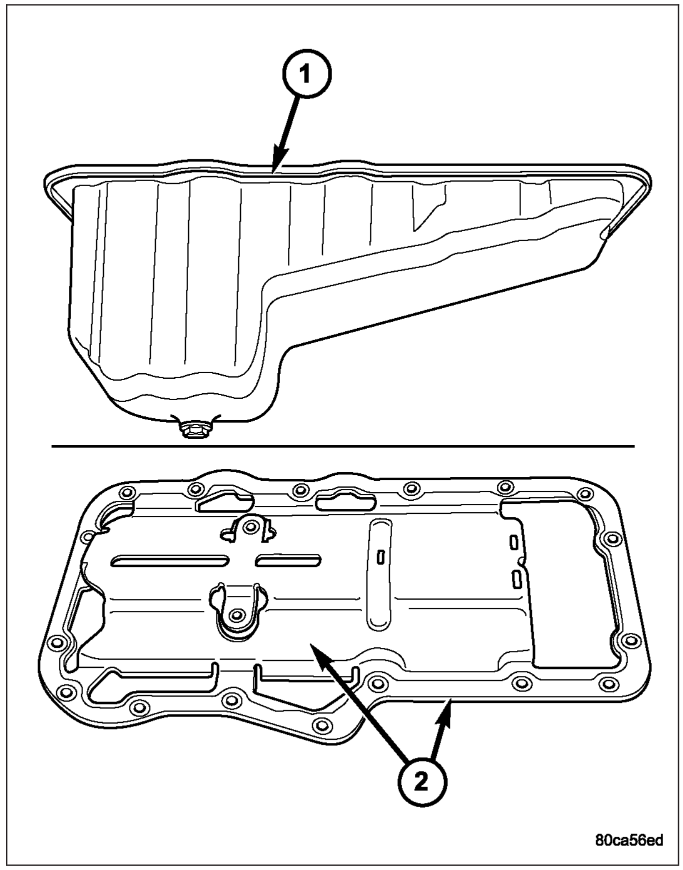



9100-7

# PAN-ENGINE OIL

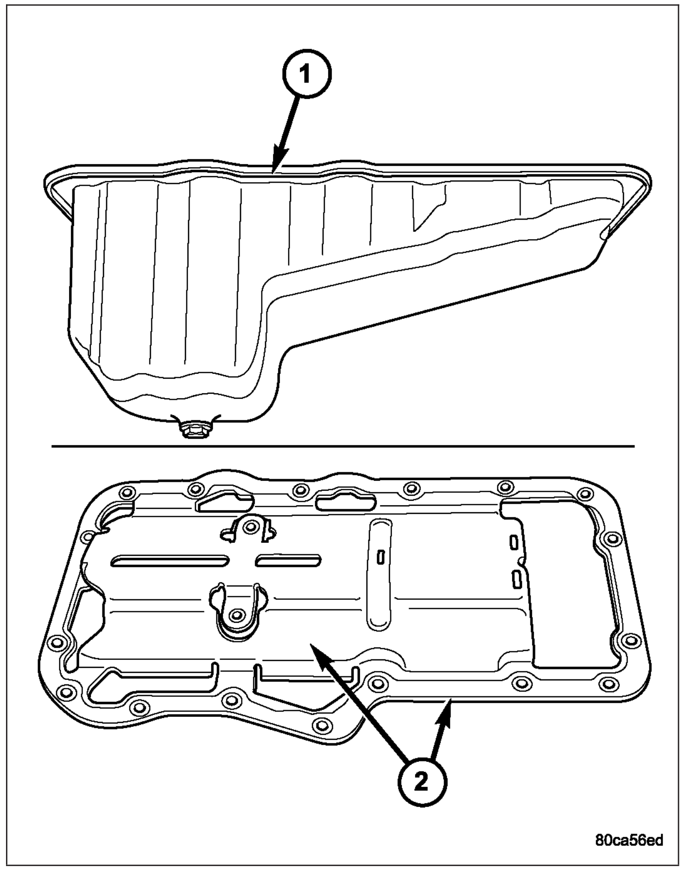
## DESCRIPTION

The engine oil pan (1)is made of laminated steel and has a single plane sealing surface. The sandwich style oil pan gasket has an integrated windage tray (2) and steel carrier. The sealing area of the gasket is molded with rubber and is designed to be reused as long as the gasket is not cut, torn or ripped.



## REMOVAL

## REMOVAL




1. Disconnect and isolate negative battery cable.
2. Install engine support fixture.
3. Raise and support vehicle.
4. Remove front wheel assemblies.
5. Remove skid plate (if equipped). (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - REMOVAL)
6. Drain engine oil.
7. Mark adjustment cam position of front lower control arm bolts.
8. Remove front lower control arm bolts. (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - REMOVAL)
9. Disconnect LH tie rod. (Refer to 19 - STEERING/ LINKAGE/TIE ROD END - REMOVAL)
10. Disconnect LH lower ball joint (Refer to 2 - SUSPENSION/FRONT/LOWER BALL JOINT - REMOVAL)
11. Disconnect LH strut clevis (Refer to 2 - SUSPENSION/FRONT/CLEVIS BRACKET - REMOVAL)
12. Remove LH front axle (Refer to 3 - DIFFERENTIAL & DRIVELINE/HALF SHAFT - REMOVAL)
13. Remove front axle brace bolts.
14. Remove front prop shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/ PROPELLER SHAFT - REMOVAL)
15. Drain front axle.
16. Using a transmission jack, support front axle.
17. Remove axle bracket bolts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - REMOVAL)
18. With RH axle still in place, remove front differential.
19. Remove transmission oil cooler line bracket.
20. Remove engine to transmission stiffening bracket.
21. Position Special Tool 8534 on fender lip and align the slots in the brackets with the fender mounting holes.
22. Secure brackets to the fender using four M6 X 1.0 X 25 MM flanged cap screws.
23. Tighten the thumbscrews to secure the sleeves to the support tube.
24. Secure the support tube in an upright position.
25. Assemble the flat washer, thrust bearing, hook and T handle.
26. Using the M10 X 1.75 mm flanged nut supplied with the support fixture, secure the chain to the front engine lifting stud.
27. Loosen engine mounts.
28. Remove oil pan bolts.
29. Seperate oil pan (1) from engine.
30. Move oil pan to one side, remove oils sump bolt and windage tray bolts,

**NOTE: Do not pry on oil pan or oil pan gasket. Gasket is integral to engine windage tray and does not come out with oil pan.**

31. Move the oil pan and windage tray (2) toward front of vehicle and remove from vehicle.

## REMOVAL - 4x4

1. Disconnect Battery.
2. Install Engine Support Fixture, special Tool 8534.
3. Raise and support vehicle.
4. Remove front wheel and tire assemblies.
5. Remove skid plate (if equipped).
6. Drain engine oil.
7. Remove engine to transmission structural cover, (if equipped).
8. Remove transmission oil cooler line bracket.
9. Remove the front axle assembly from the vehicle (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - REMOVAL).
10. Loosen both engine mount through bolts.
11. Lower the vehicle.

**NOTE: It is not necessary to remove the viscous fan , or fan shroud, for oil pan removal.**

12. Raise the engine using Engine Support Fixture, special Tool 8534, until the viscous fan almost touches the fan shroud.
13. Raise the vehicle.
14. Remove the oil pan bolts.
15. Separate the oil pan from the engine.
16. Remove the (2) nuts and (1) bolt holding the oil pump pick-up tube, and windage tray in place.

**NOTE: It will be necessary to move the oil pan from side to side to gain access to these fasteners.**

17. Drop the oil pump pick-up tube into the oil pan, and remove the oil pan, pick-up tube, and the windage tray, as an assembly, from the front of the vehicle.

## CLEANING

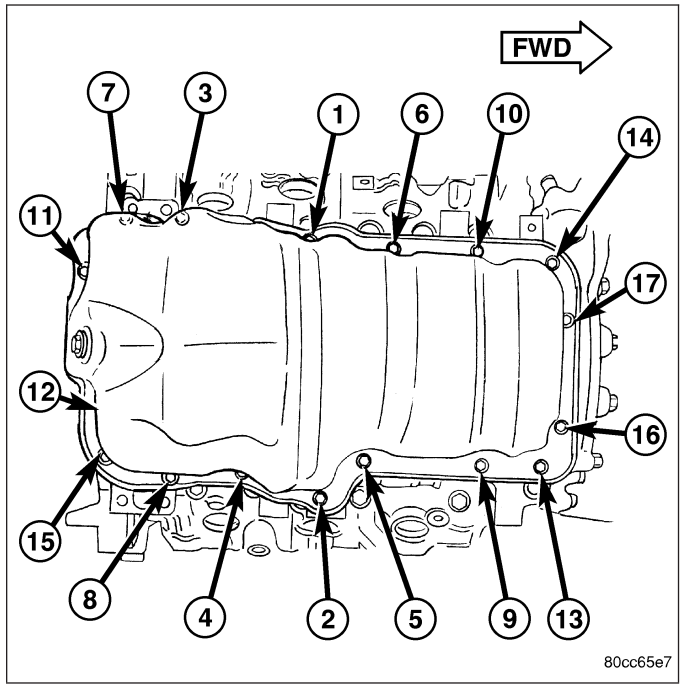
1. Clean oil pan in solvent and wipe dry with a clean cloth.
2. Clean the oil pan gasket surface. **DO NOT** use a grinder wheel or other abrasive tool to clean sealing surface.
3. Clean oil screen and tube thoroughly in clean solvent.

## INSPECTION

1. Inspect oil drain plug and plug hole for stripped or damaged threads. Repair as necessary.
2. Inspect the oil pan mounting flange for bends or distortion. Straighten flange, if necessary.

## INSTALLATION

## INSTALLATION




1. Clean the oil pan gasket mating surface of the bed-plate and oil pan.
2. Clean the oil pan and block gasket mating surfaces.
3. Inspect integrated oil pan gasket, and replace as necessary.
4. Drop the oil pump pick-up tube into the oil pan, and install the oil pan, pick-up tube, and the windage tray, as an assembly, from the front of the vehicle.
5. Install the windage tray, then the oil pump pick-up tube, and the (2) nuts and (1) bolt holding the oil pump pick-up tube, in place.

**NOTE: It will be necessary to move the oil pan from side to side to gain access to these fasteners.**

6. Torque the pick-up tube fasteners.
1. Install the oil pan.
2. Install and torque the oil pan bolts..
3. Install the engine to transmission structural cover, (if equipped).
4. Lower engine, and remove Special Tool 8534.
5. Lower the vehicle.
6. Lower the engine using Engine Support Fixture, special Tool # 8534.
7. Remove the Engine Support Fixture, special Tool # 8534.
8. Raise the vehicle.
9. Tighten both engine mount through bolts.
10. Install the transmission oil cooler line bracket.
11. Lower the vehicle.
12. Refill engine oil.
13. Reconnect battery.
14. Start engine and check for leaks.

## INSTALLATION - 4x4

1. Inspect oil pan gasket for defects, and replace if necessary.
2. Clean the oil pan and block gasket mating surfaces.
3. Drop the oil pump pick-up tube into the oil pan, and install the oil pan, pick-up tube, and the windage tray, as an assembly, from the front of the vehicle.
4. Install the windage tray, then the oil pump pick-up tube, and the (2) nuts and (1) bolt holding the oil pump pick-up tube, in place.

**NOTE: It will be necessary to move the oil pan from side to side to gain access to these fasteners.**

5. Torque the pick-up tube fasteners.
6. Install the oil pan.
7. Install and torque the oil pan bolts.
8. Install the engine to transmission structural cover, (if equipped).
9. Lower the vehicle.

10. Lower the engine using Engine Support Fixture, special Tool # 8534.
11. Remove the Engine Support Fixture, special Tool # 8534.
12. Raise the vehicle.
13. Tighten both engine mount through bolts.
14. Install the transmission oil cooler line bracket.
15. Install the front axle assembly to the vehicle (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - INSTALLATION).
16. Install the skid plate (if equipped).
17. Install the front wheel and tire assemblies.
18. Lower the vehicle.
19. Refill engine oil.
20. Reconnect battery.
21. Start engine, and check for leaks.

# SWITCH-OIL PRESSURE

## DESCRIPTION

The 1 wire, solid-state engine oil pressure sensor (sending unit) is located in an engine oil pressure gallery.

## OPERATION

The oil pressure sensor uses three circuits. They are:

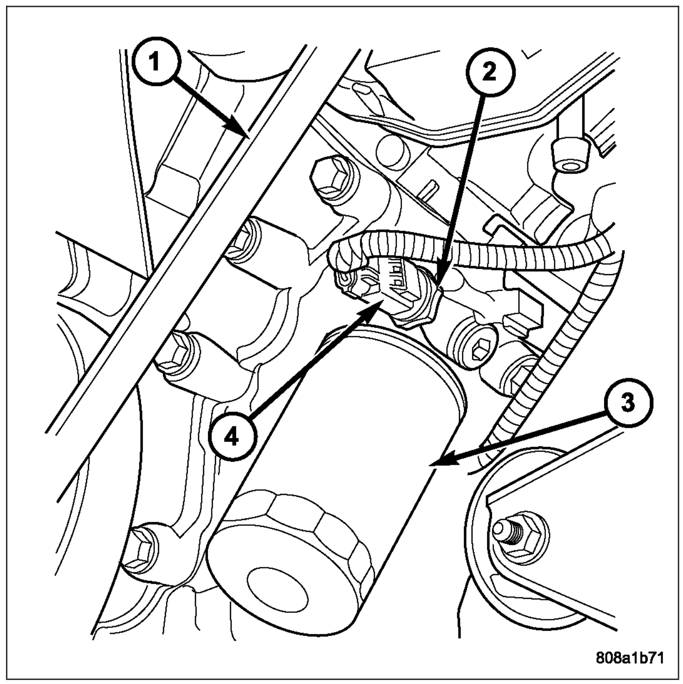
- A 5 volt power supply from the Powertrain Control Module (PCM)
- A sensor ground through the PCM's sensor return
- A signal to the PCM relating to engine oil pressure

The oil pressure sensor has a 3 wire electrical function very much like the Manifold Absolute Pressure (MAP) sensor. Meaning different pressures relate to different output voltages.

A 5 volt supply is sent to the sensor from the PCM to power up the sensor. The sensor returns a voltage signal back to the PCM relating to engine oil pressure. This signal is then transferred (bussed) to the instrument panel on either a CCD or PCI bus circuit (depending on vehicle line) to operate the oil pressure gauge and the check gauges lamp. Ground for the sensor is provided by the PCM through a low-noise sensor return.

## REMOVAL

1. Disconnect the negative cable from the battery.
2. Raise vehicle on hoist.
3. Remove front splash shield.
4. Disconnect oil pressure sender wire (4).
5. Remove the pressure sender (2).




## INSTALLATION

1. Install oil pressure sender.
2. Connect oil pressure sender wire.
3. Install front splash shield.
4. Lower vehicle.
5. Connect the negative battery cable.

# PUMP-ENGINE OIL

## REMOVAL

1. Remove the oil pan and pick-up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
2. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
3. Remove the timing chains and tensioners (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
4. Remove the four bolts, primary timing chain tensioner and the oil pump.

## DISASSEMBLY

1. Remove oil pump cover screws and lift off cover plate.
2. Remove pump inner and outer rotors.

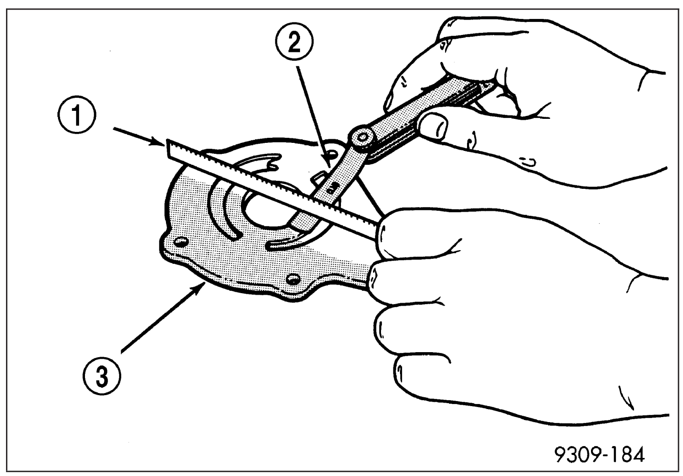
**NOTE: Once the oil pressure relief valve, cup plug, and pin are removed, the pump assembly must be replaced.**

3. If it is necessary to remove the pressure relief valve, drive the roll pin from pump housing and remove cup plug, spring and valve.

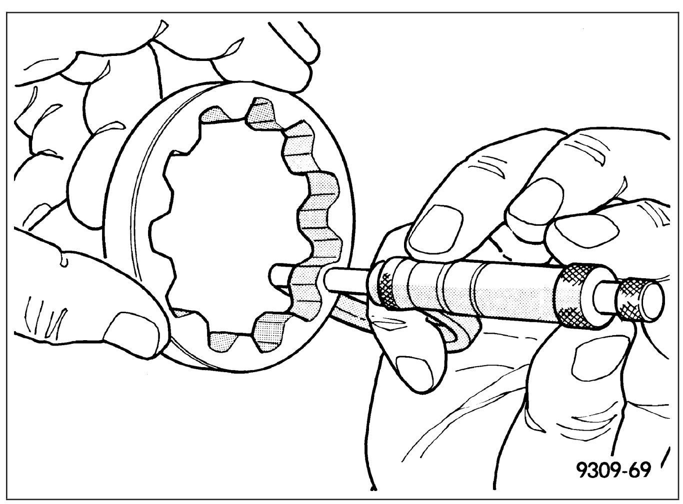
## INSPECTION

**CAUTION: Oil pump pressure relief valve and spring should not be removed from the oil pump. If these components are disassembled and or removed from the pump the entire oil pump assembly must be replaced.**

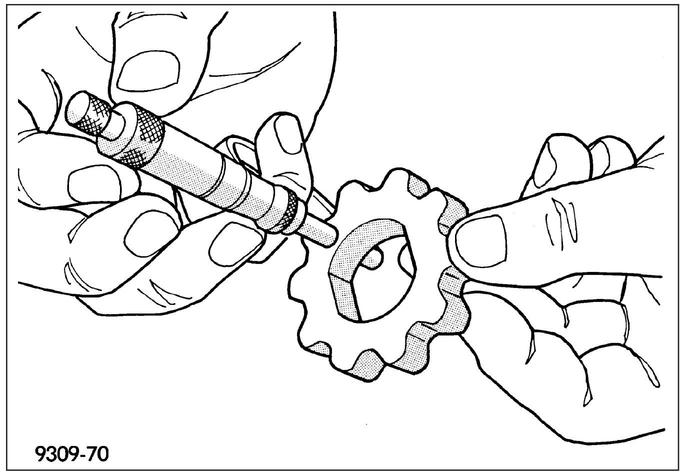
1. Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. If the pump cover is scratched or grooved the oil pump assembly should be replaced.
2. Lay a straight edge across the pump cover surface (3). If a 0.025 mm (0.001 in.) feeler gauge (2) can be inserted between the cover and the straight edge the oil pump assembly should be replaced.



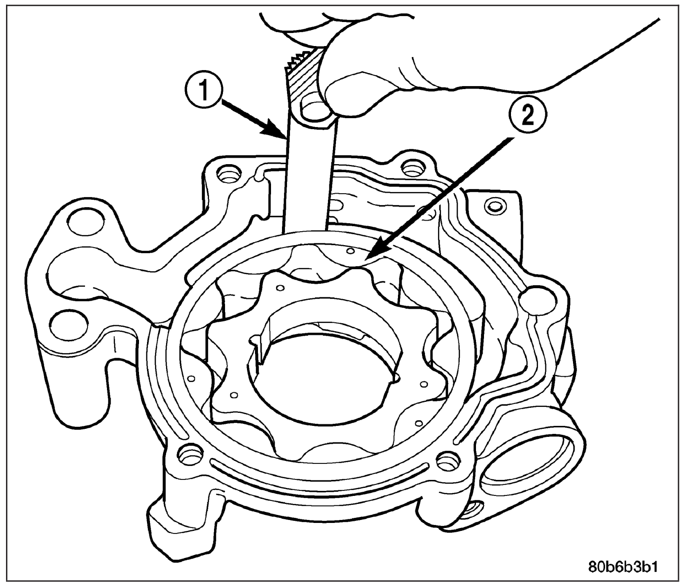

3. Measure the thickness of the outer rotor. If the outer rotor thickness measures at 12.005 mm (0.472 in.) or less the oil pump assembly must be replaced.
4. Measure the diameter of the outer rotor. If the outer rotor diameter measures at 85.925 mm (3.382 in.) or less the oil pump assembly must be replaced.



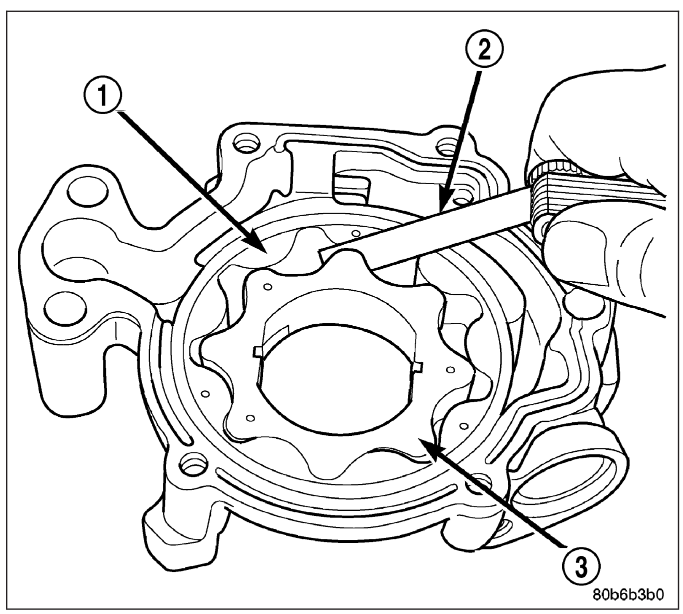
5. Measure the thickness of the inner rotor. If the inner rotor thickness measures at 12.005 mm (0.472 in.) or less then the oil pump assembly must be replaced.




6. Slide outer rotor (2) into the body of the oil pump. Press the outer rotor to one side of the oil pump body and measure clearance between the outer rotor and the body. If the measurement is 0.235mm (0.009 in.) or more the oil pump assembly must be replaced.

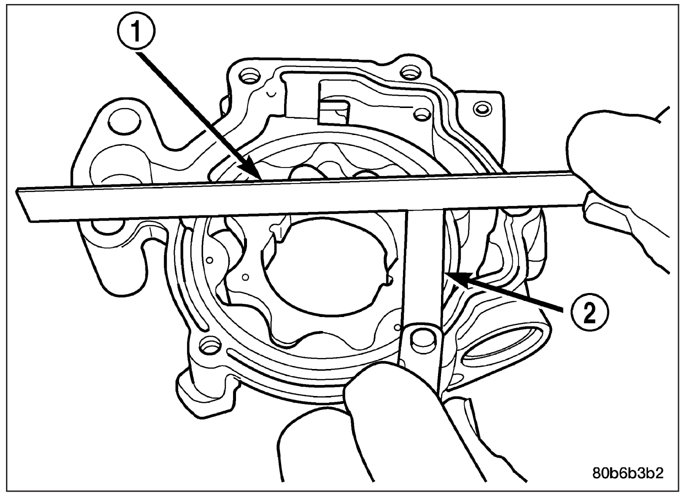



7. Install the inner rotor into the oil pump body. Measure the clearance between the inner (3) and outer (1) rotors. If the clearance between the rotors is .150 mm (0.006 in.) or more the oil pump assembly must be replaced.



8. Place a straight edge (1) across the body of the oil pump (between the bolt holes), if a feeler gauge (2) of .095 mm (0.0038 in.) or greater can be inserted between the straightedge and the rotors, the pump must be replaced.

**NOTE: The 3.7L/4.7L Oil pump is released as an assembly. There are no DaimlerChrysler part numbers for Sub-Assembly components. In the event the oil pump is not functioning or out of specification it must be replaced as an assembly.**

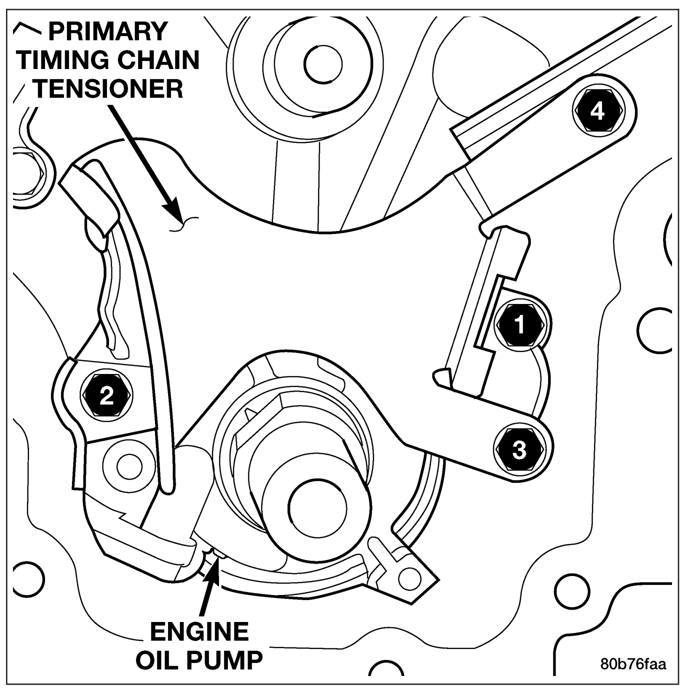



## ASSEMBLY

1. Wash all parts in a suitable solvent and inspect carefully for damage or wear.
2. Install inner and outer rotors
3. Install oil pump cover plate and install cover bolts and tighten them to 12 N·m (105 in. lbs.).
4. Prime oil pump before installation by filling rotor cavity with engine oil.
5. If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other causes for oil pressure loss.

## INSTALLATION

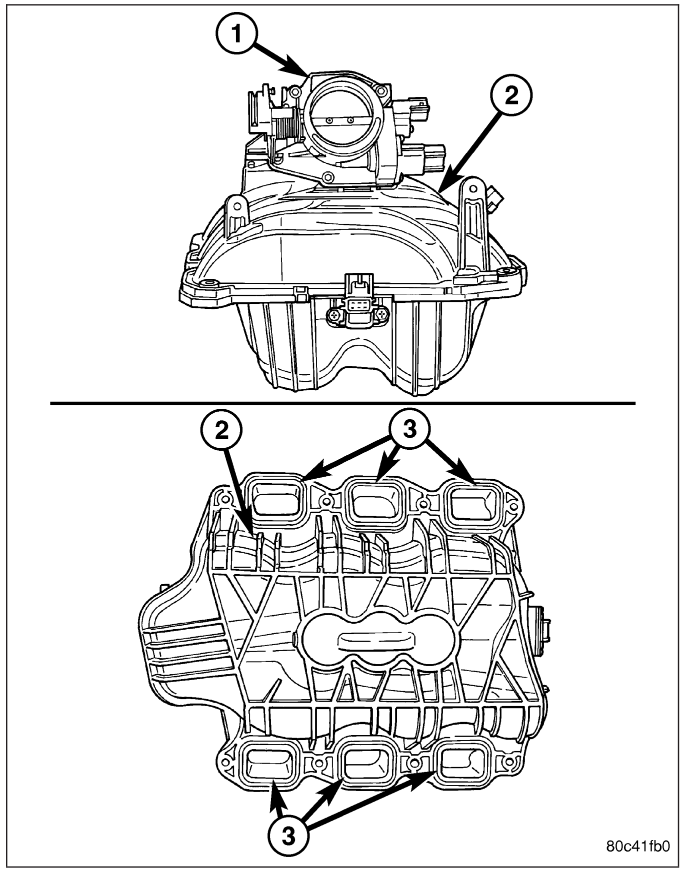
1. Position the oil pump onto the crankshaft and install two oil pump retaining bolts.
2. Position the primary timing chain tensioner and install the two retaining bolts.
3. Tighten the oil pump and primary timing chain tensioner retaining bolts to 28 N·m (250 in. lbs.) in the sequence shown.
4. Install the secondary timing chain tensioners and timing chains (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
5. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
6. Install the pick-up tube and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).



# MANIFOLD-INTAKE

## DESCRIPTION

The intake manifold (2) is made of a composite material and features 300 mm (11.811 in.) long runners which maximizes low end torque. The intake manifold uses single plane sealing which consist of six individual press in place port gaskets to prevent leaks. The throttle body attaches directly to the intake manifold. Eight studs and two bolts are used to fasten the intake to the head.




## DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

**WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.**

1. Start the engine.
2. Spray a small stream of water (spray bottle) at the suspected leak area.
3. If engine RPM'S change, the area of the suspected leak has been found.
4. Repair as required.

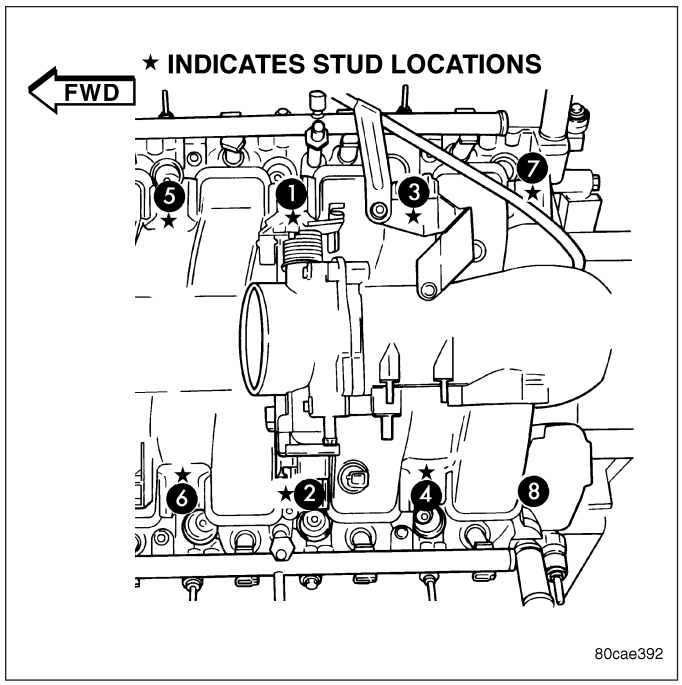
## REMOVAL

1. Disconnect negative cable from battery.
2. Remove resonator assembly and air inlet hose.
3. Disconnect throttle and speed control cables.
4. Disconnect electrical connectors for the following components: Refer to FUEL SYSTEM for component locations.
   - Manifold Absolute Pressure (MAP) Sensor
   - Intake Air Temperature (IAT) Sensor
   - Throttle Position (TPS) Sensor
   - Coolant Temperature (CTS) Sensor
   - Idle Air Control (IAC) Motor

5. Disconnect vapor purge hose, brake booster hose, speed control servo hose, positive crankcase ventilation (PCV) hose.
6. Disconnect generator electrical connections.
7. Disconnect air conditioning compressor electrical connections.
8. Disconnect left and right radio suppressor straps.
9. Disconnect and remove ignition coil towers.
10. Remove top oil dipstick tube retaining bolt and ground strap.
11. Bleed fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
12. Remove fuel rail.
13. Remove throttle body assembly and mounting bracket.
14. Drain cooling system below coolant temperature level (Refer to 7 - COOLING - STANDARD PROCEDURE).
15. Remove the heater hoses from the engine front cover and the heater core.
16. Unclip and remove heater hoses and tubes from intake manifold.
17. Remove coolant temperature sensor (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT TEMP SENSOR - REMOVAL).
18. Remove intake manifold retaining fasteners in reverse order of tightening sequence.
19. Remove intake manifold.

## INSTALLATION

1. Install intake manifold gaskets.
2. Install intake manifold.
3. Install intake manifold retaining bolts and tighten in sequence shown in to 12 N·m (105 in. lbs.).
4. Install left and right radio suppressor straps.
5. Install throttle body assembly.
6. Connect throttle cable and speed control cable to throttle body.
7. Install fuel rail.



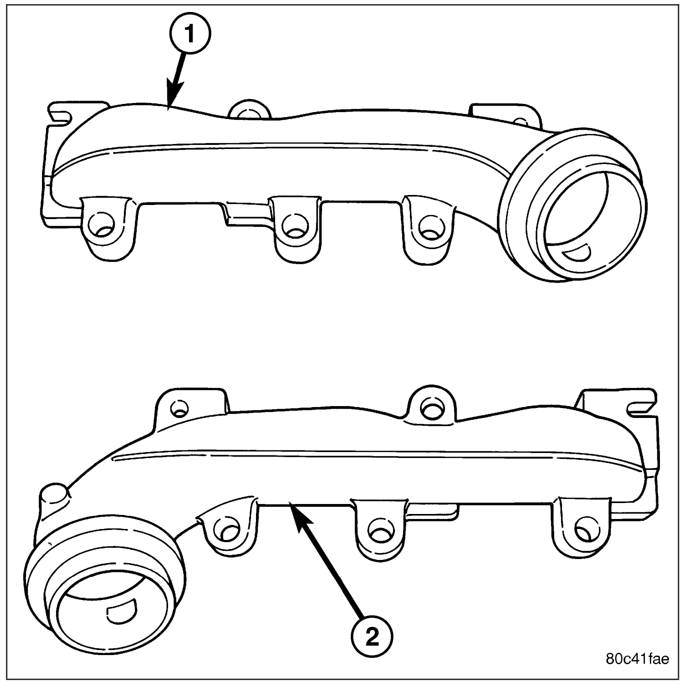

8. Install ignition coil towers.
9. Position and install heater hoses and tubes onto intake manifold.
10. Install the heater hoses to the heater core and engine front cover.
11. Connect electrical connectors for the following components:
   - Manifold Absolute Pressure (MAP) Sensor
   - Intake Air Temperature (IAT) Sensor
   - Throttle Position (TPS) Sensor
   - Coolant Temperature (CTS) Sensor
   - Idle Air Control (IAC) Motor
   - Ignition coil towers
   - Fuel injectors

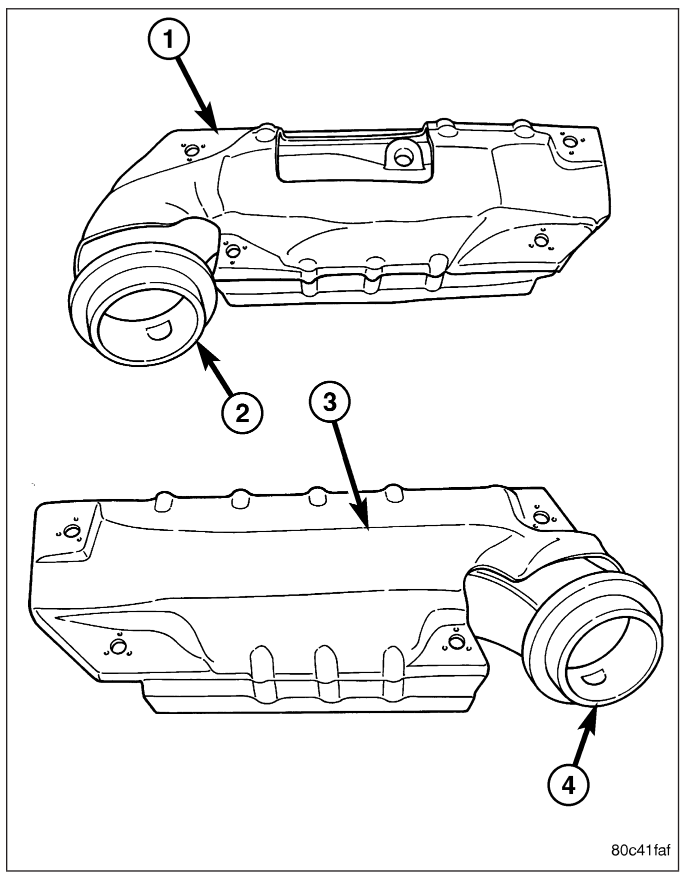
12. Install top oil dipstick tube retaining bolt and ground strap.
13. Connect generator electrical connections.
14. Connect Vapor purge hose, Brake booster hose, Speed control servo hose, Positive crankcase ventilation (PCV) hose.
15. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
16. Install resonator assembly and air inlet hose.
17. Connect negative cable to battery.

# MANIFOLD-EXHAUST

## DESCRIPTION

The exhaust manifolds (1,2) are log style with a patented flow enhancing design to maximize performance. The exhaust manifolds are made of high silicon molybdenum cast iron. A perforated core graphite exhaust manifold gasket is used to improve sealing to the cylinder head. The exhaust manifolds are covered by a three layer laminated heat shield (3) for thermal protection and noise reduction. The heat shields are fastened with a torque prevailing nut that is backed off slightly to allow for the thermal expansion of the exhaust manifold.

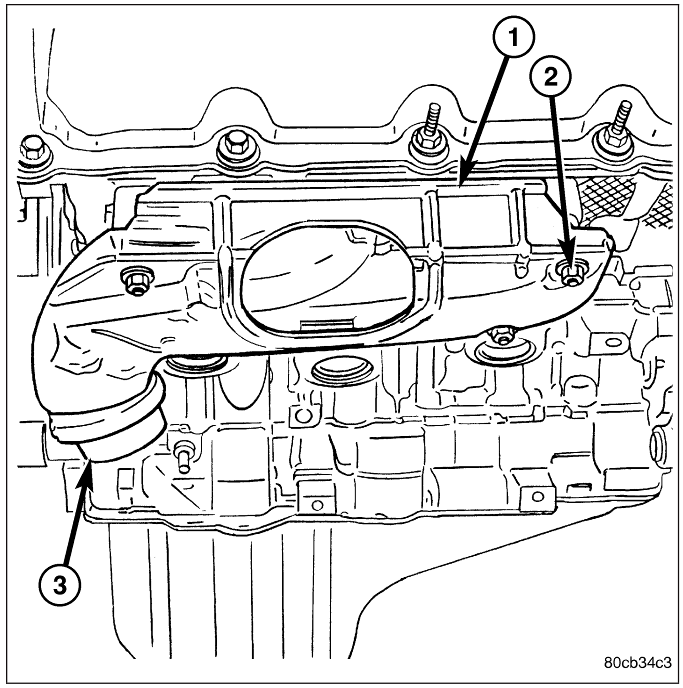



## REMOVAL

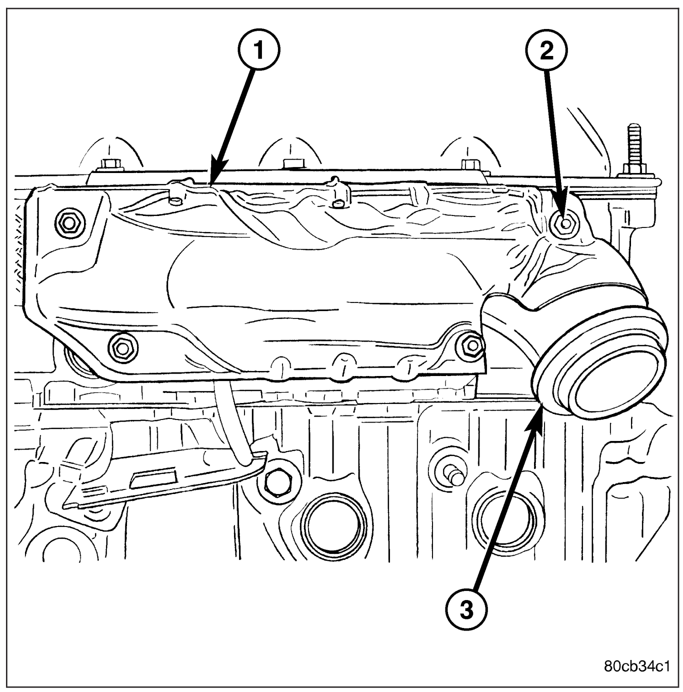
### RIGHT EXHAUST MANIFOLD

1. Disconnect the negative cable from the battery.
2. Raise and support the vehicle.
3. Remove the bolts and nuts attaching the exhaust pipe to the engine exhaust manifold.
4. Lower the vehicle.
5. Remove the exhaust heat shield (1).
6. Remove bolts, nuts and washers attaching manifold to cylinder head.
7. Remove manifold and gasket from the cylinder head.




### LEFT EXHAUST MANIFOLD

1. Disconnect the negative cable from the battery.
2. Raise and support the vehicle.
3. Remove the bolts and nuts attaching the exhaust pipe to the engine exhaust manifold.
4. Lower the vehicle.
5. Remove the exhaust heat shields (1).
6. Remove bolts, nuts and washers attaching manifold to cylinder head.
7. Remove manifold and gasket from the cylinder head.




## INSTALLATION

### RIGHT EXHAUST MANIFOLD

**CAUTION: If the studs came out with the nuts when removing the engine exhaust manifold, install new studs. Apply sealer on the coarse thread ends. Water leaks may develop at the studs if this precaution is not taken.**

1. Position the engine exhaust manifold and gasket on the two studs located on the cylinder head. Install conical washers and nuts on these studs.
2. Install remaining conical washers. Starting at the center arm and working outward, tighten the bolts and nuts to 25 N·m (18 ft. lbs.) torque.
3. Install the exhaust heat shields.
4. Raise and support the vehicle.

**CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.**

5. Assemble exhaust pipe to manifold and secure with bolts, nuts and retainers. Tighten the bolts and nuts to 34 N·m (25 ft. lbs.) torque.

## LEFT EXHAUST MANIFOLD

**CAUTION: If the studs came out with the nuts when removing the engine exhaust manifold, install new studs. Apply sealer on the coarse thread ends. Water leaks may develop at the studs if this precaution is not taken.**

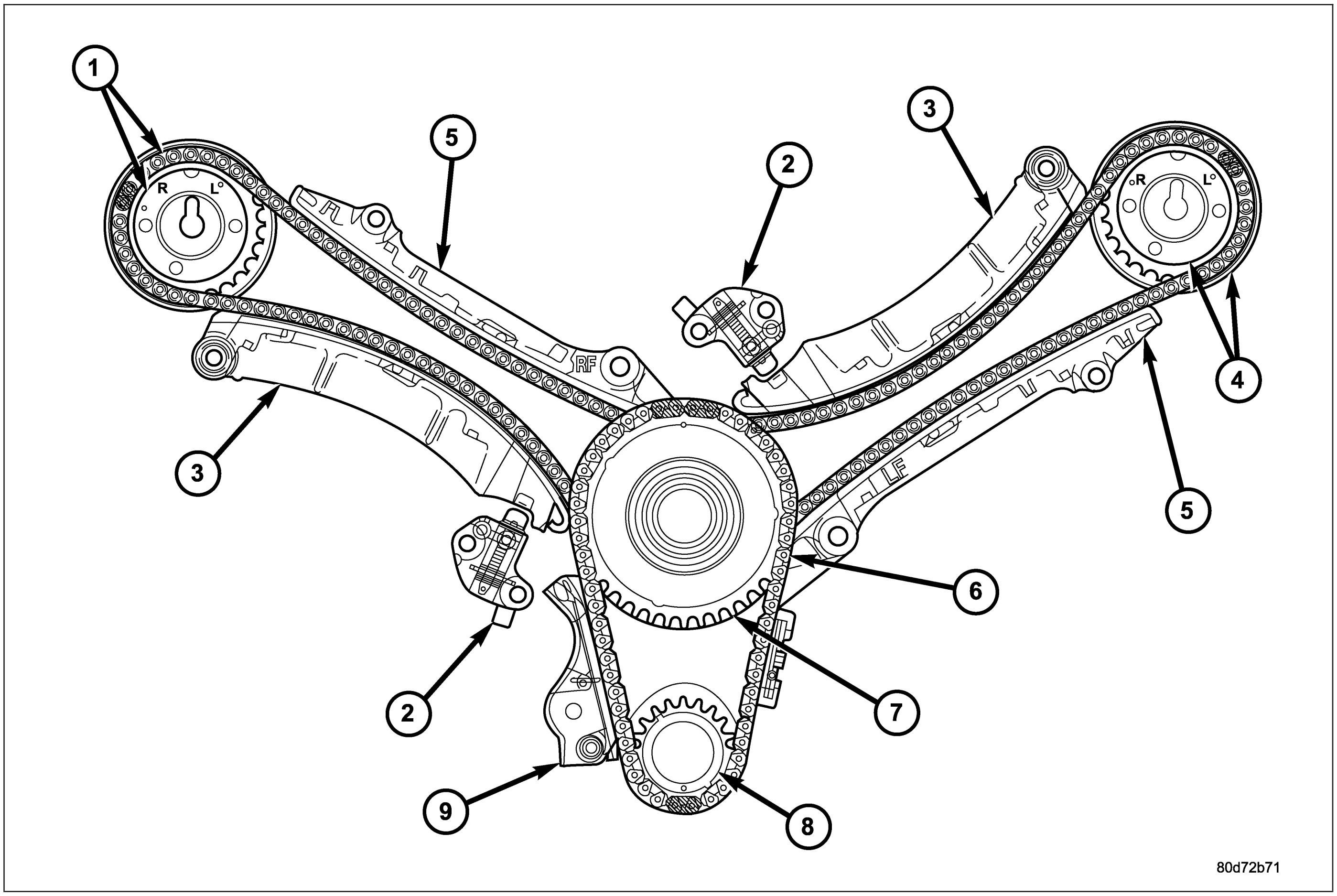
1. Position the engine exhaust manifold and gasket on the two studs located on the cylinder head. Install conical washers and nuts on these studs.
2. Install remaining conical washers. Starting at the center arm and working outward, tighten the bolts and nuts to 25 N·m (18 ft. lbs.) torque.
3. Install the exhaust heat shields.
4. Raise and support the vehicle.

**CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.**

5. Assemble exhaust pipe to manifold and secure with bolts, nuts and retainers. Tighten the bolts and nuts to 34 N·m (25 ft. lbs.) torque.

# VALVE TIMING

## DESCRIPTION




The timing drive system has been designed to provide quiet performance and reliability to support a **non-free wheeling** engine. Specifically the intake valves are non-free wheeling and can be easily damaged with forceful engine rotation if camshaft-to-crankshaft timing is incorrect. The timing drive system consists of a primary chain (6), two secondary timing chain drives (1,4) and a counterbalance shaft drive.

## OPERATION

The primary timing chain is a single inverted tooth chain type. The primary chain drives the large 50 tooth idler sprocket directly from a 25 tooth crankshaft sprocket. Primary chain motion is controlled by a pivoting leaf spring tensioner arm and a fixed guide. The arm and the guide both use nylon plastic wear faces for low friction and long wear. The primary chain receives oil splash lubrication from the secondary chain drive and designed oil pump leakage. The idler sprocket assembly connects the primary chain drive, secondary chain drives, and the counterbalance shaft. The idler sprocket assembly consists of two integral 26 tooth sprockets a 50 tooth sprocket and a helical gear that is press-fit to the assembly. The spline joint for the 50 tooth sprocket is a non serviceable press fit anti rattle type. A spiral ring is installed on the outboard side of the 50 tooth sprocket to prevent spline disengagement. The idler sprocket assembly spins on a stationary idler shaft. The idler shaft is a light press-fit into the cylinder block. A large washer on the idler shaft bolt and the rear flange of the idler shaft are used to control sprocket thrust movement. Pressurized oil is routed through the center of the idler shaft to provide lubrication for the two bushings used in the idler sprocket assembly.

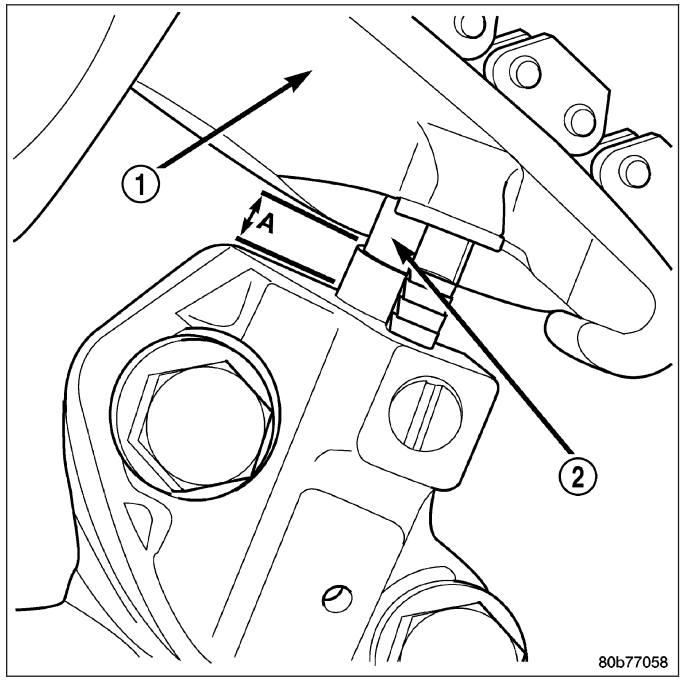
There are two secondary drive chains, both are roller type, one to drive the camshaft in each SOHC cylinder head. There are no shaft speed changes in the secondary chain drive system. Each secondary chain drives a 26 tooth cam sprocket directly from the 26 tooth sprocket on the idler sprocket assembly. A fixed chain guide and a hydraulic oil damped tensioner are used to maintain tension in each secondary chain system. The hydraulic tensioners for the secondary chain systems are fed pressurized oil from oil reservoir pockets in the block. Each tensioner incorporates a controlled leak path through a device known as a vent disc located in the nose of the piston to manage chain loads. Each tensioner also has a mechanical ratchet system that limits chain slack if the tensioner piston bleeds down after engine shut down. The tensioner arms and guides also utilize nylon wear faces for low friction and long wear. The secondary timing chains receive lubrication from a small orifice in the tensioners. This orifice is protected from clogging by a fine mesh screen which is located on the back of the hydraulic tensioners.

## STANDARD PROCEDURE

## MEASURING TIMING CHAIN WEAR

**NOTE: This procedure must be performed with the timing chain cover removed.**

1. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
2. To determine if the secondary timing chains are worn, rotate the engine clockwise until maximum tensioner piston (2) extension is obtained. Measure the distance between the secondary timing chain tensioner housing and the step ledge on the piston. The measurement at point (A) must be less than 15mm (.5906 inches).
3. If the measurement exceeds the specification the secondary timing chains are worn and require replacement (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).




## SERVICE PROCEDURE - TIMING VERIFICATION

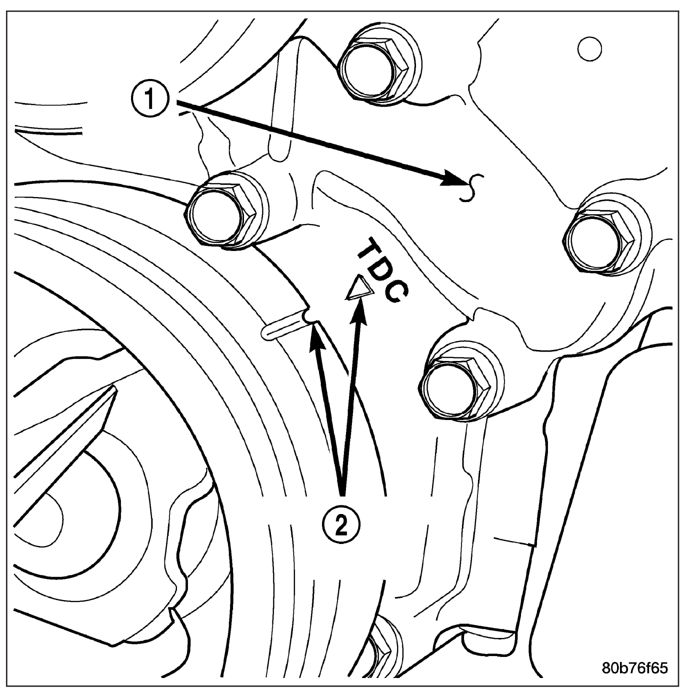
**CAUTION: The 3.7L is a non free-wheeling design engine. Therefore, correct engine timing is critical.**

**NOTE: Components referred to as left hand or right hand are as viewed from the drivers position inside the vehicle.**

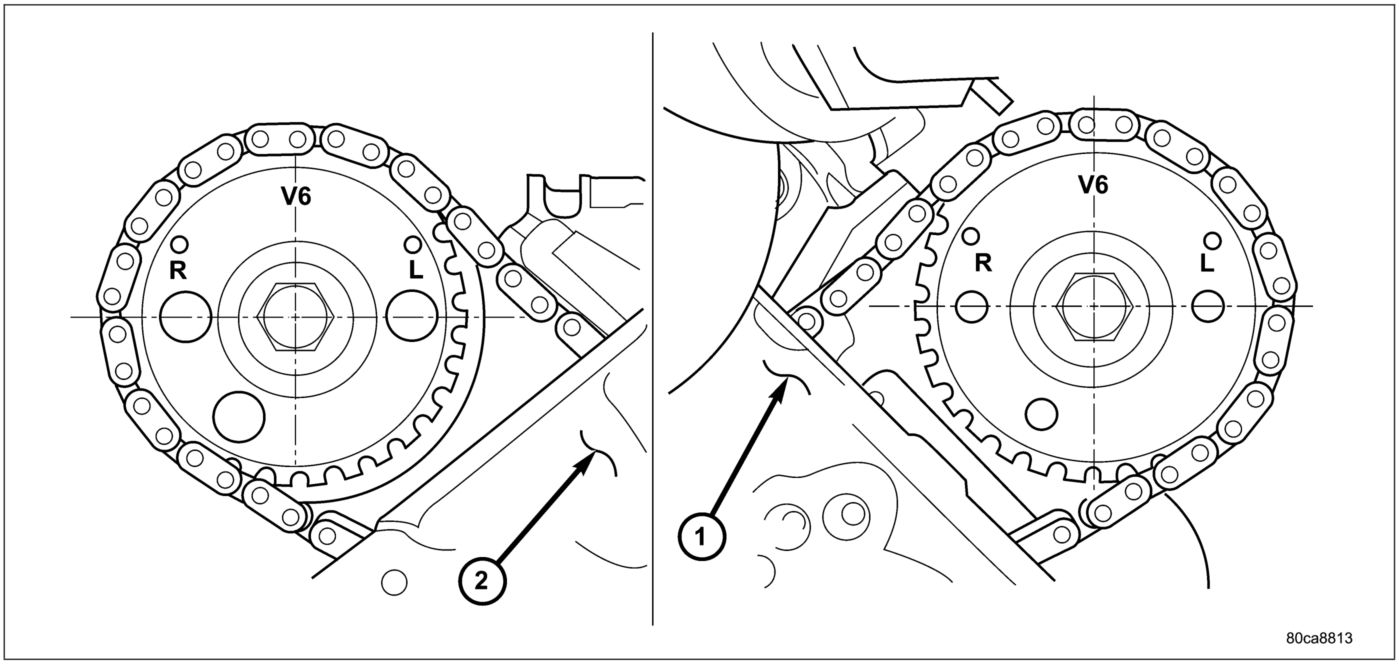
**NOTE: The blue link plates on the chains and the dots on the camshaft drive sprockets may not line up during the timing verification procedure. The blue link plates are lined up with the sprocket dots only when re-timing the complete timing drive. Once the timing drive is rotated blue link-to-dot alignment is no longer valid.**

Engine base timing can be verified by the following procedure:

1. Remove the cylinder head covers. Refer to the procedure in this section.



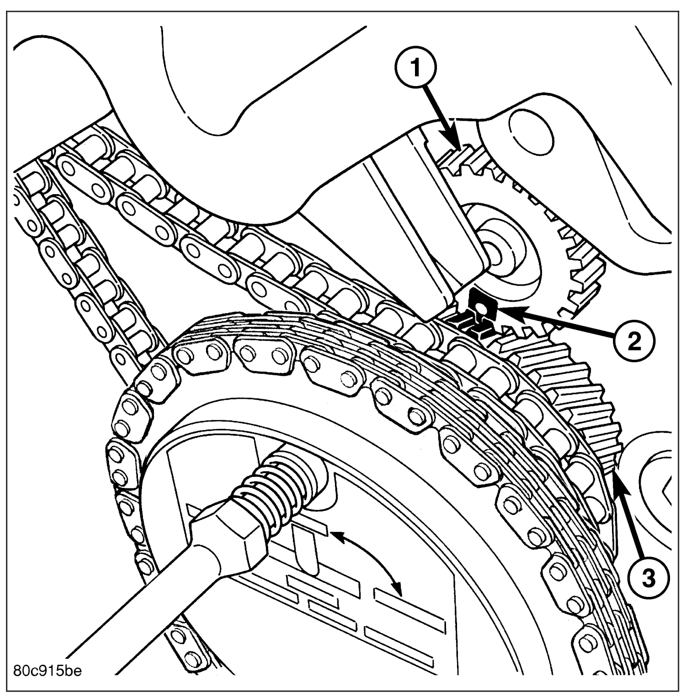
2. Using a mirror, locate the TDC arrow on the front cover. Rotate the crankshaft until the mark on the crankshaft damper (2) is aligned with the TDC arrow on the front cover (2). The engine is now at TDC.




3. Note the location of the V6 mark stamped into the camshaft drive gears (1,2). If the V6 mark on each camshaft drive gear is at the twelve o'clock position, the engine is at TDC on the exhaust stroke. If the V6 mark on each gear is at the six o'clock position, the engine is at TDC on the compression stroke.
4. If both of the camshaft drive gears are off in the same or opposite directions, the primary chain or both secondary chains are at fault. Refer to Timing Chain and Sprockets procedure in this section.
5. If only one of the camshaft drive gears is off and the other is correct, the problem is confined to one secondary chain. Refer to Single camshaft timing, in this procedure.
6. If both camshaft drive gear V6 marks are at the twelve o'clock or the six o'clock position the engine base timing is correct. Reinstall the cylinder head covers.

## COUNTER BALANCE SHAFT TIMING

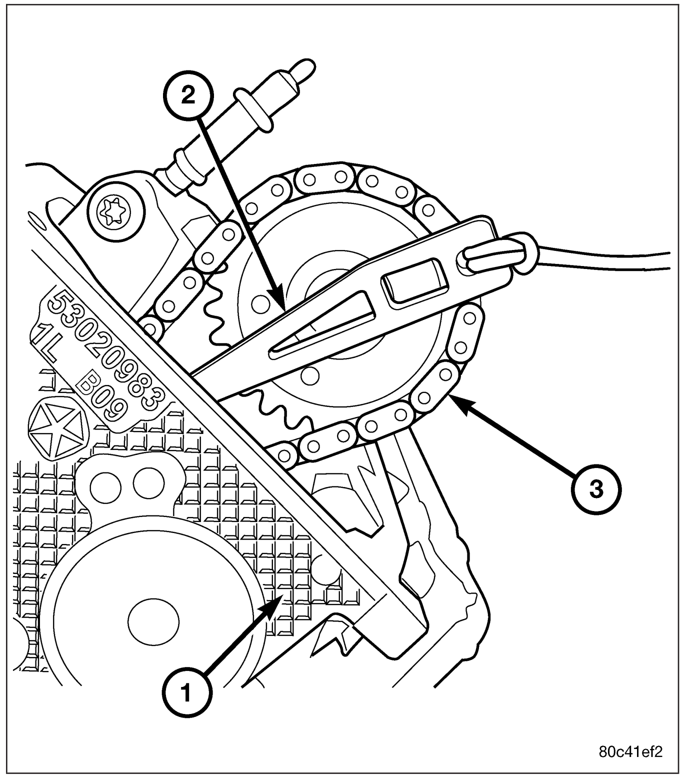
1. Ensure that the engine is at TDC with both camshaft sprocket V6 marks in the 12 o'clock position.
2. Look down the left cylinder head chain cavity. The timing dot (2) on the counter balance shaft drive gear should be in the 6 o'clock position.



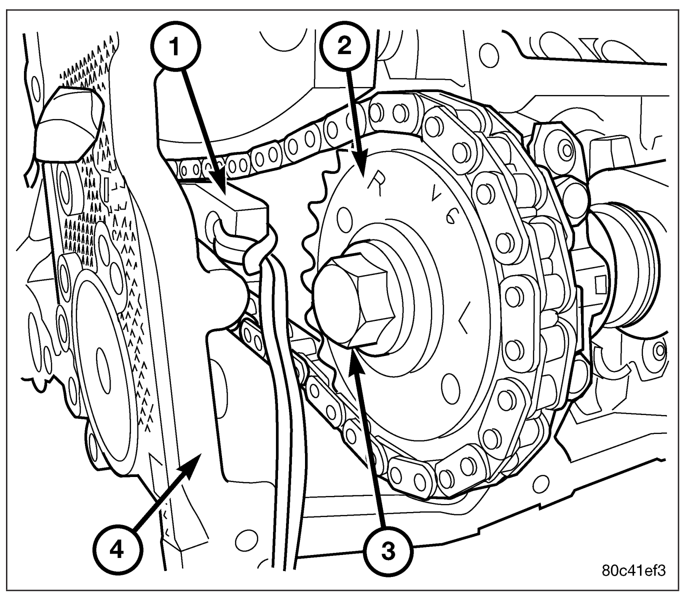
## TIMING - SINGLE CAMSHAFT

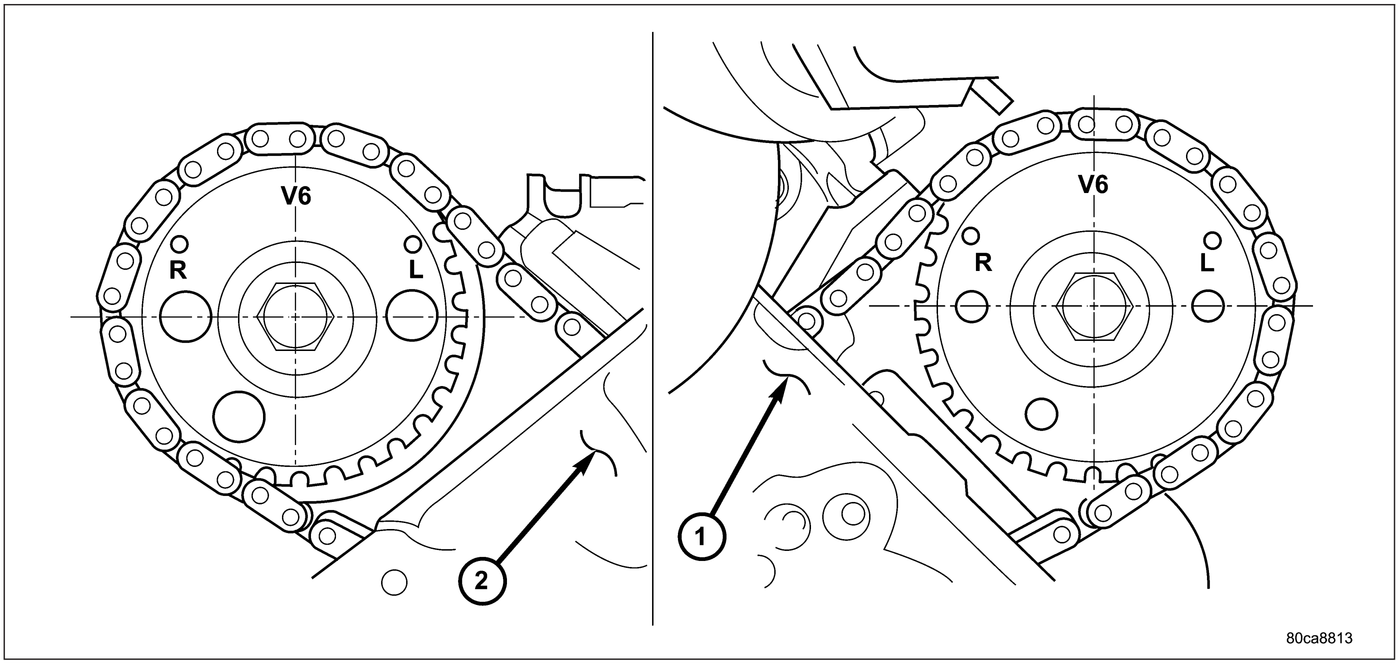
**NOTE: to adjust the timing on one camshaft, preform the following procedure.**

1. Using Chain Tensioner Wedge, Special Tool 8379 (2), stabilize the secondary chain drive. For reference purposes, mark the chain-to-sprocket position.




2. Remove the camshaft drive gear retaining bolt (3).
3. Carefully remove the camshaft drive gear from the camshaft.






4. Re-index the camshaft drive gear in the chain until the V6 mark is at the same position as the V6 mark on the opposite camshaft drive gear (1,2).
5. Using Special Tool 8428 Camshaft Wrench, rotate the camshaft until the alignment dowel on the camshaft is aligned with the slot in the camshaft drive gear.

**CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torqueing of bolt resulting in bolt failure.**

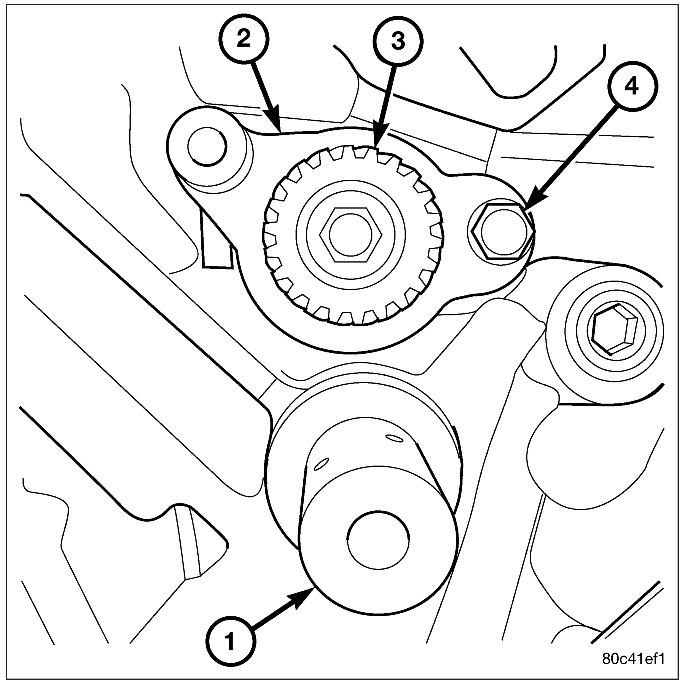
6. Position the camshaft drive gear onto the camshaft, remove oil from bolt then install the retaining bolt. Using Special Tools, Spanner Wrench 6958 with Adapter Pins 8346 and a suitable torque wrench, Tighten retaining bolt to 122 N·m (90 ft. Lbs.).
7. Remove Special Tool 8379.
8. Rotate the crankshaft two full revolutions, then verify that the camshaft drive gear V6 marks are in fact aligned.
9. Install the cylinder head covers. Refer to Cylinder Head Cover in this section.

# SHAFT-BALANCE

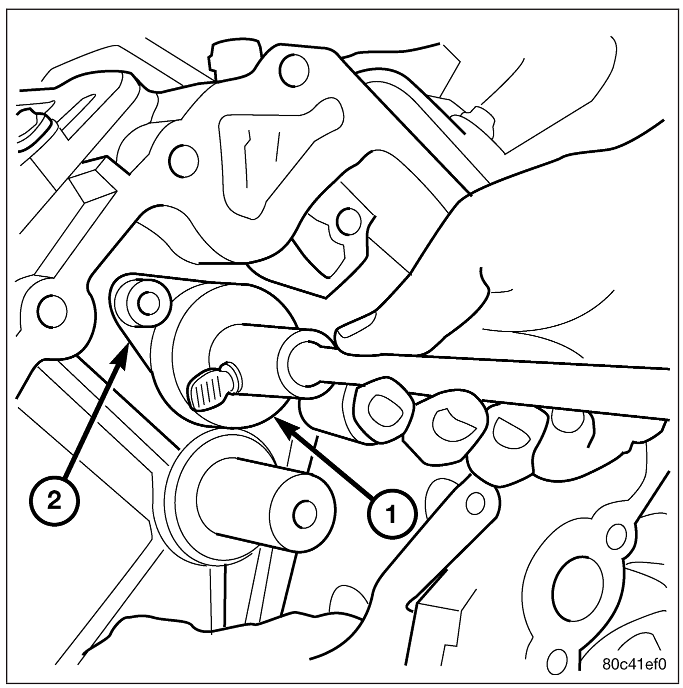
## REMOVAL

1. Remove the primary and secondary timing chains. Refer to TIMING CHAIN and SPROCKET.

**NOTE: The balance shaft and gear are serviced as an assembly. Do not attempt to remove the gear from the balance shaft.Remove the retaining bolt (4) from the counterbalance shaft thrust plate (2).**




2. Using Special Tool 8641 Counterbalance shaft remover/installer tool (1), remove the counterbalance shaft from the engine .



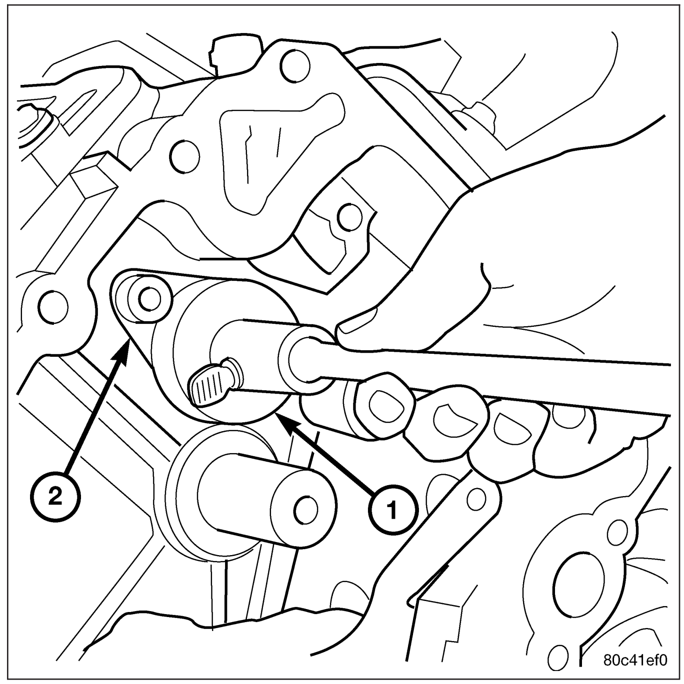
## INSTALLATION

**NOTE: The balance shaft and gear are serviced as an assembly. Do not attempt to remove the gear from the balance shaft.**

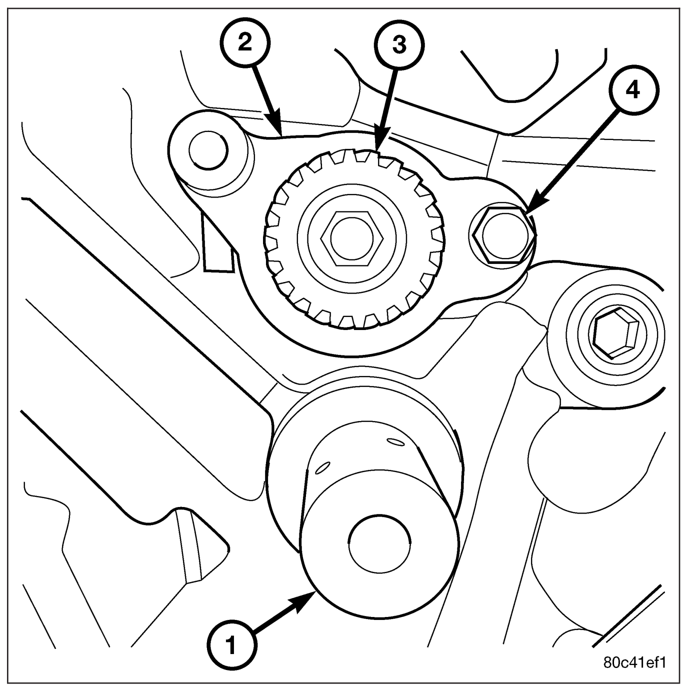
1. Coat counterbalance shaft bearing journals with clean engine oil.

**NOTE: The balance shaft is heavy, and care should be used when installing shaft, so bearings are not damaged.**

2. Using Special Tool 8641 Counterbalance shaft remover/installer tool (1), carefully install counterbalance shaft into engine.



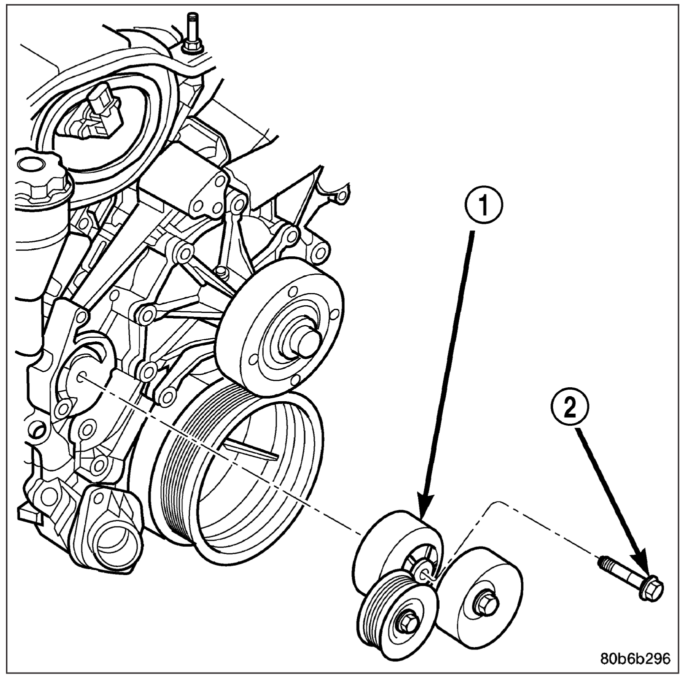

3. Install Counterbalance shaft thrust plate retaining bolt (4) finger tight.Do not tighten bolt at this time.
4. Position the right side of the thrust plate with the right chain guide bolt, install bolt finger tight.
5. Torque the thrust plate retaining bolt (4) to 28 N·m (250 in. lbs.).
6. Remove the chain guide bolt so that guide can be installed.



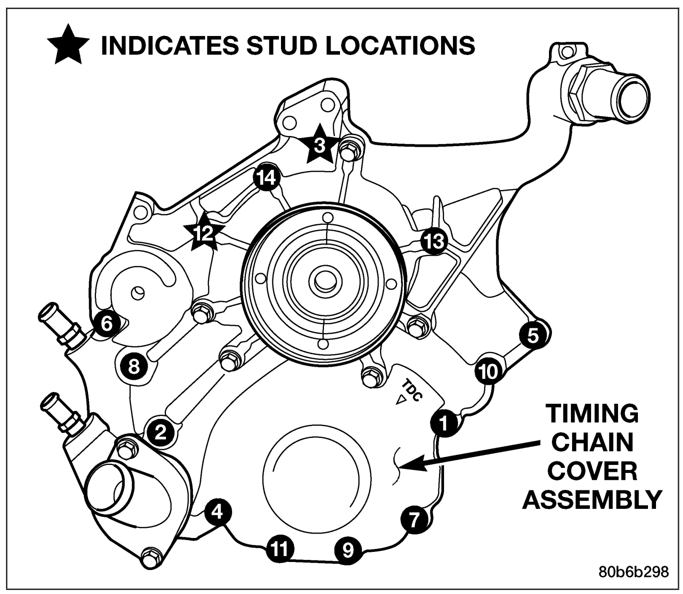
# COVER-TIMING

## REMOVAL

1. Disconnect the battery negative cable.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove electric cooling fan and fan shroud assembly.
4. Remove fan and fan drive assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
5. Disconnect both heater hoses at timing cover.
6. Disconnect lower radiator hose at engine.
7. Remove accessory drive belt tensioner assembly (1).




8. Remove crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
9. Remove the generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).
10. Remove A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL).




**CAUTION: The 3.7L engine uses an anerobic sealer instead of a gasket to seal the front cover to the engine block, from the factory. For service, Mopar® Grey Engine RTV sealant must be substituted.**

**NOTE: It is not necessary to remove the water pump for timing cover removal.**

11. Remove the bolts holding the timing cover to engine block..
12. Remove the timing cover.

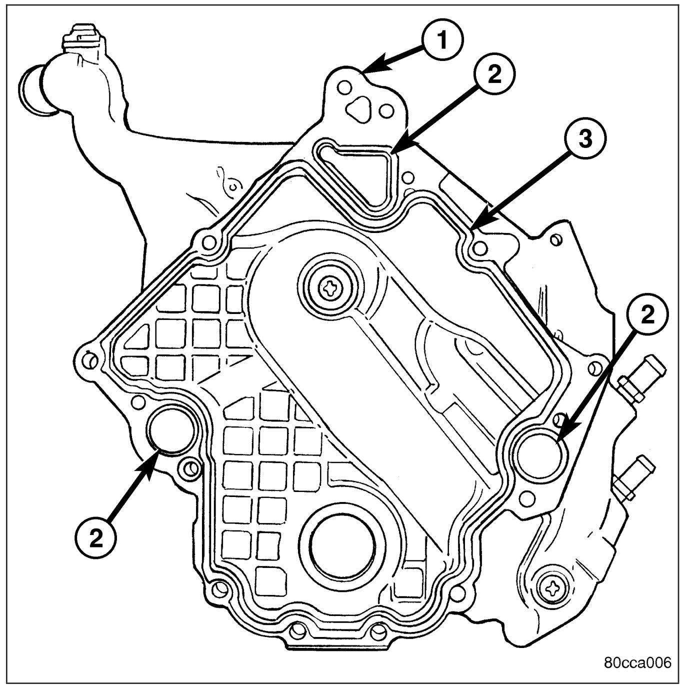
## INSTALLATION

**CAUTION: Do not use oil based liquids to clean timing cover or block surfaces. Use only rubbing alcohol, along with plastic or wooden scrapers. Use no wire brushes or abrasive wheels or metal scrapers, or damage to surfaces could result.**

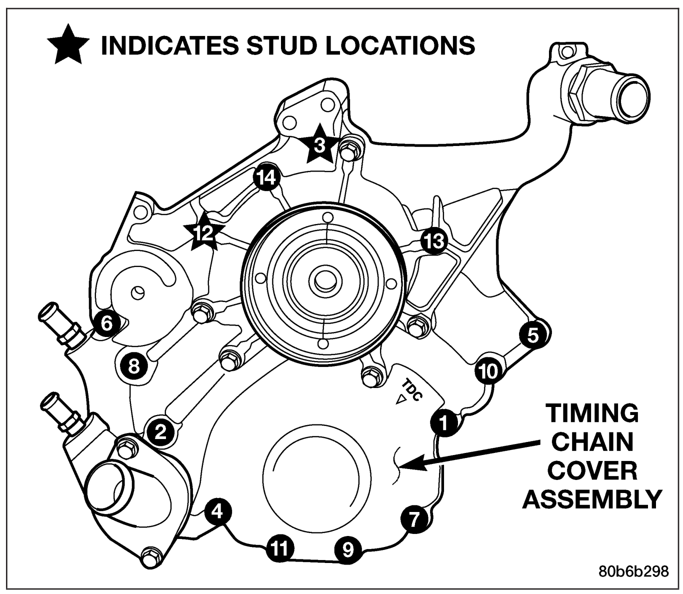
1. Clean timing chain cover and block surface using rubbing alcohol.

**CAUTION: The 3.7L uses a special anerobic sealer instead of a gasket to seal the timing cover to the engine block, from the factory. For service repairs, Mopar® Grey Engine RTV must be used as a substitute.**

2. Inspect the water passage o-rings for any damage, and replace as necessary.
3. Apply Mopar® Grey Engine RTV sealer (3) to the front cover following the path below, using a 3 to 4mm thick bead.




4. Install cover. Tighten flange head fasteners in sequence shown to 58 N·m (43 ft. lbs.).
5. Install crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
6. Install the A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION).
7. Install the generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).
8. Install accessory drive belt tensioner assembly (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - INSTALLATION).
9. Install radiator upper and lower hoses.
10. Install both heater hoses.
11. Install electric fan shroud and viscous fan drive assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
12. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
13. Connect the battery negative cable.



# SHAFT-IDLER

## REMOVAL

1. Remove the primary and secondary timing chains and sprockets. Refer to procedure in this section.

**NOTE: To remove the idler shaft, it is necessary to tap threads into the shaft, to install the removal tool.**

2. Using a 12 mm X 1.75 tap, cut threads in the idler shaft center bore.
3. Cover the radiator core with a suitable cover.

**CAUTION: Use care when removing the idler shaft, Do not strike the radiator cooling fins with the slide hammer.**

4. Using Special Tool 8517 Slide Hammer, remove the idler shaft.

## INSTALLATION

1. Thoroughly clean the idler shaft bore.
2. Position the idler shaft in the bore.

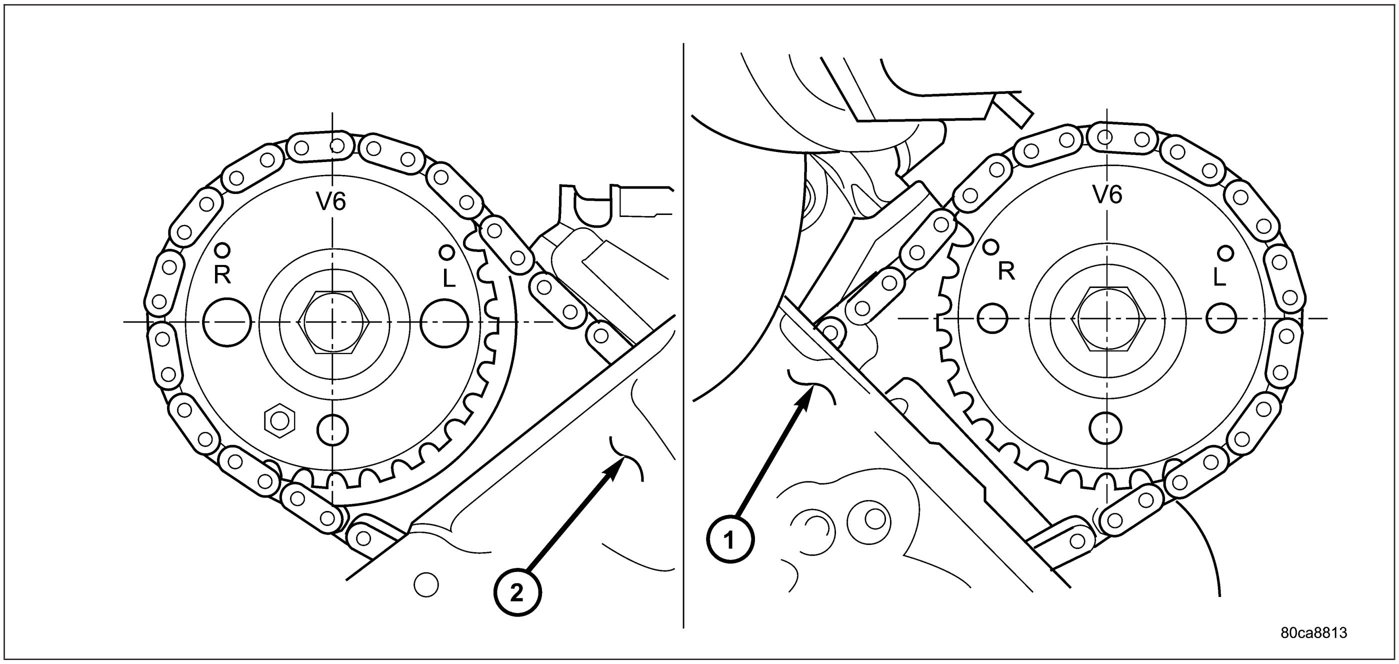
**NOTE: The two lubrication holes in the idler shaft do not require any special alignment.**

**NOTE: Before using the retaining bolt to install the idler shaft, coat the threads and the pilot on the idler shaft, with clean engine oil.**

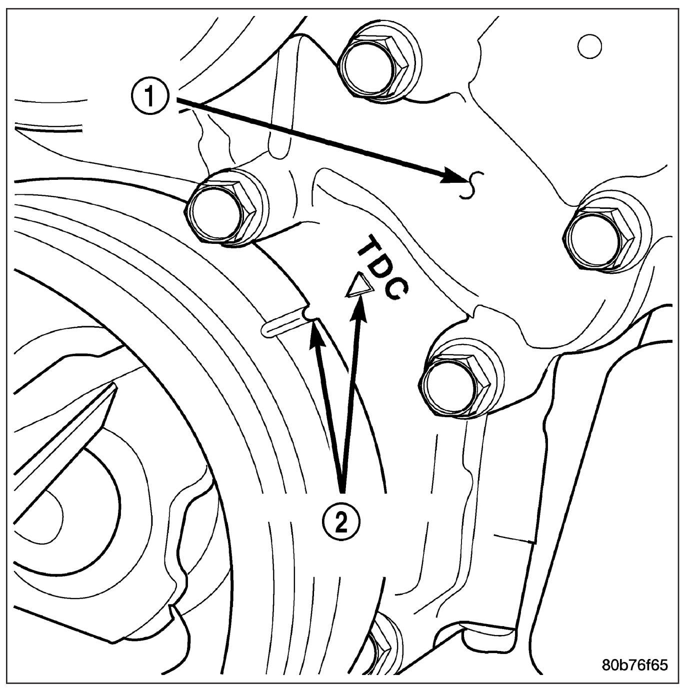
3. Using the primary idler sprocket retaining bolt and washer, carefully draw the idler shaft into the bore until fully seated.
4. Coat the idler shaft with clean engine oil.
5. Install the timing chains and sprockets. Refer to procedure in this section.

# CHAIN AND SPROCKETS-TIMING

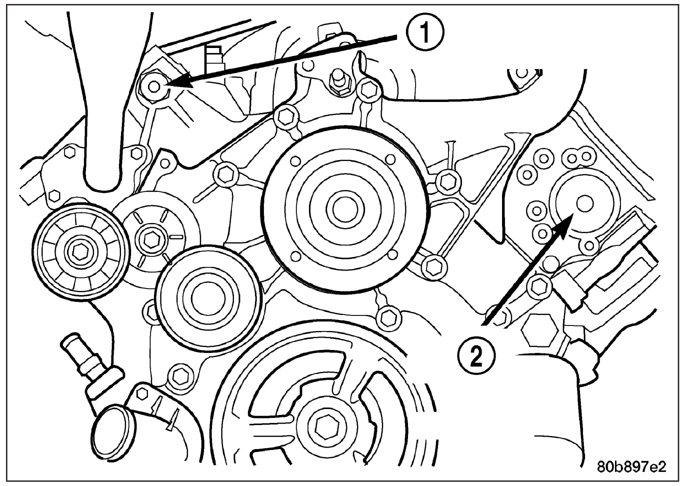
## REMOVAL




1. Disconnect negative cable from battery.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove right and left cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
4. Remove radiator fan shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
5. Rotate engine until timing mark on crankshaft damper (2) aligns with TDC mark on timing chain cover (2) and the camshaft sprocket "V6" marks are at the 12 o'clock position (No. 1 TDC exhaust stroke).



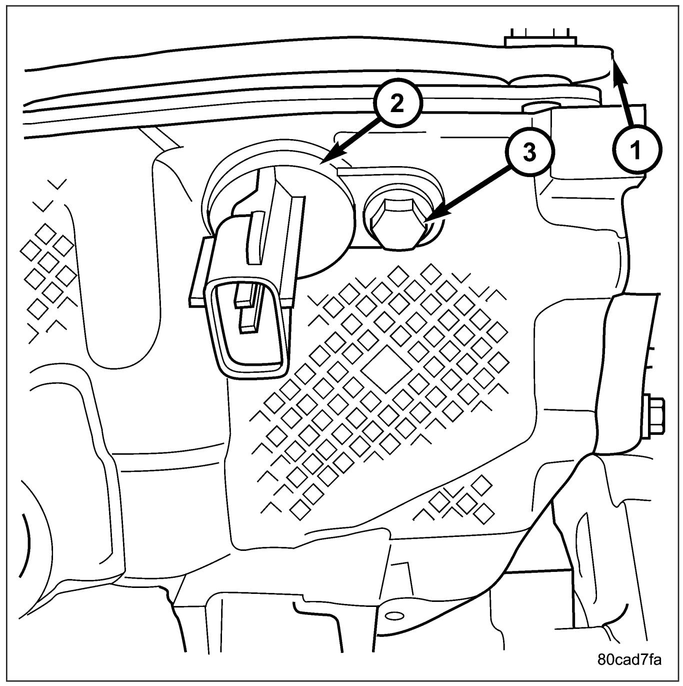
6. Remove power steering pump (Refer to 19 - STEERING/PUMP - REMOVAL).
7. Remove access plug from left and right cylinder heads for access to chain guide fasteners.
8. Remove the oil fill housing to gain access to the right side tensioner arm fastener.
9. Remove crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL) and timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).




10. Collapse and pin primary chain tensioner.

**CAUTION: Plate behind left secondary chain tensioner could fall into oil pan. Therefore, cover pan opening.**

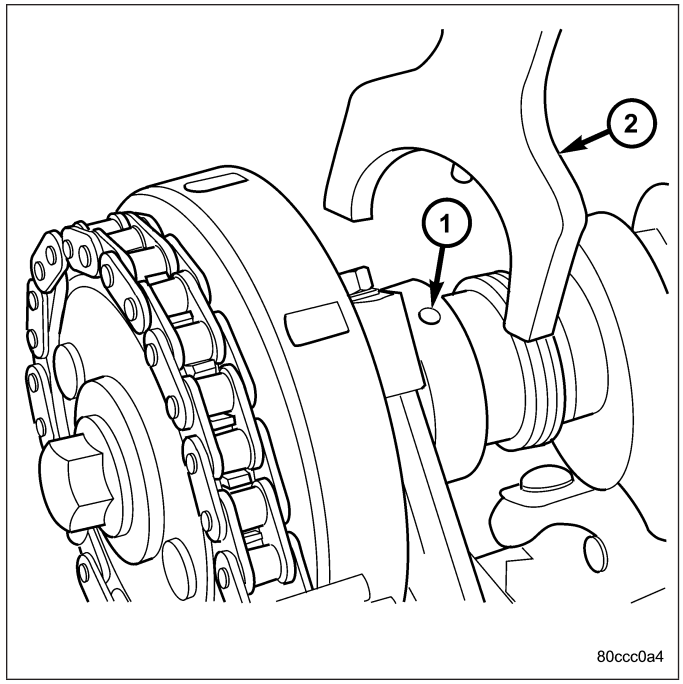
11. Remove secondary chain tensioners.
12. Remove camshaft position sensor (2).



**CAUTION: Care should be taken not to damage camshaft target wheel. Do not hold target wheel while loosening or tightening camshaft sprocket. Do not place the target wheel near a magnetic source of any kind. A damaged or magnetized target wheel could cause a vehicle no start condition.**

**CAUTION: Do not forcefully rotate the camshafts or crankshaft independently of each other. Damaging intake valve to piston contact will occur. Ensure negative battery cable is disconnected to guard against accidental starter engagement.**

13. Remove left and right camshaft sprocket bolts.
14. While holding the left camshaft steel tube with Special Tool 8428 Camshaft Wrench (2), remove the left camshaft sprocket. Slowly rotate the camshaft approximately 5 degrees clockwise to a neutral position.
15. While holding the right camshaft steel tube with Special Tool 8428 Camshaft Wrench (2), remove the right camshaft sprocket.




16. Remove idler sprocket assembly bolt.
17. Slide the idler sprocket assembly and crank sprocket forward simultaneously to remove the primary and secondary chains.
18. Remove both pivoting tensioner arms and chain guides.
19. Remove primary chain tensioner.

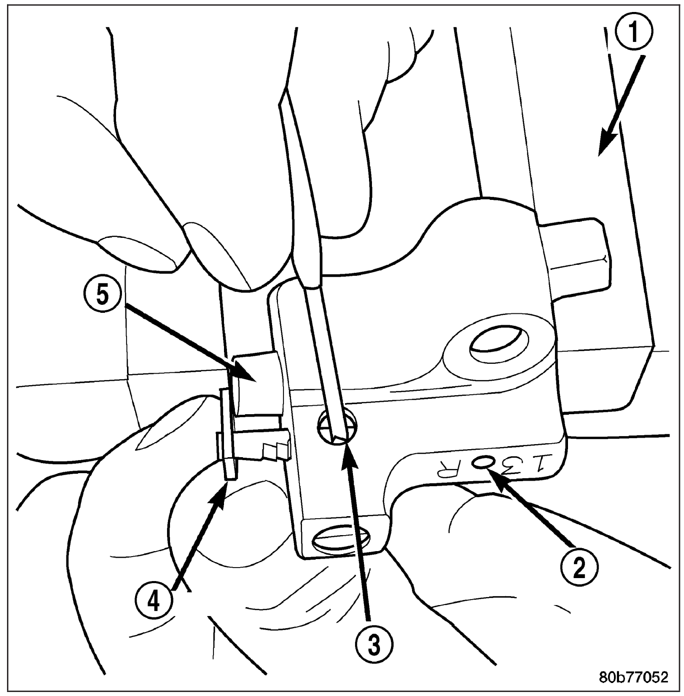
## INSPECTION

Inspect the following components:

- Sprockets for excessive tooth wear. Some tooth markings are normal and not a cause for sprocket replacement.
- Idler sprocket assembly bushing and shaft for excessive wear.
- Idler sprocket assembly spline joint. The joint should be tight with no backlash or axial movement.
- Chain guides and tensioner arms. Replace these parts if grooving in plastic face is more than 1 mm (0.039 in.) deep. If plastic face is severely grooved or melted, the tensioner lube jet may be clogged. The tensioner should be replaced.
- Secondary chain tensioner piston and ratcheting device. Inspect for evidence of heavy contact between tensioner piston and tensioner arm. If this condition exist the tensioner tensioner arm and chain should be replaced.
- Primary chain tensioner plastic faces. Replace as required.

## INSTALLATION

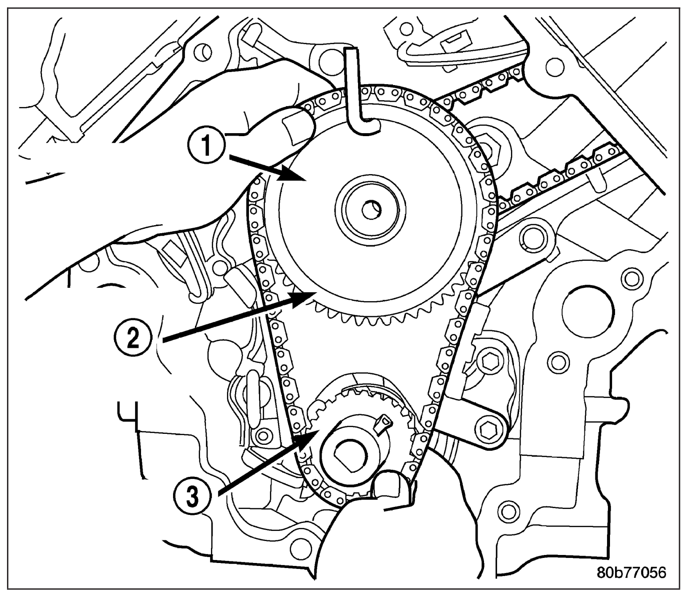
1. Using a vise, lightly compress the secondary chain tensioner piston (5) until the piston step is flush with the tensioner body. Using a pin or suitable tool, release ratchet pawl by pulling pawl back against spring force through access hole on side of tensioner. While continuing to hold pawl back, Push ratchet device to approximately 2 mm from the tensioner body. Install Special Tool 8514 lock pin (3) into hole on front of tensioner. Slowly open vise (1) to transfer piston spring force to lock pin.
2. Position primary chain tensioner over oil pump and insert bolts into lower two holes on tensioner bracket. Tighten bolts to 28 N·m (250 in. lbs.).




3. Install right side chain tensioner arm. Install Torx® bolt. Tighten Torx® bolt to 28 N·m (250 in. lbs.).

**CAUTION: The silver bolts retain the guides to the cylinder heads and the black bolts retain the guides to the engine block.**

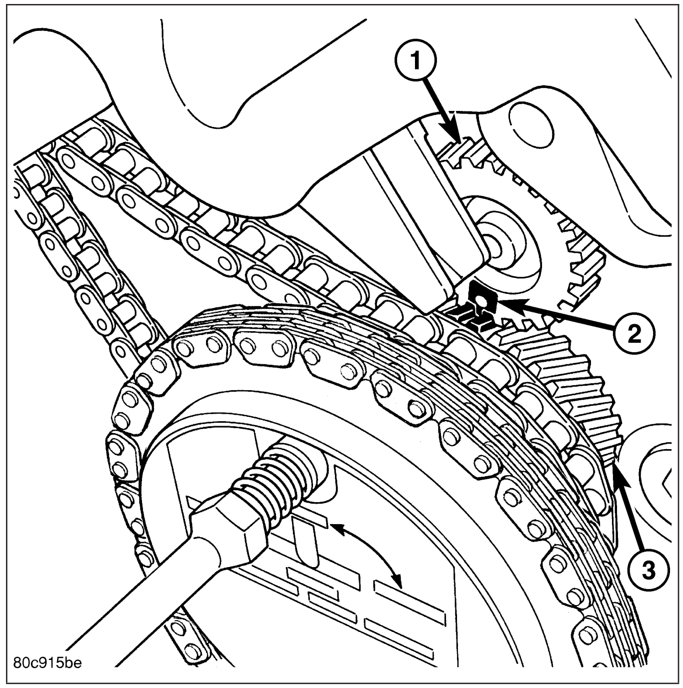
4. Install the left side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).
5. Install left side chain tensioner arm, and Torx® bolt. Tighten Torx® bolt to 28 N·m (250 in. lbs.).
6. Install the right side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).
7. Install both secondary chains onto the idler sprocket. Align two plated links on the secondary chains to be visible through the two lower openings on the idler sprocket (4 o'clock and 8 o'clock). Once the secondary timing chains are installed, position special tool 8429 (1) to hold chains in place for installation.

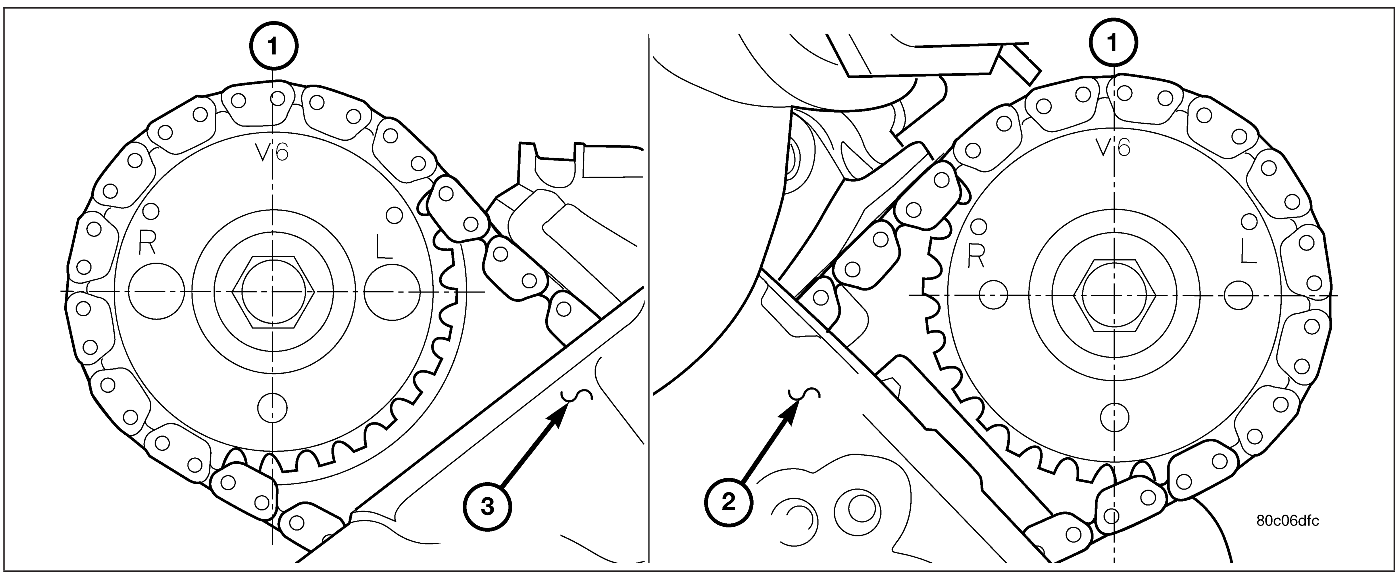



8. Align primary chain double plated links with the timing mark at 12 o'clock on the idler sprocket. Align the primary chain single plated link with the timing mark at 6 o'clock on the crankshaft sprocket.
9. Lubricate idler shaft and bushings with clean engine oil.

**NOTE: The idler sprocket must be timed to the counterbalance shaft drive gear before the idler sprocket is fully seated.**

10. Install all chains, crankshaft sprocket, and idler sprocket as an assembly. After guiding both secondary chains through the block and cylinder head openings, affix chains with a elastic strap or equivalent. This will maintain tension on chains to aid in installation. Align the timing mark (2) on the idler sprocket gear (3) to the timing mark on the counterbalance shaft drive gear (1), then seat idler sprocket fully. Before installing idler sprocket bolt, lubricate washer with oil, and tighten idler sprocket assembly retaining bolt to 34 N·m (25 ft. lbs.).




**NOTE: It will be necessary to slightly rotate camshafts for sprocket installation.**

11. Align left camshaft sprocket “L” dot to plated link on chain.
12. Align right camshaft sprocket “R” dot to plated link on chain.

**CAUTION: Remove excess oil from the camshaft sprocket bolt. Failure to do so can result in over-torque of bolt resulting in bolt failure.**

13. Remove Special Tool 8429, then attach both sprockets to camshafts. Remove excess oil from bolts, then Install sprocket bolts, but do not tighten at this time.
14. Verify that all plated links are aligned with the marks on all sprockets and the “V6” marks on camshaft sprockets are at the 12 o’clock position.

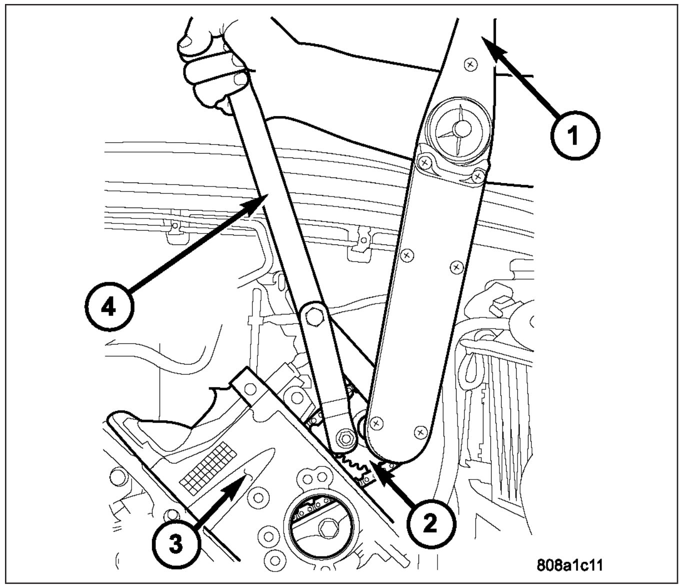
**CAUTION: Ensure the plate between the left secondary chain tensioner and block is correctly installed.**

15. Install both secondary chain tensioners. Tighten bolts to 28 N·m (250 in. lbs.).

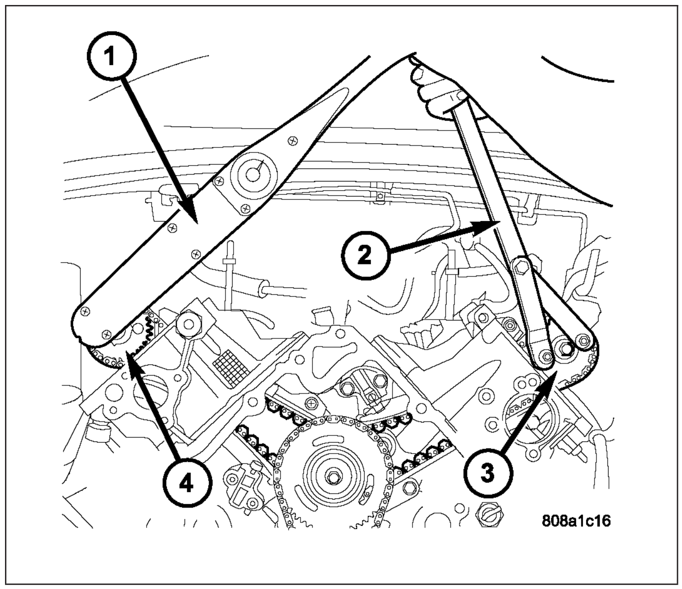
**NOTE: Left and right secondary chain tensioners are not common.**

16. Remove all 3 locking pins from tensioners.

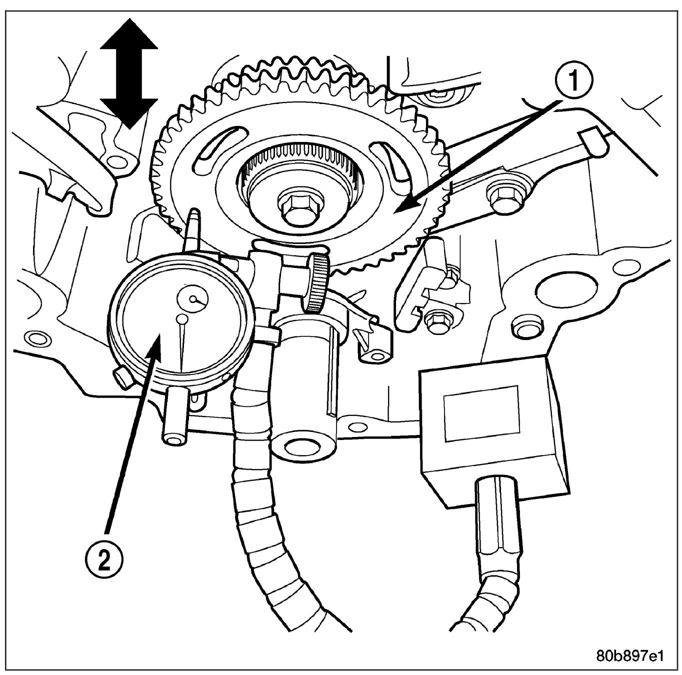
**CAUTION: After pulling locking pins out of each tensioner, DO NOT manually extend the tensioner(s) ratchet. Doing so will over tension the chains, resulting in noise and/or high timing chain loads.**




17. Using Special Tool 6958, Spanner with Adaptor Pins 8346, (4) tighten left and right camshaft sprocket bolts to 122 N·m (90 ft. lbs.).
18. Rotate engine two full revolutions. Verify timing marks are at the follow locations:
    - primary chain idler sprocket dot is at 12 o'clock
    - primary chain crankshaft sprocket dot is at 6 o'clock
    - secondary chain camshaft sprockets "V6" marks are at 12 o'clock
    - counterbalancer shaft drive gear dot is aligned to the idler sprocket gear dot
19. Lubricate all three chains with engine oil.

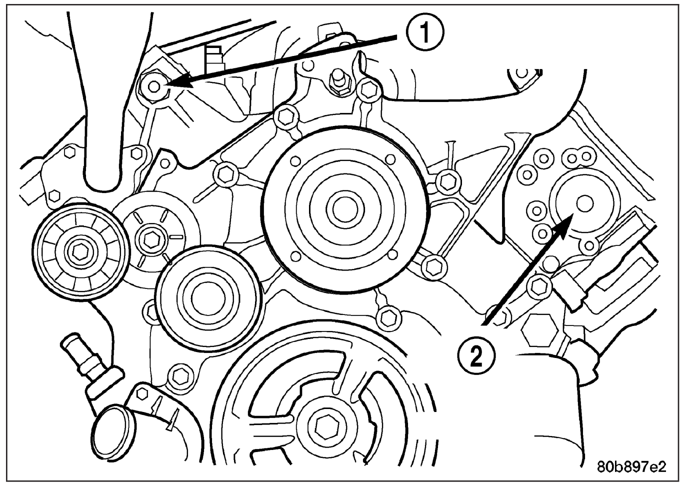



20. After installing all chains, it is recommended that the idler gear end play be checked. The end play must be within 0.10 -0.25 mm (0.004 - 0.010 in.). If not within specification, the idler gear must be replaced.
21. Install timing chain cover and crankshaft damper. Refer to procedures.
22. Install cylinder head covers (Refer to 9 - ENGINE/ CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).



**NOTE: Before installing threaded plug in right cylinder head, the plug must be coated with sealant to prevent leaks.**

23. Coat the large threaded access plug with **Mopar® Thread Sealant with Teflon**, then install into the right cylinder head (1) and tighten to 81 N·m (60 ft. lbs.) .
24. Install the oil fill housing.
25. Install access plug in left cylinder head (2).
26. Install power steering pump (Refer to 19 - STEERING/PUMP - INSTALLATION).
27. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
28. Connect negative cable to battery.



# ENGINE - 2.8L DIESEL

## TABLE OF CONTENTS

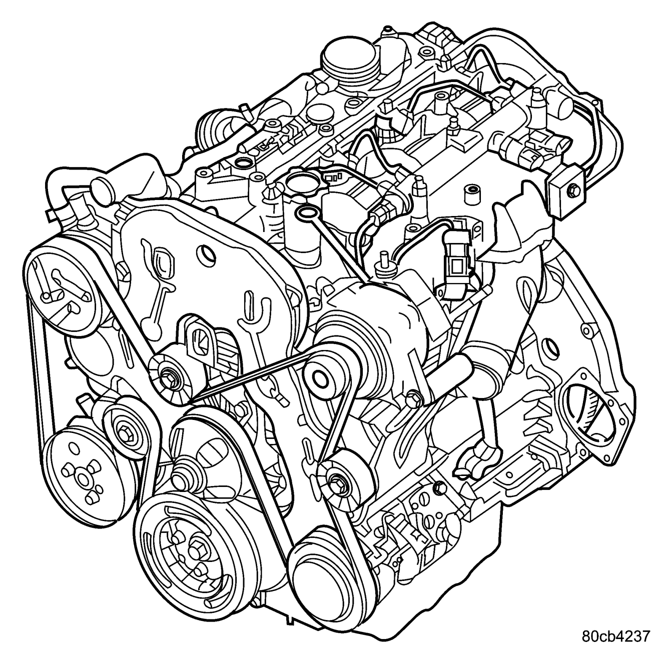
# ENGINE - 2.8L DIESEL

## DESCRIPTION

### 2.8L COMMON RAIL DIESEL ENGINE

The 2.8L (2776cc) four-cylinder “common rail” direct injection engine is an in-line overhead valve design. The engine utilize a cast iron cylinder block with a closed lower structure and tunnel housing for the crankshaft. The engine has a one piece aluminum cylinder head with four valves per cylinder and dual overhead cam shafts. The 2.8L is turbocharged, intercooled and also equipped with a EGR cooler..

The identification stamp for the 2.8L is located on the left side of the engine block, above the starter. The engine code label is located on the front timing cover and is the same as the engine I.D. and serial number. There is also a fuel system label on the front timing cover used for fuel system identification during ECM programming.

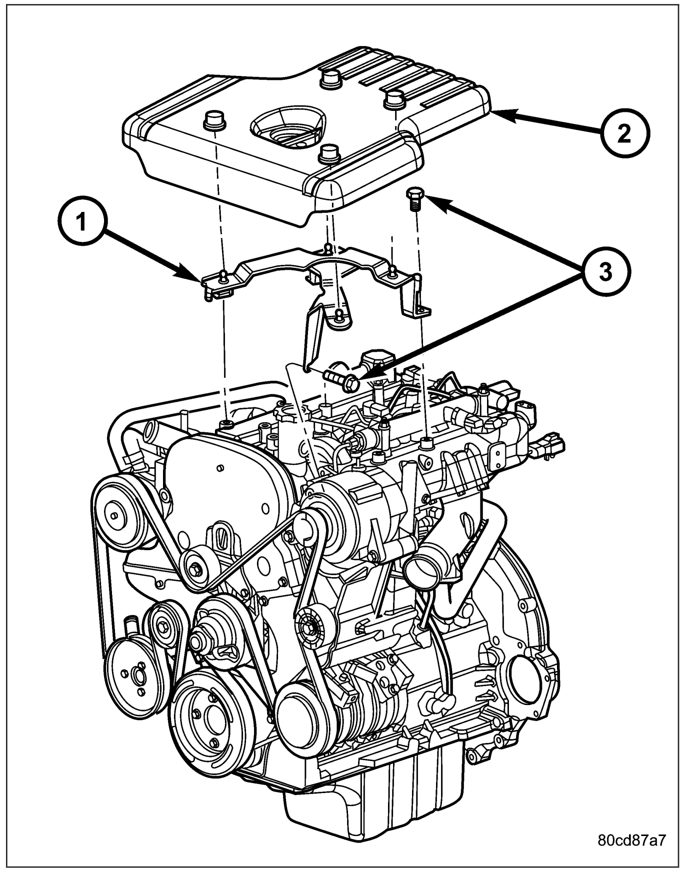

80cb4237

| DESCRIPTION | SPECIFICATION |
|---|---|
| Displacement 2.8L | 2.8L (2776cc) |
| Bore | 94.00 mm |
| Stroke | 100.00 mm |
| Compression Ratio | 17.5:1 |
| Vacuum at Idle | 700 mm/Hg (27.5 In/Hg) |
| Belt Tension | Automatic Belt Tensioner |
| Thermostat Opening | 80°C ± 2°C |
| Generator Rating | Denso 12V-95A |
| Cooling System Capacity | 13.8 Liters W/O Auxiliary Heater<br>16.6 Liters With Auxiliary Heater |
| Engine Oil Capacity | 6.0L (6.3 Qt.) W/Filter Change |
| Timing System | Belt Driven DOHC Overhead Camshafts |
| Air Intake | Dry Filter With Turbocharger and Charge Air Cooler |
| Fuel Supply | Gear - Style Pump Incorporated In The High Pressure Pump |
| Fuel System | Direct Fuel Injection Common Rail System |
| Combustion Cycle | 4 Stroke |
| Cylinder Compression Difference Between Cylinders | 5 Bar (72.5 psi.) |
| Cooling System | Water Cooling |
| Injection Pump | CP3 2nd. Generation Common Rail System |
| Lubrication | Pressure Lubricated By Rotary Pump |

| DESCRIPTION | SPECIFICATION |
|---|---|
| Minimum Oil Pressure (Warm) | 0.7 Bar (10 psi.) at Idle<br>2 Bar (29 psi) at 3800 rpm |
| Engine Rotation | Clockwise Viewed From Front Cover |

## ENGINE COVER

The insulated engine cover (2) is made of plastic and used cosmetically to cover the top of the engine and greatly reduce engine noise.




## REMOVAL

## ENGINE - 2.8L DIESEL

**NOTE: The export manual transmissions must be removed from the vehicle before removing the engine.**

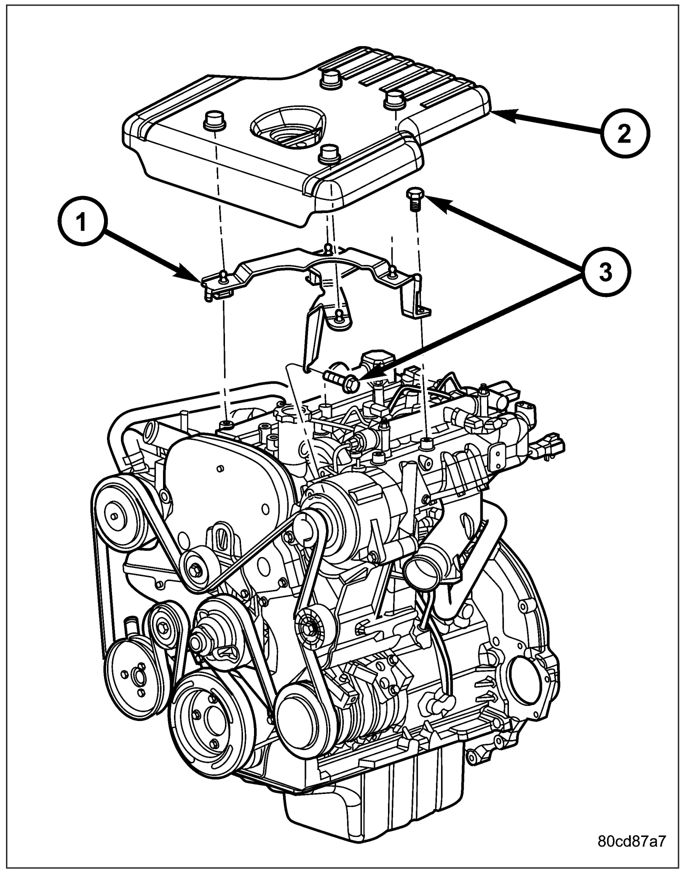
1. Disconnect negative battery cable.
2. Disconnect under hood lamp from the hood assembly.
3. Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
4. Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
5. Remove air cleaner assembly from the engine bay.
6. Recover refrigerant from A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).
7. Disconnect high side refrigerant line from the upper radiator support bracket.
8. Remove upper radiator support bracket retaining bolts and remove the support bracket.
9. Remove front grille and head lamp panel.
10. Remove from fascia.
11. Remove high side refrigerant line retaining nut and remove the line from the condenser assembly. Position the line out of the way.

12. Remove cooling fan and fan drive viscous clutch assembly.
13. Remove fan shroud retaining bolts and remove fan assembly and shroud together.
14. Disconnect charge air cooler hoses from charge air cooler.
15. Disconnect engine coolant hoses from engine assembly.
16. Disconnect coolant reservoir hose from radiator.
17. Remove low side refrigerant line retaining nut and remove line from the condenser assembly. Position the line out of the way.
18. Remove condenser assembly retaining bolts and remove condenser from the vehicle.
19. Remove power steering cooler retaining bolts and unclip air deflectors from both sides of the radiator (cooling module) assembly.
20. Remove cooling module assembly.
21. Remove charge air cooler hose from the intake manifold.
22. Remove high side refrigerant line from A/C compressor and remove high side line from the engine bay.
23. Remove coolant reservoir retaining nuts and clips retaining electrical harness, position reservoir aside to allow access to remaining hoses.
24. Disconnect remaining hoses from coolant reservoir and remove reservoir.
25. Remove accessory drive belt from the engine (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
26. Accessing bolts through the pump pulley, remove power steering pump retaining bolts and position pump aside with lines still attached.
27. Remove engine cover mounting bracket retaining bolts and remove the bracket from the top of the engine.
28. Disconnect heater core inlet and outlet hoses from the heater core.
29. Remove generator from engine (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL). This will provide access to the wires beneath it.
30. Remove low side refrigerant line retaining nuts from accumulator and compressor and remove from engine bay.
31. Trace engine wiring and disconnect electrical connectors and tie straps one at a time until all wiring is disconnected from the engine assembly. When all the engine electrical harness is disconnected position the harness aside.
32. Remove coolant elbow retaining bolts from rear of the water pump.
33. Disconnect coolant hoses leading from the coolant elbow and remove coolant elbow from engine.
34. Remove oil cooler adapter.
35. Raise and support the vehicle.
36. Remove oil filter and adaptor assembly.
37. Remove starter motor from engine (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL).
38. Remove chassis ground wire above starter mounting location on the engine block.
39. Support the transmission with a jackstand.
40. Remove the flex plate access cover.
41. Remove the flex plate fasteners.
42. Remove transmission cross member fasteners.
43. Lower the transmission.
44. Remove the upper transmission to engine fasteners.
45. Raise the transmission.
46. Install the transmission cross member fasteners.
47. Remove the transmission jack.
48. Remove exhaust inlet pipe retaining bolts and disconnect exhaust pipe from turbocharger.
49. Remove transmission to engine retaining bolts.
50. Separate transmission cooler line(s) from retainer.
51. Connect a suitable lifting device to engine assembly.
52. Remove right side engine mount retaining nut.

53. Lower vehicle.
54. Remove left side engine mount retaining nut.
55. Remove exhaust manifold rear heat shield.
56. Disconnect the fuel supply and return lines.
57. Remove crankshaft sensor heat shield.
58. Disconnect crankshaft position sensor, located on the right rear of the engine.
59. Remove the oil separator from the cylinder head cover/intake manifold.
60. Disconnect oil pressure sensor. Make certain everything is disconnected from the engine assembly.
61. Place a floor jack under the transmission to support the transmission.
62. With engine and transmission supported by a lifting device separate the engine from the transmission.
63. Lift the engine assembly out of the engine bay.

## ENGINE COVER

1. Remove oil fill cap.
2. Carefully lift engine cover (2) from corners to remove from mounting bracket (1)..




## INSTALLATION

## ENGINE - 2.8L DIESEL

1. Install engine assembly and align with the transmission.

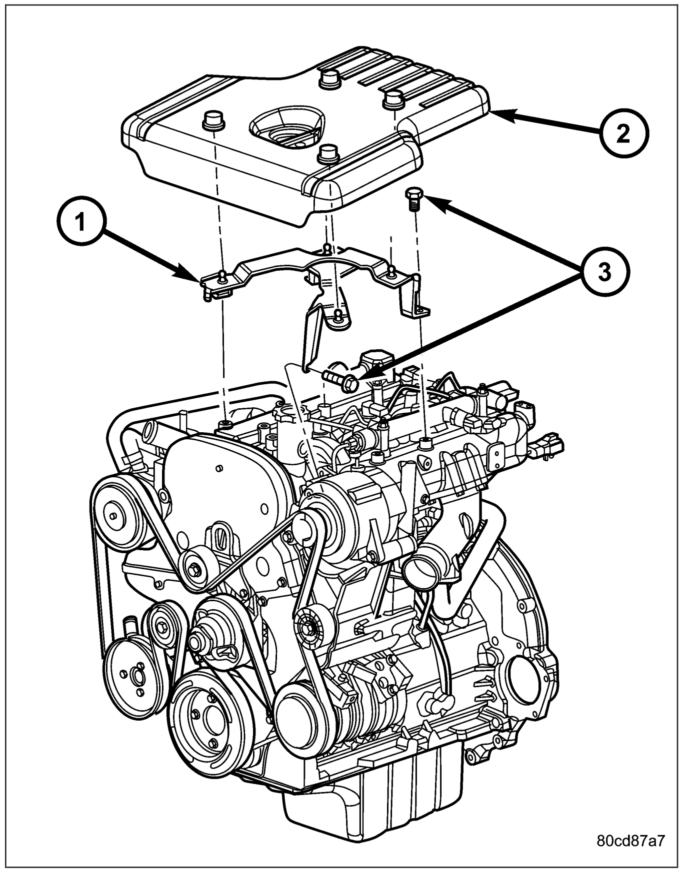
**NOTE: For vehicle equipped with a manual transmission, Install the transmission.**

2. Raise and support the vehicle.
3. Install accessable engine to transmission housing bolts. tighten bolts to 68 N·m (50 ft. lbs.).
4. Connect oil pressure sensor, located between the engine block and the turbocharger.
5. Connect crankshaft position sensor, located on the right rear of the engine.
6. Install right side engine mount on the engine block.

7. Disconnect lifting device from the engine assembly.
8. Raise and support the vehicle.
9. Install all transmission to engine retaining bolts.
10. Install exhaust inlet pipe and retaining bolts.
11. Install chassis ground wire above starter mounting location on the engine block.
12. Install starter motor on the engine.
13. Install oil filter and cooler assembly.
14. Lower vehicle.
15. Install oil cooler adapter.
16. Install coolant elbow and retaining bolts and connect the hoses leading from it.
17. Trace engine wiring and connect electrical connectors and tie straps one at a time until all wiring is connected on engine assembly.
18. Install low side refrigerant line.
19. Install generator on the engine (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).
20. Connect heater core inlet and outlet hoses at heater core.
21. Connect four large electrical connectors near rear of the right front fenderwell.
22. Install engine cover mounting bracket and retaining bolts.
23. Accessing bolts through the pump pulley, install the power steering pump and retaining bolts.
24. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
25. Install coolant reservoir and connect hoses.
26. Install coolant reservoir retaining nuts.
27. Install high side refrigerant line on compressor.
28. Install charge air cooler hose on intake manifold.
29. Install cooling module assembly in the engine bay.
30. Install power steering cooler and retaining bolts and clip the air deflectors on both sides of the radiator (cooling module) assembly.
31. Install condenser assembly and retaining bolts.
32. Install low side refrigerant line and retaining nut.
33. Connect coolant reservoir hose on radiator.
34. Connect engine coolant hoses on engine.
35. Connect charge air cooler hoses on charge air cooler.
36. Install fan shroud with cooling fan assembly inside the shroud and install the shroud retaining bolts.
37. Connect cooling fan and fan drive viscous clutch assembly to fan support.
38. Install high side refrigerant line and retaining nut.
39. Install upper radiator support bracket and retaining bolts.
40. Connect high side refrigerant line on the upper radiator support bracket.
41. Charge refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).
42. Install air filter assembly.
43. Install engine cover (Refer to 9 - ENGINE COVER - REMOVAL).
44. Install engine oil fill cap.
45. Fill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
46. With assistance from another person, install hood assembly on the vehicle.
47. Connect under hood lamp on the hood assembly.
48. Connect negative battery cable.

## ENGINE COVER

1. Align engine cover (2) with mounting bracket (1). Push down firmly on all four corners of engine cover to snap in place.
2. Install oil fill cap.




## SPECIFICATIONS

## ENGINE SPECIFICATIONS

### GENERAL DESCRIPTION

| DESCRIPTION | SPECIFICATION |
|---|---|
| Engine Type | R2816K5A |
| Weight | 270Kg (595 lbs.) dry |
| Number of Cylinders | 4 |
| Bore | 94 mm |
| Stroke | 100 mm |
| Displacement | 2776cc |
| Injection Order | 1-3-4-2 |
| Compression Ratio | 17.5:1 (± 0.5) |
| Maximum Power | 120 kW (163 H.P.) @ 3800 RPM |
| Peak Torque | 400 N·m (295 ft.lb.) @ 1800 RPM |
| Cylinder Compression (Max. Difference Between Cylinders | 5 Bar (72.5 psi) |
| Minimum Oil Pressure (Warm) | 0.7 Bar (10 psi.) @ Idle<br>2 Bar (29 psi.) @ 3800 RPM |

### CRANKSHAFT

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Front Journal Diameter-Nominal | 62.985-63.005 mm | 2.479-2.480 in |
| Front Journal Diameter- minus 0.25 | 62.735-62.755 mm | 2.469-2.470 in. |
| Front Bearing Diameter-Nominal | 63.005-63.034 mm | 2.480-2.481 in. |
| Front Bearing Diameter-minus 0.25 | 62.755-62.784 mm | 2.471-2.478 in |
| Clearance Between the Journal and Bearing | 0.00-0.049 mm | 0.000-0.001 in. |
| Center Journal Diameter-Nominal | 63.005-63.020 mm | 0.001-0.003 in. |
| Center Journal Diameter-minus 0.25 | 62.775-62.770 mm | 2.470-2.471 |
| Center Bearing Diameter-Nominal | 63.005-63.020 mm | 2.480-2.481 in. |
| Center Bearing Diameter-minus 0.25 | 62.775-62.770 mm | 2.470-2.471 in. |
| Clearance Between Journal and Bearing | 0.008-0.051 mm | 0.0003-0.0002 in |
| Rear Journal Diameter-Nominal | 89.980-90.000 mm | 3.542-3.543 in |
| Rear Journal Diameter- minus 0.25 | 89.730-99.750 mm | 3.532-3.927 in. |
| Rear Bearing Diameter-Nominal | 90.045-90.065 mm | 3.545-3.546 in. |
| Rear Bearing Diameter- minus 0.25 | 89.795-89.815 mm | 3.535-3.536 in. |
| Clearance Between Journal and Bearing | 0.045-0.080 mm | 0.001-0.003 in. |
| Connecting Rod Journal-Nominal | 53.940-53.955 mm | 2.123-2.124 in. |
| Connecting Rod Journal- minus 0.25 | 53.690-53.705 mm | 2.113-2.114 in. |
| Connecting Rod Bearing-Nominal | 53.997-54.016 mm | 2.125-2.126 in. |
| Connecting Rod Bearing- minus 0.25 | 53.727-53.766 mm | 2.115-2.116 in. |
| Clearance Between Journal and Bearing | 0.022-0.076 mm | 0.0008-0.0029 in. |
| Crankshaft End Play | 0.080-0.280 mm | 0.003-0.011 in. |
| Adjustment | Thrust Washers | Thrust Washers |
| Thrust Washers Available | 2.31-2.36 mm | 0.090-0.092 in. |
| | 2.41-2.46 mm | 0.094-0.096 in. |
| | 2.51-2.56 mm | 0.098-0.100 |
| Carrier with Thrush Washers Installed | 27.670-27.820 mm | 1.089-1.095 in. |

### MAIL BEARING CARRIERS

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Internal Diameter-Front | 67.025-67.050 mm | 2.638-2.639 in. |
| Internal Diameter-Center | 66.670-66.690 mm | 2.624-2.624 in. |
| Internal Diameter-Rear | 85.985-86.005 mm | 3.385-3.386 in. |

### LINERS

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Internal Diameter | 091.997-92.015 mm. | 3.621-3.622 in. |
| Protrusion | 0.00-0.05 mm | 0.00-0.001 in. |
| Available Adjustment Shims | 0.15 mm | 0.005 in. |
| | 0.17 mm | 0.006 in. |
| | 0.20 mm | 0.007 in. |
| | 0.23 mm | 0.009 |
| | 0.25 mm | 0.0098 |

**CYLINDER HEAD**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Minimum Thickness | 94.95-95.05 mm. | 3.738-3.742 in. |
| Gasket Thickness | 1.32 mm ± 0.08, 0 notches | 0.0051 in. ± 0.003, 0 notches |
| | 1.42 mm ± 0.08, 1 notch | 0.051 in. ± 0.003, 1 notch |
| | 1.52 mm ± 0.08, 2 notches | 0.059 in. ± 0.003, 1 notches |

**CONNECTING RODS**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Small end Bearing Internal Diameter | 32.035-32.050 mm | 1.2612-1.2618 in. |
| Large End Internal Diameter | 53.997-54.016 mm | 2.125-2.126 in. |

**PISTONS**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Skirt Diameter (measured at approximately 10 mm above the bottom of the skirt) | 93.912-93.928 mm. | 3.6973-3.6979 in. |
| Piston Clearance | 0.010-0.22 mm | 0.0003-0.0008 in. |
| Top of Piston to Cylinder Head | 0.69-0.83 mm | 0.027-0.032 in. |
| Piston Protrusion | 0.460-0.609 mm Fit Gasket, Number (1.32mm), 0 hole | 0.018-0.023 in. Fit Gasket, Number (0.051 in.), 0 notches |
| | 0.610-0.709 Fit Gasket, Number (1.42 mm) 1 hole | 0.024-0.027 in. Fit Gasket, Number (0.055 in.) 1 notch or hole |
| | 0.710-0.810 Fit Gasket, Number (1.52 mm), 2 holes | 0.027-0.031 in. Number (0.059 in) 2 notches or holes |

**PISTON PINS**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Type | Full Floating | |
| Pin Diameter | 32.004-32.010 mm | 1.259-1.260 in. |
| Clearance | 0.010-0.020 mm | 0.0003-0.0007 in. |

**PISTON RINGS**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| **Clearance in Groove** | | |
| Top Compression Ring | 0.078-0.137 mm | 0.003-0.005 in. |
| Second Compression Ring | 0.070-0.110 mm | 0.002-0.004 in. |
| Oil Control (Steel Rails) | 0.40-0.080 mm | 0.001 - 0.003 in. |
| **Fitted Gap** | | |
| Top Compression Ring | .030-0.45 mm | 0.011-0.017 in. |
| Second Compression Ring | 0.030 - 0.050 mm | 0.0011 - 0.0019 in. |
| Oil Ring (Steel Ring) | .025 - 0.50 mm | .0009 - .0019 in. |

**CAMSHAFT**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Journal Diameter-Front | 29.960-29.980 mm | 1.179-1.180 in. |
| Bearing Clearance | 0.03-0.08 mm | 0.001-0.003 in. |
| Journal Diameter-Center | 39.250-39.270 mm | 1.545-1.546 in. |
| Bearing Clearance | 0.03-0.08 mm | 0.001-0.003 in |
| Journal Diameter-Rear | 39.250-39.270 mm | 1.545-1.546 in. |
| Bearing Clearance | 0.03-0.08 mm | 0.001-0.003 in. |
| Camshaft End Play | 0.10-0.55mm | 0.004-0.021 in. |

**HYDRAULIC LIFTER**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Outside Diameter | 11.994 ± 0.006 mm | 0.472 ± 0.0002 in. |

**VALVES**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Face Angle-Intake | 45° 25’-55° 35’ mm | - |
| Face Angle-Exhaust | 45° 25’-45° 35’ mm | - |
| Intake Valve Opens | 15.6° ± 2° A.T.D.C. | - |
| Intake Valve Closes | 64.4° ± 2° A.B.D.C. | - |
| Exhaust Valve Opens | 66° ± 2° B.B.D.C. | - |

| | | |
|---|---|---|
| Exhaust Valve Closes | 32° ± 2° A.T.D.C. | - |
| Head Diameter-Intake | 32.30-32.50 mm | 1.271-1.279 in. |
| Head Diameter-Exhaust | 30.80-31.00 mm | 1.212-1.220 in. |
| Stem Diameter-Intake | 5.952-5.970 mm | 0.234-0.235 in. |
| Stem Diameter-Exhaust | 5.942-5.960 mm | 0.233-0.234 in. |
| Clearance in Guide-Intake | 0.030-0.060 mm | 0.001-0.002 in. |
| Clearance in Guide-Exhaust | 0.040-0.070 mm | 0.001-0.002 in. |

**VALVE GUIDE**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Inside Diameter | 6.00-6.012 mm | 0.2362-0.2366 in. |
| Fitted Height-Intake | 14.5-15.0 mm | 0.570-0.590 in. |
| Fitted Height-Exhaust | 16.5-17.0 mm | 0.649-0.669 in. |

**VALVE SPRING**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Free Length | 45.26 mm | 1.781 in. |
| Fitted Length | 38.0 mm | 1.496 in. |
| Load at Fitted Length | 182 ± 5-10% Kg | - |
| Load at Top of Lift | 395 ± 5% Kg | - |
| Number of Coils | 8 | - |

**LUBRICATION**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Pressure Relief Valve Opens | 6.50 bar | 94 psi |
| Pressure Relief Valve Spring-Free Length | 51.5 mm | 2.02 in. |

**OIL PUMP**

| DESCRIPTION | SPECIFICATION | |
|---|---|---|
| | Metric | Standard |
| Outer Rotor End Float | 0.060-0.160 mm | 0.002-0.006 in. |
| Inner Rotor End Float | 0.060-0.160 | 0.002-0.006 in. |
| Outer Rotor to Body Diameter Clearance | 0.130-0.240 mm | 0.005-0.009 in. |
| Rotor Body to Drive Gear Clearance (pump not fitted) | 0.90-1.50 mm | 0.035-0.059 in. |

## TORQUE

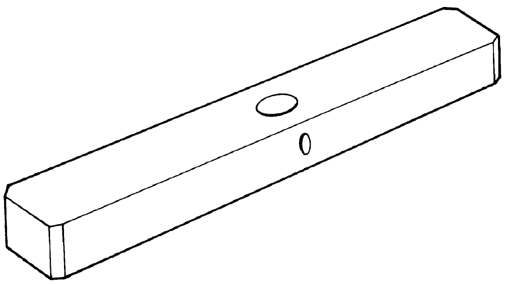
**2.8L DIESEL TORQUE SPECIFICATIONS**

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Oil Pump Bolts | 10.8 | 8 | 96 |
| Vacuum Pump Bolts | 10.8 | 8 | 96 |
| Vacuum Pump Pipe to Block | 56.9 | 42 | — |
| Crankshaft Gear Bolts | 10.8 | 8 | 96 |
| Crankshaft Position Sensor Bolts | 10.8 | 8 | 96 |
| Flywheel Bolts - 2.8L, Refer to the Service Procedure | | | |
| Flex Plate Bolts - 2.8L, Refer to the Service Procedure | | | |
| Cylinder Head Bolts - Refer to the Service Procedure | | | |
| Reluctor Wheel Bolts | 14.6 | 11 | 130 |
| Rear Main Bearing Support Bolts | 27.5 | 21 | 240 |
| Oil Cooler to Engine Block Bolt | 47.1 | 35 | — |
| Engine Block Plug In Front Of Oil Cooler | 58.8 | 43 | — |
| Oil Cooler Mounting Stud | 50 | 37 | — |
| Oil Level Indicator to Cylinder Head Cover | 10.8 | — | 96 |
| Oil Level Indicator Tube to Pan | 10.8 | — | 96 |
| Water Pump Housing Nuts | 24.4 | 18 | 212 |
| Connecting Rod Bolts - Refer to the Service Procedure | | | |
| Balance Shaft Bolts | 32.4 | 24 | — |
| Oil Jet Bolts | 10.8 | 8 | 96 |
| Oil Pump Pick-up Tube | 32.4 | 24 | — |
| Oil Pan Bolts | 11.8 | 8 | 96 |
| Structural Support to Engine and Transmission Bolts | 45.1 | 33 | — |
| Crankshaft Hub Bolt | 275 | 203 | — |
| Crankshaft Pulley Bolts | 32.4 | 24 | — |
| Front Engine Cover Bolts | 6 | — | 53 |
| Transmission to Engine Bolts | 83.4 | 62 | — |
| Cylinder Head Cover / Intake Manifold Bolts | 24.5 | 18 | — |
| Camshaft Timing Access Bolts | 24.5 | 18 | — |
| Camshaft Access Plugs | 80 | 59 | — |
| Oil Separator Bolts | 10.8 | 8 | 96 |
| Camshaft Position Sensor Bolt | 10.8 | 8 | 96 |
| Boost Pressure / Intake Air Temp. Sensor Bolts | 5.4 | — | 48 |

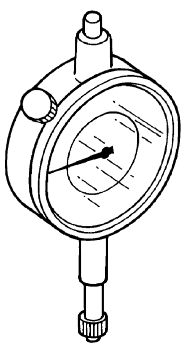
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Glow Plug | 12.5 | — | 110 |
| Accessory Drive Bracket Bolts | 45.1 | 33 | — |
| Accessory Drive Belt Idler Pulley Bolt | 53 | 39 | — |
| Vacuum Line Fitting Bolt | 56.9 | 42 | — |
| Fuel Pump Nuts | 27.5 | 21 | — |
| Fuel Line Fittings at Pump | 27.5 | 21 | — |
| Fuel Rail Retaining Bolts | 24.5 | 18 | 217 |
| Inner Timing Belt Cover Bolts | | | |
| 8mm | 10.8 | 8 | 96 |
| 10mm | 45.1 | 33 | — |
| Outer Timing Belt Cover Bolts | | | |
| 3mm | 6 | — | 54 |
| 8mm | 10.8 | 8 | 96 |
| Engine Mount Bracket to Cylinder Head Bolts | 45.1 | 33 | — |
| Structural Support to Engine and Transmission Bolts | 45.1 | 33 | — |
| Intake Inlet Tube Bolts | 10.1 | 8 | 89 |
| Camshaft Sprocket Bolts | 108 | 80 | — |
| Camshaft Timing Access Bolts | 24.5 | 18 | 212 |
| Timing Belt Idler Pulley Bolt | 47.1 | 35 | — |
| Timing Belt Tensioner Bolt | 29.4 | 22 | — |
| Fuel Injection Pump Gear Nut | 88.3 | 65 | — |
| Fuel Injection Pump Retaining Nuts | 24.4 | 18 | 212 |
| Engine Lift Hook Bolts | 45.1 | 33 | — |
| Thermostat Housing Bolts | 24.5 | 18 | — |
| Turbocharger Oil Supply Line Fitting | 24.5 | 18 | 217 |
| Turbocharger Oil Return Line Bolts | 10.8 | — | 96 |
| Exhaust Manifold Nuts | 36 | 26.5 | — |
| Exhaust Manifold Heat Shield | 24.5 | 18 | 217 |
| Exhaust Manifold Heatshield Bolts | 27.5 | 21 | — |
| EGR Valve Bolts | 24.5 | 18 | — |
| EGR Air Control Valve to Cylinder Head Cover | 10.8 | — | 96 |

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Coolant Pipe to EGR Valve Bolts | 24.5 | 18 | — |
| Turbocharger Downpipe Nuts | 32.4 | 24 | — |
| Turbocharger Support Bracket Bolts | 24.5 | 18 | — |
| Vibration Damper to Crankshaft Hub Bolts | 27.5 | 21 | — |
| Crankshaft Support Bolts | 44.1 | 33 | — |
| Turbocharger to Exhaust Manifold Nuts | 32.4 | 24 | — |

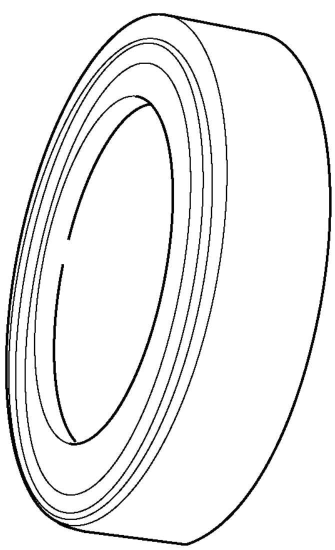
## SPECIAL TOOLS



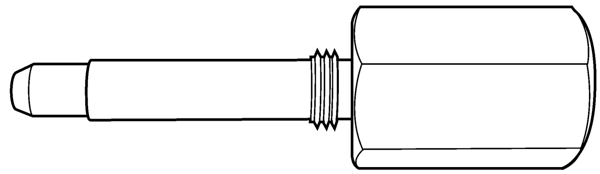

*VM.1010 CYLINDER LINER PROTRUSION TOOL*



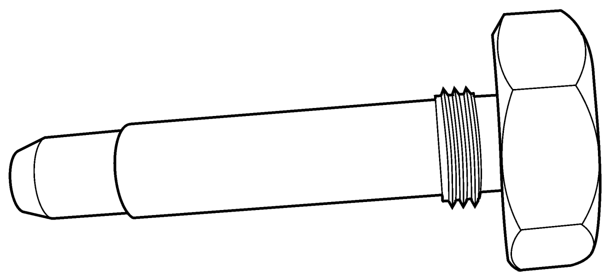

*VM.1013 DIAL INDICATOR*



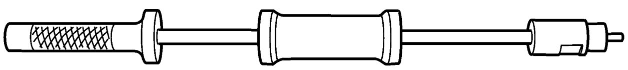

*VM.1050 CRANKSHAFT REAR SEAL INSTALLER*




*VM.1052 INTAKE CAMSHAFT ALIGNMENT PIN*

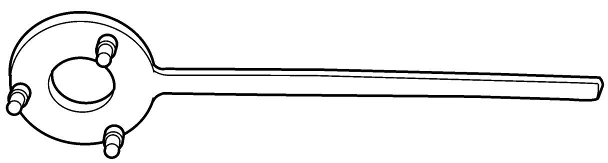



*VM.1053 EXHAUST CAMSHAFT ALIGNMENT PIN*



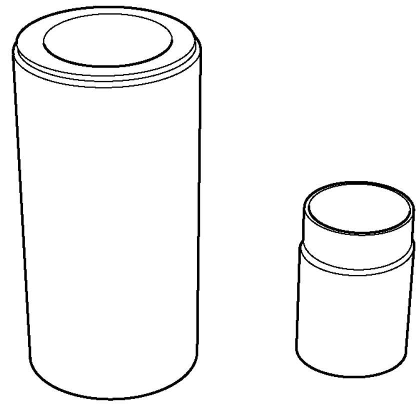
80c14546

*VM.1054 RELIEF VALVE REMOVER/CENTRAL CARRIER PIN REMOVER/INSTALLER*



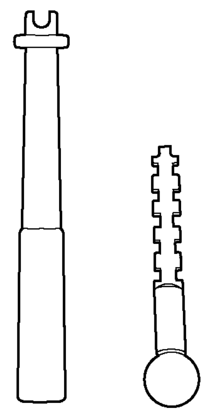
80c13cec

*VM.1055 HIGH PRESSURE INJECTION PUMP GEAR HOLDER*



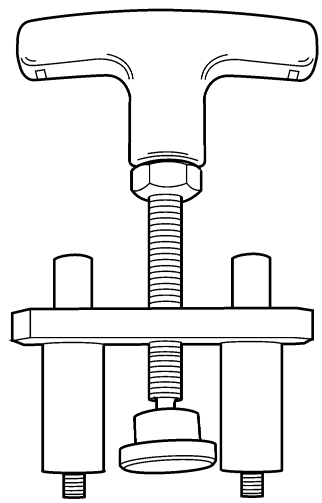
8121483c

*VM.1057 CAMSHAFT OIL SEAL INSTALLER*



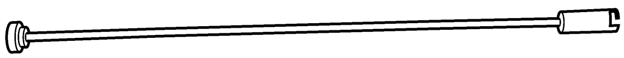
81214825

*VM.1058 CAMSHAFT OIL SEAL REMOVER*

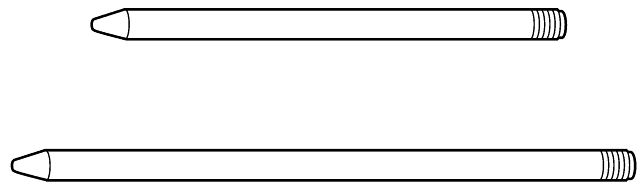


80c1570a

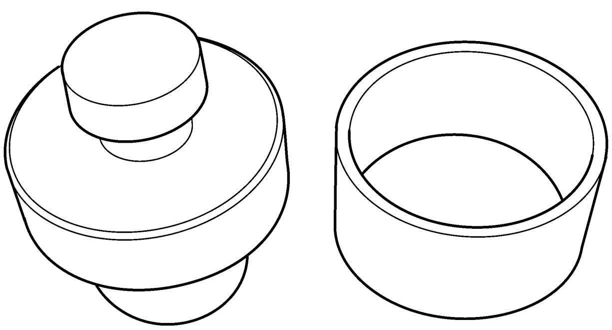
*VM.1059 OIL PRESSURE RELIEF VALVE INSTALLER*


80c17f19

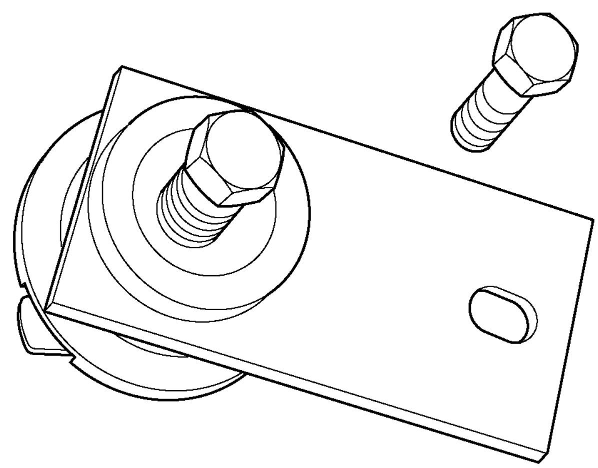
**VM.1060 OIL JET REMOVER /INSTALLER**


80c177d0

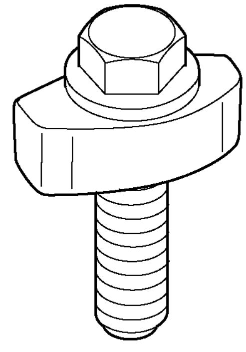
**VM.1066 VALVE COVER ALIGNMENT PINS**


80c17810

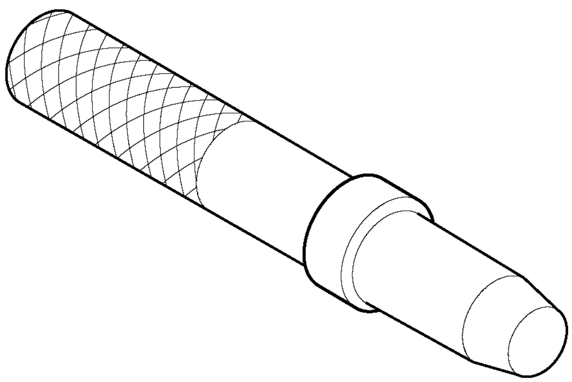
**VM.1061 FRONT COVER AND FRONT OIL SEAL INSTALLER**


8120d627

**VM.1067 HIGH PRESSURE PUMP REMOVER**

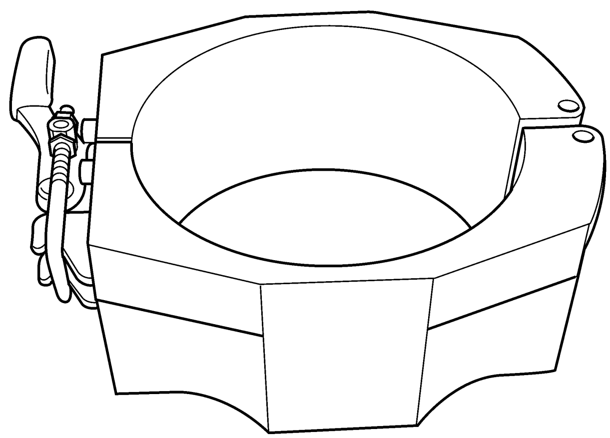

808bb90a

**VM.1076 CYLINDER RETAINER**



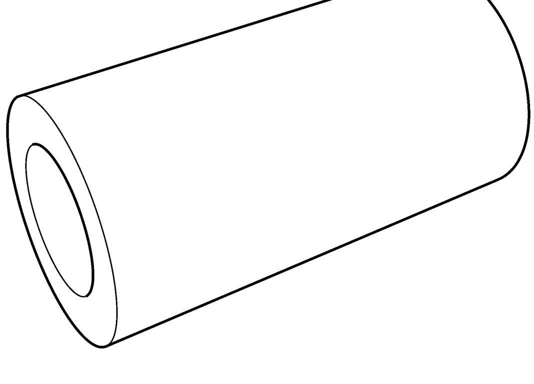
8121521d

*VM.1081 2.8L-TDC LOCATING PIN*



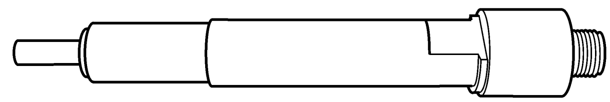
80c17f56

*VM.1082 2.8L PISTON INSTALLER*



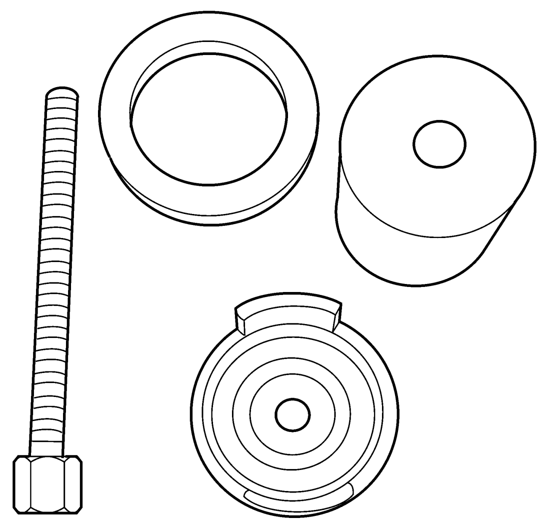
80c17f51

*VM.1069 CRANKSHAFT REM/INSTALL SLEEVE*



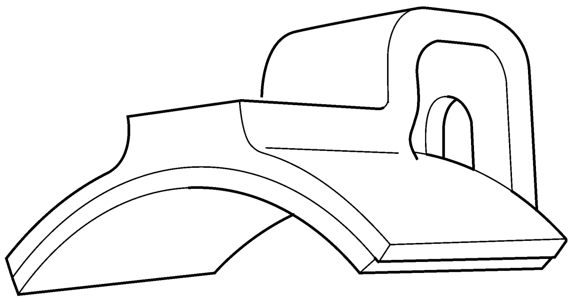
80c172d1

*VM.1072 COMPRESSION TESTER ADAPTER*

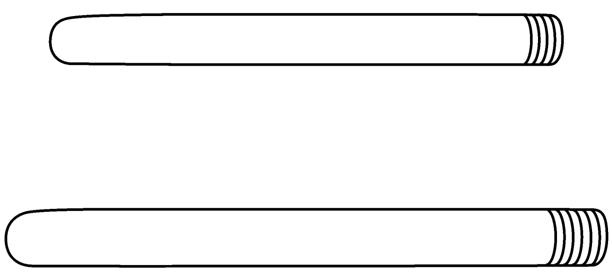


80c17883

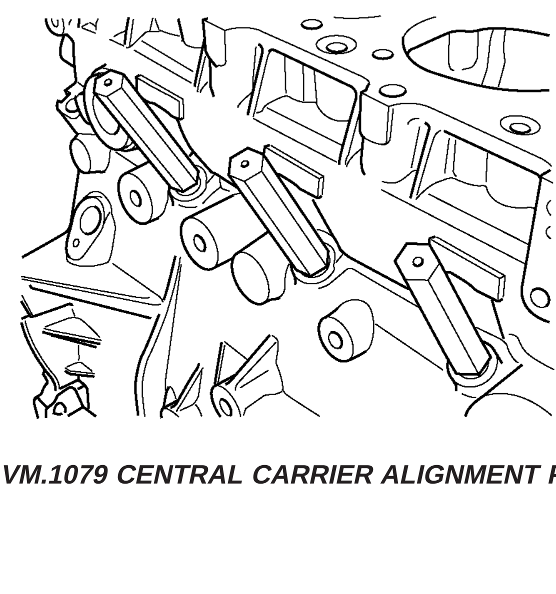
*VM.1073 CRANKSHAFT FRONT BEARING REMOVER/INSTALLER*



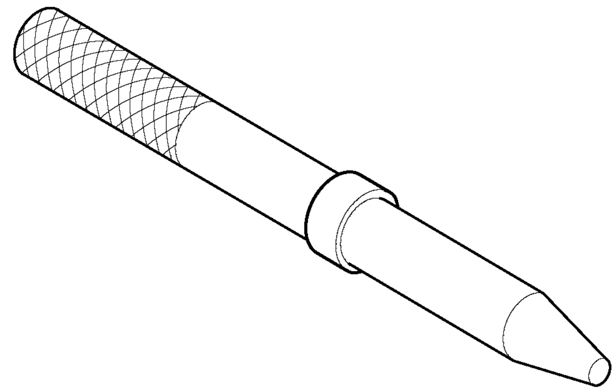

**VM.1074 TIMING BELT RETAINER**



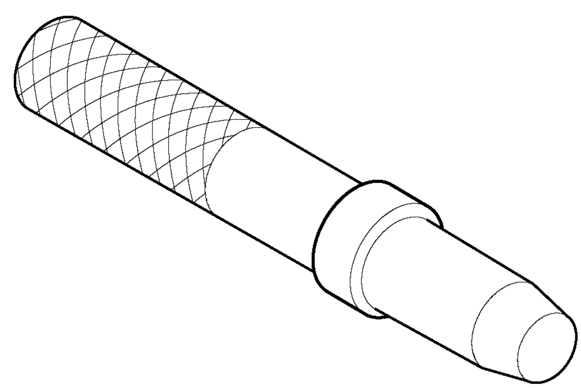

**VM.1075 FLYWHEEL ALIGNMENT PINS**



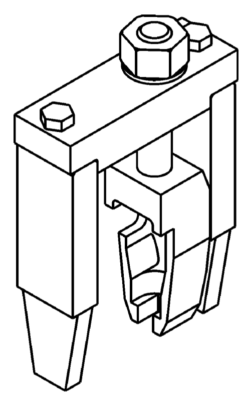

**VM.1079 CENTRAL CARRIER ALIGNMENT PINS**



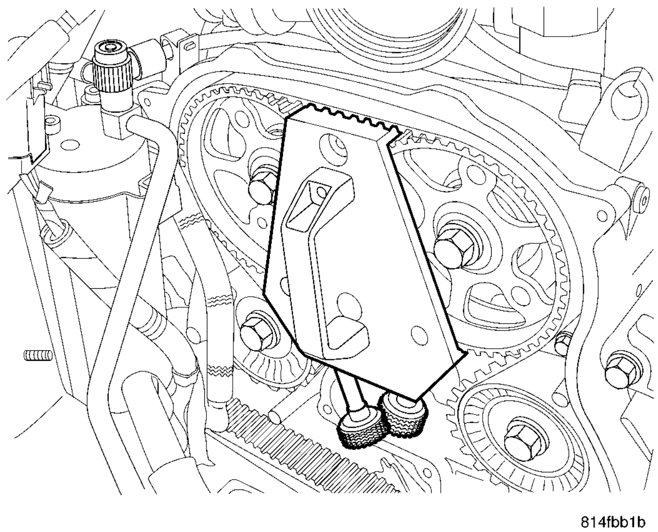

**VM.1080 2.8L 90 DEGREES AFTER TDC LOCATING PIN**



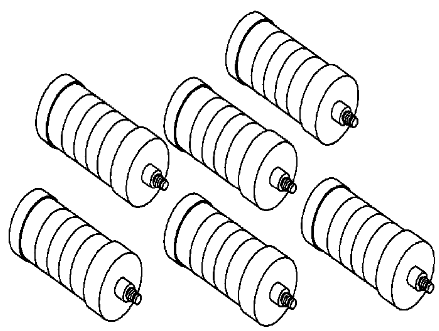

**VM.1081 2.8L-TDC LOCATING PIN**



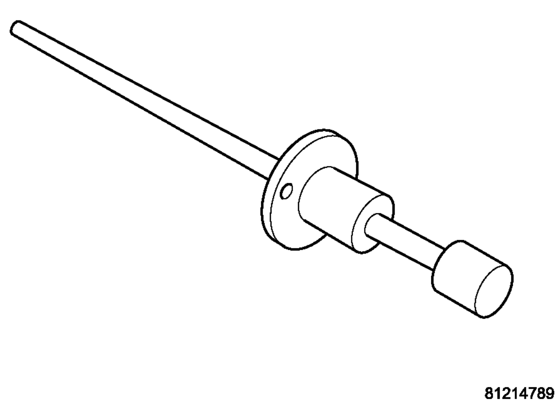
**VM.9075 FUEL INJECTOR EXTRACTOR**



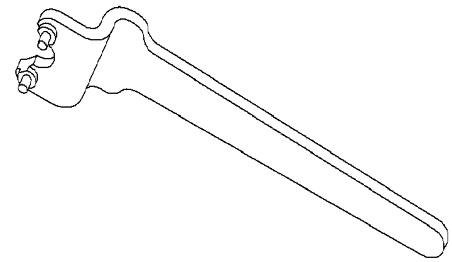

*VM.1085 CAMSHAFT LOCKING TOOL*



*VM.9545 RETURN FUEL QUANTITY VIALS*




*VM.9095 CRANKSHAFT SUPPORT RETAINER*

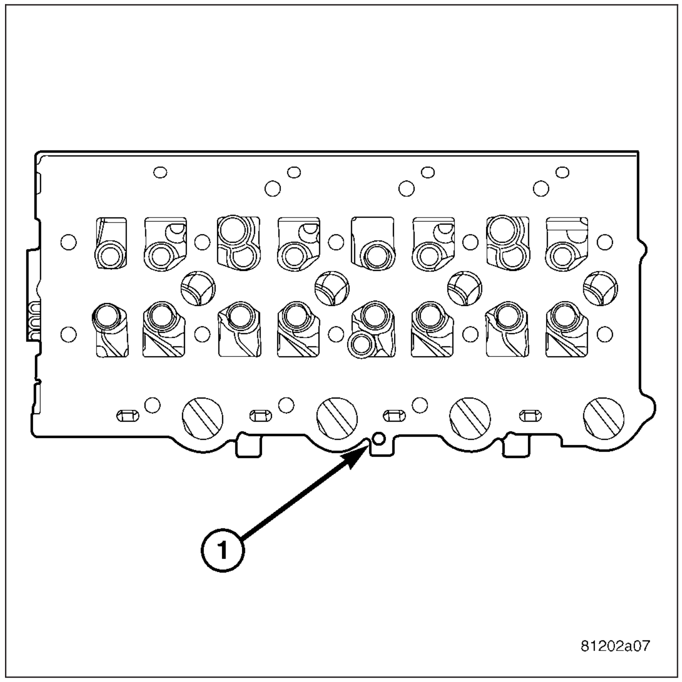


*VM.9660 TIMING BELT TENSIONER WRENCH*

# HEAD-CYLINDER

## DESCRIPTION

The 2.8L aluminum, overhead valve cylinder head (1) has different dimensions for the intake air and a bias relief port. The cylinder head itself is not resurfacable. The cylinder head uses a selectable Multi-layered Steel gasket that is available in three sizes.



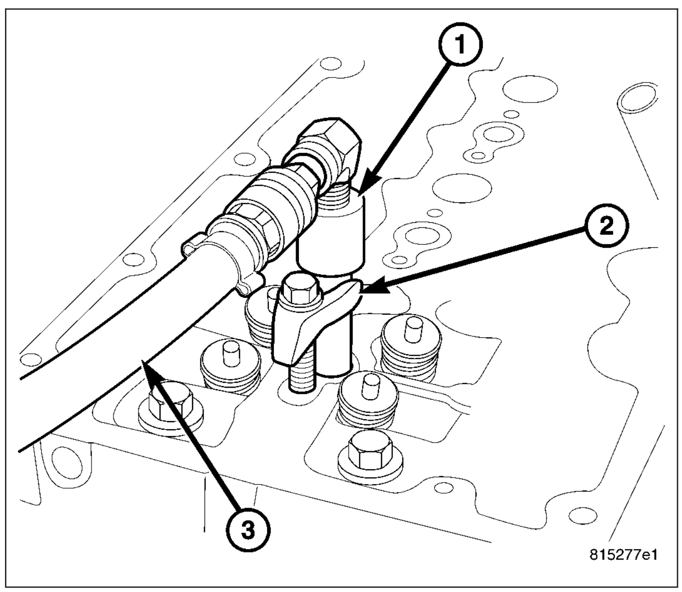

## STANDARD PROCEDURE

## VALVE SEALS - IN VEHICLE

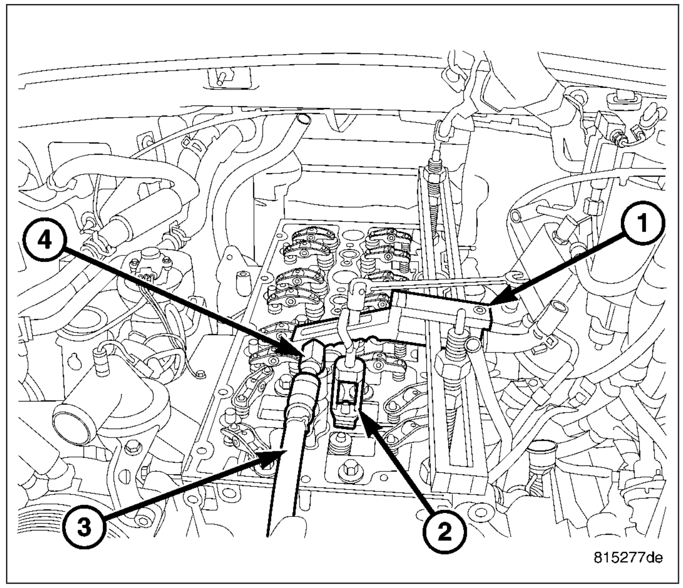
1. Disconnect the negative battery cable.
2. Remove the intake manifold/cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

**NOTE: Rocker arms and lifters must be kept in order of removal and stored in the up right position.**

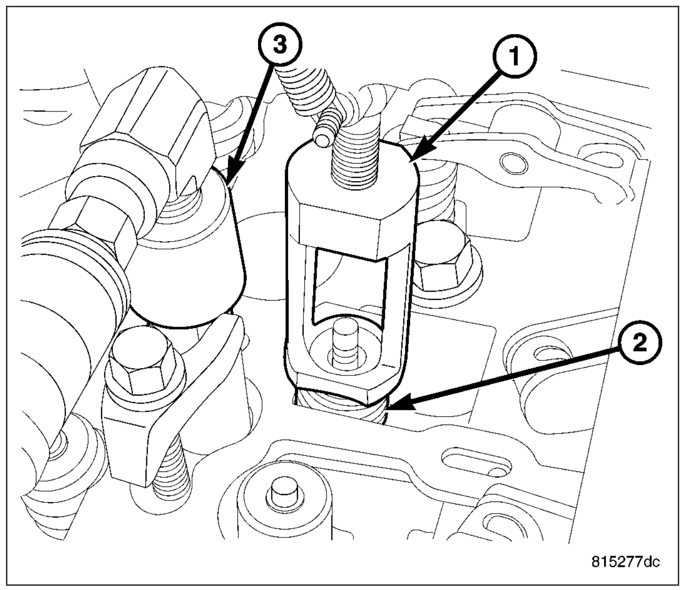
3. Position the rocker arms aside. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).
4. Install special tool VM.1072A, compression tester adaptor , into the injector hole and retain with an injector hold down (2) bolt.



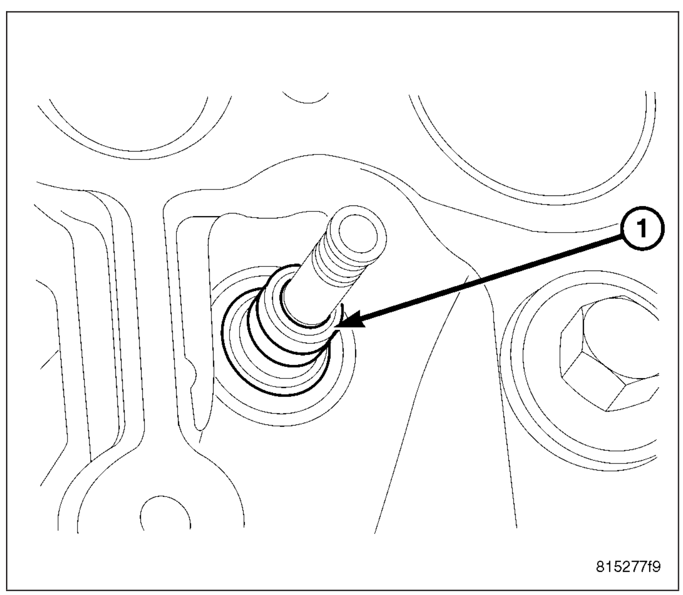
5. Prepare special tool MD998772A (1) for usage by inverting the tool to cylinder head holding screws so that the thread size matches the cylinder head.
6. Install special tool MD998772A (1) onto cylinder head and using adaptor MD998772A-15 (2), place the adaptor over the valve spring.
7. Connect a regulated air supply (3) to VM.1072A (4), and pressurize the cylinder.
8. Place shop towels around the working area of the cylinder head to prevent valve locks from accidently entering the engine.




9. Using adaptor MD998772A-15 (1), collapse the valve spring (2) and remove the locks.
10. Remove the valve spring (2) assembly.



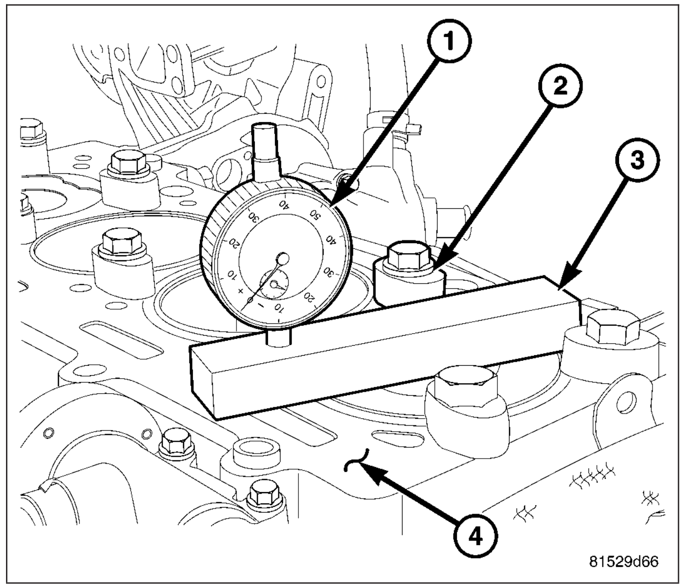

11. Remove the valve seal.
12. Repeat this procedure for all cylinders.



## STANDARD PROCEDURE - MEASURING PISTON PROTRUSION

**CAUTION: DO NOT Rotate the engine with the cylinder head off without first installing the cylinder liner retainers VM.1076. Failure to do so may result in the cylinder liner moving and a false piston protrusion reading. A false piston protrusion reading may result in a wrong cylinder head gasket selection.**

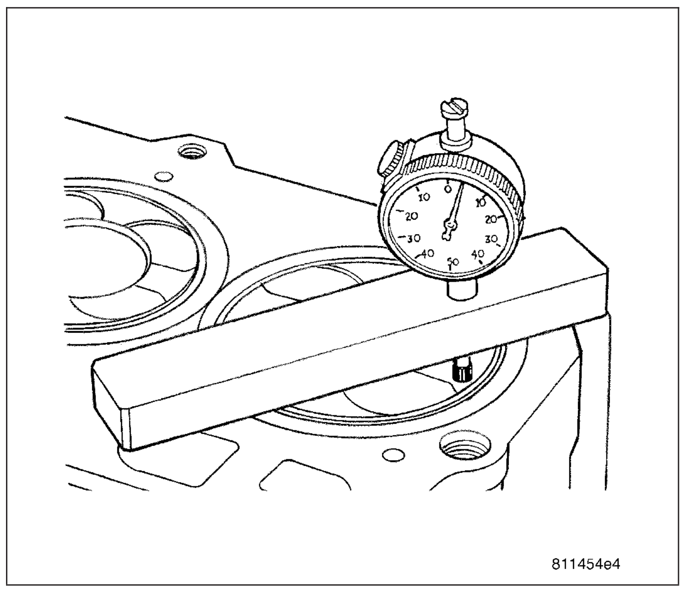
1. Use special tool VM.1010 dial indicator (1) with special tool VM.1013 (3).
2. Bring the piston of cylinder number 1 exactly to top dead center.
3. Lay the straight edge special tool VM.1013 (3) across the cylinder sleeve and zero the dial indicator (1) on the cylinder block surface (4).




4. Lay the straight edge special tool VM.1010 across the cylinder sleeve, setup the dial indicator on the piston crown (above the center of the piston pin) 5mm (1/8 in.) from the edge of the piston and note the measurement.

**NOTE: Install the cylinder liner retainers VM.1076 before rotating the engine.**

5. Repeat the procedure with the rest of the cylinders.
6. Establish the thickness of the steel gasket by averaging the four piston protrusion readings.




| | |
|---|---|
| Measure Dimension (mm) | 0.460-0.609 |
| Cylinder Head Gasket Thickness (mm) | 1.32<br>No Holes or Notches |
| Piston Clearance (mm) | 0.71-0.86 |
| | |
| Measure Dimension (mm) | 0.610-0.709 |
| Cylinder Head Gasket Thickness (mm) | 1.42<br>1 Hole or Notch |
| Piston Clearance (mm) | 0.711-0.81 |
| | |
| Measure Dimension (mm) | 0.710-0.810 |

| | |
|---|---|
| Measure Dimension (mm) | 0.460-0.609 |
| Cylinder Head Gasket Thickness (mm) | 1.52<br>2 Holes or Notches |
| Piston Clearance (mm) | 0.71-0.81 |

## VALVE SERVICE

This procedure is done with the engine cylinder head removed from the block.

### DISASSEMBLY

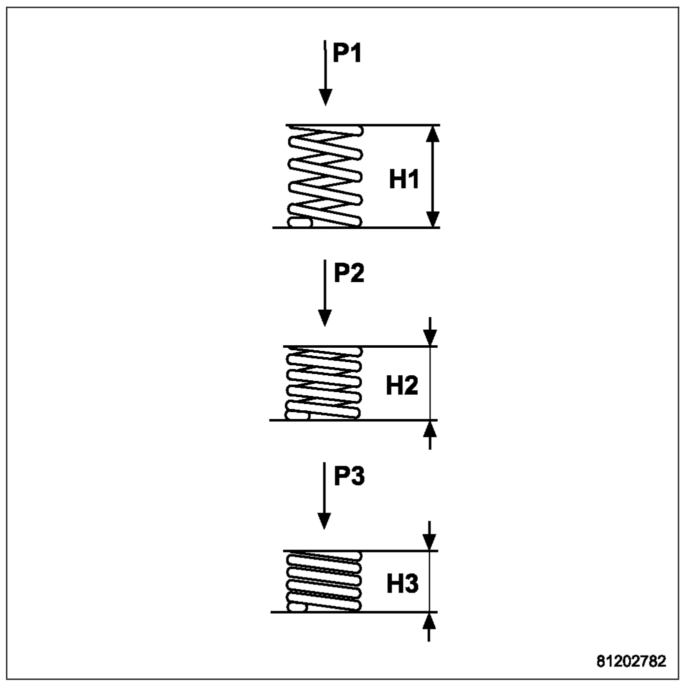
1. Remove the engine cylinder head from the cylinder block (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
2. Use Valve Spring Compressor Tool and compress each valve spring.
3. Remove the valve locks, retainers, and springs.
4. Use a smooth stone or a jewelers file to remove any burrs on the top of the valve stem, especially around the groove for the locks.
5. Remove the valves, and place them in a rack in the same order as removed.

### VALVE CLEANING

1. Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.
2. Clean all residue and gasket material from the engine cylinder head machined gasket surface.

### INSPECTION

1. Inspect for cracks in the combustion chambers and valve ports.
2. Inspect for cracks on the exhaust seat.
3. Inspect for cracks in the gasket surface at each coolant passage.
4. Inspect valves for burned, cracked or warped heads.
5. Inspect for scuffed or bent valve stems.
6. Replace valves displaying any damage.
7. Check valve spring height.

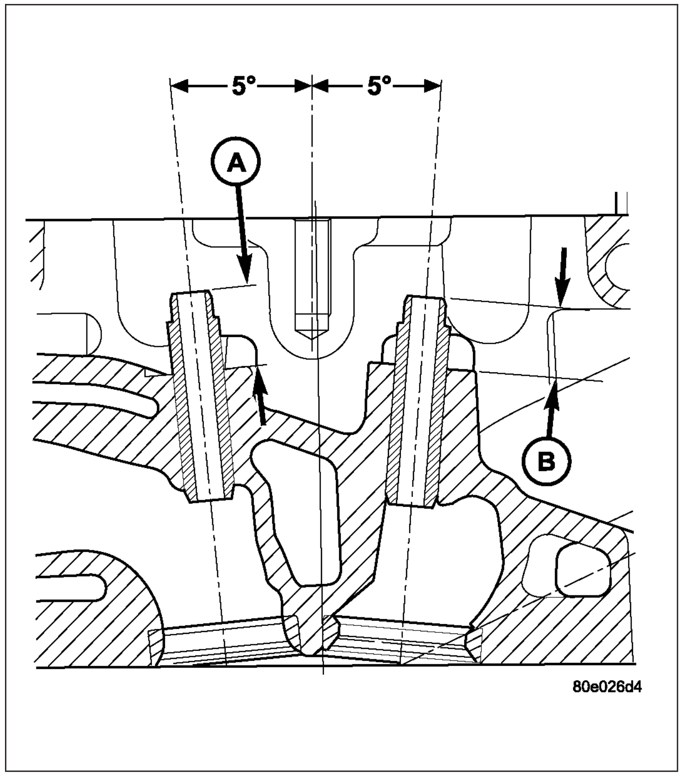



### VALVE SEAT REFACING

1. Install a pilot of the correct size in the valve guide bore. Reface the valve seat to the specified angle with a good dressing stone. Remove only enough metal to provide a smooth finish.
2. Use tapered stones to obtain the specified seat width when required.

## VALVE GUIDES

1. Valve Guides height requirement.
2. Measurement A : 16.50 - 17.00 mm. Measurment B : 14.50 - 15.00 mm.



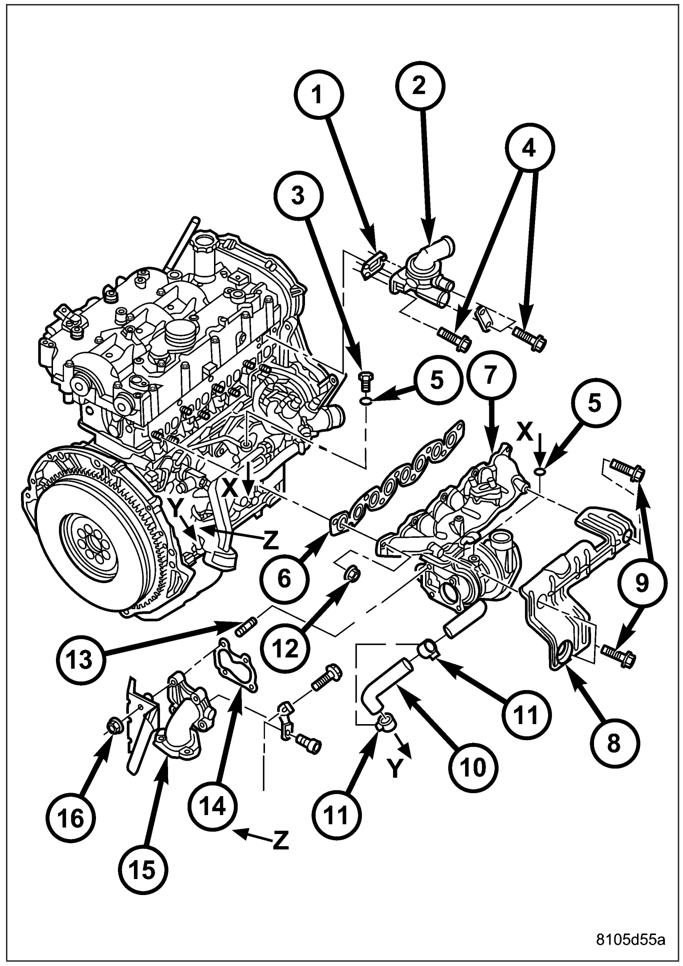

## VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

1. Measure and record internal diameter of valve guides. Valve guide internal diameter is 6.0 to 6.012 mm (0.2362 to 0.2366 in.).
2. Measure valve stems and record diameters. Intake valve stem diameter 5.952 to 5.97 mm (0.2343 to 0.2350 in). Exhaust valve stem diameter 5.942 to 5.96 mm (0.2339 to 0.2346 in).
3. Subtract diameter of valve stem from internal diameter of its respective valve guide to obtain valve stem clearance in valve guide. Clearance of inlet valve stem in valve guide is 0.03 to 0.06 mm (.0011 to .0023 in). Clearance of exhaust valve stem in valve guide is 0.04 to 0.07 mm (.0015 to .0027 in).
4. If valve stem clearance in valve guide exceeds tolerances, new valve guides must be installed.

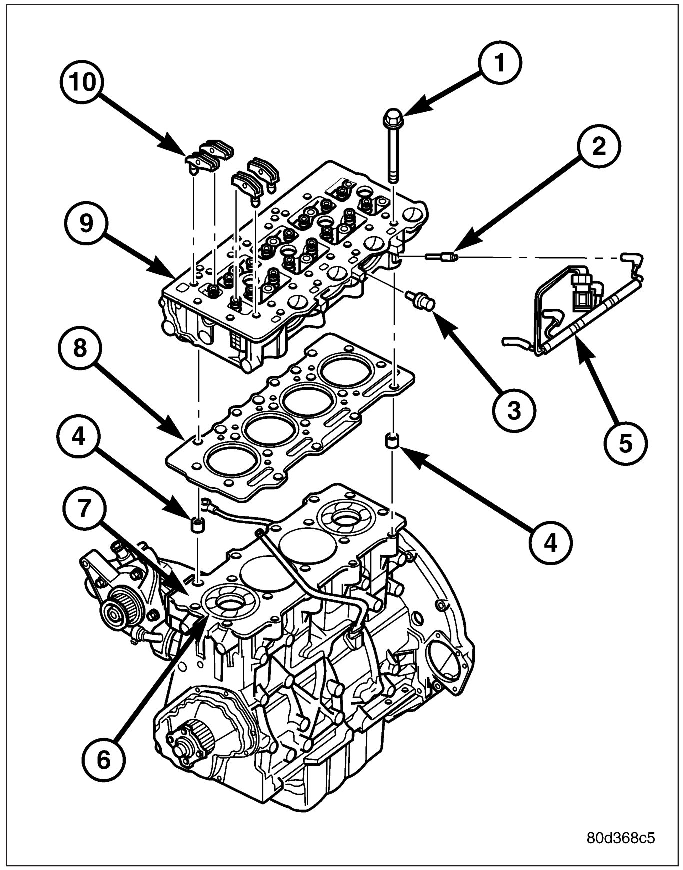
## REMOVAL

1. Disconnect negative battery cable.
2. Remove engine cover and bracket (Refer to 9 - ENGINE COVER - REMOVAL).
3. Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
4. Remove radiator core support.
5. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
6. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
7. Remove accessory drive belt tensioner and both idler pulleys, **Idler pulley bolts are L.H. thread.** (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - REMOVAL).
8. Remove power steering pump pulley.
9. Remove front engine lift bracket.
10. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
11. Remove generator and support bracketing (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).
12. Remove viscous heater.
13. Remove vibration damper.

14. Remove throttle cable assembly and set aside.
15. Disconnect main engine wiring harness connectors from right inner wheel housing.
16. Disconnect main engine wiring harness ancillary components and set harness aside.
17. Remove air cleaner housing.
18. Disconnect EGR cooler assembly water inlet pipe.
19. Remove EGR cooler from exhaust manifold (2.8L) Disconnect coolant pipe (2.5L). (Refer to 25 - EMISSIONS CONTROL/EXHAUST GAS RECIRCULATION/VALVE COOLER - REMOVAL).
20. Remove exhaust manifold heat shield.



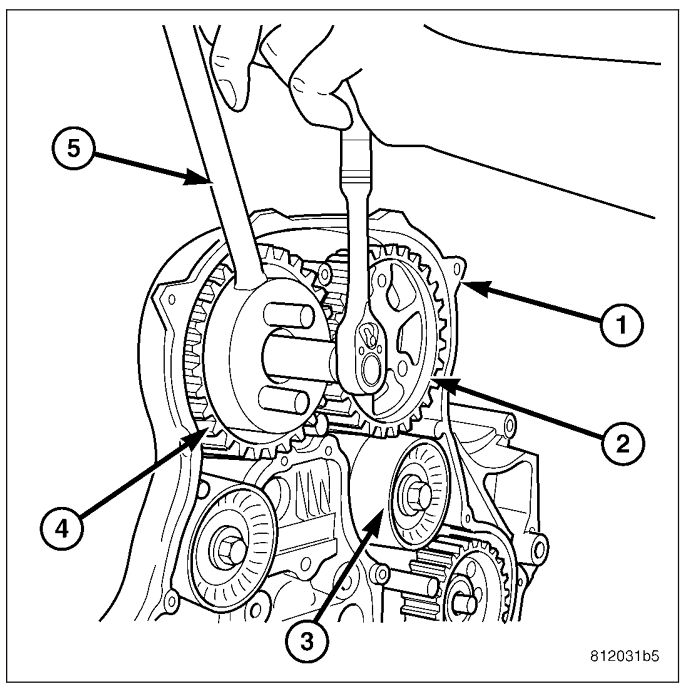
21. Remove turbocharger heat shield retaining bolt and position shield aside.
22. Remove turbocharger oil feed line from turbocharger.
23. Raise and support vehicle.
24. Disconnect exhaust stabilizer bracket at lower exhaust manifold.
25. Disconnect exhaust system bracket at transmission crossmember.
26. Lower the vehicle and remove the exhaust manifold retaining nuts.
27. Slide the exhaust manifold and turbocharger off of exhaust manifold studs .
28. Remove coolant hoses at thermostat housing.
29. Disconnect fuel return hose from fuel injectors and set aside (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
30. Remove fuel injector pressure lines (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
31. Disconnect fuel pump high pressure line at fuel rail (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
32. Disconnect oil dip stick tube from intake manifold.
33. Disconnect brake booster line bracket from intake manifold and set aside.




34. Remove fuel injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).

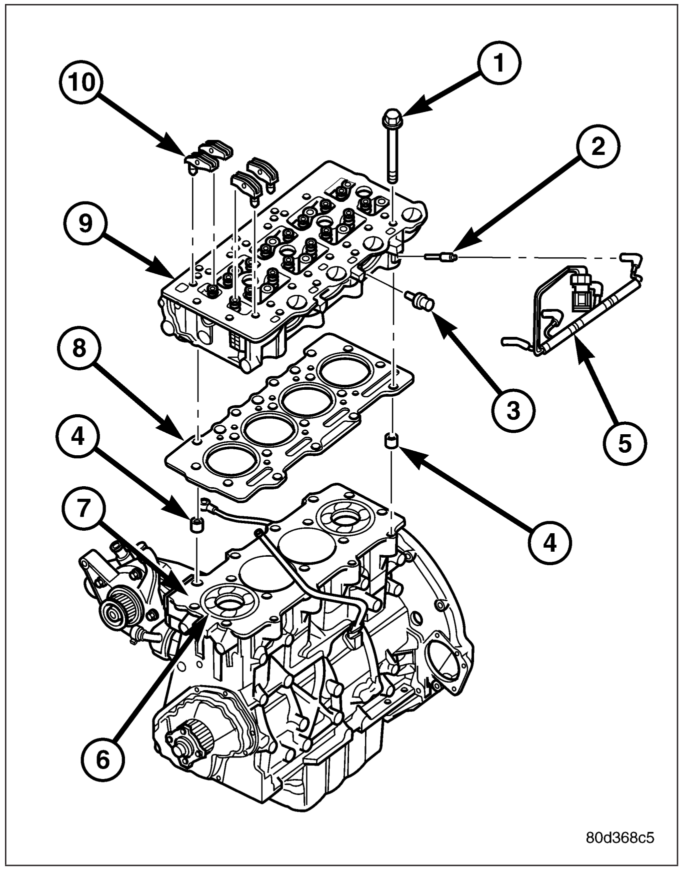
**CAUTION: Before removing the cylinder head cover/intake manifold or timing belt the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)**

35. Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
36. Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
37. Using VM.1055, remove both camshaft gears.




38. Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
39. Remove cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

40. Remove rocker arm and lifter assemblies from cylinder head. **Be sure to keep in same order as removed.**
41. Remove cylinder head cover/intake manifold gasket from cylinder head.
42. Disconnect glow plug and engine coolant temperature electrical connectors.
43. Remove turbocharger outlet to charge air cooler hose.
44. Remove cylinder head bolts.
45. Remove cylinder head assembly from engine block.




## CLEANING

Thoroughly clean the engine cylinder head and cylinder block mating surfaces. Clean the intake and exhaust manifold and engine cylinder head mating surfaces. Remove all gasket material and carbon.

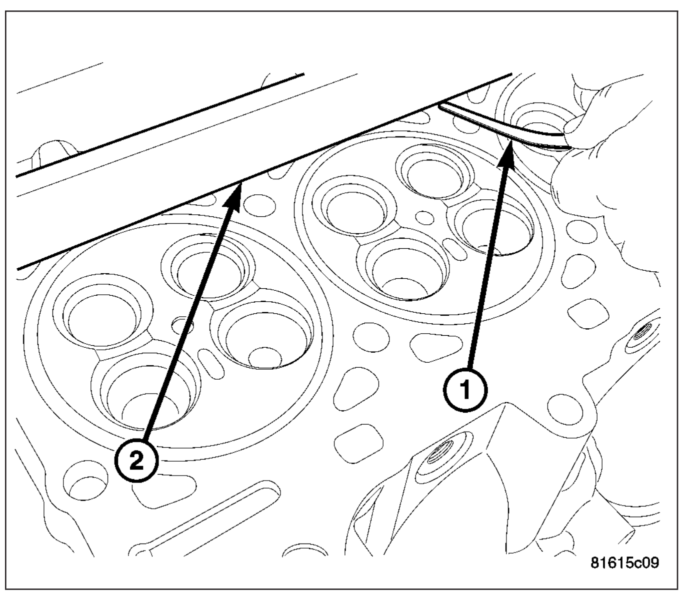
Check to ensure that no coolant or foreign material has fallen into the tappet bore area.

Remove the carbon deposits from the combustion chambers and top of the pistons.

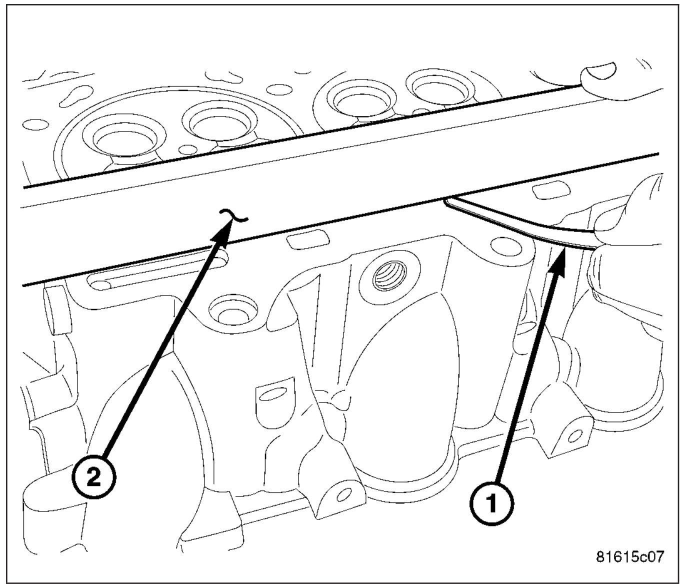
## INSPECTION

**CAUTION: The cylinder head surface and straight edge must be absolutely clean before the flatness measurement is taken. DO NOT check flatness across the combustion chamber area or on the marks left by the gasket stopper.**

Use a cleaned straight edge (2) and feeler (1) gauge to check the flatness. Lie the straight edge (2) parallel across the cooling ports. Measure before each combustion chamber toward the outer edge of the cylinder head, above and below each combustion chamber, between each combustion chamber, top and bottom , on the cylinder head and block mating surfaces. The **maximum** allowed warpage is 0.1mm (0.004 in.).



The minimum cylinder head thickness is 89.95mm (3.541 in.).




## INSTALLATION

**CAUTION: Piston protrusion must be measured to determine cylinder head gasket thickness if one or more cylinder liners have been replaced (Refer to 9 - ENGINE/CYLINDER HEAD - STANDARD PROCEDURE).**

**NOTE: If cylinder liner(s) have not been removed, the same thickness head gasket that was removed can be used.**

1. Clean and inspect gasket mating surfaces.
2. Position correct head gasket on engine block.
3. Place cylinder head on engine block.

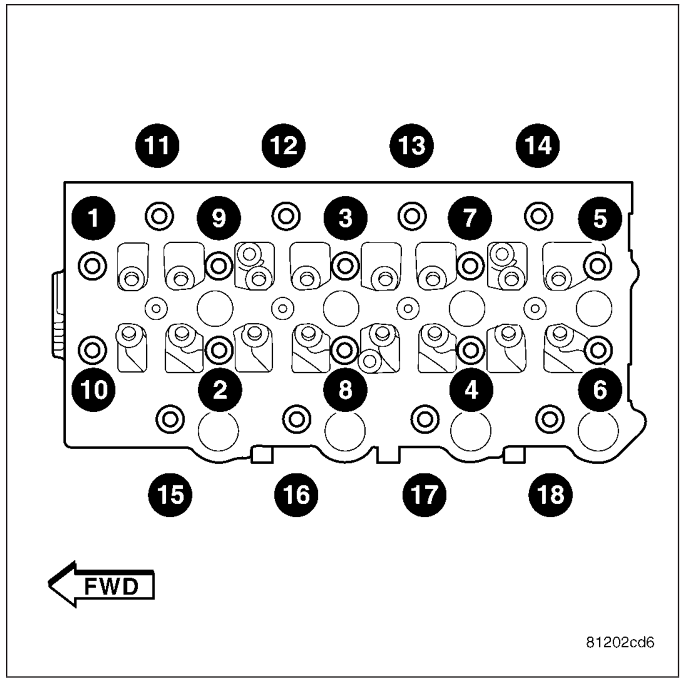
**CAUTION: New cylinder head bolts must be used. Do Not lubricate new cylinder head bolts. They already are coated with an anti scuff treatment.**

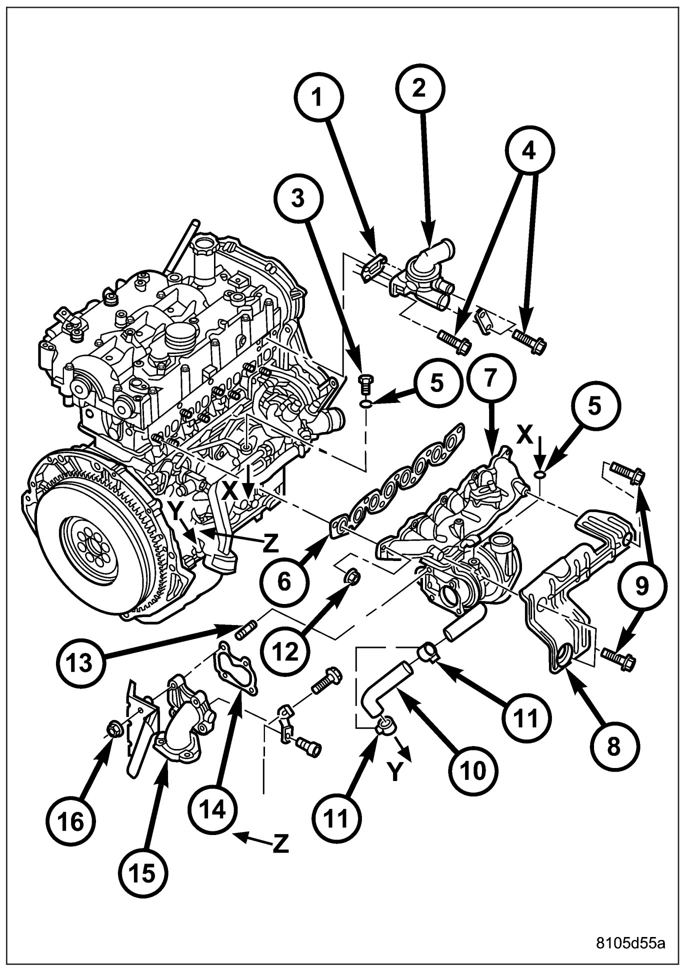
4. Tighten cylinder head bolts following procedure below.

### Cylinder Head Bolt Torquing Procedure

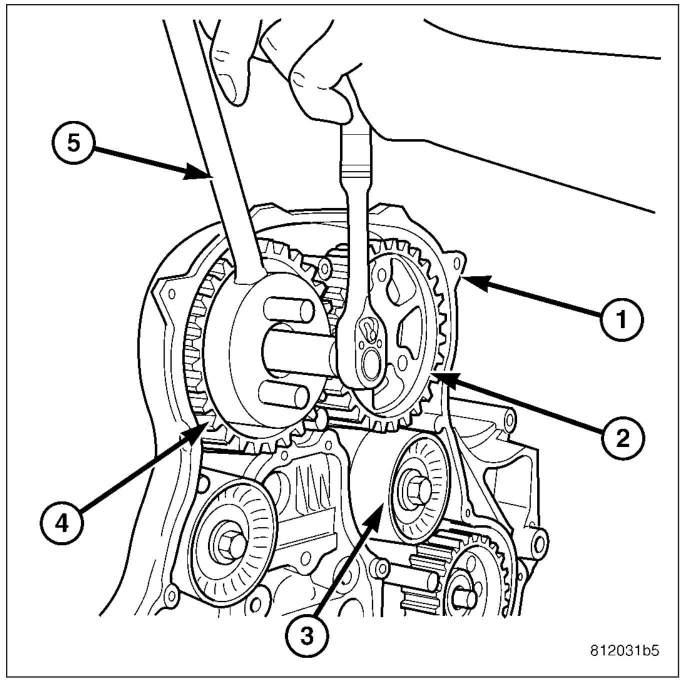
1. Tighten all cylinder head bolts starting from the center bolts, following the cylinder head scheme and the following sequence: 3-2-1-10-9-8-7-6-5-4-11-12-13-14-15-16-17-18.
2. Without loosening any bolts, starting from the center bolts, tighten each bolt an additional 75° in the following sequence: 10-9-8-7-6-5-4-3-2-1.
3. Tighten the lateral cylinder head bolts an additional 50° in the following sequence: 11-12-13-14-15-16-17-18.
4. Finally tighten all bolts an additional 75° in the following sequence: 10-9-8-7-6-5-4-3-2-1-11-12-13-14-15-16-17-18..

5. Slide exhaust manifold and turbocharger on exhaust manifold studs.
6. Install exhaust manifold retaining nuts. Tighten the nuts to 36 N·m. in a cross sequence beginning in the middle and working outward, then perform the tightening sequence to the exhaust manifold nuts again.
7. Install exhaust manifold heat shield. Torque bolts to 24.5N·m.
8. Install turbocharger outlet to charge air cooler pipe.
9. Install upper radiator hose.
10. Connect glow plug and coolant temperature sensor electrical connectors.
11. Install new cylinder head cover/intake manifold gasket.
12. Install rocker arm and lifter assemblies.**Be sure to put rocker arm and lifter assemblies in same location as removed.**
13. Install cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
14. Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
15. Using VM.1055, install both camshaft gears and tighten bolts finger tight.
16. Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
17. Using VM.1055, torque cam gear retaining bolts to 108 N·m..



18. Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
19. **Remove crankshaft and both camshaft locking pins at this time** (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).
20. Install fuel injectors (Refer to 14 - FUEL SYSTEM/ FUEL INJECTION/FUEL INJECTOR - INSTALLATION).
21. Install brake booster line bracket to intake manifold.
22. Install oil dip stick tube to intake manifold.
23. Connect fuel pump high pressure line to fuel rail.
24. Install fuel injector pressure lines.
25. Connect fuel return hose to fuel injectors.
26. Connect engine coolant hoses to thermostat housing.
27. Raise vehicle.
28. Reconnect exhaust system bracket at transmission crossmember.



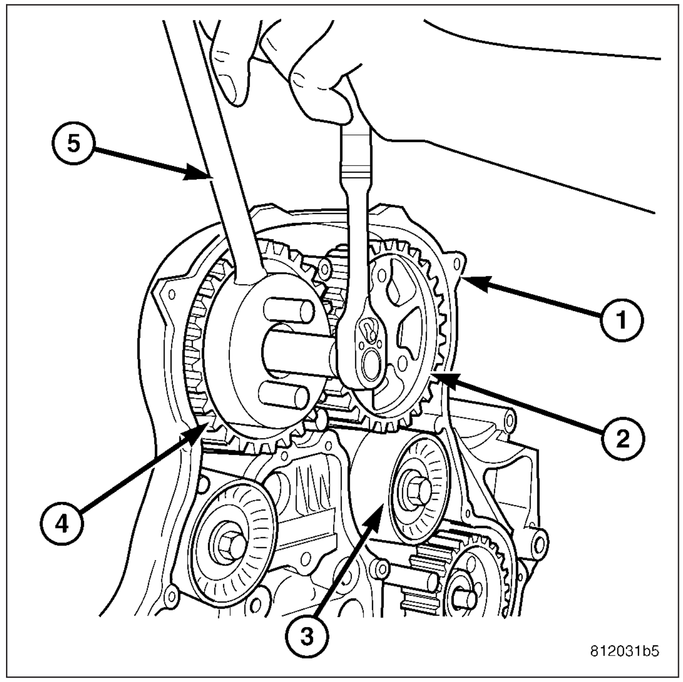

29. Connect exhaust stabilizer bracket to lower exhaust manifold.
30. Install turbocharger oil feed line to turbocharger.
31. Lower vehicle.
32. Install turbocharger heat shield.
33. Install exhaust manifold heat shield.
34. Install EGR cooler assembly and connect engine coolant hoses.
35. Install air cleaner housing.
36. Install main engine wiring harness and connect all ancillary electrical components.
37. Install throttle cable assembly.
38. Install viscous heater.
39. Install vibration damper.
40. Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).
41. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
42. Install front engine lift bracket.
43. Install power steering pump pulley.
44. Install accessory drive belt tensioner and both idler pulleys. **Idler pulley retaining bolts are L. H. Thread.**
45. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
46. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
47. Install upper radiator core support.
48. Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
49. Install engine cover and bracket (Refer to 9 - ENGINE COVER - INSTALLATION).
50. Connect negative battery cable.
51. Start engine and inspect for leaks (Refer to 14 - FUEL SYSTEM - WARNING).

# SEAL(S)-CAMSHAFT OIL

## REMOVAL

1. Disconnect negative battery cable.
2. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
3. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Remove fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
5. Remove vibration damper.
6. Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

**WARNING: Before removing the timing belt the engine must rotated to 90° after TDC and special tool VM.1080 installed. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).**




7. Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
8. Using VM.1055, remove both camshaft gears (2) and (4).
9. Remove both camshaft oil seals using special tool VM.1058.

## INSTALLATION

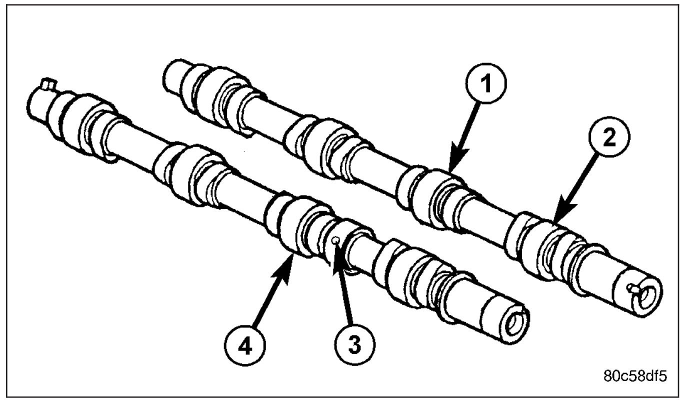
**CAUTION: Special tool VM.1080 must be removed from the flex plate after the repair is complete.**

1. Install new camshaft oil seal using VM.1057.
2. Install camshaft sprockets and tighten retaining bolts finger tight.
3. Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
4. Torque camshaft sprockets to 108 N·m using VM.1085 to hold sprockets.
5. Install outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
6. Install vibration damper.
7. Remove special tool V.M1080 from the engine block access hole.
8. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
9. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
10. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
11. Connect negative battery cable.

# CAMSHAFT(S)

## DESCRIPTION

The camshafts (1) and (2) are made of gray cast iron with eight machined lobes and four bearing journals. Each camshaft has an alignment hole (2) and (3) toward the front of the camshaft that is used during base engine timing procedures (Refer to 9 - ENGINE/ VALVE TIMING - STANDARD PROCEDURE).

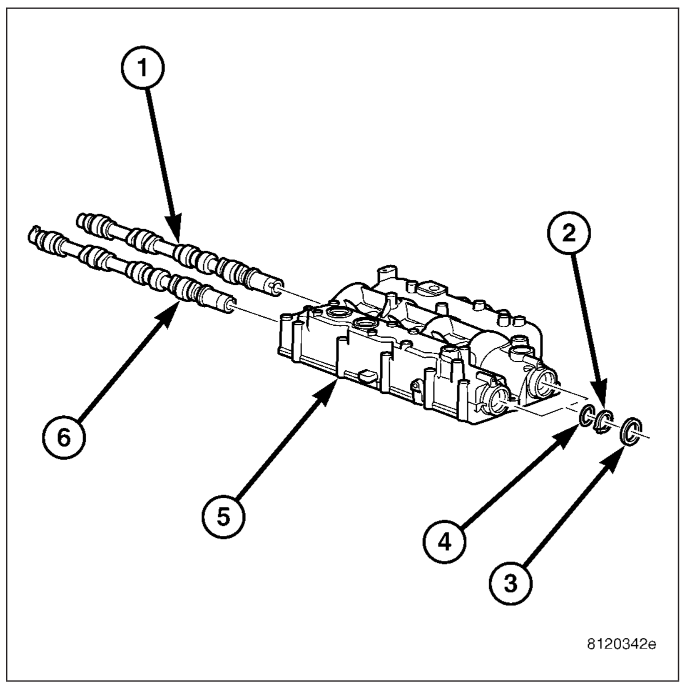



## OPERATION

When the camshaft rotates the lobes actuate the hydraulic lifters and rocker arms, forcing downward on the rocker arms which opens the valves.

## REMOVAL - CAMSHAFTS

1. Disconnect negative battery cable.
2. Remove engine cover and bracket (Refer to 9 - ENGINE - REMOVAL).
3. Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
4. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
5. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
6. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
7. Rotate the engine to 90 degrees ATDC and install special tool VM.1089. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).
8. Remove vibration damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
9. Remove generator (Refer to 8 - ELECTRICAL/ CHARGING/GENERATOR - REMOVAL).




**CAUTION: Before removing the cylinder head cover/intake manifold (5) or timing belt the engine must rotated to the 90° ATDC, or the 3 O'clock position and special tool VM.1089 installed in the 90 degree ATDC alignment hole. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)**

10. Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
11. Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

12. Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
13. Remove cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
14. With cylinder head cover/intake manifold on work bench, remove plugs at rear of cylinder head cover/intake manifold.
15. Remove camshaft oil seals.
16. Remove snap ring (2) and thrust washer (4) from camshaft.
17. Slide camshaft through access hole at rear of cylinder head cover/intake manifold (5).

## INSTALLATION - CAMSHAFTS

1. Lubricate camshafts with Mopar® Engine Oil Supplement, or equivalent.
2. Carefully install camshafts into access holes in rear of cylinder head cover/intake manifold.
3. Install thrust washer, snap ring, and camshaft oil seal.

### CHECKING CAMSHAFT ENDPLAY

1. After camshafts are properly installed in cylinder head cover check end play of camshafts with a dial indicator. The end play should be between 0.10 mm - 0.55 mm.

**NOTE: If the camshaft endplay is not within specification, measure thickness of the camshaft spacer. Camshaft spacer thickness should be 2.8 ± .02mm.**

4. Measure the camshaft end play with a dial indicator. The end play should be between 0.10 mm-0.55 mm.
5. Install access hole plugs and gaskets at rear of cylinder head cover/intake manifold. Torque plugs to 80N·m.(59 ft. lbs.).
6. Install cylinder head cover/intake manifold on engine block (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
7. Align the camshafts and install camshaft alignment pins, VM1052 and VM1053 into the camshaft cover.
8. Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

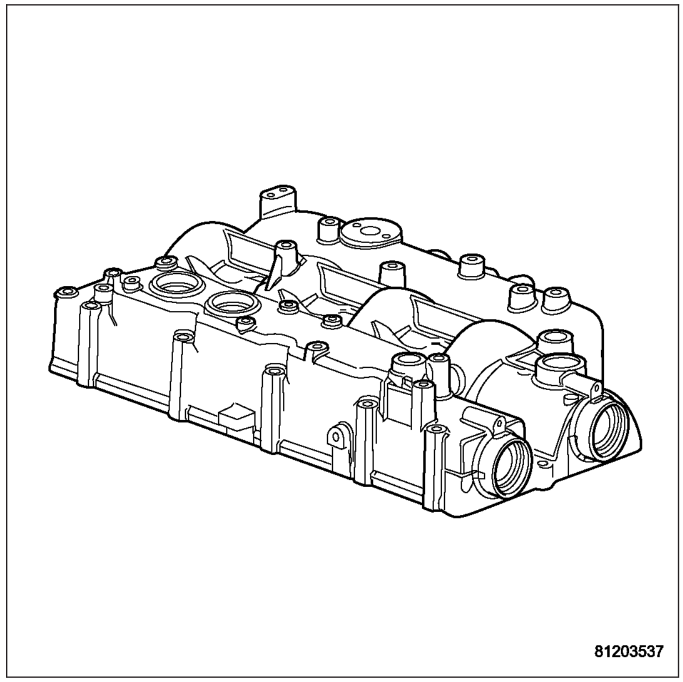
**NOTE: Crankshaft must be rotated to the 90 degree ATDC, or the 3 O'clock position (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).**

9. Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
10. Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
11. Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).
12. Install vibration damper.
13. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
14. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
15. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
16. Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
17. Connect negative battery cable.

# COVER-CYLINDER HEAD

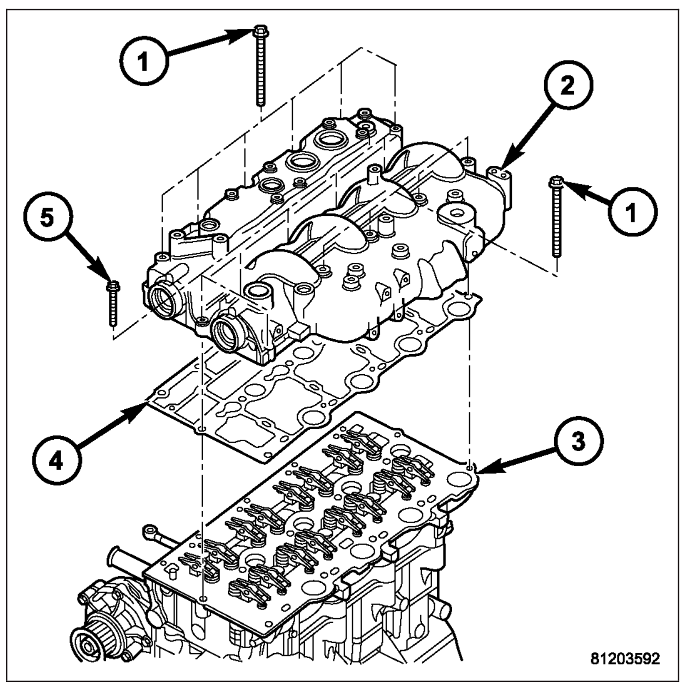
## DESCRIPTION

The cylinder head cover and the intake manifold on this engine are made of cast aluminum. The cylinder head cover also incorporates a oil drain back hole for the crankcase ventilation (CCV) system..




## REMOVAL

**CAUTION: Before removing the cylinder head cover/intake manifold (2) the witness mark on the crankshaft hub must rotated to the 3 O'clock position or, 90° after TDC to assure proper alignment of the camshafts and the crankshaft. Failure to do so could result in valve and/or piston damage during reassembly.**




1. Disconnect negative battery cable.
2. Remove engine cover and bracket (Refer to 9 - ENGINE - REMOVAL).
3. Remove the air cleaner housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
4. Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
5. Evacuate the air conditioning.
6. Disconnect the coolant recovery hose at the radiator.
7. Remove the charge air inlet hose at the coolant module.
8. Remove the upper radiator hose at the radiator.
9. Separate the A/C hoses from the cooling fan shroud.
10. Remove cooling fan and fan drive viscous drive assembly, along with the fan shroud (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
11. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
12. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

13. Disconnect the EGR cooler pipe behind the inner timing cover.
14. Remove generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL), and generator rear support bracket.
15. Remove the accessory drive belt Idler pulleys **L.H.Thread.**
16. Remove the drive belt tensioner.
17. Remove the power steering pump pulley.
18. Remove the vibration damper.

**CAUTION: Before removing the cylinder head cover/intake manifold (2) the witness mark on the crankshaft hub must rotated to the 3 O'clock position or, 90° after TDC to assure proper alignment of the camshafts and the crankshaft. Failure to do so could result in valve and/or piston damage during reassembly.**

19. Rotate the crankshaft hub to 90° after TDC (3 O'clock position).
20. Remove heater hose pipe fasteners.

**NOTE: It may be necessary to rotate the camshaft gear bolt slightly to gain proper camshaft alignment pin seating against the intake manifold. Alignment pins must seat flush against the intake manifold.**

21. Install the intake camshaft locking pin VM.1052 and exhaust camshaft locking pin VM.1053 (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).
22. Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
23. Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
24. Install special tool VM.1085 and remove camshaft gears.
25. Remove timing belt idler pulleys **L.H.Thread.**
26. Remove inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
27. Disconnect coolant temperature sensor, camshaft position sensor, boost pressure/intake air temperature sensor, fuel injectors, fuel temperature sensor, fuel rail solenoid, and EGR air flow electrical connectors.
28. Disconnect the main engine harness connectors at the right inner fender well and position the harness over the left side of the engine and aside.
29. Disconnect the brake booster vacuum pipe from the EGR air control valve.
30. Disconnect the EGR cooler pipe from the EGR air control valve.
31. Separate the main engine harness from the bracket on the EGR air control valve.
32. Remove the EGR tube from the underside of the EGR air control valve.
33. Separate the block heater wiring harness from the oil level indicator tube.
34. Remove the oil level indicator tube from the EGR air control valve.
35. Remove fuel injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
36. Remove fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - REMOVAL).
37. Disconnect oil separator outlet hose at separator.
38. Remove the oil separator from the intake manifold/cylinder head cover (2).
39. Disconnect the return fuel junction block from the intake manifold/cylinder head cover (2).
40. Remove cylinder head cover/intake manifold retaining bolts.
41. Lift cylinder head cover/intake manifold (2) from cylinder head (3).

**NOTE: When removing rocker arm and lifter assemblies, Always keep lifters in an upright position and in the order that they were removed from the cylinder head (3).**

42. Remove rocker arm and lifter assemblies from cylinder head (3).
43. Remove cylinder head cover/intake manifold gasket (4) from cylinder head (3).

## INSTALLATION

1. Clean and inspect sealing surfaces.
2. Install new gasket on cylinder head.

**NOTE: Add a small amount of grease to the top of each valve to assist with rocket arm positioning.**

3. Install rocker arm and lifter assemblies in cylinder head. **Be sure to put rocker arm and lifter assemblies in same location as removed.**

**CAUTION: Care must be taken when installing the cylinder head cover/intake manifold. Do not knock the rocker arms off of the valves when installing the cover.**

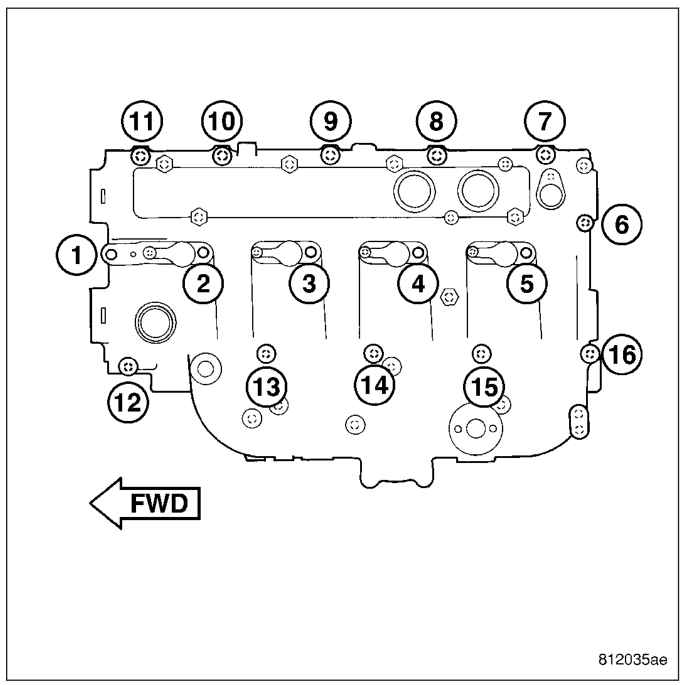
4. Install cylinder head cover/intake manifold.

**NOTE: Be sure to lubricate cylinder head cover/intake manifold retaining bolts with engine oil before assembly. If new bolts are being installed, DO NOT lubricate before assembly.**

5. Install two cylinder head cover/intake manifold retaining bolts and tighten finger tight.
6. Remove alignment studs and install remaining retaining bolts. Tighten retaining bolts finger tight.
7. Torque cylinder head cover/intake manifold retaining bolts following procedure below.

## CYLINDER HEAD COVER/INTAKE MANIFOLD TIGHTENING PROCEDURE

- Alternate between bolts #11 and #16 to seat cylinder head cover/intake manifold on cylinder head. Torque bolts to 7 N·m.
- Torque all cylinder head cover/intake manifold retaining bolts to 25 N·m in numerical order starting with #1 and ending with #16.



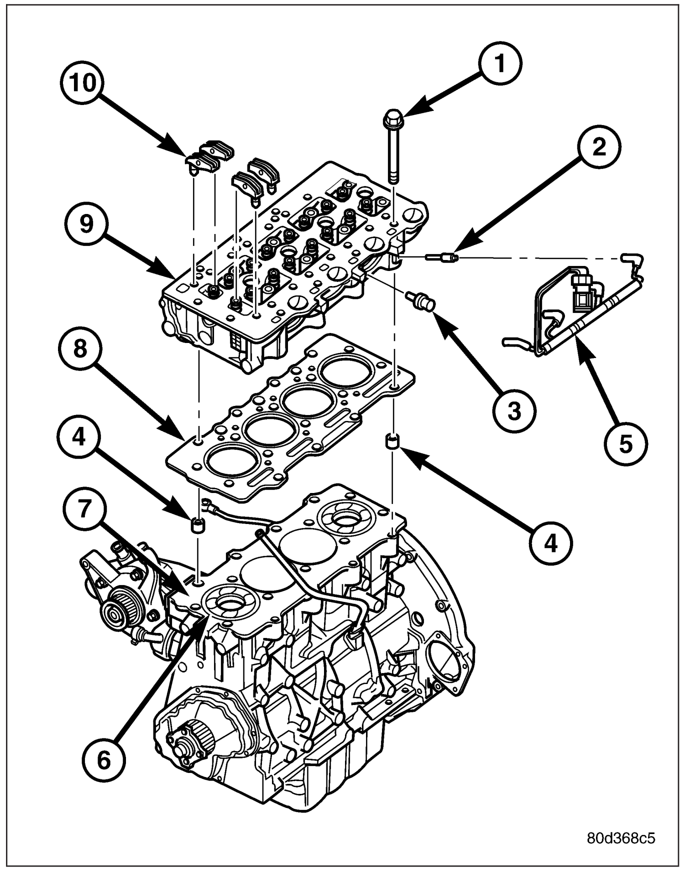

8. Connect EGR tube at intake manifold inlet tube. Torque clamp to 10.8 N·m.
9. Install turbo inlet tube retaining bolt at intake manifold. Torque bolt to 27.5 N·m.
10. Connect oil separator outlet hose at separator.
11. Install oil level indicator tube retaining bolt at intake manifold inlet. Torque bolt to 10 N·m.(88 in. lbs.).
12. Install brake booster vacuum tube retaining bolt at intake manifold inlet. Torque bolt to 10 N·m.(88 in. lbs.).
13. Install power steering pump reservoir in bracket.
14. Install fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - INSTALLATION).
15. Install fuel injectors and fuel injector supply lines (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).
16. Connect camshaft position sensor, boost pressure/intake air temperature sensor, EGR solenoid, and fuel pressure sensor electrical connectors.
17. Install inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
18. Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
19. Install outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
20. Remove crankshaft VM.1089 and both camshaft locking pins (VM.1052,VM1053) (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).

21. Install vibration damper.
22. Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).
23. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
24. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
25. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
26. Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
27. Install engine cover and bracket (Refer to 9 - ENGINE - INSTALLATION).
28. Connect negative battery cable.

# ARMS-ROCKER

## DESCRIPTION

The rocker arms (10) are made of stamped steel and serviced as an assembly along with the lifter. The rocker arm (10) also has a fracture point. This fracture point is designed to prevent engine failure if the engine is not timed properly or the timing belt breaks suddenly..

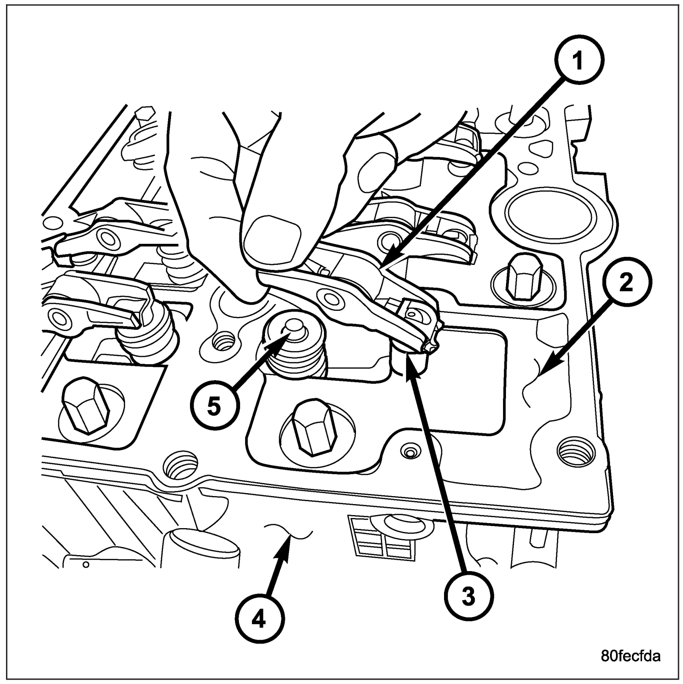



## OPERATION

The rocker arms are used as a link between the camshaft and valves. As the camshaft rotates, the lobes of the camshafts apply downward pressure on the rocker arms. This pressure is then transmitted to the valves which causes the valves to open.

## REMOVAL

**CAUTION: Before removing the cylinder head cover/intake manifold (2) the engine must rotated to 90° after TDC to assure proper alignment of the engine timing components. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)**




1. Disconnect negative battery cable.
2. Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
3. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
4. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
5. Remove the vibration damper.
6. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
7. Remove the power steering pump pulley.
8. Rotate the crankshaft to 90 degrees ATDC (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).
9. Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
10. Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
11. Remove inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
12. Remove cylinder head cover/intake manifold (2) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

**NOTE: Lifters must be kept in order of removal and stored in the up right position.**

13. Remove rocker arms (1) and lifters (3).

## INSTALLATION

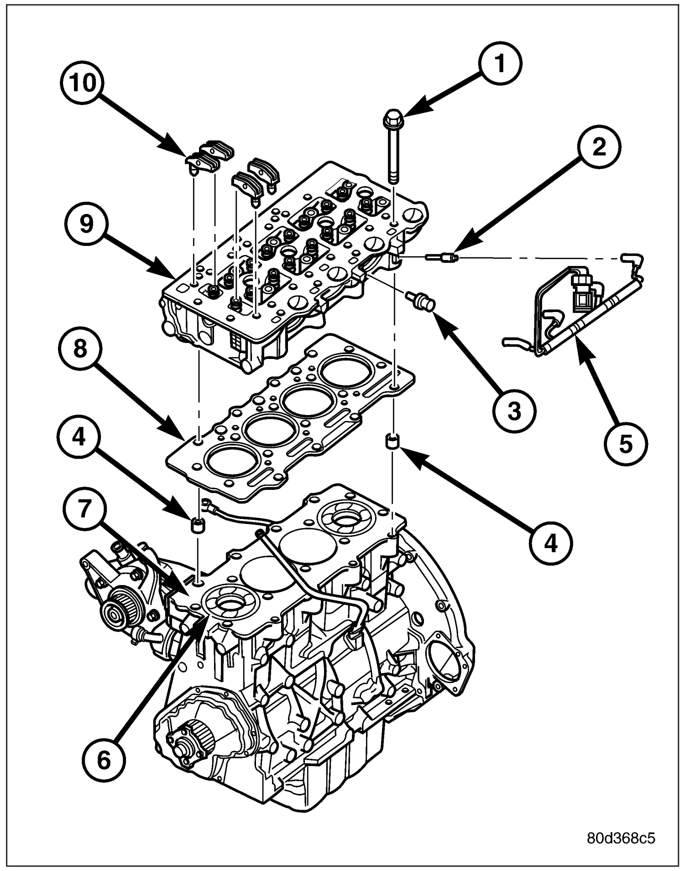
1. Clean and inspect gasket sealing surfaces.
2. Install new gasket on cylinder head.
3. Lubricate lifter ball end of lifter(s), valve(s), and rocker arm roller(s) with Mopar® Engine Oil Supplement or equivlalent.
4. Connect rocker arm(s) to lifter and reposition on valve(s).
5. Install cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
6. Install inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
7. Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
8. Install outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
9. Install vibration damper.
10. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

11. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
12. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
13. Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
14. Connect negative battery cable.

# LIFTERS-HYDRAULIC

## DESCRIPTION

Valve lash is controlled by hydraulic tappets located inside the cylinder head (9), in tappet bores below the camshafts.




## REMOVAL

1. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).

## INSPECTION

Clean each lifter assembly in cleaning solvent to remove all varnish and sludge deposits. Inspect for indications of scuffing on the side and base of each lifter body.

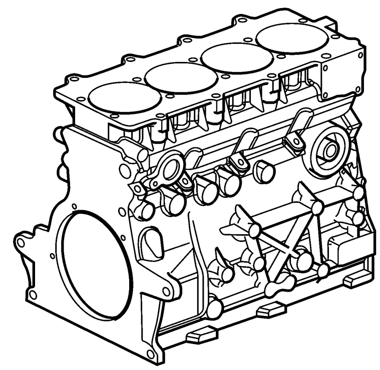
## INSTALLATION

1. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - INSTALLATION).

# BLOCK-ENGINE

## DESCRIPTION

The 2.8L CRD Diesel engine uses a cast iron engine block with wet cast iron cylinder liners. The cylinder block has increased stiffness that reduces structural flexing and a fractured connecting rod cap design that can not distort connecting rod cap fit.

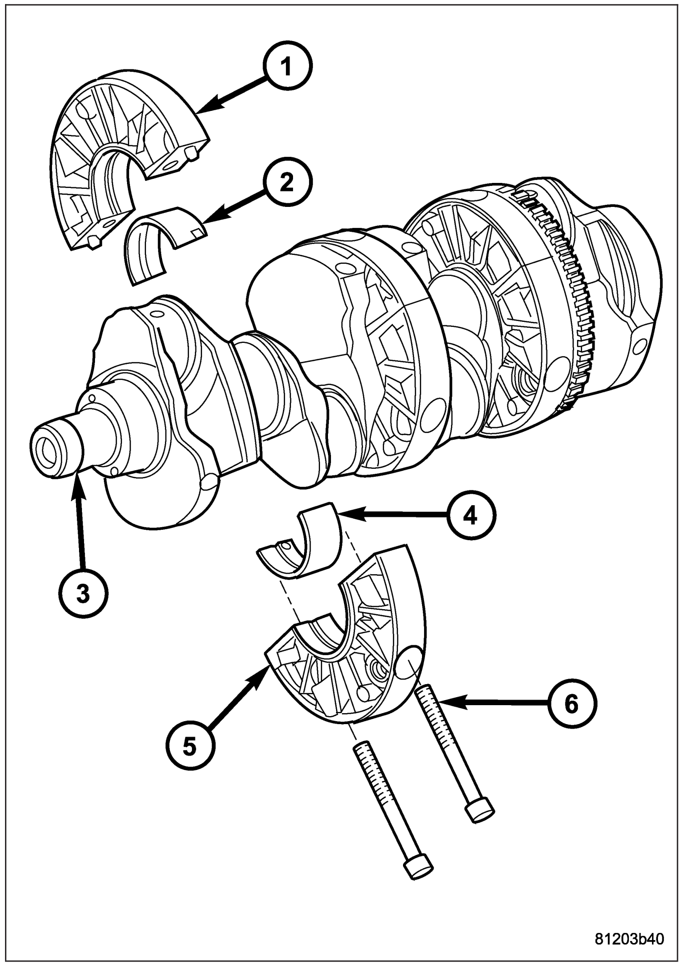


80c6aef8

# CRANKSHAFT

## DESCRIPTION

The crankshaft for the 2.8L is a forged steel type design with five main bearing journals. The crankshaft is located at the bottom of the engine block and is held in place with three main bearing supports

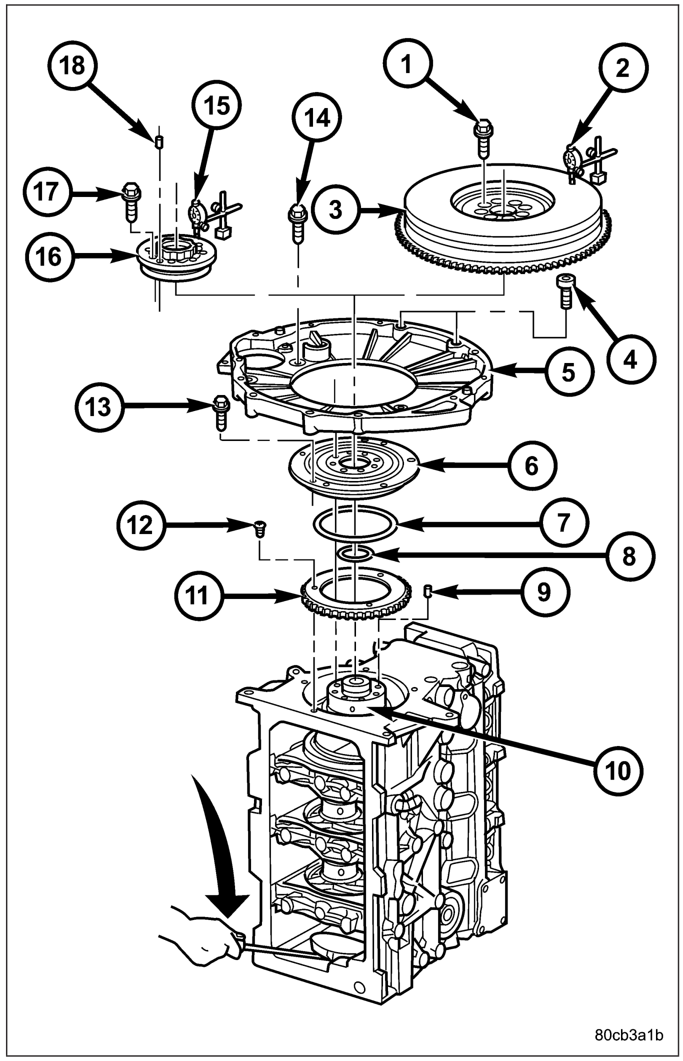



## OPERATION

The crankshaft transfers force generated by combustion within the cylinder bores to the flexplate.

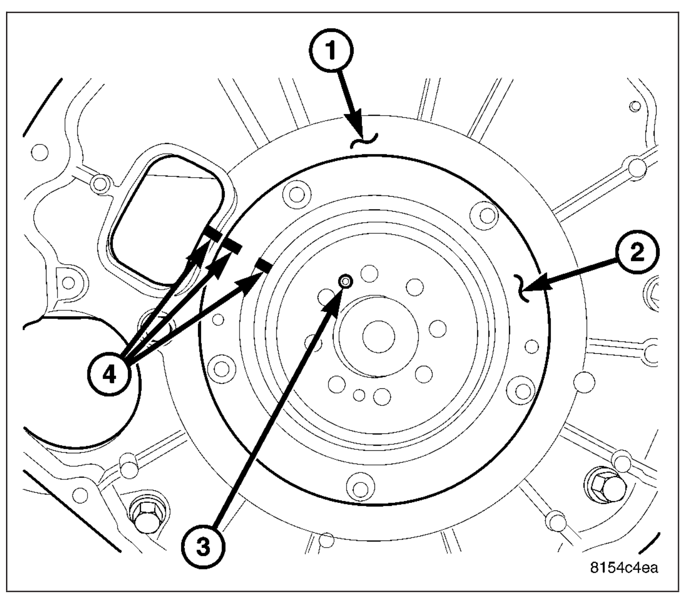
## STANDARD PROCEDURE - CHECKING CRANKSHAFT END PLAY

1. Mount a dial indicator to a stationary point at rear of engine. Locate the probe perpendicular against the flywheel.
2. Move the crankshaft (10) all the way to the front of its travel.
3. Zero the dial indicator (2).
4. Move the crankshaft (10) all the way to the rear and read dial indicator (2). For crankshaft end play clearances (Refer to 9 - ENGINE - SPECIFICATIONS).




## REMOVAL - CRANKSHAFT

**NOTE: The crankshaft is removed from the rear of the engine. Make sure to use an appropriate engine stand.**




1. Remove engine from vehicle (Refer to 9 - ENGINE - REMOVAL).
2. Mount engine on an engine stand.
3. Drain engine oil and remove oil filter.
4. Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
5. Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
6. Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
7. Remove cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

8. Remove cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
9. Remove flex plate.

**NOTE: Paint marking or scribing will assist in properly assembling and aligning oil passage ports in the crankshaft supports and engine block.**

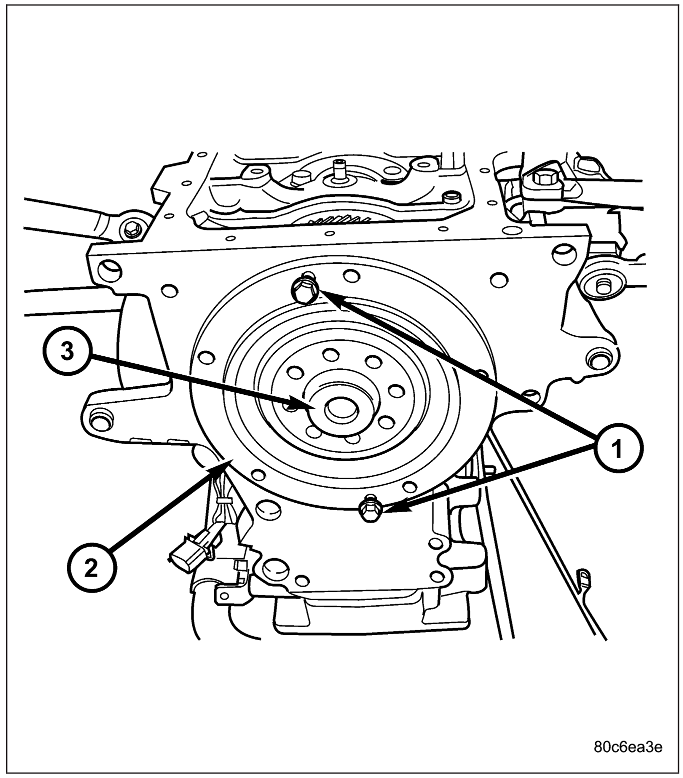
10. Paint mark or scribe (4) the relation of the rear main bearing support (2) and adaptor plate (1).

**NOTE: One of the crankshaft position sensor heat shield fasteners will have to be removed to free the adaptor plate (1) for removal.**

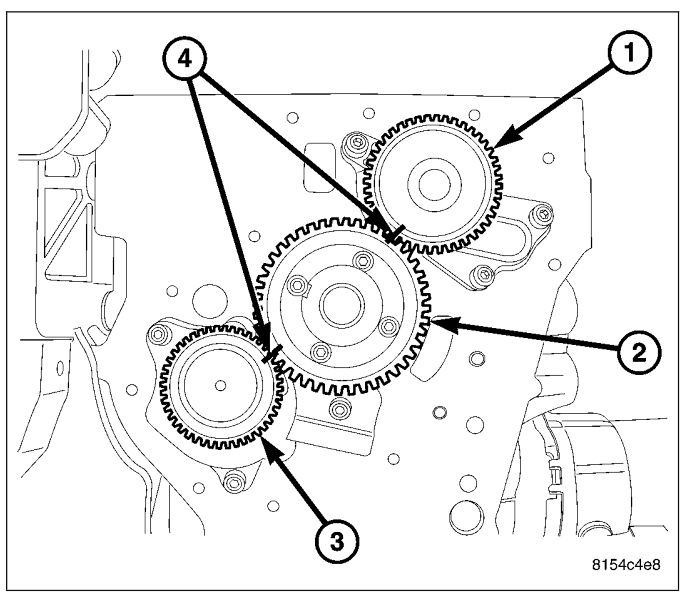
11. Remove rear main bearing support (2) and adapter plate (1) retaining bolts and remove adapter plate (1).
12. Paint mark or scribe (4) the rear main bearing support (2) to engine block relation once the adaptor plate (1) is removed.

**NOTE: Keep the rear main bearing support (2) and rear crankshaft seal together as an assembly (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - DESCRIPTION).**

13. Remove rear main bearing support (2) by threading two retaining bolts (1) in holes provided. Tighten bolts (1) equally to push main bearing support (2) out of block.

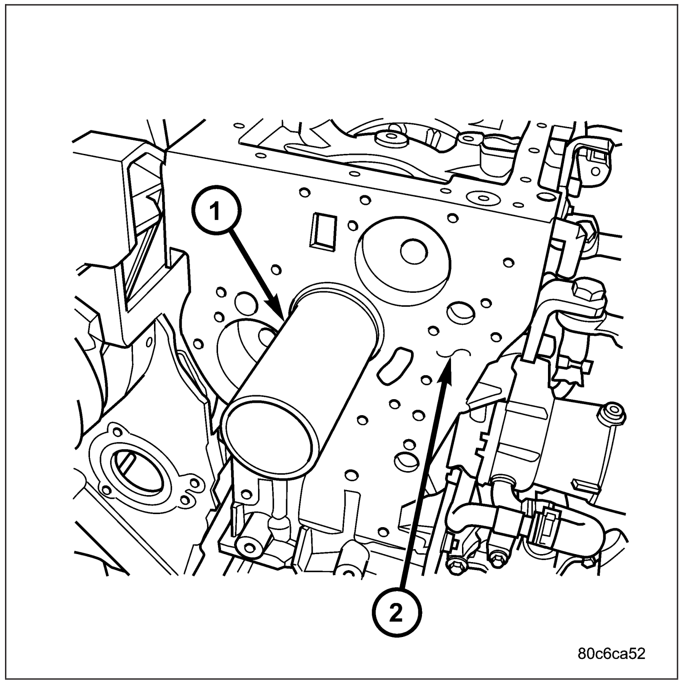



14. Remove front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL).
15. Paint mark or scribe the crankshaft gear to vacuum pump and oil pump drive gears (1).



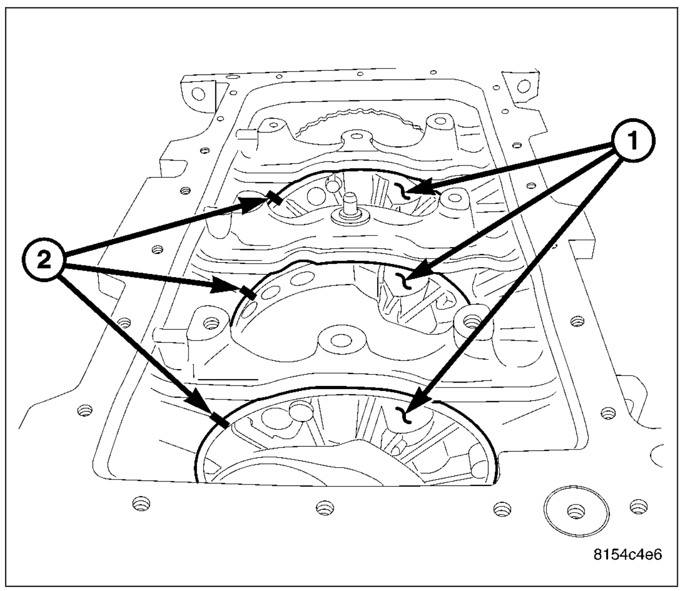
16. Remove crankshaft gear (2).

17. Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
18. Remove oil pump pickup tube (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).
19. Remove balance shaft assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - REMOVAL).
20. Remove oil jets (Refer to 9 - ENGINE/LUBRICATION/OIL JET - REMOVAL).
21. Remove piston and connecting rod assemblies (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - REMOVAL).
22. Slide special tool VM.1069 on the front of the crankshaft.

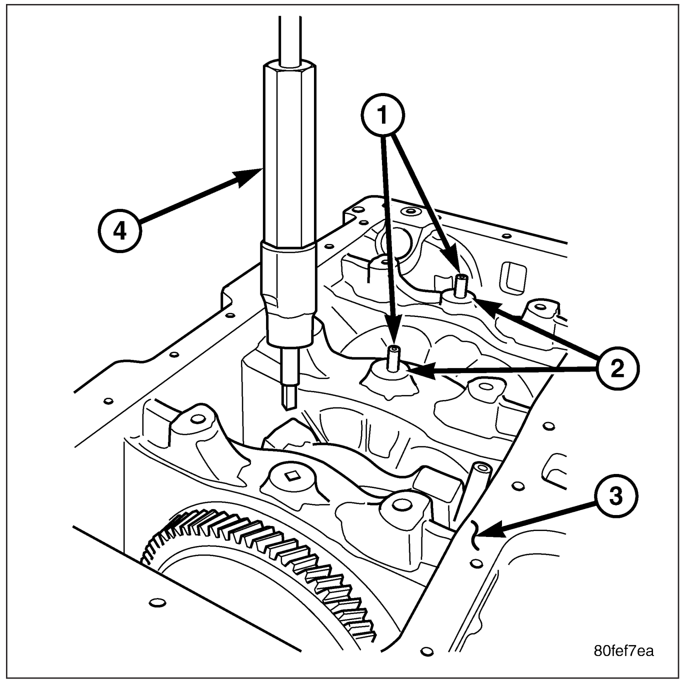



**CAUTION: Failure to properly identify and align each crankshaft support (1) will result in improperly aligned engine oil passages which will lead to engine failure.**

23. Paint mark or scribe (2) each crankshaft support (1) to engine block relation.



24. Using special tool VM.1054 (4), remove crankshaft support retainers (1) and o-rings (2), discard o-rings (2)..
25. Paint mark or scribe the relation between the crankshaft sensor tone ring and the crankshaft and remove the tone ring.
26. While holding crankshaft guide VM 1069, carefully guide crankshaft out of the rear of engine block (3).



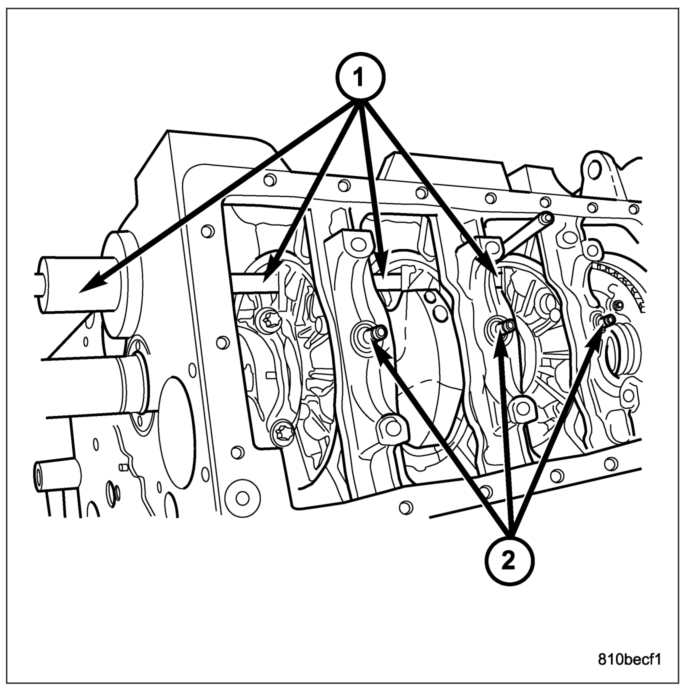

## INSTALLATION

**CAUTION: IT IS CRITICAL THAT BOTH HALVES OF THE CRANKSHAFT SUPPORT ARE ALIGNED PROPERLY WITH THE ENGINE TO SUPPORT ENGINE OIL MANAGEMENT.**

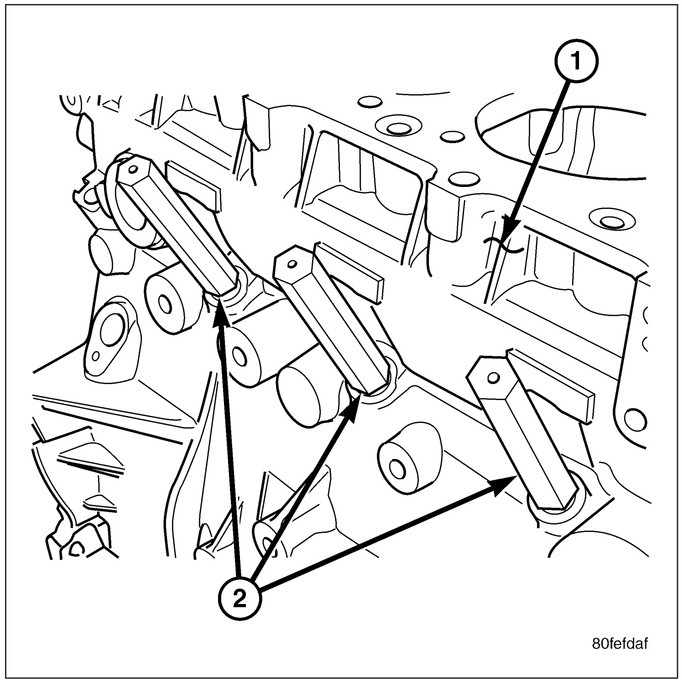
1. Install crankshaft in engine block.

**NOTE: There are two identical holes in the crankshaft support. Care must be taken to insert the special tool into the correct one..**

2. Insert crankshaft support alignment dowel into the vacuum pump access hole, through the proper crankshaft support holes then slide the tool guide flush against the engine block and retain with a vacuum pump retaining bolt.
3. Install crankshaft support retainers.



4. Remove special tool VM.1069 from crankshaft.
5. Remove special tool VM. 9095 from engine block.
6. Install crankshaft sprocket.
7. Install front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION).
8. Install rear main bearing support in engine block (1). **Be sure to align oil hole in rear main bearing support with the lubrication port in the block.**
9. Install adapter plate and retaining bolts. Torque bolts to 27.5N·m.
10. Install flex plate.
11. Install piston and connecting rod assemblies (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - INSTALLATION).
12. Install oil jets (Refer to 9 - ENGINE/LUBRICATION/OIL JET - INSTALLATION).
13. Install balance shaft assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - INSTALLATION).




14. Install oil pump pickup tube (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).
15. Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
16. Install cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
17. Install cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
18. Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
19. Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
20. Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
21. Install engine in vehicle.
22. Fill engine oil with proper oil to correct level.

# BEARINGS-CRANKSHAFT MAIN

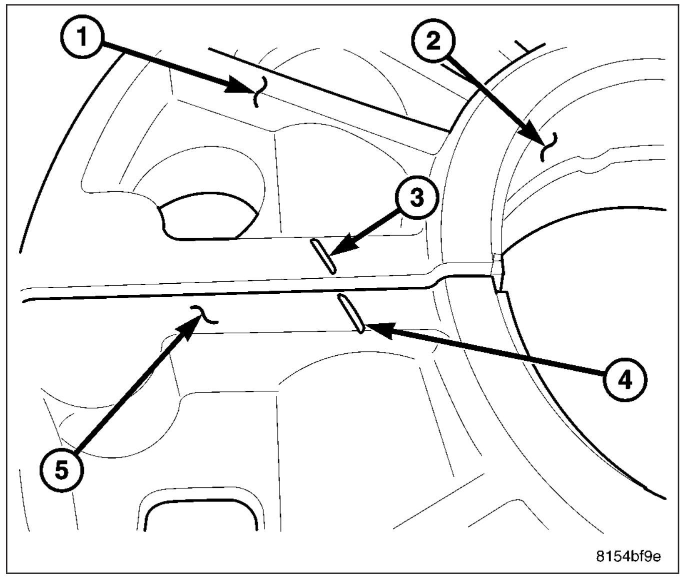
## REMOVAL

**NOTE: The crankshaft support halves can be identified by aligning the witness marks scribed on the face, located between the halves. These witness marks must face towards the front of the engine when installing the crankshaft and support assembly.**

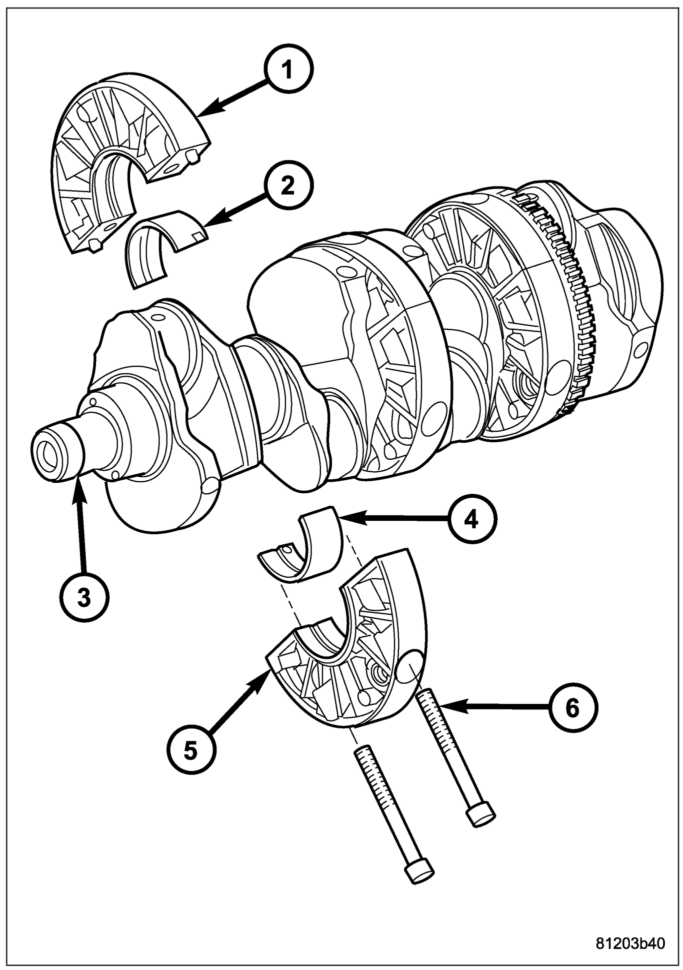
The engine must be removed from vehicle and completely disassembled to replace the front main bearing.

### CRANKSHAFT MAIN BEARINGS

1. With crankshaft assembly removed from engine.
2. Identify the crankshaft support witness marks.

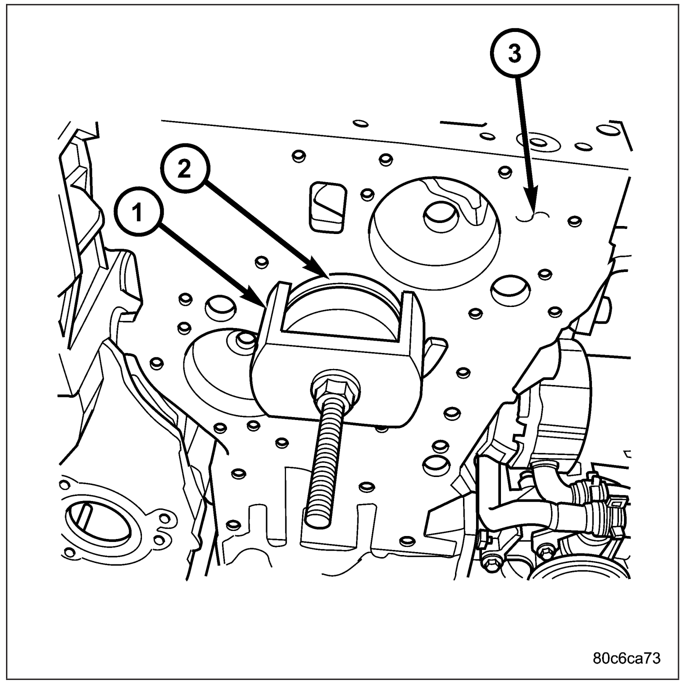



3. Remove crankshaft supports from crankshaft and remove bearing halves from supports.



### CRANKSHAFT FRONT MAIN BEARING

1. Using special tool VM.1073 push front main bearing out of front of engine block.




## INSTALLATION

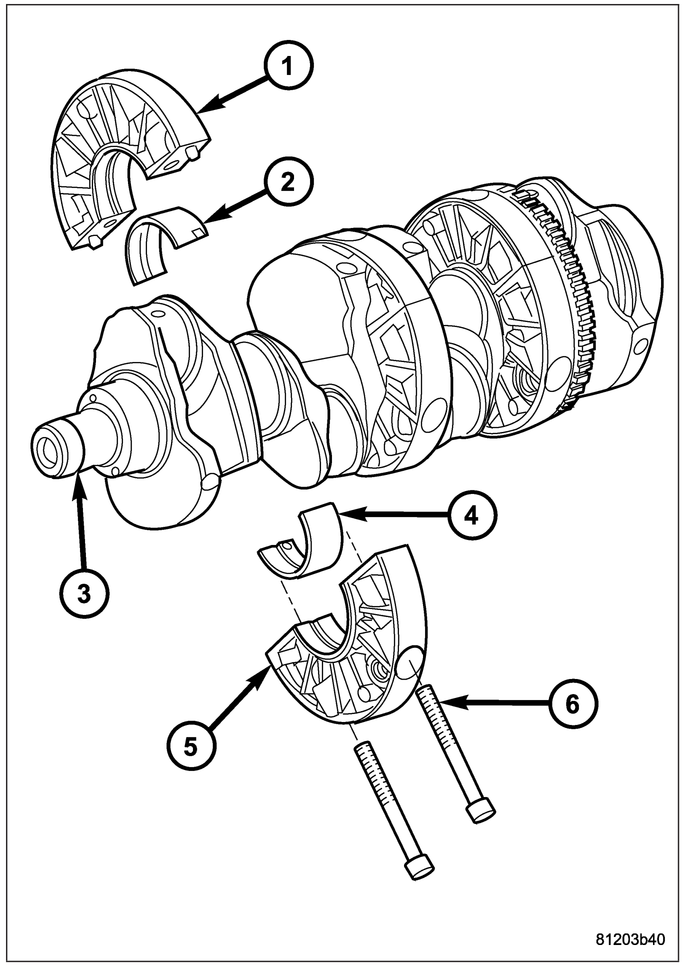
### CRANKSHAFT MAIN BEARINGS

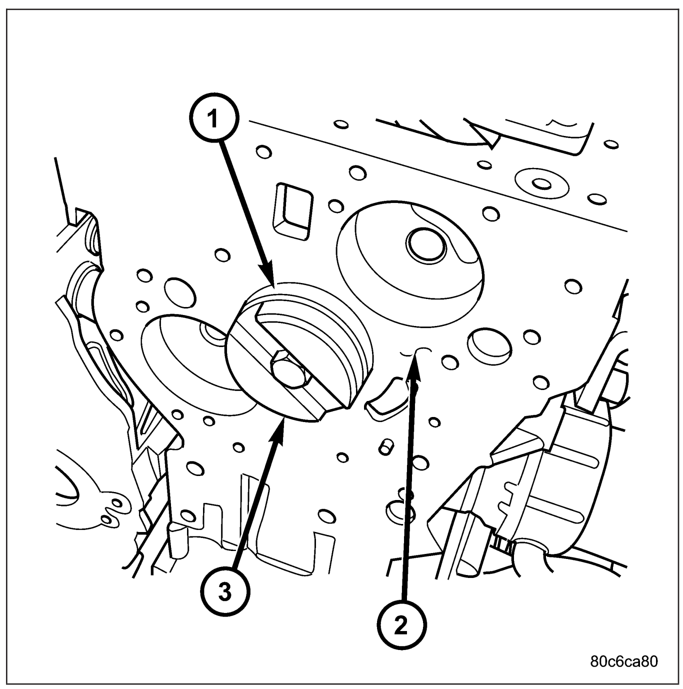
**NOTE: Identify the correct crankshaft by noting the groove on the front of the 2.8L crankshaft.**

1. Install bearing halves in crankshaft supports.
2. Lubricate crankshaft and main bearings with clean engine oil.
3. Install crankshaft supports on crankshaft. Torque bolts to 44.1N·m.

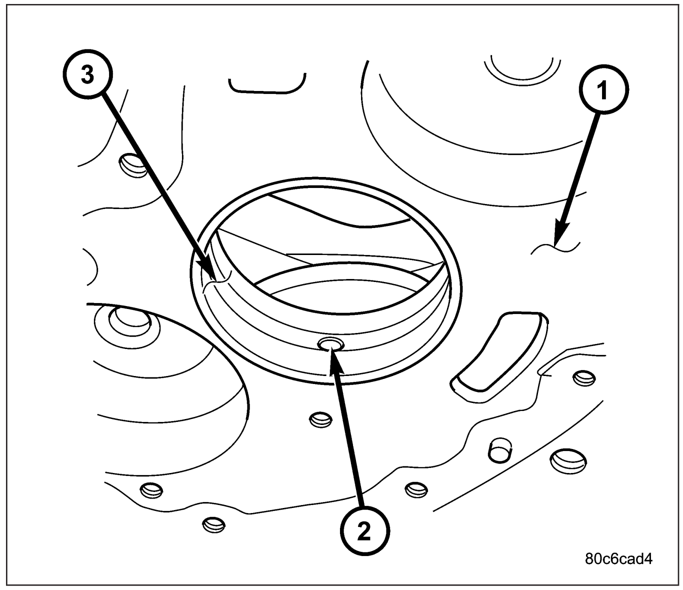
## FRONT CRANKSHAFT MAIN BEARING

1. Using special tool VM.1073, push front crankshaft main bearing in engine block.
2. Be sure oil hole in bearing lines up with oil gallery in engine block.



3. Reassemble engine and install in vehicle.



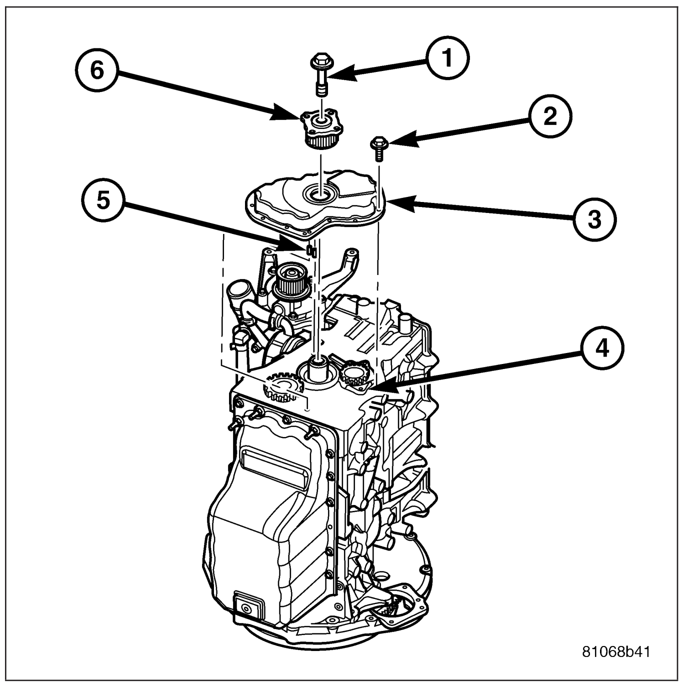
# SEAL-CRANKSHAFT OIL - FRONT

## REMOVAL

1. Disconnect negative battery cable.
2. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
3. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
5. Remove vibration damper/crankshaft pulley (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
6. Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
7. Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
8. Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

**NOTE: Crankshaft hub retaining bolt has left hand thread.**

9. Remove crankshaft hub.
10. Remove front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL) .
11. With cover on work bench, pry out old seal.



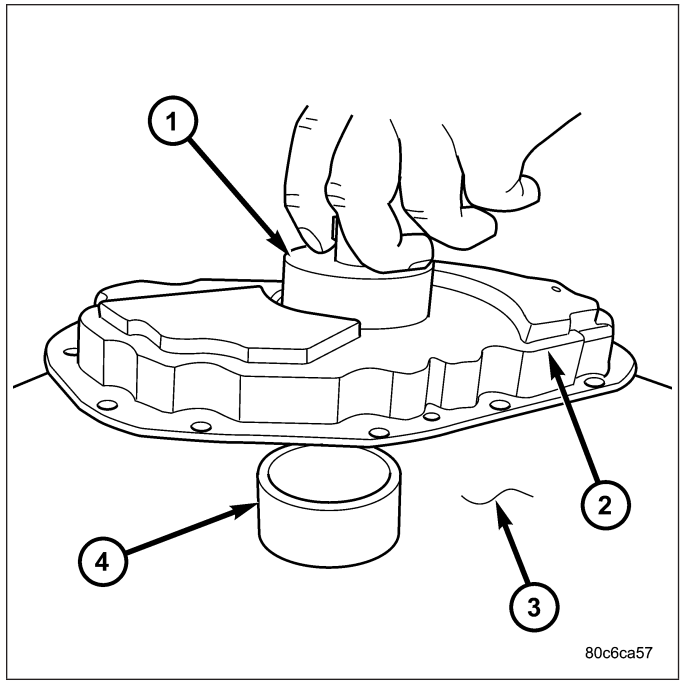

## INSTALLATION

**CAUTION: Do Not use a hammer to install the crankshaft oil seal.**

**NOTE: To prevent potential oil leaks, DO NOT touch the front crankshaft inner seal. Always handle the seal from the outer diameter.**

1. Clean engine block and front engine cover sealing surfaces.
2. Install crankshaft oil seal on VM.1061.
3. Place sleeve for VM.1061 on pressbench as shown.

4. Position VM.1061 and press in new seal into front engine cover.
5. Install front engine cover on engine (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION).
6. Install crankshaft hub and retaining bolt. Torque bolt to 304N·m.
7. Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
8. Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
9. Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
10. Install vibration damper/crankshaft pulley (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
11. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

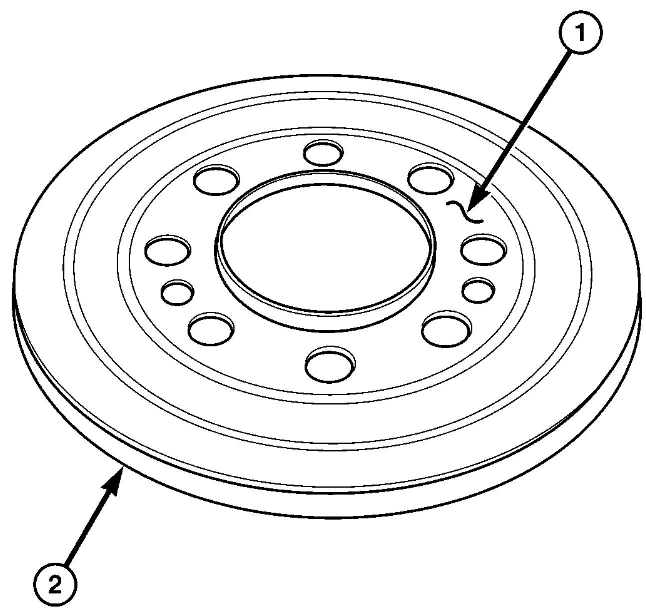



12. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
13. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
14. Connect negative battery cable.

# SEAL-CRANKSHAFT OIL - REAR

## DESCRIPTION

The rear crankshaft seal consists of two parts that reside in a third part, the rear support assembly. The rear seal is inserted into the rear cup. These pieces should be assembled WITH OUT removing one from the other. The rear support assembly, once assembled, should not be separated as well, to reduced possibility of damage to the internal rear seal lip.

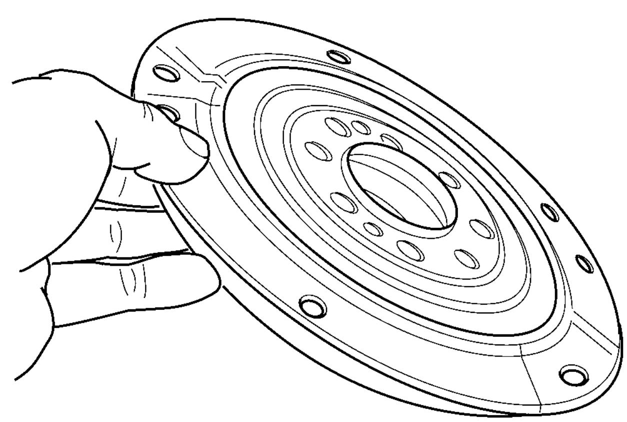



8120baaf

## REMOVAL

This must be done with either the engine or transmission removed from vehicle.

1. Remove flywheel assembly.
2. Paint mark or scribe a witness mark on the engine block to be used for alignment purposes during assembly.
3. Pry out old crankshaft oil seal.



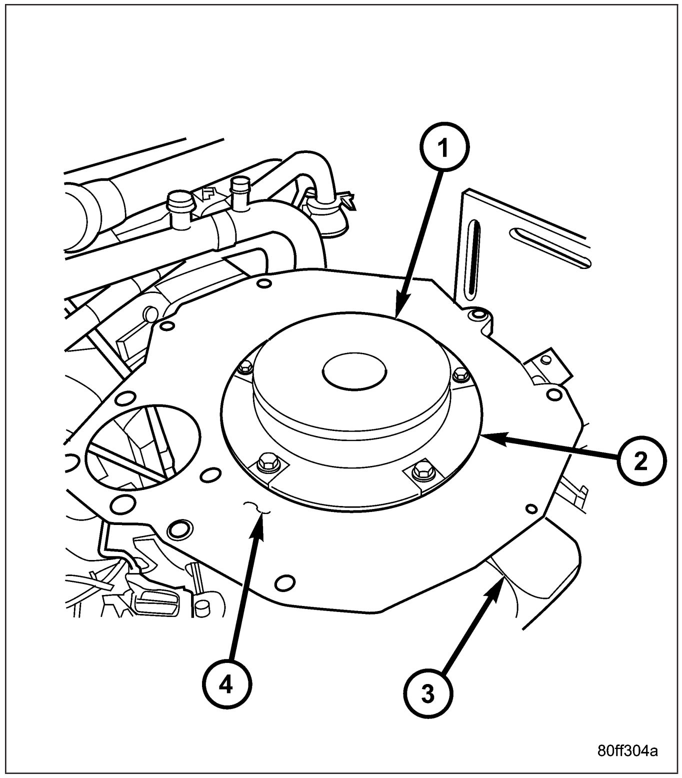
8120baae

## INSTALLATION

**CAUTION: To prevent potential oil leaks, DO NOT touch or separate the rear crankshaft inner seal from the seal cup. When replacing the rear crankshaft carrier, DO NOT touch or separate the seal cup from the rear oil seal. Always handle the components as an assembly and from their outer diameter.**

1. Using special tool VM.1050, install rear crankshaft oil seal in rear main bearing support.

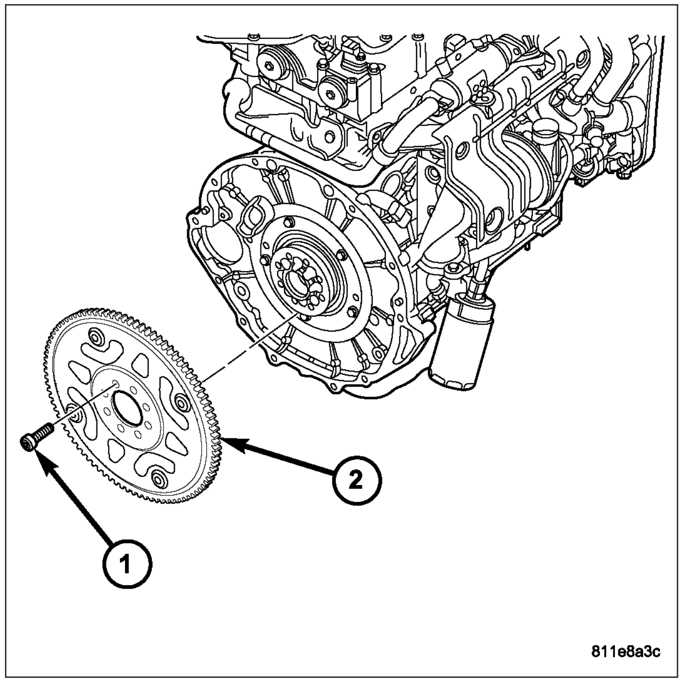
2. Install engine or transmission in vehicle.



# FLEX PLATE-2.8L

## REMOVAL

1. Remove the transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - REMOVAL), (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - REMOVAL).
2. Paint mark the flex plate hub to flex plate relation.
3. Remove the 40 mm flex plate bolts (1) and flex plate (2).
4. Inspect flex plate (2) for damage.




## INSTALLATION

**NOTE: Do Not lubracate new bolts as they are already coated with an anti-scuff treatment.Align the flex plate to hub paint marks, where applicable.**

1. Install the flex plate hub and hand tighten the fasteners.
2. Tighten each flex plate hub fastener to 50 N·m (37 lbs. ft.) in a clockwise cross sequence.
3. At this point, loosen one flex plate adaptor fastener, and with a torque wrench and angle gauge, tighten the fastener to 25 N·m (19 lbs. ft.), plus 60 degrees.
4. Perform the above procedure for the remaining flex plate adaptor bolts in a clockwise cross sequence.
5. Install the flex plate locating pin.
6. Install the flex plate to the hub and install the fasteners. Tighten the flex plate fasteners in a cross sequence to 44 N·m (32.5 ft. lbs.).
7. Install the transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - INSTALLATION), (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - INSTALLATION).

# LINERS-CYLINDER

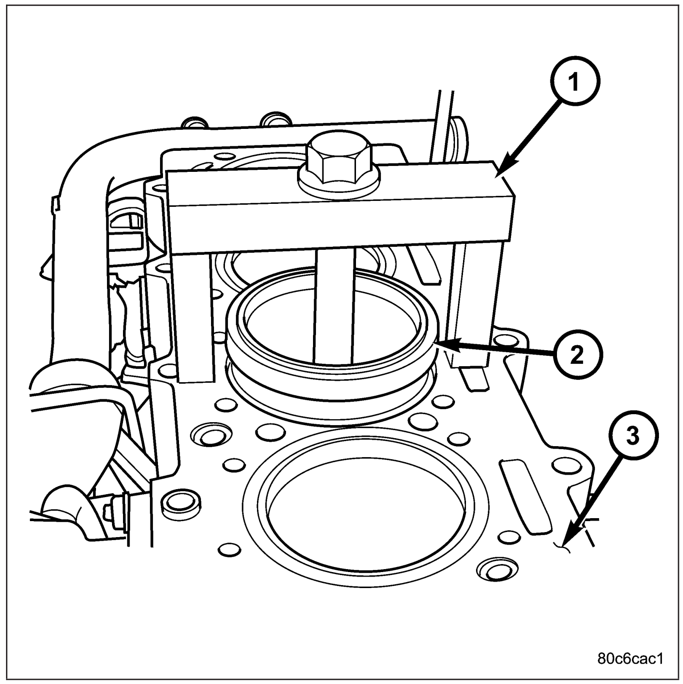
## DESCRIPTION

Each cylinder wall liner used on this engine is of the wet design. Coolant is in direct contact with the liner. Three O-rings are used to seal the liner to the engine block. The top O-rings (black) are water seals and the lower (brown) seal is an oil seal. The applicable metal shim is used for cylinder liner protrusion. If the liner is to be reused, match mark the liner and block. Anytime that the liners are removed, replace the O-rings and the shim. If one or more liners have been replaced the liner protrusion must be measured to determine the proper head gasket selection. If the liners are not removed, used the same thickness head gasket that was removed.

## REMOVAL

**CAUTION: To prevent damage to the oil jets, remove the oil jets before removing the pistons or liners.**

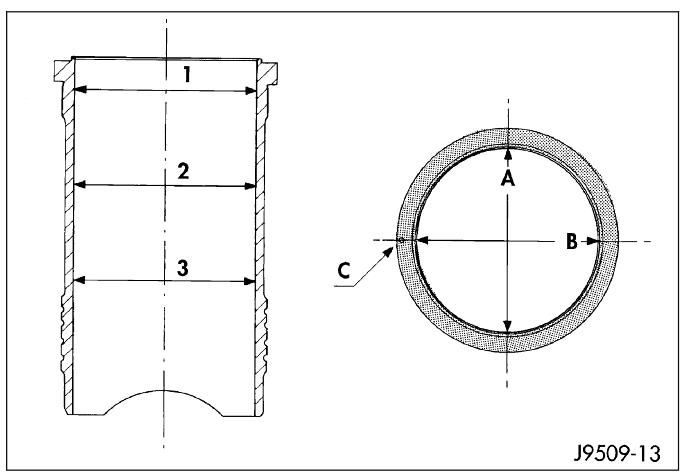
1. Remove engine from vehicle.
2. With engine completely disassembled, use special tool VM.1001 (1) to remove cylinder liner (2).
3. Tighten bolt on VM.1001 (1) to remove cylinder liner (2) from engine block (3).
4. Remove shim(s) from cylinder liner (2) or cylinder block recess. Keep shim(s) with each cylinder liner (2) until cylinder liner (2) protrusion measurement.




## INSPECTION

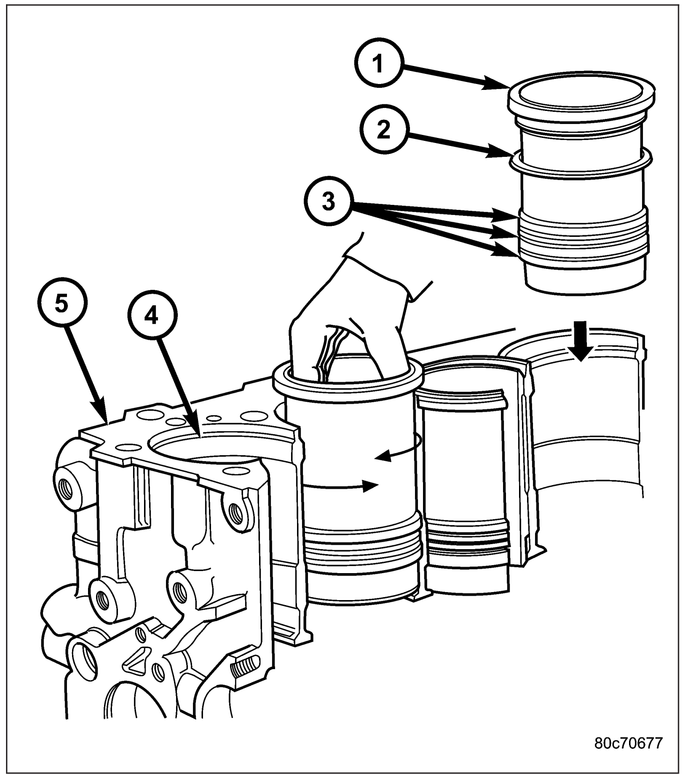
The cylinder walls should be checked for out-of-round and taper with a dial bore gauge. The cylinder bore out-of-round is 0.100 mm (.0039 in.) maximum and cylinder bore taper is 0.100 mm (.0039 in.) maximum. If the cylinder walls are badly scuffed or scored, new liners should be installed and honed, and new pistons and rings fitted.

Measure the cylinder bore at three levels in directions A and B. Top measurement should be 10 mm (3/8 in.) down and bottom measurement should be 10 mm (3/8 in.) up from the bottom bore.



## INSTALLATION

**CAUTION: Cleanliness can not be over emphasized enough when cleaning the cylinder liner (1) to engine block (5) mating surfaces. Failure to do so will result in the wrong protrusion reading. Only one shim (2) per sleeve fitting. DO NOT stack or re-use shims (2).**




**NOTE: When installing cylinder liners (1) for protrusion measurement, remove all O-rings (3) and discard original shim (2).**

1. Carefully clean cylinder liner (1) and engine block (5), and degrease the engine block deck where it comes into contact with the cylinder liners (1). Install the cylinder liners in the engine block (5) as shown, rotating them back and forth by 45° in order to guarantee correct positioning.

**NOTE: All Measurements Must Be Taken On the High Pressure Pump Side.**

2. Measure the cylinder liner (1)) recess relative to block deck with dial indicator VM.1013 mounted on a special tool VM.1010 A.. Zero dial gauge on block deck.

**NOTE: The cylinder liner (1) reading will actually be a negative number.**

3. Move dial gauge to cylinder liner (1) edge record reading on dial gauge. The reading should be negative.
4. Remove cylinder liner (1) and special tools.
5. Then select the correct shim (2) thickness to give proper protrusion (0.00 - 0.05 mm).

**NOTE: The O-rings (3) are used toward the bottom of the cylinder liner (1). Each cylinder liner (1) has three O-rings (3) that prevent coolant and engine oil from mixing. The brown (bottom) O-ring (3) is an oil seal and the two black (top) O-rings (3) are water seals.**

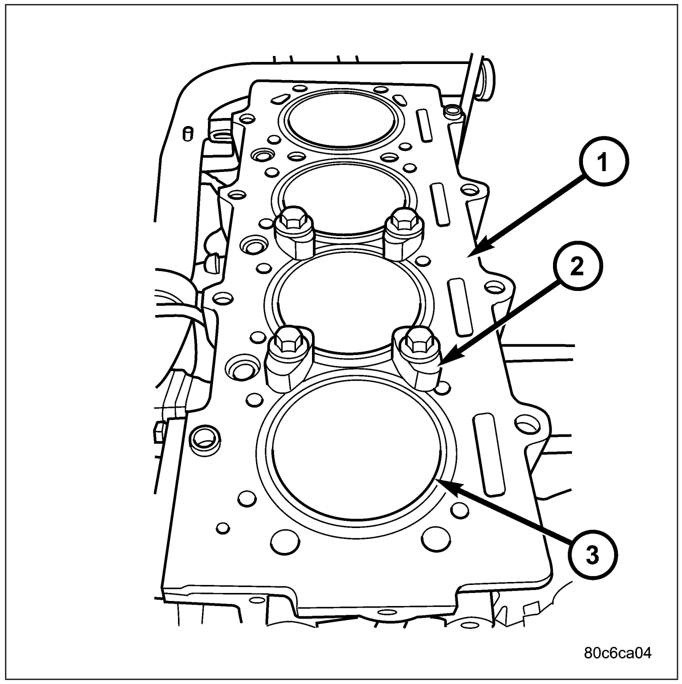
6. Fit the proper shim (2), and the O-rings (3), onto the cylinder liner (1).
7. Lubricate the lower cylinder liner (1) location in the engine block (5).

**CAUTION: When installing special tool VM.1076, make sure the tool does not rotate when tightening and damage the cylinder liner (1). DO NOT rotate the engine with out special tool VM.1076 in position.**

8. Fit the cylinder liners in the crankcase making sure that the shim (2) is positioned correctly in the seat. Lock the cylinder liners (1) in position using special tool (VM.1076) and bolts tightened to 50 N·m (37 ft.lbs.).

**NOTE: After measuring cylinder liner (1) protrusion again, piston protrusion must be measured to prevent the wrong cylinder head gasket selection.**

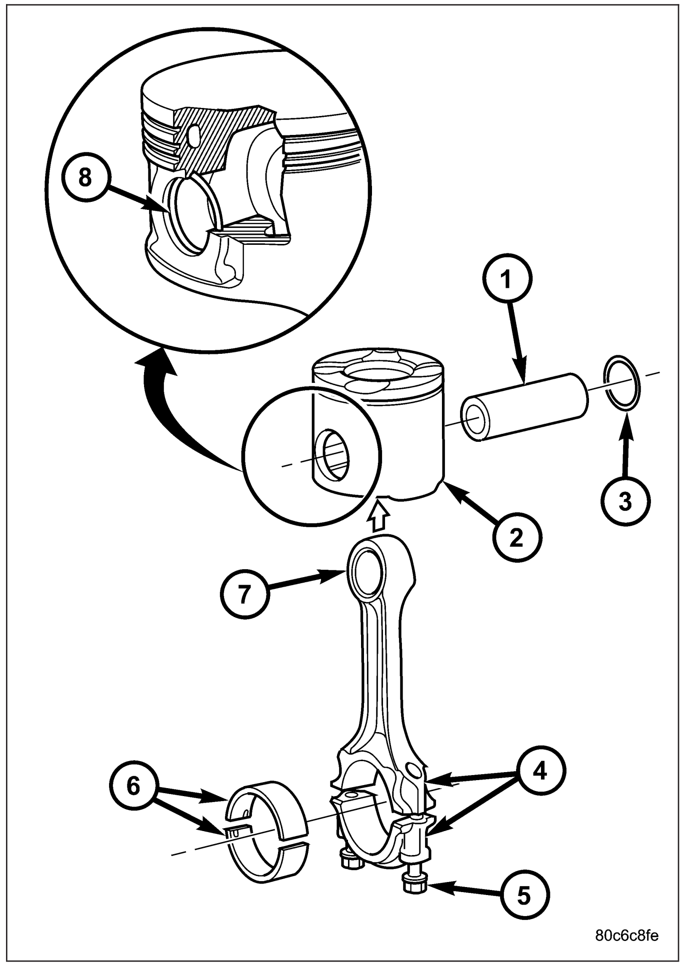
9. Measure cylinder liner (1) protrusion again. It should be 0.00 - 0.05 mm.
10. Reassemble engine.
11. Install engine in vehicle.



# ROD-PISTON AND CONNECTING

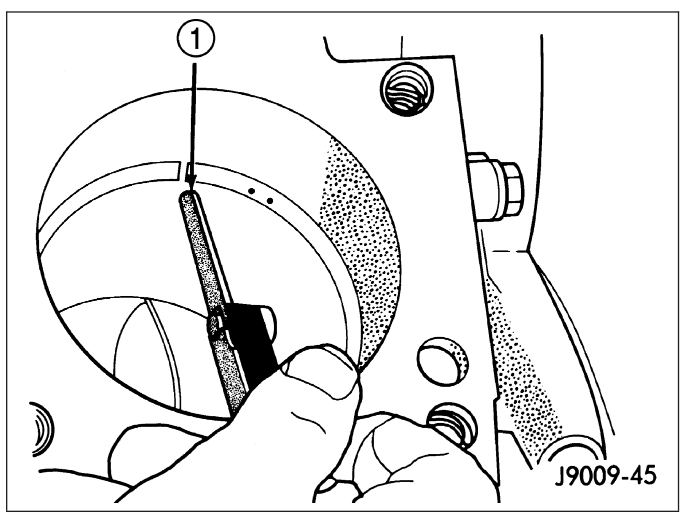
## DESCRIPTION

The pistons (2) are of a free floating design. Oil jets in the engine block lubricate and cool the piston and piston pin (1) assembly. The connecting rods (7) have a pressed in place wrist pin bushing which is lubricated by the oil jets. Connecting rod (7) and bearing caps have cracked mating surfaces and are not interchangeable..

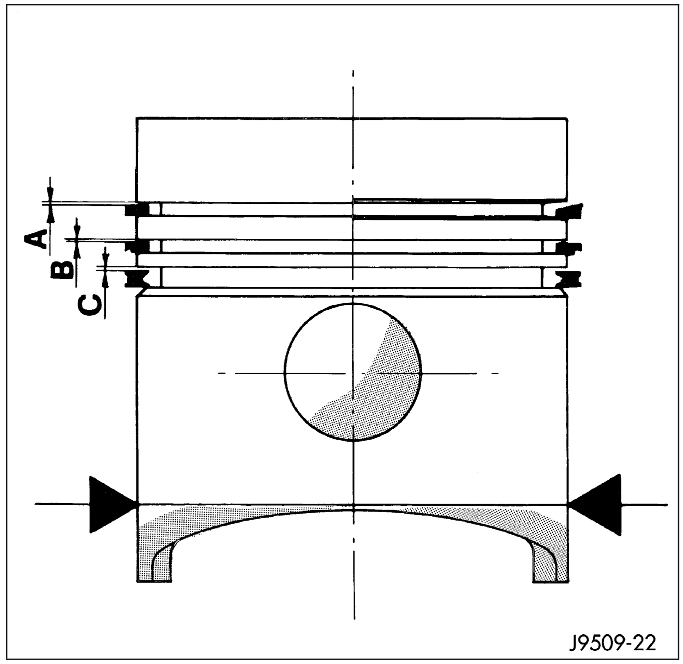



## STANDARD PROCEDURE - PISTON RING FITTING

1. Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 in.) from bottom of cylinder bore. Check gap with feeler gauge. Top compression ring gap .30 to .45mm (.0118 to .0177 in.). Second compression ring gap .30 to .45mm (.0118 to .0177 in.). Oil control ring gap .25 to .50mm (.0098 to .0196 in.).
2. If ring gaps exceed dimension given, new rings or cylinder liners must be fitted. Keep piston rings in piston sets.



3. Check piston ring to groove clearance. Top compression ring gap .080 to .130mm (.0031 to .0051 in.). Second compression ring gap .070 to .110mm (.0027 to .0043 in.). Oil control ring gap .040 to .080mm (.0015 to .0031 in.).




## REMOVAL

**NOTE: Both the connecting rod and the connecting rod cap are paint marked to aid during assembly. Paint marks disappear after time. If the rod and the cap are not marked with paint, paint mark or scribe them before disassembly.**

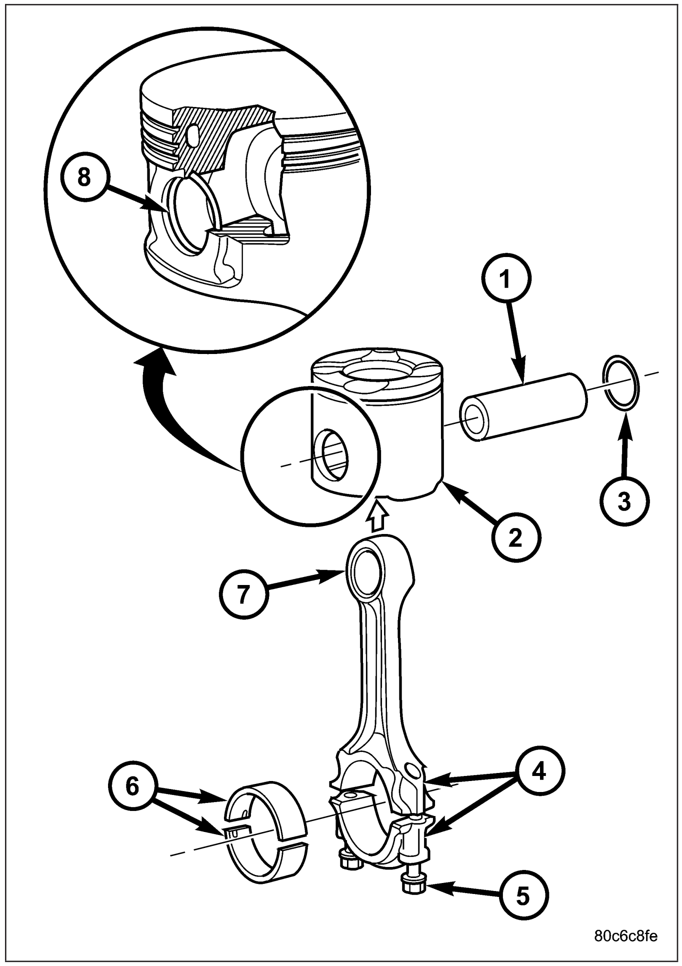
1. Disconnect negative battery cable.
2. Remove cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
3. Raise vehicle on hoist.
4. Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
5. Remove oil pump pickup tube. (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).
6. Remove balance shaft assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - REMOVAL).
7. Remove top ridge of cylinder bores with a ridge reamer before removing pistons from cylinder block. **Be sure to keep top of pistons covered during this operation.**
8. Piston and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

**NOTE: Be careful not to nick or scratch crankshaft journals**

9. After removal, install bearing cap on the mating rod and mark pistons with matching cylinder number when removed from engine block.

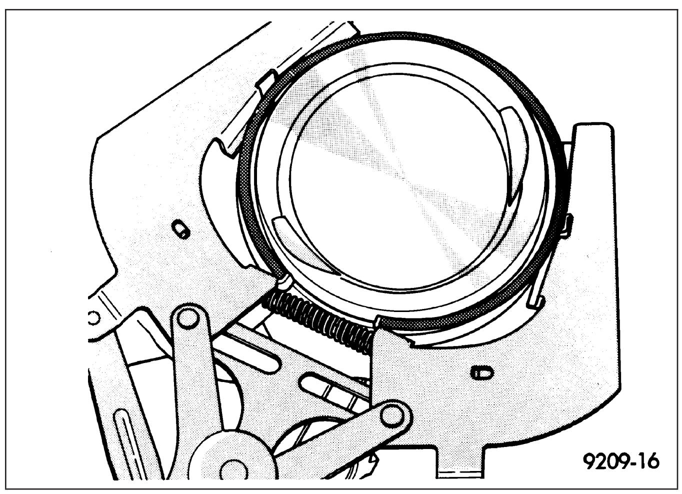
## PISTON PIN - REMOVAL

1. Secure connecting rods (7) in a soft jawed vice.
2. Remove 2 snap rings (8) securing piston pin (1).
3. Push piston pin (1) out of piston (2) and connecting rod (7).




## PISTON RING - REMOVAL

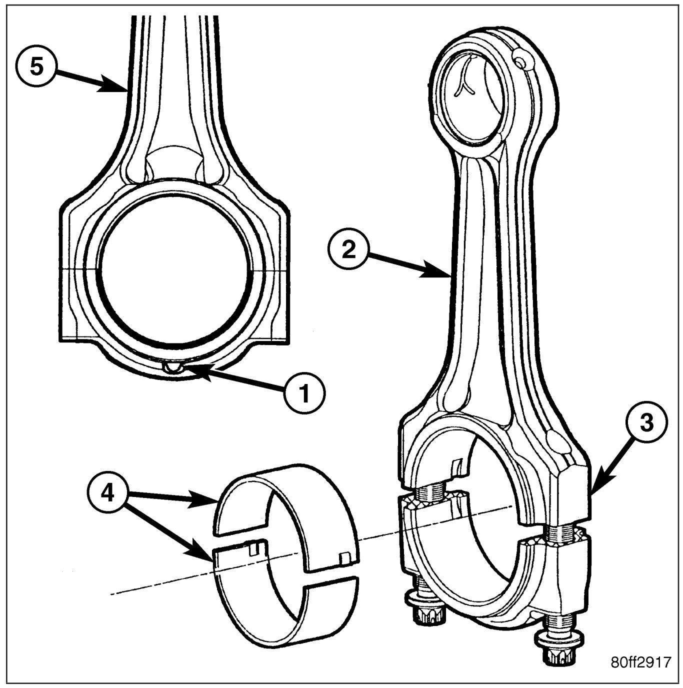
1. ID mark on face of top and second piston rings must point toward piston crown.
2. Using a suitable ring expander, remove top and second piston rings.
3. Remove upper oil ring side rail, lower oil ring side rail and then the oil expander from piston.
4. Carefully clean carbon from piston crowns, skirts and ring grooves ensuring the 4 oil holes in the oil control ring groove are clear.



## INSPECTION

### PISTONS

1. Piston Diameter: Size: 91.912-91.928mm (3.6185-3.6192 in.) Maximum wear limit .05mm (.0019 in.).
2. Check piston pin bores in piston for roundness. Make 3 checks at 120° intervals. Maximum out of roundness .05mm (.0019in.).
3. The piston diameter should be measured approximately 15 mm (.590 in.) up from the base.
4. Skirt wear should not exceed 0.1 mm (.00039 in.).
5. The clearance between the cylinder liner and piston should not exceed 0.065-0.083 mm (.0025-.0032 in.).




### CONNECTING RODS

**CAUTION: Connecting rod bolts must be replaced when disassembled. When assembling the connecting rod (2), be sure that the connecting rod pawl (1) on each of the connecting rod caps is facing the rear (fly wheel) side of the engine.**

**NOTE: Do Not lubricate the new connecting rod bolts. They are already coated with a anti scuff treatment.**

1. Assemble connecting rod bearings (4) and bearing caps to their respective connecting rods (2) ensuring that the serrations on the cap and reference marks are aligned.
2. Tighten connecting cap bolts to 10 N·m (88 in. lbs.).
3. Without loosening connecting rod bolts, tighten all bolts to 30N·m (22 ft.lbs.).
4. Using a torque angle gauge, tighten each bolt an additional 40°.
5. Recheck all bolt tightening with a torque wrench set to 88N·m (65 ft.lbs.).
6. Check and record internal diameter of crank end of connecting rod (2).

**CAUTION: When changing connecting rods (2), DO NOT use a stamp to mark the cylinder location. Identify the connecting rods (2) and caps location using a paint marker. All four must have the same weight and the same number. Replacement connecting rods (2) will only be supplied in sets of four.**

Connecting rods (2) are supplied in sets of four since they all must be of the same weight category. Max allowable weight difference is 5 gr.

### PISTON PINS

1. Measure the diameter of piston pin in the center and both ends.For specification, (Refer to 9 - ENGINE - SPECIFICATIONS), (Refer to 9 - ENGINE - SPECIFICATIONS).

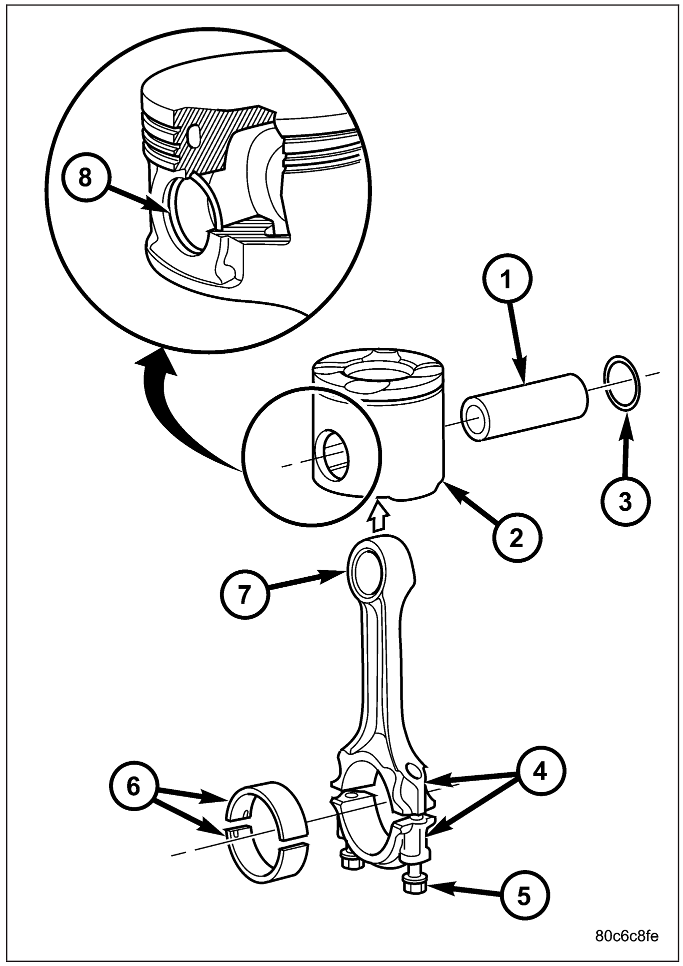
## INSTALLATION

### PISTON PIN INSTALLATION

1. Secure connecting rod (7) in soft jawed vice.
2. Lubricate piston pin (1) and piston (2) with clean engine oil.
3. Position piston (2) on connecting rod (7).

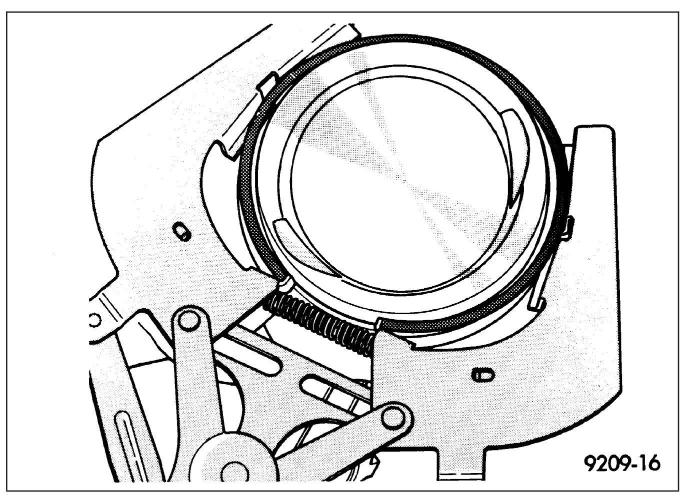
**CAUTION: Ensure arrow on piston crown and the bearing cap numbers on the connecting rod are on the opposite side.**

4. Install piston pin (1).
5. Install snap ring (3) in piston (2) to retain piston pin (1).
6. Remove connecting rod (7) from vice.

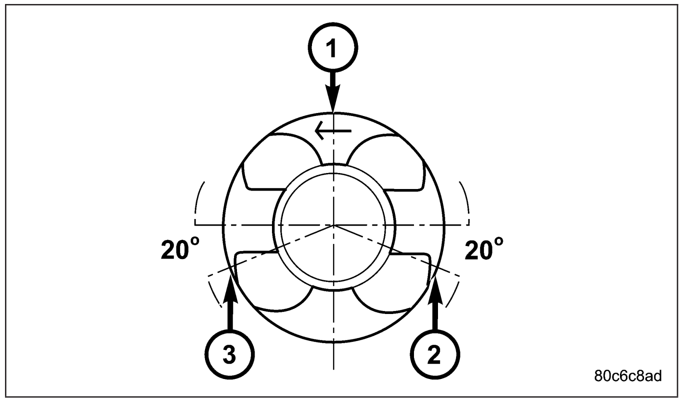



### PISTON RINGS - INSTALLATION

1. Install rings on the pistons using a suitable ring expander.



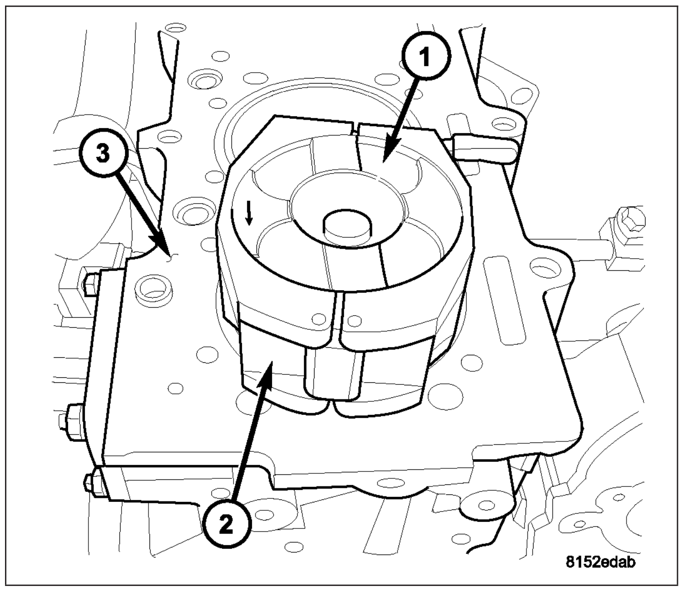
2. Top compression ring is tapered and chromium plated. The second ring is of the scraper type and must be installed with scraping edge facing bottom of the piston. The third is an oil control ring. Ring gaps must be positioned, before inserting piston into the liners, as follows.
3. Top ring gap must be positioned at the #3 position (looking at the piston crown from above).
4. Second piston ring gap should be positioned at the #1 position.
5. Oil control ring gap should be positioned at the #2 position.




6. When assembling pistons check that components are installed in the same position as before disassembly, determined by the numbers stamped on the crown of individual pistons. Engine cylinders are numbered starting from gear train end of the engine. **Face arrow on top of piston toward front of engine**. Therefore, the numbers stamped on connecting rod big end should face toward the injection pump side of engine. To insert piston into cylinder use a ring compressor as shown in.

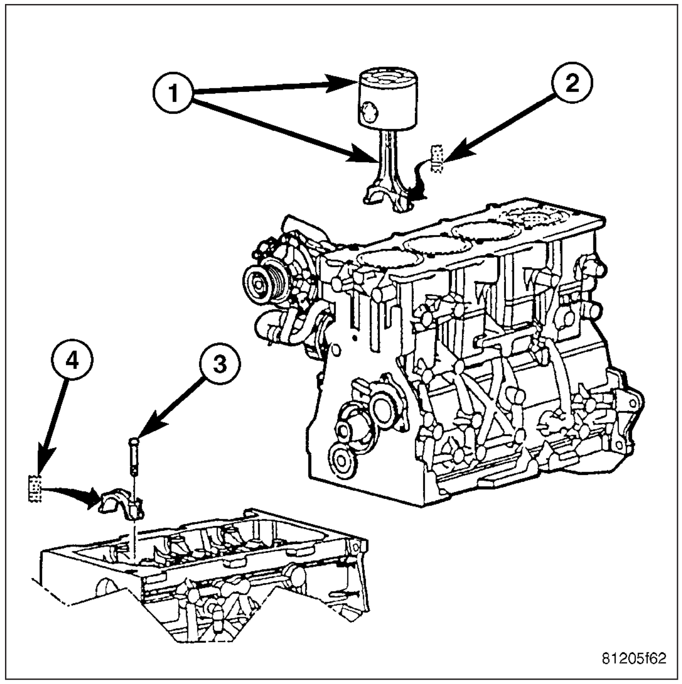
## INSTALLATION

1. Before installing pistons, and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.
2. Before installing the ring compressor, make sure the oil ring expander ends are butted together.
3. Immerse the piston head and rings in clean engine oil, slide the piston ring compressor, over the piston and tighten. **Ensure position of rings does not change during this operation**.
4. Face arrow on piston towards front of engine.



**CAUTION: Care must be taken not to nick crankshaft journal when installing pistons.**

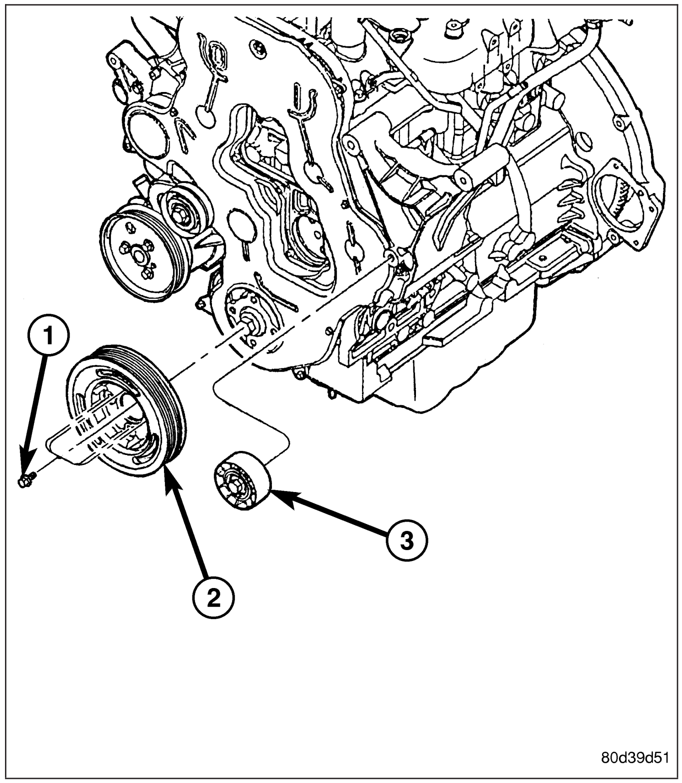
5. Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.
6. Guide the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.
7. Install connecting rod caps. Install rod bolts and torque to 10N·m (88 lbs. in.). Torque bolts the next stage to 30N·m (22 ft.lb.) plus 60°. Then with a torque wrench set at torque to 88N·m (65 ft.lb), make a tightening check.
8. Install cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
9. Install balance shaft assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - INSTALLATION).
10. Install oil pump pickup tube (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).
11. Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
12. Connect negative battery cable.



# DAMPER-VIBRATION

## REMOVAL

1. Disconnect negative battery cable.
2. Remove viscous cooling fan and shrowd (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
3. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Remove vibration damper retaining bolts (1) and damper (2(.



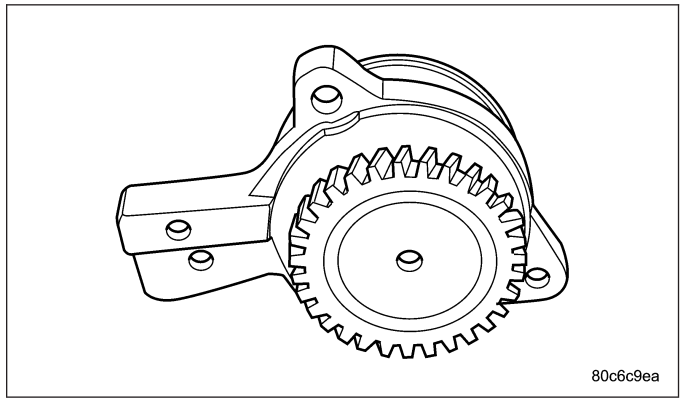

## INSTALLATION

1. Install vibration damper and retaining bolts. Torque bolts to 32.4N·m. (24 ft.lbs.).
2. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
3. Install viscous fan and fan shrowd (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
4. Connect negative battery cable.

# PUMP-INTERNAL VACUUM

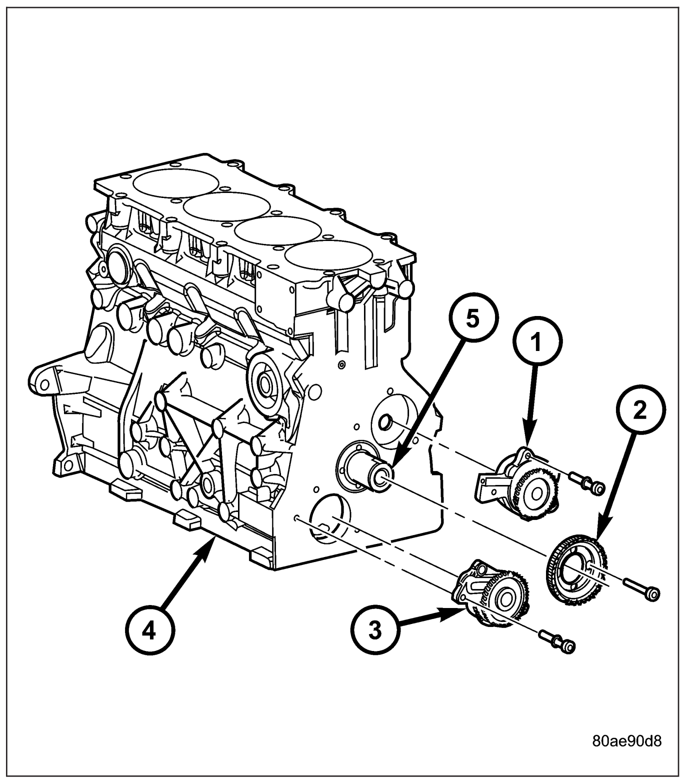
## DESCRIPTION

The diesel engine uses a internal vacuum pump. This vacuum pump is mounted in the front of the engine block under the engine front cover. The vacuum pump is driven by a sprocket on the crankshaft.




## REMOVAL

1. Disconnect negative battery cable.
2. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
3. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
5. Remove vibration damper/crankshaft pulley (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
6. Rotate the engine to 90 degrees ATDC and install alignment pin VM.1089 (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).
7. Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).




**CAUTION: Before removing the cylinder head cover/intake manifold or timing belt the engine must rotated to the 90° ATDC and special tool VM.1089 alignment pin installed. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)**

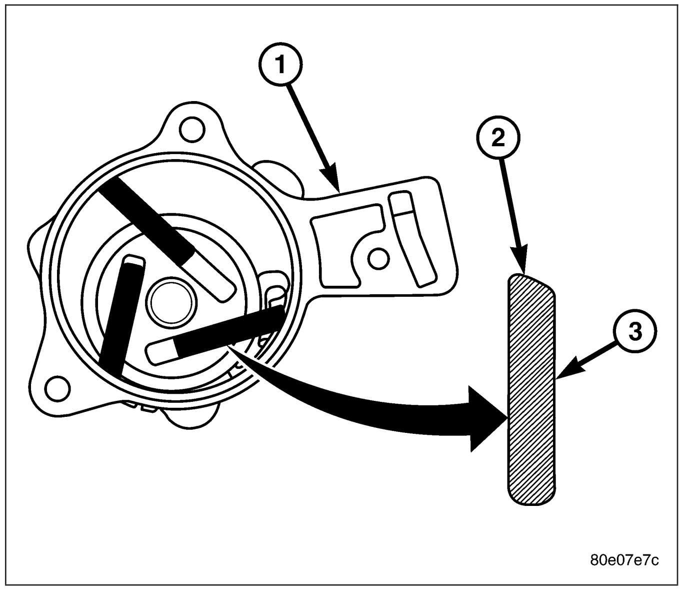
8. Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
9. Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

**NOTE: Crankshaft hub has LHD thread.**

10. Remove crankshaft hub.
11. Remove front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL).
12. Remove crankshaft sprocket.
13. Remove vacuum pump.

## INSTALLATION

**NOTE: Verify the 3 blades on the vacuum pump are in place and correctly assembled. The tapered edge should be on the outer side. Make sure the pump rotates before installation.**




1. Lubricate vacuum pump components and install in engine block. Torque bolts to 10.8N·m.
2. Install crankshaft sprocket. Torque bolts to 10.8N·m.
3. Install front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION).
4. Install front crankshaft hub. Torque bolt to 304N·m.
5. Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
6. Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
7. Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
8. Remove special tool VM.1080 from the engine block 90 degree ATDC alignment hole.
9. Install vibration damper/crankshaft pulley (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
10. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
11. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
12. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
13. Connect negative battery cable.

# COVER-ENGINE - FRONT

## DESCRIPTION

The front engine cover on this engine is a stamped steel cover which covers the oil pump and vacuum pump.

## REMOVAL

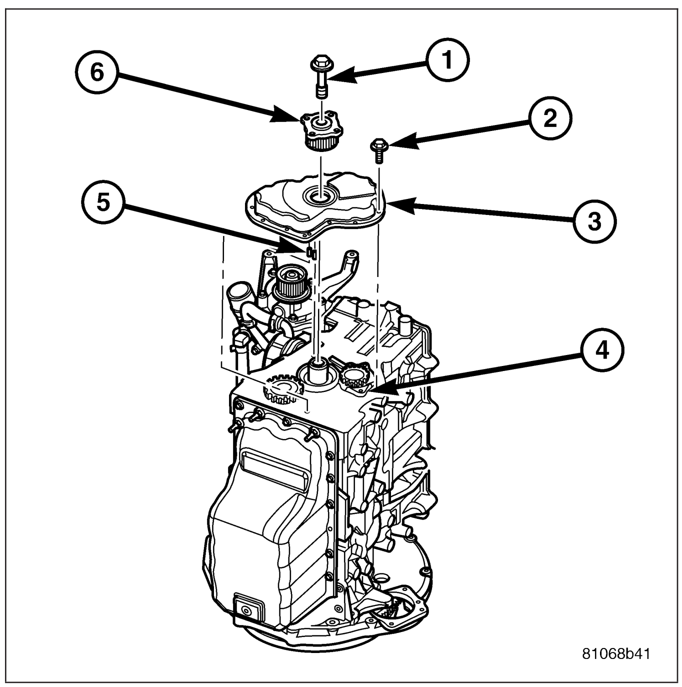
1. Disconnect negative battery cable.
2. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
3. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
5. Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
6. Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

**CAUTION: Before removing the cylinder head cover/intake manifold or timing belt the engine must aligned at 90° ATDC and special tool VM.1089 installed. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)**

7. Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
8. Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

**NOTE: Crankshaft hub has left hand thread.**

9. Remove crankshaft hub.
10. Remove front engine cover.




## INSTALLATION

1. Clean engine block and front engine cover sealing surfaces.
2. Apply a continous 3mm bead of Silicone Sealer to cover, install within 10 minutes. Torque bolts to 11.8N·m..
3. Install crankshaft hub. Torque bolt to 304N·m.

4. Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
5. Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
6. Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)
7. Remove 90 degree ATDC alignment pin VM.1080.
8. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
9. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
10. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
11. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
12. Connect negative battery cable.

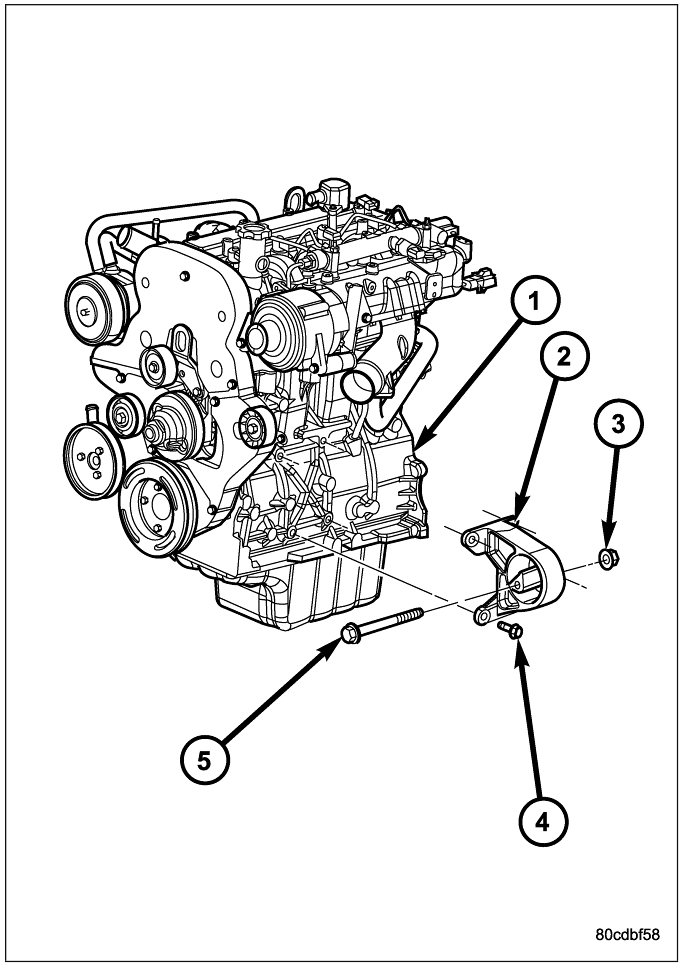
# MOUNT-LEFT ENGINE

## REMOVAL

1. Disconnect the negative battery cable.
2. Remove the cooling fan and fan shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
3. Raise and support the vehicle.
4. Loosen both engine mount through bolts.

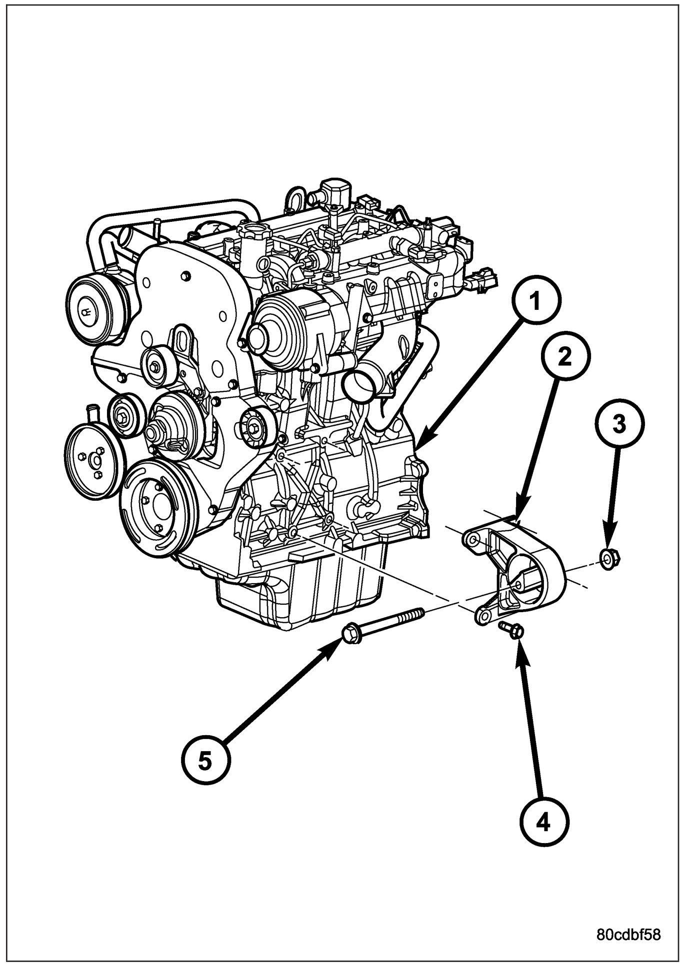
**NOTE: Care must be taken not to damage any wiring above the transmission when raising the engine.**

5. Using a suitable jack, raise and support the engine.
6. Remove the engine mount retaining bolts and remove the mount.



## INSTALLATION

1. Position the engine mount and hand tighten the retaining bolts.
2. Lower the engine mount and through bolts into the engine mount support.
3. Lower the vehicle.
4. Install the left upper engine mount bolt.Tighten bolt to 54 N·m (40 lbs. ft.).
5. Raise and support the vehicle.
6. Tighten remaining mount to engine bolts to 54 N·m (40 lbs. ft.).
7. Tighten engine mount through bolts to 54 N·m (40 lbs. ft.).
8. Lower the vehicle.
9. Install the cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
10. Connect the negative battery cable.



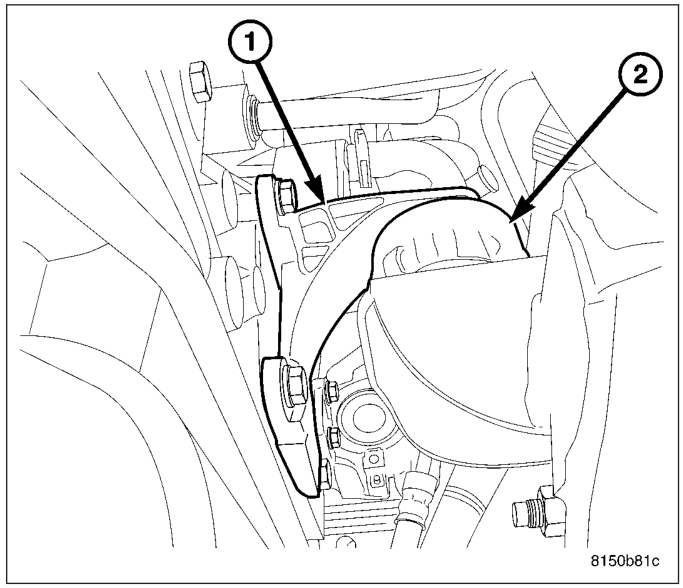
# RIGHT ENGINE MOUNT

## REMOVAL

1. Disconnect the negative battery cable.
2. Remove the cooling fan and shroud.
3. Loosen the upper engine mount fastener at the engine mount bracket.
4. Raise and support the vehicle.
5. Loosen the lower engine mount fastener.

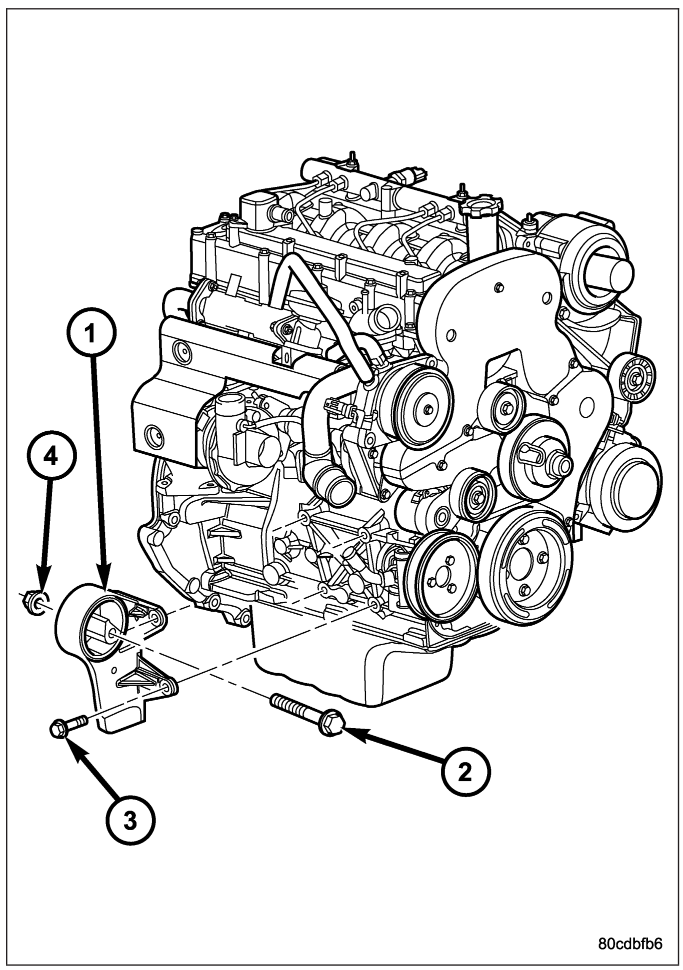
**NOTE: Care must be taken not to damage the wiring harnesses above the transmission when lifting the engine.**

6. Using a suitable jack, raise and support the engine
7. Remove the engine mount bolts and engine mount




## INSTALLATION

1. Position the engine mount and install the engine mount bolts. Tighten bolts to 54 N·m (40 lbs. ft.).
2. Lower the engine.
3. Tighten the engine mount through bolts to 54 N·m (40 lbs. ft.).
4. Lower the vehicle.
5. Install the cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
6. Connect the negative battery cable.



# OIL

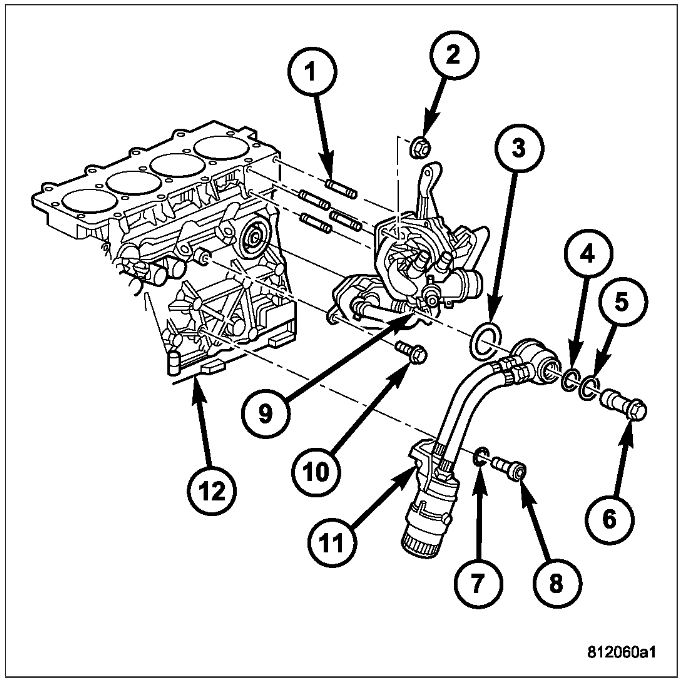
## DESCRIPTION

Refer to the Lube and Maintenance section for oil specifications (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS).

# ADAPTER-OIL FILTER

## DESCRIPTION

An oil filter adapter is used on this vehicle to relocate the oil filter for easier access when servicing .

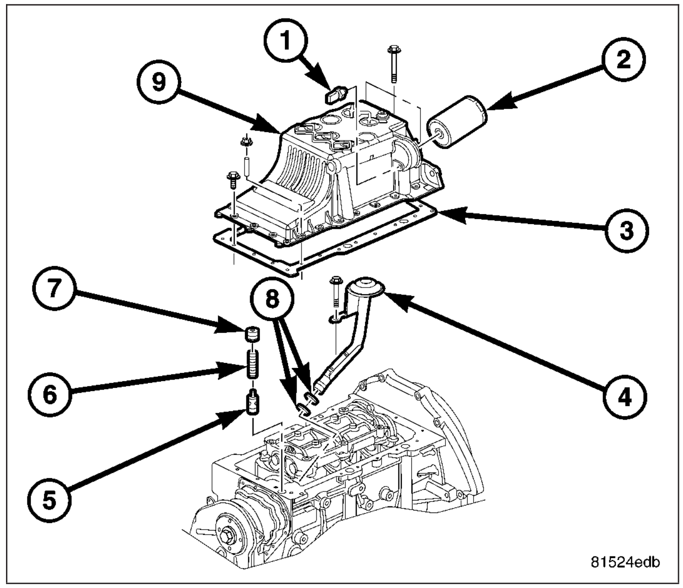


# PAN-OIL

## REMOVAL

1. Disconnect negative battery cable.
2. Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

**NOTE: When installing engine support fixture, care must be taken not to damage the hood ajar switch mounted to the right inner fender.**




3. Install engine support fixture, special tool #8534.
4. Raise vehicle on hoist.
5. Remove both front wheel and tire assemblies.
6. Remove front skid plate (if equipped).
7. Drain engine oil.
8. Disconnect the front drive shaft from the front drive axle,
9. Loosen both engine mount through bolts.
10. Lower vehicle.
11. Raise engine using support fixture, special tool #8534, until the viscous fan almost touches the fan shroud.
12. Raise vehicle on hoist.
13. Support the front cradle assembly with a suitable lifting devise.
14. Mark the front cradle to under body position to assure proper alignment during assembly.
15. Remove both inner rail cradle alignment bolts in the front wheel housing.
16. Loosen both power steering gear retaining bolts, leave the retaining nuts on the bolts.
17. Loosen power steering lines from cradle.
18. Remove both lower front strut bolts.
19. Loosen both front cradle mounting bolts.
20. Loosen both rear cradle mounting bolts.
21. Disconnect the oil sending unit harness connector.
22. Remove all oil pan retaining bolts, separate the oil level indicator tube from the pan and lower oil pan.
23. Lower front cradle using the suitable lifting devise until enough clearance is obtained to remove the oil pan.

## INSTALLATION

1. Clean oil pan and sealing surfaces. Inspect oil pan and engine block.
2. Install oil pan, gasket, oil pan retaining bolts, hand tight..
3. Push the oil pan against adaptor plate and tighten transmission to oil pan bolts first.
4. Tighten oil pan bolts to 11.8N·m (104 lbs.in.), beginning with the center bolts and then tighten the remaining bolts in a clockwise rotation. Retighten the center two bolts again after all bolts are tighten to specification.
5. Raise the front cradle using a suitable lifting devise and align the cradle with the underbody marks made during the removal procedure.
6. Torque the cradle mounting bolts to 122 N·m (90 lbs. ft.).
7. Torque the inner rail mounting bolts to 47 N·m (35 lbs. ft.).
8. Torque the steering gear mounting bolts to 162N·m (120 lbs. ft.).
9. Remove the cradle support devise and lower the vehicle.
10. Lower the engine using support fixture, special tool #8534, until the engine mount through bolts are seated in the cradle.
11. Raise the vehicle.

12. Torque engine mount through bolts to 88N·m (65 lbs. ft.).
13. Install front axle assembly (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - INSTALLATION).
14. Install front axle skid plate (if equipped) (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - INSTALLATION).
15. Install both front wheel and tire assemblies (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE) tighten to 115–155 N·m (85–115 lbs. ft.).

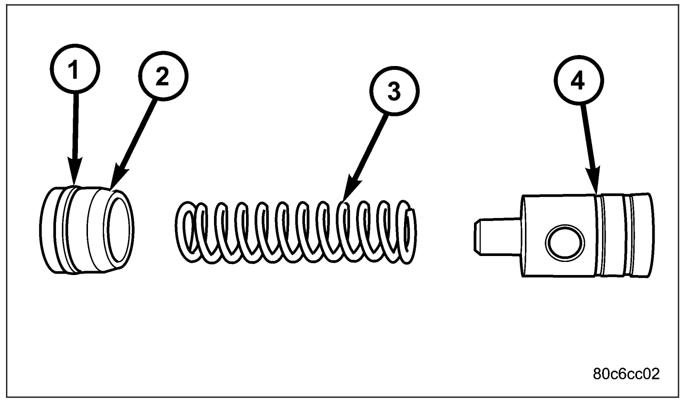
**NOTE: When removing engine support fixture, care must be taken not to damage the hood ajar switch mounted to the right inner fender well (if equipped).**

16. Lower the vehicle and remove the engine support fixture.
17. Refill engine to proper level with the correct viscosity engine oil.
18. Connect negative battery cable.
19. Start engine and inspect for leaks.
20. Install engine cover (Refer to 9 - ENGINE - INSTALLATION).
21. Perform complete front wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

# VALVE-OIL PRESSURE RELIEF

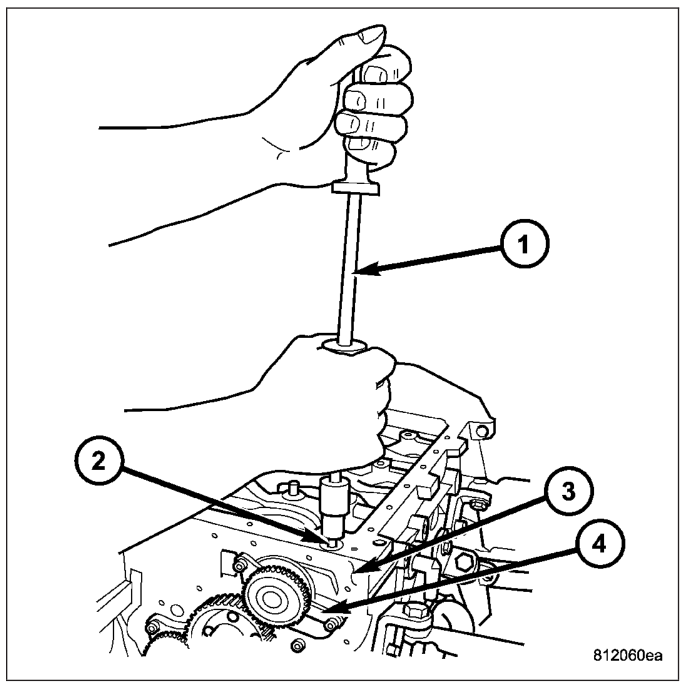
## DESCRIPTION

The oil pressure relief valve mounts in the front of the engine block and is used to control oil flow through the engines lubrication system.




## REMOVAL

1. Remove engine oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
2. Using special tool VM.1054, remove oil pressure relief valve from engine block.

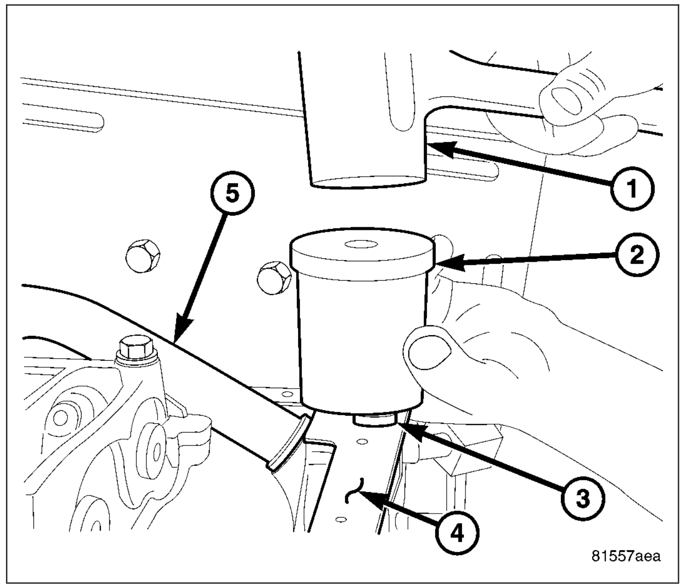


## INSTALLATION

1. Thoroughly clean all components and relief valve pocket in cylinder block.
2. Lubricate all oil pressure relief valve components with engine oil.
3. Install oil pressure relief valve plunger, spring, and cap.

**WARNING: DO NOT strike the oil pressure valve cap with a hammer**

**CAUTION: Care must be taken not to interfere with the engine front cover or the oil pick up tube when seating the oil relief valve cap. Failure to install the valve cap flush with the engine block surface correctly will result in low oil pressure and possible engine damage.**




4. Using a driver with a flat surface, carefully tap the oil pressure relief valve cap into place until the cap seats flush with engine block.
5. Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

# UNIT-OIL PRESSURE SENDING

## DESCRIPTION

The oil pressure switch is located on the right side of the engine block. The switch screws into the engines main oil gallery.

## OPERATION

The oil pressure sending unit uses three circuits. They are:

- A signal circuit to the ECM.
- A sensor ground circuit through the ECM.
- A 5 volt reference circuit from the ECM.

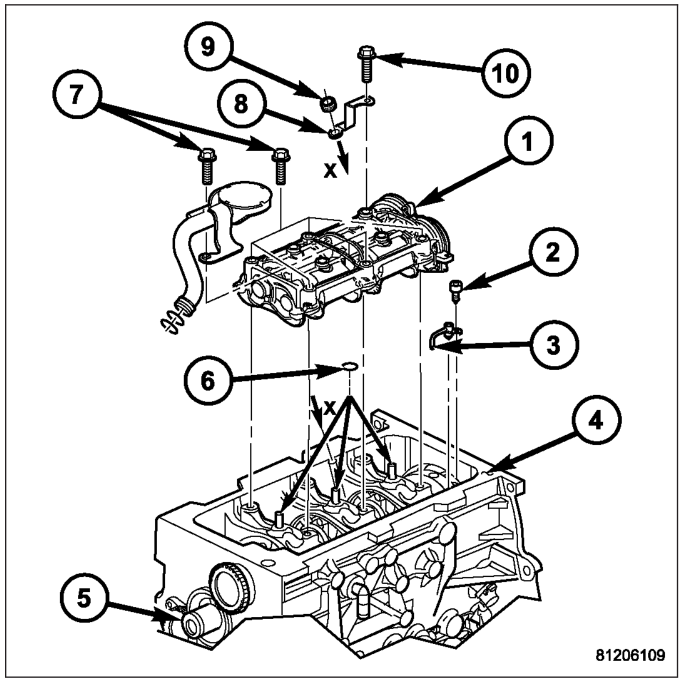
The oil pressure sending unit returns a voltage signal back to the ECM relating oil pressure. Ground for the sensor is supplied by the ECM.

# PUMP-OIL

## REMOVAL

## REMOVAL - OIL PUMP PICKUP TUBE

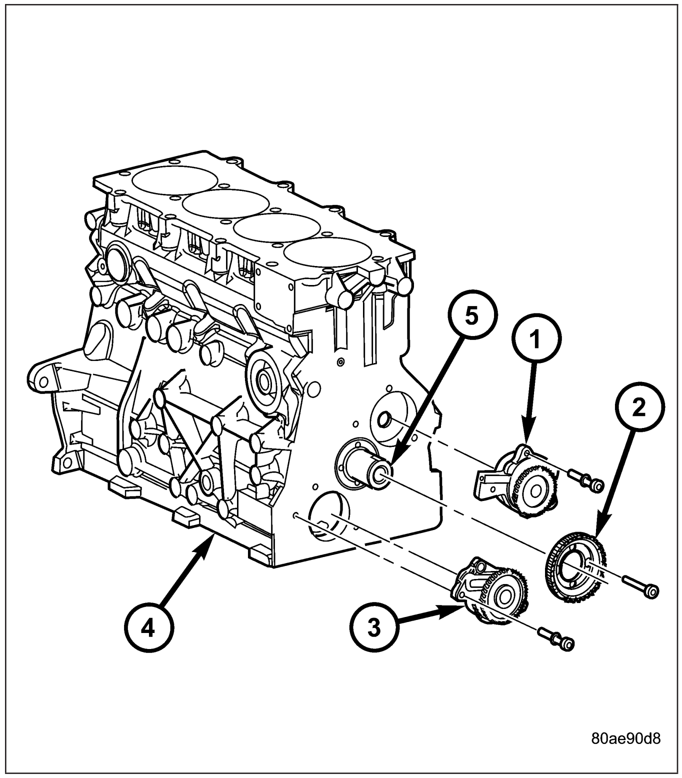
1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
4. Remove oil pump pickup tube retaining bolt and pull pickup tube from engine block. Discard O-rings.




## REMOVAL - OIL PUMP

1. Disconnect negative battery cable.
2. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
3. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
5. Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
6. Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
7. Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
8. Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
9. Remove front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL).

10. Remove crankshaft sprocket.
11. Remove oil pump retaining bolts and remove pump from engine block.



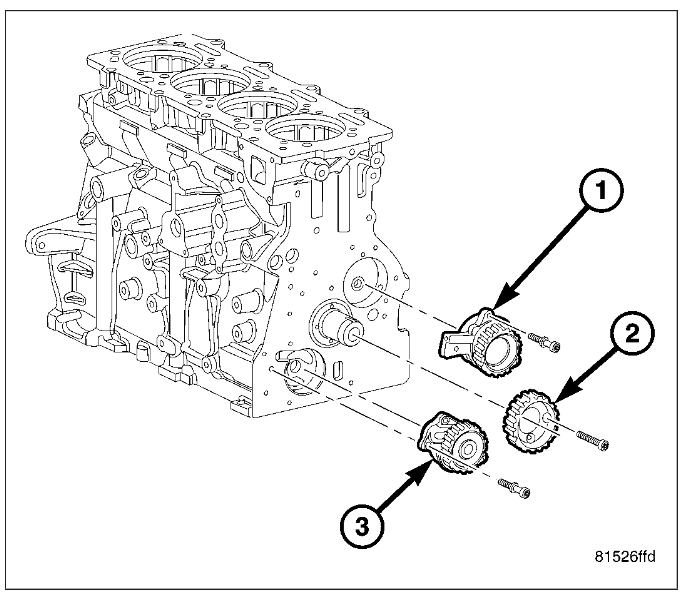

## INSTALLATION

## INSTALLATION - OIL PUMP PICKUP TUBE

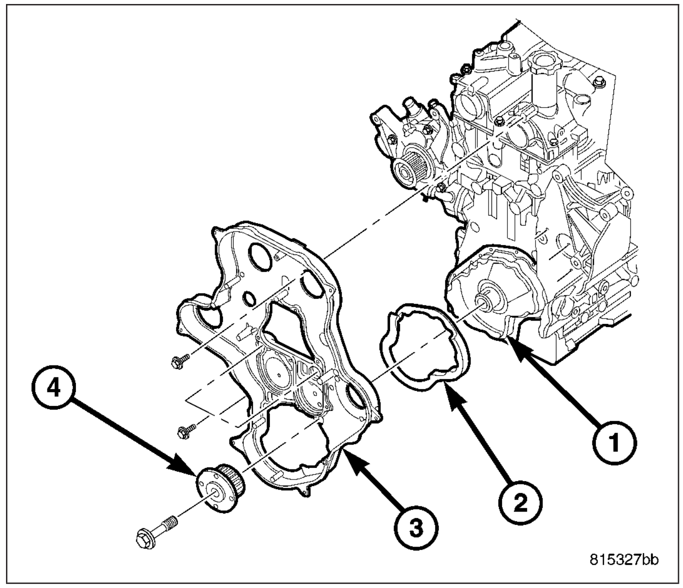
1. Lubricate o-ring on oil pump pickup tube with engine oil.
2. Install pickup tube in engine block and install retaining bolt. Torque bolt to 32.4N·m. (24 ft.lbs.)..
3. Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
4. Refill engine oil to proper level.
5. Connect negative battery cable.

## INSTALLATION - OIL PUMP

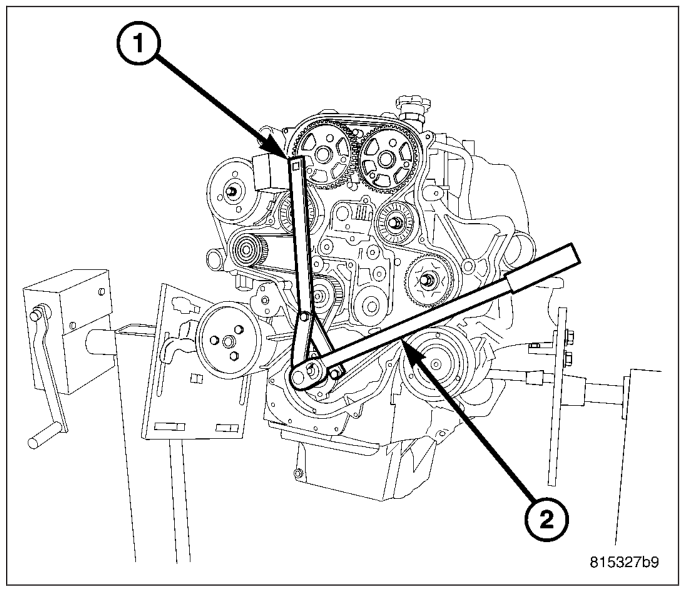
1. Lubricate oil pump rotor with engine oil.
2. Install oil pump in bore in engine block.
3. Install oil pump retaining bolts. Torque bolts to 10.8N·m. (96 in. lbs.).
4. Install crankshaft sprocket. Torque bolts to 10.8N·m. (96 in. lbs.).



5. Install front engine cover and seal (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION).
6. Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
7. Install the lower timing belt gear and hand tighten fastener.




8. Connect special tool #6958 to the lower timing gear using the vibration damper bolts and tighten the timing gear fastener to 275N·m (203 ft. lbs).
9. Remove special tool #6958.
10. Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
11. Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
12. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
13. Install power steering pump pulley.
14. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
15. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

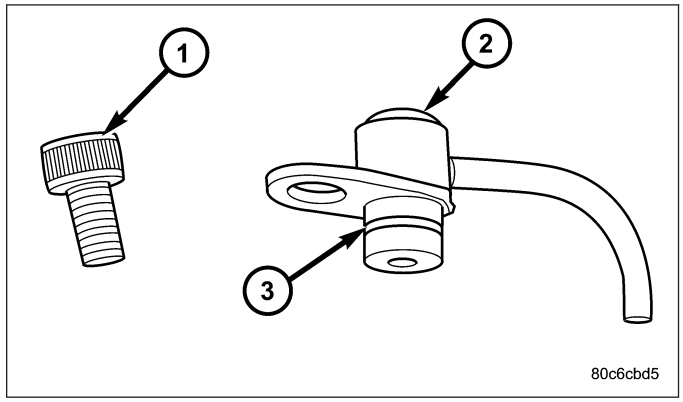



16. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
17. Remove the crankshaft and camshaft alignment pins.
18. Connect negative battery cable.

# JET-OIL

## DESCRIPTION

There are four oil jets installed in the engine block. These oil jets are used to cool and lubricate the piston assemblies.




## REMOVAL

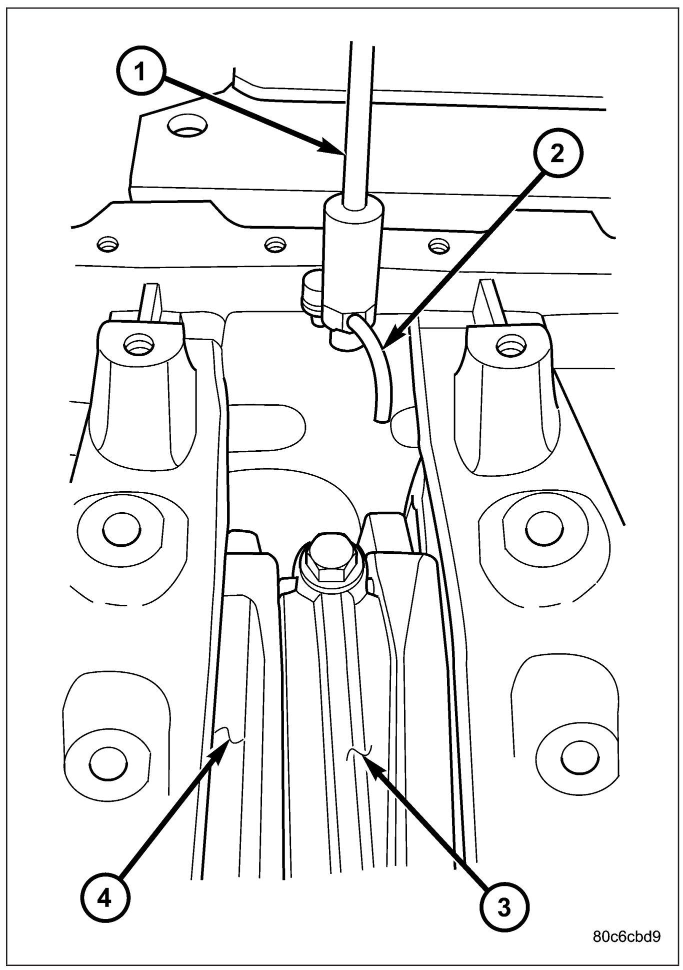
**CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage. Care must be taken not to damage the crankshaft tone ring when removing cylinder number four oil jet.**

**NOTE: Remove oil jets before removing piston, crankshaft liners.**

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

**NOTE: When removing oil jet from cylinder number four, care must be taken not to damage the crankshaft tone ring.**

4. Using special tool VM.1060 to hold oil jet. Remove oil jet retaining bolt and remove oil jet from engine block.

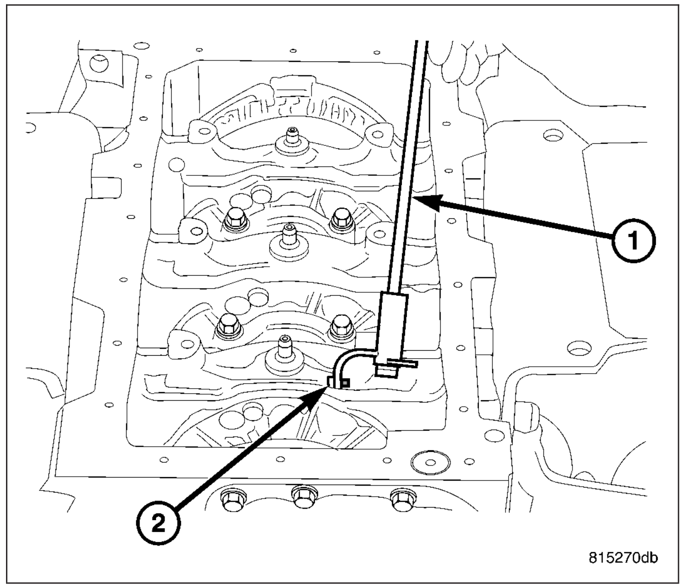


## INSTALLATION

**CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage. Care must be taken not to damage the crankshaft tone ring when installing cylinder number four oil jet.**

**NOTE: Carefully install the oil jets After assembling the engine liners, crankshaft and pistons.**

1. Lubricate o-ring on oil jet.
2. Using special tool VM.1060, install oil jet in engine block
3. Install oil jet retaining bolt. Torque bolt to 10.8N·m.(96 in.lbs.).
4. Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
5. Refill engine oil to proper level.
6. Connect negative battery cable.



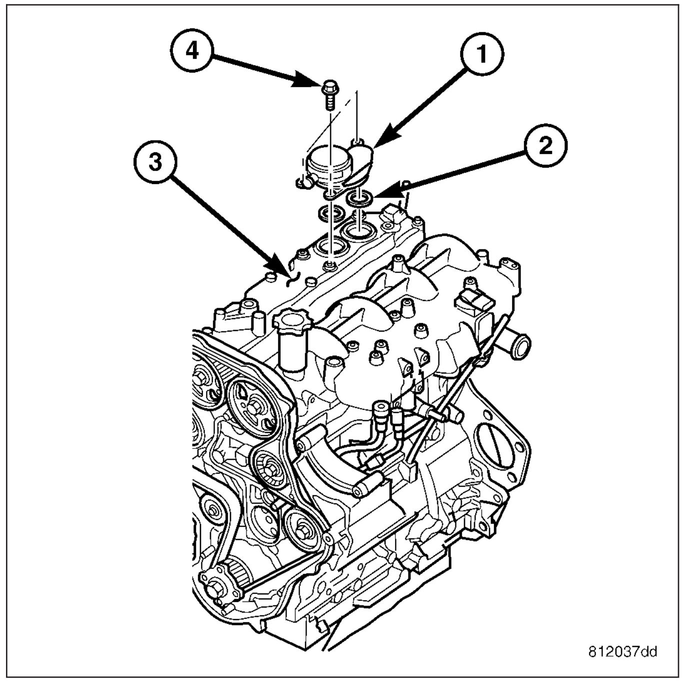
# SEPARATOR-OIL

## REMOVAL

1. Remove the engine cover.

**NOTE: Inspect the oil drain back access hole in the intake manifold/cylinder head cover to assure that it is free of obstruction.**

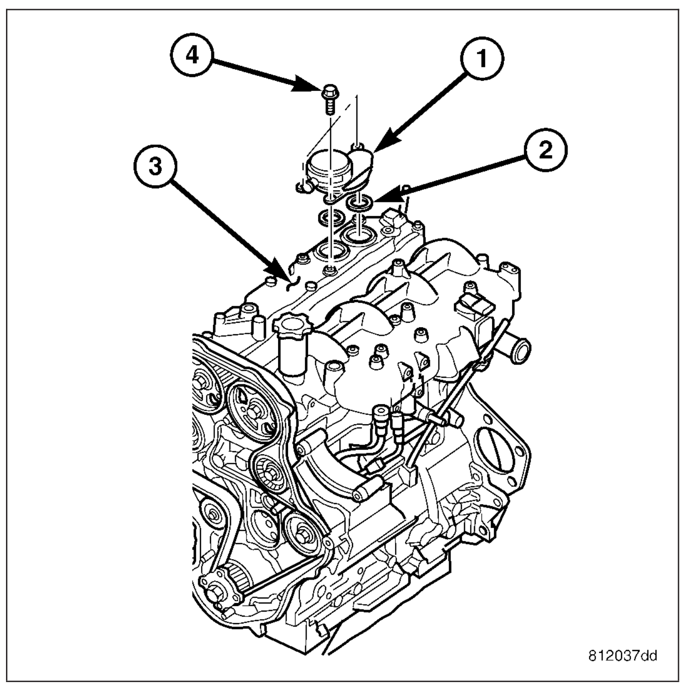
2. Remove the oil separator fasteners and oil separator.




## INSTALLATION

**NOTE: Inspect the oil drain back access hole in the intake manifold/cylinder head cover to assure that it is free of obstruction.**

1. Lubricate the oil separator o-rings with clean engine oil.
2. Carefully position and push down on the oil separator to seat.
3. Install the oil separator retaining fasteners. Tighten fasteners to 10.8 N·m (96 lbs. in.).



# MANIFOLD-INTAKE

## DESCRIPTION

(Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - DESCRIPTION)

## REMOVAL

1. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

## INSTALLATION

1. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION)

# MANIFOLD-EXHAUST

## REMOVAL

1. (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - REMOVAL)

## INSTALLATION

1. (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - INSTALLATION)

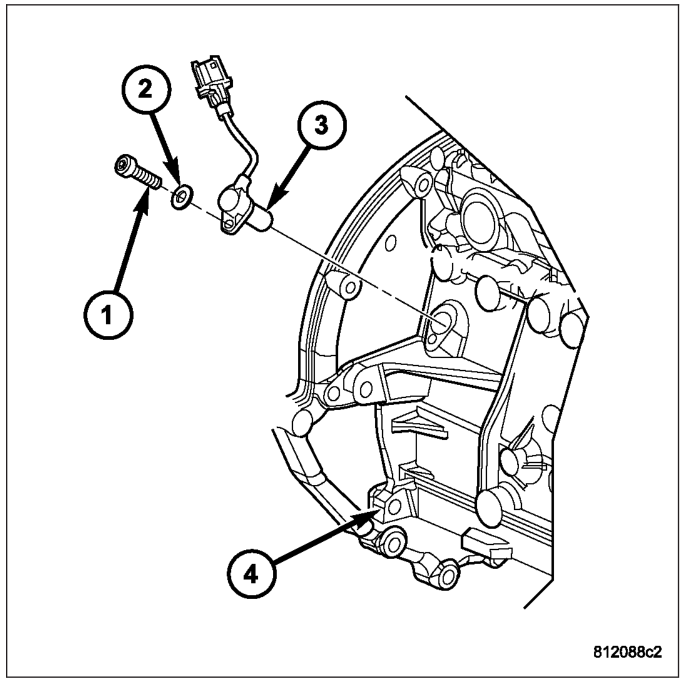
# TIMING-VALVE

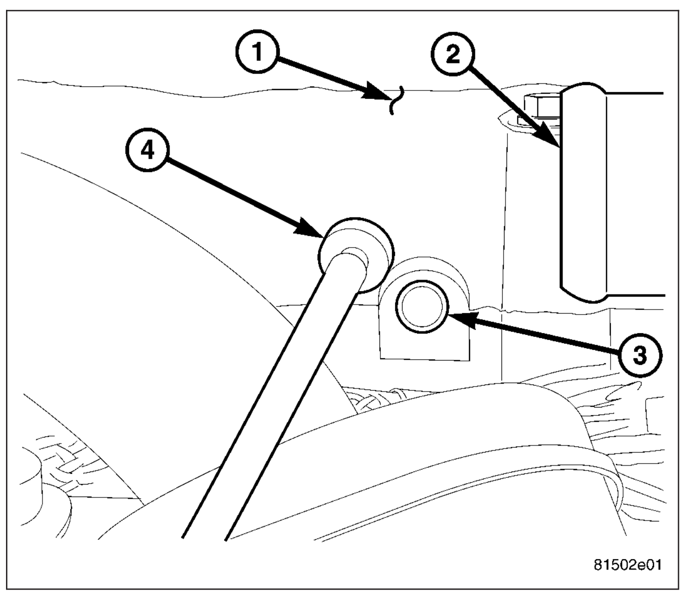
## STANDARD PROCEDURE - LOCKING ENGINE 90 DEGREES AFTER TDC

1. Disconnect negative battery cable.

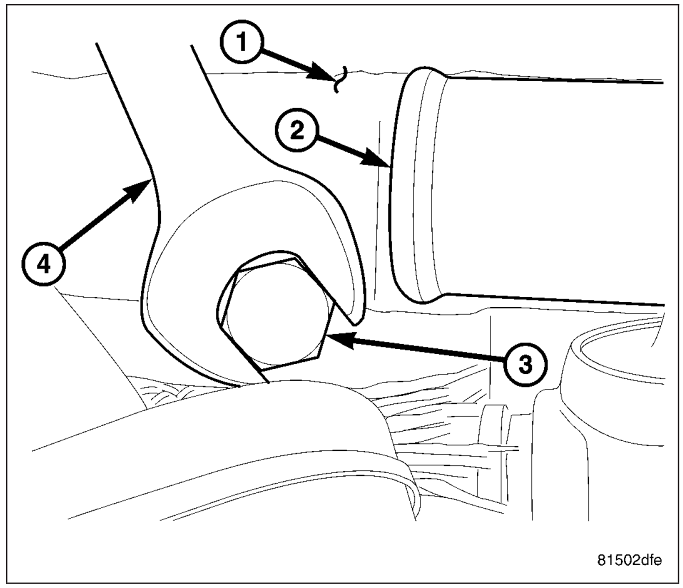
**NOTE: Rotate the engine by the front crankshaft bolt until the line next to the bolt in the front crankshaft hub reaches 12 oclock. Rotate the engine another 1/4 turn to the right, or the three oclock position. This will assist approximating the location of 90 degrees ATDC.**

2. Rotate engine by hand until special tool VM 1080 can be install through the engine access hole, locking the flex plate and preventing crankshaft movement. This locks the engine at 90° after TDC.
3. Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).
4. Remove EGR valve and EGR cooler to exhaust manifold retaining nuts.
5. Reposition EGR valve assembly out of way.
6. Remove plug in cylinder head cover/intake manifold.

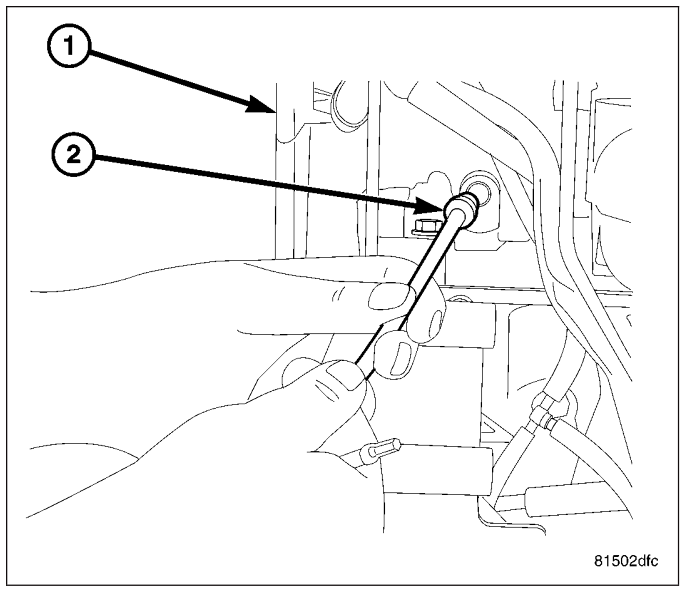


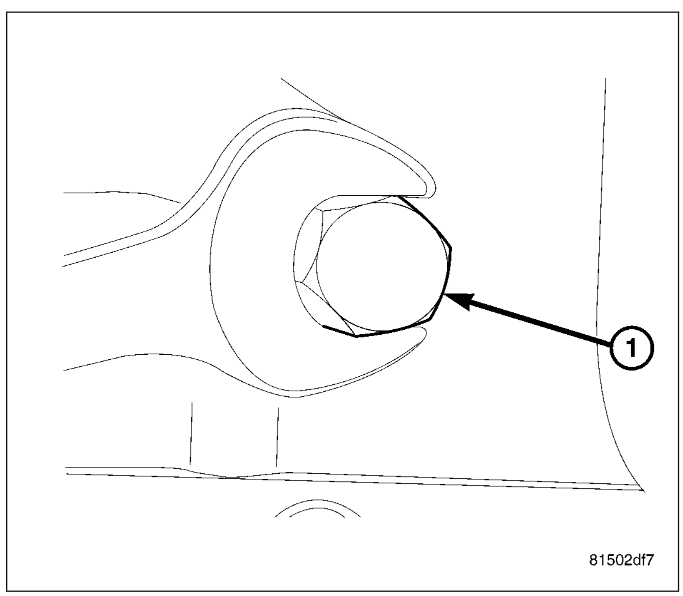



7. Insert VM.1053 to lock exhaust camshaft in position.
8. Remove generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).
9. Remove plug in cylinder head cover/intake manifold.
10. Insert VM.1052 to lock intake camshaft in position.




11. At this point the timing belt can be removed for service.
12. After engine service is completed and timing belt reinstalled, remove both camshaft locking pins from cylinder head cover/intake manifold.
13. Install both camshaft access plugs.
14. Remove 90° after TDC engine locking pin.
15. Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).
16. Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).
17. Connect negative battery cable.

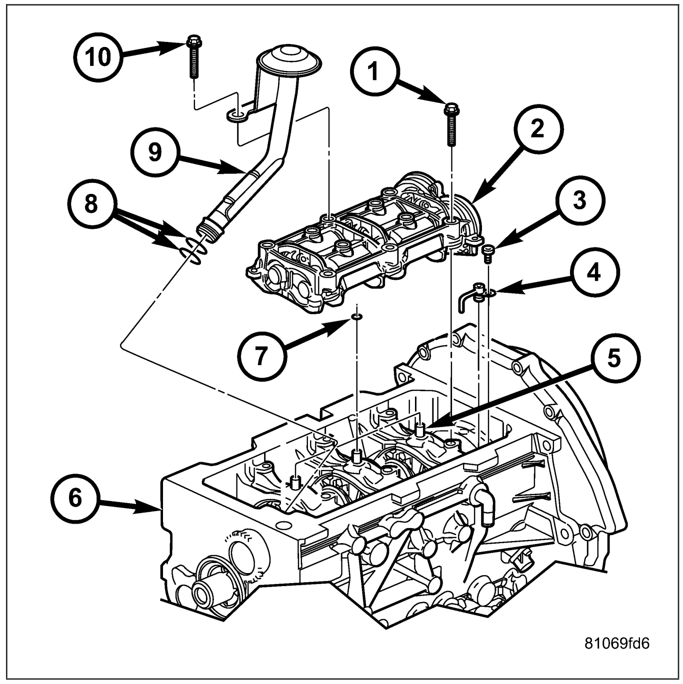


# SHAFT-BALANCE

## DESCRIPTION

The 2.8L Common Rail Diesel engine is equipped with two gear driven nodular cast iron balance shafts in a cast aluminum carrier. The balance shaft assembly is gear driven by the crankshaft and used to counteract engine vibration..

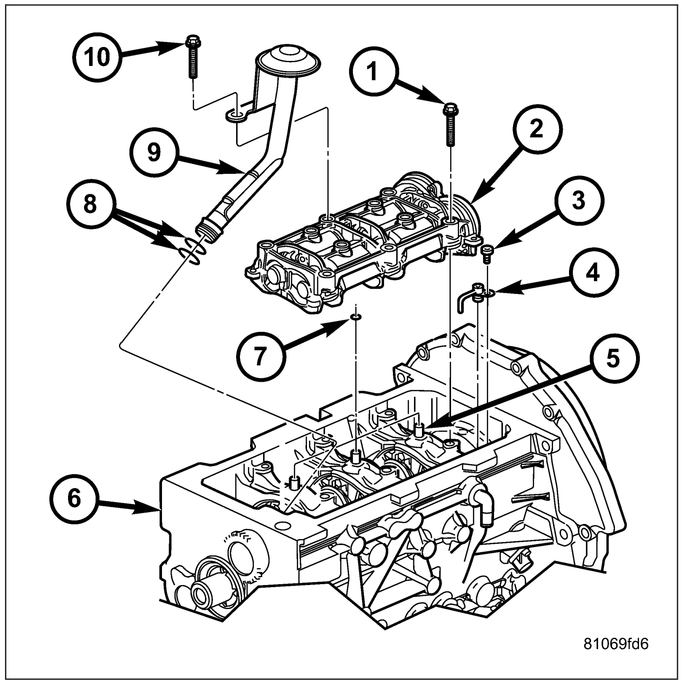



## OPERATION

The balance shaft assembly includes four balancers on two shafts. The balance shafts are connected by helical gears, and the assembly is timed with the engine. The dual-counter rotating shafts rotate at twice the engine speed and decrease second order vertical shaking forces caused by component movement. Balance shaft oiling is provided through oil passages in the crankshaft carriers.

## REMOVAL

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
4. Remove oil pump pickup tube (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).
5. Remove balance shaft assembly and discard O-rings on the central carrier pins.




## INSTALLATION

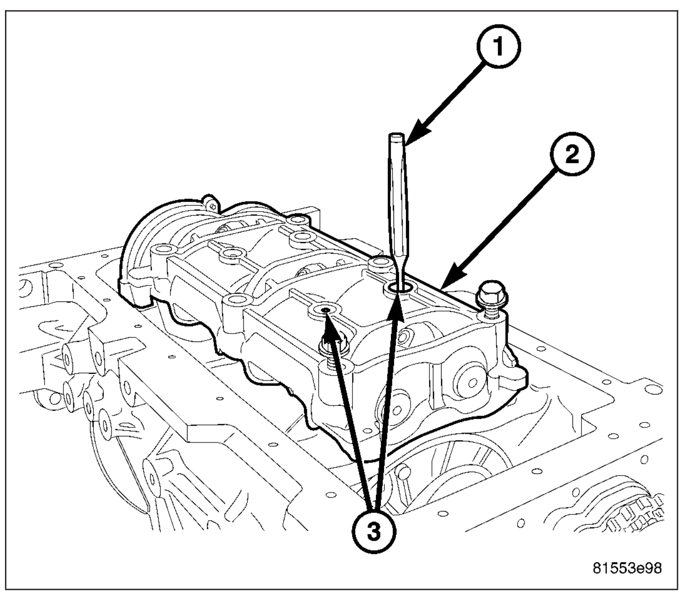
**CAUTION: Install new O-rings on the carrier pins and oil pick up tube before assembly.**

**NOTE: Before installation of the balance shaft assembly, the # 1 cylinder must be brought to TDC, or the 12 O'clock position. There is a line on the front of the crankshaft hub, next to the front crankshaft bolt, that may assist the alignment.**

1. Remove the vibration damper and roll engine over by hand until the witness line on the front of the crankshaft hub is at the 12 O'clock, or TDC position. Once the # 1 cylinder is brought to TDC, the balance shaft assembly can be installed.

**CAUTION: CARE MUST BE TAKEN DURING THE INSTALLATION OF THE DRIFT OR PUNCH. THE BACK SIDE OF THE COUNTER WEIGHTS ON THE BALANCE SHAFTS MUST BE IN THE UP POSITION BEFORE INSERTING THE TOOL INTO THE HOUSING.**

2. With balance shaft assembly on work bench. Insert a drift of a punch into balance shaft assembly alignment hole. This will ensure proper balance shaft to crankshaft timing after assembly.
3. Install the new crankshaft carrier pin O-rings, balance shaft assembly and retaining bolts. Torque bolts to 32.4N·m (24 ft. lbs.).




4. Install oil pump pickup tube with new seals (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).
5. Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

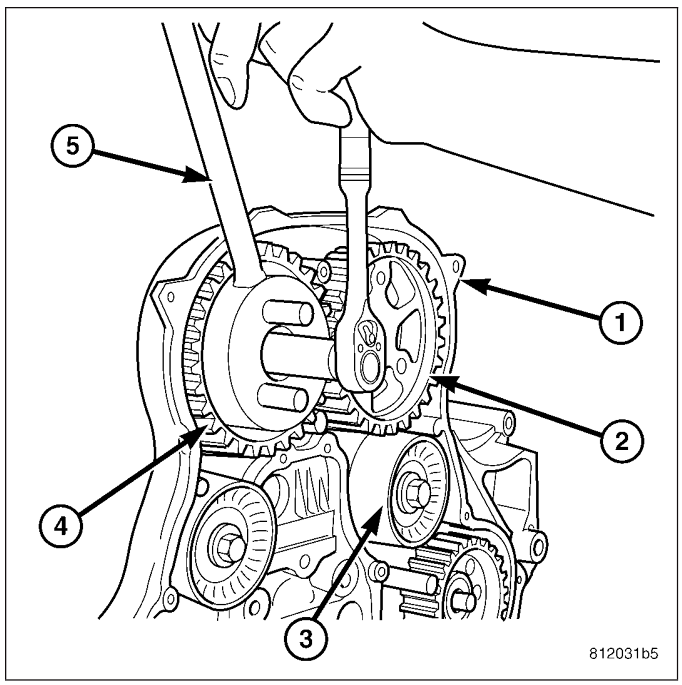
6. Refill engine oil to proper level.
7. Connect negative battery cable.

# COVER(S)-TIMING BELT AND CHAIN

## REMOVAL

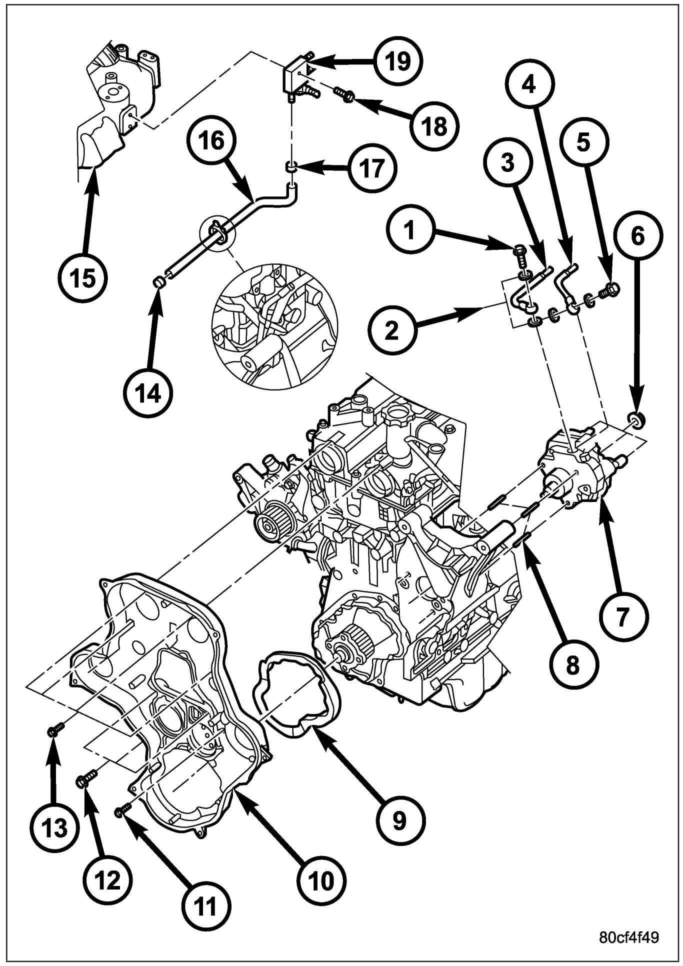
## REMOVAL - TIMING BELT INNER COVER

1. Disconnect negative battery cable.
2. Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).
3. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
4. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
5. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
6. Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
7. Rotate the engine to 90 degrees ATDC (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).
8. Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
9. Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
10. Remove timing belt idler pulleys (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT IDLER PULLEY - REMOVAL).
11. Using special tool VM.1055, remove camshaft sprockets.
12. Remove timing belt tensioner (Refer to 9 - ENGINE/VALVE TIMING/TMNG BELT/CHAIN TENSIONER&PULLEY - REMOVAL).
13. Remove injection pump sprocket (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - REMOVAL).
14. Remove timing belt inner cover retaining bolts and remove cover.



## REMOVAL - TIMING BELT OUTER COVER

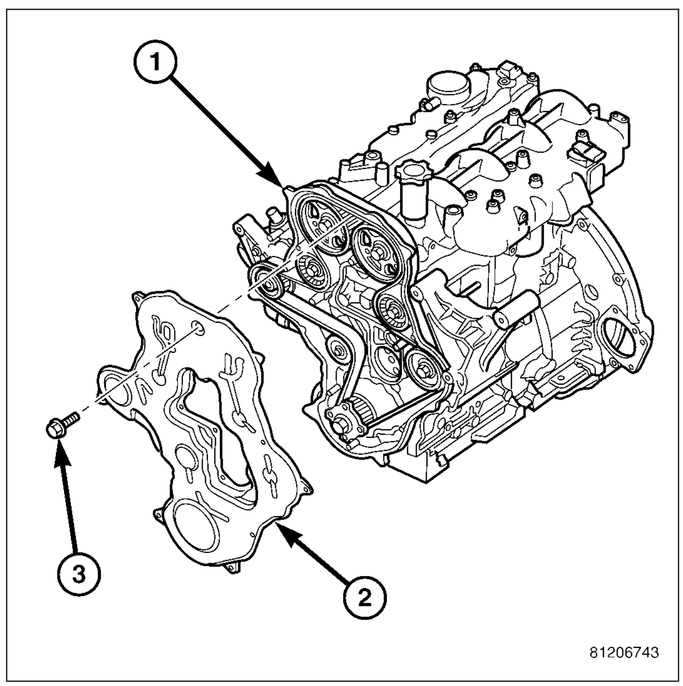
1. Disconnect negative battery cable.
2. Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).
3. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
4. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
5. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
6. Remove the power steering pump pulley.
7. Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
8. Remove timing belt outer cover retaining bolts and remove cover.




## INSTALLATION

## INSTALLATION - TIMING BELT INNER COVER

1. Install timing belt inner cover to engine front cover seal.
2. Install timing belt inner cover to cylinder head cover gaskets.
3. Install timing belt inner cover and retaining bolts. Torque 10mm bolts to 47.1N·m and 8mm bolts to 10.8N·m.
4. Install injection pump sprocket (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - INSTALLATION).
5. Install camshaft sprockets. Torque bolts to 108N·m..
6. Install timing belt idler pulleys (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT IDLER PULLEY - INSTALLATION).




7. Install timing belt and tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
8. Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
9. Remove special tool VM.1080, 90 degree ATDC pin from the flex plate.

10. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
11. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
12. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
13. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
14. Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).
15. Connect negative battery cable.

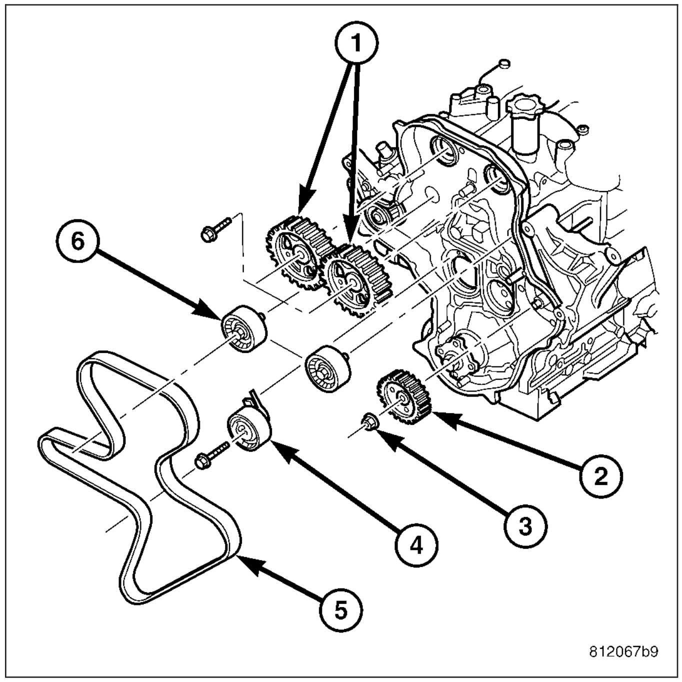
## INSTALLATION - TIMING BELT OUTER COVER

1. Install timing belt outer cover seal and cover. Torque 3mm bolts to 10.8N·m and 8mm bolts to 10.8N·m..
2. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
3. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
4. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
5. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
6. Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).
7. Connect negative battery cable.

# PULLEY-TIMING BELT IDLER

## REMOVAL

**CAUTION: Idler pulley retaining bolts are left hand thread.**




1. Disconnect negative battery cable.
2. Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).
3. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
4. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
5. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
6. Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
7. Rotate the engine to 90 degrees ATDC and install special tool VM.1089 (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).
8. Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
9. Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

**NOTE: Idler pulley retaining bolts are left hand thread.**

10. Remove timing belt idler pulleys.

## INSTALLATION

**NOTE: The idler pulley bolts are left hand thread.**

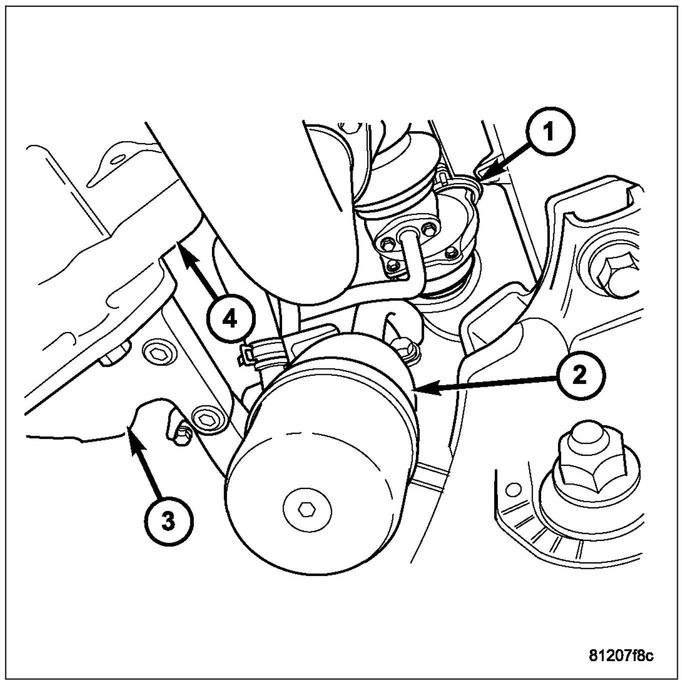
1. Install timing belt idler pulleys. Torque bolts to 47.1N·m..
2. Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
3. Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
4. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
5. Remove special tool VM.1080, 90 degree ATDC locating pin.
6. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
7. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
8. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
9. Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).
10. Connect negative battery cable.

# SPROCKET(S)-TIMING BELT AND CHAIN

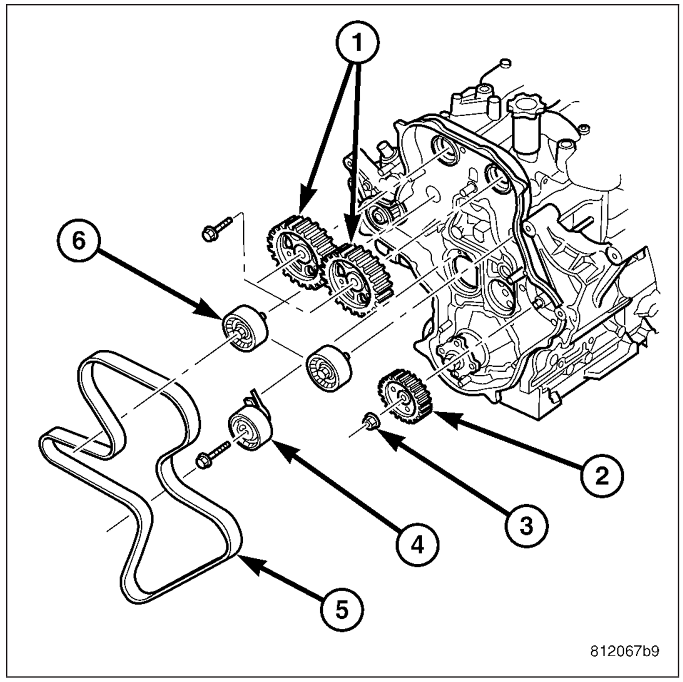
## REMOVAL

**CAUTION: BEFORE REMOVING THE TIMING BELT, THE ENGINE MUST BE PLACED AT 90° AFTER TDC. FAILURE TO DO SO MAY RESULT IN VALVE AND/OR PISTON DAMAGE DURING ASSEMBLY. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)**

1. Disconnect negative battery cable.
2. Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).
3. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
4. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
5. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
6. Bring piston #1 to TDC, turn crankshaft until notch on the crankshaft hub is at the 12 o'clock position.
7. Looking at the engine from the belt side, rotate the crankshaft 90° clockwise.
8. Install the 90° alignment pin into the crankcase threaded hole on the right side of the engine to lock the crankcase (make sure the crankshaft does not rotate).
9. Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
10. Paint mark the crankshaft hub and the oil pump cover (this will be useful during the timing check).
11. Remove the alternator.
12. Remove the intake and exhaust camshaft plugs from the camshaft cover, to introduce the camshaft timing pins VM.1052 Intake, and VM.1053 Exhaust (if the engine is timed correctly, the pins can be installed).
13. Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
14. Loosen timing belt tensioner and remove timing belt.



15. Remove the intake and exhaust camshaft alignment pins, VM.1052 Intake, and VM.1053 Exhaust.
16. Loosen camshaft gears using special tool VM 1085 to retain the gears when removing bolts.
17. Use camshaft bolt to rotate the intake camshafts until the intake alignment hole lines up with the hole on the camshaft cover. Install alignment pin VM 1052 and tighten with a wrench (repeat the operation for the exhaust camshaft alignment using alignment pin VM 1053).



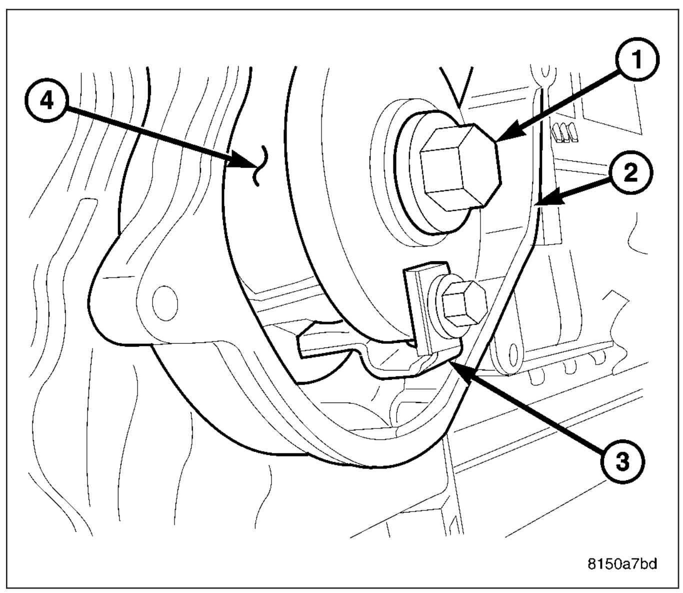

## INSTALLATION

**NOTE: There are marks on the high pressure pump gear and both camshaft gears. These ARE NOT alignment marks and should be disreguarded.**

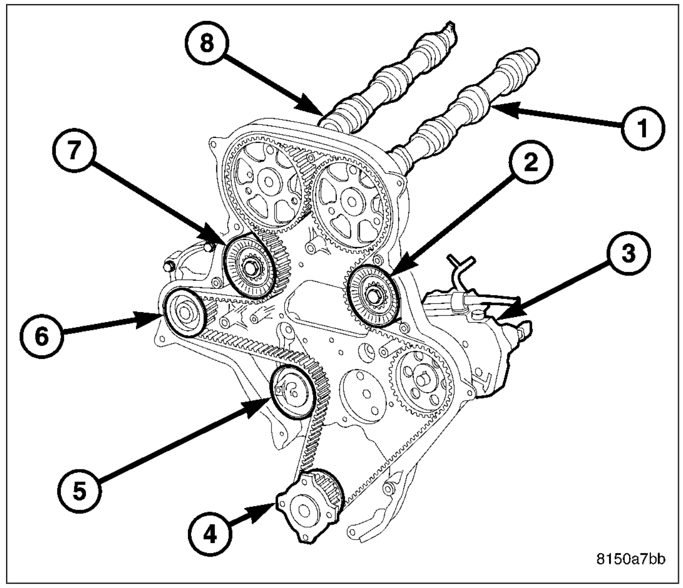
1. With both camshaft alignment pins still installed and the engine locked at 90° after TDC, verify that the camshaft gears are loose.

**NOTE: DO NOT remove the timing belt from the package until it's ready to be installed. DO NOT expose timing belt to oil, grease or water contamination. DO NOT crimp belt at a sharp angle. DO NOT clean belt, pulleys or tensioner with solvent. Check that pulleys and bearings are not seized or damage before installing belt.**

2. Install timing belt on crankshaft hub and fix it with special tool VM 1074.

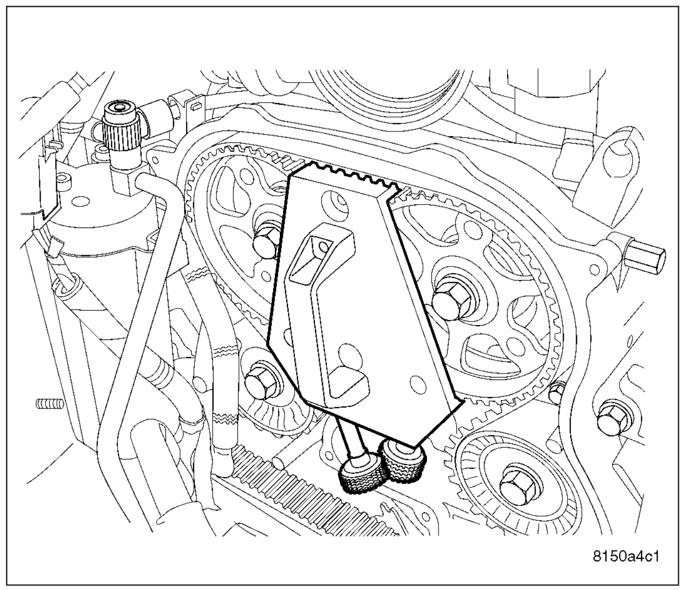


3. Route the belt around high pressure injection pump, idler pulley, intake camshaft gear, exhaust camshaft gear, idler pulley, and water pump gear.
4. Adjust the timing belt tensioner (turn it clockwise) using special tool VM.9660, lining up the center notch with the aluminum cover dowel pin. Tighten the retaining bolt to 28N·m. (Refer to 9 - ENGINE/ VALVE TIMING/TMNG BELT/CHAIN TENSIONER&PULLEY - ADJUSTMENTS).




5. Install special tool VM.1085 between camshaft gears and tighten thumb screws to engauge and retain the camshaft gears.
6. Tighten the camshaft gear bolts to 108 N·m (80 ft.lbs.) while holding the gears with special tool VM 1085.
7. Remove camshaft gear locking tool.
8. Remove intake and exhaust alignment pins.
9. Remove engine locking pin from engine block.
10. Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

**WARNING: IF CAMSHAFT COVER WAS REMOVED WAIT 30 MINUTES BEFORE ROTATING CRANK-SHAFT.**




11. Rotate the engine clockwise 2 revolutions (looking at engine from the belt side).
12. Carefully line up the crankshaft hub painted mark with the oil pump cover mark.
13. Check that the intake and exhaust camshaft alignment pins can be installed.

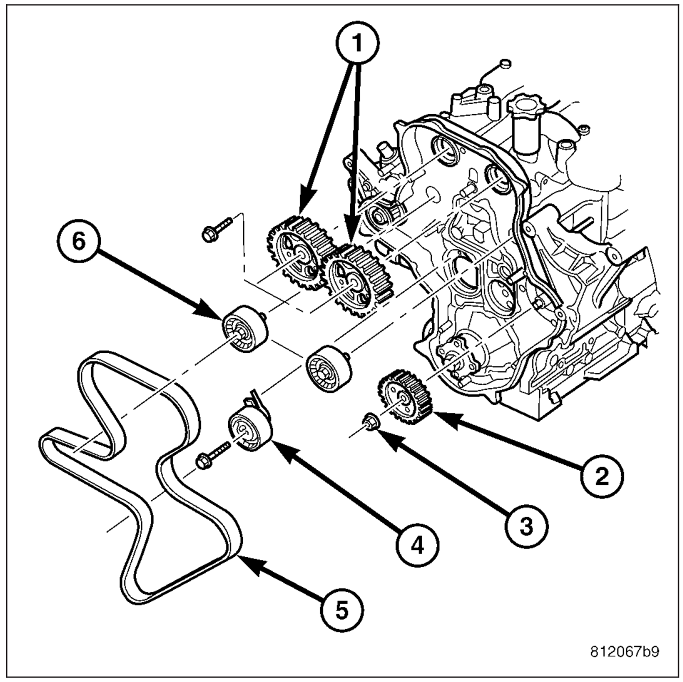
**WARNING: IF THE CAMSHAFT ALIGNMENT PINS CAN NOT BE INSTALLED AT THIS TIME, REPEAT THE PROCEDURE FROM THE BEGINNING.**

14. Install the camshaft access plugs.
15. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
16. Install the alternator.
17. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
18. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
19. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
20. Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).
21. Connect negative battery cable.

# TENSIONER AND PULLEY-TIMING BELT AND CHAIN

## REMOVAL

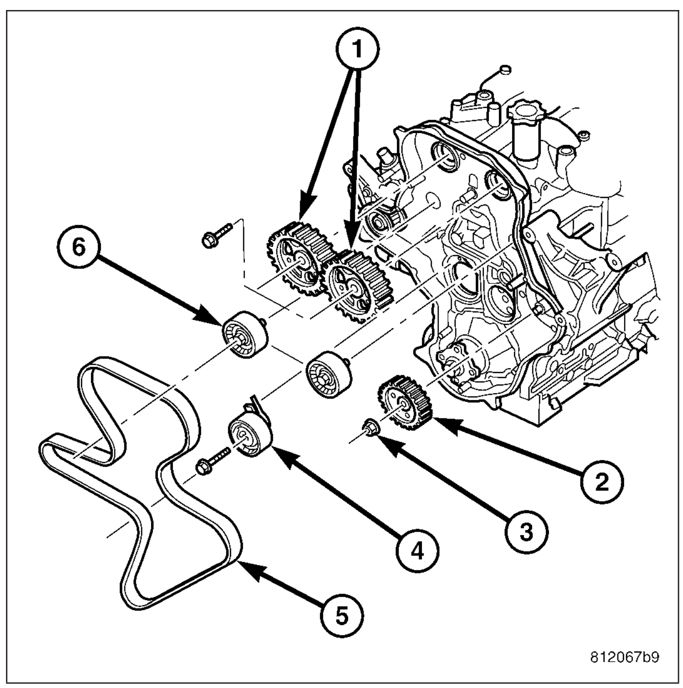
**NOTE: Before servicing the timing belt, the engine must be rotate to 90 degrees ATDC and alignment pin VM.1089 installed (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).**




1. Disconnect negative battery cable.
2. Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).
3. Remove cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
4. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
5. Remove cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
6. Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
7. Remove the power steering pump pulley.
8. Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
9. Loosen and remove timing belt tensioner.

## INSTALLATION

**NOTE: DO NOT remove the timing belt from the package until it's ready to be installed. DO NOT expose timing belt to oil, grease or water contamination. DO NOT crimp belt at a sharp angle. DO NOT clean belt, pulleys or tensioner with solvent. Check that pulleys and bearings are not seized or damage before installing belt.**



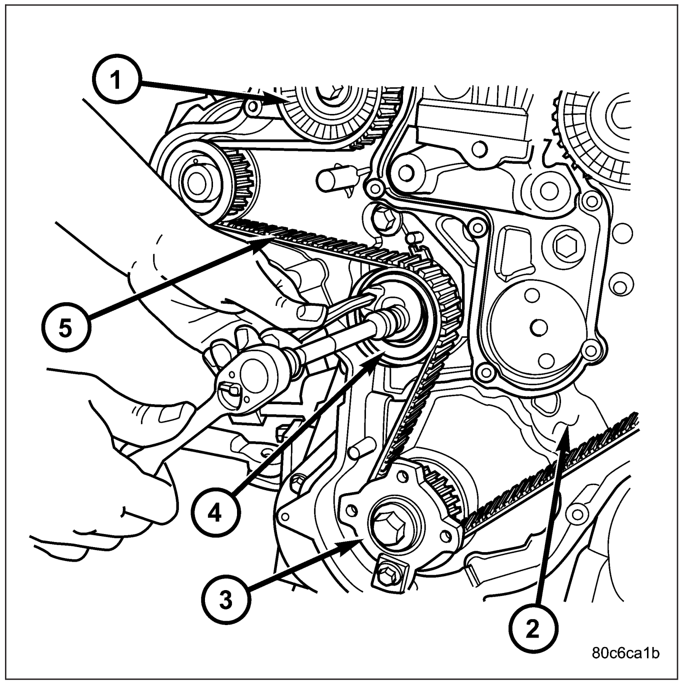

1. Install timing belt tensioner and retaining bolt.
2. Adjust timing belt tensioner (Refer to 9 - ENGINE/VALVE TIMING/TMNG BELT/CHAIN TENSIONER&PULLEY - ADJUSTMENTS).
3. Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
4. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
5. Install the power steering pump pulley.
6. Install cooling fan support (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
7. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
8. Install cooling fan and fan drive viscous clutch assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
9. Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).

10. Connect negative battery cable.

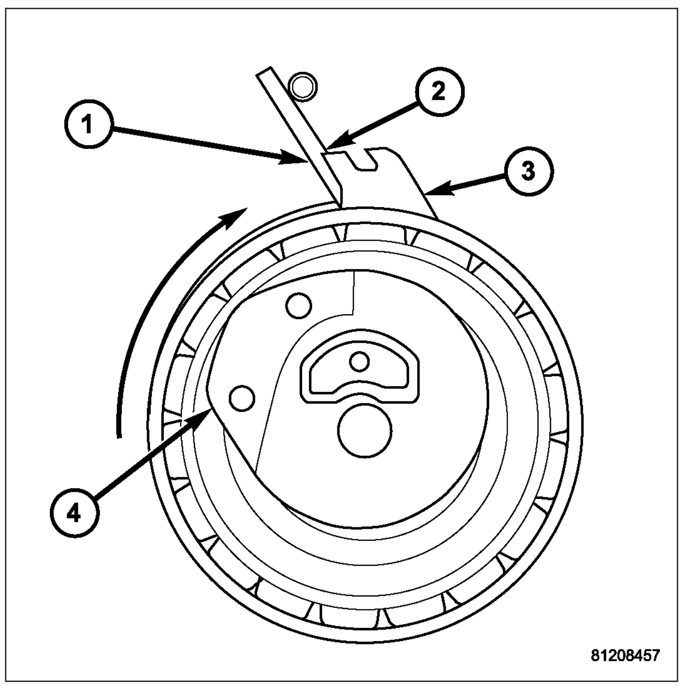
# ADJUSTMENTS

## ADJUSTMENT - TIMING BELT TENSIONER

1. With timing belt outer cover removed and timing belt installed.
2. Loosen timing belt tensioner.




3. Align timing belt tensioner using special tool 9660, with the alignment pointer as shown and torque timing belt tensioner retaining bolt to 34.7N·m.(26 ft. lbs.)..
4. Rotate engine 2 complete revolution and then recheck tensioner alignment. Readjust tensioner alignment as necessary.



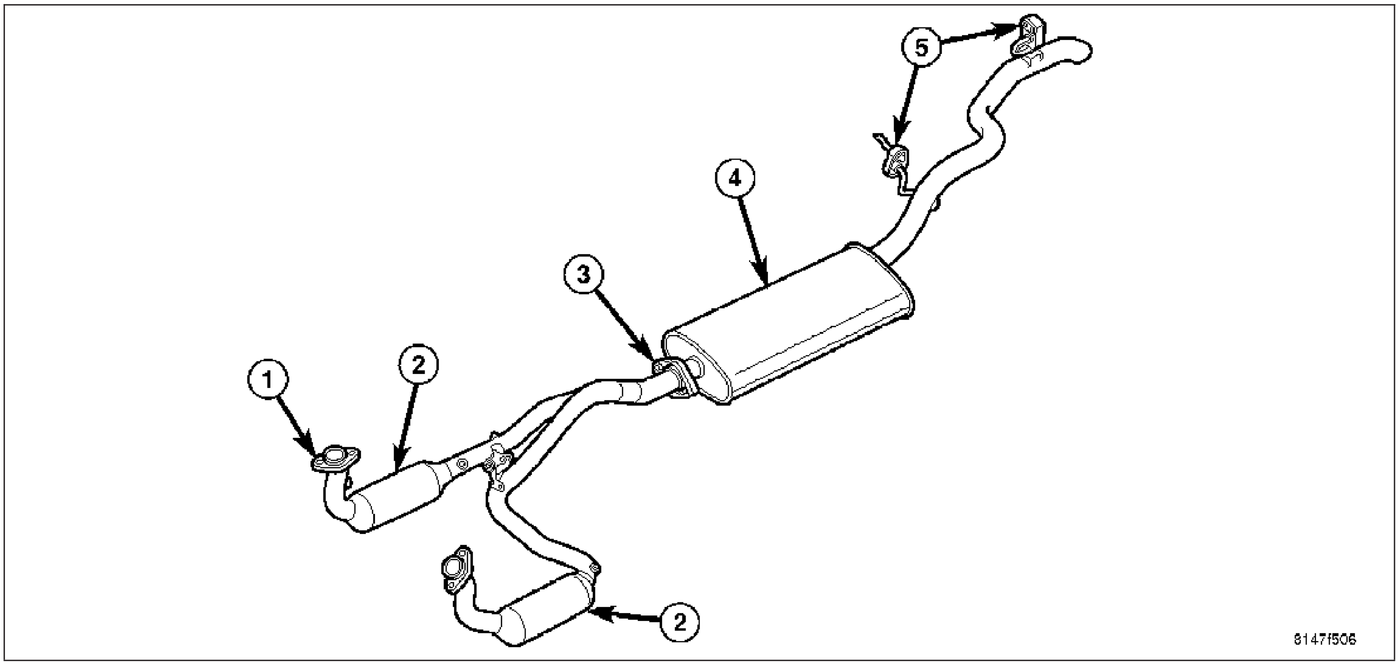
# EXHAUST SYSTEM

## TABLE OF CONTENTS

# EXHAUST SYSTEM AND TURBOCHARGER

## DESCRIPTION

## GAS ENGINES




The basic exhaust system consists of a exhaust pipe assembly with catalytic converters (2), muffler (4) and tailpipe assembly and heat shields.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. Minimum clearance between any exhaust component and the body or frame is 25 mm (1.0 in.). If the system contacts any body panel, it may amplify objectionable noises from the engine or body.

When inspecting an exhaust system, critically inspect for cracked or loose joints, stripped screw or bolt threads, corrosion damage and worn, cracked or broken hangers. Replace all components that are badly corroded or damaged. DO NOT attempt to repair.

When replacement is required, use original equipment parts (or equivalent). This will assure proper engine function and system alignment.

**CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan exhaust heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.**

## 2.8L DIESEL

**CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan exhaust heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.**

The diesel engine exhaust system consists of an engine exhaust manifold, turbocharger, EGR valve with intercooler, front exhaust pipe with catalytic converter, muffler and tailpipe assembly.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. The exhaust components should be kept a minimum of 25.4 mm (1.0 in.) away from the body and frame. If the system contacts any body panel, it may amplify objectionable noises from the engine or body.

## DIAGNOSIS AND TESTING

## DIAGNOSIS AND TESTING - EXHAUST SYSTEM

### EXHAUST SYSTEM DIAGNOSIS CHART

| CONDITION | POSSIBLE CAUSE | CORRECTION |
|---|---|---|
| EXCESSIVE EXHAUST NOISE OR LEAKING EXHAUST GASES | 1. Leaks at pipe joints. | 1. Tighten clamps/bolts to specified torque at leaking joints. |
| | 2. Rusted or blown out muffler. | 2. Replace muffler. Inspect exhaust system. |
| | 3. Broken or rusted out exhaust pipe. | 3. Replace exhaust pipe. |
| | 4. Exhaust pipe leaking at manifold flange. | 4. Tighten/replace flange attaching nuts/bolts. |
| | 5. Exhaust manifold cracked or broken. | 5. Replace exhaust manifold. |
| | 6. Leak between exhaust manifold and cylinder head. | 6. Tighten exhaust manifold to cylinder head bolts. |
| | 7. Catalytic converter rusted or blown out. | 7. Replace catalytic converter assy. |
| | 8. Restriction in exhaust system. | 8. Remove restriction, if possible. Replace restricted part if necessary. |
| CAUTION: When servicing and replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor. | | |

## DIESEL ENGINE

**CAUTION: On high mileage vehicles it is normal to see some exhaust staining around the turbocharger control rod area. This is not a sign of turbocharger failure.**

### EXHAUST SYSTEM DIAGNOSIS CHART

| CONDITION | POSSIBLE CAUSE | CORRECTION |
|---|---|---|
| EXCESSIVE EXHAUST NOISE OR LEAKING EXHAUST GASES | 1. Leaks at pipe joints. | 1. Tighten clamps/bolts at leaking joints. |
| | 2. Rusted or blown out muffler. | 2. Replace muffler. Inspect exhaust system. |
| | 3. Broken or rusted out exhaust pipe. | 3. Replace exhaust pipe. |
| | 4. Exhaust pipe leaking at manifold flange. | 4. Tighten/replace flange attaching nuts/bolts. |
| | 5. Exhaust manifold cracked or broken. | 5. Replace exhaust manifold. |
| | 6. Leak between exhaust manifold and cylinder head. | 6. Tighten exhaust manifold to cylinder head bolts. Replace gasket if necessary. |
| | 7. Turbocharger mounting flange cracked. | 7. Remove turbocharger and inspect. (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - REMOVAL). |
| | 8. Restriction in exhaust system. | 8. Remove restriction, if possible. Replace restricted part if necessary. |
| | 9. EGR pipe(s) leak | 9. Tighten bolts. Replace gasket. |
| | 10. EGR assembly leak | 10. Tighten bolts. Replace gaskets. |
| Drivability Concern - Turbo | 1. Vacuum hose disconnected | 1. Check connections, replace as necessary |
| | 2. Vacuum system leaks | 2. Inspect for damage. Check for leaks, replace as necessary |
| | 3. Boost pressure solenoid filter clogged | 3. Replace the filter. |

## SPECIFICATIONS

## TORQUE

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| EGR Pipe to EGR Inlet | 32 | 24 | - |
| Front Exhaust Pipe Flange-to-Exhaust Manifold Bolts | 36 | 28 | - |
| Front Exhaust pipe-to-Muffler Flange Nuts | 36 | 28 | - |
| Turbocharger Support Bracket Bolts | 24 | 18 | - |

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Turbocharger Downpipe Nuts | 32 | 24 | - |
| Turbocharger Oil Supply Line Fitting | 24 | 18 | 215 |
| Turbocharger Oil Return Line bolts | 11 | - | 96 |
| Turbocharger to Exhaust Manifold Nuts | 32 | 24 | - |

# CATALYTIC CONVERTER

## DESCRIPTION

**WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.**

**CAUTION: DO NOT remove spark plug wires from plugs or by any other means short out cylinders. Failure of the catalytic converter can occur due to a temperature increase caused by unburned fuel passing through the converter.**

The stainless steel catalytic converter body is designed to last the life of the vehicle. Excessive heat can result in bulging or other distortion, but excessive heat will not be the fault of the converter. If unburned fuel enters the converter, overheating may occur. If a converter is heat-damaged, correct the cause of the damage at the same time the converter is replaced. Also, inspect all other components of the exhaust system for heat damage.

**Unleaded gasoline must be used to avoid contaminating the catalyst core.**

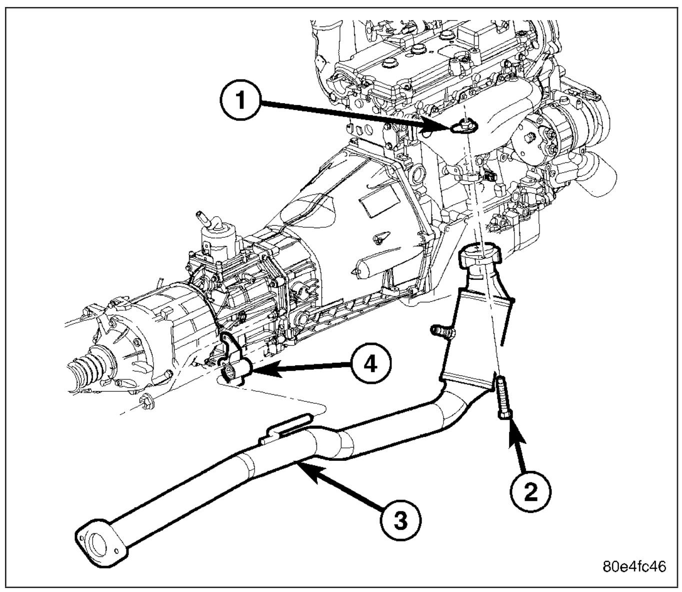
50 State emission vehicles incorporate two catalytic converters located after the exhaust manifolds and before the muffler.

## REMOVAL

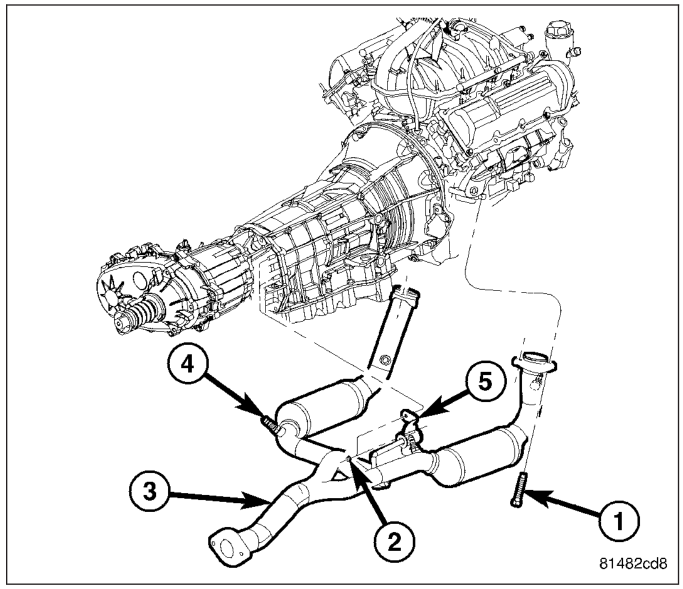
## 2.4L ENGINE

**WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.**

1. Raise and support the vehicle.
2. Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.
3. Disconnect oxygen sensor electrical connector.
4. Remove the bolts from the front exhaust pipe/catalytic converter assembly to muffler flange.
5. Remove bolts and flanged nuts at the manifold.
6. Lower the catalyst assembly (3) and slide out of the mount at the transmission (if equipped).
7. Remove the front exhaust pipe/catalytic converter assembly from the vehicle.



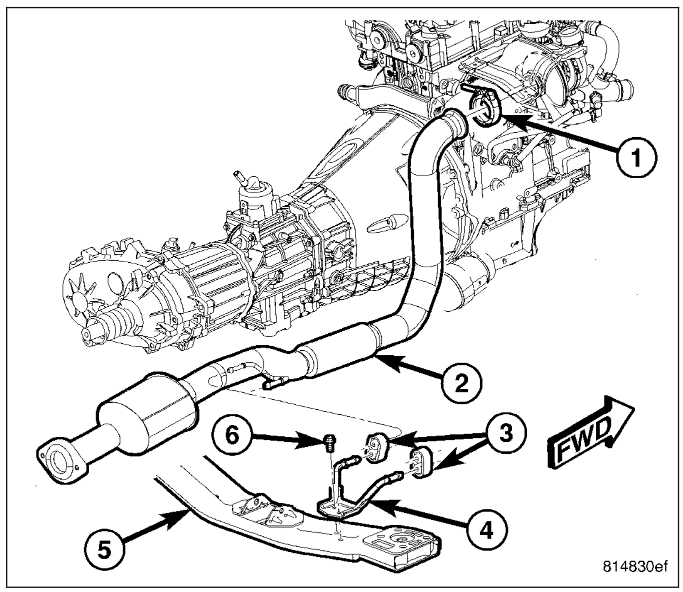
## 3.7L ENGINE




**WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.**

1. Raise and support the vehicle.
2. Saturate the bolts (1) and nuts with heat valve lubricant. Allow 5 minutes for penetration.
3. Disconnect oxygen sensor electrical connectors.
4. Remove the nuts from the front exhaust pipe and catalytic converter assembly to muffler flange.
5. Remove bolts (1) and flanged nuts at the manifold.
6. Lower the front exhaust pipe/catalytic converter assembly (3) and slide out of the mount at the transmission (if equipped).
7. Remove the front exhaust pipe/catalytic converter assembly from the vehicle.

## 2.8L DIESEL ENGINE




**WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.**

1. Raise and support the vehicle.
2. Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.
3. Remove the nuts from the front exhaust pipe and catalytic converter to muffler flange.

**NOTE: The front exhaust pipe and catalytic converter to turbocharger clamp is not reusable. Always use a new clamp when reinstalling the catalytic converter.**

4. Remove the nut from the front exhaust pipe and catalytic converter to turbocharger clamp (1). Spread the clamp.
5. Lower the catalyst assembly (2) and slide out of the mount at the transmission (if equipped).
6. Remove the front exhaust pipe/catalytic converter assembly from the vehicle.
7. Discard the front exhaust pipe and catalytic converter to turbocharger clamp (1). Discard clamp.

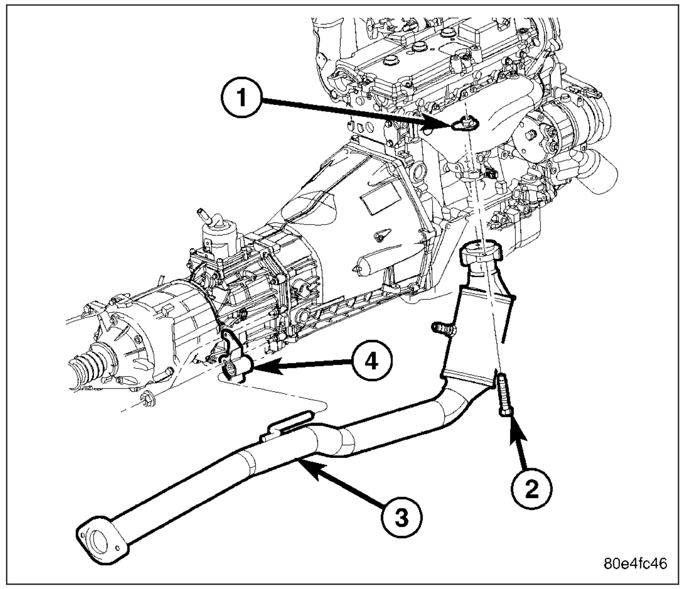
## INSPECTION

Look at the stainless steel body of the converter, inspect for bulging or other distortion that could be a result of overheating. If the converter has a heat shield attached make sure it is not bent or loose.

If you suspect internal damage to the catalyst, tapping the bottom of the catalyst with a rubber mallet may indicate a damaged core.

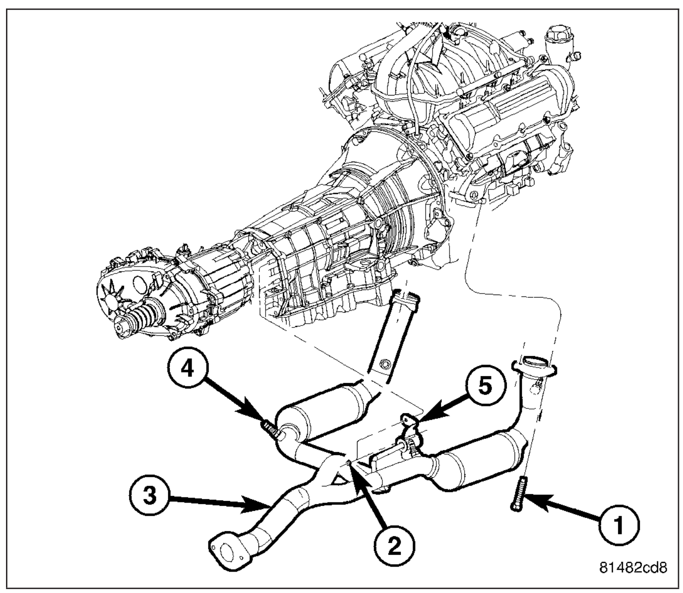
## INSTALLATION

## 2.4L ENGINE



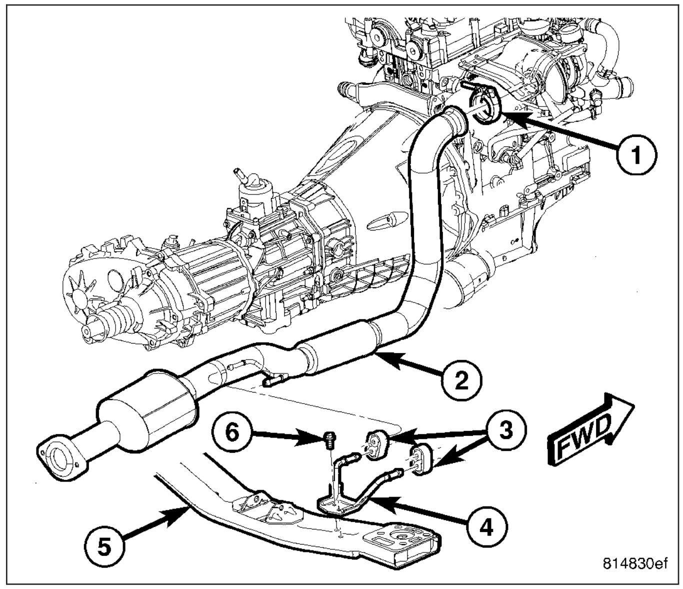

1. Position the front exhaust pipe and catalytic converter assembly (3) into the mount (4) at the transmission (if equipped) and onto the exhaust manifold flange connection.
2. Install the bolts at the muffler and front pipe connection. Do not tighten.
3. Position the exhaust pipe for proper clearance with the frame and underbody parts. A minimum clearance of 25.4 mm (1.0 in.) is required.
4. Tighten the bolt at exhaust manifold (2) to 27 N·m (19 in. lbs.) torque.
5. Tighten the front exhaust pipe and catalytic converter assembly to muffler flange nuts to 27 N·m (19 ft. lbs.) torque.
6. Connect oxygen sensor electrical connector.
7. Lower the vehicle.
8. Start the vehicle and inspect for exhaust leaks. Repair exhaust leaks as necessary.
9. Check the exhaust system for contact with the body panels. Make necessary adjustments, if necessary.

## 3.7L ENGINE




1. Position the front exhaust pipe and catalytic converter assembly (3) into the mount at the transmission (if equipped) and onto the exhaust manifold flange connection.
2. Install the nuts at the front exhaust pipe and catalytic converter assembly to muffler flange. Do not tighten.
3. Position the exhaust pipe for proper clearance with the frame and underbody parts. A minimum clearance of 25.4 mm (1.0 in.) is required.
4. Tighten the bolt (1) at exhaust manifold to 27 N·m (19 in. lbs.) torque.
5. Tighten the front exhaust pipe and catalytic converter assembly to muffler flange nuts to 27 N·m (19 ft. lbs.) torque.
6. Position the front pipe onto the exhaust manifold flange connection. Tighten the clamp to 10 N·m (95 in. lbs.) torque.
7. Connect oxygen sensor electrical connectors.
8. Lower the vehicle.
9. Start the vehicle and inspect for exhaust leaks. Repair exhaust leaks as necessary.
10. Check the exhaust system for contact with the body panels. Make adjustments, if necessary.

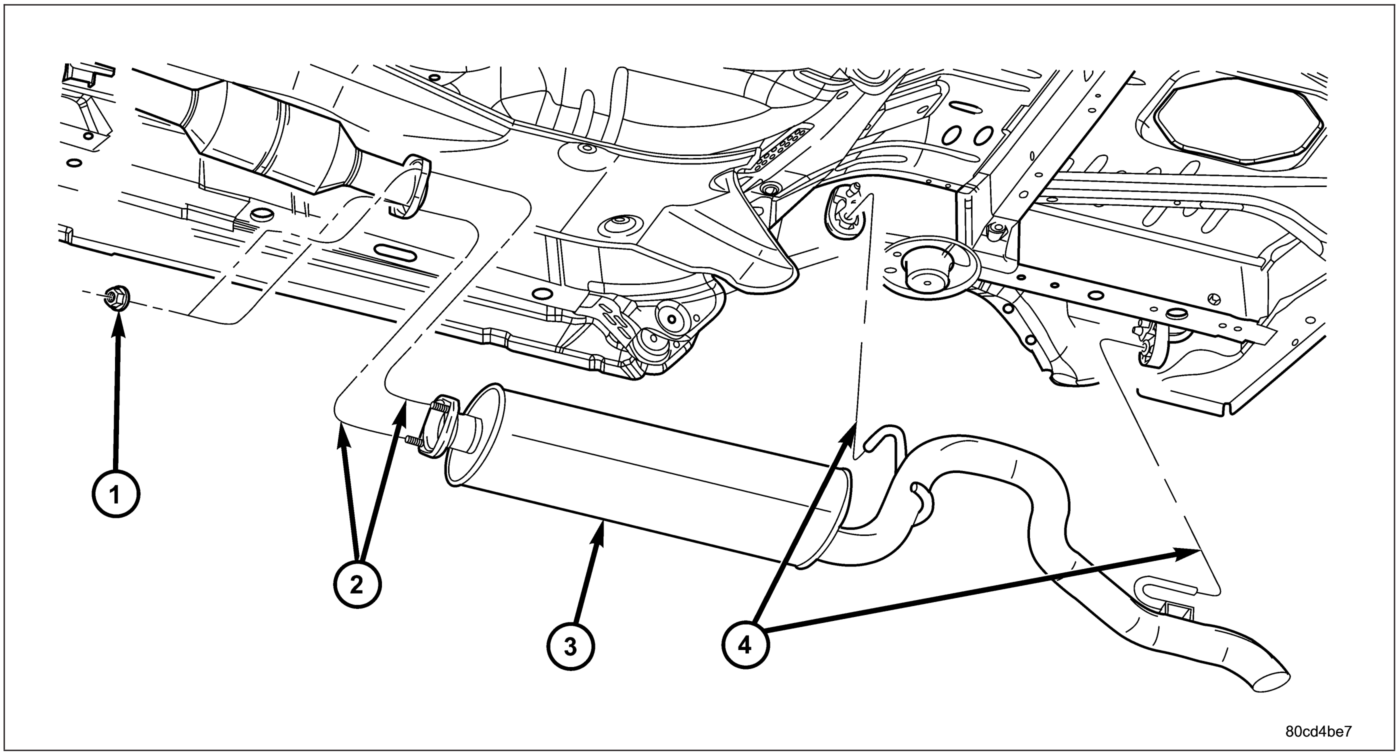
## 2.8L DIESEL




1. Position new turbocharger to front exhaust pipe and catalytic converter clamp (1) on turbocharger.
2. Position the front exhaust pipe and catalytic converter assembly (2) into the mount at the transmission (if equipped) and onto the turbocharger.
3. Install the nuts at the front exhaust pipe and catalytic converter assembly to muffler flange. Do not tighten.
4. Position the exhaust pipe for proper clearance with the frame and underbody parts. A minimum clearance of 25.4 mm (1.0 in.) is required.
5. Tighten turbocharger to front exhaust pipe and catalytic converter assembly clamp nut to 27 N·m (19 ft. lbs.) torque.
6. Install the bolts at the front exhaust pipe and catalytic converter assembly (2) to muffler flange.. Tighten the nuts to 27 N·m (19 ft. lbs.) torque.
7. Lower the vehicle.
8. Start the vehicle and inspect for exhaust leaks. Repair exhaust leaks as necessary.
9. Check the exhaust system for contact with the body panels. Make adjustments, if necessary.

# MUFFLER

## REMOVAL




1. Raise vehicle on hoist.
2. Remove exhaust pipe to muffler and tailpipe assembly retaining nuts (2).
3. Using a suitable pry bar, pry muffler and tailpipe assembly out of exhaust hanger.
4. Remove muffler and tailpipe assembly (3) from vehicle.

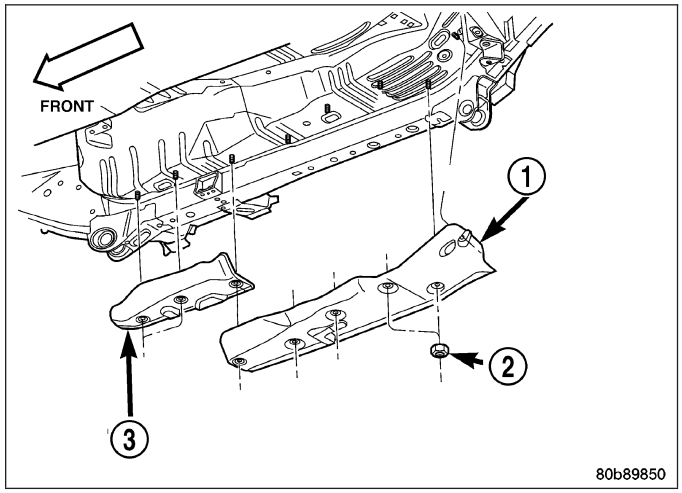
## INSTALLATION

1. Install muffler and tailpipe assembly in vehicle and attach to exhaust hangers.
2. Install muffler and tailpipe assembly to exhaust pipe retaining nuts. Torque nuts to 32 N·m.
3. Lower vehicle from hoist.

# HEAT SHIELDS

## DESCRIPTION

Heat shields (1) (3) are needed to protect both the vehicle and the environment from the high temperatures developed by the catalytic converter. The catalytic converter releases additional heat into the exhaust system. Under severe operating conditions, the temperature increases in the area of the converter. Such conditions can exist when the engine misfires or otherwise does not operate at peak efficiency.



# TURBOCHARGER SYSTEM

## DIAGNOSIS AND TESTING

### TURBOCHARGER BOOST PRESSURE

Low turbocharger boost pressure can cause poor engine performance and driveability concerns. The following procedure will test the turbocharger boost pressure.

Causes of low boost pressure include the following:

- Restricted air inlet system
- Leak in charge air cooler system
- Restricted/high pressure drop across charge air cooler
- Damaged turbocharger compressor wheel housing
- Turbocharger wastegate stuck open
- Excessive exhaust restriction

Causes of excessively high boost pressure include:

- Turbocharger wastegate stuck closed
- Turbocharger wastegate signal line leaking or damaged
- Damaged wastegate command valve O-rings
- Wastegate command valve mechanically stuck in actuated position

Several Diagnostic Trouble Codes (DTCs) can be set that will indicate high or low system boost levels. There is a DTC for circuit faults relating to the electronically controlled wastegate command valve.

(Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/CHARGE AIR COOLER AND PLUMBING - DIAGNOSIS AND TESTING) for diagnosing of low or high boost pressure due to leaks.

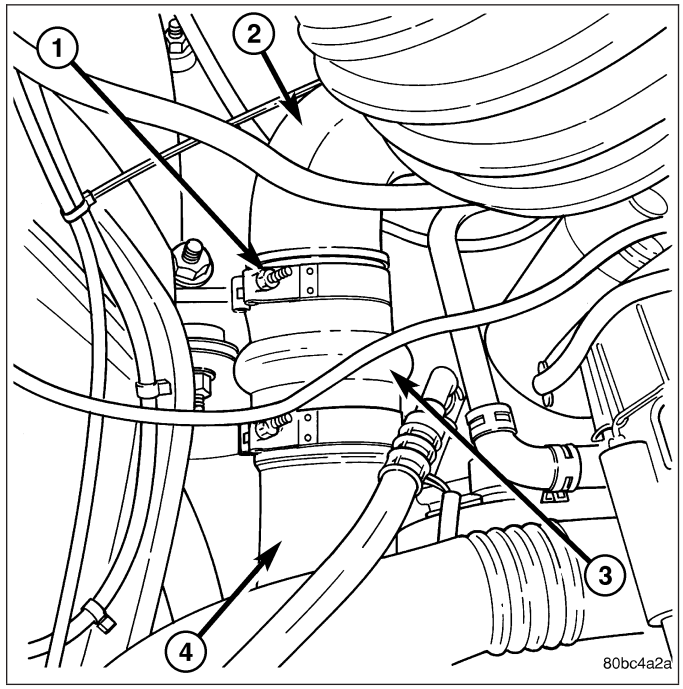
# CHARGE AIR COOLER AND PLUMBING

## DIAGNOSIS AND TESTING

## CHARGE AIR COOLER SYSTEM - LEAKS

Low turbocharger boost pressure and low engine performance can be caused by leaks in the charge air cooler or plumbing. Fuel staining on the exhaust manifold can also be an indication that there are leaks in the air system. The following procedure outlines how to check for leaks in the charge air cooler system.

This procedure can also be used to check for leaks in the wastegate signal line or the wastegate canister.




1. Loosen clamp (1) and remove air inlet hose (3) from turbocharger.
2. Insert Special Tool 9022 Adapter into the turbocharger inlet. Tighten tool clamp to 8 N·m (72 in. lbs.).

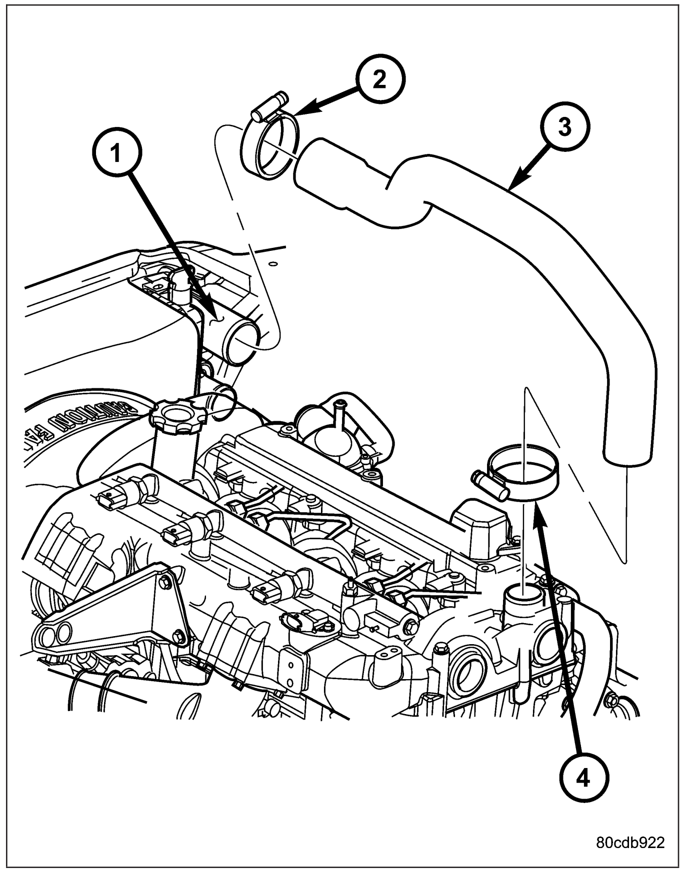
**CAUTION: Do not apply more than 138 kPa (20 psi) air pressure to the charge air cooler system; severe damage to the charge air cooler system may occur.**

3. Connect a regulated air supply to air fitting on Tool 9022 Adapter. Set air pressure to a maximum of 138 kPa (20 psi).
4. Using soapy water check the rubber sleeves, charge air cooler and intake manifold for leaks.
5. Using soapy water check for leaks at the wastegate signal line, wastegate canister and wastegate command valve.

## REMOVAL

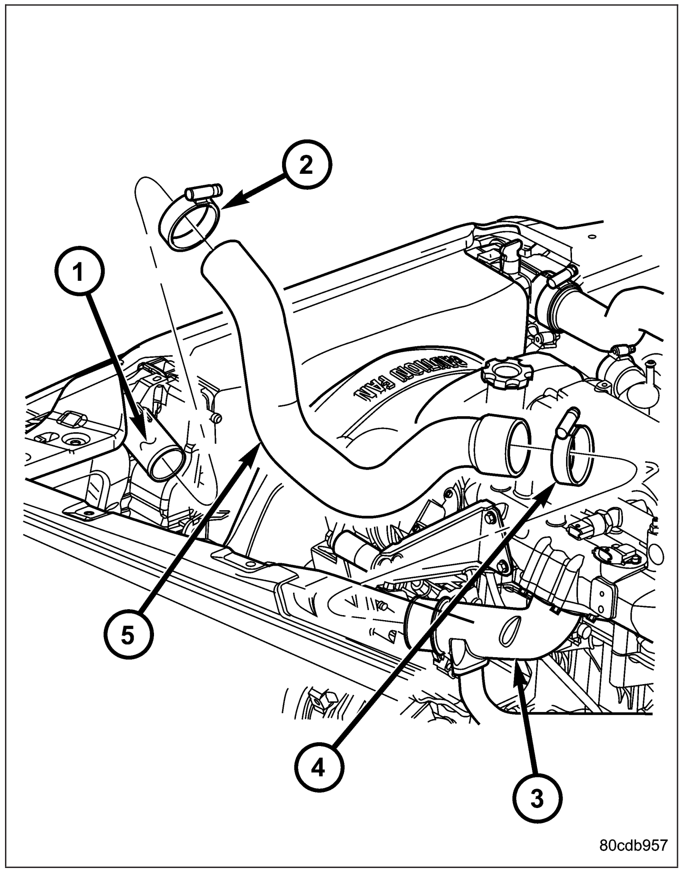
## CHARGE AIR COOLER INLET HOSE

1. Open and support hood of vehicle.
2. Loosen hose clamps at both ends of charge air cooler (CAC) inlet hose.
3. Remove CAC inlet hose (3) from turbocharger and CAC.



## CHARGE AIR COOLER OUTLET HOSE

1. Raise and support hood on vehicle.
2. Loosen hose clamps at both ends of charge air cooler (CAC) outlet hose (5).
3. Remove hose (5) from CAC and intake manifold inlet.




## INSTALLATION

## CHARGE AIR COOLER INLET HOSE

1. Install charge air cooler (CAC) inlet hose on turbocharger and CAC.
2. Tighten hose clamps.
3. Close hood.

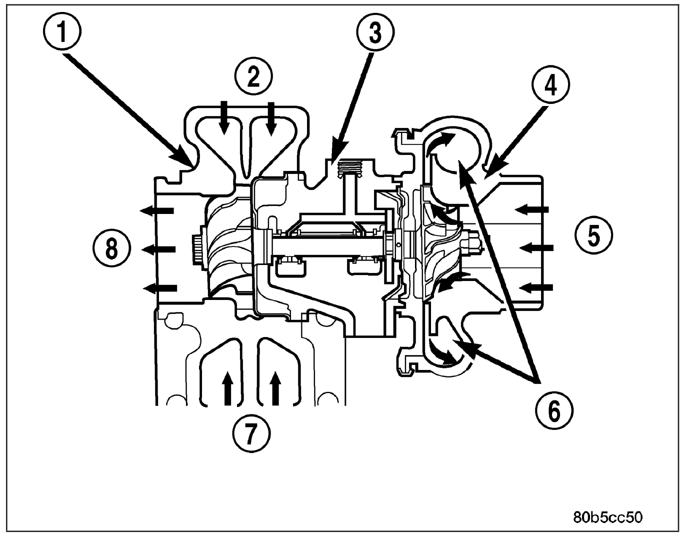
## CHARGE AIR COOLER OUTLET HOSE

1. Install charge air cooler (CAC) outlet hose on CAC and intake manifold inlet.
2. Tighten both hose clamp on CAC outlet hose.
3. Close hood.

# TURBOCHARGER

## DESCRIPTION

**CAUTION: The turbocharger is a performance part and must not be tampered with. The wastegate bracket is an integral part of the turbocharger. Tampering with the wastegate components can reduce durability by increasing cylinder pressure and thermal loading due to incorrect inlet and exhaust manifold pressure. Poor fuel economy and failure to meet regulatory emissions laws may result. Increasing the turbocharger boost WILL NOT increase engine power.**



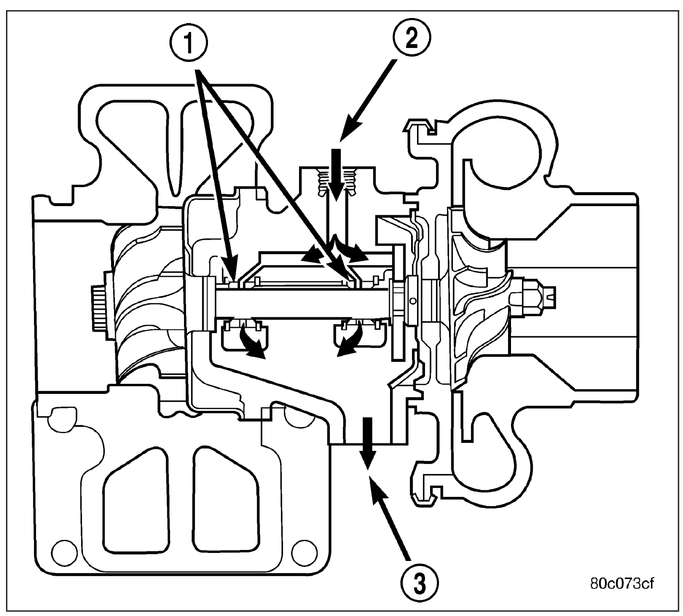

The turbocharger is an exhaust-driven supercharger which increases the pressure and density of the air entering the engine through the charge air cooler. With the increase of air entering the engine, more fuel can be injected into the cylinders, which creates more power during combustion.

The turbocharger assembly consists of four (5) major component systems

- Turbine section
- Compressor section
- Bearing housing
- Variable veins
- Actuator

## OPERATION

Exhaust gas pressure and energy drive the turbine, which in turn drives a centrifugal compressor that compresses the inlet air, and forces the air into the engine through the charge air cooler and plumbing. Since heat is a by-product of this compression, the air must pass through a charge air cooler to cool the incoming air and maintain power and efficiency.




**Increasing air flow to the engine provides:**

- Improved engine performance
- Lower exhaust smoke density
- Improved operating economy
- Altitude compensation
- Noise reduction.

The turbocharger is lubricated by engine oil that is pressurized, cooled, and filtered. The oil is delivered to the turbocharger by a supply line (2) that is tapped into the engine block. The oil travels into the bearing housing, where it lubricates the shaft (1) and bearings. A return pipe (3) at the bottom of the bearing housing, routes the engine oil back to the crankcase.

The most common turbocharger failure is bearing failure related to repeated hot shutdowns with inadequate “cool-down” periods. A sudden engine shut down after prolonged operation will result in the transfer of heat from the turbine section of the turbocharger to the bearing housing. This causes the oil to overheat and break down, which causes bearing and shaft damage the next time the vehicle is started.

Letting the engine idle after extended operation allows the turbine housing to cool to normal operating temperature. The following chart should be used as a guide in determining the amount of engine idle time required to sufficiently cool down the turbocharger before shut down, depending upon the type of driving and the amount of cargo.

| TURBOCHARGER ″COOL DOWN″ CHART | | | |
|---|---|---|---|
| **Driving Condition** | **Load** | **Turbocharger Temperature** | **Idle Time (in minutes) Before Shut Down** |
| Stop & Go | Empty | Cool | Less than 1 |
| Stop & Go | Medium | Warm | 1 |
| Highway Speeds | Medium | Warm | 2 |
| City Traffic | Max. GCWR | Warm | 3 |
| Highway Speeds | Max. GCWR | Warm | 4 |
| Uphill Grade | Max. GCWR | Hot | 5 |

## REMOVAL

1. Disconnect negative battery cable.
2. Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
3. Disconnect the MAF and Inlet air pressure sensors wiring harness connectors, disconnect the air outlet duct from the turbocharger, and remove air cleaner assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
4. Remove charge air cooler inlet hose from turbocharger (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/CHARGE AIR COOLER AND PLUMBING - REMOVAL).
5. Drain cooling system.
6. Remove coolant recovery pressure container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY PRESS CONTAINER - REMOVAL).
7. Disconnect the turbocharger actuator vacuum hose and position aside.
8. Remove turbocharger upper heat shield.
9. Raise and support the vehicle.
10. Remove the lower splash shield.
11. Disconnect the front exhaust pipe from the turbocharger.
12. Remove the turbocharger support bracket.
13. Disconnect turbocharger oil return line at turbocharger.
14. Lower the vehicle.
15. Remove the turbocharger oil supply line.
16. Remove turbocharger to exhaust manifold retaining nuts and separate turbocharger from exhaust manifold.

## CLEANING

All old gaskets should be inspected for any tears or signs of prior leakage. If any gaskets show such indications, they should be replaced with new gaskets. All gasket mating surfaces must be cleaned of old gasket material to produce a smooth and dirt free sealing surface for the new gasket.

## INSTALLATION

1. Connect turbocharger to exhaust manifold with new gasket. Torque retaining nuts to 32 N·m.

**NOTE: After Tightening The Exhaust Manifold To Specification Using a Diagonal-Cross Pattern, Retrace The Pattern Checking The Correct Torque Value Again.**

2. Install exhaust manifold and turbocharger assembly with new gasket in position on studs in cylinder head. Install retaining nuts and torque to 36 N·m.

3. Install thermostat housing (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - INSTALLATION).
4. Install viscous heater (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ELECTRIC COOLANT PUMP - INSTALLATION).
5. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
6. Raise vehicle on hoist.
7. Connect turbocharger oil return line at turbocharger.
8. Connect exhaust pipe at turbocharger downpipe.
9. Lower vehicle from hoist.
10. Connect oil supply line at turbocharger. Torque banjo fitting to 24 N·m.
11. Install exhaust manifold heat shield. Torque retaining bolts to 24 N·m (18 lbs.ft.).
12. Reposition EGR cooler and or EGR valve assembly on exhaust manifold. Torque retaining nuts and bolt to 32.4N·m.
13. Connect EGR pipe to EGR valve. Torque bolts to 32 N·m.
14. Connect EGR cooler coolant hoses at cooler (2.8L).
15. Install coolant recovery pressure container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY PRESS CONTAINER - INSTALLATION).
16. Refill cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).
17. Connect charge air cooler inlet hose at turbocharger.
18. Install air cleaner assembly.
19. Connect air inlet hose to turbocharger.
20. Install engine cover (Refer to 9 - ENGINE - INSTALLATION).
21. Connect negative battery cable.

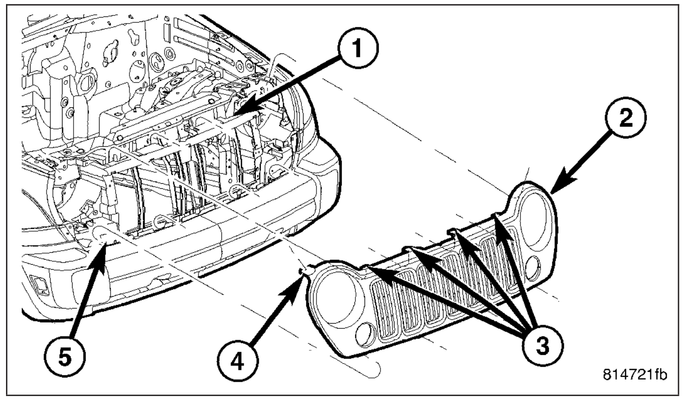
# FRAME & BUMPERS

## TABLE OF CONTENTS

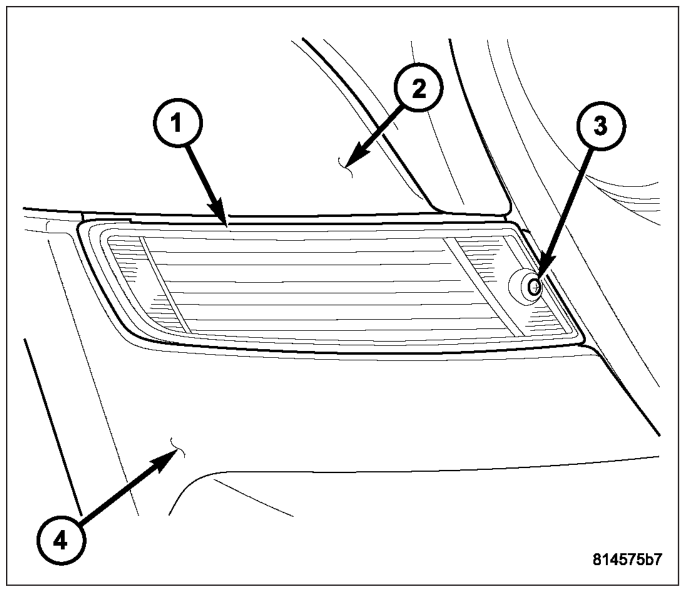
# FRONT FASCIA

## REMOVAL

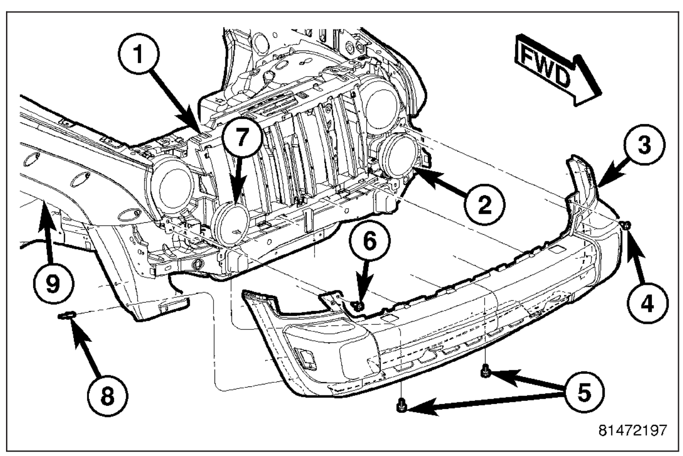
1. Remove the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).




2. Remove the turn signal lamps (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/PARK/TURN SIGNAL LAMP - REMOVAL).

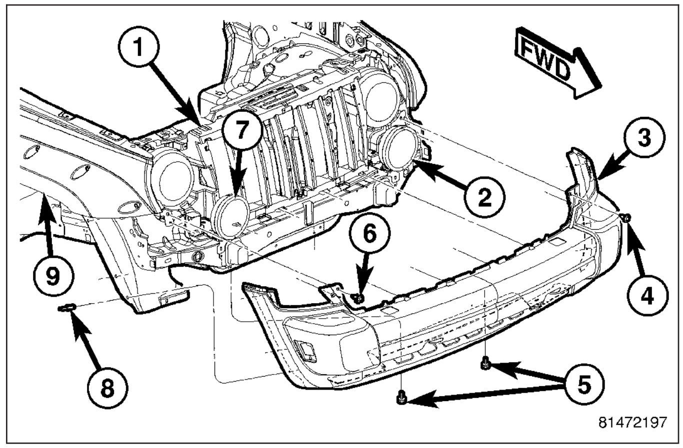



3. Remove the fascia screws next to the turn signal lamps (6).
4. Remove the two screws at the bottom of the fascia (5).
5. Remove the three plastic rivets (8) securing the fascia (3) to each wheelhouse splash shield.
6. Release the three tabs securing the fascia to the grille opening reinforcement (1).
7. Remove the fascia (3).

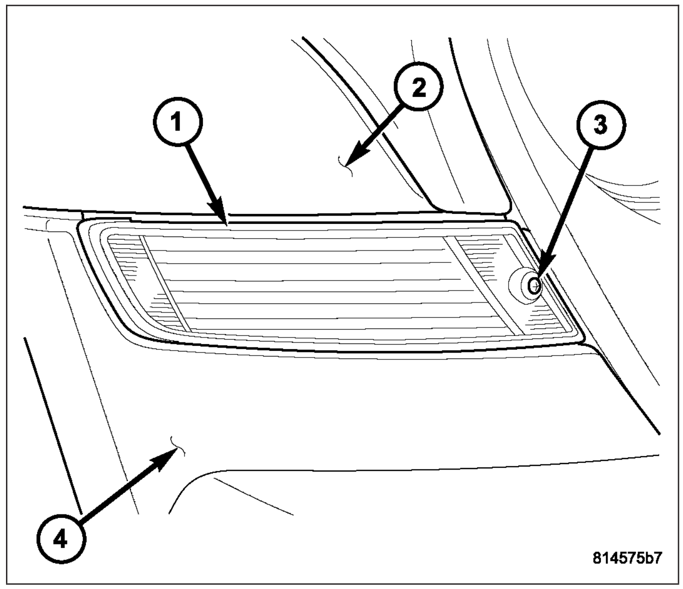


## INSTALLATION

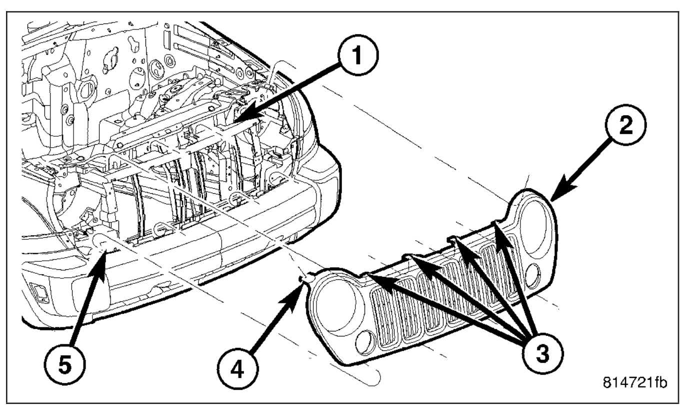
1. Position the fascia (3) onto the vehicle and align the center pin into the hole located near the center of the grille opening reinforcement (1).
2. Secure the three tabs onto the grille reinforcement fully.
3. Install the two screws (4 & 6) next to the turn signal lamps.
4. Install the two lower screws (5).
5. Install new rivets (8) attaching the wheelhouse splash shield to the fascia (3).




6. Install the turn signal lamps (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/PARK/TURN SIGNAL LAMP - INSTALLATION).



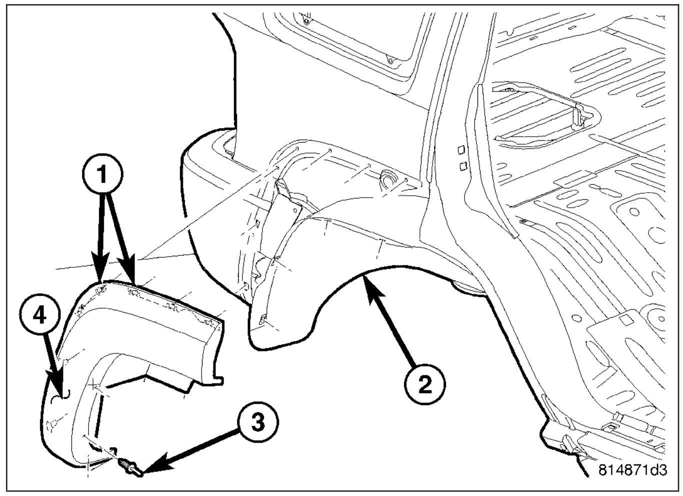

7. Install the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).



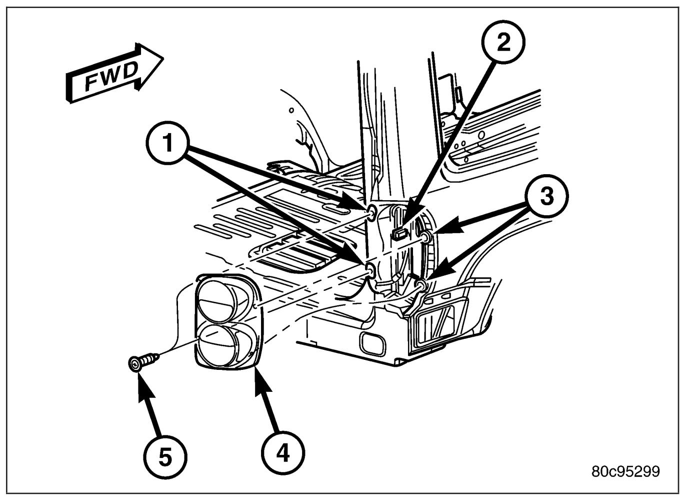
# REAR FASCIA

## REMOVAL

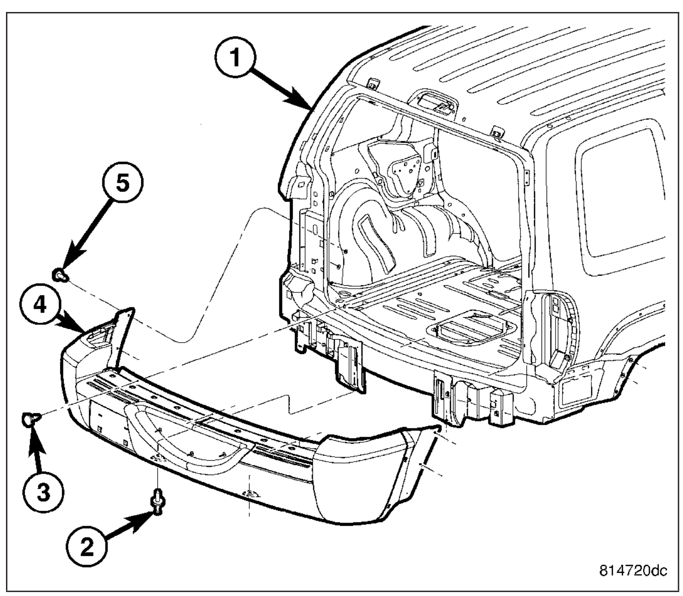
1. Remove the wheel flares (rear) (Refer to 23 - BODY/EXTERIOR/REAR WHEEL OPENING FLARE MOLDINGS - REMOVAL).




2. Remove the rear lamp units (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/REAR LAMP UNIT - REMOVAL).



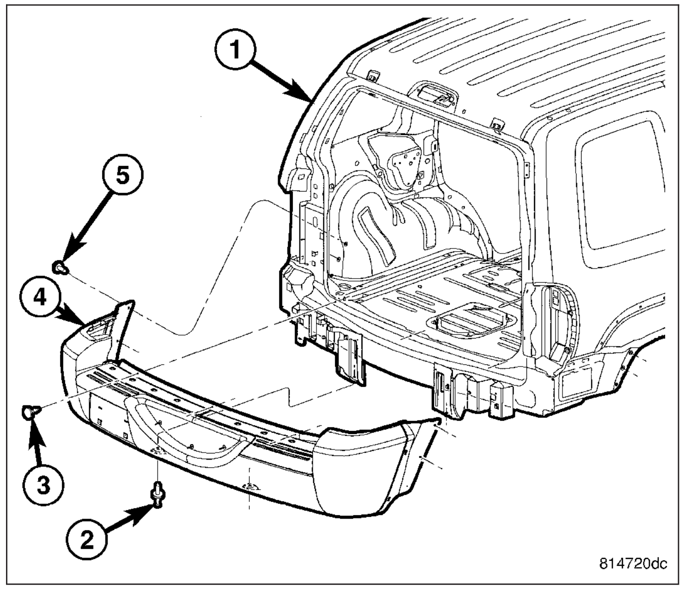

3. Remove the four side bolts.
4. Remove the two bottom rivets.
5. Remove the 3 screws along the upper edge.
6. Separate the side plastic retainers and remove the fascia from the vehicle.



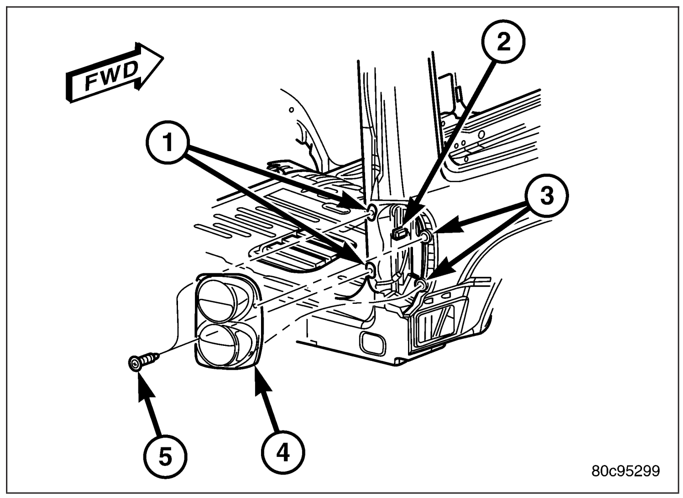
## INSTALLATION

**NOTE: Fascia must be pushed completely forward to allow the plastic retainers full engagement in their respective slots.**

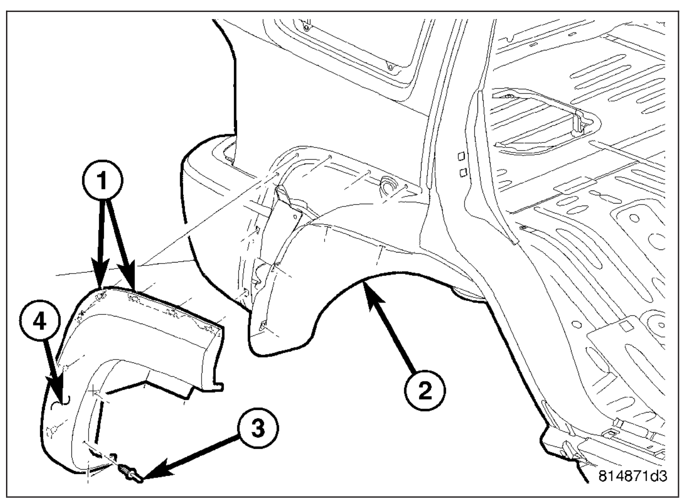
1. Install the fascia and insert the plastic retainers.
2. Install the three upper screws.
3. Install the four side bolts.
4. Install two bottom rivets.




5. Install the rear lamp units (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/REAR LAMP UNIT - INSTALLATION).



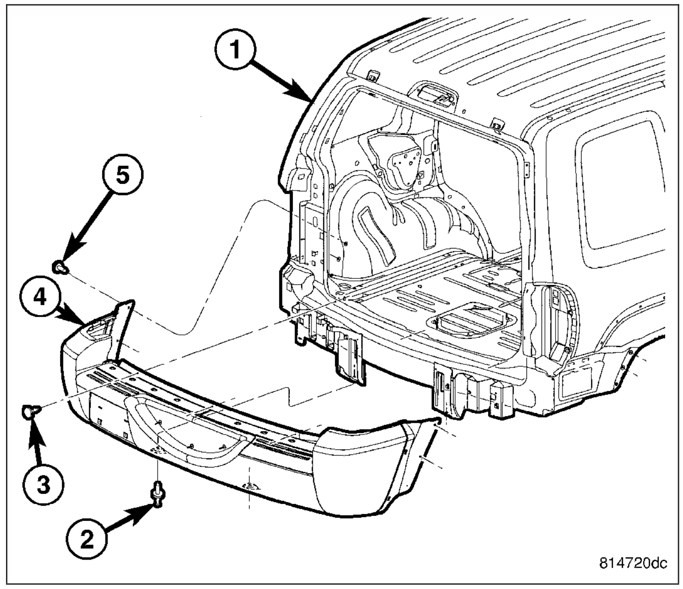

6. Install the rear half wheel opening flares (Refer to 23 - BODY/EXTERIOR/WHEEL OPENING FLARE MOLDING - INSTALLATION).



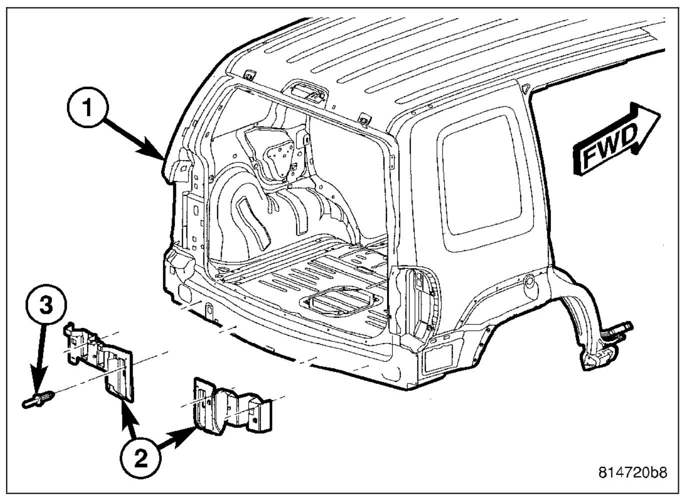
# REAR FASCIA SUPPORT

## REMOVAL

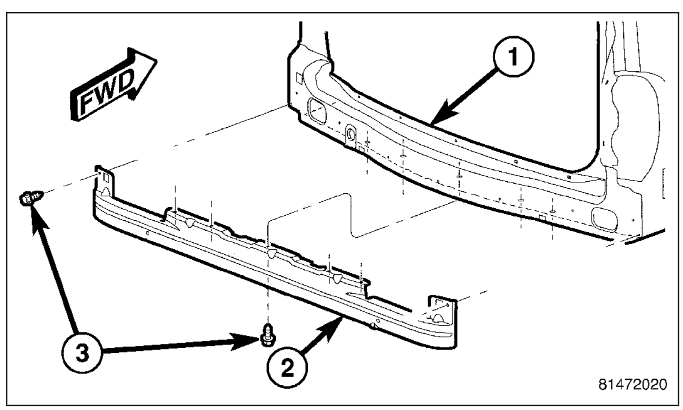
1. Remove the rear fascia assembly (Refer to 13 - FRAME & BUMPERS/BUMPERS/REAR FASCIA - REMOVAL).




2. Remove the four rivets and remove the two fascia supports.

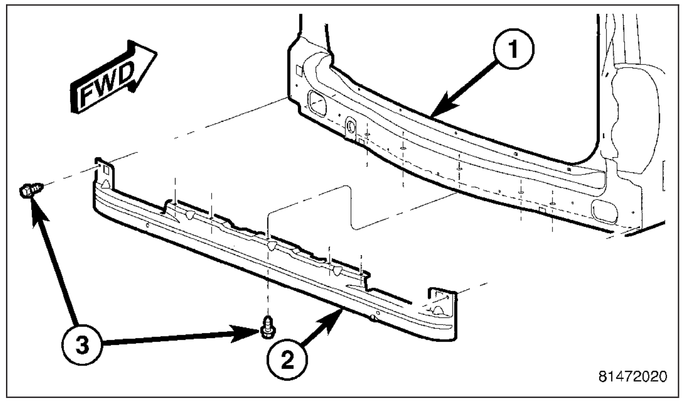



3. For export models, remove the seven bolts and remove the fascia support.

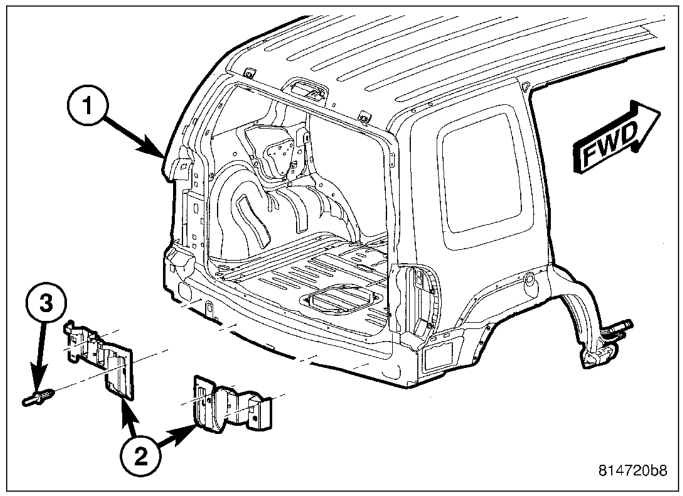


## INSTALLATION

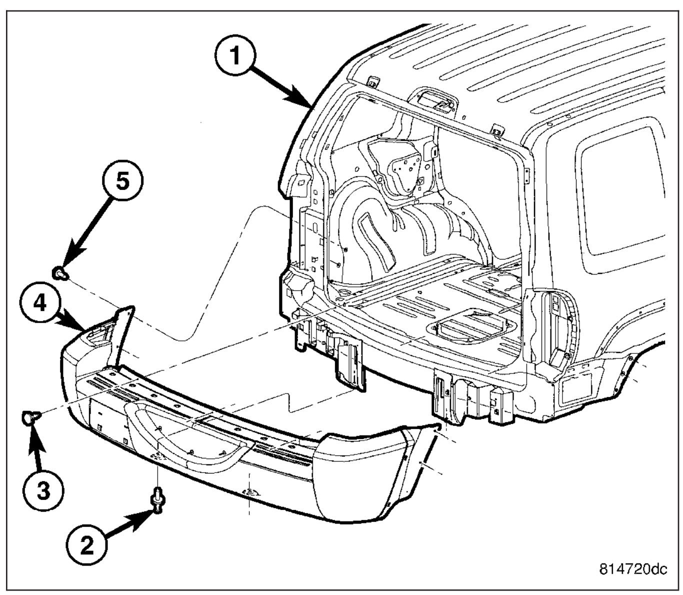
1. For export models, install the fascia support and install the seven bolts.




2. Install the fascia supports onto the vehicle and install four new rivets.




3. Install the rear fascia assembly (Refer to 13 - FRAME & BUMPERS/BUMPERS/REAR FASCIA - INSTALLATION).



# REAR FASCIA - STEP PAD

## REMOVAL

1. Remove the rear fascia (Refer to 13 - FRAME & BUMPERS/BUMPERS/REAR FASCIA - REMOVAL).
2. Remove the rain diverter (Refer to 13 - FRAME & BUMPERS/BUMPERS/REAR FASCIA - RAIN DIVERTER - REMOVAL).
3. Remove the retaining clips and remove the step pads.

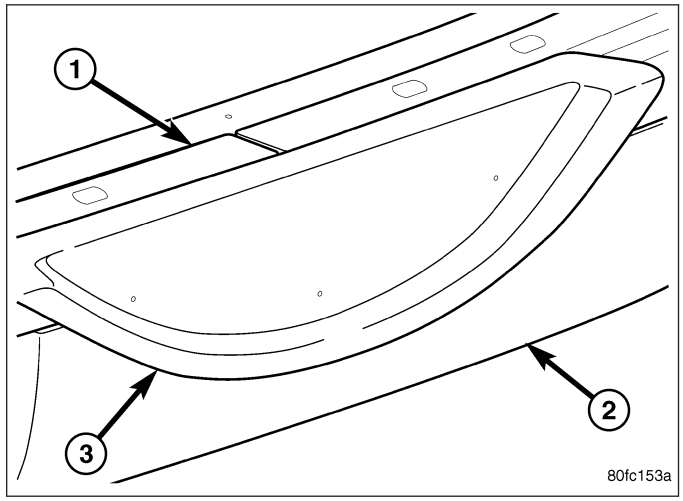
## INSTALLATION

1. Install the step pads and new retainer clips.
2. Install the rain diverter (Refer to 13 - FRAME & BUMPERS/BUMPERS/REAR FASCIA - RAIN DIVERTER - INSTALLATION).
3. Install the rear fascia (Refer to 13 - FRAME & BUMPERS/BUMPERS/REAR FASCIA - INSTALLATION).

# REAR FASCIA - RAIN DIVERTER

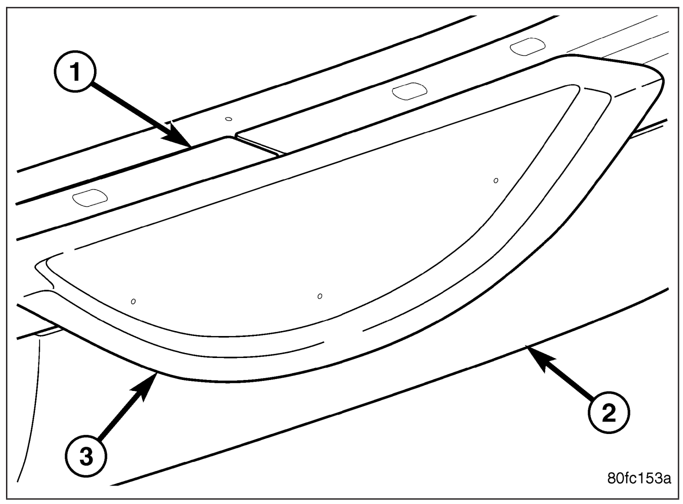
## REMOVAL

1. Open the swing gate.
2. Remove the three rivets from the diverter and remove the diverter.




## INSTALLATION

1. Install the diverter and install new rivets.



# FRAME

## SPECIFICATIONS

## SPECIFICATIONS - FRAME DIMENSIONS

Frame dimensions are listed in metric scale. All dimensions are from center to center of Principal Locating Point (PLP), or from center to center of PLP and fastener location.

### VEHICLE PREPARATION

Position the vehicle on a level work surface. Using screw or bottle jacks, adjust the vehicle PLP heights to the specified dimension above a level work surface. Vertical dimensions can be taken from the work surface to the locations indicated were applicable.

**NOTE: All measurements are in MM.**

### DIMENSION ILLUSTRATIONS

| DESCRIPTION | FIGURE |
|---|---|
| TOP VIEW | ( 1 ) |
| SIDE VIEW | ( 2 ) |

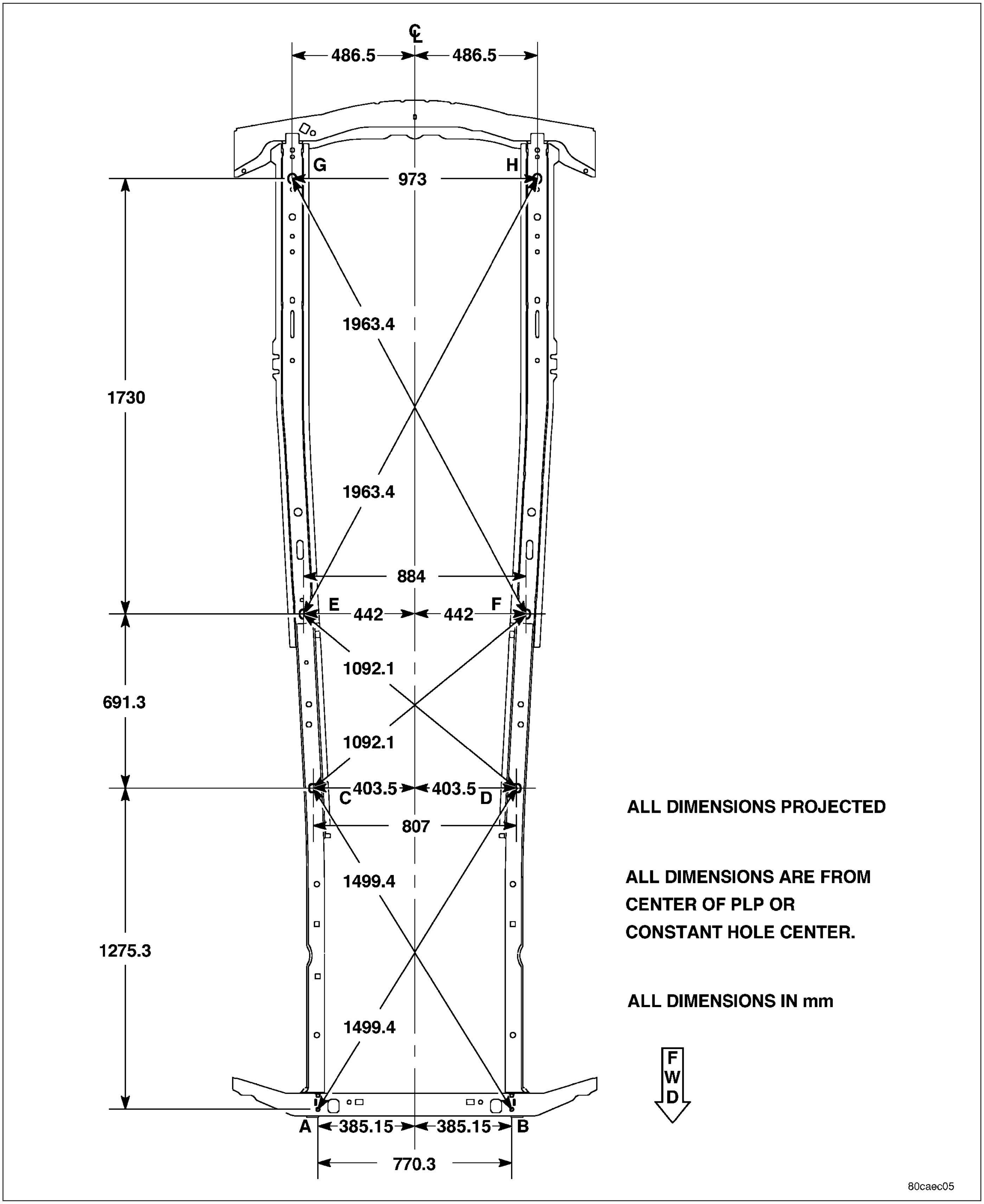



*Fig. 1 BOTTOM VIEW*

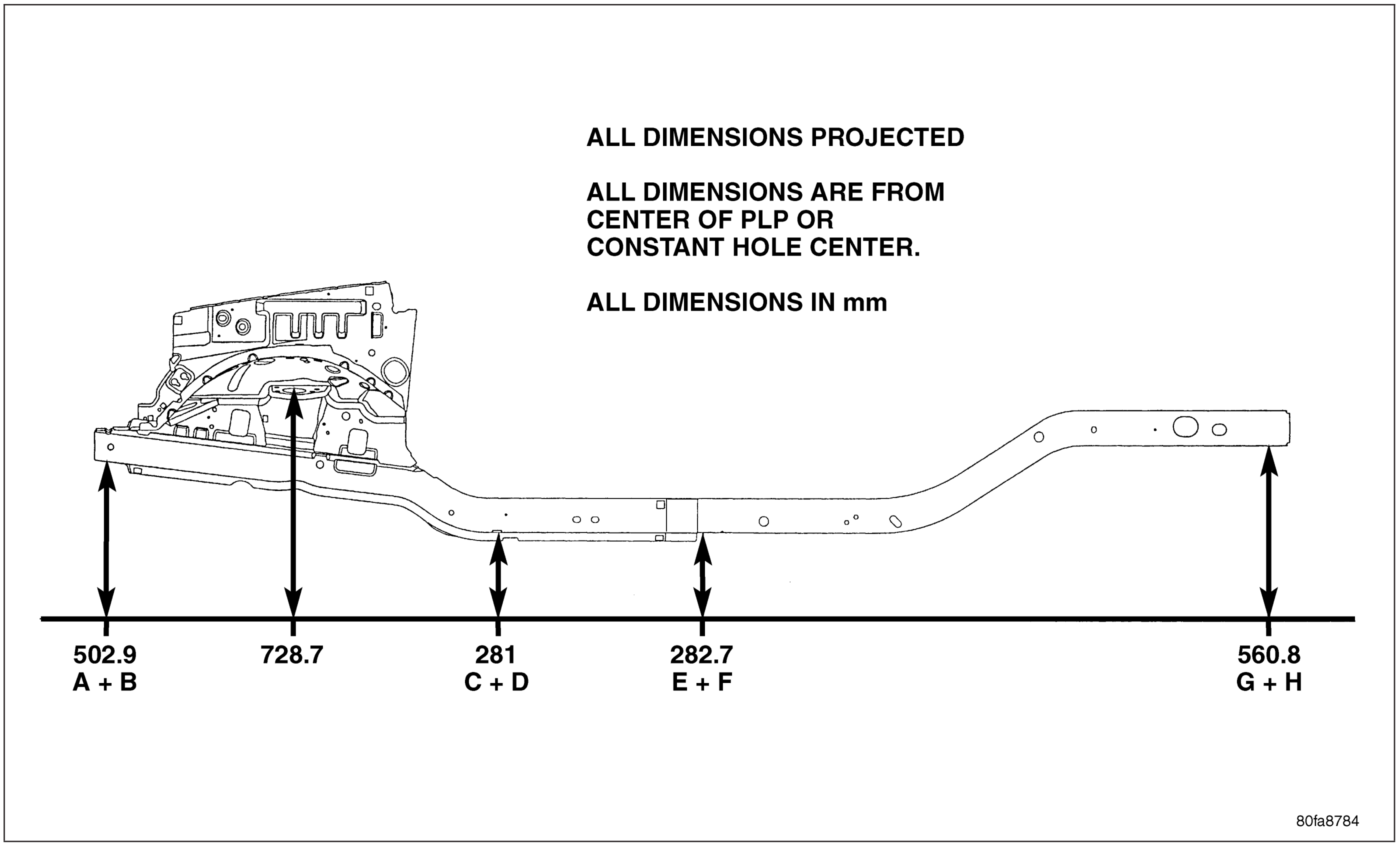



*Fig. 2 SIDE VIEW*

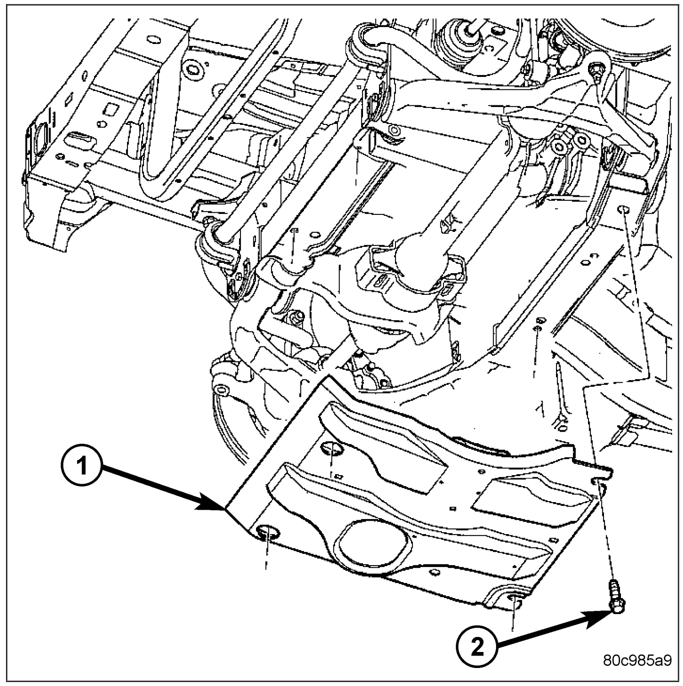
## SPECIFICATIONS - TORQUE

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Engine cradle crossmember front mounting bolts | 122 | 90 | — |
| Engine cradle crossmember rear mounting bolts | 115 | 85 | — |
| Engine mount through bolts/nuts | 88 | 65 | — |
| Front skid plate bolts | 61 | 45 | — |
| Front tow hook nuts/bolt | 61 | 45 | — |
| Fuel tank skid plate | 88 | 65 | — |
| Rear crossmember bolts | 47 | 35 | — |
| Rear tow hook bolts | 88 | 65 | — |
| Trailer hitch bolts | 88 | 65 | — |
| Transfer case skid plate bolts | 34 | 25 | — |
| Transmission mount through bolt/nut | 88 | 65 | — |

# FRONT SKID PLATE

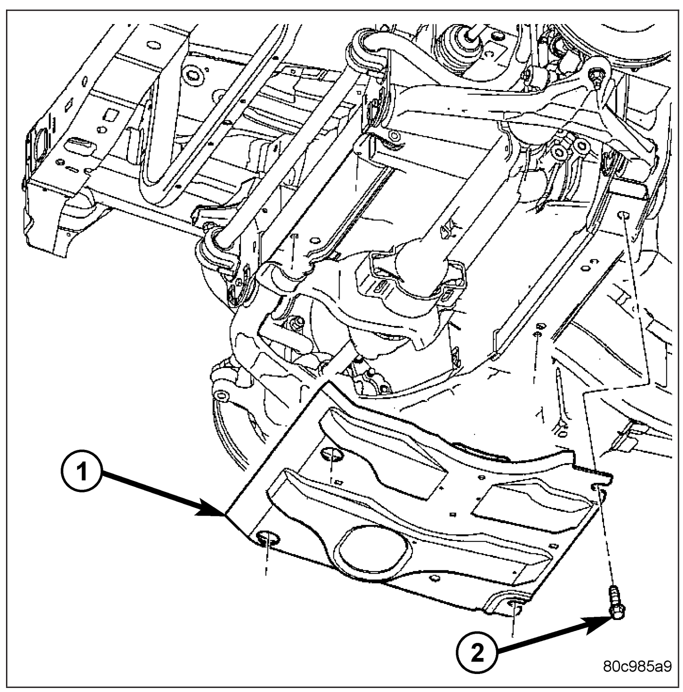
## REMOVAL

1. Raise and support the vehicle.
2. Remove the skid plate bolts and remove the skid plate.




## INSTALLATION

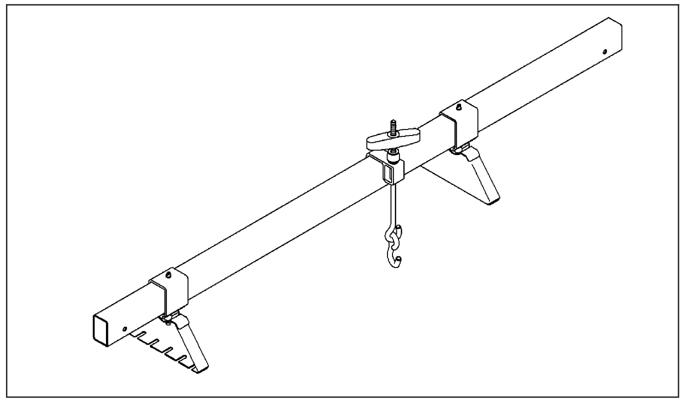
1. Install the skid plate.
2. Install the bolts and tighten to 61 N·m (45 ft. lbs.).



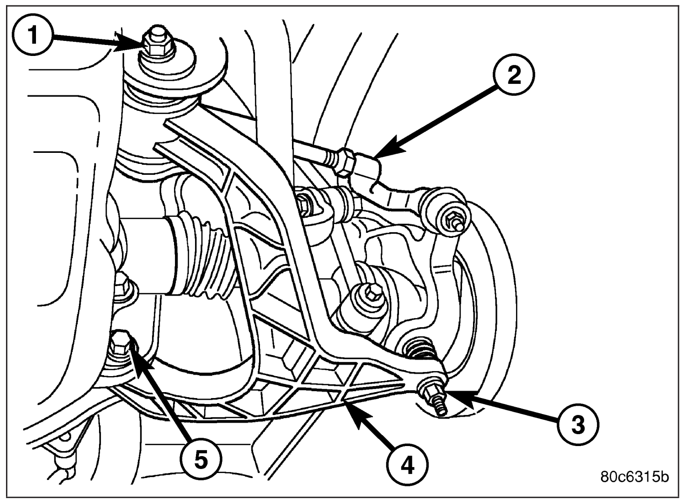
# ENGINE CRADLE CROSSMEMBER

## REMOVAL

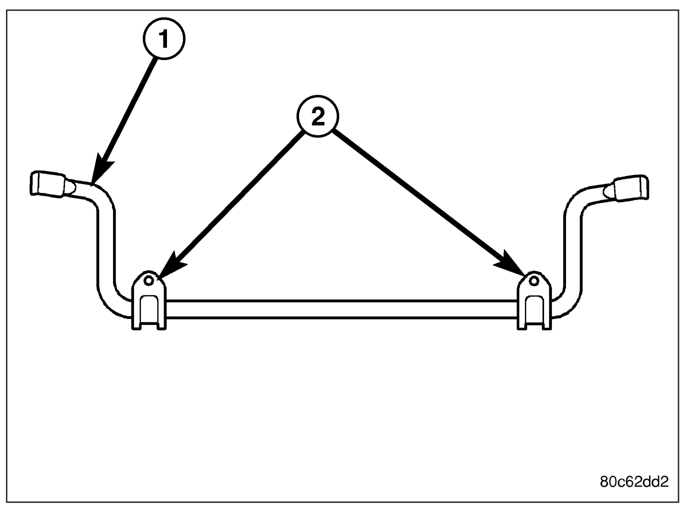
1. Install engine support tool 8534 or equivalent.



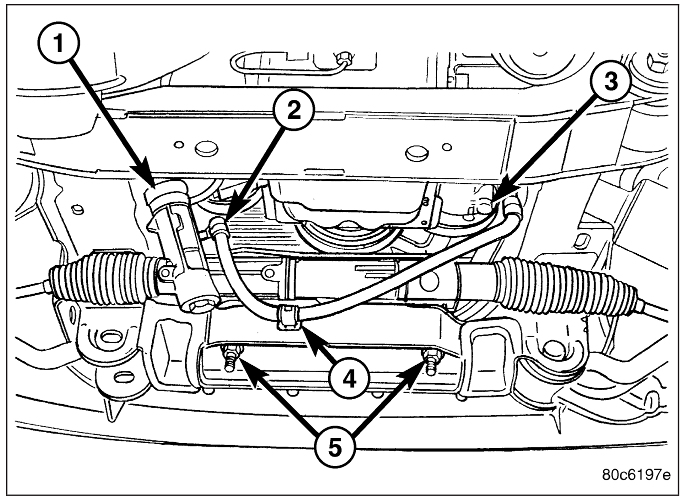
2. Raise and support the vehicle.
3. Remove the lower control arms (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - REMOVAL).



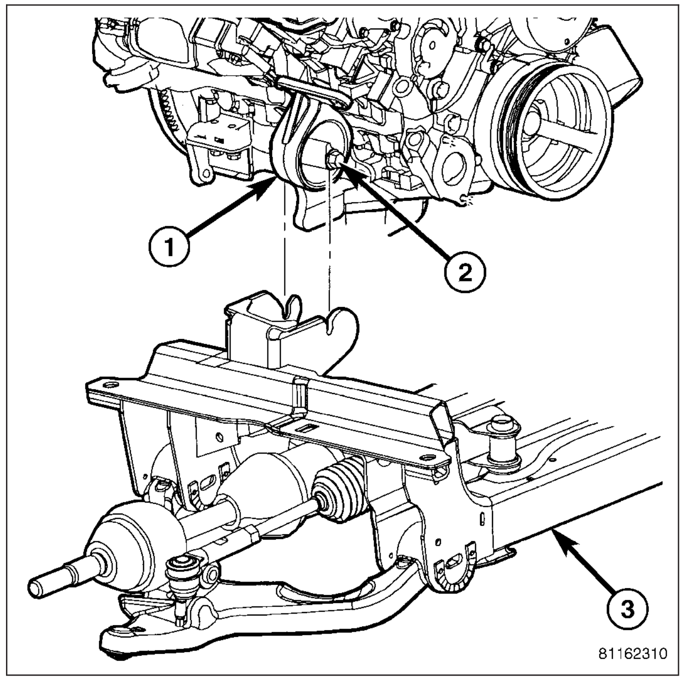

4. Remove the stabilizer bar (Refer to 2 - SUSPENSION/FRONT/STABILIZER BAR - REMOVAL).



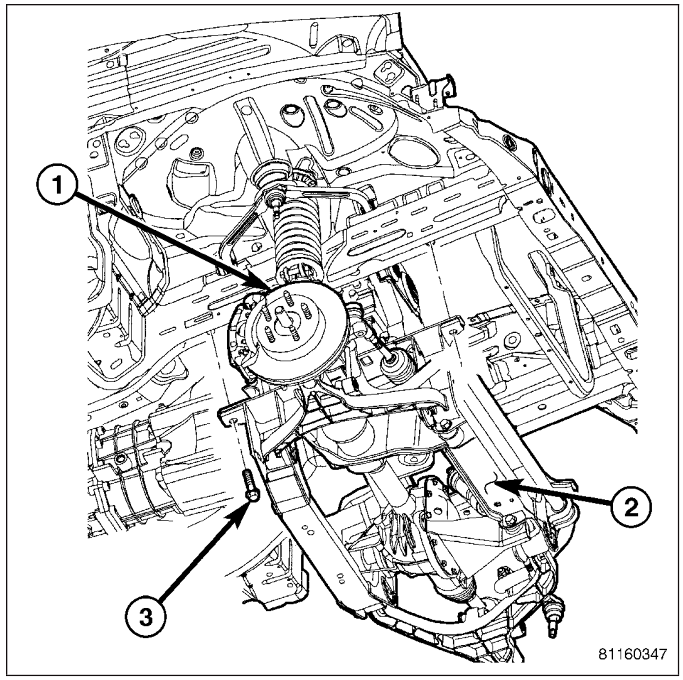
5. Remove the front axle, if equipped (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - REMOVAL).
6. Remove the power steering rack (Refer to 19 - STEERING/GEAR - REMOVAL).




7. Loosen the engine mount through bolts.

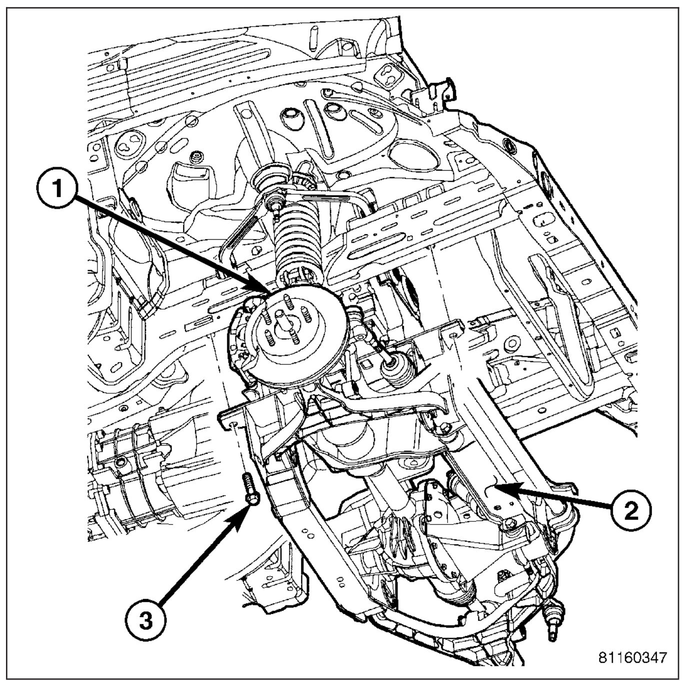


8. Support the engine cradle with a suitable lifting device.
9. Using a grease pencil or equivalent, mark the location of the engine support cradle.
10. Remove the engine cradle support bolts and remove the engine cradle.

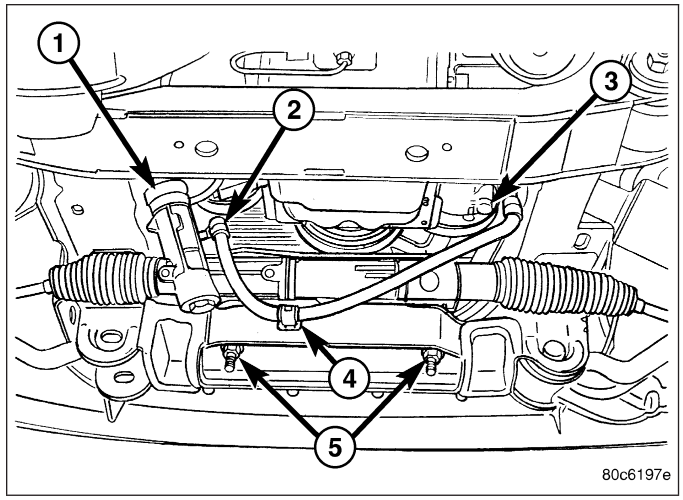



## INSTALLATION

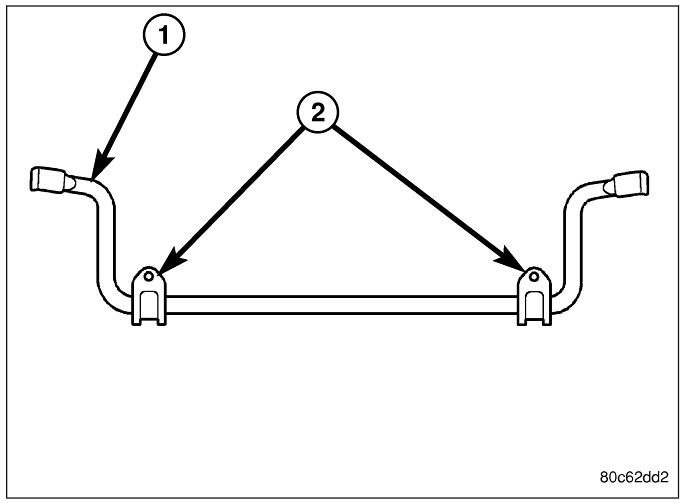
1. Raise and support the vehicle.
2. Using a suitable lifting device raise the engine cradle into the vehicle while lining up the engine mount through bolts.
3. Align the engine cradle to the marks made during removal and install the mounting and inner rail bolts.
4. Tighten the mounting front bolts to 122 N·m (90 ft. lbs.) and tighten the rear bolts to 115 N·m (85 ft. lbs.).
5. Tighten the engine mount through bolts to 88 N·m (65 ft. lbs.).



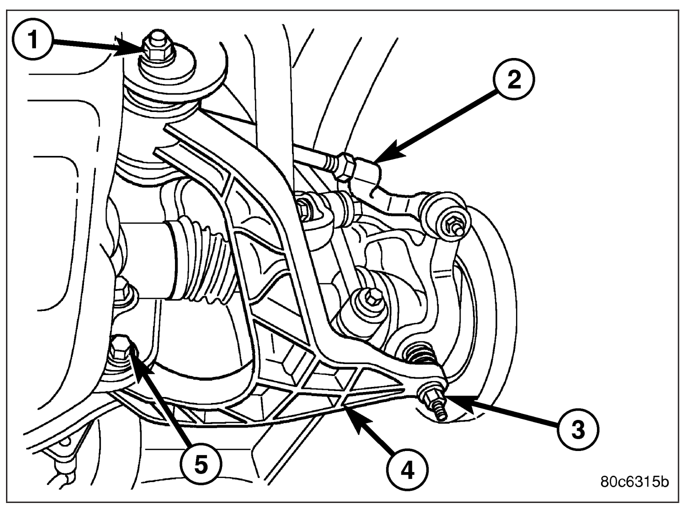
6. Install the power steering rack (Refer to 19 - STEERING/GEAR - INSTALLATION).



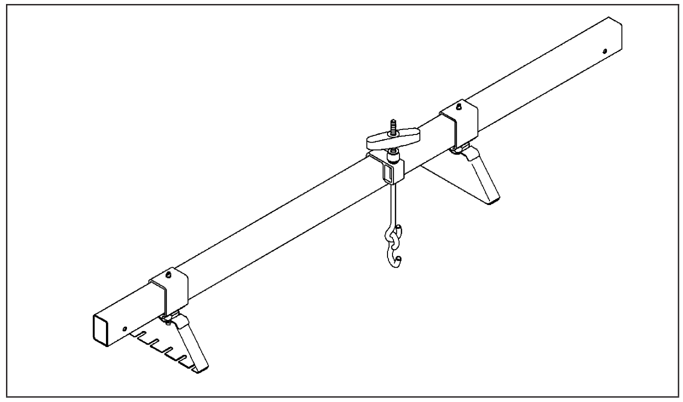

7. Install the front axle, if equipped (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - INSTALLATION).
8. Install the stabilizer bar (Refer to 2 - SUSPENSION/FRONT/STABILIZER BAR - INSTALLATION).




9. Install the lower control arms (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - INSTALLATION).



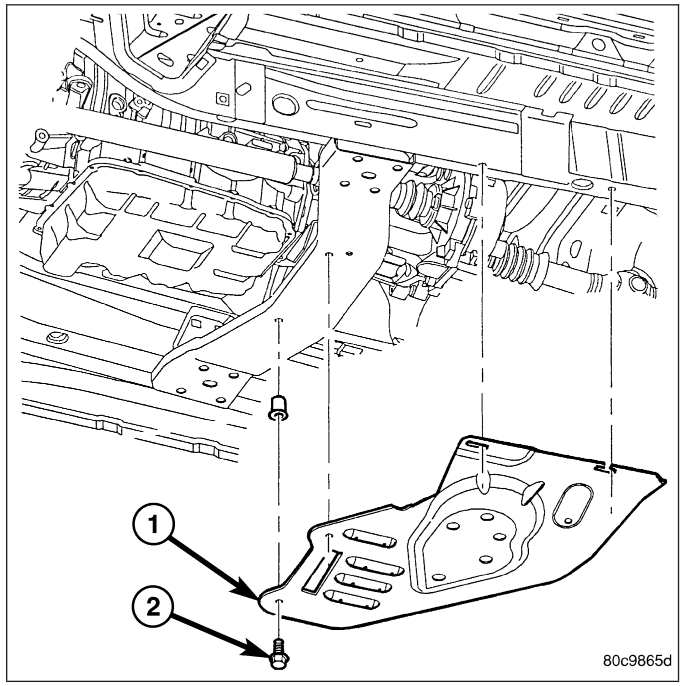
10. Lower the vehicle and remove the engine support tool.



# TRANSFER CASE SKID PLATE

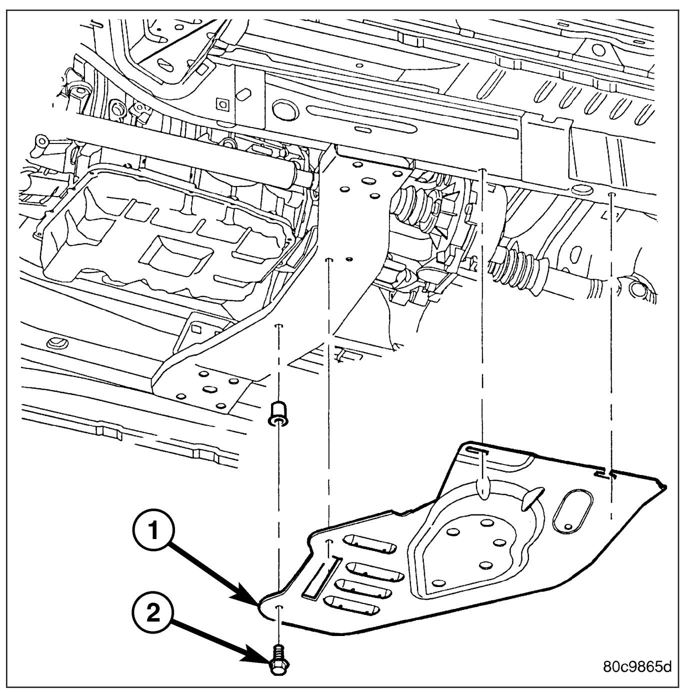
## REMOVAL

1. Remove the bolts (2) and remove the skid plate (1).




## INSTALLATION

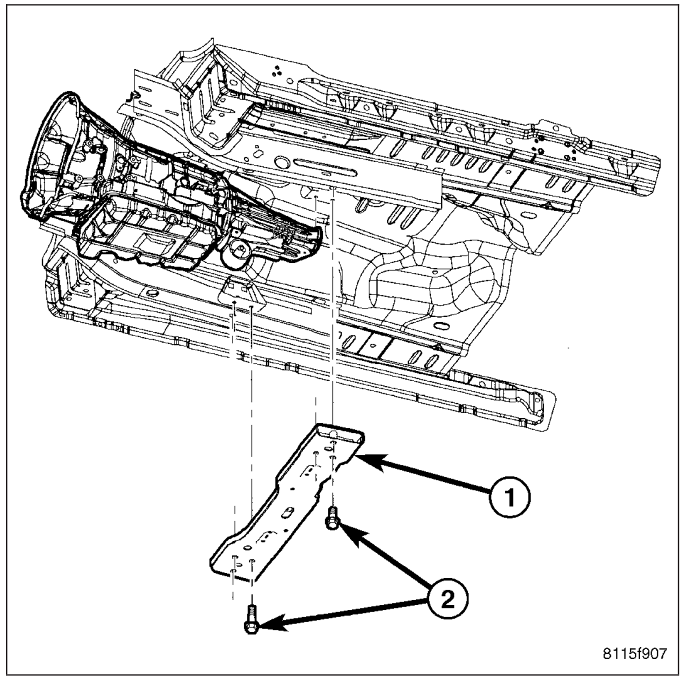
1. Install the skid plate.
2. Install the bolts and tighten to 34 N·m (25 ft. lbs.).



# REAR CROSSMEMBER

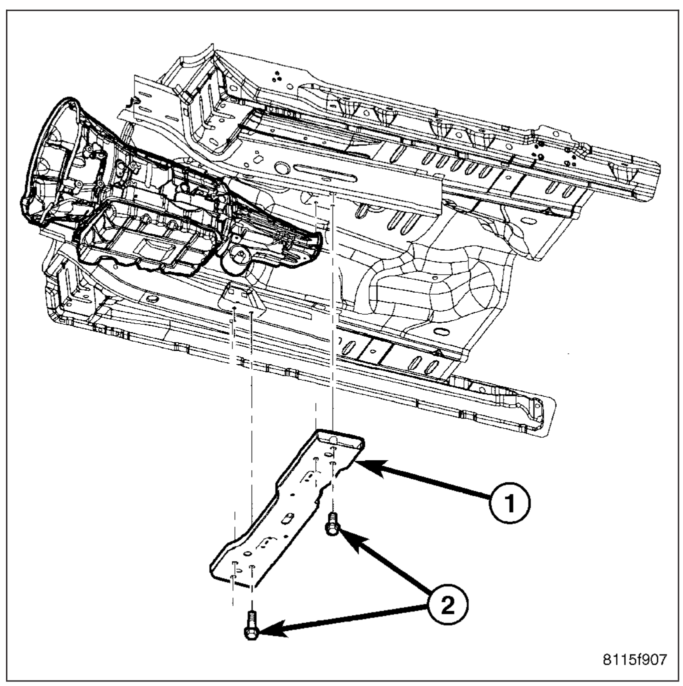
## REMOVAL

1. Raise and support the vehicle.
2. Support the transmission with a suitable lifting device.
3. Remove the transmission mount through bolt.
4. Remove the six crossmember bolts (2) and remove the crossmember.




## INSTALLATION

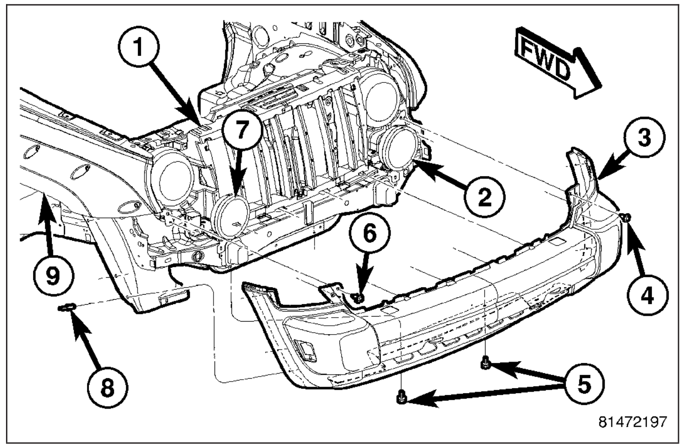
1. Install the crossmember and install the bolts.
2. Tighten the bolts to 47 N·m (35 ft. lbs.)
3. Install transmission mount through bolt and tighten to 88 N·m (65 ft. lbs.).



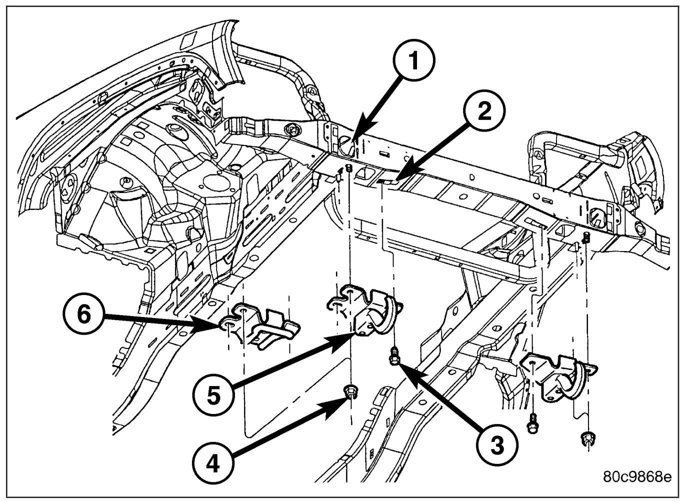
# FRONT TOW HOOK

## REMOVAL

**NOTE: Front fascia must be removed to replace the stud plate (Refer to 13 - FRAME & BUMPERS/ BUMPERS/FRONT FASCIA - REMOVAL).**

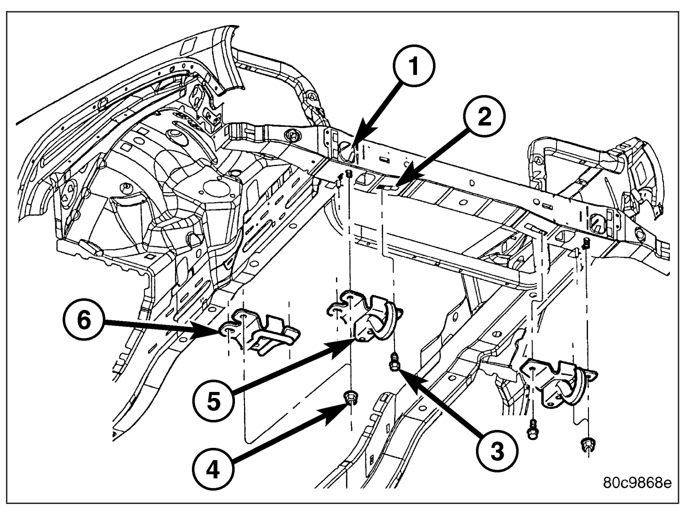



1. Remove the nuts and bolt and remove the tow eye/ hook.

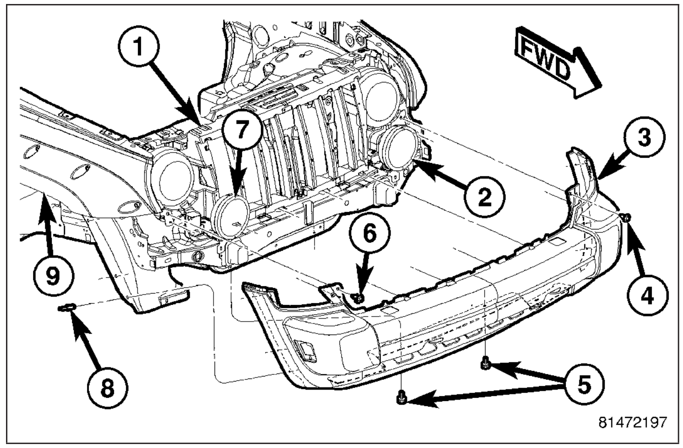



## INSTALLATION

1. Install the stud plate if previously removed.
2. Install the tow eye/hook.
3. Install the nuts and bolt and tighten to 61 N·m (45 ft. lbs.).



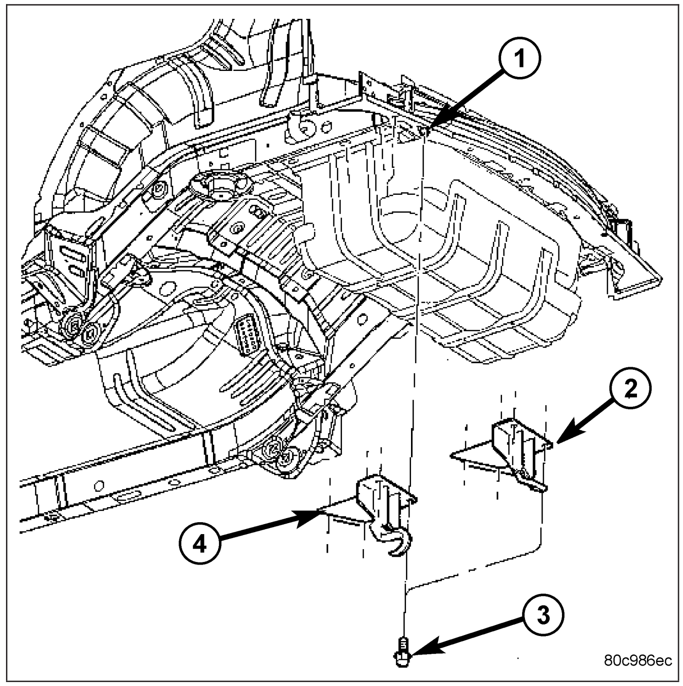
4. Install the front fascia if the stud plate was replaced (Refer to 13 - FRAME & BUMPERS/BUMPERS/ FRONT FASCIA - INSTALLATION).



# REAR TOW HOOK

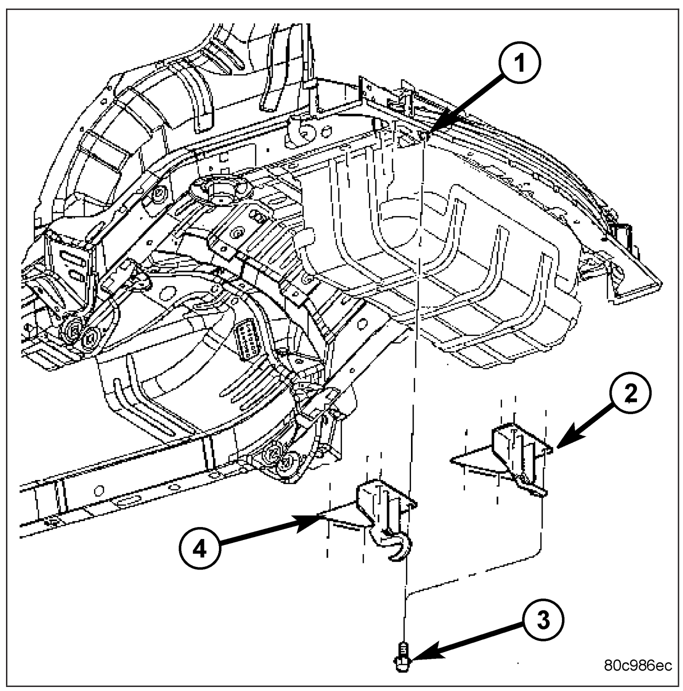
## REMOVAL

1. Remove the bolts and remove the tow hook/eye.




## INSTALLATION

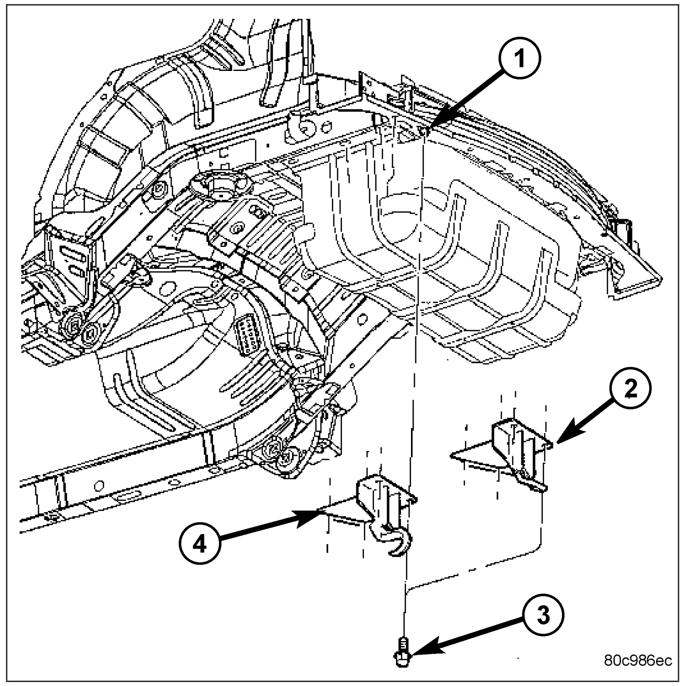
1. Install the tow hook/eye.
2. Install the bolts and tighten to 88 N·m (65 ft. lbs.).



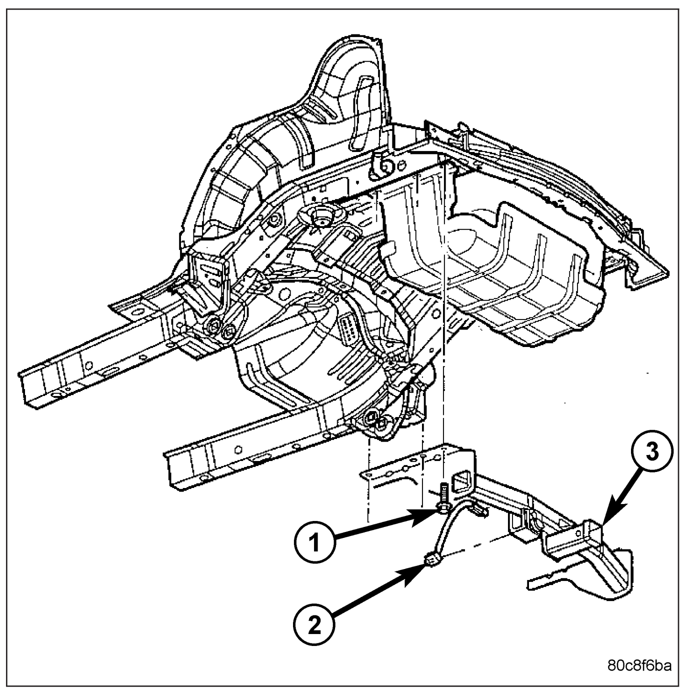
# TRAILER HITCH

## REMOVAL

1. Remove the tow hooks, if equipped (Refer to 13 - FRAME & BUMPERS/FRAME/REAR TOW HOOK - REMOVAL).

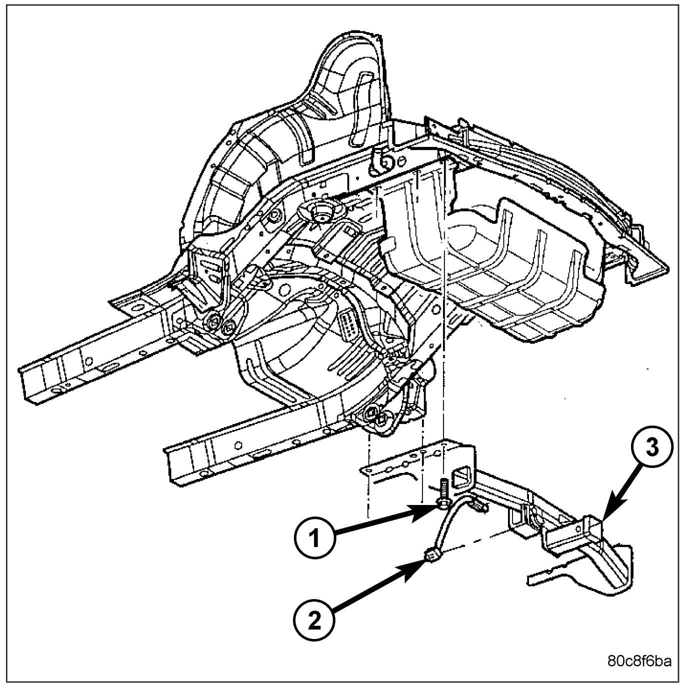



2. Disconnect trailer electrical connector.
3. Support the hitch with a suitable lifting device.
4. Remove the bolts and remove the trailer hitch.

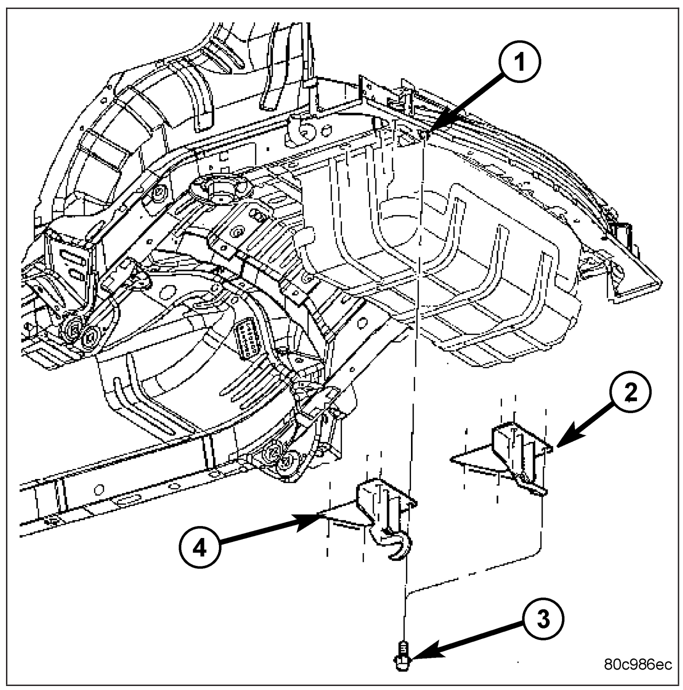


## INSTALLATION

1. Support the hitch with a suitable lifting device and install the hitch.
2. Install the bolts (1) and tighten to 88 N·m (65 ft. lbs.)
3. Connect the electrical connector.



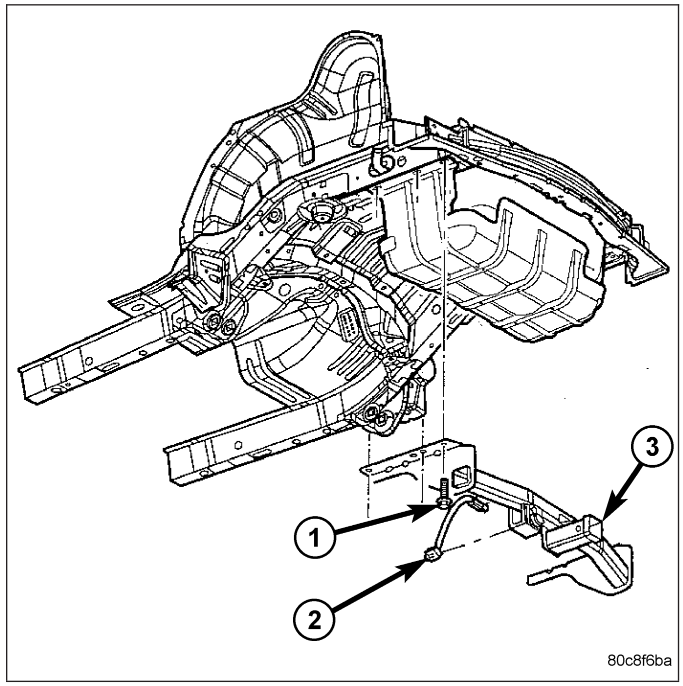

4. Install the tow hooks, if required (Refer to 13 - FRAME & BUMPERS/FRAME/REAR TOW HOOK - INSTALLATION).



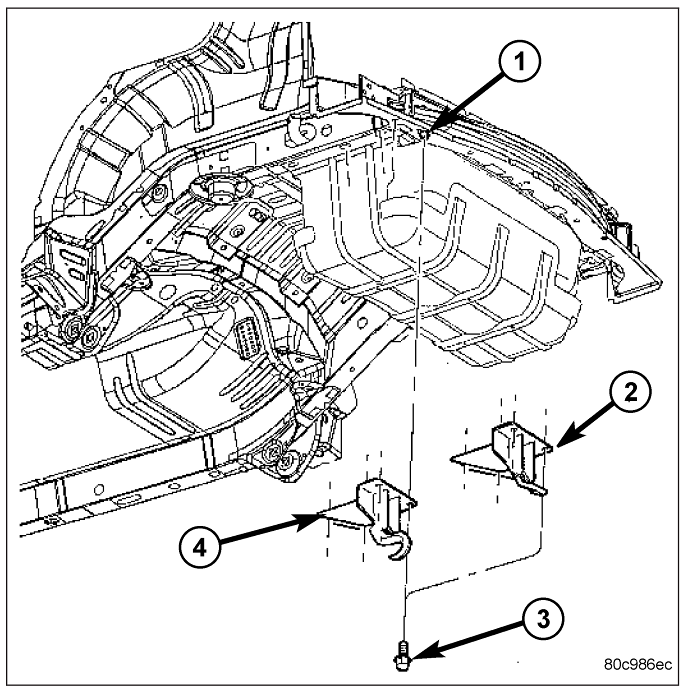
# FUEL TANK SKID PLATE

## REMOVAL

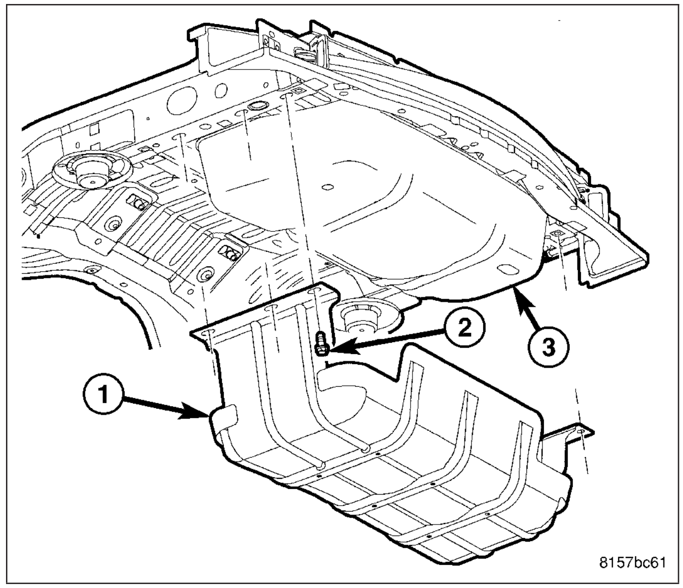
1. Raise and support the vehicle.
2. Support the skid plate with a suitable lifting device.
3. Remove the trailer hitch, if equipped (Refer to 13 - FRAME & BUMPERS/FRAME/TRAILER HITCH - REMOVAL).




4. Remove the tow hooks, if not previously removed (Refer to 13 - FRAME & BUMPERS/FRAME/REAR TOW HOOK - REMOVAL).

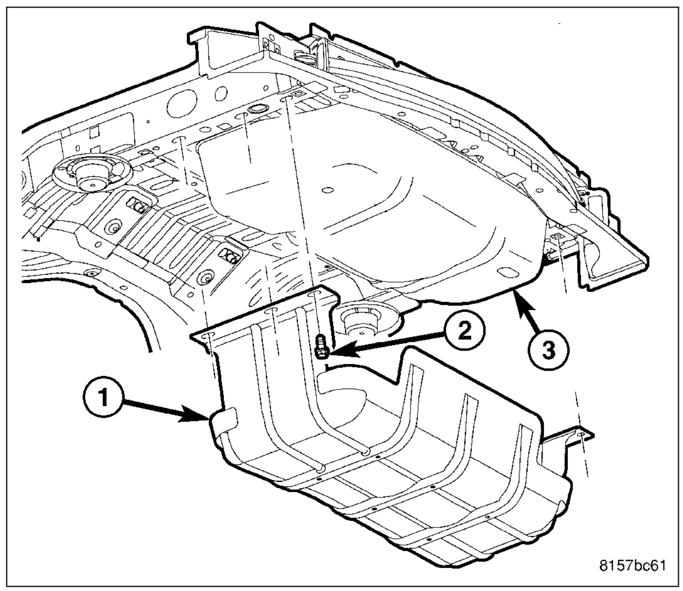


5. Remove the bolts and remove the fuel tank skid plate.

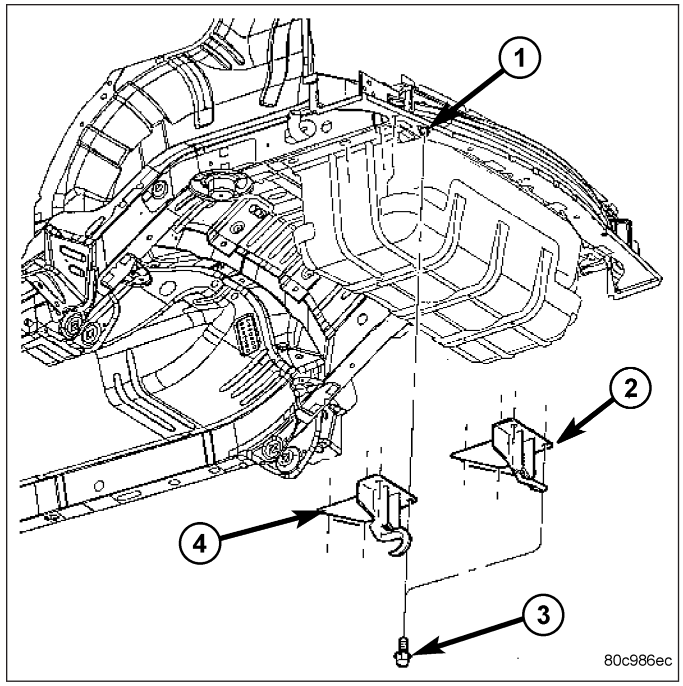



## INSTALLATION

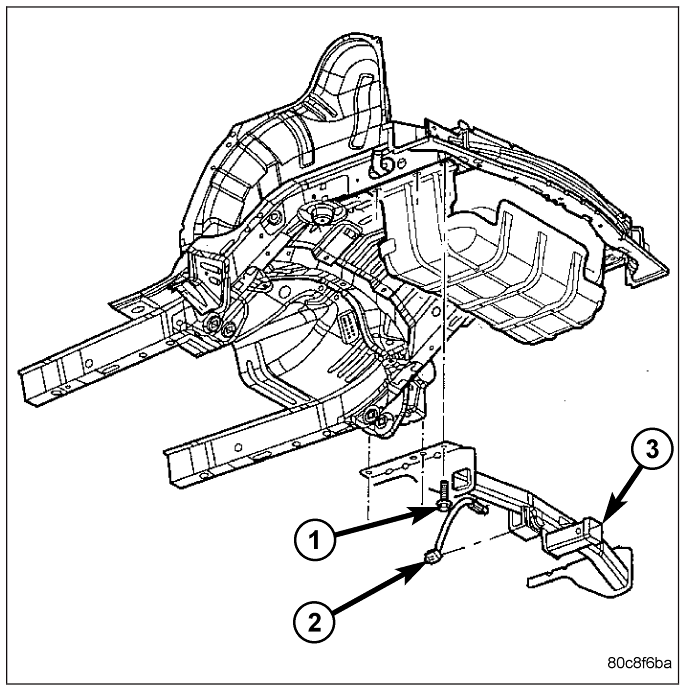
1. Install the skid plate and support with a suitable lifting device.



2. Install the tow hooks, if equipped (Refer to 13 - FRAME & BUMPERS/FRAME/REAR TOW HOOK - INSTALLATION).




3. Install the trailer hitch, if equipped (Refer to 13 - FRAME & BUMPERS/FRAME/TRAILER HITCH - INSTALLATION).
4. Install the bolts and tighten to 88 N·m (65 ft. lbs.).



# FUEL SYSTEM

## TABLE OF CONTENTS



## FUEL DELIVERY - 3.7L GAS

### TABLE OF CONTENTS

# FUEL DELIVERY - 3.7L GAS

## OPERATION

Fuel is picked up in the fuel tank by the fuel pump module. This module is located on the bottom of the fuel tank.

A fuel return system is provided within the fuel pump module using check valves. A separate fuel return line from the engine to the tank is not used.

The fuel pressure regulator and the main fuel filter are combined within the fuel pump module.

The fuel tank assembly consists of: the fuel tank, fuel pump module assembly, fuel pump module lock ring/gasket, ORVR components. (Refer to 25 - EMISSIONS CONTROL/EVAPORATIVE EMISSIONS/ORVR - DESCRIPTION)

A fuel filler/vent tube assembly using a pressure/vacuum, 1/4 turn fuel filler cap is used. A one-way check valve is installed into the tanks fuel fill fitting.

Also to be considered part of the fuel system is the evaporation control system and ORVR system. This is designed to reduce the emission of fuel vapors into the atmosphere.

Both fuel filters are designed for extended service. They do not require normal scheduled maintenance.

## STANDARD PROCEDURE

## FUEL SYSTEM PRESSURE RELEASE

**Use following procedure if the fuel injector rail is, or is not equipped with a fuel pressure test port.**

1. Remove fuel fill cap.
2. Remove fuel pump relay from Power Distribution Center (PDC). For location of relay, refer to label on underside of PDC cover.
3. Start and run engine until it stalls.
4. Attempt restarting engine until it will no longer run.
5. Turn ignition key to OFF position.

**CAUTION: Steps 1, 2, 3 and 4 must be performed to relieve high pressure fuel from within fuel rail. Do not attempt to use following steps to relieve this pressure as excessive fuel will be forced into a cylinder chamber.**

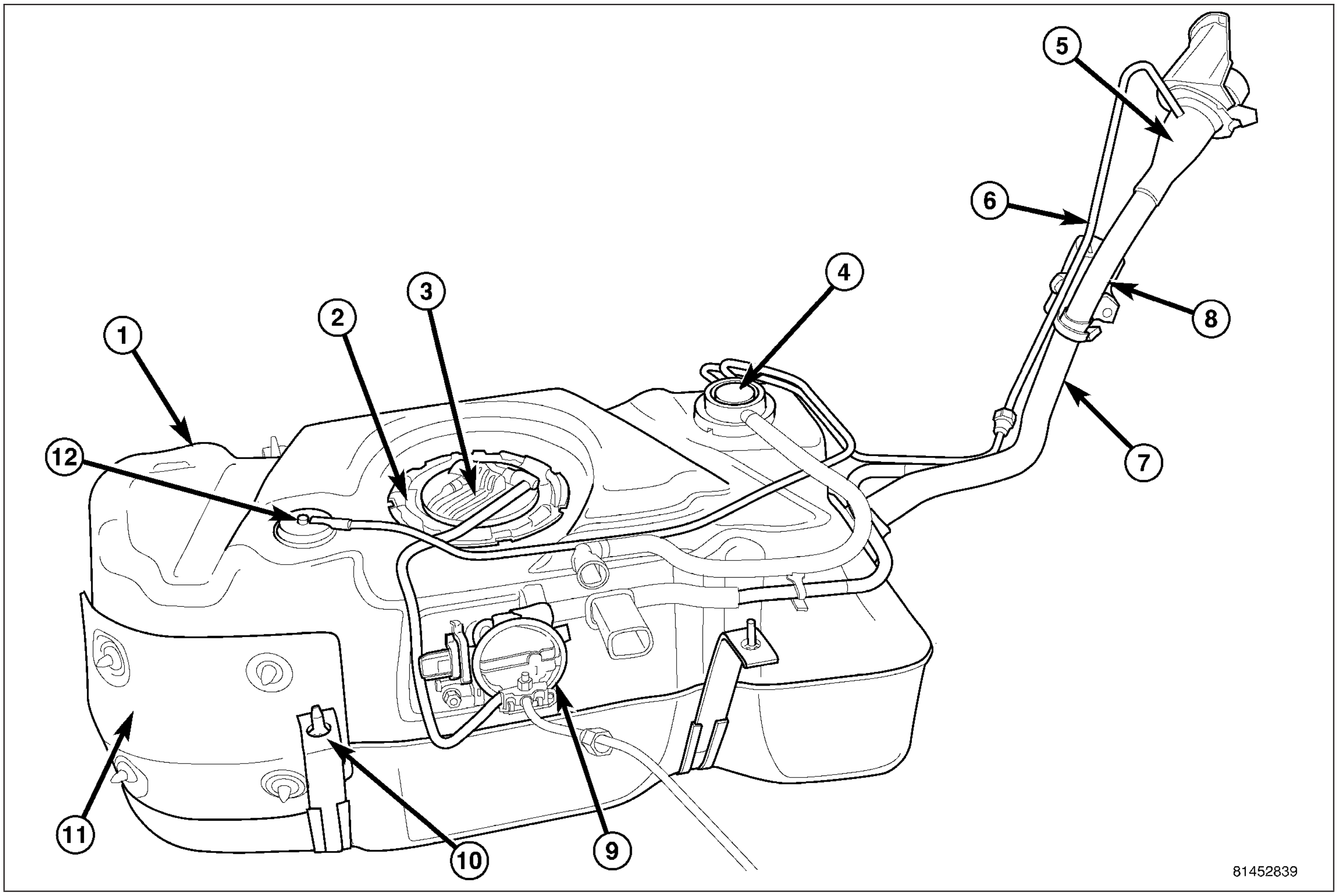
6. Unplug connector from any fuel injector.
7. Attach one end of a jumper wire with alligator clips (18 gauge or smaller) to either injector terminal.
8. Connect other end of jumper wire to positive side of battery.
9. Connect one end of a second jumper wire to remaining injector terminal.

**CAUTION: Powering an injector for more than a few seconds will permanently damage the injector.**

10. Momentarily touch other end of jumper wire to negative terminal of battery for no more than a few seconds.
11. Place a rag or towel below fuel line quick-connect fitting at fuel rail.
12. Disconnect quick-connect fitting at fuel rail. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE)
13. Return fuel pump relay to PDC.
14. One or more Diagnostic Trouble Codes (DTC's) may have been stored in PCM memory due to fuel pump relay removal. The DRB® scan tool must be used to erase a DTC.

## DRAINING FUEL TANK

**WARNING: The fuel system may be under constant fuel pressure even with the engine off. This pressure must be released before servicing fuel tank.**




Two different procedures may be used to drain fuel tank: through the fuel fill fitting on tank, or using a diagnostic scan tool.

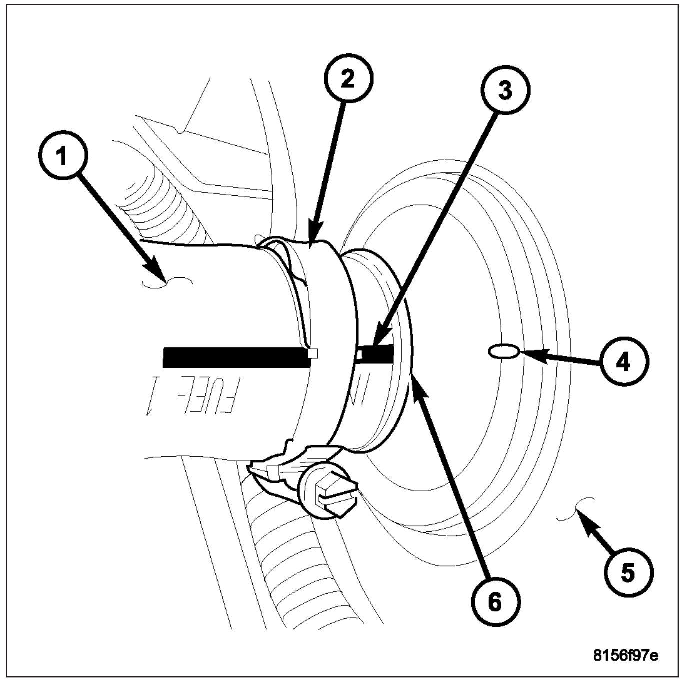
The quickest draining procedure involves removing the rubber fuel fill hose (7) from fuel tank fitting.

As an alternative procedure, the electric fuel pump may be activated allowing tank to be drained at fuel rail connection. Refer to appropriate scan tool for fuel pump activation procedures. Before disconnecting fuel line at fuel rail, release fuel pressure. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE) Attach end of Fuel Pressure Test Adapter 6631 or 6539 at fuel rail disconnection (tool number 6631 is used on 5/16" fuel lines while tool number 6539 is used on 3/8" fuel lines). Position opposite end of this hose tool to an approved gasoline draining station. Activate fuel pump and drain tank until empty.

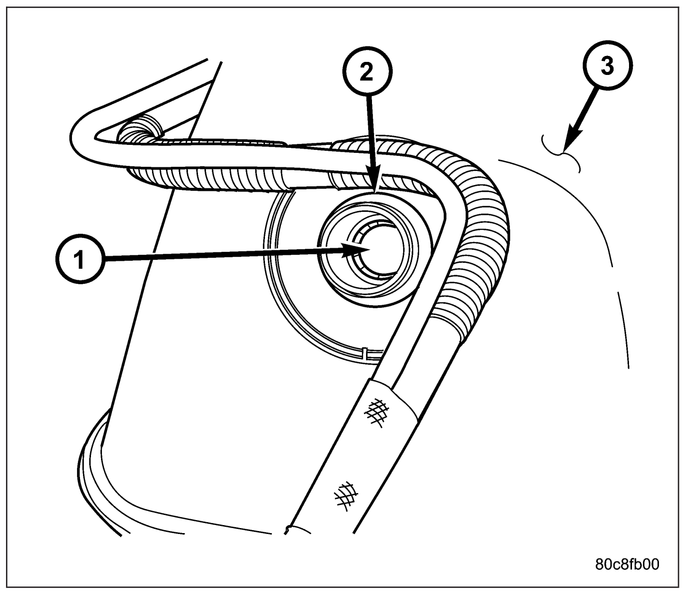
If electric fuel pump is not operating, fuel must be drained through fuel fill fitting at tank. Refer to following procedures.

1. Release fuel system pressure.
2. Raise vehicle.
3. If equipped, remove fuel tank skid plate.

4. Thoroughly clean area around fuel fill fitting (6) and rubber fuel fill hose (1) at side of fuel tank. After cleaning, loosen fuel fill hose clamp (2) at tank.
5. Before removing rubber hose (1) from fitting, note hose orientation while referring to index mark (3).




6. Disconnect rubber fuel fill hose at fuel tank fitting (2). Using an approved gas holding tank, drain fuel tank through this fitting.




## SPECIFICATIONS

## FUEL SYSTEM PRESSURE

**If equipped with NGC Powertrain Control Module using 4 electrical connectors:** The correct fuel pressure 400 kPa +/- 34 kPa (58 psi +/- 5 psi).

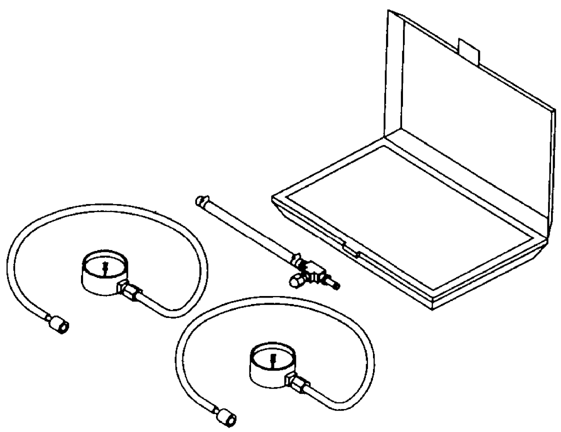
## TORQUE

| DESCRIPTION | N-m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Accelerator Pedal Bracket Mounting Nuts | 12 | - | 105 |
| Crankshaft Position Sensor - 2.4L | 28 | 21 | - |
| Crankshaft Position Sensor - 3.7L | 28 | 21 | - |
| Camshaft Position Sensor - 2.4L | 12 | - | 106 |
| Camshaft Position Sensor - 3.7L | 12 | - | 106 |
| Engine Coolant Temperature Sensor | 11 | - | 96 |
| EVAP Canister-to-Body Bolts | 48 | 35 | - |
| EVAP Canister-to-Canis. Bracket Bolt/Nut | 11 | - | 100 |
| Fuel Filler Hose Clamp at Tank | 3 | - | 30 |
| Fuel Filler Housing-to-Body Screws | 2 | - | 17 |
| Fuel Filler Tube Clamp | 3.5 | - | 30 |
| Fuel Pump Module Access Plate Nuts | 3 | - | 26 |
| Fuel Rail Mounting Bolts - 3.7L | 11 | - | 100 |
| Fuel Rail Mounting Bolts - 2.4L | 28 | - | 250 |
| Fuel Tank Heat Sheild Nuts | 5.5 | - | 49 |
| Fuel Tank Mounting Strap Bolts | 61 | 45 | - |
| Fuel Tank Skid Plate and Trailer Hitch | 88 | 65 | - |
| IAC Motor Mounting Screws | 7 | - | 60 |
| Leak Detection Pump Mounting Bracket-to-Fuel Tank Nuts | 5.5 | - | 49 |
| Leak Detection Pump-to-Bracket Nuts | 1.2 | - | 11 |
| Map Sensor Mounting Screws | 3 | - | 25 |
| O2 Sensor | 30 | 22 | - |
| PCM-to-Mounting Bracket Mounting Screws | 4 | - | 35 |
| Power Steering Pressure Switch | 14-22 | - | 124-195 |
| TPS Mounting Screws | 7 | - | 60 |
| Throttle Body Mounting Bolts | 12 | - | 105 |

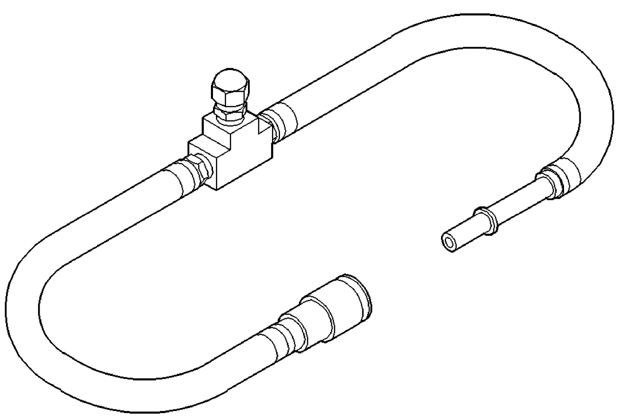
| DESCRIPTION | N-m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Oxygen Sensors | 30 | 22 | - |

## SPECIAL TOOLS

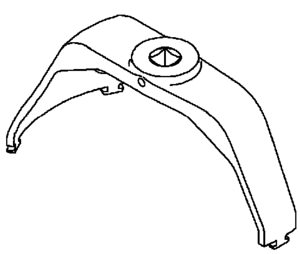
## FUEL SYSTEM

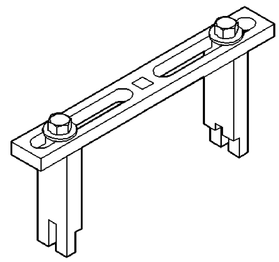


*TEST KIT, FUEL PRESSURE - 5069*

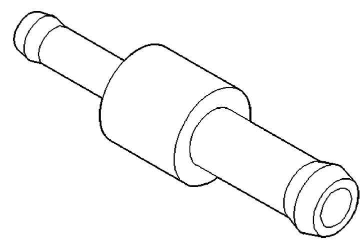


*ADAPTERS, FUEL PRESSURE TEST - 6539 or 6631*

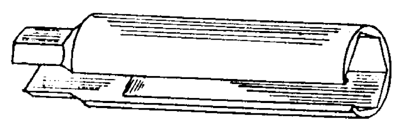




*SPANNER WRENCH - 6856*



*FITTING, AIR METERING - 6714*



*O2S (OXYGEN SENSOR) REMOVER/INSTALLER - C4907*

# VALVE-FLOW MANAGEMENT

## DESCRIPTION

The flow management valve is a part of the ORVR system. This plastic valve is placed inline between the fuel tank vent fitting and the EVAP canister. It is located on top of the fuel tank.

## OPERATION

The flow management valve is one of the components used in the ORVR system. The valve meters the flow of fuel vapors to the EVAP canister during vehicle run and refueling. Pressure from the tank during refueling opens the main port valve and allows vapors to enter the EVAP canister. During vehicle run, the vapors are metered through an orifice to the EVAP canister. It is also used as a liquid separator to keep liquid fuel out of the EVAP canister.

# FILTER-FUEL

## DESCRIPTION

The fuel filter and fuel pressure regulator are combined within the fuel pump module assembly. They are not serviceable.

# SENSOR-FUEL LEVEL SENDING UNIT

## DESCRIPTION

The fuel gauge sending unit (fuel level sensor) is attached to the fuel pump module. The sending unit consists of a float, an arm, and a variable resistor track (card).

## OPERATION

The fuel pump module has 4 different circuits (wires). Two of these circuits are used for the fuel gauge sending unit for fuel gauge operation, and for certain OBD II emission requirements. The other 2 wires are used for electric fuel pump operation.

**For Fuel Gauge Operation:** A constant current source of approximately 32 milliamps is supplied to the resistor track on the fuel gauge sending unit. This is fed directly from the Powertrain Control Module (PCM). **NOTE: For diagnostic purposes, this 12V power source can only be verified with the circuit opened (fuel pump module electrical connector unplugged). With the connectors plugged, output voltages will vary from about 0.6 volts at FULL, to about 8.6 volts at EMPTY (about 8.6 volts at EMPTY for Jeep models, and about 7.0 volts at EMPTY for Dodge Truck models).** The resistor track is used to vary the voltage (resistance) depending on fuel tank float level. As fuel level increases, the float and arm move up, which decreases voltage. As fuel level decreases, the float and arm move down, which increases voltage. The varied voltage signal is returned back to the PCM through the sensor return circuit.

Both of the electrical circuits between the fuel gauge sending unit and the PCM are hard-wired (not multi-plexed). After the voltage signal is sent from the resistor track, and back to the PCM, the PCM will interpret the resistance (voltage) data and send a message across the multi-plex bus circuits to the instrument panel cluster. Here it is translated into the appropriate fuel gauge level reading. Refer to Instrument Panel for additional information.

**For OBD II Emission Monitor Requirements:** The PCM will monitor the voltage output sent from the resistor track on the sending unit to indicate fuel level. The purpose of this feature is to prevent the OBD II system from recording/ setting false misfire and fuel system monitor diagnostic trouble codes. The feature is activated if the fuel level in the tank is less than approximately 15 percent of its rated capacity. If equipped with a Leak Detection Pump (EVAP system monitor), this feature will also be activated if the fuel level in the tank is more than approximately 85 percent of its rated capacity.

# LINES-FUEL

## DESCRIPTION

(Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE)

**WARNING: The fuel system may be under a constant pressure (even with the engine off). Before servicing any fuel system hoses, fittings, lines, or most components, fuel system pressure must be released. Refer to the fuel system pressure release procedure.**

The lines/tubes/hoses used on fuel injected vehicles are of a special construction. This is due to the higher fuel pressures and the possibility of contaminated fuel in this system. If it is necessary to replace these lines/tubes/hoses, only those marked EFM/EFI may be used.

**If equipped:** The hose clamps used to secure rubber hoses on fuel injected vehicles are of a special rolled edge construction. This construction is used to prevent the edge of the clamp from cutting into the hose. Only these rolled edge type clamps may be used in this system. All other types of clamps may cut into the hoses and cause high-pressure fuel leaks.

Use new original equipment type hose clamps.

# FITTING-QUICK CONNECT

## DESCRIPTION

Different types of quick-connect fittings are used to attach the various fuel system components, lines and tubes. These are: a single-button type, a two-button type, a pinch type, a single-tab type, a two-tab type or a plastic retainer ring type. Some are equipped with safety latch clips. Some may require the use of a special tool for disconnection and removal. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE)

**CAUTION: Before separating a quick-connect fitting, pay attention to what type of fitting is being used by referring to Quick-Connect Fitting Removal. This will prevent unnecessary fitting or fitting latch breakage.**

**CAUTION: The interior components (O-rings, clips) of quick-connect fittings are not serviced separately, but new plastic spacers and latches are available for some types. If service parts are not available, do not attempt to repair the damaged fitting or fuel line (tube). If repair is necessary, replace the complete fuel line (tube) assembly.**

## STANDARD PROCEDURE - QUICK-CONNECT FITTINGS

Different types of quick-connect fittings are used to attach the various fuel system components, lines and tubes. These are: a single-button type, a two-button type, a pinch type, a single-tab type, a two-tab type or a plastic retainer ring type. Some are equipped with safety latch clips. Some may require the use of a special tool for disconnection and removal.

## DISCONNECTING

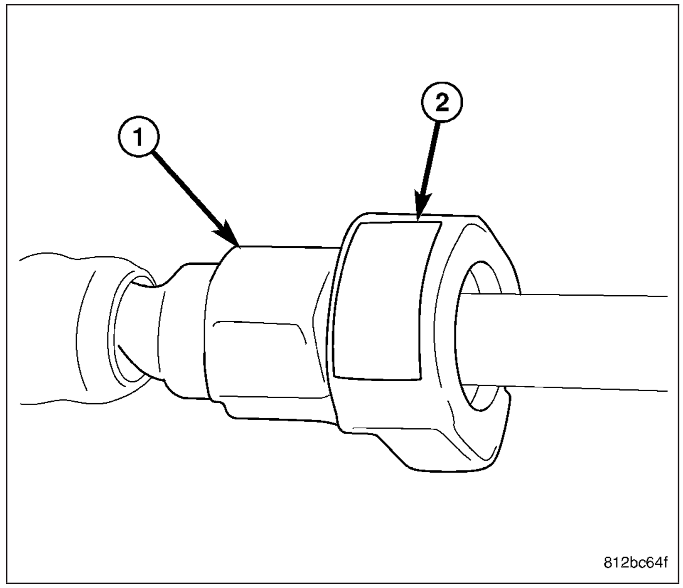
**WARNING: The fuel system is under a constant pressure (even with engine off). Before servicing any fuel system hose, fitting or line, fuel system pressure must be released. Refer to fuel system pressure release procedure.**

**CAUTION: Before separating a quick-connect fitting, pay attention to what type of fitting is being used by referring to Quick-Connect Fitting Removal. This will prevent unnecessary fitting or fitting latch breakage.**

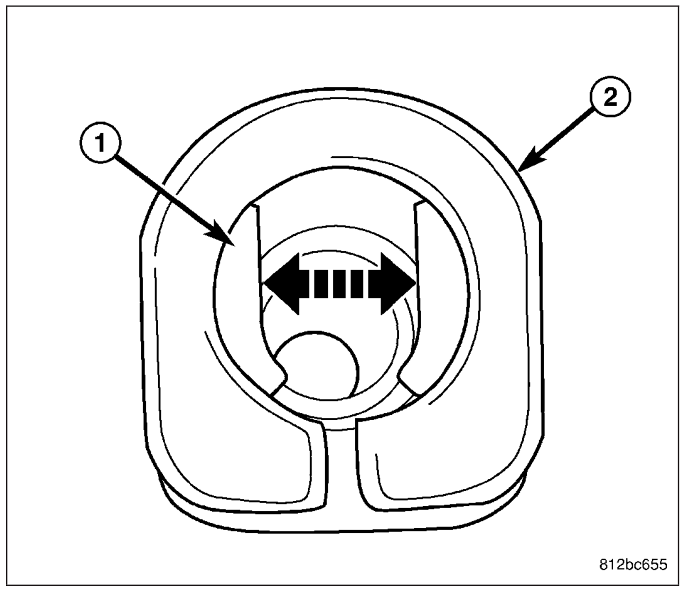
**CAUTION: The interior components (O-rings, clips) of quick-connect fittings are not serviced separately, but new plastic spacers and latches are available for some types. If service parts are not available, do not attempt to repair the damaged fitting or fuel line (tube). If repair is necessary, replace the complete fuel line (tube) assembly.**

1. Perform fuel pressure release procedure. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE)
2. Disconnect negative battery cable from battery.
3. Clean fitting of any foreign material before disassembly.

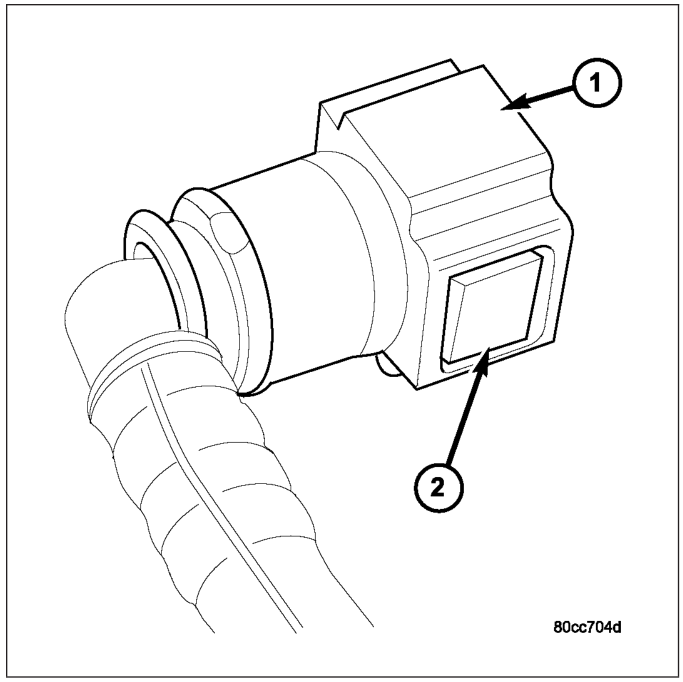
4. **Single–Button Type Fitting:** This type of fitting is equipped with a single push-button (2) located on the quick-connect fitting.



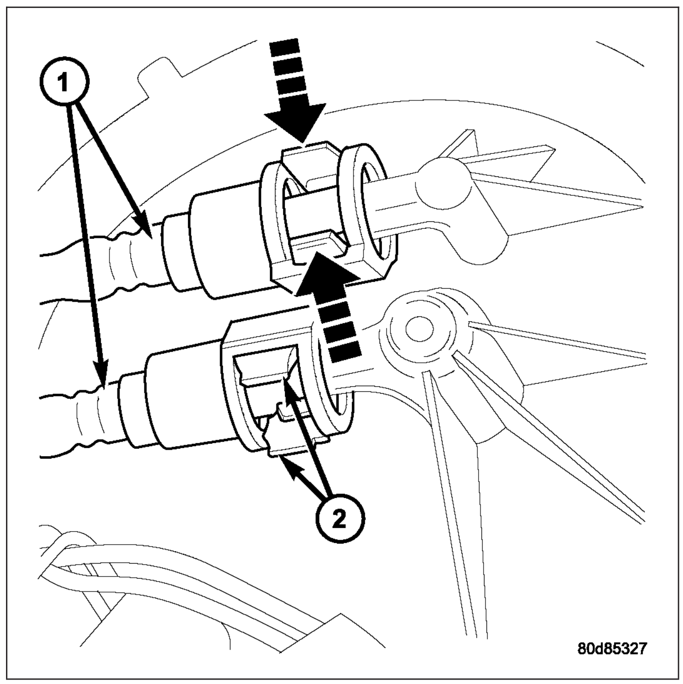

5. The push-button is attached to two internal latches (1). To disconnect, press on push-button with your thumb and unlatch fitting from fuel line. Tools are not required for disconnection. **DO NOT ATTEMPT TO PRY OR PULL UP ON PUSH-BUTTON. LATCHES WILL BE BROKEN.**



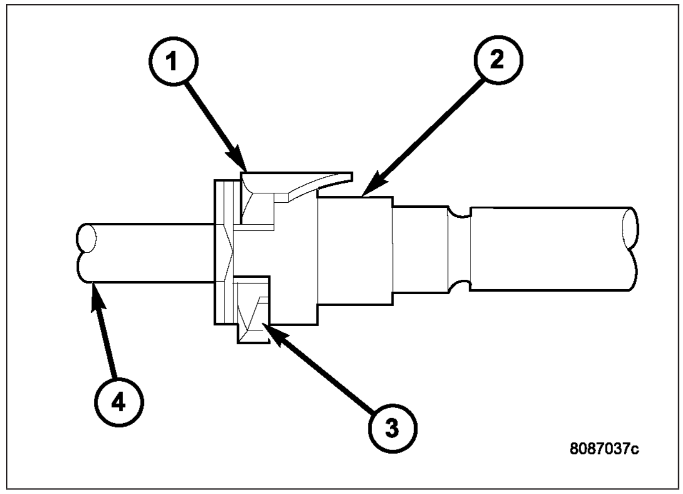
6. Perform fuel pressure release procedure. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE)
7. Disconnect negative battery cable from battery.
8. Clean fitting of any foreign material before disassembly.
9. **2–Button Type Fitting:** This type of fitting (1) is equipped with a push-button located on each side of quick-connect fitting (2). Press on both buttons simultaneously for removal. Tools are not required for disconnection.



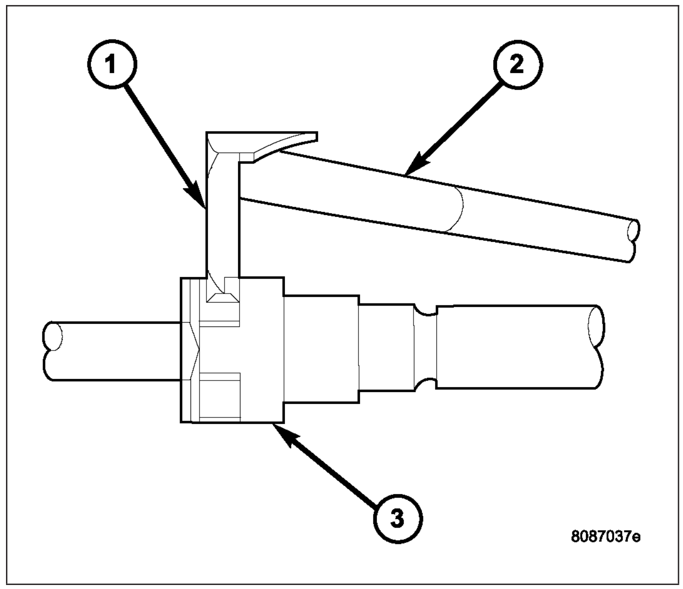

10. **Pinch-Type Fitting:** This fitting (1) is equipped with two finger tabs (2). Pinch both tabs together while removing fitting. Tools are not required for disconnection.



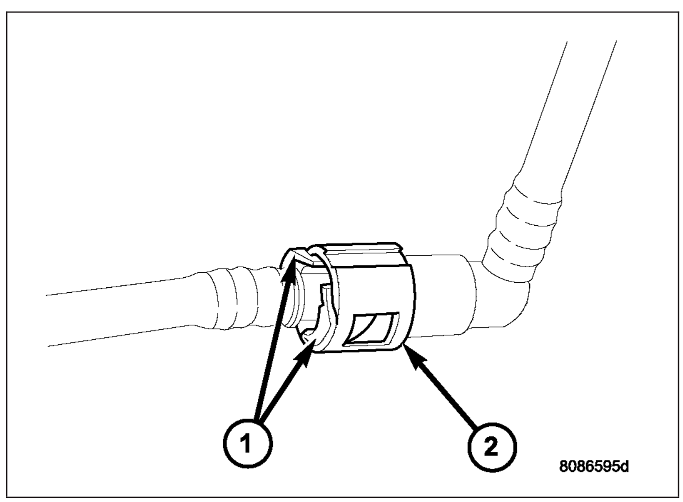
11. **Single-Tab Type Fitting:** This type of fitting (3) is equipped with a single pull tab (1). The tab is removable. After tab is removed, quick-connect fitting can be separated from fuel system component. Tools are not required for disconnection.




12. Press release tab on side of fitting to release pull tab (1). **If release tab is not pressed prior to releasing pull tab, pull tab will be damaged.**
13. While pressing release tab on side of fitting, use screwdriver (2) to pry up pull tab.
14. Raise pull tab until it separates from quick-connect fitting.




15. **Two-Tab Type Fitting:** This type of fitting (2) is equipped with tabs located on both sides of fitting (1). The tabs are supplied for disconnecting quick-connect fitting from component being serviced.
    a. To disconnect quick-connect fitting, squeeze plastic retainer tabs (1) against sides of quick-connect fitting with your fingers. Tool use is not required for removal and may damage plastic retainer.
    b. Pull fitting from fuel system component being serviced.
    c. The plastic retainer will remain on component being serviced after fitting is disconnected. The O-rings and spacer will remain in quick-connect fitting connector body.

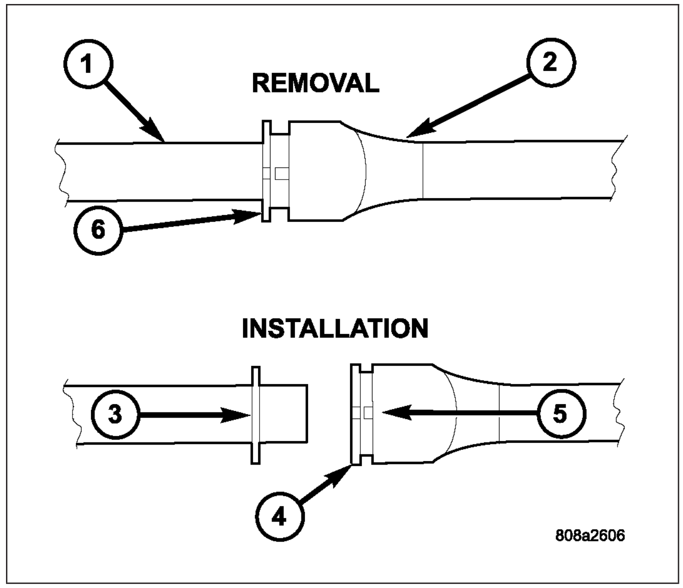


16. **Plastic Retainer Ring Type Fitting:** This type of fitting can be identified by the use of a full-round plastic retainer ring (4) usually black in color.

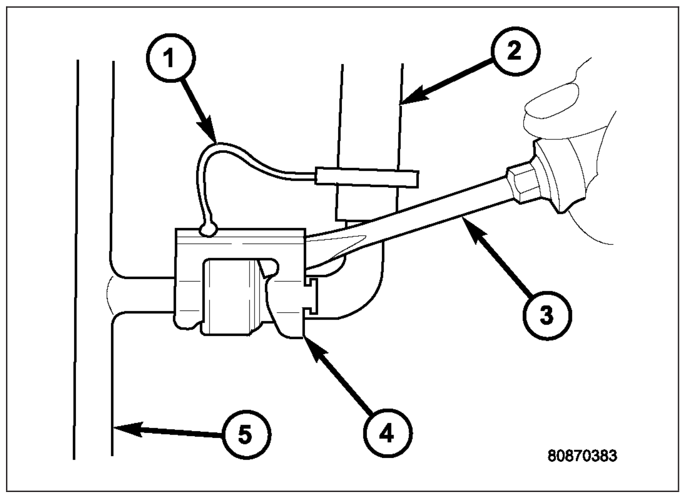
    a. To release fuel system component from quick-connect fitting, firmly push fitting towards component being serviced while firmly pushing plastic retainer ring into fitting (6). With plastic ring depressed, pull fitting from component. **The plastic retainer ring must be pressed squarely into fitting body. If this retainer is cocked during removal, it may be difficult to disconnect fitting. Use an open-end wrench on shoulder of plastic retainer ring to aid in disconnection.**

    b. After disconnection, plastic retainer ring will remain with quick-connect fitting connector body.

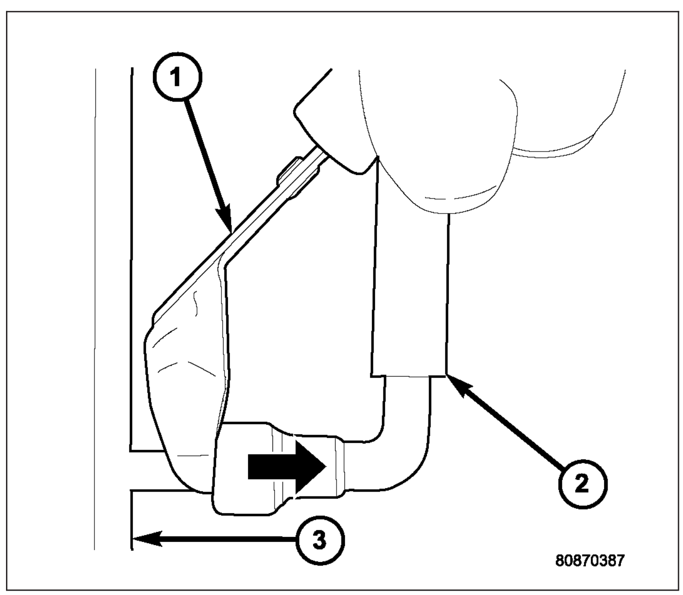
    c. Inspect fitting connector body, plastic retainer ring and fuel system component for damage. Replace as necessary.



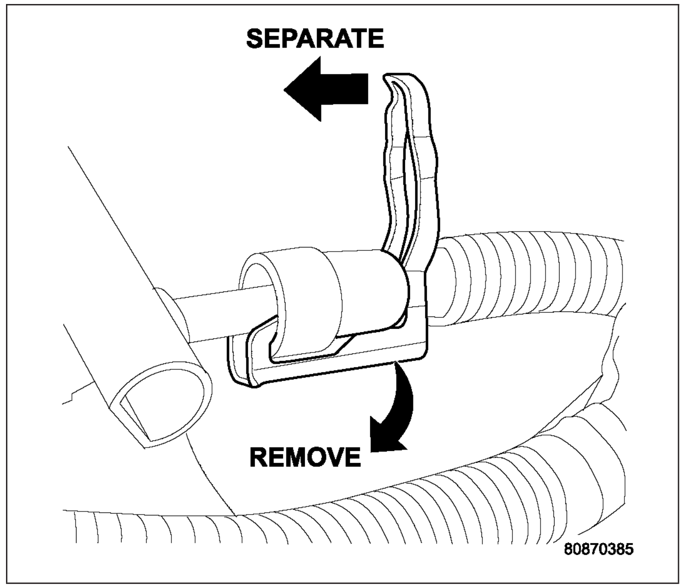

17. **Latch Clips - Type 1:** Depending on vehicle model and engine, 2 different types of safety latch clips are used. Type-1 (4) is tethered to fuel line and type-2 is not. A tool will be necessary to disconnect fuel line after latch clip is removed. The latch clip may be used on certain fuel line/fuel rail connection, or to join fuel lines together.
18. Pry up on latch clip with a screwdriver (3).
19. Slide latch clip toward fuel rail while lifting with screwdriver.



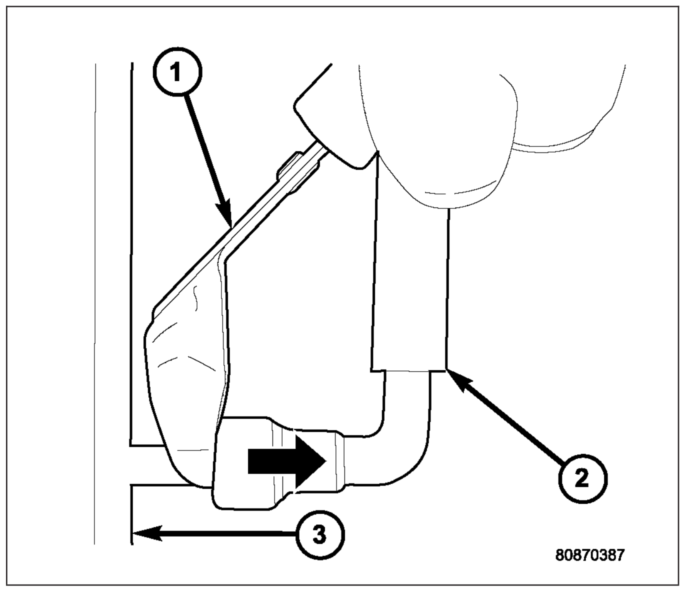

20. Insert fuel line removal tool (Snap-On number FIH 9055-1 or equivalent) into fuel line (1). Use tool to release locking fingers in end of line.
21. With tool still inserted, pull fuel line from fuel rail.
22. After disconnection, locking fingers will remain within quick-connect fitting at end of fuel line.
23. Disconnect quick-connect fitting from fuel system component being serviced.



24. **Latch Clips - Type 2:** Depending on vehicle model and engine, 2 different types of safety latch clips are used. Type-1 is tethered to fuel line and type-2 is not. A tool will be necessary to disconnect fuel line after latch clip is removed. The latch clip may be used on certain fuel line/fuel rail connection, or to join fuel lines together.
25. Type 2: Separate and unlatch 2 small arms (1) on end of clip and swing away from fuel line.
26. Slide latch clip toward fuel rail while lifting with screwdriver.




27. Insert fuel line removal tool (Snap-On number FIH 9055-1 or equivalent) into fuel line (1). Use tool to release locking fingers in end of line.
28. With tool still inserted, pull fuel line from fuel rail.
29. After disconnection, locking fingers will remain within quick-connect fitting at end of fuel line.
30. Disconnect quick-connect fitting from fuel system component being serviced.

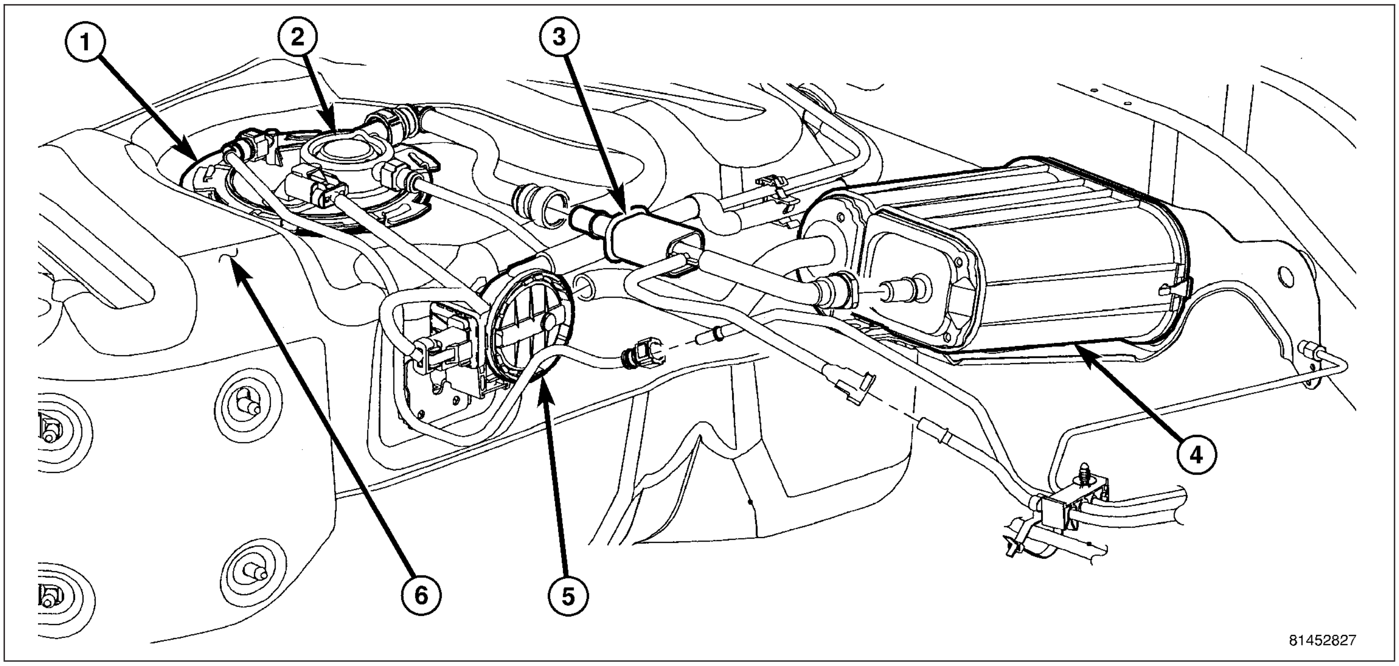



## CONNECTING

1. Inspect quick-connect fitting body and fuel system component for damage. Replace as necessary.
2. Prior to connecting quick-connect fitting to component being serviced, check condition of fitting and component. Clean parts with a lint-free cloth. Lubricate with clean engine oil.
3. Insert quick-connect fitting into fuel tube or fuel system component until built-on stop on fuel tube or component rests against back of fitting.
4. Continue pushing until a click is felt.
5. Single-tab type fitting: Push new tab down until it locks into place in quick-connect fitting.
6. Verify a locked condition by firmly pulling on fuel tube and fitting (15-30 lbs.).
7. Latch Clip Equipped: Install latch clip (snaps into position). **If latch clip will not fit, this indicates fuel line is not properly installed to fuel rail (or other fuel line). Recheck fuel line connection.**
8. Connect negative cable to battery.
9. Start engine and check for leaks.

# REGULATOR-FUEL PRESSURE

## DESCRIPTION




The fuel pressure regulator is located on the top of the fuel pump module assembly (2) , and is non-serviceable.

## OPERATION

The fuel pressure regulator is a mechanical device that is not controlled by engine vacuum or the Powertrain Control Module (PCM).

**JTEC Powertrain Control Module:** The regulator is calibrated to maintain fuel system operating pressure of approximately 339 kPa +/- 34 kPa (49.2 psi +/- 5 psi) at the fuel injectors if equipped with a JTEC powertrain control module. **NGC powertrain control module:** The regulator is calibrated to maintain fuel system operating pressure of approximately 400 kPa +/- 34 kPa (58 psi +/- 2 psi) at the fuel injectors if equipped with an NGC powertrain control module. The regulator contains a diaphragm, calibrated springs and a fuel return valve.

**Fuel Flow:** Fuel migrates into the fuel pump module reservoir through a one-way check valve located on the bottom of the module. This check valve prevents the reservoir from running empty such as when going up or down hills with a low amount of fuel in the tank. If fuel pressure at the pressure regulator exceeds approximately 49 psi (JTEC module) or 58psi (NGC module), an internal diaphragm within the regulator closes, and excess fuel is routed through a second fitting on the main fuel filter, and back into the fuel tank (the fuel pressure regulator is installed into the return side of the system). Pressure regulated fuel is then delivered from the third fitting on the fuel filter, up to and through the fuel rail, and on to the fuel injectors.

The fuel pressure regulator also acts as a check valve to maintain some fuel pressure when the engine is not operating. This will help to start the engine. A second check valve is located at the outlet of the fuel pump module housing.

A separate fuel return line from the engine is not used with this system.

# PUMP-FUEL

## DESCRIPTION

The electric fuel pump is located inside of the fuel pump module. A 12 volt, permanent magnet, electric motor powers the fuel pump. The electric fuel pump is not a separate, serviceable component.

## OPERATION

Voltage to operate the electric pump is supplied through the fuel pump relay.

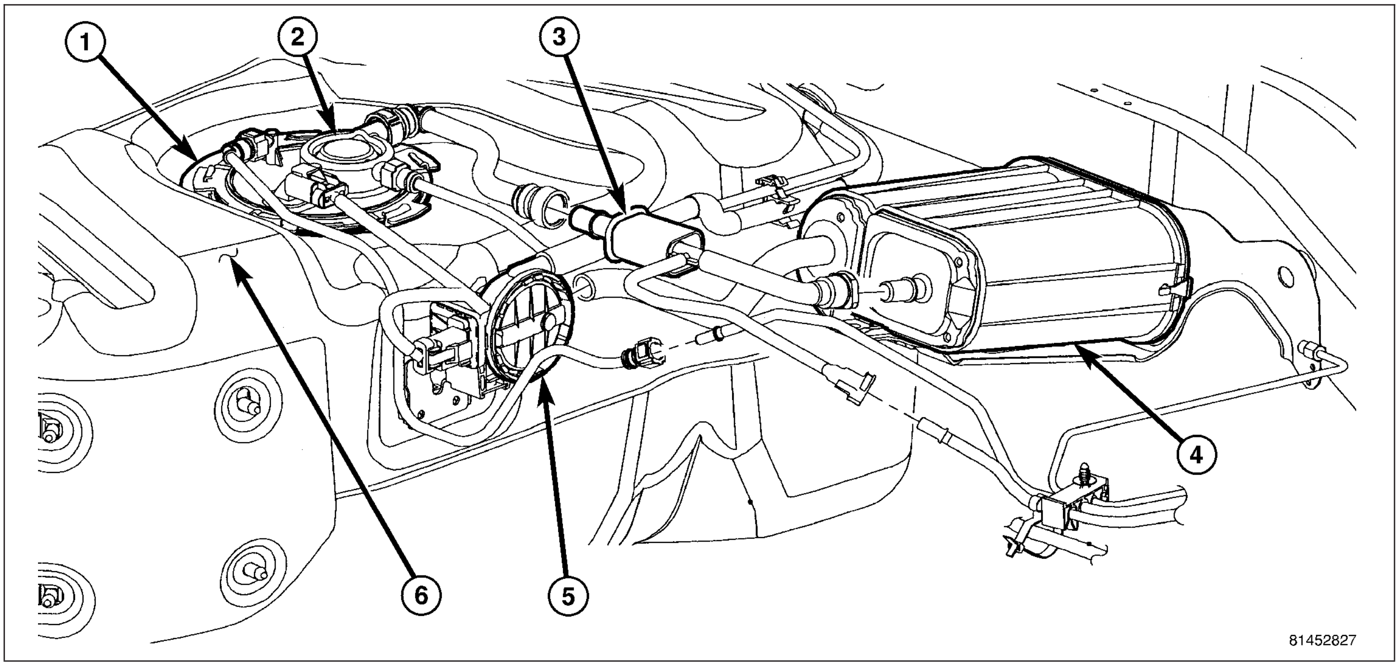
Fuel is drawn in through a filter at the bottom of the module and pushed through the electric motor gearset to the pump outlet.

**Check Valve Operation:** The fuel pump module contains a one-way check valve to prevent fuel flow back into the tank and to maintain fuel supply line pressure (engine warm) when pump is not operational. It is also used to keep the fuel supply line full of gasoline when pump is not operational. After the vehicle has cooled down, fuel pressure may drop to 0 psi (cold fluid contracts), but liquid gasoline will remain in fuel supply line between the check valve and fuel injectors. **Fuel pressure that has dropped to 0 psi on a cooled down vehicle (engine off) is a normal condition.**

The electric fuel pump is not a separate, serviceable component.

# MODULE-FUEL PUMP

## DESCRIPTION




The fuel pump module assembly (2) is located on top of the fuel tank. The complete assembly contains the following components:

- A fuel pressure regulator
- A built-in primary fuel filter
- A separate fuel pick-up, or inlet filter
- An electric fuel pump
- A lockring to retain pump module to tank
- A soft gasket between tank flange and module
- A fuel gauge sending unit (fuel level sensor)
- A fuel line connection

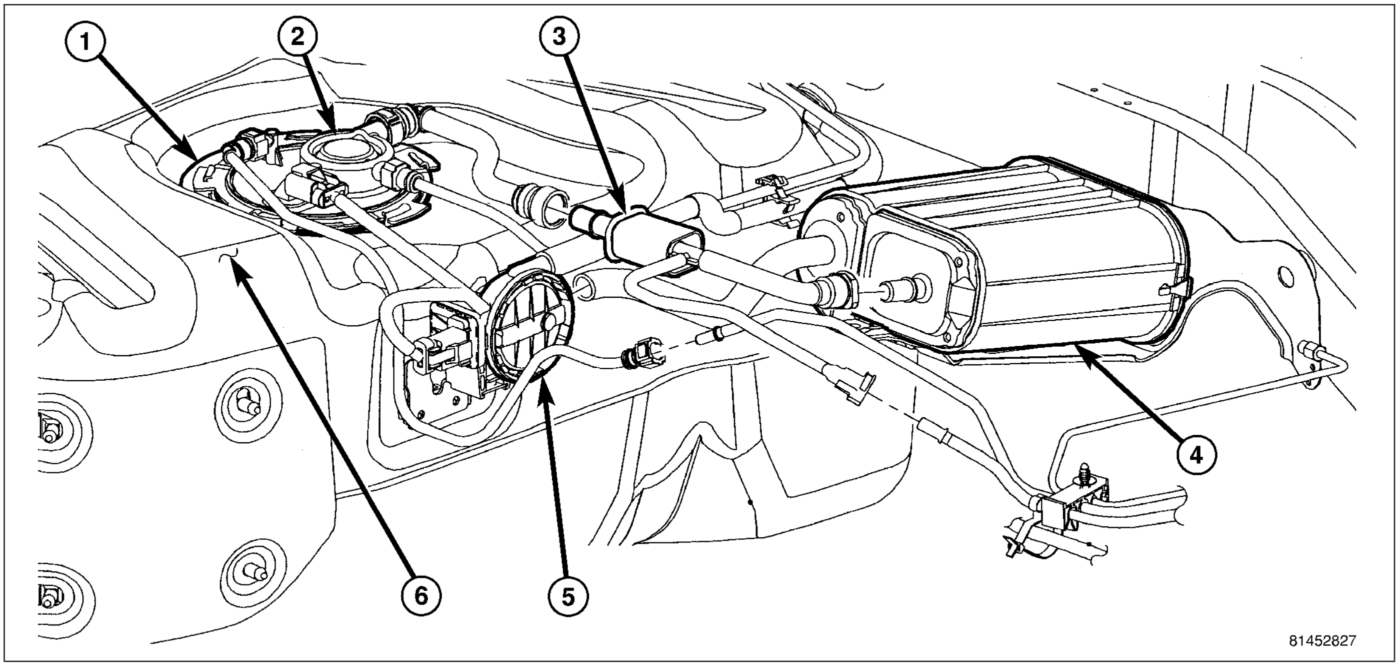
If the electrical fuel pump, primary inlet filter or fuel pressure regulator require service, the fuel pump module must be replaced.

## OPERATION

Refer to Fuel Pump, Inlet Filter, Fuel Pressure Regulator and Fuel Gauge Sending Unit.

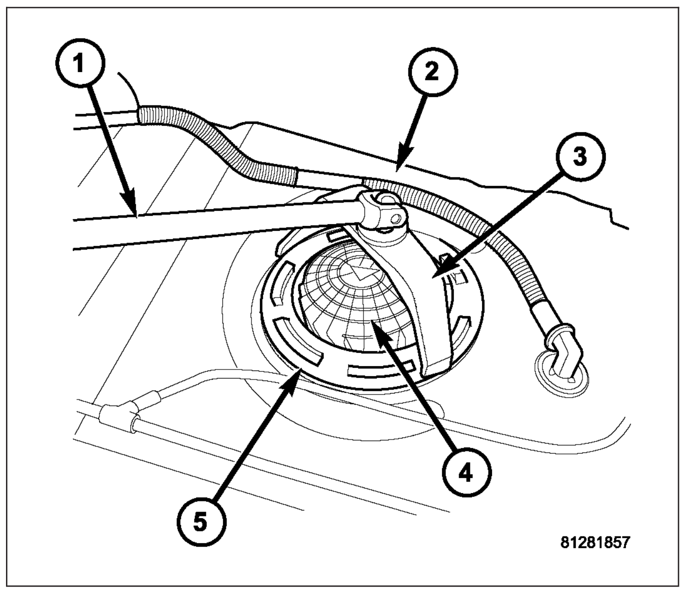
## REMOVAL

**WARNING: The fuel system may be under a constant pressure (even with the engine off). Before servicing the fuel pump module, the fuel system pressure must be released.**




The fuel pump module (2) and pump module lock ring (1) are located on the top of the fuel tank.

**A typical fuel pump module is displayed in the graphic.**

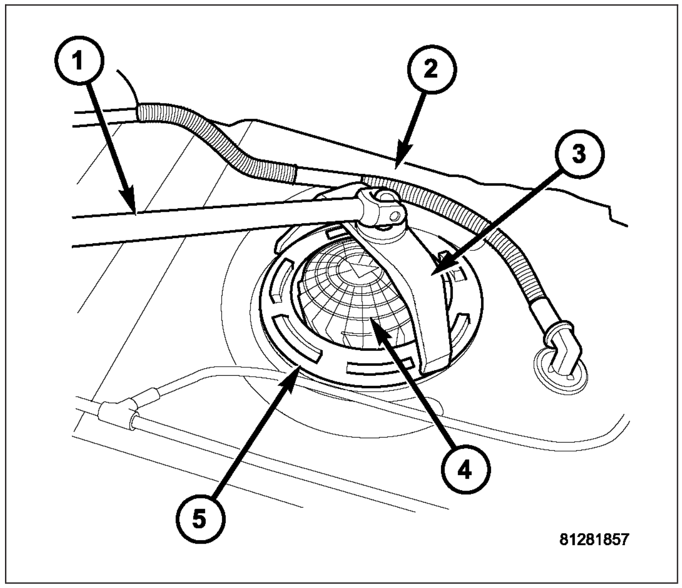



1. Drain and remove fuel tank. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TANK - REMOVAL)
2. Note rotational position of module before attempting removal. An indexing arrow is located on top of module for this purpose.
3. Position Lockring Remover/Installer 9340 (3) into notches on outside edge of lockring (5).
4. Install 1/2 inch drive breaker bar (1) to Lockring Remover/Installer 9340 (3).
5. Rotate breaker bar counterclockwise to remove lockring (5).
6. Remove lockring. The module will spring up slightly when lockring is removed.
7. Remove module from fuel tank. Be careful not to bend float arm while removing.

## INSTALLATION

**A typical fuel pump module is displayed in the graphic.**

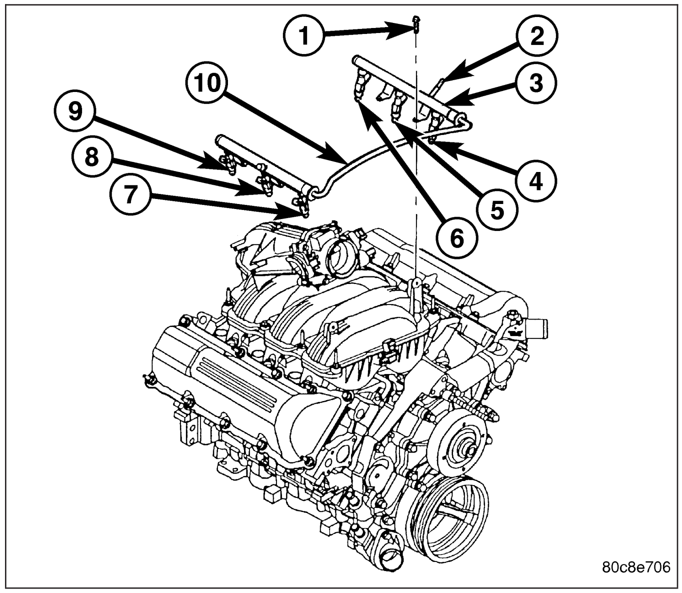
1. Using a new seal (gasket), position fuel pump module into opening in fuel tank.
2. Position lockring (5) over top of fuel pump module.
3. Rotate module until embossed alignment arrow points to center alignment mark. This step must be performed to prevent float from contacting side of fuel tank.
4. Install Lockring Remover/Installer 9340 (3) to lockring.
5. Install 1/2 inch drive breaker (1) into Lockring Remover/Installer 9340 (3).
6. Tighten lockring (clockwise) until all seven notches have engaged.
7. Install fuel tank. (Refer to 14 - FUEL SYSTEM/ FUEL DELIVERY/FUEL TANK - INSTALLATION)



# RAIL-FUEL

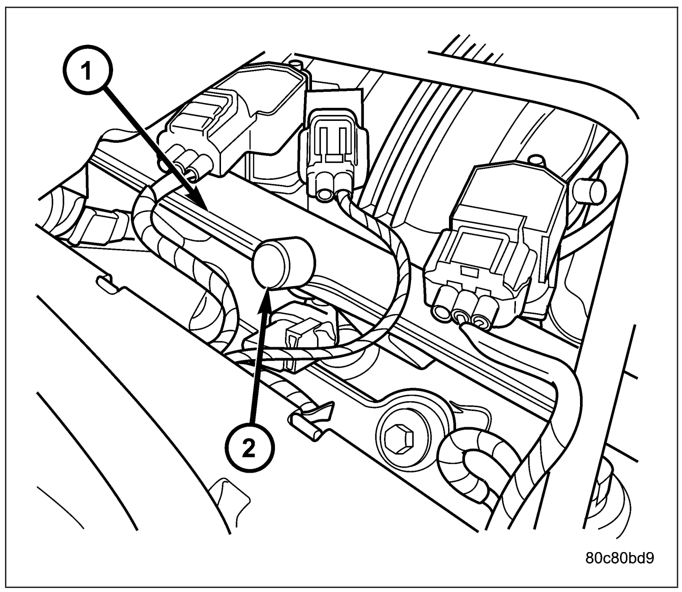
## DESCRIPTION

The fuel injector rail (3) is mounted to the intake manifold. It is used to mount the fuel injectors to the engine. The rail is equipped with a test port to check/test fuel system pressure.




The rail is equipped with a test port (2) to check/test fuel system pressure.

A fuel rail mounted, fuel damper is not used with this engine.




## OPERATION

High pressure fuel from the fuel pump is routed to the fuel rail. The fuel rail then supplies the necessary fuel to each individual fuel injector.

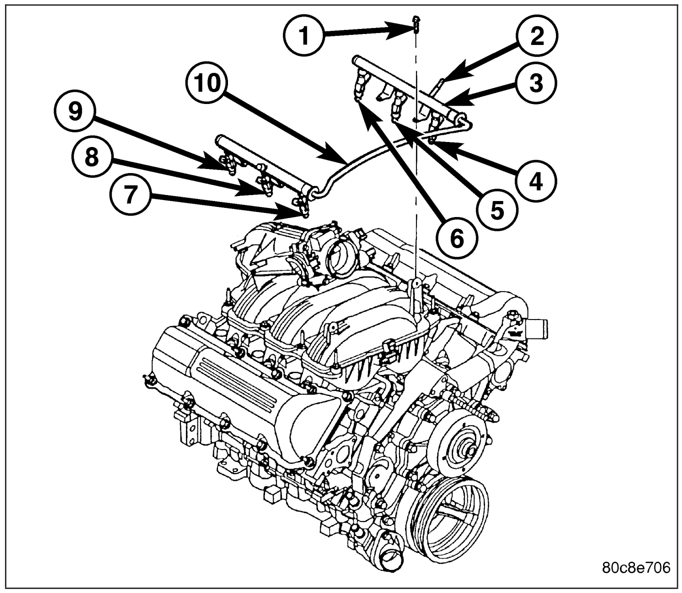
A quick-connect fitting with a safety latch is used to attach the fuel line to the fuel rail.

The fuel rail is not repairable.

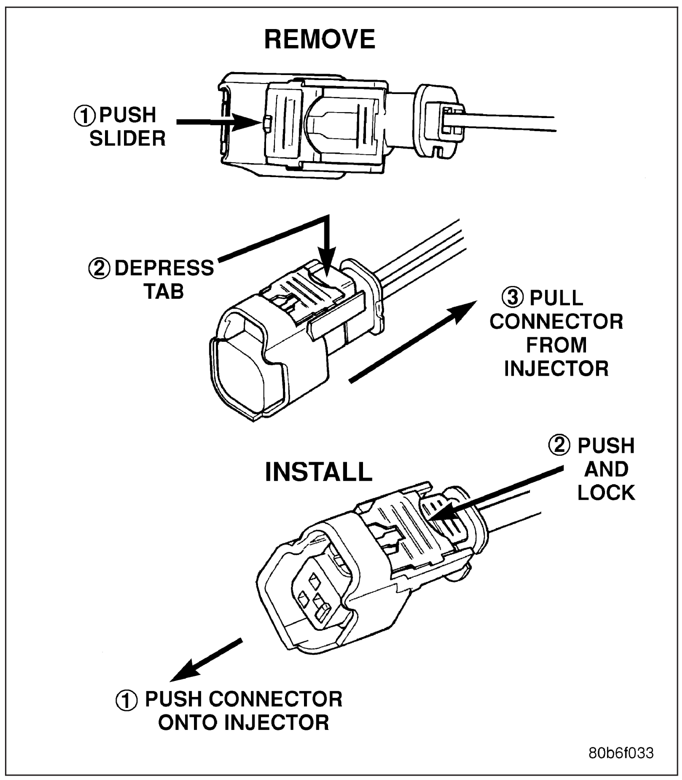
## REMOVAL

**WARNING: The fuel system is under constant pressure even with engine off. Before servicing fuel rail, fuel system pressure must be released.**

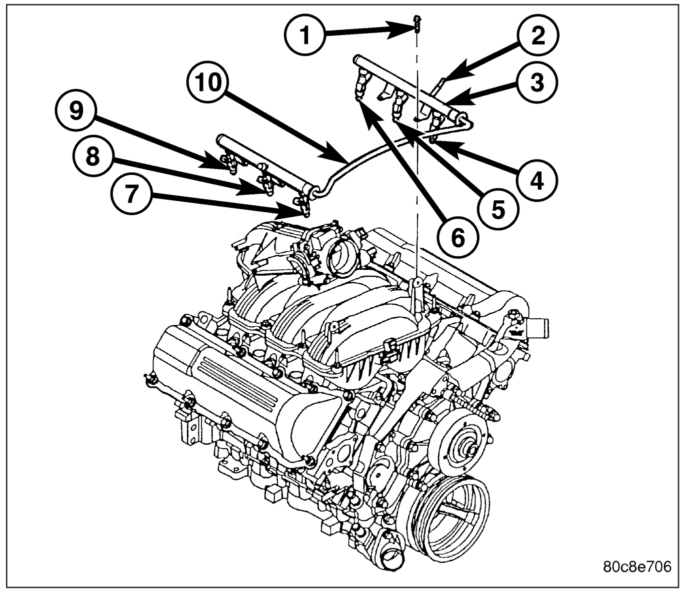
**CAUTION: The left and right fuel rails are replaced as an assembly. Do not attempt to separate rail halves at connector tube (10). Due to design of tube, it does not use any clamps. Never attempt to install a clamping device of any kind to tube. When removing fuel rail assembly for any reason, be careful not to bend or kink tube.**




1. Remove fuel tank filler tube cap.
2. Perform Fuel System Pressure Release Procedure. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE)
3. Remove negative battery cable at battery.
4. Remove air duct at throttle body air box.
5. Remove air box at throttle body.
6. Disconnect fuel line latch clip and fuel line at fuel rail. A special tool will be necessary for fuel line disconnection. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE)
7. Remove necessary vacuum lines at throttle body.
8. Disconnect electrical connectors at all 6 fuel injectors. Push red colored slider away from injector (1). While pushing slider, depress tab (2) and remove connector (3) from injector. The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for injector position identification. If harness is not tagged, note wiring location before removal.
9. Disconnect electrical connectors at throttle body sensors.
10. Remove 6 ignition coils. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - REMOVAL)

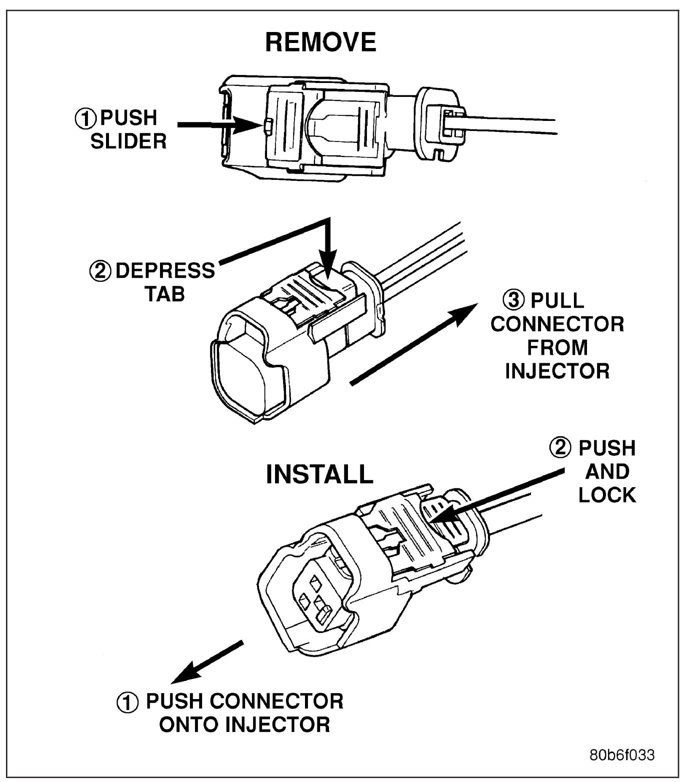


11. Remove four fuel rail mounting bolts (1).
12. Gently rock and pull **left** side of fuel rail until fuel injectors just start to clear machined holes in cylinder head. Gently rock and pull **right** side of rail until injectors just start to clear cylinder head holes. Repeat this procedure (left/right) until all injectors have cleared cylinder head holes.
13. Remove fuel rail (with injectors attached) from engine.
14. If fuel injectors are to be removed, (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL) .




## INSTALLATION

1. If fuel injectors are to be installed, (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).
2. Clean out fuel injector machined bores in intake manifold.
3. Apply a small amount of engine oil to each fuel injector O-ring. This will help in fuel rail installation.
4. Position fuel rail/fuel injector assembly to machined injector openings in cylinder head.
5. Guide each injector into cylinder head. Be careful not to tear injector O-rings.
6. Push **right** side of fuel rail down until fuel injectors have bottomed on cylinder head shoulder. Push **left** fuel rail down until injectors have bottomed on cylinder head shoulder.
7. Install 4 fuel rail mounting bolts and tighten to 11 N·m (100 in. lbs).
8. Install 6 ignition coils. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - INSTALLATION)
9. Connect electrical connectors to throttle body.
10. Connect electrical connectors at all fuel injectors. Push connector onto injector (1) and then push and lock red colored slider (2). Verify connector is locked to injector by lightly tugging on connector.
11. Connect necessary vacuum lines to throttle body.
12. Connect fuel line latch clip and fuel line to fuel rail. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE)
13. Install air box to throttle body.
14. Install air duct to air box.
15. Connect battery cable to battery.
16. Start engine and check for leaks.



# TANK - FUEL

## DESCRIPTION

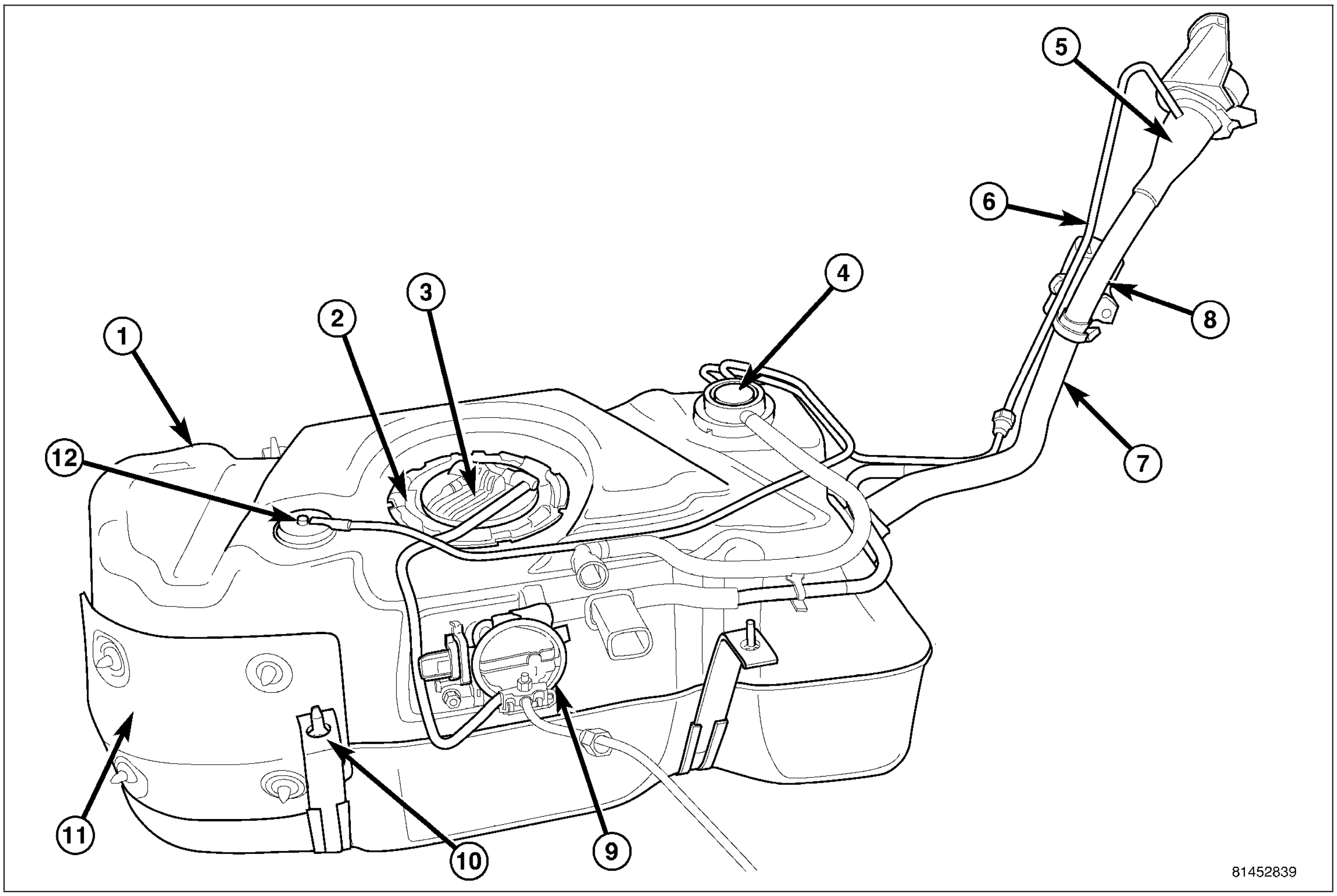
The fuel tank is constructed of a plastic material. Its main functions are for fuel storage and for placement of the fuel pump module, and certain ORVR components.

## OPERATION

All models pass a full 360 degree rollover test without fuel leakage. To accomplish this, fuel and vapor flow controls are required for all fuel tank connections.

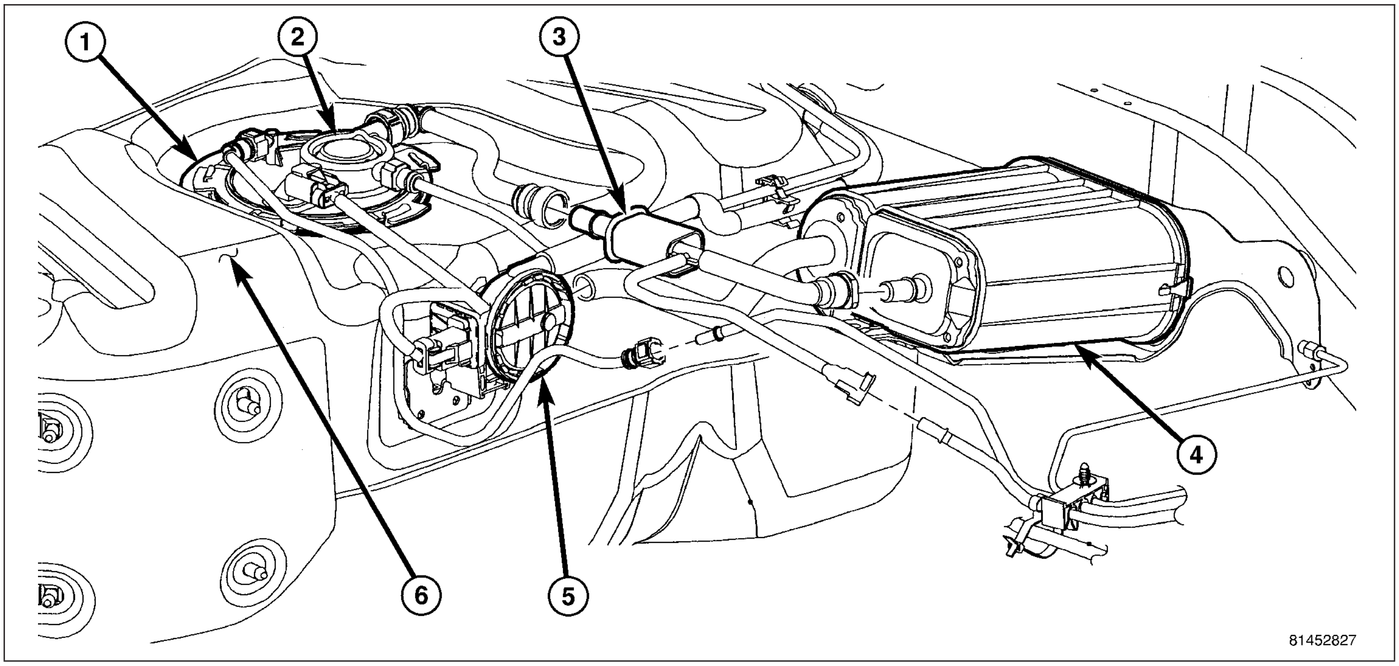
An evaporation control system is connected to the fuel tank to reduce emissions of fuel vapors into the atmosphere. When fuel evaporates from the fuel tank, vapors pass through vent hoses or tubes to a charcoal canister where they are temporarily held. When the engine is running, the vapors are drawn into the intake manifold. Certain models are also equipped with a self-diagnosing system using either an NVLD pump, or a Leak Detection Pump (LDP) and/or an ORVR system.

## REMOVAL




1. Release fuel system pressure. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE)
2. Drain fuel tank. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE)
3. If equipped, remove fuel tank skid plate and tow hooks. Certain equipment packages will also require removal of the trailer hitch.
4. Disconnect and separate fresh air tube (6) quick-connect fitting.
5. Disconnect air tubes at front of NVLD pump (9).
6. Disconnect NVLD pump (9) electrical connector.
7. Disconnect fuel pump module electrical connector jumper. This is located near front of fuel tank.
8. Support tank with a hydraulic jack.

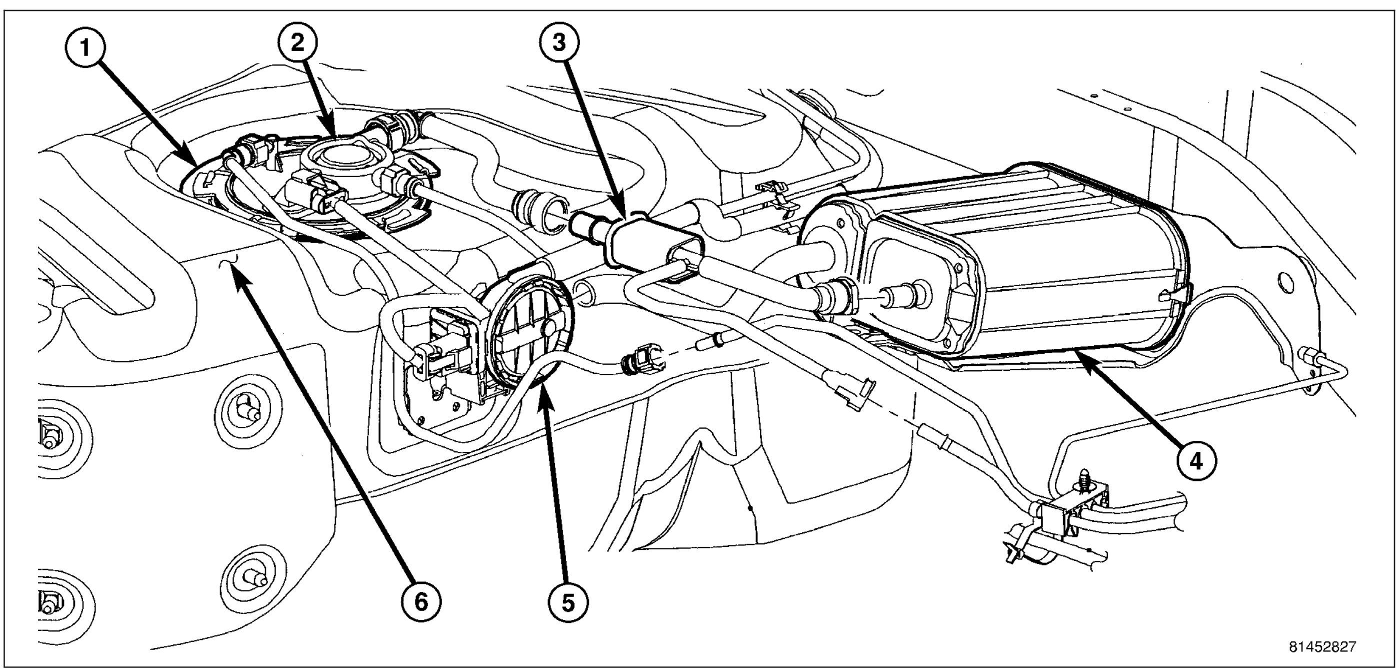
9. Remove four fuel tank strap bolts (10) (2 at front of tank; 2 at rear of tank), and remove both tank support straps.
10. Carefully lower tank a few inches.




11. Continue lowering tank while guiding remaining hoses and lines through plastic isolator sleeve (3).
12. If fuel tank is to be replaced, remove NVLD pump and fuel pump module from tank. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL PUMP MODULE - REMOVAL)

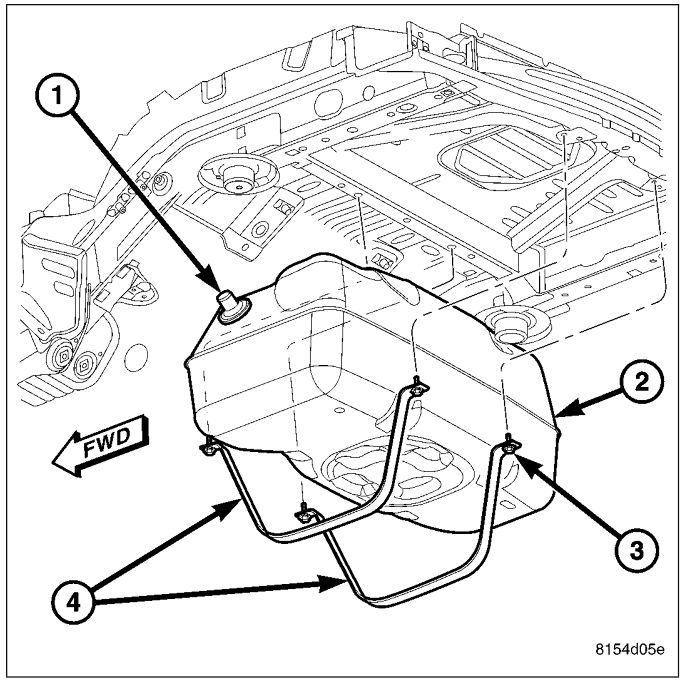
## INSTALLATION

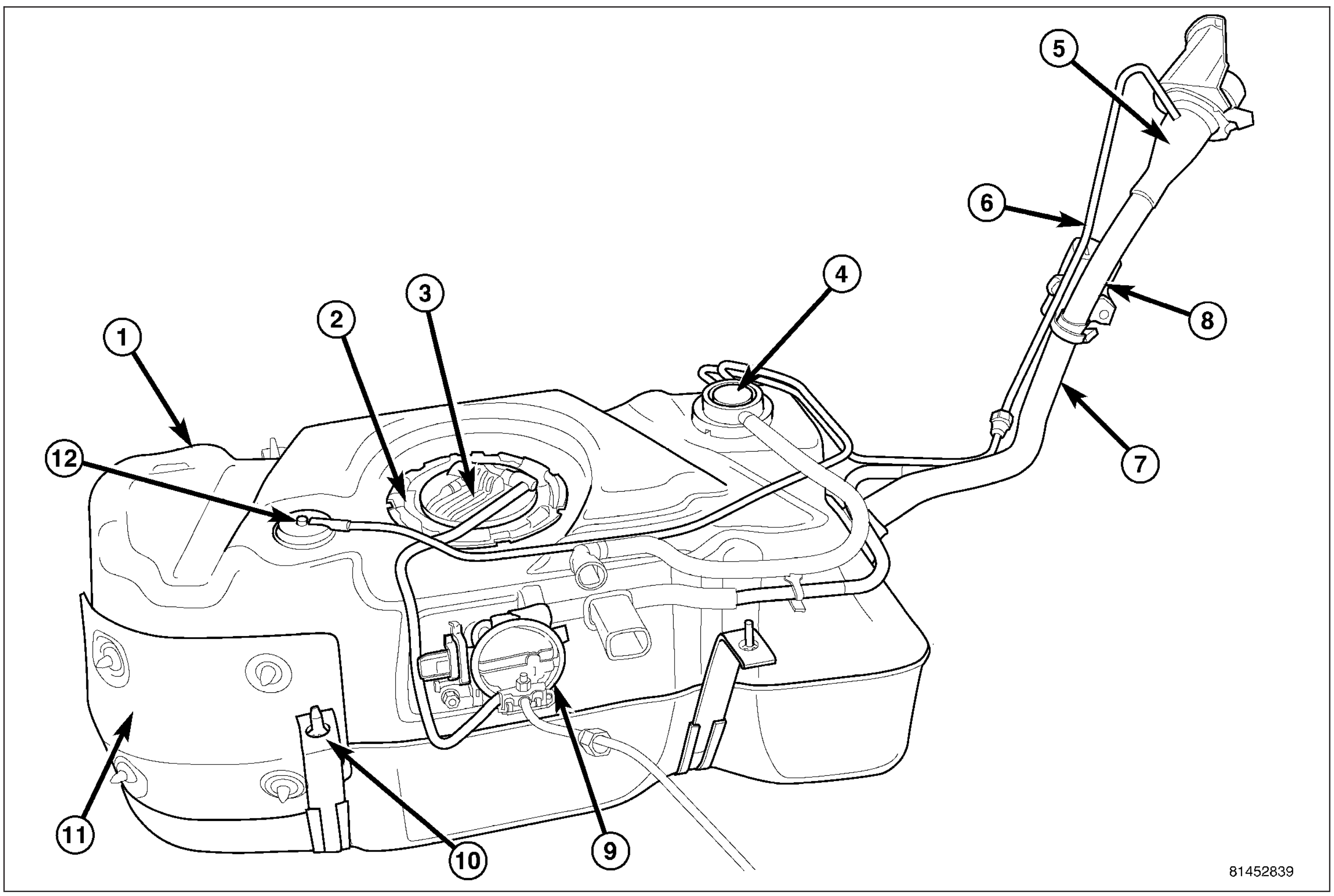
1. If fuel tank is to be replaced, install NVLD pump and fuel pump module to tank. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL PUMP MODULE - INSTALLATION)
2. Position fuel tank to hydraulic jack.




3. Raise tank while carefully guiding vent tubes/hoses through isolator sleeve (3) and crossmember.
4. Continue raising tank until positioned to body.

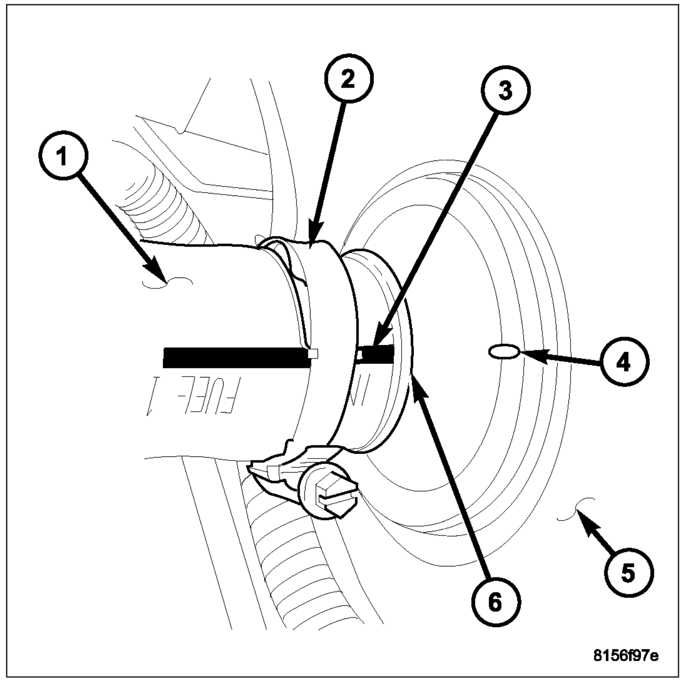
5. Attach two fuel tank mounting straps (4) and four mounting bolts (3). Tighten bolts to 61 N·m (45 ft. lbs.) torque.




6. Connect electrical connector to NVLD pump (9).
7. Connect fresh air (6) and recirculation lines to fuel fill tube.
8. Connect electrical connector to fuel pump module.
9. Connect fuel line quick-connect fitting.

10. Install fuel fill hose and hose clamp to fuel tank fitting. Rotate hose until white painted index mark (3) on hose is located at alignment notch (4) on fuel tank fitting. Tighten clamp to 3.4 N·m (30 in. lbs.) torque.
11. If equipped, install fuel tank skid plate, trailer hitch and tow hooks.
12. Lower vehicle.
13. Connect negative battery cable to battery.
14. Fill fuel tank with fuel.
15. Start engine and check for fuel leaks.



# FUEL DELIVERY - 2.8L DIESEL

## TABLE OF CONTENTS

# FUEL DELIVERY - 2.8L DIESEL

## DESCRIPTION - DIESEL FUEL DELIVERY SYSTEM

The fuel system on the 2.8L Common Rail Diesel Engine uses a fuel injection pump and an Electronic Control Module (ECM).

The fuel delivery system consists of the:

- Accelerator pedal
- Air cleaner housing/element
- Fuel filter/water separator
- Fuel temperature sensor
- Fuel heater
- Fuel rail solenoid
- Fuel rail pressure sensor
- Fuel injection pump
- Fuel injectors
- Fuel tank
- Fuel tank filler/vent tube assembly
- Fuel tank filler tube cap
- Fuel tank module containing the roll over valve and a fuel gauge sending unit (fuel level sensor).
- Fuel tubes/lines/hoses
- High-pressure fuel injector lines
- Low-pressure fuel supply and return lines
- Low-pressure fuel return line
- Overflow valve
- Quantity control valve
- Quick-connect fittings
- Water draining

## WARNING - HIGH FUEL SYSTEM PRESSURE

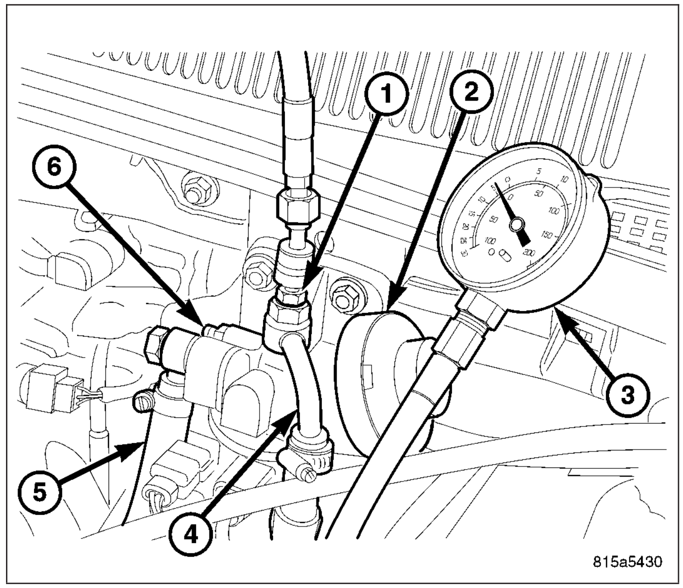
**WARNING: High-pressure fuel lines deliver fuel under extreme pressure from the injection pump to the injectors. This maybe as high as 1600bar (23,200psi). Use extreme caution when inspecting for high-pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect high-pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.**

## DIAGNOSIS AND TESTING

## FUEL SYSTEM SUPPLY

**NOTE: The gear rotor pump in the back of the high pressure pump, draws fuel from the tank, through the filter, to the back of the high pressure pump. The gear rotor pump is capable of drawing up to 20 in. of vacuum, depending on cranking speed. A specification of under 3 in. of vacuum reveals the high pressure pump suspect if there is no air intrusion into the fuel system.**

**NOTE: There can not be any visible signs of fuel leakage at the filter outlet line or fitting during testing. If a fuel leak is detected, STOP testing, remove special tool fitting #9745, and replace both fuel outlet line washer seals.**




Test Set Up Assumptions for this test are that the fuel gauge is operating properly and that there is know good fuel in the fuel tank.

- Disconnect the camshaft position sensor to prevent the vehicle from starting.
- Remove the fuel filter outlet line and install special tool fitting #9745.
- Connect vacuum and pressure gauge # 6828 to the #9745 fitting.
- Re-prime the fuel system to remove all air (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
- Restrict the inlet side of the fuel filter by clamping the inlet hose close to the filter assembly.
- Crank the engine 3–4 times in 10 seconds intervals while monitoring the gauge.

Results The supply pump should draw at least 3 in. of vacuum. If the supply pump was unable to reach 3 in. of vacuum, replace the high pressure pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - REMOVAL).

If the pump was able to reach 3 in. of vacuum, continue with this test.

Pressure Test This test will check the ability of the fuel system to hold pressure.

- Reconnect the camshaft position sensor.
- Remove the clamping pliers from the fuel inlet hose.
- Pump the hand primer until 10 psi. is obtained on the pressure side of the gauge.

Will the engine start ?

Results If the engine starts, refer to the fuel filter restriction test (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DIAGNOSIS AND TESTING).

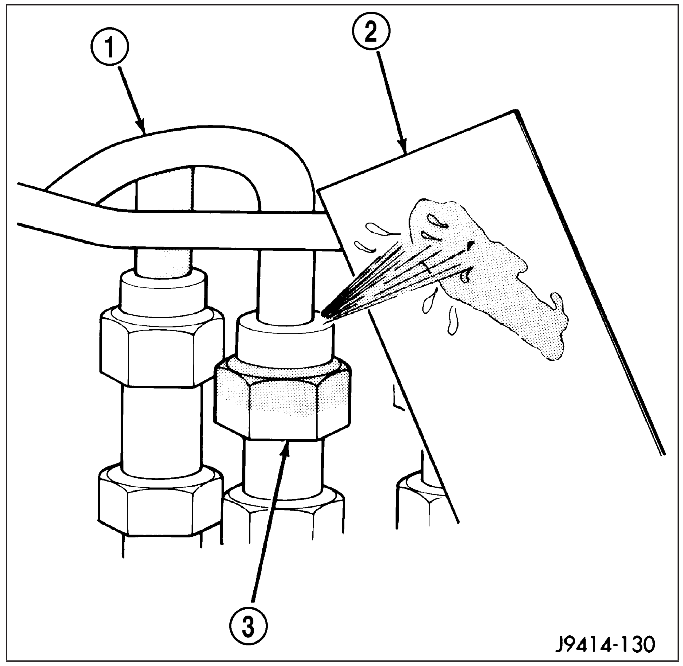
If you were able to obtain 10 psi. with the hand primer, refer to the Crank No Start Chart in the Diagnostics manual. If you were unable to obtain 10 psi. with the hand primer, check fuel supply from tank to filter assembly. If the fuel supply is OK, replace the fuel primer/filter assembly (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - REMOVAL).

## HIGH PRESSURE FUEL LEAKS

**WARNING: High - pressure lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi.). Use extreme caution when inspecting for high - pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high - pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.**

High-pressure fuel leaks can cause starting problems and poor engine performance.

Carefully place a piece of cardboard over the high-pressure fuel lines or suspected area. Move your body and hands away from the area. Start the engine and run till warm. **TURN THE ENGINE OFF**. Inspect the piece of card board for witness marks.. If a high-pressure line connection is leaking, replace damaged, restricted or leaking high-pressure fuel lines with the correct replacement line.




**CAUTION: The high-pressure fuel lines cannot contact each other or other components. Do not attempt to weld high-pressure fuel lines or to repair lines that are damaged. Only use the recommended lines when replacement of high-pressure fuel line is necessary.**

## AIR IN FUEL SYSTEM

Air will enter the fuel system whenever fuel supply lines, separator filters, injection pump, high-pressure lines or injectors are removed or disconnected. Air trapped in the fuel system can result in hard starting, a rough running engine, engine misfire, low power, excessive smoke and fuel knock.

Inspect the fuel system from the fuel tank to the injectors for loose connections (Refer to 14 - FUEL SYSTEM - WARNING). Leaking fuel is an indicator of loose connections or defective seals. Air can also enter the fuel system between the fuel tank and the fuel filter. Inspect the fuel tank and fuel lines for damage that might allow air into the system.

Trapped air or leaking lines may also be identified by placing a clear piece of fuel line between the fuel supply hose to the filter and the fuel supply hose to the high pressure pump. If a steady stream of large air bubbles are visible in the clear hose while the engine is cranking or running the air intrusion is occurring before the high pressure pump.

With the scan tool connected to the vehicle, select Engine and then select Sensor Display. Page down to view Fuel Pressure Set Point and Actual Fuel Pressure. Start the engine and observe the Fuel Pressure Set Point and the Actual Fuel Pressure. If the Actual Fuel Pressure Oscillates above and below the Fuel Pressure Set Point in a regular cycle, inspect the fuel system for air intrusion.

If the Actual Fuel Pressure gradually drops below the Fuel Pressure Set Point then spikes well above the Fuel Pressure Set Point, replace the fuel rail pressure solenoid (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL PRESSURE SOLENOID - REMOVAL).

## FUEL SUPPLY RESTRICTIONS

### LOW-PRESSURE LINES

Fuel supply line restrictions or a restricted fuel filter can cause starting problems and prevent engine from accelerating. The starting problems include; no start, longer cranking times, low power and/or white fog like exhaust.

Inspect all fuel supply lines for restrictions or blockage, including the fuel filter. Flush or replace as necessary.

## HIGH-PRESSURE LINES

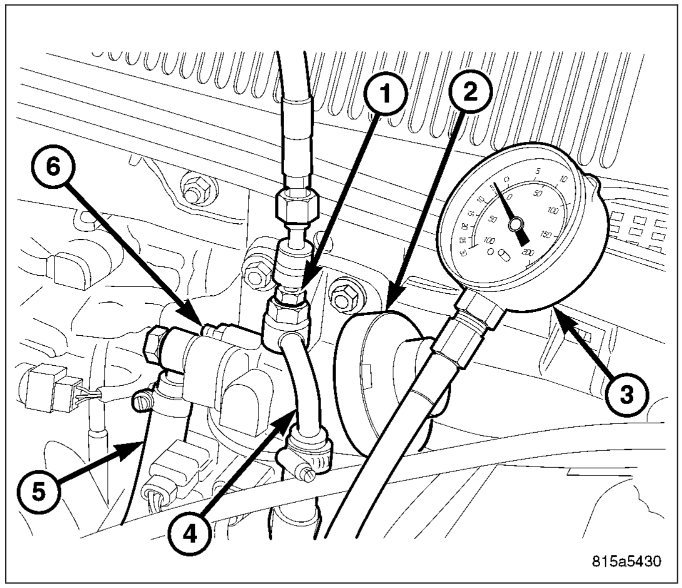
**CAUTION: High pressure lines cannot contact each other or other components. Do not attempt to weld high-pressure fuel lines or to repair lines that are damaged. High pressure lines can be reused only after close inspection for cracks or deformation around the sealing cone. Corroded pipes must be replaced. Use only recommended lines when replacement of high-pressure fuel line is necessary.**

Restricted (kinked or bent) high-pressure lines can cause starting problems, poor engine performance, engine misfire and white smoke from exhaust (Refer to 14 - FUEL SYSTEM - WARNING).

# FUEL FILTER

Refer to the maintenance schedules for the recommended fuel filter replacement intervals (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION).

The gear supply pump located in the back of the high pressure pump draws fuel from the fuel tank, through the fuel filter and into the high pressure pump. Restricted fuel filters may cause hard starting, no starting, and or white smoke.




## Testing The Filter For Restrictions

**NOTE: There can not be any visible signs of fuel leakage at the filter outlet line or fitting during testing. If a fuel leak is detected, STOP testing, remove special tool fitting #9745, and replace both fuel line washer seals.**

- Disconnect the fuel filter outlet line at the fuel filter housing.
- Install fitting, special tool #9745 in place of the fuel line bolt and tighten to 35 N·m (25 ft. lbs.)..
- Connect pressure/vacuum gauge #6828 to the fitting.
- Prime the fuel filter to remove any entrained air.
- Start the engine and allow to idle.
- Monitor and record the vacuum reading on the gauge for 30 seconds.
- Raise the engine rpm to 1500 rpm and monitor and record the vacuum reading on the gauge for 30 seconds.

The vacuum on the gauge should not exceed 10 in. H.g at idle, and throughout the entire rpm range. If the vacuum reading is higher than 10 in. Hg, inspect the low pressure fuel system for restrictions such as, kinked lines or collapsed hoses, before replacing the fuel filter.

Remove special tools, install the fuel filter outlet line using the fuel line bolt with two **new** washer seals. Tighten the fuel line bolt to 35 N·m (25 ft. lbs.).

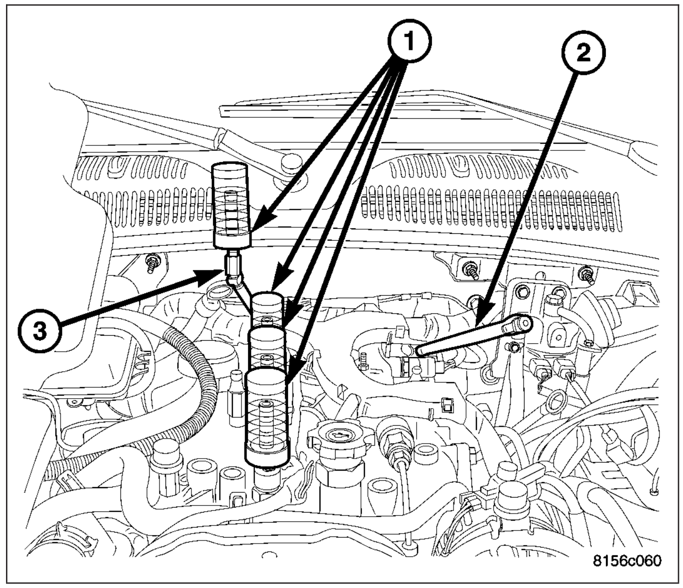
Prime fuel system (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE), start the engine, allow to warm, turn engine off and inspect for leaks at the fuel filter and housing.

## INJECTOR LEAK QUANTITY

**WARNING: Review the high pressure fuel system warning before beginning service (refer to 14 - fuel system - warning).**

**NOTE: If an injector is found to be out of specification, repeat the test procedure after the injector replacement. Hydraulic flow will take the path of least resistance and multiple failures may be identified.**

Perform this test with the engine at operating temperature. This test will assist in determining a defective or internally leaking injector(s) is present by measuring the amount of fuel return.




### Cranking Test

1. Turn the ignition off.
2. Remove the engine cover.

**NOTE: DO NOT remove the return fuel line clips retaining the return line to the injector. Push IN on the clip to release the hose and then again to install the test vials.**

3. Disconnect the return fuel hose at the top of each of the injectors.

**NOTE: Care must be taken not to damage the return line check valve between cylinder number four injector and the fuel rail.**

4. Block off the disconnected return fuel hose before the fuel return junction on the left rear of the cylinder head cover.
5. Disconnect the camshaft position sensor (CMP).

**NOTE: Attach special tool adaptor #9686 to the #4 injector and fill with clean diesel fuel to purge the air from the adaptor, then install the test vial onto the adaptor.**

6. Install the test vials onto the injectors and secure with the return hose clips.
7. Crank the engine for ten seconds while monitoring each inner test vial.
8. Evaluate the individual return quantities.

The maximum permissible difference between the return quantity of the individual injectors and the injector with the highest return quantity is 3 graduation marks in the small vial.

**EXAMPLE**

| Injector | Graduated Vial Mark | Content |
|---|---|---|
| 1 | 4 marks, small vial | 4 ml |
| 2 | 1 mark, small vial | 1 ml |
| 3 | 1 mark, small vial | 1 ml |
| 4 | 1/2 mark, small vial | 0.5 ml |

Evaluation Injector #1 has excessive fuel return quantity, replace the injector. Injectors #2, #3, #4 are OK.

9. Perform the cranking test after the repair to assure no other injectors are identified.

### Engine Running

1. Start the engine with the test vials in place.
2. Run the engine until the top mark on one of the large graduated vials is obtained.
3. Turn engine off immediately.
4. Evaluate the individual return quantities.

The maximum permissible difference between return quantities of the individual injectors, and the injector with the highest return quantity, is 3 graduation marks.

**EXAMPLE**

| Injector | Graduated Vial Mark | Content |
|---|---|---|
| 1 | 5 marks, large vial | 42 ml |
| 2 | 2 mark, large vial | 21 ml |
| 3 | 2 mark, large vial | 21 ml |
| 4 | Surround, large vial | 8 ml |

Evaluation Injector #1 has excessive return quantity, replace the injector. Injectors #2, #3, #4 are OK.

5. Perform the running test again after the repair to assure no other injectors are identified.

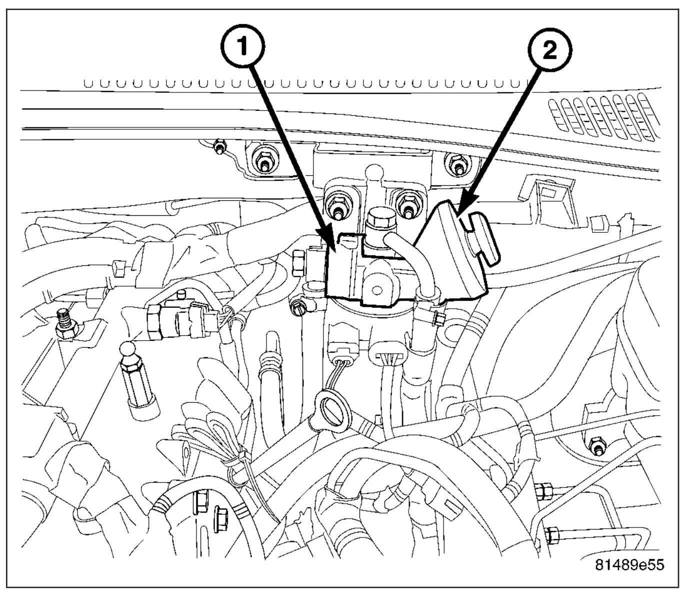
If the injectors pass the quantity test, continue with the diagnostic manual.

## STANDARD PROCEDURE

## PRIMING FUEL SYSTEM

**CAUTION: Cranking the engine for an extended period with out a fuel supply may result in damage to the high pressure fuel pump. DO NOT force the plunger when priming the fuel system. Damage to the plunger or fuel filter/water separate will result.**

**NOTE: Should the vehicle run out of fuel, the fuel system must be re-primed in order to start. Factors such as temperature, how long the vehicle has been sitting, and engine cranking speed will influence how quickly the engine starts. If the water in fuel light is illuminated in the instrument panel, refer to the water in fuel sensor for draining procedure.**




The fuel system must be primed if the fuel system has been serviced. This is done using the fuel primer button located at the top of the fuel filter/water separator.

1. With service completed on the fuel system.
2. Depress the fuel primer 20 consecutive times then open the bleeder screw on top of the housing to dispel trapped air.
3. Close the bleeder screw and continue the step above until the primer button becomes slightly harder to depress.
4. Turn the ignition to START and crank the engine a maximum of ten seconds.

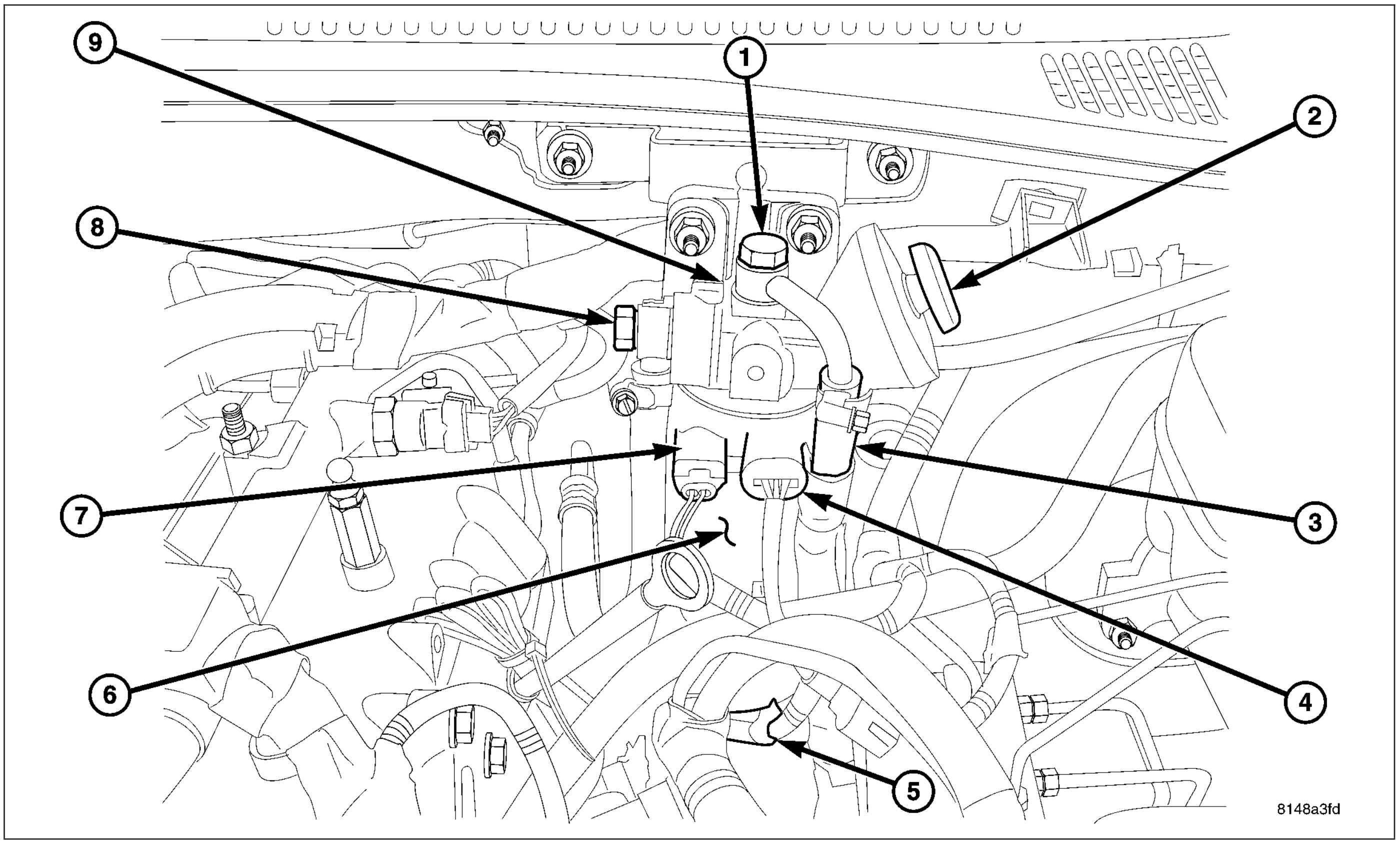
**NOTE: If the engine does not start with in ten seconds, repeat the priming procedure. The engine will typically start within ten seconds; the engine may idle, idle rough, or stall, purging any trapped air from the lines and filter.**

5. Tighten bleeder screw to 10.8 N·m (96 in.lbs.).

## CLEANING FUEL SYSTEM COMPONENTS

**CAUTION: Cleanliness cannot be overemphasized when handling or replacing diesel fuel system components. This especially includes the fuel injectors, high-pressure fuel lines, fuel rail, and fuel injection pump. Very tight tolerances are used with these parts. Dirt contamination could cause rapid part wear and possible plugging of fuel injector nozzle tip holes. This in turn could lead to possible engine misfire. Always wash/clean any fuel system component thoroughly before disassembly and then air dry. DO NOT wire brush injector nozzles when cleaning. Cap or cover any open part after disassembly. Before assembly, examine each part for dirt, grease or other contaminants and clean if necessary. When installing new parts, lubricate them with clean engine oil or clean diesel fuel only.**

## DRAINING WATER IN FUEL




**WARNING: Store fuel in approved and properly marked containers. Wear safety goggles and adequate protective clothing when servicing fuel system.**

1. Disconnect the negative battery cable.
2. Disconnect the water in fuel (WIF) wiring harness connector located under the fuel filter.
3. Connect a drain hose to the WIF sensor.
4. Place the other end of the drain hose in a approved and properly marked container.
5. Open the bleed screw on top of the fuel filter housing.
6. Loosen the WIF sensor on the bottom of the fuel filter to begin draining.
7. Allow the filter to drain into the container until fuel is visible.
8. Tighten the WIF sensor, remove the drain hose and clean any spillage.
9. Tighten the bleeder screw on top of the fuel filter housing.
10. Connect the WIF wiring harness connector.
11. Connect the negative battery cable.

## FUEL CONTAMINATION

If a diesel engine's fuel supply has been contaminated with gasoline, the following procedure must be followed:

1. Remove all fuel from the fuel tank. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE-DRAINING FUEL TANK) Use an appropriate fuel container. Dispose of the contaminated fuel using the proper procedures.

**CAUTION: Dispose of petroleum based products in a manner consistent with all applicable Local, State, Federal, and Provincial regulations.**

2. Remove and clean fuel tank. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TANK - REMOVAL)
3. Install the fuel tank. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TANK - INSTALLATION)
4. Fill fuel tank with fresh diesel fuel.
5. Drain and remove the fuel filter. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - REMOVAL)
6. Install a new fuel filter. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - INSTALLATION)
7. Check the engine control module for any diagnostic trouble codes (DTCs). Record and clear any DTCs that are present.
8. Start and run the engine. Run the engine for up to 15 minutes to allow time for any DTCs to reset and shut off the engine.
9. Check the engine control module for any diagnostic trouble codes (DTCs). Record any DTCs that are present. Refer to the appropriate engine electrical diagnostics to diagnose any DTCs that were set.

**CAUTION: With the high pressure fuel system in this vehicle, any residual contaminated fuel will be removed very quickly. Shut off the engine immediately if signs of engine damage are noted.**

The engine should then be evaluated to determine if the contaminated fuel has caused any damage to the fuel system and/or engine. Indicators that the fuel system has been damaged include the following:

- Unstable fuel rail pressure. This can manifest itself as instability of idle speeds, excessive undershoot/overshoot at engine start-up, or excessive undershoot/overshoot when the engine operating conditions change. A typical engine response to a large rail pressure undershoot would be a decrease in engine speed or engine stall.
- Excessive noise from the engine. This could indicate poor rail pressure control or the inability of the injection system to inject the proper amount of fuel.
- Excessive smoke (black or white). This could indicate the inability of the fuel system to inject the proper amount of fuel.

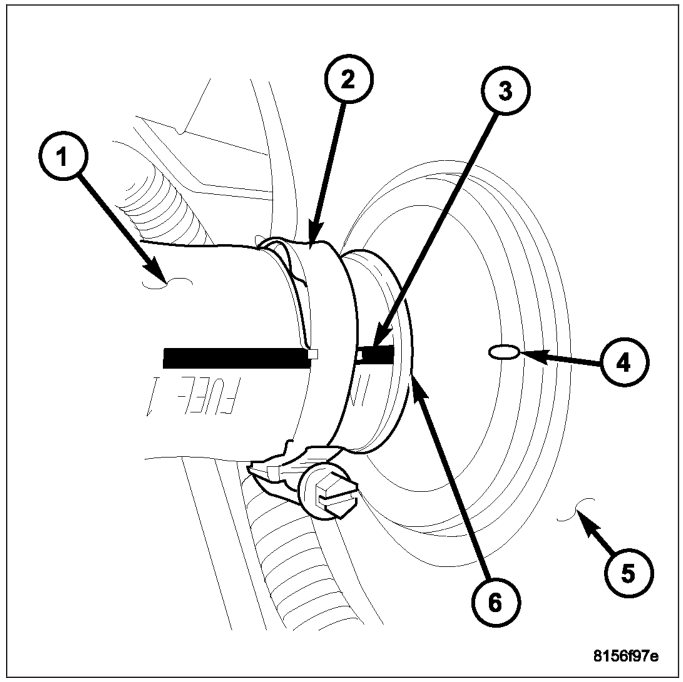
**NOTE: If any of these conditions are exhibited after cleaning the fuel system, proceed to the appropriate engine electrical diagnostic information. Repair the fuel system and/or engine as necessary.**

## DRAINING FUEL TANK - DIESEL

1. Raise vehicle.
2. Thoroughly clean area around fuel fill fitting (6) and rubber fuel fill hose (1) at side of fuel tank. After cleaning, loosen fuel fill hose clamp (2) at tank.

Note position of index mark (3) before removing hose from fuel tank fitting.

3. Remove rubber fuel fill hose (1) from fuel tank fill fitting (6). Drain fuel into an approved diesel fuel oil draining station.



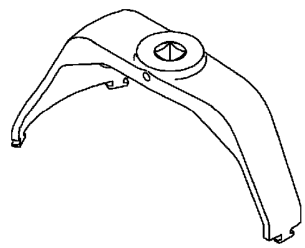

## SPECIFICATIONS

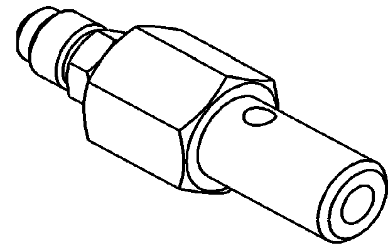
## TORQUE - 2.8L DIESEL

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Fuel Filter Housing Bleeder Screw | 10 | - | 96 |
| Camshaft Position Sensor Bolt | 10.8 | - | 95 |
| Crankshaft Position Sensor Bolt | 11.8 | - | 95 |
| Crankshaft Position Sensor Shield Bolt | 11.8 | - | 104 |
| Boost Pressure / Intake Air Temperature Sensor Bolts | 5.4 | - | 48 |
| Return Fuel Junction Block at Intake Manifold | 10.8 | - | 96 |
| Fuel Filter | 18 | - | 159 |
| Fuel Filter Screw to Housing | 30 | 22 | - |
| High Pressure Injection Pump Nuts | 27.5 | 20 | - |
| Fuel Line Fittings at Pump | 27.5 | 21 | - |
| Fuel Line Fittings at Filter Housing | 35 | 25 | - |
| High Pressure Injection Pump Sprocket Nut | 88.3 | 65 | - |
| Fuel Injector Retaining Bolts | 32.4 | 24 | - |

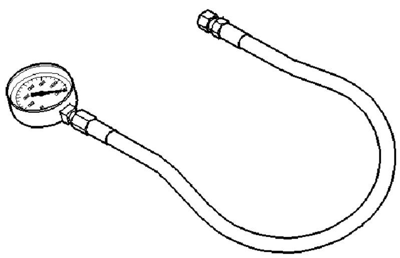
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| High Pressure Fuel Lines | 28 | 20 | 247 |
| Fuel Rail Bolts | 24.5 | 18 | - |
| Fuel Pressure Sensor | 35 | 26 | - |
| Water In Fuel Sensor | 1.2 | - | 10 |
| Fuel Water/Separator Mounting Nuts | 24.5 | 24 | - |
| Fuel Line Hose Clamp | 7 | - | 62 |
| Fuel Quantity Solenoid | 11 | - | 97 |
| Fuel Tank Straps Bolts | 61 | 45 | - |
| Fuel Filler Tube Clamp | 3.5 | - | 30 |
| APP Sensor | 11 | - | 97 |
| Turbocharger Downpipe Bolts | 32.5 | 24 | - |
| Fuel Pressure Solenoid Mounting Nut | Refer to the installation Procedure. | | |

## SPECIAL TOOLS - DIESEL

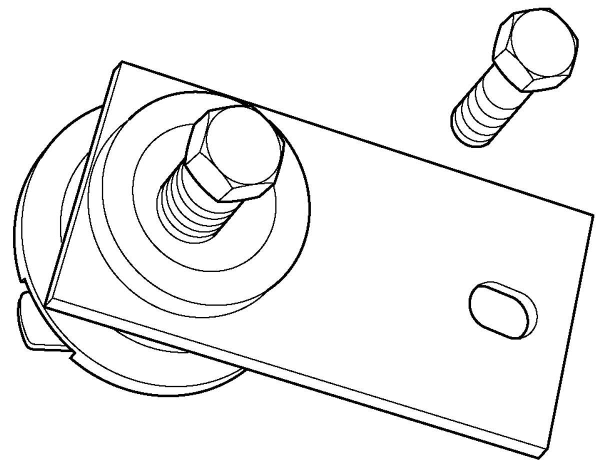




*FITTING #9745*

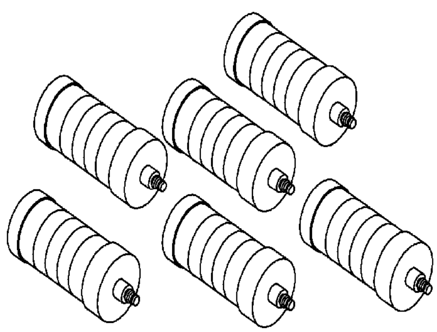


*VACUUM AND PRESSURE GAUGE 6828*

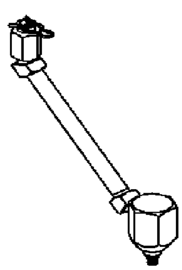


8120d627

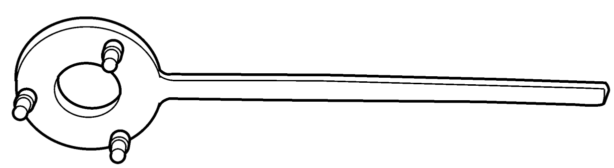
*VM.1067 HIGH PRESSURE PUMP REMOVER*



*VM.9545 RETURN FUEL QUANTITY VIALS*

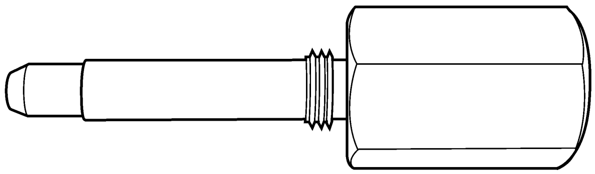


*ADAPTOR 9686*

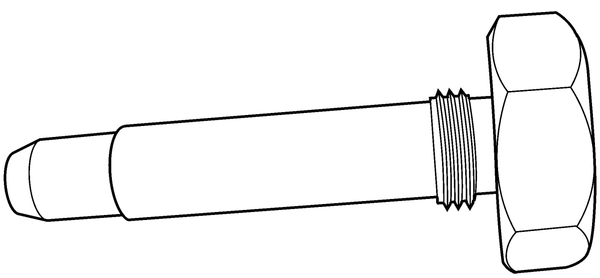


80c13cec

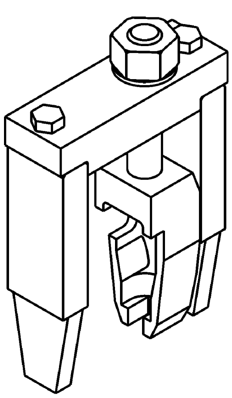
*VM.1055 HIGH PRESSURE INJECTION PUMP GEAR HOLDER*



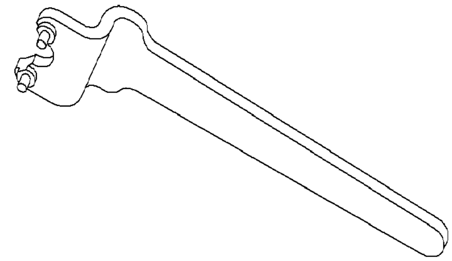

***VM.1052 INTAKE CAMSHAFT ALIGNMENT PIN***




***VM.1053 EXHAUST CAMSHAFT ALIGNMENT PIN***



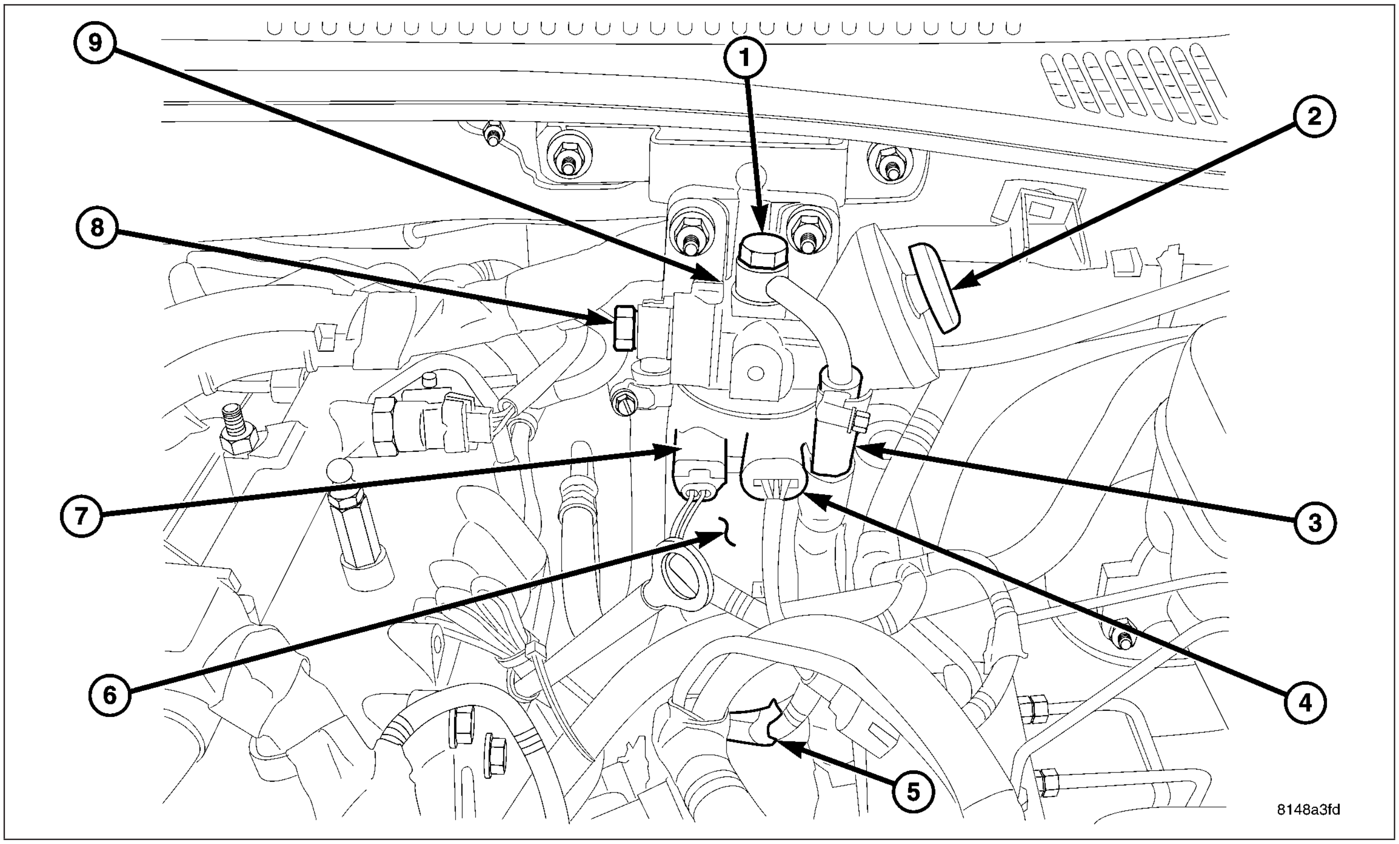
***VM.9075 FUEL INJECTOR EXTRACTOR***



***VM.9660 TIMING BELT TENSIONER WRENCH***

# FUEL FILTER / WATER SEPARATOR

## DESCRIPTION




The fuel filter/water separator assembly is located in the left rear corner of the engine compartment. It incorporates the fuel system prime button, bleed screw, fuel temperature sensor, fuel heater and a water in fuel (WIF) sensor. Only the fuel filter canister and the WIF sensor are serviced separately. The fuel filter has a 3 micron element and tightens clockwise to the housing..

## OPERATION

The fuel filter/water separator protects the high pressure fuel injection pump by removing water and contaminants from the fuel with a three micron filter element. The construction of the filter/separator allows fuel to pass through it, but helps prevent moisture (water) from doing so. Moisture collects at the bottom of the canister.

Refer to the maintenance schedules for the recommended fuel filter replacement intervals.

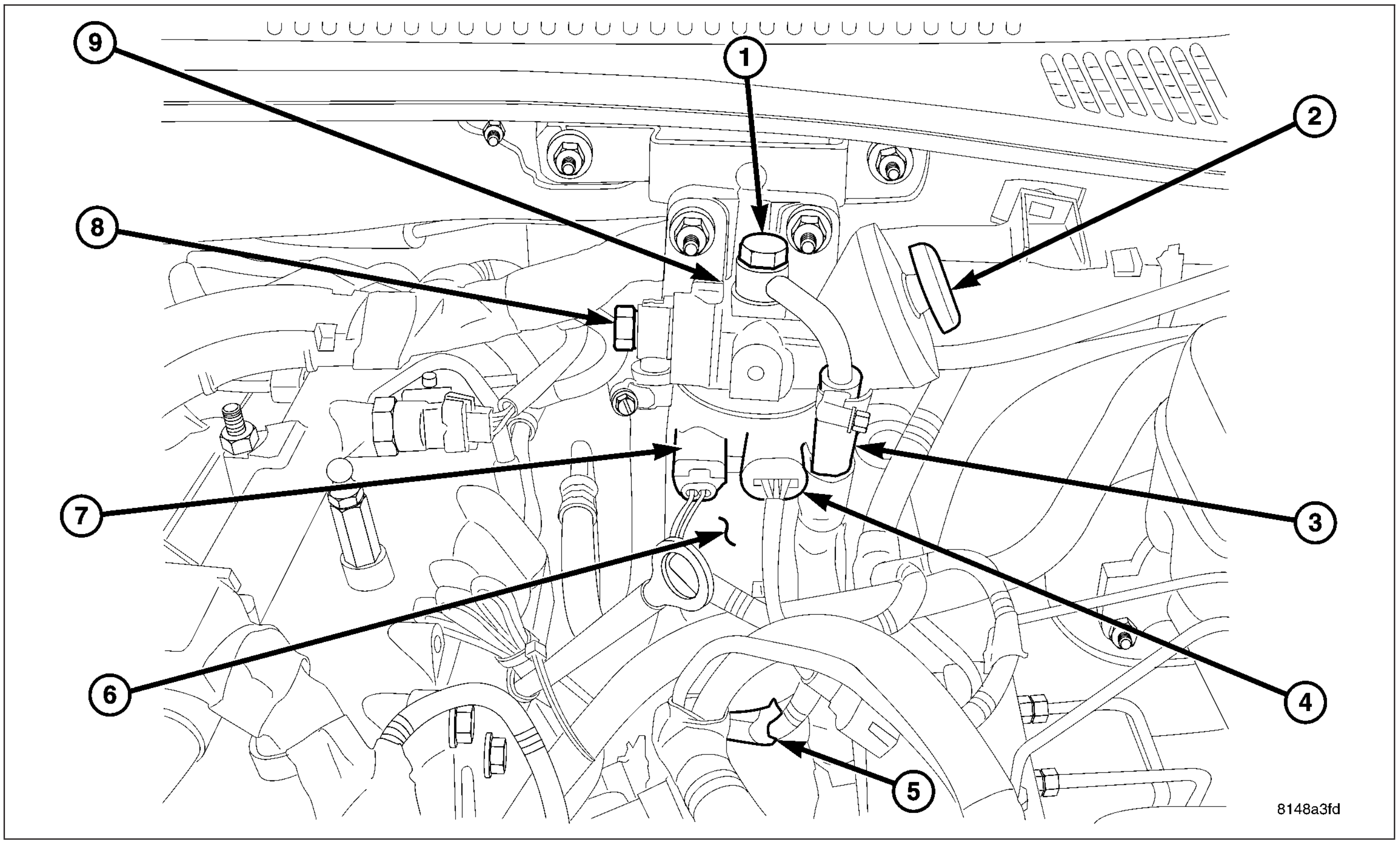
For draining of water from canister, (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).

A Water-In-Fuel (WIF) sensor is attached to the fuel filter and serviced separately. Refer to Water-In-Fuel Sensor Description/Operation.

The fuel heater and fuel temperature sensor are part of the fuel filter assembly head and not serviced separately from the head.

## REMOVAL

## FUEL FILTER/WATER SEPARATOR ASSEMBLY




**WARNING: Store fuel in approved and properly marked containers. Wear safety goggles and adequate protective clothing when servicing fuel system.**

1. Disconnect negative battery cable.
2. Drain fuel filter/water separator assembly (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE)

**NOTE: DO NOT loosen the banjo bolt fittings. Loosen the fuel hose clamps and remove hoses from the fuel lines.**

3. Remove two fuel lines from the water separator. Loosen retaining clamps and slide the hose from barbed fittings.
4. Disconnect the fuel heater and temperature sensor harness connectors.
5. Remove the fuel filter/water separator assembly from the engine cowl.

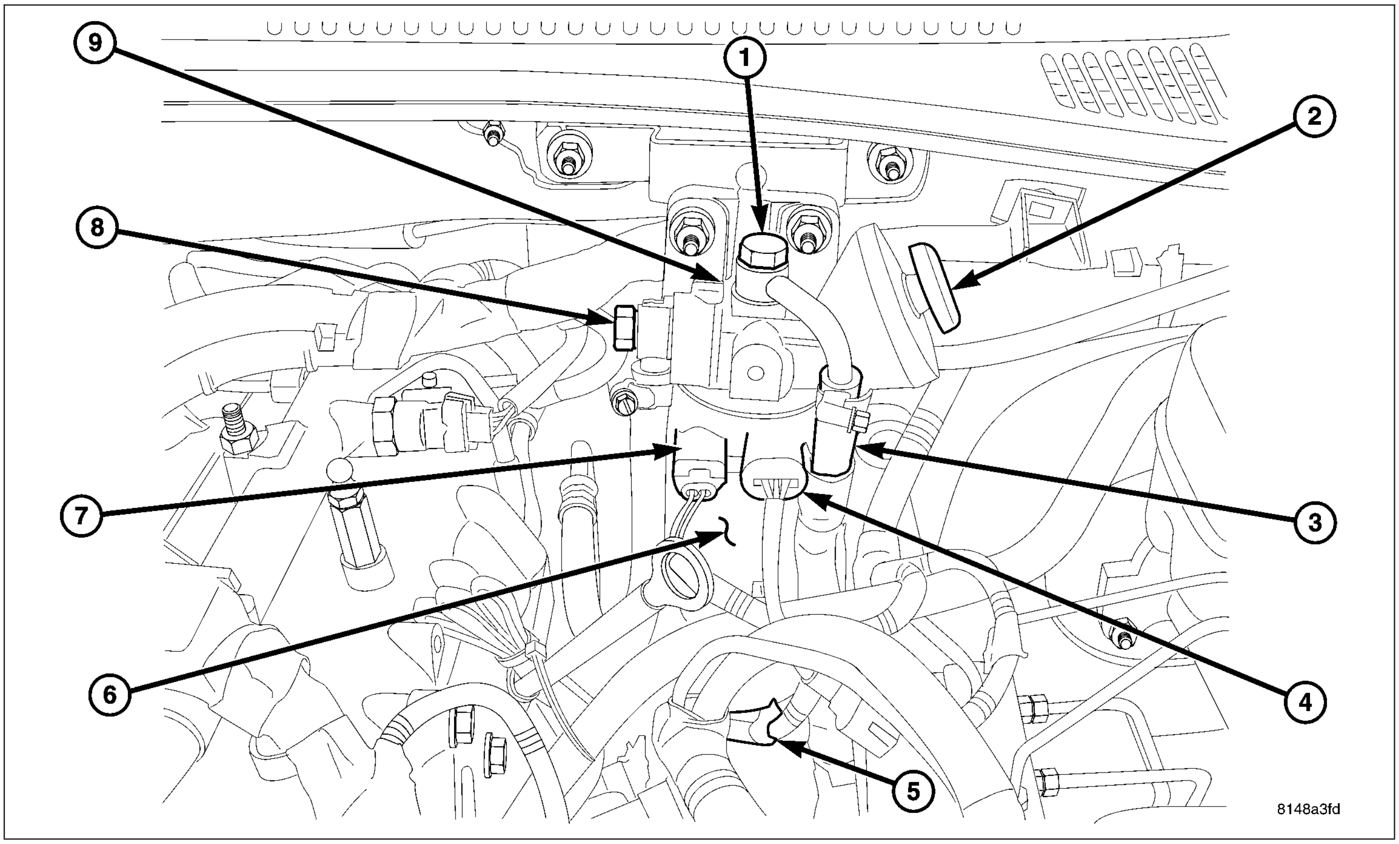
## FUEL FILTER

**NOTE: Capture all fuel in approved and appropriately marked containers. Wear safety goggles and adequate protective clothing when servicing the fuel system.**

1. Disconnect the negative battery cable.
2. Disconnect the water in fuel (WIF) sensor wiring harness connector.
3. Drain the fuel filter/water separator (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).
4. Unscrew the filter assembly from the head assembly by rotating the housing counterclockwise.
5. Separate the WIF sensor and seal from the housing by rotating counterclockwise.

## INSTALLATION

## FUEL FILTER / WATER SEPARATOR ASSEMBLY

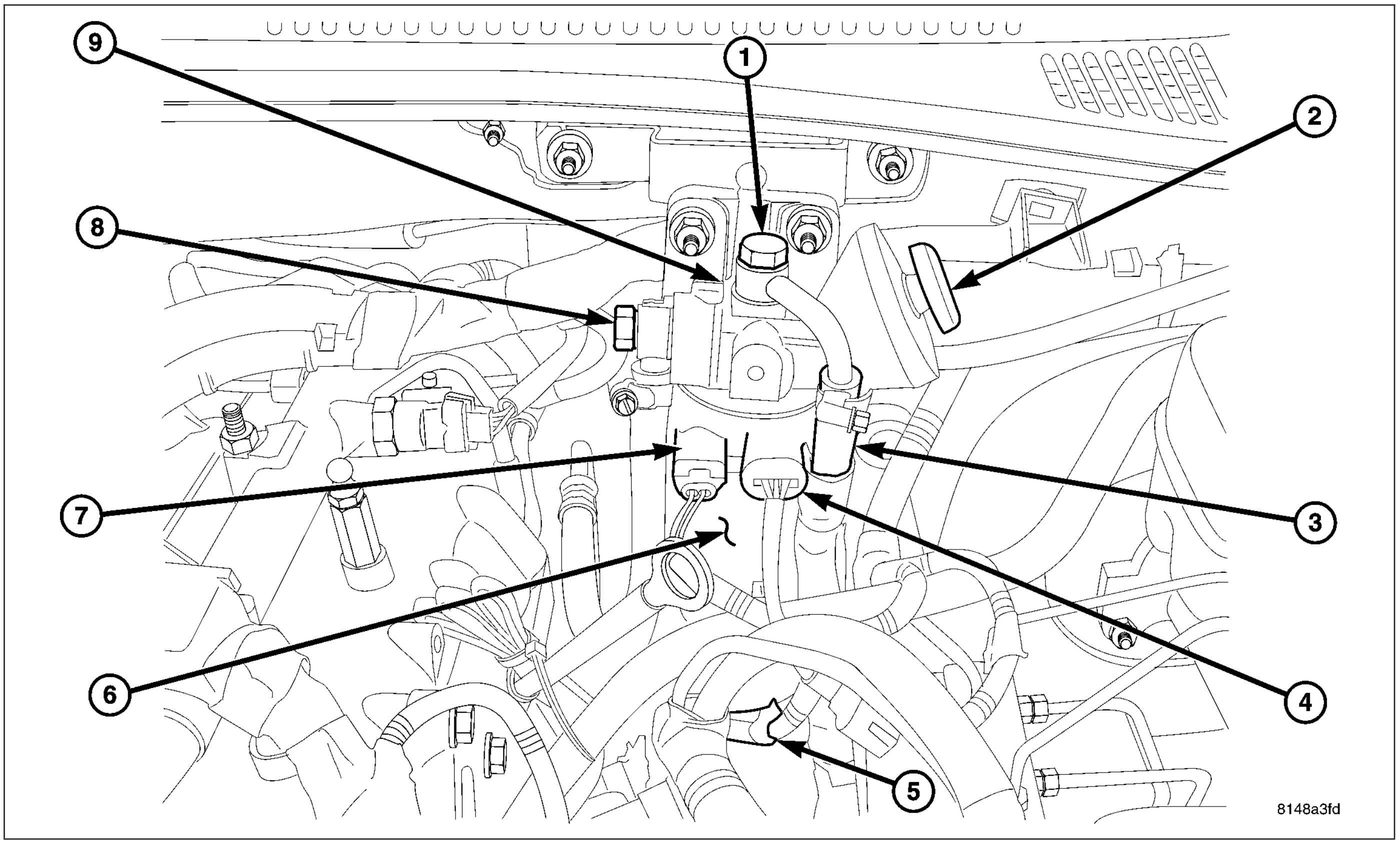



1. Carefully position fuel water separator over the mounting studs, install fasteners and tighten to 24.5 N·m (18 ft. lbs.).

**NOTE: Make sure the fuel supply hose to the high pressure pump is mounted to the left side of the filter assembly.**

2. Install the fuel lines to the housing assembly. tighten hose clamps to 7 N·m (62 in.lbs.).
3. Connect the water in fuel, fuel temperature sensor and the fuel heater electrical connectors.
4. Prime fuel system (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).
5. Connect negative battery cable.

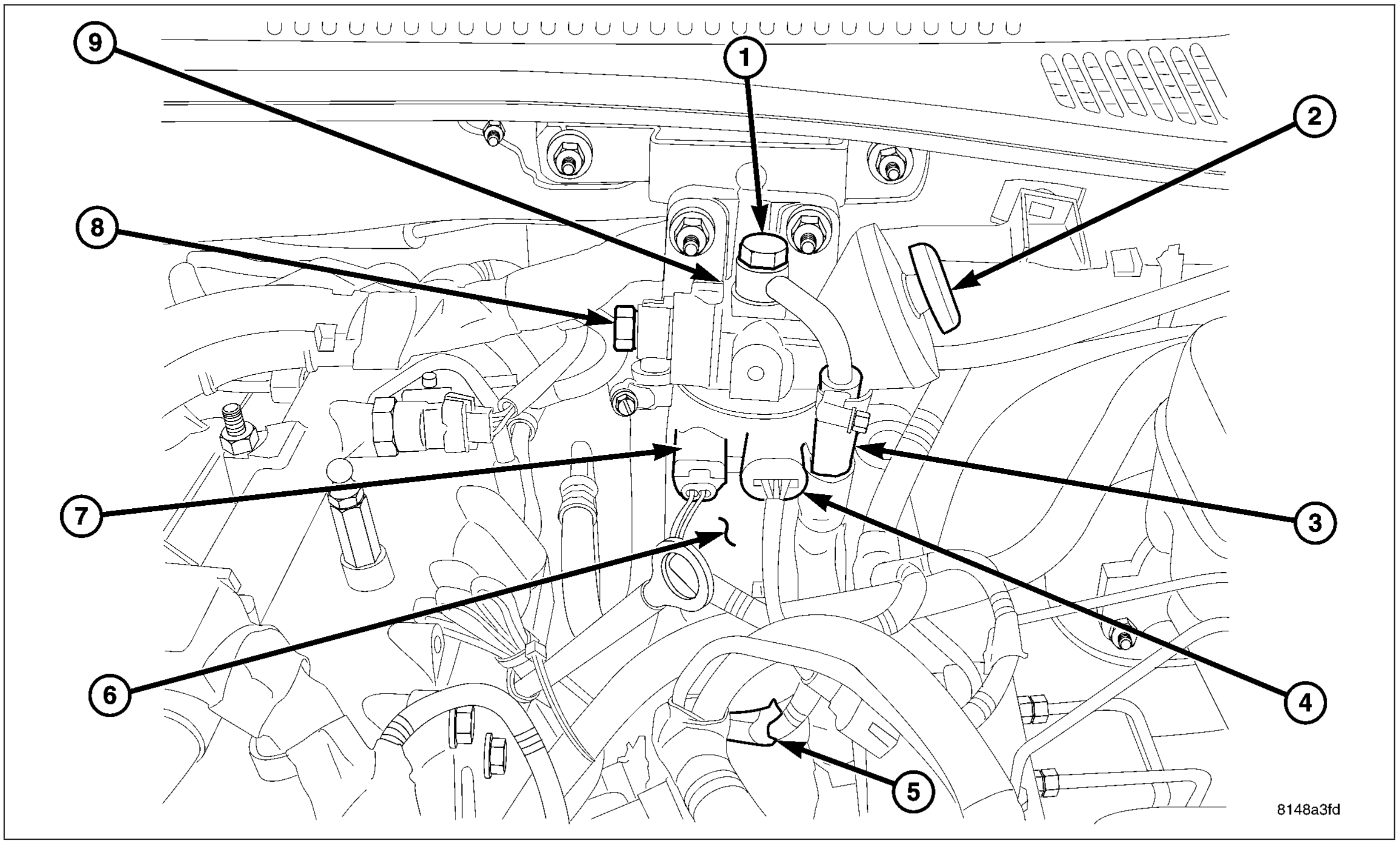
## FUEL FILTER




1. Lubricate the fuel filter seal with clean diesel fuel.
2. Install the water in fuel (WIF) sensor hand tight.
3. Screw filter assembly onto the fuel filter/water separator head. Tighten filter to 18 N·m (159 in. lbs.).
4. Connect the WIF wiring harness connector.
5. Prime the fuel system (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).
6. Start the engine and allow to warm.
7. Turn engine off and inspect for leaks.

# WATER IN FUEL SENSOR

## DESCRIPTION

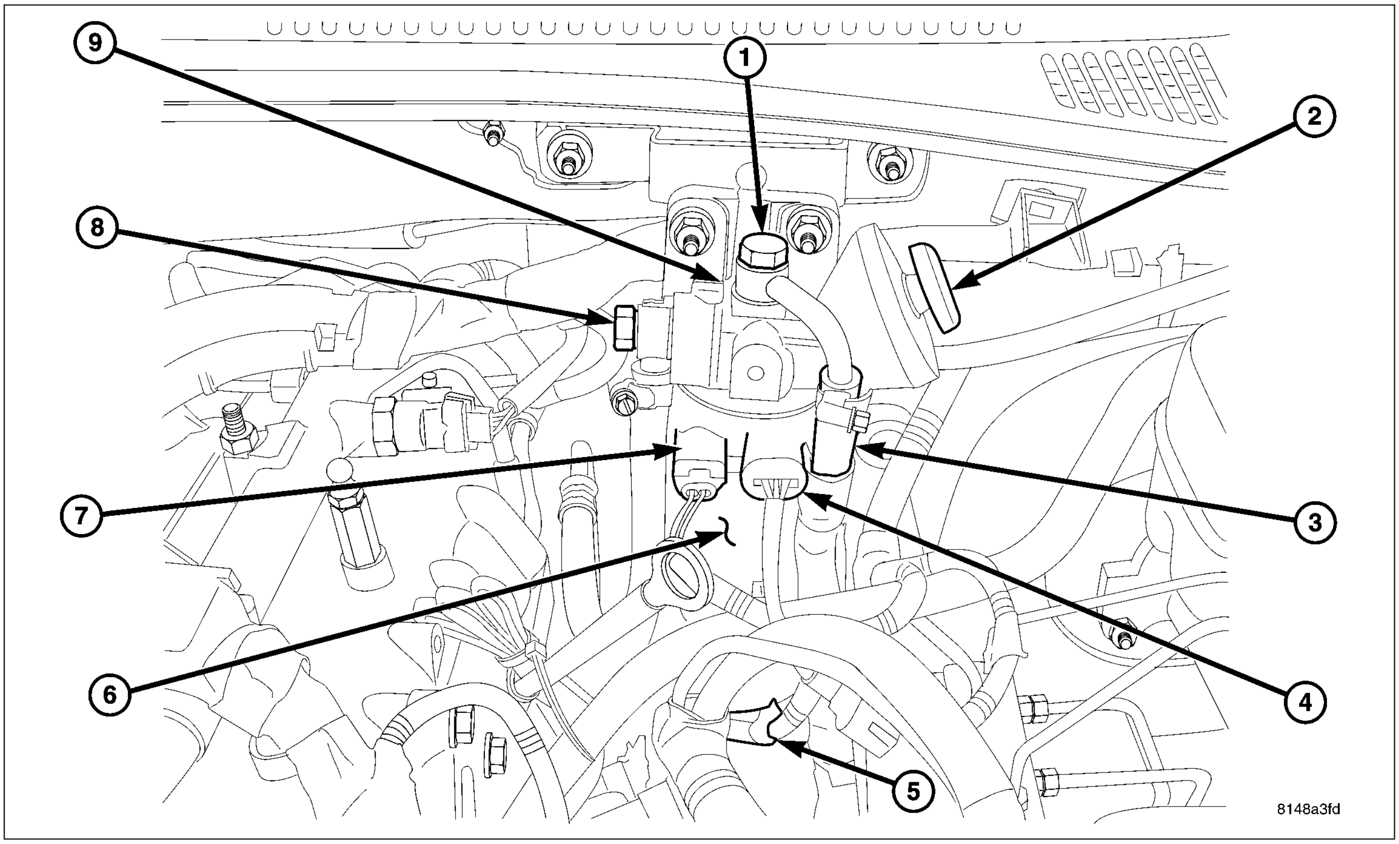



The WIF sensor is located in the bottom of the fuel filter/water separator. The sensor also has a drain channel and a protrusion for adapting a hose during draining.

## OPERATION

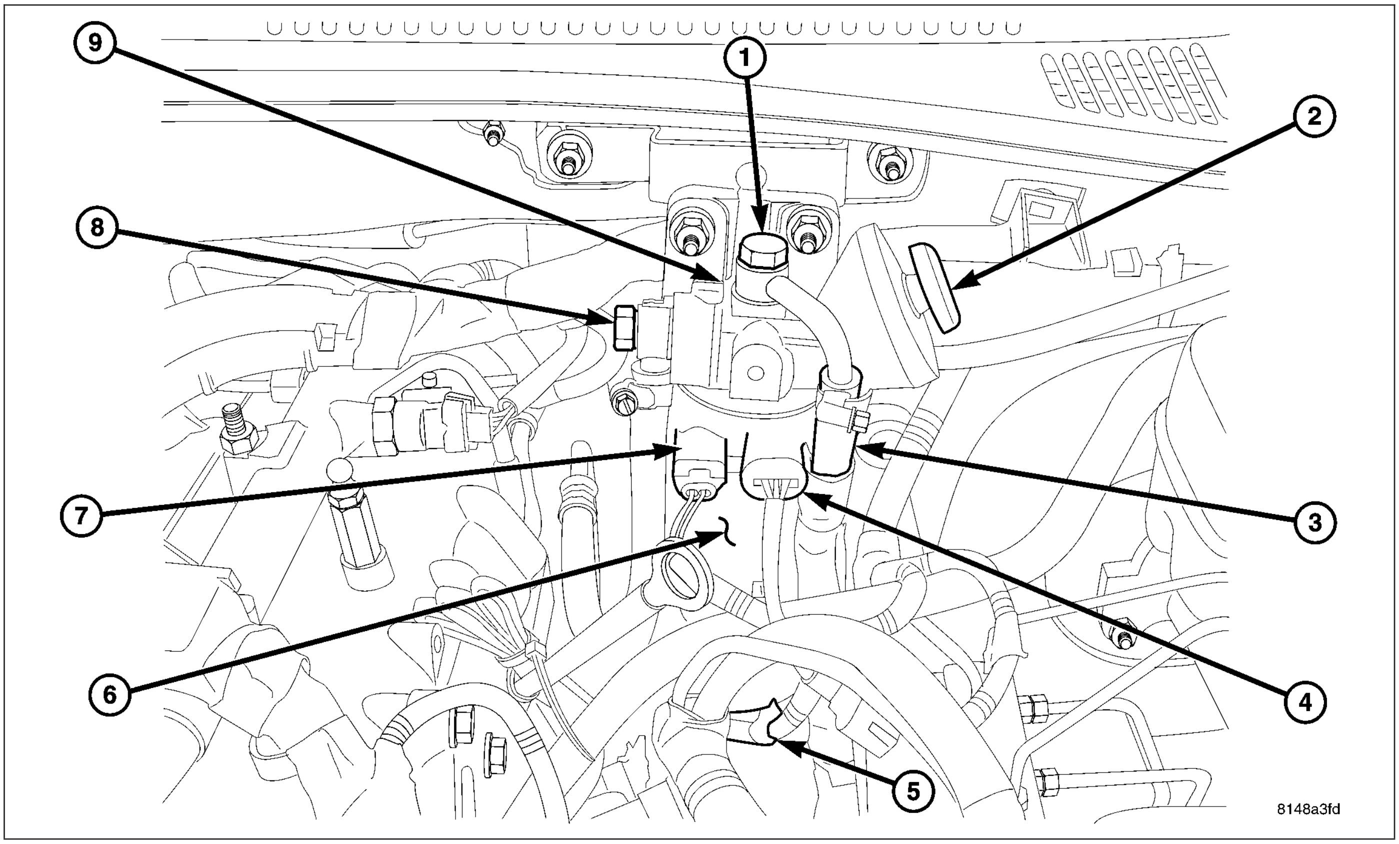
The sensor sends an input to the Engine Control Module (ECM) when it senses water in the fuel filter/water separator. As the water level in the filter/separator increases, the resistance across the WIF sensor decreases. This decrease in resistance is sent as a signal to the ECM and compared to a high water standard value. Once the value reaches 30 to 40 kilohms, the ECM will activate the water-in-fuel warning lamp. This all takes place when the ignition key is initially put in the ON position.

## REMOVAL




1. Disconnect negative battery cable.
2. Disconnect WIF sensor electrical connector.
3. Drain fuel filter/water separator assembly by loosening the WIF at bottom of fuel filter and opening the bleeder screw on top of the filter/separator. (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).
4. Unscrew WIF sensor from fuel filter/water separator assembly.

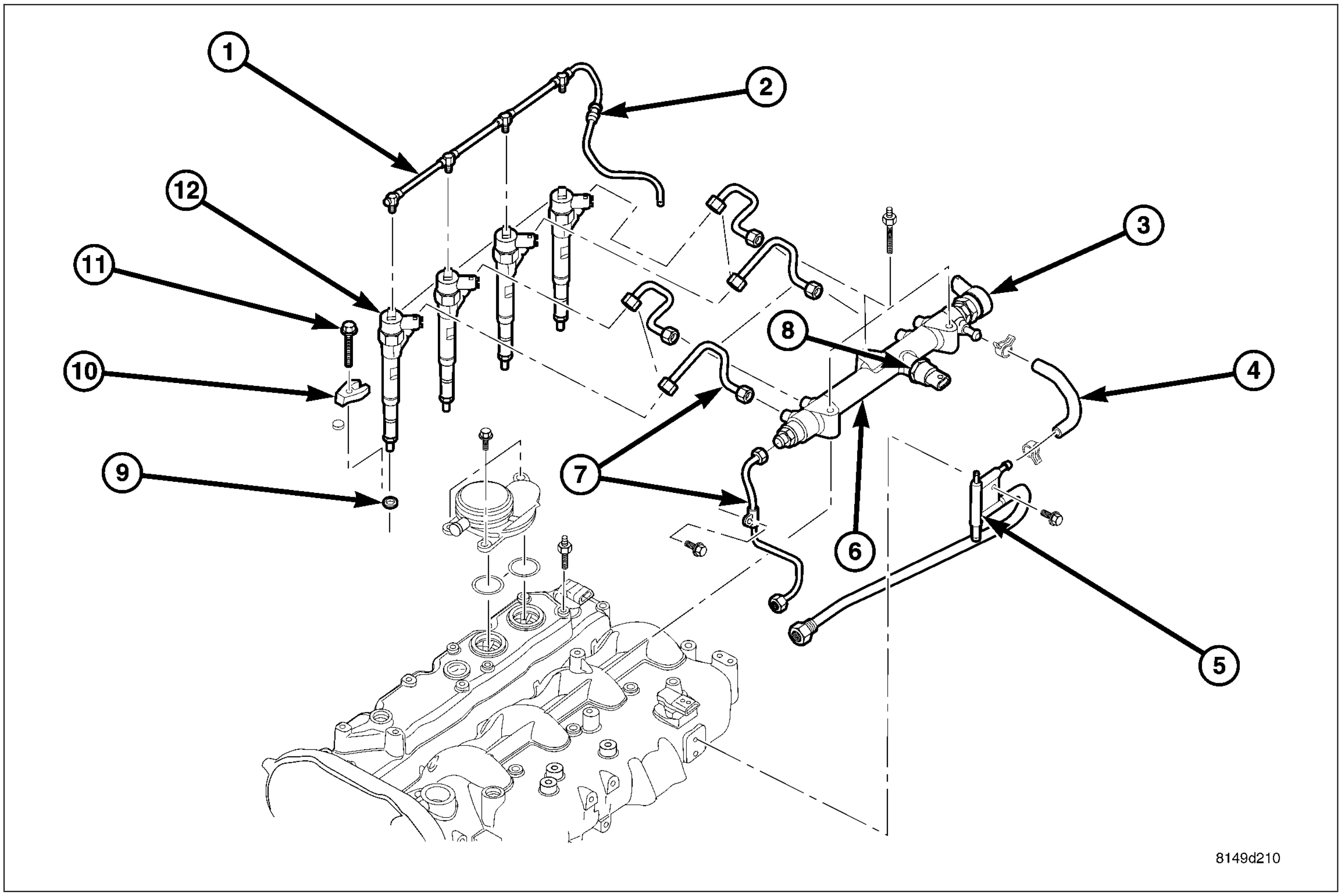
## INSTALLATION




1. Install WIF sensor with new seal into fuel filter hand tight.
2. Connect WIF sensor electrical connector.
3. Prime fuel system using fuel priming diaphragm (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).
4. Connect negative battery cable.

# FUEL RAIL

## DESCRIPTION




**WARNING: High - pressure fuel line deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi). Use extreme caution when inspecting for high - pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high - pressure leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.**

The fuel rail is mounted to the cylinder head cover/intake manifold. The rail supplies constant high fuel pressure to the fuel injectors.

## OPERATION

**WARNING: High - pressure lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600bar (23,200 psi.). Use extreme caution when inspecting for high - pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high - pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.**

The fuel rail stores the fuel for the injectors at high pressure. At the same time, the pressure oscillations which are generated due to the high-pressure pump delivery and the injection of fuel are dampened by the rail volume.

The fuel rail is common to all cylinders, hence it’s name “common rail”. Even when large quantities of fuel are extracted, the fuel rail maintains a constant inner pressure. This ensures that the injection pressure remains constant from the moment the injector opens.

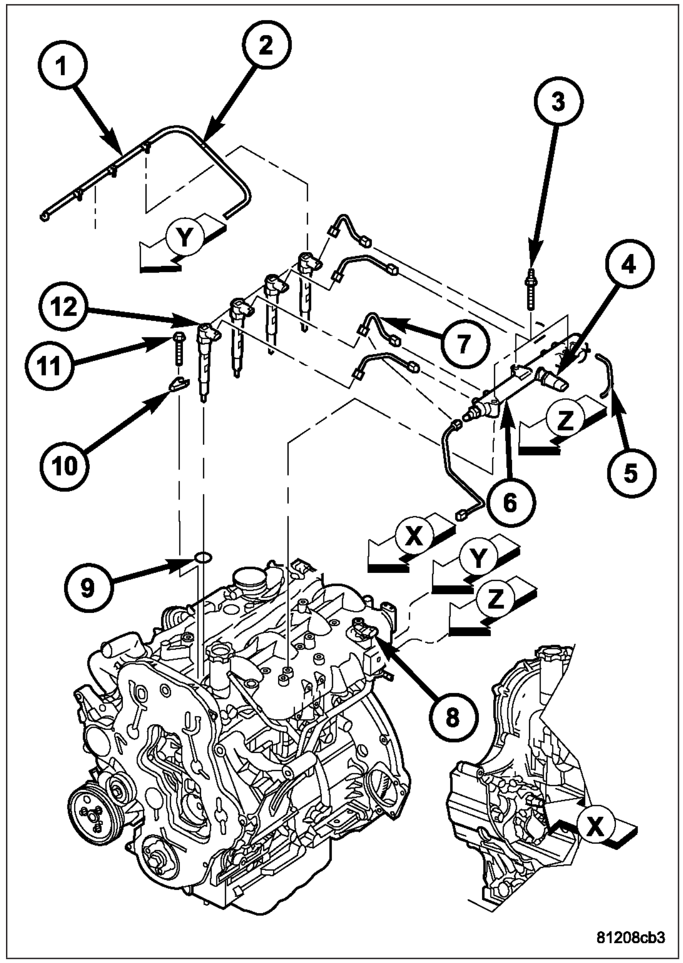
## REMOVAL

**WARNING: High - pressure lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi.). Use extreme caution when inspecting for high - pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high - pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.**

1. Disconnect negative battery cable.
2. Remove engine cover and bracket assembly (Refer to 9 - ENGINE COVER - REMOVAL).
3. Disconnect fuel pressure sensor electrical connector.

**NOTE: If fuel rail is being replaced it is necessary to replace the fuel rail solenoid.**

4. Disconnect the fuel rail solenoid electrical connector.
5. Disconnect fuel rail return line at fuel rail.
6. Disconnect fuel high pressure line from injection pump to fuel rail at fuel rail.
7. Disconnect fuel high pressure line from fuel rail to fuel injector at fuel rail.
8. Remove fuel rail retaining bolts and remove rail from cylinder head cover/intake manifold.




## INSTALLATION

**WARNING: High - pressure lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi.). Use extreme caution when inspecting for high - pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high - pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.**

**NOTE: The fuel rail solenoid must be replaced upon removal. When replacing fuel lines or solenoid it is necessary to counterhold and correctly torque the fitting. Refer to the proper procedure.**

1. Replace the fuel rail solenoid (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL PRESSURE SOLENOID - REMOVAL).
2. Install the fuel pressure sensor (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL PRESSURE SENSOR - INSTALLATION).
3. Install fuel rail on cylinder head cover/intake manifold. Torque retaining bolts to 24.5 N·m (18 ft. lbs.).
4. Connect injector high pressure fuel lines at fuel rail.
5. Connect fuel rail high pressure fuel line at fuel rail.

6. Connect fuel rail fuel return line at fuel rail.
7. Connect fuel pressure sensor electrical connector.
8. Install engine cover and bracket assembly (Refer to 9 - ENGINE COVER - INSTALLATION).
9. Connect negative battery cable.

# FUEL LINES

## DESCRIPTION

### LOW-PRESSURE FUEL LINES

All fuel lines up to the fuel injection pump are considered low-pressure. This includes the fuel lines from the fuel tank to the high pressure fuel injection pump. The fuel return lines and the fuel drain lines are also considered low-pressure lines. High-pressure lines are used between the fuel injection pump and the fuel injectors (Refer to 14 - FUEL SYSTEM - WARNING). Also refer to High-Pressure Fuel Lines Description/Operation (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL LINES - OPERATION).

### HIGH PRESSURE FUEL LINES

**CAUTION: High pressure lines can not contact each other or other components. Do not attempt to repair or weld high pressure fuel lines that are damaged. If lines are kinked or bent, they MUST be replaced. Use only recommended lines when replacement of high pressure fuel line is necessary.**

(Refer to 14 - FUEL SYSTEM - WARNING). The high-pressure fuel lines are used between the high pressure fuel injection pump and the fuel injector rail, and between the fuel injection rail and fuel injectors. All other fuel lines are considered low-pressure lines.

## OPERATION - HIGH PRESSURE FUEL LINES

**WARNING: High - pressure lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi.). Use extreme caution when inspecting for high - pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high - pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.**

**CAUTION: The high-pressure fuel lines cannot contact each other or other components. Do not attempt to weld high-pressure fuel lines or to repair lines that are damaged. If lines are ever kinked or bent, they must be replaced. Use only the recommended lines when replacement of high-pressure fuel line is necessary.**

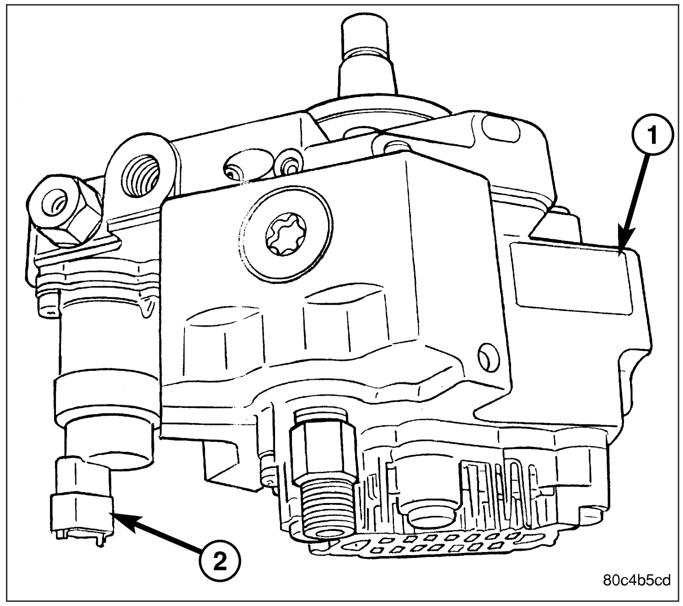
High-pressure fuel lines deliver fuel under extremely high pressure from the high pressure pump to the fuel injectors (Refer to 14 - FUEL SYSTEM - WARNING). The lines expand and contract from the high-pressure fuel pulses generated during the injection process. All high-pressure fuel lines are of the same length and inside diameter. Correct high-pressure fuel line usage and installation is critical to smooth engine operation.

# FUEL INJECTION PUMP

## DESCRIPTION

A radial, 3 piston pump with a gear type fuel pump attached to the back, is used as the high pressure pump for fuel pressure generation (Refer to 14 - FUEL SYSTEM - WARNING).

The pump is driven by the timing belt. Pressure is generated independently of the injection process. The pump is lubricated with diesel fuel and is not responsible for fuel injection timing.




## OPERATION

### Cascade Overflow Valve

Instead of using an electric supply pump, this fuel system uses a gear supply pump located inside the rear of the high pressure pump. The pump is driven by an eccentric on the end of the high pressure pump shaft. The gear pump draws fuel from the fuel tank through the fuel filter.

The pressurized outlet side of the gear pump provides pressurized fuel to a branched circuit internal to the high pressure pump flange, which supples both the fuel quantity solenoid and the cascade overflow valve. Because the gear pump increases fuel flow and pressure as the engine rpm increases, the pressure is regulated by the cascade overflow valve. The cascade overflow valve and gear supply pump are not serviced independently of the high pressure pump.

The cascade overflow valve has two functions:

- Regulation of lubrication fuel to the internal moving parts of the high pressure pump
- Regulation of the fuel pressure being supplied to the fuel quantity solenoid

The cascade valve has a machined center piece that has three drillings. One for overflow, one for lubrication and one for supply. The valve works in three stages based on the pressure entering the inlet of the valve.

### Stage 1

When the fuel pressure entering the tip of the cascade valve is between 0 and 3 bar (44 psi), the spring force is not overcome and fuel only flows through the center drilling. This drilling always allows fuel flow through to the pump center ring and lubricates the pump bushings and internal moving parts. This circuit also allows air to bleed during initial cranking and returns the air to the fuel tank. The cascade valve is only in stage one during cranking.

### Stage 2

When the fuel entering the cascade valve exceeds 3 bar (44 psi), but is less than 5 bar (73 psi), the center piece of the valve moves against the spring force aligning another passage for lubrication purposes. Stage 2 can be reached during cranking and initial start up.

### Stage 3

When fuel pressure exceeds 5 bar (73 psi), the center of the valve aligns with the overflow passage. This stage relieves the pressure into an overflow circuit that sends the fuel back to the inlet side of the gear pump which limits maximum fuel pressure to 5 bar (73 psi). Lubrication fuel also continues to flow though the other ports during this stage. Excess is sent back to the fuel tank through the return circuit.

### High Pressure Pumping Plungers

The fuel quantity solenoid supples three high pressure pumping chambers. The pumping chambers have one way inlet valves that allow fuel to flow into the chambers. The valves then close during compression of the fuel and cause the high pressure fuel to overcome a ball and angled seat outlet valve.

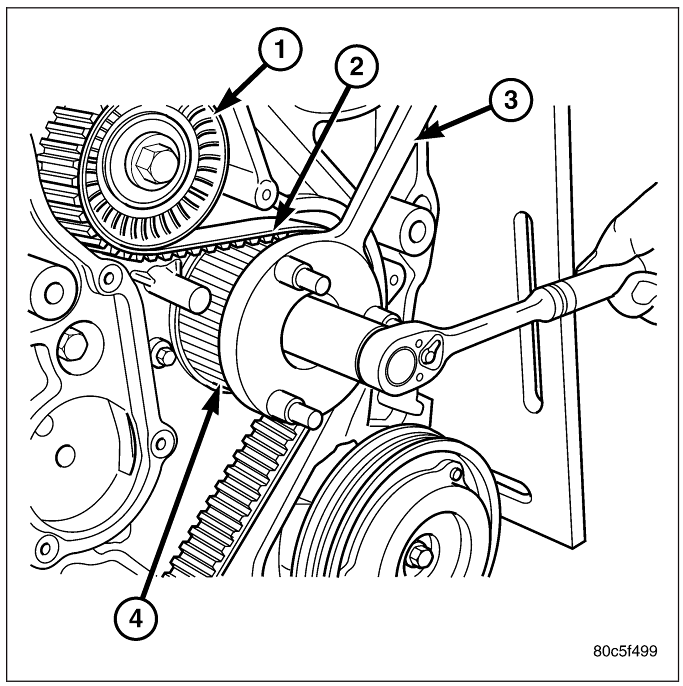
All three pumping chambers are tied together in one circuit internal to the pump and provide high pressure fuel up to 1600 bar (23,000 psi) through a steel line, to the fuel rail.

The pump is driven at 1:1 engine speed and is not responsible for injection timing. The pump is only responsible for providing high pressure fuel while the ECM controls the injection timing.

## REMOVAL

**WARNING: High - pressure lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi.). Use extreme caution when inspecting for high - pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high - pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.**

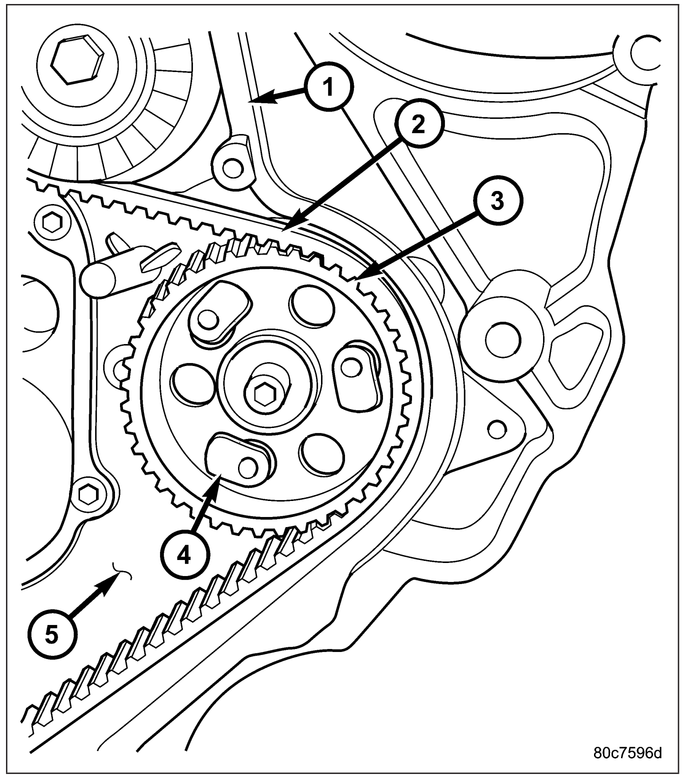
1. Disconnect negative battery cable.
2. Remove engine cover and bracket (Refer to 9 - ENGINE - REMOVAL).
3. Evacuate A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).
4. Remove cooling fan and fan shroud.
5. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
6. Remove fan support assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
7. Bring piston #1 to TDC, turn crankshaft until notch on the crankshaft hub is at the 12 o'clock position.
8. Looking at the engine from the belt side, rotate the crankshaft 90° clockwise.
9. Remove the intake and exhaust camshaft plugs from the camshaft cover, to introduce the camshaft timing pins VM.1052 Intake, and VM.1053 Exhaust (if the engine is timed correctly, the pins can be installed).



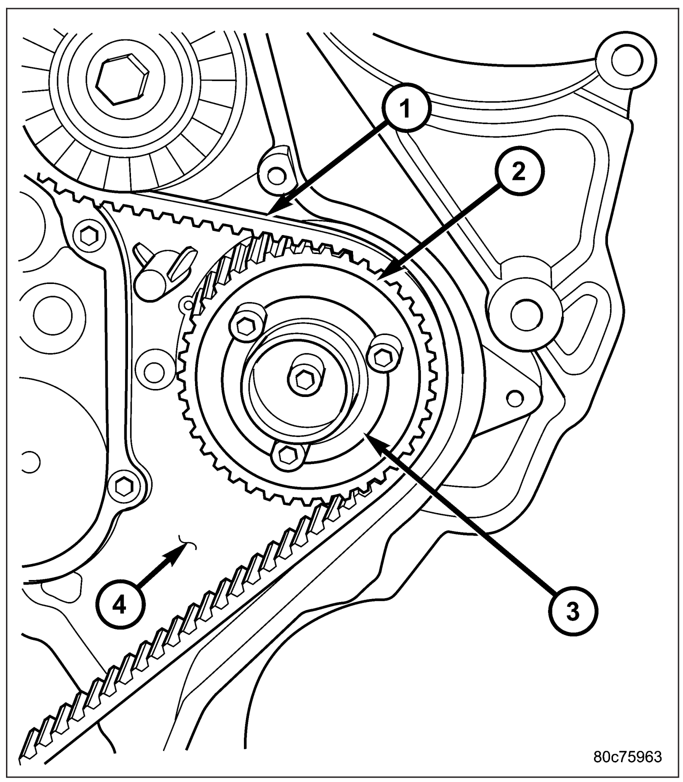

10. Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
11. Using special tool VM.1055, remove high pressure injection pump sprocket retaining nut.

**NOTE: The use of special tool VM.1067 will allow you to remove the high pressure injection pump without removing the timing belt from the engine. This will allow you to remove and install the high pressure injection pump without altering engine timing.**

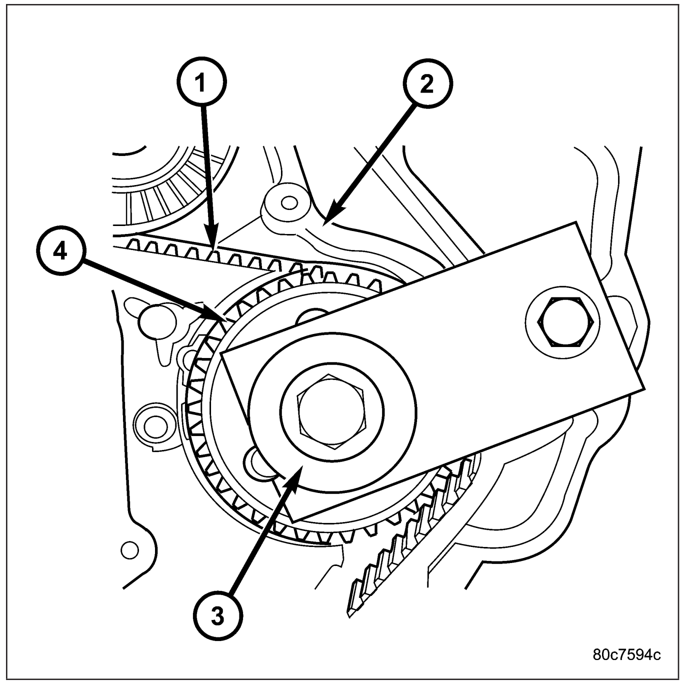
12. Install feet from VM.1067 in injection pump sprocket as shown.




13. Install inner flange of special tool VM.1067 on injection pump sprocket as shown. Secure flange to feet in injection pump sprocket with allen bolts supplied with tool.



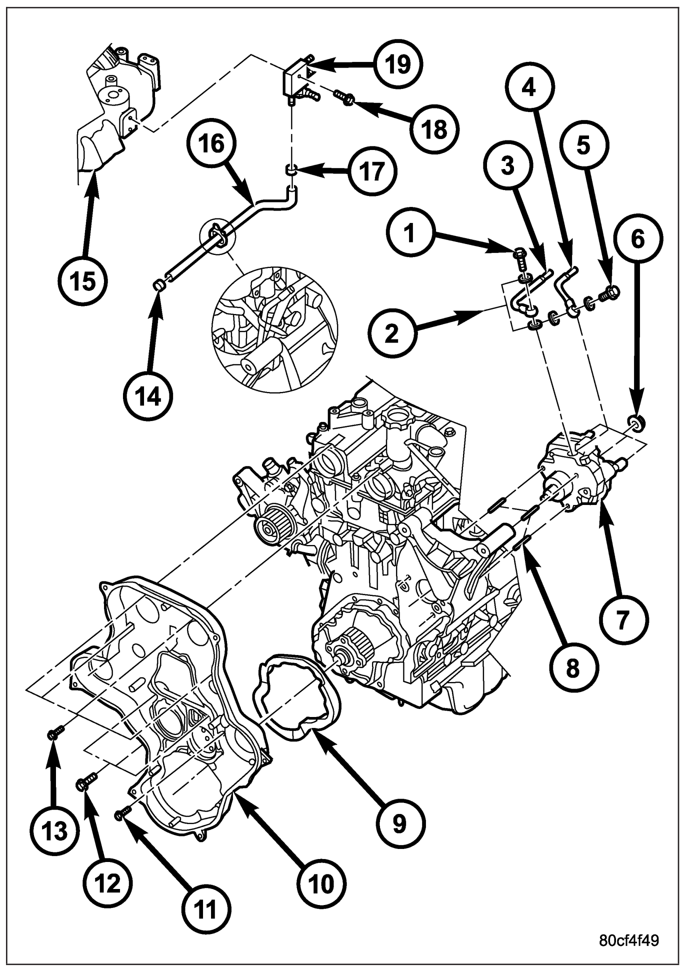
14. Screw the high pressure injection pump sprocket holding plate assembly into flange of VM.1067 Using left hand threaded bolt supplied, secure holding plate assembly to timing belt inner cover.




15. Remove the EGR airflow control valve from the intake manifold (Refer to 25 - EMISSIONS CONTROL/EXHAUST GAS RECIRCULATION/VALVE - REMOVAL).
16. Remove high pressure injection pump to fuel rail high pressure line.
17. Disconnect high pressure injection pump quantity control valve electrical connector.
18. Disconnect fuel supply and return lines at high pressure injection pump.
19. Remove alternator to intake manifold bracket.

**CAUTION: Care must be taken not to bend the brake vacuum tube when removing high pressure pump.**

20. Remove high pressure injection pump retaining nuts and remove pump.



## INSTALLATION

**WARNING: High - pressure lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi.). Use extreme caution when inspecting for high - pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high - pressure fuel leaks with a sheet of cardboard (refer to 14 - fuel system/fuel delivery - diagnosis and testing). Wear safety goggles and adequate protective clothing when servicing fuel system.**

**NOTE: If Engine Timing Is Of Concern, (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION) or (Refer to 9 - ENGINE/VALVE TIMING/TMNG BELT/CHAIN TENSIONER&PULLEY - ADJUSTMENTS).**

1. Rotate the high pressure pump as necessary to align the key in the pump to the keyway in the sprocket.
2. Loosen bolt in center of injection pump holding plate and slide high pressure injection pump through the accessory bracket into the injection pump sprocket.
3. Install high pressure injection pump retaining nuts. Torque nuts to 27.5N·m (20 ft. lbs.).
4. Unscrew injection pump holding plate (part of VM.1067) from inner timing belt cover and remove.
5. Install high pressure injection pump sprocket retaining nut to hold sprocket in place.
6. Remove flange and feet (both part of VM.1067) from high pressure injection pump sprocket.
7. Using special tool VM.1055 , torque high pressure injection pump sprocket retaining nut to 88.3N·m.(65 ft.lbs.).
8. Remove the camshaft lockpins and install the access plugs.
9. Connect fuel quantity control valve electrical connector.
10. Connect fuel supply and return lines at high pressure injection pump. (Refer to 14 - FUEL SYSTEM - WARNING).
11. Install the EGR airflow control valve (Refer to 25 - EMISSIONS CONTROL/EXHAUST GAS RECIRCULATION/VALVE - INSTALLATION).
12. Install outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
13. Install fan support assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
14. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
15. Install cooling fan and shroud assembly.
16. Install charge air cooler outlet hose.
17. Install engine cover and bracket (Refer to 9 - ENGINE - INSTALLATION).
18. Connect negative battery cable.
19. Evacuate and recharge A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

# FUEL LEVEL SENDING UNIT / SENSOR

## DESCRIPTION

The fuel gauge sending unit (fuel level sensor) is attached to the side of the lower fuel tank module. The sending unit consists of a float, an arm, and a variable resistor track (card).

## OPERATION

**For Fuel Gauge Operation:** A constant current source of approximately 32 milliamps is supplied to the resistor track on the fuel gauge sending unit. This is fed directly from the Engine Control Module (ECM). **NOTE: For diagnostic purposes, this 12V power source can only be verified with the circuit opened (fuel tank module electrical connector unplugged). With the connectors plugged, output voltages will vary from about 0.6 volts at FULL, to about 8.6 volts at EMPTY (about 8.6 volts at EMPTY for Jeep models, and about 7.0 volts at EMPTY for Dodge Truck models).** The resistor track is used to vary the voltage (resistance) depending on fuel tank float level. As fuel level increases, the float and arm move up, which decreases voltage. As fuel level decreases, the float and arm move down, which increases voltage. The varied voltage signal is returned back to the ECM through the sensor return circuit.

Both of the electrical circuits between the fuel gauge sending unit and the ECM are hard-wired (not multi-plexed). After the voltage signal is sent from the resistor track, and back to the ECM, the ECM will interpret the resistance (voltage) data and send a message across the multi-plex bus circuits to the instrument panel cluster. Here it is translated into the appropriate fuel gauge level reading. Refer to Instrument Panel for additional information.

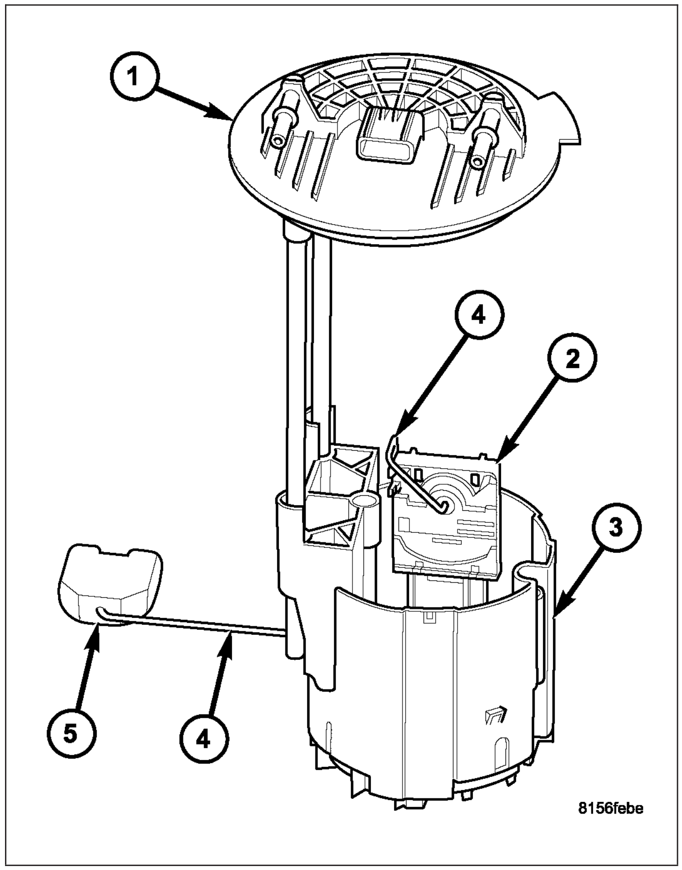
## DIAGNOSIS AND TESTING - FUEL LEVEL SENDING UNIT

The fuel level sending unit contains a variable resistor (track). As the float moves up or down, electrical resistance will change. Refer to Instrument Panel and Gauges for Fuel Gauge testing. To test the gauge sending unit only, it must be removed from vehicle. The unit is a separate part of the lower fuel tank module section. Refer to Fuel Tank Module Removal/Installation for procedures (remove only the upper section of the fuel pump module). Measure the resistance across the sending unit terminals. With float in up position, resistance should be 20 ohms (+/- 5%). With float in down position, resistance should be 220 ohms (+/- 5%).

## REMOVAL

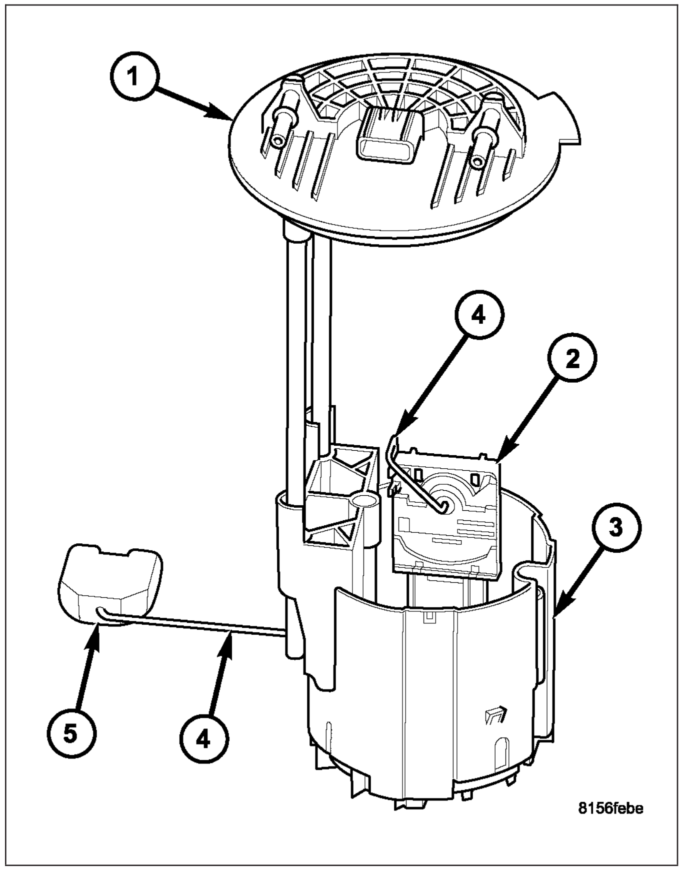
The fuel level sending unit (fuel level sensor) (2) and float assembly (4) and (5) are located on the fuel tank module.

1. Remove fuel tank module from fuel tank (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TANK MODULE - REMOVAL).
2. To remove sending unit from tank module, lift on plastic locking tab while sliding sending unit upwards.
3. Disconnect electrical connectors from fuel tank module. Separate necessary sending unit wiring.



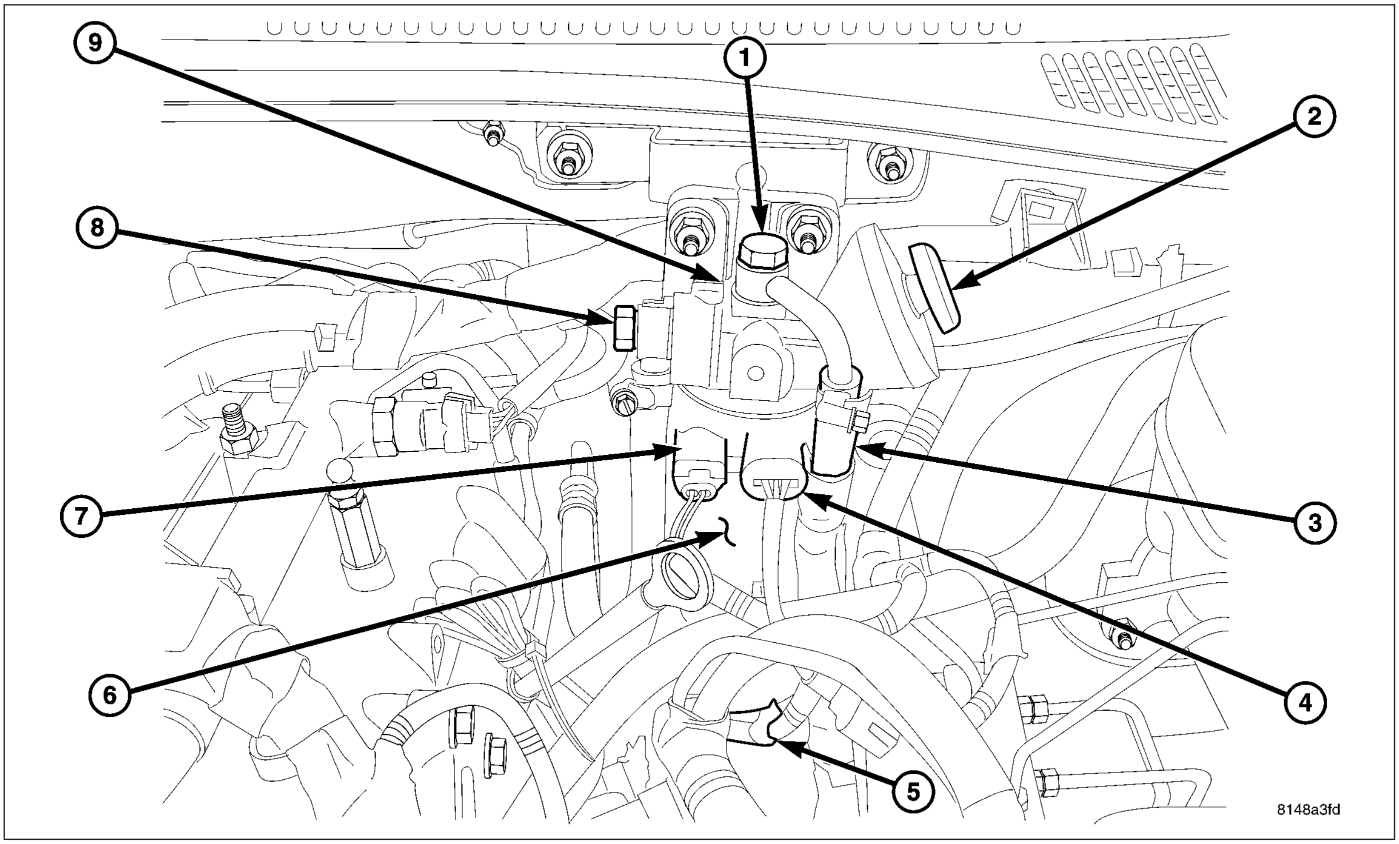
## INSTALLATION

1. Connect necessary wiring into electrical connectors.
2. Position sending unit (2) to tank module. Slide and snap into place until tab engages.
3. Install fuel tank module into fuel tank.



# FUEL HEATER

## DESCRIPTION



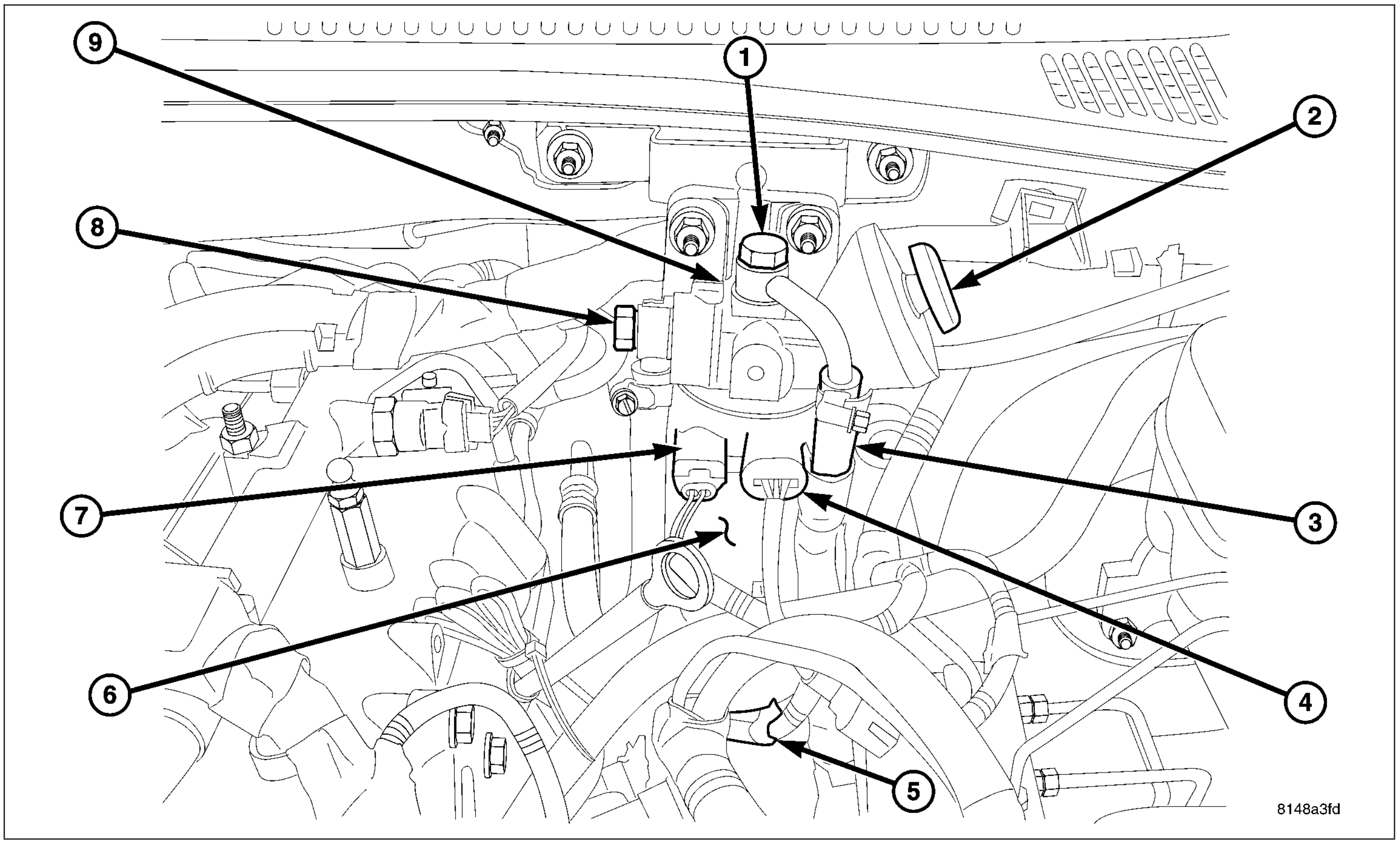

The fuel heater is used to prevent diesel fuel from waxing and plugging the fuel filter during cold weather operation. The fuel heater is located in the fuel filter/water separator assembly head, next to the fuel temperature sensor.

## OPERATION

The element inside the heater assembly is made of a Positive Temperature Coefficient (PTC) material, and has power applied to it by the fuel heater relay anytime the ignition key is in the “on” position. PTC material has a high resistance to current flow when its temperature is high, which means that it will not generate heat when the temperature is above a certain value. When the temperature is below 7°C (45° F), the resistance of the PTC element is lowered, and allows current to flow through the fuel heater element warming the fuel. When the temperature is above 29°C (85° F), the PTC element’s resistance rises, and current flow through the heater element stops .

Voltage to operate the fuel heater is supplied from the glow plug module, through the fuel heater relay, when the ECM senses the ignition (key) switch.

## REMOVAL




**WARNING: Store fuel in approved and properly marked containers. Wear safety goggles and adequate protective clothing when servicing fuel system.**

1. Disconnect negative battery cable.
2. Disconnect fuel heater, fuel temperature and water in fuel (WIF) sensor electrical connectors.
3. Drain fuel filter/water separator assembly into a suitable and appropriately marked container by loosening the WIF at the bottom of fuel filter.

**NOTE: Care must be taken to identify the fuel supply and return hoses before removal from the fuel filter housing. They can easily be crossed during installation and lead to a no start condition.**

4. Paint mark and remove the fuel inlet and outlet hoses.
5. Remove fuel supply and return hose from the housing.
6. Remove the fuel filter housing fasteners and housing.

## INSTALLATION

1. Install fuel filter/water separator assembly. Tighten retaining fasteners to 24.5 N·m (18 ft.lbs.).

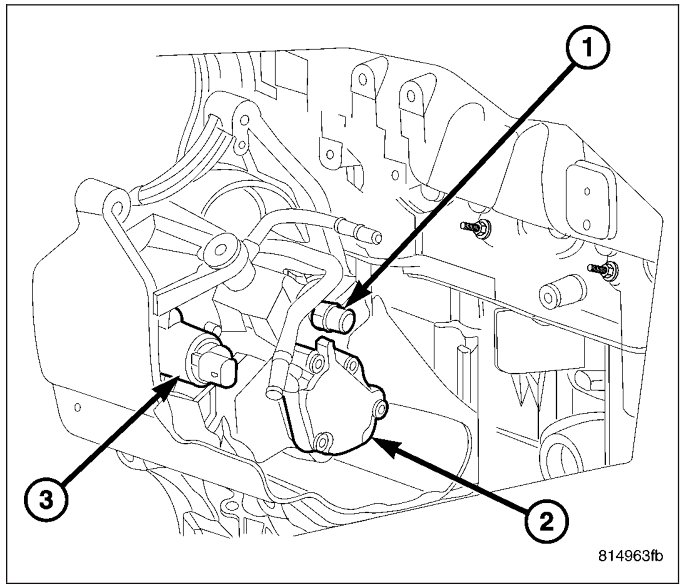
**NOTE: Care must be taken when installing the fuel lines to assure proper routing. The lines can easily be crossed and cause a no start condition after the repair.**

2. Connect the fuel supply and return lines. Tighten clamps to 7 N·m (62 in. lbs.).
3. Connect fuel heater, WIF and fuel temperature sensor electrical connectors.
4. Prime fuel system using the fuel priming plunger. (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).
5. Connect negative battery cable.

# FUEL QUANTITY SOLENOID

## DESCRIPTION

The fuel quantity solenoid is located in the back of the high pressure pump. The solenoid is pulse width modulated by the ECM and meters the amount of fuel that flows into the high pressure elements inside of the high pressure pump. The solenoid is also inactive during the first 30 seconds to allow maximum fuel pressure to the fuel rail during start up.




## OPERATION

The fuel quantity solenoid is a pulse width modulated valve that controls the amount of fuel sent or delayed to the high pressure pump elements inside of the high pressure pump. The ECM determines the fuel pressure set point based on engine sensor inputs. If the actual fuel rail pressure is too low, the ECM commands the solenoid to allow more fuel to flow to the high pressure pump. This minimizes the difference between the actual fuel rail pressure reading and the set point. The ECM will also operate the solenoid, delaying fuel if the fuel rail pressure becomes to high.

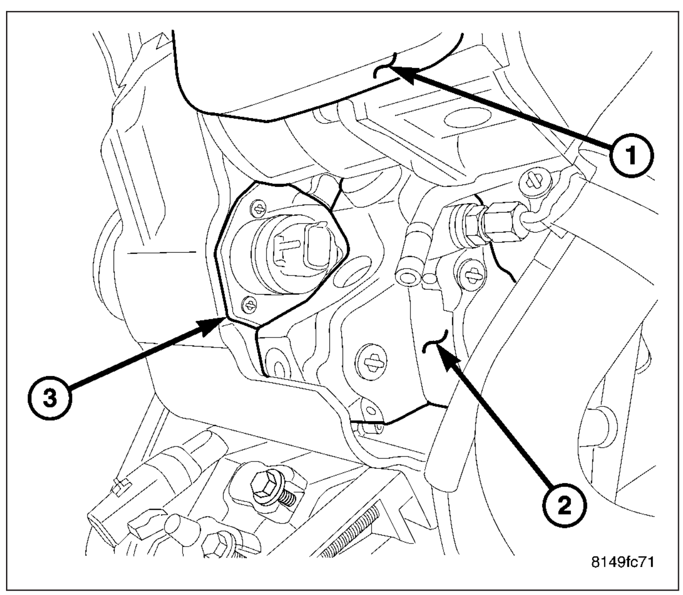
The fuel quantity solenoid is commanded open by the ECM to allow the high pressure pump to build maximum pressure (1600 BAR, 23,200 PSI) (Refer to 14 - FUEL SYSTEM - WARNING). the solenoid also has fuel tank heat protection function that meters the exact amount of fuel to prevent excess heated fuel from returning to the fuel tank

## REMOVAL

1. Disconnect the negative battery cable
2. Remove the charge air inlet hose.
3. Disconnect the fuel quantity solenoid wiring harness connector.
4. Remove the solenoid from the back of the high pressure pump.

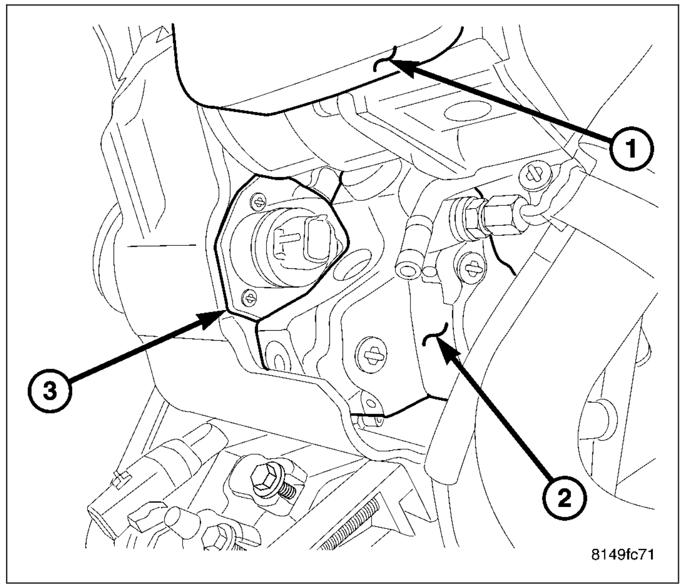
**NOTE: Inspect the fuel quantity solenoid and high pressure pump passage for contamination or corrosion. If contamination or corrosion is present replace the high pressure pump.**

5. Inspect solenoid and pump for corrosion.



## INSTALLATION

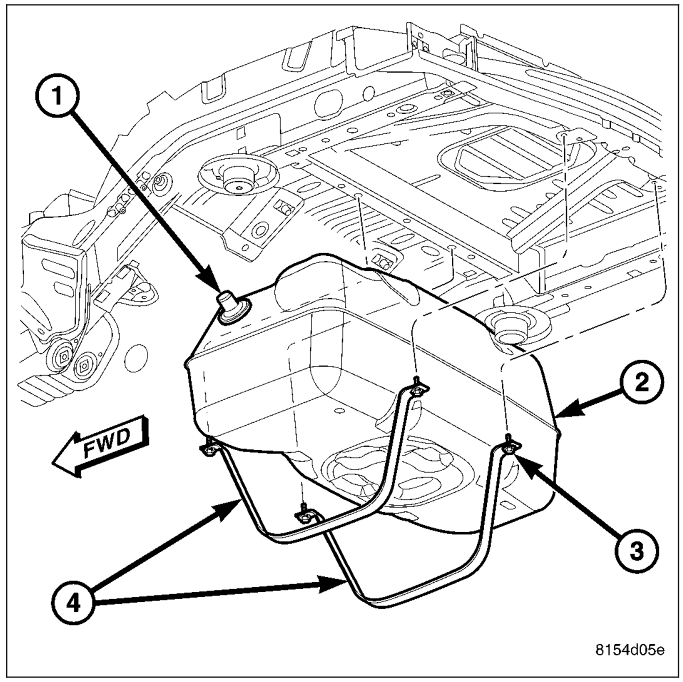
1. Review the high pressure fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING).
2. Lubricate the fuel quantity solenoid and seal with clean diesel fuel.
3. Install the solenoid into the high pressure pump, hand tighten the fasteners.
4. Torque the solenoid fasteners to 10.8 N·m (96 in. lbs.).
5. Connect the wiring harness connector.
6. Install the charge air inlet hose.
7. Start engine, allow to warm, shut engine off and inspect for leaks.

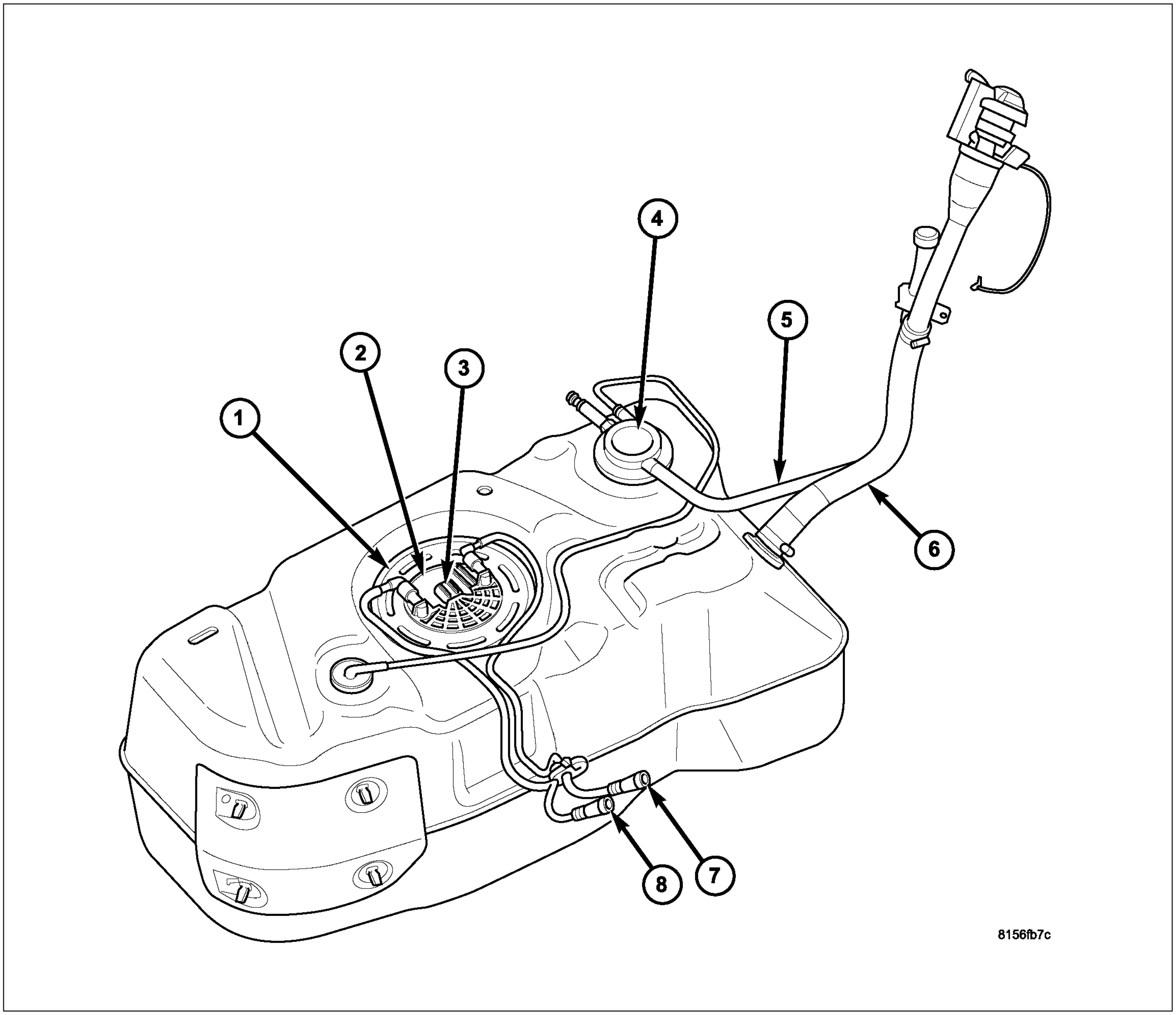


# FUEL TANK

## REMOVAL - DIESEL

1. Drain fuel tank. (Refer to 14 - FUEL SYSTEM/ FUEL DELIVERY - STANDARD PROCEDURE)
2. If equipped, remove fuel tank skid plate and tow hooks. Certain equipment packages will also require removal of the trailer hitch.
3. Support tank with a hydraulic jack.
4. Remove four fuel tank strap bolts (3) (2 at front of tank; 2 at rear of tank), and remove both tank support straps (4).
5. Carefully lower tank a few inches.

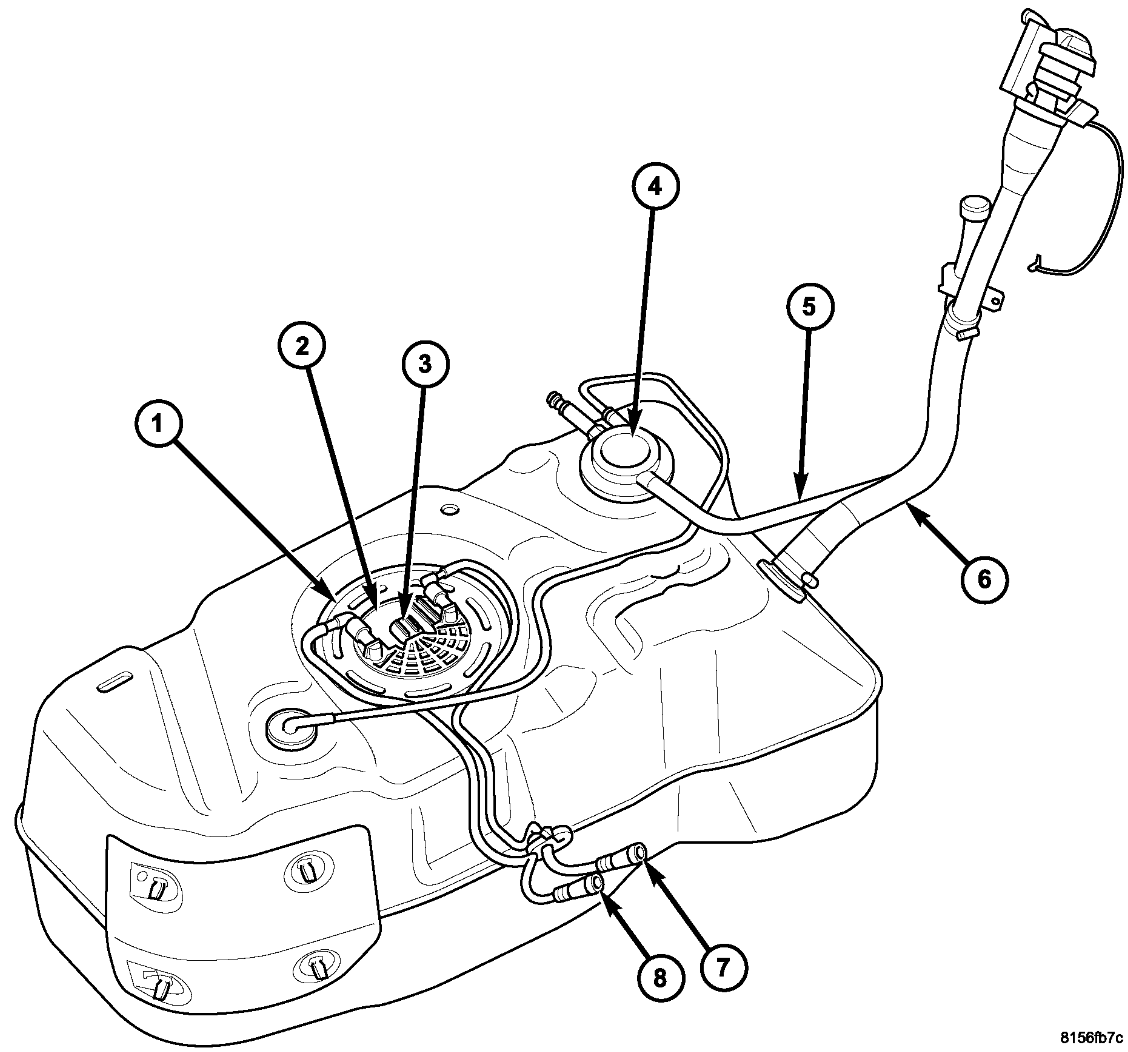





6. Disconnect fuel tank module electrical connector (3) on top of fuel tank.
7. Disconnect fuel supply line (8) at front of fuel tank.
8. Disconnect fuel return line (7) at front of fuel tank.
9. Disconnect vent hose (5).
10. Continue lowering tank while guiding remaining hoses and lines through plastic isolator sleeve on frame rail.
11. If fuel tank is to be replaced, remove fuel tank module from tank. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TANK MODULE - REMOVAL)

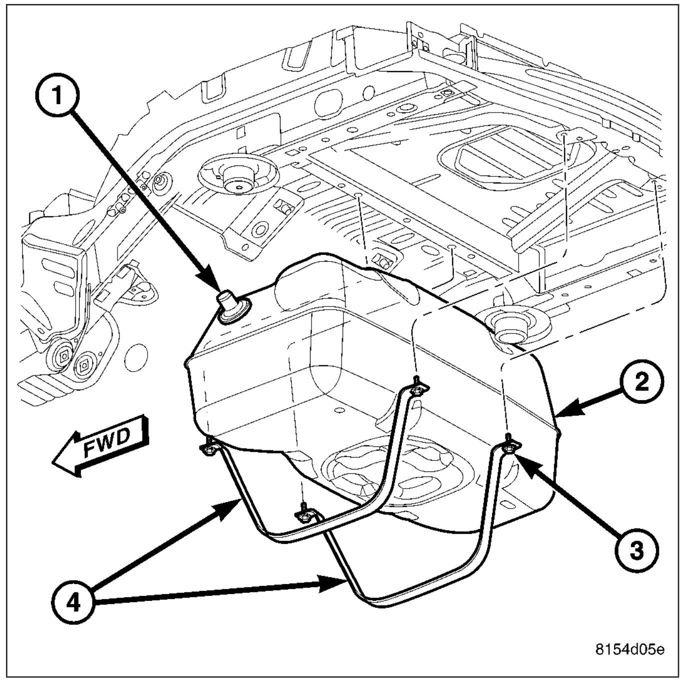
## INSTALLATION - DIESEL

1. If fuel tank is to be replaced, install fuel tank module to tank. Refer to Fuel Tank Module Removal/Installation procedures.
2. Position fuel tank to hydraulic jack.
3. Raise tank while carefully guiding vent tubes/hoses through plastic isolator sleeve located on crossmember.

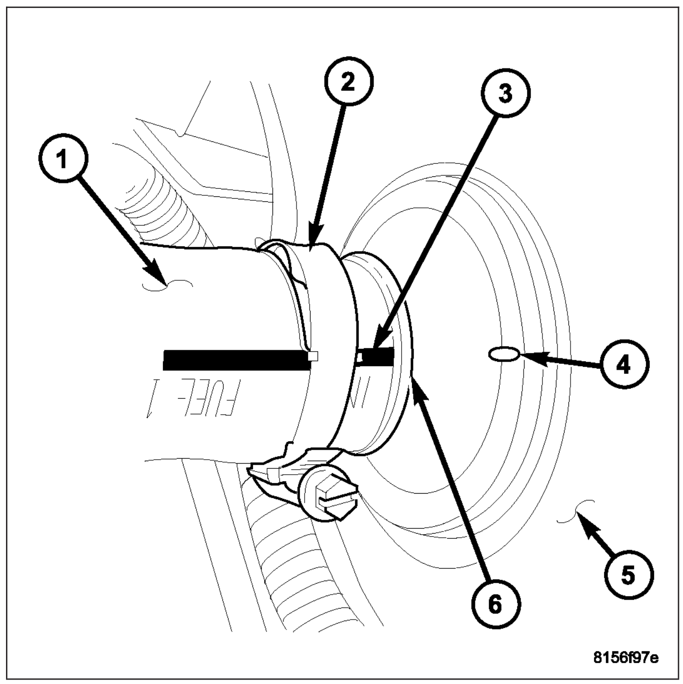



4. Continue raising tank until module electrical connector (7) can be connected. After connection has been made, continue to raise tank to body.
5. Connect fuel supply line (3).
6. Connect fuel return line (6).

7. Attach two fuel tank mounting straps (4) and four mounting bolts (3). Tighten bolts to 61 N·m (45 ft. lbs.) torque.

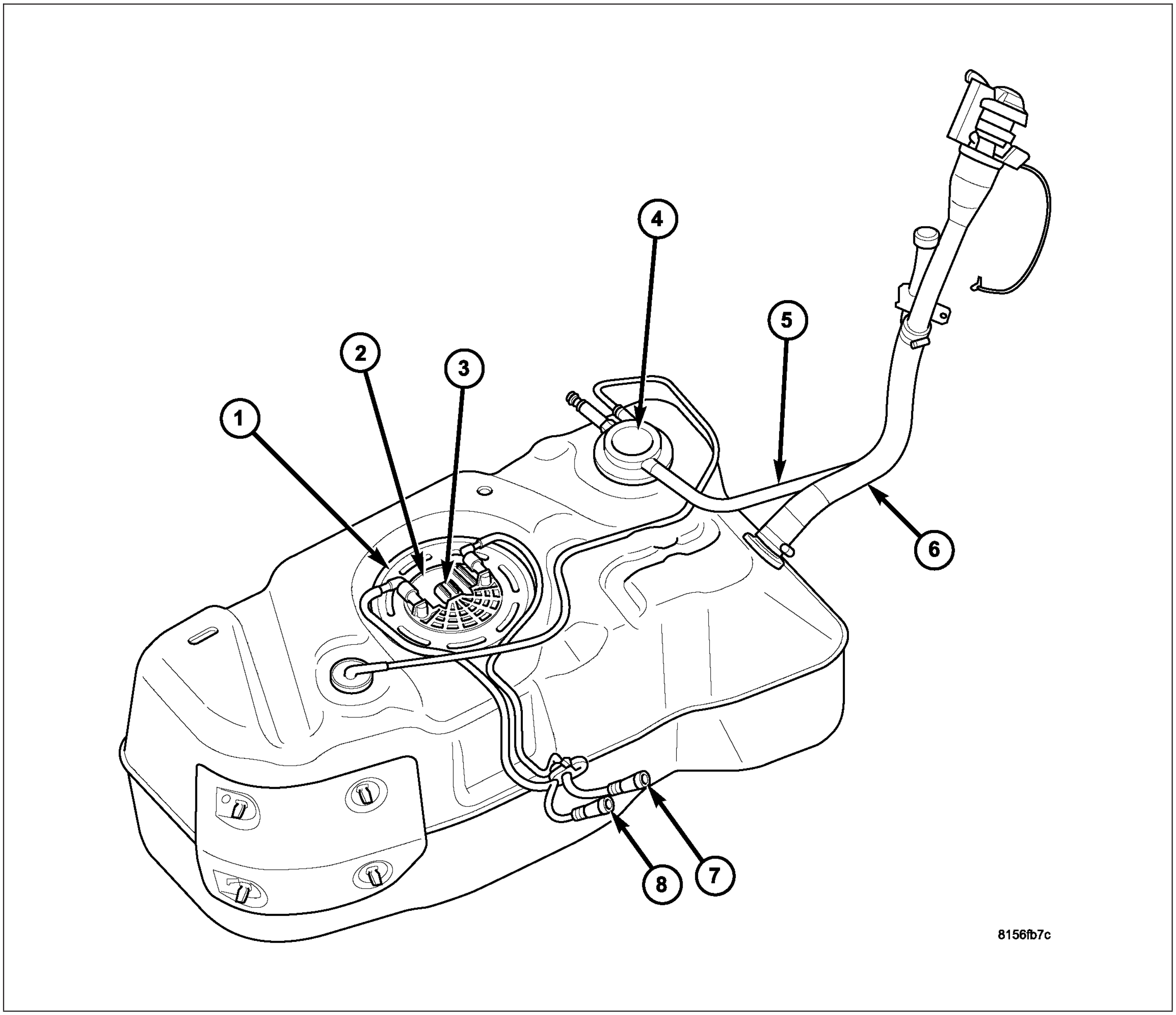



8. Install fuel fill hose and hose clamp to fuel tank fitting. Rotate hose until white painted index mark (3) on hose is located to alignment notch (4) on fuel tank fitting. Tighten clamp to 3.4 N·m (30 in. lbs.) torque.
9. If equipped, install fuel tank skid plate, trailer hitch and tow hooks. Refer to Tow Hooks, Trailer Hitch or Skid Plate in 23, Body for removal/installation procedures.
10. Lower vehicle.
11. Connect negative battery cable to battery.
12. Fill fuel tank with fuel.
13. Start engine and check for fuel leaks.



# FUEL TANK MODULE

## DESCRIPTION

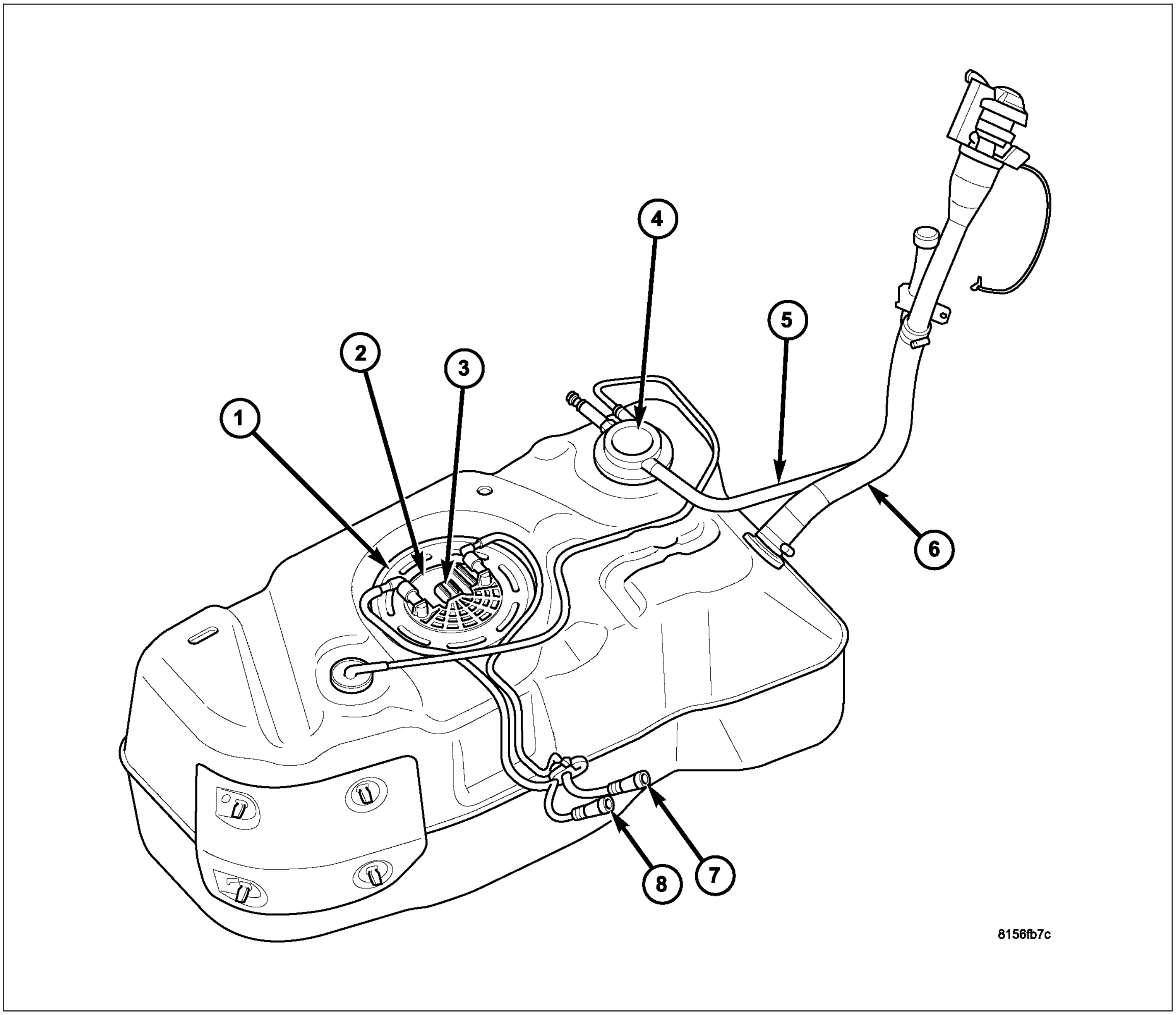



The fuel tank module (2) is installed in the top of the fuel tank. The fuel tank module contains the following components:

- Fuel reservoir
- A separate in-tank fuel filter
- Fuel gauge sending unit (fuel level sensor)
- A special lockring (1) to retain module to fuel tank
- Fuel supply line connections
- Fuel return line connections

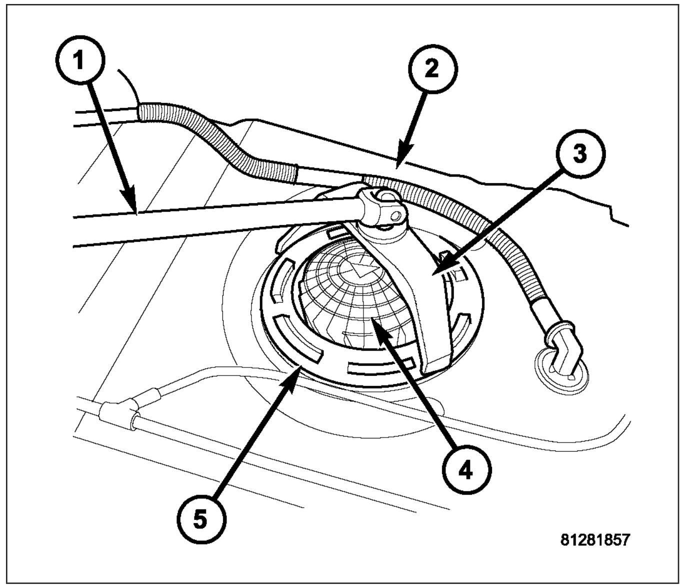
A separate electric fuel pump (sometimes referred to as a low-pressure fuel transfer or lift pump) **is not attached** to the fuel tank module. Instead, a gear supply pump is mounted to the rear of the high-pressure fuel injection pump. This supply pump draws fuel under a vacuum; through the fuel filter; and from the fuel tank. Refer to Fuel Injection Pump for additional information.

## REMOVAL




The fuel tank module (2) is located on top of the fuel tank.

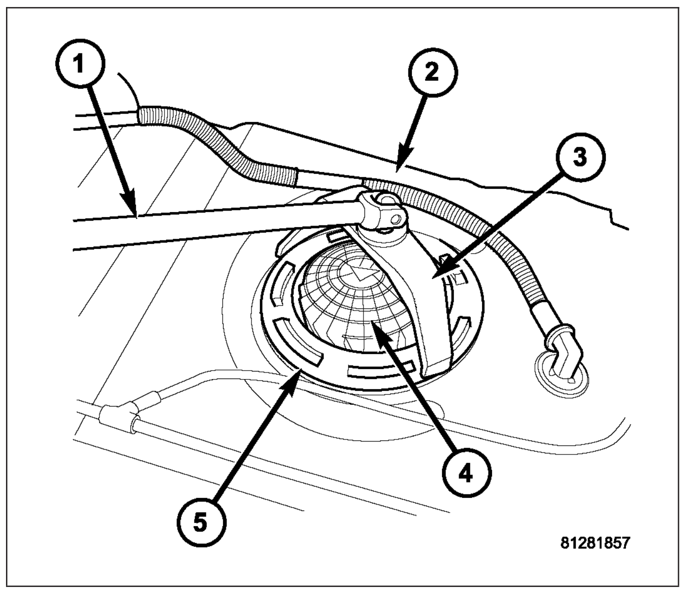
1. Drain and remove fuel tank. Refer to Fuel Tank Removal/Installation.
2. Note rotational position of module before attempting removal. An indexing arrow is located on top of module for this purpose.
3. Position Special Tool 9340 (3) into notches on outside edge of lockring (5).
4. Install 1/2 inch drive breaker bar (1) to tool 9340 (3).
5. Rotate breaker bar counter-clockwise to remove lockring.
6. Remove lockring. The module will spring up slightly when lockring is removed.
7. Remove module from fuel tank. Be careful not to bend float arm while removing.




## INSTALLATION

**CAUTION: Whenever the fuel pump module is serviced, the rubber seal (gasket) must be replaced.**

1. Using a new seal (gasket), position fuel tank module into opening in fuel tank.
2. Position lockring (5) over top of fuel pump module.
3. Rotate module until embossed alignment arrow points to center alignment mark. This step must be performed to prevent float from contacting side of fuel tank. Also be sure fuel fitting on top of pump module is pointed to front of vehicle.
4. Install Special Tool 9340 (3) to lockring.
5. Install 1/2 inch drive breaker (1) into Special Tool 9340 (3).
6. Tighten lockring (clockwise) until all seven notches have engaged.
7. Install fuel tank. Refer to Fuel Tank Removal/Installation.



# FUEL INJECTION - 3.7L GAS

## TABLE OF CONTENTS

# FUEL INJECTION - 3.7L GAS

## DESCRIPTION

The Powertrain Control Module (PCM) operates the fuel injection system. Refer to Powertrain Control Module in Electronic Control Modules for information.

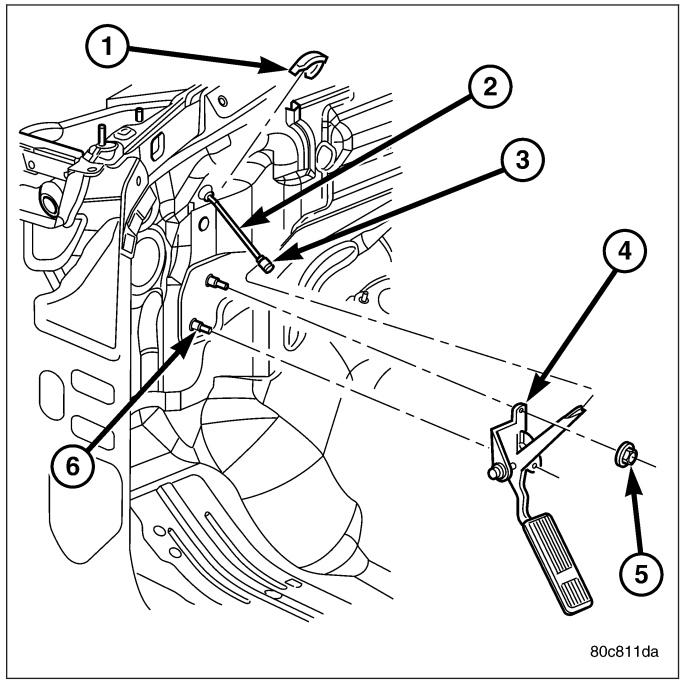
# PEDAL-ACCELERATOR

## REMOVAL

The accelerator pedal is serviced as a complete assembly including the bracket.

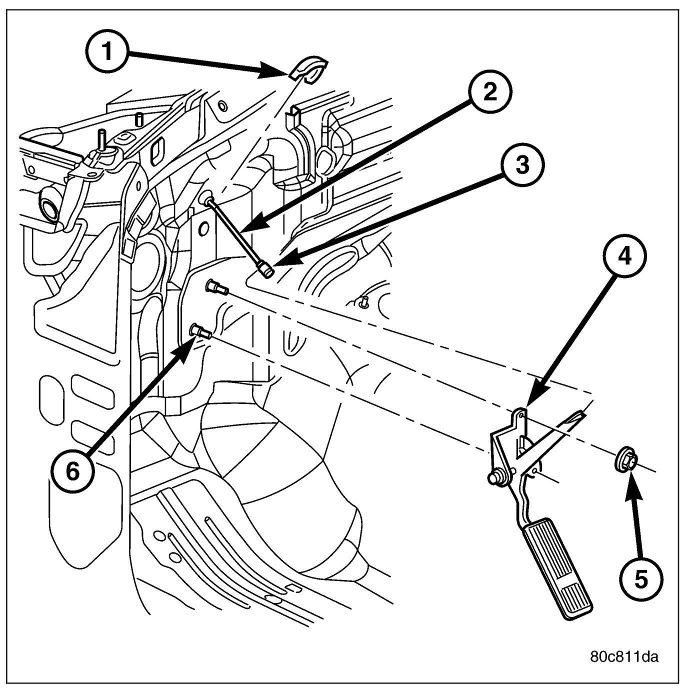
The accelerator pedal is connected to the upper part of the accelerator pedal arm by a plastic retainer (clip). This plastic retainer (3) snaps into the top of the accelerator pedal arm.

1. From inside the vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of accelerator pedal arm. Plastic cable retainer (clip) snaps into pedal arm.
2. Remove 2 accelerator pedal mounting bracket nuts (5). Remove accelerator pedal assembly (4).




## INSTALLATION

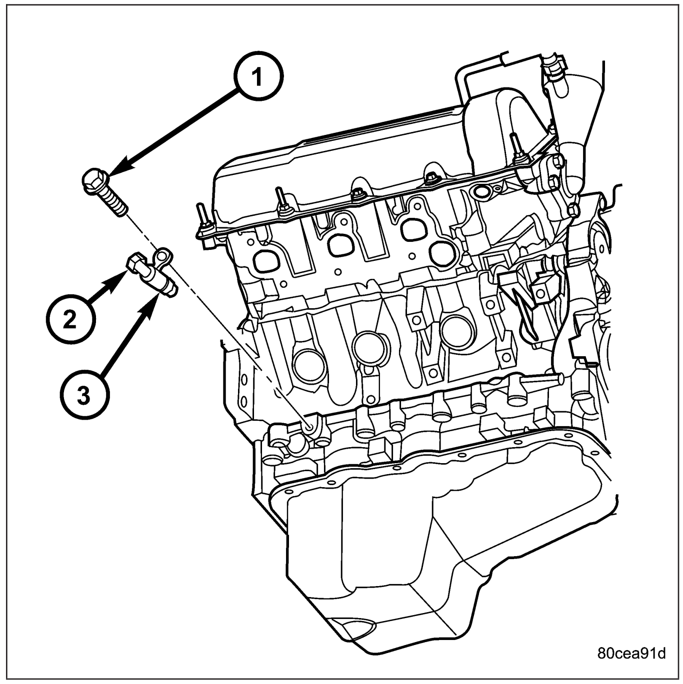
1. Place accelerator pedal assembly (4) over two mounting studs (6) protruding from floor pan.
2. Install two mounting nuts (5). Torque to 12 N·m (105 in. lbs.).
3. Slide throttle cable into opening slot in top of pedal arm.
4. Push plastic cable retainer (clip) (3) into accelerator pedal arm opening until it snaps into place.
5. Before starting engine, operate accelerator pedal to check for any binding.



# SENSOR-CRANKSHAFT POSITION

## DESCRIPTION

The Crankshaft Position (CKP) sensor (2) is mounted into the right rear side of the cylinder block. It is positioned and bolted into a machined hole.



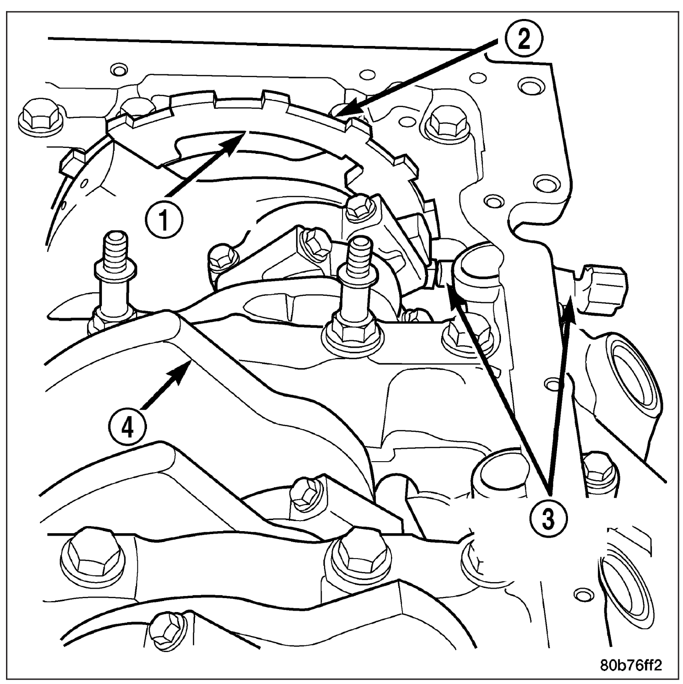

## OPERATION

Engine speed and crankshaft position are provided through the CKP (Crankshaft Position) sensor. The sensor generates pulses that are the input sent to the Powertrain Control Module (PCM). The PCM interprets the sensor input to determine the crankshaft position. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

The sensor is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

A tonewheel (targetwheel) is bolted to the engine crankshaft (1). This tonewheel has sets of notches (2) at its outer edge.

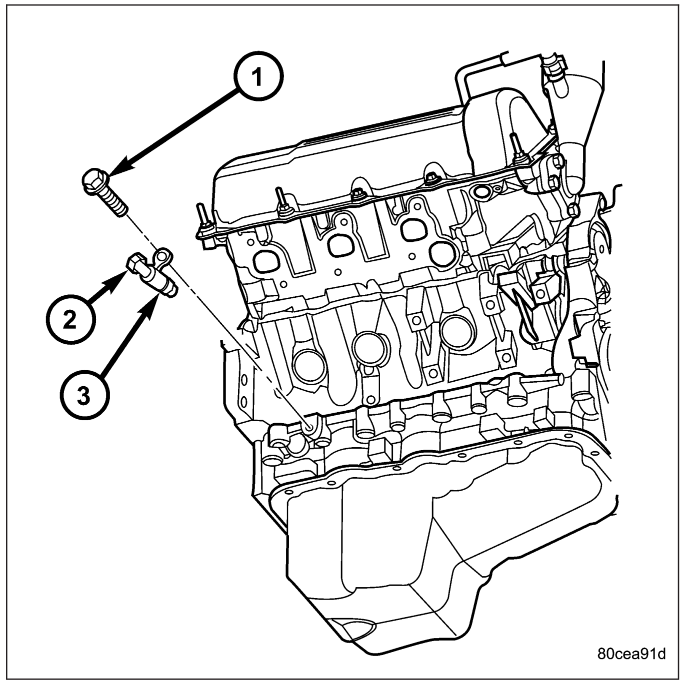
The notches (2) cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM.



## REMOVAL

The Crankshaft Position (CKP) sensor (2) is mounted into the right rear side of the cylinder block. It is positioned and bolted into a machined hole.

1. Raise vehicle.
2. Disconnect sensor electrical connector.
3. Remove sensor mounting bolt (1).
4. Carefully twist sensor from cylinder block.
5. Check condition of sensor O-ring (3).

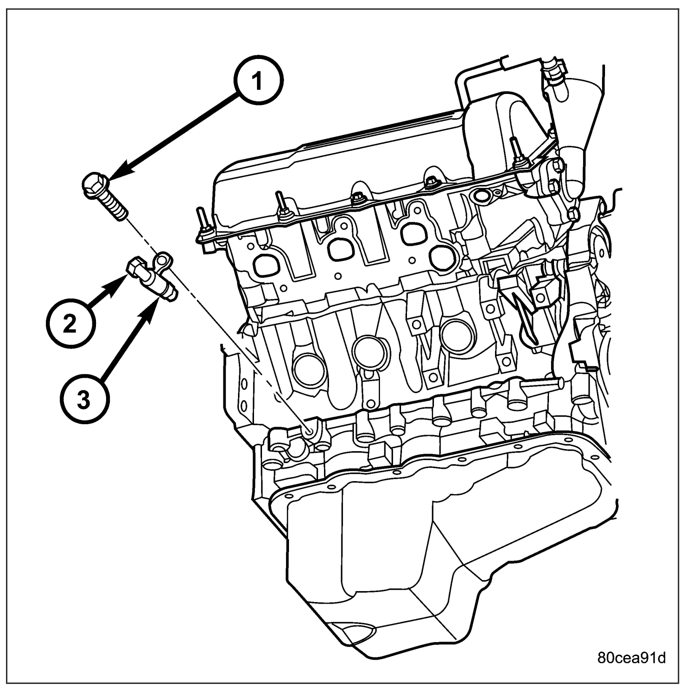



## INSTALLATION

1. Clean out machined hole in engine block.
2. Apply a small amount of engine oil to sensor O-ring (3).
3. Install sensor (2) into engine block with a slight rocking and twisting action.

**CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder block. If sensor is not flush, damage to sensor mounting tang may result.**

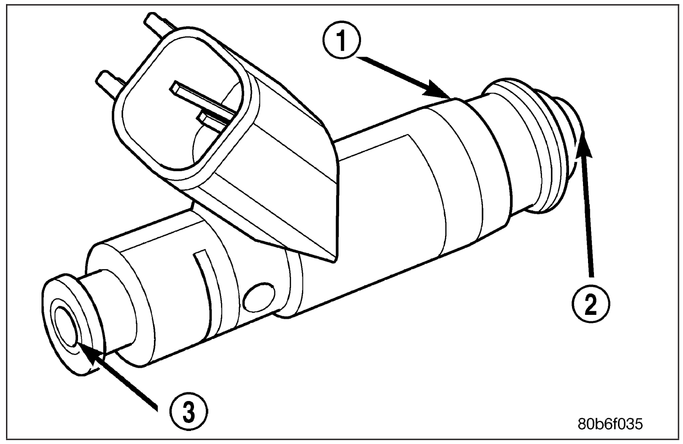
4. Install mounting bolt (1) and tighten to 28 N·m (21 ft. lbs.) torque.
5. Connect electrical connector to sensor.
6. Lower vehicle.



# INJECTOR-FUEL

## DESCRIPTION

An individual fuel injector (1) is used for each individual cylinder.




## OPERATION

## FUEL INJECTOR

The top (fuel entry) end of the injector is attached into an opening on the fuel rail.

The fuel injectors are electrical solenoids. The injector contains a pintle that closes off an orifice at the nozzle end. When electric current is supplied to the injector, the armature and needle move a short distance against a spring, allowing fuel to flow out the orifice. Because the fuel is under high pressure, a fine spray is developed in the shape of a pencil stream. The spraying action atomizes the fuel, adding it to the air entering the combustion chamber.

The nozzle (outlet) ends of the injectors are positioned into openings in the intake manifold just above the intake valve ports of the cylinder head. The engine wiring harness connector for each fuel injector is equipped with an attached numerical tag (INJ 1, INJ 2 etc.). This is used to identify each fuel injector.

The injectors are energized individually in a sequential order by the Powertrain Control Module (PCM). The PCM will adjust injector pulse width by switching the ground path to each individual injector on and off. Injector pulse width is the period of time that the injector is energized. The PCM will adjust injector pulse width based on various inputs it receives.

Battery voltage is supplied to the injectors through the ASD relay.

The PCM determines injector pulse width based on various inputs.

## PCM OUTPUT

The nozzle ends of the injectors are positioned into openings in the intake manifold just above the intake valve ports of the cylinder head. The engine wiring harness connector for each fuel injector is equipped with an attached numerical tag (INJ 1, INJ 2 etc.). This is used to identify each fuel injector with its respective cylinder number.

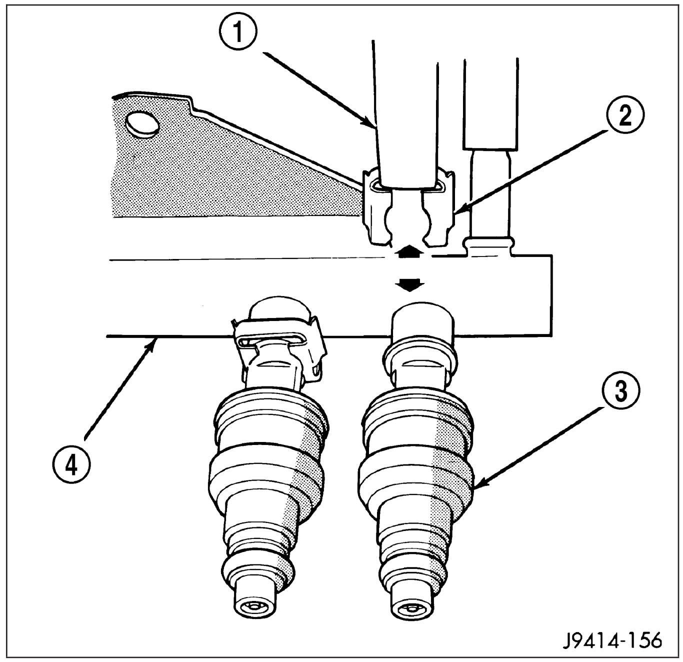
The injectors are energized individually in a sequential order by the Powertrain Control Module (PCM). The PCM will adjust injector pulse width by switching the ground path to each individual injector on and off. Injector pulse width is the period of time that the injector is energized. The PCM will adjust injector pulse width based on various inputs it receives.

Battery voltage (12 volts +) is supplied to the injectors through the ASD relay. The ASD relay will shut-down the 12 volt power source to the fuel injectors if the PCM senses the ignition is on, but the engine is not running. This occurs after the engine has not been running for approximately 1.8 seconds.

The PCM determines injector on-time (pulse width) based on various inputs.

## REMOVAL

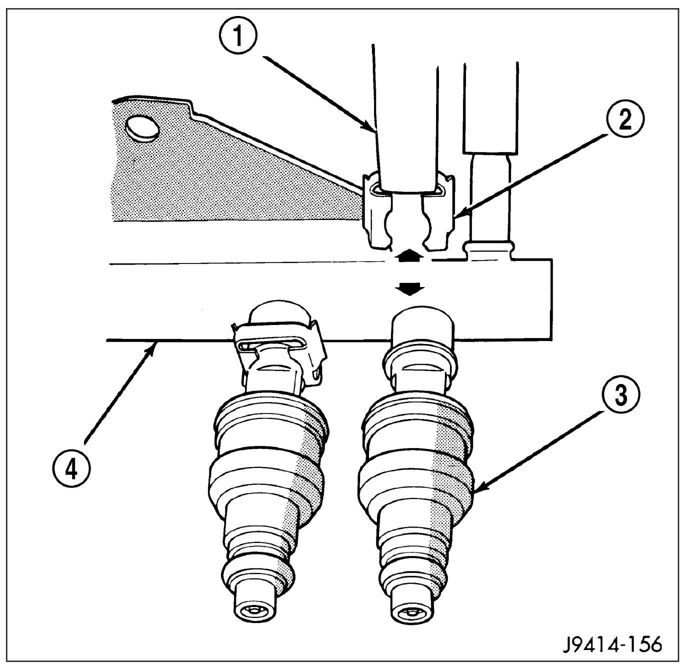
1. Remove fuel rail. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - REMOVAL)
2. Disconnect clip(s) (2) that retain fuel injector(s) (3) to fuel rail (4)




.

## INSTALLATION

1. Install fuel injector(s) (3) into fuel rail assembly (4) and install retaining clip(s) (2).
2. If same injector(s) is being reinstalled, install new O-ring(s). Two different O-rings are being used. These can be easily identified by color. Install black O-ring at intake manifold end of injector. Install red/rust colored O-ring at fuel rail end of injector.
3. Apply a small amount of clean engine oil to each injector O-ring. This will aid in installation.
4. Install fuel rail. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - INSTALLATION)
5. Start engine and check for fuel leaks.



# RELAY-FUEL PUMP

## DESCRIPTION

The 5-pin, 12-volt, fuel pump relay is located in the Power Distribution Center (PDC). Refer to the label on the PDC cover for relay location.

## OPERATION

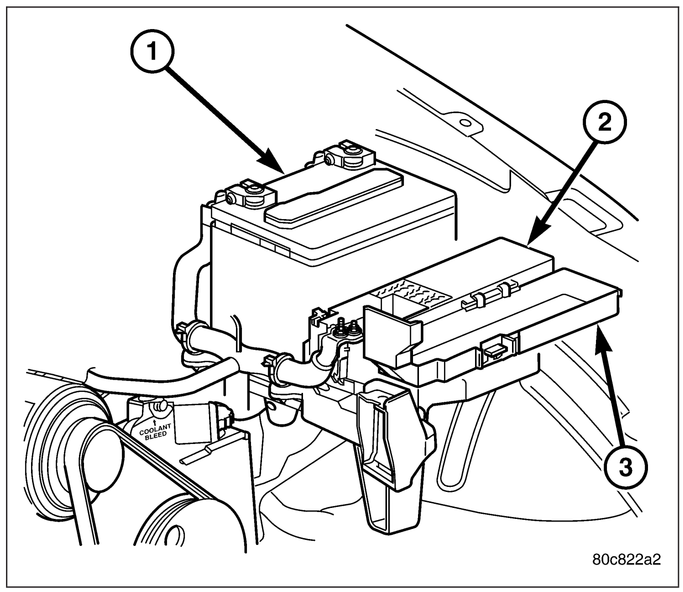
The Powertrain Control Module (PCM) energizes the electric fuel pump through the fuel pump relay. The fuel pump relay is energized by first applying battery voltage to it when the ignition key is turned ON, and then applying a ground signal to the relay from the PCM.

Whenever the ignition key is turned ON, the electric fuel pump will operate. But, the PCM will shut-down the ground circuit to the fuel pump relay in approximately 1–3 seconds unless the engine is operating or the starter motor is engaged.

## REMOVAL

The fuel pump relay is located in the Power Distribution Center (PDC) (2). Refer to label on PDC cover (3) for relay location.

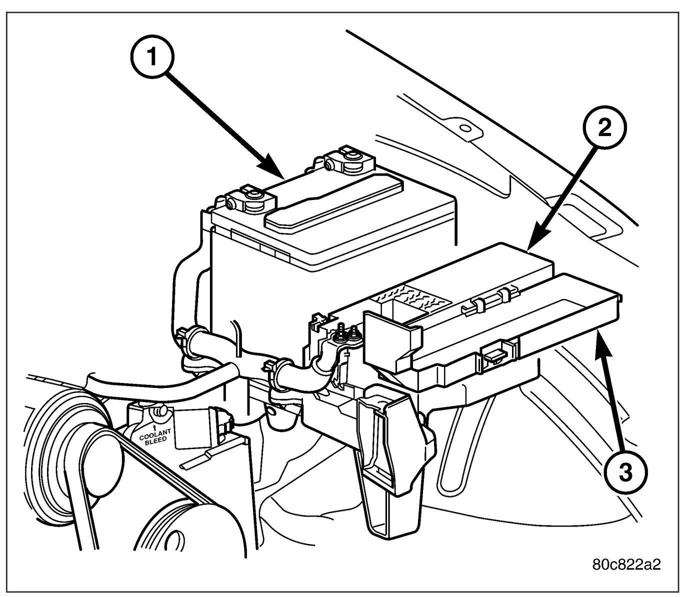
1. Remove PDC cover (3).
2. Remove relay from PDC.
3. Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.
4. Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.




## INSTALLATION

The fuel pump relay is located in the Power Distribution Center (PDC) (2). Refer to label on PDC cover (3) for relay location.

1. Install relay to PDC.
2. Install cover (3) to PDC.



# MOTOR-IDLE AIR CONTROL

## DESCRIPTION

The IAC stepper motor is mounted to the throttle body, and regulates the amount of air bypassing the control of the throttle plate. As engine loads and ambient temperatures change, engine rpm changes. A pintle on the IAC stepper motor protrudes into a passage in the throttle body, controlling air flow through the passage. The IAC is controlled by the Powertrain Control Module (PCM) to maintain the target engine idle speed.

## OPERATION

At idle, engine speed can be increased by retracting the IAC motor pintle and allowing more air to pass through the port, or it can be decreased by restricting the passage with the pintle and diminishing the amount of air bypassing the throttle plate.

The IAC is called a stepper motor because it is moved (rotated) in steps, or increments. Opening the IAC opens an air passage around the throttle blade which increases RPM.

The PCM uses the IAC motor to control idle speed (along with timing) and to reach a desired MAP during decel (keep engine from stalling).

The IAC motor has 4 wires with 4 circuits. Two of the wires are for 12 volts and ground to supply electrical current to the motor windings to operate the stepper motor in one direction. The other 2 wires are also for 12 volts and ground to supply electrical current to operate the stepper motor in the opposite direction.

To make the IAC go in the opposite direction, the PCM just reverses polarity on both windings. If only 1 wire is open, the IAC can only be moved 1 step (increment) in either direction. To keep the IAC motor in position when no movement is needed, the PCM will energize both windings at the same time. This locks the IAC motor in place.

In the IAC motor system, the PCM will count every step that the motor is moved. This allows the PCM to determine the motor pintle position. If the memory is cleared, the PCM no longer knows the position of the pintle. So at the first key ON, the PCM drives the IAC motor closed, regardless of where it was before. This zeros the counter. From this point the PCM will back out the IAC motor and keep track of its position again.

When engine rpm is above idle speed, the IAC is used for the following:

- Off-idle dashpot (throttle blade will close quickly but idle speed will not stop quickly)
- Deceleration air flow control
- A/C compressor load control (also opens the passage slightly before the compressor is engaged so that the engine rpm does not dip down when the compressor engages)
- Power steering load control

The PCM can control polarity of the circuit to control direction of the stepper motor.

**IAC Stepper Motor Program:** The PCM is also equipped with a memory program that records the number of steps the IAC stepper motor most recently advanced to during a certain set of parameters. For example: The PCM was attempting to maintain a 1000 rpm target during a cold start-up cycle. The last recorded number of steps for that may have been 125. That value would be recorded in the memory cell so that the next time the PCM recognizes the identical conditions, the PCM recalls that 125 steps were required to maintain the target. This program allows for greater customer satisfaction due to greater control of engine idle.

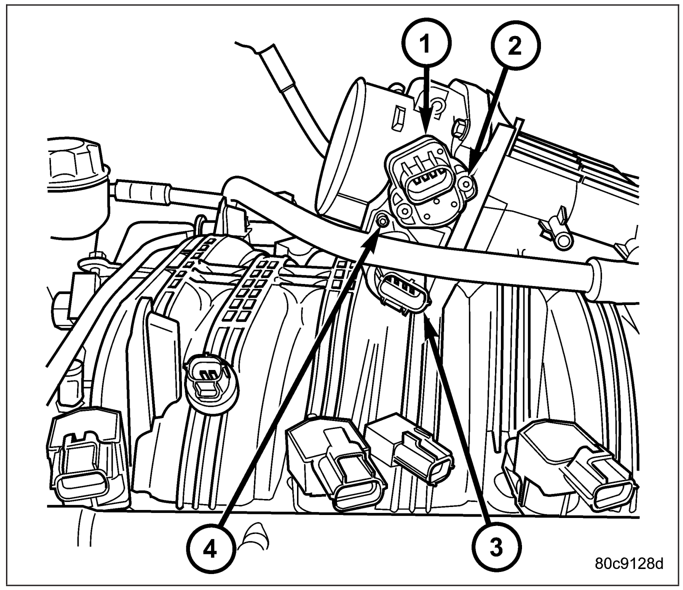
Another function of the memory program, which occurs when the power steering switch (if equipped), or the A/C request circuit, requires that the IAC stepper motor control engine rpm, is the recording of the last targeted steps into the memory cell. The PCM can anticipate A/C compressor loads. This is accomplished by delaying compressor operation for approximately 0.5 seconds until the PCM moves the IAC stepper motor to the recorded steps that were loaded into the memory cell. Using this program helps eliminate idle-quality changes as loads change. Finally, the PCM incorporates a ″No-Load″ engine speed limiter of approximately 1800 - 2000 rpm, when it recognizes that the TPS is indicating an idle signal and IAC motor cannot maintain engine idle.

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the IAC motor through the PCM.

## REMOVAL

The Idle Air Control (IAC) motor (3) is located on the side of the throttle body.

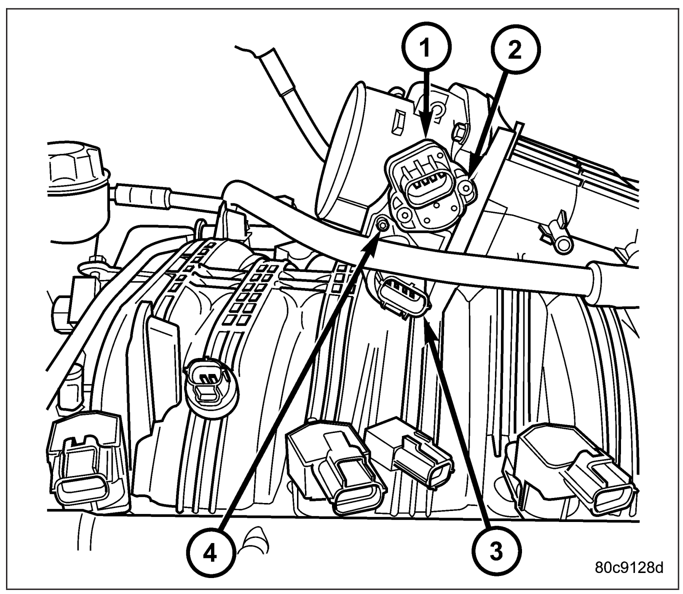
1. Disconnect electrical connector from IAC motor.
2. Remove two mounting bolts (screws) (4).
3. Remove IAC motor (3) from throttle body.




## INSTALLATION

The Idle Air Control (IAC) motor (3) is located on the side of the throttle body.

1. Install IAC motor (3) to throttle body.
2. Install and tighten two mounting bolts (screws) (4) to 7 N·m (60 in. lbs.) torque.
3. Install electrical connector.



# SENSOR-INTAKE AIR TEMPERATURE

## DESCRIPTION

The 2–wire Intake Manifold Air Temperature (IAT) sensor is installed in the intake manifold with the sensor element extending into the air stream.

The IAT sensor is a two-wire Negative Thermal Coefficient (NTC) sensor. Meaning, as intake manifold temperature increases, resistance (voltage) in the sensor decreases. As temperature decreases, resistance (voltage) in the sensor increases.

## OPERATION

The IAT sensor provides an input voltage to the Powertrain Control Module (PCM) indicating the density of the air entering the intake manifold based upon intake manifold temperature. At key-on, a 5–volt power circuit is supplied to the sensor from the PCM. The sensor is grounded at the PCM through a low-noise, sensor-return circuit.

The PCM uses this input to calculate the following:

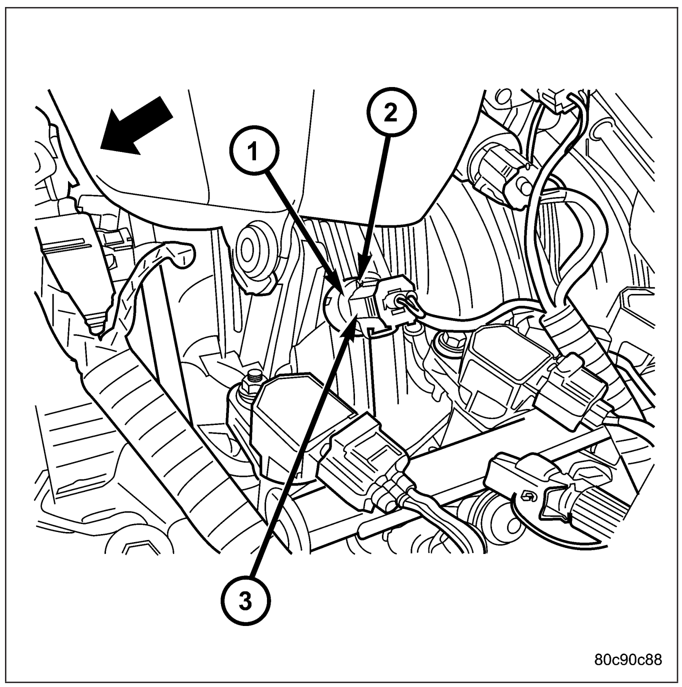
- Injector pulse-width
- Adjustment of spark timing (to help prevent spark knock with high intake manifold air-charge temperatures)

The resistance values of the IAT sensor is the same as for the Engine Coolant Temperature (ECT) sensor.

## REMOVAL

The intake manifold air temperature (IAT) sensor (1) is installed into the left side of intake manifold plenum.

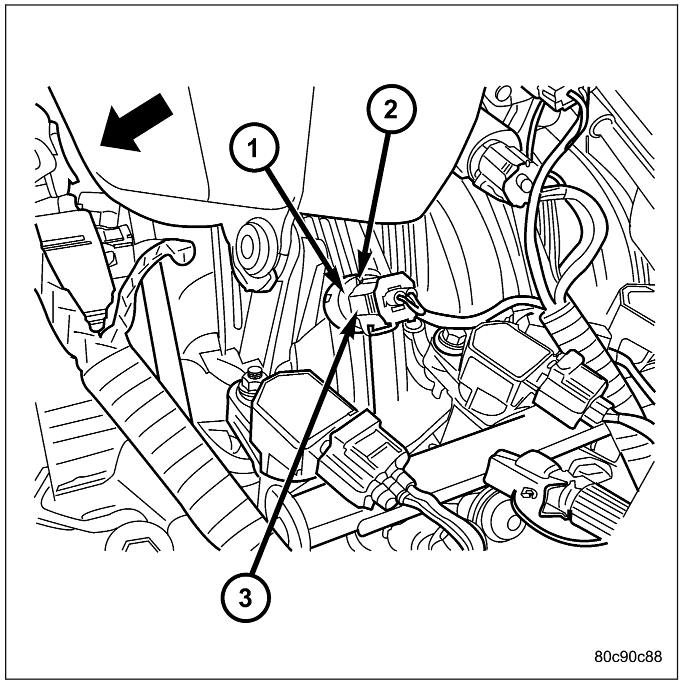
1. Disconnect electrical connector (3) from IAT sensor.
2. Clean dirt from intake manifold at sensor base.
3. Gently lift on small plastic release tab (2) or and rotate sensor about 1/4 turn counter-clockwise for removal.
4. Check condition of sensor O-ring.



## INSTALLATION

The intake manifold air temperature (IAT) sensor (1) is installed into the left side of intake manifold plenum.

1. Check condition of sensor O-ring.
2. Clean sensor mounting hole in intake manifold.
3. Position sensor into intake manifold and rotate clockwise until past release tab (2).
4. Install electrical connector (3).



# SENSOR-MANIFOLD AIR PRESSURE

## DESCRIPTION

The Manifold Absolute Pressure (MAP) sensor is mounted into the front of the intake manifold with 2 screws.

## OPERATION

The MAP sensor is used as an input to the Powertrain Control Module (PCM). It contains a silicon based sensing unit to provide data on the manifold vacuum that draws the air/fuel mixture into the combustion chamber. The PCM requires this information to determine injector pulse width and spark advance. When manifold absolute pressure (MAP) equals Barometric pressure, the pulse width will be at maximum.

A 5 volt reference is supplied from the PCM and returns a voltage signal to the PCM that reflects manifold pressure. The zero pressure reading is 0.5V and full scale is 4.5V. For a pressure swing of 0–15 psi, the voltage changes 4.0V. To operate the sensor, it is supplied a regulated 4.8 to 5.1 volts. Ground is provided through the low-noise, sensor return circuit at the PCM.

The MAP sensor input is the number one contributor to fuel injector pulse width. The most important function of the MAP sensor is to determine barometric pressure. The PCM needs to know if the vehicle is at sea level or at a higher altitude, because the air density changes with altitude. It will also help to correct for varying barometric pressure. Barometric pressure and altitude have a direct inverse correlation; as altitude goes up, barometric goes down. At key-on, the PCM powers up and looks at MAP voltage, and based upon the voltage it sees, it knows the current barometric pressure (relative to altitude). Once the engine starts, the PCM looks at the voltage again, continuously every 12 milliseconds, and compares the current voltage to what it was at key-on. The difference between current voltage and what it was at key-on, is manifold vacuum.

During key-on (engine not running) the sensor reads (updates) barometric pressure. A normal range can be obtained by monitoring a known good sensor.

As the altitude increases, the air becomes thinner (less oxygen). If a vehicle is started and driven to a very different altitude than where it was at key-on, the barometric pressure needs to be updated. Any time the PCM sees Wide Open Throttle (WOT), based upon Throttle Position Sensor (TPS) angle and RPM, it will update barometric pressure in the MAP memory cell. With periodic updates, the PCM can make its calculations more effectively.

The PCM uses the MAP sensor input to aid in calculating the following:

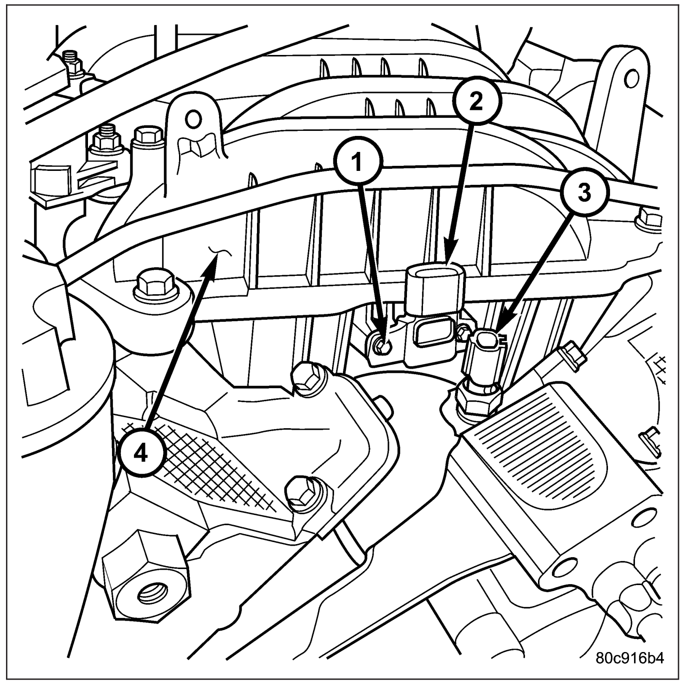
- Manifold pressure
- Barometric pressure
- Engine load
- Injector pulse-width
- Spark-advance programs
- Shift-point strategies (certain automatic transmissions only)
- Idle speed
- Decel fuel shutoff

The MAP sensor signal is provided from a single piezoresistive element located in the center of a diaphragm. The element and diaphragm are both made of silicone. As manifold pressure changes, the diaphragm moves causing the element to deflect, which stresses the silicone. When silicone is exposed to stress, its resistance changes. As manifold vacuum increases, the MAP sensor input voltage decreases proportionally. The sensor also contains electronics that condition the signal and provide temperature compensation.

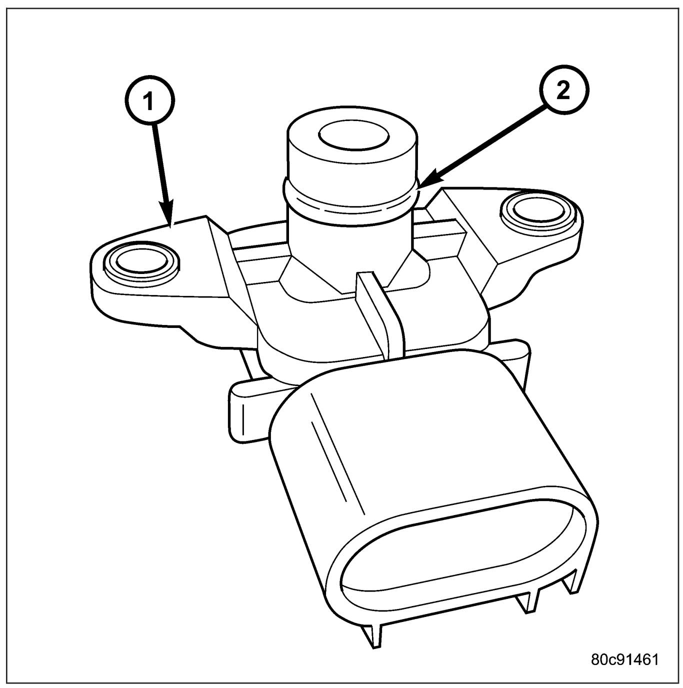
The PCM recognizes a decrease in manifold pressure by monitoring a decrease in voltage from the reading stored in the barometric pressure memory cell. The MAP sensor is a linear sensor; meaning as pressure changes, voltage changes proportionately. The range of voltage output from the sensor is usually between 4.6 volts at sea level to as low as 0.3 volts at 26 in. of Hg. Barometric pressure is the pressure exerted by the atmosphere upon an object. At sea level on a standard day, no storm, barometric pressure is approximately 29.92 in Hg. For every 100 feet of altitude, barometric pressure drops 0.10 in. Hg. If a storm goes through, it can change barometric pressure from what should be present for that altitude. You should know what the average pressure and corresponding barometric pressure is for your area.

## REMOVAL

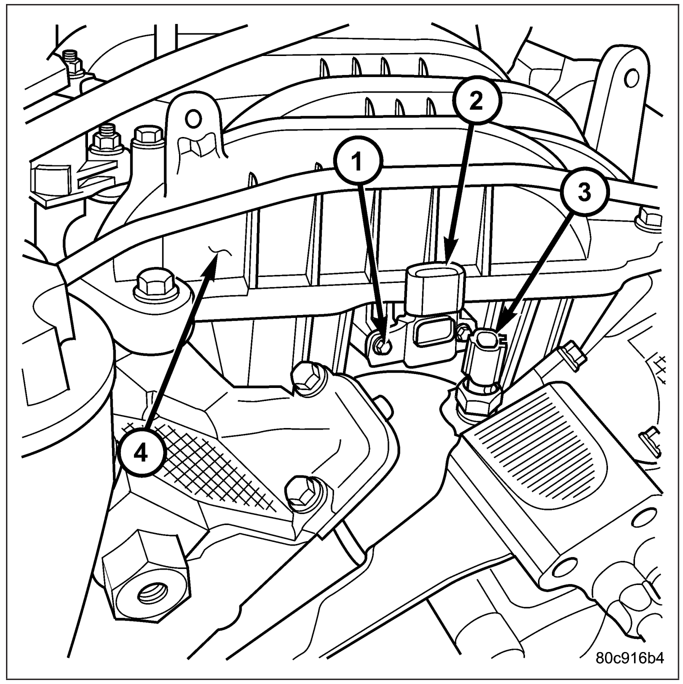
The Manifold Absolute Pressure (MAP) sensor (2) is mounted into the front of the intake manifold.




An O-ring (2) is used to seal the sensor to the intake manifold.



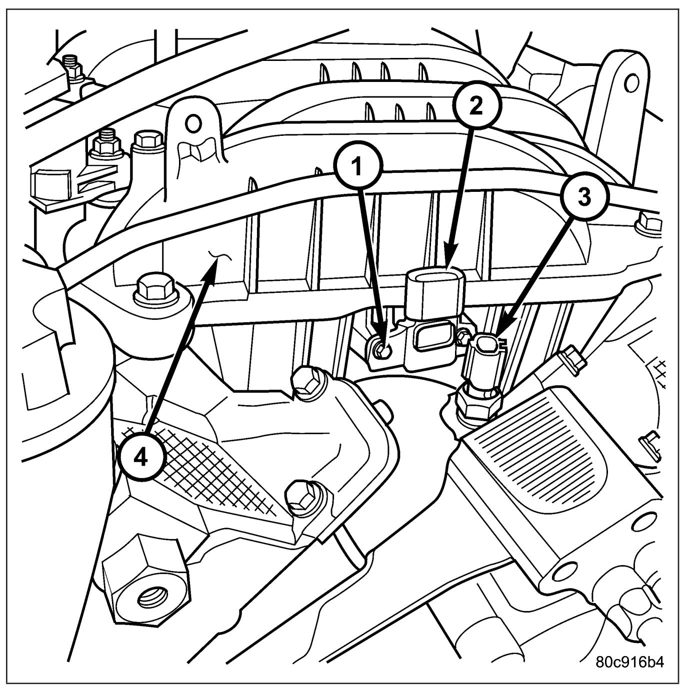
1. Disconnect electrical connector at sensor (2).
2. Clean area around MAP sensor.
3. Remove 2 sensor mounting screws (1).
4. Remove MAP sensor from intake manifold.
5. Check condition of sensor O-ring.




## INSTALLATION

The Manifold Absolute Pressure (MAP) sensor (2) is mounted into the front of the intake manifold. An O-ring is used to seal the sensor to the intake manifold.

1. Clean MAP sensor mounting hole at intake manifold.
2. Check MAP sensor O-ring seal for cuts or tears.
3. Position sensor (2) into manifold.
4. Install MAP sensor mounting bolts (screws) (1). Tighten screws to 3 N·m (25 in. lbs.) torque.
5. Connect electrical connector.



# SENSOR-OXYGEN

## DESCRIPTION

The Oxygen Sensors (O2S) are attached to, and protrude into the vehicle exhaust system. Depending on the engine or emission package, the vehicle may use a total of either 2 or 4 sensors.

On this emissions package, 4 sensors are used: 2 upstream (referred to as 1/1 and 2/1) and 2 downstream (referred to as 1/2 and 2/2). With this emission package, the right upstream sensor (2/1) is located in the right exhaust downpipe just before the mini-catalytic convertor. The left upstream sensor (1/1) is located in the left exhaust downpipe just before the mini-catalytic convertor. The right downstream sensor (2/2) is located in the right exhaust downpipe just after the mini-catalytic convertor, and before the main catalytic convertor. The left downstream sensor (1/2) is located in the left exhaust downpipe just after the mini-catalytic convertor, and before the main catalytic convertor.

## OPERATION

An O2 sensor is a galvanic battery that provides the PCM with a voltage signal (0-1 volt) inversely proportional to the amount of oxygen in the exhaust. In other words, if the oxygen content is low, the voltage output is high; if the oxygen content is high the output voltage is low. The PCM uses this information to adjust injector pulse-width to achieve the 14.7–to–1 air/fuel ratio necessary for proper engine operation and to control emissions.

The O2 sensor must have a source of oxygen from outside of the exhaust stream for comparison. Current O2 sensors receive their fresh oxygen (outside air) supply through the O2 sensor case housing.

Four wires (circuits) are used on each O2 sensor: a 12–volt feed circuit for the sensor heating element; a ground circuit for the heater element; a low-noise sensor return circuit to the PCM, and an input circuit from the sensor back to the PCM to detect sensor operation.

Four heated oxygen sensors are used. A separate oxygen sensor relay is used to supply voltage to the sensors heating elements for only the 1/2 and 2/2 downstream sensors. Voltage for the other 2 sensor heating elements is supplied directly from the Powertrain Control Module (PCM) through a Pulse Width Module (PWM) method.

**Pulse Width Module (PWM):** Voltage to the O2 sensor heating elements is supplied directly from the Powertrain Control Module (PCM) through two separate Pulse Width Module (PWM) low side drivers. PWM is used on the 2 upstream sensors (1/1 and 2/1). The main objective for a PWM driver is to avoid overheating of the O2 sensor heater element. With exhaust temperatures increasing with time and engine speed, it's not required to have a full-voltage duty-cycle on the O2 heater elements.

To avoid the large simultaneous current surge needed to operate all 4 sensors, power is delayed to the 2 downstream heater elements by the PCM for approximately 2 seconds.

**Oxygen Sensor Heater Elements:**

The O2 sensor uses a Positive Thermal Co-efficient (PTC) heater element. As temperature increases, resistance increases. At ambient temperatures around 70°F, the resistance of the heating element is approximately 4.5 ohms. As the sensor's temperature increases, resistance in the heater element increases. This allows the heater to maintain the optimum operating temperature of approximately 930°-1100°F (500°-600° C). Although the sensors operate the same, there are physical differences, due to the environment that they operate in, that keep them from being interchangeable.

Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

In Closed Loop operation, the PCM monitors certain O2 sensor input(s) along with other inputs, and adjusts the injector pulse width accordingly. During Open Loop operation, the PCM ignores the O2 sensor input. The PCM adjusts injector pulse width based on preprogrammed (fixed) values and inputs from other sensors.

Two upstream sensors are used (1/1 and 2/1). The 1/1 sensor is the first sensor to receive exhaust gases from the #1 cylinder. They provide an input voltage to the PCM. The input tells the PCM the oxygen content of the exhaust gas. The PCM uses this information to fine tune fuel delivery to maintain the correct oxygen content at the downstream oxygen sensors. The PCM will change the air/fuel ratio until the upstream sensors input a voltage that the PCM has determined will make the downstream sensors output (oxygen content) correct.

The upstream oxygen sensors also provide an input to determine mini-catalyst efficiency. Main catalytic convertor efficiency is not calculated with this package.

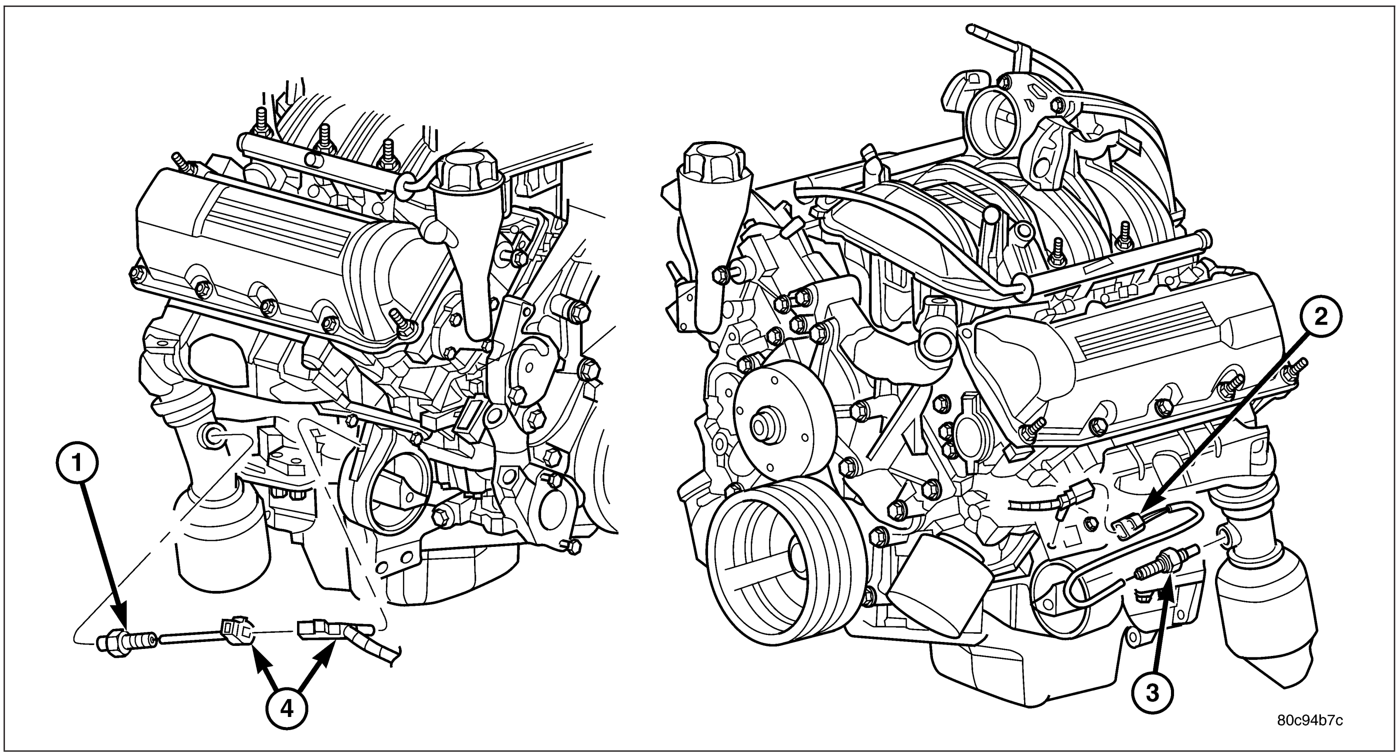
Two downstream sensors are used (1/2 and 2/2). The downstream sensors are used to determine the correct air-fuel ratio. As the oxygen content changes at the downstream sensor, the PCM calculates how much air-fuel ratio change is required. The PCM then looks at the upstream oxygen sensor voltage, and changes fuel delivery until the upstream sensor voltage changes enough to correct the downstream sensor voltage (oxygen content).

The downstream oxygen sensors also provide an input to determine mini-catalyst efficiency. Main catalytic convertor efficiency is not calculated with this package.

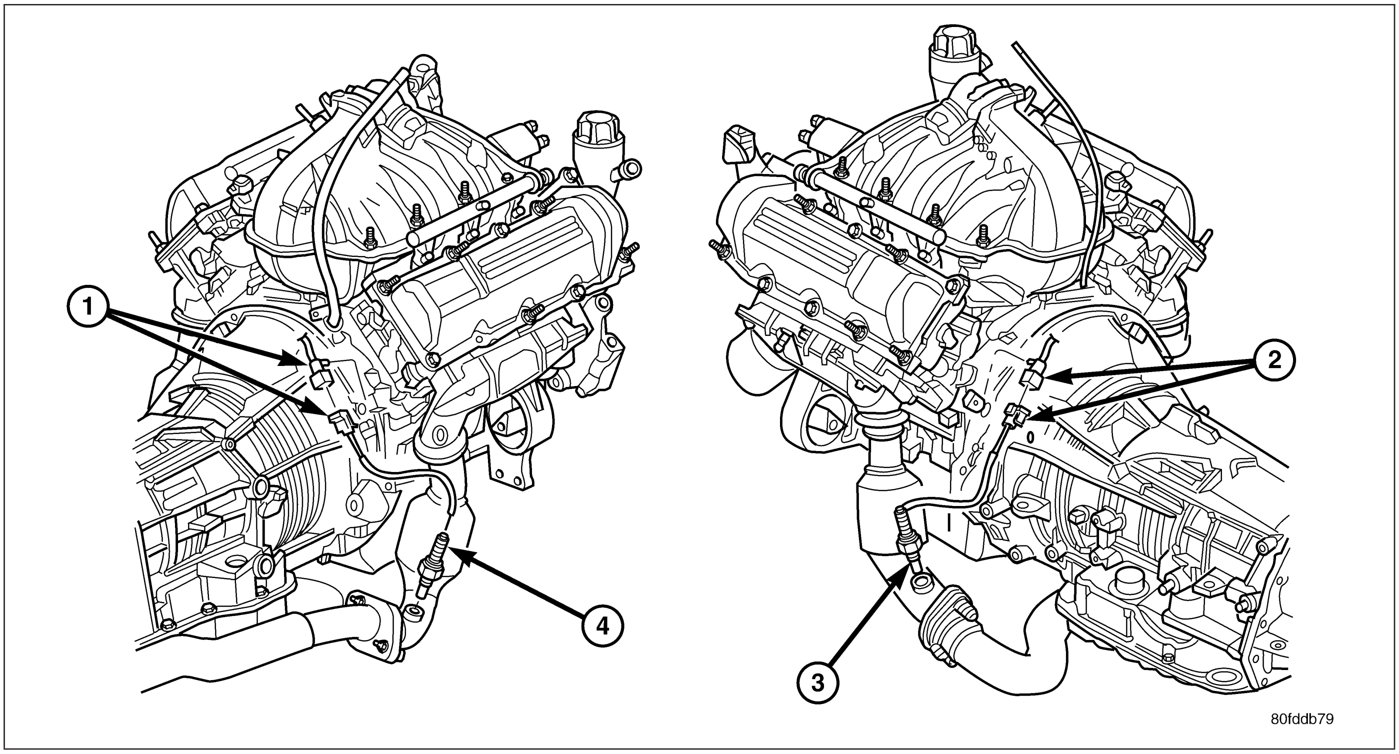
Engines equipped with either a downstream sensor(s), or a post-catalytic sensor, will monitor catalytic convertor efficiency. If efficiency is below emission standards, the Malfunction Indicator Lamp (MIL) will be illuminated and a Diagnostic Trouble Code (DTC) will be set. Refer to Monitored Systems in Emission Control Systems for additional information.

## REMOVAL

**CAUTION: Never apply any type of grease to the oxygen sensor electrical connector, or attempt any soldering of the sensor wiring harness.**




The upstream sensors are (1) and (3).




The downstream sensors are (3) and (4).

**WARNING: The exhaust manifold, exhaust pipes and catalytic converter become very hot during engine operation. Allow engine to cool before removing oxygen sensor.**

1. Raise and support vehicle.
2. Disconnect wire connector from O2S sensor.

**CAUTION: When disconnecting sensor electrical connector, do not pull directly on wire going into sensor.**

3. Remove O2S sensor with an oxygen sensor removal and installation tool.
4. Clean threads in exhaust pipe using appropriate tap.

## INSTALLATION

Threads of new oxygen sensors are factory coated with anti-seize compound to aid in removal. **DO NOT add any additional anti-seize compound to threads of a new oxygen sensor.**

1. Install O2S sensor. Tighten to 30 N·m (22 ft. lbs.) torque.
2. Connect O2S sensor wire connector.
3. Lower vehicle.

# BODY-THROTTLE

## DESCRIPTION

The throttle body is located on the intake manifold. Fuel does not enter the intake manifold through the throttle body. Fuel is sprayed into the manifold by the fuel injectors.

## OPERATION

Filtered air from the air cleaner enters the intake manifold through the throttle body. The throttle body contains an air control passage controlled by an Idle Air Control (IAC) motor. The air control passage is used to supply air for idle conditions. A throttle valve (plate) is used to supply air for above idle conditions.

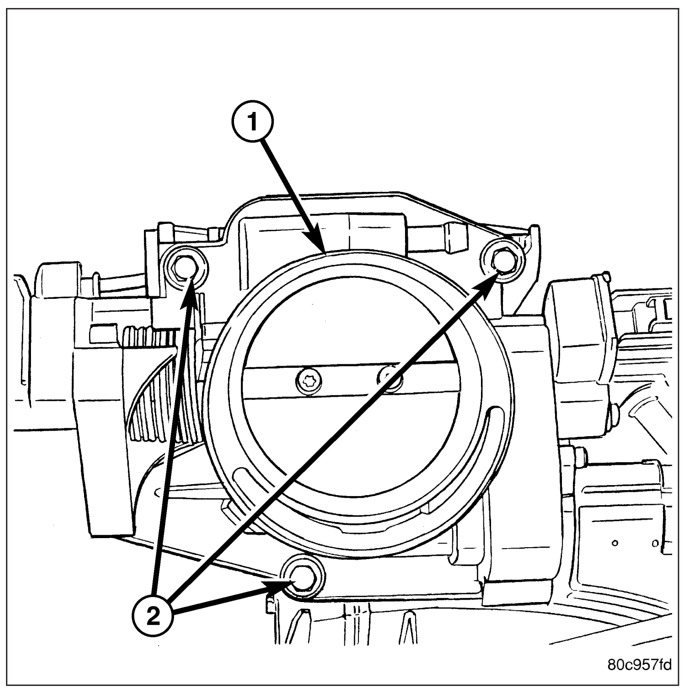
Certain sensors are attached to the throttle body. The accelerator pedal cable, speed control cable and transmission control cable (when equipped) are connected to the throttle body linkage arm.

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the PCM.

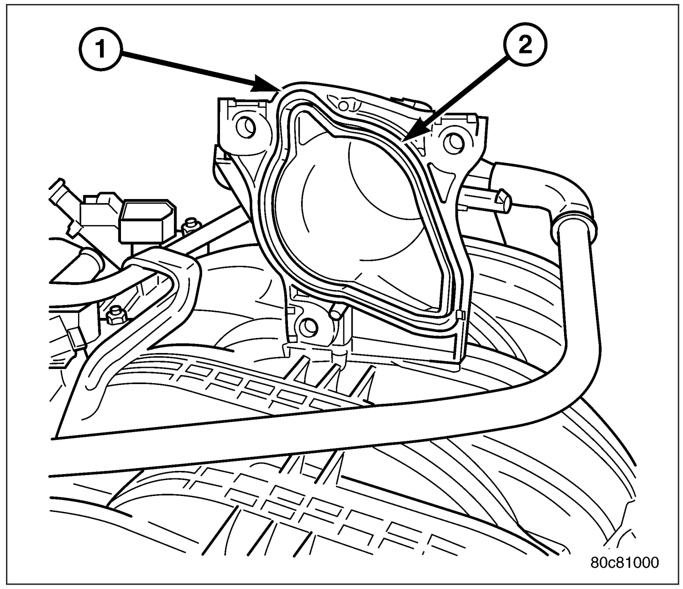
## REMOVAL

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the Powertrain Control Module (PCM).

1. Remove air cleaner tube at throttle body.
2. Disconnect throttle body electrical connectors at IAC motor and TPS.
3. Remove all control cables from throttle body (lever) arm. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/THROTTLE CONTROL CABLE - REMOVAL)
4. Disconnect necessary vacuum lines at throttle body.
5. Remove three throttle body mounting bolts (2).
6. Remove throttle body from intake manifold.

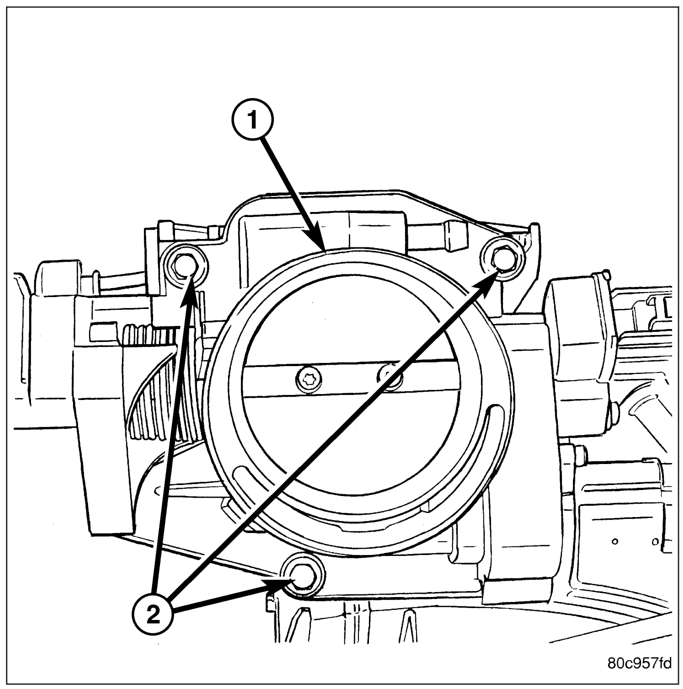


7. Check condition of old throttle body-to-intake manifold o-ring (2).




## INSTALLATION

1. Check condition of throttle body-to-intake manifold o-ring. Replace as necessary.
2. Clean mating surfaces of throttle body and intake manifold.
3. Install throttle body-to-intake manifold O-ring.
4. Install throttle body (1) to intake manifold.
5. Install three mounting bolts (2). Tighten bolts to 12 N·m (105 in. lbs.) torque.
6. Install control cables.
7. Install electrical connectors.
8. Install necessary vacuum lines.
9. Install air cleaner duct at throttle body.

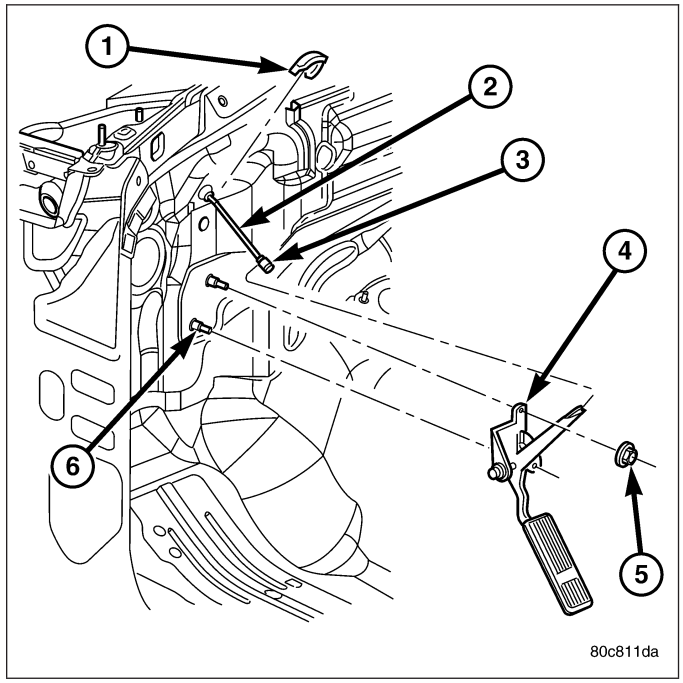


# CABLE-THROTTLE CONTROL

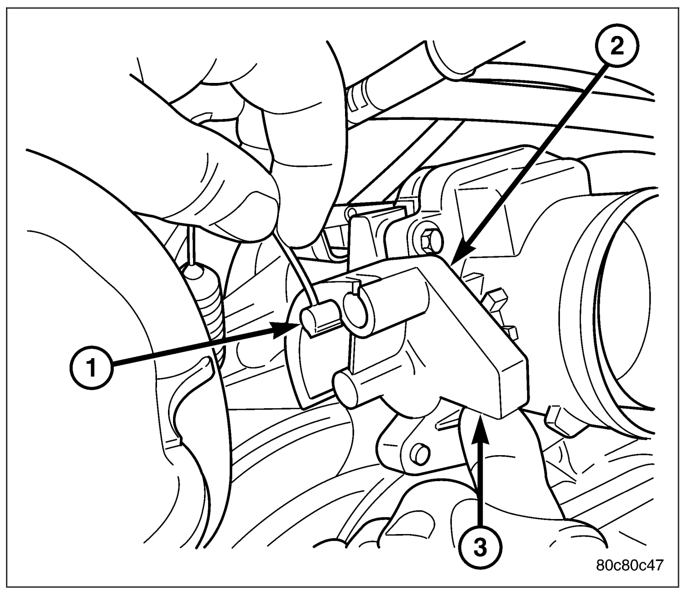
## REMOVAL

**CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing accelerator pedal or throttle cable.**

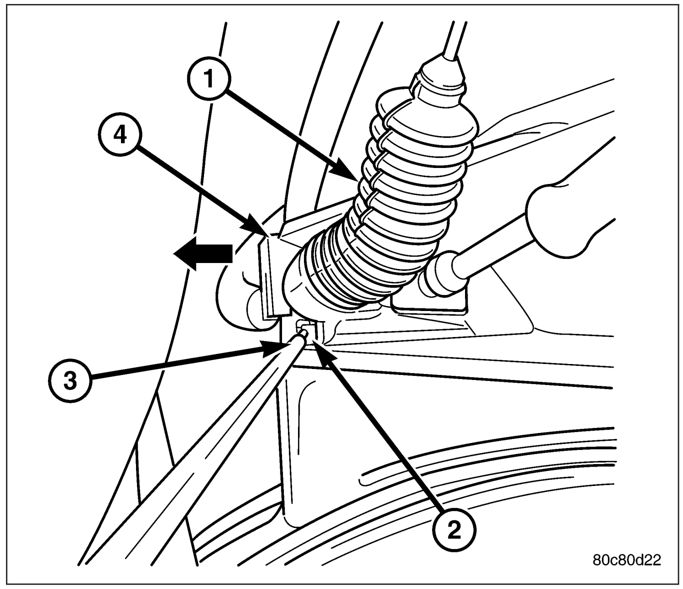
1. From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) (3) and throttle cable core wire from upper end of pedal arm. Plastic cable retainer snaps into top of pedal arm.
2. Remove cable core wire at pedal arm.
3. From inside vehicle, remove metal clip (1) holding cable to dashpanel.
4. Remove air box at throttle body.
5. Unsnap cable from dashpanel routing clip.
6. Remove cable housing from dash panel and pull into engine compartment.




7. Hold throttle in wide open position. While held in this position, slide throttle cable pin (1) from throttle body bellcrank (2).

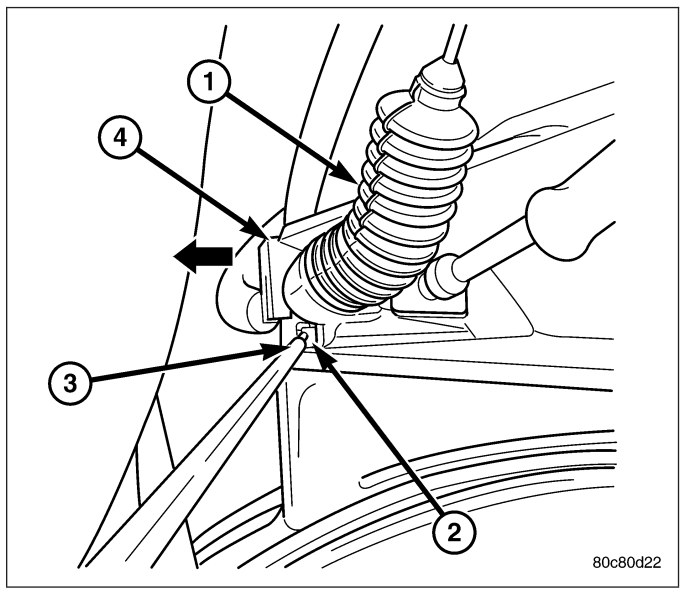


8. Using a pick or small screwdriver (3), press release tab (2) to release plastic cable mount from bracket. **Press on tab (2) only enough to release cable from bracket. If tab is pressed too much, it will be broken.** Slide plastic mount (4) towards right side of vehicle to remove throttle cable from throttle body bracket.
9. Remove throttle cable from vehicle.

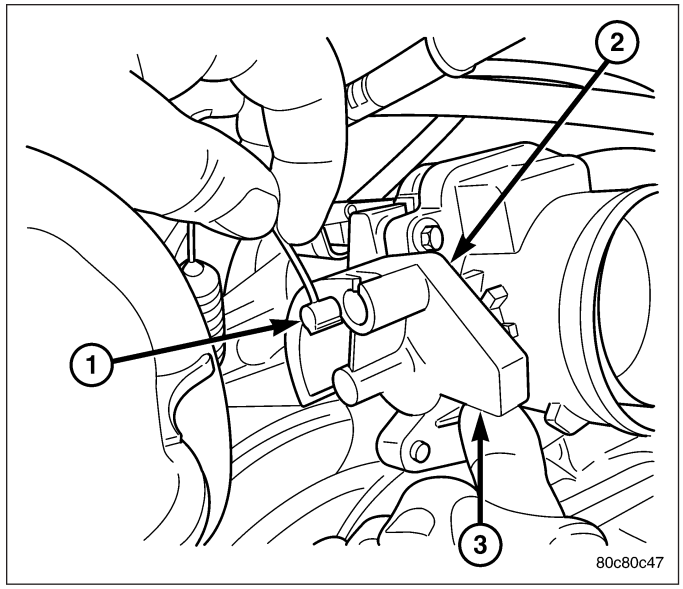



## INSTALLATION

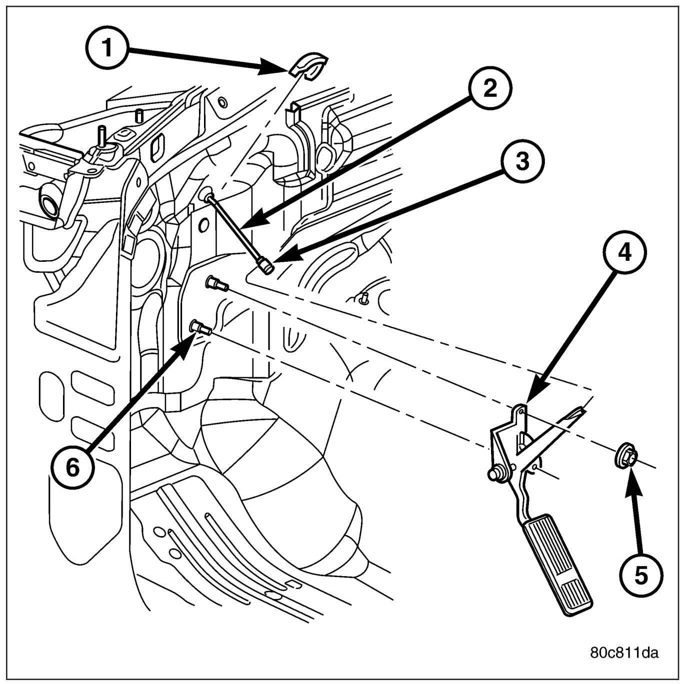
1. Slide accelerator cable plastic mount (4) into throttle body mounting bracket. Continue sliding until release tab (2) is aligned to hole in mounting bracket.



2. Hold throttle in wide open position. While held in this position, slide throttle cable pin (1) into throttle body bellcrank (2).
3. Push cable housing into rubber grommet and through opening in dash panel.




4. From inside vehicle, install metal clip (1) holding cable to dashpanel.
5. From inside vehicle, slide throttle cable core wire into opening (slot) in top of pedal arm.
6. Push plastic cable retainer (clip) (3) into pedal arm opening until it snaps in place.
7. Install air box to throttle body.
8. Before starting engine, operate accelerator pedal to check for any binding.



# SENSOR-THROTTLE POSITION

## DESCRIPTION

The 3-wire Throttle Position Sensor (TPS) is mounted on the throttle body and is connected to the throttle blade shaft.

## OPERATION

The 3-wire TPS provides the Powertrain Control Module (PCM) with an input signal (voltage) that represents the throttle blade position of the throttle body. The sensor is connected to the throttle blade shaft. As the position of the throttle blade changes, the output voltage of the TPS changes.

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS. This will vary in an approximate range of from 0.26 volts at minimum throttle opening (idle), to 4.49 volts at wide open throttle. Along with inputs from other sensors, the PCM uses the TPS input to determine current engine operating conditions. In response to engine operating conditions, the PCM will adjust fuel injector pulse width and ignition timing.

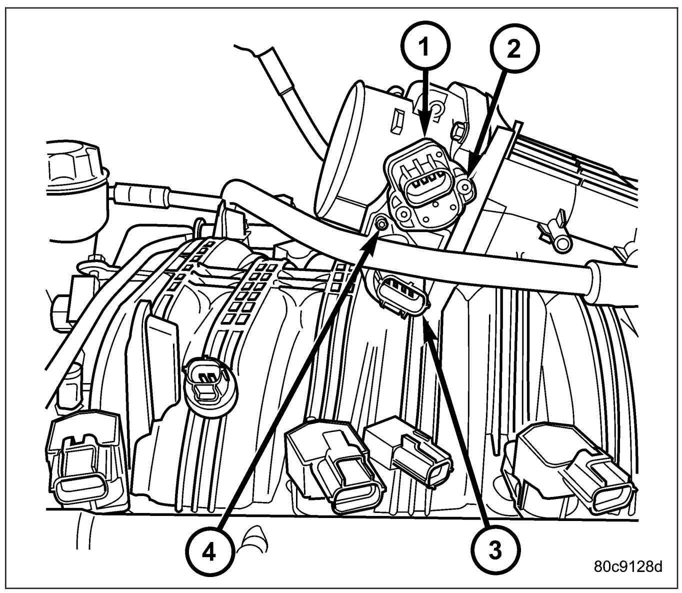
The PCM needs to identify the actions and position of the throttle blade at all times. This information is needed to assist in performing the following calculations:

- Ignition timing advance
- Fuel injection pulse-width
- Idle (learned value or minimum TPS)
- Off-idle (0.06 volt)
- Wide Open Throttle (WOT) open loop (2.608 volts above learned idle voltage)
- Deceleration fuel lean out
- Fuel cutoff during cranking at WOT (2.608 volts above learned idle voltage)
- A/C WOT cutoff (certain automatic transmissions only)

## REMOVAL

The Throttle Position Sensor (TPS) (1) is mounted to the throttle body.

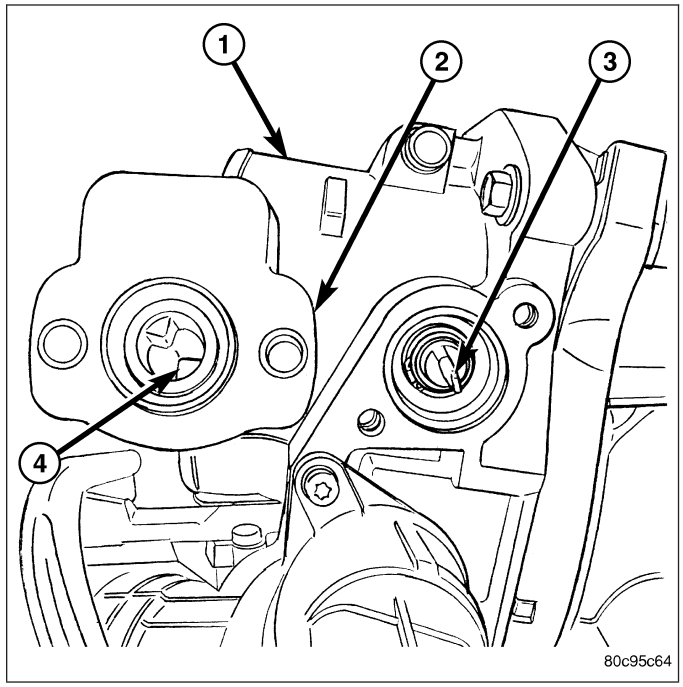
1. Disconnect TPS electrical connector.
2. Remove two TPS mounting screws (2).
3. Remove TPS.



## INSTALLATION

The throttle shaft end of the throttle body (3) slides into a socket (4) in the TPS. The TPS must be installed so that it can be rotated a few degrees. (If sensor will not rotate, install sensor with throttle shaft on other side of socket tangs). The TPS will be under slight tension when rotated.

1. Install TPS and retaining screws.
2. Tighten screws to 7 N·m (60 in. lbs.) torque.
3. Connect TPS electrical connector to TPS.
4. Manually operate throttle (by hand) to check for any TPS binding before starting engine.
5. Install air cleaner tube to throttle body.



# FUEL INJECTION - 2.8L DIESEL

## TABLE OF CONTENTS

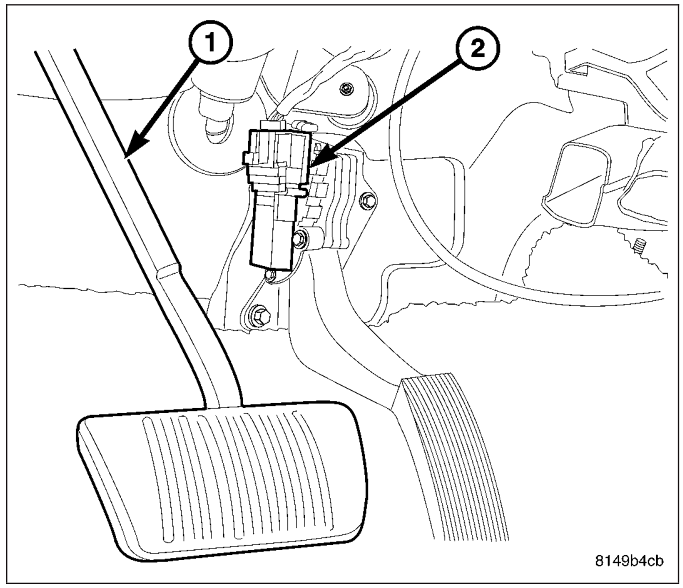
# ACCELERATOR PEDAL POSITION SENSOR

## DESCRIPTION

The Accelerator Pedal Position (APP) Sensor is a Hall Effect, angle of rotation sensor. The Accelerator Pedal Position sensor is located inside the accelerator pedal assembly. A magnet located in the pedal shaft cylinder rotates around a hall effect pick-up. The voltage signal increases as the accelerator pedal depresses. The APP sensor receives a 5–volt reference signal from the ECM and based upon the position of the pedal shift magnet relative to the windows on the Hall effect sensor, a portion of the 5 volts is returned to the ECM indicating pedal position.

## REMOVAL

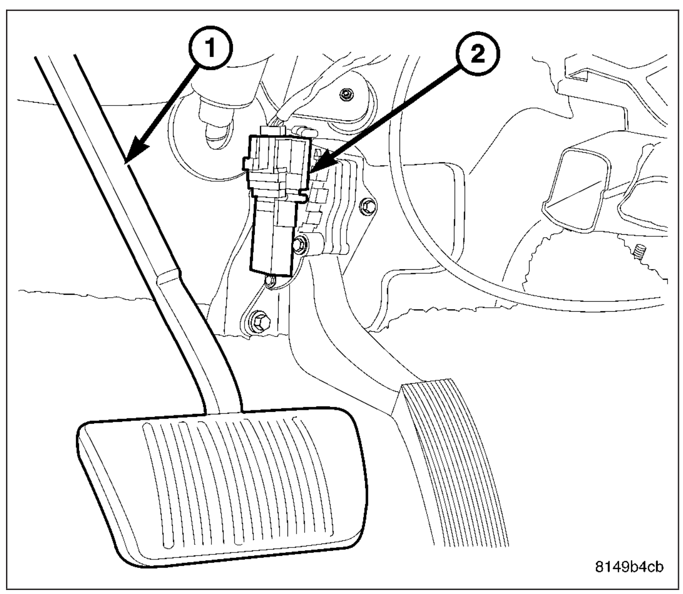
1. Disconnect negative battery cable.
2. Disconnect accelerator pedal position sensor electrical connector.
3. Remove accelerator pedal position sensor assembly mounting bolts.
4. Open accelerator pedal position sensor assembly and disconnect accelerator cable.
5. Remove accelerator pedal position sensor assembly.




## INSTALLATION

Position the APP sensor and install the fasteners hand tight.

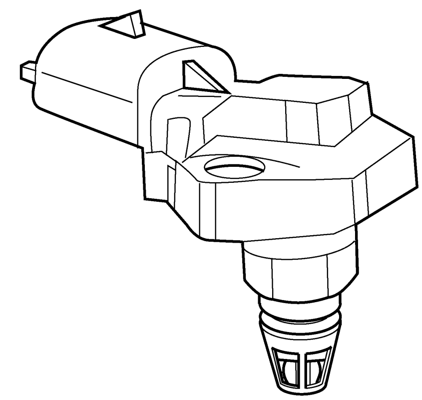
1. Tighten the APP sensor fasteners to 10.8N·m (96 in. lbs.).
2. Connect the APP sensor wiring harness connector.
3. Connect negative battery cable.



# BOOST PRESSURE SENSOR

## DESCRIPTION

The boost pressure/intake air temperature sensor is mounted to the top of the intake manifold. The sensor allows the ECM to monitor air pressure within the intake manifold. This sensor is also used to monitor the intake air temperature.



8100a221

## OPERATION

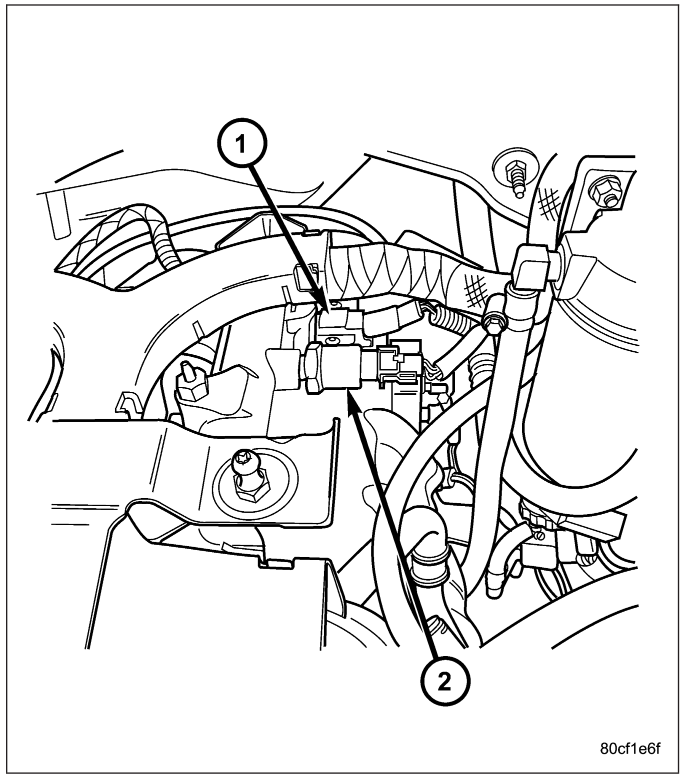
When the intake manifold pressure is low sensor voltage output is 0.25-1.8 volts at the ECM. When the intake manifold pressure is high due to turbo boost, sensor voltage output is 2.0-4.7 volts. The sensor receives a 5-volts reference from the ECM. Sensor ground is also provides by the ECM. The ECM uses boost pressure combined with intake air temerature to determine the volume of air entering the engine.

## DIAGNOSIS AND TESTING - BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR

If the boost pressure sensor fails, the ECM records a DTC into memory and continues to operate the engine in one of the three limp-in modes. When the ECM is operating in this mode, a loss of power will be present, as if the turbocharger was not operating. The best method for diagnosing faults with the boost pressure sensor is with the scan tool. Refer to the Diesel Powertrain Diagnostic Manual for more information.

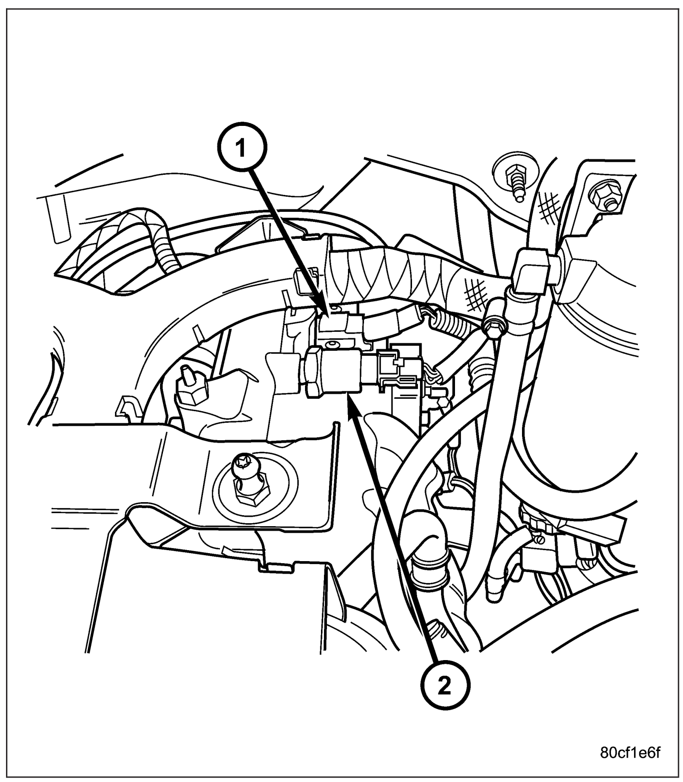
## REMOVAL

1. Disconnect negative battery cable.
2. Remove engine cover and bracket assembly (Refer to 9 - ENGINE COVER - REMOVAL).
3. Disconnect sensor electrical connector.
4. Remove retaining bolts and remove sensor (1) from cylinder head cover/intake manifold.




## INSTALLATION

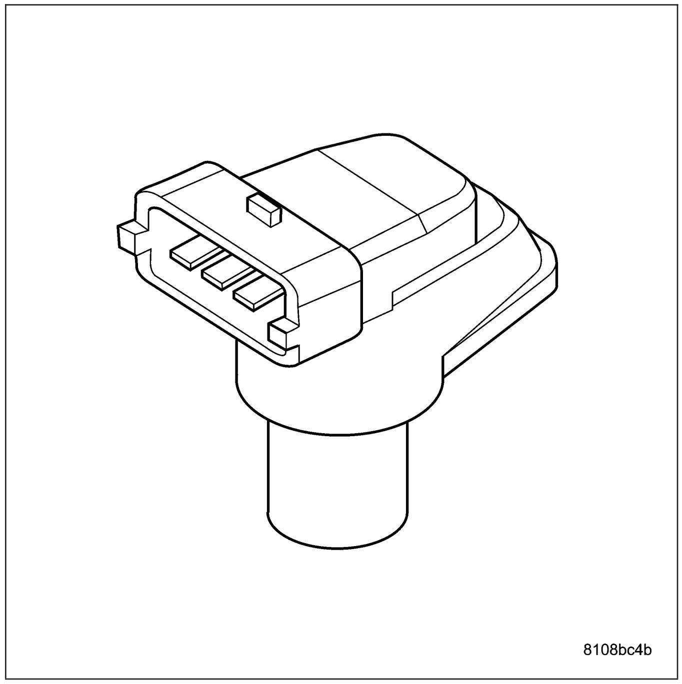
1. Install sensor (1) and retaining bolts into cylinder head cover/intake manifold. Torque to 5.4 N·m (48 in. lbs.)..
2. Connect sensor electrical connector.
3. Install engine cover and bracket assembly (Refer to 9 - ENGINE - INSTALLATION).
4. Connect negative battery cable.



# CAMSHAFT POSITION SENSOR

## DESCRIPTION

The camshaft position sensor (2) is mounted on the cylinder head cover toward the rear of the engine. The camshaft sensor utilizes a non contact method on one segment of the camshaft to record the camshaft position. When the ECM receives the signal from this sensor, it can then detect TDC of cylinder number one. The signal from the camshaft sensor is only required during engine starting. Injection timing is synchronized by means of the camshaft signal and the crankshaft signal.

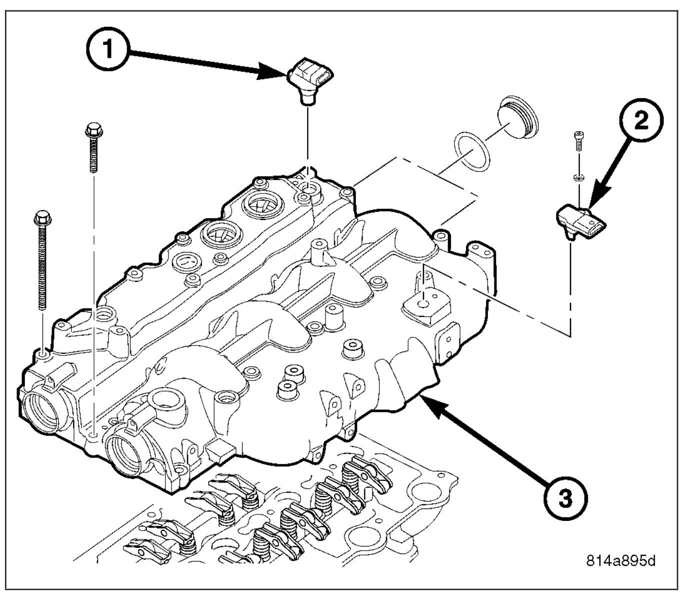



## OPERATION

On the camshaft sensor's signal line, a high signal corresponds to a voltage of 0-5V. If the segment machined into the exhaust camshaft sprocket is positioned opposite the camshaft sensor, the camshaft signal is low, approximately 0V. This signal is used by the engine control module (ECM) for detecting ignition TDC of cylinder 1 as the engine rotates. If no signal is supplied by the camshaft position sensor, the vehicle will not start because cylinder order can not be detected. If the signal is lost while the engine is running the vehicle will continue to run until shut off.

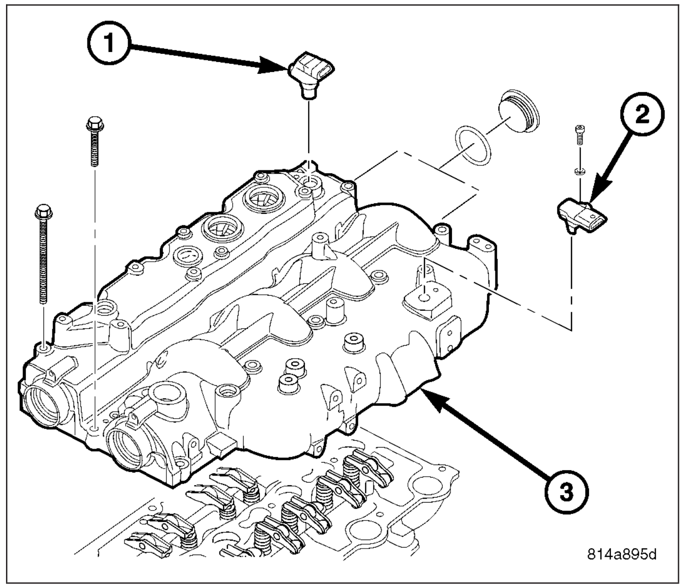
## REMOVAL

1. Disconnect negative battery cable.
2. Remove engine cover
3. Disconnect camshaft position sensor (1) electrical connector.
4. Remove retaining bolt, seal and remove sensor.



## INSTALLATION

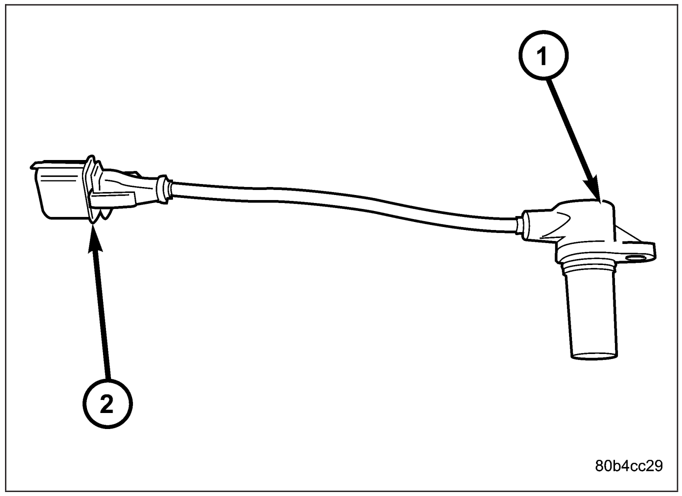
1. Install camshaft position sensor (1) and tighten bolt to 10.8 N·m (95 in lbs.).
2. Reconnect electrical connector.
3. Install engine cover.
4. Reconnect negative battery cable.



# CRANKSHAFT POSITION SENSOR

## DESCRIPTION

The crankshaft position sensor (1) is mounted in the right rear of the engine block, below the turbocharger, behind a heat shield. This sensor is used to detect engine speed.

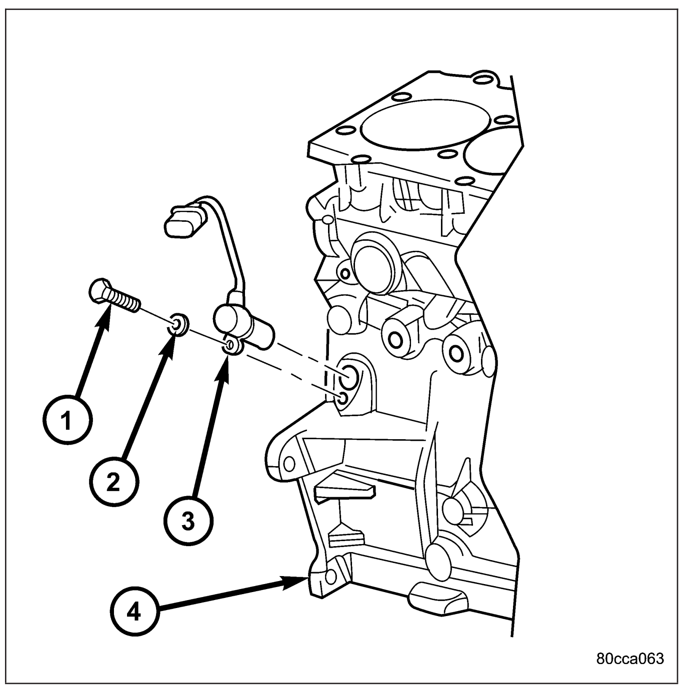



## OPERATION

The crankshaft position sensor is a magnetic pickup type sensor that generates an A/C signal. The sensor contains a permanent magnet and a coil of wire. The sensor generates an A/C signal each time a notch in the reluctor wheel on the crankshaft passes across the permanent magnet. The ECM calculates engine speed based on the frequency of the A/C signal.

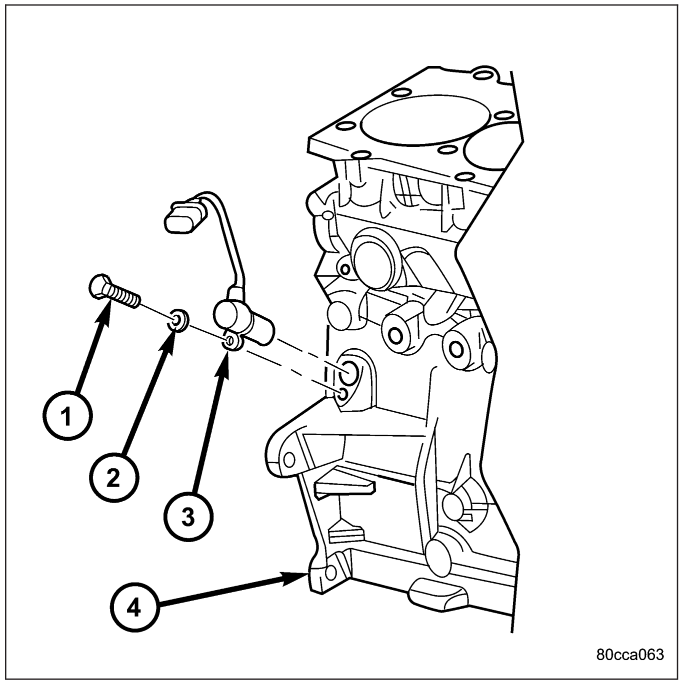
## REMOVAL

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove exhaust pipe to turbocharger down pipe retaining bolts and lower exhaust pipe from turbocharger downpipe.
4. Disconnect crankshaft position sensor electrical connector.
5. Remove the heat shield.
6. Remove crankshaft position sensor (3) retaining bolt and remove sensor from engine block.



## INSTALLATION

1. Lubricate O-ring on crankshaft position sensor and install sensor in engine block.
2. Install crankshaft position sensor (3) retaining bolt. Torque bolt to 10.8N·m.(95 in.lbs.).
3. Connect crankshaft position sensor electrical connection.
4. Install the heat shield. Tighten fasteners to 10.8 N·m (95 in. lbs.).
5. Connect exhaust pipe to turbocharger downpipe. Torque bolts to 32.4 N·m (24 ft. lbs.).
6. Lower vehicle from hoist.
7. Connect negative battery cable.



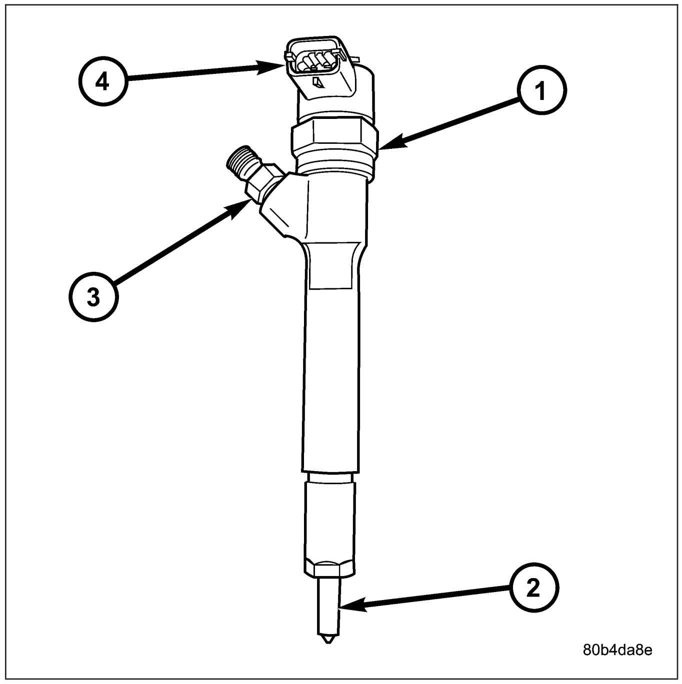
# FUEL INJECTOR

## DESCRIPTION

### FUEL INJECTOR

**CAUTION: There is a small seal at the bottom of the injector that seals the injector to the cylinder head. This seal MUST be replaced every time the injector is serviced.**

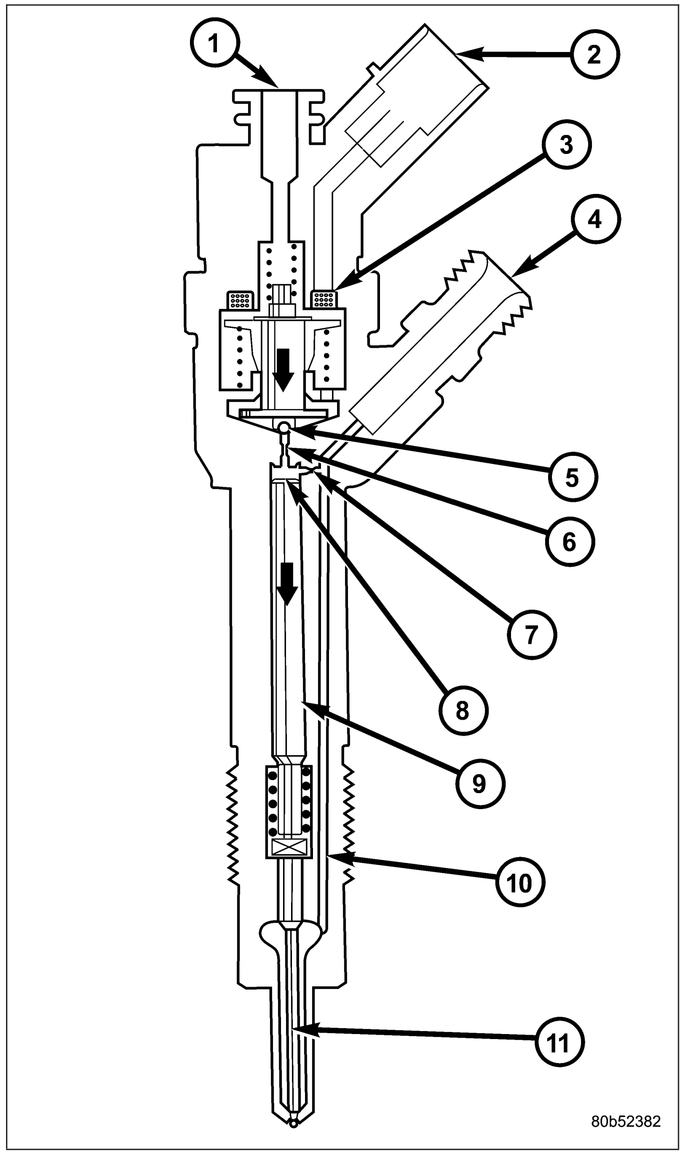
(Refer to 14 - FUEL SYSTEM - WARNING) There are individual fuel injectors (1) for all cylinders. Each injector nozzle has seven holes (2). The fuel injectors are used to spray fuel into the combustion chamber. Each injector has a six digit alphanumeric code on the injector top which identifies it's calibration. This number must be entered into to ECM using the scan tool. Specific moving parts inside the injector are graphite coated to assist with the lubrication process.



## OPERATION

(Refer to 14 - FUEL SYSTEM - WARNING) The injector operation can be subdivided into four operating states with the engine running and the high-pressure pump generating pressure:

- Injector closed (with high pressure applied)
- Injector opens (start of injection)
- Injector opened fully
- Injector closes (end of injection)




### Injector closed (with high pressure applied)

With the injector closed (at-rest state), the solenoid valve is not energized and is therefore closed. With the bleed orifice closed, the valve spring forces the armature's ball onto the bleed-orifice seat. The rail's high pressure build up in the valve control chamber, and the same pressure is also present in the nozzle's chamber volume. The rail pressure applied at the control plunger's end face, together with the force of the nozzle spring, maintain the nozzle in the closed position against the opening forces applied to its pressure stage.

### Injector opens (start of injection)

The solenoid valve is energized with the pickup current which serves to ensure that it open quickly. The force exerted by the triggered solenoid now exceeds that of the valve spring and the armature opens the bleed orifice. Almost immediately, the high-level pick-up current is reduced to the lower holding current required for the electromagnet. This is possible due to the magnetic circuit's air gap now being smaller. When the bleed orifice opens, fuel can flow from the valve control chamber into the cavity situated above it, and from there via the fuel return to the tank. The bleed orifice prevents complete pressure balance, and the pressure in the valve control chamber sinks as a result. This leads to the pressure in the valve-control chamber being lower than that in the nozzle's chamber volume which is still at the same pressure level as the rail. The reduced pressure in the valve-control chamber causes a reduction in the force exerted on the control plunger, the nozzle needle opens as a result, and injection starts.

### Injector opens fully

The control plunger reaches its upper stop where it remains supported by a cushion of fuel which is generated by the flow of fuel between the bleed and feed orifices. The injector nozzle has now opened fully, and the fuel is injected into the combustion chamber at a pressure almost equal to that in the fuel rail.

### Injector closes (end of injection)

As soon as the solenoid valve is no longer triggered, the valve spring forces the armature downwards and the ball closes the bleed orifice. The armature is a 2–piece design. Here, although the armature plate is guided by a driver shoulder in its downward movement, it can “overspring” with the return spring so that it exerts no downwards-acting forces on the armature and the ball. The closing of the bleed orifice lead to pressure build up in the control chamber via the input from the feed orifice. This pressure is the same as that in the rail and exerts an increased force on the control plunger through its end face. This force, together with that of the spring, now exceeds the force exerted by the chamber volume and the nozzle needle closes. Injection ceases as soon as the nozzle needle comes up against its bottom stop again.

## STANDARD PROCEDURE

## CLEANING FUEL INJECTORS

**NOTE: Before cleaning the injector recesses, seal the injector holes in the injector recesses with the appropriate pin to prevent debris from falling into the recesses and entering the motor.**

1. Seal the injector holes inside the cylinder head recesses.
2. Wipe out injector recesses with a non-woven cloth, then clean with a cylinder brush.
3. Clean the bottom of the cylinder recess with a round brush.
4. Blow out the recess and clean again with a non-woven cloth and cover over.
5. Perform these steps for each injector recess.

**NOTE: DO NOT clean the tip of the injector with a wire brush. Use a non - woven cloth.**

6. Clean injector body with a wire brush.
7. Clean injector tips with a non-woven cloth.

**NOTE: Do Not apply antiseize lubricant to the injector nozzle area.**

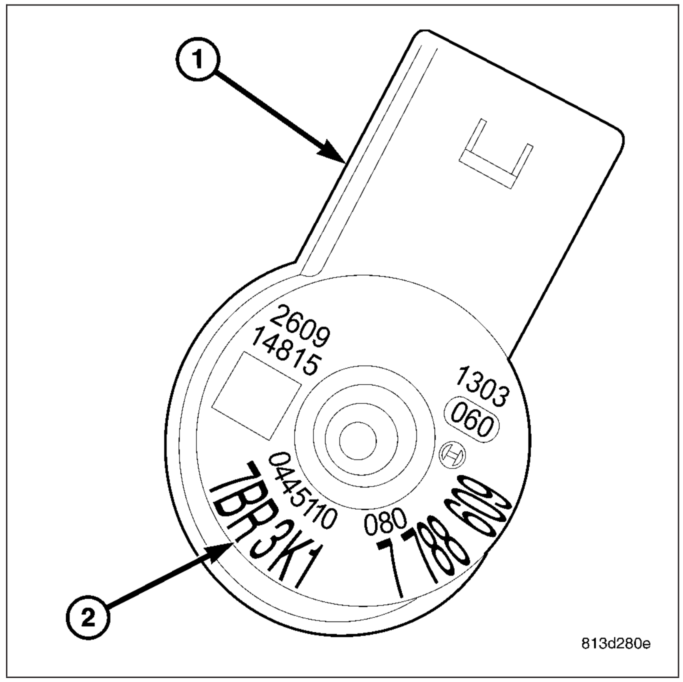
8. Grease injector body with anti seize lubricant.

**NOTE: Always replace the seals that seal off the injectors at the cylinder head to the combustion chamber and replace the retaining screws.**

## INJECTOR CLASSIFICATION

**NOTE: Fuel Injectors have different flow rates. When ALL injectors are removed, re-enter all injector six digit codes. If more than one injector is replaced, remove the injector sticker on the front of the timing cover.**

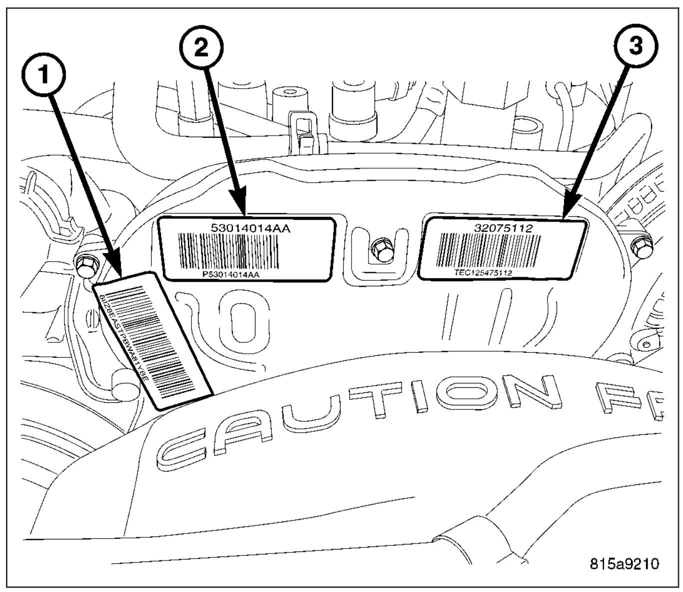
Classified injectors can be recognized by the six digit alpha-numeric code (2) on the magnetic head. The code corresponds to the classification stage. The classification stage may be checked against the fuel injector identification sticker (1) on the front of the timing cover. Number one cylinder will be the first six digits, number two cylinder will be the second six digits, and so on.




The classification of injectors describes the fuel flow quantity characteristic of the injector. This will make it possible in the future to match the engine software to the tolerances of the injector within a more narrowly graduated range. Classification can be clearly recognized, and assigned only by means of a scan tool.

These general conditions equally apply if, as a result of replacing an engine, carrying out repairs to the cylinder head etc., the cylinder selective assignment of the injectors or the engine control module assignment may have changed. If proper attention is not paid to the classification on these vehicles driveability and smoking concerns could result.

If an injector is replaced, it is then necessary to assign the classification code to the corresponding cylinder in the engine control module with the appropriate scan tool.




## INJECTOR CLASSIFICATION PROCEDURE

1. Turn ignition switch “ON”.
2. Using the scan tool, select ENGINE then MISCELLANEOUS.
3. Select LEARN INJECTORS.
4. Using the up and down arrows, scroll to the appropriate injector.
5. Using the right and left arrows, set injector to proper classification code.
6. Once injectors are classified, cycle ignition to complete.

## REMOVAL

1. Review the High Pressure Fuel System Warning (Refer to 14 - FUEL SYSTEM - WARNING).
2. Disconnect negative battery cable.
3. Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
4. Disconnect injector electrical connector.

**CAUTION: Repeated mounting of the retaining ring is not permitted.**

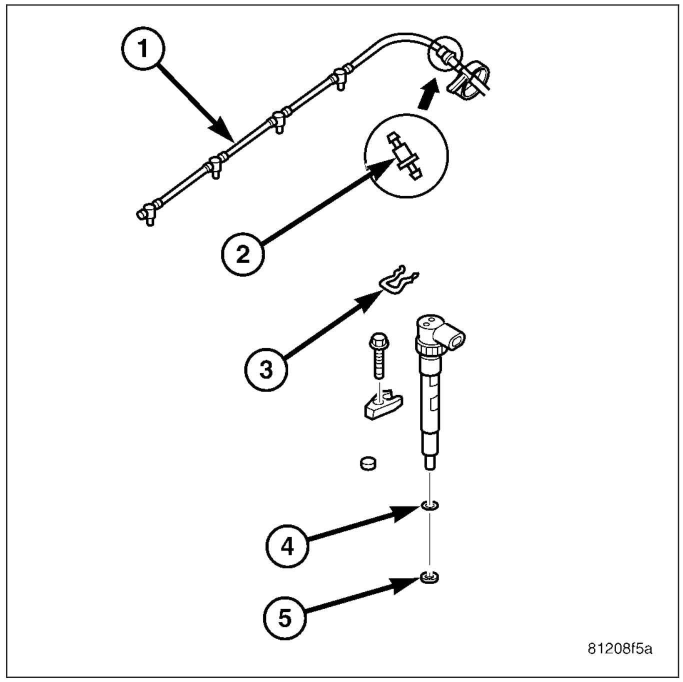
5. Remove fuel return line from injector.
6. Remove fuel injector high pressure line (Refer to 14 - FUEL SYSTEM - WARNING).
7. Remove fuel injector retainer and retaining bolt.
8. Using compressed air, clean surface area in and around injector bore to prevent foreign material from falling into the injector bore, after injector removal.

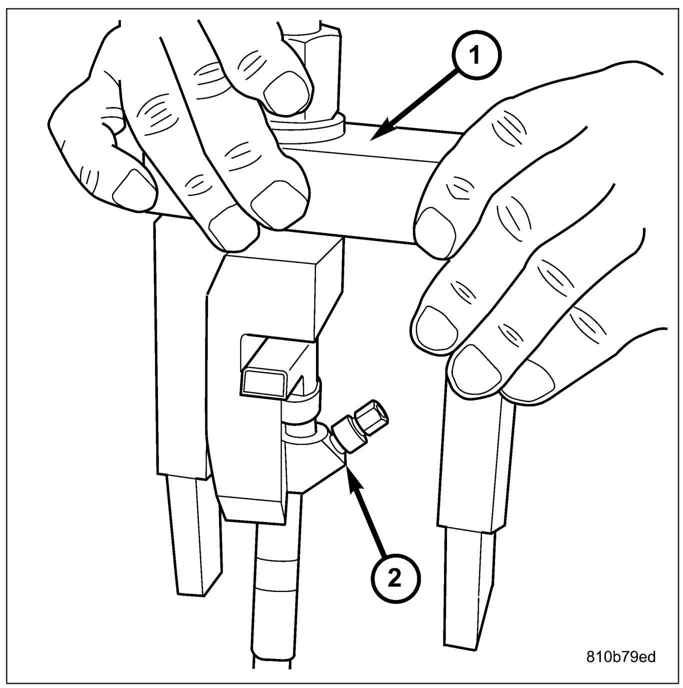
**NOTE: DO NOT use a wire brush to clean the fuel injector or nozzle. Possible restriction of the injector needle may result.**

9. Remove fuel injector from cylinder head.

**CAUTION: If the fuel injectors will not come out of the cylinder head, perform the following steps to prevent damaging other components.**

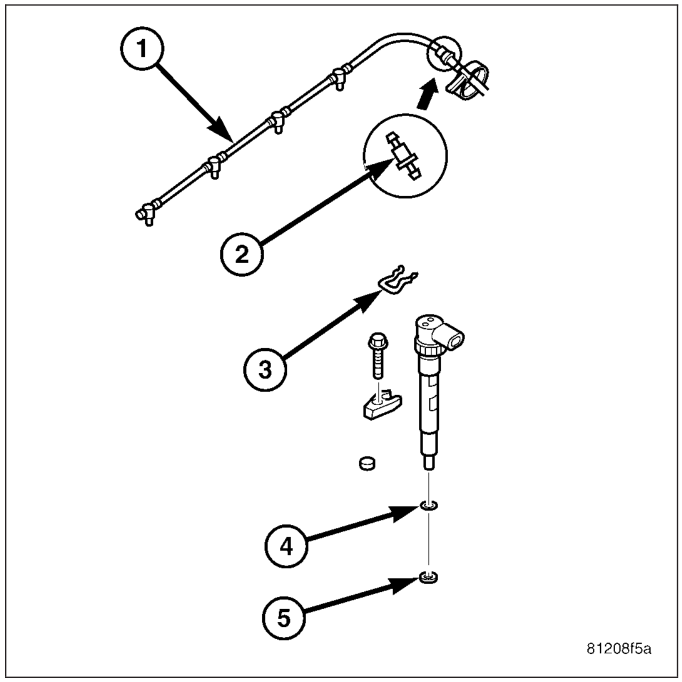
10. Assemble and install Injector extractor special tool VM 9075A on to injector and cylinder head.



## INSTALLATION

**WARNING: High - pressure lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi.). Use extreme caution when inspecting for high - pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high - pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.**




**NOTE: DO NOT use a brush to clean around the injector nozzle. DO NOT lubricate area around injector nozzle. The injector may become restricted with debris.**

**NOTE: Be sure a new copper washer/seal is installed on end of injector and the old seal is removed, before installing in cylinder head.**

**NOTE: Apply anti seize compound to injector body.**

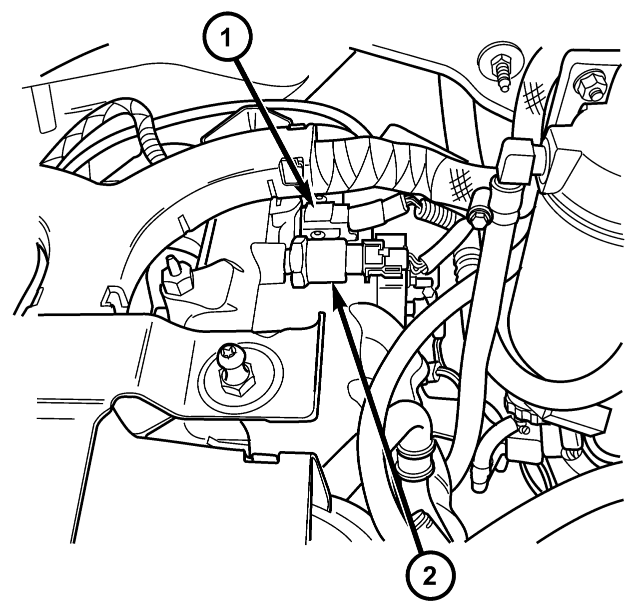
1. Install fuel injector in cylinder head with new seal and O-ring.
2. Install fuel injector retainer and bolt. Torque bolt to 32.4 N·m (24 ft. lbs.)..
3. Install fuel injector high pressure line.
4. Install fuel return line to injector.
5. Connect fuel injector electrical connector.
6. Install engine cover and bracket assembly (Refer to 9 - ENGINE COVER - INSTALLATION).
7. Connect negative battery cable.
8. Perform the injector classification procedure with the scan tool (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/ FUEL INJECTOR - STANDARD PROCEDURE).
9. Start the engine, allow to warm, **Turn Off the Ignition**, Inspect for leaks.

# FUEL PRESSURE SENSOR

## DESCRIPTION

**WARNING: High - pressure fuel line deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi). Use extreme caution when inspecting for high - pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high - pressure leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.**

The fuel rail pressure sensor (2) screws into the fuel rail at the top of the engine. The ECM uses this sensor to monitor the fuel rail pressure.



80cf1e6f

## OPERATION

Review the high pressure fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING).

The fuel flows to the fuel pressure sensor through an opening in the rail, the end of which is sealed off by the sensor diaphragm. Pressurized fuel reaches the sensor's diaphragm through a blind hole. The sensor element (semiconductor device) converts the pressure to an electric signal is mounted on this diaphragm. The signal generated by the sensor is sent to the ECM.

## REMOVAL

1. Disconnect negative battery cable.
2. Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).
3. Disconnect fuel pressure sensor electrical connector .
4. Remove fuel pressure sensor from fuel rail.

## INSTALLATION

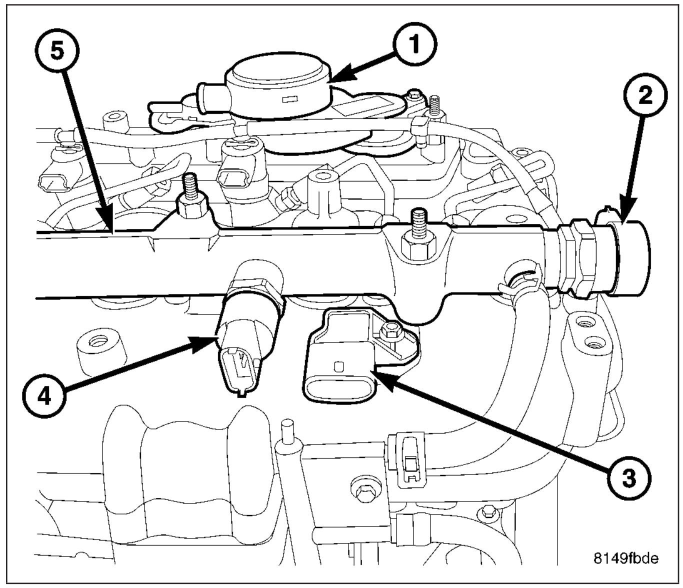
**WARNING: High - pressure lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi.). Use extreme caution when inspecting for high - pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high - pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.**

1. Install fuel pressure sensor in fuel rail. Tighten sensor to 35 N·m (26 ft. lbs.)..
2. Connect fuel pressure sensor electrical connector.
3. Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).
4. Connect negative battery cable.

# FUEL PRESSURE SOLENOID

## DESCRIPTION

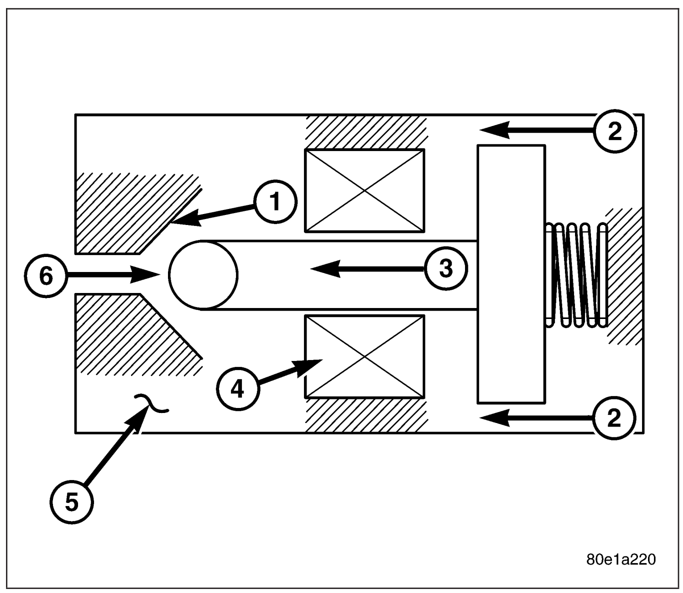
The fuel pressure solenoid is attached to the rear of the fuel rail. The tip of the fuel pressuer solenoid uses a knife edge, for metal to metal sealing. The knife edge actually deforms the metal in the fuel rail in order to seal the surfaces. The solenoid must be replaced when ever it is removed from the rail. The solenoid controls and maintains the rail pressure constant along with a control current transmitted by the engine control module (ECM).




## OPERATION

High pressure which is present in the fuel rail flows to the ball seat (1) of the pressure solenoid. The specified pressure required by the system is built up in the rail by the fuel pressure solenoid building up a magnetic force which corresponds to this specific pressure by means of a control current from the Electronic Control Module (ECM). This magnetic force equals a certain outlet cross section at the ball seat of the valve. The rail pressure is altered as a result of the quantity of fuel which flows off. The current fuel pressure is signaled by the fuel rail pressure sensor to the engine control module (ECM). The controlled fuel flows back along the return fuel line, into the tank.

In a de-energized state, the fuel pressure solenoid is closed as the spring force (2) presses the ball into the ball seat. When driving, the fuel pressure solenoid is constantly open. When engine is started, the fuel pressure solenoid is held closed by magnetic force. When driving, the pressure of the fluid counteracts the magnetic force of the coil and the slight spring force.



## REMOVAL

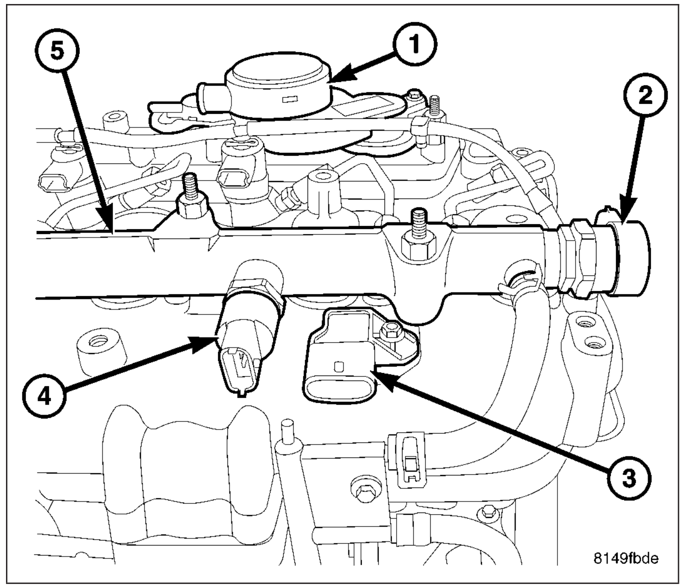
**Review the high pressure fuel system warning before beginning repair (Refer to 14 - FUEL SYSTEM - WARNING)**

**WARNING: No sparks, open flames or smoking. Risk of poisoning from inhaling and swallowing fuel. Risk of injury to eyes and skin from contact with fuel. Pour fuels only into suitable and appropriately marked containers. Wear protective clothing.**

1. Disconnect negative battery cable.
2. Remove fuel rail (Refer to 14 - FUEL SYSTEM/ FUEL INJECTION/FUEL INJECTOR - REMOVAL).
3. Clamp fuel rail securely in vise with protective jaws.

**CAUTION: Once removed, the solenoid must always be replaced.**

4. Counterhold and unscrew the fuel pressure solenoid (2).

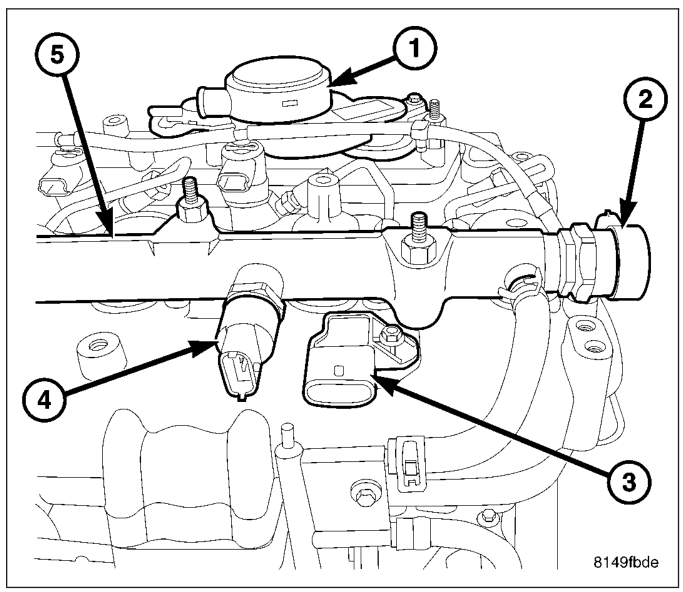



## INSTALLATION

**Review the high pressure fuel system warning before beginning repair (Refer to 14 - FUEL SYSTEM - WARNING)**

**WARNING: No sparks, open flames or smoking. Risk of poisoning from inhaling and swallowing fuel. Risk of injury to eyes and skin from contact with fuel. Pour fuels only into suitable and appropriately marked containers. Wear protective clothing.**

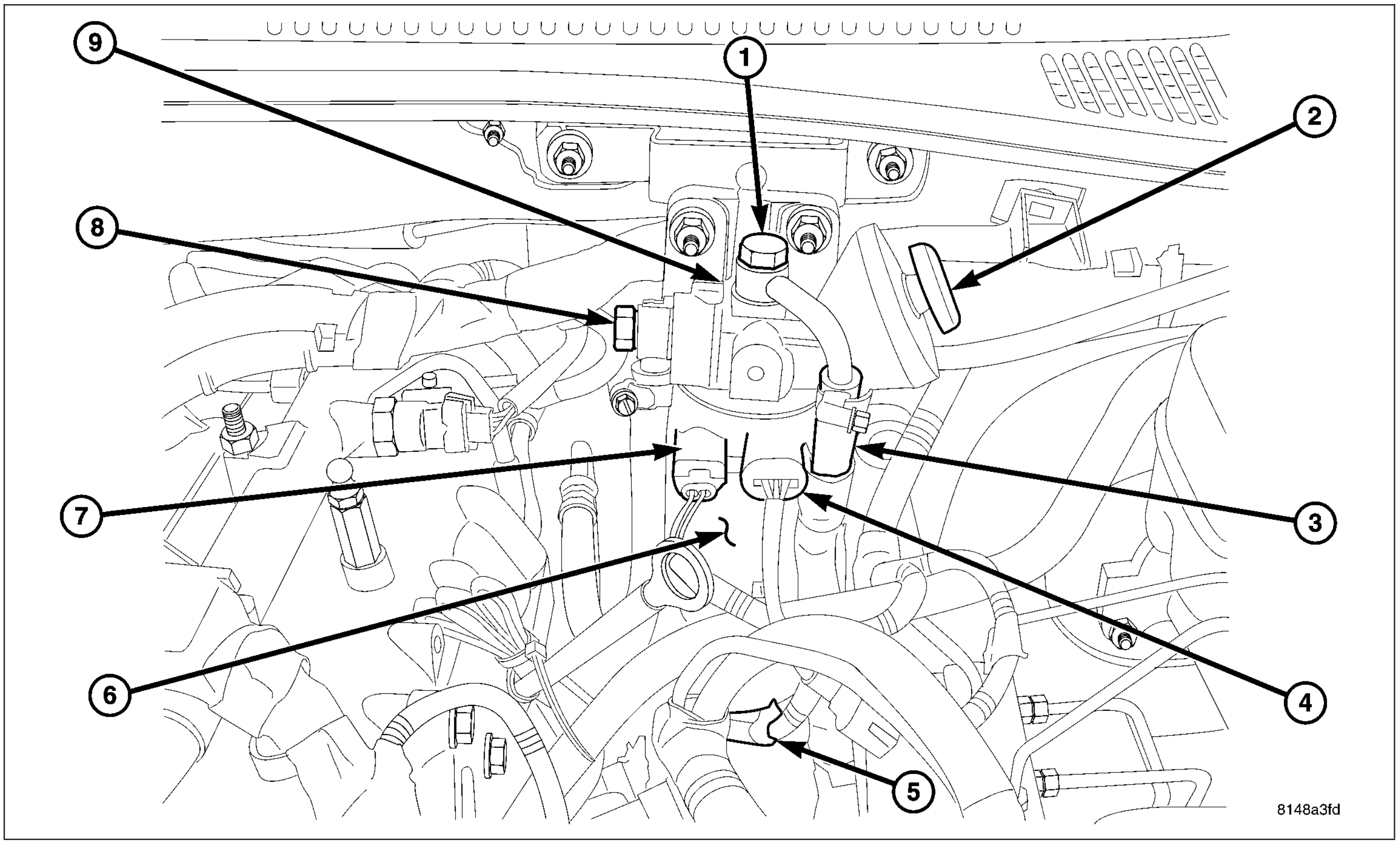
**CAUTION: There is a special tightening procedure for the fuel rail solenoid that must be followed along with the proper use of a torque wrench. Therefore the fuel rail must be removed before installing the fuel pressure solenoid.**




1. Position the fuel rail (5) into a soft jawed vise.
2. Screw the fuel pressure solenoid to the fuel rail until hand tight.
3. Tighten the fuel rail solenoid as follows:
   a. Tighten the nut to 60 N·m (44 ft. lbs.)
   b. Loosen the nut 90 degrees.
   c. Retighten the nut to 80 N·m (59 ft. lbs.).
4. Install fuel rail (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).
5. Connect negative battery cable.
6. Start engine, allow to warm, turn engine off and inspect for leaks (Refer to 14 - FUEL SYSTEM - DIAGNOSIS AND TESTING).

# FUEL TEMPERATURE SENSOR

## DESCRIPTION




The fuel temperature sensor is integrated into the fuel filter housing, along side of the fuel heater. The sensor detects the temperature of the fuel and supplies that information to the ECM. The sensor ranges from - 40°F (-40°C) to 284°F (140°C). If the engine is cold, the actual value sent will read ambient temperature. The value rises after the engine has been started. The fuel temperature sensor IS NOT SERVICED separate from the housing assembly.

## OPERATION

An negative temperature coefficient (NTC) resistor integrated in the fuel temperature sensor alters it's electrical resistance in line with the fuel temperature (the resistance drops as the temperature rises). The ECM uses this reading to calculate optimum engine performance under all driving conditions. If the fuel is to warm, the rail pressure in the system is lowered. The controlled quantity of the fuel rail pressure solenoid is reduced and the fuel temperature is lowered.

## REMOVAL

**WARNING: Store fuel in approved and properly marked containers. Wear safety goggles and adequate protective clothing when servicing fuel system.**

1. The fuel temperature sensor is serviced as an assembly along with the fuel heater (Refer to 14 - FUEL SYSTEM/ FUEL DELIVERY/FUEL HEATER - REMOVAL).

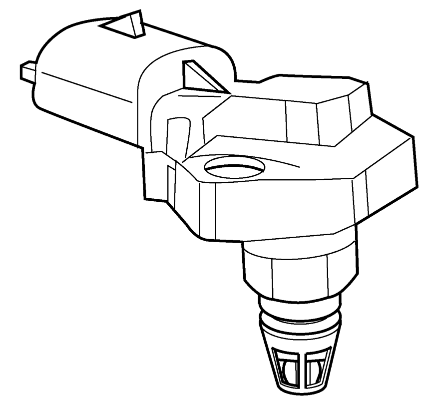
## INSTALLATION

1. The fuel temperature sensor is serviced along with the fuel heater (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL HEATER - INSTALLATION).

# INTAKE AIR TEMPERATURE SENSOR

## DESCRIPTION

The boost pressure/intake air temperature sensor is mounted to the top of the intake manifold. The sensor allows the ECM to monitor air pressure within the intake manifold. This sensor is also used to monitor the intake air temperature.


8100a221

## OPERATION

The intake air temperature sensor is a negative temperature coefficient (NTC) thermistor (resistance varies inversely with temperature). This means at cold air temperature its resistance is high, so the voltage signal will be high. As intake air temperature increases, sensor resistance decreases and the signal voltage will be low. This allows the sensor to provide an analog voltage signal (0.2-4.8 volts) to the ECM.

## REMOVAL

1. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/BOOST PRESSURE SENSOR - REMOVAL)

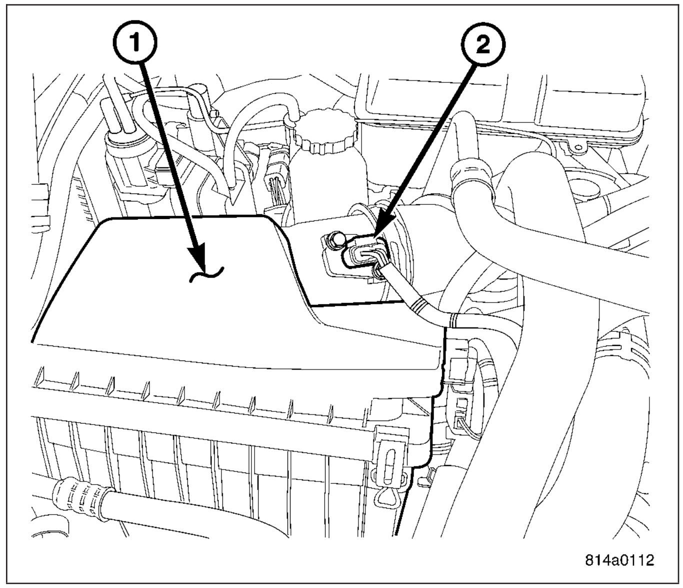
## INSTALLATION

1. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/BOOST PRESSURE SENSOR - INSTALLATION)

# MASS AIR FLOW SENSOR

## DESCRIPTION

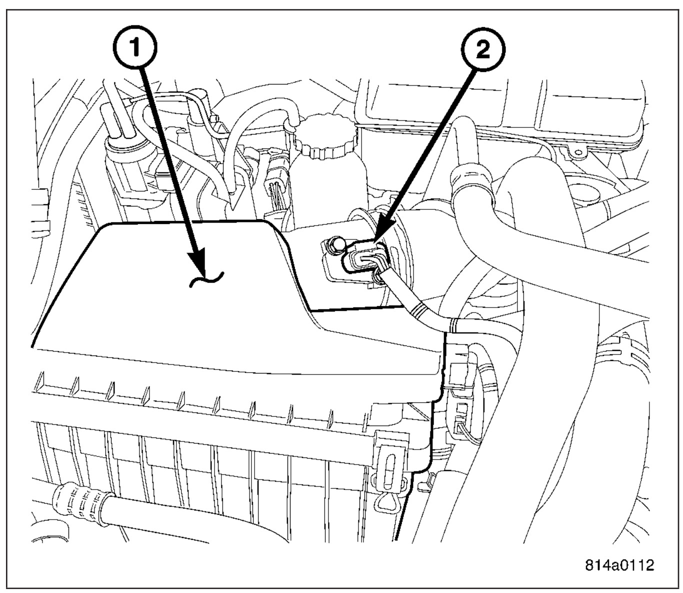
The Mass Air Flow (MAF) Sensor is located on the air cleaner cover. The MAF sensor uses semiconductor technology throughout, and is used to calculate the air mass flowing past it per time unit. This mass is important for determining the exhaust gas recirculation rate. The MAF sensor sends a corresponding signal to the ECM, which evaluates the signal to adjust the EGR air flow control valve.




## OPERATION

The ECM uses the mass air flow (MAF) sensor to measure air density. The temperature resistor located at the front of the MAF sensor measures the temperature of the inlet air. By varying the voltage, the electronic circuit regulates the temperature of the heating resistor in the rear so that it is 320° F (160°C) higher than the temperature of the intake air. The temperature at the heating resistor is measured by a sensor resistor in-between.

Because the incoming air has a cooling effect, the greater the amount of air that flows in, then the higher the voltage of the heating resistor. The heating resistor is therefore a measure of mass of air flowing past. If a temperature change occurs as a result of a increase or reduction of air flow, the ECM corrects the voltage at the heating resistor until the temperature difference is again achieved. This control voltage is use by the ECM as a unit measure for metered air mass.




## REMOVAL

The Mass Air Flow (MAF) sensor is serviced along with the air cleaner cover.

## INSTALLATION

The Mass Air Flow (MAF) sensor is serviced along with the air cleaner cover.

# STEERING

## TABLE OF CONTENTS

# STEERING

## DESCRIPTION

Power steering systems consist of:

- Steering column & Intermediate Shaft
- Rack and pinion steering gear
- Belt driven hydraulic steering pump
- Pump pressure, supply and return hoses
- Oil Cooler

## OPERATION

The steering column intermediate shaft attaches the steering column to the gear pinion. The rotation of the pinion moves the gear rack from side-to-side. This lateral action of the rack pushes and pulls the tie rods to change the direction of the front wheels.

Power assist is provided by an engine mounted hydraulic pump. The pump supplies hydraulic fluid to the steering gear. All 3.7L vehicles with trailer tow option are equipped with an oil cooler.

## DIAGNOSIS AND TESTING

## POWER STEERING SYSTEM

There is some noise in all power steering systems. One of the most common is a hissing sound evident at a standstill/parking, or when the steering is at the end of it's travel. Hiss is a high frequency noise similar to that of a water tap being closed slowly. The noise is present in all valves that have a high velocity fluid passing through an orifice. There is no relationship between this noise and steering performance.

### STEERING NOISE

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| OBJECTIONAL HISS OR WHISTLE | 1. Steering intermediate shaft to dash panel seal.<br>2. Noisy valve in power steering gear.<br>3. Inoperative or defective valve in pump | 1. Check and repair seal at dash panel.<br>2. Replace steering gear.<br>3. Replace pump |
| RATTLE OR CLUNK | 1. Gear mounting bolts loose.<br>2. Loose or damaged suspension components.<br>3. Internal gear noise.<br>4. Loose or damaged intermediate shaft or column. | 1. Tighten bolts to specification.<br>2. Inspect and repair suspension.<br>3. Replace steering gear.<br>4. Inspect and repair or replace. |
| MOAN | 1. Pressure hose in contact with other components. | 1. Reposition hose. |
| CHIRP OR SQUEAL | 1. Loose belt. | 1. Adjust or replace. |
| WHINE OR GROWL | 1. Low fluid level.<br>2. Pressure hose in contact with other components.<br>3. Internal pump noise. | 1. Fill to proper level.<br>2. Reposition hose.<br>3. Replace pump. |

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| SUCKING AIR SOUND | 1. Loose return line clamp.<br>2. O-ring missing or damaged on hose fitting.<br>3. Low fluid level.<br>4. Air leak between pump and reservoir.<br>5. Reservoir cap not installed correctly. | 1. Replace clamp.<br>2. Replace o-ring.<br>3. Fill to proper level.<br>4. Repair as necessary.<br>5. Install reservoir cap correctly. |
| SCRUBBING OR KNOCKING | 1. Wrong tire size.<br>2. Wrong gear.<br>3. Tire Pressure | 1. Verify tire size.<br>2. Verify gear.<br>3. Adjust Tire Pressure |

**BINDING AND STICKING**

| CONDITION | POSSIBLE CAUSE | CORRECTION |
|---|---|---|
| DIFFICULT TO TURN WHEEL STICKS OR BINDS | 1. Low fluid level.<br>2. Tire pressure.<br>3. Steering components (ball joints/tie rod ends).<br>4. Loose belt.<br>5. Low pump pressure.<br>6. Column Intermediate shaft binding.<br>7. Steering gear worn. | 1. Fill to proper level.<br>2. Adjust tire pressure.<br>3 Inspect and repair as necessary.<br>4. Adjust or replace.<br>5. Pressure test and replace if necessary.<br>6. Replace Intermediate Shaft.<br>7. Replace gear. |

**INSUFFICIENT ASST. OR POOR RETURN TO CENTER**

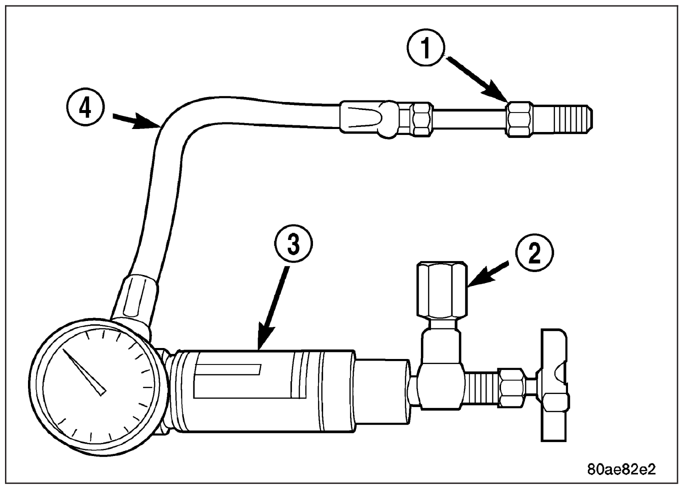
| CONDITION | POSSIBLE CAUSE | CORRECTION |
|---|---|---|
| HARD TURNING OR MOMENTARY INCREASE IN TURNING EFFORT | 1. Tire pressure.<br>2. Low fluid level.<br>3. Loose belt.<br>4. Low pump pressure.<br>5. Internal gear leak. | 1. Adjust tire pressure.<br>2. Fill to proper level.<br>3. Adjust or replace.<br>4. Pressure test and repair as necessary.<br>5. Replace gear. |
| STEERING WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION | 1. Tire pressure.<br>2. Wheel alignment.<br>3. Lack of lubrication.<br>4. High friction in steering gear. | 1. Adjust tire pressure.<br>2. Align front end.<br>3. Inspect and lubricate suspension compnents.<br>4. Replace gear. |

**LOOSE STEERING AND VEHICLE LEAD**

| CONDITION | POSSIBLE CAUSE | CORRECTION |
|---|---|---|
| EXCESSIVE PLAY IN STEERING WHEEL | 1. Worn or loose suspension or steering components. | 1. Inspect and repair as necessary. |
| | 2. Worn or loose wheel bearings. | 2. Inspect and replace bearings. |
| | 3. Steering gear mounting. | 3. Tighten / replace gear mounting bolts/ isolators to specification. |
| | 4. Gear out of adjustment. | 4. Replace gear. |
| | 5. Worn or loose steering intermediate shaft. | 5. Inspect and replace as necessary. |
| VEHICLE PULLS, DRIFTS OR LEADS TO ONE SIDE. | 1. Tire Pressure. | 1. Adjust tire pressure. |
| | 2. Radial tire lead. | 2. Rotate tires. |
| | 3. Brakes dragging. | 3. Repair as necessary. |
| | 4. Wheel alignment. | 4. Align front end. |

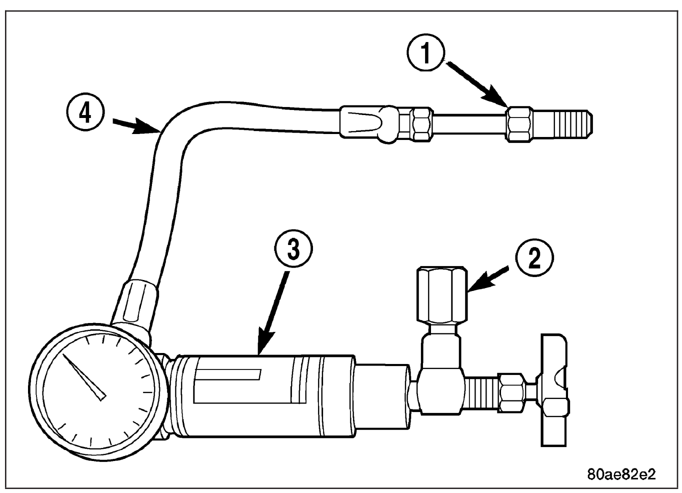
## POWER STEERING FLOW AND PRESSURE

The following procedure is used to test the operation of the power steering system on the vehicle. This test will provide the gallons per minute (GPM) or flow rate of the power steering pump along with the maximum relief pressure. Perform test any time a power steering system problem is present. This test will determine if the power steering pump or power steering gear is not functioning properly. The following pressure and flow test is performed using Power Steering Analyzer Tool kit 6815 and Adapter Kit 6893.




## FLOW AND PRESSURE TEST

1. Check the power steering belt to ensure it is in good condition and adjusted properly.
2. Connect pressure gauge hose from the Power Steering Analyzer to Tube 6844.
3. Connect Adapter 6826 to Power Steering Analyzer test valve end.
4. Disconnect the high pressure hose from the power steering pump.
5. Connect the tube to the pump hose fitting.
6. Connect the power steering hose from the steering gear to the adapter.
7. Open the test valve completely.




8. Start engine and let idle long enough to circulate power steering fluid through flow/pressure test gauge and to get air out of the fluid. Then shut off engine.
9. Check fluid level, add fluid as necessary. Start engine again and let idle.
10. Check for air bubbles, Evacuate if necessary.

11. Gauge should read below 862 kPa (125 psi). If above, inspect the hoses for restrictions and repair as necessary. The initial pressure reading should be in the range of 345-552 kPa (50-80 psi).
12. Increase the engine speed to 1500 RPM and read the flow meter. If the flow rate (GPM) is below specification, (refer to pump specification chart for GPM) the pump should be replaced.

**CAUTION: The following test procedure involves testing maximum pump pressure output and flow control valve operation. Do not leave valve closed for more than three seconds as the pump could be damaged.**

13. Close valve fully three times and record highest pressure indicated each time. **All three readings must be above specifications and within 345 kPa (50 psi) of each other.**
    - Pressures above specifications but not within 345 kPa (50 psi) of each other, replace pump.
    - Pressures within 345 kPa (50 psi) of each other but below specifications, replace pump.
14. Open the test valve and turn the steering wheel to the extreme left and right positions three times against the stops. Record the highest pressure reading at each position. Compare readings to the pump specifications chart. If pressures readings are not within 50 psi of each other, the gear is leaking internally and must be replaced.

**CAUTION: Do not force the pump to operate against the stops for more than 2 to 3 seconds at a time because, pump damage will result.**

**PUMP SPECIFICATION**

| ENGINE | RELIEF PRESSURE | FLOW RATE (GPM) AT 1500 RPM |
|---|---|---|
| ALL | 10342 kPa, PREFERRED (1450 psi) with a MAX 1550 psi & 7929 kPa, MIN (1400 psi) | 2.4 - 2.8 |

# COLUMN

## TABLE OF CONTENTS

# COLUMN

## DESCRIPTION

**NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.**

The standard non-tilt and tilt steering column has been designed to be serviced as an assembly. The column is connected to the steering gear with a one piece shaft. The upper half has a support bearing mounted to a bracket. The bracket mounts to the frame rail with two nuts. The shaft is serviceable. The key cylinder, switches, clock spring, trim shrouds and steering wheel are serviced separately.

## OPERATION - SERVICE PRECAUTIONS

Safety goggles should be worn at all times when working on steering columns.

To service the steering wheel, switches or airbag, refer to Electrical - Restraints and follow all WARNINGS and CAUTIONS.

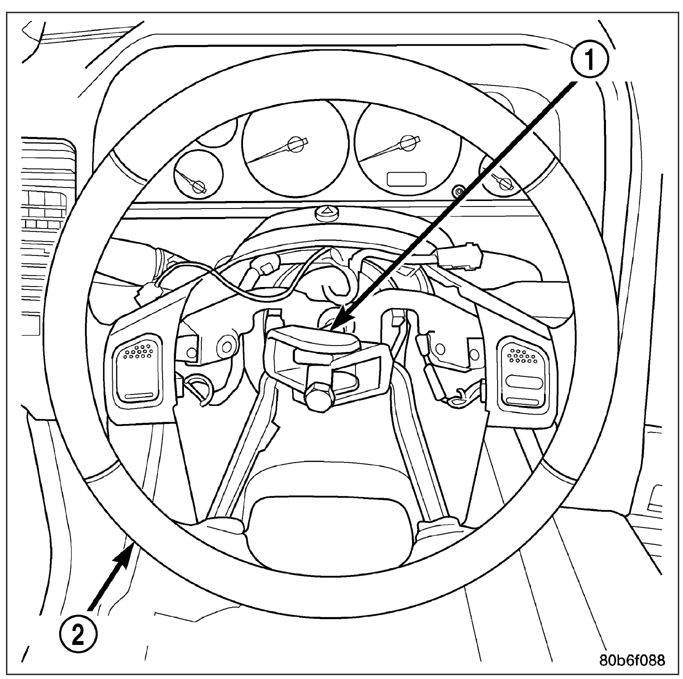
**WARNING: The airbag system is a sensitive, complex electro-mechanical unit. Before attempting to diagnose, remove or install the airbag system components you must first disconnect and isolate the battery negative (ground) cable. Then wait two minutes for the system capacitor to discharge. Failure to do so could result in accidental deployment of the airbag and possible personal injury. The fasteners, screws, and bolts, originally used for the airbag components, have special coatings and are specifically designed for the airbag system. They must never be replaced with any substitutes. Anytime a new fastener is needed, replace with the correct fasteners provided in the service package or fasteners listed in the parts books.**

## REMOVAL

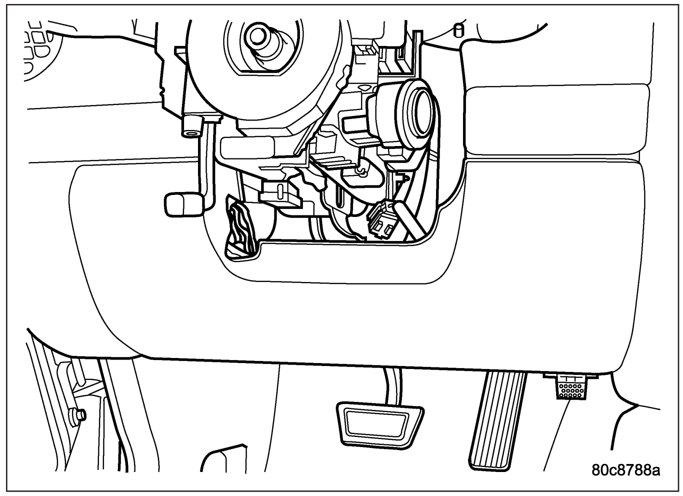
1. Position front wheels **straight ahead.**
2. Remove and isolate the negative ground cable from the battery.
3. Remove the airbag, (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

**NOTE: If equipped with cruise control, disconnect clock spring harness from the cruise switch harness on the steering wheel.**

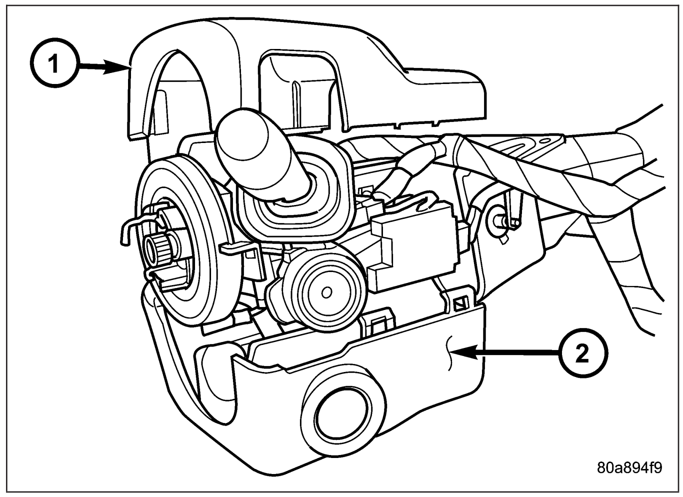
4. Remove the steering wheel (2) with puller C-3894–A (1) or an appropriate puller (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - REMOVAL).



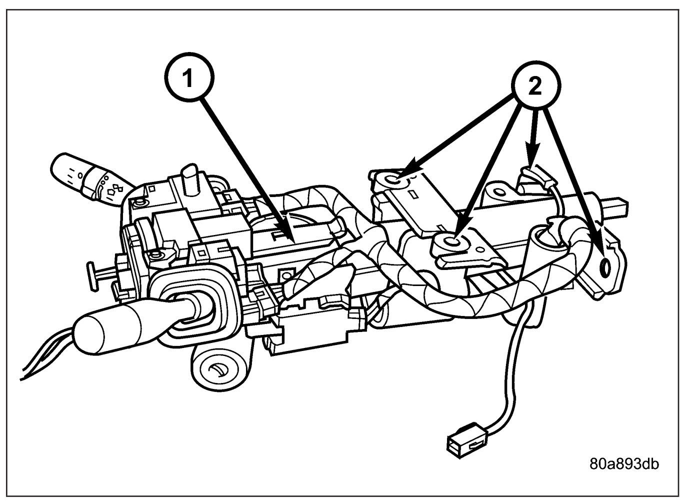
5. Remove knee blocker cover and knee blocker, (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - REMOVAL).



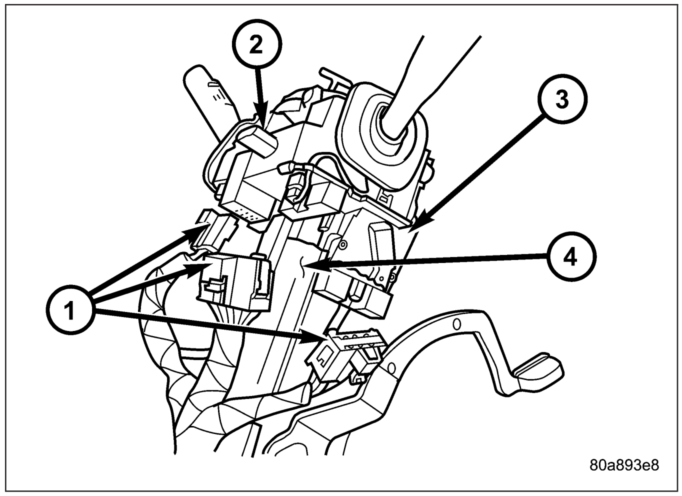

6. Remove screws from the lower column shroud (2) and remove both the upper and lower shrouds.



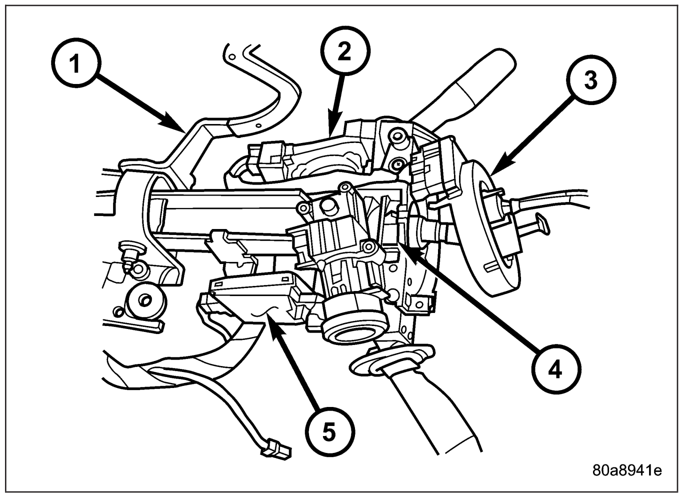

7. Turn ignition key to the on position.
8. If vehicle is equipped with automatic transmission, disconnect shifter interlock cable from the column.
9. Remove the steering coupler bolt and column mounting nuts and bolts (2) then lower column (1) off the mounting studs.



10. Disconnect and remove the wiring harness (1) from the column.
11. Slide the shifter interlock cable from the tie straps.

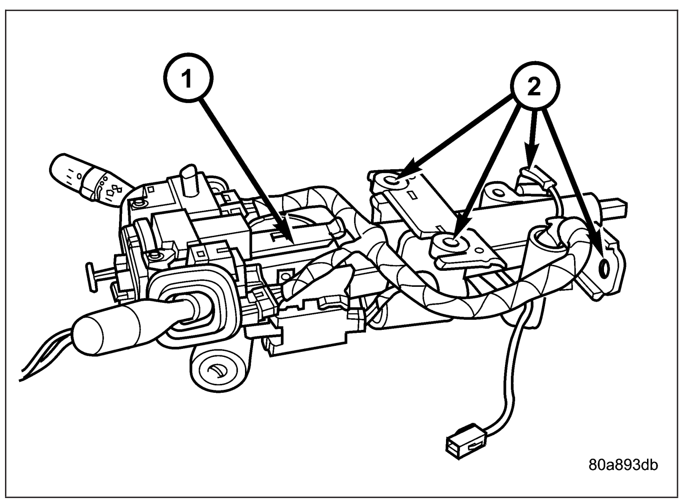



12. Remove column (4).
13. Transfer the necessary parts if needed.
14. Remove clock spring (3) , switches, (SKREEM if equipped) (5) (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

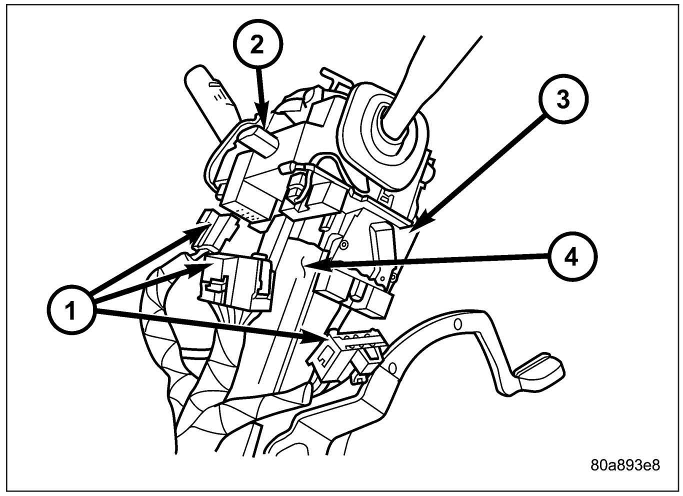



## INSTALLATION

1. Align and install column (1) into the steering coupler.



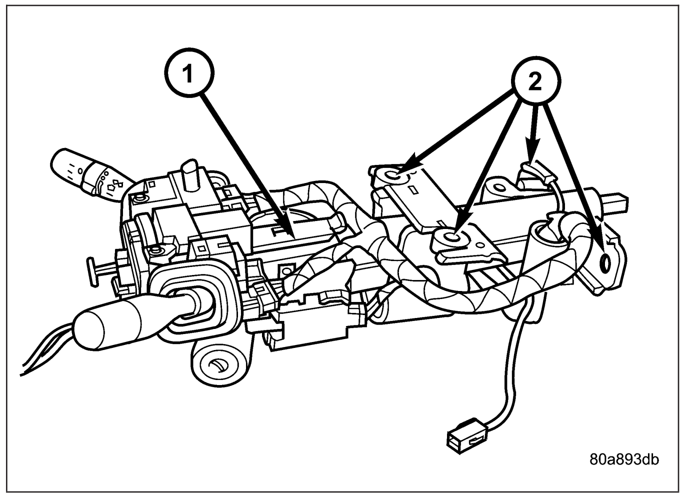
2. Install column harness (1) and connect harness to switches.
3. Reroute the shifter interlock cable through the tie straps.



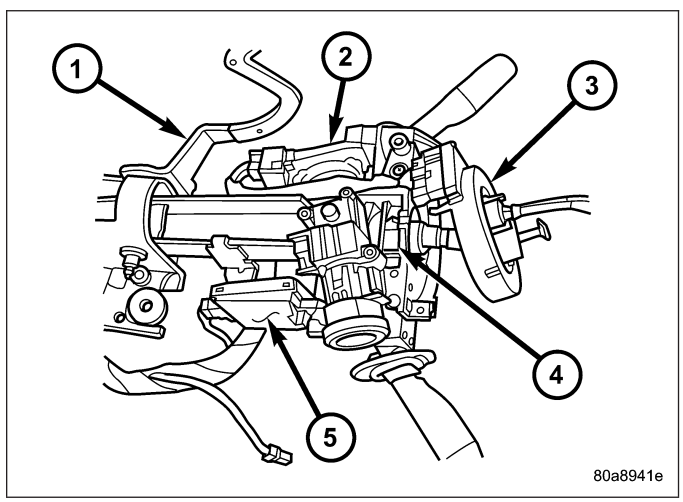

4. Install the column (1) onto the mounting studs (2).
5. Install the two mounting nuts and the two mounting bolts all finger tight.

**CAUTION: Lower nuts must be installed and tightened first then the upper nuts in order to prevent damage to the capsules.**

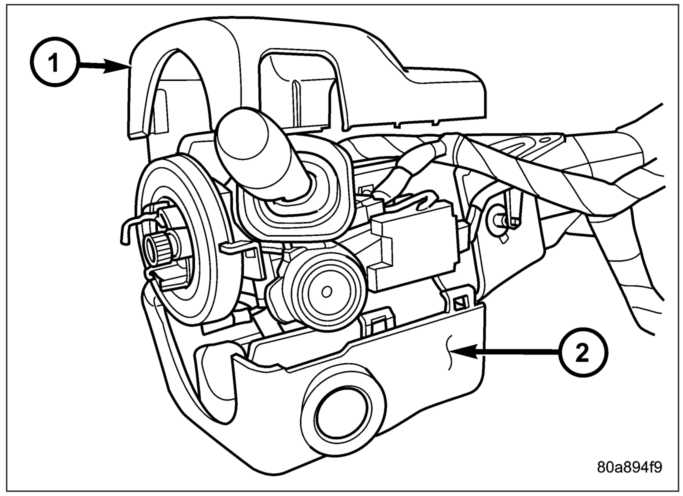
6. Tighten the lower mounting nuts to 17 N·m (150 in. lbs.).
7. Tighten the upper mounting nuts to 17 N·m (150 in. lbs.).



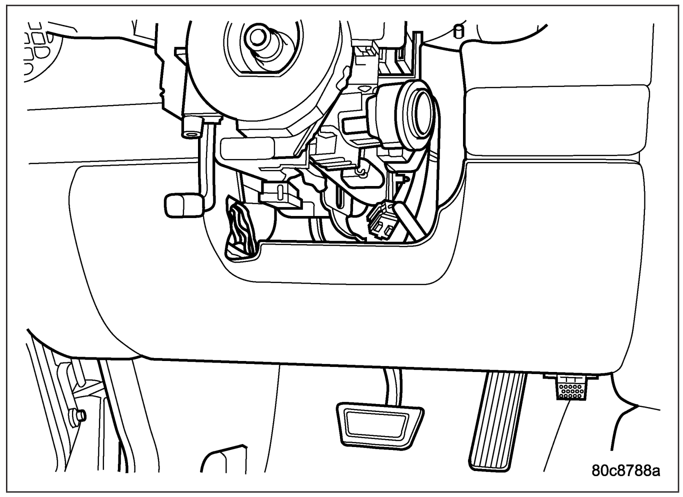

8. Install the steering column coupler bolt and tighten to 49 N·m (36 ft. lbs.).
9. Reconnect the shifter interlock cable.
10. Center the clock spring (3) (if necessary) and install it on the column (4) , (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).



11. Snap together the column shrouds (1&2) and install the mounting screws.




12. Install the knee blocker and the knee blocker cover , (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - INSTALLATION).




**NOTE: Do not reuse the old steering wheel bolt (a new bolt must be used)**

**NOTE: Be certain that the steering wheel mounting bolt is tightened to the proper torque specification to ensure proper clockspring operation.**

13. Install the steering wheel and tighten bolt to 54 N·m (40 ft. lbs.) (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - INSTALLATION).

**NOTE: If equipped with cruise control, connect clock spring harness to cruise switch harness on the steering wheel.**

14. Install the airbag, (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).
15. Install the negative battery terminal.

## SPECIFICATIONS

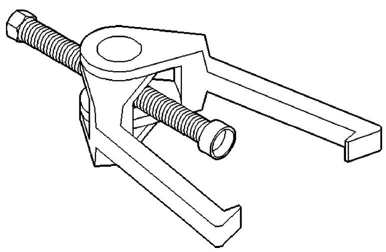
## TORQUE CHART

### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Tilt Steering Column Steering Wheel Bolt | 54 | 40 | — |
| Tilt Steering Column Mounting Bolts | 17 | — | 150 |
| Tilt Steering Column Coupler Bolt | 49 | 36 | — |
| Non-Tilt Steering Column Steering Wheel Bolt | 54 | 40 | — |
| Non-Tilt Steering Column Mounting Bolts | 17 | — | 150 |
| Non-Tilt Steering Column Coupler Bolt | 49 | 36 | — |
| Intermediate Shaft Lower Support Bearing Nuts | 14 | — | 125 |
| Ignition Switch Screws | 2 | — | 17 |

## SPECIAL TOOLS

## STEERING COLUMN



*Puller C-3894-A*

# IGNITION SWITCH

## DESCRIPTION

The electrical ignition switch is located on the steering column. It is used as the main on/off switching device for most electrical components. The mechanical key cylinder is used to engage/disengage the electrical ignition switch.

## DIAGNOSIS AND TESTING - IGNITION SWITCH

### ELECTRICAL DIAGNOSIS

For ignition switch electrical schematics, Refer to the appropriate section for the component.

### MECHANICAL DIAGNOSIS (KEY DIFFICULT TO ROTATE)

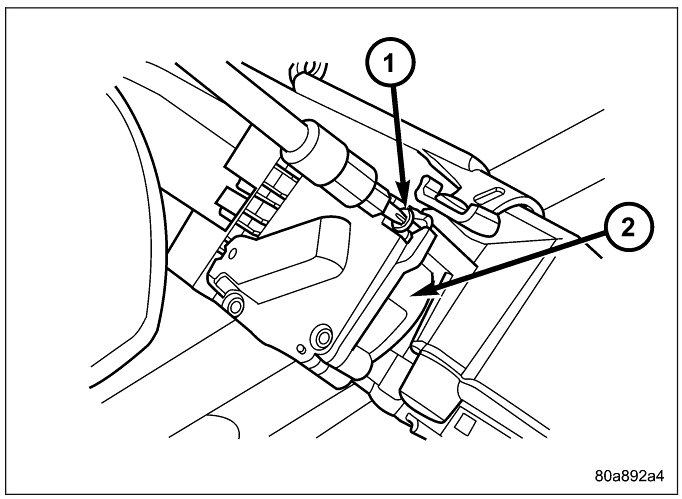
**Vehicles equipped with an automatic transmission and a floor mounted shifter:** a cable is used to connect the interlock device in the steering column assembly, to the transmission floor shift lever. This interlock system is used to lock the transmission shifter in the PARK position when the key cylinder is rotated to any position. If the ignition key is difficult to rotate to or from any position, it may not be the fault of the key cylinder or the steering column components. The brake transmission shift interlock cable may be out of adjustment. (Refer to 21 - TRANSMISSION/ TRANSAXLE/AUTOMATIC - 30RH/GEAR SHIFT CABLE - ADJUSTMENTS). The interlock system within the steering column is not serviceable. If repair is necessary, the steering column assembly must be replaced. (Refer to 19 - STEERING/COLUMN - REMOVAL).

**Vehicles equipped with a manual transmission and a floor mounted shifter:** on certain models, a button is located on the steering column behind the ignition key cylinder. The button must be manually depressed to allow rotation of the ignition key cylinder to any position. If it is difficult to rotate the key to any position, the lever mechanism may be defective. This mechanism is not serviceable. If repair is necessary, the steering column assembly must be replaced. (Refer to 19 - STEERING/COLUMN - REMOVAL).

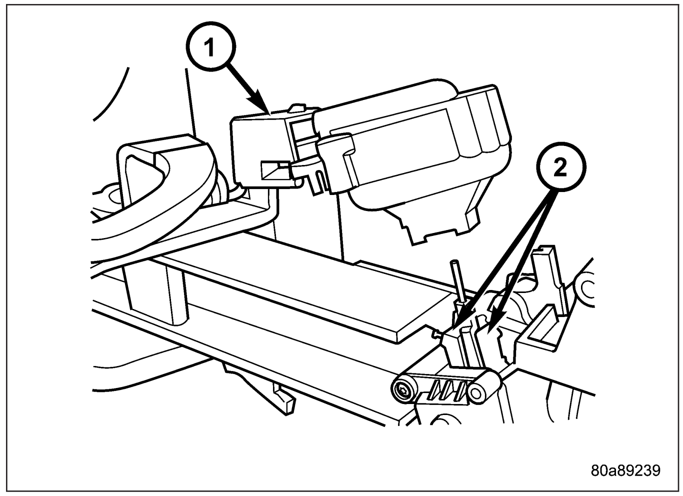
## REMOVAL

The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before removing ignition switch.

1. Remove lower steering column cover screws and remove cover.
2. Remove lock cylinder. (Refer to 19 - STEERING/ COLUMN/KEY/LOCK CYLINDER - REMOVAL).
3. Remove the multi-function switch.
4. Disconnect the electrical connector at the rear of the ignition switch.
5. Remove the ignition switch mounting screw (1). Use tamper proof torx bit to remove the screw (1).

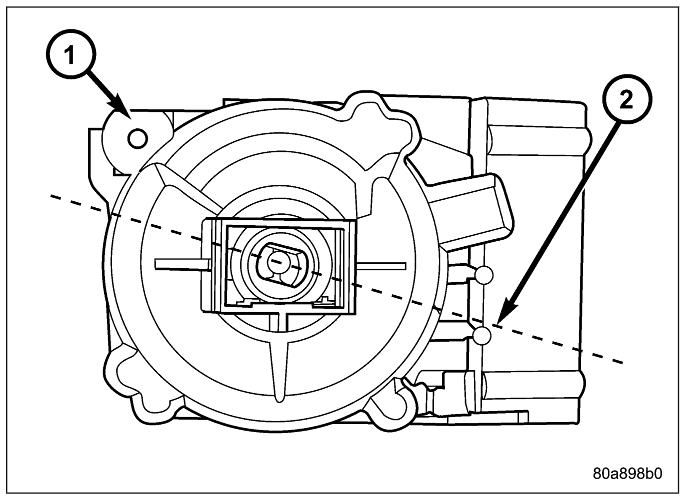


6. Pull the ignition switch (1) straight out to remove from the locking tabs (2).




## INSTALLATION

The ignition key must be in the key cylinder for cylinder installation. The key cylinder must be aligned with the ignition switch for installation.




1. Before installing ignition switch (1), rotate the slot in the switch to the ON position (2).
2. Connect the electrical connector to rear of ignition switch (1). Make sure that locking tab is fully seated into wiring connector.
3. Position the switch to the column and install tamper proof screw. Tighten screw to 2 N·m (17 in. lbs.).
4. Install the lock cylinder (Refer to 19 - STEERING/COLUMN/KEY/LOCK CYLINDER - INSTALLATION).
5. Test the operation of the lock cylinder for smooth rotating.
6. Install the multi-function switch.
7. Install steering column lower cover.

# KEY-IN IGNITION SWITCH

## DESCRIPTION

The key-in ignition switch is integral to the ignition switch, which is mounted on the left side of the steering column, opposite the ignition cylinder. It closes a path to ground for the instrument cluster chime warning circuitry when the ignition key is inserted in the ignition lock cylinder and the driver door jamb switch is closed (driver door is open). The key-in ignition switch opens the ground path when the key is removed from the ignition cylinder.

The key-in ignition switch cannot be repaired and, if faulty or damaged, the entire ignition switch must be replaced. (Refer to 19 - STEERING/COLUMN/IGNITION SWITCH - REMOVAL).

## DIAGNOSIS AND TESTING - KEY-IN IGNITION SWITCH

For circuit descriptions and diagrams, Refer to the appropriate sections on the individual components.

**WARNING: On vehicles equipped with airbags, refer to electrical - passive restraint systems before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury.**

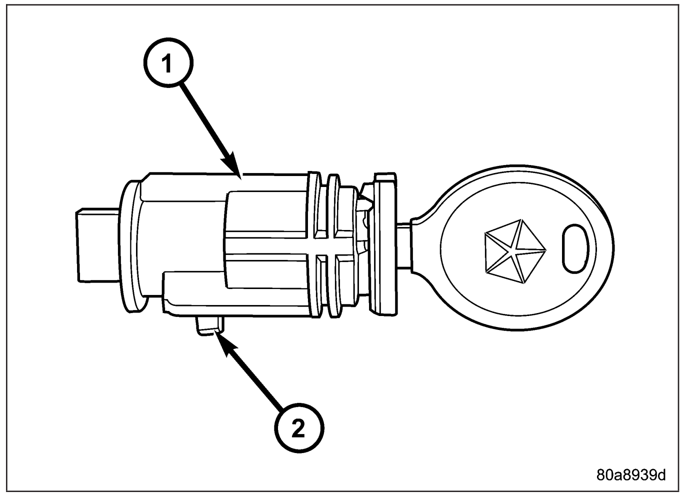
1. Disconnect and isolate the battery negative cable. Remove the steering column shrouds. Unplug the key-in ignition switch wire harness connector from the ignition switch.
2. Check for continuity between the key-in switch sense circuit and the left front door jamb switch sense circuit terminals of the key-in ignition switch. There should be continuity with the key in the ignition cylinder, and no continuity with the key removed from the ignition cylinder. If OK, go to Step 3. If not OK, replace the faulty ignition switch assembly.
3. Check for continuity between the left front door jamb switch sense circuit cavity of the key-in ignition switch wire harness connector and a good ground. There should be continuity with the driver door open, and no continuity with the driver door closed. If OK, see the diagnosis for Instrument Cluster in this group. If not OK, repair the circuit to the driver door jamb switch as required.

# KEY CYLINDER

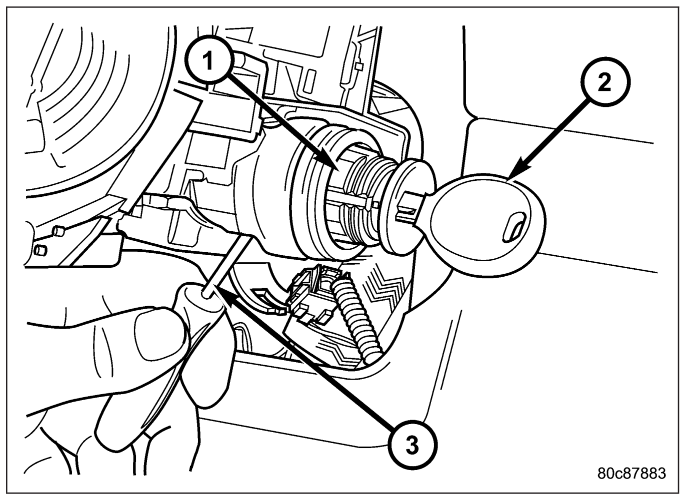
## REMOVAL

The ignition key must be in the key cylinder (1) for cylinder removal. The key cylinder must be removed first before removing ignition switch.

1. If equipped with an automatic transmission, place shifter in PARK position.
2. Remove the lower shroud cover.
3. Remove the remote keyless entry (R.K.E.) module.
4. Remove the halo ring around the cylinder.
5. Rotate key to ON position.
6. A release tang (2) is located on bottom of key cylinder (1).



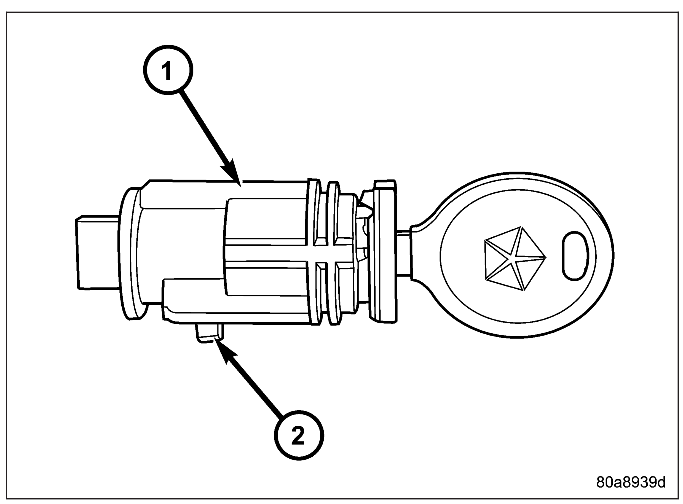

7. Position a small screwdriver or pin punch (3) into tang access hole on bottom of steering column.
8. Push the pin punch (3) up while pulling key cylinder (1) from steering column.




## INSTALLATION

The ignition key must be in the key cylinder (1) for cylinder installation.

1. Install the key cylinder (1) into the housing using care to align the end of the key cylinder with the ignition switch.
2. Push the key cylinder (1) in until it clicks .
3. Rotate the key to the insert position.
4. install the halo ring around the key cylinder housing.
5. Install the R.K.E. module.
6. Install the lower shroud cover.



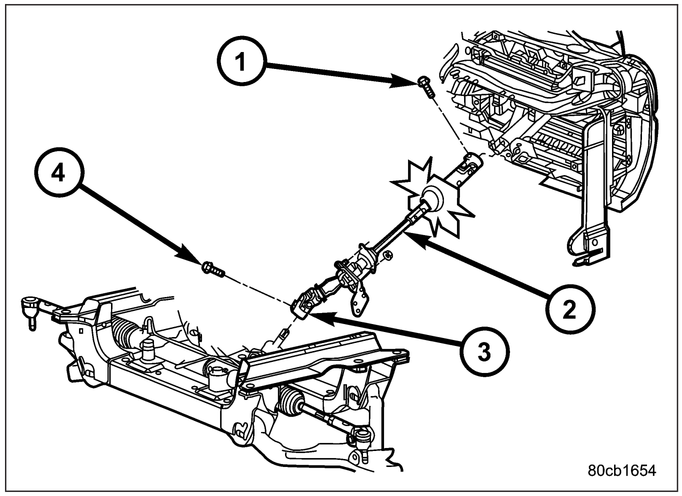
# INTERMEDIATE SHAFT

## REMOVAL

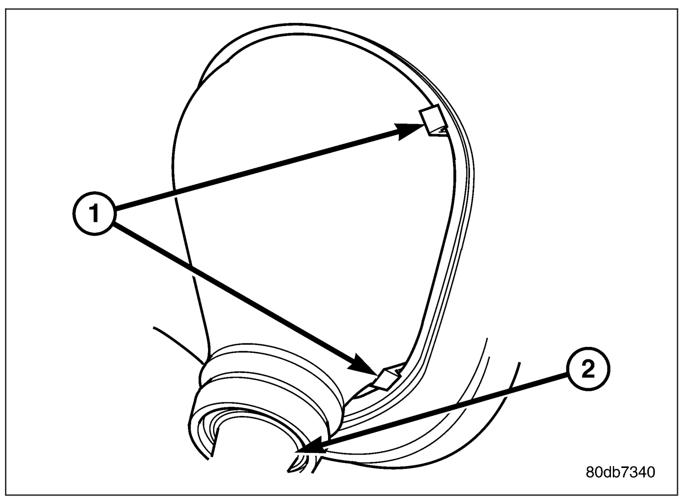
1. Disconnect the negative battery cable.
2. Remove knee blocker cover and knee blocker, (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - REMOVAL).

**NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.**

3. Lock the steering wheel with the tires in the straight ahead position.
4. Remove the lower column pinch bolt (4).
5. Lower the steering coupler (3) shaft from the column.



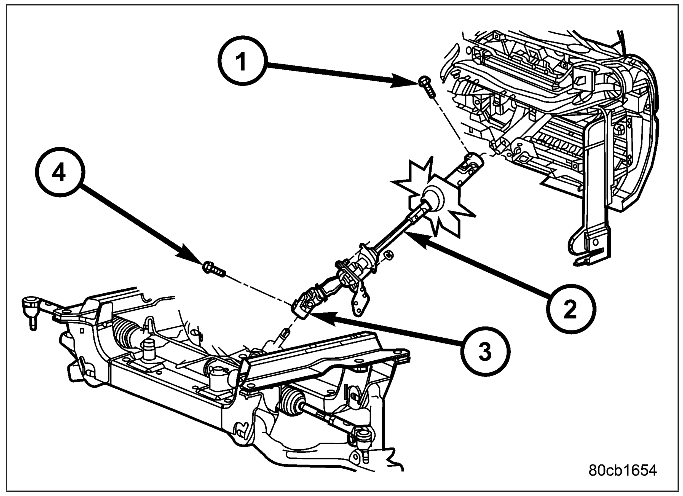

6. Remove the intermediate shaft seal by pushing in the four tangs (1) securing it to the panel.
7. Remove the center support bearing bracket from the mount on the shock tower.



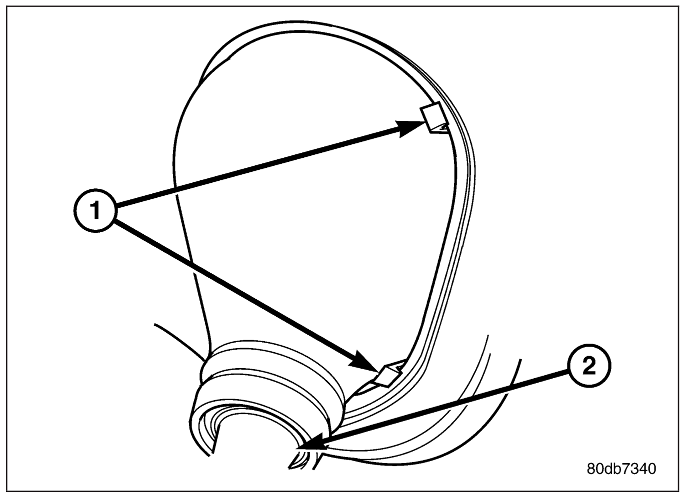

8. Remove the lower coupler pinch bolt (4) at the steering gear.
9. Remove the coupler (3) at the steering gear.
10. Remove the intermediate shaft (2) from the vehicle.
11. Remove the center support bracket from the steering shaft (if replacing the intermediate shaft).

## INSTALLATION

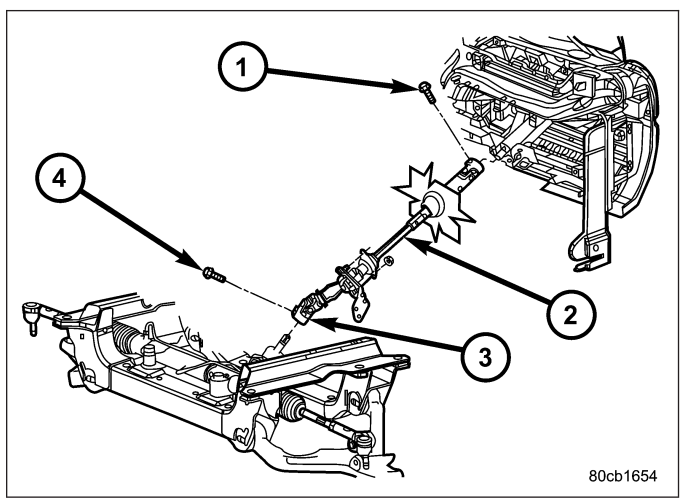
1. Install the center support bearing bracket to the steering shaft (if removed). Tighten to 14 N·m (125 in.lbs.).
2. Install the intermediate shaft (2) to the vehicle.
3. Install the coupler (3) at the steering gear.
4. Install the lower coupler pinch bolt (4) at the steering gear and tighten the bolt to 49 N·m (36 ft. lbs.).




5. Install the center support bearing bracket to the mounting holes on the shock tower.
6. Install the intermediate shaft seal by pushing it in securing the four tangs (1) to the panel.




7. Install the steering coupler shaft to the column.
8. Install the upper pinch bolt (1) and tighten the bolt to 49 N·m (36 ft. lbs.).
9. Unlock the steering wheel.
10. Install the knee blocker cover and knee blocker (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - INSTALLATION).
11. Reconnect the negative battery cable.



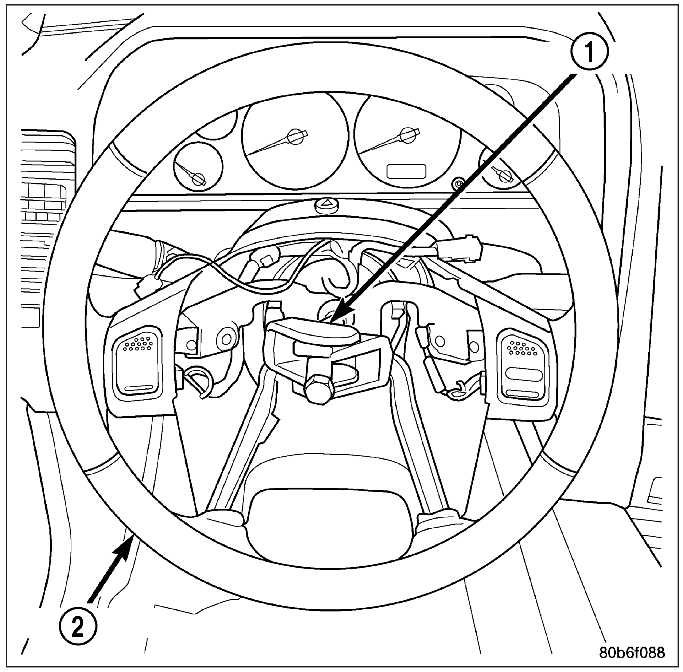
# STEERING WHEEL

## REMOVAL

1. Disable and remove the drivers side airbag. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).
2. Partially remove the steering wheel bolt and leave the bolt in the column.
3. Install puller C-3894–A or equivalent using the top of the bolt to push on.

**NOTE: Ensure the puller jaws are seated in the pockets of the steering wheel armature.**

4. Remove the steering wheel.



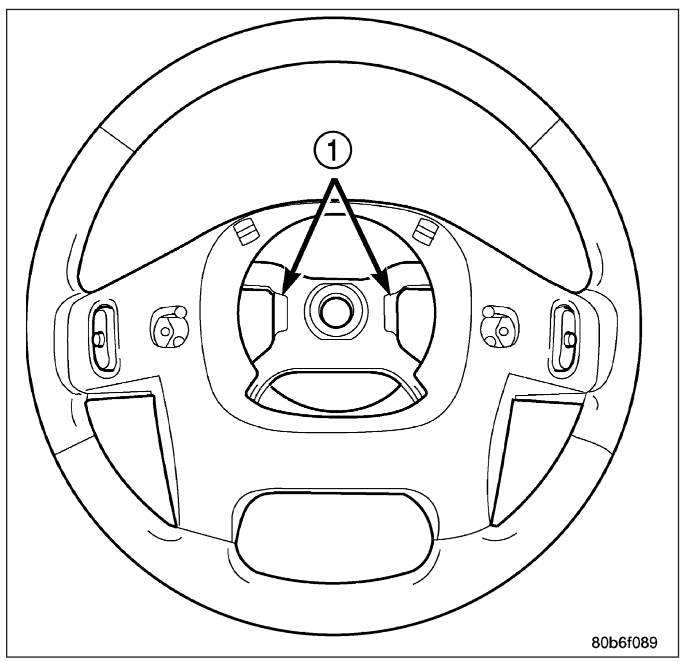

## INSTALLATION

**NOTE: Do not reuse the old steering wheel bolt (a new bolt must be used)**

1. Install steering wheel to the column

**NOTE: Be certain that the steering wheel mounting bolt is tightened to the proper torque specification to ensure proper clockspring operation.**

2. Install the new steering wheel bolt. Tighten the bolt to 54 N·m (40 ft. lbs.).
3. Install the drivers side air bag. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).



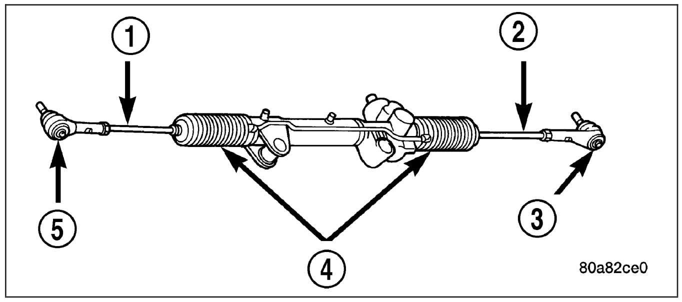
# GEAR

## TABLE OF CONTENTS

# GEAR

## DESCRIPTION

A rack and pinion steering gear is made up of two main components, the pinon shaft and the rack. The gear cannot be adjusted or internally serviced. If a malfunction or a fluid leak occurs, the gear must be replaced as an assembly, With the exception of the outer tie rods (3&5) which are serviced separately.




## OPERATION

The steering column intermediate shaft is attached to the gear pinion. The rotation of the pinion moves the gear rack from side-to-side. This lateral action of the rack pushes and pulls the tie rods, which are connected to the steering knuckles to change the direction of the front wheels.

## REMOVAL

### 4WD

1. Siphon the power steering fluid from the power steering reservoir.

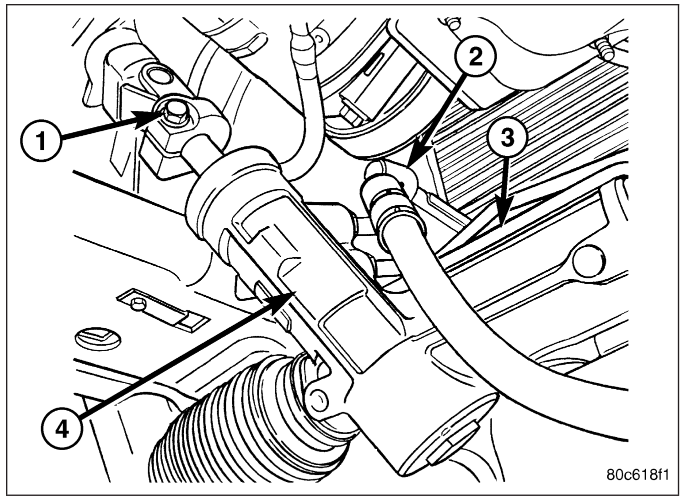
**NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.**

2. Lock the steering wheel to prevent spinning of the clockspring.
3. Raise and support the vehicle.
4. Remove the skid plate from under the front end to gain access to the gear (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - REMOVAL).
5. Remove the front tire and wheel assemblies.

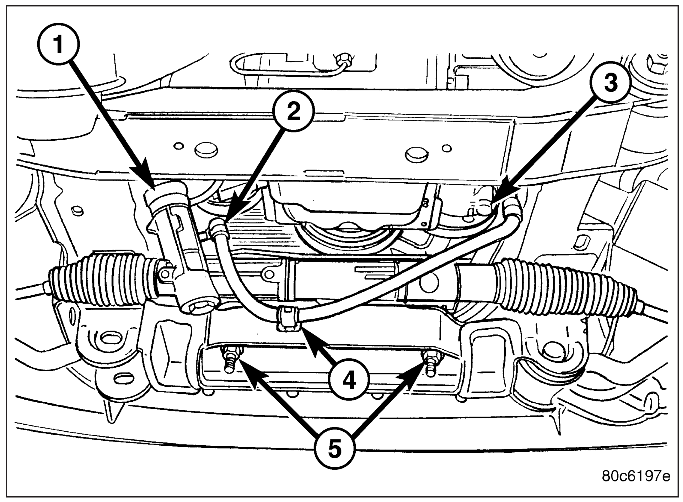
**NOTE: Mark the alignment adjusting cams for easier installation.**

6. Remove the lower control arms. (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - REMOVAL).
7. Remove the front axle. (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - REMOVAL).
8. Remove the tie rod end nuts.
9. Separate tie rod ends from the knuckles with Puller C-3894-A.

10. Remove the intermediate shaft lower coupler pinch bolt (1) and slide the coupler off the gear.
11. Remove the power steering lines (2) from the gear (4).




12. Remove the mounting bolts (5) from the gear to the front cradle.
13. Remove the steering gear (1) from the vehicle.




## 2WD

1. Siphon the power steering fluid from the power steering reservoir.

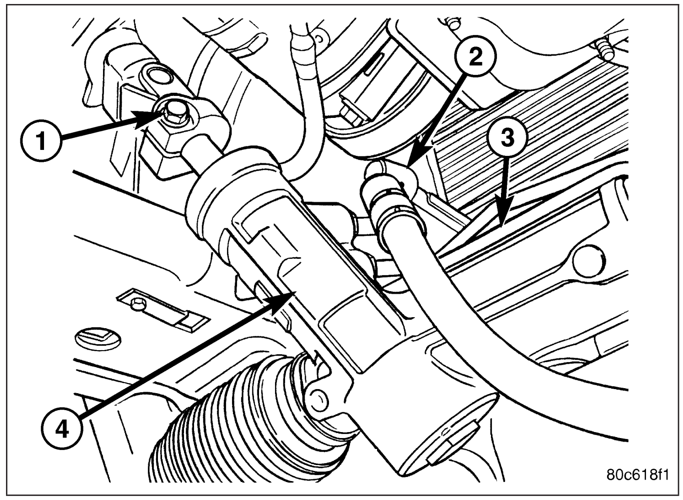
**NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.**

2. Lock the steering wheel to prevent spinning of the clockspring.
3. Raise and support the vehicle.
4. Remove the skid plate from under the front end to gain access to the gear (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - REMOVAL).
5. Remove the tire and wheel assembly.

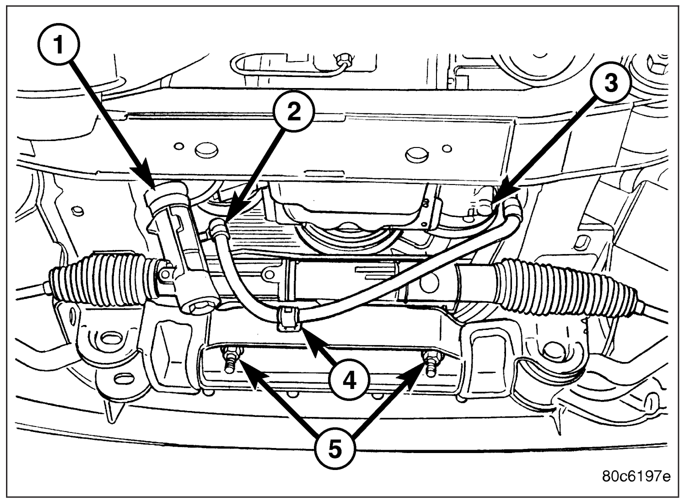
**NOTE: Mark the alignment adjusting cams and tie rod end jam nuts on the steering gear for easier installation.**

6. Remove the tie rod end nuts.
7. Separate tie rod ends from the knuckles with Puller C-3894-A.

8. Remove the lower intermediate shaft coupler pinch bolt (1) and slide the coupler off the gear (4).




9. Remove the power steering lines (2) from the gear (1).
10. Remove the mounting bolts (5) from the gear (1) to the front cradle.
11. Remove the steering gear (1) from the vehicle.




## DIESEL

1. Siphon the power steering fluid from the power steering reservoir.

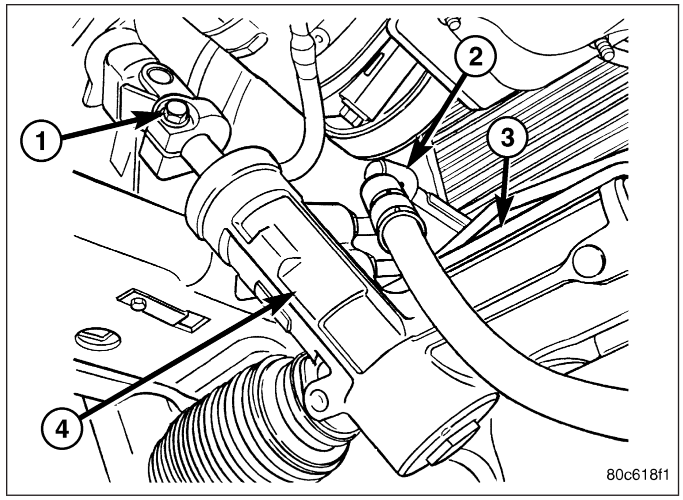
**NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.**

2. Lock the steering wheel to prevent spinning of the clockspring.
3. Raise and support the vehicle.
4. Remove the skid plate from under the front end to gain access to the gear (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - REMOVAL)
5. Remove the tire and wheel assembly.

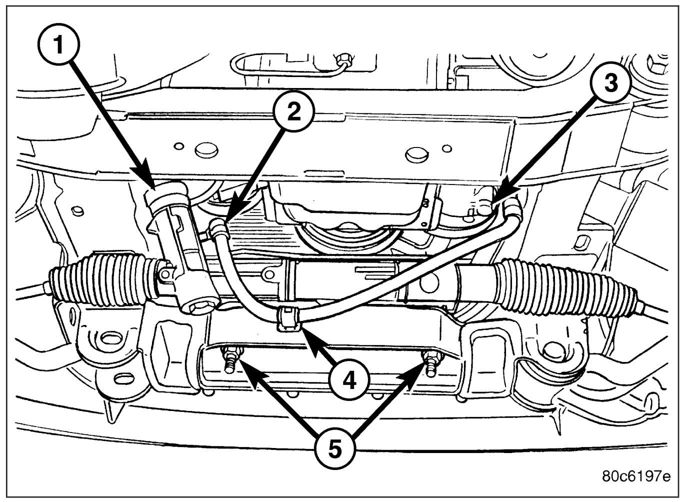
**NOTE: Mark the alignment adjusting cams for easier installation.**

6. Remove the lower control arms. (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - REMOVAL).
7. Remove the front axle. (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - REMOVAL).
8. Remove the tie rod end nuts.
9. Separate tie rod ends from the knuckles with Puller C-3894-A.

10. Remove the lower coupler pinch bolt (1) and slide the coupler off the gear (4).




11. Remove the power steering lines (2) from the gear (1).
12. Remove the mounting bolts (5) from the gear to the front cradle.
13. Remove the steering gear from the vehicle.




## RHD - 4X2 & 4X4

1. Siphon the power steering fluid from the power steering reservoir.

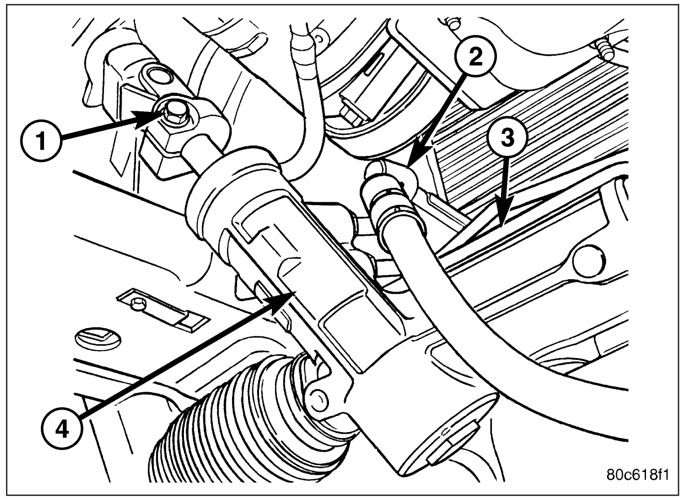
**NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.**

2. Lock the steering wheel to prevent spinning of the clockspring.
3. Raise and support the vehicle.
4. Remove the skid plate from under the front end to gain access to the gear (Refer to 13 - FRAME & BUMPERS/ FRAME/FRONT SKID PLATE - REMOVAL).
5. Remove the tire and wheel assembly.

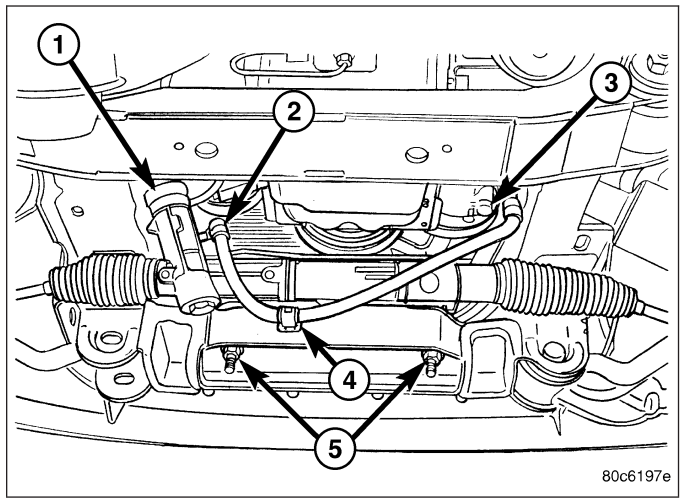
**NOTE: Mark the alignment adjusting cams and tie rod end jam nuts on the steering gear for easier installation.**

6. Remove the tie rod end nuts.
7. Separate tie rod ends from the knuckles with Puller C-3894-A.

8. Remove the lower intermediate shaft coupler pinch bolt (1) and slide the coupler off the gear (4).



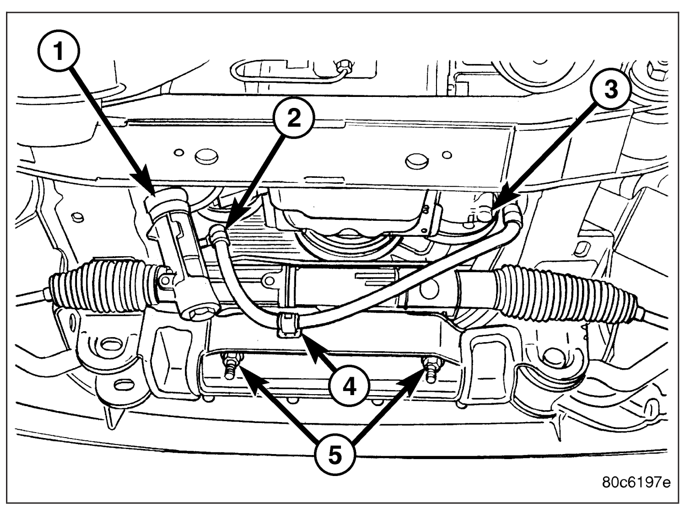

9. Remove the power steering lines (2) from the gear (1).
10. Remove the mounting bolts (5) from the gear (1) to the front cradle.
11. Remove the steering gear (1) from the vehicle.



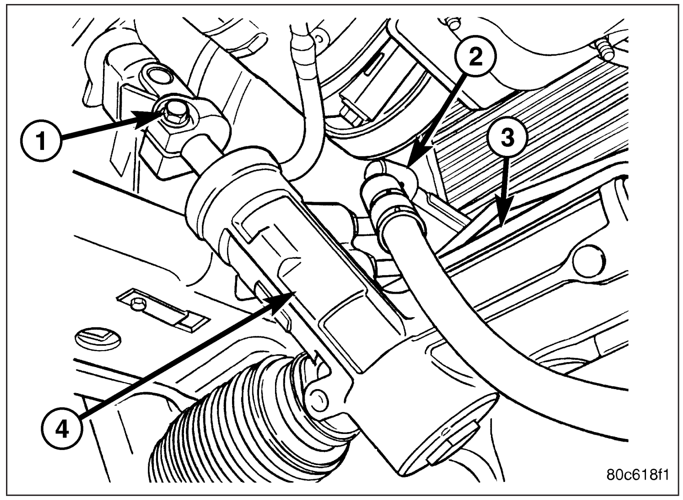

## INSTALLATION

## 4WD

1. Transfer the tie rod ends to the new steering gear (if needed).
2. Install the steering gear (1) to the vehicle.
3. Install the gear mounting bolts (5) to the front cradle. Tighten the gear mounting bolts to 162 N·m (120 ft.lbs.)
4. Install the power steering lines (2) to the gear, tighten the tube nuts to 37 N·m (20 ft.lbs.).



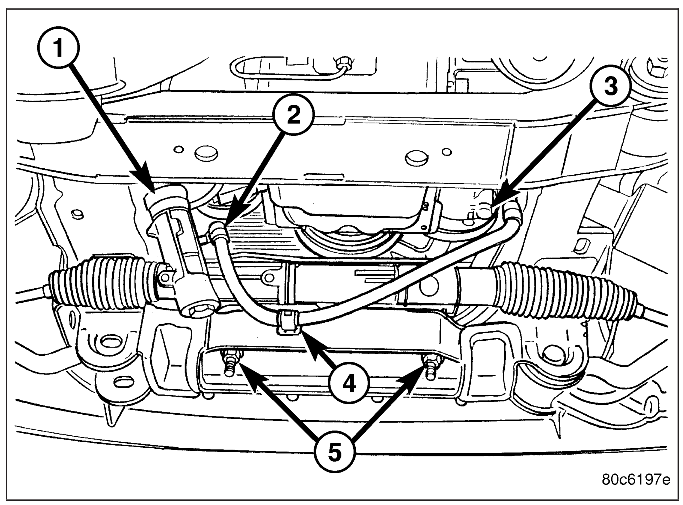
5. Install the lower coupler bolt (1) and slide the coupler on to the gear (4).



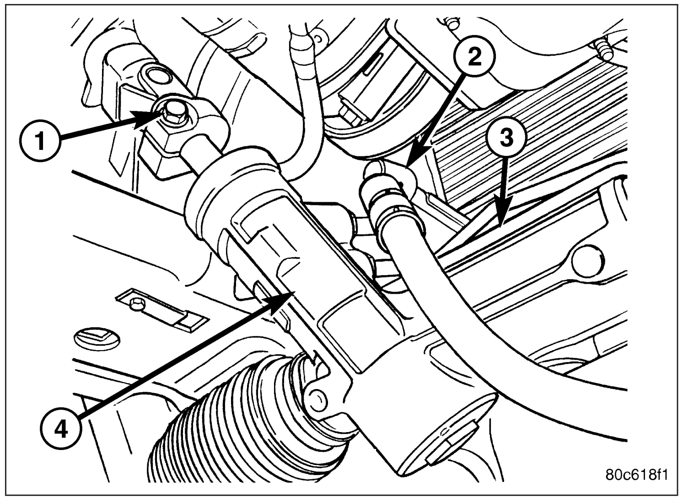

6. Install the tie rod end to the knuckle and tighten the nuts.
7. Install the front axle. (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - INSTALLATION).
8. Install the lower control arms. (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - INSTALLATION).
9. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
10. Install the skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - INSTALLATION).
11. Lower the vehicle.
12. Unlock the steering wheel.
13. Fill the power steering fluid (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).
14. Reset the toe and center the steering wheel (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

## 2WD

1. Transfer the outer tie rod ends to the new steering gear (if needed).
2. Install the steering gear to the vehicle.
3. Install the gear mounting bolts (5) to the front cradle. Tighten the gear mounting bolts to 162 N·m (120 ft.lbs.)
4. Install the power steering lines (2) to the gear (1) tighten the tube nuts to 37 N·m (20 ft.lbs.).



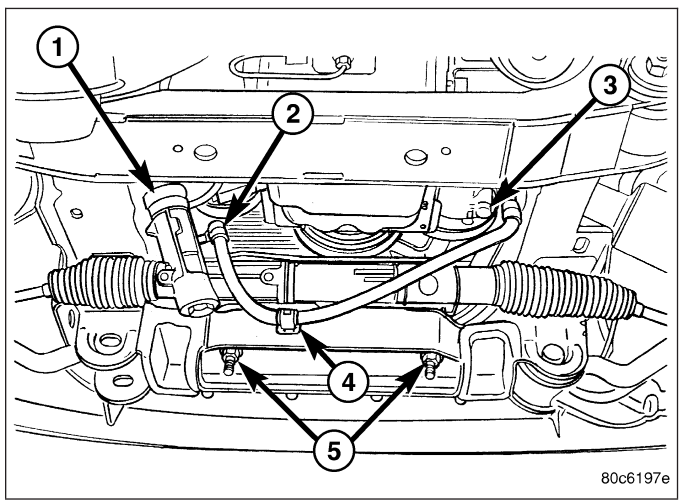
5. Install the lower coupler pinch bolt (1) and slide the coupler on to the gear (4).



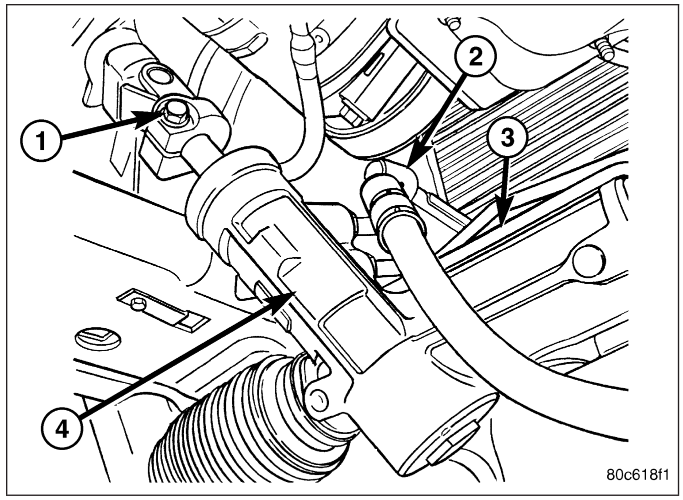

6. Install the tie rod end to the knuckle and tighten the nuts.
7. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
8. Install the skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - INSTALLATION).
9. Lower the vehicle.
10. Unlock the steering wheel.
11. Fill the power steering fluid (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).
12. Reset the toe and center the steering wheel (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

## DIESEL

1. Transfer the tie rod ends to the new steering gear (if needed).
2. Install the steering gear (1) to the vehicle.
3. Install the gear mounting bolts (5) to the front cradle . Tighten the gear mounting bolts to 162 N·m (120 ft.lbs.)
4. Install the power steering lines (2) to the gear (1), tighten the tube nuts to 37 N·m (20 ft.lbs.).



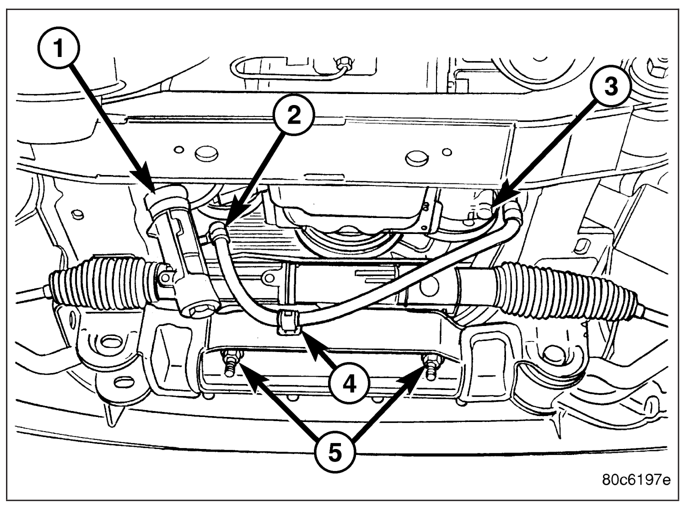
5. Install the lower coupler pinch bolt (1) and slide the coupler on to the gear (4).



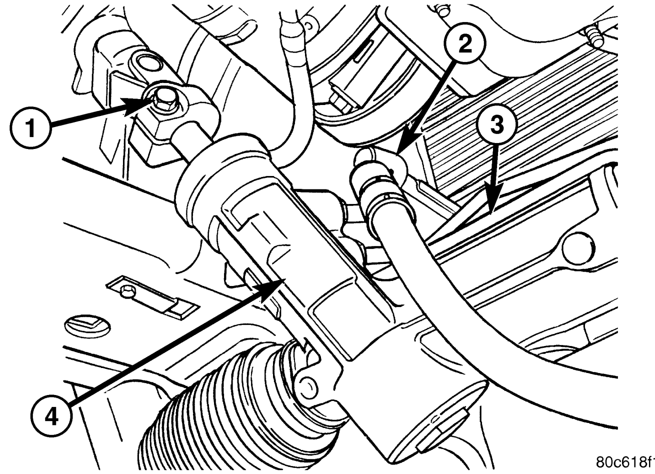

6. Install the tie rod end to the knuckle and tighten the nuts.
7. Install the front axle. (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - INSTALLATION).
8. Install the lower control arms. (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - INSTALLATION).
9. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
10. Install the skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - INSTALLATION).
11. Lower the vehicle.
12. Unlock the steering wheel.
13. Fill the power steering fluid (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).
14. Align the front end.

## RHD - 4X2 & 4X4

1. Transfer the outer tie rod ends to the new steering gear (if needed).
2. Install the steering gear (1) to the vehicle.
3. Install the gear mounting bolts (5) to the front cradle.. Tighten the gear mounting bolts to 162 N·m (120 ft.lbs.)
4. Install the power steering lines (2) to the gear (1), tighten the tube nuts to 37 N·m (20 ft.lbs.).



5. Install the lower coupler pinch bolt (1) and slide the coupler on to the gear (4).




6. Install the tie rod end to the knuckle and tighten the nuts.
7. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
8. Install the skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - INSTALLATION).
9. Lower the vehicle.
10. Unlock the steering wheel.
11. Fill the power steering fluid (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).
12. Reset the toe and center the steering wheel (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

## SPECIFICATIONS

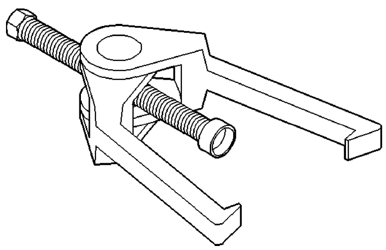
## TORQUE CHART

### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Rack and Pinion Steering Gear Gear to Frame Bolts | 162 | 120 | — |
| Rack and Pinion Steering Gear Intermediate Shaft Bolt | 49 | 36 | — |
| Tie Rod End Knuckle Nut | 108 | 80 | — |
| Tie Rod End Jam Nut | 75 | 55 | — |
| Power Steering Line Pressure Line | 27 | 20 | — |
| Power Steering Line Return Line | 27 | 20 | — |

## SPECIAL TOOLS

## OUTER TIE ROD END REMOVAL TOOL



**_Puller C-3894-A_**

# LINKAGE

## TABLE OF CONTENTS

# TIE ROD END

## STANDARD PROCEDURE - STEERING LINKAGE

The tie rod end and ball stud seals should be inspected during all oil changes. If a seal is damaged, replace the tie rod.

**CAUTION: If any steering components are replaced or serviced an alignment must be performed, to ensure the vehicle meets all alignment specifications.**

## REMOVAL

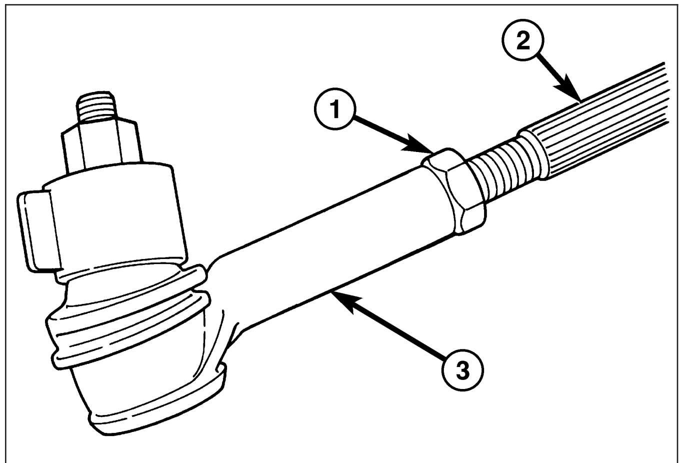
1. Raise and support the vehicle.
2. Remove the tire and wheel assembly.

**NOTE: Mark the tie rod end jam nuts on the steering gear for easier installation.**

3. Loosen the tie rod end jam nut (1).
4. Remove the outer tie rod end (3) nut.
5. Separate the outer tie rod end (3) from the knuckle using tool C3894A.

**NOTE: Count the number of turns when removing.**

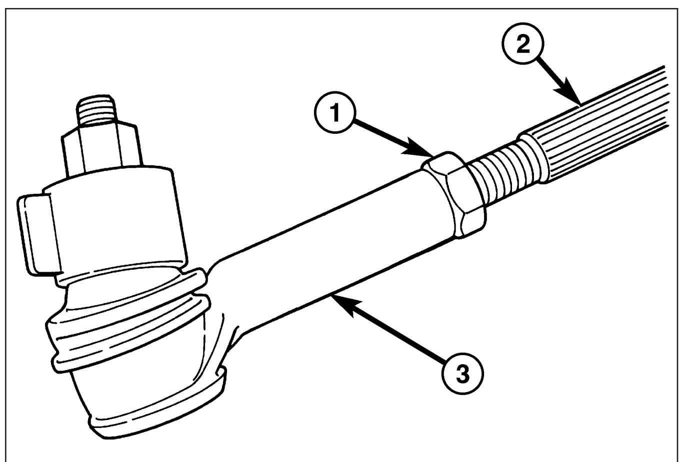
6. Remove the outer tie rod end (3) from the inner tie rod (2).



80cdf759

## INSTALLATION

1. Install the outer tie rod end (3) to the inner tie rod end (2) to the exact number of turns that it was removed.
2. Install the outer tie rod end (3) to the knuckle. Tighten the nut to 108 N·m (80 ft.lbs).
3. Tighten the jam nut to 75 N·m (55 ft.lbs).
4. Install the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
5. Reset the toe and center the steering wheel (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).



80cdf759

# PUMP

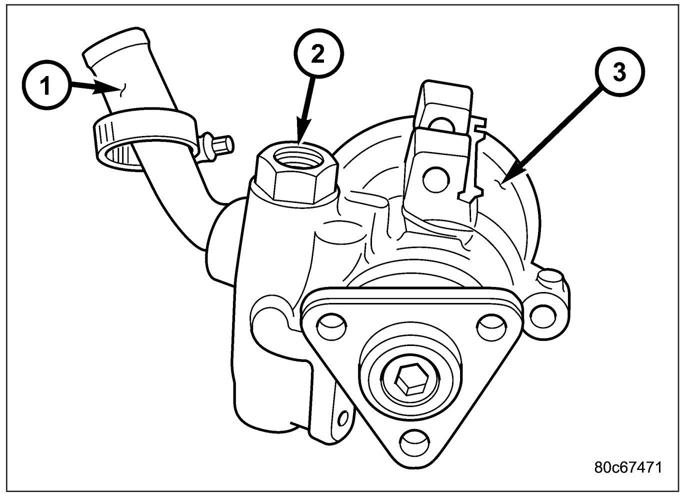
## TABLE OF CONTENTS

# PUMP

## DESCRIPTION

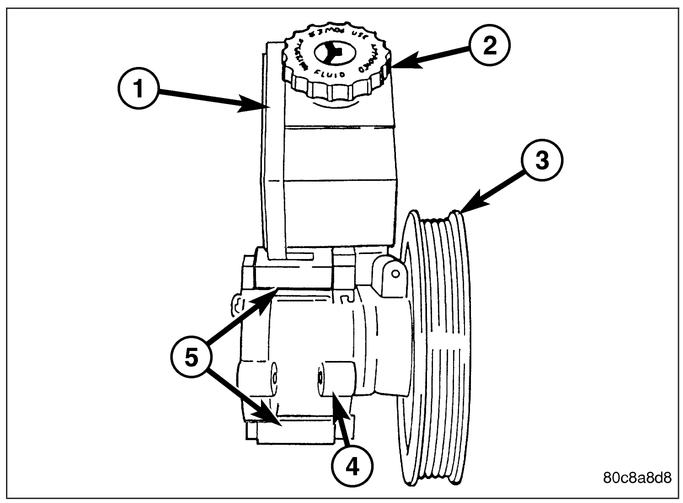
### DIESEL POWER STEERING PUMP

Hydraulic pressure for the power steering system is provided by a belt driven power steering pump (3). The pump shaft has a bolt-on drive pulley that is belt driven by the crankshaft pulley. The reservoir is seperate from the pump body (3). The power steering pump is connected to the steering gear by the pressure and return hoses.




### 3.7L POWER STEERING PUMP

Hydraulic pressure for the power steering system is provided by a belt driven power steering pump (4). The pump shaft has a pressed-on high strength plastic drive pulley (3) that is belt driven by the crankshaft pulley. The integral reservoir (1) used on the 3.7L is attached to the pump body (4) with spring clips (5).




## OPERATION

The power steering pump is a constant flow rate and displacement, vane-type pump. The pump internal parts operate submerged in fluid. The flow control orifice is part of the high pressure line fitting. The pressure relief valve inside the flow control valve limits the pump pressure.

**NOTE: Power steering pumps have different pressure rates and are not interchangeable with other pumps.**

## STANDARD PROCEDURE

### POWER STEERING PUMP - INITIAL OPERATION - GAS ENGINE

**WARNING: The fluid level should be checked with engine off to prevent injury from moving components.**

**CAUTION: MOPAR® ATF+4 is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.**

**NOTE: Power steering reservoir cap contains a dipstick. The reservoir has a molded in level indicator and a window to observe fluid level.**

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **COLD** when the fluid is at normal ambient temperature.

1. Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two minutes.
2. Raise the front wheels off the ground.
3. Slowly turn the steering wheel right and left, lightly contacting the wheel stops at least 20 times.
4. Check the fluid level add if necessary.
5. Lower the vehicle, start the engine and turn the steering wheel slowly from lock to lock.
6. Stop the engine and check the fluid level and refill as required.

**CAUTION: Do not run a vehicle with foamy fluid for an extended period. This may cause pump damage.**

7. If the fluid is extremely foamy or milky looking, allow the vehicle to stand a few minutes and repeat the procedure.
8. Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

## POWER STEERING PUMP - INITIAL OPERATION - DIESEL ENGINE

**WARNING: The fluid level should be checked with engine off to prevent injury from moving components.**

**CAUTION: MOPAR® ATF+4 is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.**

**NOTE: If the air is not purged from the power steering system correctly, pump failure could result.**

**NOTE: Power steering reservoir cap doe contains a dipstick. The reservoir has a molded in level indicator and a window to observe fluid level.**

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **COLD** when the fluid is at normal ambient temperature.

### PRE AIR EVACUATION PROCEDURE

1. Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two minutes.
2. Remove the fuel rail electrical connector.
3. Crank the engine (DO NOT START) to pressurize the system.
4. Check fluid level.
5. Repeat steps #1 & #3).
6. Reconnect the fuel rail electrical connector.

## AIR EVACUATION AND FILL PROCEDURE

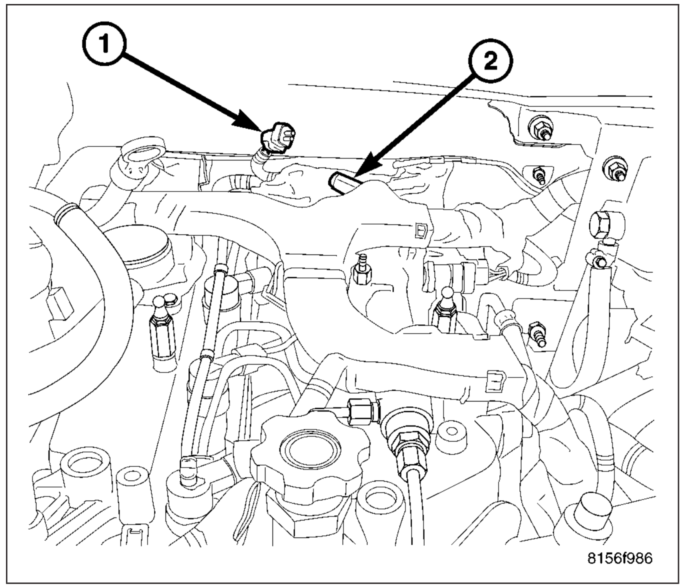
1. Fill the pump fluid reservoir to the proper level at the cold mark.
1. Tightly insert reservoir vacuum plug 9688 onto the pump reservoir.
2. Apply 20–25 in HG (68–85 Kpa) of vacuum for a minimum of 3 minutes with a hand vacuum pump.
3. Remove the vacuum and reservoir vacuum plug 9688 and add fluid to the proper level.
4. Repeat steps #2 thru # 4 until fluid level stabilizes.
5. Raise the vehicle so the front tires are off the ground.
6. With reservoir vacuum plug 9688 installed onto the reservoir apply 20–25 in HG (68–85 Kpa) of vacuum, while cycling the steering wheel from lock to lock every 30 seconds for approximately 5 minutes.

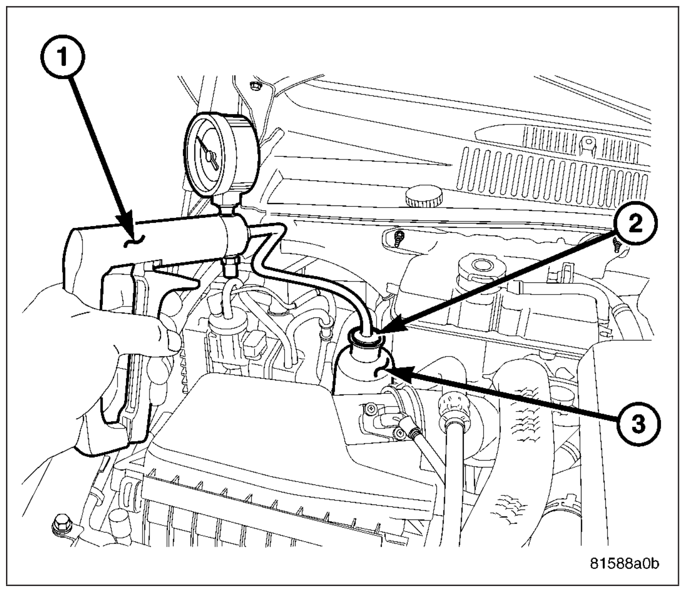
**NOTE: Do not hold the steering wheel on stops.**

7. Remove the vacuum and add fluid if necessary.
8. Start the engine and cycle the steering wheel from lock to lock every 30 seconds for approximately 5 minutes.

**NOTE: Do not hold the steering wheel on stops.**

9. Stop the engine, lower the vehicle to the floor and check for leaks at all connections. Check for any signs of air in the reservoir. If air is present repeat the procedure if necessary.
10. While the engine is off fill and adjust the fluid level to the desire level.

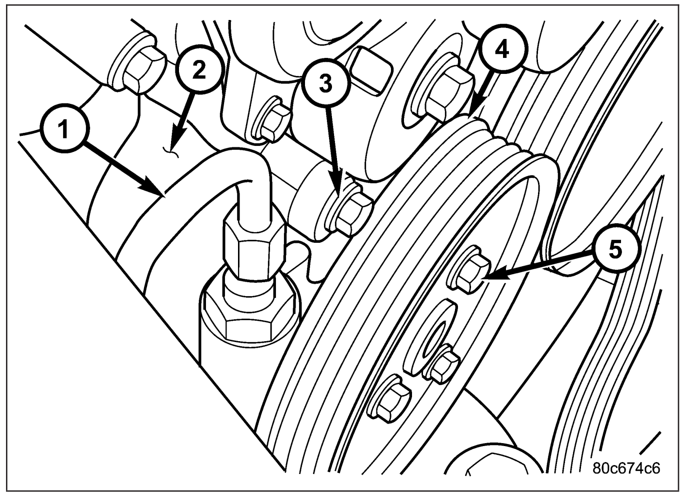


## REMOVAL

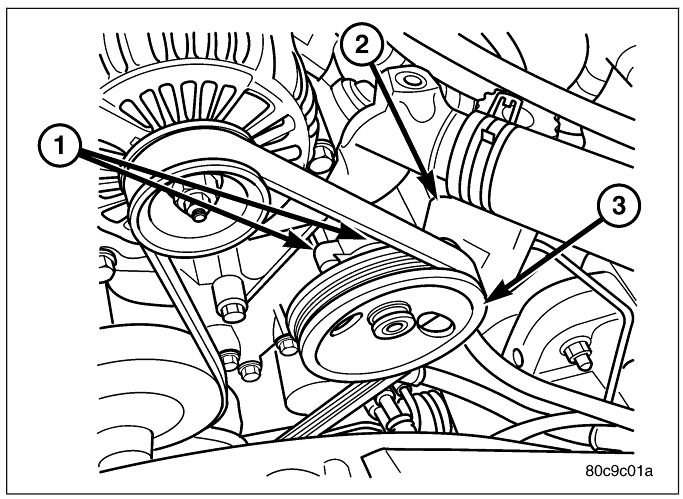
### 2.8L- DIESEL

1. Siphon out as much power steering fluid as possible.
2. Remove the engine cooling fan.
3. Remove the fan shroud
4. Remove the serpentine drive belt.
5. Remove the three bolts (5) securing the pulley (4) to the pump (2).
6. Remove the power steering hoses (1).
7. Remove the three bolts (3) securing the pump (2) to the bracket.
8. Remove the pump from the vehicle.




### 3.7L

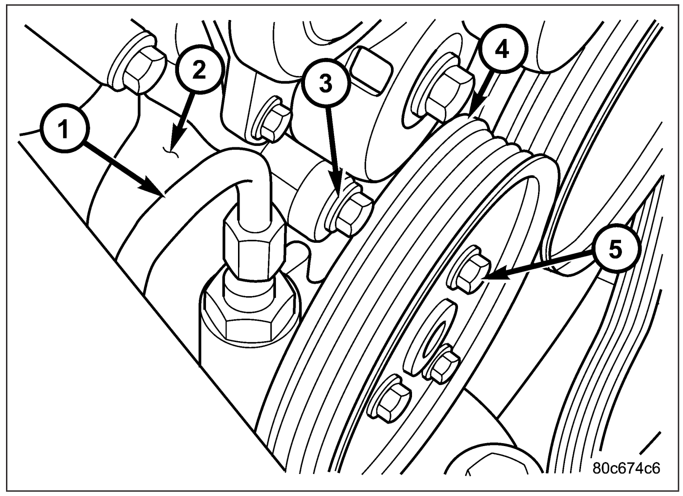
1. Siphon out as much power steering fluid as possible.
2. Remove the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Remove the power steering high pressure hose at the pump.
4. Remove the return hose at the pump.
5. Remove the three bolts (1) securing the pump to the enginet thru the holes in the pulley (3).
6. Remove the pump from the vehicle.



## INSTALLATION

### 2.8L–DIESEL

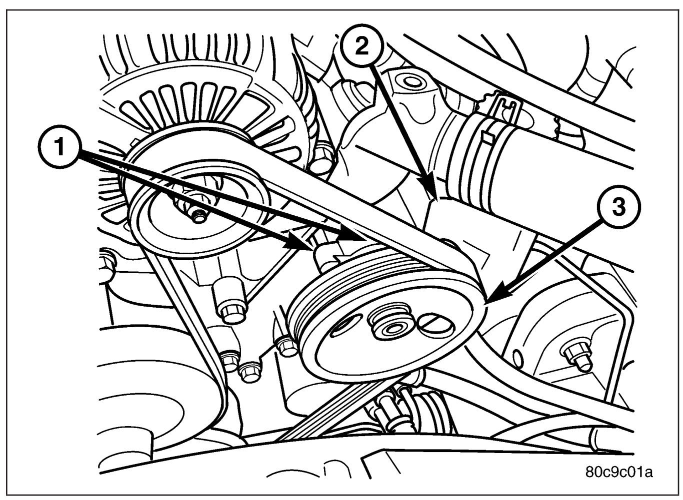
1. Install the pump to the vehicle.
2. Install the three bolts (3) securing the pump (2) to the bracket..
3. Install the power steering hoses (1).
4. Install the three bolts (5) securing the pulley (4) to the pump (2)..




5. Install the serpentine belt.
6. Install the fan shroud
7. Install the engine cooling fan.
8. Refill the power steering fluid and bleed the system (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

### 3.7L

1. Install the pump to the vehicle.
2. Install the three bolts (1) securing the pump to the engine. Tighten the bolts to 47 N·m (35 ft.lbs.).
3. Install the power steering hoses.
4. Install the serpentine belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).




5. Refill the power steering fluid and check for leaks (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

## SPECIFICATIONS

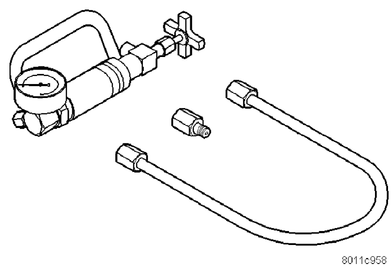
## TORQUE CHART

#### TORQUE SPECIFICATIONS

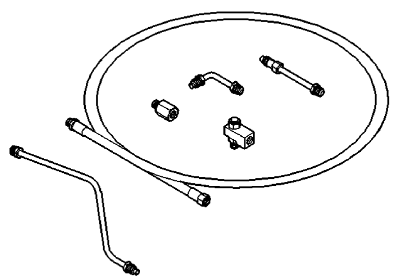
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Power Steering Pump to Engine | 47 | 35 | — |
| Power Steering Pump Bracket to Engine Diesel Engine | 47 | 35 | — |
| Power Steering Reservoir Diesel engine | 12 | 9 | 108 |
| Power Steering Pump Flow Control Valve | 75 | 55 | — |
| Power Steering Pump Pressure Line | 28 | 21 | — |
| Power Steering Pump Pressure Line Bracket | 12 | 9 | 105 |

## SPECIAL TOOLS

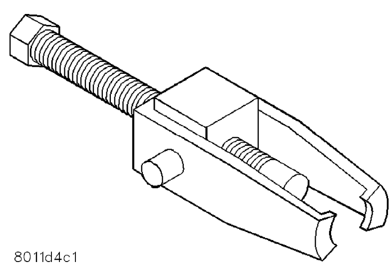
## POWER STEERING PUMP



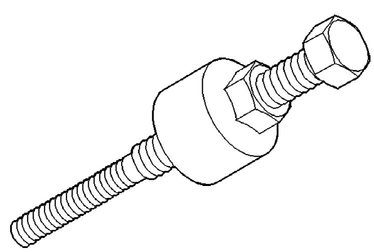

***Analyzer Set, Power Steering Flow/Pressure 6815***



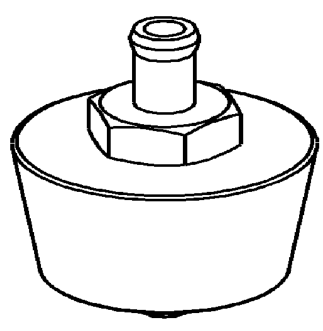
***Adapters, Power Steering Flow/Pressure Tester 6893***




***Puller C-4333***



***Installer, Power Steering Pulley C-4063B***



***RESERVOIR VACUUM PLUG - 9688***

# FLUID

## DESCRIPTION

The recommended fluid for the power steering system is Mopar® ATF +4.

Mopar® ATF+4, when new is red in color. The ATF+4 is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition, As the vehicle is driven, the ATF+4 will begin to look darker in color and may eventually become brown. **THIS IS NORMAL.** ATF+4 also has a unique odor that may change with age. Consequently, odor and color cannot be used to indicate the fluid condition or the need for a fluid change.

## STANDARD PROCEDURE - POWER STEERING FLUID LEVEL CHECKING

**WARNING: The fluid level should be checked with engine off to prevent injury from moving components.**

**CAUTION: MOPAR® ATF+4 is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.**

**NOTE: Power steering reservoir does not contain a dipstick. Fluid level indicators are molded into the side of the reservoir WITH REMOTE RESERVOIR.**

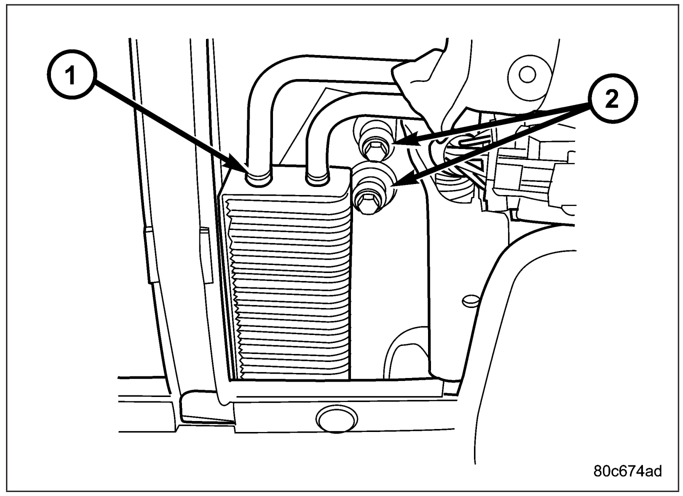
The power steering fluid level can be viewed on the dipstick attached to the filler cap. There are two ranges listed on the dipstick, COLD and HOT. Before opening power steering system, wipe the reservoir filler cap free of dirt and debris. Remove the cap and check the fluid level on its dipstick. When the fluid is at normal ambient temperature, approximately 21°C to 27°C (70°F to 80°F), the fluid level should read between the minimum and maximum area of the cold range. When the fluid is hot, fluid level is allowed to read up to the highest end of the HOT range. Only add fluid when the vehicle is cold.

**Use only Mopar® ATF+4** . Do not overfill the power steering system.

# FLUID COOLER

## DESCRIPTION

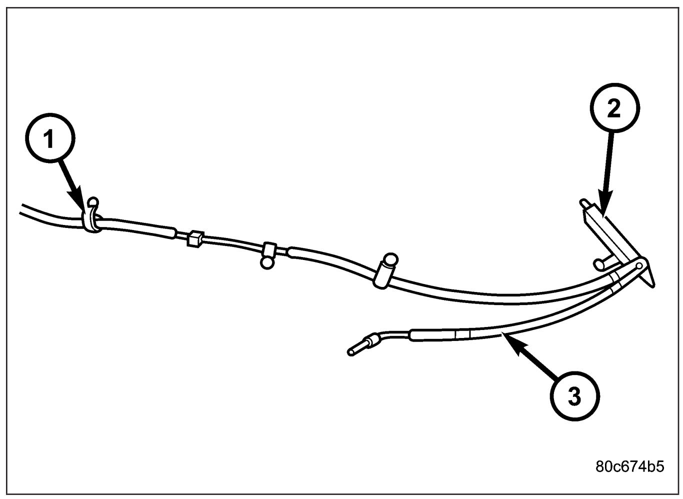
The power steering fluid cooler (1) is located at the front of the vehicle. It is mounted to the radiator lower support just forward of the air-conditioning condenser and just rearward of the front fascia. The cooler is positioned so it is in the air flow through the front fascia of the vehicle. The cooler is serviced as an assembly with the return hose.




## OPERATION

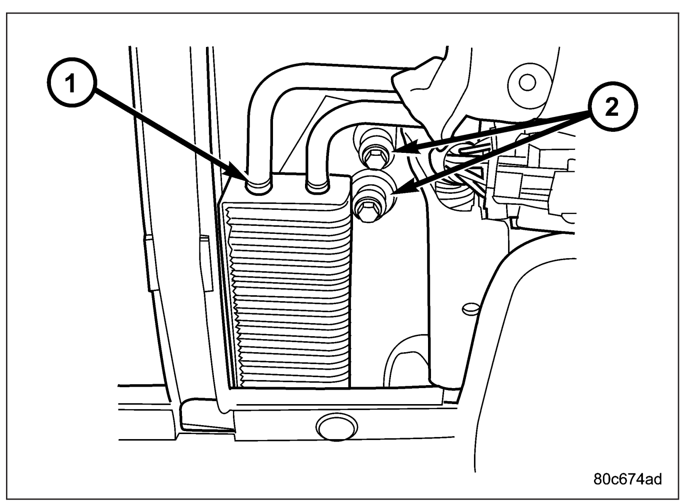
The purpose of the power steering fluid cooler (2) is to keep the temperature of the power steering system fluid from rising to a level that would affect the performance of the power steering system.

The cooler used on this vehicle is referred to as a fluid-to-air type cooler. This means that the air flow across the fin/tubes of the cooler is used to extract the heat from the cooler which it has absorbed from the power steering fluid flowing through it. The cooler is placed in series with the power steering fluid return line (1), between the steering gear and the power steering fluid reservoir. This lowers the temperature of the power steering fluid prior to it entering the power steering fluid reservoir where it is resupplied to the power steering pump.



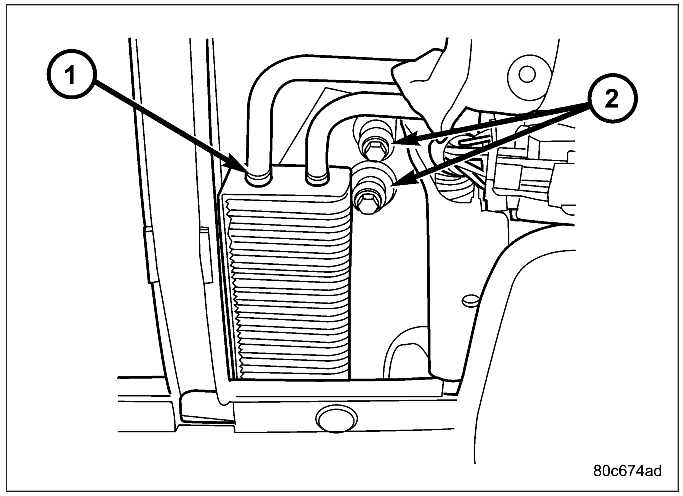

## REMOVAL

1. Remove the return line at the gear.
2. Remove the return line at the reservoir.
3. Remove the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
4. Remove the two cooler mounting bolts (2).
5. Remove the cooler (1) and return hose assembly from the vehicle.



## INSTALLATION

1. Install the cooler (1) / return hose assembly to the vehicle.
2. Install the two cooler mounting bolts (2).
3. Install the grille (Refer to 23 - BODY/EXTERIOR/ GRILLE - INSTALLATION).
4. Install the return line at the reservoir.
5. Install the return line at the gear.
6. Refill the power steering fluid and check for leaks (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

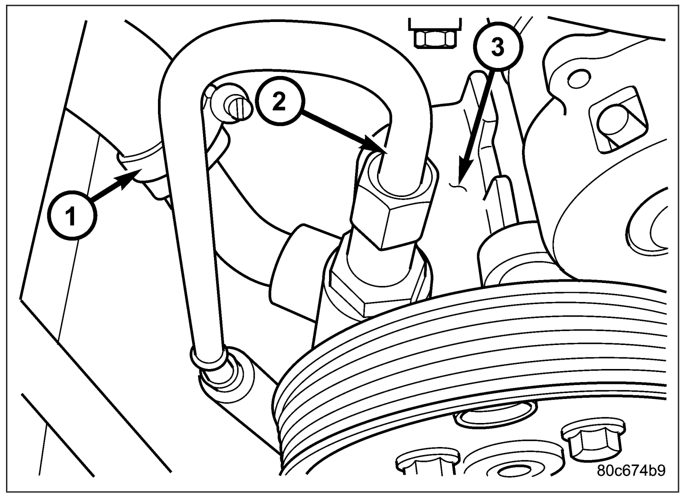


# HOSES

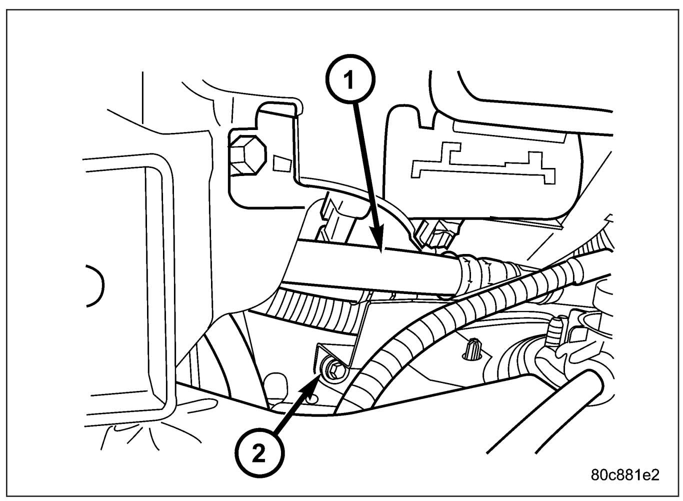
## REMOVAL

### PRESSURE HOSE

1. Siphon the power steering fluid from the reservoir.
2. Remove the radiator crossmember (Refer to 23 - BODY/EXTERIOR/RADIATOR CROSSMEMBER - REMOVAL).
3. Remove the fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
4. Remove the fan shroud.
5. Remove the serpentine belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
6. Remove the pressure hose (2) at the pump (3).




7. Remove the pressure hose from the gear.
8. Remove the pressure hose (1) mounting bracket bolts (2) from behind the headlamp assembly.
9. Remove the pressure hose (1) from the vehicle.

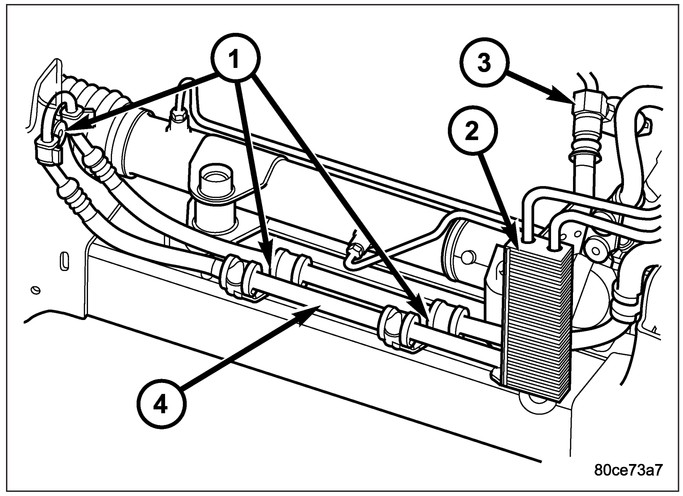



### RETURN HOSE (GEAR TO THE COOLER)

**NOTE: Return hose and the cooler are serviced as an assembly.**

1. Siphon the power steering fluid from the reservoir.
2. Remove the radiator crossmember (Refer to 23 - BODY/EXTERIOR/RADIATOR CROSSMEMBER - REMOVAL).
3. Remove the fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
4. Remove the fan shroud.
5. Remove the serpentine belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

6. Remove the return hose (4) from the gear.
7. Remove the return hose and cooler mounting bracket bolts (1) from the front cradle.
8. Remove the return hose and cooler assembly from the vehicle.

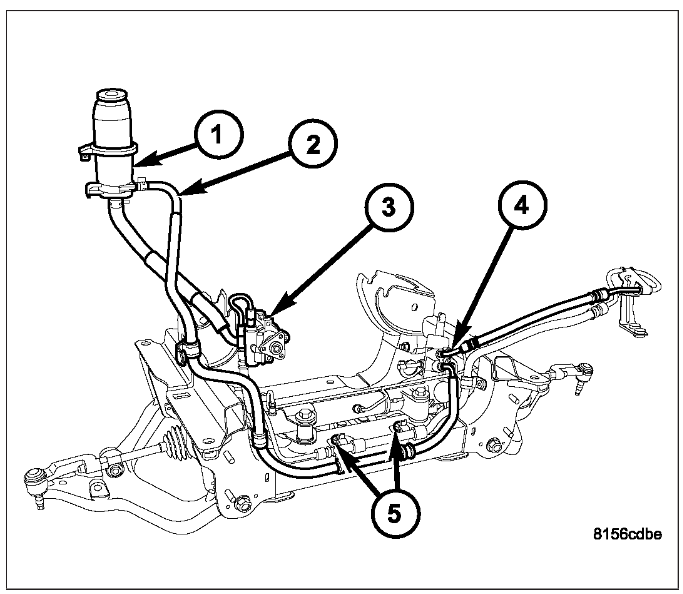



## RETURN HOSE (RESERVOIR TO THE COOLER)

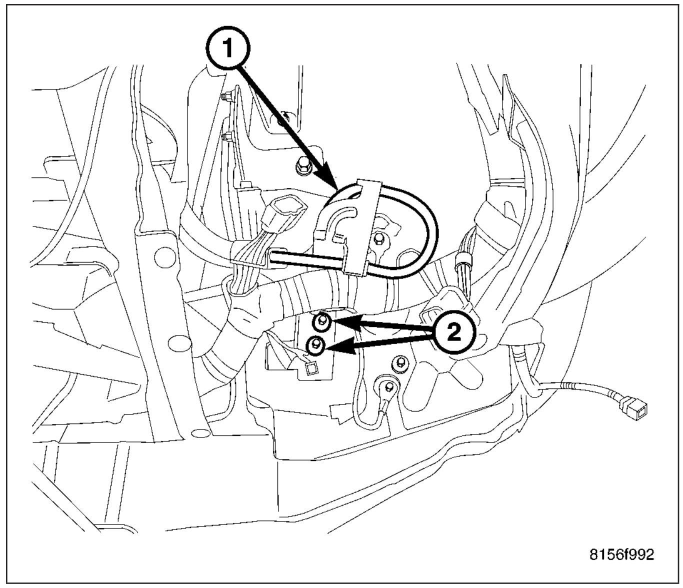
1. Siphon the power steering fluid from the reservoir.
2. Remove the return hose from the pump reservoir.
3. Remove the return hose at the cooler.
4. Remove the return hose from the vehicle.

## PRESSURE / RETURN HOSE ASSEMBLY - DIESEL

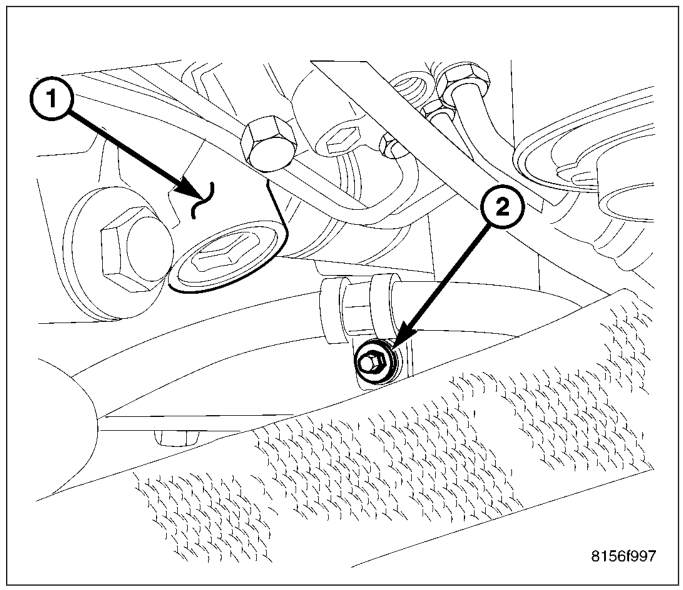
1. Siphon the power steering fluid from the reservoir.
2. Remove the air box (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
3. Remove the clutch fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
4. Remove the fan shroud.
5. Remove the front fascia (Refer to 13 - FRAME & BUMPERS/BUMPERS/FRONT FASCIA - REMOVAL).
6. Remove the grille and reinforcement (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - REMOVAL).
7. Remove the pressure line at the pump (3).
8. Remove the return hose (2) at the reservoir (1).



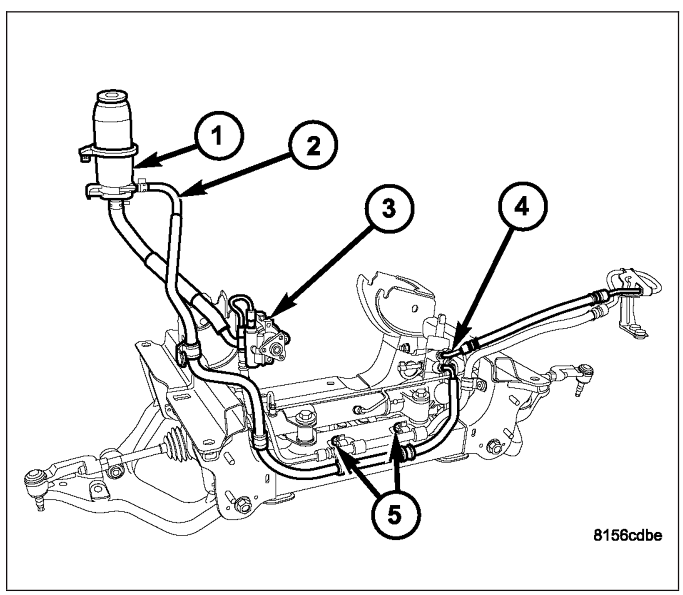
9. Remove the pressure line routing bracket bolts (2) behind the left headlight bucket.



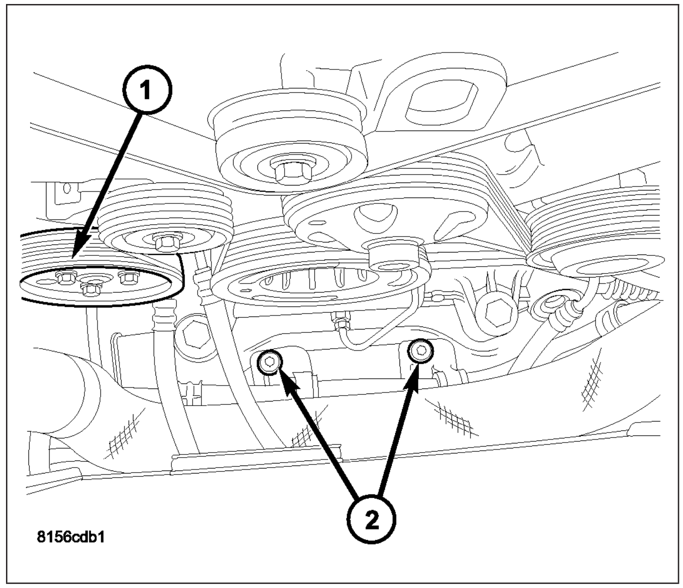

10. Remove the pressure line mounting bracket (2) at the frame both right and left side.



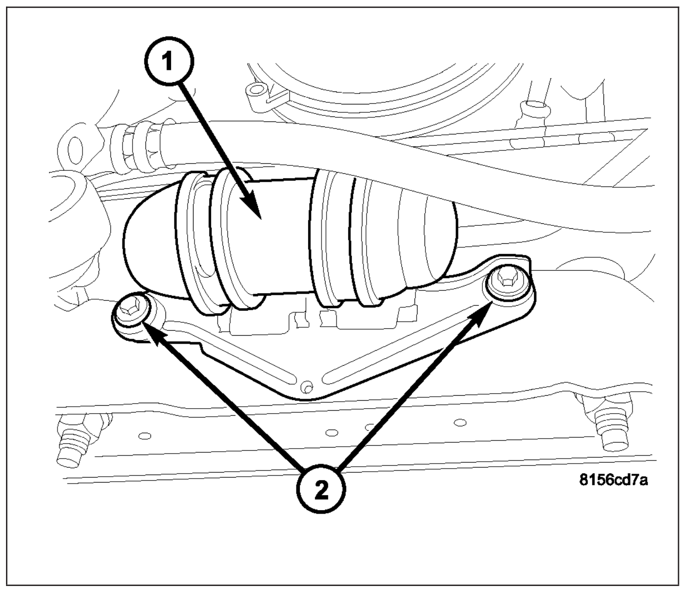

11. Remove the pressure line at the gear (4).
12. Remove the return line (2) at the gear.



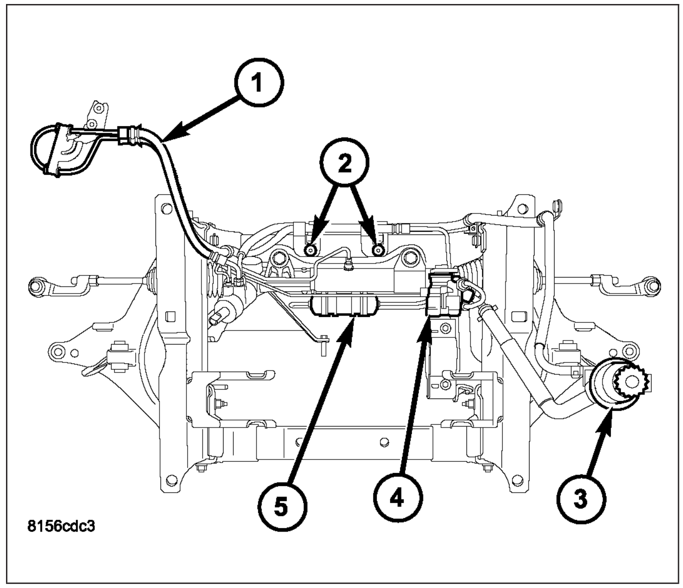
13. Remove the pressure / return line mounting bracket bolts (2) at the frame.




14. Raise and support the vehicle.
15. Remove the skid plate. (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - REMOVAL).
16. Remove the push pins and then the lower engine belly pan.
17. Disconnect the suppressor (1) from the power steering hose bundle at the frame.



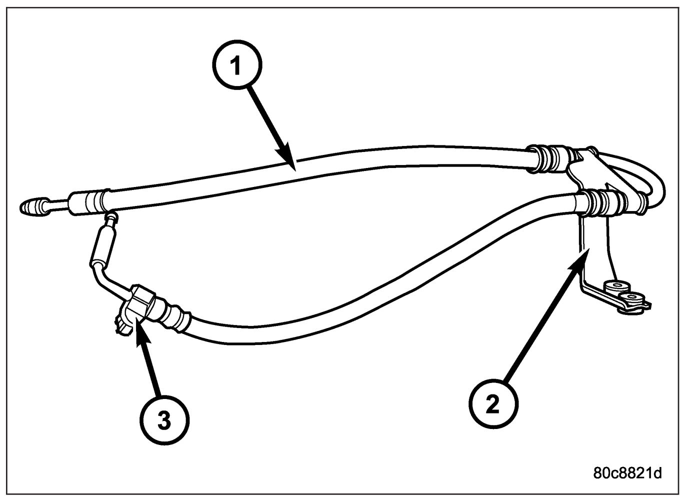
18. Remove the pressure/return hose (1) from the vehicle.



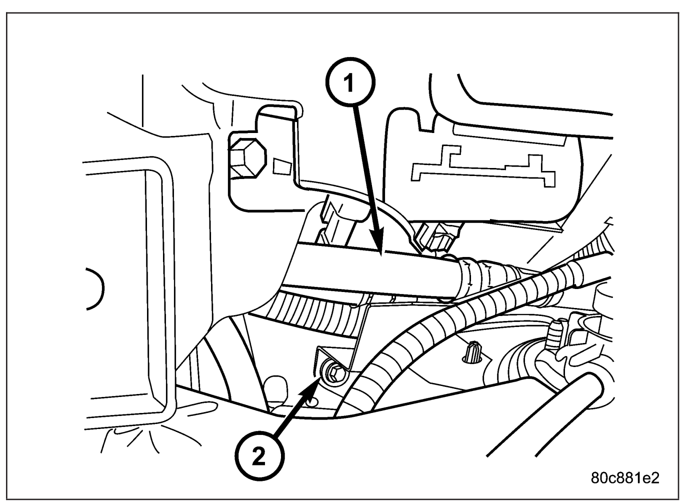

## INSTALLATION

## PRESSURE HOSE

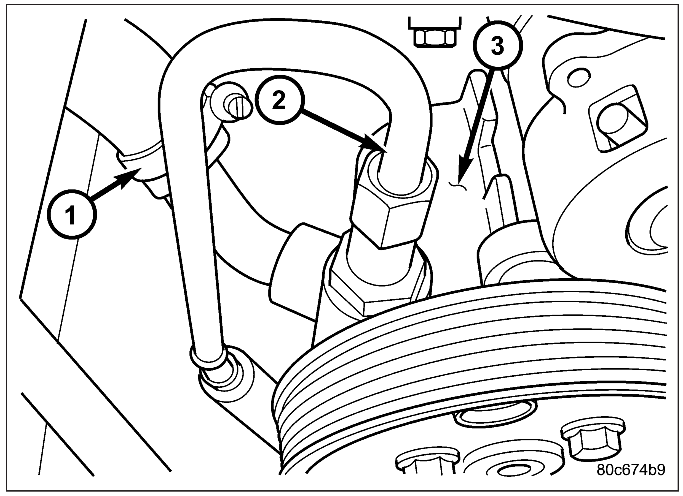
1. Install the pressure hose (1) to the vehicle..




2. Install the pressure hose mounting bracket bolts (2) behind the headlamp assembly. Tighten to to 12 N·m (9 ft.lbs.).
3. Install the pressure hose to the gear. Tighten the hose to28 N·m (21 ft.lbs.).



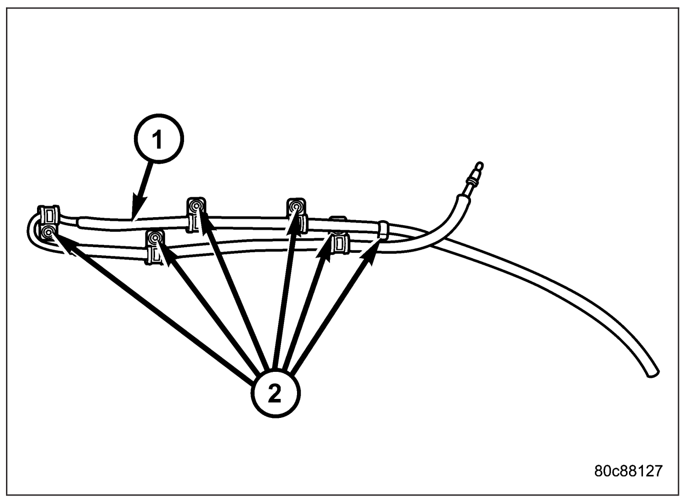
4. Install the pressure hose (2) at the pump (3). Tighten the hose to28 N·m (21 ft.lbs.).



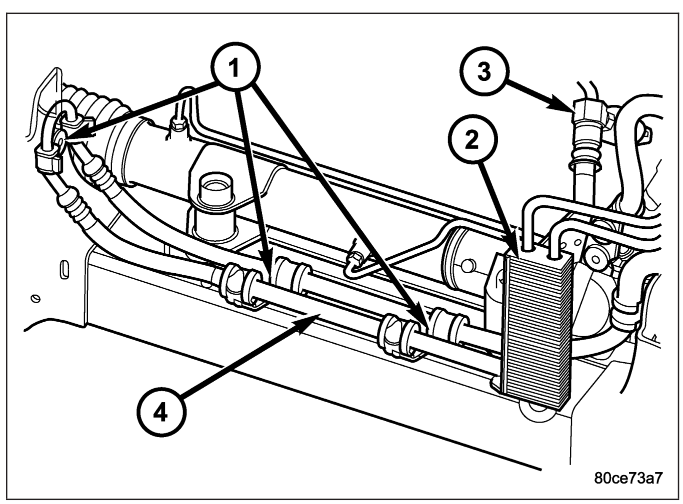

5. Install the serpentine belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
6. Install the fan shroud.
7. Install the fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
8. Install the radiator crossmember (Refer to 23 - BODY/EXTERIOR/RADIATOR CROSSMEMBER - INSTALLATION).
9. Refill the power steering fluid (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

## RETURN HOSE (GEAR TO THE COOLER)

1. Install the return hose (1) / cooler assembly to the vehicle.
2. Install the return hose and cooler mounting bracket bolts (2) to the front cradle.




3. Install the return hose (4) at the gear 28 N·m (21 ft.lbs.).



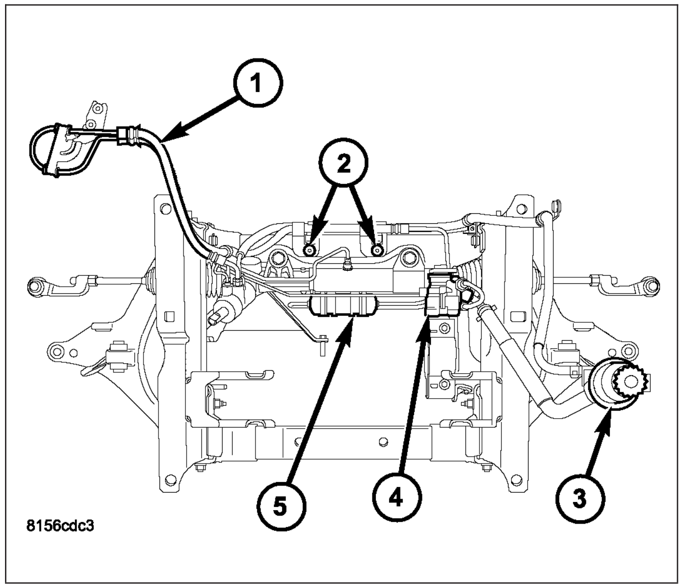
4. Install the serpentine belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
5. Install the fan shroud.
6. Install the fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
7. Install the radiator crossmember (Refer to 23 - BODY/EXTERIOR/RADIATOR CROSSMEMBER - INSTALLATION).
8. Refill the power steering fluid (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

## RETURN HOSE (RESERVOIR TO THE COOLER)

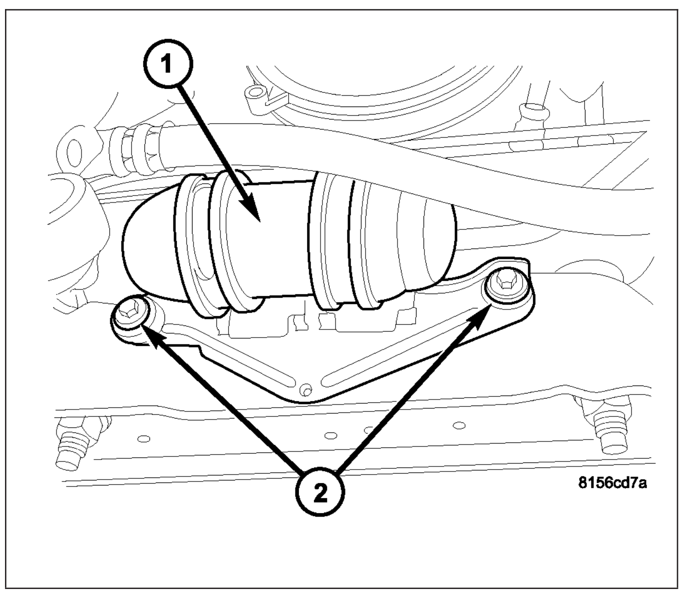
1. Install the return hose to the vehicle.
2. Install the return hose to the pump reservoir.
3. Install the return hose at the cooler.
4. Refill the power steering fluid (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

## PRESSURE / RETURN HOSE ASSEMBLY - DIESEL

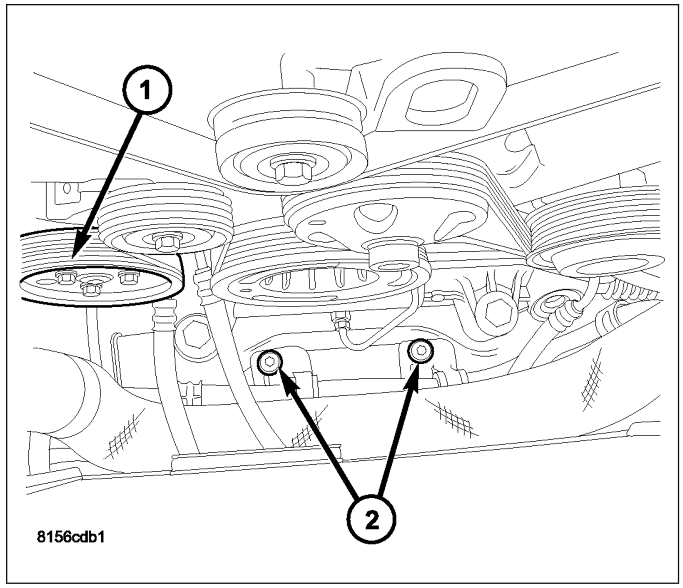
1. Install the pressure/return hose (1) to the vehicle.



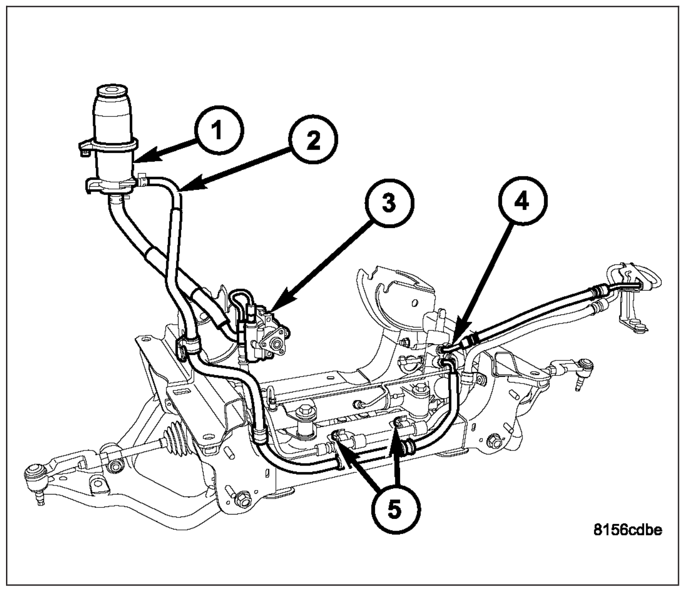

2. Install the power steering hose bundle to the suppressor (1).



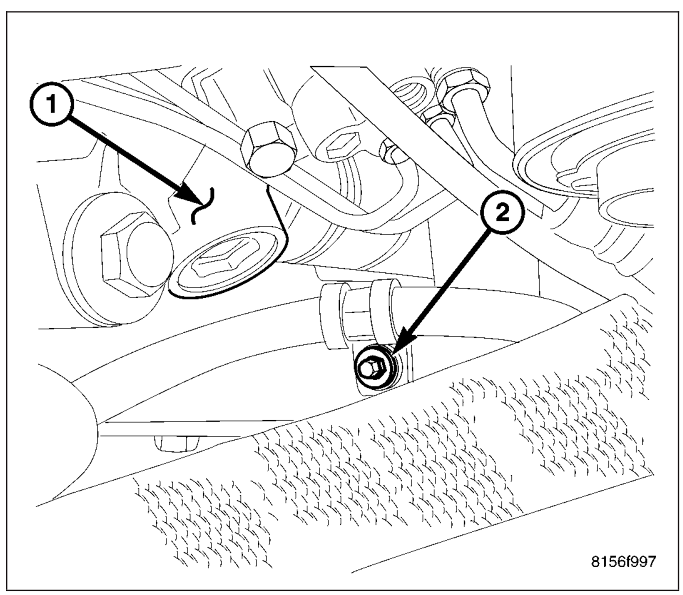
3. Install the pressure/return hose mounting bracket bolts (2) to the front cradle.



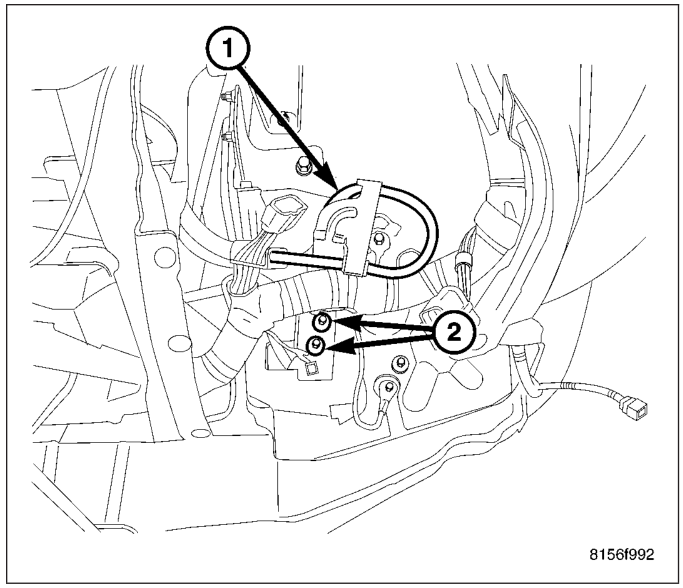

4. Install the return hose (2) at the gear.
5. Install the pressure hose at the gear (4).



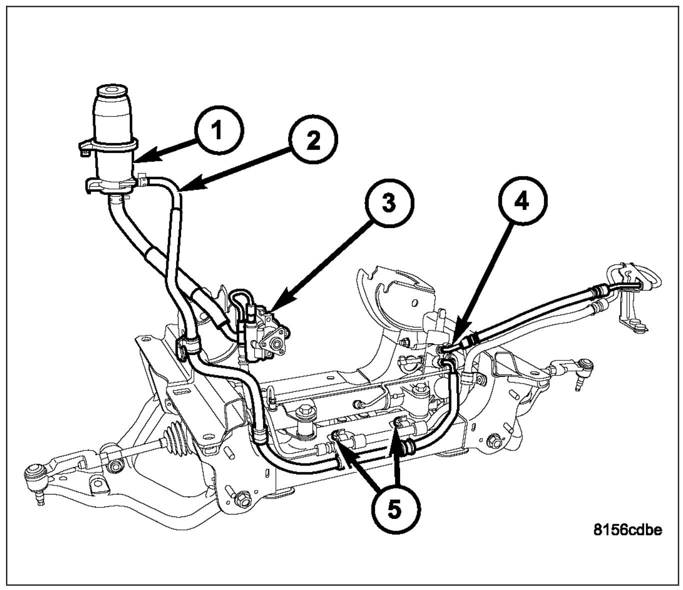

6. Install the pressure/return hose mounting bracket (2) to the left and right sides of the cradle.



7. Install the two bolts (2) for the hose (1) behind the headlamp bucket on the left side.




8. Install the return hose (2) at the reservoir (1).
9. Install the pressure line (4) at the pump.




10. Install the fan shroud.
11. Install the clutch fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
12. Install the airbox (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).
13. Refill the power steering fluid.
14. Bleed the power steering system (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).
15. Check for leaks.
16. Install the grille and grille reinforcement (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - INSTALLATION).
17. Install the front fascia (Refer to 13 - FRAME & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION).
18. Raise the vehicle and install the lower engine belly pan and push pins.
19. Install the skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - INSTALLATION).

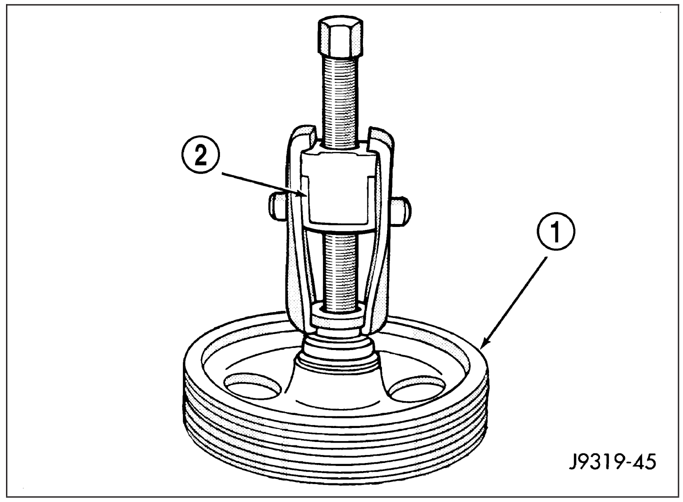
# PULLEY

## REMOVAL

### GAS

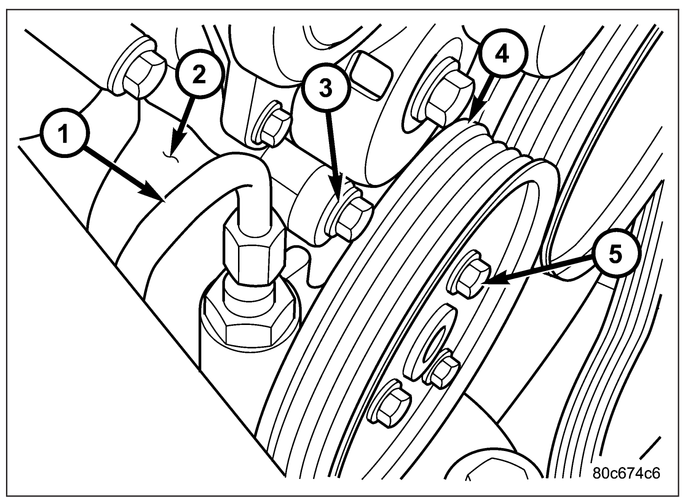
**CAUTION: On vehicles equipped with the pressed on pulley, Do not reuse the old power steering pump pulley it is not intended for reuse. A new pulley must be installed if removed.**

1. Remove pump assembly. (Refer to 19 - STEERING/PUMP - REMOVAL).
2. Remove pulley (1) from pump with Puller C-4333 (2) or equivalent puller.




### DIESEL

1. Remove the engine cooling fan.
2. Remove the fan shroud.
3. Remove the serpentine drive belt.
4. Remove the three bolts securing the pulley to the pump.



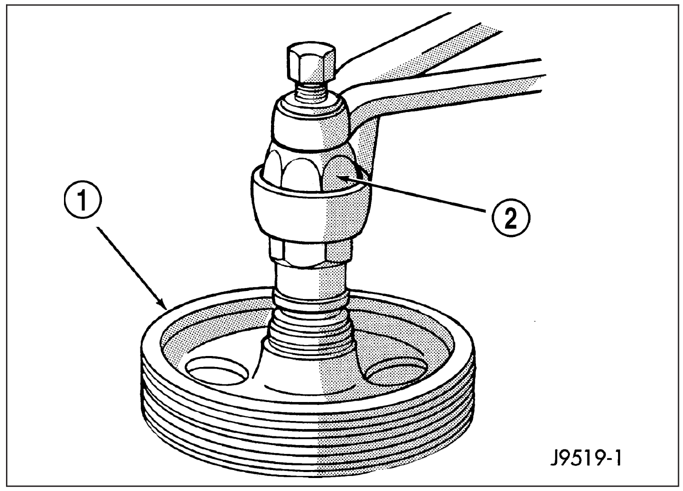
## INSTALLATION

## GAS

**CAUTION: Do not reuse the old power steering pump pulley it is not intended for reuse. A new pulley must be installed if removed.**

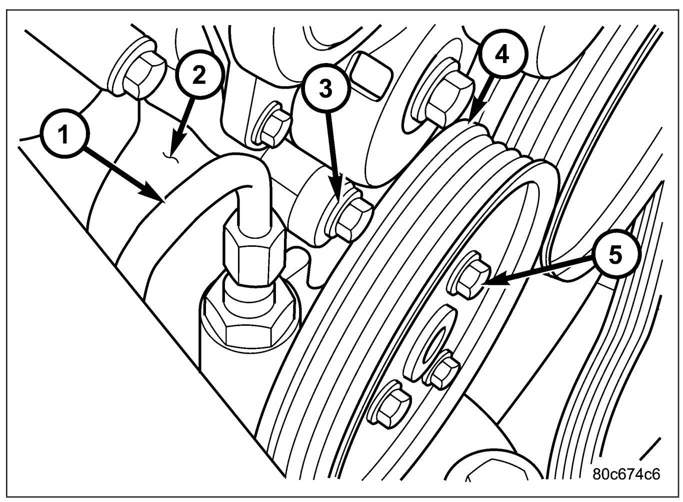
**NOTE: The pulley is marked front for installation.**

1. Replace pulley if bent, cracked, or loose.
2. Install pulley (1) on pump with Installer C-4063-B (2) or equivalent installer. The pulley must be flush with the end of the shaft. Ensure the tool and pulley are aligned with the pump shaft.
3. Install pump assembly. (Refer to 19 - STEERING/ PUMP - INSTALLATION)
4. With Serpentine Belt, run engine until warm (5 min.) and note any belt chirp. If chirp exists, move pulley outward approximately 0.5 mm (0.020 in.). If noise increases, press on 1.0 mm (0.040 in.). **Be careful that pulley does not contact mounting bolts.**




## DIESEL

1. Install the pulley to the pump shaft.
2. Install the three bolt securing the pulley to the pump .
3. Install the serpentine belt.
4. Install the fan shroud.
5. Install the engine cooling fan.



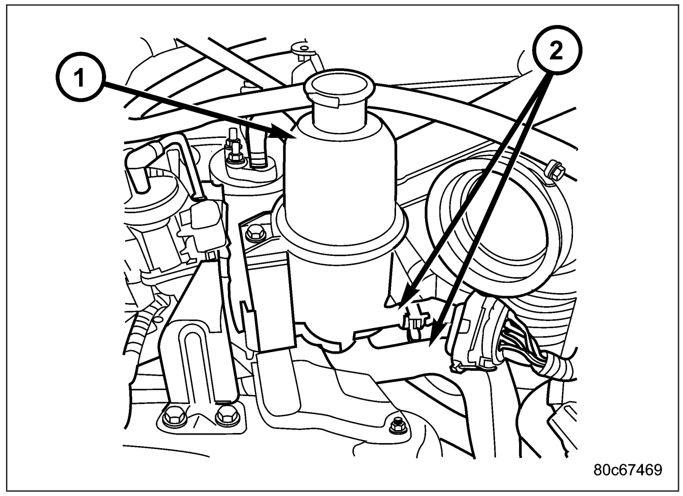
# RESERVOIR

## DESCRIPTION

Only the diesel engine reservoir is serviced separately. The 3.7L power steering reservoir is not serviced separately from the pump.

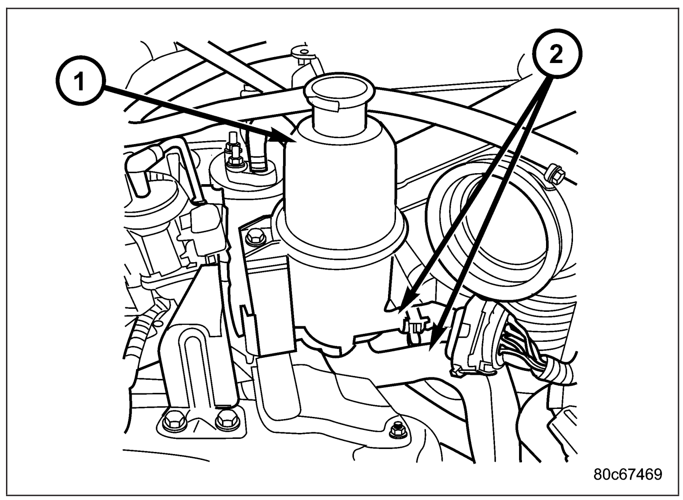
## REMOVAL - DIESEL

1. Siphon out as much power steering fluid as possible.
2. Remove the power steering hoses (2).
3. Remove the bolt securing the reservoir (1) to the mounting bracket.
4. Remove the reservoir (1).




## INSTALLATION - DIESEL

1. Install the reservoir (1) to the mounting bracket.
2. Install and tighten the bolt to 12 N·m (9 ft. lbs.).
3. Install the hoses (2).
4. Refill the power steering fluid and check for leaks (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).



# TRANSMISSION AND TRANSFER CASE

## TABLE OF CONTENTS



# MANUAL TRANSMISSION - NSG370

## TABLE OF CONTENTS

# MANUAL TRANSMISSION - NSG370

## DIAGNOSIS AND TESTING

## MANUAL TRANSMISSION - NSG370

### LOW LUBRICANT LEVEL

A low transmission lubricant level is generally the result of a leak, inadequate lubricant fill or incorrect lubricant level check.

**Rear transmission leaks** will be from the oil seals or component mating surfaces.

**Front transmission leaks** will be from the front input shaft retainer seal. Lubricant may drip from the clutch housing after extended operation. If leak is severe, it may contaminate the clutch disc.

**Lubricant level check** can only be made when the vehicle is level and allowing the lubricant to settle for a minute before checking. This will ensure an accurate check and avoid an underfill or overfill condition.

### HARD SHIFTING

Hard shifting is usually caused by low lubricant level, improper or contaminated lubricants. This will cause noise, excessive wear, internal bind, and hard shifting. Substantial lubricant leaks can result in gear, shift rail, synchro, and bearing damage. The first indications of component damage is usually hard shifting and noise.

Shift component damage, clutch adjustment, worn pressure plate or disc are also causes of increased shift effort. If clutch problem is advanced, gear clash during shifts can result. Worn or damaged synchronizer rings can cause gear clash when shifting into any forward gear. In some new or rebuilt transmissions, new synchro rings may tend to stick slightly causing hard or noisy shifts. In most cases, this condition will decline as the rings wear-in.

### TRANSMISSION NOISE

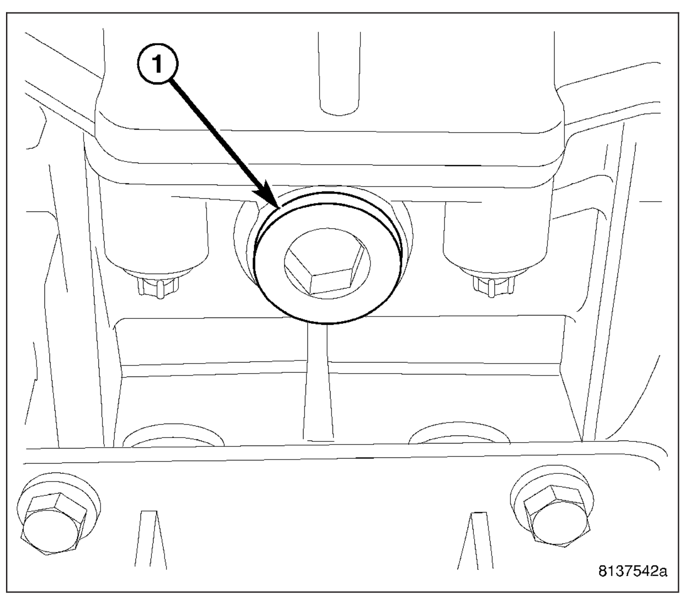
Most manual transmissions make some noise during normal operation. Rotating gears generate a mild whine that is audible, but generally only at extreme speeds.

Severe, highly audible transmission noise is generally the initial indicator of a lubricant problem. Insufficient, improper or contaminated lubricant will promote rapid wear of gears, synchros, shift rails, forks and bearings. The overheating caused by a lubricant problem, can also lead to gear and bearing damage.

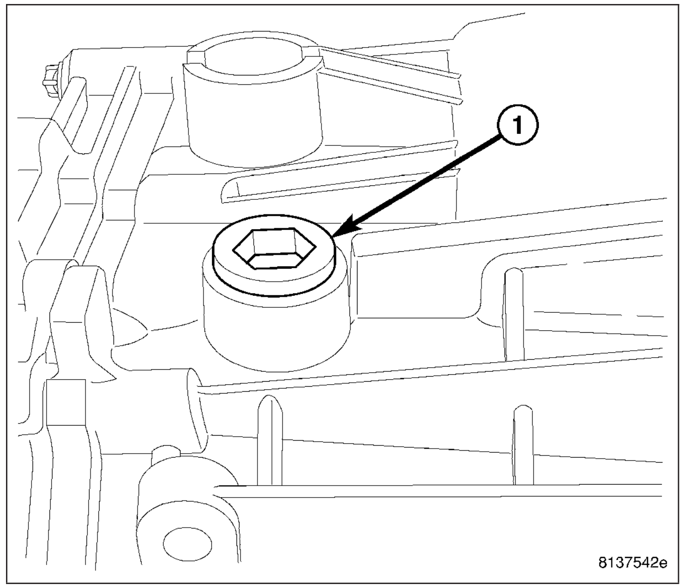
## STANDARD PROCEDURE

## DRAIN AND FILL

1. With vehicle in neutral, position vehicle on hoist.
2. Remove drain plug (1) and drain fluid.

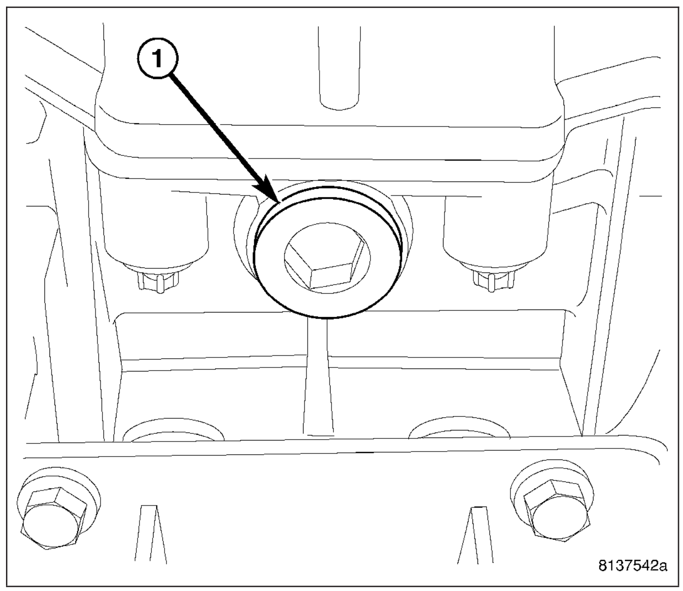


3. Install drain plug and remove fill plug (1).
4. Fill transmission with 1.5 L (3.17 pts.) of Mopar® Manual Transmission Lubricant MS-9224 or to the bottom of the fill plug (1) hole.

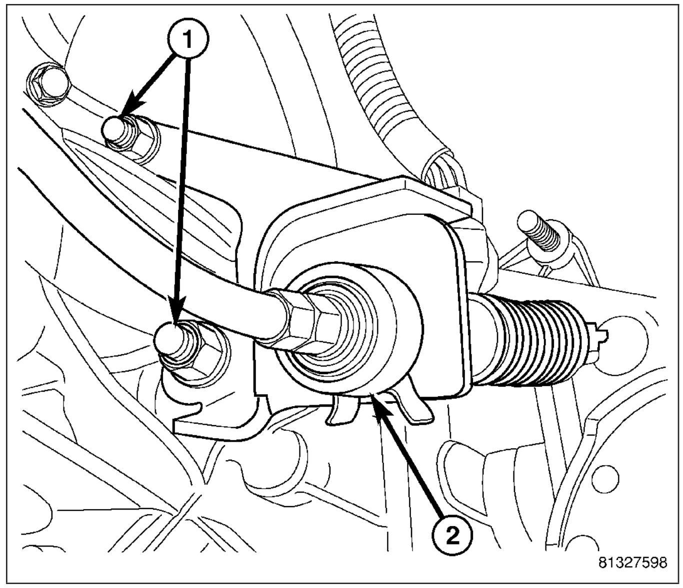



## REMOVAL

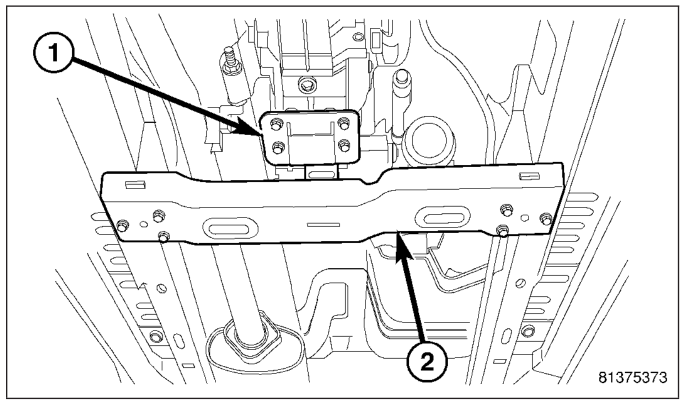
1. Disconnect negative battery cable.
2. With vehicle in neutral, position vehicle on hoist.
3. Remove drain plug (1) and drain fluid.



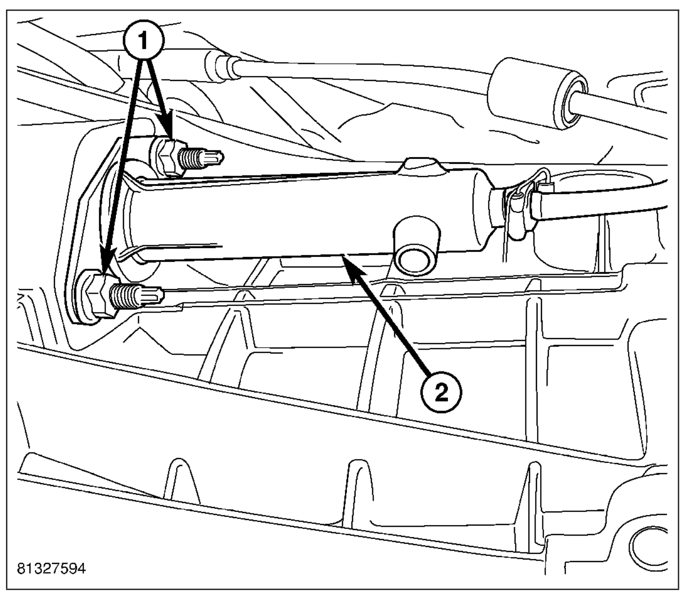
4. Mark installation reference marks on propeller shaft/shafts and remove shafts.
5. Remove transfer case shift cable (2) bracket nuts (1), cable (2), wiring connector, and vent hose, if equipped.
6. Remove transfer case, if equipped.



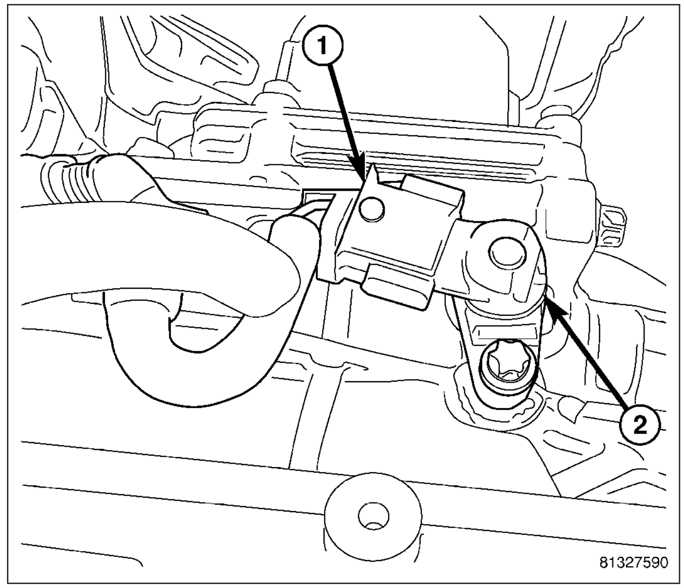

7. Support transmission with jack.
8. Remove transmission mount (1) and crossmember (2).



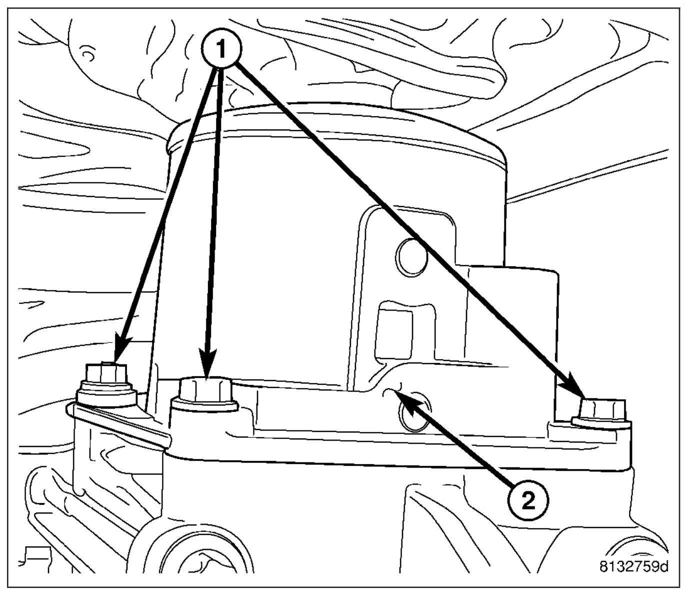

9. Remove clutch slave cylinder nuts (1) and remove cylinder (2).



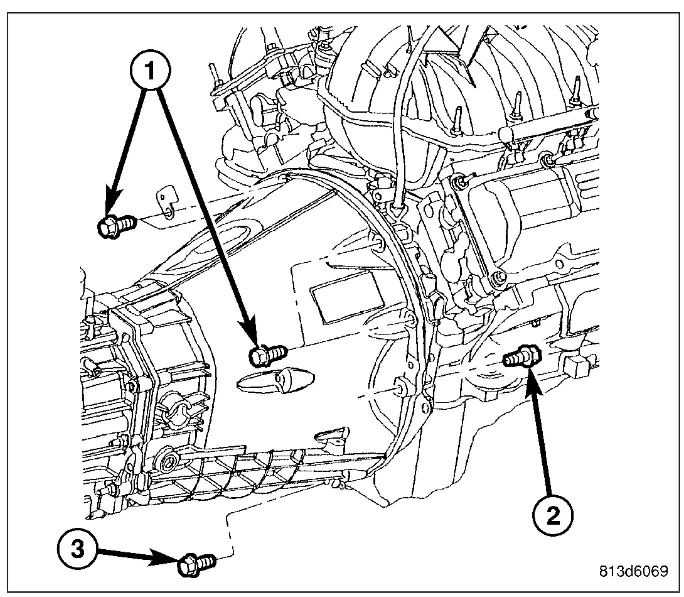
10. Remove backup lamp switch (1) wiring connector (2).



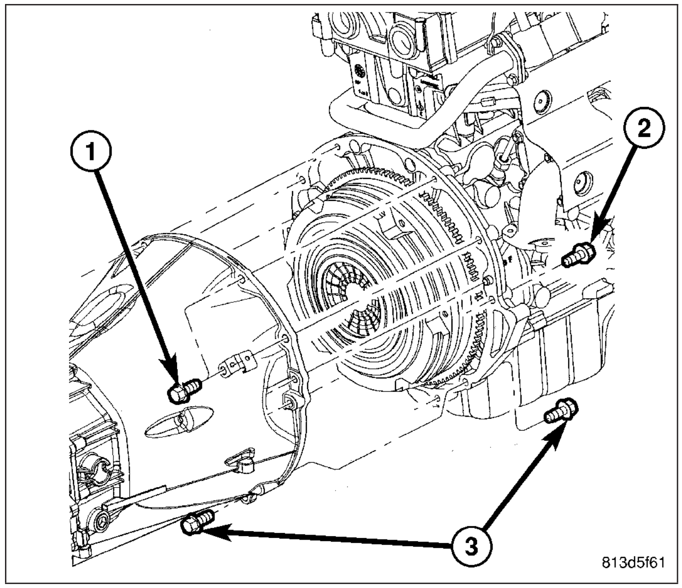

11. Remove shift lever tower bolts (1) and remove shift lever housing (2).
12. Remove starter bolts and remove starter.




13. Remove transmission bolts (1,2,3) on 3.7L engine and remove transmission.

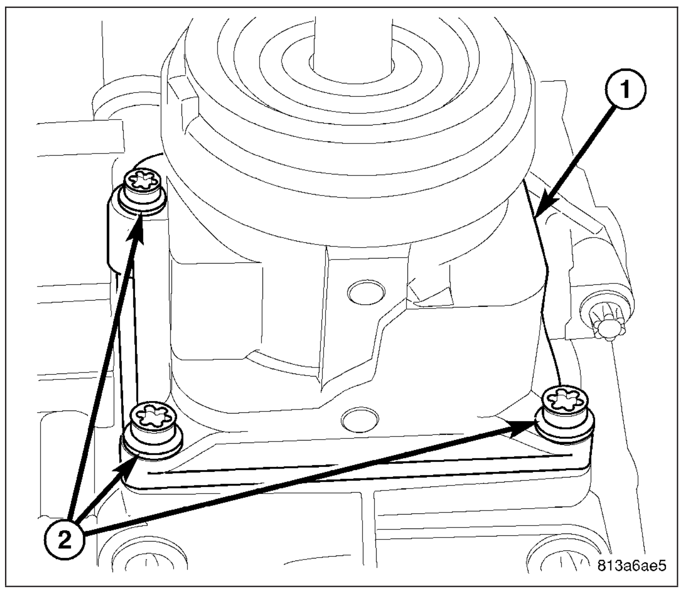


14. Remove transmission bolts (1,2,3) on 2.8L diesel engine and remove transmission.

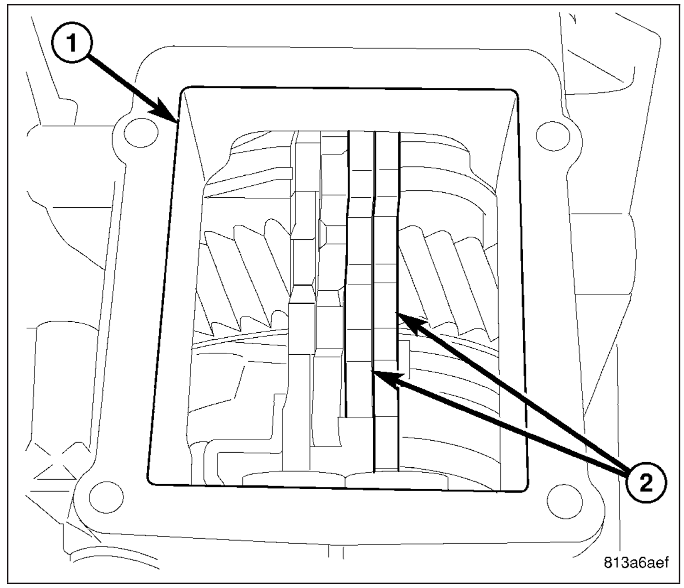



## DISASSEMBLY

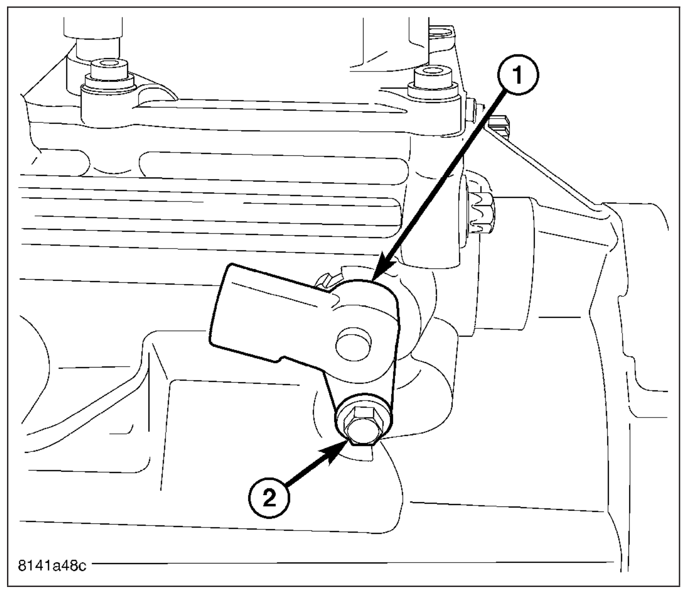
1. Remove shift tower (1) bolts (2) and remove tower.



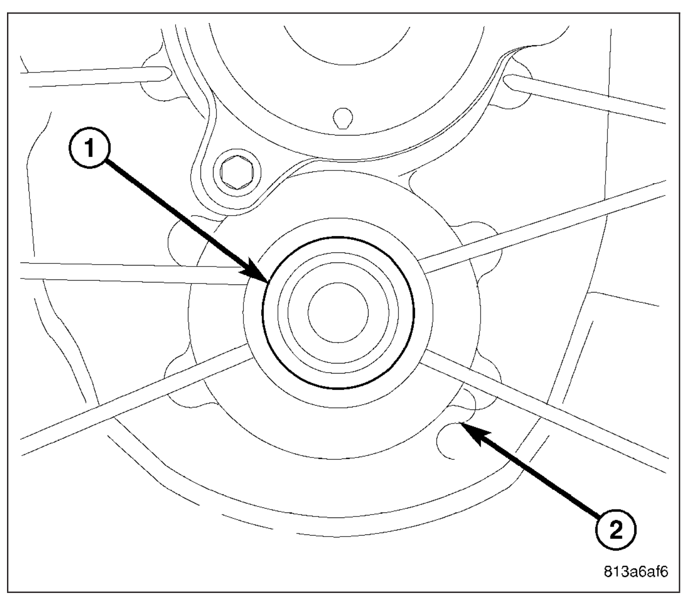
2. Through shift tower opening (1) shift two shift rails (2) forward to engage two gears.



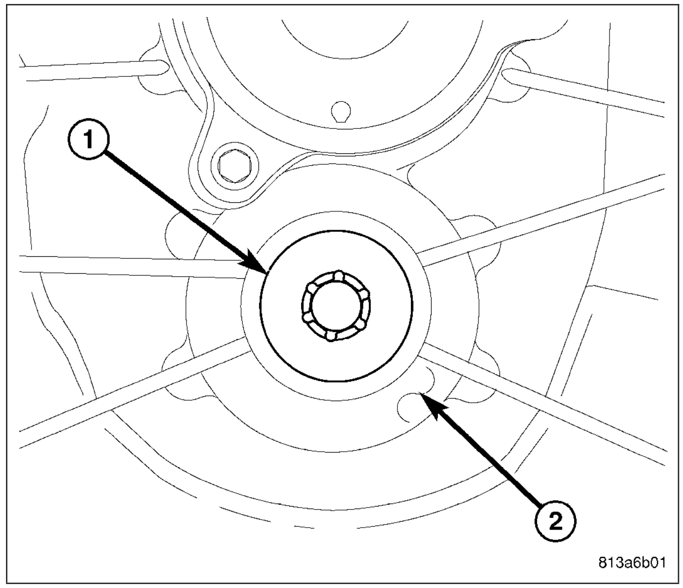

3. Remove back-up lamp switch (1) bolt (2) and remove switch.



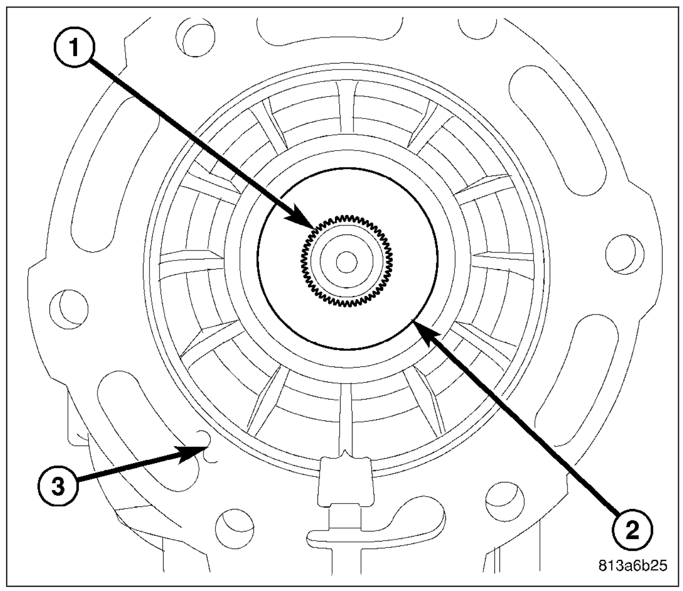

4. Remove countershaft plug (1) from the front housing (2) with a seal pick.



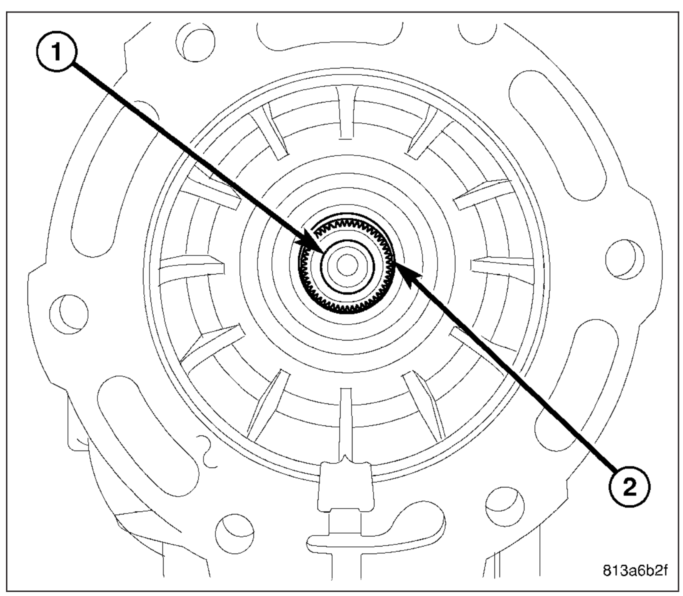
5. Remove countershaft bolt (1) from the front housing (2).



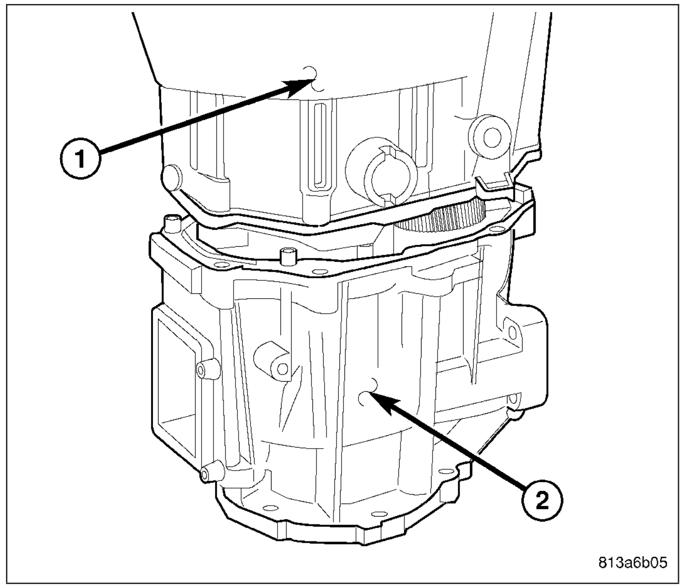

6. Remove output shaft (1) seal (2) from rear housing (3) with a seal pick.



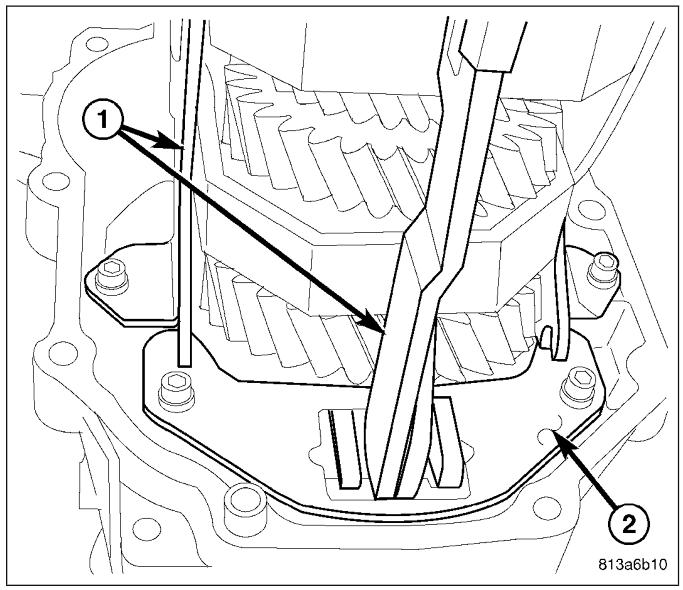

7. Remove output shaft (1) snap ring (2) 4x4 only.



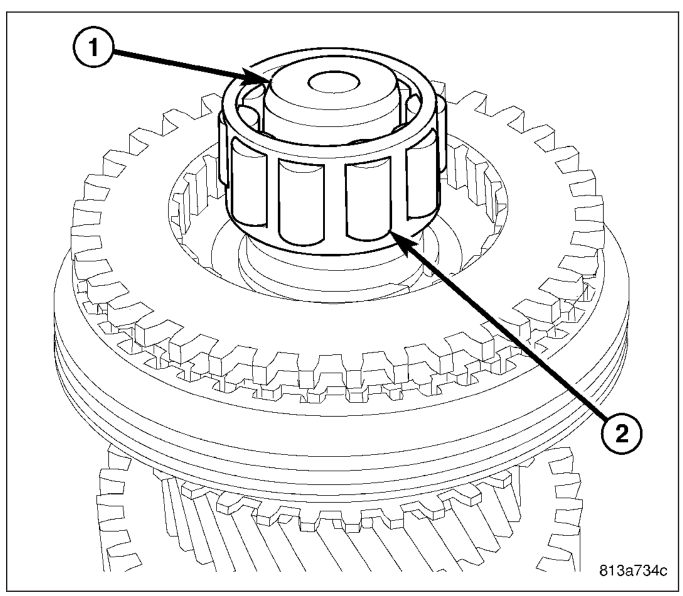
8. Stand transmission on the rear housing and remove the housing bolts.
9. Remove front housing (1) from the rear housing (2).



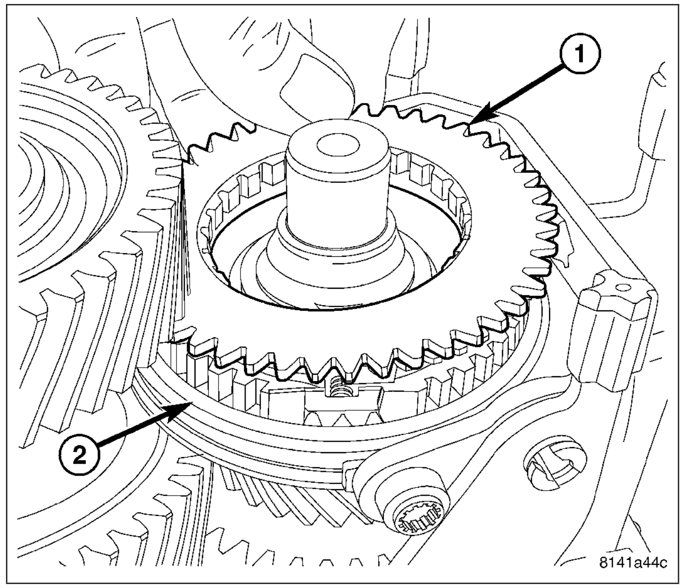

10. Remove shift rails (1) support plate (2) bolts.



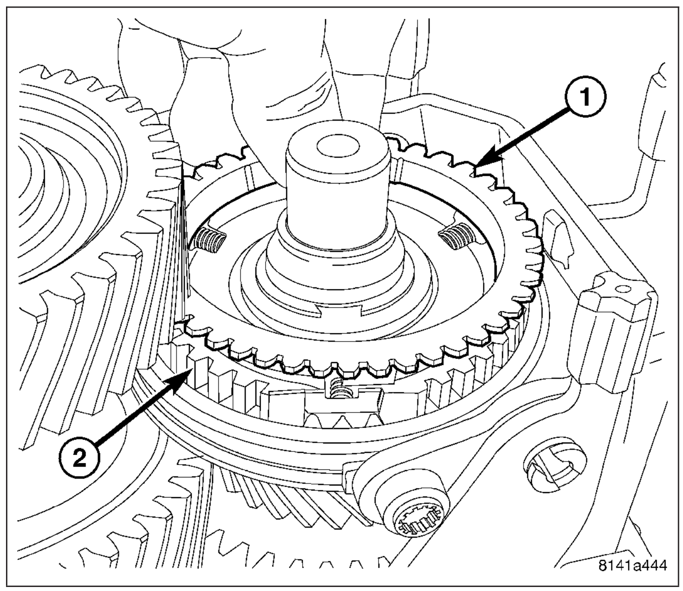

11. Remove input shaft (1) roller bearing (2).



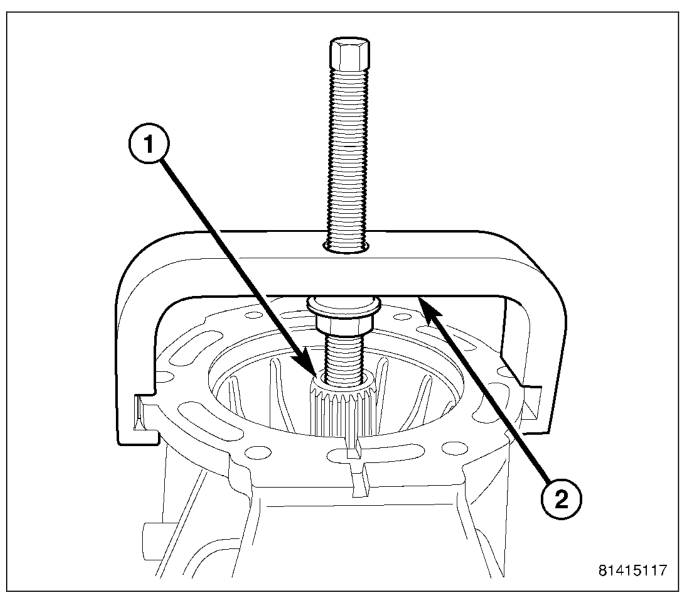
12. Remove fifth gear synchronizer blocker ring (1) from 5-6 synchronizer hub (2).



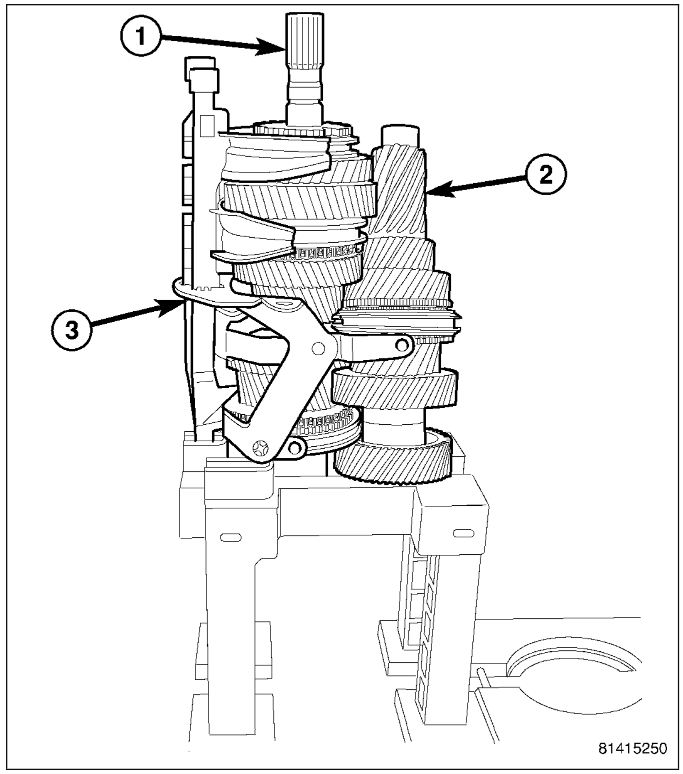

13. Remove fifth gear synchronizer friction ring (1) from 5-6 synchronizer hub (2).




14. Set geartrain and shift rails with rear housing into Fixture 9633.
15. Remove mainshaft (1) from rear housing bearing with Remover/Installer 9636 (2).

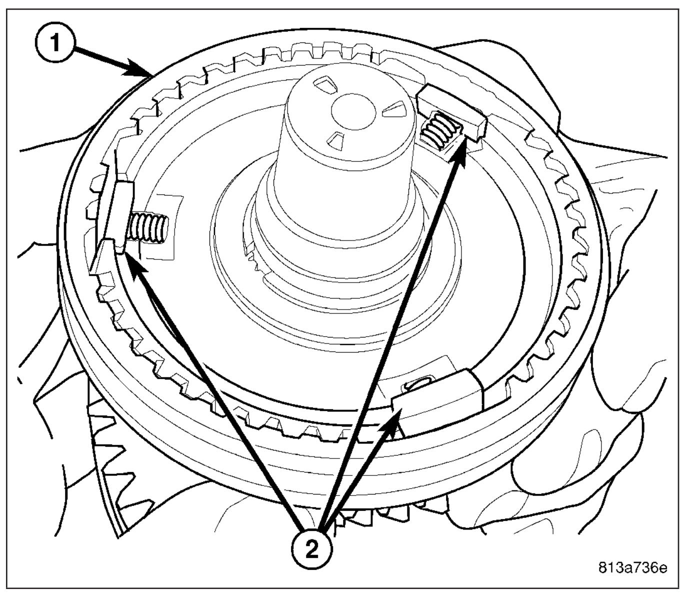


16. Remove mainshaft (1), countershaft (2) and shift rails/forks (3) from fixture.

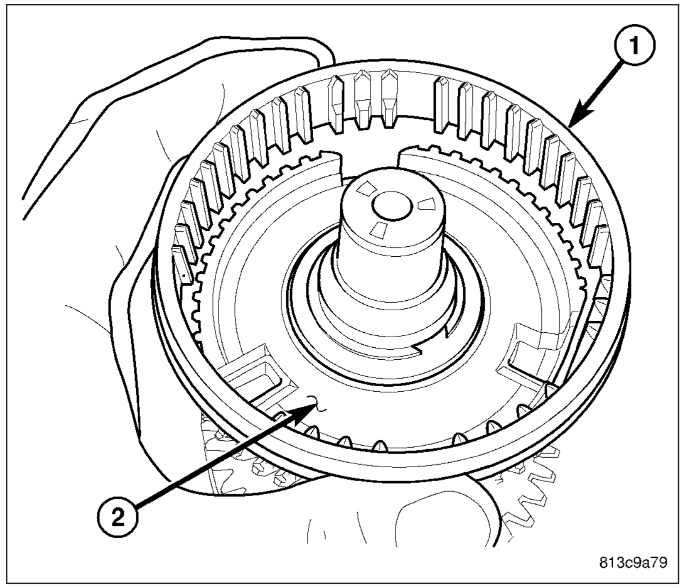



## MAINSHAFT

1. Clamp build Fixture 9648 in a vise. Install mainshaft with 5-6 synchronizer facing up in build Fixture 9648.
2. Push 5-6 synchronizer sleeve (1) down on hub and remove detents (2) springs and balls.

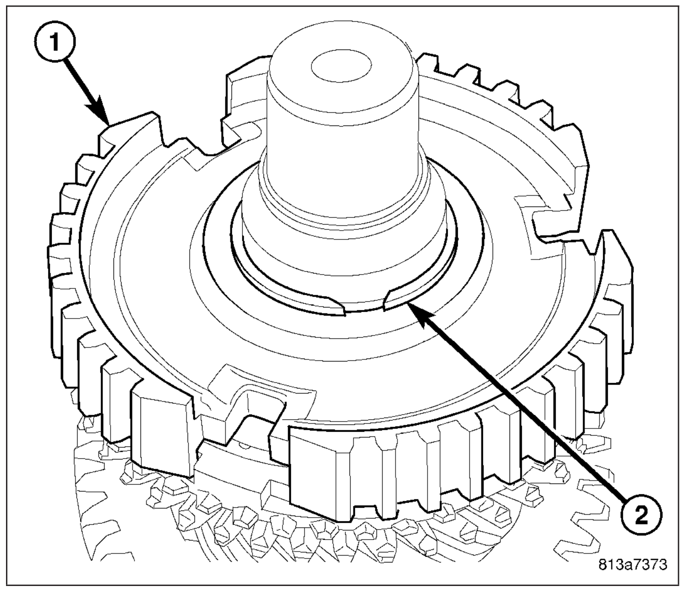


3. Remove 5-6 synchronizer sleeve (1) from synchronizer hub (2).

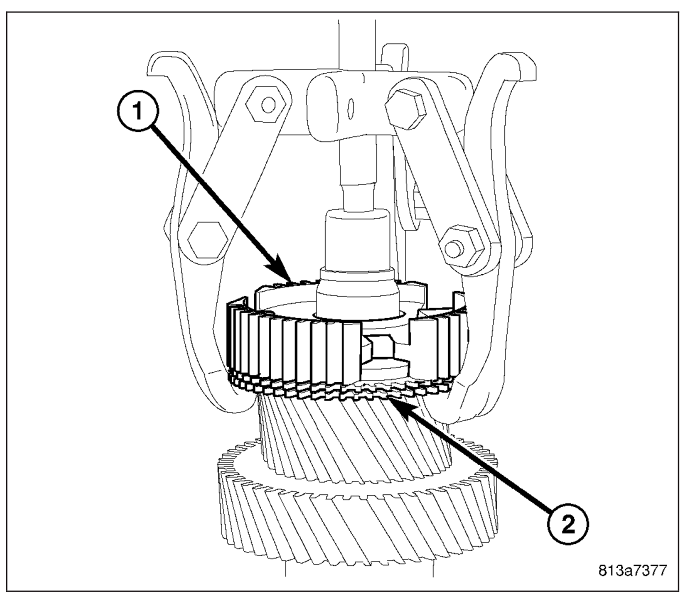



4. Remove 5-6 synchronizer hub (1) snap ring (2) and record location.

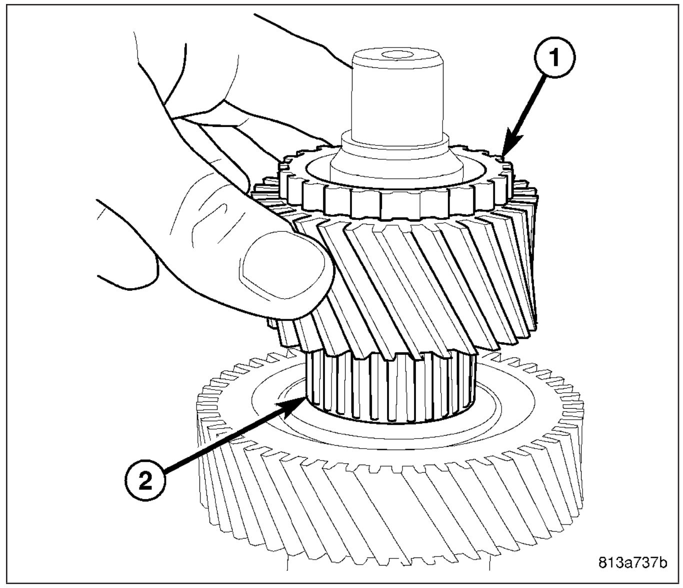
**NOTE: All snap rings are select fit from the factory, and must be installed in their original location.**



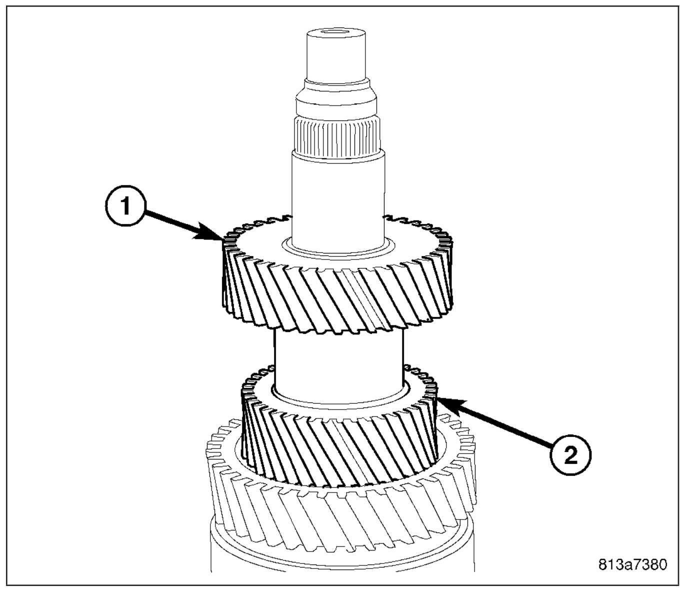

5. Remove 5-6 synchronizer hub (1) and sixth gear synchronizer rings (2) with a three jaw puller. Place puller jaws under sixth gear synchronizer rings (2).



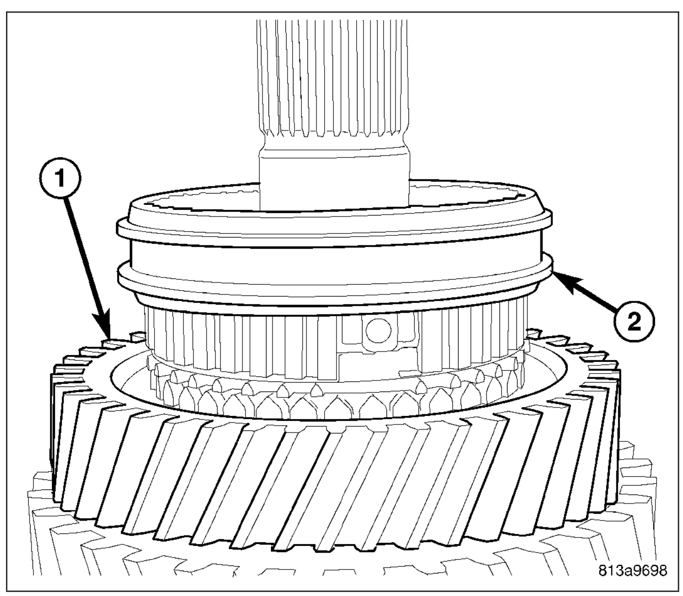
6. Remove sixth gear (1) and bearing (2).



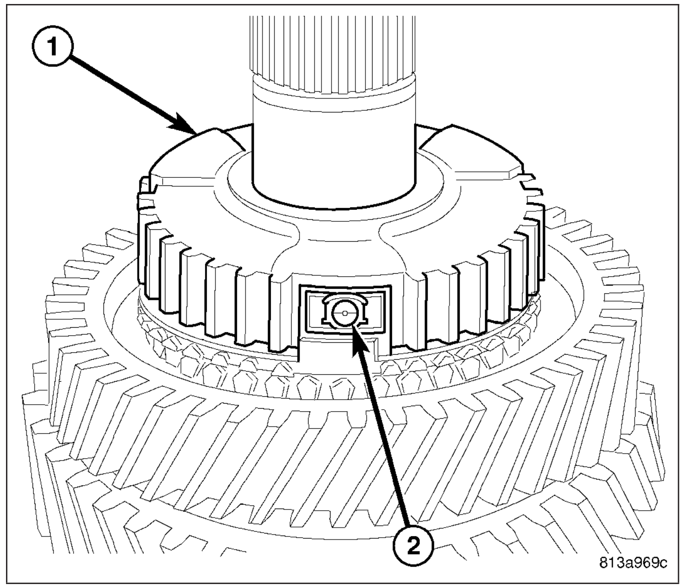

7. Third gear (1) and fourth gear (2) are serviced with the mainshaft only.
8. Remove mainshaft from Fixture 9648. Turn fixture over in vise and set opposite end of mainshaft into the fixture.



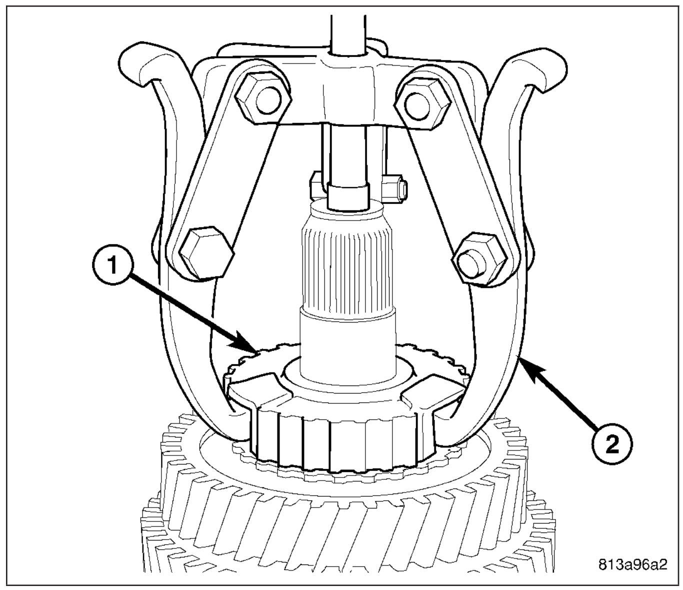

9. Remove reverse gear (1) synchronizer sleeve (2) off synchronizer hub.



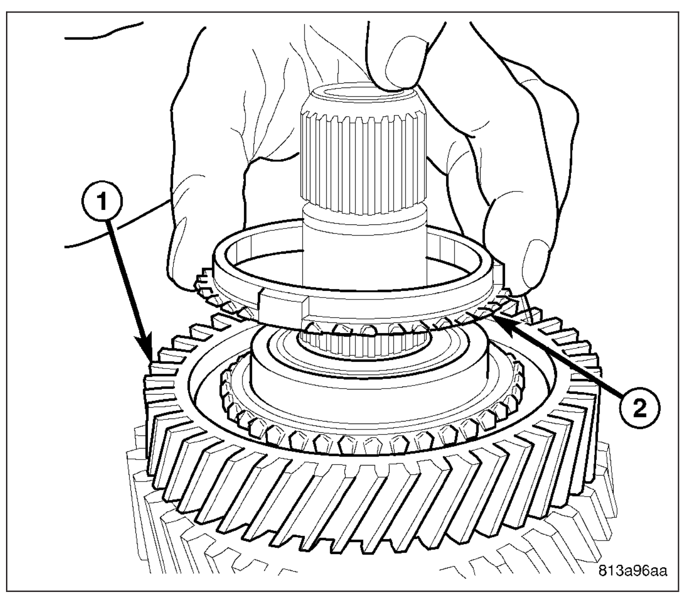
10. Remove reverse synchronizer hub (1) detents (2).



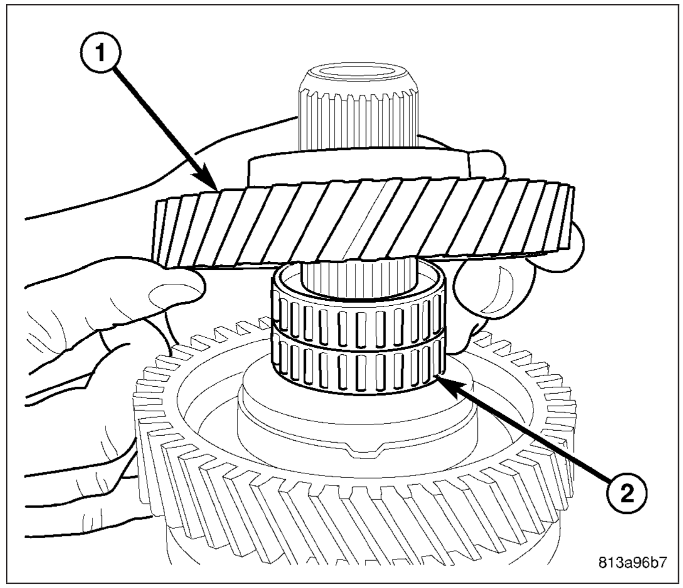

11. Remove reverse synchronizer hub (1) with three jaw puller (2). Place puller jaws in hub detent openings.



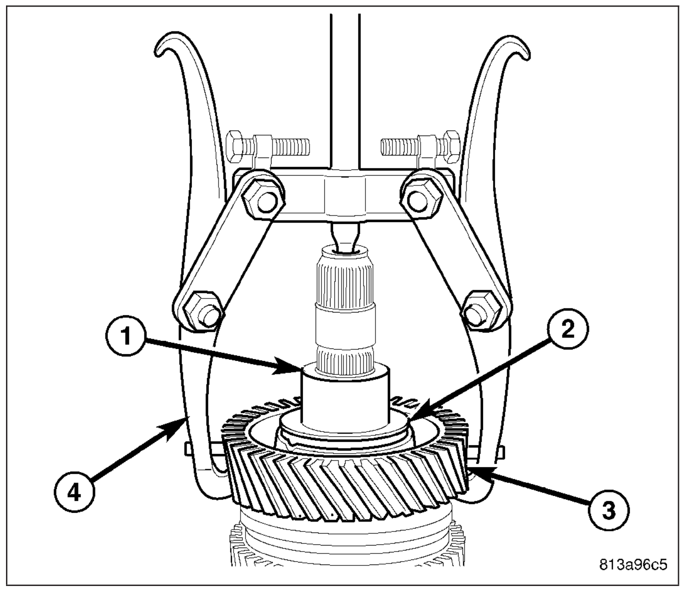

12. Remove reverse gear (1) synchronizer ring (2).



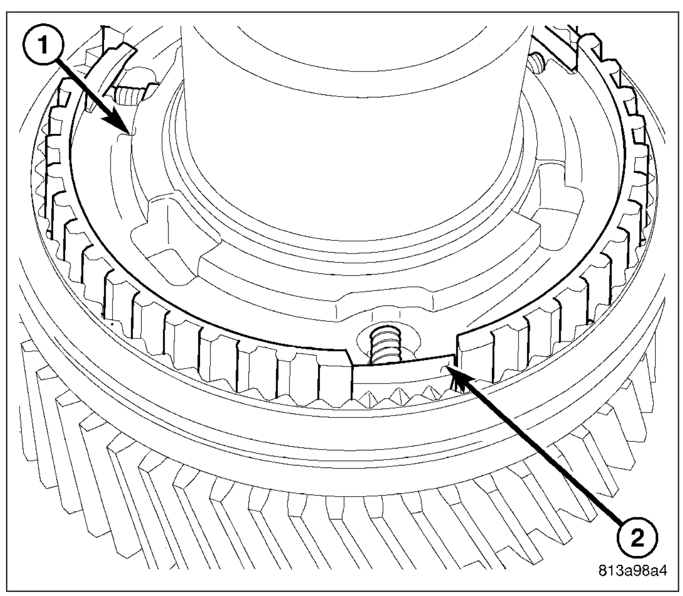
13. Remove reverse gear (1) and bearing (2).



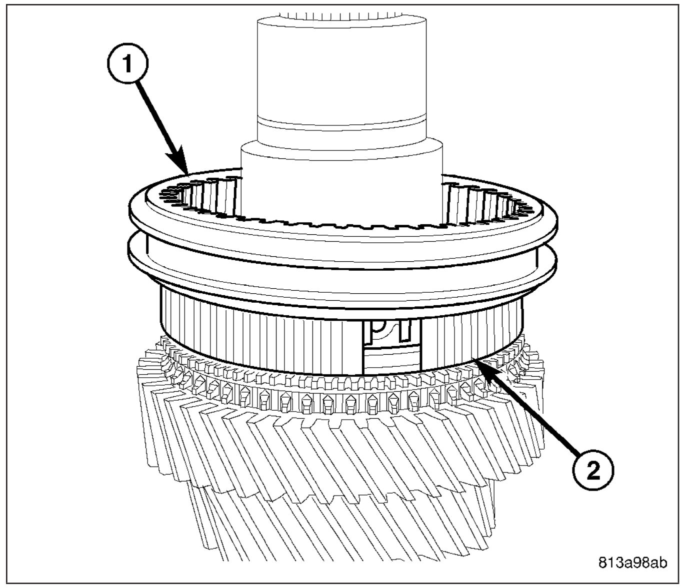

14. Remove reverse gear bearing race (1), thrust washer (2) and first gear (3) with puller (4). Place puller jaws under first gear (3).
15. Remove first gear bearing.




16. Remove first gear synchronizer rings.
17. Push 1-2 synchronizer sleeve down on synchronizer hub (1) detents (2), balls and springs.

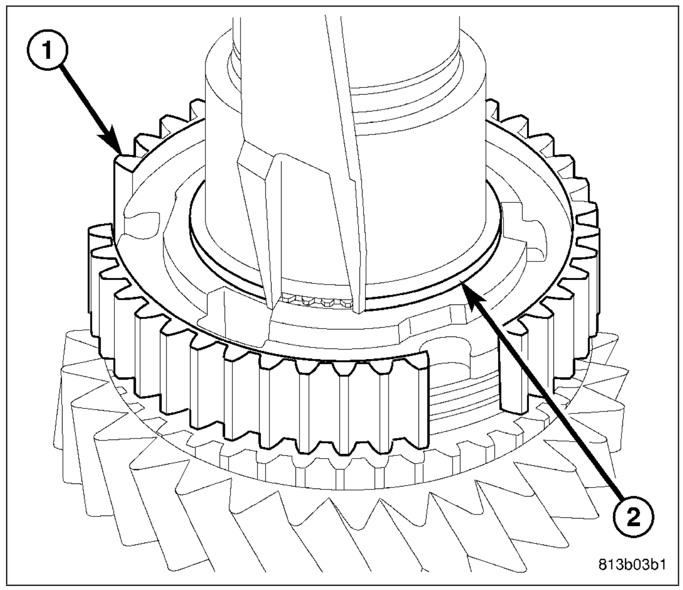


18. Remove 1-2 synchronizer sleeve (1) from synchronizer hub (2).

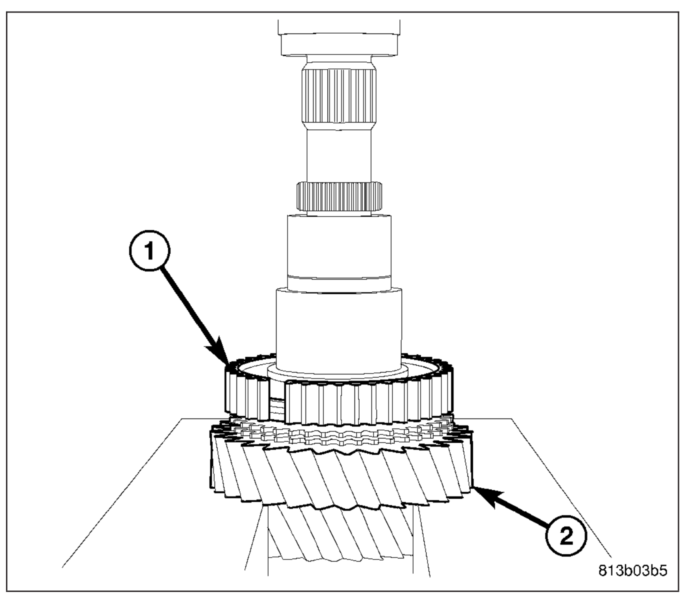



19. Remove 1-2 synchronizer hub (1) snap ring (2).

**NOTE: All snap rings are select fit from the factory, and must be installed in their original location.**

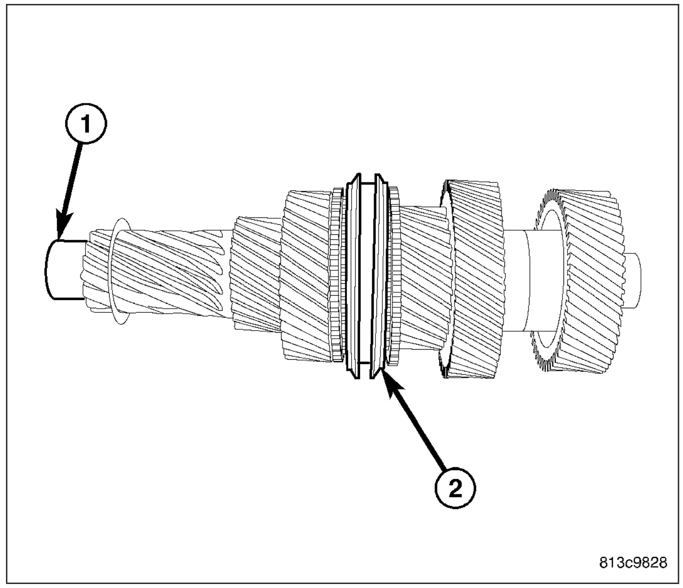



20. Remove 1-2 synchronizer hub (1), synchronizer rings and second gear (2) off shaft with a press. Place second gear (2) on press plates and press shaft through 1-2 synchronizer hub (1), synchronizer rings and second gear (2)



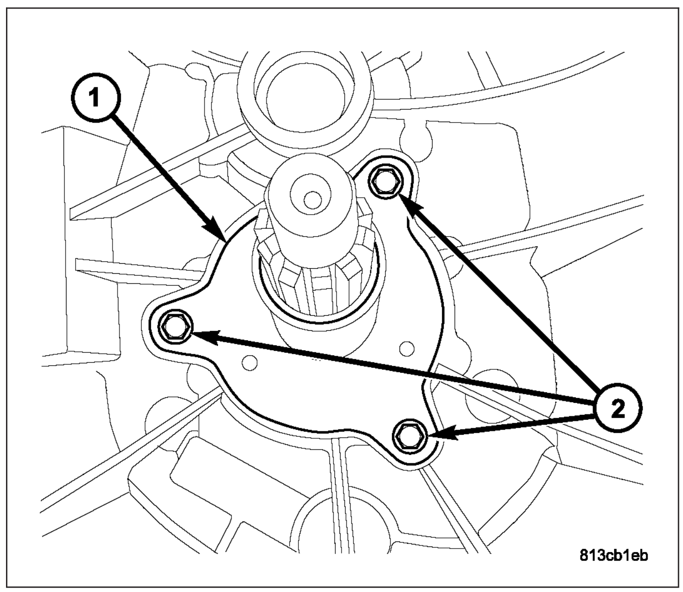
## COUNTERSHAFT

The countershaft (1) and 3-4 synchronizer (2) are serviced as an assembly only.

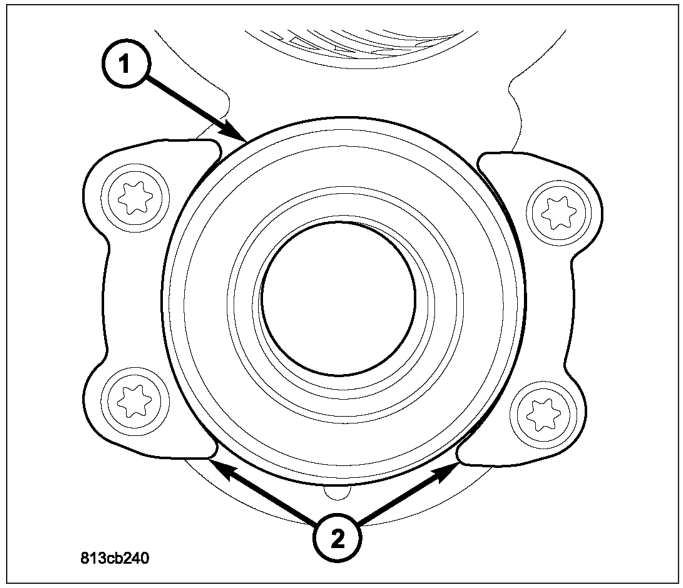



## FRONT HOUSING

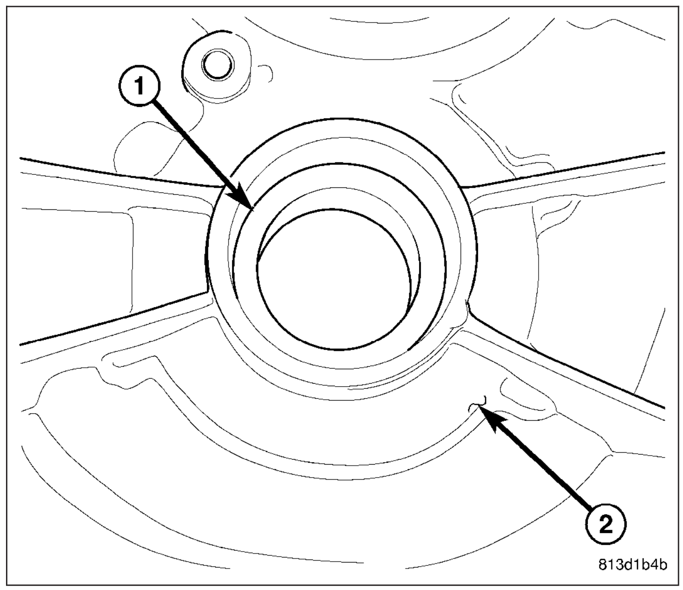
1. Remove input shaft retainer bolts (2) and remove retainer (1).



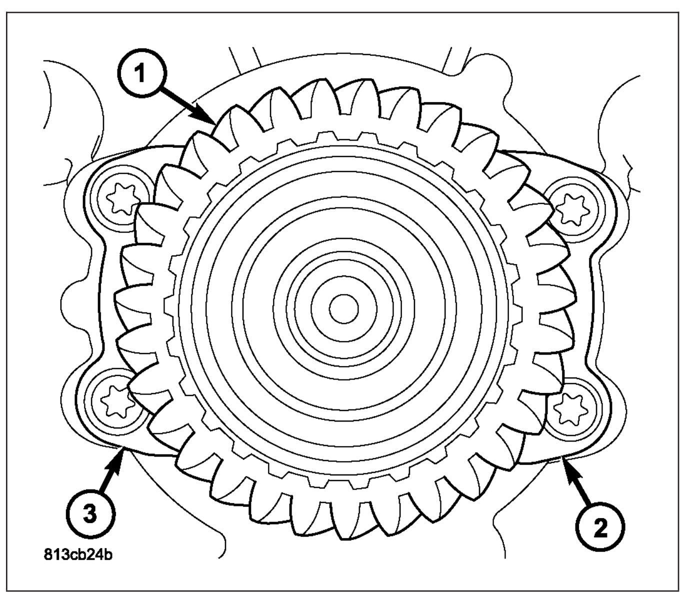
2. Remove countershaft bearing (1) retainer (2) bolts and remove retainers.



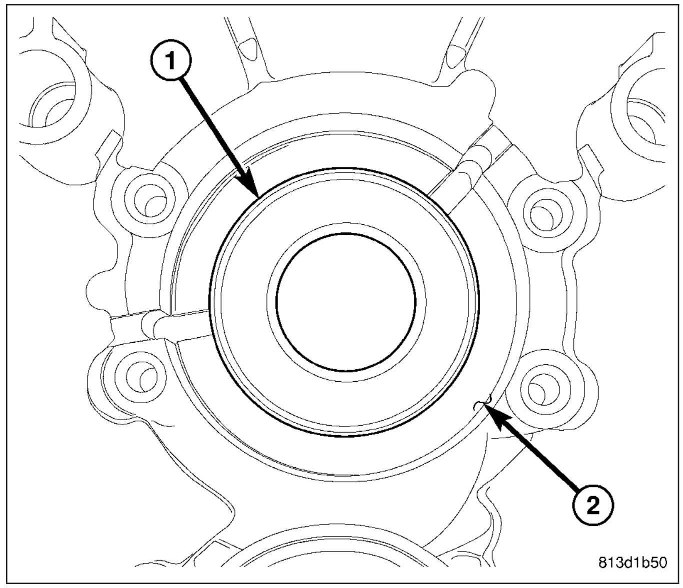

3. Remove countershaft bearing (1) from housing (2) with a hammer and driver.




4. Remove input shaft (1) bearing retainer bolts and remove retainers (2, 3).
5. Remove input shaft and bearing from housing with a dead blow hammer.



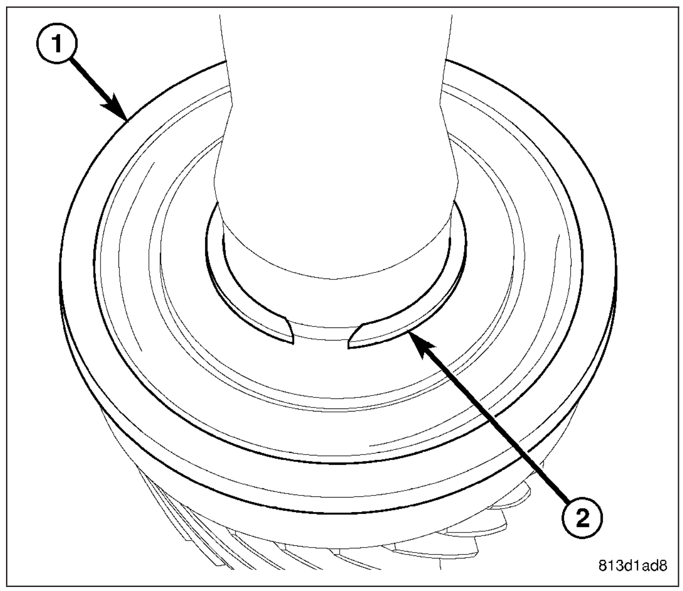
6. Remove input shaft seal (1) from housing (2) with a hammer and driver.



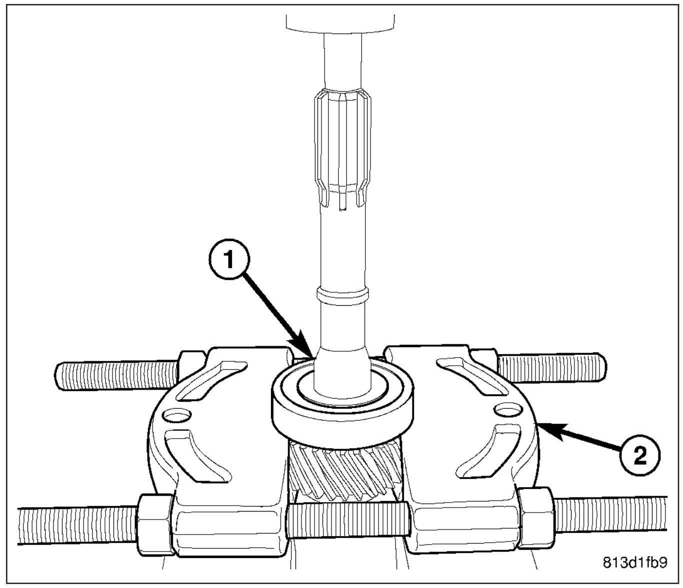

## INPUT SHAFT

1. Remove input shaft bearing (1) snap ring (2).

**NOTE: All snap rings are select fit from the factory, and must be installed in their original location.**

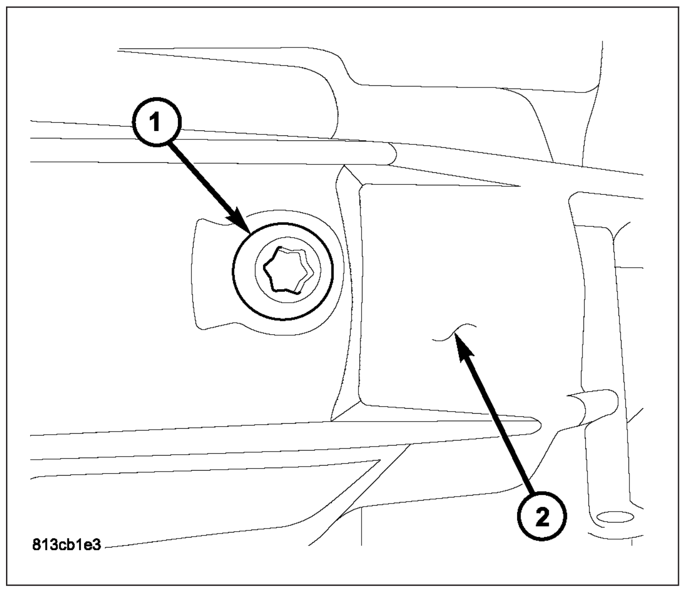


2. Remove input shaft bearing (1) from input shaft with a Splitter 1130 (2) and press. Place splitter around bearing retainer lip and press input shaft through the bearing.

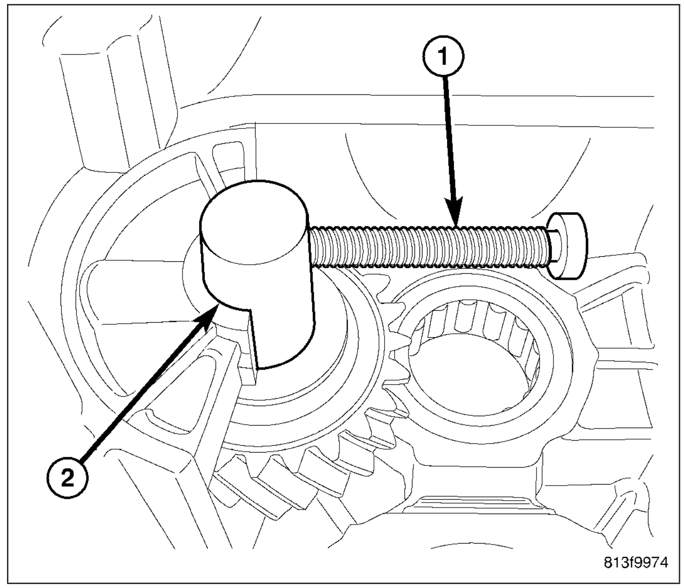



## REAR HOUSING

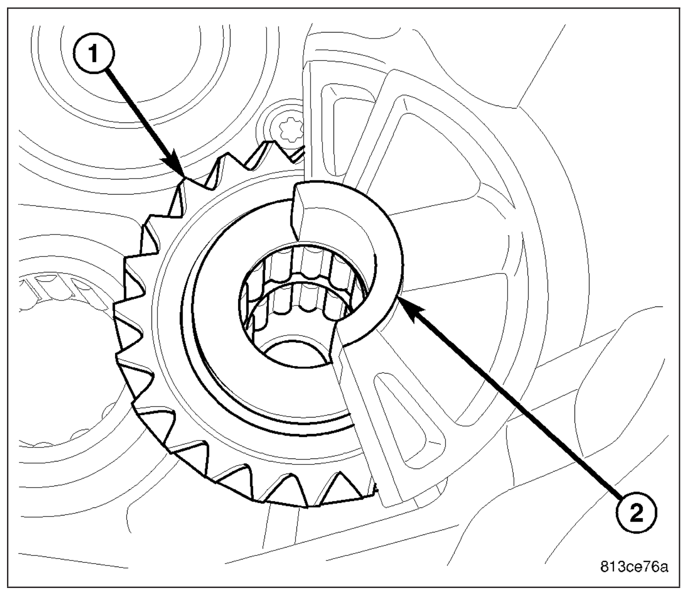
1. Remove reverse idler gear shaft bolt (1) from housing (2).



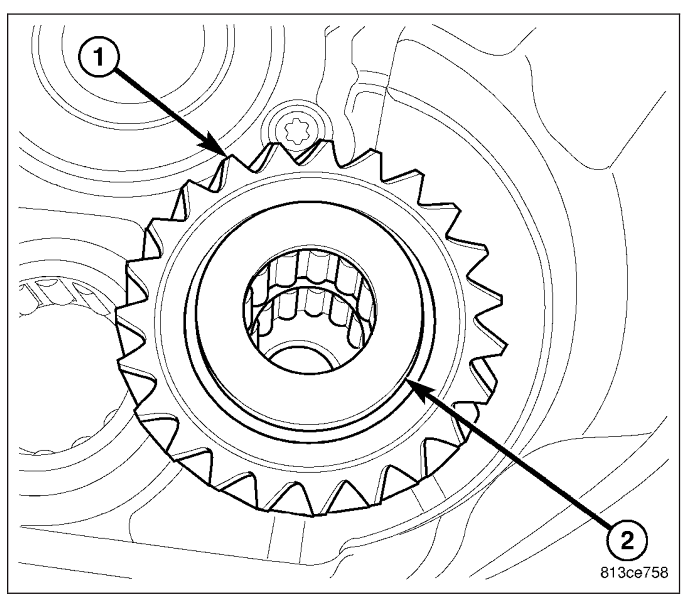
2. Thread idler gear shaft bolt (1) into the shaft (2). Then work shaft (2) out of the idler gear.



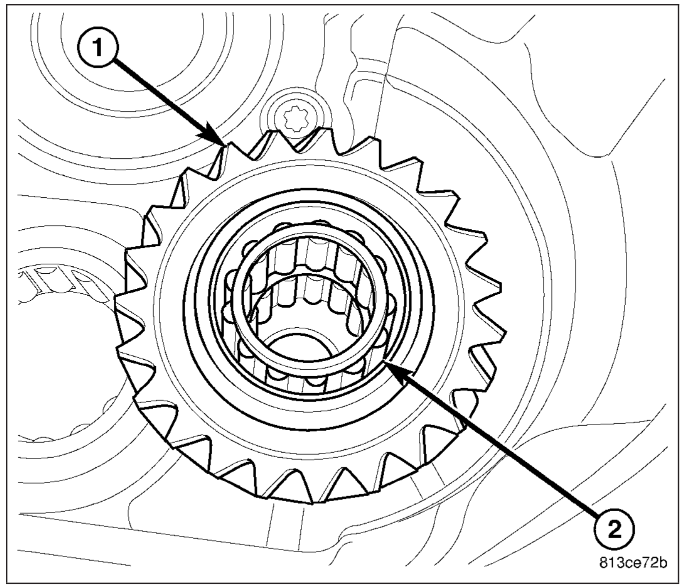

3. Remove reverse idler gear (1) shaft support (2).



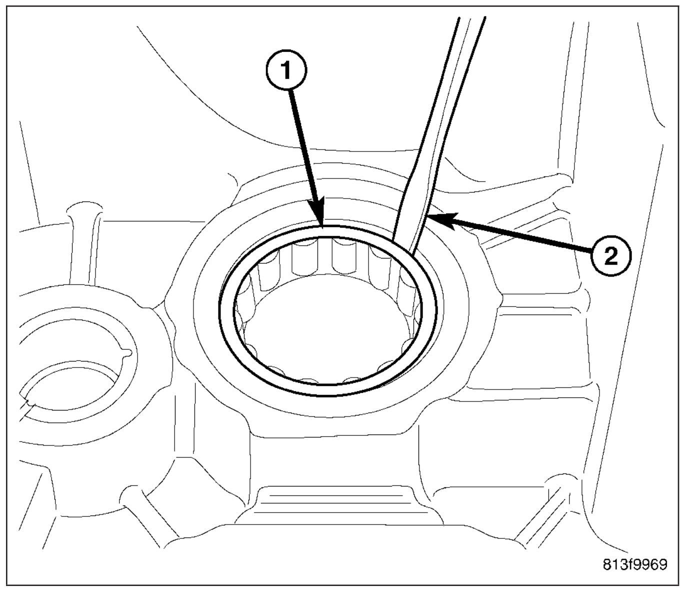

4. Remove reverse idler gear (1) thrust washer (2).



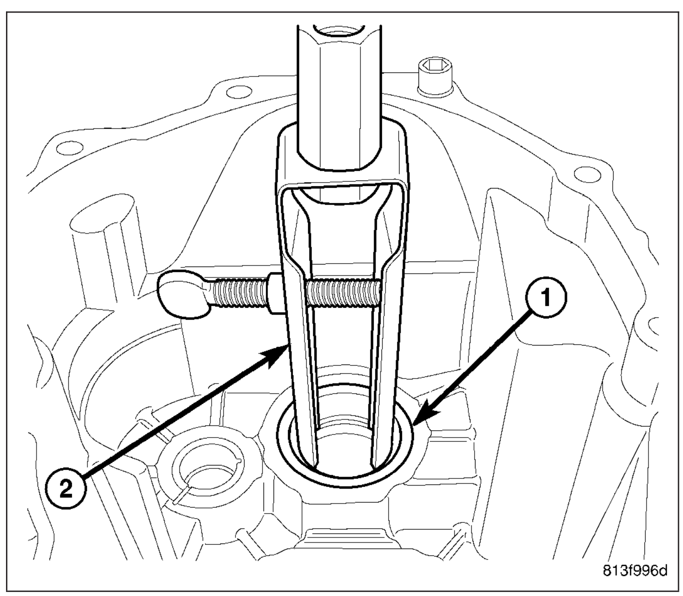
5. Remove reverse idler gear (1) and bearing (2).



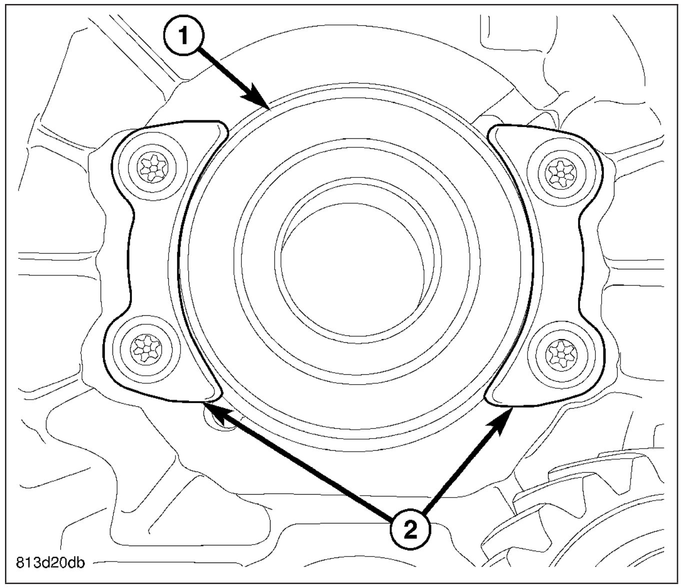

6. Break plastic countershaft roller bearing cage (1) with a screw driver (2). Then remove cage and roller bearing.




7. Remove countershaft roller bearing shell (1) from the rear housing with Remover 7794-A (2) and Slide Hammer C-637.



8. Remove mainshaft bearing (1) retainer bolts and remove retainers (2).
9. Remove bearing from housing with a hammer and driver.




## CLEANING

Clean gears, shafts, shift components and transmission housings with a standard parts cleaning solvent. Do not use acid or corrosive base solvents. Dry all parts except bearings with compressed air.

Clean shaft bearings with a mild solvent such as Mopar™ degreasing solvent or similar solvents. Do not dry the bearings with compressed air. Allow the bearings to either air dry or wipe them dry with clean shop towels.

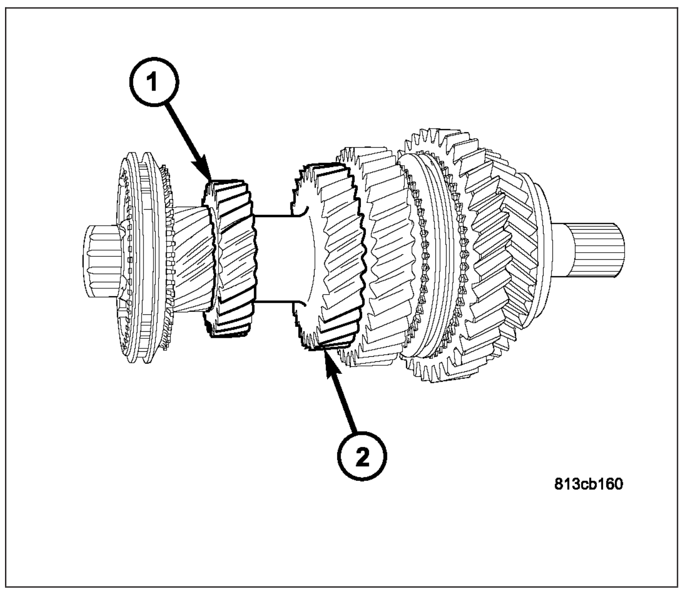
## INSPECTION

**NOTE: Minor corrosion, nicks, or pitting can be smoothed with 400 grit emery and polished out with crocus cloth.**

**Bearings:** Inspect for worn, cracked, flat-spotted or brinnelled.

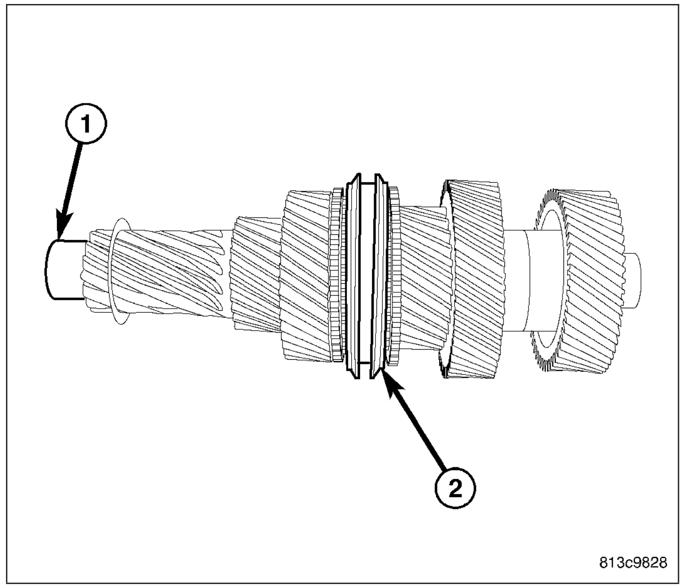
**Gears:** Inspect for worn, chipped or cracked teeth. Inspect bearing surfaces for ware or flat-spotted.

**Mainshaft:** Inspect for worn splines, snap ring grooves and threads. Inspect bearing surfaces for ware or flat-spotted. **Third gear (1) and fourth gear (2) are serviced with mainshaft only.**

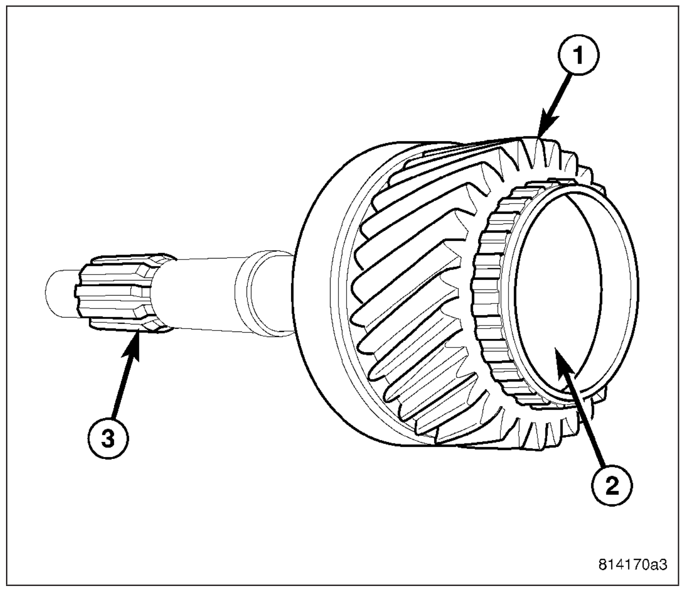


**Countershaft:** Inspect for worn, chipped or cracked teeth. Inspect bearing surfaces (1) for wear or flat-spots. Inspect 3-4 synchronizer assembly (2). Inspect oil slinger for cracks. **The countershaft is serviced as an assembly.**

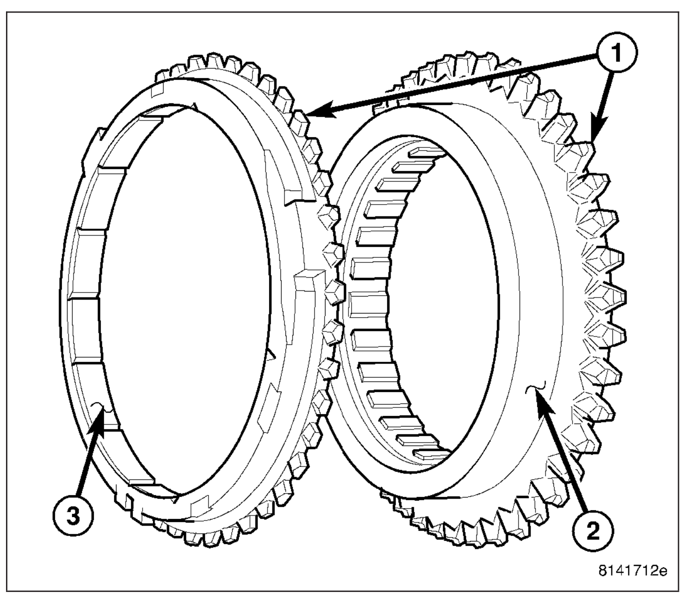
**Oil Slinger:** Inspect first/reverse oil slinger for cracks.




**Input Shaft:** Inspect for worn, chipped or cracked teeth (1). Inspect bearing surface (2) for wear or flat-spots. Inspect for worn splines (3).

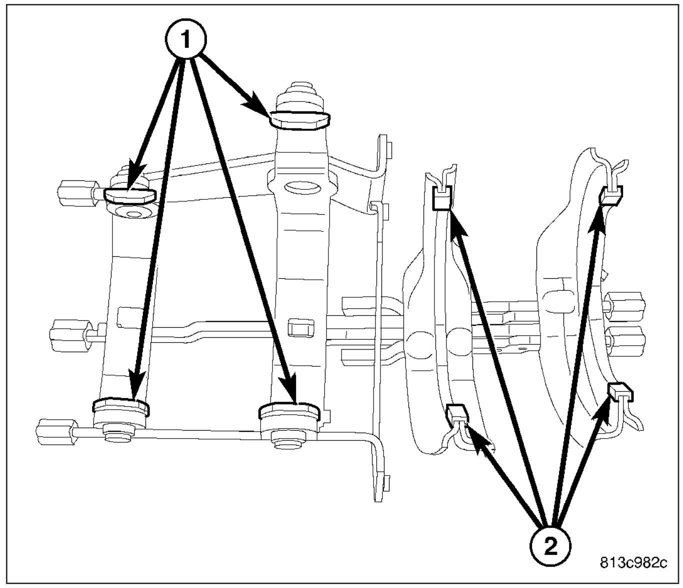



**Synchronizer components:** Inspect for worn, chipped or cracked teeth (1) and burned friction surface (2) or flaking off friction material (3). **Synchronizers are serviced as an assembly. 3-4 synchronizer assembly (2) is serviced with countershaft.**

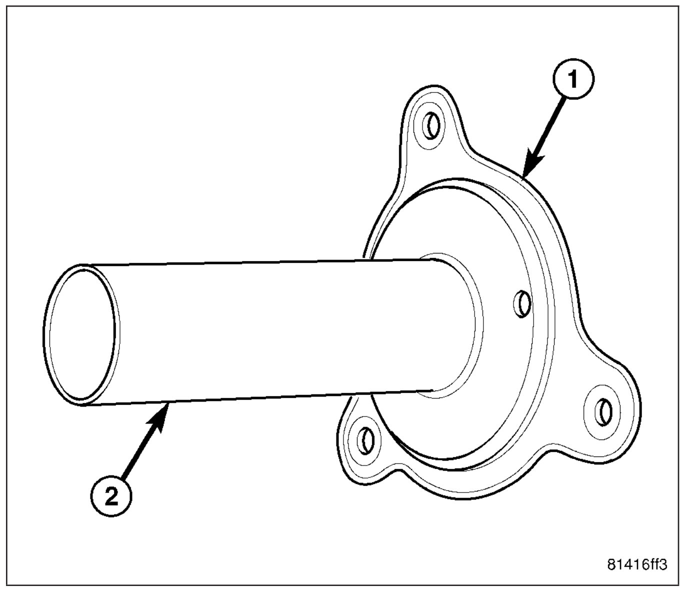


**Shift forks:** Inspect shift forks and shoes (1) for wear and distortion. Check fit of fork shoes in synchronizer sleeve to ensure parts fit and work smoothly, replace if necessary. If shift fork pads (2) are worn, the shift fork must be replaced.

**Housing/Tail housing:** Inspect sealing and mating surfaces are free of burrs and nicks. Inspect alignment dowels are tight and in good condition.



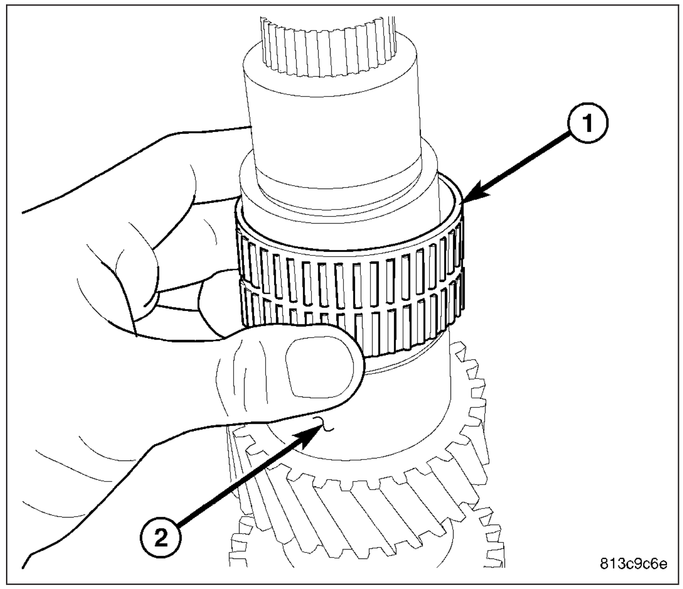

**Input Shaft Retainer:** Inspect retainer (1) release bearing slide surface (2).



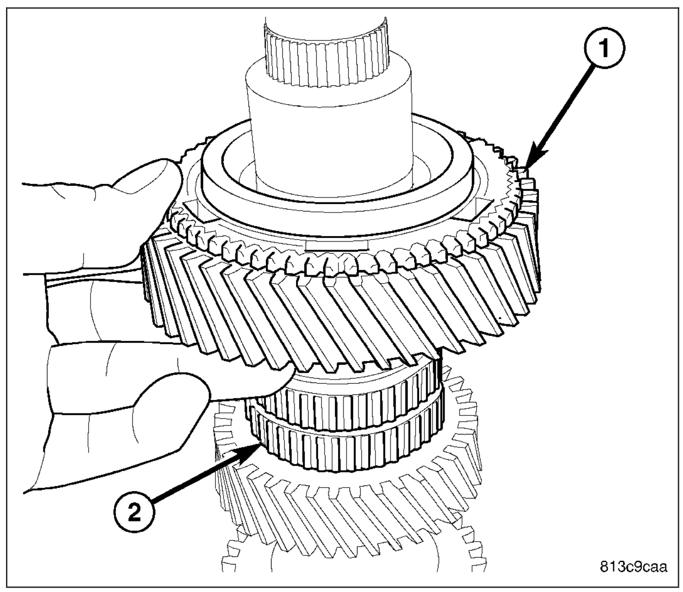
## ASSEMBLY

### MAINSHAFT

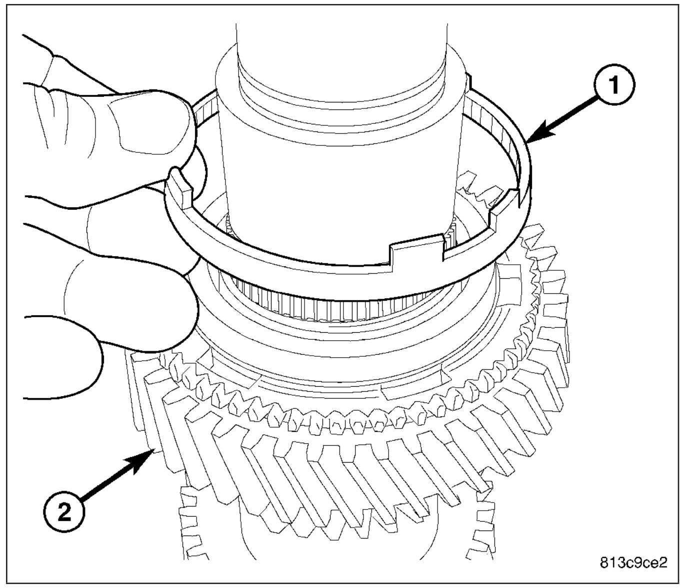
1. Place mainshaft in Fixture 9648 mounted in a vise.
2. Install second gear bearing (1) on mainshaft (2).



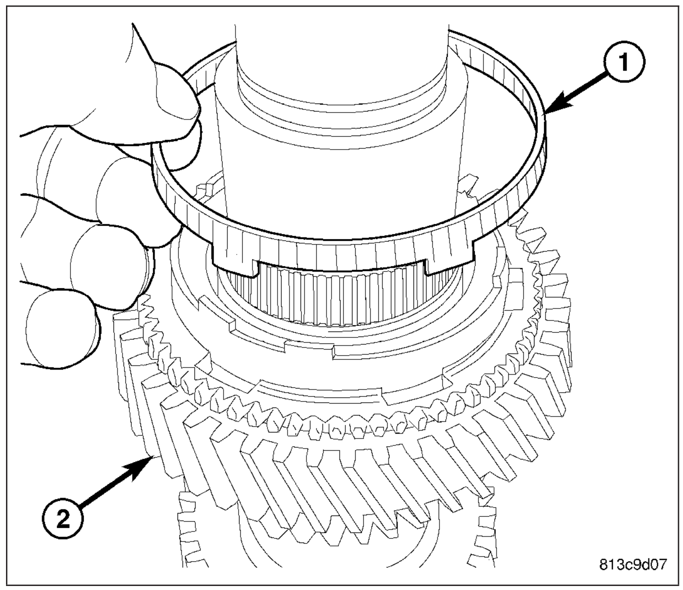

3. Install second gear (1) and bearing (2) on mainshaft.



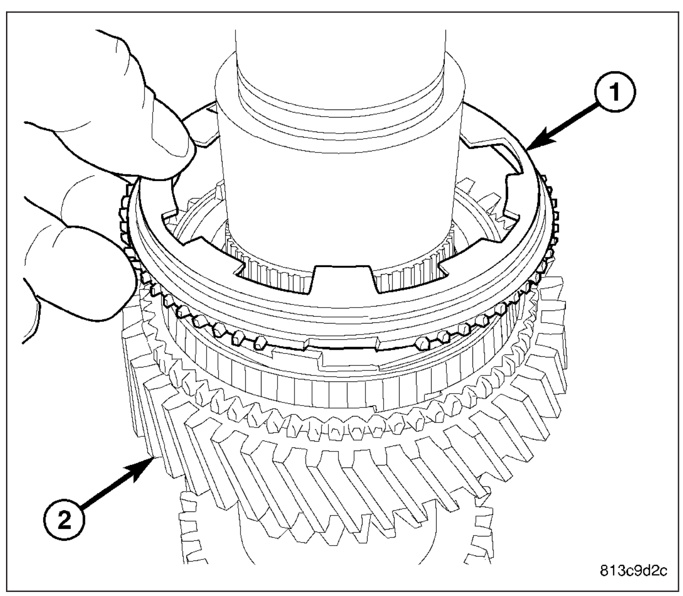
4. Install inner synchronizer friction ring (1) on second gear (2).



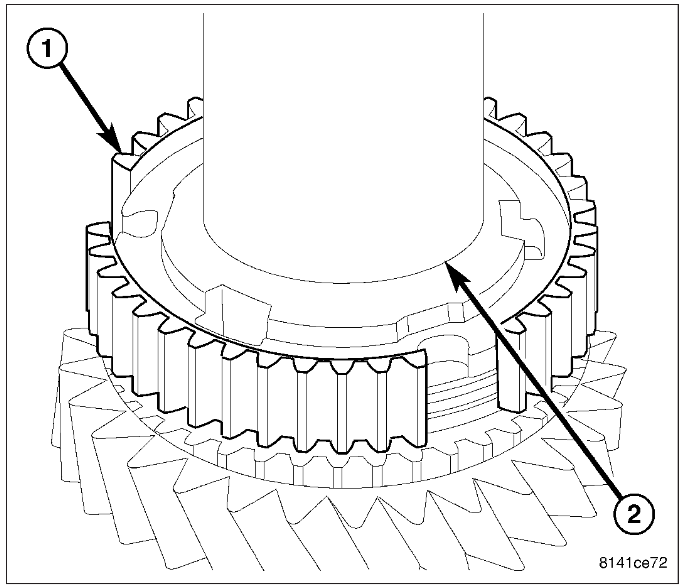

5. Install outer synchronizer friction ring (1) on second gear (2).




6. Install synchronizer blocker ring (1) on second gear (2).

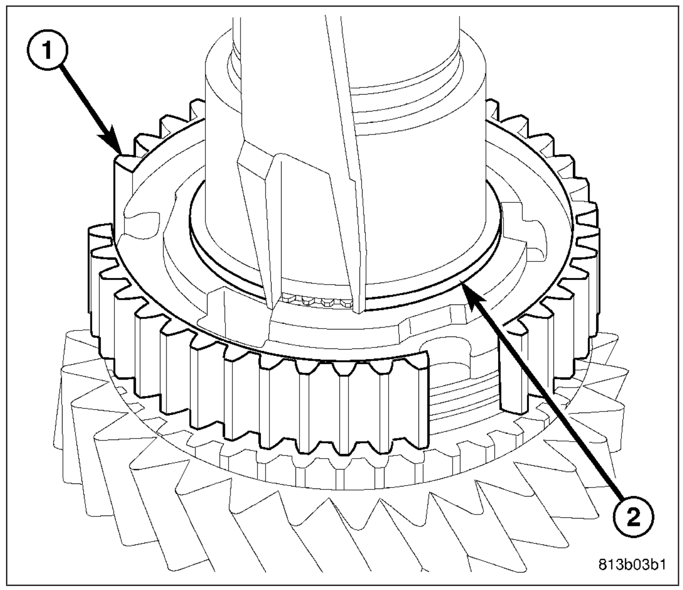


7. Install 1-2 synchronizer hub (1) with Installer 8228 (2) and a press. Align hub detent openings with synchronizer rings.

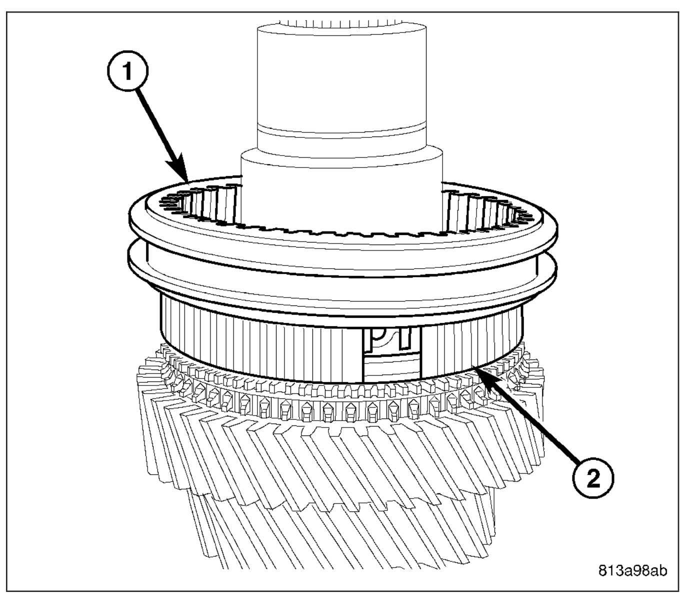



8. Install 1-2 synchronizer hub (1) snap ring (2).

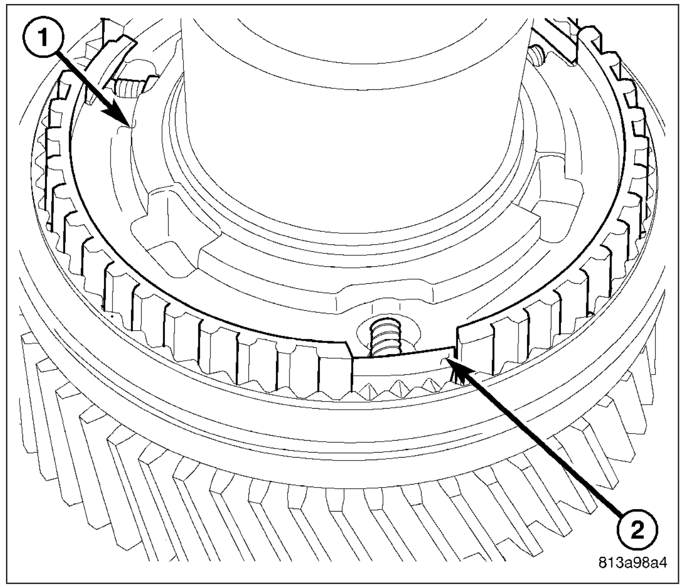
**NOTE: Reuse original snap ring or thickest ring that will fit.**



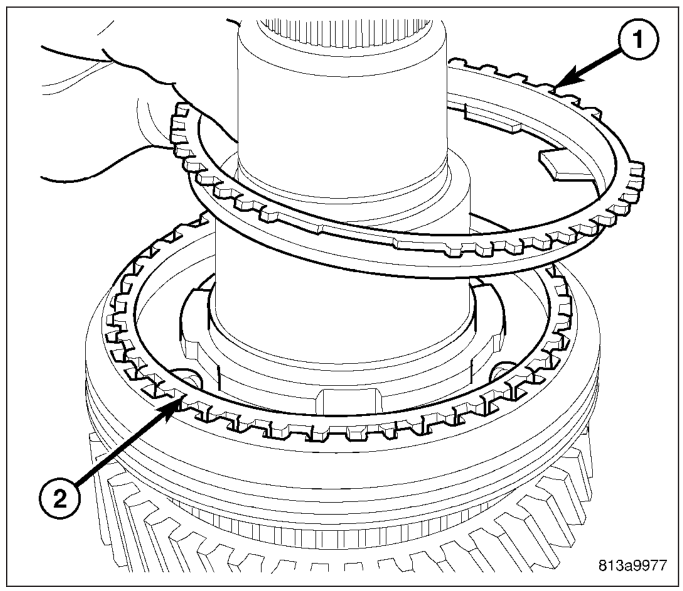

9. Install 1-2 synchronizer sleeve (1) and push to the bottom of the synchronizer hub (2).



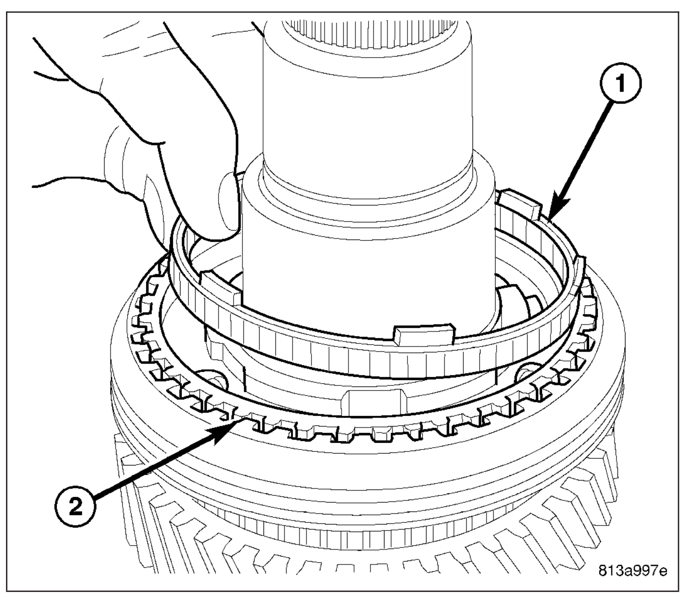
10. Install 1-2 synchronizer hub (1) detents, springs, and balls (2).



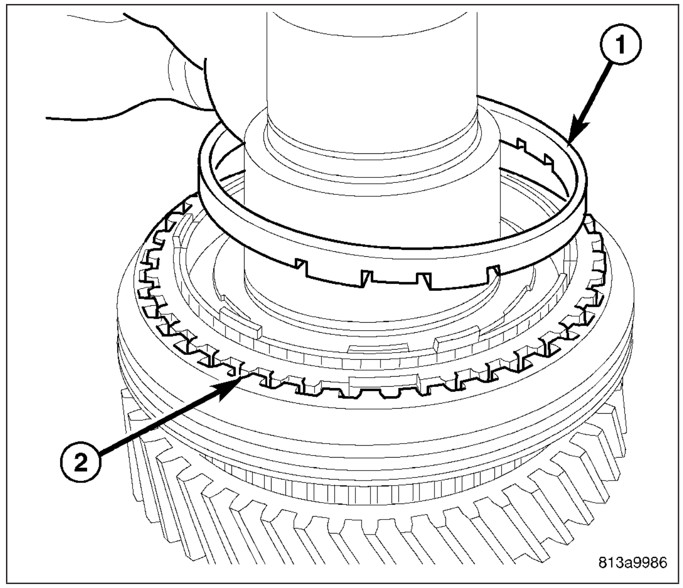

11. Install first gear blocker ring (1) into synchronizer hub (2).



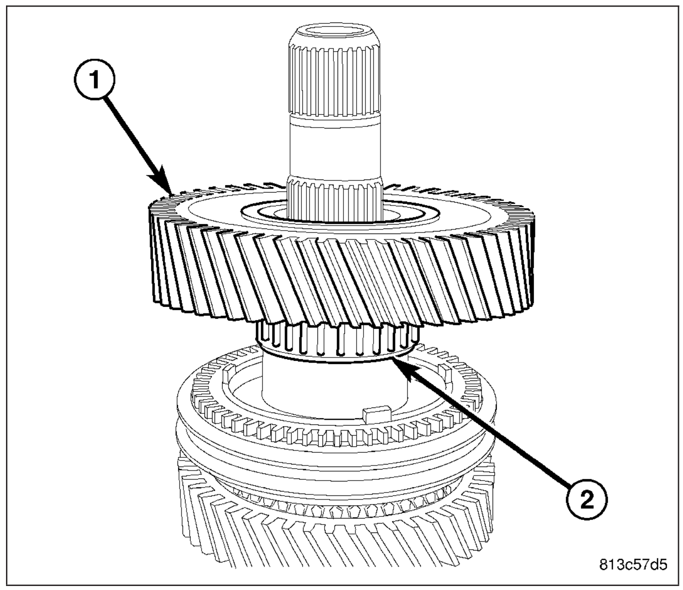

12. Install first gear outer friction ring (1) into synchronizer hub (2).



13. Install first gear inner friction ring (1) into synchronizer hub (2).

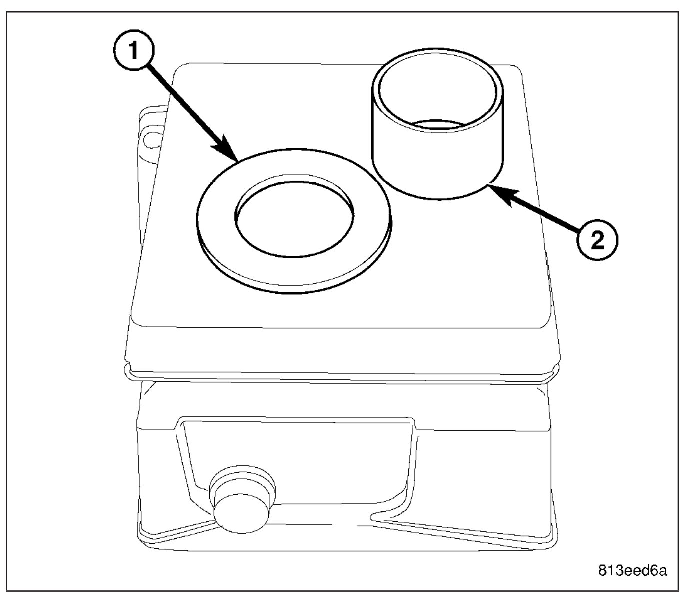



14. Install first gear (1) and bearing (2). Then center 1-2 synchronizer sleeve on synchronizer hub.

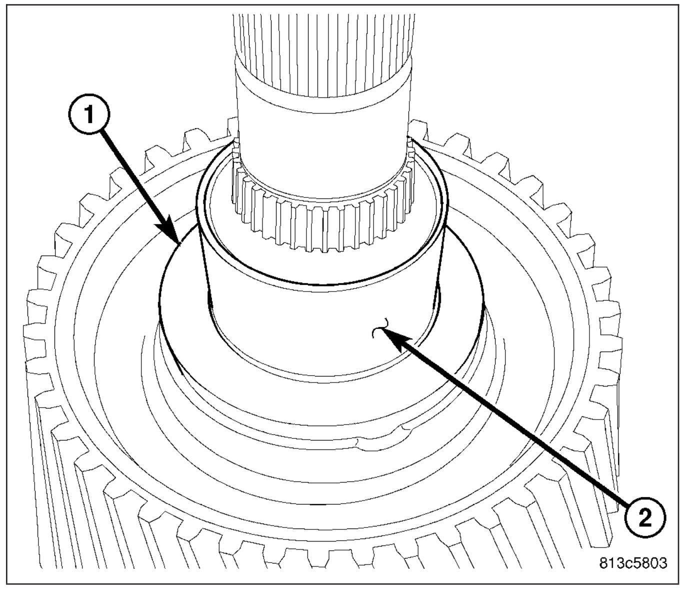



**WARNING: Use welding gloves when handling heated components. Failure to follow these instructions will result in personal injury.**

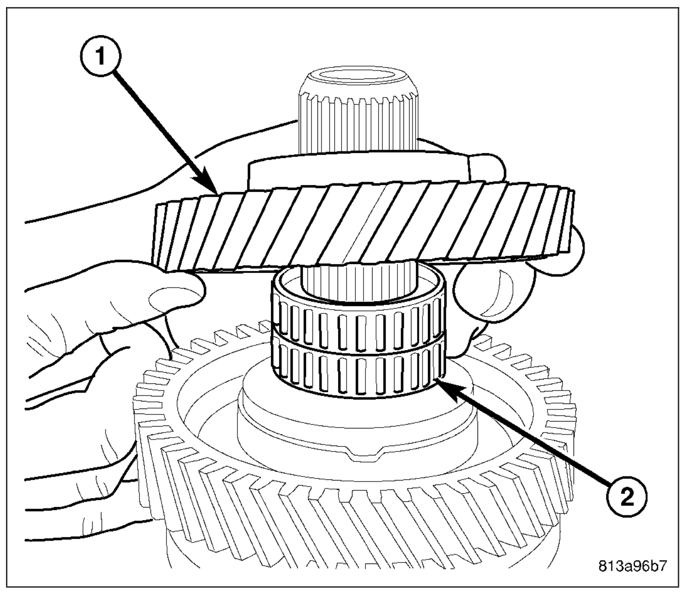
**CAUTION: A bearing heater is used to assembly first gear thrust washer (1) and reverse gear bearing race (2). Use only a bearing heater/hot plate and follow manufacture's instructions. Heat components to 100 - 177 Celsius (212° Min. - 350° Max Fahrenheit). Never use an open flame to heat components. Never leave components on heater for and extended amount of time. If component is discolored after heating, the component has been overheated and must not be used. Failure to follow these instructions will result in component damage.**



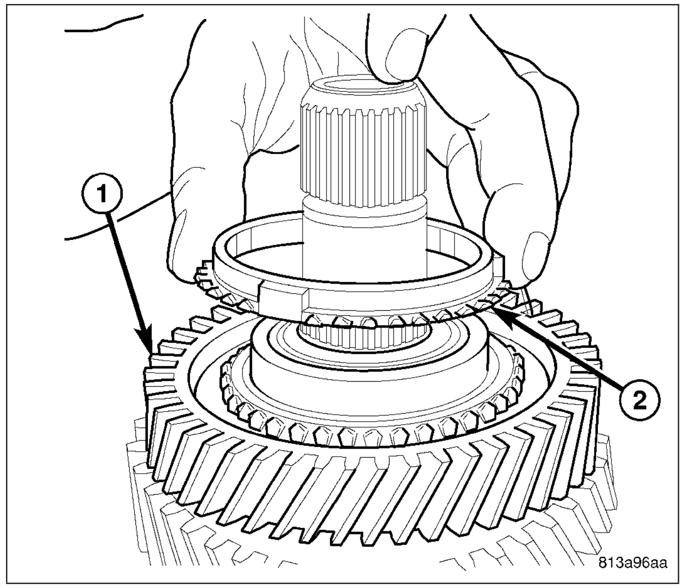
15. Heat first gear thrust washer (1) and reverse gear bearing race (2) with bearing heater to maximum of 177 Celsius (350° Fahrenheit).
16. Using welding gloves or tongs, install first gear thrust washer (1) then reverse gear bearing race (2).



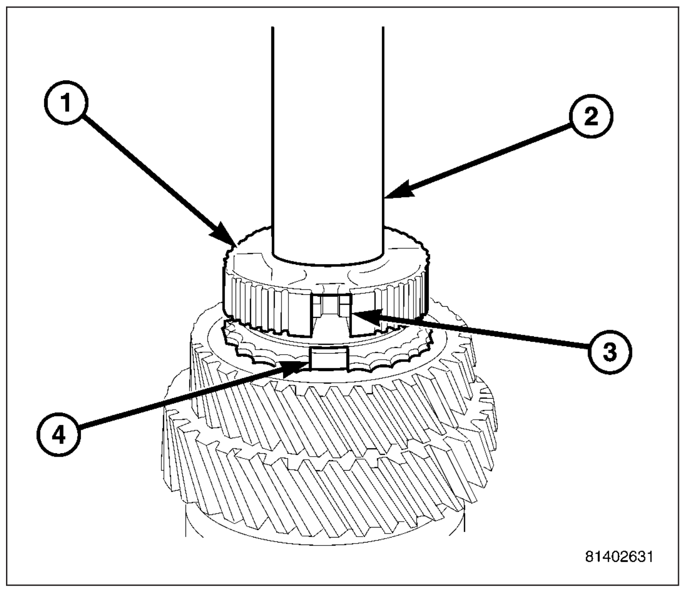

17. Install reverse gear (1) and bearing (2).



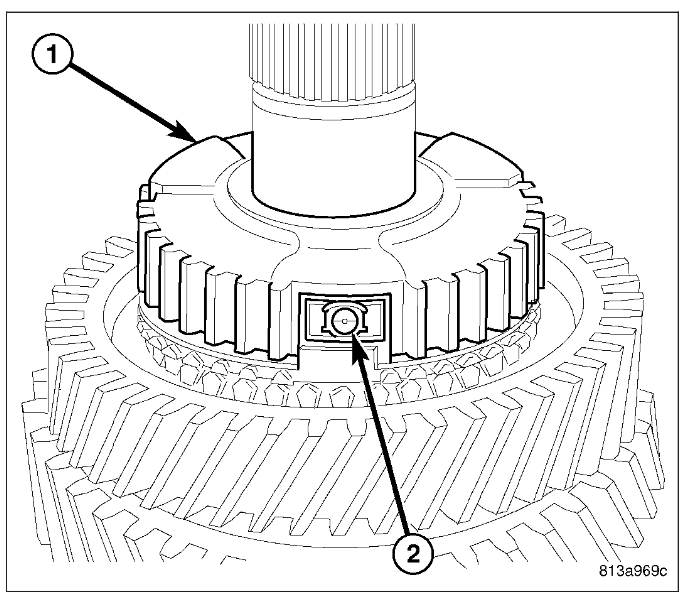
18. Install reverse gear (1) synchronizer friction ring (2).



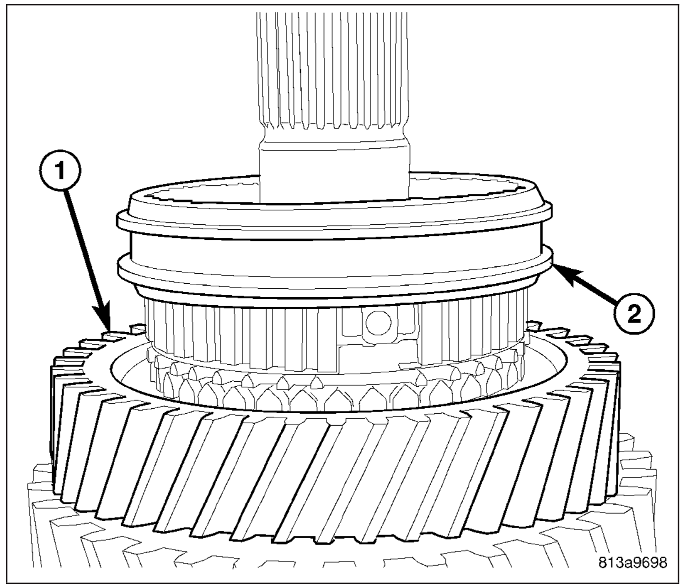

19. Install reverse gear synchronizer hub (1) on main-shaft with Installer W-262 (2) and a press. Align hub detent opening (3) with friction ring (4) lugs.



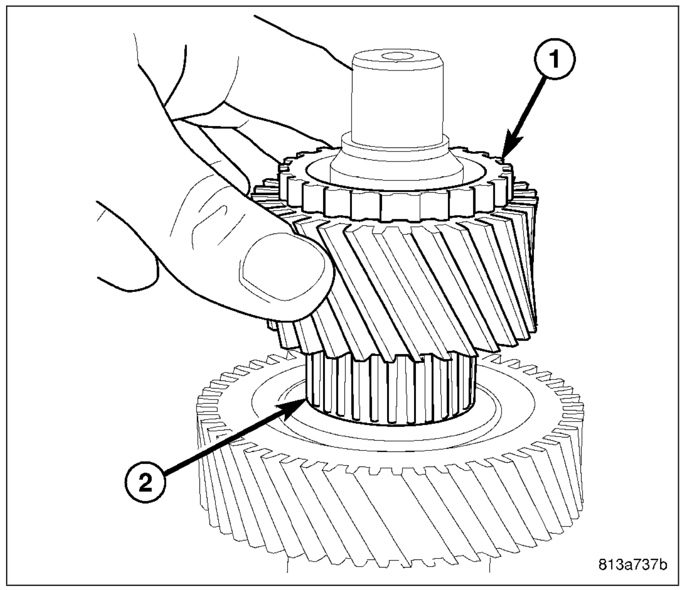

20. Install reverse gear synchronizer hub (1) detents (2).



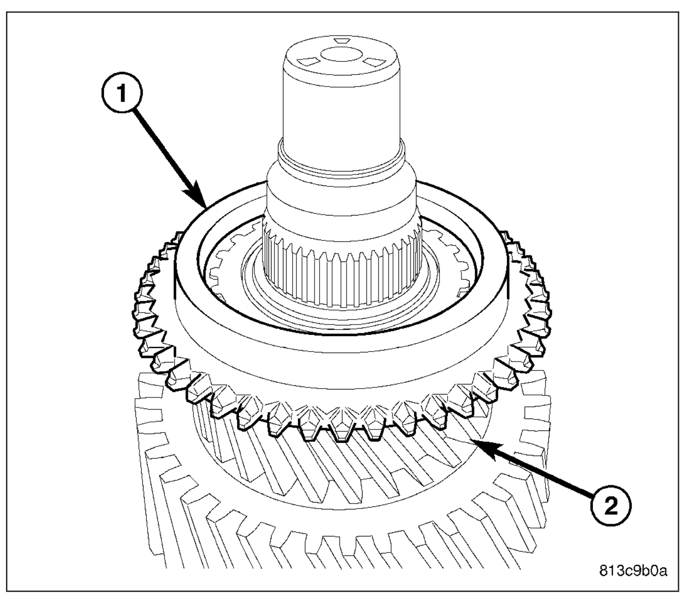
21. Install reverse gear (1) synchronizer sleeve (2) and center sleeve on synchronizer hub.
22. Remove mainshaft from Fixture 9648. Turn fixture over in the vise, then install opposite end of mainshaft in the fixture.



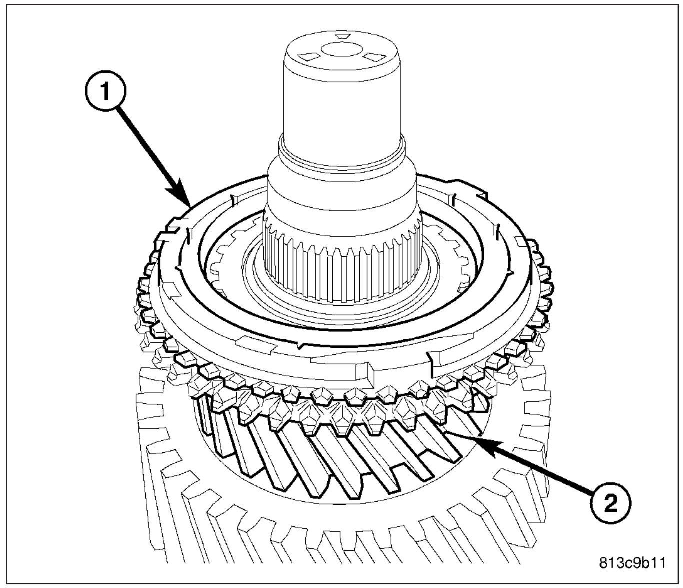

23. Install sixth gear (1) and bearing (2) on mainshaft.




24. Install sixth gear synchronizer blocker ring (1) on sixth gear (2).

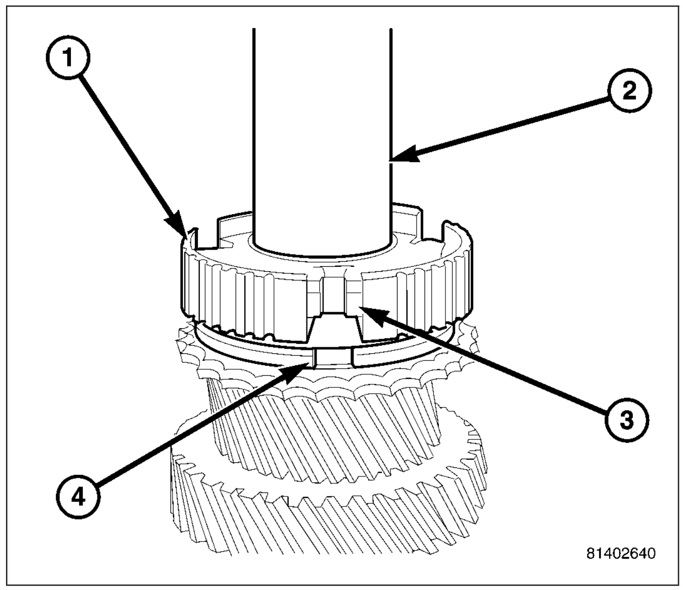


25. Install sixth gear synchronizer friction ring (1) on sixth gear (2).




26. Install 5-6 synchronizer hub (1) with Installer W-262 (2) and a press. Align hub detent opening (3) with friction ring lugs (4).

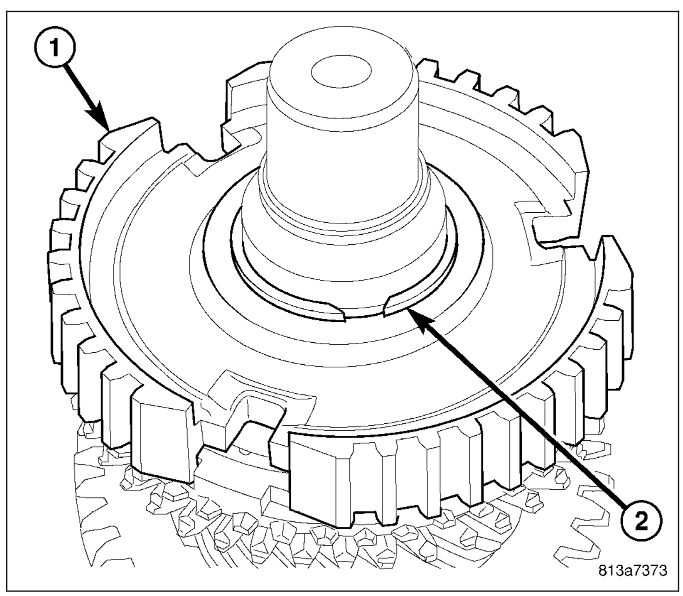
**NOTE: 5-6 synchronizer hub center, is offset and must be install larger offset down.**




27. Install 5-6 synchronizer hub (1) snap ring (2).

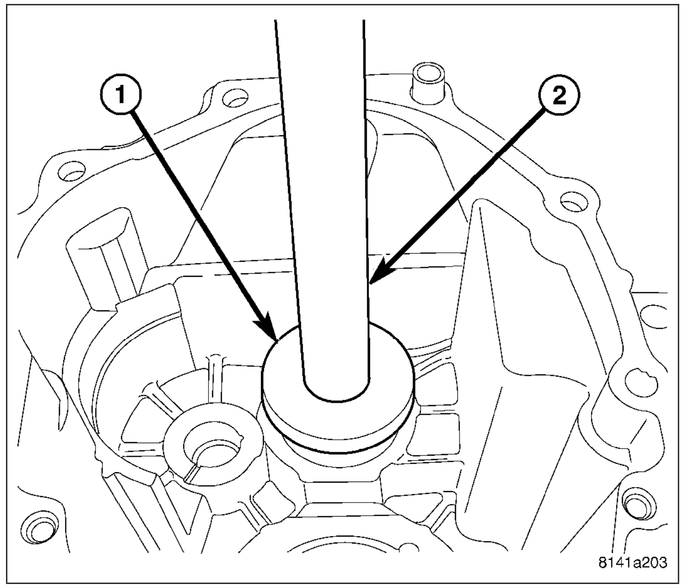
**NOTE: Reuse original snap ring or thickest ring that will fit.**

28. Install 5-6 synchronizer sleeve on hub (1).

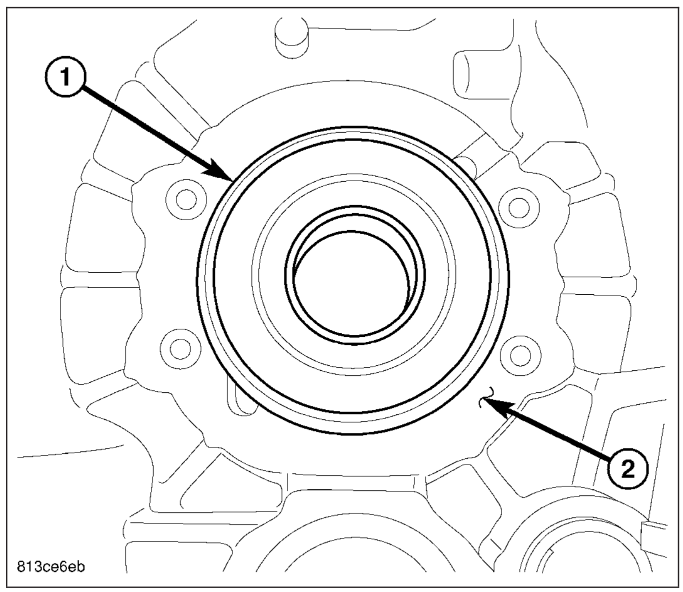


## REAR HOUSING

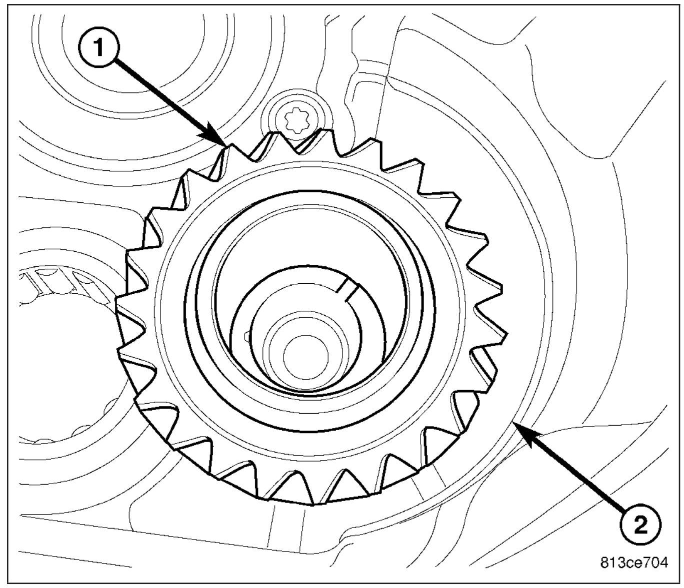
1. Install countershaft bearing into rear housing with Installer 9643 (1) and Handle C-4171 (2).



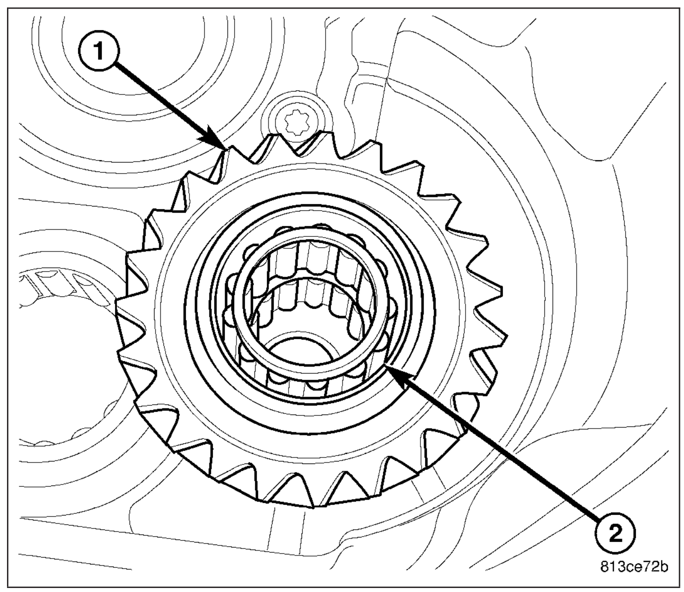

2. Install mainshaft bearing (1) into housing (2).
3. Install bearing retainer and tighten bolts to 10 N·m (7.3 ft. lbs.).



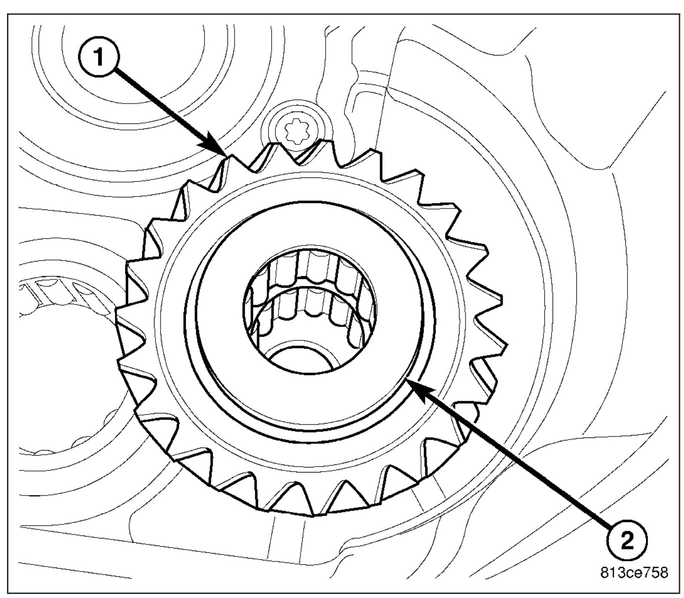
4. Install reverse idler gear (1) into housing (2).



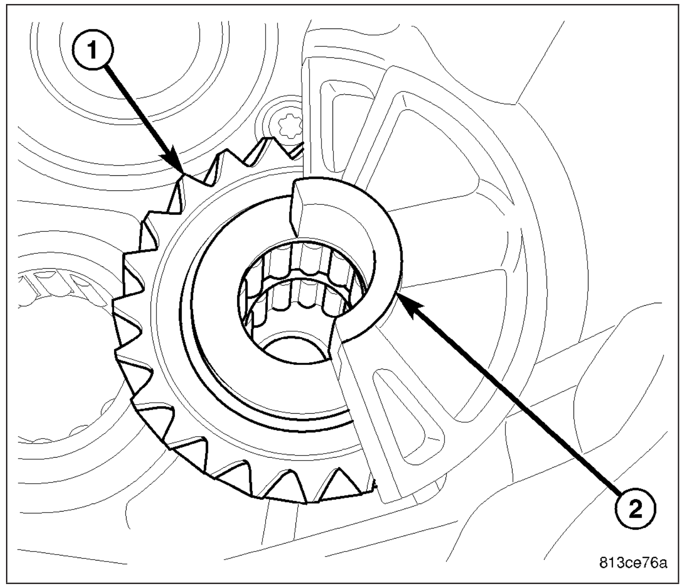

5. Install idler gear (1) bearing (2) into gear.



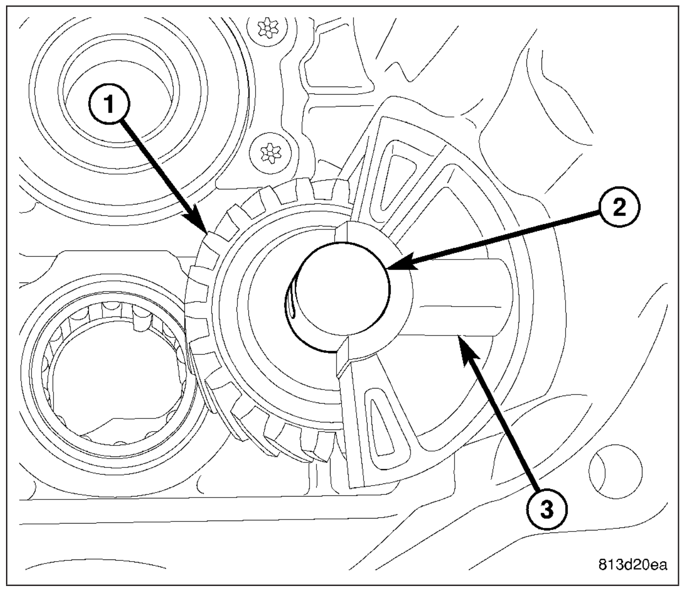

6. Install idler gear (1) thrust washer (2) on idler gear.



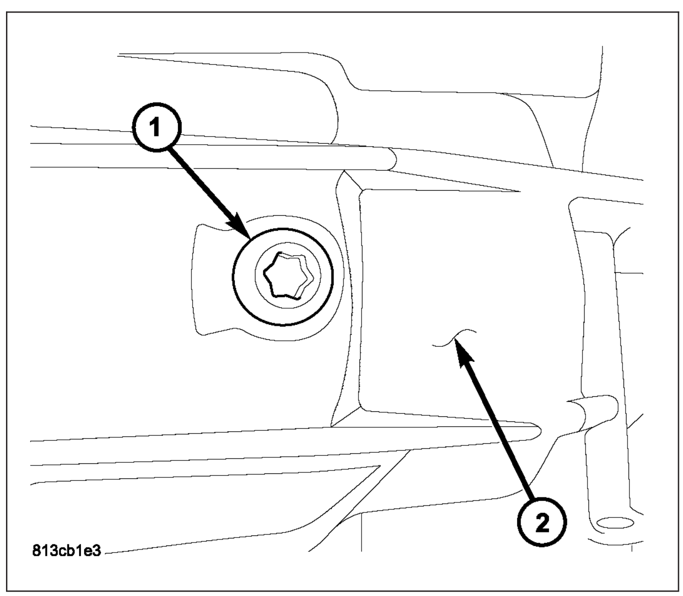
7. Install idler gear (1) shaft support (2) into housing.



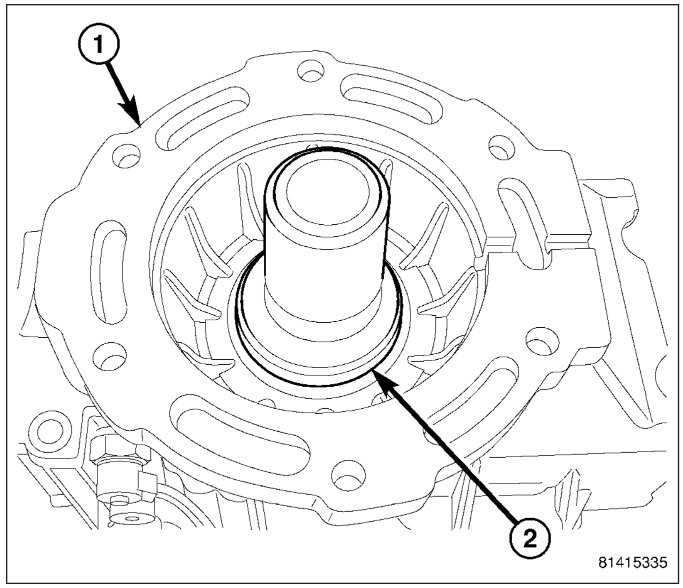

8. Install idler gear (1) shaft (2) with shaft bolt hole aliened with shaft support hole (3).




9. Install idler gear shaft bolt (1) into the housing (2) and tighten to 20 N.m (15 ft. lbs.).

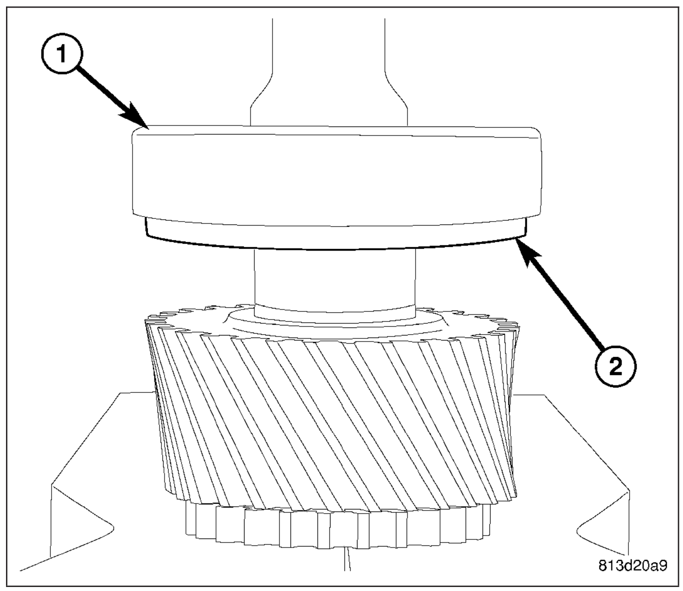


10. Install 4x4 output shaft seal into rear housing (1) with Installer 9638 (2). Install 4x2 output shaft seal into rear housing with Installer 9635 and Installer 6448A.

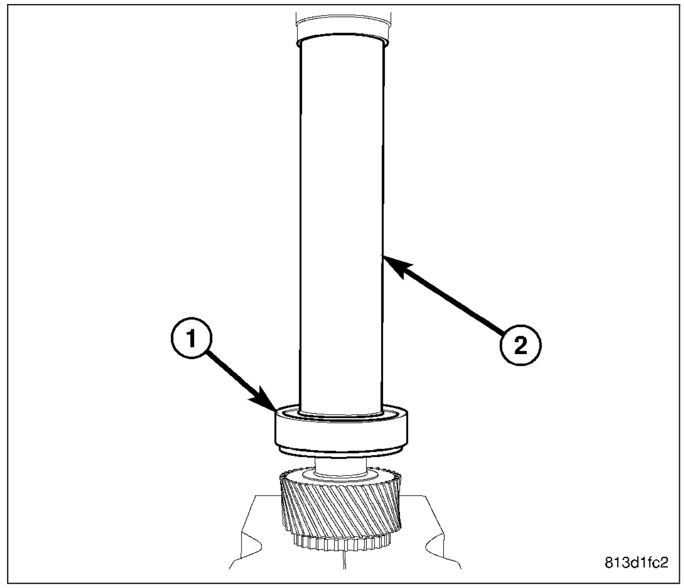



## INPUT SHAFT

1. Install input shaft bearing (1) on input shaft with the bearing retainer lip (2) facing fifth gear.

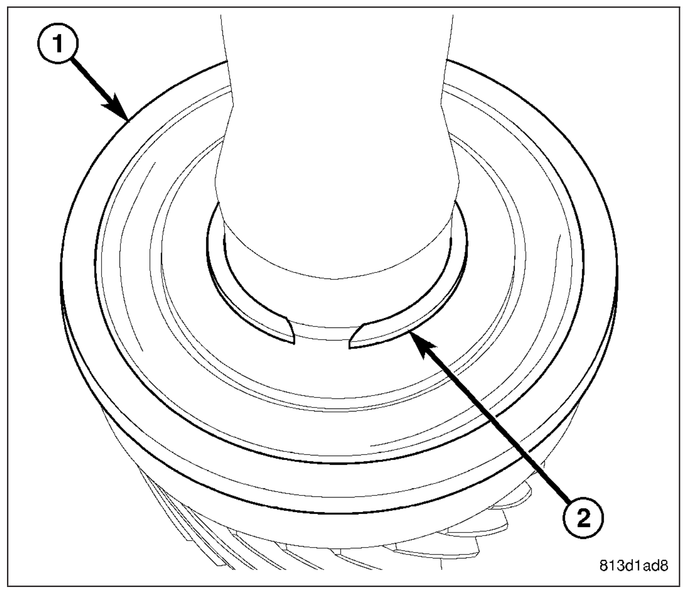


2. Install input shaft bearing (1) with Installer 6448A (2) and a press.



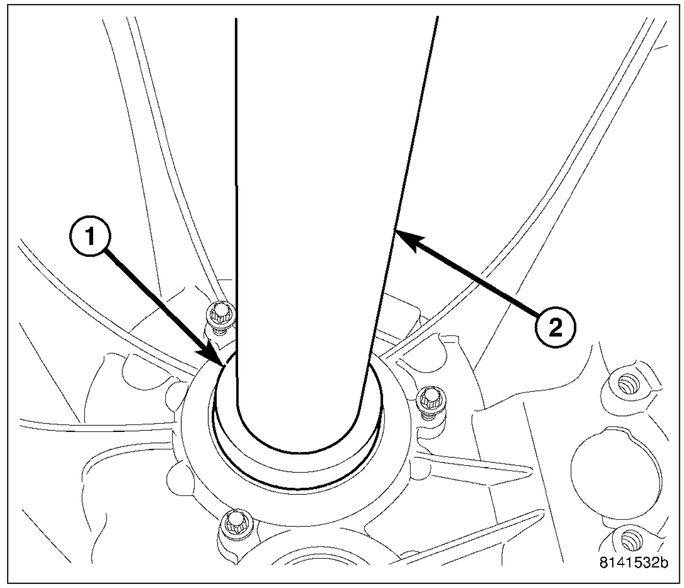

3. Install input shaft bearing (1) snap ring (2).

**NOTE: Reuse original snap ring or thickest ring that will fit.**

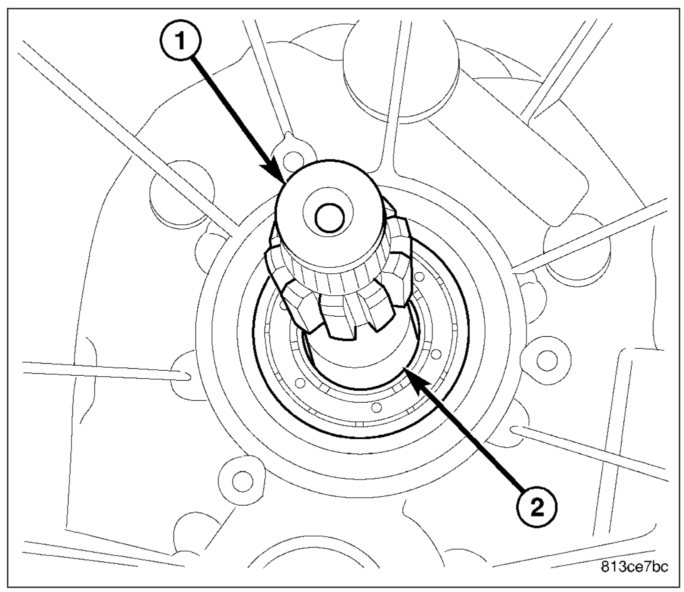


## FRONT HOUSING

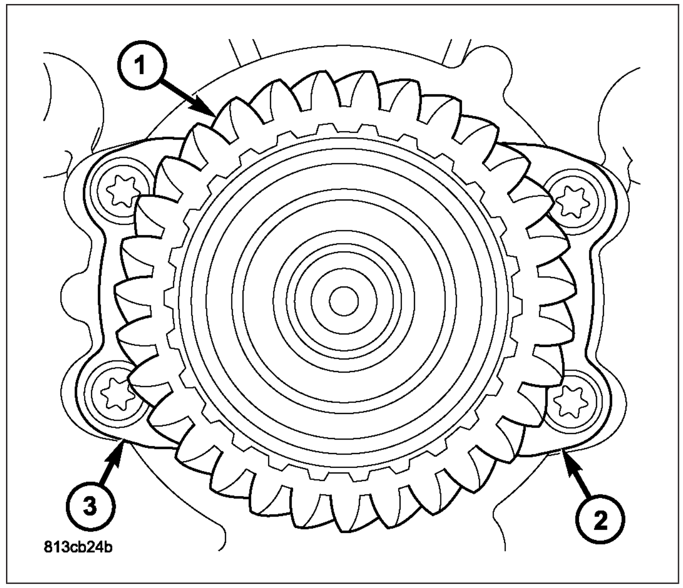
1. Install input shaft seal with Installer 9635 (1) Installer 6448A (2).



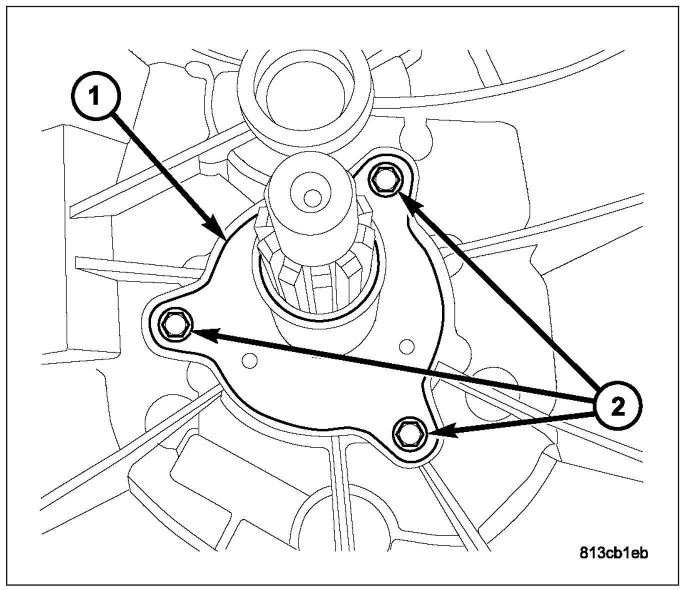

2. Install input shaft (1) with bearing (2) into housing.



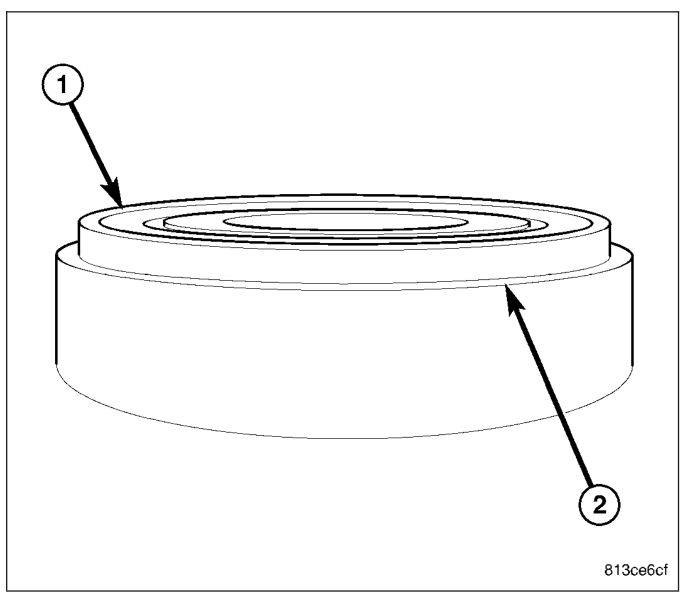
3. Install input shaft (1) bearing retainers (2, 3) and tighten bolts to 10 N·m (88 in. lbs.).



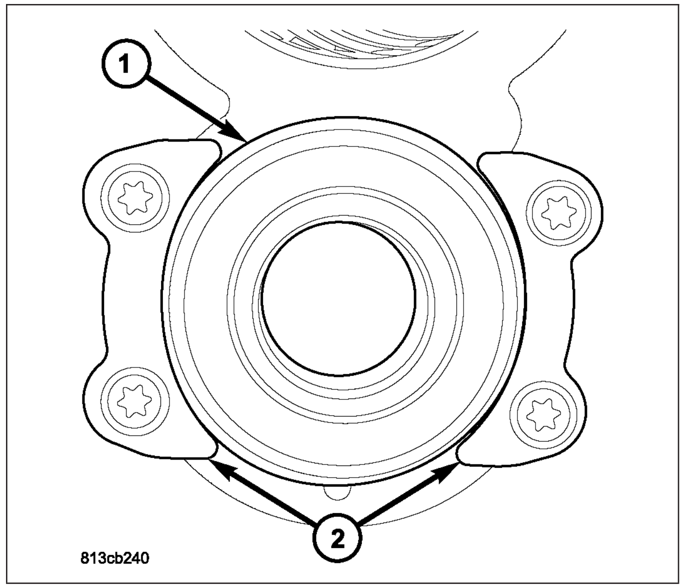

4. Install input shaft retainer (1) and tighten bolts (2) to 9 N·m (80 in. lbs.).




5. Install countershaft bearing (1) into housing with bearing retainer lip (2) facing up.

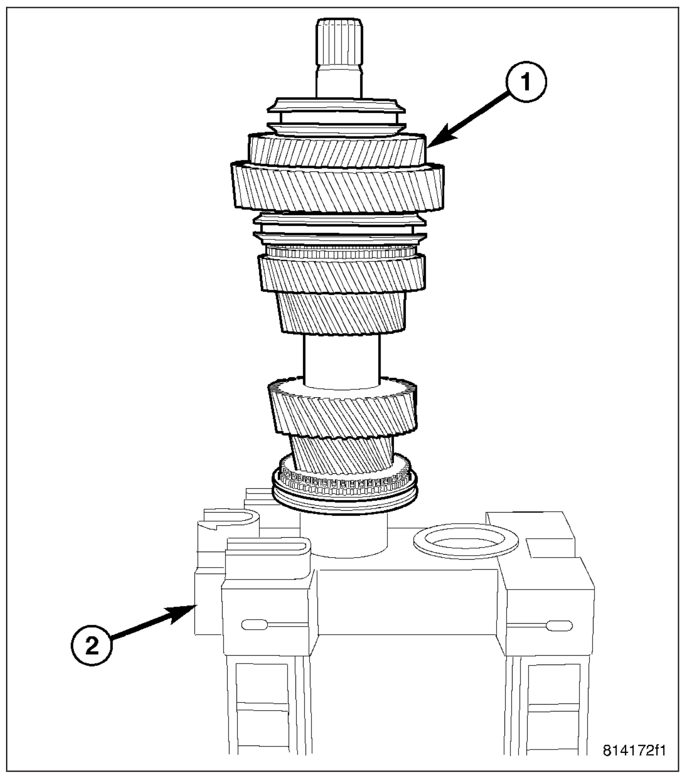


6. Install countershaft bearing (1) retainers (2) and tighten bolts to 10 N·m (88 in. lbs.).

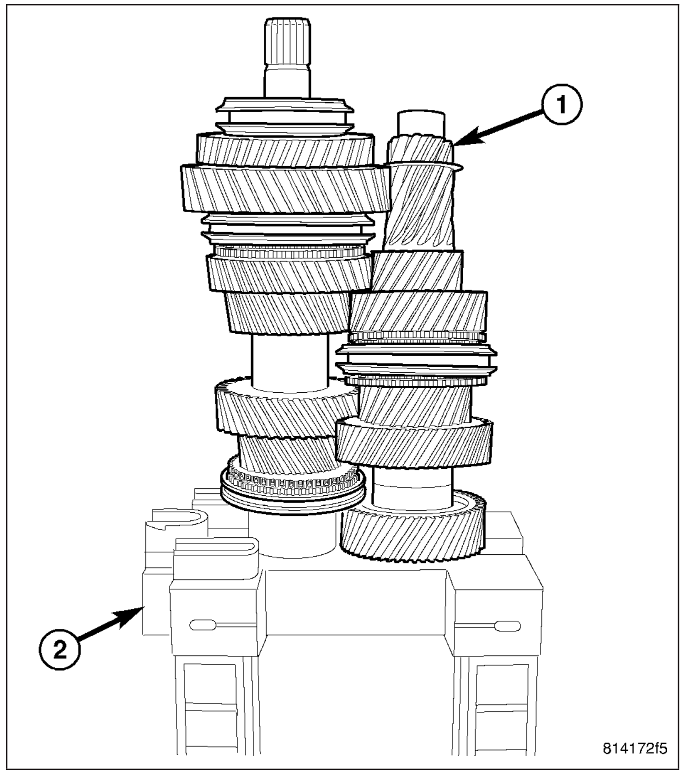



## FINAL ASSEMBLY

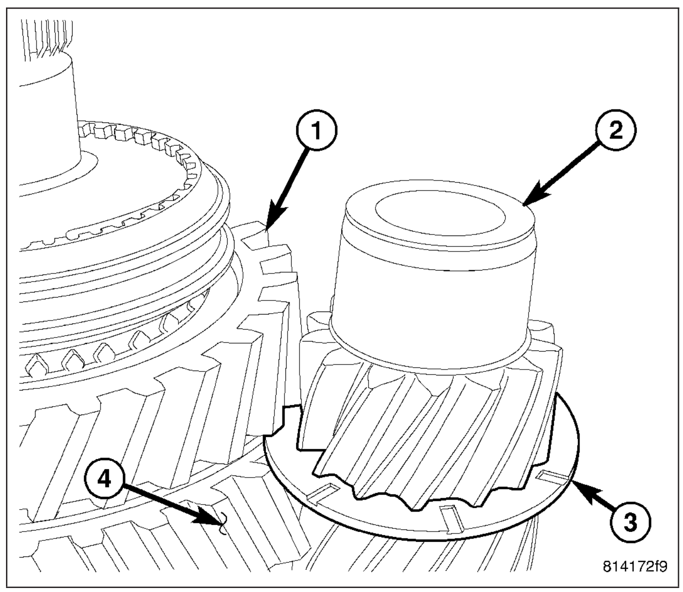
1. Install mainshaft (1) onto Build Fixture 9633 (2).



2. Install countershaft (1) onto Build Fixture 9633 (2).

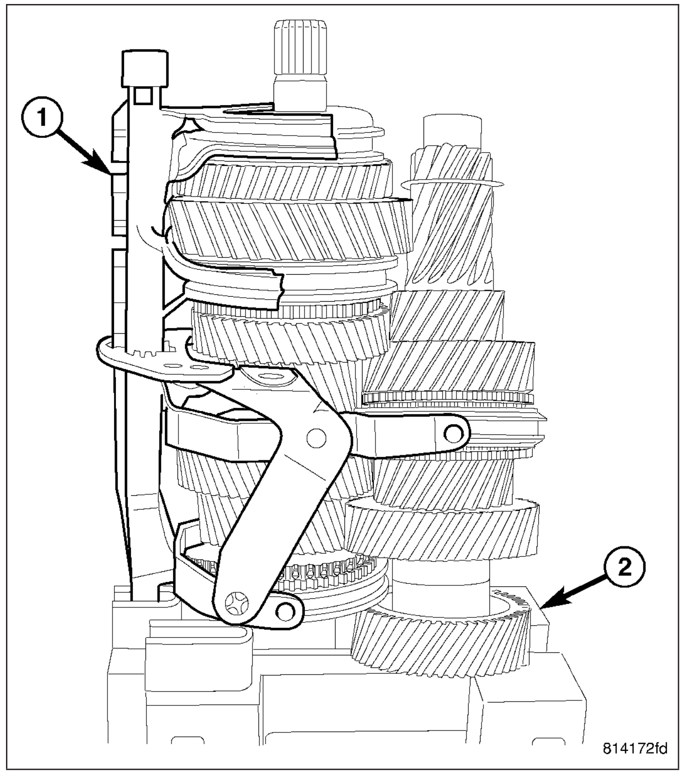



3. Install oil slinger (3) on countershaft (2) between reverse (1) and first gear (4).

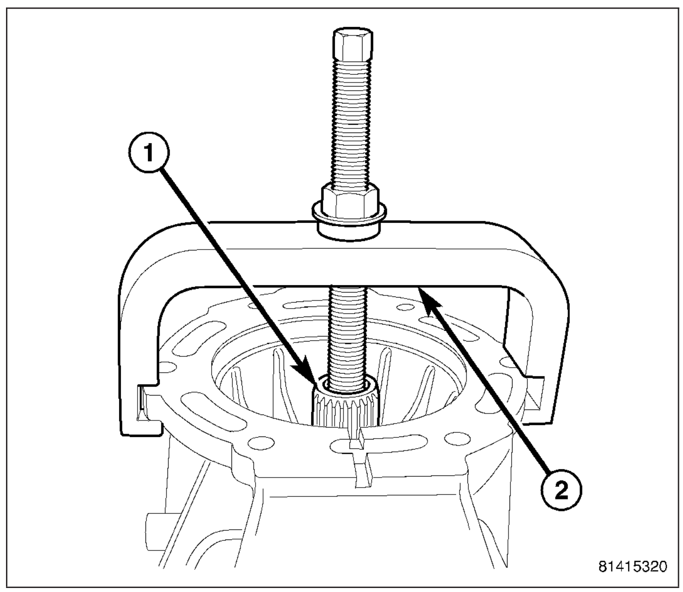



**CAUTION: Oil slinger is fragile and can crack during installation. Failure to follow these instructions will result in cracking the oil slinger and lack of oil to first/reverse bearing.**

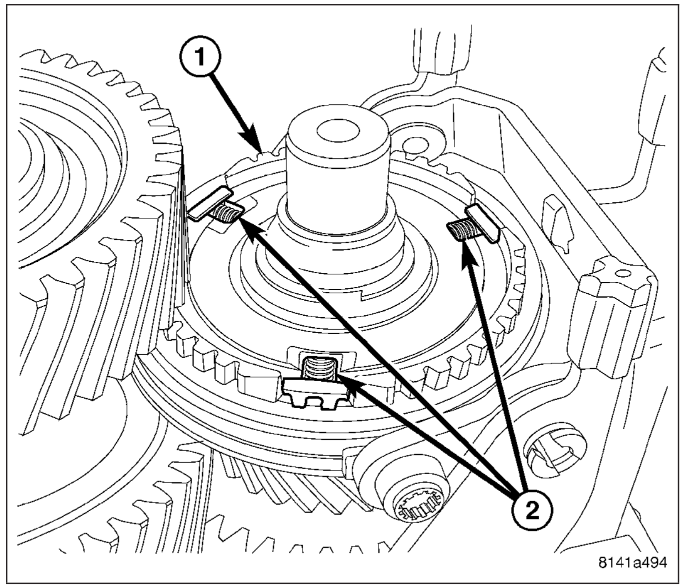
4. Install shift rails and forks (1) onto Build Fixture 9633 (2) and countershaft/mainshaft.



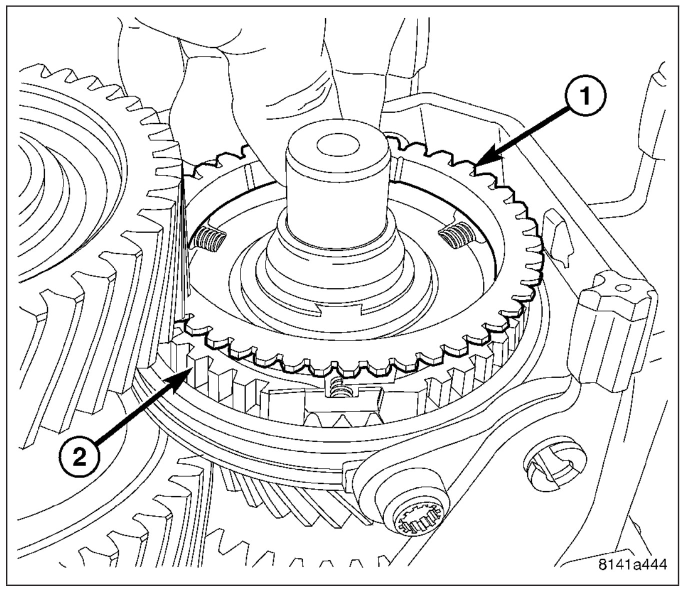

5. Install rear housing on mainshaft (1) with Installer 9636 (2).



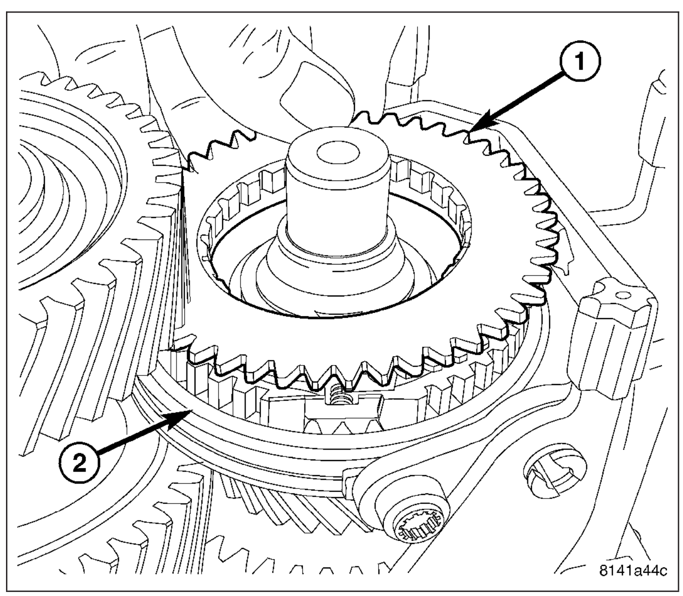
6. Remove rear housing with mainshaft, countershaft and shift rails from fixture. Set assembly on rear housing with shafts pointing up.
7. Install 5-6 synchronizer hub (1) detents, springs, and balls (2).



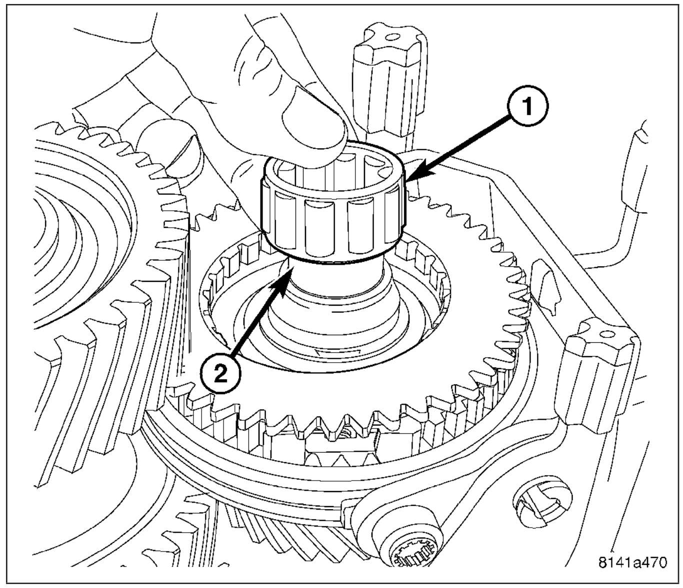

8. Install fifth gear synchronizer friction ring (1) on 5-6 synchronizer hub (2).



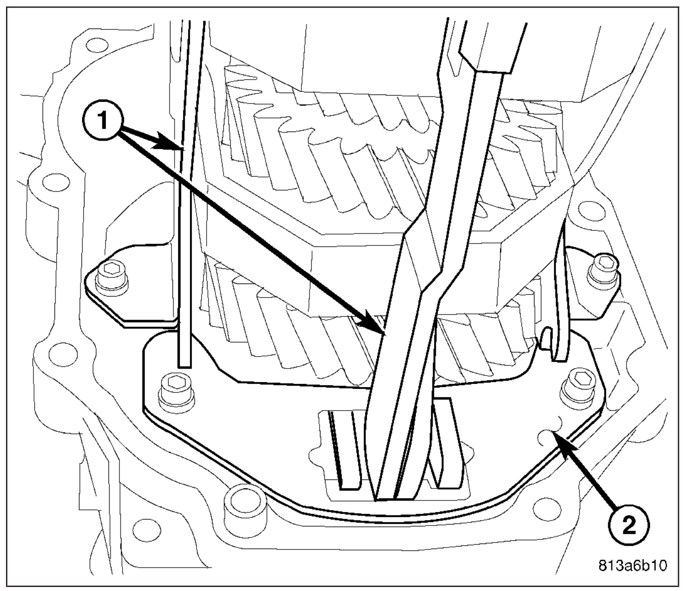

9. Install fifth gear blocker ring (1) on 5-6 synchronizer hub (2). Then hold blocker ring and center synchronizer sleeve.



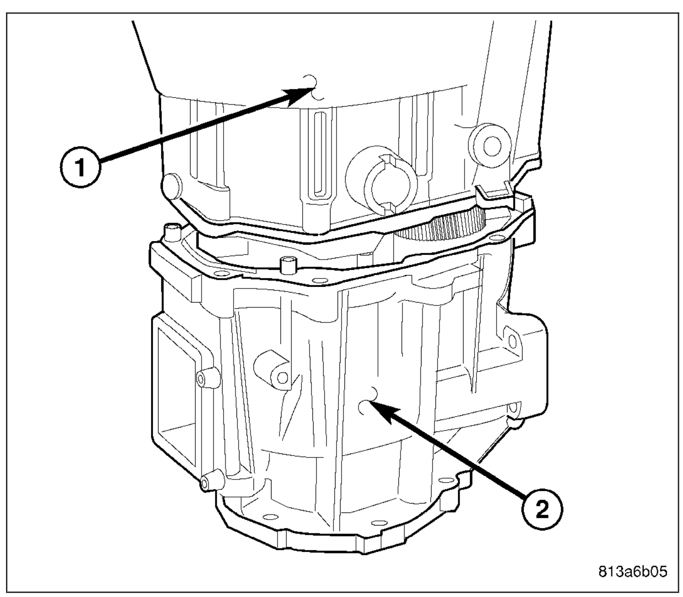
10. Install input shaft roller bearing (1) on mainshaft (2).



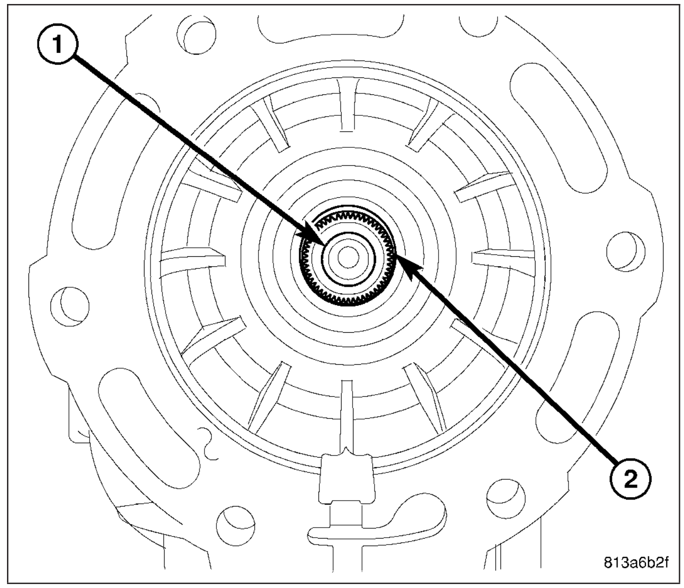

11. Install shift rail (1) support plate (2) bolts and tighten to 8 N·m (71 in. lbs.).



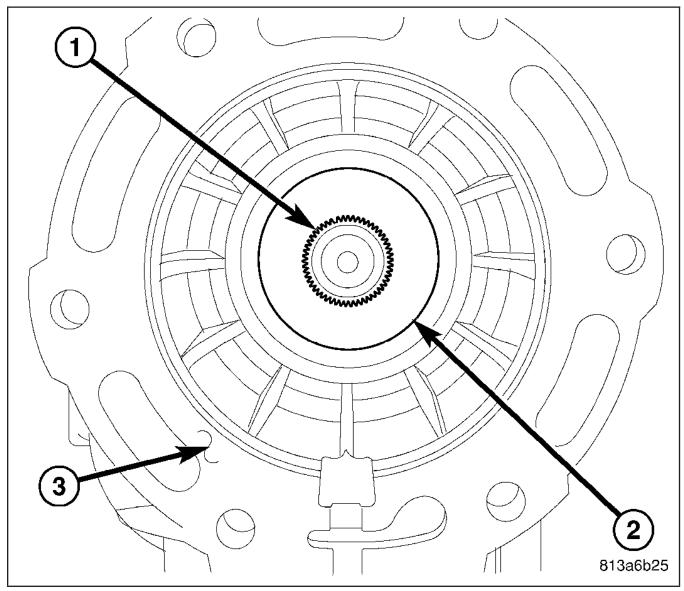

12. Apply MOPAR® Gasket Maker to front housing.
13. Install front housing (1) on rear housing (2) and tighten bolts to 28 N·m (21 ft. lbs.).



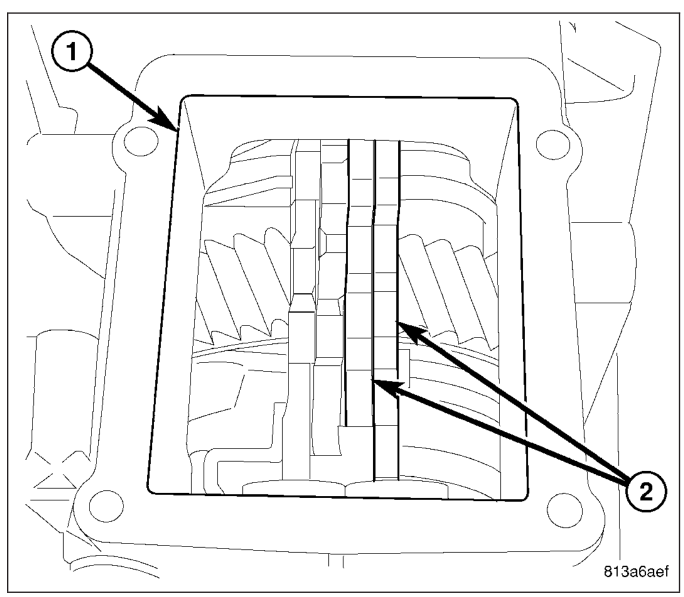
14. Install output shaft (1) snap ring (2) 4x4 only.



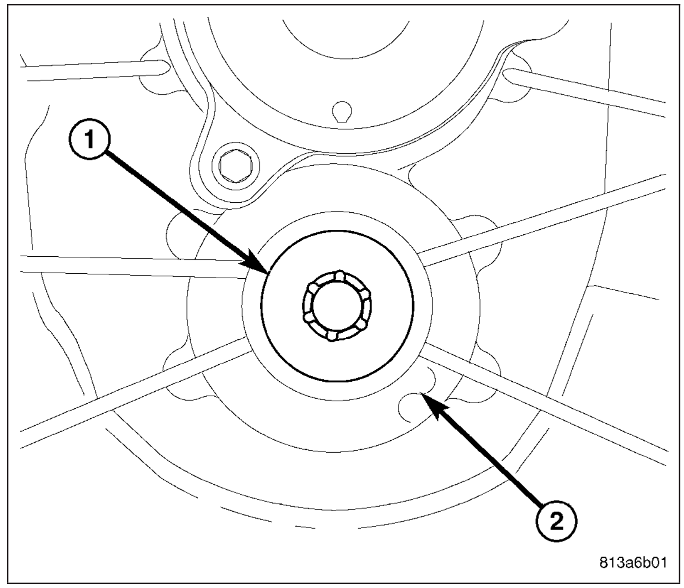

15. Install output shaft (1) seal (2) in rear housing with Installer 9638.



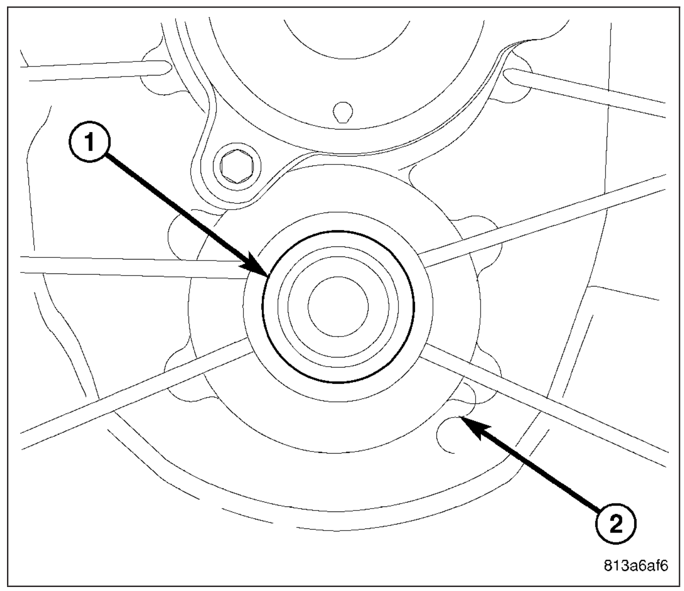

16. Through the shift tower opening (1) move two shift rails (2) forward to lock the transmission in two gear.



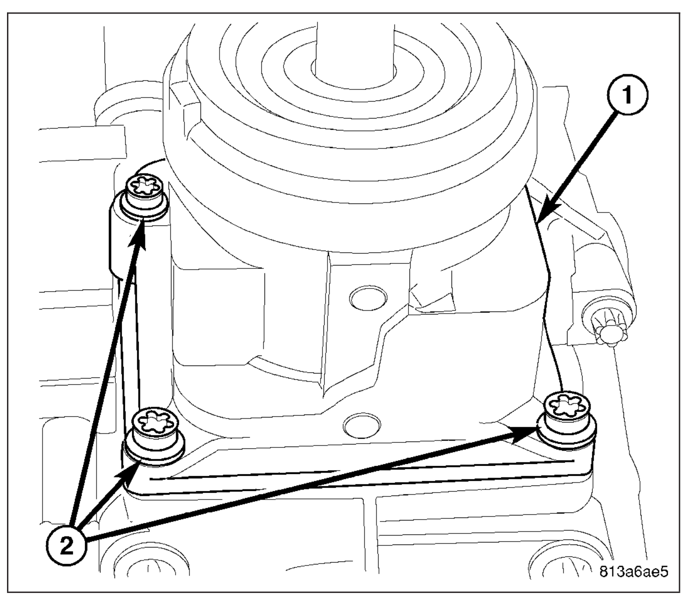
17. Install countershaft bolt (1) into the front housing (2) and tighten to 100 N·m (74 ft. lbs.).



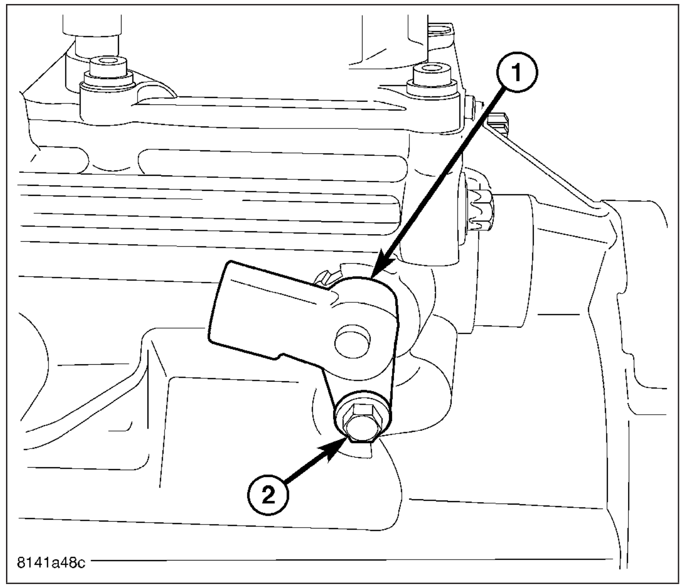

18. Install countershaft plug (1) in front housing (2) with Installer 7829-A and Handle C-4171.




19. Move shift rails to neutral.
20. Apply MOPAR™ Gasket Maker to shift tower (1).
21. Install shift tower (1) and tighten bolts (2) to 14 N·m (10 ft. lbs.).

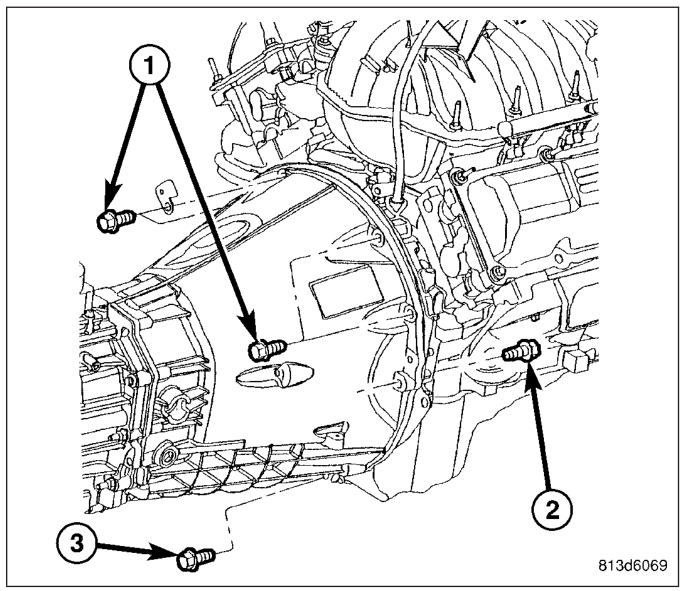


22. Install back up lamp switch (1) and bolt (2).

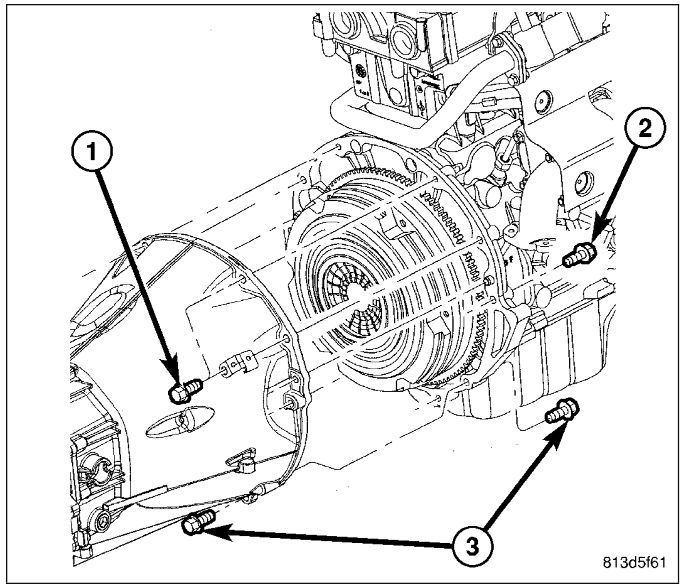



## INSTALLATION

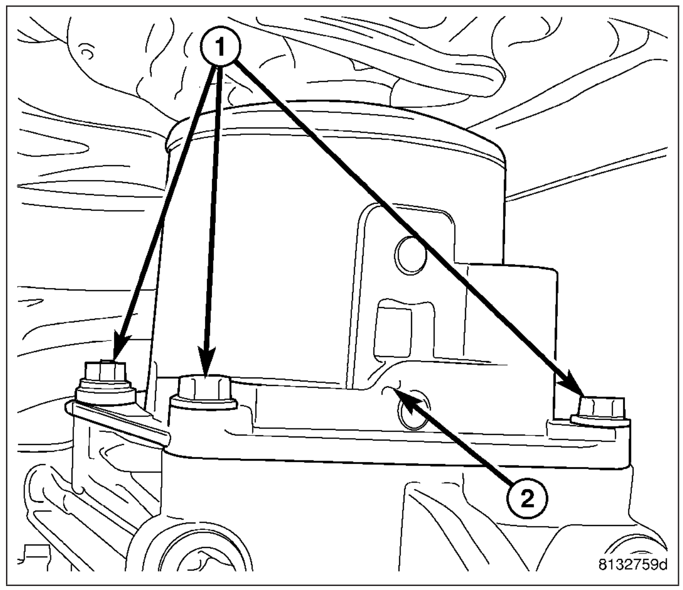
1. Install transmission on engine.
2. On 3.7L engine tighten bolts (1) to 41 N·m (30 ft. lbs.). Tighten bolts (2) to 67 N·m (50 ft. lbs.). Tighten bolts (3) to 54 N·m (40 ft. lbs.).



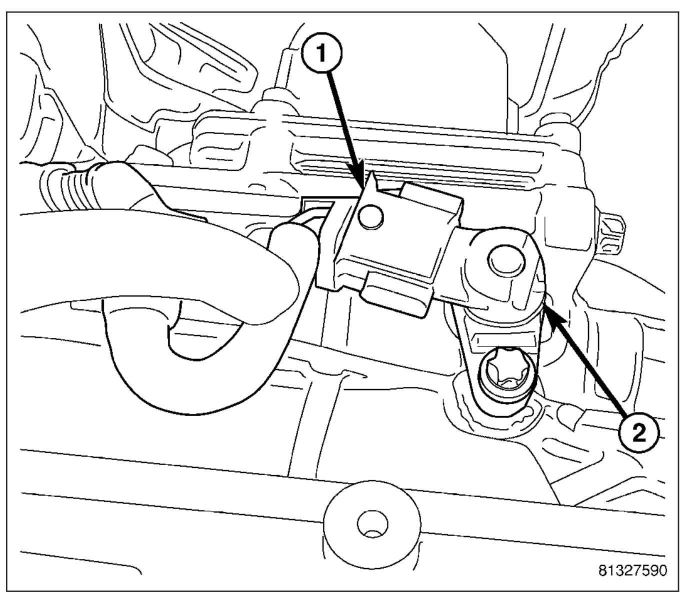
3. On 2.8L diesel engine tighten bolts (1) to 41 N·m (30 ft. lbs.). Tighten bolts (2) to 67 N·m (50 ft. lbs.). Tighten bolts (3) to 54 N·m (40 ft. lbs.).



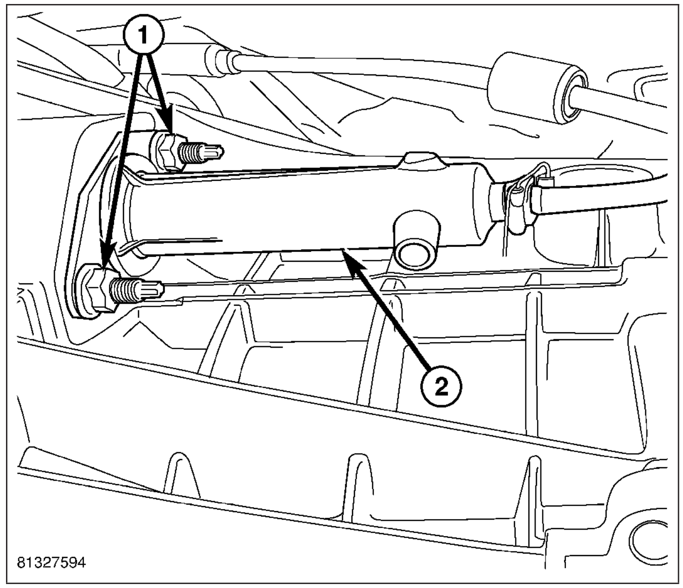

4. Clean shift tower and mating surface then apply Mopar Gasket Maker to shift tower.
5. Install shift tower (2) and tighten bolts (1) to 14 N·m (10 ft. lbs.).
6. Install transmission crossmember and tighten bolts to 47 N·m (35 ft. lbs.). Install transmission mount bolts and tighten to 47 N·m (35 ft. lbs.).



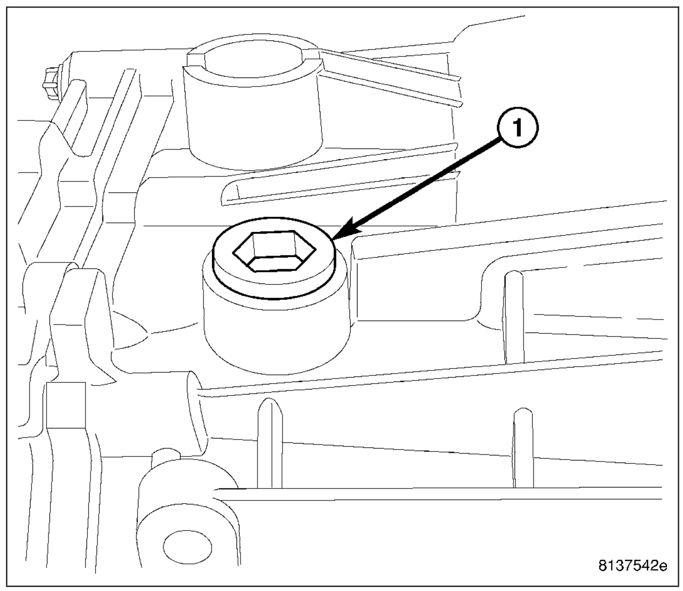

7. Install backup lamp (2) wiring connector (1).



8. Install clutch slave cylinder (2) and mounting nuts (1).
9. Install transfer case and shift linkage, if equipped.
10. Install transfer case wiring connector and vent hose.
11. Install propeller shaft/shafts with reference marks aligned.




12. Remove fill plug (1) and fill transmission to specifications.




## SPECIFICATIONS

## MANUAL TRANSMISSION - NSG370

### TORQUE SPECIFICATIONS

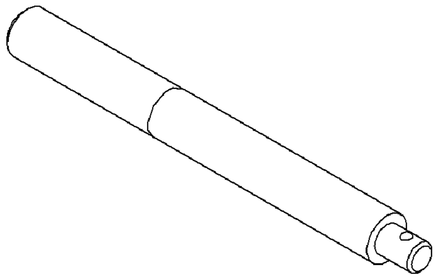
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Drain Plug | 30 | 22 | - |
| Fill Plug | 30 | 22 | - |
| Shift Tower Bolts | 14 | 10 | - |
| Housing Bolts | 28 | 21 | - |
| Transmission Mounting Bolts | 47 | 35 | - |
| Input Shaft Retainer Bolts | 9 | - | 80 |
| Bearing Retainer Bolts | 10 | - | 88 |
| Shift Rail Support Bolts | 8 | - | 71 |

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Idler Gear Shaft Bolt | 20 | 15 | - |
| Countershaft Bolt | 100 | 74 | - |

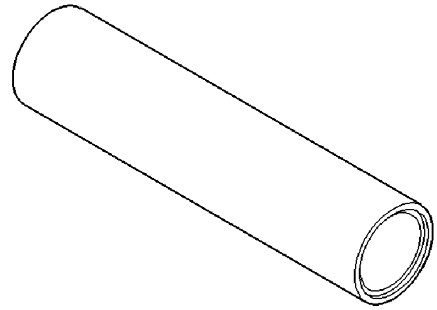
**GEAR SPECIFICATIONS**

| GEAR | RATIO |
|---|---|
| FIRST | 4.46 |
| SECOND | 2.61 |
| THIRD | 1.72 |
| FOURTH | 1.25 |
| FIFTH | 1.00 |
| SIXTH | 0.84 |
| REVERSE | 4.06 |

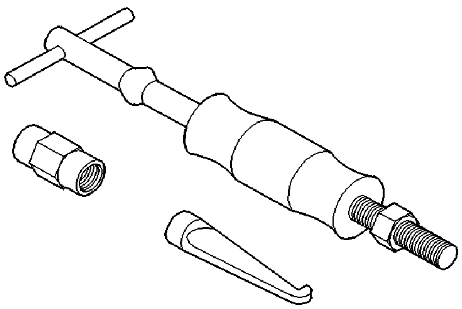
## SPECIAL TOOLS



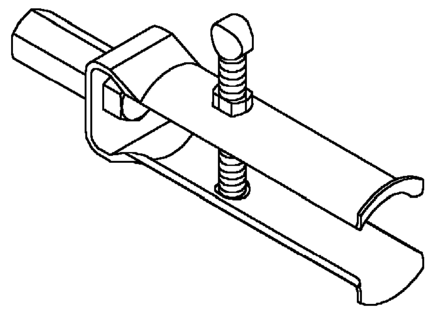
HANDLE C-4171



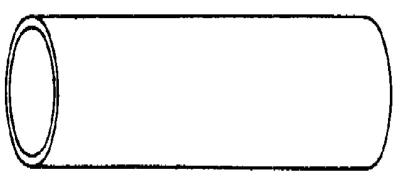
INSTALLER 6448A



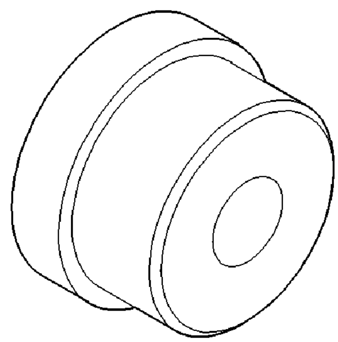
SLIDE HAMMER C-637



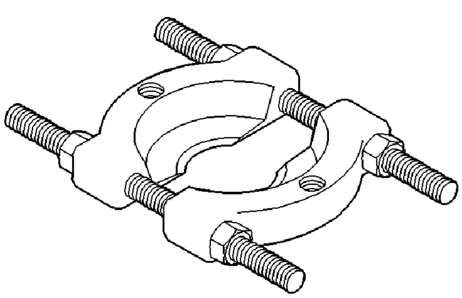
REMOVER 7794-A



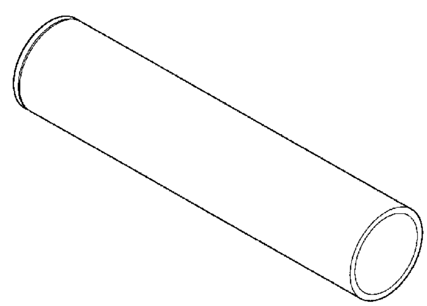
INSTALLER W-262



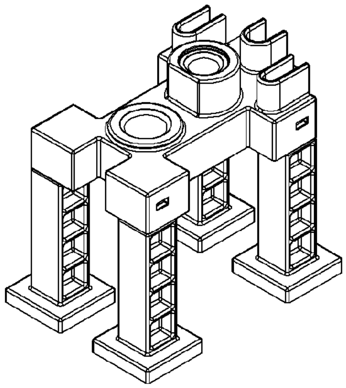
INSTALLER 7828-A



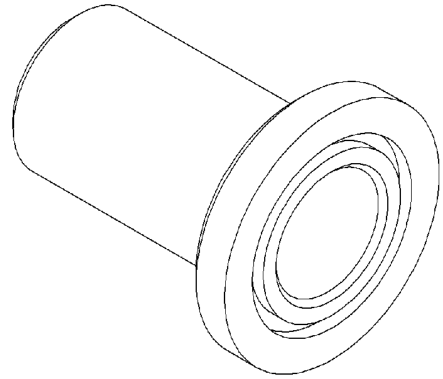
SPLITTER 1130



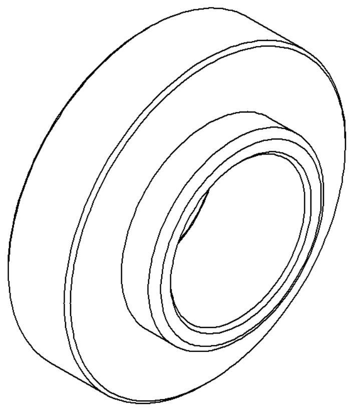
INSTALLER 8228



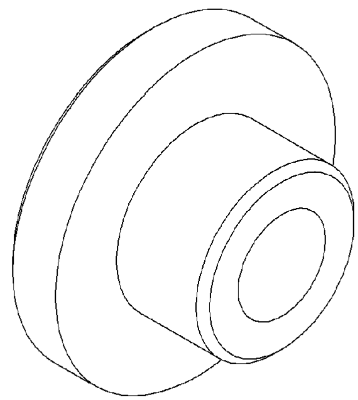
FIXTURE 9633



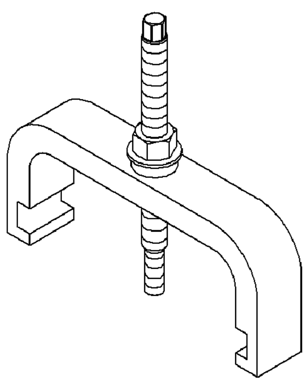
INSTALLER 9638



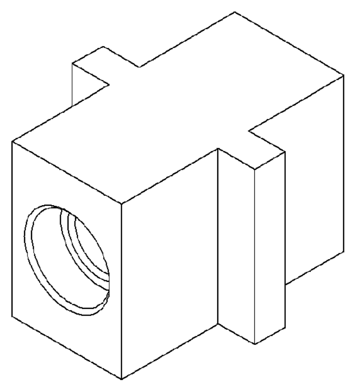
INSTALLER 9635



INSTALLER 9643



REMOVER/INSTALLER 9636



FIXTURE 9648

# AUTOMATIC TRANSMISSION 42RLE - ELECTRICAL DIAGNOSTICS

## TABLE OF CONTENTS

# AUTOMATIC TRANSMISSION 42RLE - ELECTRICAL DIAGNOSTICS

## DIAGNOSIS AND TESTING

## P0122-TPS/APP CIRCUIT LOW

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored TPS voltage drops below .078 volts for the period of 0.48 seconds.

| Possible Causes |
|---|
| RELATED TPS ENGINE DTCS PRESENT |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

The powertrain controller receives the throttle position signal from the Throttle Position Sensor (TPS). The controller provides the TPS with a 5 volt pull up and a sensor ground. The signal is checked for being out of range as well as for intermittent operation (excessive signal changes). The engine controller transmits the throttle value onto the Bus. Most engine controllers will calculate the throttle value if the throttle signal is lost. If an error is detected by the transmission controller and the throttle value is available on the Bus, the Bus value will be used, normal operation will continue, and a TPS code will be set. If an error is detected and the throttle value is not available on the Bus, normal operation will be discontinued, a TPS DTC will be set, and the MIL will be turned on after 5 minutes of calculated operation.

### Diagnostic Test

#### 1. DETERMINING IF RELATED ENGINE TPS DTCS ARE PRESENT

With the scan tool, check Engine DTCs, including pending DTCs and one trip failures.

**Are there any Engine TPS DTCs present?**

**Yes** >> Refer to the Driveability category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 2

#### 2. CHECK IF THE DTC IS CURRENT

With the scan tool, record the DTC EVENT DATA to help identify the conditions in which the DTC was set.

With the scan tool, erase Transmission DTCs.

**NOTE: To erase EVENT DATA information, a BATTERY DISCONNECT must be performed. Performing a BATTERY DISCONNECT will reset all learned Transmission values to controller defaults which may lead to erratic shift schedules.**

Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the DTC EVENT DATA.

With the scan tool, read Transmission DTCs.

**Does this DTC reset?**

**Yes** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

Pay particular attention to the TPS signal and sensor ground circuits.

With the scan tool, check the EVENT DATA to help identify the conditions in which the DTC was set.

Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0123-TPS/APP CIRCUIT HIGH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored TPS voltage rises above 4.94 volts for the period of 0.48 seconds.

| Possible Causes |
|---|
| RELATED TPS ENGINE DTCS PRESENT |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

The powertrain controller receives the throttle position signal from the Throttle Position Sensor (TPS). The controller provides the TPS with a 5 volt pull up and a sensor ground. The signal is checked for being out of range as well as for intermittent operation (excessive signal changes). The engine controller transmits the throttle value onto the Bus. Most engine controllers will calculate the throttle value if the throttle signal is lost. If an error is detected by the transmission controller and the throttle value is available on the Bus, the Bus value will be used, normal operation will continue, and a TPS code will be set. If an error is detected and the throttle value is not available on the Bus, normal operation will be discontinued, a TPS DTC will be set, and the MIL will be turned on after 5 minutes of calculated operation.

### Diagnostic Test

#### 1. DETERMINING IF RELATED ENGINE TPS DTCS ARE PRESENT

With the scan tool, check Engine DTCs, including pending DTCs and one trip failures.

**Are there any Engine TPS DTCs present?**

**Yes** >> Refer to the Driveability category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 2

#### 2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, record the DTC EVENT DATA to help identify the conditions in which the DTC was set.

With the scan tool, erase Transmission DTCs.

**NOTE: To erase EVENT DATA information, a BATTERY DISCONNECT must be performed. Performing a BATTERY DISCONNECT will reset all learned Transmission values to controller defaults which may lead to erratic shift schedules.**

Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the DTC EVENT DATA.

With the scan tool, read Transmission DTCs.

**Does this DTC reset?**

**Yes** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

Pay particular attention to the TPS signal and sensor ground circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0124-TPS/APP INTERMITTENT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored TPS throttle angle between the angles of 6° and 120° and the degree change is greater than 5° within a period of less than 7.0 ms.

| Possible Causes |
|---|
| RELATED TPS ENGINE DTCS PRESENT |
| THROTTLE POSITION SENSOR |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The powertrain controller receives the throttle position signal from the Throttle Position Sensor (TPS). The controller provides the TPS with a 5 volt pull up and a sensor ground. The signal is checked for being out of range as well as for intermittent operation (excessive signal changes). The engine controller transmits the throttle value onto the Bus. Most engine controllers will calculate the throttle value if the throttle signal is lost. If an error is detected by the transmission controller and the throttle value is available on the Bus, the Bus value will be used, normal operation will continue, and a TPS code will be set. If an error is detected and the throttle value is not available on the Bus, normal operation will be discontinued, a TPS DTC will be set, and the MIL will be turned on after 5 minutes of calculated operation.

## Diagnostic Test

### 1. CHECK IF RELATED ENGINE TPS DTCS ARE PRESENT

With the scan tool, check Engine DTCs, including pending DTCs and one trip failures.

**Are there any Engine TPS DTCs present?**

**Yes** >> Refer to the Driveability category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK IF THE DTC IS CURRENT

With the scan tool, record the DTC EVENT DATA to help identify the conditions in which the DTC was set.

With the scan tool, erase Transmission DTCs.

**NOTE: To erase EATX EVENT DATA information, a BATTERY DISCONNECT must be performed. Performing a BATTERY DISCONNECT will reset all learned Transmission values to controller defaults which may lead to erratic shift schedules.**

Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the EVENT DATA.

With the scan tool, read Transmission DTCs.

**Does this DTC reset?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK THE THROTTLE POSITION SENSOR OPERATION

Ignition on, engine not running.

With the scan tool, under Transmission Sensors, monitor the TPS voltage in the following step.

Slowly open and close the throttle while checking for erratic voltage changes.

**Did the TPS voltage change smooth and consistent?**

**Yes** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Replace the Throttle Position Sensor per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

Pay particular attention to the TPS signal and sensor ground circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0218-HIGH TEMPERATURE OPERATION ACTIVATED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running.
- **Set Condition:**
  Immediately when a Overheat shift schedule is activated when the Transmission Oil Temperature reaches 155° C or 240° F.

| Possible Causes |
|---|
| ENGINE COOLING SYSTEM OPERATION |
| TRANSMISSION OIL COOLER PLUGGED |
| HIGH TEMPERATURE OPERATIONS ACTIVATED |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

If the transmission oil temperature rises above 115° C (240° F), the overheat shift schedule is activated refer to Transmission Operation as a function of Transmission Oil Temperature and the code is set. The DTC is an informational code only and is being set to aid the technician in determining root cause of a customer driveability issue. The code is also intended to alert the technician to determine if a cooling system malfunction has occurred or if an additional transmission air to oil cooler should be added to the vehicle if the customer regularly drives in a manner that overheats the transmission. Extended operation above 115° C (240° F) will reduce the durability of the transmission and should be avoided. Correcting the cooling system malfunction or installing an additional transmission oil cooler will improve transmission durability especially for customers who operate in city/construction stop and go traffic, tow trailers regularly, drive aggressively in low gear or drive regularly in mountainous areas.

### Diagnostic Test

#### 1. CHECK ENGINE COOLING SYSTEM

Perform Engine Cooling System diagnostics per the Service Information.

**Is the Engine Cooling System functioning properly?**

**Yes** >> Go To 2

**No** >> Repair the cause of the engine overheating. Refer to the Service Information for the related diagnostic or repair procedures.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

#### 2. TRANSMISSION OIL COOLER RESTRICTED

Check the Transmission Oil Cooler Flow in accordance with the Service Information.

**Is the transmission oil cooler restricted or plugged?**

**Yes** >> Go To 3

**No** >> Repair the cause of the plugged Transmission Oil Cooler as necessary and repair or replace the Transmission Oil Cooler per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 3. HIGH TEMPERATURE OPERATION

This DTC is an informational DTC designed to aid the Technician in diagnosing shift quality complaints.

This DTC indicates that the transmission has been operating in the ″Overheat″ shift schedule which may generate a customer complaint.

The customer driving patterns may indicate the need for an additional transmission oil cooler.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

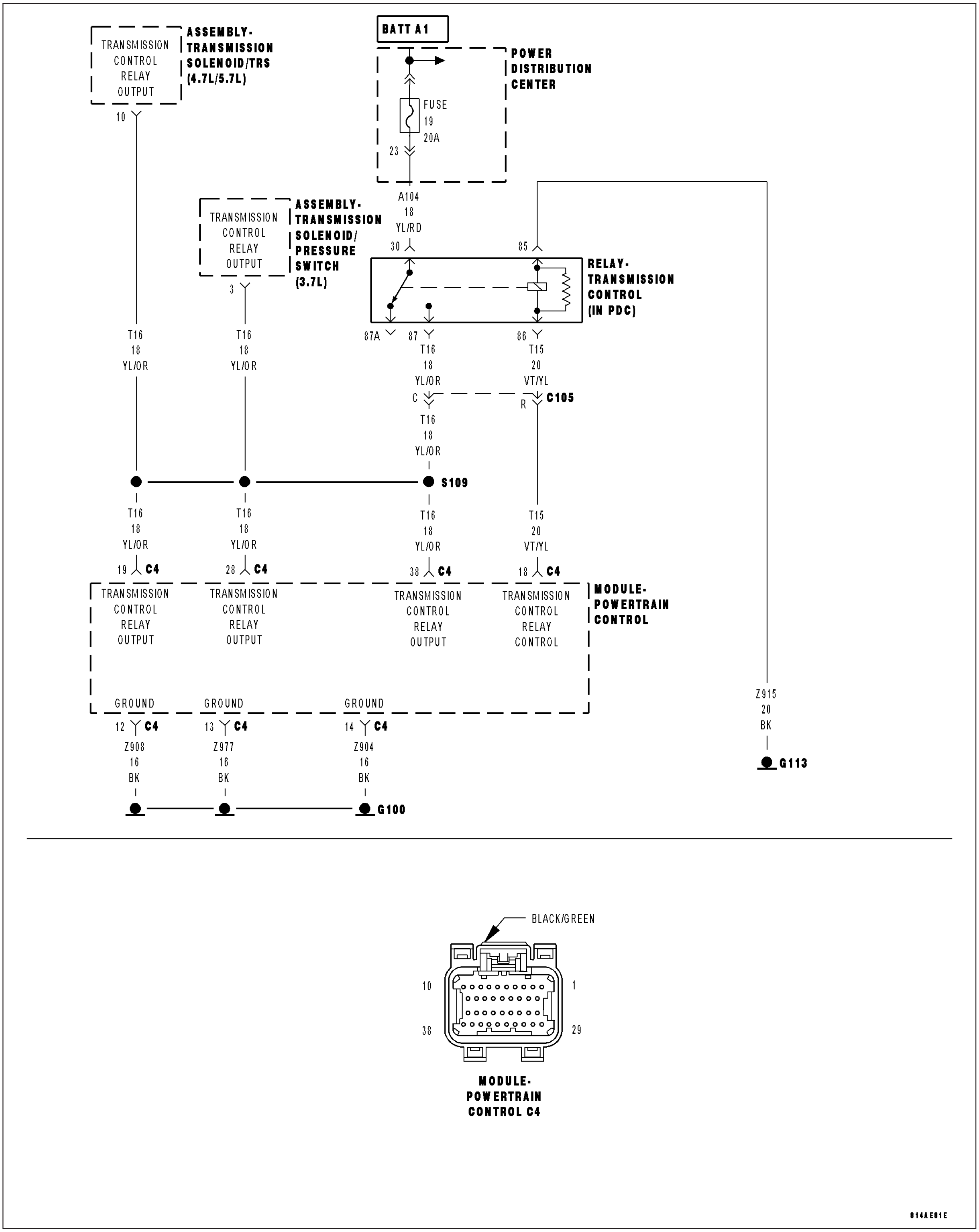
**If there are no possible causes remaining, view repair.**

**Repair**

Repair the cause of transmission overheating per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## P0562-BATTERY VOLTAGE LOW




*42RLE MINI PWR GND CKTS*

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running and the PCM has closed the Transmission Control Relay.
- **Set Condition:**
  If the battery voltage of the Transmission Control Relay Output Sense circuit(s) to the PCM is less than 10.0 volts for the period of 15 seconds. Note: P0562 generally indicates a gradually falling battery voltage or a resistive connection(s) to the PCM. The DTC will also set if the battery voltage sensed at the PCM is less than 6.5 volts for 200ms or when Transmission Control Relay Output circuits are less than 7.2 volts for 200ms.

| Possible Causes |
|---|
| RELATED CHARGING SYSTEM DTC'S |
| (Z908) OR (Z977) GROUND CIRCUIT OPEN OR HIGH RESISTANCE |
| (A104) FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT TO TCM OPEN OR HIGH RESISTANCE |
| TRANSMISSION CONTROL RELAY |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

Transmission damage may occur if there is insufficient supply voltage to properly control the solenoids. To prevent this possibility, the battery voltage is monitored and the system is placed in logical limp-in if the battery voltage drops below the limit.

## Diagnostic Test

### 1. CHECK FOR RELATED CHARGING SYSTEM DTC'S

With the scan tool, read the Engine DTC's.

**Are there any Charging System related DTCs present?**

**Yes** >> Refer to the Charging System category and repair any Charging System DTCs before proceeding. After repairing the Charging System DTCs, perform the Transmission Verification test to verify the transmission and or controller was not damaged.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK IF THE DTC IS CURRENT

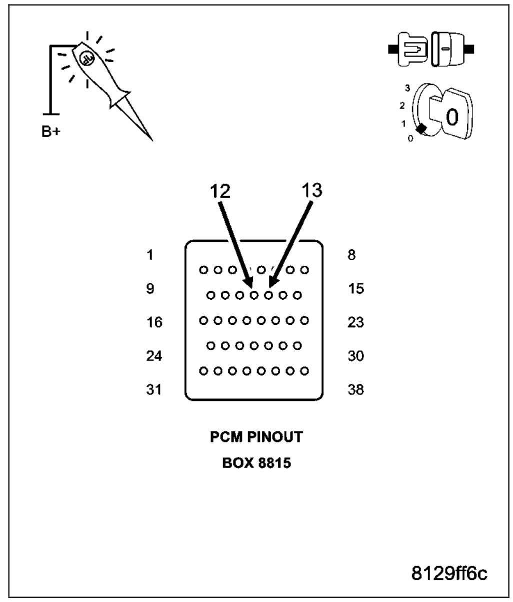
**NOTE: Generator, battery, and charging system must be fully functional before performing this test.**
With the scan tool, read DTCs.

**Is the status for this DTC Active or the STARTS SINCE SET counter set at 0?**

**Yes** >> Go To 3

**No** >> Go To 7

## 3. CHECK THE (Z908) AND (Z977) GROUND CIRCUITS FOR AN OPEN




Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Using a 12-volt test light connected to 12-volts, check the (Z908) and (Z977) Ground circuits in the appropriate terminals of Miller tool #8815.

**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

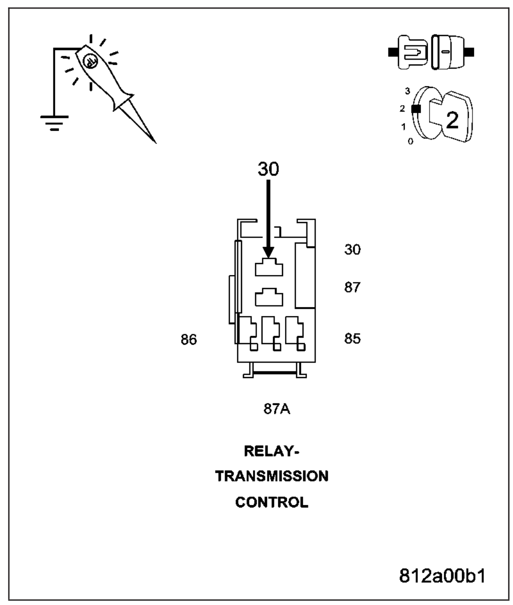
**Does the test light illuminate brightly for all the Ground circuits?**

**Yes** >> Go To 4

**No** >> Repair the (Z908) and/or (Z977) Ground circuit for an open circuit or high resistance.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 4. CHECK THE (A104) FUSED B+ CIRCUIT FOR AN OPEN




Turn the ignition off to the lock position.

Remove the Transmission Control Relay.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, check the (A104) Fused B+ circuit in the Transmission Control Relay connector.

**Does the test light illuminate brightly?**

**Yes** >> Go To 5

**No** >> Repair the (A104) Fused B+ circuit for an open or high resistance.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

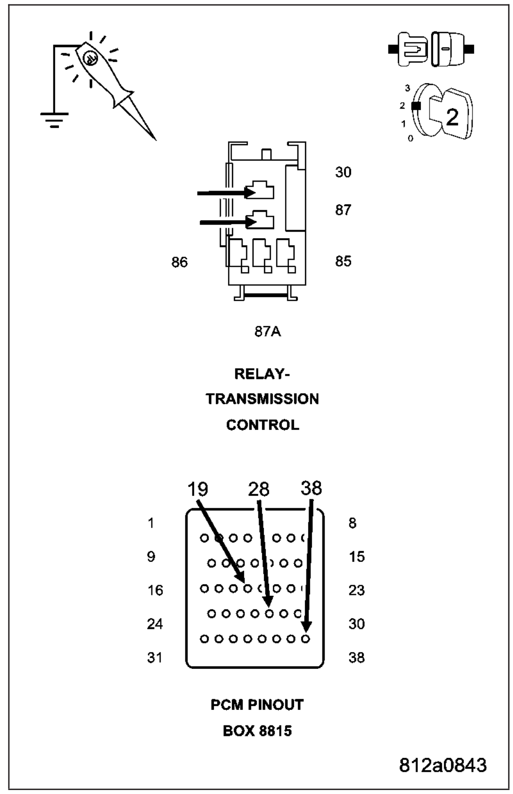
## 5. CHECKING THE (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Connect a jumper wire between (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, check all (T16) Transmission Control Relay Output circuits in the appropriate terminal of Miller tool #8815.




**Does the test light illuminate brightly?**

**Yes** >> Go To 6

**No** >> Repair the (T16) Transmission Control Relay Output circuit(s) for an open or high resistance.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 6. CHECK THE TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.

Install a substitute Relay in place of the Transmission Control Relay.

Start the engine.

Using a voltmeter, measure the battery voltage.

With the scan tool, monitor the Transmission Switched Battery Voltage.

Compare the scan tool Transmission Switched Battery voltage to the actual battery voltage.

**Is the scan tool voltage within 2.0 volts of the battery voltage?**

**Yes** >> Replace the Transmission Control Relay.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorts and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0602-CONTROL MODULE PROGRAMMING ERROR/NOT PROGRAMMED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Check for generic software is made at power-up.
- **Set Condition:**
  If generic software is found, the MIL will light immediately. This DTC is designed to signal the technician that the controller still has generic software installed.

| Possible Causes |
|---|
| PCM - PROGRAMMING ERROR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

The controller is programmed during manufacturing with generic software to facilitate testing. This software does not have the proper calibrations to control a transmission in a vehicle. The check for generic software is made at power-up. If generic software is found, the MIL will light immediately and the MIL will stay on even if the fault is cleared, until the proper software is installed. Note: Transmission will be placed in limp-in mode.

### Diagnostic Test

#### 1. CONTROL MODULE PROGRAMMING ERROR

**NOTE: Controller is programmed with generic software and will not allow the correct vehicle Powertrain management.**

Record the controller part number.

Update the controller with the correct software in accordance with the Service Information.

**Verify that the controller updated successfully.**

**Test Complete**

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## P0604-INTERNAL CONTROL MODULE RAM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  One time after the ignition key is turned to the run position.
- **Set Condition:**
  The read value does not match the written value in any RAM location.

| Possible Causes |
|---|
| PCM - INTERNAL ERROR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

After the controller is reset, the microprocessor checks the integrity of each RAM location by writing to it and reading back from it. The read value should be the same as the written value. MIL on after 10 seconds of vehicle operation and transmission will be placed in limp-in.

### Diagnostic Test

#### 1. PCM - INTERNAL ERROR

**If there are no possible causes remaining, view repair.**

**Repair**

Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## P0605-INTERNAL CONTROL MODULE ROM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  One time after the ignition key is turned to the run position.
- **Set Condition:**
  If the ROM checksum does not match a known constant.

| Possible Causes |
|---|
| PCM - INTERNAL ERROR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

After the controller is reset, the microprocessor checks the integrity of the program memory (ROM). A checksum is calculated by adding all used bytes in the program memory. The sum should be the same as a known constant stored in memory. MIL on after 10 seconds of vehicle operation and transmission will be placed in limp-in.

### Diagnostic Test

#### 1. PCM - INTERNAL ERROR

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

**If there are no possible causes remaining, view repair.**

**Repair**

Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## P0613-INTERNAL TRANSMISSION PROCESSOR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  After the ignition key is turned to the run position and 60 seconds thereafter.
- **Set Condition:**
  Either of the following conditions occur 3 times in less than 590 milliseconds: The watchdog line remains high after the watchdog test or the transmission relay coil is energized and remains on after the watchdog delay expires.

| Possible Causes |
|---|
| PCM - INTERNAL ERROR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

The internal watchdog is a separate hardware circuit which continuously monitors the microprocessor. To make sure the transmission is operating properly, the watchdog must receive a signal from the microprocessor within a specific time window. MIL on after 10 seconds of vehicle operation and transmission will be placed in limp-in.

### Diagnostic Test

1. **PCM - INTERNAL ERROR**

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

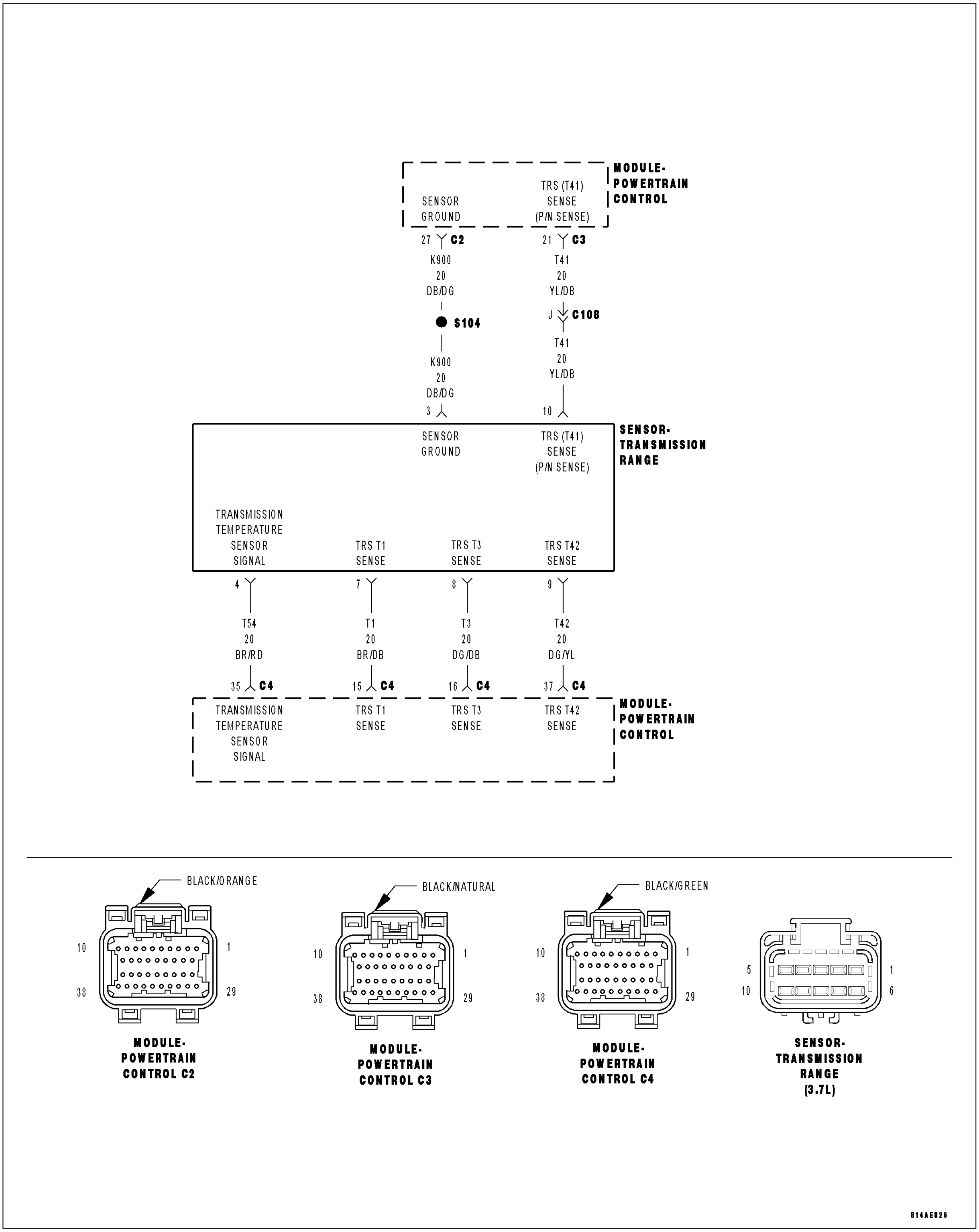
**If there are no possible causes remaining, view repair.**

**Repair**

Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## P0706-TRANSMISSION RANGE SENSOR RATIONALITY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on.
- **Set Condition:**
  The DTC will set if the controller detects an invalid PRNDL code which lasts for more than 0.042 seconds.

| Possible Causes |
|---|
| SHIFTER OUT OF ADJUSTMENT |
| TRS SENSE CIRCUIT OPEN |
| TRS SENSE CIRCUIT SHORT TO GROUND |
| TRS SENSE CIRCUIT SHORT TO VOLTAGE |
| METAL DEBRIS IN OIL PAN |
| TRANSMISSION RANGE SENSOR |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The C1 through C4 (T1, T3, T41, and T42) sense circuits communicate the shift lever position to the PCM. Each circuit is terminated at the transmission with a switch. Each switch can be either open or closed, depending on the shift lever position. The PCM can decode this information and determine the shift lever position. Each shift lever position has a certain combination of switches, which will be open and closed, this is called a PRNDL code. There are 4 switches, therefore: there are many possible combinations of open and closed switches (codes). However, there are only 9 valid codes (8 for AutoStick), one for each gear position and three recognized between gear codes. The remainder of the codes should never occur, these are called invalid codes. The following chart shows the normal switch states for each shift lever position.

**TRS SWITCH STATES**

| SLP | T42 | T41 | T3 | T1 |
|---|---|---|---|---|
| **P** | CLOSED | CLOSED | CLOSED | OPEN |
| **R** | CLOSED | OPEN | OPEN | OPEN |
| **N** | CLOSED | CLOSED | OPEN | CLOSED |
| **OD** | OPEN | OPEN | OPEN | CLOSED |
| **3** | OPEN | OPEN | CLOSED | OPEN |
| **L** | CLOSED | OPEN | CLOSED | CLOSED |

## Diagnostic Test

### 1. CHECK TO SEE IF P0706 DTC IS CURRENT

With the scan tool, perform the Shift Lever Position Test.

**Select the test outcome from the following:**

**Test passes:**
Go To 6

**Test fails with Error Code:**
Go To 2

**Test fails without Error Code:**
Perform the Gearshift Adjustment Procedure per the Service Information.
Perform the PRNDL Fault Clearing Procedure – Go To 7

## 2. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, perform the Shift Lever Position Test.

When the scan tool instructs you to put the Gear Selector in a particular position, you must do so using the selector switch on the Transmission Simulator.

The LED for the gear position in question must be illuminated on the Transmission Simulator prior to pressing ″ENTER″ on the scan tool.

**NOTE: When the scan tool requests the O/D off button be depressed, you must use the O/D OFF button in the vehicle or you will fail the Shift Lever Position Test with an error code 11 or OD-TOW/HALL STUCK OPEN.**

**NOTE: If the Shift Lever Position test fails, make sure to note the identification of the TRS Sense circuit for future reference.**

**Did the Shift Lever Position test pass?**

**Yes** >> Remove the Oil Pan and Main Valve Body Assembly per the Service Information. Check for metal debris on top of the TRS Assembly. If debris is present, determine the cause of the debris and repair the transmission as necessary. If no problems are found, replace the Transmission TRS Assembly per the Service Information.

Perform the PRNDL Fault Clearing Procedure – Go To 7

**No** >> Go To 3

## 3. TRS SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM harness connectors and install Miller tool #8815.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance of the identified (T1, T3, T41, or T42) TRS Sense circuit, from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the identified (T1, T3, T41, or T42) TRS Sense circuit for an open.

Perform the PRNDL Fault Clearing Procedure – Go To 7

**No** >> Go To 4

## 4. TRS SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the identified (T1, T3, T41, or T42) TRS Sense circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the identified (T1, T3, T41, or T42) TRS Sense circuit for a short to ground.
Perform the PRNDL Fault Clearing Procedure – Go To 7

**No** >> Go To 5

## 5. TRS SENSE CIRCUIT SHORT TO OTHER CIRCUITS

Measure the resistance between the identified (T1, T3, T41, or T42) TRS Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

**Is the resistance below 100k ohms between the identified (T1, T3, T41, or T42) TRS Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the identified (T1, T3, T41, or T42) TRS Sense circuit for a short to other circuit(s).
Perform the PRNDL Fault Clearing Procedure – Go To 7

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform the PRNDL Fault Clearing Procedure – Go To 7

## 6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform the PRNDL Fault Clearing Procedure – Go To 7

**No** >> Test Complete.

## 7. PRNDL FAULT CLEARING PROCEDURE

With the scan tool, erase Transmission DTCs.

Cycle the ignition off, then start the vehicle.

Firmly apply the brakes and shift into Overdrive.

**NOTE: Vehicle must remain in Overdrive for at least 3.0 seconds.**

With the brakes firmly applied, shift slowly through all gears (PRNDL) as least three times, pausing momentarily in each gear.

**NOTE: If all the PRNDL lights box individually then the error was cleared.**

Shift into park and turn the ignition off to the lock position.

Ignition on, engine not running.

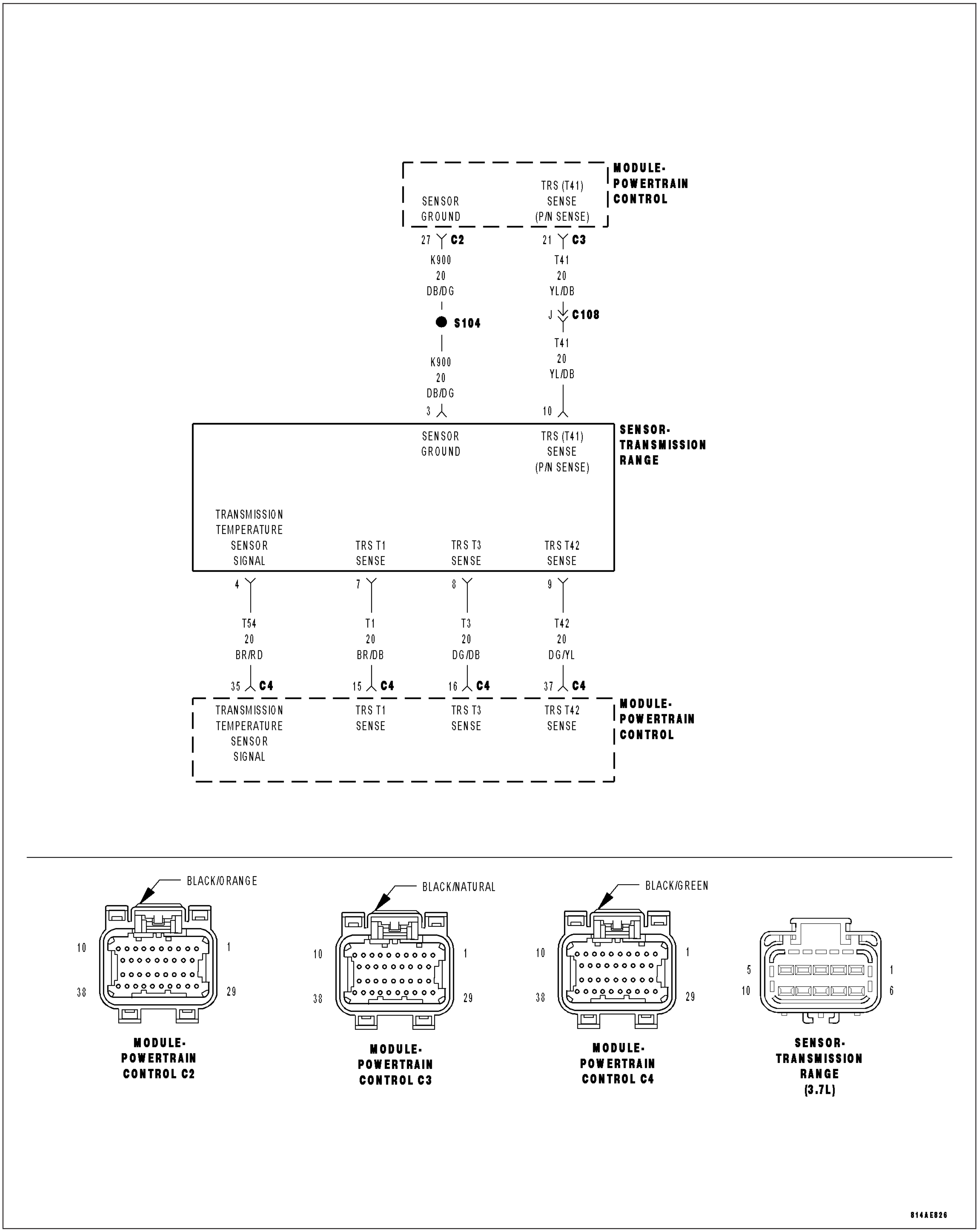
With the scan tool, read Transmission DTCs.

**Does the DTC P0706 reset, or do all the PRNDL indicators remain boxed in park or neutral?**

**Yes** >> Return to the symptom list and perform diagnostics for P0706.
Go To 1

**No** >> Test Complete.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  DTC will set when the transmission temperature does not reach a normal operating temperature within a given time frame. Time is variable due to ambient temperature. Approximate DTC set time is 10 to 35 minutes. The following are starting temperature to warm up times to set this DTC: starting temperature -40° C (-40° F) warm up time 35 minutes, starting temperature -28° C ( -20° F) 25 minutes, starting temperature -6.6° C (20° F) 20 minutes, starting temperature 15.5 ° C (60° F) 10 minutes. When the fault is set, calculated temperature is substituted for measured temperature, however the DTC is stored only after three consecutive occurrences.

| Possible Causes |
|---|
| RELATED TRANSMISSION TEMPERATURE DTC'S PRESENT |
| TRANSMISSION TEMPERATURE SENSOR |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The temperature sensor is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter operation and when or if some diagnostics are run. A failed temperature sensor could affect the OBD diagnostics. If a problem occurs in the transmission temperature sensor circuit, transmission temperature will be based on a calculated value.

## Diagnostic Test

### 1. DETERMINE IF RELATED TRANSMISSION TEMPERATURE DTCS ARE PRESENT

With the scan tool, check Transmission DTCs.

**Are there any other Transmission Temperature Sensor related DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate diagnostic procedure.

**No** >> Go To 2

### 2. CHECK TO SEE IF DTC IS ACTIVE

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 4

### 3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**
Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

**Do the readings on the Transmission Simulator match the scan tool readings ± 0.2 volts?**

**Yes** >> Replace Transmission Solenoid/TRS Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for any Service Bulletins and S.T.A.R. ON-LINE for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

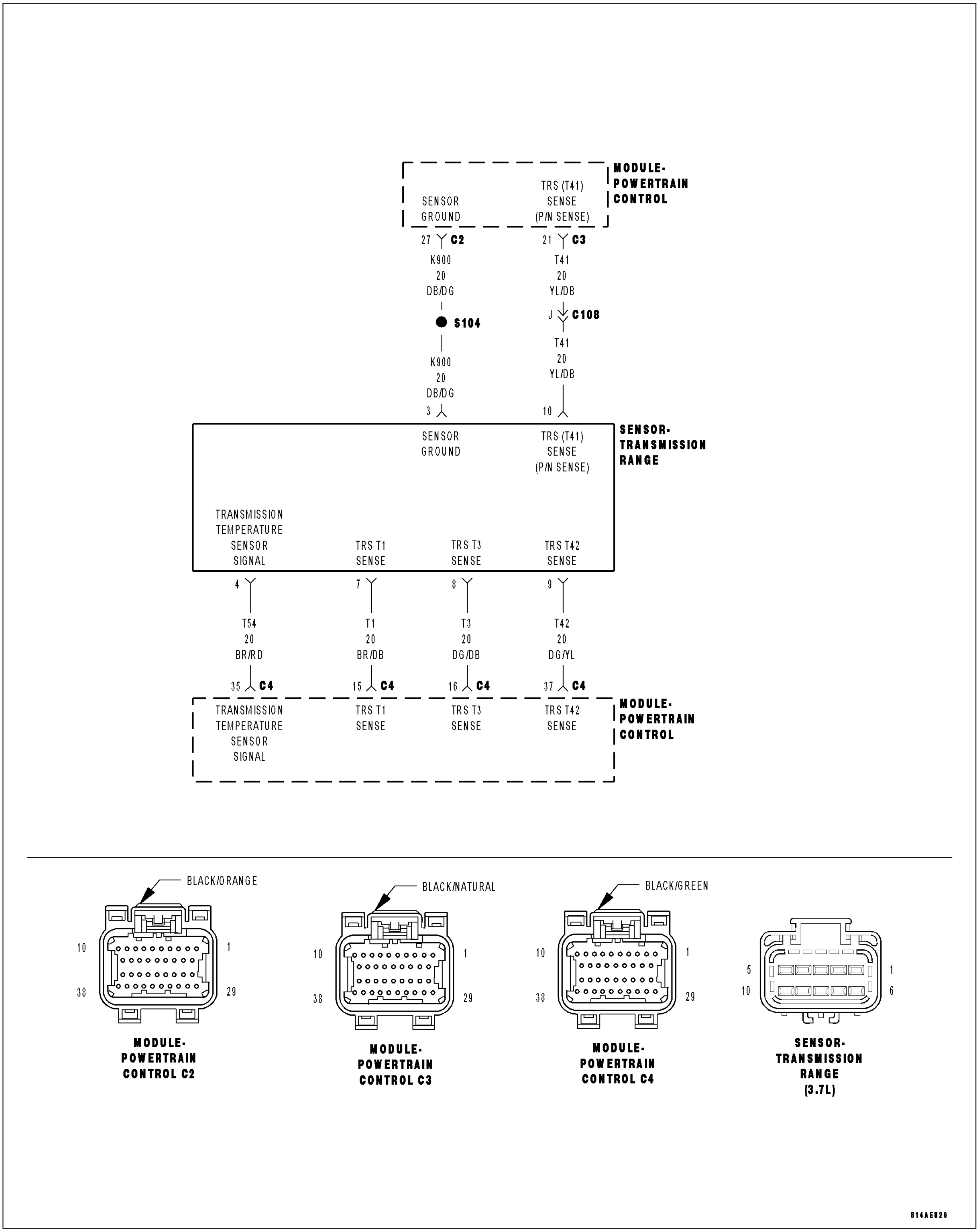
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0712-TRANSMISSION TEMPERATURE SENSOR LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set when the monitored Temperature Sensor voltage drops below 0.078 volts for the period of 1.45 seconds. When the fault is set, calculated temperature is substituted for measured temperature, however the fault code is stored only after three consecutive occurrences of the fault.

| Possible Causes |
|---|
| RELATED DTCS PRESENT |
| (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND |
| TRANSMISSION TEMPERATURE SENSOR |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The temperature sensor is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter operation and when or if some diagnostics are run. A failed temperature sensor could affect the OBD diagnostics. If a problem occurs in the transmission temperature sensor circuit, transmission temperature will be based on a calculated value.

## Diagnostic Test

### 1. DETERMINE IF RELATED DTCS ARE PRESENT

With the scan tool, check Transmission DTCs.

**Are there any Speed Sensor DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate diagnostic procedure. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. CHECK TO SEE IF DTC IS ACTIVE

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 5

### 3. CHECK THE PCM AND WIRING WITH THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

**NOTE: Check connectors - Clean/repair as necessary.**

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

**Do the readings on the Transmission Simulator match the scan tool readings ± 0.2 volts?**

**Yes** >> Replace Transmission Solenoid Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off to the lock position.

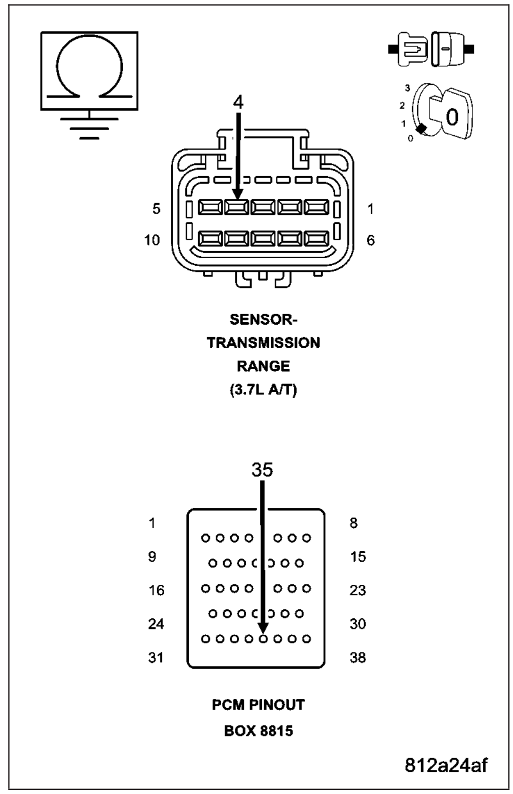
Disconnect the PCM C4 harness connector.

Disconnect the TRS harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Tool #8815 to perform diagnosis.**

Measure the resistance between ground and the (T54) Transmission Temperature Sensor Signal circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T54) Transmission Temperature Sensor Signal circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

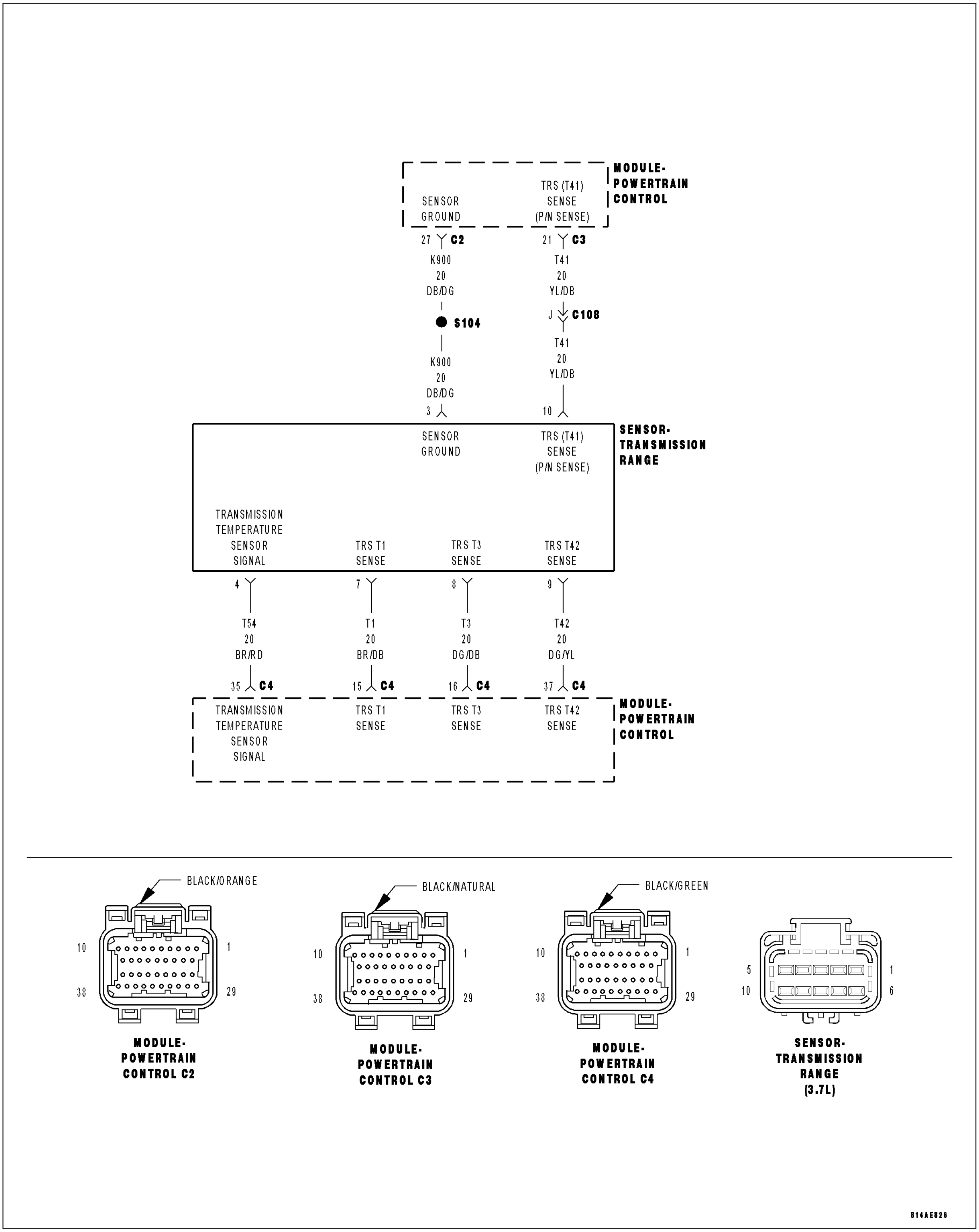
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0713-TRANSMISSION TEMPERATURE SENSOR HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set when the monitored Temperature Sensor voltage rises above 4.94 volts for the period of 1.45 seconds. When the fault is set, calculated temperature is substituted for measured temperature, however the fault code is stored only after three consecutive occurrences of the fault.

| Possible Causes |
|---|
| (K900) SENSOR GROUND OPEN |
| (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN |
| (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION TEMPERATURE SENSOR |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The temperature sensor is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter operation and when or if some diagnostics are run. A failed temperature sensor could affect the OBD diagnostics. If a problem occurs in the transmission temperature sensor circuit, transmission temperature will be based on a calculated value.

### 1. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, view DTCs.

**Is the status Active for this DTC or is STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 2

**No** >> Go To 6

### 2. CHECK THE PCM AND WIRING WITH THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

**NOTE: Check connectors - Clean/repair as necessary.**

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

**Do the readings on the Transmission Simulator match the scan tool readings ± 0.2 volts?**

**Yes** >> Replace Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECK THE (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

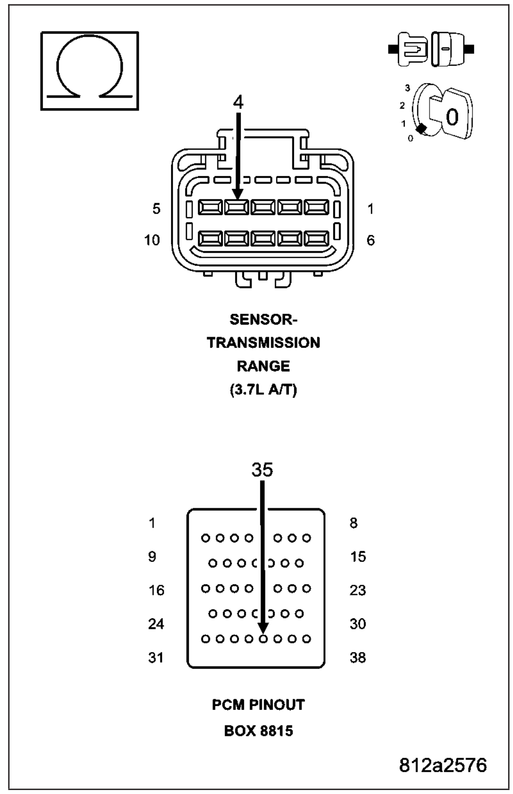
Disconnect the PCM C4 harness connector.

Disconnect the TRS harness connector

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Tool #8815 to perform diagnosis.**

Measure the resistance of the Transmission Temperature Sensor Signal circuit between the appropriate terminal of Miller tool #8815 and the TRS harness connector.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the Transmission Temperature Sensor Signal circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

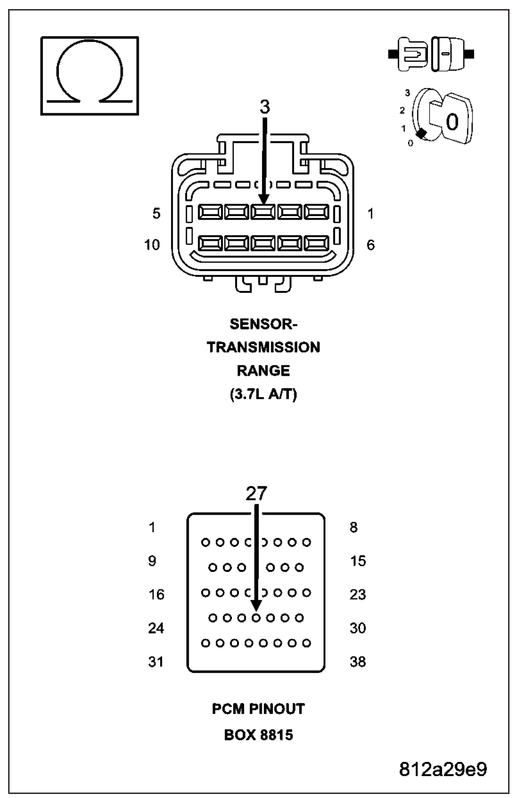
**No** >> Go To 4

## 4. CHECK THE (K900) SENSOR GROUND CIRCUIT FOR AN OPEN

Disconnect the PCM C2 harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

Measure the resistance of the (K900) Sensor Ground circuit between the appropriate terminal of Miller tool #8815 and the TRS harness connector.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (K900) Sensor Ground circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

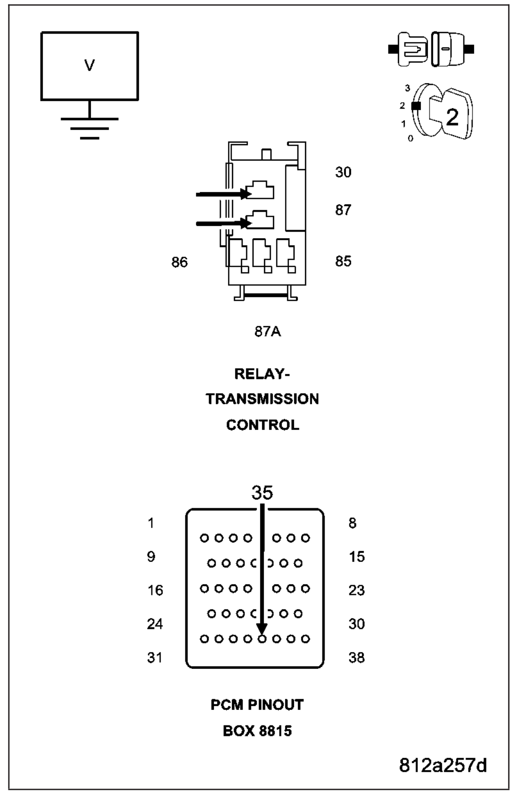
Remove the Transmission Control Relay.

**NOTE: Check connectors - Clean/repair as necessary.**

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T54) Transmission Temperature Sensor Signal circuit in the appropriate terminal of Miller tool #8815.




**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T54) Transmission Temperature Sensor Signal circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

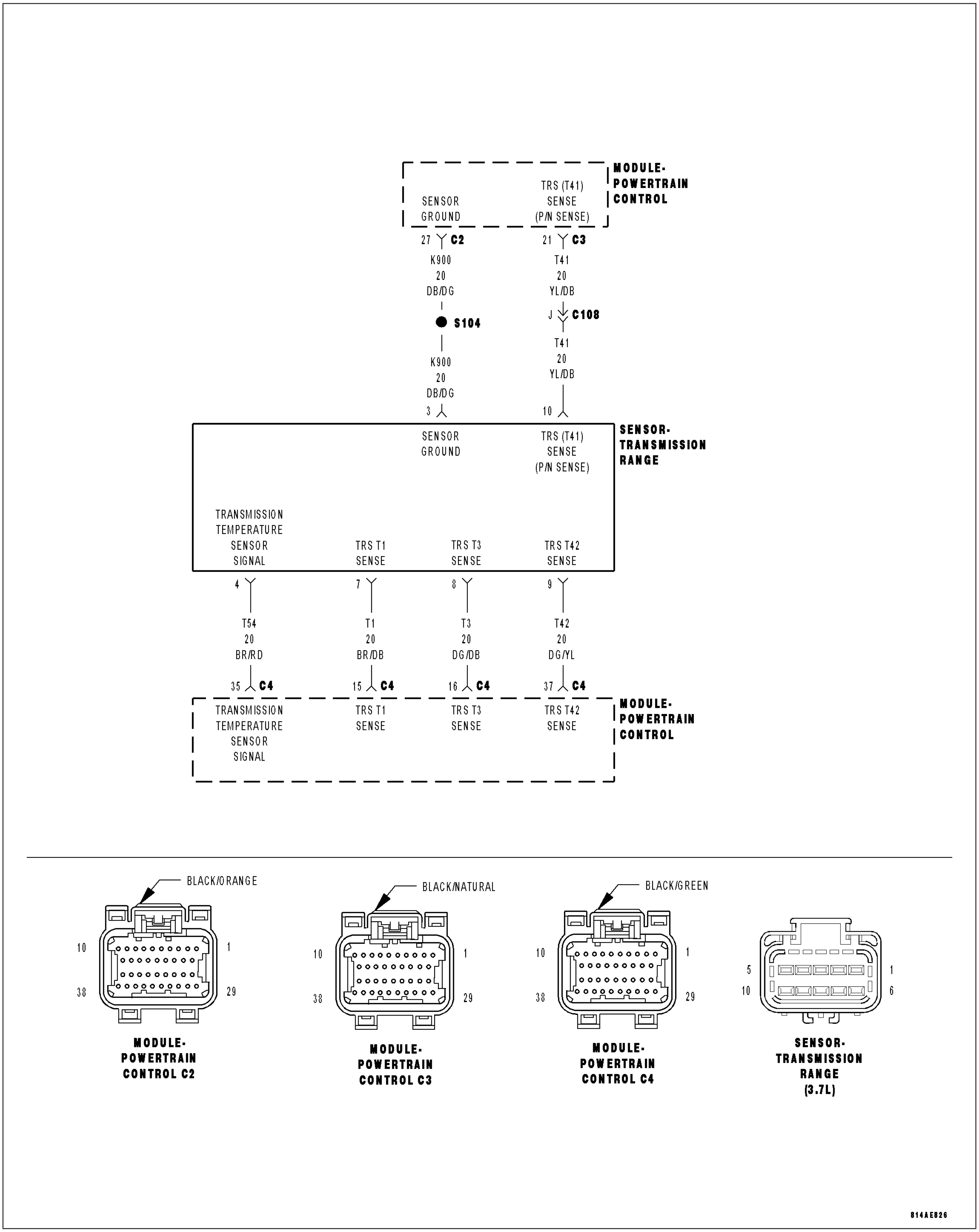
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set when the monitored Temperature Sensor voltage fluctuates or changes abruptly within a predetermined period of time.

| Possible Causes |
|---|
| TRANSMISSION TEMPERATURE SENSOR |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The temperature sensor is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter operation and when or if some diagnostics are run. A failed temperature sensor could affect the OBD diagnostics. If a problem occurs in the transmission temperature sensor circuit, transmission temperature will be based on a calculated value.

### 1. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 2

**No** >> Go To 3

### 2. CHECK THE PCM AND WIRING WITH THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool , monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

**Do the readings on the Transmission Simulator match a non-fluctuating scan tool reading ± 0.2 volts?**

**Yes** >> Replace Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 3. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool , check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

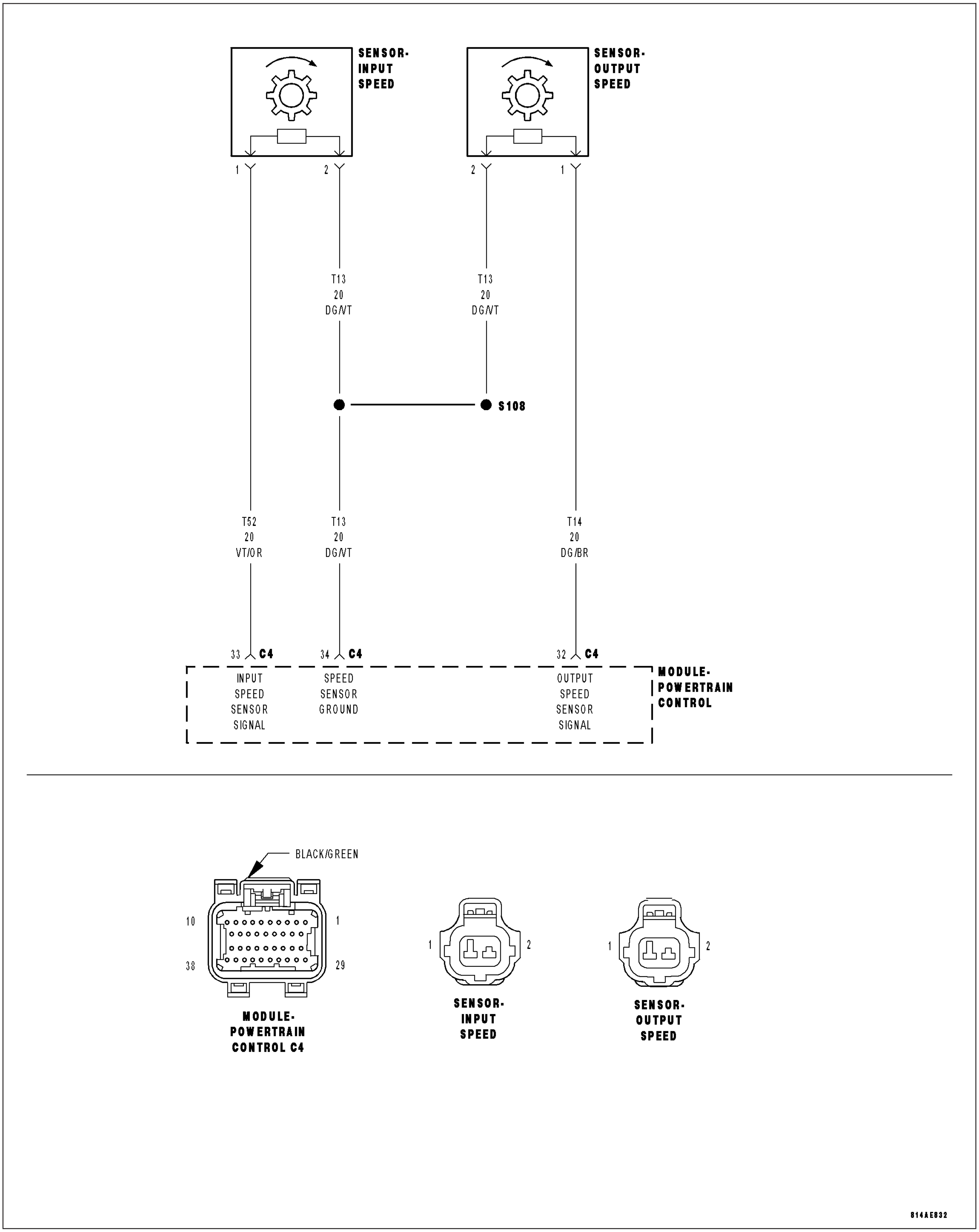
Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0715-INPUT SPEED SENSOR 1 CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If there is an excessive change in the Input RPM in any valid gear (R, 1st, 2nd, 3rd, or 4th).

| Possible Causes |
|---|
| (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT OPEN |
| (T13) SPEED SENSOR GROUND CIRCUIT OPEN |
| (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND |
| (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE |
| (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE |
| INPUT SPEED SENSOR |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission control system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through system checks.

## Diagnostic Test

### 1. CHECK TO SEE IF DTC P0715 IS CURRENT

Start the engine.

Place the shifter in park.

With the scan tool , read the Input Speed Sensor RPM.

**Is the Input Speed Sensor reading below 400 RPM?**

**Yes** >> Go To 2

**No** >> Go To 8

### 2. CHECK THE PCM AND WIRING WITH THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, set the ″Input/Output Speed″ switch to ″ON″ and the rotary switch to the ″3000/1250″ position.

With the scan tool, read the Input and Output RPM.

**Does the Input speed read 3000 RPM and the Output speed read 1250 RPM ± 50 RPM?**

**Yes** >> Replace the Input Speed Sensor per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECK THE (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT FOR AN OPEN

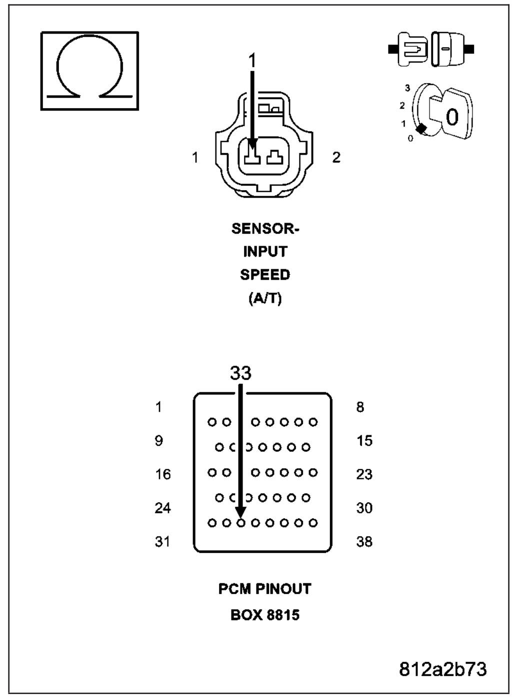
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Input Speed Sensor harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance of the (T52) Input Speed Sensor Signal circuit between the Input Speed Sensor harness connector and the appropriate terminal of Miller tool #8815.




**Is the resistance above 5.0 ohms?**

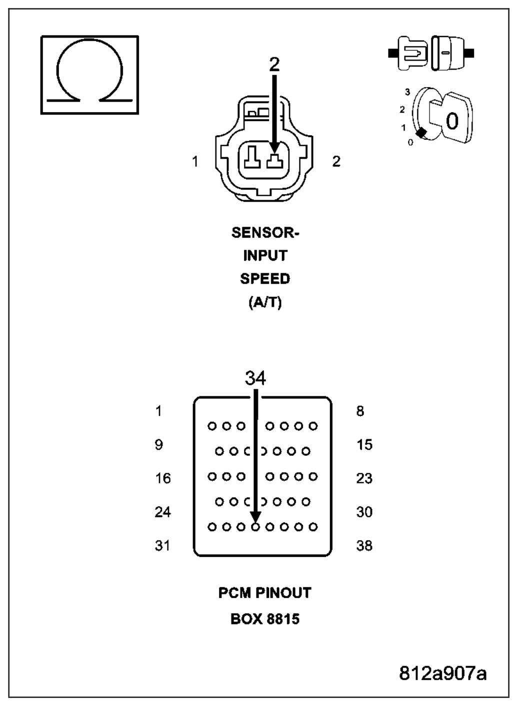
**Yes** >> Repair the (T52) Input Speed Sensor Signal circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the (T13) Speed Sensor Ground circuit between the Input Speed Sensor harness connector and the appropriate terminal of Miller tool #8815.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

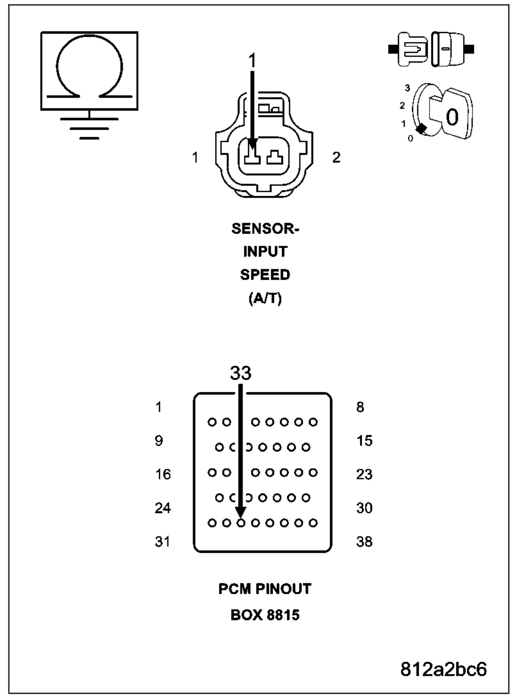
Measure the resistance between ground and the (T52) Input Speed Sensor Signal circuit.

**Is the resistance Below 5.0 ohms?**

**Yes** >> Repair the (T52) Input Speed Sensor Signal circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 6




## 6. CHECK THE (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Disconnect the Output Speed Sensor harness connector.

Remove the Transmission Control Relay.

Connect a jumper wire between the (A104) Fused B(+) circuit and (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

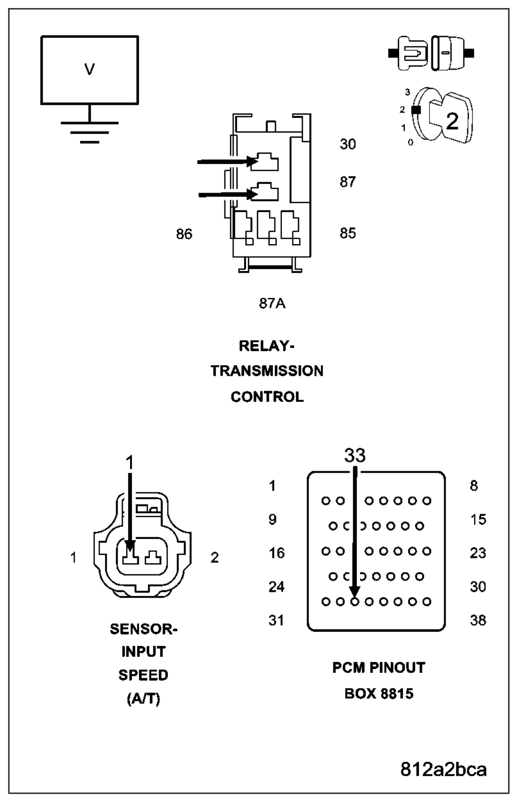
Measure the voltage of the (T52) Input Speed Sensor Signal circuit.

**Is the voltage above 0.5 volt?**

**Yes** >> Repair the (T52) Input Speed Sensor Signal circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

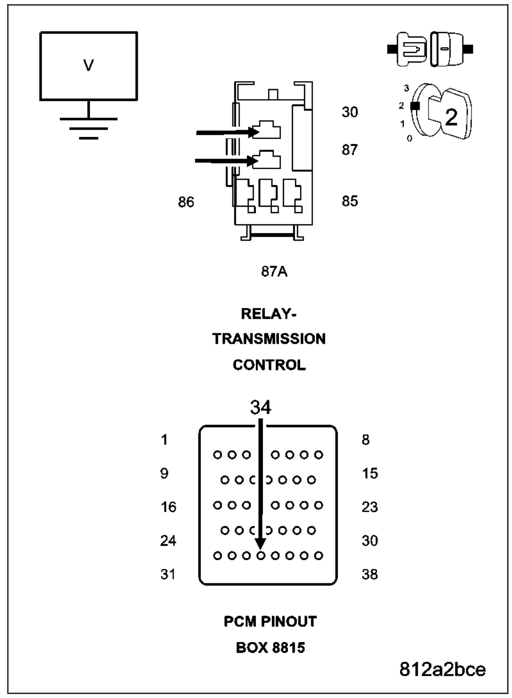
**No** >> Go To 7



## 7. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO VOLTAGE

**NOTE: The jumper wire must still be connected.**

Measure the voltage of the (T13) Speed Sensor Ground circuit.




**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 8. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool , check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

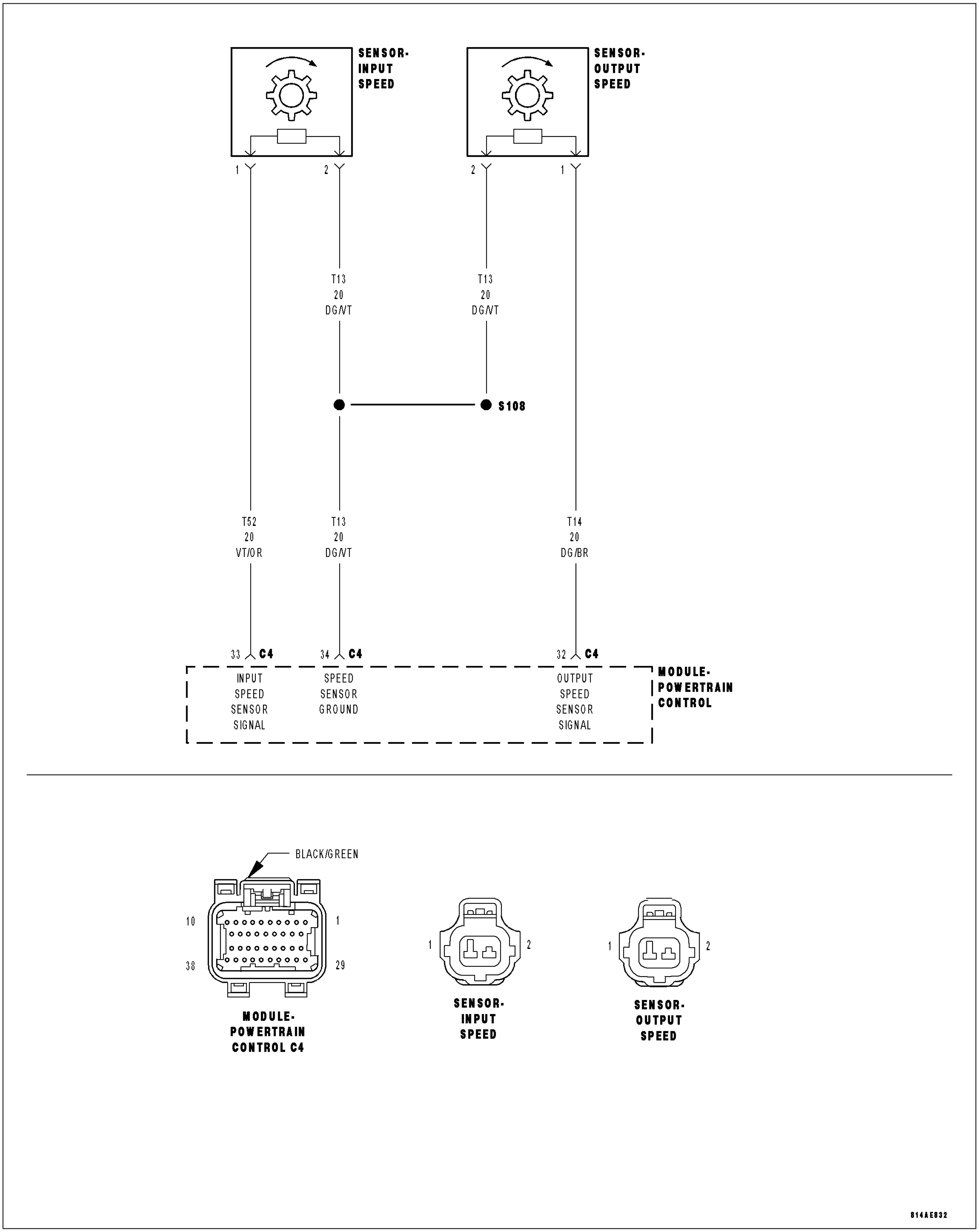
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0720-OUTPUT SPEED SENSOR CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If there is an excessive change in the Output RPM in any gear.

| Possible Causes |
|---|
| (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT OPEN |
| (T13) SPEED SENSOR GROUND CIRCUIT OPEN |
| (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND |
| (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE |
| (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE |
| OUTPUT SPEED SENSOR |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through system checks.

## Diagnostic Test

### 1. CHECK IF THE DTC IS CURRENT

Start the engine in park.

Raise the drive wheels off of the ground.

**WARNING: Properly support the vehicle.**

Firmly apply the brakes and place the transmission selector in drive.

**WARNING: Be sure to keep hands and feet clear of rotating wheels.**

Release the brakes and allow the drive wheels to spin freely.

**NOTE: The drive wheels must be turning at this point.**

With the scan tool, read the Output RPM

**Is the Output RPM below 100?**

**Yes** >> Go To 2

**No** >> Go To 8

### 2. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, set the ″Input/Output Speed″ switch to ″ON″ and the rotary switch to the ″3000/1250″ position.

With the scan tool , read the Input and Output RPM.

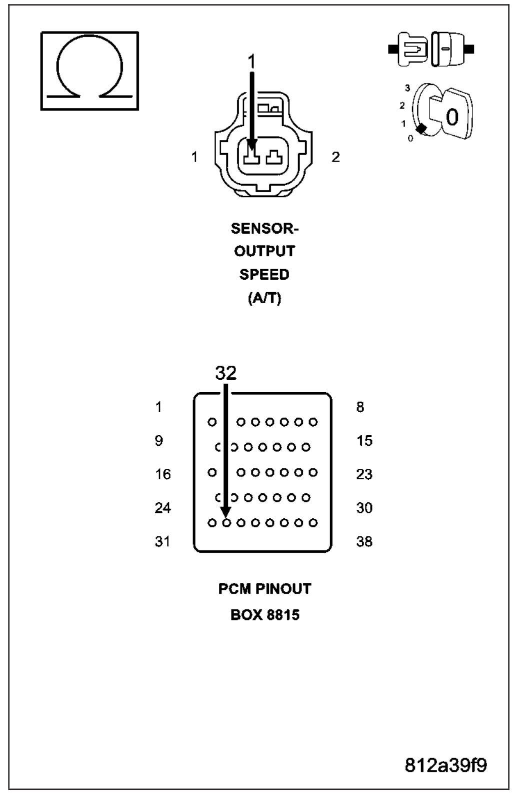
**Does the Input RPM read 3000 and the Output RPM read 1250 (within 50 RPM)?**

**Yes** >> Replace the Output Speed Sensor per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECK THE (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT FOR AN OPEN




Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Output Speed Sensor harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance of the (T14) Output Speed Sensor Signal circuit between the Output Speed Sensor harness connector and the appropriate terminal of Miller tool #8815.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T14) Output Speed Sensor Signal circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 4

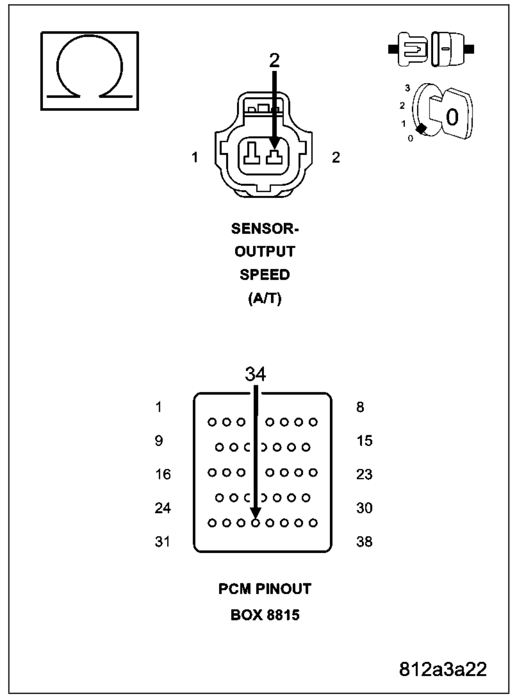
## 4. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR AN OPEN

Measure the resistance of the Speed Sensor Ground circuit between the appropriate terminal of Miller tool #8815 and the Output Speed Sensor harness connector.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5



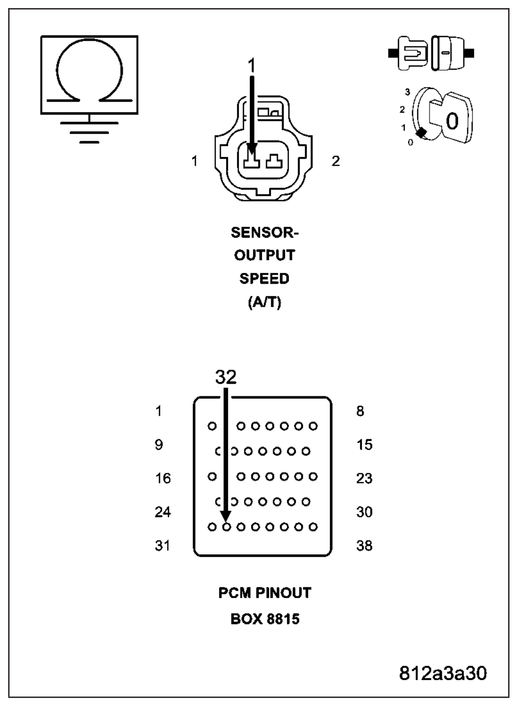

## 5. CHECK THE (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T14) Output Speed Sensor Signal circuit.

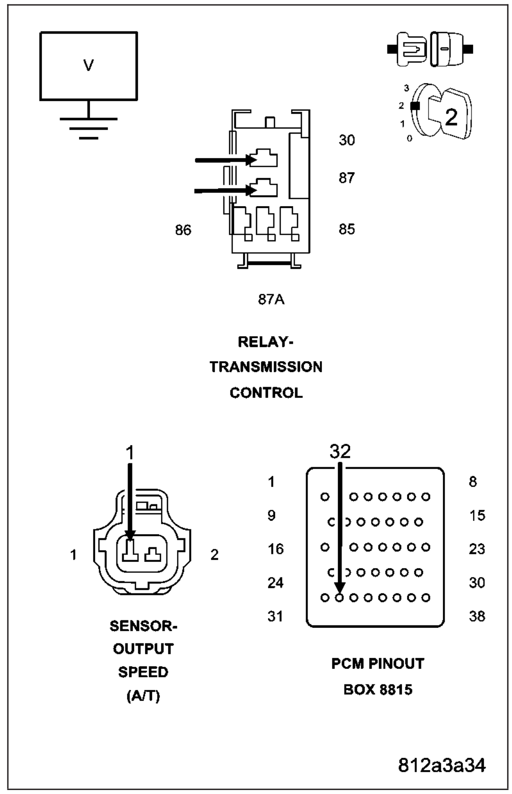
**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T14) Output Speed Sensor Signal circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 6



## 6. CHECK THE (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE




Remove the Transmission Control Relay.

Connect a jumper wire between the (A104) Fused B(+) circuit and (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T14) Output Speed Sensor Signal circuit.

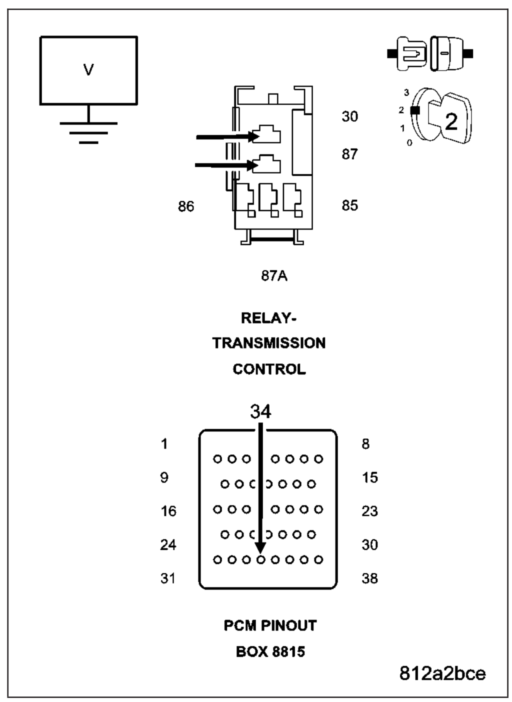
**Is the voltage above 0.5 volt?**

**Yes** >> Repair the (T14) Output Speed Sensor Signal circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO VOLTAGE




**NOTE: The jumper wire must still be connected.**

Measure the voltage of the (T13) Speed Sensor Ground circuit.

**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 8. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool , check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0725-ENGINE SPEED SENSOR CIRCUIT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running.
- **Set Condition:**
  The Engine RPM is less than 390 or greater than 8000 for more than 2 seconds while the engine is running.

| Possible Causes |
|---|
| ENGINE DTCS PRESENT |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

The PCM uses a dual port RAM internal to the controller to send the engine speed signal to the Transmission Control System. The calculated engine RPM is compared to a minimum and maximum value. If the PCM interprets this signal to be out of range when the engine is running the code is set. The MIL illuminates after 10 seconds of vehicle operation and the transmission system defaults to Limp-in mode.

### Diagnostic Test

#### 1. CHECK IF THE DTC IS CURRENT

Start the engine.

**NOTE: This DTC is not a Transmission Input Speed Sensor DTC.**
With the scan tool, read transmission DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter set at 0?**

**Yes** >> Go To 2

**No** >> Go To 3

#### 2. CHECK IF ENGINE DTCS ARE PRESENT

With the scan tool, read engine DTCs.

**Are there any engine DTC's present?**

**Yes** >> Refer to Section 9 – Engine Electrical Diagnostics and perform the appropriate diagnostic procedure.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 3. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

# P0731-GEAR RATIO ERROR IN 1ST

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio when compared to the known gear ratio.

| Possible Causes |
|---|
| RELATED TRANSMISSION DTCS PRESENT |
| INTERMITTENT GEAR RATIO ERRORS |
| INTERNAL TRANSMISSION |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into Limp-in mode after four gear ratio error events occur in a given driving cycle.

## Diagnostic Test

### 1. DETERMINING IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

**Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCs present?**

**Yes** >> Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTC's are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.

**No** >> Go To 2

### 2. CHECK TO SEE IF P0731 IS CURRENT

With the scan tool, perform the 1st gear clutch test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

**CAUTION: Do not overheat the transmission.**

**Did the Clutch Test pass, Input Speed remain at zero?**

**Yes** >> Go To 3

**No** >> Repair internal Transmission as necessary. Check all of the components related to the UD and LR clutches. Inspect the Oil Pump and repair or replace as necessary. Refer to the Service Information for the proper repair procedures.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

### 3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Check the wiring and connectors for the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator.

This DTC can also be set under extreme temperature conditions. This is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

# P0732-GEAR RATIO ERROR IN 2ND

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio when compared to the known gear ratio.

| Possible Causes |
|---|
| RELATED TRANSMISSION DTCS PRESENT |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| INTERMITTENT GEAR RATIO ERRORS |
| INTERNAL TRANSMISSION |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into Limp-in mode after four gear ratio error events occur in a given driving cycle.

## Diagnostic Test

### 1. CHECK IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

**Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCs present?**

**Yes** >> Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCs are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.

**No** >> Go To 2

### 2. CHECK IF THE DTC IS CURRENT

With the scan tool, perform the 2nd gear clutch test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

**CAUTION: Do not overheat the transmission.**

**Did the Clutch Test pass, Input Speed remain at zero?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Check the wiring and connectors to the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator.

This DTC can also be set under extreme temperature conditions. This is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## 4. CHECK FOR RELATED PRESSURE SWITCH DTCS

With the scan tool, read Transmission DTC's.

**Are the DTCs P0845 and/or P0846 present also?**

**Yes** >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Repair internal Transmission per the Service Information. Check all of the components related to the UD and 2/4 clutches. Inspect the Oil Pump and repair or replace as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

# P0733-GEAR RATIO ERROR IN 3RD

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio when compared to the known gear ratio.

| Possible Causes |
|---|
| RELATED TRANSMISSION DTCS PRESENT |
| INTERMITTENT GEAR RATIO ERRORS |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| INTERNAL TRANSMISSION |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into Limp-in mode after four gear ratio error events occur in a given driving cycle.

## Diagnostic Test

### 1. CHECK IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

**Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCs present?**

**Yes** >> Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCs are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK IF THE DTC IS CURRENT

With the scan tool, perform the 3rd gear clutch test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

**CAUTION: Do not overheat the transmission.**

**Did the Clutch Test pass, Input Speed remain at zero?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Check the wiring and connectors for the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator.

This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## 4. CHECK FOR RELATED PRESSURE SWITCH DTCS

With the scan tool, read Transmission DTCs.

**Are the DTCs P0870 and/or P0871 present also?**

**Yes** >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Repair internal Transmission per the Service Information. Check all of the components related to the UD and O/D clutches. Inspect the Oil Pump and repair or replace as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## P0734-GEAR RATIO ERROR IN 4TH

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio when compared to the known gear ratio.

| Possible Causes |
|---|
| RELATED TRANSMISSION DTCS PRESENT |
| INTERMITTENT GEAR RATIO ERRORS |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| INTERNAL TRANSMISSION |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into Limp-in mode after four gear ratio error events occur in a given driving cycle.

### Diagnostic Test

#### 1. CHECK IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

**Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCs present?**

**Yes** >> Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCs are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.

**No** >> Go To 2

#### 2. CHECK IF THE DTC IS CURRENT

With the scan tool, perform the 4th gear clutch test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

**CAUTION: Do not overheat the transmission.**

**Did the Clutch Test pass, Input Speed remain at zero?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTC's can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets a Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Check the wiring and connectors for the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator.

This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## 4. CHECK FOR RELATED PRESSURE SWITCH DTCS

With the scan tool, read Transmission DTC's.

**Are the DTC's P0870 and/or P0871 present also?**

**Yes** >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Repair internal Transmission per the Service Information. Check all of the components related to the O/D and 2/4 clutches. Inspect the Oil Pump and repair or replace as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

# P0736-GEAR RATIO ERROR IN REVERSE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio when compared to the known gear ratio.

| Possible Causes |
|---|
| RELATED TRANSMISSION DTCS PRESENT |
| INTERMITTENT GEAR RATIO ERRORS |
| INTERNAL TRANSMISSION |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through data checks. When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding gear ratio error trouble code is set. The transmission will go into Limp-in mode after four gear ratio error events occur in a given driving cycle.

## Diagnostic Test

### 1. DETERMINING IF RELATED TRANSMISSION DTCS ARE PRESENT

With the scan tool, read Transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

**Are there any Loss of Prime, Line Pressure Sensor and/or Speed Sensor DTCs present?**

**Yes** >> Refer to appropriate diagnostic procedure in the Transmission category. If any of these DTCs are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present.

**No** >> Go To 2

### 2. CHECK TO SEE IF P0731 IS CURRENT

With the scan tool, perform the Reverse gear clutch test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

**CAUTION: Do not overheat the transmission.**

**Did the Clutch Test pass, Input Speed remain at zero?**

**Yes** >> Go To 3

**No** >> Repair internal Transmission per the Service Information. Check all of the components related to the Reverse and LR clutches. Inspect the Oil Pump and repair or replace as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not current at this time.

Check the gearshift linkage adjustment.

Gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the Clutch Test and still sets Gear Ratio DTC, check the Speed Sensors for proper operation.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Check the wiring and connectors related to the Speed Sensors for a good connection, then perform a wiggle test using the Transmission Simulator.

This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0740-TCC OUT OF RANGE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The Torque Converter Clutch (TCC) is in FEMCC or PEMCC, Transmission temperature is hot, Engine temperature is greater than 38° C or 100° F, Transmission Input Speed greater than engine speed, TPS less than 30°, and brake not applied.
- **Set Condition:**
  The TCC is modulated by controlling the duty cycle of the L/R Solenoid until the difference between the Engine RPM and the Transmission Input Speed RPM or duty cycle is within a desired range. The DTC is set after the period of 10 seconds and 3 occurrences of either: FEMCC - with slip greater than 100 RPM or PEMCC - duty cycle greater than 85%.

| Possible Causes |
|---|
| RELATED L/R SOLENOID OR PRESSURE SWITCH DTCS PRESENT |
| INTERNAL TRANSMISSION |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

When in 2nd, 3rd, or 4th gear, the torque converter clutch (TCC) can be locked or partially locked when certain conditions are met. The TCC piston is electronically modulated by increasing the duty cycle of the LR/TCC solenoid until the torque converter slip difference (difference between engine and turbine speed) is within 60 RPM. Then the LR/TCC solenoid is fully energized (FEMCC / 100% duty cycle). Torque converter slip is monitored in FEMCC to ensure adequate clutch capacity. The transmission will attempt normal EMCC operation (not in Limp-in) even after the MIL is illuminated. MIL will illuminate after 5 minutes of accumulated slip in FEMCC.

### Diagnostic Test

#### 1. CHECK IF RELATED DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are the DTCs P0750 and/or P0841 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

#### 2. CHECK IF THE DTC IS CURRENT

Ignition on, engine not running.

With the scan tool, record and erase DTCs.

Drive the vehicle until it is fully warmed up to at least 43° C (110° F).

Perform the following step 3 times.

Drive the vehicle at 50 mph and allow 4th gear to engage for at least 10 seconds. Close the throttle, then tip back in until the throttle angle is between 25 and 29 degrees. Note that if you go over 30 degrees, you must back off of the throttle and retry.

**Did the TCC engage during any of the attempts?**

**Yes** >> Go To 3

**No** >> Perform the Hydraulic Pressure test per the Service Information and repair the internal transmission components and Torque convertor as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 3. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

This DTC can also be set under extreme temperature conditions. This is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

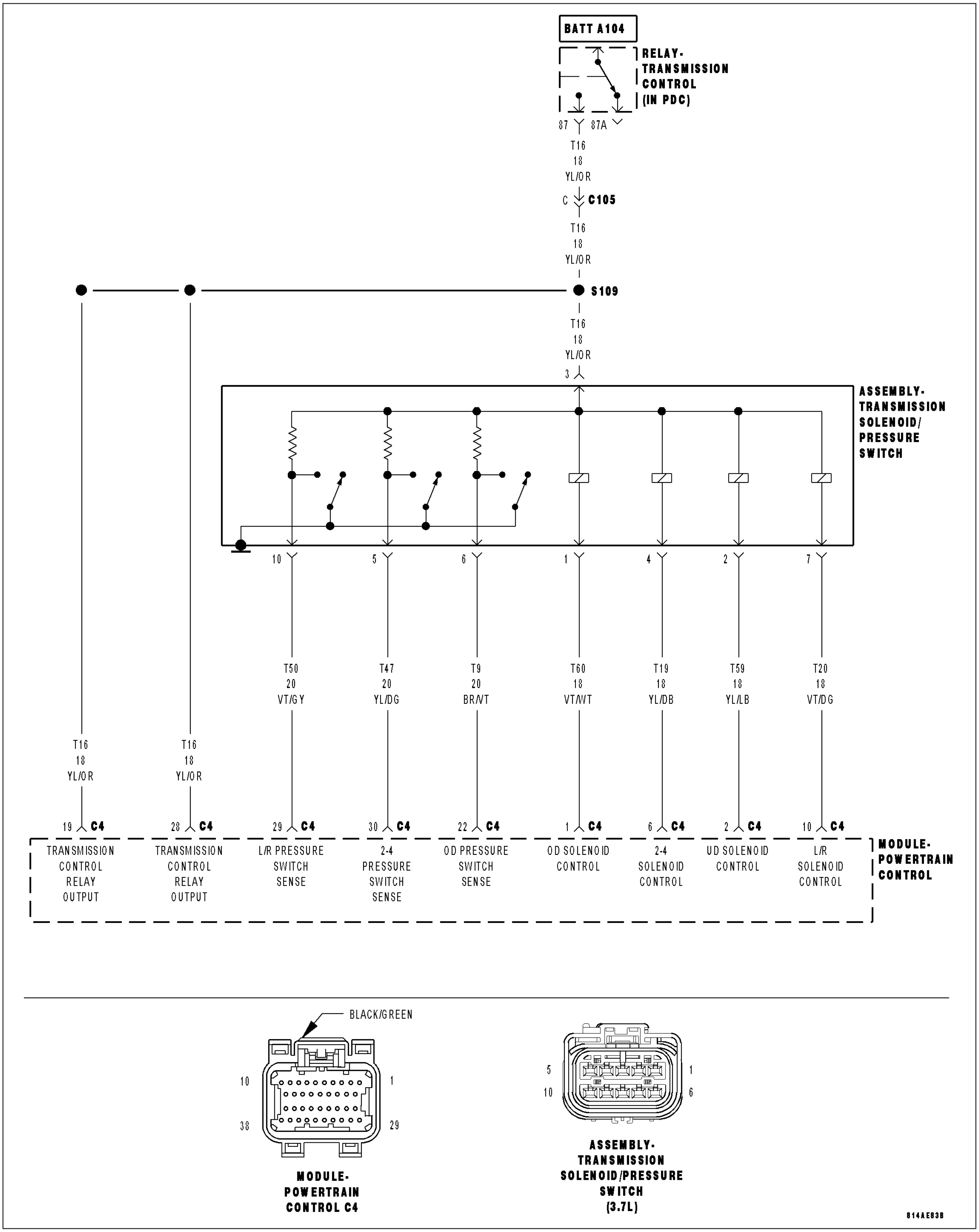
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0750-LR SOLENOID CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Initially at ignition on, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio error or pressure switch error is detected.
- **Set Condition:**
  Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

| Possible Causes |
|---|
| RELATED TRANSMISSION RELAY DTCS PRESENT |
| (T20) L/R SOLENOID CONTROL CIRCUIT OPEN |
| (T20) L/R SOLENOID CONTROL CIRCUIT SHORT TO GROUND |
| (T20) L/R SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

Four solenoids are used to control the friction elements (clutches). The continuity of the solenoids circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the PCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate DTC being set. The MIL will illuminate and the transmission goes into neutral, if the DTC is set above 35 Kmh (22 mph), Limp-in mode when vehicle speed is below 35 Kmh (22 mph).

## Diagnostic Test

### 1. CHECK IF RELATED RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any Transmission Control Relay DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate diagnostic procedure.

**No** >> Go To 2

### 2. CHECK IF THE DTC IS CURRENT

With the scan tool, view DTCs.

**Is the status Active or is STARTS SINCE SET counter set at 0 for this DTC?**

**Yes** >> Go To 3

**No** >> Go To 7

### 3. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, actuate the L/R Solenoid.

Monitor the L/R Solenoid LED on the Transmission Simulator.

**Did the L/R Solenoid LED on the Transmission Simulator blink on and off during actuation?**

**Yes** >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE (T20) L/R SOLENOID CONTROL CIRCUIT FOR AN OPEN

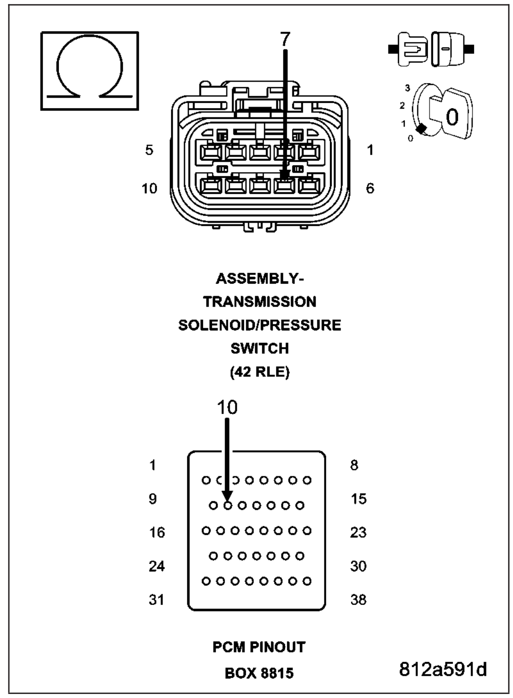
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance of the (T20) L/R Solenoid Control circuit between the Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.



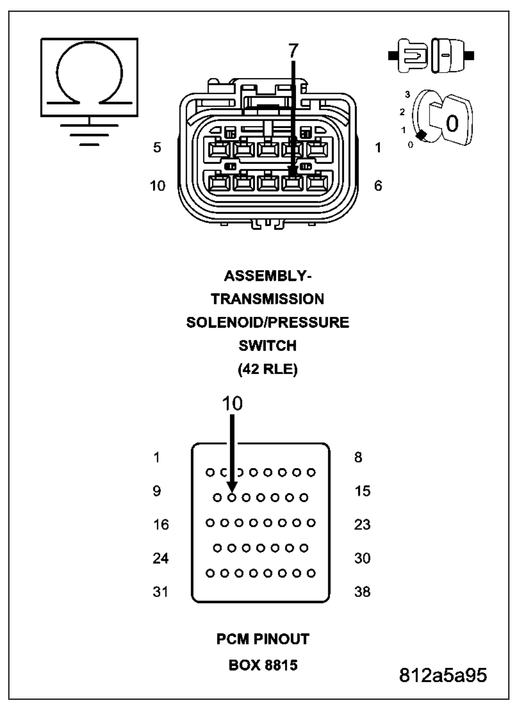

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T20) L/R Solenoid Control circuit for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE (T20) L/R SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T20) L/R Solenoid Control circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T20) L/R Solenoid Control circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 6

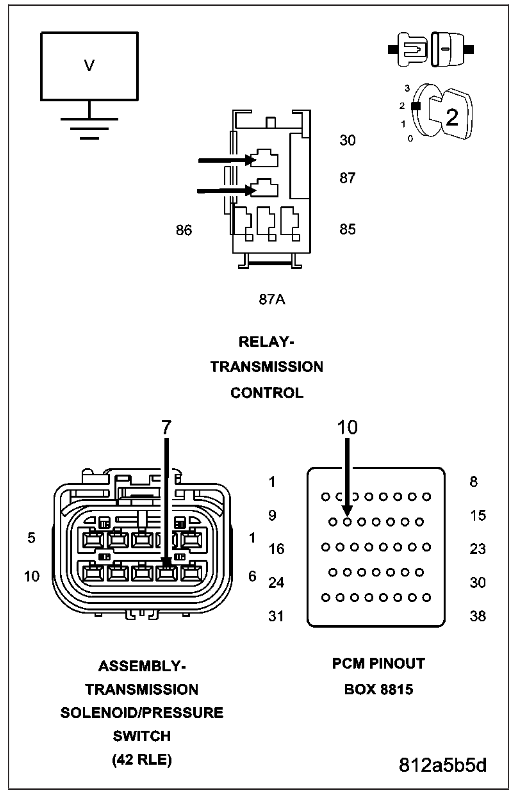
## 6. CHECK THE (T20) L/R SOLENOID CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

Remove the Transmission Control Relay.

Connect a jumper wire between the (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T20) L/R Solenoid Control circuit.




**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T20) L/R Solenoid Control circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

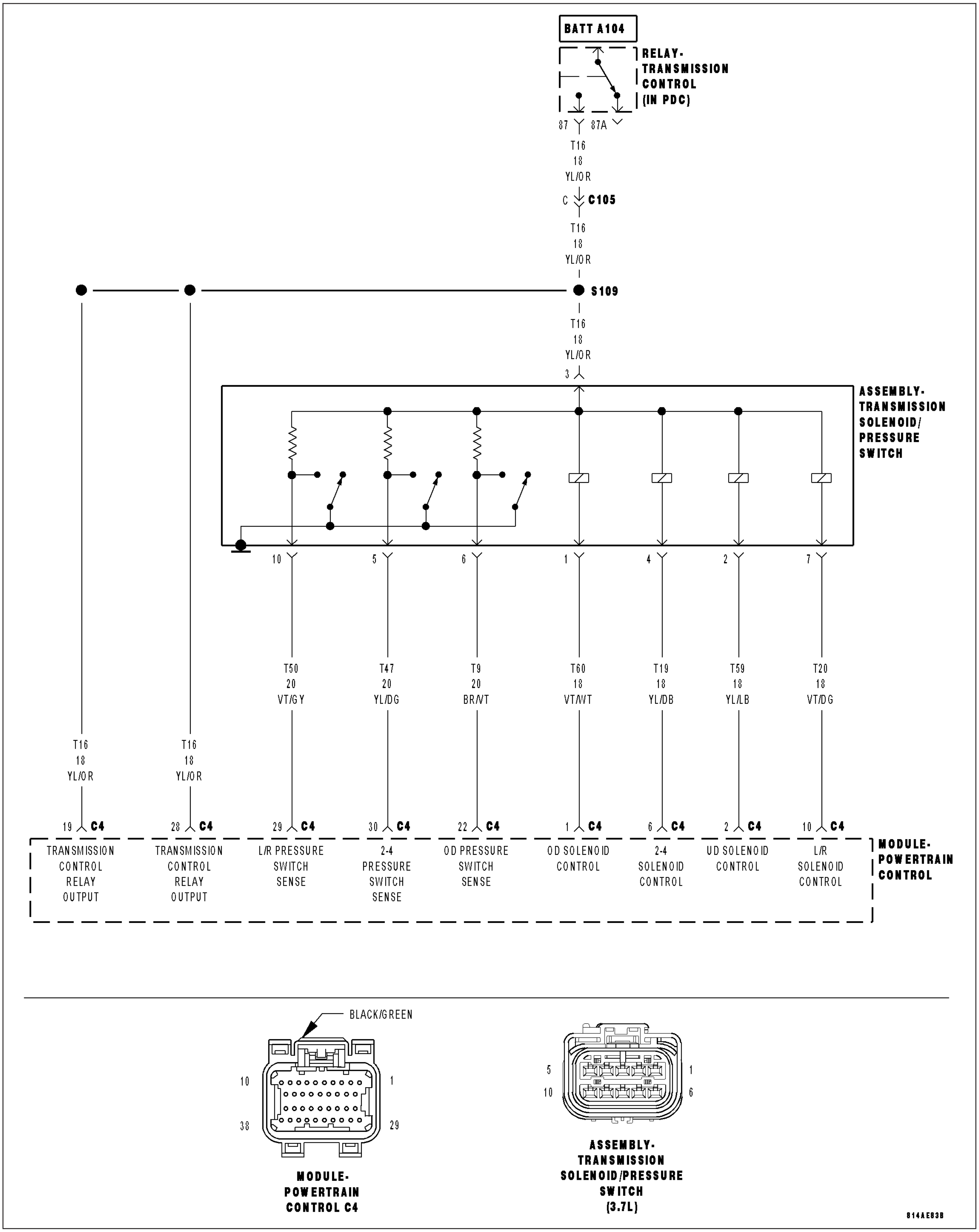
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0755-2/4 SOLENOID CIRCUIT




42RLE MINI SOL PRS CKTS

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Initially at ignition on, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio error or pressure switch error is detected.
- **Set Condition:**
  Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

| Possible Causes |
|---|
| RELATED TRANSMISSION RELAY DTCS PRESENT |
| (T19) 2/4 SOLENOID CONTROL CIRCUIT OPEN |
| (T19) 2/4 SOLENOID CONTROL CIRCUIT SHORT TO GROUND |
| (T19) 2/4 SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

Four solenoids are used to control the friction elements (clutches). The continuity of the solenoids circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the PCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate DTC being set. The MIL will illuminate and the transmission goes into neutral, if the DTC is set above 35 Kmh (22 mph), Limp-in mode when vehicle speed is below 35 Kmh (22 mph).

## Diagnostic Test

### 1. CHECK IF RELATED TRANSMISSION RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any Transmission Control Relay DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate diagnostic procedure.

**No** >> Go To 2

### 2. CHECK TO SEE IF P0755 IS CURRENT

With the scan tool, view DTCs.

**Is the status Active or is the STARTS SINCE SET counter set at 0 for this DTC?**

**Yes** >> Go To 3

**No** >> Go To 7

## 3. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, actuate the 2/4 Solenoid.

Monitor the 2/4 Solenoid LED on the Transmission Simulator.

**Did the 2/4 Solenoid LED on the Transmission Simulator blink on and off during actuation?**

**Yes** >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE (T19) 2/4 SOLENOID CONTROL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

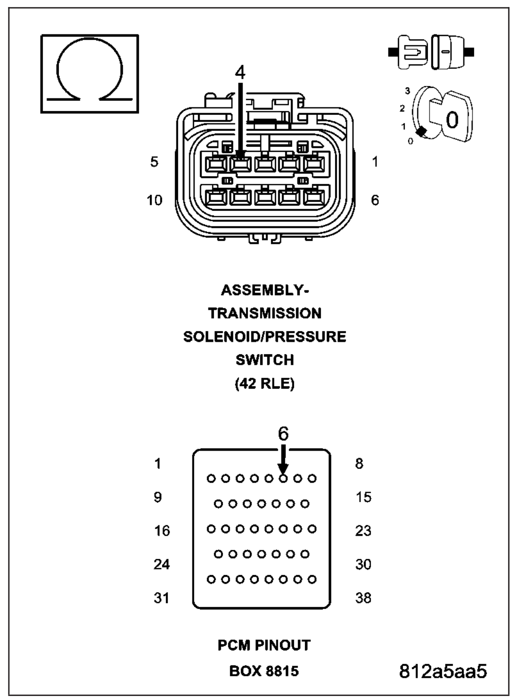
Measure the resistance of the (T19) 2/4 Solenoid Control circuit between the Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T19) 2/4 Solenoid Control circuit for an open.

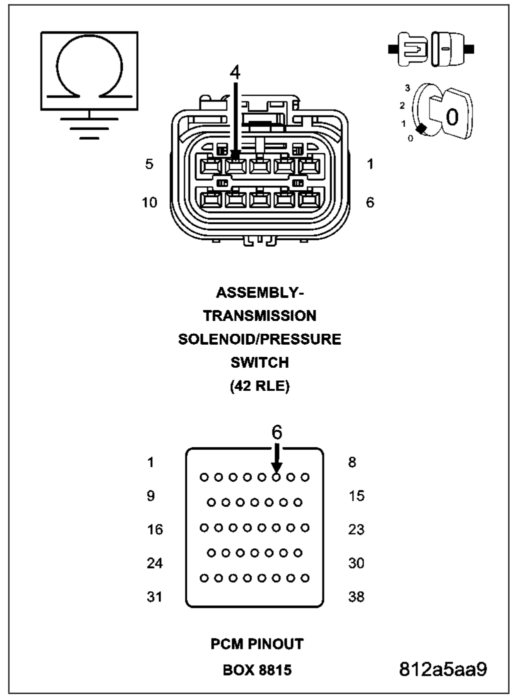
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5



## 5. CHECK THE (T19) 2/4 SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T19) 2/4 Solenoid Control circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T19) 2/4 Solenoid Control circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECK THE (T19) 2/4 SOLENOID CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

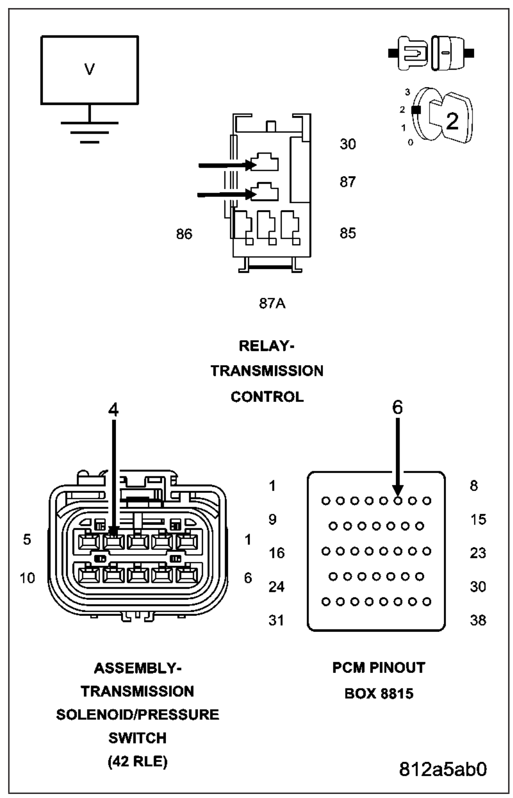
Remove the Transmission Control Relay.

**NOTE: Check connectors - Clean/repair as necessary.**

Connect a jumper wire between the (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T19) 2/4 Solenoid Control circuit.




**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T19) 2/4 Solenoid Control circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

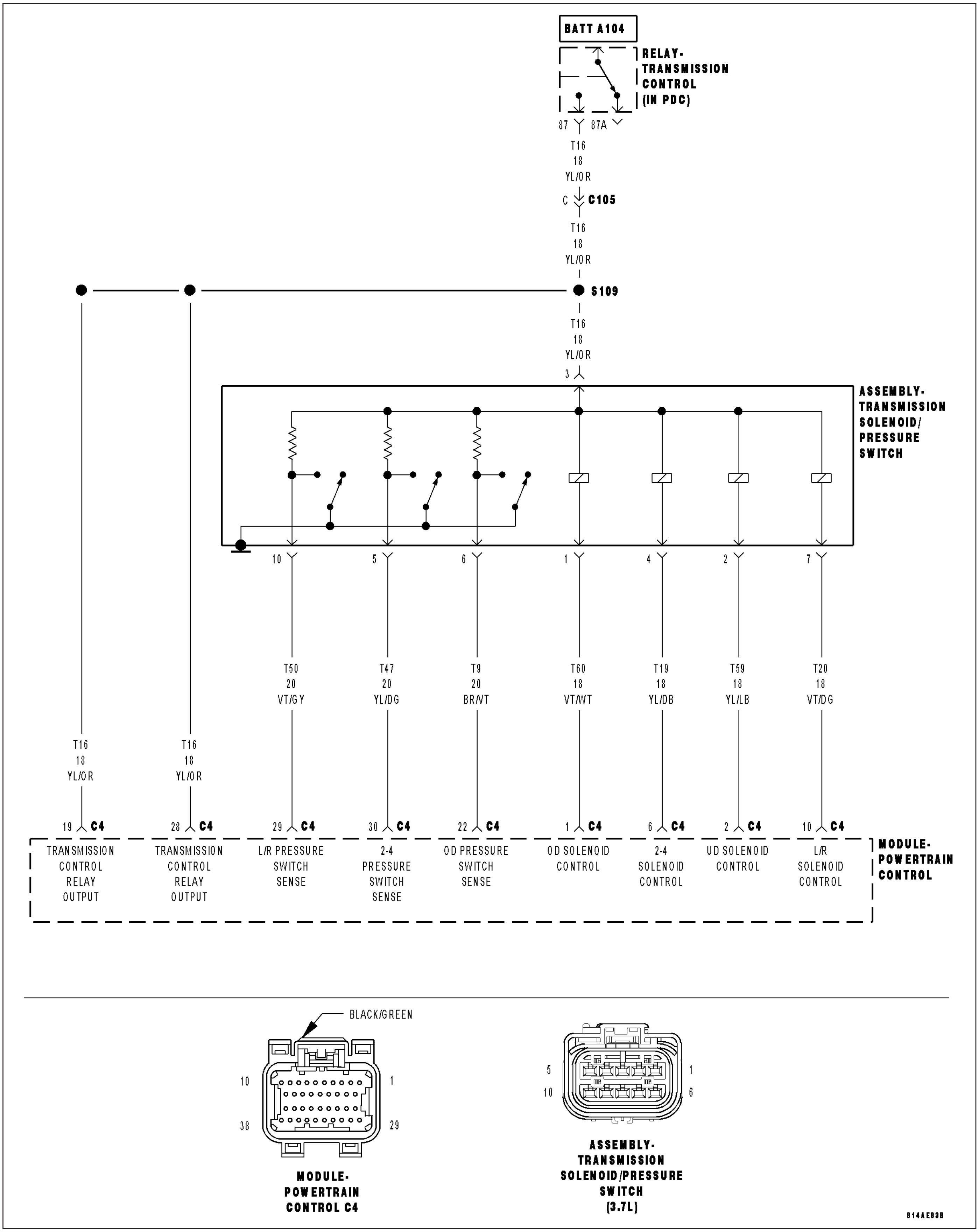
Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0760-OD SOLENOID CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Initially at ignition on, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio error or pressure switch error is detected.
- **Set Condition:**
  Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

| Possible Causes |
|---|
| RELATED TRANSMISSION CONTROL OUTPUT DTCS PRESENT |
| (T60) OD SOLENOID CONTROL CIRCUIT OPEN |
| (T60) OD SOLENOID CONTROL CIRCUIT SHORT TO GROUND |
| (T60) OD SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

Four solenoids are used to control the friction elements (clutches). The continuity of the solenoid circuits is periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the PCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate DTC being set. The MIL will illuminate and the transmission goes into neutral, if the DTC is set above 35 Kmh (22 mph), Limp-in mode when vehicle speed is below 35 Kmh (22 mph).

## Diagnostic Test

### 1. CHECK IF RELATED RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any Transmission Control Relay DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate diagnostic procedure.

**No** >> Go To 2

### 2. CHECK IF DTC IS CURRENT

With the scan tool, view DTCs.

**Is the status Active or is the STARTS SINCE SET counter set at 0 for this DTC?**

**Yes** >> Go To 3

**No** >> Go To 7

### 3. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, actuate the OD Solenoid.

Monitor the OD Solenoid LED on the Transmission Simulator.

**Did the OD Solenoid LED on the Transmission Simulator blink on and off during actuation?**

**Yes** >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE (T60) OD SOLENOID CONTROL CIRCUIT FOR AN OPEN

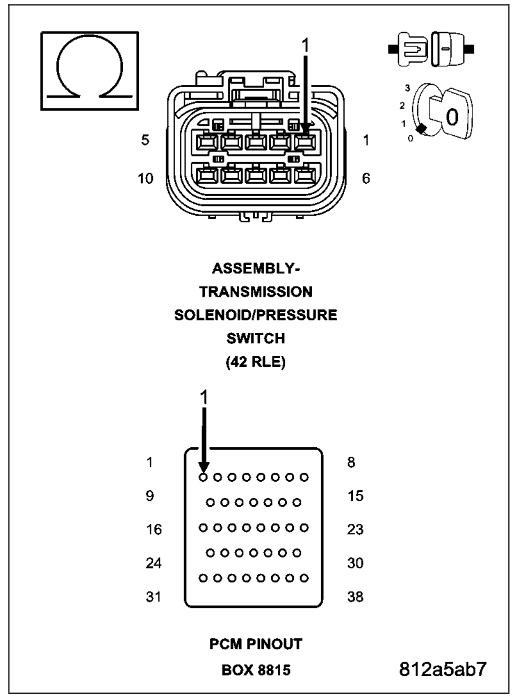
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance of the (T60) OD Solenoid Control circuit between the appropriate terminal of Miller tool #8815 and the Solenoid/Pressure Switch Assembly harness connector.




**Is the resistance above 5.0 ohms?**

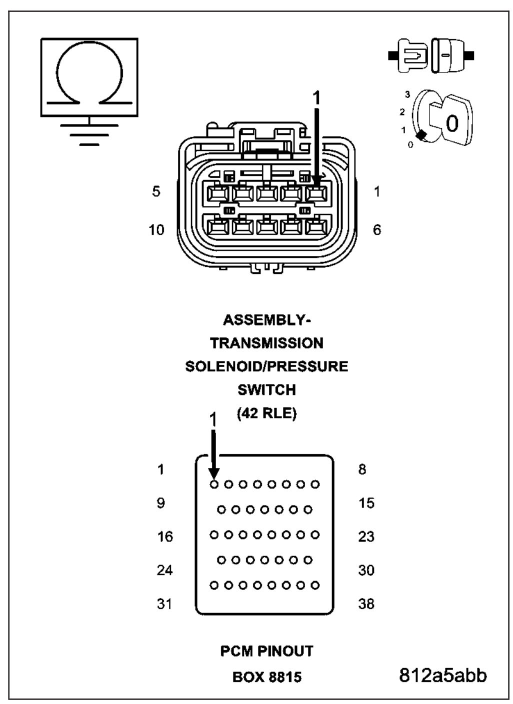
**Yes** >> Repair the (T60) OD Solenoid Control circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE (T60) OD SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T60) OD Solenoid Control circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T60) OD Solenoid Control circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECK THE (T60) OD SOLENOID CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

Remove the Transmission Control Relay.

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T60) OD Solenoid Control circuit.

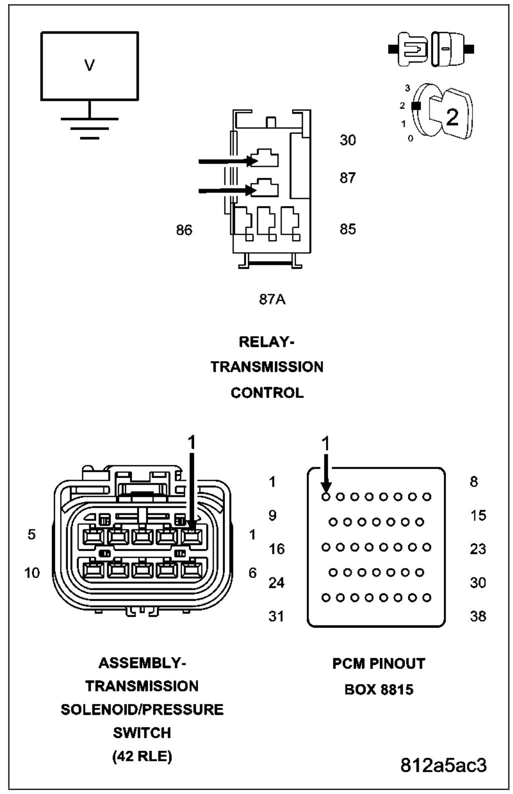
**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T60) OD Solenoid Control circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)




## 7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

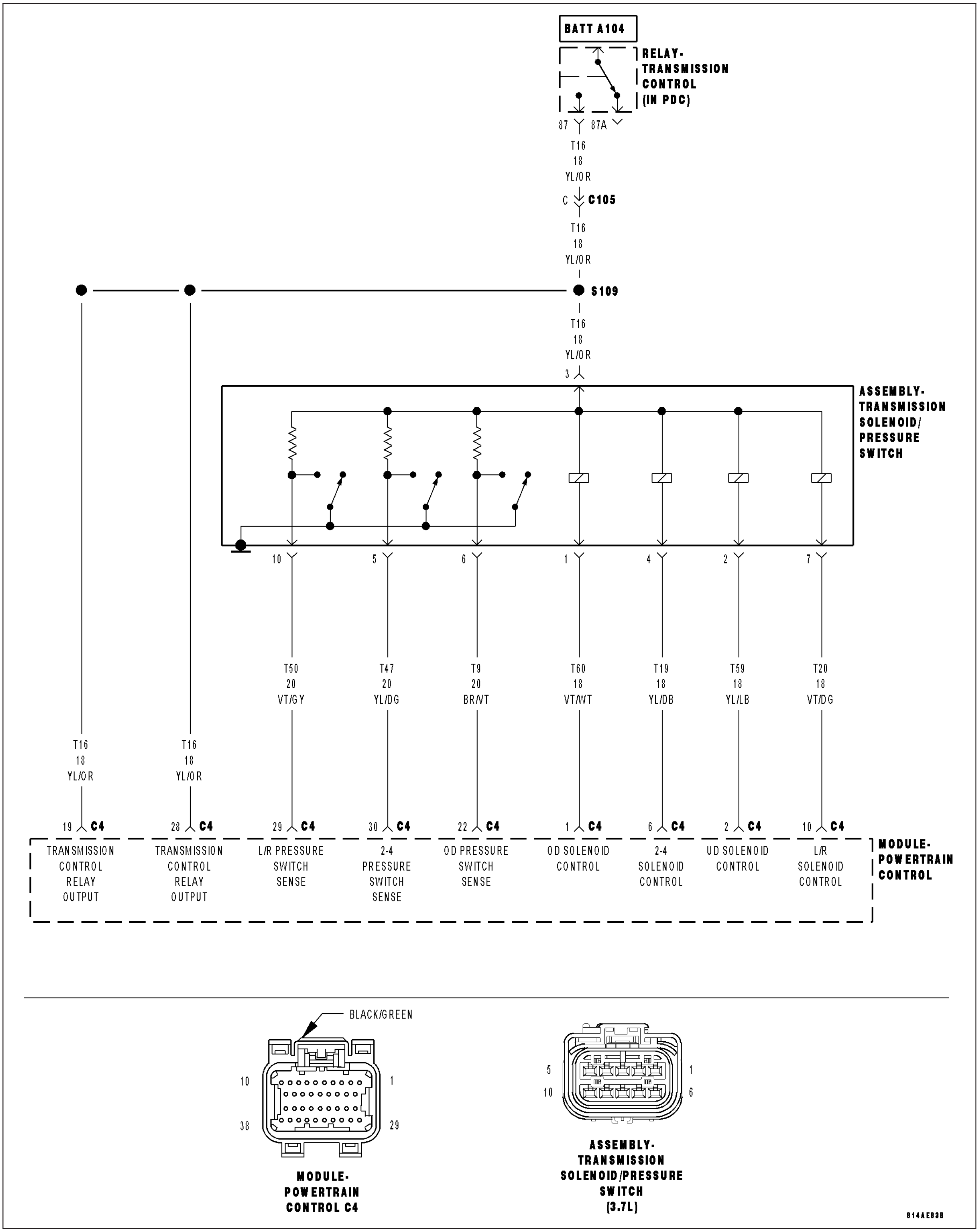
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0765-UD SOLENOID CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Initially at ignition on, then every 10 seconds thereafter. The solenoids will also be tested immediately after a gear ratio error or pressure switch error is detected.
- **Set Condition:**
  Three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error.

| Possible Causes |
| --- |
| RELATED TRANSMISSION CONTROL OUTPUT DTCS PRESENT |
| (T59) UD SOLENOID CONTROL CIRCUIT OPEN |
| (T59) UD SOLENOID CONTROL CIRCUIT SHORT TO GROUND |
| (T59) UD SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

Four solenoids are used to control the friction elements (clutches). The continuity of the solenoid circuits is periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the PCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate DTC being set. The MIL will illuminate and the transmission goes into neutral, if the DTC is set above 35 Kmh (22 mph), Limp-in mode when vehicle speed is below 35 Kmh (22 mph).

## Diagnostic Test

### 1. CHECK IF RELATED RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any Transmission Control Relay DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK IF THE DTC IS CURRENT

With the scan tool, view DTCs.

**Is the status Active or is the STARTS SINCE SET counter set at 0 for this DTC?**

**Yes** >> Go To 3

**No** >> Go To 7

### 3. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, actuate the UD Solenoid.

Monitor the UD Solenoid LED on the Transmission Simulator.

**Did the UD Solenoid LED on the Transmission Simulator blink on and off during actuation?**

**Yes** >> Replace Transmission Solenoid/Pressure Switch Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DISASSEMBLY)

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE (T59) UD SOLENOID CONTROL CIRCUIT FOR AN OPEN

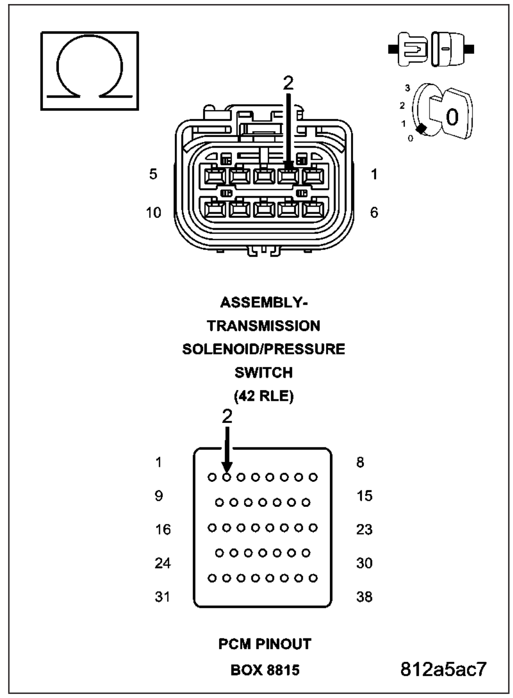
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance of the (T59) UD Solenoid Control circuit between the Solenoid/Pressure Switch Assembly harness connector and the appropriate terminal of Miller tool #8815.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T59) UD Solenoid Control circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE (T59) UD SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

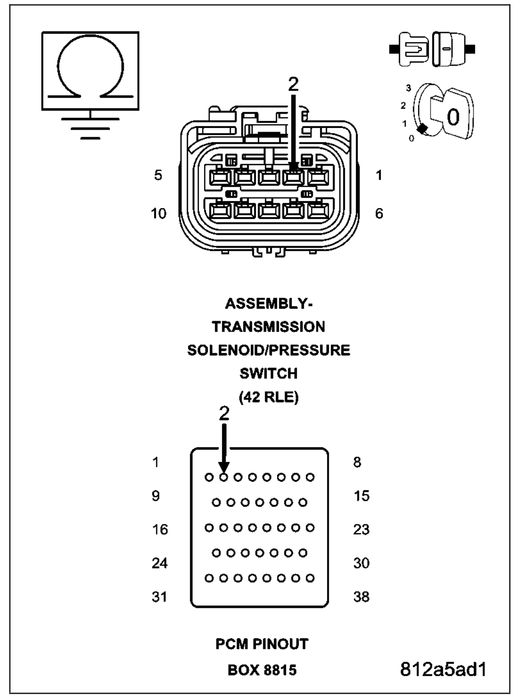
Measure the resistance between ground and the (T59) UD Solenoid Control circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T59) UD Solenoid Control circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 6




## 6. CHECK THE (T59) UD SOLENOID CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

Remove the Transmission Control Relay.

**NOTE: Check connectors - Clean/repair as necessary.**

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T59) UD Solenoid Control circuit.

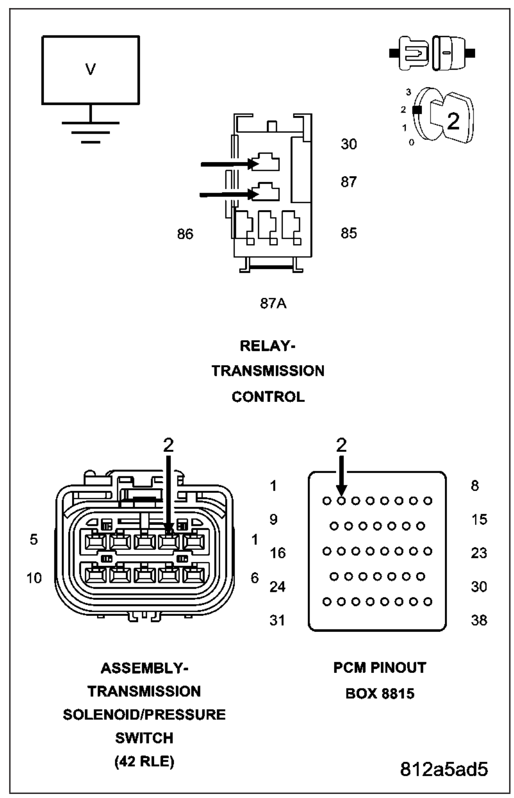
**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T59) UD Solenoid Control circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



## 7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

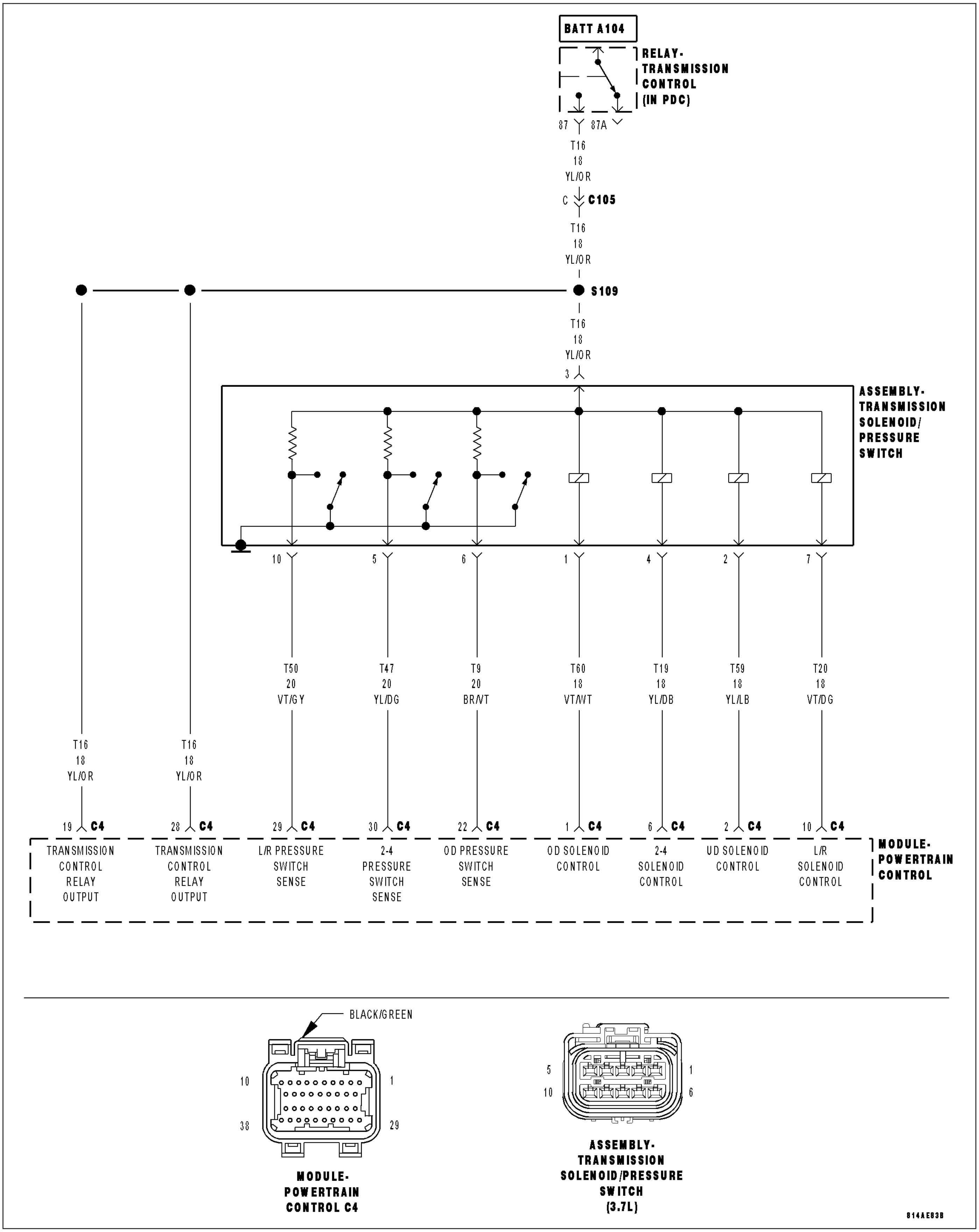
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/ TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0841-LR PRESSURE SWITCH RATIONALITY




*42RLE MINI SOL PRS CKTS*

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running.
- **Set Condition:**
  The DTC is set if one of the pressure switches are open or closed at the wrong time in a given gear. If the problem is identified for 3 successive key starts, the transmission will go into Limp-in mode and the MIL will turn on after 10 seconds of vehicle operation.

| Possible Causes |
|---|
| RELATED TRANSMISSION RELAY DTCS PRESENT |
| LOSS OF PRIME DTC PRESENT |
| (T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).**

## Theory of Operation

The Transmission system uses three pressure switches to monitor the fluid pressure in the LR, 2/4, and OD elements. The pressure switches are continuously monitored for the correct states in each gear. If a set condition is identified, 1st gear and torque converter lock-up (EMCC) will be inhibited. The vehicle will launch in 2nd gear and shift normally through the gears without allowing EMCC. If during the same key start, the set condition is no longer valid, the transmission will return to normal operation (1st and EMCC available). Limp-in will not occur unless DTC P0841 is accompanied by a code P0706 and the MIL will illuminate after 5 minutes of substituted operation.

**PRESSURE SWITCH STATES**

| GEAR | L/R | 2/4 | OD |
|---|---|---|---|
| R | OP | OP | OP |
| P/N | CL | OP | OP |
| 1st | CL | OP | OP |
| 2nd | OP | CL | OP |
| D | OP | OP | CL |
| OD | OP | CL | CL |

**OP = OPEN**

**CL = CLOSED**

## Diagnostic Test

### 1. DETERMINING IF RELATED TRANSMISSION RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any Transmission Control Relay DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

## 2. CHECK FOR LOSS OF PRIME DTC

With the scan tool, check for other Transmission DTCs.

**Is the DTC P0944 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 3

## 3. CHECK TO SEE IF P0841 IS CURRENT

With the scan tool, view DTCs.

**Is the status active for this DTC or is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 4

**No** >> Go To 8

## 4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector to L/R.

With the scan tool , monitor the L/R Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

**Did the L/R Pressure Switch state change?**

**Yes** >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

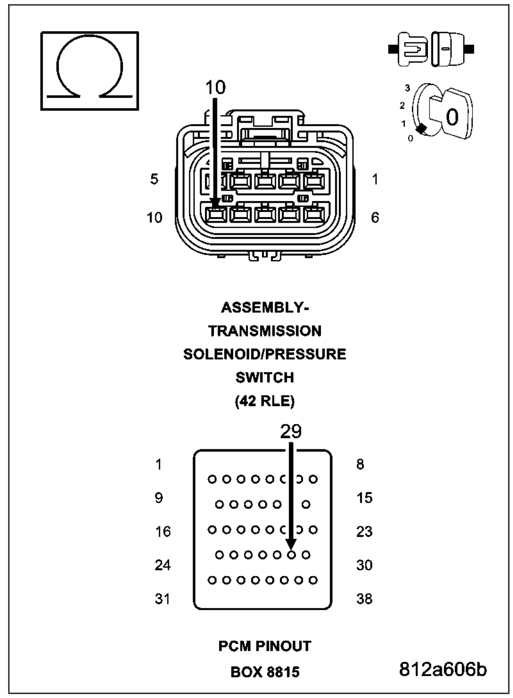
Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (T50) L/R Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.




**Is the resistance above 5.0 ohms?**

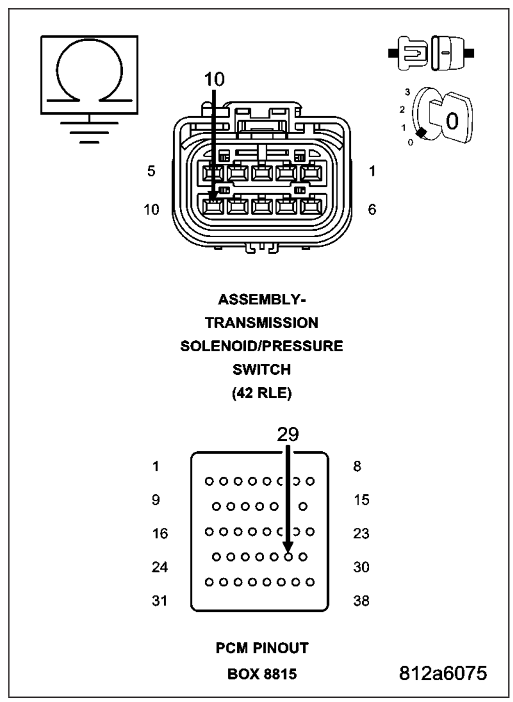
**Yes** >> Repair the (T50) L/R Pressure Switch Sense circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T50) L/R Pressure Switch Sense circuit.



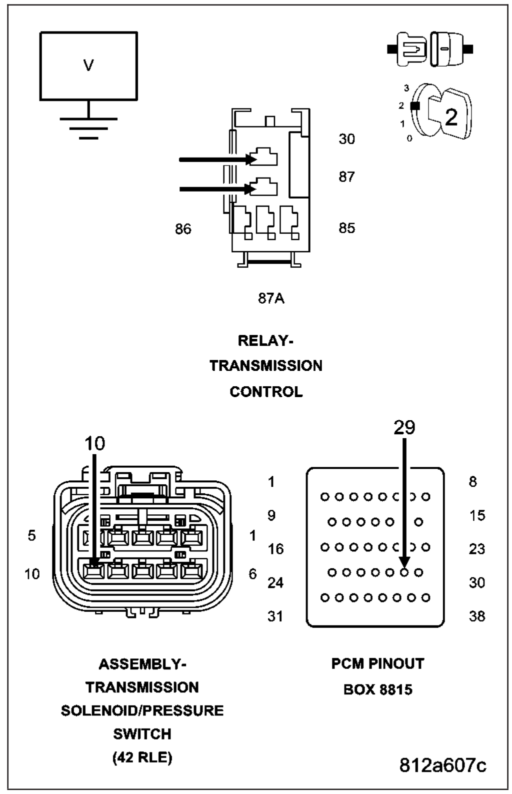

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE




Remove the Transmission Control Relay.

Connect a jumper wire between the (A104) Fused B+ circuit and (T16) Transmission Control Relay Output circuit.

Ignition on, engine not running.

Measure the voltage of the (T50) L/R Pressure Switch Sense circuit.

**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 8. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

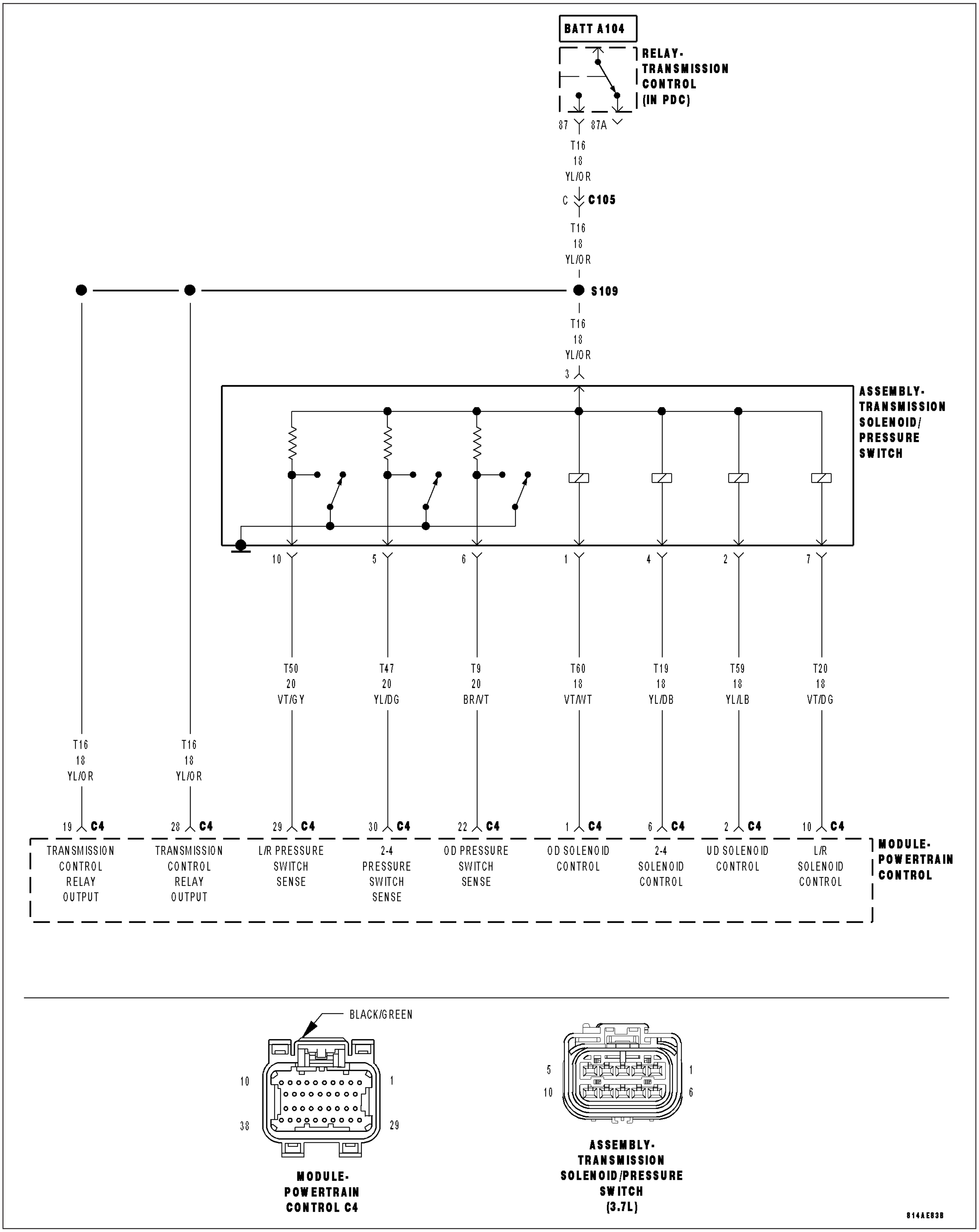
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0845-2/4 HYDRAULIC PRESSURE TEST




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM, shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed greater than 1000 RPM, the PCM momentarily turns on element pressure to the clutch circuits that don't have pressure to verify that the correct pressure switch closes. If the pressure switch does not close 2 times the DTC sets

| Possible Causes |
|---|
| LOSS OF PRIME P0944 PRESENT |
| (T16) TRANSMISSION CONTROL OUTPUT CIRCUIT OPEN |
| (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T47) 2/4 PRESSURE SWITCH CIRCUIT SHORT TO GROUND |
| (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| INTERNAL TRANSMISSION |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

Pressure switches are normally off or open (no pressure applied) and read high (+12 volts). When an element is applied, the corresponding pressure switch closes to ground (0 volts) or turns on. The controller tests the OD and 24 pressure switches when they are off (when the corresponding friction element is not applied) by briefly applying the OD and 24 elements which will cause the corresponding pressure switch to close. The test verifies that the switches are operational and that the switch will close when the corresponding element is applied. If a switch fails to respond, it is re-tested. The MIL illuminates and the transmission system defaults to Limp-in mode.

## Diagnostic Test

### 1. CHECKING FOR LOSS OF PRIME DTC

With the scan tool, check for other Transmission DTCs.

**Is the DTC P0944 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK FOR RELATED TRANSMISSION DTCS

With the scan tool, read Transmission DTCs.

**Are any of the DTCs P0732, P0734 and/or P0846 present also?**

**Yes** >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECK TO SEE IF DTC P0845 IS CURRENT

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 4

**No** >> Go To 9

## 4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to 2/4.

With the scan tool, monitor the UD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Wiggle the wires leading to the PCM while pressing and holding the Pressure Switch Test button.

**Did the 2/4 Pressure Switch state change to closed and remain closed while wiggling the wires?**

**Yes** >> Disassemble and inspect the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/Pressure Switch Assembly.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT OPEN

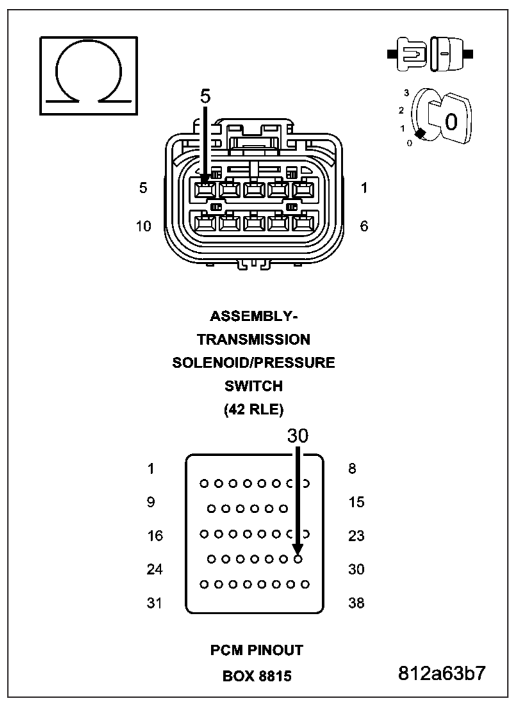
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance of the (T47) 2/4 Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.




**Is the resistance above 5.0 ohms?**

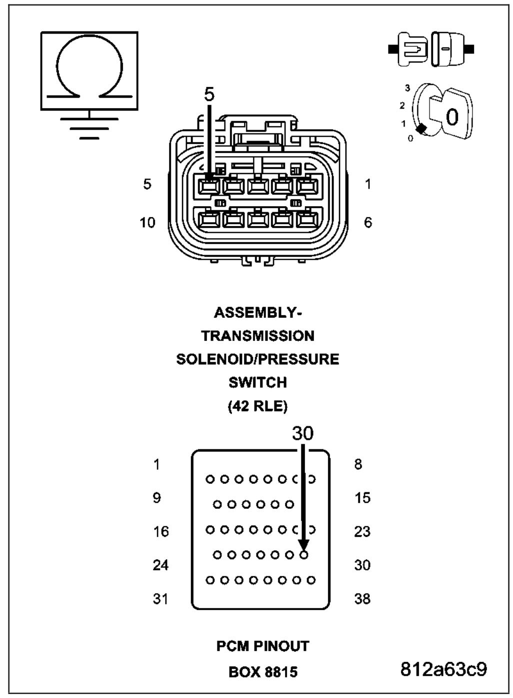
**Yes** >> Repair the (T47) 2/4 Pressure Switch Sense circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T47) 2/4 Pressure Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T47) 2/4 Pressure Switch Sense circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

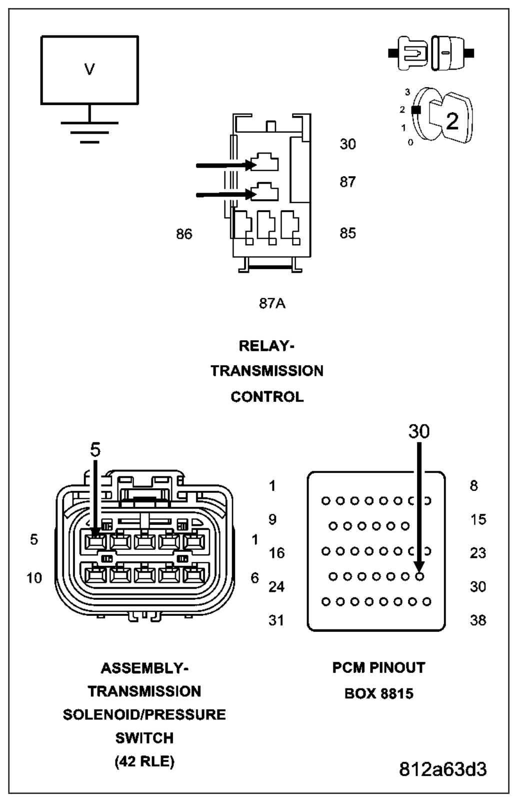
Remove the Transmission Control Relay.

**NOTE: Check connectors - Clean/repair as necessary.**

Connect a jumper wire between the (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output circuit.

Ignition on, engine not running.

Measure the voltage of the (T47) 2/4 Pressure Switch Sense circuit.



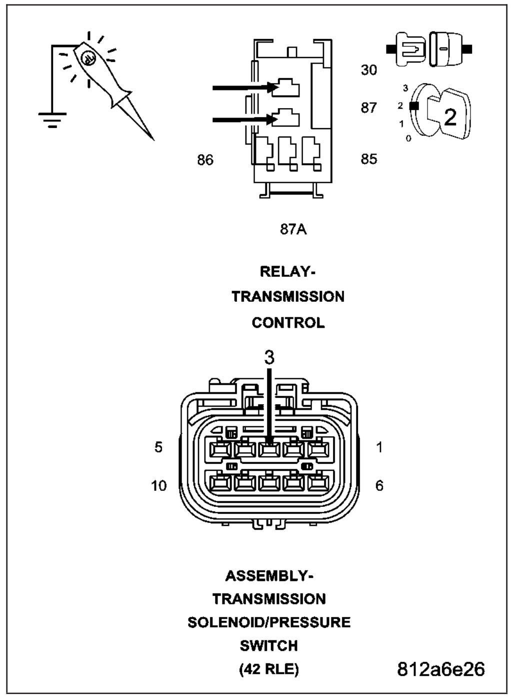

**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T47) 2/4 Pressure Switch Sense circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN




**NOTE: The jumper wire must still be in place.**

Using a 12-volt test light connected to ground, check (T16) Transmission Control Relay Output circuit in the Transmission Solenoid/Pressure Switch Assembly harness connector.

**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

**Does the test light illuminate brightly?**

**Yes** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Repair the Transmission Control Relay Output circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 9. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

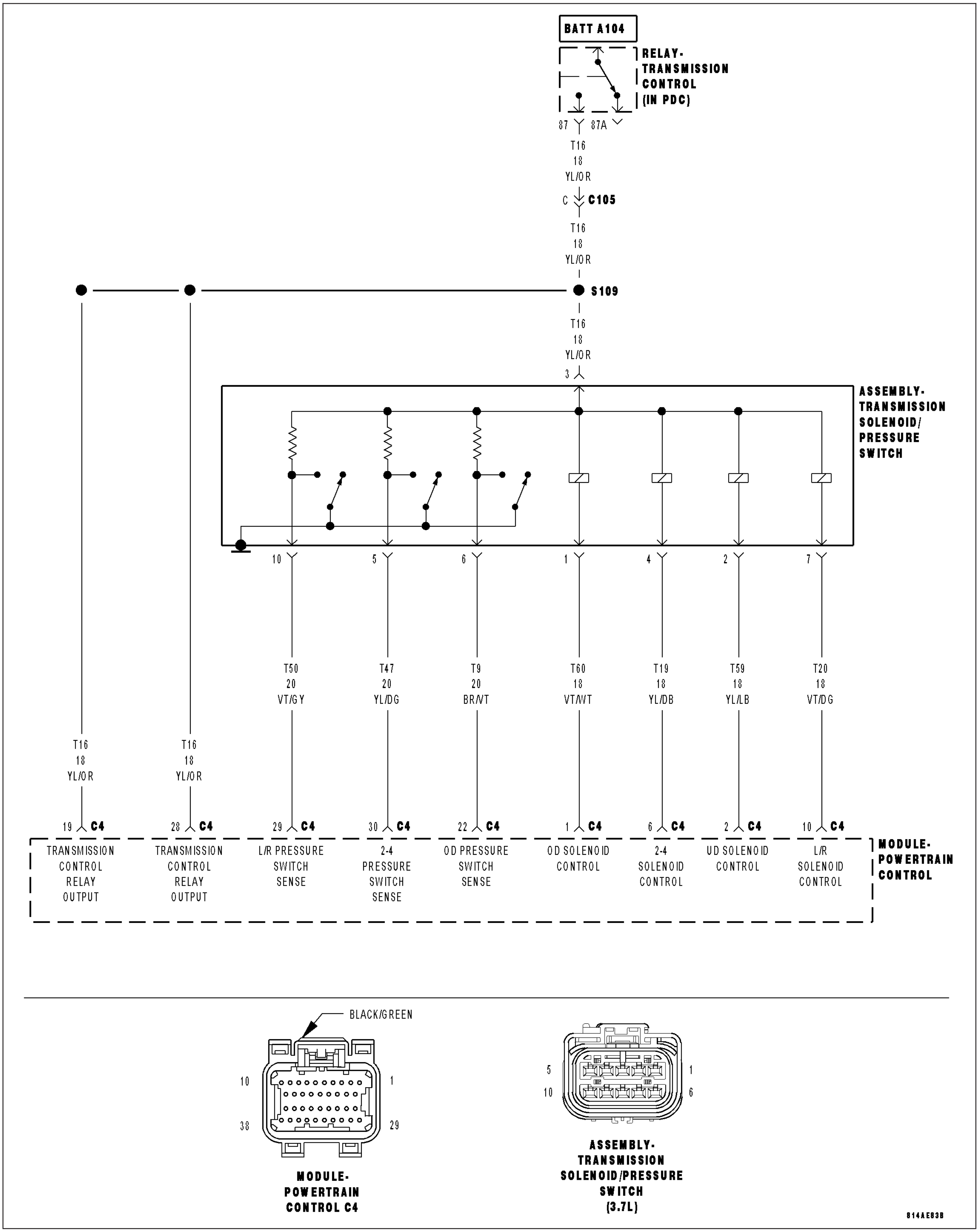
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0846-2/4 PRESSURE SWITCH RATIONALITY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running.
- **Set Condition:**
  The DTC is set if one of the pressure switches are open or closed at the wrong time in a given gear. If the problem is identified for 3 successive key starts, the transmission will go into Limp-in mode and the MIL will turn on after 10 seconds of vehicle operation.

| Possible Causes |
| --- |
| RELATED TRANSMISSION CONTROL OUTPUT DTCS PRESENT |
| LOSS OF PRIME DTC PRESENT |
| (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission system uses three pressure switches to monitor the fluid pressure in the LR, 2/4, and OD elements. The pressure switches are continuously monitored for the correct states in each gear. The 2/4 pressure switch monitors the fluid pressure to the 2/4 clutch to confirm proper operation of the 2/4 solenoid. If the 2/4 pressure switch is identified as closed in P or N, the code will immediately be set and normal operation will be allowed for that given key start. If the problem is identified for 3 successive ignition cycles, the transmission will go into Limp-in mode.

**PRESSURE SWITCH STATES**

| GEAR | L/R | 2/4 | OD |
| --- | --- | --- | --- |
| R | OP | OP | OP |
| P/N | CL | OP | OP |
| 1st | CL | OP | OP |
| 2nd | OP | CL | OP |
| D | OP | OP | CL |
| OD | OP | CL | CL |

**OP = OPEN**

**CL = CLOSED**

## Diagnostic Test

### 1. DETERMINING IF RELATED TRANSMISSION RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any Transmission Control Relay DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

## 2. CHECK FOR LOSS OF PRIME DTC

With the scan tool, check for other Transmission DTCs.

**Is the DTC P0944 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate diagnostic procedure.

**No** >> Go To 3

## 3. CHECK TO SEE IF P0846 IS CURRENT

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 4

**No** >> Go To 8

## 4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector to 2/4.

With the scan tool , monitor the 2/4 Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

**Did the 2/4 Pressure Switch state change?**

**Yes** >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

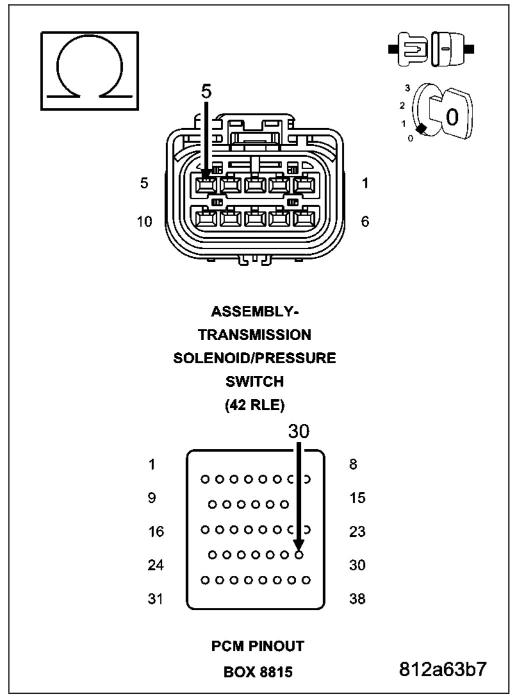
Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance of the (T47) 2/4 Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.




**Is the resistance above 5.0 ohms?**

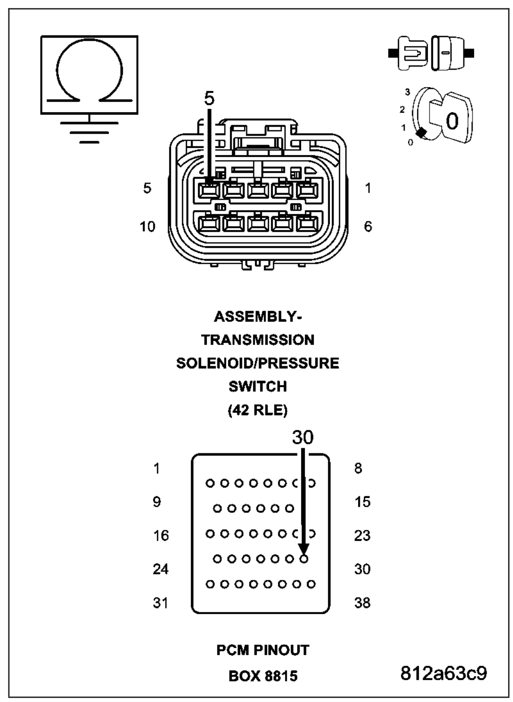
**Yes** >> Repair the (T47) 2/4 Pressure Switch Sense circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T47) 2/4 Pressure Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T47) 2/4 Pressure Switch Sense circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

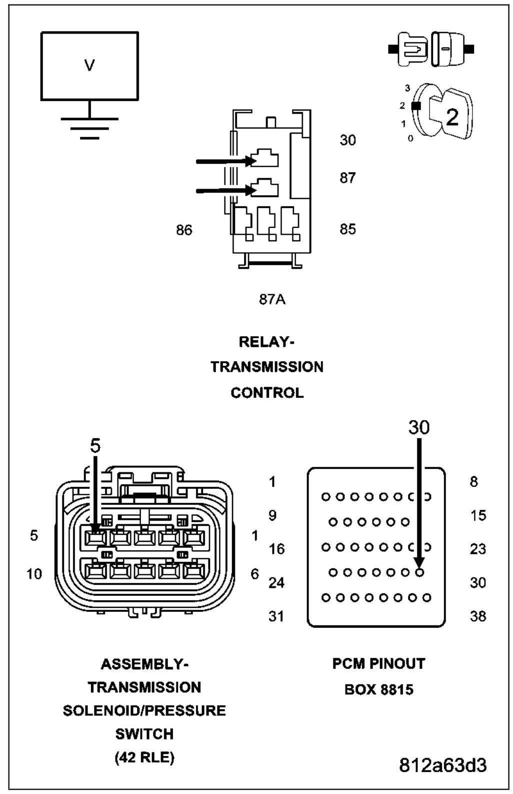
Remove the Transmission Control Relay.

**NOTE: Check connectors - Clean/repair as necessary.**

Connect a jumper wire between the (A104) Fused B+ circuit and (T16) Transmission Control Relay Output circuit.

Ignition on, engine not running.

Measure the voltage of the (T47) 2/4 Pressure Switch Sense circuit.




**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T47) 2/4 Pressure Switch Sense circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 8. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

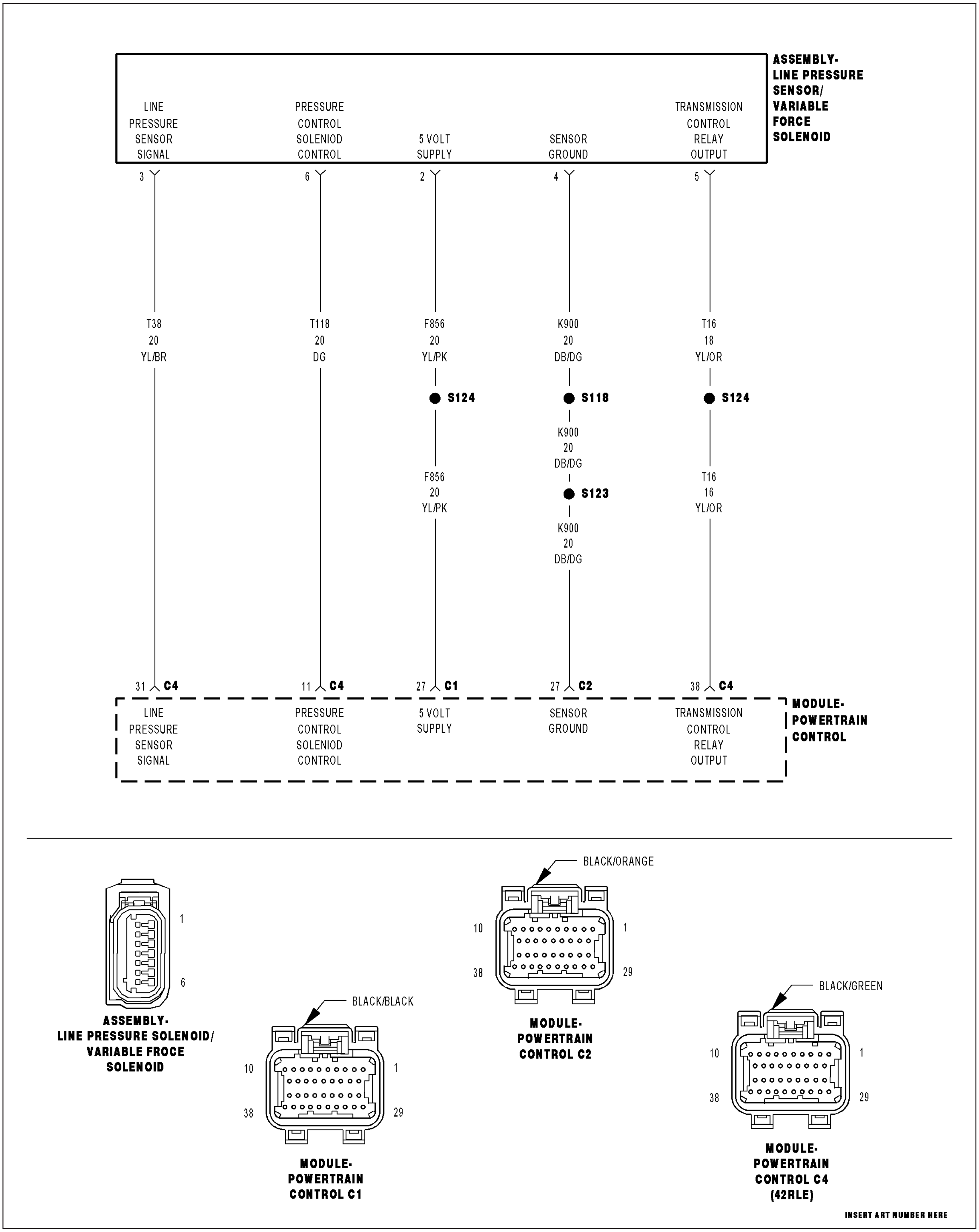
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0868-LINE PRESSURE LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while driving in a forward gear.
- **Set Condition:**
  The PCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If the Actual Line Pressure is more than 10 psi below Desired Line Pressure, this DTC will set.

| Possible Causes |
|---|
| CHECK FOR RELATED DTC'S |
| LOW FLUID LEVEL |
| (F856) 5-VOLT SUPPLY CIRCUIT OPEN |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORT TO VOLTAGE |
| (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT SHORT TO ANOTHER CIRCUIT |
| INTERNAL TRANSMISSION |
| LINE PRESSURE SENSOR |
| CRACKED, PLUGGED, OR MIS-INSTALLED PRIMARY OIL FILTER |
| STUCK OR STICKING MAIN REGULATOR VALVE |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

Line pressure is measured by the Line Pressure Sensor (LPS) and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS) controlled by the Transmission Control System. (5% duty cycle = solenoid off = Max line pressure, 62% duty cycle = solenoid on = Min line pressure). The Transmission Control System calculates the desired line pressure based on inputs from both the engine and transmission.

The Transmission Control System calculates torque input to the transmission and uses it as the primary input to the desired line pressure calculation. This is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 or 931 kPa (120 or 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality. The desired line pressure is continuously being compared to the actual line pressure. If the actual line pressure is consistently lower than the target while driving, the line pressure low DTC P0868 will set.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs

**Is the DTC P0932 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

## 2. CHECK IF THE DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0868.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET COUNTER 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 10

## 3. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay from the PDC.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

On the Transmission Simulator select the ″OFF″ position of the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure during the following steps.

Using the Transmission Simulator, set the rotary knob to each of the 3 line pressure positions.

**NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.**

**Did the Line Pressure read within ± 14 kPa or 2.0 psi in all three positions?**

**Yes** >> Go To 4

**No** >> Go To 6

## 4. CHECK THE LINE PRESSURE SENSOR

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333 and reconnect all previously disconnected connectors.

Install a Pressure Gauge, 0 to 2000 kPa or 0 to 300 psi to the L/R test port.

Start the engine in park.

Monitor the line pressure readings of both the scan tool and the pressure gauge and compare the two readings.

**Is the line pressure gauge reading within 34 kPa or 5 psi of the scan tool reading?**

**Yes** >> Go To 5

**No** >> Replace the Line Pressure Sensor per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 5. CHECK FOR A PLUGGED TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Transmission Oil Filter per the Service Information.

**Does the Oil Pan contain excessive debris and/or is the Transmission Oil Filter plugged?**

**Yes** >> Repair as necessary. If the Transmission Oil Filter is plugged or there is excessive debris, refer to the Service Information for the proper Hydraulic repair procedure.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Repair internal transmission and inspect the Transmission Oil Pump per the Service Information and replace if necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

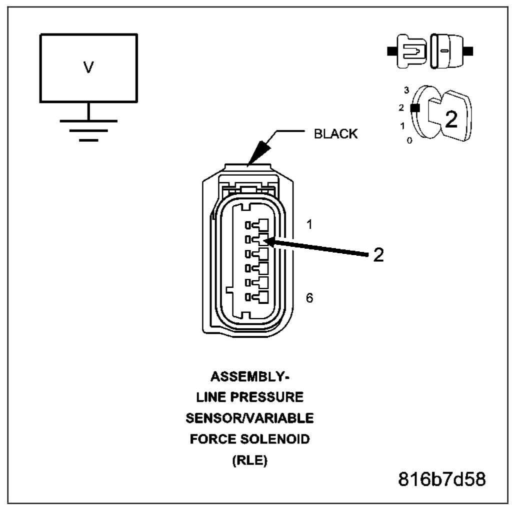
## 6. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

Disconnect the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Reconnect all previously disconnected connectors except the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector.

Ignition on, engine not running.

Measure the voltage of the (F856) 5-volt Supply circuit.



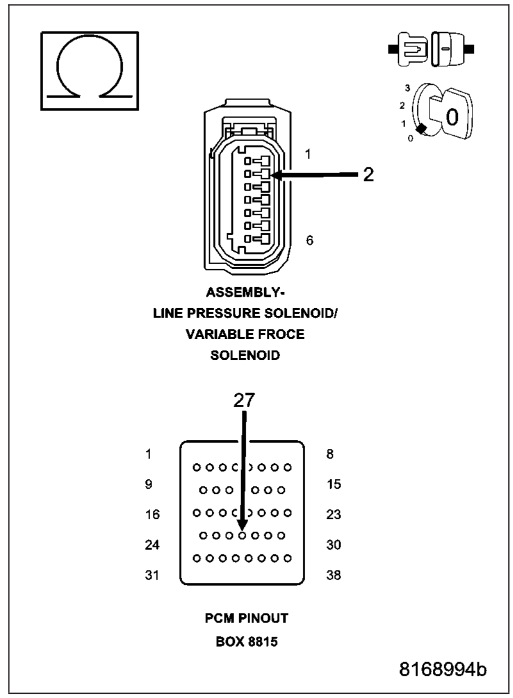

**Is the voltage above 5.5 volts?**

**Yes** >> Repair the (F856) 5-volt Supply circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN




Turn the ignition off to the lock position.

Disconnect the PCM C1 harness connector and connect Miller tool #8815.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance of the (F856) 5-volt Supply circuit between the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector and the appropriate terminal of Miller tool #8815.

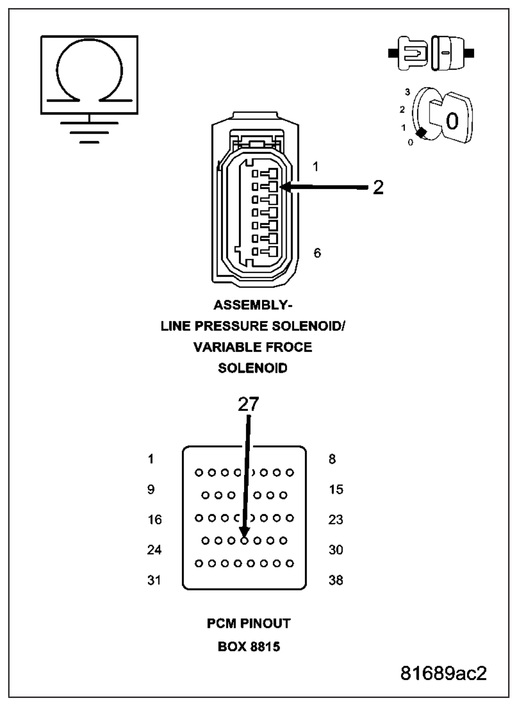
**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (F856) 5-volt Supply circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND




Measure the resistance between ground and the (F856) 5-volt Supply circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (F856) 5-volt Supply circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 9

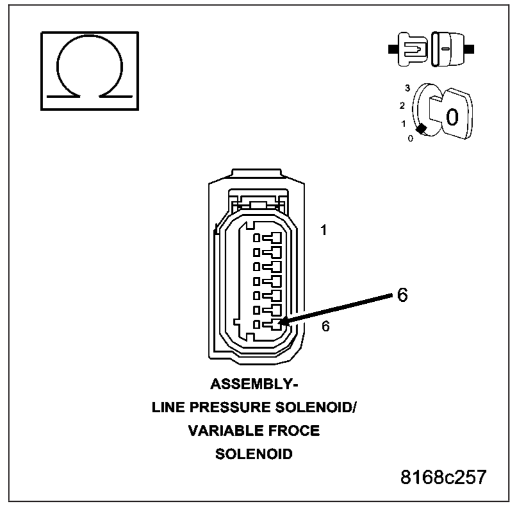
## 9. CHECK THE (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector.

Disconnect all PCM harness connectors.

Measure the resistance between the (T118) Pressure Control Solenoid Control circuit and all other circuits in the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T118) Pressure Control Solenoid Control circuit and any other circuit(s) in the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector?**

**Yes** >> Repair the (T118) Pressure Control Solenoid Control circuit for a short to another circuit(s).

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 10. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

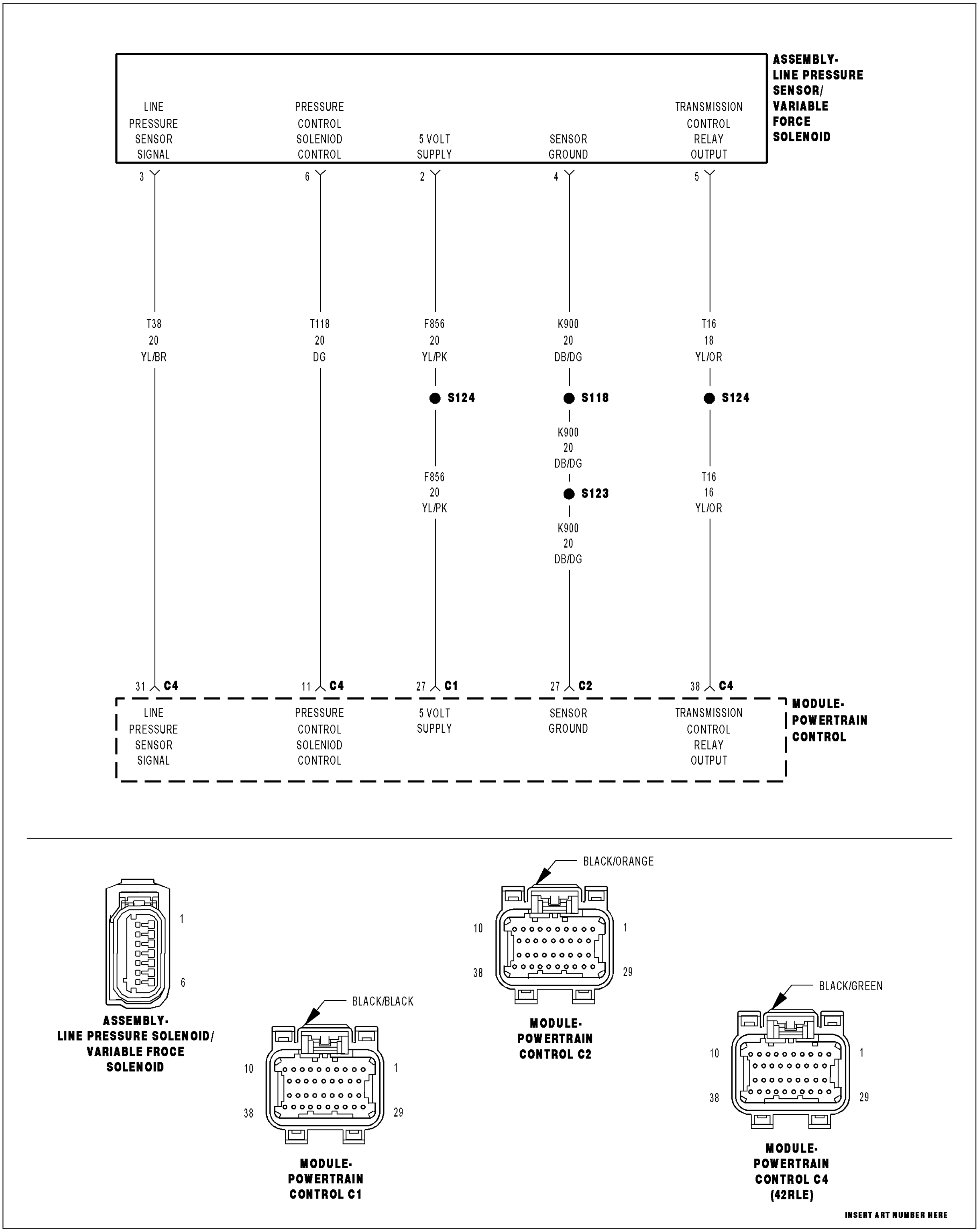
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0869-LINE PRESSURE HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while driving in a forward gear.
- **Set Condition:**
  The PCM continuously monitors Actual Line Pressure. If the Actual Line Pressure reading is greater than the highest Desired Line Pressure ever used in the current gear, while the Pressure Control Solenoid duty cycle is at or near its maximum value (which should result in minimum line pressure), the DTC will set.

| Possible Causes |
|---|
| (F856) 5-VOLT SUPPLY CIRCUIT OPEN |
| LINE PRESSURE SENSOR CONNECTION |
| (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT OPEN |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND |
| (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT SHORT TO GROUND |
| TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT |
| LINE PRESSURE SENSOR |
| STUCK OR STICKING MAIN REGULATOR VALVE |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

Line pressure is measured by the Line Pressure Sensor (LPS) and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS) controlled by the Transmission Control System. (5% duty cycle = solenoid off = Max line pressure, 62% duty cycle = solenoid on = Min line pressure). The Transmission Control System calculates the desired line pressure based on inputs from both the engine and transmission.

The Transmission Control System calculates torque input to the transmission and uses it as the primary input to the desired line pressure calculation. This is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 or 931 kPa (120 or 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality. The desired line pressure is continuously being compared to the actual line pressure. If the actual line pressure is consistently higher than the highest desired line pressure ever used in the current gear, the line pressure high DTC P0869 will set.

## Diagnostic Test

### 1. CHECK FOR RELATED DTC'S

With the scan tool, check for other Transmission DTC's

**Are there any line pressure sensor or transmission relay output DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK IF THE DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0869.

**Is the STARTS SINCE SET COUNTER 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 9

## 3. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure during the following step.

Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

**NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.**

**Did the Line Pressure read within ± 14 kPa or 2.0 psi in all three positions?**

**Yes** >> Go To 4

**No** >> Go To 5

## 4. CHECK THE LINE PRESSURE SENSOR CALIBRATION

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit and reconnect all previously disconnected connectors.

Install the Line Pressure Gauge, Miller tool #C-3293, 0 to 2000 kPa or 0 to 300 psi in the L/R pressure port.

Start the engine in park.

Monitor the Line Pressure readings on the scan tool and the pressure gauge.

Compare the Line Pressure readings between the scan tool and the pressure gauge.

**Is the pressure gauge reading within 34 kPa or 5 psi of the scan tool reading?**

**Yes** >> Repair the internal transmission and inspect the Transmission Oil Pump per the Service Information and replace if necessary. If no problem is found, replace the Pressure Control Solenoid.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Replace the Line Pressure Sensor per the Service information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 5. CHECK THE (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT FOR AN OPEN

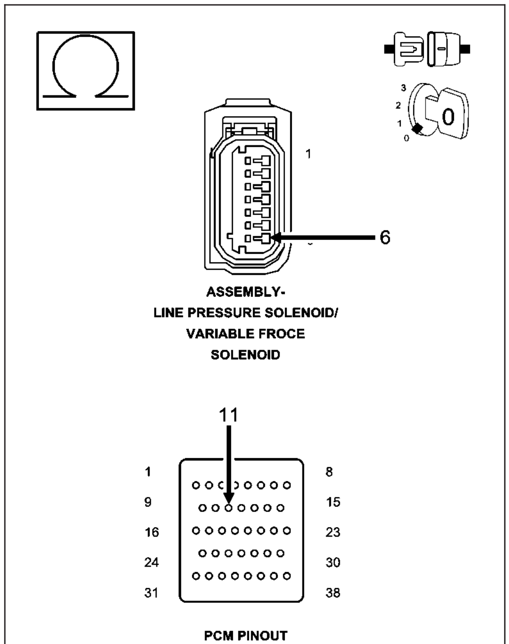
Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the Powertrain Control Module C4 harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance of the (T118) Pressure Control Solenoid Control circuit between the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector and the appropriate terminal of Miller tool #8815.



816896d2

**Is the resistance above 5.0 ohms?**

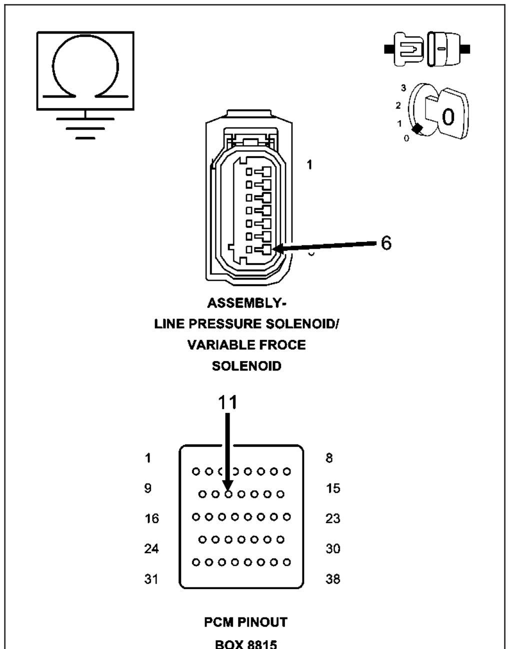
**Yes** >> Repair the (T118) Pressure Control Solenoid Control circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECK THE (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T118) Pressure Control Solenoid Control circuit.



816897c7

**Is the resistance below 5.0 ohms?**

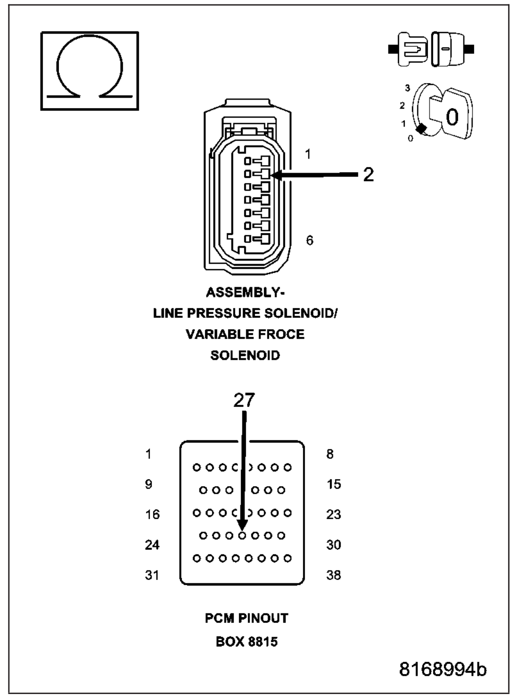
**Yes** >> Repair the (T118) Pressure Control Solenoid Control circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Measure the resistance of the (F856) 5-volt Supply circuit between the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector to the appropriate terminal of Miller tool #8815.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (F856) 5-volt Supply circuit for an open.

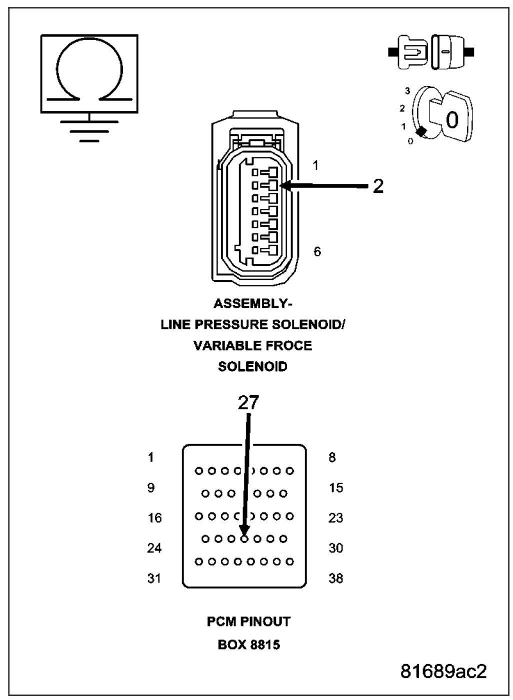
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Disconnect the PCM C1 harness connector.

Disconnect the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector.




**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (F856) 5-volt Supply circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 9. INTERMITTENT WIRING AND CONNECTORS

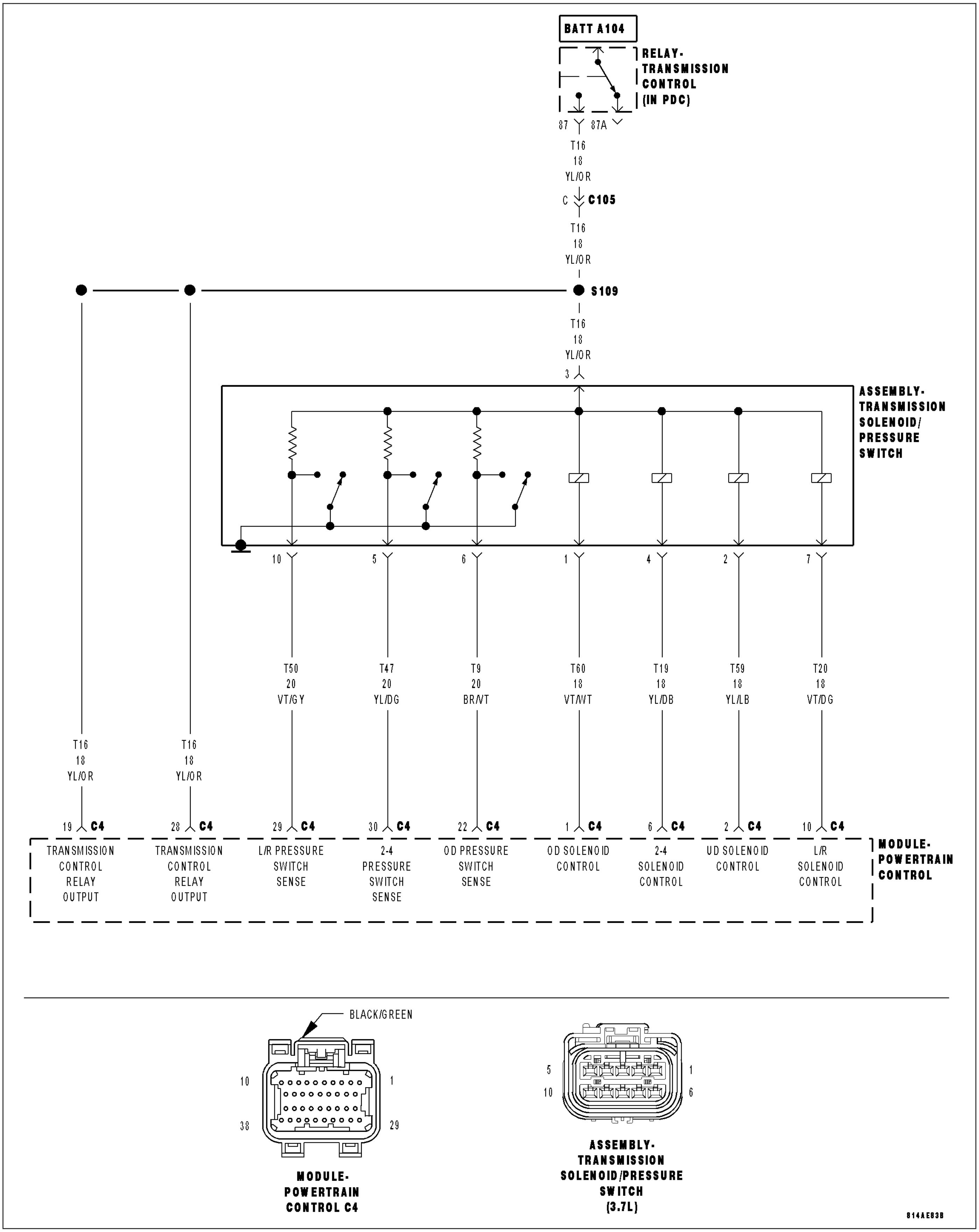
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Where there any problems found?**

**Yes** >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0870-OD HYDRAULIC PRESSURE TEST




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM, shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed greater than 1000 RPM, the PCM momentarily turns on element pressure to the clutch circuits that don't have pressure to identify the correct pressure switch closes. If the pressure switch does not close 2 times the DTC sets.

| Possible Causes |
|---|
| LOSS OF PRIME P0944 PRESENT |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T9) OD PRESSURE SWITCH CIRCUIT SHORT TO GROUND |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| INTERNAL TRANSMISSION |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

Pressure switches are normally off or open (no pressure applied) and read high (+12 volts). When an element is applied, the corresponding pressure switch closes to ground (0 volts) or turns on. The controller tests the OD and 2/4 pressure switches when they are off (when the corresponding friction element is not applied) by briefly applying the OD and 2/4 elements which will cause the corresponding pressure switch to close. The test verifies that the switches are operational and that the switch will close when the corresponding element is applied. If a switch fails to respond, it is re-tested. The MIL illuminates and the transmission system defaults to Limp-in mode.

## Diagnostic Test

### 1. CHECKING FOR LOSS OF PRIME DTC

With the scan tool, check for other Transmission DTCs.

**Is the DTC P0944 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate diagnostic procedure.

**No** >> Go To 2

### 2. CHECK FOR RELATED TRANSMISSION DTCS

With the scan tool, read Transmission DTCs.

**Are any of the DTCs P0732, P0734 and/or P0846 present also?**

**Yes** >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECK TO SEE IF DTC P0870 IS CURRENT

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 4

**No** >> Go To 9

## 4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to OD.

With the scan tool, monitor the UD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

Wiggle the wires leading to the PCM while pressing and holding the Pressure Switch Test button.

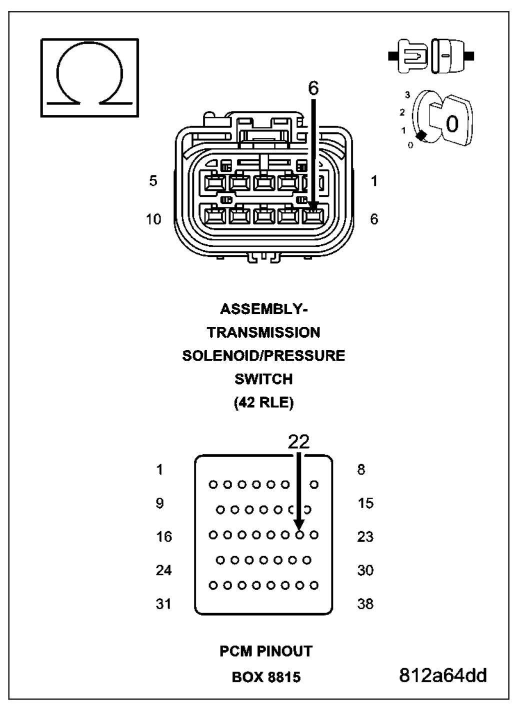
**Did the OD Pressure Switch state change to closed and remain closed while wiggling the wires?**

**Yes** >> Disassemble and inspect the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/Pressure Switch Assembly.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN




Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (T9) OD Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

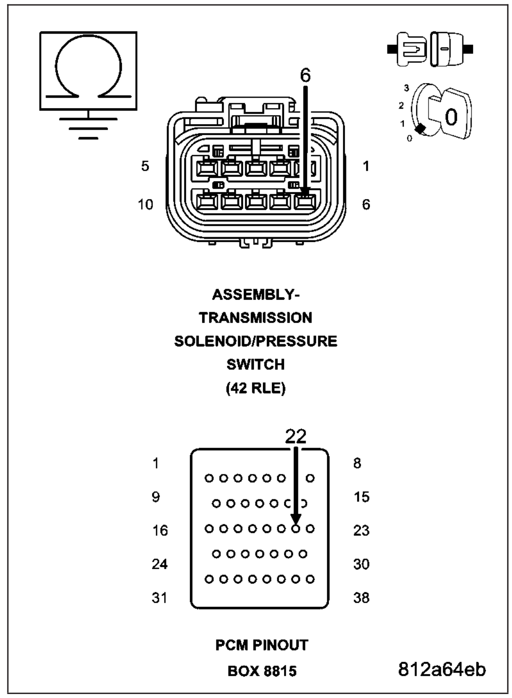
Measure the resistance between ground and the (T9) OD Pressure Switch Sense circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 7




## 7. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

Remove the Transmission Control Relay.

**NOTE: Check connectors - Clean/repair as necessary.**

Connect a jumper wire between the (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output circuit.

Ignition on, engine not running.

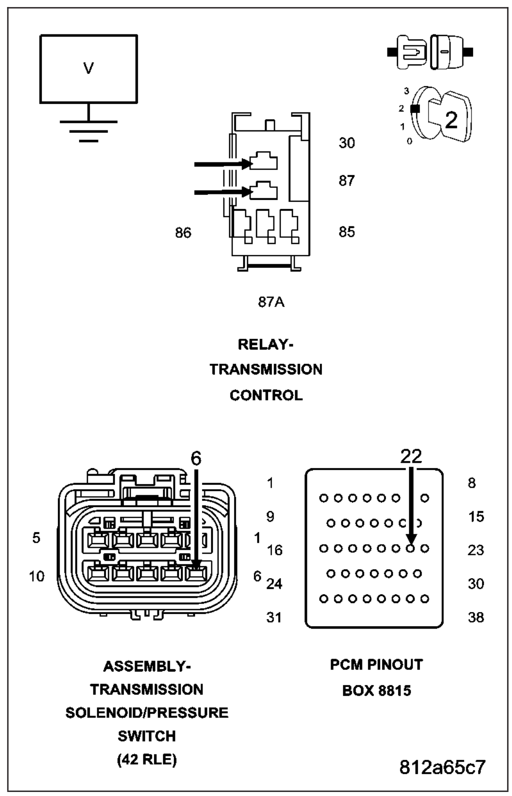
Measure the voltage of the (T9) OD Pressure Switch Sense circuit.

**Is the voltage above 0.5 volts?**

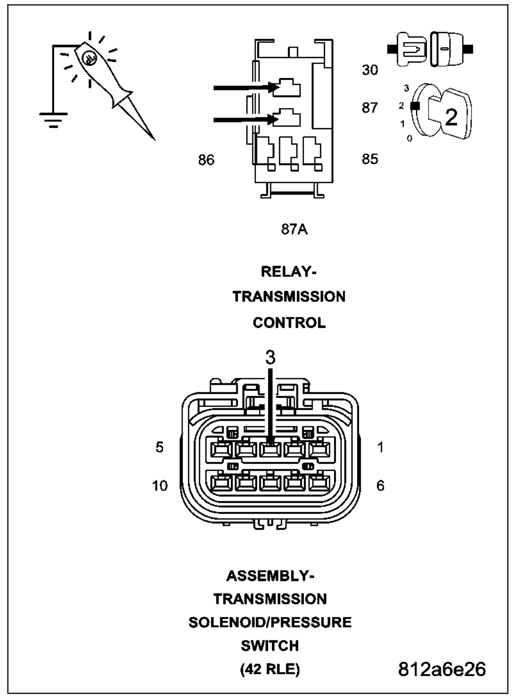
**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 8



## 8. (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN




**NOTE: The jumper wire must still be in place.**

Using a 12-volt test light connected to ground, check (T16) Transmission Control Relay Output circuit in the Transmission Solenoid/Pressure Switch Assembly harness connector.

**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

**Does the test light illuminate brightly?**

**Yes** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Repair the (T16) Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 9. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

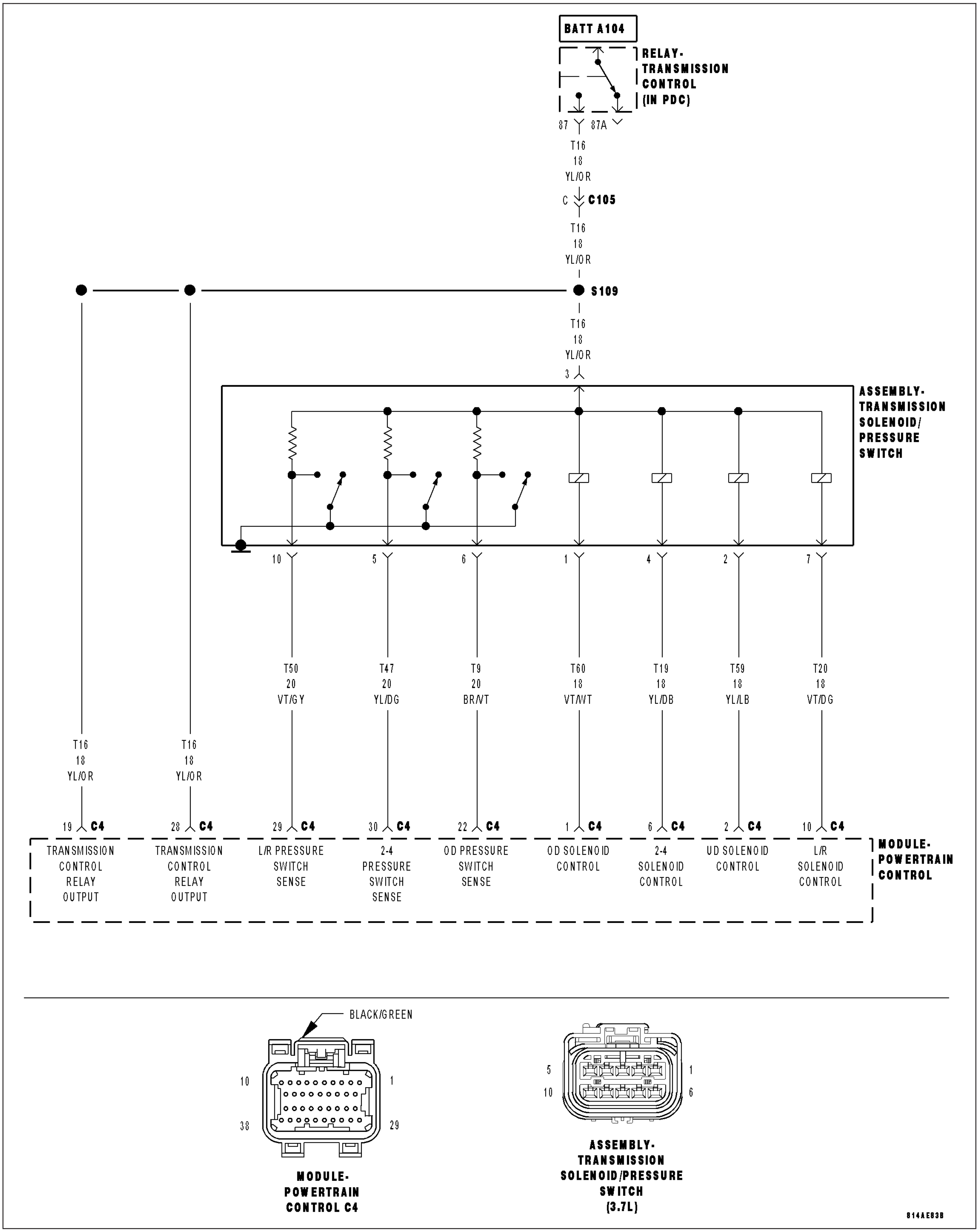
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0871-OD PRESSURE SWITCH RATIONALITY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running.
- **Set Condition:**
  The DTC is set if one of the pressure switches are open or closed at the wrong time in a given gear. If the problem is identified for 3 successive key starts, the transmission will go into Limp-in mode and the MIL will turn on after 10 seconds of vehicle operation.

| Possible Causes |
| --- |
| RELATED TRANSMISSION RELAY DTCS PRESENT |
| LOSS OF PRIME DTC PRESENT |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).**

## Theory of Operation

The Transmission system uses three pressure switches to monitor the fluid pressure in the LR, 2/4, and OD elements. The pressure switches are continuously monitored for the correct states in each gear. Normal operation will be experienced if no other codes are present. Transmission Control System will ignore the code. Limp-in condition will only occur if DTC P0871 is present with a DTC P0706.

**PRESSURE SWITCH STATES**

| GEAR | L/R | 2/4 | OD |
| --- | --- | --- | --- |
| R | OP | OP | OP |
| P/N | CL | OP | OP |
| 1st | CL | OP | OP |
| 2nd | OP | CL | OP |
| D | OP | OP | CL |
| OD | OP | CL | CL |

**OP = OPEN**

**CL = CLOSED**

## Diagnostic Test

### 1. DETERMINING IF RELATED TRANSMISSION RELAY DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any Transmission Control Relay DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Go To 2

## 2. CHECK FOR LOSS OF PRIME DTC

With the scan tool, check for other Transmission DTCs.

**Is the DTC P0944 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate diagnostic procedure.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Go To 3

## 3. CHECK TO SEE IF P0841 IS CURRENT

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 4

**No** >> Go To 10

## 4. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay is to prevent a Transmission NO RESPONSE condition and to disable the starter.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

**NOTE: Check connectors - Clean/repair as necessary.**

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector to OD.

With the scan tool , monitor the OD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

**Did the OD Pressure Switch state change?**

**Yes** >> Go To 8

**No** >> Go To 5

## 5. (T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

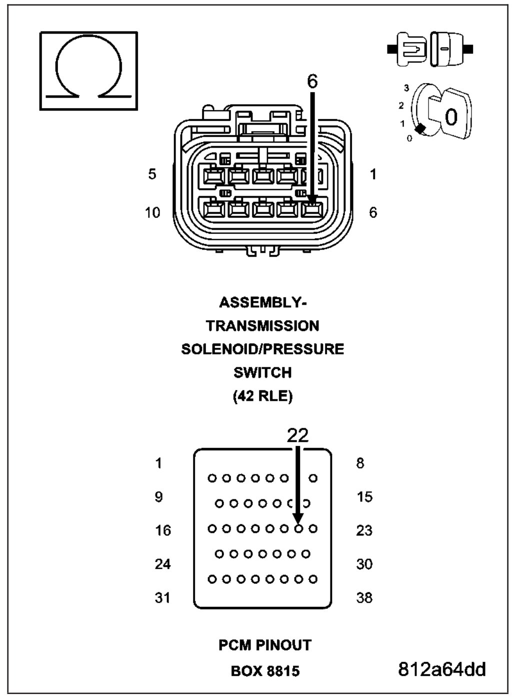
Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of the (T9) OD Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.



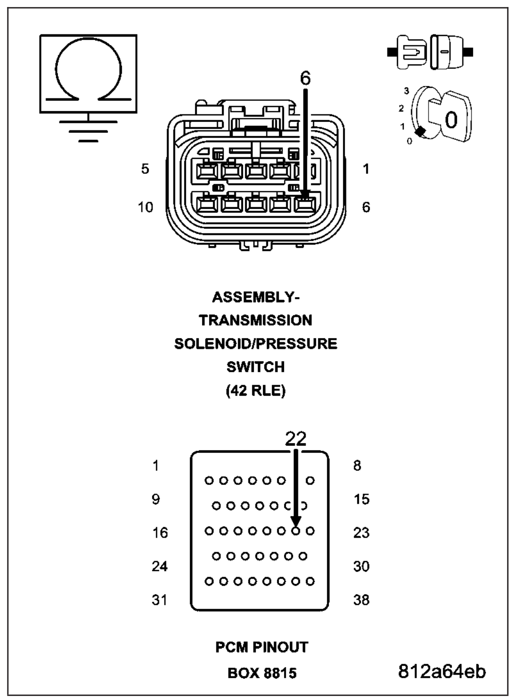

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for an open.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Go To 6

## 6. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T9) OD Pressure Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for a short to ground.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Go To 7

## 7. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

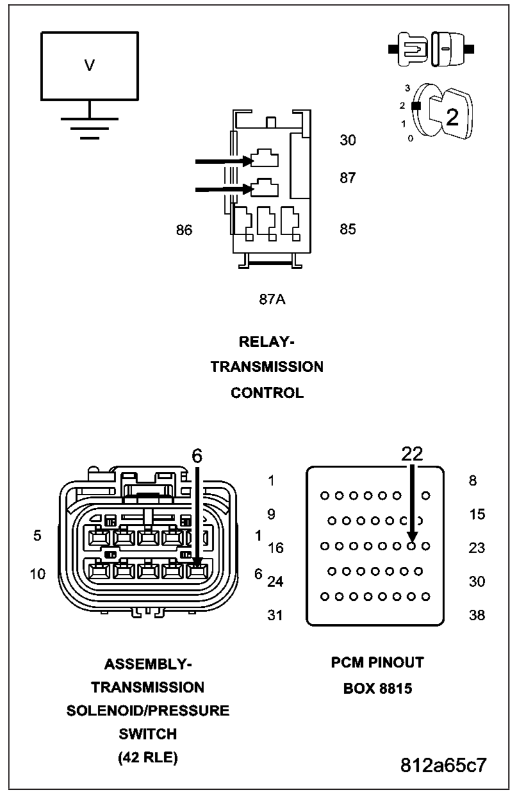
Remove the Transmission Control Relay.

**NOTE: Check connectors - Clean/repair as necessary.**

Connect a jumper wire between the (A104) Fused B+ circuit and (T16) Transmission Control Relay Output circuit.

Ignition on, engine not running.

Measure the voltage of the (T9) OD Pressure Switch Sense circuit.




**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Go To 9

## 8. OD PRESSURE SWITCH

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

## 9. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

## 10. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

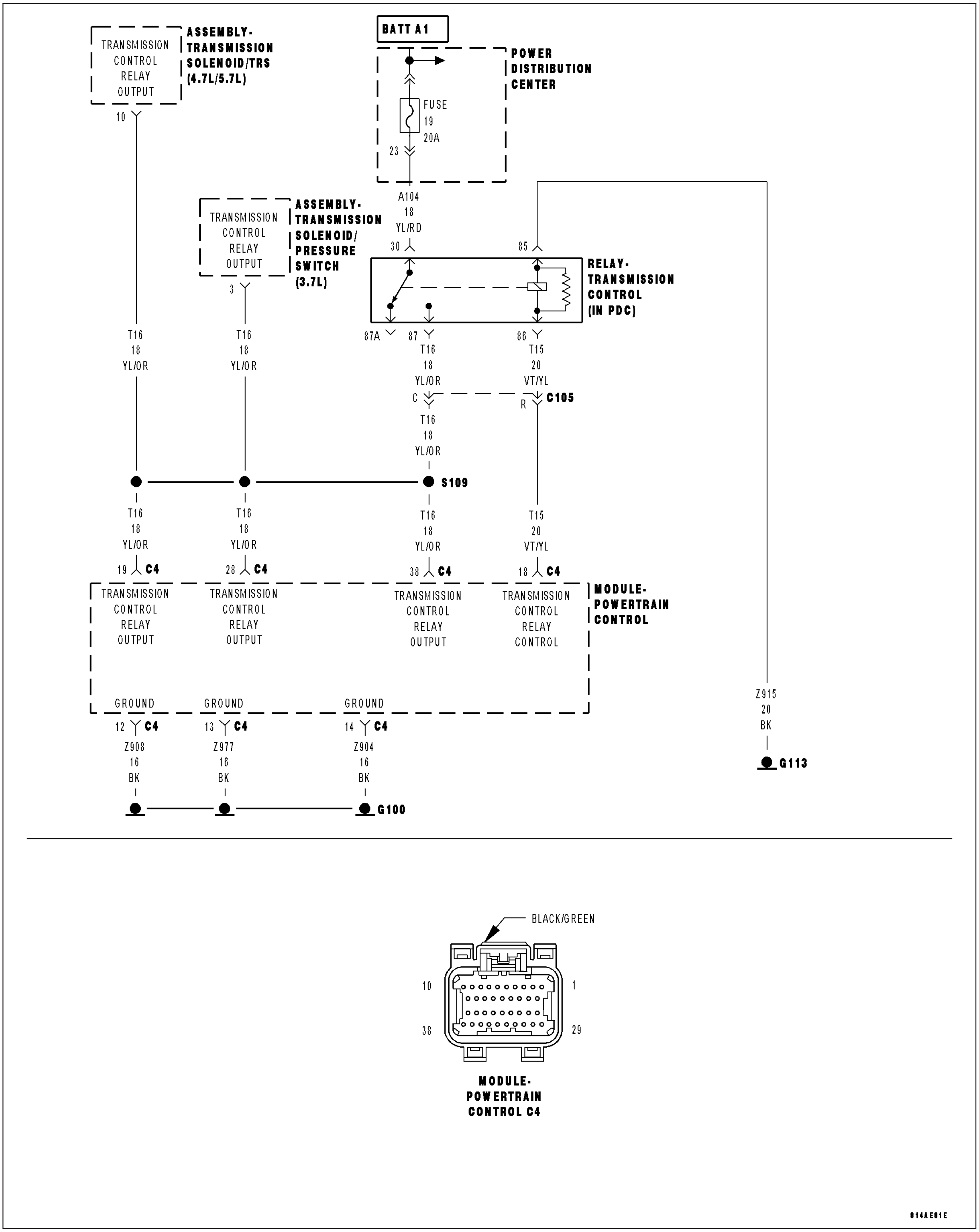
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Test Complete.

## P0882-TCM POWER INPUT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  This DTC is set when the Transmission Control Relay output circuit voltage at the Powertrain Control Module is less than 3 volts when the PCM is energizing the relay. Note: Due to the integration of the Powertrain and Transmission Control Modules, the transmission part of the PCM has its own specific power and ground circuits.

| Possible Causes |
| --- |
| (A104) FUSED B(+) CIRCUIT OPEN |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN |
| (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT OPEN |
| (Z915) TRANSMISSION CONTROL RELAY GROUND CIRCUIT OPEN |
| (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO GROUND |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORT TO GROUND |
| TRANSMISSION CONTROL RELAY |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission control relay is used to supply power to the solenoid pack when the transmission is in normal operating mode. When the relay is off, no power is supplied to the solenoid pack and the transmission is in Limp-in mode. The relay output is fed back to the PCM. It is referred to as the Trans Relay Output circuit or switched battery. After a controller reset (ignition key turned to the run position or after cranking engine), the controller energizes the relay. Prior to this, the PCM verifies that the contacts are open by checking for no voltage at the transmission control relay outputs (switched battery) terminals. After the relay is energized, the PCM monitors the terminals to verify that the voltage is greater than 3 volts. The MIL illuminates and the transmission will be placed in Limp-in.

## Diagnostic Test

### 1. CHECK TO SEE IF DTC P0882 IS CURRENT

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter equal to 0?**

**Yes** >> Go To 2

**No** >> Go To 10

## 2. CHECK THE (A104) FUSED B(+) CIRCUIT

Turn the ignition off to the lock position.

Remove the Transmission Control Relay.

**NOTE: Check connectors - Clean/repair as necessary.**

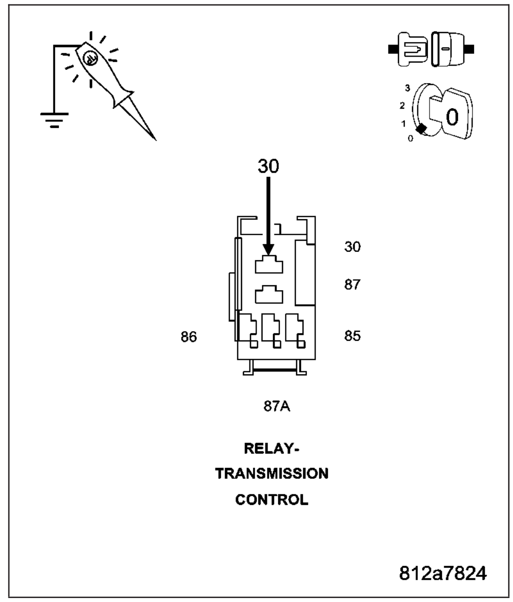
Using a 12-volt test light connected to ground, check the (A104) Fused B(+) circuit in the Transmission Control Relay connector.

**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Go To 8




## 3. (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN

Connect a jumper wire between the (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output circuits at the Transmission Control Relay connector.

Ignition on, engine not running.

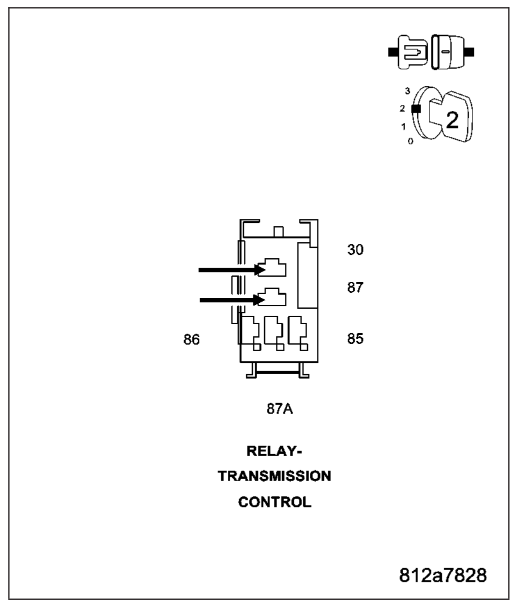
With the scan tool, read the Transmission Switched Battery voltage.

**Is the Switched Battery voltage equal to battery voltage?**

**Yes** >> Go To 4

**No** >> Repair the (T16) Transmission Control Relay Output circuits for an open or high resistance. Note: There are multiple Transmission Control Relay Output circuits.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)




## 4. TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.

Install a substitute Relay in place of the Transmission Control Relay.

Ignition on, engine not running.

With the scan tool, read the Transmission Switched Battery voltage.

**Is the Switched Battery voltage equal to battery voltage?**

**Yes** >> Replace the Transmission Control Relay.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (Z915) TRANSMISSION CONTROL RELAY GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z915) Transmission Control Relay Ground circuit.

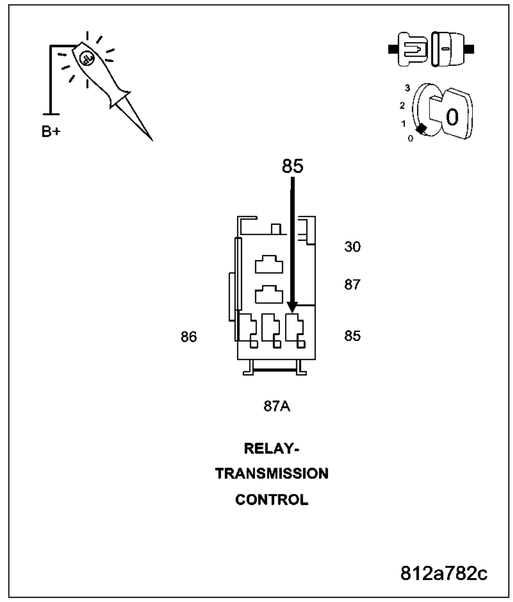
**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

**Does the test light illuminate brightly?**

**Yes** >> Go To 6

**No** >> Repair the (Z915) Transmission Control Relay Ground circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)




## 6. (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

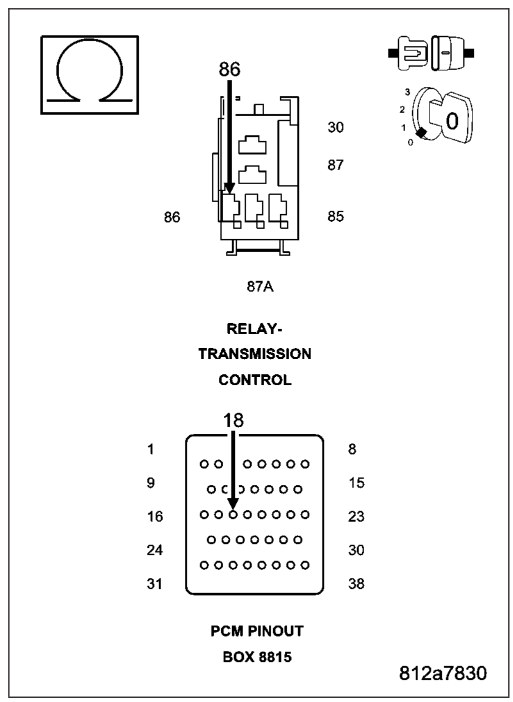
Measure the resistance of the (T15) Transmission Control Relay Control circuit between the Transmission Control Relay connector and the appropriate terminal of special tool #8815.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T15) Transmission Control Relay Control circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 7



## 7. (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T15) Transmission Control Relay Control circuit.

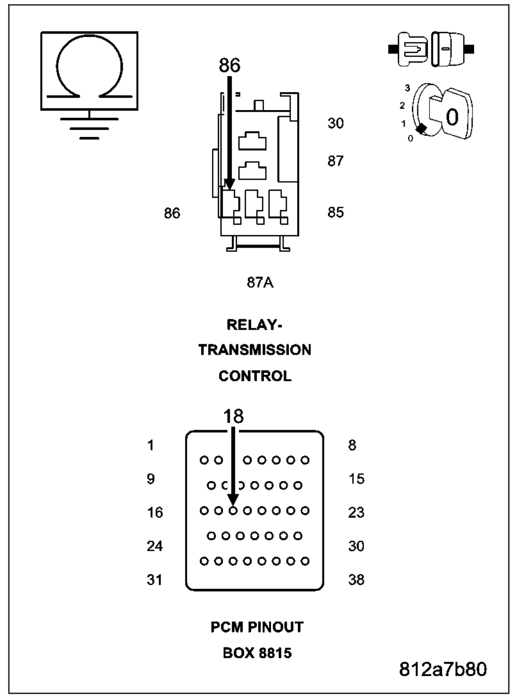
**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T15) Transmission Control Relay Control circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)




## 8. CHECK THE FUSED B(+) CIRCUIT FOR SHORT TO GROUND

Turn the ignition off to the lock position.

Remove the Transmission Control Relay.

Disconnect the PCM C4 harness connectors.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

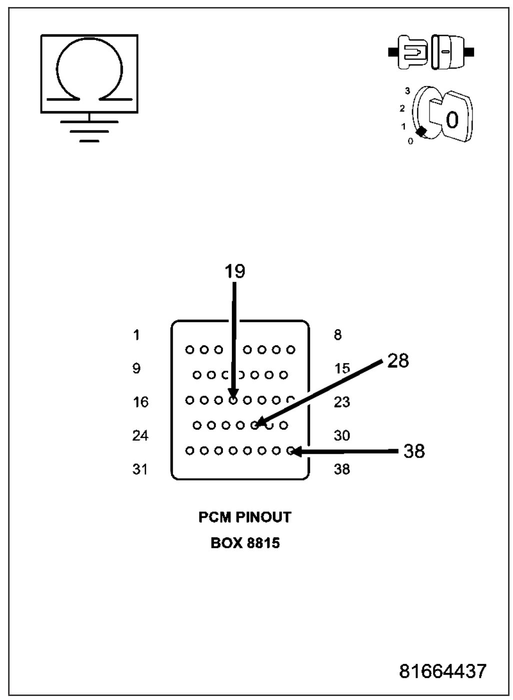
Measure the resistance between ground and the (T16) Transmission Control Relay Output circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 9

**No** >> Repair the Fused B(+) circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



## 9. (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORT TO GROUND

Disconnect the Transmission Solenoid/Pressure Switch harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

Measure the resistance between ground and the (T16) Transmission Control Relay Output circuit.

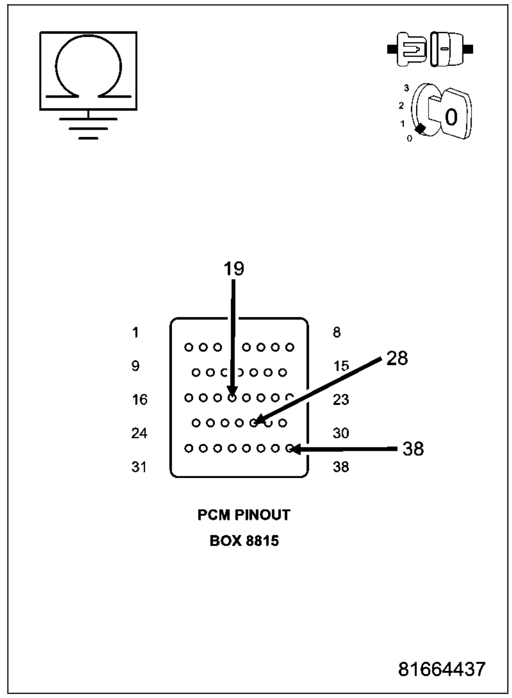
**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T16) Transmission Control Relay Output circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)




## 10. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the EVENT DATA to help identify the conditions in which the DTC was set.

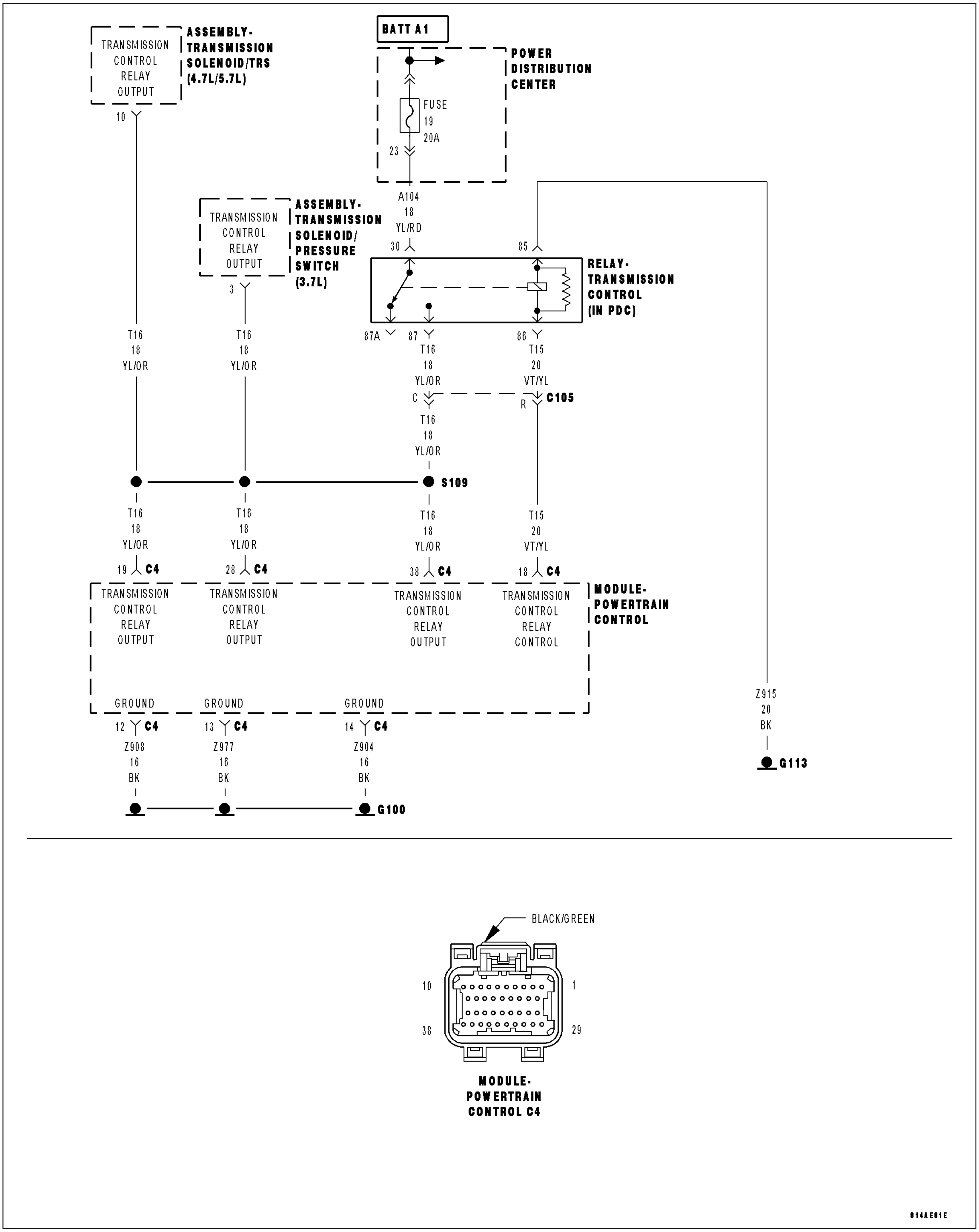
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0883-TCM POWER INPUT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  After a reset (ignition key turned to the RUN position) and after a power down.
- **Set Condition:**
  Relay output (Switched Battery) is higher than 3 volts when relay is not energized by the controller. Fault Set Time: Less than 100 msec

| Possible Causes |
|---|
| TRANSMISSION CONTROL RELAY STUCK CLOSED |
| (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO VOLTAGE |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUITS SHORT TO VOLTAGE |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission relay is used to supply power to the solenoid pack when in normal operating mode and to turn off power to produce transmission ″limp-in″ mode. The relay output (which supplies power to the solenoid pack) is fed back to the controller This is referred to as SWITCHED BATTERY. After a controller reset (ignition key turned to the RUN position or after cranking engine), the controller verifies that the relay contacts are open by checking for no voltage on Switched battery line (relay output) before the relay is energized. Transmission locked in Limp-In. MIL on after 10 seconds of vehicle operation.

## Diagnostic Test

### 1. CHECK TO SEE IF DTC P0883 IS CURRENT

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter equal to 0?**

**Yes** >> Go To 2

**No** >> Go To 5

### 2. TRANSMISSION CONTROL RELAY CONTACTS STUCK CLOSED

Turn the ignition off to the lock position.

Remove the Transmission Control Relay.

**NOTE: Check connectors - Clean/repair as necessary.**

Measure the resistance between the Fused B(+) circuit and the Transmission Control Relay Output Circuit at the terminals of the Transmission Control Relay.

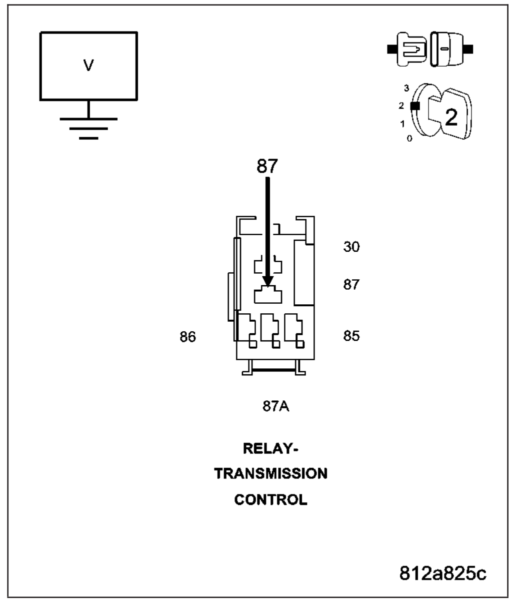
**Is the resistance above 5.0 ohms?**

**Yes** >> Go To 3

**No** >> Replace the Transmission Control Relay.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 3. (T16) TRANSMISSION RELAY OUTPUT CIRCUIT SHORT TO VOLTAGE




Ignition on, engine not running.

Measure the voltage at the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

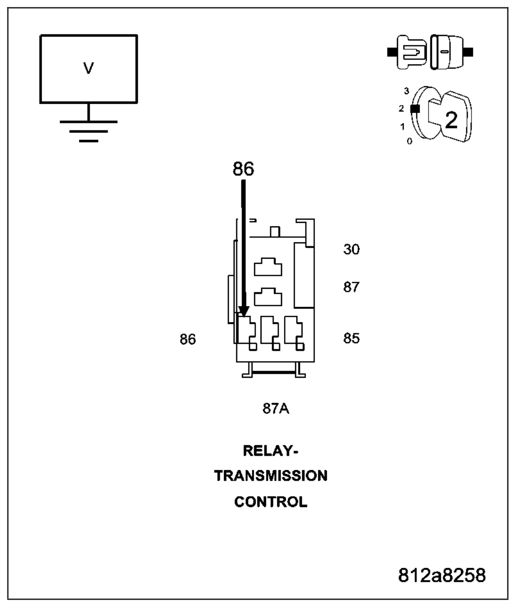
**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T16) Transmission Control Relay Output circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO VOLTAGE




**NOTE: The Transmission Controller will power up the Transmission Control Relay Control circuit for approximately 3.0 seconds after initial ignition on. Wait at least 3.0 seconds after turning the ignition to the on position before performing the following voltage check.**

**NOTE: P0882 Relay Always Off may set. Disregard this DTC.**

Measure the voltage at the (T15) Transmission Control Relay Control circuit after a 3.0 second wait period.

**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T15) Transmission Control Relay Control circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0884-POWER UP AT SPEED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  One time after each controller reset. Note: the Transmission Control Module is integrated with Powertrain Control Module. The Transmission Control Module has separate powers and grounds specifically to its portion of the PCM.
- **Set Condition:**
  This DTC will set if the PCM powers up and senses the vehicle in a valid forward gear (no PRNDL DTCs) with a output speed above 800 RPM, approximately 32 Kmh or 20 mph.

| Possible Causes |
|---|
| INTERMITTENT POWER AND GROUND CIRCUITS |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

If a vehicle loses power to the PCM, the vehicle will go to the 2nd gear mode since there is no power available to control the transmission solenoids. However if power is restored, the PCM will power-up and normal operation will be restored. This DTC identifies that power to the PCM was restored when the gear selector was in a ″Drive″ position while the vehicle was moving at speeds above 32 Kmh (20 mph). If a customer shifts to Neutral and cycles the ignition key and quickly shifts to ″Drive″ while moving before the PCM comes out of its START ROUTINE, the DTC can be set. Therefore it is critical that this DTC diagnosis repair procedure should only be used if the vehicle is experiencing intermittent 2nd gear operation and subsequently a return to normal operation during normal driving. The transmission will not be placed in Limp-in. This is an informational DTC to be used when attempting to diagnose an intermittent 2nd gear operation and subsequent return to normal transmission operation.

### Diagnostic Test

#### 1. CHECK THE POWER AND GROUND CIRCUITS

This DTC is set when the PCM is initialized while the vehicle is moving in a valid forward gear. This is usually caused by a momentary loss of power to the Transmission portion of the PCM.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

**NOTE: Due to the integration of the Powertrain and Transmission Control Modules, the transmission part of the PCM has its own specific power and ground circuits.**

Check all of the Fused B(+), Fused Ignition Switch Output, and Ground circuits related to the PCM for an intermittent open or short to ground.

Perform a wiggle test on all wiring and connectors pertaining to the PCM while looking for shorted or open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

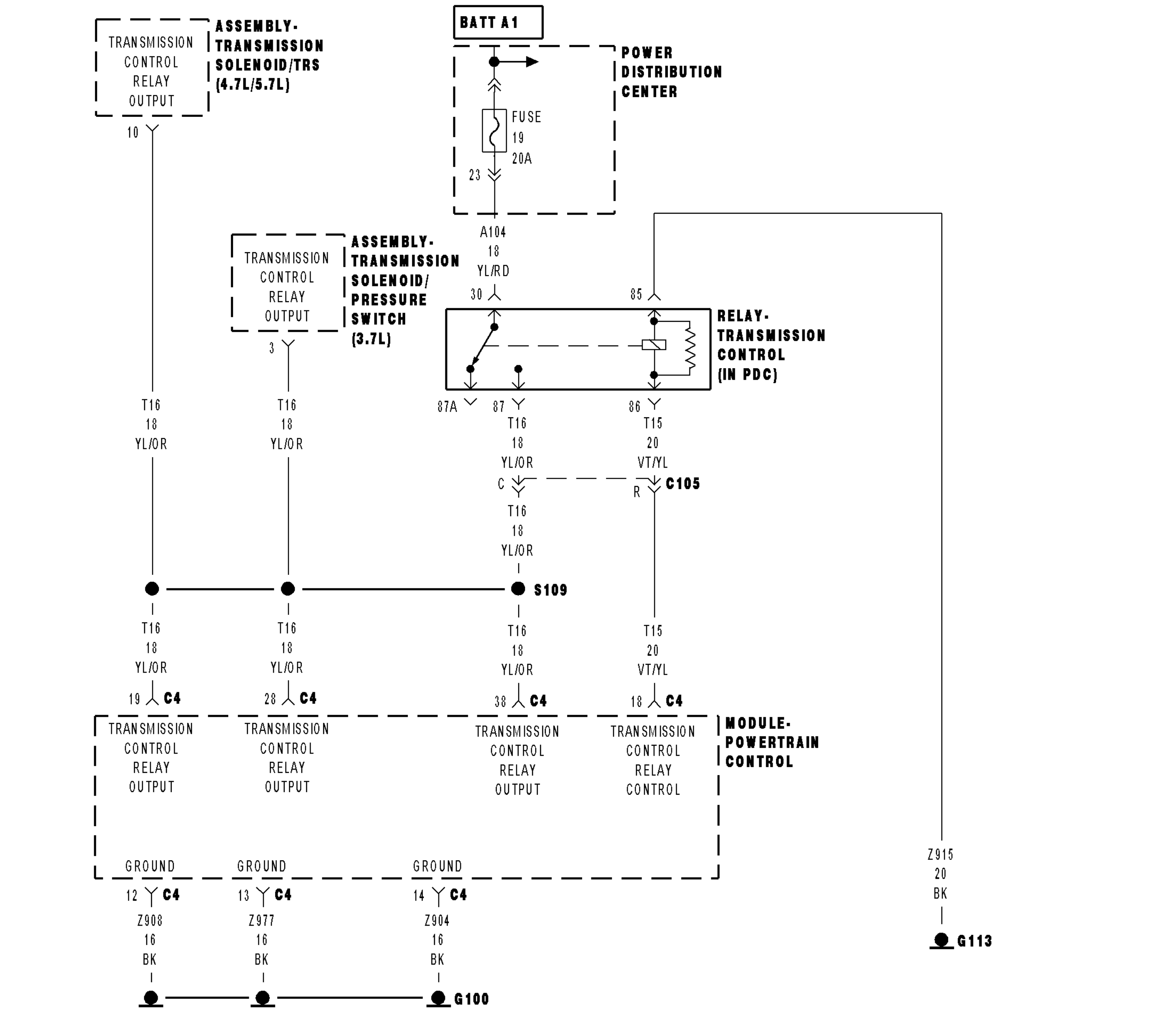
**If there are no possible causes remaining, view repair.**

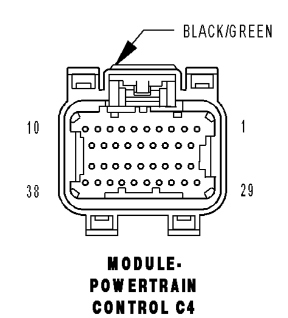
**Repair**

Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## P0888-TRANSMISSION RELAY ALWAYS OFF




*42RLE MINI PWR GND CKTS*

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously
- **Set Condition:**
  This DTC is set when the Transmission Control Relay output circuit voltage at the Powertrain Control Module is less than 3 volts when the PCM is energizing the relay. Note: Due to the integration of the Powertrain and Transmission Control Modules, the transmission part of the PCM has its own specific power and ground circuits.

| Possible Causes |
|---|
| (A104) FUSED B+ CIRCUIT OPEN |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN |
| (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT OPEN |
| (Z915) TRANSMISSION CONTROL RELAY GROUND CIRCUIT OPEN |
| (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO GROUND |
| (A104) FUSED B+ CIRCUIT SHORT TO GROUND |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORT TO GROUND |
| TRANSMISSION CONTROL RELAY |
| TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission control relay is used to supply power to the solenoid pack when the transmission is in normal operating mode. When the relay is off, no power is supplied to the solenoid pack and the transmission is in Limp-in mode. The relay output is fed back to the PCM. It is referred to as the Trans Relay Output circuit or switched battery. After a controller reset (ignition key turned to the run position or after cranking engine), the controller energizes the relay. Prior to this, the PCM verifies that the contacts are open by checking for no voltage at the transmission control relay outputs (switched battery) terminals. After the relay is energized, the PCM monitors the terminals to verify that the voltage is greater than 3 volts. The MIL illuminates and the transmission will be placed in Limp-in.

## Diagnostic Test

### 1. CHECK TO SEE IF DTC P0888 IS CURRENT

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter equal to 0?**

**Yes** >> Go To 2

**No** >> Go To 12

## 2. CHECK THE (A104) FUSED B+ CIRCUIT FOR VOLTAGE

Turn the ignition off to the lock position.

Remove the Transmission Control Relay.

**NOTE: Check connectors - Clean/repair as necessary.**

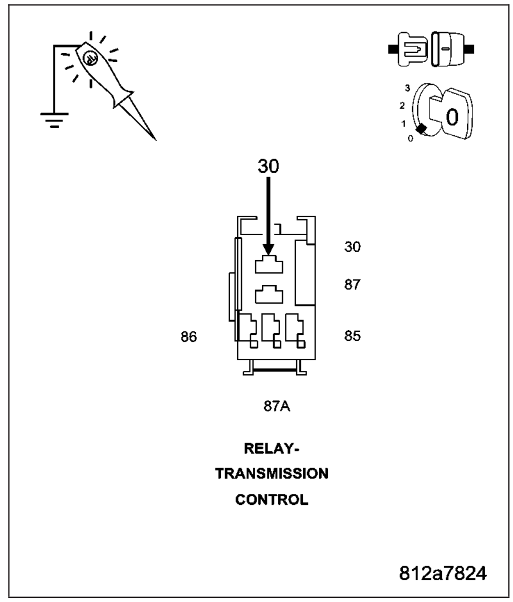
Using a 12-volt test light connected to ground, check the (A104) Fused B+ circuit in the Transmission Control Relay connector.

**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Go To 9




## 3. (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN

Connect a jumper wire between the (A104) Fused B+ circuit and the (T16) Transmission Control Relay Output circuits at the Transmission Control Relay connector.

Ignition on, engine not running.

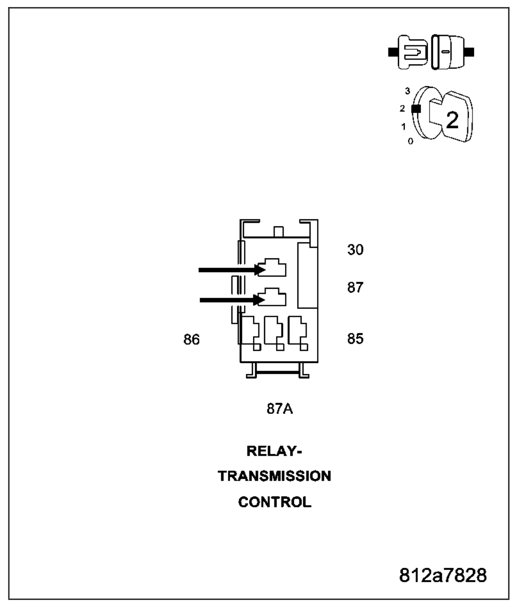
With the scan tool, read the Transmission Switched Battery voltage.

**Is the Switched Battery voltage equal to battery voltage?**

**Yes** >> Go To 4

**No** >> Repair the (T16) Transmission Control Relay Output circuits for an open or high resistance. Note: There are multiple Transmission Control Relay Output circuits.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)




## 4. TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.

Install a substitute Relay in place of the Transmission Control Relay.

Ignition on, engine not running.

With the scan tool, read the Transmission Switched Battery voltage.

**Is the Switched Battery voltage equal to battery voltage?**

**Yes** >> Replace the Transmission Control Relay.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (Z915) TRANSMISSION CONTROL RELAY GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, check the (Z915) Transmission Control Relay Ground circuit.

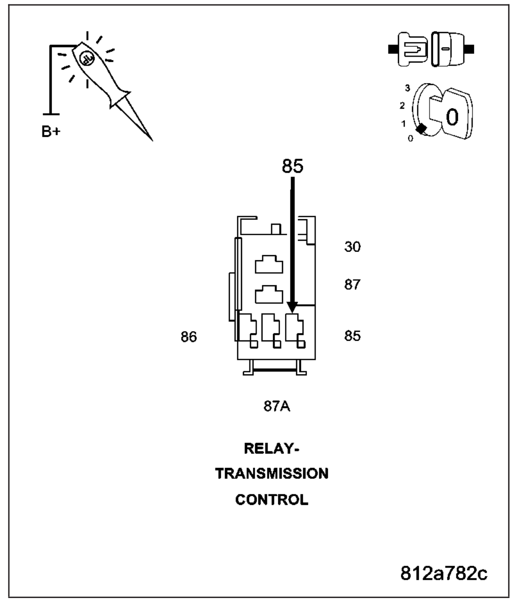
**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

**Does the test light illuminate brightly?**

**Yes** >> Go To 6

**No** >> Repair the (Z915) Transmission Control Relay Ground circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)




## 6. (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

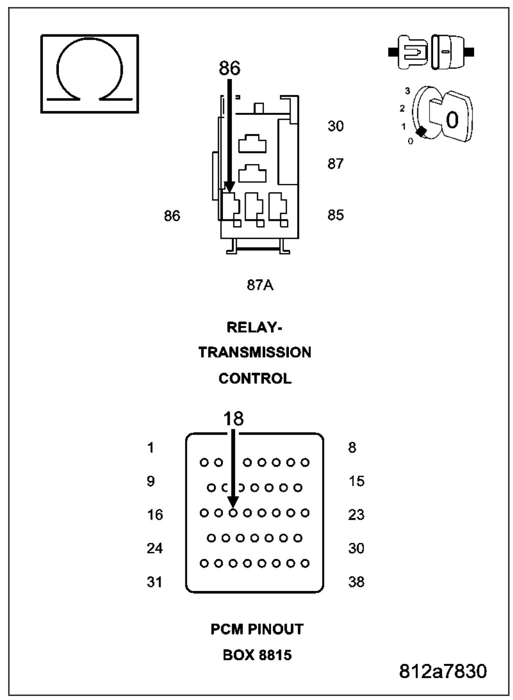
Measure the resistance of the (T15) Transmission Control Relay Control circuit between the Transmission Control Relay connector and the appropriate terminal of special tool #8815.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T15) Transmission Control Relay Control circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 7



## 7. (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO GROUND

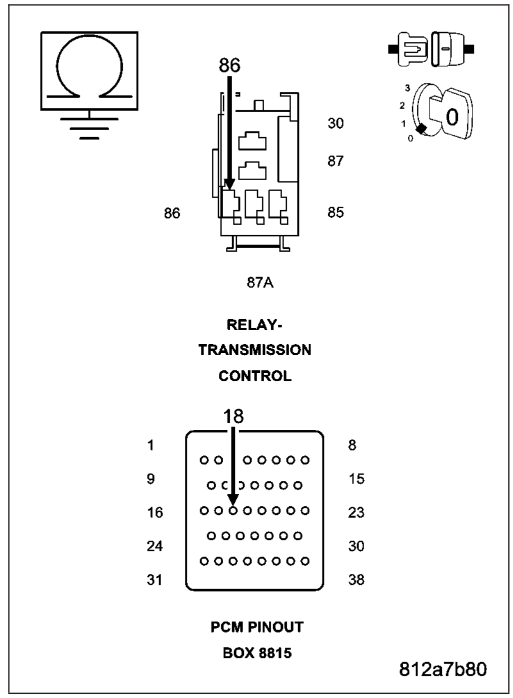
Measure the resistance between ground and the (T15) Transmission Control Relay Control circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T15) Transmission Control Relay Control circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 8




## 8. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Powertrain Control Module per the Service Information. With the scan tool PERFORM QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 9. CHECK THE FUSED B+ CIRCUIT FOR SHORT TO GROUND

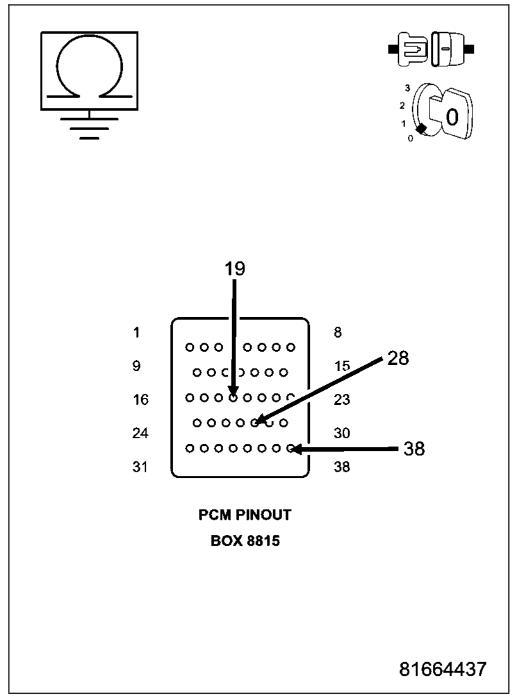
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connectors.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance between ground and the (T16) Transmission Control Relay Output circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 10

**No** >> Repair the Fused B+ circuit for an open.

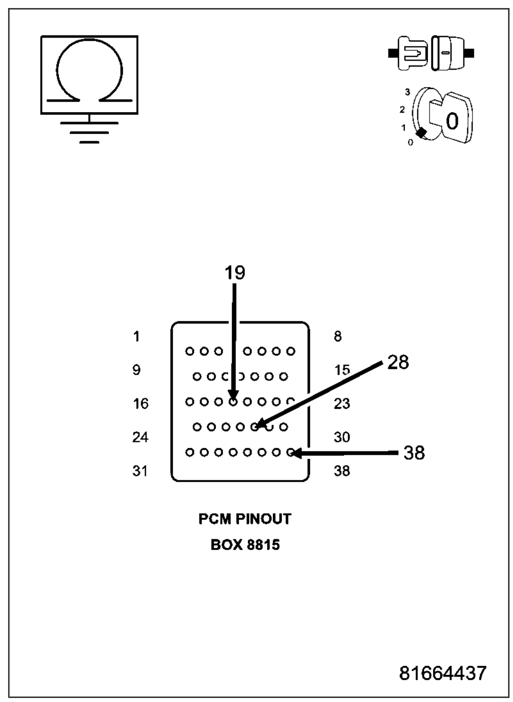
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 10. (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORT TO GROUND

Disconnect the Transmission Solenoid/Pressure Switch harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

Measure the resistance between ground and the (T16) Transmission Control Relay Output circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T16) Transmission Control Relay Output circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 11

## 11. TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

**If there are no possible causes remaining, view repair.**

**Repair**

Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 12. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the EVENT DATA to help identify the conditions in which the DTC was set.

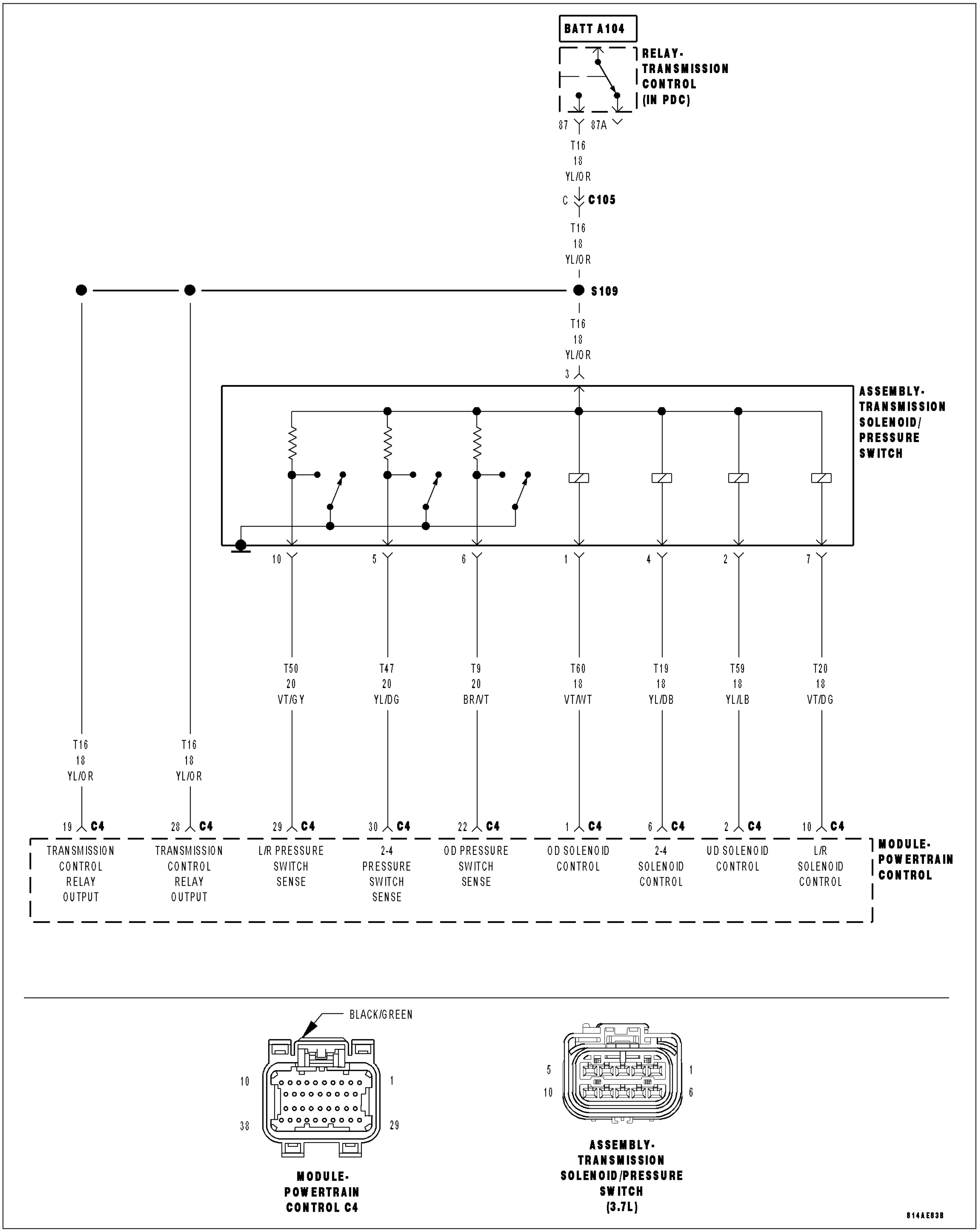
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0890-SWITCHED BATTERY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  One time after a reset (ignition key turned to the RUN position or after cranking engine).
- **Set Condition:**
  A fault is set if voltage greater than 4.5 volts is detected for 7 msec on any of the pressure switch circuits before the relay is energized. The transmission is placed in Limp-In. The MIL is on after 10 seconds. of vehicle operation.

| Possible Causes |
|---|
| (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission relay is used to supply power to the solenoid pack when in normal operating mode and to turn off power to produce transmission ″limp-in″ mode. The relay output (which supplies power to the solenoid pack) is fed back to the controller. It is referred to as SWITCHED BATTERY. After a controller reset (ignition key turned to the RUN position or after cranking engine), the controller verifies that the relay contacts are open by checking for no voltage on Switched battery line (transmission control relay output) before the relay is energized. After switched battery is verified for no voltage, the voltage of each of the solenoid pack pressure switches is also checked. Since the solenoid pack is not powered up, there should be no voltage on any of the pressure switches.

## Diagnostic Test

### 1. CHECK TO SEE IF DTC P0890 IS PRESENT

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter set at 0?**

**Yes** >> Go To 2

**No** >> Go To 5

## 2. (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

Remove the Transmission Control Relay.

**NOTE: Check connectors - Clean/repair as necessary.**

Connect a jumper wire between the (A104) Fused B+ circuit and (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

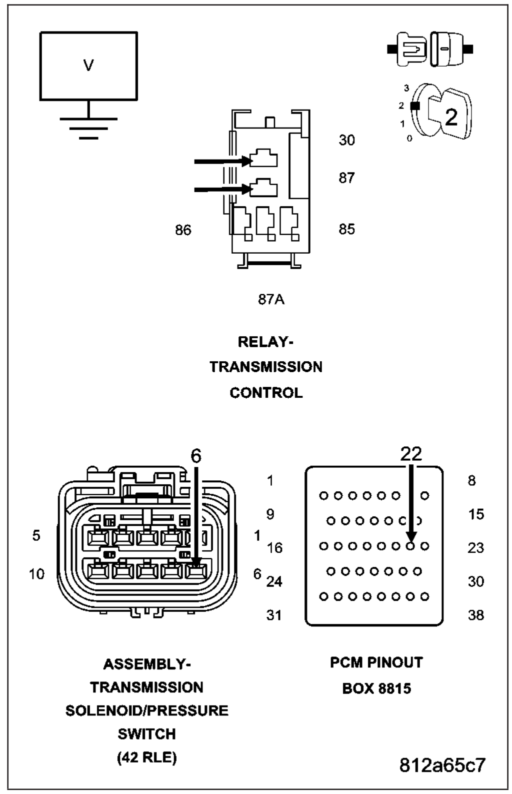
Ignition on, engine not running.

Measure the voltage of the (T9) OD Pressure Switch Sense circuit.

**Is the voltage above 0.5 volt?**

**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 3




## 3. (T47) 2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

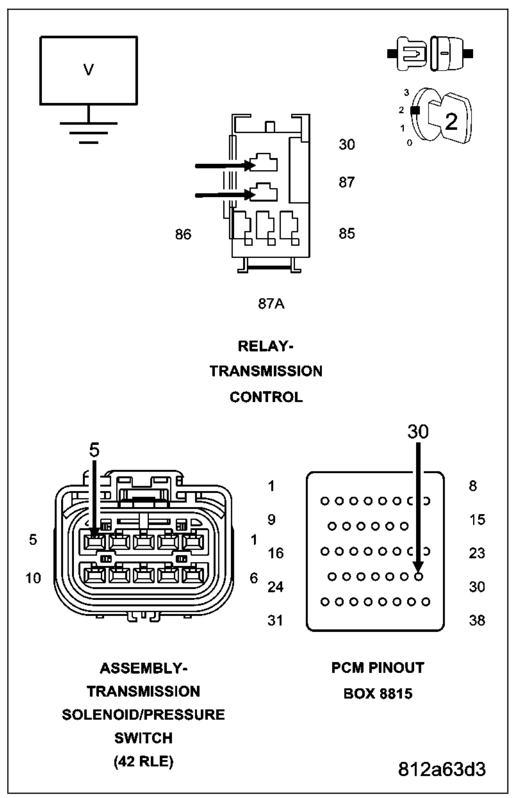
**NOTE: The jumper wire must still be in place.**

Measure the voltage of the (T47) 2/4 Pressure Switch Sense circuit.

**Is the voltage above 0.5 volt?**

**Yes** >> Repair the (T47) 2/4 Pressure Switch Sense circuit for a short to voltage.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 4

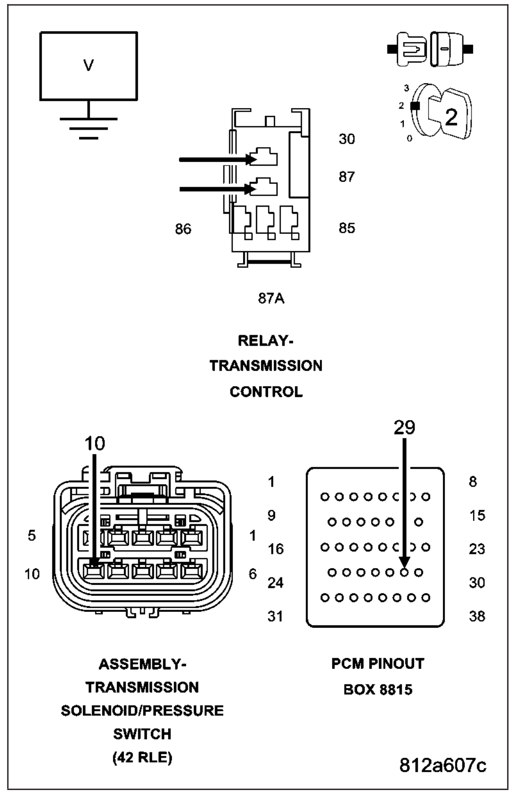


## 4. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

**NOTE: The jumper wire must still be in place.**

Measure the voltage of the (T50) L/R Pressure Switch Sense circuit.

**Is the voltage above 0.5 volts?**




**Yes** >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

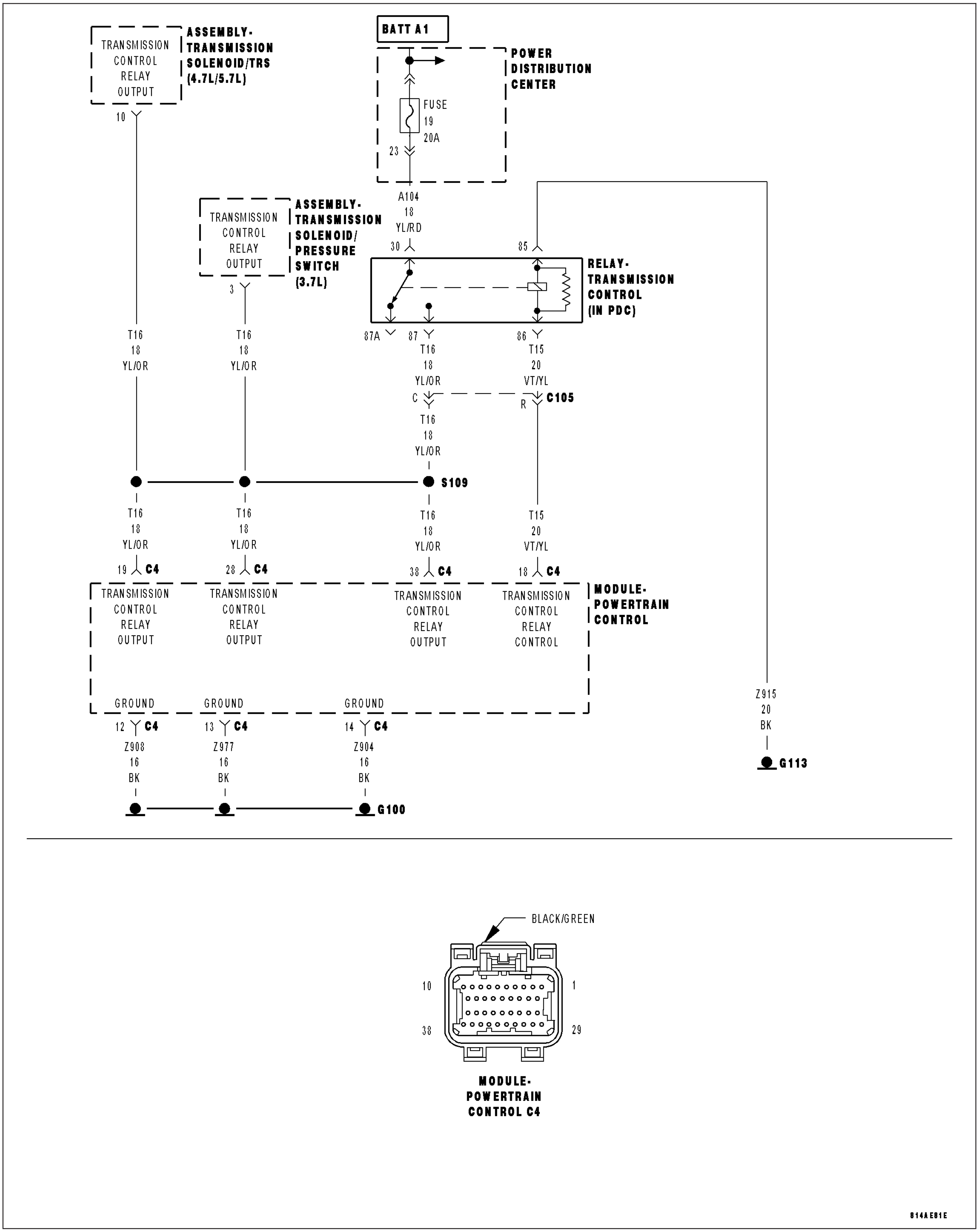
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0891-TRANSMISSION RELAY ALWAYS ON




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  After a reset (ignition key turned to the RUN position) and after a power down.
- **Set Condition:**
  Relay output (Switched Battery) is higher than 3 volts when relay is not energized by the controller. Fault Set Time: Less than 100 msec

| Possible Causes |
| --- |
| TRANSMISSION CONTROL RELAY STUCK CLOSED |
| (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO VOLTAGE |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUITS SHORT TO VOLTAGE |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission relay is used to supply power to the solenoid pack when in normal operating mode and to turn off power to produce transmission ″limp-in″ mode. The relay output (which supplies power to the solenoid pack) is fed back to the controller This is referred to as SWITCHED BATTERY. After a controller reset (ignition key turned to the RUN position or after cranking engine), the controller verifies that the relay contacts are open by checking for no voltage on Switched battery line (relay output) before the relay is energized. Transmission locked in Limp-In. MIL on after 10 seconds of vehicle operation.

## Diagnostic Test

### 1. CHECK TO SEE IF DTC P0891 IS CURRENT

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter equal to 0?**

**Yes** >> Go To 2

**No** >> Go To 5

### 2. TRANSMISSION CONTROL RELAY CONTACTS STUCK CLOSED

Turn the ignition off to the lock position.

Remove the Transmission Control Relay.

**NOTE: Check connectors - Clean/repair as necessary.**

Measure the resistance between the Fused B(+) circuit and the Transmission Control Relay Output Circuit at the terminals of the Transmission Control Relay.

**Is the resistance above 5.0 ohms?**

**Yes** >> Go To 3

**No** >> Replace the Transmission Control Relay.

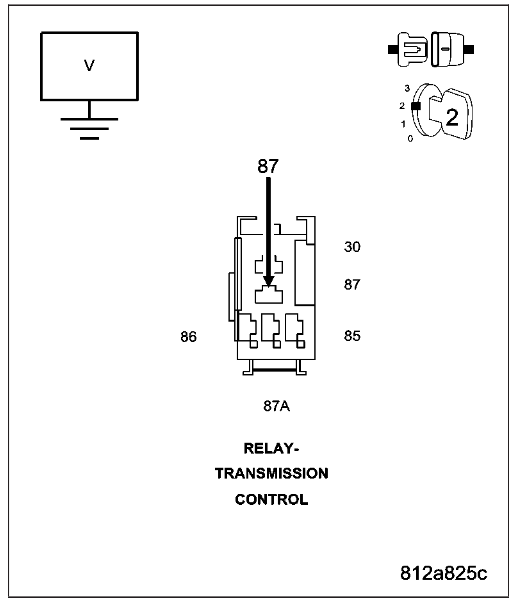
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 3. (T16) TRANSMISSION RELAY OUTPUT CIRCUIT SHORT TO VOLTAGE

Ignition on, engine not running.

Measure the voltage at the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

**Is the voltage above 0.5 volts?**




**Yes** >> Repair the (T16) Transmission Control Relay Output circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 4

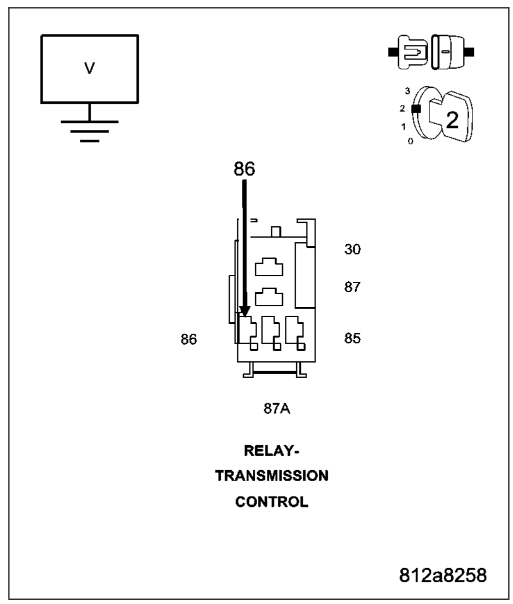
## 4. (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO VOLTAGE

**NOTE: The Transmission Controller will power up the Transmission Control Relay Control circuit for approximately 3.0 seconds after initial ignition on. Wait at least 3.0 seconds after turning the ignition to the on position before performing the following voltage check.**

**NOTE: P0888 Relay Always Off may set. Disregard this DTC.**

Measure the voltage at the (T15) Transmission Control Relay Control circuit after a 3.0 second wait period.

**Is the voltage above 0.5 volts?**




**Yes** >> Repair the (T15) Transmission Control Relay Control circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wiring and connectors while checking for shorted and open circuits.
With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Test Complete.

## P0897-TRANSMISSION FLUID DETERIORATED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Each transition from full EMCC to partial EMCC for A/C bump prevention.
- **Set Condition:**
  DTC set if 20 occurrences of a turbine acceleration sum. Fault Set Time: 20 transitions from full EMCC to partial EMCC. Transmission will not use partial EMCC. Established for A/C bump prevention.

| Possible Causes |
|---|
| WORN OUT/ BURNT TRANSAXLE FLUID |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

To prevent a bump due to A/C clutch engagement, a temporary torque converter partial EMCC condition is established prior to A/C clutch engagement. A message is received over the bus indicating that A/C clutch engagement is imminent. Partial EMCC is then established and a reply message, ″OK to engage A/C clutch″ is sent via the bus. Partial EMCC will be held for 450 ms before returning to full EMCC. During the transition from full to partial EMCC, a turbine acceleration sum is calculated, if this value exceeds a threshold value for several transitions, degraded transmission fluid is indicated.

### Diagnostic Test

#### 1. WORN OUT/ BURNT TRANSMISSION FLUID

Turn the ignition off to the lock position.

Flush the Transmission Oil Cooler and lines, replace the Transmission Oil Filter, refill with new Transmission Fluid, start the engine, and adjust the fluid per the Service Information.

**NOTE: The Transmission Cooler must be flushed before proceeding.**

Allow the engine to idle for 10 minutes, in Park.

Turn the ignition off to the lock position.

Again, flush the Transmission Oil Cooler and lines, replace the Transmission Oil Filter, refill with new Transmission Fluid, start the engine, and adjust the fluid per the Service Information.

With the scan tool, perform a Battery Disconnect.

**NOTE: The Battery Disconnect must be done to re-enable EMCC during an A/C Clutch engagement.**

**NOTE: The vehicle may exhibit intermittent shudder during the first few hundred miles. The new Transmission Fluid will gradually penetrate the Torque Convertor Clutch friction material and the shudder should disappear.**

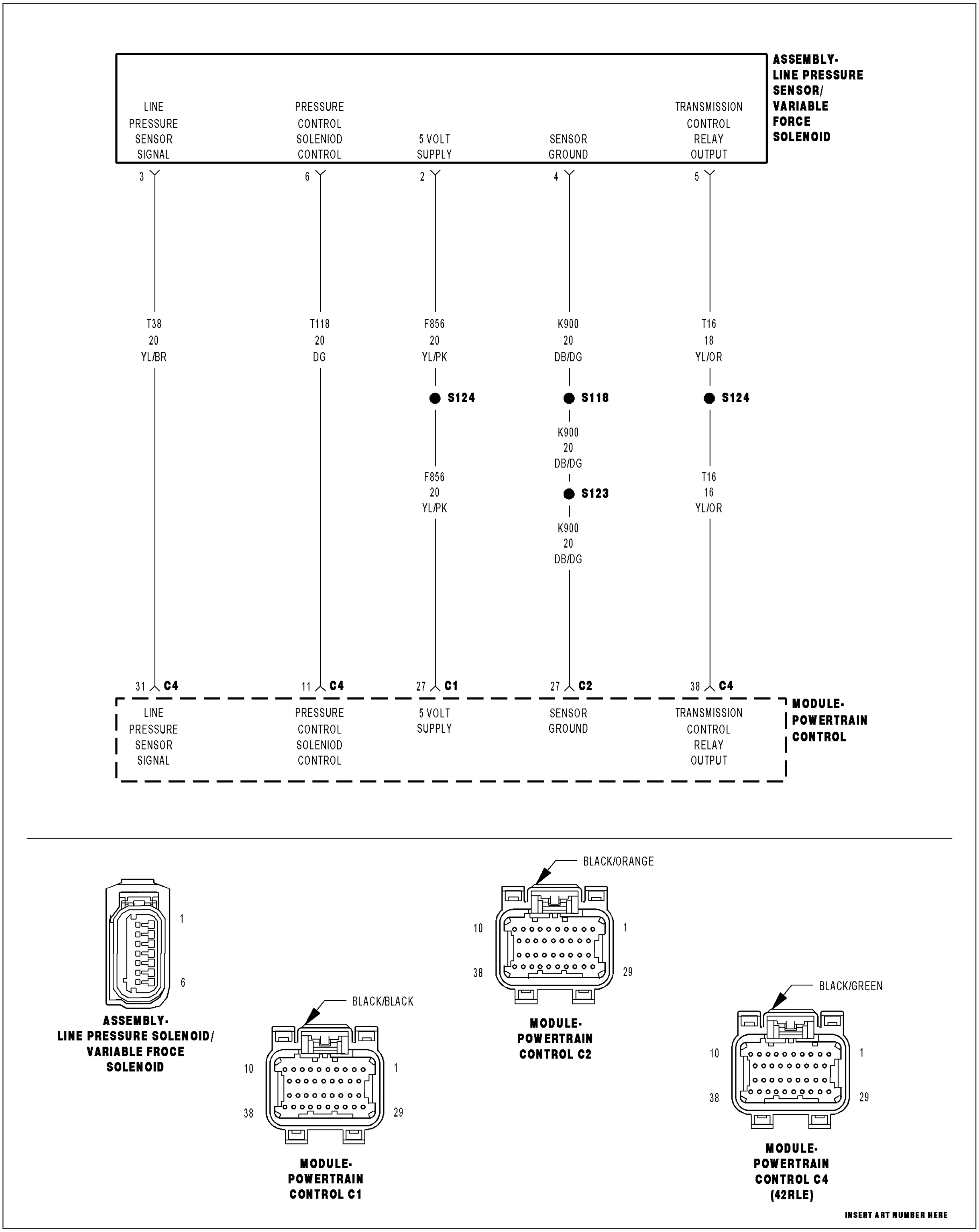
Erase the DTC and return the vehicle to the customer.

**Did the DTC reset and/or does the vehicle still shudder after a few thousand miles?**

**Yes** >> Replace the Torque Converter per the Service Information.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0932-LINE PRESSURE SENSOR CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  The PCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If the Actual Line Pressure reading is more than 172.4 kPa (25 psi) higher than the Desired Line Pressure, but is less than the highest Line Pressure ever used in the current gear, the DTC sets.

| Possible Causes |
|---|
| RELATED DTC'S PRESENT |
| LINE PRESSURE CONNECTOR AND WIRING |
| INTERNAL TRANSMISSION |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality.

## Diagnostic Test

### 1. DETERMINING IF RELATED DTCS ARE PRESENT

With the scan tool, check for other transmission DTCs.

**Are there any other line pressure related DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. Perform the test for P0934 and/or P0935 first if present.

**No** >> Go To 2

### 2. COMPARE ACTUAL LINE PRESSURE TO DESIRED LINE PRESSURE

**CAUTION: Apply Parking Brake**
Start the engine.

**CAUTION: Firmly apply the brakes.**
With the scan tool, monitor the Line Pressure, Desired Line Pressure and the TPS degrees.

While firmly applying the brakes, place the shifter in reverse, then slowly press the accelerator pedal to a TPS degree of 15°.

Compare the Line Pressure reading to the Desired Line Pressure reading on the scan tool.

**Does the Line Pressure stay within ± 34 kPa or 5 psi of the Desired Line Pressure?**

**Yes** >> Go To 5

**No** >> Go To 3

## 3. CHECK LINE PRESSURE CONNECTOR AND WIRING

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure Sensor voltage while wiggling the wiring harness and connectors pertaining to the Line Pressure Sensor/Variable Force Solenoid Assembly.

**Did the voltage remain steady while wiggling the wiring harness and connectors?**

**Yes** >> Go To 4

**No** >> Disconnect and properly reconnect the Line Pressure Sensor/Variable Force Solenoid Assembly connector. Inspect terminals and repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 4. CHECK PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure during the following step.

With the Transmission Simulator, turn the selector switch to each of the 3 Line Pressure positions.

**NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.**

**Did the Line Pressure read within ± 14 kPa or 2.0 psi in all three positions?**

**Yes** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Repair internal transmission and inspect the oil pump per the Service information and replace if necessary. If no problems are found, replace the Line Pressure Sensor/Variable Force Solenoid Assembly — possible cause is the Pressure Control Solenoid is stuck.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 5. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

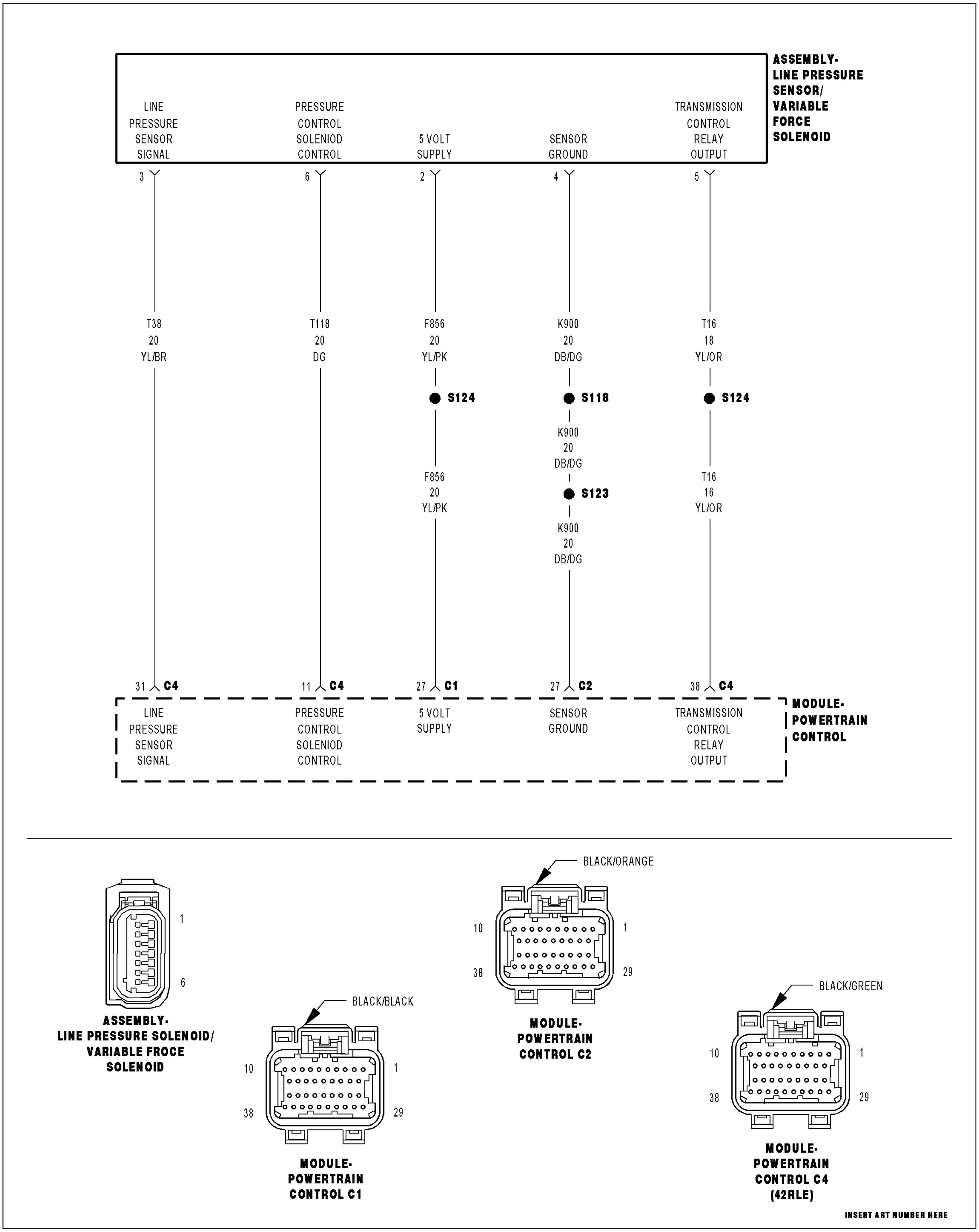
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0934-LINE PRESSURE SENSOR CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set when the monitored Line Pressure Sensor voltage is less than or equal to 0.35 volts for 0.18 seconds.

| Possible Causes |
|---|
| (F856) 5-VOLT SUPPLY CIRCUIT OPEN |
| (F856) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND |
| (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND |
| LINE PRESSURE SENSOR |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality.

The monitored Line Pressure Sensor voltage should always be between 0.35 and 4.75 volts. Any monitored voltages outside these parameters indicate an Line Pressure Sensor or wiring problem and will cause either DTC P0934 or P0935 to set.

## Diagnostic Test

### 1. CHECK IF DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0934.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 2

**No** >> Go To 6

### 2. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, under Transmission Sensors, monitor the Line Pressure.

Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

**NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.**

**Did the Line Pressure read within ± 14 kPa or 2.0 psi in all three positions?**

**Yes** >> Replace the Line Pressure Sensor per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

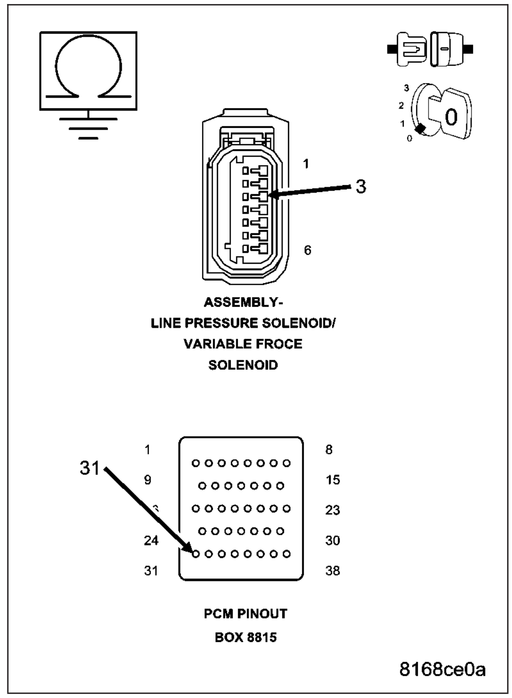
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

Disconnect the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance between ground and the (T38) Line Pressure Sensor Signal circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T38) Line Pressure Sensor Signal circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Disconnect the PCM C1 harness connector and connect Miller tool #8815.

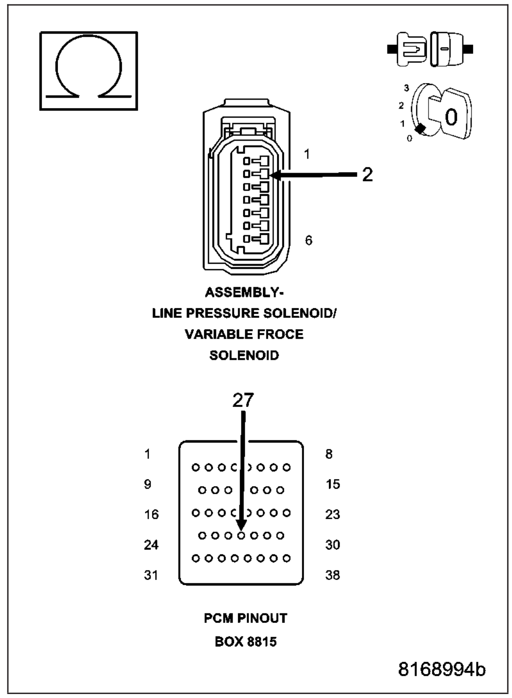
Measure the resistance of the (F856) 5-volt Supply circuit between Line Pressure Sensor/Variable Force Solenoid Assembly harness connector and the appropriate terminal of Miller tool #8815.

**Is the resistance below 5.0 ohms?**

**Yes** >> Go To 5

**No** >> Repair the (F856) 5-volt Supply circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)




## 5. CHECK THE (F856) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Disconnect the PCM C1 harness connector and connect Miller tool #8815.

Measure the resistance between ground and the (F856) 5-volt Supply circuit.

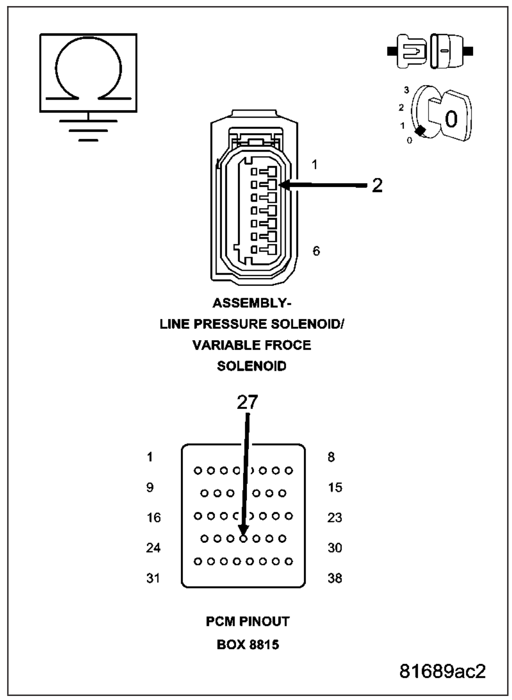
**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (F856) 5-volt Supply circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)



## 6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

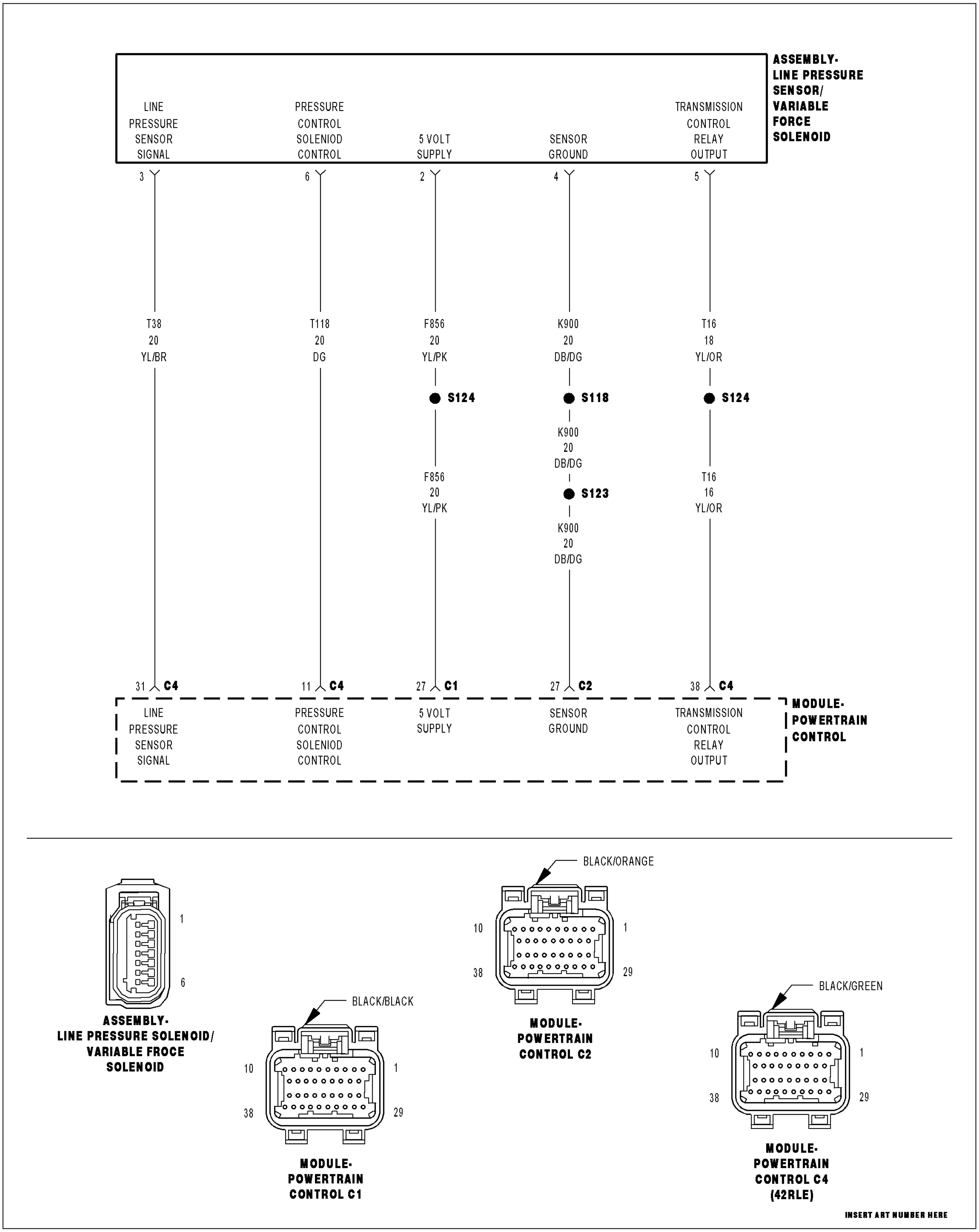
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0935-LINE PRESSURE SENSOR CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored Line Pressure Sensor voltage is greater than or equal to 4.75 volts for the period of 0.18 seconds

| Possible Causes |
|---|
| (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT OPEN |
| (K900) SENSOR GROUND CIRCUIT OPEN |
| (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE |
| LINE PRESSURE SENSOR |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality.

The monitored Line Pressure Sensor voltage should always be between 0.35 and 4.75 volts. Any monitored voltages outside these parameters indicate an Line Pressure Sensor or wiring problem and will cause either DTC P0934 or P0935 to set.

## Diagnostic Test

### 1. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0935.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 2

**No** >> Go To 6

### 2. CHECK THE PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Removal of the Starter Relay is to prevent a Transmission, NO RESPONSE, condition and disable the starter.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure.

Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

**NOTE: All three scan tool Line Pressure readings should be steady and ± 14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.**

**Did the Line Pressure read within ± 14 kPa or 2.0 psi in all three positions?**

**Yes** >> Replace the Line Pressure Sensor per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECK THE (K900) SENSOR GROUND CIRCUIT FOR AN OPEN

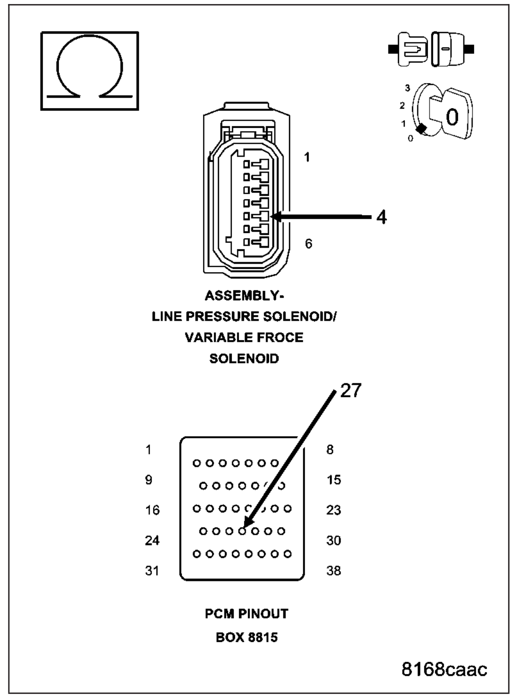
Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Disconnect the PCM C2 harness connector and connect Miller tool #8815.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance of the (K900) Sensor Ground circuit from the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector to the appropriate terminal of Miller tool #8815.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (K900) Sensor Ground circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

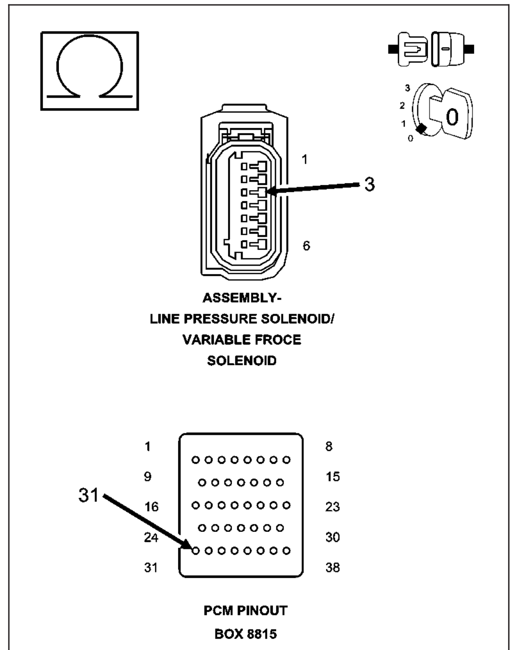
**No** >> Go To 4

## 4. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR AN OPEN

Disconnect the PCM C4 harness connector and connect Miller tool #8815.

Measure the resistance of the (T38) Line Pressure Sensor Signal circuit from the Line Pressure Sensor/Variable Force Solenoid Assembly harness connector to the appropriate terminal of Miller tool #8815.

**Is the resistance above 5.0 ohms?**




8168ca63

**Yes** >> Repair the (T38) Line Pressure Sensor Signal circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

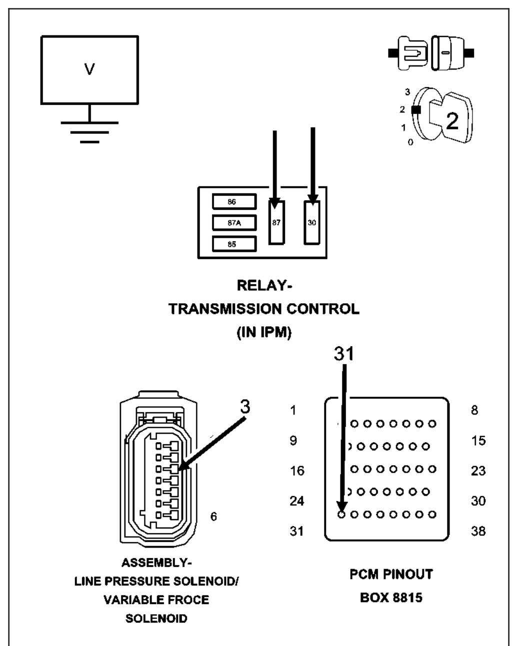
Remove the Transmission Control Relay.

Connect a jumper wire between the (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T38) Line Pressure Sensor Signal circuit.

**Is the voltage above 5.5 volts?**




8168cb27

**Yes** >> Repair the (T38) Line Pressure Sensor Signal circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 6. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Where there any problems found?**

**Yes** >> Repair as necessary.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0944-LOSS OF HYDRAULIC PUMP PRIME

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Every 350 msec
- **Set Condition:**
  If the transmission begins to slip in any forward gear, and the pressure switch or switches that should be closed for a given gear are open, a loss of prime test begins. All available elements (in 1st gear LR, 2/4 and OD, in 2nd, 3rd, and 4th gear 2/4 and OD) are turned on by the PCM to see if pump prime exists. The code is set if none of the pressure switches respond. The PCM will continue to run the loss of prime test until pump pressure returns. The vehicle will not move or the transmission will slip. Normal operation will continue if pump prime returns.

| Possible Causes |
|---|
| LOW TRANSMISSION FLUID LEVEL |
| SHIFT LEVER POSITION |
| PLUGGED TRANSMISSION FILTER |
| TRANSMISSION OIL PUMP |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

The Loss of Prime Test is used to prevent transmission defaults and erroneous fault codes during temporary loss of pump prime that may occur with low transmission fluid under severe braking conditions, start-up, etc. and to point towards more subtle problems such as a plugged or ruptured oil filter. The Loss of Prime fault is set by a loss of hydraulic pressure in the transmission system. This condition, if sustained, will result in the vehicle being unable to move.

### Diagnostic Test

1. **CHECK TO SEE IF DTC P0944 IS CURRENT**

Place the gear selector in park.

Start the engine.

**NOTE: The Transmission Temperature must be at least 43° C (110° F) before performing the following steps.**
The Transmission must be at operating temperature prior to checking pressure. Cold transmission fluid will result in higher pressure readings.

Place the Transmission in Reverse.

With the scan tool, observe the Transmission Pressure Switch states.

**Are any of the Pressure Switches closed?**

**Yes** >> Go To 2

**No** >> Go To 4

## 2. INTERMITTENT OPERATION

The conditions necessary to set this DTC are not present at this time.

Test drive the vehicle. Allow the Transmission to shift through all gears and ranges.

**Was a delayed engagement and/or a no drive condition present during the test drive?**

**Yes** >> Go To 4

**No** >> Go To 3

## 3. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring while checking for shorted and open circuits.

With the scan tool, check the EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## 4. SHIFT LEVER POSITION TEST

With the scan tool, perform a Shift Lever Position test. Follow the instructions on the screen.

**Did the Shift Lever Position Test pass?**

**Yes** >> Go To 5

**No** >> Perform the diagnostic procedure for P0706-CHECK SHIFTER SIGNAL.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 5. CHECK FOR PLUGGED TRANSMISSION FILTER

Remove the Transmission Pan and inspect the Transmission Fluid and Transmission Filter per the Service Information.

**Does the Transmission Oil Pan contain excessive debris and/or is the Oil Filter plugged?**

**Yes** >> Repair the cause of the plugged Transmission Filter. Refer to the Service Information for the proper repair procedure.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Oil Pump per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## P0992-2/4/OD HYDRAULIC PRESSURE TEST

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM, shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed greater than 1000 RPM, the PCM momentarily turns on element pressure to the clutch circuits that do not have pressure to identify that the correct pressure switch closes. If the pressure switch does not close 2 times the DTC sets.

| Possible Causes |
|---|
| CONDITION P0992 PRESENT |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).**

### Theory of Operation

Pressure switches are normally off or open (no pressure applied) and read high (+12 volts). When an element is applied, the corresponding pressure switch closes to ground (0 volts) or turns on. The controller tests the OD and 2/4 pressure switches when they are off (when the corresponding friction element is not applied) by briefly applying the OD and 2/4 elements which will cause the corresponding pressure switch to close. The test verifies that the switches are operational and that the switch will close when the corresponding element is applied. If a switch fails to respond, it is re-tested. The MIL illuminates and the transmission system defaults to Limp-in mode.

### 1. CHECK TO SEE IF DTC P0992 IS CURRENT

**NOTE: The vehicle must be driven to set this DTC. The transmission must at operating temperature with the Engine RPM above 1000 RPM.**

This DTC is an indication of both the 2/4 and the O/D Hydraulic Pressure Switch DTCs present.

Perform the diagnostic procedures for both P0845 and P0870.

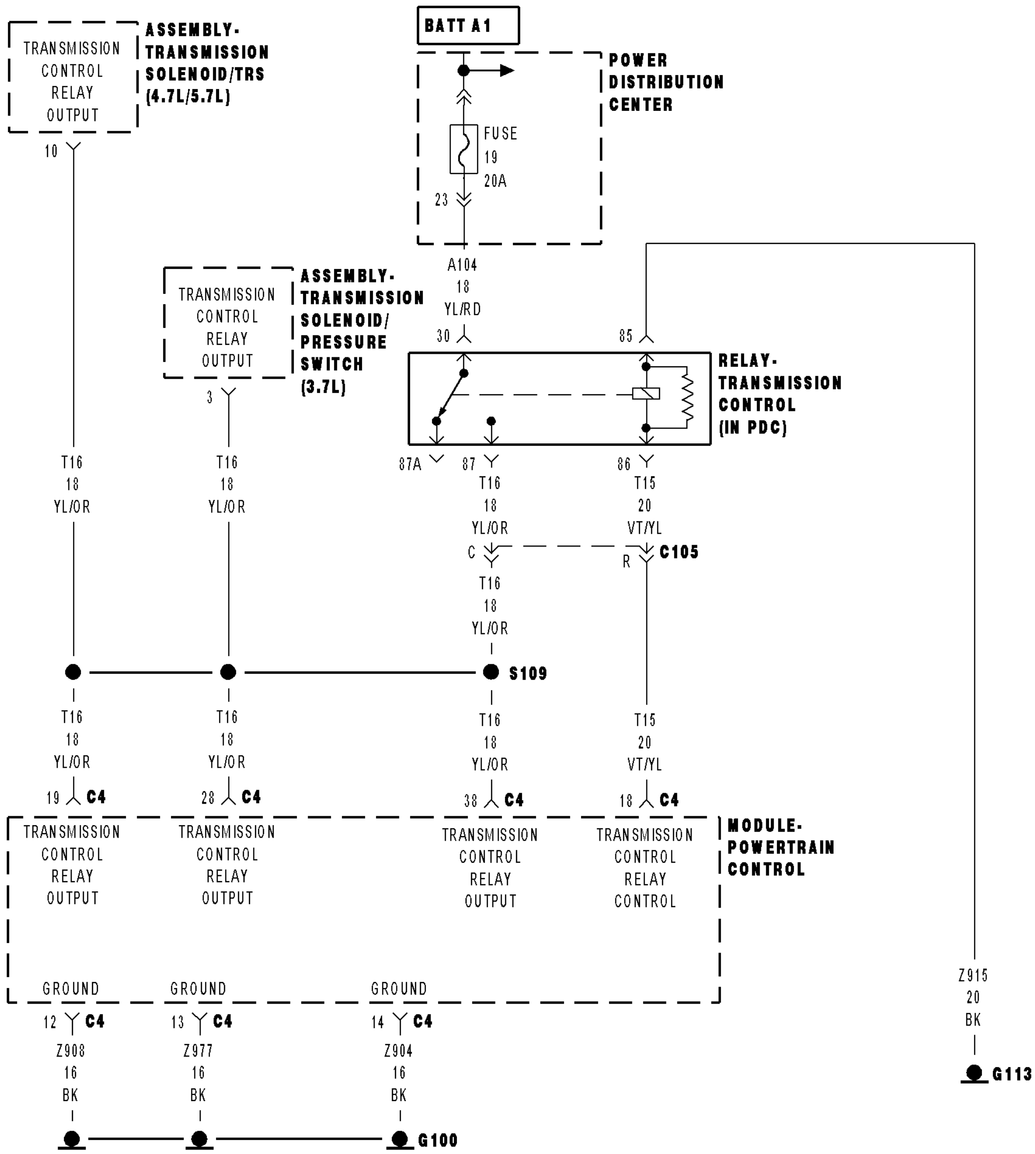
With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

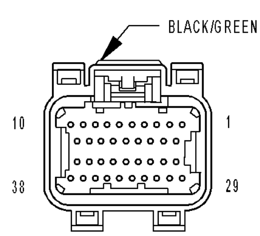
**If there are no possible causes remaining, view repair.**

**Repair**

Refer to the Transmission category and perform the diagnostic procedures for P0845 and P0870.

## P1684-BATTERY WAS DISCONNECTED




MODULE-POWERTRAIN CONTROL C4

814AE81E

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  After a reset (ignition key turned to the RUN position).
- **Set Condition:**
  The checksum of the battery backed RAM does not match the stored checksum. Set Time: Less than 7 msec.

| Possible Causes |
|---|
| BATTERY WAS DISCONNECTED |
| PCM WAS REPLACED OR DISCONNECTED |
| QUICK LEARN WAS PERFORMED |
| (A919) FUSED B+ CIRCUIT TO PCM OPEN |
| (Z908 and Z977) GROUND CIRCUIT OPEN |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING).**

## Theory of Operation

Note: This is not a fault code. It exists to provide reference information only. A battery backed RAM is used to maintain some learned values. When the battery is disconnected, this memory is lost. When the battery is reconnected, the loss of learned values will be detected by the controller. The code will be set and the learned values will be initialized to known constants and the learning process will continue. Setting the code has no effect except for re-initialization of learned values.

## Diagnostic Test

### 1. BATTERY WAS DISCONNECTED

**Has the battery been disconnected, lost it's charge, or been replaced recently?**

**Yes** >> Disconnecting or replacing the battery will set this DTC. Erase the DTC.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Go To 2

### 2. WAS QUICK LEARN PERFORMED

**Has a Quick Learn procedure been performed?**

**Yes** >> Performing Quick Learn will set this DTC. Erase the DTC.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Go To 3

### 3. PCM REPLACED OR DISCONNECTED

**Has the PCM been replaced or disconnected?**

**Yes** >> Replacing or disconnecting the PCM will set this DTC. Erase the DTC.
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Go To 4

## 4. (A919) FUSED B+ CIRCUIT

Turn the ignition off to the lock position.

Disconnect the PCM C1 harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Using a 12-volt test light connected to ground, check the (A919) Fused B+ circuit.

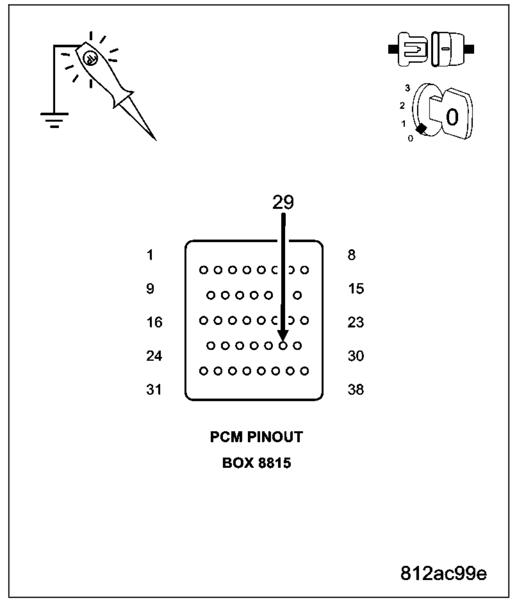
**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

**Does the test light illuminate brightly?**

**Yes** >> Go To 5

**No** >> Repair the Fused B+ circuit for an open. If the fuse is open make sure to check for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.




## 5. (Z908) AND (Z977) GROUND CIRCUITS

Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

Using a 12-volt test light connected to 12-volts, check the (Z908) and (Z977) Ground circuits in the appropriate terminal of special tool #8815.

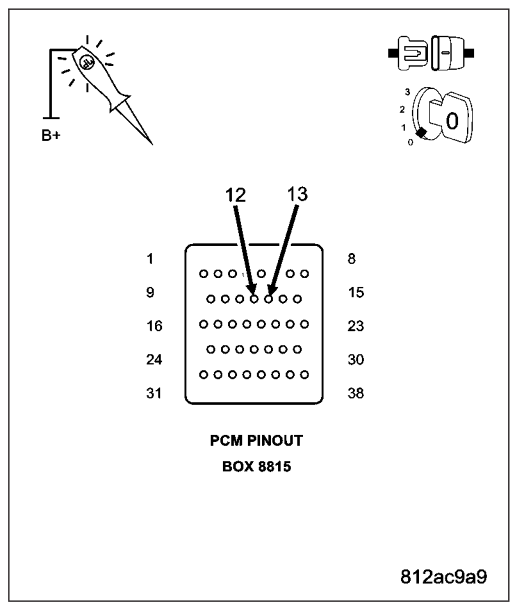
**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

**Does the test light illuminate brightly for all of the ground circuits?**

**Yes** >> Go To 6

**No** >> Repair the Ground circuits for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.




## 6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the EATX DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLETRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Test Complete.

## P1713-RESTRICTED MANUAL VALVE IN T2 RANGE

For a complete wiring diagram**Refer to Section 8W**

- **When Monitored:**
  Ignition on, engine running with the gear shift selector in a valid forward gear.
- **Set Condition:**
  This DTC sets whenever Transmission control system detects the manual valve is in the T2 range when it should be in OD. This is mainly an informational DTC.

| Possible Causes |
|---|
| RELATED TRANSMISSION DTC'S PRESENT |
| CUSTOMER DRIVING HABITS |
| MIS-ADJUSTED SHIFTER CABLE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Diagnostic Test

### 1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

**Are there any speed sensor or gear ratio DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK THE GEAR SHIFT CABLE FOR PROPER ADJUSTMENT

Check the Gear shift cable adjustment per the Service Information.

Also check the cable for possible binding or improperly routed.

**Is the Gear shift cable properly adjusted and not binding or improperly routed?**

**Yes** >> Go To 3

**No** >> Adjust the Shifter Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

### 3. CHECK CUSTOMER DRIVING HABIT

This DTC can be set if the customer does not move the shift lever completely into the OD position (in between gears) causing the manual valve to be in the T2 position.

When this occurs, the feed port to the clutch is restricted, the transmission will declare neutral, and this DTC will set.

This DTC can also be set by simply bumping the shift lever toward neutral while accelerating.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**If there are no possible causes remaining, view repair.**

**Repair**

This DTC can be set by the shift lever in the wrong position or not completely in the OD position. Make sure the customer is properly informed.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

# P1745-TRANSMISSION LINE PRESSURE TOO HIGH FOR TOO LONG

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with ignition on.
- **Set Condition:**
  If the transmission has been operating in an open-loop line pressure control for 2000 miles or 1000 2-3 upshifts.

| Possible Causes |
|---|
| LINE PRESSURE DTCS PRESENT |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

This DTC is an informational DTC to inform the technician that transmission has been operating in an open-loop line pressure control for 2000 miles or 1000 2-3 upshifts resulting from a Line Pressure DTC. The 42RLE Transmission is not designed to operate in open-loop line pressure control for an extended period time. This DTC is intended to protect the transmission. If the DTC sets, the transmission controller will place the transmission into limp-in mode.

## Diagnostic Test

### 1. CHECK FOR RELATED DTC'S

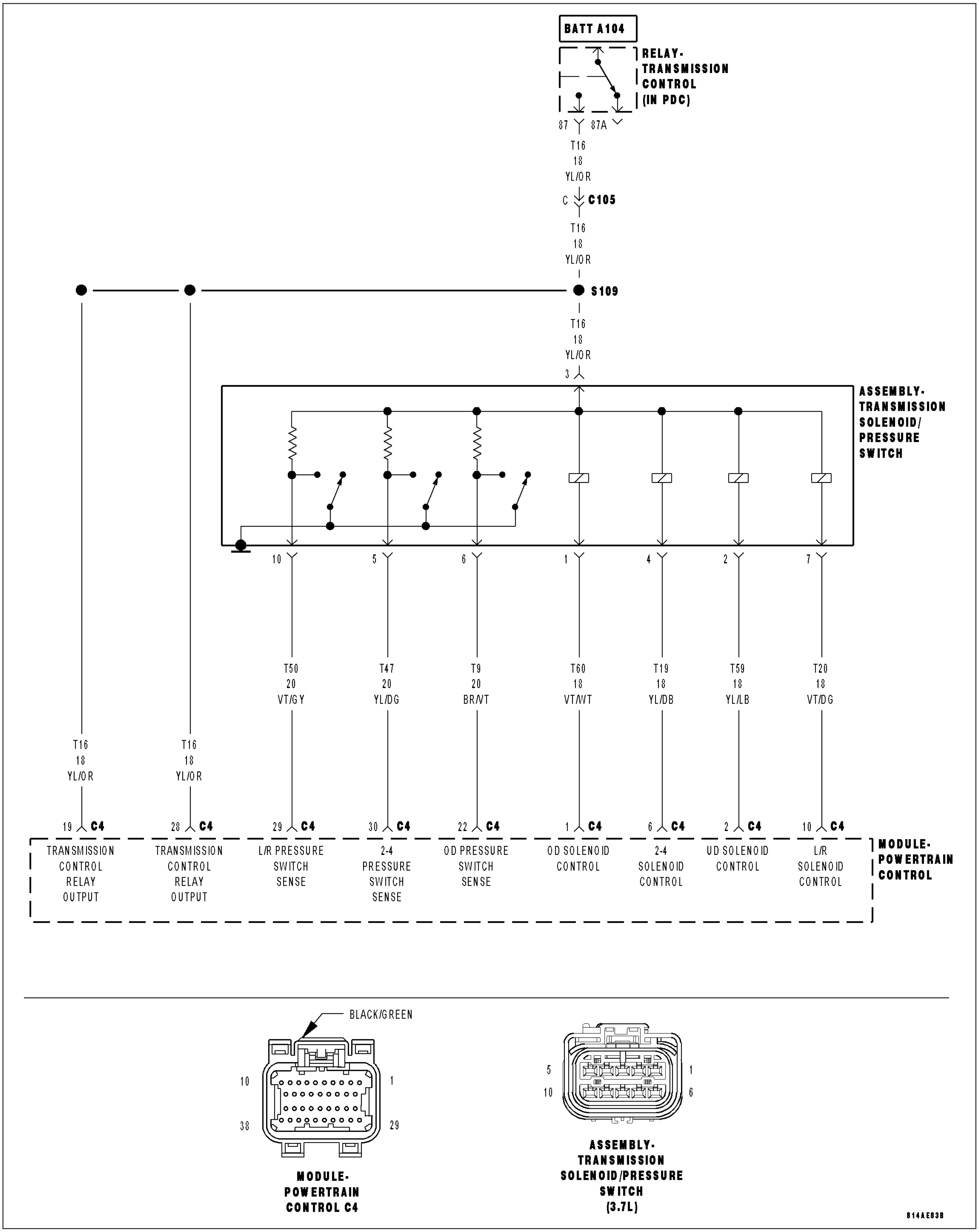
With the scan tool, check for Transmission Line Pressure DTCs.

**View repair**

**Repair**

Refer to the Transmission category and perform the appropriate symptom. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING)

## P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Prior to a shift into 1st gear.
- **Set Condition:**
  Transmission temperature must be hot. DTC is set after six unsuccessful attempts to shift into 1st gear.

| Possible Causes |
|---|
| RELATED DTC P0841 PRESENT |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN |
| (T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| INTERNAL TRANSMISSION |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The Solenoid Switch Valve, an internal, hydraulically operated valve, controls the direction of the transmission fluid when the LR solenoid is energized. When the solenoid switch valve is in the downshifted position and the LR solenoid is energized, fluid is directed to the LR element for 1st gear. When the solenoid switch valve is In the upshifted position (2nd, 3rd, and 4th gear) and the LR solenoid is energized, fluid is directed into the Lockup Switch Valve which controls the Torque Converter Clutch. When shifting into 1st gear, a special sequence is followed to insure solenoid switch valve movement into the downshifted position. The LR pressure switch is monitored to confirm switch valve movement. If the solenoid switch valve movement is not confirmed (i.e. no LR pressure when the LR solenoid is energized), 2nd gear is substituted for 1st. No 1st gear (2nd gear is substituted). The transmission Torque converter FEMCC operation is inhibited. MIL on after 5 min. of substituted operation.

## Diagnostic Test

### 1. DETERMINING IF RELATED DTCS ARE PRESENT

With the scan tool, check for other Transmission DTCs

**Is the DTC P0841 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK TO SEE IF DTC P1775 IS CURRENT

With the scan tool, view DTCs.

**Is the status Active for this DTC or is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 8

## 3. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to L/R.

With the scan tool, monitor the L/R Pressure Switch State while pressing the Pressure Switch Test button.

**Did the Pressure Switch state change from open to closed when the test button was pressed?**

**Yes** >> Repair internal transmission as necessary per the Service Information. Inspect the Solenoid Switch Valve per the Service Information and repair or replace as necessary. If no problems are found, replace the Transmission Solenoid/Pressure Switch Assembly.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

Disconnect the PCM C4 harness connector.

Remove the Transmission Control Relay.

Remove the Starter Relay.

Connect a jumper wire between the (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output circuit at the Transmission Control Relay connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Using a 12-volt test light connected to ground, check all (T16) Transmission Control Relay Output circuits in the appropriate terminals of special tool #8815.

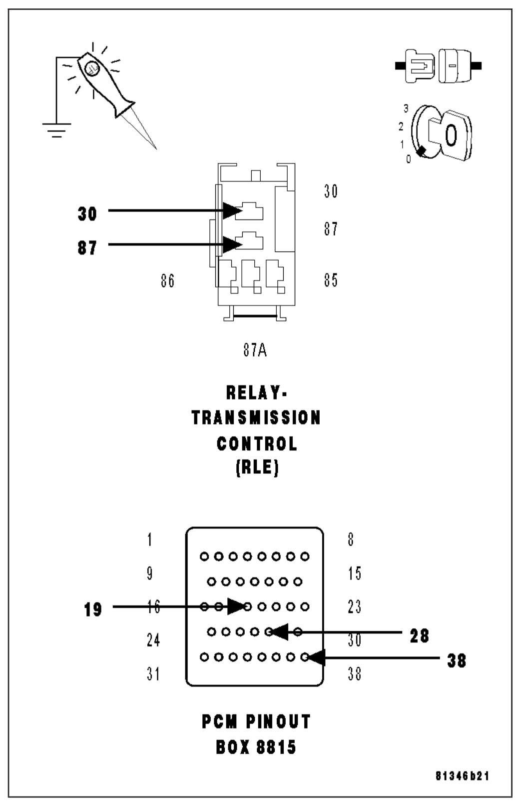
**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

**Does the test light illuminate brightly on all Transmission Control Relay Output circuits?**

**Yes** >> Repair the (T16) Transmission Control Relay Output circuit for an open.

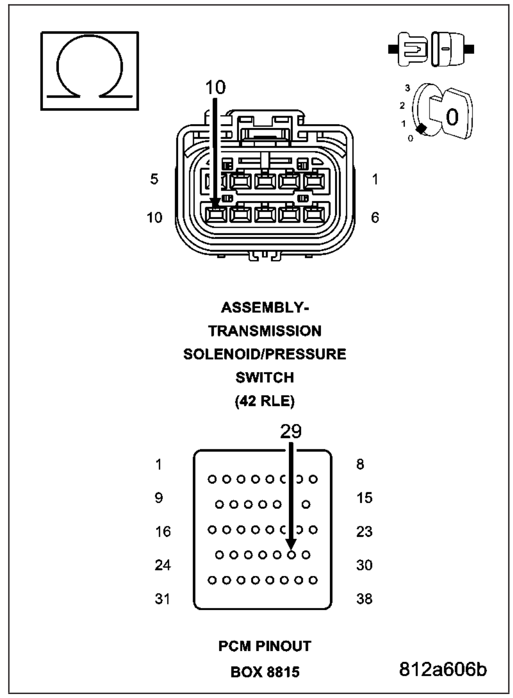
Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 5



## 5. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN

Measure the resistance of the (T50) L/R Pressure Switch Sense circuit from the appropriate terminal of special tool #8815 to the Transmission Solenoid/Pressure Switch Assembly harness connector.




**Is the resistance above 5.0 ohms?**

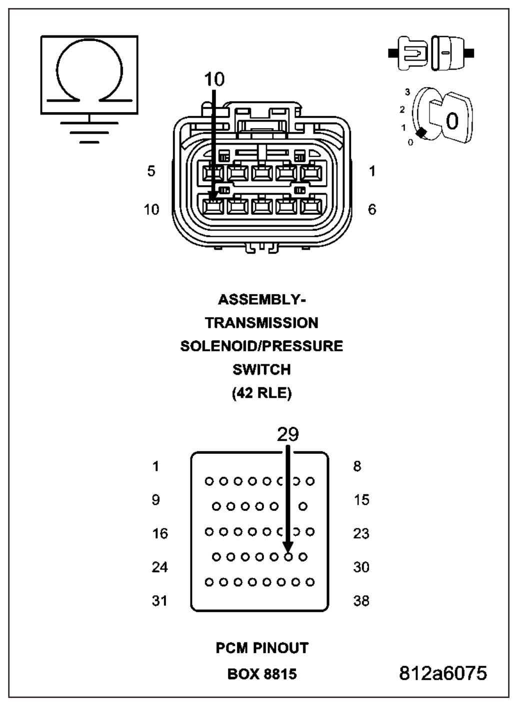
**Yes** >> Repair the (T50) L/R Pressure Switch Sense circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T50) L/R Pressure Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 7

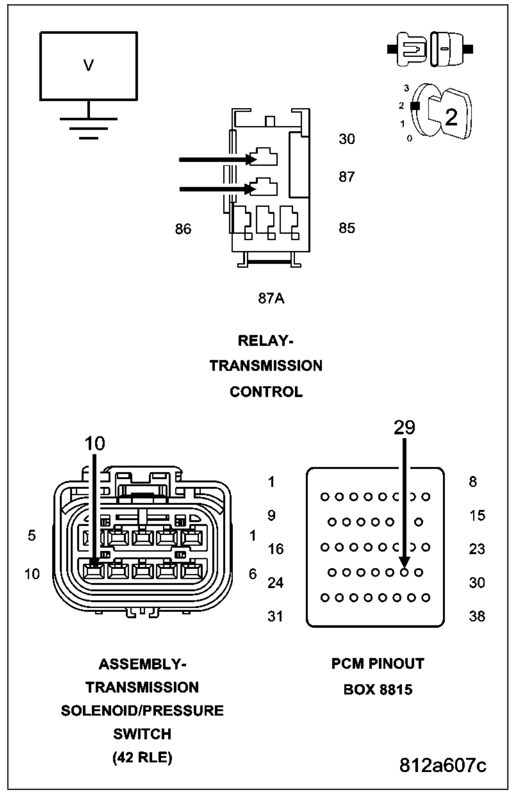
## 7. (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE

**NOTE: The jumper wire must still be in place in the Transmission Control Relay connector.**

Ignition on, engine not running.

Measure the voltage of the (T50) L/R Pressure Switch Sense circuit.

**Is the voltage above 0.5 volts?**




**Yes** >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 8. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Test drive and verify if the transmission is launching in 2nd gear and/or no TCC engagement.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

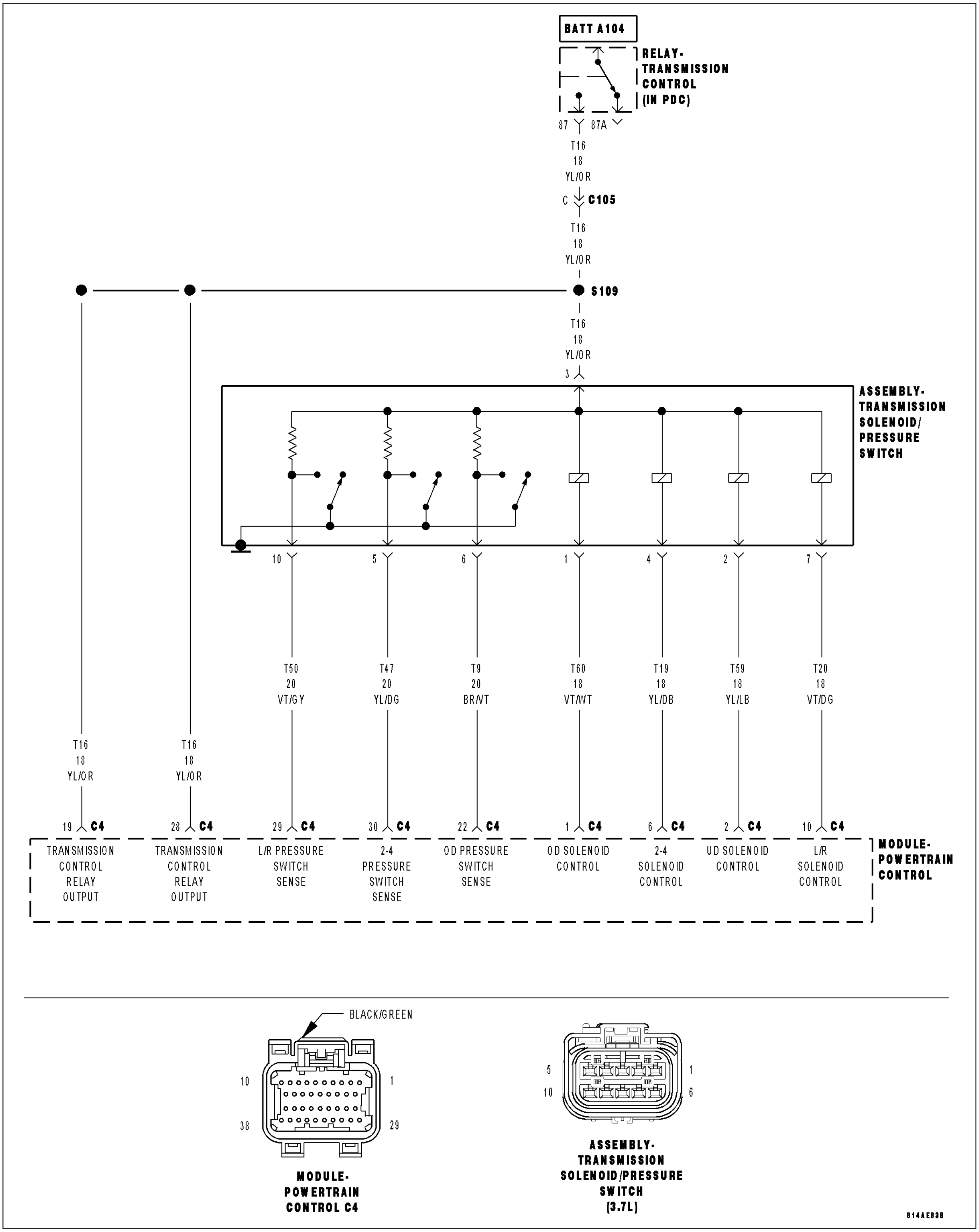
**Are there 2nd gear launches and/or no TCC engagement?**

**Yes** >> Disassemble and inspect the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid Pressure Switch Assembly.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Every 7 ms when doing PEMCC or FEMCC.
- **Set Condition:**
  Must be in partial or full EMCC. The DTC is set if L/R pressure is detected high for the fourth time.

| Possible Causes |
|---|
| RELATED DTC P0841 PRESENT |
| DTC EVENT DATA SHOWS TRS CODE TR2 - SHIFT LEVER OR MANUAL CONTROL VALVE IN A INVALID POSITION |
| SHIFTER CABLE OUT OF ADJUSTMENT |
| SOLENOID SWITCH VALVE STICKING IN ITS BORE |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN |
| (T50) L/R PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| (T50) L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| VALVE BODY |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The Solenoid Switch Valve, an internal, hydraulically operated valve, controls the direction of the transmission fluid when the L/R solenoid is energized. When the solenoid switch valve is in the downshifted position and the L/R solenoid is energized, fluid is directed to the L/R element for 1st gear. When the solenoid switch valve is In the up-shifted position (2nd, 3rd, and 4th gear) and the L/R solenoid is energized, fluid is directed into the Lockup Switch Valve which controls the Torque Converter Clutch. When doing PEMCC or FEMCC, the L/R pressure switch should indicate no pressure if the solenoid switch valve is in the LU position. If the L/R pressure switch indicates pressure for some time while in partial or full EMCC, the EMCC operation is aborted and momentarily inhibited to avoid accidental application of the L/R clutch. EMCC is attempted again when there is no L/R pressure. The fourth detection of L/R pressure while in PEMCC or FEMCC will result in setting the DTC.Torque converter EMCC operation inhibited. MIL on after 5 min. of substituted operation.

## Diagnostic Test

### 1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other Transmission DTC's

**Is the DTC P0841 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK THE DTC EVENT DATA FOR TRS CODE TR2

With the scan tool, check the DTC EVENT DATA for P1776.

**Does the DTC EVENT DATA show a TRS Code of TR2?**

**Yes** >> This indicates the shift lever and the manual control valve were in an invalid position between Neutral and OD. Check the shifter cable for: proper adjustment, binding, friction, improper routing, or the shifter was moved in transit. Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECK TO SEE IF DTC P1776 IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P1776.

**NOTE: This counter only applies to the last DTC set.**

**Is the status Active or is the STARTS SINCE SET counter 2 or less for this DTC?**

**Yes** >> Go To 4

**No** >> Go To 9

## 4. CHECK THE PCM AND WIRING USING THE TRANSMISSION SIMULATOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to L/R.

With the scan tool, monitor the L/R Pressure Switch State while pressing the Pressure Switch Test button.

**Did the Pressure Switch state change from open to closed when the test button was pressed?**

**Yes** >> Go To 5

**No** >> Go To 6

## 5. CHECK THE SOLENOID SWITCH VALVE FOR STICKING

Remove the transmission oil pan and Valve body and inspect the Solenoid Switch Valve for sticking in its bore, repair or replace as necessary.

**NOTE: This DTC may be caused by debris lodged in the Transmission Solenoid Switch Valve bore. If debris is found, clean the valve body and reassemble the transmission per the Service Information.**

With the scan tool, record the DTC EVENT DATA for P1776 and erase DTCs.

Reassemble the transmission and test drive the vehicle. Try to duplicate the original set conditions using the DTC EVENT DATA recorded earlier.

With the scan tool, check Transmission DTCs.

**Did the DTC P1776 reset?**

**Yes** >> Replace the Transmission Solenoid Assembly per the Service Information.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 6. CHECK THE (T50) L/R PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

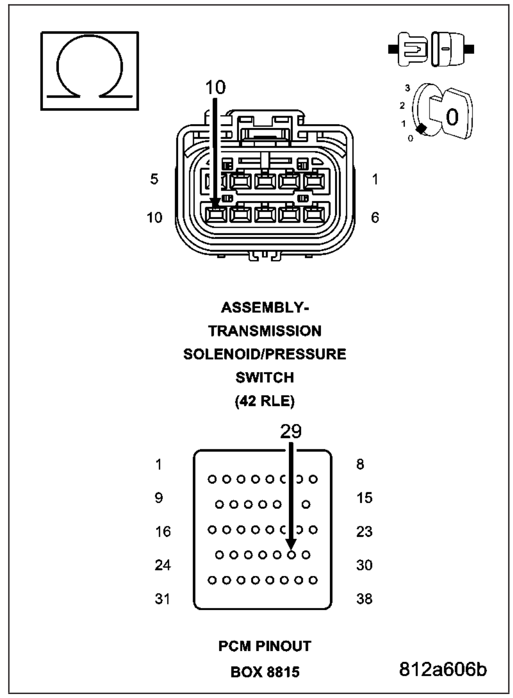
Turn the ignition off to the lock position.

Disconnect the PCM C4 harness connector.

Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller tool #8815 to perform diagnosis.**

Measure the resistance of the (T50) L/R Pressure Switch Sense circuit between the appropriate terminal of Miller tool #8815 and the Transmission Solenoid/Pressure Switch Assembly harness connector.




**Is the resistance above 5.0 ohms?**

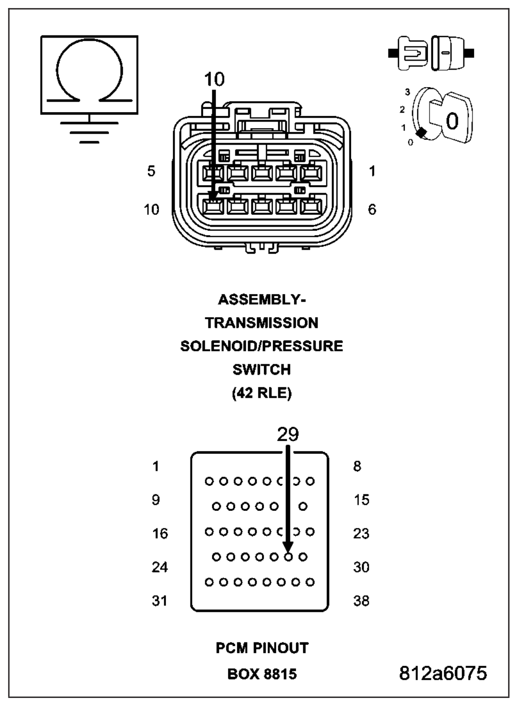
**Yes** >> Repair the (T50) L/R Pressure Switch Sense circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CHECK THE (T50) L/R PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T50) L/R Pressure Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to ground.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 8

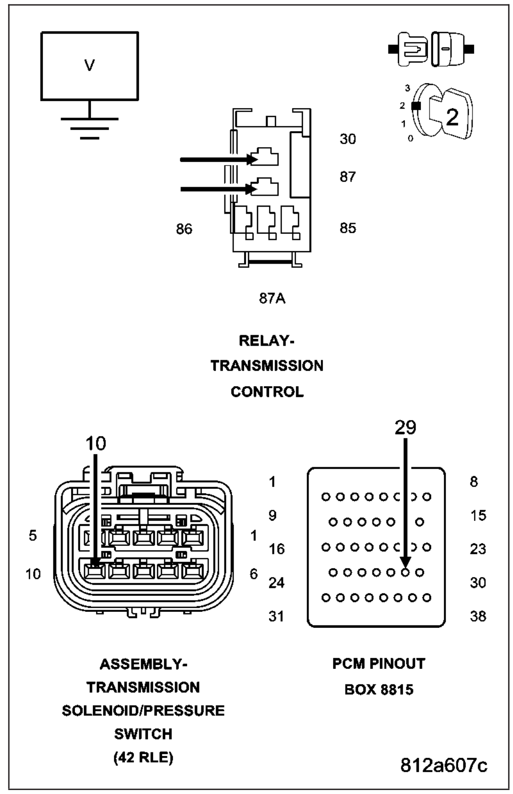
## 8. CHECK THE (T50) L/R PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO VOLTAGE

Remove the Transmission Control Relay.

Connect a jumper wire between the (Internal) Fused B(+) circuit and (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T50) L/R Pressure Switch Sense circuit.




**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T50) L/R Pressure Switch Sense circuit for a short to voltage.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. Check for Service Information Tune-ups or Service Bulletins for any possible causes that may apply. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 9. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Test Drive the vehicle and verify if the transmission is launching in 2nd gear and/or there is no TCC engagement.

With the scan tool, check the EVENT DATA to help identify the conditions in which the DTC was set.

Check for any Service Information Tune-ups or Service Bulletins for possible causes that may apply.

**Are there 2nd gear launches and/or no TCC engagement?**

**Yes** >> Disassemble and inspect the Valve Body per the Service Information Inspect the Solenoid Switch Valve for sticking in its bore and repair or replace as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P1790-FAULT IMMEDIATELY AFTER SHIFT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  After a Gear Ratio Error code is stored.
- **Set Condition:**
  After a Gear Ratio Error DTC has already been set. The DTC is set if the fault happened within 1.3 seconds of a shift. The DTC set time will vary from 1.214 seconds to 15 seconds.

| Possible Causes |
|---|
| FAULT AFTER SHIFT |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

This DTC is not stored alone. It is stored if a Gear Ratio DTC is detected immediately after shift. The existence of DTC P1790 indicates a mechanical or hydraulic (not electrical) related problems. It should be noted, however, that all mechanical problems don't necessarily result in DTC P1790. When this DTC exists, diagnosing the system should be based on the associated DTC and only mechanical causes should be considered.

### Diagnostic Test

1. **FAULT AFTER SHIFT**

This DTC is set along with a Gear Ratio DTC. Perform the appropriate test for the Gear Ratio DTC stored.

**NOTE: Check Pending DTCs or 1 trip failures if there are no Active or Stored Gear Ratio DTCs.**

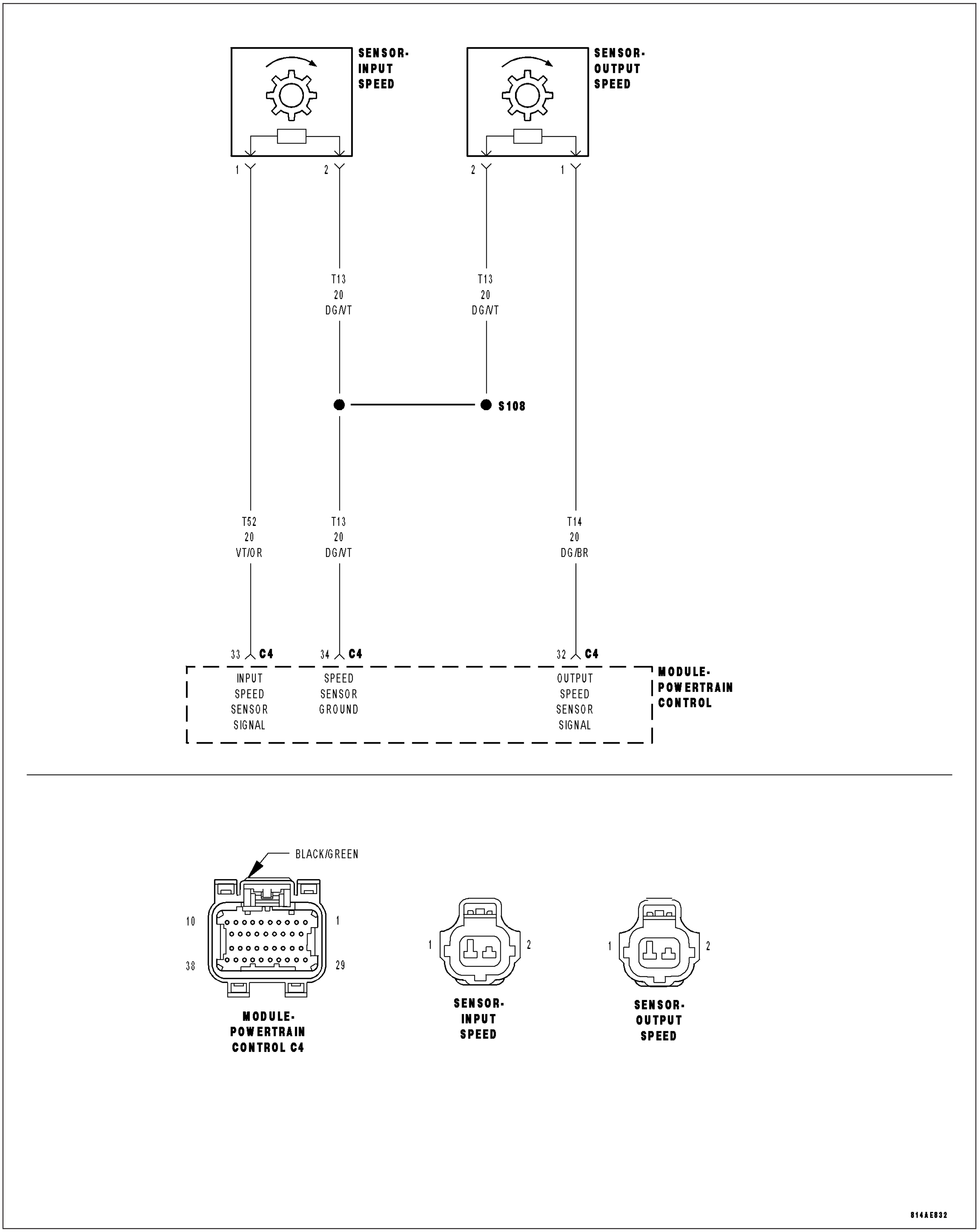
**If there are no possible causes remaining, view repair.**

**Repair**

Refer to the Transmission category and perform the appropriate symptom.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## P1794-SPEED SENSOR GROUND ERROR




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Every 7ms after a controller reset with transmission in neutral.
- **Set Condition:**
  After a PCM reset in neutral and Input and Output sensor ratio equals 2.50 to 1.0 ± 50.0 RPM.

| Possible Causes |
|---|
| SPEED SENSOR GROUND CIRCUIT OPEN |
| POWERTRAIN CONTROL MODULE |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

## Theory of Operation

The input and output speed sensors use a common ground circuit. The loss of this common ground results in the input signal being sensed for both. After a reset in neutral, and after observing a specific ratio, the Speed Check Fault Counter will increment. Because the speed sensors and the thermistor share the same ground circuit, this DTC may indicate a loss of the common speed sensor ground. In some cases this fault will cause a Gear Ratio Error DTC to be set.

## Diagnostic Test

### 1. PCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A.

Ignition on, engine not running.

With the Transmission Simulator, set the ″Input/Output Speed″ switch to ″ON″ and the rotary switch to the ″3000/1250″ position.

With the scan tool, monitor the Input and Output Speed Sensor readings.

**Does the Input Speed read 3000 RPM and the Output Speed read 1250 RPM, ± 50 RPM?**

**Yes** >> Go To 2

**No** >> Go To 4

## 2. (T13) SPEED SENSOR GROUND CIRCUIT OPEN

Turn the ignition off to the lock position.

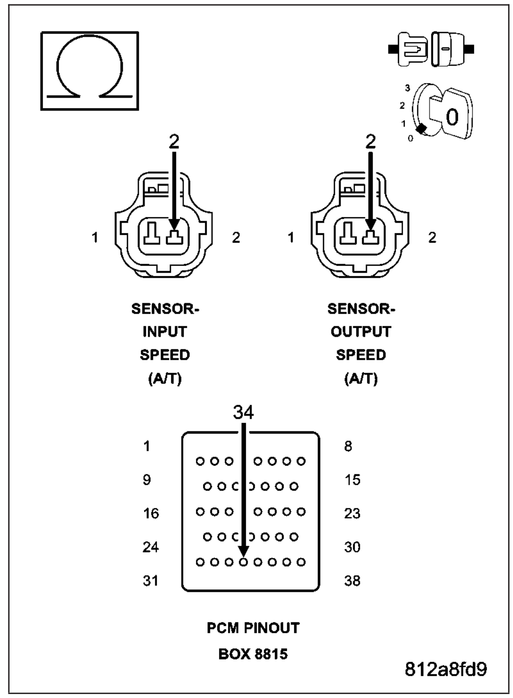
Disconnect the PCM C4 harness connector.

Disconnect the Input and Output Speed Sensor harness connectors.

**NOTE: Check connectors - Clean/repair as necessary.**

**CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.**

Measure the resistance of both of the (T13) Speed Sensor Ground circuits from the appropriate terminal of special tool #8815 to the Input and Output Speed Sensor harness connectors.




**Is the resistance above 5.0 ohms on either circuit?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for an open.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. POWERTRAIN CONTROL MODULE

Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits.

**If there are no possible causes remaining, view repair.**

**Repair**

Replace and program the Powertrain Control Module per the Service Information. With the scan tool perform QUICK LEARN.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## 4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P1797-MANUAL SHIFT OVERHEAT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with engine running.
- **Set Condition:**
  If the Engine Temperature exceeds 123° C (255° F) or the Transmission Temperature exceeds 135° C (275° F) while in AutoStick® mode. Note: Aggressive driving or driving in low for extended periods of time will set this DTC.

| Possible Causes |
| --- |
| MANUAL SHIFT OVERHEAT |

**Always perform the 42RLE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)**

### Theory of Operation

The major cause of heat build up in the transmission is torque converter slip. With the transmission in the AutoStick® mode, the torque converter can slip during aggressive driving or heavy loading conditions such as trailer towing or driving up steep grades. In the non AutoStick® mode, internal controller logic prevents the transmission from overheating by managing the shift and EMCC schedule. In the AutoStick® mode, when the transmission or engine temperature approaches an overheat condition, the manual shift overheat DTC sets and the AutoStick® mode is temporarily suspended until the temperature returns to normal.

### Diagnostic Test

#### 1. MANUAL SHIFT OVERHEAT

This is an informational DTC only.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

Check the engine and transmission cooling system for proper operation.

Check the Radiator Cooling Fan operation.

Check the Transmission Cooling operation.

Check the Transmission Fluid Level per the Service Information to verify that it is not overfilled.

**NOTE: Aggressive driving or driving in low for extended periods of time will set this DTC.**

**If there are no possible causes remaining, view repair.**

**Repair**

If the Transmission Fluid is low, repair any Transmission Fluid leak as necessary and adjust the Transmission Fluid Level per the Service Information. Refer to Service Information for the related symptoms and repair as necessary.

Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

## U0100 LOST COMMUNICATION WITH ECM/PCM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Every 7 msec with:
  1) Engine speed greater than 500 RPM.
  2) Battery voltage between 10 and 16 volts.
- **Set Condition:**
  CAN C bus messages are not received for 10 seconds.

## Theory of Operation

The NGC controller communicates over the CAN C bus. The transmission controller continuously monitors bus activity. The CAN C bus is also used to communicate transmission MIL status to the Engine Controller. If the Engine Controller is unable to communicate with the Transmission Controller, a DTC will set and the Engine Controller will illuminate the MIL.

**(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for diagnostic procedures and for further possible causes.**

## U0002–CAN C BUS OFF PERFORMANCE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  If the Anti-Lock Brakes Module detects a short in either CAN C Bus circuit.

Perform CAN C Bus Communication Failure diagnostic test procedure. **(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING)**.

## U0121 LOST COMMUNICATION WITH ABS

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Every 7 msec with:
  1) Engine speed greater than 500 RPM.
  2) Battery voltage between 10 and 16 volts.
- **Set Condition:**
  CAN C bus messages are not received for 10 seconds.

## Theory of Operation

The NGC controller communicates over the CAN C bus. The transmission controller continuously monitors bus activity. The CAN C bus is also used to communicate transmission MIL status to the Engine Controller. If the Engine Controller is unable to communicate with the Transmission Controller, a DTC will set and the Engine Controller will illuminate the MIL.

**(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING) for diagnostic procedures and for further possible causes.**

## STANDARD PROCEDURE

## PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE - 42RLE

For a complete wiring diagram **Refer to Section 8W**.

### 1.

Perform the following steps prior to any diagnostic procedure:

- Many transmission symptoms can be caused by a low fluid level. If the fluid level is low, locate and repair any leaks and fill the transmission to the proper fluid level. Refer to the Service Information for the proper repair and fluid fill procedures.
- Testing should only be performed with the battery fully charged to avoid false diagnosis.
- With the scan tool, read Engine (PCM) DTCs. If Engine DTCs are present, refer to the Driveability Category and perform to the appropriate diagnostic procedure(s) before proceeding.
- With the scan tool, read Transmission (TCM) DTCs. Record all Stored, Active, and Pending DTC information. Diagnose any Pending DTC as a matured DTC.
- With the scan tool, read DTC EVENT DATA. Use this data to identify the conditions in which the DTC was set.
-

**NOTE: Performing a Battery Disconnect will clear all DTC EVENT DATA and reset all learned Transmission values to the controllers default values, which may temporarily result in erratic shift schedules.**

- With the scan tool, perform the Shift Lever Position Test. If the test does not pass, refer to the diagnostic procedure for P0706-Check Shifter Signal.
- For Gear Ratio Error DTCs, use the scan tool to read and record the Clutch Volume Index (CVI) information.
- Use the wiring diagram as a guide, inspect the wiring and connectors related to this circuit and repair as necessary.
- Refer to the When Monitored and Set Conditions for this DTC. DTCs can set at ignition on, at start up, driving under specific conditions, and after controller diagnostic monitors have run.
- Refer to applicable Technical Service Bulletins (TSBs) for controller software update information. Some conditions can be corrected by upgrading the Engine (PCM) or Transmission (TCM) controller software.
- Check for any Service Information Tune-ups or Service Bulletins for any possible causes that may apply.

**Were there any repairs made that fixed the vehicle?**

**Yes** >> Testing complete.

Perform 42RLE VERIFICATION TEST - VER 1 (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - STANDARD PROCEDURE)

**No** >> Refer to the Transmission category and perform the appropriate diagnostic procedure(s). (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING)

## 42RLE TRANSMISSION VERIFICATION TEST - VER 1

# 1.

Perform the following after completion of a diagnostic repair:

-

**NOTE: After completion of the Transmission Verification Test, the Powertrain Verification Test must be performed. Refer to the Engine Category.**

- Reconnect any disconnected components.
- With the scan tool, erase all Transmission and Engine DTCs.
- Erase DTC P0700 under engine to turn off the MIL off after completion of transmission repairs.
- Perform *PRNDL FAULT CLEARING PROCEDURE after completion of repairs for P0706-TRANSMISSION RANGE SENSOR RATIONALITY.
- If the Powertrain Control Module or the Transmission has been repaired or replaced, it is necessary to perform the scan tool Quick Learn Procedure.
- If the Torque converter has been replaced, with the scan tool perform TCC BREAK-IN.
- If the Powertrain Control Module or Front Control Module has been replaced you must reset the Pinion Factor in the Front Control Module.
- With the scan tool, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT, above 43° C or 110° F.
- Check the transmission fluid and adjust if necessary. Refer to the Service Information for the Fluid Fill procedure.
- Road test the vehicle. With the scan tool, monitor the engine RPM. Make 15 to 20 1-2, 2-3, 3-4 upshifts. Perform these shifts from a standing start to 45 mph with a constant throttle opening of 20 to 25 degrees.
- With speeds below 25 MPH, make 5 to 8 wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown.
- For a specific DTC, drive the vehicle to the Symptom's When Monitored/When Set conditions to verify the DTC is repaired.
- If equipped with AutoStick®, upshift and downshift several times using the AutoStick® feature during the road test.
-

**NOTE: Use the OBDII task manager to run a Good Trip in each gear, this will confirm the repair and to ensure that the DTC has not re-matured.**

- Check for any Diagnostic Trouble Codes (DTC's) during and after the road test.

**Did any Diagnostic Trouble Codes set during the road test?**

**Yes** >> Repair is not complete. Refer to the Transmission category and perform the appropriate symptom(s). (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING)

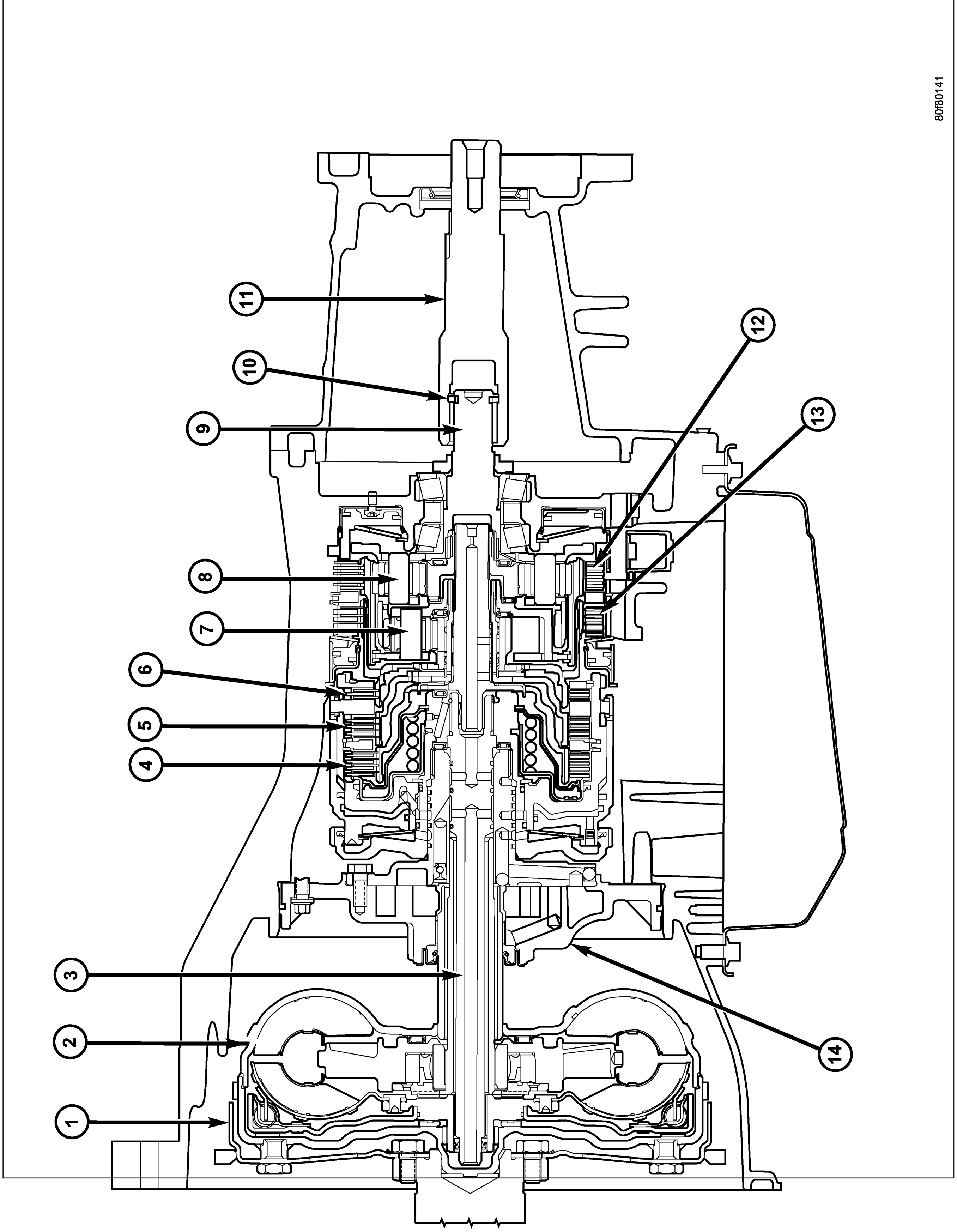
**No** >> Repair is complete.

# AUTOMATIC TRANSMISSION - 42RLE

## TABLE OF CONTENTS

# AUTOMATIC TRANSMISSION - 42RLE

## DESCRIPTION



The 42RLE is a four-speed transmission that is a conventional hydraulic/mechanical assembly controlled with adaptive electronic controls and monitors. The hydraulic system of the transmission consists of the transmission fluid, fluid passages, hydraulic valves, and various line pressure control components. An input clutch assembly which houses the underdrive, overdrive, and reverse clutches is used. It also utilizes separate holding clutches: 2nd/4th gear and Low/Reverse. The primary mechanical components of the transmission consist of the following:

- Three multiple disc input clutches
- Two multiple disc holding clutches
- Four hydraulic accumulators
- Two planetary gear sets
- Hydraulic oil pump
- Valve body
- Solenoid/Pressure switch assembly

Control of the transmission is accomplished by fully adaptive electronics. Optimum shift scheduling is accomplished through continuous real-time sensor feedback information provided to the Transmission Control Module (TCM) portion of the Powertrain Control Module (PCM).

The TCM is the heart of the electronic control system and relies on information from various direct and indirect inputs (sensors, switches, etc.) to determine driver demand and vehicle operating conditions. With this information, the TCM can calculate and perform timely and quality shifts through various output or control devices (solenoid pack, transmission control relay, etc.).

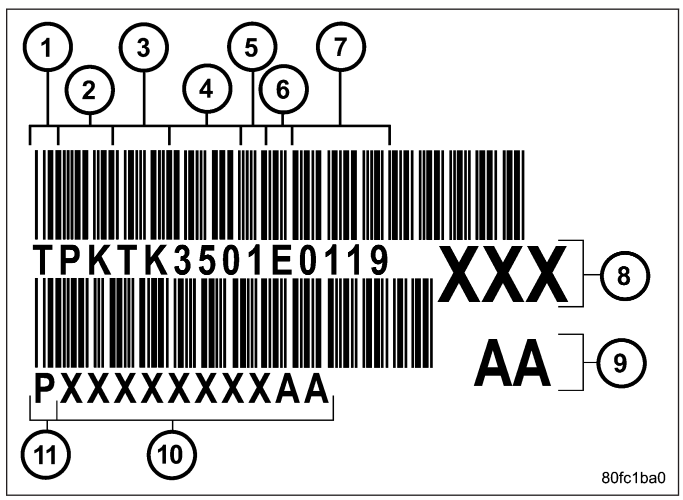
The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data, DTC's, etc.) which is helpful in proper diagnosis and repair. This information can be viewed with the scan tool.

## TRANSMISSION IDENTIFICATION

The 42RLE transmission can be identified by a barcode label that is affixed to the upper left area of the bellhousing.

The label contains a series of digits that can be translated into useful information such as transmission part number (10), date of manufacture (4, 5), manufacturing origin (2), assembly line identifier (6), build sequence number (7), etc..

If the tag is not legible or is missing, the "PK" number, which is stamped into the left rear flange of the transmission case, can be referred to for identification. The entire part number, build code, and sequence number are stamped into the flange.

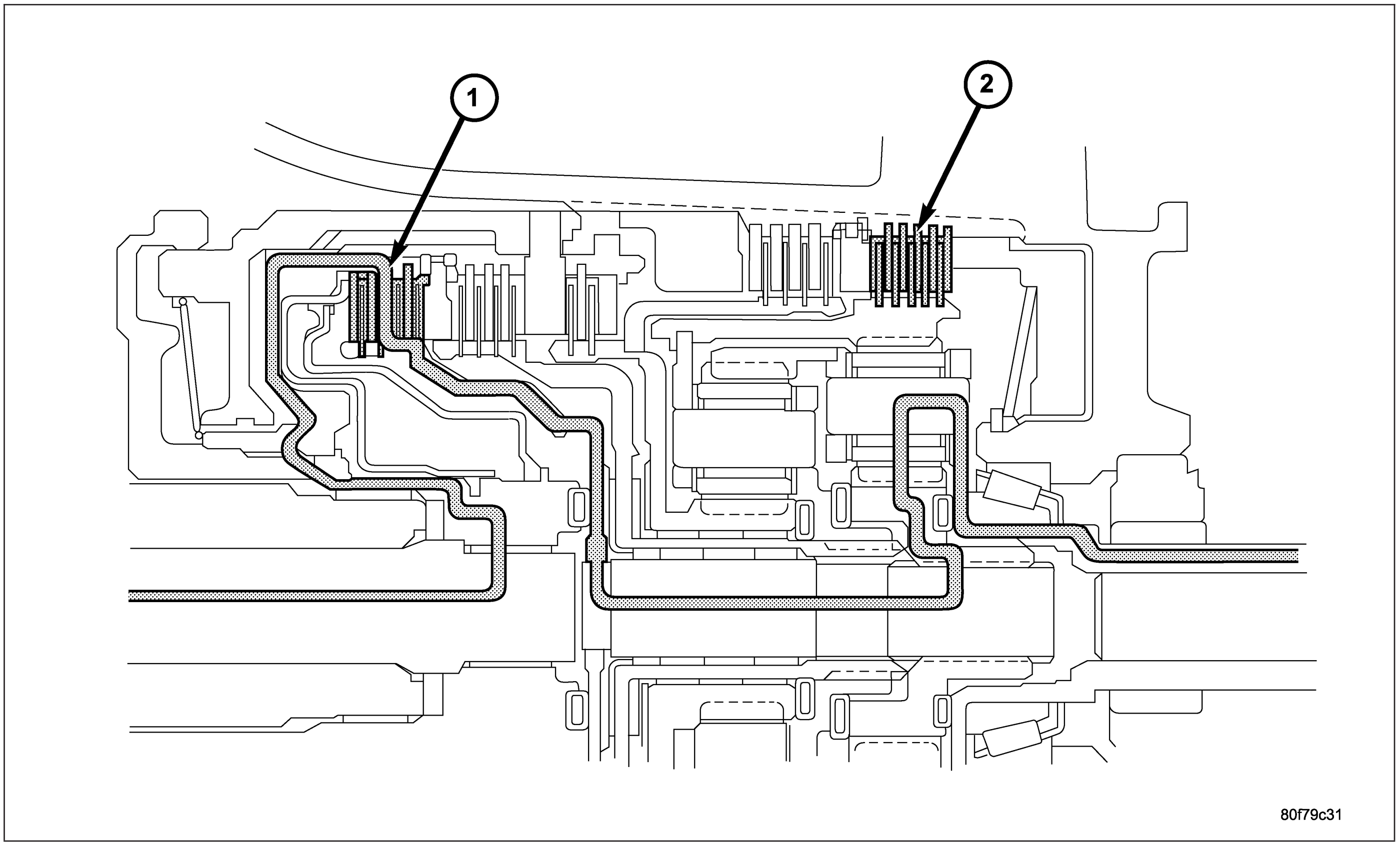



## OPERATION

The 42RLE transmission ratios are:

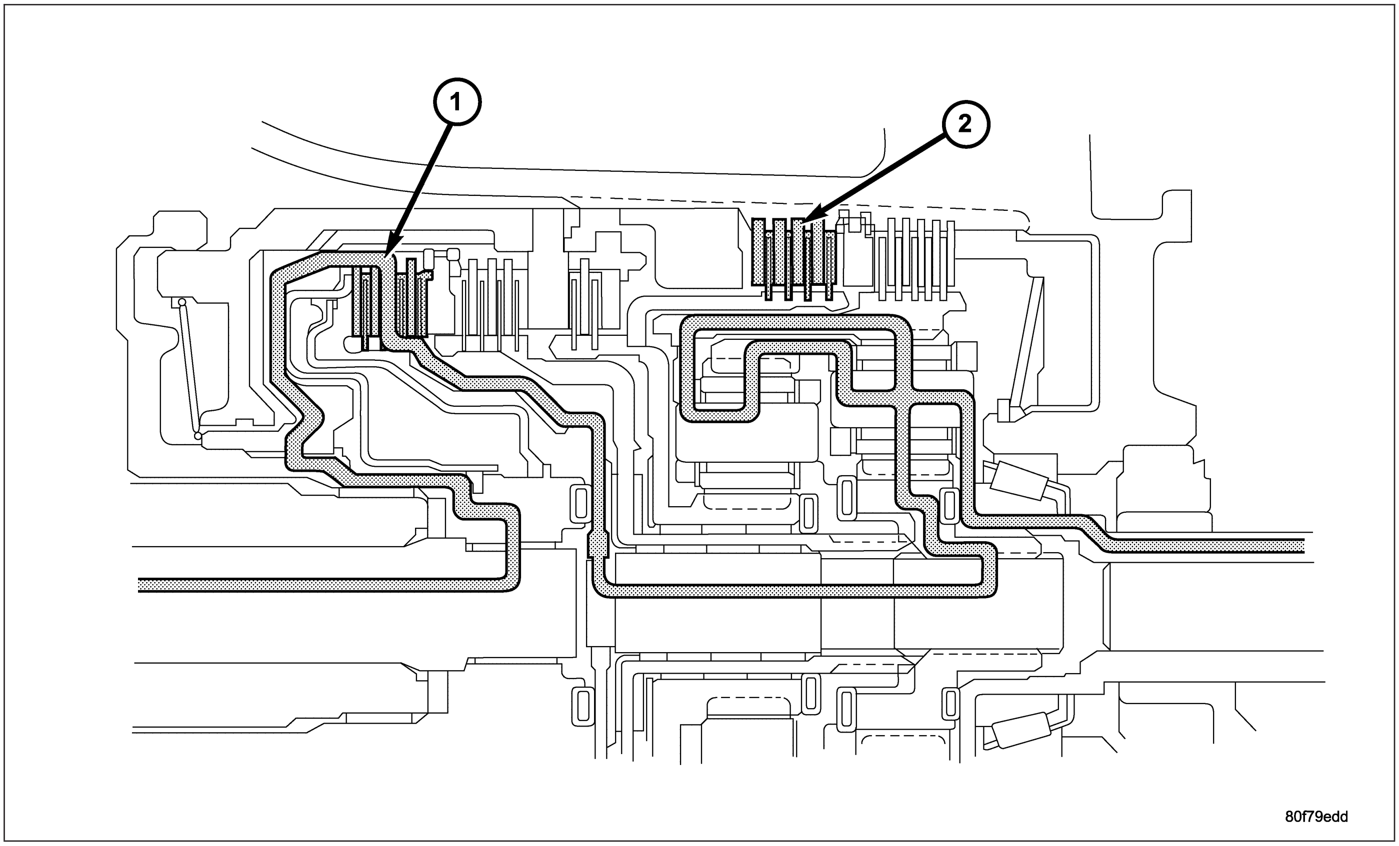
| | |
|---|---|
| First | 2.84 : 1 |
| Second | 1.57 : 1 |
| Third | 1.00 : 1 |
| Overdrive | 0.69 : 1 |
| Reverse | 2.21 : 1 |

## FIRST GEAR POWERFLOW



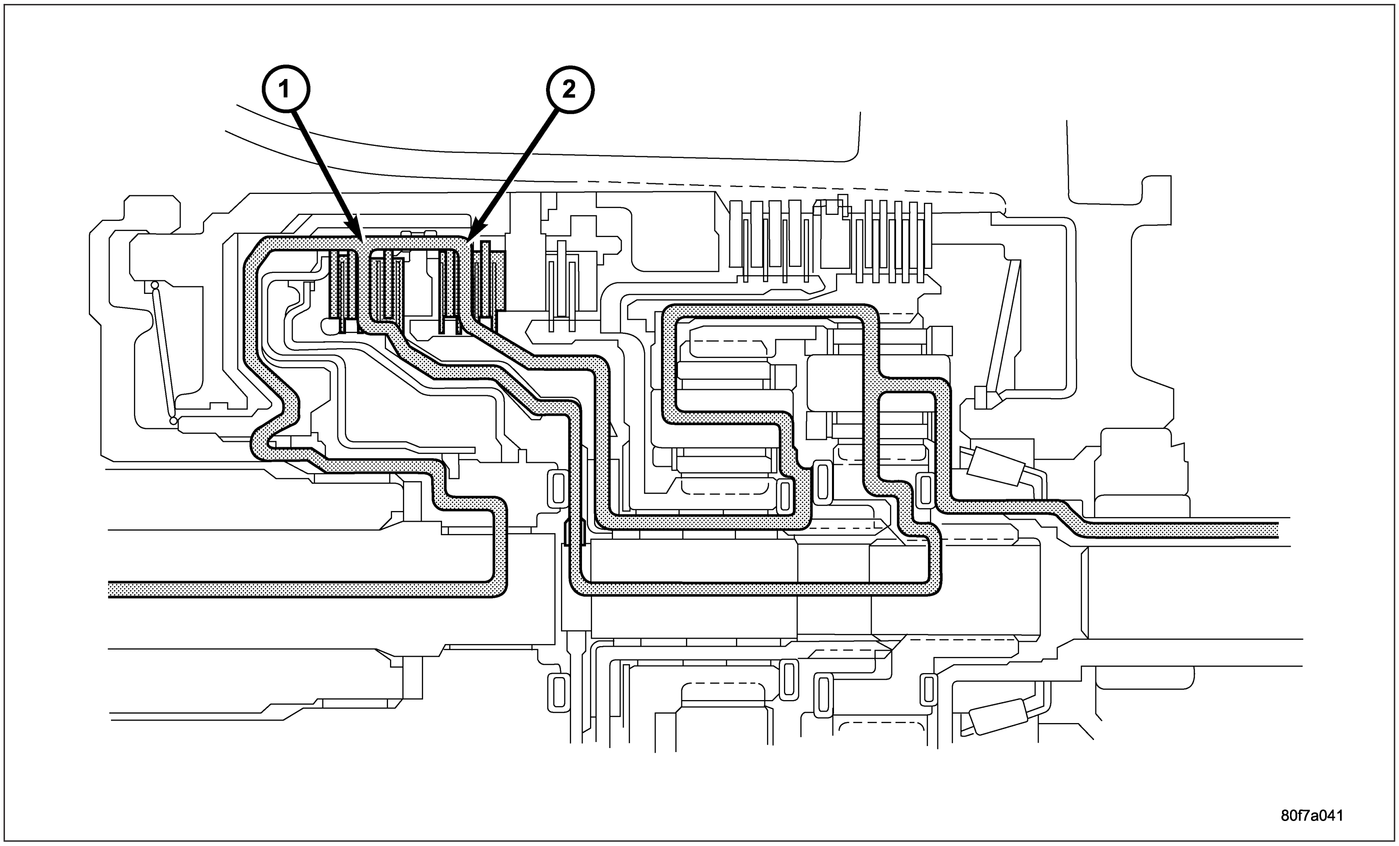

In first gear range, torque input is through the underdrive clutch (1) to the underdrive hub assembly. The underdrive hub is splined to the rear sun gear. When the underdrive clutch is applied, it rotates the underdrive hub and rear sun gear. The L/R clutch (2) is applied to hold the front carrier/rear annulus assembly. The rear sun gear drives the rear planetary pinion gears. The rear planetary pinion gears are forced to walk around the inside of the stationary rear annulus gear. The pinions are pinned to the rear carrier and cause the rear carrier assembly to rotate as they walk around the annulus gear. This provides the torque output for first gear. The other planetary gearset components are freewheeling. The first gear ratio is 2.84:1.

## SECOND GEAR POWERFLOW



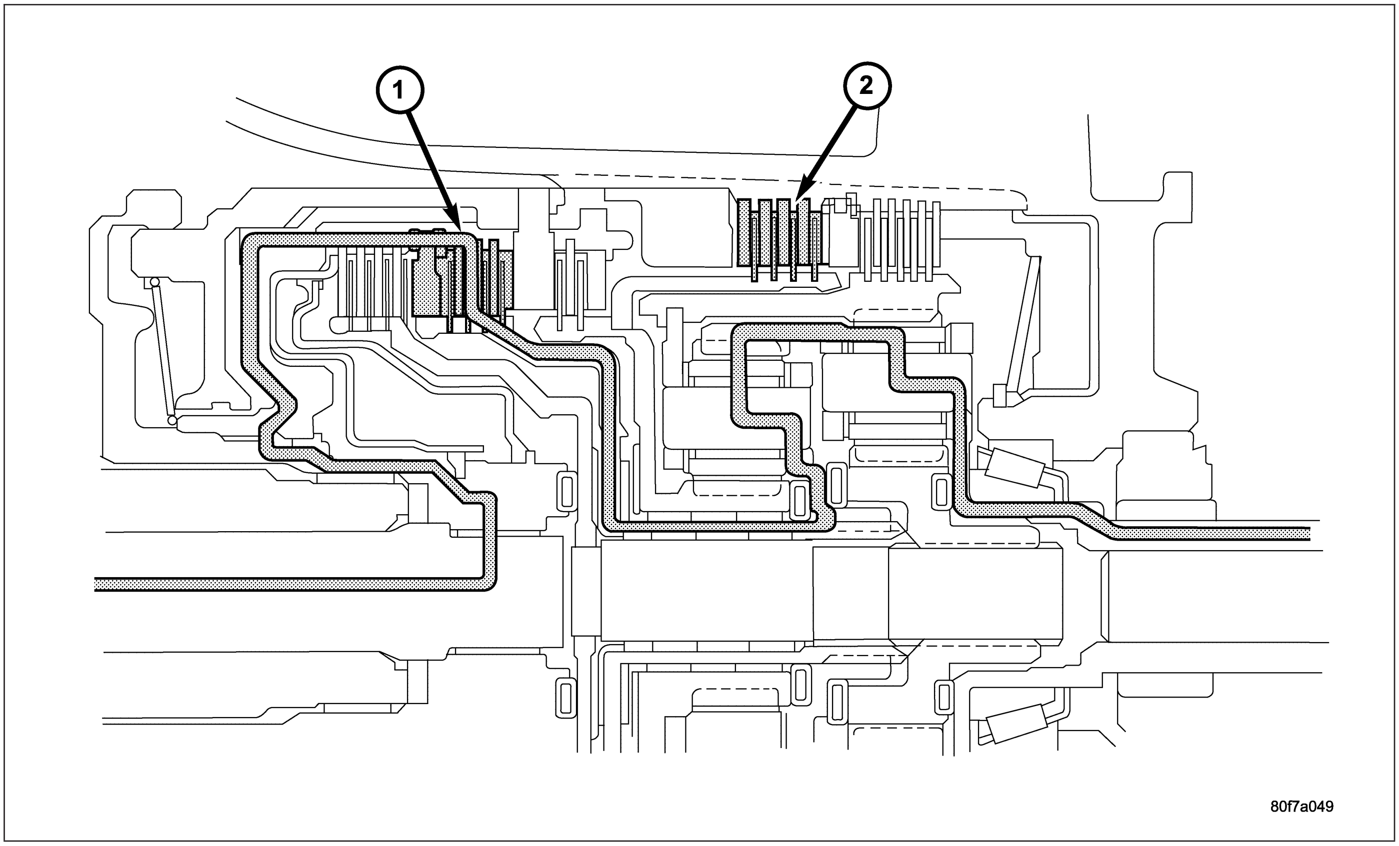

Second gear is achieved by having both planetary gear sets contribute to torque multiplication. As in first gear, torque input is through the underdrive clutch (1) to the rear sun gear. The 2/4 clutch (2) is applied to hold the front sun gear stationary. The rotating rear sun gear turns the rear planetary pinions. The rear pinions rotate the rear annulus/front carrier assembly. The pinions of the front carrier walk around the stationary front sun gear. This transmits torque to the front annulus/rear carrier assembly, which provides output torque and a gear ratio of 1.57:1.

## THIRD GEAR POWERFLOW



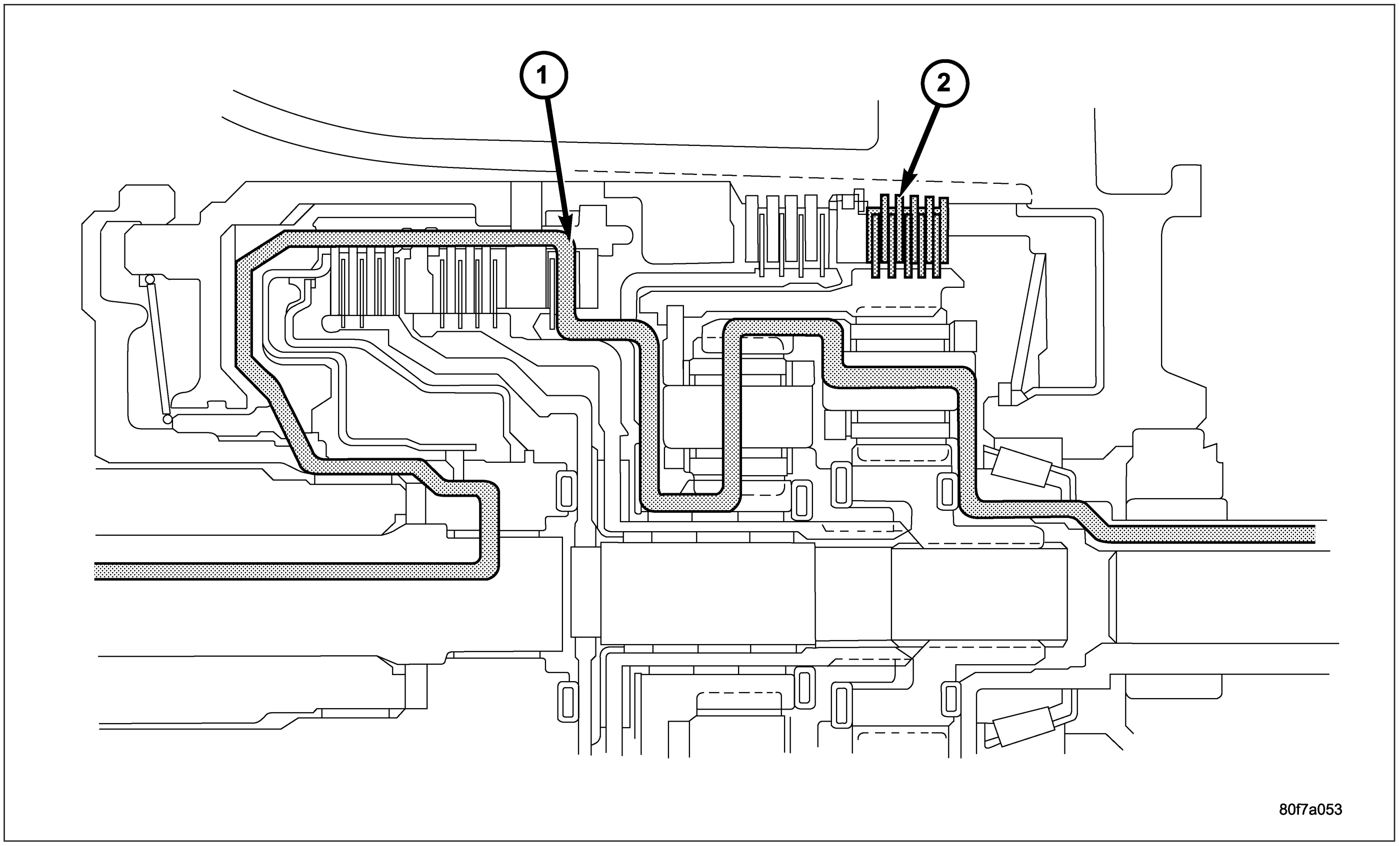

In third gear, two input clutches are applied to provide torque input: the underdrive clutch (1) and overdrive clutch (2). The underdrive clutch rotates the rear sun gear, while the overdrive clutch rotates the front carrier/rear annulus assembly. The result is two components (rear sun gear and rear annulus gear) rotating at the same speed and in the same direction. This effectively locks the entire planetary gearset together and is rotated as one unit. The gear ratio in third is 1:1.

## FOURTH GEAR POWERFLOW




In fourth gear input torque is through the overdrive clutch (1) which drives the front carrier. The 2/4 clutch (2) is applied to hold the front sun gear. As the overdrive clutch rotates the front carrier, it causes the pinions of the front carrier to walk around the stationary front sun gear. This causes the front carrier pinions to turn the front annulus/ rear carrier assembly which provides output torque. In fourth gear, transmission output speed is more than engine input speed. This situation is called overdrive and the gear ratio is 0.69:1.

## REVERSE GEAR POWERFLOW




In reverse, input power is through the reverse clutch (1). When applied, the reverse clutch drives the front sun gear through the overdrive hub and shaft. The L/R clutch (2) is applied to hold the front carrier/rear annulus assembly stationary. The front carrier is being held by the L/R clutch so the pinions are forced to rotate the front annulus/rear carrier assembly in the reverse direction. Output torque is provided, in reverse, with a gear ratio of 2.21:1.

## DIAGNOSIS AND TESTING

## AUTOMATIC TRANSMISSION

**CAUTION: Before attempting any repair on the 42RLE Four Speed Automatic Transmission, always check for proper shift cable adjustment. Also check for diagnostic trouble codes with the scan tool and the 42RLE Transmission Diagnostic information.**

42RLE automatic transmission malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions
- Electronic malfunctions

When diagnosing a problem always begin with recording the complaint. The complaint should be defined as specific as possible. Include the following checks:

- Temperature at occurrence (cold, hot, both)
- Dynamic conditions (acceleration, deceleration, upshift, cornering)
- Elements in use when condition occurs (what gear is transmission in during condition)
- Road and weather conditions
- Any other useful diagnostic information.

After noting all conditions, check the easily accessible variables:

- Fluid level and condition
- Shift cable adjustment
- Diagnostic trouble code inspection

Then perform a road test to determine if the problem has been corrected or that more diagnosis is necessary. If the problem exists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

## ROAD TEST

Prior to performing a road test, verify that the fluid level, fluid condition, and linkage adjustment have been approved.

During the road test, the transmission should be operated in each position to check for slipping and any variation in shifting.

If the vehicle operates properly at highway speeds, but has poor acceleration, the converter stator overrunning clutch may be slipping. If acceleration is normal, but high throttle opening is needed to maintain highway speeds, the converter stator clutch may have seized. Both of these stator defects require replacement of the torque converter and thorough transmission cleaning.

Slipping clutches can be isolated by comparing the “Elements in Use” chart with clutch operation encountered on a road test. This chart identifies which clutches are applied at each position of the selector lever.

A slipping clutch may also set a DTC and can be determined by operating the transmission in all selector positions.

**ELEMENTS IN USE AT EACH POSITION OF SELECTOR LEVER**

| Shift Lever Position | INPUT CLUTCHES | | | HOLDING CLUTCHES | |
|---|---|---|---|---|---|
| | Underdrive | Overdrive | Reverse | 2/4 | Low/Reverse |
| P - PARK | | | | | X |
| R - REVERSE | | | X | | X |
| N - NEUTRAL | | | | | X |
| OD - OVERDRIVE | | | | | |
| First | X | | | | X |
| Second | X | | | X | |
| Direct | X | X | | | |
| Overdrive | | X | | X | |
| D - DRIVE* | | | | | |
| First | X | | | | X |
| Second | X | | | X | |
| Direct | X | X | | | |
| L - LOW* | | | | | |
| First | X | | | | X |
| Second | X | | | X | |
| Direct | X | X | | | |
| * Vehicle upshift and downshift speeds are increased when in these selector positions. | | | | | |

The process of elimination can be used to detect any unit which slips and to confirm proper operation of good units. Road test analysis can diagnose slipping units, but the cause of the malfunction cannot be determined. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

## HYDRAULIC PRESSURE TESTS

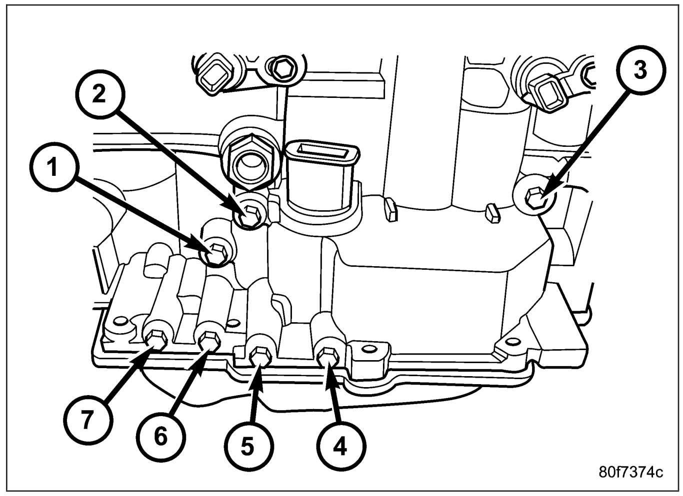
Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the cause of most transmission problems.

Before performing pressure tests, be certain that fluid level and condition, and shift cable adjustments have been checked and approved. Fluid must be at operating temperature, 65.5°-93° C (150°-200° F).

Install an engine tachometer, raise vehicle on hoist which allows the wheels to turn, and position tachometer so it can be read.

Using Adapter Set L-4559, attach 300 psi Pressure Gauge(s) C-3293SP to the port(s) required for test being conducted.

Test port locations are shown in the Pressure Taps graphic.




## TEST ONE - SELECTOR IN MANUAL 1 (1st Gear)

**NOTE: This test checks pump output, pressure regulation and condition of the low/reverse clutch hydraulic circuit and shift schedule.**

1. Attach pressure gauge to the low/reverse clutch tap.
2. Move selector lever to the MANUAL 1 position.
3. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed to 20 mph.
4. Low/reverse clutch pressure should read 115 to 145 psi.

## TEST TWO - SELECTOR IN MANUAL 2 (Second Gear)

**NOTE: This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.**

1. Attach gauge to the underdrive clutch tap.
2. Move selector lever to the MANUAL 2 position.
3. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph.
4. In second gear the underdrive clutch pressure should read 110 to 145 psi.

## TEST TWO A - SELECTOR IN DRIVE (OD ON - Fourth Gear)

**NOTE: This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.**

1. Attach gauge to the underdrive clutch tap.
2. Move selector lever to the DRIVE position. Verfy that the OD switch is ON.
3. Allow wheels to rotate freely and increase throttle opening to achieve an indicated speed of 40 mph.
4. Underdrive clutch pressure should read below 5 psi. If not, than either the solenoid assembly or controller is at fault.

## TEST THREE - SELECTOR IN DRIVE (OD OFF - Third and Second Gear)

**NOTE: This test checks the overdrive clutch hydraulic circuit as well as the shift schedule.**

1. Attach gauge to the overdrive clutch tap.
2. Move selector lever to the DRIVE position.
3. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 20 mph.

4. Overdrive clutch pressure should read 74 to 95 psi.
5. Move selector lever to the DRIVE position and increase indicated vehicle speed to 30 mph.
6. The vehicle should be in second gear and overdrive clutch pressure should be less than 5 psi.

## TEST FOUR - SELECTOR IN DRIVE (OD ON - Fourth Gear)

**NOTE: This test checks the 2/4 clutch hydraulic circuit.**

1. Attach gauge to the 2/4 clutch tap.
2. Move selector lever to the DRIVE position.
3. Allow vehicle front wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph. Vehicle should be in fourth gear.
4. The 2/4 clutch pressure should read 75 to 95 psi.

## TEST FIVE-SELECTOR IN DRIVE (OD ON - Fourth Gear, CC on)

**NOTE: These tests check the torque converter clutch hydraulic circuit.**

1. Attach gauge to the torque converter clutch off pressure tap.
2. Move selector lever to the DRIVE position.
3. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 50 mph. Vehicle should be in 4th gear, CC on.

**CAUTION: Both wheels must turn at the same speed.**

4. Torque converter clutch off pressure should be less than 5 psi.
5. Now attach the gauge to the torque converter clutch on pressure tap.
6. Move selector to the OD position.
7. Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 50 mph.
8. Verify the torque converter clutch is applied mode using the RPM display of the scan tool.
9. Torque converter clutch on pressure should be 60-90 psi.

## TEST SIX-SELECTOR IN REVERSE

**NOTE: This test checks the reverse clutch hydraulic circuit.**

1. Attach gauge to the reverse and low/reverse clutch tap.
2. Move selector lever to the REVERSE position.
3. Read reverse clutch pressure with output stationary (foot on brake) and throttle opened to achieve 1500 rpm.
4. Reverse and low/reverse clutch pressure should read 165 to 235 psi.

## TEST RESULT INDICATIONS

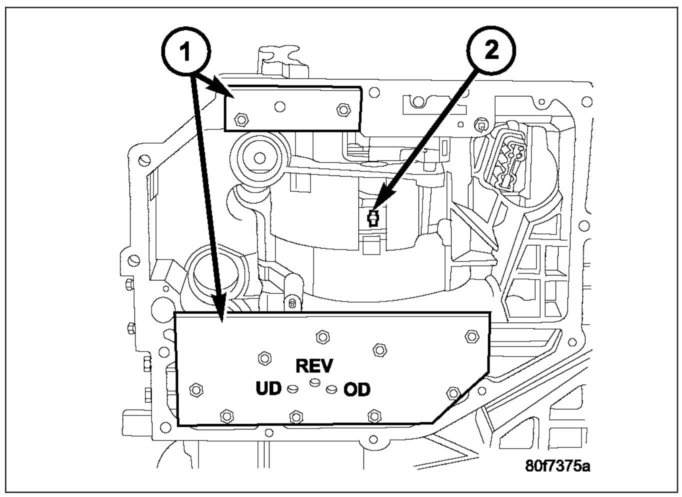
1. If proper line pressure is found in any one test, the pump and pressure regulator are working properly.
2. Low pressure in all positions indicates a defective pump, a clogged filter, or a stuck pressure regulator valve.
3. Clutch circuit leaks are indicated if pressures do not fall within the specified pressure range.
4. If the overdrive clutch pressure is greater than 5 psi in Step 6 of Test Three, a worn reaction shaft seal ring or a defective solenoid assembly is indicated.
5. If the underdrive clutch pressure is greater than 5 psi in Step 4 of Test Two-A, a defective solenoid/pressure switch assembly or controller is the cause.

**ALL PRESSURE SPECIFICATIONS ARE PSI (on hoist, with wheels free to turn)**

| Gear Selector Position | Actual Gear | PRESSURE TAPS | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Underdrive Clutch | Overdrive Clutch | Reverse Clutch | Torque Converter Clutch Off | Torque Converter Clutch On | 2/4 Clutch | Low/ Reverse Clutch |
| PARK - 0 mph * | PARK | 0-2 | 0-5 | 0-2 | 60-110 | 45-100 | 0-2 | 115-145 |
| REVERSE - 0 mph * | REVERSE | 0-2 | 0-7 | 165-235 | 50-100 | 35-85 | 0-2 | 165-235 |
| NEUTRAL - 0 mph * | NEUTRAL | 0-2 | 0-5 | 0-2 | 60-110 | 45-100 | 0-2 | 115-145 |
| Low - 20 mph # | FIRST | 110-145 | 0-5 | 0-2 | 60-110 | 45-100 | 0-2 | 115-145 |
| Third - 30 mph # | SECOND | 110-145 | 0-5 | 0-2 | 60-110 | 45-100 | 115-145 | 0-2 |
| Third - 45 mph # | DIRECT | 75-95 | 75-95 | 0-2 | 60-90 | 45-80 | 0-2 | 0-2 |
| OD - 30 mph # | OVERDRIVE | 0-2 | 75-95 | 0-2 | 60-90 | 45-80 | 75-95 | 0-2 |
| OD - 50 mph # | OVERDRIVE WITH TCC | 0-2 | 75-95 | 0-2 | 0-5 | 60-95 | 75-95 | 0-2 |
| *** Engine Speed at 1500 rpm** | | | | | | | | |
| **# CAUTION: Both wheels must be turning at same speed.** | | | | | | | | |

## CLUTCH AIR PRESSURE TESTS

Inoperative clutches can be located by substituting air pressure for fluid pressure. The clutches may be tested by applying air pressure to their respective passages after the valve body has been removed. Use Plate Set 6599-1 (1) and 6599-2 (1) to perform test.




To make air pressure tests, proceed as follows:

**NOTE: The compressed air supply must be free of all dirt and moisture. Use a pressure of 30 psi.**

1. Remove oil pan and valve body. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/VALVE BODY - REMOVAL)
2. Apply air pressure to the holes in the special tool (1), one at a time.
3. Listen for the clutch to apply. It will give a slight thud sound. If a large amount of air is heard escaping, the transmission must be removed from vehicle, disassembled and all seals inspected.

### 2/4 CLUTCH

Apply air pressure to the feed hole located on the 2/4 clutch retainer (2). Look in the area where the 2/4 piston contacts the first separator plate and watch carefully for the 2/4 piston to move rearward. The piston should return to its original position after the air pressure is removed.

### OVERDRIVE CLUTCH

Apply air pressure to the overdrive clutch apply passage and watch for the push/pull piston to move forward. The piston should return to its starting position when the air pressure is removed.

### REVERSE CLUTCH

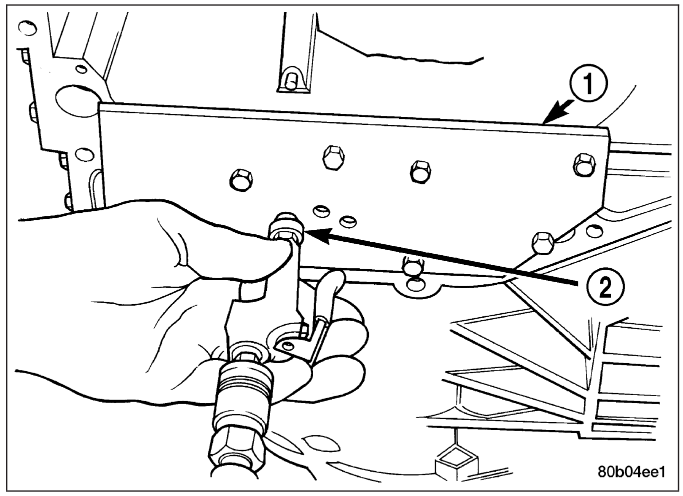
Apply air pressure to the reverse clutch apply passage and watch for the push/pull piston to move rearward. The piston should return to its starting position when the air pressure is removed.

### LOW/REVERSE CLUTCH

Apply air pressure to the low/reverse clutch feed hole passage. Look in the area where the low/reverse piston contacts the first separator plate. Watch carefully for the piston to move forward. The piston should return to its original position after the air pressure is removed.

### UNDERDRIVE CLUTCH

Because this clutch piston cannot be seen, its operation is checked by function. Use an air nozzle (2) to apply air pressure is to the low/reverse or the 2/4 clutch opening in Plate Set 6599-1 (2). This locks the output shaft. Use a piece of rubber hose wrapped around the input shaft and a pair of clamp-on pliers to turn the input shaft. Next apply air pressure to the underdrive clutch. The input shaft should not rotate with hand torque. Release the air pressure and confirm that the input shaft will rotate.



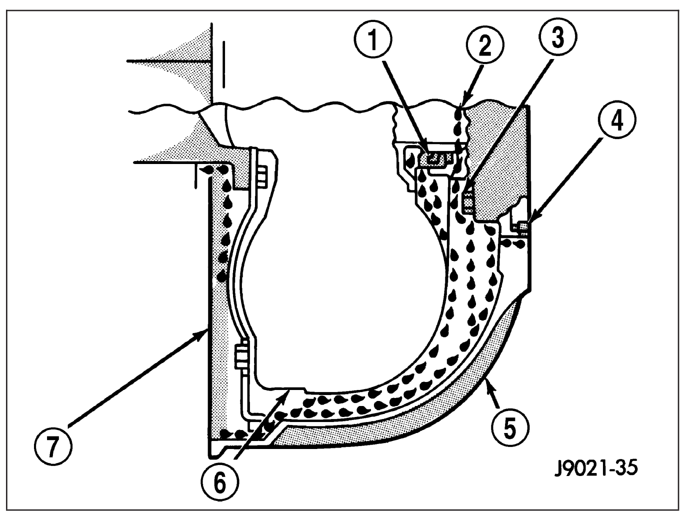

## FLUID LEAKAGE

### FLUID LEAKAGE - TORQUE CONVERTER HOUSING AREA

When diagnosing converter housing (5) fluid leaks, three actions must be taken before repair:

1. Verify proper transmission fluid level.
2. Verify that the leak originates from the converter housing area and is transmission fluid.
3. Determine the true source of the leak.

Fluid leakage at or around the torque converter area may originate from an engine oil leak (7). The area should be examined closely. Factory fill fluid is red and, therefore, can be distinguished from engine oil.



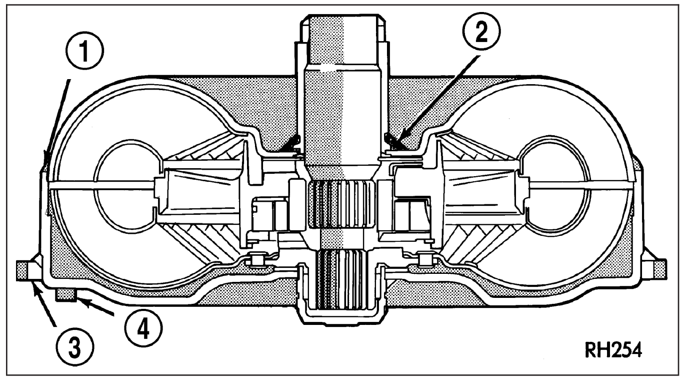

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill, or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair.

Pump seal (1) leaks tend to move along the drive hub and onto the rear of the converter. Pump o-ring or pump body leaks follow the same path as a seal leak. Pump attaching bolt (3) leaks are generally deposited on the inside of the converter housing (5) and not on the converter itself. Pump seal (1) or gasket (4) leaks usually travel down the inside of the converter housing.

## TORQUE CONVERTER LEAKAGE

Possible sources of torque converter leakage are:

- Torque converter weld leaks at the outside diameter weld (1).
- Torque converter hub weld (2).



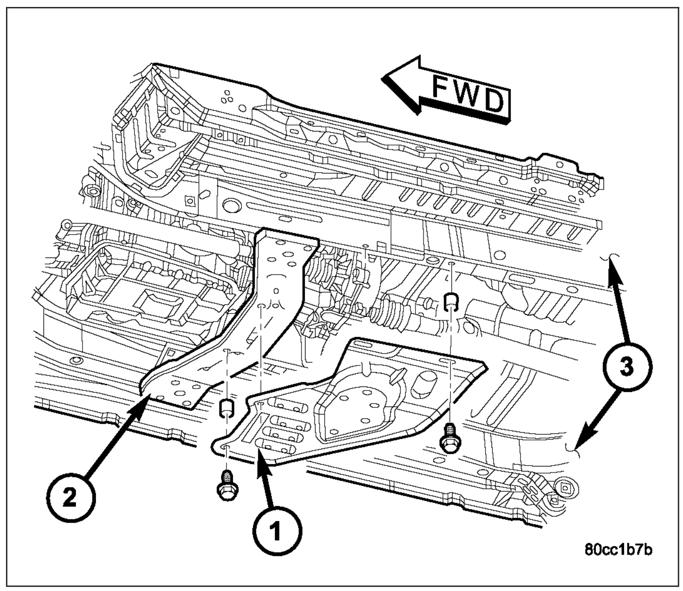

## STANDARD PROCEDURE - ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils®, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil® tap, or equivalent, and installing a Heli-Coil® insert, or equivalent, into the hole. This brings the hole back to its original thread size.

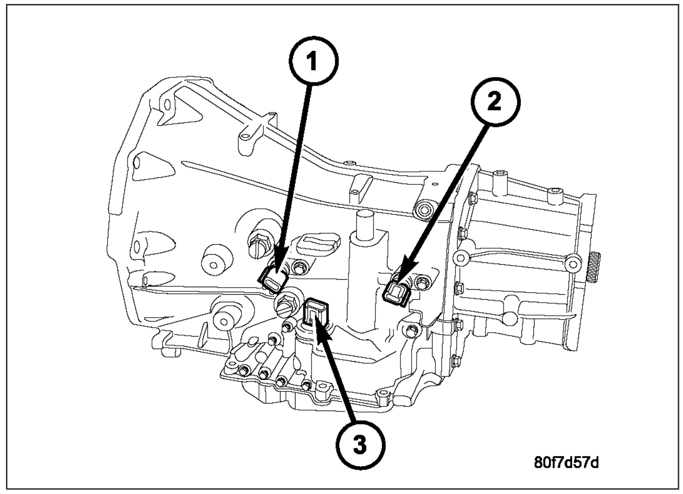
Heli-Coil®, or equivalent, tools, and inserts are readily available from most automotive parts suppliers.

## REMOVAL

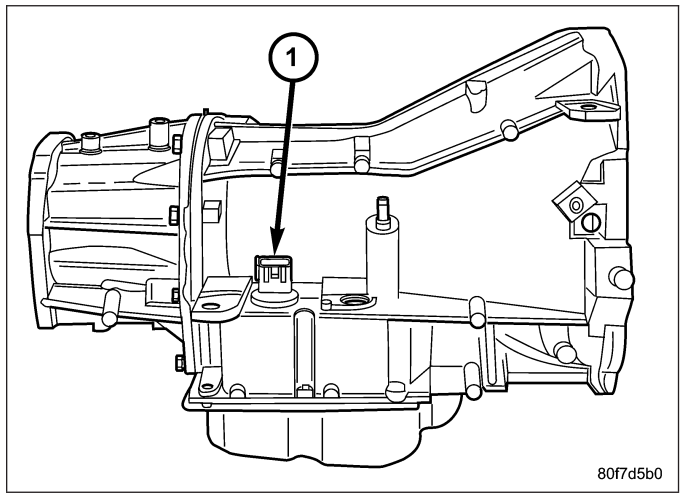
1. Disconnect the negative battery cable.
2. Raise and support the vehicle
3. Remove any necessary skid plates (1). (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - REMOVAL)



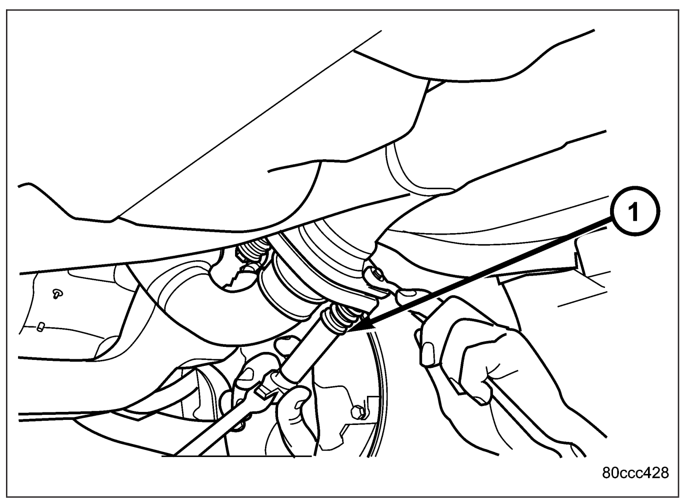
4. Mark propeller shaft and axle companion flanges for assembly alignment.
5. Remove the rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
6. Remove the front propeller shaft, if necessary. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
7. Disconnect wires from the input and output speed sensors (1, 2).
8. Disconnect wires from the transmission range sensor (3).



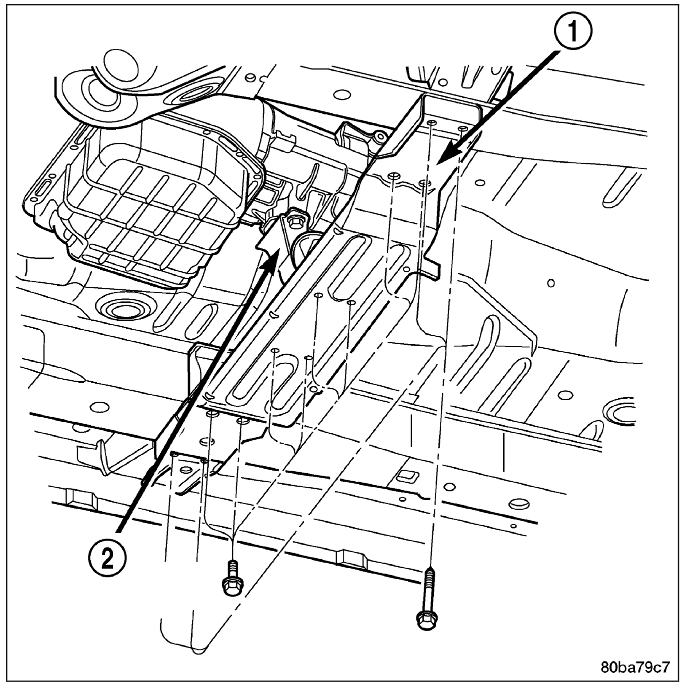

9. Disconnect wires from the solenoid/pressure switch assembly (1).




10. Remove the bolts (1) holding the exhaust crossover pipe to the pre-catalytic converter pipe flanges.
11. Remove the bolts holding the exhaust crossover pipe to the catalytic converter flange.



12. Disconnect gearshift cable from transmission manual valve lever.
13. Disengage the shift cable from the cable support bracket.
14. Remove the starter motor.
15. Remove the engine to transmission collar.
16. Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.
17. Disconnect the transmission vent hose from the transmission.
18. Remove transfer case.
19. Support rear of engine with safety stand or jack.
20. Raise transmission slightly with service jack to relieve load on crossmember and supports.
21. Remove bolts securing rear support and cushion (2) to transmission and crossmember (1).
22. Remove bolts attaching crossmember to frame and remove crossmember.




23. Disconnect transmission fluid cooler lines at transmission fittings and clips.
24. Remove all remaining converter housing bolts.
25. Carefully work transmission and torque converter assembly rearward off engine block dowels.
26. Hold torque converter in place during transmission removal.
27. Lower transmission and remove assembly from under the vehicle.
28. To remove torque converter, carefully slide torque converter out of the transmission.

## DISASSEMBLY

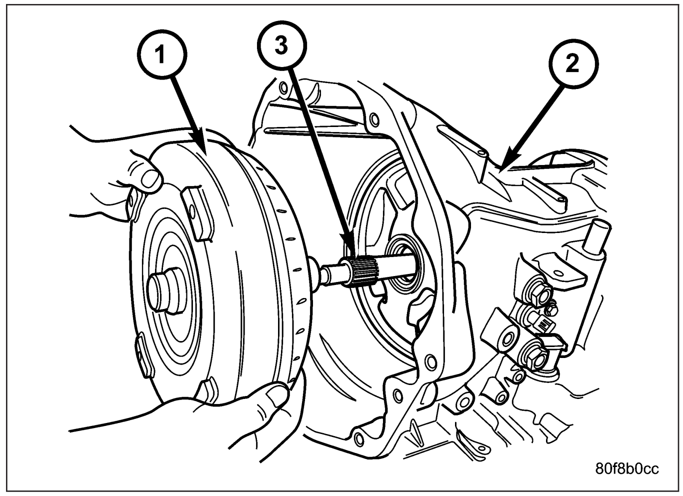
**NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Quick Learn Procedure using the scan tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).**

**NOTE: Tag all clutch pack assemblies, as they are removed, for reassembly identification.**

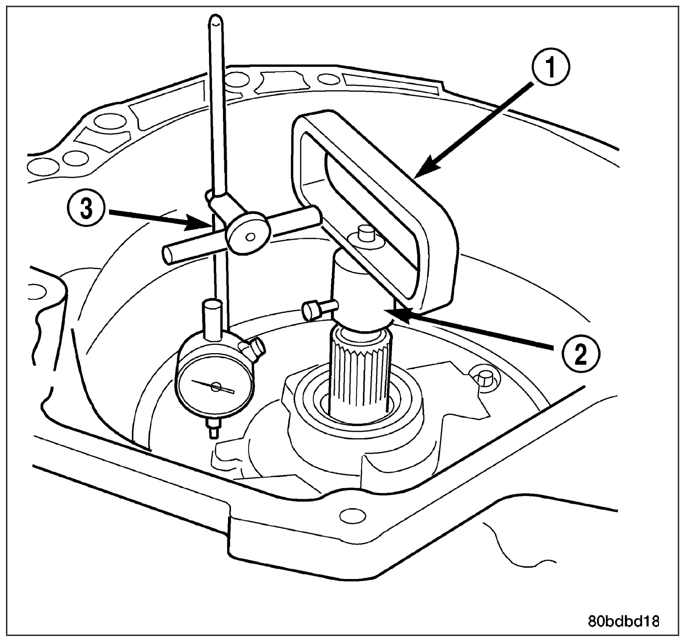
**CAUTION: Do not intermix clutch discs or plates as the unit might then fail.**

Before disassembling transmission, move the shift lever clockwise as far as it will go and then remove the shift lever.

1. Remove the torque converter (1) from the transmission input shaft (3).

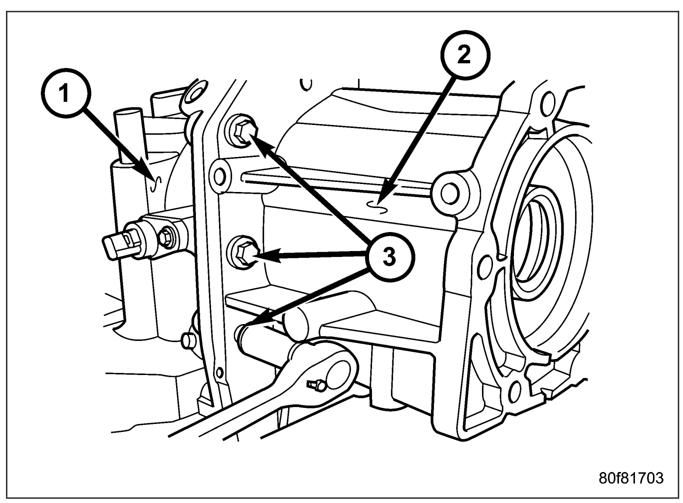



2. Measure input shaft end play using End Play Set 8266 (1, 2). Set up the required items from End Play Set 8266 and a dial indicator as shown.
3. Move input shaft in and out to obtain end play reading. End play specifications are 0.127 to 0.635 mm (0.005 to 0.025 inch). Record indicator reading for reference when reassembling the transmission. If end play exceeds the specified range, the #4 thrust plate needs to be inspected and changed if necessary.

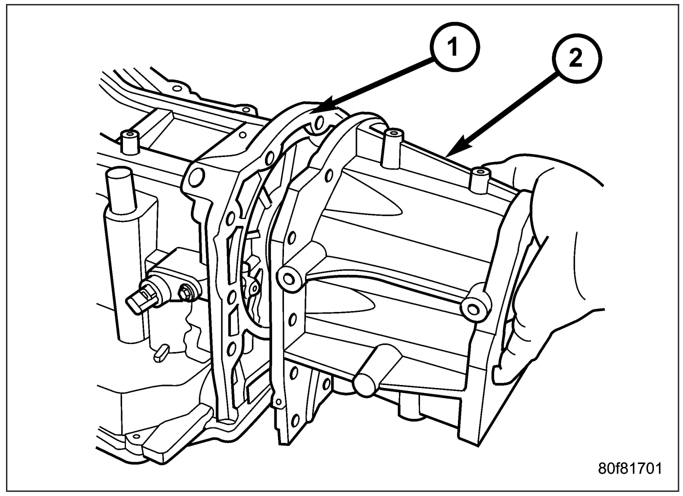



**NOTE: The four bolts (3) along the bottom of the adapter or extension housing (2) have a sealing patch applied from the factory. Note the locations of these bolts and separate these bolts for reuse.**

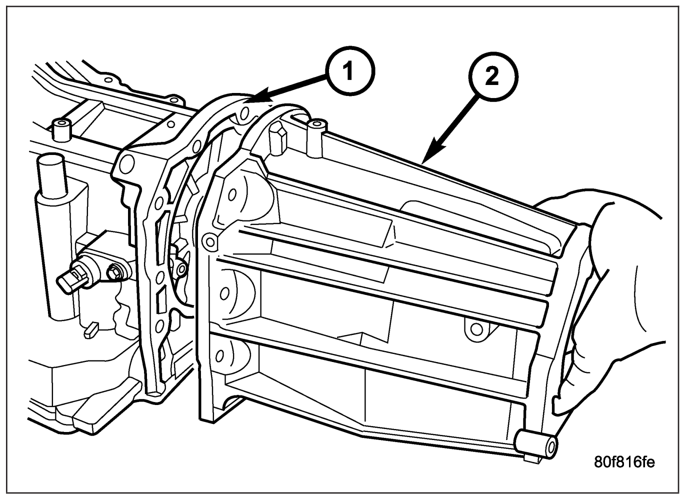
4. Remove the bolts that hold the adapter or extension housing (2) onto the transmission case.



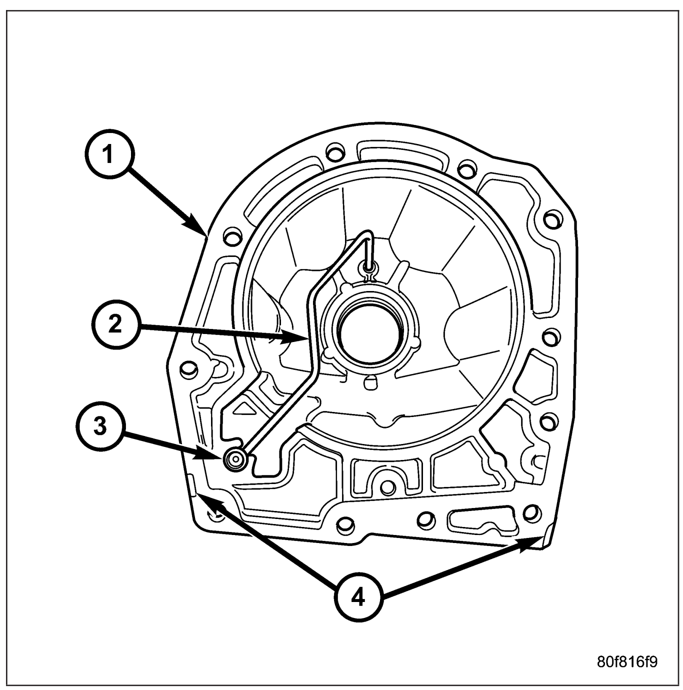
5. Remove the adapter (2) housing, 4X4 vehicles only, from the transmission case. There are two pry slots located near the bottom corners of the housing for separating the housing from the transmission case.




6. Remove the extension (2) housing, 4X2 vehicles only, from the transmission case. There are two pry slots located near the bottom corners of the housing for separating the housing from the transmission case.

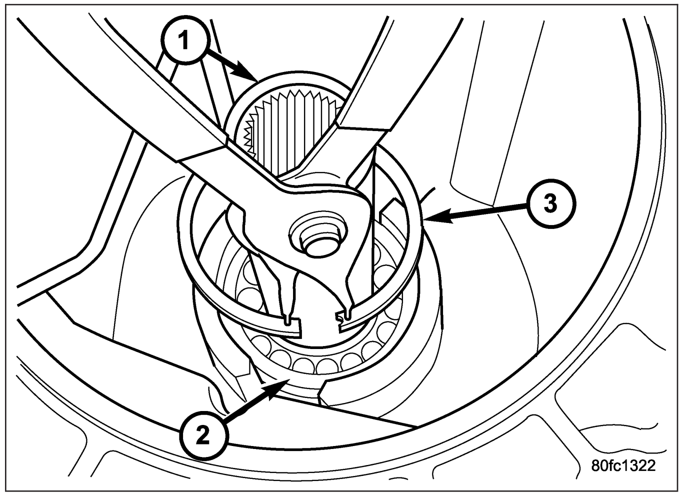



7. Inspect the lube tube grommet (3) for damage. If the grommet lip is damaged, it will need to be replaced.



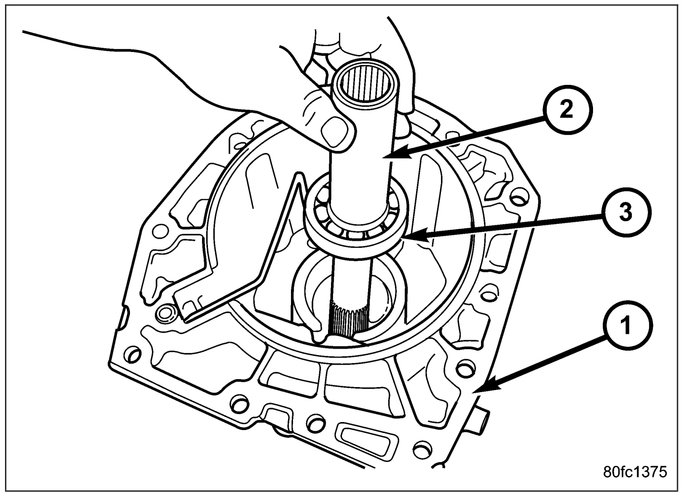

8. On 4X2 transmissions, perform the following, if necessary:

a. Remove the extension shaft bearing snap ring (3) from the extension housing.



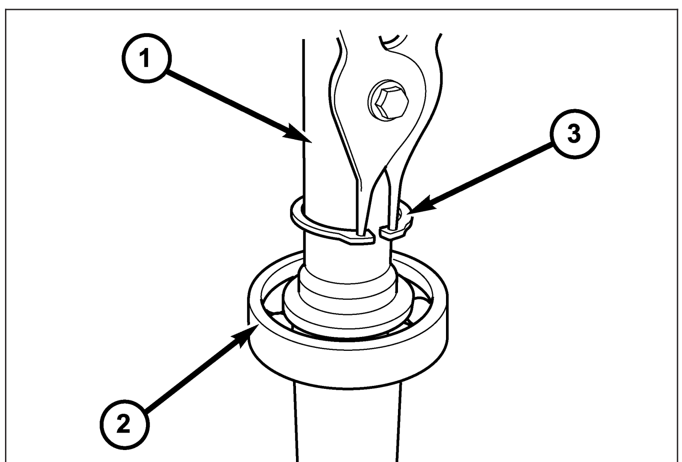
80fc1322

b. Remove the extension shaft and bearing assembly (2) from the extension housing (1).



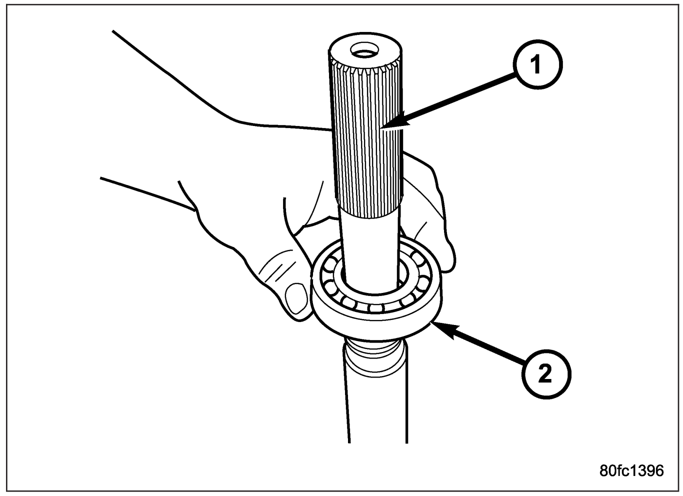
80fc1375

c. Remove the extension shaft bearing retaining ring (3) from the extension shaft (1).

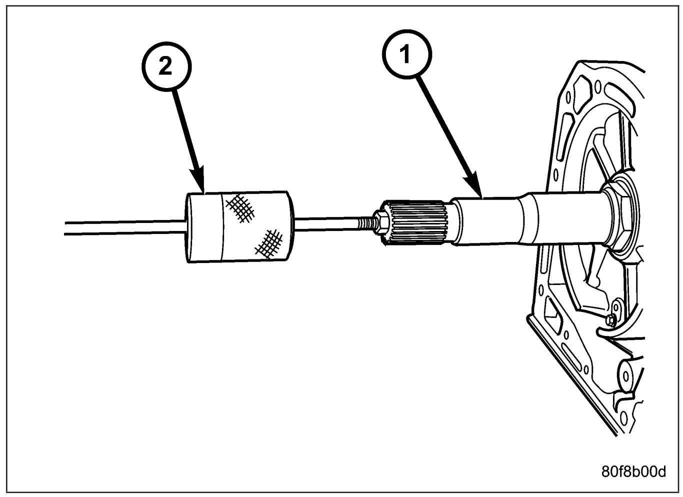


80fc1386

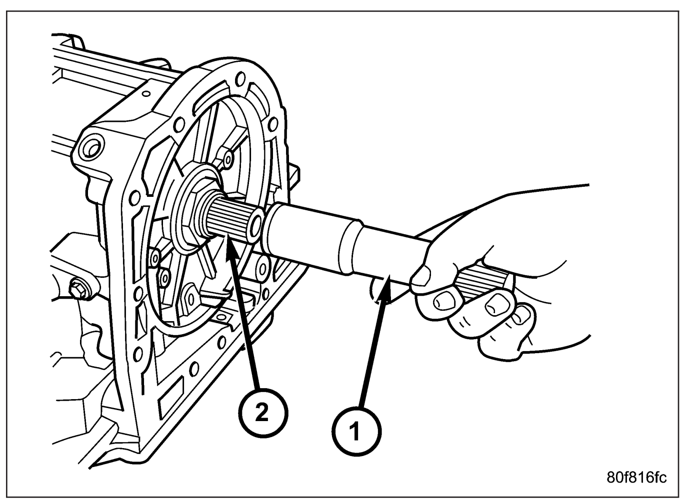
d. Remove the extension shaft bearing (2) from the extension shaft (1).




9. Using a Slide Hammer C-3752 (2), remove the 4X4 stub shaft (1).

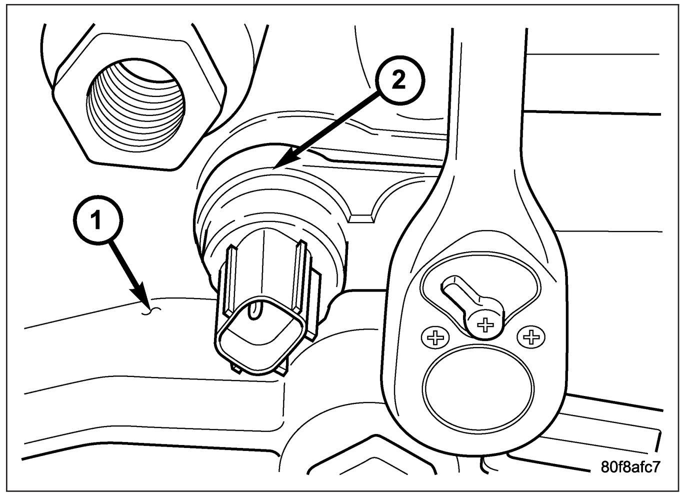



10. Remove the 4X4 stub shaft (1) from the transmission output shaft. Inspect the cir-clip on the shaft for damage and replace the clip if necessary.



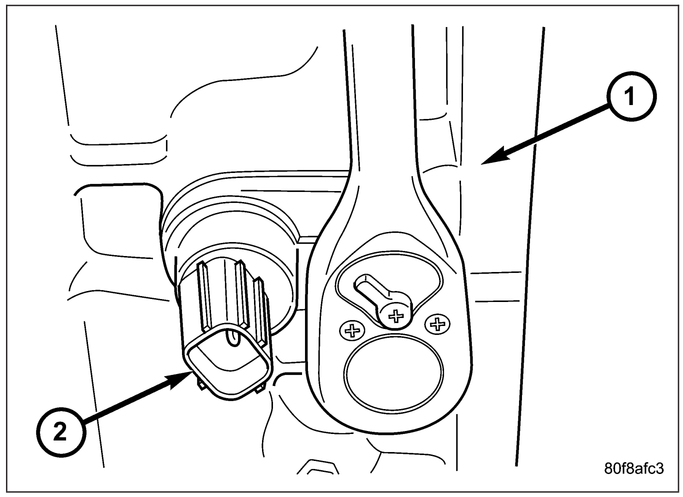
**NOTE: The speed sensor bolts have a sealing patch applied from the factory. Separate these bolts for reuse.**

11. Remove the input speed sensor bolt.

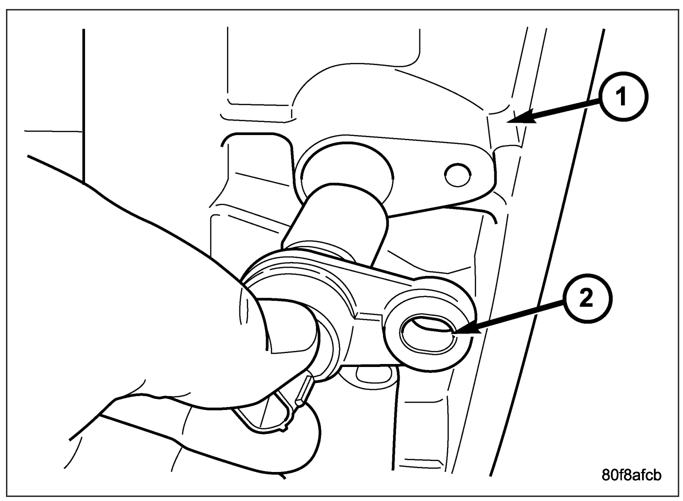



**NOTE: The speed sensor bolts have a sealing patch applied from the factory. Separate these bolts for reuse.**

12. Remove the output speed sensor bolt.

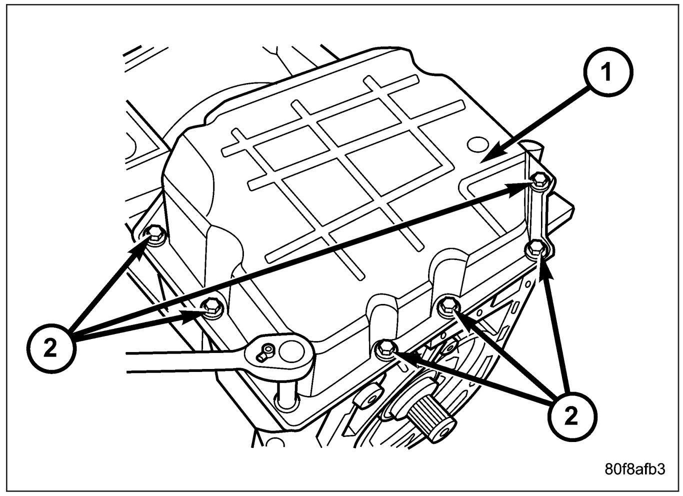



13. Remove the input and output (2) speed sensors. Identify the speed sensors for re-installation since they are not interchangeable.

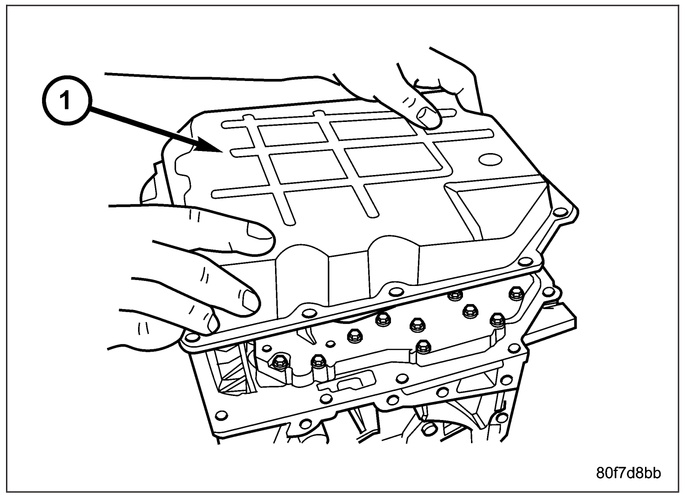


**NOTE: One of the oil pan bolts has a sealing patch applied from the factory. Separate this bolt for reuse.**

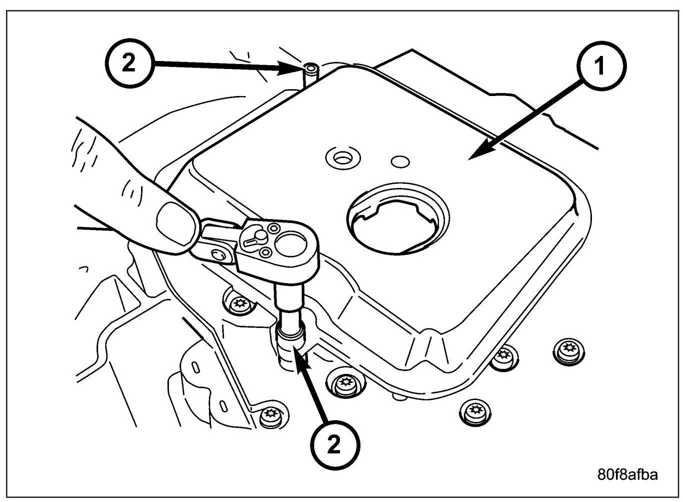
14. Remove the transmission oil pan bolts (2).



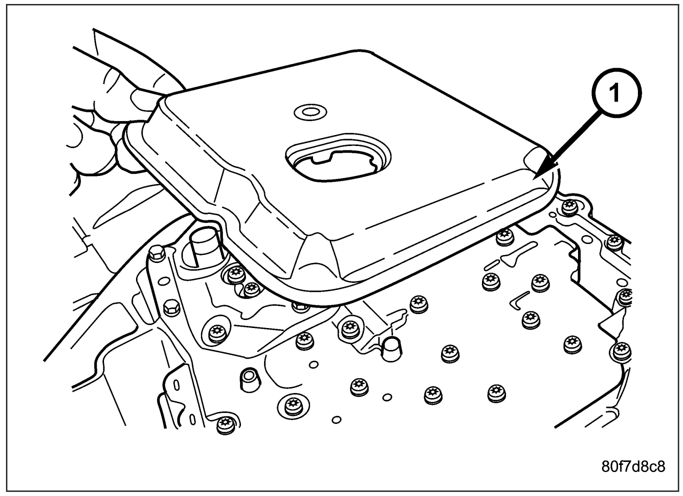

15. Remove the transmission oil pan (1).



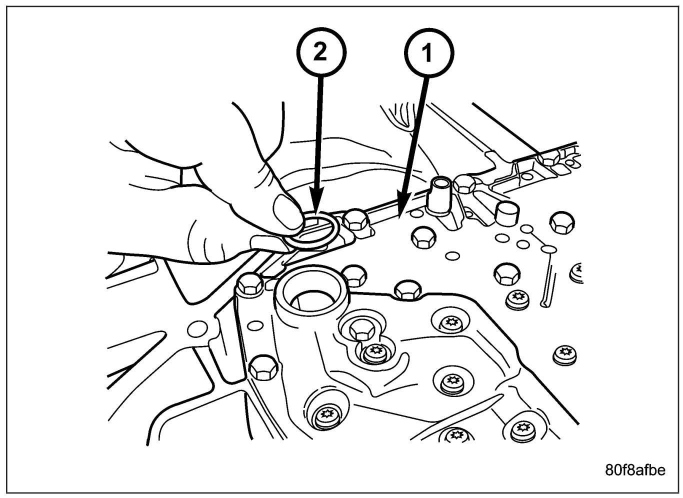

16. Remove the transmission oil filter screws (2).



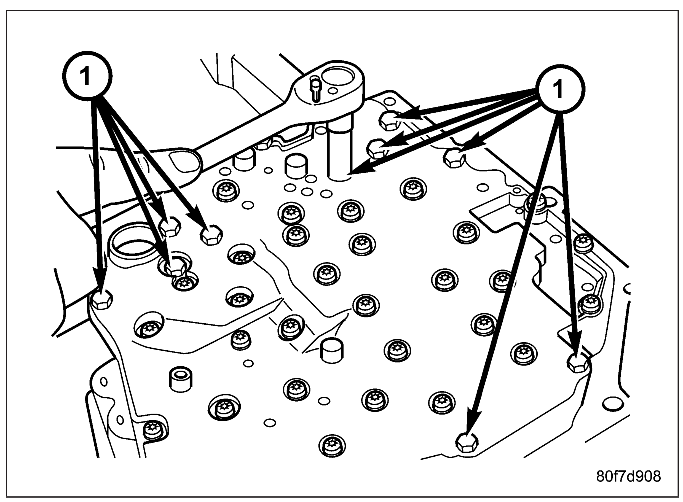
17. Remove transmission oil filter (1).




18. Remove the oil filter o-ring (2) from the valve body.

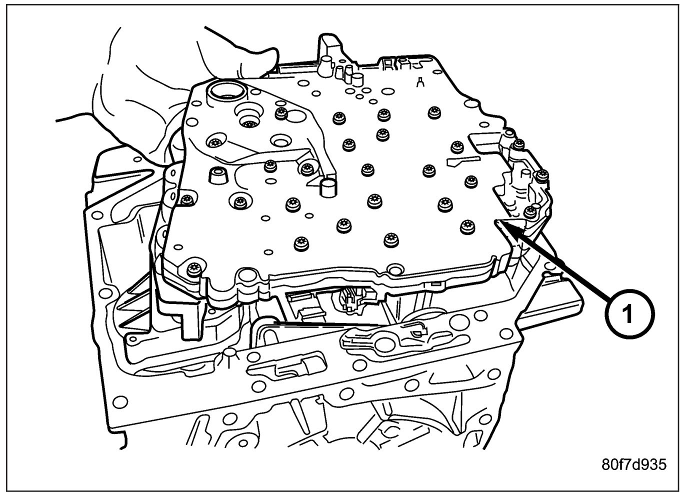



19. Remove valve body-to-case bolts (1).

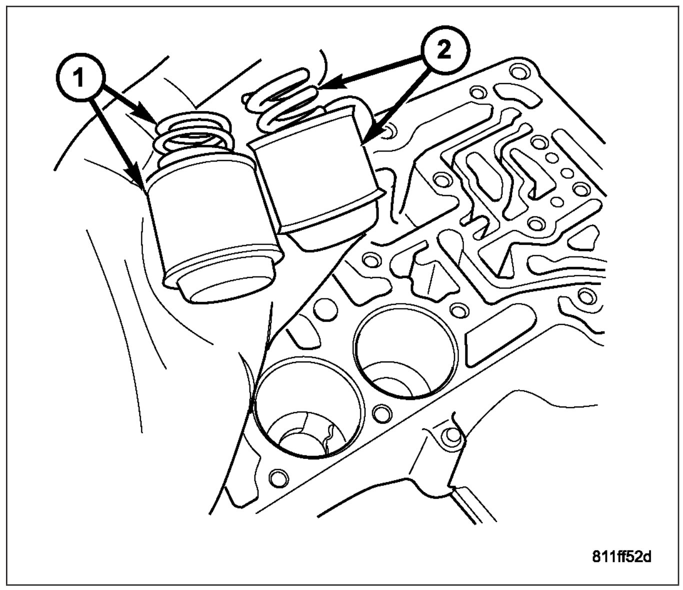


**CAUTION: Do not handle the valve body by the manual shaft. Damage could result.**

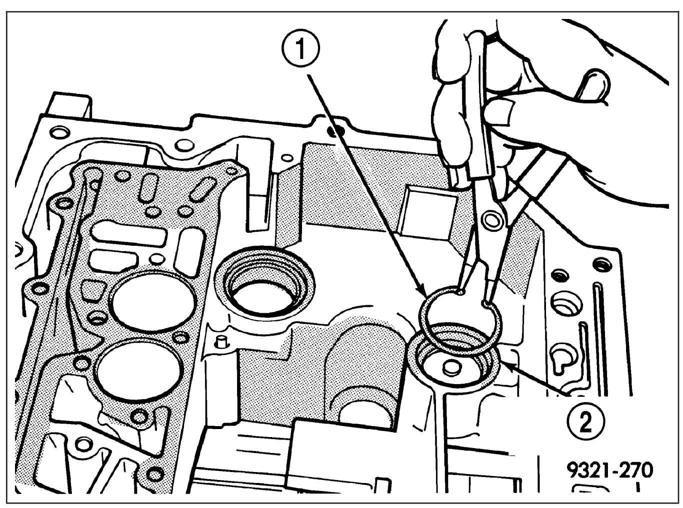
20. Remove valve body (1) from transmission.



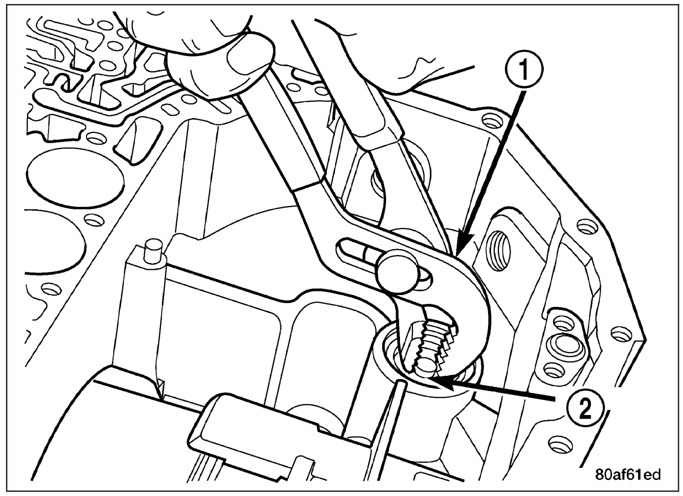

21. Remove underdrive and overdrive accumulators (1, 2).



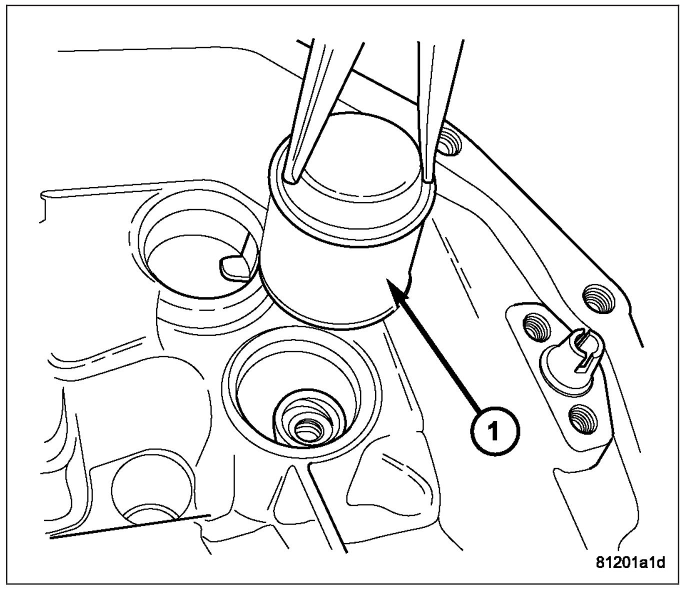

22. Remove the low/reverse accumulator snap ring (1).



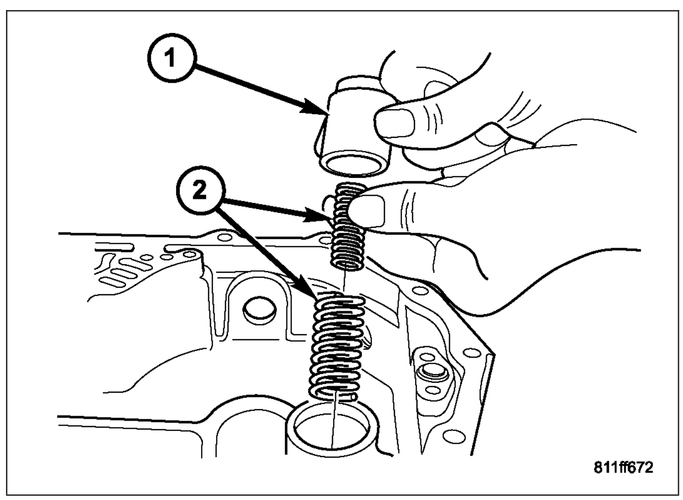
23. Remove the low/reverse accumulator plug (2).



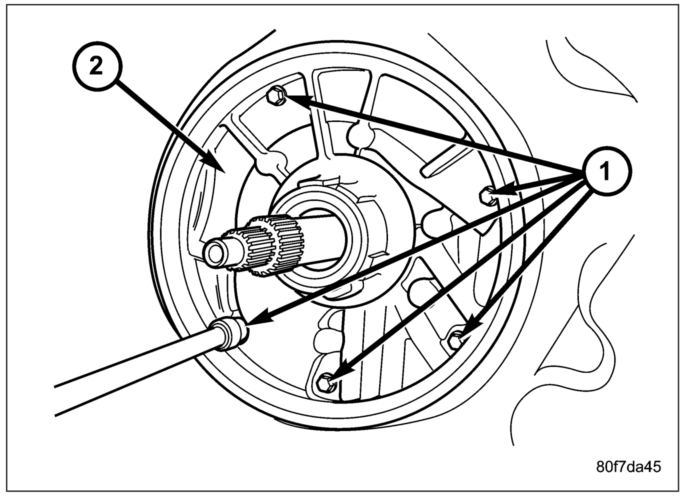

24. Remove low/reverse accumulator piston (1) using suitable pliers.



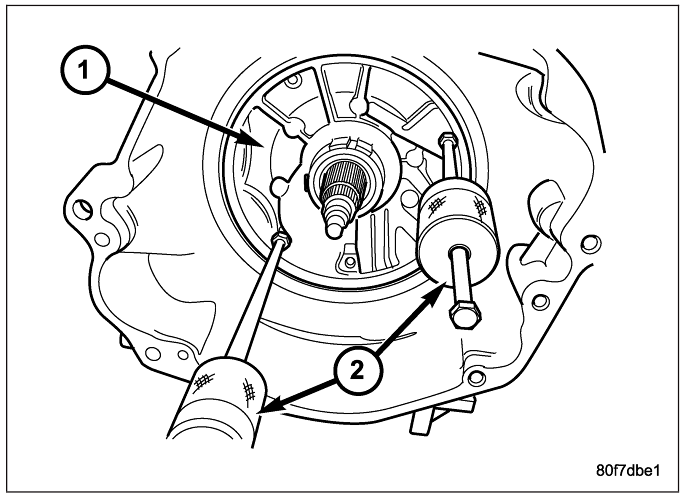

25. Remove piston (1) and springs (2).



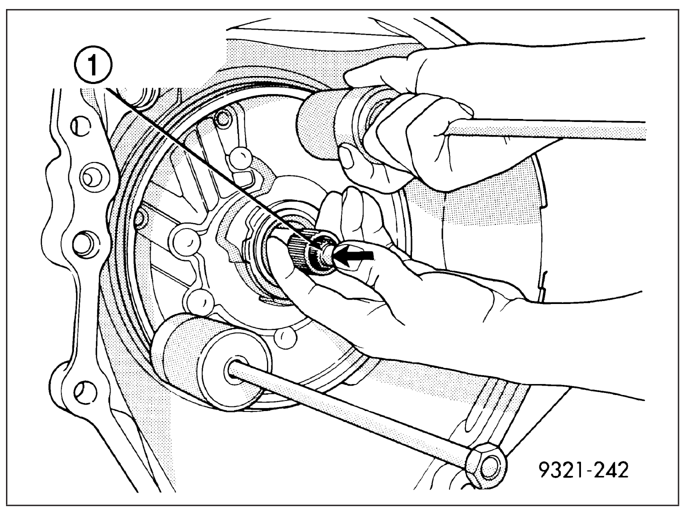
26. Remove and discard the oil pump-to-case bolts (1). The oil pump bolts are not to be reused.



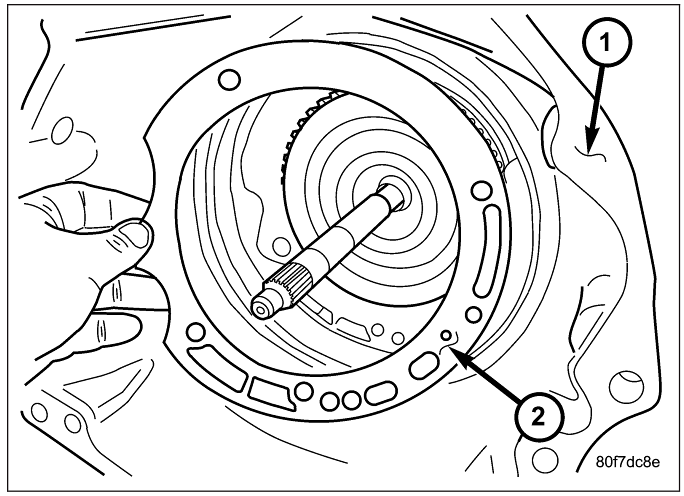

27. Remove oil pump using Slide Hammers C-3752 (2).




28. Remove oil pump while pushing in on input shaft (1).

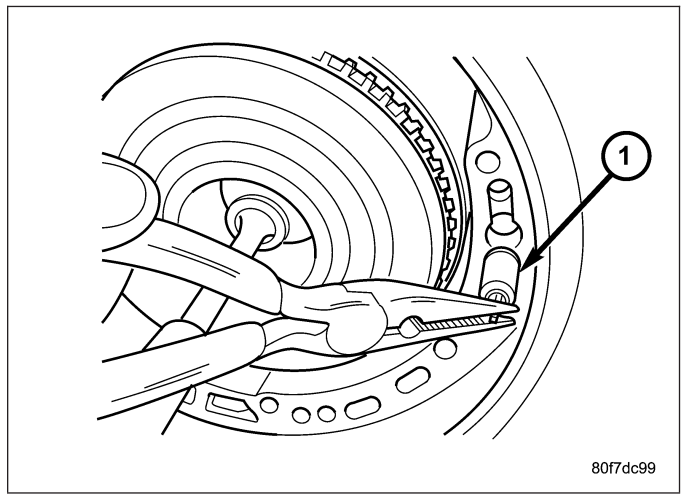


29. Remove oil pump gasket (2).

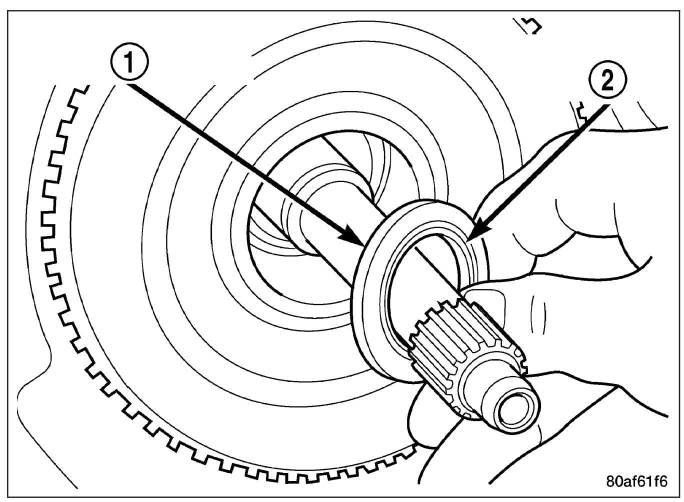



**CAUTION: By-pass valve must be replaced if transmission failure occurs.**

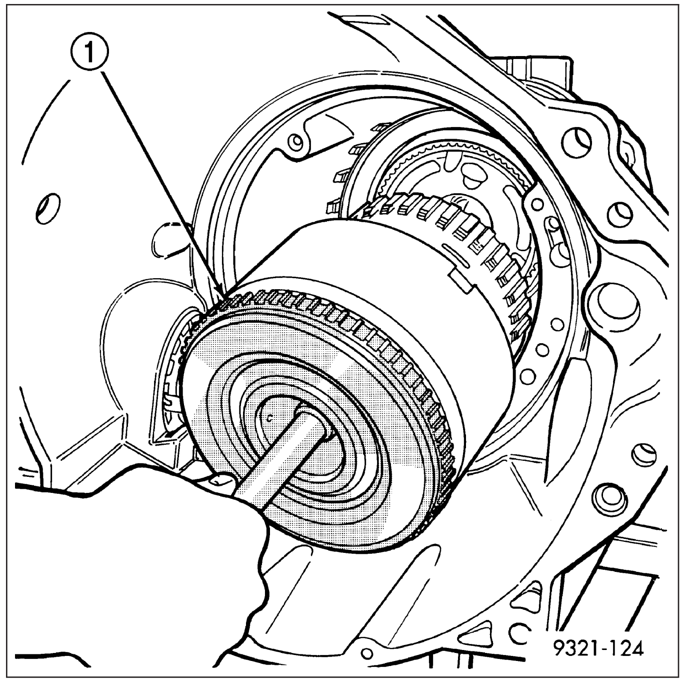
30. Remove the cooler by-pass valve (1).



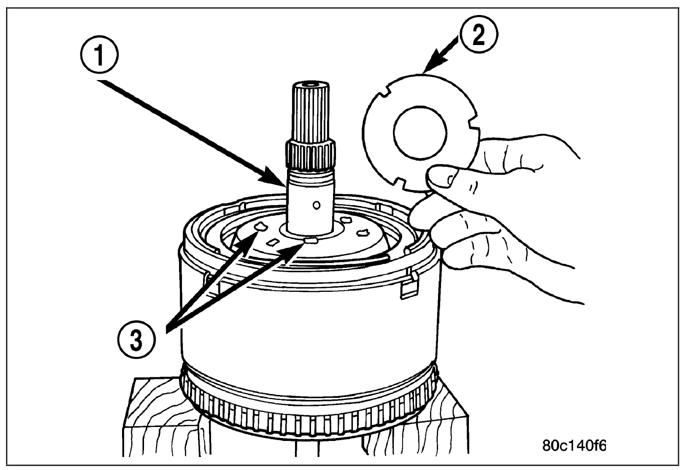

31. Remove the #1 caged needle bearing (1).



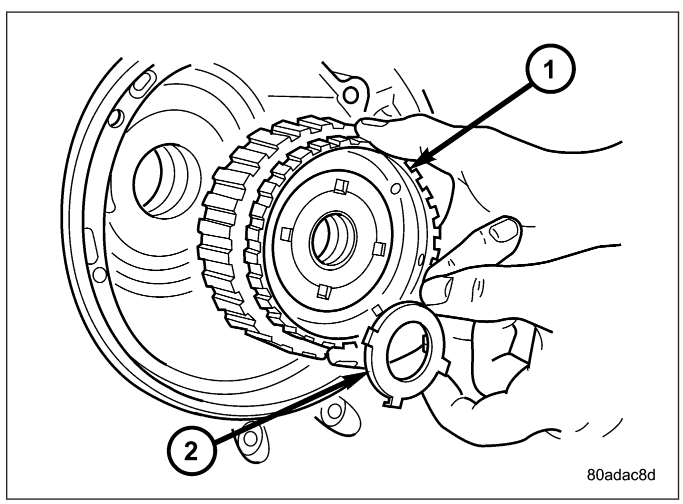
32. Remove the input clutch assembly (1).



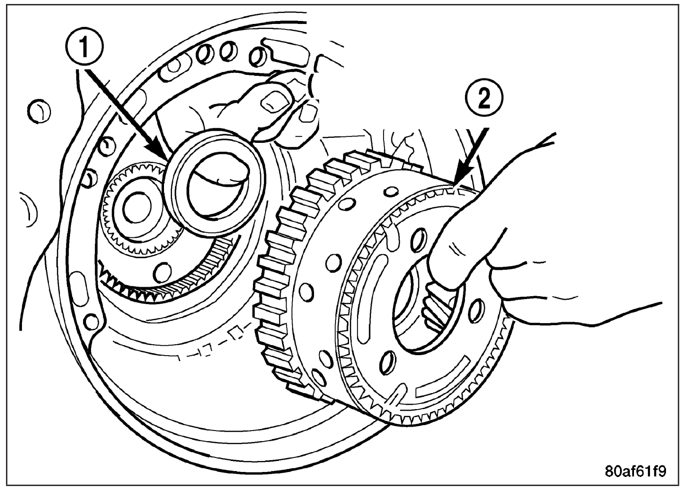

33. Remove the #4 thrust plate (2).



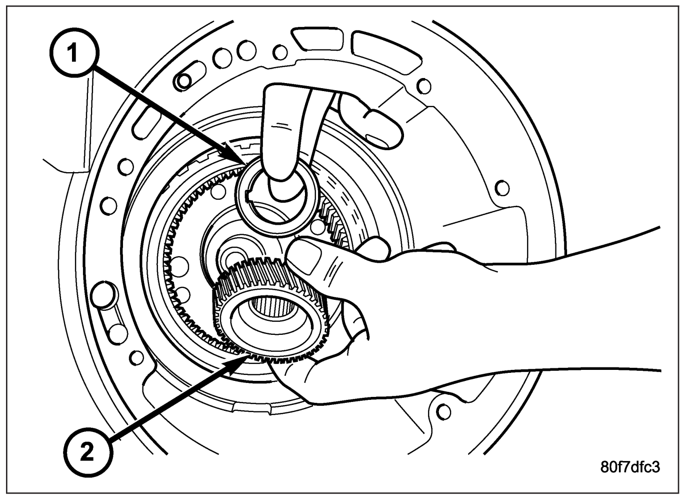

34. Remove the front sun gear assembly (1) and #4 thrust washer (if still in place).



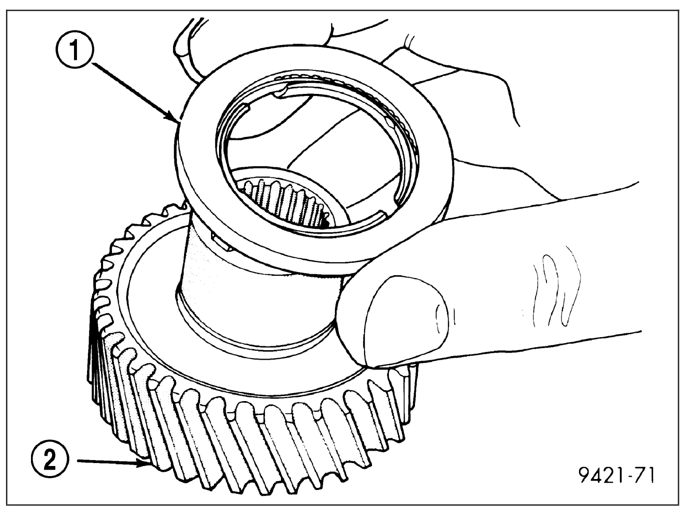
35. Remove the front carrier/rear annulus (2) and #6 needle bearing (1).




36. Remove the rear sun gear (2) and #7 needle bearing (1).

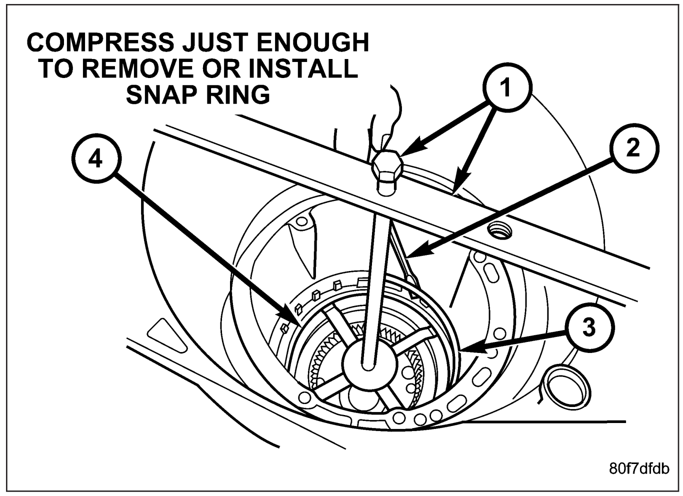



**NOTE: The number seven needle bearing (1) has three antireversal tabs and is common with the number five and number two position. The orientation should allow the bearing to seat flat against the rear sun gear. A small amount of petrolatum can be used to hold the bearing to the rear sun gear.**



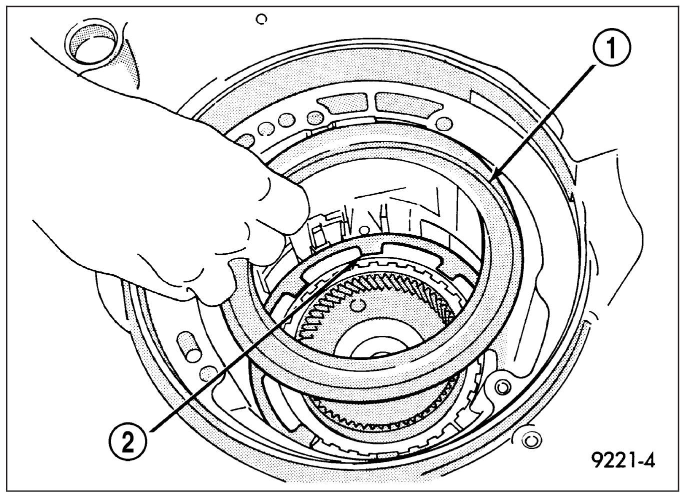
**NOTE: Verify that Compressor 5058A (1) is centered properly over the 2/4 clutch retainer (4) before compressing. If necessary, fasten the Compressor 5058A bar to the bellhousing flange with any combination of locking pliers and bolts to center the tool properly.**

37. Install and load Compressor 5058A to remove the 2/4 clutch retainer snap ring (3).

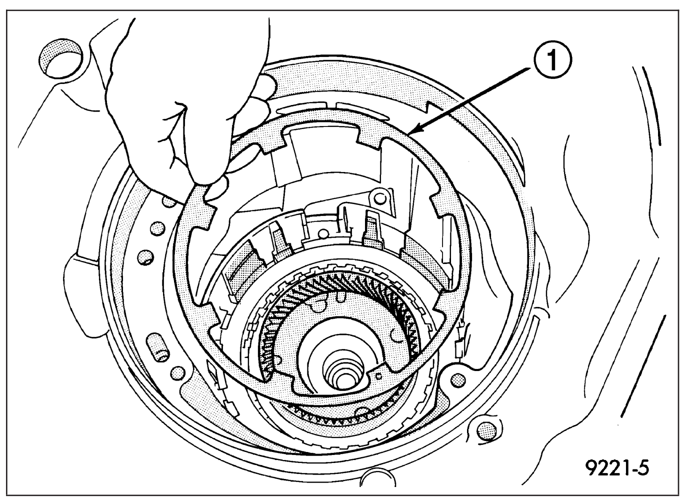



**NOTE: The 2/4 Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.**

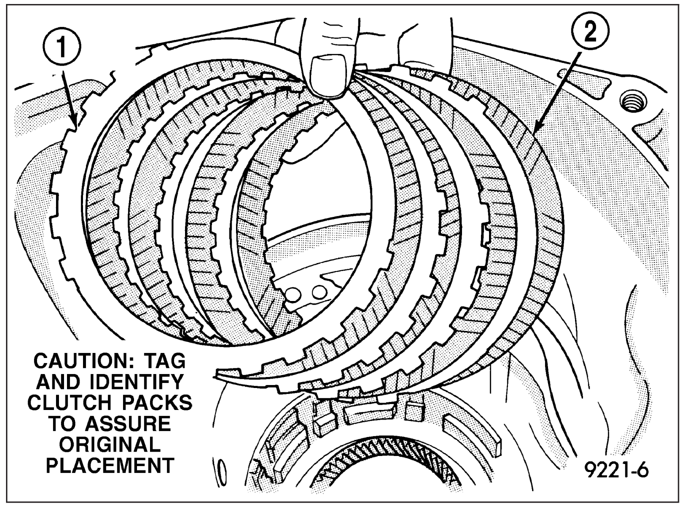
38. Remove the 2/4 clutch retainer (1).



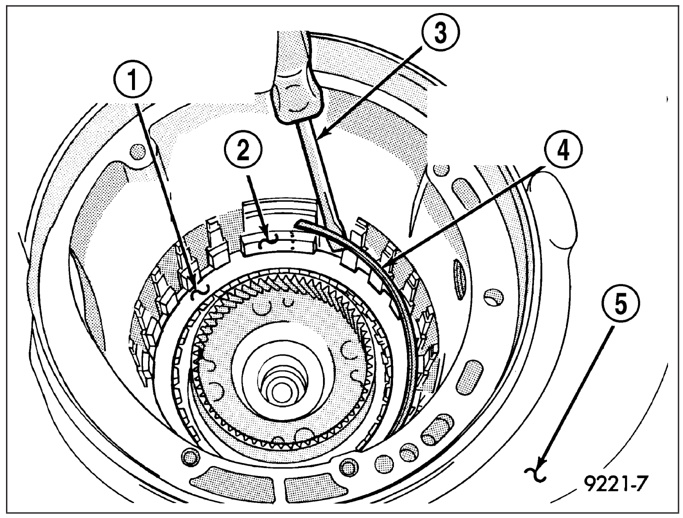

39. Remove the 2/4 clutch return spring (1).



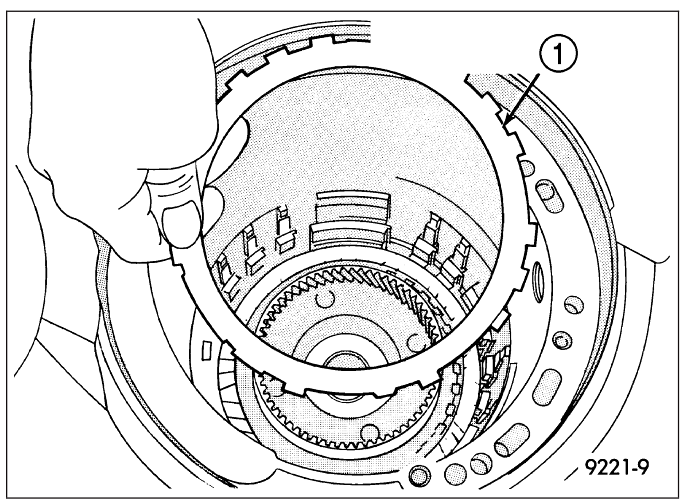
40. Remove the 2/4 clutch pack (1, 2).



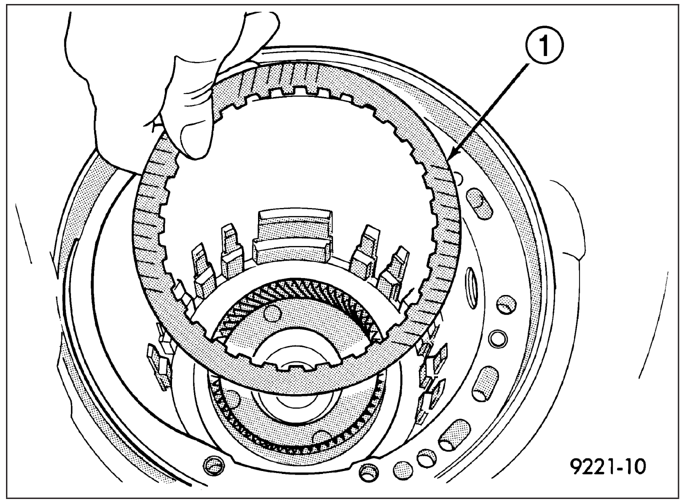

41. Remove the tapered snap ring (4).



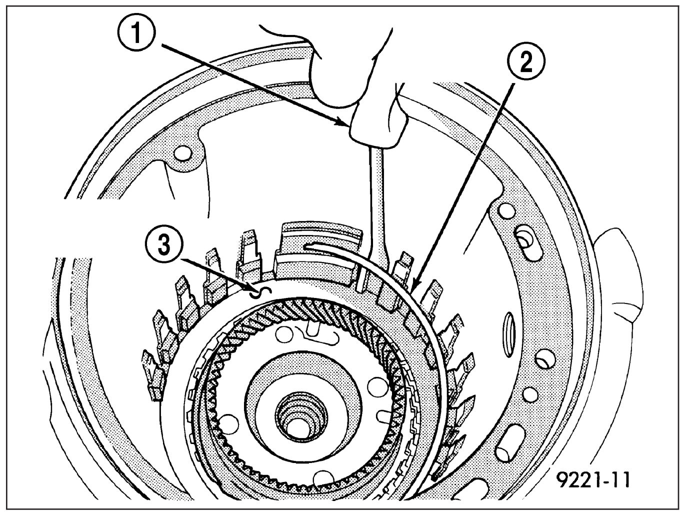

42. Remove the low/reverse reaction plate (1).



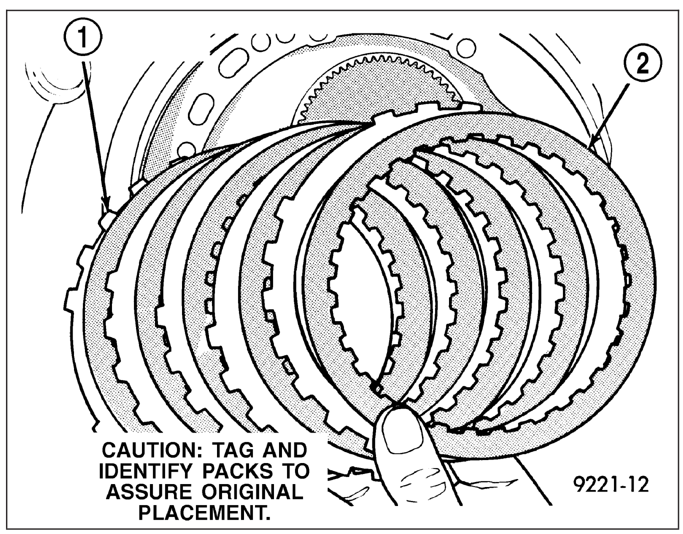
43. Remove one (1) low/reverse clutch disc to facilitate snap ring removal.




44. Remove the low/reverse reaction plate snap ring (2).

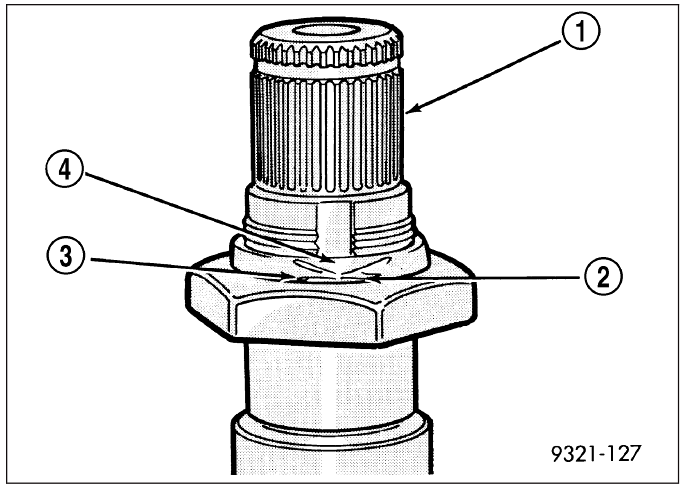



45. Remove the low/reverse clutch pack (1, 2).

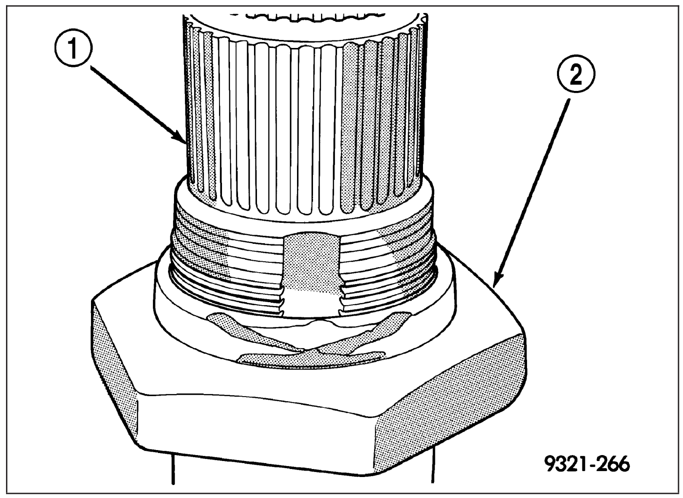


**CAUTION: Failure to grind and open stakes (4) of the output shaft nut will result in thread damage to the shaft during nut removal.**

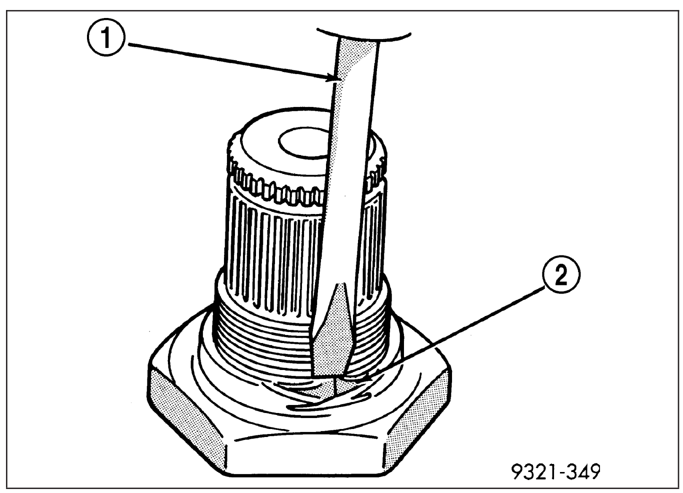
**WARNING: Wear safety goggles while grinding stake nuts.**



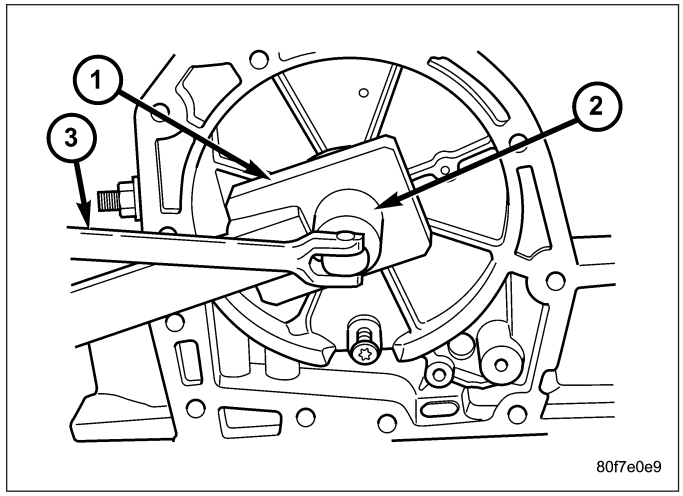

46. Using a die grinder or equivalent, grind the stakes in the shoulder of the shaft nut (2) as shown. Do not grind all the way through the nut and into the shaft. There are two stakes on each nut.



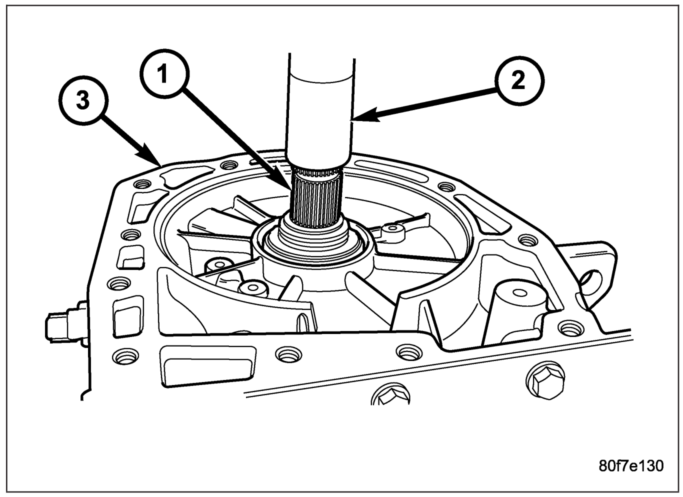

47. Using a small chisel (1), carefully open the stakes on nut (2).



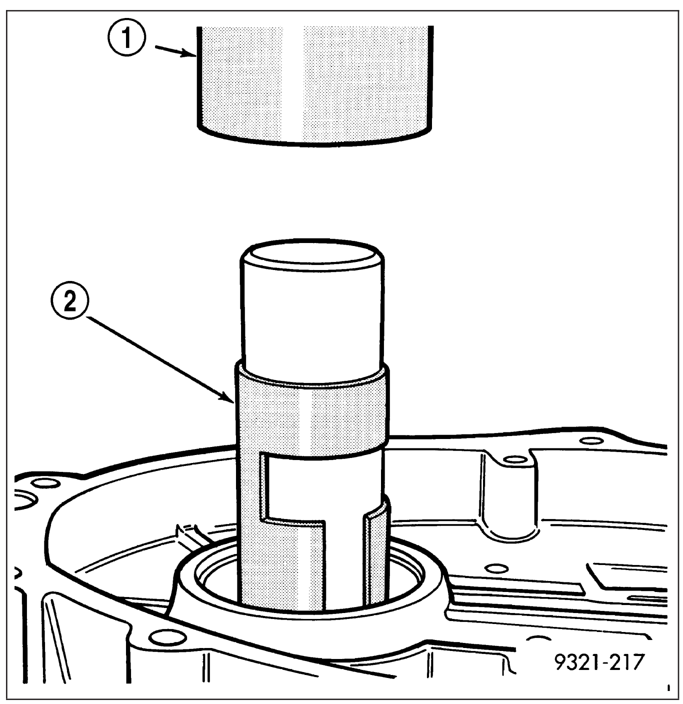
48. Use Wrench 6497 (1) and Wrench 6498A (2) to remove the output shaft nut.



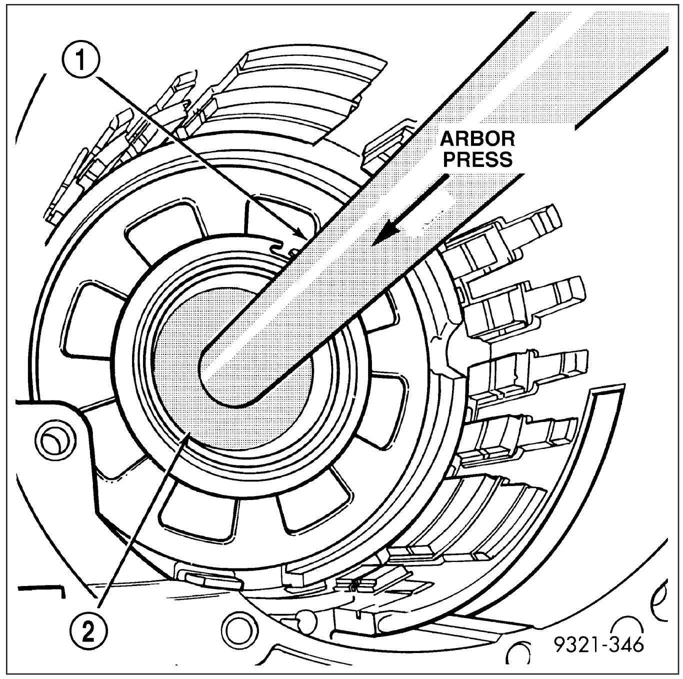

49. Remove the output shaft (1) from case (3) using a shop press (2).



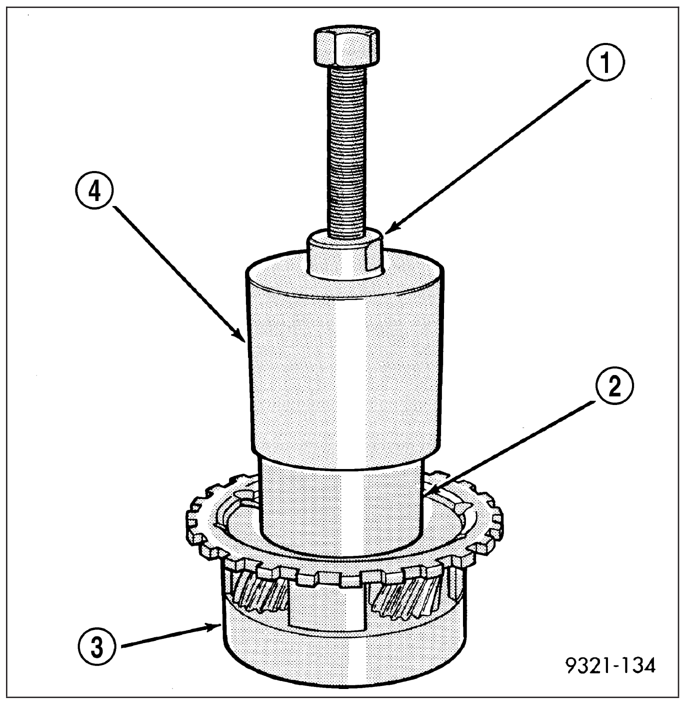

50. Use Remover 6596 (2) with a shop press (1) to remove the front output shaft bearing cup.



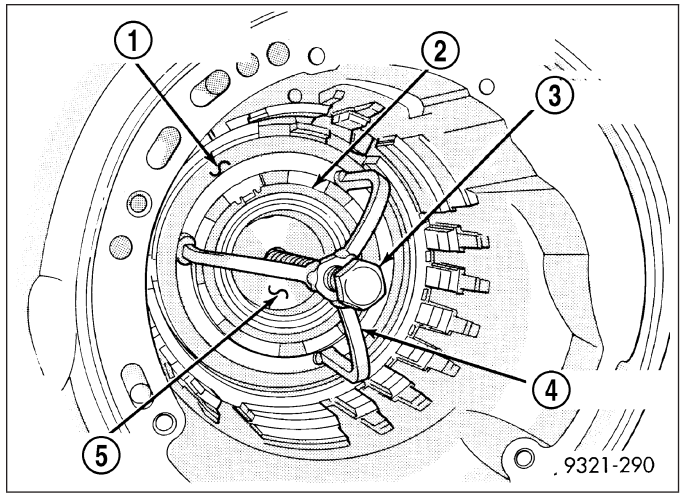
51. Use Disc 6597 (2) and Universal Handle C-4171 (1) and Handle Extension C-4171-2 to press the rear output shaft bearing cup rearward.



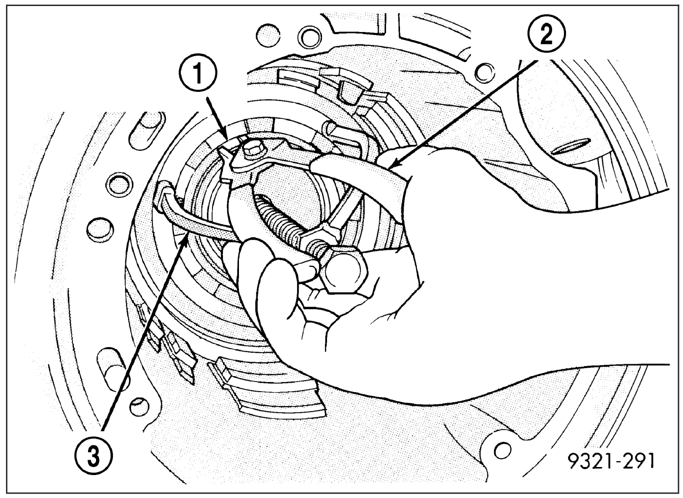

52. Remove the rear carrier front bearing cone (3).



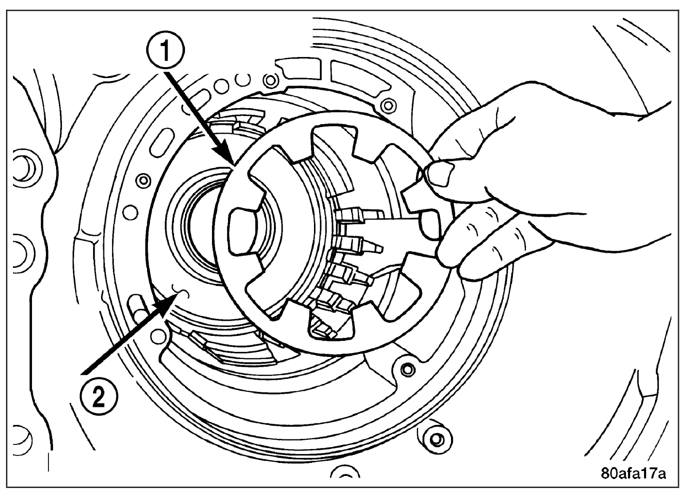
53. Install and load Compressor 5059A (4), Compressor 5058A (3), and Disc 6057 (5) as shown.



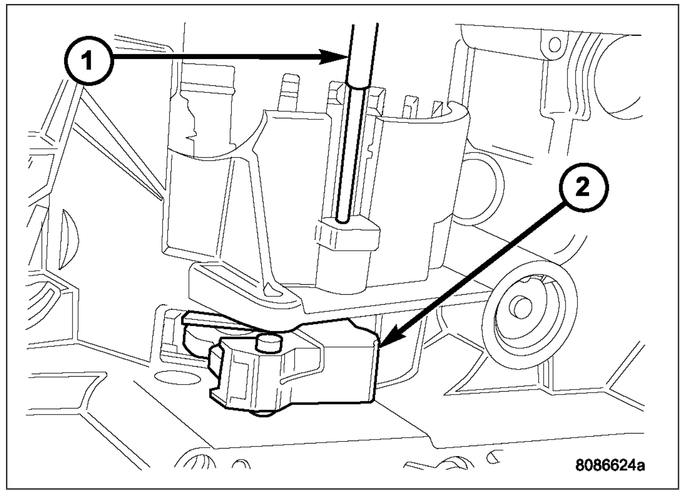

54. Remove the low/reverse belleville spring snap ring (1).



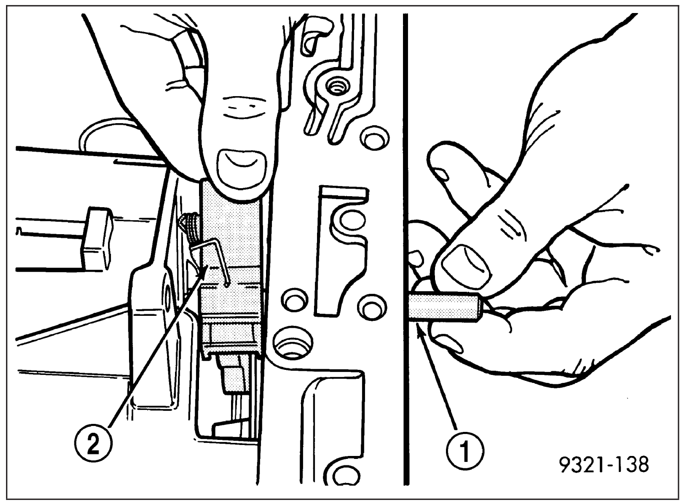

55. Remove the low/reverse piston belleville spring (1).



56. Remove the park sprag pivot retaining screw.
57. Drive out the anchor shaft using suitable punch (1).

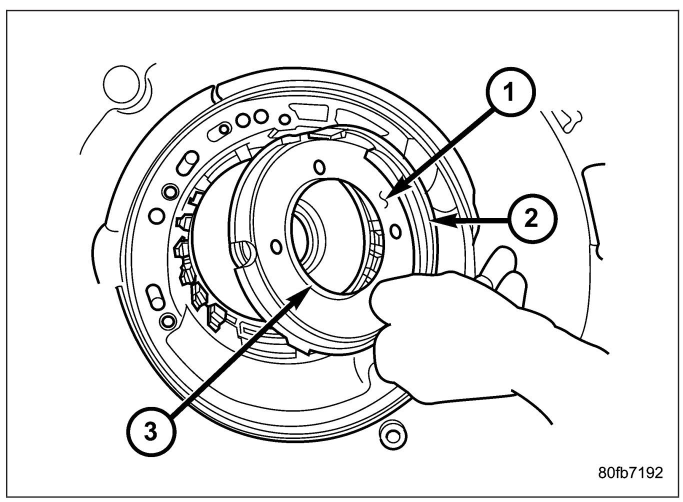



58. Remove the guide bracket pivot pin (1). Inspect all components for wear and replace if necessary.

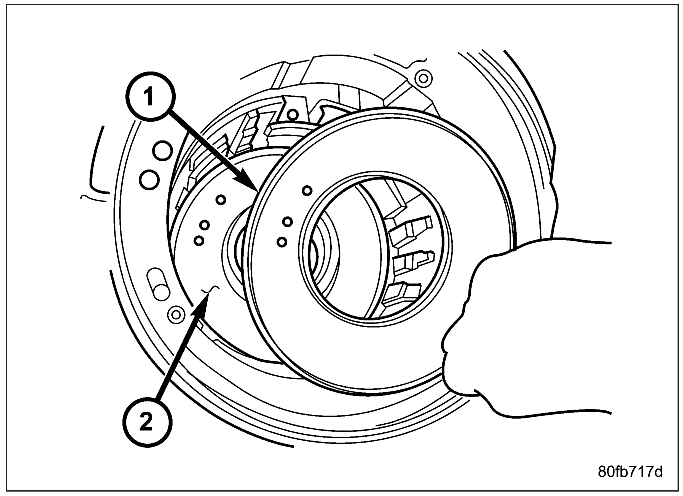



**NOTE: The Low/Reverse Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.**

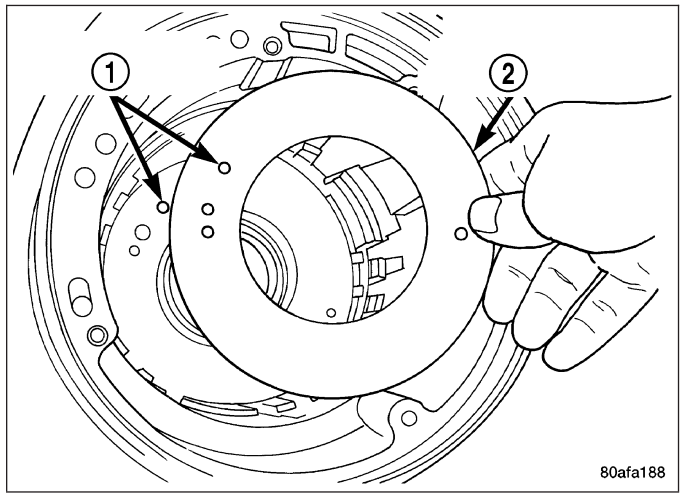
59. Remove the low/reverse clutch piston (1).
60. Remove the low/reverse piston retainer screws.



61. Remove low/reverse piston retainer (1).



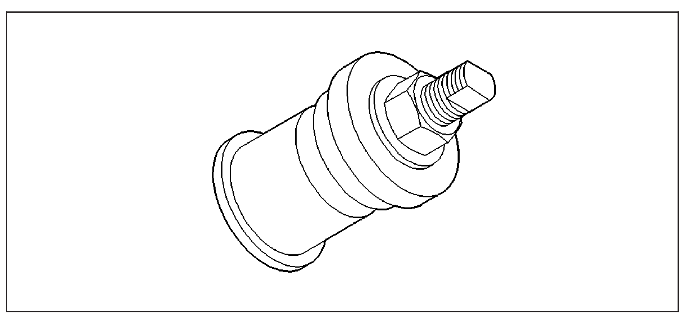

62. Remove the low/reverse piston retainer gasket (2).



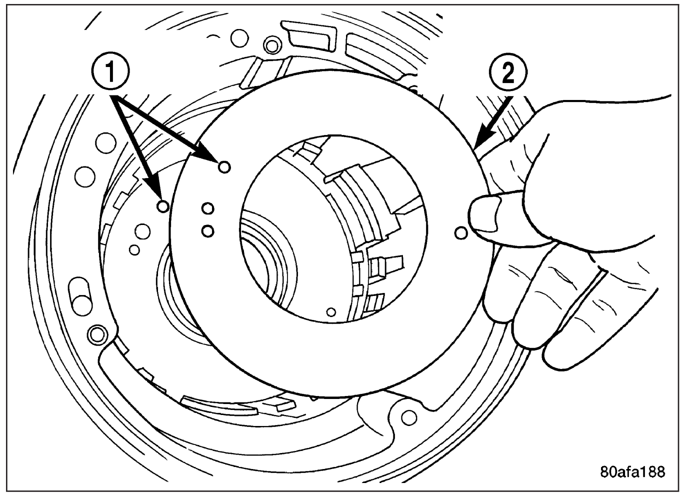

## ASSEMBLY

**NOTE: If the transmission assembly is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Quick Learn Procedure using the scan tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).**

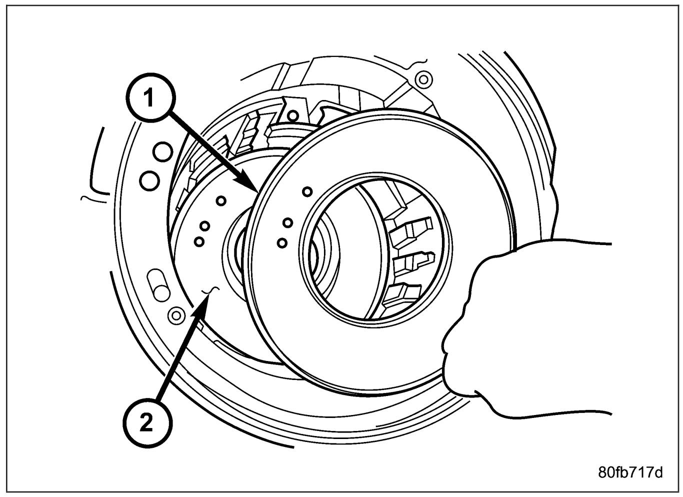
1. Install the output bearing cups using Installer 5050A.



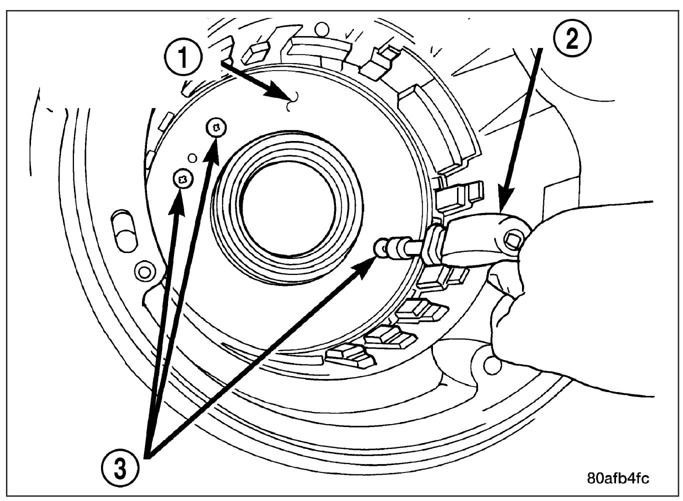
2. Install low/reverse piston retainer gasket (2).




3. Install low/reverse piston retainer (1).

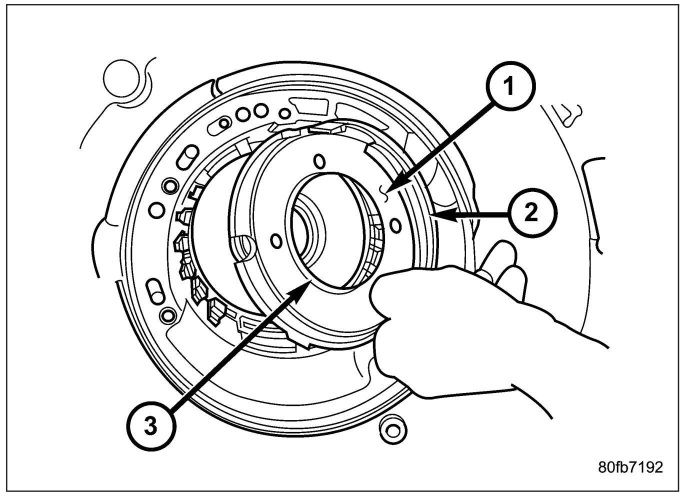



4. Install low/reverse piston retainer-to-case screws (3) and torque to 5 N·m (45 in. lbs.).

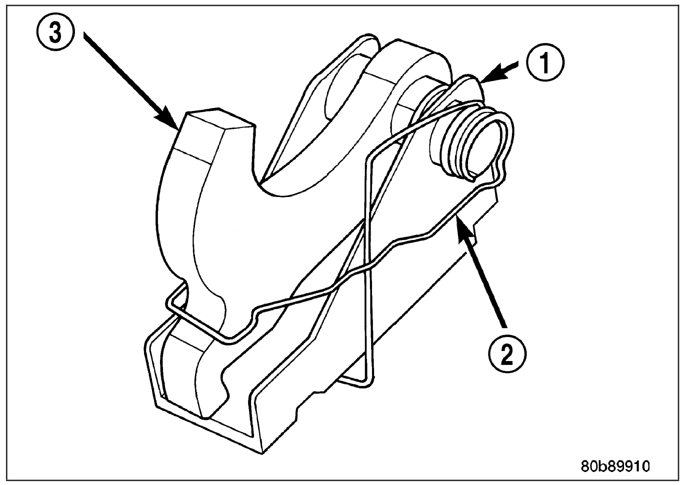


**NOTE: The Low/Reverse Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.**

5. Install low/reverse clutch piston (1).

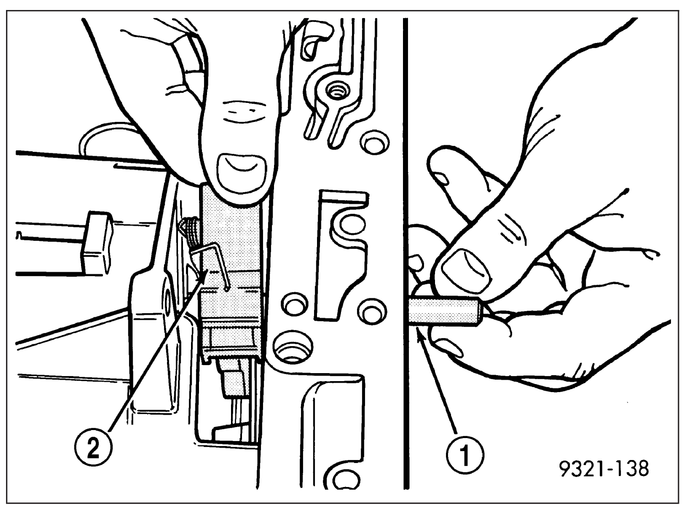



6. Assemble guide bracket (1) assembly as shown, if necessary.

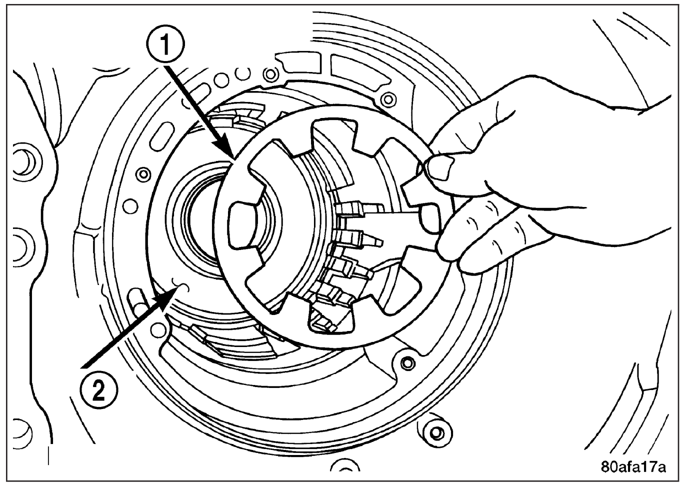



**CAUTION: When installing, be sure guide bracket and split sleeve touch the rear of the transmission case.**

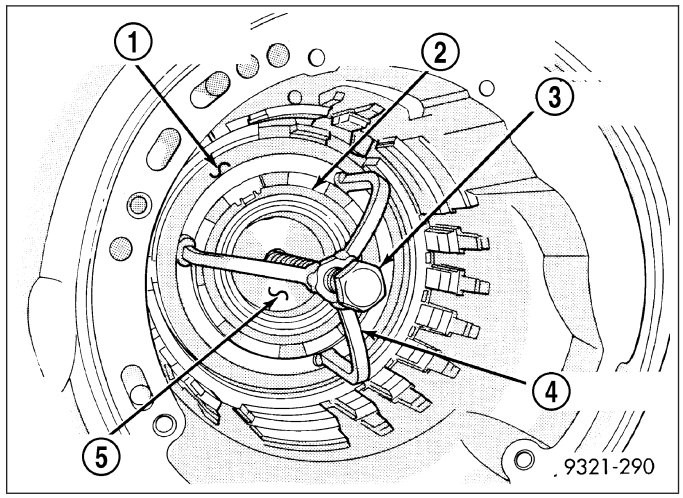
7. Install guide bracket pivot pin (1).
8. Install park sprag pivot retaining screw and torque to 4.5 N·m (40 in. lbs.).



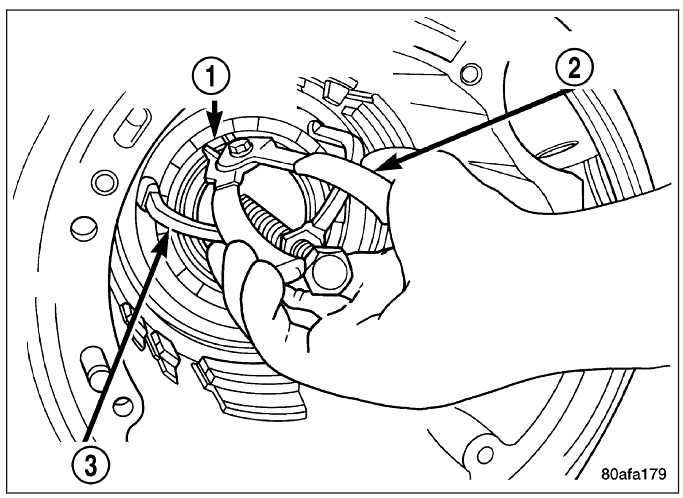
9. Install low/reverse piston belleville spring (1) into position.



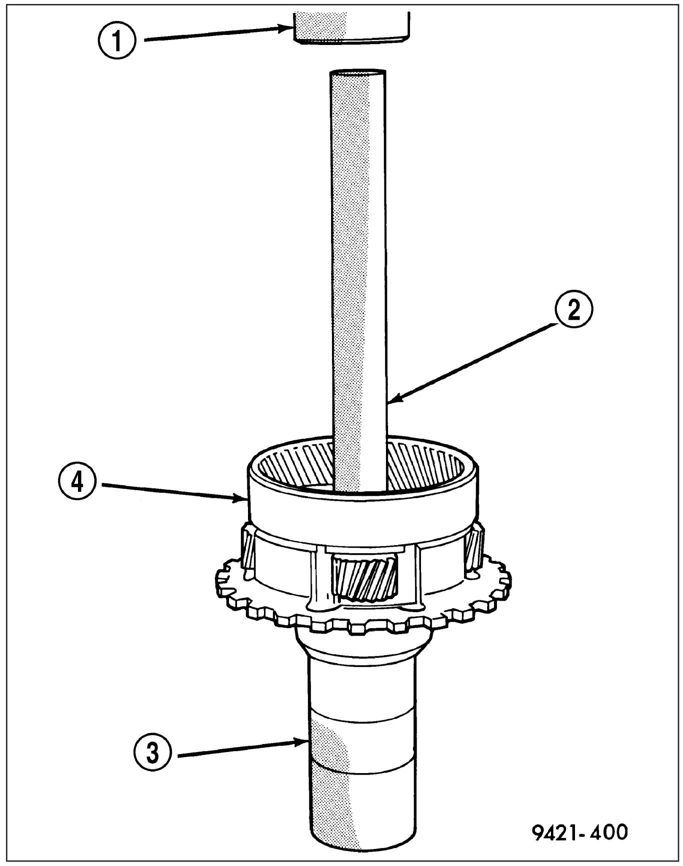

10. Install and load low/reverse spring compressor tool (3, 4, 5) as shown in to facilitate snap ring (2) installation.




11. Install snap ring (1) and remove compressor tool.



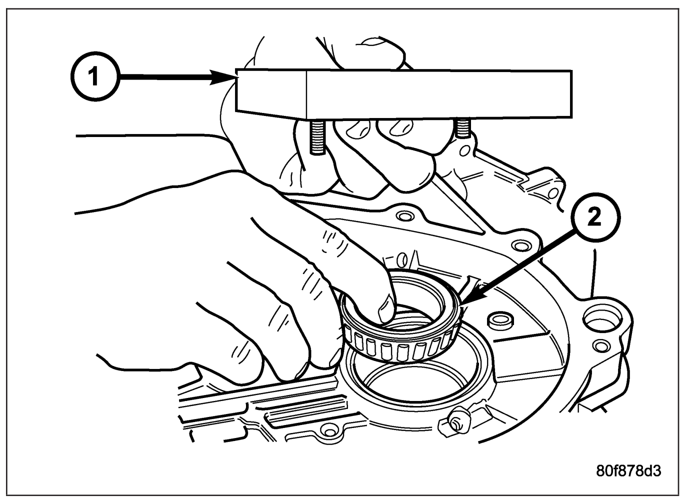
12. Install rear carrier (4) front bearing cone.



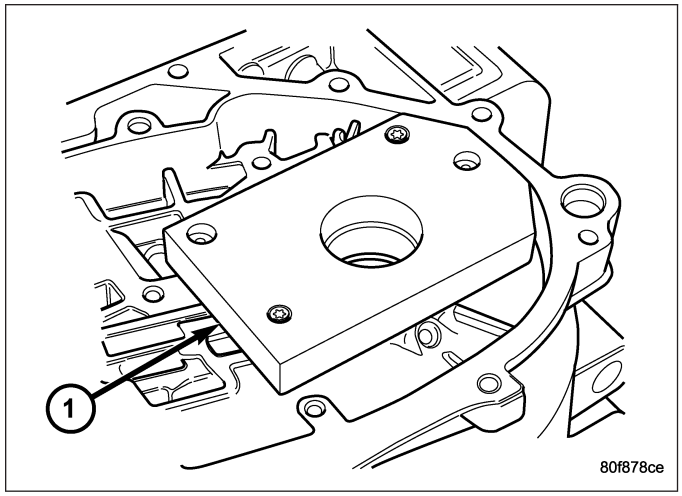

Check output bearing preload. **Output bearing preload must be checked and/or adjusted if any of the following items have been replaced:**

- Output shaft (rear carrier assembly)
- Output shafts bearings
- Transmission case

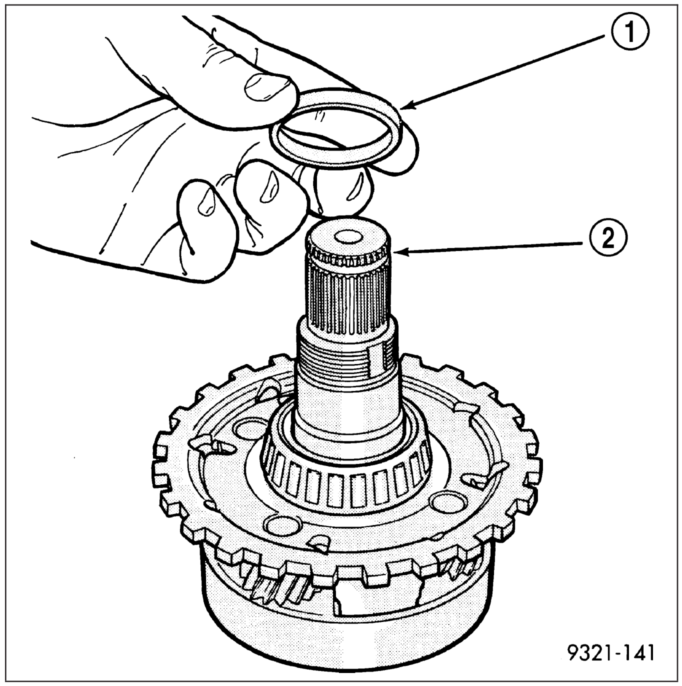
13. **PRELOAD CHECK/SHIM SELECTION:** Install rear output shaft bearing cone and Support Plate 6618A (1).



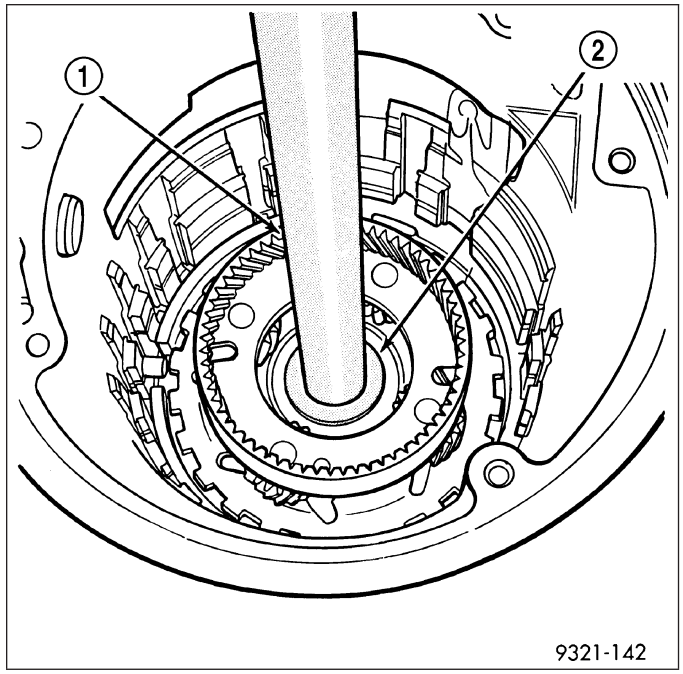
14. Install Support Plate 6618A (1). Lightly tighten retaining screws. Screws should be below the plate surface, but do not snug screws.
15. Turn case over on arbor press so that the plate is resting on the press base. **CAUTION: The output shaft will extend through the hole of Support Plate 6618A. Ensure your press table has clearance for the output shaft.**




16. Install shim (1) on output shaft (2). Apply small amount of petrolatum onto the shim to hold it in place. Use the original shim as a starting point. If original shim is not available, use the thickest shim available.

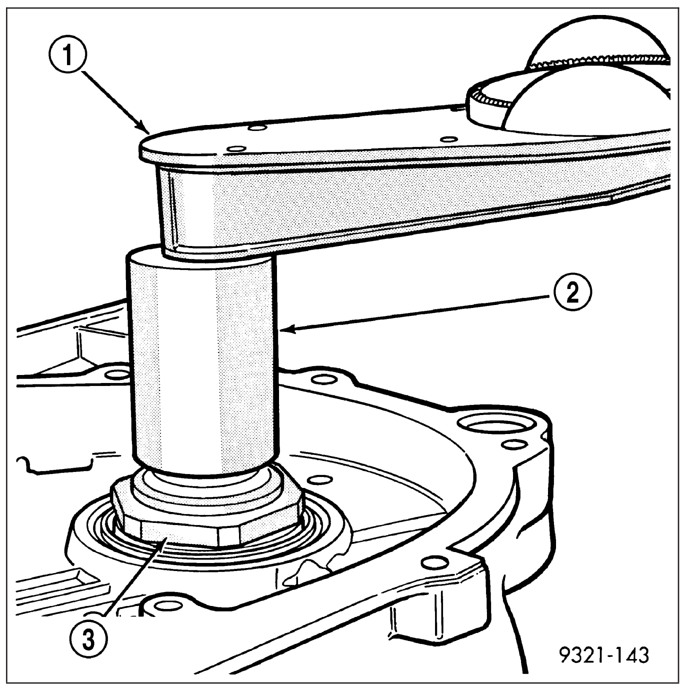


17. Install output shaft/rear carrier into rear bearing. The shaft must be pressed into position. Use Disc MD-998911 (2) and Universal Handle C- 4171 and Handle Extension C4171-2 (1) to press shaft into rear bearing.



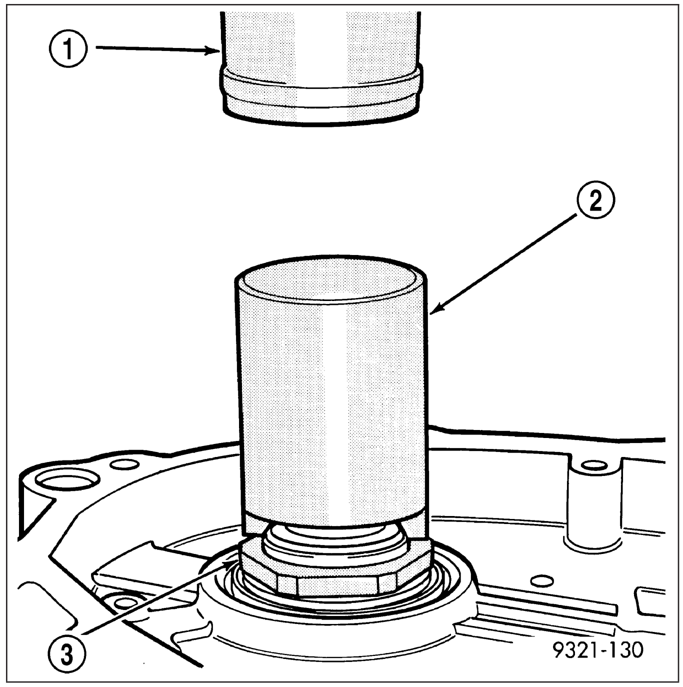

**CAUTION: Do not re-use old output shaft nut because the removed stake weakens the nut flange. Using Wrenches 6497 and 6498-A, install new output shaft nut. Tighten new output shaft nut to 271 N·m (200 ft. lbs.).**

18. Check the turning torque (1) of the output shaft. The shaft should have 1 to 8 in. lbs. of turning torque. If the turning torque is **higher than** 8 in. lbs., install a thicker shim. If turning torque is **less than** 1 in. lb., install a thinner shim. Make sure there is no end play.

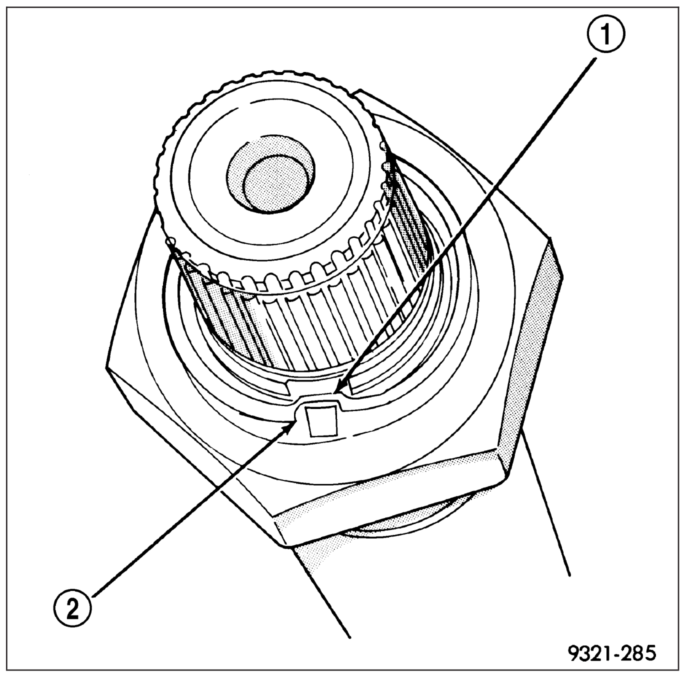


**CAUTION: Failure to stake nut could allow the nut to back-off during use.**

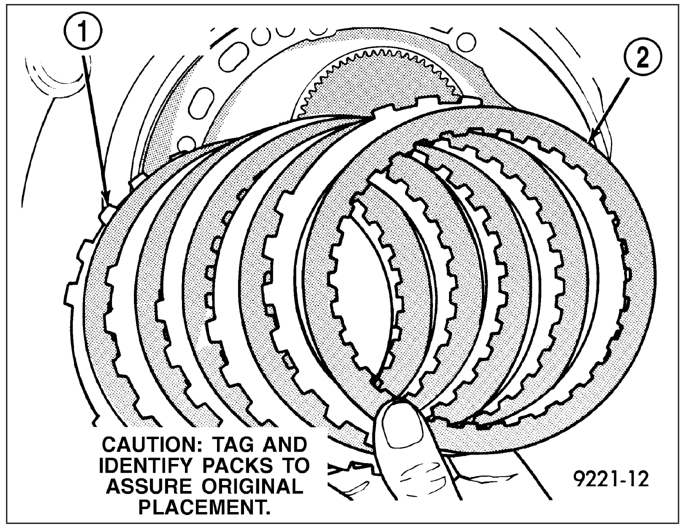
19. The new nut (3) must be staked after the correct turning torque is obtained. Use Staking Tool 6639 (2) to stake output shaft nut.



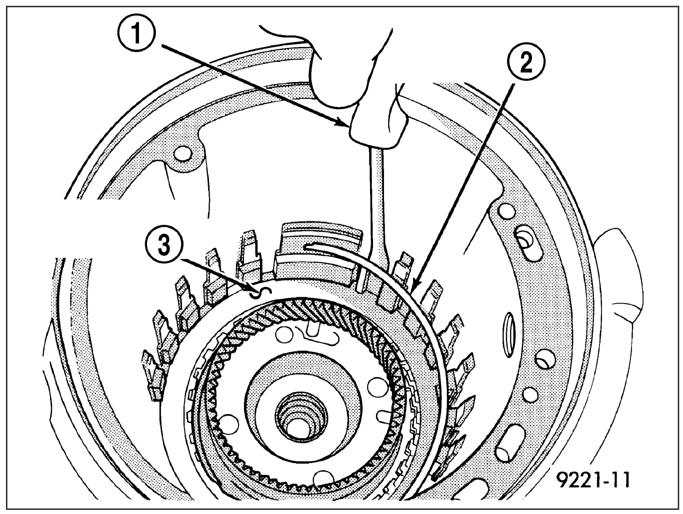

20. Verify that the nut has been properly staked to the output shaft.



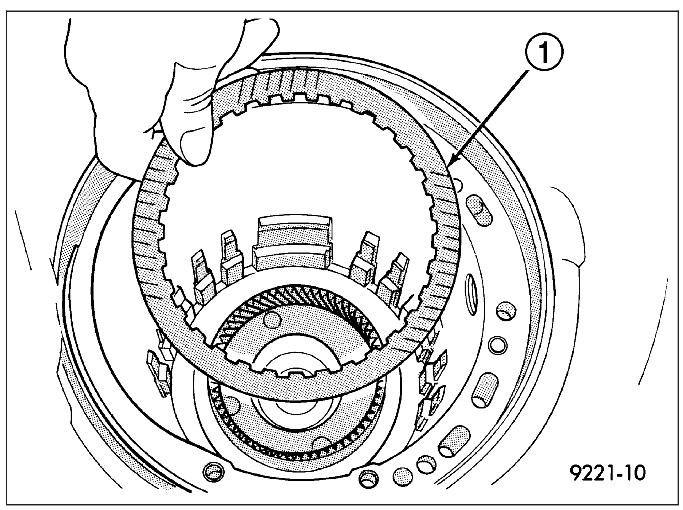
21. Install low/reverse clutch pack (1, 2). Leave uppermost disc out to facilitate snap ring installation.



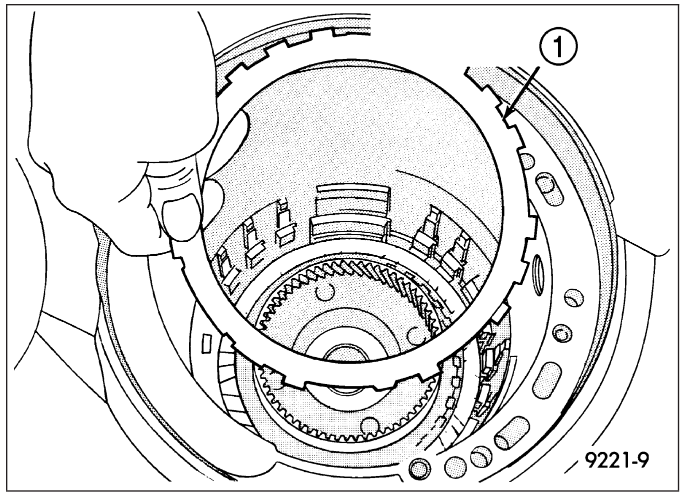

22. Install low/reverse reaction plate snap ring (2).



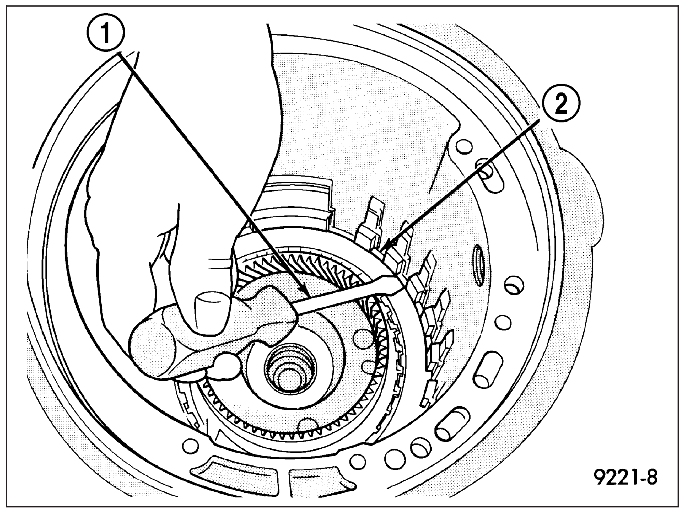

23. Install one low/reverse clutch disc (1).



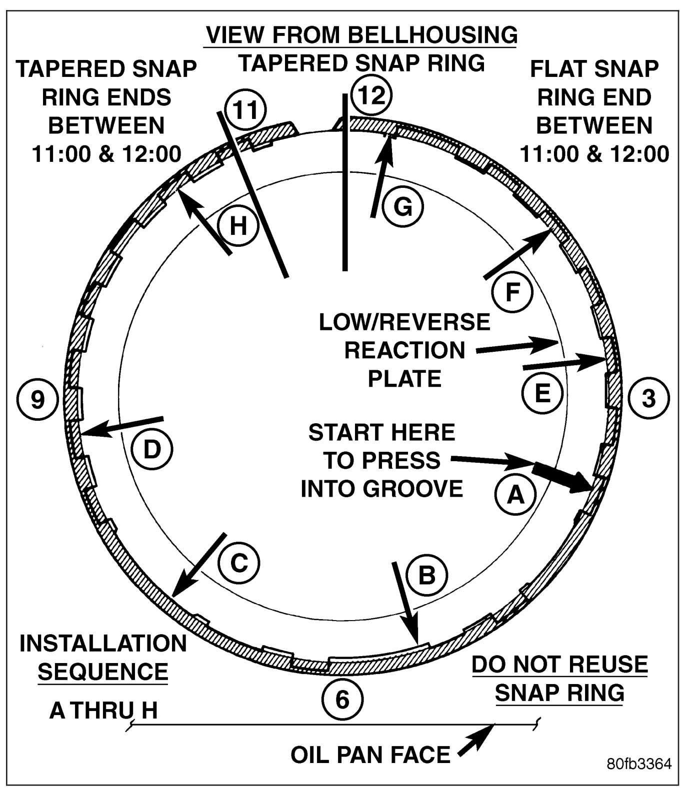
24. Install low/reverse reaction plate (1) with flat side up.



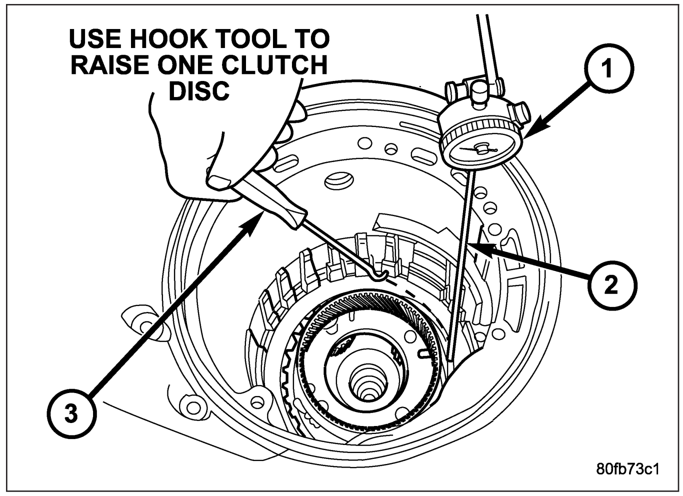

25. Install a new tapered snap ring (2) (tapered side out).



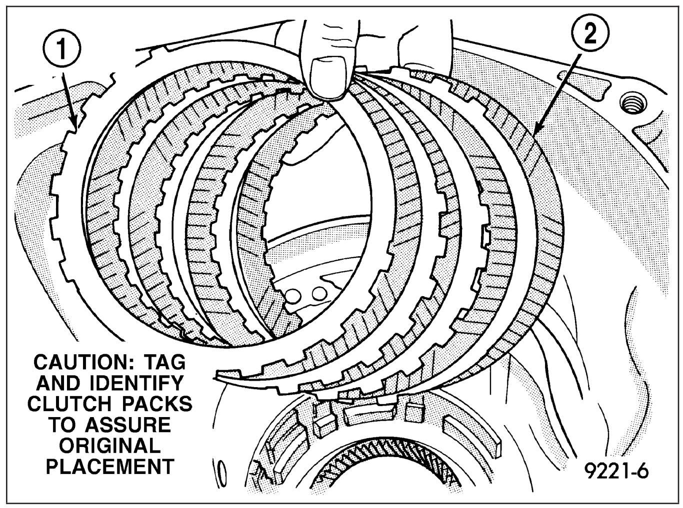

26. Make sure that the snap ring ends are oriented as shown.



27. Measure low/reverse clutch pack. Set up dial indicator (1) as shown. Press down clutch pack with finger and zero dial indicator. Record measurement in four (4) places and take average reading. **Low/Reverse clutch pack clearance is 0.84 to 1.60 mm (0.033 to 0.063 inch).**
28. Select the proper low/reverse reaction plate to achieve specifications.

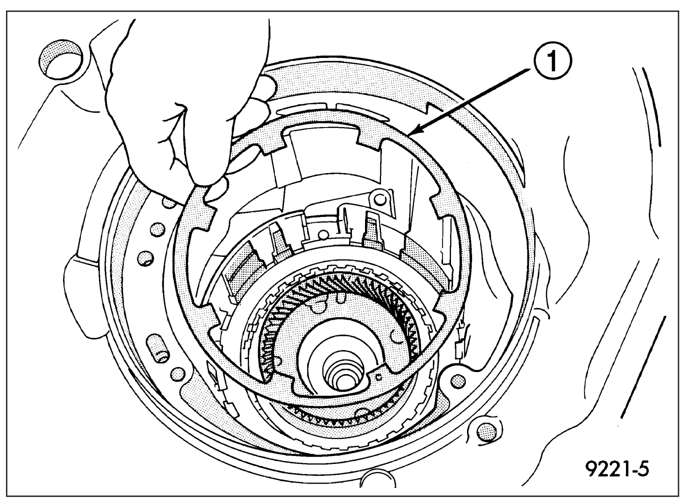



29. Install 2/4 clutch pack (1, 2).

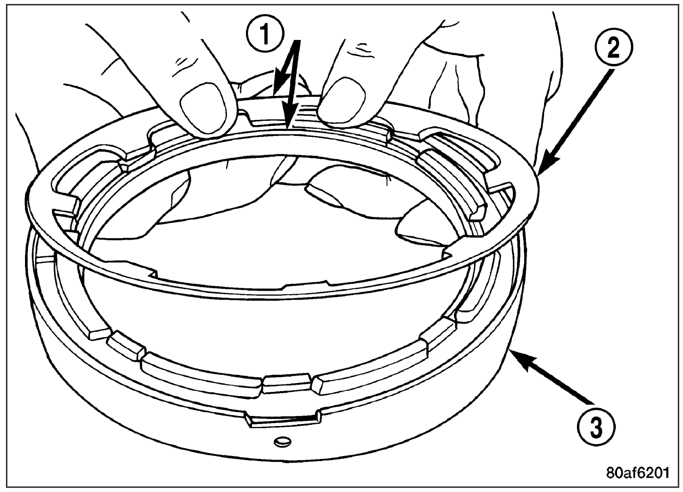



**NOTE: The 2/4 Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.**

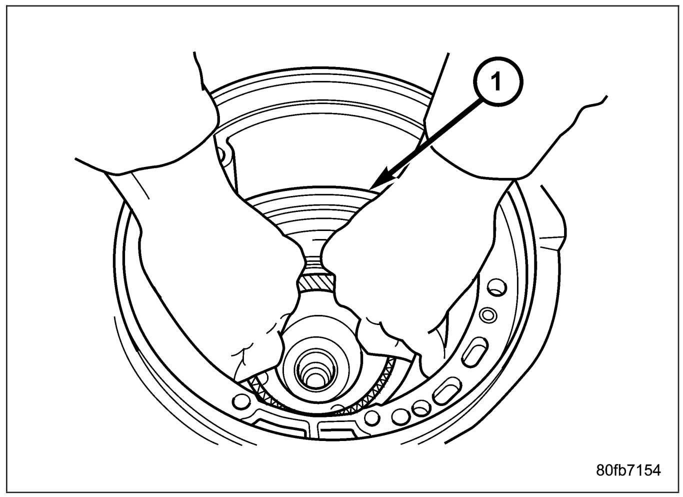
30. Install 2/4 clutch belleville spring (1).



31. Verify the proper orientation of the return spring (2) to the 2/4 retainer (3).

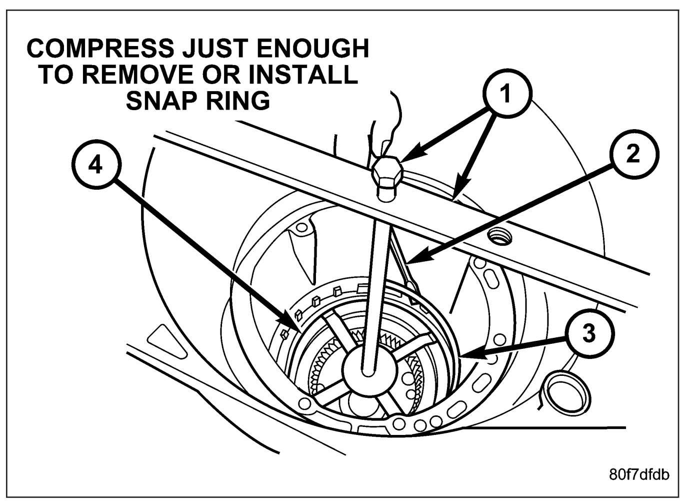



32. Install 2/4 clutch retainer (1).

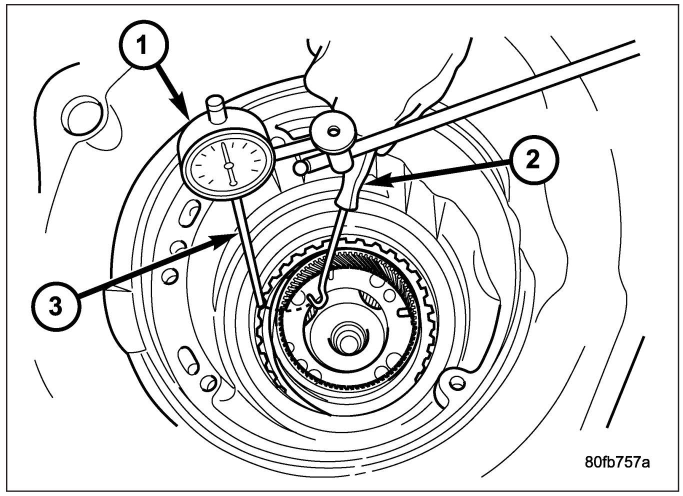



**NOTE: Verify that Compressor 5058A (1) is centered properly over the 2/4 clutch retainer (4) before compressing. If necessary, fasten the bar from Compressor 5058A to the bellhousing flange with any combination of locking pliers and bolts to center the tool properly.**

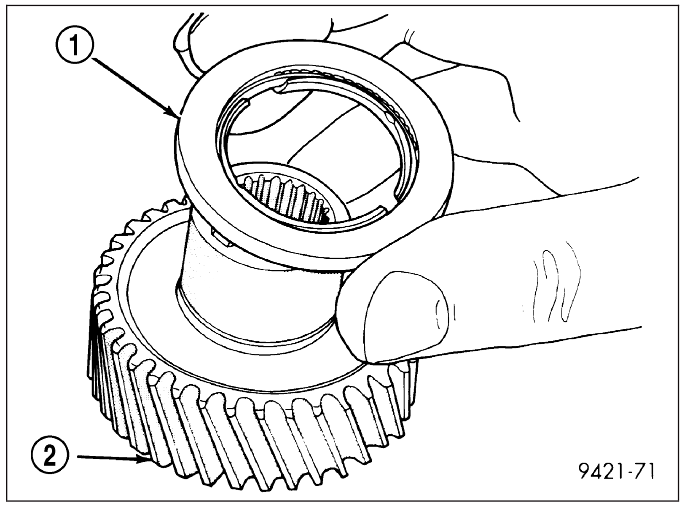
33. Set up Compressor 5058 (1) as shown. Compress 2/4 clutch just enough to facilitate snap ring installation.



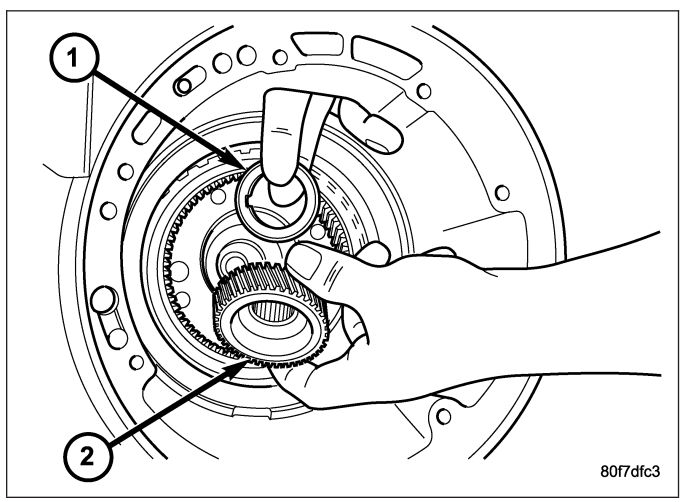
34. **Measure 2/4 clutch clearance:** Set up dial indicator (1) as shown. Press down clutch pack with finger and zero dial indicator. Record measurement in four (4) places and take average reading. **The 2/4 clutch pack clearance is 0.76 to 2.64 mm (0.030 to 0.104 inch).** If not within specifications, the clutch is not assembled properly or is excessively worn. **There is no adjustment for the 2/4 clutch clearance.**



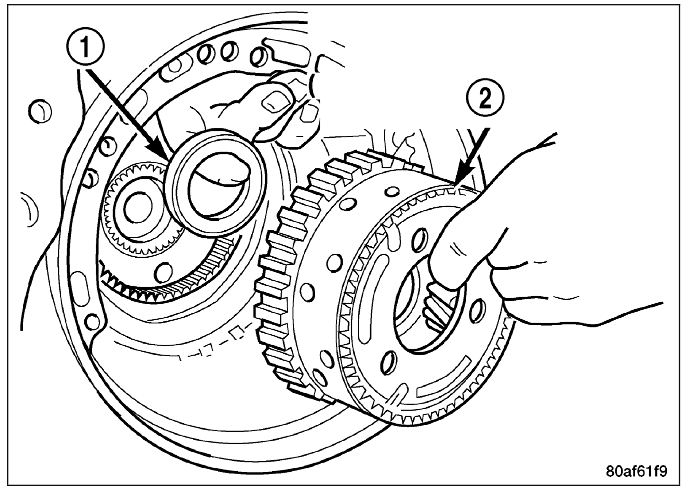

35. Install the #7 needle bearing (1) to the rear sun gear (2). **The number 7 needle bearing has three antireversal tabs and is common with the number 5 and number 2 position. The orientation should allow the bearing to seat flat against the rear sun gear. A small amount of petrolatum can be used to hold the bearing to the rear sun gear.**



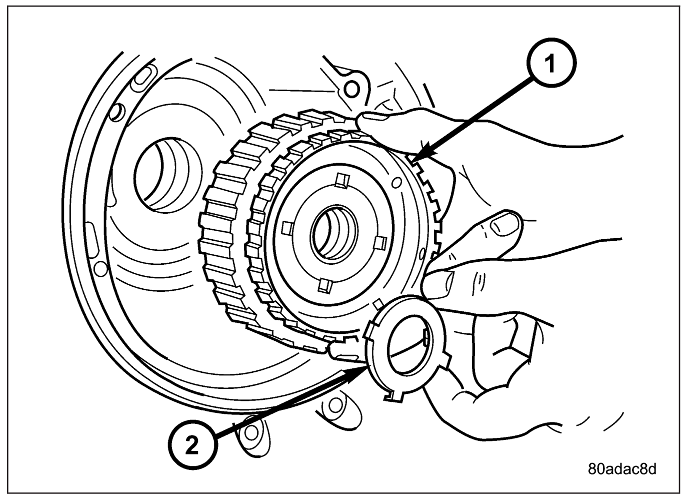

36. Install rear sun gear (2) and #7 needle bearing (1).



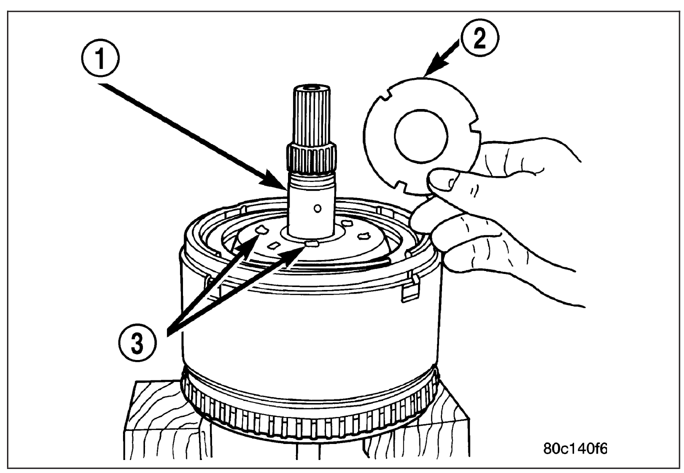
37. Install front carrier/rear annulus assembly (2) and #6 needle bearing (1).



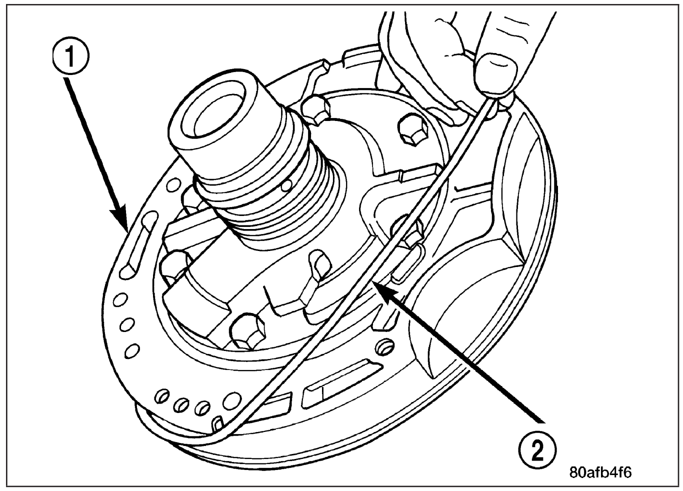

38. Install front sun gear assembly (1) and #4 thrust washer (2).



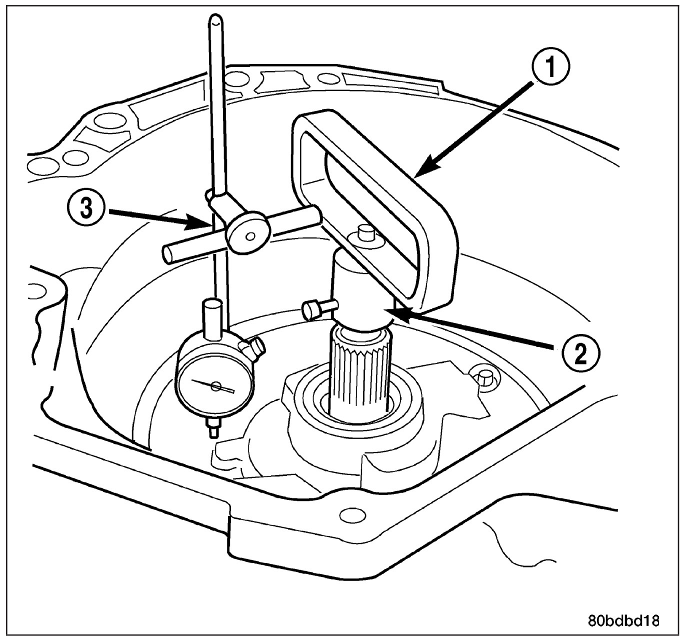

39. Determine proper #4 thrust plate thickness. Select the thinnest available #4 thrust plate.
40. Install #4 thrust plate (2) using petrolatum to hold into position.
41. Install input clutch assembly. Ensure the input clutch assembly is completely seated by viewing position through input speed sensor hole. **If the speed sensor tone wheel is not centered in the opening, the input clutches assembly is not seated properly.**



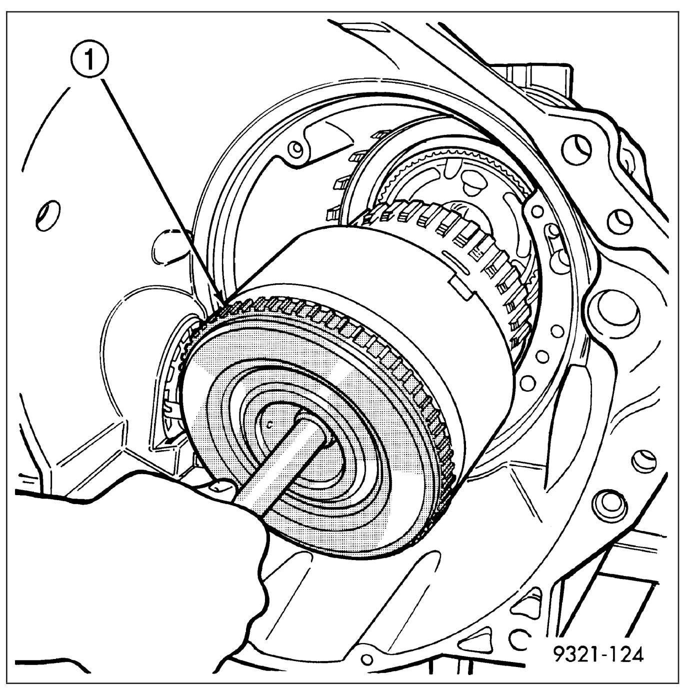
42. Remove the oil pump o-ring (2) and install oil pump and gasket to transmission. **Use screw-in dowels or Phillips head screwdrivers to align pump to case. Be sure to reinstall O-ring on oil pump after selecting the proper No. 4 thrust plate.**



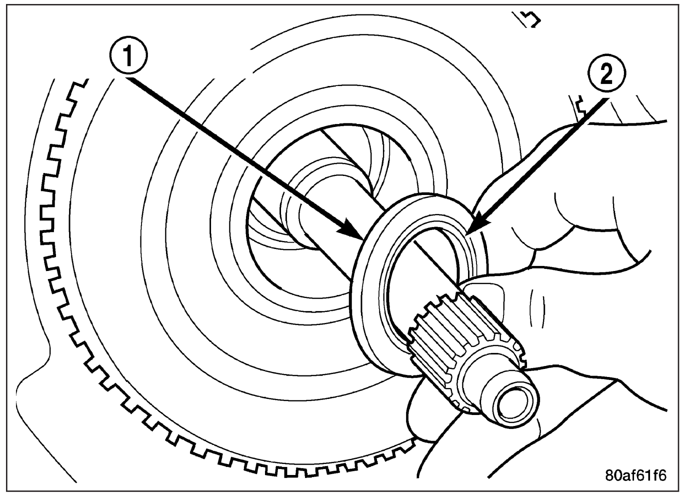

43. Measure the input shaft end play with the transmission in the vertical position. This will ensure that the measurement will be accurate.
44. Set up and measure endplay using End Play Set 8266 (1, 2) and Dial Indicator Set C3339 (3) as shown.
45. Measure input shaft end play. **Input shaft end play must be 0.127 to 0.635 mm (0.005 to 0.025 inch).** For example, if end play reading is 0.055 inch, select No. 4 Thrust Plate which is 0.071 to 0.074 thick. This should provide an input shaft end play reading of 0.020 inch, which is within specifications.




46. Remove oil pump, gasket, and input clutch assembly to gain access to and install proper #4 thrust plate.
47. Install input clutch assembly (1) with proper thrust plate.

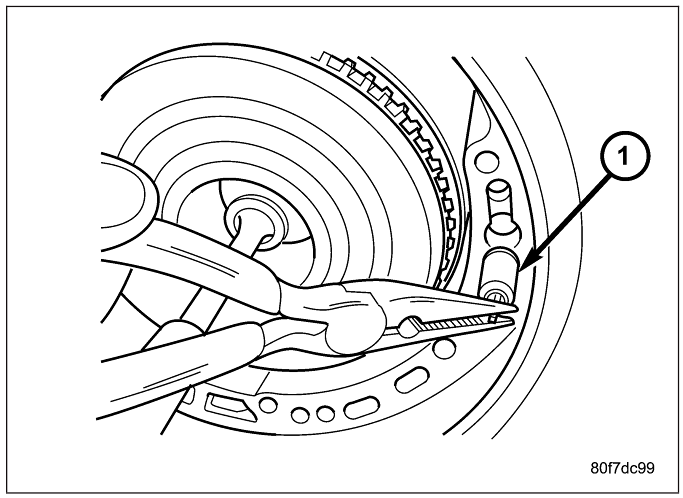


48. Install #1 caged needle bearing (1).



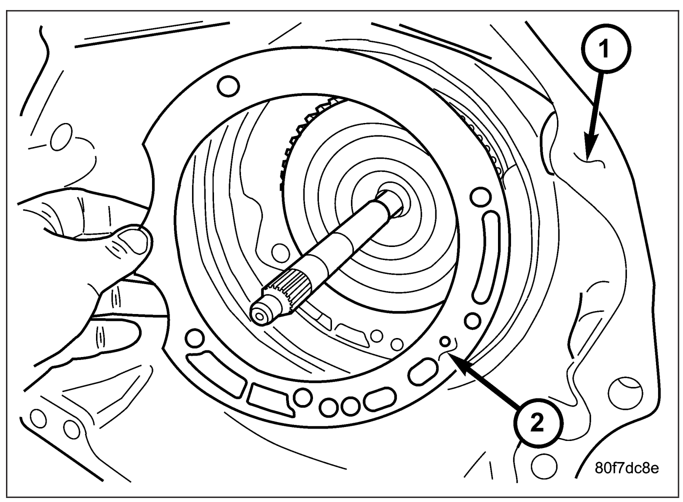

**CAUTION: By-pass valve MUST be replaced if transmission failure occurs.**

49. Replace cooler by-pass valve (1) if transmission failure has occurred.

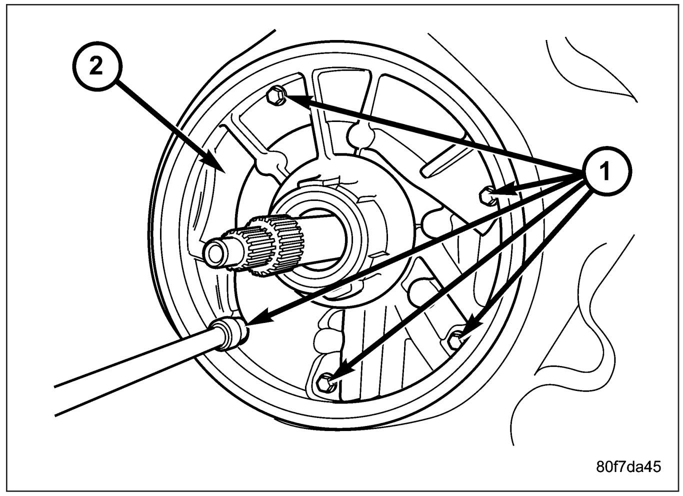



**NOTE: To align oil pump, gasket, and case during installation, use threaded dowels or Phillips screwdrivers.**

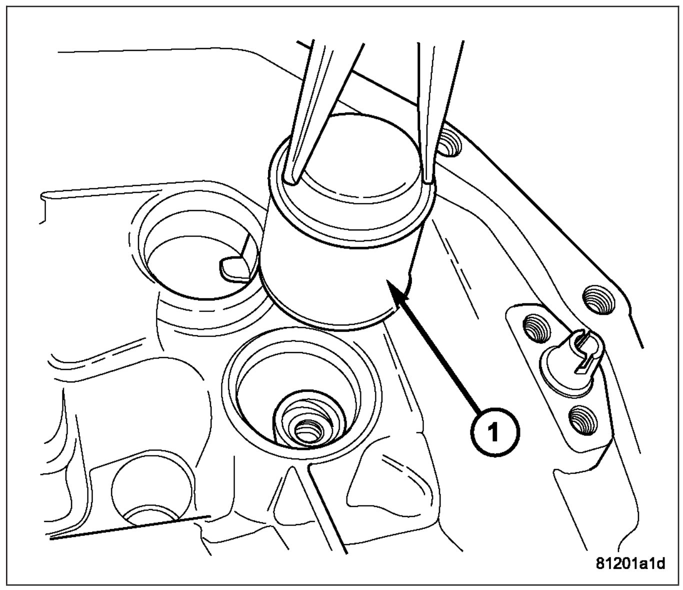
50. Install oil pump gasket (2).



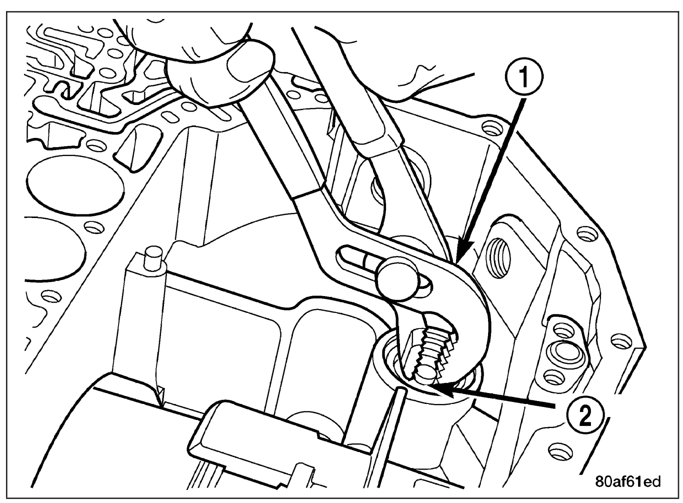
51. Install oil pump (2) and torque oil pump-to-case bolts (1) to 30 N·m (265 in. lbs.). Do not reuse original oil pump bolts.



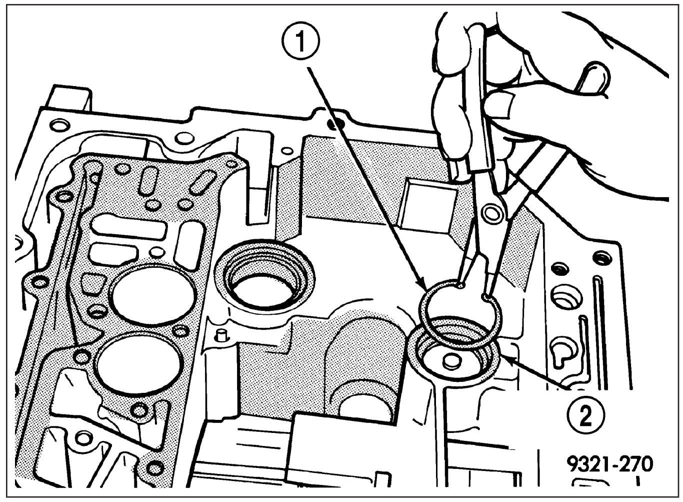

52. Install low/reverse accumulator (1) as shown.



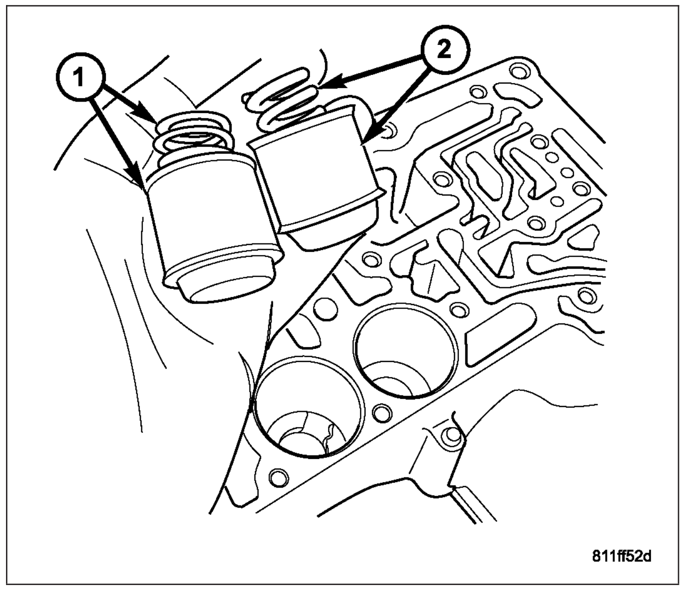

53. Install low/reverse accumulator plug (2).



54. Install low/reverse accumulator snap ring (1).

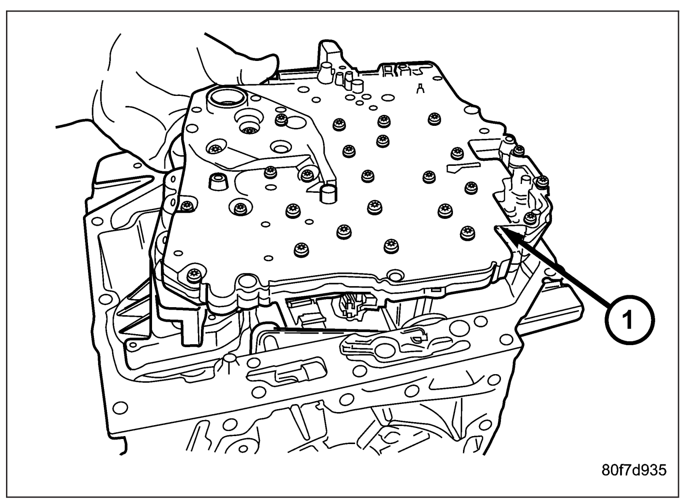



55. Install underdrive (2) and overdrive (1) accumulators and springs.

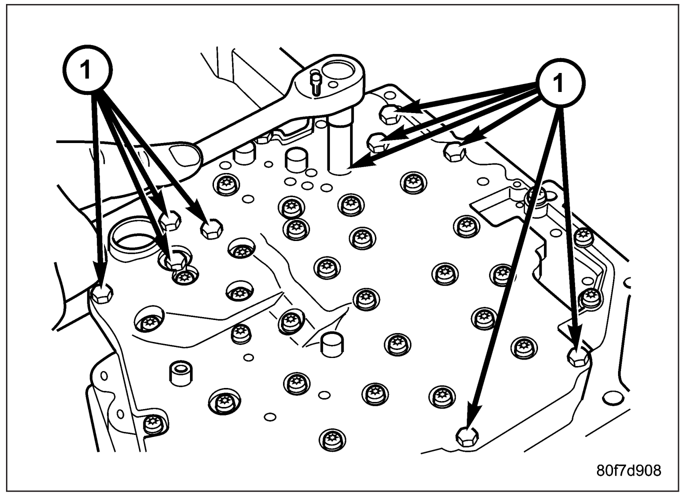



**CAUTION: Do not handle the valve body by the manual shaft. Damage could result.**

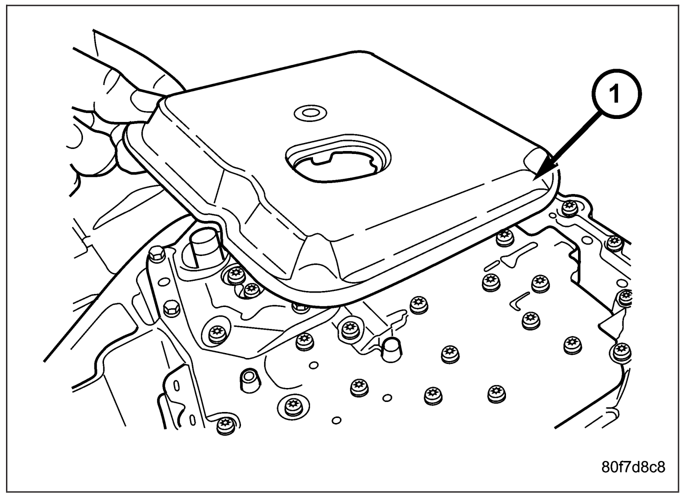
56. Install valve body (1) into place as shown.



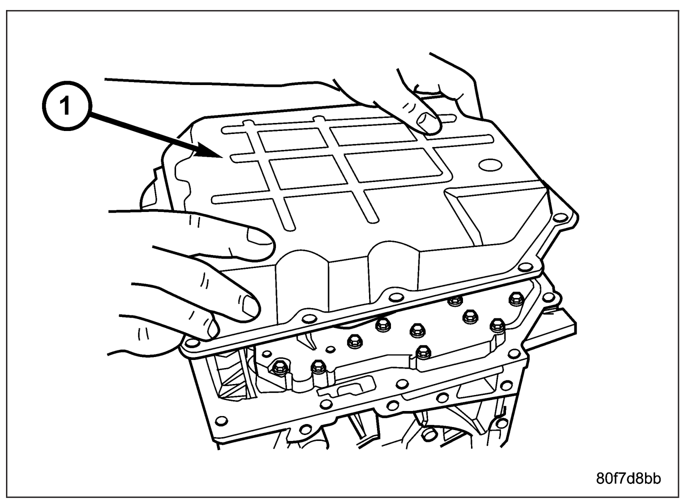
57. Install seven (7) valve body-to-case bolts (1) and torque to 12 N·m (105 in. lbs.).




58. Install transmission oil filter (1). Tighten the bolts to 5 N·m (45 in. lbs.).

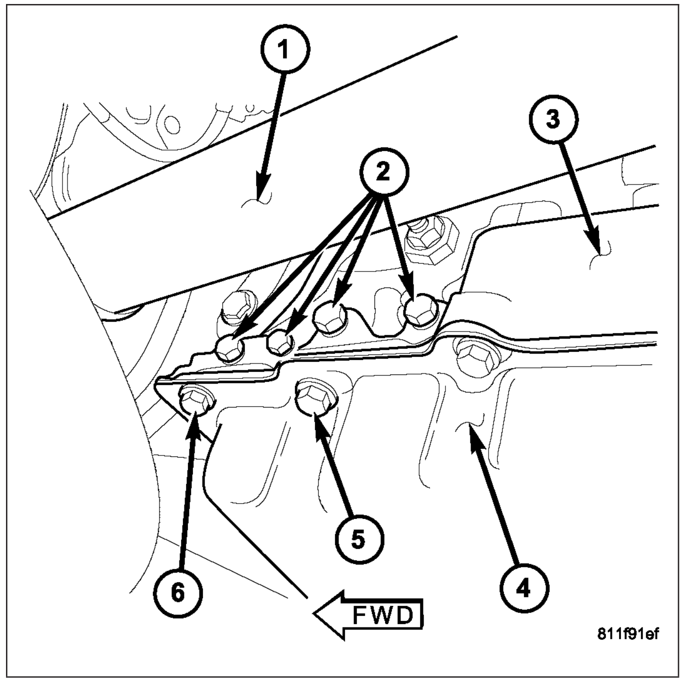



59. Install transmission oil pan (1) with a bead of Mopar® ATF RTV.



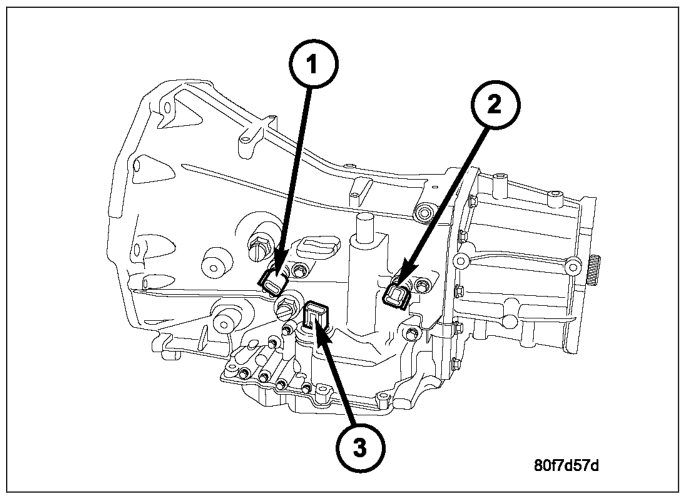
**NOTE: Before installing the oil pan bolt in the bolt hole located between the torque converter clutch on and U/D clutch pressure tap circuits , it will be necessary to replenish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.**

60. Install and torque the oil pan-to-case bolts to 20 N·m (14.5 ft. lbs.).

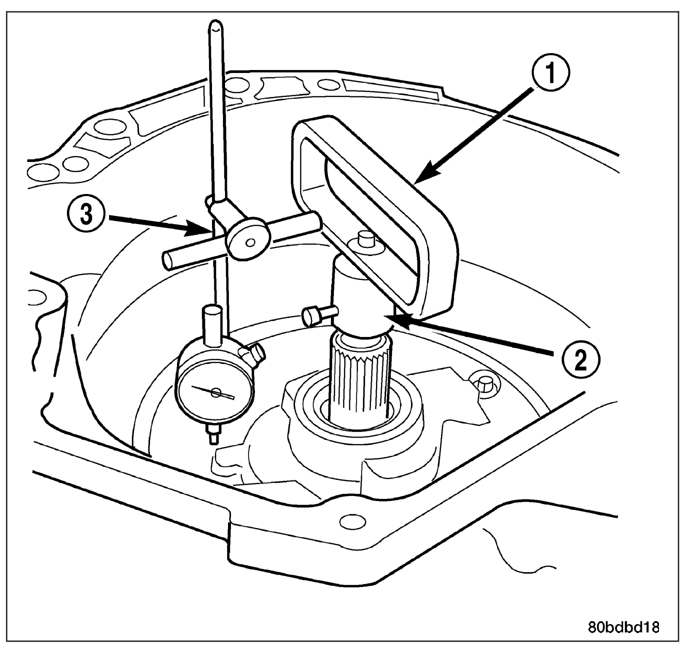



**NOTE: Before installing either speed sensor bolt, it will be necessary to replenish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.**

61. Install both speed sensors (1, 2) into the transmission case. Torque the speed sensor bolts to 9 N·m (80 in. lbs.).

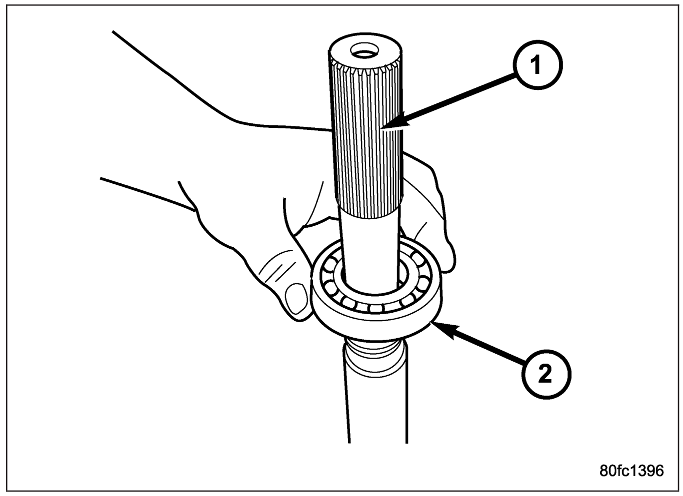



62. As a final check of the transmission, measure the input shaft end play. This will indicate when a #4 thrust plate change is required. The #4 thrust plate is located behind the overdrive clutch hub. Attach a dial indicator to transmission bell housing with its plunger seated against end of input shaft. Move input shaft in and out to obtain end play reading. **Input shaft end play must be 0.127 to 0.635 mm (0.005 to 0.025 inch).** If not within specifications, make the necessary thrust plate adjustment.

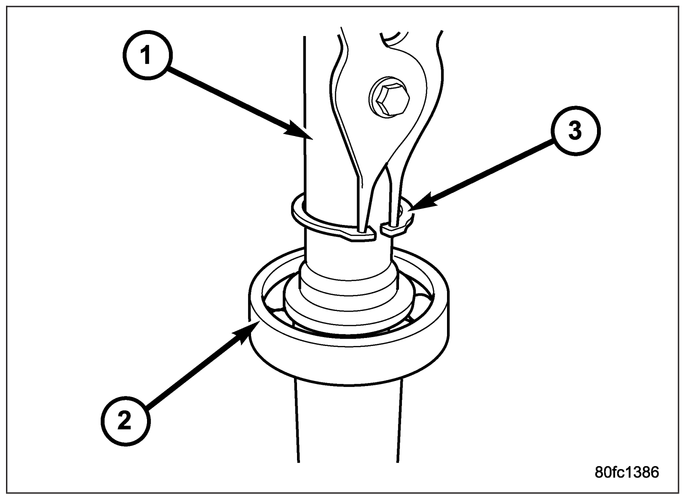


63. On 4X2 transmissions, perform the following, if necessary:

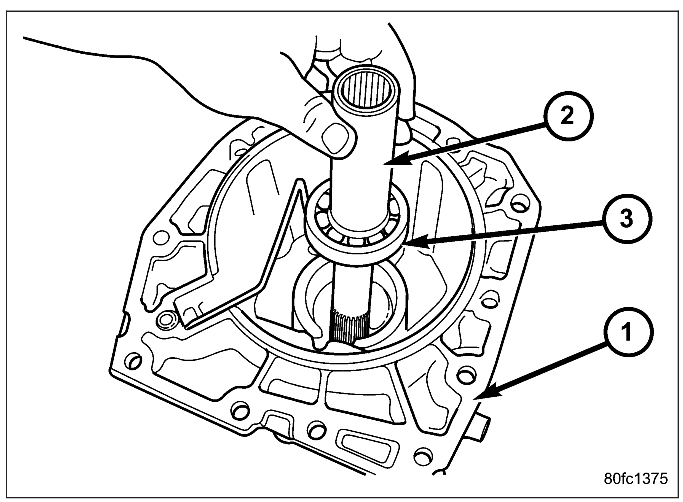
a. Install the extension shaft bearing (2) onto the extension shaft.



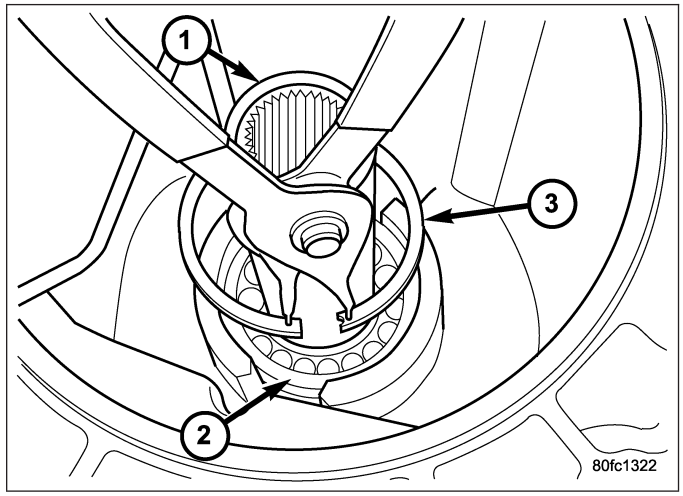

b. Install the extension shaft bearing retaining ring (3) onto the extension shaft (1).



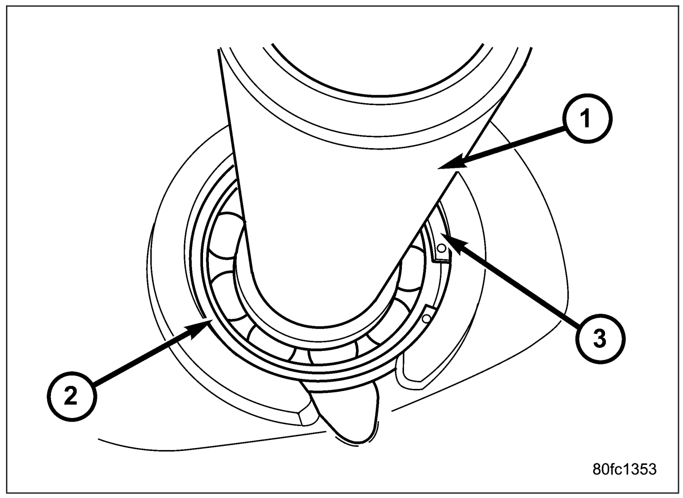

c. Install the extension shaft (2) and bearing assembly (3) into the extension housing (1).



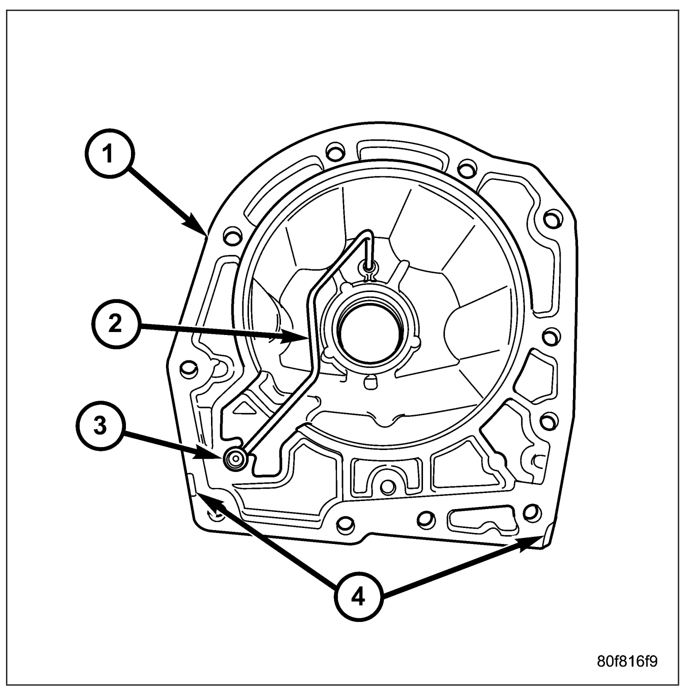
d. Install the extension shaft bearing snap ring (3) into the extension housing.



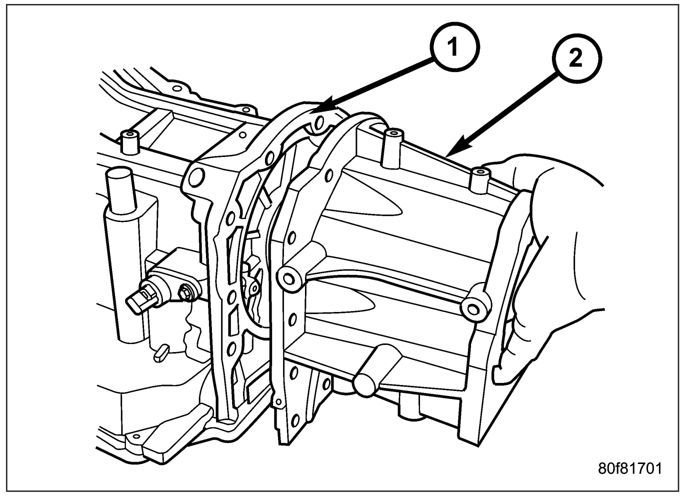

e. Verify that the extension shaft snap ring (3) is fully engaged in the snap ring groove.



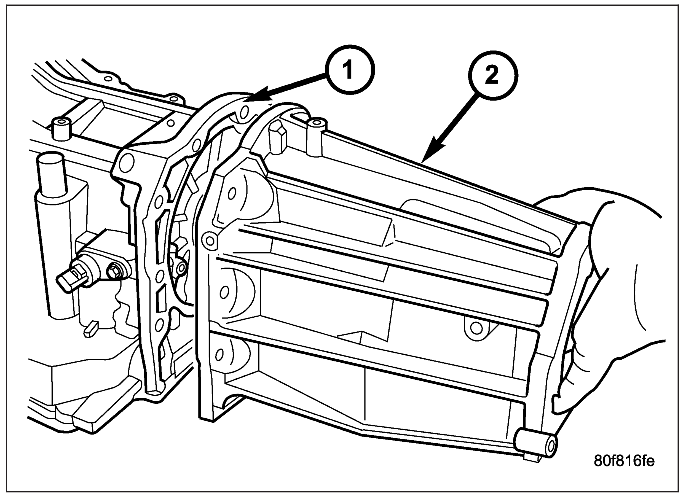

64. Inspect the lube tube grommet (2) for damage. If the grommet lip is damaged, it will need to be replaced.



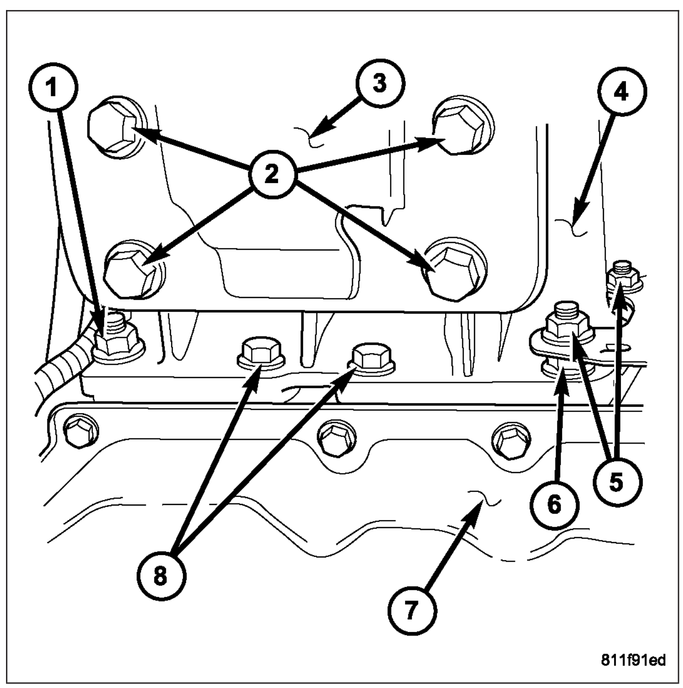
65. Install the 4X4 stub shaft onto the transmission output shaft.
66. Place a bead of Mopar® ATF RTV on the rear surface of the transmission case for the adapter/extension housing.
67. Install the adapter housing (2) onto the transmission case, 4X4 vehicles only.



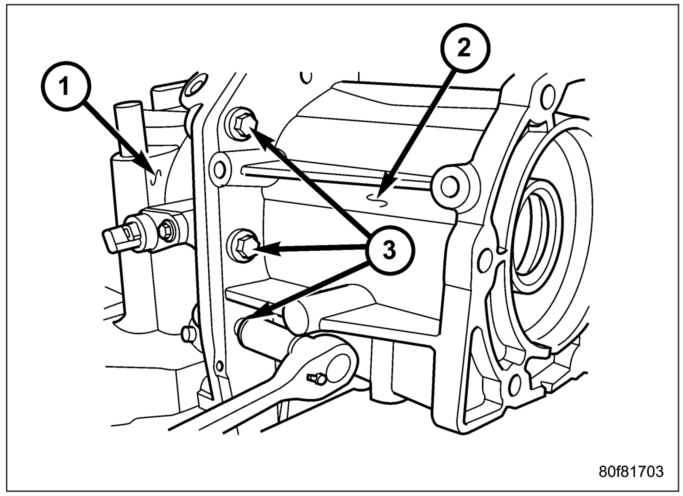

68. Install the extension housing (2) onto the transmission case, 4X2 vehicles only.




**NOTE: Before installing the lowermost four adapter/extension housing bolts, it will be necessary to replenish the sealing patch on the bolts using Mopar® Lock & Seal Adhesive.**

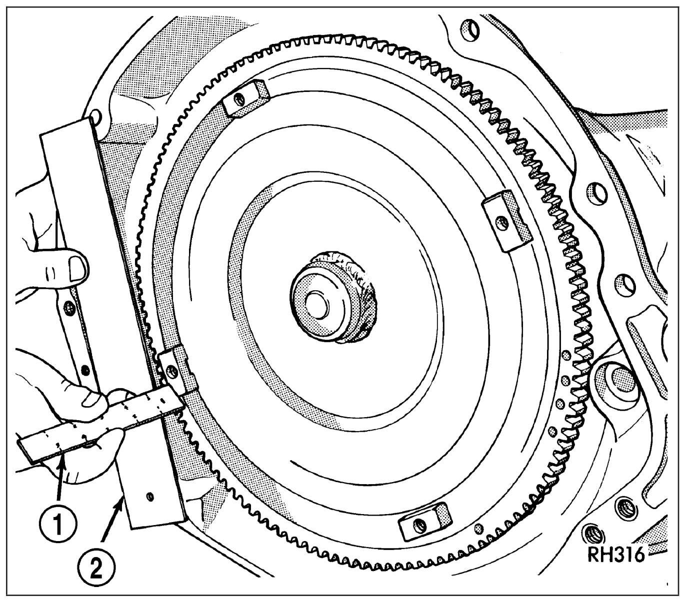


69. Install the bolts that hold the adapter or extension housing onto the transmission case. Be sure to install any stud bolts to their original locations. Tighten the bolts to 54 N·m (40 ft.lbs.).

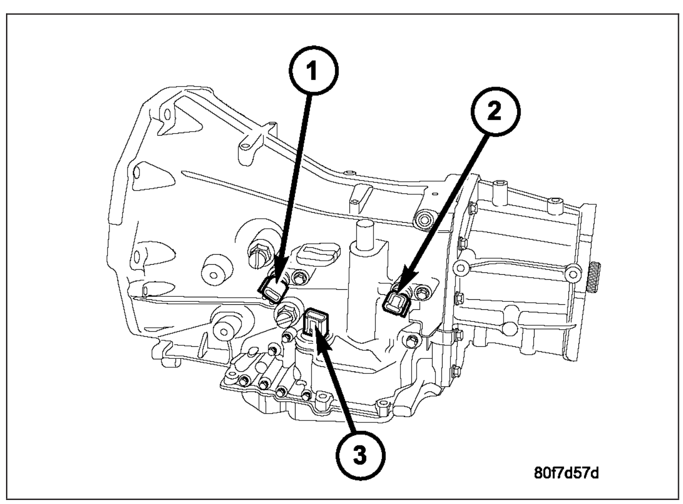



## INSTALLATION

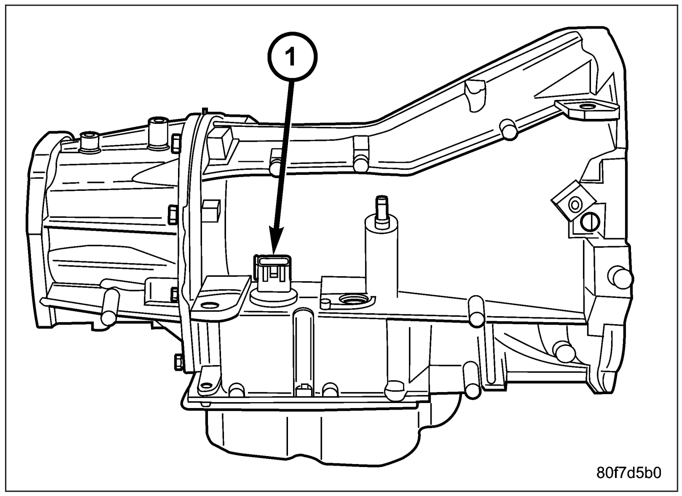
1. Check torque converter hub and hub drive flats for sharp edges burrs, scratches, or nicks. Polish the hub and flats with 320/400 grit paper and crocus cloth if necessary. Verify that the converter hub o-ring is properly installed and is free of any debris. The hub must be smooth to avoid damaging pump seal at installation.
2. If a replacement transmission is being installed, transfer any components necessary, such as the manual shift lever and shift cable bracket, from the original transmission onto the replacement transmission.
3. Lubricate oil pump seal lip with transmission fluid.
4. Align converter and oil pump.
5. Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.



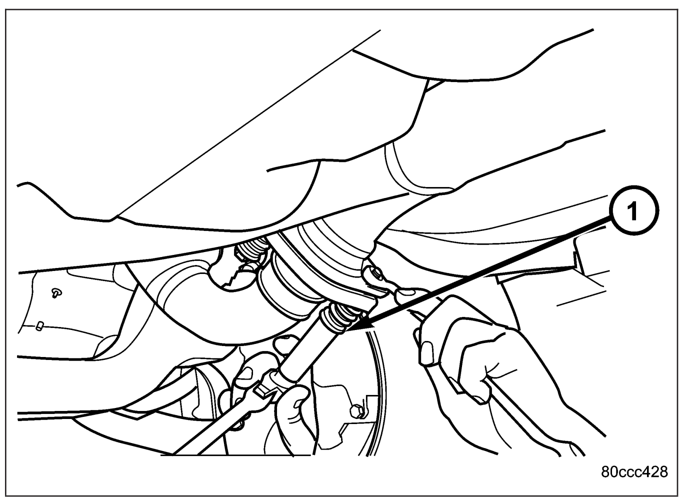

6. Check converter seating with steel scale (1) and straightedge (2). Surface of converter lugs should be at least 13mm (1/2 in.) to rear of straightedge when converter is fully seated.
7. Temporarily secure converter with C-clamp.
8. Position transmission on jack and secure it with chains.
9. Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**
10. Apply a light coating of MOPAR® High Temp Grease to the torque converter hub pocket in the rear pocket of the engine's crankshaft.
11. Raise transmission and align the torque converter with the drive plate and transmission converter housing with the engine block.
12. Move transmission forward. Then raise, lower or tilt transmission to align the converter housing with engine block dowels.



13. Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft. Verify that no wires, or the transmission vent hose, have become trapped between the engine block and the transmission.
14. Install two bolts to attach the transmission to the engine.
15. Install remaining torque converter housing to engine bolts. Tighten to 68 N·m (50 ft.lbs.).
16. Install transfer case, if equipped. Tighten transfer case nuts to 35 N·m (26 ft.lbs.).
17. Install rear transmission crossmember. Tighten crossmember to frame bolts to 68 N·m (50 ft.lbs.).
18. Install rear support to transmission. Tighten bolts to 47 N·m (35 ft.lbs.).
19. Lower transmission onto crossmember and install bolts attaching transmission mount to crossmember. Tighten clevis bracket to crossmember bolts to 47 N·m (35 ft.lbs.). Tighten the clevis bracket to rear support bolt to 68 N·m (50 ft.lbs.).
20. Remove engine support fixture.
21. Connect gearshift cable to support bracket and transmission manual lever.
22. Connect input (1) and output speed sensor (3) wires.
23. Connect wires to the transmission range sensor (3).
24. Connect wires to the solenoid/pressure switch assembly (1).

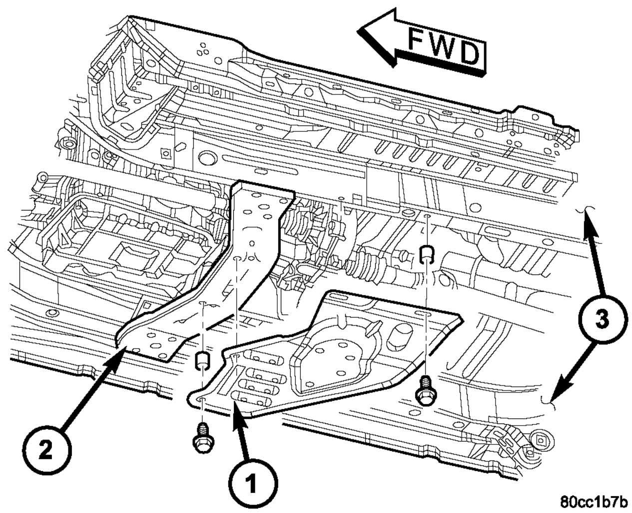



**CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the clutch surface inside the converter.**



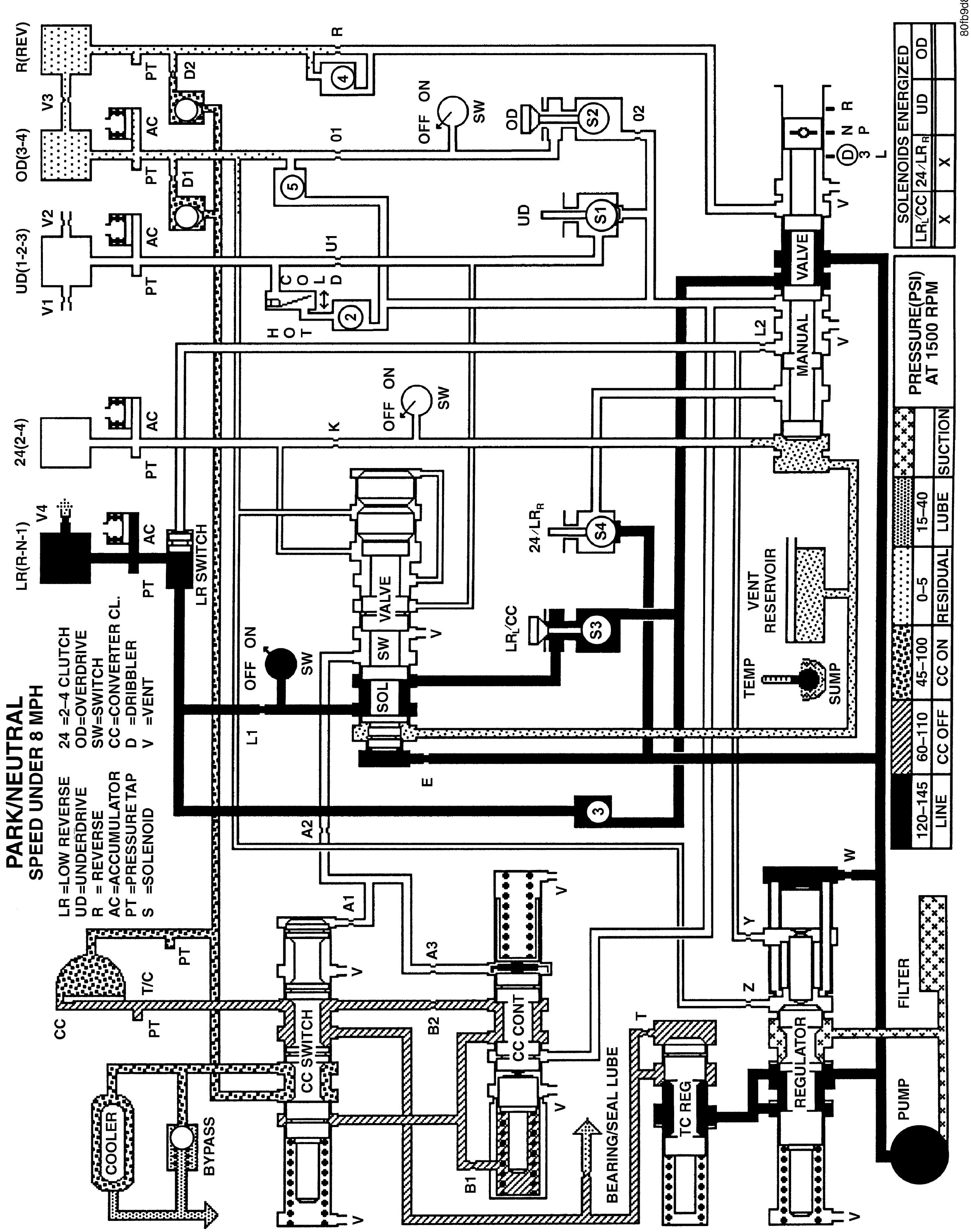

25. Install torque converter-to-driveplate bolts. Tighten bolts to 88 N·m (65 in. lbs.).
26. Install starter motor and cooler line bracket.
27. Connect cooler lines to transmission.
28. Install transmission fill tube.
29. Install exhaust components (1).

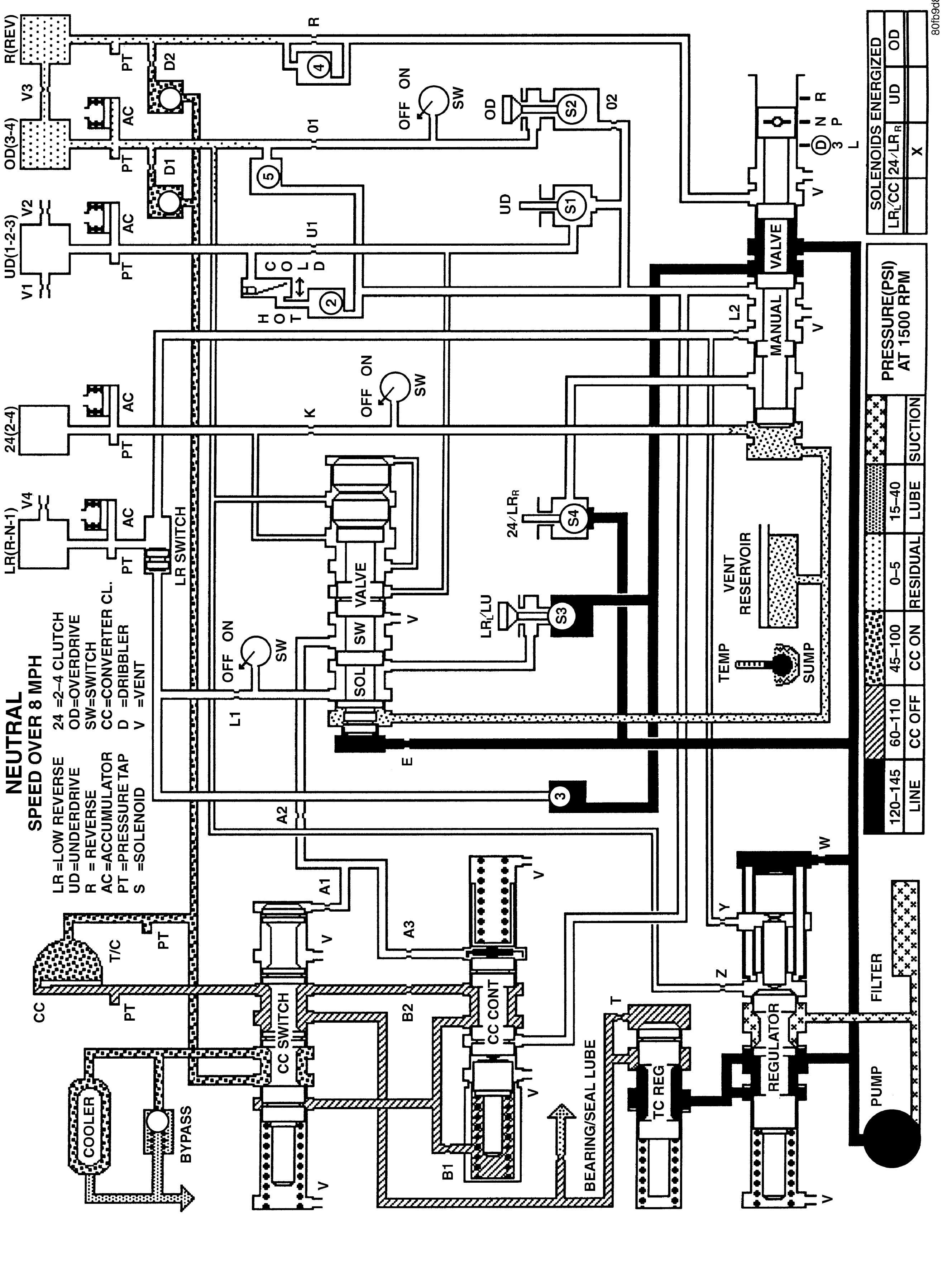
30. Align and connect propeller shaft(s).
31. Adjust gearshift cable if necessary.
32. Install any skid plates removed previously (1). (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION)
33. Lower vehicle.
34. Fill transmission with Mopar® ATF +4, Automatic Transmission Fluid.

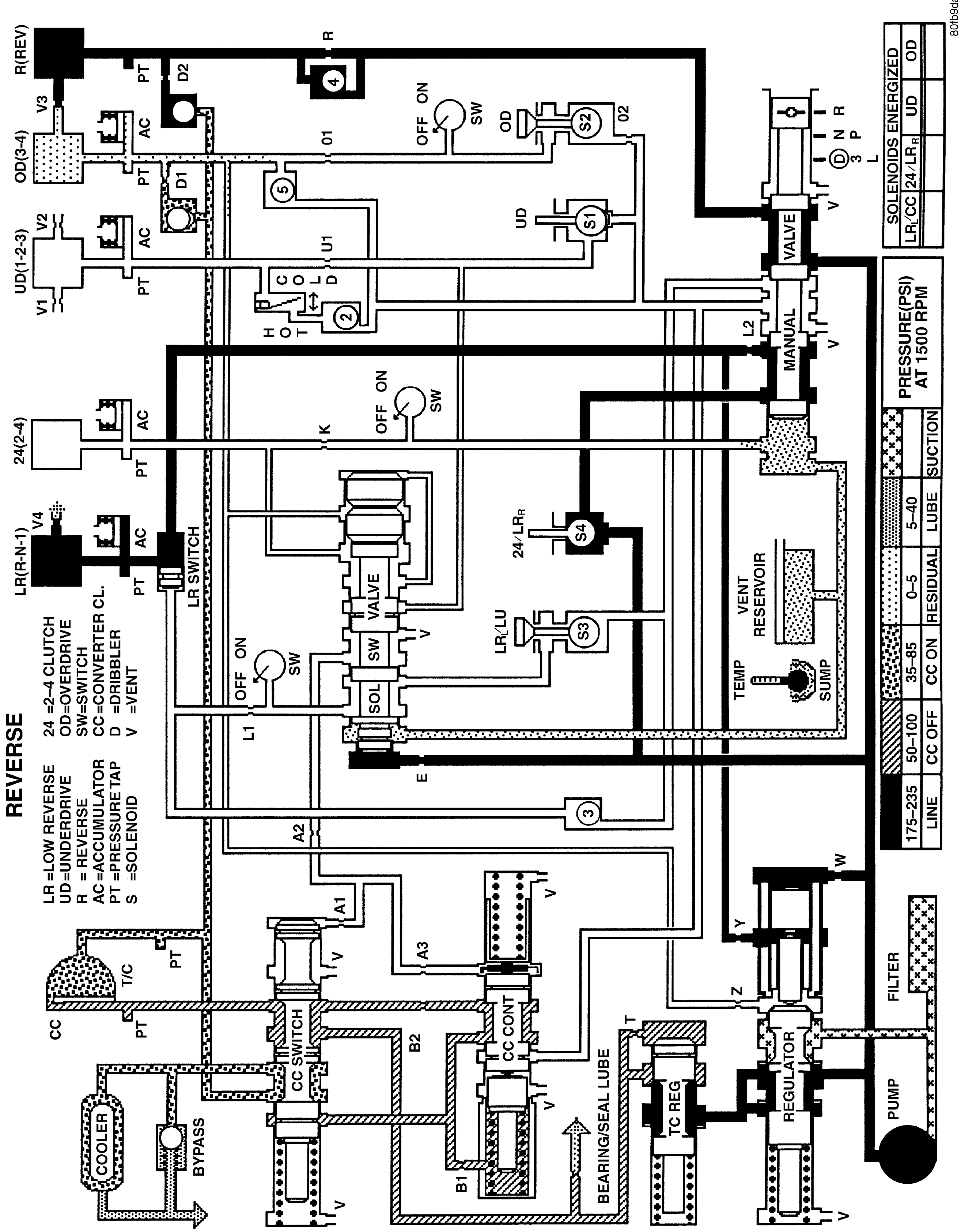


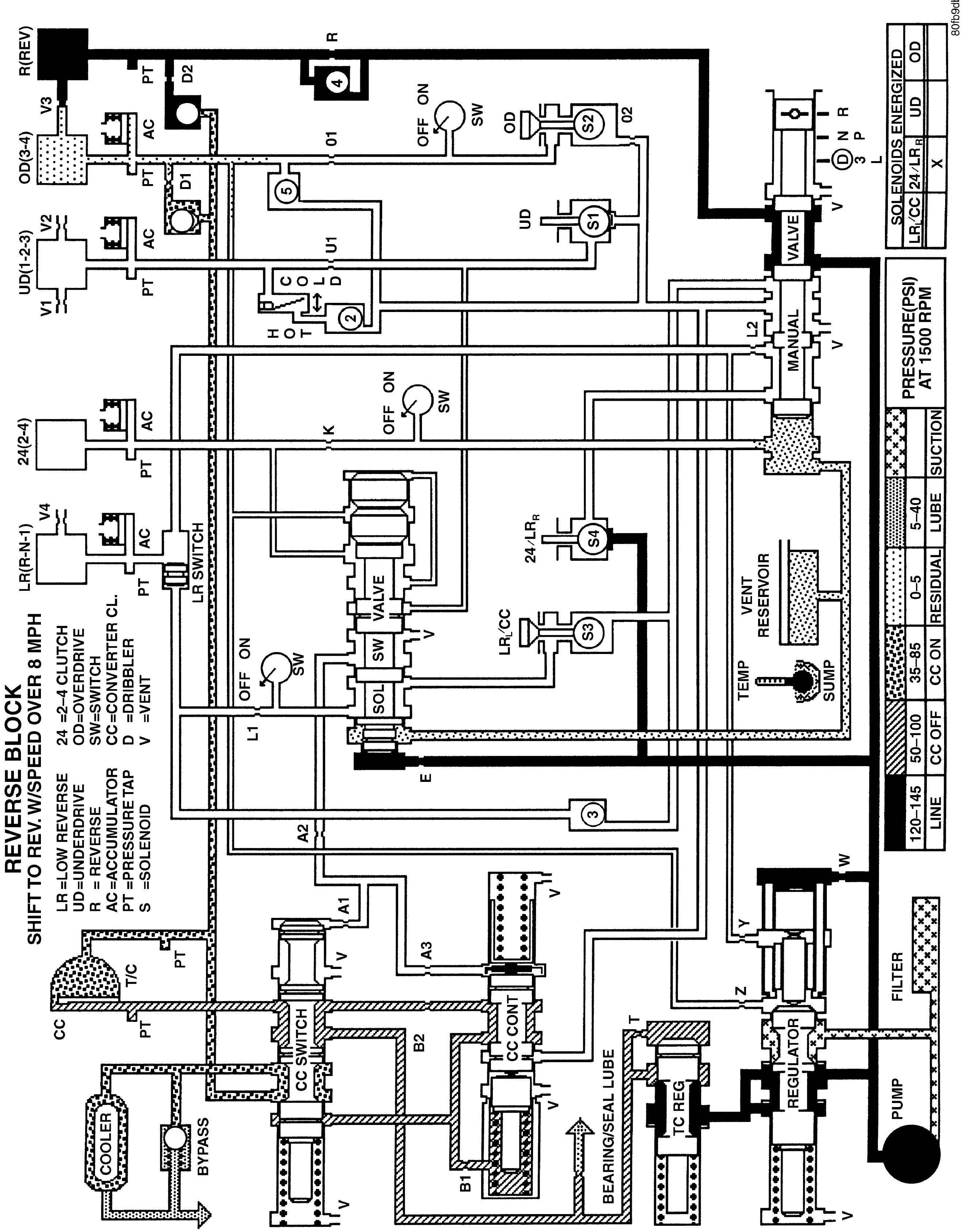
## SCHEMATICS AND DIAGRAMS

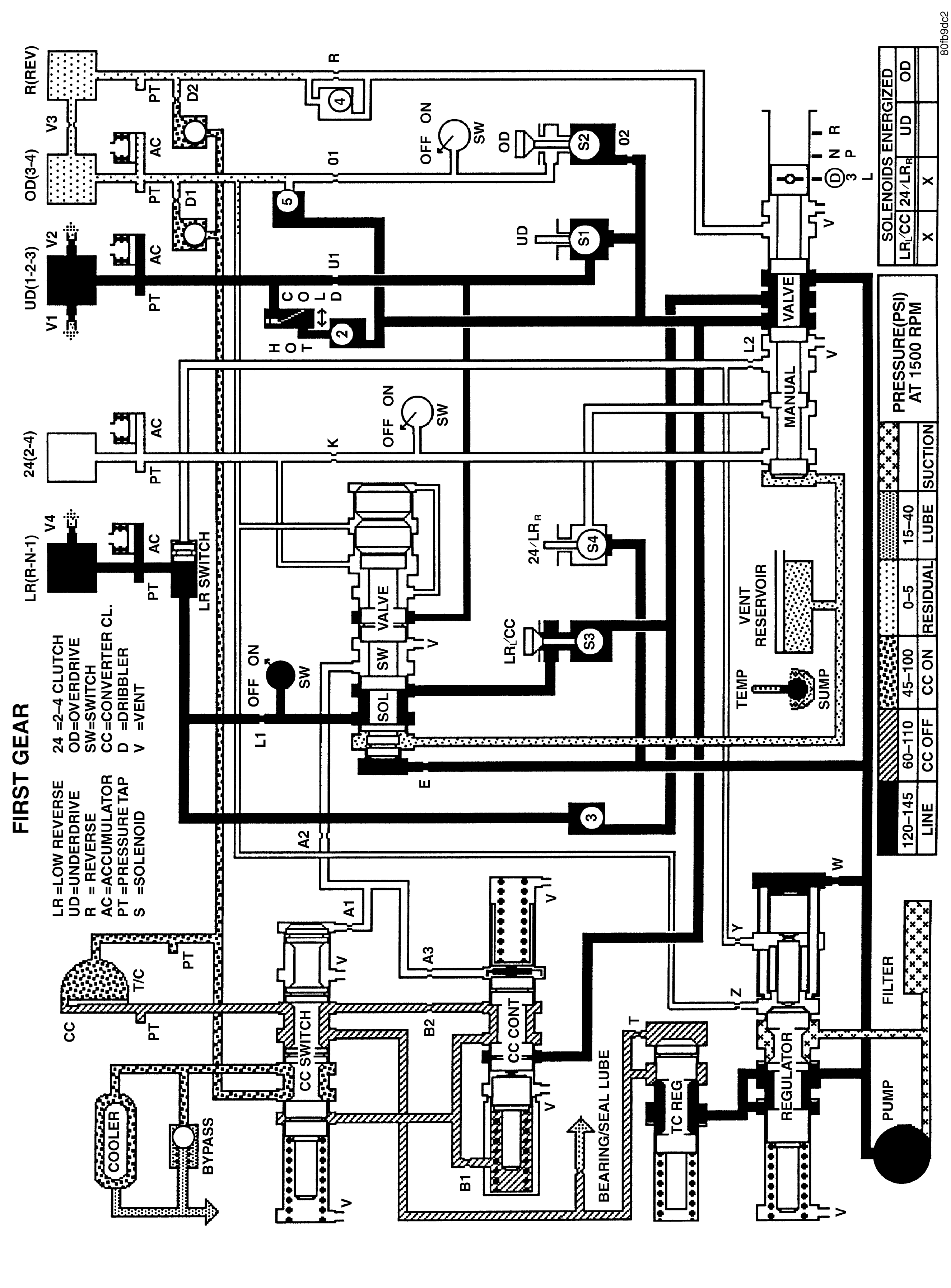
### 42RLE - WITHOUT VARIABLE LINE PRESSURE

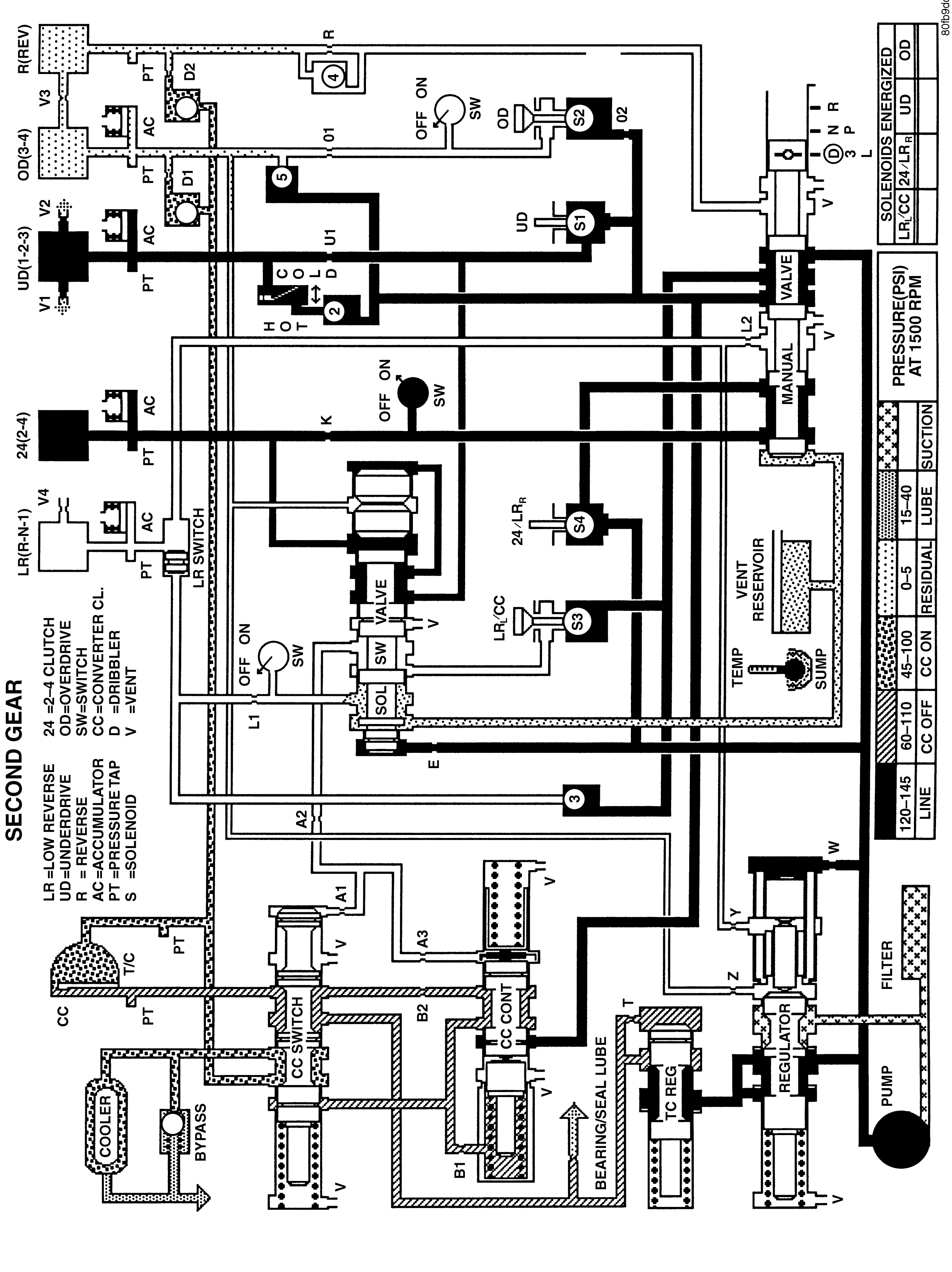

PARK/NEUTRAL
SPEED UNDER 8 MPH
LR =LOW REVERSE
UD =UNDERDRIVE
R = REVERSE
AC =ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
LR(R-N-1)
24(2-4)
UD(1-2-3)
OD(3-4)
R(REV)
LR SWITCH
SOL
SW
VALVE
MANUAL
VALVE
COOLER
BYPASS
CC SWITCH
CC CONT
BEARING/SEAL LUBE
TC REG
REGULATOR
PUMP
FILTER
TEMP
SUMP
VENT
RESERVOIR
T/C
SOLENOIDS ENERGIZED
LR/CC
24/LR
UD
OD
PRESSURE(PSI)
AT 1500 RPM
120–145 LINE
60–110 CC OFF
45–100 CC ON
0–5 RESIDUAL
15–40 LUBE
SUCTION
80fb9d86

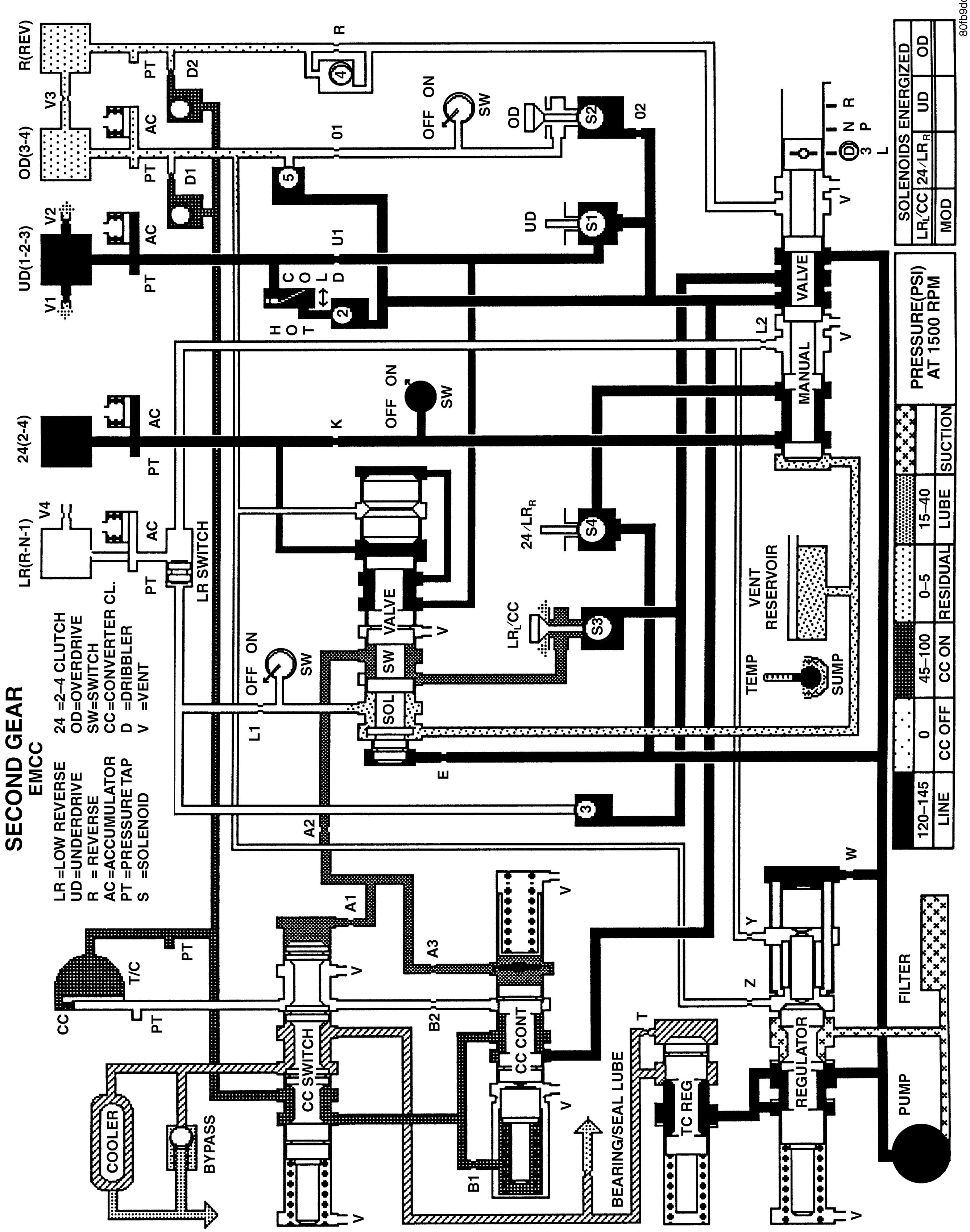

NEUTRAL
SPEED OVER 8 MPH
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
LR(R-N-1)
24(2-4)
UD(1-2-3)
OD(3-4)
R(REV)
LR SWITCH
SOL SW VALVE
MANUAL VALVE
CC SWITCH
CC CONT
TC REG
REGULATOR
PUMP
FILTER
COOLER
BYPASS
BEARING/SEAL LUBE
T/C
TEMP
SUMP
VENT
RESERVOIR
HOT COLD
PRESSURE(PSI) AT 1500 RPM
120–145 LINE
60–110 CC OFF
45–100 CC ON
0–5 RESIDUAL
15–40 LUBE
SUCTION
SOLENOIDS ENERGIZED
LR/CC 24/LR UD OD
X
80fb9d8d

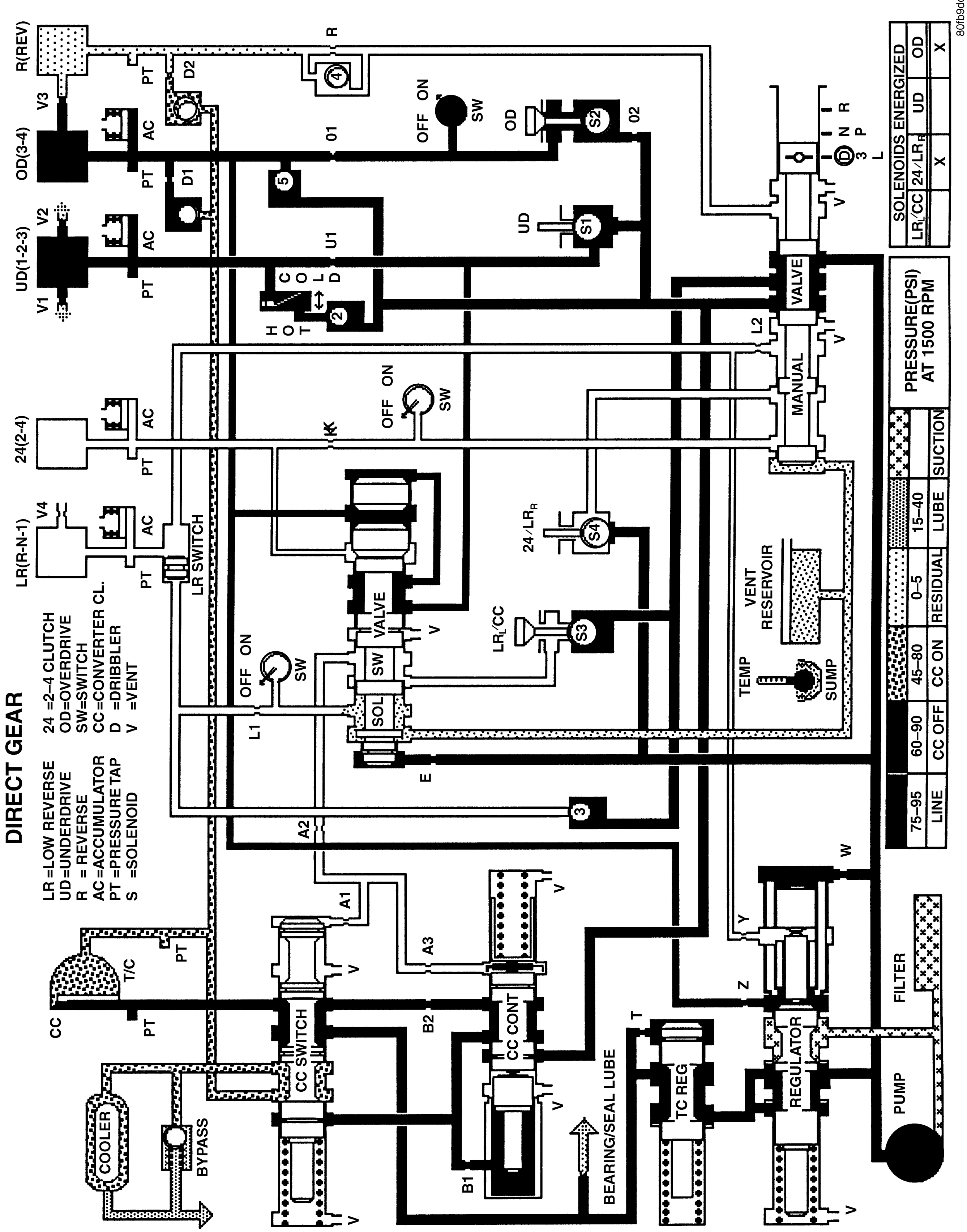

REVERSE
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
LR(R-N-1)
24(2-4)
UD(1-2-3)
OD(3-4)
R(REV)
LR SWITCH
SW VALVE
SOL
MANUAL VALVE
CC SWITCH
CC CONT
TC REG
REGULATOR
PUMP
FILTER
COOLER
BYPASS
T/C
BEARING/SEAL LUBE
TEMP
SUMP
VENT RESERVOIR
SOLENOIDS ENERGIZED
LR/CC
24/LR
UD
OD
PRESSURE(PSI) AT 1500 RPM
175–235 LINE
50–100 CC OFF
35–85 CC ON
0–5 RESIDUAL
5–40 LUBE
SUCTION
80fb9dab


REVERSE BLOCK
SHIFT TO REV. W/SPEED OVER 8 MPH
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
LR(R-N-1)
24(2-4)
UD(1-2-3)
OD(3-4)
R(REV)
LR SWITCH
CC SWITCH
CC CONT
TC REG
REGULATOR
MANUAL VALUE
SOL SW VALVE
COOLER
BYPASS
BEARING/SEAL LUBE
PUMP
FILTER
TEMP
SUMP
VENT RESERVOIR
HOT COLD
OFF ON SW
SOLENOIDS ENERGIZED
LR/CC 24/LR OD UD
X
PRESSURE(PSI) AT 1500 RPM
120–145 LINE
50–100 CC OFF
35–85 CC ON
0–5 RESIDUAL
5–40 LUBE
SUCTION
80fb9db9

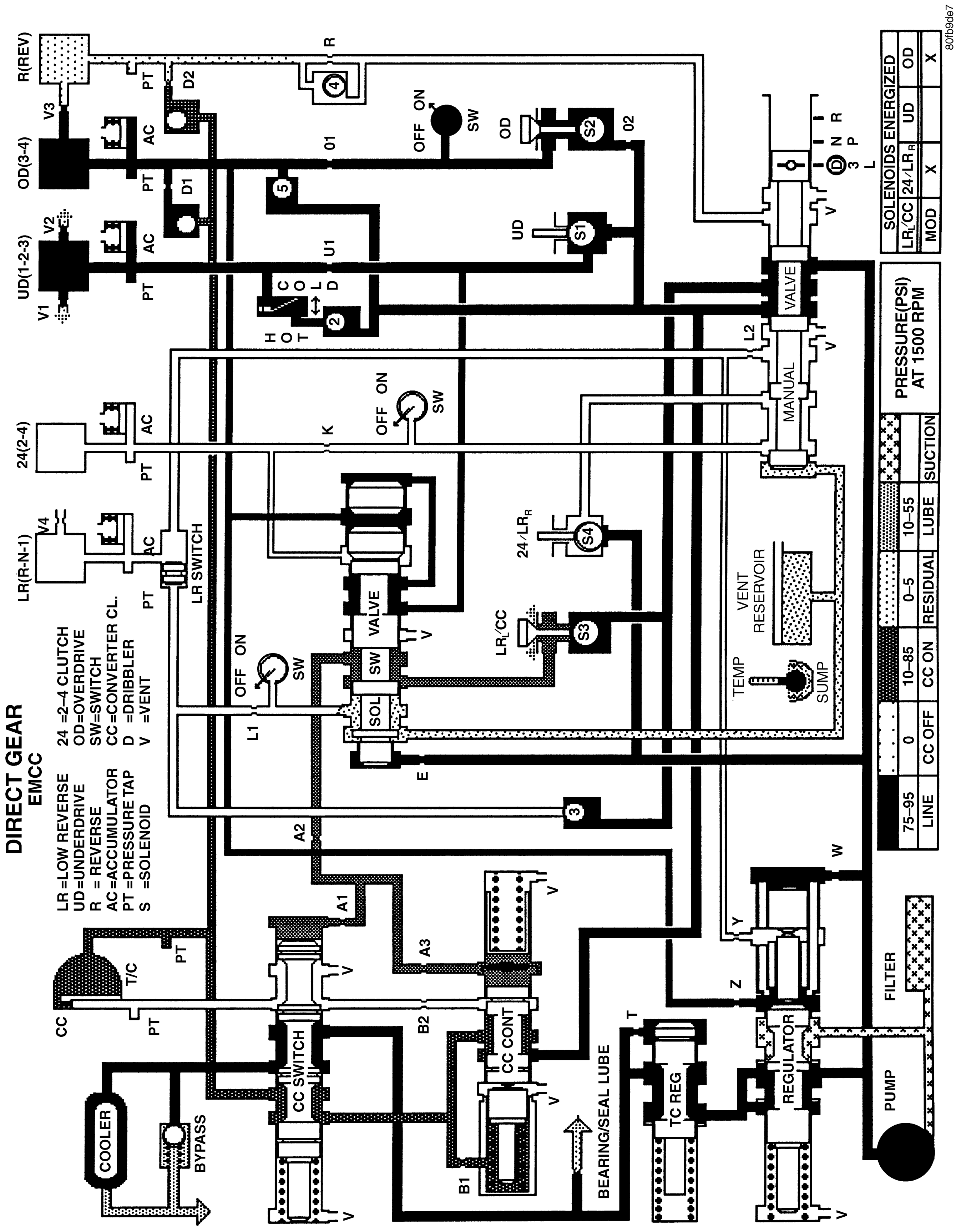

FIRST GEAR
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
LR(R-N-1)
24(2-4)
UD(1-2-3)
OD(3-4)
R(REV)
V1
V2
V3
V4
AC
PT
D1
D2
LR SWITCH
SOL
SW
VALVE
MANUAL
OFF ON
S1
S2
S3
S4
TEMP
SUMP
VENT
RESERVOIR
CC SWITCH
CC CONT
TC REG
REGULATOR
PUMP
FILTER
COOLER
BYPASS
T/C
CC
BEARING/SEAL LUBE
PRESSURE(PSI) AT 1500 RPM
120–145 LINE
60–110 CC OFF
45–100 CC ON
0–5 RESIDUAL
15–40 LUBE
SUCTION
SOLENOIDS ENERGIZED
LR/CC
24/LR
UD
OD
80fb9dc2

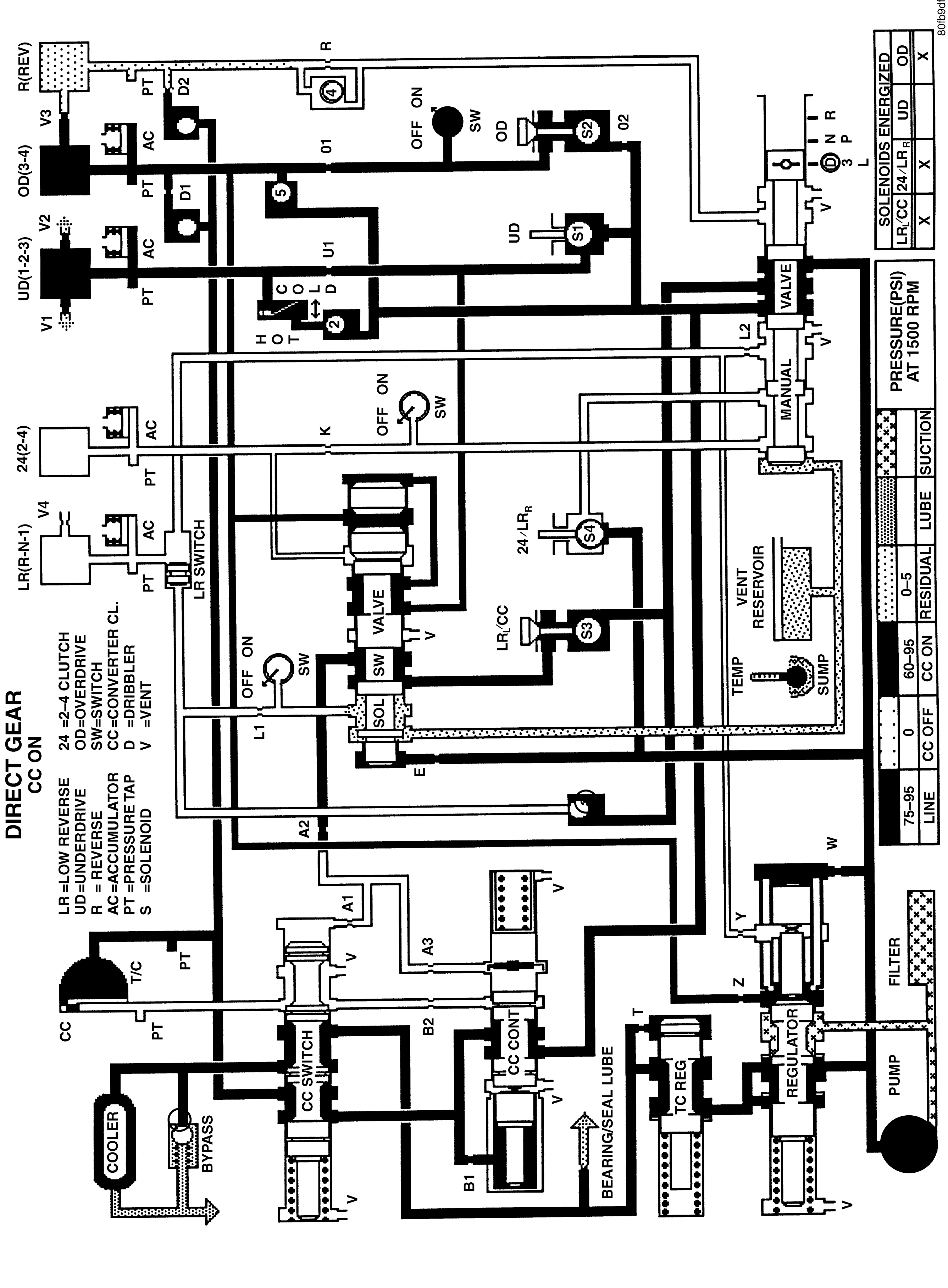

SECOND GEAR
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
LR(R-N-1)
V4
24(2-4)
V1
UD(1-2-3)
V2
OD(3-4)
V3
R(REV)
AC
PT
D1
D2
LR SWITCH
K
U1
01
02
R
HOT
COLD
OFF ON
SW
S1
S2
S3
S4
UD
OD
24/LR
LR/CC
VALVE
MANUAL
SOL
L1
L2
E
A1
A2
A3
B1
B2
T/C
CC
COOLER
BYPASS
CC SWITCH
CC CONT
BEARING/SEAL LUBE
TC REG
REGULATOR
PUMP
FILTER
T
W
Y
Z
TEMP
SUMP
VENT
RESERVOIR
P R N D 3 L
PRESSURE(PSI) AT 1500 RPM
120–145 LINE
60–110 CC OFF
45–100 CC ON
0–5 RESIDUAL
15–40 LUBE
SUCTION
SOLENOIDS ENERGIZED
LR/CC
24/LR
UD
OD
80fb9dc6

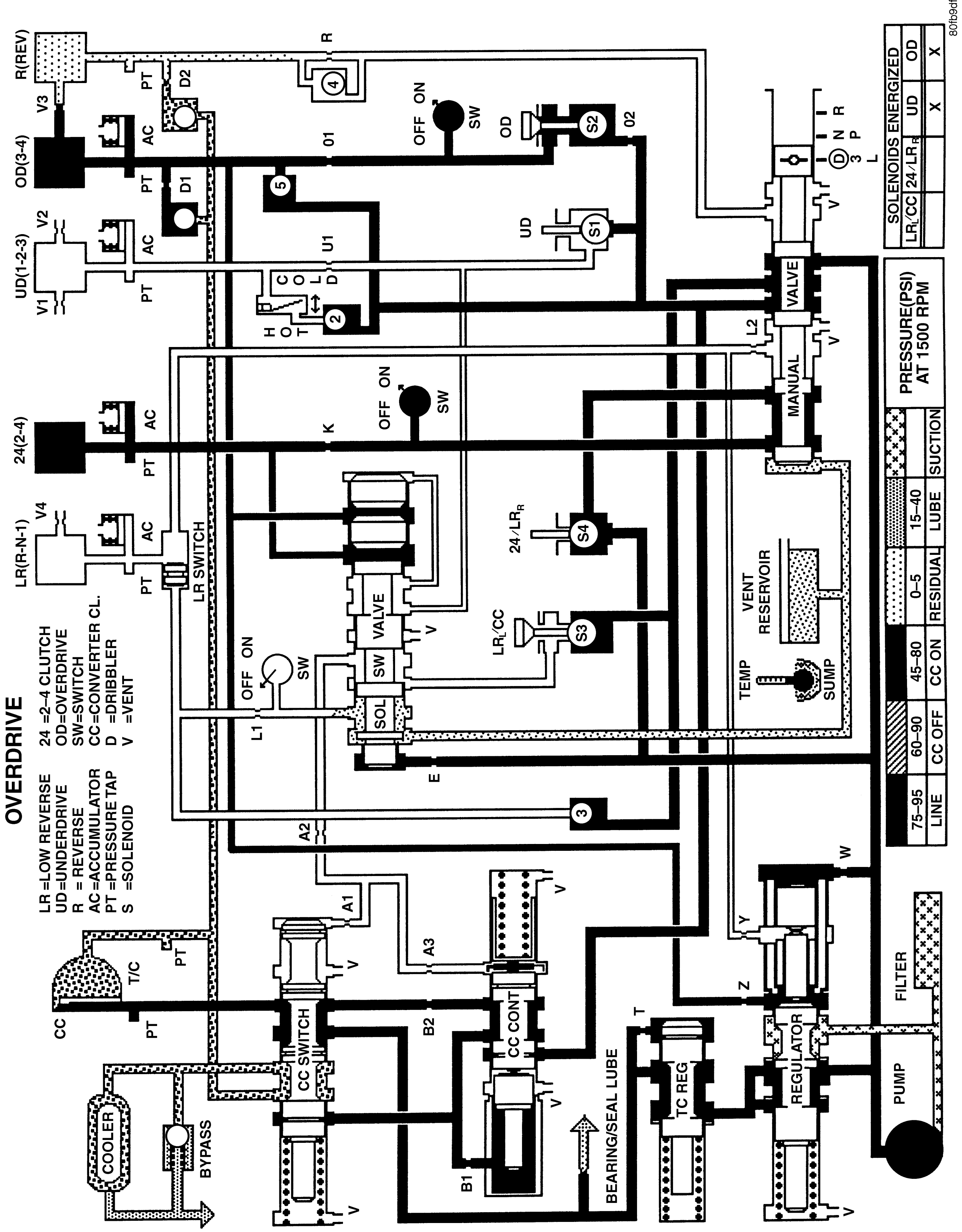

SECOND GEAR
EMCC
LR =LOW REVERSE
UD=UNDERDRIVE
R =REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
LR(R-N-1)
24(2-4)
UD(1-2-3)
OD(3-4)
R(REV)
LR SWITCH
COOLER
BYPASS
CC SWITCH
CC CONT
BEARING/SEAL LUBE
TC REG
REGULATOR
PUMP
FILTER
MANUAL VALVE
SOL SW VALVE
TEMP
SUMP
VENT RESERVOIR
PRESSURE(PSI) AT 1500 RPM
120–145 LINE
0 CC OFF
45–100 CC ON
0–5 RESIDUAL
15–40 LUBE
SUCTION
SOLENOIDS ENERGIZED
LR/CC
24/LR
UD
OD
MOD
80fb9dd2

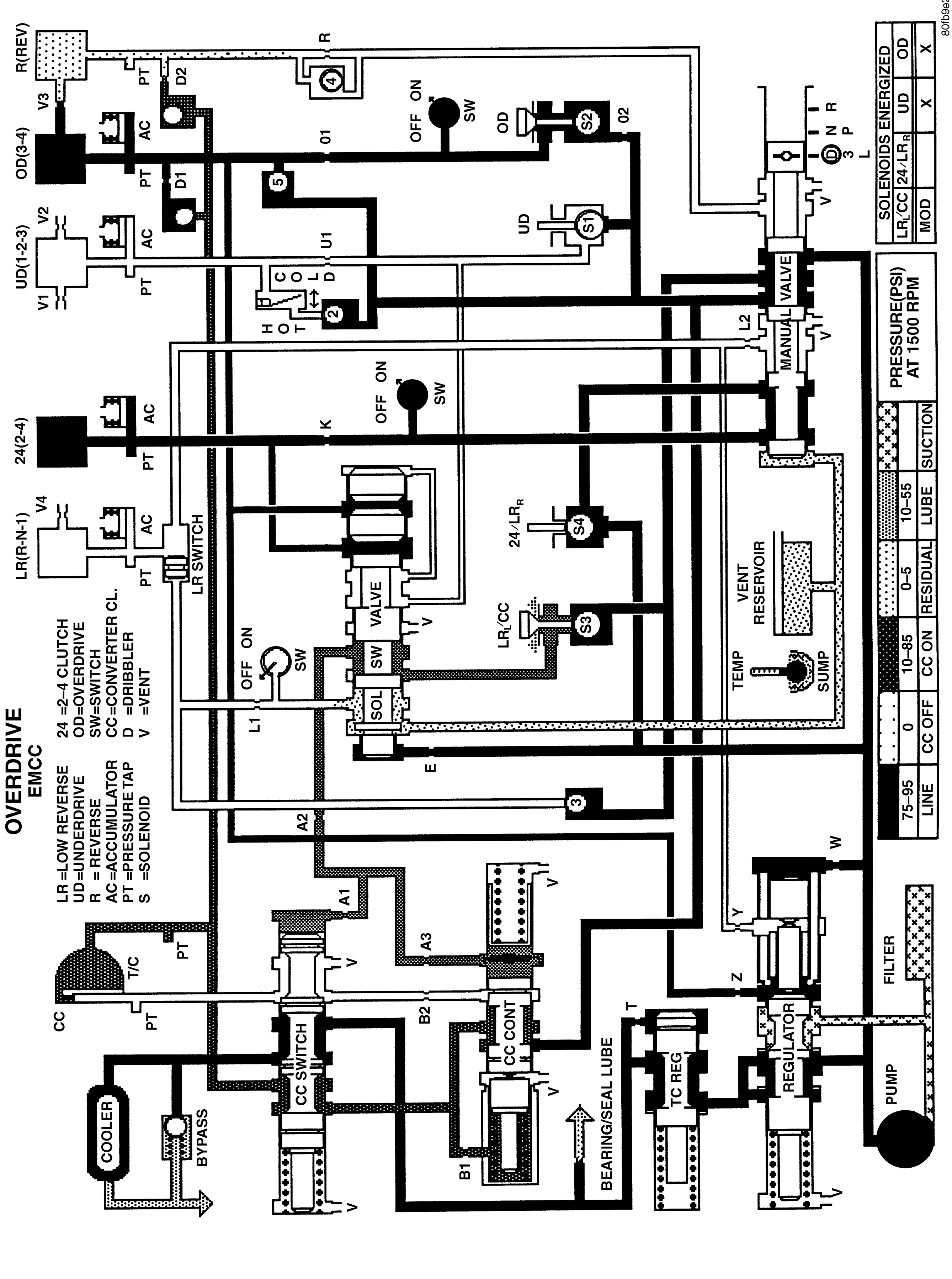


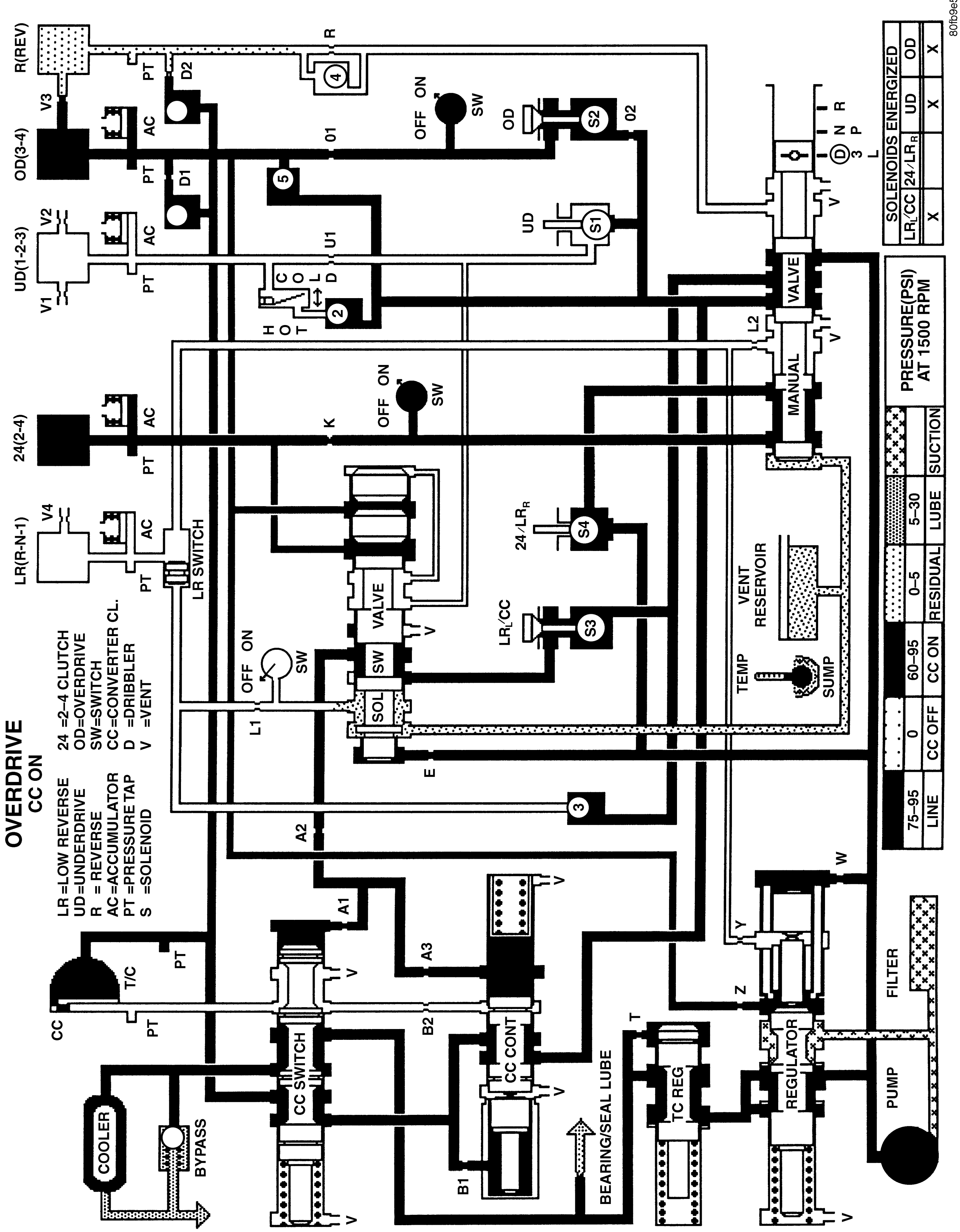
DIRECT GEAR
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
LR(R-N-1)
24(2-4)
UD(1-2-3)
OD(3-4)
R(REV)
V1
V2
V3
V4
AC
PT
D1
D2
LR SWITCH
HOT
COLD
U1
01
02
OFF ON
SW
OD
UD
S1
S2
S3
S4
24/LR
LR/CC
VALVE
SOL
MANUAL
L1
L2
A1
A2
A3
B1
B2
E
T
W
Y
Z
K
VENT
RESERVOIR
TEMP
SUMP
CC
T/C
COOLER
BYPASS
CC SWITCH
CC CONT
BEARING/SEAL LUBE
TC REG
REGULATOR
PUMP
FILTER
D N R
3 P
L
PRESSURE(PSI) AT 1500 RPM
75–95 LINE
60–90 CC OFF
45–80 CC ON
0–5 RESIDUAL
15–40 LUBE
SUCTION
SOLENOIDS ENERGIZED
LR/CC
24/LR
UD
OD
X
X
80fb9dd6


DIRECT GEAR
EMCC
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
R(REV)
OD(3-4)
UD(1-2-3)
24(2-4)
LR(R-N-1)
V1
V2
V3
V4
PT
AC
D1
D2
LR SWITCH
CC
T/C
COOLER
BYPASS
CC SWITCH
CC CONT
BEARING/SEAL LUBE
TC REG
REGULATOR
PUMP
FILTER
A1
A2
A3
B1
B2
L1
L2
U1
01
02
E
K
T
W
Y
Z
HOT
COLD
OFF ON
SW
OD
UD
LR/CC
24/LR
S1
S2
S3
S4
SOL
VALVE
MANUAL
TEMP
SUMP
VENT
RESERVOIR
P R N D 3 L
PRESSURE(PSI) AT 1500 RPM
75–95 LINE
0 CC OFF
10–85 CC ON
0–5 RESIDUAL
10–55 LUBE
SUCTION
SOLENOIDS ENERGIZED
LR/CC
24/LR
UD
OD
MOD
X
80fb9de7

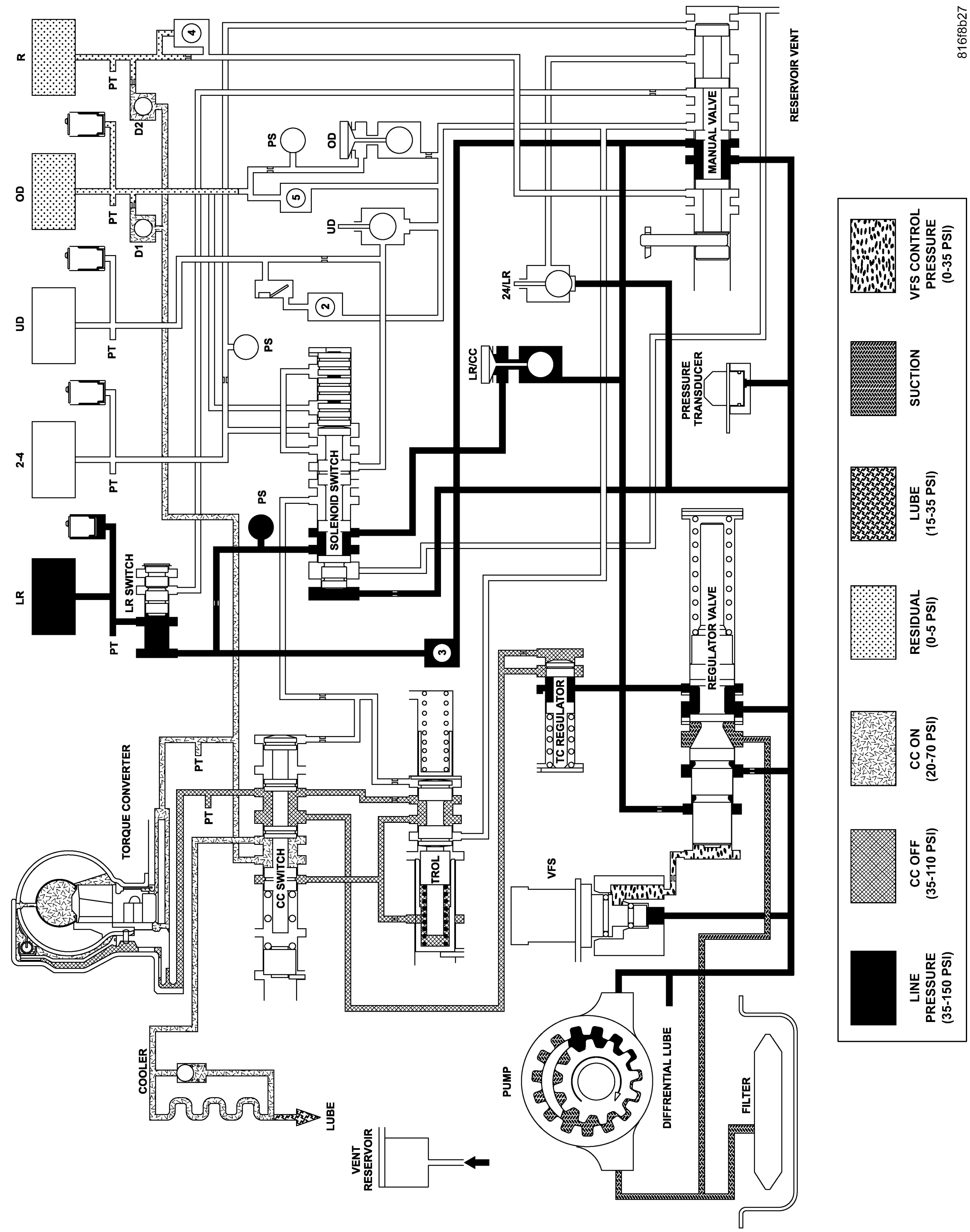

DIRECT GEAR
CC ON
LR =LOW REVERSE
UD=UNDERDRIVE
R =REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
R(REV)
OD(3-4)
UD(1-2-3)
24(2-4)
LR(R-N-1)
V1
V2
V3
V4
D1
D2
AC
PT
LR SWITCH
OFF ON
SW
HOT
COLD
MANUAL
VALVE
SOL
S1
S2
S3
S4
UD
OD
LR/CC
24/LR
VENT
RESERVOIR
TEMP
SUMP
CC
T/C
COOLER
BYPASS
CC SWITCH
CC CONT
BEARING/SEAL LUBE
TC REG
REGULATOR
PUMP
FILTER
P R N D 3 L
PRESSURE(PSI) AT 1500 RPM
75–95 LINE
0 CC OFF
60–95 CC ON
0–5 RESIDUAL
LUBE
SUCTION
SOLENOIDS ENERGIZED
LR/CC X
24/LR X
UD
OD X
80fb9df4


OVERDRIVE
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
LR(R-N-1)
24(2-4)
UD(1-2-3)
OD(3-4)
R(REV)
LR SWITCH
MANUAL VALVE
CC SWITCH
CC CONT
TC REG
REGULATOR
PUMP
FILTER
COOLER
BYPASS
BEARING/SEAL LUBE
VENT RESERVOIR
TEMP
SUMP
PRESSURE(PSI) AT 1500 RPM
75–95 LINE
60–90 CC OFF
45–80 CC ON
0–5 RESIDUAL
15–40 LUBE
SUCTION
SOLENOIDS ENERGIZED
LR/CC
24/LR
UD X
OD X
80fb9df8

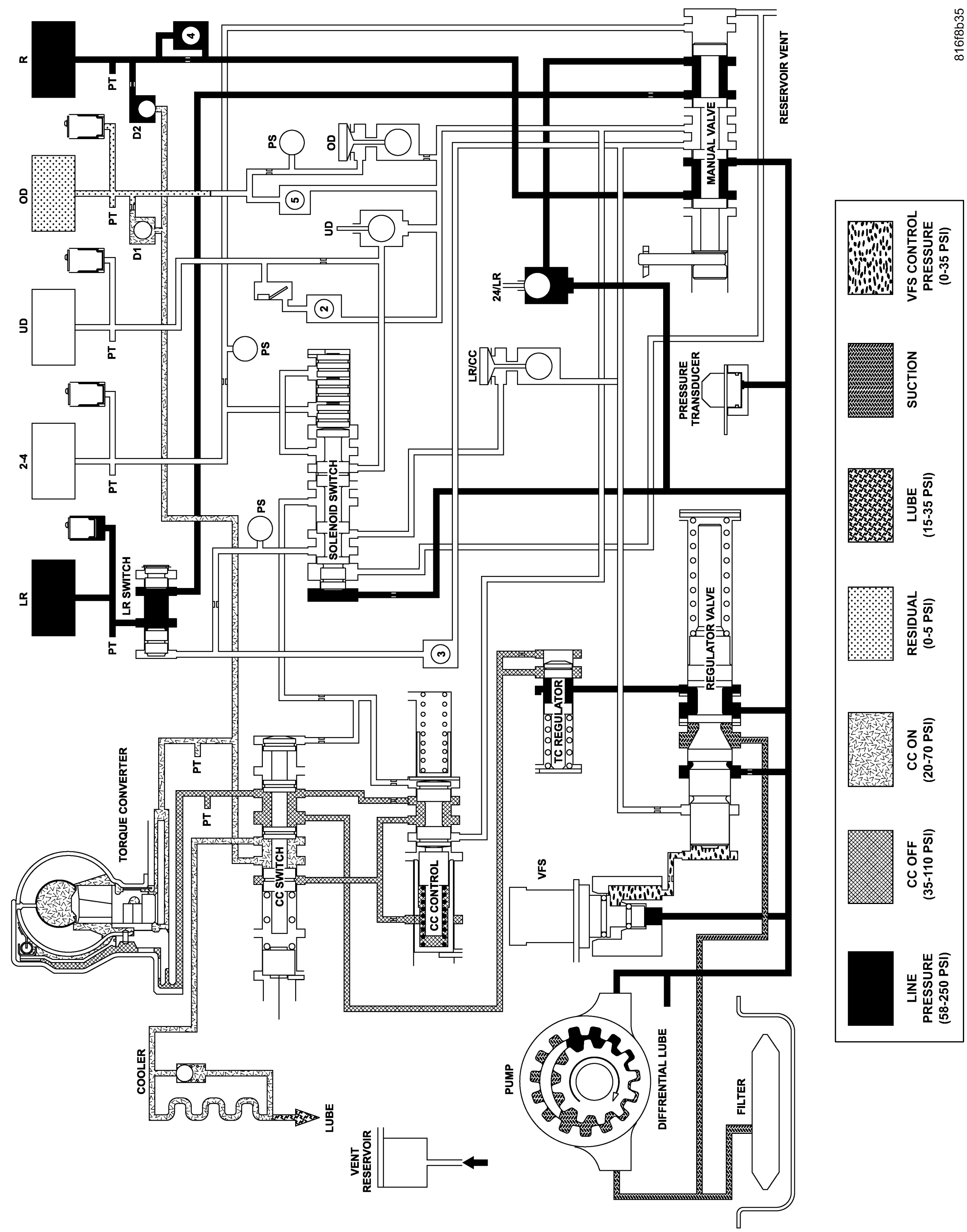

OVERDRIVE
EMCC
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
LR(R-N-1)
24(2-4)
UD(1-2-3)
OD(3-4)
R(REV)
LR SWITCH
MANUAL VALVE
CC SWITCH
CC CONT
TC REG
REGULATOR
PUMP
FILTER
COOLER
BYPASS
BEARING/SEAL LUBE
TEMP
SUMP
VENT
RESERVOIR
SOLENOIDS ENERGIZED
PRESSURE(PSI) AT 1500 RPM
75–95 LINE
0 CC OFF
10–85 CC ON
0–5 RESIDUAL
10–55 LUBE
SUCTION
80fb9e20


OVERDRIVE
CC ON
LR =LOW REVERSE
UD=UNDERDRIVE
R = REVERSE
AC=ACCUMULATOR
PT =PRESSURE TAP
S =SOLENOID
24 =2–4 CLUTCH
OD=OVERDRIVE
SW=SWITCH
CC=CONVERTER CL.
D =DRIBBLER
V =VENT
R(REV)
OD(3-4)
UD(1-2-3)
24(2-4)
LR(R-N-1)
LR SWITCH
T/C
CC
COOLER
BYPASS
CC SWITCH
CC CONT
BEARING/SEAL LUBE
TC REG
REGULATOR
PUMP
FILTER
MANUAL
VALVE
SOL
SW
TEMP
SUMP
VENT
RESERVOIR
PRESSURE(PSI)
AT 1500 RPM
75–95 LINE
0 CC OFF
60–95 CC ON
0–5 RESIDUAL
5–30 LUBE
SUCTION
SOLENOIDS ENERGIZED
LR/CC 24/LR UD OD
X X X
80fb9e5c

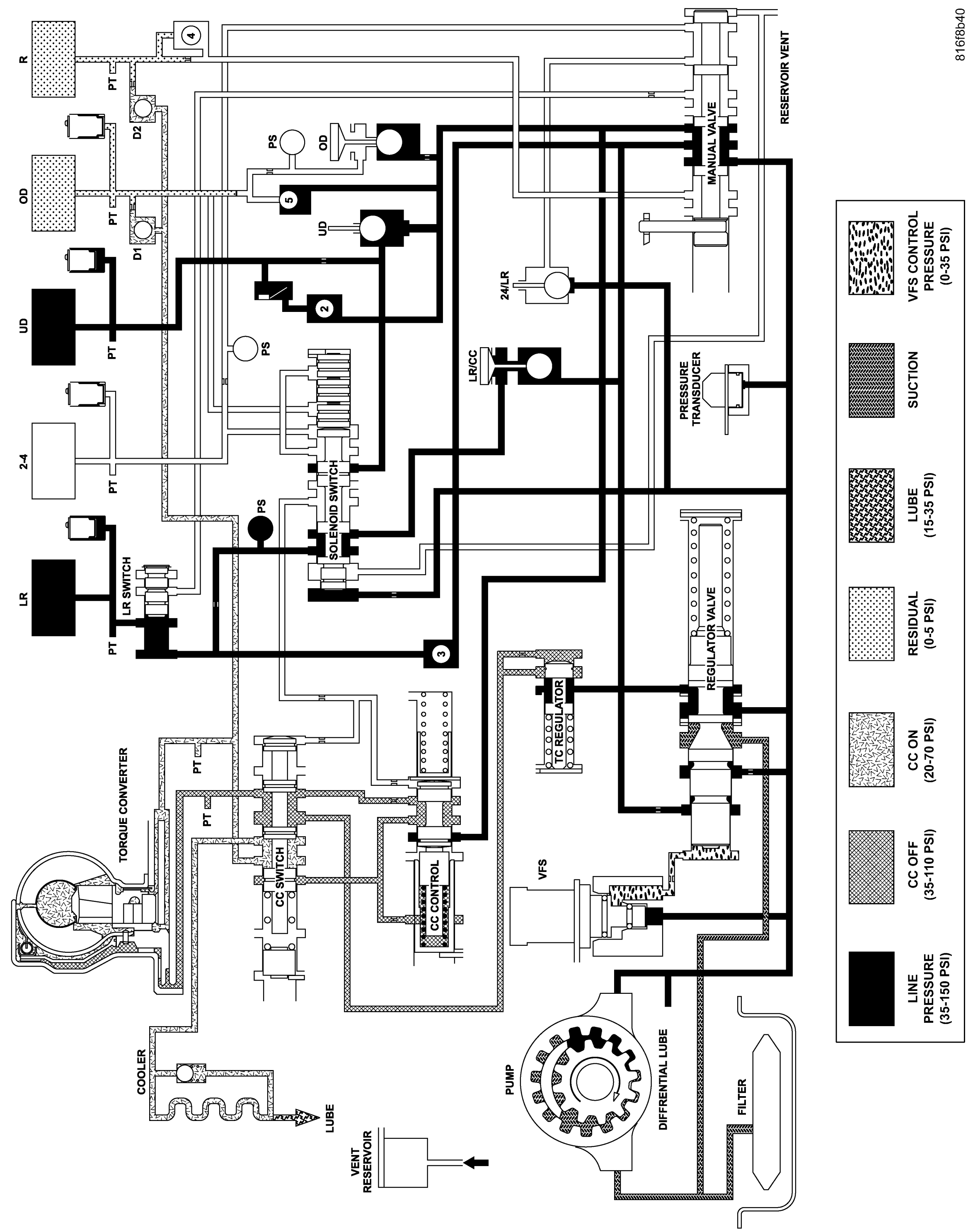
## 42RLE - WITH VARIABLE LINE PRESSURE



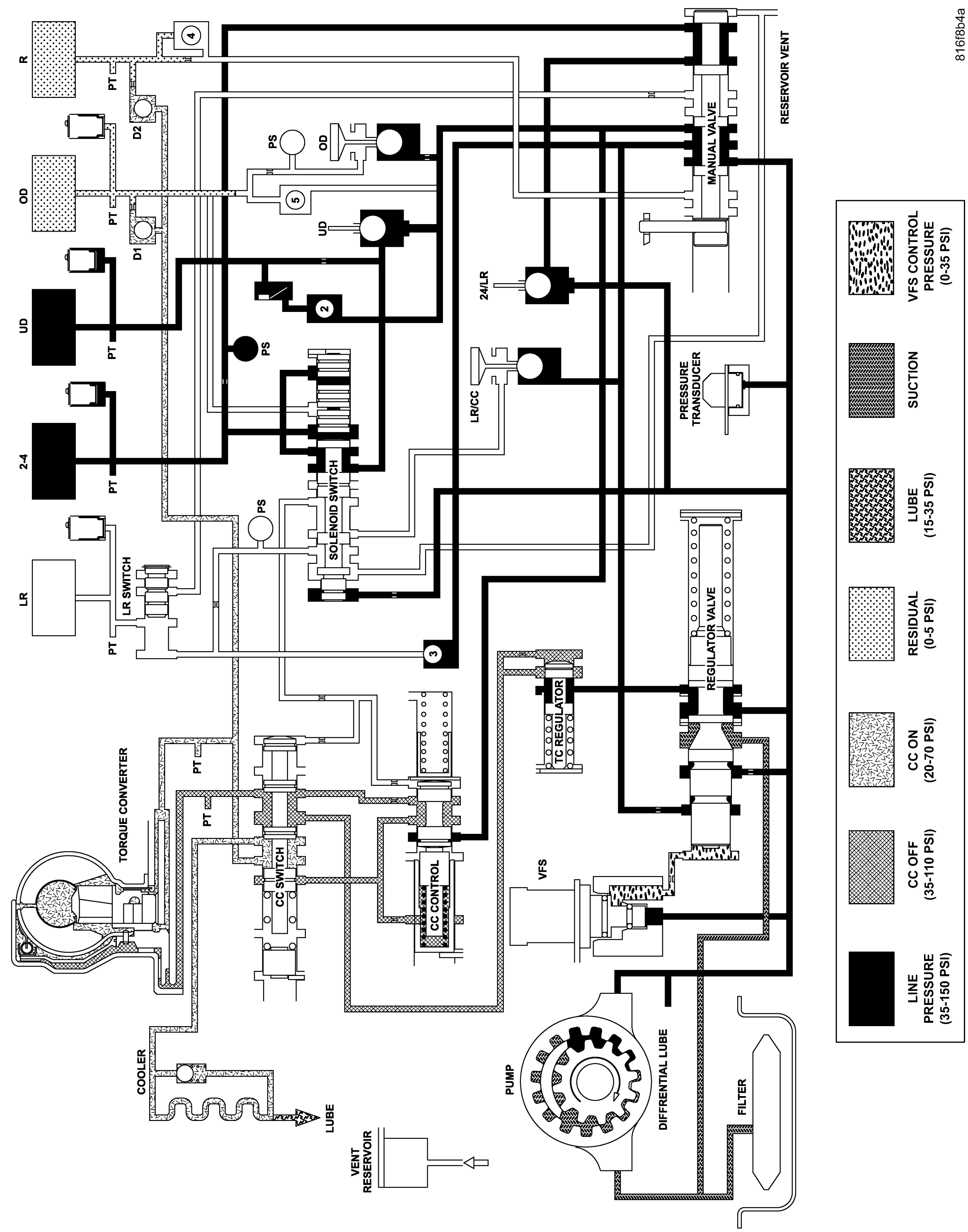

*Park and Neutral*


R
PT
D2
OD
D1
UD
2-4
LR
LR SWITCH
PS
SOLENOID SWITCH
MANUAL VALVE
RESERVOIR VENT
24/LR
LR/CC
PRESSURE TRANSDUCER
REGULATOR VALVE
TC REGULATOR
TORQUE CONVERTER
CC SWITCH
CC CONTROL
VFS
COOLER
LUBE
VENT RESERVOIR
PUMP
DIFFRENTIAL LUBE
FILTER
LINE PRESSURE (58-250 PSI)
CC OFF (35-110 PSI)
CC ON (20-70 PSI)
RESIDUAL (0-5 PSI)
LUBE (15-35 PSI)
SUCTION
VFS CONTROL PRESSURE (0-35 PSI)
816f8b35

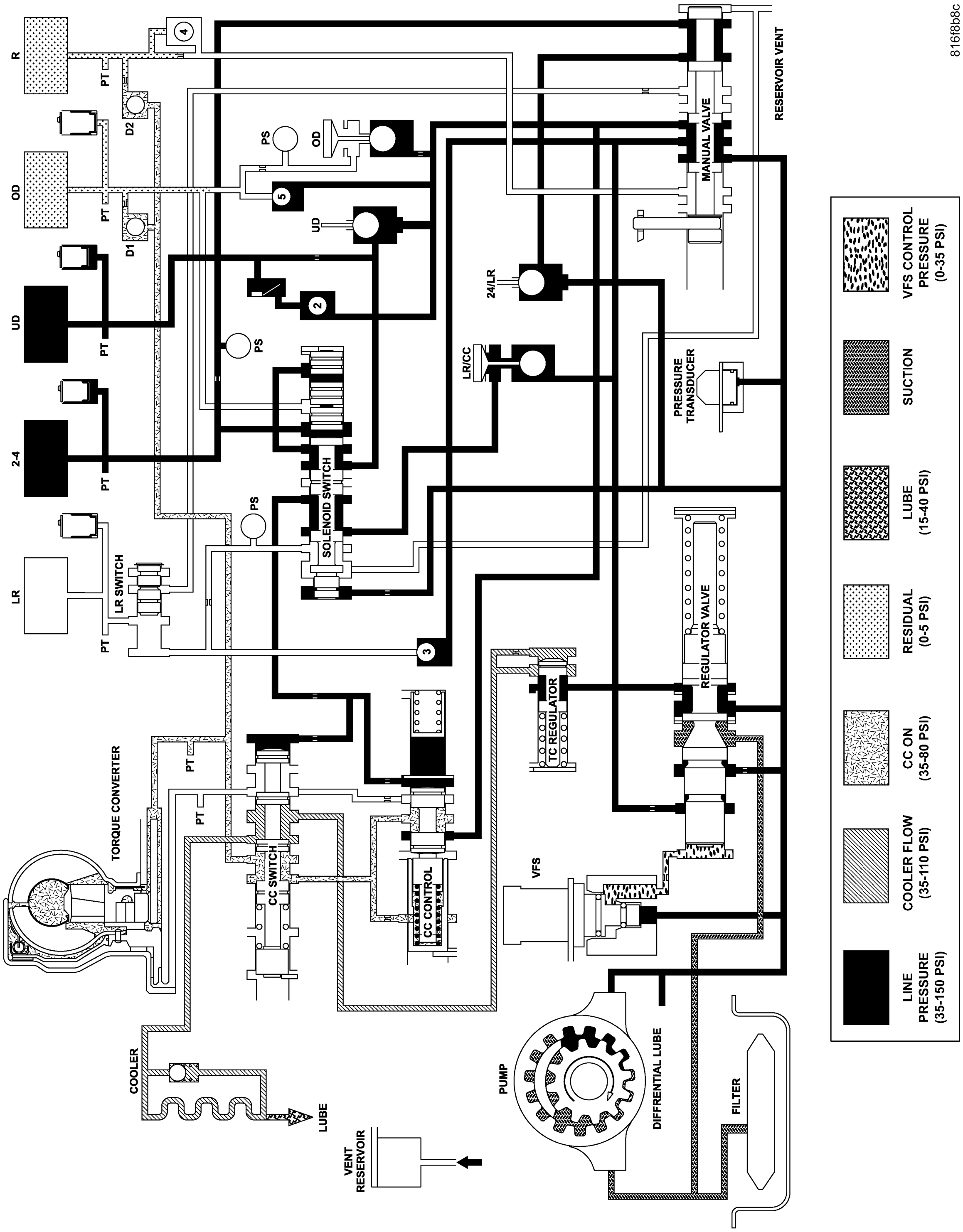
*Reverse*



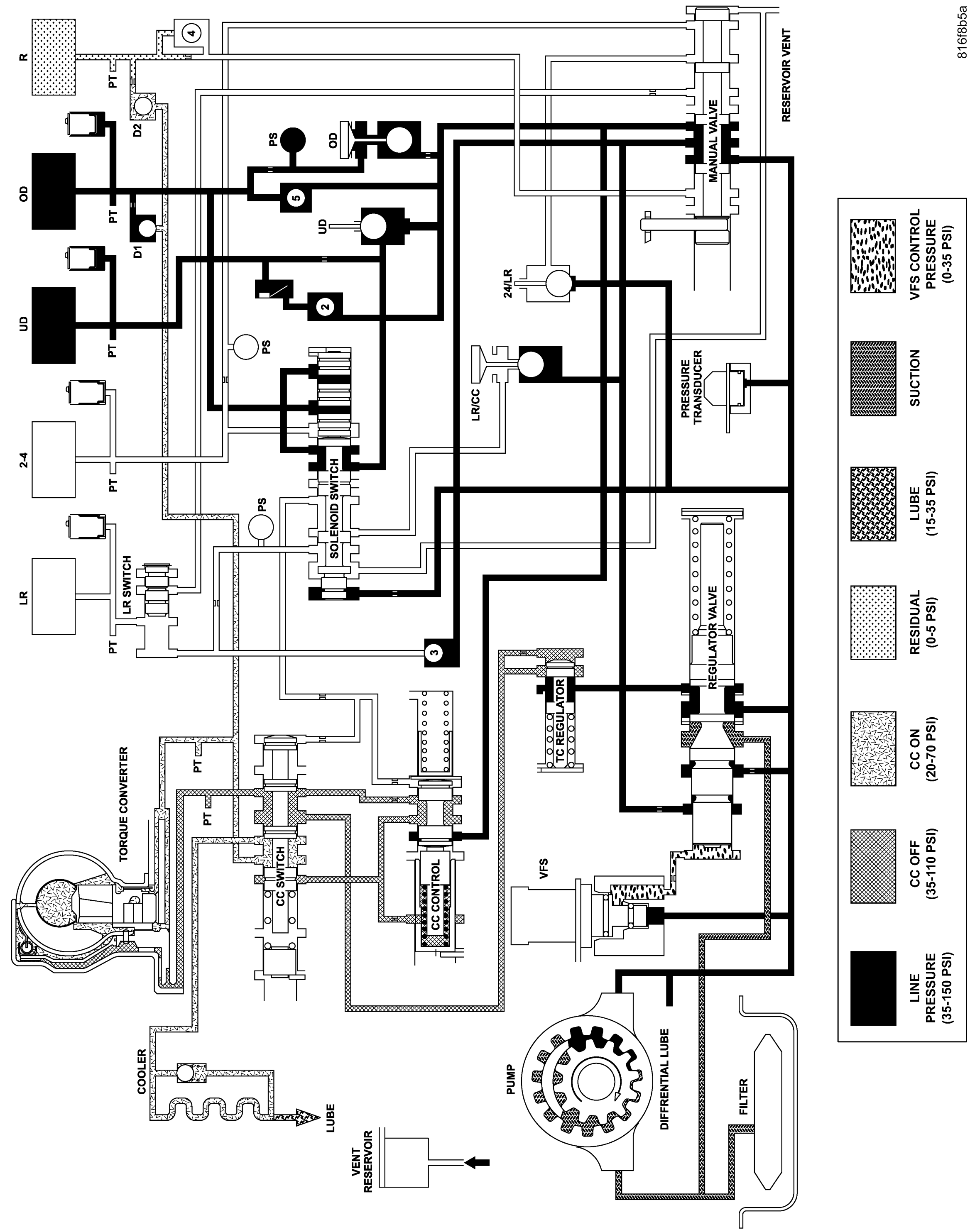

*Drive - First Gear*



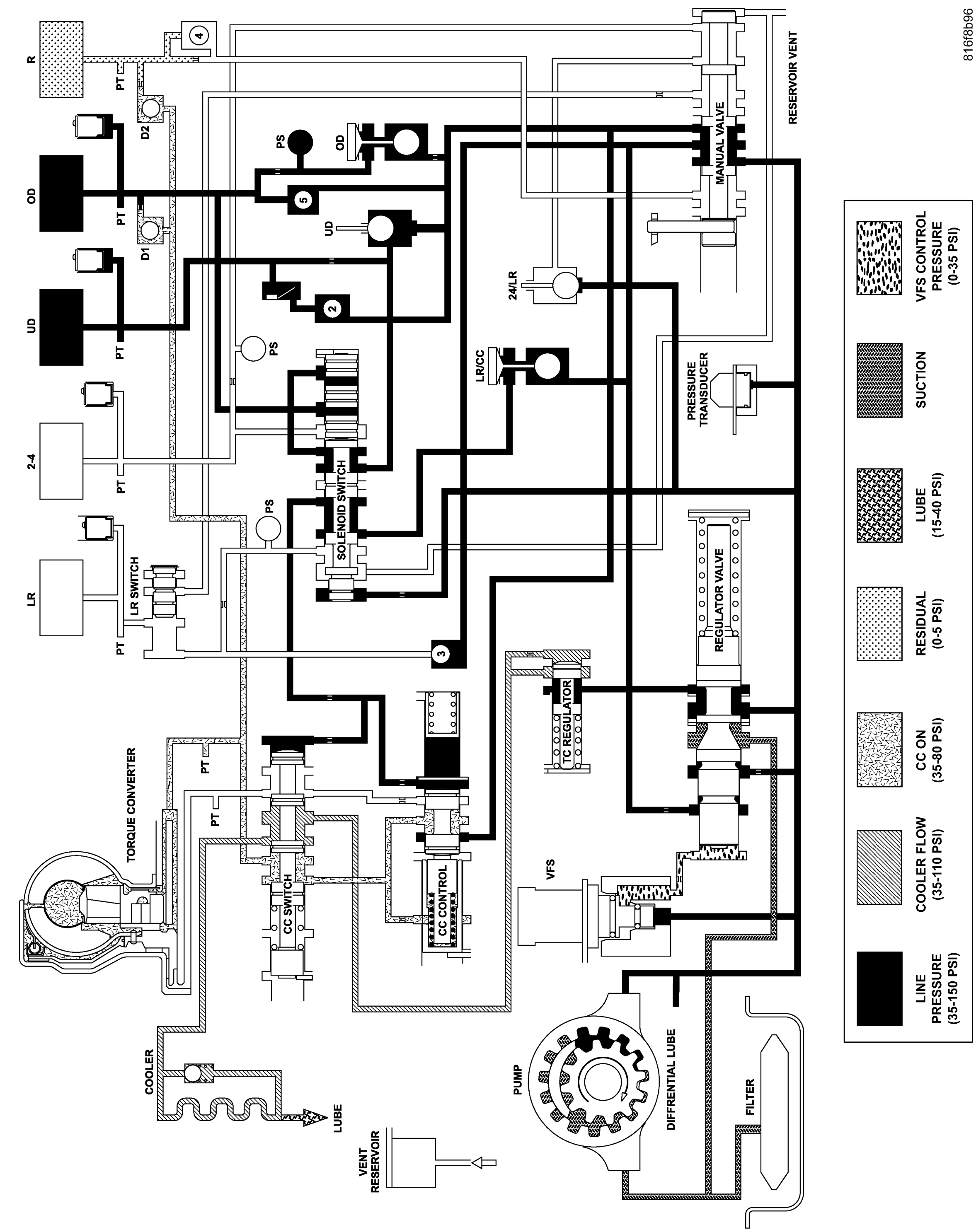

*Drive - Second Gear*



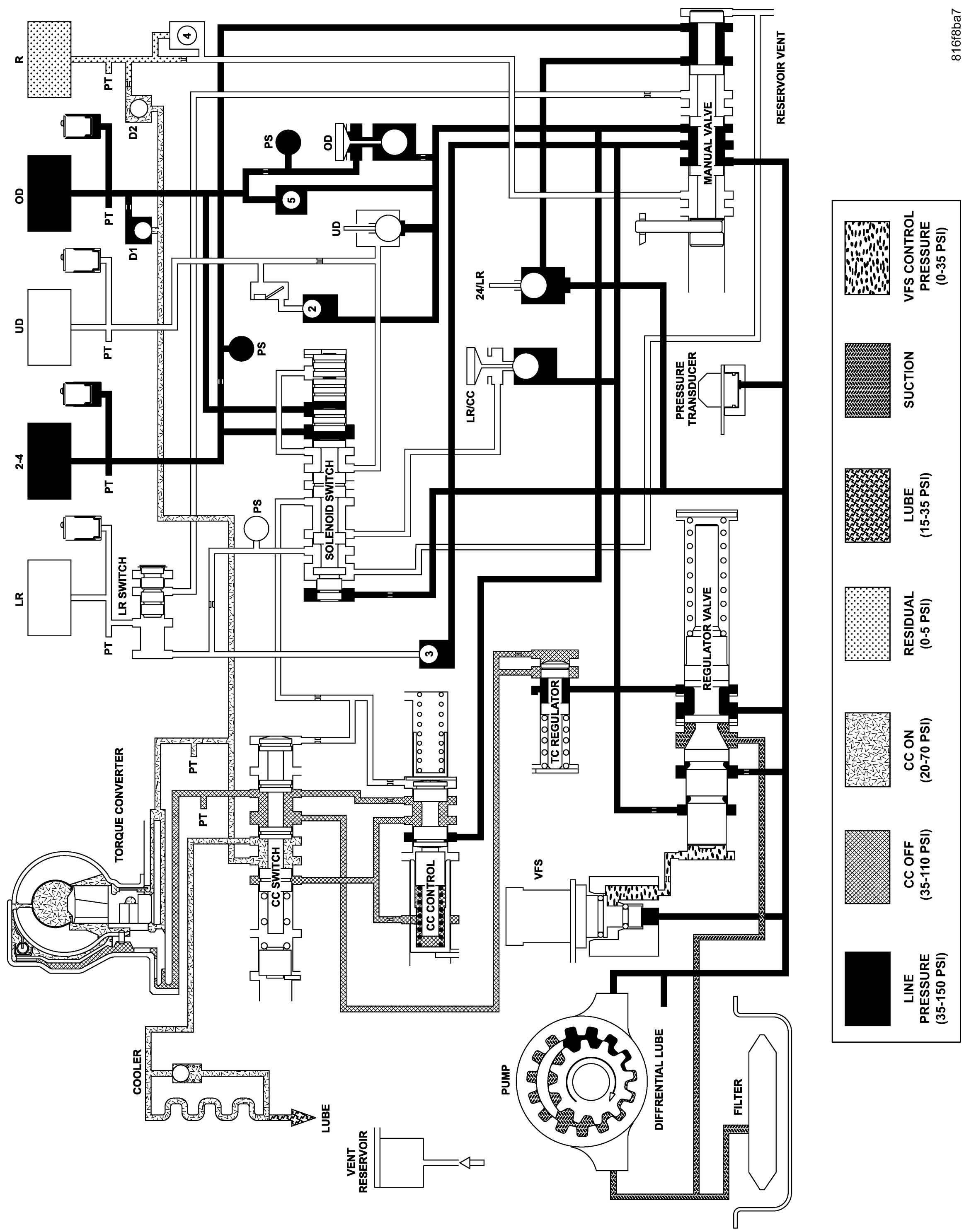

Drive - Second Gear EMCC



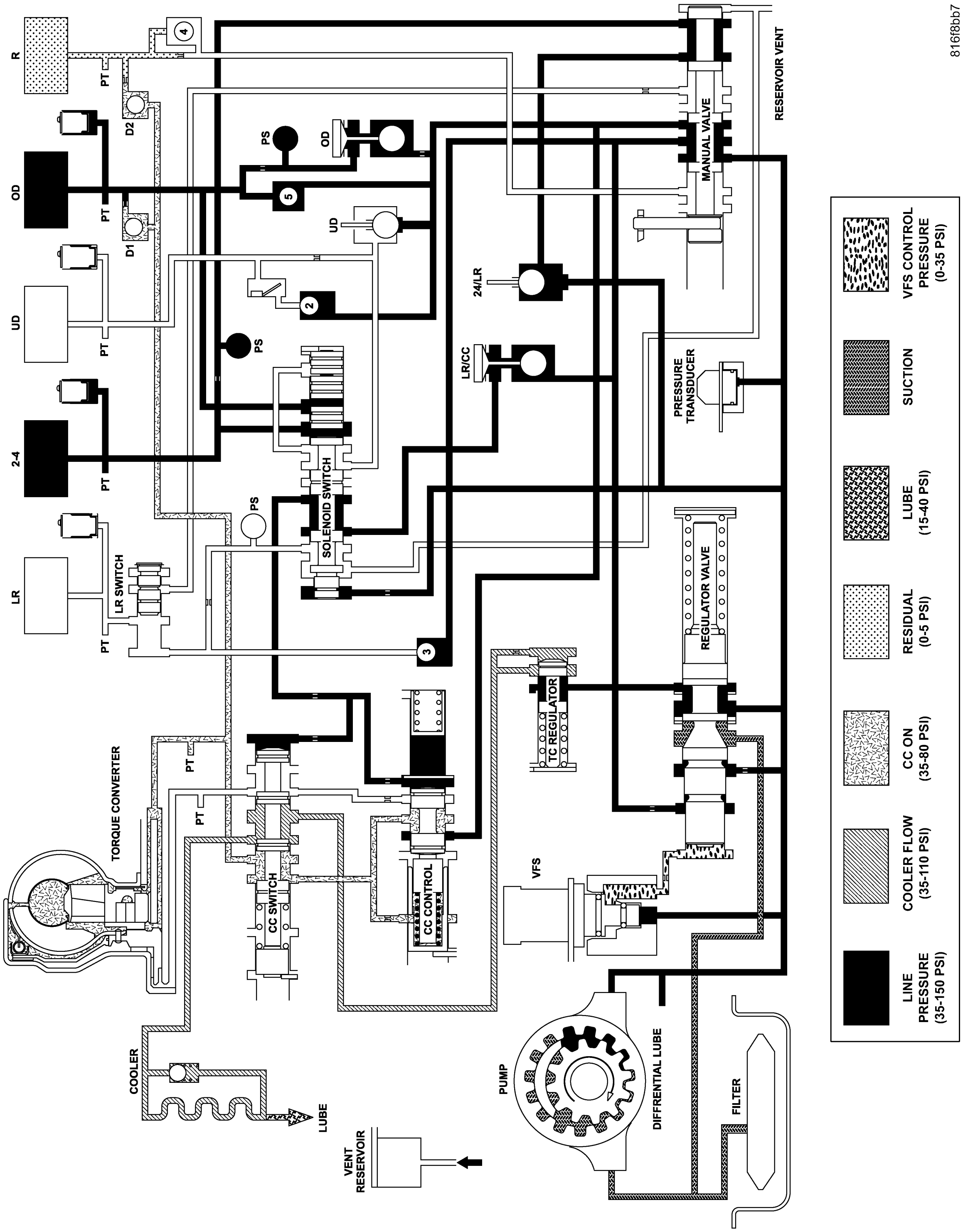

Drive - Direct Gear




*Drive - Direct Gear EMCC*




*Drive - Fourth Gear (Overdrive)*




*Drive - Fourth Gear (Overdrive) EMCC*

# SPECIFICATIONS

## 42RLE AUTOMATIC TRANSMISSION

### GENERAL SPECIFICATIONS

| | |
|---|---|
| Transmission Type | Four-Speed Automatic, Electronically Controlled, Fully Adaptive, Electronically Modulated Torque Converter |
| Lubrication Method | Pump (internal - external gear-type) |
| Cooling Method | Water Heat Exchanger and/or Air-to-Oil Heat Exchanger |

### GEAR RATIOS

| | |
|---|---|
| 1st Gear | 2.84:1 |
| 2nd Gear | 1.57:1 |
| 3rd Gear (Direct) | 1.00:1 |
| 4th Gear (Overdrive) | 0.69:1 |
| Reverse Gear | 2.21:1 |

### BEARING PRELOAD (Drag Torque)

| Description | Metric | Standard |
|---|---|---|
| Output Shaft | 0.22-0.903 N·m | 1-8 in. lbs. |

### CLUTCH PACK

| Description | Metric | Standard |
|---|---|---|
| Low/Reverse Clutch (Select Reaction Plate) | 0.84-1.60 mm | 0.033-0.063 in. |
| Two/Four Clutch (No Select) | 0.76-2.64 mm | 0.030-0.104 in. |
| Reverse Clutch (Select Snap Ring) | 0.89-1.37 mm | 0.035-0.054 in. |
| Overdrive Clutch (No Select) | 1.07-3.25 mm | 0.042-0.128 in. |
| Underdrive Clutch (Select Reaction Plate) | 0.94-1.50 mm | 0.037-0.059 in. |

### INPUT SHAFT

| Description | Metric | Standard |
|---|---|---|
| End Play | 0.127-0.635 mm | 0.005-0.025 in. |

### OIL PUMP CLEARANCES

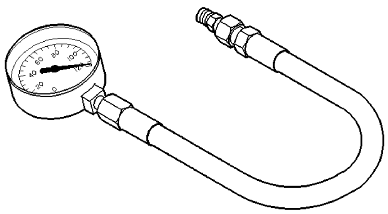
| DESCRIPTION | METRIC | STANDARD |
|---|---|---|
| Outer Gear-to-Crescent | 0.060-0.298 mm | 0.0023-0.0117 in. |
| Inner Gear-to-Crescent | 0.093-0.385 mm | 0.0036-0.0151 in. |
| Outer Gear-to-Pocket | 0.089-0.202 mm | 0.0035-0.0079 in. |
| Outer Gear Side Clearance | 0.020-0.046 mm | 0.0008-0.0018 in. |
| Inner Gear Side Clearance | 0.020-0.046 mm | 0.0008-0.0018 in. |

### TORQUE SPECIFICATIONS

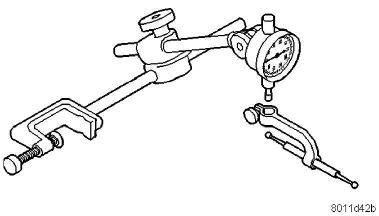
| Description | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Bolt, Torque Converter Housing to Engine | 68 | 50 | - |
| Bolt, Converter-to-Driveplate | 88 | 65 | - |
| Bolt, Fluid Filter-to-Valve Body | 5 | - | 45 |
| Bolt, L/R Piston Retainer-to-Case | 5 | - | 45 |
| Bolt, Adapter/Extension Housing | 54 | 40 | - |
| Bolt, Manual Valve Lever-to-Manual Valve | 5 | - | 45 |
| Bolt, Oil Pan-to-Case | 20 | 14.5 | - |
| Bolt, Oil Pump-to-Case | 30 | - | 265 |
| Bolt, Park Sprag Retainer | 4.5 | - | 40 |
| Bolt, Reaction Shaft Support Halves | 28 | - | 250 |
| Bolt, Solenoid/Pressure Switch Assembly-to-Valve Body | 5.5 | - | 50 |
| Bolt, Valve Body-to-Case | 12 | - | 105 |
| Bolt, Valve Body-to-Transfer Plate | 5 | - | 45 |
| Fitting, Cooler Line | 47.5 | 35 | - |
| Nut, Output Shaft | 271 | 200 | - |
| Plug, Pressure Tap | 5 | - | 45 |
| Bolt, Input Speed-to-Case Sensor | 9 | - | 80 |
| Bolt, Output Speed-to-Case Sensor | 9 | - | 80 |
| Nut, Transfer Case | 47 | 35 | - |
| Bolt, Crossmember to Frame | 68 | 50 | - |
| Bolt, Rear Support to Transmission | 47 | 35 | - |
| Bolt, Clevis Bracket to Crossmember | 47 | 35 | - |
| Bolt, Clevis Bracket to Transmission | 68 | 50 | - |
| Screw, TRS/Manual Shaft Retaining | 5 | - | 45 |
| Screw, 2/4 Accumulator Retainer Plate | 5 | - | 45 |

## SPECIAL TOOLS

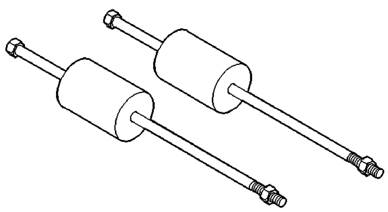
## 42RLE AUTOMATIC TRANSMISSION



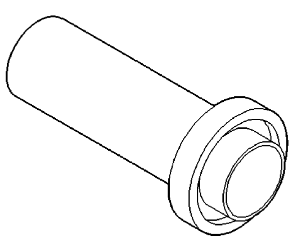
*Pressure Gauge (High) C-3293SP*



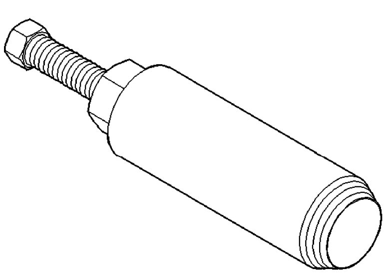

*Dial Indicator C-3339*



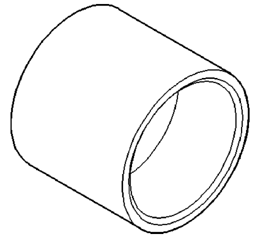
*Hammer, Slide - C-3752*



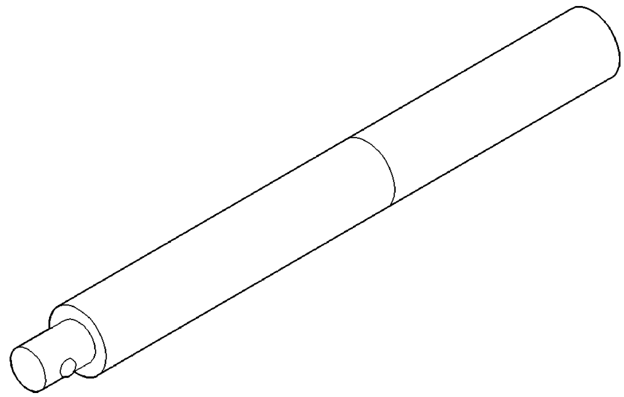
*Installer, Seal - C-3860A*



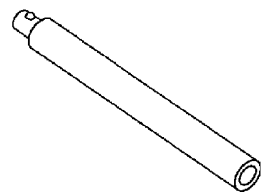
*Puller, Seal - C-3981B*



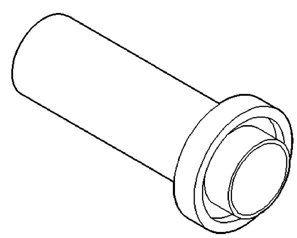
*Installer, Seal - C-3995A*



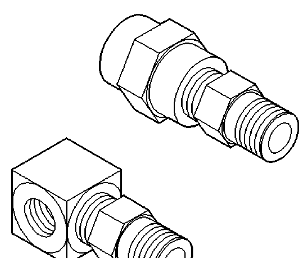
*Universal Handle C-4171*



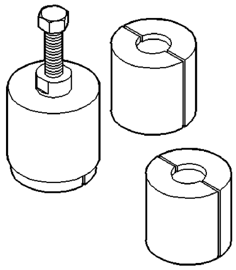
*Extension, Handle - C-4171-2*



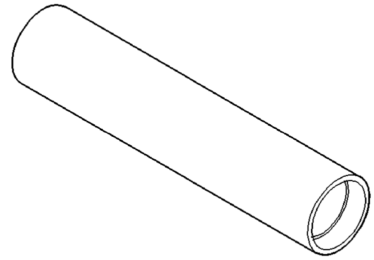
*Installer, Seal - C-4193A*



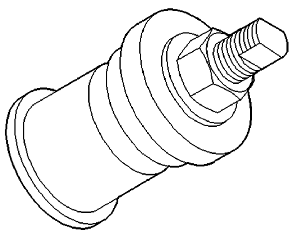
*Adapter Set - L-4559*



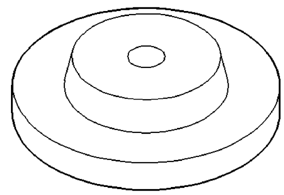
*Puller Set 5048*



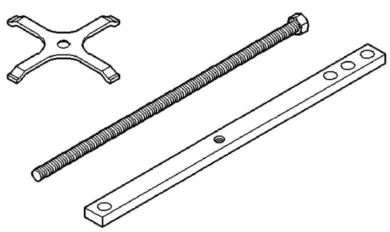
*Installer 6052*



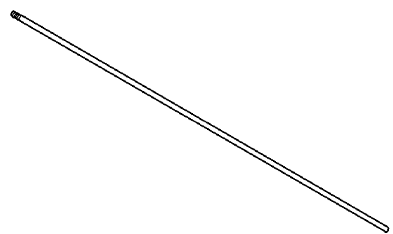
*Installer - 5050A*



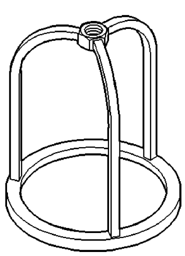
*Disc - 6057*



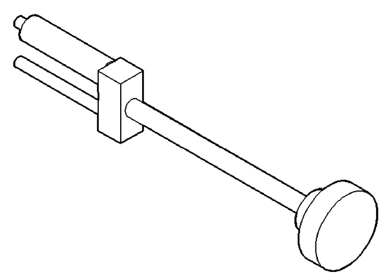
*Compressor - 5058A*



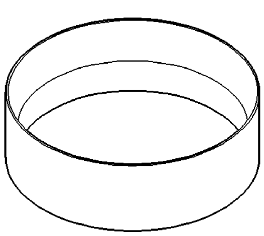
*Tip - 6268*



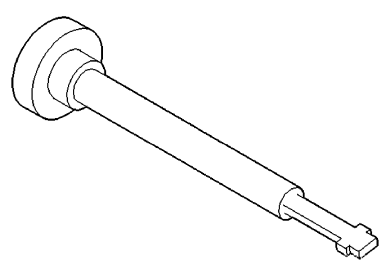
*Compressor - 5059-A*



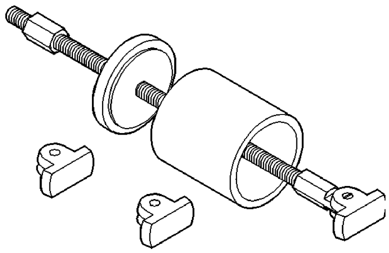
*Remover/Installer - 6301*



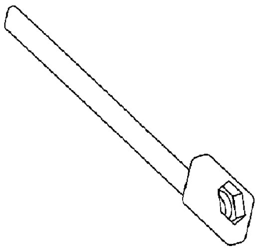
*Installer - 5067*



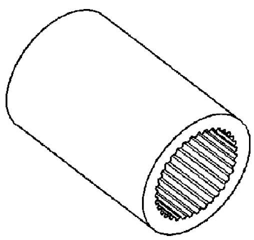
*Remover/Installer - 6302*



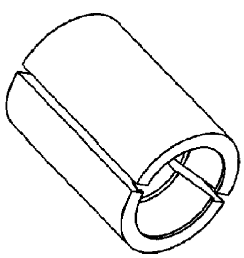
***Remover 6310***



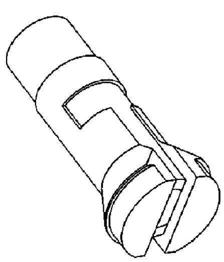
***Wrench - 6497***



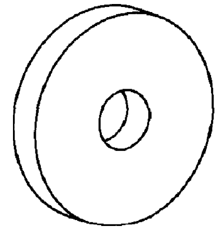
***Wrench - 6498-A***



***Puller Jaws - 6545***



***Remover - 6596***



***Remover - 6597***

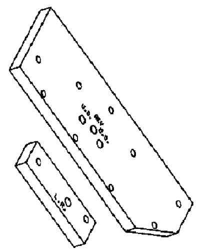
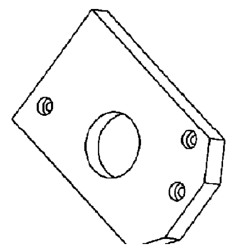
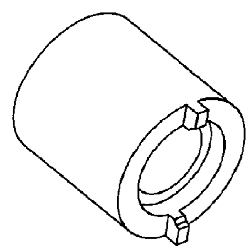


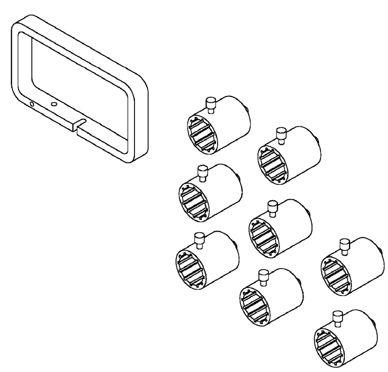
***Plate Set - 6599***



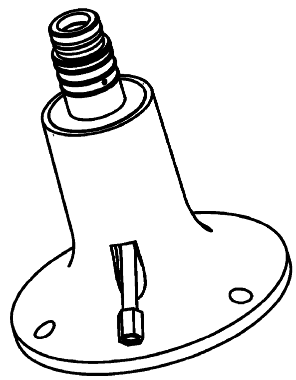
***Plate, Support - 6618A***



***Tool, Staking - 6639***



***End Play Set - 8266***

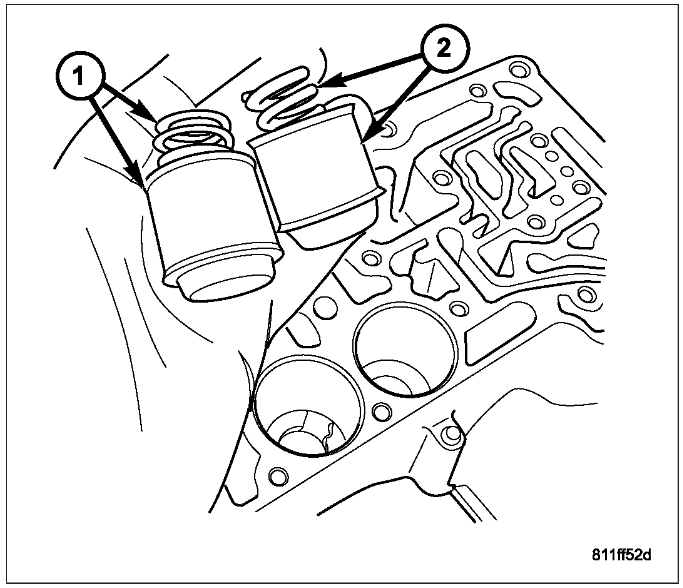


*Fixture, Pressure - 8391*

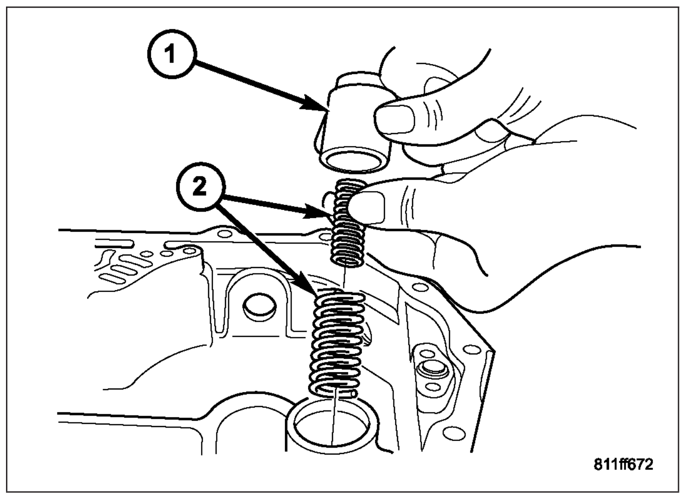
# ACCUMULATOR

## DESCRIPTION

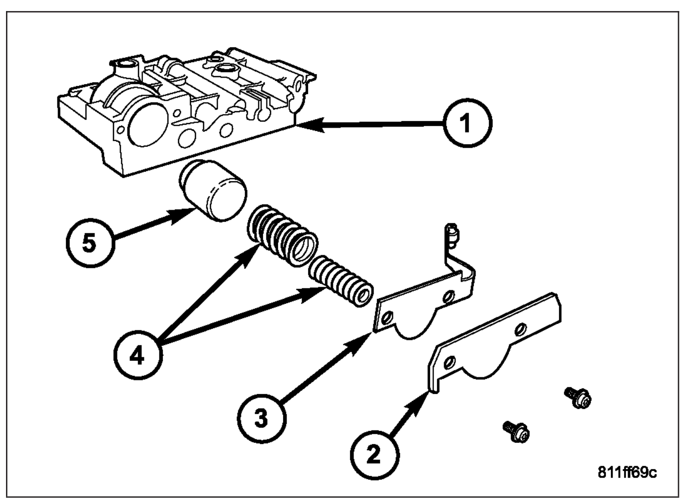
The 42RLE underdrive, overdrive, low/reverse, and 2/4 clutch hydraulic circuits each contain an accumulator. An accumulator typically consists of a piston, return spring(s), and a cover or plug. The overdrive (1) and underdrive (2) accumulators are located within the transmission case, and are retained by the valve body.




The low reverse (1) accumulator is also located within the transmission case, but the assembly is retained by a cover and a snap-ring.




The 2/4 accumulator (5) is located in the valve body. It is retained by a cover and retaining screws.



## OPERATION

The function of an accumulator is to cushion the application of a frictional clutch element. When pressurized fluid is applied to a clutch circuit, the application force is dampened by fluid collecting in the respective accumulator chamber against the piston and springs. The intended result is a smooth, firm clutch application.

# ADAPTER HOUSING SEAL

## REMOVAL

1. Remove the transfer case (Refer to 21 - TRANSMISSION/TRANSFER CASE - REMOVAL).
2. Using a screw mounted in a slide hammer, remove the adapter housing seal.

## INSTALLATION

1. Install a new adapter housing seal with Universal Handle C-4171 and Seal Installer C-3860-A.
2. Install the transfer case (Refer to 21 - TRANSMISSION/TRANSFER CASE - INSTALLATION).

# BEARINGS

## ADJUSTMENTS

### BEARING ADJUSTMENT PROCEDURES

Take extreme care when removing and installing bearing cups and cones. **Use only an arbor press for installation,** as a hammer may not properly align the bearing cup or cone. Burrs or nicks on the bearing seat will give a false end play reading, while gauging for proper shims. Improperly seated bearing cup and cones are subject to low-mileage failure.

Bearing cups and cones should be replaced if they show signs of pitting or heat distress.

If distress is seen on either the cup or bearing rollers, both cup and cone must be replaced.

**NOTE: Bearing drag torque specifications must be maintained to avoid premature bearing failures.**

Used (original) bearing may lose up to 50 percent of the original drag torque after break-in.

**NOTE: All bearing adjustments must be made with no other component interference or gear inter-mesh.**

Oil all bearings before checking turning torque.

# BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM

## DESCRIPTION

The Brake Transmission Shift Interlock System (BTSI), consists of a Park-Interlock cable and a solenoid mounted in the shift lever assembly. The Park-Interlock cable connects the automatic transmission floor mounted shifter to the steering column ignition switch.

## OPERATION

The system locks the shifter into the PARK position. The interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed approximately one-half an inch. A magnetic holding device in the shift lever assembly is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

## DIAGNOSIS AND TESTING - BRAKE TRANSMISSION SHIFT INTERLOCK SYSTEM

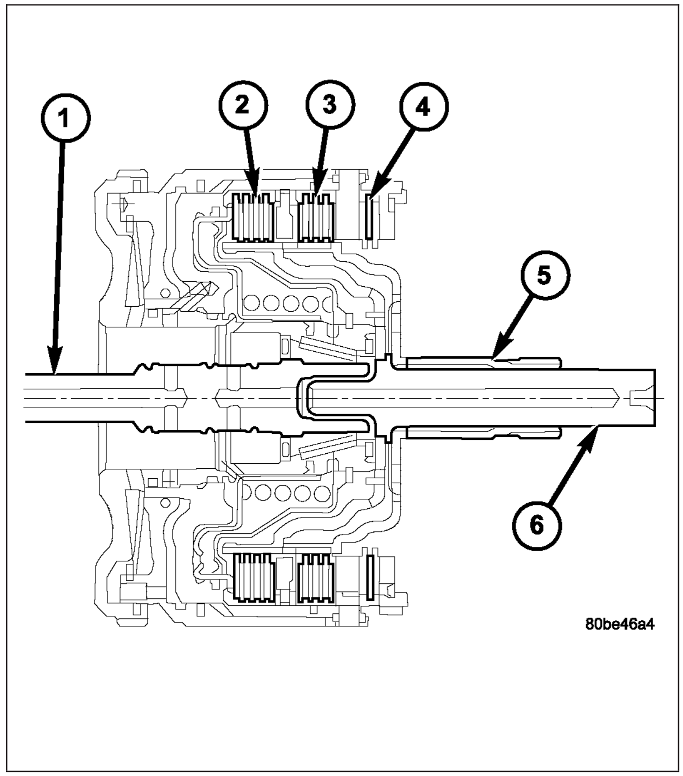
1. Verify that the key can only be removed in the PARK position
2. When the shift lever is in PARK And the shift handle pushbutton is in the “OUT” position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.
3. Shifting out of PARK should not be possible when the ignition key cylinder is in the OFF position.
4. Shifting out of PARK should not be possible while applying normal pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12mm).
5. Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.
6. Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions.

# DRIVING CLUTCHES

## DESCRIPTION

Three hydraulically applied input clutches are used to drive planetary components. The underdrive (2), overdrive (3), and reverse (4) clutches are considered input/driving clutches and are contained within the input clutch assembly. The input clutch assembly also contains:

- Input shaft
- Input hub
- Clutch retainer
- Underdrive piston
- Overdrive/reverse piston
- Overdrive hub
- Underdrive hub




## OPERATION

The three input clutches are responsible for driving different components of the planetary geartrain.

**NOTE: (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING) for a collective view of which clutch elements are applied at each position of the selector lever.**

### UNDERDRIVE CLUTCH

The underdrive clutch is hydraulically applied in first, second, and third (direct) gears by pressurized fluid against the underdrive piston. When the underdrive clutch is applied, the underdrive hub drives the rear sun gear.

### OVERDRIVE CLUTCH

The overdrive clutch is hydraulically applied in third (direct) and overdrive gears by pressurized fluid against the overdrive/reverse piston. When the overdrive clutch is applied, the overdrive hub drives the front planet carrier.

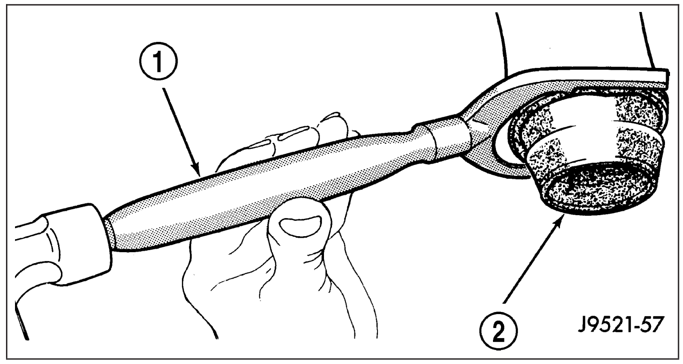
### REVERSE CLUTCH

The reverse clutch is hydraulically applied in reverse gear only by pressurized fluid against the overdrive/reverse piston. When the reverse clutch is applied, the front sun gear assembly is driven.

# EXTENSION HOUSING SEAL

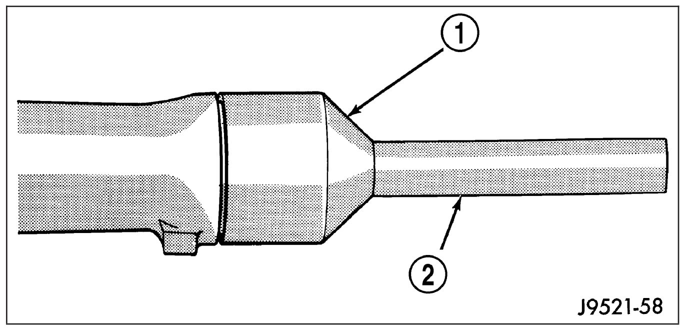
## REMOVAL

1. Raise vehicle.
2. Mark propeller shaft and axle yoke, or companion flange, for alignment reference.
3. Disconnect and remove propeller shaft.
4. Remove old seal with a generic seal remover (1) from overdrive extension housing.




## INSTALLATION

1. Place seal in position on overdrive housing.
2. Drive seal into overdrive housing with Seal Installer C-3995-A (1).
3. Carefully guide propeller shaft slip yoke into housing and onto output shaft splines. Align marks made at removal and connect propeller shaft to rear axle pinion yoke.



# FLUID AND FILTER

## DIAGNOSIS AND TESTING

## DIAGNOSIS AND TESTING - CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has two primary causes.

1. A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a damaged main cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.
2. Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

## EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation, and varnish buildup which interferes with valve and clutch operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

## FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to replace contaminated converter after repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission, an overhaul is necessary.

The torque converter should be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

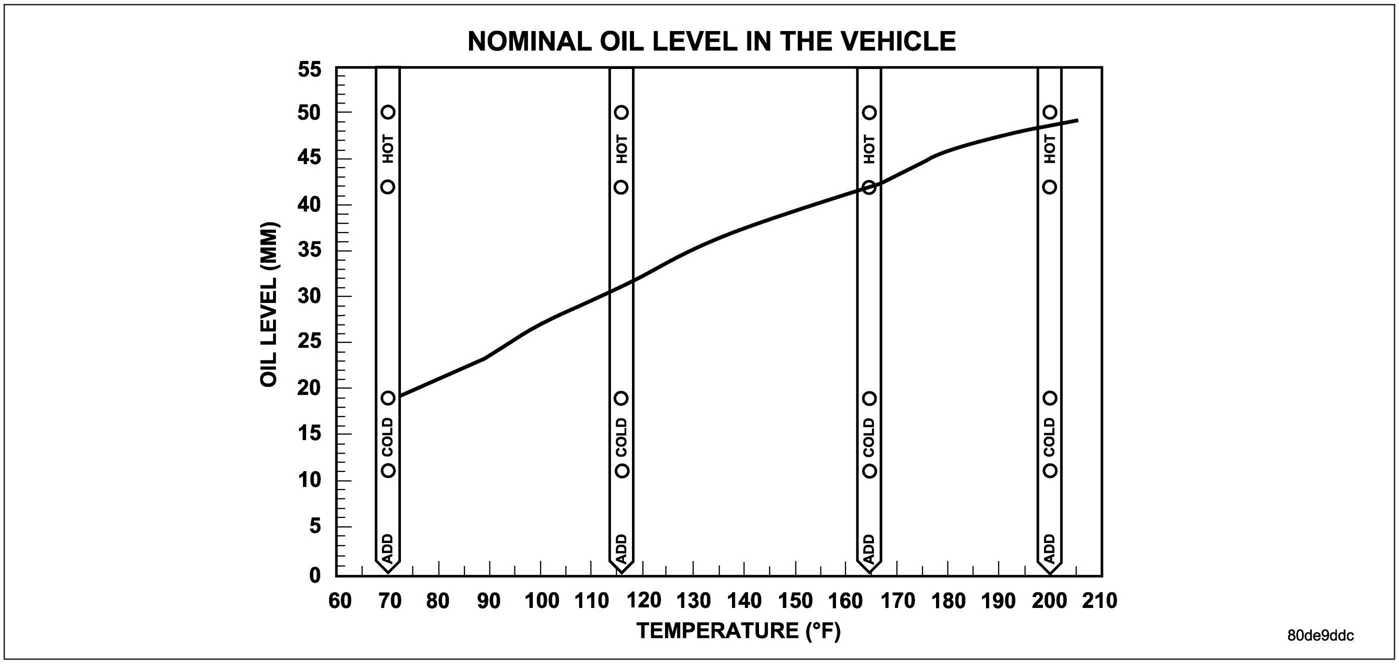
## STANDARD PROCEDURE

## FLUID LEVEL CHECK

The transmission sump has a dipstick to check oil similar to most automatic transmissions. It is located on the left side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

The torque converter fills in both the PARK and NEUTRAL positions. Place the selector lever in PARK to be sure that the fluid level check is accurate. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground.** At normal operating temperature (approximately 82° C or 180° F), the fluid level is correct if it is in the HOT region (cross-hatched area) on the oil level indicator. The fluid level should be in COLD region at 21° C (70° F) fluid temperature. Adjust fluid level as necessary. Use only Mopar® ATF+4, Automatic Transmission Fluid.

## FLUID LEVEL CHECK USING SCAN TOOL




**NOTE: Engine and Transmission should be at normal operating temperature before performing this procedure.**

1. Start engine and apply parking brake.
2. Connect scan tool and select transmission.
3. Select sensors.
4. Read the transmission temperature value.
5. Compare the fluid temperature value with the chart.
6. Adjust transmission fluid level shown on the dipstick according to the 42RLE Fluid Temperature Chart. Use only Mopar® ATF+4, Automatic Transmission Fluid.
7. Check transmission for leaks.

## FLUID/FILTER SERVICE

**NOTE: Only fluids of the type labeled Mopar® ATF+4, Automatic Transmission Fluid, should be used in the transmission sump. A filter change should be made at the time of the transmission oil change. The magnet (on the inside of the oil pan) should also be cleaned with a clean, dry cloth.**

**NOTE: If the transmission is disassembled for any reason, the fluid and filter should be changed.**

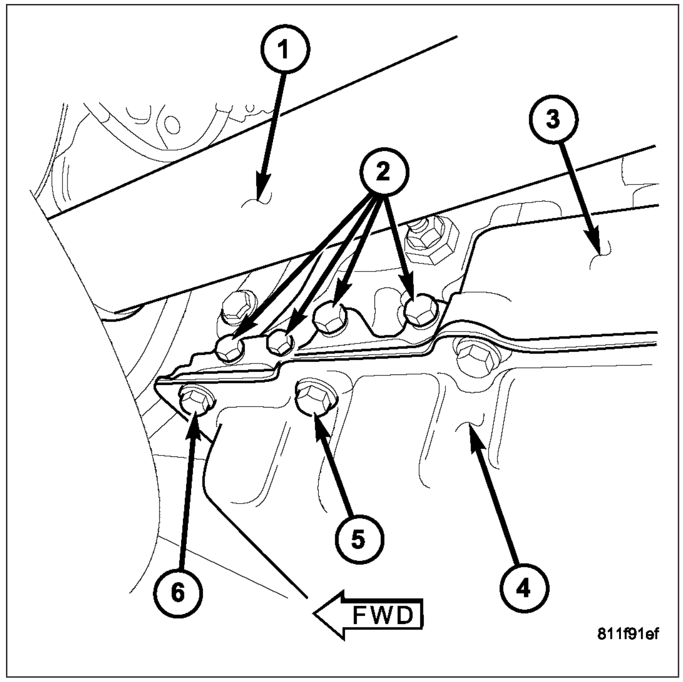
1. Raise vehicle on a hoist. Place a drain container with a large opening, under transmission oil pan.

**NOTE: One of the oil pan bolts (5) has a sealing patch applied from the factory. Separate this bolt for reuse.**

2. Loosen pan bolts and tap the pan at one corner to break it loose allowing fluid to drain, then remove the oil pan.
3. Install a new filter and o-ring on bottom of the valve body and tighten retaining screws to 5 N·m (45 in. lbs.).

**NOTE: Before installing the oil pan bolt (5) in the bolt hole located between the torque converter clutch on and U/D clutch pressure tap circuits, it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.**

4. Clean the oil pan and magnet. Reinstall pan using new Mopar® Silicone Adhesive sealant. Tighten oil pan bolts to 20 N·m (14.5 ft. lbs.).
5. Pour four quarts of Mopar® ATF+4, Automatic Transmission Fluid, through the dipstick opening.




6. Start engine and allow to idle for at least one minute. Then, with parking and service brakes applied, move selector lever momentarily to each position, ending in the park or neutral position.
7. Check the transmission fluid level and add an appropriate amount to bring the transmission fluid level to 3mm (1/8 in.) below the lowest mark on the dipstick.
8. Recheck the fluid level after the transmission has reached normal operating temperature, 82° C (180°F).
9. To prevent dirt from entering transmission, make certain that dipstick is fully seated into the dipstick opening.

## STANDARD PROCEDURE - TRANSMISSION FILL

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

1. Remove dipstick and insert clean funnel in transmission fill tube.
2. Add following initial quantity of Mopar® ATF +4, Automatic Transmission Fluid, to transmission:
   a. If only fluid and filter were changed, add **6 pints (3 quarts)** of ATF +4 to transmission.
   b. If transmission was completely overhauled, or torque converter was replaced or drained, add **10 pints (5 quarts)** of ATF +4 to transmission.
3. Apply parking brakes.
4. Start and run engine at normal curb idle speed.
5. Apply service brakes, shift transmission through all gear ranges then back to NEUTRAL, set parking brake, and leave engine running at curb idle speed.
6. Remove funnel, insert dipstick and check fluid level. If level is low, **add fluid to bring level to MIN mark on dipstick.** Check to see if the oil level is equal on both sides of the dipstick. If one side is noticably higher than the other, the dipstick has picked up some oil from the dipstick tube. Allow the oil to drain down the dipstick tube and re-check.
7. Drive vehicle until transmission fluid is at normal operating temperature.
8. With the engine running at curb idle speed, the gear selector in NEUTRAL, and the parking brake applied, check the transmission fluid level.

**CAUTION: Do not overfill transmission, fluid foaming and shifting problems can result.**

9. Add fluid to bring level up to MAX arrow mark.

When fluid level is correct, shut engine off, release park brake, remove funnel, and install dipstick in fill tube.

# GEARSHIFT CABLE

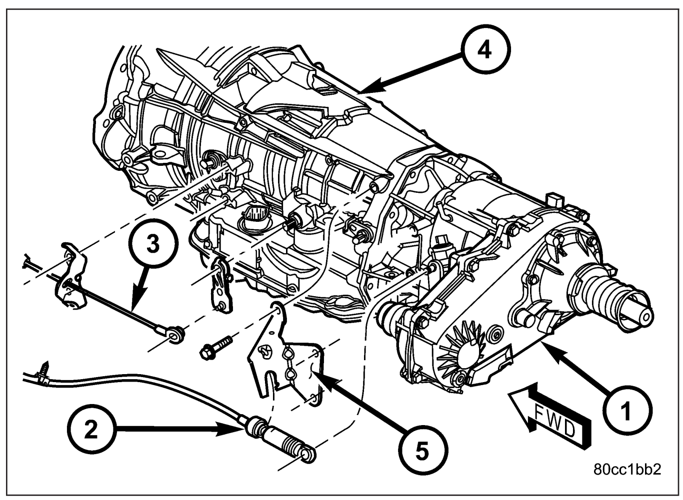
## DIAGNOSIS AND TESTING

## GEARSHIFT CABLE

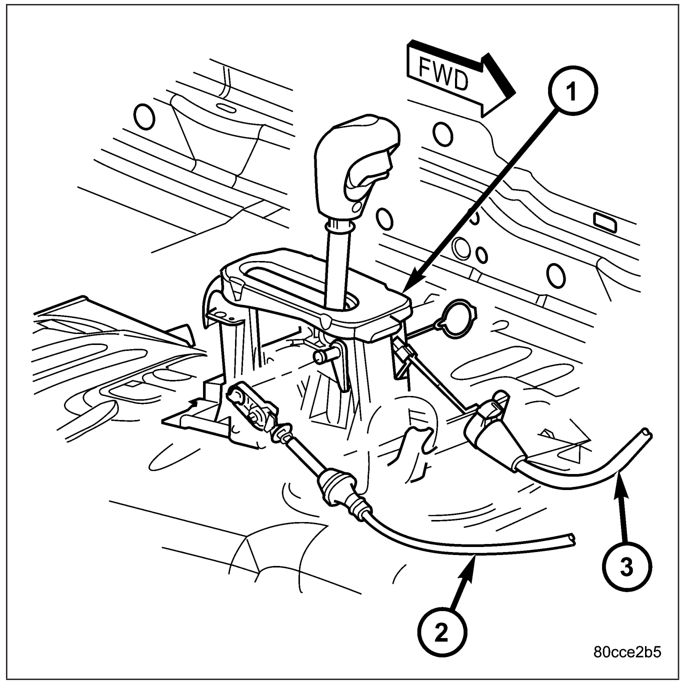
1. The floor shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.
2. Engine starts must be possible with floor shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.
3. With floor shift lever handle push-button not depressed and lever in:
   a. PARK position - Apply forward force on center of handle and remove pressure. Engine starts must be possible.
   b. PARK position - Apply rearward force on center of handle and remove pressure. Engine starts must be possible.
   c. NEUTRAL position - Normal position. Engine starts must be possible.
   d. NEUTRAL position - Engine running and brakes applied, apply forward force on center of shift handle. Transmission shall not be able to shift from NEUTRAL to REVERSE.

## REMOVAL

1. Shift transmission into PARK.
2. Raise vehicle.
3. Remove the shift cable eyelet from the transmission manual shift lever.
4. Remove shift cable from the cable support bracket.
5. Lower vehicle.
6. Remove necessary console parts for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
7. Disconnect cable at shift lever and shifter assembly bracket.
8. Remove the nuts holding the shift cable seal plate to the floor pan.

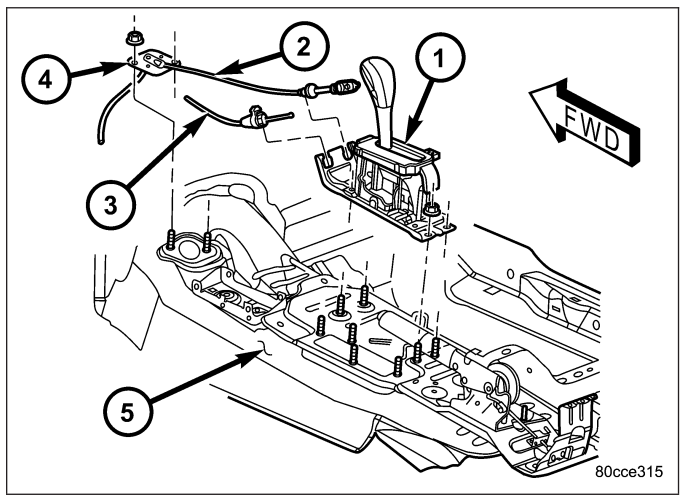


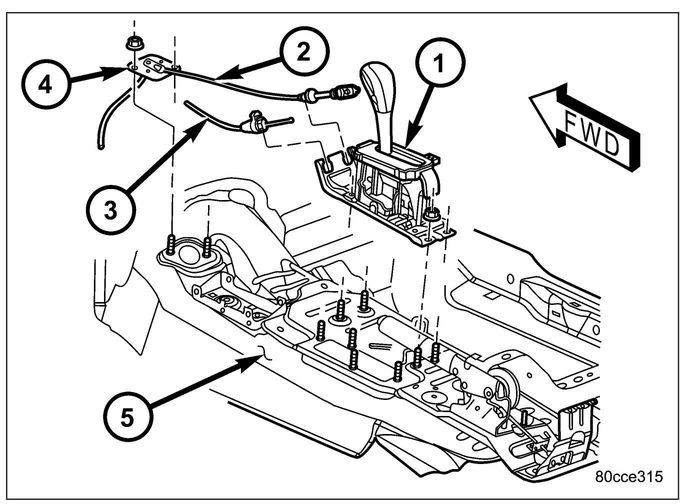
9. Pull cable through floor panel opening.
10. Remove shift cable from vehicle.



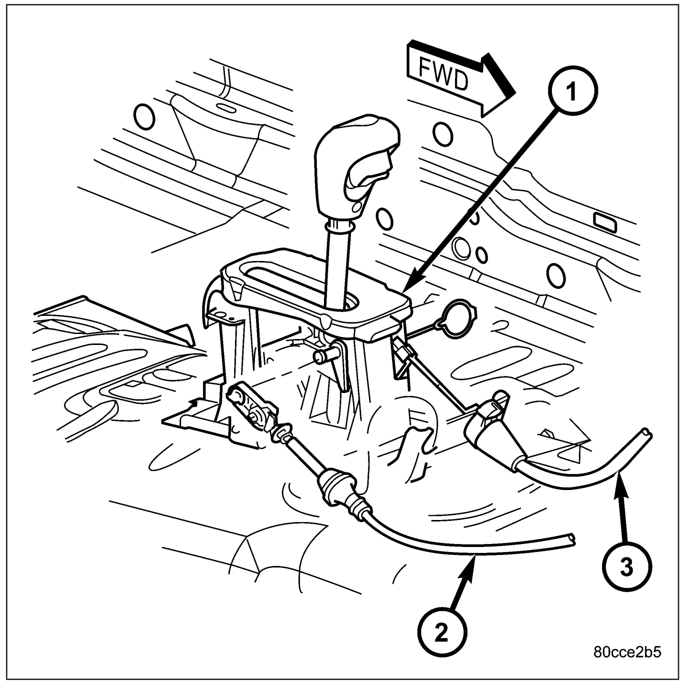

## INSTALLATION

1. Route cable through hole in floor pan.
2. Install seal plate to studs in floor pan.
3. Install nuts to hold seal plate to floor pan. Tighten nuts to 7 N·m (65 in.lbs.).
4. Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.
5. Place the floor shifter lever in PARK position.
6. Loosen the adjustment screw on the shift cable.
7. Snap the shift cable onto the shift lever pin.



8. Raise the vehicle.
9. Install the shift cable to the shift cable support bracket.
10. Shift the transmission into PARK. PARK is the rearmost detent position on the transmission manual shift lever.
11. Snap the shift cable onto the transmission manual shift lever.
12. Lower vehicle.
13. Verify that the shift lever is in the PARK position.
14. Tighten the adjustment screw to 7 N·m (65 in.lbs.).
15. Verify correct shifter operation.
16. Install any console parts removed for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

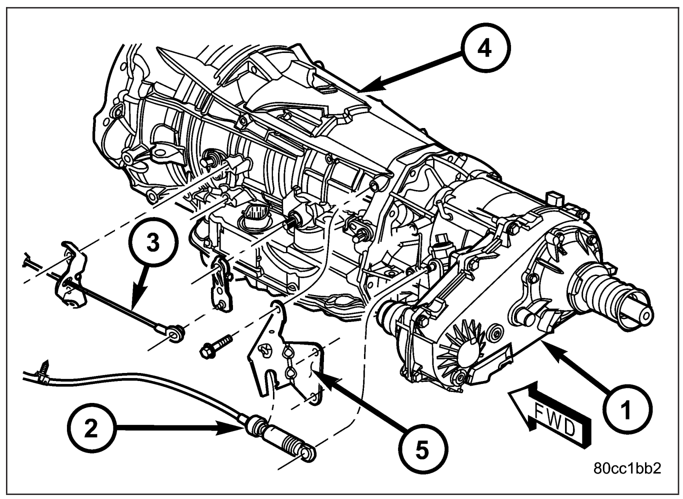



## ADJUSTMENTS - GEARSHIFT CABLE

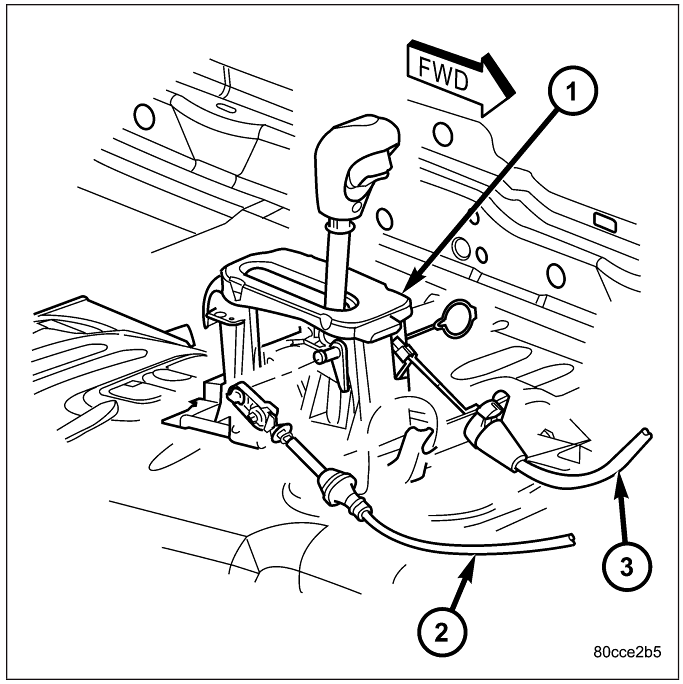
Check adjustment by starting the engine in PARK and NEUTRAL. Adjustment is CORRECT if the engine starts only in these positions. Adjustment is INCORRECT if the engine starts in one but not both positions. If the engine starts in any position other than PARK or NEUTRAL, or if the engine will not start at all, the TRS may be faulty.

### Gearshift Adjustment Procedure

1. Shift transmission into PARK.
2. Remove floor console as necessary for access to the shift cable adjustment. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
3. Loosen the shift cable adjustment screw.



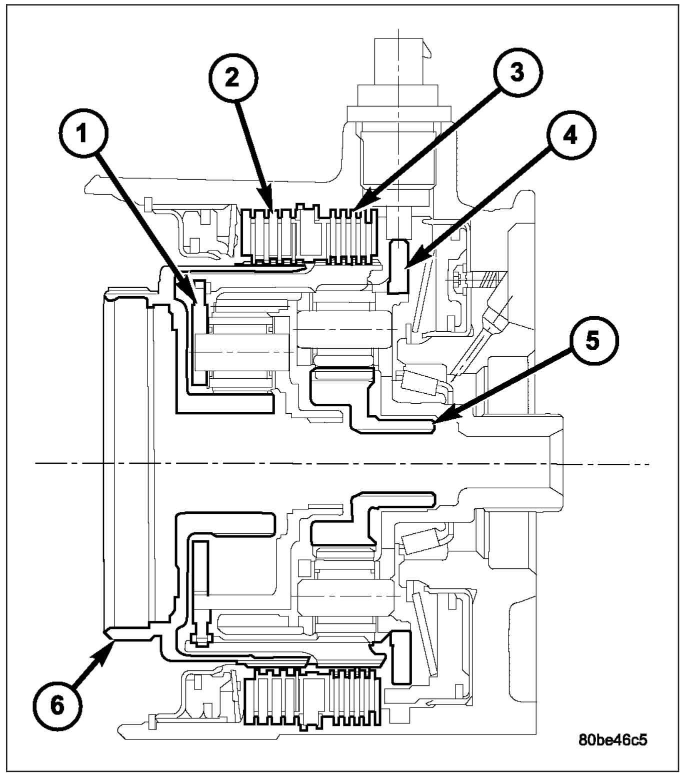
4. Raise vehicle.
5. Unsnap cable eyelet from transmission shift lever.
6. Verify transmission shift lever is in PARK detent by moving lever fully rearward. Last rearward detent is PARK position.
7. Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.
8. Snap cable eyelet onto transmission shift lever.
9. Lower vehicle
10. Tighten the shift cable adjustment screw to 7 N·m (65 in.lbs.).
11. Verify correct operation.
12. Install any floor console components removed for access. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)



# HOLDING CLUTCHES

## DESCRIPTION

Two hydraulically applied multi-disc clutches are used to hold planetary geartrain components stationary while the input clutches drive others. The 2/4 (2) and Low/Reverse (3) clutches are considered holding clutches and are contained at the rear of the transmission case.




## OPERATION

**NOTE: (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING) for a collective view of which clutch elements are applied at each position of the selector lever.**

### 2/4 CLUTCH

The 2/4 clutch is hydraulically applied in second and fourth gears by pressurized fluid against the 2/4 clutch piston. When the 2/4 clutch is applied, the front sun gear assembly is held or grounded to the transmission case.

### LOW/REVERSE CLUTCH

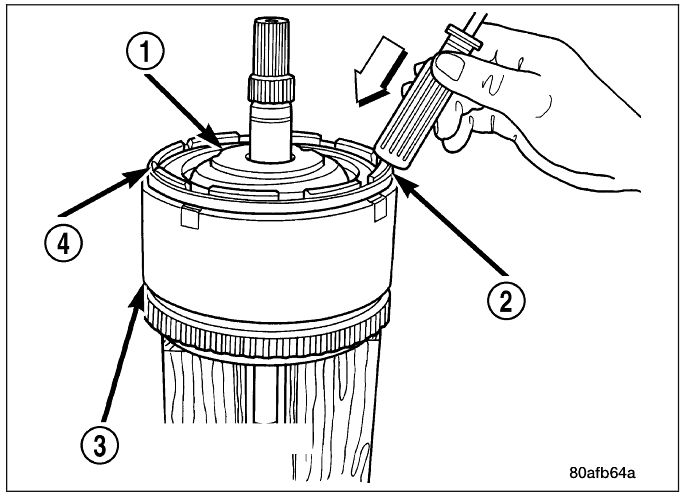
The Low/Reverse clutch is hydraulically applied in park, reverse, neutral, and first gears by pressurized fluid against the Low/Reverse clutch piston. When the Low/Reverse clutch is applied, the front planet carrier/rear annulus assembly is held or grounded to the transmission case.

# INPUT CLUTCH ASSEMBLY

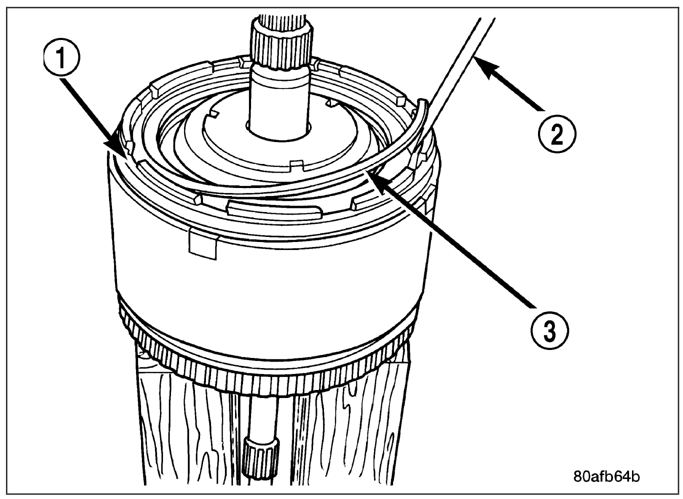
## DISASSEMBLY

**NOTE: If the input clutch assembly is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Quick Learn Procedure using the scan tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).**

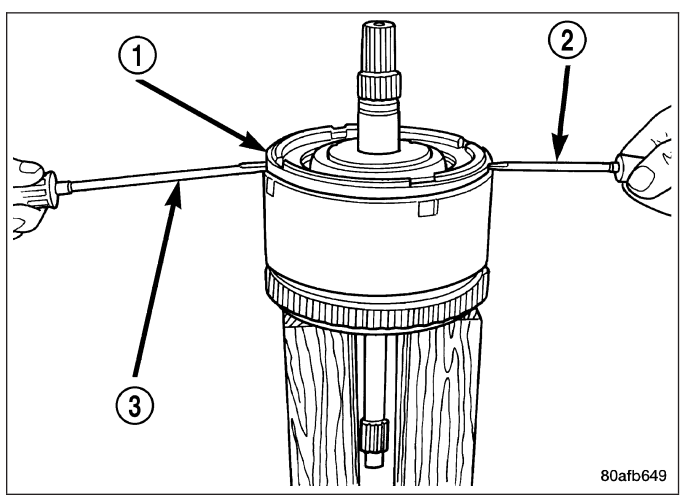
1. Mount input clutch assembly to Input Clutch Pressure Fixture (Tool 8391).
2. Tap down (2) reverse clutch reaction plate (4) to release pressure from snap ring.



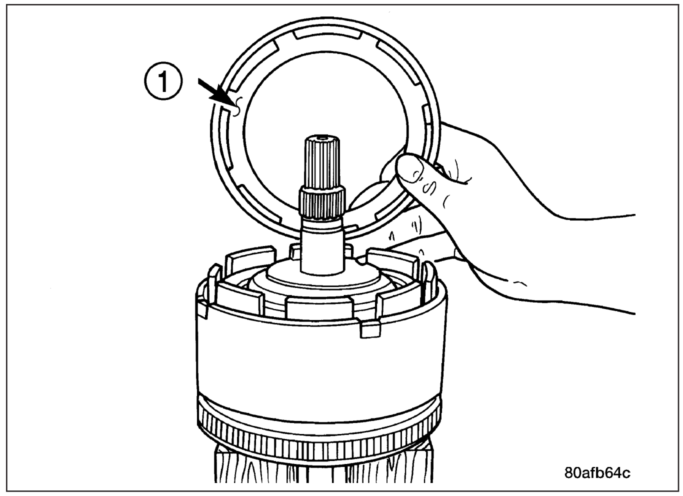

3. Remove reverse clutch snap ring (3).




4. Pry up reverse clutch reaction plate (1).

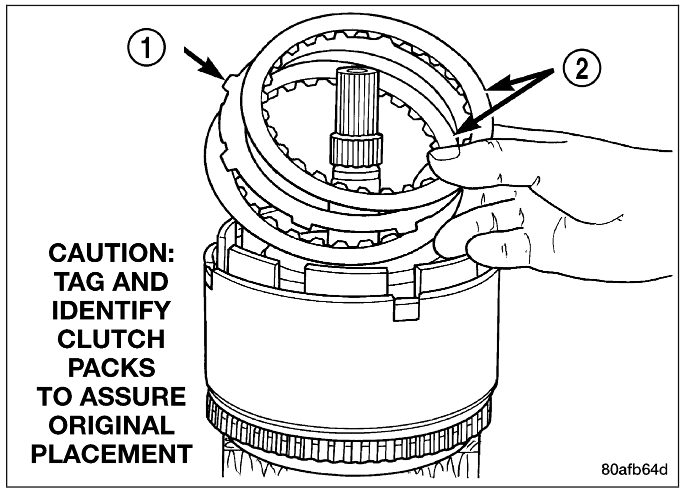


5. Remove reverse clutch reaction plate (1).

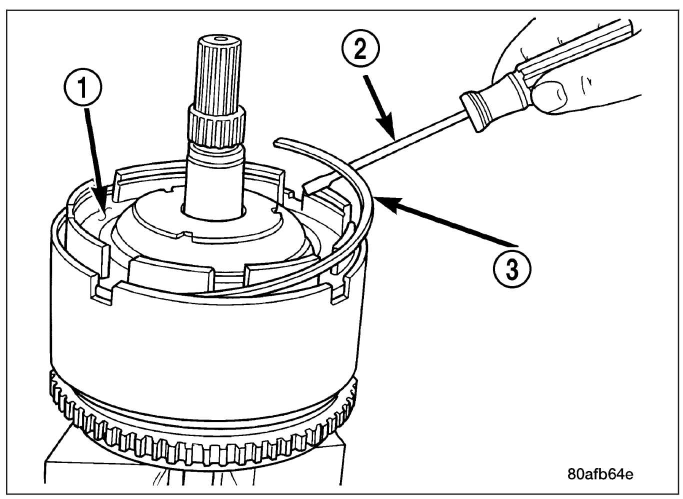



**NOTE: Tag reverse clutch pack for reassembly identification.**

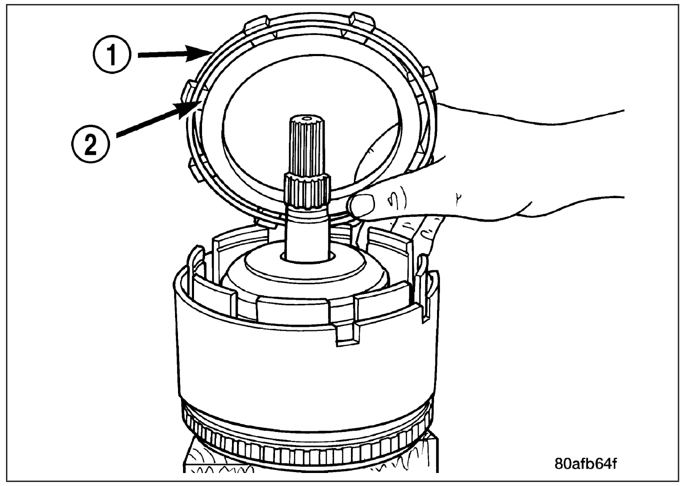
6. Remove the reverse clutch pack (two fibers/one steel) (1, 2).



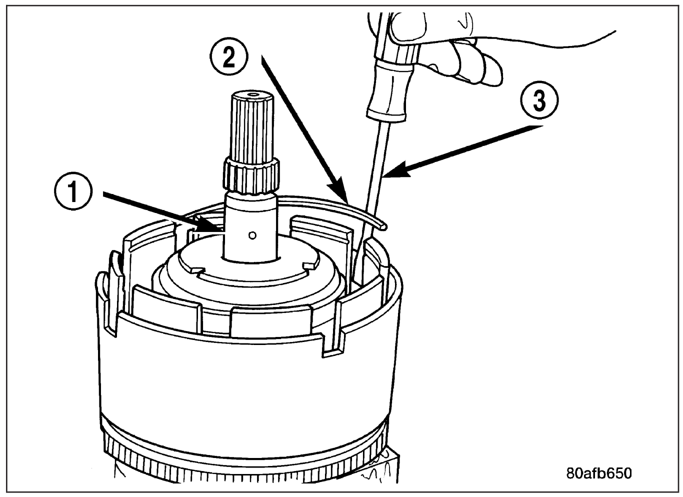

7. Remove the OD/Reverse reaction plate (1) snap ring (3).



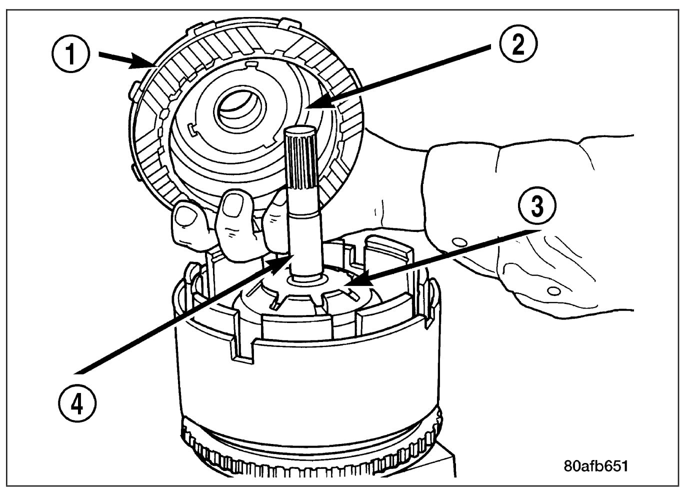
8. Remove OD/Reverse pressure plate (1).




9. Remove OD/Reverse reaction plate wave snap ring (2).

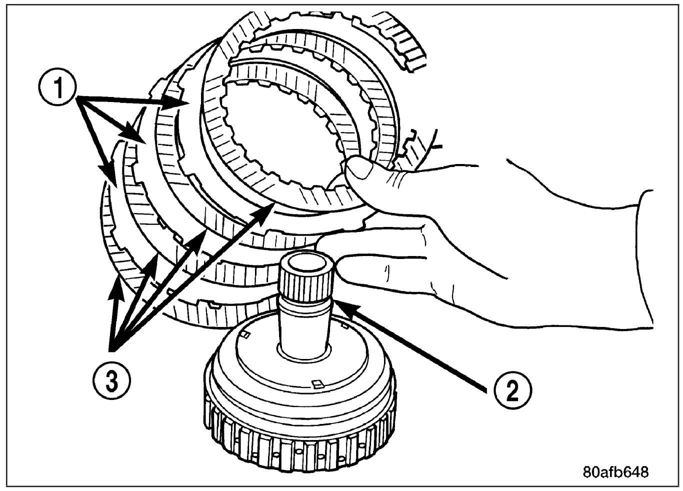



10. Remove OD shaft/hub and OD clutch pack (1).

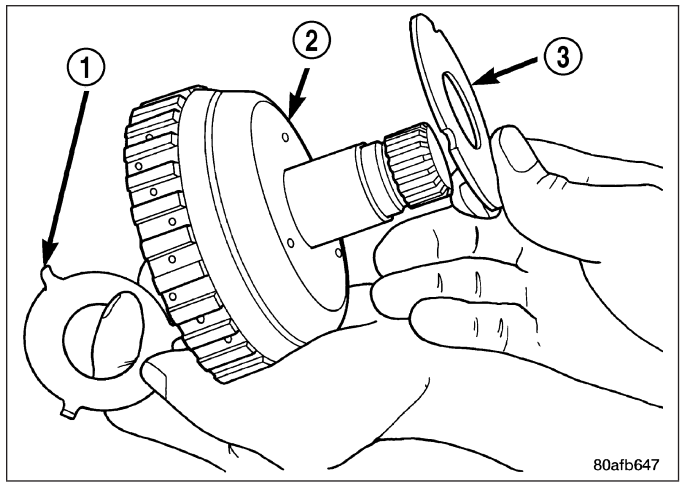


**NOTE: Tag overdrive clutch pack for reassembly identification.**

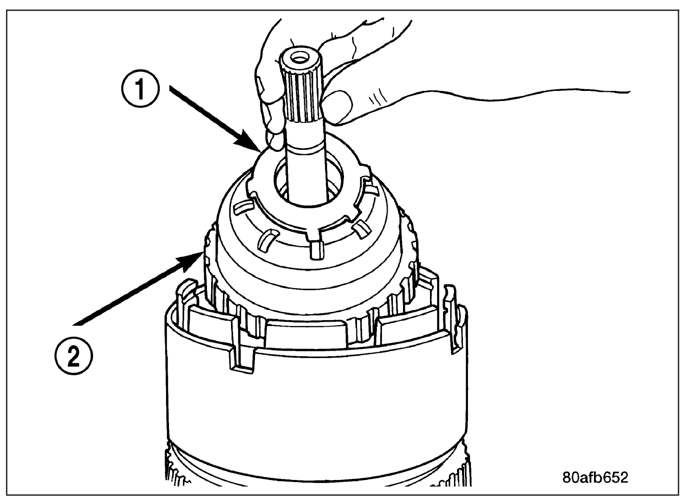
11. Remove the overdrive clutch (1, 3) from the overdrive hub/shaft (2).



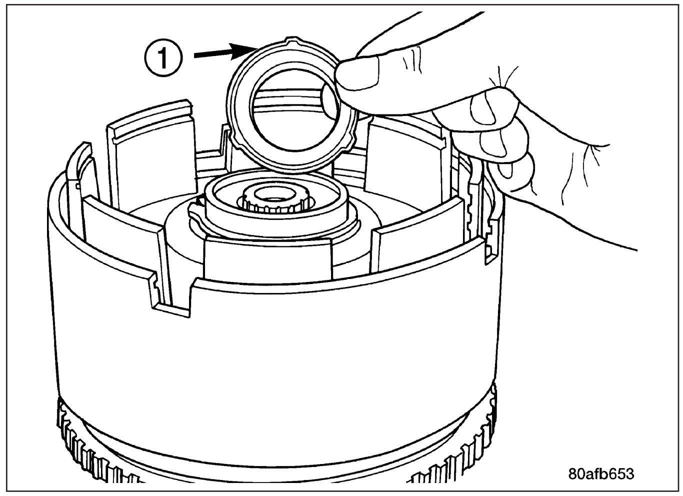

12. Remove and inspect number 3 and 4 thrust plates (1, 3).



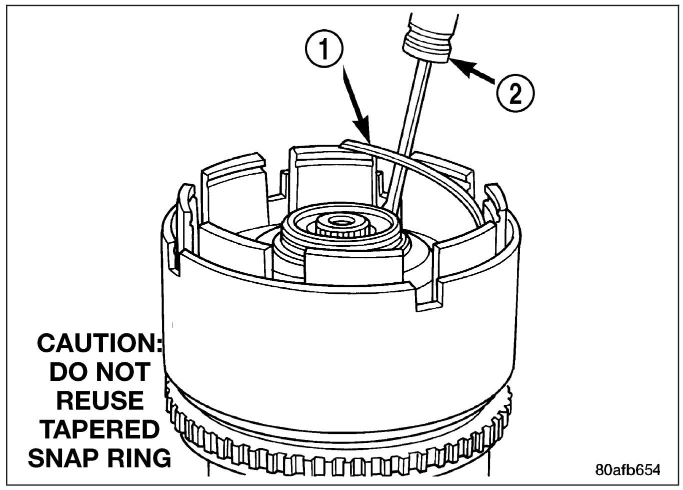

13. Remove the underdrive shaft assembly (2).



14. Remove the number 2 needle bearing (1).

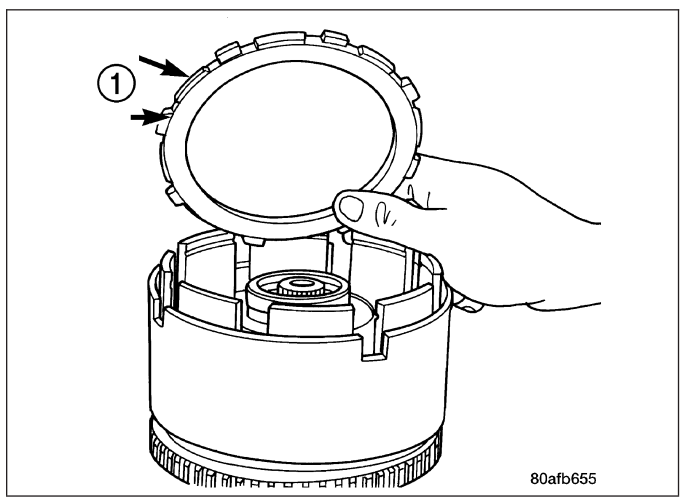



15. Remove the OD/UD reaction plate tapered snap ring (1).

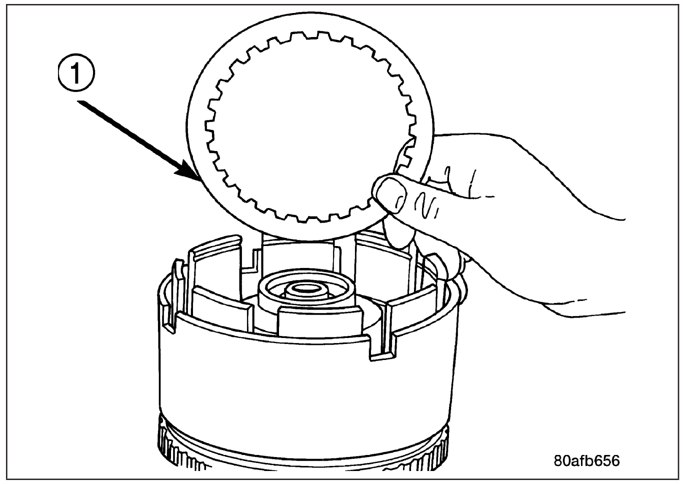



**NOTE: The OD/UD clutch reaction plate has a step on both sides. The OD/UD clutches reaction plate goes tapered step side up.**

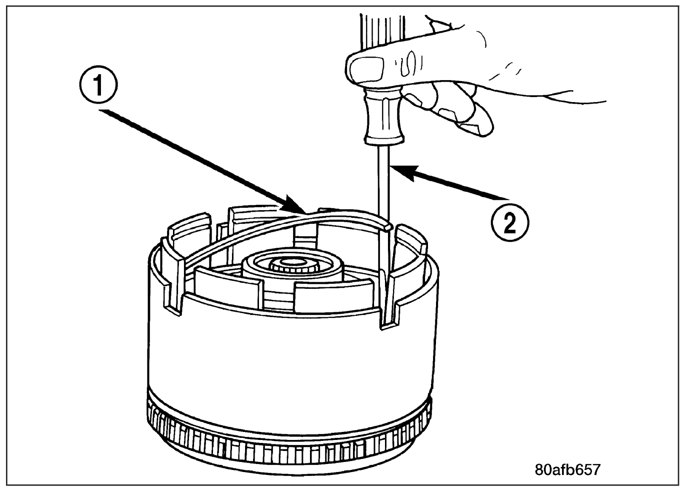
16. Remove the OD/UD reaction plate (1).



17. Remove the first UD clutch disc (1).

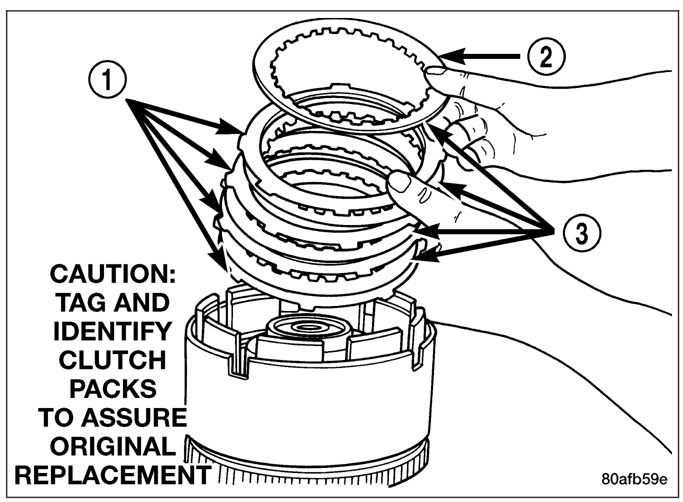



18. Remove the UD clutch flat snap ring (1).



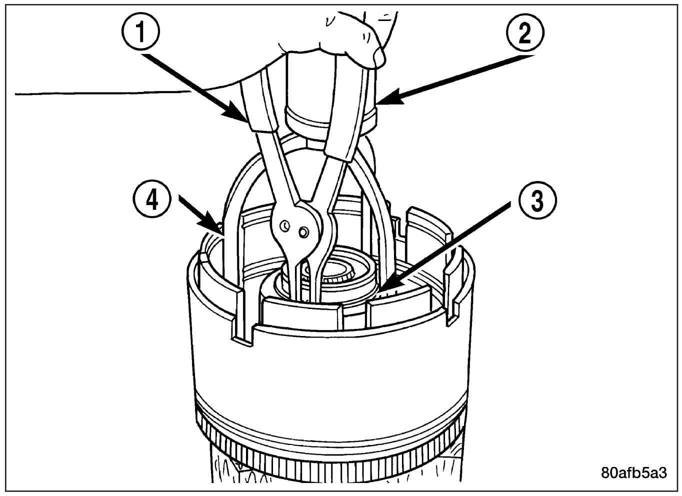

**NOTE: Tag underdrive clutch pack for reassembly identification.**

19. Remove the UD clutch pack (1, 3).



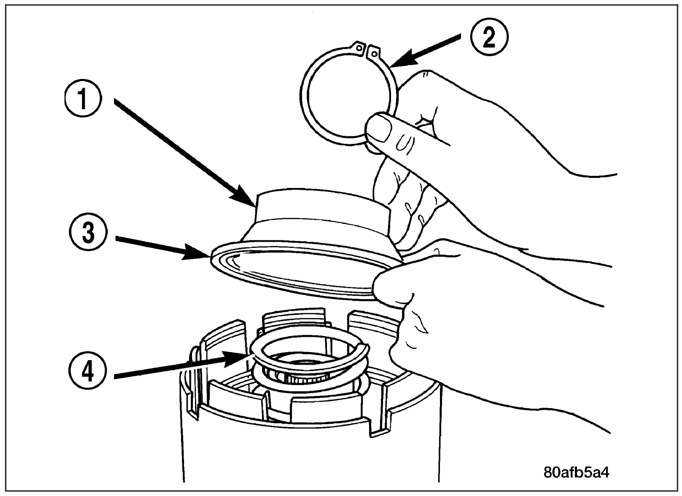
**CAUTION: Compress return spring just enough to remove or install snap ring.**

20. Using Compressor 5059A (4) and an arbor press (2), compress UD clutch piston enough to remove snap ring (3).



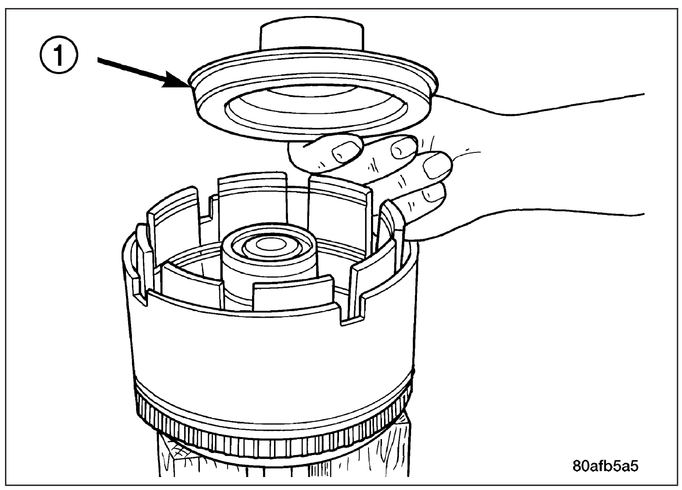

80afb5a3

21. Remove the underdrive spring retainer snap ring (2), spring retainer (1), and spring (4).



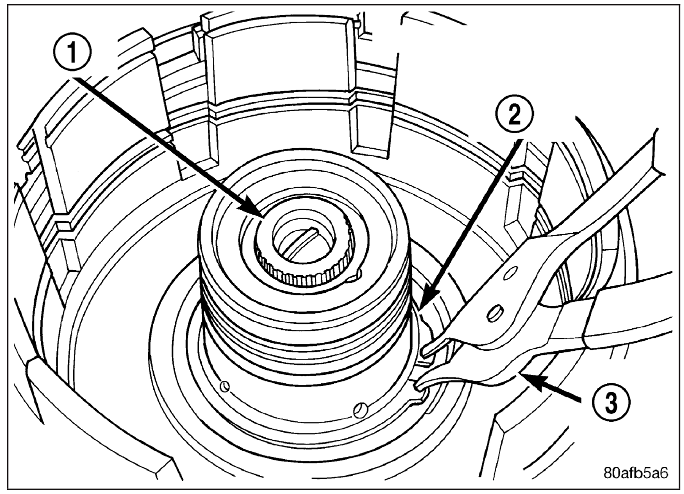

80afb5a4

22. Remove the UD clutch piston (1).

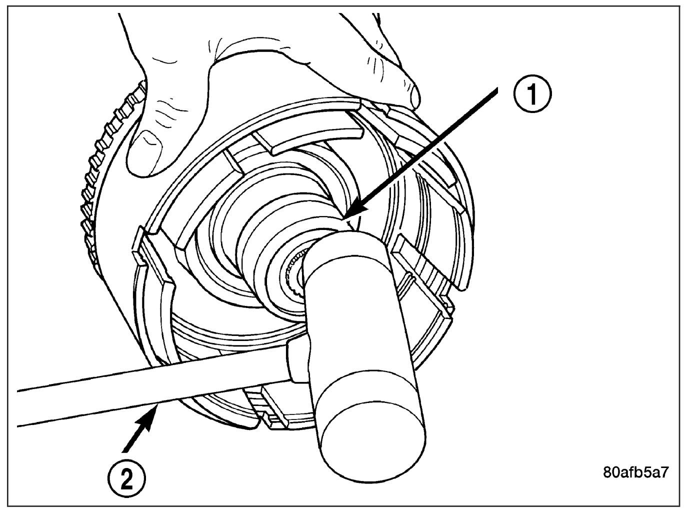



80afb5a5

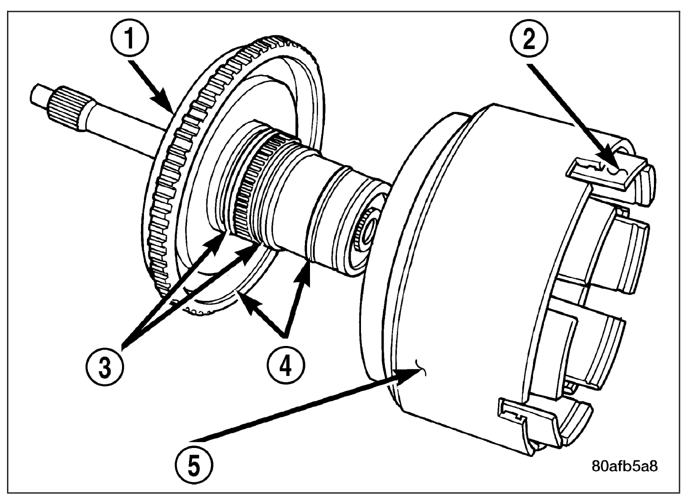
23. Remove the input hub tapered snap ring (2).



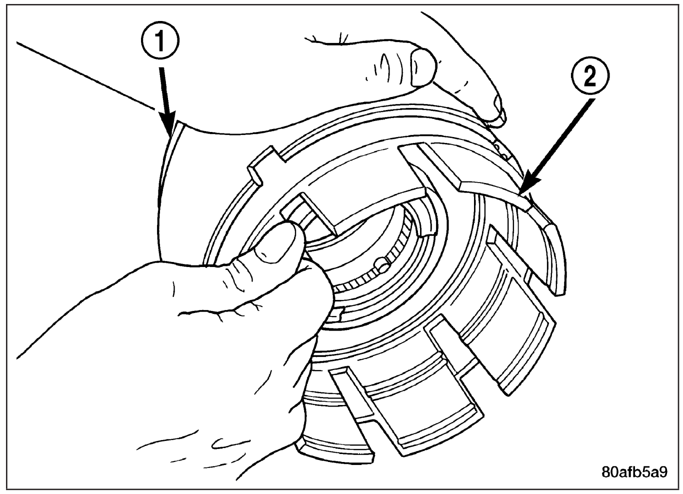

24. Tap on input hub (1) with soft faced hammer (2) and separate input hub from OD/Reverse piston and clutch retainer.



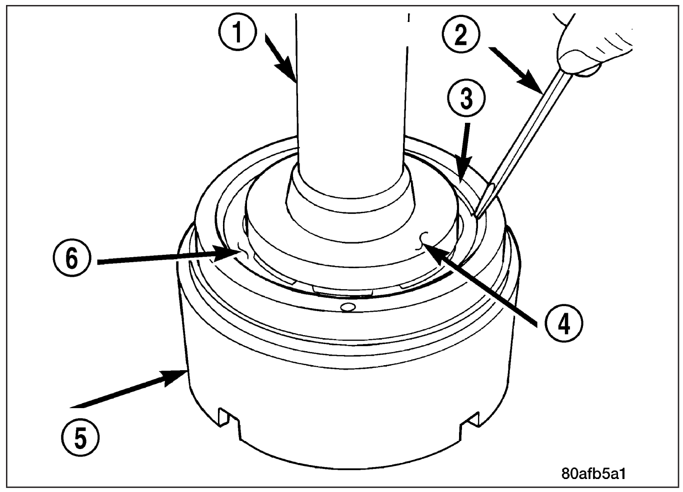

25. Separate the input hub from OD/Reverse piston (5) and clutch retainer (2).



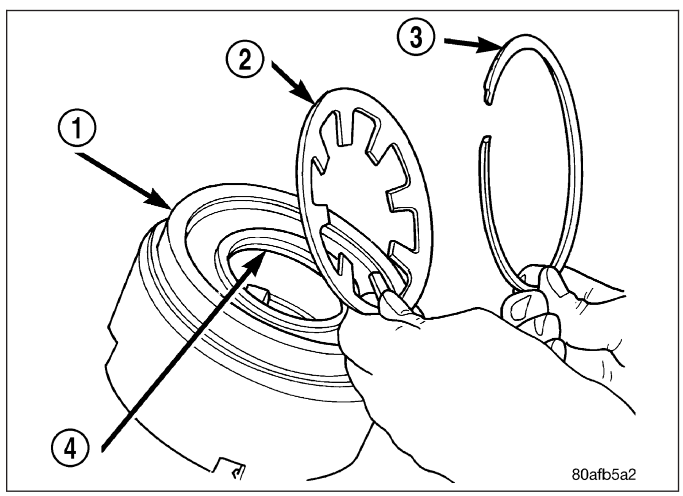
26. Separate clutch retainer (2) from OD/Reverse piston (1).



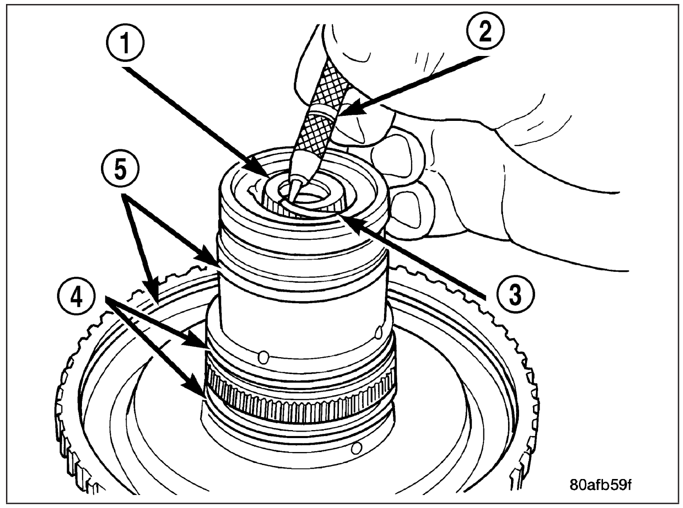

27. Using Disc 6057 (4) and an arbor press (1), compress OD/Reverse piston (5) return spring just enough to remove snap ring (3).



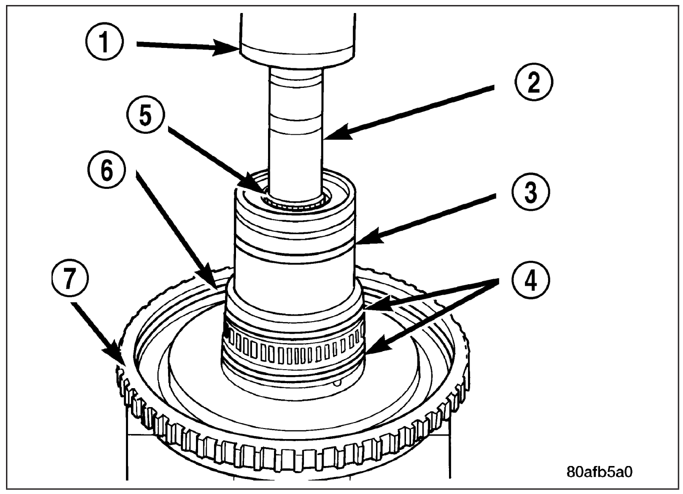

28. Remove the OD/Reverse piston return spring (2) and snap ring (3).



29. Remove input shaft (1) to input clutch hub snap ring (3).



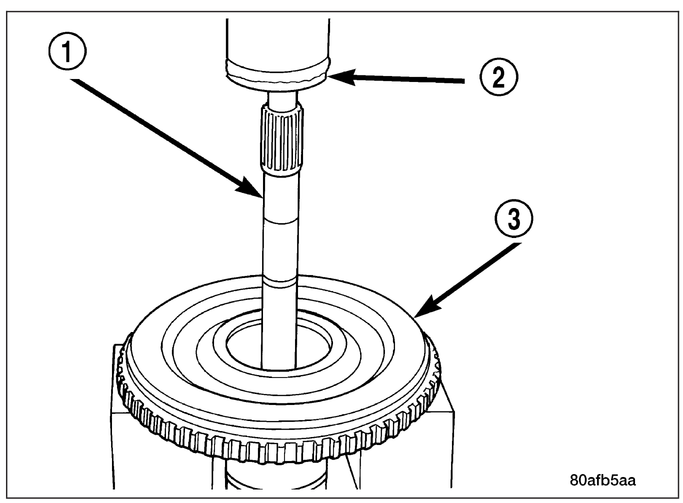

30. Using a suitably sized socket (2) and an arbor press (1), remove input shaft (5) from input shaft hub.



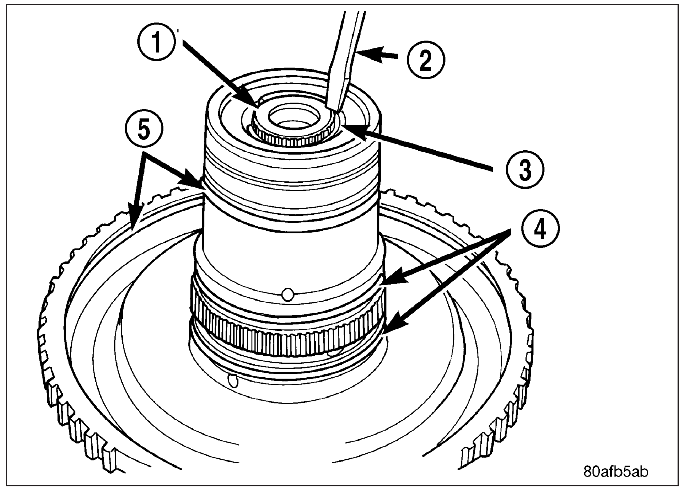

## ASSEMBLY

Use petrolatum on all seals to ease assembly of components.

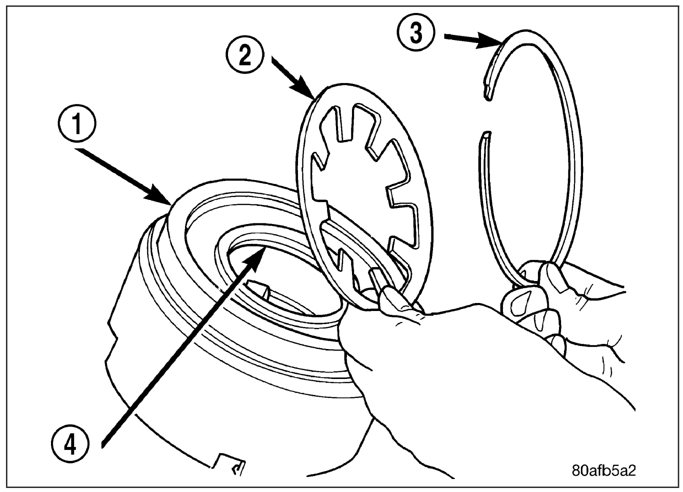
1. Using an arbor press (2), install input shaft (1) to input shaft hub (3).



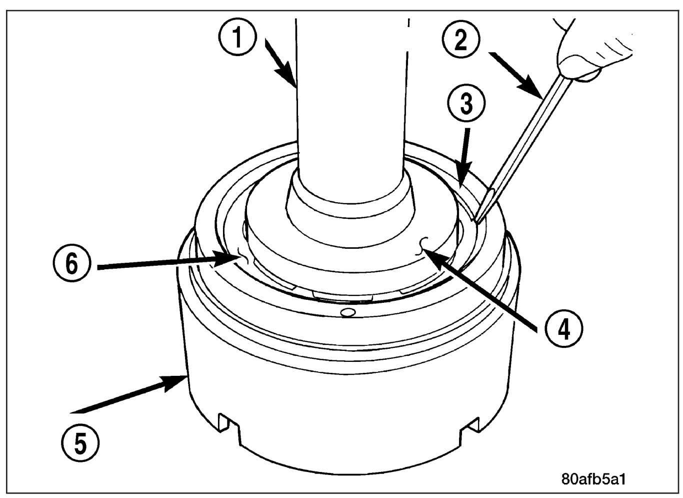
2. Install input shaft snap ring (3).



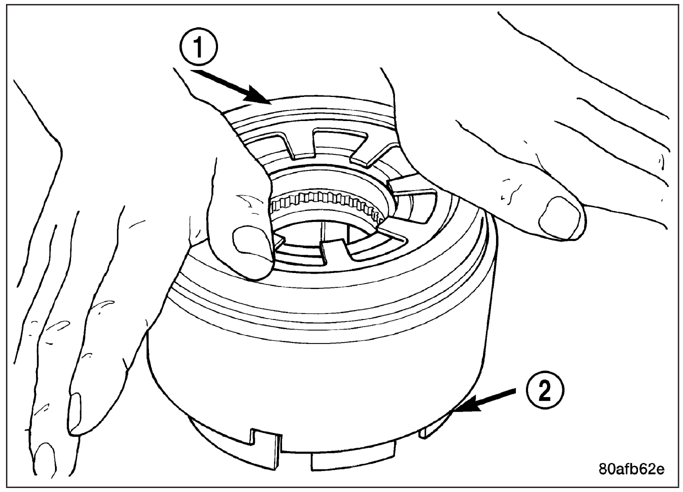

3. Position the OD/Reverse piston return spring (2) and snap ring (3) onto the OD/Reverse piston (1).



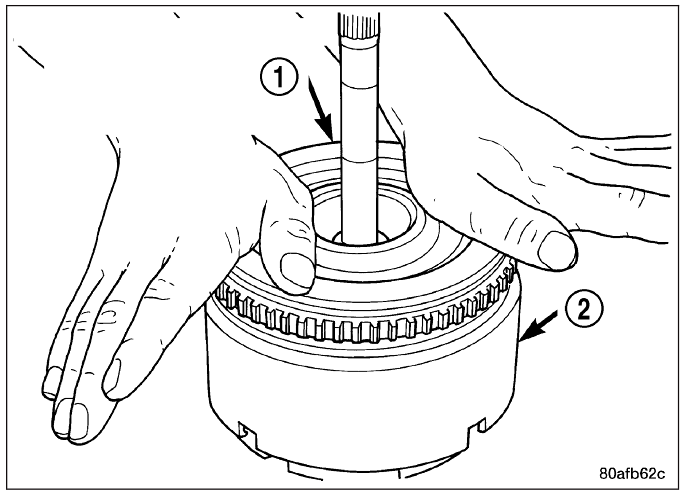

4. Using an arbor press (1) and Disc 6057 (4), install the OD/Reverse piston return spring (6) and snap ring (3).



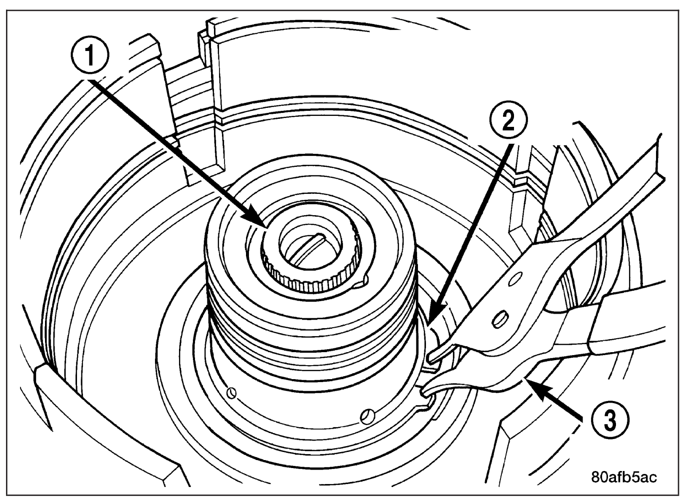
5. Install the OD/Reverse piston (1) assembly to the input clutch retainer (2).



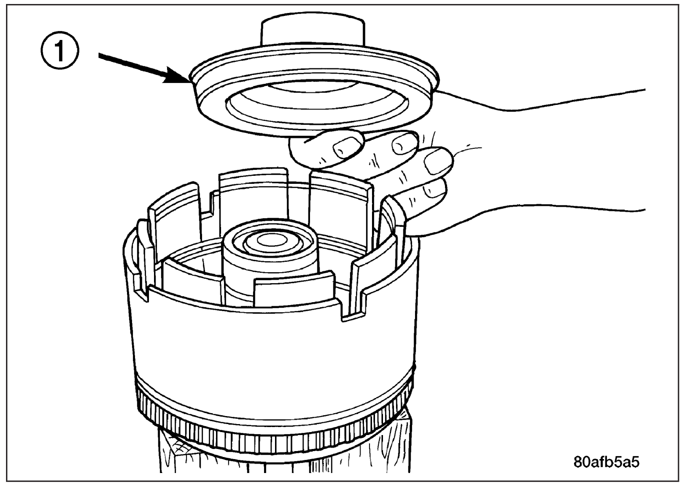

6. Install the input hub/shaft assembly (1) to the OD/Reverse piston/clutch retainer assembly (2).



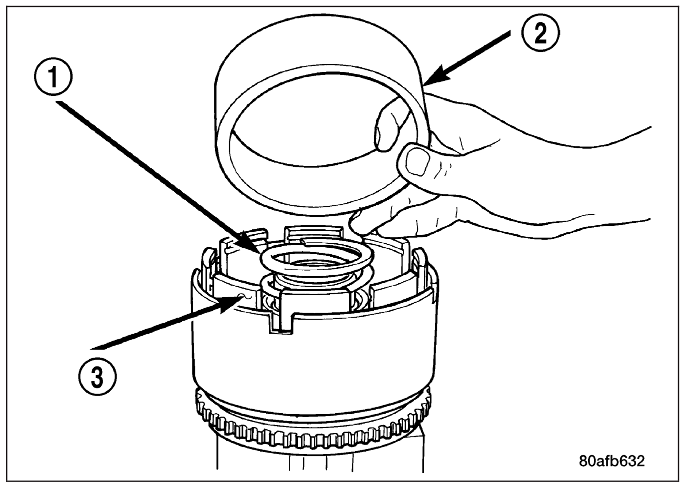

7. Install input hub tapered snap ring (2). **Make sure snap ring is fully seated.**



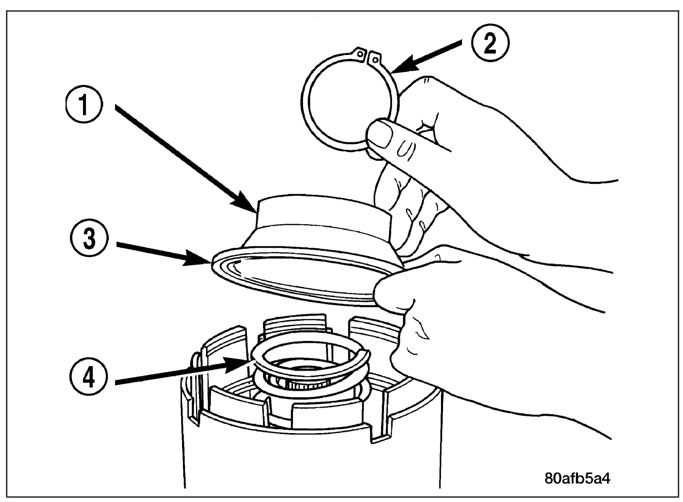
8. Install the UD clutch piston (1).




9. Install UD piston return spring (1) and Disc 5067 (2).

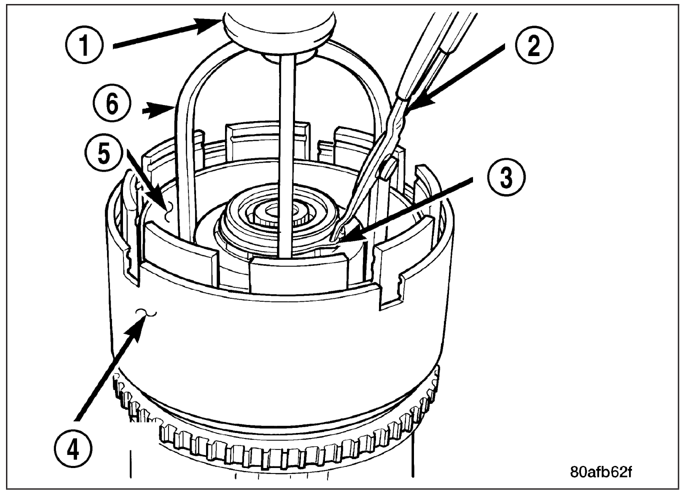



10. Position the UD spring retainer (1) and snap ring (2) on the piston return spring (4).

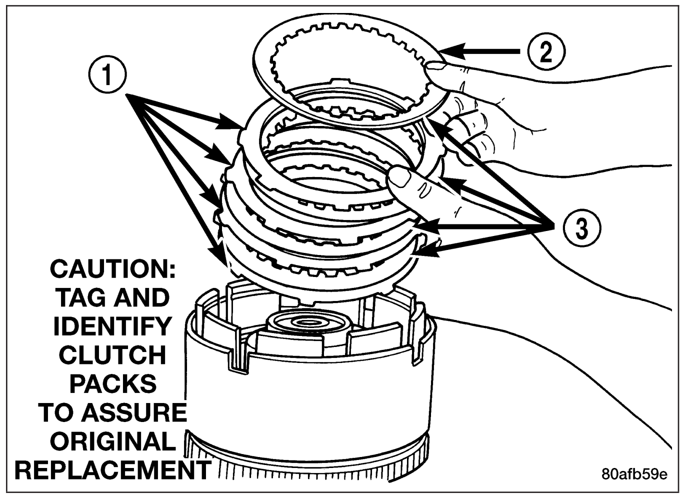


**CAUTION: Compress return spring just enough to install snap ring.**

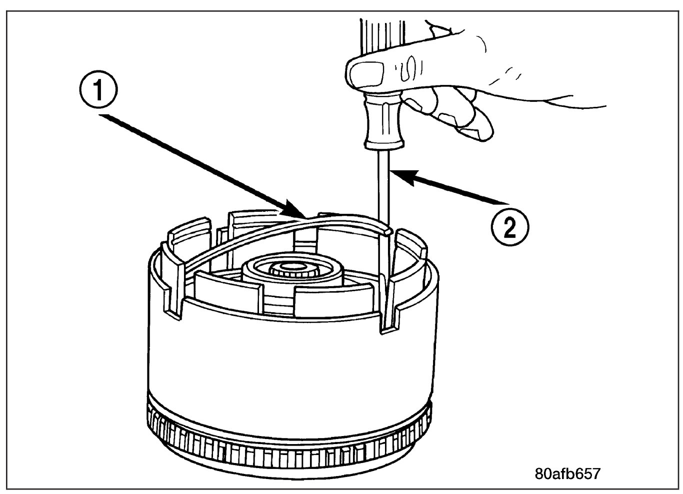
11. Using Compressor 5059A (6) and an arbor press (1), install the UD spring retainer and snap ring (3).



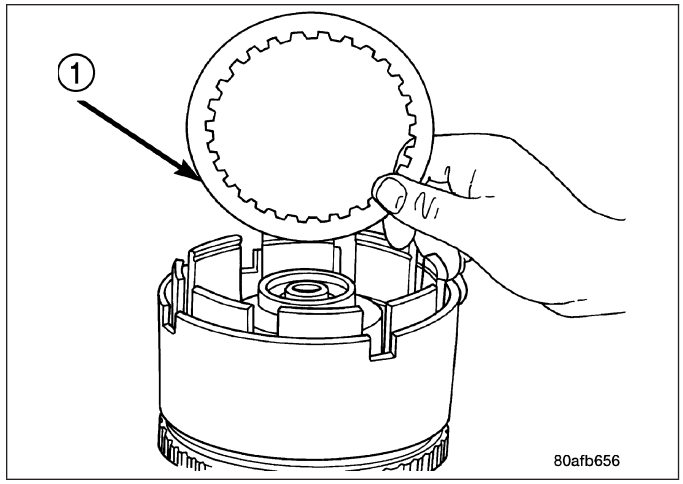

12. Install the UD clutch pack (four fibers/four steels) (1, 3). Leave the top disc (2) out until after the snap ring is installed.



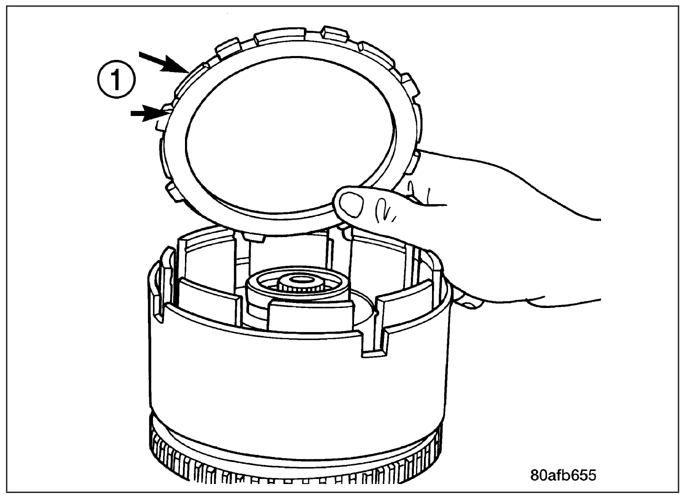

13. Install the UD clutch flat snap ring (1).



14. Install the last UD clutch disc (1).

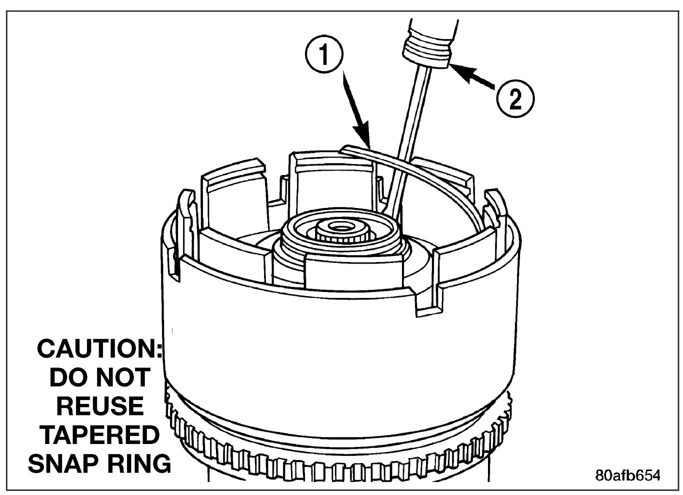



15. Install the OD/UD clutch reaction plate (1). The OD/UD clutches reaction plate has a step on both sides. Install the OD/UD clutches reaction plate tapered step side up.

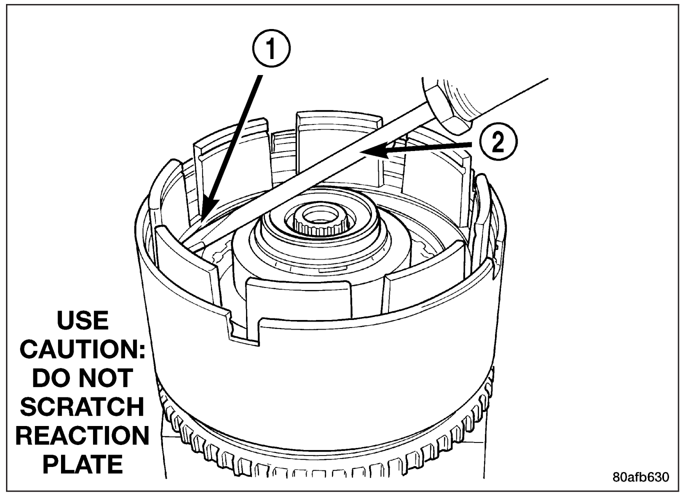



**NOTE: Snap ring ends must be located within one finger of the input clutch hub. Be sure that snap ring is fully seated, by pushing with screwdriver, into snap ring groove all the way around.**

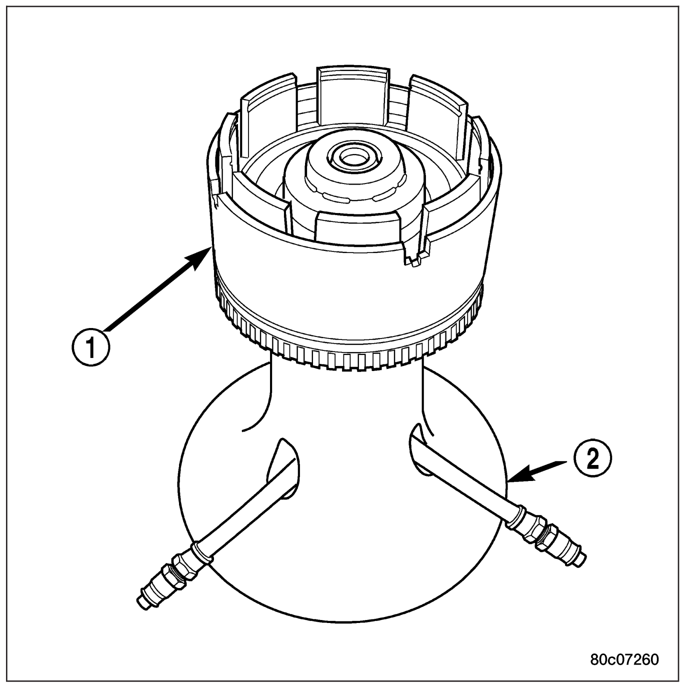
16. Install the UD/OD tapered snap ring (1).



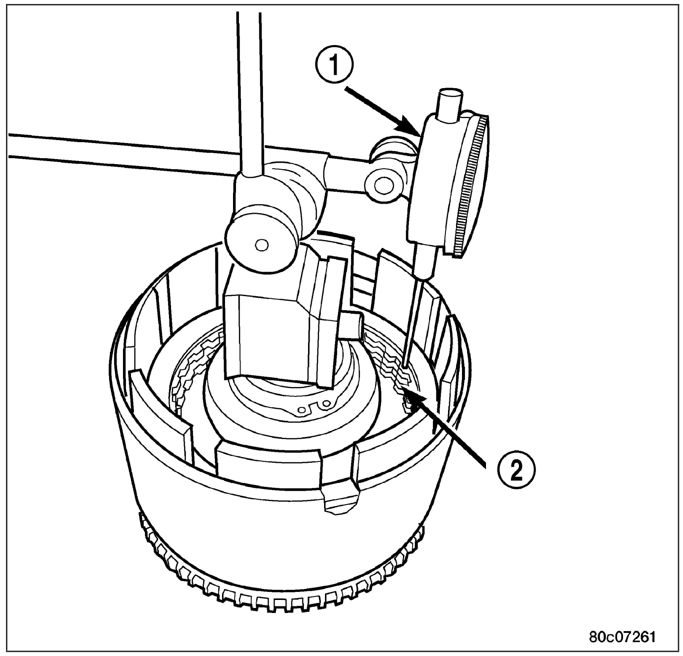
17. Seat tapered snap ring (1) to ensure proper installation.




18. Install input clutch assembly (1) to the Input Clutch Pressure Fixture 8391 (2).



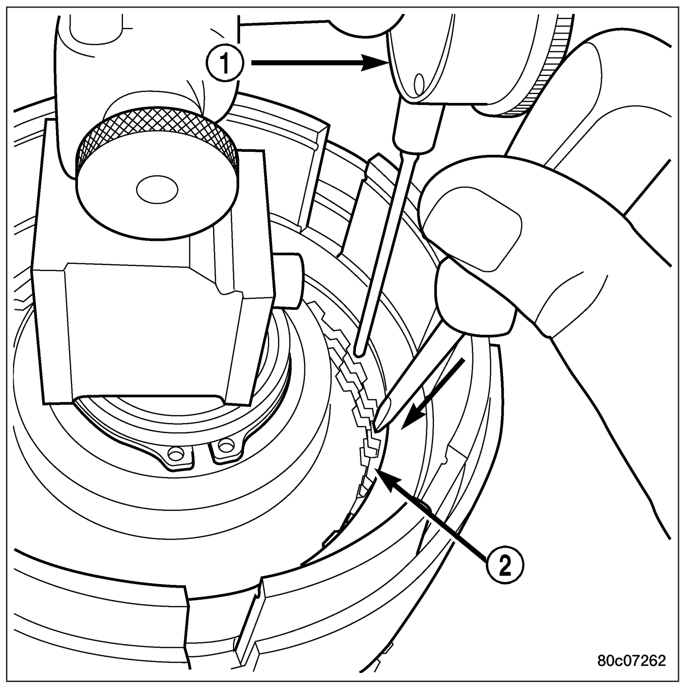
19. Set up Dial Indicator C-3339 (1) on the UD clutch pack (2).



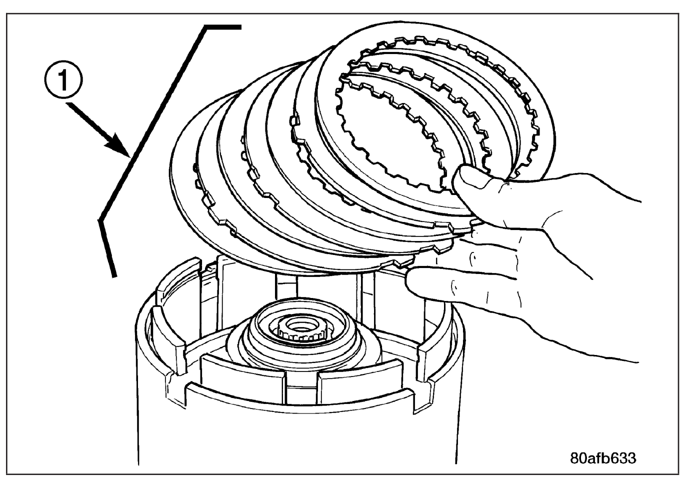

20. Using moderate pressure, press down and hold (near indicator) the UD clutch pack (2) with screwdriver or suitable tool and zero dial indicator (1). When releasing pressure on clutch pack, indicator reading should advance 0.005-0.010 inches.

**CAUTION: Do not apply more than 30 psi (206 kPa) to the underdrive clutch pack.**

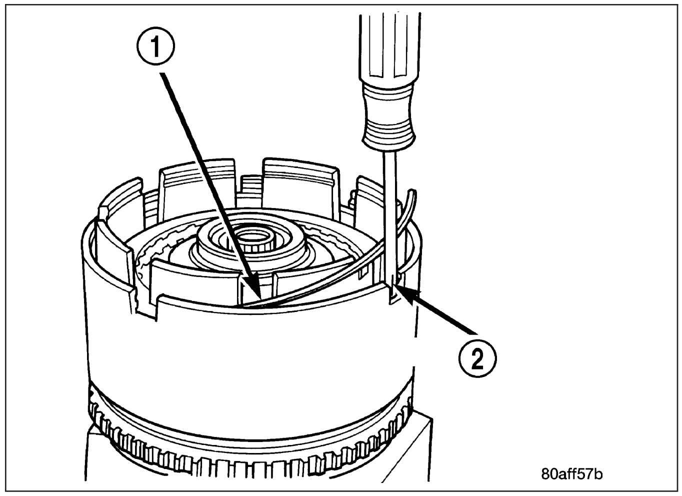
21. Apply 30 psi (206 kPa) to the underdrive hose on Pressure Fixture 8391 and measure UD clutch clearance. Measure and record UD clutch pack measurement in four (4) places, 90° apart.
22. Take average of four measurements and compare with UD clutch pack clearance specification. **Underdrive clutch pack clearance must be 0.94-1.50 mm (0.037-0.059 in.).**
23. If necessary, select the proper reaction plate to achieve specifications.



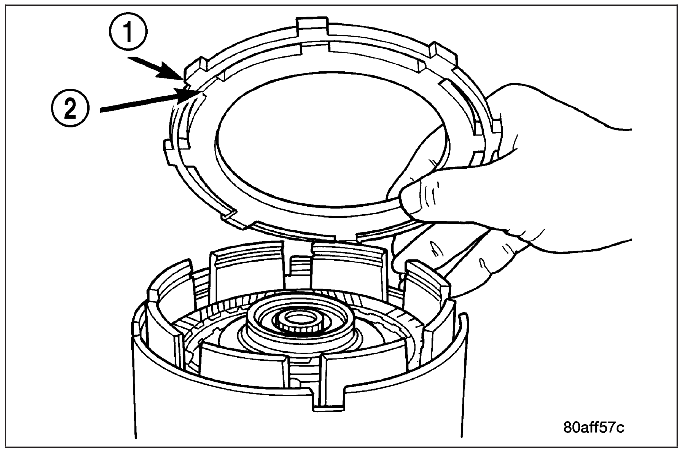

24. Install the OD clutch pack (four fibers/three steels) (1).



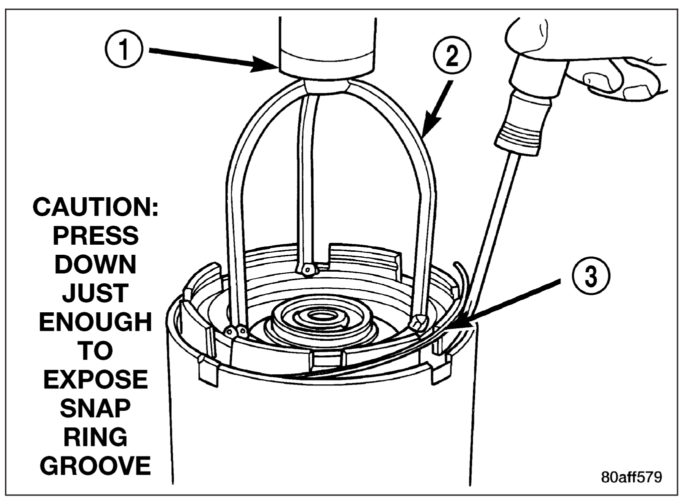
25. Install OD reaction plate waved snap ring (1).




26. Install the OD/Reverse reaction plate (1) with large step down (towards OD clutch pack).

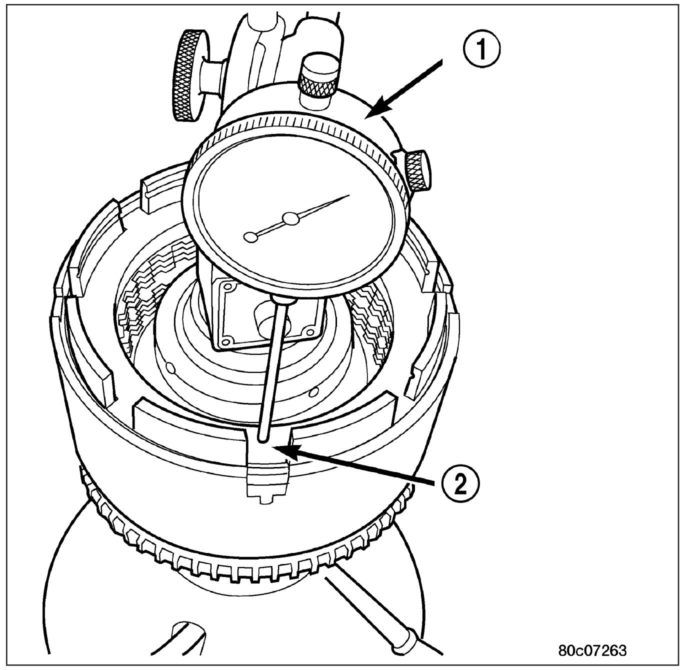



27. Install OD reaction plate flat snap ring (3).

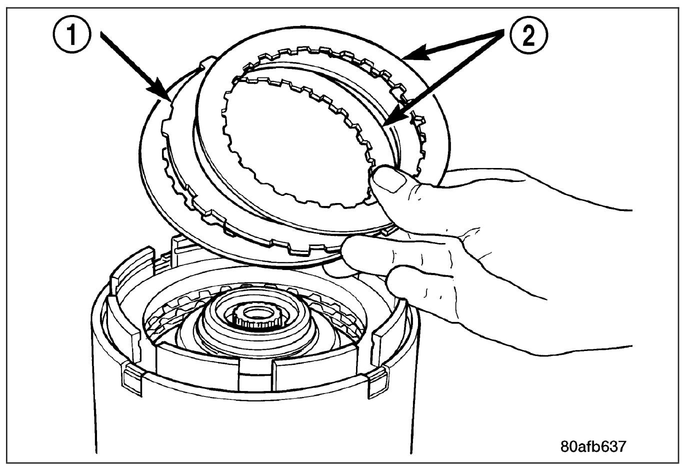


28. Measure OD clutch pack clearance. Set up Dial Indicator C-3339 (1) on top of the OD/Reverse reaction plate (2).
29. Zero dial indicator and apply 30 psi (206 kPa) air pressure to the overdrive clutch hose on Pressure Fixture 8391. Measure and record OD clutch pack measurement in four (4) places, 90° apart.
30. Take average of four measurements and compare with OD clutch pack clearance specification. **The overdrive (OD) clutch pack clearance is 1.07-3.25 mm (0.042-0.128 in.).**

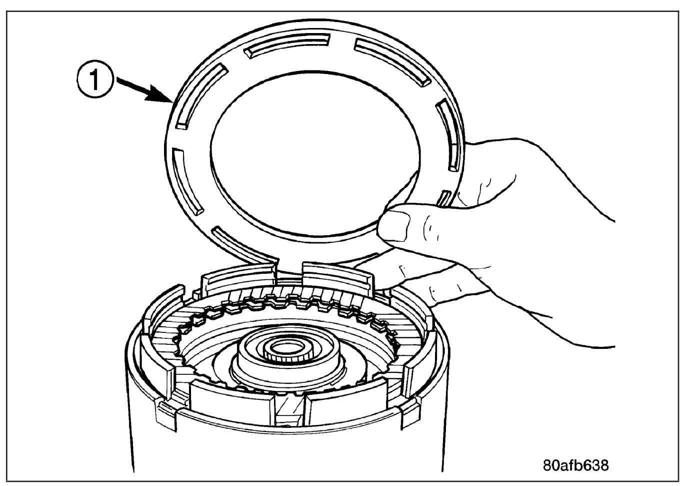
If not within specifications, the clutch is not assembled properly. There is no adjustment for the OD clutch clearance.



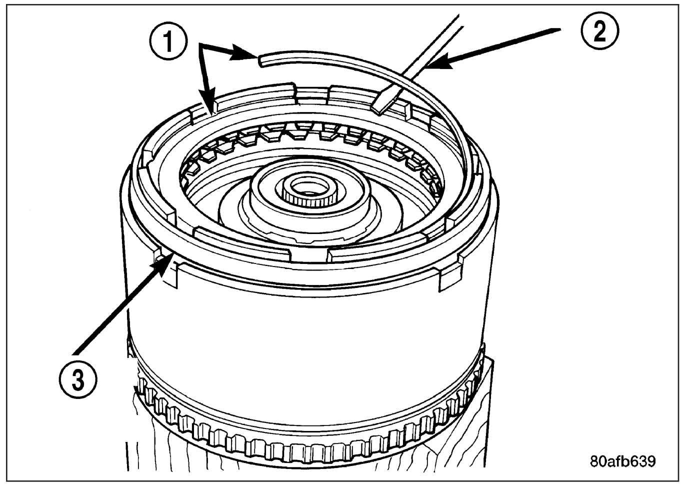

31. Install reverse clutch pack (two fibers/one steel) (1, 2).



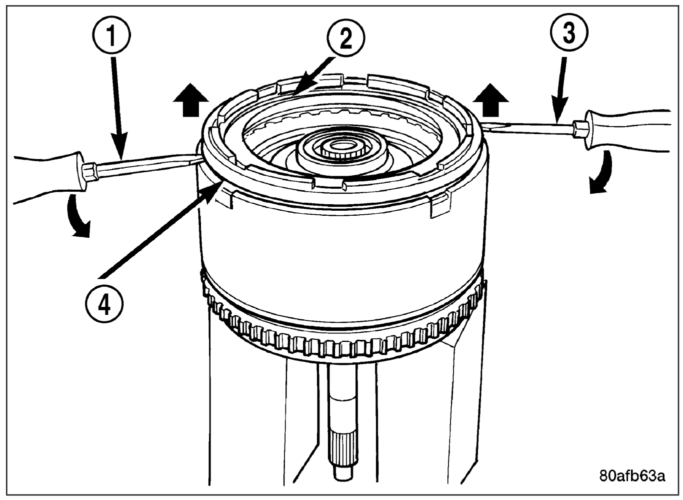

32. Install reverse clutch reaction plate (1) with the flat side down towards reverse clutch.



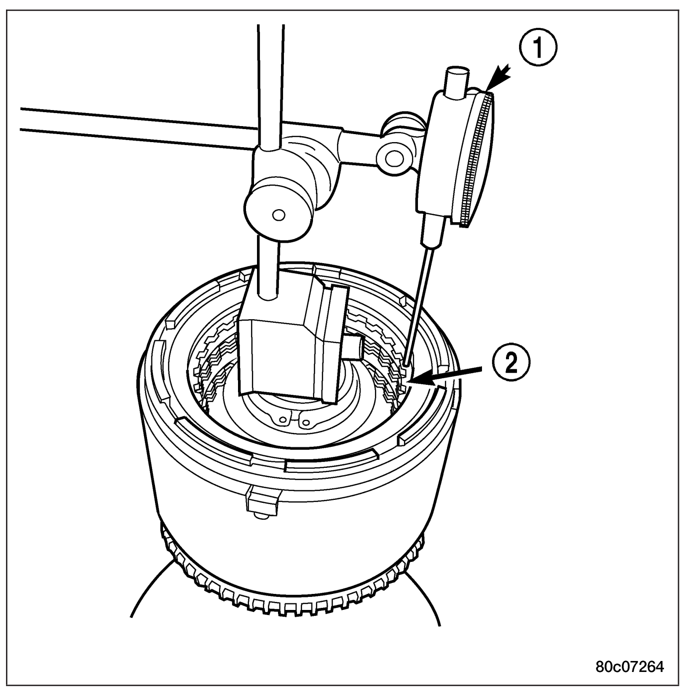
33. Tap reaction plate (3) down to allow installation of the reverse clutch snap ring (1). Install reverse clutch snap ring (1).



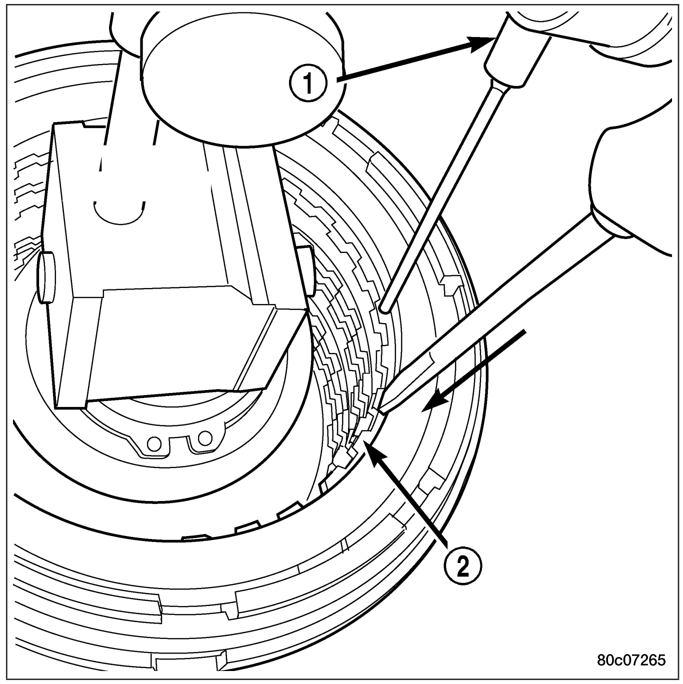

34. Pry up reverse reaction plate (4) to seat against snap ring (2).



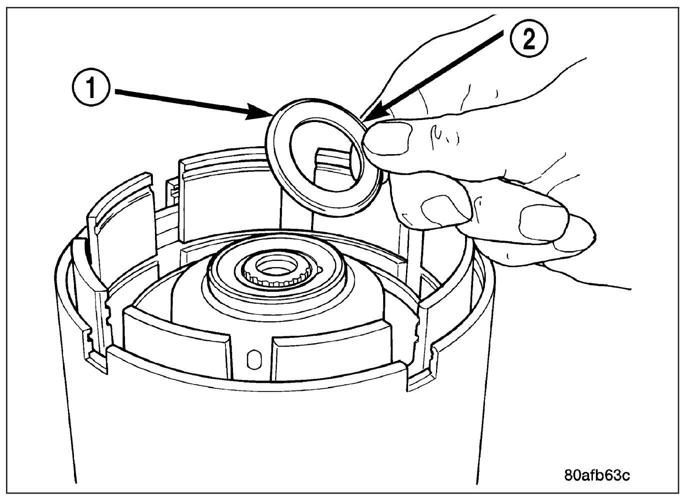

35. Set up a Dial Indicator C-3339 (1) on the reverse clutch pack (2).



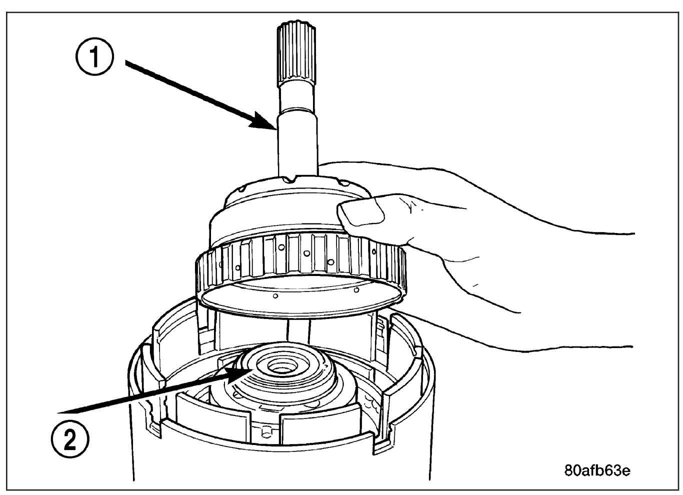
36. Using moderate pressure, press down and hold (near indicator) reverse clutch disc (2) with screwdriver or suitable tool and zero dial indicator (1). When releasing pressure, indicator should advance 0.005-0.010 inches as clutch pack relaxes.
37. Apply 30 psi (206 kPa) air pressure to the reverse clutch hose on Pressure Fixture 8391. Measure and record reverse clutch pack measurement in four (4) places, 90° apart.
38. Take average of four measurements and compare with reverse clutch pack clearance specification. **The reverse clutch pack clearance is 0.89-1.37 mm (0.035-0.054 in.).** Select the proper reverse clutch snap ring to achieve specifications.
39. To complete the assembly, reverse clutch and overdrive clutch must be removed.



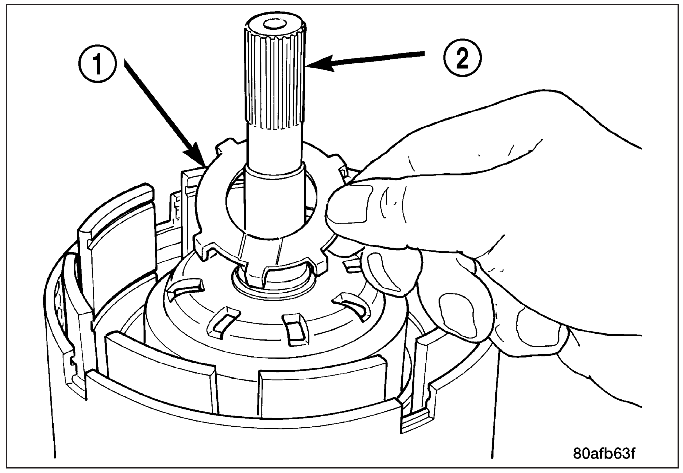

40. Install the number 2 needle bearing (1).



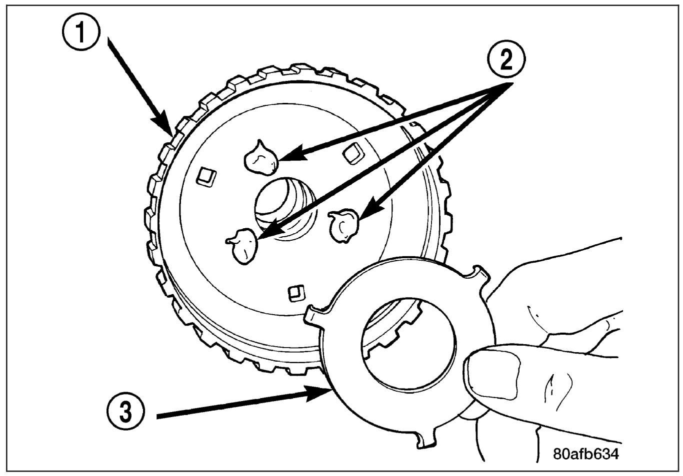

41. Install the underdrive shaft assembly (1).



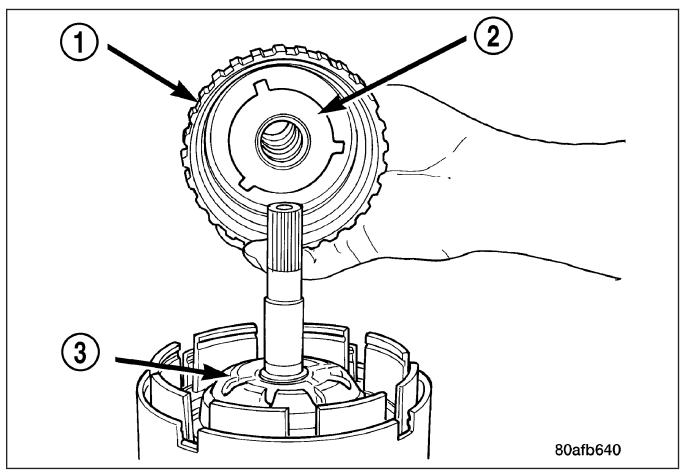
42. Install the number 3 thrust washer (1) to the underdrive shaft assembly (2). Be sure five tabs are seated properly.



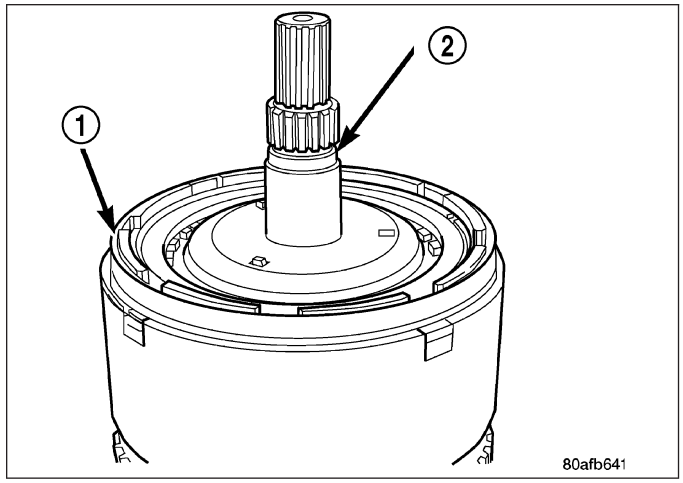

43. Install the number 3 thrust plate (3) to the bottom of the overdrive shaft assembly (1). Retain with petrolatum or transmission assembly gel (2).




44. Install the overdrive shaft assembly (1).



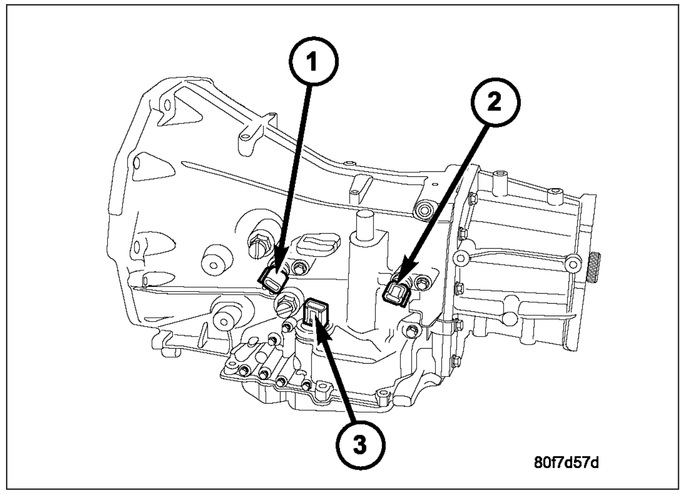
45. Reinstall overdrive and reverse clutch. **Rechecking these clutch clearances is not necessary.**



# INPUT SPEED SENSOR

## DESCRIPTION

The Input (1) and Output (2) Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).




## OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

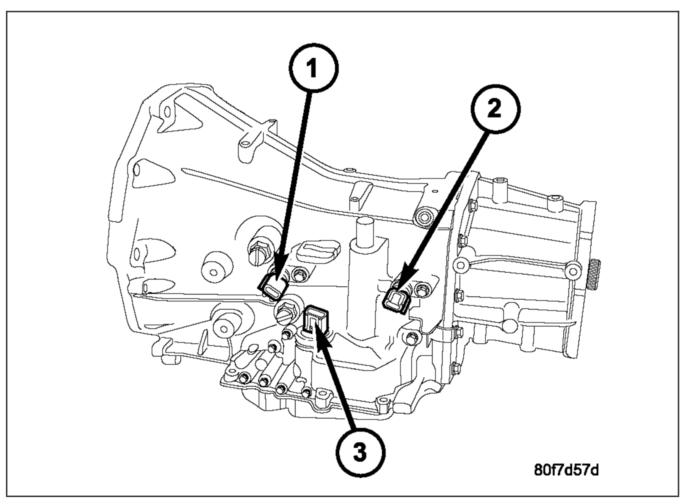
- Torque converter clutch slippage
- Torque converter element speed ratio

## REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the input speed sensor.

**NOTE: The speed sensor bolt has a sealing patch applied from the factory. Be sure to reuse the same bolt.**

4. Remove the bolt holding the input speed sensor to the transmission case.
5. Remove the input speed sensor from the transmission case.

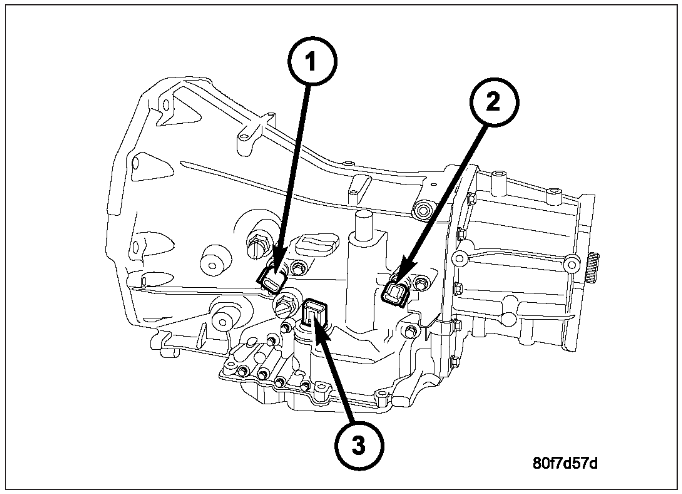


## INSTALLATION

1. Install the input speed sensor (1) into the transmission case.

**NOTE: Before installing the speed sensor bolt, it will be necessary to replenish the sealing patch on the bolt using MOPAR® Lock & Seal Adhesive.**

2. Install the bolt to hold the input speed sensor into the transmission case. Tighten the bolt to 9 N·m (80 in.lbs.).
3. Install the wiring connector onto the input speed sensor
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.

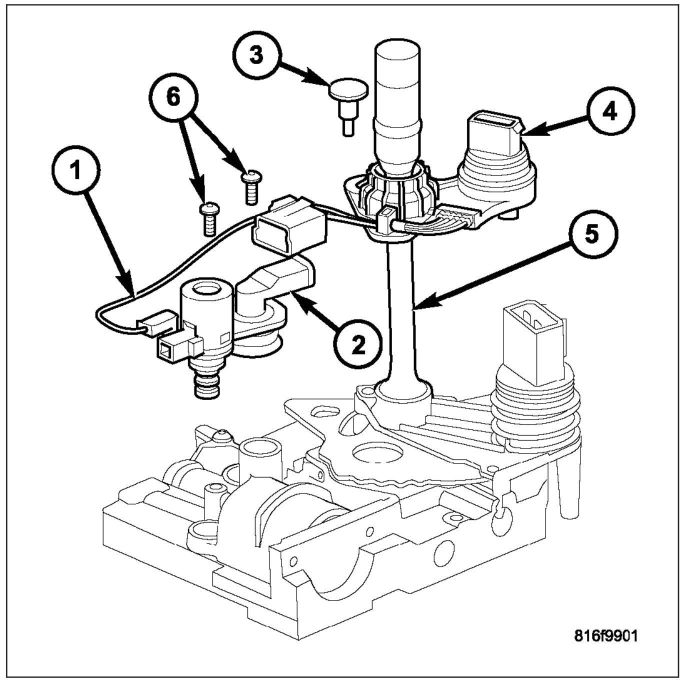


# SENSOR-VARIABLE LINE PRESSURE

## DESCRIPTION

The line pressure sensor (2) is mounted on the top of the valve body, next to the pressure control solenoid (1).

The TCM utilizes a closed-loop system to control transmission line pressure. The system contains a variable force style solenoid, the Pressure Control Solenoid. The solenoid is duty cycle controlled by the TCM to vent the unnecessary line pressure supplied by the oil pump back to the sump. The system also contains a variable pressure style sensor, the Line Pressure Sensor, which is a direct input to the TCM. The line pressure solenoid monitors the transmission line pressure and completes the feedback loop to the TCM. The TCM uses this information to adjust its control of the pressure control solenoid to achieve the desired line pressure.

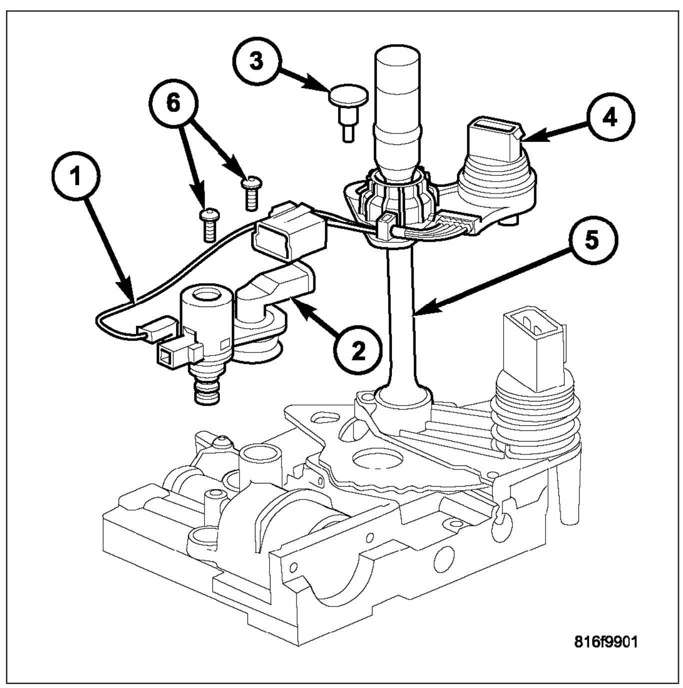



## OPERATION

The TCM calculates the desired line pressure based upon inputs from the transmission and engine. The TCM calculates the torque input to the transmission and uses that information as the primary input to the calculation. The line pressure is set to a predetermined value during shifts and when the transmission is in the PARK and NEUTRAL positions. This is done to ensure consistent shift quality. During all other operation, the actual line pressure is compared to the desired line pressure and adjustments are made to the pressure control solenoid duty cycle.

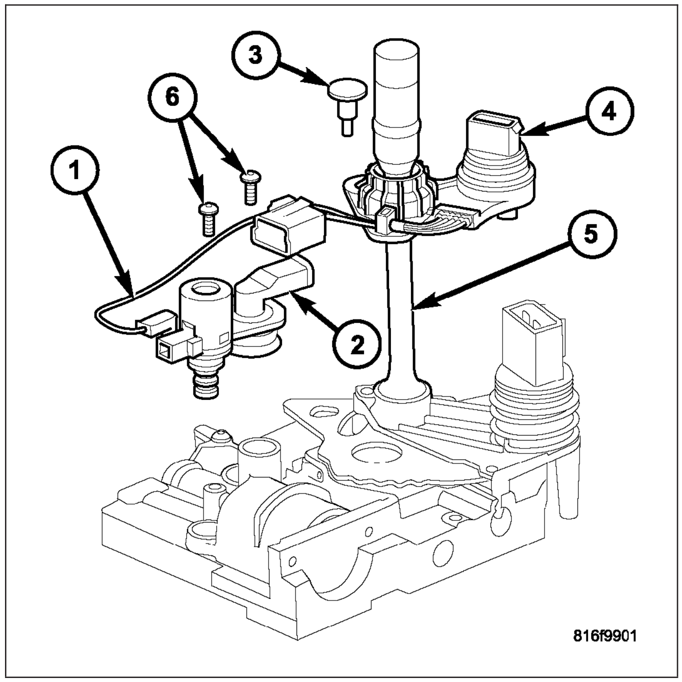
## REMOVAL

1. Remove the valve body from the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE/VALVE BODY - REMOVAL)
2. Remove the electrical connectors from the pressure control solenoid (1) and the line pressure sensor (2).
3. Remove the screws (6) holding the pressure control solenoid (1) and line pressure sensor (2) to the valve body.
4. Remove the pressure control solenoid and line pressure sensor from the valve body.



## INSTALLATION

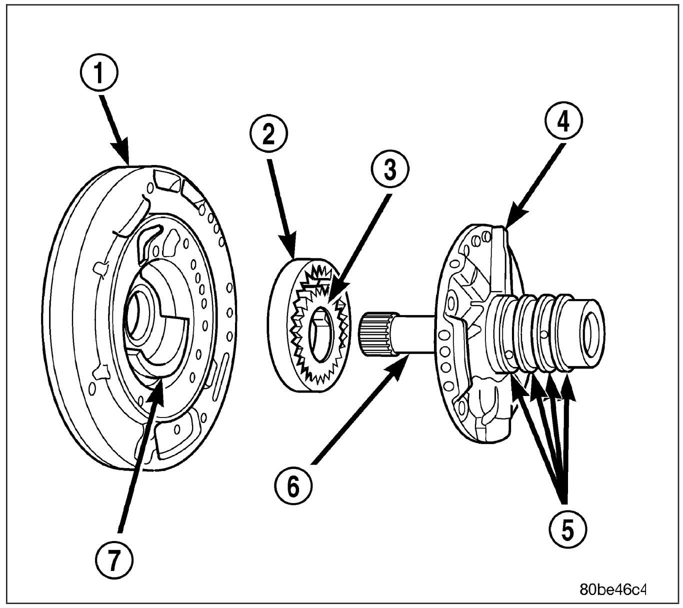
1. Install the pressure control solenoid (1) and line pressure sensor (2) into the valve body.
2. Install the screws (6) to hold the pressure control solenoid (1) and line pressure sensor (2) to the valve body.
3. Install the electrical connectors to the pressure control solenoid (1) and the line pressure sensor (2).
4. Install the valve body into the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE/VALVE BODY - INSTALLATION)



# OIL PUMP

## DESCRIPTION

The oil pump is located in the pump housing inside the bell housing of the transmission case. The oil pump assembly consists of an inner (3) and outer (2) gear, a housing (1), and a cover that also serves as the reaction shaft support (6).

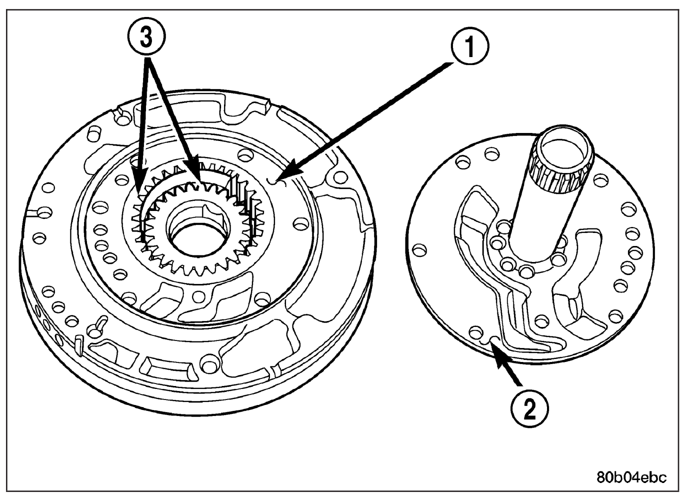



## OPERATION

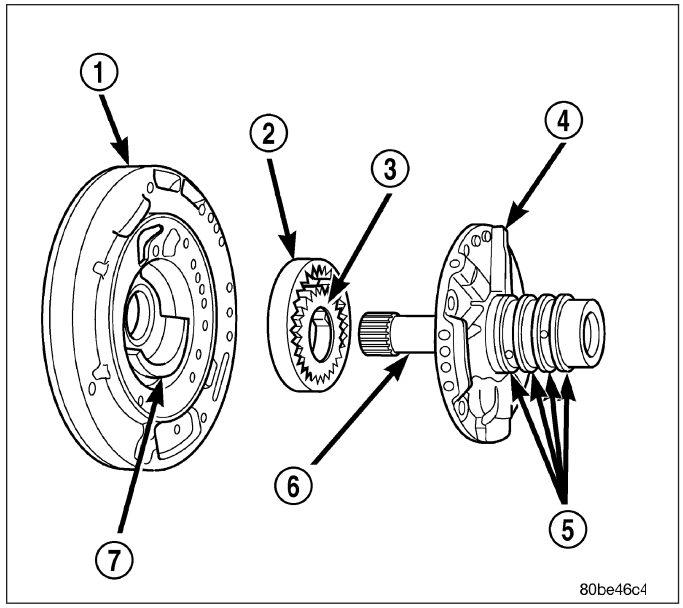
As the torque converter rotates, the converter hub rotates the inner and outer gears. As the gears rotate, the clearance between the gear teeth increases in the crescent area, and creates a suction at the inlet side of the pump. This suction draws fluid through the pump inlet from the oil pan. As the clearance between the gear teeth in the crescent area decreases, it forces pressurized fluid into the pump outlet and to the valve body.

## DISASSEMBLY

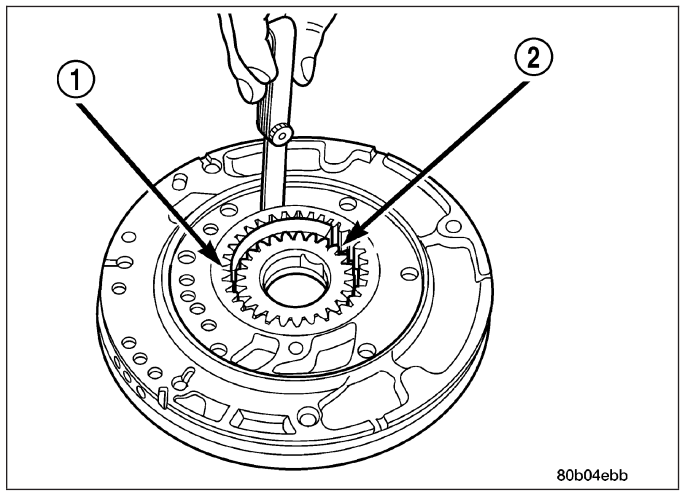
1. Remove the reaction shaft support bolts.
2. Remove the reaction shaft support (2) from the pump housing (1).



3. Remove the pump gears (2, 3) and check for wear and damage on pump housing (1) and gears (2, 3).



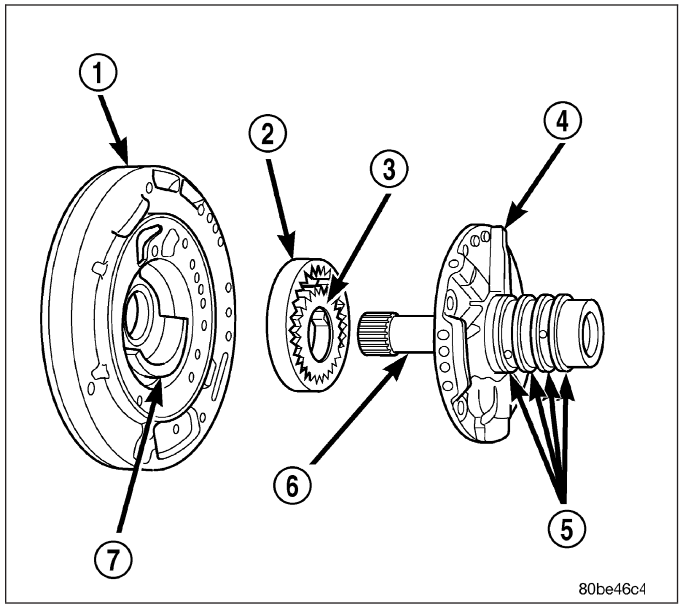

4. Re-install the gears and check clearances.
5. Measure the clearance between the outer gear (1) and the pump pocket (2). Clearance should be 0.089-0.202 mm (0.0035-0.0079 in.).
6. Measure clearance between outer gear and crescent. Clearance should be 0.060-0.298 mm (0.0023-0.0117 in.).
7. Measure clearance between inner gear and crescent. Clearance should be 0.093-0.385 mm (0.0036-0.0151 in.).
8. Position an appropriate piece of Plastigage across both pump gears.
9. Align the Plastigage to a flat area on the reaction shaft support housing.
10. Install the reaction shaft to the pump housing. Tighten the bolts to 28 N·m (250 in. lbs.).




11. Remove bolts and carefully separate the housings. Measure the Plastigage following the instructions supplied.
12. Clearance between outer gear side and the reaction shaft support should be 0.020-0.046 mm (0.0008-0.0018 in.). Clearance between inner gear side and the reaction shaft support should be 0.020-0.046 mm (0.0008-0.0018 in.).

## ASSEMBLY

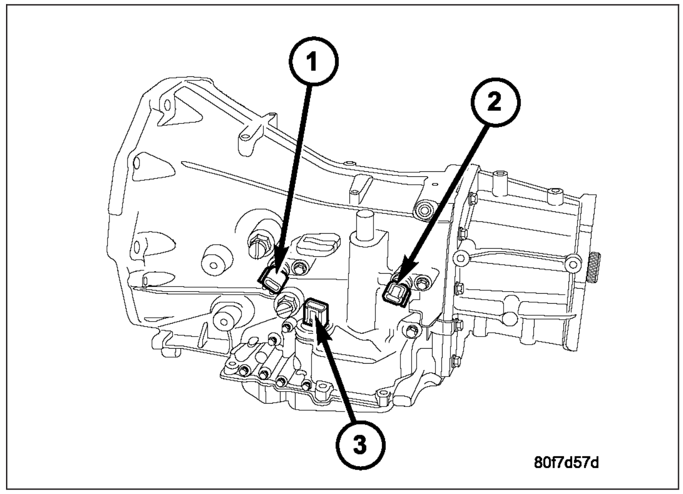
1. Assemble oil pump as shown
2. Install and torque reaction shaft support-to-oil pump housing bolts to 28 N·m (250 in. lbs.) torque.



# OUTPUT SPEED SENSOR

## DESCRIPTION

The Input (1) and Output (2) Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).




## OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

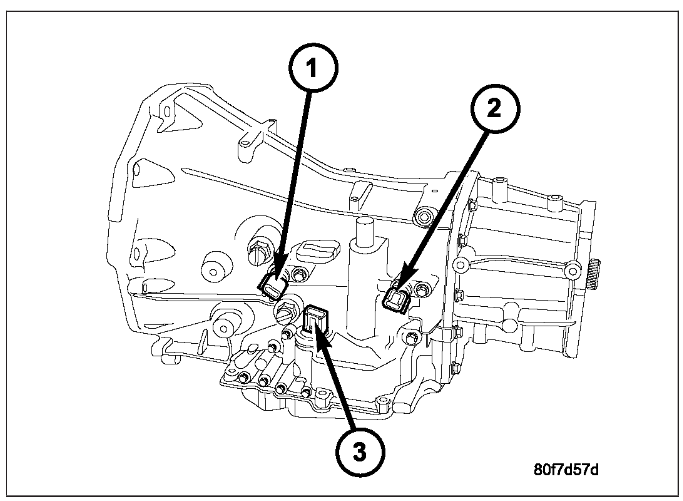
- Torque converter clutch slippage
- Torque converter element speed ratio

## REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the output speed sensor (2).

**NOTE: The speed sensor bolt has a sealing patch applied from the factory. Be sure to reuse the same bolt.**

4. Remove the bolt holding the output speed sensor to the transmission case.
5. Remove the output speed sensor (2) from the transmission case.

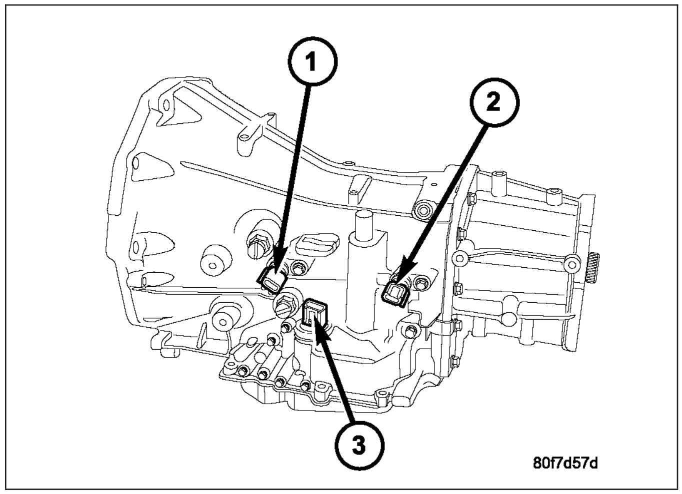


## INSTALLATION

1. Install the output speed sensor (2) into the transmission case.

**NOTE: Before installing the speed sensor bolt, it will be necessary to replenish the sealing patch on the bolt using MOPAR® Lock & Seal Adhesive.**

2. Install the bolt to hold the output speed sensor into the transmission case. Tighten the bolt to 9 N·m (80 in.lbs.).
3. Install the wiring connector onto the output speed sensor
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.



# OVERDRIVE SWITCH

## DESCRIPTION

The overdrive OFF (control) switch is located in the shifter handle. The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function.

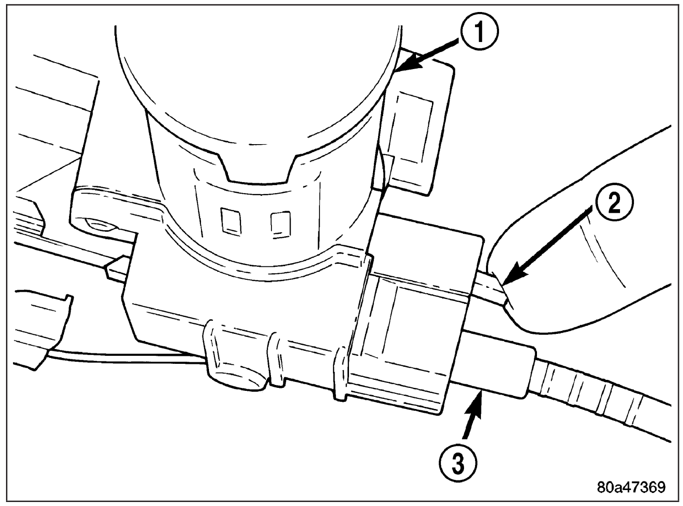
## OPERATION

At key-on, fourth gear operation is allowed. Pressing the switch once causes the overdrive OFF mode to be entered and the overdrive OFF switch lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the overdrive lamp to be turned off. The overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoids and allow upshifts to fourth gear. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

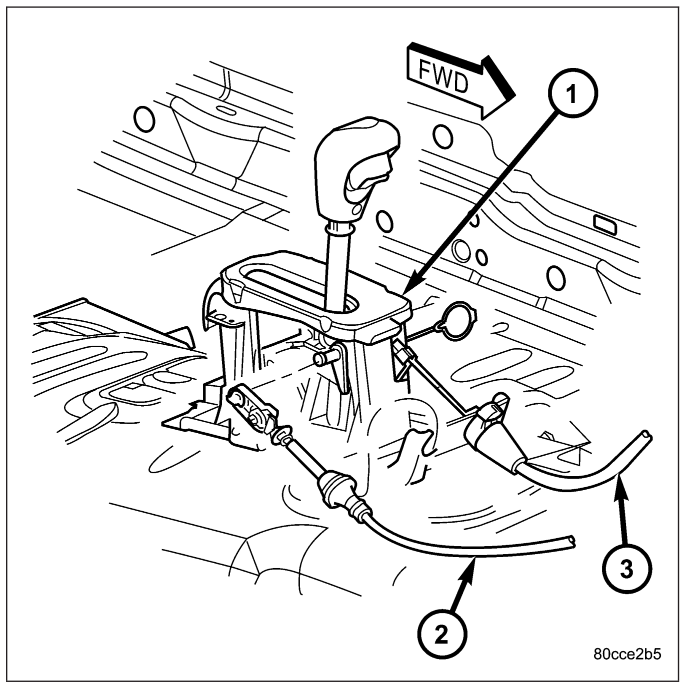
# PARK INTERLOCK CABLE

## REMOVAL

1. Lower the steering column.
2. With the ignition switch in the “RUN” position depress the park-interlock cable locking tab (2), located on top of the cable connector at the steering column and pull the cable straight out.

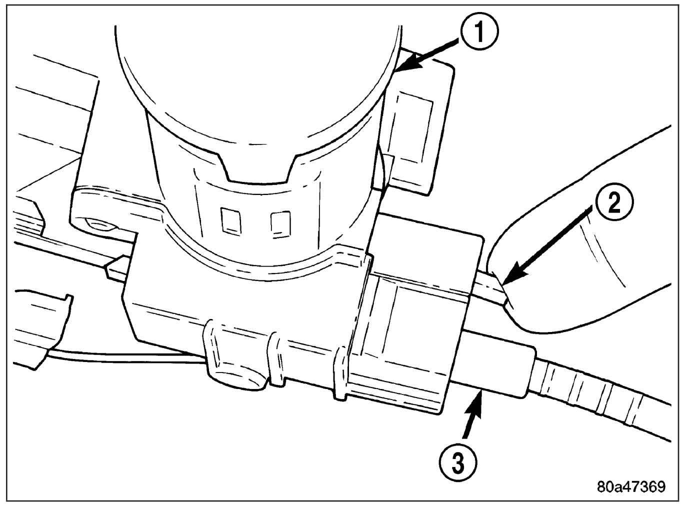



3. Remove the park-interlock cable from steering column.
4. Remove the floor console and related trim. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
5. Disconnect the park-interlock cable (3) from the shift lever assembly and remove the cable from the shifter assembly bracket.
6. Release the park-interlock cable from any remaining clips.
7. Remove park-interlock cable from the vehicle.

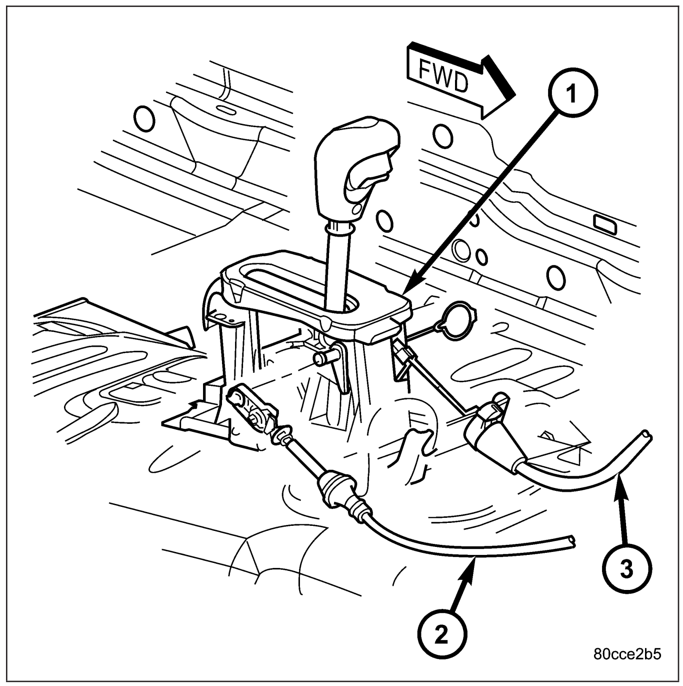


## INSTALLATION

**NOTE: The gearshift cable must be secured into position and properly adjusted before the installation of the Park-Interlock Cable.**




1. Push the park-interlock cable (3) straight into the square mounting hole in the steering column until cable snaps in place.
2. Snap park-interlock cable tie strap into hole in steering column tube.

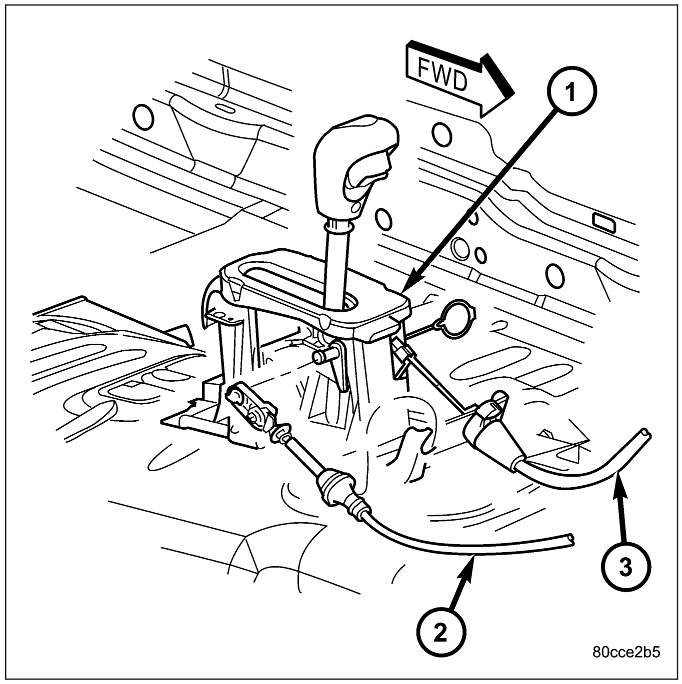



3. Route cable to the shifter mechanism.
4. Install the cable end fitting into shifter lever (1).
5. Snap cable adjuster ears into floor shifter bracket.
6. Place the ignition key cylinder in the LOCK position.
7. Push the cable adjuster lock clamp downward to lock it.
8. Test the park-interlock cable operation.
9. Install the floor console and related trim. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

## ADJUSTMENTS - PARK-INTERLOCK CABLE

The park-interlock cable is part of the Brake Transmission Shift Interlock (BTSI) system. Correct cable adjustment is important to proper interlock operation. The gear shift and park lock cables must both be correctly adjusted in order to shift out of PARK.

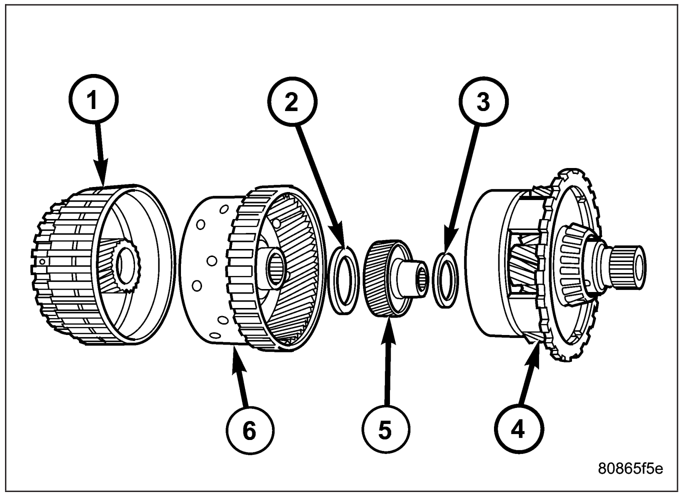
1. Remove floor console as necessary for access to the park-interlock cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
2. Shift the transmission into the PARK position.
3. Turn ignition switch to LOCK position. **Be sure ignition key cylinder is in the LOCK position. Cable will not adjust correctly in any other position.**
4. Pull cable lock button up to release cable (3).
5. Ensure that the cable is free to self-adjust by pushing cable rearward and releasing.
6. Push lock button down until it snaps in place.
7. Verify proper operation. (Refer to 21 - TRANSMISSION/AUTOMATIC/SHIFT INTERLOCK SYSTEM - DIAGNOSIS AND TESTING)



# PLANETARY GEARTRAIN

## DESCRIPTION

The planetary geartrain is located between the input clutch assembly and the rear of the transmission case. The planetary geartrain consists of two sun gears, two planetary carriers, two annulus (ring) gears, and one output shaft.




## OPERATION

The planetary geartrain utilizes two planetary gear sets that connect the transmission input shaft to the output shaft. Input and holding clutches drive or lock different planetary members to change output ratio or direction.

# OIL PUMP SEAL

## REMOVAL

1. Remove the transmission from the vehicle (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - REMOVAL).
2. Remove the torque converter from the transmission bellhousing.
3. Use a screw mounted in a slide hammer to remove oil pump seal.

## INSTALLATION

1. Clean and inspect oil pump seal seat. Then install seal using Seal Installer C-4193-A.
2. Clean and inspect torque converter hub. If nicks, scratches or hub wear are found, torque converter replacement will be required.

**CAUTION: If the torque converter is being replaced, apply a light coating of grease to the crankshaft pilot hole. Also inspect the engine drive plate for cracks. If any cracks are found replace the drive plate. Do not attempt to repair a cracked drive plate. Always use new torque converter to drive plate bolts.**

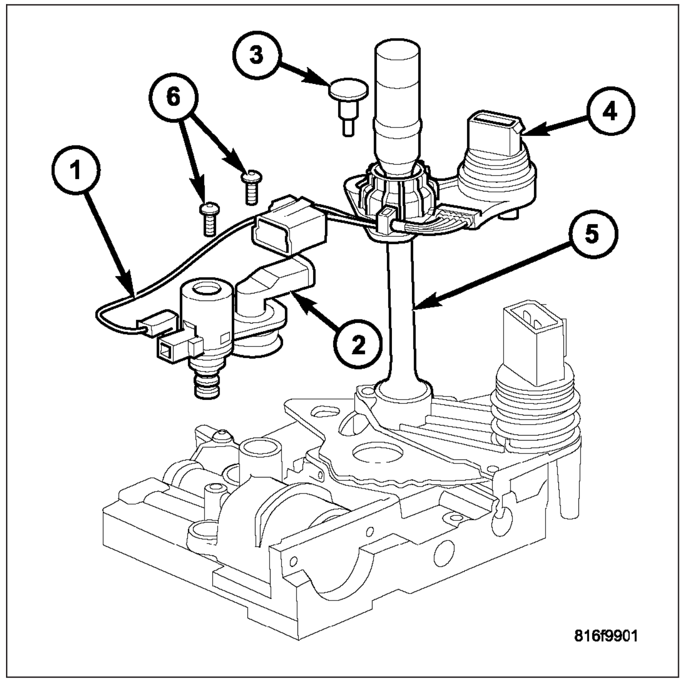
3. Apply a light film of transmission oil to the torque converter hub and oil seal lips. Then install torque converter into transmission. Be sure that the hub lugs mesh with the front pump lugs when installing.
4. Reinstall the transmission into the vehicle. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE - INSTALLATION)

# SOLENOID-PRESSURE CONTROL

## DESCRIPTION

The pressure control solenoid (1) is mounted on the top of the valve body, next to the line pressure sensor (2).

The TCM utilizes a closed-loop system to control transmission line pressure. The system contains a variable force style solenoid, the Pressure Control Solenoid. The solenoid is duty cycle controlled by the TCM to vent the unnecessary line pressure supplied by the oil pump back to the sump. The system also contains a variable pressure style sensor, the Line Pressure Sensor, which is a direct input to the TCM. The line pressure solenoid monitors the transmission line pressure and completes the feedback loop to the TCM. The TCM uses this information to adjust its control of the pressure control solenoid to achieve the desired line pressure.



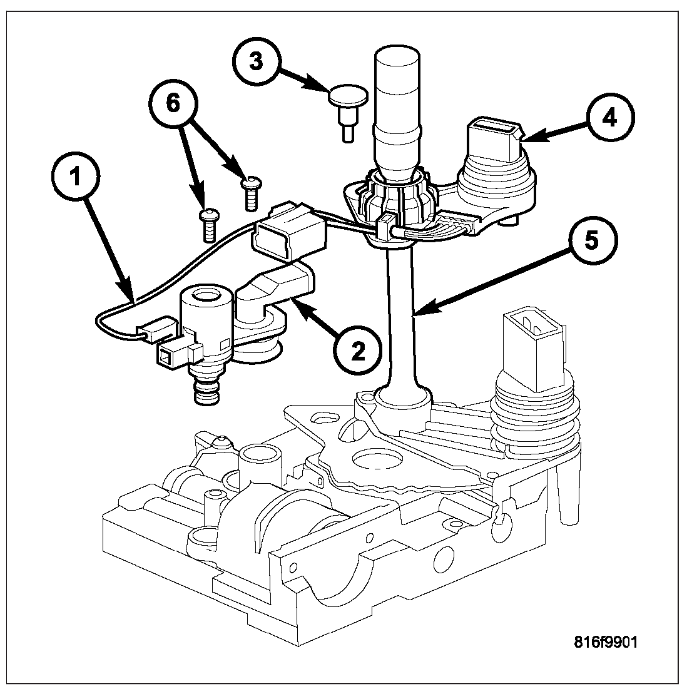

## OPERATION

The pressure control solenoid (PCS) is a variable force (VFS) style solenoid. A VFS solenoid is an electro-hydraulic actuator, combining a solenoid and a regulating valve.

The transmission control module varies the current for the PCS, which varies the pressure in the line pressure hydraulic circuit. When the current (duty cycle) of the PCS is low, the pressure in the circuit is higher. At 0 current (0% duty cycle), the pressure is at the maximum value. Conversely, when the current is maximized (100% duty cycle), the pressure in the circuit is at the lowest possible value.

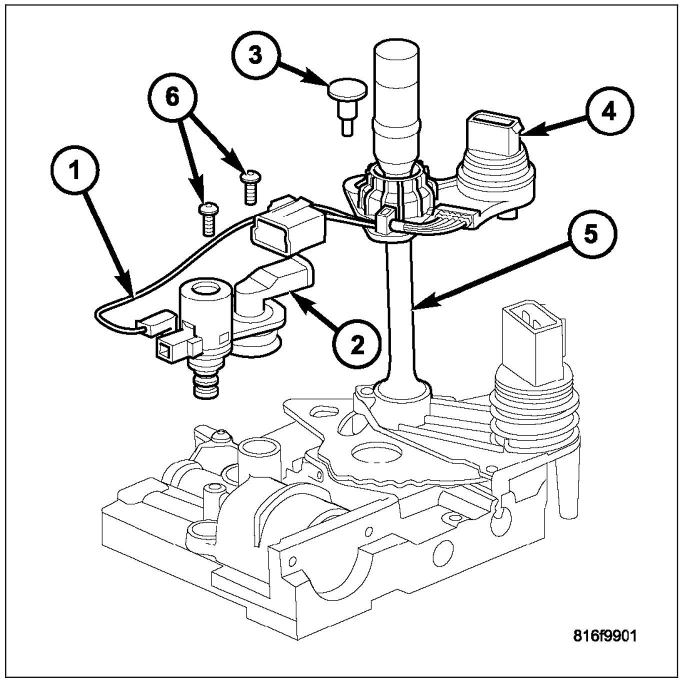
## REMOVAL

1. Remove the valve body from the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE/VALVE BODY - REMOVAL)
2. Remove the electrical connectors from the pressure control solenoid (1) and the line pressure sensor (2).
3. Remove the screws (6) holding the pressure control solenoid (1) and line pressure sensor (2) to the valve body.
4. Remove the pressure control solenoid and line pressure sensor from the valve body.



## INSTALLATION

1. Install the pressure control solenoid (1) and line pressure sensor (2) into the valve body.
2. Install the screws (6) to hold the pressure control solenoid (1) and line pressure sensor (2) to the valve body.
3. Install the electrical connectors to the pressure control solenoid (1) and the line pressure sensor (2).
4. Install the valve body into the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 42RLE/VALVE BODY - INSTALLATION)



# SHIFT MECHANISM

## DESCRIPTION

The gear shift mechanism provides six shift positions which are:

- Park (P)
- Reverse (R)
- Neutral (N)
- Drive (D)
- Manual second (2)
- Manual low (1)

## OPERATION

MANUAL LOW (1) range provides first gear only. Overrun braking is also provided in this range. MANUAL SECOND (2) range provides first and second gear only.

DRIVE range provides FIRST, SECOND THIRD and OVERDRIVE FOURTH gear ranges. The shift into OVERDRIVE FOURTH gear range occurs only after the transmission has completed the shift into D THIRD gear range. No further movement of the shift mechanism is required to complete the 3-4 shift.

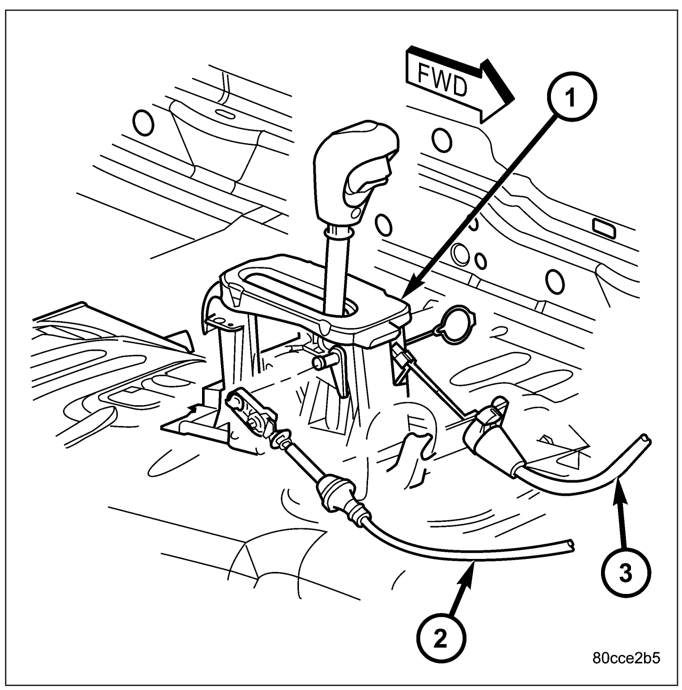
The FOURTH gear upshift occurs automatically when the overdrive selector switch is in the ON position. No upshift to FOURTH gear will occur if any of the following are true:

- The transmission fluid temperature is below 10° C (50° F) or above 121° C (250° F).
- The shift to THIRD is not yet complete.
- Vehicle speed is too low for the 3-4 shift to occur.

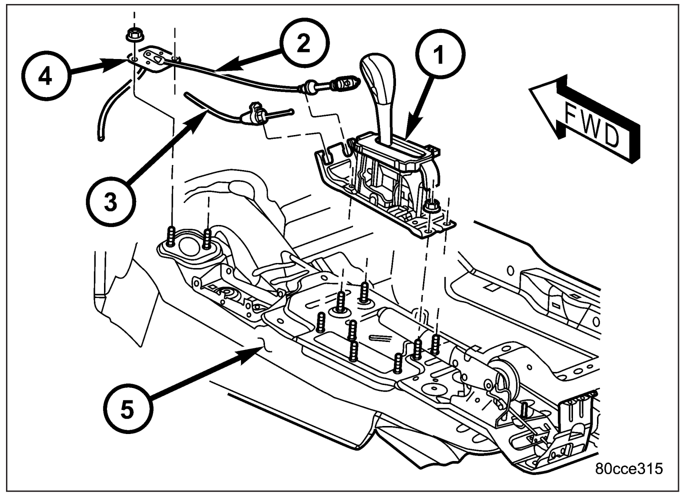
Upshifts into FOURTH will be delayed when the transmission fluid temperature is below 4.5° C (40° F) or above 115.5° C (240° F).

## REMOVAL

1. Remove any necessary console parts for access to shift lever assembly and shifter cables. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
2. Shift transmission into PARK.
3. Disconnect the transmission shift cable at shift lever and shifter assembly bracket.
4. Disconnect the park-interlock cable from the shifter lever and the shifter assembly bracket.
5. Disengage all wiring connectors from the shifter assembly.
6. Remove all nuts holding the shifter assembly to the floor pan.
7. Remove the shifter assembly from the vehicle.



## INSTALLATION




1. Install shifter assembly onto the shifter assembly studs on the floor pan.
2. Install the nuts to hold the shifter assembly onto the floor pan. Tighten nuts to 28 N·m (250 in.lbs.).
3. Install wiring harness to the shifter assembly bracket. Engage any wire connectors removed from the shifter assembly.
4. Install the park-interlock cable into the shifter assembly bracket and into the shifter lever.
5. Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.
6. Place the floor shifter lever in park position.
7. Loosen the adjustment screw on the shift cable.
8. Snap the shift cable onto the shift lever pin.
9. Verify that the shift lever is in the PARK position.
10. Tighten the adjustment screw to 7 N·m (65 in.lbs.).
11. Verify correct shifter operation.
12. Verify proper BTSI operation. (Refer to 21 - TRANSMISSION/AUTOMATIC/SHIFT INTERLOCK SYSTEM - DIAGNOSIS AND TESTING) Adjust the park-interlock cable as necessary. (Refer to 21 - TRANSMISSION/AUTOMATIC/SHIFT INTERLOCK CABLE - ADJUSTMENTS)
13. Install any console parts removed for access to shift lever assembly and shift cables. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

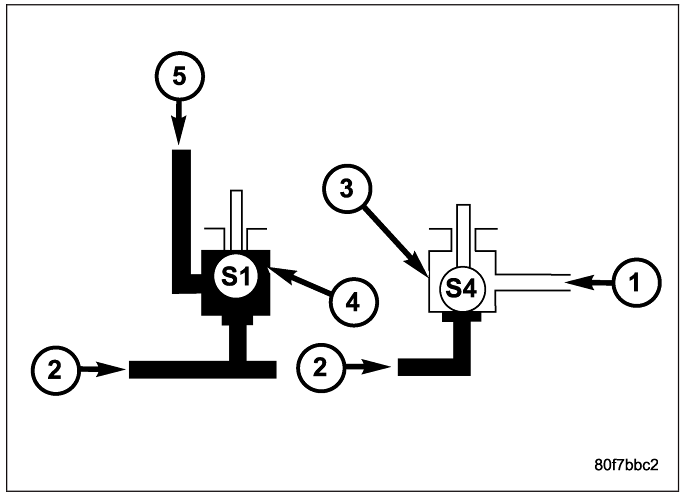
# SOLENOID

## DESCRIPTION

The typical electrical solenoid used in automotive applications is a linear actuator. It is a device that produces motion in a straight line. This straight line motion can be either forward or backward in direction, and short or long distance.

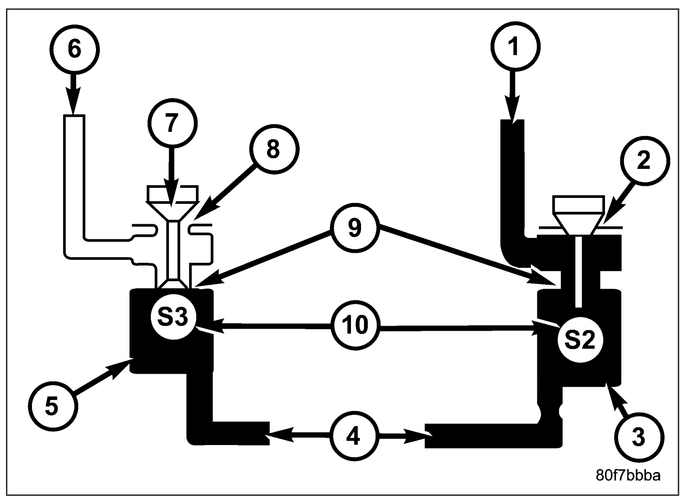
A solenoid is an electromechanical device that uses a magnetic force to perform work. It consists of a coil of wire, wrapped around a magnetic core made from steel or iron, and a spring loaded, movable plunger, which performs the work, or straight line motion.

The solenoids used in transmission applications are attached to valves which can be classified as **normally open** or **normally closed.** The **normally open** solenoid valve is defined as a valve which allows hydraulic flow when no current or voltage is applied to the solenoid. The **normally closed** solenoid valve is defined as a valve which does not allow hydraulic flow when no current or voltage is applied to the solenoid. These valves perform hydraulic control functions for the transmission and must therefore be durable and tolerant of dirt particles. For these reasons, the valves have hardened steel poppets and ball valves. The solenoids operate the valves directly, which means that the solenoids must have very high outputs to close the valves against the sizable flow areas and line pressures found in current transmissions. Fast response time is also necessary to ensure accurate control of the transmission.




The strength of the magnetic field is the primary force that determines the speed of operation in a particular solenoid design. A stronger magnetic field will cause the plunger to move at a greater speed than a weaker one. There are basically two ways to increase the force of the magnetic field:

1. Increase the amount of current applied to the coil or
2. Increase the number of turns of wire in the coil.




The most common practice is to increase the number of turns by using thin wire that can completely fill the available space within the solenoid housing. The strength of the spring and the length of the plunger also contribute to the response speed possible by a particular solenoid design.

A solenoid can also be described by the method by which it is controlled. Some of the possibilities include variable force, pulse-width modulated, constant ON, or duty cycle. The variable force and pulse-width modulated versions utilize similar methods to control the current flow through the solenoid to position the solenoid plunger at a desired position somewhere between full ON and full OFF. The constant ON and duty cycled versions control the voltage across the solenoid to allow either full flow or no flow through the solenoid's valve.

## OPERATION

When an electrical current is applied to the solenoid coil, a magnetic field is created which produces an attraction to the plunger, causing the plunger to move and work against the spring pressure and the load applied by the fluid the valve is controlling. The plunger is normally directly attached to the valve which it is to operate. When the current is removed from the coil, the attraction is removed and the plunger will return to its original position due to spring pressure.

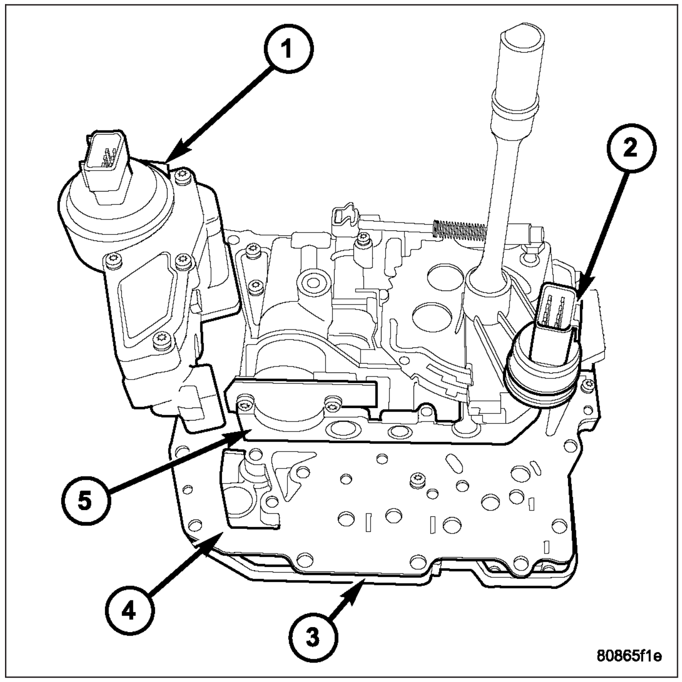
The plunger is made of a conductive material and accomplishes this movement by providing a path for the magnetic field to flow. By keeping the air gap between the plunger and the coil to the minimum necessary to allow free movement of the plunger, the magnetic field is maximized.

# SOLENOID/PRESSURE SWITCH ASSY

## DESCRIPTION

The Solenoid/Pressure Switch Assembly (1) is inside the transmission and mounted to the valve body assembly. The assembly consists of four solenoids that control hydraulic pressure to the L/R, 2/4, OD, and UD friction elements (transmission clutches), and the torque converter clutch. The reverse clutch is controlled by line pressure from the manual valve in the valve body. The solenoids are contained within the Solenoid/Pressure Switch Assembly, and can only be serviced by replacing the assembly.

The solenoid assembly also contains pressure switches that monitor and send hydraulic circuit information to the TCM. Likewise, the pressure switches can only be service by replacing the assembly.




## OPERATION

### SOLENOIDS

The solenoids receive electrical power from the Transmission Control Relay through a single wire. The TCM energizes or operates the solenoids individually by grounding the return wire of the solenoid needed. When a solenoid is energized, the solenoid valve shifts, and a fluid passage is opened or closed (vented or applied), depending on its default operating state. The result is an apply or release of a frictional element.

The 2/4 and UD solenoids are normally applied, which allows fluid to pass through in their relaxed or “off” state. By design, this allows transmission limp-in (P,R,N,2) in the event of an electrical failure.

The continuity of the solenoids and circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the TCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a speed ratio or pressure switch error occurs.

### PRESSURE SWITCHES

The TCM relies on three pressure switches to monitor fluid pressure in the L/R, 2/4, and OD hydraulic circuits. The primary purpose of these switches is to help the TCM detect when clutch circuit hydraulic failures occur. The range for the pressure switch closing and opening points is 11-23 psi. Typically the switch opening point will be approximately one psi lower than the closing point. For example, a switch may close at 18 psi and open at 17 psi. The switches are continuously monitored by the TCM for the correct states (open or closed) in each gear as shown in the following chart:

**PRESSURE SWITCH STATES**

| GEAR | L/R | 2/4 | OD |
|---|---|---|---|
| R | OP | OP | OP |
| P/N | CL | OP | OP |
| 1st | CL | OP | OP |
| 2nd | OP | CL | OP |
| D | OP | OP | CL |
| OD | OP | CL | CL |

**OP = OPEN**

**CL = CLOSED**

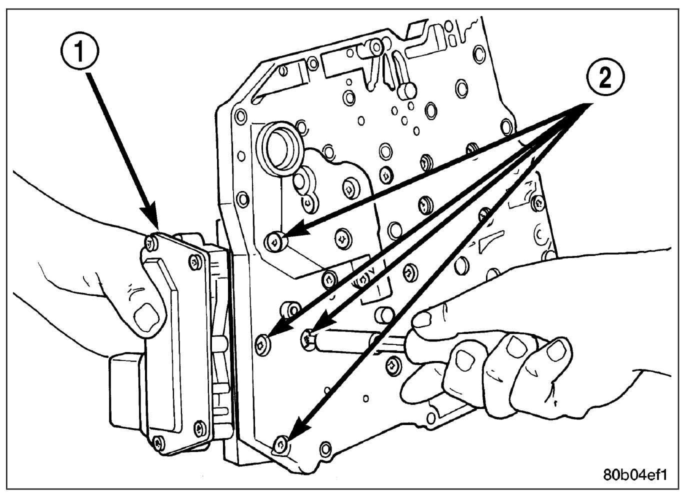
A Diagnostic Trouble Code (DTC) will set if the TCM senses any switch open or closed at the wrong time in a given gear.

The TCM also tests the 2/4 and OD pressure switches when they are normally off (OD and 2/4 are tested in 1st gear, OD in 2nd gear, and 2/4 in 3rd gear). The test simply verifies that they are operational, by looking for a closed state when the corresponding element is applied. Immediately after a shift into 1st, 2nd, or 3rd gear with the engine speed above 1000 rpm, the TCM momentarily turns on element pressure to the 2/4 and/or OD clutch circuits to identify that the appropriate switch has closed. If it doesn't close, it is tested again. If the switch fails to close the second time, the appropriate Diagnostic Trouble Code (DTC) will set.

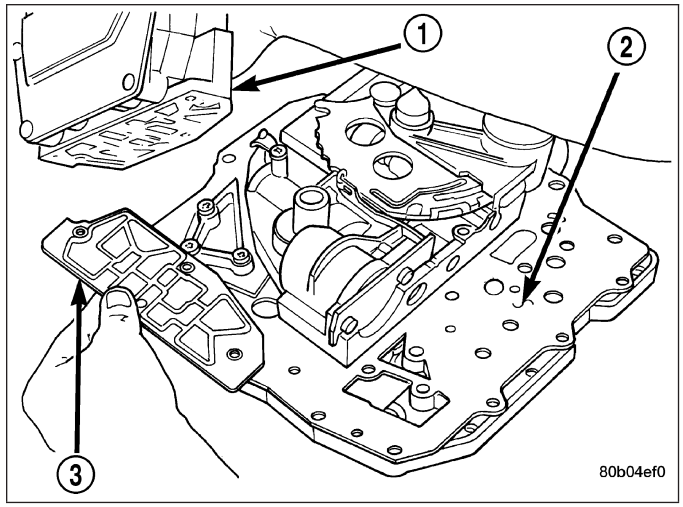
## REMOVAL

**NOTE: If the Solenoid/Pressure Switch Assembly is being replaced, the Quick Learn Procedure must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)**

1. Raise vehicle on hoist.
2. Remove valve body assembly from transmission. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/VALVE BODY - REMOVAL)
3. Remove Solenoid/Pressure Switch Assembly retaining screws (2) from solenoid.



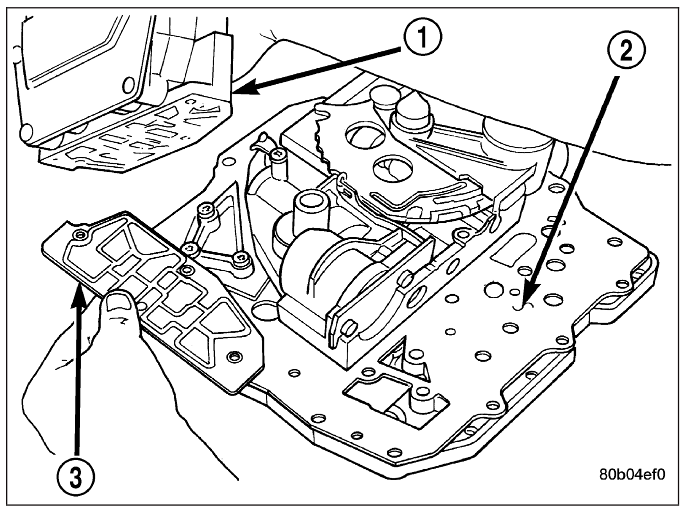
4. Remove Solenoid/Pressure Switch Assembly (1) and screen from valve body (2).



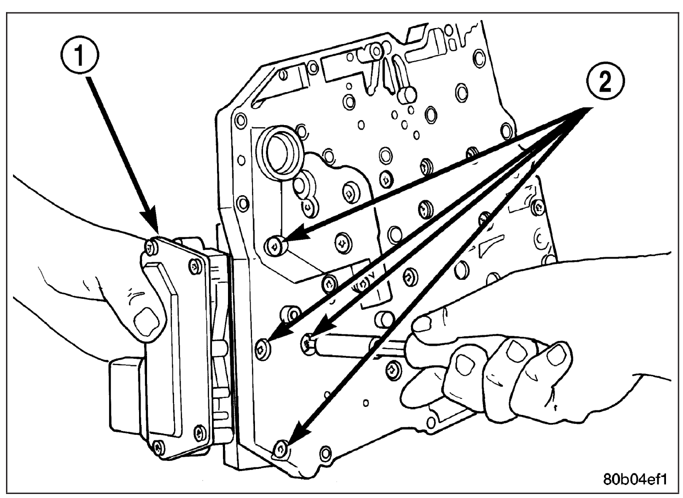

## INSTALLATION

**NOTE: If the Solenoid/Pressure Switch assembly is being replaced, the Quick Learn Procedure must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)**

1. Install Solenoid/Pressure Switch Assembly (1) and screen (3) to the separator and transfer plates.




2. Install and tighten retaining screws (2) to 5.5 N·m (50 in. lbs.) torque.
3. Install valve body. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/VALVE BODY - INSTALLATION)



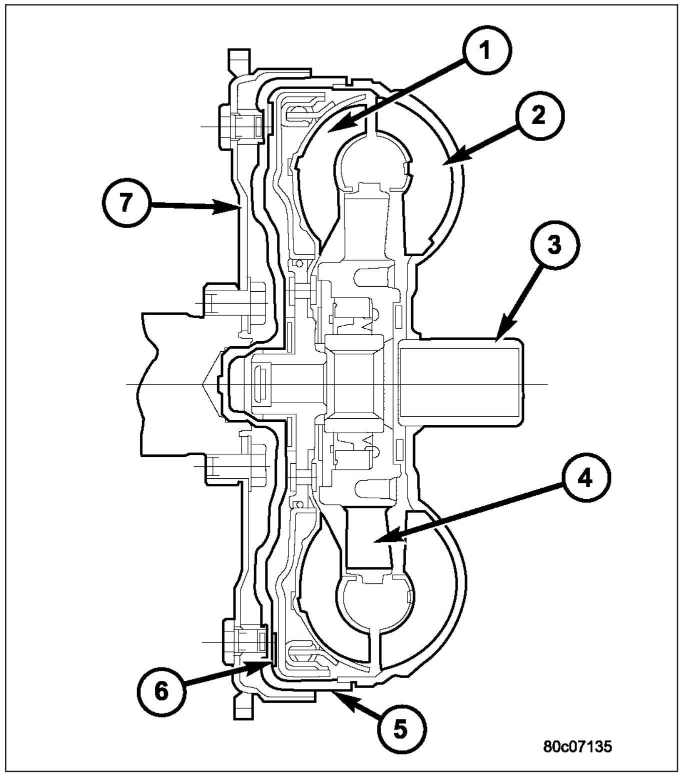
# TORQUE CONVERTER

## DESCRIPTION

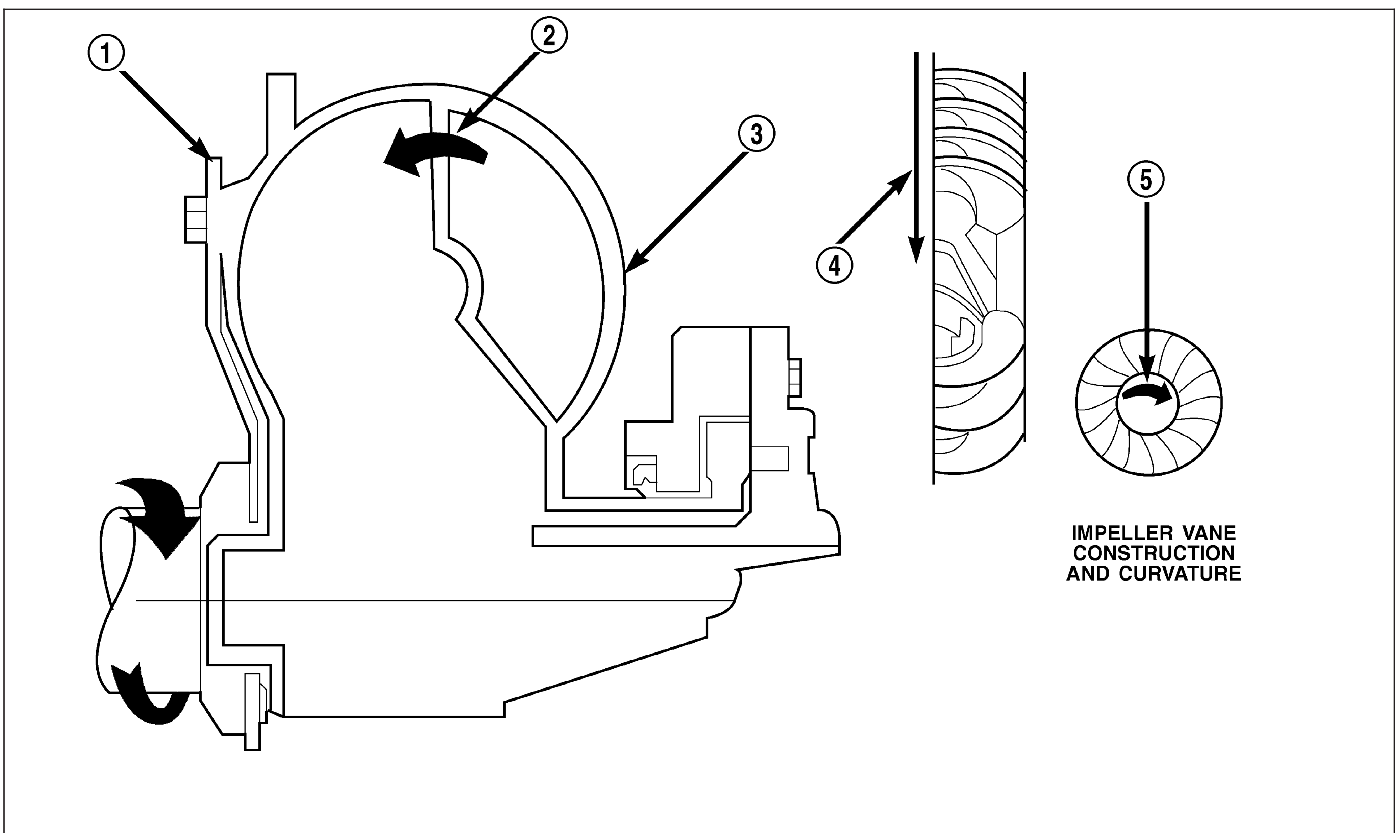
The torque converter is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine (1), a stator (4), an overrunning clutch, an impeller (2) and an electronically applied converter clutch (6). The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The torque converter hub drives the transmission oil (fluid) pump.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

**CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid.**

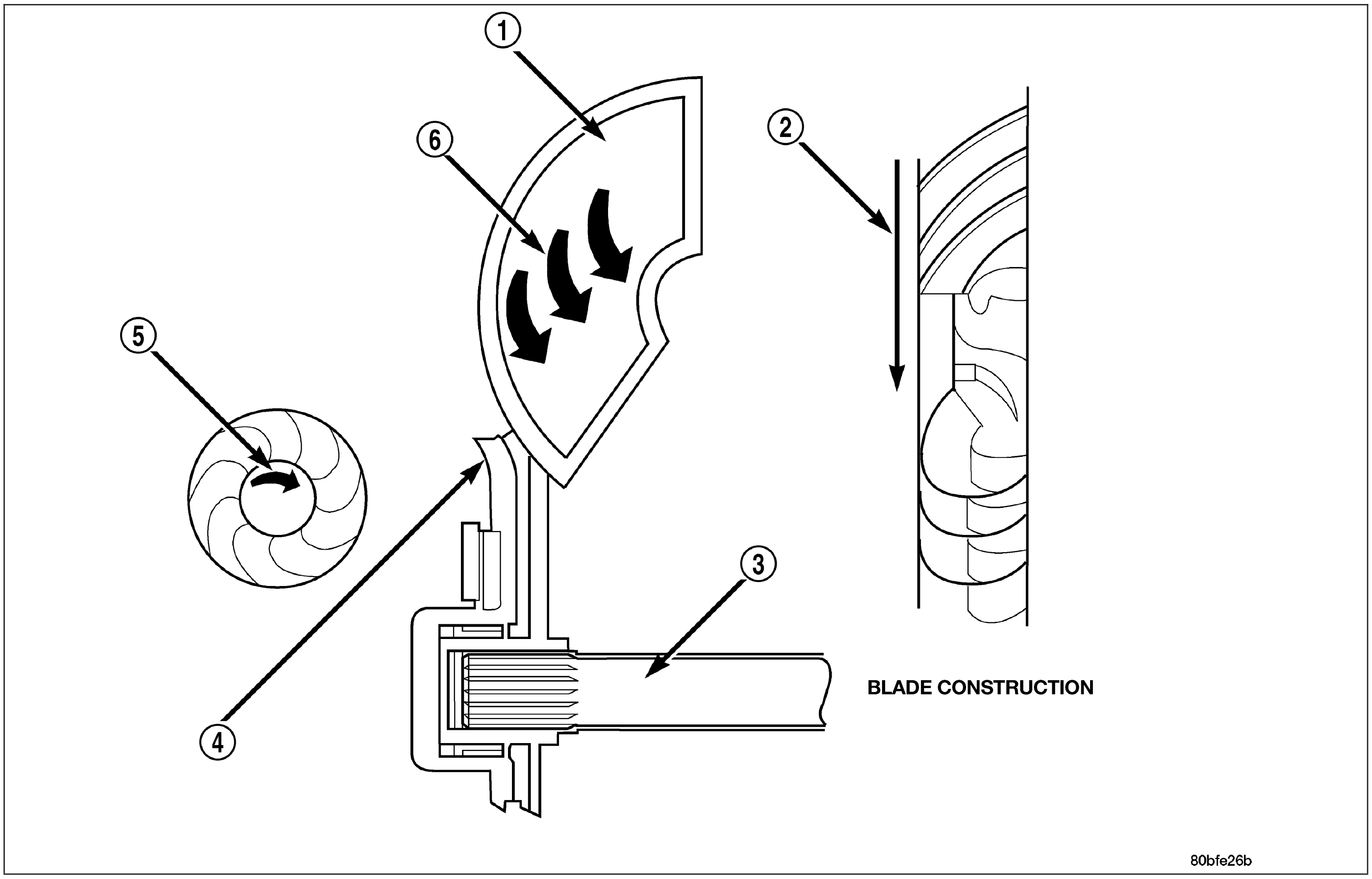



## IMPELLER



The impeller is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving members of the system.

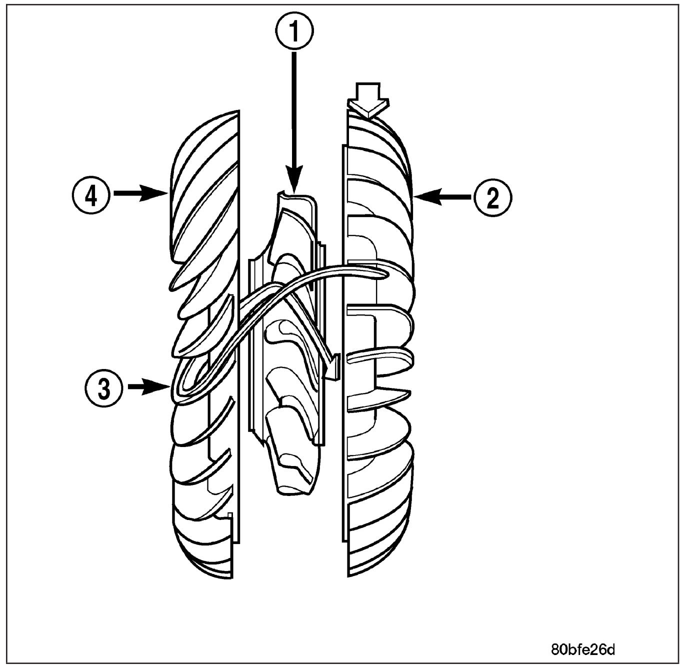
## TURBINE



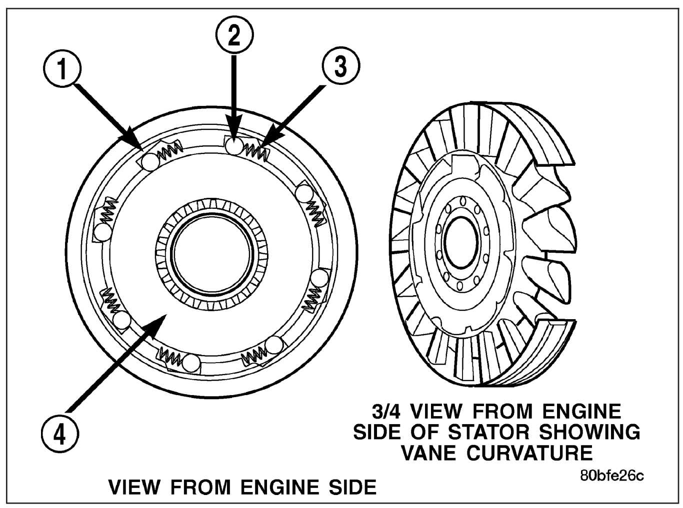

The turbine is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

## STATOR

The stator assembly is mounted on a stationary shaft which is an integral part of the oil pump. The stator (1) is located between the impeller (2) and the turbine (4) within the torque converter case.

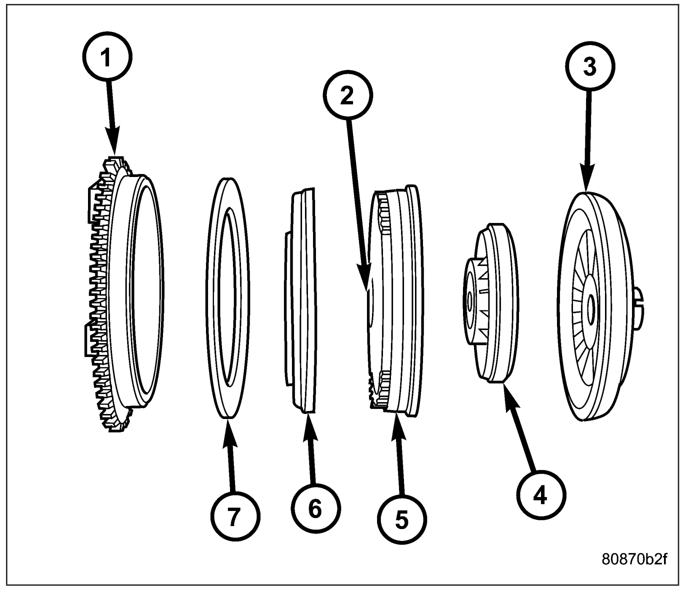



The stator contains an over-running clutch (1-4), which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.



## TORQUE CONVERTER CLUTCH (TCC)

The TCC was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock-free power transfer, it is natural for all fluid couplings to slip. If the impeller (3) and turbine (5) were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston (6) with friction material (7) was added to the turbine assembly (5) to provide this mechanical lock-up.

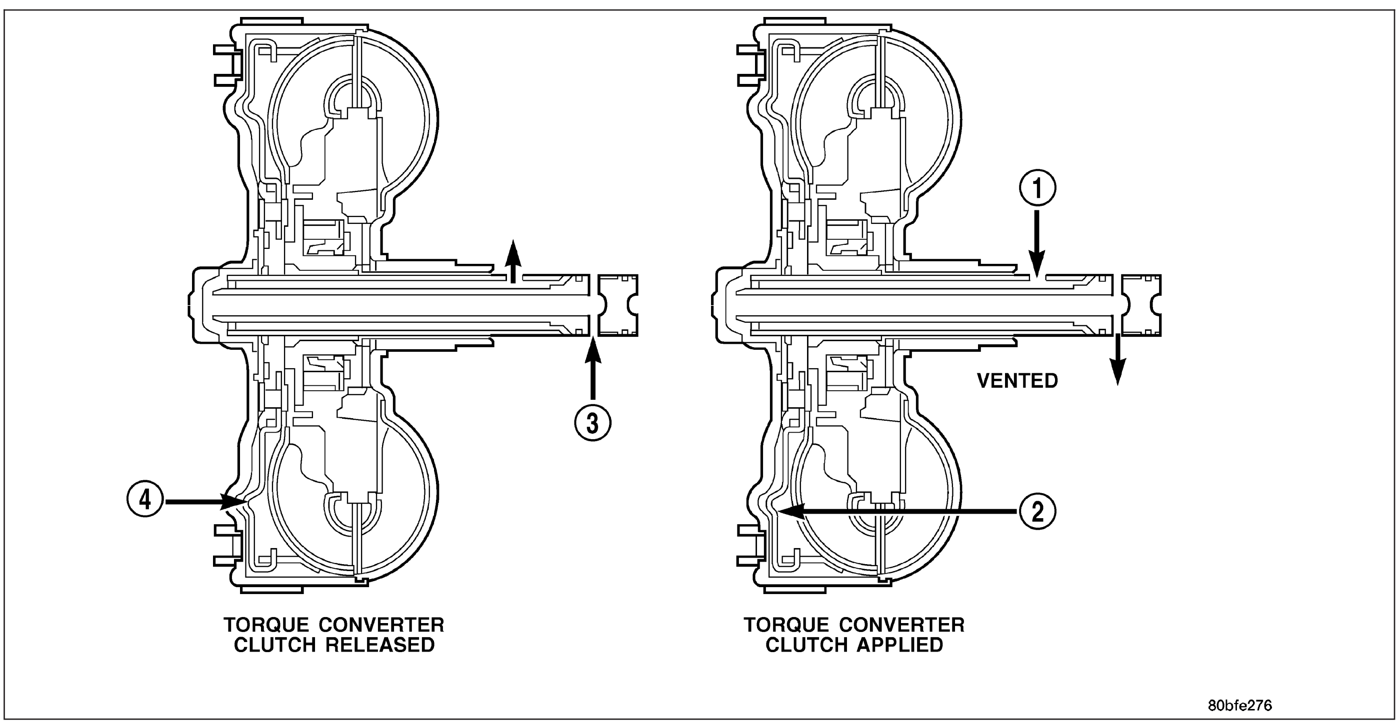



In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the L/R-CC Solenoid to achieve a smooth application of the torque converter clutch. This function, referred to as Electronically Modulated Converter Clutch (EMCC) can occur at various times depending on the following variables:

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature
- Input speed
- Throttle angle
- Engine speed

## OPERATION

The converter impeller (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.



## TURBINE

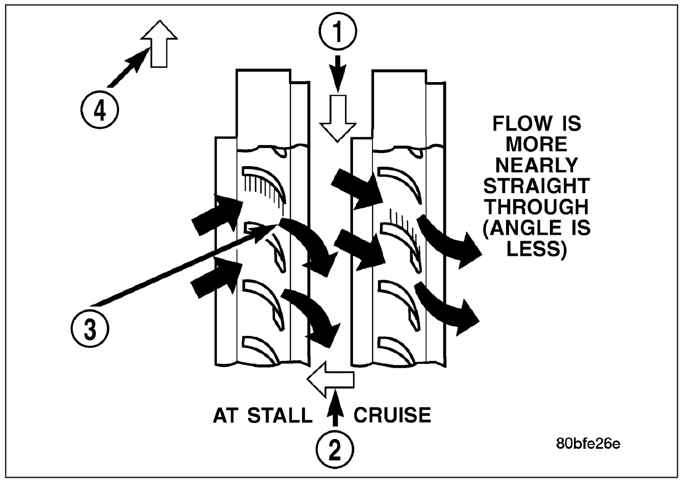
As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a "hindering" direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

## STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft. Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counterclockwise direction. When this happens the overrunning clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a "helping" direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.4:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such as way as to cause it to lock-up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.

## TORQUE CONVERTER CLUTCH (TCC)

The torque converter clutch is hydraulically applied and is released when fluid is vented from the hydraulic circuit by the torque converter control (TCC) solenoid on the valve body. The torque converter clutch is controlled by the Powertrain Control Module (PCM). The torque converter clutch engages in fourth gear, and in third gear under various conditions, such as when the O/D switch is OFF, when the vehicle is cruising on a level surface after the vehicle has warmed up. The torque converter clutch will disengage momentarily when an increase in engine load is sensed by the PCM, such as when the vehicle begins to go uphill or the throttle pressure is increased.




## REMOVAL

1. Remove transmission and torque converter from vehicle. (Refer to 21 - TRANSMISSION/AUTOMATIC - 45RFE/545RFE - REMOVAL)
2. Place a suitable drain pan under the converter housing end of the transmission.

**CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.**

3. Pull the torque converter forward until the center hub clears the oil pump seal.
4. Separate the torque converter from the transmission.

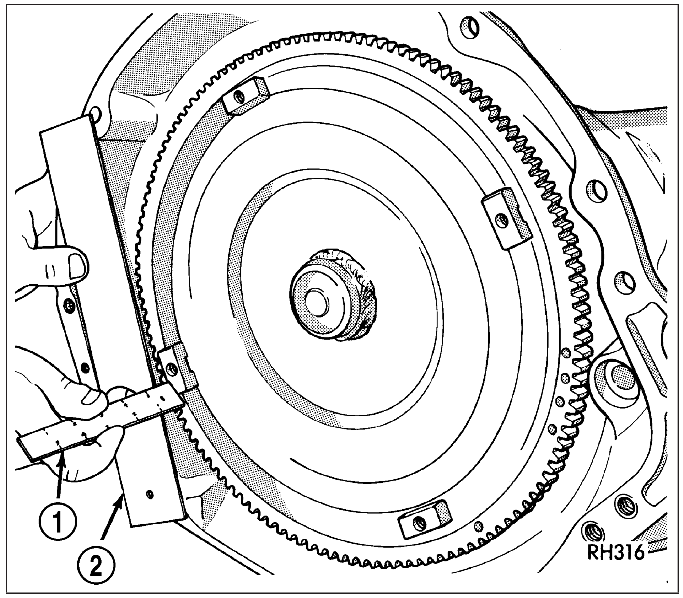
## INSTALLATION

**NOTE: Check converter hub and drive notches for sharp edges, burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation.**

1. Lubricate oil pump seal lip with transmission fluid.
2. Place torque converter in position on transmission.

**CAUTION: Do not damage oil pump seal or bushing while inserting torque converter into the front of the transmission.**

3. Align torque converter to oil pump seal opening.
4. Insert torque converter hub into oil pump.
5. While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.
6. Check converter seating with a scale (1) and straightedge (2). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.
7. If necessary, temporarily secure converter with C-clamp attached to the converter housing.
8. Install the transmission in the vehicle.
9. Fill the transmission with the recommended fluid.



# TRANSMISSION CONTROL RELAY

## DESCRIPTION

The relay is supplied fused B+ voltage, energized by the TCM, and is used to supply power to the solenoid pack when the transmission is in normal operating mode.

## OPERATION

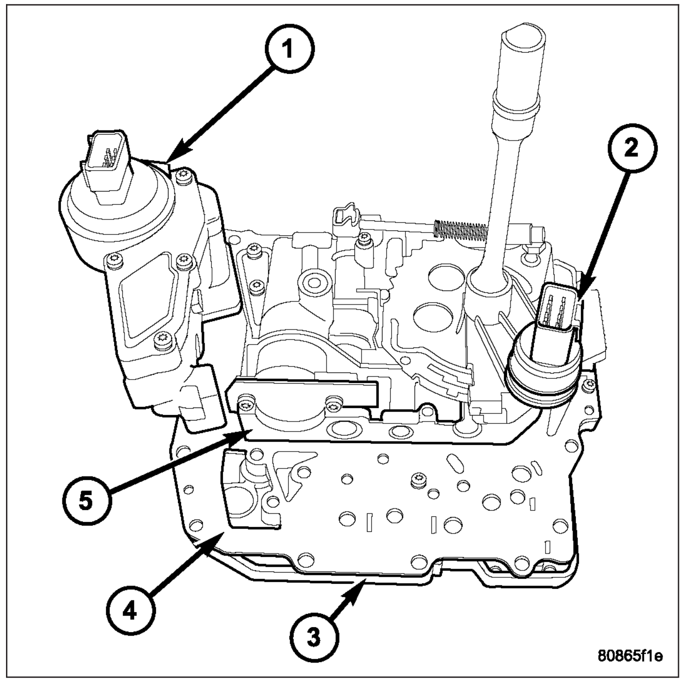
When the relay is "off", no power is supplied to the solenoid pack and the transmission is in "limp-in" mode. After a controller reset, the TCM energizes the relay. Prior to this, the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the solenoid pack pressure switches is checked. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

# TRANSMISSION RANGE SENSOR

## DESCRIPTION

The Transmission Range Sensor (TRS) (2) is mounted to the top of the valve body inside the transmission and can only be serviced by removing the valve body assembly. The electrical connector extends through the transmission case.

The Transmission Range Sensor (TRS) has four switch contacts that monitor shift lever position and send the information to the PCM.




## OPERATION

The Transmission Range Sensor (TRS) communicates shift lever position (SLP) to the TCM as a combination of open and closed switches. Each shift lever position has an assigned combination of switch states (open/closed) that the TCM receives from four sense circuits. The TCM interprets this information and determines the appropriate transmission gear position and shift schedule.

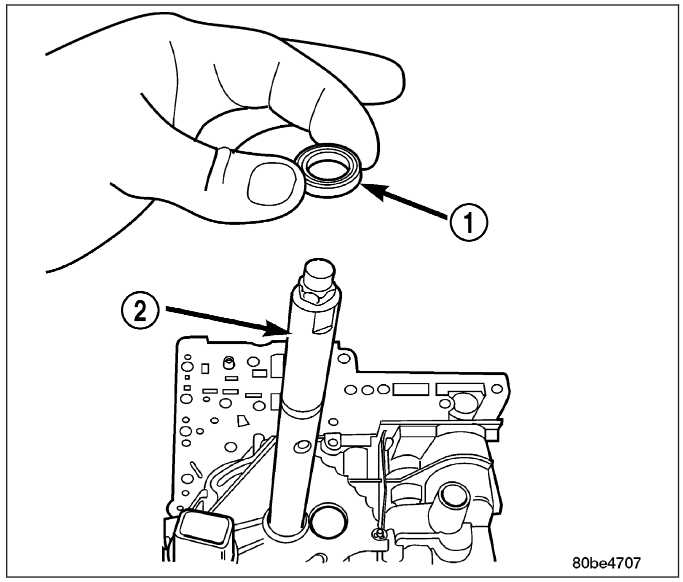
Since there are four switches, there are 16 possible combinations of open and closed switches (codes). Seven of these codes are related to gear position and three are recognized as “between gear” codes. This results in six codes which should never occur. These are called “invalid” codes. An invalid code will result in a DTC, and the TCM will then determine the shift lever position based on pressure switch data. This allows reasonably normal transmission operation with a TRS failure.

**TRS SWITCH STATES**

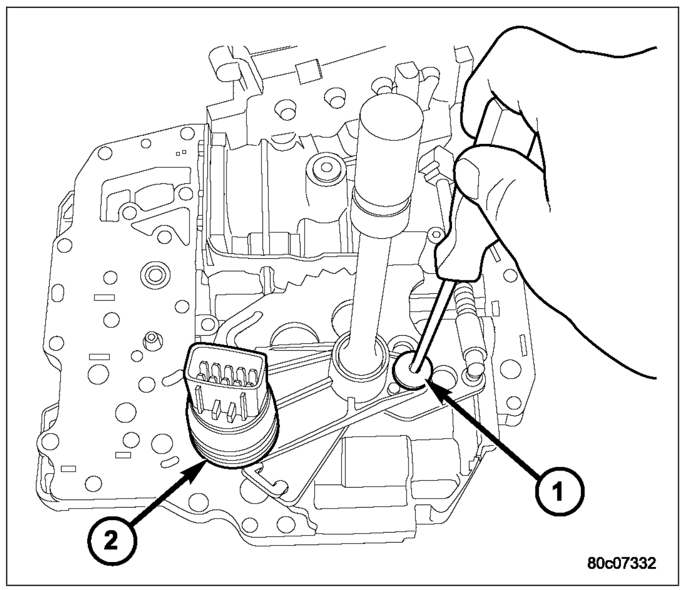
| SLP | T42 | T41 | T3 | T1 |
|---|---|---|---|---|
| **P** | CL | CL | CL | OP |
| **R** | CL | OP | OP | OP |
| **N** | CL | CL | OP | CL |
| **D** | OP | OP | OP | CL |
| **2** | OP | OP | CL | OP |
| **1** | CL | OP | CL | CL |

## REMOVAL

1. Remove valve body assembly from vehicle. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/ VALVE BODY - REMOVAL)
2. Remove the manual shaft seal (1).

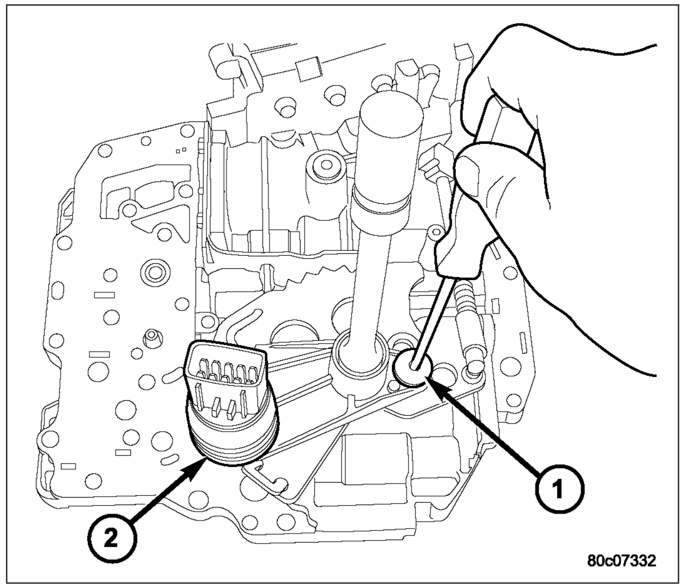



3. Remove manual shaft/TRS retaining screw (1).
4. Slide TRS off of manual valve shaft.

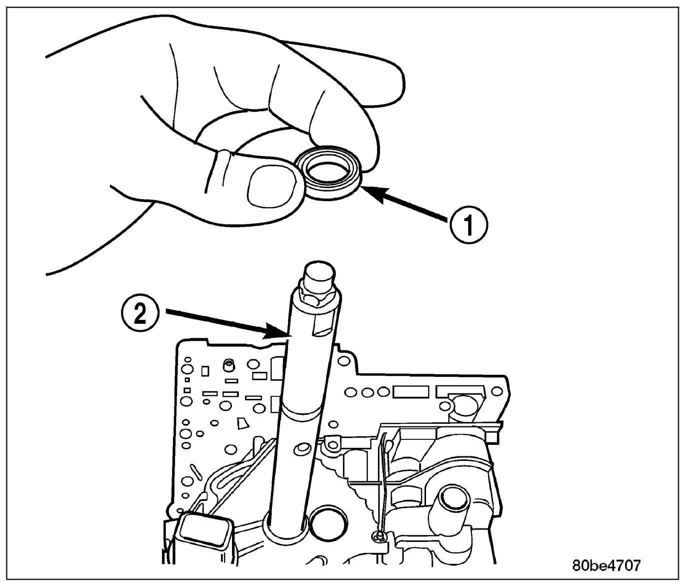


## INSTALLATION

1. Install the TRS (2) to the manual shaft. Make sure TRS locating pin rests in manual valve bore slot.
2. Install the TRS/manual shaft retaining screw (1) and torque to 5 N·m (45 in. lbs.) torque.



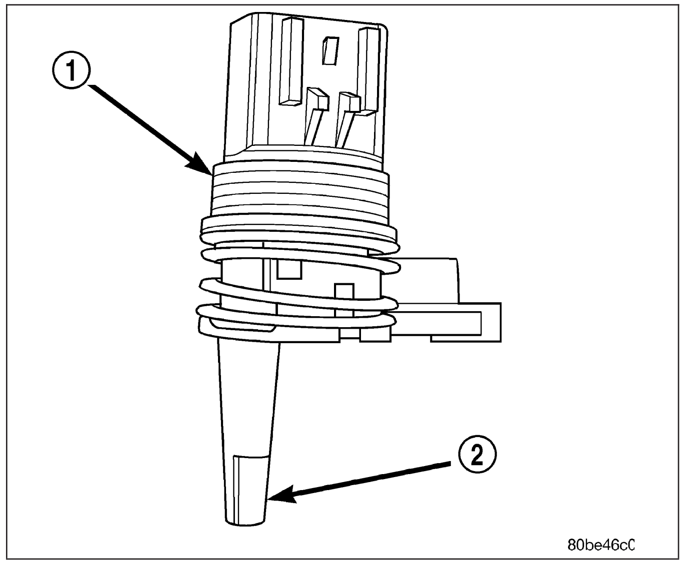

3. Install the manual shaft seal (1).
4. Install valve body to the transmission. (Refer to 21 - TRANSMISSION//AUTOMATIC - 42RLE/VALVE BODY - INSTALLATION)



# TRANSMISSION TEMPERATURE SENSOR

## DESCRIPTION

The transmission temperature sensor (2) is located in the transmission range sensor (1) and communicates transmission sump temperature to the TCM.




## OPERATION

The transmission range sensor (TRS) has an integrated thermistor that the TCM uses to monitor the transmission's sump temperature. Since fluid temperature can affect transmission shift quality and convertor lock up, the TCM requires this information to determine which shift schedule to operate in. The TCM also monitors this temperature data so it can energize the vehicle cooling fan(s) when a transmission “overheat” condition exists. If the thermistor circuit fails, the TCM will revert to calculated oil temperature usage.

## CALCULATED TEMPERATURE

A failure in the temperature sensor or circuit will result in calculated temperature being substituted for actual temperature. Calculated temperature is a predicted fluid temperature which is calculated from a combination of inputs:

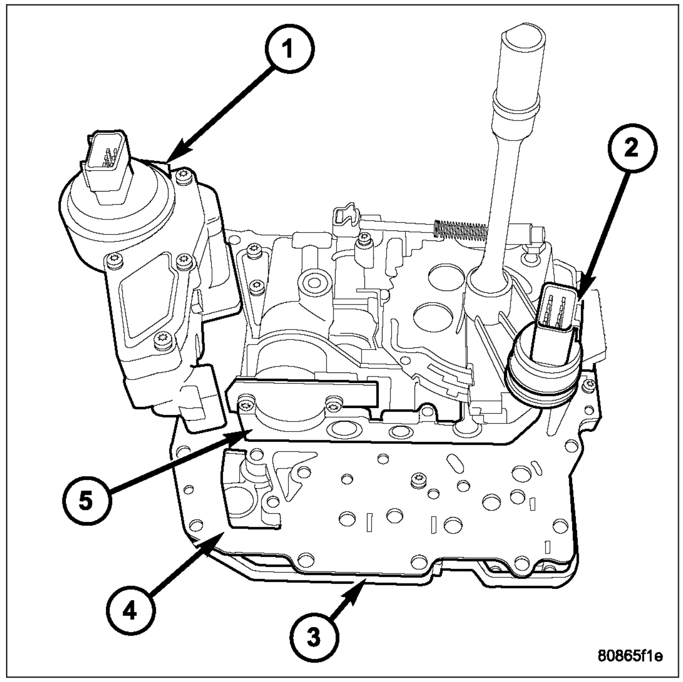
- Battery (ambient) temperature
- Engine coolant temperature
- In-gear run time since start-up

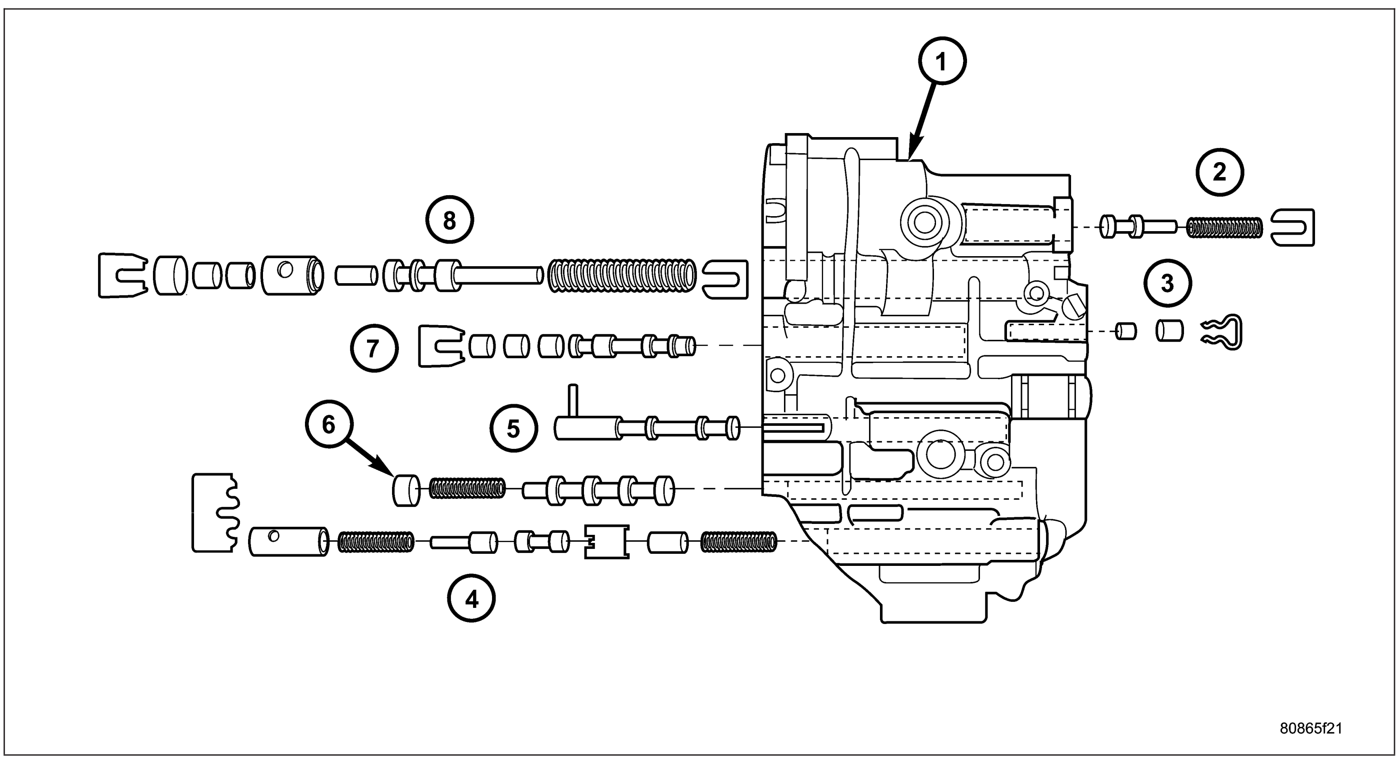
# VALVE BODY

## DESCRIPTION

The valve body assembly consists of a cast aluminum valve body (5), separator plate (4), and transfer plate (3). The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, solenoid/pressure switch assembly, and frictional clutches.

Also mounted to the valve body assembly are the solenoid/pressure switch assembly and the transmission range sensor (2).




The valves contained within the valve body (1) include the following :

- Regulator valve (8)
- Solenoid switch valve (7)
- Manual valve (5)
- Converter clutch switch valve (6)
- Converter clutch control valve (4)
- Torque converter regulator valve (2)

- Low/Reverse switch valve (3)

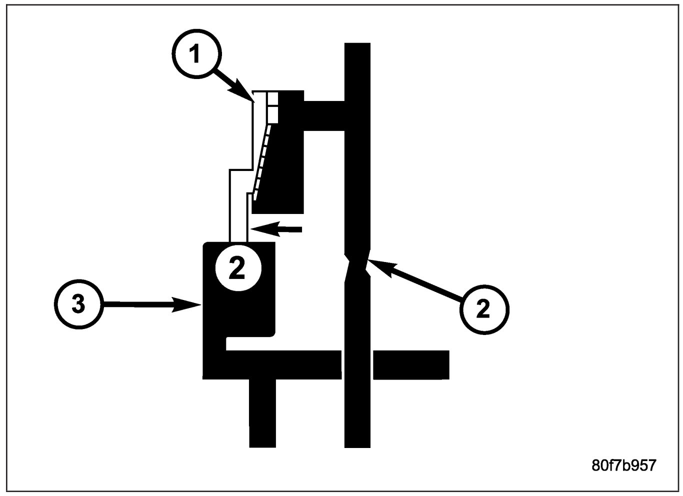
In addition, the valve body also contains the thermal valve, #2, 3, 4 & 5 check balls and the 2/4 accumulator assembly.

## OPERATION

**NOTE: (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS) for a visual aid in determining valve location, operation and design.**

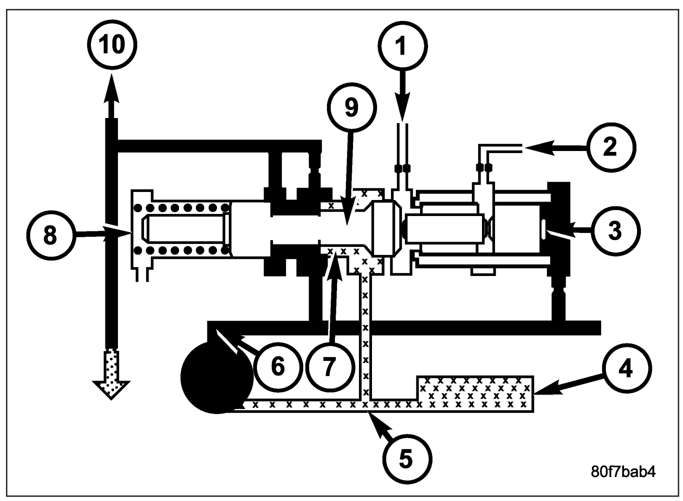
### THERMAL VALVE

The thermal valve (1) is a bi-metallic shudder valve that helps control the venting rate of oil pressure in the underdrive clutch passage during release of the clutch. When the oil temperature is approximately 20 degrees Fahrenheit or less, the valve is fully open to assist in venting oil past the U1 orifice (2). At temperatures above 20 degrees, the valve starts to close and becomes fully closed at approximately 140 degrees. The thermal valve is located in the transfer plate of the valve body.



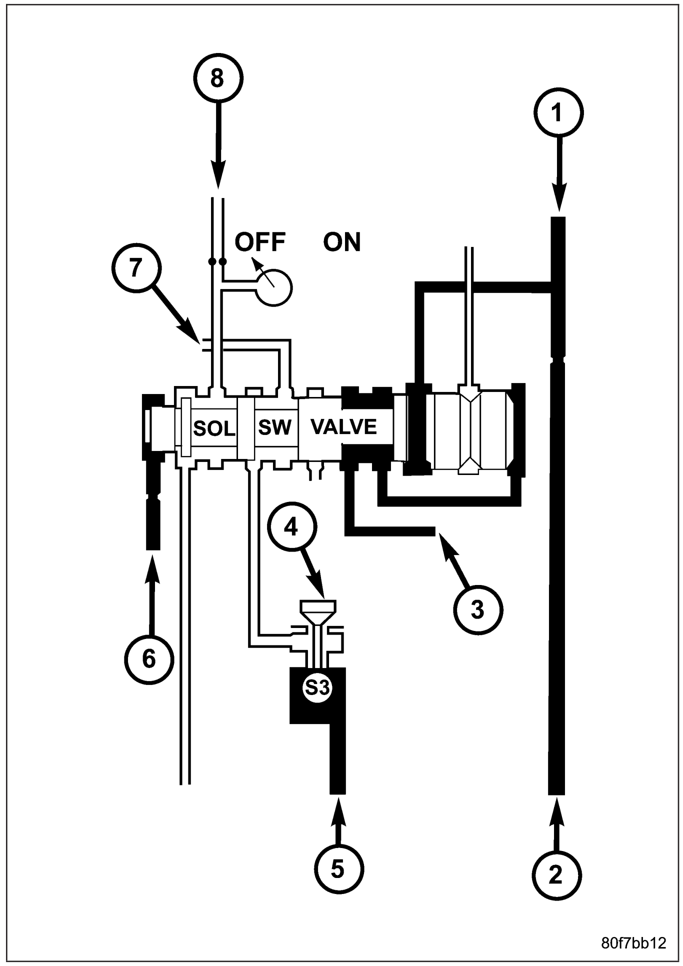

### REGULATOR VALVE

The regulator valve (9) controls hydraulic pressure in the transmission. It receives unregulated pressure from the pump (6), which works against spring tension (8) to maintain oil at specific pressures. A system of sleeves and ports allows the regulator valve to work at one of three predetermined pressure levels. Regulated oil pressure is also referred to as "line pressure."



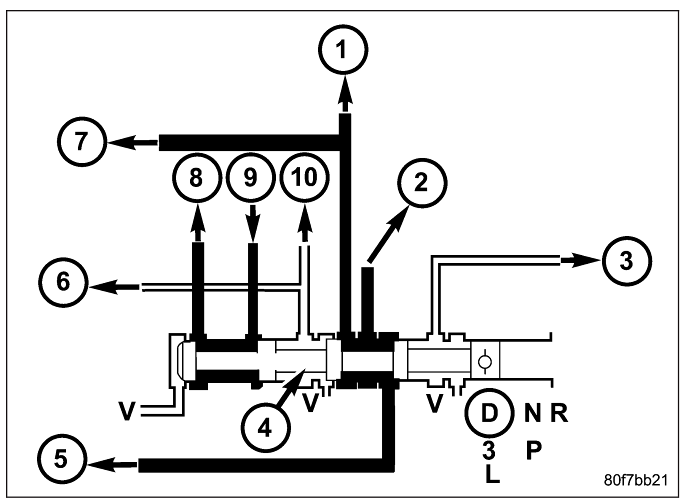
## SOLENOID SWITCH VALVE

The solenoid switch valve controls line pressure from the LR/CC solenoid (4). In one position, it allows the low/reverse clutch to be pressurized. In the other, it directs line pressure to the converter control and converter clutch valves (7).



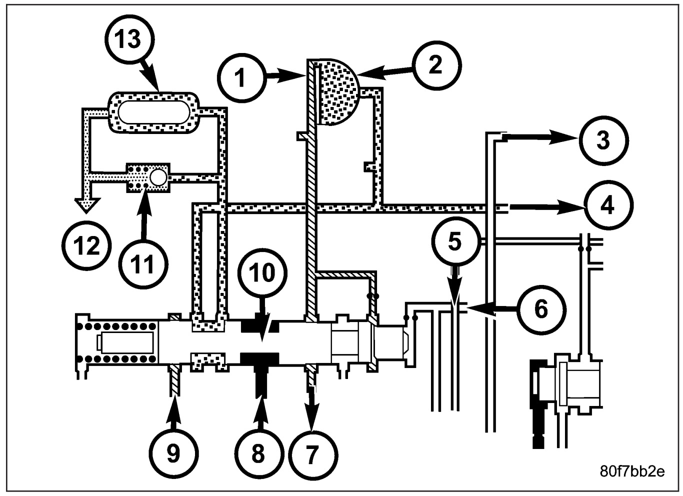

## MANUAL VALVE

The manual valve (4) is operated by the mechanical shift linkage. Its primary responsibility is to send line pressure to the appropriate hydraulic circuits and solenoids. The valve has three operating ranges or positions.



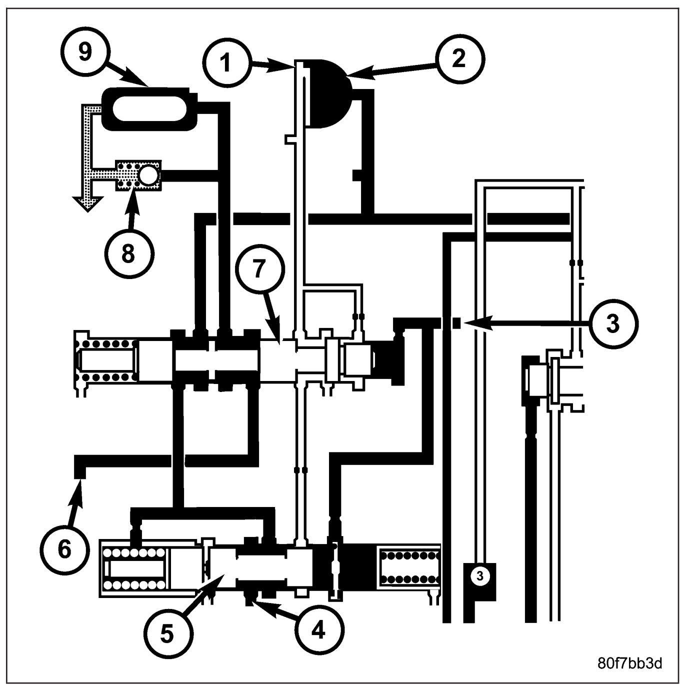
## CONVERTER CLUTCH SWITCH VALVE

The main responsibility of the converter clutch switch valve (10) is to control hydraulic pressure applied to the front (off) side of the converter clutch piston. Line pressure from the regulator valve (5) is fed to the torque converter regulator valve (8). The pressure is then directed to the converter clutch switch valve (10) and to the front side of the converter clutch piston. This pressure pushes the piston back and disengages the converter clutch.




## CONVERTER CLUTCH CONTROL VALVE

The converter clutch control valve (5) controls the back (on) side of the torque converter clutch (1). When the controller energizes or modulates the LR/CC solenoid to apply the converter clutch piston, both the converter clutch control valve (5) and the converter control valve move, allowing pressure to be applied to the back side of the clutch.




## T/C REGULATOR VALVE

The torque converter regulator valve slightly regulates the flow of fluid to the torque converter.

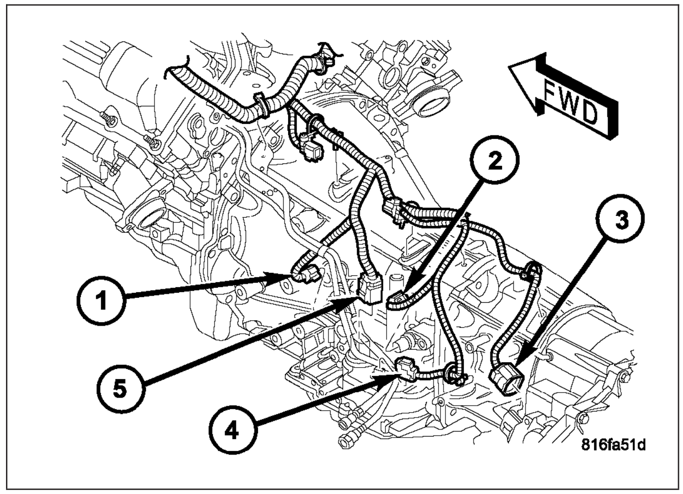
## LOW/REVERSE SWITCH VALVE

The low/reverse clutch is applied from different sources, depending on whether low (1st) gear or reverse is selected. The low/reverse switch valve alternates positions depending on from which direction fluid pressure is applied. By design, when the valve is shifted by fluid pressure from one channel, the opposing channel is blocked. The switch valve alienates the possibility of a sticking ball check, thus providing consistent application of the low/reverse clutch under these operating conditions.

## REMOVAL

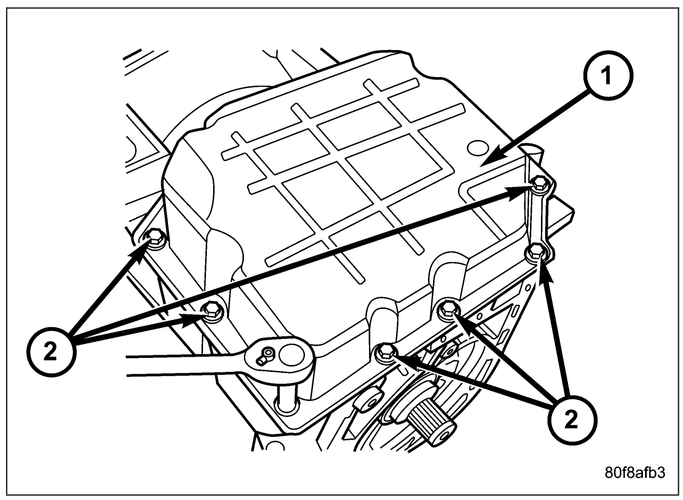
**NOTE: If valve body is being reconditioned or replaced, it is necessary to perform the Quick Learn Procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)**

1. Disconnect the transmission range sensor (5) and solenoid/pressure switch assembly wiring connectors.
2. Disconnect the variable line pressure connector (4), if equipped.
3. Disconnect the shift cable from the shift lever (at the transmission).
4. Move the manual shift lever clockwise as far as it will go. This should be one position past the L position. Then remove the manual shift lever.

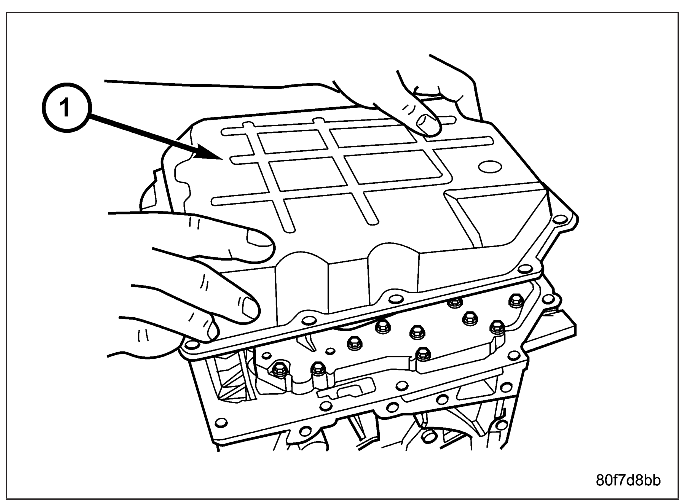



**NOTE: One of the oil pan bolts has a sealing patch applied from the factory. Separate this bolts for reuse.**

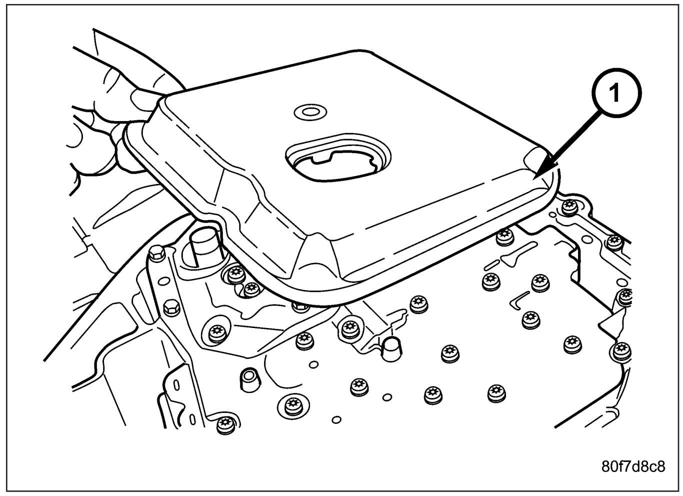
5. Remove transmission pan bolts (2).



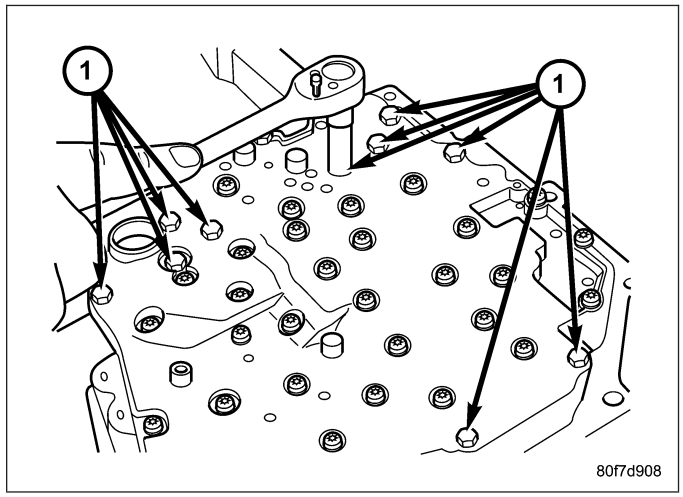

6. Remove transmission oil pan (1).



7. Remove oil filter (1) from valve body. It is held in place by two screws.

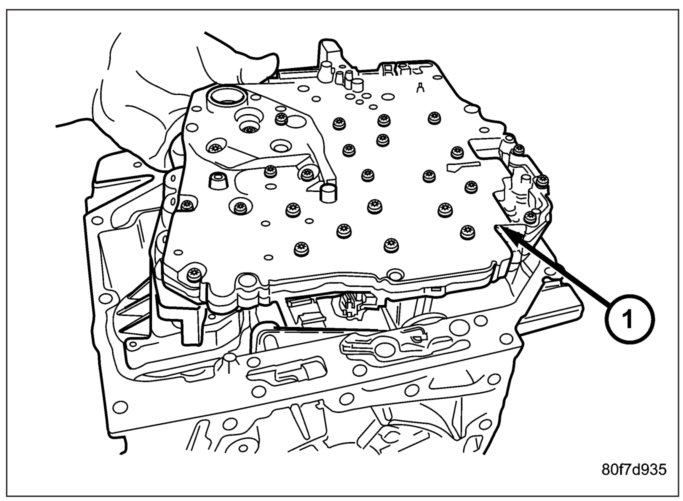



8. Remove valve body bolts-to-case (1).




**CAUTION: The overdrive and underdrive accumulators and springs may fall out when removing the valve body.**

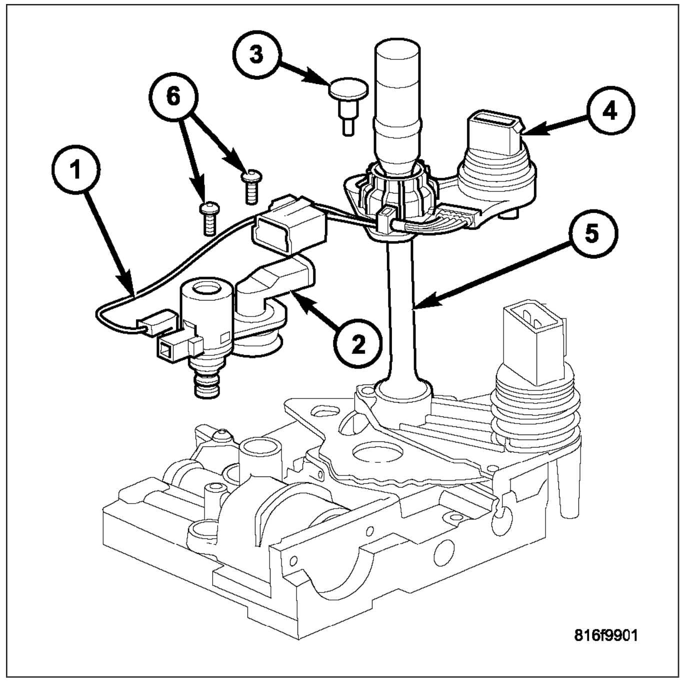
9. Carefully remove valve body assembly (1) from the transmission.



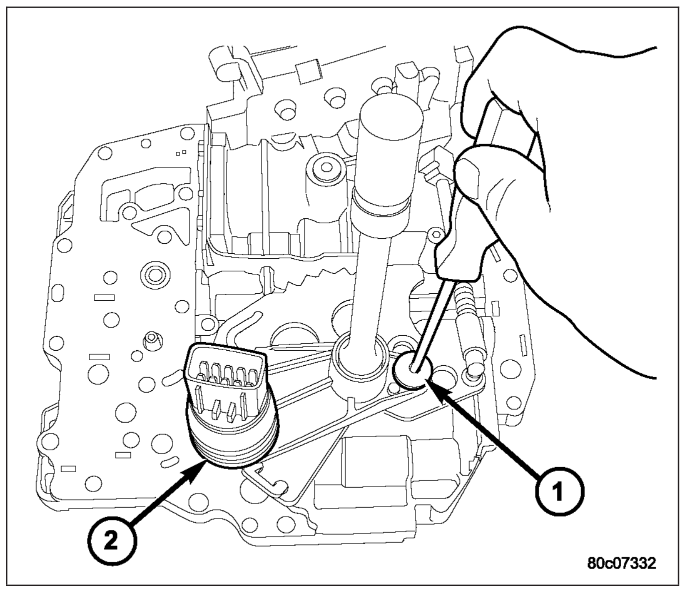

## DISASSEMBLY

**NOTE: If the valve body is being reconditioned or replaced, it is necessary to perform the Quick Learn Procedure using the scan tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)**

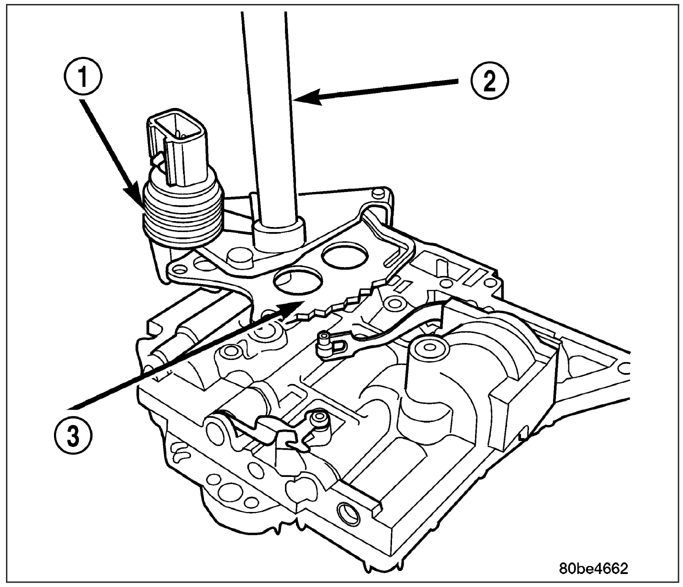
1. Remove the electrical connectors from the pressure control solenoid (1) and the line pressure sensor (2).
2. Remove the screws (6) holding the pressure control solenoid (1) and line pressure sensor (2) to the valve body.
3. Remove the pressure control solenoid and line pressure sensor from the valve body.
4. Remove the shoulder screw (3) holding the variable line pressure header (4) to the valve body.
5. Remove the variable line pressure header from the manual shaft (5).



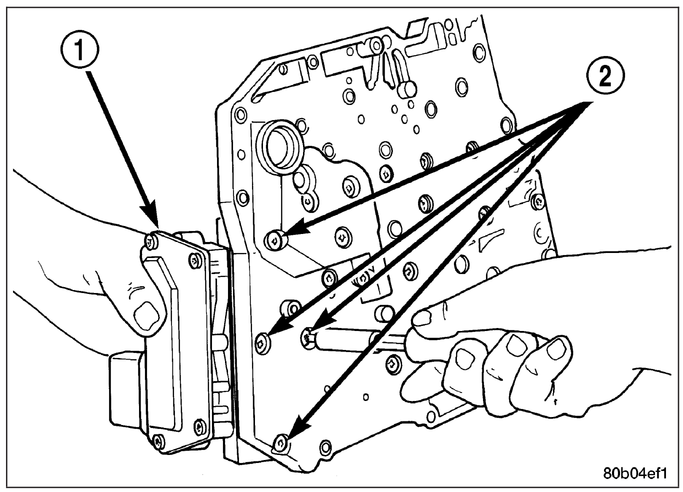

6. Remove manual shaft seal.
7. Remove manual shaft screw (1).



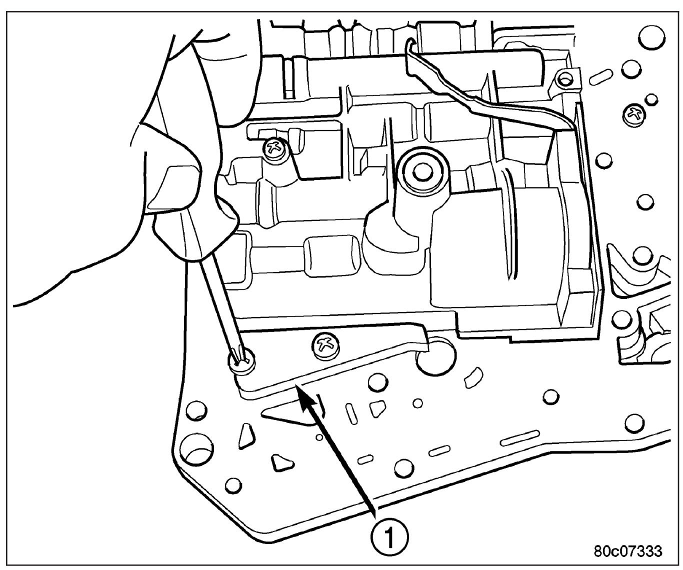
8. Remove Transmission Range Sensor (TRS) (1) and manual shaft (2).



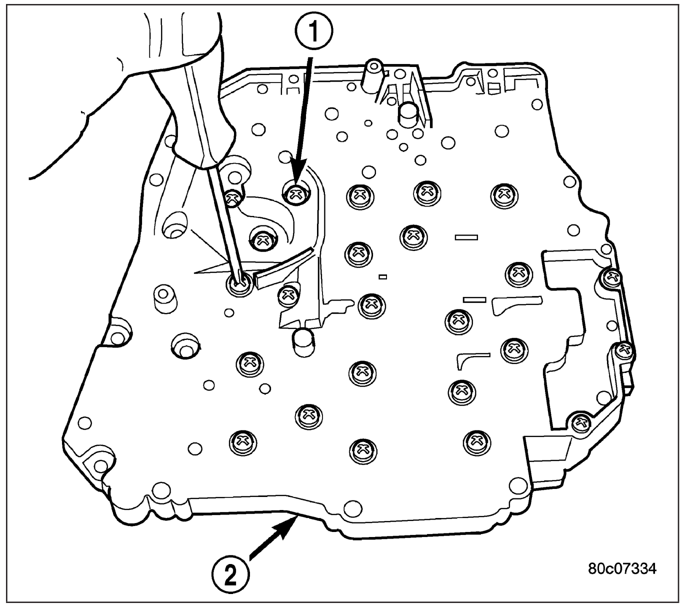

9. Remove Solenoid/Pressure Switch Assembly (1) from valve body.



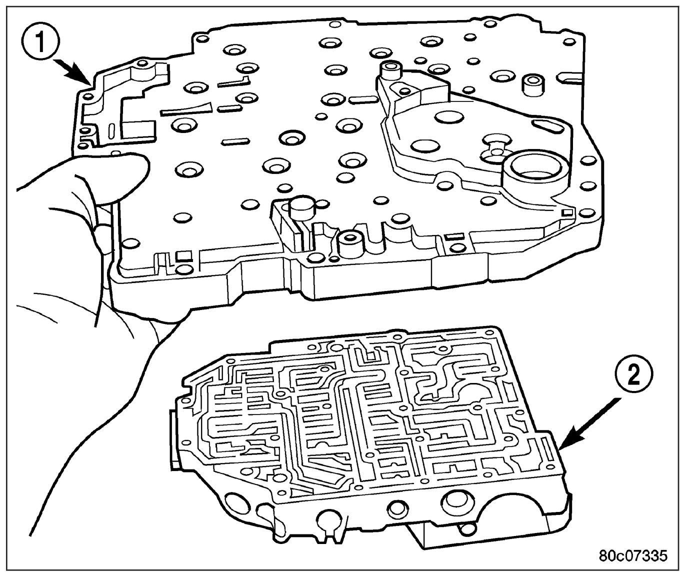

10. Remove valve body stiffener plate (1).



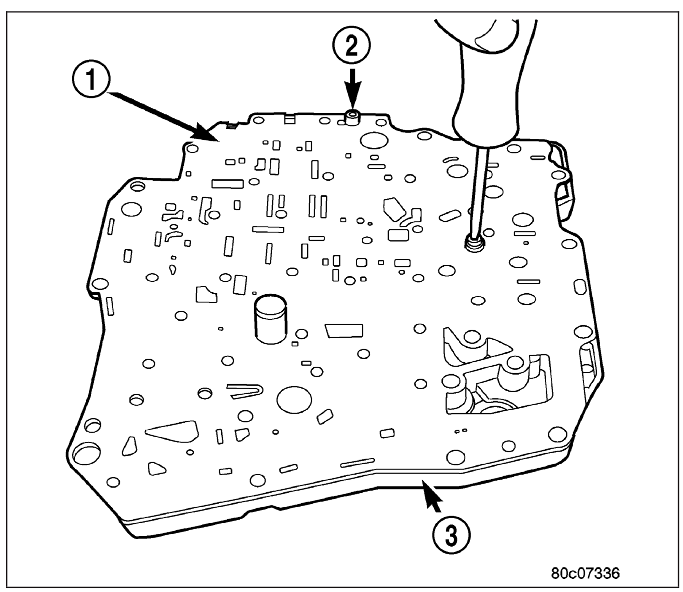
11. Invert valve body assembly and remove transfer plate-to-valve body screws (1).



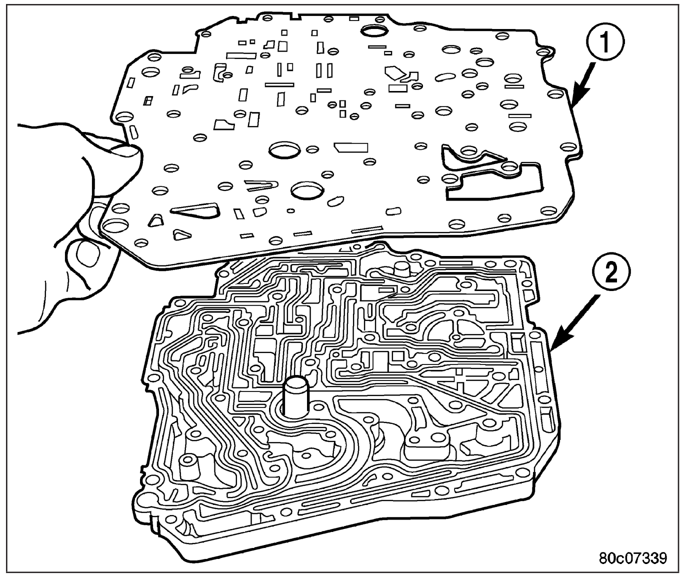

12. Remove transfer/separator plate (1) from valve body (2)



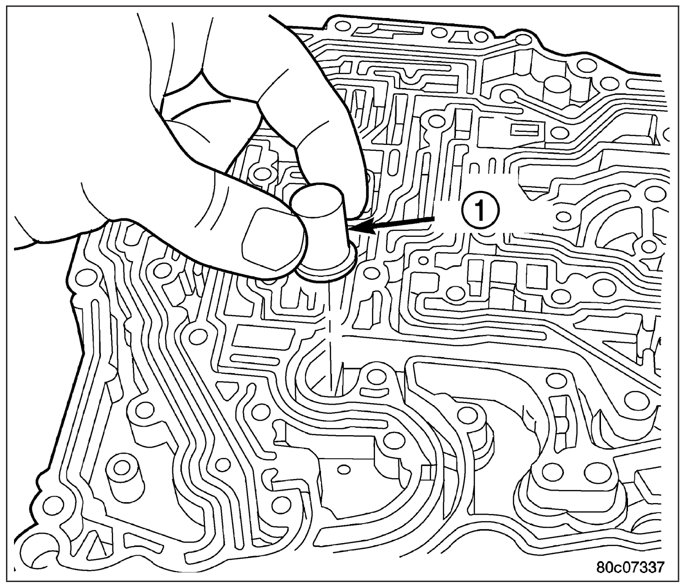

13. Remove separator plate-to-transfer plate screws (2).



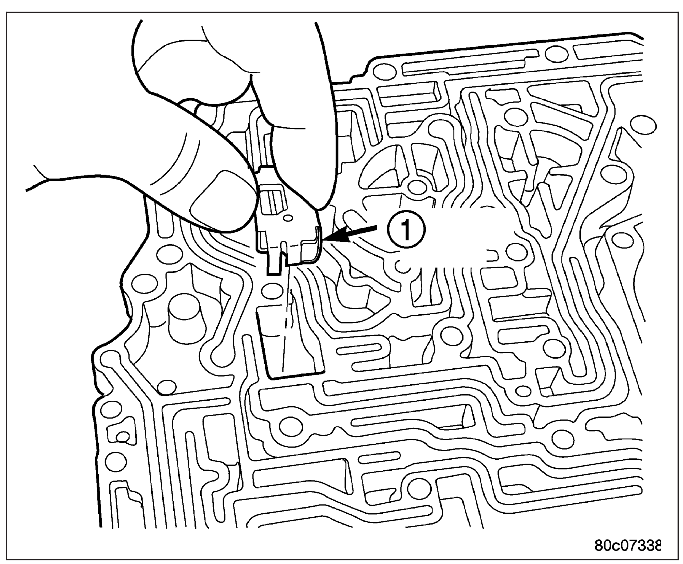
14. Remove separator plate (1) from transfer plate (2).

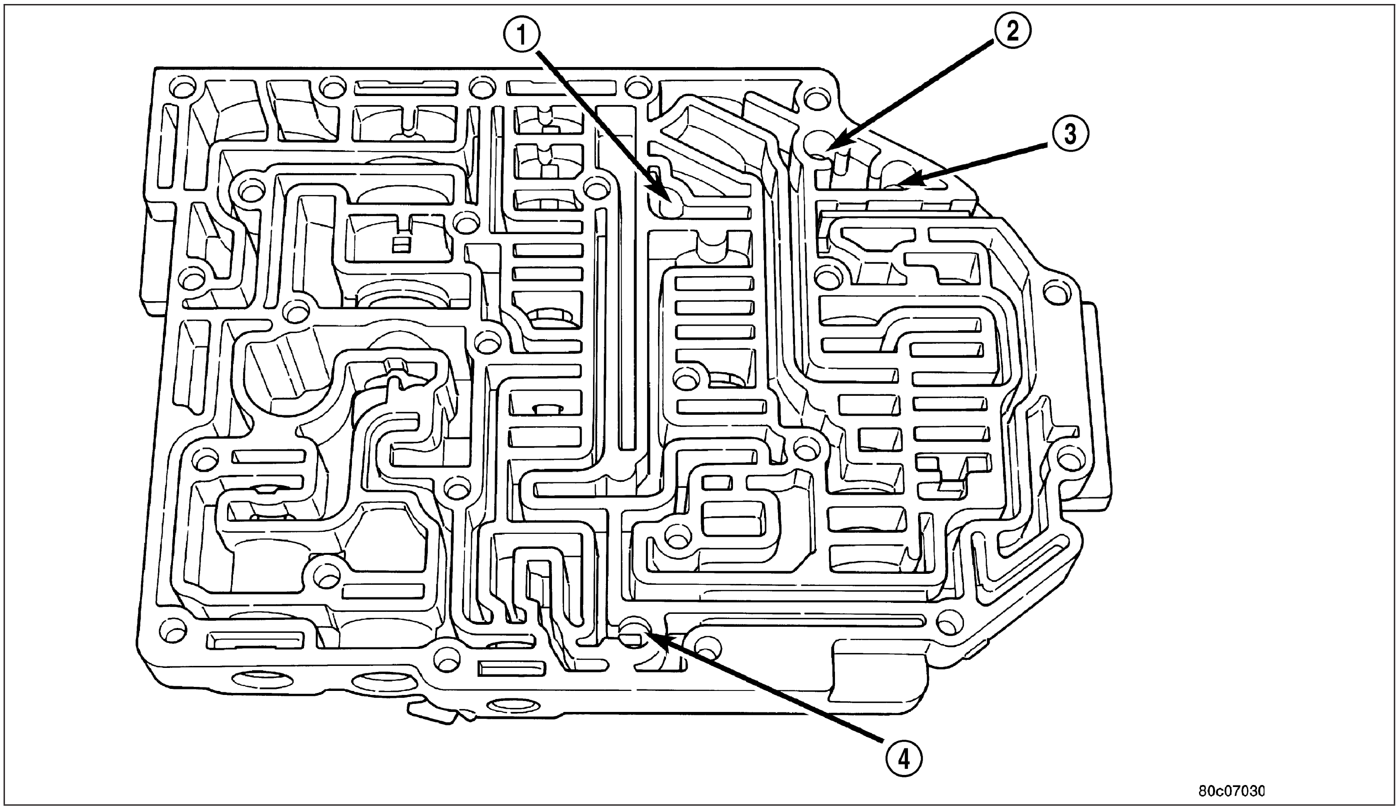



15. Remove the oil screen (1) from the transfer plate.

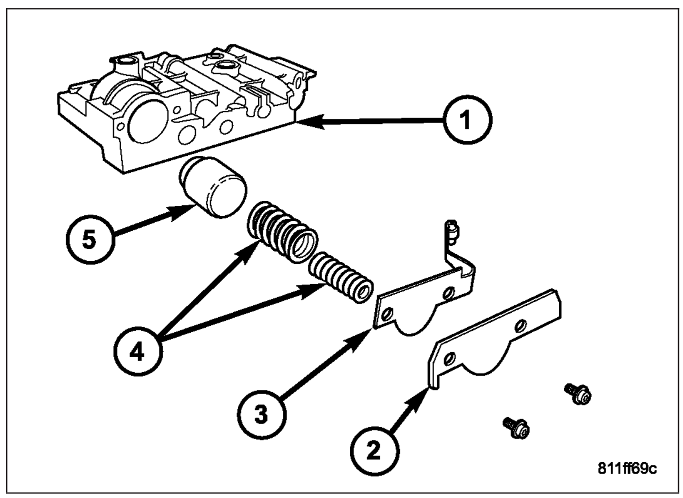



16. Remove thermal valve (1) from transfer plate.

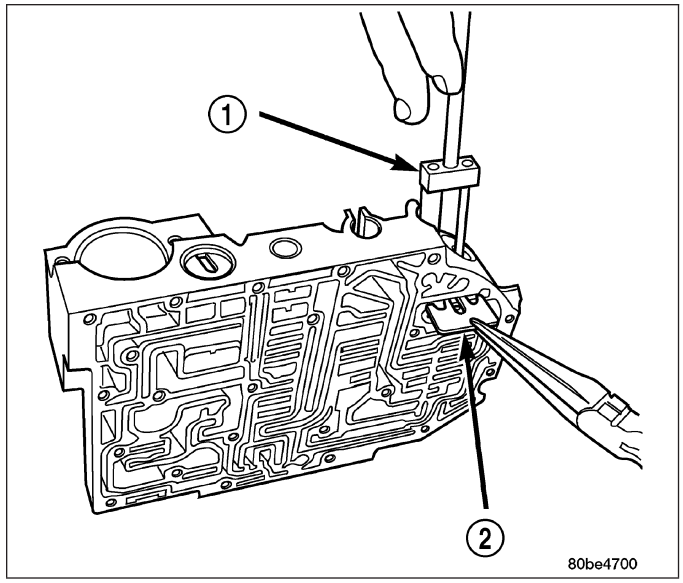




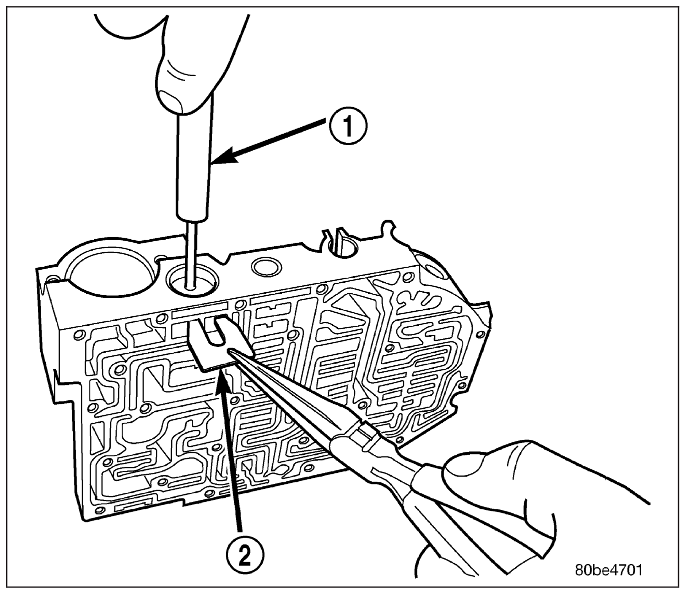

17. Remove valve body check balls (1-4). Note their location for assembly ease.
18. Remove 2/4 accumulator assembly (1-5).



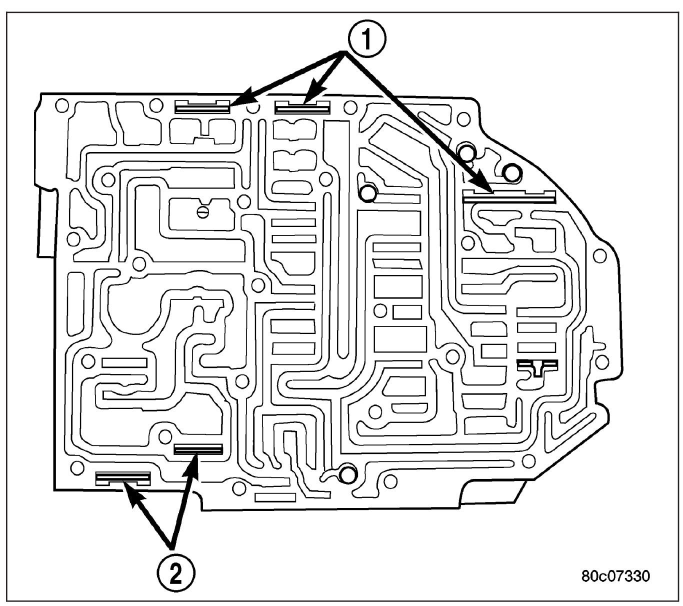
19. Remove dual retainer plate (2) from valve body. Use Remover/Installer 6301 (1) to remove plate (2).

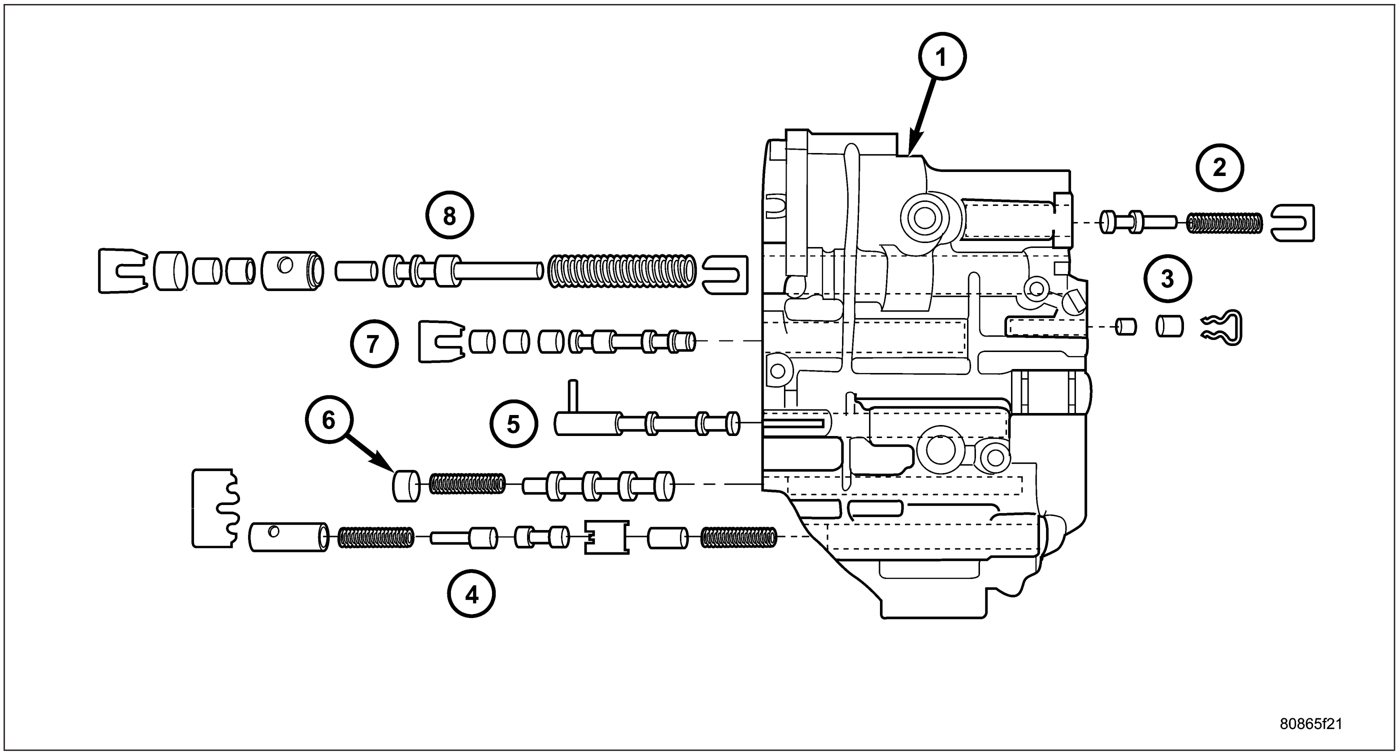



20. Remove regulator valve spring retainer (2).




21. Remove remaining retainers (1, 2).

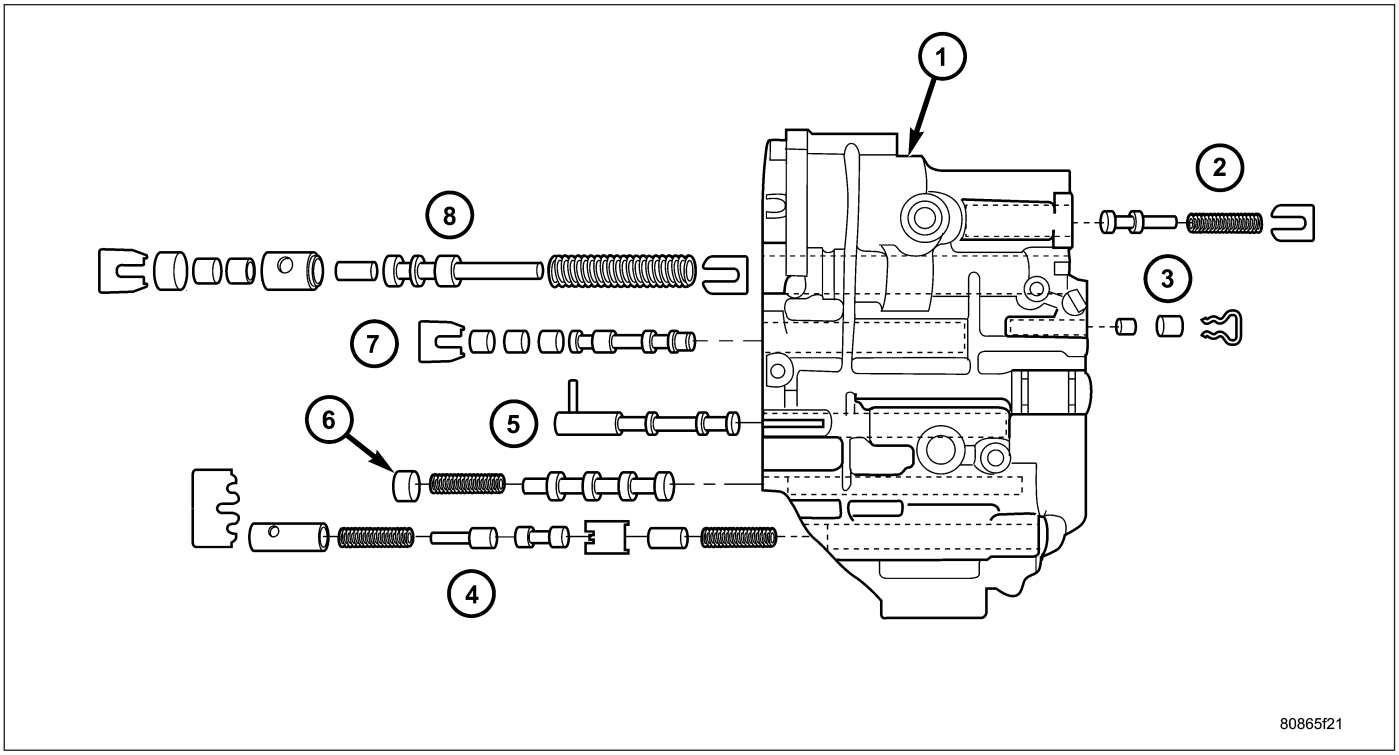




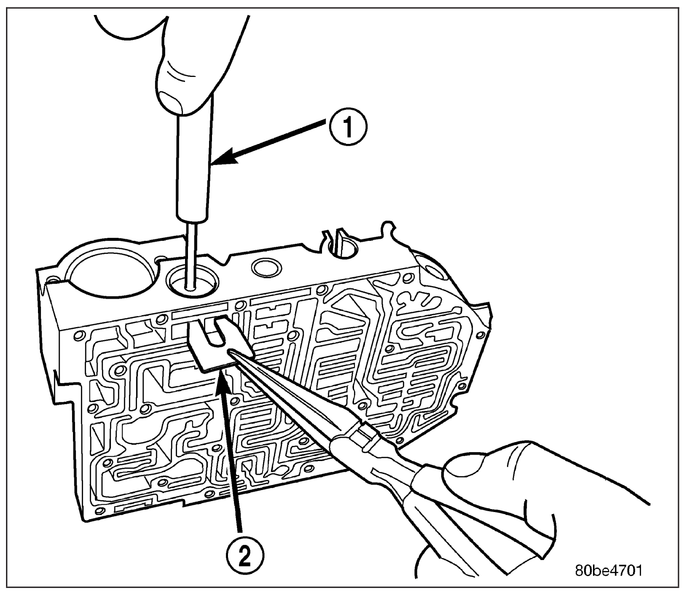

22. Remove all valves and springs.
23. Cleanliness through entire disassembly and assembly of the valve body cannot be overemphasized. When disassembling, each part should be washed in a suitable solvent, then dried by compressed air. **Do not wipe parts with shop towels.** All mating surfaces in the valve body are accurately machined; therefore, careful handling of all parts must be exercised to avoid nicks or burrs.

## ASSEMBLY

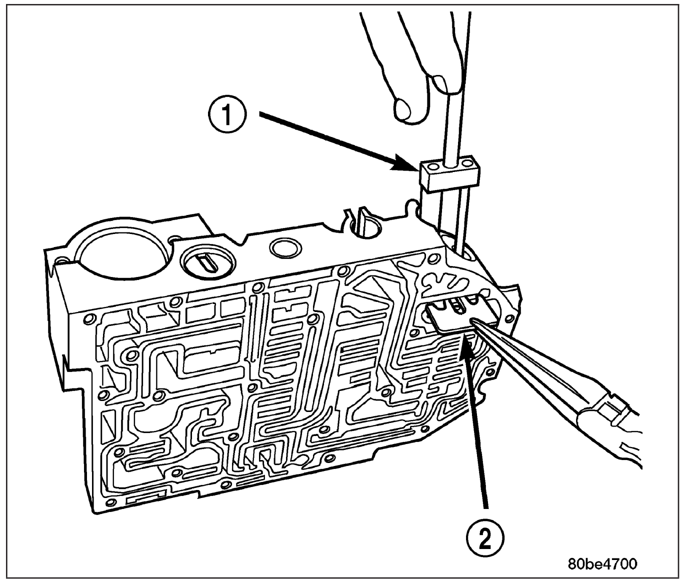
**NOTE: If the valve body assembly is being reconditioned or replaced, it is necessary to perform the Quick Learn Procedure using the scan tool. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)**



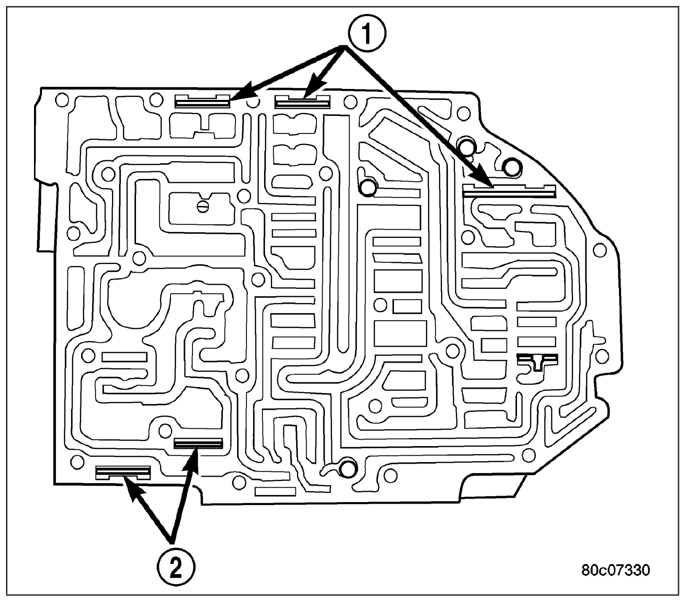

1. Install all valves and springs as shown.
2. Install regulator valve spring retainer (2).



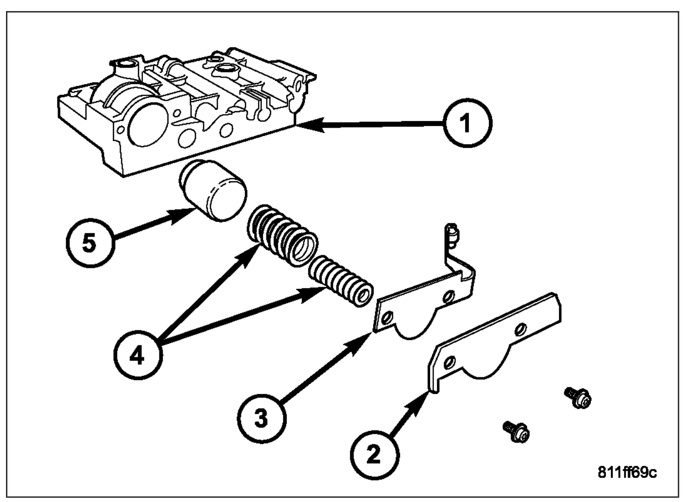
3. Install dual retainer plate (2) using Remover/Installer 6301 (1).

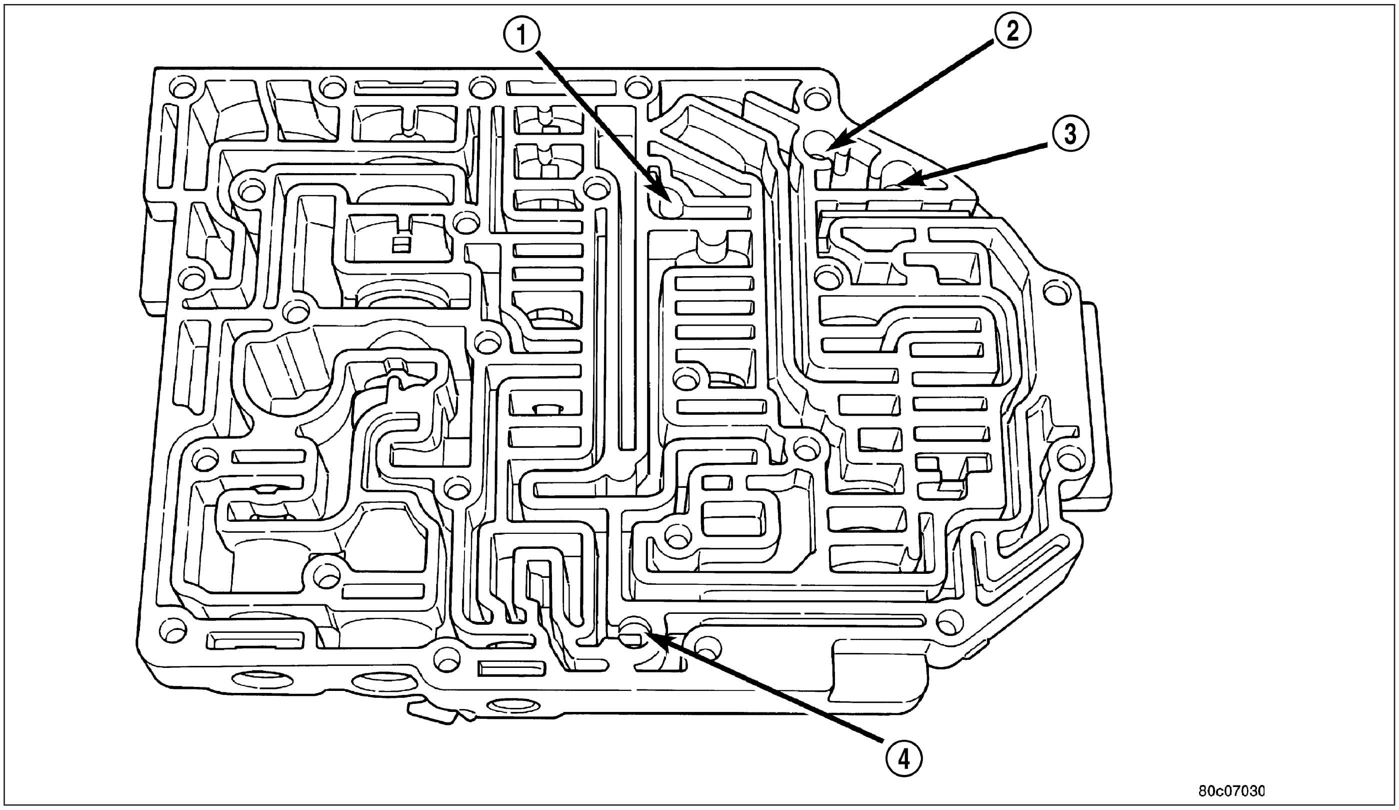



4. Verify that all retainers (1, 2) are installed as shown. Retainers should be flush or below valve body surface.

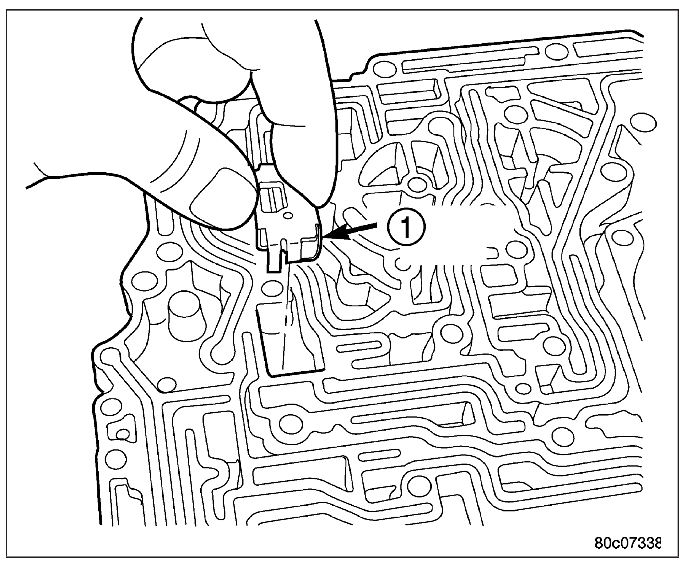



5. Install 2/4 Accumulator components (1-5) as shown. Torque 2/4 Accumulator retainer plate to 5 N·m (45 in. lbs.).

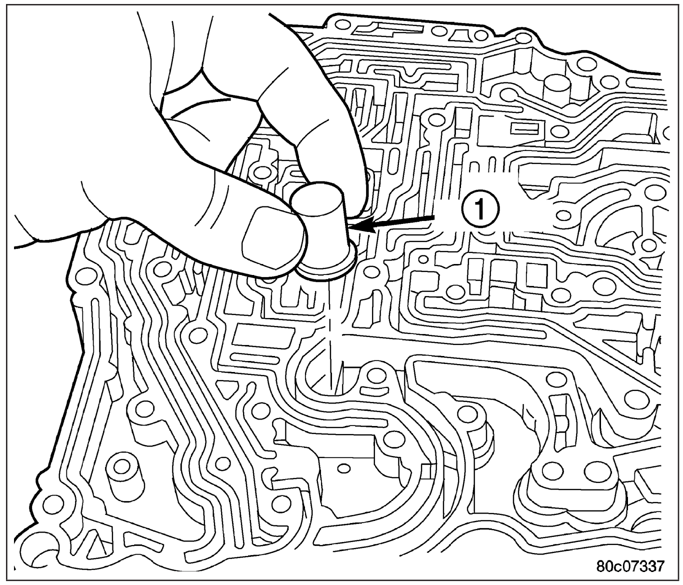




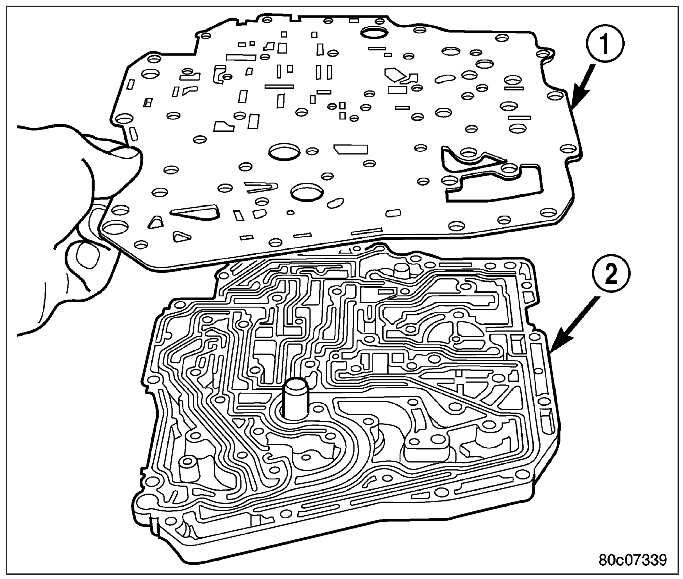

6. Install check balls into position as shown. If necessary, secure them with petrolatum or transmission assembly gel for assembly ease.
7. Install thermal valve (1) to the transfer plate.



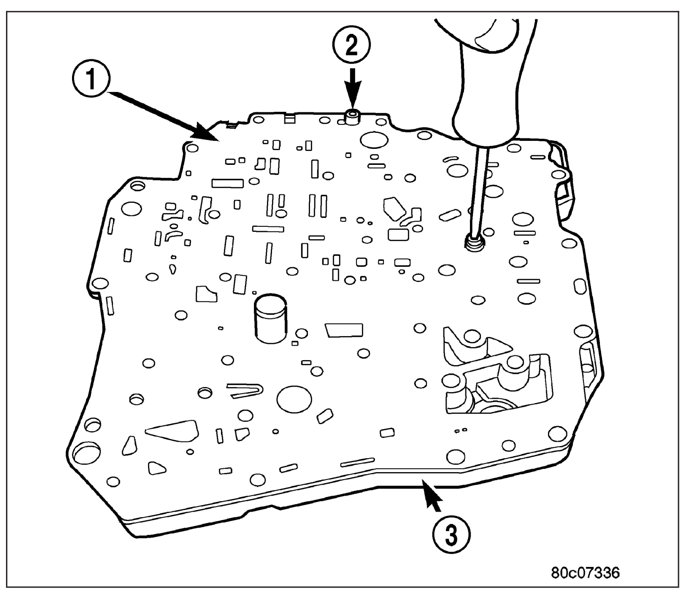
8. Install the oil screen (1) to the transfer plate.



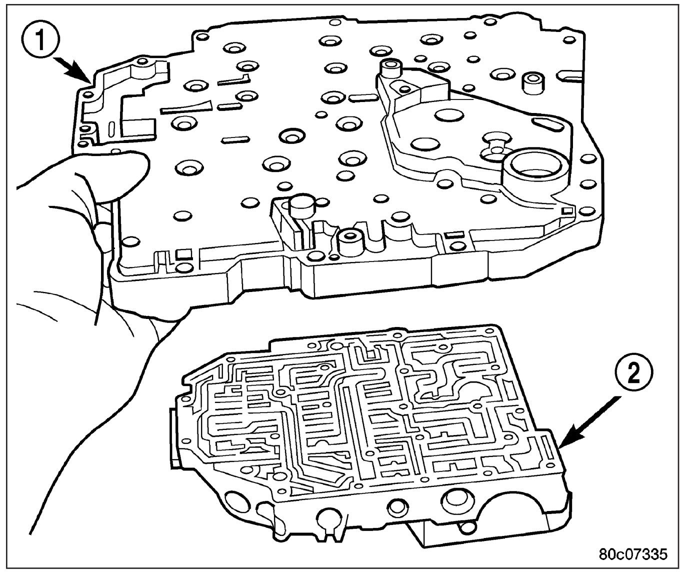

9. Install separator plate (1) to transfer plate (2).



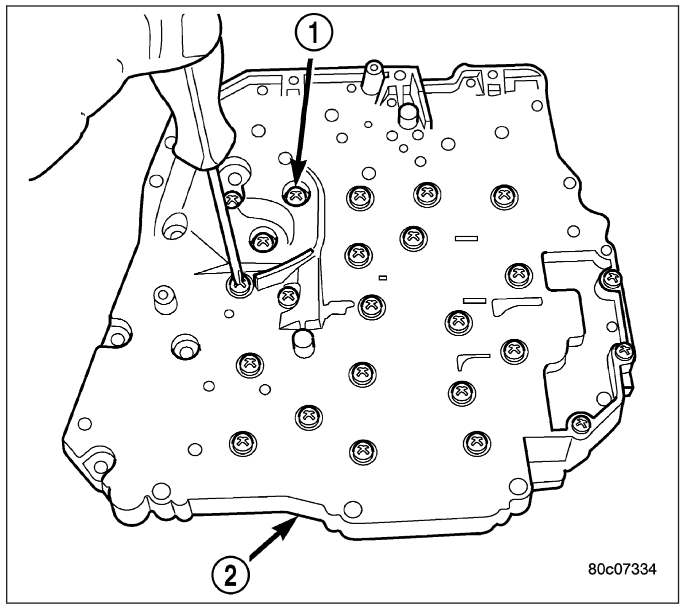

10. Install the two separator plate-to-transfer plate screws (2).



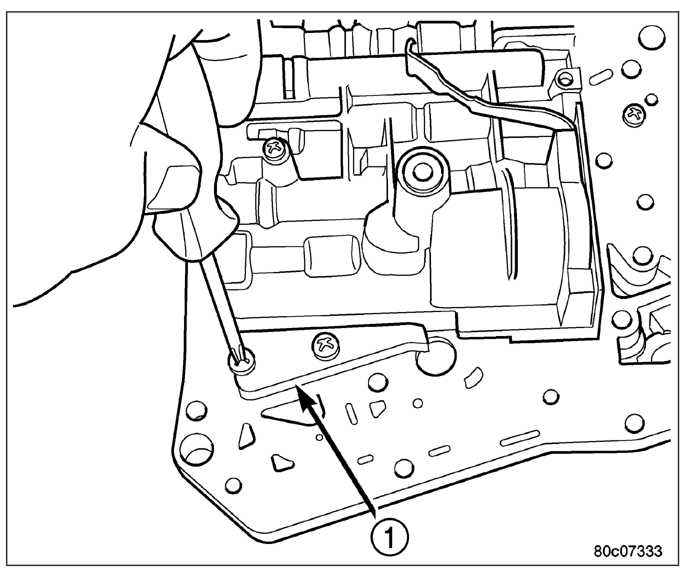
11. Install the transfer plate (1) to the valve body (2).



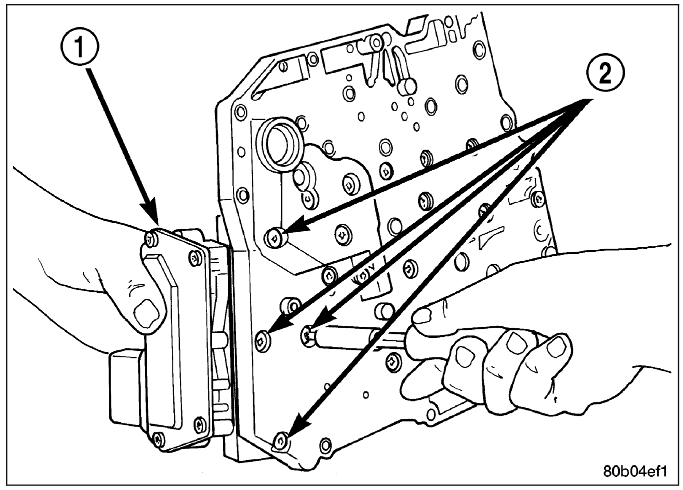

12. Install the transfer plate-to-valve body screws (1) and torque to 5 N·m (45 in. lbs.).



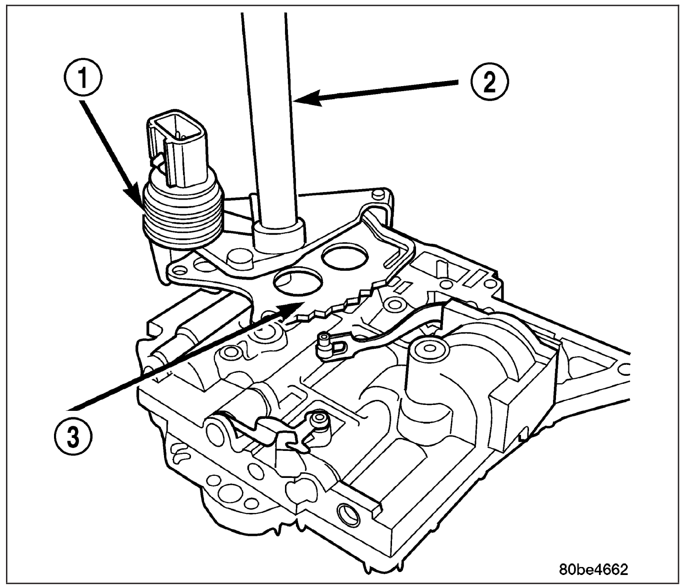

13. Install the stiffener plate (1).



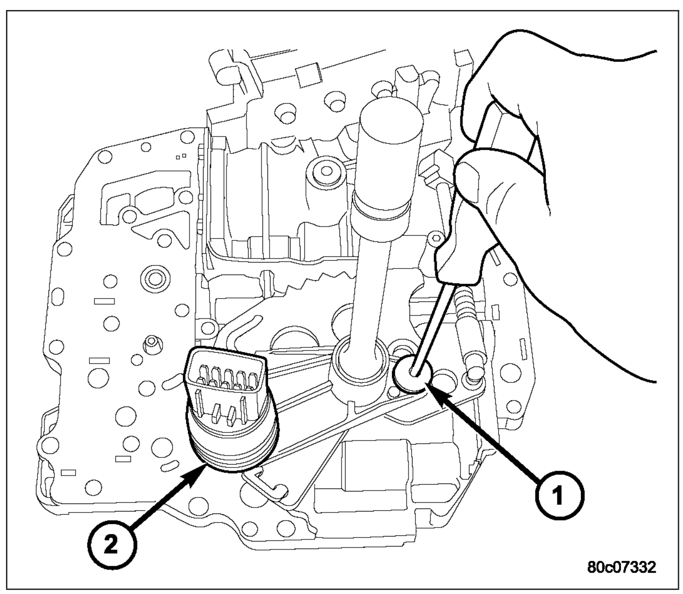
14. Install the solenoid/pressure switch assembly (1) and screws to the transfer plate and torque to 5.5 N·m (50 in. lbs.).



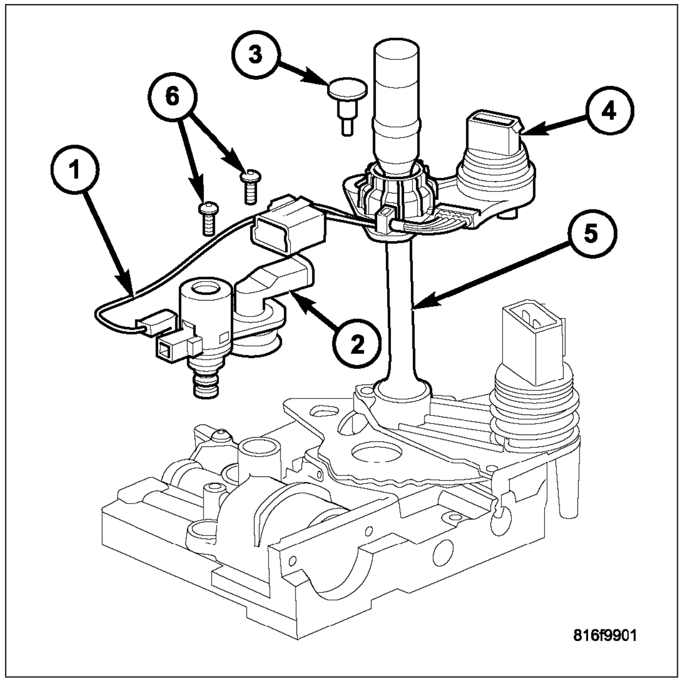

15. Install the manual shaft/rooster comb (3) and transmission range sensor (1) to the valve body.




16. Install the TRS/manual shaft retaining screw (1) and torque to 5 N·m (45 in. lbs.).
17. Install manual shaft seal.

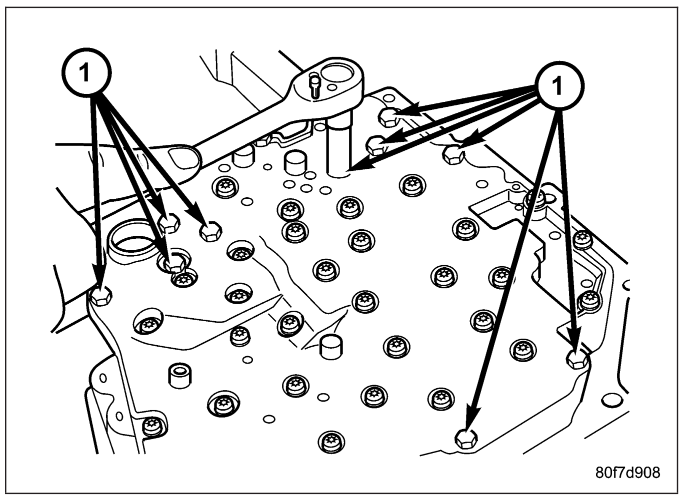


18. Install the variable line pressure header onto the manual shaft (5).
19. Install the shoulder screw (3) to hold the variable line pressure header (4) to the valve body.
20. Install the pressure control solenoid and line pressure sensor into the valve body.
21. Install the screws (6) to hold the pressure control solenoid (1) and line pressure sensor (2) to the valve body.
22. Install the electrical connectors to the pressure control solenoid (1) and the line pressure sensor (2).

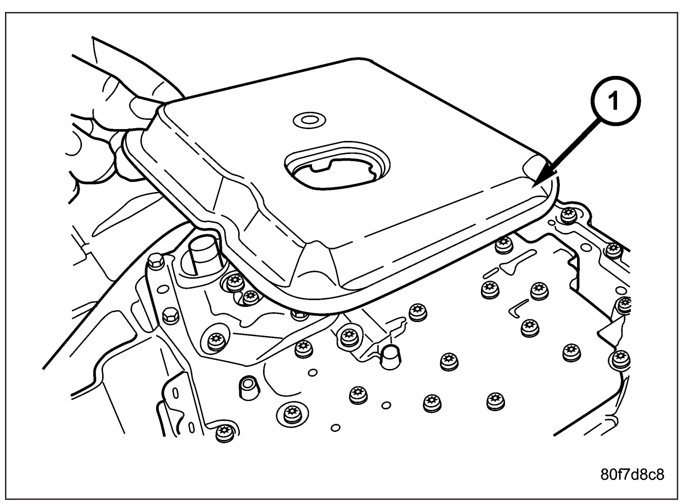



## INSTALLATION

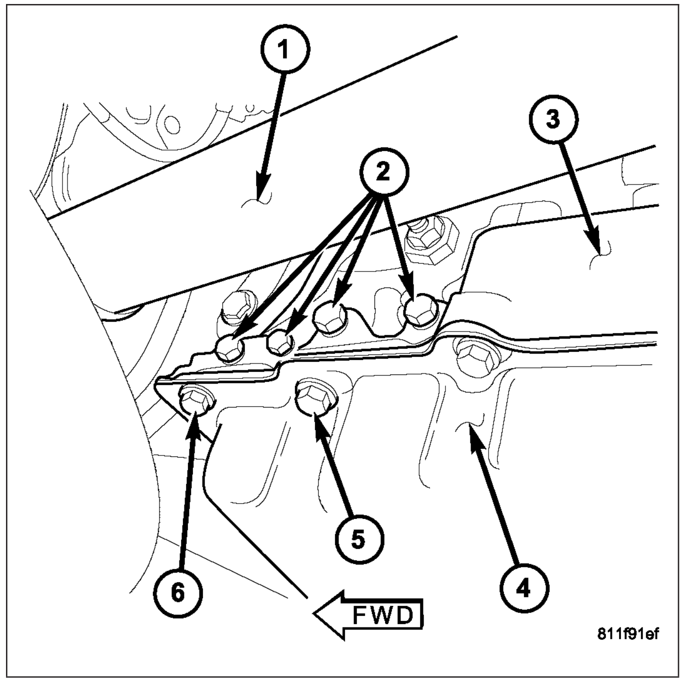
1. Install valve body into position and start bolts (1). Torque valve body to transmission case bolts (1) to 12 N·m (105 in. lbs.) torque.



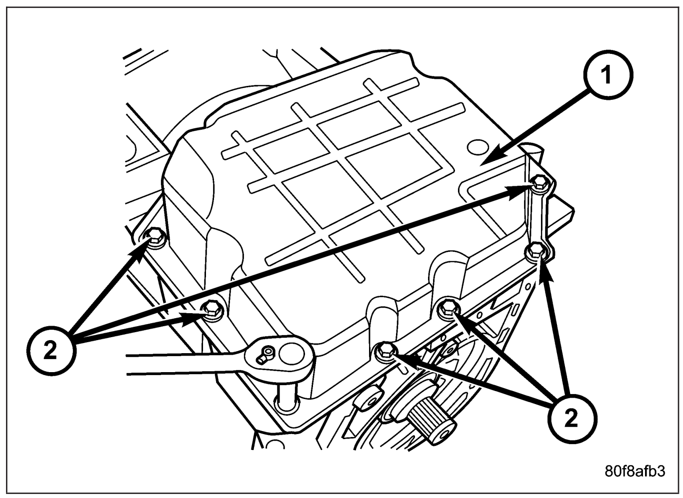

2. Install transmission oil filter (1).



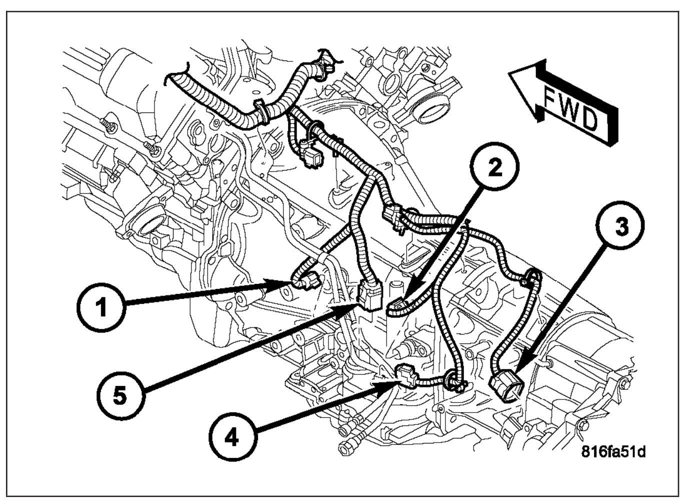
**NOTE: Before installing the oil pan bolt in the bolt hole (5) located between the torque converter clutch on and U/D clutch pressure tap circuits, it will be necessary to replenish the sealing patch on the bolt using MOPAR® Lock & Seal Adhesive.**




3. Make sure oil pan (1) and case rail are clean and dry. Install an 1/8” bead of RTV to the transmission oil pan and install to case. Tighten bolts (2) to 20 N·m (14.5 ft. lbs.).




4. Lower vehicle and connect the transmission range sensor (5) connector.
5. Connect solenoid/pressure switch assembly connector.
6. Connect the variable line pressure connector (4), if equipped.
7. Lower vehicle.
8. Fill transmission with ATF+4, Automatic Transmission Fluid. Verify proper fluid level. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/FLUID - STANDARD PROCEDURE)




**NOTE: If the valve body has been reconditioned or replaced, it is necessary to perform the Quick Learn Procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)**

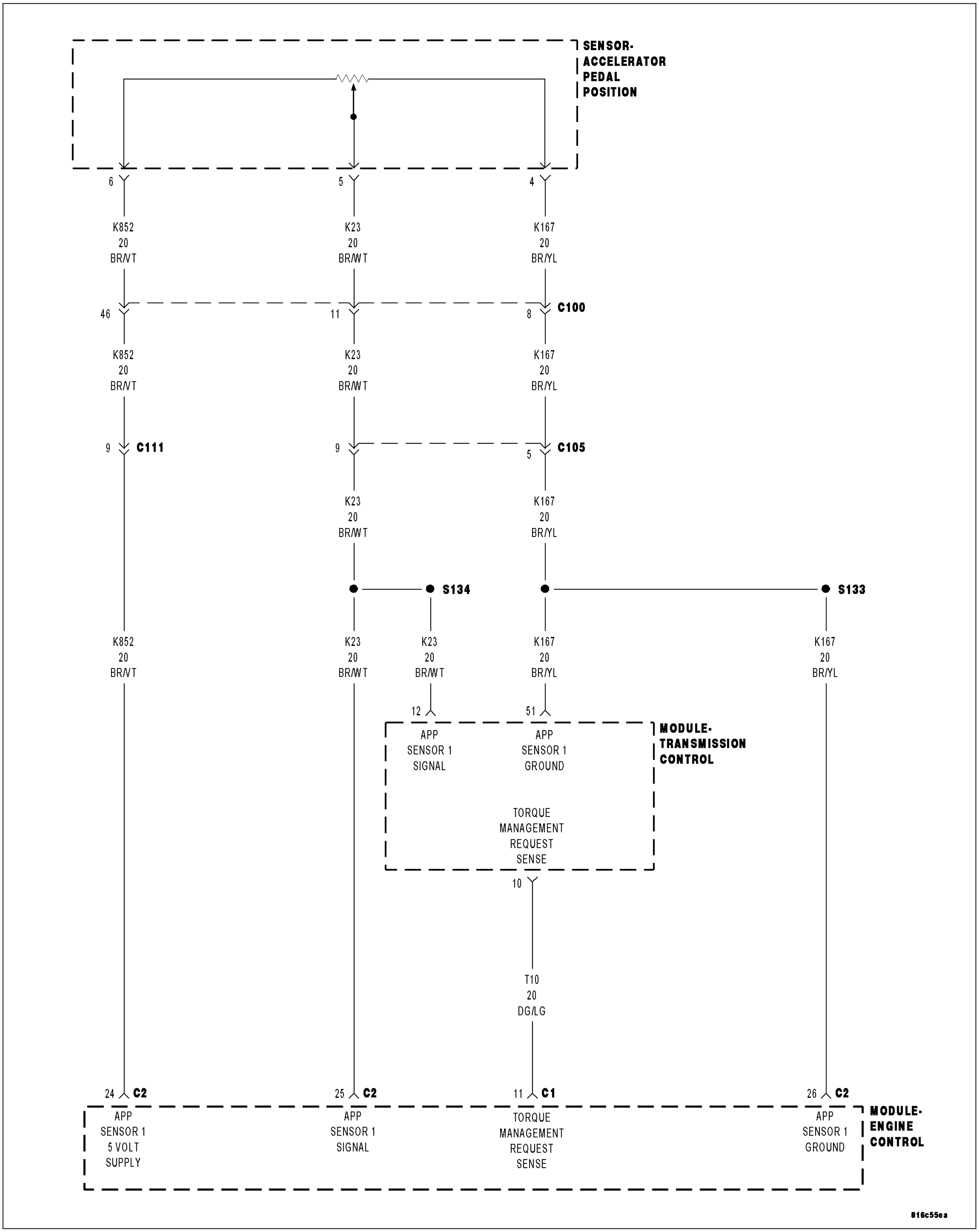
# AUTOMATIC TRANSMISSION 545RFE - ELECTRICAL DIAGNOSTICS - (DIESEL)

## TABLE OF CONTENTS

# AUTOMATIC TRANSMISSION 545RFE - ELECTRICAL DIAGNOSTICS - (DIESEL)

## DIAGNOSIS AND TESTING

## P0122-TPS/APP CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored APPS voltage drops below 0.078 volts for the period of 0.48 seconds.

| Possible Causes |
|---|
| (K23) APP SENSOR 1 SIGNAL CIRCUIT OPEN |
| (K23) APP SENSOR 1 SIGNAL CIRCUIT SHORT TO GROUND |
| ACCELERATOR PEDAL POSITION SENSOR |
| TRANSMISSION CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Accelerator Pedal Position Sensor (APPS) is a linear potentiometer. It provides the ECM and the TCM with a voltage signal proportional to the angle, or position of the accelerator pedal. The APPS signal along with inputs from other sensors is used by the ECM and the TCM to calculate the throttle position.

## Diagnostic Test

### 1. CHECK IF RELATED ENGINE TPS/APPS DTC'S ARE PRESENT

With the scan tool, check Engine DTC's.

**Are there any Engine TPS/APPS DTCs present?**

**Yes** >> Refer to the Drivability Category and perform the appropriate Symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK TO SEE IF THE DTC IS CURRENT

With the scan tool in Transmission Sensors, read the TPS/APPS voltage.

**Is the TPS/APPS voltage below 0.1 volts?**

**Yes** >> Go To 3

**No** >> Go To 6

### 3. ACCELERATOR PEDAL POSITION SENSOR

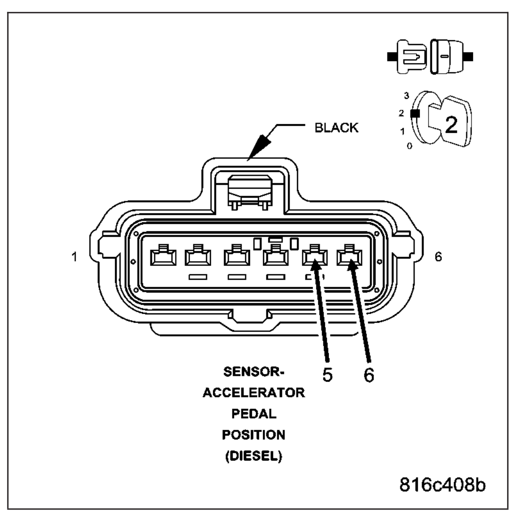
Turn the ignition off to the lock position.

Disconnect the APP Sensor harness connector.

Connect a jumper wire between the (K852) 5-volt Supply circuit and the (K23) APP Sensor 1 Signal circuit.

Ignition on, engine not running.

With the scan tool in Transmission Sensors, read the TPS/APPS voltage.




**Is the TPS/APPS voltage above 4.5 volts?**

**Yes** >> Replace the Accelerator Pedal Position Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANS-

AXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

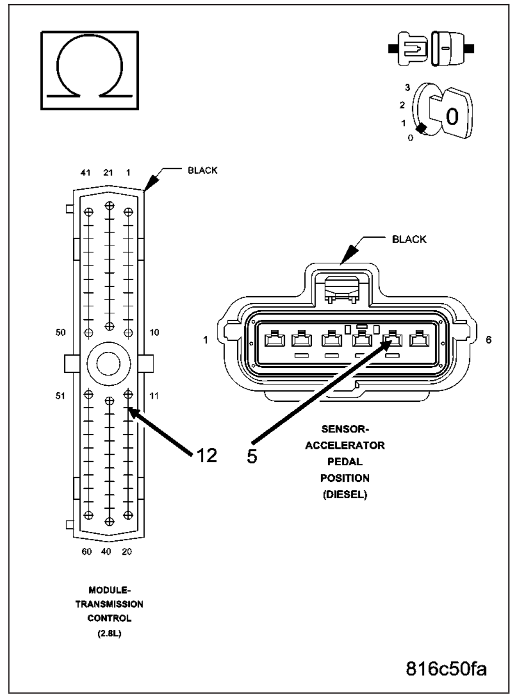
**No** >> Go To 4

## 4. (K23) APP SENSOR 1 SIGNAL CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the TCM harness connector.

Measure the resistance of the (K23) APP Sensor 1 Signal circuit between the TCM harness connector and the APP Sensor harness connector.




**Is the resistance above 5.0 ohms?**

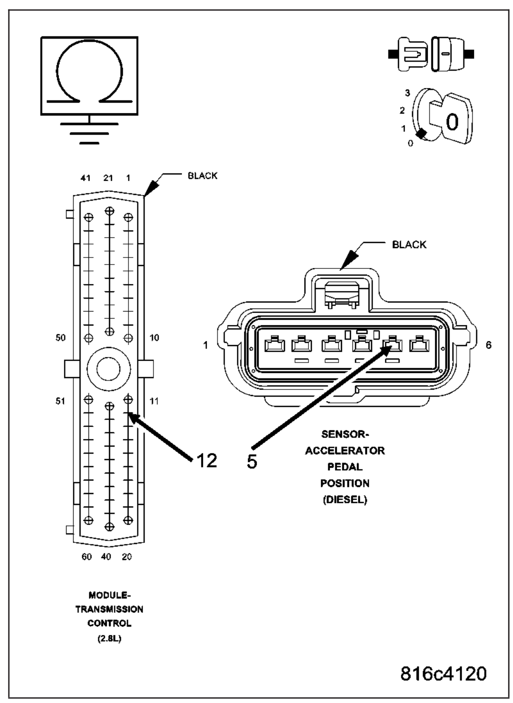
**Yes** >> Repair the (K23) APP Sensor 1 Signal circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (K23) APP SENSOR 1 GROUND CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (K23) APP Sensor 1 Signal circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (K23) APP Sensor 1 Signal circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Engine Control Module (ECM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the ECM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

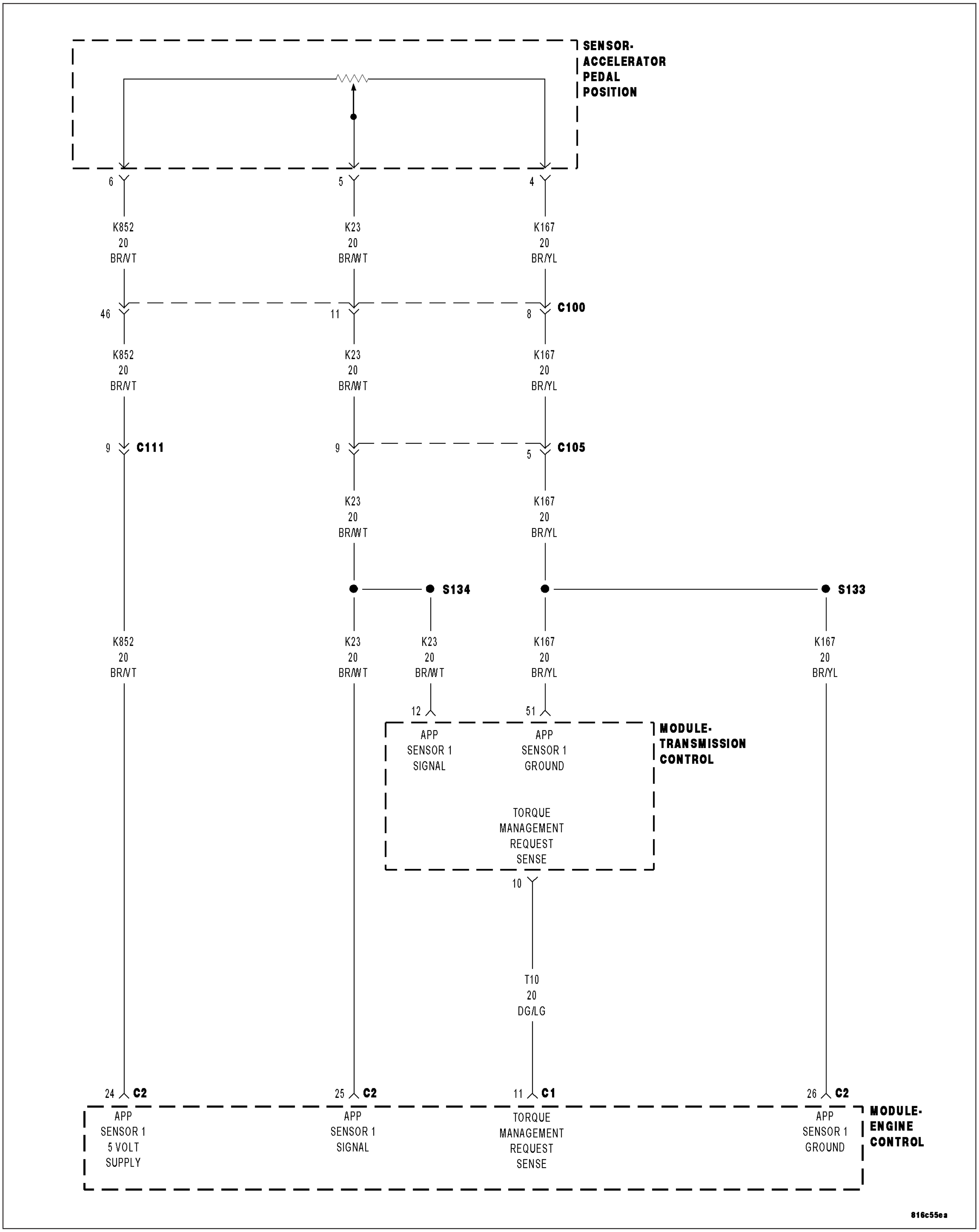
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0123-TPS/APP CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored TPS voltage rises above 4.94 volts for the period of 0.48 seconds.

| Possible Causes |
| --- |
| RELATED ENGINE TPS/APPS DTC'S PRESENT |
| (K23) APP SENSOR 1 SIGNAL CIRCUIT SHORT VOLTAGE |
| (K167) APP SENSOR 1 GROUND CIRCUIT OPEN |
| ACCELERATOR PEDAL POSITION SENSOR |
| TRANSMISSION CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Accelerator Pedal Position Sensor (APPS) is a linear potentiometer. It provides the ECM and the TCM with a voltage signal proportional to the angle, or position of the accelerator pedal. The APPS signal along with inputs from other sensors is used by the ECM and the TCM to calculate the throttle position.

## Diagnostic Test

### 1. CHECK IF RELATED ENGINE TPS/APPS DTC'S ARE PRESENT

With the scan tool, check Engine DTC's.

**Are there any Engine TPS/APPS DTCs present?**

**Yes** >> Refer to the Drivability Category and perform the appropriate Symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK TO SEE IF THE DTC IS CURRENT

With the scan tool in Transmission Sensors, read the TPS/APPS voltage.

**Is the TPS/APPS voltage above 4.94 volts?**

**Yes** >> Go To 3

**No** >> Go To 5

### 3. ACCELERATOR PEDAL POSITION SENSOR

Turn the ignition off to the lock position.

Disconnect the APP Sensor harness connector.

Ignition on, engine not running.

With the scan tool in Transmission Sensors, read the TPS/APPS voltage.

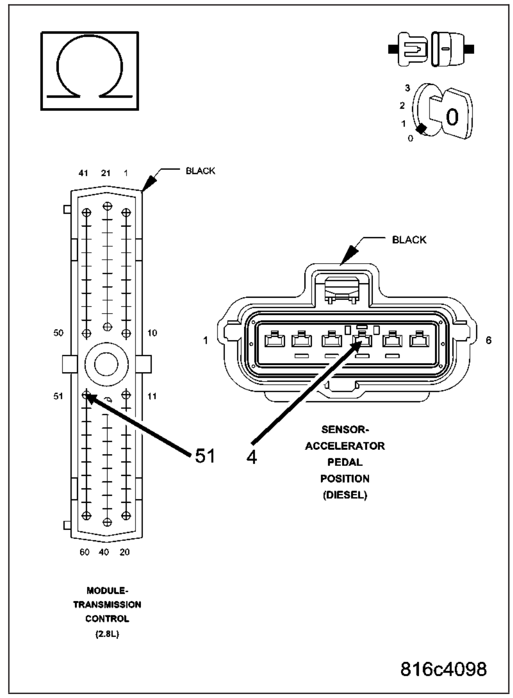
**Is the TPS/APPS voltage below 0.5 volts?**

**Yes** >> Go To 4

**No** >> Repair the (K23) APP Sensor 1 Signal circuit for a short to voltage.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 4. (K167) APP SENSOR 1 GROUND CIRCUIT OPEN

Measure the resistance of the (K167) APP Sensor 1 Ground circuit between the APP Sensor harness connector and the TCM harness connector.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (K167) APP Sensor 1 Ground circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Engine Control Module (ECM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the ECM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 5. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

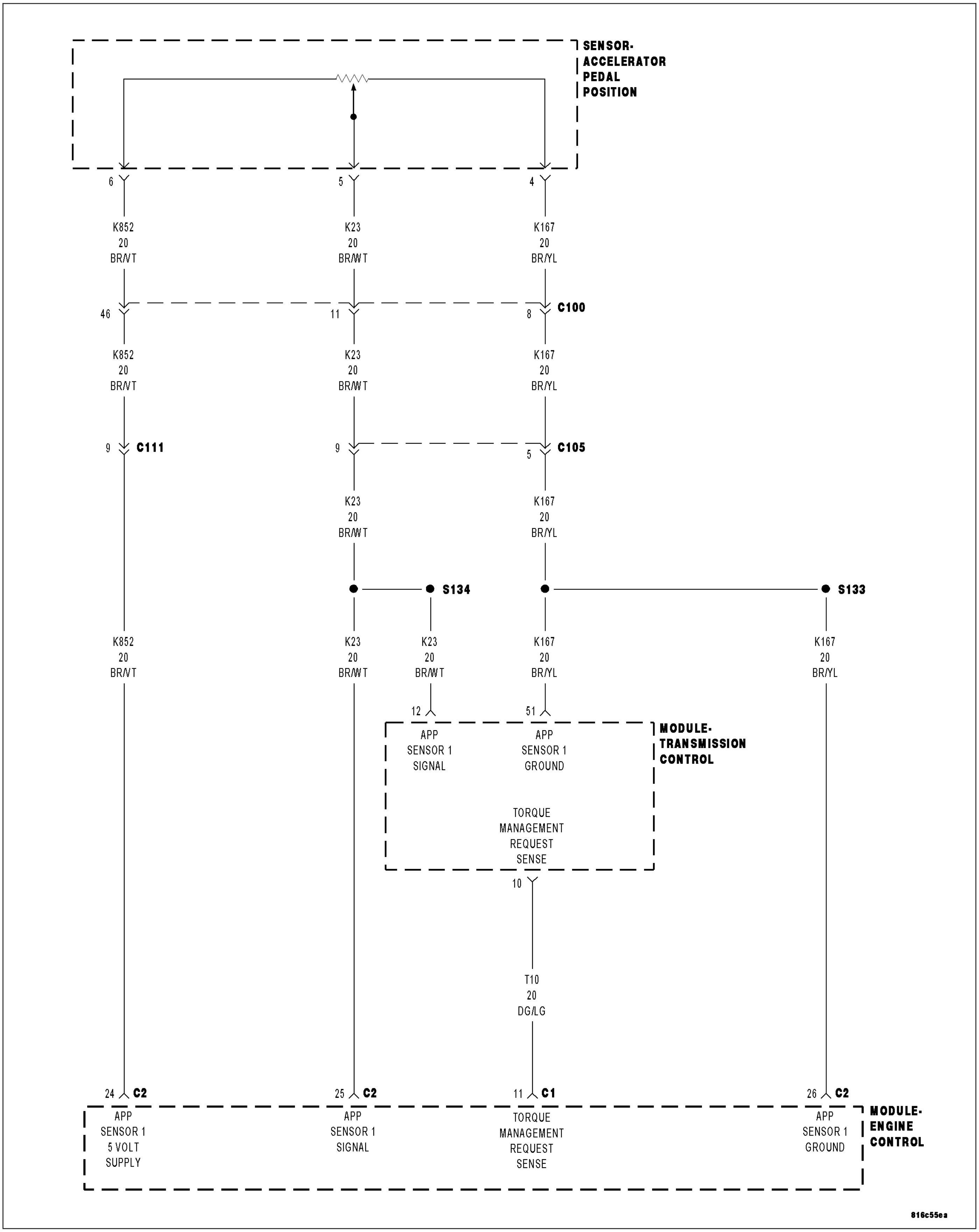
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/SION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0124-TPS/APP INTERMITTENT




For a complete Transmission wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored TPS throttle angle between the angles of 6° and 120° and the degree change is greater than 5° within a period of less than 7.0 msec.

| Possible Causes |
|---|
| RELATED TPS ENGINE DTC'S PRESENT |
| THROTTLE POSITION SENSOR |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Accelerator Pedal Position Sensor (APPS) is a linear potentiometer. It provides the ECM and the TCM with a voltage signal proportional to the angle, or position of the accelerator pedal. The APPS signal along with inputs from other sensors is used by the ECM and the TCM to calculate the throttle position.

## Diagnostic Test

### 1. DETERMINING IF RELATED ENGINE TPS DTC'S ARE PRESENT

With the scan tool, check Engine DTC's including all one trip failures.

**Are there any Engine TPS/APPS DTCs present?**

**Yes** >> Refer to the Powertrain category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, record the DTC EVENT DATA to help identify the conditions in which the DTC was set.

With the scan tool, erase Transmission DTCs.

**NOTE: To erase EVENT DATA information, a BATTERY DISCONNECT must be performed. Performing a BATTERY DISCONNECT may reset all learned transmission values to controller default. This may lead to erratic shift schedules.**

Drive the vehicle and try to duplicate the conditions in which the DTC was reported by the DTC EVENT DATA.

With the scan tool, read Transmission DTCs.

**Did the DTC P0124 TPS/APPS INTERMITTENT, reset?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK THROTTLE POSITION SENSOR OPERATION

Ignition on, engine not running.

With the scan tool, under Transmission Sensors, monitor the TPS/APPS 1 voltage in the following step.

Slowly press and depress the throttle peddle while checking for erratic voltage changes.

**Was the TPS/APPS 1 voltage change smooth and consistent?**

**Yes** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the APP Sensor per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set the DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wiring and connectors while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

# P0218-HIGH TEMPERATURE OPERATION ACTIVATED

For a complete wiring diagram **Refer to Section 8W**.

## Theory of Operation

The DTC is intended as an informational DTC to aid the technician in determining the root cause of a customer dirveability issue. The DTC is also intended to alert the technician to determine if a cooling system malfunction has occurred or if an additional transmission air to oil cooler is needed to support the customers driving behavior.

- **When Monitored:**
  Whenever the engine is running.
- **Set Condition:**
  Immediately after a Overheat shift schedule is activated when the Transmission temperature exceeds 127° C or 260° F.

| Possible Causes |
|---|
| HIGH TEMPERATURE OPERATION ACTIVATED |
| TORQUE CONVERTER CLUTCH SLIPPING / NOT ACTIVATING |
| EXCESSIVE TIME IDLING IN GEAR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Diagnostic Test

### 1. HIGH TEMPERATURE OPERATION

This DTC is an informational DTC designed to aid the Technician in diagnosing shift quality complaints.

This DTC indicates that the transmission has been operating in the ″Overheat″ shift schedule which may generate a customer complaint.

The customer driving patterns may indicate the need for an additional transmission oil cooler.

Verify proper Engine cooling system operation which would affect proper transmission operation.

Verify proper torque converter clutch operation.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

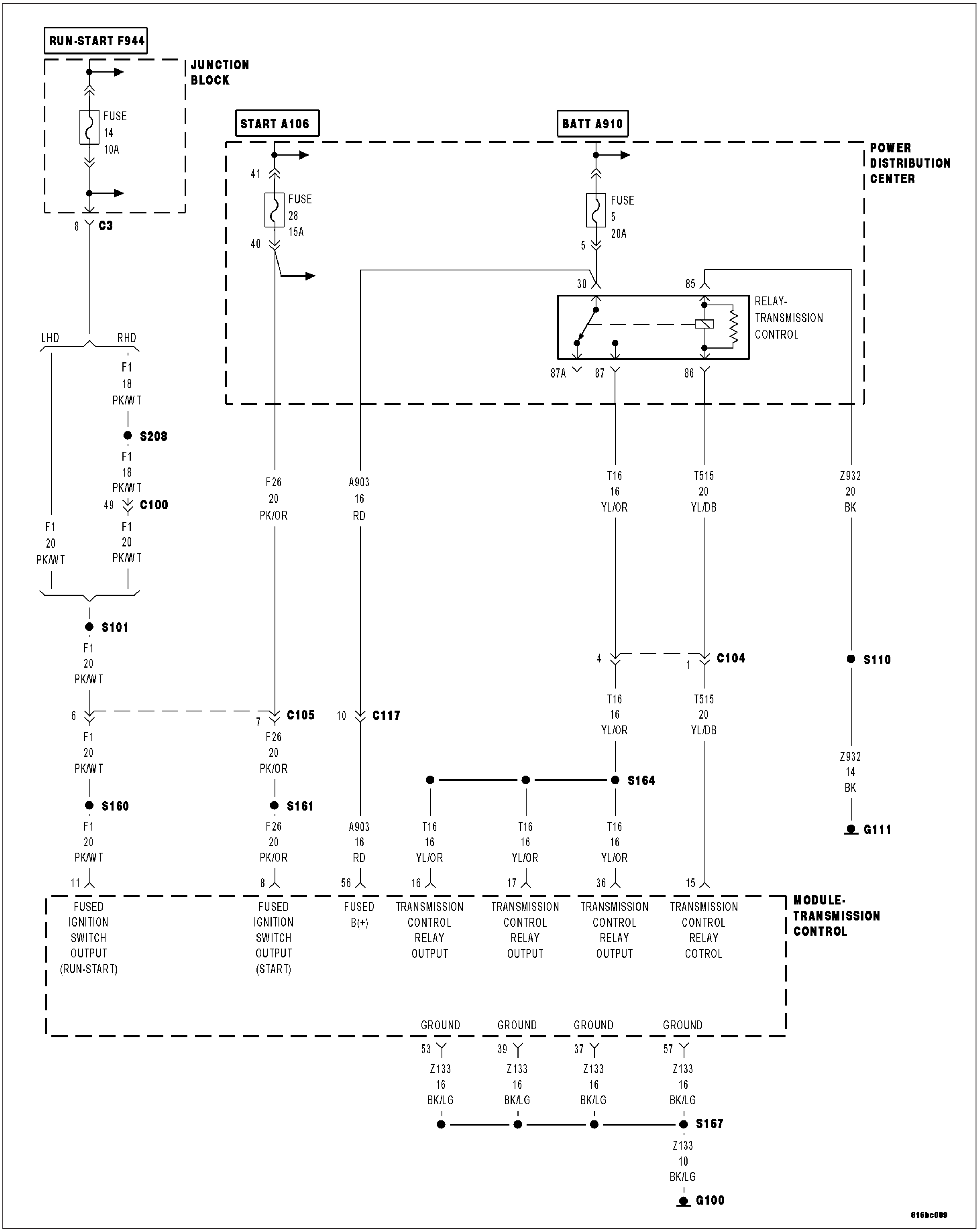
**If there are no possible causes remaining, view repair.**

**Repair**

Repair the cause of transmission overheating. Refer to the Service Information for the proper repair procedure. Make sure to check for any Service Bulletins pertaining to this problem.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P0562-BATTERY VOLTAGE LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running and the TCM has closed the Transmission Control Relay.
- **Set Condition:**
  If the battery voltage of the Transmission Control Relay Output Sense circuit(s) to the TCM is less than 10.0 volts for the period of 15 seconds. Note: P0562 generally indicates a gradually falling battery voltage or a resistive connection(s) to the TCM. The DTC will also set if the battery voltage sensed at the TCM is less than 6.5-volts for 200ms or where Transmission Control Relay Output circuits are less than 7.2-volts for 200ms.

| Possible Causes |
|---|
| RELATED CHARGING SYSTEM DTC'S |
| (Z133) GROUND CIRCUIT OPEN OR HIGH RESISTANCE |
| (A903) FUSED B(+) CIRCUIT TO TCM OPEN OR HIGH RESISTANCE |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE |
| TRANSMISSION CONTROL RELAY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

Friction element distress could result from an insufficient supply voltage to properly control the solenoids. To prevent this possibility, the battery voltage is monitored and the system is placed in logical limp-in if the battery voltage drops below the limit.

## Diagnostic Test

### 1. RELATED CHARGING SYSTEM DTC'S

With the scan tool, read the Engine DTC's.

**Are there any related Charging System DTCs also present?**

**Yes** >> Refer to the Charging System category and repair any Engine Charging System DTCs, before testing DTC P0562. NOTE: After repairing the Engine Charging System DTCs, perform the Transmission Verification test to verify the transmission was not damaged.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CONDITION P0562 PRESENT

**NOTE: Generator, battery, and charging system must be fully functional before performing this test.**
With the scan tool, read Transmission DTC's.

With the scan tool, Check the STARTS SINCE SET counter for P0562.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter set at 0?**

**Yes** >> Go To 3

**No** >> Go To 7

## 3. CHECK THE (Z133) GROUND CIRCUITS

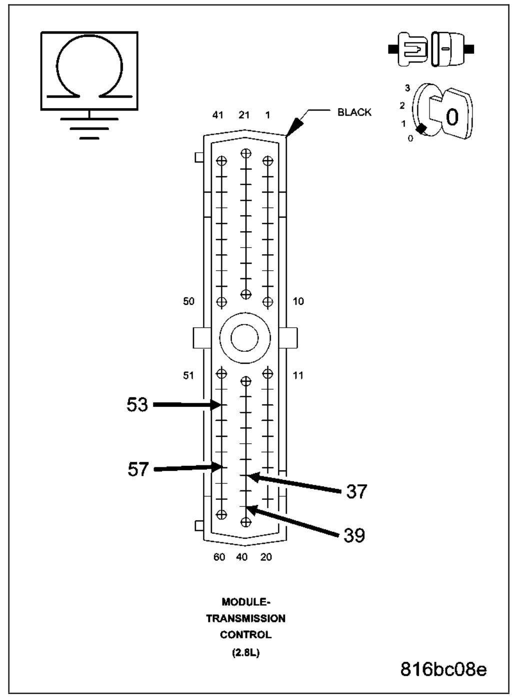
Turn the ignition off to the lock position.

Disconnect the TCM harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

Using a 12-volt test light connected to 12-volts, check the (Z133) Ground circuits.

**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**




**Does the test light illuminate brightly for all the (Z133) Ground circuits?**

**Yes** >> Go To 4

**No** >> Repair the (Z133) Ground circuit(s) for an open or high resistance.

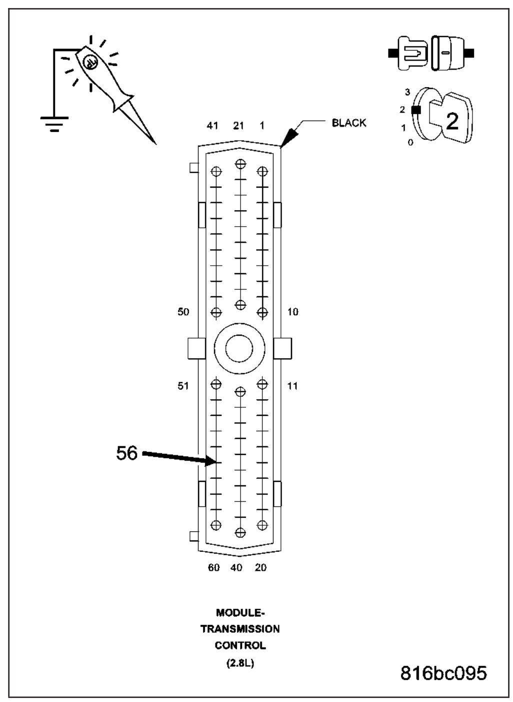
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 4. CHECK THE (A903) FUSED B(+) CIRCUIT

Remove the Transmission Control Relay.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, check the (A104) Fused B(+) circuit at the Transmission Control Relay connector.



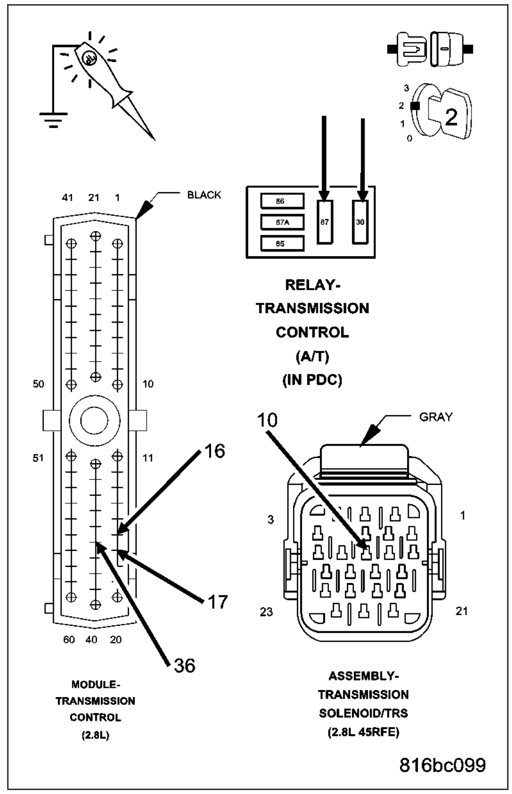

**Does the test light illuminate brightly?**

**Yes** >> Go To 5

**No** >> Repair the (A104) Fused B(+) circuit for an open or high resistance.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 5. CHECK THE (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT




Turn the ignition off to the lock position.

**NOTE: Check connectors - Clean/repair as necessary.**

Connect a jumper wire between (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, check all (T16) Transmission Control Relay Output circuits at the TCM harness connector.

**Does the test light illuminate brightly?**

**Yes** >> Go To 6

**No** >> Repair the (T16) Transmission Control Relay Output circuit for an open or high resistance.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. CHECK THE TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.

Reconnect all previously disconnected connectors.

Install a substitute Relay in place of the Transmission Control Relay.

Start the engine.

Using a voltmeter, measure the vehicles battery voltage.

With the scan tool, monitor the Transmission Switched Battery Voltage.

Compare the scan tool Transmission Switched Battery voltage to the actual battery voltage reading on the voltmeter.

**Is the scan tool voltage within 1.0 volt of the battery voltage?**

**Yes** >> Replace the Transmission Control Relay.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 7. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Where there any problems found?**

**Yes** >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

# P0602-CONTROL MODULE PROGRAMMING ERROR/NOT PROGRAMMED

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Check for generic software is made at power-up
- **Set Condition:**
  If generic software is found, the MIL will light immediately. This DTC is designed to inform the technician that the controller still has generic software installed.

| Possible Causes |
|---|
| TCM - PROGRAMMING ERROR |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The controller is programmed during manufacturing with generic software to facilitate testing. However, generic software does not have the proper calibrations to control a transmission in a vehicle. The check for generic software is made at power-up. If generic software is found , the MIL will light immediately and the MIL will stay on even if the fault is cleared, until the proper software is installed. Note: Transmission will be placed in limp-in mode.

## Diagnostic Test

### 1. CONTROL MODULE PROGRAMMING ERROR

**NOTE: Controller is programmed with generic software and will not allow the correct vehicle Powertrain management.**

With the scan tool.

Record the vehicles controller part number.

Select Use Controller Part Number under the Flash Tab.

Flash the controller with the correct software.

**Verify the controller flashed successfully.**

**Test Complete**

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P0604-INTERNAL CONTROL MODULE RAM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  One time after the controller is reset (ignition turned to the RUN position).
- **Set Condition:**
  Whenever the Transmission Control Module (TCM) detects an internal controller problem.

| Possible Causes |
|---|
| POWER OR GROUND CIRCUIT |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

### Theory of Operation

After the controller is reset (ignition turned to the RUN position), the microprocessor checks the integrity of each RAM location by writing to it and reading back from it. The read value should be same as value written.

### Diagnostic Test

#### 1. CHECK WIRING AND CONNECTORS FOR INTERMITTENT OPERATION

Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

Wiggle the wires while checking for shorted and open circuits.

Check for any Service Bulletins that may apply.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

# P0605-INTERNAL CONTROL MODULE ROM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  One time after the controller is reset (ignition turned to the RUN position).
- **Set Condition:**
  Whenever the Transmission Control Module (TCM) detects an internal controller problem.

| Possible Causes |
|---|
| POWER OR GROUND CIRCUITS |
| POWERTRAIN CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

After the controller is reset (ignition turned to the RUN position) the microprocessor checks the integrity of the program memory (ROM). A checksum is calculated by adding all used bytes in the program memory. The sum should be the same as a known constant stored in the program memory.

## Diagnostic Test

### 1. CHECK WIRING AND CONNECTORS FOR INTERMITTENT OPERATION

Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

Wiggle the wires while checking for shorted and open circuits.

Check for any Service Bulletins that may apply.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

# P0613-INTERNAL TCM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  1) One time after the controller is reset (ignition turned to the RUN position) and every 60 seconds thereafter. The Delay Test is executed after a reset only.
  2) 2 seconds after an invalid test.
- **Set Condition:**
  If either of the following conditions occur 3 times:
  1) The watchdog fault line remains high after the period has elapsed for the too early - too late watchdog test.
  2) The Transmission Control Relay remains on after the watchdog delay expired.

| Possible Causes |
|---|
| POWER OR GROUND CIRCUIT |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The internal Watchdog (WD) is a separate hardware circuit that continuously monitors the microprocessor. To insure the proper operation of the Transmission controller the watchdog must receive a signal from the microprocessor within a specific time window (14 msec ± 1 msec) to prevent a system shutdown after a short delay (570 msec). The microprocessor periodically tests the WD's ability to provide this shutdown function using a three phase test;

1) Send the signal too late > 15 msec

2) Send the signal too early < 13 msec

3) Delay test < 590 msec

If the watchdog input signal arrives too early or too late, the Watchdog Fault line will go low and the watchdog delay will start to time out. The delay will be reset by the correct timing of watchdog signal sent during subsequent operations.

The Delay Test checks the delay time out. The Delay Monitor line is pulled low, which forces the delay to start timing out. At the end of the delay time the Transmission Relay will be turned off. The delay test, upon detection of the relay turning off, will immediately turn the relay back on before shutdown can occur.

## Diagnostic Test

### 1. CHECK THE WIRING AND CONNECTORS

Using the schematics as a guide, check the Powertrain Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

Wiggle the wires while checking for shorted and open circuits.

Check for any Service Bulletins that may apply.

**Were there any problems found?**

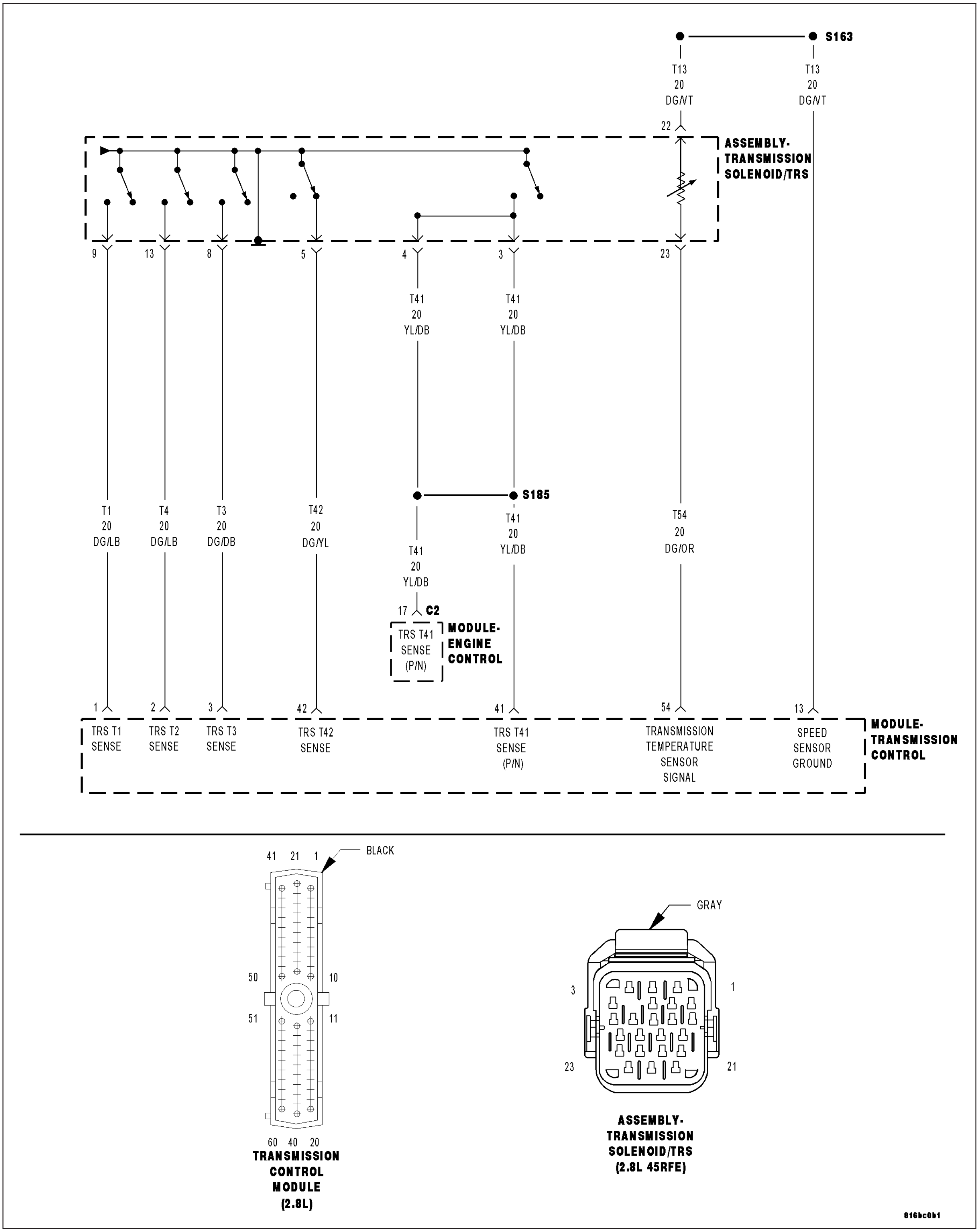
**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P0706-TRANSMISSION RANGE SENSOR RATIONALITY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on.
- **Set Condition:**
  The DTC will set if the controller detects an invalid PRNDL code which lasts for more than 0.042 seconds.

| Possible Causes |
|---|
| SHIFTER OUT OF ADJUSTMENT |
| TRS SENSE CIRCUIT OPEN |
| TRS SENSE CIRCUIT SHORT TO GROUND |
| TRS SENSE CIRCUIT SHORT TO VOLTAGE |
| METAL DEBRIS IN OIL PAN |
| TRANSMISSION RANGE SENSOR |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The T1, T2, T3, T41, or T42 (C1 - C5) Sense circuits communicate the shift lever position to the Transmission Control System. Each circuit is terminated at the transmission by a switch (TRS). Each switch can be either open or closed, depending on the shift lever position. The TCM can decode this information and determine the shift lever position.

Each shift lever position has it own unique combination of closed and open switches. This is called a PRNDL code. There are 5 switches, therefore: there are many possible combinations of open and closed switches (codes). There are 12 valid codes: two for neutral, one for each other gear position (5), and five temporary (transition zone) codes. The remainder of the codes should never occur, these are called invalid codes.

## Diagnostic Test

### 1. CHECK IF P0706 DTC IS CURRENT

With the scan tool, perform the Shift Lever Position Test.

**Select the test outcome from the following:**

**Test passes:**
Go To 6

**Test fails with Error Code:**
Go To 2

**Test fails without Error Code:**
Perform the Gearshift Adjustment Procedure per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

### 2. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the scan tool, perform the Shift Lever Position Test.

When the scan tool instructs you to put the Gear Selector in a particular position, you must do so using the selector switch on the Transmission Simulator.

The LED for the gear position in question must be illuminated on the Transmission Simulator prior to pressing ″ENTER″ on the scan tool.

**NOTE: When the scan tool requests the O/D off button be depressed, you must use the O/D OFF button in the vehicle or you will fail the Shift Lever Position Test with an error code 11 or OD-TOW/HALL STUCK OPEN.**

**NOTE: If the Shift Lever Position test fails, make sure to note the identification of the TRS Sense circuit for future reference.**

**Did the Shift Lever Position test pass?**

**Yes** >> Remove the Oil Pan and Main Valve Body Assembly per the Service Information. Check for metal debris on top of the Solenoid/TRS Assembly and the manual valve code plate. If debris is present, determine the cause of the debris and repair the transmission as necessary. If no problems are found, replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECK THE TRS SENSE CIRCUITS FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance of the identified (T1, T2, T3, T41, or T42) TRS Sense circuit, from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of Miller tool #8815.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the identified (T1, T2, T3, T41, or T42) TRS Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE TRS SENSE CIRCUITS FOR A SHORT TO GROUND

Measure the resistance between ground and the identified (T1, T2, T3, T41, or T42) TRS Sense circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the identified (T1, T2, T3, T41, or T42) TRS Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE TRS SENSE CIRCUITS FOR A SHORT TO ANOTHER CIRCUIT

Measure the resistance between the identified (T1, T2, T3, T41, or T42) TRS Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

**Is the resistance below 100k ohms between the identified (T1, T2, T3, T41, or T42) TRS Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the identified (T1, T2, T3, T41, or T42) TRS Sense circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Using the schematics as a guide, check the Powertrain Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. CHECK WIRING AND CONNECTORS

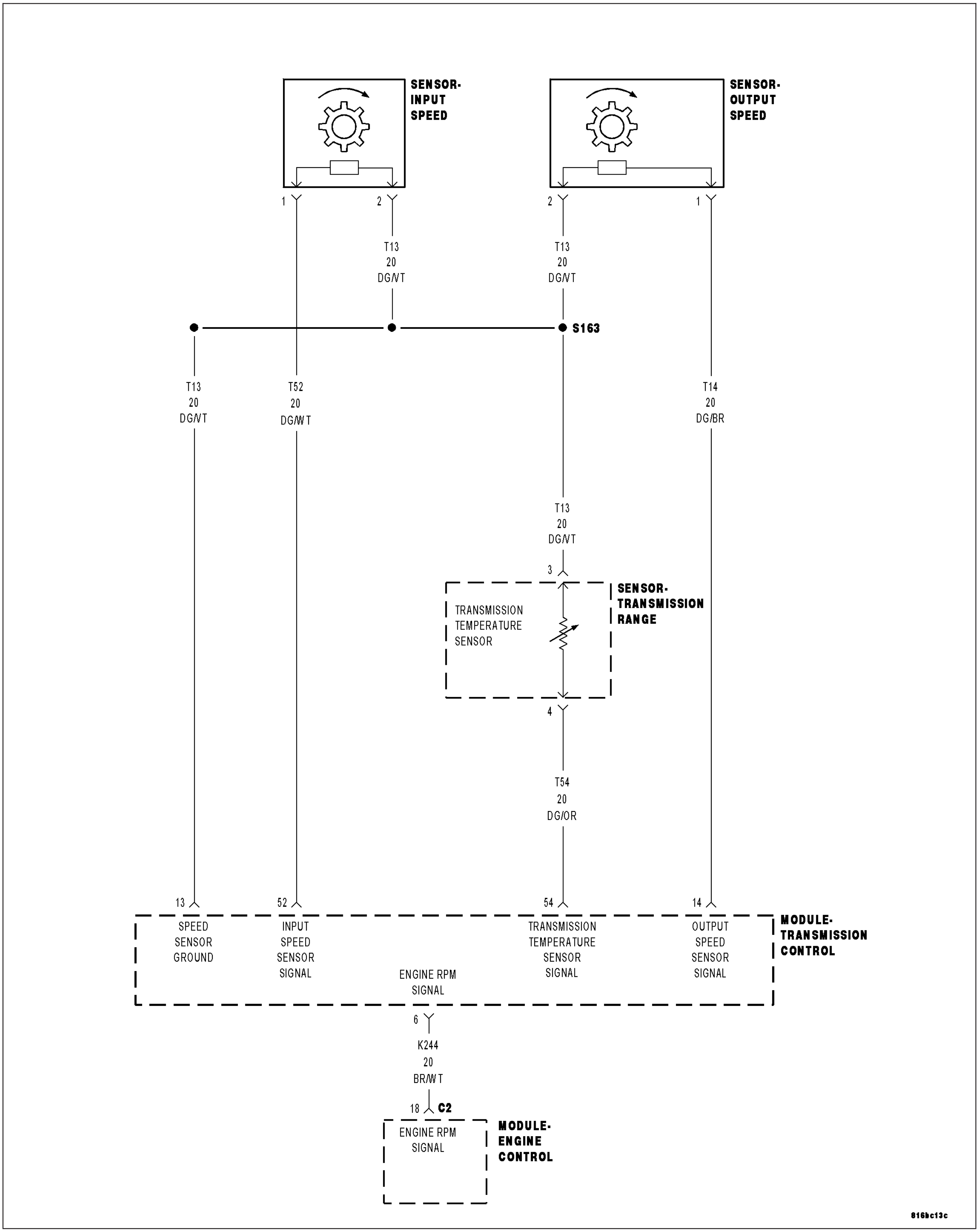
The conditions necessary to set the DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wiring and connectors while checking for shorted and open circuits.
With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set when the desired transmission temperature does not reach a normal operating temperature within a given time frame. Time is variable due to ambient temperature. Approximate times are starting temperature to warm up time: (-40° F / -40° C - 35 min) (-20° F / -28° C - 25 min) (20° F / -6.6° C - 20 min) (60° F / 15.5 ° C - 10 min)

| Possible Causes |
|---|
| RELATED DTC'S PRESENT |
| TRANSMISSION TEMPERATURE SENSOR |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Temperature Sensor is a variable resistor that changes with temperature, or otherwise known as a thermister. The temperature of the transmission fluid can affect a variety of electronically controlled transmission operations such as shift quality, torque converter lock-up, and when and/or if certain OBDII or system self-diagnostic test are performed. The Transmission Control Module (TCM) substitutes a calculated transmission temperature value if a fault is detected in the Transmission Temperature Sensor circuit.

## Diagnostic Test

### 1. DETERMINE IF RELATED DTC'S ARE PRESENT

With the scan tool, check Transmission DTC's.

**Are there any other related Transmission Temperature Sensor DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0711.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 4

### 3. TRANSMISSION TEMPERATURE SENSOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings to the voltage readings listed on the Transmission Simulator.

**Do the readings on the scan tool match the Transmission Simulator readings ± 0.2 volts?**

**Yes** >> Replace Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

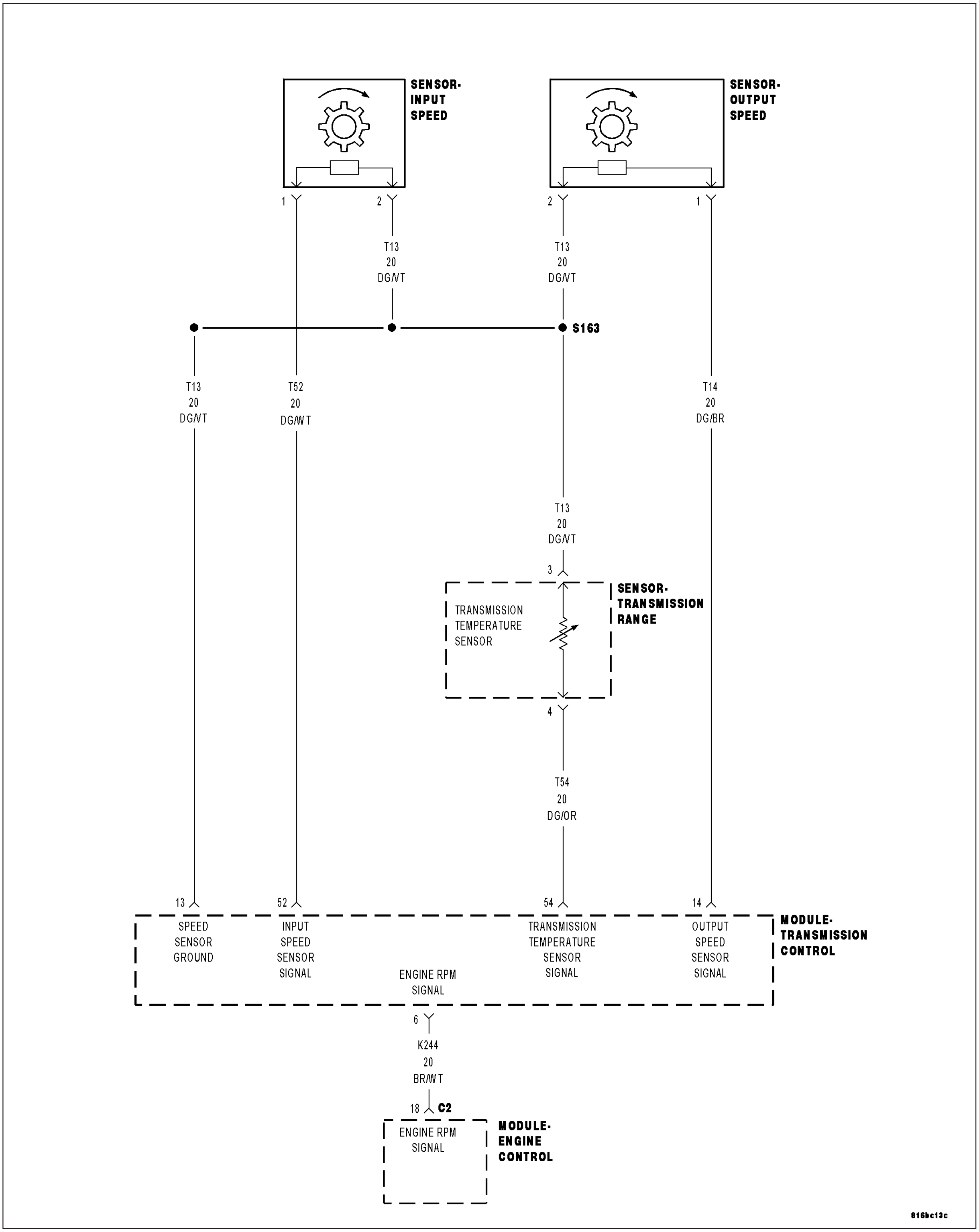
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0712-TRANSMISSION TEMPERATURE SENSOR LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set when the monitored Temperature Sensor voltage drops below 0.078 volts for the period of 0.45 seconds.

| Possible Causes |
| --- |
| RELATED DTC'S PRESENT |
| (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND |
| TRANSMISSION TEMPERATURE SENSOR |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Temperature Sensor is a variable resistor that changes with temperature, or otherwise known as a thermister. The temperature of the transmission fluid can affect a variety of electronically controlled transmission operations such as shift quality, torque converter lock-up, and when and/or if certain OBDII or system self-diagnostic test are performed. The Transmission Control Module (TCM) substitutes a calculated transmission temperature value if a fault is detected in the Transmission Temperature Sensor circuit.

## Diagnostic Test

### 1. CHECK IF RELATED DTCS ARE PRESENT

With the scan tool, check Transmission DTCs.

**Are there any line pressure or throttle position sensor DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0712.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 5

### 3. CHECK THE TRANSMISSION TEMPERATURE SENSOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**
Install the Transmission Simulator, Miller tool #8333.

**NOTE: Check connectors - Clean/repair as necessary.**
Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

**Do the readings on the Transmission Simulator match the scan tool readings ± 0.2 volts?**

**Yes** >> Replace Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

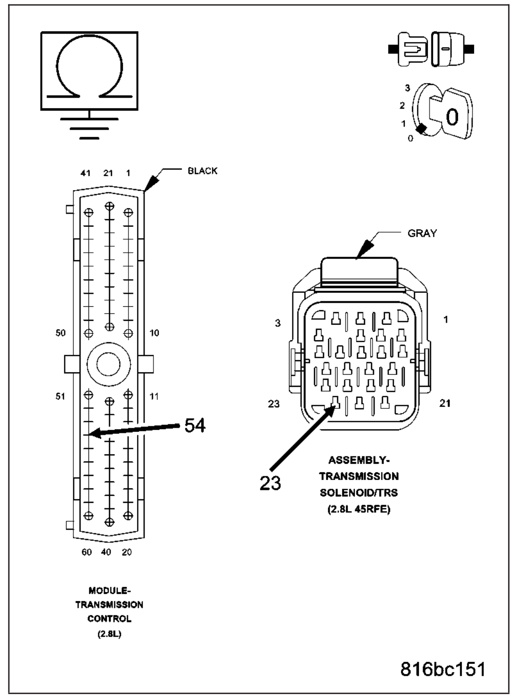
## 4. CHECK THE (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance between ground and the (T54) Transmission Temperature Sensor Signal circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T54) Transmission Temperature Sensor Signal circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 5. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

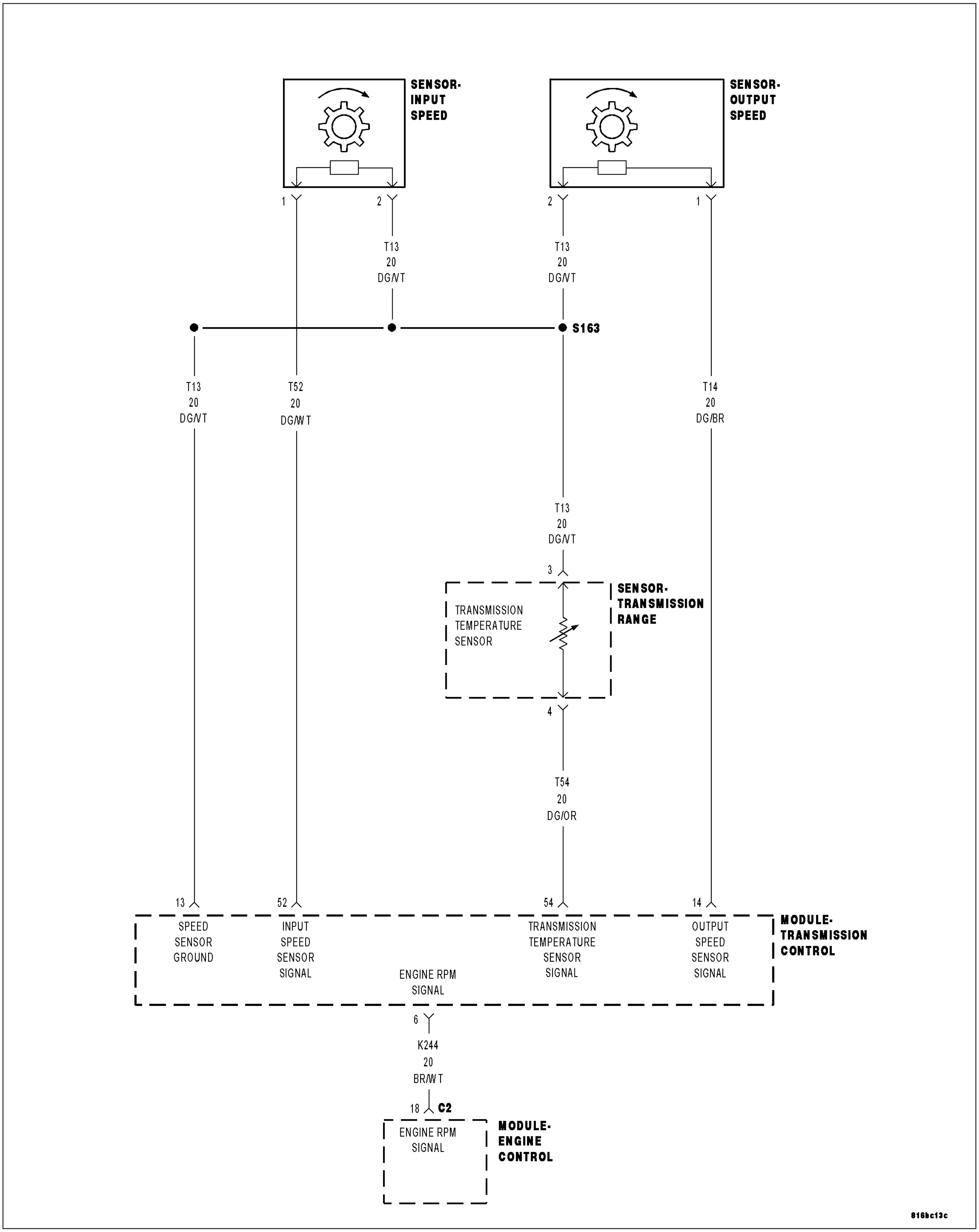
With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0713-TRANSMISSION TEMPERATURE SENSOR HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set when the monitored Temperature Sensor voltage rises above 4.94 volts for the period of 0.45 seconds.

| Possible Causes |
| --- |
| RELATED DTC'S PRESENT |
| (T54) TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO OTHER CIRCUITS |
| TRANSMISSION TEMPERATURE SENSOR |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Temperature Sensor is a variable resistor that changes with temperature, or otherwise known as a thermister. The temperature of the transmission fluid can affect a variety of electronically controlled transmission operations such as shift quality, torque converter lock-up, and when and/or if certain OBDII or system self-diagnostic test are performed. The Transmission Control Module (TCM) substitutes a calculated transmission temperature value if a fault is detected in the Transmission Temperature Sensor circuit.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check Transmission DTC's.

**Are there any line pressure or throttle position sensor DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK IF DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0713.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 5

### 3. CHECK THE TRANSMISSION TEMPERATURE SENSOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

**Do the readings on the Transmission Simulator match the scan tool readings ± 0.2 volts?**

**Yes** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

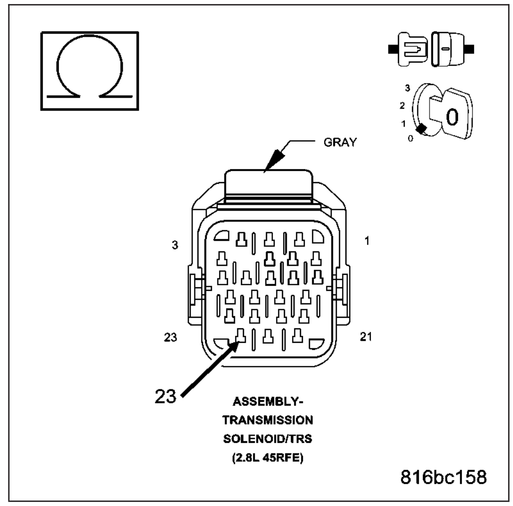
## 4. CHECK THE (T54) TRANSMISSION SENSOR SIGNAL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance between the (T54) Transmission Temperature Sensor Signal circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T54) Transmission Temperature Sensor Signal circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the Transmission Temperature Sensor Signal circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 5. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

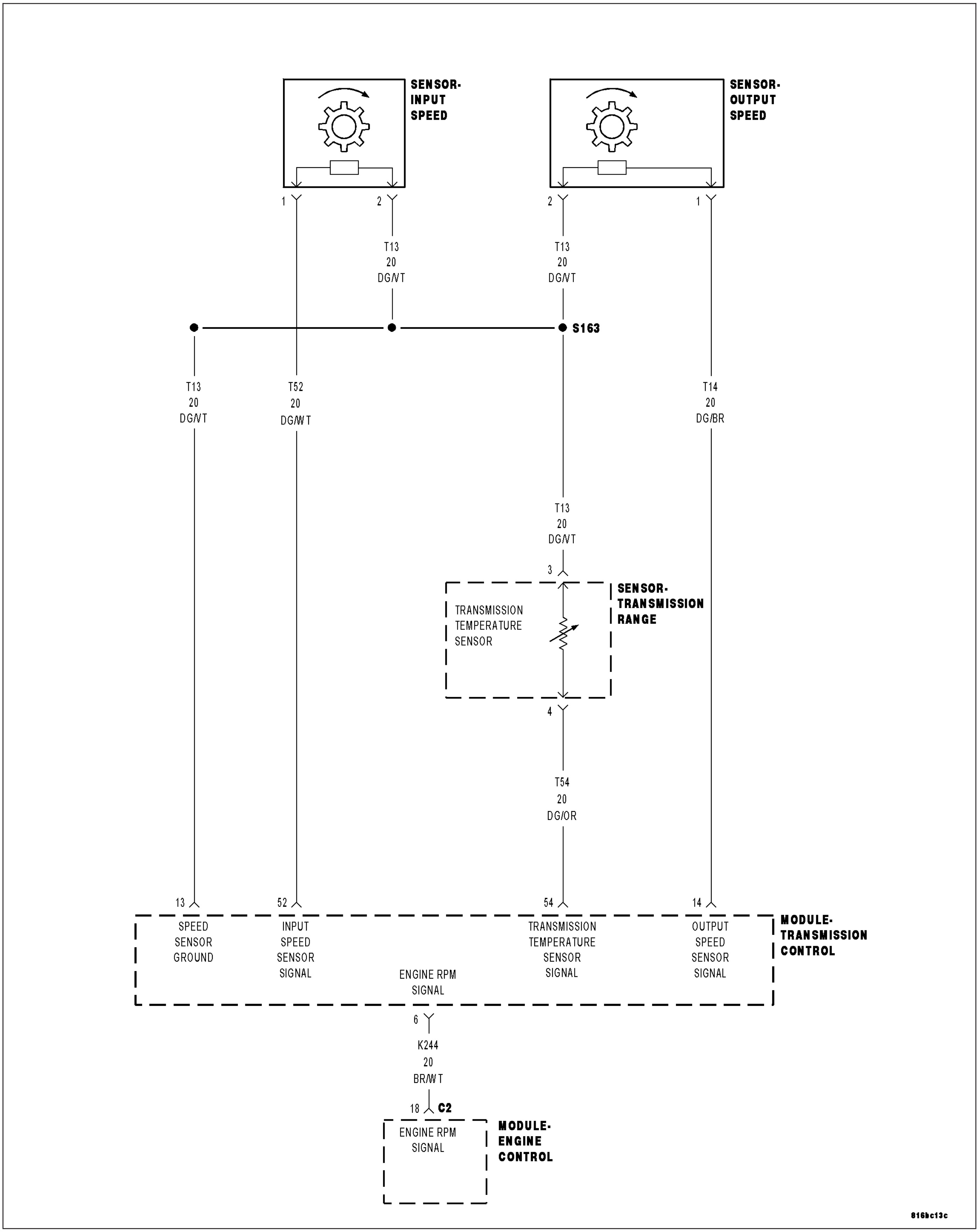
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

# P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set when the monitored Temperature Sensor voltage fluctuates or changes abruptly within a predetermined period of time.

| Possible Causes |
|---|
| RELATED DTC'S PRESENT |
| TRANSMISSION TEMPERATURE SENSOR |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Temperature Sensor is a variable resistor that changes with temperature, or otherwise known as a thermister. The temperature of the transmission fluid can affect a variety of electronically controlled transmission operations such as shift quality, torque converter lock-up, and when and/or if certain OBDII or system self-diagnostic test are performed. The Transmission Control Module (TCM) substitutes a calculated transmission temperature value if a fault is detected in the Transmission Temperature Sensor circuit.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check Transmission DTCs.

**Are there any line pressure or throttle position sensor DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0714.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 4

### 3. CHECK THE TRANSMISSION TEMPERATURE SENSOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Input/Output switch to OFF.

With the scan tool, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator.

Compare the scan tool readings with the numbers listed on the Transmission Simulator.

**Do the readings on the Transmission Simulator match a non-fluctuating scan tool reading ± 0.2 volts?**

**Yes** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 4. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

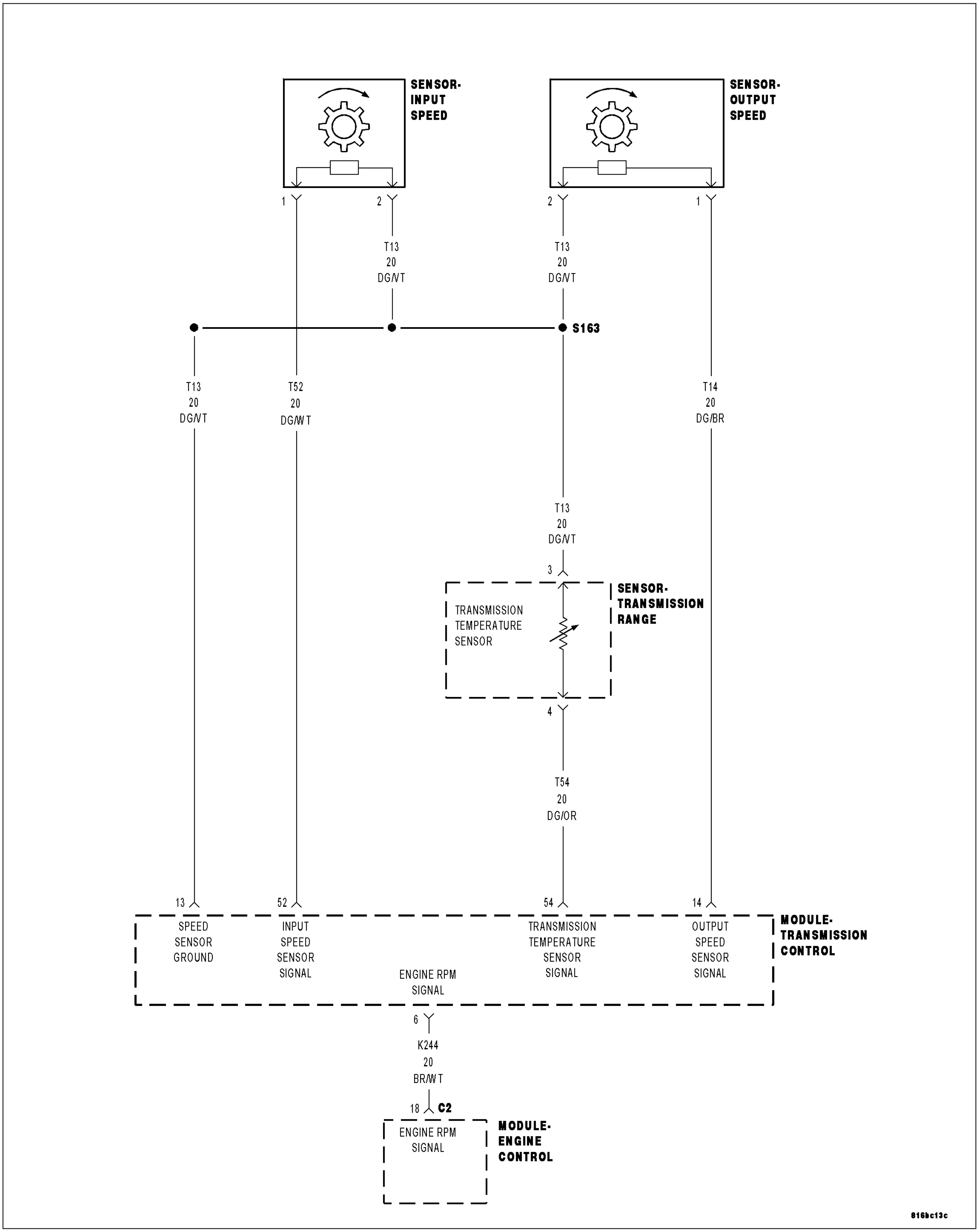
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0715-INPUT SPEED SENSOR 1 CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If there is an excessive change in input RPM in any gear. This DTC can take up to five minutes of problem identification before illuminating the MIL.

| Possible Causes |
|---|
| (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT OPEN |
| (T13) SPEED SENSOR GROUND CIRCUIT OPEN |
| (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND |
| (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND |
| (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE |
| (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE |
| INPUT SPEED SENSOR |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent which may result in the DTCs P0715 and/or P0720 to set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the signal from the input speed sensor at idle in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set when at a stop.

## Diagnostic Test

### 1. CHECK IF DTC P0715 IS CURRENT

Start the engine in park.

With the scan tool, monitor the Input Speed Sensor RPM.

**Is the Input Speed Sensor RPM below 400 RPM?**

**Yes** >> Go To 2

**No** >> Go To 9

## 2. CHECK THE INPUT SPEED SENSOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, set the selector switch to 3000/1000 and the Input/Output switch to ON.

With the scan tool, monitor the Input and Output Speed Sensor RPM.

**Does the Input speed read 3000 RPM and the Output speed read 1000 RPM ± 50 RPM?**

**Yes** >> Replace the Input Speed Sensor per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECK THE (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off to the lock position.

Disconnect the TCM harness connector.

**NOTE: Make sure to leave the Speed Sensor, Transmission Solenoid/TRS Assembly, and Line Pressure Sensor harness connectors disconnected.**

Remove the Transmission Control Relay.

Place a jumper wire between the (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

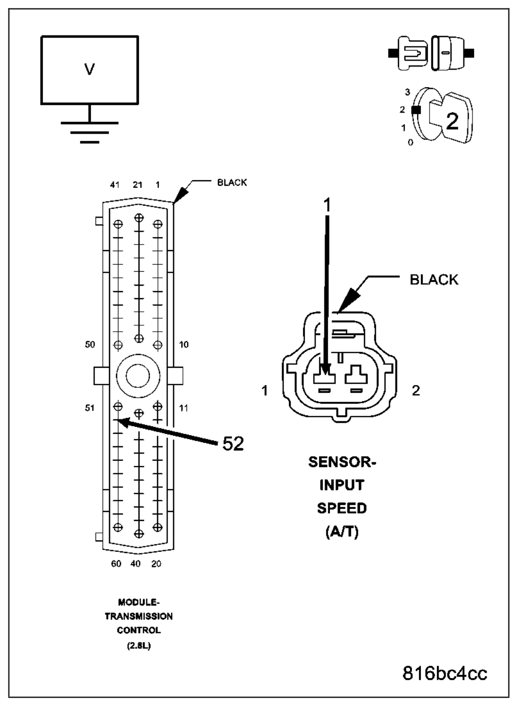
Measure the voltage of the (T52) Input Speed Sensor Signal circuit.

**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T52) Input Speed Sensor Signal circuit for a short to voltage.

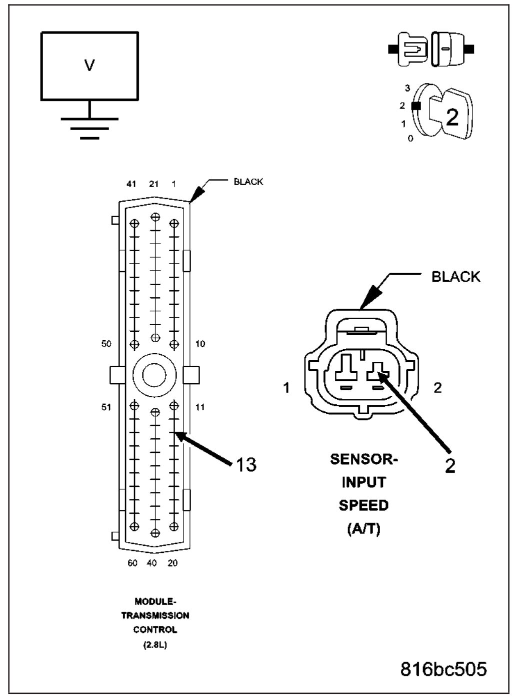
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4



## 4. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO VOLTAGE

Measure the voltage of the (T13) Speed Sensor Ground circuit.




**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for a short to voltage.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

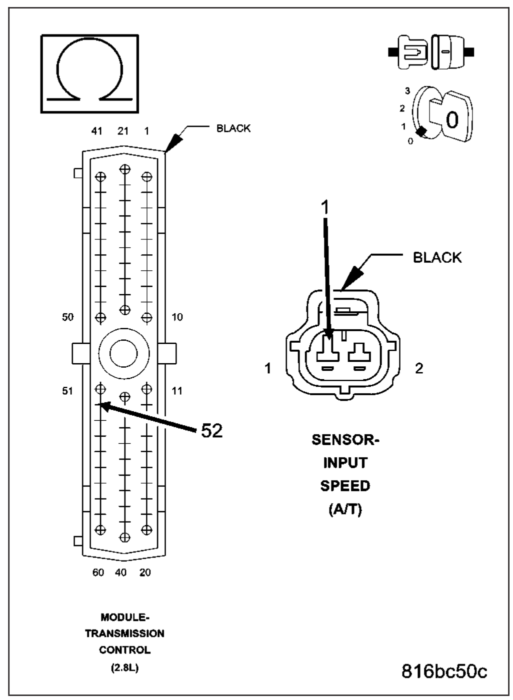
**No** >> Go To 5

## 5. CHECK THE (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the jumper wire between the (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Measure the resistance of the (T52) Input Speed Sensor Signal circuit between the Input Speed Sensor harness connector and the TCM harness connector.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T52) Input Speed Sensor Signal circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR AN OPEN

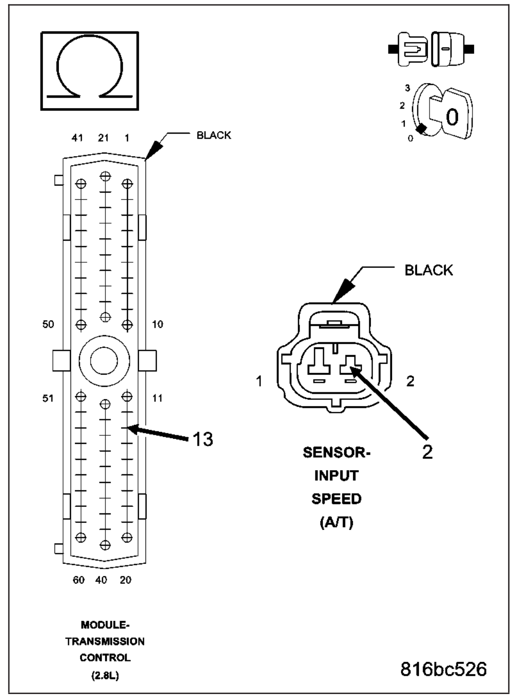
Measure the resistance of the (T13) Speed Sensor Ground circuit between the Input Speed Sensor harness connector and the TCM harness connector.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 7




## 7. CHECK THE (T52) INPUT SPEED SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

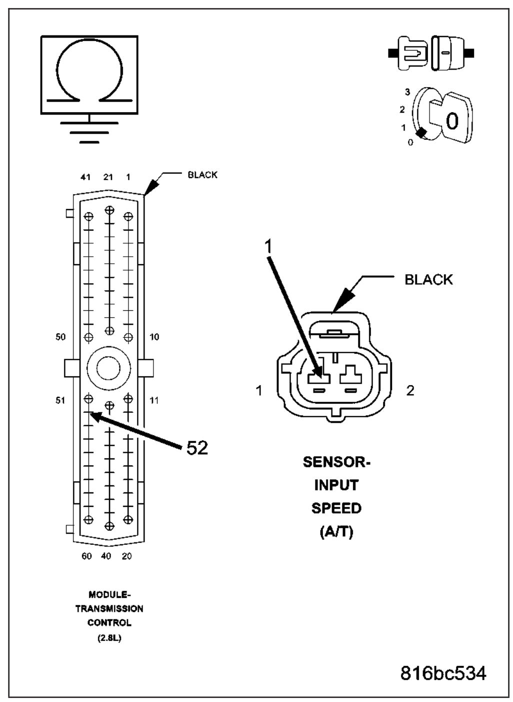
Measure the resistance between ground and the Input Speed Sensor Signal circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T52) Input Speed Sensor Signal circuit for a short to ground.

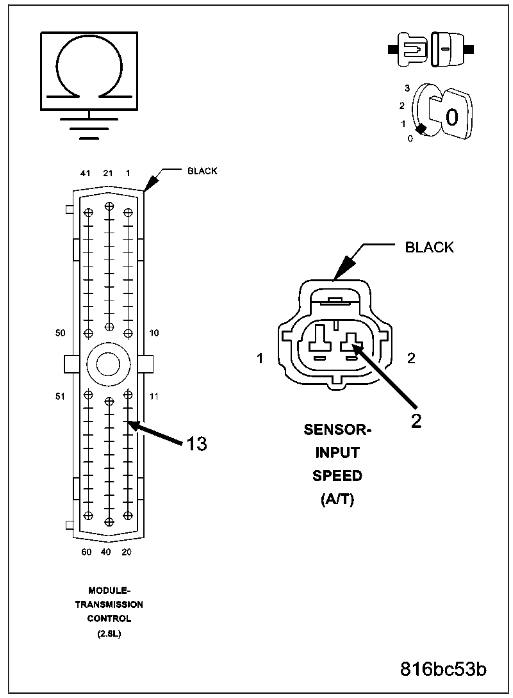
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 8



## 8. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T13) Speed Sensor Ground circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 9. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

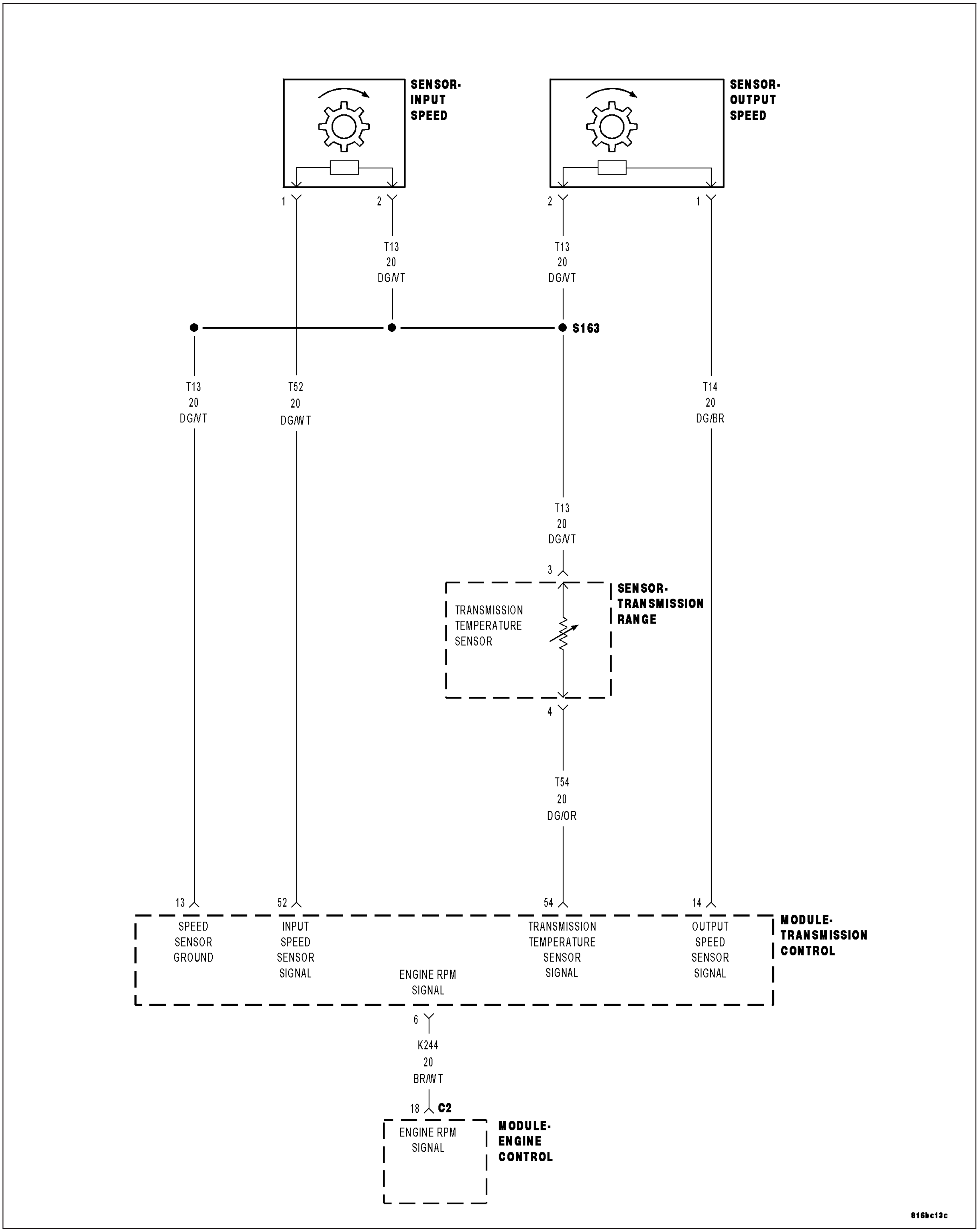
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

# P0720-OUTPUT SPEED SENSOR CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The transmission gear ratio is monitored continuously while the transmission is in gear.
- **Set Condition:**
  If there is an excessive change in output RPM in any gear. This DTC can take up to five minutes of problem identification before illuminating the MIL.

| Possible Causes |
|---|
| OUTPUT SPEED SENSOR SIGNAL CIRCUIT OPEN |
| SPEED SENSOR GROUND CIRCUIT OPEN |
| OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND |
| SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND |
| OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE |
| SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE |
| OUTPUT SPEED SENSOR |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (codes P0731 through P0736).

2) An excessive change in input or output speeds indicating signal intermittent will result in codes P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the signal from the input speed sensor at idle in neutral. Since the input speed sensor has 60 teeth and the output speed sensor has 30 teeth, this results in a an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

## Diagnostic Test

### 1. CHECK IF DTC P0720 IS CURRENT

Turn the ignition off to the lock position.

**CAUTION: Properly support the vehicle and raise all drive wheels off the ground.**
Release the parking brake.

Start the engine in park.

Place the transmission gear selector in drive, release foot from brake.

**WARNING: Be sure to keep hands and feet clear of rotating wheels.**
With the scan tool, monitor the Output Speed Sensor RPM.

**Is the Output Speed Sensor RPM below 100 RPM?**

**Yes** >> Go To 2

**No** >> Go To 9

## 2. CHECK THE OUTPUT SPEED SENSOR

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, set the selector switch to 3000/1000 and the Input/Output switch to ON.

With the scan tool, monitor the Input and Output Speed Sensor RPM

**Does the Input Speed read 3000 RPM and the Output Speed read 1000 RPM, ± 50 RPM?**

**Yes** >> Replace the Output Speed Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 3

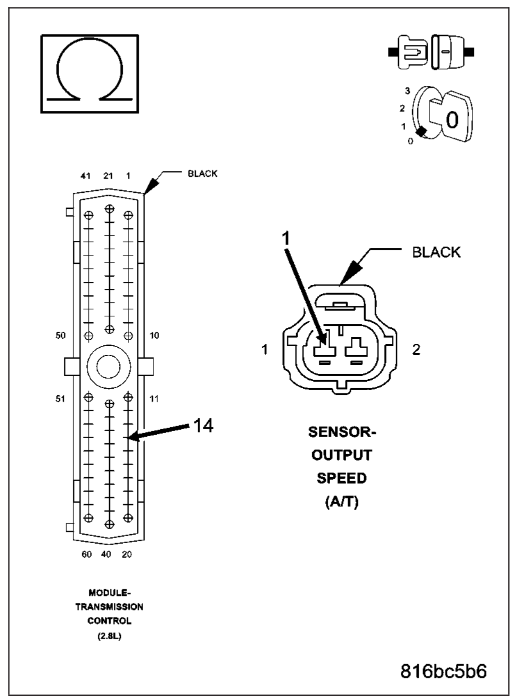
## 3. CHECK THE (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance of the (T14) Output Speed Sensor Signal circuit between the Output Speed Sensor harness connector and the TCM harness connector.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T14) Output Speed Sensor Signal circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR AN OPEN

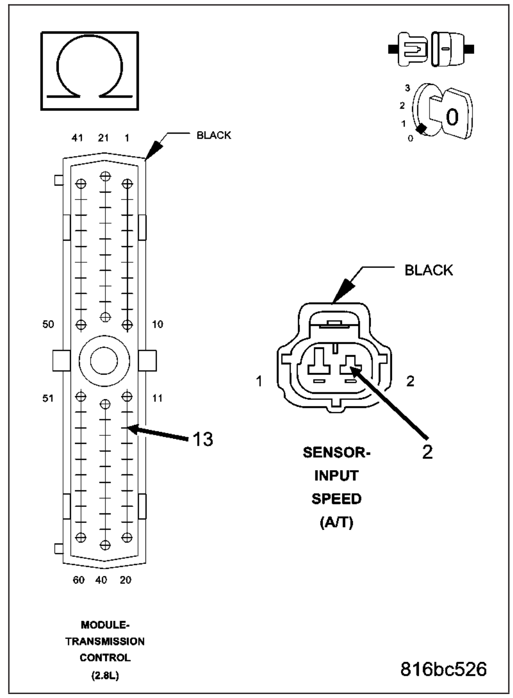
Measure the resistance of the (T13) Speed Sensor Ground circuit between the Output Speed Sensor harness connector and the TCM harness connector.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5




## 5. CHECK THE (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

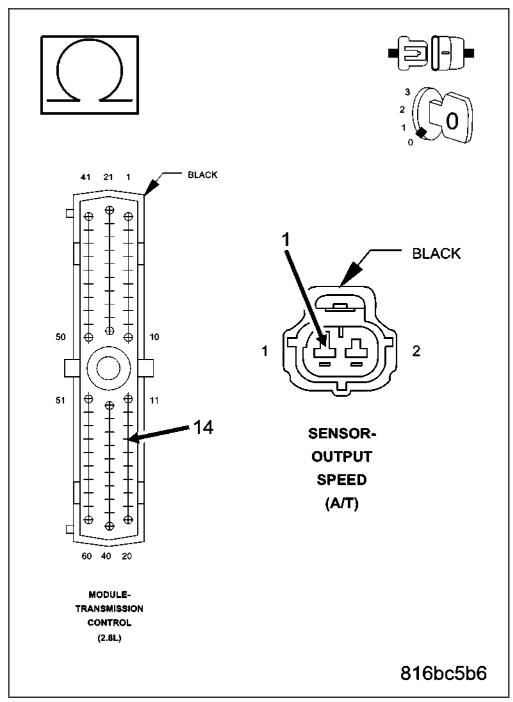
Measure the resistance between ground and the (T14) Output Speed Sensor Signal circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T14) Output Speed Sensor Signal circuit for a short to ground.

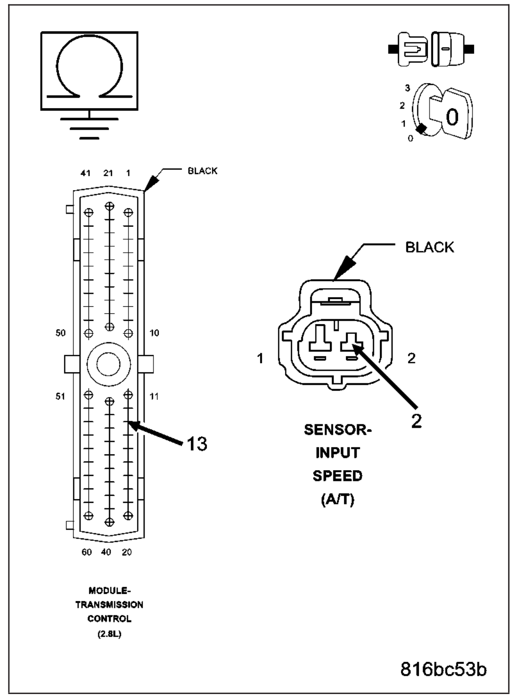
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 6



## 6. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T13) Speed Sensor Ground circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 7

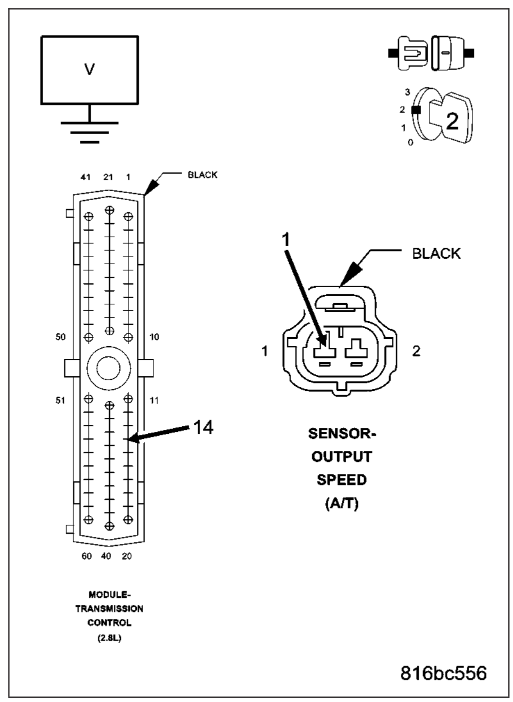
## 7. CHECK THE (T14) OUTPUT SPEED SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Remove the Transmission Control Relay.

Place a jumper wire between the Fused B(+) circuit and the Transmission Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T14) Output Speed Sensor Signal circuit.




**Is the voltage above 0.5 volts?**

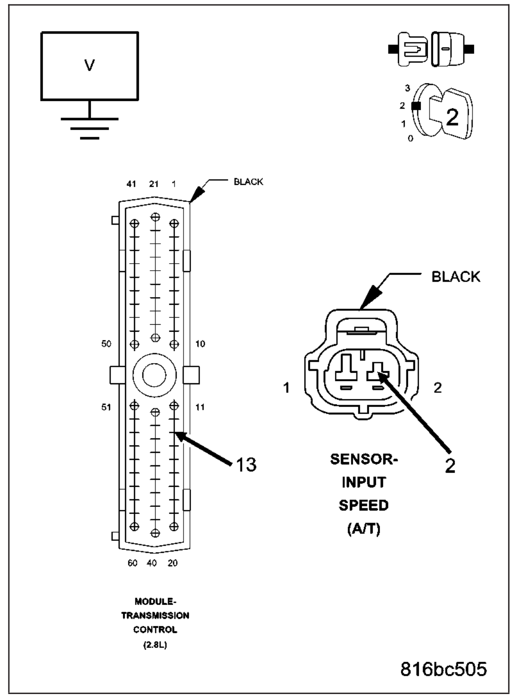
**Yes** >> Repair the (T14) Output Speed Sensor Signal circuit for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. CHECK THE (T13) SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO VOLTAGE

Measure the voltage of the (T13) Speed Sensor Ground circuit.




**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 9. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

# P0725-ENGINE SPEED SENSOR CIRCUIT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously every 7 msec with the ignition on and engine running.
- **Set Condition:**
  This DTC will set when the calculated engine speed is less than 390 RPM with the engine running, or greater than 8000 RPM, for the period of 2.0 seconds. The TCM will place the Transmission in Limp-in when this DTC is set. **Note: This is not a Transmission Input Speed Sensor DTC.**

| Possible Causes |
|---|
| RELATED ENGINE DTC'S PRESENT |
| ENGINE RPM SIGNAL CIRCUIT OPEN |
| ENGINE RPM SIGNAL CIRCUIT SHORT TO GROUND |
| ENGINE RPM SIGNAL CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION CONTROL MODULE |
| POWERTRAIN CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Control System calculates the engine RPM by directly reading the engine crank position sensor. It compares the calculated value to the engine speed sensor signal transmitted from the Engine Control System over the Engine RPM Signal circuit. The calculated engine RPM is also compared to a minimum and a maximum value.

## Diagnostic Test

### 1. CHECK FOR RELATED ENGINE DTCS

**NOTE: This is not a Transmission Input Speed Sensor DTC.**
Ignition on, engine not running.

With the scan tool, read all Engine DTCs. This includes any active or stored or one trip DTCs.

**Are there any engine RPM related DTCs present?**

**Yes** >> Refer to the Powertrain category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK IF THE DTC IS CURRENT

Ignition on, engine not running.

With the scan tool, check the Starts Since Set counter for this DTC.

**Is the Starts Since Set counter 2 or less?**

**Yes** >> Repair the (K244) Engine RPM Signal circuit for a short to voltage.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECK THE (K244) ENGINE RPM SIGNAL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the TCM harness connector.

Disconnect the ECM harness connector.

Measure the resistance of the (K244) Engine RPM Signal circuit between the TCM harness connector and the ECM harness connector.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (K244) Engine RPM Signal circuit for an open

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE (K244) ENGINE RPM SIGNAL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (K244) Engine RPM Signal circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (K244) Engine RPM Signal circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE (K244) ENGINE RPM SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Ignition on, engine not running.

Check the voltage of the (K244) Engine RPM Signal circuit.

**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (K244) Engine RPM Signal circuit for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECK THE TCM

Turn the ignition off to the lock position.

Replace and program the TCM per the Service Information.

Start the engine and allow the engine to idle for 6 minutes.

Check the voltage of the (K244) Engine RPM Signal circuit.

**Does the DTC reset?**

**Yes** >> Replace the ECM per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 7. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0731-GEAR RATIO ERROR IN 1ST

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

| Possible Causes |
|---|
| CUT UD PISTON SEAL |
| LOW FLUID LEVEL |
| CRACKED OR MIS-INSTALLED PRIMARY OIL FILTER OR SEAL |
| STUCK OR STICKING MAIN REGULATOR VALVE |
| FAILED OVERRUNNING CLUTCH |
| CUT UD ACCUMULATOR SEAL RING |
| BROKEN UD ACCUMULATOR PISTON |
| BROKEN REACTION SHAFT SUPPORT SEAL RING |
| LOW LINE PRESSURE |
| BROKEN / MISSING MAIN VALVE BODY BLEED ORIFICE |
| BROKEN / MISSING DRIBBLER ORIFICE ASSEMBLY IN REACTION SHAFT SUPPORT |
| POOR MACHINING ON PUMP VALVE BODY FACE |
| INPUT SPEED SENSOR AND RELATED WIRING |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

### Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs.

If any of these DTCs are present, perform their respective tests first.

**Are there any Transmission; solenoid, line pressure, speed sensor, and/or loss of prime DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they may cause a Speed Ratio Error. Perform the test for P0944 first if it is present.

**No** >> Go To 2

### 2. CHECK IF DTC P0731 IS CURRENT

With the scan tool, perform the 1st Gear Clutch Test. Follow the instructions on the scan tool.

Increase the throttle angle or TPS Degree to 30° for no more than a few seconds.

**CAUTION: Do not overheat the transmission.**

**Did the Clutch Test pass, Input Speed remain at zero?**

**Yes** >> Go To 3

**No** >> Go To 4

### 3. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not currently present.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

- If the DTC Event Data shows fault P0731 was set in Park, Reverse, or Neutral, replace the Powertrain Control Module.
- If the DTC Event Data shows fault P0731 set with input RPM = zero, check the input speed sensor and related wiring.
- If the DTC Event Data shows fault P0731 set with line pressure significantly below desired line pressure, check for the cause of low line pressure (i.e., oil level, mis-installed or damaged primary filter or filter seal, sticking main regulator valve in pump, etc.).
- If the DTC Event Data shows fault P0731 set with the UD pressure switch open (but line pressure matches Desired Line Pressure), air check the UD hydraulic clutch circuit for leakage per the Service Information. If the UD hydraulic clutch circuit is OK, replace the solenoid/TRS assembly.

Check the gearshift linkage adjustment.

Intermittent Gear Ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Wiggle wiring and connectors while checking for intermittent operation with the Transmission Simulator.

Gear ratio DTCs can also be set under extreme temperature conditions.

Verify if the problem is only experienced under extreme hot or cold conditions.

**Were there any problems found.**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## 4. CHECK INTERNAL TRANSMISSION

Repair internal transmission as necessary. Refer to the Service Information.

If there were any line pressure DTCs present along with this DTC, make sure to inspect the: Primary oil filter and seal, Transmission Oil Pump, and the Main regulator valve per the Service Information.

If DTCs P0876 and/or P0875 were present in addition to the P0731, replace the Transmission Solenoid/TRS Assembly in addition to necessary internal repairs.

Pay particular attention to the following list of possible causes when repairing the transmission:

- Cut UD piston seal
- Failed overrunning clutch
- Cut UD accumulator seal ring
- Broken UD accumulator piston
- Low line pressure
- Broken/missing main valve body bleed orifice
- Broken/missing dribbler orifice assembly in reaction shaft support
- Poor machining on pump valve body face
- Transmission Solenoid/TRS Assembly

**View repair**

**Repair**

Repair internal transmission per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P0732-GEAR RATIO ERROR IN 2ND

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

| Possible Causes |
| --- |
| RELATED DTC'S PRESENT |
| INPUT SPEED SENSOR OR WIRING |
| LOW FLUID LEVEL |
| CRACKED OR MIS-INSTALLED PRIMARY OIL FILTER OR SEAL |
| WORN SOLENOID SWITCH VALVE OR PLUGS |
| STUCK OR STICKING MAIN REGULATOR VALVE |
| BURNED UD OR 2C CLUTCH |
| CUT 2C OR UD PISTON SEAL |
| BROKEN 2C PISTON CASTING |
| BROKEN OR MISSING 2C BLEED ORIFICE |
| BROKEN OR MISSING UD BLEED ORIFICE |
| CUT 2C OR UD ACCUMULATOR PISTON SEAL |
| CRACKED 2C OR UD ACCUMULATOR PISTON |
| CUT OR MISSING #5 OR #7 CHECK BALL |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| BROKEN WELD - REACTION CARRIER TO REVERSE SUN GEAR |
| MISSING TEETH ON INPUT CLUTCH HUB TONE WHEEL |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36).

2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs.

**Are there any Transmission: solenoid, line pressure, speed sensor, and/or loss of prime DTCs present?**

**Yes** >> Refer to appropriate symptom in the Transmission category. Perform the test for P0944-LOSS OF PRIME first if it is present.

**No** >> Go To 2

### 2. CHECK IF DTC IS CURRENT

With the scan tool, read and record the DTC EVENT DATA.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA display information for the DTC P0732?**

**Yes** >> Go To 4

**No** >> Go To 3

### 3. CHECK DTC EVENT DATA

In the DTC EVENT DATA, identify the DTC that was recorded earlier.

**Does the DTC EVENT DATA display information for the DTC P1790, with target gear = 2nd, or with both 2C and UD clutches applying?**

**Yes** >> Go To 4

**No** >> Go To 7

### 4. CHECK RPM IN DTC EVENT DATA

Refer to the DTC EVENT DATA recorded earlier.

**Does the Input RPM read zero?**

**Yes** >> Check the input speed sensor and wiring. Refer to test P0715 and diagnose as if the DTC is current.

**No** >> Go To 5

### 5. CHECK LINE PRESSURE READING

Refer to the DTC EVENT DATA recorded earlier.

**Is the line pressure reading more than 10 psi below the desired line pressure?**

**Yes** >> Go To 6

**No** >> Go To 7

### 6. CHECK TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

**NOTE: Make sure the Primary Transmission Oil Filter and seal are properly installed and are not cracked or split.**

**Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked, plugged or mis-in-**

**stalled?**

**Yes** >> Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or seal. If excessive clutch debris is present, check the clutches for damage. Refer to the Service Information for the proper hydraulic clutch repair procedure.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Remove the Transmission Oil Pump per the Service Information. Check the main Regulator Valve for sticking in its bore, scoring, and/or damage and clean and repair as necessary. If no problem is found, replace the Transmission Solenoid/TRS Assembly.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 7. CHECK IF THE DTC P0732 IS CURRENT

With the scan tool, perform the 2nd Gear Clutch Test. Follow the instructions on the scan tool.

Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds.

**CAUTION: Do not overheat the transmission.**

**NOTE: If the 2C clutch is faulty, the overrunning clutch will hold and the slip test will pass. The 2nd gear clutch test will not detect a faulty 2C clutch. However, it will detect a faulty UD clutch.**

**Did the clutch test pass, did the Input Speed remain at zero?**

**Yes** >> Go To 8

**No** >> Go To 10

## 8. CHECK FOR INTERMITTENT OPERATION

Check the Shifter adjustment per the Service Information.

Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. CHECK FOR SLIPPAGE

With the scan tool, erase Transmission DTCs.

Road test the vehicle.

**Is there an obvious slippage noticed in 2nd gear, or runaway on the 1–2 shift?**

**Yes** >> Go To 12

**No** >> Go To 15

## 10. CHECK THE UD HYDRAULIC CLUTCH CIRCUIT

Remove Transmission Oil Pan and check for excessive debris.

Remove the Valve Body and air check the UD hydraulic clutch circuit (in the case) per the Service Information.

**NOTE: The UD clutch passage contains a small bleed orifice, a small amount of air leakage is normal.**

**Were there any problems found, excessive debris and/or excessive air leakage in the UD clutch hydraulic circuit?**

**Yes** >> Repair as necessary. Check the UD clutch piston seals, reaction shaft support seal rings and the dribbler assembly, and the flatness of the pump valve body and pump housing faces. Check main regulator valve for sticking in the bore.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 11

## 11. CHECK THE UD ACCUMULATOR PISTON

Check the UD bleed orifice, accumulator piston, and accumulator piston seal in the main valve body.

**Were there any problems found?**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 12. CHECK FOR EXCESSIVE DEBRIS

Remove the Transmission Oil Pan and check for excessive debris.

If grey sludge is present, check for a improperly assembled 2C clutch with the thick reaction plate not against the case.

Remove the valve body and air check the 2C hydraulic clutch circuit (in the 2C/4C clutch retainer) per the Service Information.

**NOTE: The 2C clutch passage contains a small bleed orifice, a small amount of air leakage is normal.**

**Were there any problems found, excessive debris, improperly assembled 2C clutch and/or excessive air leakage in the 2C hydraulic clutch circuit?**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures. Note: Check the 2C piston seals and bleed orifice.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. CHECK THE 2C ACCUMULATOR

Check the 2C Accumulator piston for cracks or a cut seal.

Check for a cut or missing #7 or #5 check ball.

Check the Solenoid Switch Valve and its plugs for sticking in its bore or excessive wear.

**Were there any problems found**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 14

## 14. CHECK FOR BROKEN REVERSE SUN GEAR WELD

Working through the windows in the bottom of the case, check for a broken Reverse Sun gear weld to the reaction carrier as follows:

1) Hold the Transmission Output Shaft by holding the Transmission Manual Lever in the park position.

2) Rotate the Input Annulus gear and drive shell (the drum that encloses the two rearmost carriers).

3) Check to see if the reaction carrier (the front-most carrier, whose outer shell is splined to the 2C clutch) is rotating faster than the drive shell is being turned.

**Is the reaction carrier turning faster than the drive shell?**

**Yes** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the reaction carrier per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 15. CHECK IF DTC RESETS

**Did the DTC P0732 reset during the road test?**

**Yes** >> Go To 16

**No** >> Go To 17

## 16. LIST OF POSSIBLE CAUSES

If any other DTCs set during the road test, refer to the appropriate symptom in the Transmission category.

If no other DTCs set during the road test, below is a list of possible causes, but not strictly limited to those:

- Check for excessive debris in the Transmission Oil pan, plugged, cracked, or misinstalled Primary Transmission Oil Filter and/or seal.
- Check for cut and/or missing #7 and #5 check balls in the main valve body.
- Check the 2C and UD accumulator pistons and seals, UD bleed orifice, and the Solenoid Switch Valve and Plugs in the main valve body.
- Check the UD clutch piston seals, reaction shaft support seal rings and dribbler assembly.
- Check the 2C clutch piston seals, and bleed orifice.
- Check the main regulator valve for sticking in its bore and the flatness of the pump valve body and pump housing faces.
- Check for a improperly assembled 2C clutch with the thick reaction plate not against the case.

**View repair**

**Repair**

Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 17. INTERMITTENT DTC

The conditions to set this DTC are not currently present.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

- If the DTC Event Data shows fault P0732 was set in Park, Reverse, or Neutral, replace the Powertrain Control Module.
- If the DTC Event Data shows fault P0732 set with input RPM = zero, check the input speed sensor and related wiring.
- If the DTC Event Data shows fault P0732 set with line pressure significantly below desired line pressure, check for the cause of low line pressure (i.e., oil level, misinstalled or damaged primary filter or filter seal, sticking main regulator valve in pump, etc.).
- If the DTC Event Data shows fault P0732 set with the UD or 2C pressure switch open (but line pressure matches Desired Line Pressure), air check the UD and 2C hydraulic clutch circuits for leakage per the Service Information. If the UD and 2C hydraulic clutch circuits are OK, replace the Transmission Solenoid/TRS assembly.

Check the gearshift linkage adjustment.

Intermittent Gear Ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install Transmission Simulator, Miller tool #8333.

Wiggle wiring and connectors while checking for intermittent operation with the Transmission Simulator.

Gear ratio DTCs can also be set under extreme temperature conditions.

Verify if the problem is only experienced under extreme hot or cold conditions.

**Were there any problems found.**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0733-GEAR RATIO ERROR IN 3RD

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

| Possible Causes |
|---|
| RELATED DTCS PRESENT |
| INPUT SPEED SENSOR OR WIRING |
| LOW FLUID LEVEL |
| CRACKED OR MIS-INSTALLED PRIMARY OIL FILTER OR SEAL |
| BENT OR BROKEN ACCUMULATOR COVER ON MAIN VALVE BODY |
| WORN SOLENOID SWITCH VALVE OR PLUGS |
| STUCK OR STICKING MAIN REGULATOR VALVE |
| BURNED UD OR OD CLUTCH |
| CUT OD OR UD PISTON SEAL |
| BROKEN OR MISSING UD OR OD BLEED ORIFICE IN MAIN VALVE BODY |
| BROKEN OR MISSING BLEED ORIFICE IN UD OR OD CLUTCH PISTON |
| CUT OD OR UD ACCUMULATOR PISTON SEAL |
| CRACKED OD OR UD ACCUMULATOR PISTON |
| CUT OR MISSING #6 CHECK BALL |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| BROKEN WELD - REVERSE CARRIER HUB TO CARRIER |
| BROKEN REACTION SHAFT SUPPORT SEAL RING |
| POOR MACHINING ON PUMP VALVE BODY FACE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36).

2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

## Diagnostic Test

### 1. CHECK IF RELATED DTCS ARE PRESENT

With the scan tool, check for other transmission DTCs

**Are there any Transmission; solenoid, line pressure, speed sensor, and/or loss of prime DTCs present?**

**Yes** >> Refer to appropriate symptom in the Transmission category. Perform the test for P0944-LOSS OF PRIME first if it is present.

**No** >> Go To 2

### 2. CHECK DTC EVENT DATA

With the scan tool, read and record the DTC EVENT DATA.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA display information for the DTC P0733?**

**Yes** >> Go To 4

**No** >> Go To 3

### 3. CHECK THE TARGET GEAR IN DTC EVENT DATA

In the DTC EVENT DATA, identify the DTC that was recorded earlier.

**Does the DTC EVENT DATA display information for the DTC P1790, with target gear = 3rd, or with both OD and UD clutches applying?**

**Yes** >> Go To 4

**No** >> Go To 7

### 4. CHECK INPUT RPM IN DTC EVENT DATA

Refer to the DTC EVENT DATA recorded earlier.

**Does the Input RPM read zero?**

**Yes** >> Check the input speed sensor and wiring. Refer to test P0715 and diagnose as if the DTC is current.

**No** >> Go To 5

### 5. CHECK LINE PRESSURE READING

Refer to the DTC EVENT DATA recorded earlier.

**Is the line pressure reading more than 10 psi below the desired line pressure?**

**Yes** >> Go To 6

**No** >> Go To 7

### 6. CHECK TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

**NOTE: Make sure the Primary Transmission Oil Filter and seal are properly installed and are not cracked or split.**

**Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked, plugged or mis-in-**

**stalled?**

**Yes** >> Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or seal. If excessive clutch debris is present, check the clutches for damage. Refer to the Service Information for the proper hydraulic clutch repair procedure.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Remove the Transmission Oil Pump per the Service Information. Check the main Regulator Valve for sticking in its bore, scoring, and/or damage and clean and repair as necessary. If no problem is found, replace the Transmission Solenoid/TRS Assembly.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 7. CHECK IF DTC P0733 IS CURRENT

With the scan tool, perform the 3rd Gear Clutch Test. Follow the instructions on the scan tool.

Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds.

**CAUTION: Do not overheat the transmission.**

**NOTE: If the OD clutch is faulty, the overrunning clutch will hold and the slip test will pass. The 3rd gear clutch test will not detect a faulty OD clutch. However, it will detect a faulty UD clutch.**

**Did the clutch test pass, did the Input Speed remain at zero?**

**Yes** >> Go To 8

**No** >> Go To 10

## 8. CHECK FOR INTERMITTENT OPERATION

Check the Shifter adjustment per the Service Information.

Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. CHECK FOR SLIPPAGE

With the scan tool, erase Transmission DTCs.

Road test the vehicle. Check operation in 3rd gear, 4th gear, and Reverse.

**Is there an obvious slippage noticed in 3rd gear, or runaway on the 2-3 shift?**

**Yes** >> Go To 12

**No** >> Go To 16

## 10. CHECK THE UD HYDRAULIC CLUTCH CIRCUIT

Remove Transmission Oil Pan and check for excessive debris.

Remove the Valve Body and air check the UD hydraulic clutch circuit (in the case) per the Service Information.

**NOTE: The UD clutch passage contains a small bleed orifice, a small amount of air leakage is normal.**

**Were there any problems found, excessive debris and/or excessive air leakage in the UD hydraulic clutch circuit?**

**Yes** >> Repair as necessary. Check the UD clutch piston seals, reaction shaft support seal rings and dribbler assemblies, and the flatness of the pump valve body and pump housing faces. Check main regulator valve for sticking in the bore.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 11

## 11. CHECK UD ACCUMULATOR PISTON

Check the UD bleed orifice, accumulator piston, and accumulator piston seal in the main valve body.

**Were there any problems found?**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures.

**No** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 12. CHECK FOR EXCESSIVE DEBRIS

Remove the Transmission Oil Pan and check for excessive debris.

Remove the valve body and check if the accumulator cover is intact.

Air check the OD hydraulic clutch circuit (in the case) per the Service Information.

**NOTE: The OD clutch passage contains a small bleed orifice which connects to the Reverse clutch hydraulic circuit, a small amount of air leakage into the Reverse clutch passage is normal.**

**Were there any problems found, excessive debris, and/or excessive air leakage in the OD hydraulic clutch circuit?**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures. Note: Check the bleed orifice in the OD/Reverse clutch piston.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. CHECK THE OD ACCUMULATOR

Check the OD Accumulator piston for cracks or a cut seal.

Check for a cut or missing #6 check ball.

Check the Solenoid Switch Valve and its plugs for sticking in its bore or excessive wear.

**Were there any problems found?**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 14

## 14. CHECK FOR NO REVERSE

**During the road test on a previous test, did the vehicle have no reverse and no 3rd gear, but 1st and 2nd gears were OK?**

**Yes** >> Go To 15

**No** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 15. CHECK FOR BROKEN REVERSE CARRIER WELD

Remove the Transmission per the Service Information and inspect the weld on the reverse carrier hub.

**Were there any problems found?**

**Yes** >> Repair as necessary.

**No** >> Disassemble and inspect the input clutch assembly. Check the OD and Reverse clutch seals, discs, and bleed orifice (in the OD/Reverse clutch piston). Check the OD hub and shaft. Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 16. CHECK IF DTC RESETS

**Did the DTC P0733 reset during the road test?**

**Yes** >> Go To 17

**No** >> Go To 18

## 17. LIST OF POSSIBLE CAUSES

If any other DTCs set during the road test, refer to the appropriate symptom in the Transmission category.

If no other DTCs set during the road test, below is a list of possible causes, but not strictly limited to those.

Check for:

- Excessive debris in the Transmission Oil pan, plugged, cracked, or mis-installed Primary Transmission Oil Filter and/or seal.
- Cut or missing #6 check ball in the main valve body.
- OD and UD accumulator pistons and seals and bleed orifices, and the Solenoid Switch Valve and Plugs in the main valve body.
- OD and UD clutch piston seals, reaction shaft support seal rings and dribbler assemblies, and the flatness of the pump valve body and pump housing faces.
- Main regulator valve for sticking in its bore.

**View repair**

**Repair**

Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 18. CHECK FOR INTERMITTENT OPERATION

The conditions to set this DTC are not currently present.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

- If the DTC Event Data shows fault P0733 was set in the Park, Reverse, or Neutral, replace the Powertrain Control Module.
- If the DTC Event Data shows fault P0733 set with input RPM = zero, check the input speed sensor and related wiring.
- If the DTC Event Data shows fault P0733 set with line pressure significantly below desired line pressure, check for the cause of low line pressure (i.e., oil level, misinstalled or damaged primary filter or filter seal, sticking main regulator valve in pump, etc.).
- If the DTC Event Data shows fault P0733 set with the OD or UD pressure switch open (but line pressure matches Desired Line Pressure), air check the OD and UD hydraulic clutch circuits for leakage per the Service Information. If the OD and UD hydraulic clutch circuits are OK, replace the Transmission Solenoid/TRS assembly.

Check the gearshift linkage adjustment.

Intermittent Gear Ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Wiggle wiring and connectors while checking for intermittent operation with the Transmission Simulator.

Gear ratio DTCs can also be set under extreme temperature conditions.

Verify if the problem is only experienced under extreme hot or cold conditions.

**Were there any problems found.**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0734-GEAR RATIO ERROR IN 4TH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

| Possible Causes |
|---|
| LOW FLUID LEVEL |
| INPUT SPEED SENSOR OR WIRING |
| VALVE BODY ACCUMULATOR COVER FAILED |
| CUT OD OR 4C ACCUMULATOR SEAL |
| CRACKED OD OR 4C ACCUMULATOR PISTON |
| BROKEN OR MISSING OD BLEED ORIFICE IN MAIN VALVE BODY |
| CUT 4C TOWER SEAL |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| CUT OR MISSING #5 OR #6 CHECK BALL |
| WORN SOLENOID SWITCH VALVE OR PLUGS |
| CUT OD OR 4C PISTON SEAL |
| STUCK MAIN REGULATOR VALVE |
| BURNED OD OR 4C CLUTCH |
| BROKEN OR MISSING 4C BLEED ORIFICE IN 2C/4C RETAINER |
| BROKEN REACTION SHAFT SUPPORT SEAL RING |
| POOR MACHINING ON PUMP VALVE BODY FACE |
| LOOSE / MISSING DRIBBLER ORIFICE ASSEMBLY IN REACTION SHAFT SUPPORT |
| CRACKED / LOOSE / MISSING OD/REVERSE PISTON BLEED ORIFICE |
| BROKEN REVERSE CARRIER HUB WELD |
| BROKEN REVERSE SUN GEAR WELD TO REACTION CARRIER |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs

If any of these DTCs are present, perform their respective tests first.

**Are there any Transmission; solenoid, line pressure, speed sensor, and/or loss of prime DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they may cause a Speed Ratio Error. Perform the test for P0944 first if it is present.

**No** >> Go To 2

### 2. CHECK DTC EVENT DATA

With the scan tool, read and record the DTC EVENT DATA.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA display information for the DTC P0734?**

**Yes** >> Go To 4

**No** >> Go To 3

### 3. CHECK FOR ANOTHER DTC

**In the DTC EVENT DATA recorded earlier, does the DTC EVENT DATA show the DTC P1790, with Target Gear = 4th, or with both the 4C and OD clutches applying?**

**Yes** >> Go To 4

**No** >> Go To 6

### 4. CHECK INPUT RPM

**In the DTC EVENT DATA recorded earlier, does the Input RPM read zero?**

**Yes** >> Refer to the Transmission category and perform the diagnostic procedure for P0715 (Input Speed Sensor Error). Diagnose the DTC as if it is set and current.

**No** >> Go To 5

### 5. CHECK LINE PRESSURE READING

**In the DTC EVENT DATA recorded earlier, is the line pressure reading more than 10 PSI below the desired line pressure reading?**

**Yes** >> Remove the Transmission Oil pan and check the Transmission Oil filter for improper installation or plugged, if Primary oil filter is OK, check the main regulator valve in pump. If excessive debris is in the oil pan, check clutches and repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECK TRANSMISSION FOR SLIPPAGE

Erase DTCs and road test the vehicle.

Check the transmission operation in reverse and all forward gears.

**During the road test, was there any obvious slippage noted in 4th gear or a runaway during the 3-4 shift?**

**Yes** >> Go To 8

**No** >> Go To 7

## 7. CHECK IF DTC RESETS

With the scan tool, check for Transmission DTCs after the road test.

**Did the DTC P0734 reset?**

**Yes** >> Go To 8

**No** >> Test Complete.

## 8. CHECK INTERNAL TRANSMISSION

Remove the Transmission Oil Pan and Valve Body per the Service Information and check for the following:

- Excessive debris in the oil pan.
- Remove the Valve Body and check if the accumulator cover is intact and the 4C tower seal is not cut or split.
- OD and 4C accumulator pistons for cracks and/or cut seals.
- Solenoid Switch Valve and its plugs for stickiness or wear.
- Cut or missing #5 and/or #6 check ball.
- OD bleed orifice on top of the Valve Body
- Air check the OD and 4C hydraulic clutch circuits for excessive leakage. Refer to the Service information.

**NOTE: Both the OD and 4C hydraulic clutch circuits contain a small bleed orifice. A small amount of air leakage is considered normal. The OD hydraulic clutch circuit bleed orifice connects to the Reverse input clutch hydraulic cavity. A small amount of air leakage into the Reverse hydraulic clutch circuit is considered normal.**

**Were there any problems found?**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

**Was there no reverse gear during the road test?**

**Yes** >> Go To 10

**No** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 10. CHECK ROAD TEST RESULTS

**During the road test, was there no 2nd gear and no 4th gear, but 3rd gear (limp-in) was OK?**

**Yes** >> Go To 11

**No** >> Go To 12

## 11. CHECK FOR BROKEN REVERSE SUN GEAR WELD

Working through the windows in the bottom of the case, check for a broken Reverse Sun gear weld to the reaction carrier as follows:

1) Hold the Transmission Output Shaft by holding the Transmission Manual Lever in the park position.

2) Rotate the Input Annulus gear and drive shell (the drum that encloses the two rearmost carriers).

3) Check to see if the reaction carrier (the front most carrier, whose outer shell is splined to the 2C clutch) is rotating faster than the drive shell is being turned.

**Is the reaction carrier turning faster than the drive shell?**

**Yes** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the reaction carrier per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 12. CHECK FOR NO REVERSE

Remove the Transmission per the Service Information and inspect the weld on the reverse carrier hub.

**Were there any problems found?**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Disassemble and inspect the input clutch assembly. Check the OD and Reverse clutch seals, discs, and bleed orifice (in the OD/Reverse clutch piston). Check the OD hub and shaft. Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P0735-GEAR RATIO ERROR IN 5TH

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL.

| Possible Causes |
|---|
| LOW FLUID LEVEL |
| INPUT SPEED SENSOR OR WIRING |
| VALVE BODY ACCUMULATOR COVER FAILED |
| CUT OD OR 2C ACCUMULATOR SEAL |
| CRACKED OD OR 2C ACCUMULATOR PISTON |
| BROKEN OR MISSING OD BLEED ORIFICE IN MAIN VALVE BODY |
| CUT 2C TOWER SEAL |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| CUT OR MISSING #5, #6, OR #7 CHECK BALL |
| WORN SOLENOID SWITCH VALVE OR PLUGS |
| CUT OD OR 2C PISTON SEAL |
| STUCK MAIN REGULATOR VALVE |
| BURNED OD OR 2C CLUTCH |
| BROKEN OR MISSING 2C BLEED ORIFICE IN 2C/4C RETAINER |
| BROKEN REACTION SHAFT SUPPORT SEAL RING |
| POOR MACHINING ON PUMP VALVE BODY FACE |
| LOOSE / MISSING DRIBBLER ORIFICE ASSEMBLY IN REACTION SHAFT SUPPORT |
| CRACKED / LOOSE / MISSING OD/REVERSE PISTON BLEED ORIFICE |
| BROKEN REVERSE CARRIER HUB WELD |
| BROKEN REVERSE SUN GEAR WELD TO REACTION CARRIER |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36).

2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTC's

If any of these DTCs are present, perform their respective tests first.

**Are there any Transmission; solenoid, line pressure, speed sensor, and/or loss of prime DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. If any of these DTCs are present, they may cause a Speed Ratio Error. Perform the test for P0944 first if it is present.

**No** >> Go To 2

### 2. CHECK DTC EVENT DATA

With the scan tool, read and record the DTC EVENT DATA.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA display information for the DTC P0735?**

**Yes** >> Go To 4

**No** >> Go To 3

### 3. CHECK THE TARGET GEAR

**In the DTC EVENT DATA recorded earlier, does the DTC EVENT DATA show the DTC P1790, with Target gear = 5th, or with both the 2C and OD clutches applying?**

**Yes** >> Go To 4

**No** >> Go To 6

### 4. CHECK INPUT RPM

**In the DTC EVENT DATA recorded earlier, does the Input RPM read zero?**

**Yes** >> Refer to the Transmission category and perform the diagnostic procedure for P0715 (Input Speed Sensor Error). Diagnose the DTC as if it is set and current.

**No** >> Go To 5

### 5. CHECK LINE PRESSURE READING

**In the DTC EVENT DATA recorded earlier, is the line pressure reading more than 10 PSI below the desired line pressure reading?**

**Yes** >> Remove the Transmission Oil pan and check the Transmission Oil filter for improper installation or plugged, if Primary oil filter is OK, check the main regulator valve in pump. If excessive debris is in the oil pan, check clutches and repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECK TRANSMISSION FOR SLIPPAGE

Erase DTCs and road test the vehicle.

Check the transmission operation in reverse and all forward gears.

**During the road test, was there any obvious slippage noted in 5th gear or a runaway during the 4–5 shift?**

**Yes** >> Go To 8

**No** >> Go To 7

## 7. CHECK IF DTC RESETS

With the scan tool, check for Transmission DTCs after the road test.

**Did the DTC P0735 reset?**

**Yes** >> Go To 8

**No** >> Test Complete.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 8. CHECK INTERNAL TRANSMISSION

Remove the Transmission Oil Pan and Valve Body, per the Service Information, and check for the following:

- Excessive clutch and or metal debris in the oil pan.
- If the accumulator cover is intact and the 2C tower seal is not cut or split.
- OD and 2C accumulator pistons for cracks or cut seals.
- Solenoid Switch Valve and its plugs for stickiness or wear.
- Cut or missing #5, #6, or #7 check ball.
- OD bleed orifice on top of the valve body.
- Air check the OD and 2C hydraulic clutch circuits for excessive leakage. Refer to the Service information.

**NOTE: Both the OD and 2C hydraulic clutch circuits contain a small bleed orifice. A small amount of air leakage is considered normal. The OD hydraulic clutch circuit bleed orifice connects to the Reverse input clutch hydraulic cavity. A small amount of air leakage into the Reverse hydraulic clutch circuit is considered normal.**

**Were there any problems found?**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P0736-GEAR RATIO ERROR IN REVERSE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

| Possible Causes |
|---|
| LOW FLUID LEVEL |
| CUT LR TOWER SEAL ON MAIN VALVE BODY |
| CUT LR CLUTCH PISTON SEALS |
| BROKEN OR MISSING LR CLUTCH BLEED ORIFICE (IN LR CLUTCH RETAINER) |
| CUT LR ACCUMULATOR PISTON SEAL IN MAIN VALVE BODY |
| CRACKED LR ACCUMULATOR PISTON IN MAIN VALVE BODY |
| CUT OD/REV PISTON SEALS |
| BROKEN OR MISSING OD/REV BLEED ORIFICE (IN OD/REV CLUTCH PISTON) |
| BROKEN REVERSE CARRIER HUB WELD |
| BROKEN REVERSE SUN GEAR WELD TO THE REACTION CARRIER |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

### Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) Once in a particular gear, if the gear ratio varies from the correct gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36).

2) An excessive change in input or output speeds indicating signal intermittent may result in the DTCs P0715 and/or P0720 being set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the pulses from the input speed sensor when at a stop in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set.

### Diagnostic Test

#### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTC's

**Are there any Transmission; solenoid, line pressure, speed sensor, and/or loss of prime DTC's present?**

**Yes** >> Refer to appropriate symptom in the Transmission category. Perform the test for P0944-LOSS OF PRIME first if it is present.

**No** >> Go To 2

## 2. CHECK IF DTC IS CURRENT

With the scan tool, perform the Reverse Gear Clutch test. Follow the instructions on the scan tool.

Increase the throttle angle, TPS degree, to 30°, for no more than a few seconds.

**CAUTION: Do not overheat the transmission.**

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Did the clutch test pass, input speed remain at zero?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK DTC EVENT DATA

The conditions necessary to set this DTC are not currently present.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Does the DTC EVENT DATA show an input speed reading of zero?**

**Yes** >> Go To 8

**No** >> Go To 4

## 4. POSSIBLE INTERNAL TRANSMISSION CAUSES

Remove the Transmission Oil Pan and Valve Body and check the following per the Service Information:

- Clutch or metal debris in the pan
- LR clutch tower seal on the main valve body or cuts and the LR accumulator piston and seals.
- Air check the Reverse and LR Hydraulic Clutch circuits (in the case) for excessive air leakage.

**NOTE: Both Hydraulic Clutch circuits contain a small bleed orifice , a small amount of air leakage is normal. The Reverse hydraulic clutch circuit bleed orifice connects to the OD hydraulic clutch cavity. A small amount of air leakage into the OD hydraulic clutch circuit is considered normal.**

**Were there any problems found?**

**Yes** >> Repair as necessary. If clutch debris is present, remove the transmission and inspect the Reverse and LR clutches, and inspect the Transmission Oil Pump and Main Regulator Valve for damage or sticking in its bore.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CLUTCH TEST FAILURE

**Did the clutch test fail in reverse?**

**Yes** >> Go To 6

**No** >> Test complete.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. CHECK FOR BROKEN REVERSE SUN GEAR WELD

Working through the windows in the bottom of the case, check for a broken Reverse Sun gear weld to the reaction carrier as follows:

1) Hold the Transmission Output Shaft by holding the Transmission Manual Lever in the park position.

2) Rotate the Input Annulus gear and drive shell, (the drum that encloses the two rearmost carriers).

3) Check to see if the reaction carrier (the front-most carrier, whose outer shell is splined to the 2C clutch) is rotating faster than the drive shell is being turned.

**Is the reaction carrier turning faster than the drive shell?**

**Yes** >> Go To 7

**No** >> Replace the reaction carrier per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 7. CHECK REVERSE CARRIER HUB

Remove the Transmission per the Service Information and inspect the weld on the reverse carrier hub.

**Were there any problems found?**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Disassemble and inspect the input clutch assembly. Check the Reverse clutch reaction plate snap ring. Check the OD and Reverse clutch seals, discs, and bleed orifice (in the OD/Reverse clutch piston). Check the Reverse hub and shaft. Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 8. CHECK FOR INTERMITTENT OPERATION

Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test complete.

## P0740-TCC OUT OF RANGE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  During Electronically Modulated Converter Clutch (EMCC) Operation.
- **Set Condition:**
  Transmission must be in EMCC, with input speed greater than 1750 RPM. TCC-LR Solenoid achieves the maximum duty cycle and can not pull engine speed within 60 RPM of input speed. Also when the transmission is in FEMCC and the engine slips TCC less than 100 RPM for 10 seconds. This DTC can take up to five minutes of problem identification before illuminating the MIL.

| Possible Causes |
|---|
| RELATED DTC P0750 PRESENT |
| L/R SOLENOID |
| TCC SWITCH VALVE STUCK |
| TCC REGULATOR VALVE STUCK |
| INPUT SHAFT SEAL RING CUT |
| TORQUE CONVERTER AND/OR INTERNAL TRANSMISSION |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

When in 2nd, 2nd Prime, 3rd, 4th or 5th gear, the torque converter clutch (TCC) can be engaged when certain conditions are met. The TCC piston is electronically modulated by increasing the duty cycle of the LR Solenoid until the torque converter slip difference (difference between engine and transmission input speed) is within 60 RPM. Then the LR solenoid is fully energized (FEMCC – 100% duty cycle). Torque converter slip is monitored in FEMCC to ensure adequate clutch capacity.

## Diagnostic Test

### 1. CHECK FOR RELATED DTC P0750

With the scan tool, read transmission DTCs.

**Is the DTC P0750 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK IF DTC P0740 IS CURRENT

With the scan tool, Read and RECORD ALL Transmission DTC's. After recording DTCs, erase DTCs.

Drive the vehicle until the transmission temperature is at least 43° C or 110° F and the engine temperature at least 49° C or 120° F.

Perform the following steps 3 times.

Drive the vehicle to the speed of at least 88 Kmh or 55 mph.

Allow 4th or 5th gear to engage for at least 10 seconds.

Close the throttle.

Tip back into the throttle until the TPS angle is between 25 and 29 degrees.

**NOTE: If the throttle angle goes over 30 degrees, you must close the throttle and try again.**

**Did the TCC engage during any of the attempts, Engine speed approximately equal to input speed?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorts and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## 4. CHECK THE LR SOLENOID

With the scan tool, check for other transmission DTC's.

**Are the DTCs P1775 and P0841 present also?**

**Yes** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE TORQUE CONVERTER AND/OR INTERNAL TRANSMISSION

Repair internal transmission as necessary.

Check for the following possible causes. Refer to the Service information for the proper repair procedures.

Inspect the Transmission Oil Pump and Valve Body.

If no problems are found, replace the Transmission Solenoid/TRS Assembly.

Check the Torque Converter Switch Valve and the Torque Converter Clutch Control Valve for sticking in the bore.

Check the Teflon seal rings on the input shaft. Note: If one of the seal rings is , the loose piece will often lodge in the TCC switch valve, causing it to stick in it bore.

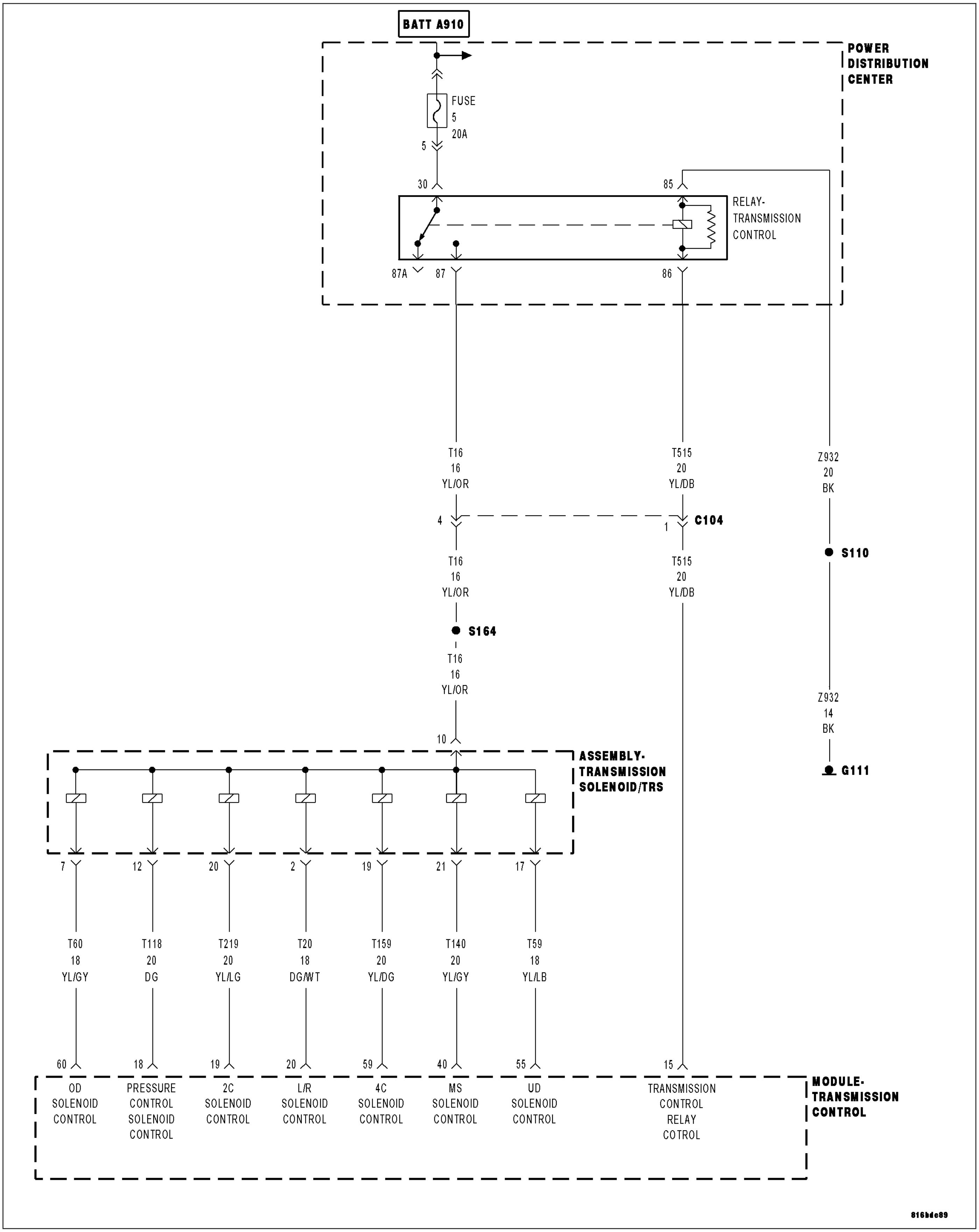
**View repair**

**Repair**

In all cases, replace the Torque Converter. Make sure to check all other possible causes in addition to the Torque Converter.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

# P0750-LR SOLENOID CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.
- **Set Condition:**
  After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

| Possible Causes |
|---|
| RELATED TCM POWER INPUT DTCS PRESENT |
| (T20) LR SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS |
| (T20) LR SOLENOID CONTROL CIRCUIT OPEN |
| (T20) LR SOLENOID CONTROL CIRCUIT SHORT TO GROUND |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

## Diagnostic Test

### 1. DETERMINE IF RELATED TCM POWER INPUT DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any TCM Power Input DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. CHECK IF DTC P0750 IS PRESENT

Ignition on, engine not running.

With the scan tool, erase all Transmission DTC's.

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit.

Ignition on, engine not running.

With the scan tool, actuate the LR Solenoid.

Monitor the LR Solenoid LED on the Transmission Simulator.

**Did the LR Solenoid LED on the Transmission Simulator blink on and off?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the LR Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

**Did the DTC P0750 reset during the actuation test?**

**Yes** >> Go To 4

**No** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

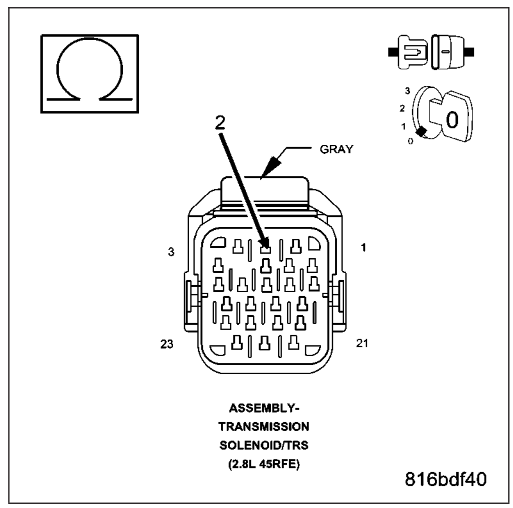
## 4. CHECK THE (T20) LR SOLENOID CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance between the (T20) LR Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T20) LR Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T20) LR Solenoid Control circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE (T20) LR SOLENOID CONTROL CIRCUIT FOR AN OPEN

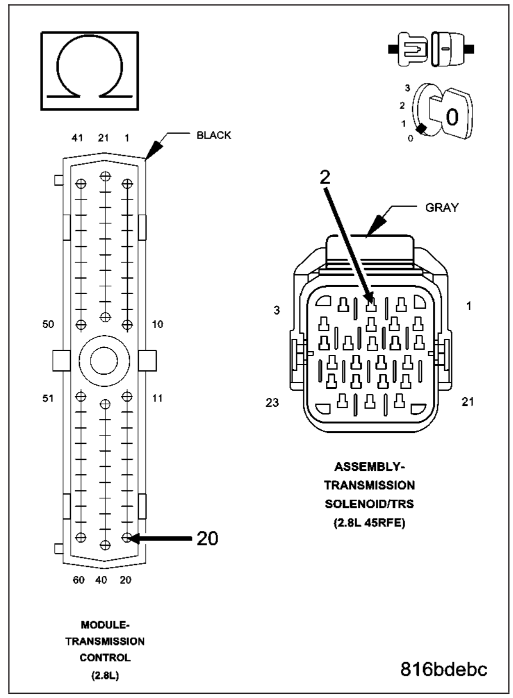
Measure the resistance of the (T20) LR Solenoid Control circuit from the Transmission Solenoid/TRS Assembly harness connector to the TCM harness connector.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T20) LR Solenoid Control circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 6




## 6. CHECK THE (T20) LR SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T20) LR Solenoid Control circuit.

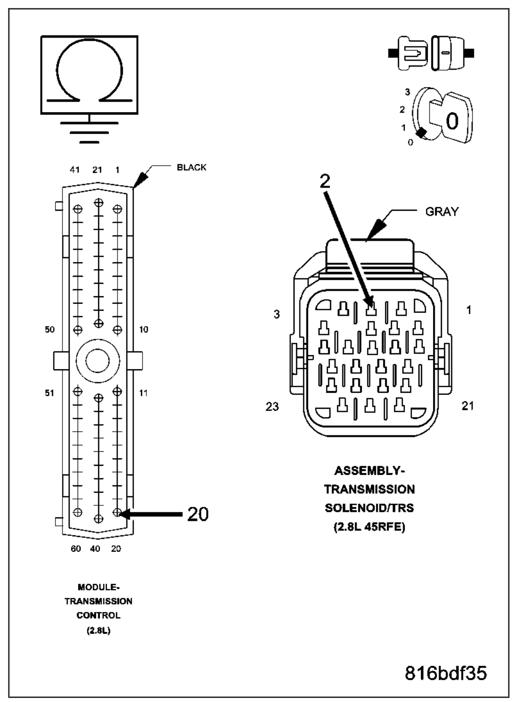
**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T20) LR Solenoid Control circuit for a short to ground.

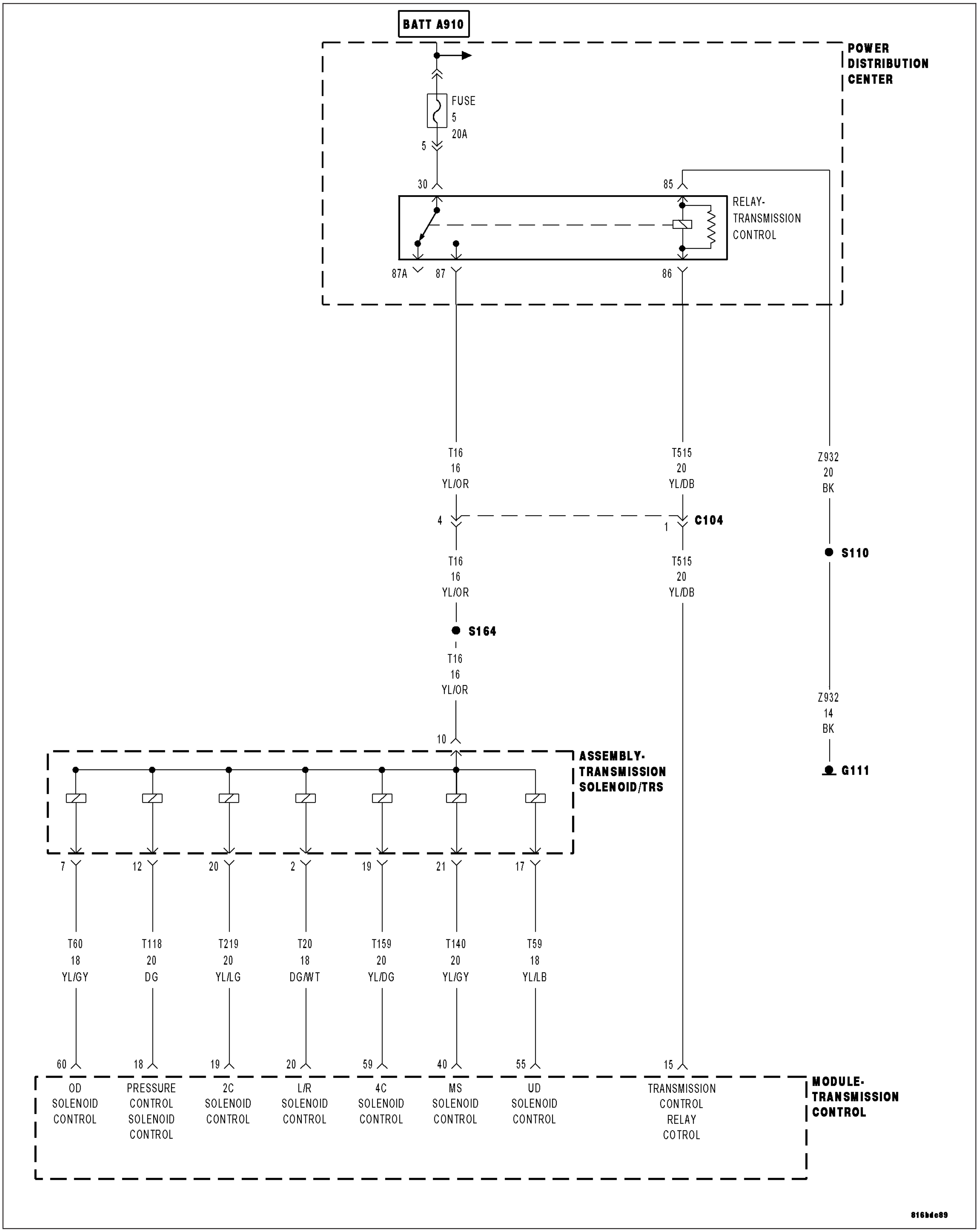
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (PCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the PCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



## P0755-2C SOLENOID CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.
- **Set Condition:**
  After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

| Possible Causes |
|---|
| RELATED TCM POWER INPUT DTCS PRESENT |
| (T219) 2C SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS |
| (T219) 2C SOLENOID CONTROL CIRCUIT OPEN |
| (T219) 2C SOLENOID CONTROL CIRCUIT SHORT TO GROUND |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

## Diagnostic Test

### 1. DETERMINE IF RELATED TCM POWER INPUT DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any TCM Power Input DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. CHECK IF DTC P0755 IS PRESENT

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**
Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the scan tool, actuate the 2C Solenoid.

**Did the 2C Solenoid LED blink on and off on the Transmission Simulator?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the 2C Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

**Did the DTC P0755 reset during the actuation test?**

**Yes** >> Go To 4

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

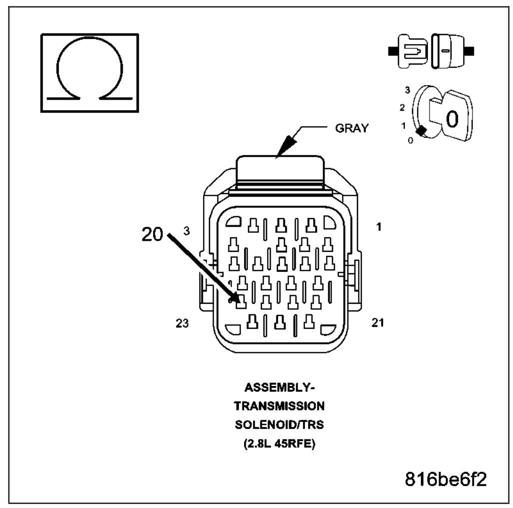
## 4. CHECK THE (T219) 2C SOLENOID CONTROL CIRCUIT SHORT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance between the (T219) 2C Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T219) 2C Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

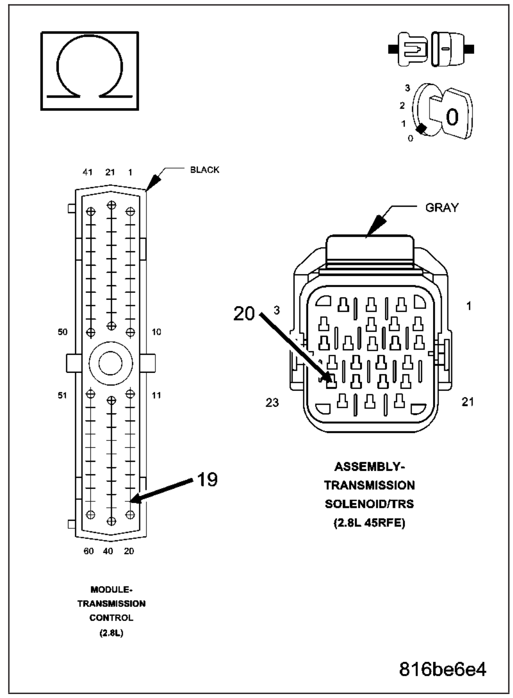
**Yes** >> Repair the (T219) 2C Solenoid Control circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE (T219) 2C SOLENOID CONTROL CIRCUIT FOR AN OPEN

Measure the resistance of the (T219) 2C Solenoid Control circuit between the Transmission Solenoid/TRS Assembly harness connector and the TCM harness connector




**Is the resistance above 5.0 ohms?**

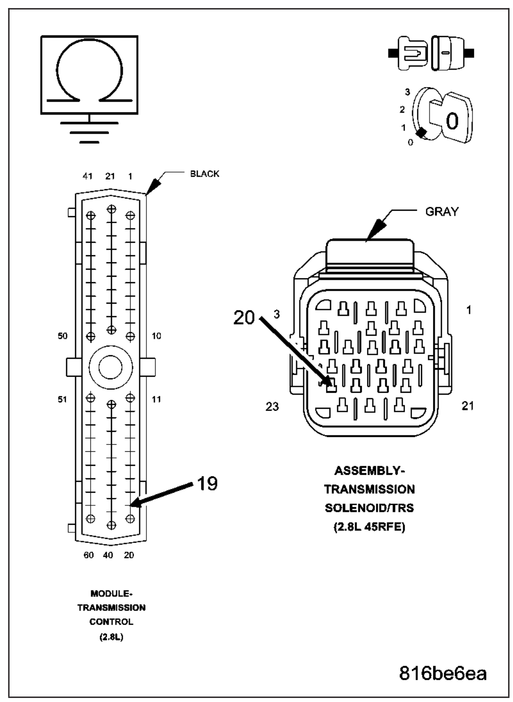
**Yes** >> Repair the (T219) 2C Solenoid Control circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECK THE (T219) 2C SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T219) 2C Solenoid Control circuit.




**Is the resistance below 5.0 ohms?**

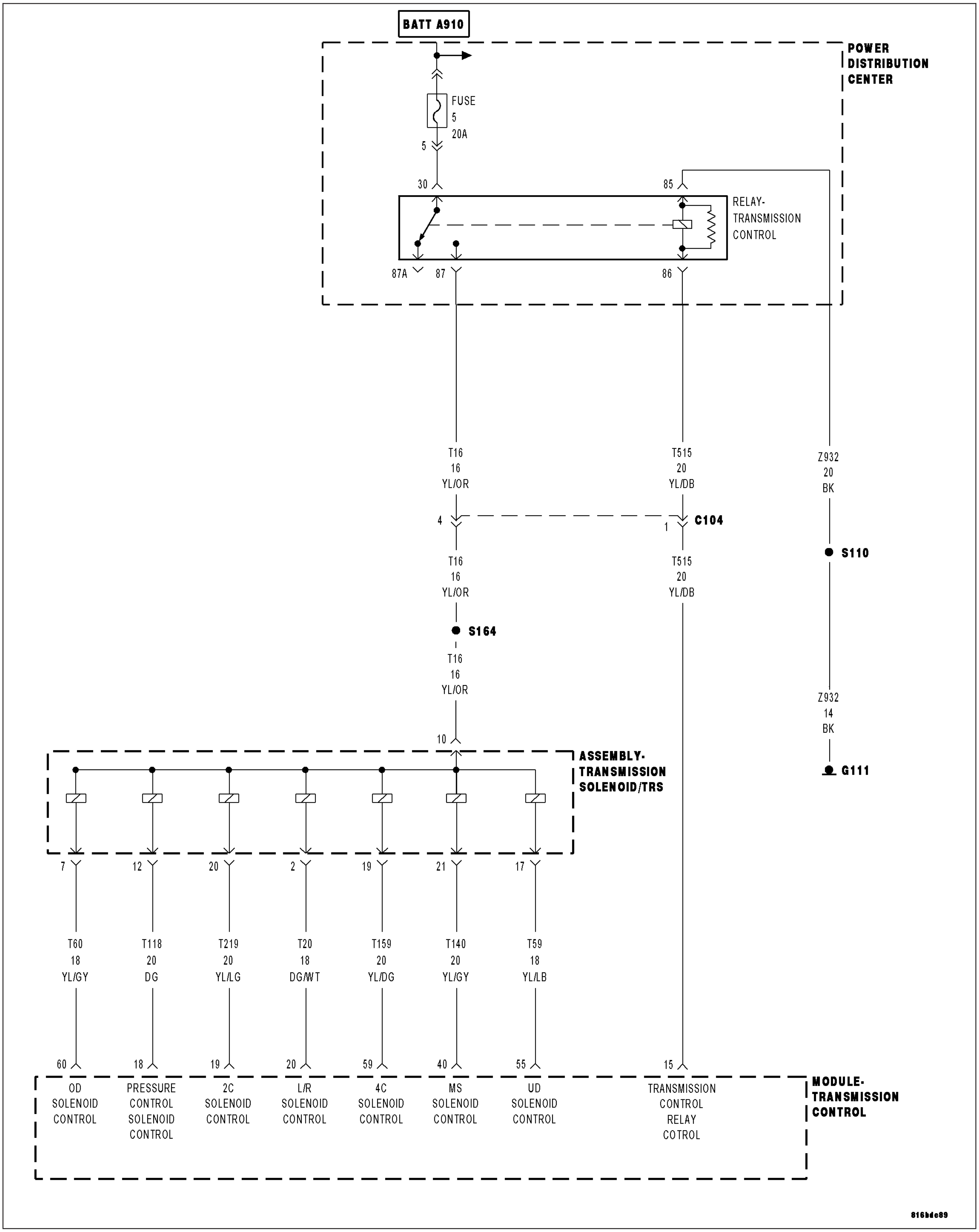
**Yes** >> Repair the (T219) 2C Solenoid Control circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P0760-OD SOLENOID CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.
- **Set Condition:**
  After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

| Possible Causes |
| --- |
| RELATED TCM POWER INPUT DTCS PRESENT |
| (T60) OD SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS |
| (T60) OD SOLENOID CONTROL CIRCUIT OPEN |
| (T60) OD SOLENOID CONTROL CIRCUIT SHORT TO GROUND |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

## Diagnostic Test

### 1. DETERMINE IF RELATED TCM POWER INPUT DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any TCM Power Input DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK IF DTC P0760 IS PRESENT

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the scan tool, actuate the OD Solenoid.

Monitor the OD Solenoid LED on the Transmission Simulator.

**Did the OD Solenoid LED on the Transmission Simulator blink on and off?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the OD Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

**Did the DTC P0760 reset during the actuation test?**

**Yes** >> Go To 4

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

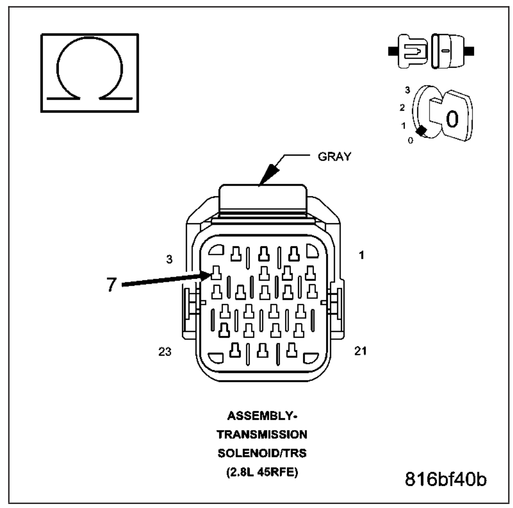
## 4. CHECK THE (T60) OD SOLENOID CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance between the (T60) OD Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T60) OD Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T60) OD Solenoid Control circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE (T60) OD SOLENOID CONTROL CIRCUIT FOR AN OPEN

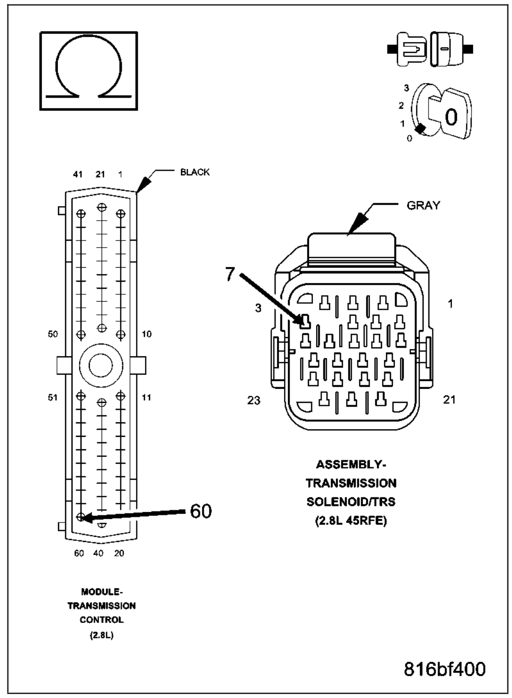
Measure the resistance of the (T60) OD Solenoid Control circuit between the Transmission Solenoid/TRS Assembly harness connector and the TCM harness connector.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T60) OD Solenoid Control circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 6




## 6. CHECK THE (T60) OD SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T60) OD Solenoid Control circuit.

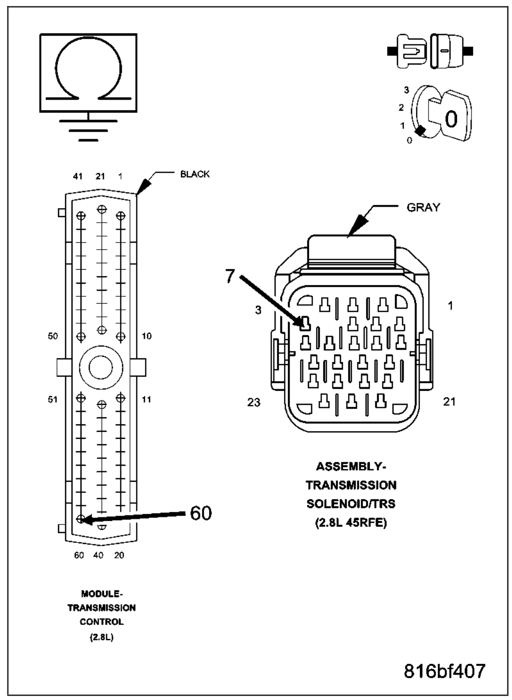
**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T60) OD Solenoid Control circuit for a short to ground.

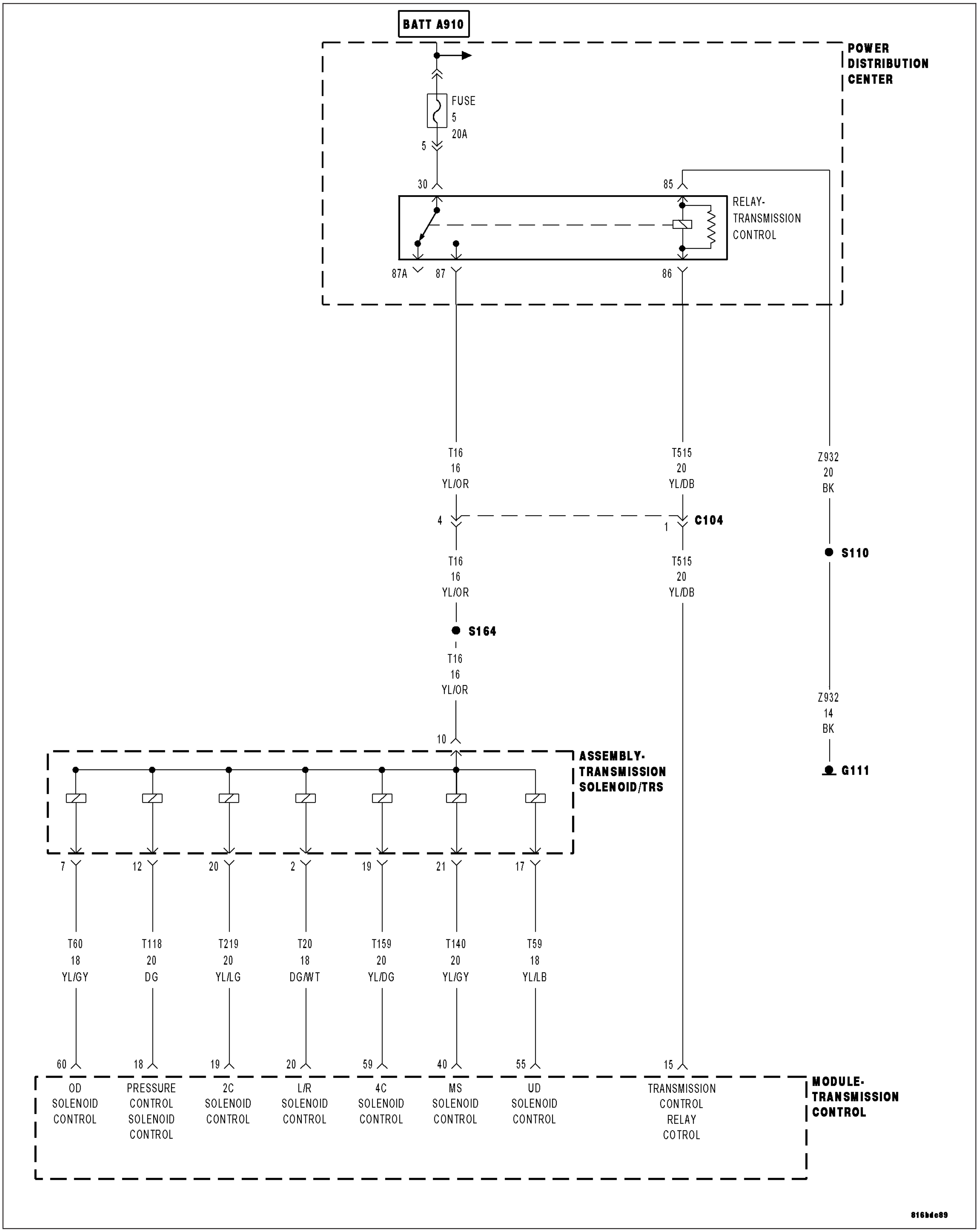
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)



## P0765-UD SOLENOID CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.
- **Set Condition:**
  After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

| Possible Causes |
|---|
| RELATED TCM POWER INPUT DTCS PRESENT |
| (T59) UD SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS |
| (T59) UD SOLENOID CONTROL CIRCUIT OPEN |
| (T59) UD SOLENOID CONTROL CIRCUIT SHORT TO GROUND |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

## Diagnostic Test

### 1. DETERMINE IF RELATED TCM POWER INPUT DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any TCM Power Input DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. CHECK IF DTC P0765 IS PRESENT

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the scan tool, actuate the UD Solenoid.

Monitor the UD Solenoid LED on the Transmission Simulator.

**Did the UD Solenoid LED on the Transmission Simulator blink on and off?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the UD Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

**Did the DTC P0765 reset during the actuation test?**

**Yes** >> Go To 4

**No** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

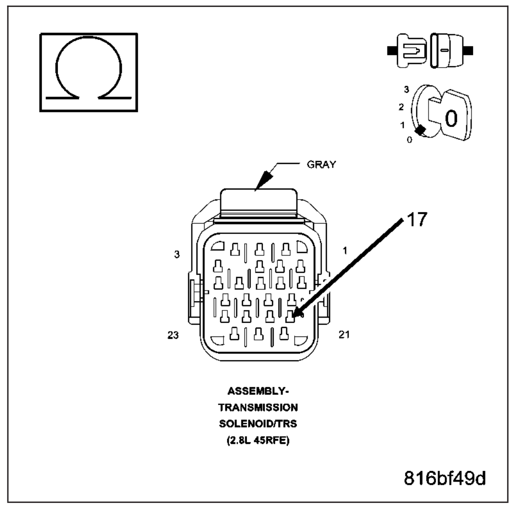
## 4. CHECK THE (T59) UD SOLENOID CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance between the (T59) UD Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T59) UD Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

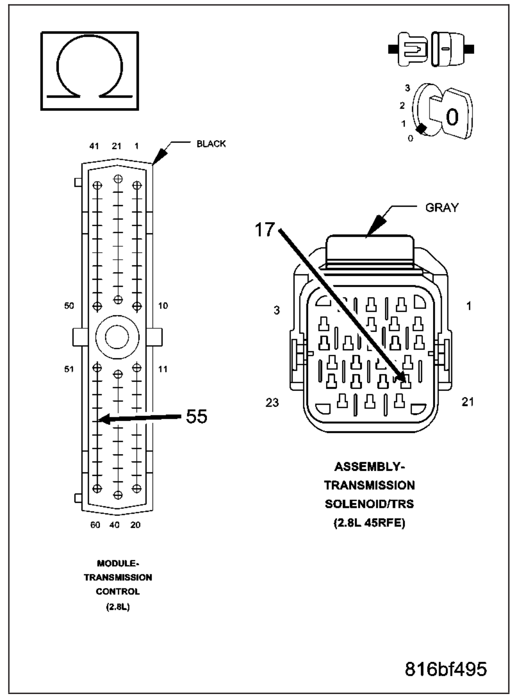
**Yes** >> Repair the (T59) UD Solenoid Control circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE (T59) UD SOLENOID CONTROL CIRCUIT FOR AN OPEN

Measure the resistance of the (T59) UD Solenoid Control circuit between the Transmission Solenoid/TRS Assembly harness connector and the TCM harness connector.




**Is the resistance above 5.0 ohms?**

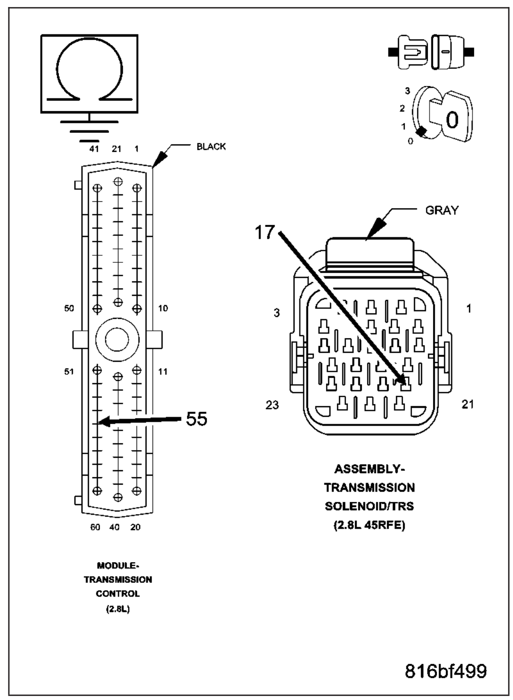
**Yes** >> Repair the (T59) UD Solenoid Control circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECK THE (T59) UD SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T59) UD Solenoid Control circuit.




**Is the resistance below 5.0 ohms?**

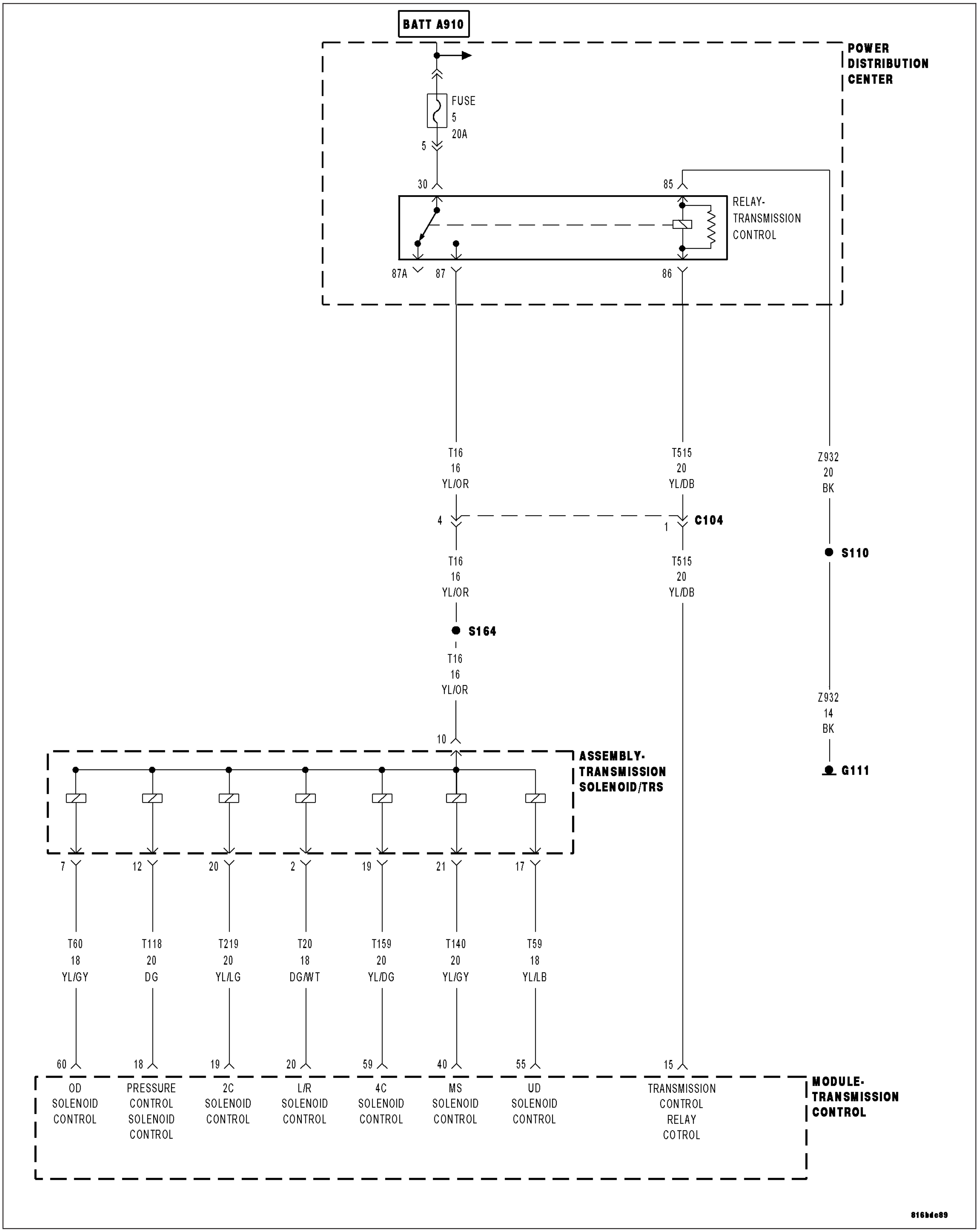
**Yes** >> Repair the (T59) UD Solenoid Control circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P0770-4C SOLENOID CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.
- **Set Condition:**
  After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

| Possible Causes |
|---|
| RELATED TCM POWER INPUT DTCS PRESENT |
| (T48) 4C SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS |
| (T48) 4C SOLENOID CONTROL CIRCUIT OPEN |
| (T48) 4C SOLENOID CONTROL CIRCUIT SHORT TO GROUND |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

## Diagnostic Test

### 1. CHECK FOR RELATED TRANSMISSION RELAY DTCS

With the scan tool, check for other transmission DTCs.

**Are there any Transmission Control Relay DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK IF DTC P0770 IS PRESENT

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the scan tool, actuate the 4C Solenoid.

Monitor the 4C Solenoid LED on the Transmission Simulator.

**Did the 4C Solenoid LED on the Transmission Simulator blink on and off?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the 4C Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

**Did the DTC P0770 reset during the actuation test?**

**Yes** >> Go To 4

**No** >> Replace Transmission Solenoid/TRS Assembly per the Service Information. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/TRANS SOLENOID/TRS ASSY - REMOVAL)

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

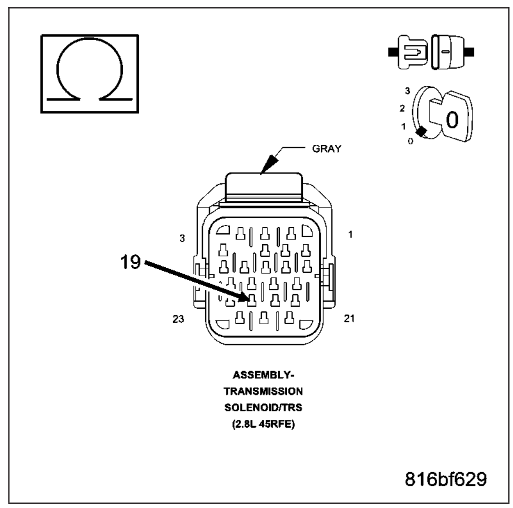
## 4. CHECK THE (T48) 4C SOLENOID CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance between the (T48) 4C Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T48) 4C Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

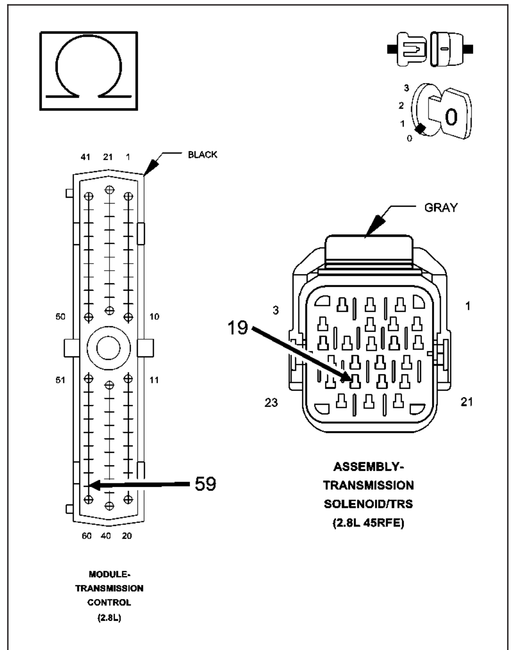
**Yes** >> Repair the (T48) 4C Solenoid Control circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK THE (T48) 4C SOLENOID CONTROL CIRCUIT FOR AN OPEN

Measure the resistance of the (T48) 4C Solenoid Control circuit between the Transmission Solenoid/TRS Assembly harness connector and the TCM harness connector.




816bf587

**Is the resistance above 5.0 ohms?**

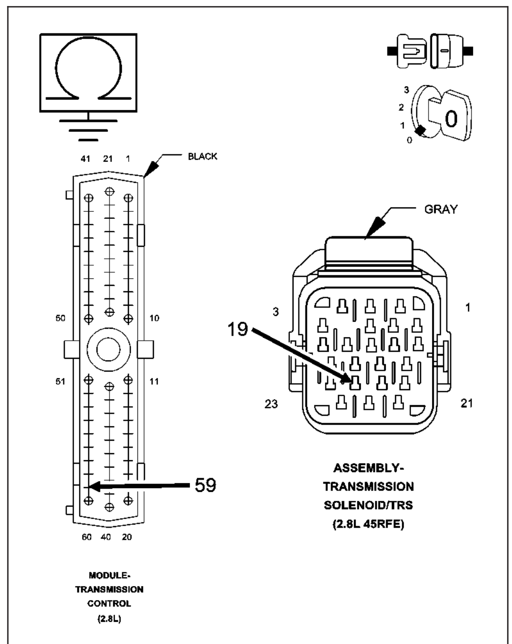
**Yes** >> Repair the (T48) 4C Solenoid Control circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. CHECK THE (T48) 4C SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T48) 4C Solenoid Control circuit.




816bf6c1

**Is the resistance below 5.0 ohms?**

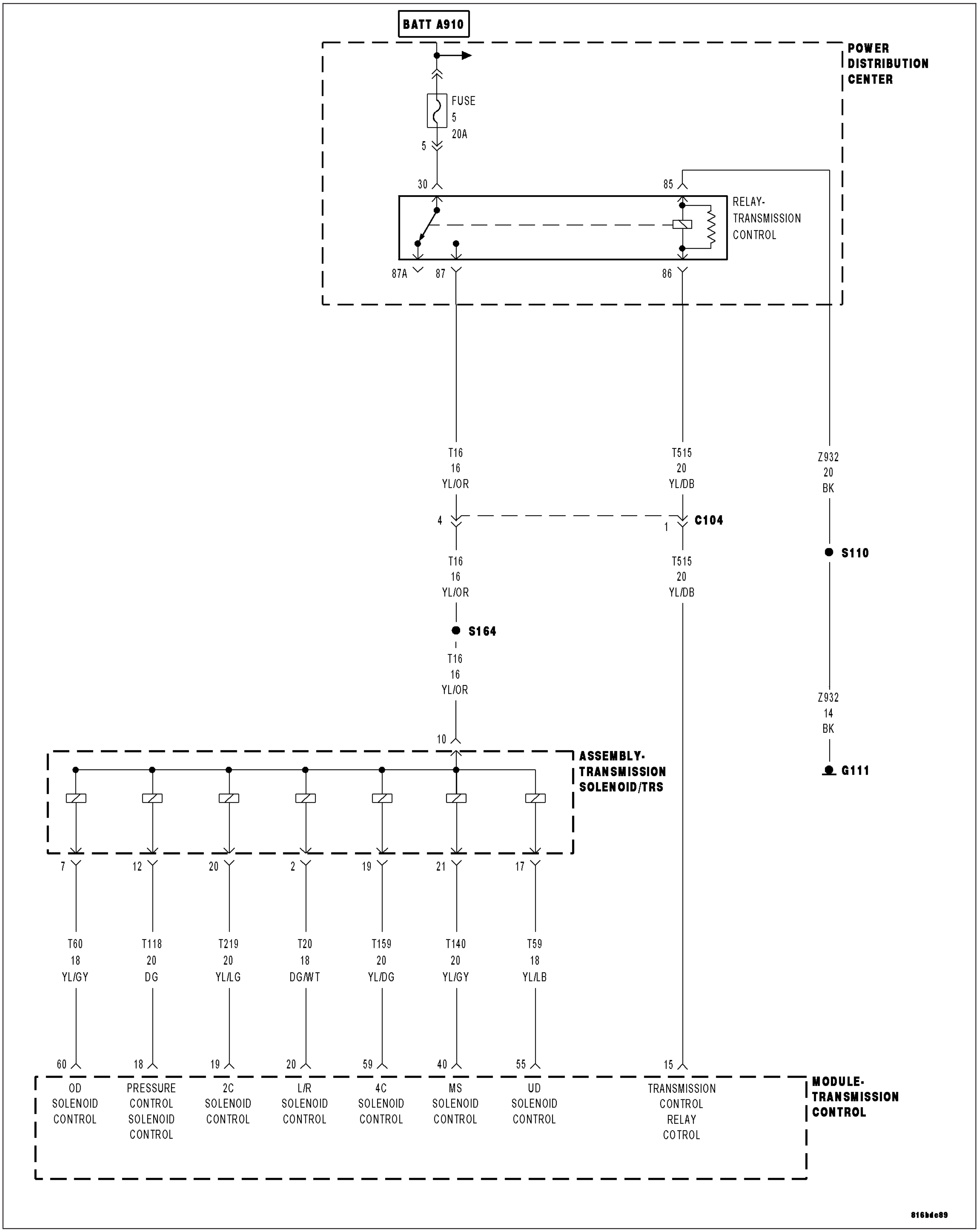
**Yes** >> Repair the (T48) 4C Solenoid Control circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P0841-LR PRESSURE SWITCH RATIONALITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The DTC will set if the LR Pressure Switch reads open or closed at the wrong time in a given gear.

| Possible Causes |
|---|
| LOSS OF PRIME AND/OR TCM POWER INPUT DTCS PRESENT |
| LOW FLUID LEVEL |
| LOW LINE PRESSURE |
| REVERSE CARRIER SNAP RING DISLODGED |
| CRACKED OR MIS-INSTALLED PRIMARY OIL FILTER OR FILTER SEAL |
| STICKING MAIN REGULATOR VALVE IN PUMP VALVE BODY |
| NO. 1 CHECK BALL CUT OR DAMAGED |
| WIRING AND CONNECTORS |
| (T50) LR PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T50) LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| (T50) LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the LR, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

| GEAR | L/R | 2C | 4C | UD | OD |
|---|---|---|---|---|---|
| **REVERSE** | OPEN | OPEN | OPEN | OPEN | OPEN |
| **P/N** | CLOSED** | OPEN | OPEN | OPEN | OPEN |
| **1ST** | CLOSED* | OPEN | OPEN | CLOSED | OPEN |
| **2ND** | OPEN | CLOSED | OPEN | CLOSED | OPEN |
| **2ND PRIME** | OPEN | OPEN | CLOSED | CLOSED | OPEN |
| **3RD** | OPEN | OPEN | OPEN | CLOSED | CLOSED |
| **4TH** | OPEN | OPEN | CLOSED | OPEN | CLOSED |
| **5TH** | OPEN | CLOSED | OPEN | OPEN | CLOSED |

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.

**May be open when rolling in Neutral or at low oil temperatures.

## Diagnostic Test

## 1. CHECK FOR OTHER DTCS

Ignition on, engine not running.

With the scan tool, check for other transmission DTCs.

**Are there any Loss of Prime and/or TCM Power Input DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. If the DTC P0944 is present, perform its respective test first. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

## 2. CHECK IF DTC P0841 IS PRESENT

With the scan tool, check the DTC EVENT DATA for P0841.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA show the DTC P0841?**

**Yes** >> Go To 3

**No** >> Refer to the Symptom Category and perform diagnostics for the DTC reported in the DTC EVENT DATA.

## 3. CHECK IF DTC SET IN REVERSE

**Does the DTC EVENT DATA show the DTC P0841 set while in Reverse?**

**Yes** >> Go To 10

**No** >> Go To 4

## 4. CHECK IF THE LR PRESSURE SWITCH WAS CLOSED

**Does the DTC EVENT DATA show the LR Pressure Switch reading CLOSED when the DTC P0841 was set?**

**Yes** >> Go To 5

**No** >> Go To 14

## 5. CHECK THE TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

Turn the Pressure Switch selector to LR on the Transmission Simulator.

With the scan tool, monitor the LR Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

**Did the LR Pressure Switch state change from open to closed while pressing the Pressure Switch Test button on the Transmission Simulator?**

**Yes** >> Go To 6

**No** >> Go To 10

## 6. CHECK WIRING AND CONNECTORS

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CHECK IF DTC SET IN FIRST GEAR

With the DTC EVENT DATA recorded earlier, check what gear the transmission was in when the DTC P0841 was set.

**Does the DTC EVENT DATA show the Present Gear as first gear when the DTC P0841 was set ?**

**Yes** >> Go To 8

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 8. CHECK IF THE NO. 1 CHECK BALL IS CUT OR DAMAGED

Turn the ignition off to the lock position.

Remove the Transmission Valve Body per the Service Information.

Check the No. 1 Check Ball for any possible cuts or damage.

**Is the No. 1 Check Ball cut or damaged?**

**Yes** >> Replace the No. 1 Check Ball and check for clutch debris in the transmission oil pan. If there is excessive debris, perform internal repairs to the LR Clutch assembly. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. CHECK IF THE REVERSE CARRIER SNAP RING IS DISLODGED

Looking through the windows in the bottom of the case, check whether the snap ring at the front of the Reverse (center) Carrier has dislodged.

**NOTE: It may be necessary to pry the Input Annulus Gear Shell rearward to check this snap ring.**

**Is the Reverse Carrier Snap Ring dislodged?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

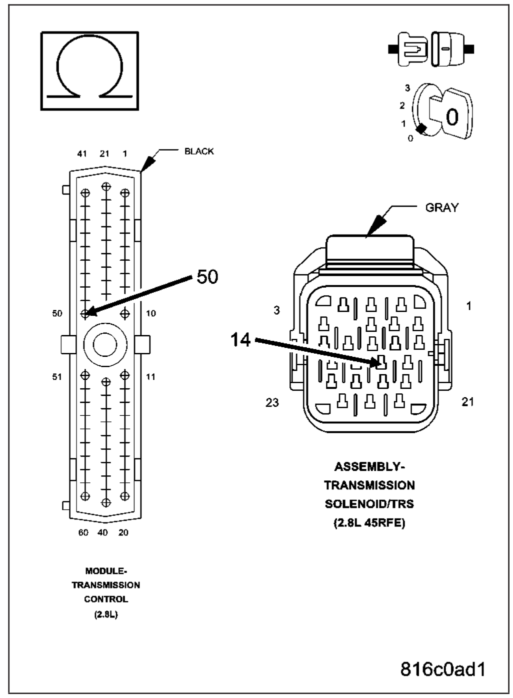
## 10. CHECK THE (T50) LR PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333 if connected in a previous step or disconnect the Transmission Solenoid/TRS Assembly harness connector.

Disconnect the TCM harness connector.

Measure the resistance of the (T50) LR Pressure Switch Sense circuit from the Solenoid/TRS Assembly harness connector and the TCM harness connector.




**Is the resistance above 5.0 ohms?**

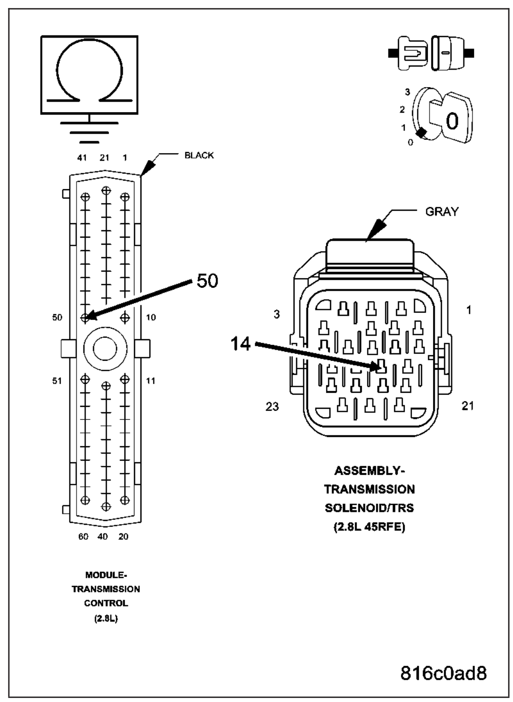
**Yes** >> Repair the (T50) LR Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 11

## 11. CHECK THE (T50) LR PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T50) LR Pressure Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T50) LR Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 12

## 12. CHECK THE TCM POWERS AND GROUNDS

Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. CHECK IF THE DTC RESETS

With the scan tool, clear the DTC and road test the vehicle.

Try to duplicate the conditions in which the DTC originally set using the DTC EVENT DATA recorded earlier.

**Did the DTC P0841 reset?**

**Yes** >> Replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 17

## 14. CHECK FOR LOW LINE PRESSURE

In the DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

**Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?**

**Yes** >> Repair as necessary to correct low line pressure. Check for low fluid level. Check the Primary Oil Filter seal for a split, crack, or improperly installed. Refer to the Service Information for the proper installation procedure. If the fluid level and Primary Oil Filter are OK, check the Main Regulator Valve in the Oil Pump per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 15

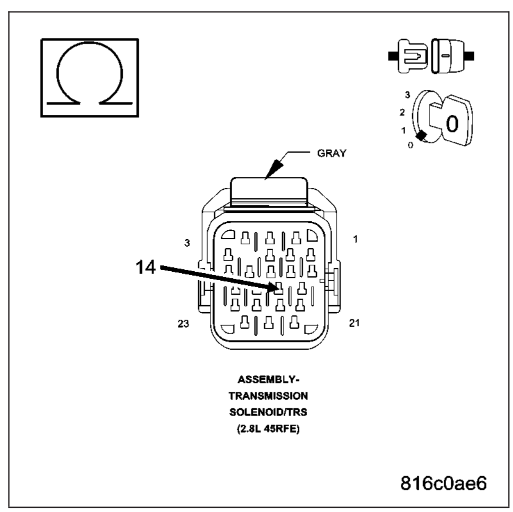
## 15. CHECK THE (T50) LR PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Disconnect the TCM harness connector.

Measure the resistance between the (T50) LR Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T50) LR Pressure Switch Sense circuit and all other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T50) LR Pressure Switch Sense circuit for a short to other circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. CHECK IF DTC RESETS

With the scan tool, clear the DTC and road test the vehicle.

Try to duplicate the conditions in which the DTC originally set using the DTC EVENT DATA recorded earlier.

**Did the DTC P0841 reset?**

**Yes** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 17

## 17. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

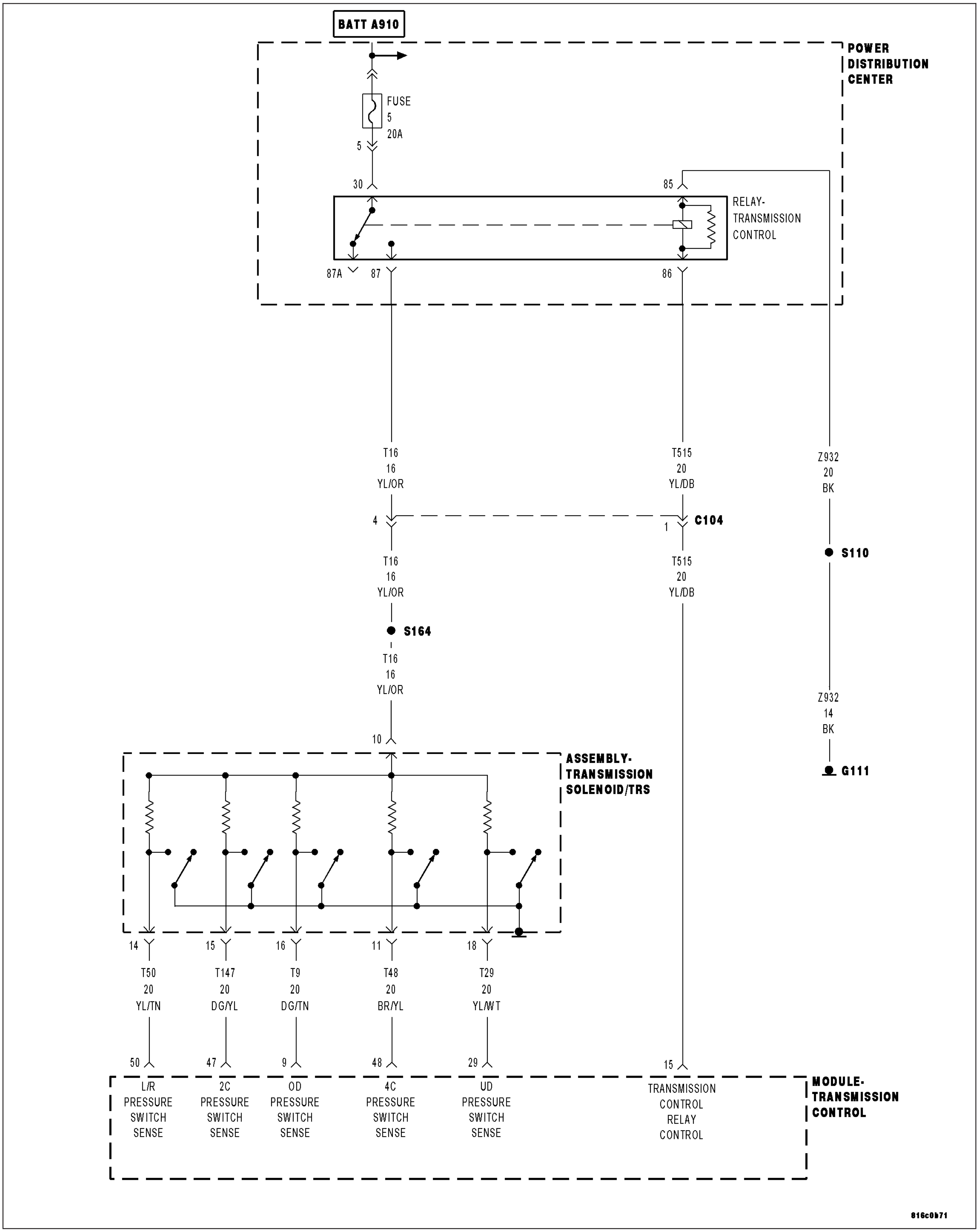
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0845-2C HYDRAULIC PRESSURE TEST




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed above 1000 RPM, the TCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

| Possible Causes |
|---|
| LINE PRESSURE SENSOR |
| TRANSMISSION FLUID CONTAMINATION |
| RELATED TCM POWER INPUT DTCS PRESENT |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| EXCESSIVE DEBRIS IN OIL PAN |
| POOR LINE PRESSURE SENSOR CONNECTION |
| (T147) 2C PRESSURE SWITCH SENSE CIRCUIT OPEN |
| TRANSMISSION CONTROL RELAY DTCS PRESENT |
| (T147) 2C PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T39) 5-VOLT SUPPLY CIRCUIT OPEN |
| (T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| (T39) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND |
| (T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| INTERNAL TRANSMISSION |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Control System tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The Transmission Control System verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the DTC will set, the MIL will illuminate and the transmission system will default to the orderly Shutdown routine.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs

**Are there any Loss of Prime and/or TCM Power Input DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. If the DTC, P0944-LOSS OF PRIME is present, perform its respective test first. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

## 2. CHECK IF DTC P0755 IS PRESENT

With the scan tool, check Transmission DTCs.

**Is the DTC P0755 also present?**

**Yes** >>

Refer to the Transmission category and perform diagnostics for P0755-2C SOLENOID CIRCUIT. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

**No** >> Go To 3

## 3. CHECK IF DTCS P0732, P0735 AND/OR P0846 ARE PRESENT

With the scan tool, check for other transmission DTC's

**Are the DTCs P0732, P0735, and/or P0846 present also?**

**Yes** >> Go To 12

**No** >> Go To 4

## 4. CHECK IF DTC P0845 IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0845.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 5

**No** >> Go To 17

## 5. CHECK IF THE LINE PRESSURE STAYS THE SAME

Start the engine.

Warm the transmission to 82° C or 180° F.

Firmly apply the brakes.

With the scan tool, monitor the Line Pressure during the following step.

Move the shift lever to each gear position, pausing momentarily in each position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range.

**Did the line pressure remain at a steady value between 585 and 655 kPa or 85 and 95 psi in each position?**

**Yes** >> Go To 6

**No** >> Go To 10

## 6. CHECK THE LINE PRESSURE SENSOR CONNECTION

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

**Did the Line Pressure reading on the scan tool change to about 207 kPa or 30 psi when the connector was pushed inward?**

**Yes** >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CHECK THE LINE PRESSURE SENSOR OPERATION

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while turning the Pressure Switch selector to each of the 3 line pressure positions on the Transmission Simulator.

**NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.**

**Did the scan tool Line Pressure readings match the specified readings on the Transmission Simulator and remain steady in all three positions?**

**Yes** >> Replace the Line Pressure Sensor per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 8

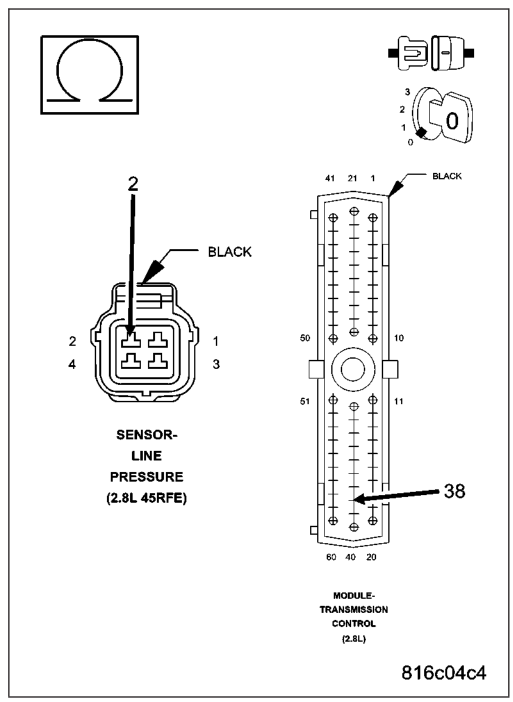
## 8. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect Transmission Simulator.

Disconnect the TCM harness connector.

Measure the resistance of the (T39) 5-volt Supply circuit from the Line Pressure Sensor harness connector to the appropriate terminal of the TCM harness connector.




**Is the resistance above 5.0 ohms?**

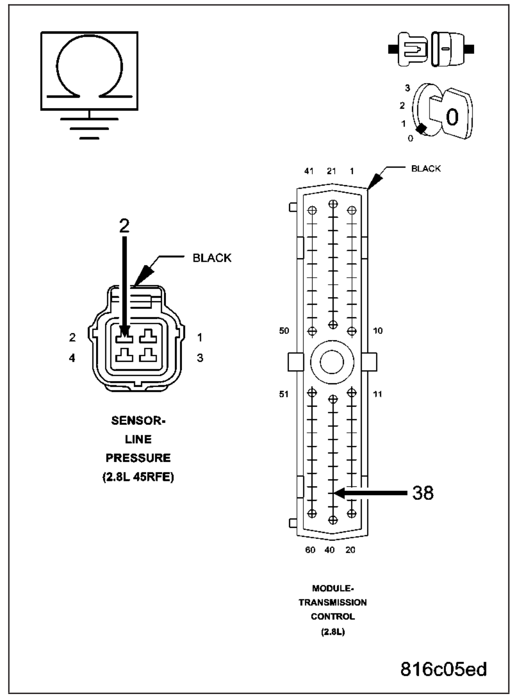
**Yes** >> Repair the (T39) 5-volt Supply circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T39) 5-volt Supply circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T39) 5-volt Supply circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 10. COMPARE SCAN TOOL TO THE PRESSURE GAUGE

Turn the ignition off to the lock position.

Connect the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP. Refer to the Service Information for proper installation procedure.

**CAUTION: Apply parking brake.**

Start the engine.

In the following steps, compare the scan tool Line Pressure to the Pressure Gauge readings in each gear.

**CAUTION: Do not overheat transmission.**

With the gear selector in park, raise the RPM to 1500, and compare line pressure readings.

Firmly apply the brakes, move the gear selector into reverse, raise the RPM to 1500, and compare the line pressure readings.

Firmly apply the brakes, move the gear selector into drive, raise the RPM to 1500, and compare the line pressure readings.

**Does the scan tool Line Pressure readings match the Pressure Gauge readings ± 10 psi?**

**Yes** >> Go To 11

**No** >> Replace the Line Pressure Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 11. CHECK WIRING AND CONNECTORS

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Remove the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP.

Install the Transmission Simulator, Miller tool #8333.

On the Transmission Simulator, turn the Pressure Switch selector switch to 2C.

Ignition on, engine not running.

With the scan tool, monitor the 2C Pressure Switch state while pressing and holding the Pressure Switch test button and wiggling the wire harness and connectors that pertain to the 2C Pressure Switch.

**Did the 2C Pressure Switch state change to closed and remain closed while wiggling the wires?**

**Yes** >> Go To 12

**No** >> Go To 14

## 12. CHECK FOR EXCESSIVE DEBRIS

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Remove and inspect the Transmission Oil Pan per the Service Information.

**Does the Transmission Oil Pan contain excessive debris or contamination?**

**Yes** >> Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. CHECK THE 2C HYDRAULIC CLUTCH CIRCUIT

Remove the Valve Body and air check the 2C clutch hydraulic circuit, in the 2C/4C clutch retainer, for leakage per the Service Information.

**NOTE: The 2C hydraulic clutch circuit contains a small bleed orifice, a small amount of air leakage is normal.**

**Was there excessive air leakage noticed during the air check?**

**Yes** >> Repair as necessary. Check the 2C clutch piston, piston seals and bleed orifice assembly.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Disassemble and inspect the Valve Body and repair as necessary. Inspect the 2C Accumulator piston and seals. Check for an extra check ball downstream from the #7 check ball pocket and repair as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

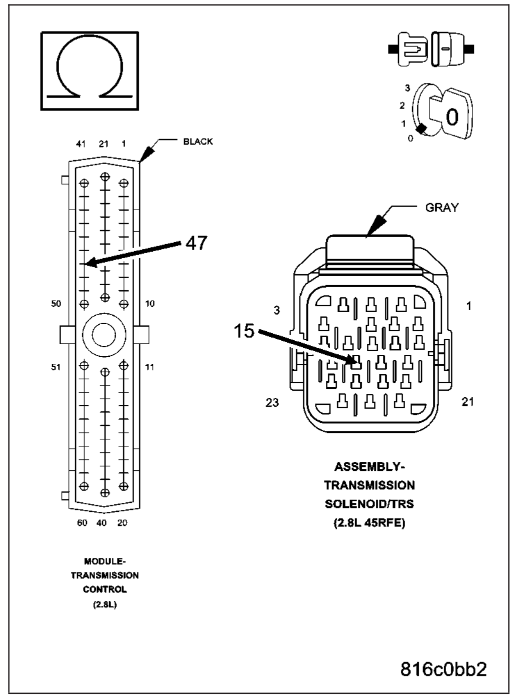
## 14. CHECK THE (T147) 2C PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance of the (T147) 2C Pressure Switch Sense circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of the TCM harness connector.




**Is the resistance above 5.0 ohms?**

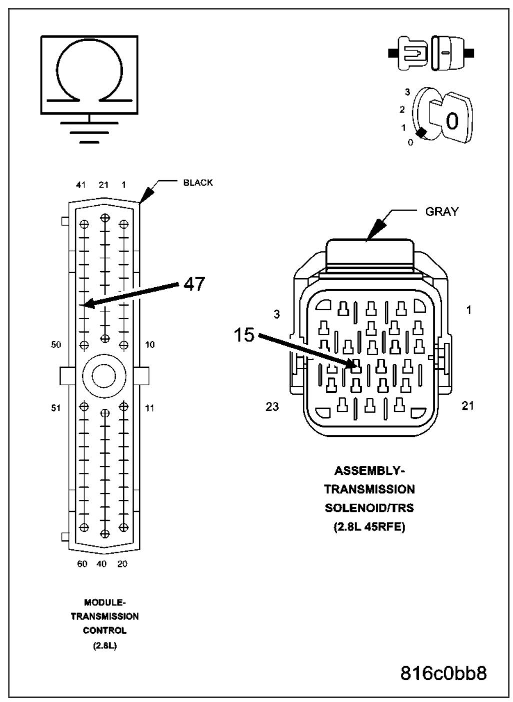
**Yes** >> Repair the (T147) 2C Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANS-AXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 15

## 15. CHECK THE (T147) 2C PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T147) 2C Pressure Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T147) 2C Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANS-AXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 16

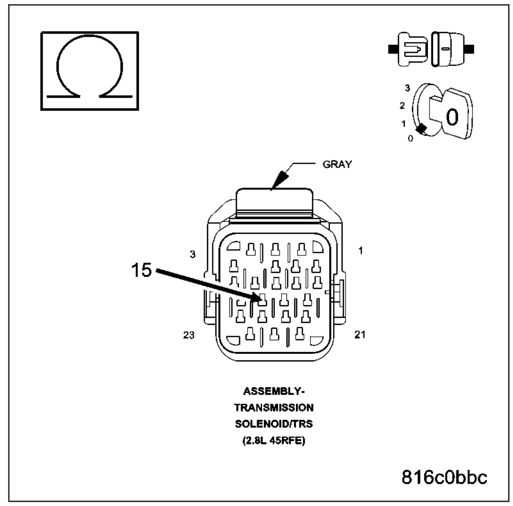
## 16. CHECK THE (T147) 2C PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Disconnect TCM harness connector.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

**NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.**

Measure the resistance between the (T147) 2C Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T147) 2C Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T147) 2C Pressure Switch Sense circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 17. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

If the DTC EVENT DATA shows the DTC P0845 set while the Line Pressure was significantly below the Desired Line Pressure reading, check for causes of low line pressure (low fluid level, broken or mis-installed primary oil filter or filter seal, sticking Main Regulator Valve in the Pump Valve Body etc.). If the data shows the DTC set while the Line Pressure reading was significantly higher than the Desired Line Pressure, check the Line Pressure Sensor and related wiring.

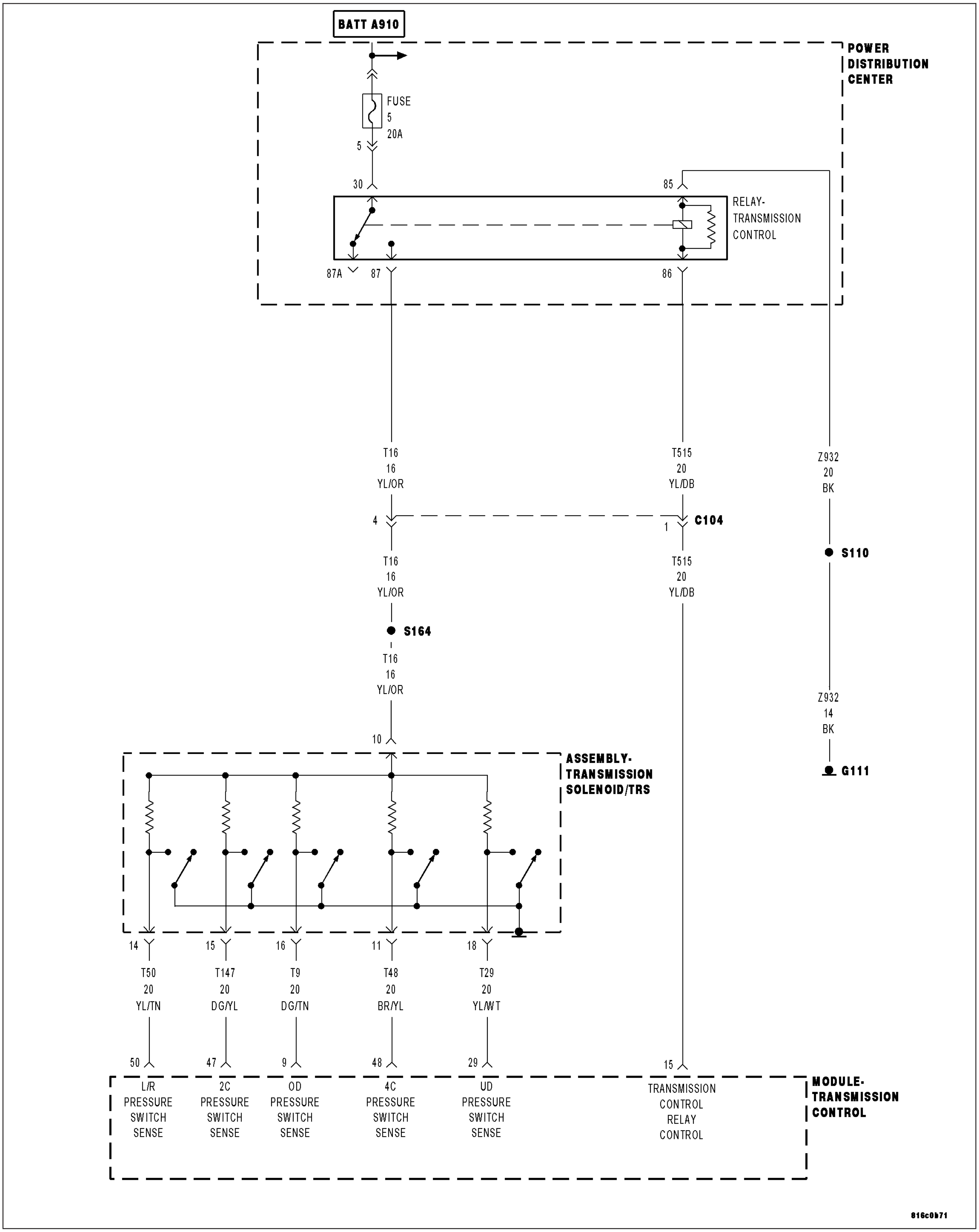
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0846-2C PRESSURE SWITCH RATIONALITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  The DTC is set if the 2C Pressure Switch reads open or closed at the wrong time in a given gear.

| Possible Causes |
| --- |
| RELATED TCM POWER INPUT DTCS PRESENT |
| (T147) 2C PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| (T147) 2C PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS |
| EXCESSIVE FLUID LEAKAGE IN 2C CLUTCH CIRCUIT |
| NO. 5 AND/OR NO. 7 CHECK BALL CUT OR DAMAGED |
| EXTRA CHECK BALL DOWNSTREAM OF THE NO. 7 CHECK BALL SOCKET |
| LOW LINE PRESSURE |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |
| WIRING AND CONNECTORS |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the LR, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

| GEAR | L/R | 2C | 4C | UD | OD |
| --- | --- | --- | --- | --- | --- |
| **REVERSE** | OPEN | OPEN | OPEN | OPEN | OPEN |
| **P/N** | CLOSED** | OPEN | OPEN | OPEN | OPEN |
| **1ST** | CLOSED* | OPEN | OPEN | CLOSED | OPEN |
| **2ND** | OPEN | CLOSED | OPEN | CLOSED | OPEN |
| **2ND PRIME** | OPEN | OPEN | CLOSED | CLOSED | OPEN |
| **3RD** | OPEN | OPEN | OPEN | CLOSED | CLOSED |
| **4TH** | OPEN | OPEN | CLOSED | OPEN | CLOSED |
| **5TH** | OPEN | CLOSED | OPEN | OPEN | CLOSED |

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.

**May be open when rolling in Neutral or at low oil temperatures.

## Diagnostic Test

### 1. DETERMINE IF RELATED TCM POWER INPUT DTCS ARE PRESENT

With the scan tool, check for other transmission DTCs.

**Are there any TCM Power Input DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

## 2. CHECK IF THE DTC IS CURRENT

With the scan tool, check the DTC EVENT DATA.

**Does the DTC EVENT DATA show data for DTC P0846?**

**Yes** >> Go To 3

**No** >> Refer to the Transmission category and perform the appropriate symptom shown in the DTC EVENT DATA.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 3. CHECK FOR MULTIPLE DTCS

With the scan tool, check for other transmission DTC's.

**Are there two or more related pressure switch rationality DTCs present in addition to P0846?**

**Yes** >> Go To 4

**No** >> Go To 7

## 4. CHECK IF ALL PRESSURE SWITCHES READ CLOSED

With the scan tool, check the DTC EVENT DATA for P0846.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Do all the pressure switches read CLOSED in the DTC EVENT DATA for P0846?**

**Yes** >> Refer to Transmission category and perform diagnostics for P0888.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK IF ALL PRESSURE SWITCHES READ OPEN

In the DTC EVENT DATA recorded earlier, read the state of all pressure switches.

**Do all the pressure switches read OPEN?**

**Yes** >> Go To 6

**No** >> Go To 7

## 6. CHECK FOR LOW LINE PRESSURE

In the DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

**Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?**

**Yes** >> Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 7. CHECK IF THE DTC SET IN PARK REVERSE OR NEUTRAL

With the scan tool, check the DTC EVENT DATA for P0846.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA show the DTC P0846 set in Park, Reverse, or Neutral?**

**Yes** >> Go To 12

**No** >> Go To 8

## 8. CHECK IF THE 2C PRESSURE SWITCH READS CLOSED

With the scan tool, check the DTC EVENT DATA for P0846.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA show the 2C Pressure Switch reading CLOSED?**

**Yes** >> Go To 10

**No** >> Go To 9

## 9. COMPARE THE LINE PRESSURE TO THE DESIRED LINE PRESSURE

In the DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

**Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?**

**Yes** >> Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 15

## 10. CHECK THE TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to the 2C position.

With the scan tool, monitor the 2C Pressure Switch while pressing the Pressure Switch test button on the Transmission Simulator.

**Did the state of the 2C Pressure Switch change while pressing the Pressure Switch Test button?**

**Yes** >> Go To 11

**No** >> Go To 12

## 11. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

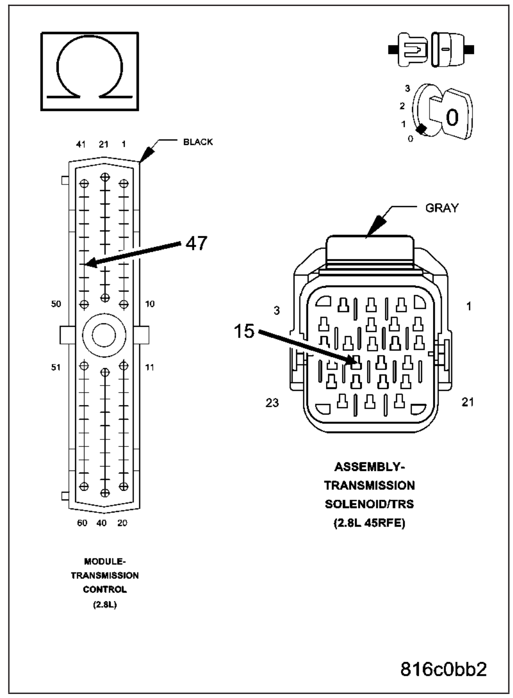
## 12. CHECK THE (T147) 2C PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance of the (T147) 2C Pressure Switch Sense circuit between the Transmission Solenoid/TRS Assembly harness connector and the TCM harness connector.




**Is the resistance above 5.0 ohms?**

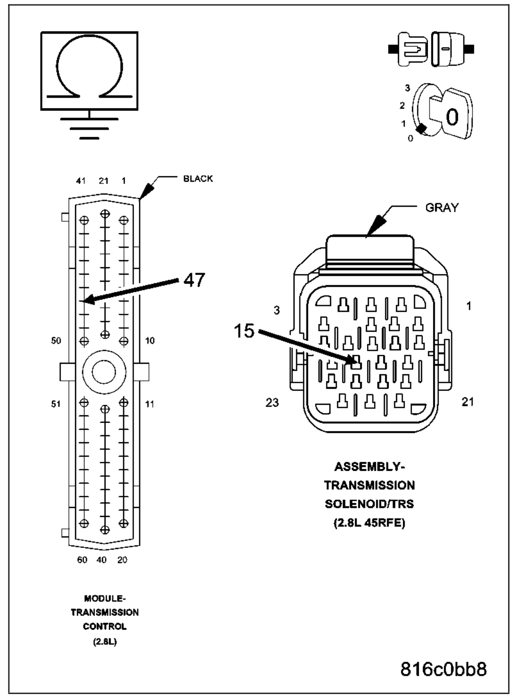
**Yes** >> Repair the (T147) 2C Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. CHECK THE (T147) 2C PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T147) 2C Pressure Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

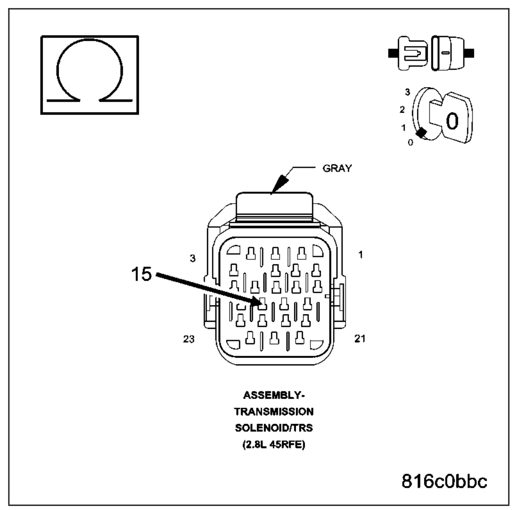
**Yes** >> Repair the (T147) 2C Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 14

## 14. CHECK THE (T147) 2C PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Measure the resistance between the (T147) 2C Pressure Switch Sense circuit and all the other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T147) 2C Pressure Switch Sense circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Powertrain Control Module per the Service Information. With the scan tool, perform the QUICK LEARN procedure.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 15. CHECK IF THE #5 AND/OR #7 CHECK BALL IS CUT OR DAMAGED

Turn the Ignition off to the lock position.

Remove the Valve Body Assembly per the Service Information.

Inspect the #5 and #7 check balls for any cuts or damage.

Inspect the 2C accumulator piston and seals and also the 2C tower seal on top of the valve body. Refer to the Service Information.

**Where there any problems found?**

**Yes** >> Repair as necessary. Check for excessive clutch debris in the transmission oil pan. If excessive clutch debris is present, repair 2C clutch as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. CHECK FOR EXCESSIVE FLUID LEAKAGE WITHIN 2C CLUTCH CIRCUIT

Air check the 2C Clutch hydraulic circuit. Refer to the Service Information.

**NOTE: This hydraulic clutch circuit contains a small bleed orifice. Small leakage is considered normal.**

**Was there excessive air leakage in the 2C Clutch hydraulic circuit?**

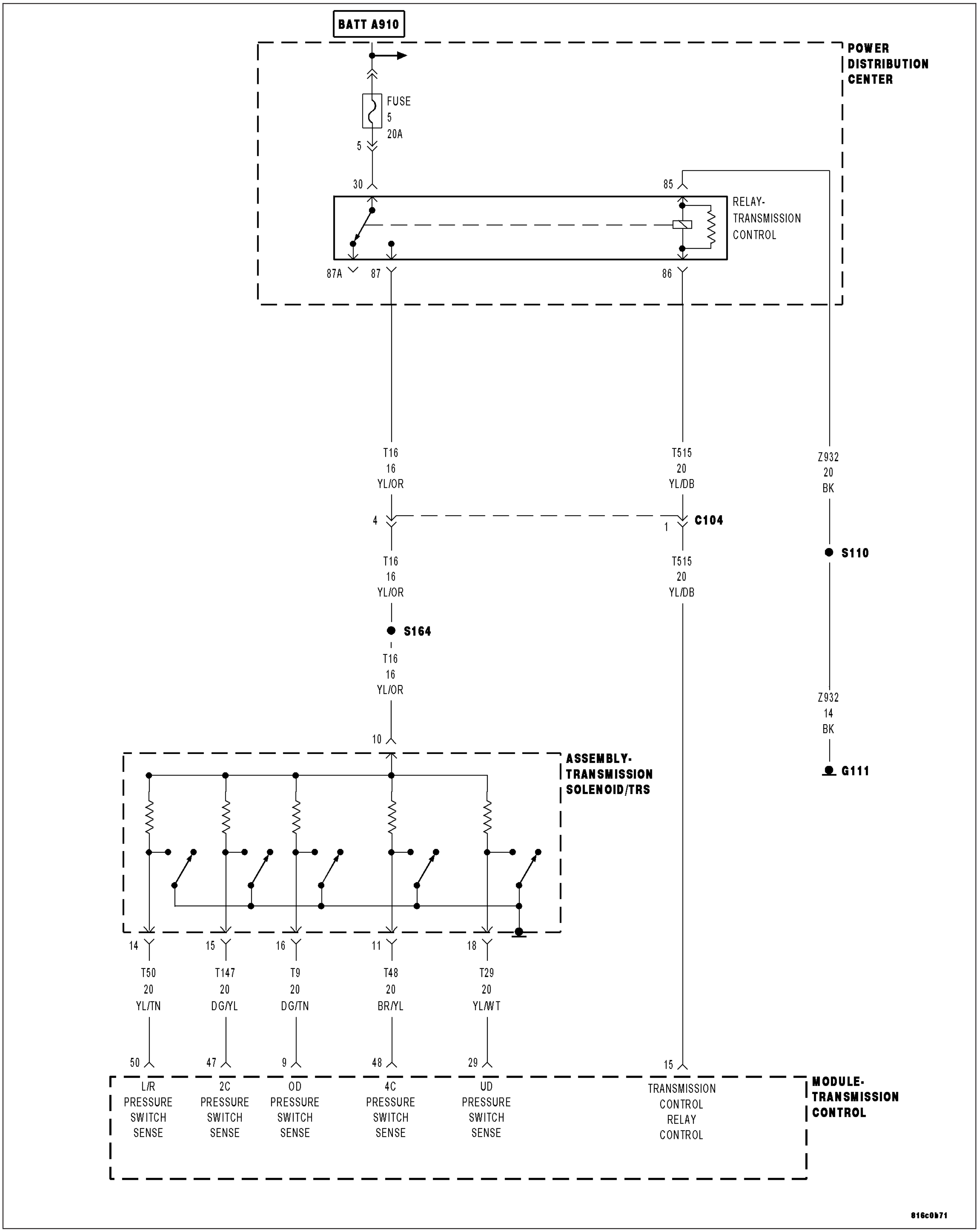
**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P0868-LINE PRESSURE LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while driving in a forward gear.
- **Set Condition:**
  The TCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If the Actual Line Pressure is more than 10 psi below Desired Line Pressure, this DTC will set.

| Possible Causes |
|---|
| CHECK FOR RELATED DTC'S |
| LOW FLUID LEVEL |
| (T39) 5-VOLT SUPPLY CIRCUIT OPEN |
| POOR LINE PRESSURE SENSOR CONNECTION |
| (T39) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND |
| (T39) 5-VOLT SUPPLY CIRCUIT SHORT TO VOLTAGE |
| (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT SHORT TO ANOTHER CIRCUIT |
| INTERNAL TRANSMISSION |
| LINE PRESSURE SENSOR |
| CRACKED, PLUGGED, OR MIS-INSTALLED PRIMARY OIL FILTER |
| STUCK OR STICKING MAIN REGULATOR VALVE |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

Line pressure is measured by the Line Pressure Sensor (LPS) and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS) controlled by the Transmission Control System. (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure). The Transmission Control System calculates the desired line pressure based on inputs from both the engine and transmission.

The Transmission Control System calculates torque input to the transmission and uses it as the primary input to the desired line pressure calculation. This is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 or 931 kPa (120 or 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality. The desired line pressure is continuously being compared to the actual line pressure. If the actual line pressure is consistently lower than the target while driving, the line pressure low DTC P0868 will set.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs.

**Is the DTC P0932 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

## 2. CHECK IF THE DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0868.

**NOTE: This counter only applies to the last DTC set.**

**Is the START SINCE SET COUNTER 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 11

## 3. CHECK THE LINE PRESSURE SENSOR CONNECTION

Ignition on, **engine not running.**

With the scan tool, monitor the Line Pressure, firmly push the Line Pressure Sensor harness connector towards the Transmission.

**Did the Line Pressure change to about 207 kPa or 30 psi when the connector was pushed?**

**Yes** >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure during the following steps.

Using the Transmission Simulator, set the rotary knob to each of the 3 line pressure positions.

**NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.**

**Did the Line Pressure read within ±14 kPa or 2.0psi in all three positions?**

**Yes** >> Go To 5

**No** >> Go To 7

## 5. CHECK THE LINE PRESSURE SENSOR

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333 and reconnect all previously disconnected connectors.

Install the Line Pressure Adaptor, Miller tool #8259, and the Pressure Gauge, Miller tool #C-3293, 0 to 2000 kPa or 0 to 300 psi.

Start the engine in park.

Monitor the line pressure readings of both the scan tool and the pressure gauge and compare the two readings.

**Is the line pressure gauge reading within 34 kPa or 5psi of the scan tool reading?**

**Yes** >> Go To 6

**No** >> Replace the Line Pressure Sensor per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. CHECK FOR A PLUGGED TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

**NOTE: Make sure the Primary Transmission Oil Filter and/or O-ring is not cracked or split.**

**Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked or plugged?**

**Yes** >> Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or O-ring. If the Primary Transmission Oil Filter is plugged refer to the Service Information for the proper Hydraulic repair procedure.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Repair internal transmission and inspect the Transmission Oil Pump per the Service Information and replace if necessary. If no problem is found, replace the Solenoid/TRS Assembly.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

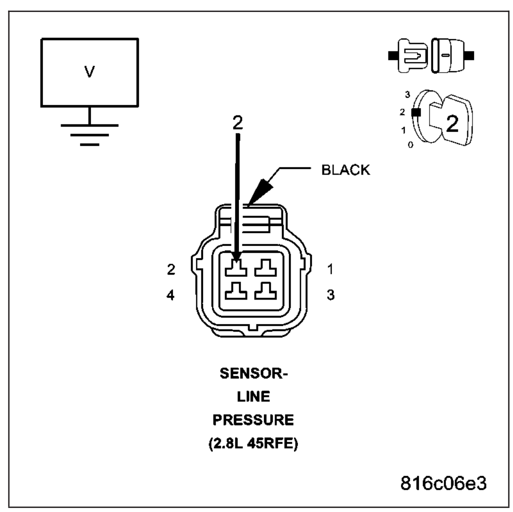
## 7. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

Disconnect the Transmission Simulator, Miller tool #8333.

Reconnect all previously disconnected connectors except the Line Pressure Sensor harness connector.

Ignition on, engine not running.

Measure the voltage of the (T39) 5-volt Supply circuit in the Line Pressure Sensor harness connector.




**Is the voltage above 5.5 volts?**

**Yes** >> Repair the (T39) 5-volt Supply circuit for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

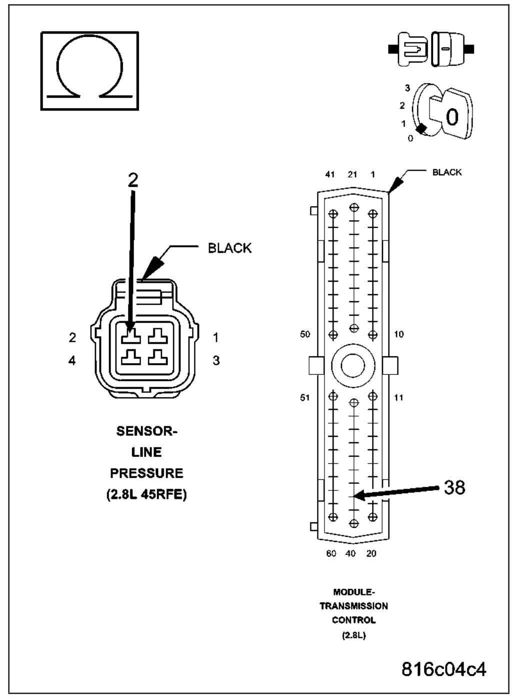
**No** >> Go To 8

## 8. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the TCM harness connector.

Measure the resistance of the (T39) 5-volt Supply circuit between the Line Pressure Sensor harness connector and the appropriate terminal of the TCM harness connector.




**Is the resistance above 5.0 ohms?**

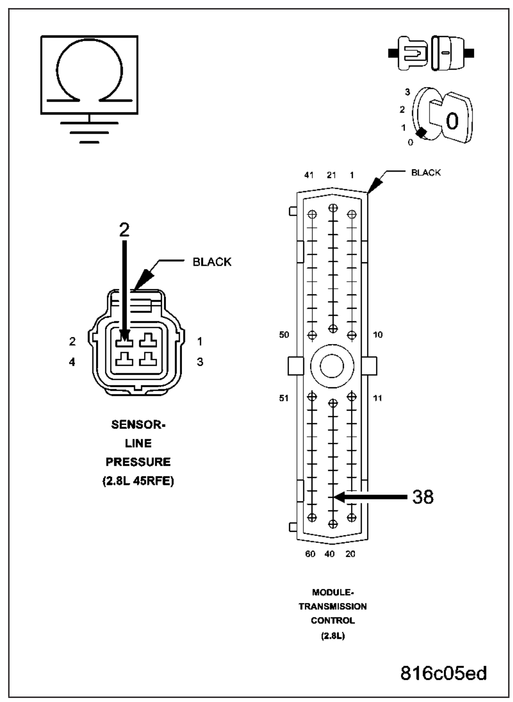
**Yes** >> Repair the (T39) 5-volt Supply circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANS-AXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T39) 5-volt Supply circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T39) 5-volt Supply circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANS-AXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 10

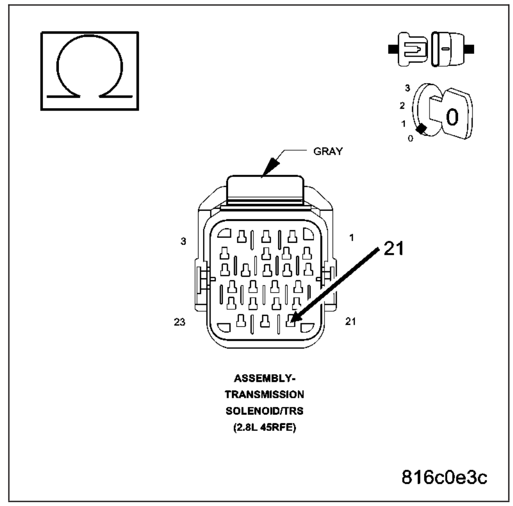
## 10. CHECK THE (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Disconnect the TCM harness connector.

Measure the resistance between the (T118) Pressure Control Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T118) Pressure Control Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T118) Pressure Control Solenoid Control circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 11. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

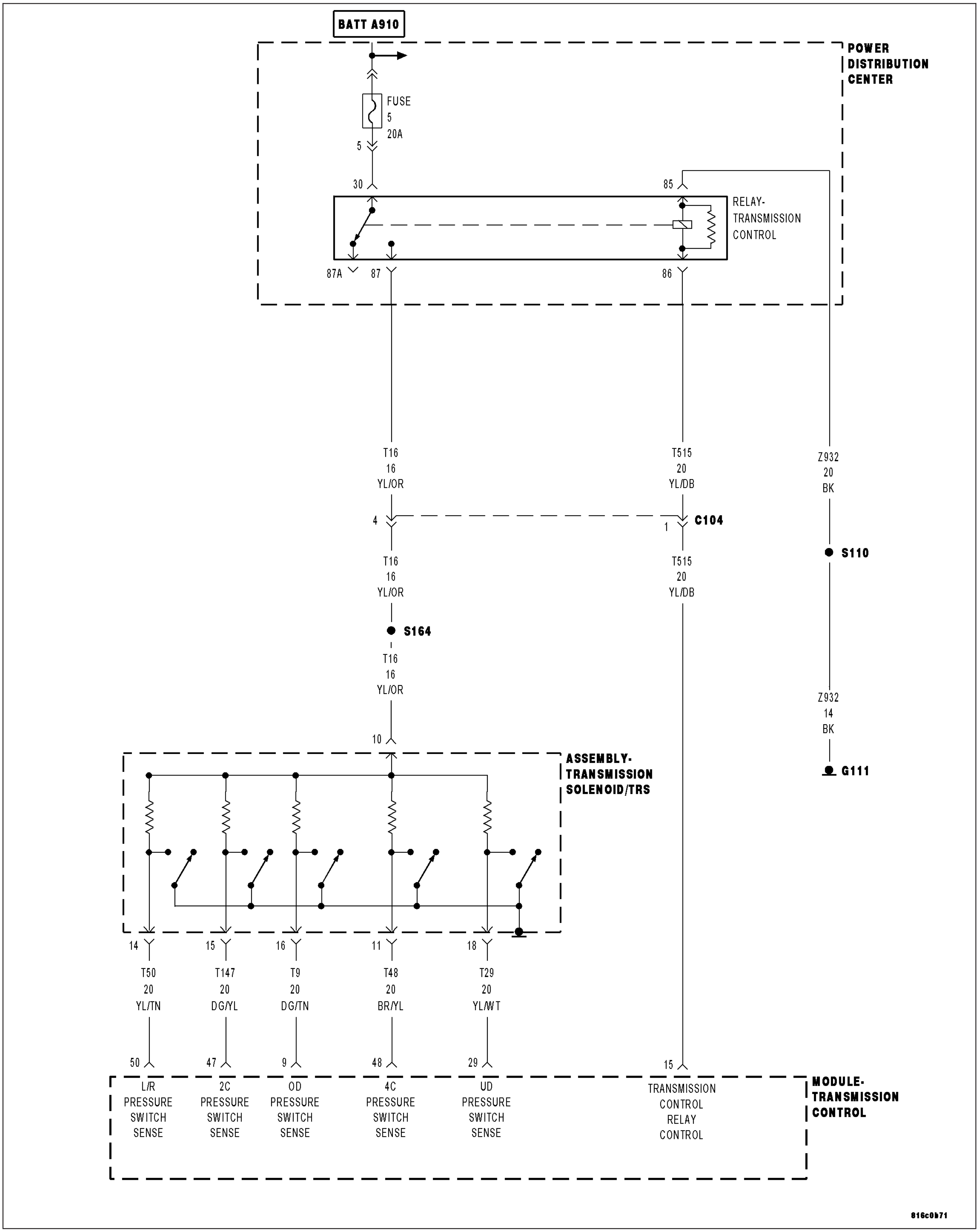
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0869-LINE PRESSURE HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously while driving in a forward gear.
- **Set Condition:**
  The TCM continuously monitors Actual Line Pressure. If the Actual Line Pressure reading is greater than the highest Desired Line Pressure ever used in the current gear, while the Pressure Control Solenoid duty cycle is at or near its maximum value (which should result in minimum line pressure), the DTC will set.

| Possible Causes |
|---|
| (T39) 5-VOLT SUPPLY CIRCUIT OPEN |
| LINE PRESSURE SENSOR CONNECTION |
| (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT OPEN |
| (T39) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND |
| (T118) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT SHORT TO GROUND |
| TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT |
| LINE PRESSURE SENSOR |
| STUCK OR STICKING MAIN REGULATOR VALVE |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

Line pressure is measured by the Line Pressure Sensor (LPS) and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS) controlled by the Transmission Control System. (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure). The Transmission Control System calculates the desired line pressure based on inputs from both the engine and transmission.

The Transmission Control System calculates torque input to the transmission and uses it as the primary input to the desired line pressure calculation. This is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 or 931 kPa (120 or 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality. The desired line pressure is continuously being compared to the actual line pressure. If the actual line pressure is consistently higher than the highest desired line pressure ever used in the current gear, the line pressure high DTC P0869 will set.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other Transmission DTCs.

**Is the DTC P0932 or P0882 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK IF THE DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0869.

**Is the STARTS SINCE SET COUNTER 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 10

## 3. CHECK THE LINE PRESSURE SENSOR CONNECTION

Ignition on, engine not running.

With the scan tool, monitor the Transmission Line Pressure.

Firmly push the Line Pressure Sensor harness connector inward towards the Transmission.

**Did the Line Pressure change to about 207 kPa or 30 psi when the sensor connector was pushed?**

**Yes** >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure during the following step.

Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

**NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.**

**Did the Line Pressure read within ±14 kPa or 2.0 psi in all three positions?**

**Yes** >> Go To 5

**No** >> Go To 6

## 5. CHECK THE LINE PRESSURE SENSOR CALIBRATION

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333 and reconnect all previously disconnected connectors.

Install the Line Pressure Adaptor, Miller tool #8259, and Pressure Gauge, Miller tool #C-3293, 0 to 2000 kPa or 0 to 300 psi.

Start the engine in park.

Monitor the Line Pressure readings on the scan tool and the pressure gauge.

Compare the Line Pressure readings between the scan tool and the pressure gauge.

**Is the pressure gauge reading within 34 kPa or 5 psi of the scan tool reading?**

**Yes** >> Repair the internal transmission and inspect the Transmission Oil Pump per the Service Information and replace if necessary. If no problem is found, replace the Transmission Solenoid/TRS Assembly, possible cause is a stuck Pressure Control Solenoid.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Line Pressure Sensor per the Service information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

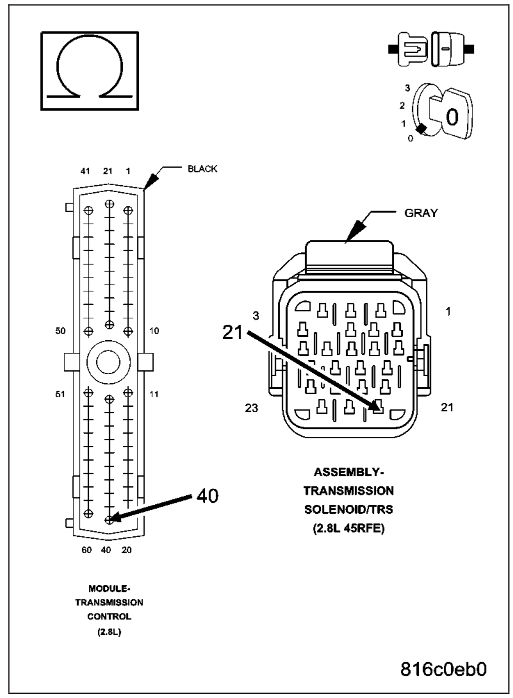
## 6. CHECK THE (T140) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance of the (T118) Pressure Control Solenoid Control circuit between the Solenoid/TRS harness connector and the TCM harness connector.




**Is the resistance above 5.0 ohms?**

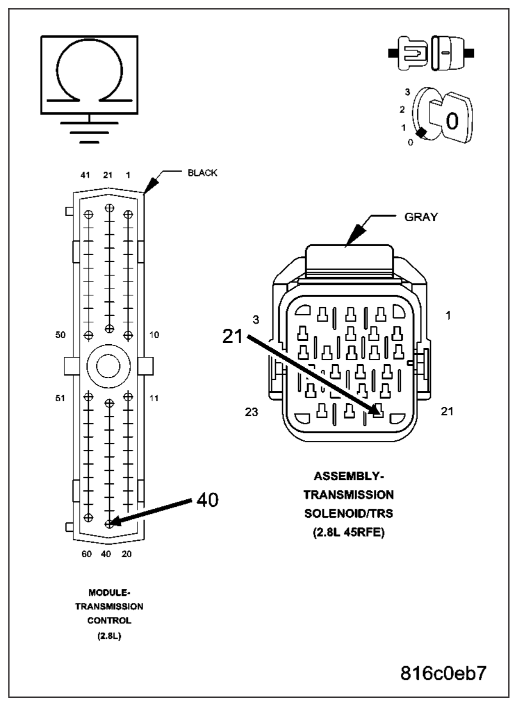
**Yes** >> Repair the (T118) Pressure Control Solenoid Control circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CHECK THE (T140) PRESSURE CONTROL SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T118) Pressure Control Solenoid Control circuit.




**Is the resistance below 5.0 ohms?**

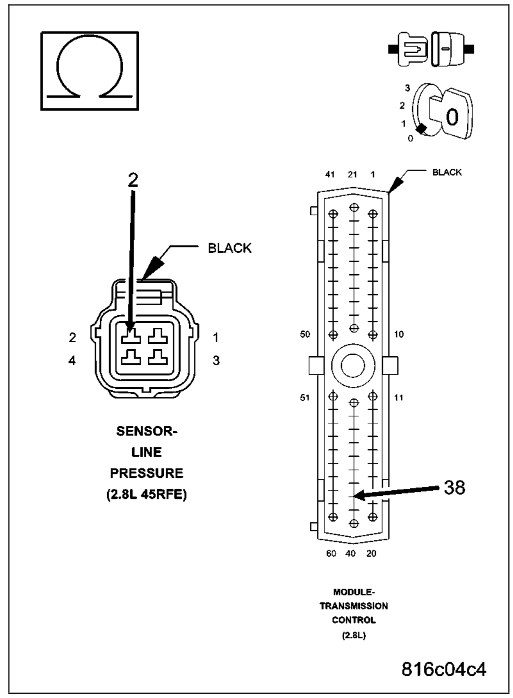
**Yes** >> Repair the (T118) Pressure Control Solenoid Control circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Measure the resistance of the (T39) 5-volt Supply circuit between the Line Pressure Sensor harness connector and the TCM harness connector.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T39) 5-volt Supply circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

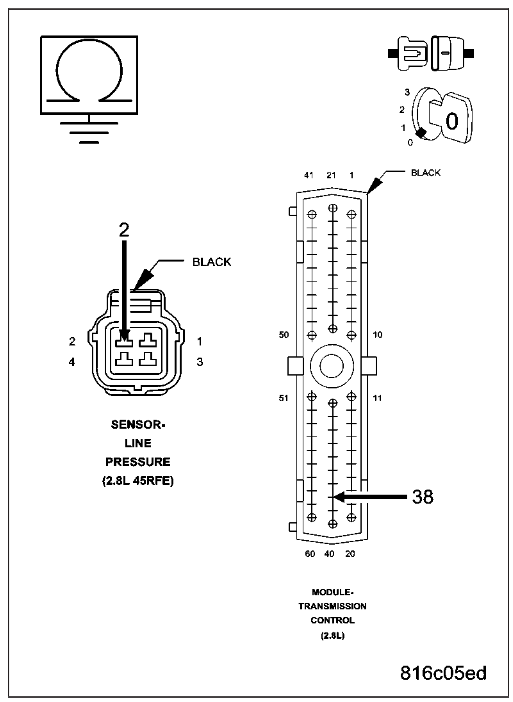
**No** >> Go To 9

## 9. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Disconnect the TCM harness connector.

Disconnect the Line Pressure Sensor harness connector.

Measure the resistance between ground and the (T39) 5-volt Supply circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T39) 5-volt Supply circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Control Module per the Service Information. With the scan tool perform the QUICK LEARN procedure.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 10. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

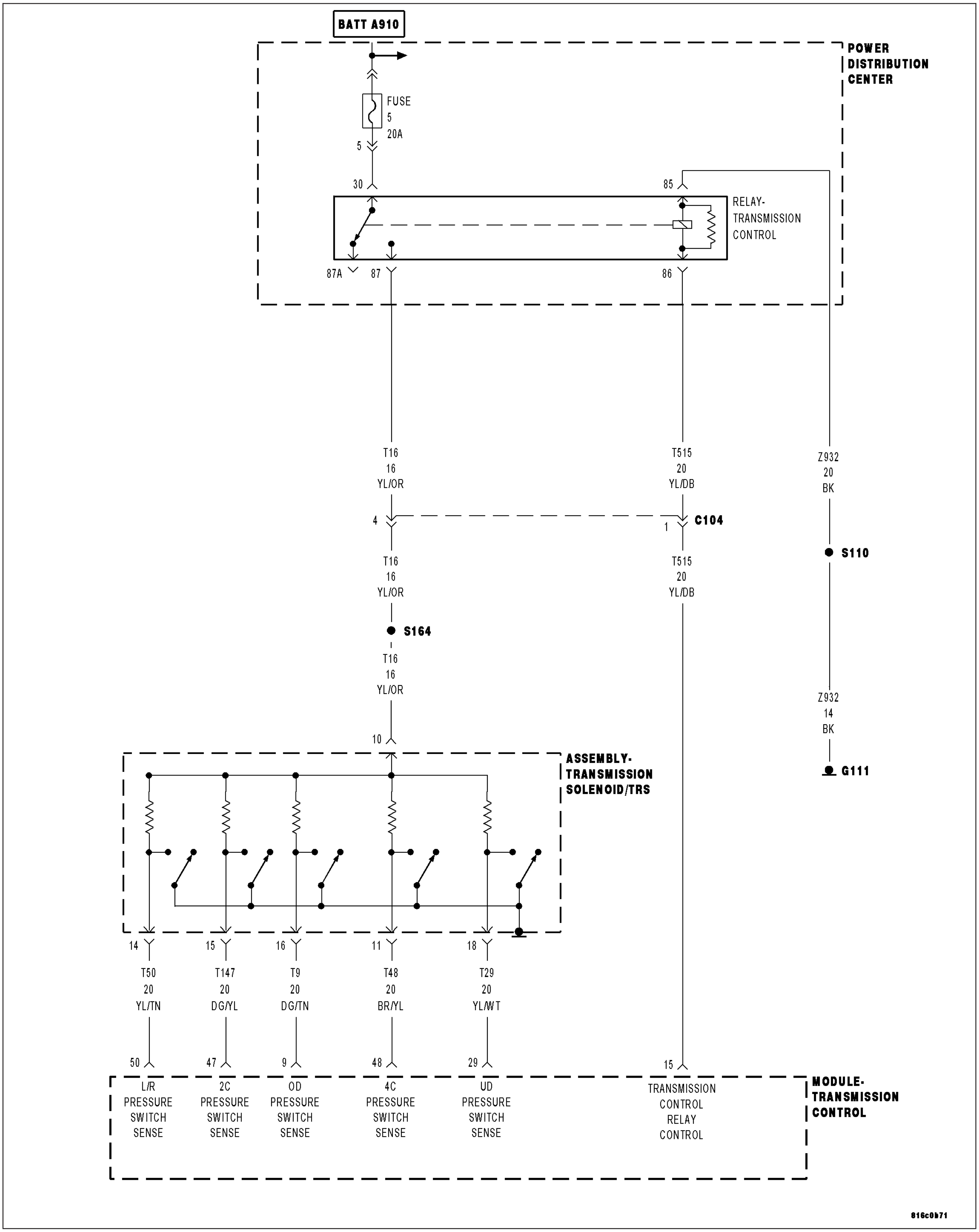
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0870-OD HYDRAULIC PRESSURE TEST




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed above 1000 RPM, the TCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

| Possible Causes |
|---|
| LINE PRESSURE SENSOR |
| TRANSMISSION FLUID CONTAMINATION |
| RELATED DTC'S PRESENT |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| EXCESSIVE DEBRIS IN OIL PAN |
| POOR LINE PRESSURE SENSOR CONNECTION |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN |
| RELATED TCM POWER INPUT DTCS PRESENT |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T39) 5-VOLT SUPPLY CIRCUIT OPEN |
| TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| (T39) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| INTERNAL TRANSMISSION |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Control System tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The Transmission Control System verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the DTC will set, the MIL will illuminate and the transmission system will default to the orderly Shutdown routine.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs.

**Is there any Loss of Prime, TCM Power Input, and/or Line Pressure Sensor DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. If the DTC, P0944-LOSS OF PRIME is present, perform its respective test first.

**No** >> Go To 2

## 2. CHECK IF DTC P0760 IS PRESENT

With the scan tool, check Transmission DTCs.

**Is the DTC P0760 also present?**

**Yes** >> Refer to the symptom list and perform diagnostics for P0760-OD SOLENOID CIRCUIT. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

**No** >> Go To 3

## 3. CHECK FOR OTHER DTCS

With the scan tool, check for other transmission DTCs

**Are any of the DTCs, P0733, P0734 ,P0735 and/or P0871 present also?**

**Yes** >> Go To 12

**No** >> Go To 4

## 4. CHECK IF DTC P0870 IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0870.

**Is the STARTS SINCE SET COUNTER 2 or less?**

**Yes** >> Go To 5

**No** >> Go To 17

## 5. CHECK LINE PRESSURE

Start the engine.

Warm the transmission to 82° C or 180° F.

Firmly apply the brakes.

With the scan tool, monitor the Line Pressure during the following step.

Move the shift lever to each gear position, pausing momentarily in each position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range.

**Did the line pressure remain at a steady value between 585 and 655 kPa or 85 and 95 psi in each position?**

**Yes** >> Go To 6

**No** >> Go To 10

## 6. CHECK THE LINE PRESSURE SENSOR CONNECTION

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

**Did the Line Pressure reading on the scan tool change to about 207 kPa or 30 psi when the connector was pushed inward?**

**Yes** >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CHECK THE LINE PRESSURE SENSOR OPERATION

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while turning the Pressure Switch selector to each of the 3 line pressure positions on the Transmission Simulator.

**NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.**

**Did the scan tool Line Pressure readings match the specified readings on the Transmission Simulator and remain steady in all three positions?**

**Yes** >> Replace the Line Pressure Sensor per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect Transmission Simulator.

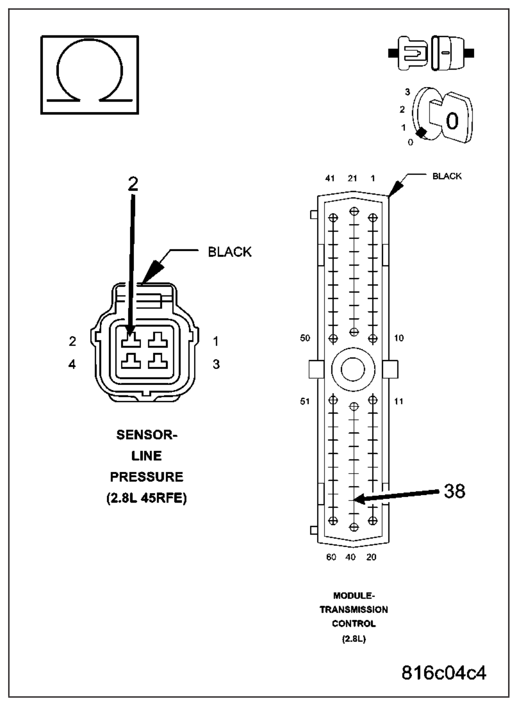
Disconnect the TCM harness connector.

Measure the resistance of the (T39) 5-volt Supply circuit from the Line Pressure Sensor harness connector to the appropriate terminal of the TCM harness connector.

**Is the resistance above 5.0 ohms?**

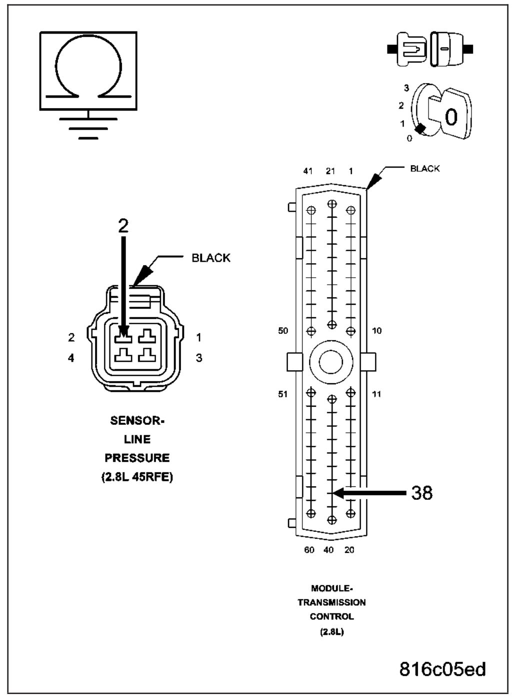
**Yes** >> Repair the (T39) 5-volt Supply circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 9



## 9. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T39) 5-volt Supply circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T39) 5-volt Supply circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 10. COMPARE SCAN TOOL TO PRESSURE GAUGE

Turn the ignition off to the lock position.

Connect the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP. Refer to the Service Information for proper installation procedure.

**CAUTION: Apply parking brake.**

Start the engine.

In the following steps, compare the scan tool Line Pressure to the Pressure Gauge readings in each gear.

**CAUTION: Do not overheat transmission.**

With the gear selector in park, raise the RPM to 1500, and compare line pressure readings.

Firmly apply the brakes, move the gear selector into reverse, raise the RPM to 1500, and compare the line pressure readings.

Firmly apply the brakes, move the gear selector into drive, raise the RPM to 1500, and compare the line pressure readings.

**Does the scan tool Line Pressure readings match the Pressure Gauge readings ± 10 psi?**

**Yes** >> Go To 11

**No** >> Replace the Line Pressure Sensor per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 11. CHECK TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

On the Transmission Simulator, turn the Pressure Switch selector switch to OD.

Ignition on, engine not running.

With the scan tool, monitor the OD Pressure Switch state while pressing and holding the Pressure Switch test button and wiggling the wire harness and connectors that pertain to the OD Pressure Switch.

**Did the OD Pressure Switch state change to closed and remain closed while wiggling the wires?**

**Yes** >> Go To 12

**No** >> Go To 14

## 12. CHECK FOR EXCESSIVE DEBRIS

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Remove and inspect the Transmission Oil Pan per the Service Information.

**Does the Transmission Oil Pan contain excessive debris or contamination?**

**Yes** >> Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. CHECK THE OD HYDRAULIC CLUTCH CIRCUIT

Remove the Valve Body and air check the OD hydraulic clutch circuit (in the case) for leakage per the Service Information.

**NOTE: The OD hydraulic clutch circuit contains a small bleed orifice which connects to the Reverse hydraulic clutch circuit. A small amount of air leakage is normal.**

**Was there excessive air leakage noticed during the air check?**

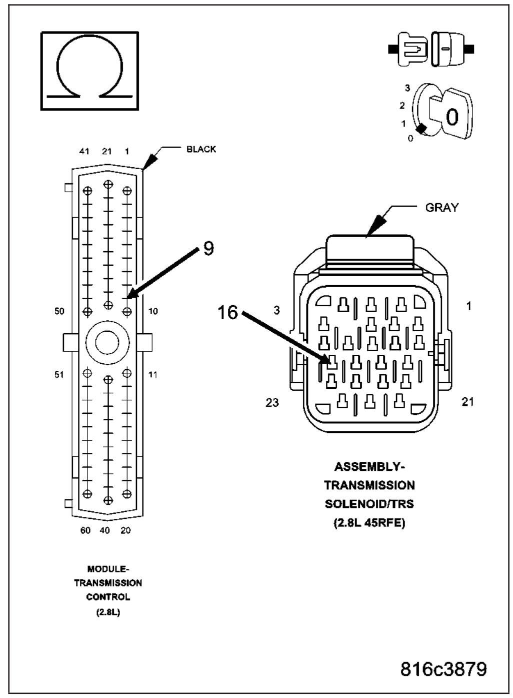
**Yes** >> Repair as necessary. Check the OD/Rev clutch piston seals, bleed orifice assembly, reaction shaft support seal rings, and machining of the main mating faces on the pump housing, pump valve body, and reaction shaft support.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Disassemble and inspect the Valve Body and repair as necessary. Inspect the OD Accumulator piston and seals. Check for an extra check ball downstream from the #6 check ball pocket and repair as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 14. CHECK THE (T9) OD PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN




Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance of the (T9) OD Pressure Switch Sense circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of the TCM harness connector.

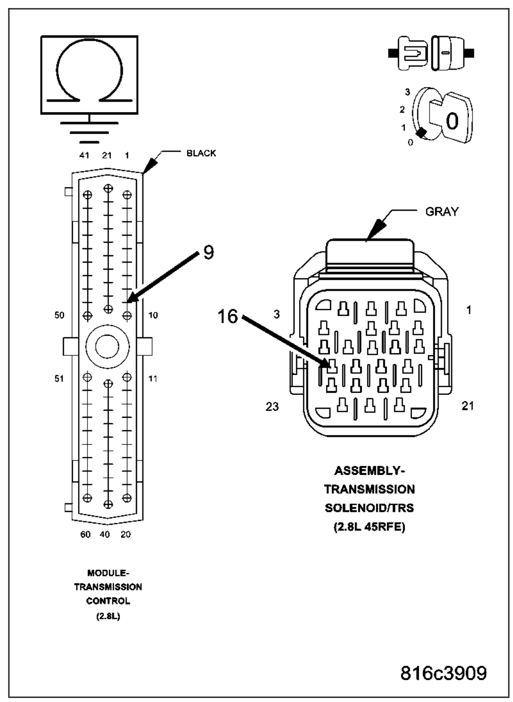
**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 15

## 15. CHECK THE (T9) OD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND




Measure the resistance between ground and the (T9) OD Pressure Switch Sense circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. CHECK THE (T9) OD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

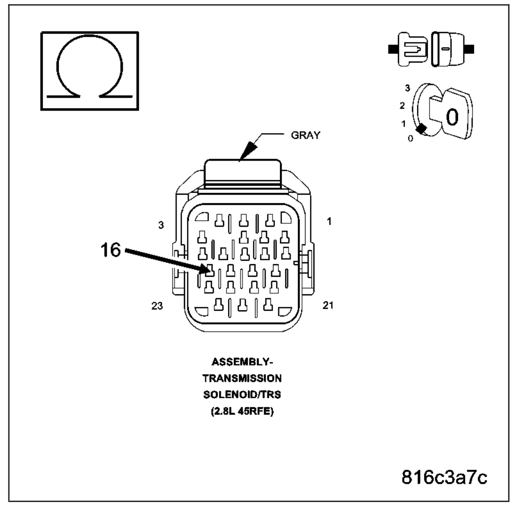
Disconnect the TCM harness connector.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

**NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.**

**NOTE: Check connectors - Clean/repair as necessary.**

Measure the resistance between the (T9) OD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T9) OD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 17. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

If the DTC EVENT DATA shows the DTC P0870 set while the Line Pressure was significantly below the Desired Line Pressure reading, check for causes of low line pressure (low fluid level, broken or mis-installed primary oil filter or filter seal, sticking Main Regulator Valve in the Pump Valve Body etc.). If the data shows the DTC set while the Line Pressure reading was significantly higher than the Desired Line Pressure, check the Line Pressure Sensor and related wiring.

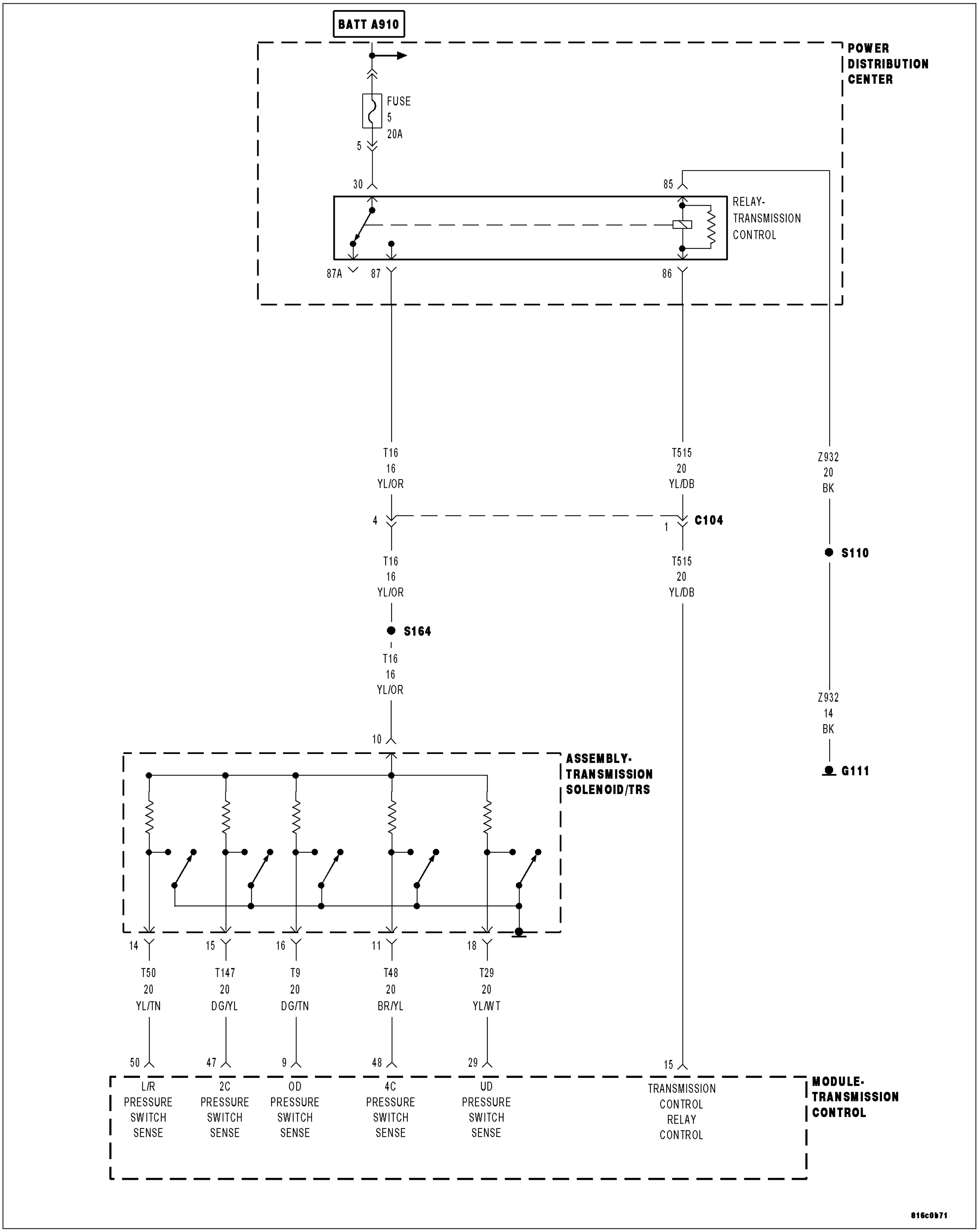
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0871-OD PRESSURE SWITCH RATIONALITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  The appropriate DTC is set if one of the pressure switches are open or closed at the wrong time in a given gear.

| Possible Causes |
|---|
| RELATED TCM POWER INPUT DTCS PRESENT |
| LINE PRESSURE DTCS PRESENT |
| NO. 4 OR 6 CHECK BALL CUT OR DAMAGED |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| (T9) OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS |
| LOW LINE PRESSURE |
| WIRING AND CONNECTORS |
| CUT OD/REV PISTON SEAL |
| BROKEN OR MISSING DO/REV PISTON BLEED ORIFICE |
| BROKEN REACTION SHAFT SUPPORT SEAL RING |
| POOR MACHINING ON PUMP VALVE BODY FACE |
| BROKEN OR MISSING DRIBBLER ORIFICE ASSEMBLY IN REACTION SHAFT SUPPORT |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| CUT OD ACCUMULATOR PISTON SEAL |
| CRACKED OD ACCUMULATOR PISTON |
| BROKEN OR MISSING OD BLEED ORIFICE IN MAIN VALVE BODY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the LR, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

| GEAR | L/R | 2C | 4C | UD | OD |
|---|---|---|---|---|---|
| **REVERSE** | OPEN | OPEN | OPEN | OPEN | OPEN |
| **P/N** | CLOSED** | OPEN | OPEN | OPEN | OPEN |
| **1ST** | CLOSED* | OPEN | OPEN | CLOSED | OPEN |
| **2ND** | OPEN | CLOSED | OPEN | CLOSED | OPEN |
| **2ND PRIME** | OPEN | OPEN | CLOSED | CLOSED | OPEN |
| **3RD** | OPEN | OPEN | OPEN | CLOSED | CLOSED |
| **4TH** | OPEN | OPEN | CLOSED | OPEN | CLOSED |
| **5TH** | OPEN | CLOSED | OPEN | OPEN | CLOSED |

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.

**May be open when rolling in Neutral or at low oil temperatures.

## Diagnostic Test

### 1. DETERMINE IF RELATED TCM POWER INPUT DTCS ARE PRESENT

With the scan tool, check for other transmission DTCs.

**Are there any TCM Power Input DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK FOR LINE PRESSURE DTCS

With the scan tool, read Transmission DTCs.

**Are there any Line Pressure DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 3

### 3. CHECK FOR OTHER PRESSURE SWITCH DTCS

With the scan tool, check Transmission DTCs.

**Are there two or more other pressure switch rationality DTCs present in addition to P0871?**

**Yes** >> Go To 5

**No** >> Go To 4

### 4. CHECK IF DTC IS CURRENT

With the scan tool, check and record the DTC EVENT DATA.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA show data for P0871?**

**Yes** >> Go To 8

**No** >> Refer to the Transmission category and perform the appropriate symptom. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

### 5. CHECK IF PRESSURE SWITCHES READ CLOSED

With the scan tool, check and record the DTC EVENT DATA.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Do all the pressure switches read CLOSED in the DTC EVENT DATA?**

**Yes** >> Refer to the Transmission category and perform diagnostics for P0882. Follow instructions as if the DTC is current. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

**No** >> Go To 6

## 6. CHECK IF PRESSURE SWITCHES READ OPEN

In the DTC EVENT DATA recorded earlier, read the state of all pressure switches.

**Do all the pressure switches read open?**

**Yes** >> Go To 7

**No** >> Go To 8

## 7. CHECK FOR LOW LINE PRESSURE

In the DTC EVENT DATA recorded earlier, compare the Line Pressure to the Desired Line Pressure.

**Is the Line Pressure less than 40 PSI, and significantly below the Desired Line Pressure?**

**Yes** >> Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter weal for a spit, crack , or improperly installed. If the filer and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 8. CHECK IF IN DTC SET IN PARK, NEUTRAL, OR REVERSE

Ignition on, engine not running.

With the scan tool, read and record the DTC EVENT DATA for P0871.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA show the OD Pressure Switch DTC set while in Park, Neutral, or Reverse?**

**Yes** >> Go To 18

**No** >> Go To 9

## 9. CHECK IF THE OD PRESSURE SWITCH IS OPEN

Refer to the DTC EVENT DATA recorded earlier for P0871.

**Did the OD Pressure Switch read OPEN?**

**Yes** >> Go To 10

**No** >> Go To 15

## 10. CHECK FOR LOW LINE PRESSURE

Refer to the DTC EVENT DATA recorded earlier and compare the Line Pressure and the Desired Line Pressure.

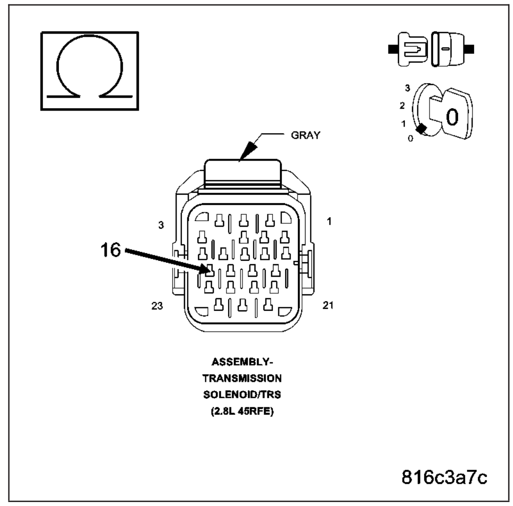
**Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?**

**Yes** >> Repair as necessary to correct low line pressure. Check the fluid level. Check the Primary Oil Filter seal for a split, crack, or improperly installed. Refer to the Service Information for the proper installation procedure. If the fluid level and filter are OK, check the Main Regulator Valve in the Oil Pump.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 11

## 11. CHECK THE (T9) OD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT




Turn the ignition off to the lock position.

Disconnect the TCM harness connector.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

**NOTE: Check connectors - Clean/repair as necessary.**

Measure the resistance between the (T9) OD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

**Is the resistance below 5.0 ohms between the (T9) OD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 12

## 12. CHECK IF DTC RESETS

Reconnect all previously disconnected connectors.

With the scan too, erase transmission DTCs.

Test drive the vehicle, use the DTC EVENT DATA recorded earlier to help duplicate the conditions when the DTC originality set.

**Does the DTC P0871 reset?**

**Yes** >> Go To 13

**No** >> Go To 22

## 13. CHECK THE TRANSMISSION CONTROL MODULE

Remove the Transmission Control Relay.

Operate the vehicle in Drive.

**Is the transmission slipping while in Drive?**

**Yes** >> Go To 14

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 14. CHECK INTERNAL TRANSMISSION

Perform an Air Check Transmission Clutch Operation procedure per the Service Information.

**NOTE: The OD/Rev piston contains a small bleed orifice, a small amount of leakage between the OD and Reverse hydraulic clutch circuits is considered normal.**

**Is there excessive air leakage in any clutch circuit?**

**Yes** >> Check the OD/Rev piston seals and bleed orifice, reaction shaft support seal rings, dribbler orifice assemblies in the reaction shaft support and for poor machine on the pump valve body faces. Refer to the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Repair the Valve Body. Check the OD Accumulator piston and seals, OD bleed orifice, and No. 6 check ball cuts or damage. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 15. CHECK TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to OD.

With the scan tool, monitor the OD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

**Did the state of the OD Pressure Switch change from OPEN to CLOSED while pressing the Test button?**

**Yes** >> Go To 16

**No** >> Go To 18

## 16. CHECK IF THE NO. 4 AND/OR NO. 6 CHECK BALL IS CUT OR DAMAGED

With the scan tool, erase previously stored DTC's and test drive the vehicle, use the DTC EVENT DATA to help duplicate the conditions when the DTC originality set. Note any DTCs that may set.

Remove the Transmission Valve Body per the Service Information.

Check the No. 4 and No. 6 Check Balls for cuts or damage.

**Is the No. 4 and/or No. 6 Check Ball cut or damaged?**

**Yes** >> Replace the No. 4 and/or No. 6 Check Ball and check for clutch debris in the transmission oil pan. If there is excessive debris, perform internal repairs to the OD Clutch Assembly. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 17

## 17. TRANSMISSION SOLENOID/TRS ASSEMBLY

**Did the DTC P0871 reset during the test drive in the previous step?**

**Yes** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 22

## 18. CHECK THE (T9) OD PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the TCM harness connector.

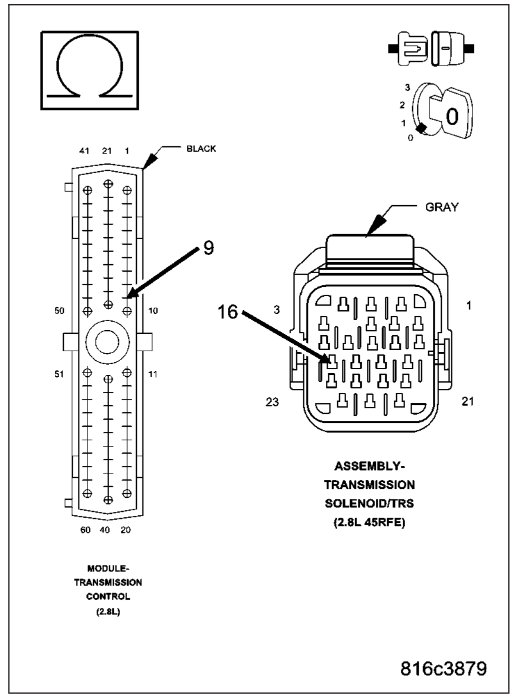
Disconnect the Transmission Solenoid/TRS Assembly harness connector

Measure the resistance of the (T9) OD Pressure Switch Sense circuit from the Solenoid/TRS Assembly harness connector to the appropriate terminal of the TCM harness connector.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for an open.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 19



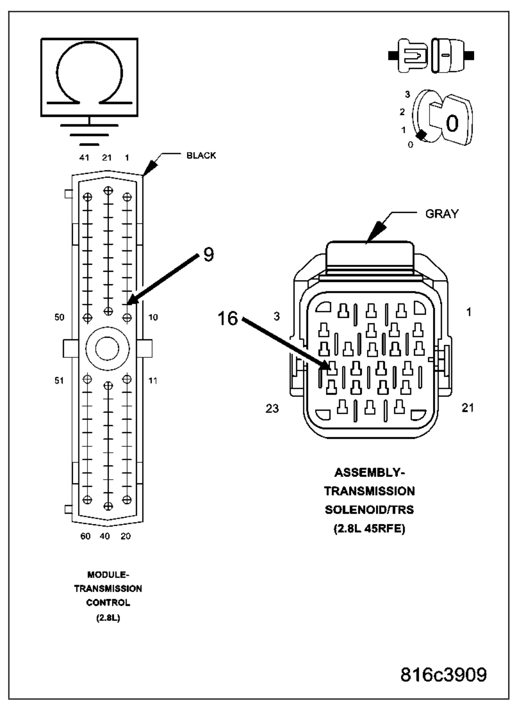

## 19. CHECK THE (T9) OD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T9) OD Pressure Switch Sense circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T9) OD Pressure Switch Sense circuit for a short to ground.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 20



## 20. CHECK WIRING AND CONNECTORS

Using the schematics as a guide, inspect the wiring and connectors. Pay particular attention to all power and ground circuits.

**Were there any problems found**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 21

## 21. CHECK IF DTC RESETS

Reconnect all previously disconnected connectors.

Make sure all DTC EVENT DATA is recorded.

With the scan tool, erase previously stored DTC's and test drive the vehicle, use the DTC EVENT DATA to help duplicate the conditions when the DTC originality set.

**Does the DTC P0871 reset?**

**Yes** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 22

## 22. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

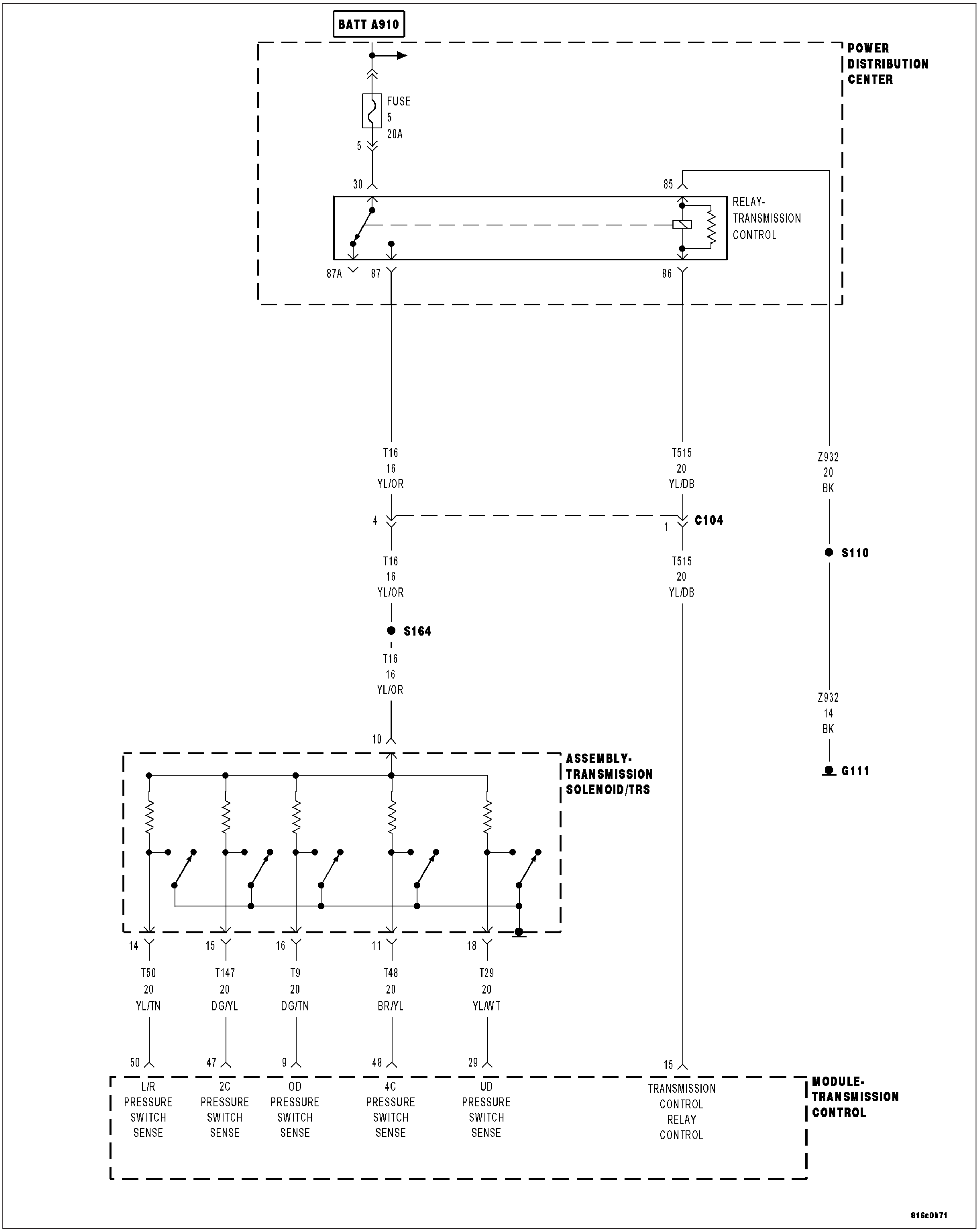
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0875-UD HYDRAULIC PRESSURE TEST




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed above 1000 RPM, the PCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

| Possible Causes |
| --- |
| LINE PRESSURE SENSOR |
| TRANSMISSION FLUID CONTAMINATION |
| RELATED DTC'S PRESENT |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| EXCESSIVE DEBRIS IN OIL PAN |
| POOR LINE PRESSURE SENSOR CONNECTION |
| (T29) UD PRESSURE SWITCH SENSE CIRCUIT OPEN |
| TRANSMISSION CONTROL RELAY DTCS PRESENT |
| (T29) UD PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T39) 5-VOLT SUPPLY CIRCUIT OPEN |
| (T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| (T39) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND |
| (T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| INTERNAL TRANSMISSION |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Control System tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The Transmission Control System verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the DTC will set, the MIL will illuminate and the transmission system will default to the orderly Shutdown routine.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs.

**Is there any Loss of Prime, Transmission Control Relay, and/or Line Pressure Sensor DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. If the DTC, P0944-LOSS OF PRIME is present, perform its respective test first.

**No** >> Go To 2

## 2. CHECK FOR DTC P0765

With the scan tool, check Transmission DTCs.

**Is the DTC P0765 also present?**

**Yes** >> Refer to the Transmission category and perform diagnostics for P0765-UD SOLENOID CIRCUIT.

**No** >> Go To 3

## 3. CHECK FOR OTHER DTCS

With the scan tool, check for other transmission DTCs.

**Are any of the DTCs, P0731, P0732, P0733, P0876, and/or P1736 present also?**

**Yes** >> Go To 12

**No** >> Go To 4

## 4. CHECK IF DTC P0875 IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0875.

**Is the STARTS SINCE SET COUNTER 2 or less?**

**Yes** >> Go To 5

**No** >> Go To 17

## 5. CHECK LINE PRESSURE

Start the engine.

Warm the transmission to 82° C or 180° F.

Firmly apply the brakes.

With the scan tool, monitor the Line Pressure during the following step.

Move the shift lever to each gear position, pausing momentarily in each position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range.

**Did the line pressure remain at a steady value between 585 and 655 kPa or 85 and 95 psi in each position?**

**Yes** >> Go To 6

**No** >> Go To 10

## 6. CHECK LINE PRESSURE SENSOR CONNECTION

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

**Did the Line Pressure reading on the scan tool change to about 207 kPa or 30 psi when the connector was pushed inward?**

**Yes** >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CHECK LINE PRESSURE SENSOR OPERATION

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while turning the Pressure Switch selector to each of the 3 line pressure positions on the Transmission Simulator.

**NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 psi of the reading specified on the Transmission Simulator.**

**Did the scan tool Line Pressure readings match the specified readings on the Transmission Simulator and remain steady in all three positions?**

**Yes** >> Replace the Line Pressure Sensor per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect Transmission Simulator.

Disconnect the TCM harness connector.

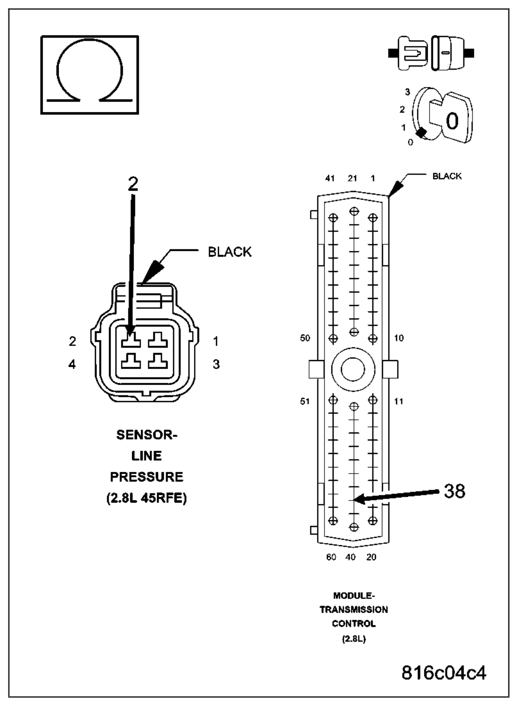
Measure the resistance of the (T39) 5-volt Supply circuit from the Line Pressure Sensor harness connector to the appropriate terminal of the TCM harness connector.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T39) 5-volt Supply circuit for an open.

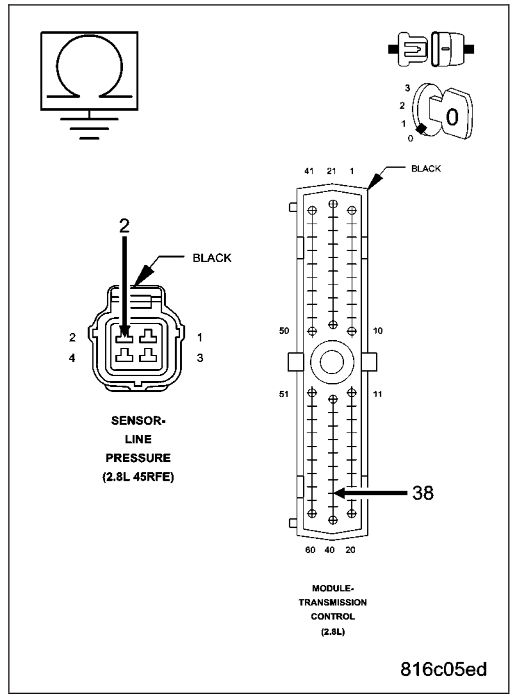
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 9



## 9. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T39) 5-volt Supply circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T39) 5-volt Supply circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 10. COMPARE SCAN TOOL TO PRESSURE GAUGE

Turn the ignition off to the lock position.

Connect the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP. Refer to the Service Information for proper installation procedure.

**CAUTION: Apply parking brake.**

Start the engine.

In the following steps, compare the scan tool Line Pressure to the Pressure Gauge readings in each gear.

**CAUTION: Do not overheat transmission.**

With the gear selector in park, raise the RPM to 1500, and compare line pressure readings.

Firmly apply the brakes, move the gear selector into reverse, raise the RPM to 1500, and compare the line pressure readings.

Firmly apply the brakes, move the gear selector into drive, raise the RPM to 1500, and compare the line pressure readings.

**Does the scan tool Line Pressure readings match the Pressure Gauge readings ± 10 psi?**

**Yes** >> Go To 11

**No** >> Replace the Line Pressure Sensor per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 11. CHECK WIRING AND CONNECTORS

Turn the ignition off to the lock position.

Remove the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

On the Transmission Simulator, turn the Pressure Switch selector switch to UD.

Ignition on, engine not running.

With the scan tool, monitor the UD Pressure Switch state while pressing and holding the Pressure Switch test button and wiggling the wire harness and connectors that pertain to the UD Pressure Switch.

**Did the UD Pressure Switch state change to closed and remain closed while wiggling the wires?**

**Yes** >> Go To 12

**No** >> Go To 14

## 12. CHECK FOR EXCESSIVE DEBRIS

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Remove and inspect the Transmission Oil Pan per the Service Information.

**Does the Transmission Oil Pan contain excessive debris or contamination?**

**Yes** >> Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. CHECK THE UD HYDRAULIC CLUTCH CIRCUIT

Remove the Valve Body and air check the UD hydraulic clutch circuit (in the case) for leakage per the Service Information.

**NOTE: The UD hydraulic clutch circuit contains a small bleed orifice. A small amount of air leakage is normal.**

**Was there excessive air leakage noticed during the air check?**

**Yes** >> Repair as necessary. Check the UD clutch piston, piston seals and bleed orifice, reaction shaft support seal rings, and machining of the main mating faces of the pump housing, pump valve body, and reaction shaft support.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Disassemble and inspect the Valve Body and repair as necessary. Inspect the UD Accumulator piston and seals. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

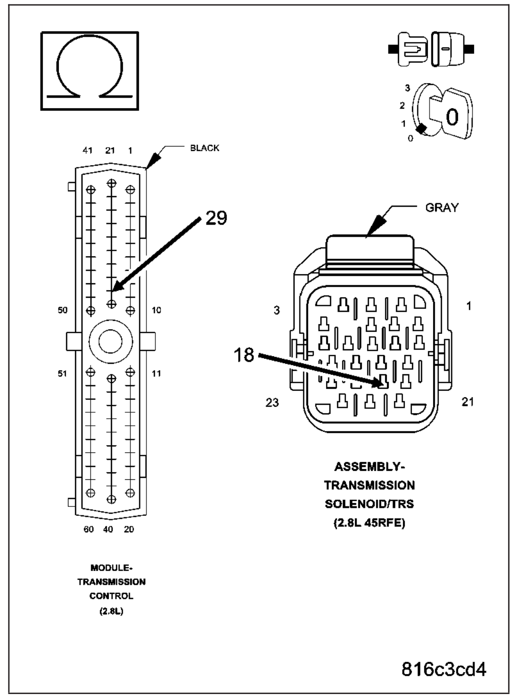
## 14. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance of the (T29) UD Pressure Switch Sense circuit between the Transmission Solenoid/TRS Assembly harness connector and the appropriate terminal of the TCM harness connector.




**Is the resistance above 5.0 ohms?**

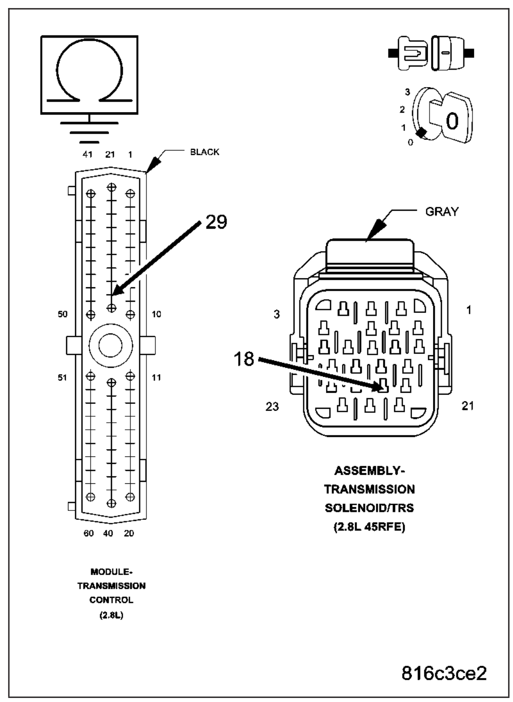
**Yes** >> Repair the (T29) UD Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 15

## 15. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T29) UD Pressure Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T29) UD Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 16

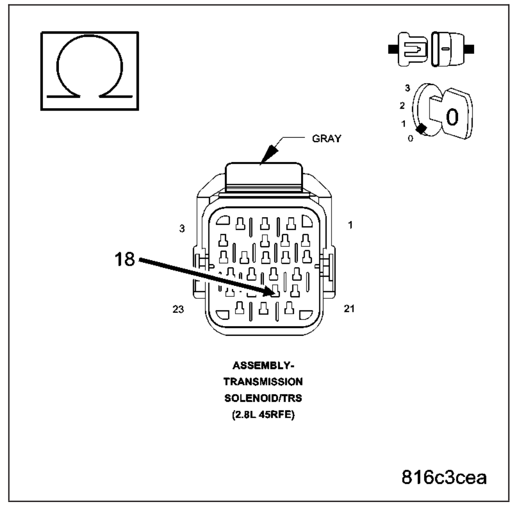
## 16. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Disconnect the TCM harness connector.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

**NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.**

Measure the resistance between the (T29) UD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T29) UD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T29) UD Pressure Switch Sense circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 17. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

If the DTC EVENT DATA shows the DTC P0875 set while the Line Pressure was significantly below the Desired Line Pressure reading, check for causes of low line pressure (low fluid level, broken or mis-installed primary oil filter or filter seal, sticking Main Regulator Valve in the Pump Valve Body etc.). If the data shows the DTC set while the Line Pressure reading was significantly higher than the Desired Line Pressure, check the Line Pressure Sensor and related wiring.

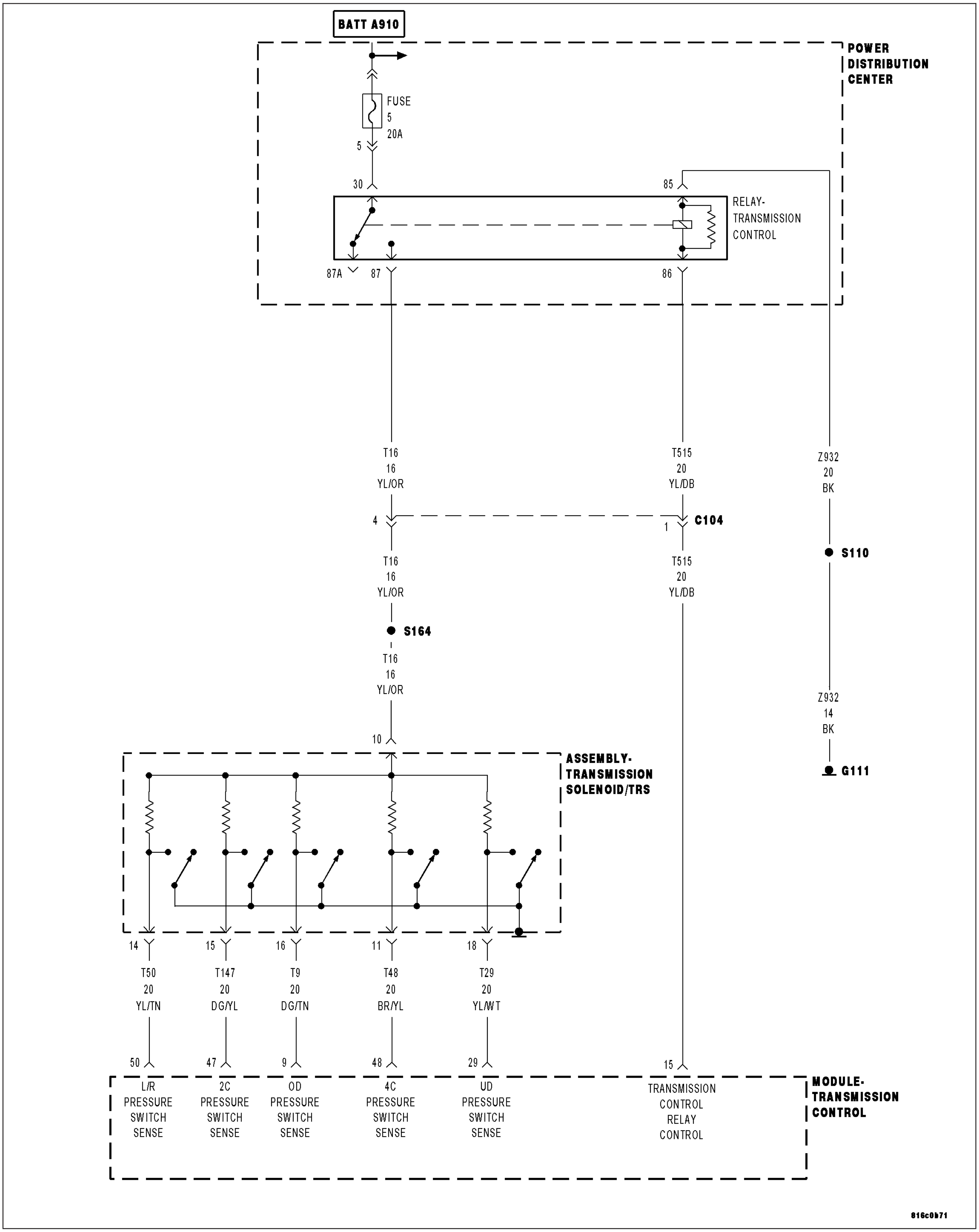
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0876-UD PRESSURE SWITCH RATIONALITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC is set if the UD pressure switch is in the wrong state for the current gear. For example, this code would be set if the UD pressure switch remained off while the transmission was in second gear.

| Possible Causes |
|---|
| RELATED RELAY DTC'S PRESENT |
| LOW FLUID LEVEL |
| NO. 2 CHECK BALL CUT OR DAMAGED |
| LOW LINE PRESSURE |
| CRACKED OR MISINSTALLED SUMP FILTER OR SEAL |
| STICKING MAIN REGULATOR VALVE IN PUMP VALVE BODY |
| (T29) UD PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T29) UD PRESSURE SWITCH CIRCUIT SHORT TO GROUND |
| (T29) UD PRESSURE SWITCH SENSE CIRCUIT SHORT TO ANOTHER CIRCUITS |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the LR, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

| GEAR | L/R | 2C | 4C | UD | OD |
|---|---|---|---|---|---|
| **REVERSE** | OPEN | OPEN | OPEN | OPEN | OPEN |
| **P/N** | CLOSED** | OPEN | OPEN | OPEN | OPEN |
| **1ST** | CLOSED* | OPEN | OPEN | CLOSED | OPEN |
| **2ND** | OPEN | CLOSED | OPEN | CLOSED | OPEN |
| **2ND PRIME** | OPEN | OPEN | CLOSED | CLOSED | OPEN |
| **3RD** | OPEN | OPEN | OPEN | CLOSED | CLOSED |
| **4TH** | OPEN | OPEN | CLOSED | OPEN | CLOSED |
| **5TH** | OPEN | CLOSED | OPEN | OPEN | CLOSED |

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is closed in Manual 1.

**May be open when rolling in Neutral or at low oil temperatures.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTC's.

**Are there any Transmission Control Relay, Line Pressure, and/or Loss of Prime DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. If a Loss of Prime DTC is present, perform its respective test first. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

## 2. CHECK FOR PRESSURE SWITCH DTCS

**Are there two or more other pressure switch rationality DTCs present in addition to P0876?**

**Yes** >> Go To 3

**No** >> Go To 4

## 3. CHECK IF ALL PRESSURE SWITCHES READ CLOSED

With the scan tool, read and record all DTC EVENT DATA.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA show all pressure switches reading CLOSED?**

**Yes** >> Refer to the symptom category and perform diagnostics for P0882. Diagnose the symptom as if the DTC is current.

**No** >> Go To 4

## 4. CHECK FOR OTHER DTCS

With the scan tool, check for other transmission DTC's.

**Is the DTC P2704 present also?**

**Yes** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. CHECK DTC EVENT DATA

With the scan tool, read and record the DTC EVENT DATA.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA display information for the DTC P0876?**

**Yes** >> Go To 6

**No** >> Refer to the symptom list and perform diagnostics for the DTC listed in the DTC EVENT DATA.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. CHECK IF DTC EVENT DATA WAS SET IN PARK, NEUTRAL OR REVERSE

Refer to the DTC EVENT DATA recorded earlier.

**Did the DTC P0876 set in Park, Neutral, or Reverse?**

**Yes** >> Go To 10

**No** >> Go To 7

## 7. CHECK FOR UD PRESSURE SWITCH STATUS

Refer to the DTC EVENT DATA recorded earlier.

**Did the DTC P0876 set with the UD Pressure Switch closed?**

**Yes** >> Go To 10

**No** >> Go To 8

## 8. CHECK LINE PRESSURE

In the DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

**Is the Line Pressure less than 40 PSI, and significantly below the Desired Line Pressure?**

**Yes** >> Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 9

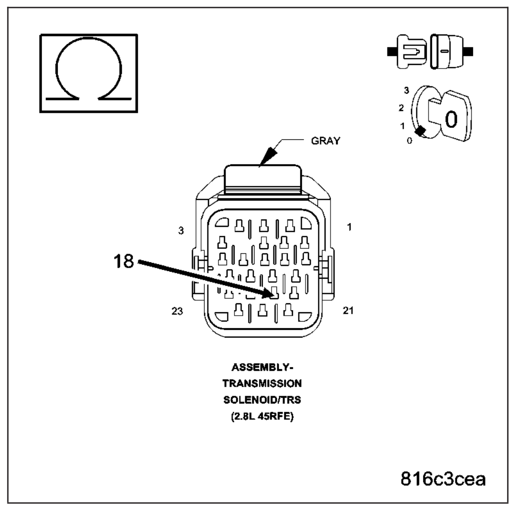
## 9. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

Turn the ignition off to the lock position.

Disconnect the TCM harness connector.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Measure the resistance between the (T29) UD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T29) UD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T29) UD Pressure Switch Sense circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 10. CHECK THE TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to the UD position.

With the scan tool, monitor the UD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

**Did the state of the UD Pressure Switch change while pressing the Pressure Switch Test button?**

**Yes** >> Go To 14

**No** >> Go To 11

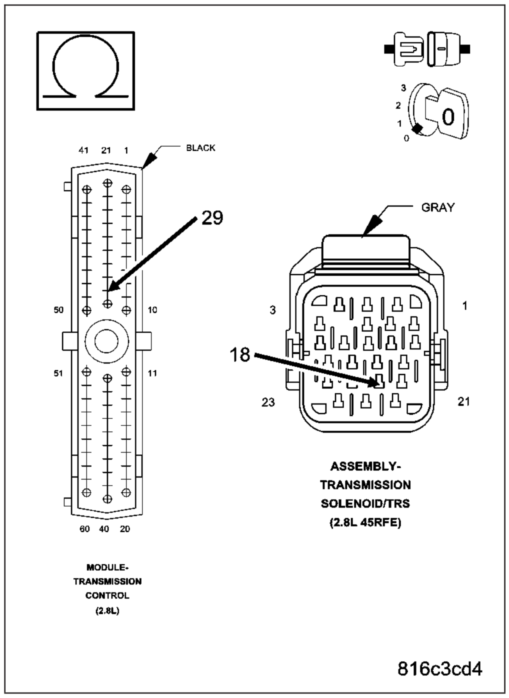
## 11. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance of the (T29) UD Pressure Switch Sense circuit from the Transmission Solenoid/TRS Assembly harness connector and the appropriate terminal of the TCM harness connector.




**Is the resistance above 5.0 ohms?**

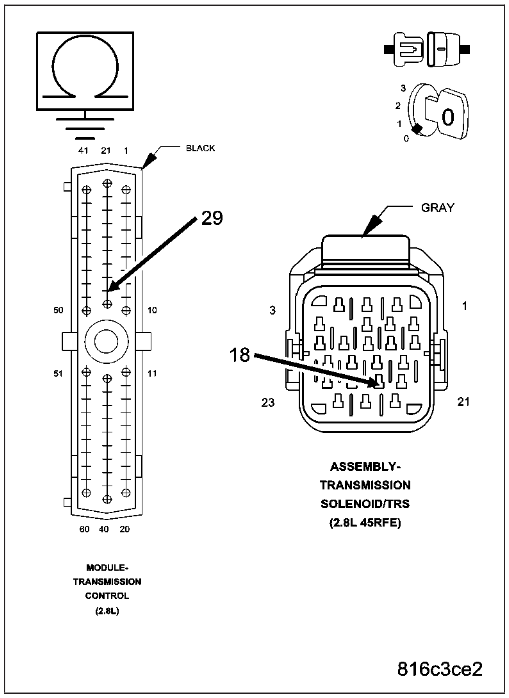
**Yes** >> Repair the (T29) UD Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 12

## 12. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T29) UD Pressure Switch Sense circuit.



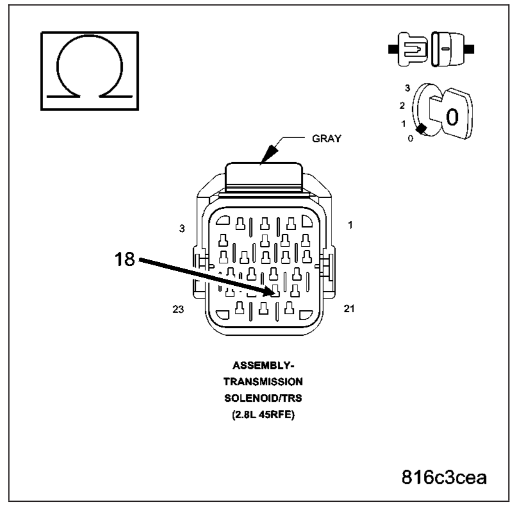

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T29) UD Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. CHECK THE (T29) UD PRESSURE SWITCH SENSE CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT




Disconnect the TCM harness connector.

**NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.**

Measure the resistance between the (T29) UD Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

**Is the resistance below 5.0 ohms between the (T29) UD Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T29) UD Pressure Switch Sense circuit for a short to another circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 14. WIGGLE TEST USING THE TRANSMISSION SIMULATOR

Perform the steps in the previous test while wiggling the wiring harness and connectors pertaining to the UD Pressure Switch.

**Did the state of the UD Pressure Switch change while pressing the Pressure Switch Test button?**

**Yes** >> Repair the wiring harness and/or connectors as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

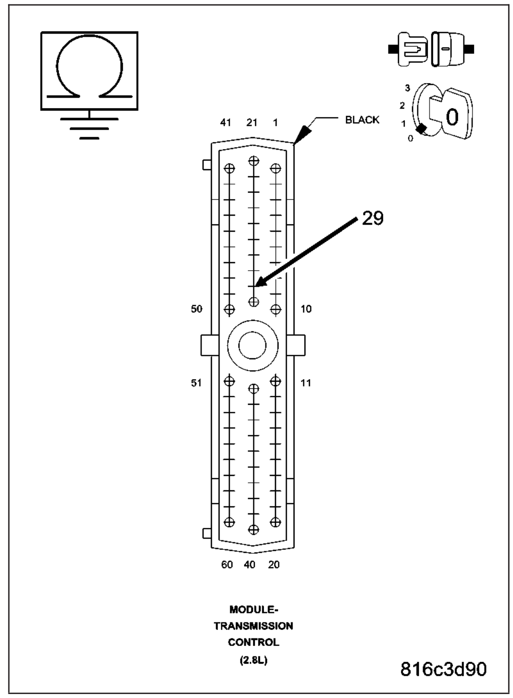
**No** >> Go To 15

## 15. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

Disconnect the Transmission Simulator and reconnect the Transmission Solenoid/TRS Assembly harness connector.

Disconnect the TCM harness connector.

Measure the resistance between ground and the (T29) UD Pressure Switch Sense circuit in the TCM harness connector.




**Is the resistance below 5.0 ohms?**

**Yes** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. CHECK IF THE DTC RESETS

Reconnect all previously disconnected connectors.

With the scan tool, erase all transmission DTCs.

Test drive the vehicle. Using the DTC EVENT DATA recorded earlier, try to duplicate the conditions in which the DTC originally set.

**Does the DTC P0876 reset?**

**Yes** >> Go To 17

**No** >> Go To 18

## 17. CHECK FOR A CUT NO. 2 CHECK BALL

Remove the Valve Body per the Service Information.

Check the No. 2 check ball for cuts or damage.

**Is the No. 2 check ball cut or damaged?**

**Yes** >> Replace the No. 2 check ball. Check for excessive clutch debris in the oil pan. If excessive debris is present, check the UD Clutch and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information. Check for excessive clutch debris in the oil pan. If excessive debris is present, check the UD Clutch and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 18. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

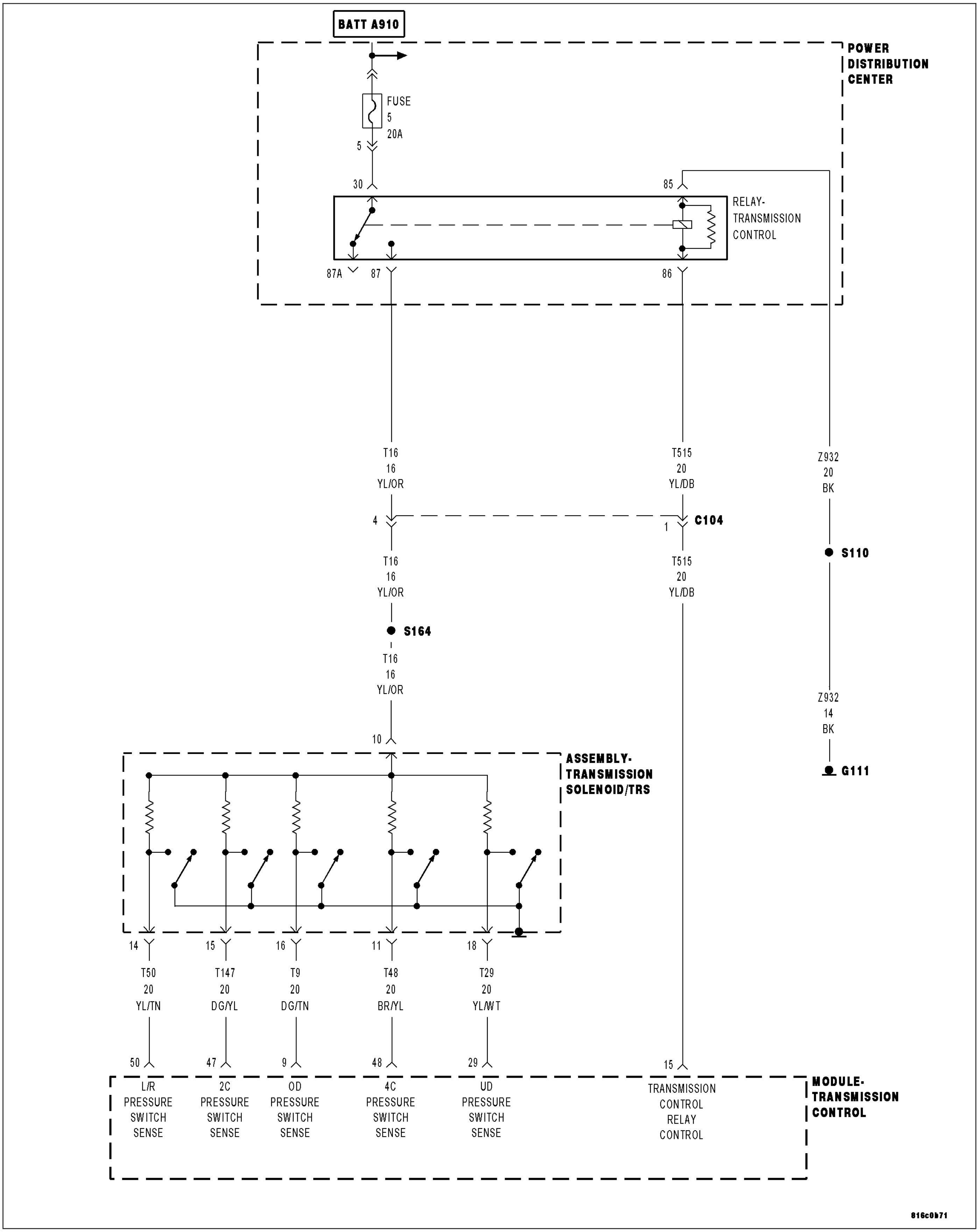
**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0882-TCM POWER INPUT LOW




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  When the ignition is turned from ″OFF″ position to ″RUN″ position and/or the ignition is turned from ″START″ position to ″RUN″ position.
- **Set Condition:**
  This DTC is set when less than 3.0 volts are present at the transmission control relay output circuits at the Transmission Control Module when the TCM is energizing the relay.

| Possible Causes |
|---|
| (A104) FUSED B+ CIRCUIT OPEN |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORT TO GROUND |
| (T515) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT OPEN |
| (T515) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO GROUND |
| (Z915) TRANSMISSION CONTROL RELAY GROUND CIRCUIT OPEN |
| TRANSMISSION CONTROL RELAY STUCK OPEN |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission control relay is used to supply power to the solenoids and pressure switches when the transmission is in normal operating mode. The relay output is fed back to the TCM through pins 16, 17, and 36. It is referred to as ″Transmission Control Relay Output″. This circuit does not supply power to the TCM, it is only a sense circuit. When the relay is off, no power is supplied to the solenoids and pressure switches, and the transmission is in ″limp-in″ or ″default″ mode. **Note: Inadequate Transmission Control Relay Output voltage can also cause DTCs P0846, P0869, P0871, P0876 or P0988 to set. This does not indicate an internal transmission or solenoid/ TRS problem. Repairing the P0888 fault should also eliminate the related DTCs.**

## Diagnostic Test

### 1. CHECK TO SEE IF DTC P0882 IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0882.

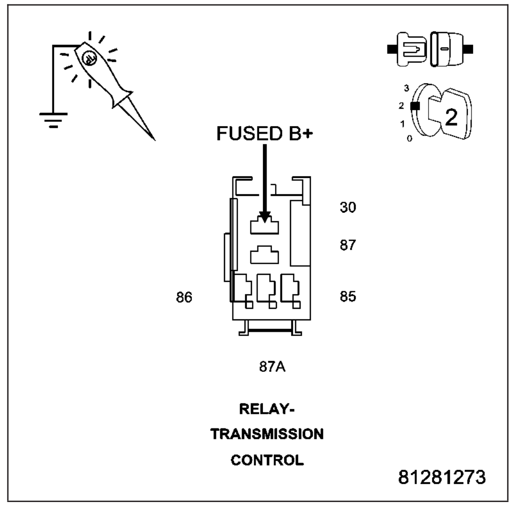
**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter equal to 0?**

**Yes** >> Go To 2

**No** >> Go To 9

## 2. CHECK THE (A104) FUSED B+ CIRCUIT FOR AN OPEN




Turn the ignition off to the lock position.

Remove the Transmission Control Relay.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, check the (A104) Fused B(+) circuit in the Transmission Control Relay connector.

**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**

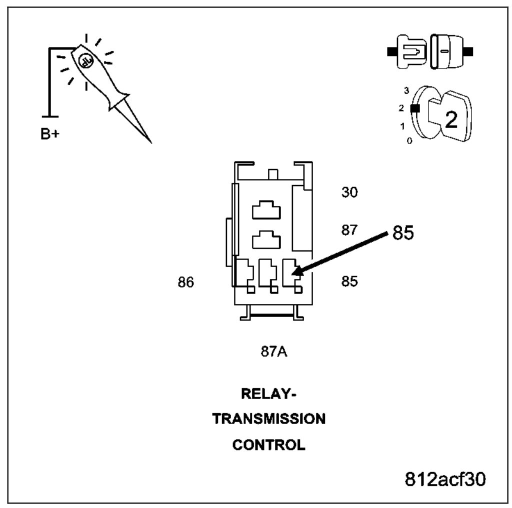
**Does the test light illuminate brightly?**

**Yes** >> Go To 3

**No** >> Repair the (A104) Fused B(+) circuit for an open. If the fuse is open make sure to check for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 3. CHECK THE (Z915) TRANSMISSION CONTROL RELAY GROUND CIRCUIT FOR AN OPEN




Turn the ignition off to the lock position.

Using a 12-volt test light connected to 12-volts, check the (Z915) Transmission Control Relay Ground circuit in the Transmission Control Relay connector.

**Does the test light illuminate brightly?**

**Yes** >> Go To 4

**No** >> Repair the (Z915) Transmission Control Relay Ground circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 4. CHECK THE TRANSMISSION CONTROL RELAY

Install a substitute relay in place of the Transmission Control Relay.

Start the vehicle.

With the scan tool, check transmission DTCs.

**Did the DTC P0882 reset?**

**Yes** >> Go To 5

**No** >> Replace the Transmission Control Relay.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 5. CHECK THE (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT FOR AN OPEN

Turn the ignition off to the lock position.

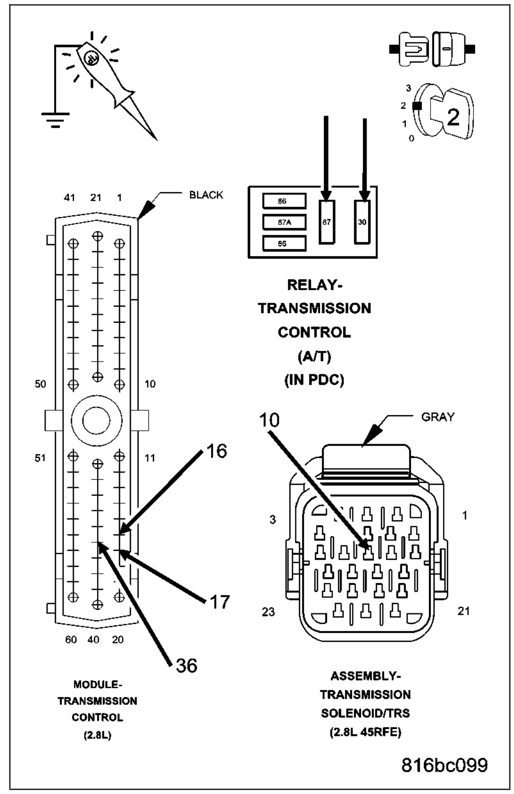
Disconnect the TCM harness connector.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Connect a jumper wire between the (A104) Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, check all four (T16) Transmission Control Relay Output circuits in the TCM harness connector and Transmission Solenoid/TRS Assembly harness connector.




**Does the test light illuminate brightly on all four (T16) Transmission Control Relay Output circuits?**

**Yes** >> Go To 6

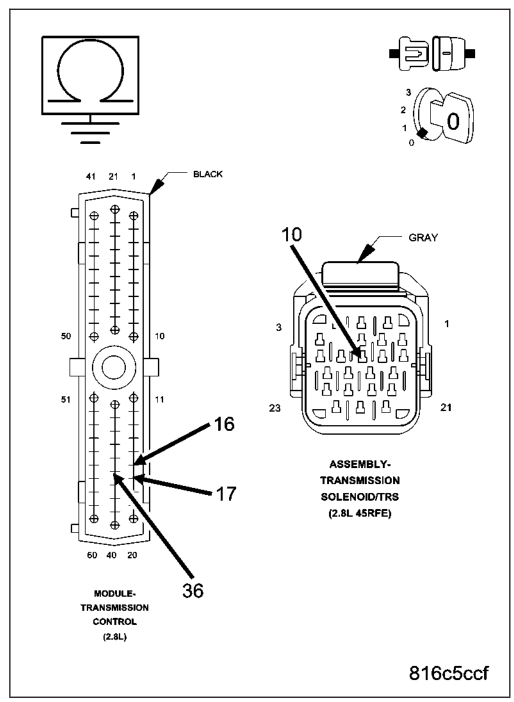
**No** >> Repair the (T16) Transmission Control Relay Output circuit(s) for an open or high resistance.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. CHECK THE (T16) TRANSMISSION RELAY OUTPUT CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off to the lock position.

Measure the resistance between ground and the (T16) Transmission Control Relay Output circuit.




**Is the resistance below 5.0 ohms?**

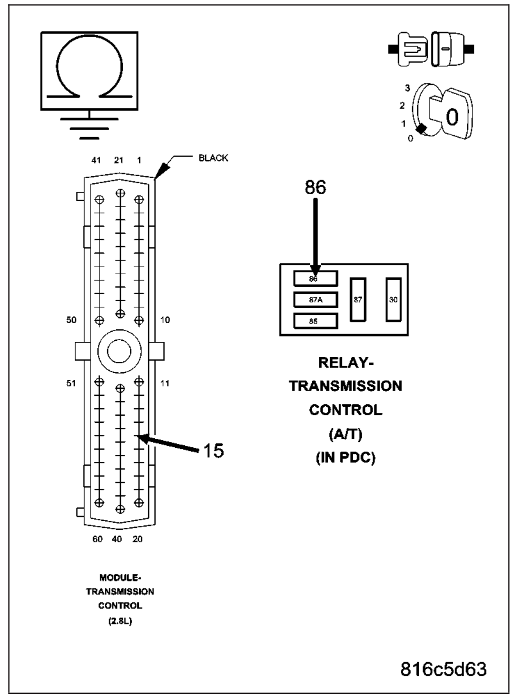
**Yes** >> Repair the (T16) Transmission Control Relay Output circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. CHECK THE (T515) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT FOR A SHORT TO GROUND

Measure the resistance between ground and the (T515) Transmission Control Relay Control circuit.




**Is the resistance below 5.0 ohms?**

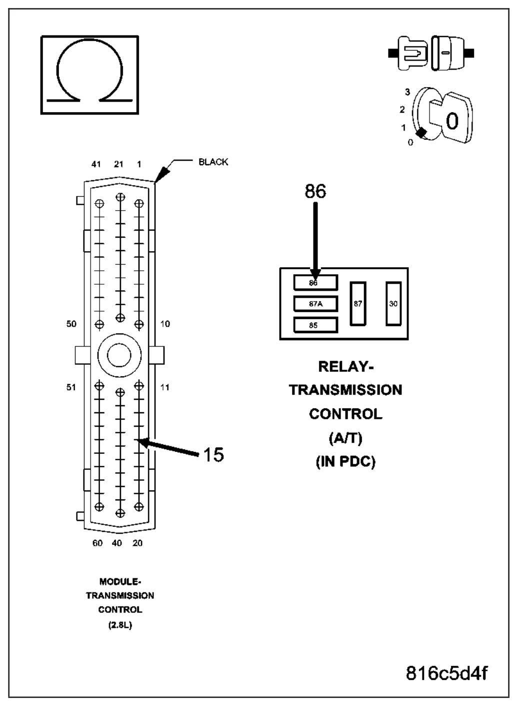
**Yes** >> Repair the (T515) Transmission Control Relay Control circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. CHECK THE (T515) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT FOR AN OPEN

Measure the resistance of the (T515) Transmission Control Relay Control circuit between the Transmission Control Relay connector and the appropriate terminal of the TCM harness connector..




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T515) Transmission Control Relay Control circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 9. CHECK WIRING AND CONNECTORS

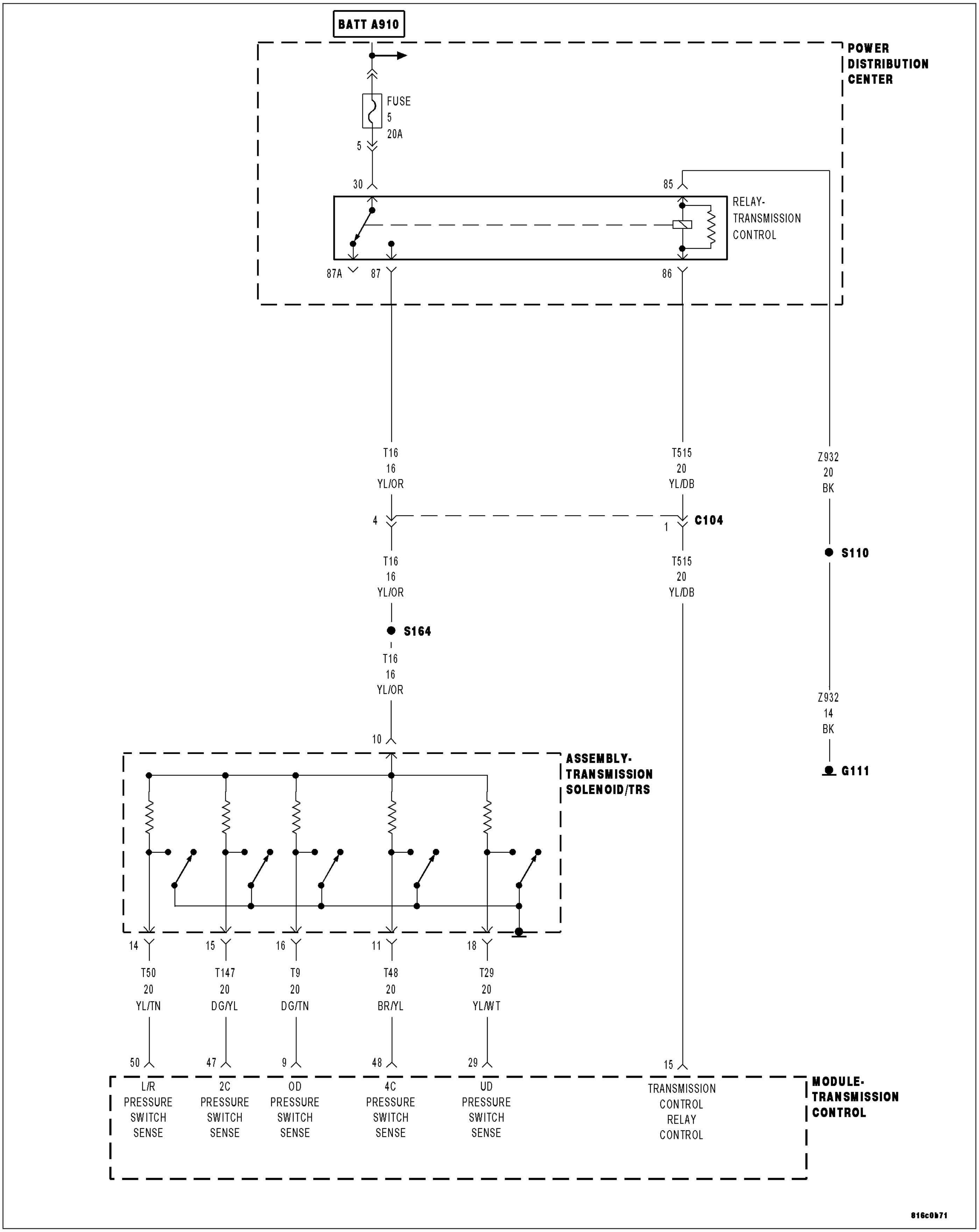
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wires while checking for shorted and open circuits.
With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Where there any problems found?**

**Yes** >> Repair as necessary.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0883-TCM POWER INPUT HIGH




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is turned from ″OFF″ position to ″RUN″ position and/or the ignition is turned from ″START″ position to ″RUN″ position.
- **Set Condition:**
  This DTC is set if the Transmission Control Module senses greater than 3.0 volts on the Transmission Control Relay Output circuits prior to a request from the TCM to energize the Transmission Control Relay.

| Possible Causes |
|---|
| (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT SHORT TO VOLTAGE |
| (T16) TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORT VOLTAGE |
| TRANSMISSION CONTROL RELAY |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Control Relay is used to supply power (Transmission Control Relay Output) to the Transmission Solenoid/TRS Assembly when in normal operating mode and to pins C4–19, C4–28 and C4–38 of the PCM. The purpose of the Transmission Control Relay is to allow the PCM to turn off the power to the Transmission Solenoid/TRS Assembly in event that the transmission should need to be placed into “limp-in” mode due to a DTC.

After a TCM reset, (ignition switch turned to the run position, or after cranking engine) the TCM verifies that the Transmission Control Relay contacts are open by checking for voltage on the Transmission Control Relay Output circuit before the Transmission Control Relay is energized. If voltage is detected, the DTC will set.

## Diagnostic Test

### 1. CHECK TO SEE IF DTC P0883 IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0883.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter set to 0?**

**Yes** >> Go To 2

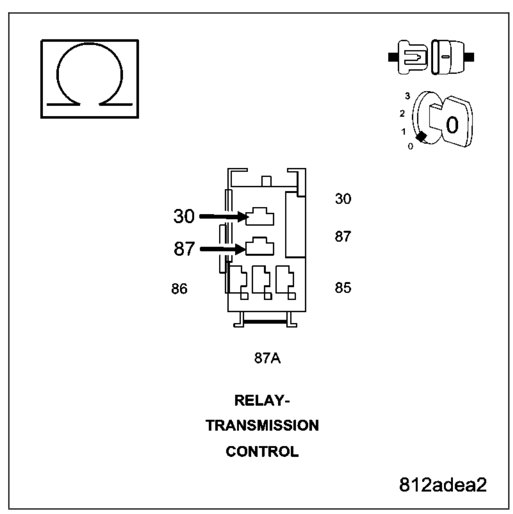
**No** >> Go To 6

### 2. CHECK THE TRANSMISSION CONTROL RELAY

Turn the ignition off to the lock position.

Disconnect the Transmission Control Relay.

Measure the resistance between the (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output Circuit of the Transmission Control Relay.




**Is the resistance above 5.0 ohms?**

**Yes** >> Go To 3

**No** >> Replace the Transmission Control Relay.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 3. CHECK THE (T16) TRANSMISSION RELAY OUTPUT CIRCUIT FOR A SHORT TO VOLTAGE

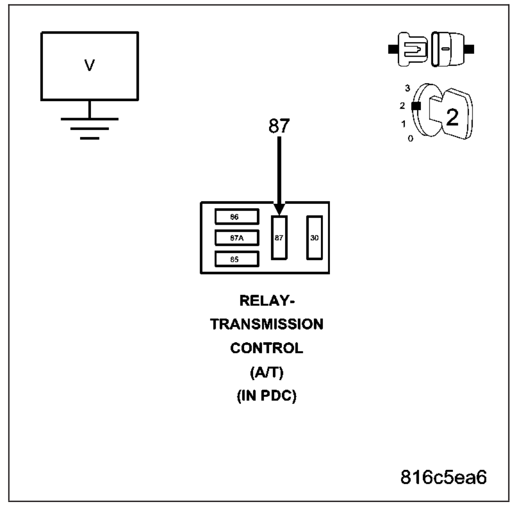
Ignition on, engine not running.

Measure the voltage at the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

**Is the voltage above 0.5 volts?**

**Yes** >> Go To 4

**No** >> Go To 5




## 4. CHECK THE TRANSMISSION SOLENOID/TRS ASSEMBLY

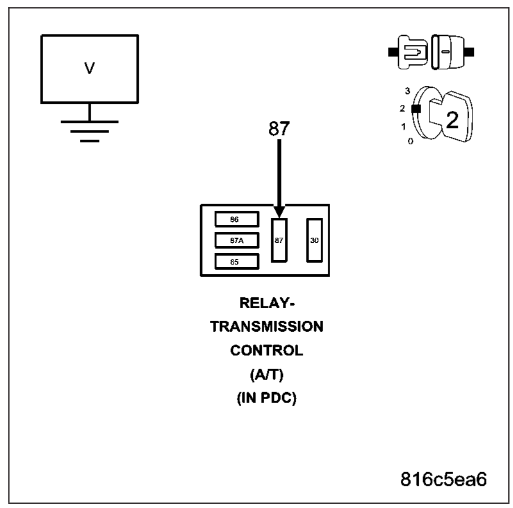
Turn the ignition off to the lock position.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Ignition on, engine not running.

Measure the voltage at the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

**Is the voltage above 0.5 volts?**




**Yes** >> Repair the (T16) Transmission Control Relay Output circuit for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 5. CHECK THE (T15) TRANSMISSION CONTROL RELAY CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

Turn the ignition off to the lock position.

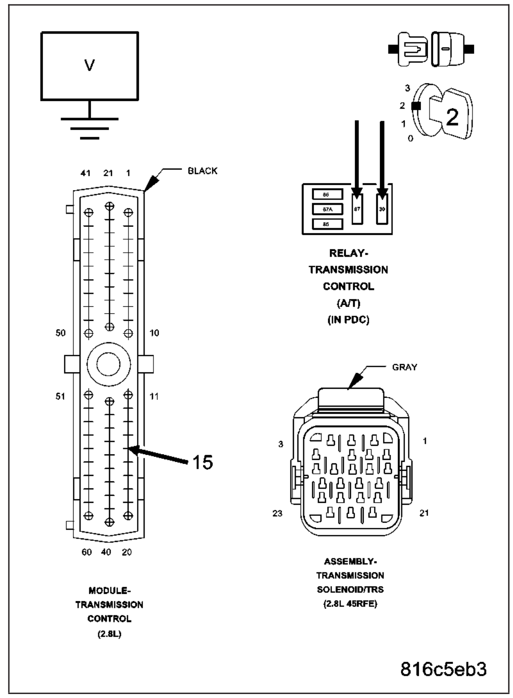
Disconnect the TCM harness connector.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Connect a jumper wire between the (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T15) Transmission Control Relay Control circuit.




**Is the voltage above 0.5 volts?**

**Yes** >> Repair the (T15) Transmission Control Relay Control circuit for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

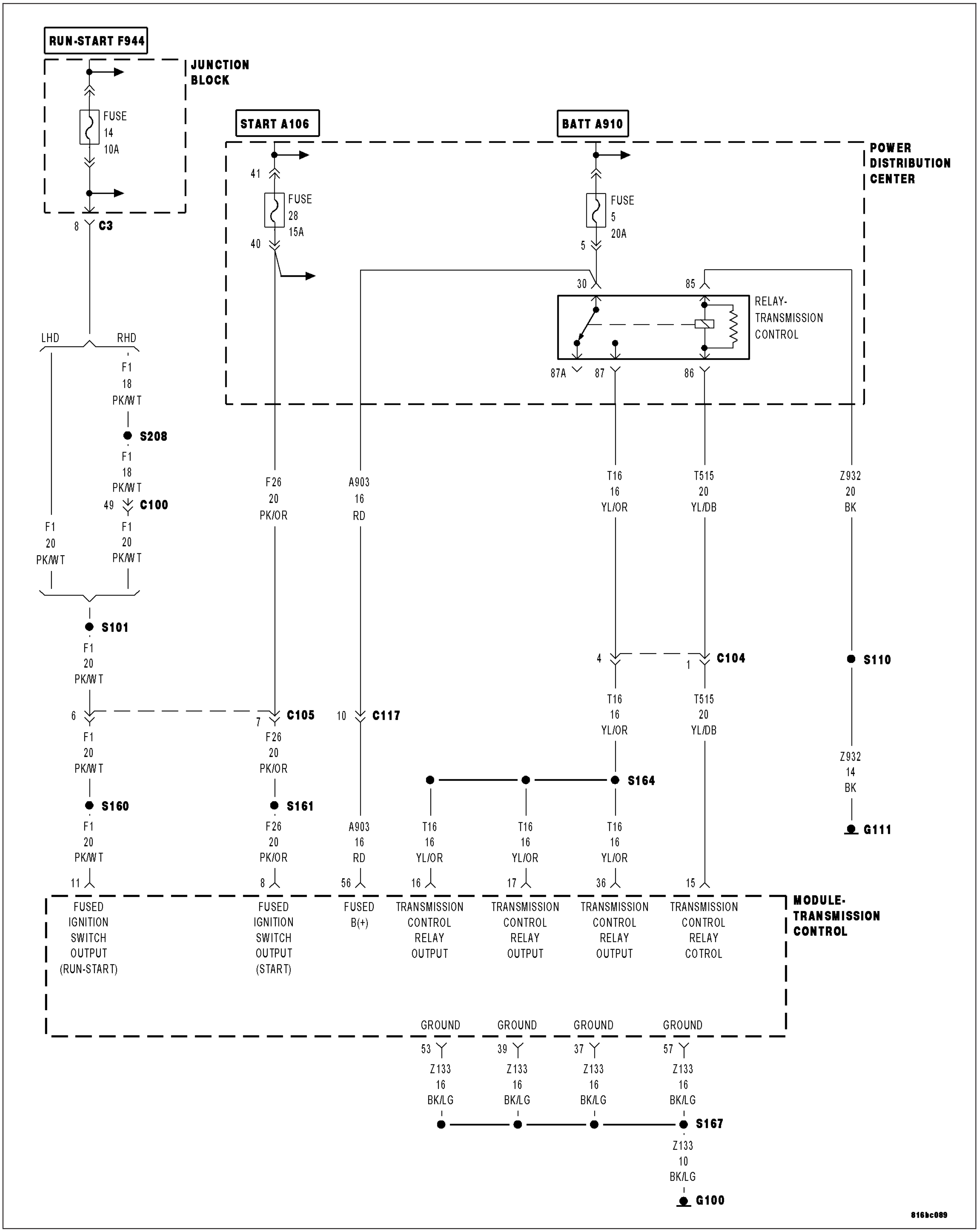
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0884-POWER UP AT SPEED




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When Transmission Control Module initially powers up.
- **Set Condition:**
  This DTC will set if the PCM powers up and senses the vehicle in a valid forward gear, with no PRNDL DTCs, and an output speed above 800 RPM, approximately 32 Kmh (20 MPH).

| Possible Causes |
|---|
| POWER UP AT SPEED |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

If a vehicle loses power to the Transmission Control System, the solenoids (LR, 2C, OD, UD, 4C) will go to their respective power off state. Some solenoids are normally vented and some are normally applied in their power off state. The transmission is designed to be in 3rd gear with all of the solenoids in this state. However, if power is restored, the Transmission Control System will power-up and normal operation will be restored.

This code identifies that power to the Transmission Control System was restored when the gear selector was in a ″Drive″ position while the vehicle was moving at speeds above 32 Kmh (20 MPH). **This DTC does not indicate a problem with the transmission or Transmission Control System,** instead, it suggests intermittent problems in the fused ignition switch output, fused B(+), or ground circuits to the TCM. Alternately, if a person performs a rolling restart maneuver, the DTC can be set. Therefore it is critical that this DTC be investigated if the vehicle is experiencing intermittent 3rd gear operation and a subsequent return to normal operation.

## Diagnostic Test

### 1. CHECK THE POWER AND GROUND CIRCUITS

This DTC is set when the Trnasmission Control Module is initialized while the vehicle is moving down the road in a valid forward gear.

Using the wiring diagram/schematic as a guide, inspect the wiring and connectors.

Check all of the Fused B(+), Fused Ignition Switch Output, and ground circuits to the TCM for an intermittent open or short to ground.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

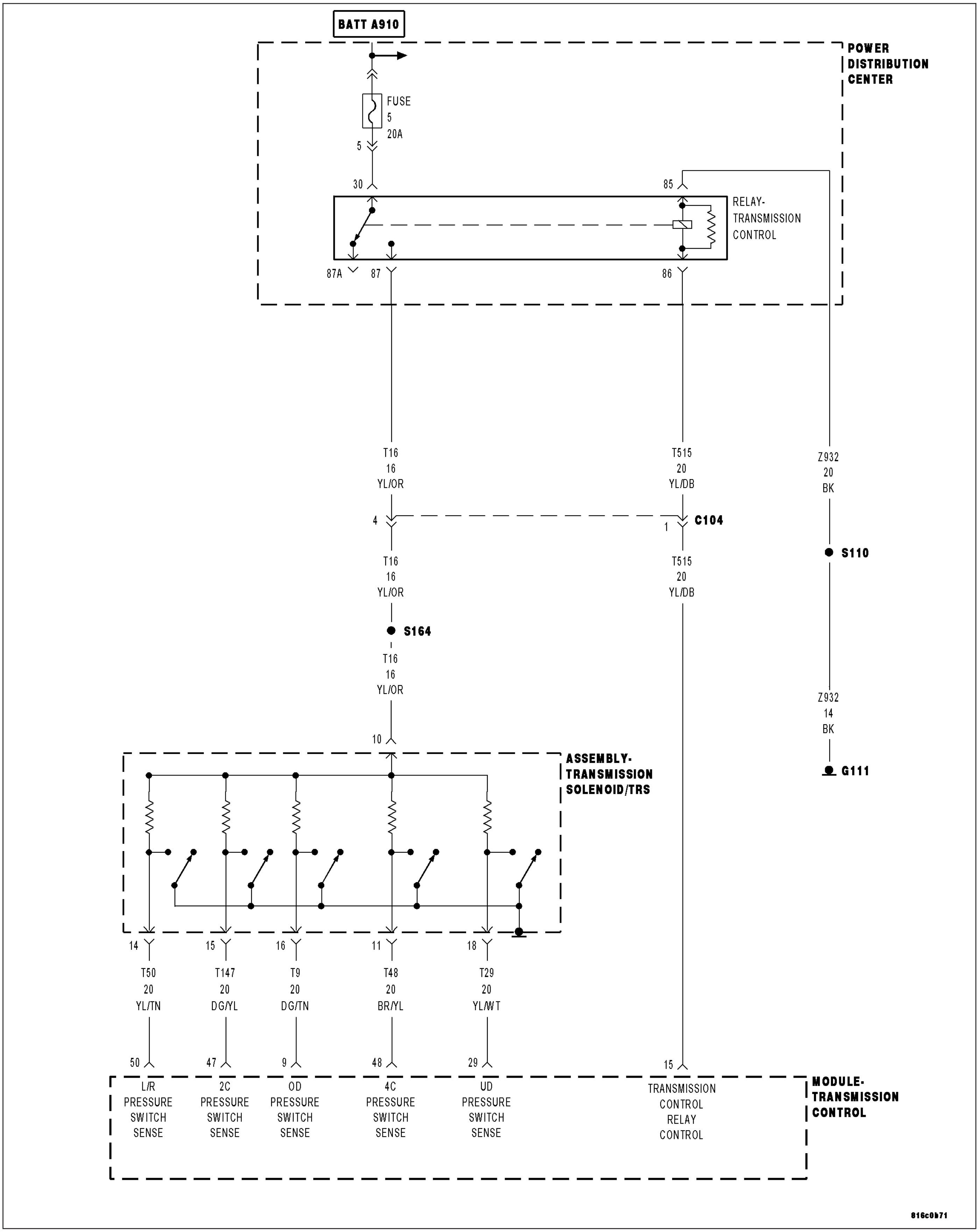
**If there are no possible causes remaining, view repair.**

**Repair**

Check all power and ground circuits to the TCM and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P0890-SWITCHED BATTERY




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is turned from ″OFF″ position to ″RUN″ position and/or the ignition is turned from ″START″ position to ″RUN″ position.
- **Set Condition:**
  This DTC is set if the Transmission Control Module senses voltage on any of the pressure switch inputs prior to the Transmission Control Relay being energized.

| Possible Causes |
|---|
| PRESSURE SWITCH SENSE CIRCUITS SHORT TO VOLTAGE |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission control relay is used to supply power to the solenoids and pressure switches (Transmission Solenoid/TRS Assembly) when the transmission is in normal operating mode. When the relay is off, no power is supplied and the transmission is in ″limp-in″ mode. The relay output is fed back to the TCM through pins C4-19, C4-28 and C4–38 and are referred to as ″Transmission Control Relay Output″.

Immediately after a controller reset (ignition key turned to the ″run″ position or after cranking engine), the TCM verifies that the relay contacts are open by checking for no voltage at the transmission control relay output terminals. After this is verified, the voltage at the pressure switches are checked. There should be no voltage on the pressure switches at this time. The TCM will then activate the relay.

## Diagnostic Test

### 1. CHECK TO SEE IF DTC P0890 IS PRESENT

With the scan tool, Check the STARTS SINCE SET counter for P0890.

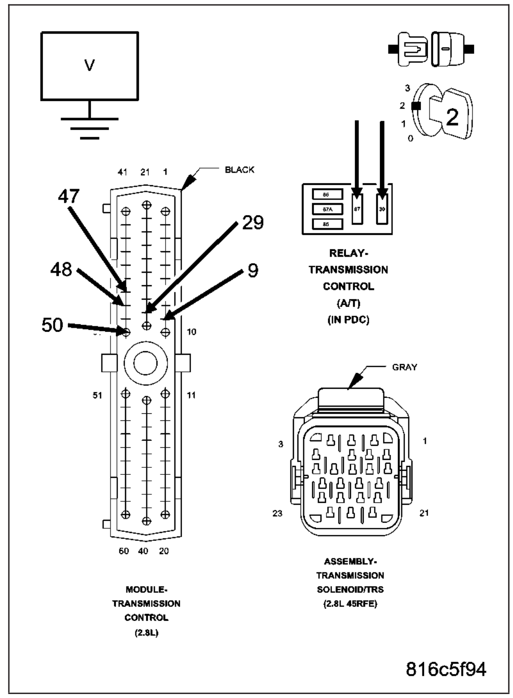
**NOTE: This counter only applies to the last DTC set.**

**Is the ″Starts Since Set″ counter set at 0?**

**Yes** >> Go To 2

**No** >> Go To 4

## 2. PRESSURE SWITCH SENSE CIRCUITS SHORT TO VOLTAGE




Turn the ignition off to the lock position.

Disconnect the TCM harness connector.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Remove the Transmission Control Relay.

Connect a jumper wire between the Fused B(+) circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T147) 2C, (T48) 4C, (T50) LR, (T9) OD, and (T29) UD Pressure Switch Sense circuits in the TCM harness connector.

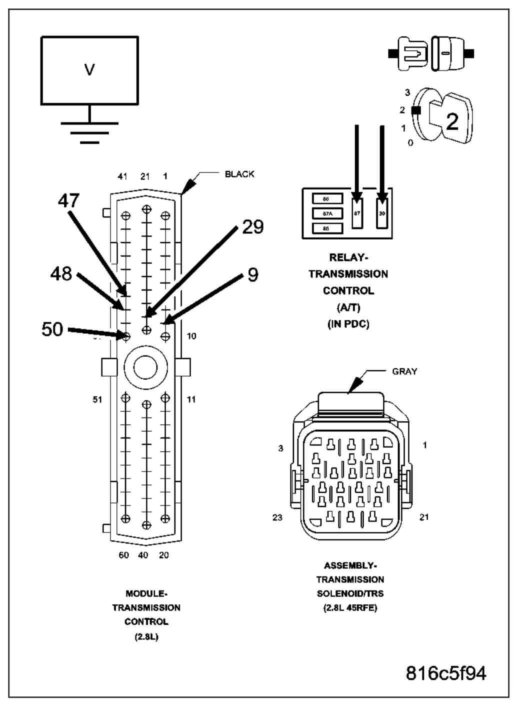
**Is the voltage above 0.5 volt on any of the measured circuits?**

**Yes** >> Repair the (T147) 2C, (T48) 4C, (T50) LR, (T9) OD, and/or (T29) UD Pressure Switch Sense circuit(s) for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. TRANSMISSION SOLENOID/TRS ASSEMBLY




Turn the ignition off.

Remove the jumper wire.

**NOTE: Do not reinstall the Transmission Relay.**

Reconnect the Transmission Solenoid/TRS Assembly harness connector.

Ignition on, engine not running.

Measure the voltage of the (T147) 2C, (T48) 4C, (T50) LR, (T9) OD, and (T29) UD Pressure Switch Sense circuits in Miller tool #8815.

**Is the voltage above 0.5 volts on any of the sense circuits?**

**Yes** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 4. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

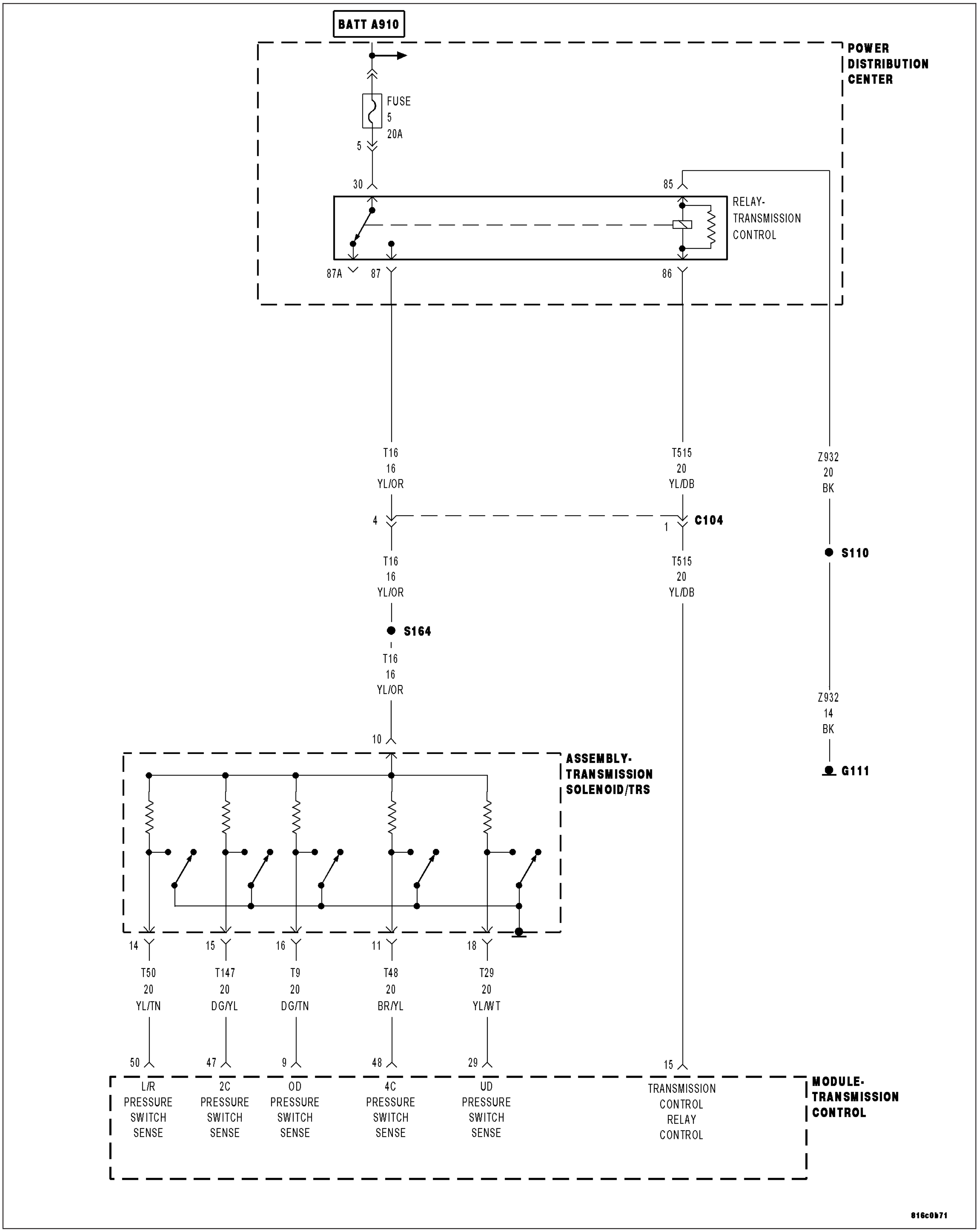
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0932-LINE PRESSURE SENSOR CIRCUIT




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  The TCM continuously monitors Actual Line Pressure and compares it to Desired Line Pressure. If the Actual Line Pressure reading is more than 172.4 kPa (25 psi) higher than the Desired Line Pressure, but is less than the highest Line Pressure ever used in the current gear, the DTC sets.

| Possible Causes |
|---|
| RELATED DTC'S PRESENT |
| LINE PRESSURE CONNECTOR AND WIRING |
| INTERNAL TRANSMISSION |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTCs.

**Are there any other line pressure related DTC's present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. Perform the test for P0934 and/or P0935 first if present. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

**No** >> Go To 2

### 2. CONDITION P0932 PRESENT

**CAUTION: Apply Parking Brake**
Start the engine.

**CAUTION: Firmly apply the brakes.**
With the scan tool, monitor the Line Pressure, Desired Line Pressure and the TPS degrees.

While firmly applying the brakes, place the shifter in reverse, then slowly press the accelerator pedal to a TPS degree of 15°.

Compare the Line Pressure reading to the Desired Line Pressure reading on the scan tool.

**Does the Line Pressure stay within ± 34 kPa or 5 PSI of the Desired Line Pressure?**

**No** >> Go To 3

**Yes** >> Go To 5

## 3. CHECK LINE PRESSURE CONNECTOR AND WIRING

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure Sensor voltage while wiggling the wiring harness and connectors pertaining to the Line Pressure Sensor and the Transmission Solenoid/TRS Assembly.

**Did the voltage remain steady while wiggling the wiring harness and connectors?**

**Yes** >> Go To 4

**No** >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 4. CHECK TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure during the following step.

With the Transmission Simulator, turn the selector switch to each of the 3 Line Pressure positions.

**NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 PSI of the reading specified on the Transmission Simulator.**

**Does the Line Pressure on the scan tool fluctuate up and down more than 69 kPa or 10 PSI at any of the 3 line pressure positions on the Transmission Simulator?**

**Yes** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Repair internal transmission and inspect the oil pump per the Service information and replace if necessary. If no problems are found, replace the Transmission Solenoid/TRS Assembly — possible cause is the Pressure Control Solenoid is stuck.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 5. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

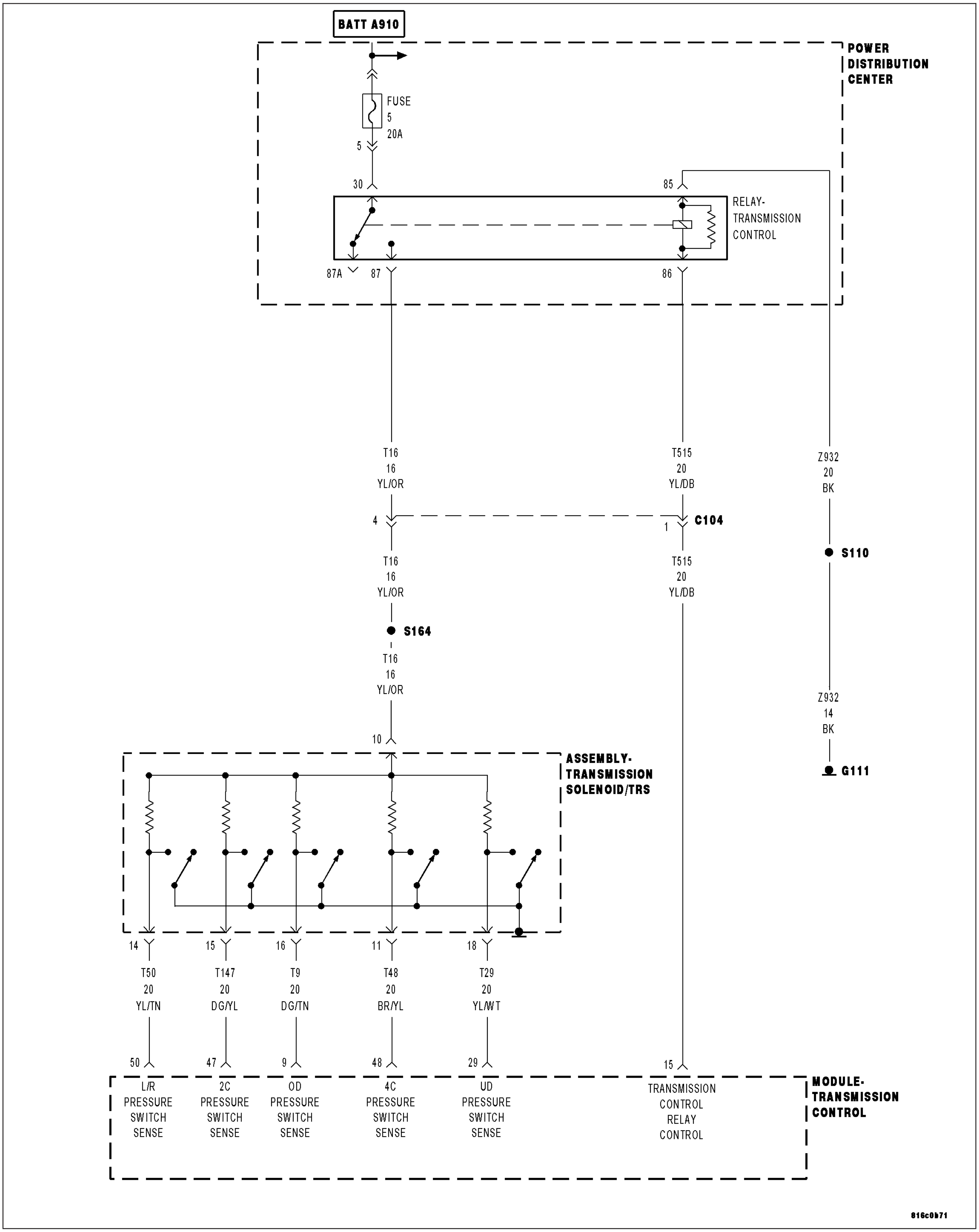
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0934-LINE PRESSURE SENSOR CIRCUIT LOW




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on and engine running.
- **Set Condition:**
  This DTC will set when the monitored Line Pressure Sensor voltage is less than or equal to 0.35 volts for 0.18 seconds.

| Possible Causes |
|---|
| (T39) 5-VOLT SUPPLY CIRCUIT OPEN |
| (T39) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND |
| (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND |
| LINE PRESSURE SENSOR |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality.

The monitored Line Pressure Sensor voltage should always be between 0.35 and 4.75 volts. Any monitored voltages outside these parameters indicate an Line Pressure Sensor or wiring problem and will cause either DTC P0934 or P0935 to set.

## Diagnostic Test

### 1. CHECK IF DTC IS CURRENT

With the scan tool, check the STARTS SINCE SET counter for P0934.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 2

**No** >> Go To 6

### 2. CHECK TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the scan tool, under Transmission Sensors, monitor the Line Pressure.

Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

**NOTE: The readings should be within ±14 kPa or 2.0 PSI on the scan tool to the pressure readings specified on Transmission Simulator.**

**Does the Line Pressure on the scan tool match the line pressures on the Transmission Simulator?**

**Yes** >> Replace the Line Pressure Sensor per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 3

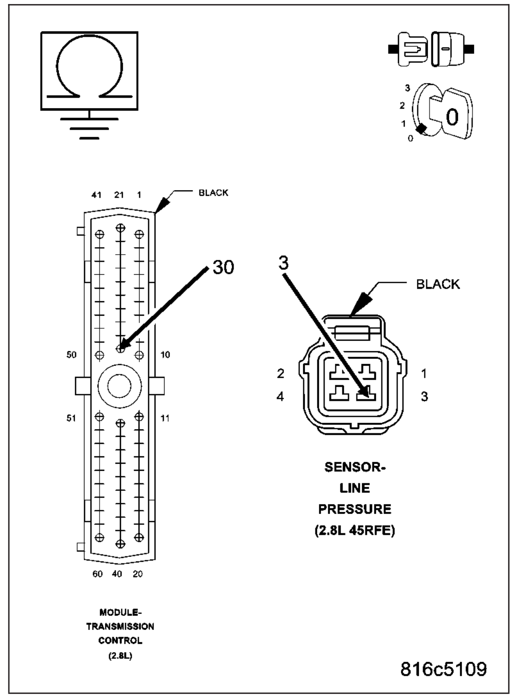
## 3. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

Turn the ignition off to the lock position.

Disconnect the TCM harness connector.

Disconnect the Transmission Simulator, Miller tool #8333.

Measure the resistance between ground and the (T38) Line Pressure Sensor Signal circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T38) Line Pressure Sensor Signal circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

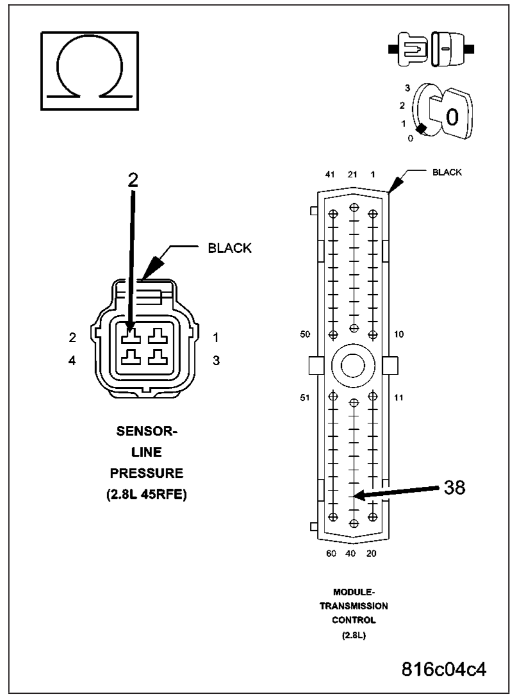
**No** >> Go To 4

## 4. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR AN OPEN

Disconnect the TCM harness connector.

Measure the resistance of the (T39) 5-volt Supply circuit between Line Pressure sensor harness connector and the appropriate terminal of the TCM harness connector.

**Is the resistance below 5.0 ohms?**




**Yes** >> Repair the (T39) 5-volt Supply circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

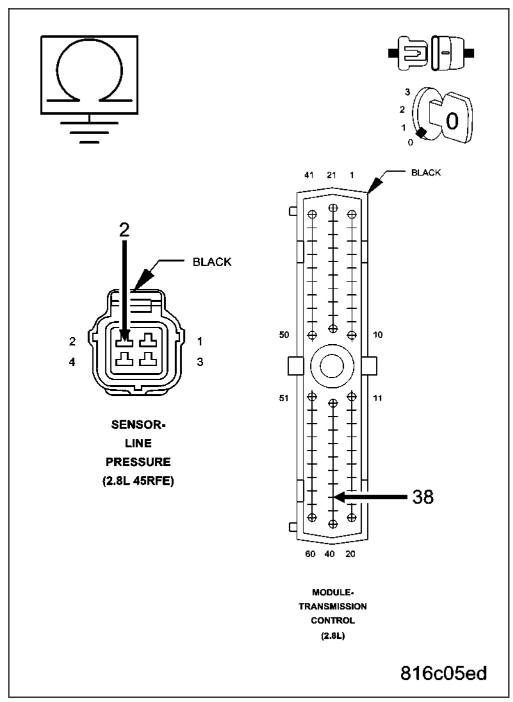
**No** >> Go To 5

## 5. CHECK THE (T39) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO GROUND

Disconnect the TCM harness connector.

Measure the resistance between ground and the (T39) 5-volt Supply circuit.

**Is the resistance below 5.0 ohms?**




**Yes** >> Repair the (T39) 5-volt Supply circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

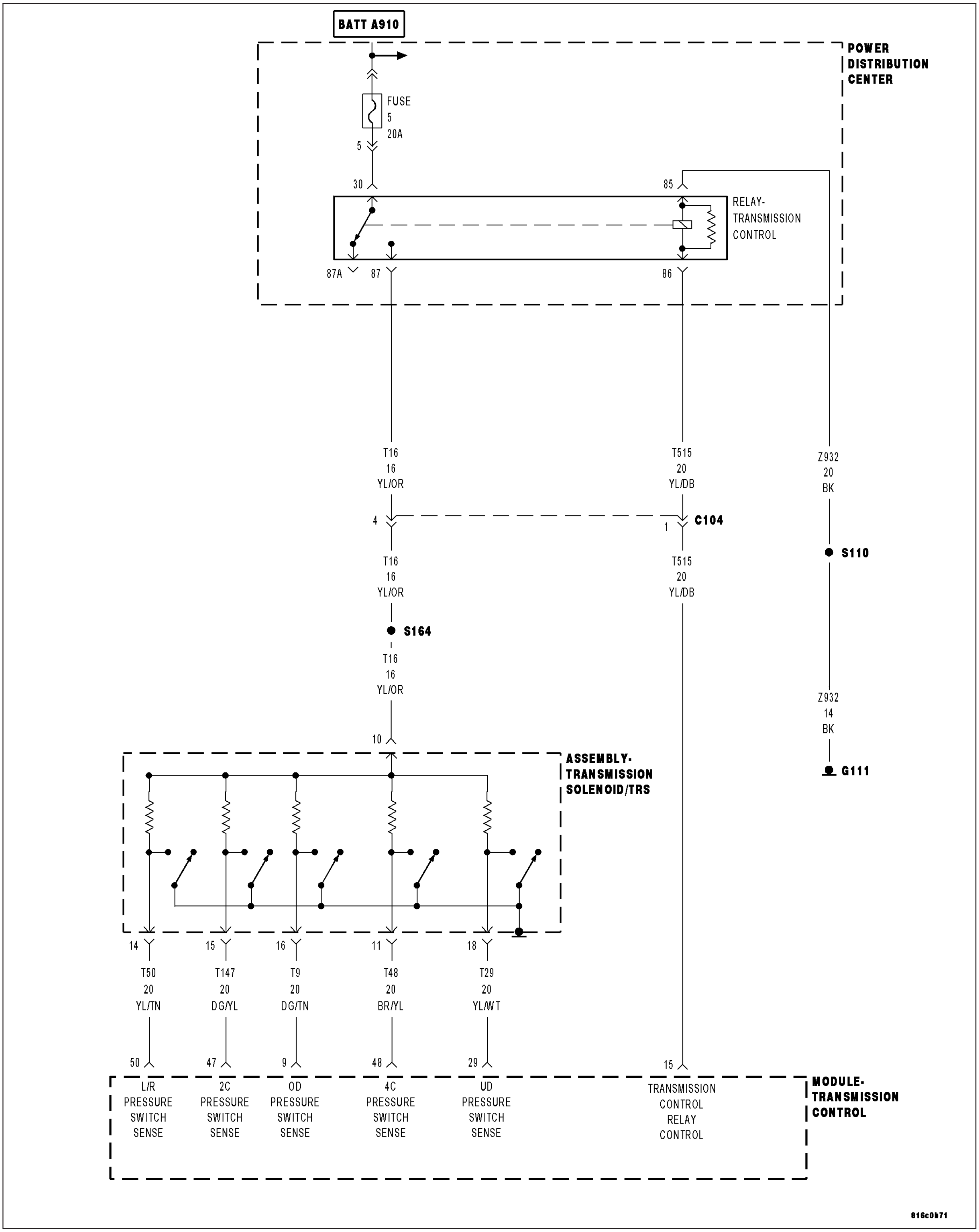
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0935-LINE PRESSURE SENSOR CIRCUIT HIGH




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with ignition on and engine running.
- **Set Condition:**
  This DTC will set if the monitored Line Pressure Sensor voltage is greater than or equal to 4.75 volts for the period of 0.18 seconds

| Possible Causes |
|---|
| (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT OPEN |
| (Z133) SENSOR GROUND CIRCUIT OPEN |
| (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE |
| LINE PRESSURE SENSOR |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

Line pressure is electronically controlled by the Transmission Control System and is measured by the Line Pressure Sensor (LPS). The desired line pressure is continuously being compared to the actual line pressure and is regulated by electronically changing the duty cycle of the Pressure Control Solenoid (PCS). (5% duty cycle = solenoid off = max line pressure, 62% duty cycle = solenoid on = min line pressure).

The Transmission Control System calculates the desired line pressure based on inputs from the transmission and engine. A calculated torque input to the transmission is used as the primary input of the desired line pressure calculation and is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 to 931 kPa (120 to 135 PSI) during shifts and in Park and Neutral to ensure consistent shift quality.

The monitored Line Pressure Sensor voltage should always be between 0.35 and 4.75 volts. Any monitored voltages outside these parameters indicate an Line Pressure Sensor or wiring problem and will cause either DTC P0934 or P0935 to set.

## Diagnostic Test

### 1. CHECK TO SEE IF DTC IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P0935.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 2

**No** >> Go To 6

### 2. TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure.

Using the Transmission Simulator, set the rotary switch to each of the 3 line pressure positions.

**NOTE: The readings should be within ±14 kPa or 2.0 PSI on the scan tool of the pressure reading specified on Transmission Simulator.**

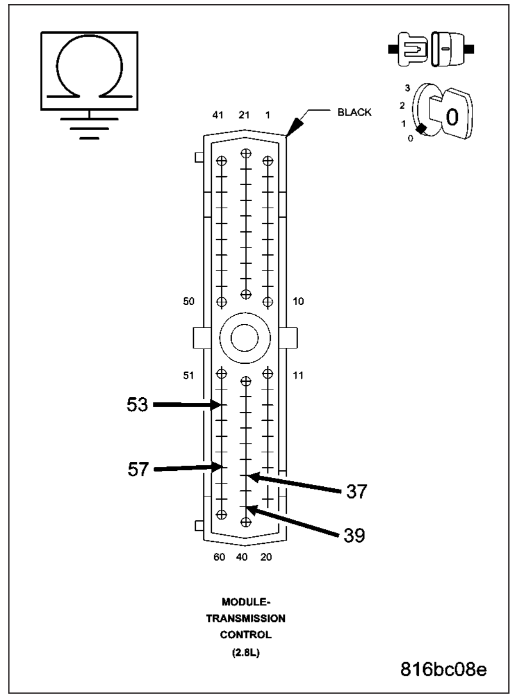
**Does the 3 line pressures on the scan tool match the Line pressure readings on the Transmission Simulator?**

**Yes** >> Replace the Line Pressure Sensor per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. CHECK THE (Z133) SENSOR GROUND CIRCUIT FOR AN OPEN




Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance of the (Z133) Sensor Ground circuit from the Line Pressure Sensor harness connector to the appropriate terminal of the TCM harness connector.

**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (Z133) Sensor Ground circuit for an open.

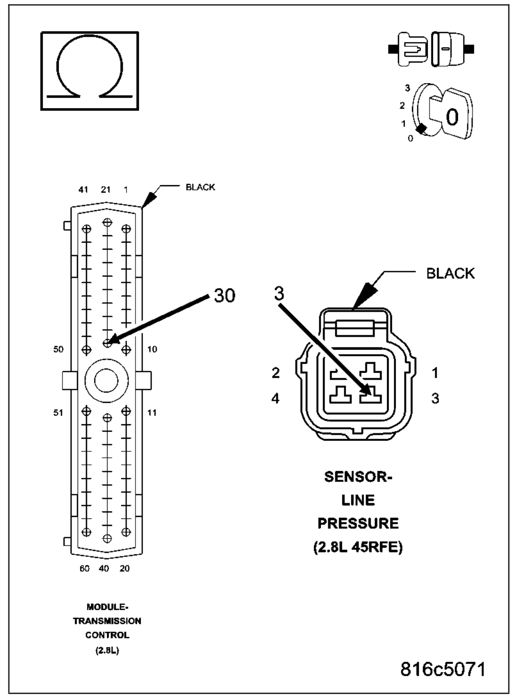
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR AN OPEN

Disconnect the TCM harness connector.

Measure the resistance of the (T38) Line Pressure Sensor Signal circuit between the Line Pressure Sensor harness connector and the appropriate terminal of the TCM harness connector.




**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the (T38) Line Pressure Sensor Signal circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

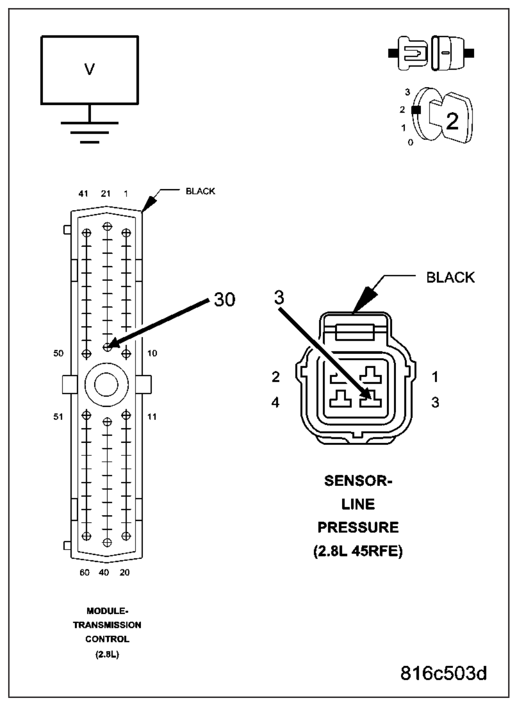
## 5. CHECK THE (T38) LINE PRESSURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

Remove the Transmission Control Relay.

Connect a jumper wire between the (A104) Fused B(+) circuit and the (T16) Transmission Control Relay Output circuit in the Transmission Control Relay connector.

Ignition on, engine not running.

Measure the voltage of the (T38) Line Pressure Sensor Signal circuit.




**Is the voltage above 5.5 volts?**

**Yes** >> Repair the (T38) Line Pressure Sensor Signal circuit for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0944-LOSS OF HYDRAULIC PUMP PRIME

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  If the transmission is slipping in any forward gear and all the pressure switches are not indicating pressure, a loss of prime test is run.
- **Set Condition:**
  If the transmission begins to slip in a forward gear and all the pressure switch(s) that should be closed are open a loss of prime test begins. Available elements are turned on by the TCM to see if pump prime exists. The DTC sets if no pressure switch(s) respond.

| Possible Causes |
|---|
| SHIFT LEVER OUT OF ADJUSTMENT |
| IMPROPER FLUID LEVEL |
| CRACKED OR IMPROPERLY INSTALLED PRIMARY OIL FILTER OR SEAL |
| LOOSE COOLER RETURN FILTER |
| STUCK OR STICKING MAIN REGULATOR VALVE |
| TRANSMISSION OIL PUMP |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

### Theory of Operation

The Loss of prime test is used to prevent transmission defaults and erroneous fault codes during temporary loss of pump prime that may occur with low transmission fluid under severe braking conditions, start-up, etc. and to point towards more subtle problems such as a plugged or cracked oil filter.

The Loss of Prime DTC is set by a loss of hydraulic pressure in the transmission system. This condition, if sustained, will result in the vehicle being unable to move.

### Diagnostic Test

#### 1. SHIFT LEVER POSITION TEST

Using the scan tool, perform a Shift Lever Position test. Follow the instructions on the scan tool.

**Did the Shift Lever Position Test pass?**

**Yes** >> Go To 2

**No** >> Refer to the Transmission category and perform the appropriate symptom.

#### 2. CHECK TO SEE IF DTC P0944 IS CURRENT

Place the gear selector in Park.

Start the engine.

The transmission must be at operating temperature prior to checking pressure. A cold transmission will give higher readings.

Run the engine at 1500 RPM.

With the scan tool, monitor the Transmission Line Pressure.

**Does the Line Pressure match the Desired Line Pressure within ± 5 psi?**

**No** >> Go To 6

**Yes** >> Go To 3

## 3. CHECK LINE PRESSURE IN DRIVE AND REVERSE

Firmly apply the brake and repeat the previous test in both Drive and the Reverse gear positions.

With the scan tool, monitor the Transmission Line Pressure.

**Does the Line Pressure match the Desired Line Pressure within ± 5 psi in all gear ranges?**

**Yes** >> Go To 4

**No** >> Go To 5

## 4. REVIEW CUSTOMER COMMENTS

The conditions necessary to set this DTC are not present at this time.

Verify with the customer if a delayed engagement and/or an intermittent ″No Drive″ condition has occurred.

If the customers answer is ″No″ erase the DTC and return the vehicle to the customer.

Make sure to check for any TSBs or controller flash updates that my apply.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Has the customer experienced any delayed engagement and/or ″No Drive″ conditions?**

**Yes** >> Repair internal transmission as necessary. Replace the Transmission Oil Pump if inspection reveals no signs of internal seal leakage. Refer to the Service Information for the proper repair procedure.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## 5. DTC VERIFICATION

Read and record the DTC and the DTC EVENT DATA information.

Test drive the vehicle and attempt to operate the vehicle within the parameters in which the DTC set.

With the scan tool, read DTCs.

**Did any following DTCs set, P0868, P0944, P0841, P0846, P0871, P0876, or P0988?**

**Yes** >> Go To 6

**No** >> Test Complete.

## 6. CHECK TRANSMISSION OIL FILTER

Remove and inspect the Transmission Oil Pan per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

Inspect the oil filter seal for damage and proper installation.

**Does the Oil Pan contain excessive debris and/or is the Oil Filter plugged or seal damaged?**

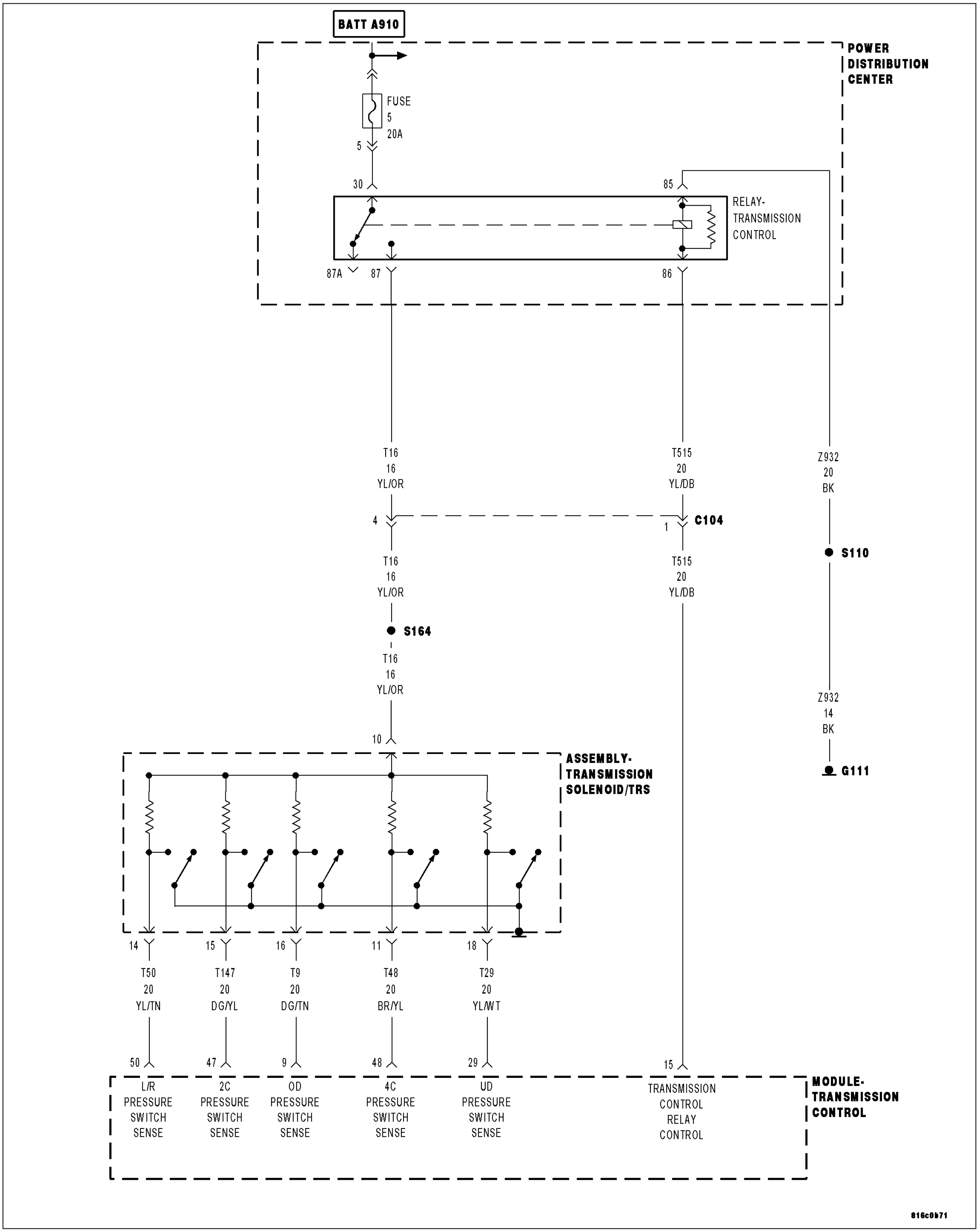
**Yes** >> Repair the cause of the plugged transmission oil filter or excessive debris. Check the Transmission Oil Filter seal for improper installation onto filter neck instead of into the pump bore, not fully seated against pump housing, filter neck not engaged into pump. Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Repair the Transmission Oil Pump as necessary. Check for a stuck main regulator valve and clean if necessary. Refer to the Service Information for the proper repair procedure.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P0987-4C HYDRAULIC PRESSURE TEST




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.
- **Set Condition:**
  After a shift into a forward gear, with engine speed above 1000 RPM, the TCM momentarily turns on element pressure to the Clutch circuits that don't have pressure to identify the correct Pressure Switch closes. If the Pressure Switch does not close 2 times, the DTC sets.

| Possible Causes |
|---|
| LINE PRESSURE SENSOR |
| TRANSMISSION FLUID CONTAMINATION |
| RELATED DTC'S PRESENT |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| EXCESSIVE DEBRIS IN OIL PAN |
| POOR LINE PRESSURE SENSOR CONNECTION |
| RELATED TCM POWER INPUT DTCS PRESENT |
| (T48) 4C PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T39) 5-VOLT SUPPLY CIRCUIT OPEN |
| (T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| (T39) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND |
| (T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHERS |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| INTERNAL TRANSMISSION |
| TRANSMISSION CONTROL MODULE |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Control System tests the pressure switches when they are off. The test verifies that the switches are operational (They will close with pressure applied). The Transmission Control System verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is re-tested. If it fails the second test, the DTC will set, the MIL will illuminate and the transmission system will default to the orderly Shutdown routine.

## Diagnostic Test

### 1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

**Is there any Loss of Prime, Transmission Control Relay, and/or Line Pressure Sensor DTCs present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. If the DTC P0944 is present, perform its respective test first.

**No** >> Go To 2

## 2. DTC P0770 PRESENT

With the scan tool, check Transmission DTCs.

**Is the DTC P0770 also present?**

**Yes** >> Refer to the symptom list and perform diagnostics for P0770.

**No** >> Go To 3

## 3. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTC's

**Are the DTCs P0988 and/or P1736 present also?**

**Yes** >> Go To 12

**No** >> Go To 4

## 4. CHECK TO SEE IF DTC P0987 IS CURRENT

With the scan tool, check if the DTC P0987-4C HYDRAULIC PRESSURE TEST FAILURE is active or stored.

**Is the DTC P0987-4C HYDRAULIC PRESSURE TEST FAILURE active?**

**Yes** >> Go To 5

**No** >> Go To 17

## 5. LINE PRESSURE STAYS THE SAME

Start the engine.

Warm the transmission to 82° C or 180° F.

Firmly apply the brakes.

With the scan tool, monitor the Line Pressure during the following step.

Move the shift lever to each gear position, pausing momentarily in each position and record the line pressure reading. Allow the pressure to stabilize for at least 5 seconds in each range.

**Did the line pressure remain at a steady value between 585 and 655 kPa or 85 and 95 PSI in each position?**

**Yes** >> Go To 6

**No** >> Go To 10

## 6. CHECK LINE PRESSURE SENSOR CONNECTION

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while firmly pushing the Transmission Line Pressure Sensor connector inwards towards the Transmission.

**Did the Line Pressure reading on the scan tool change to about 207 kPa or 30 PSI when the connector was pushed inward?**

**Yes** >> Disconnect and properly reconnect the Line Pressure Sensor connector. Inspect terminals and repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 7

## 7. LINE PRESSURE SENSOR OPERATION

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

With the Transmission Simulator select the ″OFF″ position on the ″Input/Output Speed″ switch.

Ignition on, engine not running.

With the scan tool, monitor the Line Pressure while turning the Pressure Switch selector to each of the 3 line pressure positions on the Transmission Simulator.

**NOTE: All three scan tool Line Pressure readings should be steady and ±14 kPa or 2.0 PSI of the reading specified on the Transmission Simulator.**

**Did the scan tool Line Pressure readings match the specified readings on the Transmission Simulator and remain steady in all three positions?**

**Yes** >> Replace the Line Pressure Sensor per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 8

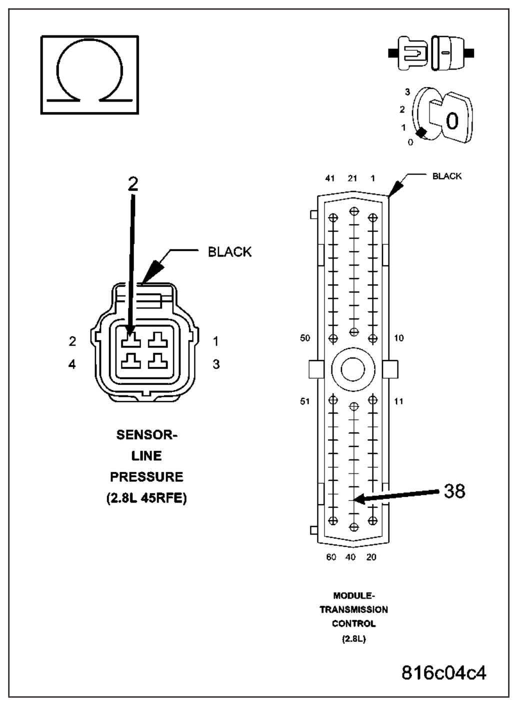
## 8. (T39) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect Transmission Simulator.

Disconnect the TCM harness connector.

Measure the resistance of the (T39) 5-volt Supply circuit from the Line Pressure Sensor harness connector to the appropriate terminal of the TCM harness connector.




**Is the resistance above 5.0 ohms?**

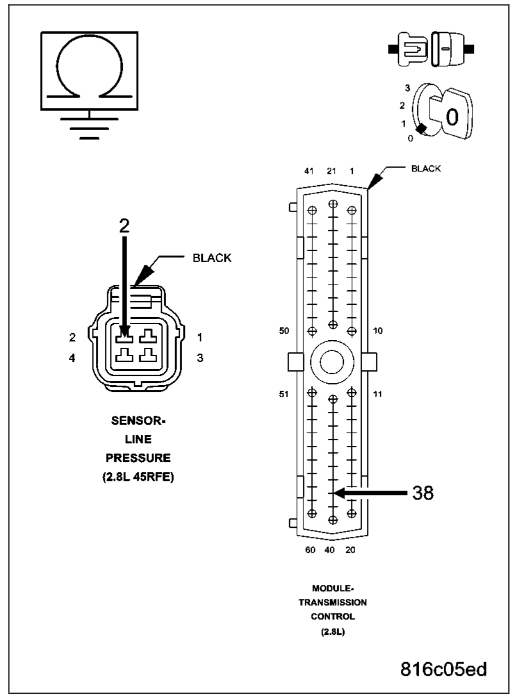
**Yes** >> Repair the (T39) 5-volt Supply circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 9

## 9. (T39) 5-VOLT SUPPLY CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T39) 5-volt Supply circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T39) 5-volt Supply circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 10. COMPARE SCAN TOOL TO PRESSURE GAUGE

Turn the ignition off to the lock position.

Connect the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP. Refer to the Service Information for proper installation procedure.

**CAUTION: Apply parking brake.**

Start the engine.

In the following steps, compare the scan tool Line Pressure to the Pressure Gauge readings in each gear.

**CAUTION: Do not overheat transmission.**

With the gear selector in park, raise the RPM to 1500, and compare line pressure readings.

Firmly apply the brakes, move the gear selector into reverse, raise the RPM to 1500, and compare the line pressure readings.

Firmly apply the brakes, move the gear selector into drive, raise the RPM to 1500, and compare the line pressure readings.

**Does the scan tool Line Pressure readings match the Pressure Gauge readings ± 10 psi?**

**Yes** >> Go To 11

**No** >> Replace the Line Pressure Sensor per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 11. WIRING AND CONNECTORS

Turn the ignition off to the lock position.

Remove the Starter Relay.

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Remove the Line Pressure Adapter, Miller tool #8259 and 0-300 psi Test Gauge, Miller tool #C-3293-SP.

Install the Transmission Simulator, Miller tool #8333.

On the Transmission Simulator, turn the Pressure Switch selector switch to 4C.

Ignition on, engine not running.

With the scan tool, monitor the 4C Pressure Switch state while pressing and holding the Pressure Switch test button and wiggling the wire harness and connectors that pertain to the 4C Pressure Switch.

**Did the 4C Pressure Switch state change to closed and remain closed while wiggling the wires?**

**Yes** >> Go To 12

**No** >> Go To 14

## 12. CHECK FOR EXCESSIVE DEBRIS

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Remove and inspect the Transmission Oil Pan per the Service Information.

**Does the Transmission Oil Pan contain excessive debris or contamination?**

**Yes** >> Repair the cause of the excessive debris in the Transmission Oil Pan. Refer to the Service Information for the proper procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. CHECK 4C HYDRAULIC CLUTCH CIRCUIT

Remove the Valve Body and air check the 4C hydraulic clutch circuit (in the case) for leakage per the Service Information.

**NOTE: The 4C hydraulic clutch circuit contains a small bleed orifice. A small amount of air leakage is normal.**

**Was there excessive air leakage noticed during the air check?**

**Yes** >> Repair as necessary. Check the 4C clutch piston, piston seals and bleed orifice assembly.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Disassemble and inspect the Valve Body and repair as necessary. Inspect the 4C Accumulator piston and seals. If no problems are found in the Valve Body, replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

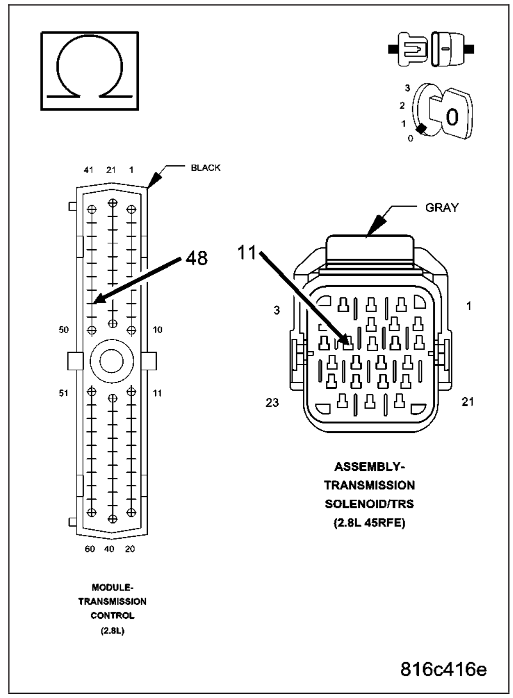
## 14. (T48) 4C PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Remove the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance of the (T48) 4C Pressure Switch Sense circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of the TCM harness connector.




**Is the resistance above 5.0 ohms?**

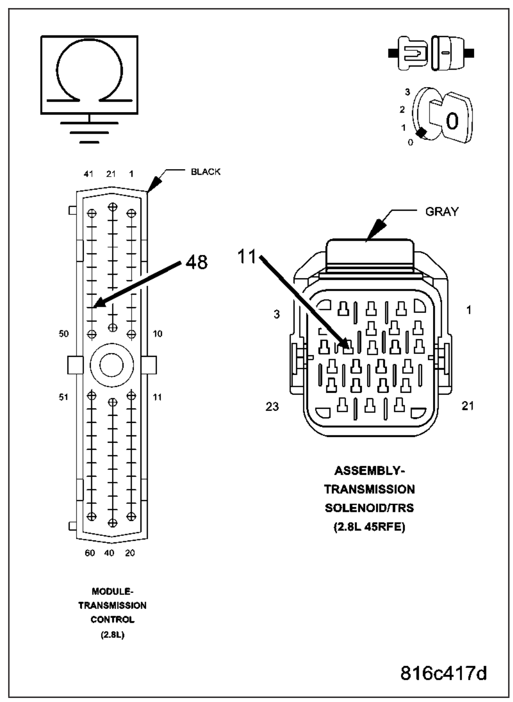
**Yes** >> Repair the (T48) 4C Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 15

## 15. (T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T48) 4C Pressure Switch Sense circuit.



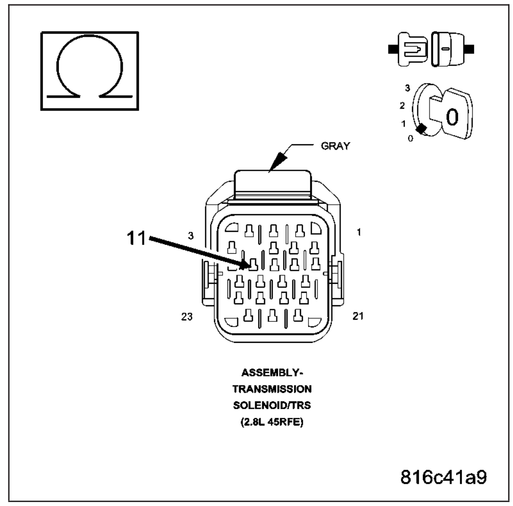

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T48) 4C Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. (T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS




Disconnect the TCM harness connector.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

**NOTE: Make sure the Transmission Solenoid/TRS Assembly harness connector is disconnected.**

**NOTE: Check connectors - Clean/repair as necessary.**

Measure the resistance between the (T48) 4C Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.

**Is the resistance below 5.0 ohms between the (T48) 4C Pressure Switch Sense circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T48) 4C Pressure Switch Sense circuit for a short to other circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 17. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

If the DTC EVENT DATA shows the DTC P0987 set while the Line Pressure was significantly below the Desired Line Pressure reading, check for causes of low line pressure (low fluid level, broken or mis-installed primary oil filter or filter seal, sticking Main Regulator Valve in the Pump Valve Body etc.). If the data shows the DTC set while the Line Pressure reading was significantly higher than the Desired Line Pressure, check the Line Pressure Sensor and related wiring.

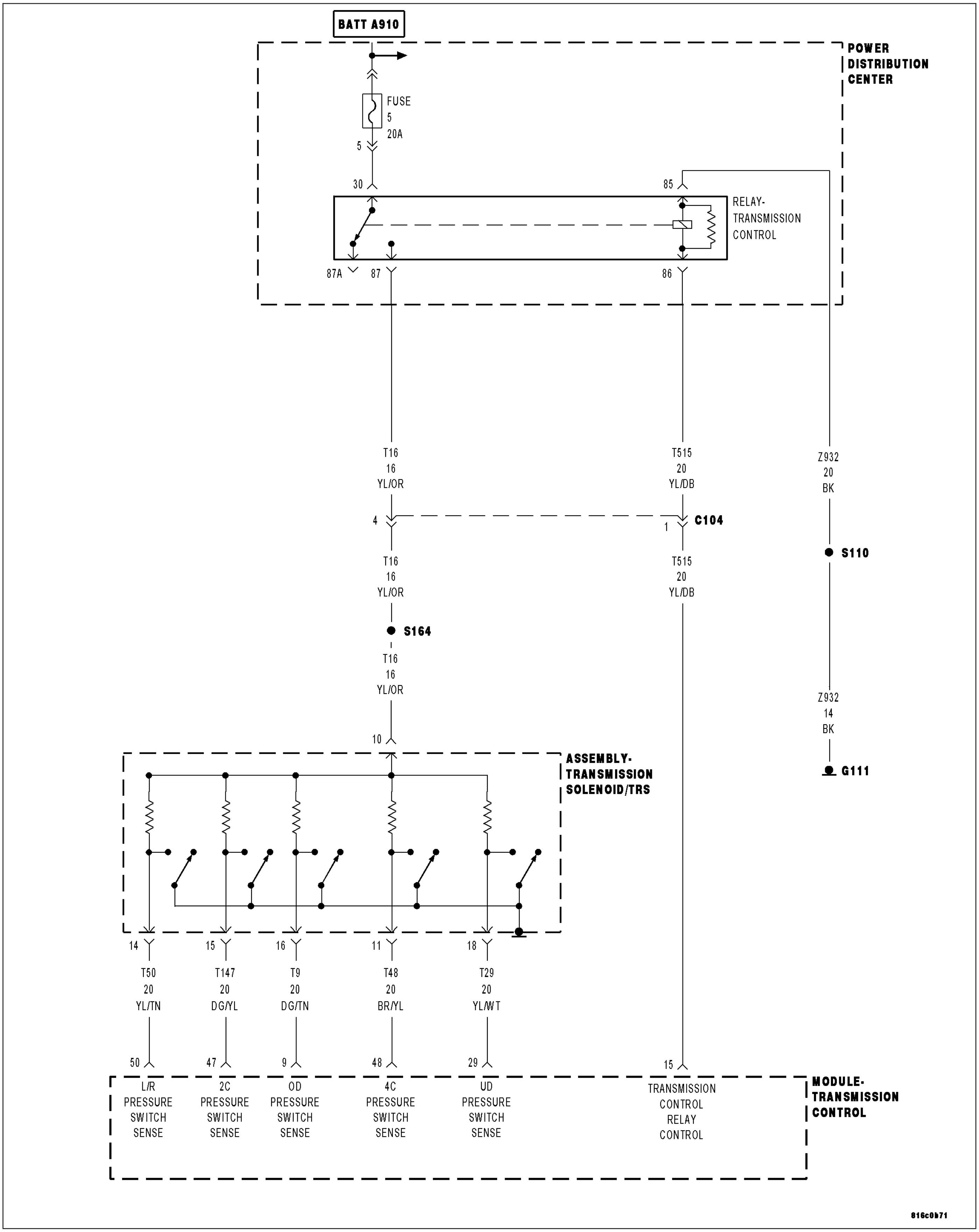
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P0988-4C PRESSURE SWITCH RATIONALITY




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  The DTC is set if the 4C Pressure Switch reads open or closed at the wrong time in a given gear.

| Possible Causes |
|---|
| RELATED TCM POWER INPUT DTCS PRESENT |
| DTC P0871 ALSO PRESENT |
| LOSS OF 12-VOLT FEED |
| (T48) 4C PRESSURE SWITCH SENSE CIRCUIT OPEN |
| (T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| EXCESSIVE FLUID LEAKAGE WITH 2C CLUTCH CIRCUIT |
| #5 AND/OR #7 CHECK BALL CUT OR DAMAGED |
| LOW LINE PRESSURE |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |
| WIRING AND CONNECTORS |

**Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission system uses five pressure switches to monitor the fluid pressure in the LR, 2C, 4C, UD, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown.

| GEAR | L/R | 2C | 4C | UD | OD |
|---|---|---|---|---|---|
| **REVERSE** | OPEN | OPEN | OPEN | OPEN | OPEN |
| **P/N** | CLOSED | OPEN | OPEN | OPEN | OPEN |
| **1ST** | CLOSED* | OPEN | OPEN | CLOSED | OPEN |
| **2ND** | OPEN | CLOSED | OPEN | CLOSED | OPEN |
| **2ND PRIME** | OPEN | OPEN | CLOSED | CLOSED | OPEN |
| **DRIVE** | OPEN | OPEN | OPEN | CLOSED | CLOSED |
| **4TH** | OPEN | OPEN | CLOSED | OPEN | CLOSED |
| **5TH** | OPEN | CLOSED | OPEN | OPEN | CLOSED |

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is open in Manual 1.

## Diagnostic Test

### 1. DETERMINE IF RELATED TCM POWER INPUT DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any TCM Power Input DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

## 2. DTC DATA SHOW CURRENT DTC

With the scan tool, check the DTC EVENT DATA.

**Does the DTC EVENT DATA show data for DTC P0988?**

**Yes** >> Go To 3

**No** >> Refer to the Transmission category and perform the appropriate symptom shown in the DTC EVENT DATA.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 3. MULTIPLE DTCS PRESENT

With the scan tool, check for other transmission DTC's.

**Are there two or more related Pressure Switch Sense DTCs present in addition to P0988?**

**Yes** >> Go To 4

**No** >> Go To 7

## 4. RELATED DTC PRESENT

With the scan tool, check the DTC EVENT DATA for P0988.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Do all the pressure switches read CLOSED in the DTC EVENT DATA for P0988?**

**Yes** >> Refer to Transmission category and perform diagnostics for the DTC P0888.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. DTC EVENT DATA READ OPEN

In the DTC EVENT DATA recorded earlier, read the state of all pressure switches.

**Do all the pressure switches read OPEN?**

**Yes** >> Go To 6

**No** >> Go To 7

## 6. LOW LINE PRESSURE

In the DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

**Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?**

**Yes** >> Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 7. DTC P0871 ALSO PRESENT

With the scan tool, check Transmission DTCs.

**Is the DTC P0871 also present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. DTC EVENT DATA READ PARK REVERSE OR NEUTRAL

With the scan tool, check the DTC EVENT DATA for P0988.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA show the DTC set in Park, Neutral, or Reverse for P0988?**

**Yes** >> Go To 13

**No** >> Go To 9

## 9. DTC EVENT DATA READ CLOSED

With the scan tool, check the DTC EVENT DATA for P0988.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA show the 4C Pressure Switch reading CLOSED?**

**Yes** >> Go To 11

**No** >> Go To 10

## 10. PRIMARY OIL FILTER SEAL

In the DTC EVENT DATA recorded earlier, compare the Line Pressure and the Desired Line Pressure.

**Is the Line Pressure less than 40 psi, and significantly below the Desired Line Pressure?**

**Yes** >> Repair as necessary to correct low line pressure. Check fluid level and adjust as necessary. If fluid level is OK, check the Primary Oil Filter seal for a split, crack, or improperly installed. If the filter and seal are OK, check the Main Regulator Valve in the Oil Pump. Refer to the Service Information for the above procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 15

## 11. TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to the 4C position.

With the scan tool, monitor the 4C Pressure Switch while pressing the Pressure Switch test button on the Transmission Simulator.

**Did the state of the 4C Pressure Switch change while pressing the Pressure Switch Test button?**

**Yes** >> Go To 12

**No** >> Go To 13

## 12. TRANSMISSION SOLENOID/TRS ASSEMBLY

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

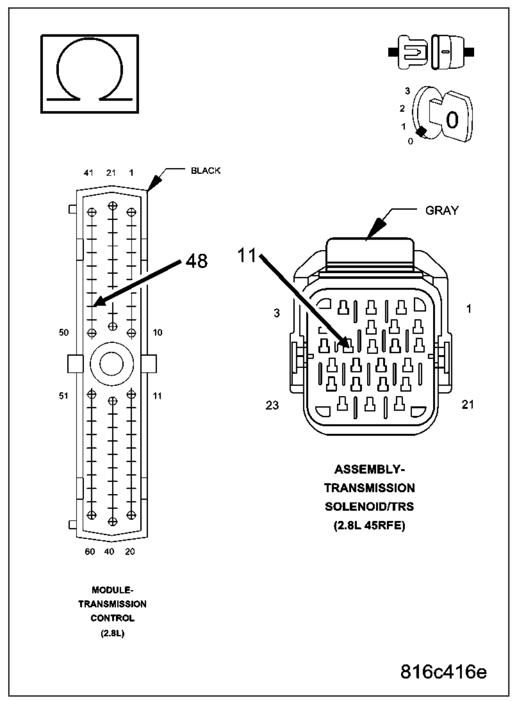
## 13. (T48) 4C PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance of the (T48) 4C Pressure Switch Sense circuit from the appropriate terminal of the TCM harness connector to the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance above 5.0 ohms?**

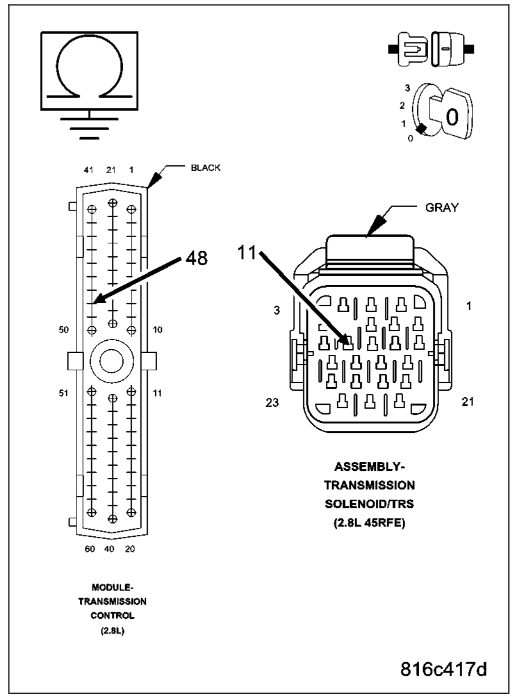
**Yes** >> Repair the (T48) 4C Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 14

## 14. (T48) 4C PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T48) 4C Pressure Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T48) 4C Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Powertrain Control Module per the Service Information. With the scan tool, perform the QUICK LEARN procedure.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 15. #5 AND/OR #7 CHECK BALL CUT OR DAMAGED

Turn the Ignition off to the lock position.

Remove the Valve Body Assembly per the Service Information.

Inspect the #5 and #7 check balls for any cuts or damage.

Inspect the 4C accumulator piston and seals and also the 4C tower seal on top of the valve body. Refer to the Service Information.

**Where there any problems found?**

**Yes** >> Repair as necessary. Check for excessive clutch debris in the transmission oil pan. If excessive clutch debris is present, repair 4C clutch as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 16

## 16. EXCESSIVE FLUID LEAKAGE WITH 4C CLUTCH CIRCUIT

Air check the 4C Clutch hydraulic circuit. Refer to the Service Information.

**NOTE: This hydraulic clutch circuit contains a small bleed orifice. Small leakage is considered normal.**

**Was there excessive air leakage in the 4C Clutch hydraulic circuit?**

**Yes** >> Repair as necessary. Refer to the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P1684-BATTERY WAS DISCONNECTED

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the ignition is in the Run/Start position.
- **Set Condition:**
  This DTC will set whenever Powertrain Control Module is disconnected from Fused B(+) or ground. It will also be set using the scan tool to perform a Battery Disconnect and/or Quick Learn procedure.

| Possible Causes |
| --- |
| BATTERY WAS DISCONNECTED |
| SCAN TOOL BATTERY DISCONNECT PERFORMED |
| TCM WAS REPLACED OR DISCONNECTED |
| QUICK LEARN WAS PERFORMED |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The TCM uses a battery backed RAM (Random Access Memory) is used to maintain some learned values. When the battery B(+) is disconnected, the memory is lost. When the B(+) is restored, this memory loss is detected by the Transmission Control System. The DTC is set and the learned values are initialized to known constants or previously learned values from EEPROM (Electronic Erasable Programmable Read Only Memory). This results in the reinitialization of some parameters.

## Diagnostic Test

### 1. POSSIBLE CAUSES

This DTC is an informational DTC only.

This DTC is set due to a momentary loss of power and/or the ground circuits to the TCM.

Below are a list of possible causes associated with this DTC.

Battery was disconnected.

The BATTERY DISCONNECT feature on the scan tool was performed.

The QUICK LEARN feature on the scan tool was performed.

TCM was replaced or disconnected.

**Were any of the above possible causes performed?**

**Yes** >> This is the cause of the DTC. Erase the DTC and return vehicle to customer.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 2

## 2. CHECK WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

**NOTE: Check all power and ground circuits to the TCM for a intermittent or high resistance condition.**

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P1715-RESTRICTED MANUAL VALVE IN T3 RANGE

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  Whenever the PRNDL code indicates Temp 3.
- **Set Condition:**
  This DTC sets when conditions for the DTC P1776 are satisfied or 3 unsuccessful attempts to engage 1st gear while the shifter is in the temp 3 zone. This indicates a restricted port at the manual valve because the shifter is not fully engaged in the drive position.

| Possible Causes |
|---|
| RELATED TRANSMISSION DTC'S PRESENT |
| CUSTOMER DRIVING HABITS |
| MISADJUSTED SHIFTER |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

### Diagnostic Test

#### 1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

**Are any of the following DTC's P0731, P0732, P0733, P0734, P1736 or P0715 present?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

#### 2. CHECK SHIFTER ADJUSTMENT

Check Shifter adjustment per the Service Information.

**Is the shifter properly adjusted?**

**Yes** >> Go To 3

**No** >> Adjust the Shifter Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

#### 3. CHECK CUSTOMER DRIVING HABIT

This DTC can be set if the customer rests their hand on the shift lever while they are driving. The transmission can be put in the T3 position if just enough forward pressure is exerted on the shift lever.

When this occurs, the feed port to the clutch is restricted, the transmission will declare neutral, and this DTC will be set. The customer should be informed not to rest their hand on the shifter while driving.

This DTC can also be set by simply bumping the shift lever toward neutral while accelerating.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**If there are no possible causes remaining, view repair.**

**Repair**

This DTC can be set by putting too much forward pressure on the shift lever while it is in the OD position. Make sure the customer is informed.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P1736-GEAR RATIO ERROR IN 2ND PRIME

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on, engine running, with the transmission in gear.
- **Set Condition:**
  If the ratio of the Input RPM to the Output RPM does not match the current gear ratio. This DTC can take up to five minutes of problem identification before illuminating the MIL

| Possible Causes |
|---|
| RELATED DTC'S PRESENT |
| INPUT SPEED SENSOR OR WIRING |
| LOW FLUID LEVEL |
| CRACKED OR MIS-INSTALLED PRIMARY OIL FILTER OR SEAL |
| WORN SOLENOID SWITCH VALVE OR PLUGS |
| STUCK OR STICKING MAIN REGULATOR VALVE |
| BURNED UD OR 4C CLUTCH |
| CUT 4C OR UD PISTON SEAL |
| BROKEN 4C PISTON CASTING |
| BROKEN OR MISSING 4C BLEED ORIFICE |
| BROKEN OR MISSING UD BLEED ORIFICE |
| CUT 4C OR UD ACCUMULATOR PISTON SEAL |
| CRACKED 4C OR UD ACCUMULATOR PISTON |
| EXTRA CHECK BALL IN PASSAGE DOWNSTREAM OF #7 CHECK BALL POCKET |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| BROKEN WELD - REACTION CARRIER TO REVERSE SUN GEAR |
| MISSING TEETH ON INPUT CLUTCH HUB TONE WHEEL |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

### Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (DTCs P0731-36).

2) An excessive change in input or output speeds indicating signal intermittent which may result in the DTCs P0715 and/or P0720 to set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the signal from the input speed sensor at idle in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set when at a stop.

## Diagnostic Test

### 1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTCs.

**Are any Transmission: solenoid, line pressure, speed sensor, or loss of prime DTCs present?**

**Yes** >> Refer to appropriate symptom in the Transmission category. Perform the test for P0944-LOSS OF PRIME first if it is present.

**No** >> Go To 2

### 2. CHECK DTC EVENT DATA

With the scan tool, read and record the DTC EVENT DATA.

**NOTE: Make sure to record all DTC EVENT DATA stored in the scan tool for future reference in this test procedure.**

**Does the DTC EVENT DATA display information for the DTC P1736?**

**Yes** >> Go To 3

**No** >> Go To 6

### 3. CHECK RPM IN DTC EVENT DATA

Refer to the DTC EVENT DATA recorded earlier.

**Does the Input RPM read zero?**

**Yes** >> Check the input speed sensor and wiring. Refer to test P0715 and diagnose as if the DTC is current.

**No** >> Go To 4

### 4. CHECK LINE PRESSURE READING

Refer to the DTC EVENT DATA recorded earlier.

**Is the line pressure reading more than 10 psi below the desired line pressure?**

**Yes** >> Go To 5

**No** >> Go To 6

### 5. PLUGGED TRANSMISSION OIL FILTER

Turn the ignition off to the lock position.

Remove and inspect the Transmission Oil Pan for excessive debris per the Service Information.

Remove and inspect the Primary Oil Filter per the Service Information.

**NOTE: Make sure the Primary Transmission Oil Filter and/or seal is not cracked or split.**

**Does the Oil Pan contain excessive debris and/or is the Primary Oil Filter cracked or plugged?**

**Yes** >> Repair the plugged, cracked, or split Primary Transmission Oil Filter and/or seal. If the Primary Transmission Oil Filter is plugged, refer to the Service Information for the proper hydraulic clutch repair procedure.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Remove the Transmission Oil Pump per the Service Information. Check the main Regulator Valve for sticking in its bore, scoring, and/or damage and clean and repair as necessary. If no problem is found, replace the Transmission Solenoid/TRS Assembly.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. CHECK TO SEE IF DTC P1736 IS CURRENT

With the scan tool, perform the 2nd Prime Gear Clutch Test. Follow the instructions on the scan tool.

Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds.

**CAUTION: Do not overheat the transmission.**

**NOTE: If the 4C clutch is faulty, the overrunning clutch will hold and the slip test will pass. The 2nd Prime Gear Clutch Test will not detect a faulty 4C clutch. However, it will detect a faulty UD clutch.**

**Did the clutch test pass, did the Input Speed remain at zero?**

**Yes** >> Go To 7

**No** >> Go To 9

## 7. CHECK FOR INTERMITTENT OPERATION

Check the Shifter adjustment per the Service Information.

Intermittent gear ratio DTCs can be set by problems in the Input and Output Speed Sensor circuits and/or Speed Sensor Ground circuit.

Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 8

## 8. CHECK FOR SLIPPAGE

With the scan tool, erase Transmission DTCs.

Road test the vehicle.

During the road test, operate in 4th gear, and perform kickdown shifts from 4th to 2nd (prime) gears.

**Is there an obvious slippage noticed in 4th or 2nd prime gears, or runaway on the 4-2 shift?**

**Yes** >> Go To 11

**No** >> Go To 14

## 9. UD CLUTCH HYDRAULIC CIRCUIT

Remove Transmission Oil Pan and check for excessive debris.

Remove the Valve Body and air check the UD clutch hydraulic circuit (in the case) per the Service Information.

**NOTE: The UD clutch passage contains a small bleed orifice, a small amount of air leakage is normal.**

**Were there any problems found, excessive debris and/or excessive air leakage in the UD clutch hydraulic circuit?**

**Yes** >> Repair as necessary. Check the UD clutch piston seals and the dribbler assembly, reaction shaft support seal rings, and the flatness of the pump valve body and pump housing faces. Check main regulator valve for sticking in the bore.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 10

## 10. UD ACCUMULATOR PISTON

Check the UD bleed orifice, accumulator piston, and accumulator piston seal in the main valve body.

**Were there any problems found?**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures.

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 11. EXCESSIVE DEBRIS

Remove the Transmission Oil Pan and check for excessive debris.

Remove the valve body and air check the 4C clutch hydraulic circuit per the Service Information.

**NOTE: The 4C clutch passage contains a small bleed orifice, a small amount of air leakage is normal.**

**Were there any problems found, excessive debris, improperly assembled 4C clutch and/or excessive air leakage in the 4C clutch hydraulic circuit?**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures. Note: Check the 4C piston seals and bleed orifice.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 12

## 12. 4C ACCUMULATOR

Check the 4C Accumulator piston for cracks or a cut seal.

Check for a cut or missing #7 or #5 check balls.

Check the Solenoid Switch Valve and its plugs for sticking in its bore or excessive wear.

**Were there any problems found**

**Yes** >> Repair as necessary. Refer to the Service Information for proper repair procedures.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 13

## 13. CHECK FOR BROKEN REVERSE SUN GEAR WELD

Working through the windows in the bottom of the case, check for a broken Reverse Sun gear weld to the reaction carrier as follows:

(1) Hold the Transmission Output Shaft by holding the Transmission Manual Lever in the park position.

(2) Rotate the Input Annulus gear and drive shell, (the drum that encloses the two rearmost carriers).

(3) Check to see if the reaction carrier (the front most carrier, whose outer shell is splined to the 4C clutch) is rotating faster than the drive shell is being turned.

**Is the reaction carrier turning faster than the drive shell?**

**Yes** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the reaction carrier per the Service Information.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 14. CHECK IF DTC RESET

**Did the DTC P1736 reset during the road test?**

**Yes** >> Go To 15

**No** >> Go To 16

## 15. LIST OF POSSIBLE CAUSES

If any other DTC's set during the road test, refer to the appropriate symptom in the Transmission category.

If no other DTC's set during the road test, below is a list of possible causes, but not strictly limited to those:

Check for excessive debris in the Transmission Oil pan, plugged, cracked, or split Primary Transmission Oil Filter and/or seal.

Check for cuts or missing #7 and #5 check balls in the main valve body.

Check the 4C and UD accumulator pistons and seals, UD bleed orifice, and the Solenoid Switch Valve and Plugs in the main valve body.

Check the UD clutch piston seals, reaction shaft support seal rings, and the flatness of the pump valve body and pump housing faces.

Check the 4C clutch piston seals, and bleed orifice.

Check the UD clutch piston seals, reaction shaft support seal rings, and dribbler assemblies, and the flatness of the pump valve body and pump housing faces.

**View repair**

**Repair**

Repair as necessary. Refer to the Service Information for proper repair procedures.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 16. INTERMITTENT DTC

The conditions necessary to set this DTC are not present at this time.

Use the DTC EVENT DATA to help identify the conditions and/or possible causes that may have caused the DTC to set.

Check for any Service Information Tune-ups or Technical Service Bulletins that may apply.

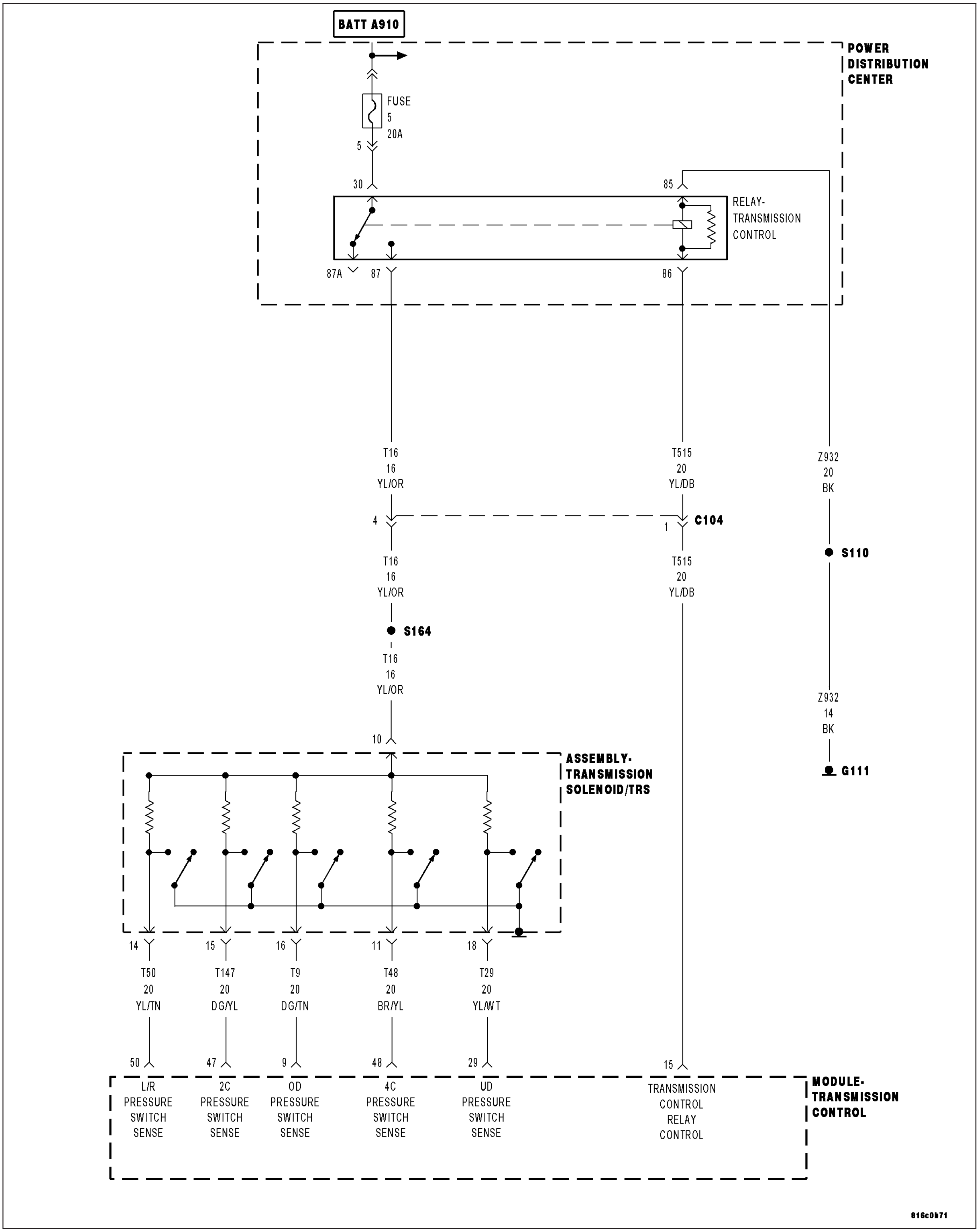
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During an attempted shift into 1st gear.
- **Set Condition:**
  This DTC is set if three unsuccessful attempts are made to shift the Solenoid Switch Valve (SSV) into the downshifted position in one given ignition start. This DTC can take up to five minutes to mature before illuminating the MIL.

| Possible Causes |
|---|
| RELATED DTC P0841 PRESENT |
| SOLENOID SWITCH VALVE STICKING |
| LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the L/R Solenoid is energized. The SSV will be in the downshifted position in 1st gear, thus directing the fluid to the L/R clutch circuit. In 2nd through 5th gears, it will be in the upshifted position and directing the fluid into the torque converter clutch (TCC).

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R Pressure Switch is monitored to confirm SSV movement. If movement is not confirmed (the L/R pressure switch does not close), EMCC is inhibited until SSV operation is confirmed.

## Diagnostic Test

### 1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

**Is the DTC P0841 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK TO SEE IF DTC P1775 IS CURRENT

Perform a visual inspection of all connectors, wiring, and cooler connections before proceeding. Repair as necessary.

With the scan tool, Check the STARTS SINCE SET counter.

**NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter for P1775 at 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 6

## 3. TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to LR.

With the scan tool, monitor the LR Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

**Did the state of the L/R Pressure Switch change while pressing the Pressure Switch Test button?**

**Yes** >> Go To 4

**No** >> Go To 5

## 4. SOLENOID SWITCH VALVE STICKING

Turn the ignition off to the lock position.

Remove the Transmission Oil Pan per the Service Information.

Remove the Transmission Valve body per the Service Information.

Inspect the Solenoid Switch Valve and Plugs for sticking.

**Is the Solenoid Switch Valve or Plugs sticking?**

**Yes** >> Clean and inspect per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

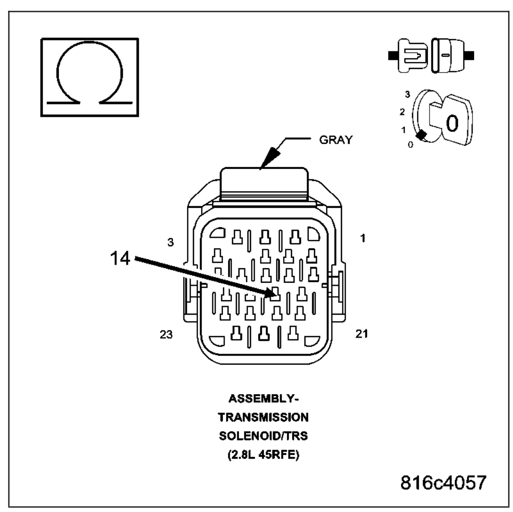
## 5. LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.

Disconnect the Transmission Solenoid/TRS Assembly harness connector.

Disconnect all TCM harness connector.

Measure the resistance between the (T50) LR Pressure Switch Sense circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T50) LR Pressure Switch Sense circuit and all other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T50) LR Pressure Switch Sense circuit for a short to other circuit(s).

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANS-

AXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

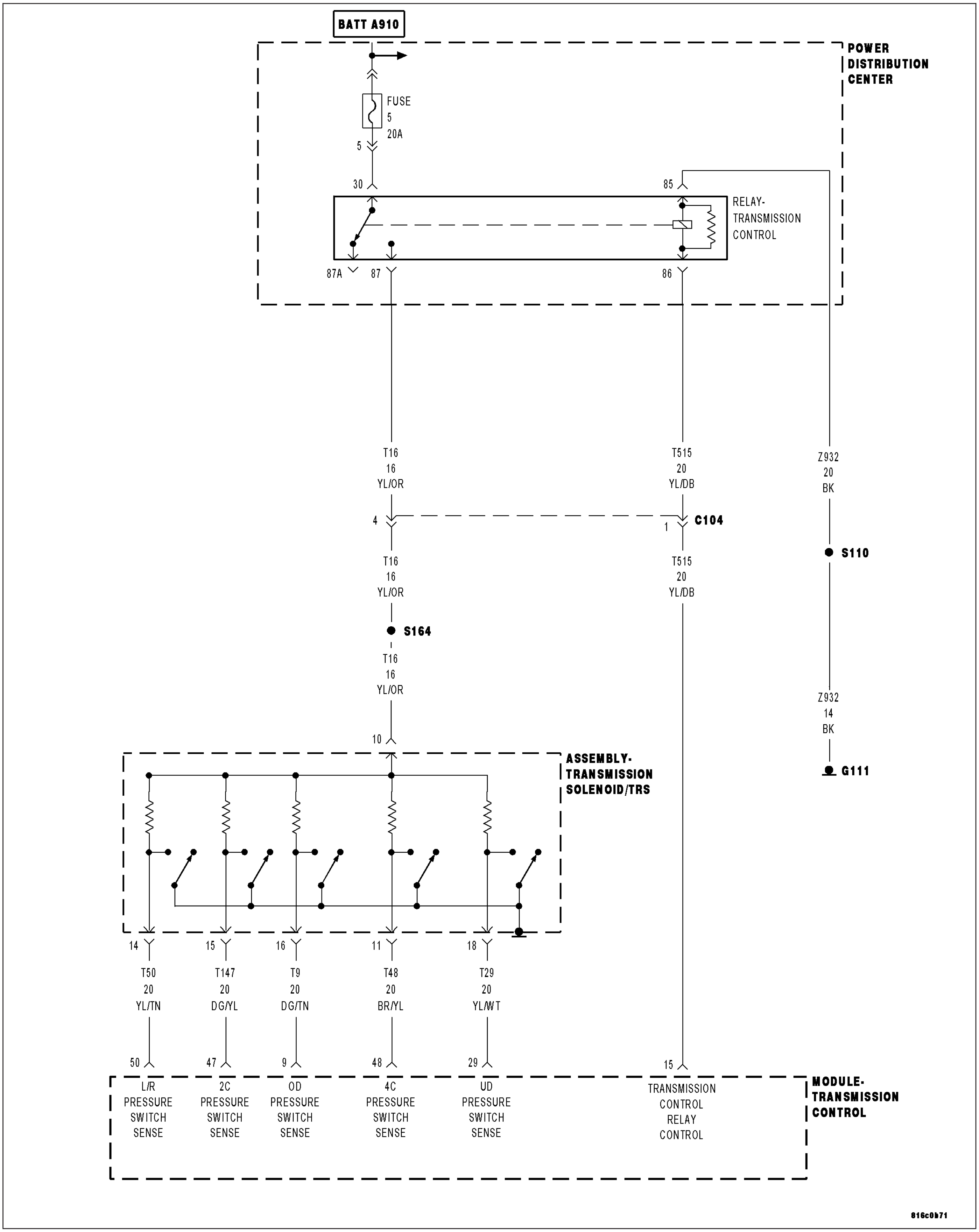
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously when performing partial or full EMCC - PEMCC or FEMCC.
- **Set Condition:**
  If the transmission senses the L/R pressure switch closing while performing PEMCC or FEMCC. This DTC will set after two unsuccessful attempts to perform PEMCC or FEMCC. This DTC can take up to five minutes of problem identification before illuminating the MIL.

| Possible Causes |
|---|
| RELATED DTC P0841 PRESENT |
| LR PRESSURE SWITCH SENSE CIRCUIT OPEN |
| LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND |
| SOLENOID SWITCH VALVE |
| TRANSMISSION CONTROL MODULE |
| INTERMITTENT WIRING AND CONNECTORS |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the L/R Solenoid is energized. The SSV will be in the downshifted position in 1st gear, thus directing the fluid to the L/R clutch circuit. In 2nd through 5th gears, it will be in the upshifted position and directing the fluid into the torque converter clutch (TCC).

When in 2nd, 2nd Prime, 3rd, 4th, or 5th gear, the Torque Converter Clutch (TCC) can be engaged when certain conditions are met. The TCC piston is electronically modulated by increasing the duty cycle of the L/R solenoid until the torque converter slip difference (difference between engine and transmission input speed) is within 60 RPM. Then the L/R solenoid is fully energized (FEMCC / 100% duty cycle). Torque converter slip is monitored in FEMCC to ensure adequate clutch capacity.

## Diagnostic Test

### 1. DETERMINING IF RELATED DTC'S ARE PRESENT

With the scan tool, check for other transmission DTC's

**Is the DTC P0841 present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK TO SEE IF DTC P1776 IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter.

**NOTE: NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 7

## 3. TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install the Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the Transmission Simulator, turn the Pressure Switch selector switch to the LR position.

With the scan tool, monitor the LR Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator.

**Did the state of the LR Pressure Switch change while pressing the Pressure Switch Test button?**

**Yes** >> Go To 4

**No** >> Go To 5

## 4. SOLENOID SWITCH VALVE

Remove the Valve Body per the Service Information.

Inspect the Solenoid Switch Valve and plugs for sticking in the bore and/or wear.

**Were there any problems found?**

**Yes** >> Clean and repair as necessary per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 7

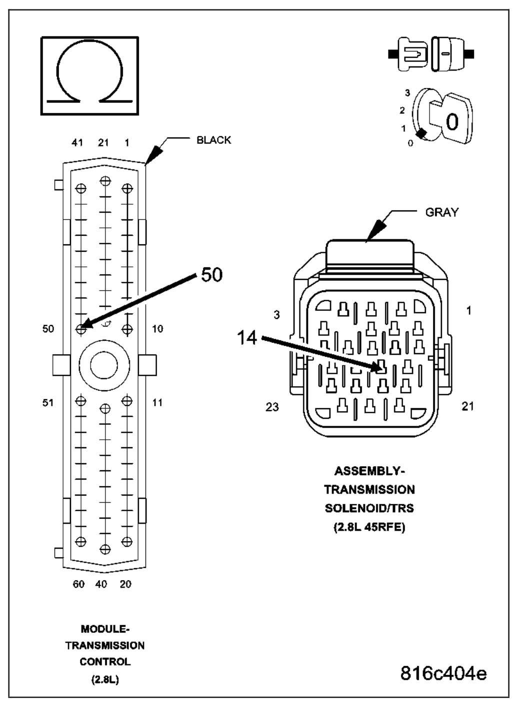
## 5. LR PRESSURE SWITCH SENSE CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the TCM harness connector.

Measure the resistance of the (T50) LR Pressure Switch Sense circuit between the appropriate terminal of the TCM harness connector to the Solenoid/TRS Assembly harness connector.




**Is the resistance above 5.0 ohms?**

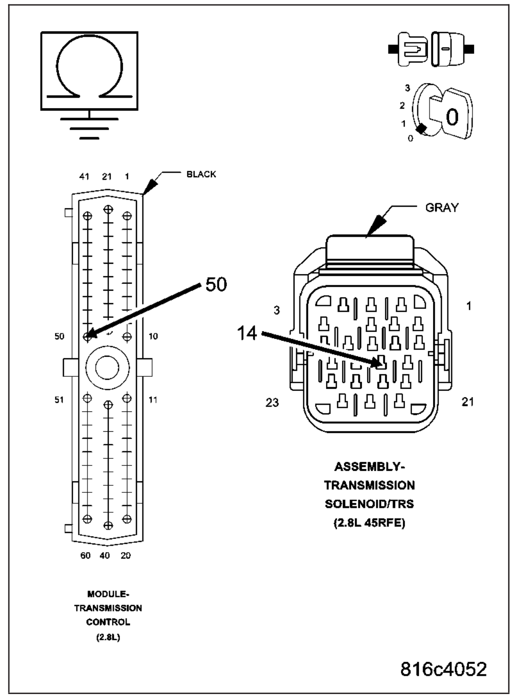
**Yes** >> Repair the (T50) LR Pressure Switch Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 6

## 6. (T50) LR PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T50) LR Pressure Switch Sense circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T50) LR Pressure Switch Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

This DTC can also be set by the Solenoid Switch Valve intermittently sticking in it’s bore under extreme temperature conditions, or by a worn Solenoid Switch Valve or plugs.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P1790-FAULT IMMEDIATELY AFTER SHIFT

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  After a speed ratio error is stored.
- **Set Condition:**
  This DTC is set if the associated speed ratio DTC is stored within 1.3 seconds after a shift.

| Possible Causes |
|---|
| FAULT AFTER SHIFT |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

### Theory of Operation

This DTC will only be stored along with a gear ratio DTC. If this DTC is set, it indicates a probable hydraulic (line pressure) or mechanical problem exists. Diagnosing the transmission should be based on the associated speed ratio DTC and mechanical causes should be considered first.

| INTENDED GEAR | CLUTCHES APPLYING | RECOMENDED DTC |
|---|---|---|
| REVERSE | UD** - MS | P0738 |
| 1ST | UD - LR* | P0731 |
| 2ND | UD - 2C | P0732 |
| 2ND PRIME | UD - 4C | P1736 |
| 3RD | UD - OD/MS | P0733 |
| 4TH | OD/MS - 2C | P0734 |
| 5TH | OD/MS - 2C | P0735 |

* L/R is used only up to 150 output RPM in 1st gear. ** UD will show as applied in Reverse but the UD clutch is actually released. OD/MS is OD and/or MS.

### Diagnostic Test

#### 1. INTENDED GEAR TO APPLIED CLUTCH

With the scan tool, check the DTC EVENT DATA to determine in which gear the slippage occurred and the clutches that were applied.

With the DTC EVENT DATA, use the information provided above to determine the proper symptom for diagnosis.

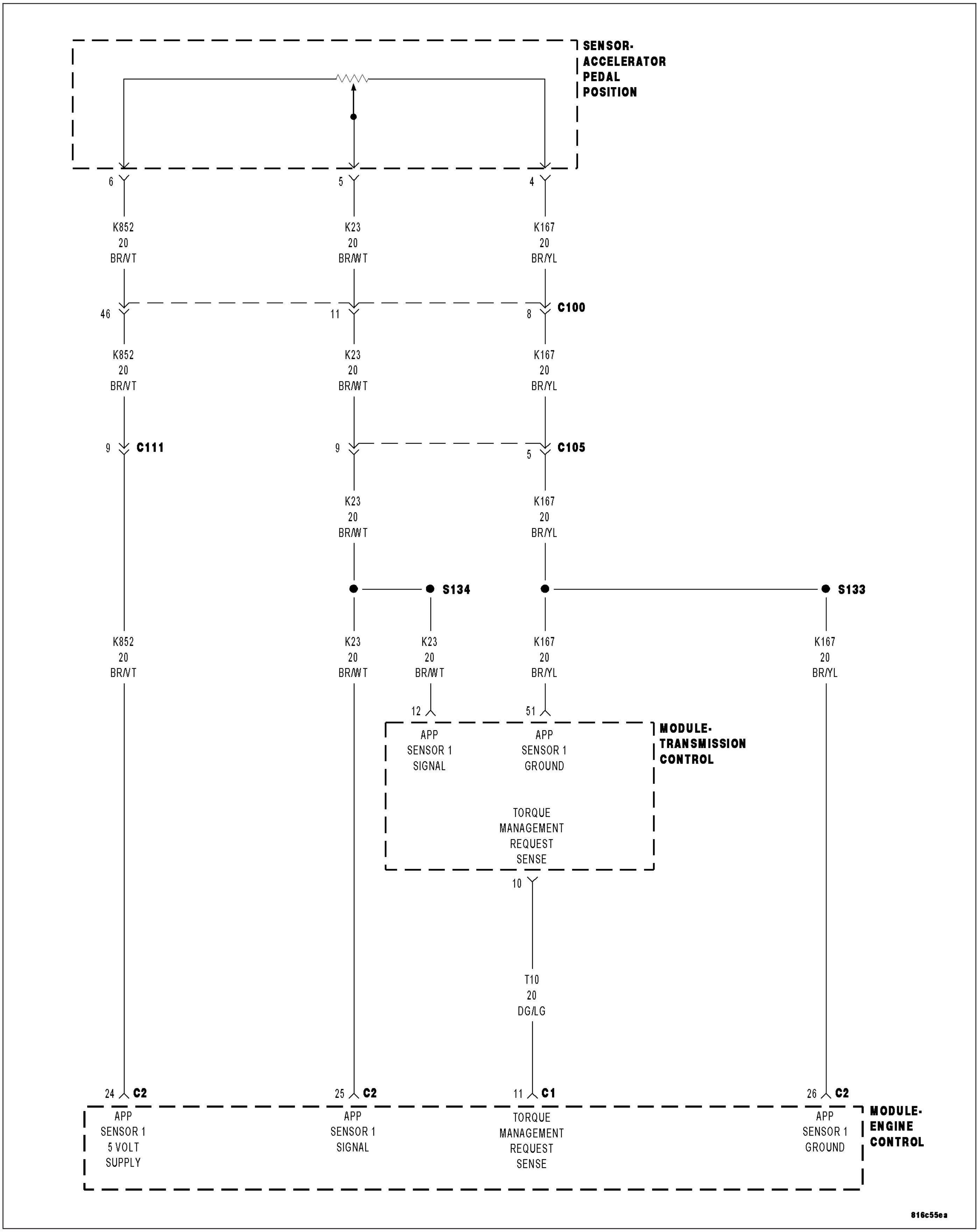
**View repair**

**Repair**

Refer to the Transmission category and perform the appropriate symptom identified from the DTC EVENT DATA, intended gear, and applied clutches.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## P1793-TRD LINK COMMUNICATION ERROR




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During torque managed shifts with Throttle angle above 54 degrees. This system is also tested whenever the vehicle is stopped and the engine speed is below 1000 RPM.
- **Set Condition:**
  This code is set when the Transmission Control Module sends two subsequent Torque Reduction messages (pulses the Torque Management Request Sense circuit to ground) to the Engine Control Module via the Torque Management Request Sense circuit and the TCM does not receive a confirmation from the ECM over the communication bus.

| Possible Causes |
|---|
| RELATED DTC'S PRESENT |
| TORQUE MANAGEMENT REQUEST SENSE CIRCUIT OPEN |
| TORQUE MANAGEMENT REQUEST SENSE CIRCUIT SHORT TO GROUND |
| TORQUE MANAGEMENT REQUEST SENSE CIRCUIT SHORTED TO VOLTAGE |
| ENGINE CONTROL MODULE |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting Procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

Engine Torque Management is used during heavy throttle, high-torque, high speed 1-2, 2-3, 4-2, and 3-1 shifts in order to reduce the energy dissipation in the 2-4 and OD clutches to an acceptable level. The Engine Control Module is expected to respond to a torque management test or request by transmitting a message over the communication bus to the Transmission Control Module.

## Diagnostic Test

### 1. CHECK FOR RELATED DTCS

With the scan tool, check for other transmission DTC's

**Are any of the DTCs P1694, P0731, P0732, P0733, P0734, and/or P1736 present also?**

**Yes** >> If any of these DTCs are present, disregard the P1793 DTC. Refer to the Transmission category and perform the appropriate symptom.
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 2

### 2. CHECK TO SEE IF DTC P1793 IS CURRENT

With the scan tool, Check the STARTS SINCE SET counter for P1793.

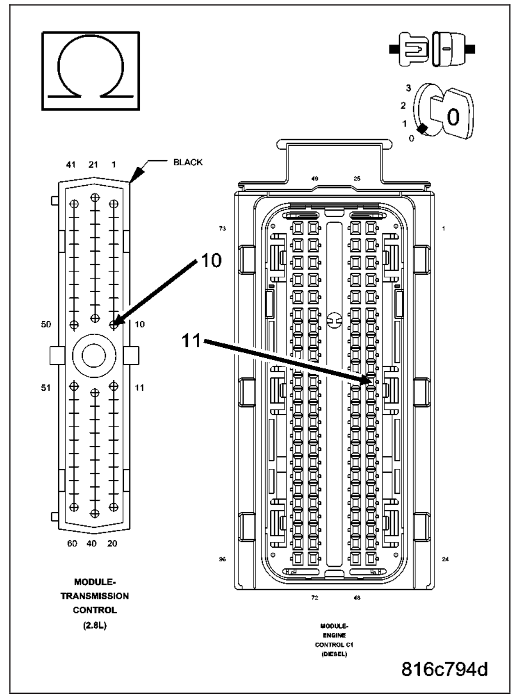
**NOTE: NOTE: This counter only applies to the last DTC set.**

**Is the STARTS SINCE SET counter set at 2 or less?**

**Yes** >> Go To 3

**No** >> Go To 7

## 3. TORQUE MANAGEMENT REQUEST SENSE CIRCUIT OPEN




Turn the ignition off to the lock position.

Disconnect the TCM harness connector.

Disconnect the ECM harness connector.

Measure the resistance of the Torque Management Request Sense circuit from the TCM harness connector to the ECM harness connector.

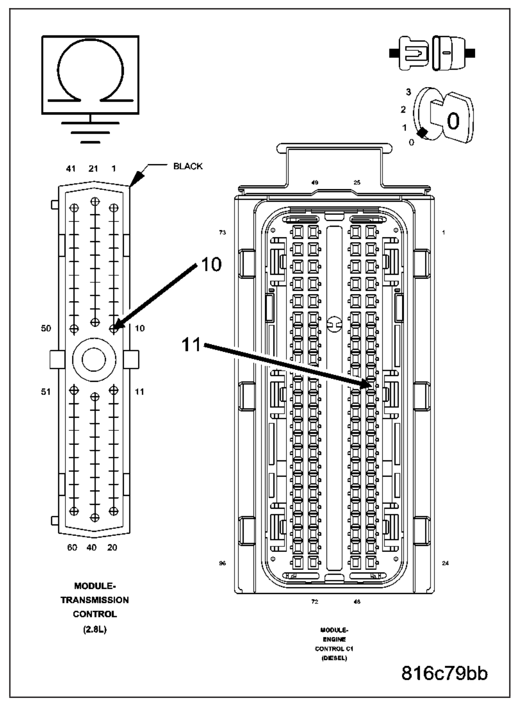
**Is the resistance above 5.0 ohms?**

**Yes** >> Repair the Torque Management Request Sense circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. TORQUE MANAGEMENT REQUEST SENSE CIRCUIT SHORT TO GROUND




Measure the resistance between ground and the Torque Management Request Sense circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the Torque Management Request Sense circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. TORQUE MANAGEMENT REQUEST SENSE CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

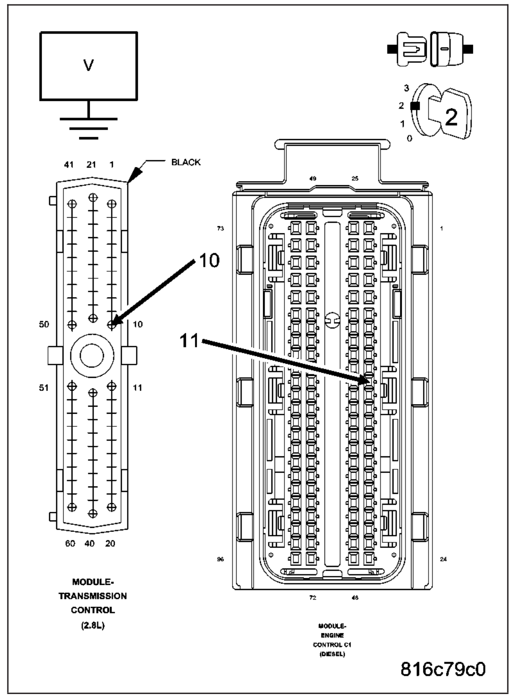
Measure the voltage of the Torque Management Request Sense circuit in the TCM harness connector.

**Is the voltage above 10.5 volts?**

**Yes** >> Repair the Torque Management Request Sense circuit for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 6




## 6. TRANSMISSION CONTROL MODULE

Measure the voltage of the Torque Management Request Sense circuit in the TCM harness connector.

**Is the voltage above 7.0 volts?**

**Yes** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Powertrain Control Module (ECM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the ECM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 7. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

This DTC can also be set by the Solenoid Switch Valve intermittently sticking in it’s bore under extreme temperature conditions, or by a worn Solenoid Switch Valve or plugs.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

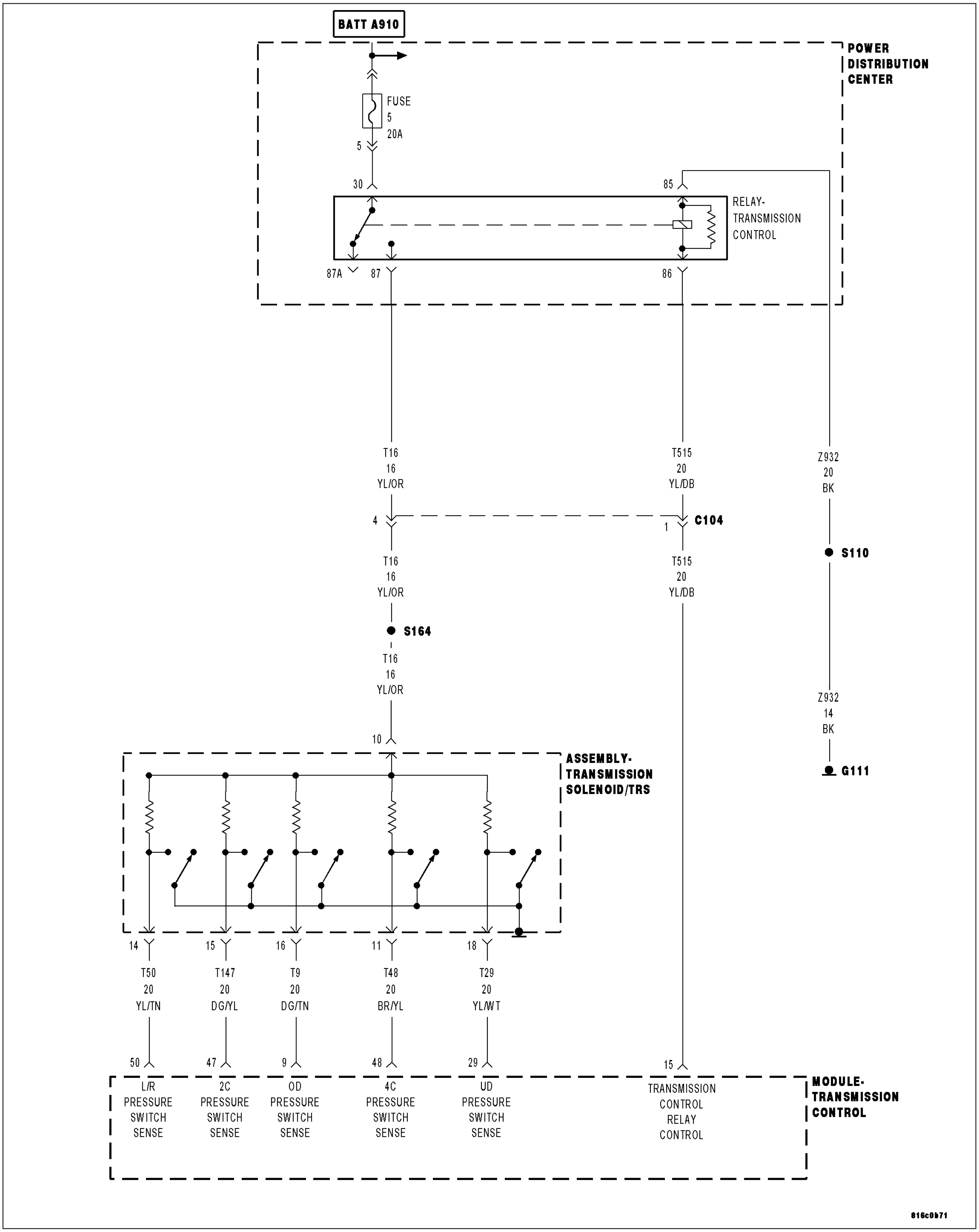
**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P1794-SPEED SENSOR GROUND ERROR




For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  The gear ratio is monitored continuously while the Transmission is in gear.
- **Set Condition:**
  After a controller reset in neutral and a ratio of input to output, of 1 to 2. This DTC can take up to five minutes of problem identification before illuminating the MIL.

| Possible Causes |
| --- |
| (T13) SPEED SENSOR GROUND CIRCUIT OPEN |
| (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND |
| (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (DTCs P0731–36).

2) An excessive change in input or output speeds indicating signal intermittent which may result in the DTCs P0715 and/or P0720 to set.

3) If the common speed sensor ground circuit is lost, both sensor inputs will read the signal from the input speed sensor at idle in neutral. Since the input speed sensor reads 60 teeth from the input clutch hub and the output speed sensor reads 30 teeth from the park gear, the result is an apparent speed ratio of 1:2 and may cause the DTC P1794 to set when at a stop.

## Diagnostic Test

### 1. CHECK TO SEE IF DTC P1794 IS CURRENT

Engine Running, Shift lever in park.

With the scan tool, read the Transmission Output and Input Speed Sensor states.

**Is the Output Speed Sensor reading twice the Input Speed Sensor reading?**

**Yes** >> Go To 2

**No** >> Go To 6

### 2. TCM AND WIRING

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**
Install the Transmission Simulator, Miller tool 8333.

With the Transmission Simulator, set the Input/Output Speed selector switch to the ″3000/1000″ position. Turn the Input/Output Speed switch to ″ON″.

Ignition on, engine not running.

With the scan tool, monitor the Input and Output Speed Sensor state.

**Does the Input speed read 3000 RPM and the Output speed read 1000 RPM, within 50 RPM?**

**Yes** >> Go To 6

**No** >> Go To 3

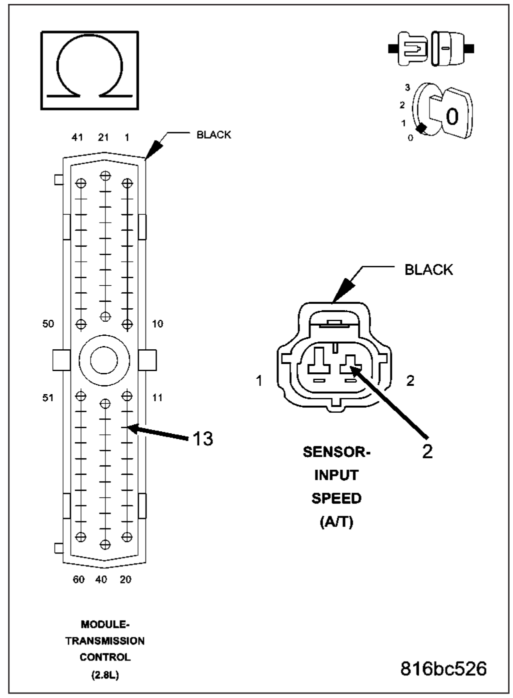
## 3. (T13) SPEED SENSOR GROUND CIRCUIT OPEN

Turn the ignition off to the lock position.

Disconnect the TCM harness connector.

Disconnect the Transmission Simulator, Miller tool #8333.

Measure the resistance of the (T13) Speed Sensor Ground circuit from the appropriate terminal of the TCM harness connector to the Transmission Solenoid/TRS Assembly and both Input and Output Speed Sensor harness connectors.




**Is the resistance above 5.0 ohms on any of the above measurements?**

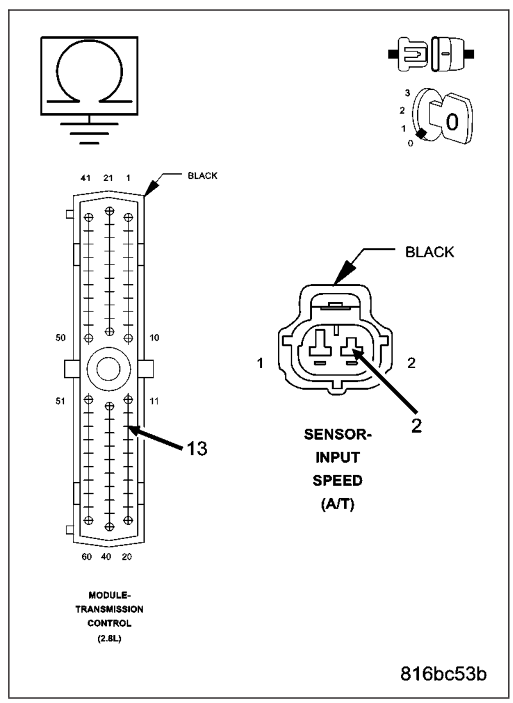
**Yes** >> Repair the (T13) Speed Sensor Ground circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T13) Speed Sensor Ground circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for a short to ground.

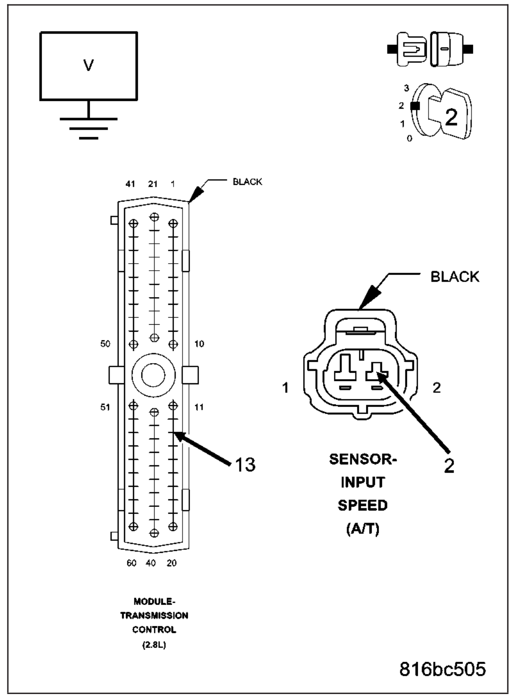
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (T13) SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE

Ignition on, engine not running.

Measure the voltage of the (T13) Speed Sensor Ground circuit.




**Is the voltage above 0.5 volt?**

**Yes** >> Repair the (T13) Speed Sensor Ground circuit for a short to voltage.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 6. INTERMITTENT WIRING AND CONNECTORS

The conditions necessary to set this DTC are not present at this time.

Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

Wiggle the wires while checking for shorted and open circuits.

With the scan tool, check the DTC EVENT DATA to help identify the conditions in which the DTC was set.

**Where there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P2700-INADEQUATE ELEMENT VOLUME LR

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running. The LR clutch volume index (CVI) is updated during a 3-1 or 2-1 manual downshift with throttle angle below 5 degrees. Transmission temperature must be at least 43° C (110° F).
- **Set Condition:**
  When the LR clutch volume index (CVI) falls below 16.

| Possible Causes |
| --- |
| HYDRAULIC LEAK IN THE VALVE BODY |
| BROKEN L/R CLUTCH PISTON RETURN SPRING OR SPRING RETAINERS |
| BROKEN L/R ACCUMULATOR SPRING(S) |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTC's, which indicates an internal transmission problem.

## Diagnostic Test

### 1. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTCs.

**Are there any Pressure Switch Sense circuit DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK LR CLUTCH VOLUME INDEX

With the scan tool, erase DTCs.

Start the engine and warm the transmission.

**NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.**

Drive the vehicle and perform at least ten 3-1 manual downshifts at closed throttle from speeds of about 32 Kmh or 20 MPH.

With the scan tool, read the LR CL VOL INDEX.

**Is the LR CL VOL INDEX below 20?**

**Yes** >> Go To 3

**No** >> Go To 5

## 3. L/R CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan per the Service Information.

Remove the valve body per the service information.

Check condition of the L/R accumulator springs.

Look for possible leak paths into the L/R clutch hydraulics circuit within the valve body.

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. AIR CHECK L/R CLUTCH CIRCUITS

Perform an air check on the L/R Clutch circuit per the Service Information.

Watch and listen for L/R Clutch piston movement.

**Does the L/R piston stroke and return properly?**

**Yes** >> Replace the Transmission/TRS Solenoid Assembly per the service information. With the scan tool, perform Quick Learn.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Repair internal transmission as necessary. Pay attention to the components related to the L/R clutch. A broken or weak L/R clutch return spring, Accumulator Spring, and/or dislocated snap ring could cause this problem.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 5. VERIFY TCM OPERATION

**NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.**

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 Kmh or 50 MPH, then brake lightly to a stop. Turn off engine.

With the scan tool, record the CL VOL INDEX (CVI) for all clutches

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVI's and compare them to the readings recorded before the BATTERY DISCONNECT.

**Are any of the CVI's less than 5 or different than before the BATTERY DISCONNECT?**

**Yes** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

# P2701-INADEQUATE ELEMENT VOLUME 2C

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running. The 2C clutch volume index (CVI) is updated during a 3-2 kickdown with throttle angle between 10 and 54 degrees. Transmission temperature must be at least 43° C (110° F).
- **Set Condition:**
  When the 2C CVI falls below 5.

| Possible Causes |
|---|
| HYDRAULIC LEAK IN THE VALVE BODY |
| BROKEN 2C CLUTCH PISTON RETURN SPRING / DISLODGED SNAP RING |
| BROKEN ACCUMULATOR SPRING(S) |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTC's, which indicates an internal transmission problem.

## Diagnostic Test

### 1. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTCs.

**Are there any Pressure Switch Sense circuit DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. CHECK 2C CLUTCH VOLUME INDEX

With the scan tool, erase Transmission DTCs.

Drive the vehicle at about 80 Kmh or 50 MPH, then depress the OD off button. This will put the vehicle into third gear.

**NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.**
Perform at least ten 3-2 kickdowns by depressing the throttle between 10 and 54 TPS DEGREES at speeds of about 80 Kmh or 50 MPH.

With the scan tool, read the 2C CL VOL INDEX.

**Is the 2C CL VOL INDEX below 10?**

**Yes** >> Go To 3

**No** >> Go To 5

## 3. 2C CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan per the Service Information.

Remove the valve body per the service information.

Check condition of the 2C accumulator springs.

Look for possible leak paths into the 2C clutch hydraulics circuit within the valve body.

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. AIR CHECK 2C CLUTCH CIRCUIT

Turn the ignition off to the lock position.

Perform an air check on the 2C Clutch circuit per the Service Information.

Watch and listen for 2C Clutch piston movement.

**Dose the piston stroke and return properly?**

**Yes** >> Replace the Transmission/TRS Solenoid Assembly per the service information. With the scan tool, perform Quick Learn.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Repair internal transmission as necessary. Pay attention to the components related to the 2C clutch. A broken or dislodged 2C return spring, snap ring or broken 2C Accumulator Spring could cause this problem.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 5. VERIFY TCM OPERATION

**NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.**

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 Kmh or 50 MPH, then brake lightly to a stop. Turn off engine.

With the scan tool, record the CL VOL INDEX (CVI) for all clutches

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVI's and compare them to the readings recorded before the BATTERY DISCONNECT.

**Are any of the CVI's less than 5 or different than before the BATTERY DISCONNECT?**

**Yes** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P2702-INADEQUATE ELEMENT VOLUME OD

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running. The OD clutch volume index (CVI) is updated during a 2-3 upshift with throttle angle between 10 and 54 degrees. Transmission temperature must be at least 43° C (110° F).
- **Set Condition:**
  When the OD CVI falls below 5.

| Possible Causes |
| --- |
| HYDRAULIC LEAK IN THE VALVE BODY |
| BROKEN OD ACCUMULATOR SPRING |
| BROKEN OD/REV PISTON BELLEVILLE SPRING OR DISLODGED SNAP RING |
| INTERNAL LEAKAGE IN PUMP ASSEMBLY |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

### Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTC's, which indicates an internal transmission problem.

### Diagnostic Test

#### 1. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTCs.

**Are there any Pressure Switch Sense circuit DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

#### 2. CHECK THE OD CLUTCH VOLUME INDEX

With the scan tool, erase DTCs.

**NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.**
Drive the vehicle and perform at least ten 2-3 upshifts with the TPS degree between 10 and 54.

With the scan tool, read the OD CL VOL INDEX.

**Is the OD CL VOL INDEX below 10?**

**Yes** >> Go To 3

**No** >> Go To 5

## 3. OD CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan per the Service Information.

Remove the valve body per the service information.

Check condition of the OD accumulator spring.

Look for possible leak paths into the OD clutch hydraulics circuit within the valve body.

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. AIR CHECK OD CLUTCH CIRCUIT

Perform an air check on the OD Clutch circuit per the Service Information.

Watch and listen for OD Clutch piston movement.

Air check all other pump passages and watch for air leakage into the OD clutch passage.

**NOTE: There is a bleed orifice between the OD and Reverse Clutch passages, so a small amount of air leakage from Reverse to OD is normal.**

**Were any problems found?**

**Yes** >> Repair internal transmission. Pay attention to the OD Clutch. Broken or weak return spring or a dislocated snap ring could cause this problem. If no problems were found in the OD clutch, or if leakage into the OD passage was noted, replace Pump Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission/TRS Solenoid Assembly per the service information. With the scan tool, perform Quick Learn.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 5. VERIFY TCM OPERATION

**NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.**

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 Kmh or 50 MPH, then brake lightly to a stop. Turn off engine.

With the scan tool, record the CL VOL INDEX (CVI) for all clutches.

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVI's and compare them to the readings recorded before the BATTERY DISCONNECT.

**Are any of the CVI's less than 5 or different than before the BATTERY DISCONNECT?**

**Yes** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P2703- INADEQUATE ELEMENT VOLUME UD

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running. The UD clutch volume index (CVI) is updated during a 4-3 kickdown with throttle angle between 10 and 54 degrees. Transmission temperature must be at least 43° C (110° F).
- **Set Condition:**
  When the UD CVI falls below 11.

| Possible Causes |
|---|
| BROKEN UD ACCUMULATOR SPRING(S) |
| BROKEN UD CLUTCH PISTON SPRING OR DISLODGED SNAP RING |
| INTERNAL LEAKAGE IN PUMP OR VALVE BODY ASSEMBLIES |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

### Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTC's, which indicates an internal transmission problem.

### Diagnostic Test

#### 1. OTHER DTCS PRESENT

With the scan tool, check for other transmission DTCs.

**Are there any Pressure Switch Sense circuit DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

#### 2. CHECK UD CLUTCH VOLUME INDEX

With the scan tool, erase Transmission DTCs.

**NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.**

Drive the vehicle and perform at least ten 4-3 kickdowns by depressing the throttle between 30 and 54 TPS degrees at speeds about 80 Kmh or 50 MPH.

With the scan tool, read the UD clutch volume index (CVI).

**Is the UD CVI below 10?**

**Yes** >> Go To 3

**No** >> Go To 5

## 3. UD CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan and valve body per the Service Information.

Check the condition of the UD accumulator springs.

Look for possible leak paths into the UD clutch hydraulics circuit within the valve body.

**Were there any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. AIR CHECK UD CLUTCH CIRCUIT

Perform an air check on the UD Clutch circuit per the Service Information.

Watch and listen for UD Clutch piston movement.

Air check all other pump passages for air leakage into the UD Clutch circuit.

**Were any problems found?**

**Yes** >> Repair internal transmission. Pay attention to components related to the UD clutch. Broken or weak return spring or a dislocated snap ring. If no trouble is found in UD clutch component or UD clutch leakage was noted in passage, replace the Pump Assembly.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission/TRS Solenoid Assembly per the service information. With the scan tool, perform Quick Learn.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 5. VERIFY TCM OPERATION

**NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.**

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 80 Kmh or 50 MPH, then brake lightly to a stop. Turn off engine.

With the scan tool, record the clutch volume index (CVI) for all clutches.

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVI's and compare them to the readings recorded before the BATTERY DISCONNECT.

**Are any of the CVI's less than 5 or different than before the BATTERY DISCONNECT?**

**Yes** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

## P2704-INADEQUATE ELEMENT VOLUME 4C

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Whenever the engine is running. The 4C clutch volume index (CVI) is updated during a 3-4 upshift with throttle angle between 10 and 54 degrees. Transmission temperature must be at least 43° C (110° F).
- **Set Condition:**
  When the 4C CVI falls below 5.

| Possible Causes |
|---|
| BROKEN 4C RETURN SPRING OR DISLODGED SNAP RING |
| BROKEN 4C ACCUMULATOR SPRING(S) |
| HYDRAULIC LEAK IN THE VALVE BODY |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

### Theory of Operation

The volumes of the transmission fluid needed to apply the friction elements are continuously monitored and learned for adaptive controls. As the clutch friction material wears, the volume of fluid needed to apply the clutch increases. Certain transmission mechanical problems can cause near-zero learned volumes resulting in setting a DTC. The DTC will usually set with other DTC's, which indicates an internal transmission problem.

### Diagnostic Test

#### 1. CHECK THE 4C CLUTCH VOLUME

With the scan tool, record the 4C clutch volume index (CVI) and erase DTC's.

Perform at least 10, 3-4 upshifts with the throttle between 10 and 54 degrees. The Transmission temperature must be at least 43° C or 110° F.

With the scan tool, read the 4C CVI.

**Is the current 4C CVI below 10?**

**Yes** >> Go To 2

**No** >> Go To 5

#### 2. DTC P0876 PRESENT

With the scan tool, read DTCs.

**NOTE: The DTC P0876 must also be set with P2704 in order for this test to be valid.**

**Is the DTC P0876 also present?**

**Yes** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. 4C CLUTCH CIRCUIT LEAKS IN THE VALVE BODY

Turn the ignition off to the lock position.

Remove the transmission oil pan per the Service Information.

Remove the valve body per the Service Information.

Check condition of the 4C accumulator springs.

Look for possible leak paths into the 4C clutch hydraulics circuit within the valve body.

**Were any problems found?**

**Yes** >> Repair as necessary.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 4

## 4. AIR CHECK 4C CLUTCH CIRCUIT

Perform an air check on the 4C Clutch circuit per the Service Information.

Listen for proper 4C Clutch piston movement.

**Were any problems found?**

**Yes** >> Repair Internal transmission as necessary. Pay attention to the mechanical components related to the 4th clutch. A broken or weak return spring or a dislocated snap ring could cause this problem.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Replace the Transmission Solenoid/TRS Assembly per the service information. With the scan tool, perform Quick Learn.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

## 5. VERIFY TCM OPERATION

Perform eight learnable starts. A learnable start is defined as follows: Start engine. From a standstill, accelerate lightly to 50 MPH, then brake lightly to a stop. Turn off engine.

With the scan tool, record Transmission CL VOL INDEX (CVI) for all clutches.

With the scan tool, perform a BATTERY DISCONNECT.

With the scan tool, read the CVI's and compare them to the reading recorded before the BATTERY DISCONNECT.

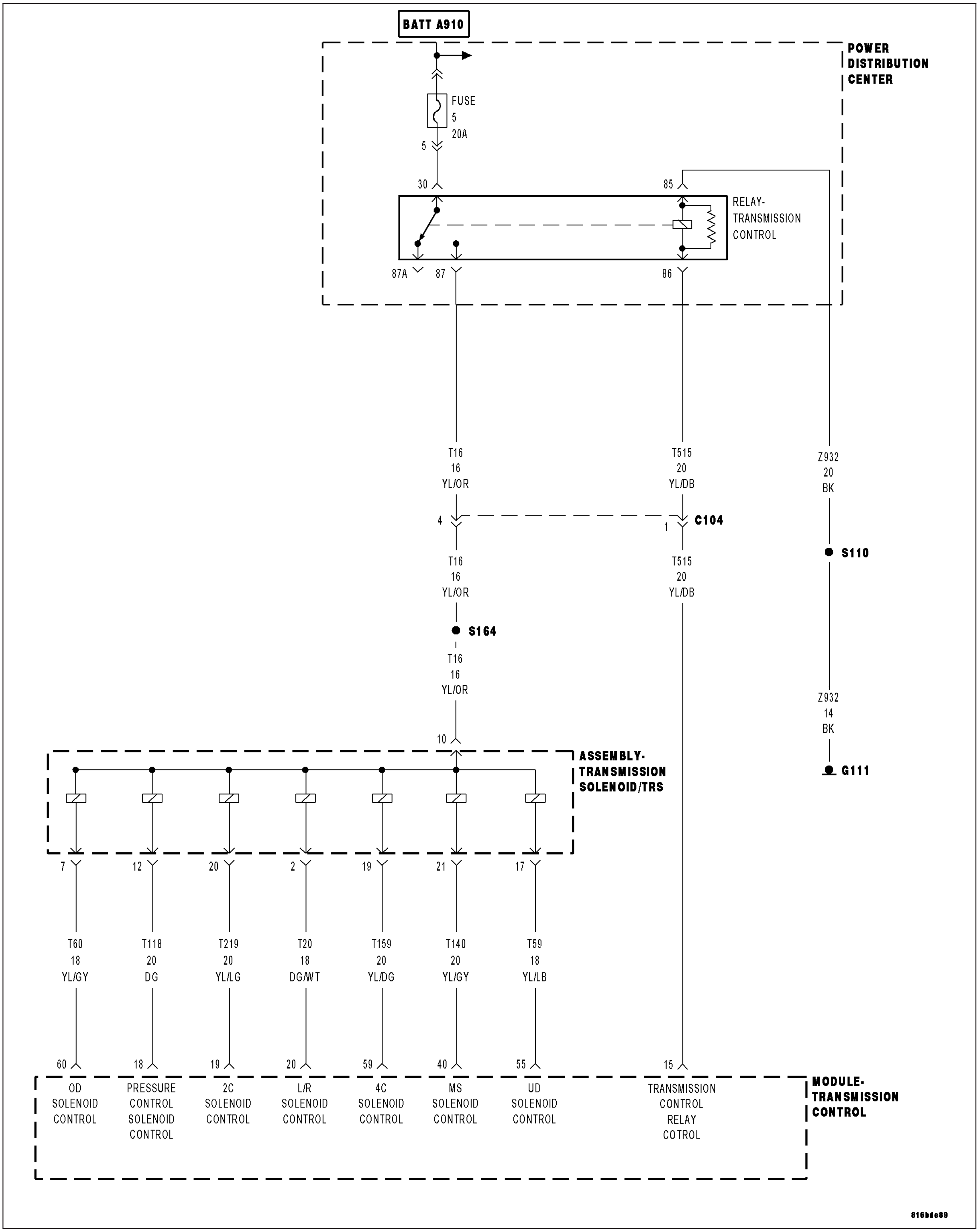
**Are any of the CVI's less than 5 or are they different than before the battery disconnect?**

**Yes** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Test Complete.

# P2706-MS SOLENOID CIRCUIT




For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Initially at power-up, then every 10 seconds thereafter. The solenoid circuits will also be tested immediately after a gear ratio or pressure switch error is detected.
- **Set Condition:**
  After three consecutive solenoid continuity test failures, or one failure if test is run in response to a gear ratio or pressure switch error. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

| Possible Causes |
|---|
| RELATED TCM POWER INPUT DTCS PRESENT |
| (T118) MS SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS |
| (T118) MS SOLENOID CONTROL CIRCUIT OPEN |
| (T118) MS SOLENOID CONTROL CIRCUIT SHORT TO GROUND |
| TRANSMISSION SOLENOID/TRS ASSEMBLY |
| TRANSMISSION CONTROL MODULE |

**Always perform the 45RFE/545RFE Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)**

## Theory of Operation

The Transmission Control System uses six electronically controlled solenoids that allow hydraulic fluid to be applied to various friction elements (clutches), which enables the gear requested. The continuity of each solenoid circuit is periodically tested. Each inactive solenoid is turned on for a few milliseconds, then off. Each active solenoid is turned off for a few milliseconds, then on. This pulsing of voltage to the solenoid causes an inductive spike which can be sensed by the Transmission Control System. If an inductive spike is not sensed by the Transmission Control System during the continuity check, it is tested again. If the test fails three consecutive times, the appropriate Diagnostic Trouble Code (DTC) is set. If the solenoid test is run in response to a gear ratio or pressure switch error, one failure will result in setting the appropriate DTC. **Note: This DTC is strictly an electrical fault and does not apply to any internal transmission failures.**

## Diagnostic Test

### 1. DETERMINE IF RELATED TCM POWER INPUT DTCS ARE PRESENT

With the scan tool, read Transmission DTCs

**Are there any TCM Power Input DTCs present also?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom.

**No** >> Go To 2

### 2. TRANSMISSION SOLENOID/TRS ASSEMBLY

Turn the ignition off to the lock position.

Remove the Starter Relay.

**CAUTION: Removal of the Starter Relay will prevent the vehicle from being started in gear.**

**WARNING: The Starter Relay must be removed from the PDC. Failure to do so can result in personal injury or death.**

**NOTE: Failure to remove the Starter Relay can cause a Transmission - No Response condition.**

Install Transmission Simulator, Miller tool #8333.

Ignition on, engine not running.

With the scan tool, actuate the MS Solenoid.

Monitor the MS Solenoid LED on the Transmission Simulator.

**Did the MS Solenoid LED on the Transmission Simulator blink on and off?**

**Yes** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 3

## 3. TRANSMISSION SOLENOID/TRS ASSEMBLY

With the scan tool, continue to actuate the MS Solenoid for the period of 2 minutes with the Transmission Simulator still connected.

After 2 minutes of actuation, with the scan tool, stop the actuation and check for transmission DTCs.

**Did the DTC P2706 reset during the actuation test?**

**Yes** >> Go To 4

**No** >> Replace the Transmission Solenoid/TRS Assembly per the Service Information.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

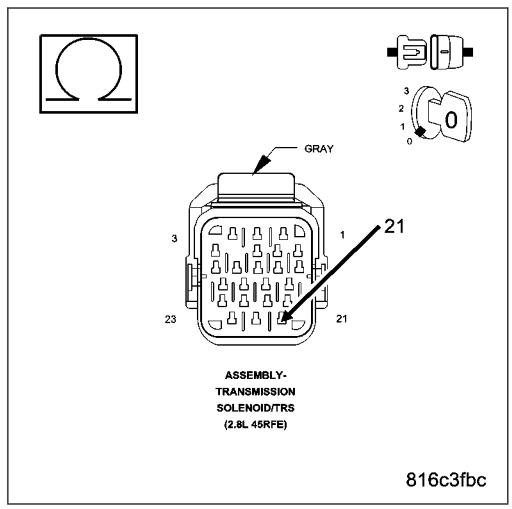
## 4. (T140) MS SOLENOID CONTROL CIRCUIT SHORT TO OTHER CIRCUITS

Turn the ignition off to the lock position.

Disconnect the Transmission Simulator, Miller tool #8333.

Disconnect the PCM harness connectors.

Measure the resistance between the (T140) MS Solenoid Control circuit and all other circuits in the Transmission Solenoid/TRS Assembly harness connector.




**Is the resistance below 5.0 ohms between the (T140) MS Solenoid Control circuit and any other circuit(s) in the Transmission Solenoid/TRS Assembly harness connector?**

**Yes** >> Repair the (T140) MS Solenoid Control circuit for a short to other circuit(s).

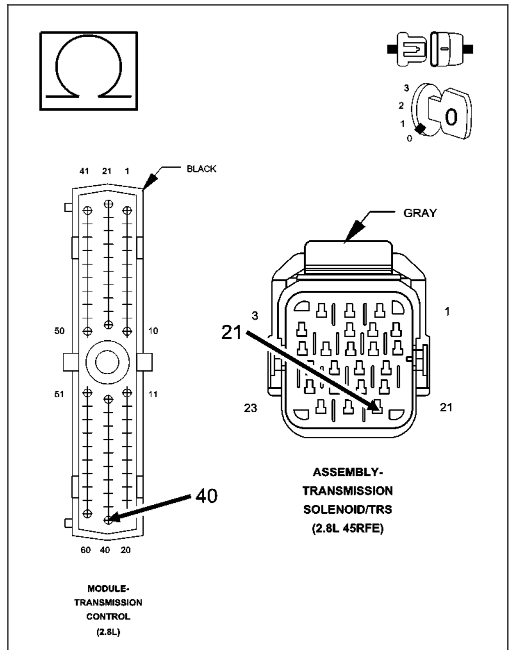
Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Go To 5

## 5. (T140) MS SOLENOID CONTROL CIRCUIT OPEN

Disconnect the TCM harness connector.

Measure the resistance of the (T140) MS Solenoid Control circuit from the Transmission Solenoid/TRS Assembly harness connector to the appropriate terminal of the TCM harness connector.



816c0eb0

**Is the resistance above 5.0 ohms?**

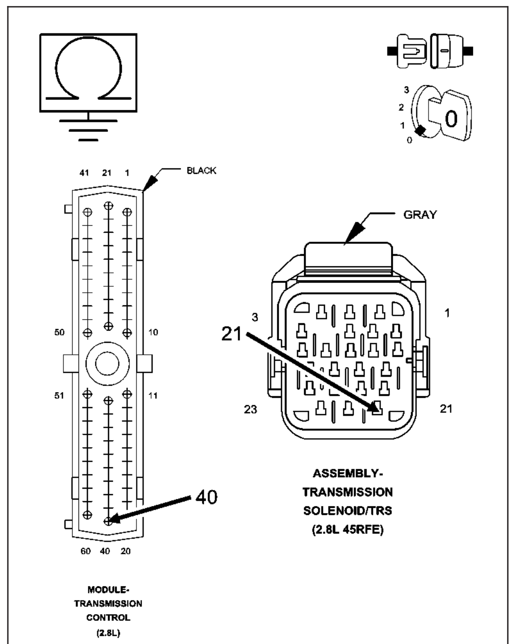
**Yes** >> Repair the (T140) MS Solenoid Control circuit for an open.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANS-AXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PRO-CEDURE)

**No** >> Go To 6

## 6. (T140) MS SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (T140) MS Solenoid Control circuit.



816c0eb7

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (T140) MS Solenoid Control circuit for a short to ground.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1.

**No** >> Using the schematics as a guide, check the Transmission Control Module (TCM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the TCM per the Service Information. With the scan tool, perform QUICK LEARN.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANS-AXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PRO-CEDURE)

## STANDARD PROCEDURE

## 45RFE/545RFE PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

For a complete wiring diagram **Refer to Section 8W**.

# 1.

Perform the following before attempting any diagnostic procedures:

- Check the transmission fluid level. If the fluid level is low, locate and repair any leaks and fill the transmission to the proper level. Refer to the appropriate Service Information for procedures. Many transmission symptoms can be caused by a low fluid level.
- Check the battery. To avoid false diagnosis, testing should only be performed with the battery fully charged.
- With the scan tool, read Engine (PCM) DTCs. If DTCs are present, refer to the Driveability Category and perform to the appropriate diagnostic procedure(s) before proceeding.
- With the scan tool, read Transmission (TCM) DTCs. Record all Stored, Active, and Pending DTC information. Diagnose any Pending DTC as a matured DTC.
- With the scan tool, read DTC EVENT DATA. Use this data to identify the conditions in which the DTC was set.
- Performing a Battery Disconnect will clear all DTC EVENT DATA and reset all learned Transmission values to the default values, which may temporarily result in erratic shift schedules.
- With the scan tool, perform the Shift Lever Position Test. If the test does not pass, refer to the diagnostic procedure for P0706 Check Shifter Signal.
- For Gear Ratio Error DTCs, use the scan tool to view CVI Monitor data. Read and record the Clutch Volume Index information.
- Use the wiring diagram as a guide. Inspect the wiring and connectors related to this circuit. Repair as necessary.
- Refer to the When Monitored and Set Conditions for this DTC. DTCs can set at ignition on, at start up, after driving under specific conditions and after diagnostic monitors have been run.
- Refer to applicable Technical Service Bulletins (TSBs) for controller software update information. Some conditions can be corrected by upgrading the Engine (PCM) or Transmission (TCM) controller software.
- Refer to any Service Information Tune Ups or Technical Service Bulletins that apply.

**Were there any repairs made that fixed the vehicle?**

**Yes** >> Testing complete.

Perform 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - STANDARD PROCEDURE)

**No** >> Refer to the Transmission category and perform the appropriate diagnostic procedure(s).

## 45RFE/545RFE TRANSMISSION VERIFICATION TEST - VER 1

For a complete wiring diagram **Refer to Section 8W**.

### 1.

Perform the following after completion of a diagnostic repair:

- **After completion of the Transmission Verification Test, the Powertrain Verification Test must be performed.**
- Connect the scan tool to the Data Link Connector (DLC).
- Reconnect any disconnected components.
- If the PCM has been replaced or updated (flashed), or the transmission has been repaired or replaced, using the scan tool, perform a Quick Learn Procedure.
- With the scan tool, erase all Transmission and Engine DTC's.
- With the scan tool, perform a BATTERY DISCONNECT, this will clear the DTC EVENT DATA
- With the scan tool, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT.
- Check the Transmission fluid level and adjust if necessary. Refer to the Service Information for the Fluid Fill procedure. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE/FLUID - STANDARD PROCEDURE)
- Road test the vehicle.
- Perform the following shifts from a standing start with a constant throttle opening of 20 to 25 degrees to the speeds of 97 Kmh or 60 MPH; make fifteen to twenty 1 to 2, 2 to 3, 3 to 4 upshifts and for 545RFE, 4 to 5.
- Perform the following shifts with speeds below 40 Kmh or 25 MPH; make five to eight wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown.
- Check for DTCs during and after the road test.
- If after performing the road test, if any shift concerns are noted, perform the drive learn procedure for those affected shifts. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)
- **Use the EATX OBDII task manager to run Good Trip time in each gear, this will confirm the repair and to ensure that the DTC does not re-mature.**

**Were there any Diagnostic Trouble Codes (DTCs) set during the road test?**

**Yes** >> Refer to the Transmission category and perform the appropriate symptom. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - DIAGNOSIS AND TESTING)

**No** >> Repair is complete.

# AUTOMATIC TRANSMISSION - 545RFE

## TABLE OF CONTENTS

# AUTOMATIC TRANSMISSION - 545RFE

## DESCRIPTION

The 545RFE automatic transmission is a sophisticated, multi-range, electronically controlled transmission which combines optimized gear ratios for responsive performance, state of the art efficiency features and low NVH. Other features include driver adaptive shifting and three planetary gear sets to provide wide ratio capability with precise ratio steps for optimum driveability. The three planetary gear sets also make available a unique alternate second gear ratio. The primary 2nd gear ratio fits between 1st and 3rd gears for normal through-gear accelerations. The alternate second gear ratio (2prime) allows smoother 4-2 kickdowns at high speeds to provide 2nd gear passing performance over a wider highway cruising range. An additional overdrive ratio (0.67:1) is also provided for greater fuel economy and less NVH at highway speeds.

The hydraulic portion of the transmission consists of the transmission fluid, fluid passages, hydraulic valves, and various line pressure control components.

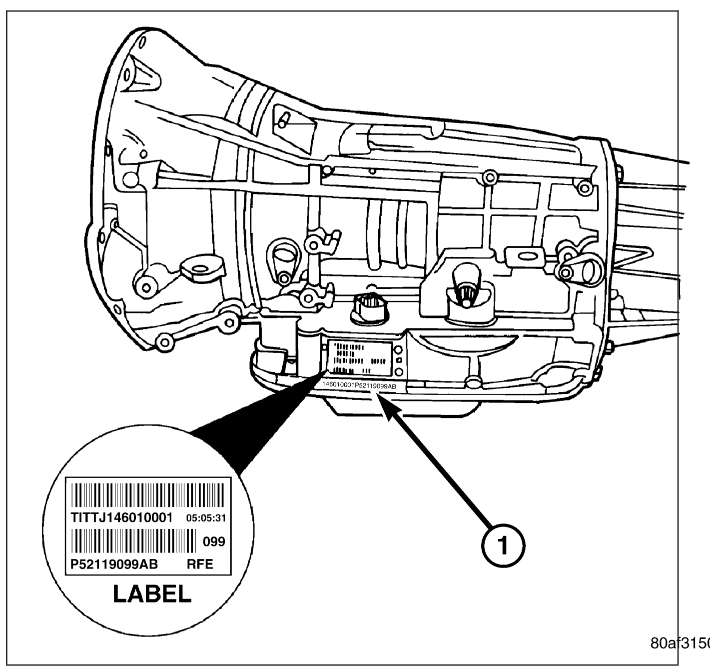
The primary mechanical components of the transmission consist of the following:

- Three multiple disc input clutches
- Three multiple disc holding clutches
- Five hydraulic accumulators
- Three planetary gear sets
- Dual Stage Hydraulic oil pump
- Valve body
- Solenoid pack

The Transmission Control Module (TCM) is the "heart" or "brain" of the electronic control system and relies on information from various direct and indirect inputs (sensors, switches, etc.) to determine driver demand and vehicle operating conditions. Depending on the vehicle configuration, the TCM may be a standalone module or it it may be housed along with the Powertrain Control Module (PCM) in a single module. With this information, the TCM can calculate and perform timely and quality shifts through various output or control devices (solenoid pack, transmission control relay, etc.).

## TRANSMISSION IDENTIFICATION

Transmission identification numbers (1) are stamped on the left side of the case just above the oil pan sealing surface. Refer to this information when ordering replacement parts. A label is attached to the transmission case above the stamped numbers. The label gives additional information which may also be necessary for identification purposes.




## GEAR RATIOS

The 545RFE gear ratios are:

| | |
|---|---|
| 1st | 3.00:1 |
| 2nd | 1.67:1 |
| 2nd Prime | 1.50:1 |
| 3rd | 1.00:1 |
| 4th | 0.75:1 |
| 5th | 0.67:1 |
| Reverse | 3.00:1 |

## OPERATION

The 545RFE offers full electronic control of all automatic up and downshifts, and features real-time adaptive closed-loop shift and pressure control. Electronic shift and torque converter clutch controls help protect the transmission from damage due to high temperatures, which can occur under severe operating conditions. By altering shift schedules, line pressure, and converter clutch control, these controls reduce heat generation and increase transmission cooling.

To help reduce efficiency-robbing parasitic losses, the transmissions includes a dual-stage transmission fluid pump with electronic output pressure control. Under most driving conditions, pump output capacity greatly exceeds that which is needed to keep the clutches applied. The 45RFE/545RFE pump-pressure control system monitors input torque and adjusts the pump pressure accordingly. The primary stage of the pump works continuously; the second stage is bypassed when demand is low. The control system also monitors input and output speed and, if incipient clutch slip is observed, the pressure control solenoid duty cycle is varied, increasing pressure in proportion to demand.

A high-travel torque converter damper assembly allows earlier torque converter clutch engagement to reduce slippage. Needle-type thrust bearings reduce internal friction. The 45RFE/545RFE is packaged in a one-piece die-cast aluminum case. To reduce NVH, the case has high lateral, vertical and torsional stiffness. It is also designed to maximize the benefit of the structural dust cover that connects the bottom of the bell housing to the engine bedplate, enhancing overall power train stiffness. Dual filters protect the pump and other components. A cooler return filter is added to the customary main sump filter. Independent lubrication and cooler circuits assure ample pressure for normal transmission operation even if the cooler is obstructed or the fluid cannot flow due to extremely low temperatures.

The hydraulic control system design (without electronic assist) provides the transmission with PARK, REVERSE, NEUTRAL, SECOND, and THIRD gears, based solely on driver shift lever selection. This design allows the vehicle to be driven (in “limp-in” mode) in the event of a electronic control system failure, or a situation that the Transmission Control Module (TCM) recognizes as potentially damaging to the transmission.

The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data, DTC’s, etc.) which is helpful in proper diagnosis and repair. This information can be viewed with the scan tool.

## DIAGNOSIS AND TESTING

## AUTOMATIC TRANSMISSION

**CAUTION: Before attempting any repair on a 545RFE automatic transmission, check for Diagnostic Trouble Codes with the scan tool.**

Transmission malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions
- Electronic malfunctions

Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and condition, gearshift cable adjustment. Then perform a road test to determine if the problem has been corrected or if more diagnosis is necessary. If the problem persists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

## PRELIMINARY

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

### VEHICLE IS DRIVABLE

1. Check for transmission fault codes using scan tool.
2. Check fluid level and condition.
3. Adjust gearshift cable if complaint was based on delayed, erratic, or harsh shifts.
4. Road test and note how transmission upshifts, downshifts, and engages.
5. Perform hydraulic pressure test if shift problems were noted during road test.
6. Perform air-pressure test to check clutch operation.

### VEHICLE IS DISABLED

1. Check fluid level and condition.
2. Check for broken or disconnected gearshift cable.
3. Check for cracked, leaking cooler lines, or loose or missing pressure-port plugs.
4. Raise and support vehicle on safety stands, start engine, shift transmission into gear, and note following:
   a. If propeller shaft turns but wheels do not, problem is with differential or axle shafts.
   b. If propeller shaft does not turn and transmission is noisy, stop engine. Remove oil pan, and check for debris. If pan is clear, remove transmission and check for damaged driveplate, converter, oil pump, or input shaft.
   c. If propeller shaft does not turn and transmission is not noisy, perform hydraulic-pressure test to determine if problem is hydraulic or mechanical.

## ROAD TESTING

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that all diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch, overrunning clutch, or line presure problems.

A slipping clutch can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch Application chart provides a basis for analyzing road test results.

**545RFE CLUTCH APPLICATION CHART**

| SLP | UD | OD | R | 2C | 4C | L/R | OVERRUNNING |
|---|---|---|---|---|---|---|---|
| **P–PARK** | | | | | | ON | |
| **R–REVERSE** | | | ON | | | ON | |
| **N-NEUTRAL** | | | | | | ON | |
| **D–FIRST** | ON | | | | | ON* | ON |
| **D–SECOND** | ON | | | ON | | | |
| **D–SECOND PRIME** | ON | | | | ON | | |
| **D–THIRD** | ON | ON | | | | | |
| **D–FOURTH** | | ON | | | ON | | |
| **D–FIFTH** | | ON | | ON | | | |
| **D–LIMP-IN** | ON | ON | | | | | |
| **2–FIRST** | ON | | | | | ON* | ON |

| SLP | UD | OD | R | 2C | 4C | L/R | OVERRUNNING |
|---|---|---|---|---|---|---|---|
| **2–SECOND** | ON | | | ON | | | |
| **2–LIMP-IN** | ON | | | ON | | | |
| **1–LOW** | ON | | | | | ON | ON |

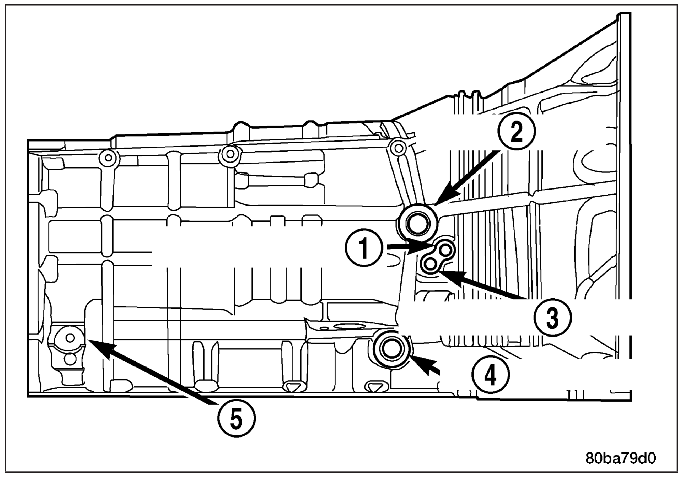
*L/R clutch is on only with the output shaft speed below 150 rpm.

## HYDRAULIC PRESSURE TEST

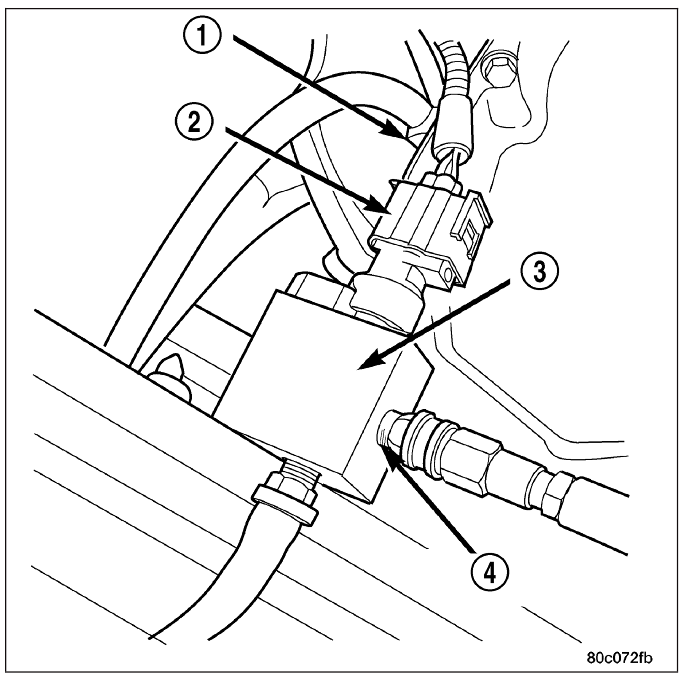
An accurate tachometer and pressure test gauges are required. Oil Pressure Gauge C-3293-SP has a 300 psi range and is used at all locations where pressures exceed 100 psi.

### Pressure Test Port Locations

Only two pressure ports are supplied on the transmission case. The torque converter clutch apply (3) and release (1) ports are located on the right side of the transmission case.

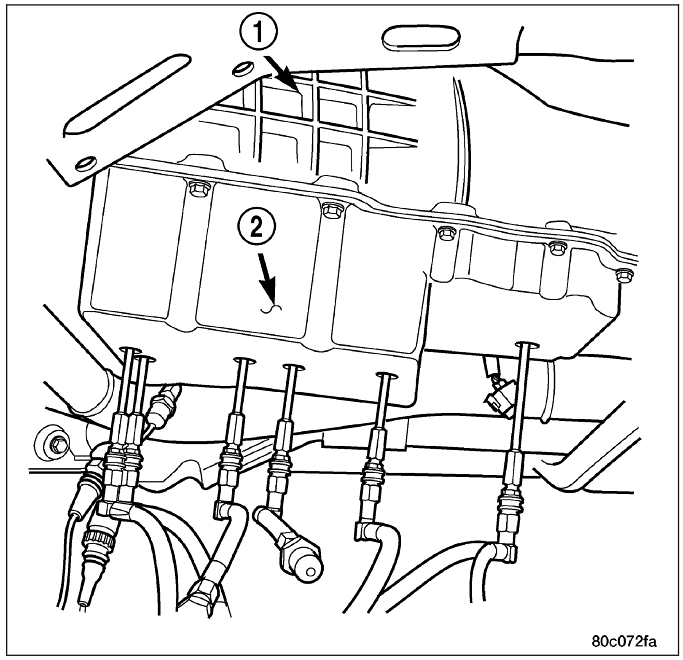



To determine the line pressure, there are two available methods. The scan tool can be used to read line pressure from the line pressure sensor. The second method is to install Line Pressure Adapter 8259 (3) into the transmission case and then install the pressure gauge and the original sensor (2) into the adapter. This will allow a comparison of the scan tool readings and the gauge reading to determine the accuracy of the line pressure sensor. The scan tool

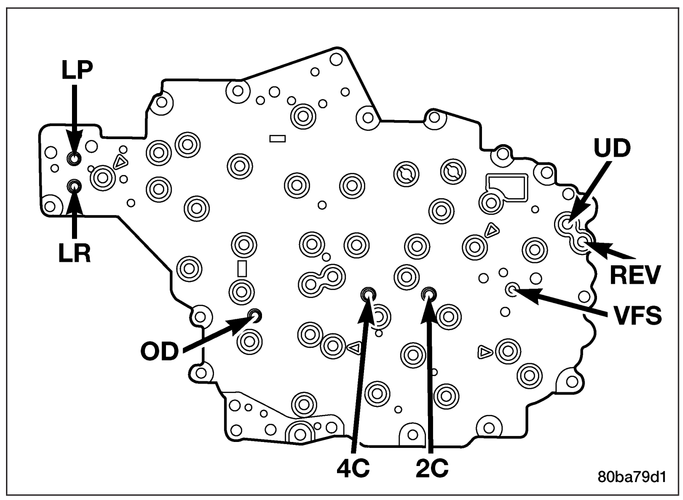


line pressure reading should match the gauge reading within ±10 psi.

In order to access any other pressure tap locations, the transmission oil pan must be removed, the pressure port plugs removed and Valve Body Pressure Tap Adapter 8258-A (2) installed. The extensions supplied with Adapter 8258-A will allow the installation of pressure gauges to the valve body.




Refer to the Pressure Tap Locations graphic for correct pressure tap location identification.




## TEST PROCEDURE

All pressure readings should be taken with the transmission fluid level full, transmission oil at the normal operating temperature, and the engine at 1500 rpm. Check the transmission for proper operation in each gear position that is in question or if a specific element is in question, check the pressure readings in at least two gear positions that employ that element. Refer to the Hydraulic Schematics at the rear of this section to determine the correct pressures for each element in a given gear position.

**NOTE: The 45RFE/545RFE utilizes closed loop control of pump line pressure. The pressure readings may therefore vary greatly but should always follow line pressure.**

Some common pressures that can be measured to evaluate pump and clutch performance are the upshift/downshift pressures, garage shift pressures, and TCC pressure. The upshift/downshift pressure for all shifts are shown in UPSHIFT PRESSURES and DOWNSHIFT PRESSURES . In-gear maximum pressure for each gear position is shown in IN-GEAR PRESSURES . The garage shift pressure when performing a N-R shift is 220 psi. The garage shift pressure for the R-N shift is 120 psi. The garage shift pressure for the N-1 shift is 135 psi. Torque converter lock-up pressure is 120 psi.

**UPSHIFT PRESSURES**

| 1-2 | 2-3 | 2prime-3 | 3-4 | 2prime-4 | 2-5 | 3-5 | 4-5 |
|---|---|---|---|---|---|---|---|
| 120 | 120 | 120 | 120 | 120 | 120 | 120 | 130 |

**DOWNSHIFT PRESSURES**

| 5-4 | 5-3 | 5-2 | 4-3 | 4-2prime | 3-2 | 3-2prime | 2prime-1 | 2-1 | 3-1 |
|---|---|---|---|---|---|---|---|---|---|
| 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 |

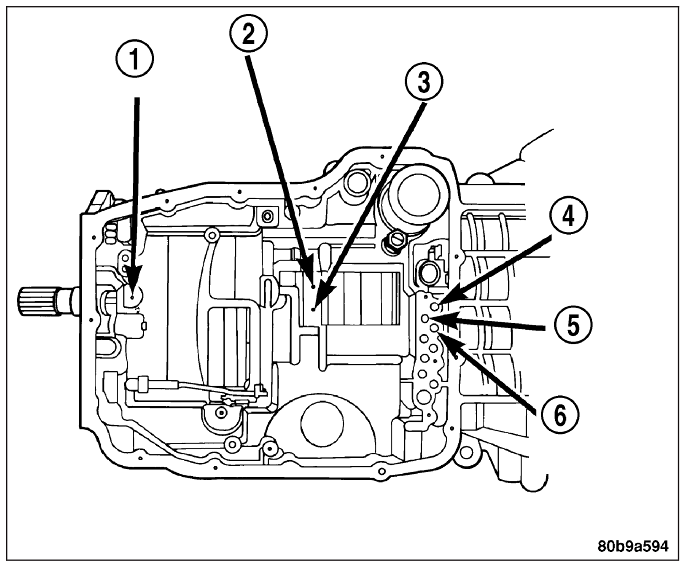
**IN-GEAR PRESSURES**

| 1 | 2 | 2prime | 3 | 4 | 5 | NEUTRAL | REVERSE |
|---|---|---|---|---|---|---|---|
| 135 | 120 | 120 | 120 | 120 | 120 | 120 | 220 |

## AIR CHECKING TRANSMISSION CLUTCH OPERATION

Air-pressure testing can be used to check transmission clutch operation. The test can be conducted with the transmission either in the vehicle or on the work bench, as a final check.

Air-pressure testing requires that the oil pan and valve body be removed from the transmission. The clutch apply passages are shown in the Air Pressure Test Passages graphic.




**NOTE: The air supply which is used must be free of moisture and dirt. Use a pressure of 30 psi to test clutch operation.**

Apply air pressure at each port. If the clutch is functioning, a soft thump will be heard as the clutch is applied. The clutch application can also be felt by touching the appropriate element while applying air pressure. As the air pressure is released, the clutch should also release.

## CONVERTER HOUSING FLUID LEAK

When diagnosing converter housing fluid leaks, two items must be established before repair.

1. Verify that a leak condition actually exists.
2. Determined the true source of the leak.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair. Torque converter seal leaks tend to move along the drive hub and onto the rear of the converter. Pump cover seal leaks tend to run down the cover and the inside surface of the bellhousing.

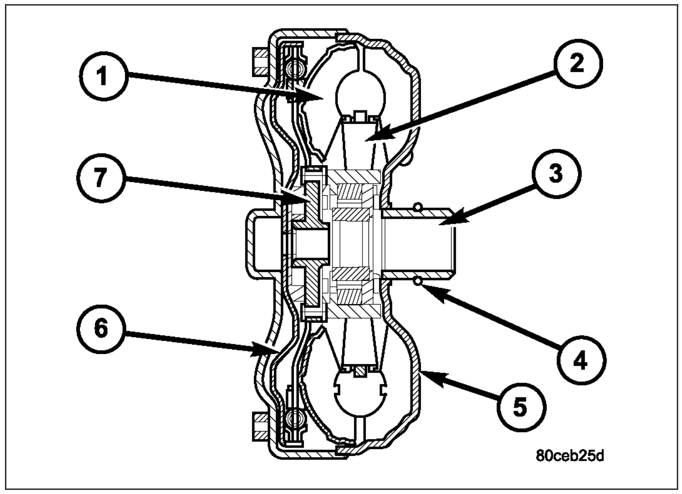
Some leaks, or suspected leaks, may be particularly difficult to locate. If necessary, a Mopar® approved dye should be used to locate and confirm a leak.

## TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are:

1. Leaks at the weld joint around the outside diameter weld.
2. Leaks at the converter hub weld.

In most cases, a torque converter which is wet from transmission fluid indicates a leak at one of these areas.



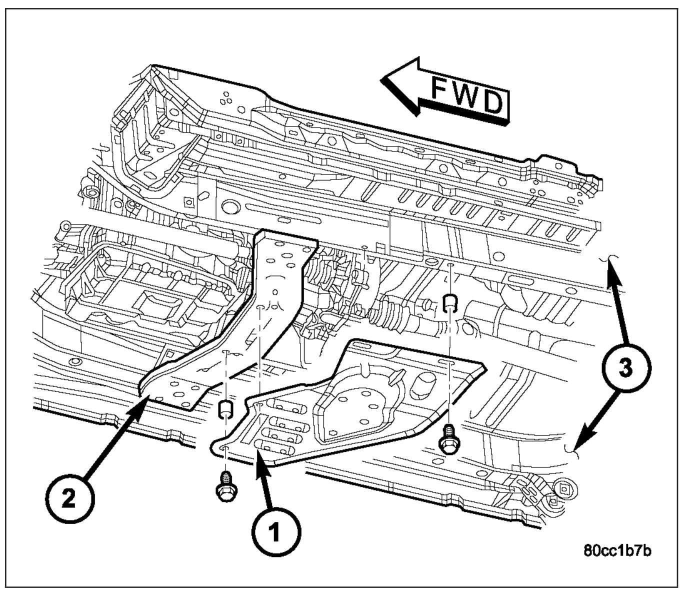

## STANDARD PROCEDURE - ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils™, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil™ tap, or equivalent, and installing a Heli-Coil™ insert, or equivalent, into the hole. This brings the hole back to its original thread size.

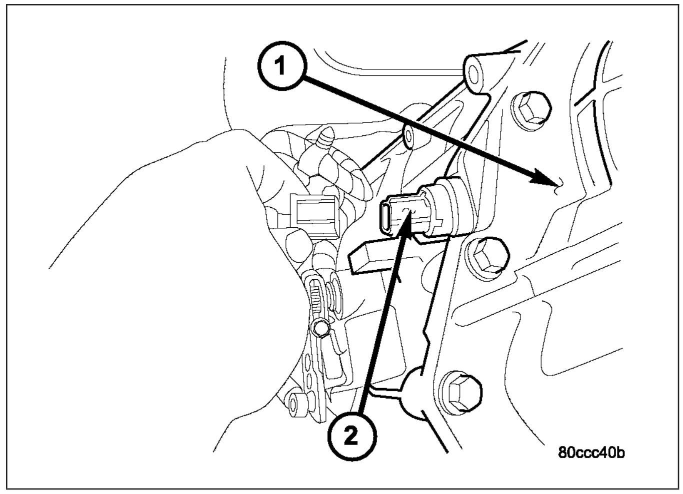
Heli-Coil™, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

## REMOVAL

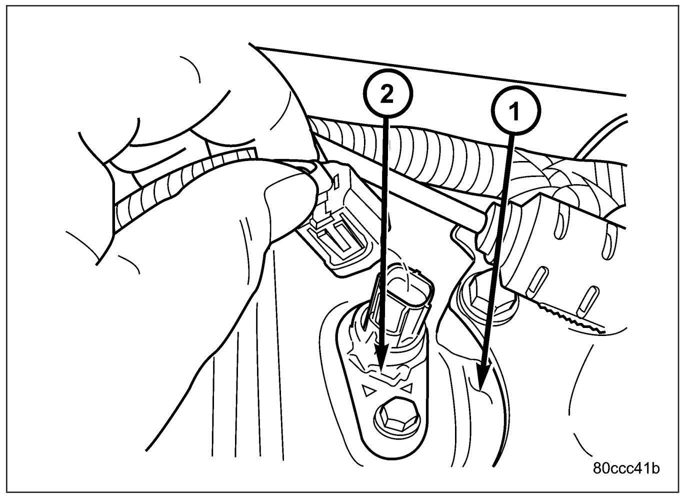
1. Disconnect the negative battery cable.
2. Raise and support the vehicle
3. Remove any necessary skid plates (1). (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - REMOVAL)



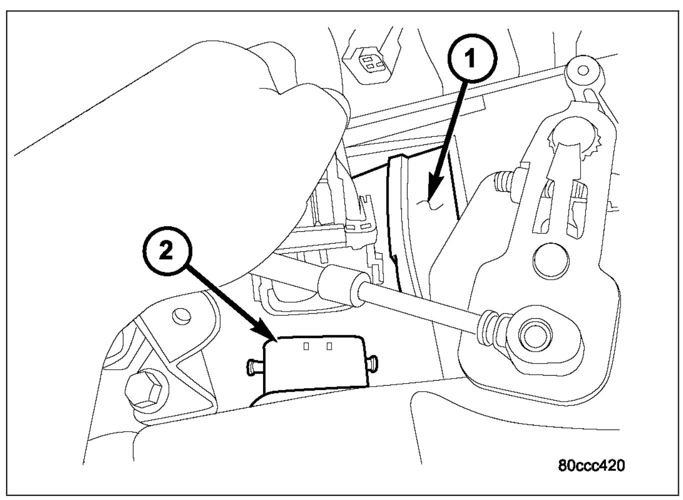
4. Mark propeller shaft and axle companion flanges for assembly alignment.
5. Remove the rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
6. Remove the front propeller shaft, if necessary. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
7. Disengage the output speed sensor connector from the output speed sensor (2).



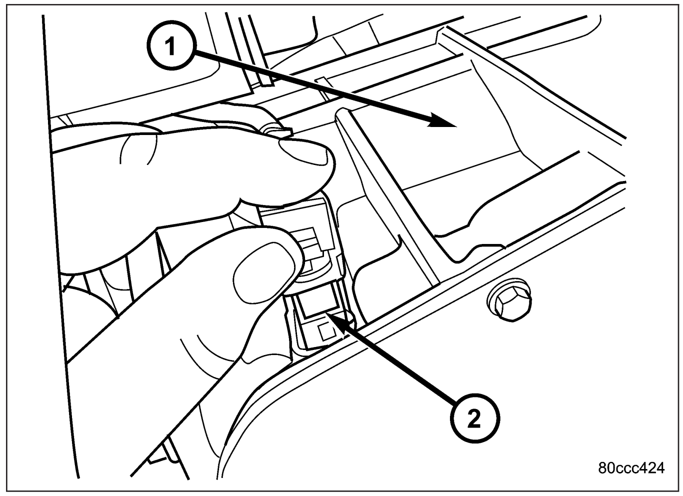

8. Disengage the input speed sensor connector from the input speed sensor (2).



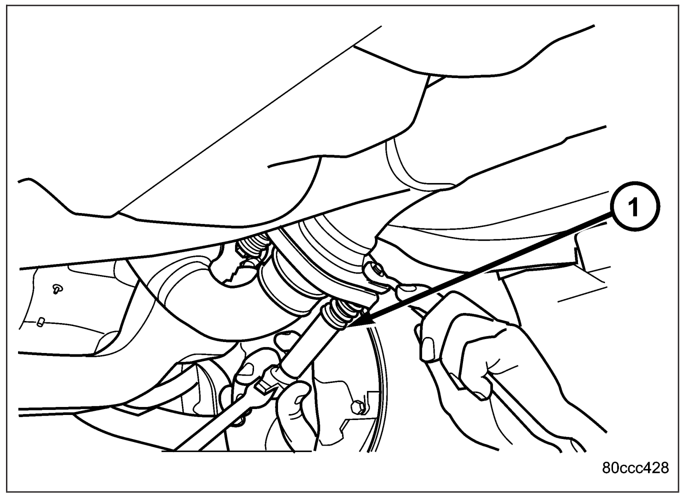

9. Disengage the transmission solenoid/TRS assembly connector from the transmission solenoid/TRS assembly (2).



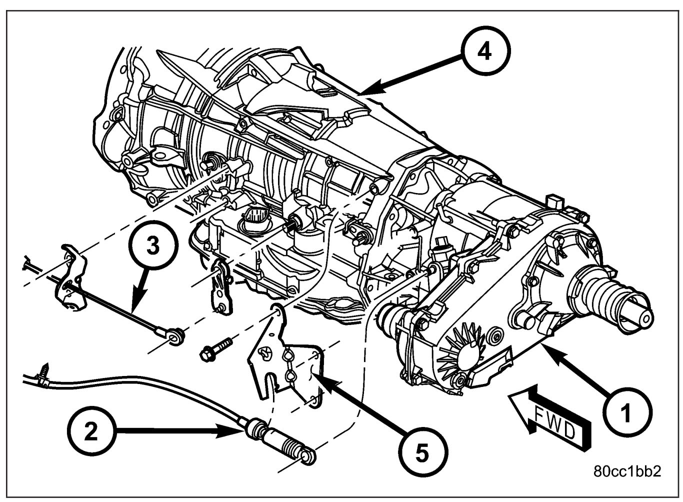
10. Disengage the line pressure sensor connector from the line pressure sensor (2).



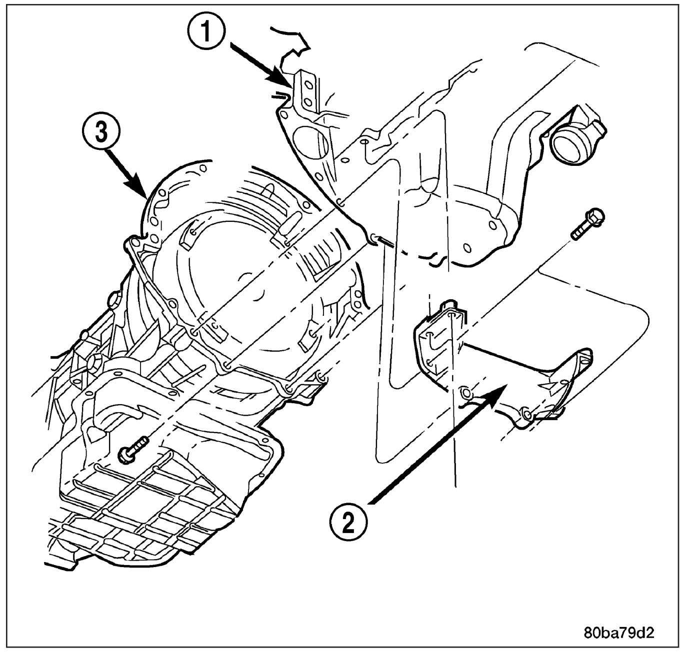

11. Remove the bolts (1) holding the exhaust crossover pipe to the pre-catalytic converter pipe flanges.
12. Remove the bolts holding the exhaust crossover pipe to the catalytic converter flange.



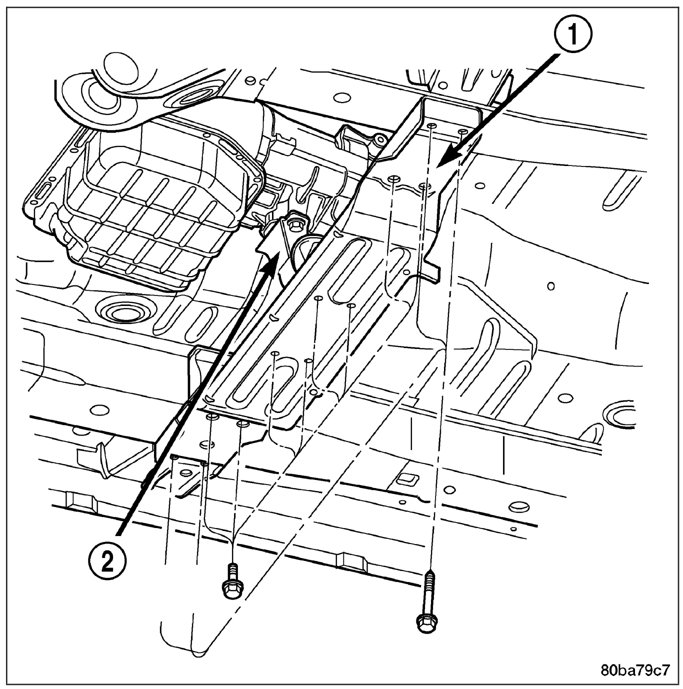

13. Disconnect gearshift cable (2) from transmission manual valve lever.



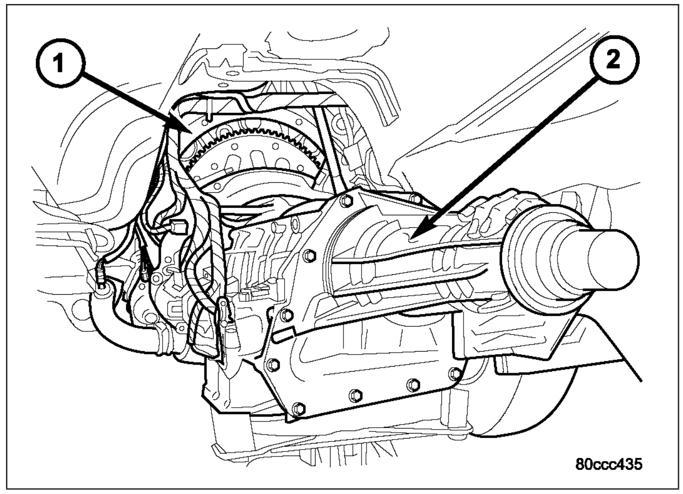
14. Disengage the shift cable from the cable support bracket.
15. Remove the starter motor.
16. Remove the engine to transmission collar (2).




17. Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.
18. Disconnect transmission fluid cooler lines at transmission fittings and clips.
19. Disconnect the transmission vent hose from the transmission.
20. Remove transfer case.
21. Support rear of engine with safety stand or jack.
22. Raise transmission slightly with service jack to relieve load on crossmember and supports.
23. Remove bolts securing rear support and cushion (2) to transmission and crossmember (1).
24. Remove bolts attaching crossmember to frame and remove crossmember.

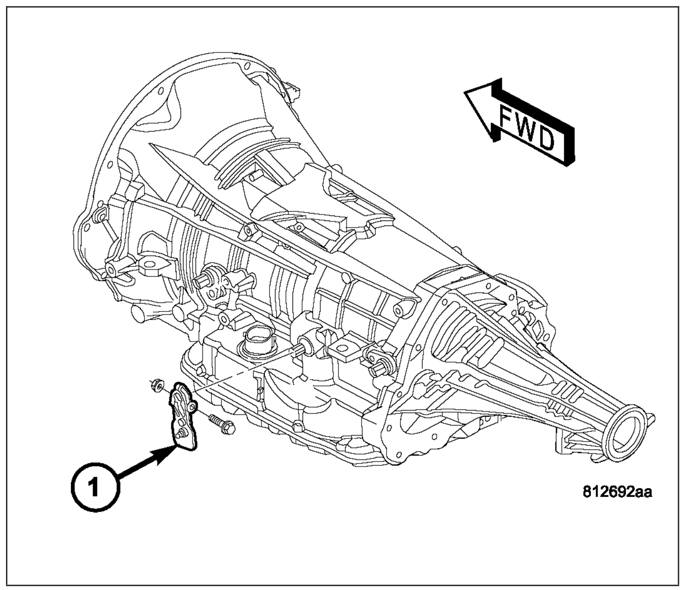


25. Remove all remaining converter housing bolts.
26. Carefully work transmission and torque converter assembly rearward off engine block dowels.
27. Hold torque converter in place during transmission removal.
28. Lower transmission and remove assembly (2) from under the vehicle.
29. To remove torque converter, carefully slide torque converter out of the transmission.

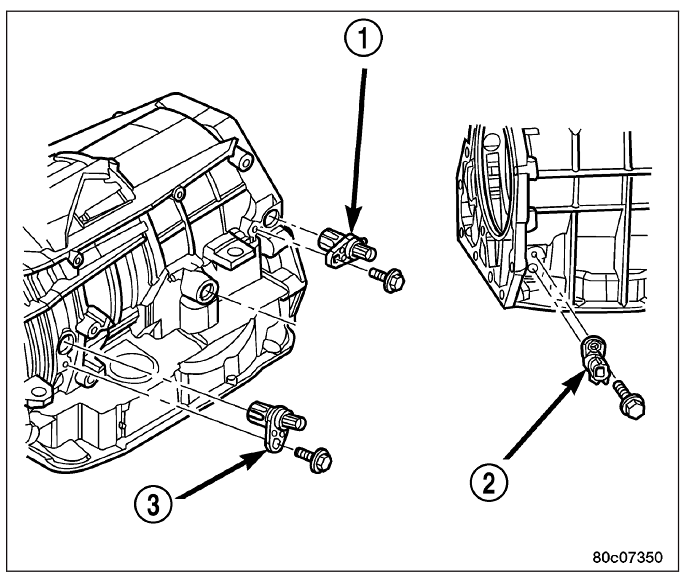



## DISASSEMBLY

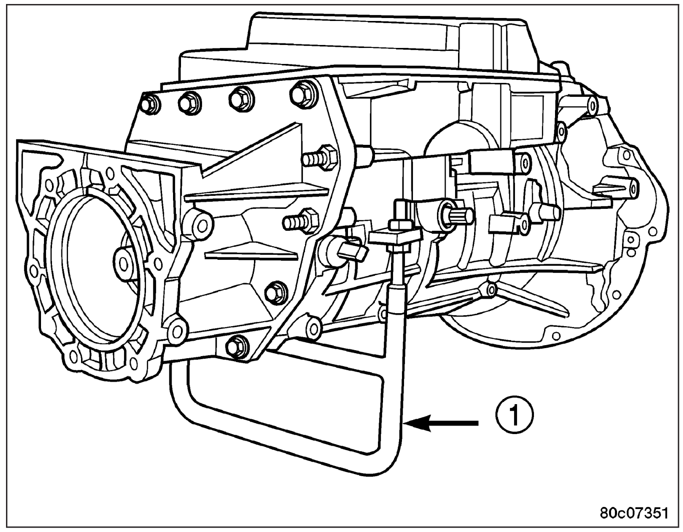
1. Drain fluid from transmission.
2. Clean exterior of transmission with suitable solvent or pressure washer.
3. Remove the torque converter from the transmission.
4. Remove the manual shift lever (1) from the transmission.




5. Remove the input (3), output (1), and line pressure sensors (2) from the transmission case.
6. Inspect the ends of the sensors for debris, which may indicate the nature of the transmission failure.

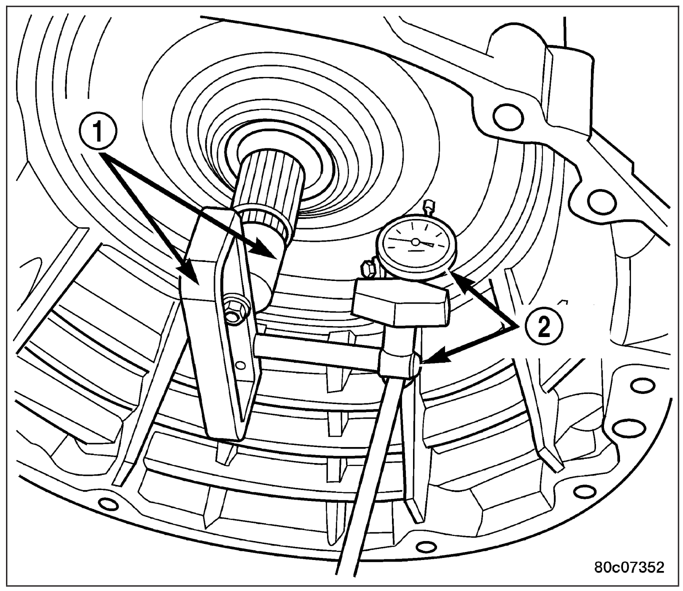


7. Install Support Stand 8257 (1) onto the transmission case.

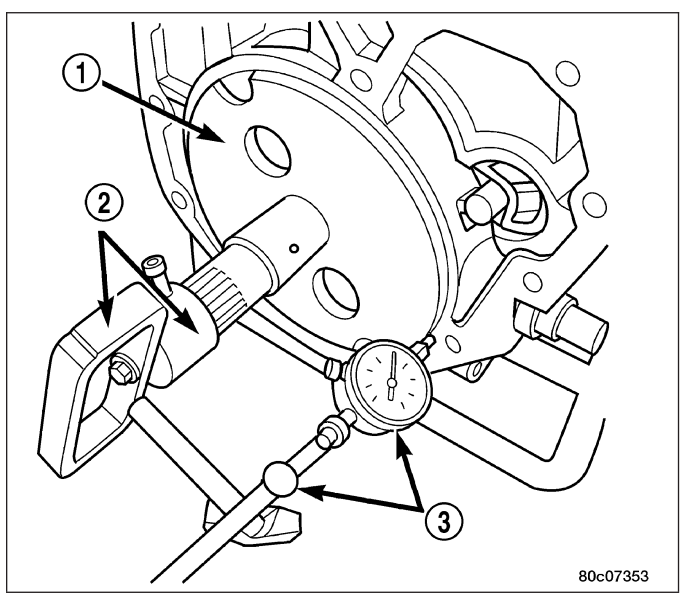



8. Using Adapter 8266-1 from End-Play Tool Set 8266 (1) and Dial Indicator C-3339 (2), measure and record the input shaft end-play.

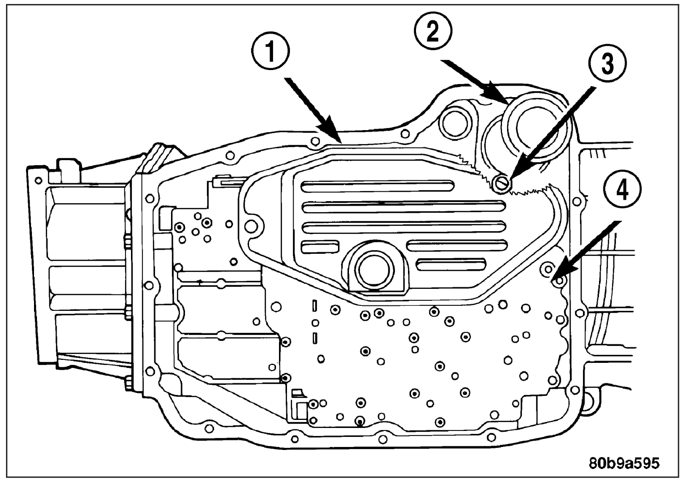
**NOTE: When measuring the input shaft end-play, two ″stops″ will be felt. When the input shaft is pushed inward and the dial indicator zeroed, the first ″stop″ felt when the input shaft is pulled outward is the movement of the input shaft in the input clutch housing hub. This value should not be included in the end-play measured value and therefore must be recorded and subtracted from the dial indicator reading.**



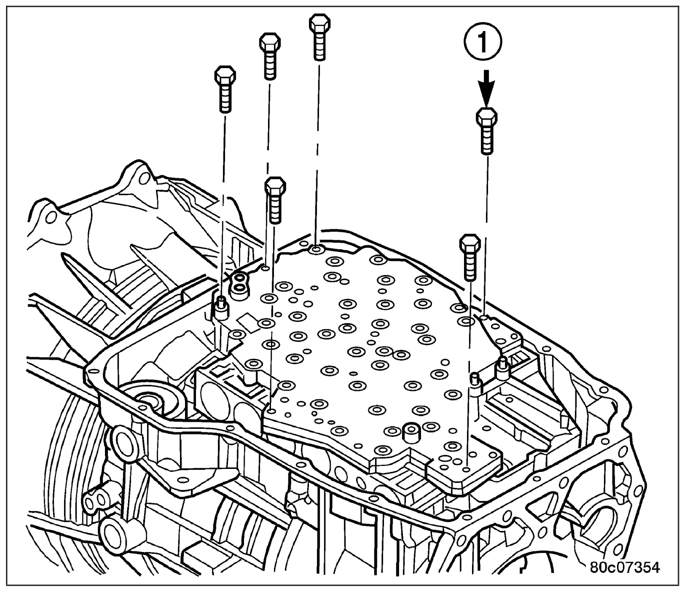

9. Remove the bolts holding the transmission extension/adapter housing to the transmission case.
10. Remove the extension/adapter housing from the transmission case.
11. Using Alignment Plate 8261 (1), Adapter 8266-17 from End-Play Tool Set 8266 (2) and Dial Indicator C-3339 (3), measure and record the output shaft end-play.



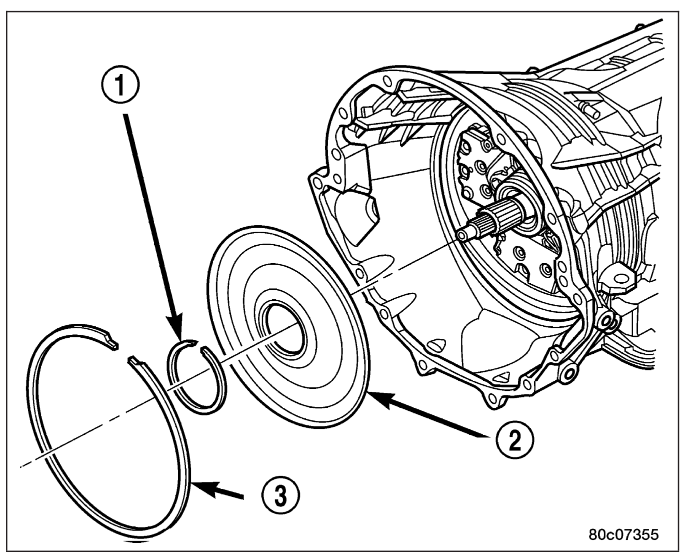
12. Remove the bolts holding the transmission oil pan to the transmission case.
13. Remove the transmission oil pan from the transmission case.
14. Remove the primary oil filter (1) and the oil cooler return filter (2).
15. Remove the cooler return filter bypass valve (3).




16. Remove the bolts (1) holding the valve body to the transmission case.
17. Remove the valve body from the transmission case.

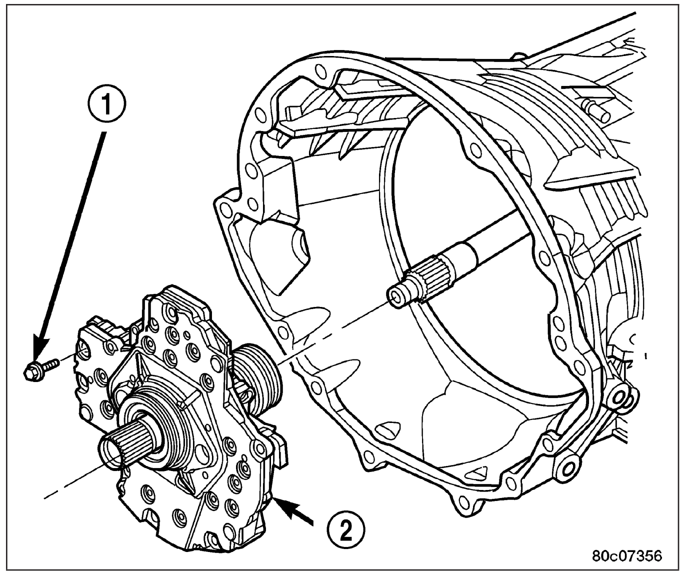



18. Remove the outer snap-ring (3) securing the transmission front cover (2) into the transmission case.
19. Remove the inner snap-ring (1) securing the transmission front cover to the oil pump.
20. Reaching through a case opening in the valve body area with a long blunted tool, remove the transmission front cover from the transmission case.

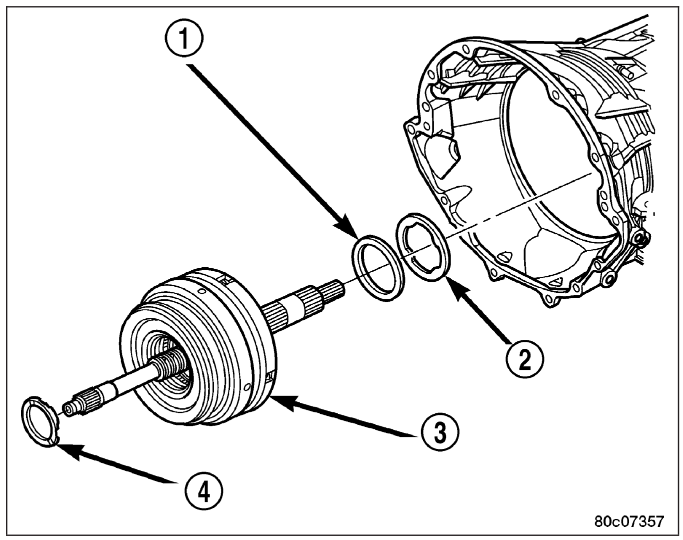


21. Remove the bolts (1) holding the oil pump into the transmission case.
22. Remove the oil pump (2). Hold inward on the input shaft to prevent pulling the input clutch assembly with the oil pump.

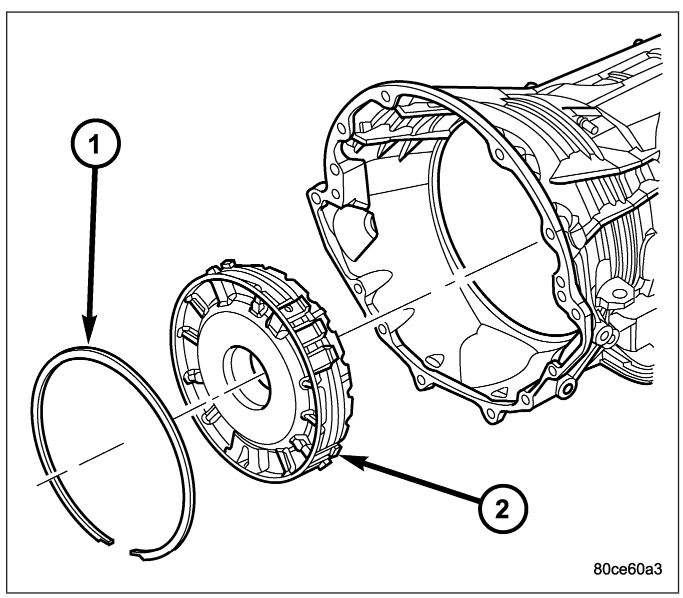
**CAUTION: If the input shaft is not held during oil pump removal, the input clutch assembly will attempt to move forward with the oil pump and the numbers 2, 3, or 4 bearings inside the input clutch assembly may become dislodged.**



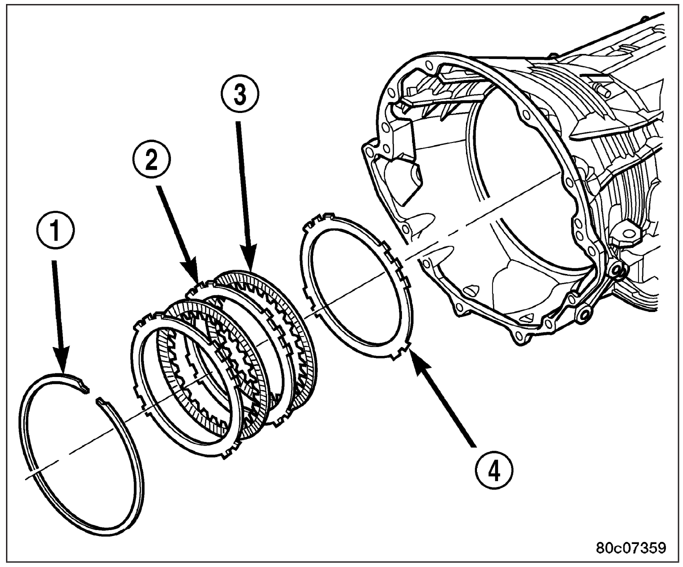

23. Remove the number 1 thrust bearing (4) from the input clutch assembly.
24. Remove the input clutch assembly (3) from the transmission case.
25. Remove the number 5 thrust bearing (1) and selective thrust plate (2) from the input clutch assembly (3), or the 4C clutch retainer/bulkhead.

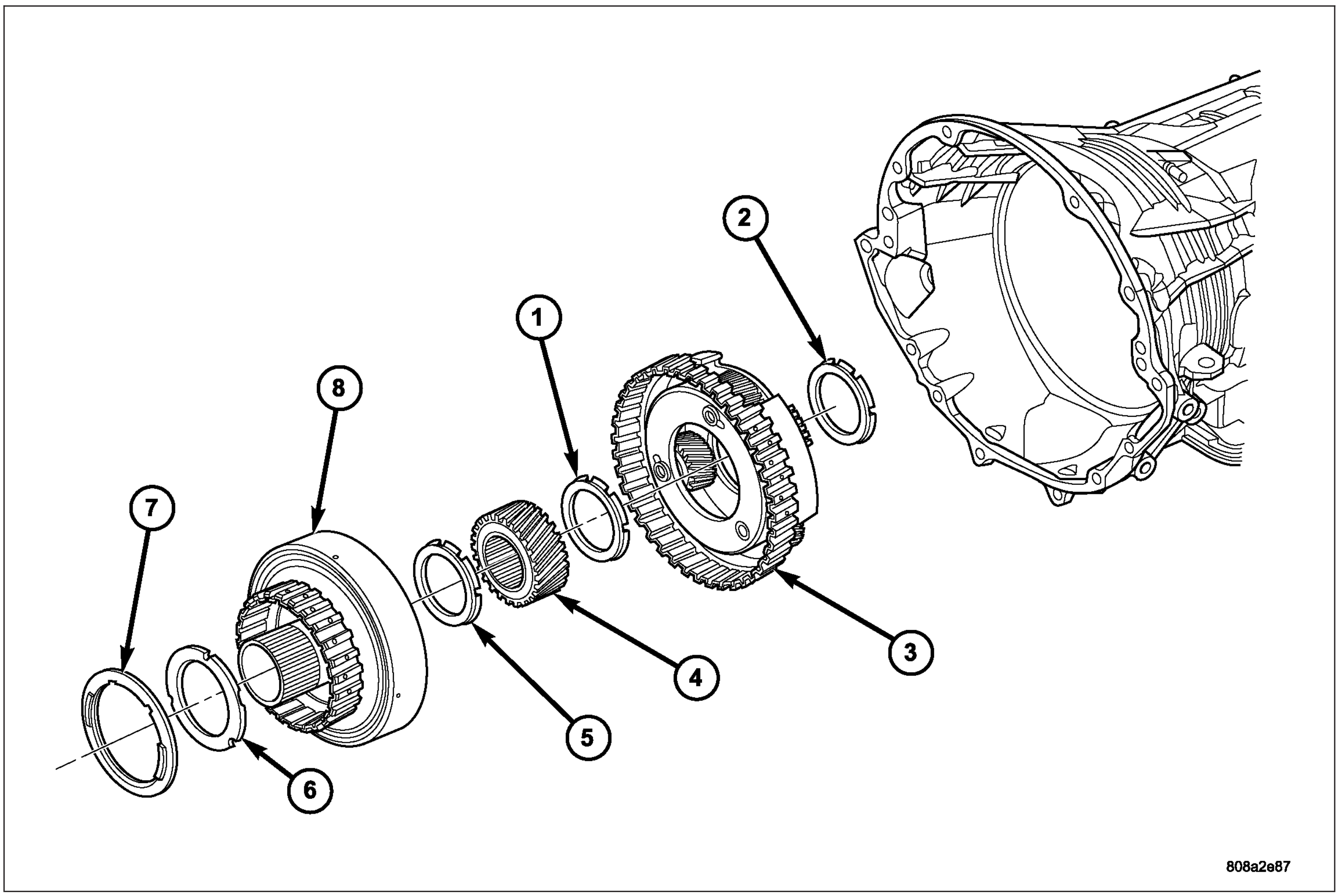



26. Remove the 4C clutch retainer/bulkhead tapered snap-ring (1) from the transmission case.
27. Remove the 4C clutch retainer/bulkhead (2) from the transmission case.



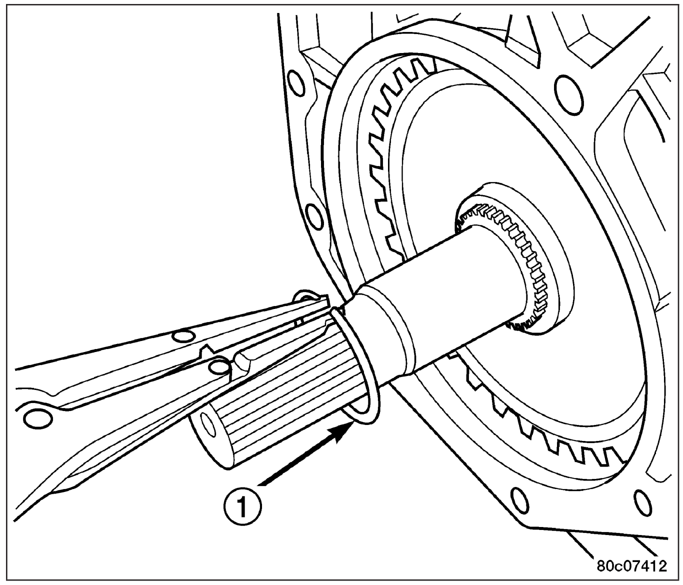
28. Remove the front 2C clutch pack snap-ring (1) from the transmission case.
29. Remove the 2C clutch pack (2, 3, 4) from the transmission case.



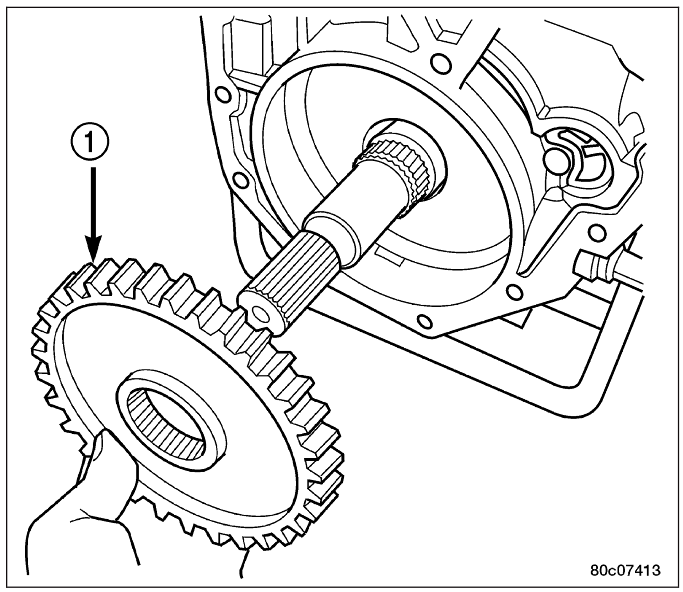




30. Remove the rear selective plate (6) and number 6 thrust bearing (7) from the reaction annulus (8).
31. Remove the reaction annulus (8) from the reaction planetary carrier (3).
32. Remove the number 7 thrust bearing (5).
33. Remove the reaction sun gear (4).
34. Remove the number 8 thrust bearing (1) from the reaction planetary carrier (3).
35. Remove the reaction planetary carrier (3). Note that this planetary gear set has three pinion gears.
36. Remove the number 9 thrust bearing (2) from the reverse planetary gear set.

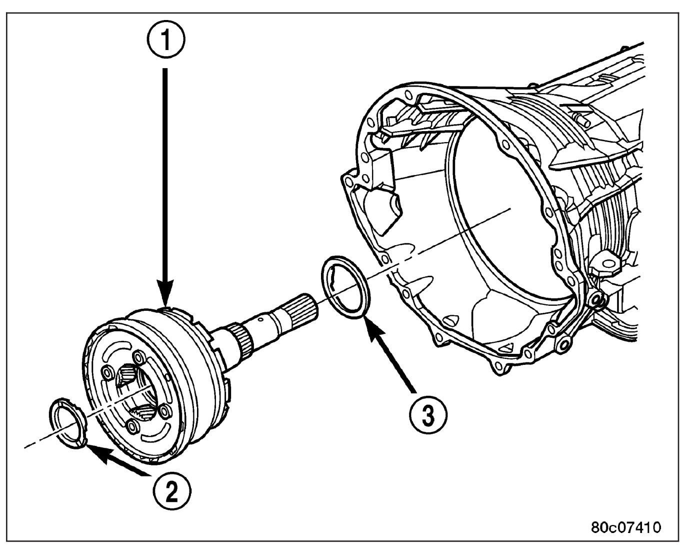
37. Remove the snap-ring (1) holding the park sprag gear onto the output shaft.



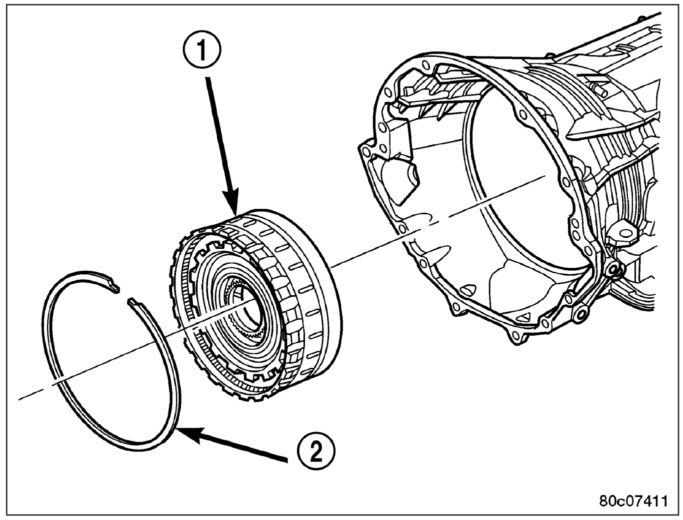

38. Remove the park sprag gear (1) from the output shaft.



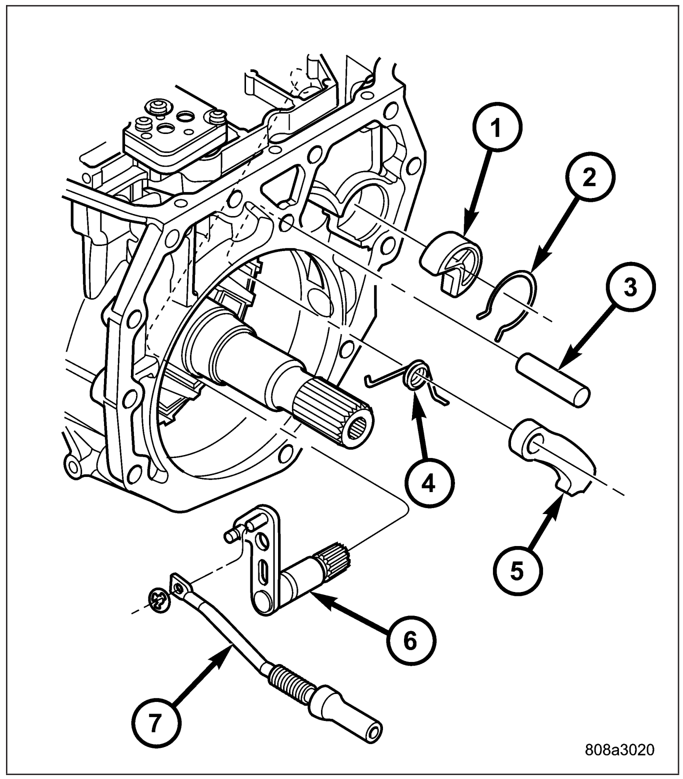

39. Remove the input/reverse planetary assembly (1).
40. Remove the number 12 thrust bearing (3) from the input/reverse planetary assembly (1).



41. Remove the snap-ring (2) holding the low/reverse clutch retainer (1) into the transmission case.
42. Remove the low/reverse clutch retainer (1) from the transmission case.




43. Remove the park rod (7) and e-clip.
44. Remove the park rod guide snap-ring (2).
45. Remove the park rod guide (1).
46. Remove the park pawl pivot shaft (3), park pawl (5), and spring (4).
47. Remove the manual selector shaft (6).
48. Remove the manual selector shaft seal.
49. Remove the dipstick tube seal.




## CLEANING

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on shafts, or valves, use extreme care to avoid rounding off sharp edges. Sharp edges are vital as they prevent foreign matter from getting between the valve and valve bore.

Do not reuse oil seals, gaskets, seal rings, or O-rings during overhaul. Replace these parts as a matter of course. Also do not reuse snap rings or E-clips that are bent or distorted. Replace these parts as well.

Lubricate transmission parts with Mopar® ATF +4, Automatic Transmission Fluid, during overhaul and assembly. Use petroleum jelly, Mopar® Door Ease, or Ru-Glyde to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used to hold parts in place during reassembly.

Clean the case in a solvent tank. Flush the case bores and fluid passages thoroughly with solvent. Dry the case and all fluid passages with compressed air. Be sure all solvent is removed from the case and that all fluid passages are clear.

**NOTE: Do not use shop towels or rags to dry the case (or any other transmission component) unless they are made from lint-free materials. Lint will stick to case surfaces and transmission components and circulate throughout the transmission after assembly. A sufficient quantity of lint can block fluid passages and interfere with valve body operation.**

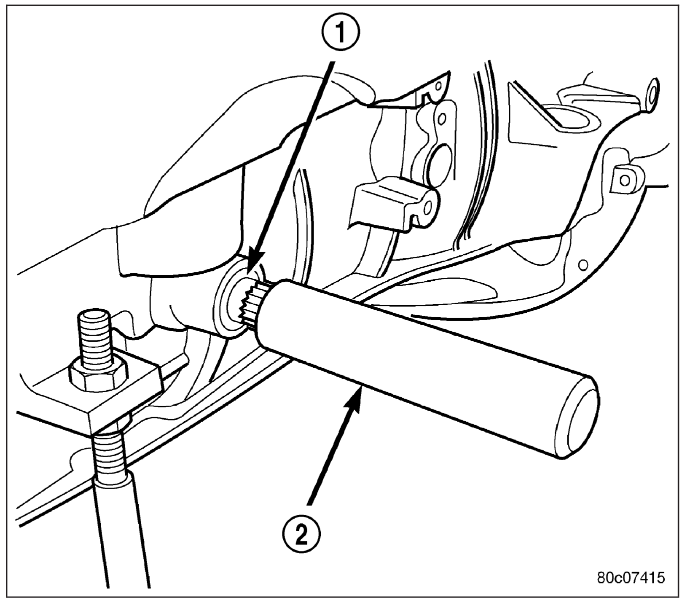
## INSPECTION

Inspect the case for cracks, porous spots, worn bores, or damaged threads. Damaged threads can be repaired with Helicoil® thread inserts. However, the case will have to be replaced if it exhibits any type of damage or wear.

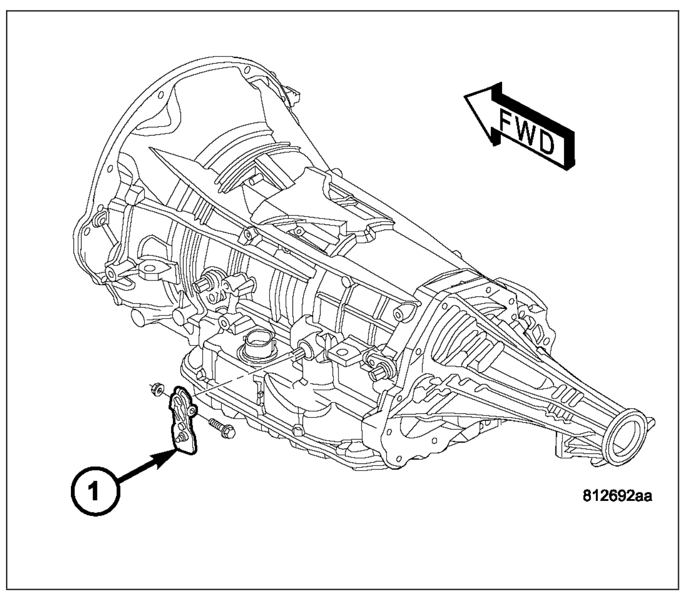
## ASSEMBLY

**NOTE: Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.**

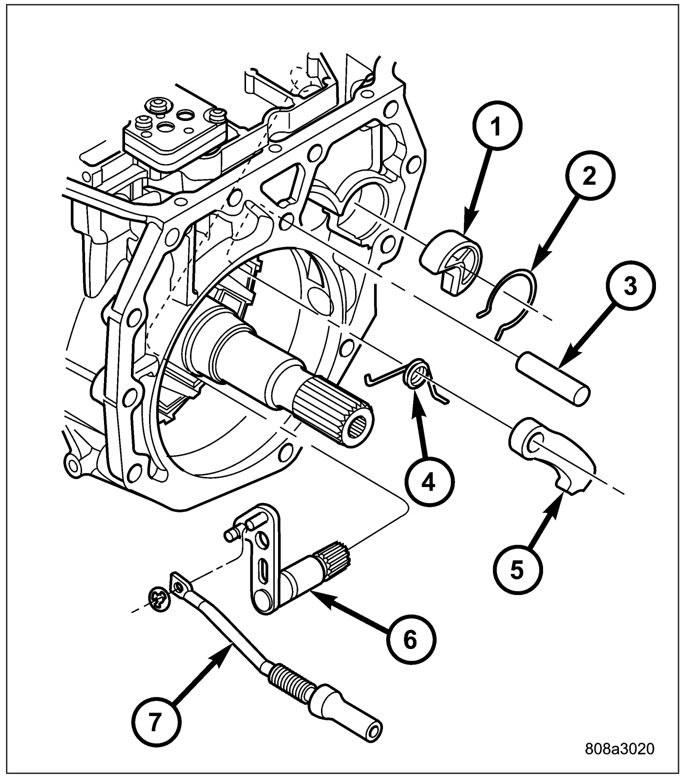
1. Install the cooler filter bypass valve. Torque the bypass valve to specification. The valve uses a tapered pipe thread and excessive torque can damage the transmission case. Tighten the cooler filter bypass valve to 4.5 N·m (40 in.lbs.).
2. Install a new selector shaft seal (1) using Seal Installer 8253 (2).



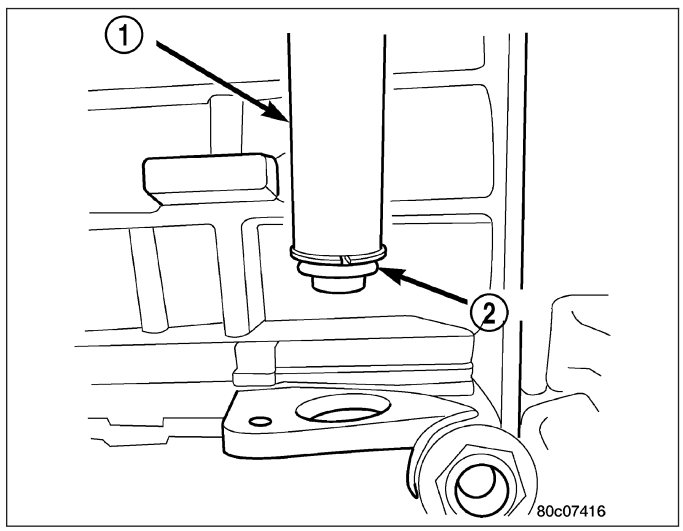

3. Install the manual selector shaft and retaining screw. Tighten the manual selector shaft retaining screw to 28 N·m (250 in.lbs.).
4. Install the manual shift lever (1) onto the manual selector shaft. Torque the retaining cross-bolt to 16 N·m (140 in.lbs.).



5. Install the park pawl (5), spring (4), and shaft (3).
6. Install the park rod (7) and e-clip.
7. Install the park rod guide (1) and snap-ring (2).

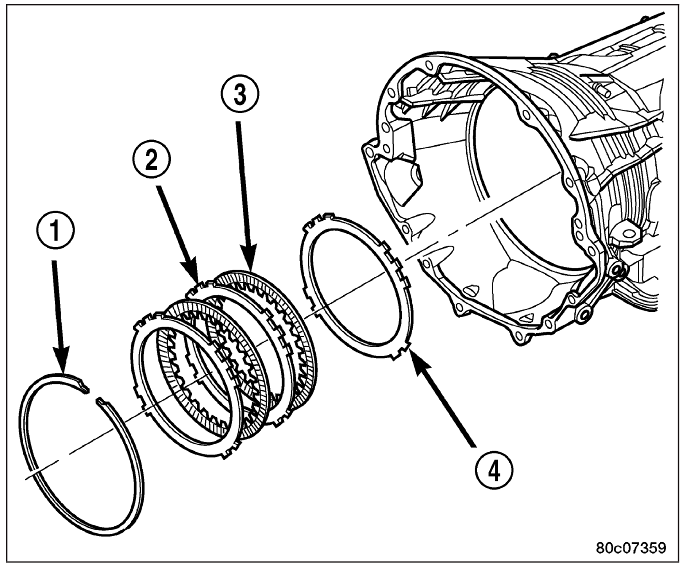



8. Install a new dipstick tube seal (2) using Seal Installer 8254 (1).

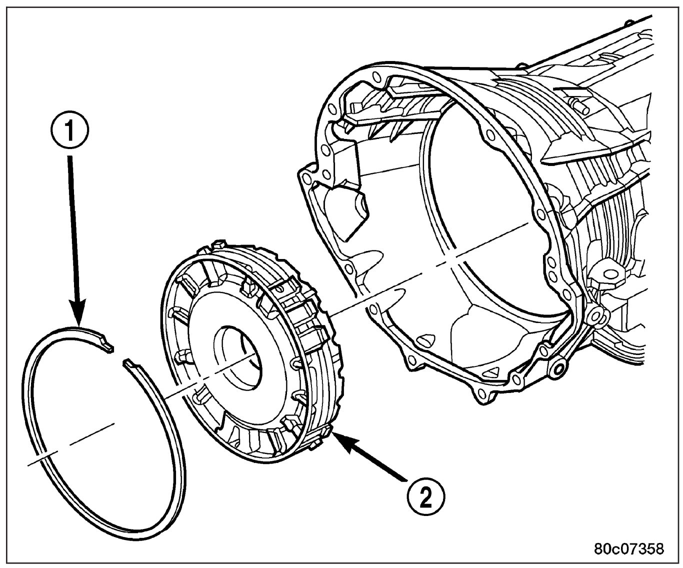


**NOTE: Before final assembly of transmission centerline, the 2C/4C clutch components should be installed into position and measured as follows:**

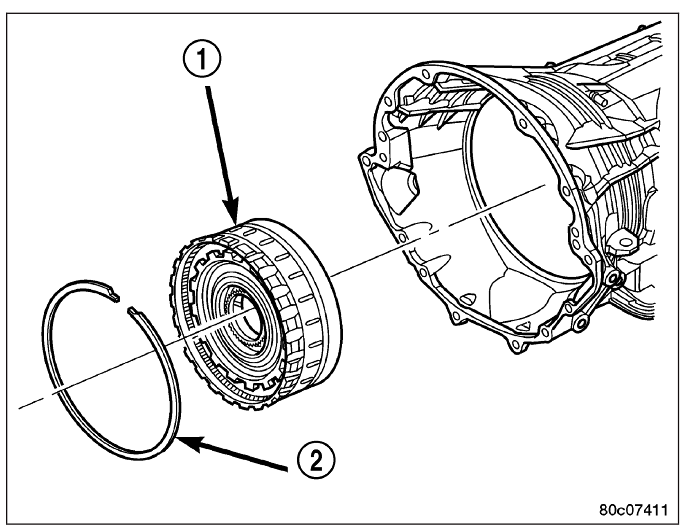
9. Install the 2C reaction plate (4) into the transmission case.
10. Install the 2C clutch pack (2, 3) into the transmission case.
11. Install the flat 2C clutch snap-ring (1) into the transmission case.



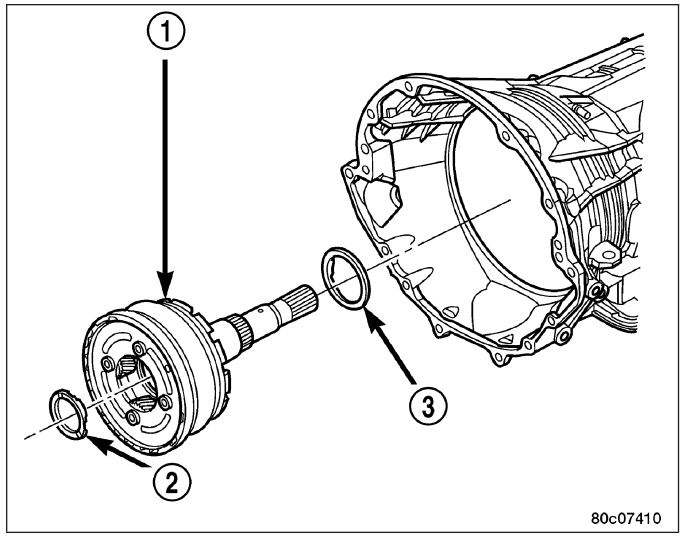

12. Install the 4C retainer/bulkhead (2) into the transmission case. Make sure that the oil feed holes are pointing toward the valve body area.
13. Install the 4C retainer/bulkhead tapered snap-ring (1) into the transmission case. Make sure that the open ends of the snap-ring are located in the case opening toward the valve body area.
14. Using a feeler gauge through the opening in the rear of the transmission case, measure the 2C clutch pack clearance between the 2C reaction plate and the transmission case at four different points. The average of these measurements is the 2C clutch pack clearance. The correct clutch clearance is 0.455-1.335 mm (0.018-0.053 in.). The reaction plate is not selective. If the clutch pack clearance is not within specification, the reaction plate, all the friction discs, and steels must be replaced.
15. Remove the 4C retainer/bulkhead and all of the 2C clutch components from the transmission case.



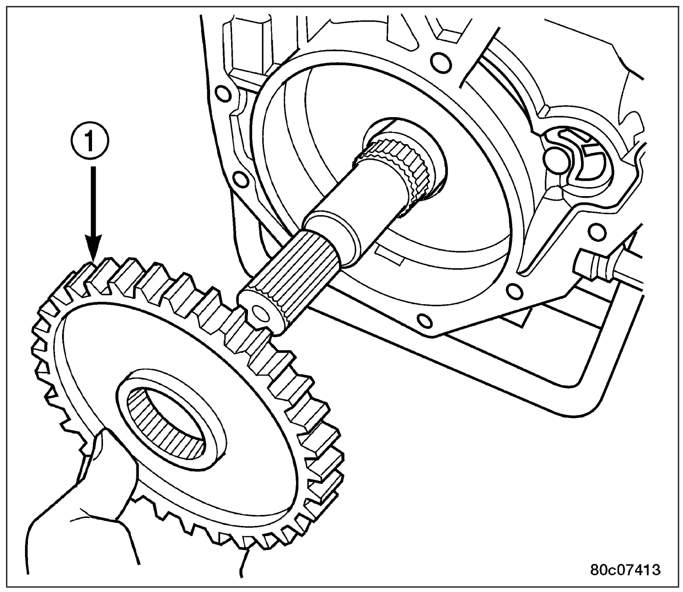

16. Install the low/reverse clutch assembly (1). Make sure that the oil feed hole points toward the valve body area and that the bleed orifice is aligned with the notch in the rear of the transmission case.
17. Install the snap-ring (2) to hold the low/reverse clutch retainer into the transmission case. The snap-ring is tapered and must be installed with the tapered side forward. Once installed, verify that the snap-ring is fully seated in the snap-ring groove.
18. Air check the low/reverse clutch and verify correct overrunning clutch operation.



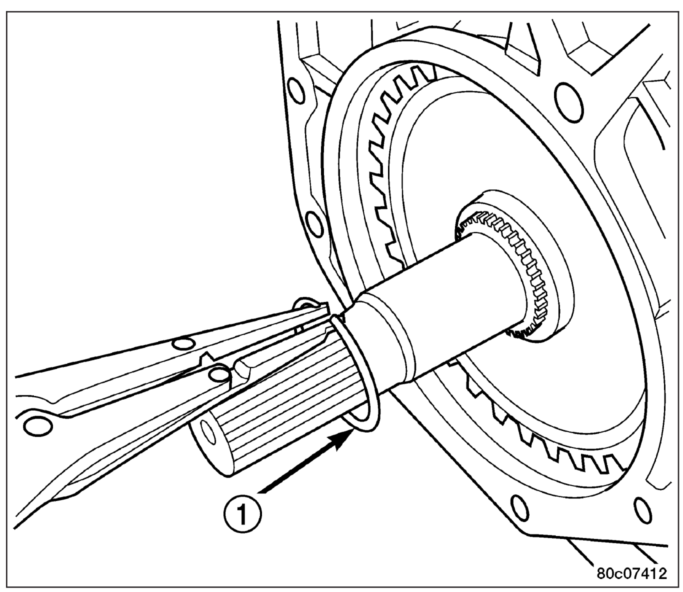
19. Install the number 12 thrust bearing (3) over the output shaft and against the rear planetary gear set. The flat side of the bearing goes toward the planetary gearset and the raised tabs on the inner race should face the rear of the transmission.
20. Install the reverse/input planetary assembly (1) through the low/reverse clutch assembly.



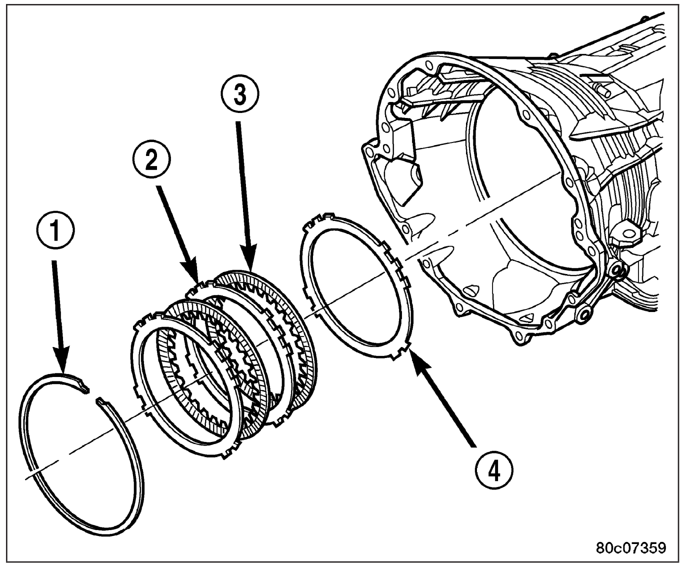

21. Install the park sprag gear (1) onto the output shaft.

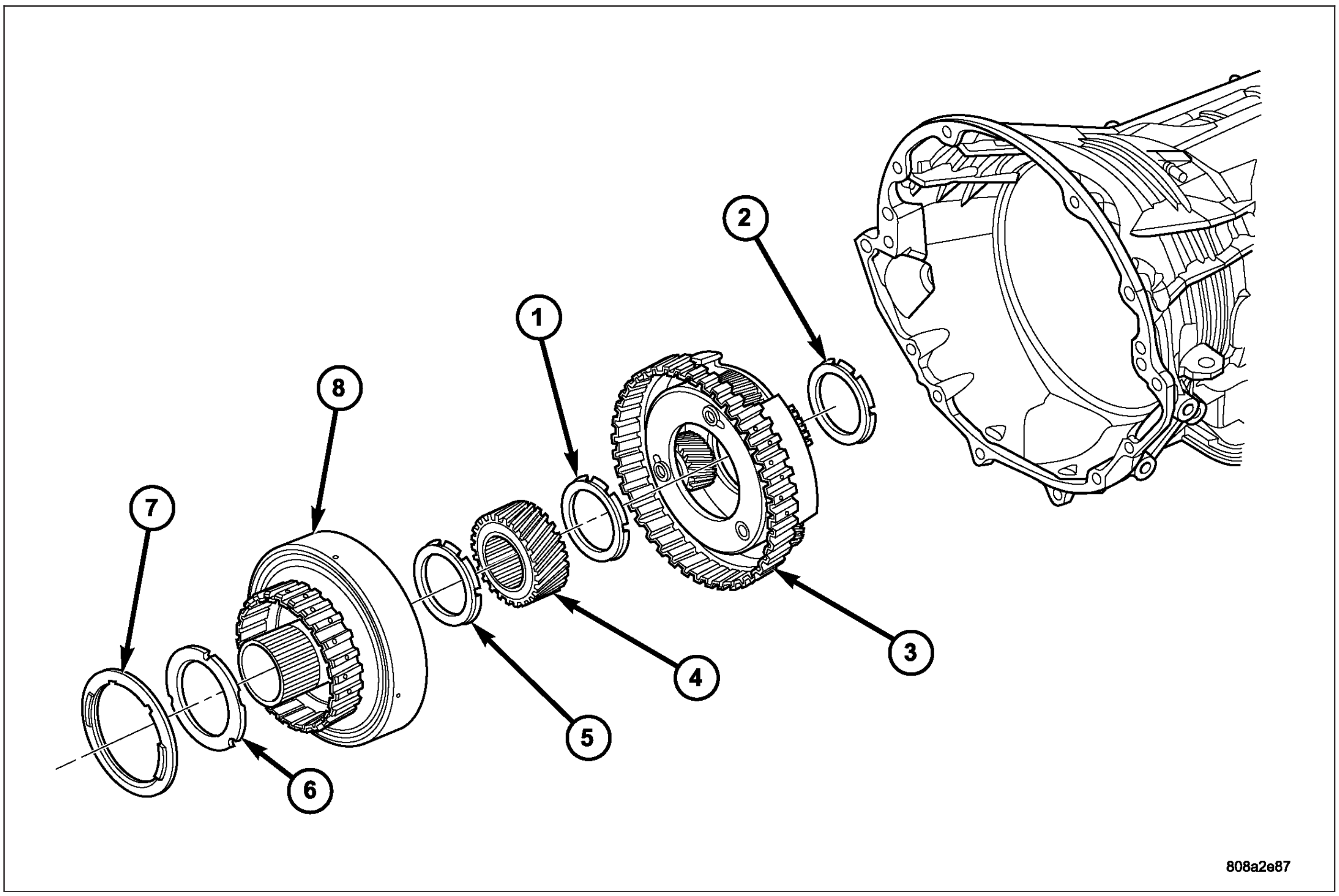



22. Install the snap-ring (1) to hold the park sprag onto the output shaft.



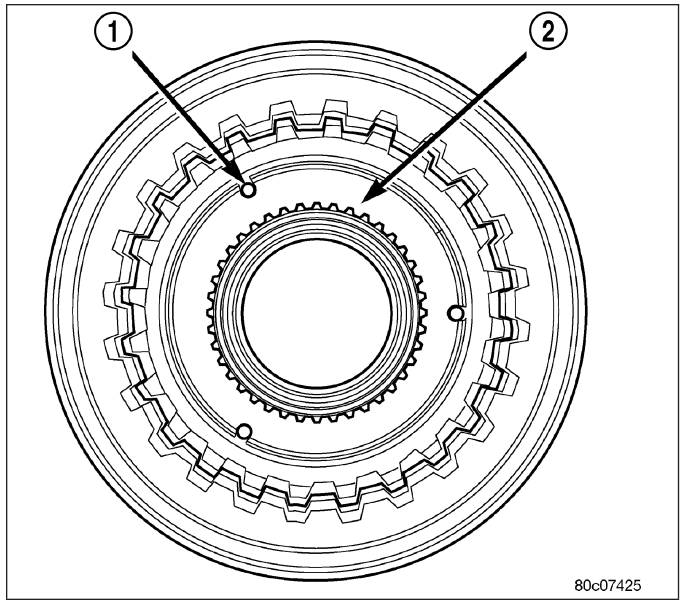
23. Install the 2C reaction plate (4) into the transmission case.
24. Install the 2C clutch pack (2, 3, 4) into the transmission case.

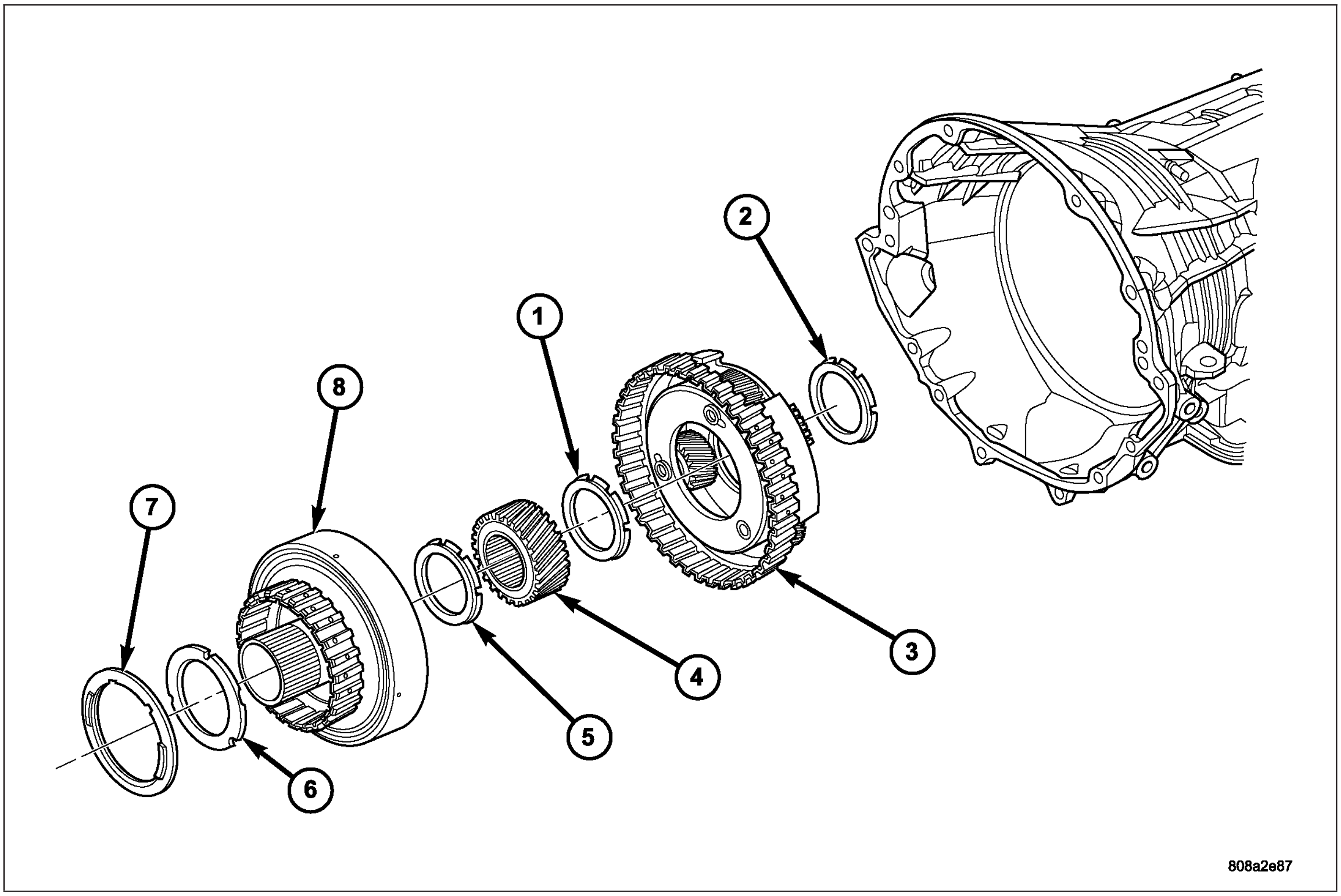



25. Install the number 8 thrust bearing (1) inside the reaction carrier with the outer race against the reaction planetary carrier (3).
26. Install the reaction planetary gear set and the number 9 thrust bearing (2), with the inner race against the reaction planetary carrier (3), into the transmission case.
27. Install the flat 2C clutch snap-ring into the transmission case.
28. Install the reaction sun gear (4) into the reaction planetary gear set. **Make sure** the small shoulder is facing the front of the transmission.
29. Install the number 7 thrust bearing (5) onto the reaction sun gear (4) with the inner race against the sun gear.

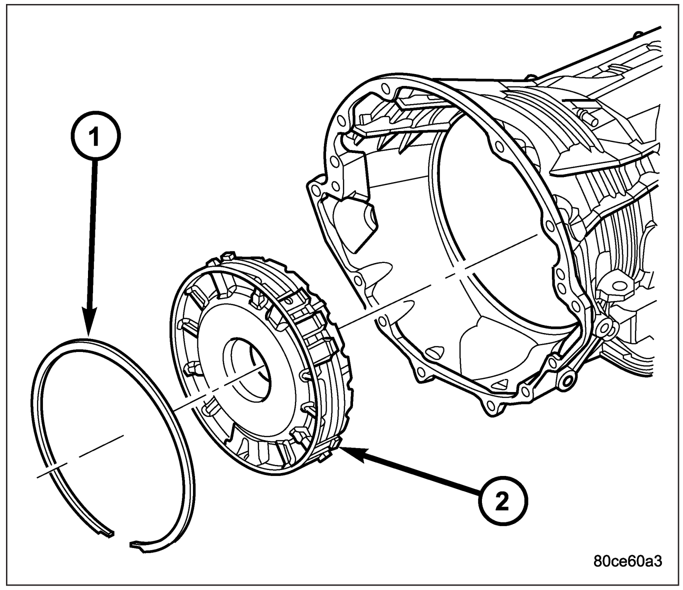
30. Install the output shaft selective thrust plate (2) onto the reaction annulus with the oil grooves facing the annulus gear and the lugs (1) and notches aligned as shown.



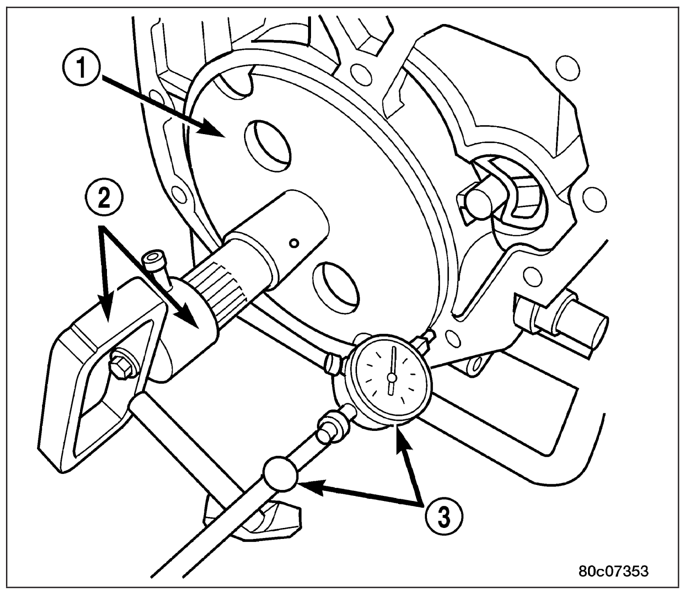




31. Install the number 6 thrust bearing (7) against the output shaft selective thrust plate (6) with the flat side against the thrust plate and the raised tabs on the inner race facing the front of the transmission.
32. Install the reaction annulus (8) into the reaction planetary gear set.

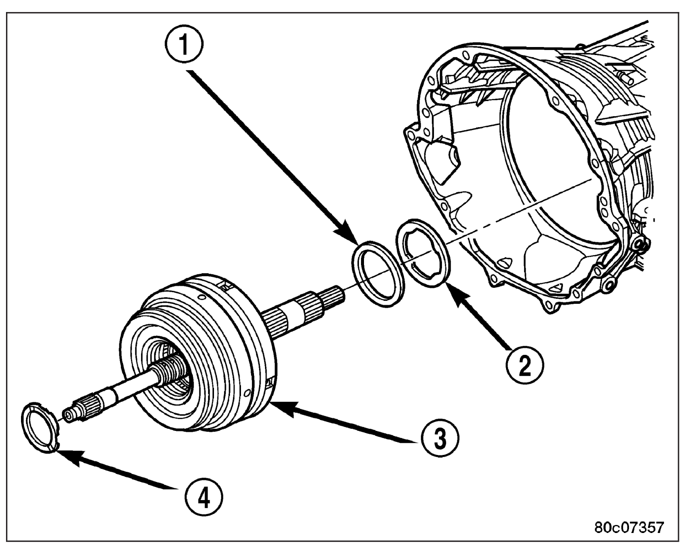
33. Install the 4C retainer/bulkhead (2) into the transmission case. Make sure that the oil feed holes are pointing toward the valve body area. Rotate the reaction annulus during the installation of the 4C retainer/bulkhead to ease installation.
34. Install the 4C retainer/bulkhead tapered snap-ring (1) into the transmission case with the taper toward the front of the case. Make sure that the open ends of the snap-ring are located in the case opening toward the valve body area.
35. Air check the 2C and 4C clutch operation.



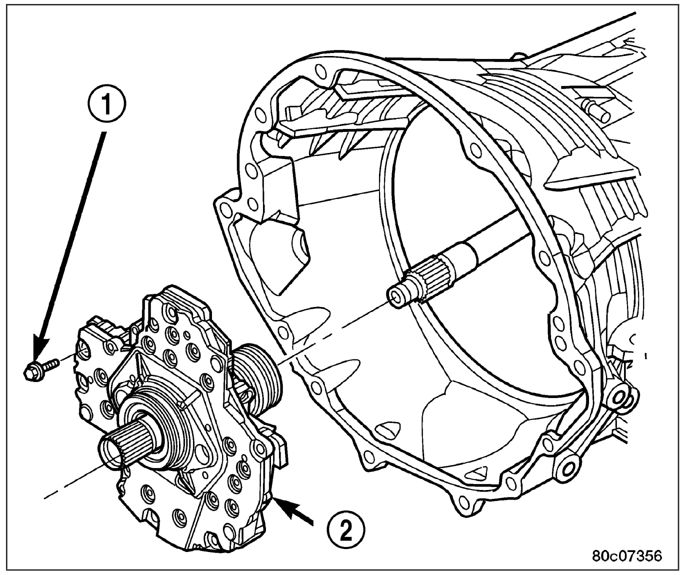

36. Using Alignment Plate 8261 (1), Adapter 8266-17 from End-Play Tool Set 8266 (2) and Dial Indicator C-3339 (3), measure and record the output shaft end-play. The correct output shaft end-play is 0.22-0.55 mm (0.009-0.021 in.). Adjust as necessary. Install the chosen output shaft selective thrust plate and re-measure end-play to verify selection.
37. Apply a bead of RTV silicone and install the extension/adapter housing onto the transmission case.
38. Install and torque the bolts to hold the extension/adapter housing onto the transmission case. The correct torque is 54 N·m (40 ft.lbs.).




39. Install the number 5 thrust bearing (1) and selective thrust plate (2) onto the 4C retainer/bulkhead. Be sure that the outer race of the bearing is against the thrust plate.
40. Install the input clutch assembly (3) into the transmission case. Make sure that the input clutch assembly is fully installed by performing a visual inspection through the input speed sensor hole. If the tone wheel teeth on the input clutch assembly are centered in the hole, the assembly is fully installed.
41. Install the number 1 thrust bearing (4) with the outer race up in the pocket of the input clutch assembly.

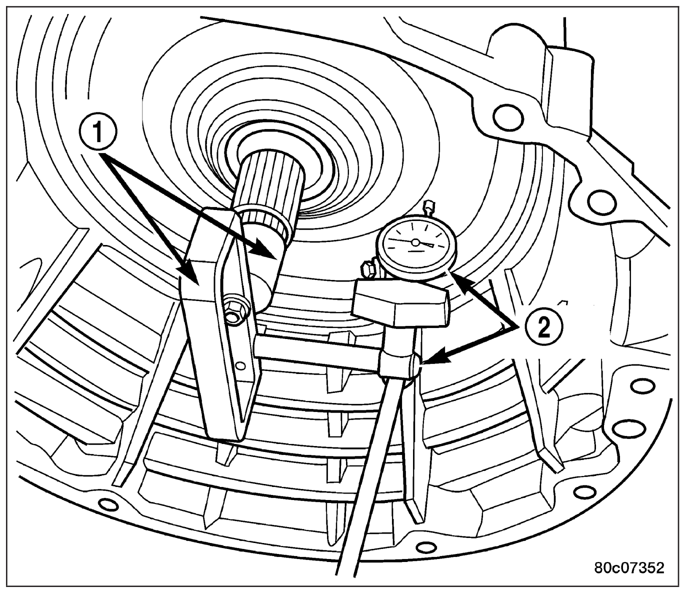


42. Install the oil pump (2) into the transmission case.
43. Install the bolts (1) to hold the oil pump into the transmission case. Tighten the oil pump bolts to 28 N·m (250 in.lbs.).

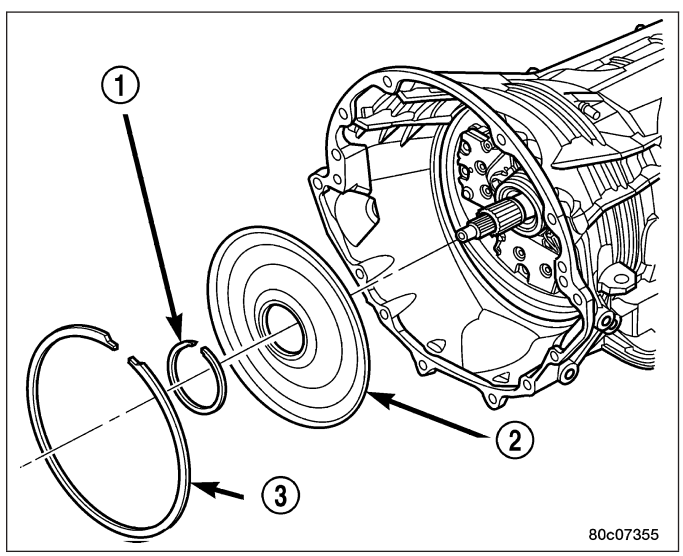



44. Using Adapter 8266-1 from End-Play Tool Set 8266 (1) and Dial Indicator C-3339 (2), measure and record the input shaft end-play. The correct end-play is 0.46-0.89 mm (0.018-0.035 in.). Adjust as necessary. Install the chosen thrust plate on the number 5 thrust bearing and re-measure end-play to verify selection.

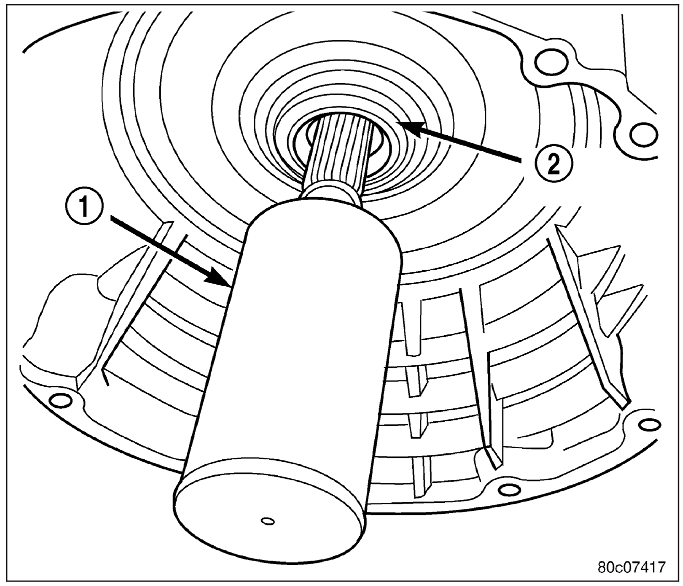
**NOTE: When measuring the input shaft end-play, two ″stops″ will be felt. When the input shaft is pushed inward and the dial indicator zeroed, the first ″stop″ felt when the input shaft is pulled outward is the movement of the input shaft in the input clutch housing hub. This value should not be included in the end-play measured value and therefore must be recorded and subtracted from the dial indicator reading.**



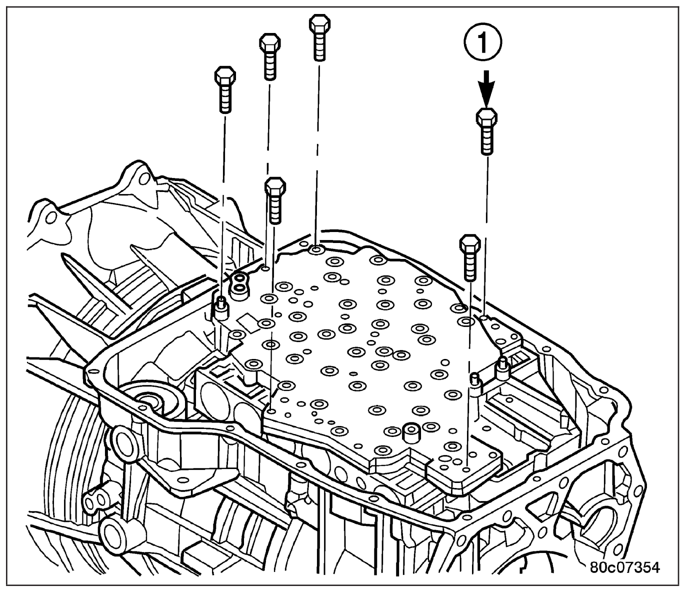

45. Install the transmission front cover (2) into the transmission case.
46. Install the outer snap-ring (3) to hold the transmission front cover (2) into the transmission case.
47. Partially install the inner transmission front cover snap-ring (1) onto the oil pump.



48. Using Snap-ring Installer 8255 (1), install the inner transmission front cover snap-ring (2) the remainder of the way onto the oil pump.

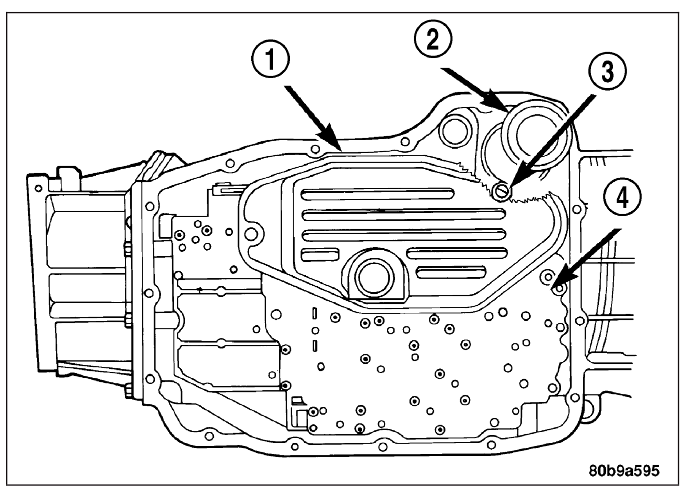



49. Install the valve body. Verify that the pin on the manual lever has properly engaged the TRS selector plate. Tighten the valve body to transmission case bolts (1) to 12 N·m (105 in.lbs.).



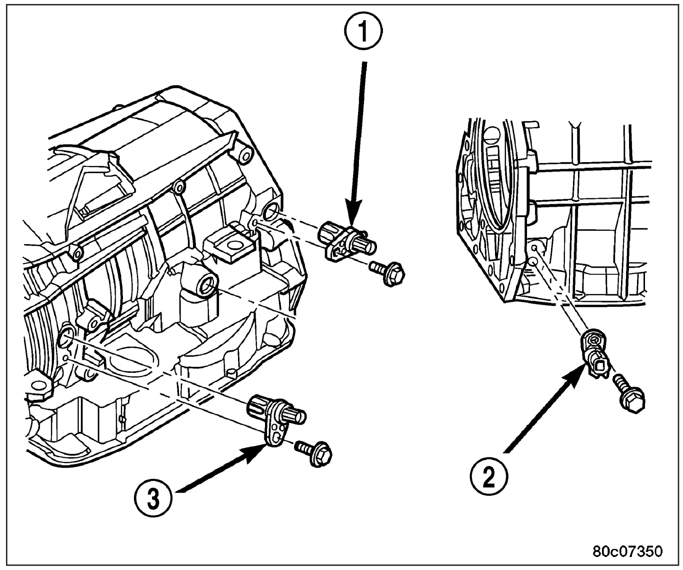

**CAUTION: The primary oil filter seal MUST be fully installed flush against the oil pump body. DO NOT install the seal onto the filter neck and attempt to install the filter and seal as an assembly. Damage to the transmission will result.**

50. Install a new primary oil filter seal in the oil pump inlet bore. Seat the seal in the bore with the butt end of a hammer, or other suitable tool.
51. Install the primary oil filter (1) and the oil cooler return filter (2). Tighten the screw to hold the primary oil filter to the valve body to 4.5 N·m (40 in.lbs.). Using Filter Wrench 8321, tighten the cooler return oil filter to the transmission case to 9.5 N·m (7 ft.lbs.).



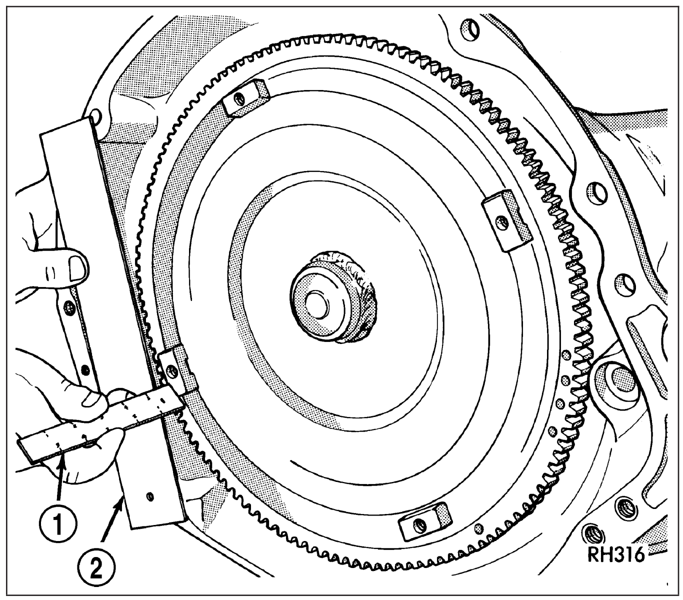

52. Apply RTV silicone to the oil pan and install the transmission oil pan. Tighten the bolts to 12 N·m (105 in.lbs.).

53. Install the input (3), output (1), and line pressure sensors (2). Tighten the bolts to 12 N·m (105 in.lbs.).

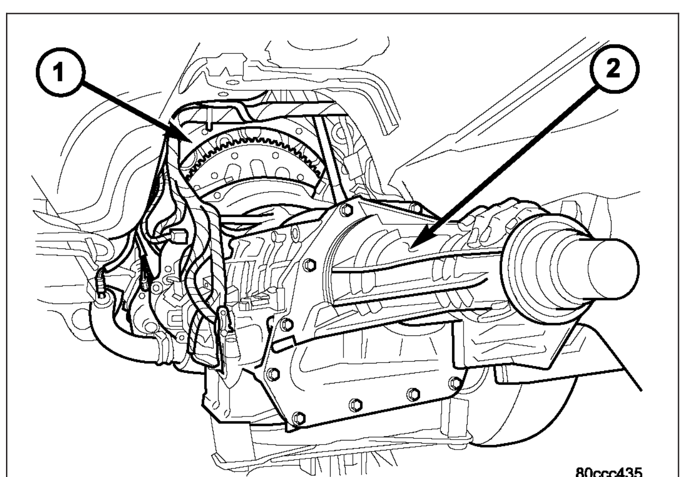



## INSTALLATION

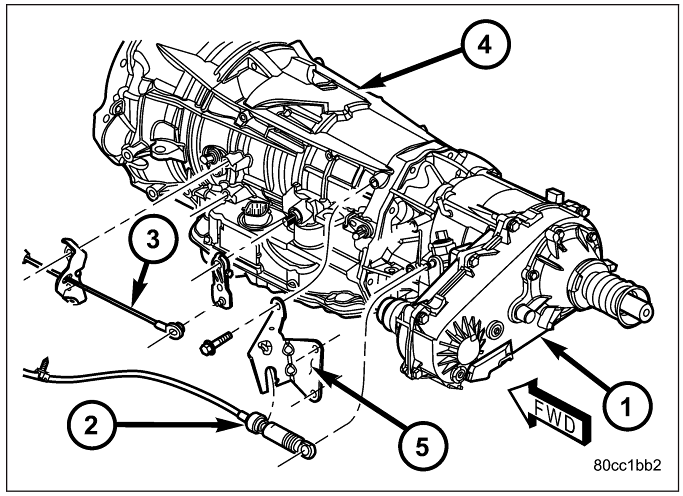
1. Check torque converter hub and hub drive flats for sharp edges burrs, scratches, or nicks. Polish the hub and flats with 320/400 grit paper and crocus cloth if necessary. Verify that the converter hub o-ring is properly installed and is free of any debris. The hub must be smooth to avoid damaging pump seal at installation.
2. If a replacement transmission is being installed, transfer any components necessary, such as the manual shift lever and shift cable bracket, from the original transmission onto the replacement transmission.
3. Lubricate oil pump seal lip with transmission fluid.
4. Align converter and oil pump.
5. Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.



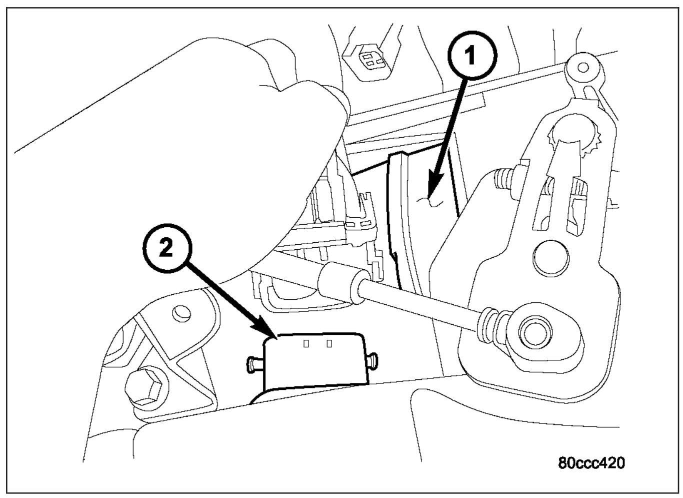

6. Check converter seating with steel scale (1) and straightedge (2). Surface of converter lugs should be at least 13 mm (1/2 in.) to rear of straightedge when converter is fully seated.
7. Temporarily secure converter with C-clamp.
8. Position transmission on jack and secure it with chains.
9. Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**
10. Apply a light coating of Mopar® High Temp Grease to the torque converter hub pocket in the rear pocket of the engine's crankshaft.
11. Raise transmission (2) and align the torque converter with the drive plate and transmission converter housing with the engine block.



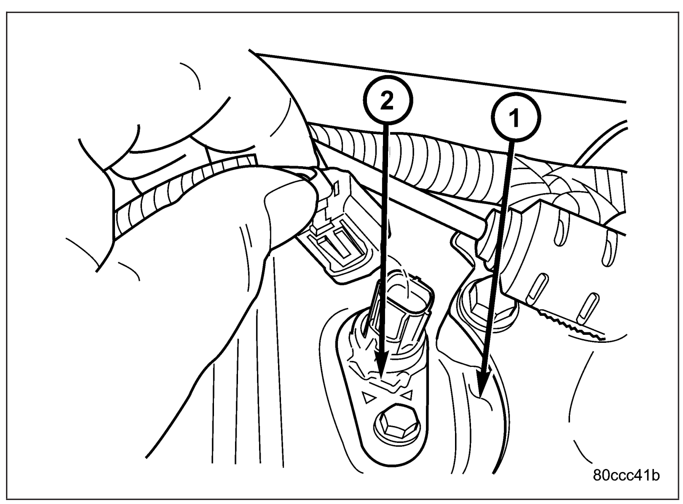
12. Move transmission forward. Then raise, lower or tilt transmission to align the converter housing with engine block dowels.
13. Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft. Verify that no wires, or the transmission vent hose, have become trapped between the engine block and the transmission.
14. Install two bolts to attach the transmission to the engine.
15. Install remaining torque converter housing to engine bolts. Tighten to 68 N·m (50 ft.lbs.).
16. Install transfer case, if equipped. Tighten transfer case nuts to 35 N·m (26 ft.lbs.).
17. Install rear transmission crossmember. Tighten crossmember to frame bolts to 68 N·m (50 ft.lbs.).



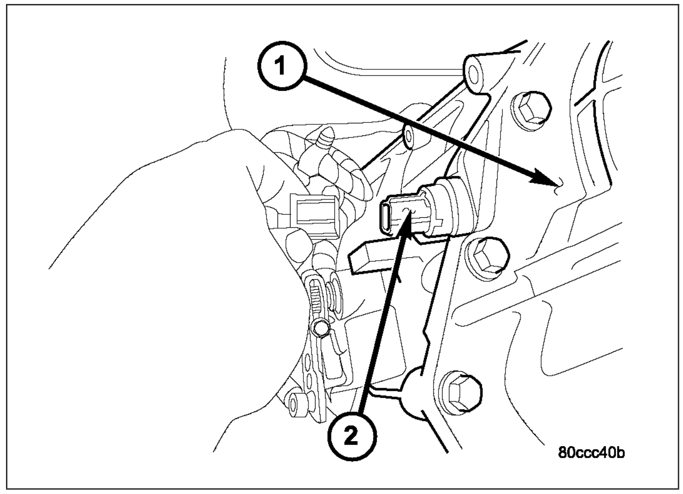

18. Install rear support to transmission. Tighten bolts to 47 N·m (35 ft.lbs.).
19. Lower transmission onto crossmember and install bolts attaching transmission mount to crossmember. Tighten clevis bracket to crossmember bolts to 47 N·m (35 ft.lbs.). Tighten the clevis bracket to rear support bolt to 68 N·m (50 ft.lbs.).
20. Remove engine support fixture.
21. Connect gearshift cable (3) to support bracket and transmission manual lever.
22. Connect wires to solenoid and pressure switch assembly (2).



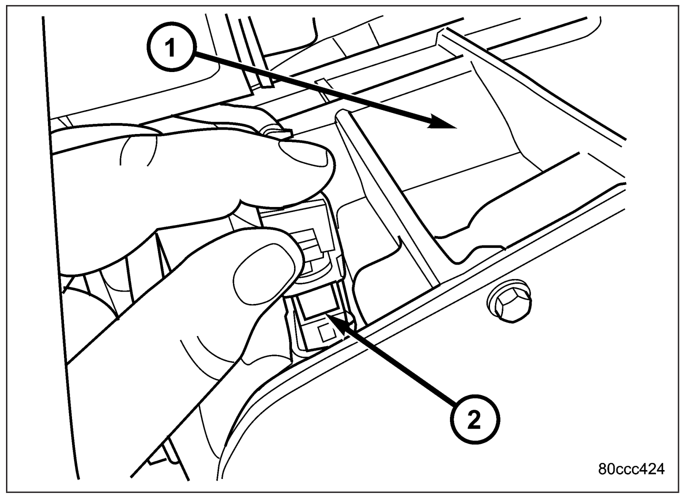

23. Connect wires to input speed sensor (2).



24. Connect wires to output speed sensor (2).

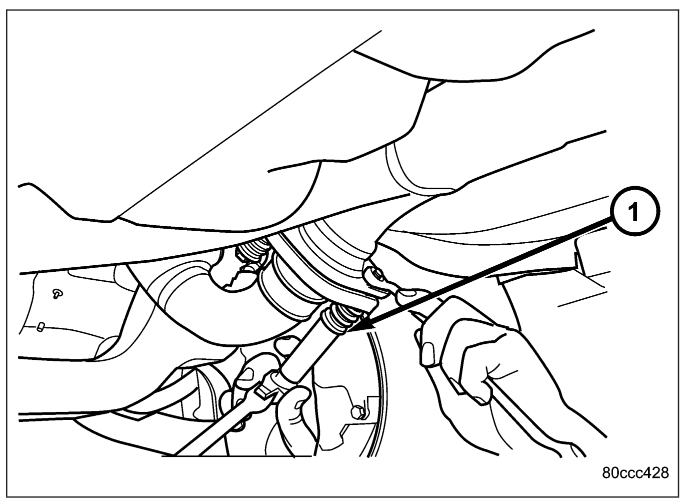



25. Connect wires to line pressure sensor (2). Be sure transmission harnesses are properly routed.

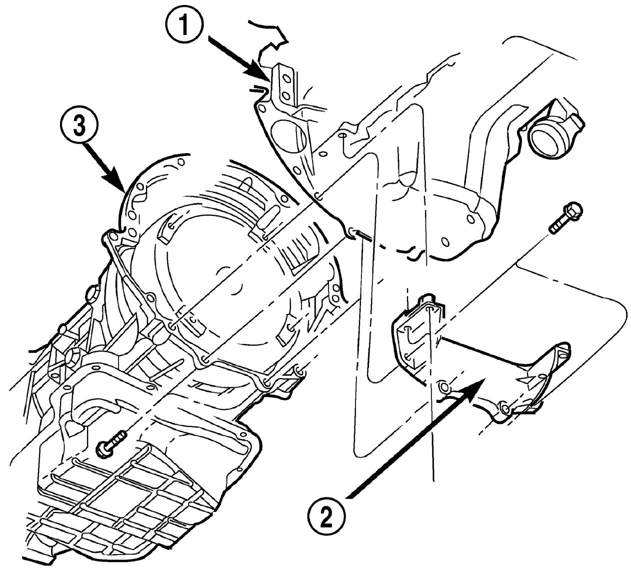



**CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the clutch surface inside the converter.**

26. Install torque converter-to-driveplate bolts. Tighten bolts to 31 N·m (270 in.lbs.).
27. Install starter motor and cooler line bracket.
28. Connect cooler lines to transmission.
29. Install transmission fill tube.
30. Install exhaust components (1).

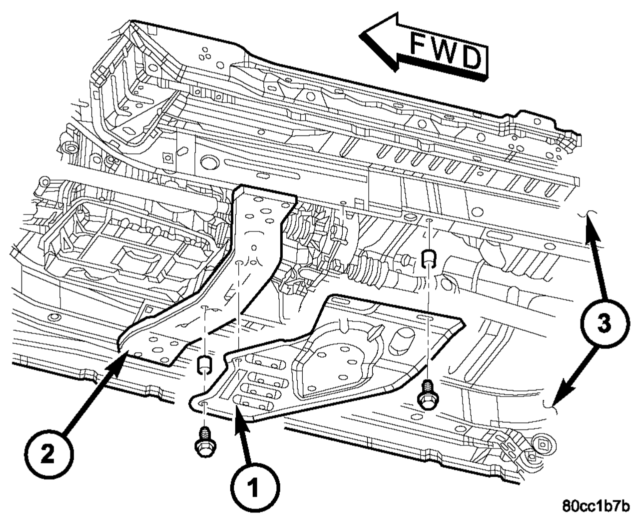


31. Install the structural dust cover (2) (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - INSTALLATION) onto the transmission and the engine.



80ba79d2

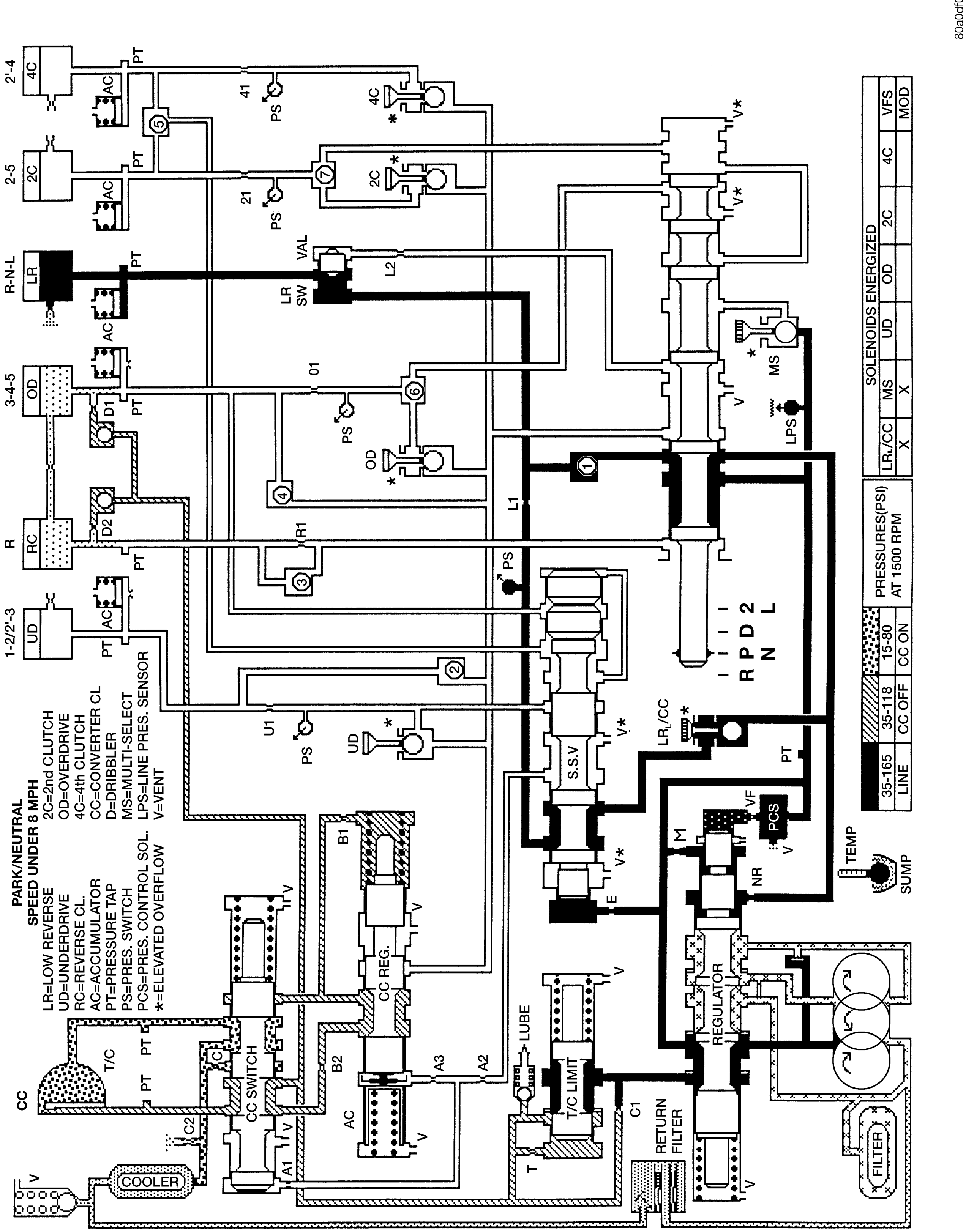
32. Align and connect propeller shaft(s).
33. Adjust gearshift cable if necessary.
34. Install any skid plates (1) removed previously. (Refer to 13 - FRAMES & BUMPERS/FRAME/ TRANSFER CASE SKID PLATE - INSTALLATION)
35. Lower vehicle.
36. Fill transmission with Mopar® ATF +4, type 9602, Automatic Transmission Fluid.

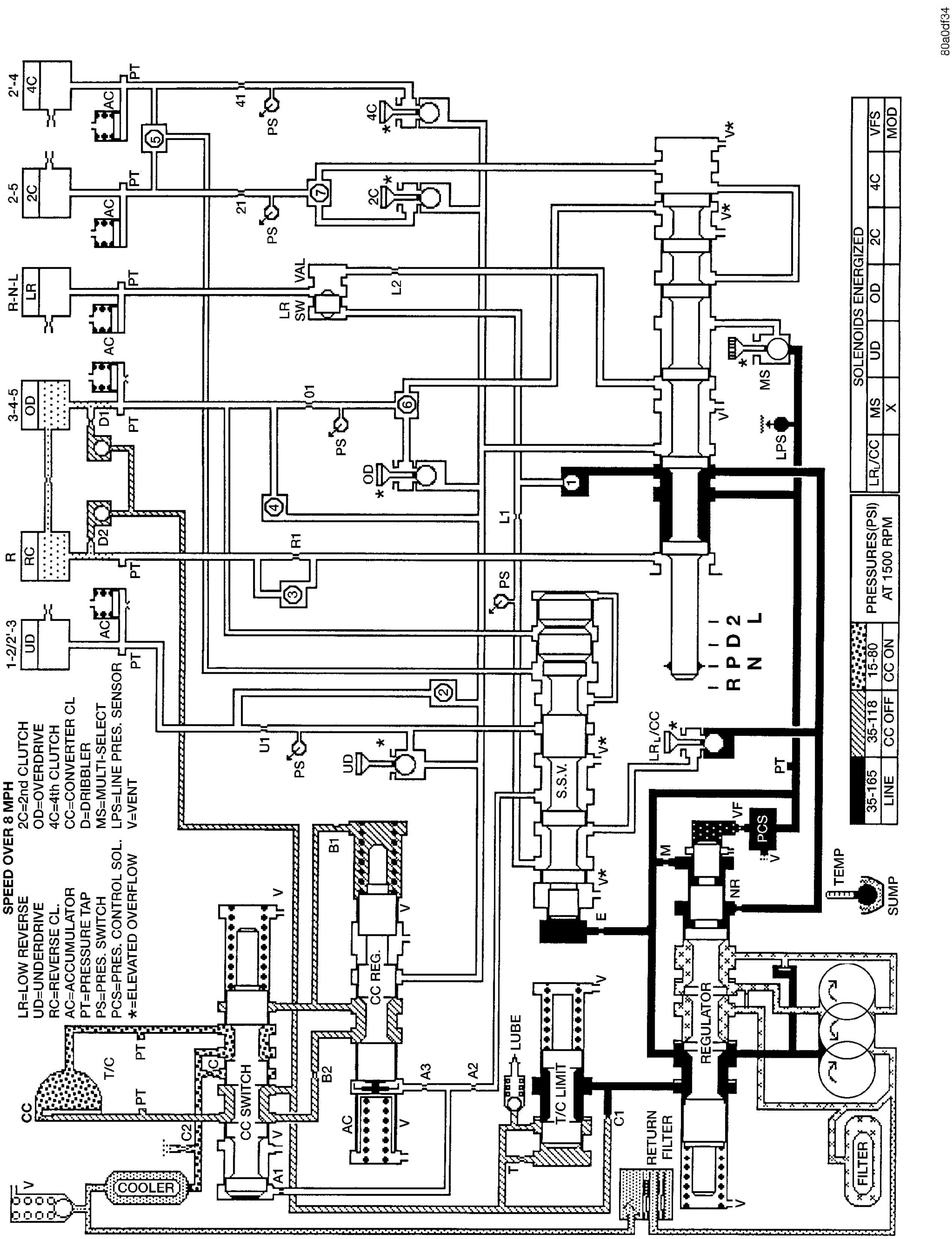


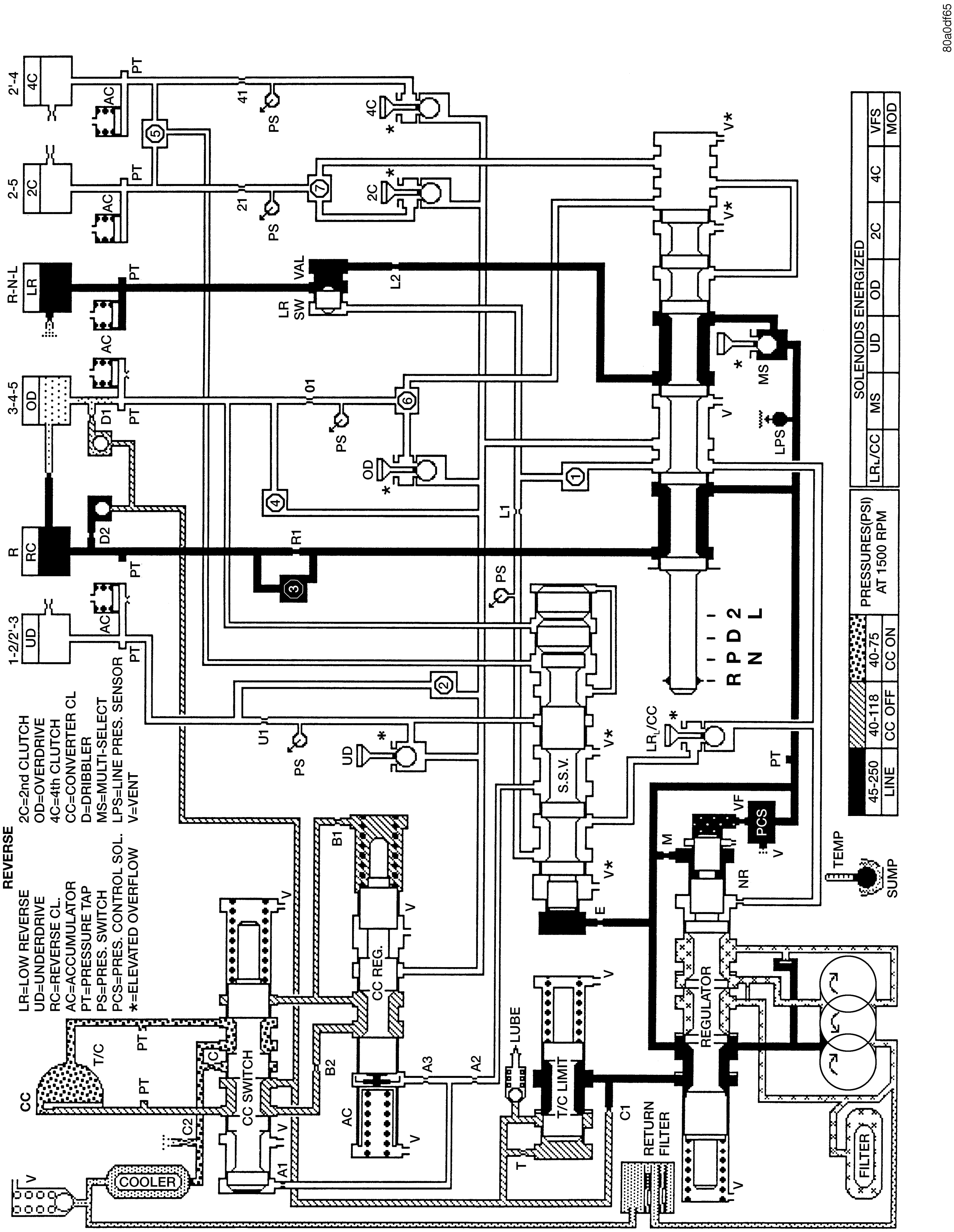
80cc1b7b

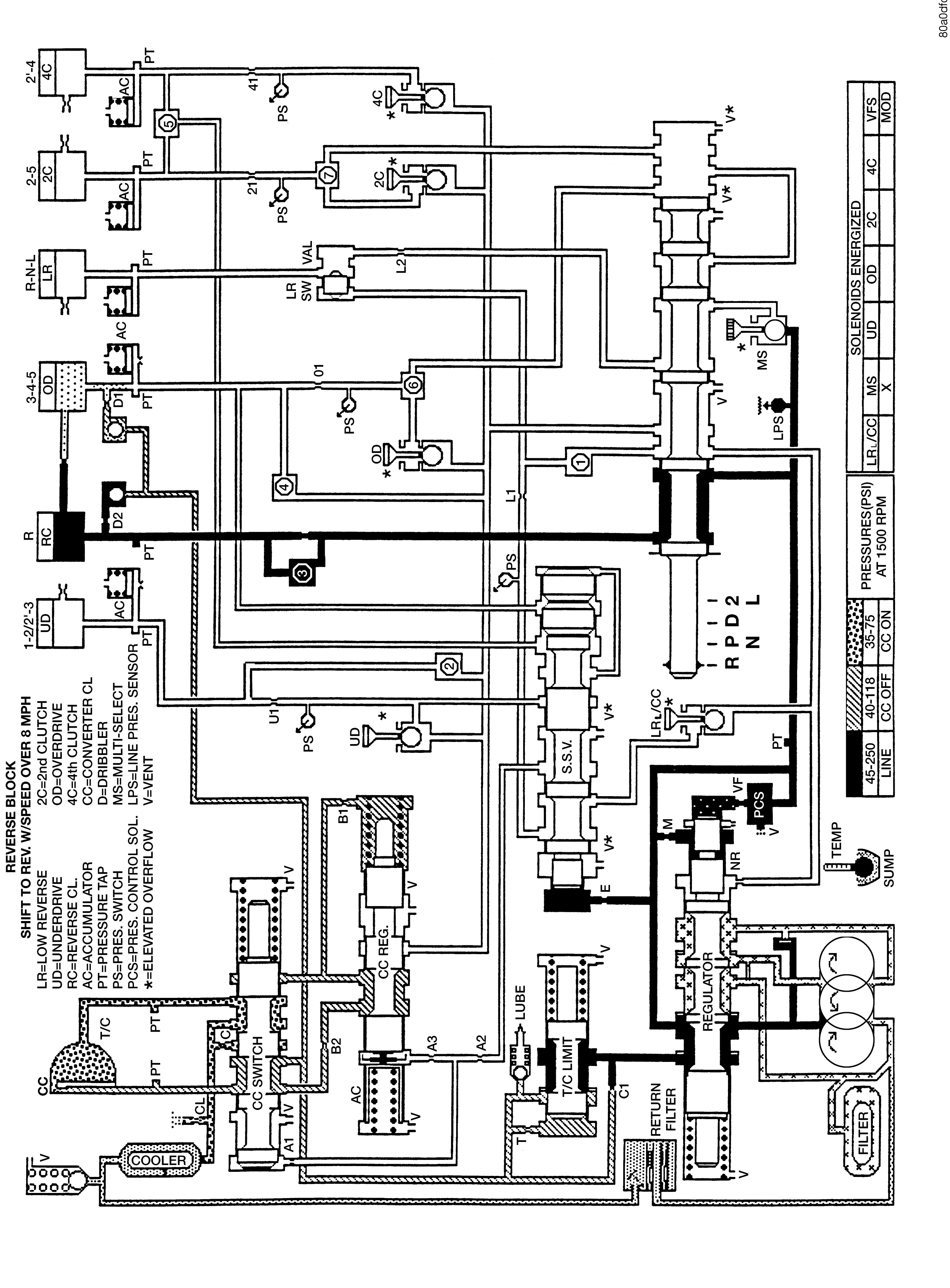
## SCHEMATICS AND DIAGRAMS

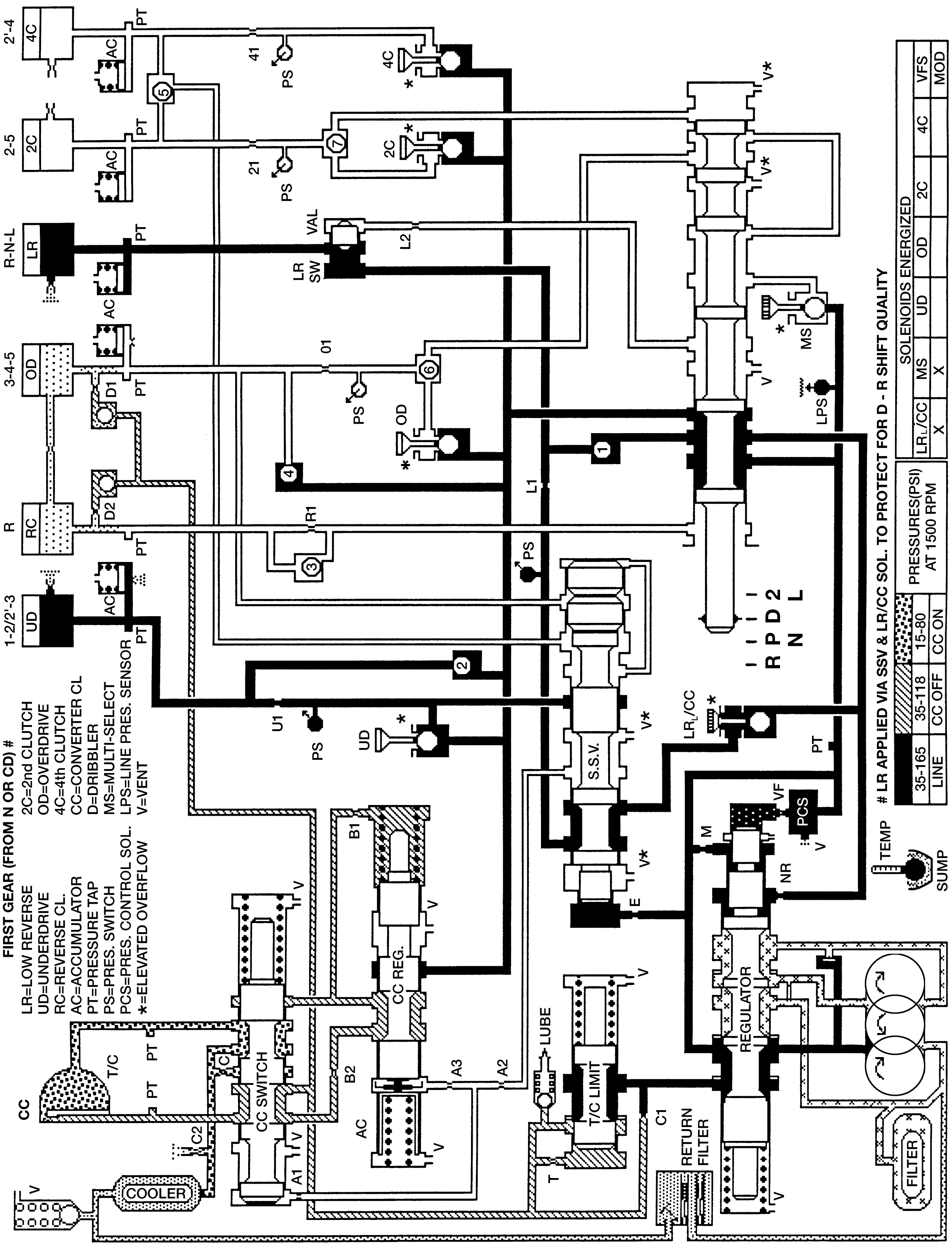
## HYDRAULIC SCHEMATICS


80a0df0a
PARK/NEUTRAL
SPEED UNDER 8 MPH
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
SOLENOIDS ENERGIZED
LR/CC X
MS X
UD
OD
2C
4C
VFS MOD
1-2/2'-3
R
3-4-5
R-N-L
2-5
2'-4
CC
T/C
COOLER
CC SWITCH
CC REG.
T/C LIMIT
LUBE
RETURN FILTER
REGULATOR
FILTER
SUMP
TEMP
PCS
S.S.V
R P D 2
N L


NEUTRAL
SPEED OVER 8 MPH
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3
UD
R
RC
3-4-5
OD
R-N-L
LR
2-5
2C
2'-4
4C
AC
PT
D1
D2
PS
U1
R1
01
21
41
L1
L2
LR SW
VAL
S.S.V.
LR/CC
MS
LPS
R P D 2
N L
CC
T/C
CC SWITCH
CC REG.
B1
B2
A1
A2
A3
C1
C2
COOLER
LUBE
T/C LIMIT
RETURN FILTER
REGULATOR
FILTER
PCS
VF
M
NR
E
TEMP
SUMP
SOLENOIDS ENERGIZED
LR/CC
MS
UD
OD
2C
4C
VFS
X
MOD
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
80a0df34


REVERSE
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
PRESSURES(PSI) AT 1500 RPM
45-250 LINE
40-118 CC OFF
40-75 CC ON
SOLENOIDS ENERGIZED
LR/CC MS UD OD 2C 4C VFS MOD
COOLER
FILTER
RETURN FILTER
REGULATOR
T/C LIMIT
CC SWITCH
CC REG.
S.S.V.
TEMP
SUMP
LUBE
80a0df65

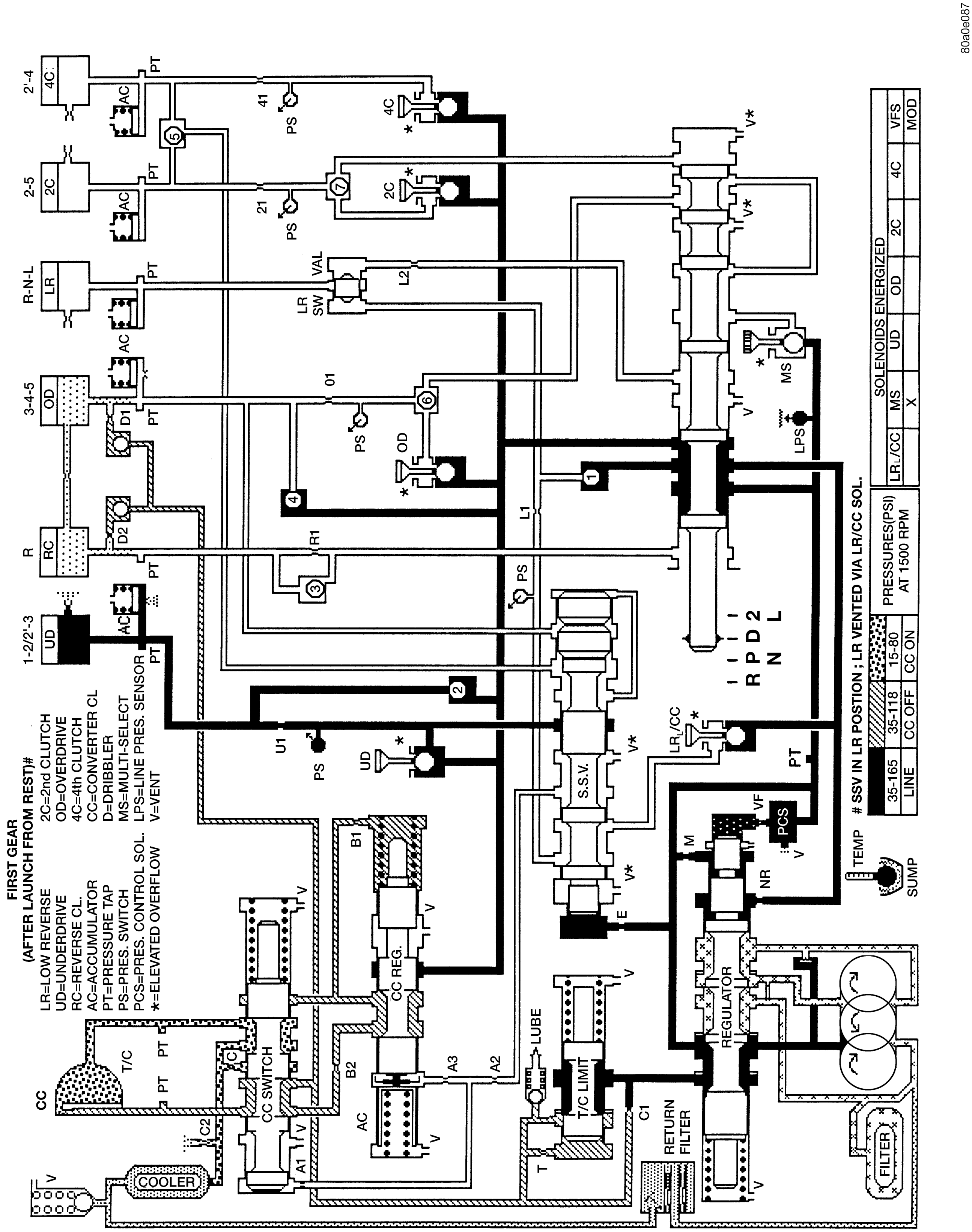

80a0dfc5
REVERSE BLOCK
SHIFT TO REV. W/SPEED OVER 8 MPH
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
∗=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3 UD
R RC
3-4-5 OD
R-N-L LR
2-5 2C
2'-4 4C
S.S.V.
CC SWITCH
CC REG.
T/C LIMIT
REGULATOR
COOLER
FILTER
RETURN FILTER
LUBE
TEMP
SUMP
PCS
R P D 2 N L
PRESSURES(PSI) AT 1500 RPM
45-250 LINE
40-118 CC OFF
35-75 CC ON
SOLENOIDS ENERGIZED
LR/CC MS UD OD 2C 4C VFS
X
MOD



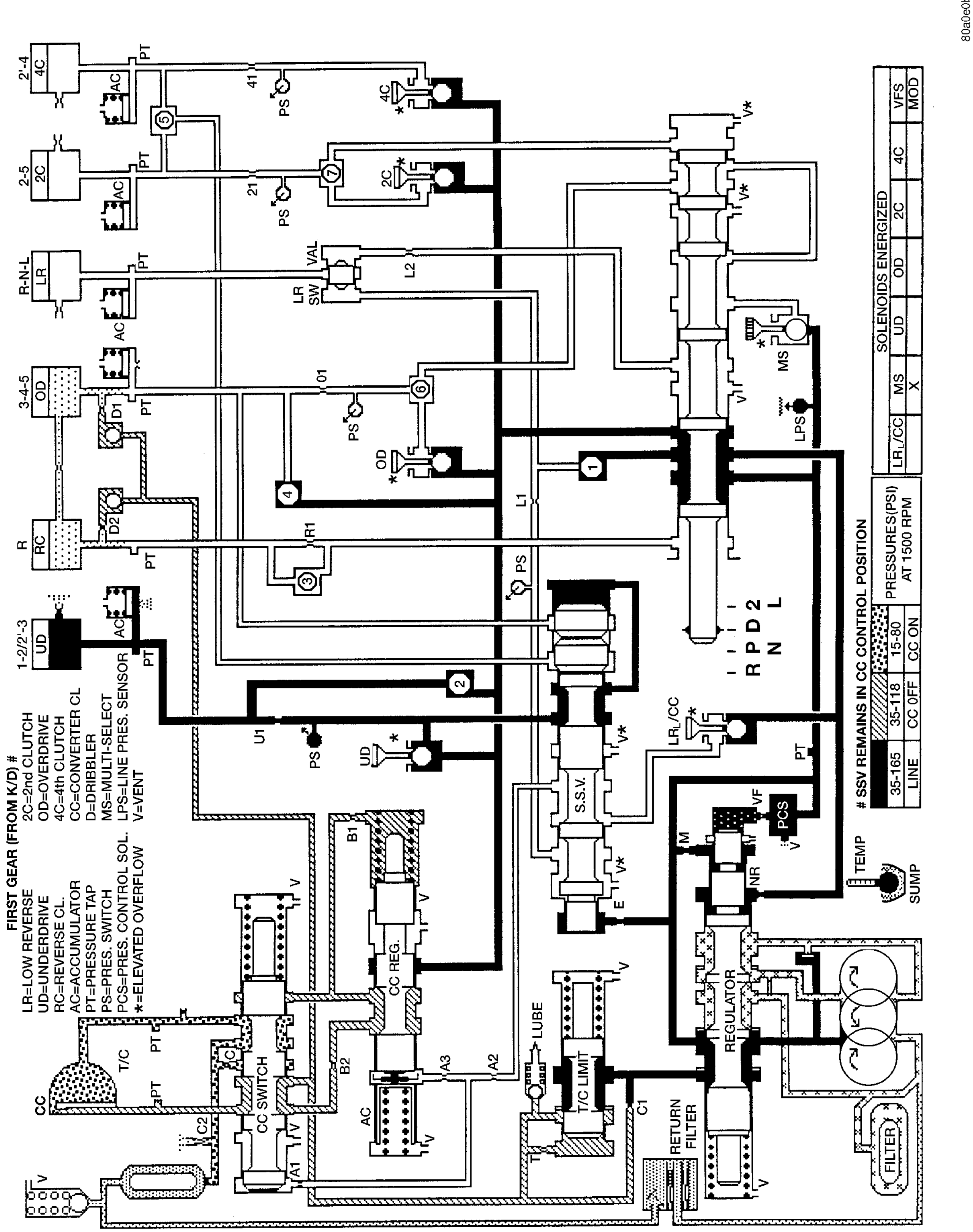

| LR/CC | MS | UD | OD | 2C | 4C | VFS |
|---|---|---|---|---|---|---|
| X | X | | | | | MOD |

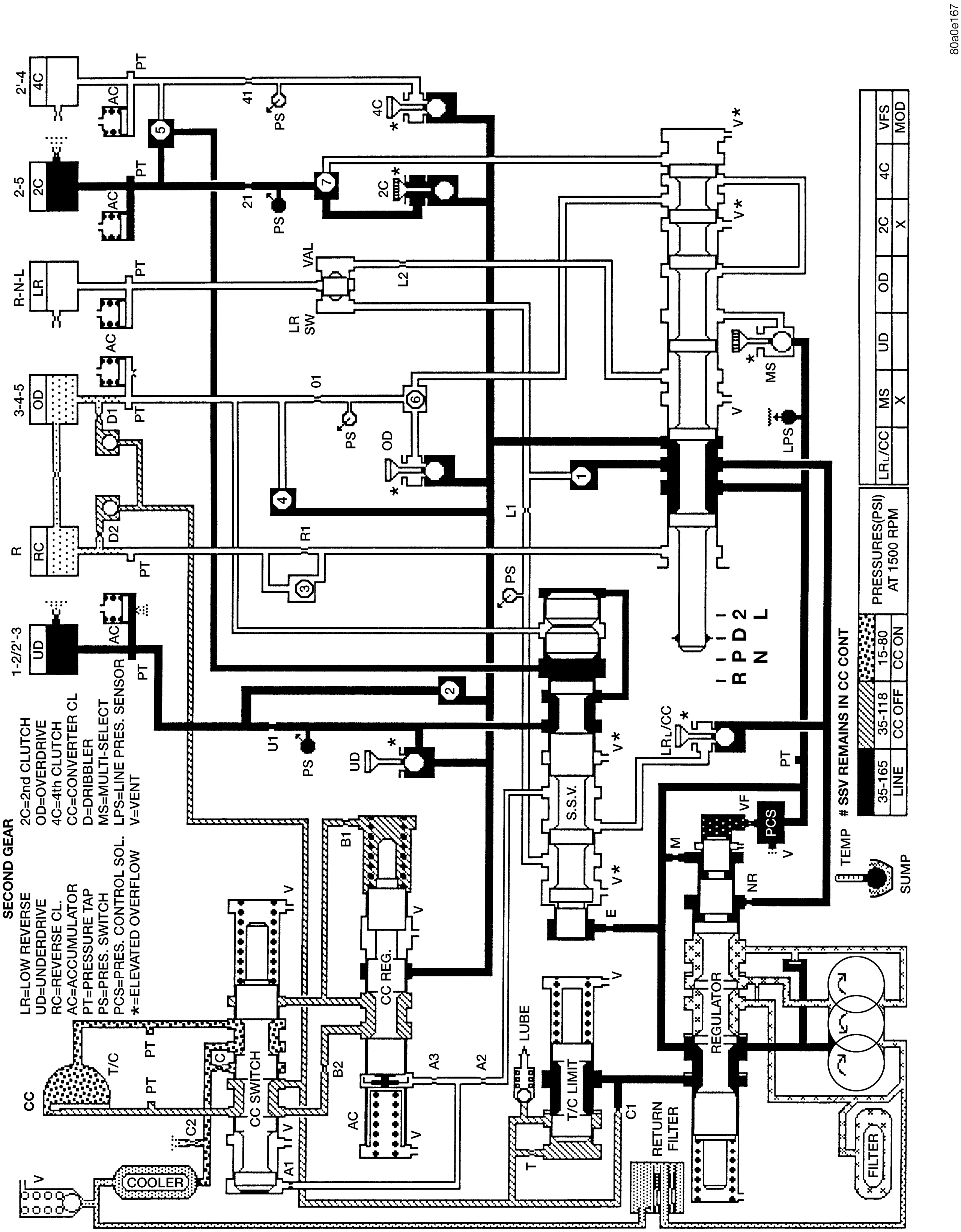
| 35-165 | 35-118 | 15-80 |
|---|---|---|
| LINE | CC OFF | CC ON |

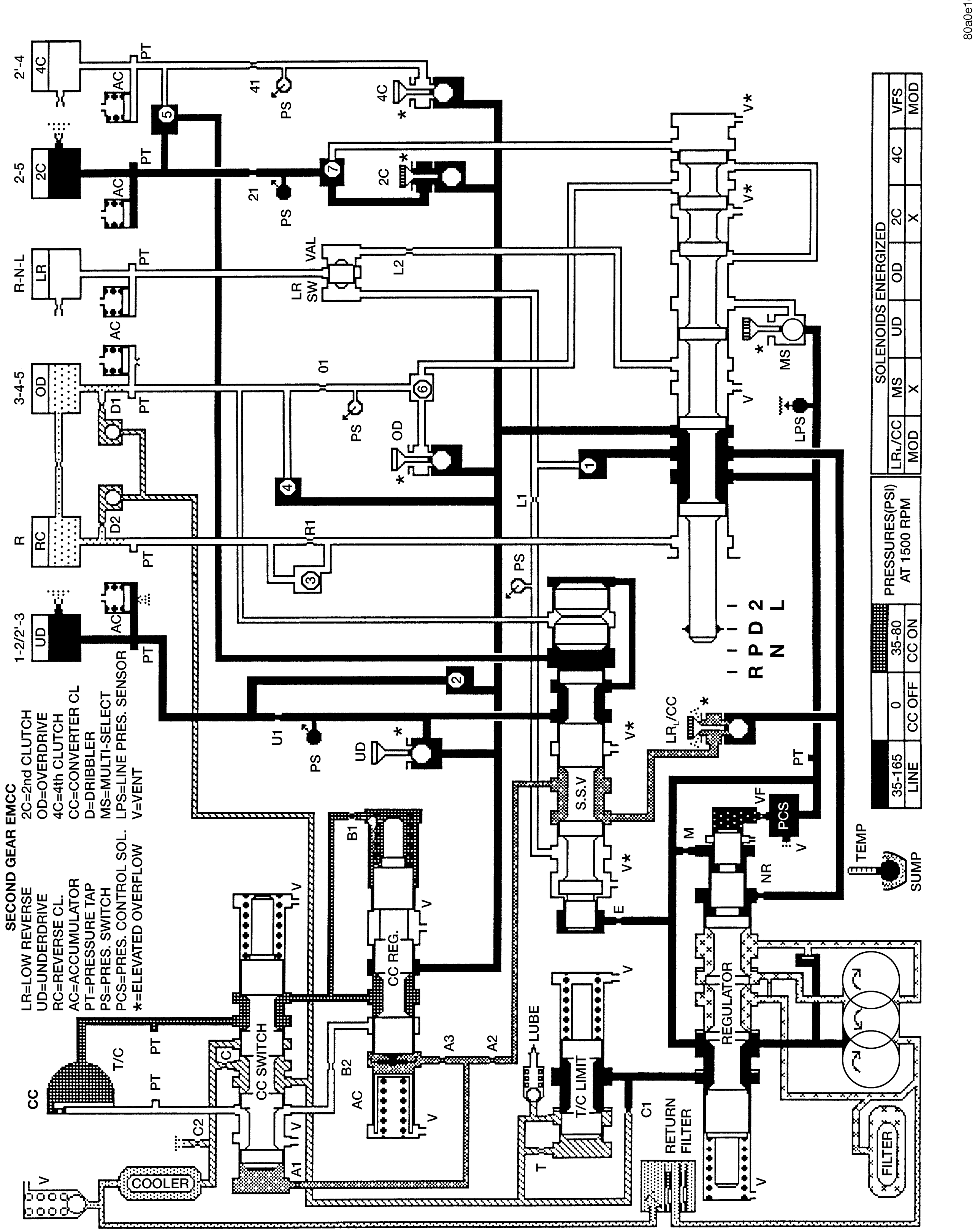
80a0dfee



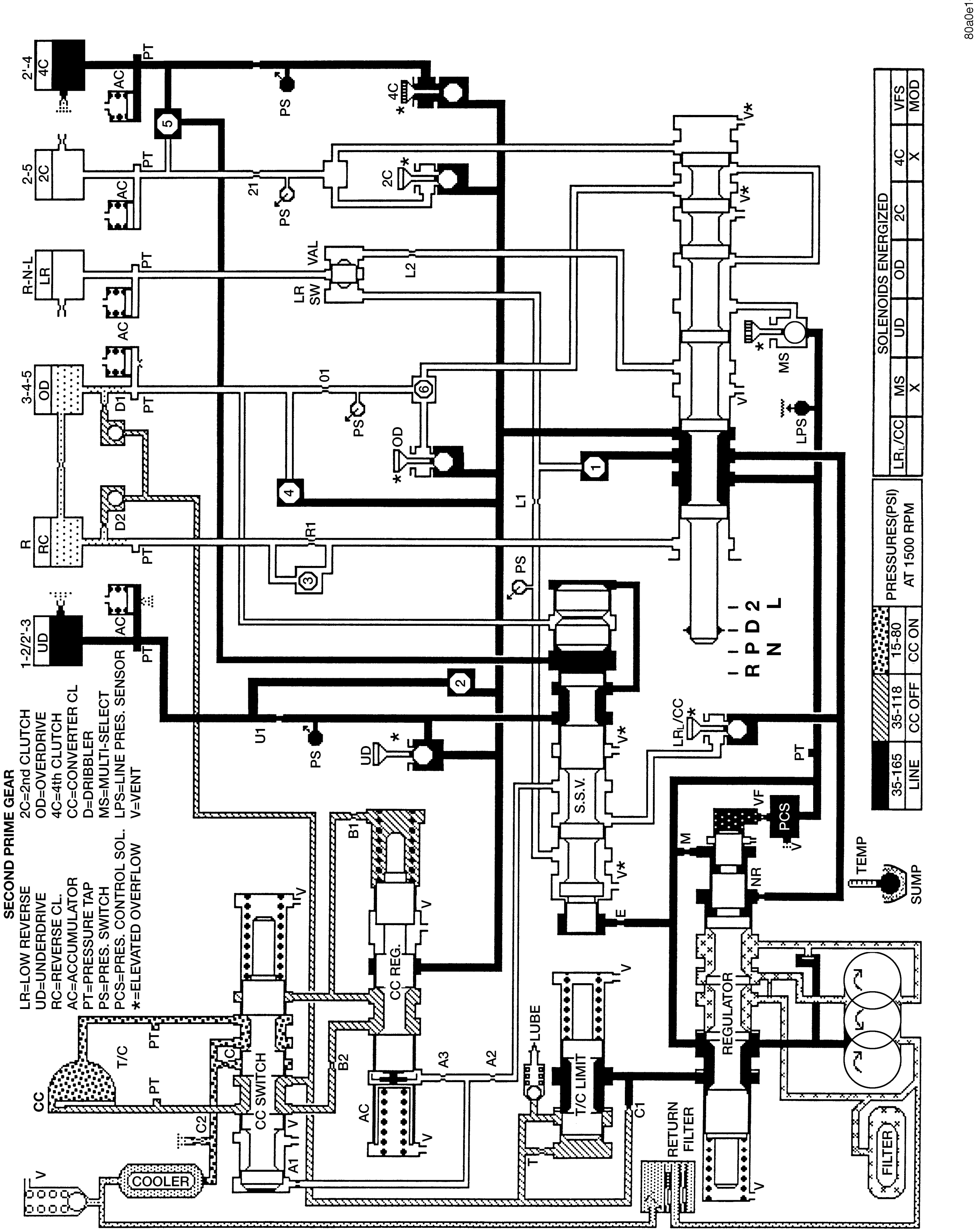
FIRST GEAR
(AFTER LAUNCH FROM REST)#
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
# SSV IN LR POSITION ; LR VENTED VIA LR/CC SOL.
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
SOLENOIDS ENERGIZED
LR/CC MS UD OD 2C 4C VFS MOD
X
1-2/2'-3
R
3-4-5
R-N-L
2-5
2'-4
UD
RC
OD
LR
2C
4C
CC
T/C
COOLER
CC SWITCH
CC REG.
S.S.V.
T/C LIMIT
REGULATOR
RETURN FILTER
FILTER
SUMP
TEMP
PCS
LUBE
R P D 2 N L
80a0e087

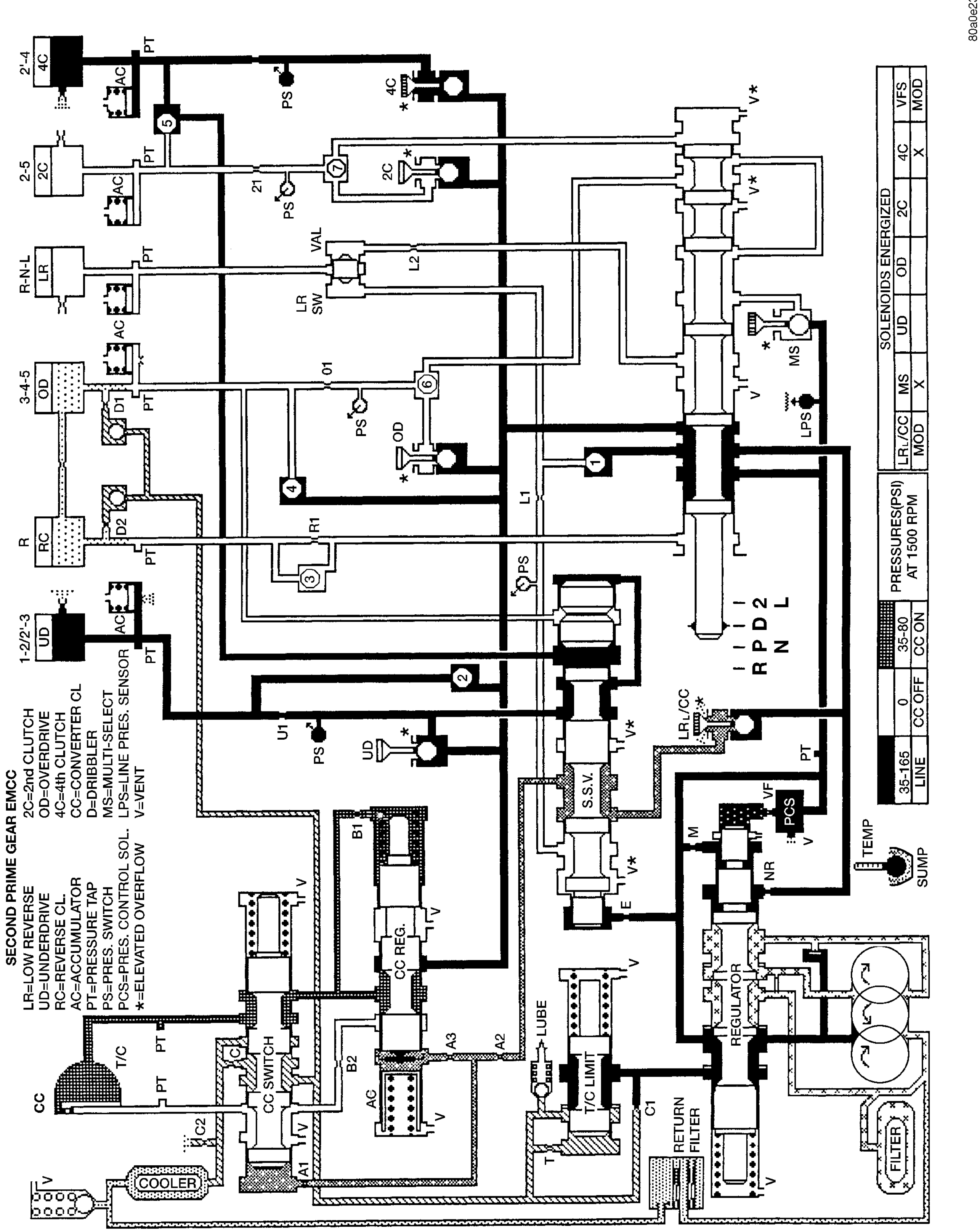

FIRST GEAR (FROM K/D) #
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
∗=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
# SSV REMAINS IN CC CONTROL POSITION
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC 0FF
15-80 CC ON
SOLENOIDS ENERGIZED
LRL/CC
MS X
UD
OD
2C
4C
VFS MOD
1-2/2'-3 UD
R RC
3-4-5 OD
R-N-L LR
2-5 2C
2'-4 4C
CC
T/C
CC SWITCH
CC REG.
AC
LUBE
T/C LIMIT
RETURN FILTER
REGULATOR
FILTER
TEMP
SUMP
PCS
S.S.V.
R P D 2
N L
80a0e0b7

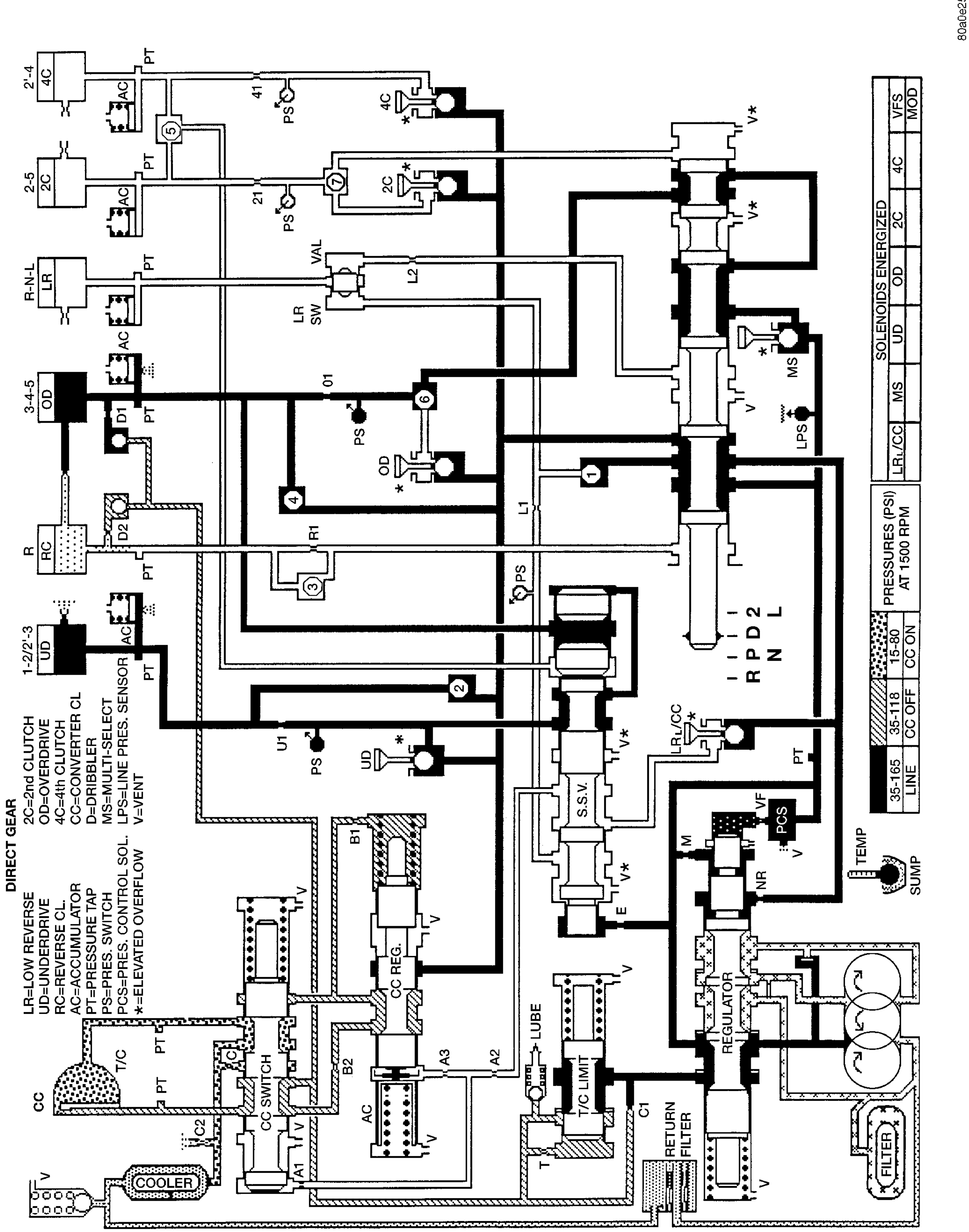

SECOND GEAR
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3
UD
R
RC
3-4-5
OD
R-N-L
LR
2-5
2C
2'-4
4C
CC
T/C
COOLER
CC SWITCH
CC REG.
AC
T/C LIMIT
LUBE
RETURN FILTER
REGULATOR
FILTER
SUMP
TEMP
PCS
S.S.V.
LR SW
VAL
LPS
R P D 2
N L
# SSV REMAINS IN CC CONT
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
LRL/CC
MS
UD
OD
2C
4C
VFS MOD
80a0e167

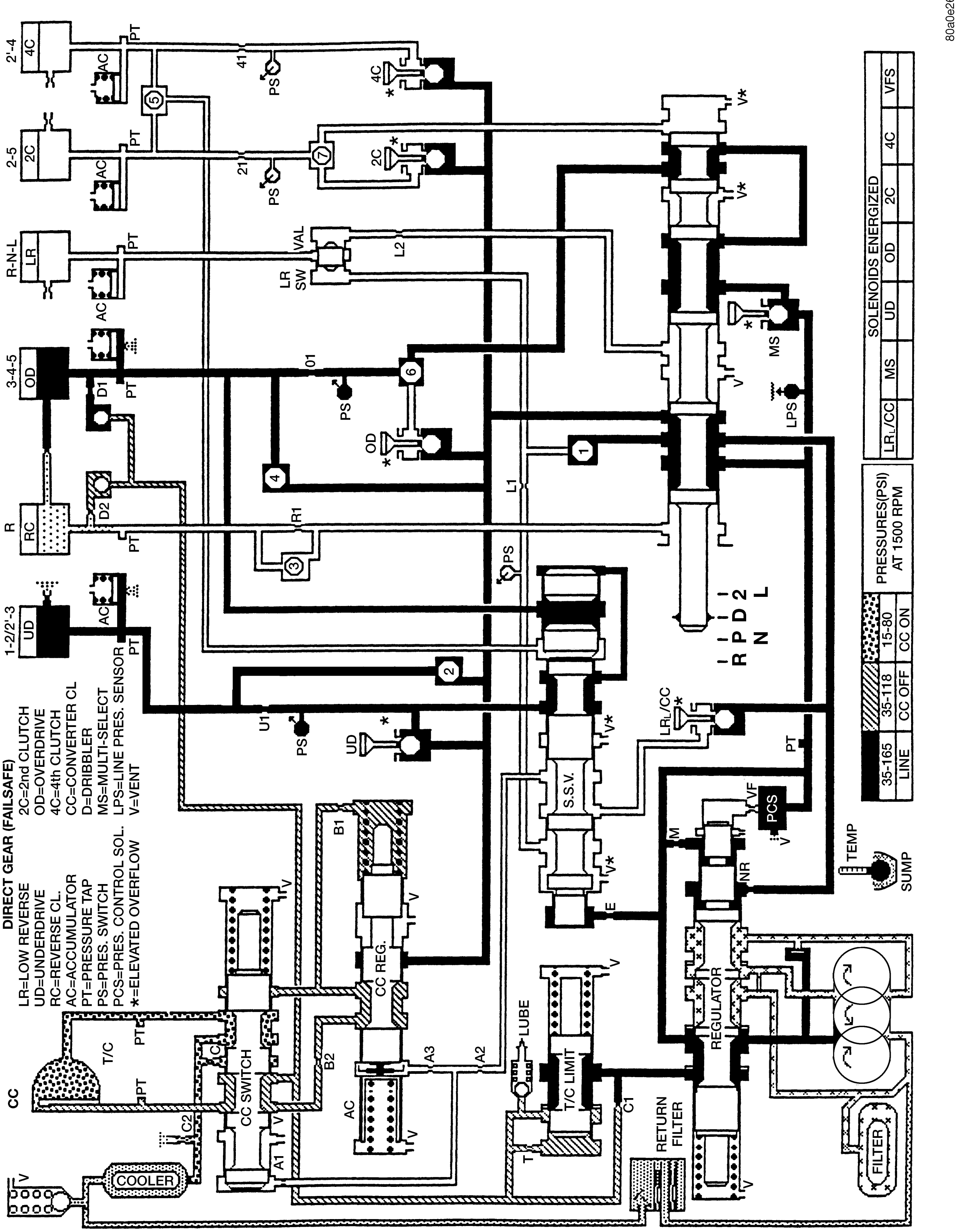


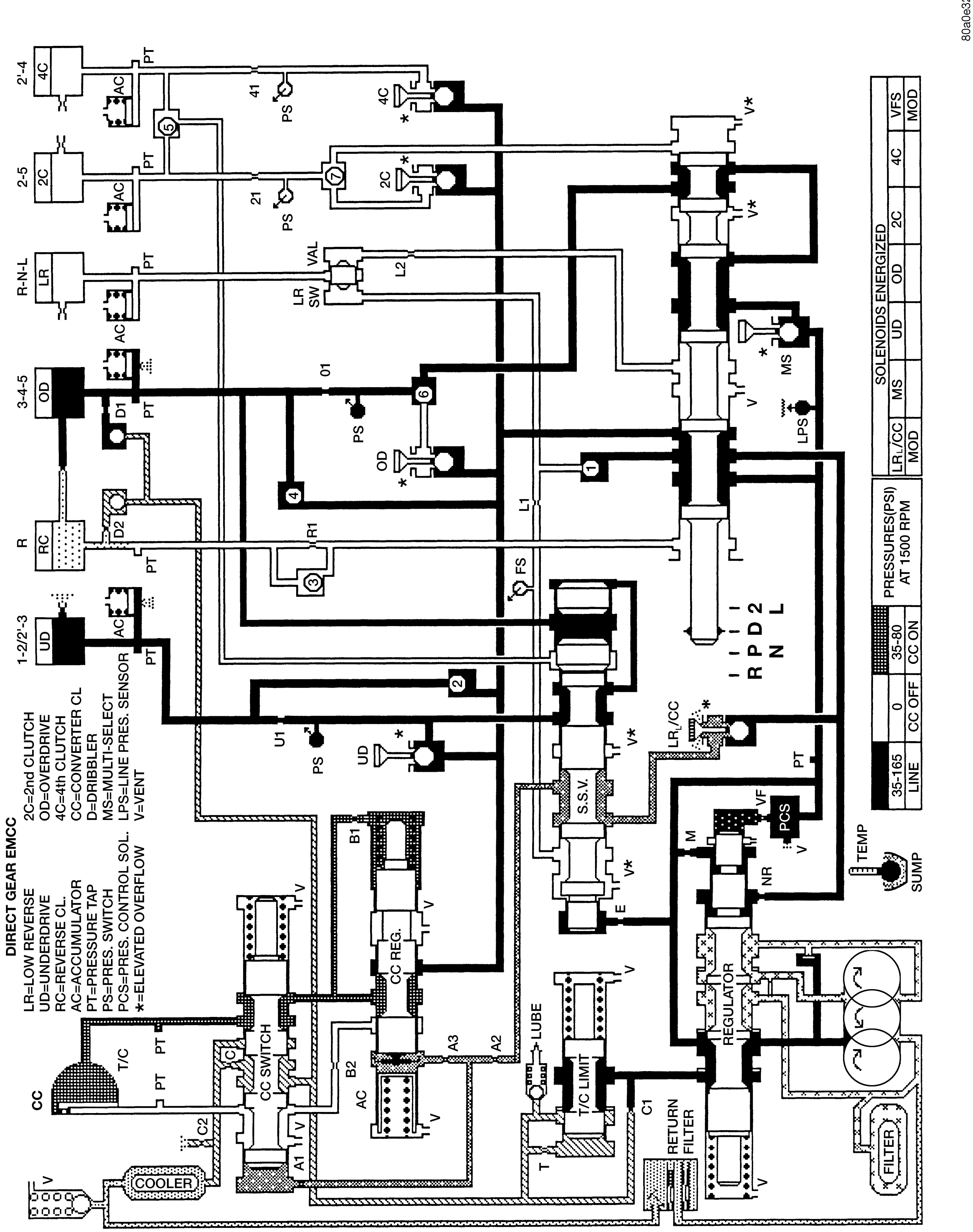
80a0e1cb
SECOND GEAR EMCC
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
∗=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3 UD
R RC
3-4-5 OD
R-N-L LR
2-5 2C
2'-4 4C
CC T/C
COOLER
CC SWITCH
CC REG.
T/C LIMIT
LUBE
RETURN FILTER
REGULATOR
S.S.V
PCS
TEMP
SUMP
FILTER
R P D 2 N L
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
0 CC OFF
35-80 CC ON
SOLENOIDS ENERGIZED
LR/CC MS UD OD 2C 4C VFS
MOD X X MOD

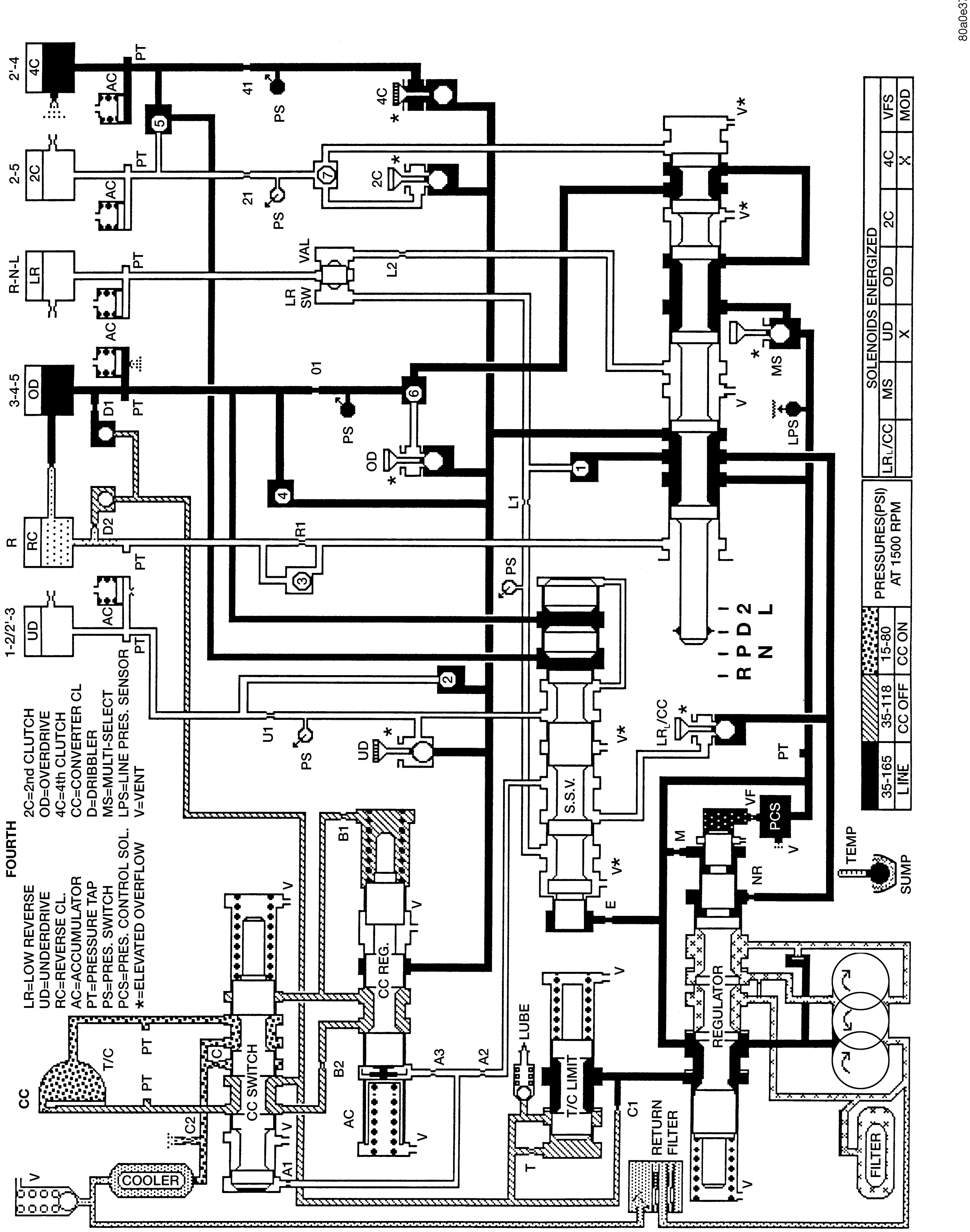

SECOND PRIME GEAR
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
∗=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3
UD
R
RC
3-4-5
OD
R-N-L
LR
2-5
2C
2'-4
4C
CC
T/C
COOLER
CC SWITCH
CC REG.
AC
T/C LIMIT
LUBE
RETURN
FILTER
REGULATOR
S.S.V.
PCS
TEMP
SUMP
FILTER
R P D 2
N L
LR SW
VAL
PRESSURES(PSI)
AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
SOLENOIDS ENERGIZED
LRL/CC
MS X
UD
OD
2C
4C X
VFS MOD
80a0e1ed

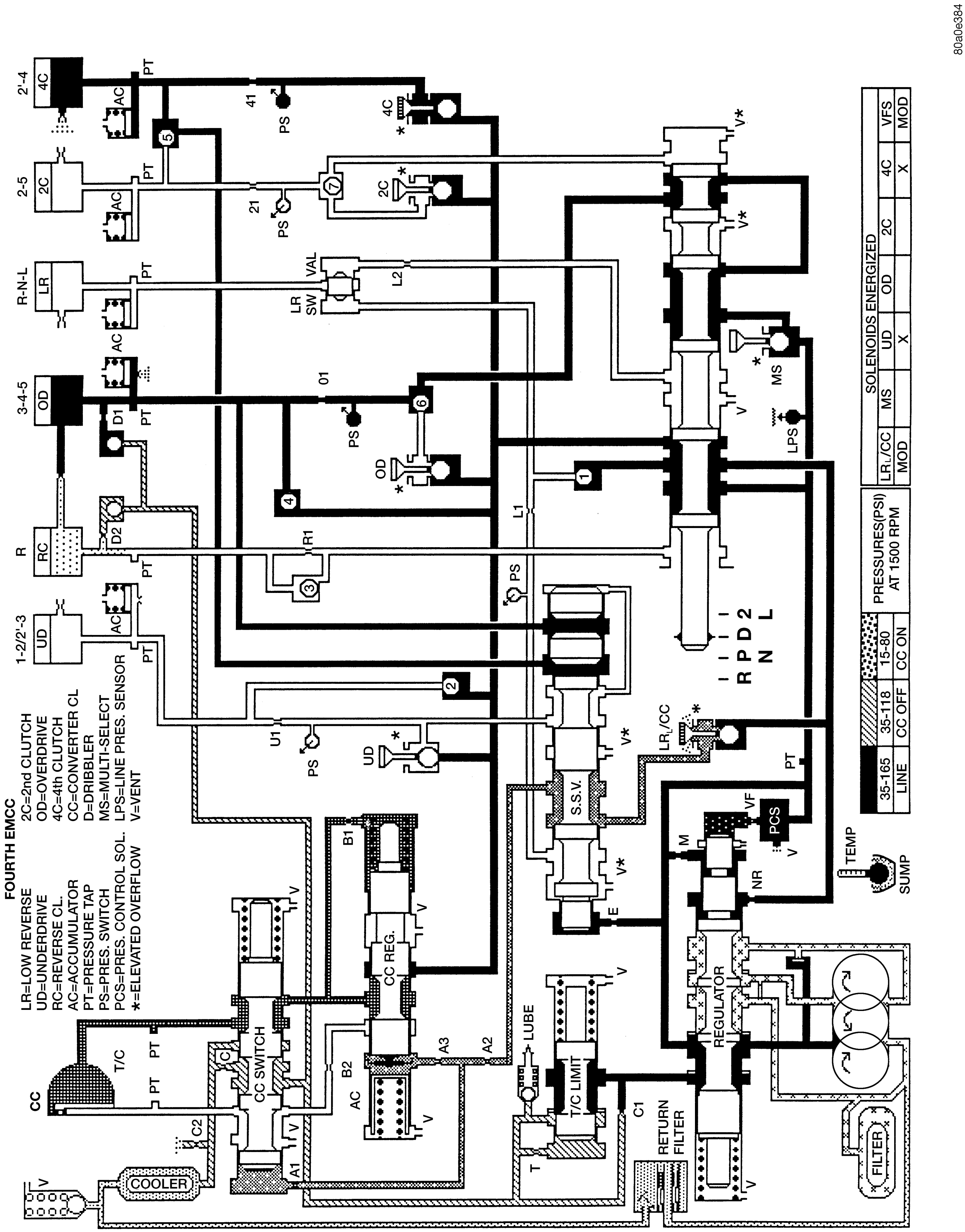

SECOND PRIME GEAR EMCC
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
✱=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3
UD
R
RC
3-4-5
OD
R-N-L
LR
2-5
2C
2'-4
4C
CC
T/C
COOLER
CC SWITCH
CC REG.
AG
B1
B2
A1
A2
A3
C1
C2
LUBE
T/C LIMIT
RETURN FILTER
REGULATOR
FILTER
S.S.V.
PCS
TEMP
SUMP
LR/CC
LR SW
VAL
MS
LPS
R P D 2
N L
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
0 CC OFF
35-80 CC ON
SOLENOIDS ENERGIZED
LR/CC MOD
MS X
UD
OD
2C
4C X
VFS MOD
80a0e238

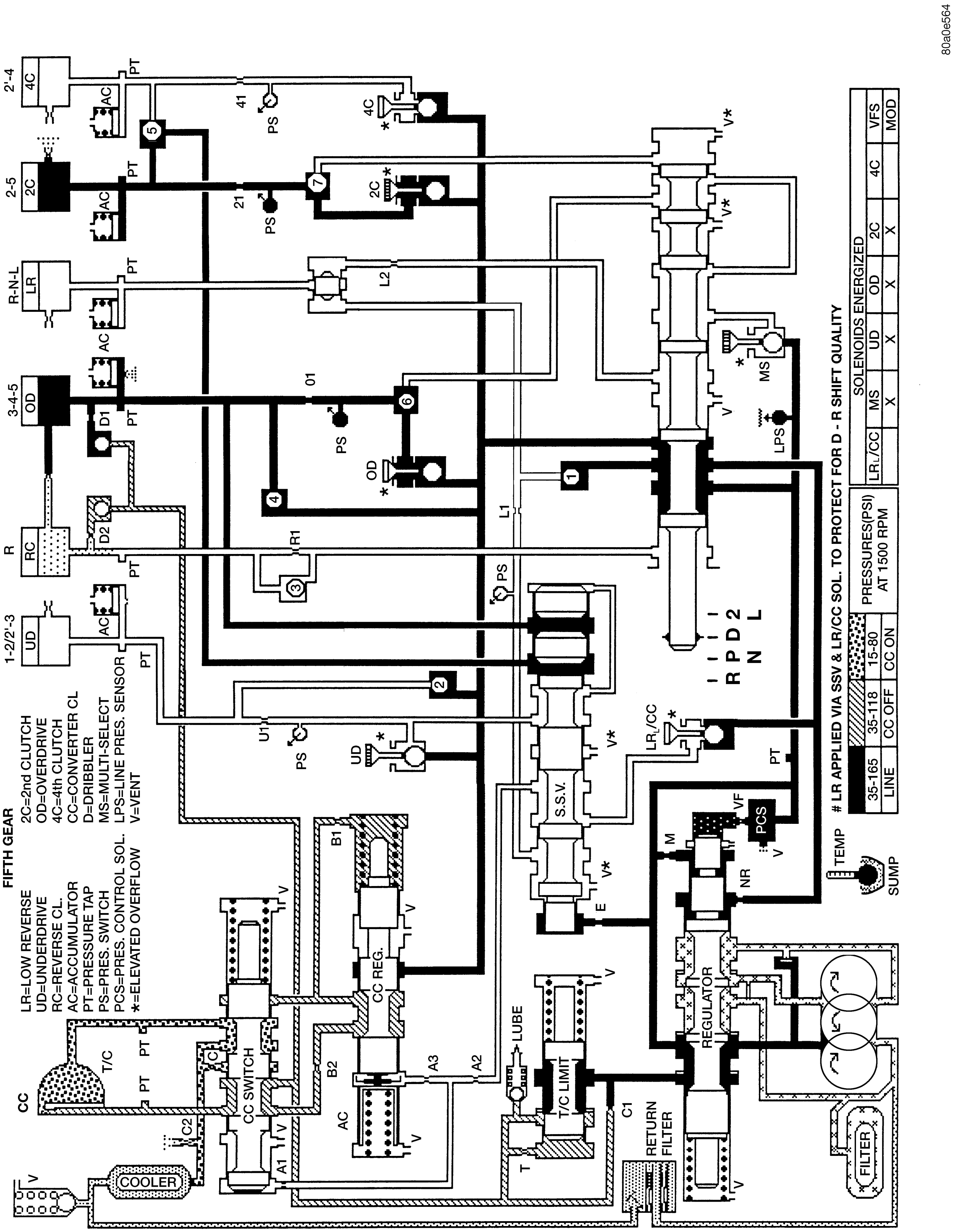

DIRECT GEAR
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
∗=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3
3-4-5
R-N-L
2-5
2'-4
COOLER
CC SWITCH
CC REG.
T/C LIMIT
RETURN FILTER
REGULATOR
FILTER
TEMP
SUMP
S.S.V.
LUBE
R P D 2
N L
35-165 LINE
35-118 CC OFF
15-80 CC ON
PRESSURES (PSI) AT 1500 RPM
SOLENOIDS ENERGIZED
LR/CC
MS
UD
OD
2C
4C
VFS MOD
80a0e258


DIRECT GEAR (FAILSAFE)
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
∗=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3
3-4-5
R-N-L
2-5
2'-4
CC
T/C
COOLER
CC SWITCH
CC REG.
AC
T/C LIMIT
LUBE
RETURN FILTER
REGULATOR
S.S.V.
PCS
TEMP
SUMP
FILTER
R P D 2
N L
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
SOLENOIDS ENERGIZED
LRL/CC
MS
UD
OD
2C
4C
VFS
80a0e26d


DIRECT GEAR EMCC
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3
UD
R
RC
3-4-5
OD
R-N-L
LR
2-5
2C
2'-4
4C
CC
T/C
CC SWITCH
CC REG.
S.S.V.
T/C LIMIT
LUBE
COOLER
RETURN FILTER
REGULATOR
FILTER
TEMP
SUMP
PCS
LR/CC
LR SW
VAL
R P D 2
N L
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
0 CC OFF
35-80 CC ON
SOLENOIDS ENERGIZED
LR/CC MOD
MS
UD
OD
2C
4C
VFS MOD
80a0e328

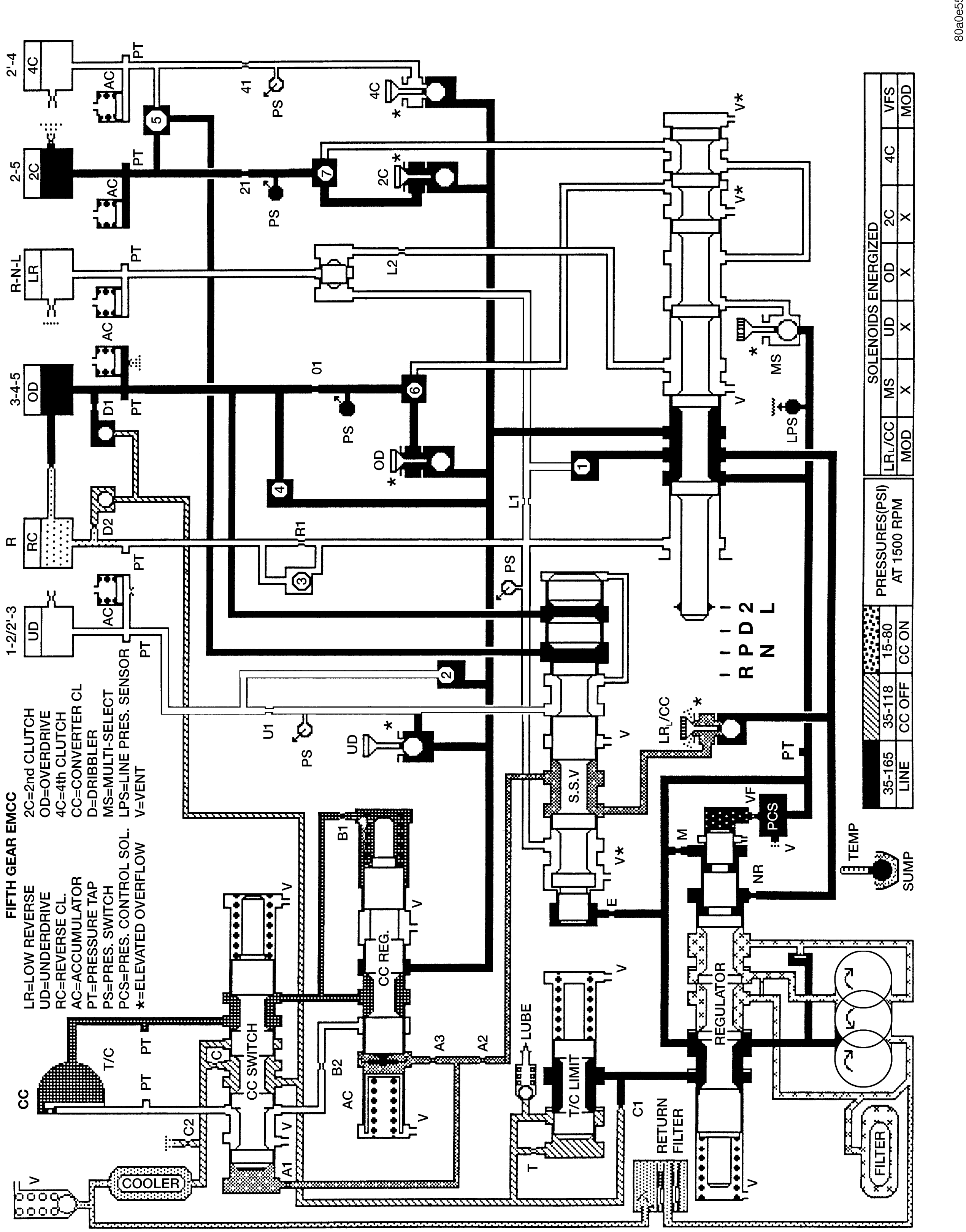

FOURTH
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3
UD
R
RC
3-4-5
OD
R-N-L
LR
2-5
2C
2'-4
4C
LR SW
VAL
S.S.V.
CC REG.
CC SWITCH
T/C
T/C LIMIT
REGULATOR
LUBE
COOLER
RETURN FILTER
FILTER
TEMP
SUMP
PCS
SOLENOIDS ENERGIZED
LRL/CC MS UD OD 2C 4C VFS
X X X MOD
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
R P D 2
N L
80a0e373

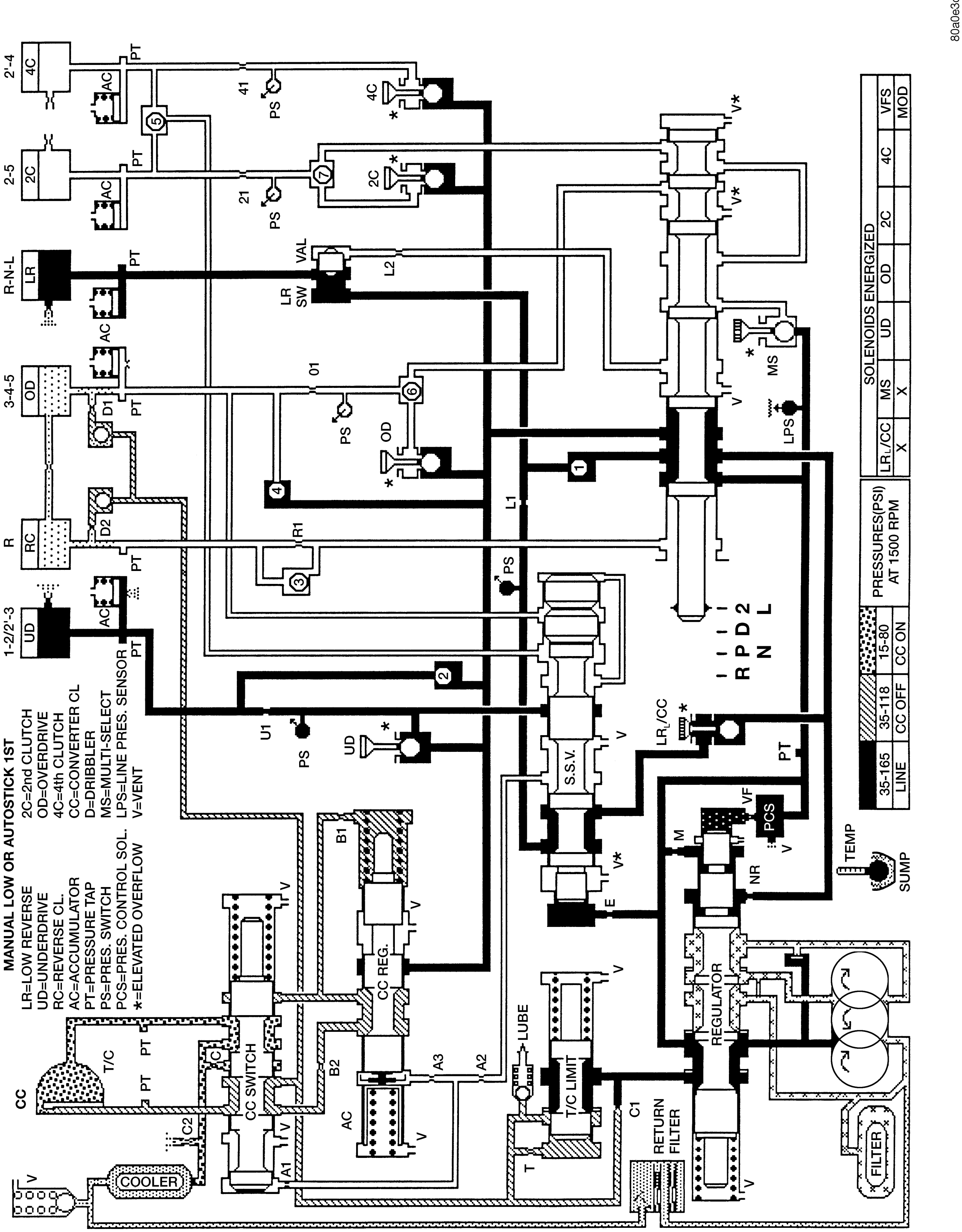

FOURTH EMCC
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
∗=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3
R
3-4-5
R-N-L
2-5
2'-4
UD
RC
OD
LR
2C
4C
CC
T/C
COOLER
CC SWITCH
CC REG.
T/C LIMIT
RETURN FILTER
REGULATOR
FILTER
SUMP
TEMP
PCS
S.S.V.
LUBE
R P D 2 N L
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
SOLENOIDS ENERGIZED
LRL/CC MOD
MS
UD X
OD
2C
4C X
VFS MOD
80a0e384

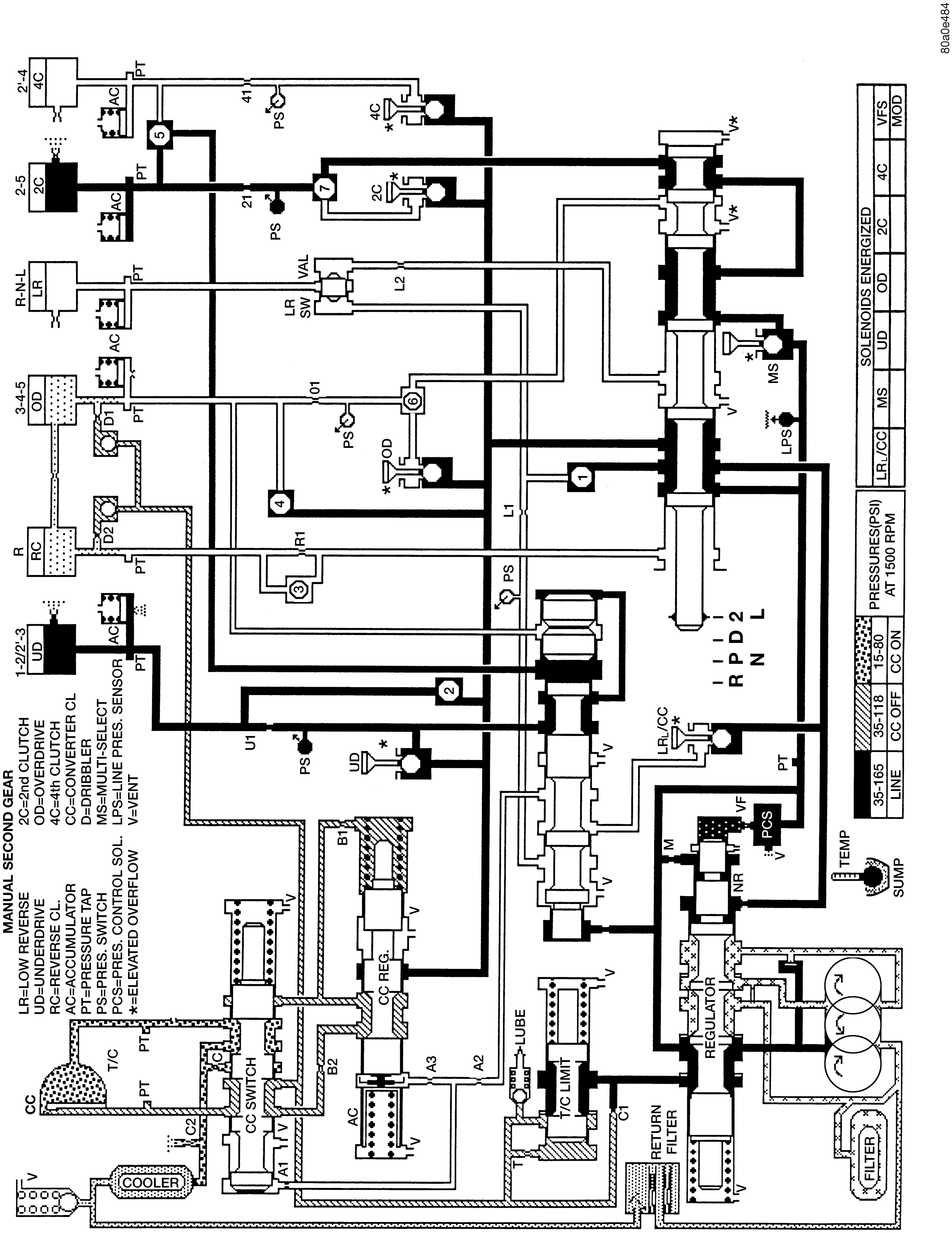


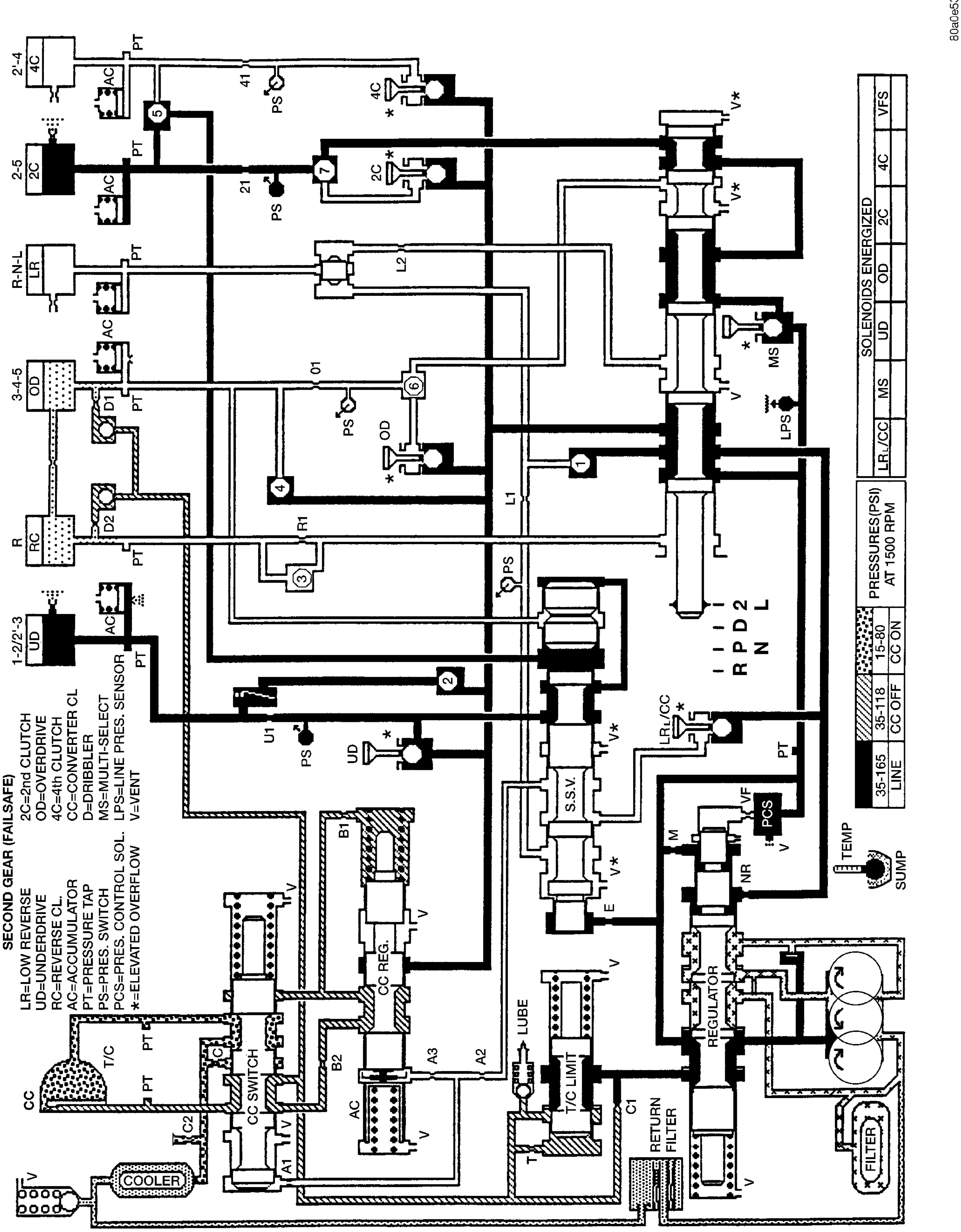

| 35-165 | 35-118 | 15-80 |
|---|---|---|
| LINE | CC OFF | CC ON |

| LR/CC | MS | UD | OD | 2C | 4C | VFS |
|---|---|---|---|---|---|---|
| | X | X | X | X | | MOD |


FIFTH GEAR EMCC
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3
UD
R
RC
3-4-5
OD
R-N-L
LR
2-5
2C
2'-4
4C
CC
T/C
COOLER
CC SWITCH
CC REG.
S.S.V
T/C LIMIT
REGULATOR
RETURN FILTER
FILTER
LUBE
SUMP
TEMP
PCS
LR/CC
MS
LPS
R P D 2
N L
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
SOLENOIDS ENERGIZED
LR/CC MOD
MS X
UD X
OD X
2C X
4C
VFS MOD
80a0e555


MANUAL LOW OR AUTOSTICK 1ST
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3
R
3-4-5
R-N-L
2-5
2'-4
UD
RC
OD
LR
2C
4C
CC
T/C
CC SWITCH
CC REG.
T/C LIMIT
S.S.V.
REGULATOR
COOLER
RETURN FILTER
FILTER
LUBE
TEMP
SUMP
PCS
R P D 2 N L
SOLENOIDS ENERGIZED
LRL/CC MS UD OD 2C 4C VFS
X X MOD
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
80a0e3c7


MANUAL SECOND GEAR
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
∗=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3 UD
R RC
3-4-5 OD
R-N-L LR
2-5 2C
2'-4 4C
T/C
CC SWITCH
CC REG.
COOLER
LUBE
T/C LIMIT
RETURN FILTER
REGULATOR
FILTER
SUMP
TEMP
PCS
LR SW
VAL
R P D 2 N L
SOLENOIDS ENERGIZED
LRL/CC MS UD OD 2C 4C VFS MOD
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
80a0e484


SECOND GEAR (FAILSAFE)
LR=LOW REVERSE
UD=UNDERDRIVE
RC=REVERSE CL.
AC=ACCUMULATOR
PT=PRESSURE TAP
PS=PRES. SWITCH
PCS=PRES. CONTROL SOL.
*=ELEVATED OVERFLOW
2C=2nd CLUTCH
OD=OVERDRIVE
4C=4th CLUTCH
CC=CONVERTER CL
D=DRIBBLER
MS=MULTI-SELECT
LPS=LINE PRES. SENSOR
V=VENT
1-2/2'-3
R
3-4-5
R-N-L
2-5
2'-4
CC SWITCH
CC REG.
T/C LIMIT
REGULATOR
S.S.V.
COOLER
RETURN FILTER
FILTER
TEMP
SUMP
LUBE
PRESSURES(PSI) AT 1500 RPM
35-165 LINE
35-118 CC OFF
15-80 CC ON
SOLENOIDS ENERGIZED
LR/CC
MS
UD
OD
2C
4C
VFS
80a0e533

# SPECIFICATIONS

## TRANSMISSION

### GENERAL

| Component | Metric | Inch |
|---|---|---|
| Output Shaft End Play | 0.22-0.55 mm | 0.009-0.021 in. |
| Input Shaft End Play | 0.46-0.89 mm | 0.018-0.035 in. |
| 2C Clutch Pack Clearance | 0.455-1.335 mm | 0.018-0.053 in. |
| 4C Clutch Pack Clearance | 0.770-1.390 mm | 0.030-0.055 in. |
| L/R Clutch Pack Clearance | 1.00-1.74 mm | 0.039-0.069 in. |
| OD Clutch Pack Clearance | 1.103-1.856 mm | 0.043-0.073 in. |
| UD Clutch Pack Clearance | 0.84-1.54 mm | 0.033-0.061 in. |
| Reverse Clutch Pack Clearance | 0.58-1.47 mm | 0.023-0.058 in. |
| Recommended fluid | Mopar® ATF +4 | |

### GEAR RATIOS

| | |
|---|---|
| 1ST | 3.00:1 |
| 2ND | 1.67:1 |
| 2ND Prime | 1.50:1 |
| 3RD | 1.00:1 |
| 4TH | 0.75:1 |
| 5TH | 0.67:1 |
| REVERSE | 3.00:1 |

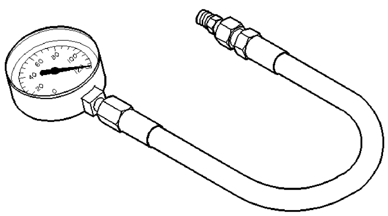
### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Fitting, Cooler Line at Trans | 17.5 | - | 155 |
| Bolt, Torque Converter | 31 | 23 | 270 |
| Bolt, Torque Converter Housing | 68 | 50 | - |
| Bolt/nut, Crossmember | 68 | 50 | - |
| Bolt, Driveplate to Crankshaft | 75 | 55 | - |
| Bolt, Oil Pan | 12 | - | 105 |
| Screw, Primary Fluid Filter | 4.5 | - | 40 |
| Filter, Cooler Return | 9.5 | 7 | - |
| Bolt, Oil Pump | 28 | - | 250 |
| Bolt, Oil Pump Body to Cover | 4.5 | - | 40 |
| Screw, Plate to Oil Pump Body | 4.5 | - | 40 |
| Bolt, Valve Body to Case | 12 | - | 105 |
| Plug, Pressure Test Port | 5 | - | 45 |

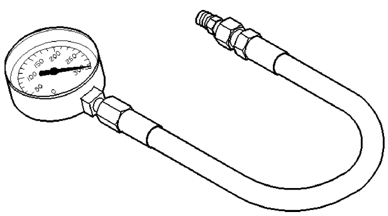
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Bolt, Reaction Shaft Support | 12 | - | 105 |
| Screw, Valve Body to Transfer Plate | 6 | - | 50 |
| Screw, Solenoid Module to Transfer Plate | 6 | - | 50 |
| Screw, Accumulator Cover | 7 | - | 60 |
| Screw, Detent Spring | 4.5 | - | 40 |
| Bolt, Input Speed Sensor | 12 | - | 105 |
| Bolt, Output Speed Sensor | 12 | - | 105 |
| Bolt, Line Pressure Sensor | 12 | - | 105 |
| Bolt, Extension Housing | 54 | 40 | - |
| Bolt, Transmission Rear Support to Transmission | 47 | - | 35 |
| Bolt, Transmission Support Clevis Bracket to Crossmember | 47 | - | 35 |
| Bolt, Engine Oil Pan to Transmission | 54 | 40 | - |
| Valve, Cooler Return Filter Bypass | 4.5 | - | 40 |
| Screw, Manual Valve Cam Retaining | 4.5 | - | 40 |
| Screw, Manual Selector Shaft Retaining | 28 | - | 250 |
| Bolt, Manual Shift Lever Pinch | 16 | - | 140 |
| Nut, Shifter Mechanism Adjustment | 30 | - | 265 |
| Nut, Shifter Assembly to Floorpan | 12 | - | 105 |

## SPECIAL TOOLS

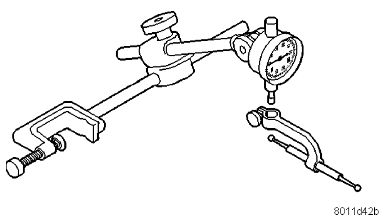
## AUTOMATIC TRANSMISSION - RFE



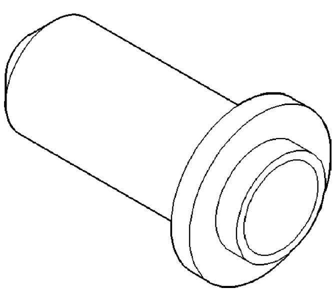
*Gauge, Oil Pressure - C-3292*



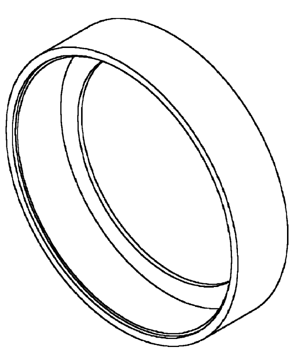
*Gauge, Oil Pressure - C-3293SP*



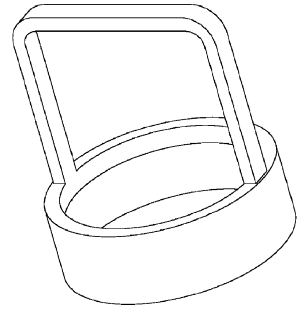

*Dial Indicator - C-3339*



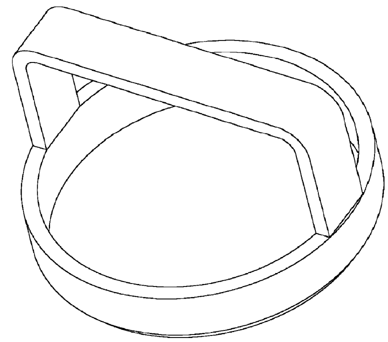
*Installer, Seal - C-3860-A*



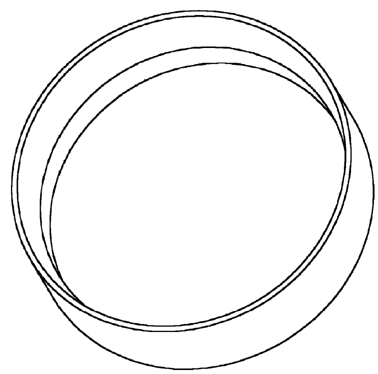
*Compressor, Spring - 8249*



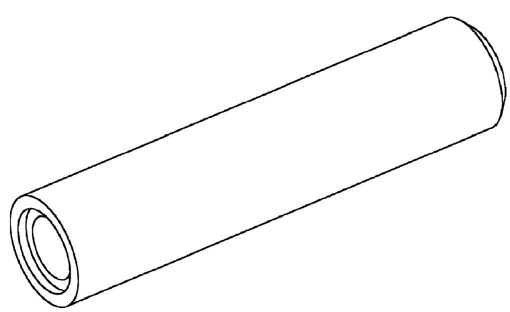
*Compressor, Spring - 8250*



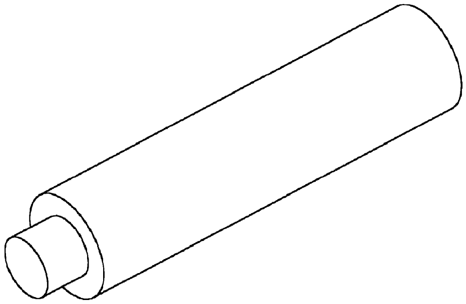
*Compressor, Spring - 8251*



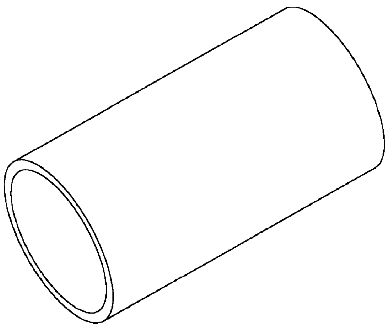
*Installer, Piston - 8252*



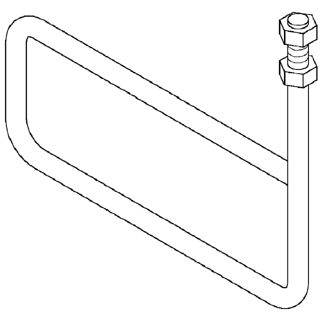
*Installer, Seal - 8253*



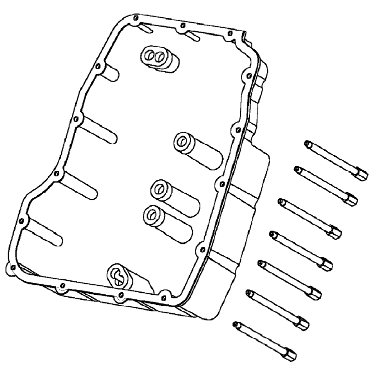
***Installer, Seal - 8254***



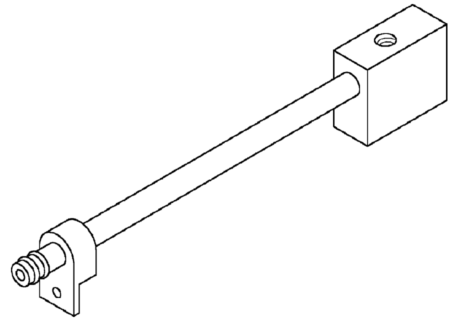
***Installer, Snap-ring - 8255***



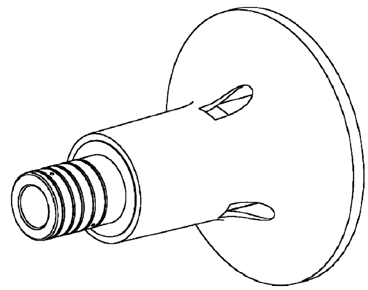
***Stand, Support - 8257***



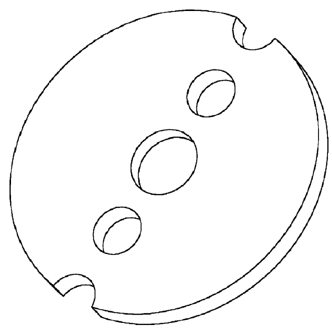
***Adapter, Pressure Tap - 8258-A***



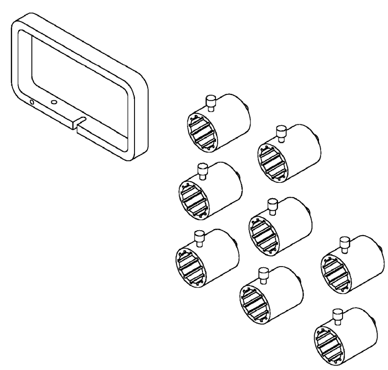
***Adapter, Line Pressure - 8259***



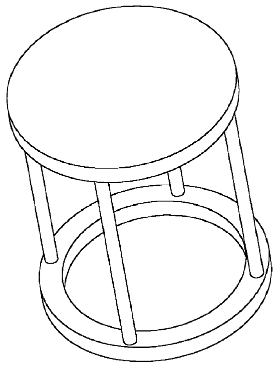
***Fixture, Input Clutch Pressure - 8260***



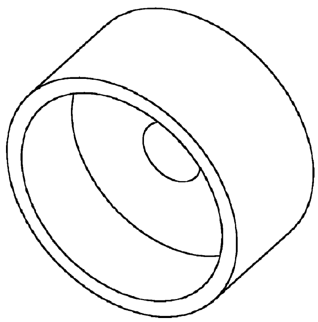
***Plate, Alignment - 8261***



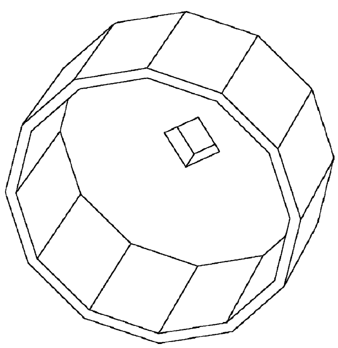
***End Play Set - 8266***



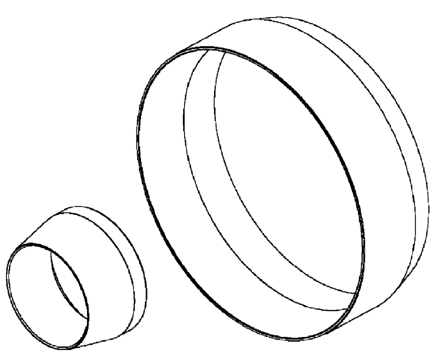
*Compressor, Spring - 8285*



*Installer, Bearing - 8320*



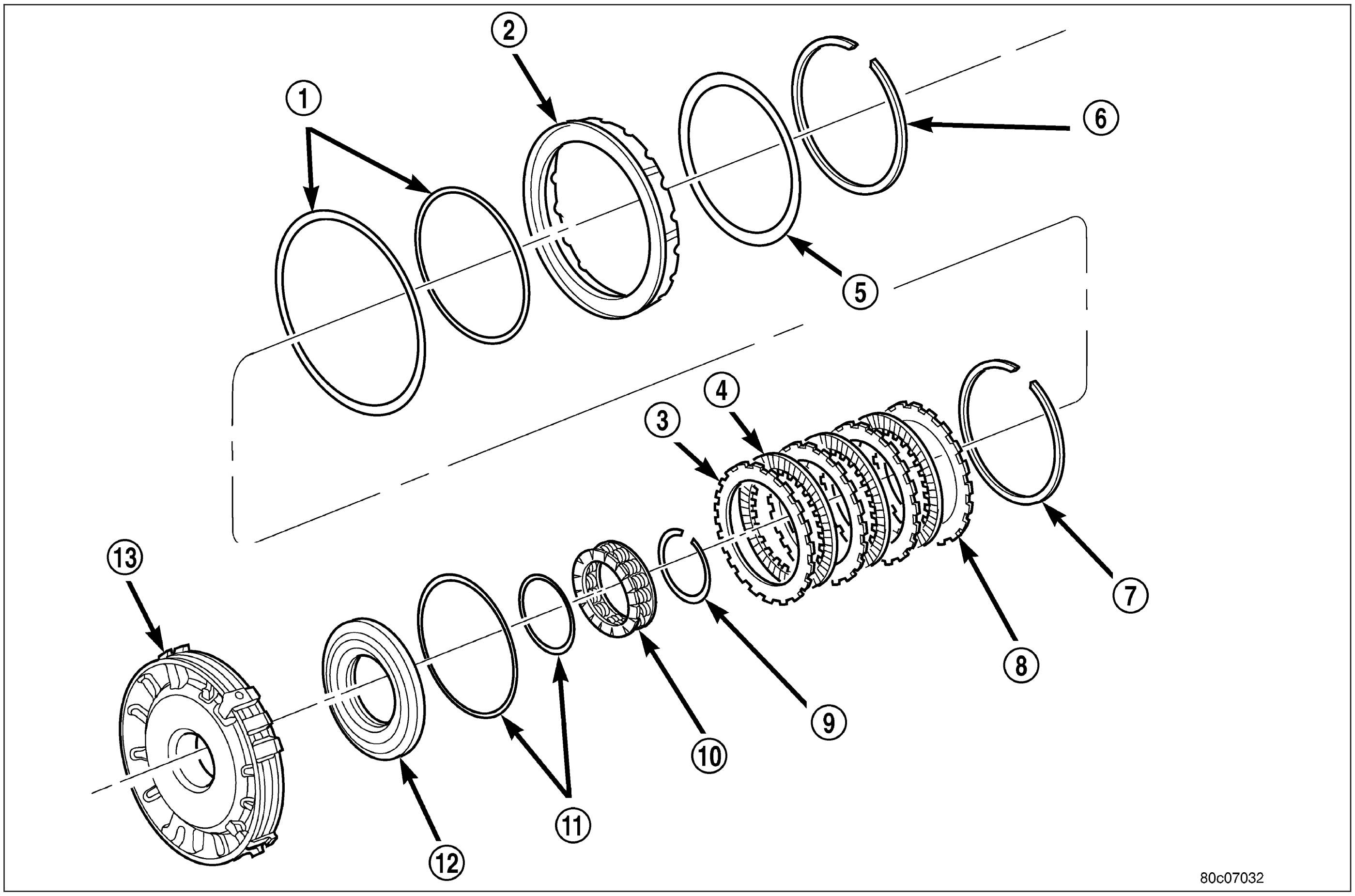
*Wrench, Filter - 8321*



*Installer, Piston - 8504*

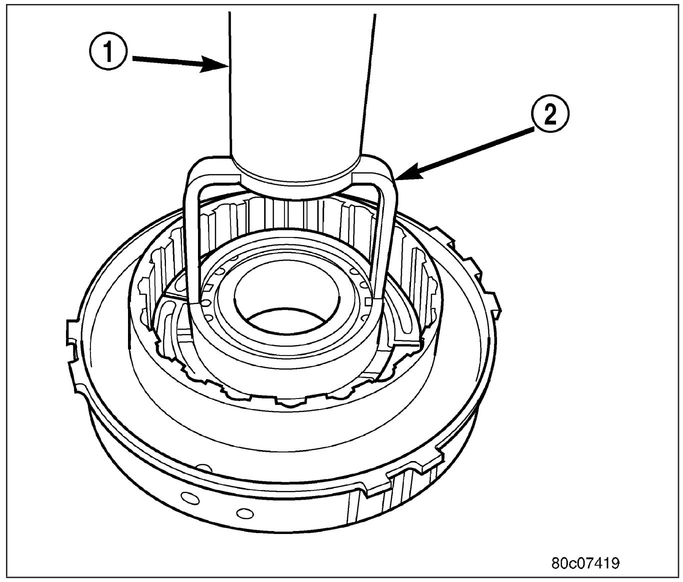
# RETAINER/BULKHEAD-4C

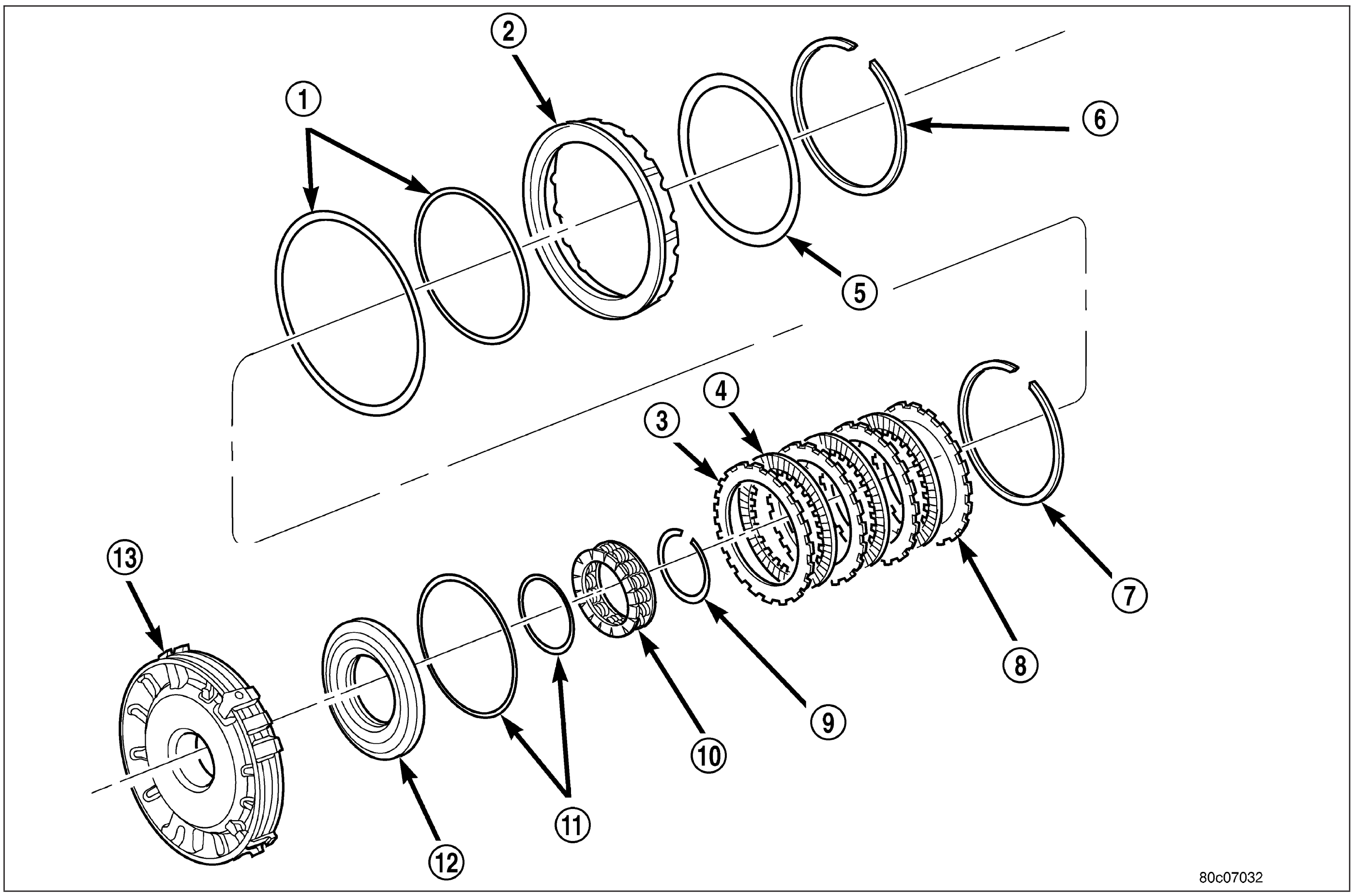
## DISASSEMBLY




1. Remove the 2C piston Belleville spring snap-ring (6) from the 4C retainer/bulkhead (13).
2. Remove the 2C piston Belleville spring (5) from the retainer/bulkhead (13).
3. Remove the 2C piston (2) from the retainer/bulkhead (13). Use 20 psi of air pressure to remove the piston if necessary.
4. Remove the 4C clutch snap-ring (7) from the retainer/bulkhead (13).
5. Remove the 4C clutch pack (3, 4, 8) from the retainer/bulkhead (13).

6. Using Spring Compressor 8250 (2) and a suitable shop press (1), compress the 4C piston return spring and remove the snap-ring.

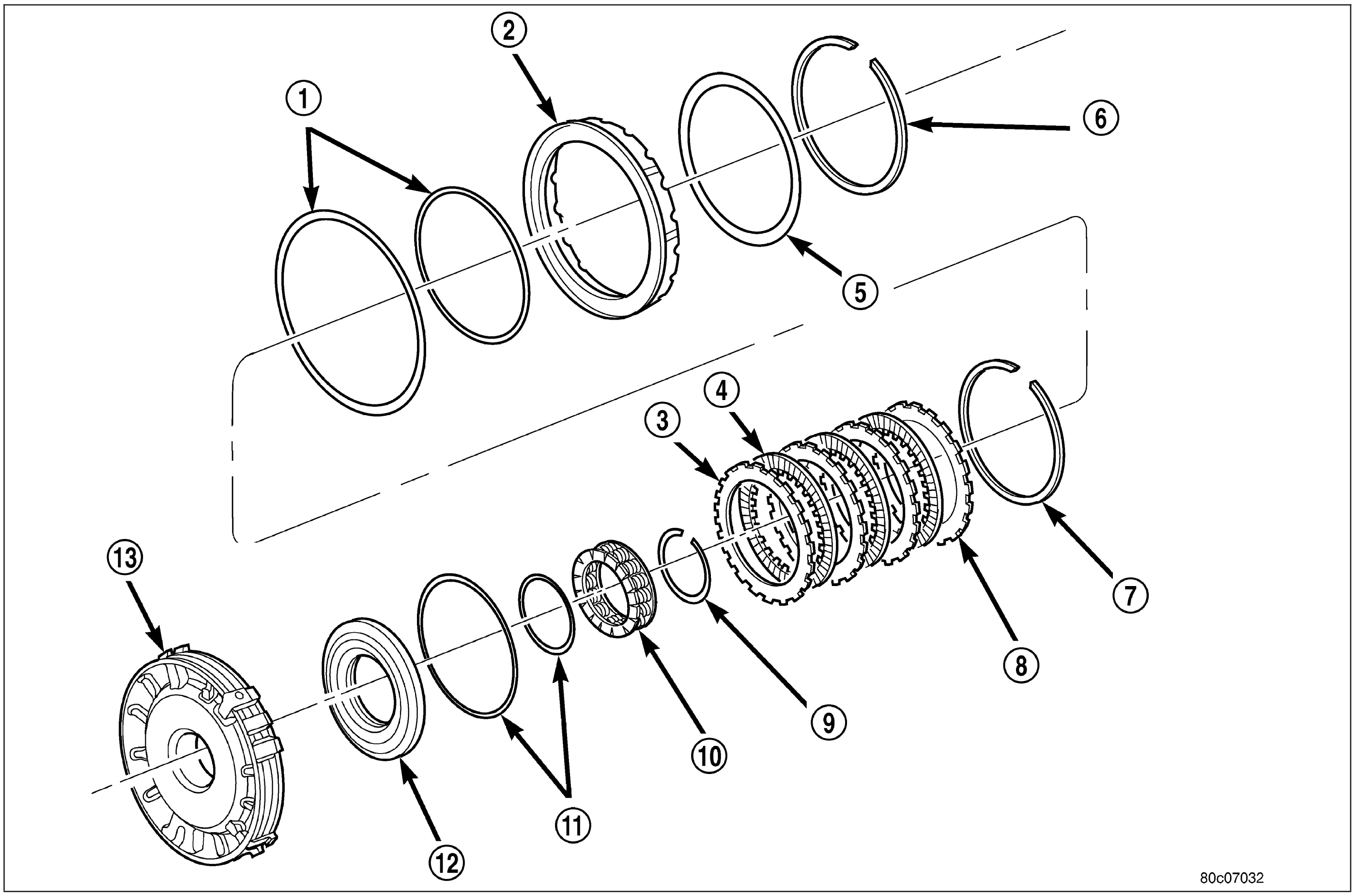


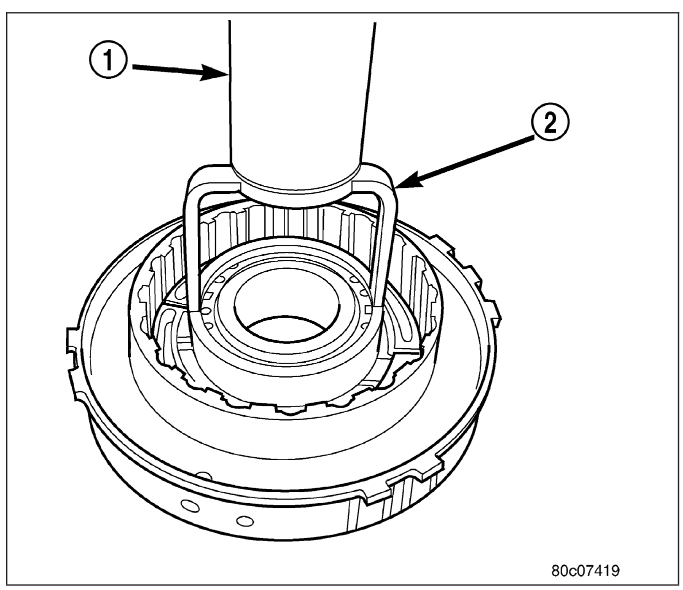

7. Remove the 4C piston return spring (10) and piston (12) from the retainer/bulkhead (13). Use 20 psi of air pressure to remove the piston if necessary.

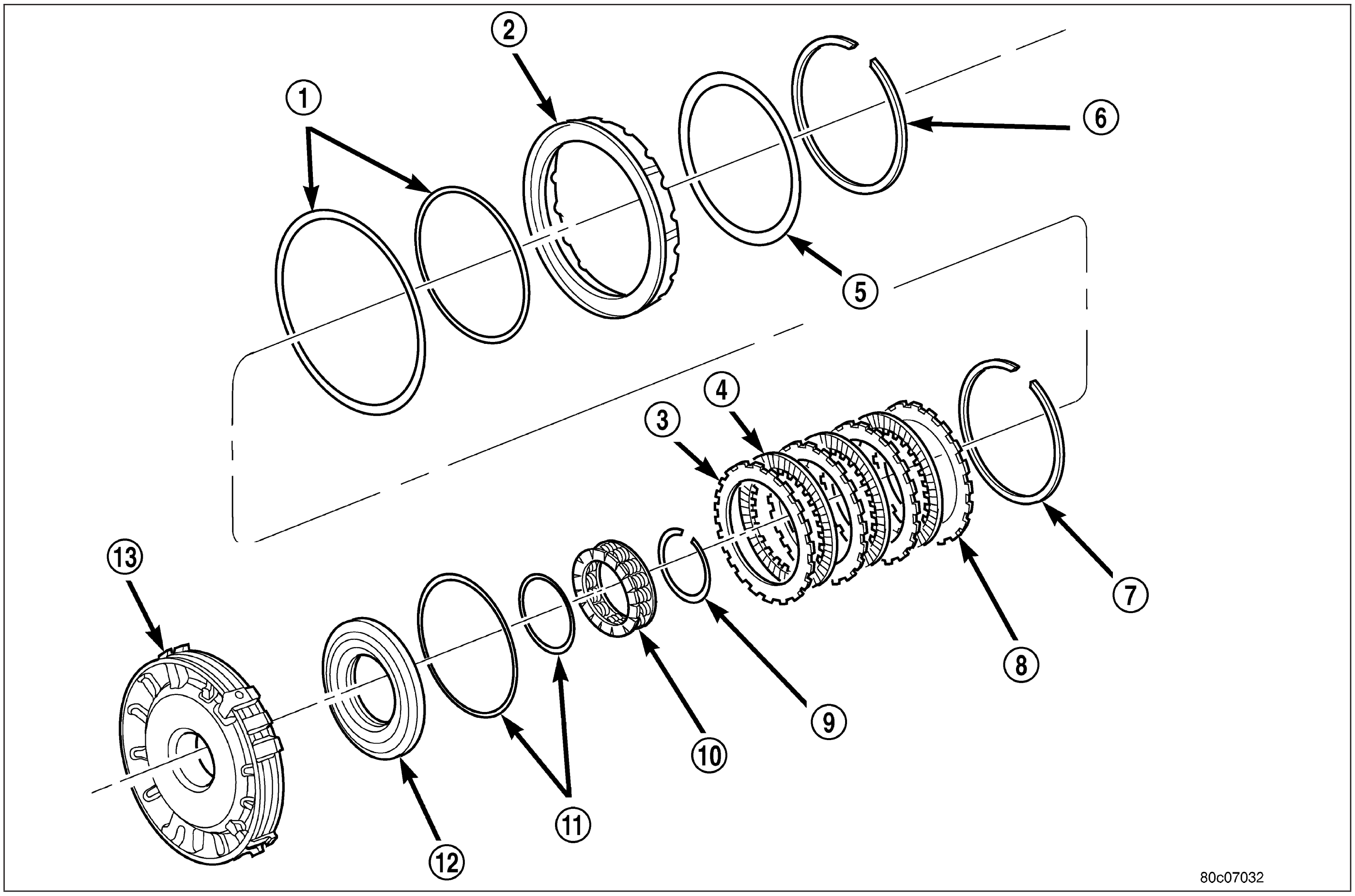
## ASSEMBLY

**NOTE: Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.**

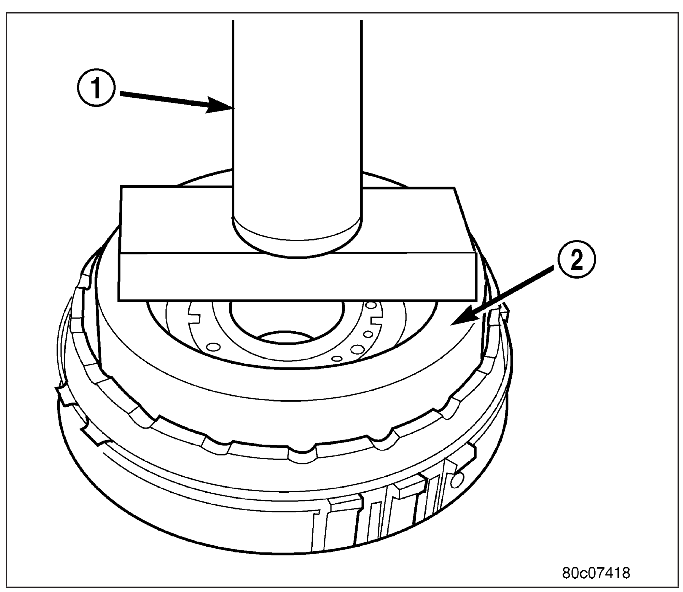



1. Install new seals (1, 11) on the 2C and 4C pistons or in the piston retainers.
2. Lubricate all seals with Mopar® ATF +4 prior to installation.
3. Install the 4C piston (12) into the 4C retainer/bulkhead (13).
4. Position the 4C piston return spring (10) onto the 4C piston (12).
5. Using Spring Compressor 8250 (2) and a suitable shop press (1), compress the 4C piston return spring and install the snap-ring.






6. Assemble and install the 4C clutch pack (3, 4) into the retainer/bulkhead (13) with the steel separator plate against the piston.
7. Install the 4C reaction plate (8) and snap-ring (7) into the retainer/bulkhead (13). The 4C reaction plate is non-directional.
8. Measure the 4C clutch clearance. The correct clutch clearance is 0.770-1.390 mm (0.030-0.055 in.). The snap-ring (7) is selectable. Install the chosen snap-ring and re-measure to verify the selection.
9. Install the 2C piston (2) into the retainer/bulkhead (13).
10. Position the 2C Belleville spring (5) onto the 2C piston (2).
11. Position the 2C Belleville spring snap-ring (6) onto the 2C Belleville spring (5).
12. Using Spring Compressor 8249 (2) and a suitable shop press (1), compress the Belleville spring until the snap-ring is engaged with the snap-ring groove in the retainer/bulkhead.



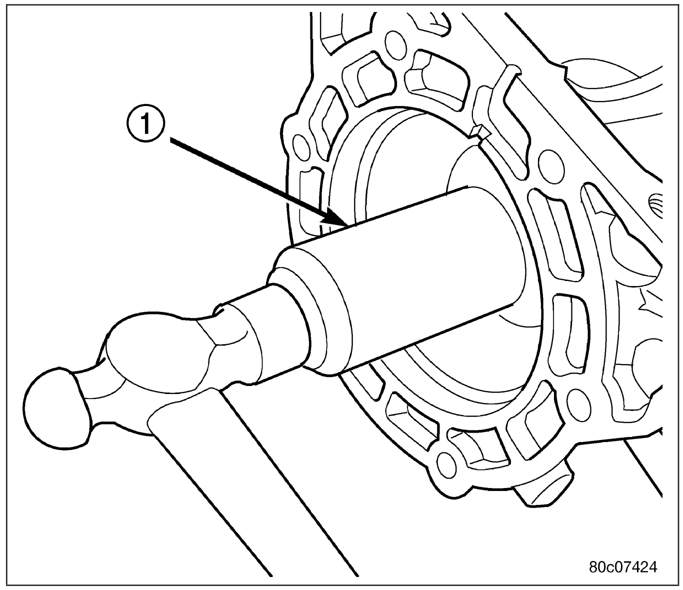
# SEAL-ADAPTER HOUSING

## REMOVAL

1. Remove the transfer case from the transmission.
2. Using a screw mounted on a slide hammer, remove the adapter housing seal.

## INSTALLATION

1. Clean the adapter seal bore in the adapter housing of any residue or particles remaining from the original seal.
2. Install new oil seal in the adapter housing using Seal Installer C-3860-A (1) . A properly installed seal is flush to the face of the seal bore.
3. Install the transfer case onto the transmission.



# SYSTEM-BRAKE TRANSMISSION SHIFT INTERLOCK

## DESCRIPTION

The Brake Transmission Shift Interlock System (BTSI), consists of a Park-Interlock cable and a solenoid mounted in the shift lever assembly. The Park-Interlock cable connects the automatic transmission floor mounted shifter to the steering column ignition switch.

## OPERATION

The system locks the shifter into the PARK position. The interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed approximately one-half an inch. A magnetic holding device in the shift lever assembly is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

## DIAGNOSIS AND TESTING - BRAKE TRANSMISSION SHIFT INTERLOCK SYSTEM

1. Verify that the key can only be removed in the PARK position
2. When the shift lever is in PARK And the shift handle pushbutton is in the “OUT” position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.
3. Shifting out of PARK should not be possible when the ignition key cylinder is in the OFF position.
4. Shifting out of PARK should not be possible while applying normal pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12mm).
5. Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.
6. Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions.

# FLUID AND FILTER

## DIAGNOSIS AND TESTING

## EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation, and varnish buildup which interferes with valve and clutch operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

## CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has three primary causes.

1. Internal clutch slippage, usually caused by low line pressure, inadequate clutch apply pressure, or clutch seal failure.
2. A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged oil cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.
3. Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

## FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to replace contaminated converter after repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission, an overhaul is necessary.

The torque converter should be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

## STANDARD PROCEDURE

## FLUID LEVEL CHECK

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

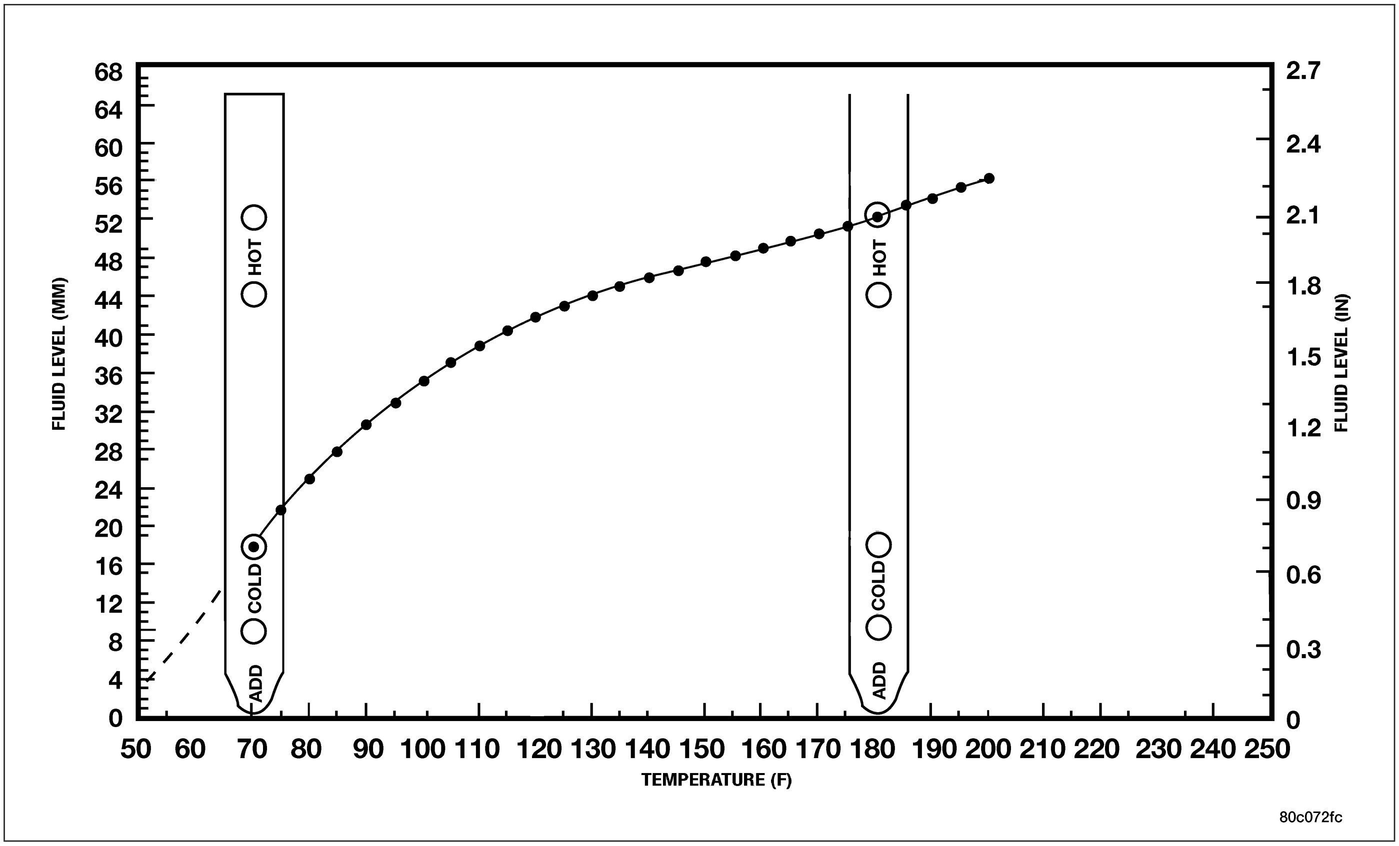
Improper filling can also raise the fluid level too high. When the transmssion has too much fluid, the geartrain churns up foam and cause the same conditions which occur with a low fluid level.

In either case, air bubbles can cause overheating and/or fluid oxidation, and varnishing. This can interfere with normal valve, clutch, and accumulator operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.

After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

The transmission has a dipstick to check oil level. It is located on the right side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

The torque converter fills in both the P (PARK) and N (NEUTRAL) positions. Place the selector lever in P (PARK) to be sure that the fluid level check is accurate. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground.** At normal operating temperature (approximately 82° C. or 180° F), the fluid level is correct if it is in the HOT region (cross-hatched area) on the oil level indicator. The fluid level will be approximately at the upper COLD hole of the dipstick at 21° C (70° F) fluid temperature.




**NOTE: Engine and Transmission should be at normal operating temperature before performing this procedure.**

1. Start engine and apply parking brake.
2. Shift the transmission into DRIVE for approximately 2 seconds.
3. Shift the transmission into REVERSE for approximately 2 seconds.
4. Shift the transmission into PARK.
5. Hook up scan tool and select transmission.
6. Select sensors.
7. Read the transmission temperature value.
8. Compare the fluid temperature value with the chart.
9. Adjust transmission fluid level shown on the dipstick according to the Transmission Fluid Temperature Chart.

**NOTE: After adding any fluid to the transmission, wait a minimum of 2 minutes for the oil to fully drain from the fill tube into the transmission before rechecking the fluid level.**

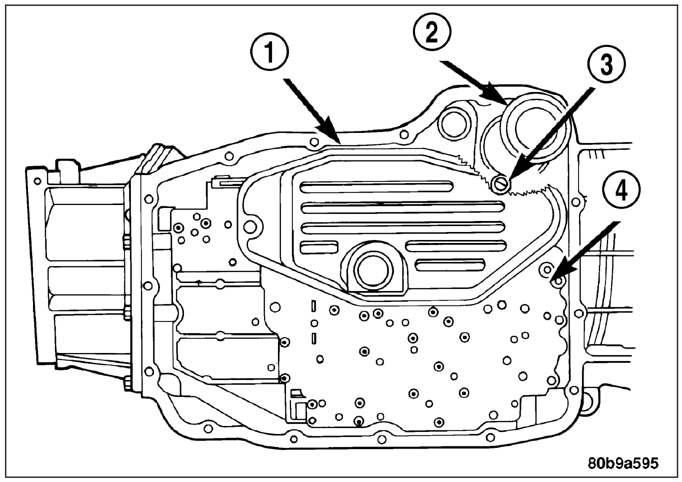
10. Check transmission for leaks.

## FLUID AND FILTER REPLACEMENT

For proper service intervals (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION).

### REMOVAL

1. Hoist and support vehicle on safety stands.
2. Place a large diameter shallow drain pan beneath the transmission pan.
3. Remove bolts holding front and sides of pan to transmission.
4. Loosen bolts holding rear of pan to transmission.
5. Slowly separate front of pan away from transmission allowing the fluid to drain into drain pan.
6. Hold up pan and remove remaining bolts holding pan to transmission.
7. While holding pan level, lower pan away from transmission.
8. Pour remaining fluid in pan into drain pan.
9. Remove the screw holding the primary oil filter (1) to valve body.
10. Separate filter from valve body and oil pump and pour fluid in filter into drain pan.
11. Inspect the oil filter seal in the bottom of the oil pump. If the seal is not installed completely in the oil pump, or is otherwise damaged, then remove and discard the oil filter seal from the bottom of the oil pump. If the seal is installed correctly and is in good condition, it can be reused.
12. If replacing the cooler return filter (2), use Oil Filter Wrench 8321 to remove the filter from the transmission.
13. Dispose of used trans fluid and filter(s) properly.




### INSPECTION

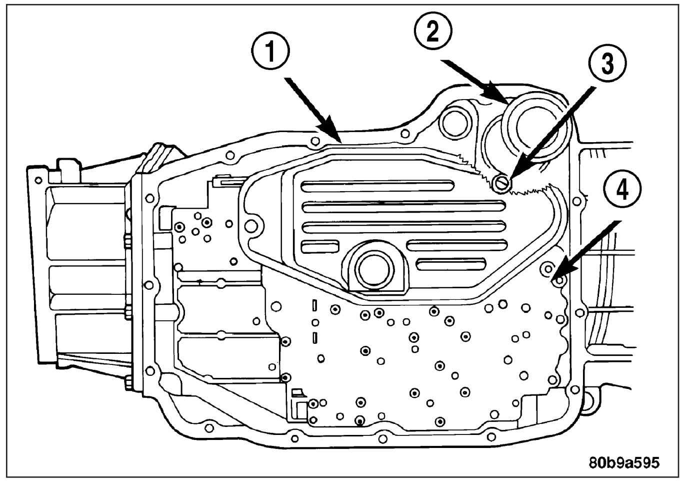
Inspect bottom of pan and magnet for excessive amounts of metal. A light coating of clutch material on the bottom of the pan does not indicate a problem unless accompanied by a slipping condition or shift lag. If fluid and pan are contaminated with excessive amounts of debris, refer to the diagnosis section of this group.

### CLEANING

1. Using a suitable solvent, clean pan and magnet.
2. Using a suitable gasket scraper, clean original sealing material from surface of transmission case and the transmission pan.

## INSTALLATION

**CAUTION: The primary oil filter seal MUST be fully installed flush against the oil pump body. DO NOT install the seal onto the filter neck and attempt to install the filter and seal as an assembly. Damage to the transmission will result.**




1. If necessary, install a new primary oil filter seal in the oil pump inlet bore. Seat the seal in the bore with a suitable tool (appropriately sized drift or socket, the butt end of a hammer, or other suitable tool).
2. Place replacement filter in position on valve body and into the oil pump.
3. Install screw to hold the primary oil filter (1) to valve body. Tighten screw to 4.5 N·m (40 in. lbs.) torque.
4. Install new cooler return filter (2) onto the transmission, if necessary. Torque the filter to 9.5 N·m (7 ft.lbs.).
5. Place bead of Mopar® RTV sealant onto the transmission case sealing surface.
6. Place pan in position on transmission.
7. Install bolts to hold pan to transmission. Tighten bolts to 12 N·m (105 in. lbs.) torque.
8. Lower vehicle and fill transmission with MOPAR® ATF +4.

## TRANSMISSION FILL

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

1. Remove dipstick and insert clean funnel in transmission fill tube.
2. Add following initial quantity of Mopar® ATF +4 to transmission:
   a. If only fluid and filter were changed, add **10 pints (5 quarts)** of ATF +4 to transmission.
   b. If transmission was completely overhauled and the torque converter was replaced or drained, add **24 pints (12 quarts)** of ATF +4 to transmission.
3. Check the transmission fluid (Refer to 21 - TRANSMISSION/AUTOMATIC - RFE/FLUID - STANDARD PROCEDURE) and adjust as required.

# CABLE-GEARSHIFT

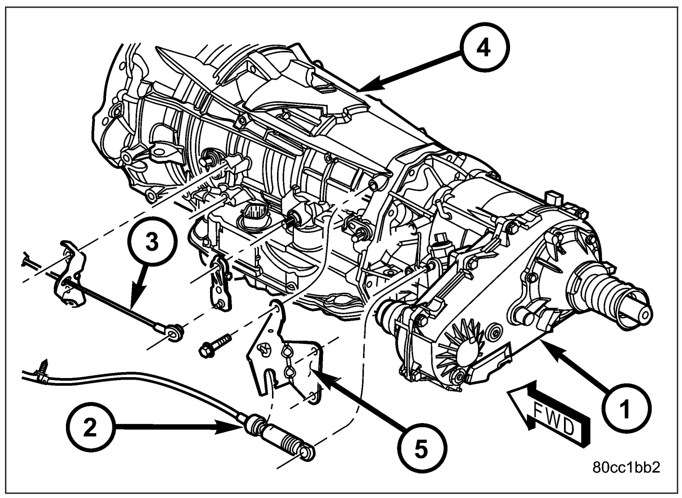
## DIAGNOSIS AND TESTING

### GEARSHIFT CABLE

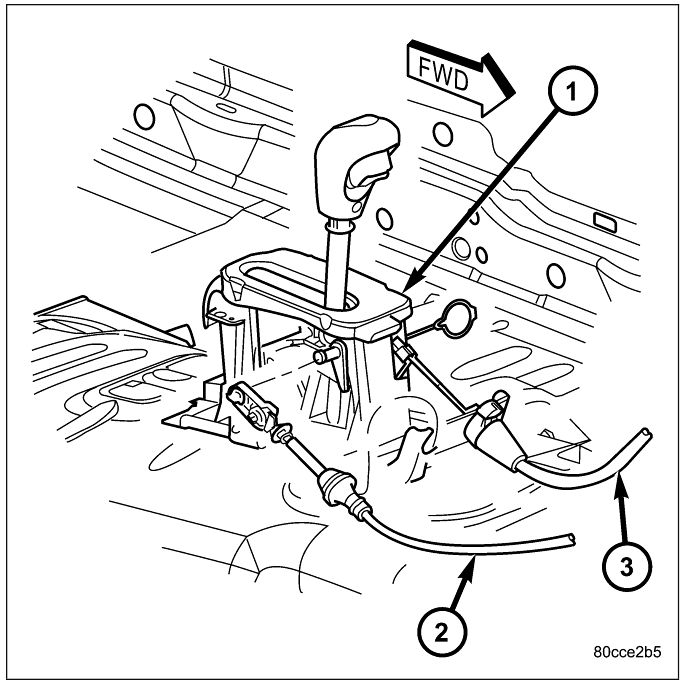
1. The floor shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.
2. Engine starts must be possible with floor shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.
3. With floor shift lever handle push-button not depressed and lever in:
   a. PARK position - Apply forward force on center of handle and remove pressure. Engine starts must be possible.
   b. PARK position - Apply rearward force on center of handle and remove pressure. Engine starts must be possible.
   c. NEUTRAL position - Normal position. Engine starts must be possible.
   d. NEUTRAL position - Engine running and brakes applied, apply forward force on center of shift handle. Transmission shall not be able to shift from NEUTRAL to REVERSE.

## REMOVAL

1. Shift transmission into PARK.
2. Raise vehicle.
3. Remove the shift cable eyelet from the transmission manual shift lever.
4. Remove shift cable from the cable support bracket.
5. Lower vehicle.
6. Remove necessary console parts for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
7. Disconnect cable at shift lever and shifter assembly bracket.
8. Remove the nuts holding the shift cable seal plate to the floor pan.

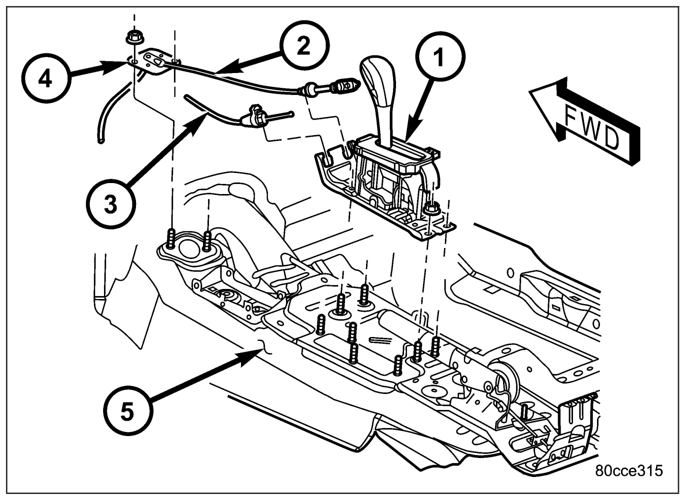


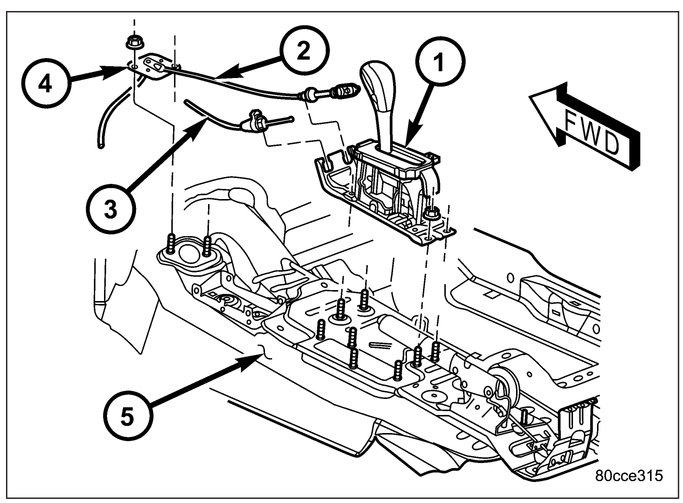
9. Pull cable through floor panel opening.
10. Remove shift cable from vehicle.



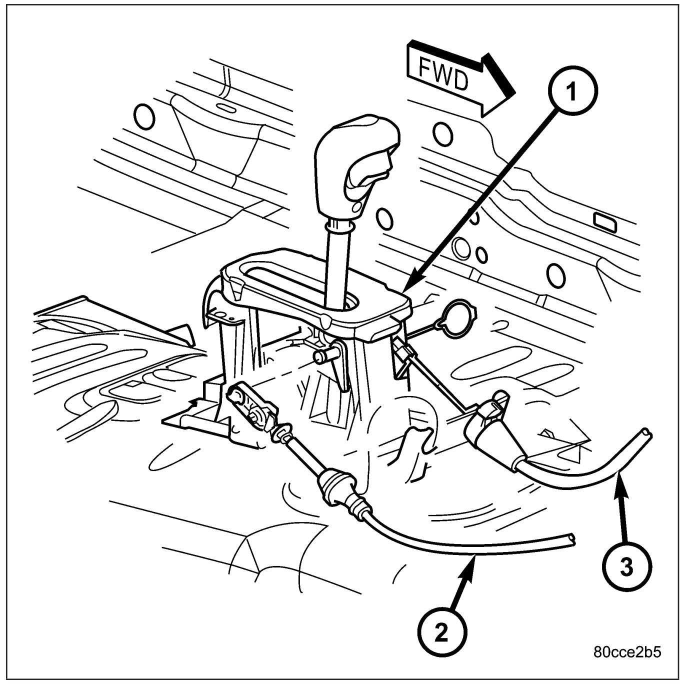

## INSTALLATION

1. Route cable through hole in floor pan.
2. Install seal plate to studs in floor pan.
3. Install nuts to hold seal plate to floor pan. Tighten nuts to 7 N·m (65 in.lbs.).
4. Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.
5. Place the floor shifter lever in PARK position.
6. Loosen the adjustment screw on the shift cable.
7. Snap the shift cable onto the shift lever pin.



8. Raise the vehicle.
9. Install the shift cable to the shift cable support bracket.
10. Shift the transmission into PARK. PARK is the rearmost detent position on the transmission manual shift lever.
11. Snap the shift cable onto the transmission manual shift lever.
12. Lower vehicle.
13. Verify that the shift lever is in the PARK position.
14. Tighten the adjustment screw to 7 N·m (65 in.lbs.).
15. Verify correct shifter operation.
16. Install any console parts removed for access to shift lever assembly and shift cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

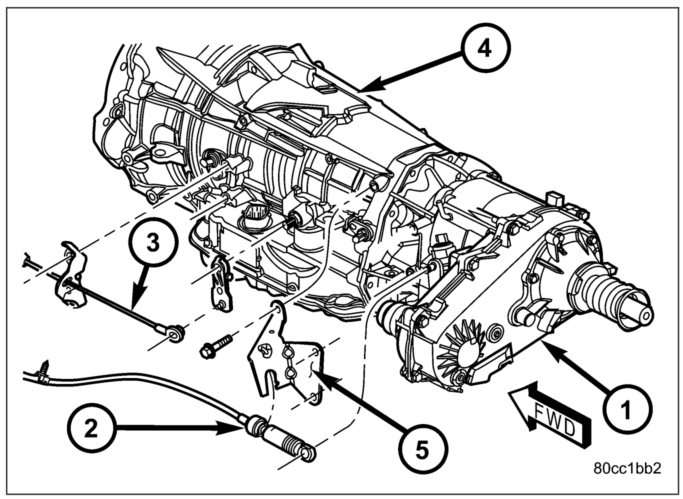



## ADJUSTMENTS - GEARSHIFT CABLE

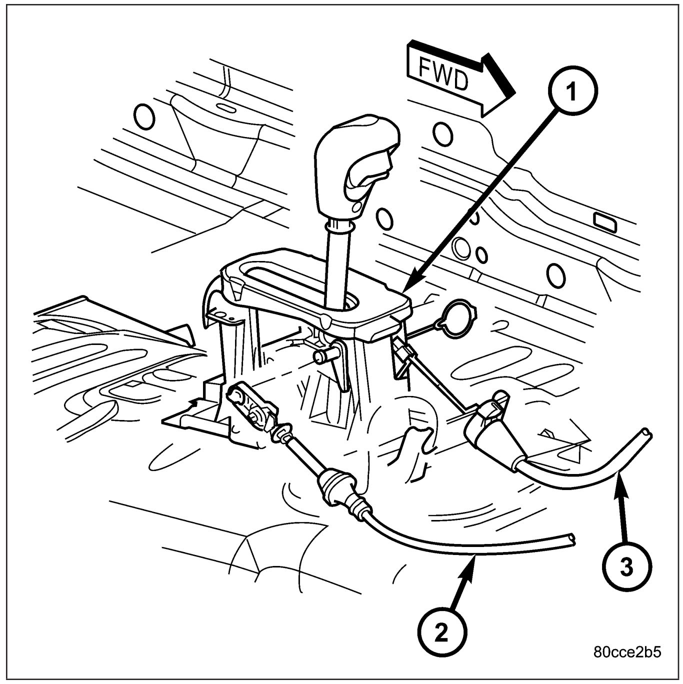
Check adjustment by starting the engine in PARK and NEUTRAL. Adjustment is CORRECT if the engine starts only in these positions. Adjustment is INCORRECT if the engine starts in one but not both positions. If the engine starts in any position other than PARK or NEUTRAL, or if the engine will not start at all, the TRS may be faulty.

### Gearshift Adjustment Procedure

1. Shift transmission into PARK.
2. Remove floor console as necessary for access to the shift cable adjustment. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
3. Loosen the shift cable adjustment screw.

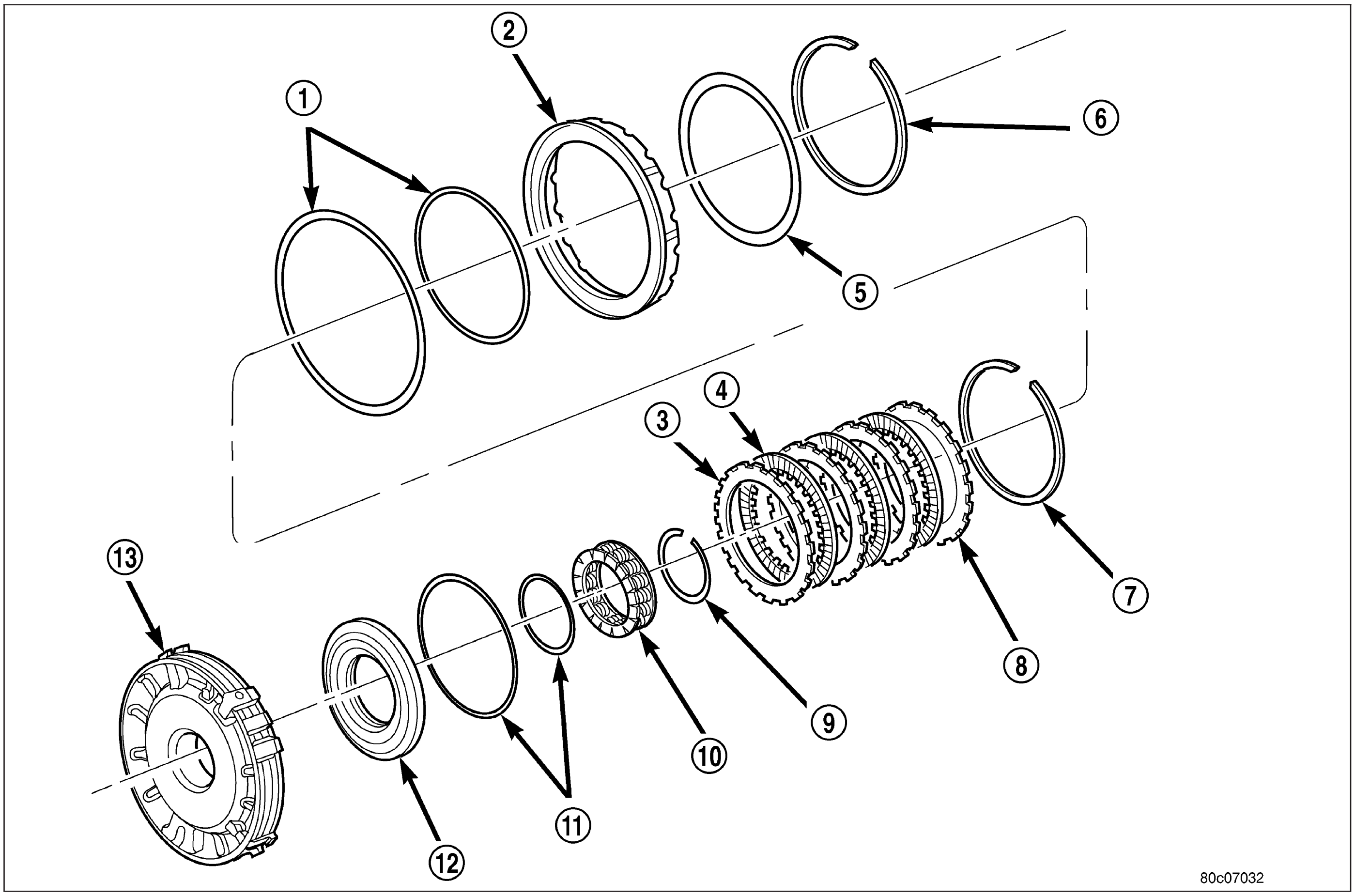


4. Raise vehicle.
5. Unsnap cable eyelet from transmission shift lever.
6. Verify transmission shift lever is in PARK detent by moving lever fully rearward. Last rearward detent is PARK position.
7. Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.
8. Snap cable eyelet onto transmission shift lever.
9. Lower vehicle
10. Tighten the shift cable adjustment screw to 7 N·m (65 in.lbs.).
11. Verify correct operation.
12. Install any floor console components removed for access. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

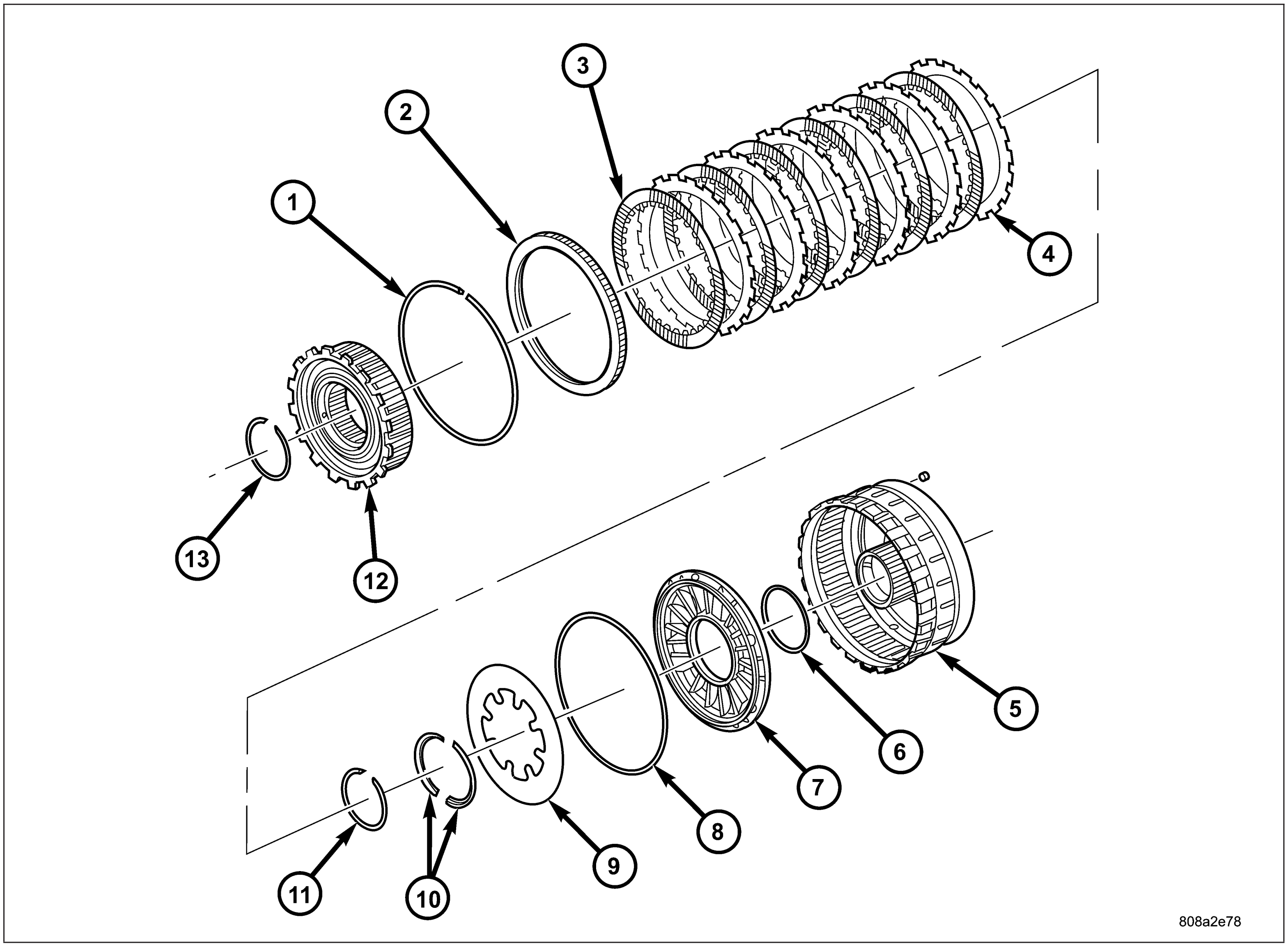


# CLUTCHES-HOLDING

## DESCRIPTION




Three hydraulically applied multi-disc clutches are used to hold some planetary geartrain components stationary while the input clutches drive others. The 2C, 4C, and Low/Reverse clutches are considered holding clutches. The 2C and 4C clutches are located in the 4C retainer/bulkhead (13).




The Low/Reverse clutch is located at the rear of the transmission case.

# OPERATION

## 2C CLUTCH

The 2C clutch is hydraulically applied in second and fifth gear by pressurized fluid against the 2C piston. When the 2C clutch is applied, the reverse sun gear assembly is held or grounded to the transmission case by holding the reaction planetary carrier.

## 4C CLUTCH

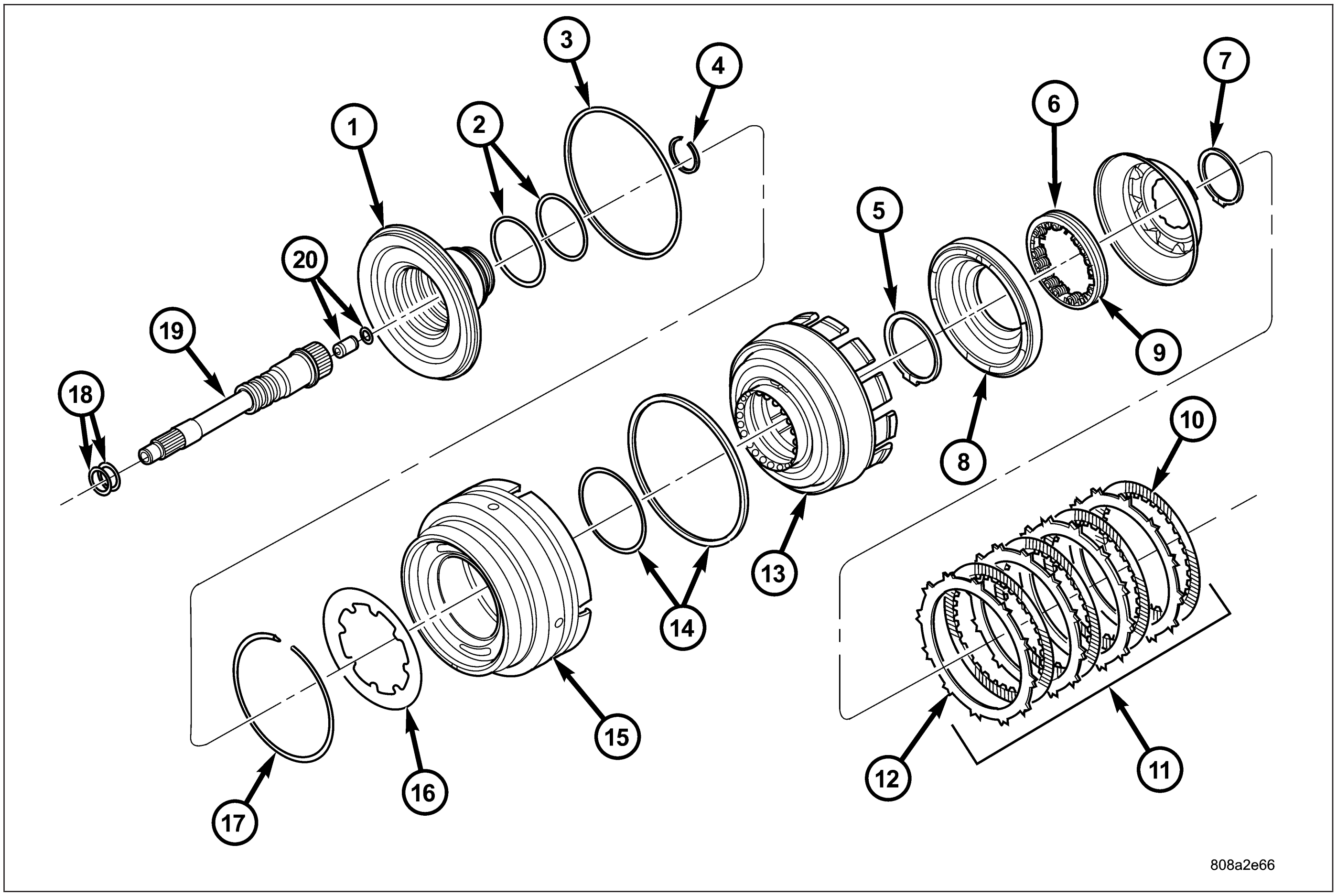
The 4C clutch is hydraulically applied in second prime and fourth gear by pressurized fluid against the 4C clutch piston. When the 4C clutch is applied, the reaction annulus gear is held or grounded to the transmission case.

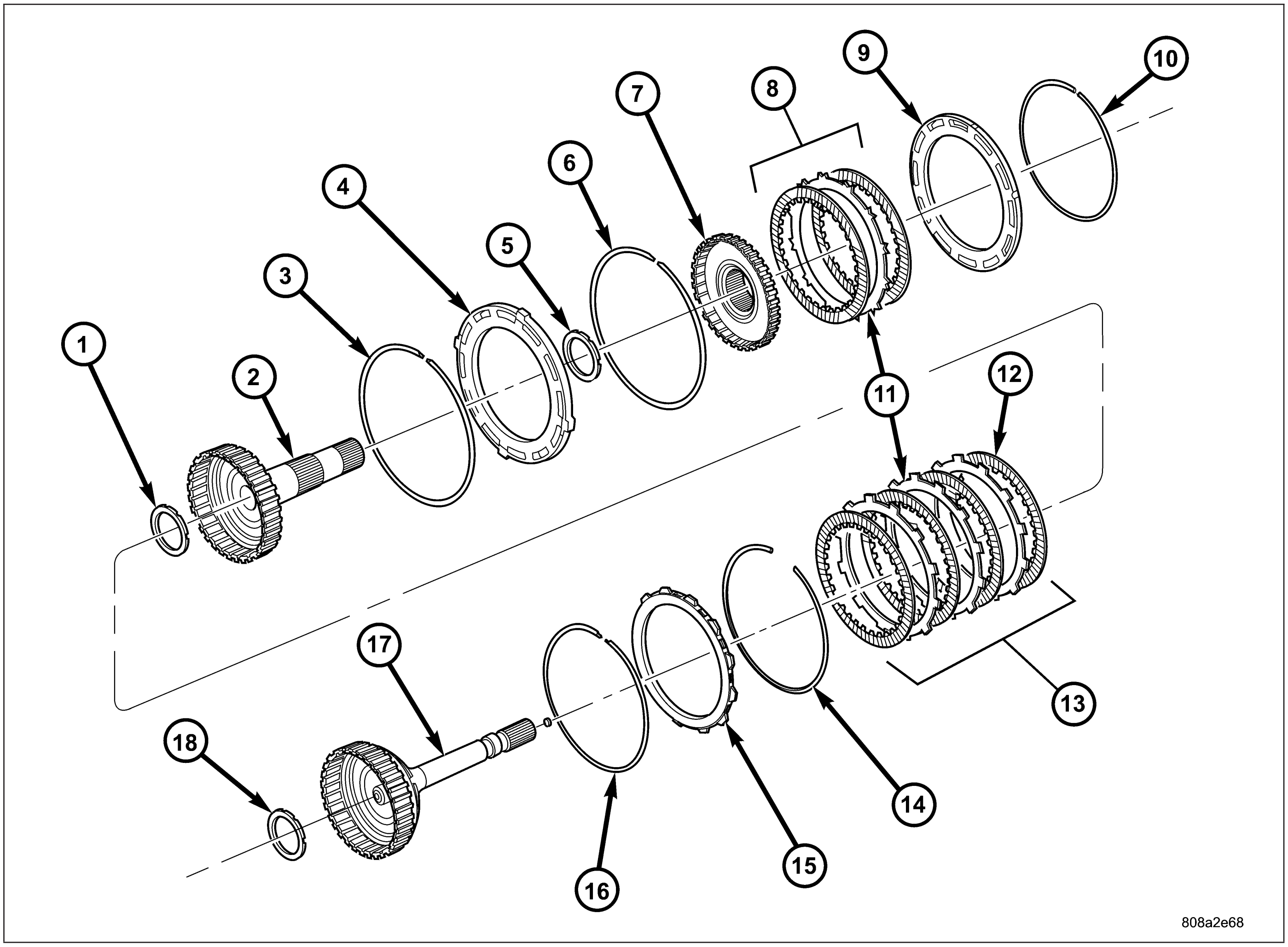
## LOW/REVERSE CLUTCH

The Low/Reverse clutch is hydraulically applied in park, reverse, neutral, and first gear, only at low speeds, by pressurized fluid against the Low/Reverse clutch piston. When the Low/Reverse clutch is applied, the input annulus assembly is held or grounded to the transmission case.

# ASSEMBLY-INPUT CLUTCH

## DESCRIPTION






Three hydraulically applied input clutches are used to drive planetary components. The underdrive, overdrive, and reverse clutches are considered input clutches and are contained within the input clutch assembly.

The input clutch assembly also contains:

- Input shaft
- Input hub
- Clutch retainer
- Underdrive piston
- Overdrive/reverse piston
- Overdrive hub
- Underdrive hub

## OPERATION

The three input clutches are responsible for driving different components of the planetary geartrain.

### UNDERDRIVE CLUTCH

The underdrive clutch is hydraulically applied in first, second, second prime, and third (direct) gears by pressurized fluid against the underdrive piston. When the underdrive clutch is applied, the underdrive hub drives the input sun gear.

### OVERDRIVE CLUTCH

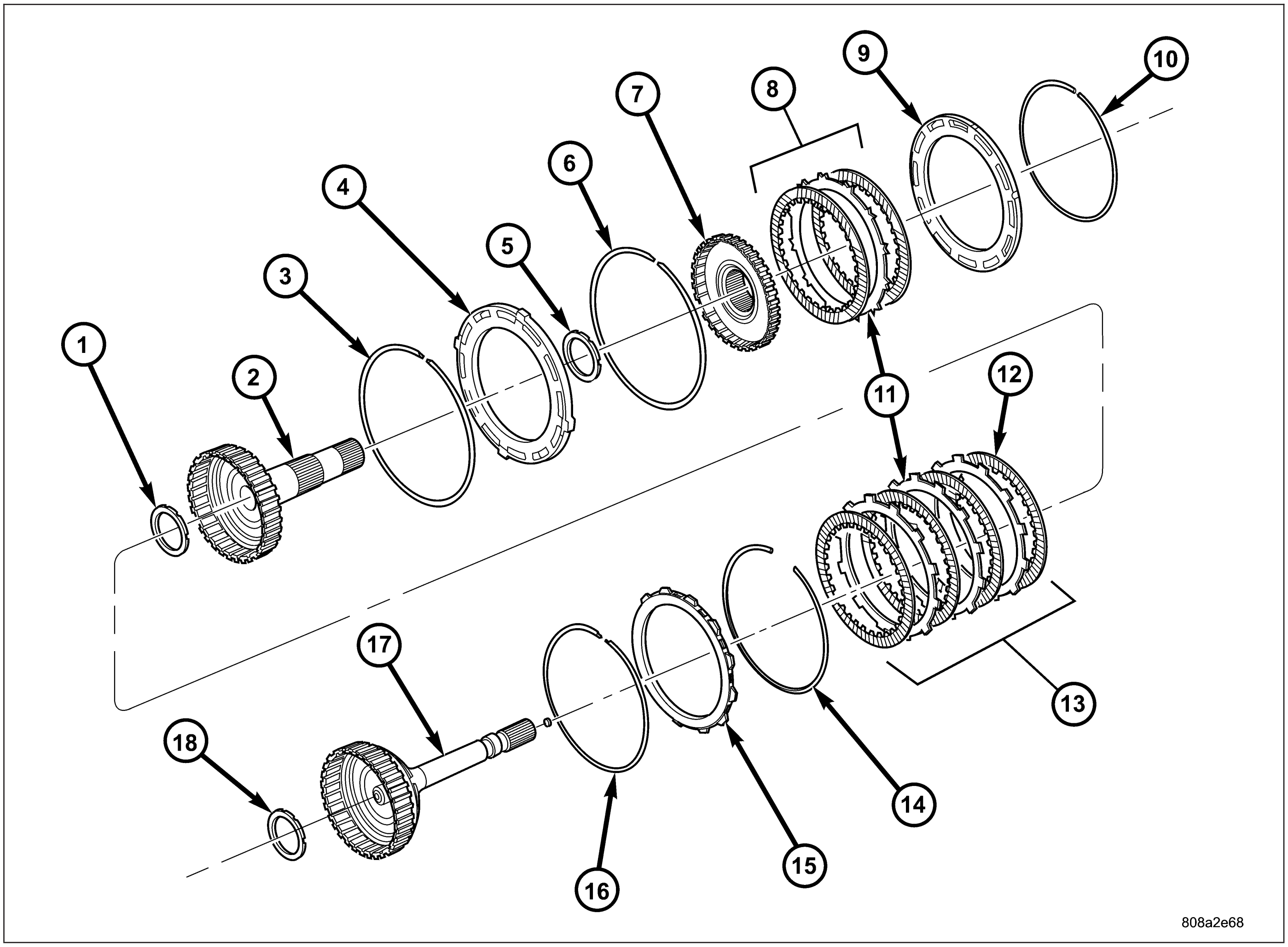
The overdrive clutch is hydraulically applied in third (direct), fourth, and fifth gears by pressurized fluid against the overdrive/reverse piston. When the overdrive clutch is applied, the overdrive hub drives the reverse carrier/input annulus assembly.

## REVERSE CLUTCH

The reverse clutch is hydraulically applied in reverse gear by pressurized fluid against the overdrive/reverse piston. When the reverse clutch is applied, the reaction annulus gear is driven.

## DISASSEMBLY

**NOTE: If the input clutch assembly is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Quick Learn Procedure using the scan tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).**

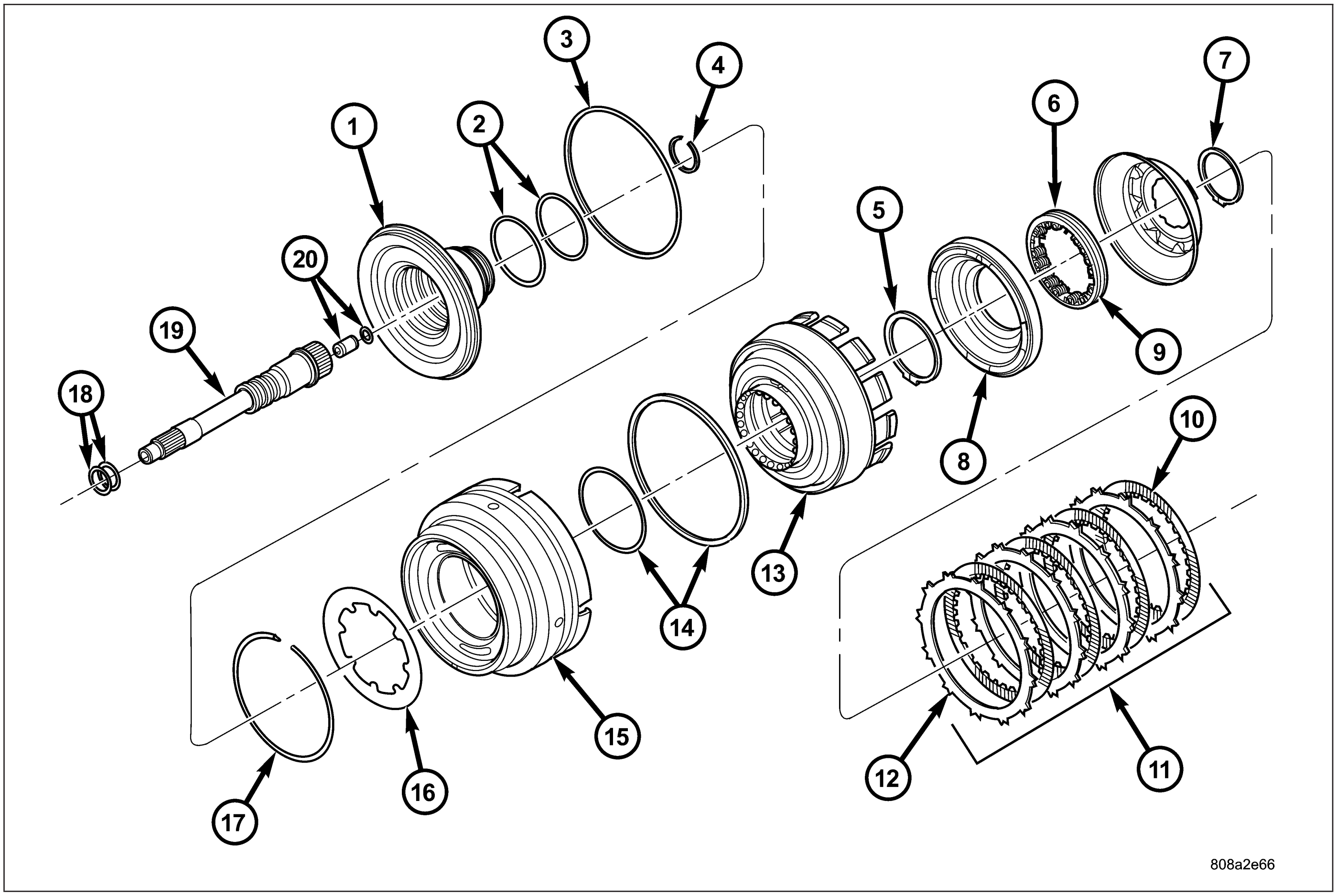



1. Remove the reverse reaction plate selective snap-ring (10) from the input clutch retainer (13).
2. Remove the reverse reaction plate (9) from the input clutch retainer.
3. Remove the reverse hub (7) and reverse clutch pack (8) from the input clutch retainer.
4. Remove the number 4 thrust bearing (5) from the overdrive hub (2).
5. Remove the overdrive hub (2) from the input clutch retainer.
6. Remove the number 3 thrust bearing (1) from the underdrive hub (17).
7. Remove the OD/reverse reaction plate snap-ring (6) from the input clutch retainer.
8. Remove the underdrive hub (17), overdrive clutch (13), and overdrive reaction plate (15) from the input clutch retainer.

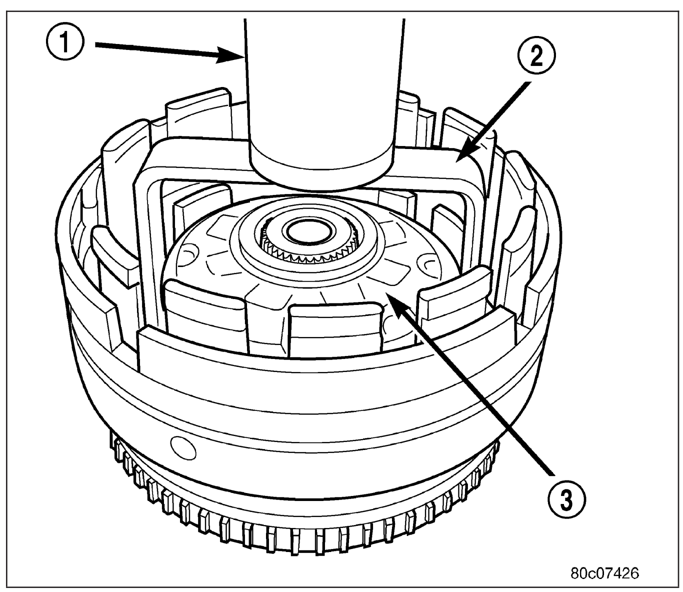
**NOTE: The overdrive friction discs and steel discs are thicker than the matching components in the underdrive and reverse clutches.**

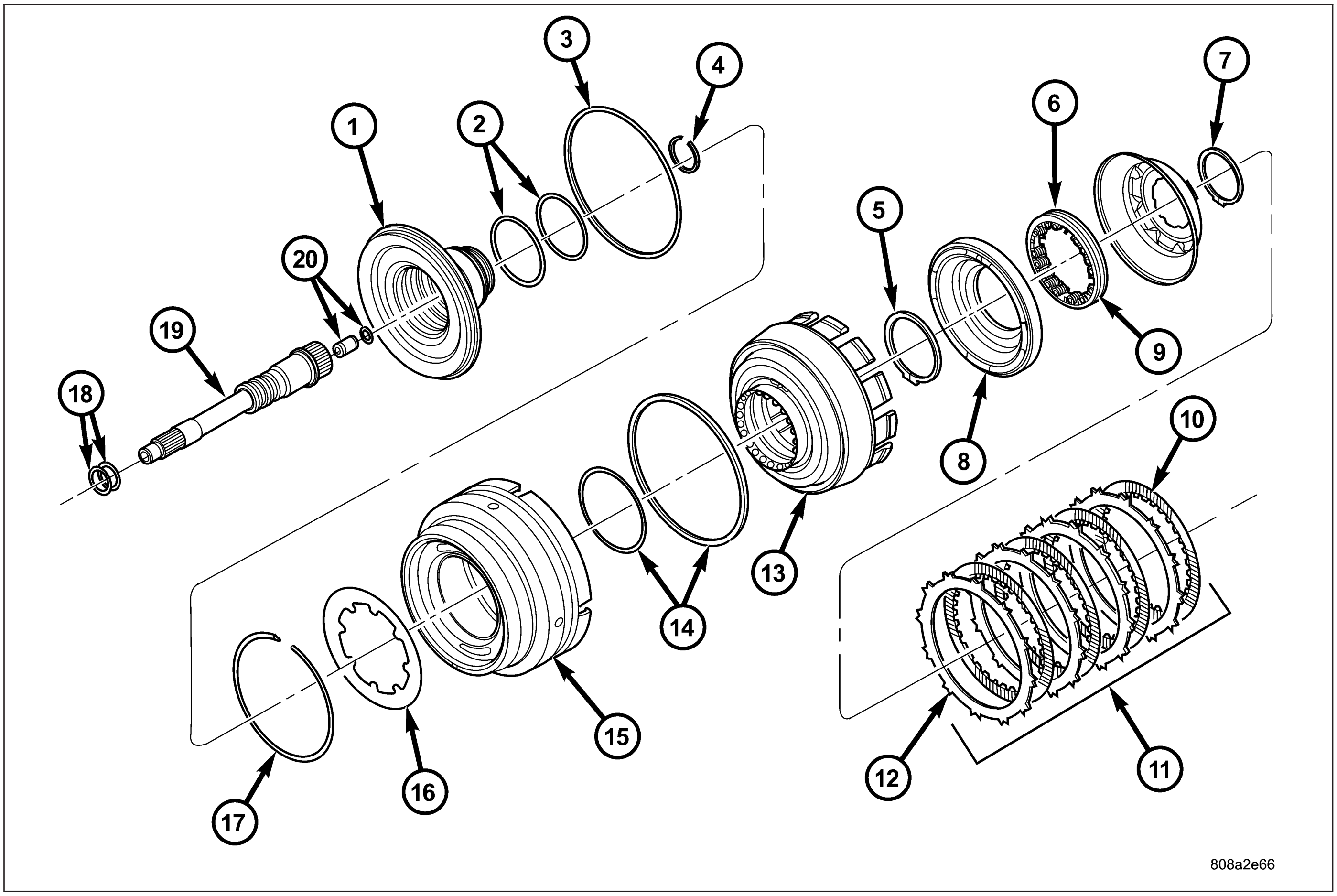
9. Remove the number 2 thrust bearing (18) from the input clutch hub.

10. Remove the overdrive clutch wave snap-ring (3) from the input clutch retainer.
11. Remove the UD/OD reaction plate tapered snap-ring (14) from the input clutch retainer (13).
12. Remove the UD/OD reaction plate (15) from the input clutch retainer.
13. Remove the UD/OD reaction plate flat snap-ring (16) from the input clutch retainer.




14. Remove the underdrive clutch pack (11) from the input clutch retainer (13).
15. Using Spring Compressor 8251 (2) , compress the UD/OD balance piston (3) and remove the snap-ring from the input clutch hub.



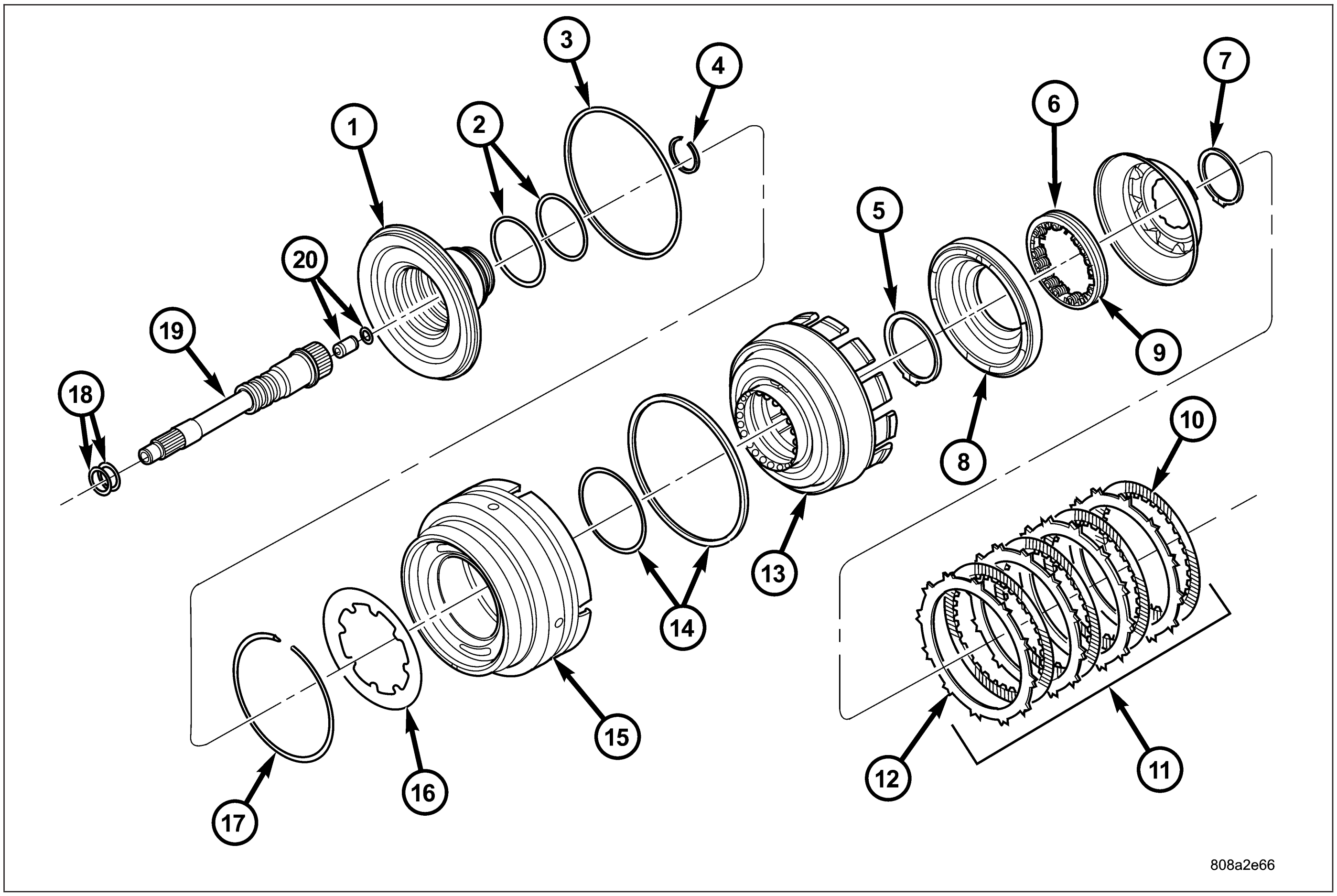



16. Remove the UD/OD balance piston (6) and piston return spring (9) from the input clutch retainer (13).
17. Remove the underdrive piston (8) from the input clutch retainer (13).

**NOTE: Both the UD/OD balance piston and the underdrive piston have seals molded onto them. If the seal is damaged, do not attempt to install a new seal onto the piston. The piston/seal must be replaced as an assembly.**

18. Remove the input clutch retainer tapered snap-ring (5).
19. Separate input clutch retainer (13) from input clutch hub (1).
20. Separate OD/reverse piston (15) from input clutch hub retainer (13).
21. Remove all seals and o-rings from the input shaft and input hub. The o-rings on the input hub are color coded. Be sure to make note of which o-ring belongs in which location.

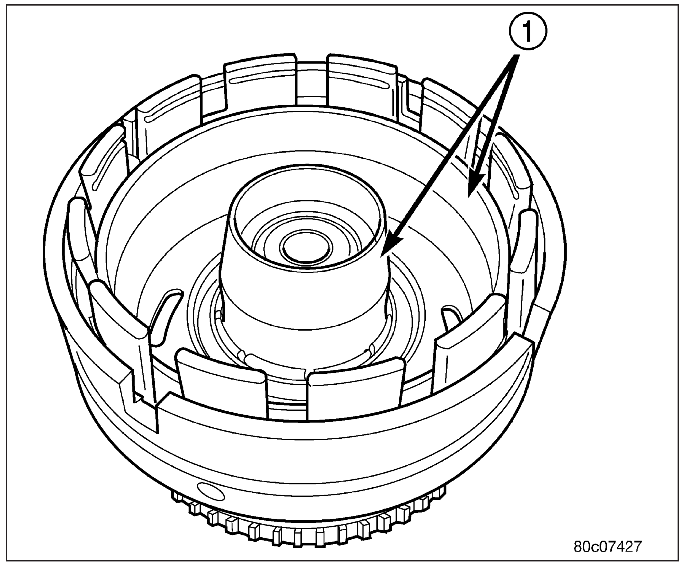
## ASSEMBLY



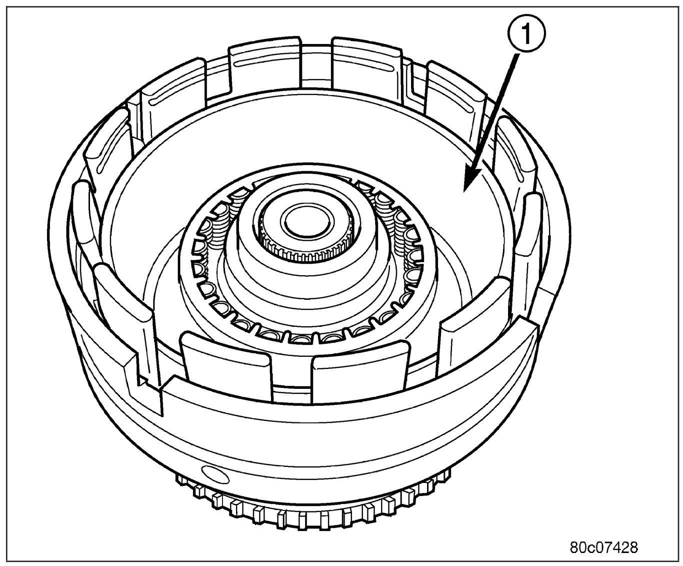

**NOTE: Install all new seals and o-rings onto the input shaft and input hub. The o-rings on the input hub are color coded. Be sure to install the correct o-ring in the correct location.**

1. Check the transmission lubrication check valve (20) located in the input shaft using shop air. The valve should only allow air flow in one direction. If the valve allows no air flow, or air flow in both directions, the valve will need to be replaced.
2. Lubricate all seals with Mopar® ATF +4, Automatic Transmission Fluid, prior to installation.
3. Assemble the OD/reverse piston (15) onto the input clutch hub (1).
4. Assemble the input clutch retainer (13) onto the input clutch hub (1).
5. Install the input clutch retainer tapered snap-ring (5) with tapered side up onto the input clutch hub (1).

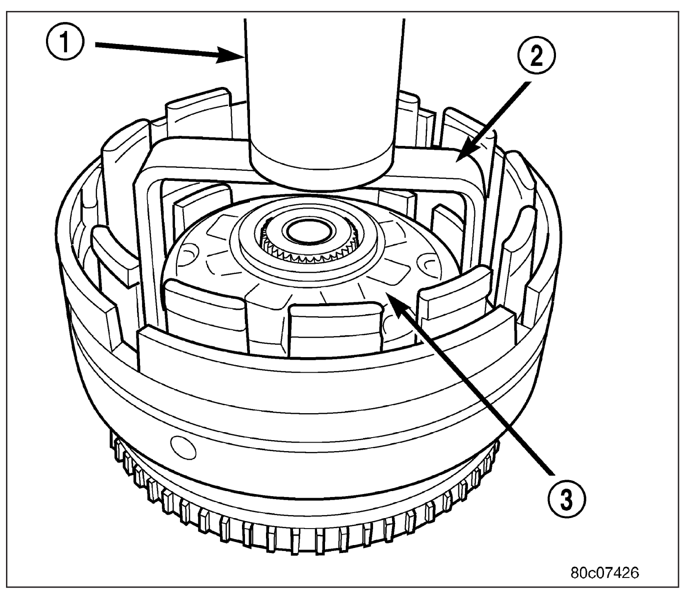
6. Install Piston Installer 8504 (1) into the input clutch retainer and onto the input clutch hub to guide the inner and outer underdrive piston seals into position.
7. Install the underdrive piston into the input clutch retainer and over the input clutch hub.

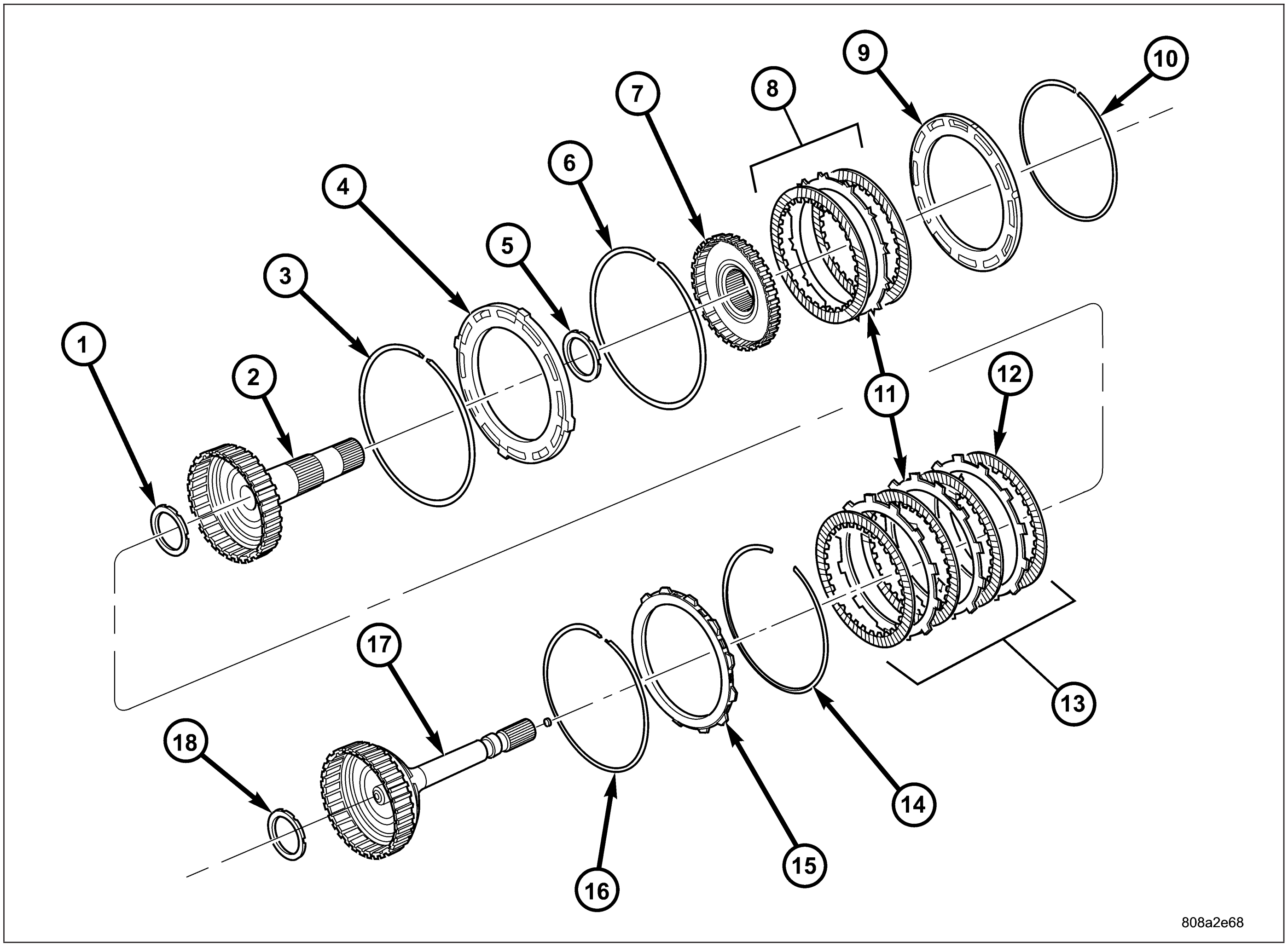



8. Install the UD/OD balance piston return spring pack into the input clutch retainer.
9. Install Piston Installer 8252 (1) into the input clutch retainer to guide the UD/OD balance piston seal into position inside the underdrive piston.

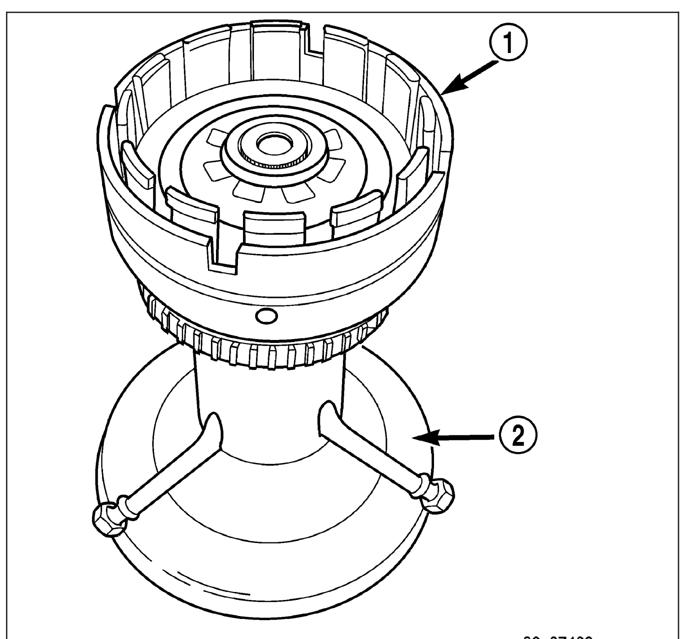



10. Install the UD/OD balance piston (3) into the input clutch retainer and the underdrive piston.
11. Using Spring Compressor 8251 (2), compress the UD/OD return spring pack and secure the piston in place with the snap-ring.
12. Install the underdrive clutch pack into the input clutch retainer.

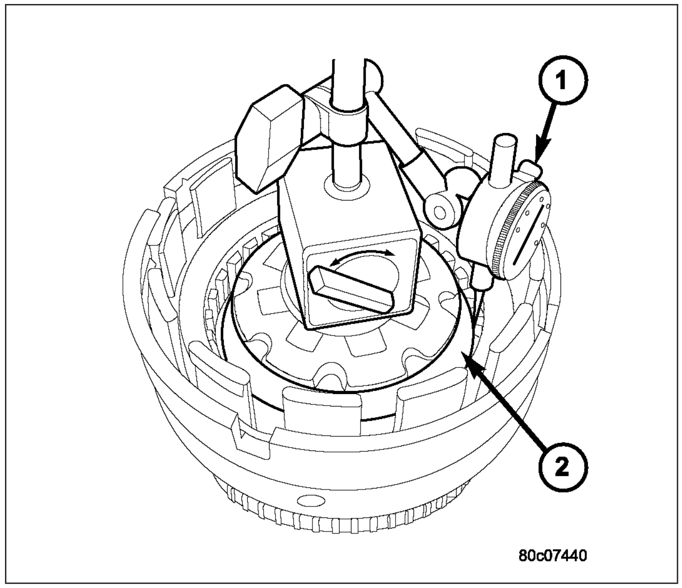


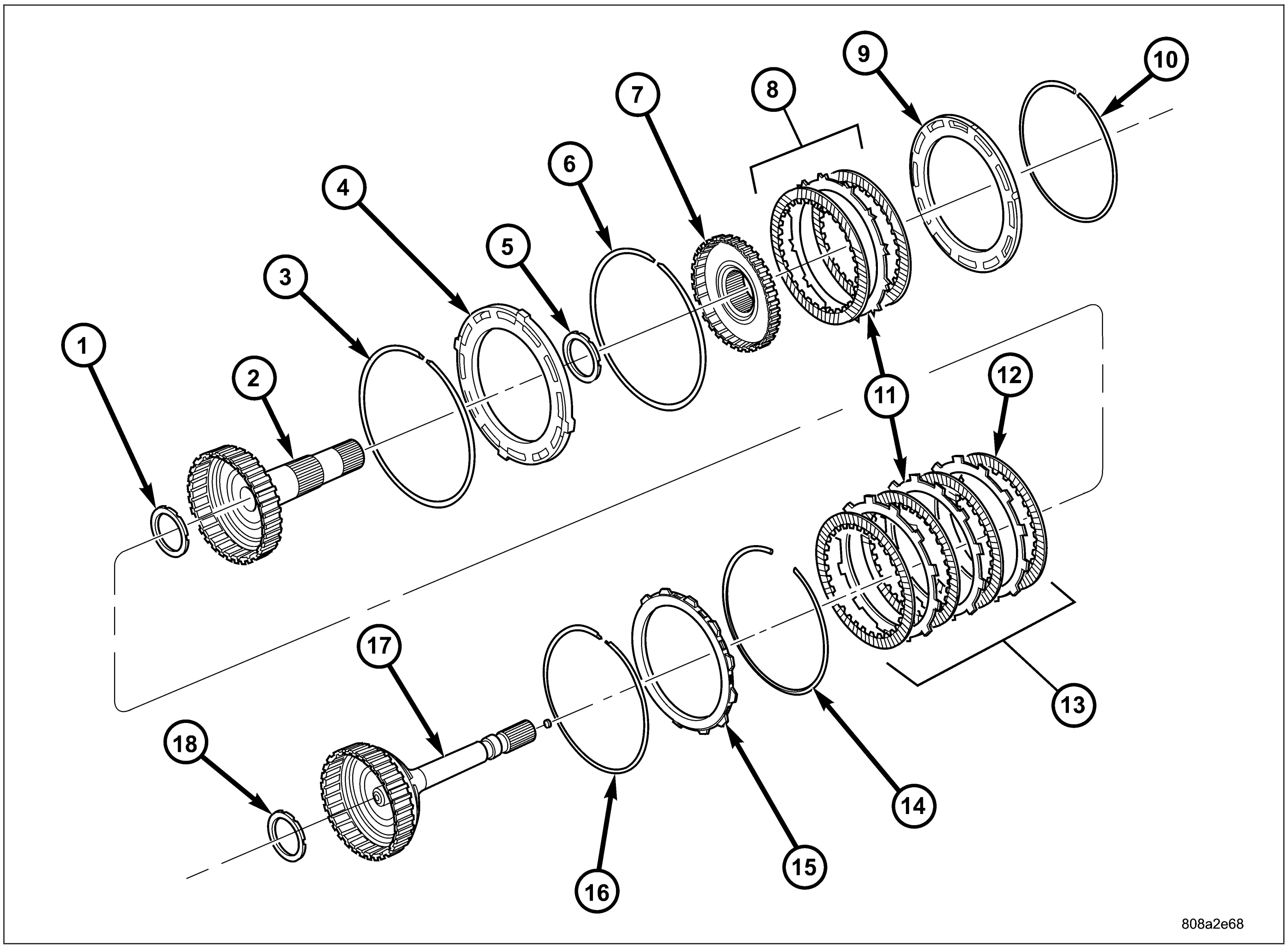



13. Install the UD/OD reaction plate lower flat snap-ring (16). The correct snap-ring can be identified by the two tabbed ears.
14. Install the UD/OD reaction plate (15) into the input clutch retainer. The reaction plate is to be installed with the big step down.
15. Install the UD/OD reaction plate upper tapered snap-ring (14) with tapered side up.
16. Install the input clutch assembly into Input Clutch Pressure Fixture 8260 (2).



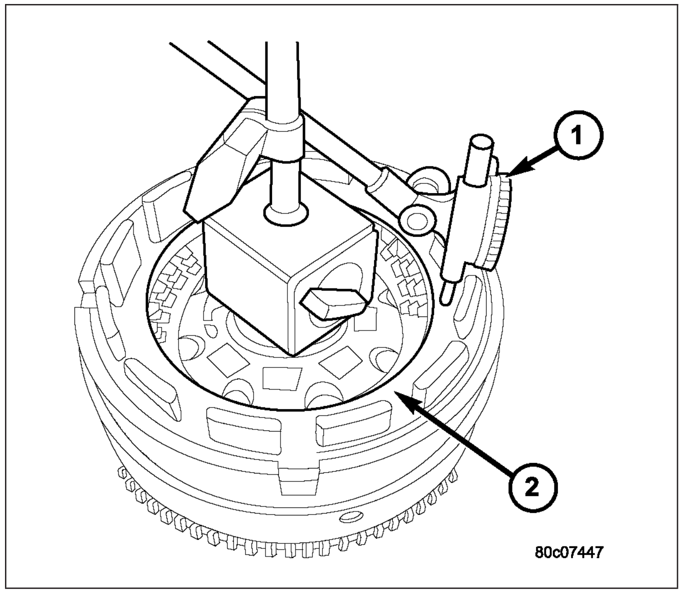
17. Mount a dial indicator to the assembly, push down on the clutch discs and zero the indicator against the underdrive clutch discs. Apply 20 psi of air pressure to the underdrive clutch and record the dial indicator reading. Measure and record UD clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with UD clutch pack clearance specification. The correct clutch clearance is 0.84-1.54 mm (0.033-0.061 in.). The reaction plate is not selective. If the clutch clearance is not within specification, replace the reaction plate along with all the friction and steel discs.



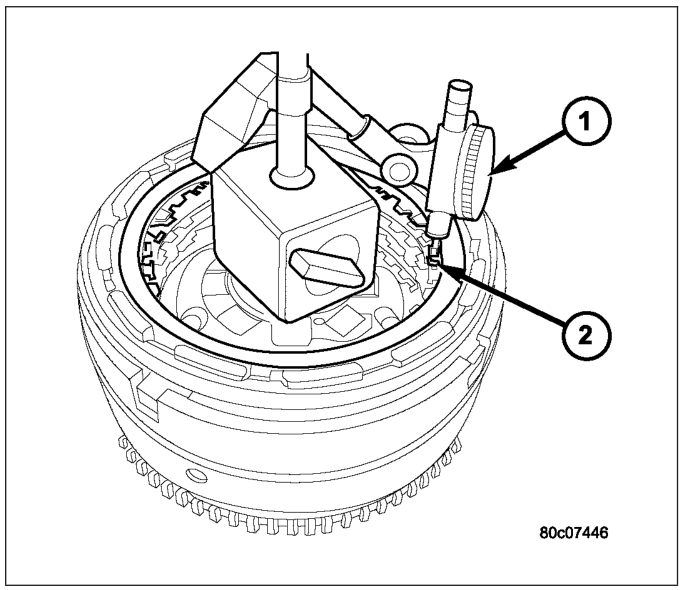



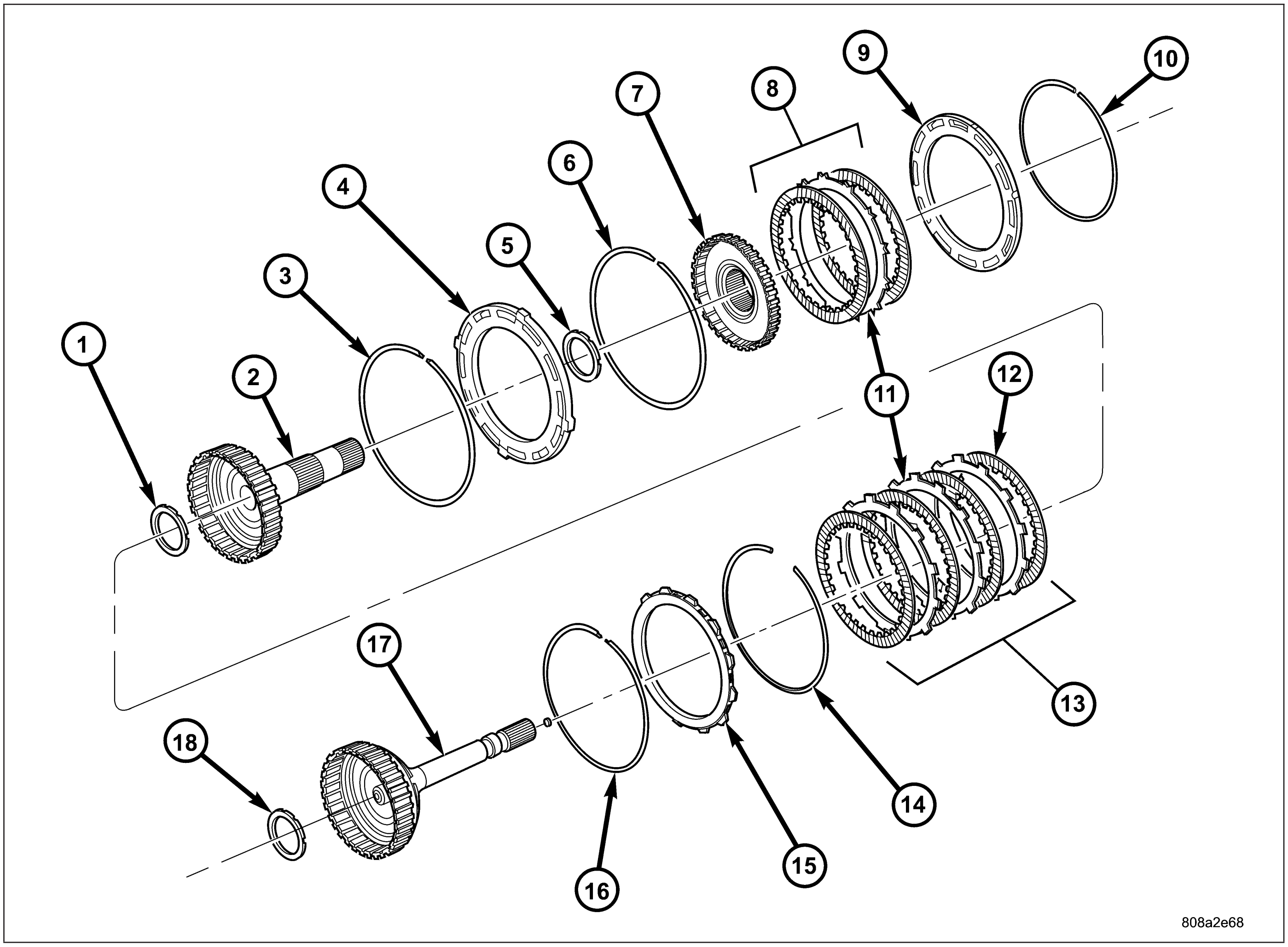

18. Install the overdrive clutch pack (13) into the input clutch retainer. The overdrive steel separator plates can be identified by the lack of the half-moon cuts in the locating tabs.
19. Install the overdrive clutch wavy snap-ring (3) with the two tabbed ears into the input clutch retainer.
20. Install the OD/reverse reaction plate (4) into the input clutch retainer. The reaction plate is non-directional.
21. Install the OD/reverse reaction plate flat snap-ring (6) into the input clutch retainer.

22. Mount a dial indicator to the assembly and zero the indicator against the OD/reverse reaction plate (2). Apply 20 psi of air pressure to the overdrive clutch and record the dial indicator reading. Measure and record OD clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with OD clutch pack clearance specification.Verify that the clutch clearance is 1.103-1.856 mm (0.043-0.073 in.). The reaction plate is not selective. If the clutch clearance is not within specification, replace the reaction plate along with all the friction and steel discs.




23. Install the reverse clutch pack into the input clutch retainer.
24. Install the reverse reaction plate into the input clutch retainer.
25. Install the reverse reaction plate selective snap-ring into the input clutch retainer.
26. Mount a dial indicator to the assembly, push down on the clutch discs, pull up on the reaction plate to ensure the plate is properly seated and zero the indicator against the reverse clutch discs (2). Apply 20 psi of air pressure to the reverse clutch and record the dial indicator reading. Measure and record Reverse clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with Reverse clutch pack clearance specification. The correct clutch clearance is 0.81-1.24 mm (0.032-0.049 in.). Adjust as necessary. Install the chosen snap-ring and re-measure to verify selection.






27. Remove the reverse clutch pack (8) from the input clutch retainer.
28. Install the number 2 thrust bearing (18) onto the underdrive hub (17) with outer race against the hub with petroleum jelly.
29. Install the underdrive hub (17) into the input clutch retainer.
30. Install the number 3 thrust bearing (1) into the overdrive hub (2) with the outer race against the hub with petroleum jelly.
31. Install the overdrive hub (2) into the input clutch retainer.
32. Install the number 4 thrust bearing (5) into the reverse hub with outer race against the hub with petroleum jelly.
33. Install the reverse hub (7) into the input clutch retainer.
34. Install the complete reverse clutch pack (8).
35. Install the reverse reaction plate (9) and snap-ring (10).
36. Push up on reaction plate to allow reverse clutch to move freely.

# SENSOR-INPUT SPEED

## DESCRIPTION

The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

## OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

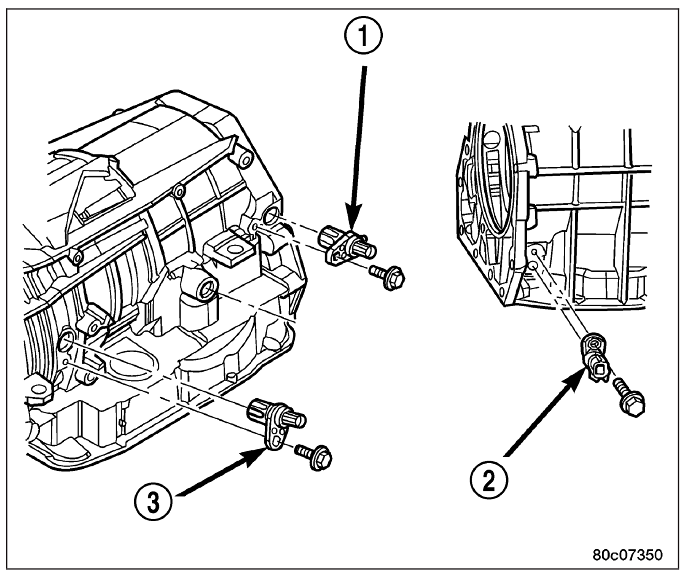
- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

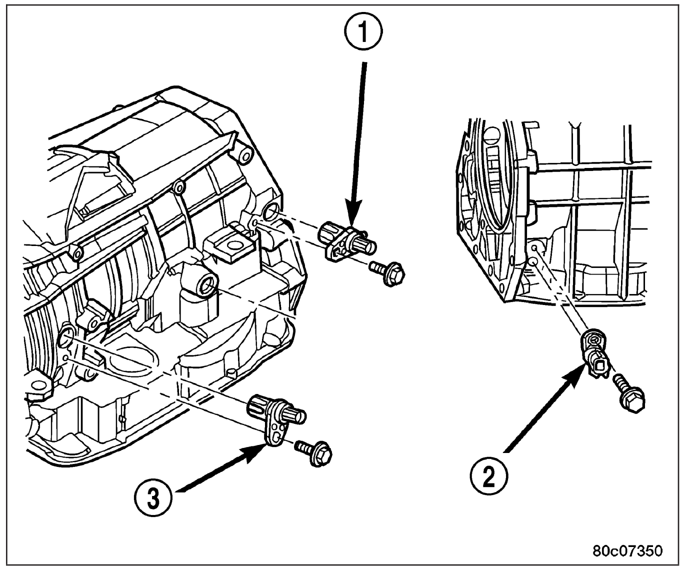
## REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the input speed sensor (3).
4. Remove the bolt holding the input speed sensor to the transmission case.
5. Remove the input speed sensor (3) from the transmission case.



## INSTALLATION

1. Install the input speed sensor (3) into the transmission case.
2. Install the bolt to hold the input speed sensor (3) into the transmission case. Tighten the bolt to 12 N·m (105 in.lbs.).
3. Install the wiring connector onto the input speed sensor.
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.



# SENSOR-LINE PRESSURE (LP)

## DESCRIPTION

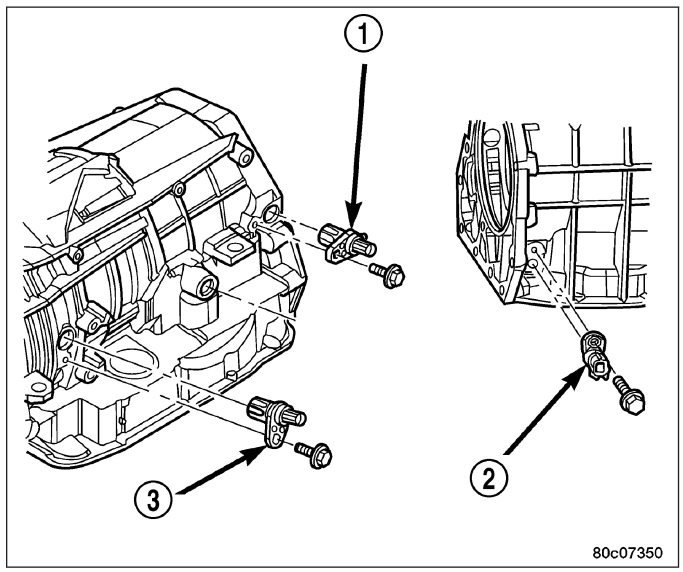
The TCM utilizes a closed-loop system to control transmission line pressure. The system contains a variable force style solenoid, the Pressure Control Solenoid, mounted on the side of the solenoid and pressure switch assembly. The solenoid is duty cycle controlled by the TCM to vent the unnecessary line pressure supplied by the oil pump back to the sump. The system also contains a variable pressure style sensor, the Line Pressure Sensor, which is a direct input to the TCM. The line pressure solenoid monitors the transmission line pressure and completes the feedback loop to the TCM. The TCM uses this information to adjust its control of the pressure control solenoid to achieve the desired line pressure.

## OPERATION

The TCM calculates the desired line pressure based upon inputs from the transmission and engine. The TCM calculates the torque input to the transmission and uses that information as the primary input to the calculation. The line pressure is set to a predetermined value during shifts and when the transmission is in the PARK and NEUTRAL positions. This is done to ensure consistent shift quality. During all other operation, the actual line pressure is compared to the desired line pressure and adjustments are made to the pressure control solenoid duty cycle.

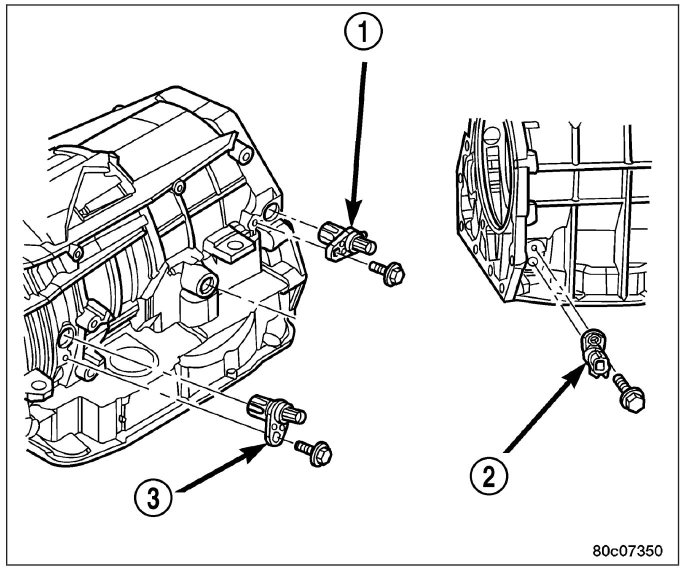
## REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the line pressure sensor (2).
4. Remove the bolt holding the line pressure sensor (2) to the transmission case.
5. Remove the line pressure sensor (2) from the transmission case.



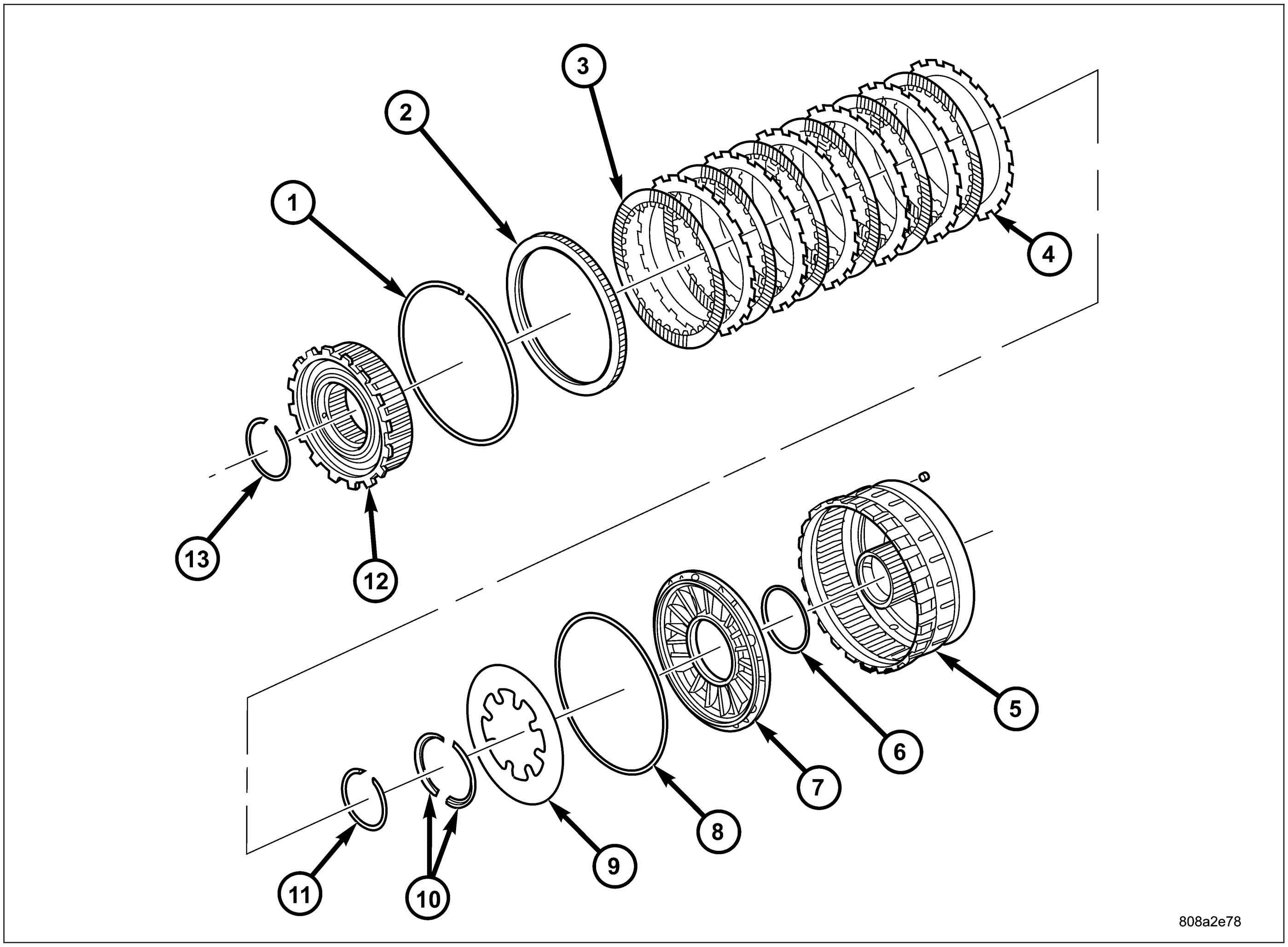
## INSTALLATION

1. Install the line pressure sensor (2) into the transmission case.
2. Install the bolt to hold the line pressure sensor (2) into the transmission case. Tighten the bolt to 12 N·m (105 in.lbs.).
3. Install the wiring connector onto the line pressure sensor (2).
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.



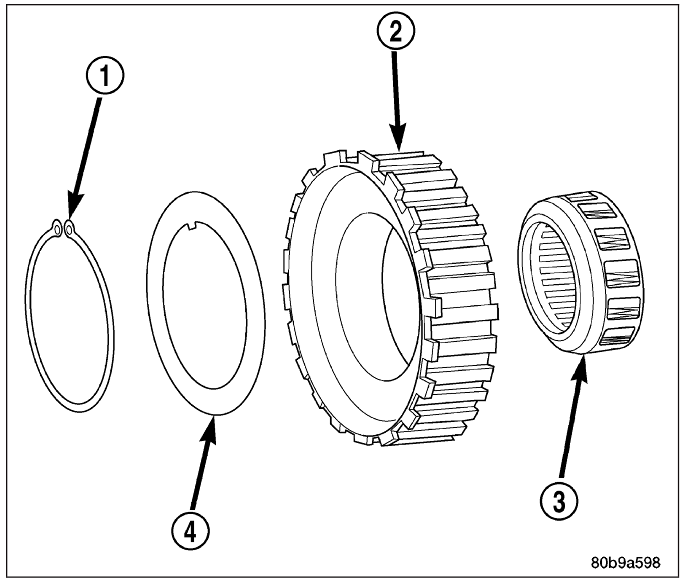
# CLUTCH-LOW/REVERSE

## DISASSEMBLY

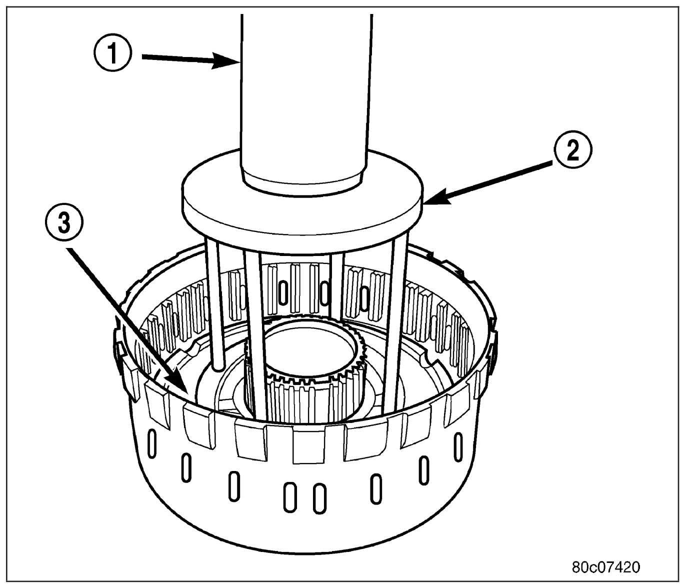



1. Remove the inner overrunning clutch snap-ring (13) from the low/reverse clutch retainer (5).
2. Remove the outer low/reverse reaction plate flat snap-ring (1).
3. Remove the low/reverse clutch (3, 4) and the overrunning clutch (12) from the low/reverse clutch retainer (5) as an assembly.
4. Separate the low/reverse clutch (3, 4) from the overrunning clutch (12).

5. Remove the overrunning clutch snap-ring (1).
6. Remove the spacer (4) from the overrunning clutch (3).
7. Separate the inner and outer races (2) of the overrunning clutch (3).
8. Remove the overrunning clutch lower snap-ring.




9. Using Spring Compressor 8285 (2) and a suitable shop press (1), compress the low/reverse Belleville spring (3) and remove the split retaining ring holding the Belleville spring into the low/reverse clutch retainer.
10. Remove the low/reverse Belleville spring (3) and piston from the low/reverse clutch retainer. Use 20 psi of air pressure to remove the piston if necessary.




## CLEANING

Clean the overrunning clutch assembly, clutch cam, and low-reverse clutch retainer. Dry them with compressed air after cleaning.

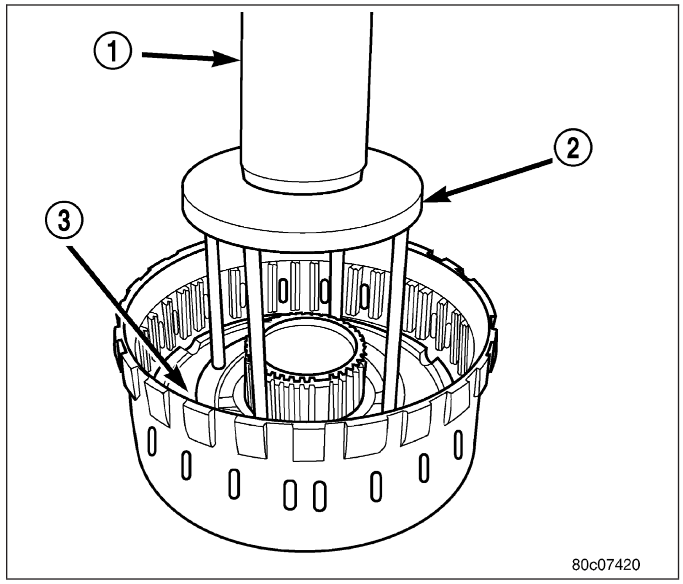
## INSPECTION

Inspect condition of each clutch part after cleaning. Replace the overrunning clutch roller and spring assembly if any rollers or springs are worn or damaged, or if the roller cage is distorted, or damaged. Replace the cam if worn, cracked or damaged.

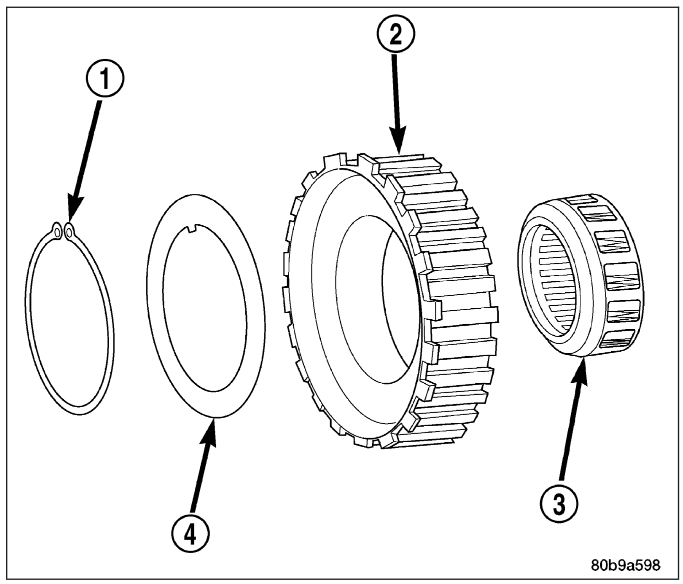
Replace the low-reverse clutch retainer if the clutch race, roller surface or inside diameter is scored, worn or damaged.

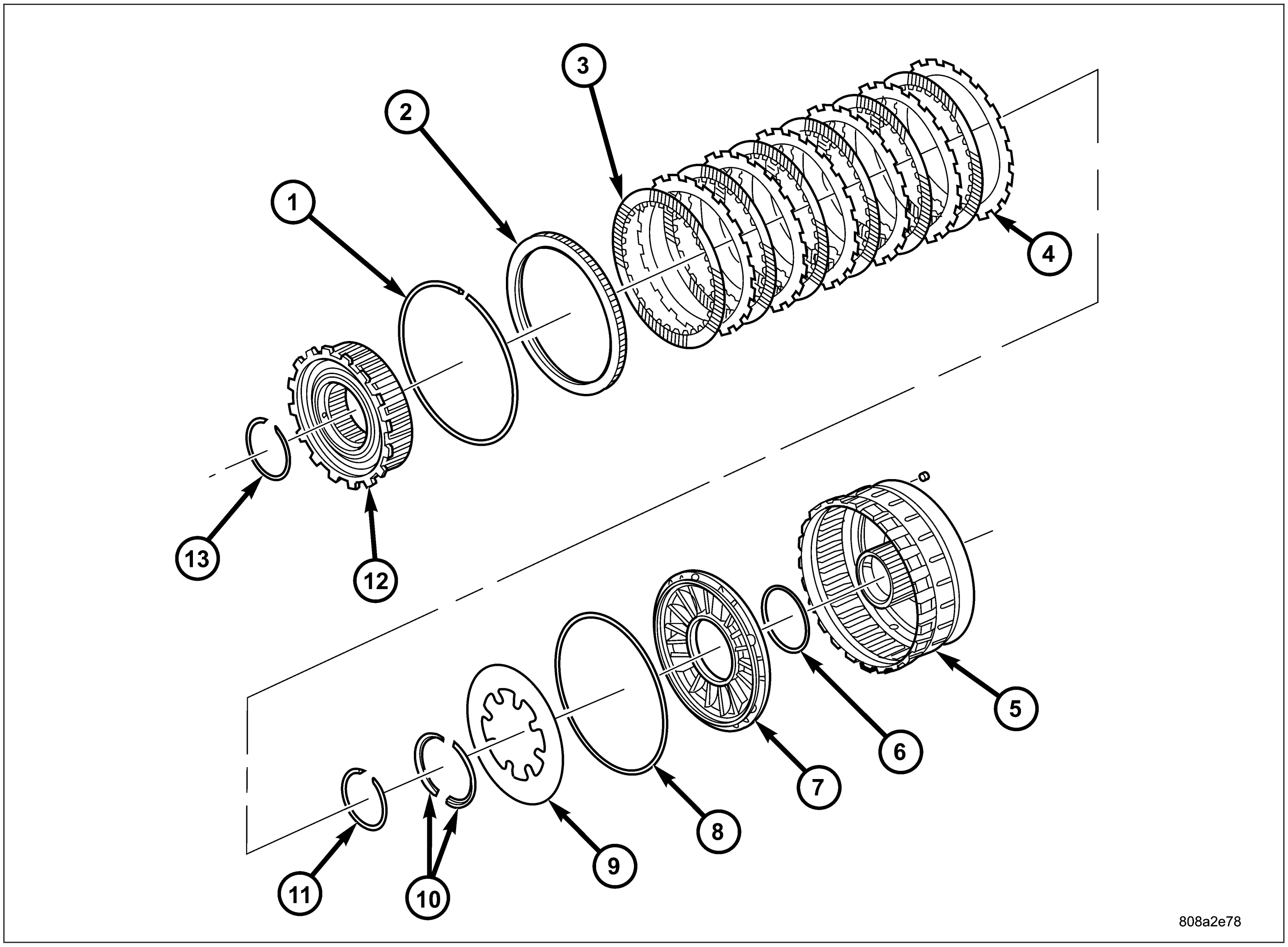
## ASSEMBLY

1. Check the bleed orifice to ensure that it is not plugged or restricted.
2. Install a new seal on the low/reverse piston. Lubricate the seal with Mopar® ATF +4, Automatic Transmission Fluid, prior to installation.
3. Install the low/reverse piston into the low/reverse clutch retainer.
4. Position the low/reverse Belleville spring (3) on the low/reverse piston.
5. Using Spring Compressor 8285 (2) and a suitable shop press (1), compress the low/reverse Belleville spring (3) and install the split retaining ring to hold the Belleville spring into the low/reverse clutch retainer.




6. Install the lower overrunning clutch snap-ring.
7. Assemble the inner and outer races (2) of the overrunning clutch (3).
8. Position the overrunning clutch spacer (4) on the overrunning clutch (3).
9. Install the upper overrunning clutch snap-ring (1).



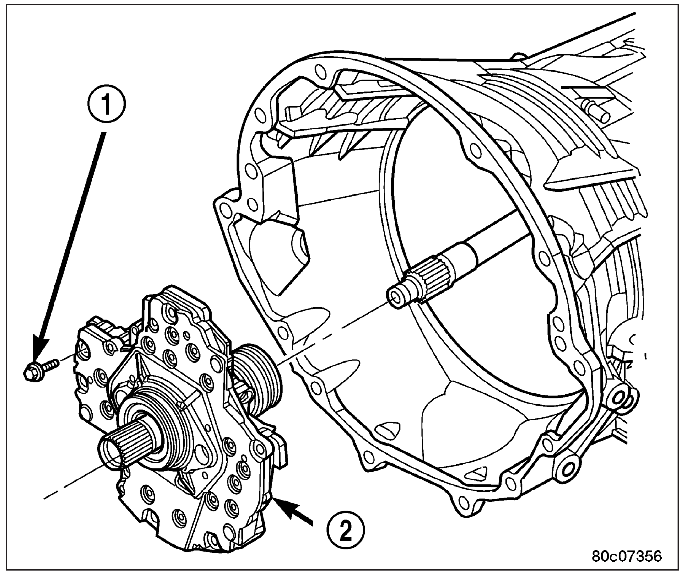



10. Assemble and install the low/reverse clutch pack (3, 4) into the low/reverse clutch retainer (5).
11. Install the low/reverse reaction plate (2) into the low/reverse clutch retainer (5). The reaction plate is directional and must be installed with the flat side down.
12. Install the low/reverse clutch pack snap-ring (1). The snap-ring is selectable and should be chosen to give the correct clutch pack clearance.
13. Measure the low/reverse clutch pack clearance and adjust as necessary. The correct clutch clearance is 1.00-1.74 mm (0.039-0.069 in.).
14. Install the overrunning clutch (12) into the low/reverse clutch retainer (5) making sure that the index splines are aligned with the retainer.
15. Install the overrunning clutch inner snap-ring (13).

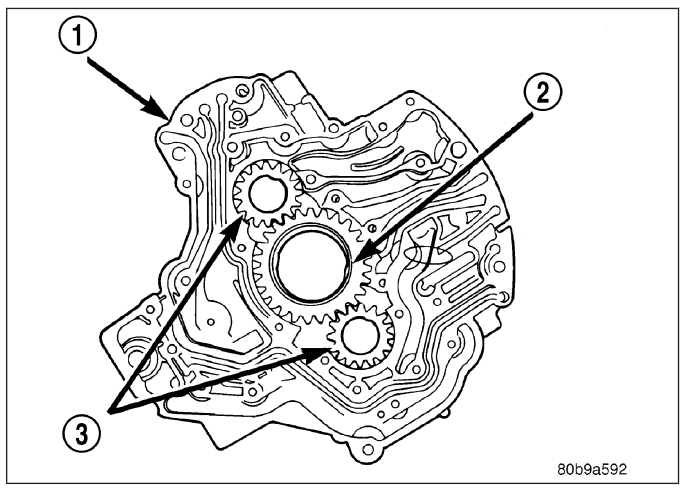
# PUMP-OIL

## DESCRIPTION

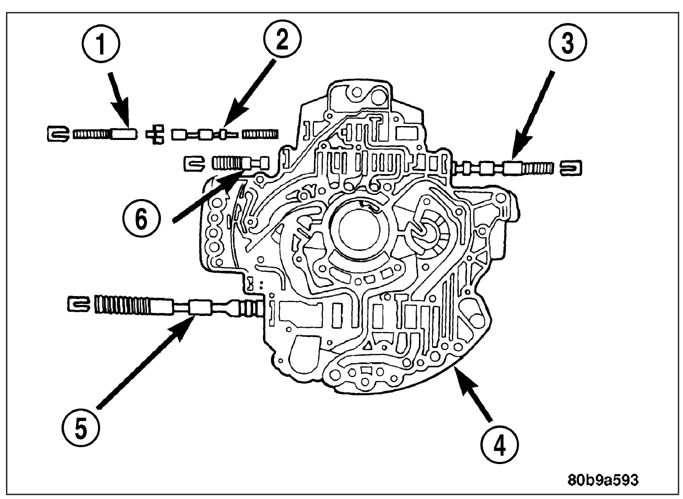
The oil pump (2) is located at the front of the transmission inside the bell housing and behind the transmission front cover.

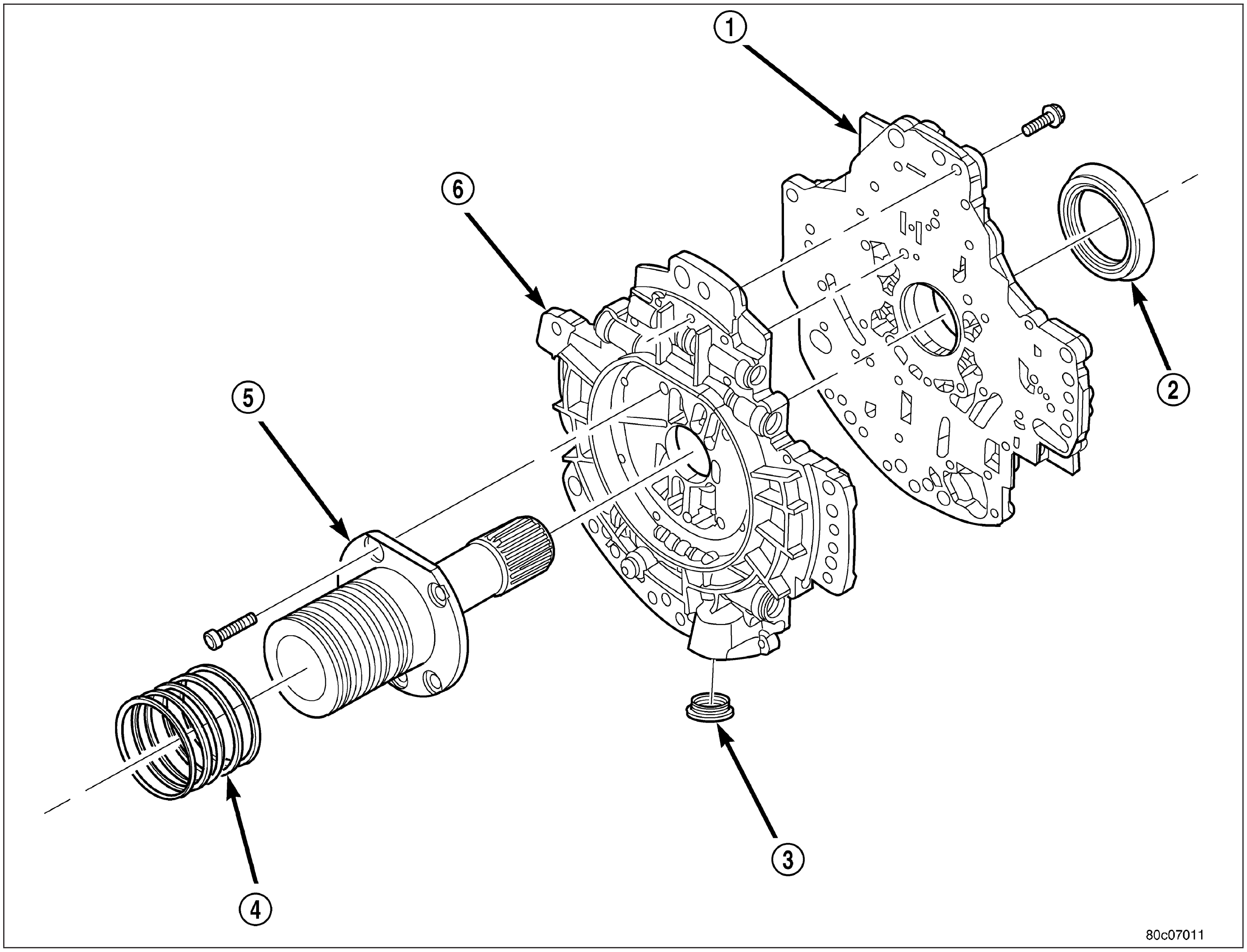



The oil pump consists of two independent pumps.




The oil pump also contains a number of valves. The converter clutch switch (3) and control valves (2), pressure regulator valve (5), and converter pressure limit valve (6) are all located in the oil pump valve body.






A front seal (2), and a bolt on reaction shaft (5) complete the oil pump assembly.

## OPERATION

As the torque converter rotates, the converter hub rotates the oil pump drive gear. As the drive gear rotates both driven gears, a vacuum is created when the gear teeth come out of mesh. This suction draws fluid through the pump inlet from the oil pan. As the gear teeth come back into mesh, pressurized fluid is forced into the pump outlet and to the oil pump valves.

At low speeds, both sides of the pump supply fluid to the transmission. As the speed of the torque converter increases, the flow from both sides increases until the flow from the primary side alone is sufficient to meet system demands. At this point, the check valve located between the two pumps closes. The secondary side is shut down and the primary side supplies all the fluid to the transmission.

### CONVERTER CLUTCH SWITCH VALVE

The converter clutch switch valve is used to control the hydraulic pressure supplied to the front (OFF) side of the torque converter clutch.

### CONVERTER CLUTCH REGULATOR VALVE

The converter clutch regulator valve is used to control the hydraulic pressure supplied to the back (ON) side of the torque converter clutch.

### TORQUE CONVERTER LIMIT VALVE

The torque converter limit valve serves to limit the available line pressure to the torque converter clutch.

## STANDARD PROCEDURE - OIL PUMP VOLUME CHECK

Measuring the oil pump output volume will determine if sufficient oil flow to the transmission oil cooler exists, and whether or not an internal transmission failure is present.

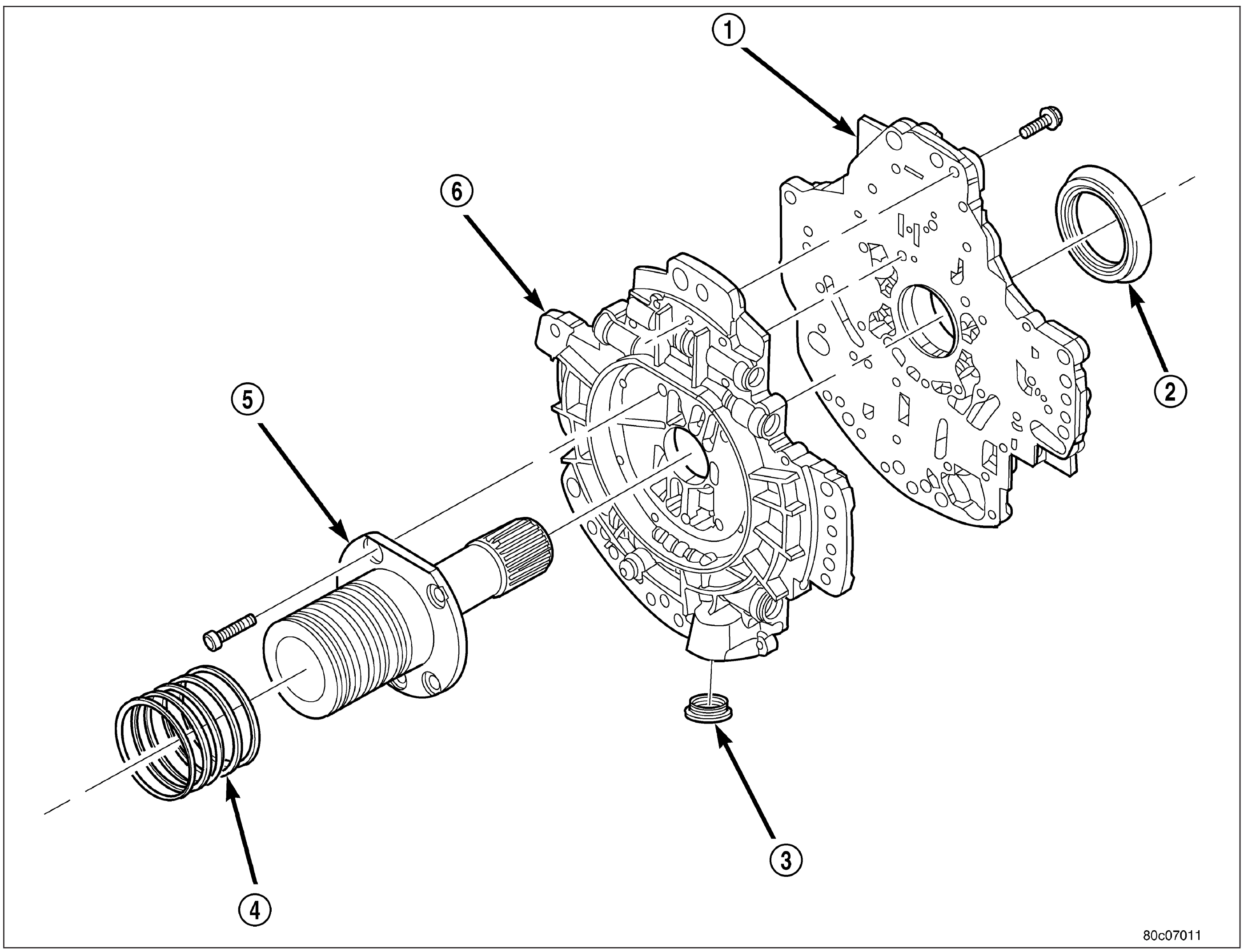
Verify that the transmission fluid is at the proper level. Refer to the Fluid Level Check procedure in this section. If necessary, fill the transmission to the proper level with Mopar® ATF +4, Automatic Transmission Fluid.

1. Disconnect the **To cooler** line at the cooler inlet and place a collecting container under the disconnected line.

**CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.**

2. Run the engine **at 1800 rpm**, with the shift selector in neutral. Verify that the transmission fluid temperature is below 104.5° C (220° F) for this test.
3. If one quart of transmission fluid is collected in the container in 30 seconds or less, oil pump flow volume is within acceptable limits. If fluid flow is intermittent, or it takes more than 30 seconds to collect one quart of fluid, refer to the Hydraulic Pressure tests in this section for further diagnosis.
4. Re-connect the **To cooler** line to the transmission cooler inlet.
5. Refill the transmission to proper level.

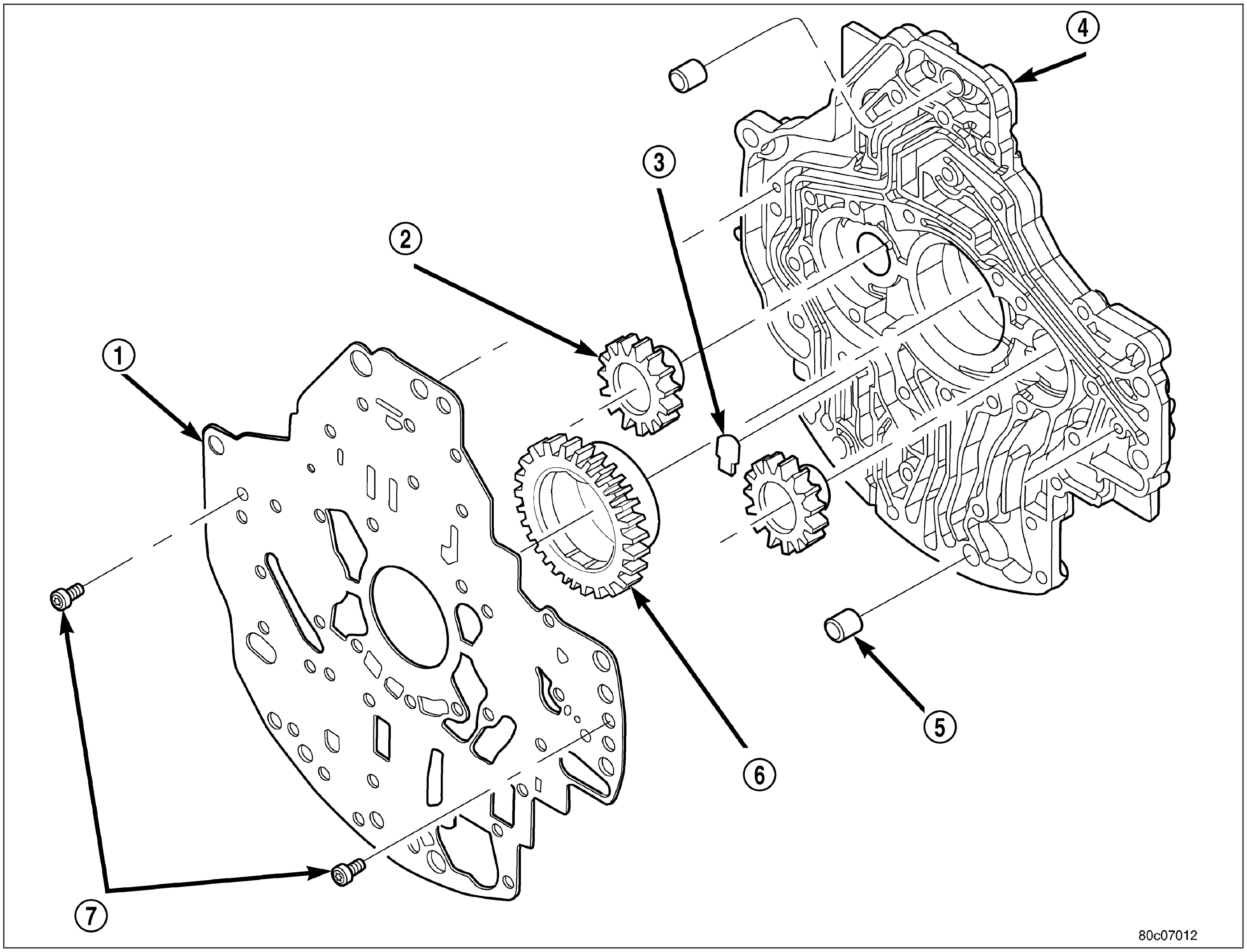
## DISASSEMBLY




1. Remove the bolts holding the reaction shaft support (5) to the oil pump.
2. Remove the reaction shaft support (5) from the oil pump.
3. Remove all bolts holding the oil pump halves together.

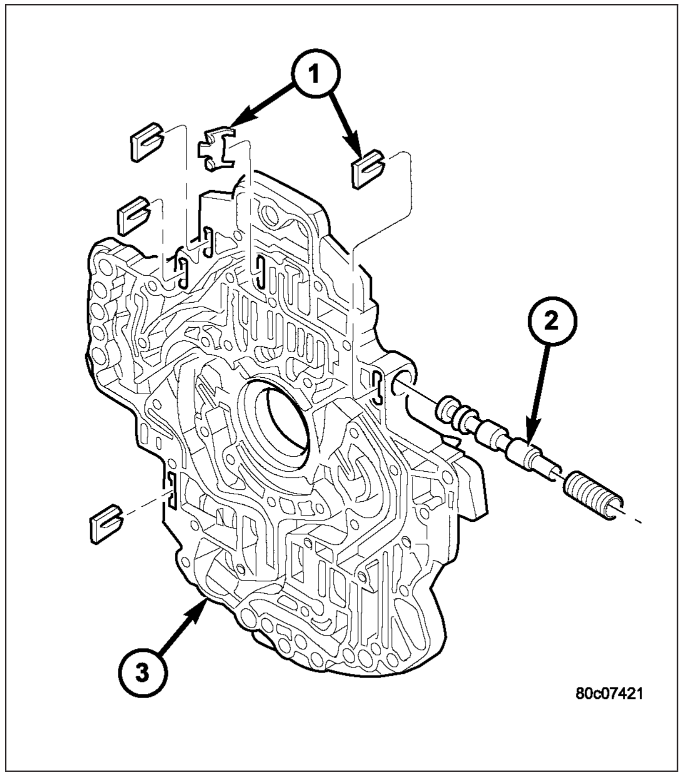
4. Using suitable prying tools, separate the oil pump sections by inserting the tools in the supplied areas and prying the halves apart.

**NOTE: The oil pump halves are aligned to each other through the use of two dowels. Be sure to pry upward evenly to prevent damage to the oil pump components.**

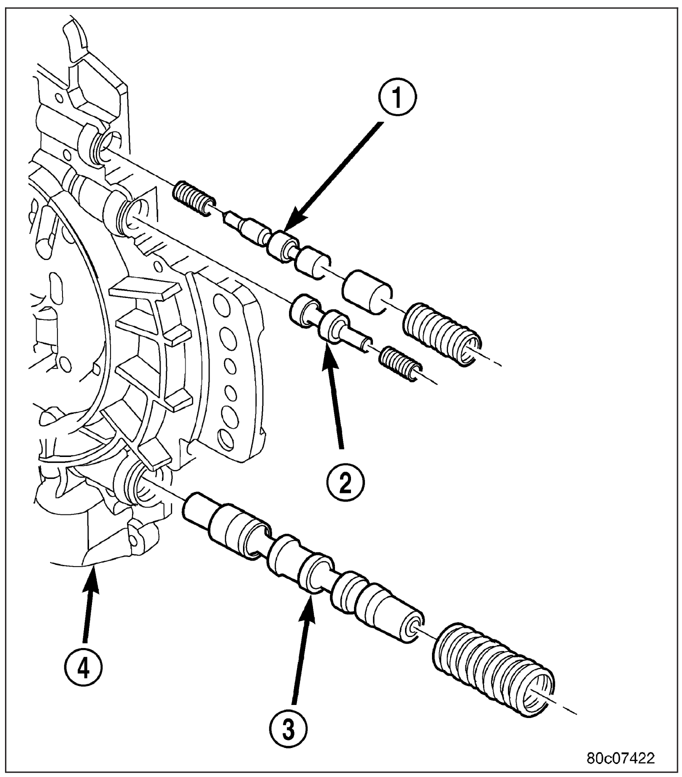



5. Remove the screws (7) holding the separator plate (1) onto the oil pump housing (4).
6. Remove the separator plate (1) from the oil pump housing (4).
7. Mark all gears for location. The gears are select fit and if the oil pump is to be reused, the gears must be returned to their original locations.
8. Remove the oil pump gears (2, 6) from the oil pump housing (4).

9. Remove the oil pump valve retainers (1) and associated valve (2) and spring one at a time. Mark the combination of components as a group and tag them as to the location from which they were removed.




10. Remove the T/C regulator valve (1), T/C limit valve (2), and regulator valve (3).




## CLEANING

Clean pump and support components with solvent and dry them with compressed air.

## INSPECTION

Check condition of the seal rings and thrust washer on the reaction shaft support. The seal rings do not need to be replaced unless cracked, broken, or severely worn.

Inspect the pump and support components. Replace the pump or support if the seal ring grooves or machined surfaces are worn, scored, pitted, or damaged. Replace the pump gears if pitted, worn chipped, or damaged.

Inspect the pump reaction shaft support bushings. Replace either bushing only if heavily worn, scored or damaged. It is not necessary to replace the bushings unless they are actually damaged.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.** Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

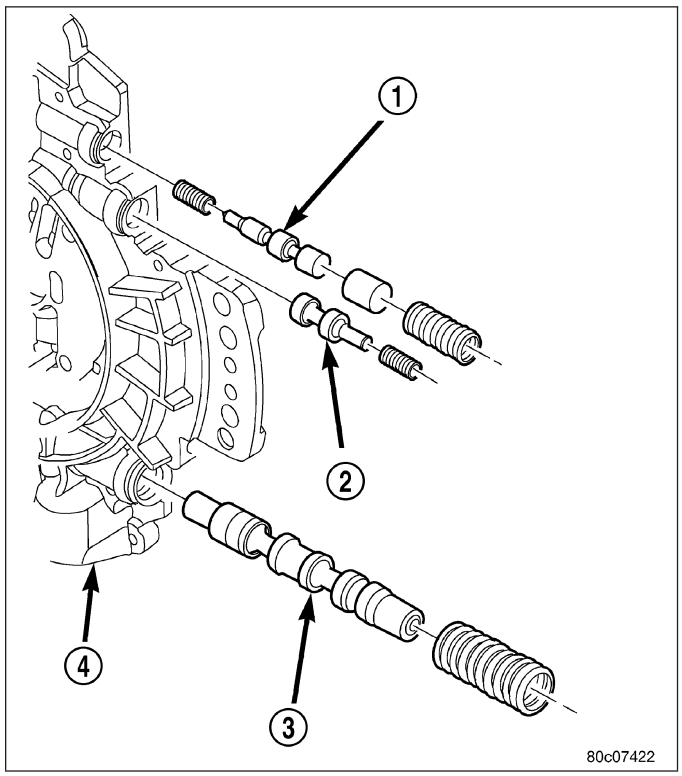
Inspect all the valve and plug bores in the oil pump cover. Use a penlight to view the bore interiors. Replace the oil pump if any bores are distorted or scored. Inspect all of the valve springs. The springs must be free of distortion, warpage or broken coils.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

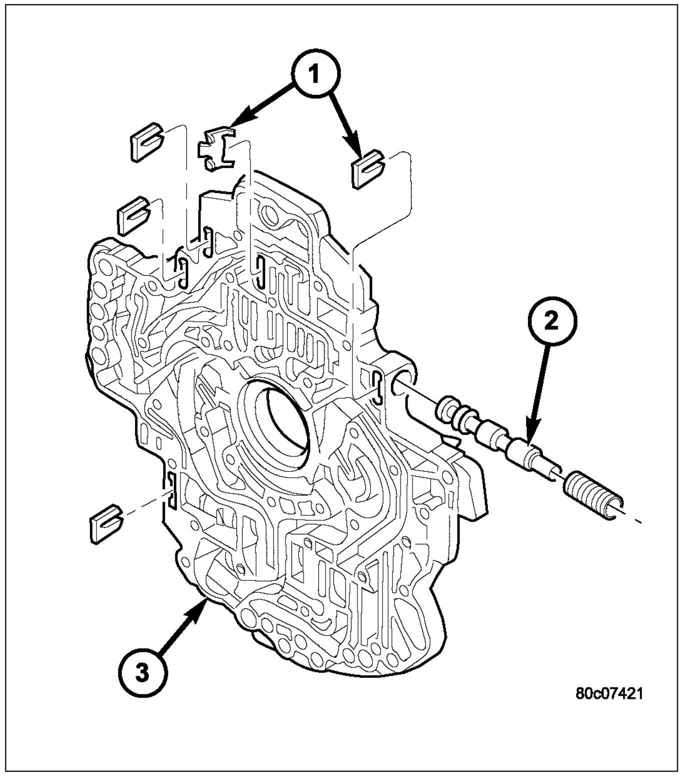
## ASSEMBLY

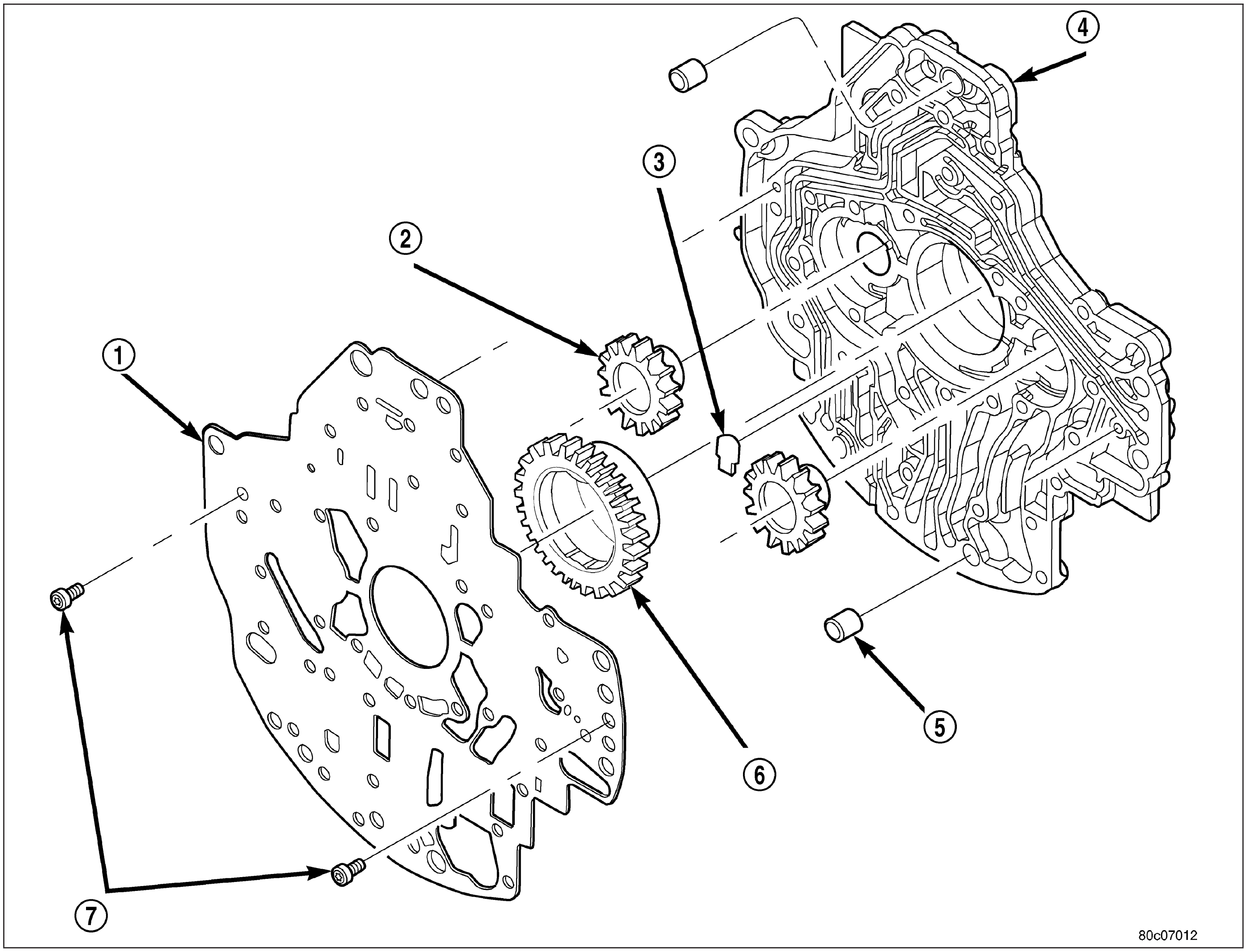
**NOTE: Clean and inspect all components. Make sure that all passages are thoroughly cleaned and are free from dirt or debris. Make sure that all valves move freely in their proper bore. Make sure that all gear pockets and bushings are free from excessive wear and scoring. Replace the oil pump if any excessive wear or scoring is found.**

1. Install the T/C regulator valve (1), T/C limit valve (2), and regulator valve (3).

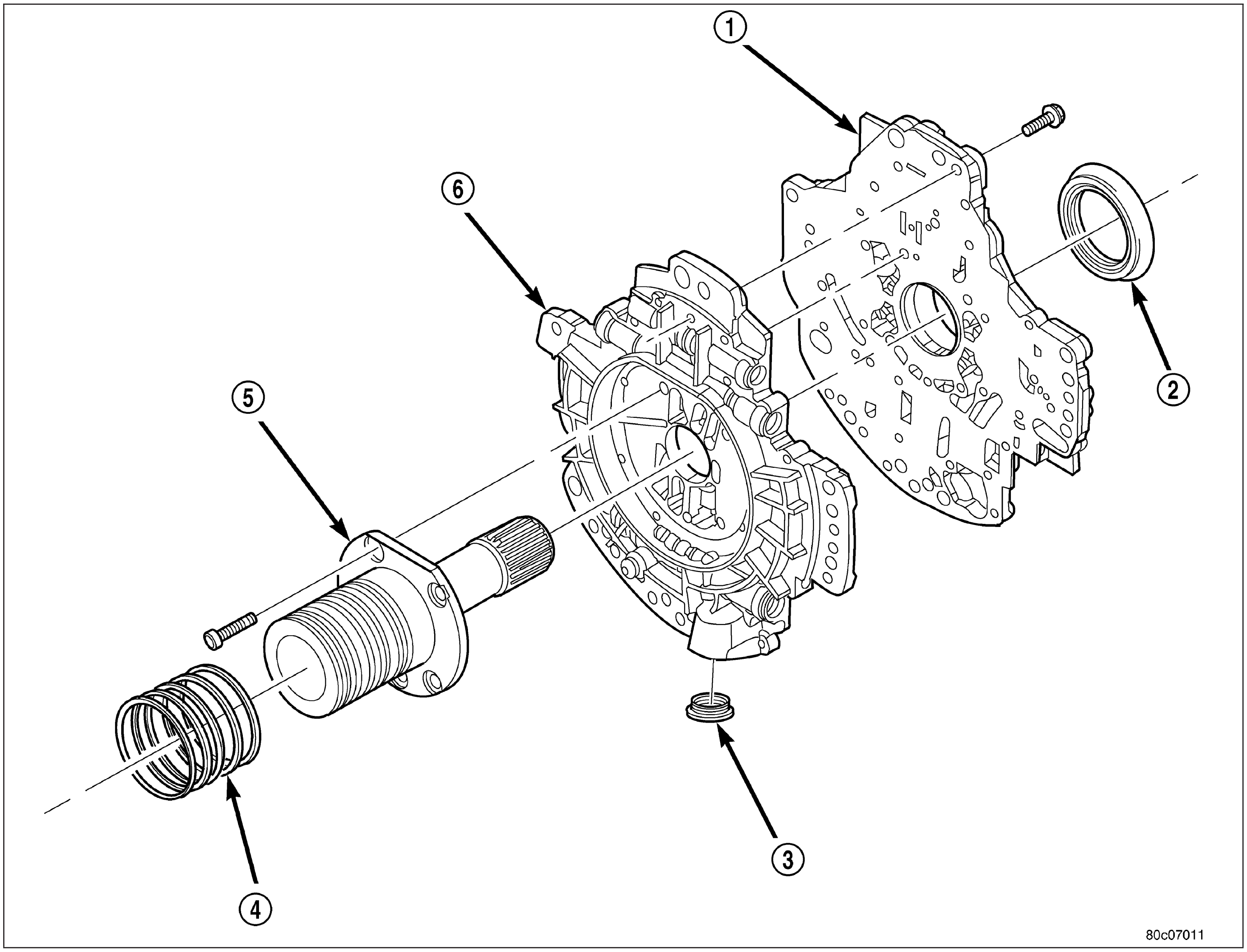


2. Lubricate the oil pump valves with Mopar® ATF +4 and install the valve (2), spring, and retainer (1) into the appropriate oil pump valve body (3) bore.






3. Coat the gears (2, 6) with Mopar® ATF +4 and install into their original locations.
4. Place the separator plate (1) onto the oil pump housing (4).
5. Install the screws (7) to hold the separator plate (1) onto the oil pump housing (4). Tighten the screws to 4.5 N·m (40 in.lbs.).




6. Position the oil pump valve body (6) onto the locating dowels.
7. Seat the two oil pump halves together and install all bolts finger tight.
8. Torque all bolts down slowly starting in the center and working outward. The correct torque is 4.5 N·m (40 in.lbs.).
9. Verify that the oil pump gears rotate freely and smoothly.
10. Position the reaction shaft support (5) onto the oil pump valve body (6).
11. Install and torque the bolts to hold the reaction shaft support (5) to the oil pump valve body (6). The correct torque is 12 N·m (105 in.lbs.).

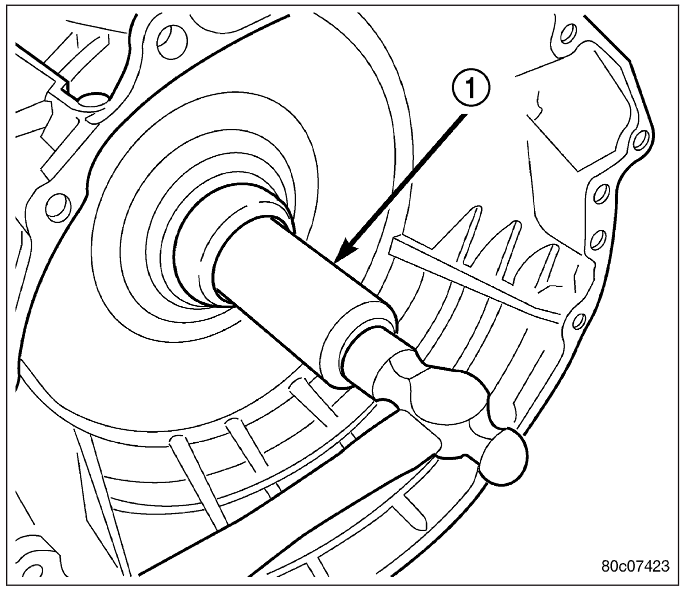
# SEAL-OIL PUMP FRONT

## REMOVAL

1. Remove transmission from the vehicle.
2. Remove the torque converter from the transmission.
3. Using a screw mounted in a slide hammer, remove the oil pump front seal.

## INSTALLATION

1. Clean seal bore of the oil pump of any residue or particles from the original seal.
2. Install new oil seal in the oil pump housing using Seal Installer C-3860-A (1).



# SENSOR-OUTPUT SPEED

## DESCRIPTION

The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

## OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

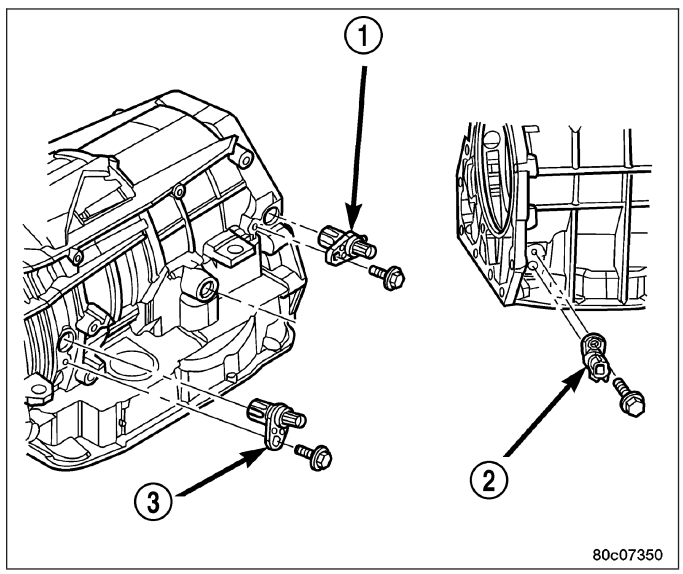
- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

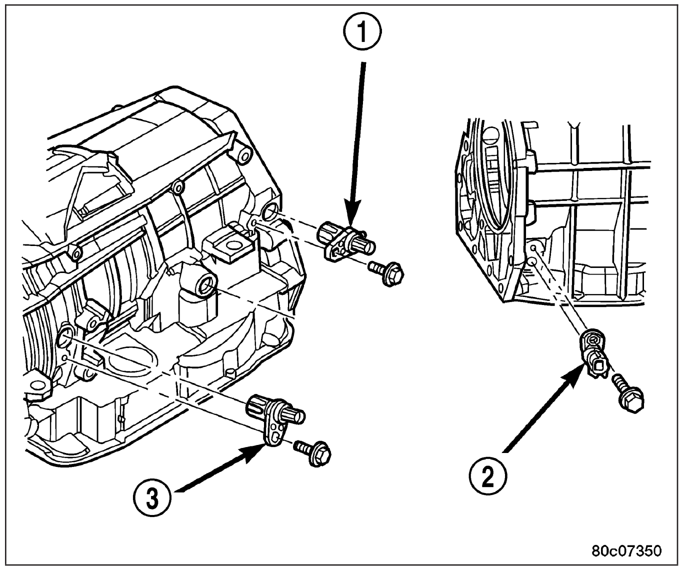
## REMOVAL

1. Raise vehicle.
2. Place a suitable fluid catch pan under the transmission.
3. Remove the wiring connector from the output speed sensor (1).
4. Remove the bolt holding the output speed sensor (1) to the transmission case.
5. Remove the output speed sensor (1) from the transmission case.



## INSTALLATION

1. Install the output speed sensor (1) into the transmission case.
2. Install the bolt to hold the output speed sensor (1) into the transmission case. Tighten the bolt to 12 N·m (105 in.lbs.).
3. Install the wiring connector onto the output speed sensor (1).
4. Verify the transmission fluid level. Add fluid as necessary.
5. Lower vehicle.



# SWITCH-OVERDRIVE

## DESCRIPTION

The overdrive OFF (control) switch is located in the shifter handle. The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function.

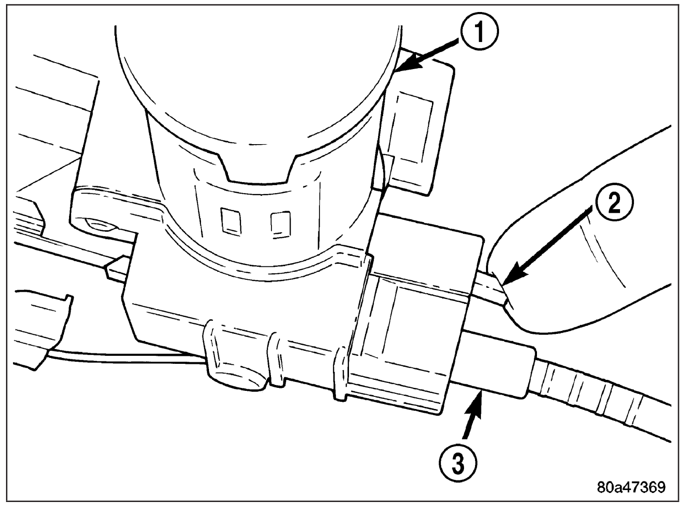
## OPERATION

At key-on, fourth gear operation is allowed. Pressing the switch once causes the overdrive OFF mode to be entered and the overdrive OFF switch lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the overdrive lamp to be turned off. The overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoids and allow upshifts to fourth gear. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

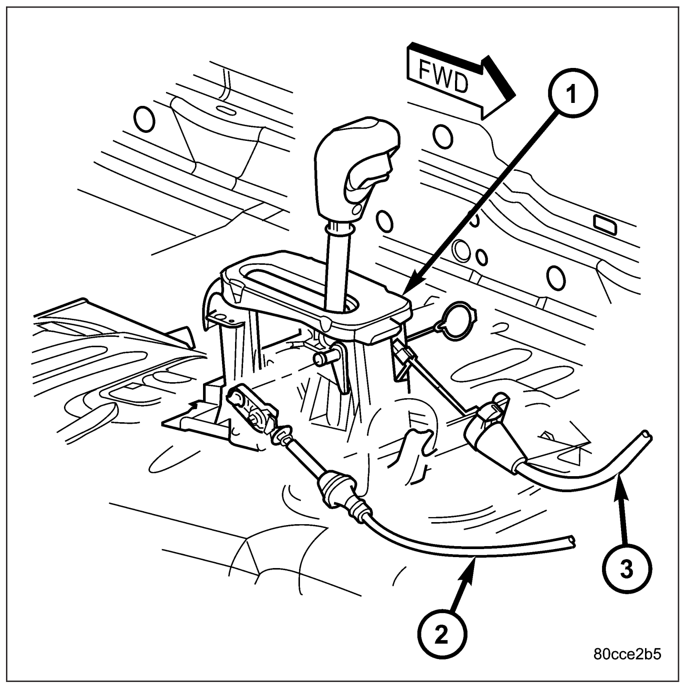
# CABLE-PARK INTERLOCK

## REMOVAL

1. Lower the steering column.
2. With the ignition switch in the “RUN” position depress the park-interlock cable locking tab (2), located on top of the cable connector at the steering column and pull the cable straight out.



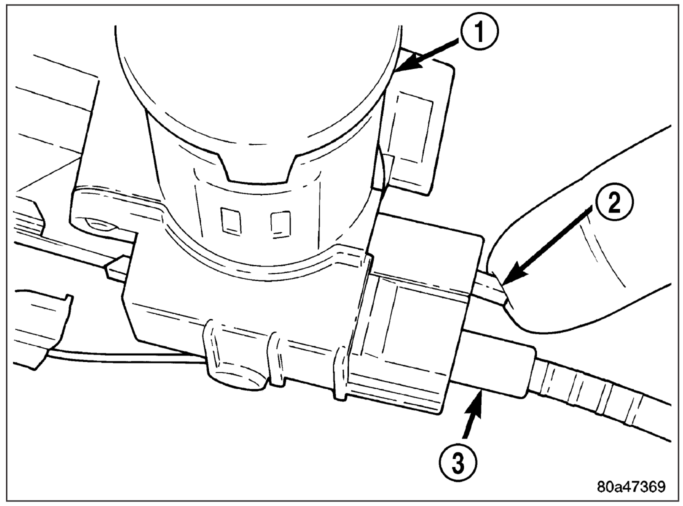

3. Remove the park-interlock cable from steering column.
4. Remove the floor console and related trim. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
5. Disconnect the park-interlock cable (3) from the shift lever assembly and remove the cable from the shifter assembly bracket.
6. Release the park-interlock cable from any remaining clips.
7. Remove park-interlock cable from the vehicle.



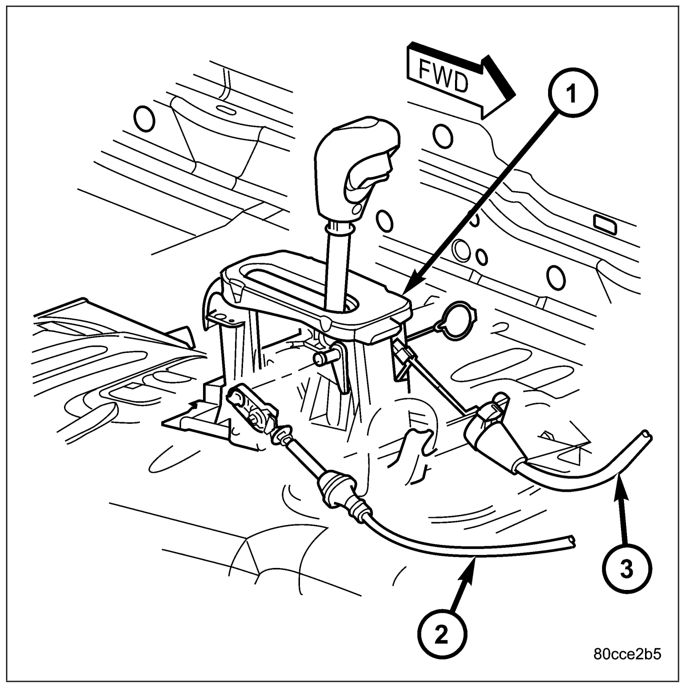
## INSTALLATION

**NOTE: The gearshift cable must be secured into position and properly adjusted before the installation of the Park-Interlock Cable.**

1. Push the park-interlock cable (3) straight into the square mounting hole in the steering column until cable snaps in place.
2. Snap park-interlock cable tie strap into hole in steering column tube.



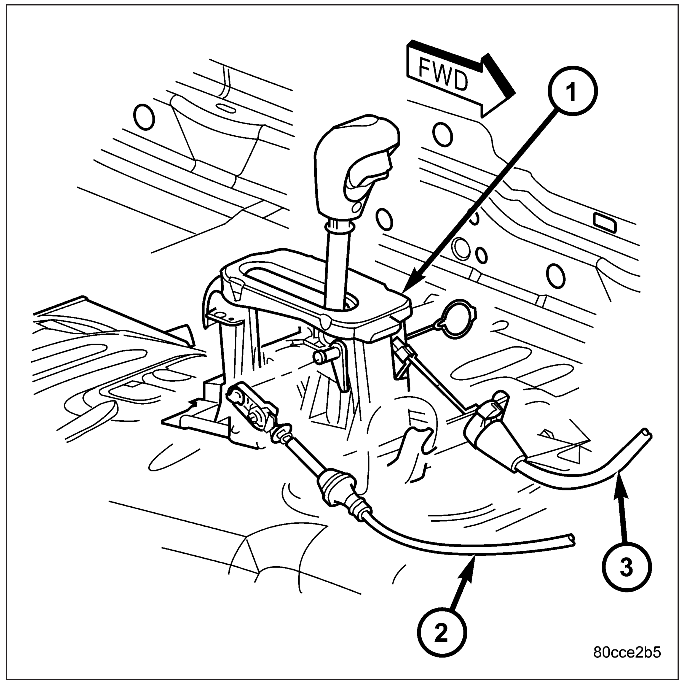

3. Route cable to the shifter mechanism.
4. Install the cable end fitting into shifter lever (1).
5. Snap cable adjuster ears into floor shifter bracket.
6. Place the ignition key cylinder in the LOCK position.
7. Push the cable adjuster lock clamp downward to lock it.
8. Test the park-interlock cable operation.
9. Install the floor console and related trim. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)



## ADJUSTMENTS - PARK-INTERLOCK CABLE

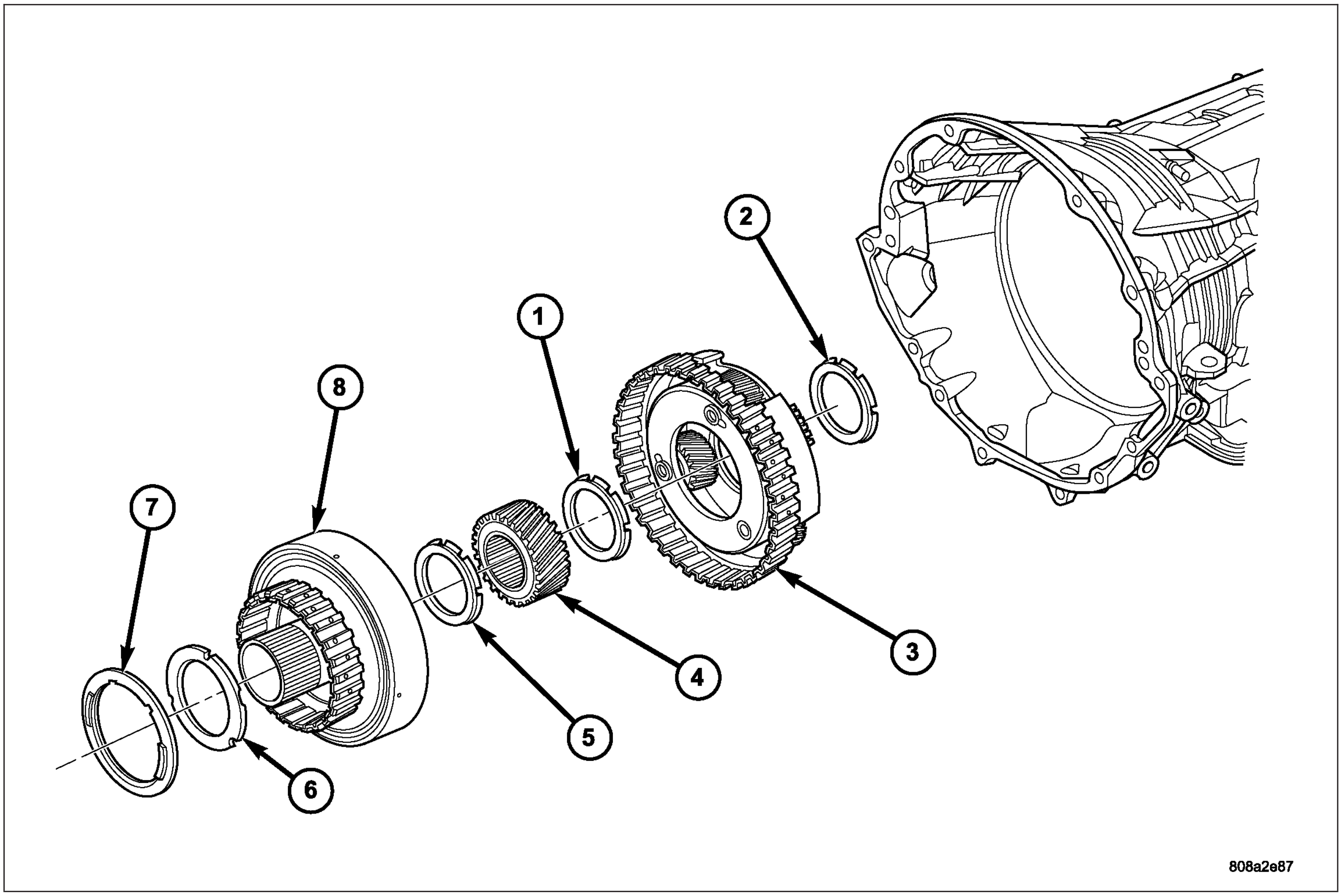
The park-interlock cable is part of the Brake Transmission Shift Interlock (BTSI) system. Correct cable adjustment is important to proper interlock operation. The gear shift and park lock cables must both be correctly adjusted in order to shift out of PARK.

1. Remove floor console as necessary for access to the park-interlock cable. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
2. Shift the transmission into the PARK position.
3. Turn ignition switch to LOCK position. **Be sure ignition key cylinder is in the LOCK position. Cable will not adjust correctly in any other position.**
4. Pull cable lock button up to release cable (3).
5. Ensure that the cable is free to self-adjust by pushing cable rearward and releasing.
6. Push lock button down until it snaps in place.
7. Verify proper operation. (Refer to 21 - TRANSMISSION/AUTOMATIC/SHIFT INTERLOCK SYSTEM - DIAGNOSIS AND TESTING)



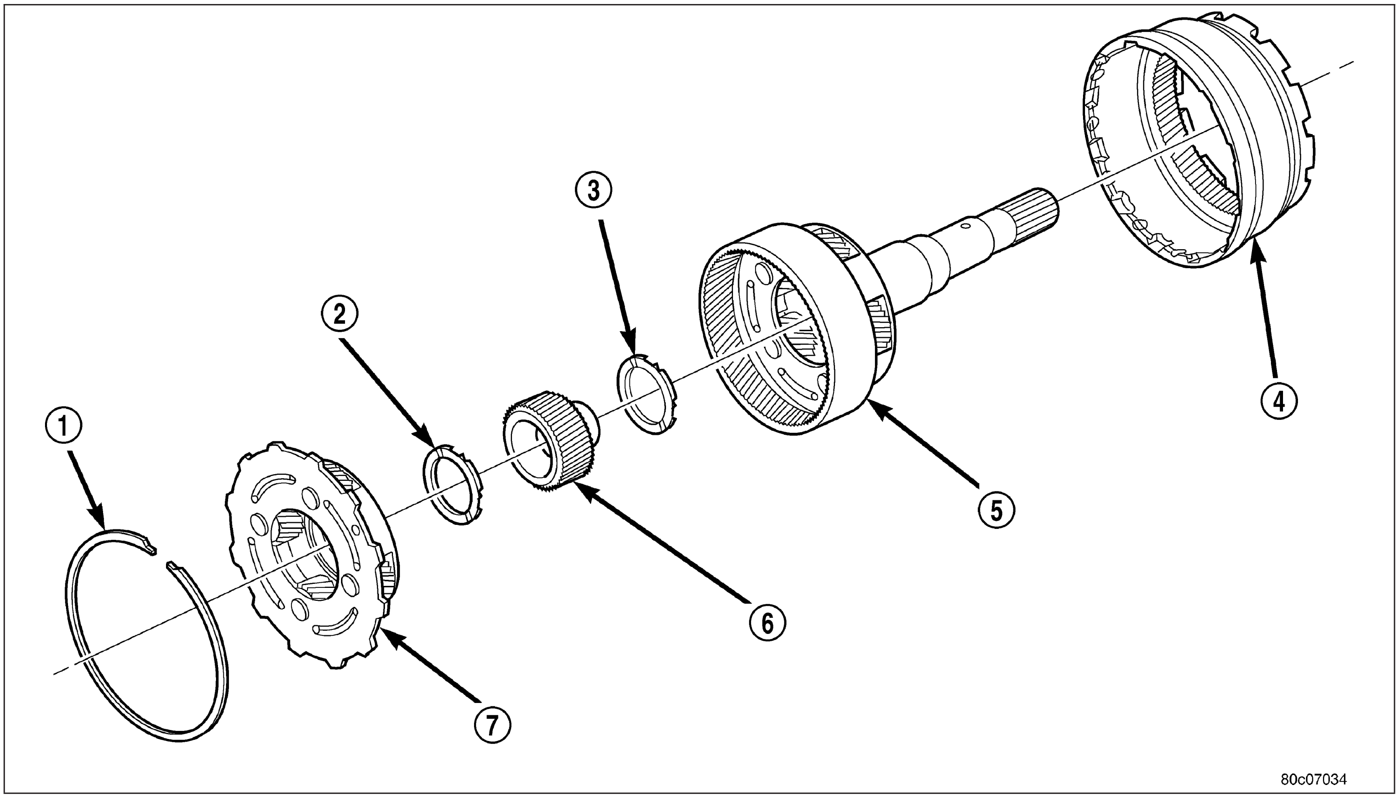
# GEARTRAIN-PLANETARY

## DESCRIPTION




The planetary geartrain is located behind the 4C retainer/bulkhead, toward the rear of the transmission. The planetary geartrain consists of three primary assemblies:

- Reaction (3, 4, 8).




- Reverse (7).
- Input (4, 5, 6).

## OPERATION

### REACTION PLANETARY GEARTRAIN

The reaction planetary carrier and reverse sun gear of the reaction planetary geartrain are a single component which is held by the 2C clutch when required. The reaction annulus gear is a stand alone component that can be driven by the reverse clutch or held by the 4C clutch. The reaction sun gear is driven by the overdrive clutch.

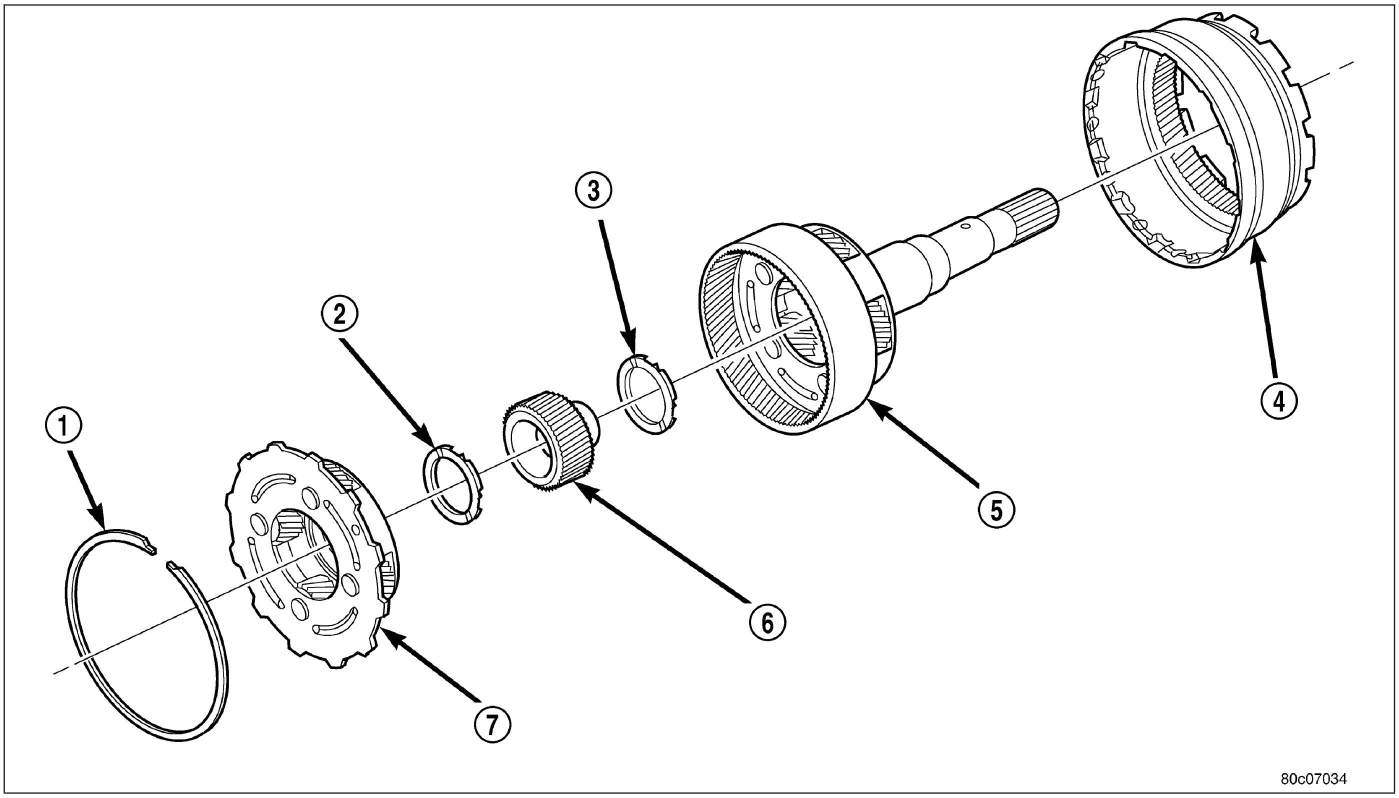
### REVERSE PLANETARY GEARTRAIN

The reverse planetary geartrain is the middle of the three planetary sets. The reverse planetary carrier can be driven by the overdrive clutch as required. The reverse planetary carrier is also splined to the input annulus gear, which can be held by the low/reverse clutch. The reverse planetary annulus, input planetary carrier, and output shaft are all one piece.

### INPUT PLANETARY GEARTRAIN

The input sun gear of the input planetary geartrain is driven by the underdrive clutch.

## DISASSEMBLY




1. Remove the snap-ring (1) holding the input annulus (4) into the input carrier (5).
2. Remove the input annulus (4) from the input carrier (5).
3. Remove the number 9 thrust bearing from the reverse planetary carrier (7). Note that this planetary carrier has four pinion gears.
4. Remove the reverse planetary gear carrier (7).
5. Remove the number 10 thrust bearing (2) from the input sun gear (6).
6. Remove the input sun gear (6) from the input carrier (5).
7. Remove the number 11 thrust bearing (3) from the input carrier (5).

## CLEANING

Clean the planetary components in solvent and dry them with compressed air.

## INSPECTION

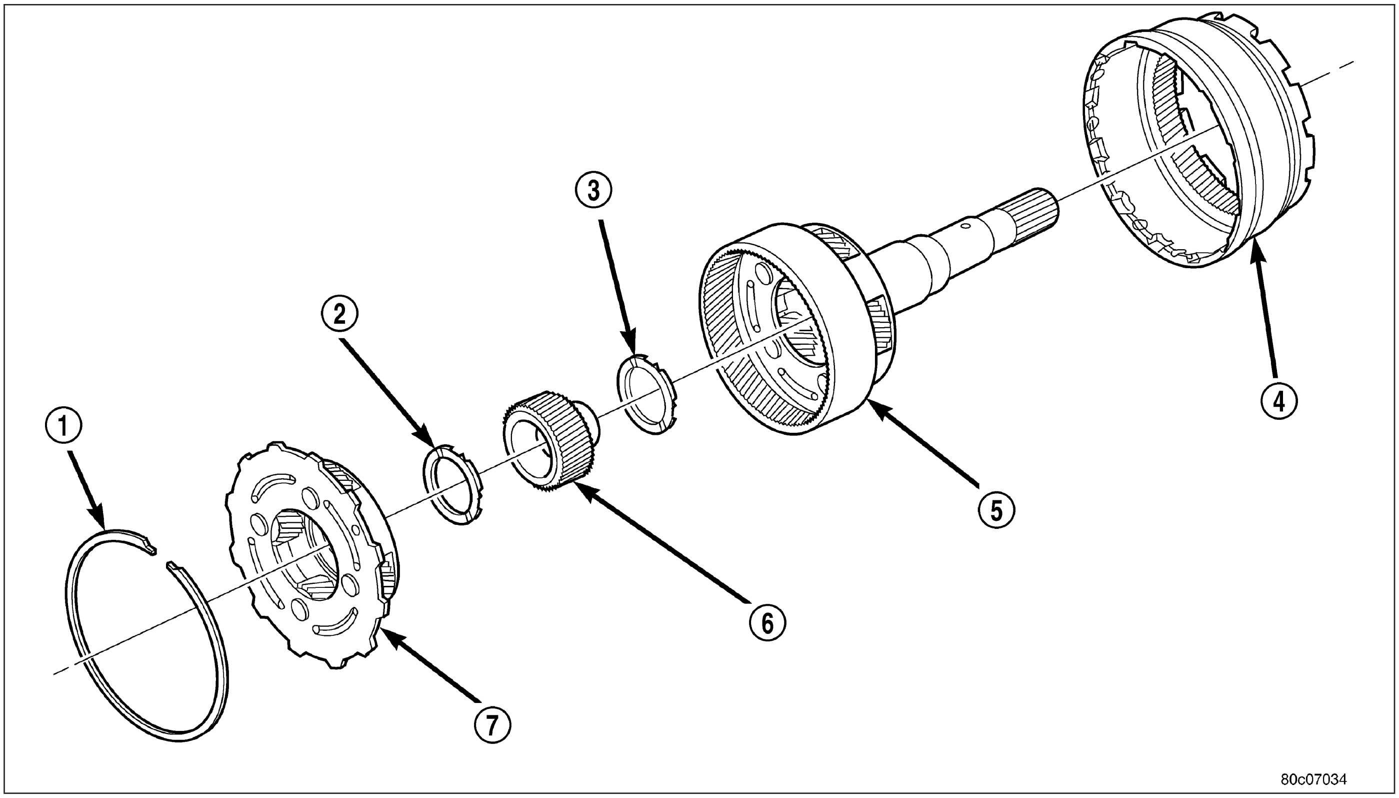
Check sun gear and driving shell condition. Replace the gear if damaged or if the bushings are scored or worn. The bushings are not serviceable. Replace the driving shell if worn, cracked or damaged.

Replace planetary gear sets if gears, pinion pins, or carrier are damaged in any way. Replace the annulus gears and supports if either component is worn or damaged.

Replace the output shaft if the machined surfaces are scored, pitted, or damaged in any way. Also replace the shaft if the splines are damaged, or exhibits cracks at any location.

## ASSEMBLY

**NOTE: Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.**




1. Install the number 11 thrust bearing (3) into the input planetary carrier (5) so that the inner race will be toward the front of the transmission.
2. Install the input sun gear (6) into the input carrier (5).
3. Install the number 10 thrust bearing (2) onto the rear of the reverse planetary carrier (7) with the inner race toward the carrier.
4. Install the number 9 thrust bearing onto the front of the reverse planetary carrier (7) with the outer race toward the carrier and the inner race facing upward.
5. Install the reverse planetary gear carrier (7) into the input carrier (5).
6. Install the input annulus gear (4) into the input carrier (5).
7. Install the snap-ring (1) to hold the input annulus gear (4) into the input carrier (5).

# MECHANISM-SHIFT

## DESCRIPTION

The gear shift mechanism provides six shift positions which are:

- Park (P)
- Reverse (R)
- Neutral (N)
- Drive (D)
- Manual second (2)
- Manual low (1)

## OPERATION

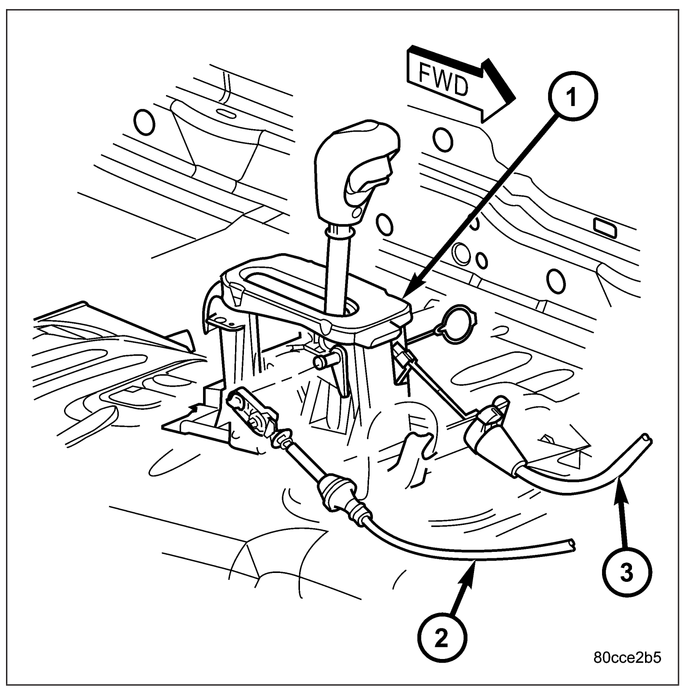
MANUAL LOW (1) range provides FIRST gear only. Overrun braking is also provided in this range. MANUAL SECOND (2) range provides FIRST and SECOND gear only.

DRIVE range provides FIRST, SECOND, THIRD and OVERDRIVE FOURTH and FIFTH gear ranges. The shift into OVERDRIVE FOURTH and FIFTH gear range occurs only after the transmission has completed the shift into D THIRD gear range. No further movement of the shift mechanism is required to complete the 3-4 or 4-5 shifts.

The FOURTH and FIFTH gear upshifts occurs automatically when the overdrive selector switch is in the ON position. An upshift to FOURTH and FIFTH gears may not occur or may be delayed in some of the possible shift schedules. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - OPERATION)

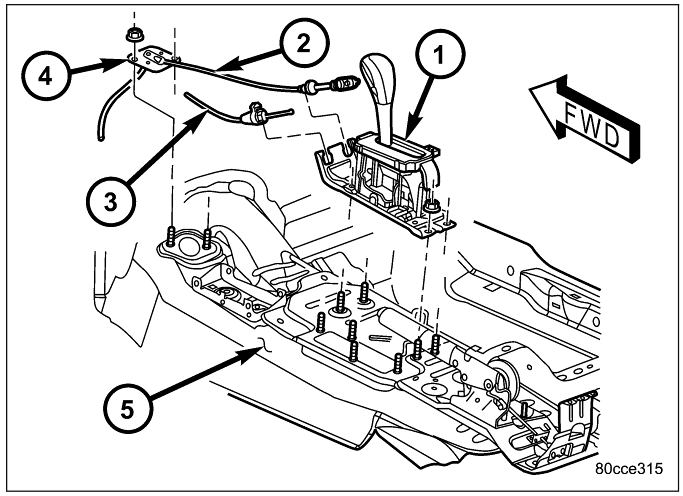
## REMOVAL

1. Remove any necessary console parts for access to shift lever assembly and shifter cables. (Refer to 23 - BODY/ INTERIOR/FLOOR CONSOLE - REMOVAL)
2. Shift transmission into PARK.
3. Disconnect the transmission shift cable at shift lever and shifter assembly bracket.
4. Disconnect the park-interlock cable from the shifter lever and the shifter assembly bracket.
5. Disengage all wiring connectors from the shifter assembly.
6. Remove all nuts holding the shifter assembly to the floor pan.
7. Remove the shifter assembly from the vehicle.



## INSTALLATION

1. Install shifter assembly onto the shifter assembly studs on the floor pan.
2. Install the nuts to hold the shifter assembly onto the floor pan. Tighten nuts to 28 N·m (250 in.lbs.).
3. Install wiring harness to the shifter assembly bracket. Engage any wire connectors removed from the shifter assembly.
4. Install the park-interlock cable into the shifter assembly bracket and into the shifter lever.
5. Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.
6. Place the floor shifter lever in park position.
7. Loosen the adjustment screw on the shift cable.
8. Snap the shift cable onto the shift lever pin.
9. Verify that the shift lever is in the PARK position.
10. Tighten the adjustment screw to 7 N·m (65 in.lbs.).
11. Verify correct shifter operation.
12. Verify proper BTSI operation. (Refer to 21 - TRANSMISSION/AUTOMATIC/SHIFT INTERLOCK SYSTEM - DIAGNOSIS AND TESTING) Adjust the park-interlock cable as necessary. (Refer to 21 - TRANSMISSION/AUTOMATIC/SHIFT INTERLOCK CABLE - ADJUSTMENTS)
13. Install any console parts removed for access to shift lever assembly and shift cables. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)



# SWITCH-VALVE-SOLENOID

## DESCRIPTION

The Solenoid Switch Valve (SSV) is located in the valve body and controls the direction of the transmission fluid when the L/R-TCC solenoid is energized.

## OPERATION

The Solenoid Switch Valve controls line pressure from the LR-TCC solenoid. In 1st gear, the SSV will be in the downshifted position, thus directing fluid to the L/R clutch circuit. In 2nd, 3rd, 4th, and 5th gears, the solenoid switch valve will be in the upshifted position and directs the fluid into the torque converter clutch (TCC) circuit.

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R pressure switch is monitored to confirm SSV movement. If the movement is not confirmed (the L/R pressure switch does not close), 2nd gear is substituted for 1st. A DTC will be set after three unsuccessful attempts are made to get into 1st gear in one given key start.

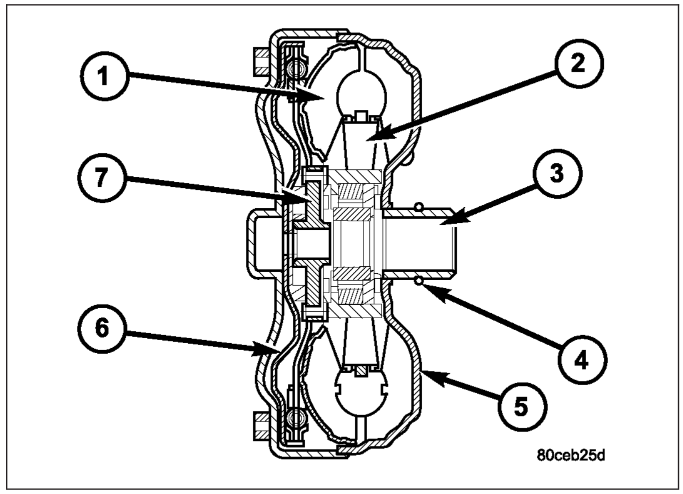
# CONVERTER-TORQUE

## DESCRIPTION

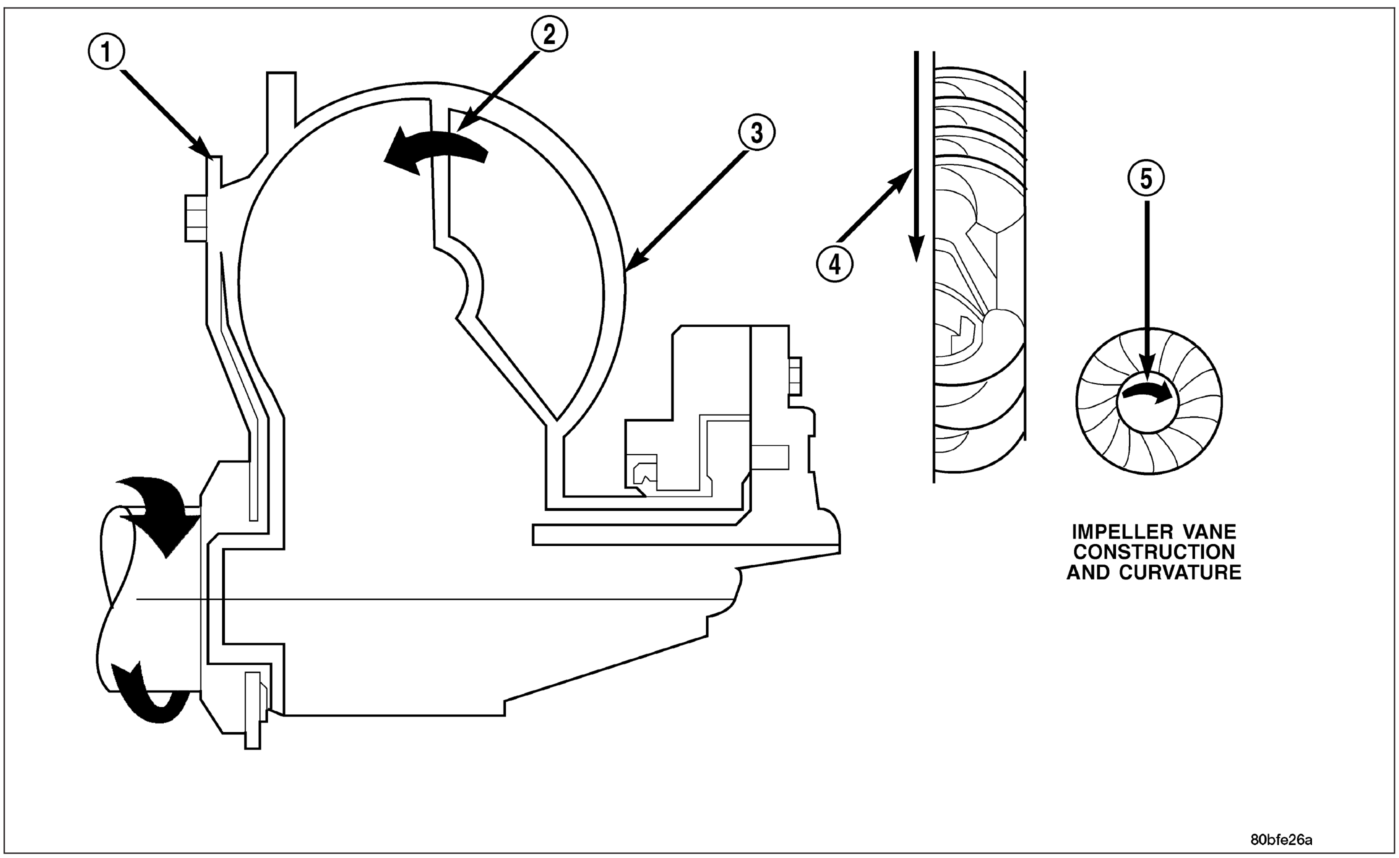
The torque converter is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine (1), a stator (2), an overrunning clutch, an impeller (5), and an electronically applied converter clutch (6). The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The torque converter hub (3) drives the transmission oil (fluid) pump and contains an o-ring seal (4) to better control oil flow.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

**CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid.**

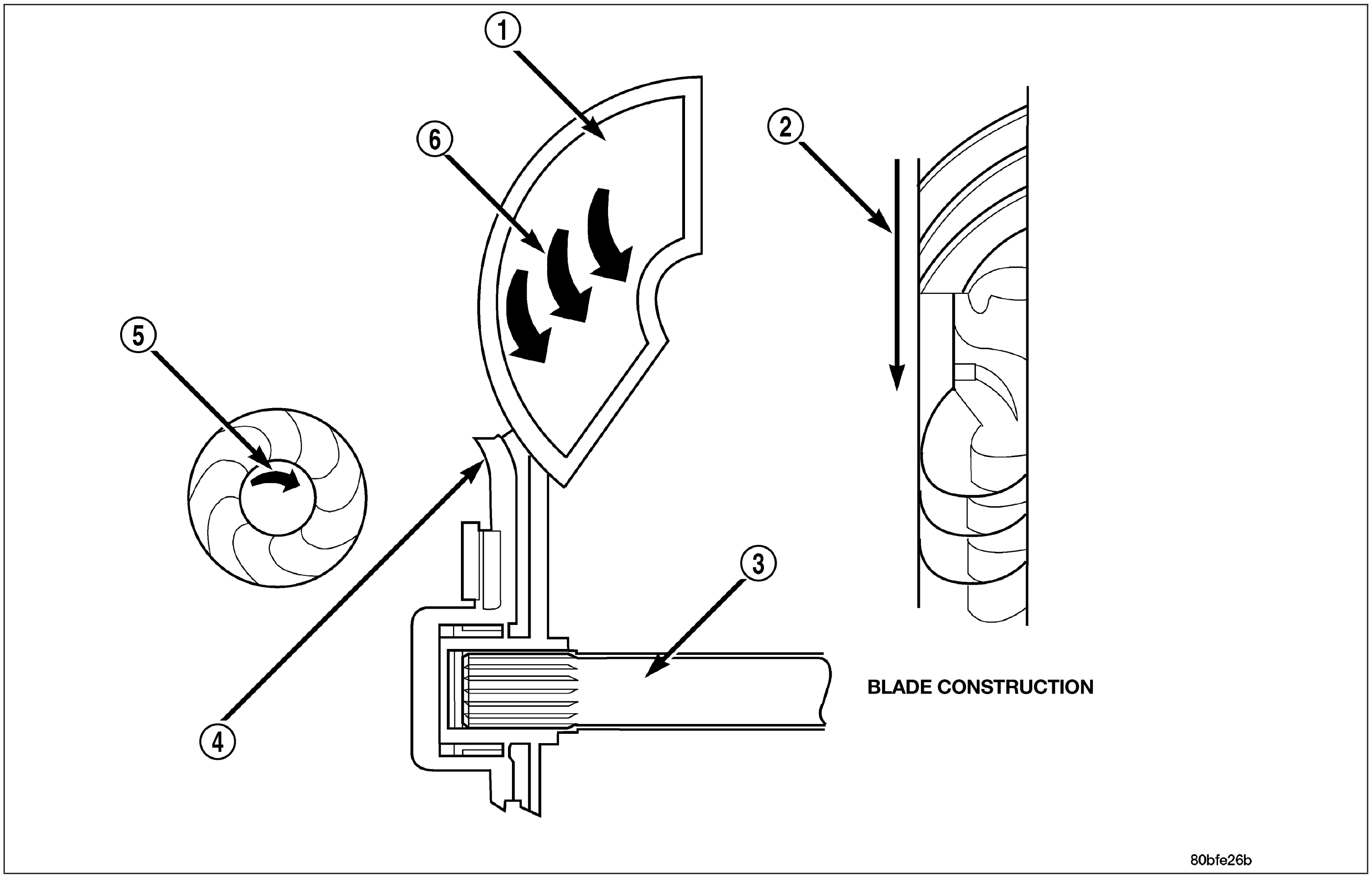



## IMPELLER




The impeller is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving members of the system.

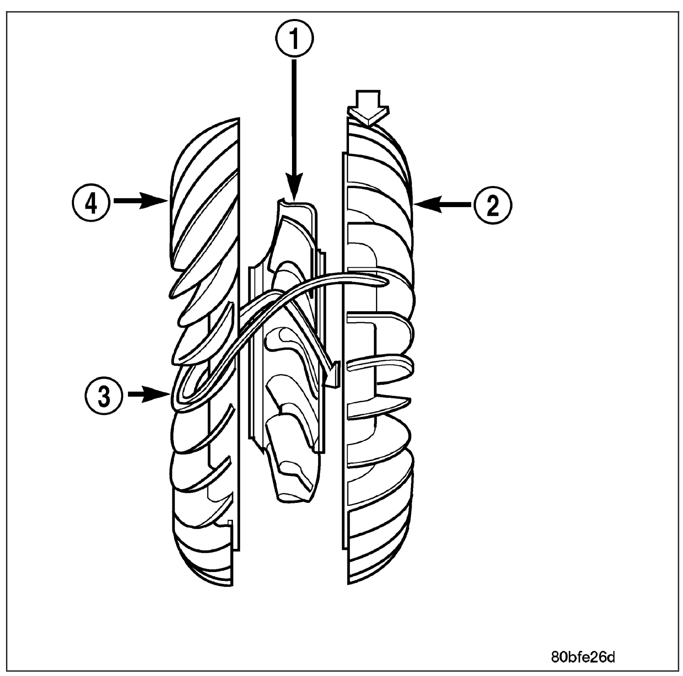
## TURBINE



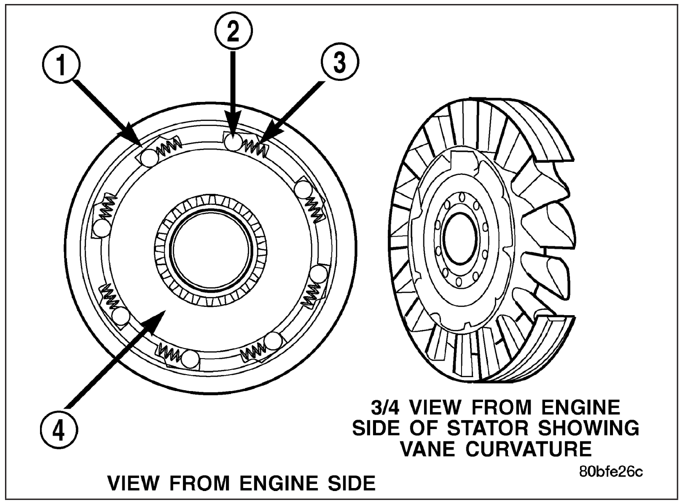

The turbine is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

## STATOR

The stator assembly is mounted on a stationary shaft which is an integral part of the oil pump. The stator (1) is located between the impeller (2) and the turbine (4) within the torque converter case.

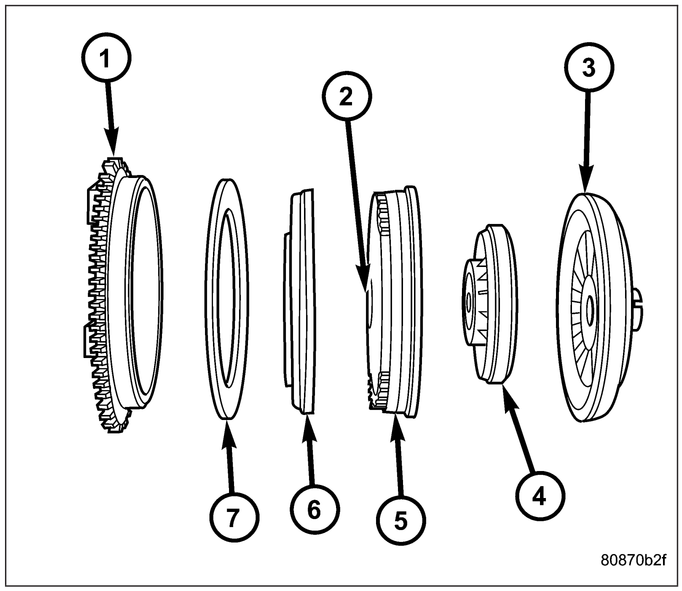


The stator contains an over-running clutch (1-4), which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.




## TORQUE CONVERTER CLUTCH (TCC)

The TCC was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock-free power transfer, it is natural for all fluid couplings to slip. If the impeller (3) and turbine (5) were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston (6) with friction material (7) was added to the turbine assembly (5) to provide this mechanical lock-up.

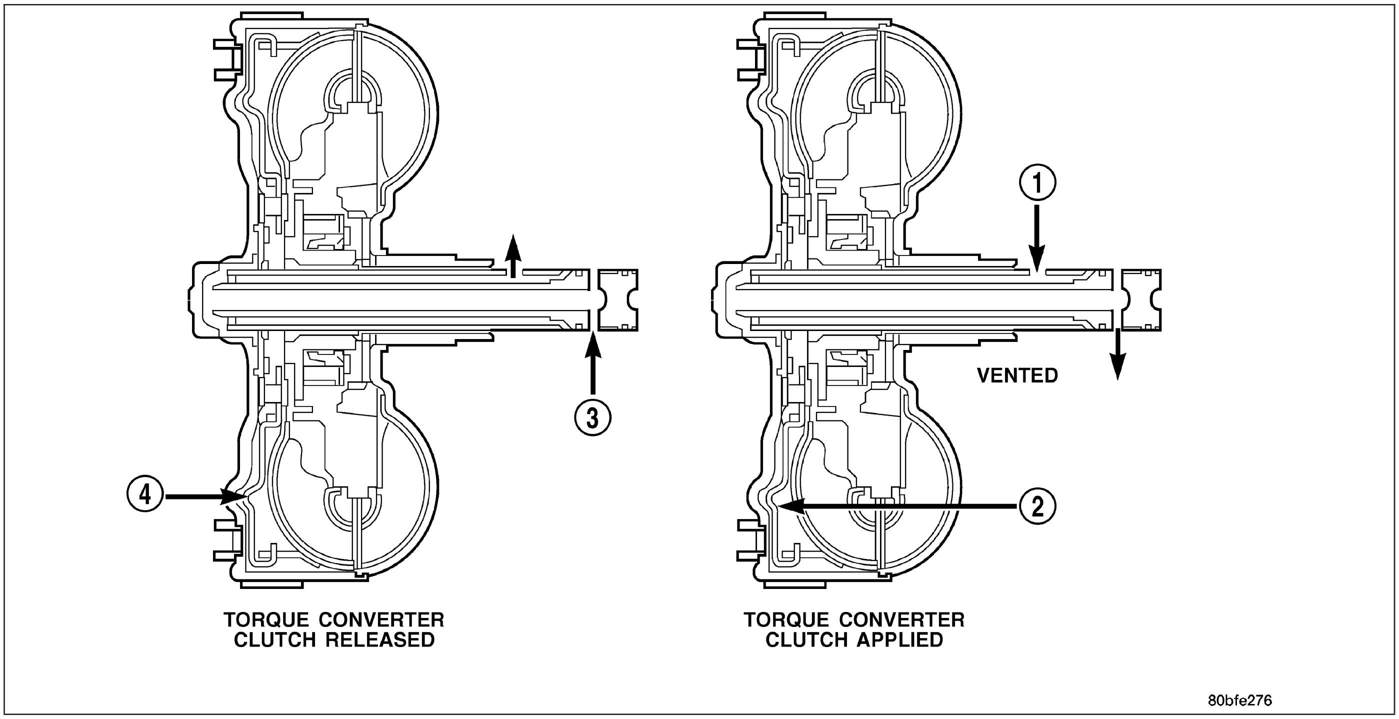



In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the L/R-CC Solenoid to achieve a smooth application of the torque converter clutch. This function, referred to as Electronically Modulated Converter Clutch (EMCC) can occur at various times depending on the following variables:

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature
- Input speed
- Throttle angle
- Engine speed

## OPERATION

The converter impeller (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.



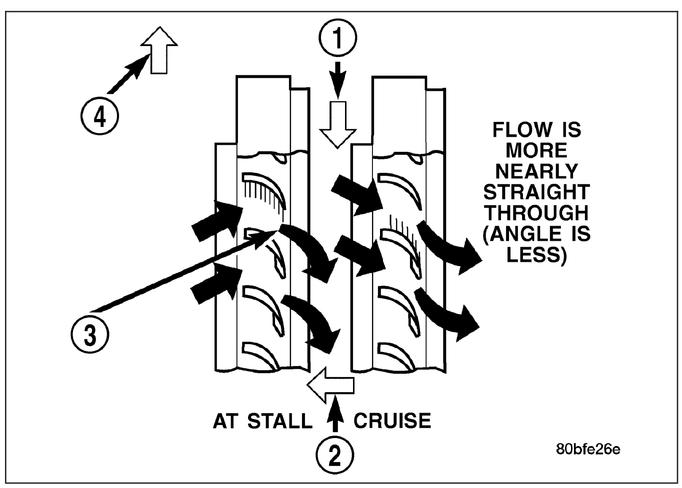

## TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a "hindering" direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

## STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft. Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counterclockwise direction. When this happens the over-running clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a "helping" direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.4:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such as way as to cause it to lock-up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.

## TORQUE CONVERTER CLUTCH (TCC)




In a standard torque converter, the impeller and turbine are rotating at about the same speed and the stator is freewheeling, providing no torque multiplication. By applying the turbine's piston and friction material to the front cover, a total converter engagement can be obtained. The result of this engagement is a direct 1:1 mechanical link between the engine and the transmission.

The clutch can be engaged in second, third, fourth, and fifth gear ranges depending on overdrive control switch position. If the overdrive control switch is in the normal ON position, the clutch will engage after the shift to fourth gear, and above approximately 72 km/h (45 mph). If the control switch is in the OFF position, the clutch will engage after the shift to third gear, at approximately 56 km/h (35 mph) at light throttle.

The TCM controls the torque converter by way of internal logic software. The programming of the software provides the TCM with control over the L/R-CC Solenoid. There are four output logic states that can be applied as follows:

- No EMCC
- Partial EMCC
- Full EMCC
- Gradual-to-no EMCC

**NO EMCC**

Under No EMCC conditions, the L/R Solenoid is OFF. There are several conditions that can result in NO EMCC operations. No EMCC can be initiated due to a fault in the transmission or because the TCM does not see the need for EMCC under current driving conditions.

**PARTIAL EMCC**

Partial EMCC operation modulates the L/R Solenoid (duty cycle) to obtain partial torque converter clutch application. Partial EMCC operation is maintained until Full EMCC is called for and actuated. During Partial EMCC some slip does occur. Partial EMCC will usually occur at low speeds, low load and light throttle situations.

**FULL EMCC**

During Full EMCC operation, the TCM increases the L/R Solenoid duty cycle to full ON after Partial EMCC control brings the engine speed within the desired slip range of transmission input speed relative to engine rpm.

**GRADUAL-TO-NO EMCC**

This operation is to soften the change from Full or Partial EMCC to No EMCC. This is done at mid-throttle by decreasing the L/R Solenoid duty cycle.

## REMOVAL

1. Remove transmission and torque converter from vehicle. (Refer to 21 - TRANSMISSION/AUTOMATIC - 45RFE/545RFE - REMOVAL)
2. Place a suitable drain pan under the converter housing end of the transmission.

**CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.**

3. Pull the torque converter forward until the center hub clears the oil pump seal.
4. Separate the torque converter from the transmission.

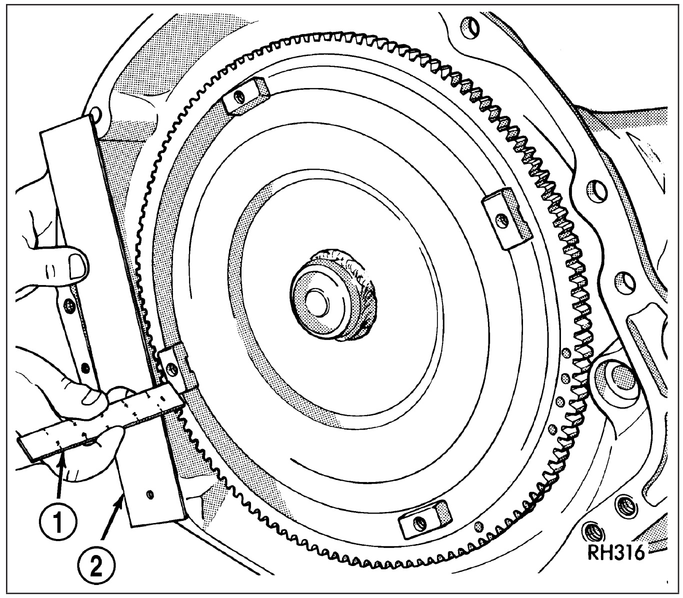
## INSTALLATION

**NOTE: Check converter hub and drive flats for sharp edges, burrs, scratches, or nicks. Polish the hub and flats with 320/400 grit paper or crocus cloth if necessary. Verify that the converter hub o-ring is properly installed and is free from debris. The hub must be smooth to avoid damaging the pump seal at installation.**

1. Lubricate oil pump seal lip with transmission fluid.
2. Place torque converter in position on transmission.

**CAUTION: Do not damage oil pump seal or converter hub o-ring while inserting torque converter into the front of the transmission.**

3. Align torque converter to oil pump seal opening.
4. Insert torque converter hub into oil pump.
5. While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.
6. Check converter seating with a scale (1) and straightedge (2). Surface of converter lugs should be at least 13 mm (1/2 in.) to rear of straightedge when converter is fully seated.
7. If necessary, temporarily secure converter with C-clamp attached to the converter housing.
8. Install the transmission in the vehicle.
9. Fill the transmission with the recommended fluid.



# RELAY-TRANSMISSION CONTROL

## DESCRIPTION

The relay is supplied fused B+ voltage, energized by the TCM, and is used to supply power to the solenoid pack when the transmission is in normal operating mode.

## OPERATION

When the relay is "off", no power is supplied to the solenoid pack and the transmission is in "limp-in" mode. After a controller reset, the TCM energizes the relay. Prior to this, the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the solenoid pack pressure switches is checked. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

# SENSOR-TRANSMISSION RANGE

## DESCRIPTION

The Transmission Range Sensor (TRS) is part of the solenoid module, which is mounted to the top of the valve body inside the transmission.

The Transmission Range Sensor (TRS) has five switch contact pins that:

- Determine shift lever position
- Supply ground to the Starter Relay in Park and Neutral only.
- Supply +12 V to the backup lamps in Reverse only.

The TRS also has an integrated temperature sensor (thermistor) that communicates transmission temperature to the TCM and PCM.

## OPERATION

The Transmission Range Sensor (TRS) communicates shift lever position to the TCM as a combination of open and closed switches. Each shift lever position has an assigned combination of switch states (open/closed) that the TCM receives from four sense circuits. The TCM interprets this information and determines the appropriate transmission gear position and shift schedule.

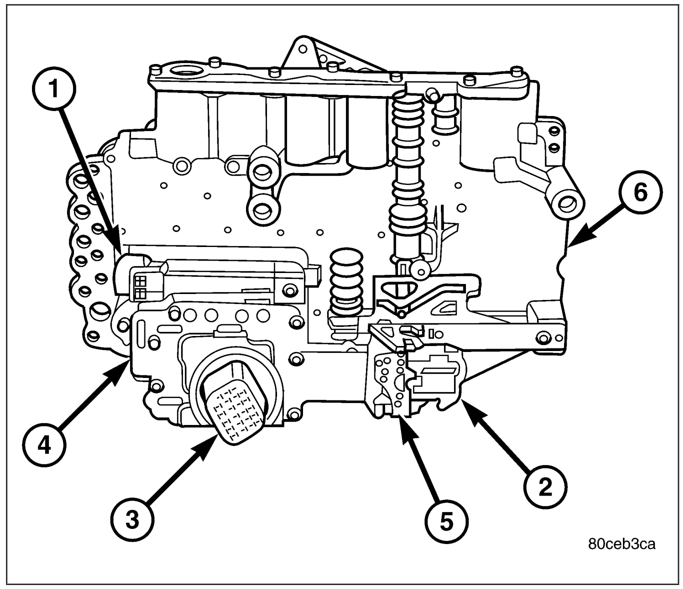
There are many possible combinations of open and closed switches (codes). Seven of these possible codes are related to gear position and five are recognized as “between gear” codes. This results in many codes which should **never occur**. These are called “invalid” codes. An invalid code will result in a DTC, and the TCM will then determine the shift lever position based on pressure switch data. This allows reasonably normal transmission operation with a TRS failure.

| GEAR | C5 | C4 | C3 | C2 | C1 |
|---|---|---|---|---|---|
| **Park** | CL | OP | OP | CL | CL |
| **Temp 1** | CL | OP | OP | CL | OP |
| **Reverse** | OP | OP | OP | CL | OP |
| **Temp 2** | OP | OP | CL | CL | OP |
| **Neutral 1** | OP | OP | CL | CL | CL |
| **Neutral 2** | OP | CL | CL | CL | CL |
| **Temp 3** | OP | CL | CL | CL | OP |
| **Drive** | OP | CL | CL | OP | OP |
| **Temp 4** | OP | CL | OP | OP | OP |
| **Manual 2** | CL | CL | OP | OP | OP |
| **Temp 5** | CL | OP | OP | OP | OP |
| **Manual 1** | CL | OP | CL | OP | OP |

# ASSEMBLY-TRANSMISSION SOLENOID/TRS

## DESCRIPTION

The transmission solenoid/TRS assembly is internal to the transmission and mounted on the valve body assembly. The assembly consists of six solenoids that control hydraulic pressure to the six friction elements (transmission clutches), and the torque converter clutch. The pressure control solenoid is located on the side of the solenoid/TRS assembly. The solenoid/TRS assembly also contains five pressure switches that feed information to the TCM.




## OPERATION

### SOLENOIDS

Solenoids are used to control the L/R, 2C, 4C, OD, and UD friction elements. The reverse clutch is controlled by line pressure and the position of the manual valve in the valve body. All the solenoids are contained within the Solenoid and Pressure Switch Assembly. The solenoid and pressure switch assembly contains one additional solenoid, Multi-Select (MS), which serves primarily to provide 2nd and 3rd gear limp-in operation.

The solenoids receive electrical power from the Transmission Control Relay through a single wire. The TCM energizes or operates the solenoids individually by grounding the return wire of the solenoid as necessary. When a solenoid is energized, the solenoid valve shifts, and a fluid passage is opened or closed (vented or applied), depending on its default operating state. The result is an apply or release of a frictional element.

The MS and UD solenoids are normally applied to allow transmission limp-in in the event of an electrical failure.

The continuity of the solenoids and circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the TCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a speed ratio or pressure switch error occurs.

### PRESSURE SWITCHES

The TCM relies on five pressure switches to monitor fluid pressure in the L/R, 2C, 4C, UD, and OD hydraulic circuits. The primary purpose of these switches is to help the TCM detect when clutch circuit hydraulic failures occur. The switches close at approximately 23 psi and open at approximately 11 psi, and simply indicate whether or not pressure exists. The switches are continuously monitored by the TCM for the correct states (open or closed) in each gear as shown in the following chart:

| GEAR | L/R | 2C | 4C | UD | OD |
|---|---|---|---|---|---|
| **R** | OP | OP | OP | OP | OP |
| **P/N** | CL | OP | OP | OP | OP |
| **1ST** | CL* | OP | OP | CL | OP |
| **2ND** | OP | CL | OP | CL | OP |
| **2ND PRIME** | OP | OP | CL | CL | OP |

| GEAR | L/R | 2C | 4C | UD | OD |
|---|---|---|---|---|---|
| D | OP | OP | OP | CL | CL |
| 4TH | OP | OP | CL | OP | CL |
| 5TH | OP | CL | OP | OP | CL |

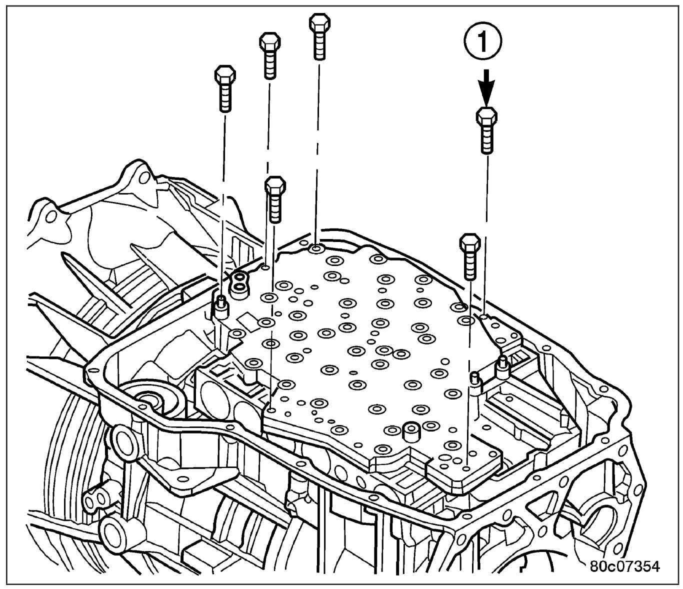
*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is open in Manual 1.

A Diagnostic Trouble Code (DTC) will set if the TCM senses any switch open or closed at the wrong time in a given gear.

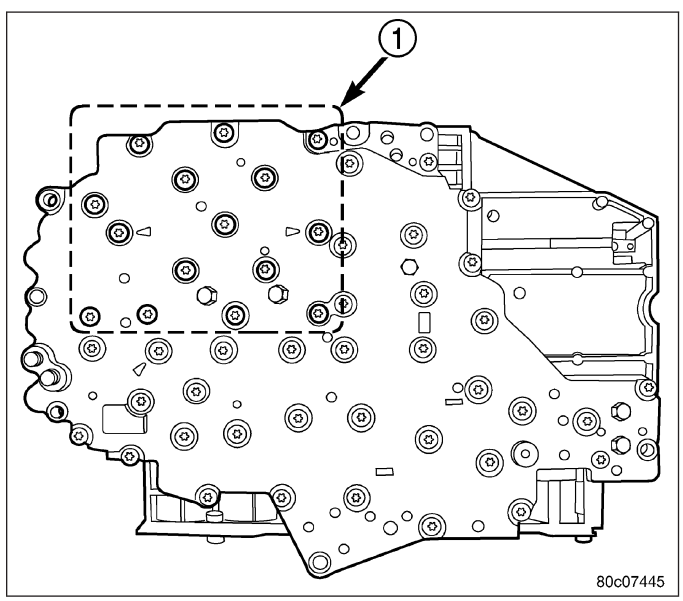
## REMOVAL

**NOTE: If the Transmission Solenoid/TRS Assembly is being replaced, the Quick Learn Procedure must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)**

1. Remove the valve body from the transmission. (Refer to 21 - TRANSMISSION/AUTOMATIC - 45RFE/545RFE/VALVE BODY - REMOVAL)

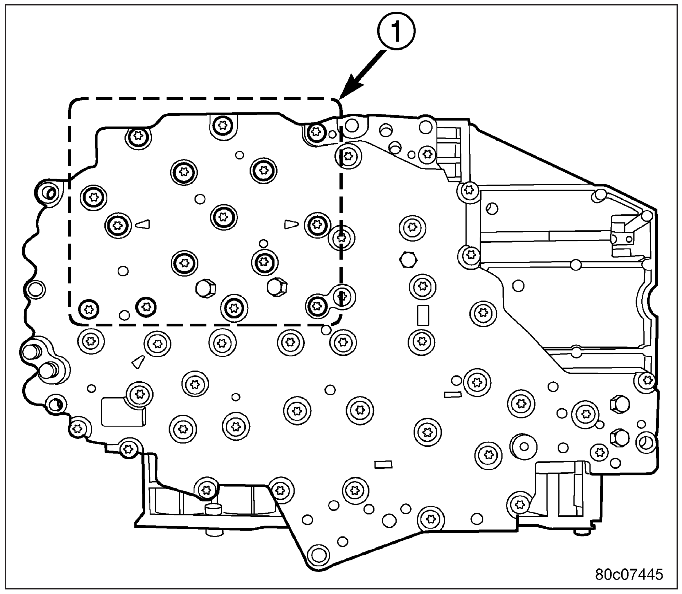



2. Remove the bolts (1) holding the transmission solenoid/TRS assembly onto the valve body.
3. Separate the transmission solenoid/TRS assembly from the valve body.



## INSTALLATION

1. Place TRS selector plate in the PARK position.
2. Position the transmission solenoid/TRS assembly onto the valve body. Be sure that both alignment dowels are fully seated in the valve body and that the TRS switch contacts are properly positioned in the selector plate
3. Install the bolts (1) to hold the transmission solenoid/TRS assembly onto the valve body.
4. Tighten the solenoid assembly screws adjacent to the arrows cast into the bottom of the valve body first. Tighten the screws to 6 N·m (50 in.lbs.).
5. Tighten the remainder of the solenoid assembly screws to 6 N·m (50 in.lbs.).
6. Install the valve body into the transmission.



# SENSOR-TRANSMISSION TEMPERATURE

## DESCRIPTION

The transmission temperature sensor is a thermistor that is integral to the Transmission Range Sensor (TRS).

## OPERATION

The transmission temperature sensor is used by the TCM to sense the temperature of the fluid in the sump. Since fluid temperature can affect transmission shift quality and convertor lock up, the TCM requires this information to determine which shift schedule to operate in.

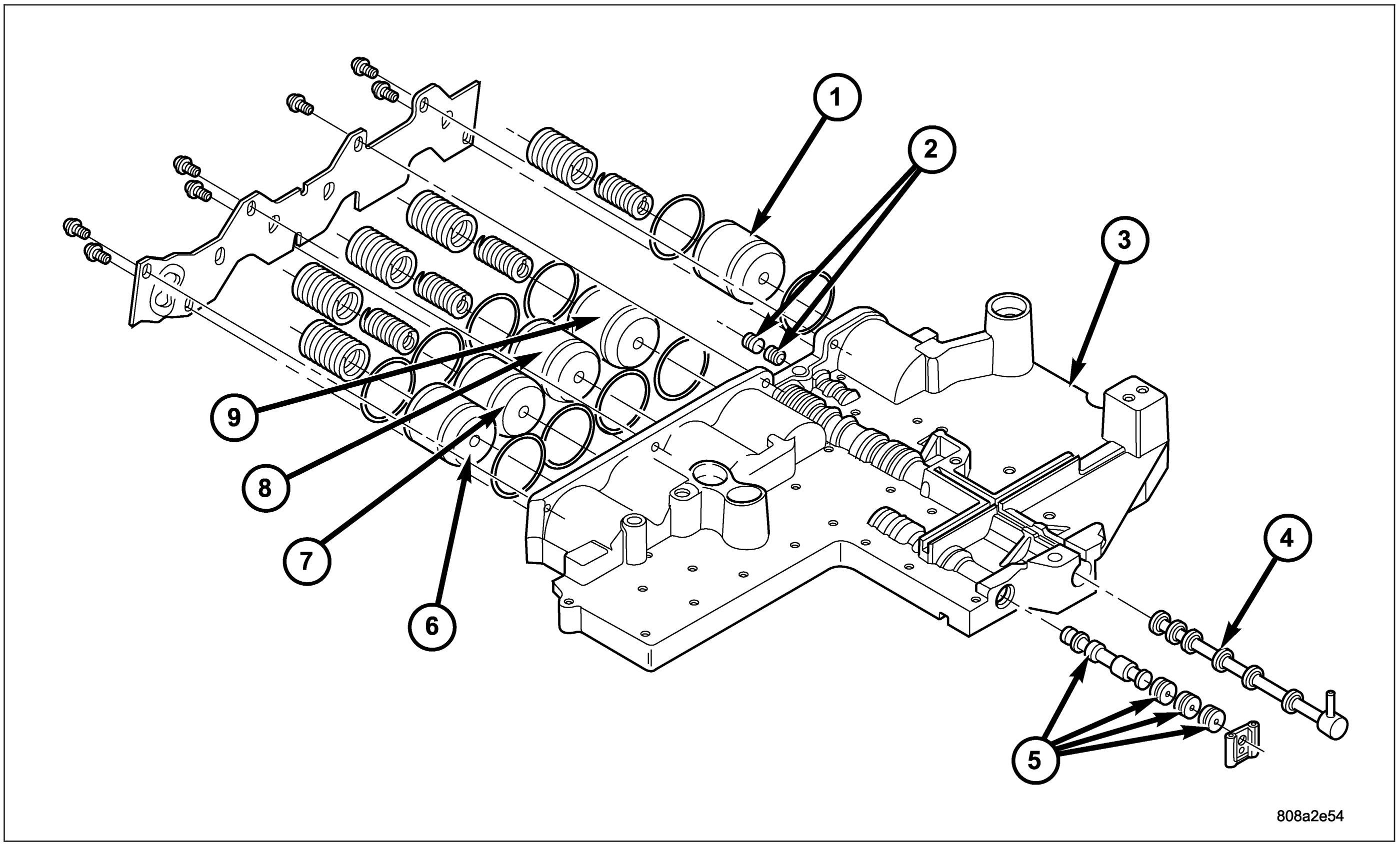
### Calculated Temperature

A failure in the temperature sensor or circuit will result in calculated temperature being substituted for actual temperature. Calculated temperature is a predicted fluid temperature which is calculated from a combination of inputs:

- Battery (ambient) temperature
- Engine coolant temperature
- In-gear run time since start-up

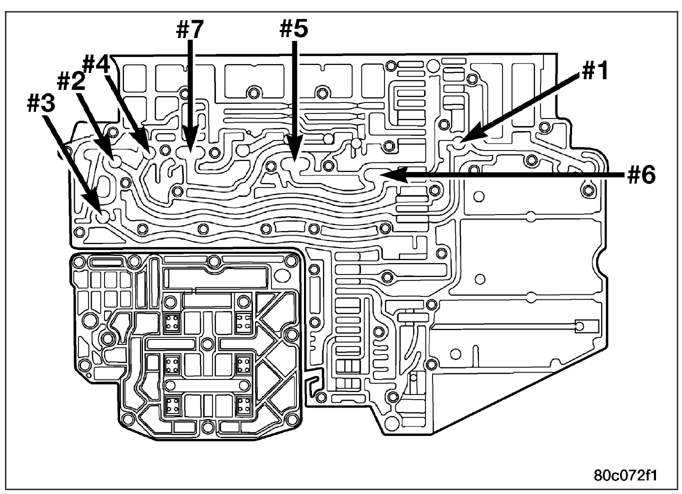
# BODY-VALVE

## DESCRIPTION




The valve body consists of a cast aluminum valve body, a separator plate, and a transfer plate. The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, bands, and frictional clutches. The valve body contains the following components :

- Solenoid switch valve
- Manual valve
- Low/reverse switch valve
- 5 Accumulators
- 7 check balls



## OPERATION

**NOTE: Refer to the Hydraulic Schematics for a visual aid in determining valve location, operation and design.**

### SOLENOID SWITCH VALVE

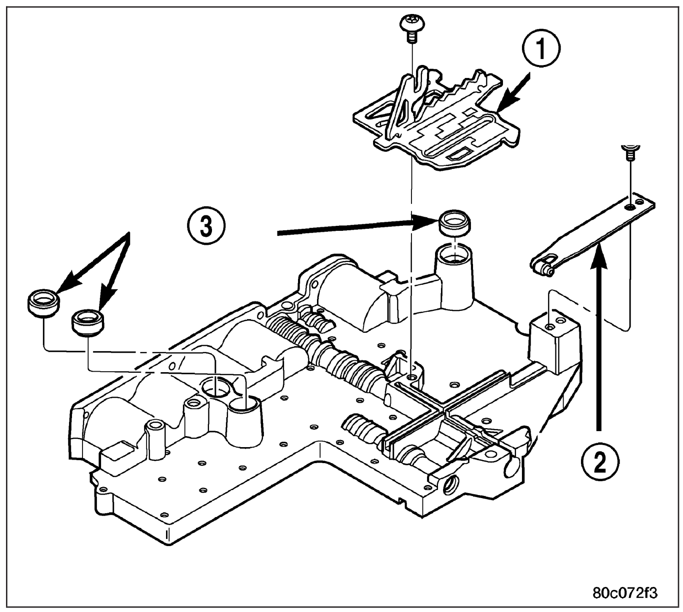
The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the L/R-TCC solenoid is energized.

The Solenoid Switch Valve controls line pressure from the LR-TCC solenoid. In 1st gear, the SSV will be in the downshifted position, thus directing fluid to the L/R clutch circuit. In 2nd, 3rd, 4th, and fifth gears, the solenoid switch valve will be in the upshifted position and directs the fluid into the torque converter clutch (TCC) circuit.

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R pressure switch is monitored to confirm SSV movement. If the movement is not confirmed (the L/R pressure switch does not close), 2nd gear is substituted for 1st. A DTC will be set after three unsuccessful attempts are made to get into 1st gear in one given key start.

### MANUAL VALVE

The manual valve is a relay valve. The purpose of the manual valve is to direct fluid to the correct circuit needed for a specific gear or driving range. The manual valve, as the name implies, is manually operated by the driver with a lever located on the top of the valve body. The valve is connected mechanically by a cable to the gearshift mechanism. The valve is held in each of its positions by a roller detent spring (2) that engages the roostercomb of the TRS selector plate (1).



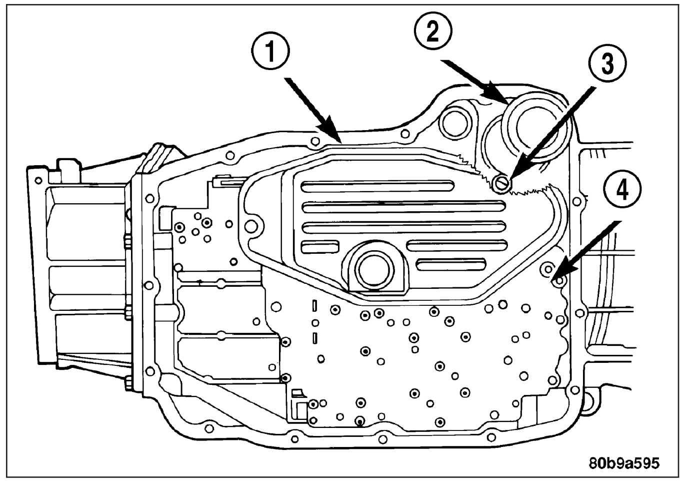

### LOW/REVERSE SWITCH VALVE

The low/reverse switch valve allows the low/reverse clutch to be operated by either the LR/CC solenoid or the MS solenoid.

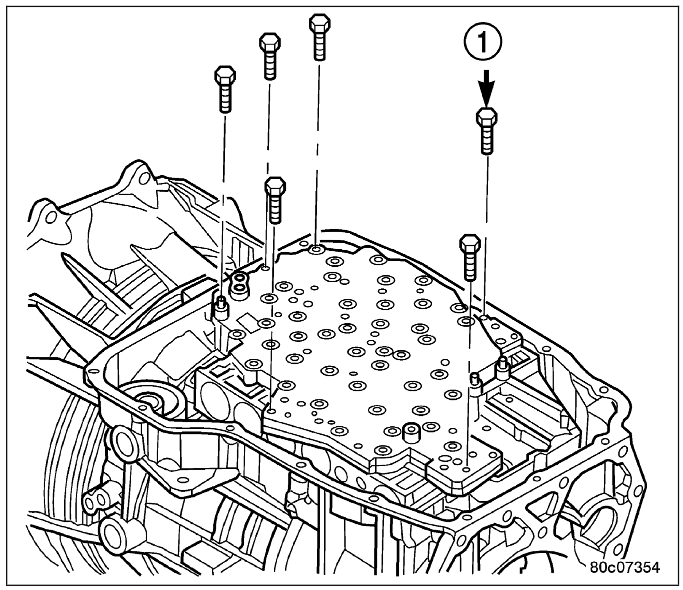
## REMOVAL

**NOTE: The valve body can be removed for service without having to remove the transmission assembly. The valve body can be disassembled for cleaning and inspection of the individual components. (Refer to 21 - TRANSMISSION/AUTOMATIC - 45RFE/VALVE BODY - DISASSEMBLY)**

1. Shift transmission into PARK.
2. Raise vehicle.
3. Disconnect wires at the solenoid and pressure switch assembly connector.
4. Position drain pan under transmission oil pan.
5. Remove transmission oil pan.
6. Remove the primary oil filter (1) from valve body.

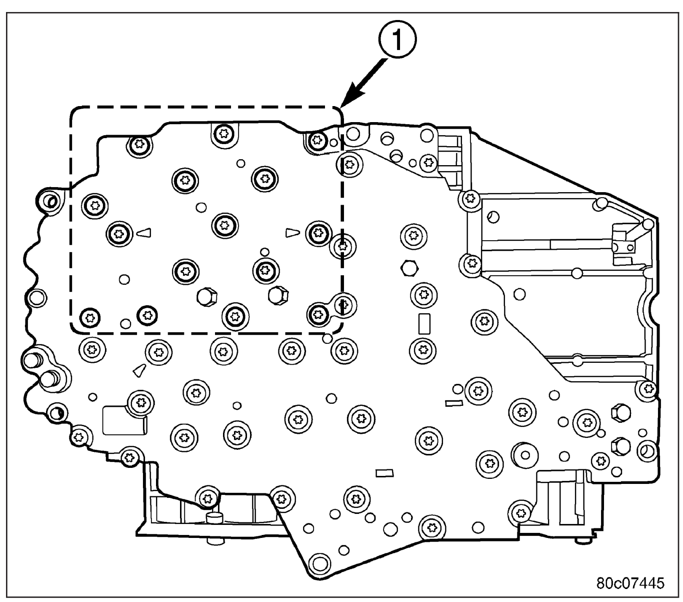



7. Remove bolts (1) attaching valve body to transmission case.
8. Lower the valve body and work the electrical connector out of transmission case.
9. Separate the valve body from the transmission.

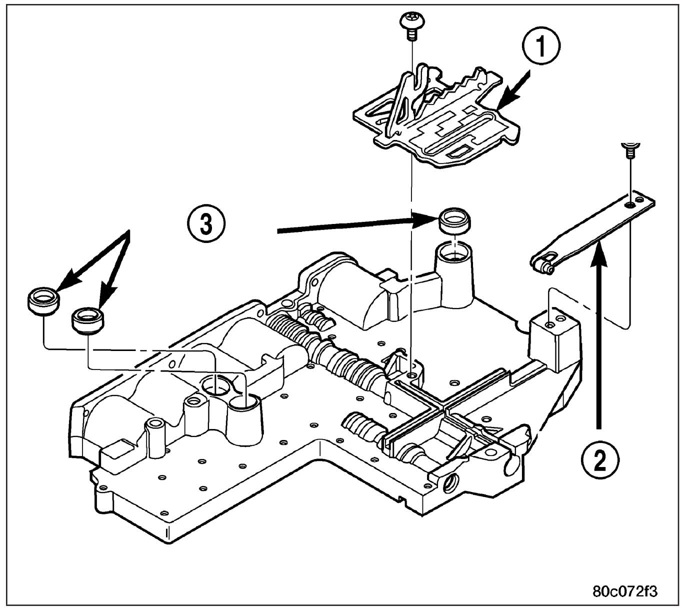


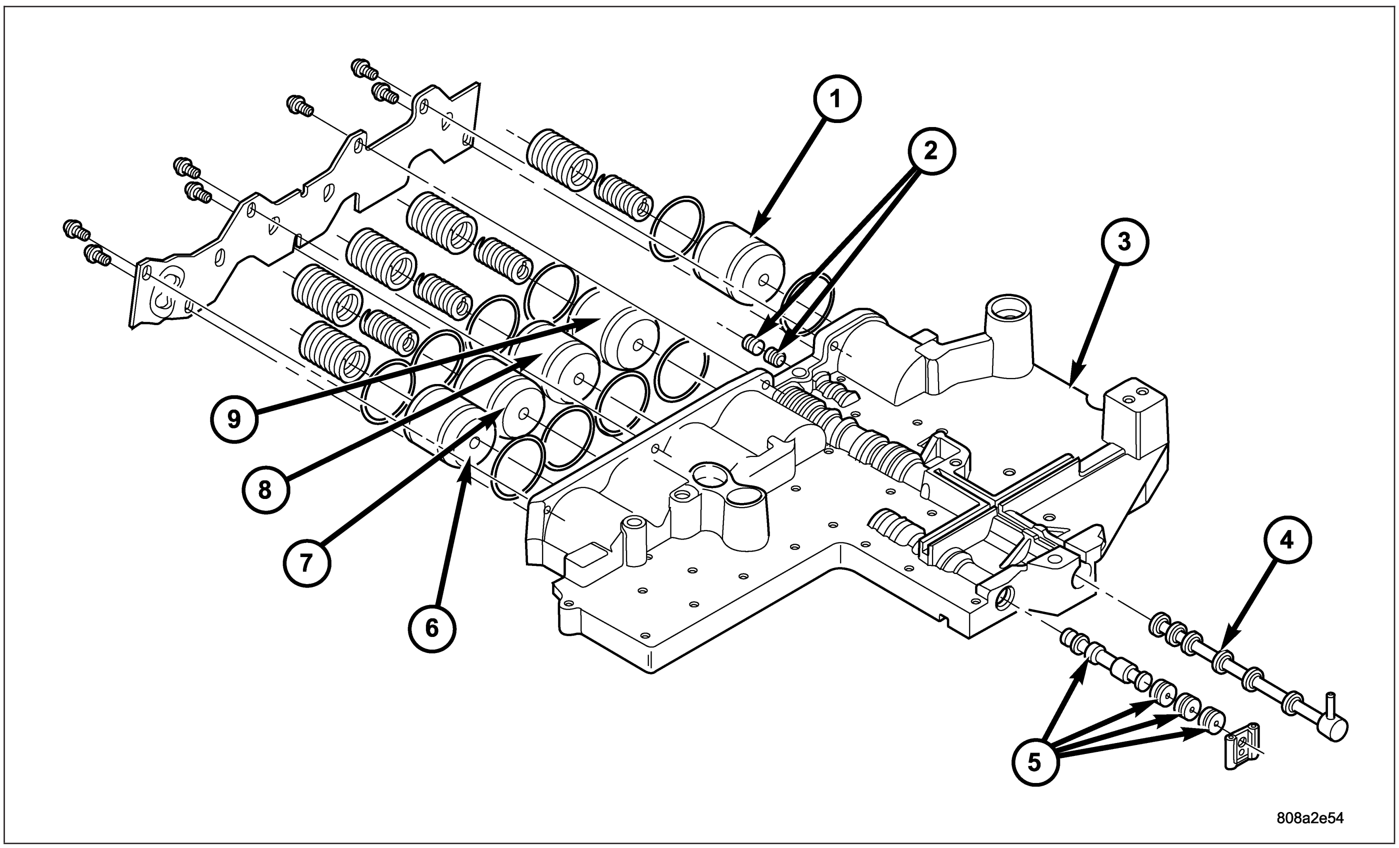

## DISASSEMBLY

1. Remove the bolts (1) holding the solenoid and pressure switch assembly to the valve body. Do not remove the screws on the top of the solenoid and pressure switch assembly.
2. Separate the solenoid and pressure switch assembly from the valve body.



3. Remove the screw holding the detent spring (2) onto the valve body.
4. Remove the detent spring (2) from the valve body.
5. Remove the TRS selector plate (1) from the valve body and the manual valve.
6. Remove the clutch passage seals (3) from the valve body, if necessary.



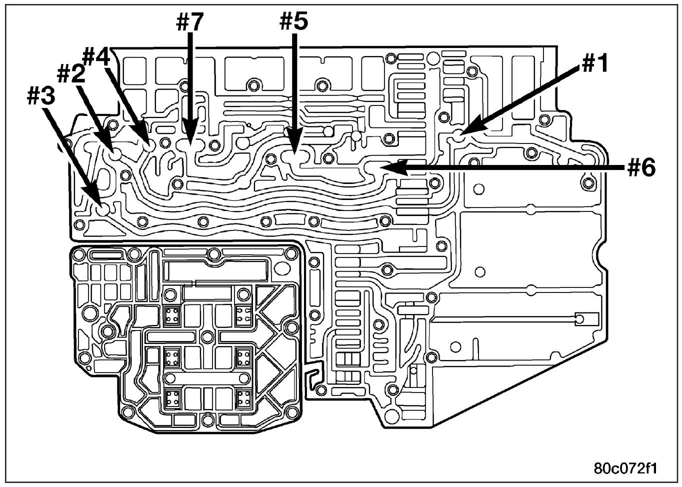



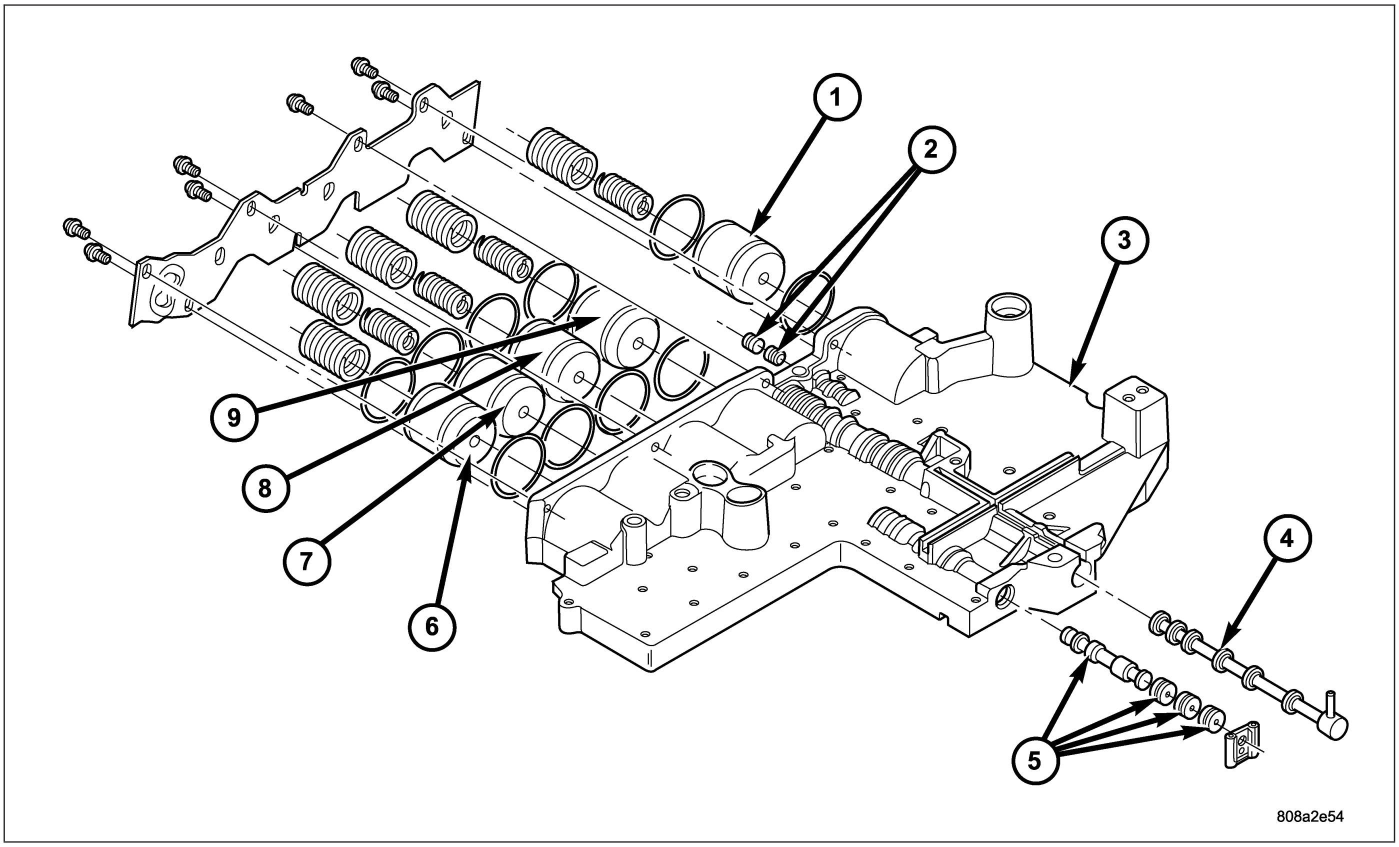

7. Remove the screws holding the accumulator cover onto the valve body.
8. Remove the accumulator springs and pistons (1, 6-9) from the valve body. Note which accumulator piston and spring belong in each location.

9. Place the valve body on the bench with the transfer plate upward.

**NOTE: The valve body contains seven check balls. The transfer plate must be placed upward to prevent losing the check balls when the transfer plate is removed from the valve body.**

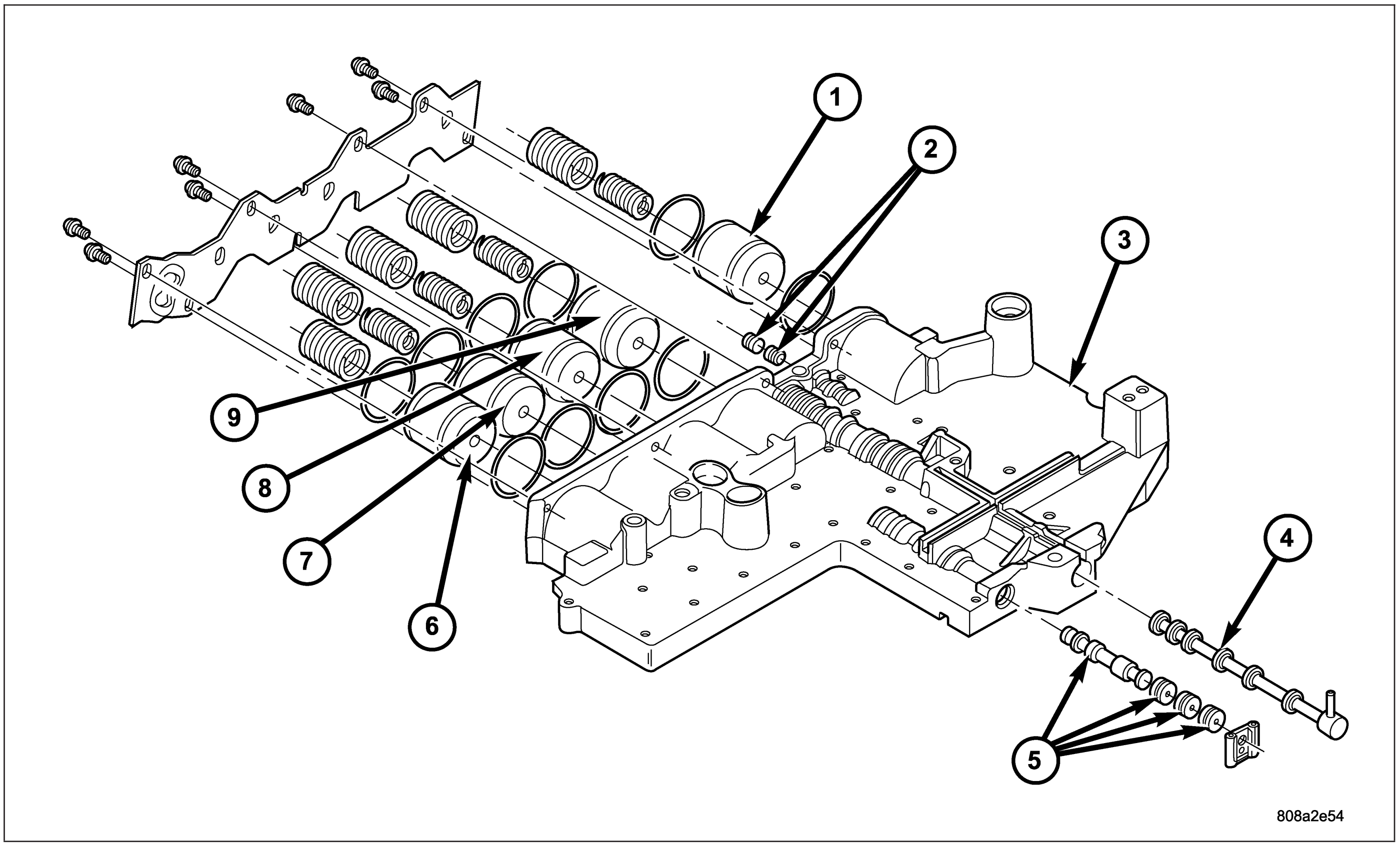
10. Remove the screws holding the valve body to the valve body transfer plate.
11. Remove the transfer plate from the valve body. Note the location of all check balls.
12. Remove the check balls from the valve body.




13. Remove the retainers securing the solenoid switch valve (5), manual valve (4), and the low/reverse switch valve (2) from the valve body and remove the associated valve and spring. Tag each valve and spring combination with location information to aid in assembly.

## CLEANING

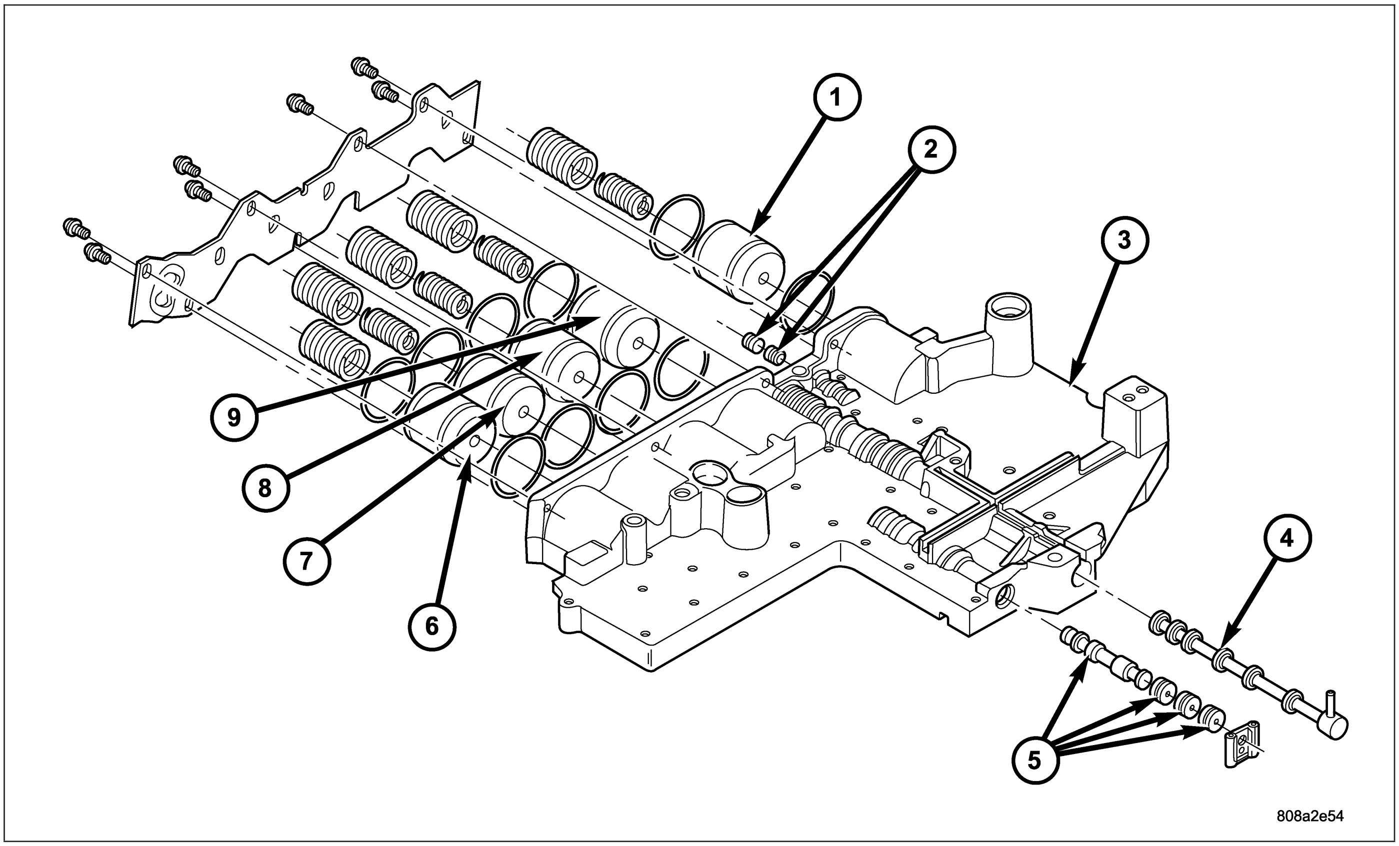



Clean the valve housings, valves, plugs, springs, and separator plates with a standard parts cleaning solution only. Do not use gasoline, kerosene, or any type of caustic solution.

Do not immerse any of the electrical components in cleaning solution. Clean the electrical components by wiping them off with dry shop towels only.

Dry all except the electrical parts with compressed air. Make sure all passages are clean and free from obstructions. **Do not use rags or shop towels to dry or wipe off valve body components. Lint from these materials can stick to valve body parts, interfere with valve operation, and clog filters and fluid passages.**

## INSPECTION




Inspect all of the valve body mating surfaces for scratches, nicks, burrs, or distortion. Use a straightedge to check surface flatness. Minor scratches may be removed with crocus cloth using only very light pressure.

Minor distortion of a valve body mating surface may be corrected by smoothing the surface with a sheet of crocus cloth. Position the crocus cloth on a surface plate, sheet of plate glass or equally flat surface. If distortion is severe or any surfaces are heavily scored, the valve body will have to be replaced.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.** Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

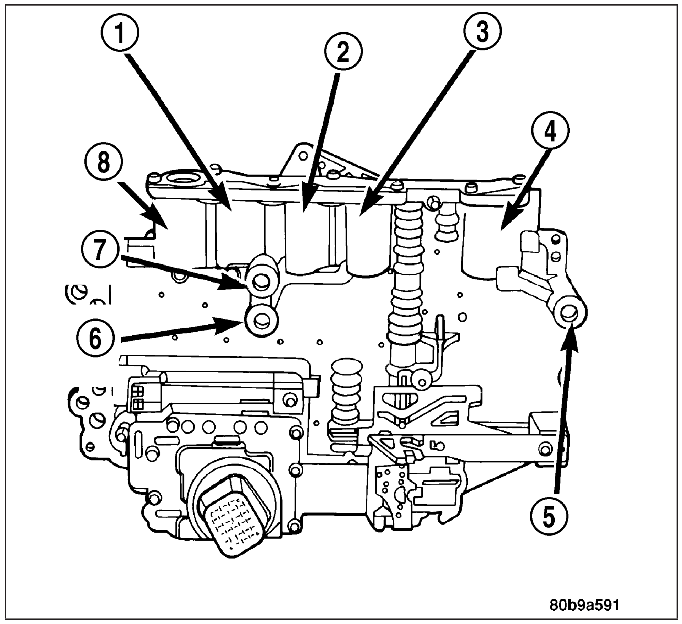
Inspect all the valve and plug bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the valve body springs. The springs must be free of distortion, warpage or broken coils.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

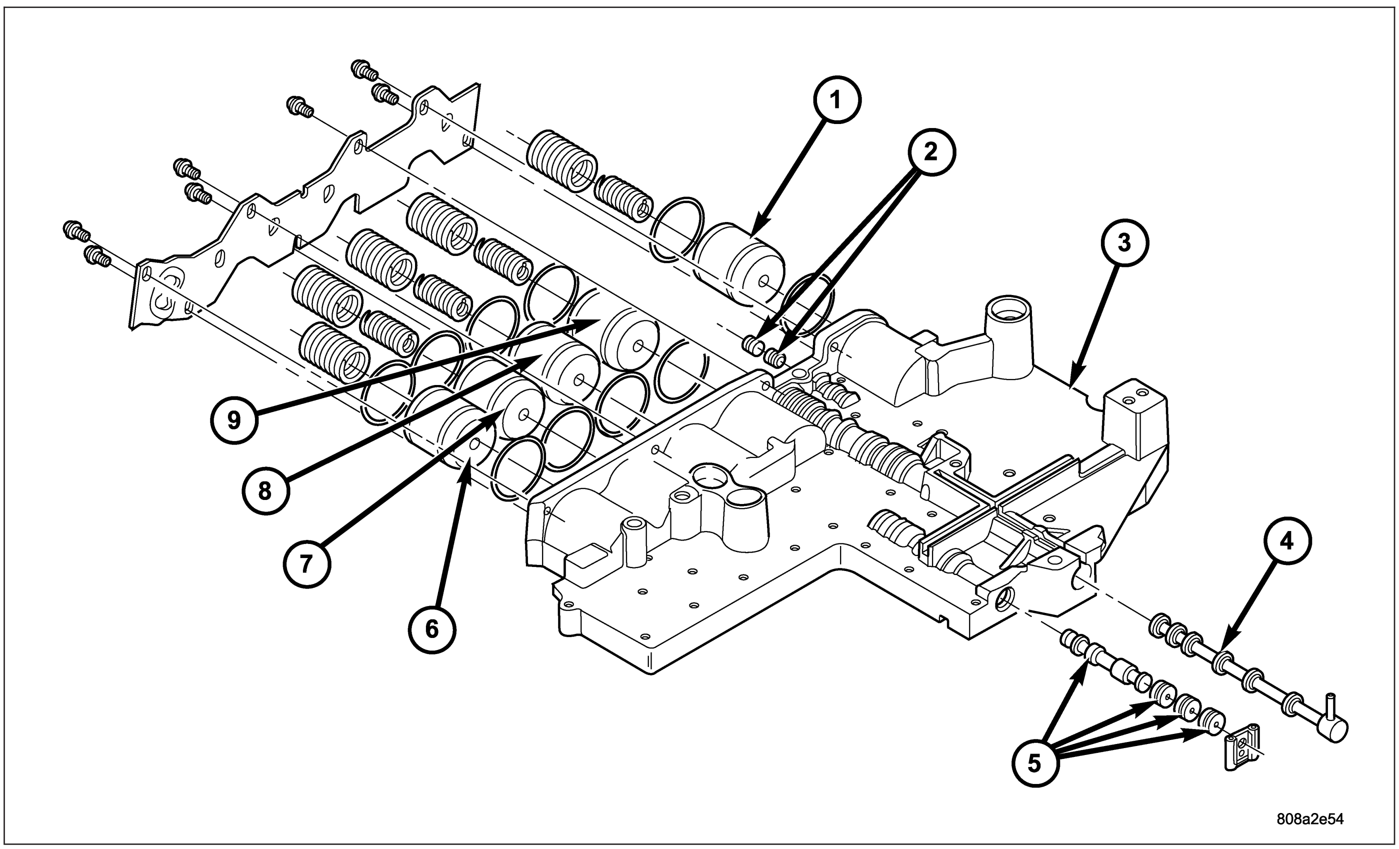
Valve body bores do not change dimensionally with use. If the valve body functioned correctly when new, it will continue to operate properly after cleaning and inspection. It should not be necessary to replace a valve body assembly unless it is damaged in handling.

Inspect all the accumulator bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the accumulator springs. The springs must be free of distortion, warpage or broken coils.

Inspect all the fluid seals on the valve body. Replace any seals that are cracked, distorted, or damaged in any way. These seals pass fluid pressure directly to the clutches. Any pressure leak at these points, may cause transmission performance problems.

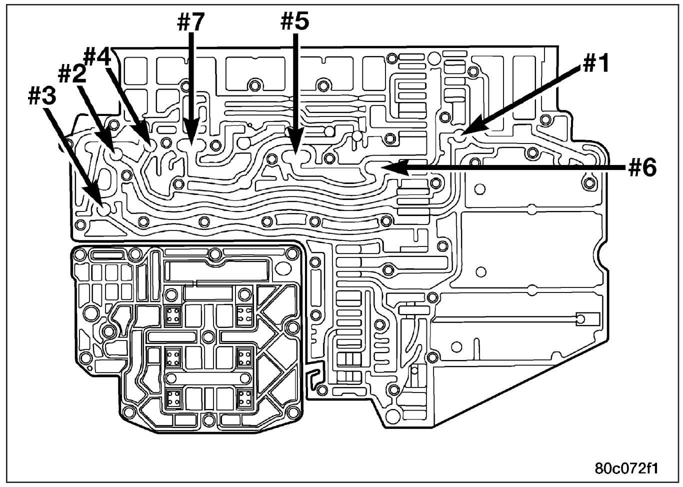


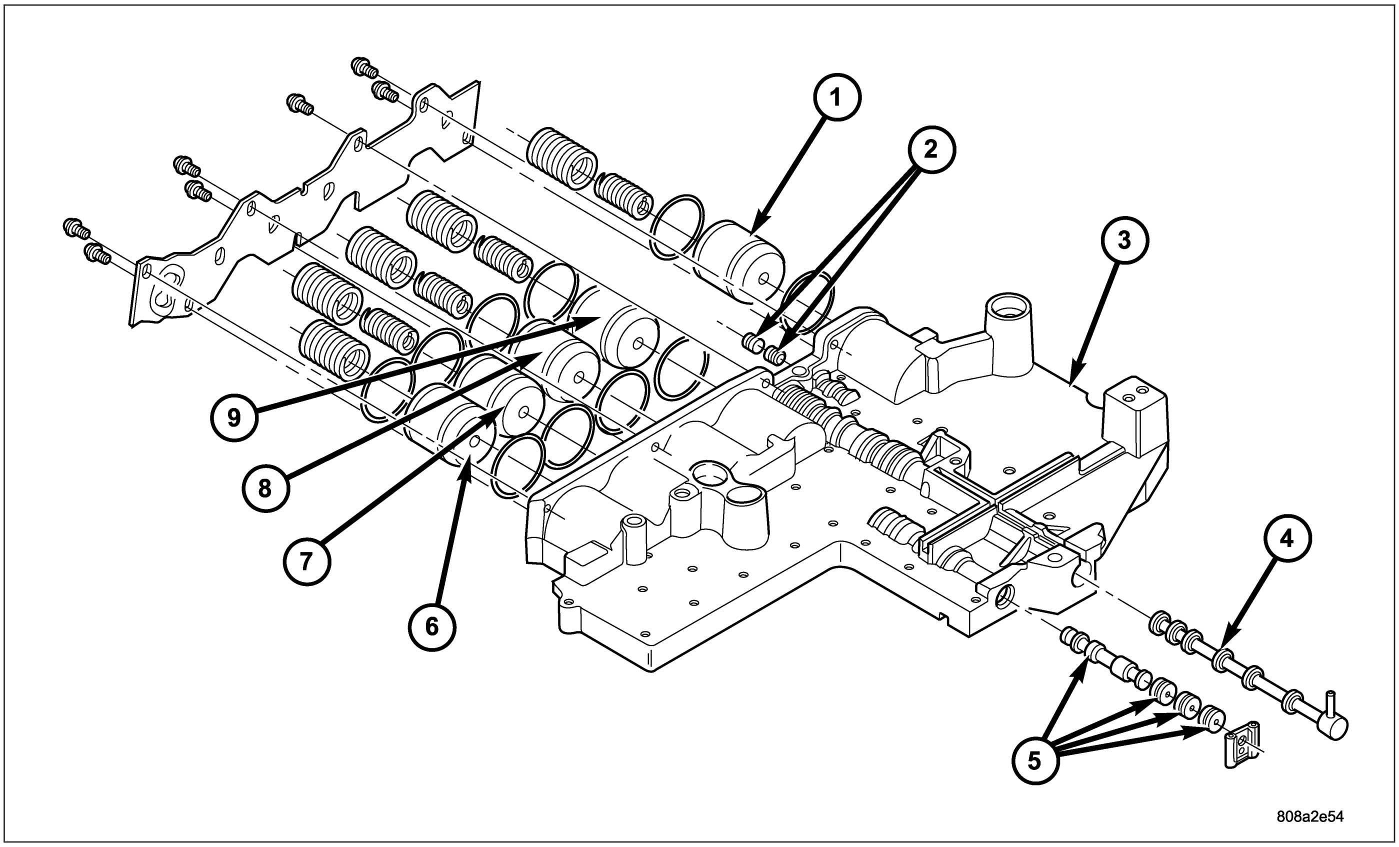

## ASSEMBLY




1. Lubricate valves, springs, and the housing valve bores with clean transmission fluid.
2. Install solenoid switch valve (5), manual valve (4), and the low/reverse switch valve (2) into the valve body.
3. Install the retainers to hold each valve into the valve body.

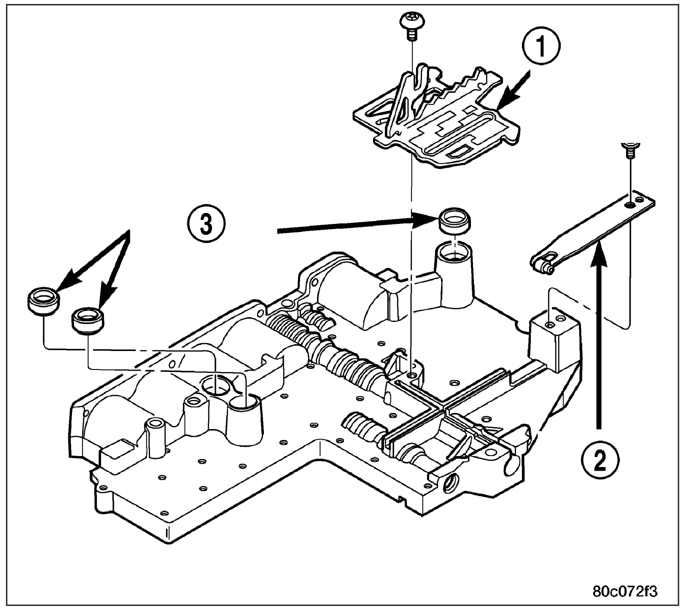
4. Install the valve body check balls into their proper locations.
5. Position the transfer plate onto the valve body.
6. Install the screws to hold the transfer plate to the valve body. Tighten the screws to 6 N·m (50 in. lbs.).



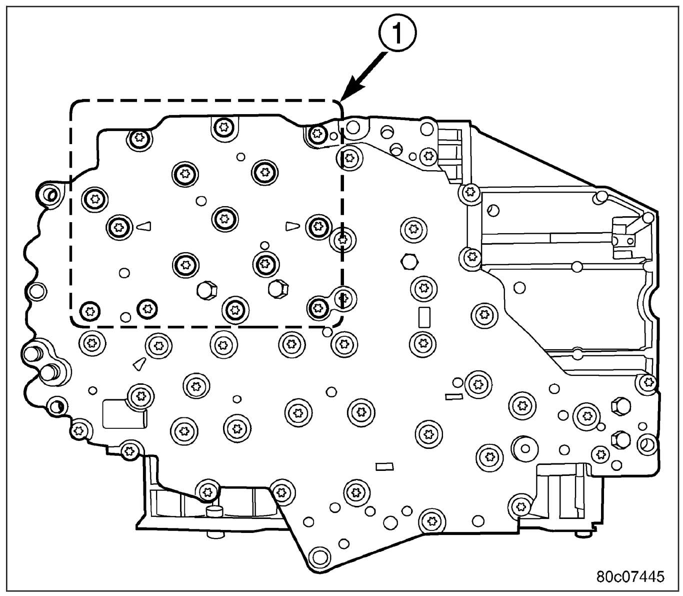




7. Install the accumulator pistons (1, 6-9) and springs into the valve body in the location from which they were removed. Note that all accumulators except the overdrive have two springs. The overdrive accumulator piston (6) has only one spring.
8. Position the accumulator cover onto the valve body.
9. Install the screws to hold the accumulator cover onto the valve body. Tighten the screws to 7 N·m (60 in. lbs.).

10. Install the TRS selector plate (1) onto the valve body and the manual valve.
11. Position the detent spring (2) onto the valve body.
12. Install the screw to hold the detent spring (2) onto the valve body. Tighten the screw to 4.5 N·m (40 in. lbs.).
13. Install new clutch passage seals (3) onto the valve body, if necessary.

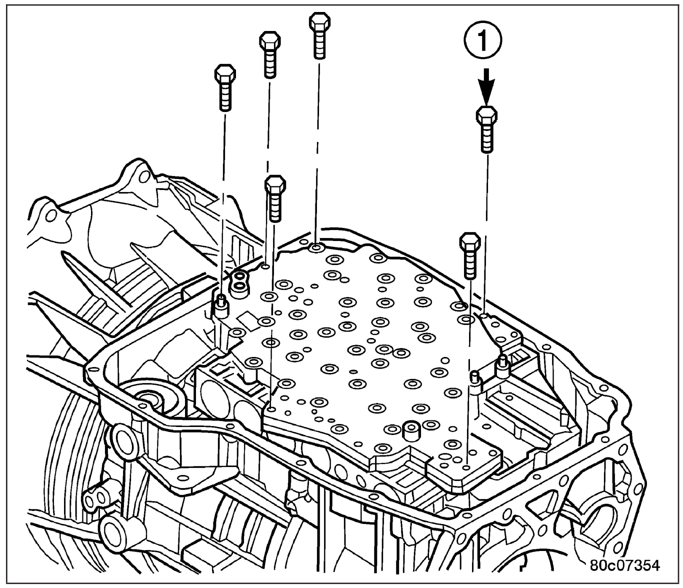



14. Install the solenoid and pressure switch assembly onto the valve body.
15. Install the bolts (1) to hold the solenoid and pressure switch assembly onto the valve body. Tighten the bolts to 6 N·m (50 in. lbs.). Tighten the bolts adjacent to the arrows cast into the bottom of the transfer plate first.

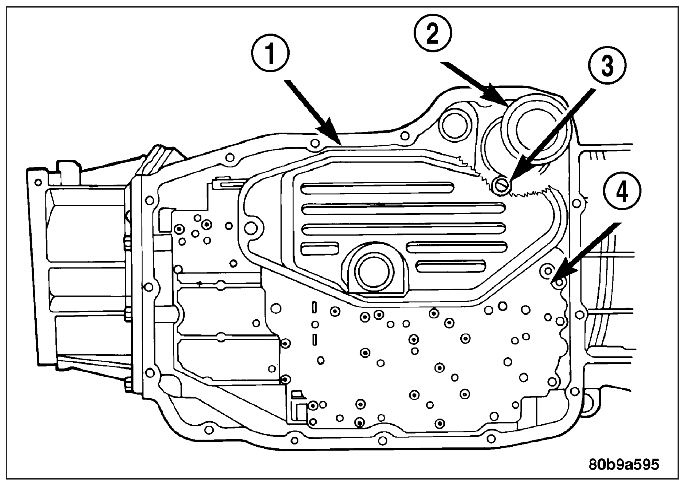


## INSTALLATION

1. Check condition of seals on valve body and the solenoid and pressure switch assembly. Replace seals if cut or worn.
2. Place TRS selector plate in the PARK position.
3. Place the transmission in the PARK position.
4. Lubricate seal on the solenoid and pressure switch assembly connector with petroleum jelly.
5. Position valve body in transmission and align the manual lever on the valve body to the pin on the transmission manual shift lever.
6. Seat valve body in case and install one or two bolts to hold valve body in place.
7. Tighten valve body bolts alternately and evenly to 12 N·m (105 in. lbs.) torque.




**CAUTION: The primary oil filter seal MUST be fully installed flush against the oil pump body. DO NOT install the seal onto the filter neck and attempt to install the filter and seal as an assembly. Damage to the transmission will result.**




8. Install a new primary oil filter seal in the oil pump inlet bore. Seat the seal in the bore with the butt end of a hammer, or other suitable tool.
9. Place replacement filter (1) in position on valve body and into the oil pump.
10. Install screw to hold filter to valve body. Tighten screw to 4.5 N·m (40 in. lbs.) torque.
11. Connect the solenoid and pressure switch assembly connector.
12. Install oil pan. Tighten pan bolts to 12 N·m (105 in. lbs.) torque.
13. Lower vehicle and fill transmission with Mopar® ATF +4.
14. Check and adjust gearshift cable, if necessary.

# TRANSFER CASE - NV231

## TABLE OF CONTENTS

# TRANSFER CASE - NV231

## DESCRIPTION

The NV231 is a part-time transfer case with a low range reduction gear system. The NV231 has three operating ranges plus a NEUTRAL position. A low range system provides a reduction ratio for increased low speed torque capability.

The geartrain is mounted in two aluminum case halves attached with bolts. The mainshaft front and rear bearings are mounted in aluminum retainer housings bolted to the case halves.

### OPERATING RANGES

Transfer case operating ranges are:

- 2WD (2-wheel drive)
- 4Hi (4-wheel drive)
- 4 Lo (4-wheel drive low range)

The 2WD range is for use on any road surface at any time.

The 4Hi and 4 Lo ranges are for off road use only. They are not for use on hard surface roads. The only exception being when the road surface is wet or slippery or covered by ice and snow.

The low range reduction gear system is operative in 4 Lo range only. This range is for extra pulling power in off road situations. Low range reduction ratio is 2.72:1.

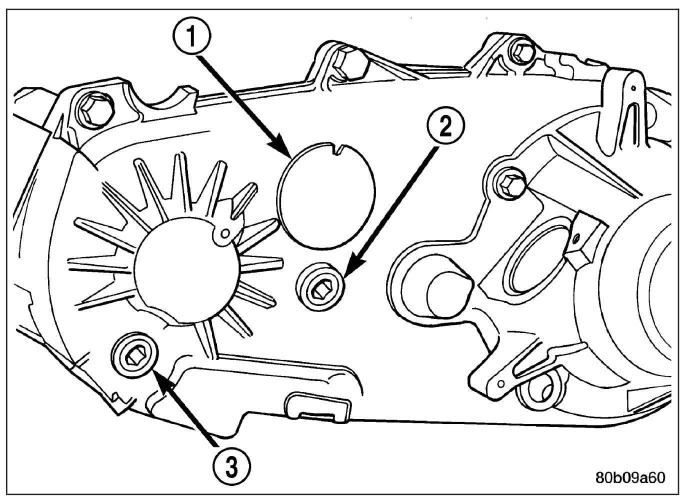
### SHIFT MECHANISM

Operating ranges are selected with a floor mounted shift lever. The shift lever is connected to the transfer case range lever by a shift cable. A straight line shift pattern is used. Range positions are marked on the shifter knob bezel.

### IDENTIFICATION

A circular ID tag (1) is attached to the rear case of each transfer case. The ID tag provides the transfer case model number, assembly number, serial number, and low range ratio.

The transfer case serial number also represents the date of build.




## OPERATION

The input gear is splined to the transmission output shaft. The input gear drives the mainshaft through the planetary assembly and range hub. The front output shaft is operated by a drive chain that connects the shaft to a drive sprocket on the mainshaft. The drive sprocket is engaged/disengaged by the mode fork, which operates the mode sleeve and hub. The sleeve and hub are not equipped with a synchronizer mechanism for shifting.

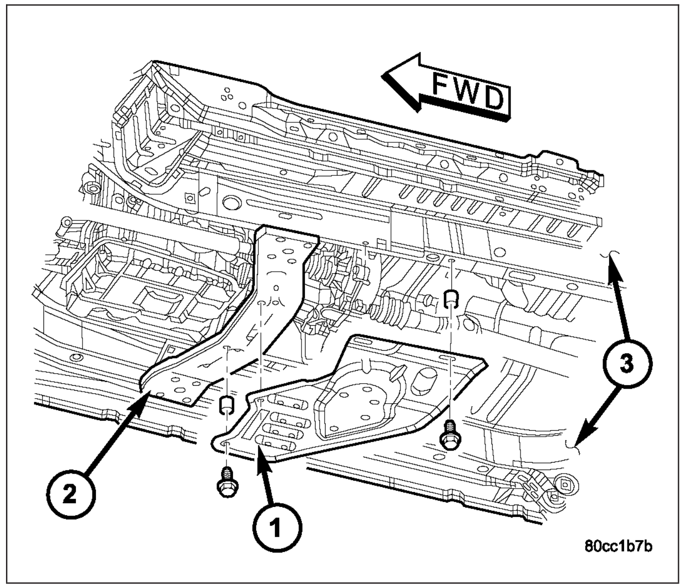
## DIAGNOSIS AND TESTING - TRANSFER CASE - NV231

### DIAGNOSIS CHART

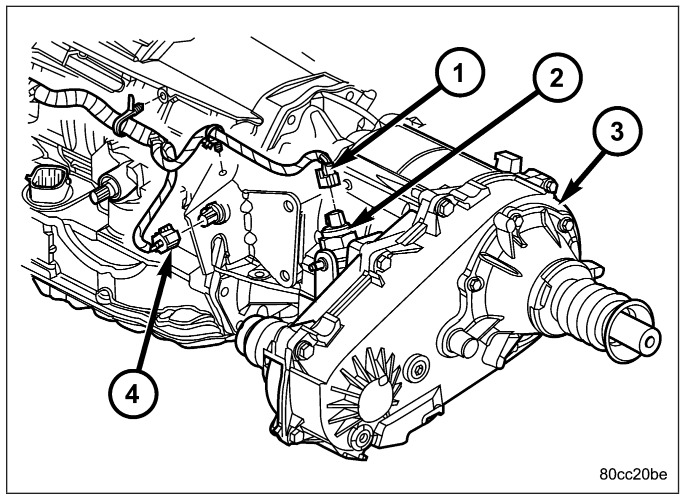
| Condition | Possible Cause | Correction |
|---|---|---|
| Transfer case difficult to shift or will not shift into desired range. | 1) Vehicle speed too great to permit shifting. | 1) Slow vehicle and shift into desired range. |
| | 2) If vehicle was operated for an extended period in 4H mode on dry surface, driveline torque load may cause difficulty. | 2) Stop vehicle and shift transfer case to Neutral position. Transfer case can then be shifted to the desired mode. |
| | 3) Transfer case shift cable binding. | 3) Repair or replace cable as necessary. |
| | 4) Insufficient or incorrect lubricant. | 4) Drain and refill transfer case with the correct type and quantity of lubricant. |
| | 5) Internal transfer case components binding, worn, or damaged. | 5) Repair or replace components as necessary. |
| Transfer case noisy in all drive modes. | 1) Insufficient or incorrect lubricant. | 1) Drain and refill transfer case with the correct type and quantity of lubricant. |
| Transfer case noisy while in, or jumps out of, 4L mode. | 1) Transfer case not completely engaged in 4L position. | 1) Slow vehicle, shift transfer case to the Neutral position, and then shift into the 4L mode. |
| | 2) Transfer case shifter binding. | 2) Repair, replace, or tighten shifter as necessary. |
| | 3) Range fork damaged, inserts worn, or fork is binding on the shift rail. | 3) Repair or replace components as necessary. |
| | 4) Low range gear worn or damaged. | 4) Repair or replace components as necessary. |
| Lubricant leaking from transfer case seals or vent. | 1) Transfer case overfilled. | 1) Drain lubricant to the correct level. |
| | 2) Transfer case vent closed or restricted. | 2) Clean or replace vent as necessary. |
| | 3) Transfer case seals damaged or installed incorrectly. | 3) Replace suspect seal. |
| Abnormal tire wear. | 1) Extended operation in 4Hi mode on dry surfaces, | 1) Operate vehicle in 2H mode on dry surfaces. |

## REMOVAL

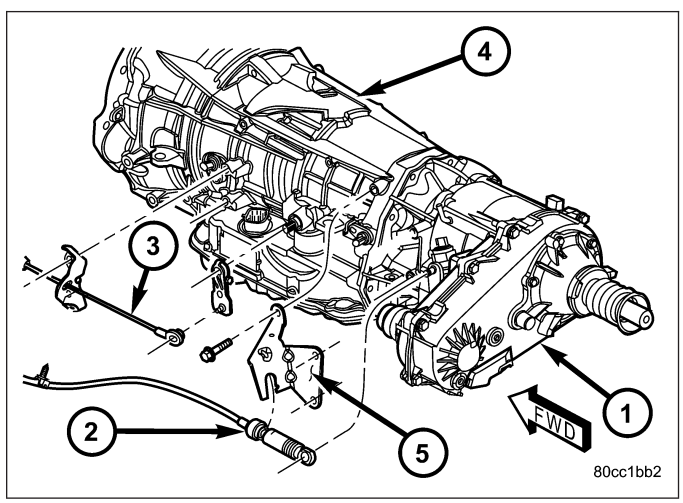
1. Shift transfer case into NEUTRAL.
2. Raise vehicle.
3. Remove skid plate (1).



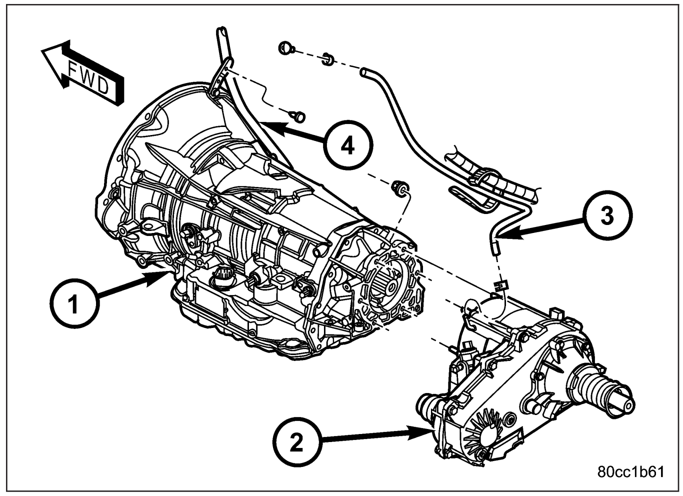

4. Drain transfer case lubricant.
5. Mark front and rear propeller shaft yokes for alignment reference.
6. Disconnect front/rear propeller shafts at transfer case.
7. Disconnect transfer case position sensor connector (1).




8. Disconnect transfer case shift cable (2) at the range lever.
9. Disconnect the transfer case shift cable from the shift cable bracket.



10. Disconnect transfer case vent hose (3).
11. Support transfer case with transmission jack.
12. Secure transfer case to jack with chains.
13. Remove nuts attaching transfer case to transmission.
14. Pull transfer case and jack rearward to disengage transfer case.
15. Remove transfer case from under vehicle.

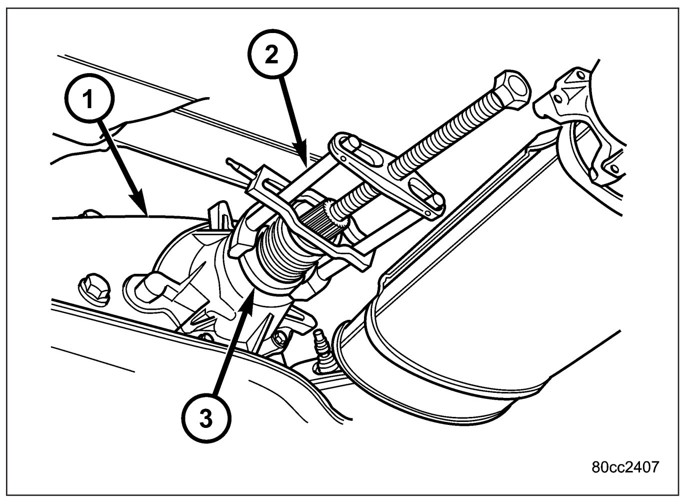



## DISASSEMBLY

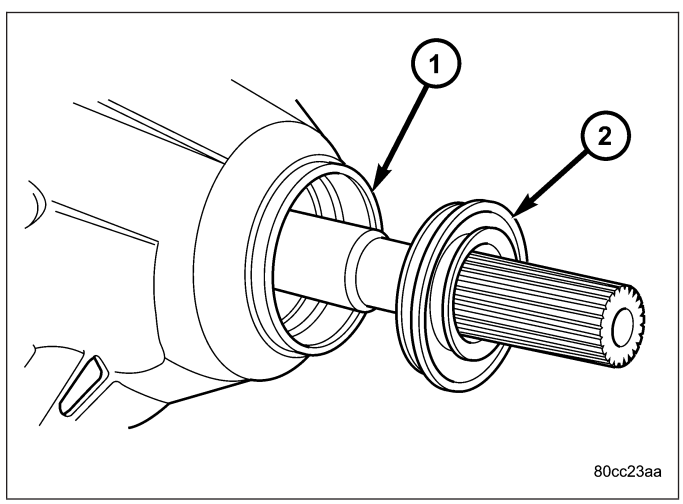
Position transfer case on shallow drain pan. Remove drain plug and drain lubricant remaining in case.

### REAR RETAINER AND OIL PUMP

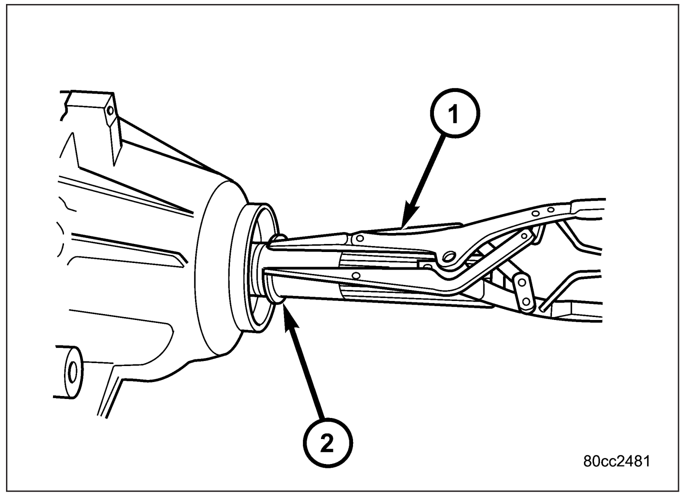
1. Spread band clamp which holds output shaft boot to the output shaft slinger with a suitable awl, or equivalent.
2. Remove output shaft boot from slinger and output shaft.
3. Remove the output shaft rear slinger (3) using Puller MD-998056-A (2).



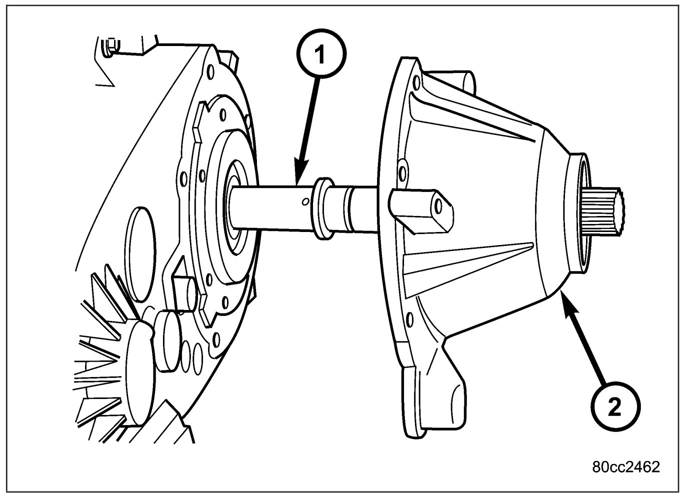

4. Use a suitable pry tool, or a slide hammer mounted screw, to remove the seal (2) from the rear retainer (1).



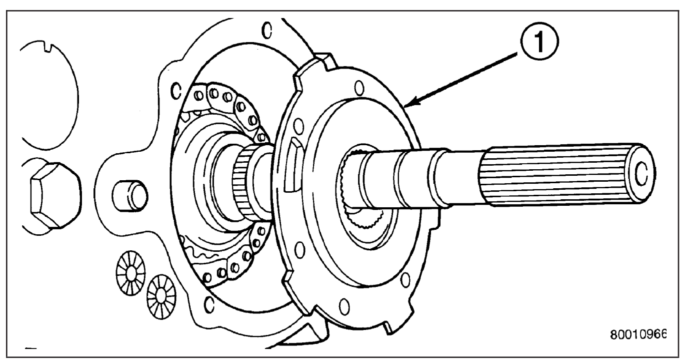
5. Remove the rear output bearing I.D. retaining ring (2).
6. Remove the bolts holding the rear retainer to the rear case half.



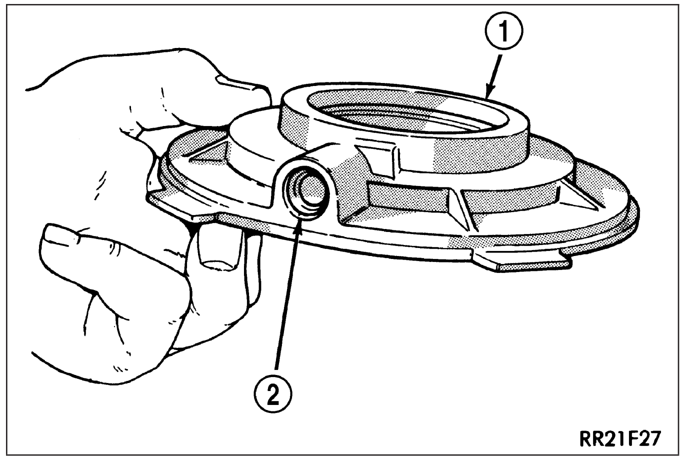

7. Tap rear retainer with rawhide or rubber mallet to loosen sealer bead.
8. Remove rear retainer (2) from rear case half.




9. Remove the remaining output shaft bearing snap-ring.
10. Disengage oil pickup tube from oil pump (1) and remove oil pump assembly. Remove oil pump by tilting the edge of the oil pump from under the edge of the rear case half and sliding the pump off the output shaft.

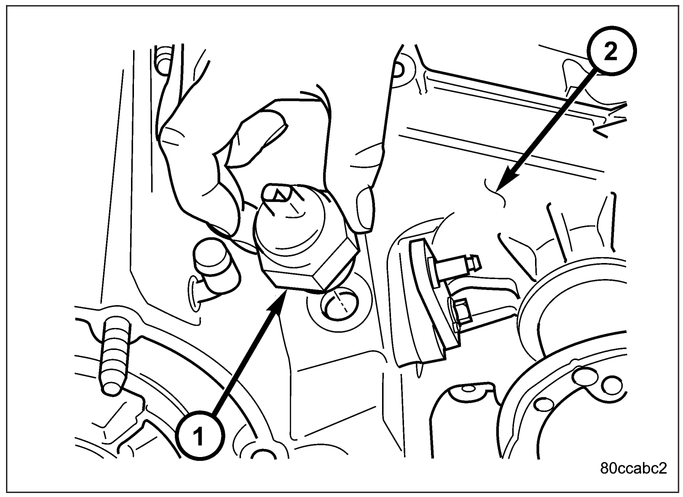


11. Remove pick-up tube o-ring (2) from oil pump (1), if necessary. Do not disassemble the oil pump, it is not serviceable.

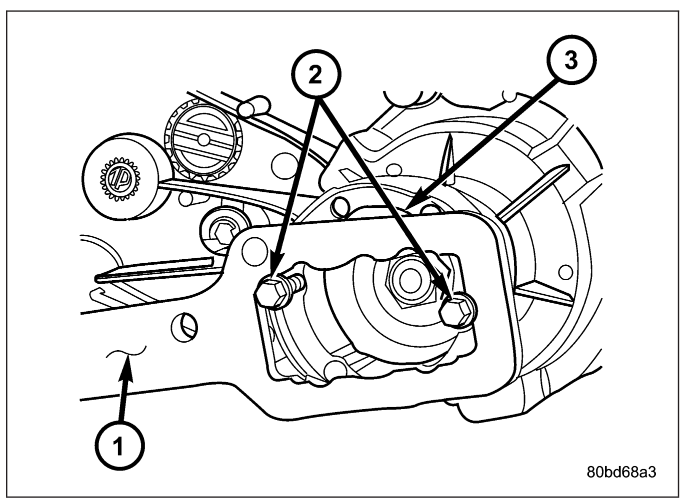



## COMPANION FLANGE AND RANGE LEVER

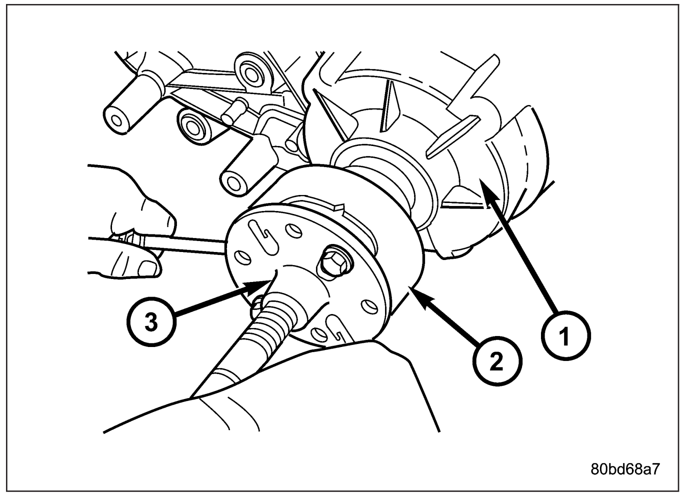
1. Remove transfer case position sensor (1).




2. Install two bolts (2) partially into the propeller shaft companion flange (3), 180° from each other.
3. Install the rectangular end of the Flange Holder C-3281 (1) over the bolts to hold the companion flange stationary and remove the nut holding the companion flange to the output shaft.

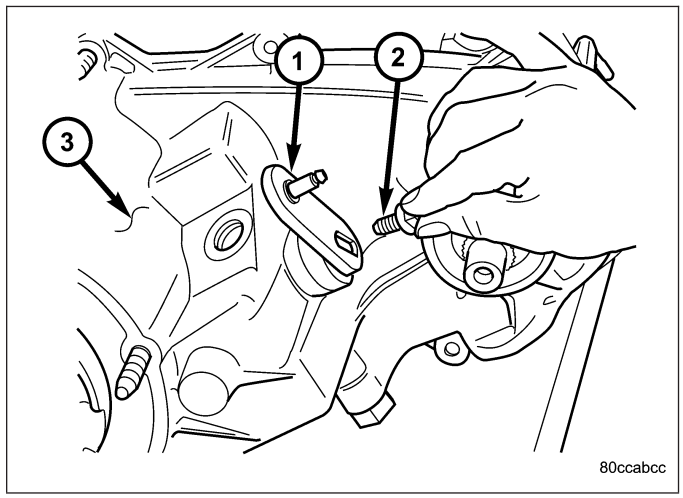


4. Use Remover C-452 (3) to remove the companion flange (2).



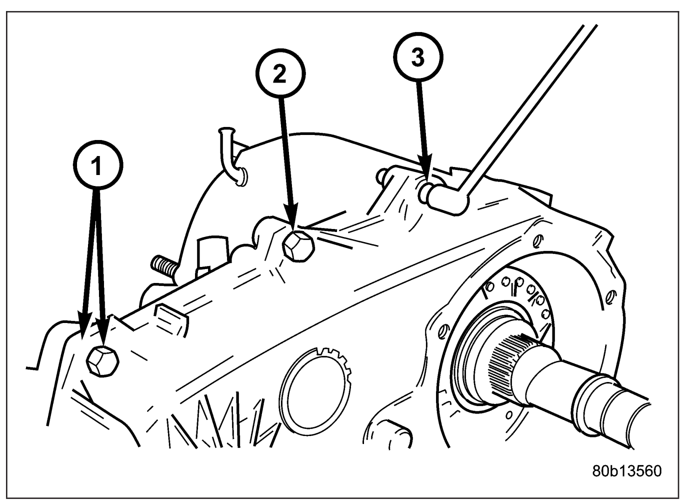

**NOTE: Be sure to note the orientation of the range lever (lever up or down) so that it may be re-installed in the same direction.**

5. Remove seal washer from front output shaft. Discard washer as it should not be reused.
6. Remove the bolt (2) that attaches the range lever (1) to sector shaft. Then move sector to neutral position and remove range lever from shaft.

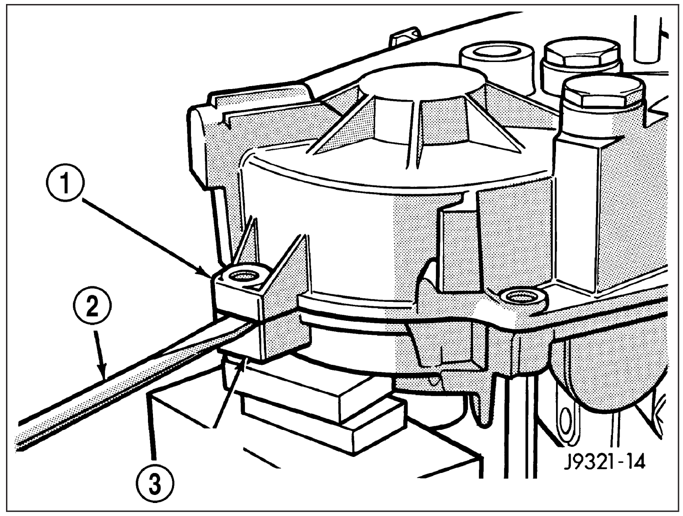



## FRONT OUTPUT SHAFT AND DRIVE CHAIN

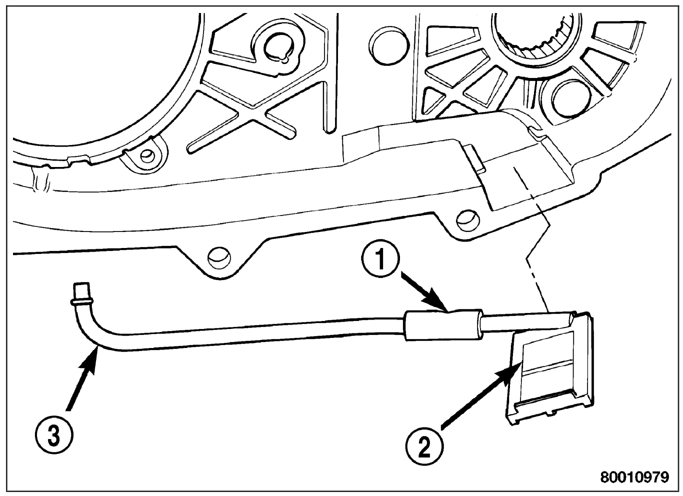
1. Support transfer case so rear case is facing upward.
2. Remove bolts (2) holding front case to rear case. The case alignment bolts require flat washers (1).



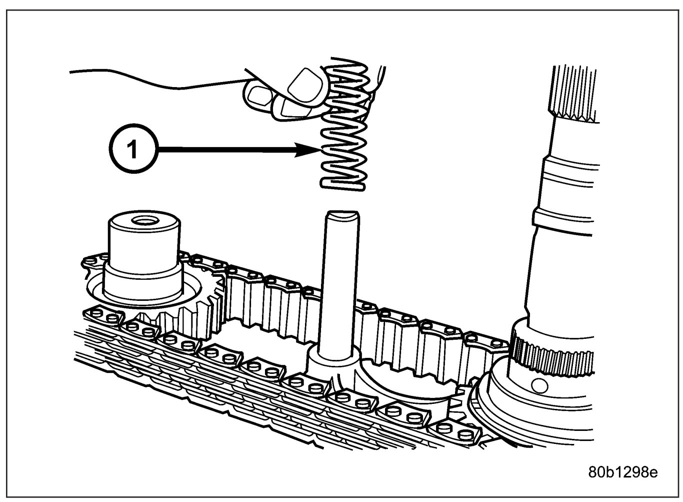
3. Loosen rear case (1) with flat blade screwdriver to break sealer bead. Insert pry tool (2) blade only into notches provided at each end of case.
4. Remove rear case from front case.



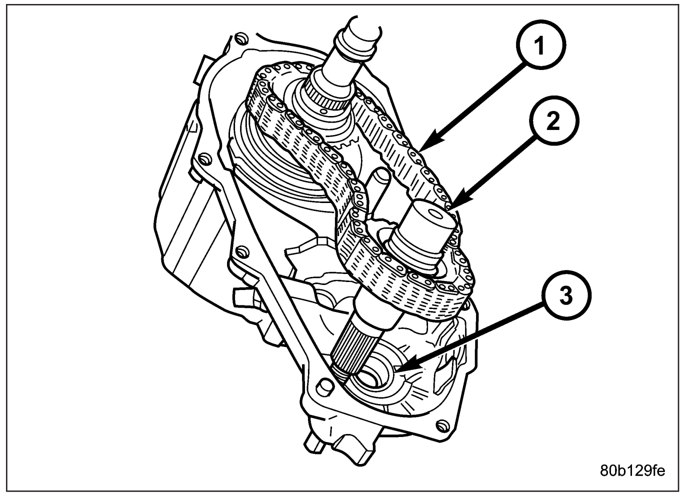

5. Remove oil pickup tube (2) from rear case.




6. Remove mode fork spring (1).

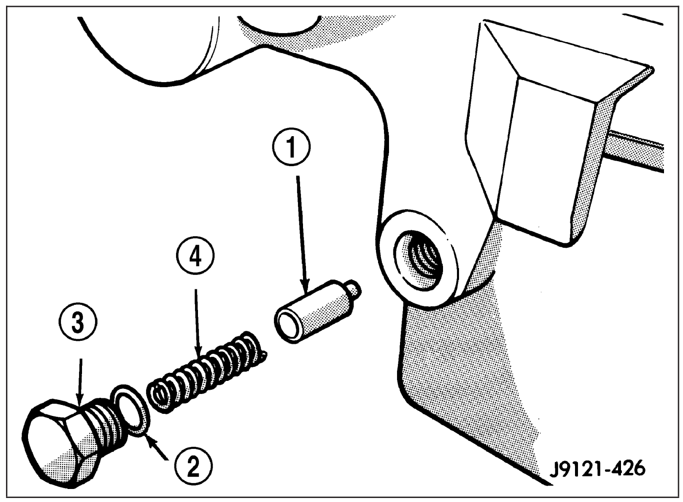


7. Pull front output shaft (2) upward and out of front output shaft bearing (3).
8. Remove front output shaft and chain.

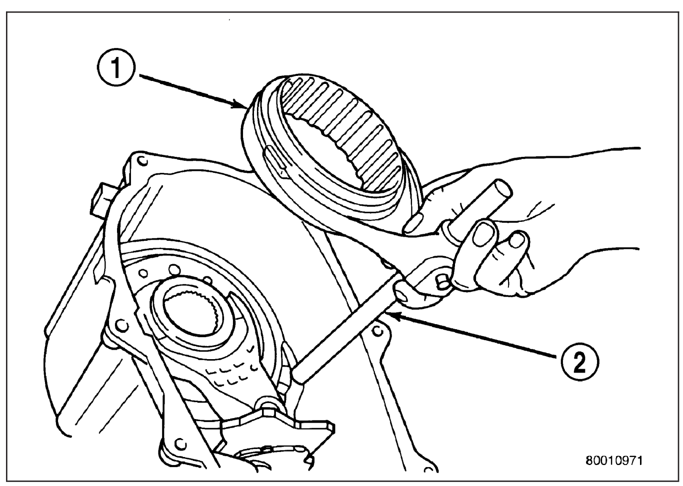



## SHIFT FORKS AND MAINSHAFT

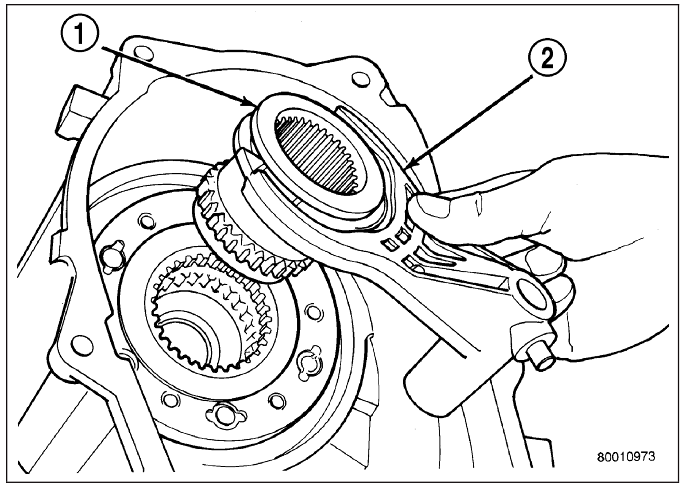
1. Remove mainshaft from mode sleeve and input gear pilot bearing.
2. Remove detent plug (3), O-ring (2), detent spring (4), and detent plunger (1).



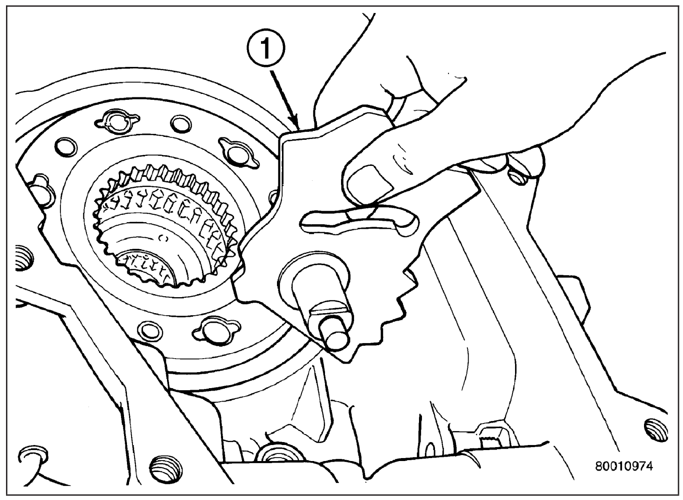

3. Remove mode fork (2) and sleeve (1) as an assembly. Note position of sleeve for assembly reference. The short side of the sleeve faces upward.



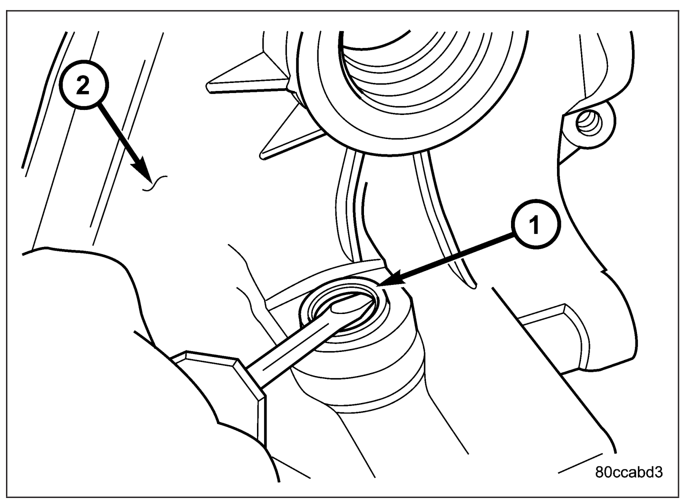
4. Remove range fork (2) and hub as an assembly. Note fork position for installation reference.



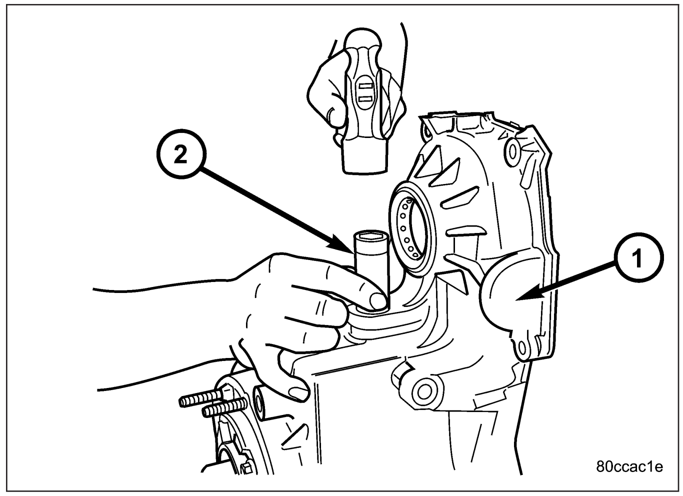

5. Remove shift sector (1) from front case.




6. Remove the shift sector shaft seal (1).

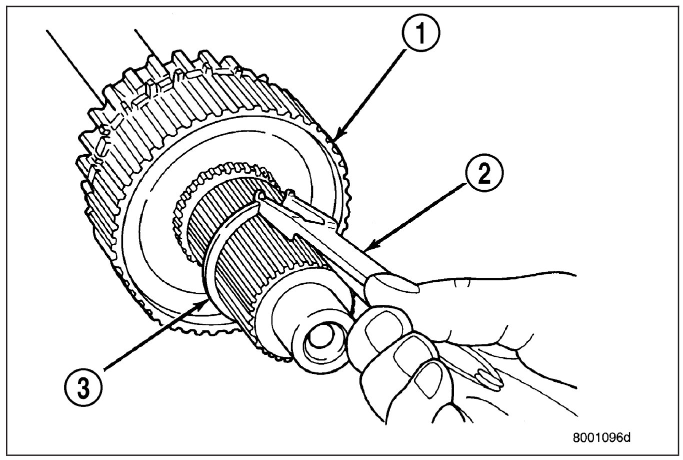


7. Remove the shift sector shaft bearing with an appropriate socket (2).

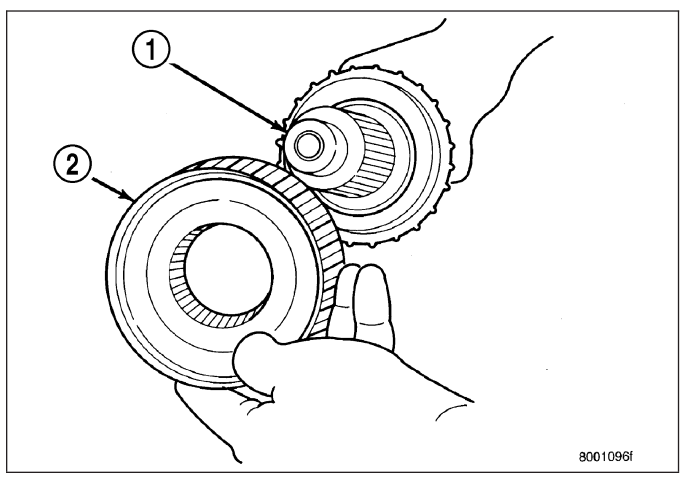



## MAINSHAFT

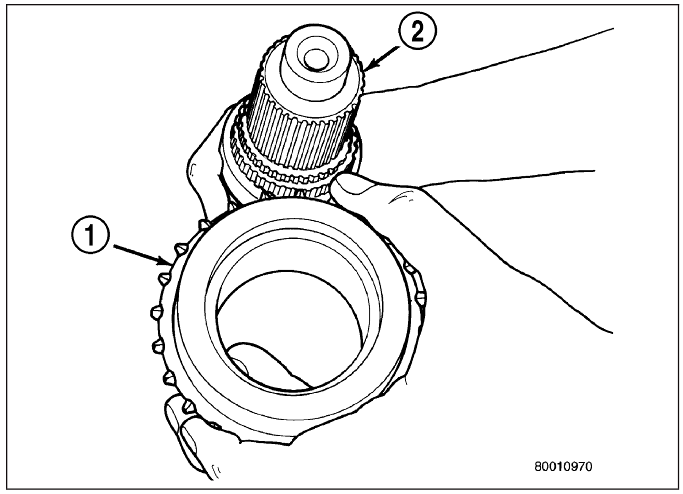
1. Remove mode hub (1) retaining ring (3) with heavy duty snap-ring pliers (2).




2. Slide mode hub (2) off mainshaft (1).

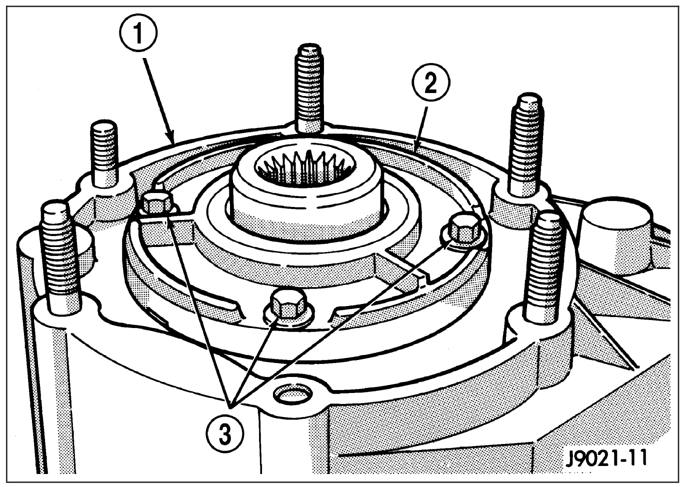


3. Slide drive sprocket (1) off mainshaft (2).

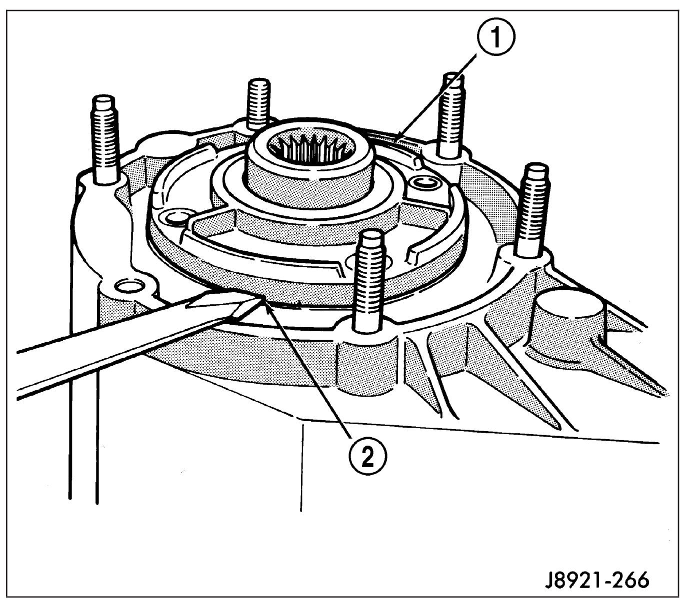



## INPUT GEAR AND LOW RANGE GEAR

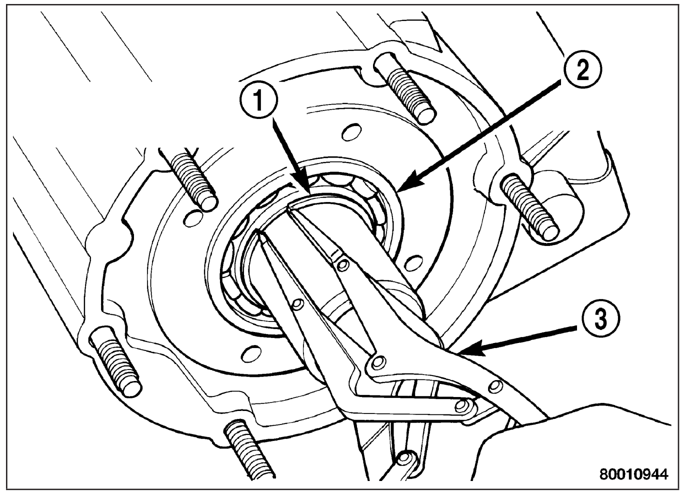
1. Remove front bearing retainer (2) attaching bolts (3).



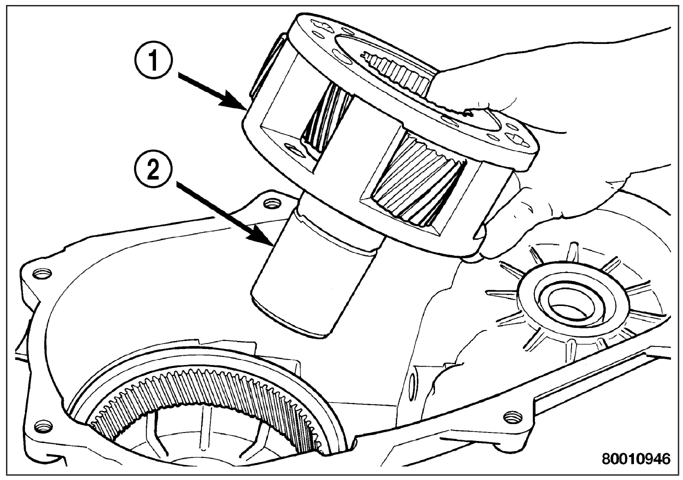

2. Remove front bearing retainer (1). Pry retainer loose with pry tool positioned in slots (2) at each end of retainer.



3. Remove front bearing retainer.
4. Remove input gear retaining ring (1) with heavy duty snap-ring pliers (3)

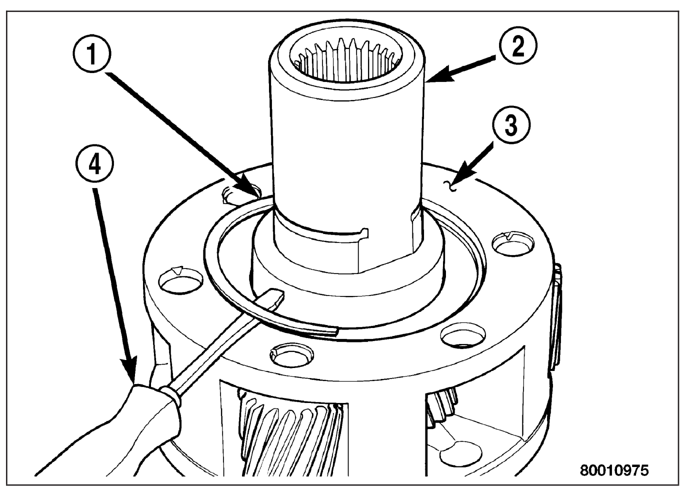



5. Place front case in horizontal position. Then remove input gear (2) and low range gear as an assembly (1). Tap gear out of bearing with plastic mallet if necessary.

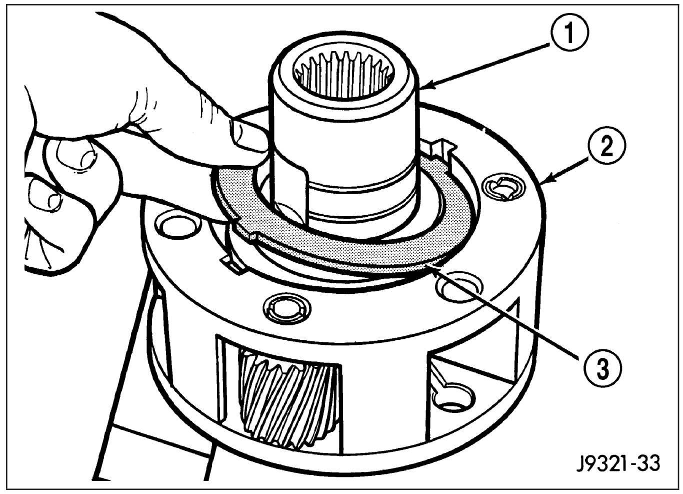



## INPUT AND LOW RANGE GEAR

1. Remove snap-ring (1) that retains input gear (2) in low range gear (3).

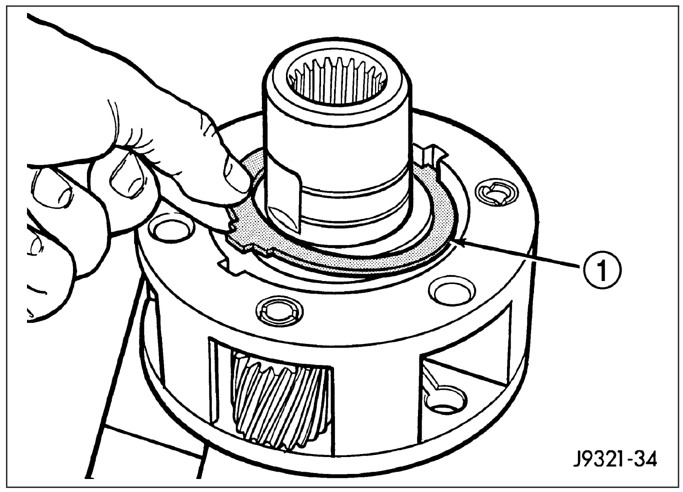


2. Remove retainer (3).



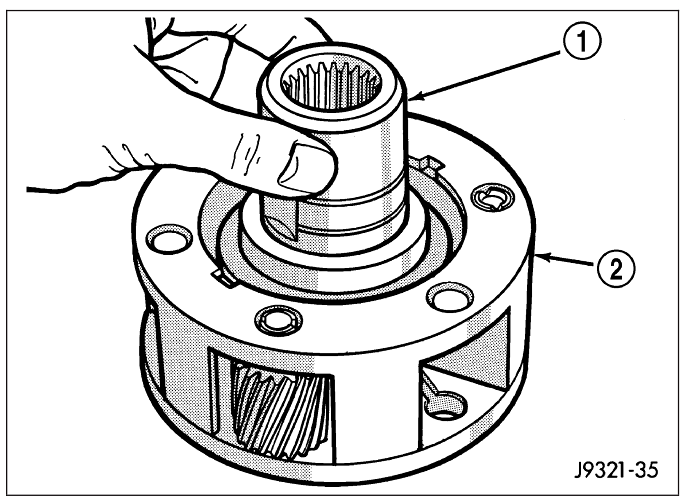
J9321-33

3. Remove front tabbed thrust washer (1).



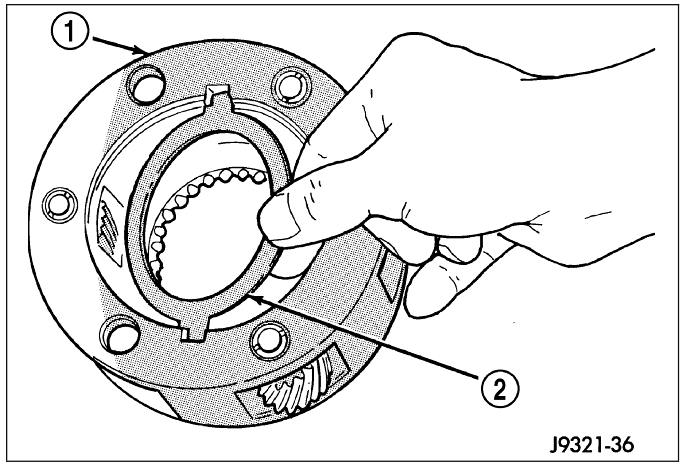
J9321-34

4. Remove input gear (1).



J9321-35

5. Remove rear tabbed thrust washer (2) from low range gear (1).

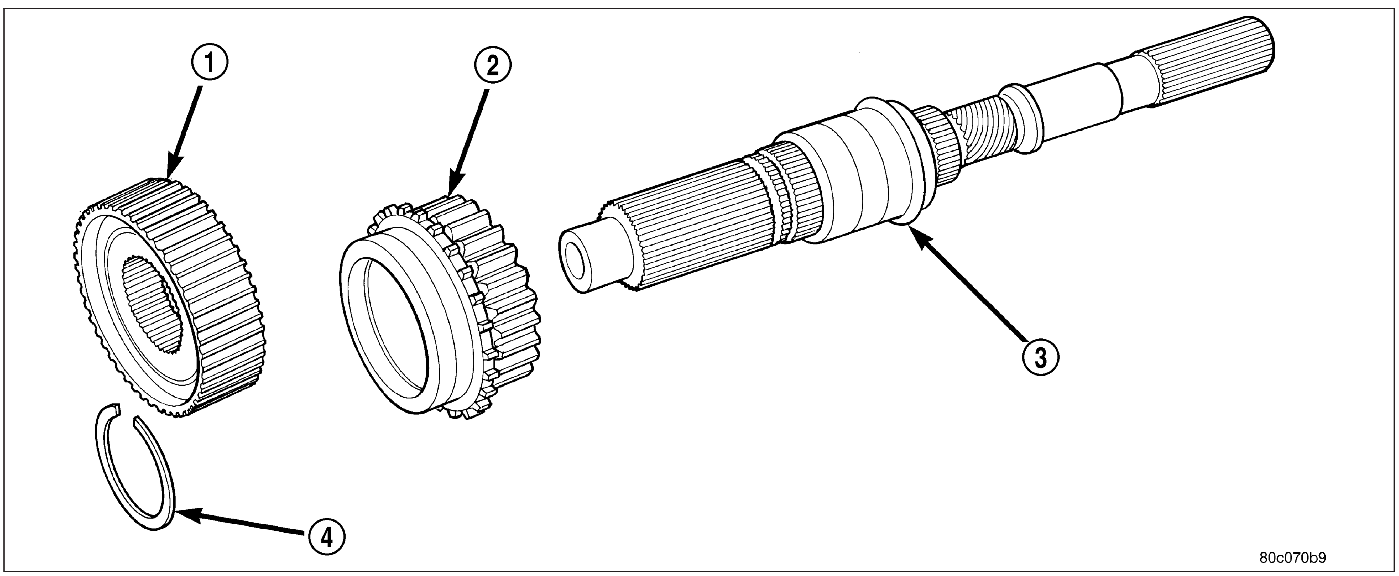



## CLEANING

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and 3M™ all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.

## INSPECTION

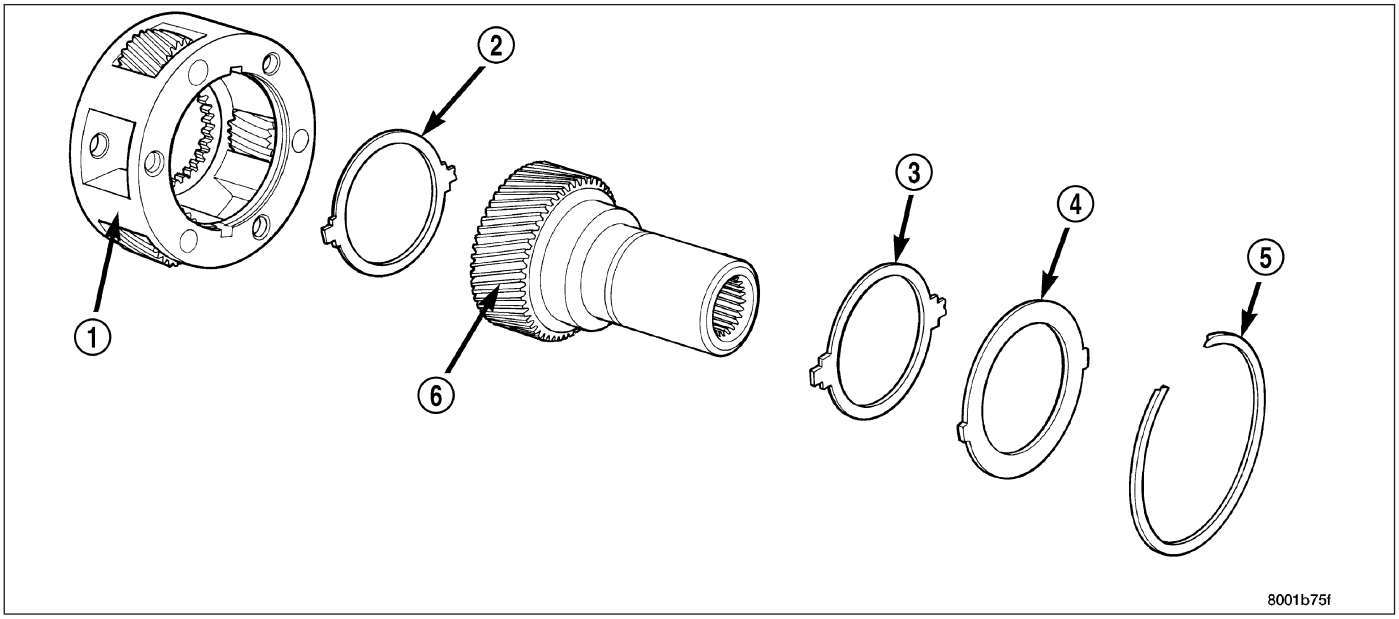
### MAINSHAFT/SPROCKET/HUB




Inspect the splines on the hub (1) and shaft (3) and the teeth on the sprocket (2). Minor nicks and scratches can be smoothed with an oilstone. However, replace any part that is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320-400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

## INPUT GEAR AND PLANETARY CARRIER




***Input Gear And Carrier Components***

1 - PLANETARY CARRIER
2 - REAR THRUST WASHER
3 - FRONT THRUST WASHER
4 - CARRIER LOCK RING
5 - CARRIER LOCK RETAINING RING
6 - INPUT GEAR

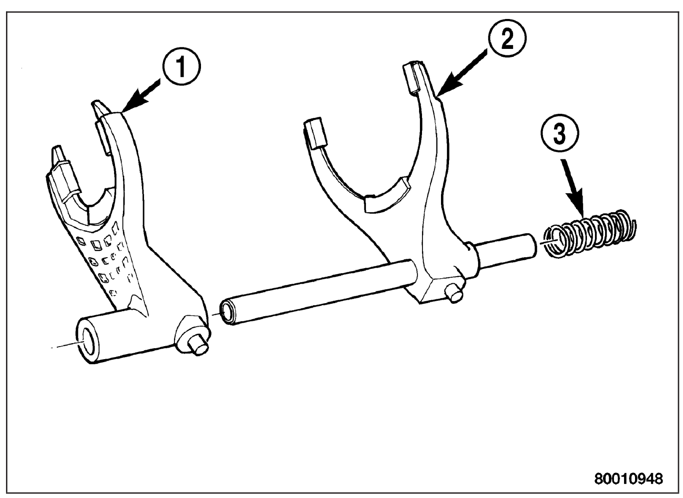
Check the teeth on the gear (6). Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300-400 grit emery cloth if necessary.

Examine the carrier body (1) and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged.

Check the lock ring (4) and both thrust washers (2, 3) for wear or cracks. Replace them if necessary. Also replace the lock retaining ring if bent, distorted, or broken.

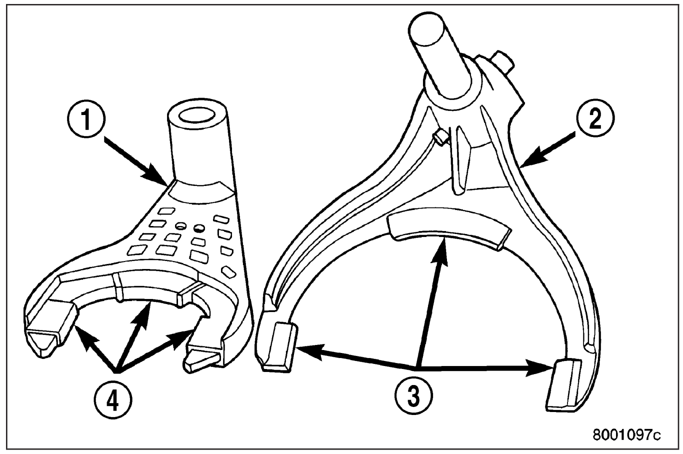
## SHIFT FORKS/HUBS/SLEEVES

Check condition of the shift forks and mode fork shift rail (2). Minor nicks on the shift rail can be smoothed with 320-400 grit emery cloth.

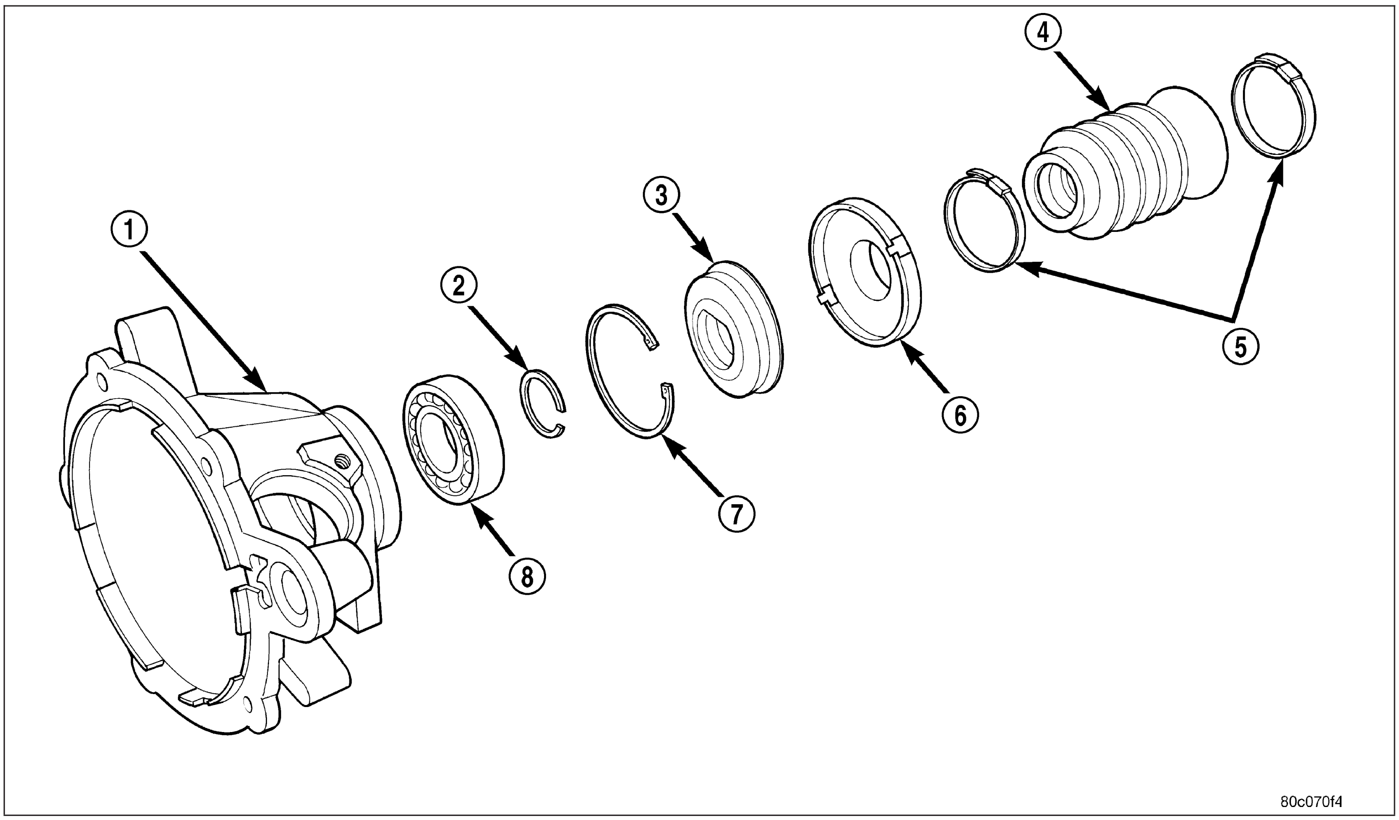


Inspect the shift fork wear pads (3, 4). The mode fork (2) pads are serviceable and can be replaced if necessary. The range fork (1) pads are not serviceable. The fork must be replaced as an assembly if the pads are worn or damaged.

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.




## REAR RETAINER/BEARING/ SEAL/SLINGER/BOOT




Inspect the retainer components. Replace the bearing (8) if rough or noisy. Check the retainer (1) for cracks or wear in the bearing bore. Clean the retainer sealing surfaces with a scraper and 3M™ all purpose cleaner. This will ensure proper adhesion of the sealer during reassembly.

The output shaft slinger and seal (3) should be replaced outright; do not reuse either part.

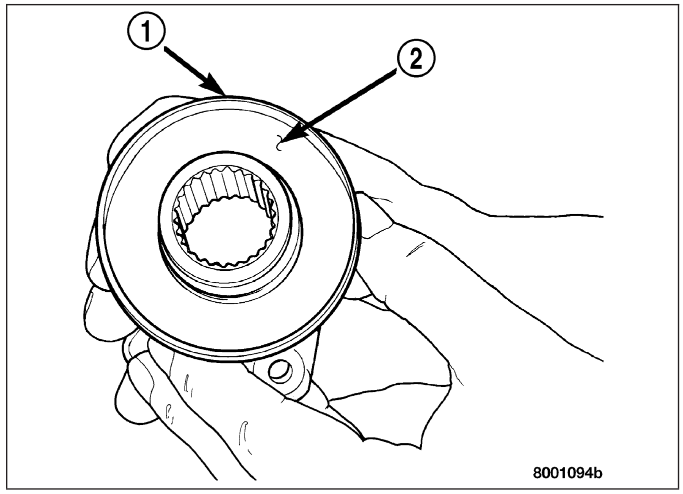
Replace any part if distorted, bent, or broken. Also replace the boot if cut or torn. Replace the boot band clamps, do not reuse them.

## REAR OUTPUT SHAFT/YOKE/DRIVE CHAIN

Check condition of the seal contact surfaces of the yoke slinger (2). This surface must be clean and smooth to ensure proper seal life. Replace the yoke nut and seal washer as neither part should be reused.

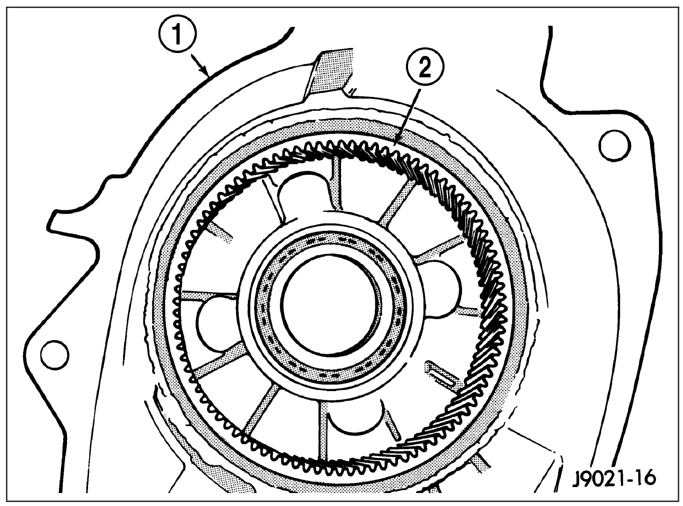
Inspect the shaft threads, sprocket teeth, and bearing surfaces. Minor nicks on the teeth can be smoothed with an oilstone. Use 320-400 grit emery to smooth minor scratches on the shaft bearing surfaces. Rough threads on the shaft can be chased if necessary. Replace the shaft if the threads are damaged, bearing surfaces are scored, or if any sprocket teeth are cracked or broken.

Examine the drive chain and shaft bearings. Replace the chain and both sprockets if the chain is stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.




## LOW RANGE ANNULUS GEAR

Inspect annulus gear condition carefully. The gear is only serviced as part of the front case. If the gear is damaged, it will be necessary to replace the gear and front case as an assembly. Do not attempt to remove the gear (2)




## FRONT/REAR CASES AND FRONT RETAINER

Inspect the cases and retainer for wear and damage. Clean the sealing surfaces with a scraper and 3M™ all purpose cleaner. This will ensure proper sealer adhesion at assembly. Replace the input retainer seal; do not reuse it.

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

Check the front case mounting studs and vent tube. The tube can be secured with Loctite™ 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil™ stainless steel inserts if required.

## OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any part appears to be worn or damaged. Do not disassemble the pump as individual parts are not available. The pump is only available as a complete assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

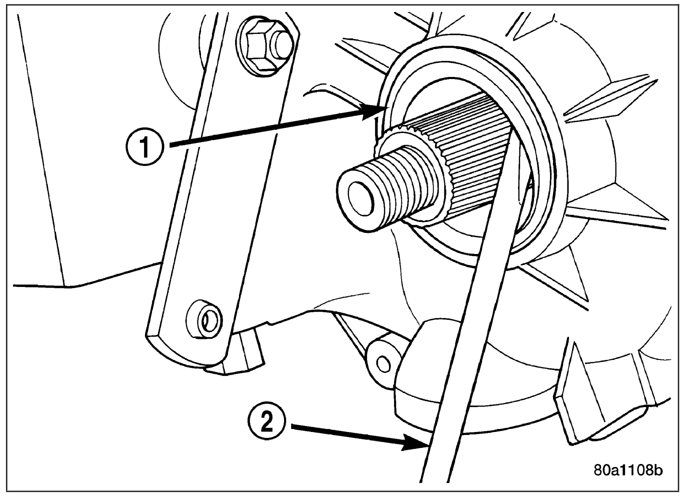
## ASSEMBLY

Lubricate transfer case components with Mopar® ATF +4, Automatic Transmission Fluid or petroleum jelly (where indicated) during assembly.

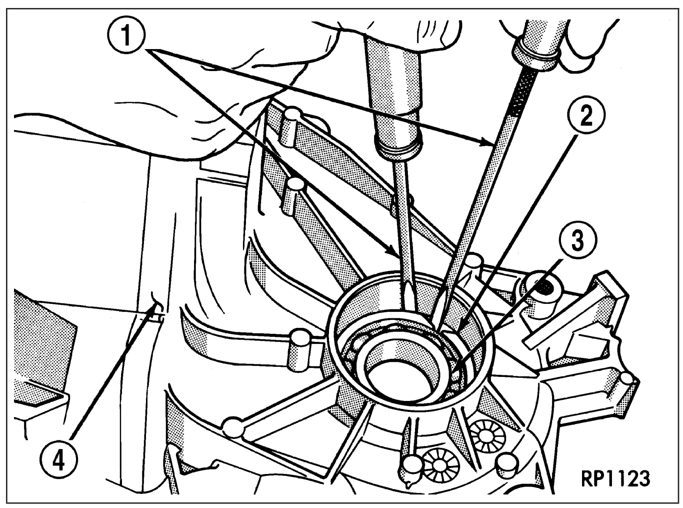
### BEARINGS AND SEALS

**CAUTION: The bearing bores in various transfer case components contain oil feed holes. Make sure replacement bearings do not block the holes.**

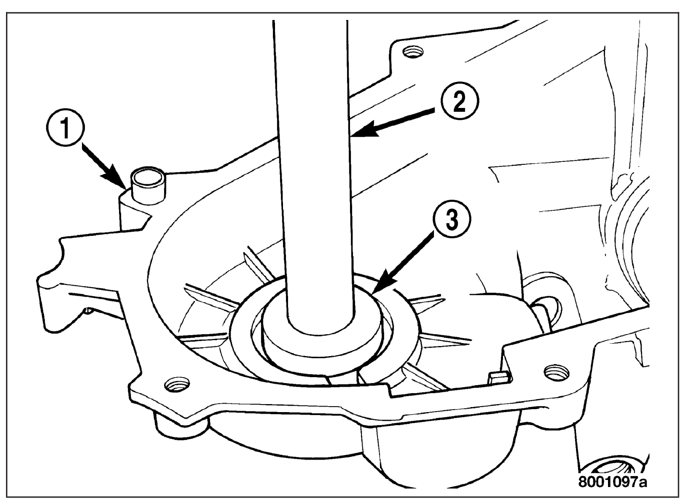
1. Remove the front output shaft seal (1) from case with pry tool (2).



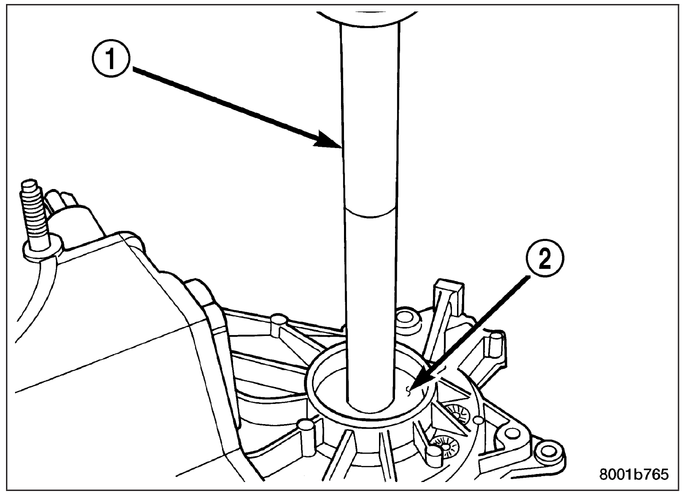

2. Remove the front output shaft bearing (3) retaining ring (2) with screwdriver (1).



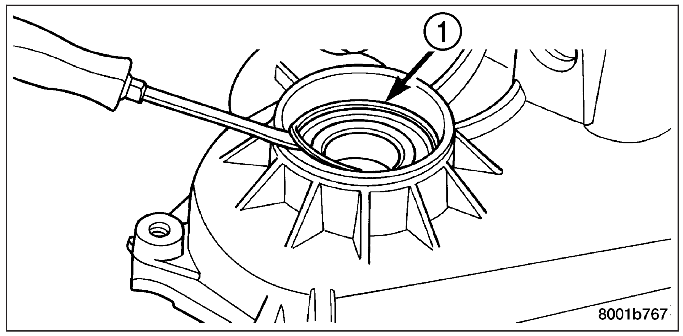

3. Remove bearing with Universal Handle C-4171 (2) and Installer 5065 (3).



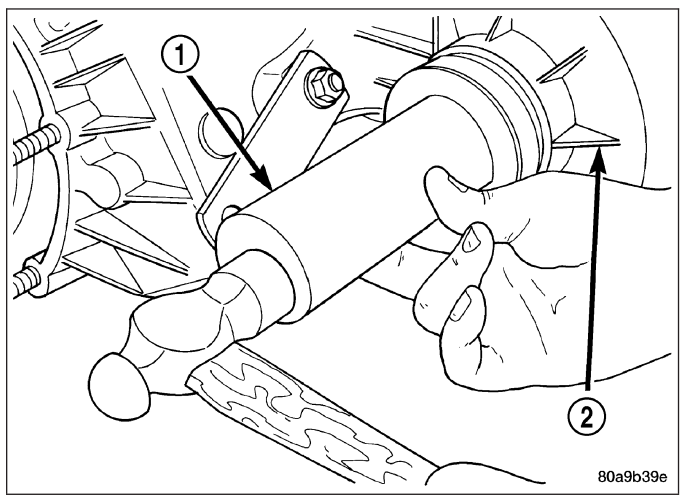
4. Install front output shaft front bearing in case with Universal Handle C-4171 (1) and Installer 5064 (2).



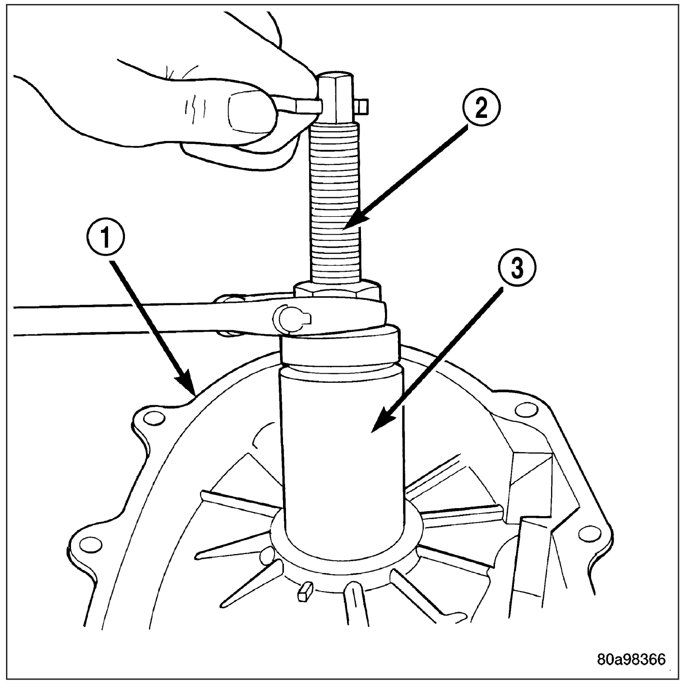

5. Install output shaft front bearing retaining ring (1). Start ring into place by hand. Then use small screwdriver to work ring into case groove. Be sure ring is fully seated before proceeding.



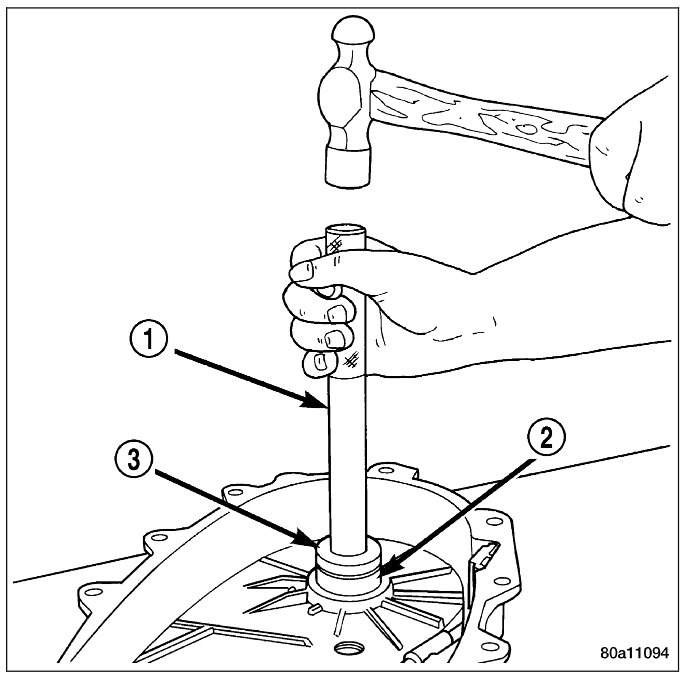

6. Install new front output seal in front case with Seal Installer 8143-A (1) as follows:
   a. Place new seal on tool. **Garter spring on seal goes toward interior of case.**
   b. Start seal in bore with light taps from hammer. Once seal is started, continue tapping seal into bore until installer tool bottoms against case.



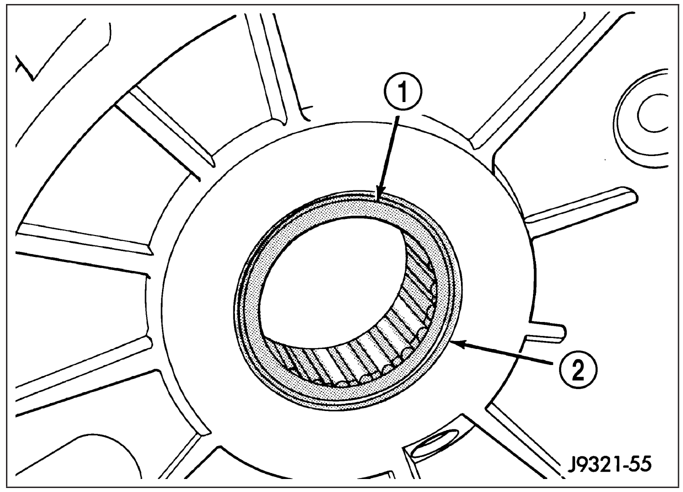
7. Remove the output shaft rear bearing with the screw and jaws from Remover L-4454 (2) and Cup 8148 (3).



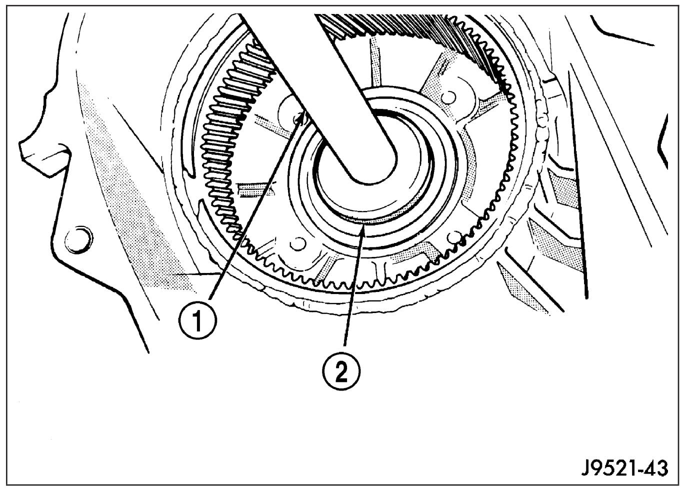

8. Install new bearing with Universal Handle C-4171 (1) and Installer 5066 (3).



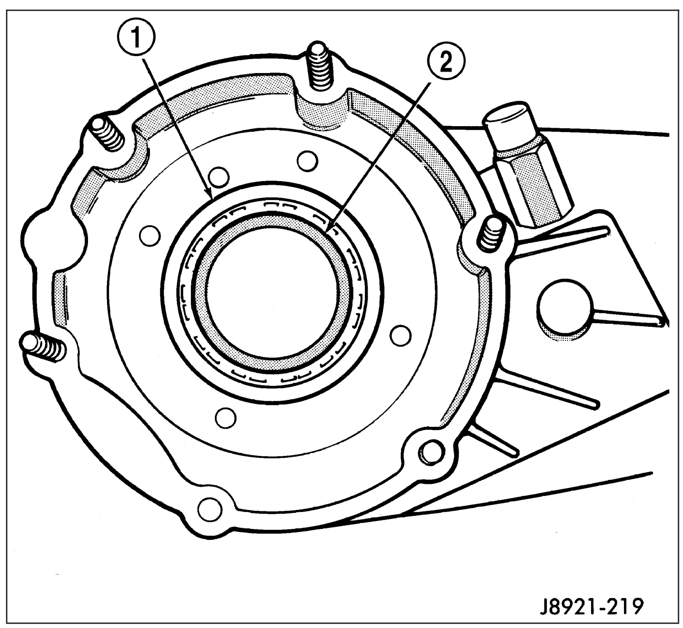
9. The bearing bore is chamfered at the top. Install the bearing (1) so it is flush with the lower edge of this chamfer (2).



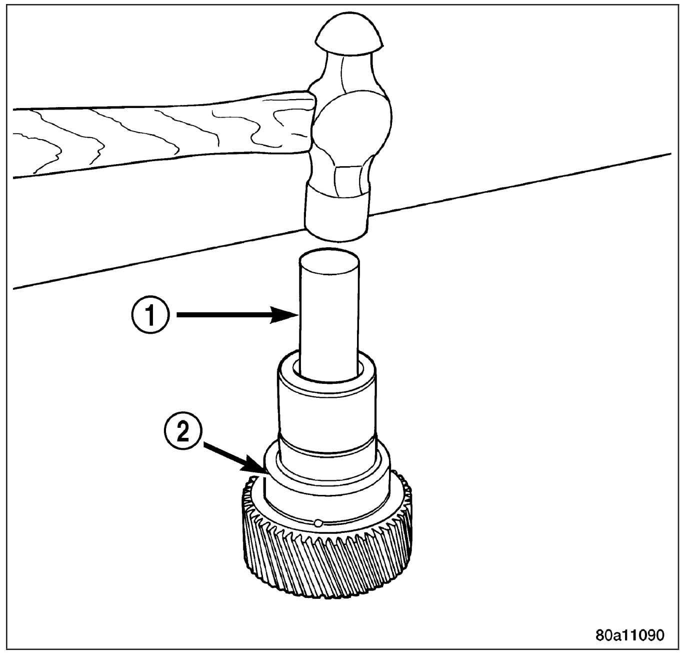

10. Using Remover C-4210 (2) and Universal Handle C-4171 (1), drive input shaft bearing from inside the annulus gear opening in the case.



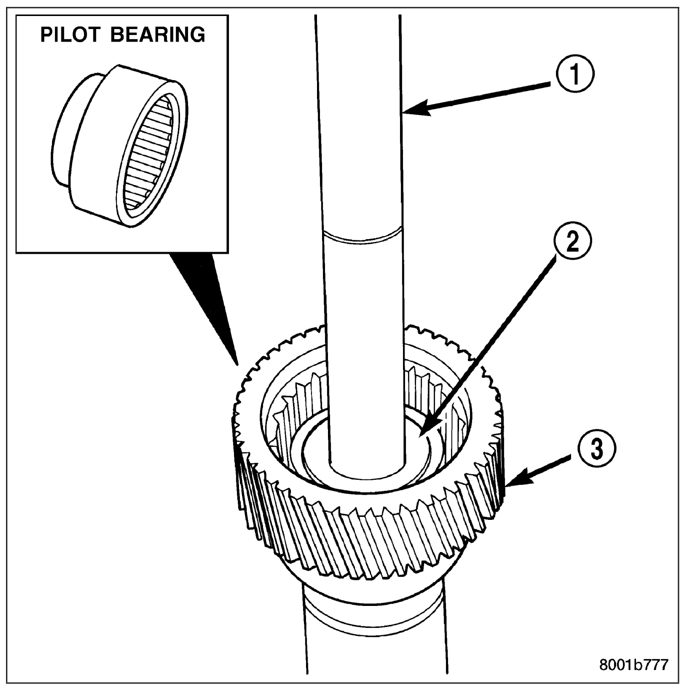

11. Install locating ring on new bearing.
12. Position case so forward end is facing upward.
13. Using Remover C-4210 and Handle C-4171, drive input shaft bearing (1) into case. The bearing locating ring (1) must be fully seated against case surface.



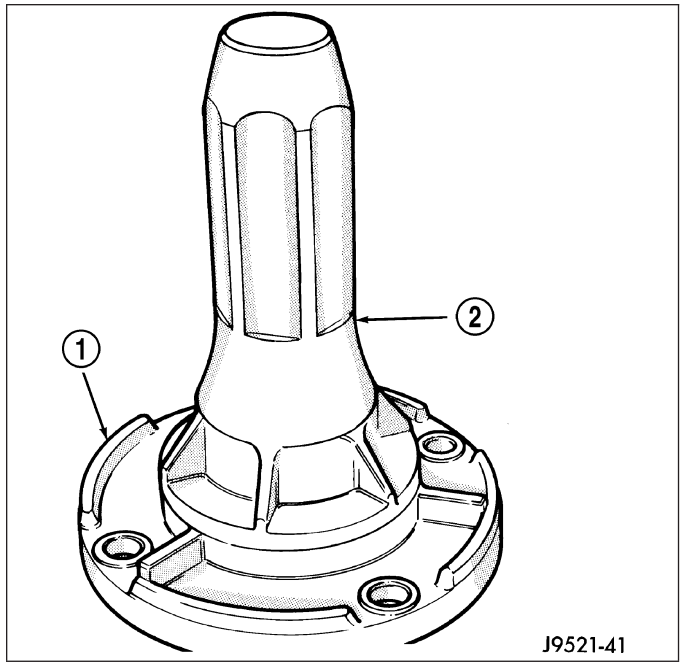
14. Remove input gear pilot bearing by inserting a suitably sized drift (1) into the splined end of the input gear (2) and driving the bearing out with the drift and a hammer.



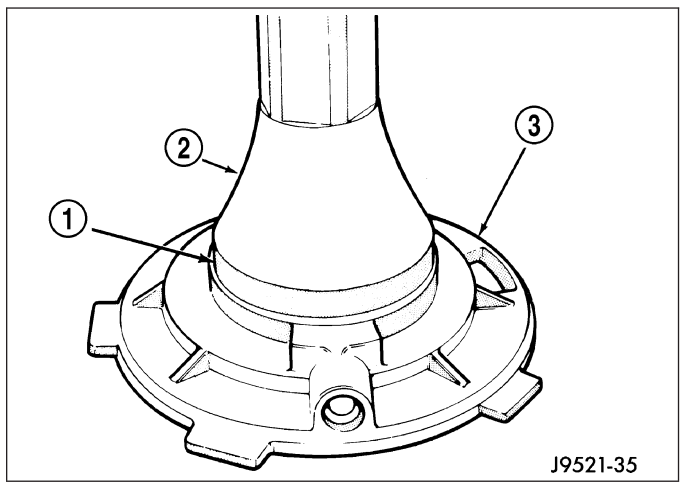

15. Install new pilot bearing with Installer 5065 (2) and Handle C-4171 (1).



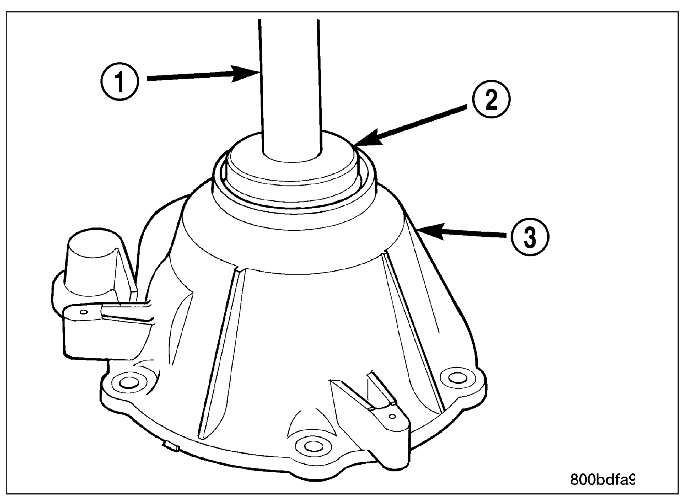
16. Remove front bearing retainer seal with suitable pry tool.
17. Install new front bearing retainer (1) seal with Installer 7884 (2).




18. Remove seal from oil pump housing with a suitable pry tool
19. Install new seal in oil pump housing with Seal Installer 7888 (2).

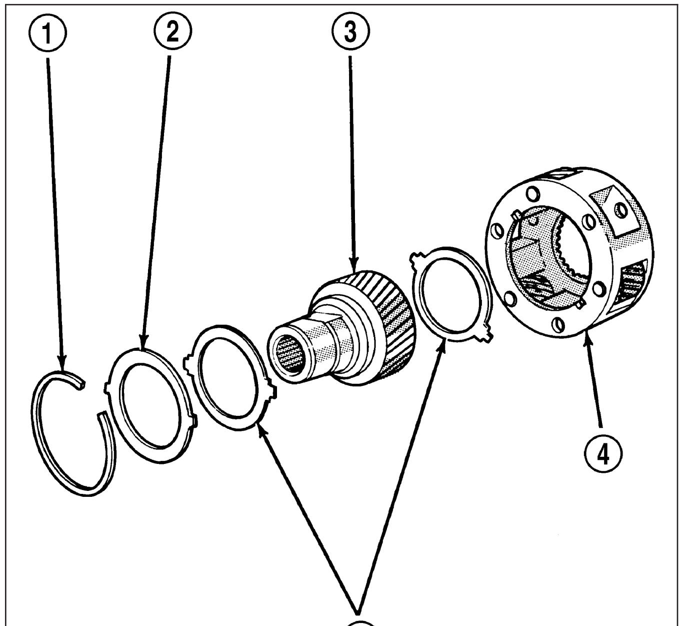



20. Remove rear retainer bearing with Installer 8128 and Handle C-4171.
21. Install rear bearing in retainer with Universal Handle C-4171 (1) and Installer 5052 (2).



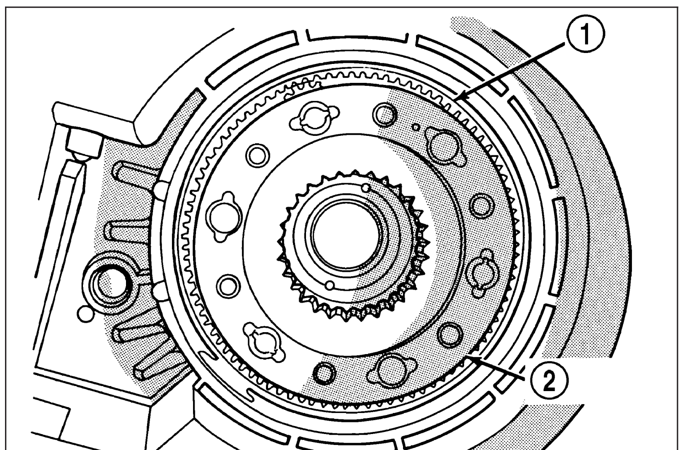
## INPUT AND LOW RANGE GEAR

1. Install first thrust washer (5) in low range gear (3). Be sure washer tabs are properly aligned in gear notches.
2. Install input gear in low range gear (4). Be sure input gear is fully seated.
3. Install remaining thrust washer (5) in low range gear and on top of input gear. Be sure washer tabs are properly aligned in gear notches.
4. Install retainer on input gear and install snap-ring (1).



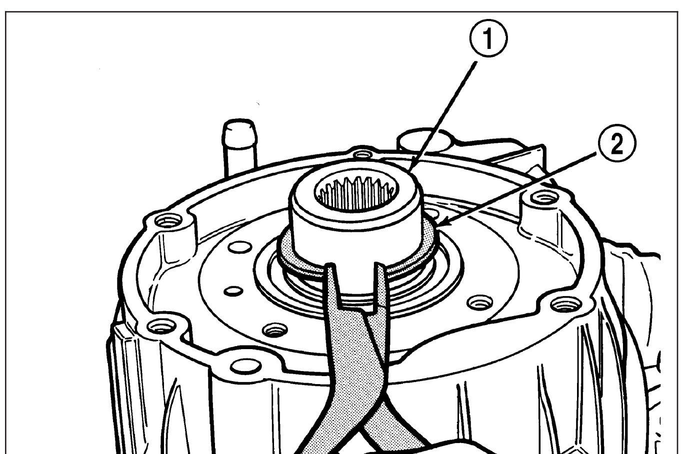
J9321-60

5. Align and install low range/input gear assembly (2) in front case. Be sure low range gear pinions are engaged in annulus gear (1) and that input gear shaft is fully seated in front bearing.



J9321-61

6. Install snap-ring (2) to hold input/low range gear (1) into front bearing.

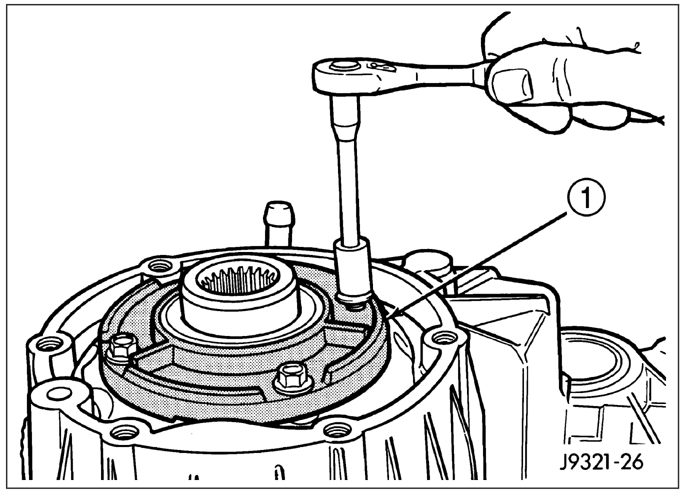


J9321-28

7. Clean gasket sealer residue from retainer and inspect retainer for cracks or other damage.
8. Apply a 3 mm (1/8 in.) bead of Mopar® gasket maker or silicone adhesive to sealing surface of retainer.
9. Align cavity in seal retainer with fluid return hole in front of case.

**CAUTION: Do not block fluid return cavity on sealing surface of retainer when applying Mopar® gasket maker or silicone adhesive sealer. Seal failure and fluid leak can result.**

10. Install bolts to hold retainer (1) to transfer case. Tighten to 21 N·m (16 ft. lbs.) of torque.

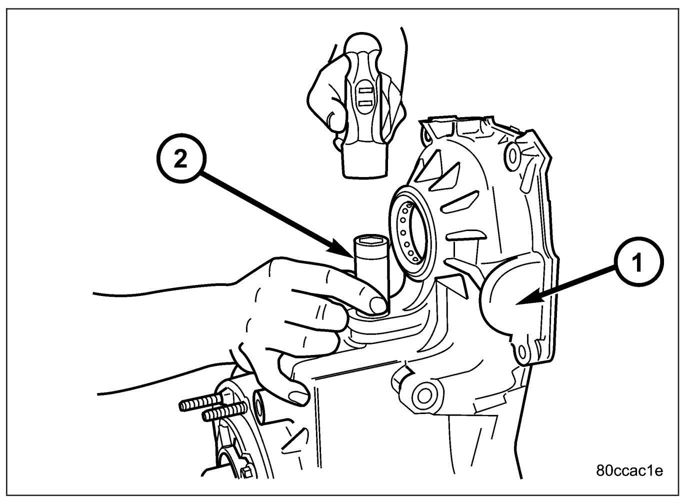



## MAINSHAFT

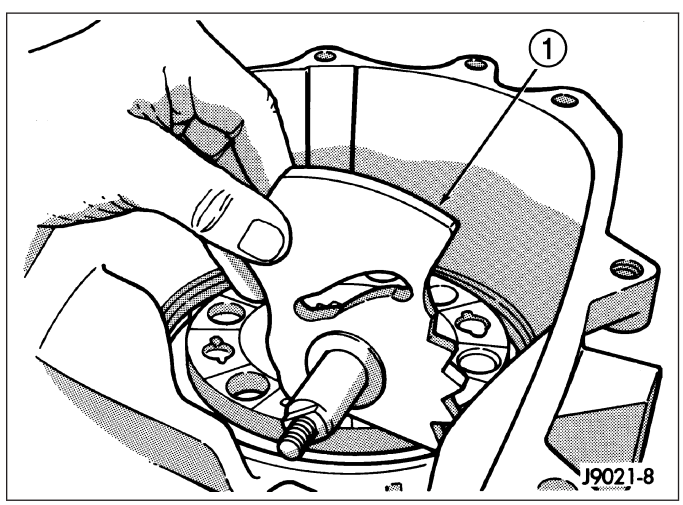
1. Lubricate mainshaft splines with recommended transmission fluid.
2. Slide drive sprocket onto mainshaft.
3. Slide mode hub onto mainshaft.
4. Install mode hub retaining ring. Verify that the retaining ring is fully seated in mainshaft groove.

## SHIFT FORKS, SECTOR, AND MAINSHAFT

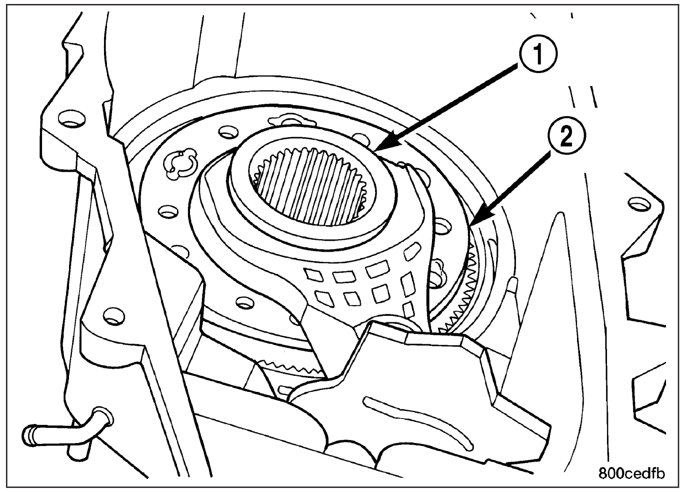
1. Install the shift sector shaft bearing using a suitable socket (2) until the bearing is flush to the bottom, inner edge of the bore.



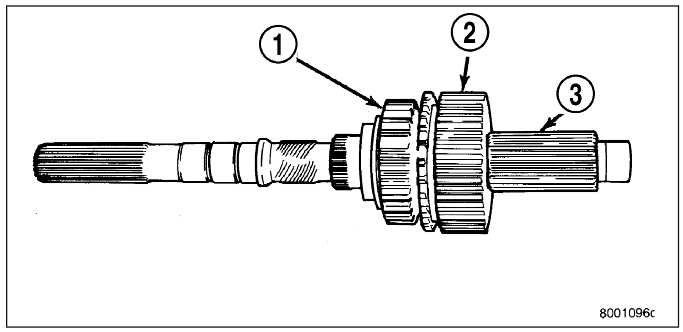

2. Install a new shift sector shaft seal using a suitable socket until the seal is flush to the bottom of the bore lead-in chamfer.
3. Install shift sector (1) in case. Lubricate sector shaft with transmission fluid before installation.



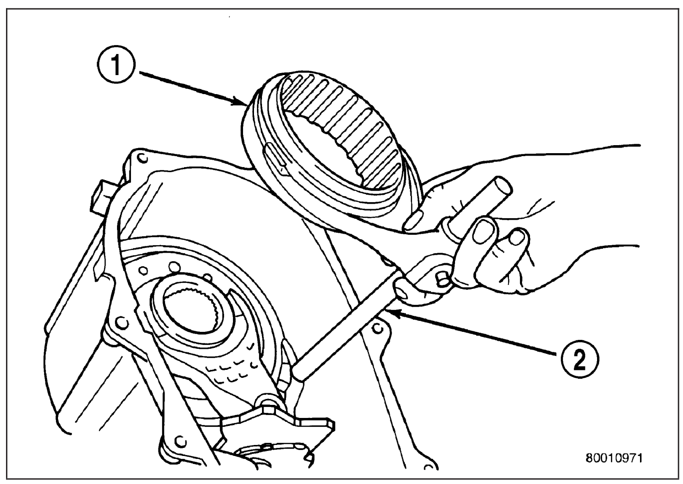
4. Assemble and install range fork (2) and hub (1). Be sure hub is properly seated in low range gear and engaged to the input gear.
5. Align and insert range fork pin in shift sector slot.



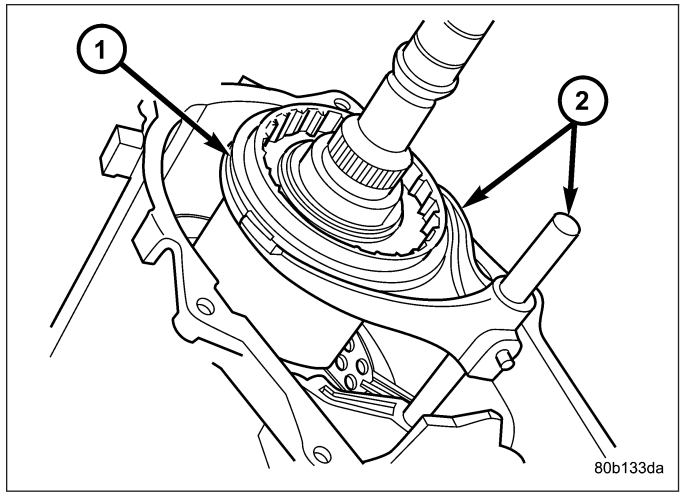

6. Install assembled mainshaft (3). Be sure shaft is seated in pilot bearing and input gear.



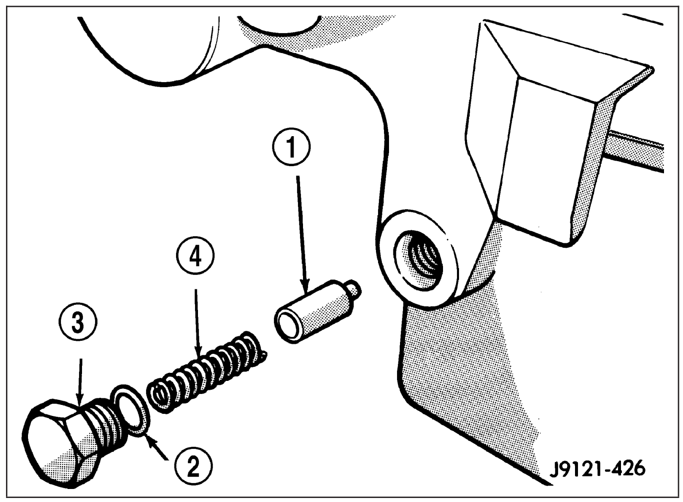

7. Install new pads on mode fork if necessary.
8. Insert mode sleeve (1) in mode fork. Be sure long side of sleeve is toward long end of shift rail (2).



9. Install assembled mode fork (2) and sleeve (1). Be sure fork rail goes through range fork and into case bore. Also be sure sleeve is aligned and seated on mainshaft hub.

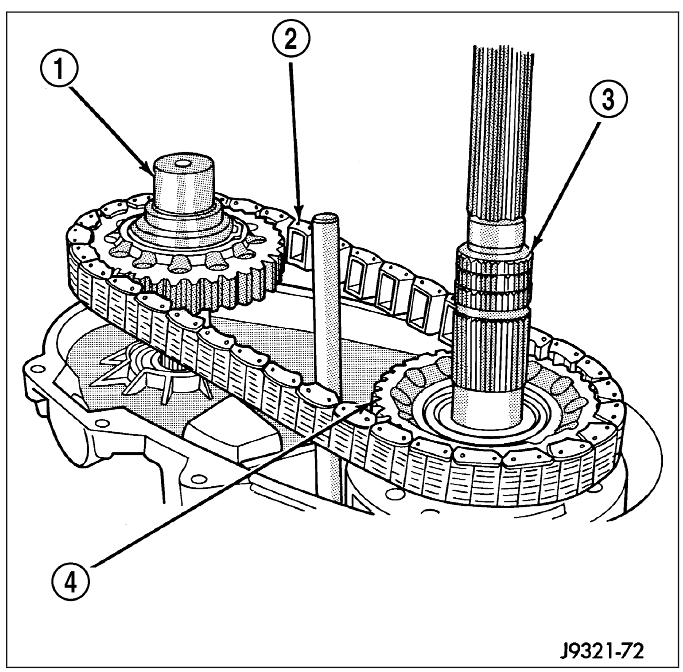



10. Rotate sector to NEUTRAL position.
11. Install new O-ring (2) on detent plug (3).
12. Lubricate detent plunger with transmission fluid or light coat of petroleum jelly.
13. Install detent plunger (1), spring (4). and plug (3).
14. Verify that plunger is properly engaged in sector.

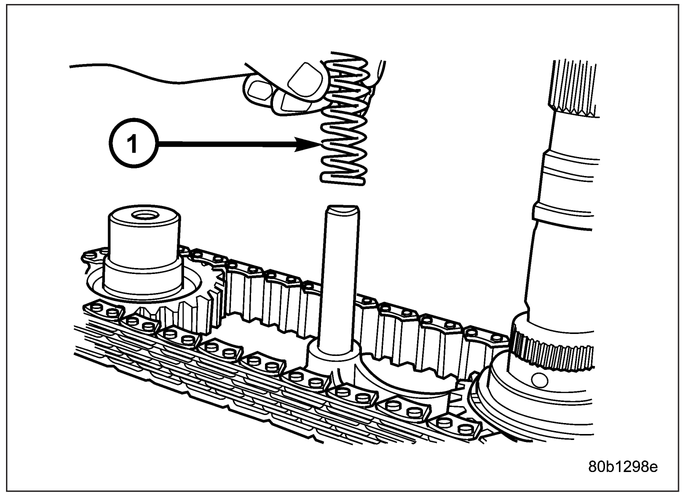



## FRONT OUTPUT SHAFT AND DRIVE CHAIN

1. Lubricate front output shaft-sprocket assembly, drive chain, and drive sprocket with transmission fluid.
2. Assemble drive chain (2) and front output shaft (1).
3. Start chain on mainshaft drive sprocket.
4. Guide front shaft into bearing and drive sprocket onto mainshaft drive gear.

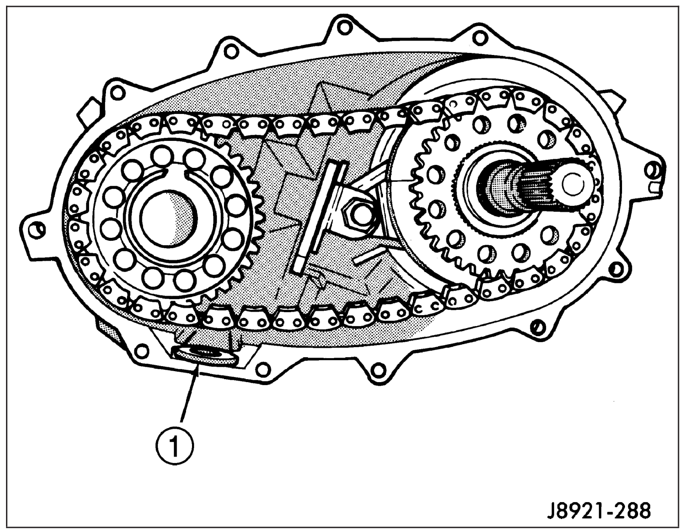


5. Install mode spring (1) on upper end of mode fork shift rail.

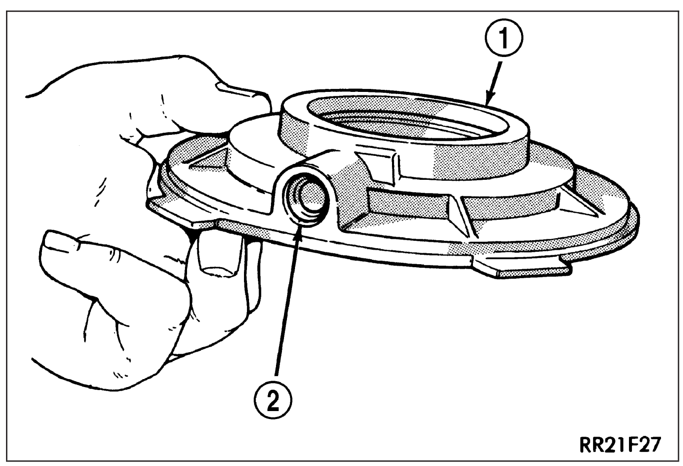



## OIL PUMP AND REAR CASE

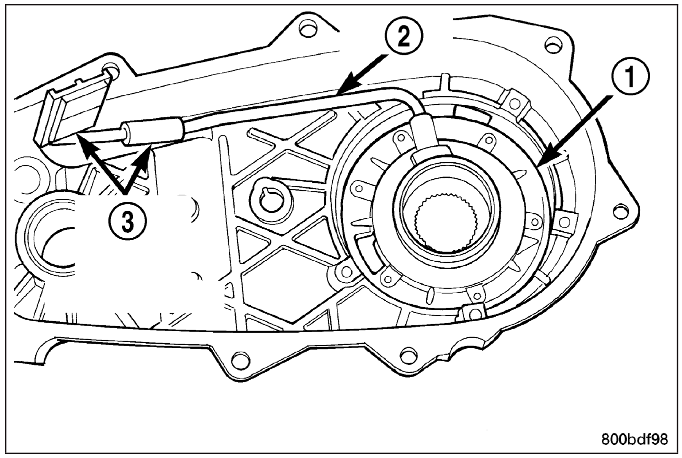
1. Install magnet (1) in front case pocket.



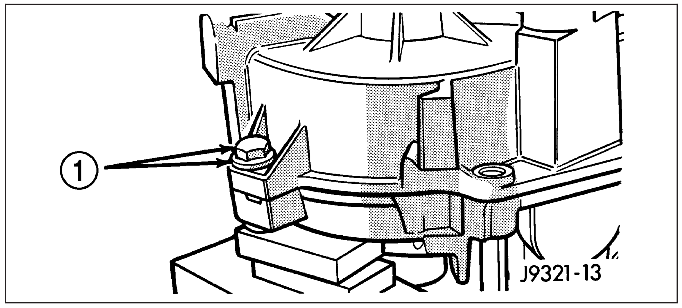

2. Assemble oil pickup screen, connecting hose, and tube.
3. Install new pickup tube O-ring (2) in oil pump (1).



4. Insert oil pickup tube (2) in oil pump (1) inlet.
5. Position assembled oil pump and pickup tube in rear case. Be sure pickup screen is securely seated in case slot. Also be sure oil pump locating tabs are outside rear case.

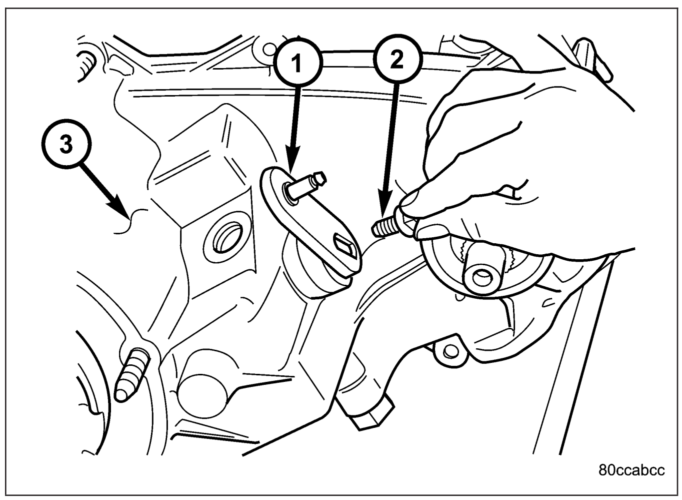



6. Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to mounting flange of front case. Work sealer bead around bolt holes.
7. Lift rear case and oil pump and carefully position assembly on front case. Be sure case dowels are aligned and that mode fork rail extends through rear case before seating rear case on front case.
8. Install case attaching bolts. Alignment bolts at each end of case are only ones requiring washers (1).
9. Tighten case bolts to 27-34 N·m (20-25 ft. lbs.) torque.

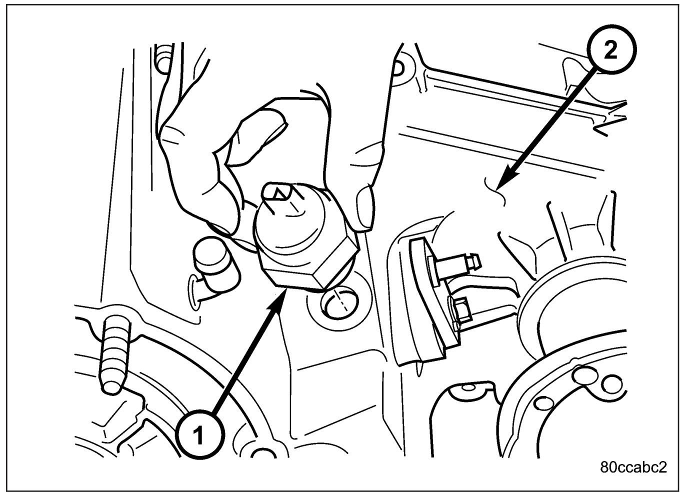



## COMPANION FLANGE AND RANGE LEVER

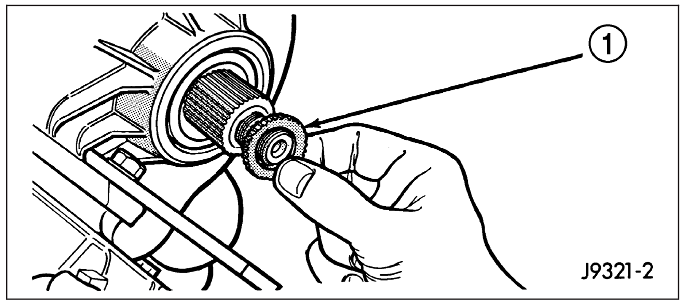
1. Install range lever (1) and bolt (2) on sector shaft. Tighten bolt to 27-34 N·m (20-25 ft. lbs.) torque.



2. Inspect the o-ring on the transfer case position sensor. Replace the o-ring if necessary.
3. Install the transfer case position sensor (1) in the front case. Tighten sensor to 20-34 N·m (15-25 ft. lbs.) torque.

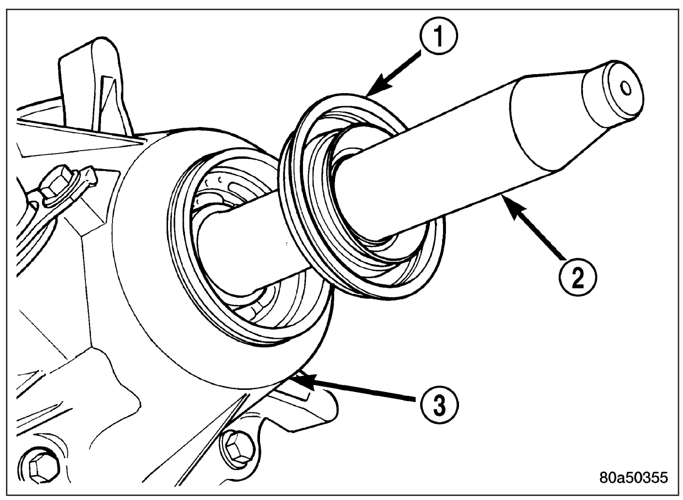



4. Install new seal washer (1) on front output shaft.
5. Lubricate companion flange hub with transmission fluid and install flange onto the front output shaft.
6. Install new seal washer on front shaft.
7. Install new flange nut onto front output shaft.
8. Tighten flange nut to 122-176 N·m (90-130 ft. lbs.) torque.

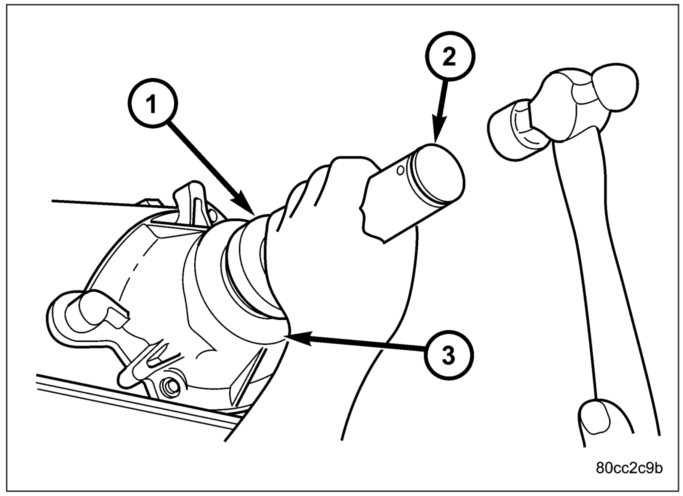



## REAR RETAINER

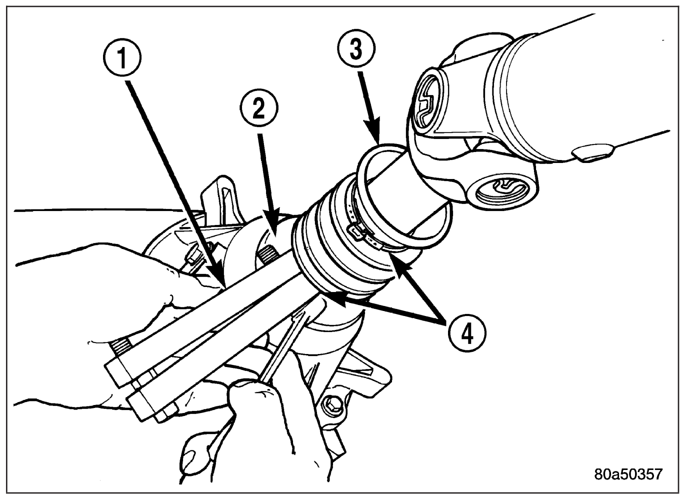
1. Apply bead of Mopar® Sealer P/N 82300234, or Loctite™ Ultra Gray, to mating surface of rear retainer. Sealer bead should be a maximum of 3/16 inch.
2. Install the forward rear output shaft bearing locating snap-ring.
3. Install rear retainer on rear case. Tighten retainer bolts to 20-27 N·m (15-20 ft. lbs.) torque.
4. Install rear bearing I.D. retaining ring onto output shaft.
5. Apply liberal quantity of petroleum jelly to new rear seal and to output shaft. Petroleum jelly is needed to protect seal lips during installation.
6. Slide seal onto Seal Protector 8824 (2). Slide seal protector and seal onto output shaft.



7. Slide Installer 8691 (1) onto seal and mainshaft. Drive seal into rear bearing retainer.




8. Install a new output shaft rear slinger with Installer 9023.
9. Install boot on output shaft slinger and crimp retaining clamp with tool C-4975-A (1).




## INSTALLATION

1. Mount transfer case on a transmission jack.
2. Secure transfer case to jack with chains.
3. Position transfer case under vehicle.
4. Align transfer case and transmission shafts and install transfer case on transmission.
5. Install and tighten transfer case attaching nuts to 35 N·m (26 ft. lbs.) torque.
6. Connect vent hose.
7. Connect transfer case position sensor connector to sensor.
8. Align and connect propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION).
9. Fill transfer case with correct fluid. Check transmission fluid level. Correct as necessary.
10. Install skid plate. (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION)
11. Remove transmission jack and support stand.
12. Connect shift cable to transfer case range lever.
13. Lower vehicle and verify transfer case shift operation.

# SPECIFICATIONS

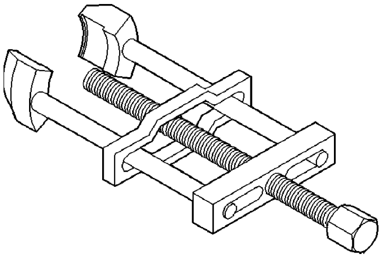
## TRANSFER CASE - NV231

### TORQUE

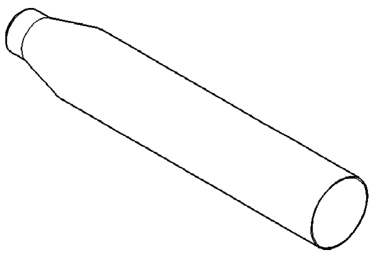
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Plug, Detent | 16-24 | 12-18 | - |
| Plug, Drain/Fill | 20-34 | 15-25 | - |
| Bolt, Front Brg. Retainer | 21 | 16 | - |
| Bolt, Case Half | 27-34 | 20-25 | - |
| Nut, Front Companion Flange | 122-176 | 90-130 | - |
| Bolt, Range Lever | 27-34 | 20-25 | - |
| Bolt, Rear Retainer | 35-46 | 26-34 | - |
| Nuts, Mounting | 35-47 | 26-35 | - |
| Sensor, Transfer Case Position | 20-34 | 15-25 | - |

## SPECIAL TOOLS

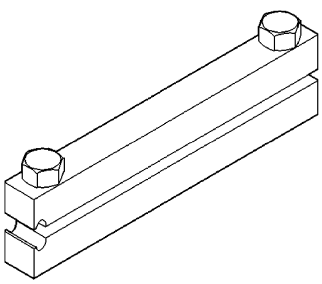
## TRANSFER CASE - NV231



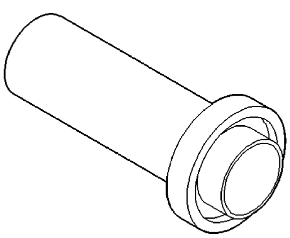
*Puller, Slinger - MD-998056-A*



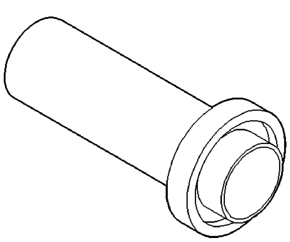
*Protector, Seal - 8824*



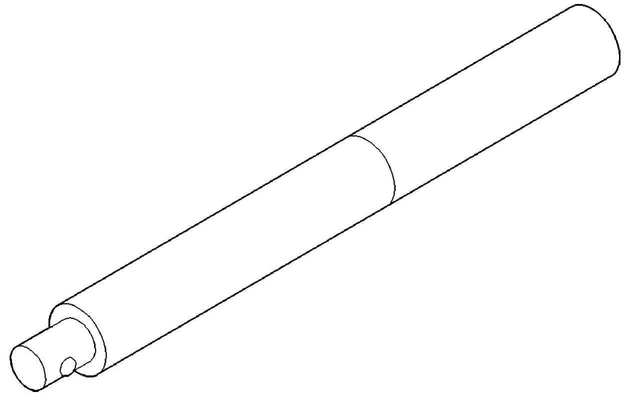
*Installer, Boot Clamp - C-4975-A*



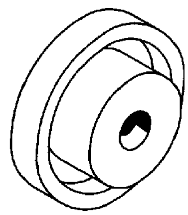
*Installer, Seal - 8143-A*



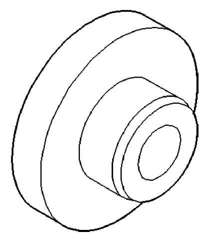
*Installer, Seal - 8691*



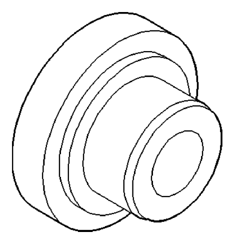
*Handle, Universal - C-4171*



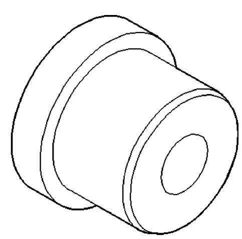
*Installer, Seal - C-4210*



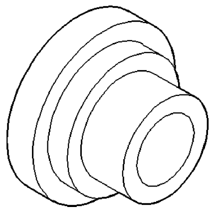
*Installer, Bearing - 5052*



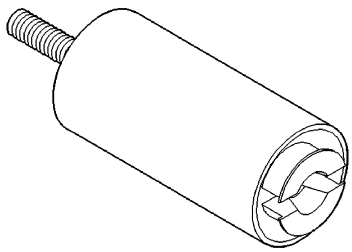
*Installer, Bearing - 5065*



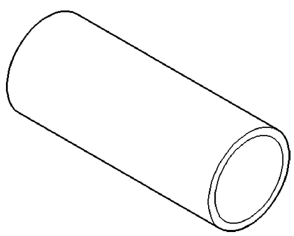
*Installer, Bushing - 5066*



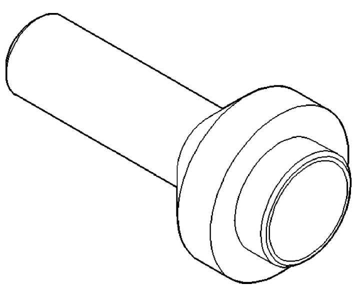
***Installer, Bearing - 8128***



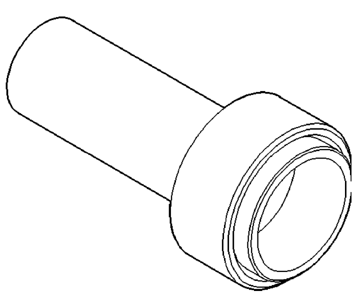
***Remover - L-4454***



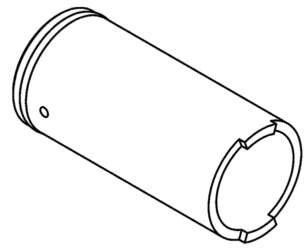
***Cup - 8148***



***Installer, Seal - 7884***



***Installer, Pump Housing Seal - 7888***

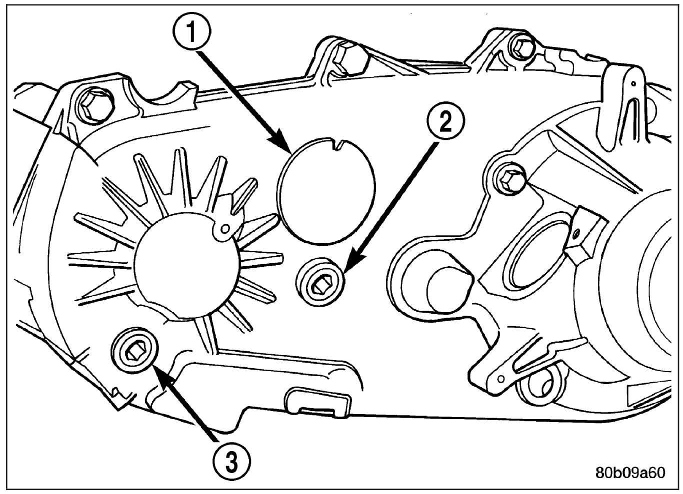


***Installer, Output Shaft Slinger - 8408***

# FLUID

## STANDARD PROCEDURE - FLUID DRAIN AND FILL

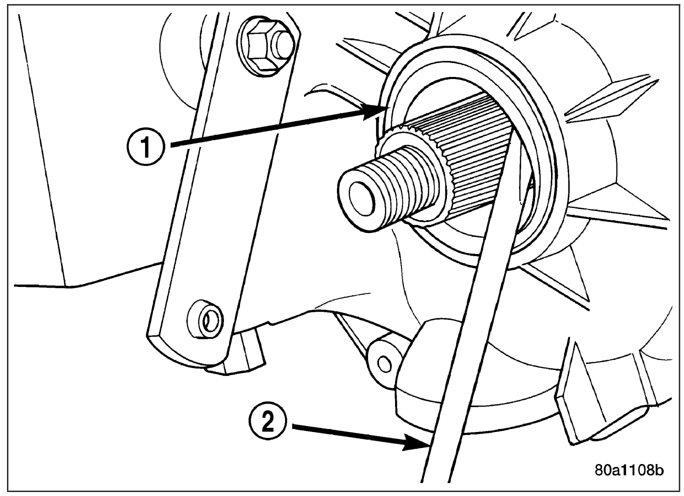
The fill (2) and drain (3) plugs are both in the rear case. Correct fill level is to the bottom edge of the fill plug hole. Be sure the vehicle is level to ensure an accurate fluid level check.



# SEAL-FRONT OUTPUT SHAFT

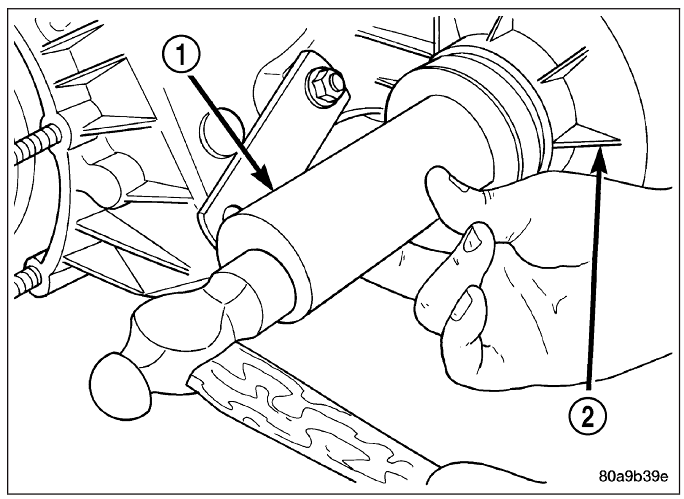
## REMOVAL

1. Raise vehicle.
2. Remove front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
3. Remove front output shaft companion flange.
4. Remove seal (1) from front case with pry tool (2).




## INSTALLATION

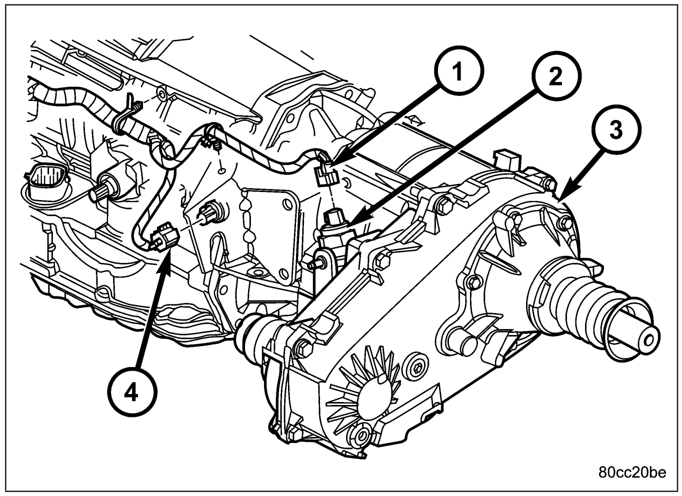
1. Install new front output seal in front case with Seal Installer 8143-A (1) as follows:
   a. Place new seal on tool. Garter spring on seal goes toward interior of case.
   b. Start seal in bore with light taps from hammer. Once seal is started, continue tapping seal into bore until installer tool seats against case.
2. Install the front output shaft companion flange.
3. Install the front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)



# SENSOR-POSITION

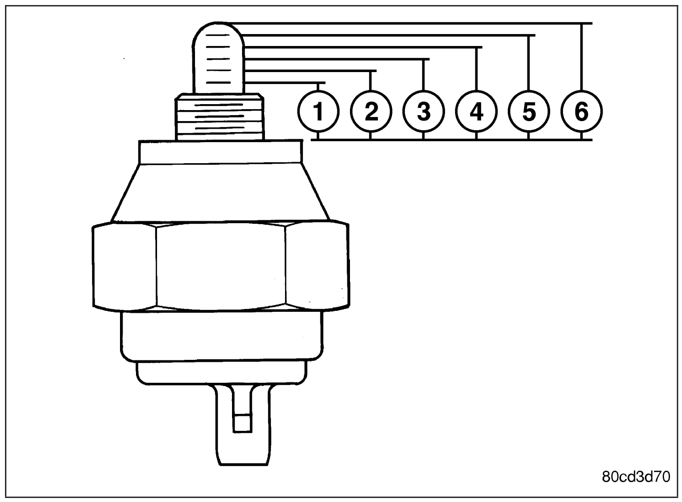
## DESCRIPTION

The transfer case position sensor (2) is an electronic device whose output can be interpreted to indicate the transfer case's current operating mode. The sensor consists of a five position, resistive multiplexed circuit which returns a specific resistance value to the Powertrain Control Module (PCM) for each transfer case operating mode. The sensor is located on the top of the transfer case, just left of the transfer case centerline and rides against the sector plate roostercomb. The PCM supplies 5VDC (+/- 0.5V) to the sensor and monitors the return voltage to determine the sector plate, and therefore the transfer case, position.




## OPERATION

During normal vehicle operation, the Powertrain Control Module (PCM) monitors the transfer case position sensor return voltage to determine the operating mode of the transfer case. Refer to the Operating Mode Versus Resistance table for the correct resistance for each position. Note that the NEUTRAL position is allowed to float between sensor positions 3 and 4. If a resistance is measured anywhere in either range, the sensor is operating correctly.




***Position Sensor Linear Movement***

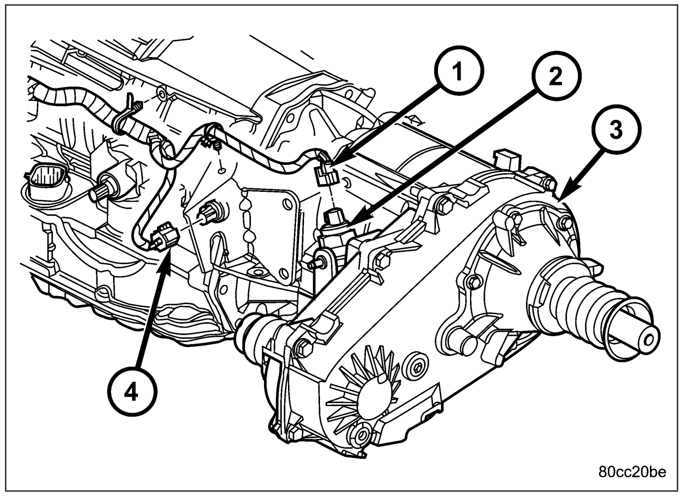
1 - POSITION 1 - 10mm ±0.5mm
2 - POSITION 2 - 12mm ±0.5mm
3 - POSITION 3 - 14mm ±0.5mm
4 - POSITION 4 - 16mm ±0.5mm
5 - POSITION 5 - 18mm ±0.5mm
6 - POSITION 6 - 20mm±0.5mm - FULL EXTENSION

**Operating Mode Versus Resistance**

| SENSOR POSITION | OPERATING MODE | SENSOR RESISTANCE (ohms) |
|---|---|---|
| 1 | 2WD | 1124-1243 |
| 2 | 4WD PART TIME | 650-719 |
| 3 | NEUTRAL | 389-431 |
| 4 | NEUTRAL | 199-221 |
| 5 | 4WD LOW | 57-64 |

## REMOVAL

1. Raise and support the vehicle.
2. Disengage the transfer case position sensor connector from the position sensor (2).
3. Remove the position sensor from the transfer case.



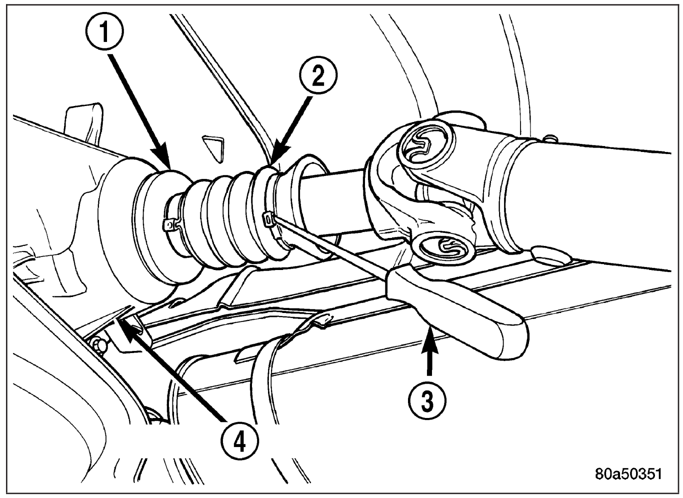

## INSTALLATION

1. Inspect the o-ring seal on the transfer case position sensor. Replace the o-ring if necessary.
2. Install the transfer case position sensor into the transfer case. Torque the sensor to 27 N·m (20 ft.lbs.).
3. Engage the transfer case position sensor connector to the position sensor.
4. Lower vehicle.
5. Verify proper sensor operation.

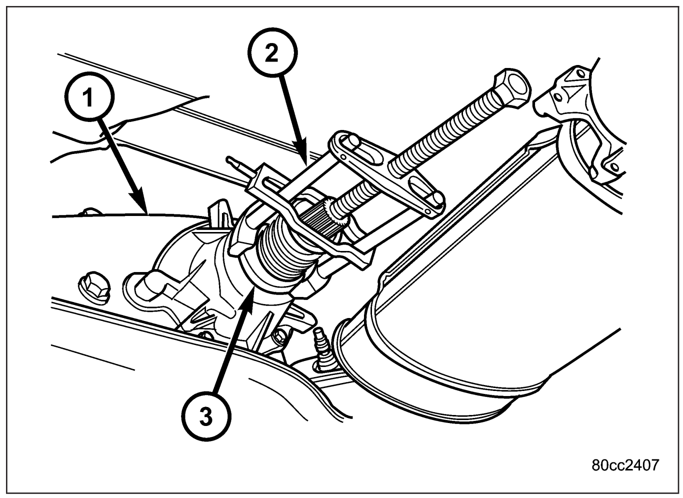
# SEAL-REAR OUTPUT SHAFT

## REMOVAL

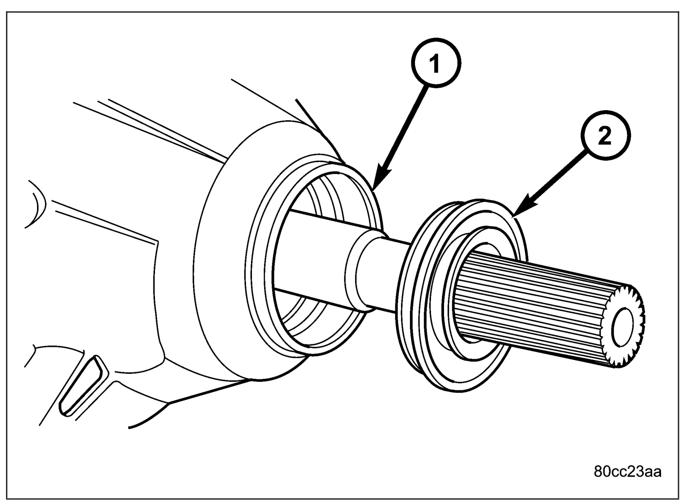
1. Shift the transmission and transfer case into NEUTRAL.
2. Raise and support vehicle.
3. Mark a line across the pinion shaft and at each end of the propeller shaft for installation reference.
4. Remove the U-joint strap bolts at the pinion shaft yoke.
5. Pry open clamp holding the dust boot (2) to propeller shaft yoke.




6. Slide the slip yoke off of the transmission/transfer case output shaft and remove the propeller shaft.
7. Spread band clamp which holds output shaft boot to the output shaft slinger with a suitable awl, or equivalent.
8. Remove output shaft boot from slinger and output shaft.
9. Remove the output shaft rear slinger (3) using Puller MD-998056-A (2).

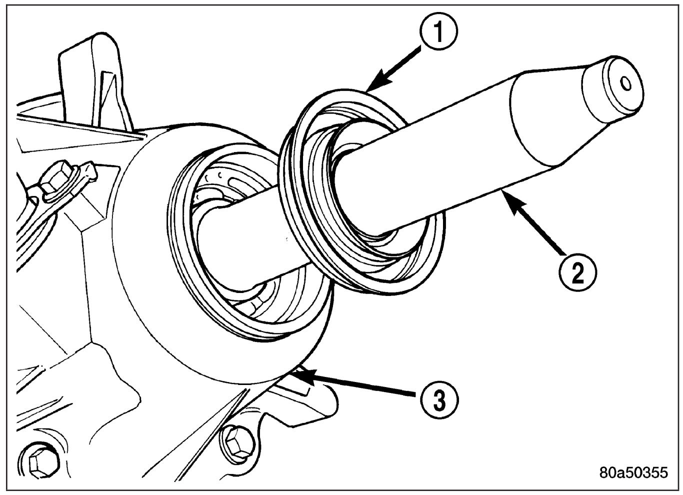



10. Use a suitable pry tool, or a slide hammer mounted screw, to remove the seal (2) from the rear retainer (1).

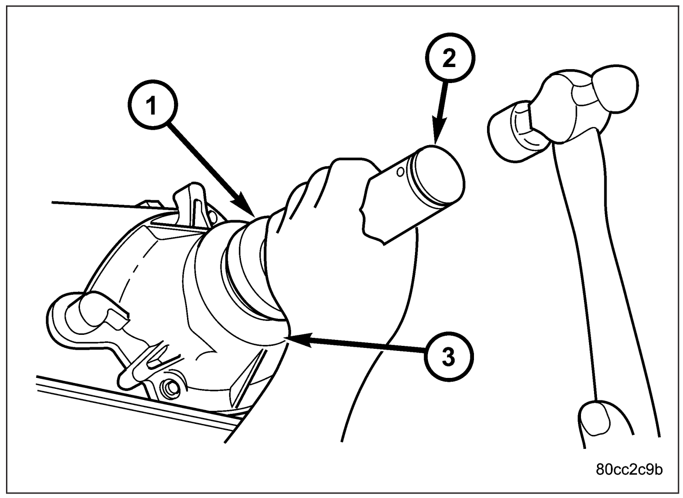


## INSTALLATION

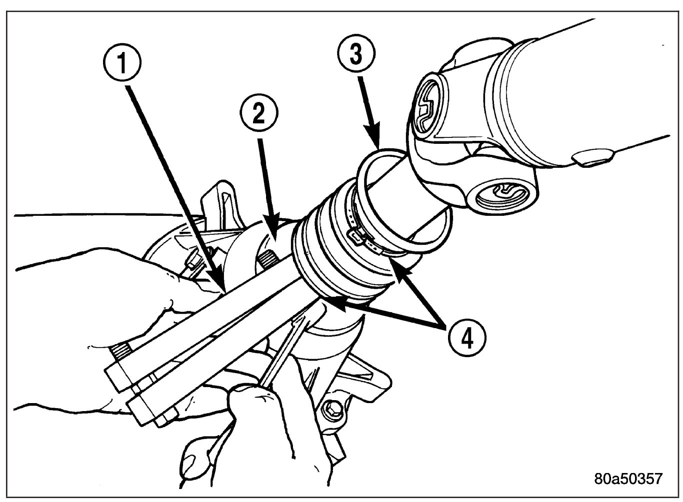
1. Apply liberal quantity of petroleum jelly to new rear seal and to output shaft. Petroleum jelly is needed to protect seal lips during installation.
2. Slide seal onto Seal Protector 8824 (2). Slide seal protector and seal onto output shaft.




3. Slide Installer 8691 (1) onto seal and mainshaft. Drive seal into rear bearing retainer.



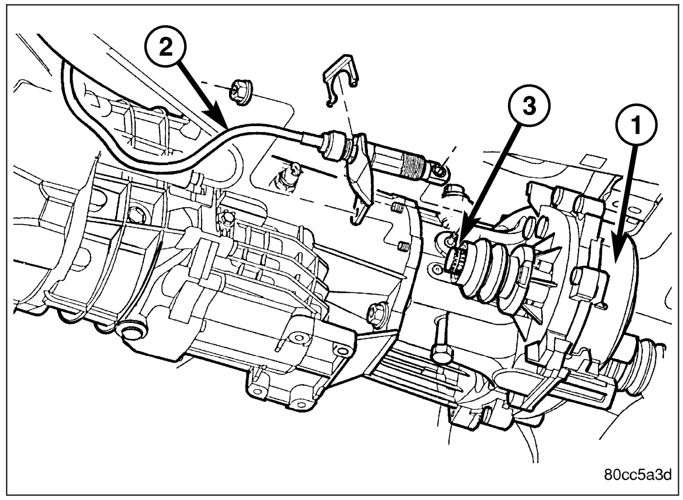

4. Install a new output shaft rear slinger with Installer 9023.
5. Install boot (3) on output shaft slinger and crimp retaining clamp with tool C-4975-A (1).
6. Slide the slip yoke on the transmission/transfer case output shaft. Align installation reference marks at the axle yoke and install the propeller shaft.
7. Tighten the U-joint strap/clamp bolts at the axle yoke to 19 N·m (14 ft. lbs.).
8. Crimp clamp with Clamp Tool C-4975A to hold dust boot to propeller shaft yoke.
9. Remove support and lower the vehicle.



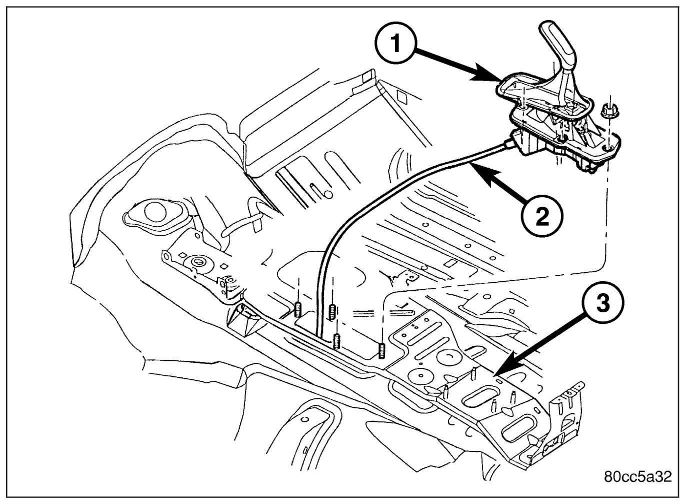
# LEVER-SHIFT

## REMOVAL

1. Shift transfer case into 4L.
2. Raise vehicle.
3. Remove clip securing the transfer case shift cable (2) to the shift cable support bracket.
4. Disengage any additional shift cable routing clips, if necessary.
5. Disengage the shift cable from the transfer case manual lever.




6. Lower vehicle.
7. Remove the floor console as necessary to access the shifter mechanism. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
8. Remove the nuts attaching lever assembly (1) to floorpan and remove assembly and shift cable (2).
9. Remove the shifter mechanism and cable assembly from the vehicle.




## INSTALLATION

1. Route the shift cable through the opening in the floor pan.
2. Position the shift mechanism over the shifter retaining studs on the floor pan.
3. Install the nuts to hold the shifter mechanism to the floor pan. Tighten the nuts to 11.86 N·m (105 in.lbs.).
4. Install any floor console components previously removed. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)
5. Verify that the floor shifter is in the 4L position.
6. Raise vehicle.
7. Route the shift cable through the opening in the shift cable support bracket.
8. Install the cable and a new spring clip into the slot in the support bracket.
9. Install any additional routing clips on the shift cable.
10. Verify that the transfer case is in the 4L position. The 4L position for the transfer case is with the manual lever to the full rearward position.
11. Attach the shift cable to the transfer case manual lever.
12. Lower vehicle and check for proper transfer case shifter operation.

# TRANSFER CASE - NV241 GENII

## TABLE OF CONTENTS

# TRANSFER CASE - NV241 GENII

## DESCRIPTION

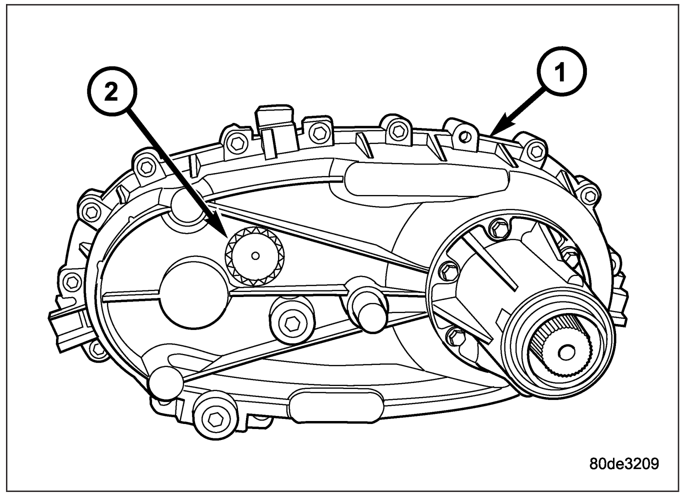
The NV241 GENII transfer case is a part-time transfer case with a low-range gear system. It provides three operating ranges plus a NEUTRAL position. The low range position provides a gear reduction ratio of 2.72:1 for increased low speed torque capability.

The gear cases and extension are all of aluminum. Drive sprockets and an interconnecting drive chain are used to transmit engine torque to the front/rear propeller shafts. The mainshaft, input gear and front output shaft are supported by ball and needle bearings.

### IDENTIFICATION

An identification tag (2) is attached to the rear case of every transfer case. The tag provides the transfer case model number, assembly number, serial number, and low range ratio.

The transfer case serial number also represents the date of build.




## OPERATION

### OPERATING RANGE

Transfer case operating ranges are:

- 2H (2-wheel drive)
- 4H (4-wheel drive)
- 4LO (4-wheel drive low range

The 2H range is for use on any road surface at any time.

The 4H and 4LO ranges are for off road use only. They are not for use on hard surface roads. The only exception being when the road surface is covered by ice and snow.

The low range reduction gear system is operative in 4LO range only. This range is for extra pulling power in off road situations. Low range reduction ratio is 2.72:1.

### SHIFT MECHANISM

Operating ranges are selected with a floor mounted shift lever. The shift lever is connected to the transfer case range lever by a shift cable. A straight line shift pattern is used. Range positions are marked on the shifter knob bezel.

### SHIFTING

The transfer case can be shifted between the 2H and 4H operating ranges while the vehicle is in motion. The vehicle must have the transmission placed in NEUTRAL, or the clutch depressed in the case of a manual transmission, and be moving less than 2-3 MPH when shifting into and out of the 4L operating range.

## DIAGNOSIS AND TESTING - TRANSFER CASE - NV241 GENII

Before beginning repair on a suspected transfer case malfunction, check all other driveline components beforehand.

The actual cause of a problem may be related to such items as: front hubs, axles, propeller shafts, wheels and tires, transmission, or clutch instead. If all other driveline components are in good condition and operating properly, refer to the Diagnosis Chart for further information.

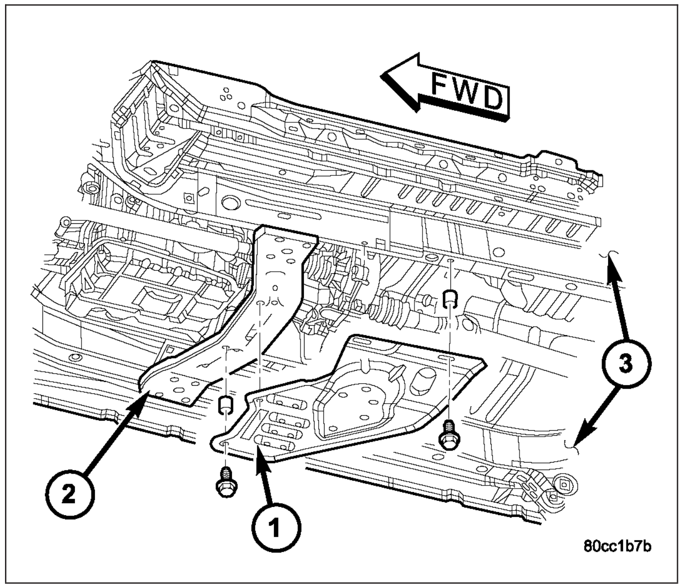
### DIAGNOSIS CHART

| Condition | Possible Cause | Correction |
|---|---|---|
| Transfer Case difficult to shift or will not shift into desired range. | 1) Vehicle speed too great to permit shifting. | 1) Stop vehicle and shift into desired range. Or, reduce speed to below 3-4 km/h (2-3 mph) before attempting the shift. |
| | 2) If vehicle was operated for an extended period in 4H on a dry paved surface, the driveline torque load may be causing a bind. | 2) Stop vehicle and shift the transmission into neutral. Shift the transfer case to 2H and operate vehicle in 2H on dry paved surfaces. |
| | 3) Transfer case external shift linkage binding. | 3) Lubricate, repair, or replace linkage bushings, or tighten loose components as necessary. |
| | 4) Insufficient or incorrect lubricant. | 4) Drain and refill to edge of fill hole with Mopar® ATF +4, Automatic Transmission fluid. |
| | 5) Internal components binding, worn, or damaged. | 5) Disassemble the transfer case and replace worn or damaged components as necessary. |
| Transfer Case noisy in all operating ranges. | 1) Insufficient or incorrect lubricant. | 1) Drain and refill to edge of fill hole with Mopar® ATF +4, Automatic Transmission fluid. |
| Noisy in, or jumps out of, four wheel drive low range. | 1) Transfer case not completely engaged in 4L position. | 1) With the transmission in NEUTRAL, or the clutch depressed in the case of a manual transmission and the vehicle moving under 3-4 km/h (2-3 mph), shift the transfer case to NEUTRAL and then shift into the 4L position. |
| | 2) Shift linkage out of adjustment. | 2) Adjust linkage. |
| | 3) Shift linkage loose or binding. | 3) Tighten, lubricate, or repair linkage as necessary. |
| | 4) Range fork damaged, inserts worn, or fork is binding on the shift rail. | 4) Disassemble unit and repair as necessary. |
| | 5) Low range gear worn or damaged. | 5) Disassemble unit and repair as necessary. |

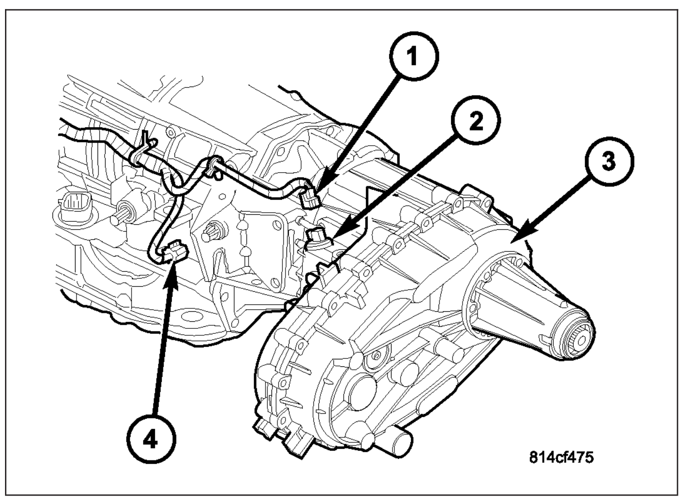
| Condition | Possible Cause | Correction |
|---|---|---|
| Lubricant leaking from output shaft seal or vent. | 1) Transfer case overfilled. | 1) Drain lubricant to the correct level. |
| | 2) Vent closed or restricted. | 2) Clear or replace vent as necessary. |
| | 3) Output shaft seals damaged or installed incorrectly. | 3) Replace seal as necessary. Check to ensure that another component, the propeller shaft slip yoke for example, is not causing damage to seal. |
| Abnormal tire wear. | 1) Extended operation on hard, dry surfaces in the 4H position. | 1) Operate vehicle in the 2H position on hard, dry surfaces. |

## REMOVAL

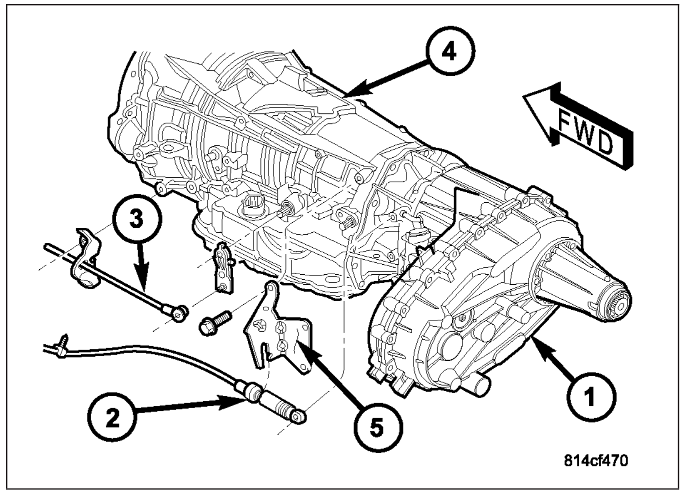
1. Shift transfer case into NEUTRAL.
2. Raise vehicle.
3. Remove skid plate (1).



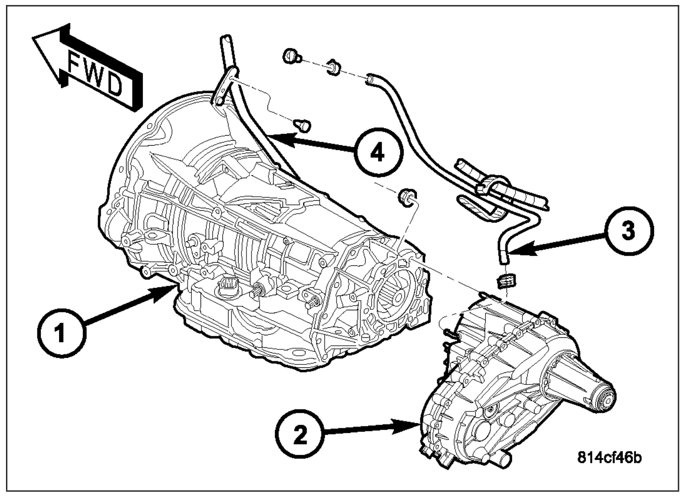

4. Drain transfer case lubricant.
5. Mark front and rear propeller shaft yokes for alignment reference.
6. Remove the front/rear propeller shafts at transfer case. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
7. Disconnect transfer case position sensor connector (1) from the position sensor (2).



8. Disconnect transfer case shift cable (2) at the range lever.
9. Disconnect the transfer case shift cable (2) from the shift cable bracket (5).




10. Disconnect transfer case vent hose (3).
11. Support transfer case (2) with transmission jack.
12. Secure transfer case to jack with chains.
13. Remove nuts attaching transfer case to transmission (1).
14. Pull transfer case and jack rearward to disengage transfer case.
15. Remove transfer case from under vehicle.

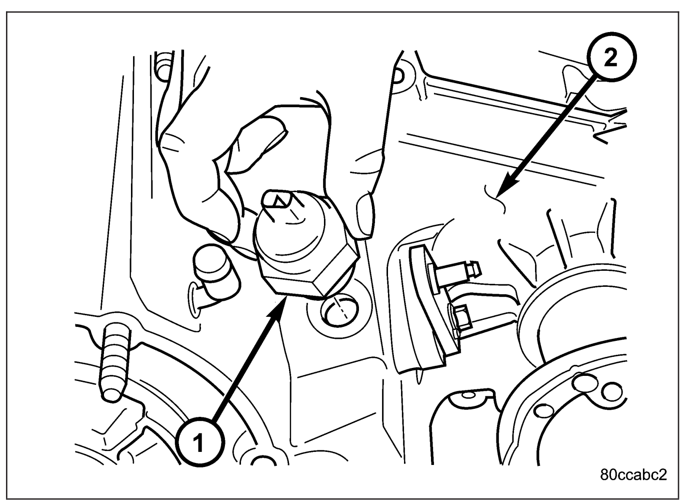



## DISASSEMBLY

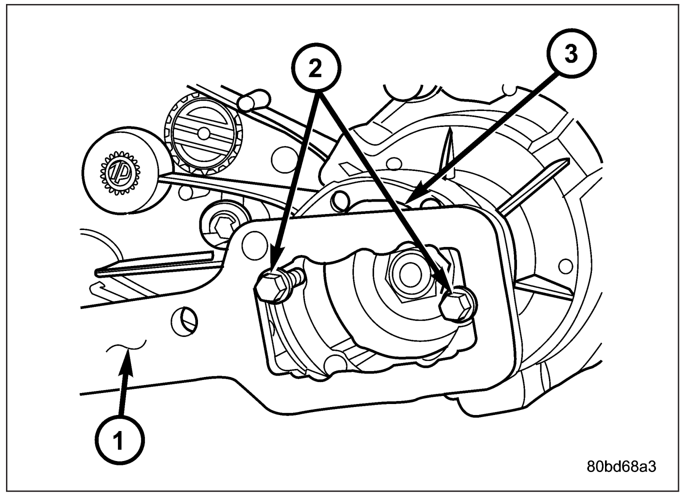
Position transfer case in a shallow drain pan. Remove drain plug and drain any remaining lubricant remaining in case.

## COMPANION FLANGE AND RANGE LEVER

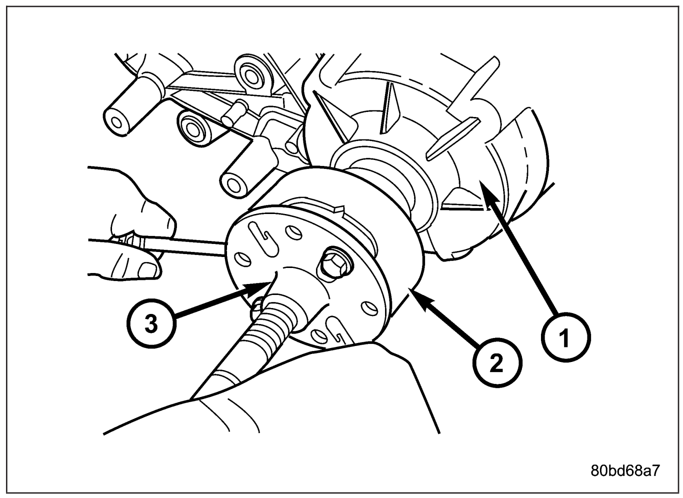
1. Remove transfer case position sensor (1).



2. Install two bolts (2) partially into the propellor shaft companion flange (3), 180° from each other.
3. Install the rectangular end of the Flange Holder C-3281 (1) over the bolts to hold the companion flange stationary and remove the nut holding the companion flange to the output shaft.

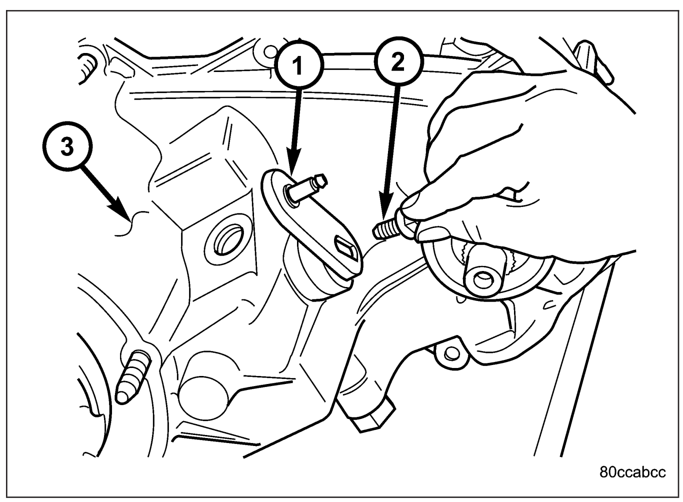



4. Use Remover C-452 (3) to remove the companion flange (2).



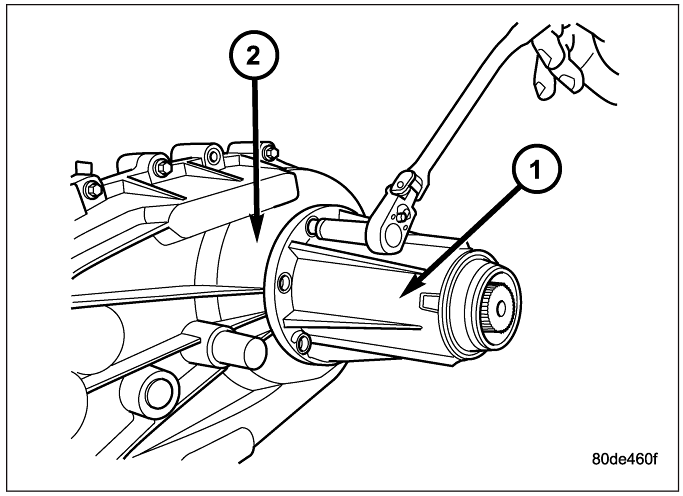

5. Remove seal washer from front output shaft. Discard washer as it should not be reused.
6. Remove the bolt (2) that attaches the range lever (1) to sector shaft. Then move sector to neutral position and remove range lever from shaft.

**NOTE: Be sure to note the orientation of the range lever (lever up or down) so that it may be re-installed in the same direction.**

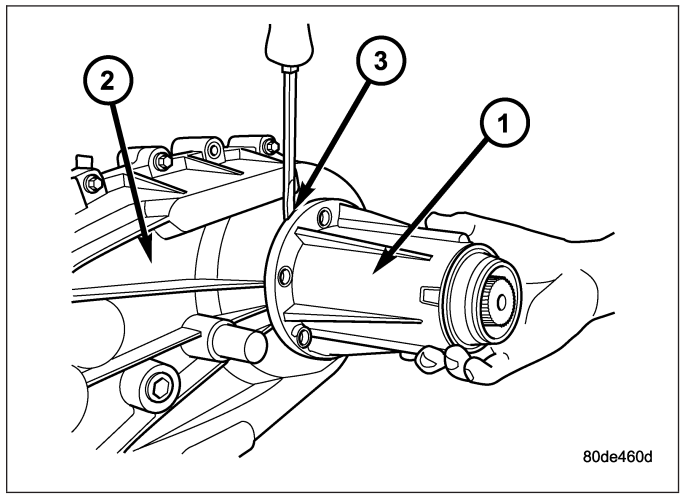


## REAR EXTENSION

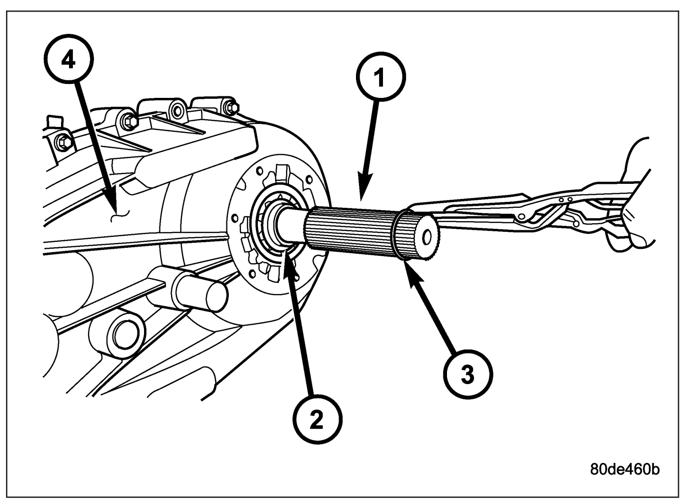
1. Remove rear extension (1) bolts.




2. Remove rear extension housing (1). Tap extension once or twice with a plastic mallet to break sealer bead and loosen it.

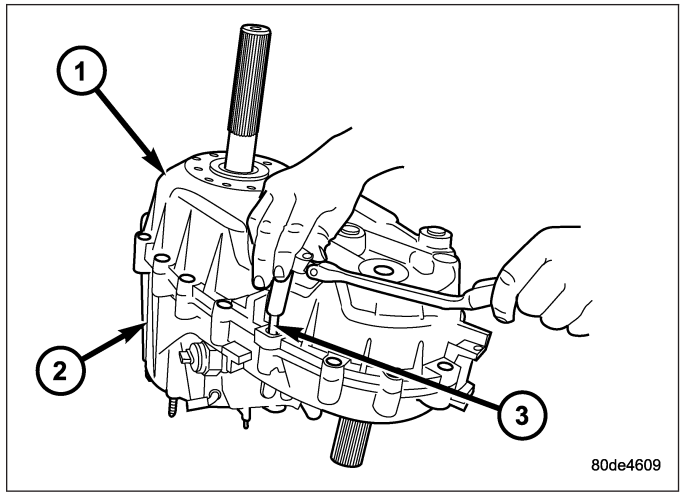



3. Remove output bearing (2) retaining ring (3) with heavy duty snap-ring pliers.

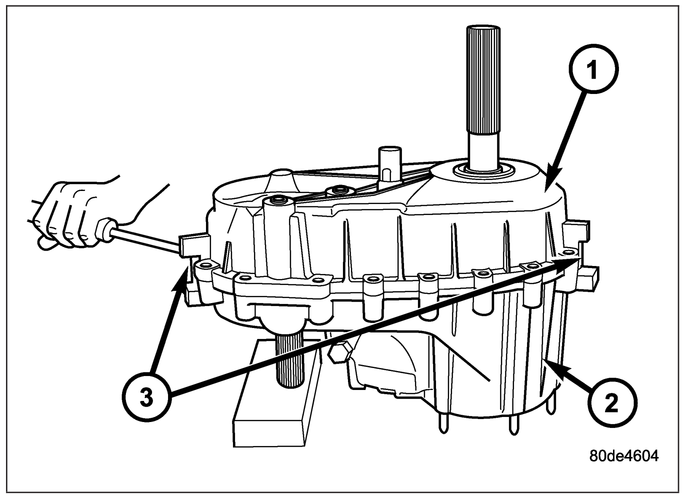


## OIL PUMP AND REAR CASE

1. Remove rear case(1)-to-front case (2) bolts (3).

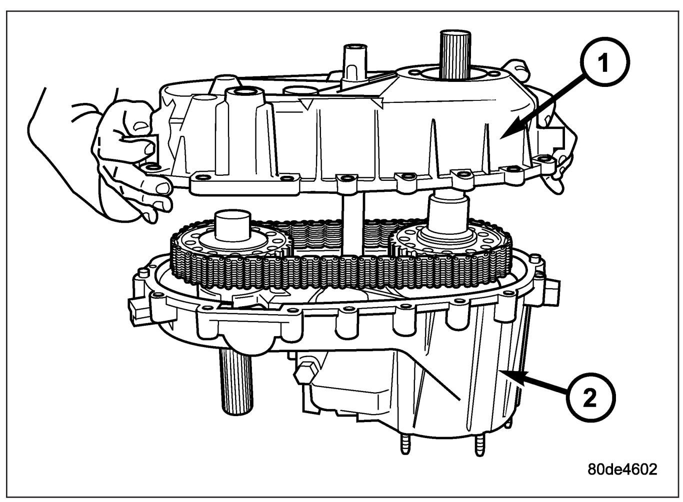



2. Loosen rear case (1) with pry tool to break sealer bead. Insert tool in slot (3) at each end of case.



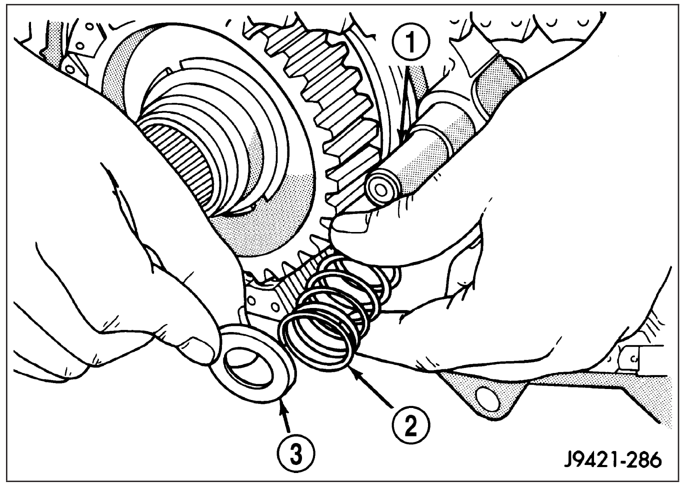

3. Unseat rear case (1) from alignment dowels.
4. Remove rear case and oil pump assembly from front case.

**CAUTION: Do not remove the bolts holding the oil pump cover to the rear case half. The oil pump cover is aligned to the rear output shaft bearing inner race and will become mis-aligned if the bolts are loosened. If the transfer case failure has generated any debris which may have become trapped in the oil pump, the rear case and oil pump assembly MUST be replaced.**

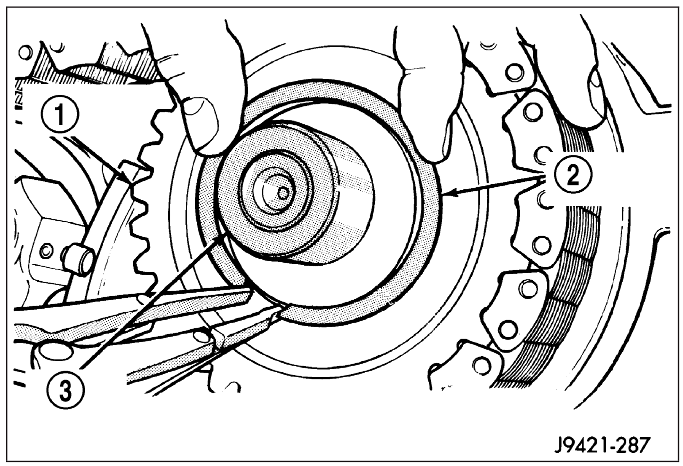


## FRONT OUTPUT SHAFT AND DRIVE CHAIN

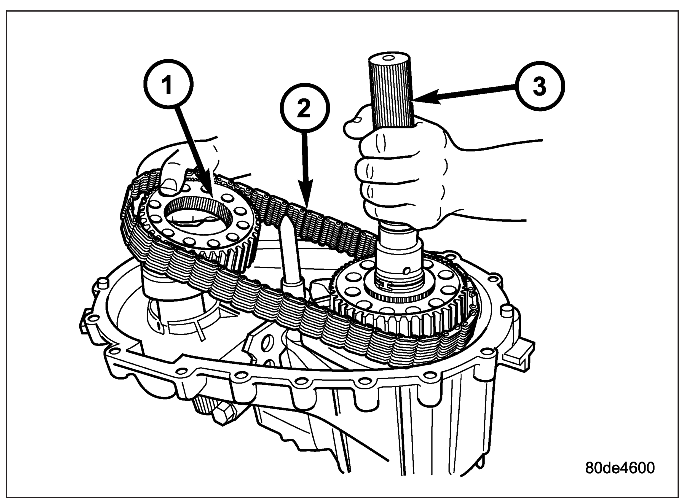
1. Remove shift rail (1) cup (3) and spring (2).




2. Remove front sprocket (1) retaining ring (2).

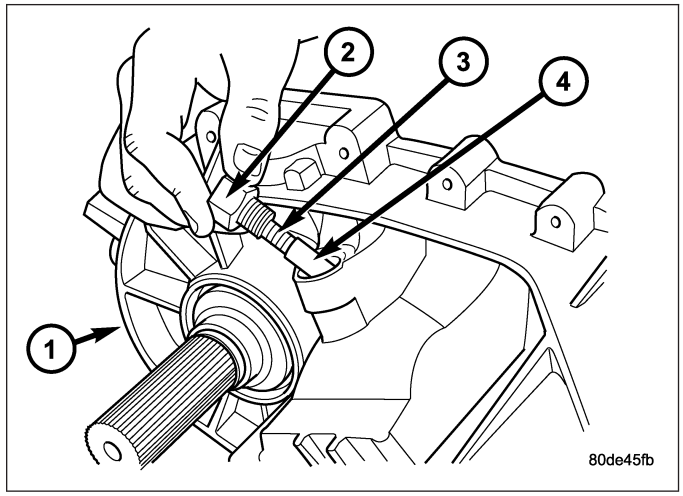



3. Pull mainshaft (3), front sprocket (1) and chain outward about 25.4 mm (1-inch) simultaneously.
4. Remove chain from mainshaft drive sprocket and remove front sprocket and chain as assembly.

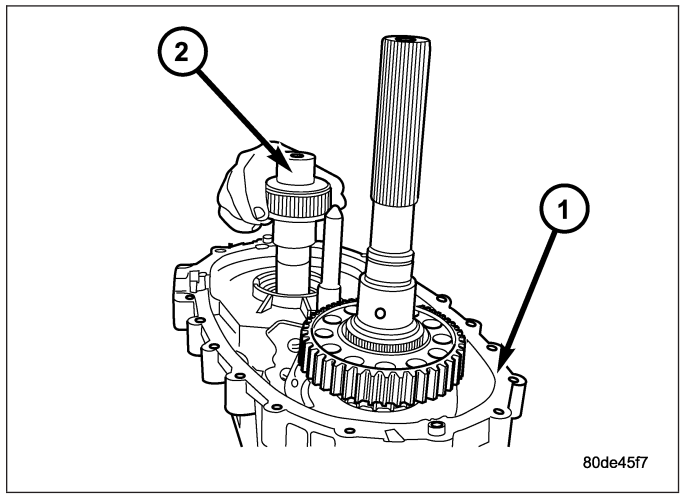


## SHIFT FORKS AND MAINSHAFT

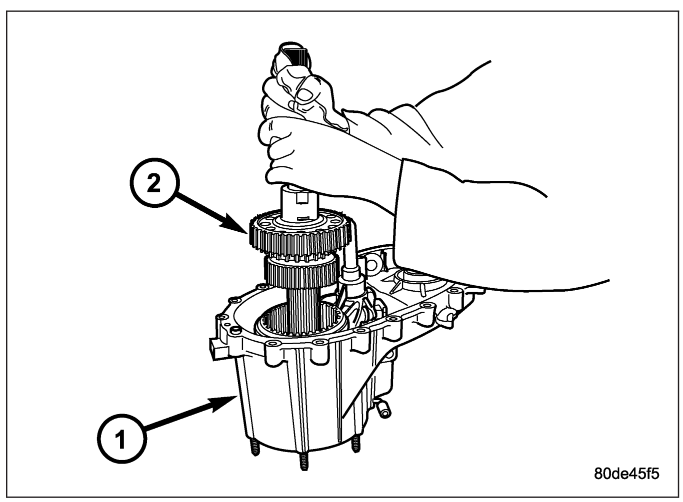
1. Loosen detent plug (2).
2. Remove detent plug (2), spring (3), and plunger (4). Note that the plug has an O-ring seal. Remove and discard this seal.



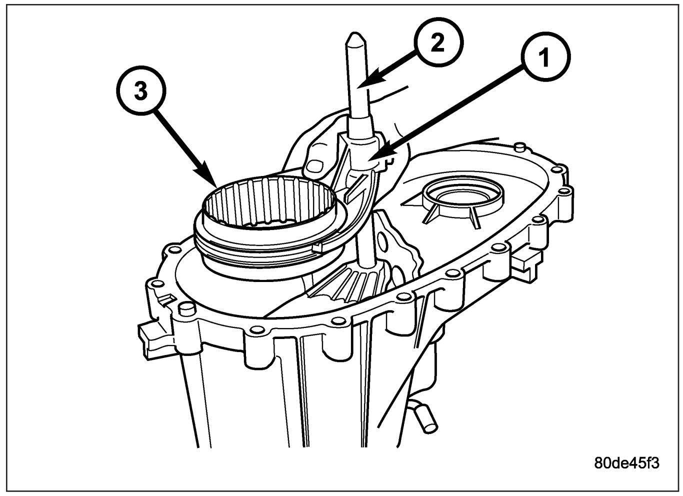

3. Remove front output shaft (2) from bearing in the front case (1).



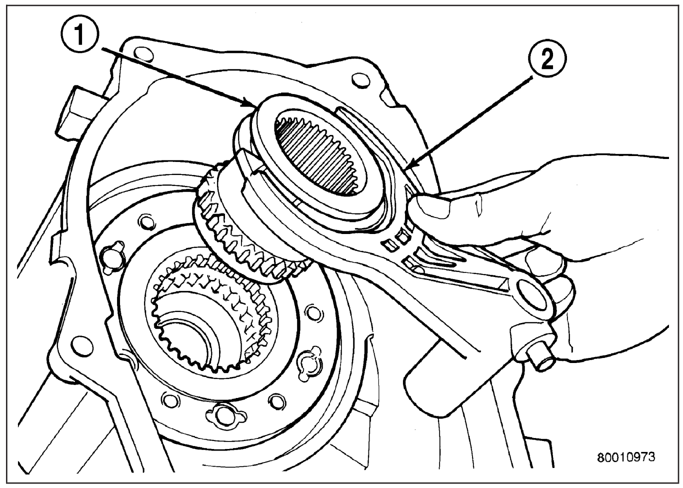

4. Pull mainshaft assembly (2) out of input gear, mode sleeve, and front case (1).



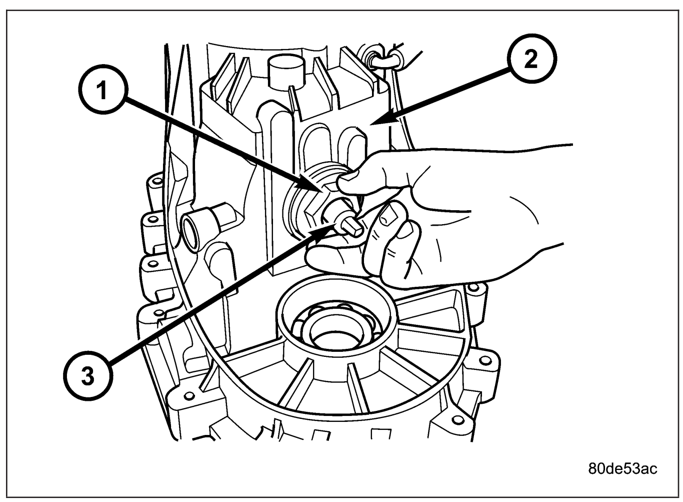
5. Remove mode fork (1), mode sleeve (3), and shift rail (2) as assembly. Note which way the sleeve fits in the fork (long side of sleeve goes to front).



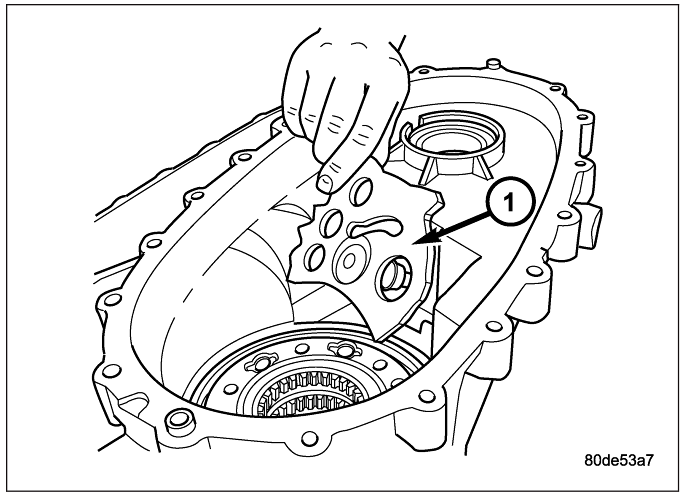

6. Remove range fork retaining ring.
7. Remove range fork (2) and hub (1) as an assembly. Note fork position for installation reference.




8. Remove the shift sector support (1).

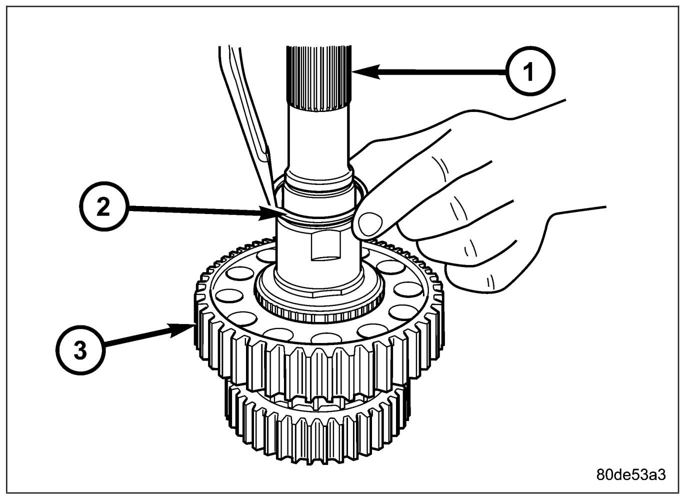


9. Remove shift sector (1).

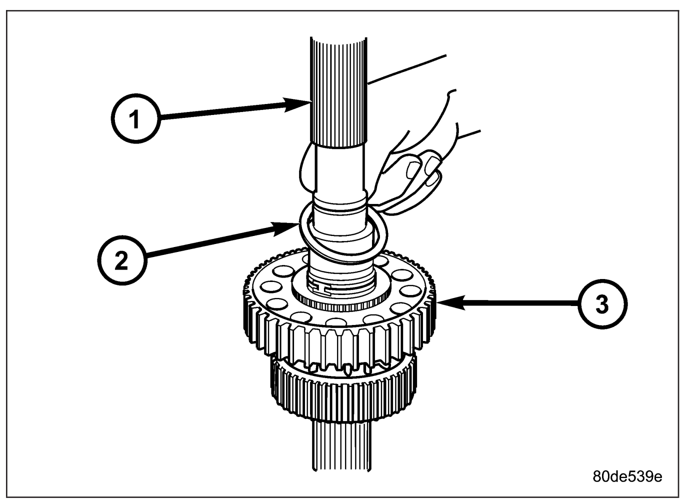



## MAINSHAFT

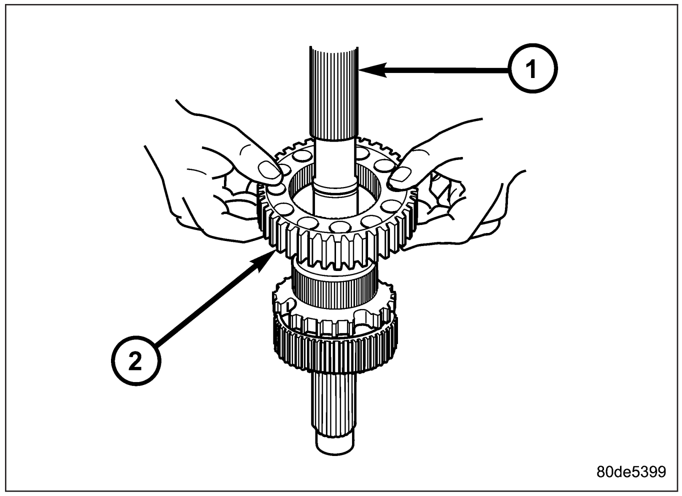
1. Remove the drive sprocket retaining ring (2) from the output shaft (1).



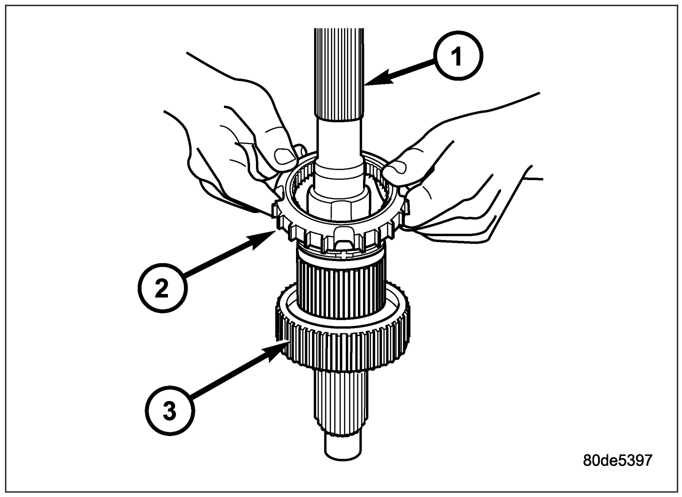

2. Remove the drive sprocket (3) thrust washer (2) from the output shaft (1).



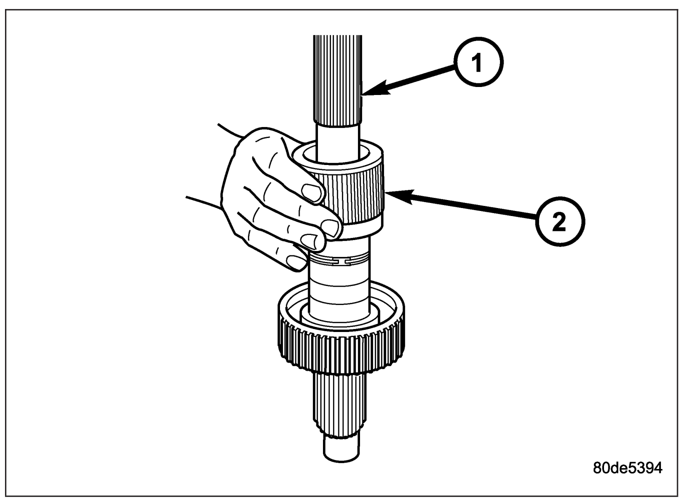
3. Remove drive sprocket (2) from the output shaft (1).



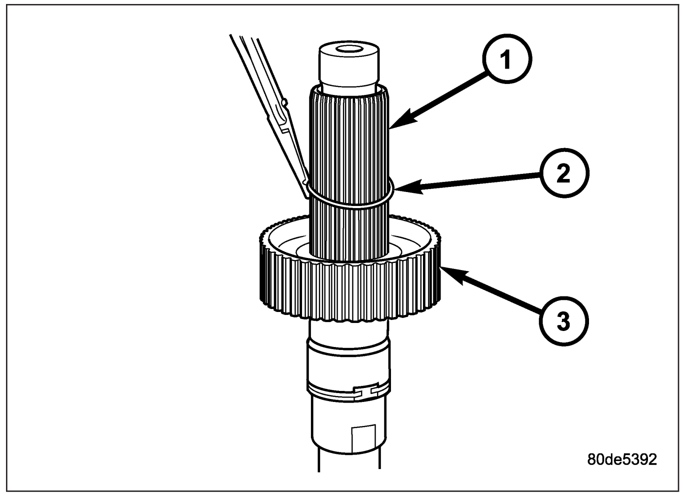

4. Remove the clutch gear (2) from the output shaft (1).



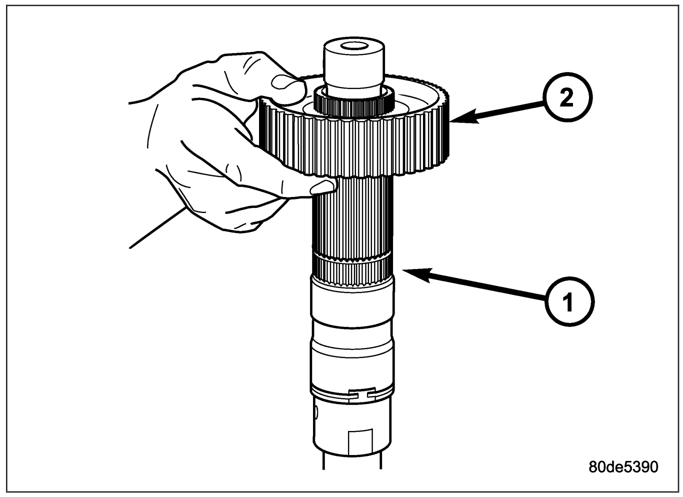

Remove the sprocket hub (2) from the output shaft (1).



5. Remove the mode hub (3) retaining ring (2) from the output shaft (1).

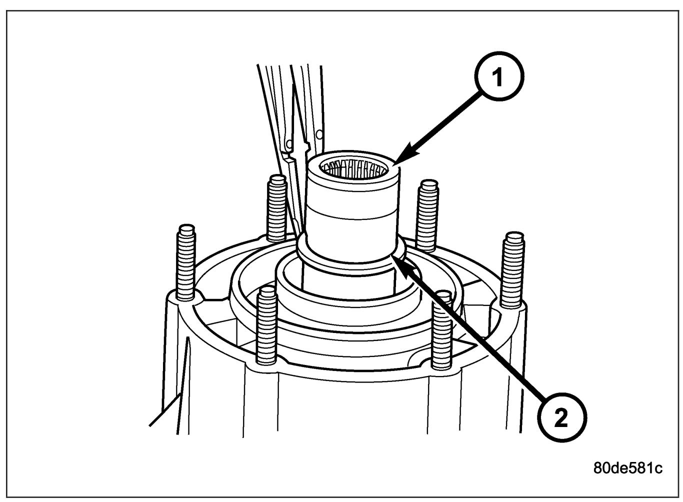



6. Remove the mode hub (2) from the output shaft (1).

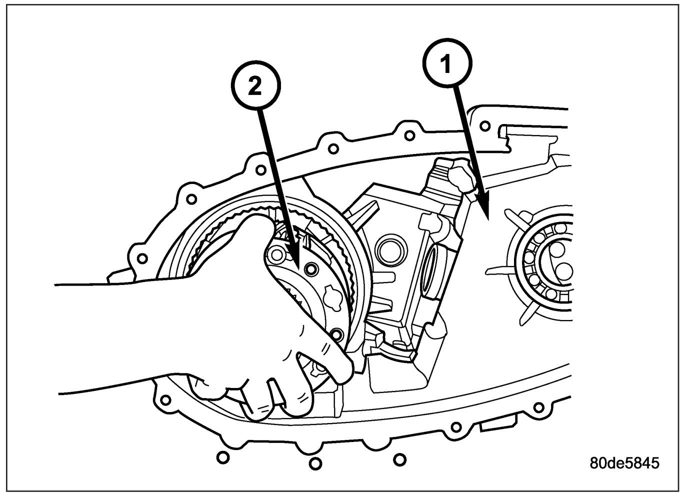



## INPUT AND PLANETARY GEAR

1. Remove input gear seal with suitable screw and slide hammer.
2. Remove input gear (1) retaining ring (2) with heavy duty snap-ring pliers.

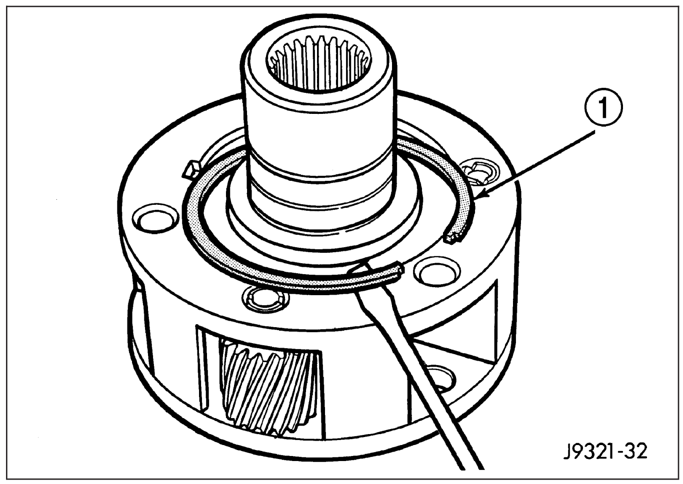


3. Place front case in horizontal position. Then remove input gear and low range gear as an assembly (2). Tap gear out of bearing with plastic mallet, if necessary.

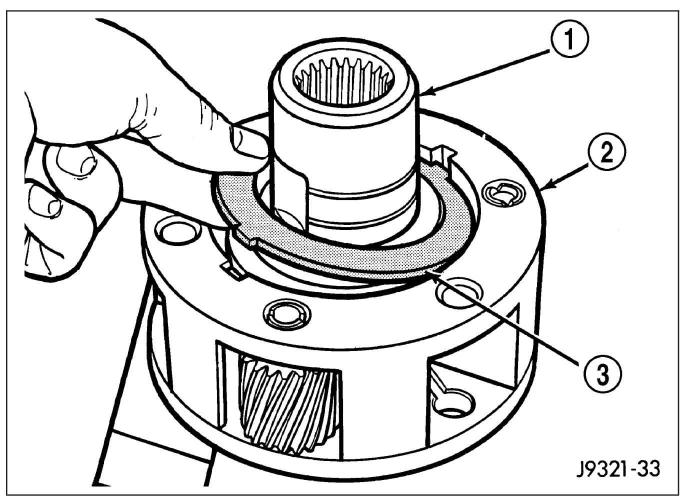



## INPUT AND PLANETARY GEAR

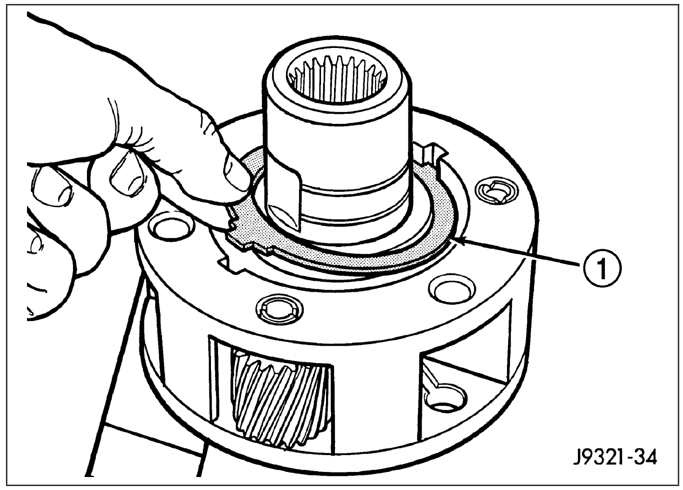
1. Remove snap-ring (1) that retains input gear in low range gear.



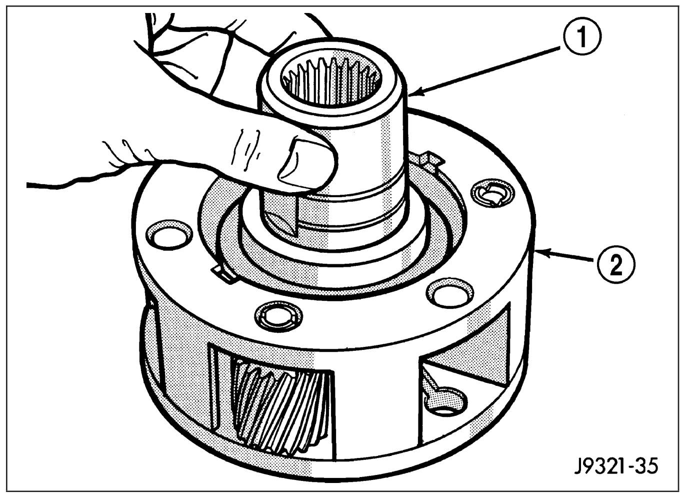

2. Remove retainer (3).



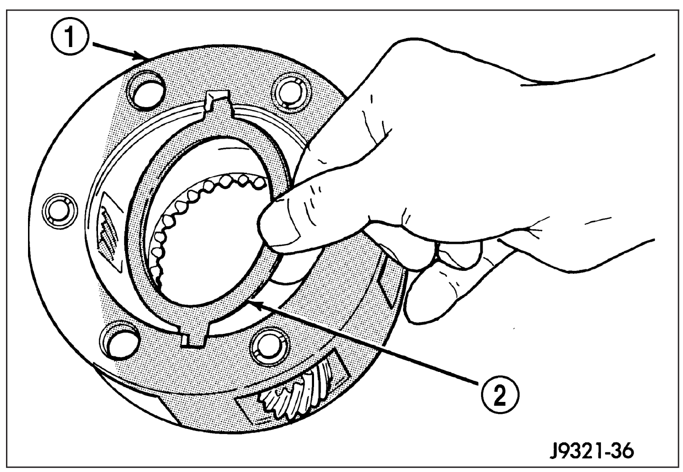
3. Remove front tabbed thrust washer (1).




4. Remove input gear (1).




5. Remove rear tabbed thrust washer (2) from low range gear (1).




## CLEANING

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and 3M™ all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.

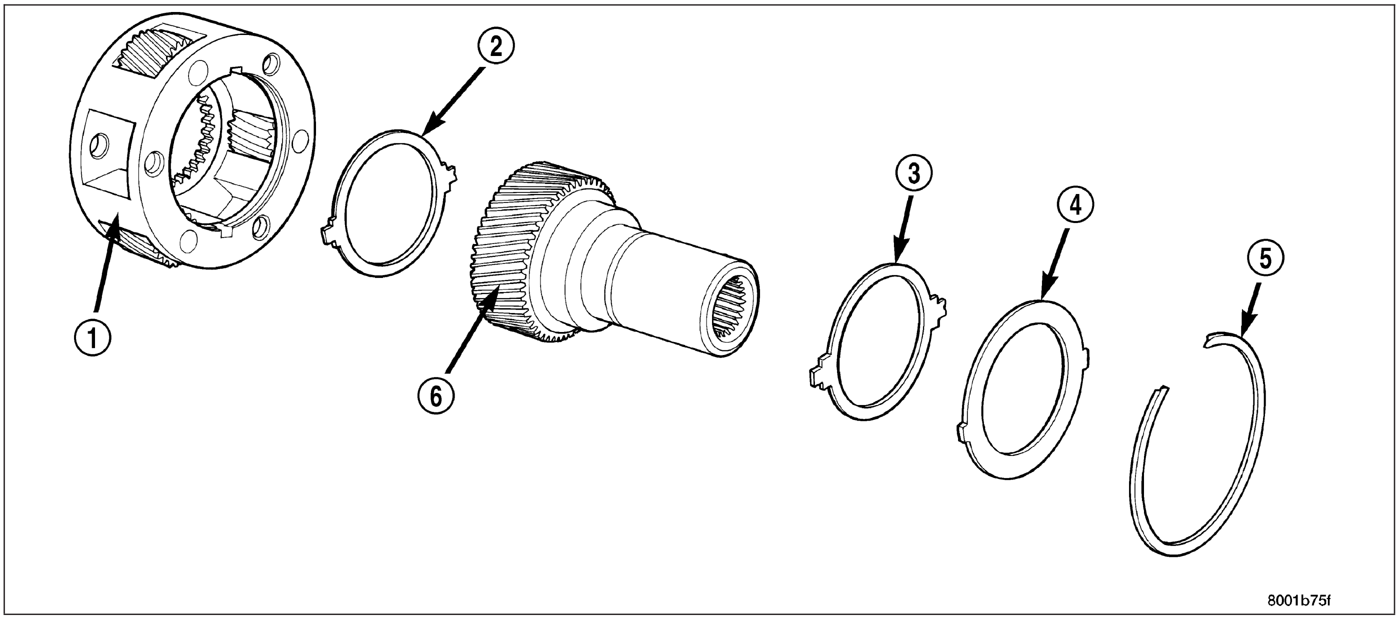
# INSPECTION

## MAINSHAFT/SPROCKET/HUB

Inspect the splines on the hub and shaft and the teeth on the sprocket. Minor nicks and scratches can be smoothed with an oilstone, however, replace any part that is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320-400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

## INPUT GEAR AND PLANETARY CARRIER




***Input Gear And Carrier Components***

1 - PLANETARY CARRIER
2 - REAR THRUST WASHER
3 - FRONT THRUST WASHER
4 - CARRIER LOCK RING
5 - CARRIER LOCK RETAINING RING
6 - INPUT GEAR

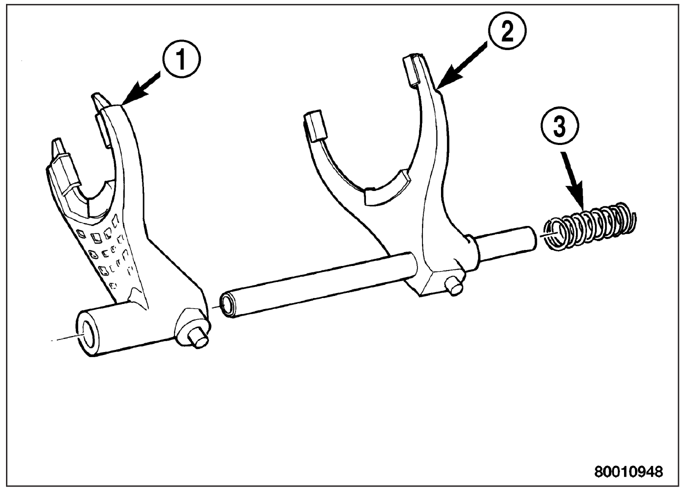
Check the teeth on the input gear (6). Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300-400 grit emery cloth if necessary.

Examine the planetary carrier body (1) and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged.

Check the carrier lock ring (4) and both thrust washers (2, 3) for wear or cracks. Replace them if necessary. Also replace the carrier lock retaining ring (5) if bent, distorted, or broken.

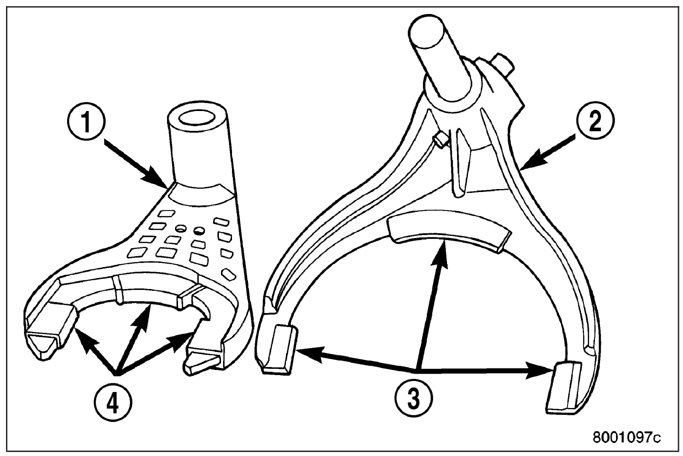
## SHIFT FORKS/HUBS/SLEEVES

Check condition of the shift forks and mode fork shift rail (2). Minor nicks on the shift rail can be smoothed with 320-400 grit emery cloth.




Inspect the shift fork wear pads (3, 4). The mode fork pads are serviceable and can be replaced if necessary. The range fork pads are not serviceable. The fork must be replaced as an assembly if the pads are worn or damaged.

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.




## REAR RETAINER COMPONENTS

Inspect the retainer components. Replace the bearing if rough or noisy. Check the retainer for cracks or wear in the bearing bore.

Inspect the retaining rings and washers. Replace any part if distorted, bent, or broken. Reuse is not recommended.

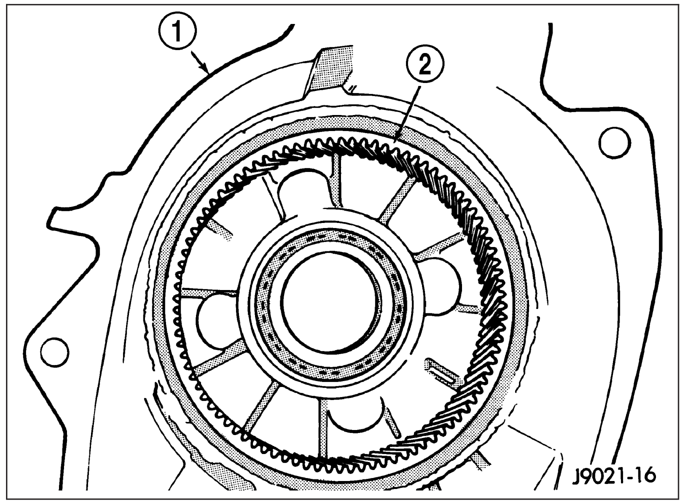
Inspect rear extension bushing. Replace if worn or scored.

## DRIVE CHAIN

Examine the drive chain and shaft bearings. replace the chain if stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.

## LOW RANGE ANNULUS GEAR

Inspect annulus gear (2) condition carefully. The gear is only serviced as part of the front case. If the gear is damaged, it will be necessary to replace the gear and front case as an assembly. Do not attempt to remove the gear.




## FRONT CASE AND REAR CASE

Inspect the cases for wear and damage.

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

Check the front case mounting studs and vent tube. The tube can be secured with Loctite™ 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil™ stainless steel inserts if required.

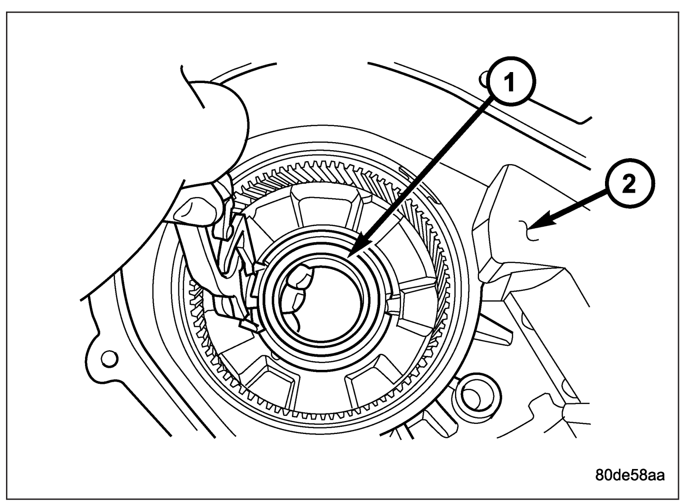
## OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any part appears to be worn or damaged. Do not disassemble the pump as individual parts are not available. The pump is only available as a complete assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

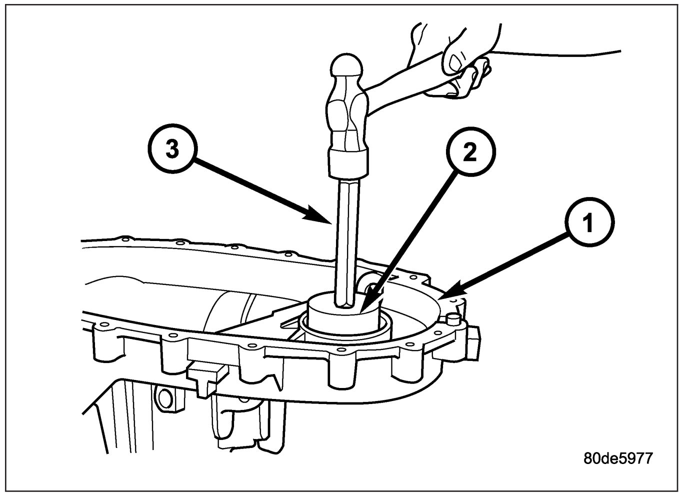
# ASSEMBLY

## BEARINGS AND SEALS

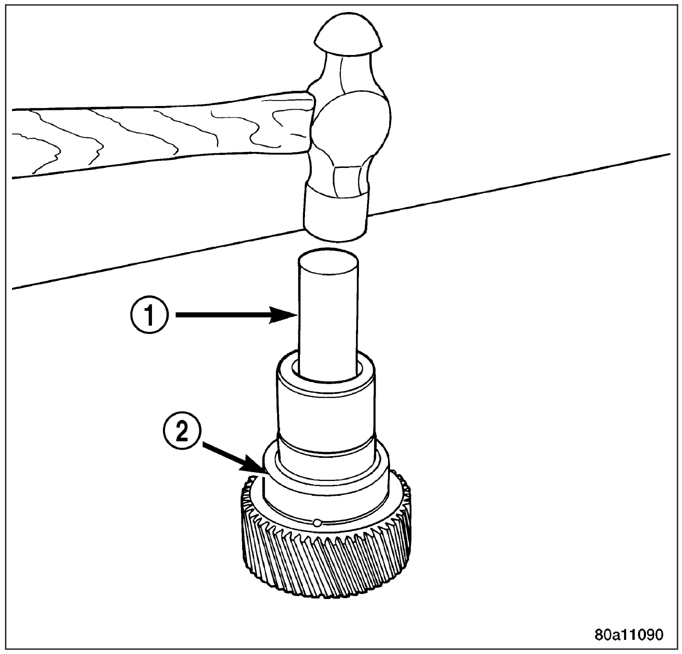
1. Remove the input shaft bearing (1) from the front case (2) with suitable snap-ring pliers.
2. Transfer the retaining ring to the new bearing if necessary and install the bearing into the front case.



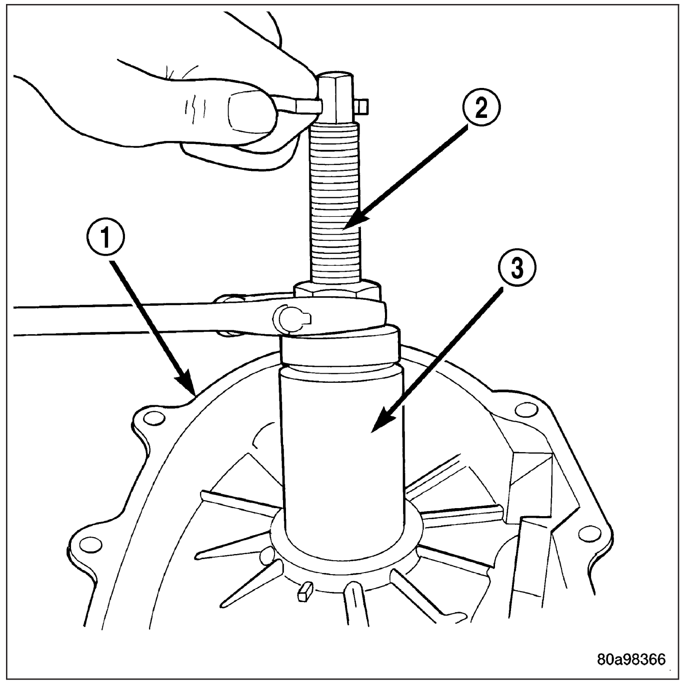
3. Using Installer 6436 (2) and Handle C-4171 (3), remove front output shaft bearing.
4. Start front output shaft bearing in case. Then seat bearing with Handle C-4171 and Installer 6953.
5. Install front output shaft bearing retaining ring.



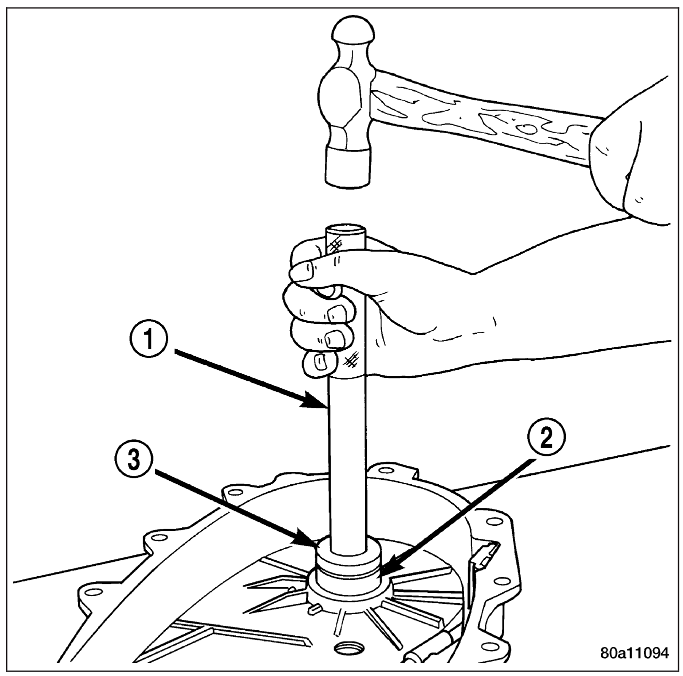

6. Remove input gear pilot bearing by inserting a suitably sized drift (1) into the splined end of the input gear (2) and driving the bearing out with the drift and a hammer.
7. Install new pilot bearing with Remover/Installer 8684.



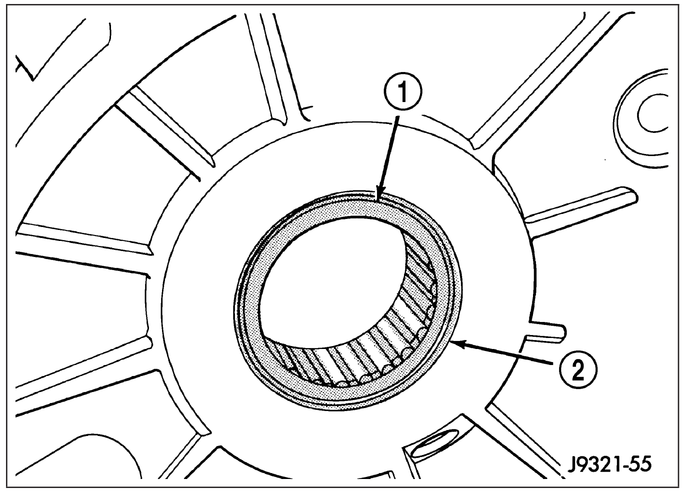
8. Remove the front output shaft rear bearing with the screw and jaws from Remover L-4454 (2) and Cup 8148 (3).



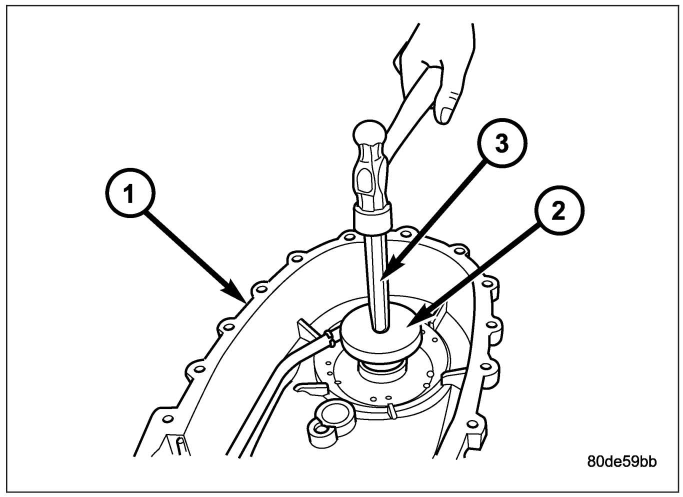

9. Install new bearing with Tool Handle C-4171 (1) and Installer 5066 (3).



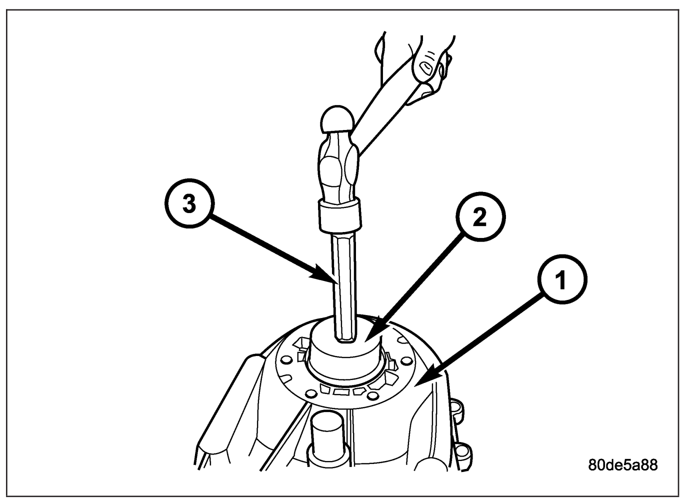
10. The bearing bore is chamfered (1) at the top. Install the bearing so it is flush with the lower edge of this chamfer.




11. Remove the rear output shaft bearing from the rear case using Remover/Installer 8684 (2) and Handle C-4171 (3).

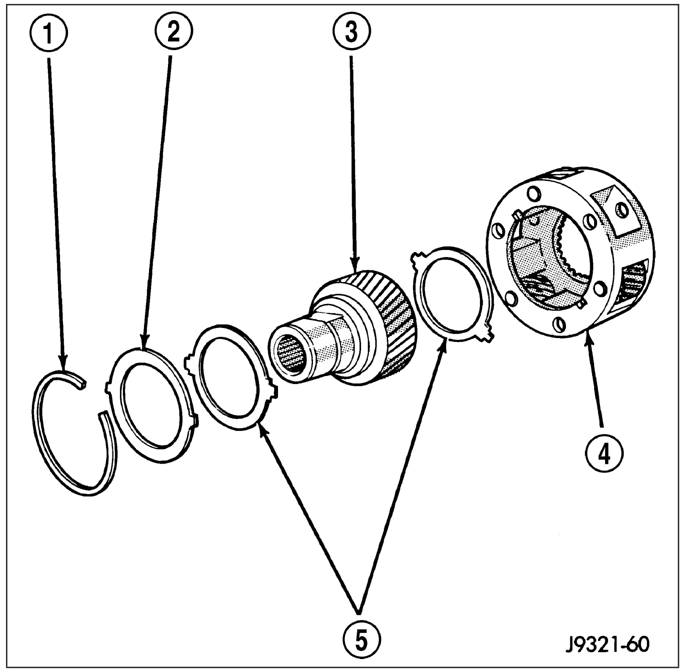



12. Install the rear output shaft bearing into the rear case (1) using Remover/Installer 6953 (2) and Handle C-4171 (3).

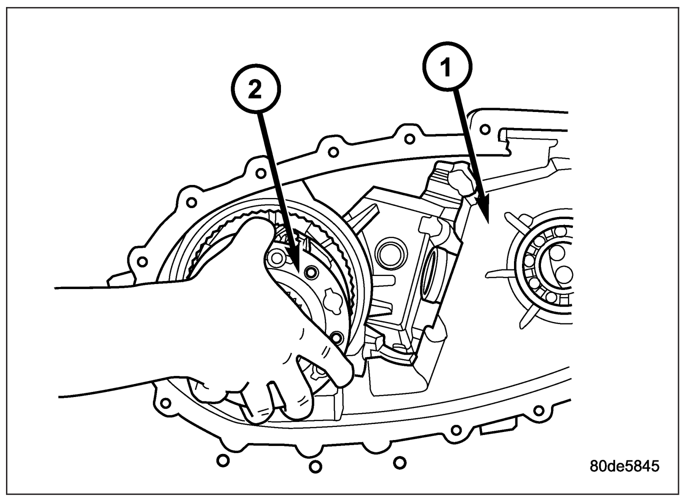


## INPUT AND PLANETARY GEAR

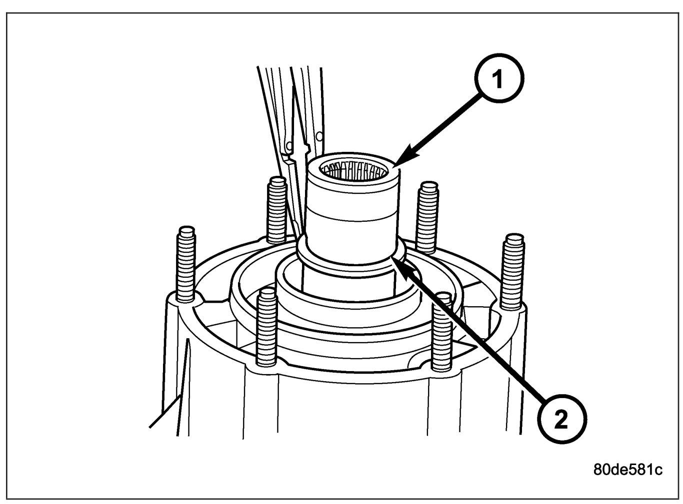
1. Lubricate gears (3, 4) and thrust washers (5) with recommended transmission fluid.
2. Install first thrust washer (5) in low range gear (3). Be sure washer tabs are properly aligned in gear notches.
3. Install input gear (3) in low range gear (4). Be sure input gear is fully seated.
4. Install remaining thrust washer (5) in low range gear (4) and on top of input gear (3). Be sure washer tabs are properly aligned in gear notches.
5. Install retainer (2) on input gear and install snap-ring (1).




6. Align and install low range/input gear assembly (2) in front case (1). Be sure low range gear pinions are engaged in annulus gear and that input gear shaft is fully seated in front bearing.

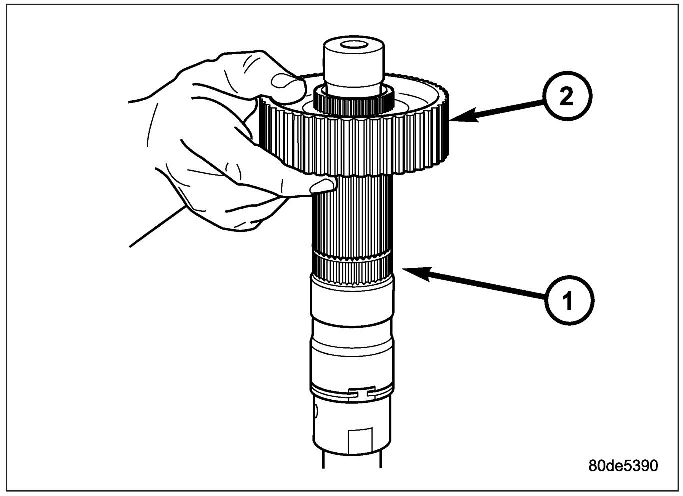



7. Install snap-ring (2) to hold input/low range gear (1) into front bearing.
8. Install a new input gear seal using Installer 8841 and Handle C-4171.

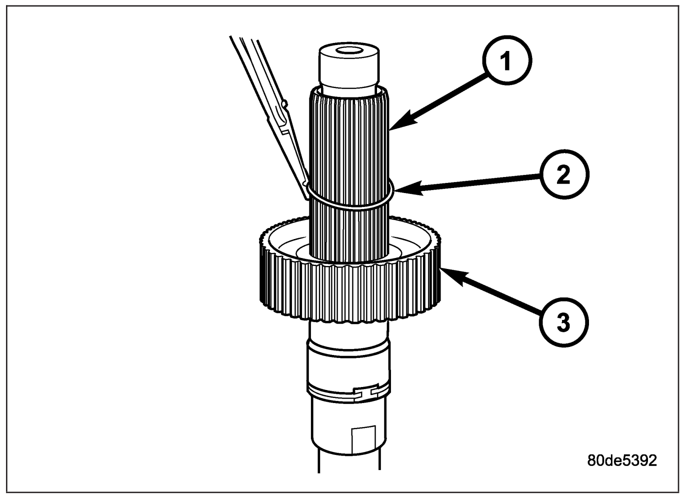


## SHIFT FORKS AND MAINSHAFT

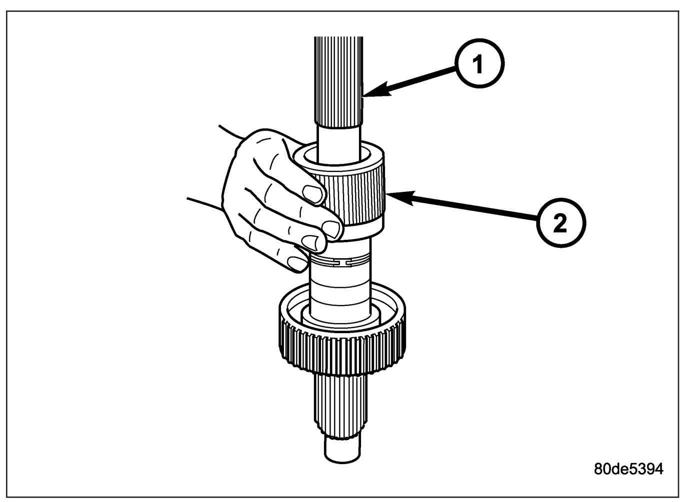
1. Lubricate mainshaft splines with recommended transmission fluid.
2. Install the mode hub (1) onto the output shaft.



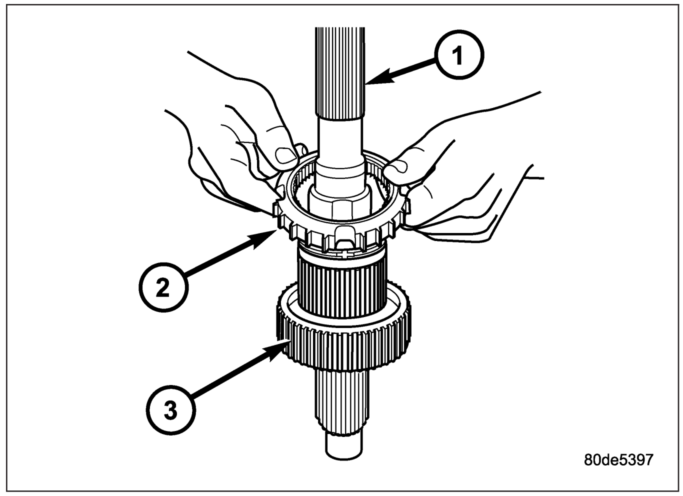

3. Install the mode hub retaining ring (2) onto the output shaft (1).



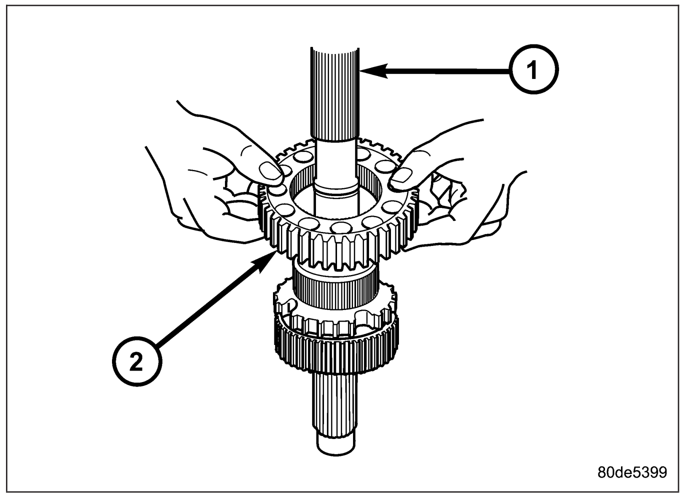

4. Install the sprocket hub (2) onto the output shaft (1).



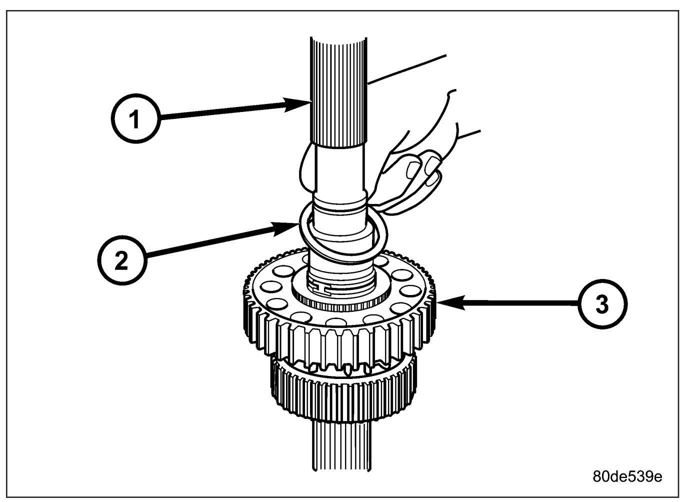
5. Install the clutch gear (2) onto the output shaft (1).



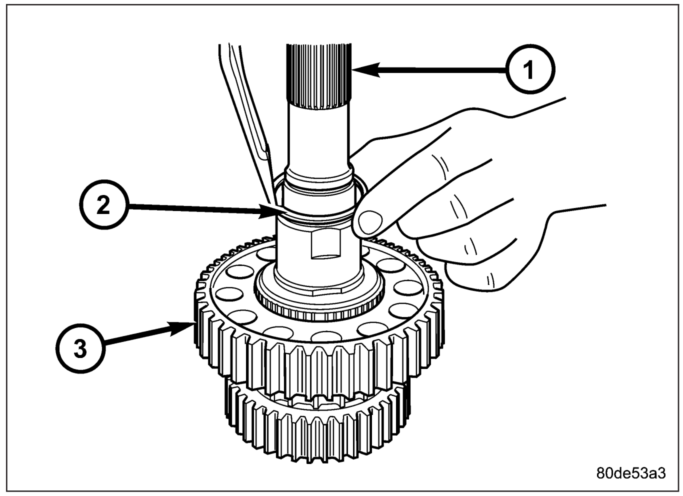

6. Install the drive sprocket (2) onto the output shaft (1).



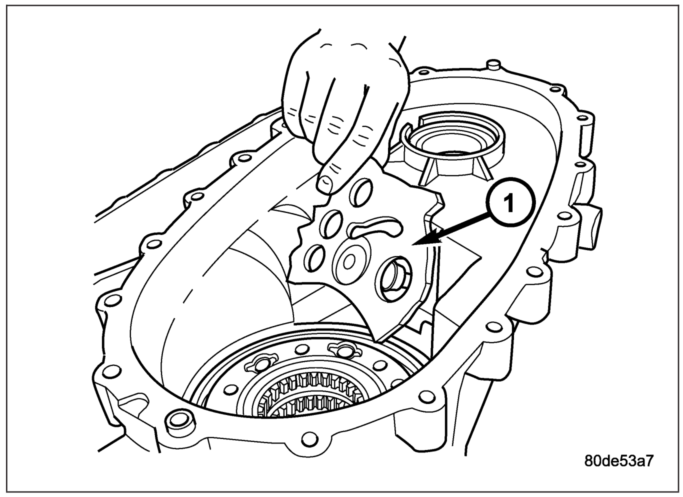

7. Install the drive sprocket (3) thrust washer (2) onto the output shaft (1).



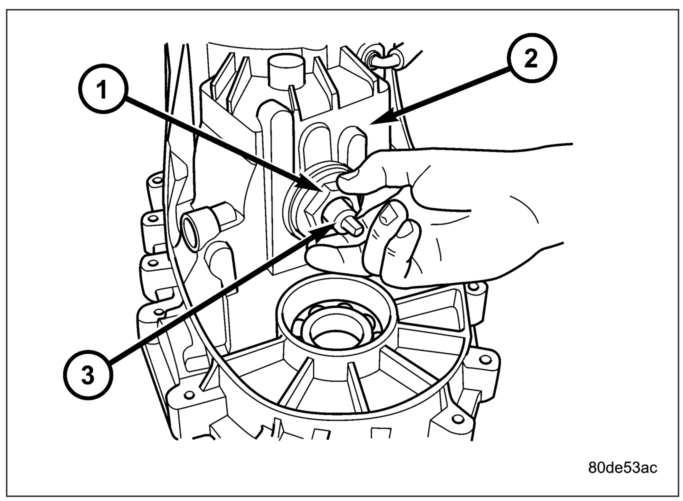
8. Install the drive sprocket retaining ring (2) onto the output shaft (1).



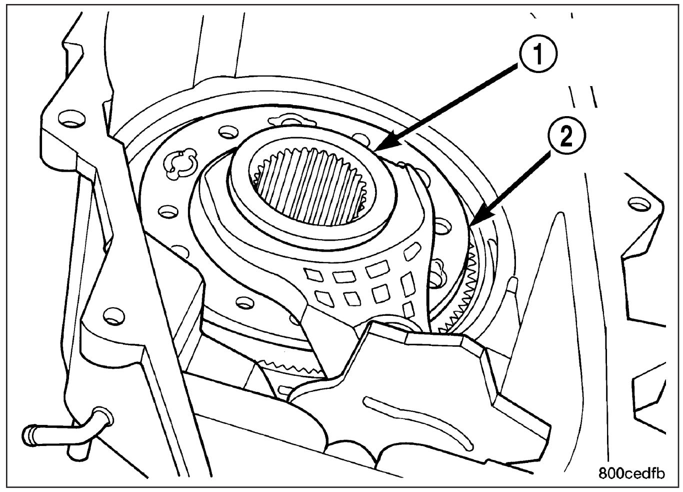

9. Lubricate sector shaft with transmission fluid and install shift sector (1) in case. Position slot in sector so it will be aligned with shift fork pin when shift forks are installed.



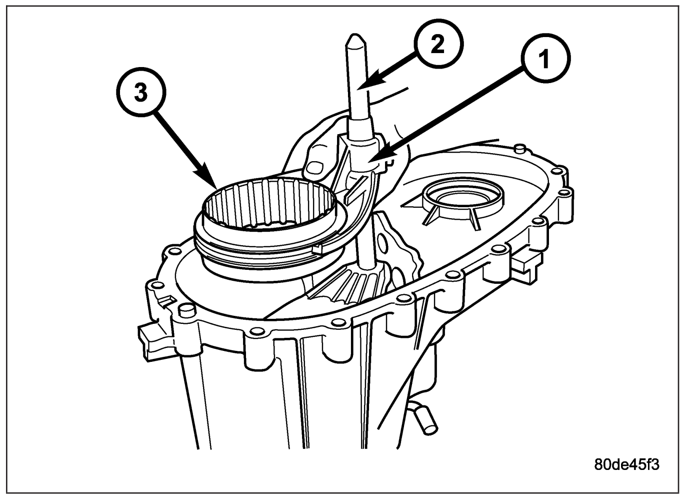

10. Install the shift sector support (1). Tighten the sector support to 27-42 N·m (20-30 ft.lbs.).



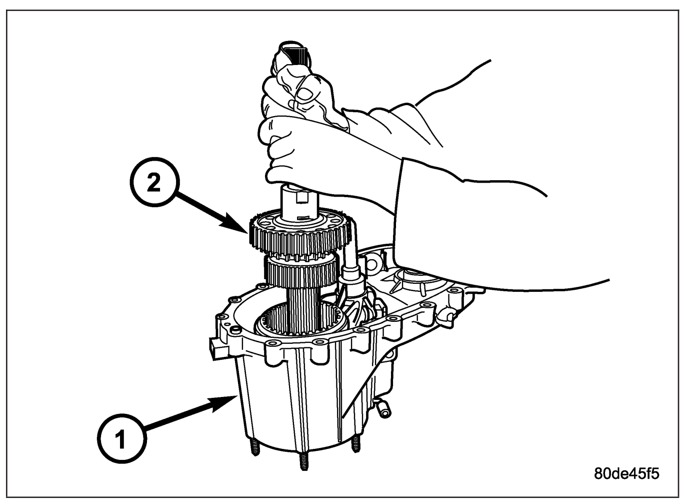
11. Assemble and install range fork (2) and hub (1). Be sure hub is properly seated in low range gear and engaged to the input gear.
12. Align and insert range fork pin in shift sector slot.
13. Install the range fork retaining ring.



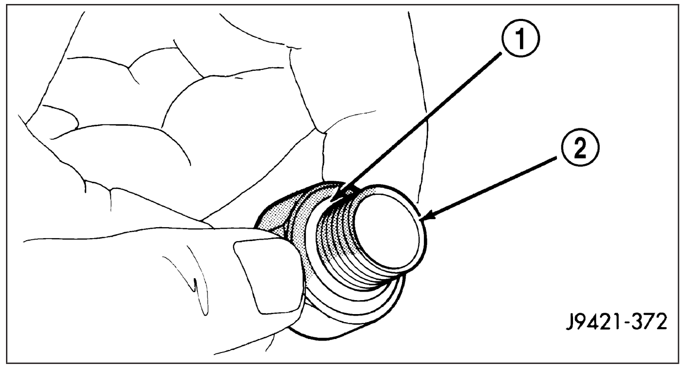

14. Install mode fork (1) and shift rail (2) onto the mode sleeve (3).
15. Install the mode fork, sleeve, and shift rail into the transfer case.



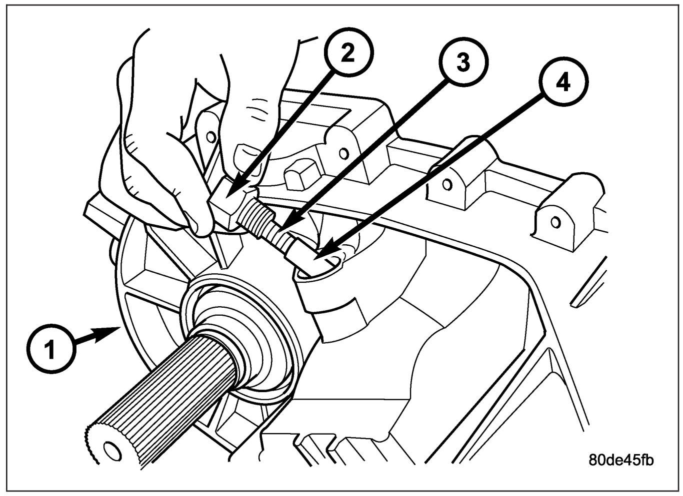

16. Install mainshaft (2) into the transfer case (1). Guide mainshaft through the mode and range sleeves and into the input gear.



17. Install new o-ring on detent plug (2).

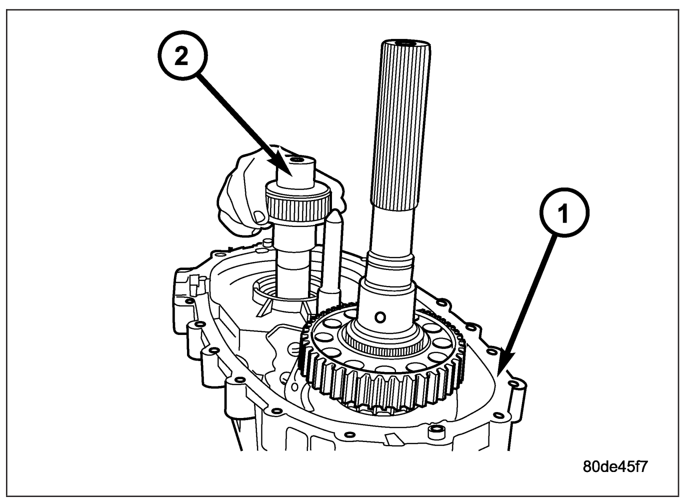



18. Install detent plunger (4), spring (3), and plug (2). Tighten the plug to 16-25 N·m (12-18 ft. lbs.).

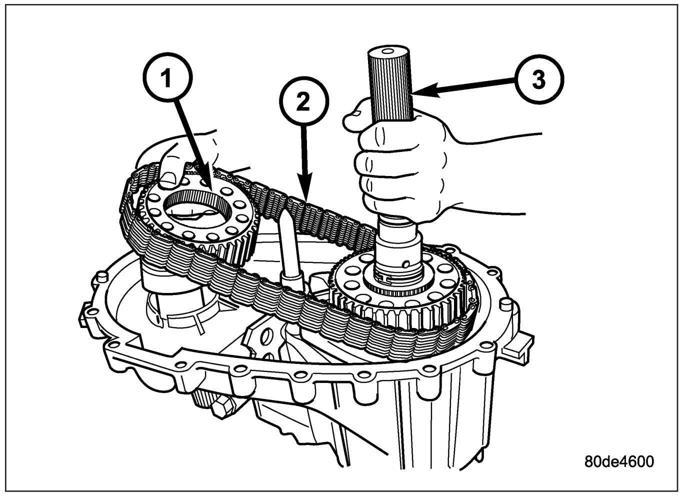



## FRONT OUTPUT SHAFT AND DRIVE CHAIN

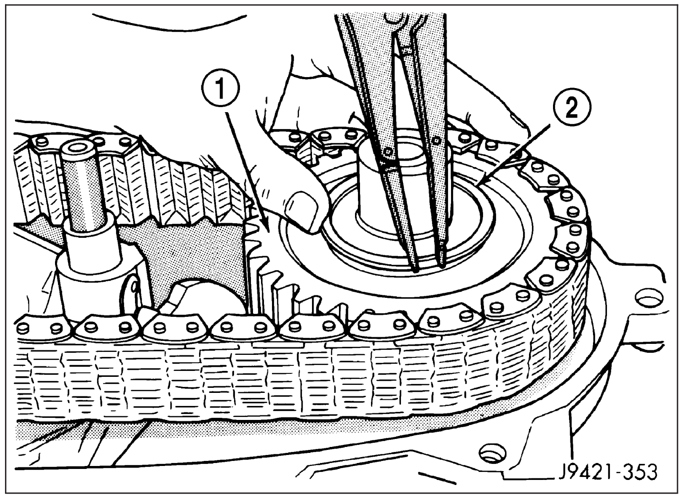
1. Install the front output shaft (2) into the front output shaft bearing.



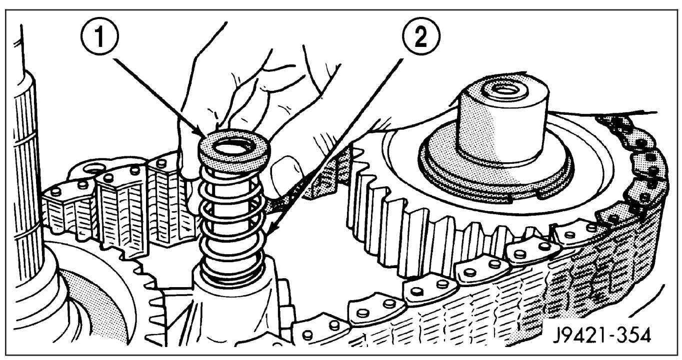
2. Insert front sprocket in drive chain.
3. Install drive chain (2) around mainshaft sprocket (1). Then position front sprocket over front shaft.
4. Raise mainshaft about 2.54 cm (one inch) and seat front sprocket on front output shaft.



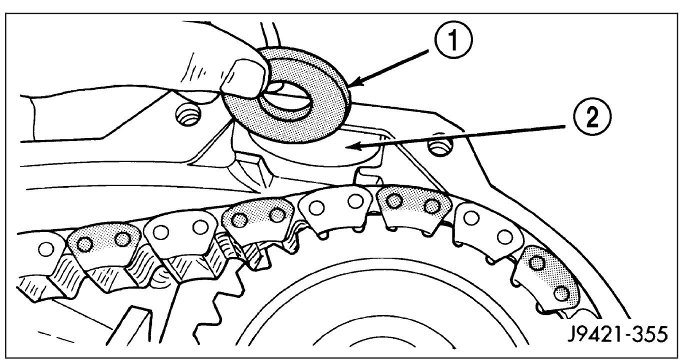

5. If mainshaft and mode sleeve were unseated during chain installation, align and reseat mainshaft in input gear and hub.
6. Install front sprocket (1) retaining ring (2).




7. Install spring (2) and cup (1) on shift rail.



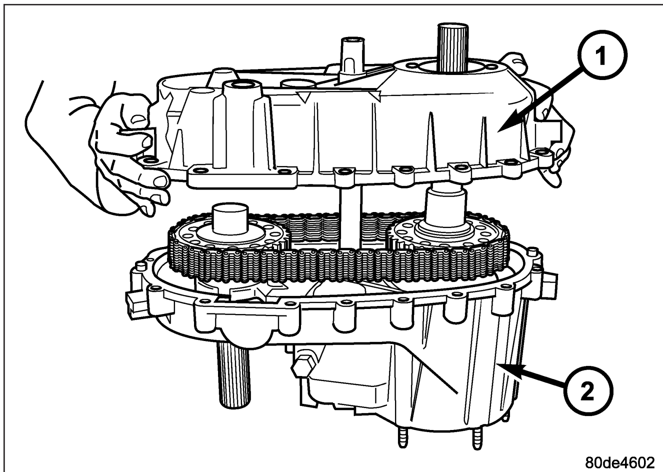

8. Insert magnet (1) in front case pocket (2).



## OIL PUMP AND REAR CASE

**CAUTION: Do not remove the bolts holding the oil pump cover to the rear case half. The oil pump cover is aligned to the rear output shaft inner bearing race and will become mis-aligned if the bolts are loosened. If the transfer case failure has generated any debris which may have become trapped in the oil pump. the rear case and oil pump assembly MUST be replaced.**

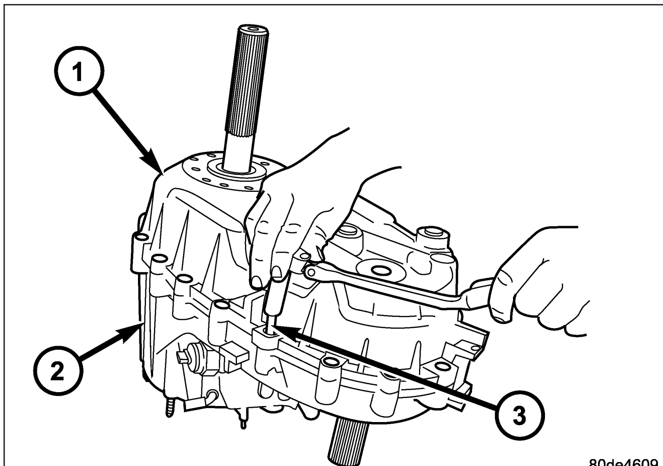
1. Apply bead of Mopar® Gasket Maker, or equivalent, to mating surface of front case. Keep sealer bead width to maximum of 3/16 inch. Do not use excessive amount of sealer as excess will be displaced into case interior.
2. Align oil pump with mainshaft and align shift rail with bore in rear case. Then install rear case (1) and oil pump assembly.



80de4602

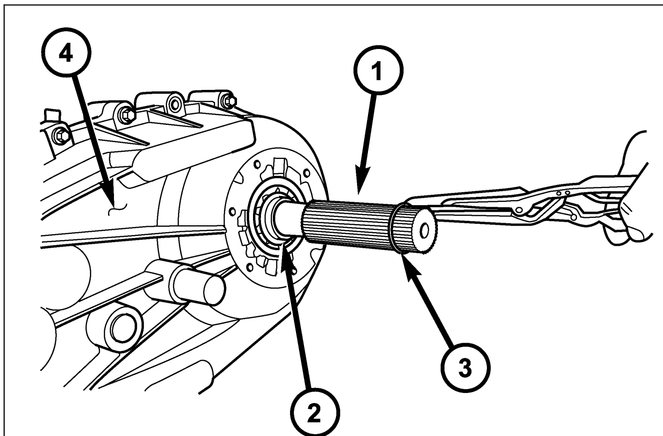
3. Install 4-5 rear case(1)-to front case (2) bolts to hold rear case in position. Tighten bolts snug but not to specified torque at this time.

**CAUTION: Verify that shift rail, and case alignment dowels are seated before installing any bolts. Case could be cracked if shaft rail or dowels are misaligned.**



80de4609

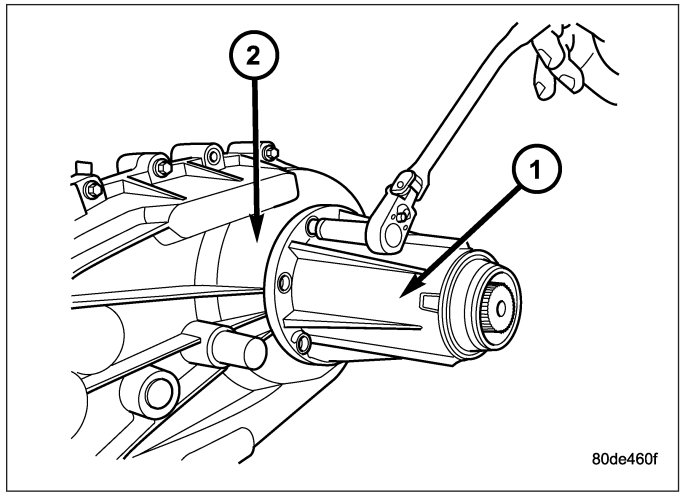
4. Apply Loctite™ 242 to remainder of rear case-to-front case bolt threads and install bolts. Tighten bolts to 20-27 N·m (15-24 ft. lbs.),
5. Install rear output bearing (2) snap-ring (3) to output shaft.



80de460b

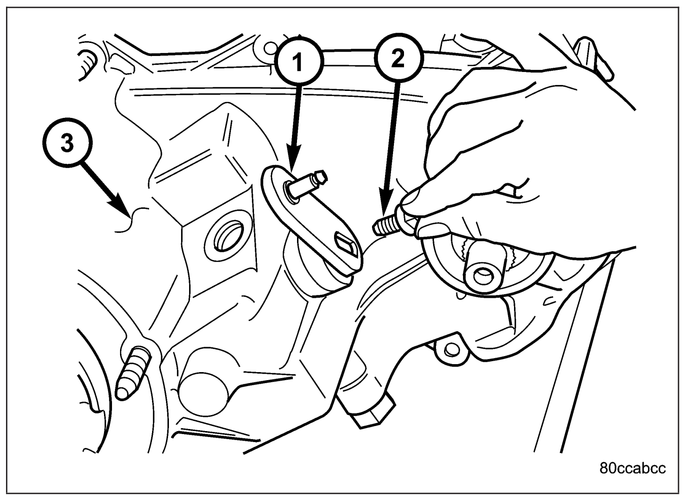
## REAR EXTENSION

1. Install new seal in rear extension housing seal with Installer D-163 and Handle C-4171..
2. Apply bead of Mopar® Gasket Maker, or equivalent, to mating surface of rear extension housing. Keep sealer bead width to maximum of 3/16 inch. Do not use excessive amount of sealer as excess could be displaced into output bearing.
3. Align and install rear extension housing (1) on retainer.
4. Apply Mopar® Silicone Sealer to threads of rear extension housing bolts. Then install and tighten bolts to 16-24 N·m (12-18 ft. lbs.) torque.

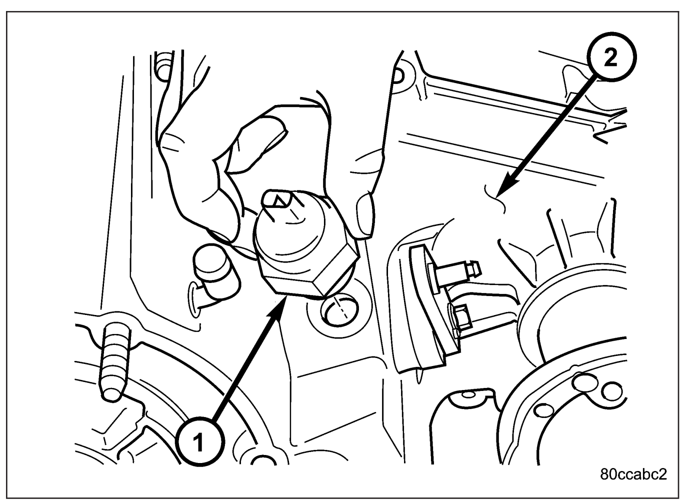



## COMPANION FLANGE AND RANGE LEVER

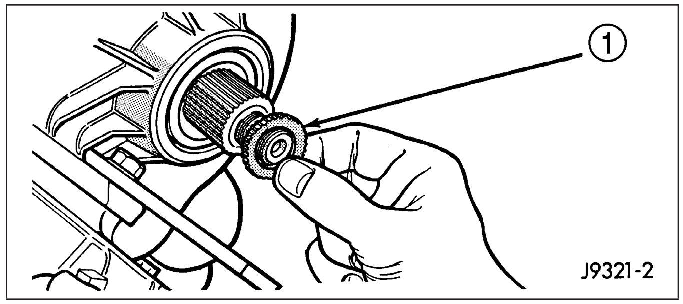
1. Install range lever (1) and bolt (2) on sector shaft. Tighten bolt to 27-34 N·m (20-25 ft. lbs.) torque.




2. Inspect the o-ring on the transfer case position sensor. Replace the o-ring if necessary.
3. Install the transfer case position sensor (1) in the front case (2). Tighten sensor to 20-34 N·m (15-25 ft. lbs.) torque.

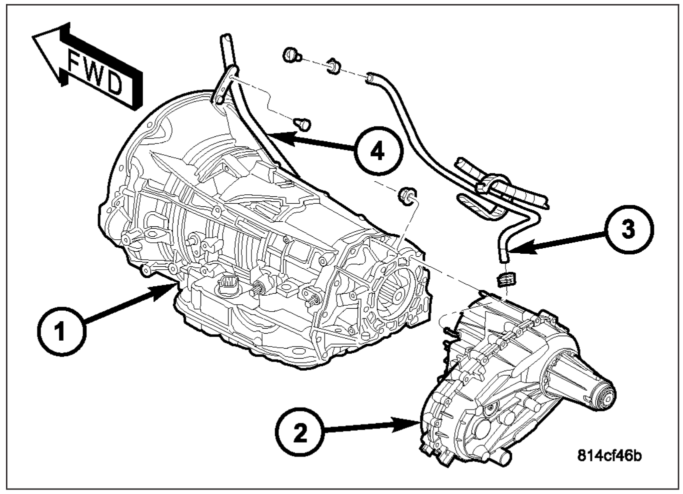


4. Install new seal washer (1) on front output shaft.
5. Lubricate companion flange hub with transmission fluid and install flange onto the front ouput shaft.
6. Install new flange nut onto front output shaft.
7. Tighten flange nut to 122-176 N·m (90-130 ft. lbs.) torque.

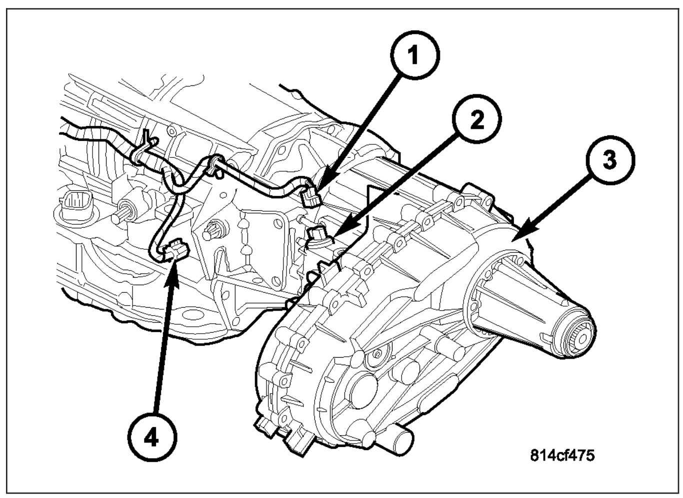



## INSTALLATION

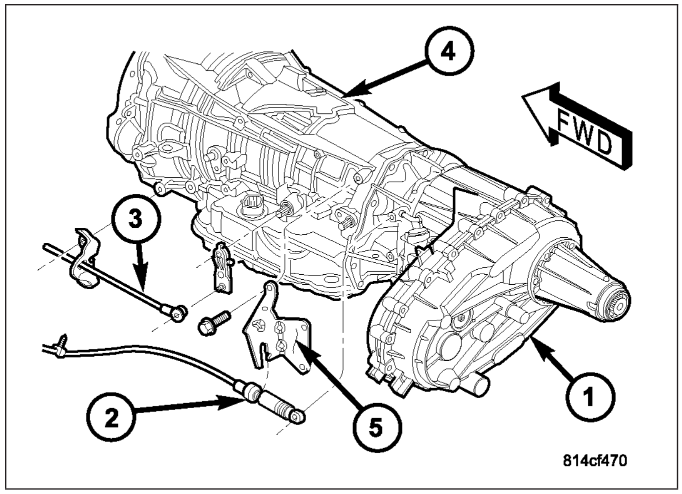
1. Mount transfer case on a transmission jack.
2. Secure transfer case to jack with chains.
3. Position transfer case under vehicle.
4. Align transfer case and transmission shafts and install transfer case on transmission.
5. Install and tighten transfer case attaching nuts to 35 N·m (26 ft. lbs.) torque.
6. Connect vent hose (3).



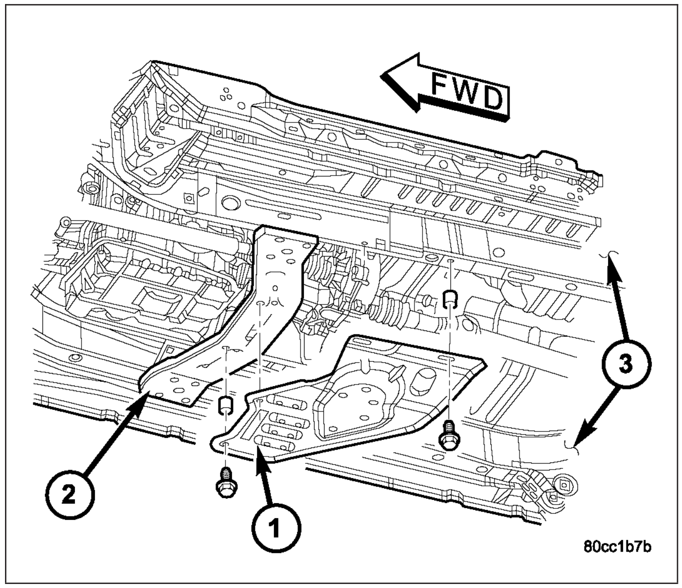

7. Connect transfer case position sensor connector (1) to sensor (2).
8. Align and connect propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION).



9. Connect shift cable (2) to transfer case range (1) lever.




10. Fill transfer case with correct fluid. Check transmission fluid level. Correct as necessary.
11. Install skid plate (1). (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION)
12. Remove transmission jack and support stand.
13. Lower vehicle and verify transfer case shift operation.




## SPECIFICATIONS

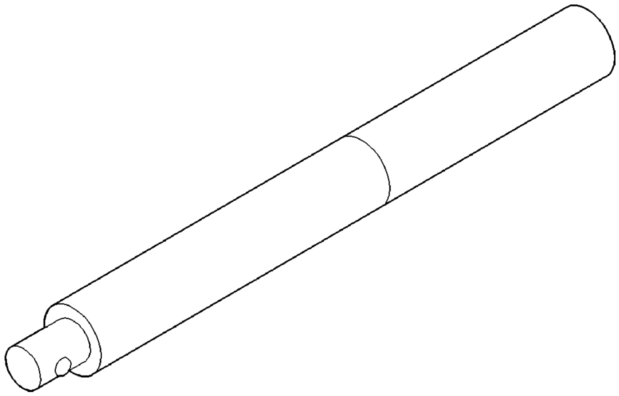
## TRANSFER CASE - NV241 GENII

### TORQUE SPECIFICATIONS

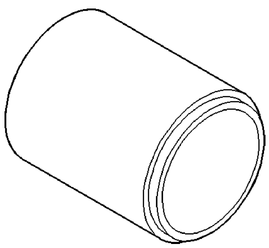
| DESCRIPTION | N-m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Plug, Detent | 16-24 | 12-18 | - |
| Plug, Drain/Fill | 20-34 | 15-25 | - |
| Bolt, Extension Housing | 16-24 | 12-18 | - |
| Bolt, Case Half | 20-27 | 15-24 | - |
| Screw, Oil Pump | 12-16 | 8-12 | - |
| Nut, Front Companion Flange | 122-176 | 90-130 | |
| Nut, Range Lever | 27-34 | 20-25 | - |
| Sector Support | 27-42 | 20-30 | - |
| Nuts, Mounting | 30-41 | 20-30 | - |
| Position Sensor | 20-34 | 16-25 | - |

## SPECIAL TOOLS

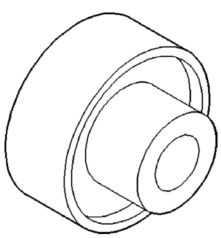
## TRANSFER CASE - NV241 GENII



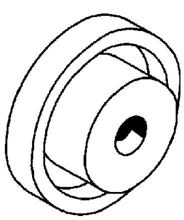
*Handle, Universal - C-4171*



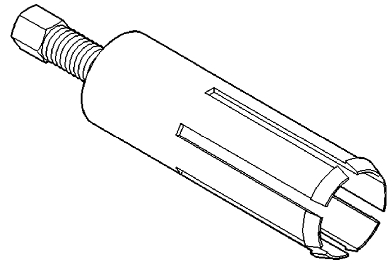
*Installer, Seal - 6888*



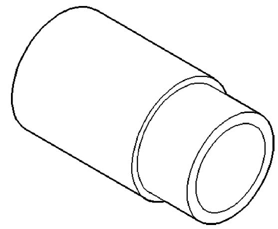
*Installer, Bearing - 6953*



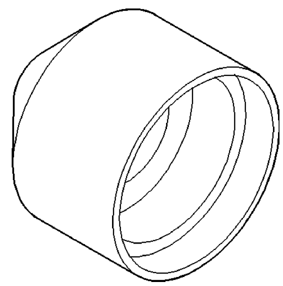
*Installer, Seal - C-4210*



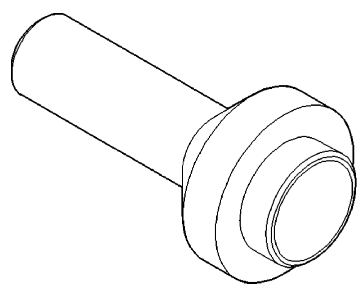
*Remover, Bushing - 6957*



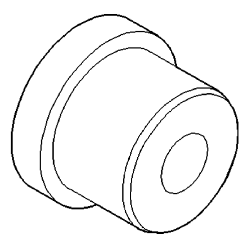
*Installer, Bushing - 8157*



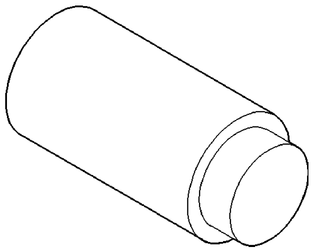
*Installer, Seal - D-163*



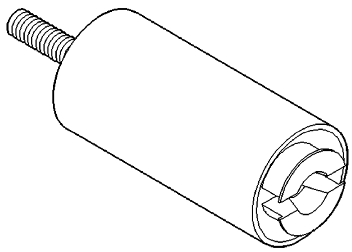
*Installer, Seal - 7884*



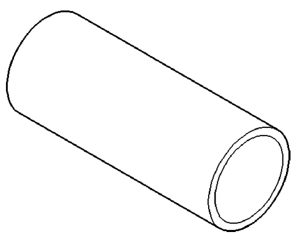
*Installer, Bushing - 5066*



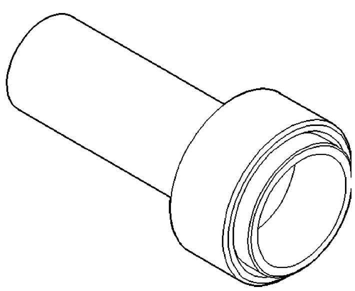
***Plug, Extension - C-293-3***



***Remover - L-4454***



***Cup - 8148***



***Installer, Pump Housing Seal - 7888***

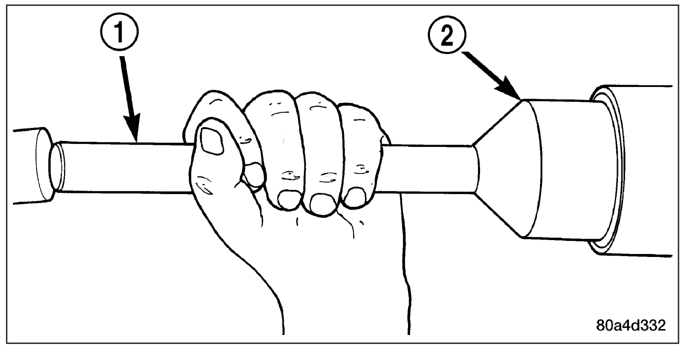
# SEAL-EXTENSION HOUSING

## REMOVAL

1. Raise and support vehicle.
2. Remove rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
3. Using a suitable pry tool or slide-hammer mounted screw, remove the extension housing seal.

## INSTALLATION

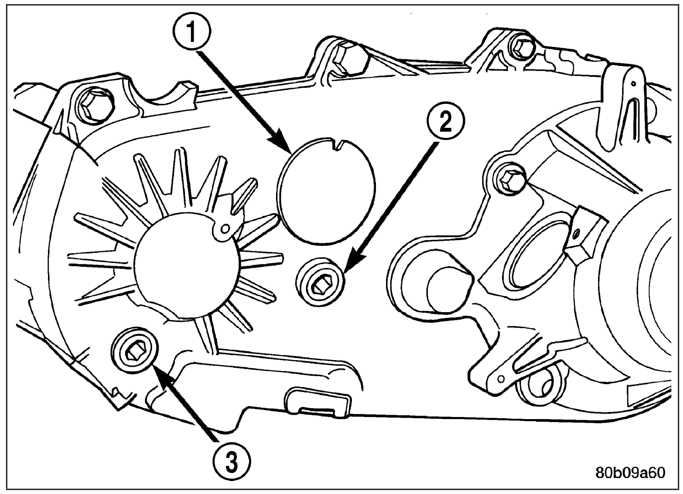
1. Clean fluid residue from sealing surface and inspect for defects.
2. Using Seal Installer D-163 (2) and Universal Handle C-4171 (1), install seal in extension housing.
3. Install propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)
4. Verify proper transfer case fluid level.
5. Lower vehicle.



# FLUID

## STANDARD PROCEDURE - FLUID DRAIN AND FILL

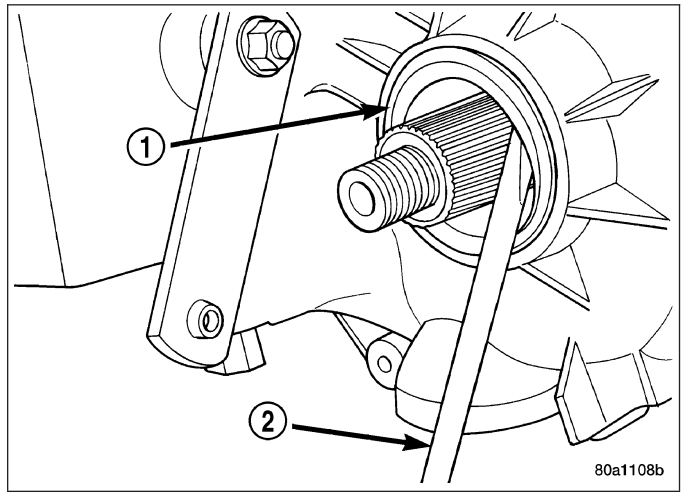
The fill (2) and drain (3) plugs are both in the rear case. Correct fill level is to the bottom edge of the fill plug hole. Be sure the vehicle is level to ensure an accurate fluid level check.



# SEAL-FRONT OUTPUT SHAFT

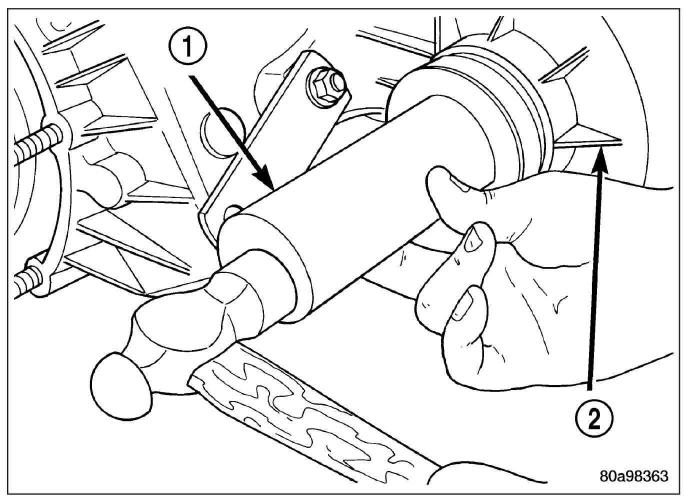
## REMOVAL

1. Raise vehicle.
2. Remove front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
3. Remove front output shaft companion flange.
4. Remove seal (1) from front case with pry tool (2).




## INSTALLATION

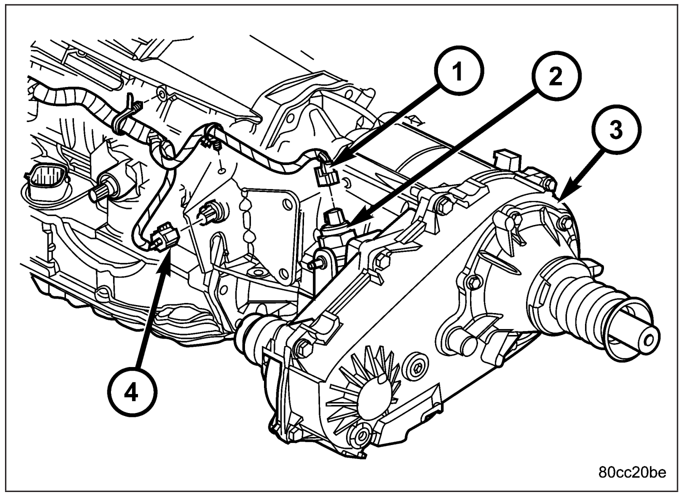
1. Install new front output seal in front case (2) with Installer Tool 6952-A (1) as follows:
   a. Place new seal on tool. Garter spring on seal goes toward interior of case.
   b. Start seal in bore with light taps from hammer. Once seal is started, continue tapping seal into bore until installer tool seats against case.
2. Install the front output shaft companion flange. Tighten the companion flange nut to 149 N·m (110 ft.lbs.).
3. Install the front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)



# SENSOR-POSITION

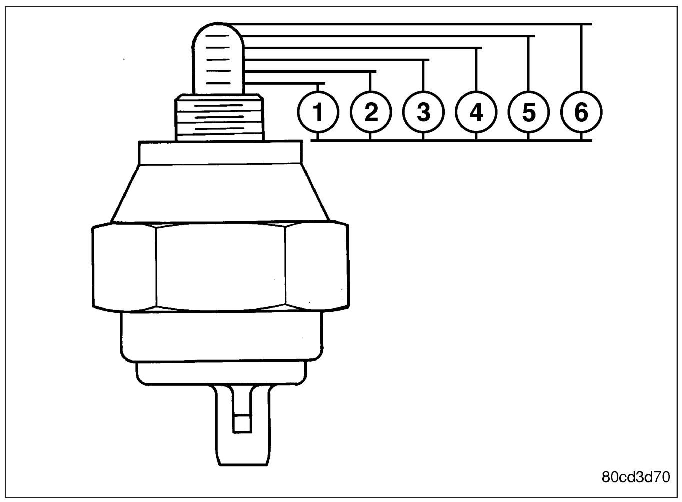
## DESCRIPTION

The transfer case position sensor (2) is an electronic device whose output can be interpreted to indicate the transfer case's current operating mode. The sensor consists of a five position, resistive multiplexed circuit which returns a specific resistance value to the Powertrain Control Module (PCM) for each transfer case operating mode. The sensor is located on the top of the transfer case, just left of the transfer case centerline and rides against the sector plate roostercomb. The PCM supplies 5VDC (+/- 0.5V) to the sensor and monitors the return voltage to determine the sector plate, and therefore the transfer case, position.




## OPERATION

During normal vehicle operation, the Powertrain Control Module (PCM) monitors the transfer case position sensor return voltage to determine the operating mode of the transfer case. Refer to the Operating Mode Versus Resistance table for the correct resistance for each position.




***Position Sensor Linear Movement***

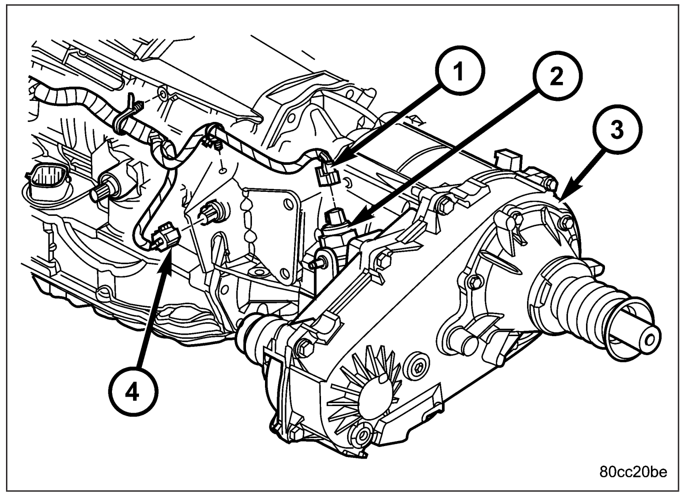
1 - POSITION 1 - 10mm ±0.5mm
2 - POSITION 2 - 12mm ±0.5mm
3 - POSITION 3 - 14mm ±0.5mm
4 - POSITION 4 - 16mm ±0.5mm
5 - POSITION 5 - 18mm ±0.5mm
6 - POSITION 6 - 20mm±0.5mm - FULL EXTENSION

**Operating Mode Versus Resistance**

| SENSOR POSITION | OPERATING MODE | SENSOR RESISTANCE (ohms) |
|---|---|---|
| 1 | 2WD | 1124-1243 |
| 2 | 4WD PART TIME | 650-719 |
| 3 | 4WD FULL TIME | 389-431 |
| 4 | NEUTRAL | 199-221 |
| 5 | 4WD LOW | 57-64 |

## REMOVAL

1. Raise and support the vehicle.
2. Disengage the transfer case position sensor connector from the position sensor (2).
3. Remove the position sensor from the transfer case.



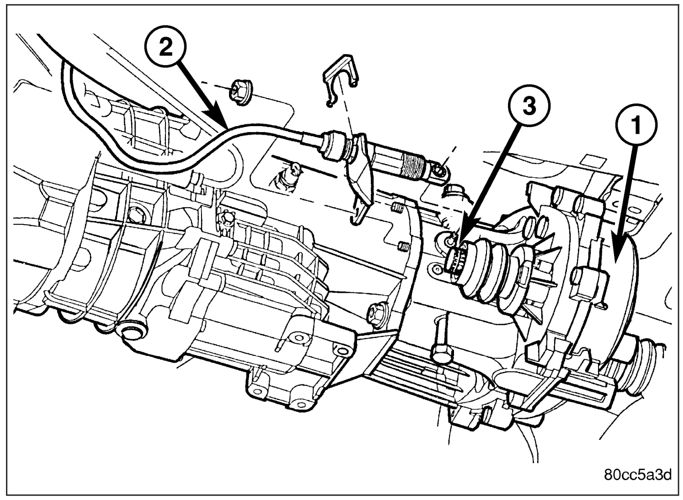

## INSTALLATION

1. Inspect the o-ring seal on the transfer case position sensor. Replace the o-ring if necessary.
2. Install the transfer case position sensor into the transfer case. Torque the sensor to 27 N·m (20 ft.lbs.).
3. Engage the transfer case position sensor connector to the position sensor.
4. Lower vehicle.
5. Verify proper sensor operation.

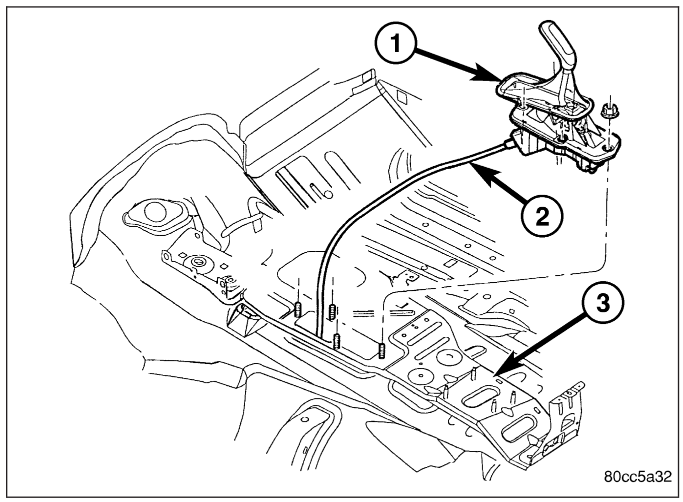
# LEVER-SHIFT

## REMOVAL

1. Shift transfer case into 4L.
2. Raise vehicle.
3. Remove clip securing the transfer case shift cable (2) to the shift cable support bracket.
4. Disengage any additional shift cable routing clips, if necessary.
5. Disengage the shift cable from the transfer case manual lever.




6. Lower vehicle.
7. Remove the floor console as necessary to access the shifter mechanism. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
8. Remove the nuts attaching lever assembly (1) to floorpan and remove assembly and shift cable (2).
9. Remove the shifter mechanism and cable assembly from the vehicle.




## INSTALLATION

1. Route the shift cable through the opening in the floor pan.
2. Position the shift mechanism over the shifter retaining studs on the floor pan.
3. Install the nuts to hold the shifter mechanism to the floor pan. Tighten the nuts to 11.86 N·m (105 in.lbs.).
4. Install any floor console components previously removed. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)
5. Verify that the floor shifter is in the 4L position.
6. Raise vehicle.
7. Route the shift cable through the opening in the shift cable support bracket.
8. Install the cable and a new spring clip into the slot in the support bracket.
9. Install any additional routing clips on the shift cable.
10. Verify that the transfer case is in the 4L position. The 4L position for the transfer case is with the manual lever to the full rearward position.
11. Attach the shift cable to the transfer case manual lever.
12. Lower vehicle and check for proper transfer case shifter operation.

# TRANSFER CASE - NV242

## TABLE OF CONTENTS

# TRANSFER CASE - NV242

## DESCRIPTION

The NV242 is a full-time transfer case. It provides full time 2-wheel, or 4-wheel drive operation.

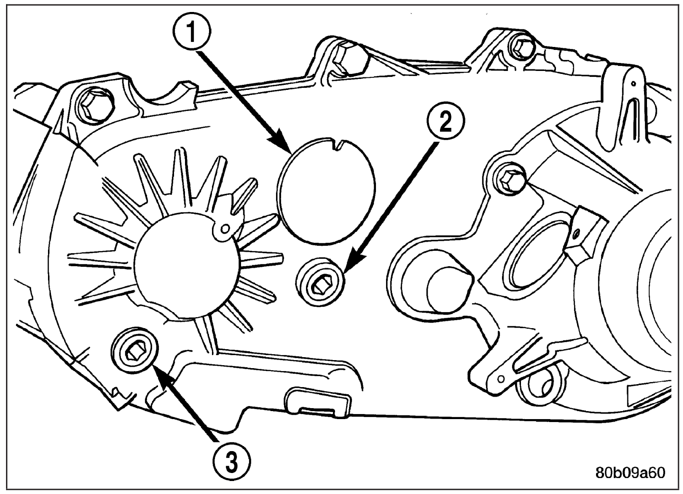
A differential in the transfer case is used to control torque transfer to the front and rear axles. A low range gear provides increased low speed torque capability for off road operation. The low range provides a 2.72:1 reduction ratio.

The geartrain is mounted in two aluminum case halves attached with bolts. The mainshaft front and rear bearings are mounted in aluminum retainer housings bolted to the case halves.

### TRANSFER CASE IDENTIFICATION

A circular ID tag (1) is attached to the rear case of each transfer case. The ID tag provides the transfer case model number, assembly number, serial number, and low range ratio.

The transfer case serial number also represents the date of build.




### OPERATING RANGES

NV242 operating ranges are 2WD (2-wheel drive), 4x4 part-time, 4x4 full time, 4 Lo, and Neutral.

The 2WD and 4x4 full time ranges can be used at any time and on any road surface.

The 4x4 part-time and 4 Lo ranges are for off road use only. The only time these ranges can be used on hard surface roads, is when the surface is covered with snow and ice.

### SHIFT MECHANISM

Operating ranges are selected with a floor mounted shift lever. The shift lever is connected to the transfer case range lever by a shift cable. A straight line shift pattern is used. Range positions are marked on the shifter bezel cover plate, or on the shift knob.

## OPERATION

The input gear is splined to the transmission output shaft. It drives the mainshaft through the planetary gear and range hub. The front output shaft is operated by a drive chain that connects the shaft to a drive sprocket on the mainshaft. The drive sprocket is engaged/disengaged by the mode fork, which operates the mode sleeve and hub. The sleeve and hub are not equipped with a synchro mechanism for shifting.

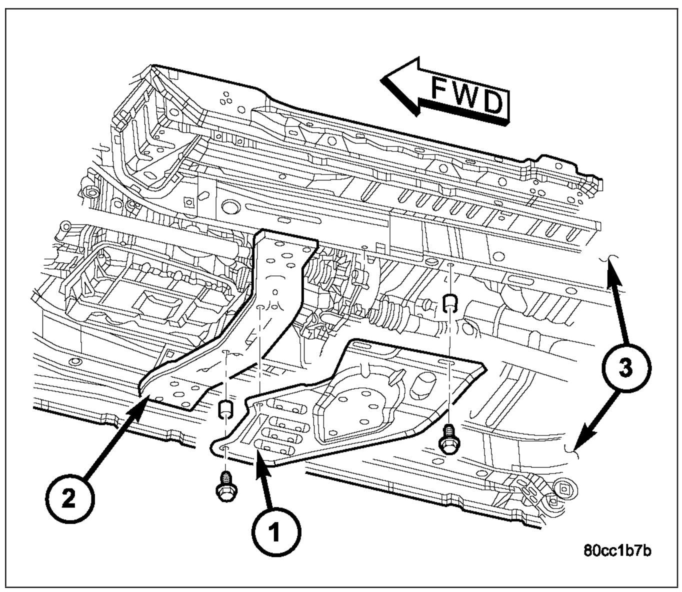
## DIAGNOSIS AND TESTING - TRANSFER CASE - NV242

#### DIAGNOSIS CHART

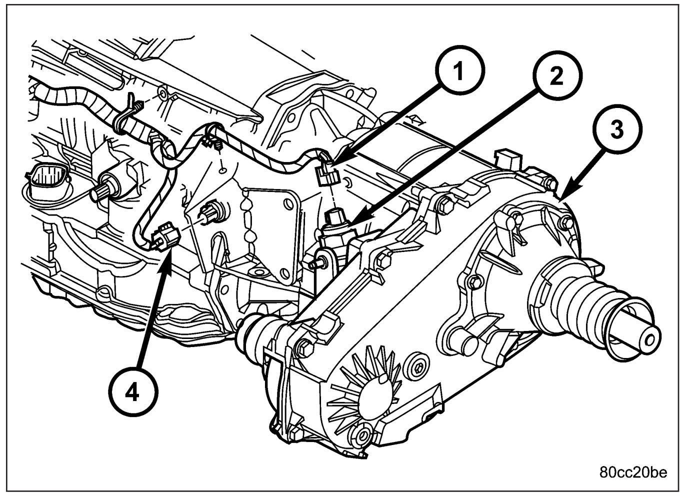
| CONDITION | POSSIBLE CAUSE | CORRECTION |
|---|---|---|
| Transfer case difficult to shift or will not shift into desired range. | 1) Transfer case shift cable binding. | 1) Repair or replace cable as necessary. |
| | 2) Insufficient or incorrect lubricant. | 2) Drain and refill transfer case with the correct type and quantity of lubricant. |
| | 3) Internal transfer case components binding, worn, or damaged. | 3) Repair or replace components as necessary. |
| Transfer case noisy in all drive modes. | 1) Insufficient or incorrect lubricant. | 1) Drain and refill transfer case with the correct type and quantity of lubricant. |
| Lubricant leaking from transfer case seals or vent. | 1) Transfer case overfilled. | 1) Drain lubricant to the correct level. |
| | 2) Transfer case vent closed or restricted. | 2) Clean or replace vent as necessary. |
| | 3) Transfer case seals damaged or installed incorrectly. | 3) Replace suspect seal. |
| Transfer case will not shift through 4X4 part time range (light remains on) | 1) Incomplete shift due to drivetrain torque load. | 1) Momentarily release the accelerator pedal to complete the shift. |
| | 2) Incorrect tire pressure. | 2) Correct tire pressure as necessary. |
| | 3) Excessive Tire wear. | 3) Correct tire condition as necessary. |
| | 4) Excessive vehicle loading. | 4) Correct as necessary. |

## REMOVAL

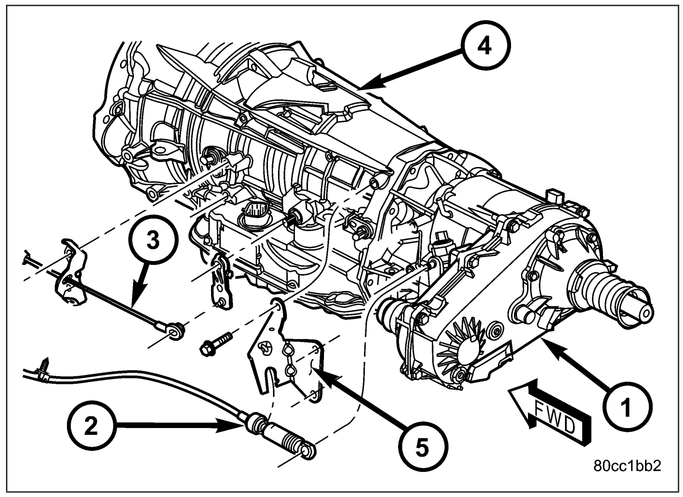
1. Shift transfer case into NEUTRAL.
2. Raise vehicle.
3. Remove skid plate (1).



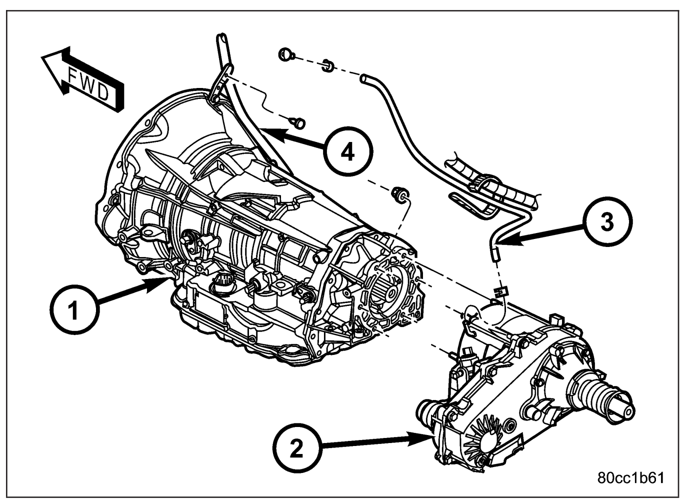
4. Drain transfer case lubricant.
5. Mark front and rear propeller shaft yokes for alignment reference.
6. Disconnect front/rear propeller shafts at transfer case.
7. Disconnect transfer case position sensor connector (1).




8. Disconnect transfer case shift cable (2) at the range lever.
9. Disconnect the transfer case shift cable from the shift cable bracket.



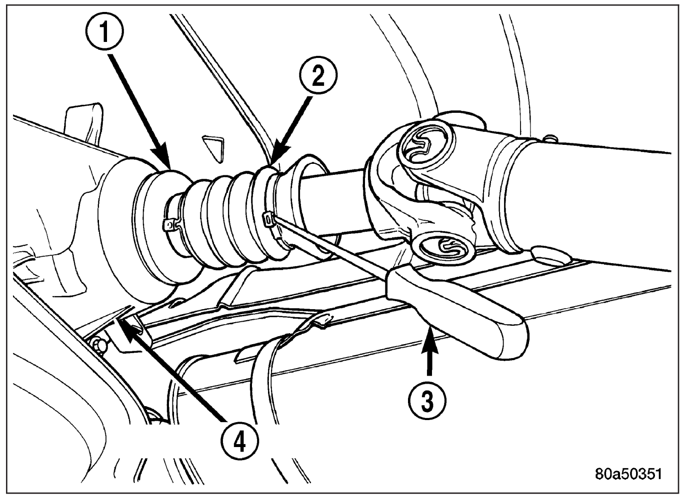

10. Disconnect transfer case vent hose (3).
11. Support transfer case with transmission jack.
12. Secure transfer case to jack with chains.
13. Remove nuts attaching transfer case to transmission.
14. Pull transfer case and jack rearward to disengage transfer case.
15. Remove transfer case from under vehicle.



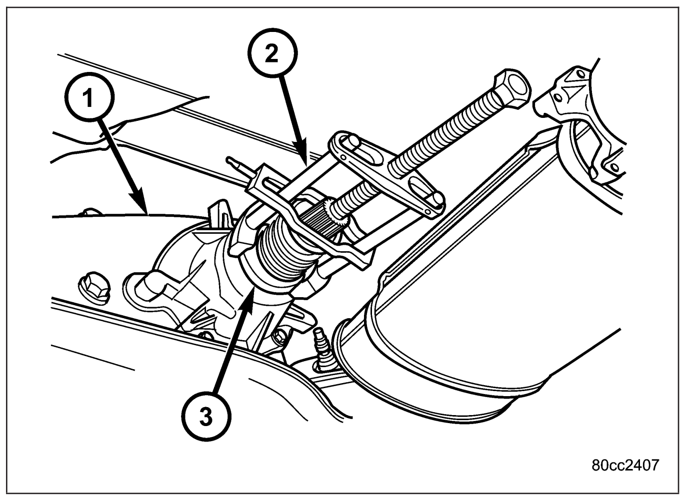
## DISASSEMBLY

### REAR RETAINER

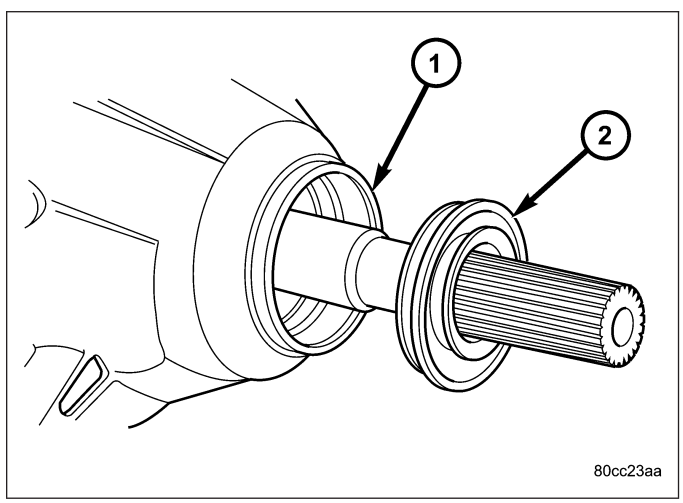
1. Remove output shaft boot (2). Spread band clamp that secures boot on slinger with a suitable awl. Then slide boot off shaft.



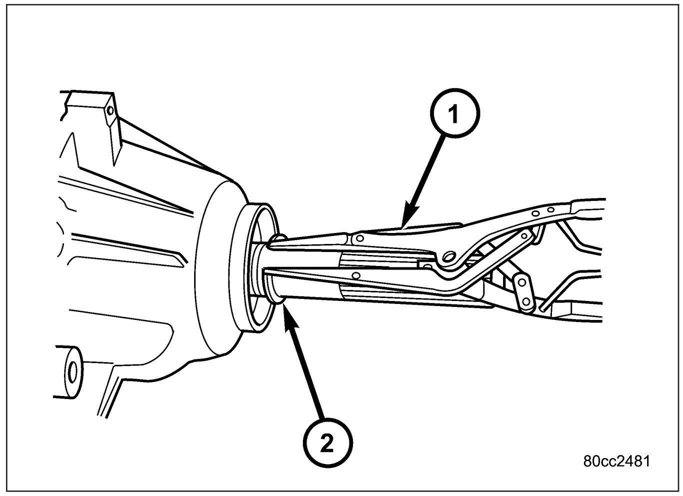

2. Using puller MD-998056-A (2), remove rear slinger (3).



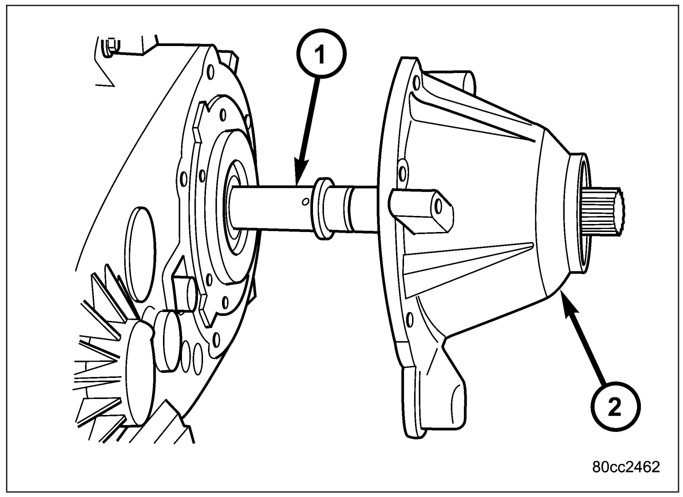

3. Remove rear seal (2) from retainer (1). Use pry tool, or collapse seal with punch to remove it.



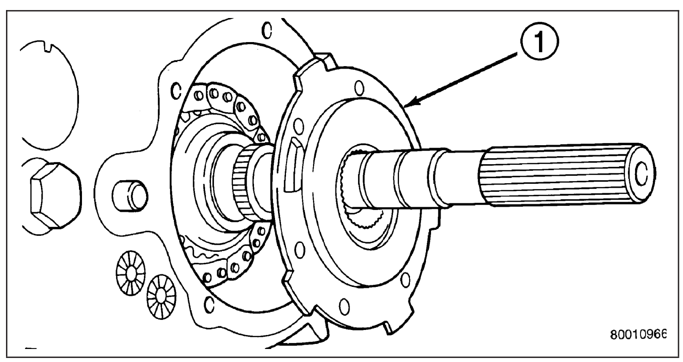
4. Remove rear output bearing I.D. retaining ring (2).



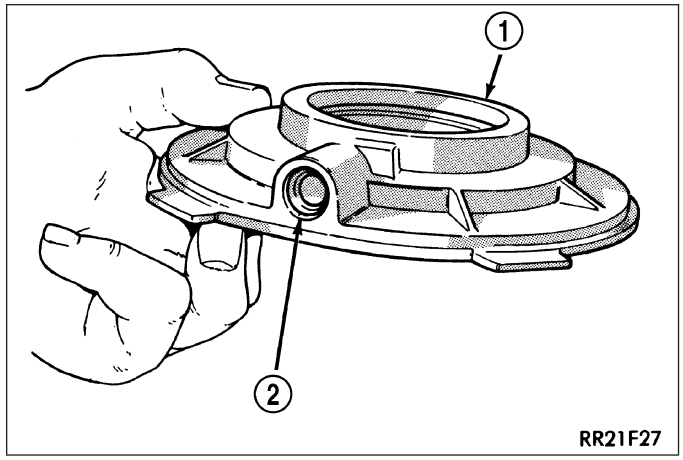

5. Remove rear retainer bolts.
6. Remove rear retainer (2). Tap retainer with mallet and pry upward to break sealer bead. Then slide retainer off case and output shaft.



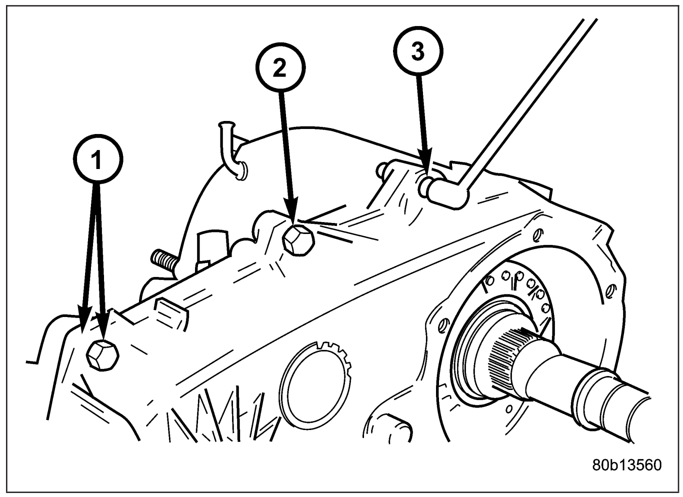

7. Remove rear bearing O.D. retaining ring with snap-ring pliers. Then tilt oil pump (1) and slide it off output shaft.



8. Remove pickup tube O-ring (2) from pump (1) but do not disassemble pump; it is not a serviceable part.

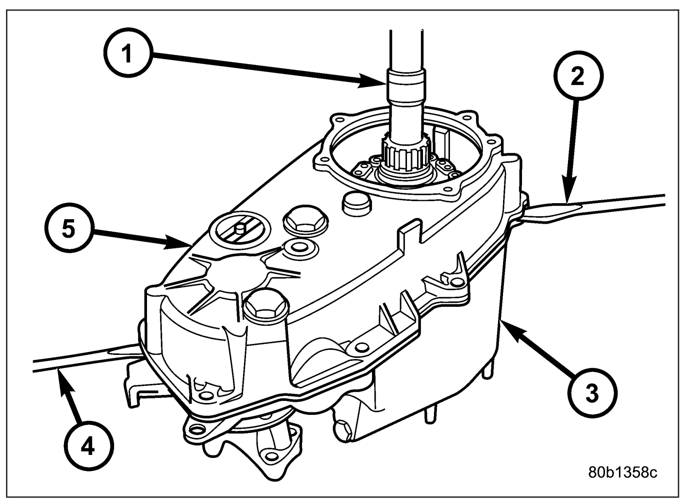



9. Remove bolts (2) attaching rear case to front case. Note position of the two black finish bolts (1) at each end of the case. These bolts go through the case dowels and require a washer under the bolt head.

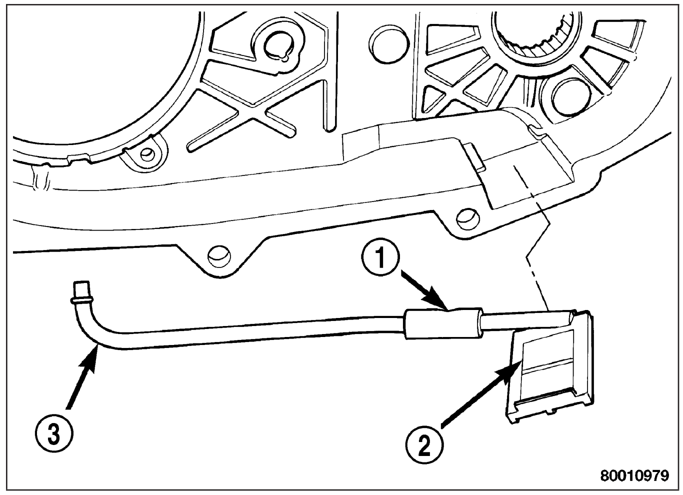



**CAUTION: Do not pry on the sealing surface of either case half as the surfaces will become damaged.**

10. Remove rear case (5) from front case (3). Insert screwdrivers into slots cast into each end of case. Then pry upward to break sealer bead and remove rear case.

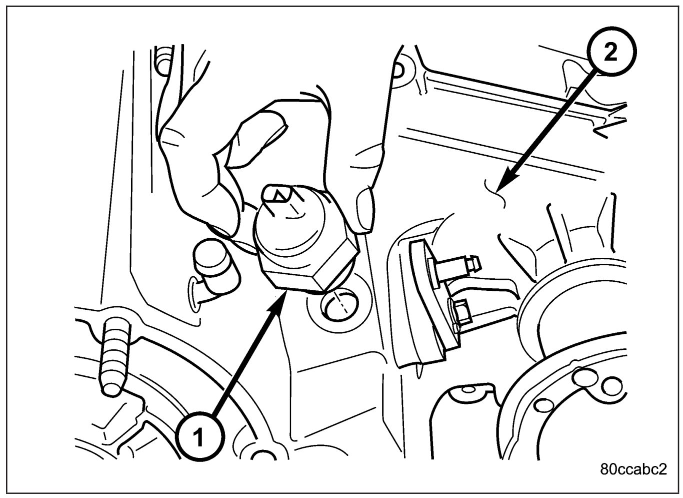


11. Remove oil pickup tube (3) and screen (2) from rear case.

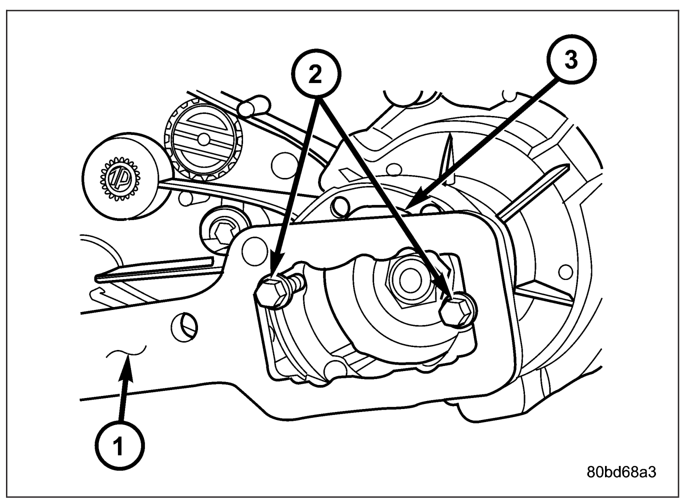



## COMPANION FLANGE AND RANGE LEVER

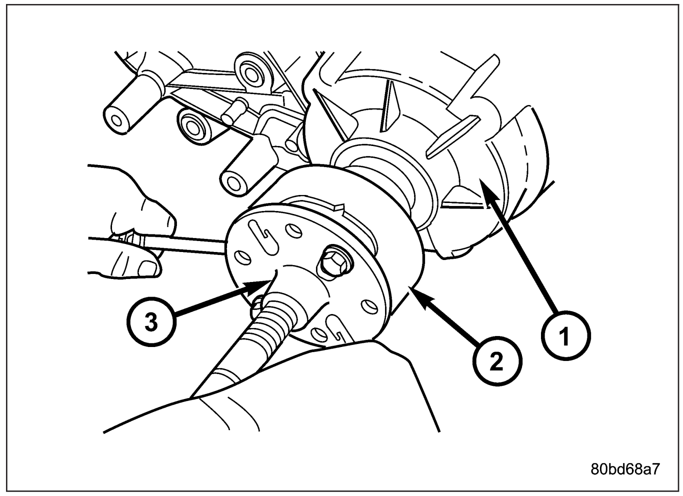
1. Remove transfer case position sensor (1).




2. Install two bolts (2) partially into the propeller shaft companion flange, 180° from each other.
3. Install the rectangular end of the Flange Holder C-3281 (1) over the bolts to hold the companion flange (3) stationary and remove the nut holding the companion flange to the output shaft.

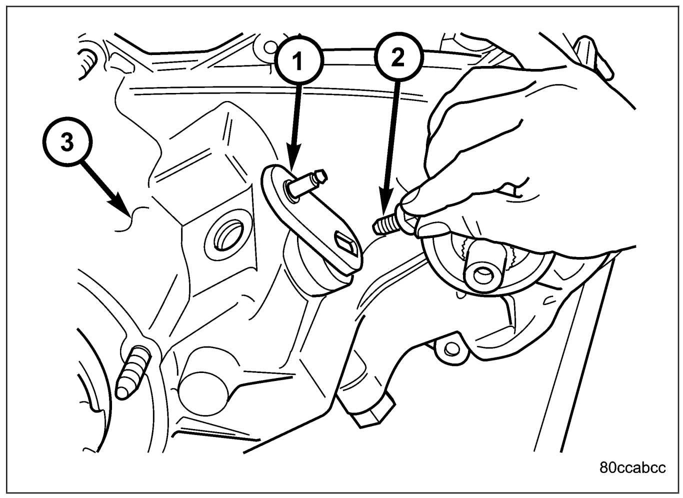


4. Use Remover C-452 (3) to remove the companion flange (2).



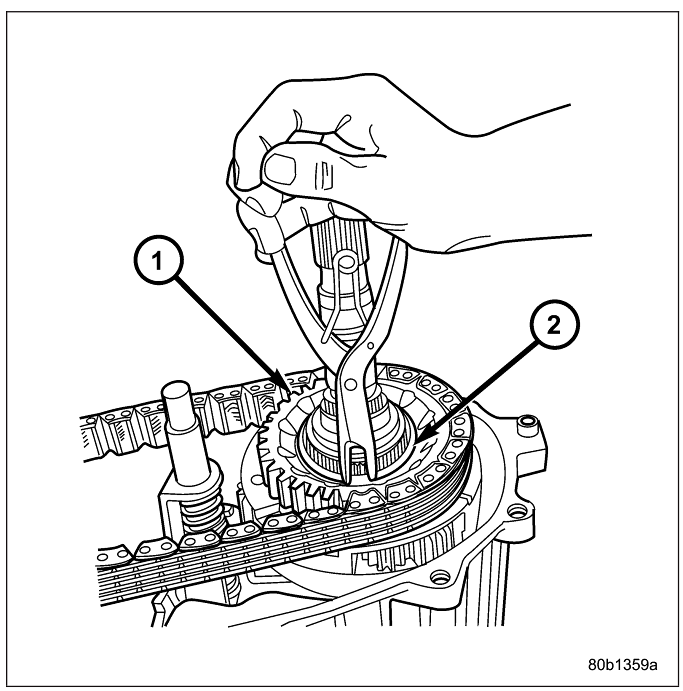

**NOTE: Be sure to note the orientation of the range lever (lever up or down) so that it may be re-installed in the same direction.**

5. Remove seal washer from front output shaft. Discard washer as it should not be reused.
6. Remove the bolt (2) that attaches the range lever (1) to sector shaft. Then move sector to neutral position and remove range lever from shaft.

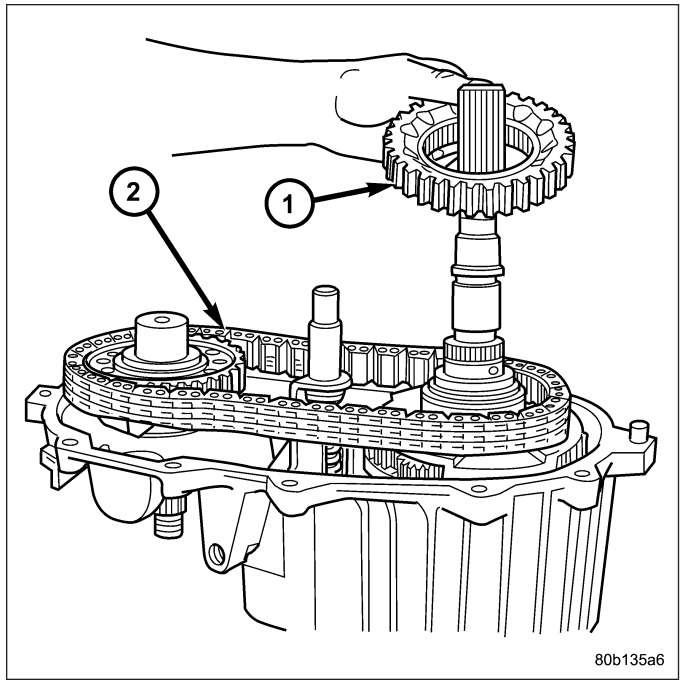



## FRONT OUTPUT SHAFT AND DRIVE CHAIN

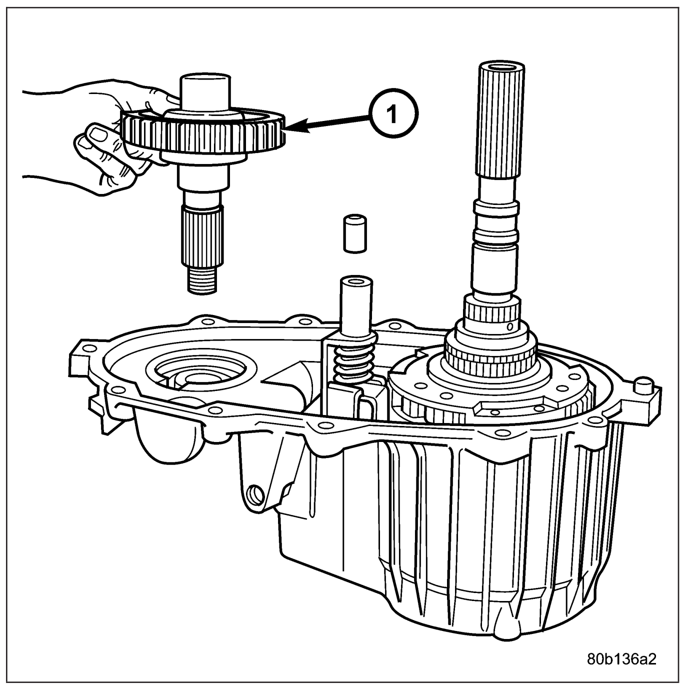
1. Remove drive sprocket (1) snap-ring (2).



2. Remove drive sprocket (1) and chain (2).

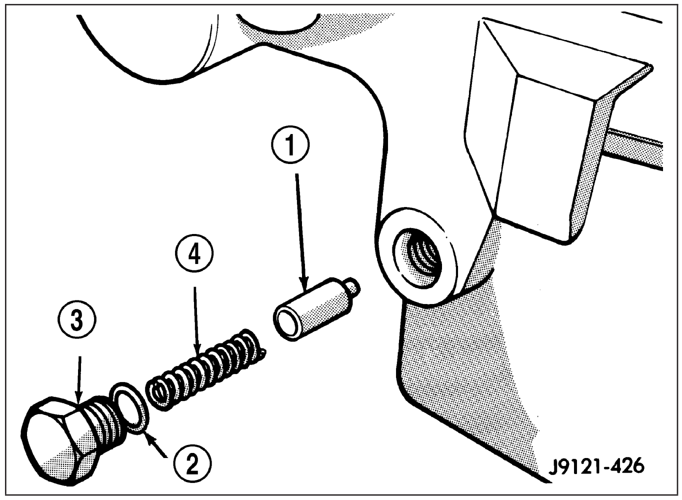



3. Remove front output shaft (1).

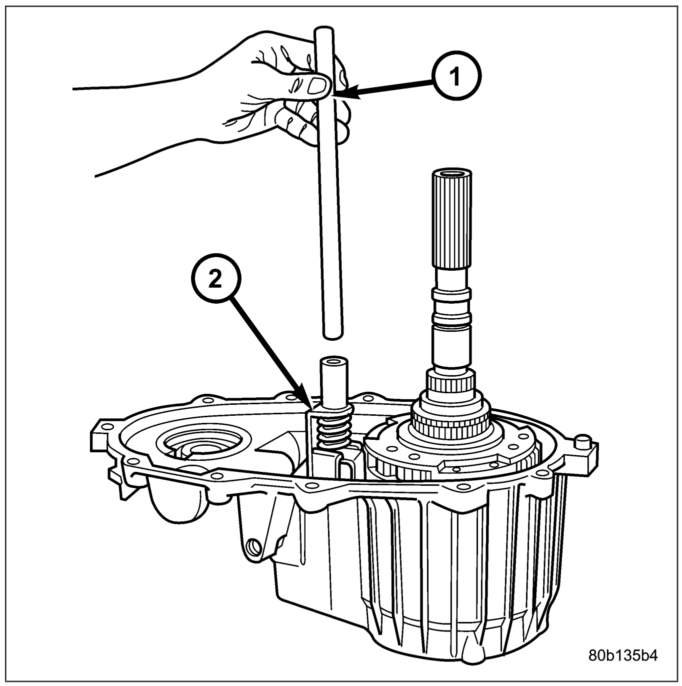


## SHIFT FORKS AND MAINSHAFT

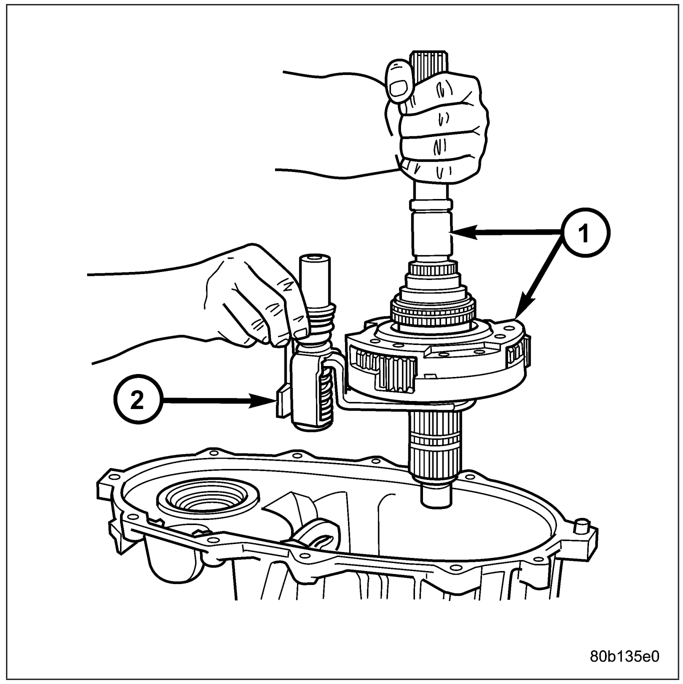
1. Remove shift detent plug (3), spring (4), and plunger (1).



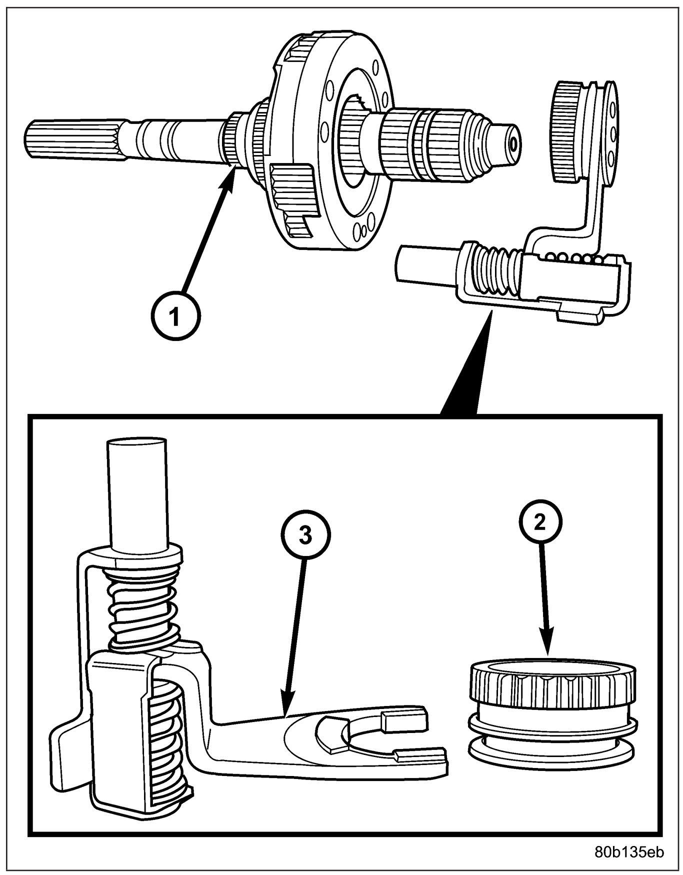

2. Remove seal plug from low range fork lockpin access hole. Then move shift sector to align low range fork lockpin with access hole.
3. Remove range fork lockpin with size number one easy-out tool as follows:
   a. Insert easy-out tool through access hole in side of transfer case and into lock-pin.
   b. Tap easy-out tool into lock-pin with hammer until tool is securely engaged into the lock-pin.
   c. Install a t-handle, such as from a tap and die set, onto the easy-out tool.
   d. Securely tighten the t-handle onto the tool.
   e. In one motion, pull upward and turn the t-handle counter-clockwise to remove the lock-pin.
4. Remove shift rail (1) by pulling it straight up and out of fork (2).



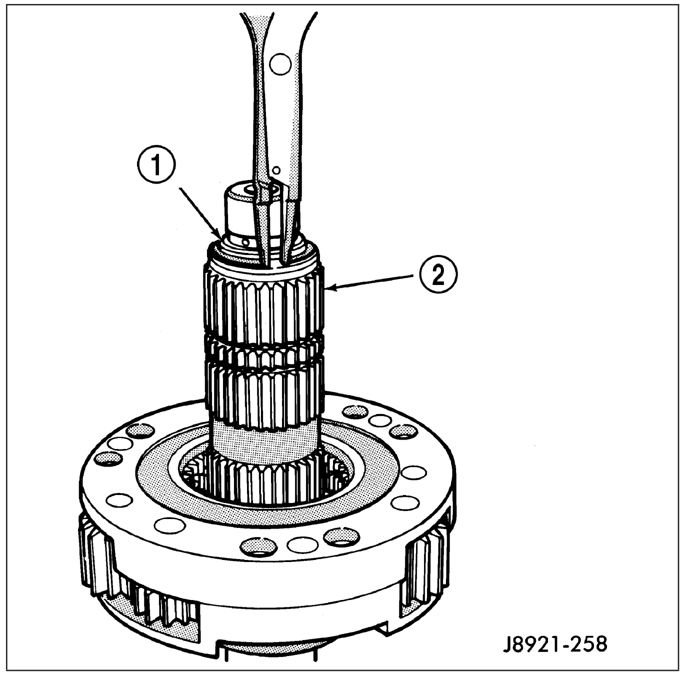
5. Remove mode fork (2) and mainshaft as assembly (1).



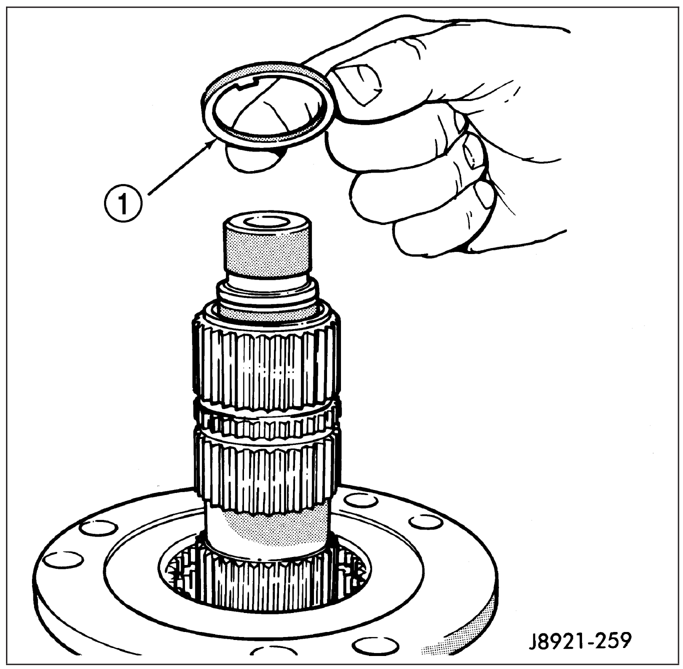

6. Remove mode shift sleeve (2) and mode fork assembly (3) from mainshaft (1). Note position of mode sleeve in fork and remove sleeve.



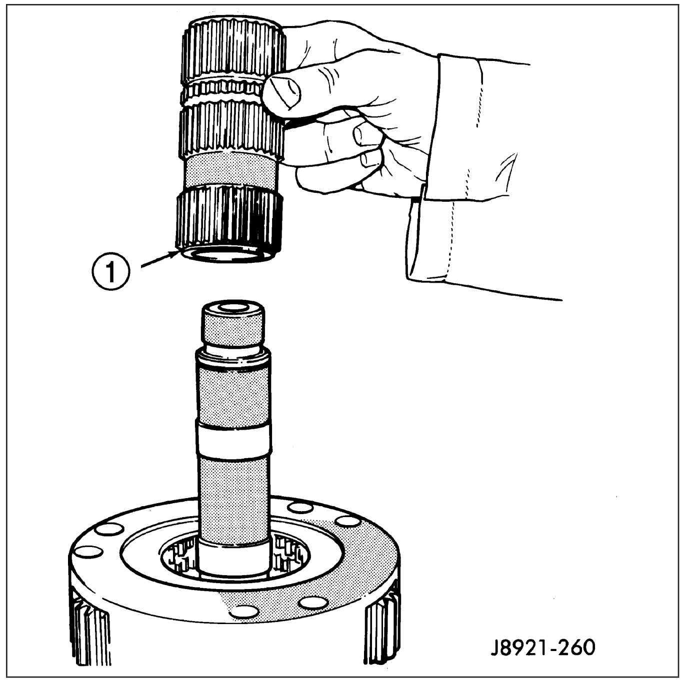
7. Remove intermediate clutch shaft (2) snap-ring (1).



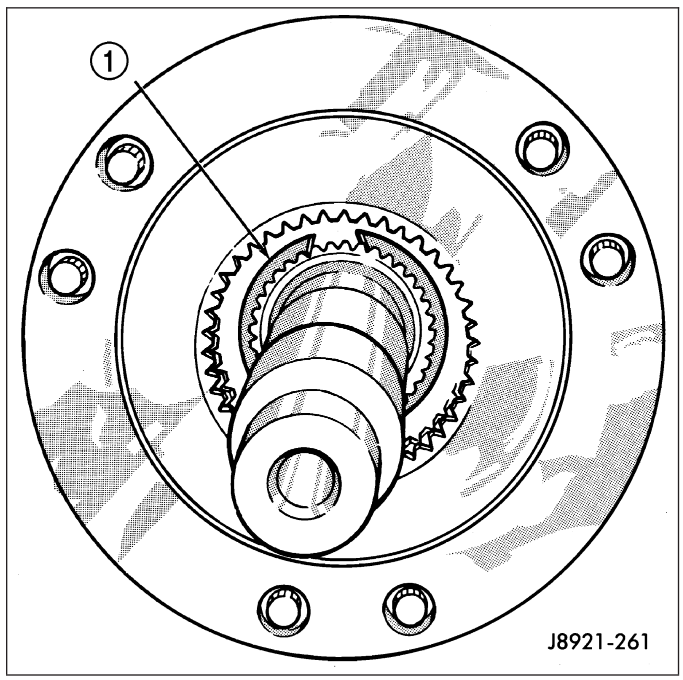

8. Remove clutch shaft thrust ring (1).



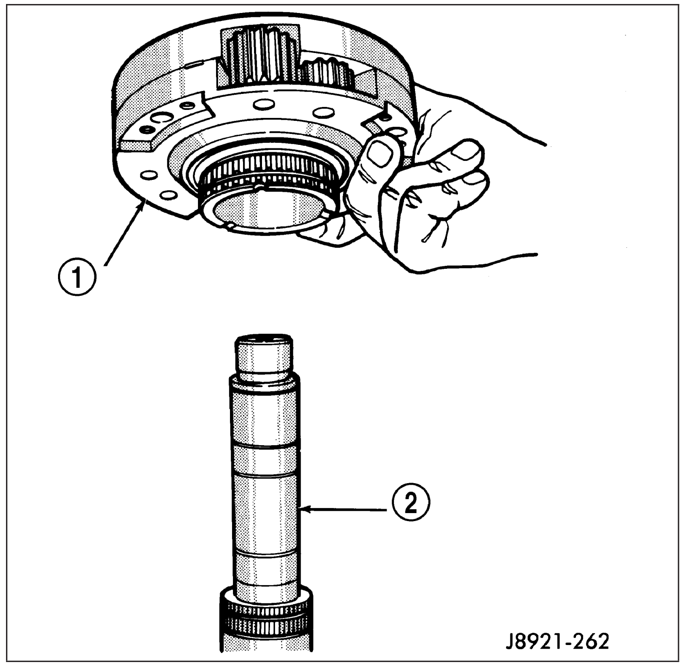
9. Remove intermediate clutch shaft (1).



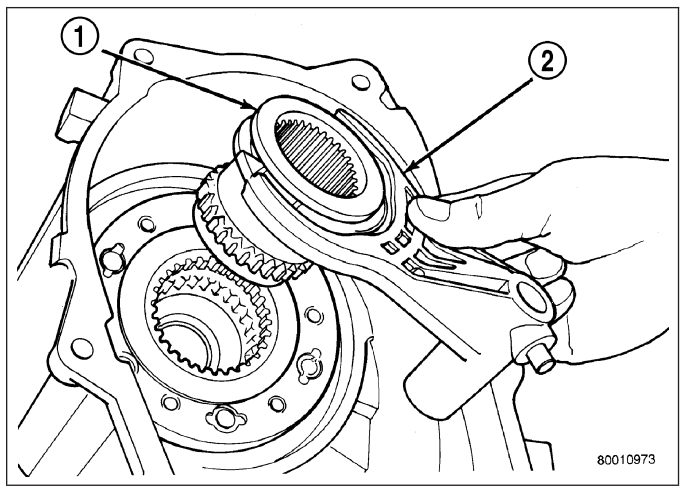

10. Remove differential snap-ring (1).



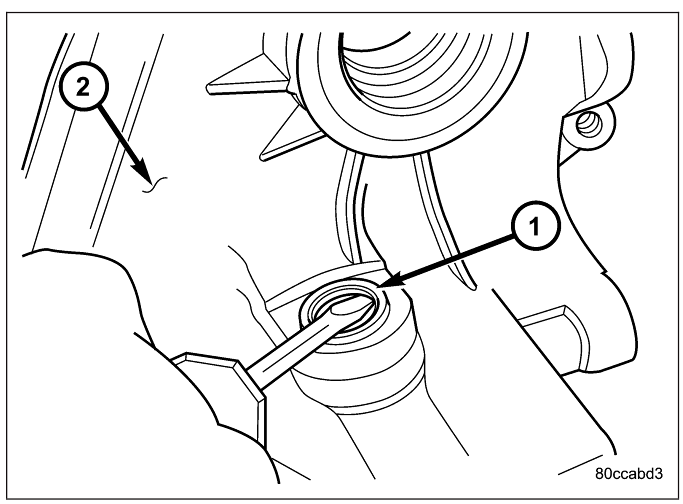
11. Remove differential (1).
12. Remove differential needle bearings and both needle bearing thrust washers from mainshaft.



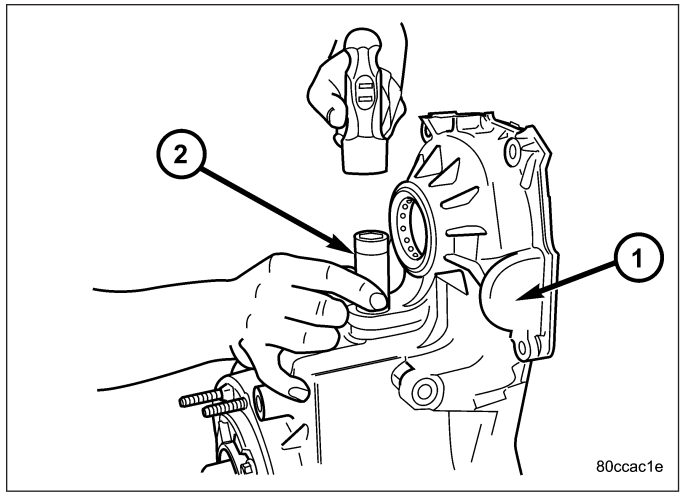

13. Slide low range fork pin out of shift sector slot.
14. Remove low range fork (2) and hub (1).
15. Remove shift sector.




16. Remove the shift sector shaft seal (1).

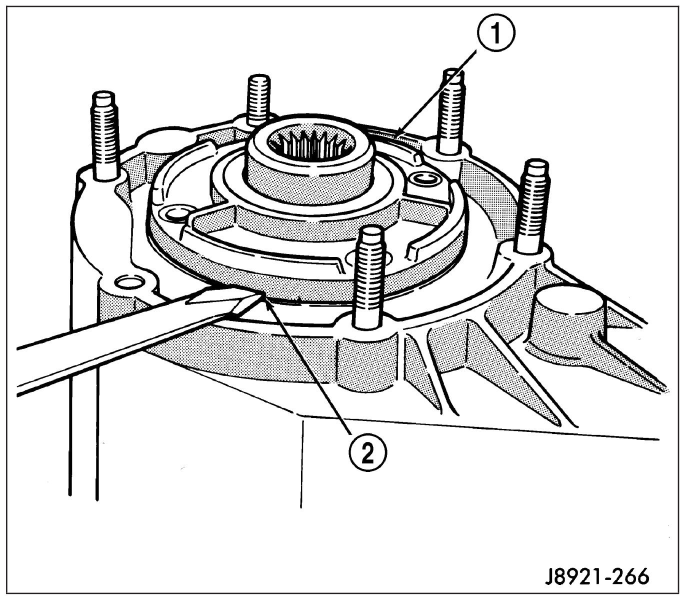


17. Remove the shift sector shaft bearing with an appropriate socket (2).

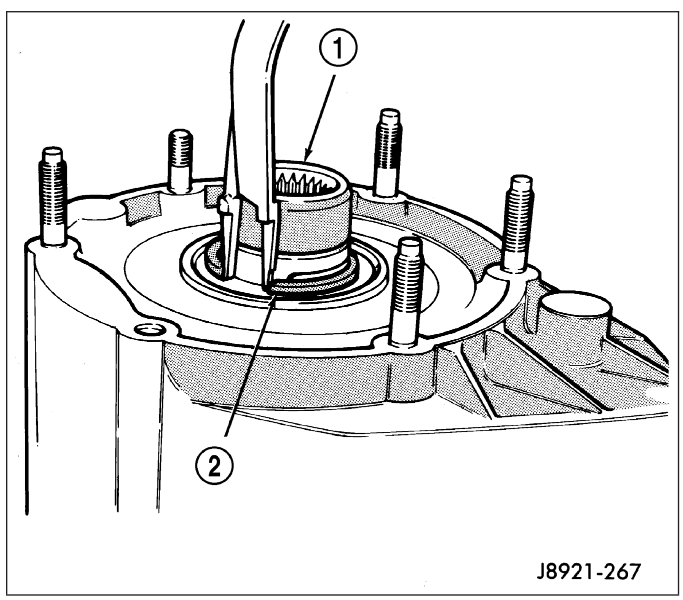



## INPUT GEAR/LOW RANGE ASSEMBLY

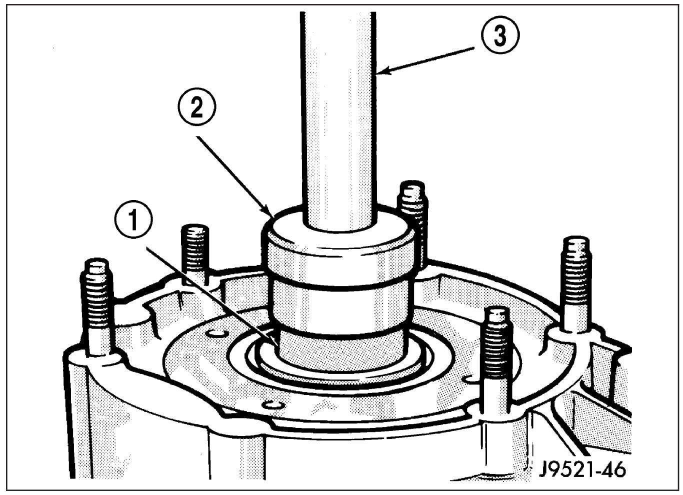
1. Remove front bearing retainer bolts.
2. Remove front bearing retainer (1). Carefully pry retainer loose with screwdriver. Position screwdriver in slots (2) cast into retainer.



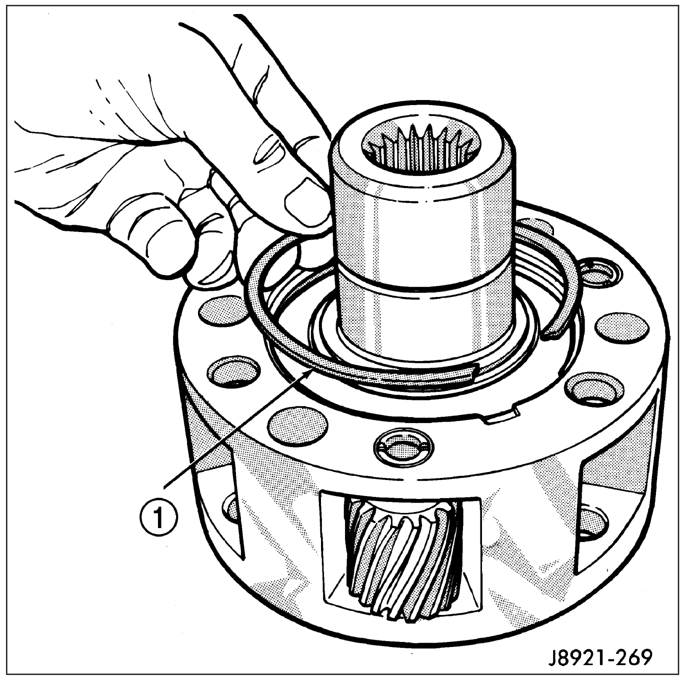

3. Remove input gear snap-ring (2).



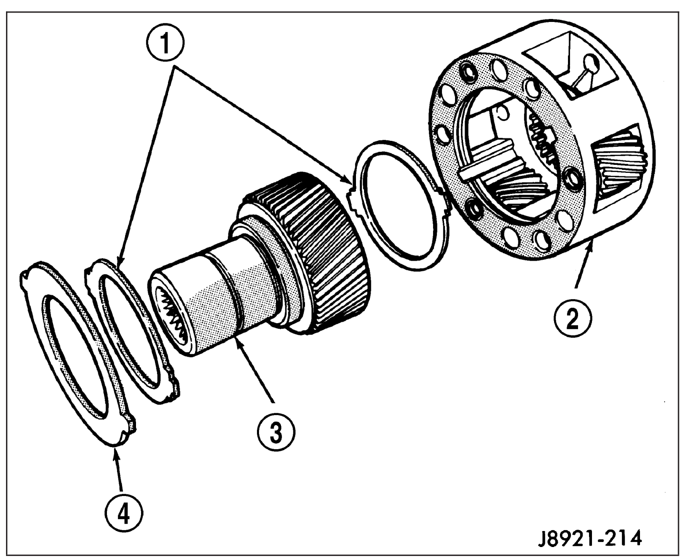
4. Remove input/low range gear assembly from bearing with Universal Handle C-4171 (3) and Tool 7829-A (2).



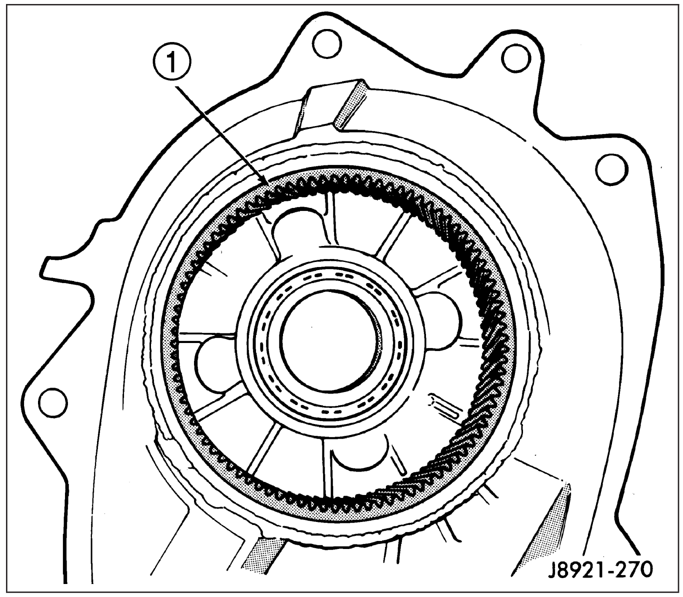

5. Remove low range gear snap-ring (1).




6. Remove input gear retainer, thrust washers (1), and input gear (3) from low range gear (2).

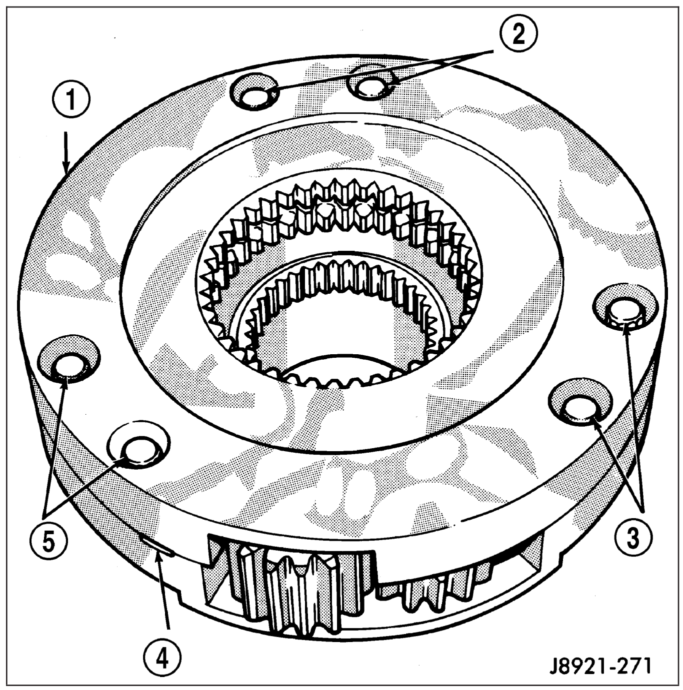


7. Inspect low range annulus gear (1). The annulus gear is not a serviceable component. If damaged, replace gear and front case as assembly.
8. Remove oil seals from following components:
   - front bearing retainer.
   - rear retainer.
   - oil pump.
   - case halves.

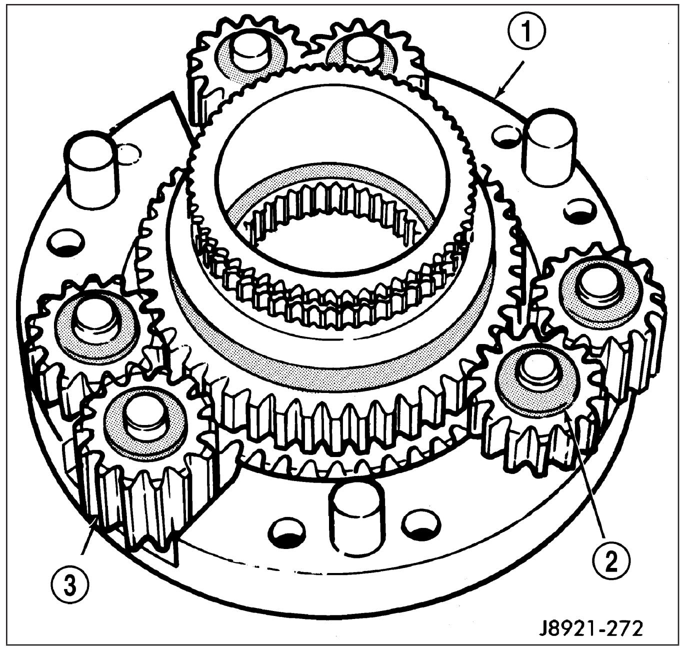



## DIFFERENTIAL

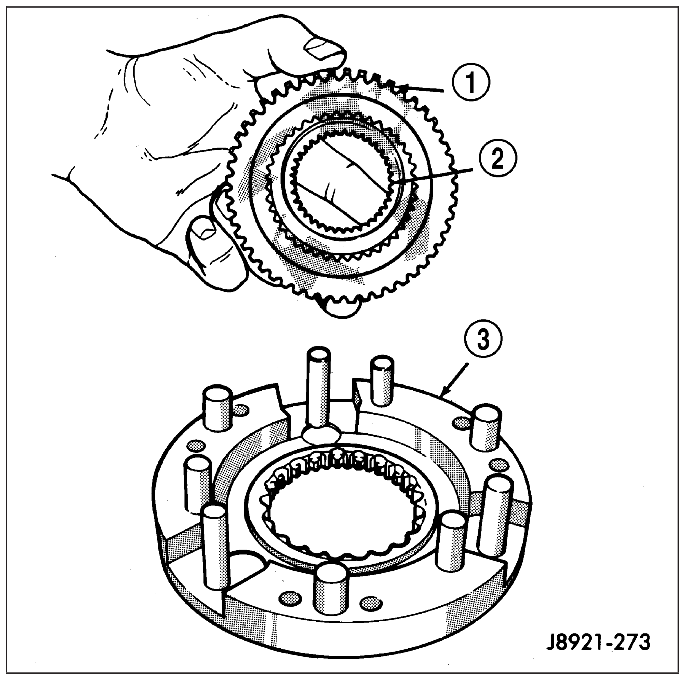
1. Mark differential case halves for reference.
2. Remove differential case bolts.
3. Invert differential on workbench.
4. Separate top case (1) from bottom case. Use slots in case halves to pry them apart.



5. Remove thrust washers (2) and planet gears (3) from case pins.




6. Remove mainshaft (1) and sprocket (2) gears from bottom case (3). Note gear position for reference before separating them.




## CLEANING

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.

The oil pickup screen can be cleaned with solvent. Shake excess solvent from the screen after cleaning and allow it to air dry. Do not use compressed air.

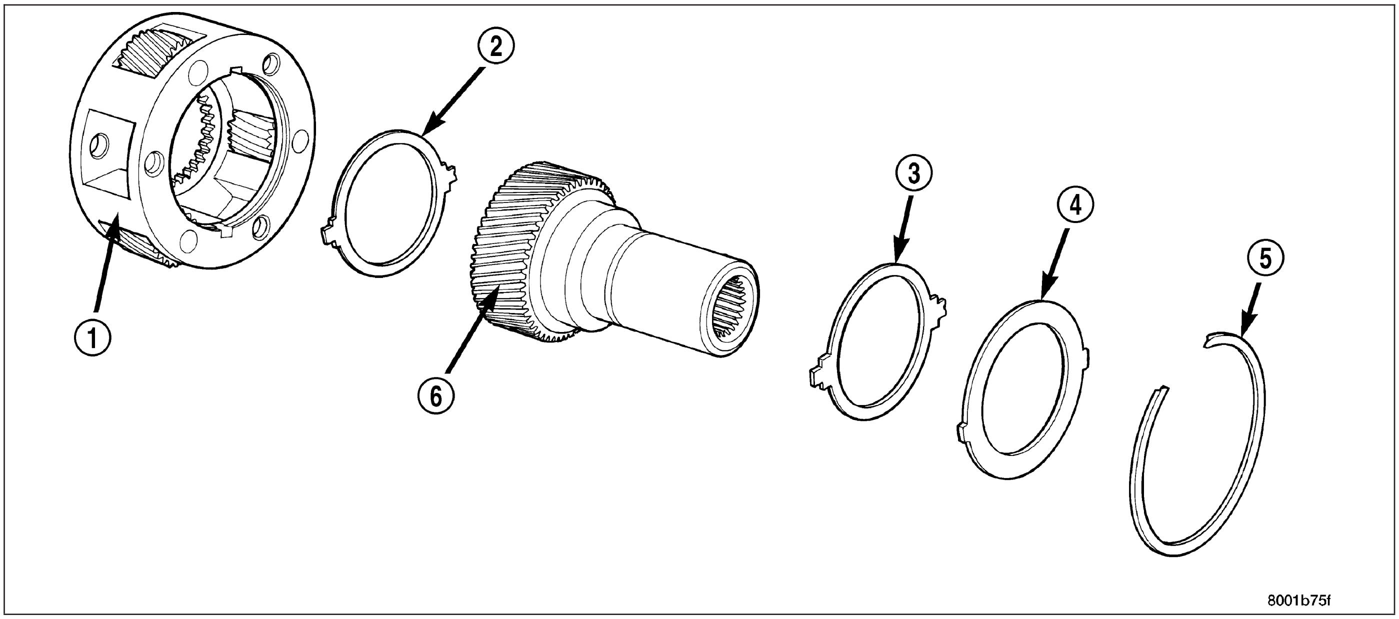
# INSPECTION

## MAINSHAFT/SPROCKET/HUB

Inspect the splines on the hub and shaft and the teeth on the sprocket. Minor nicks and scratches can be smoothed with an oilstone. However, replace any part that is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320-400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

## INPUT GEAR AND PLANETARY CARRIER




Check the teeth on the gear (6). Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300-400 grit emery cloth if necessary.

Examine the carrier body (1) and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged.

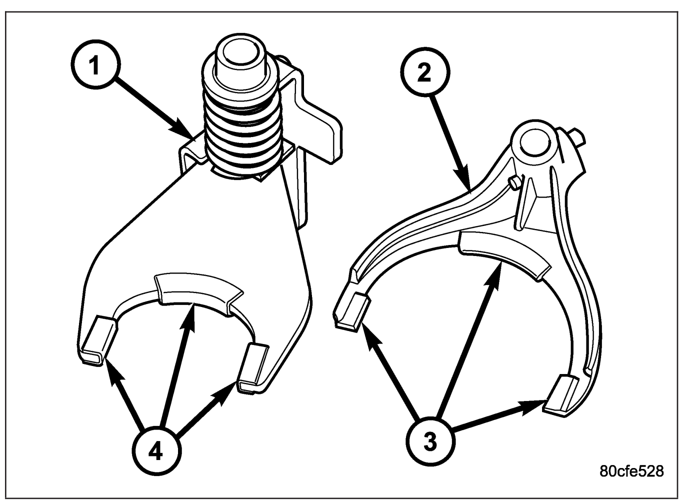
Check the lock ring (4) and both thrust washers (2, 3) for wear or cracks. Replace them if necessary. Also replace the lock retaining ring if bent, distorted, or broken.

## SHIFT FORKS/HUBS/SLEEVES

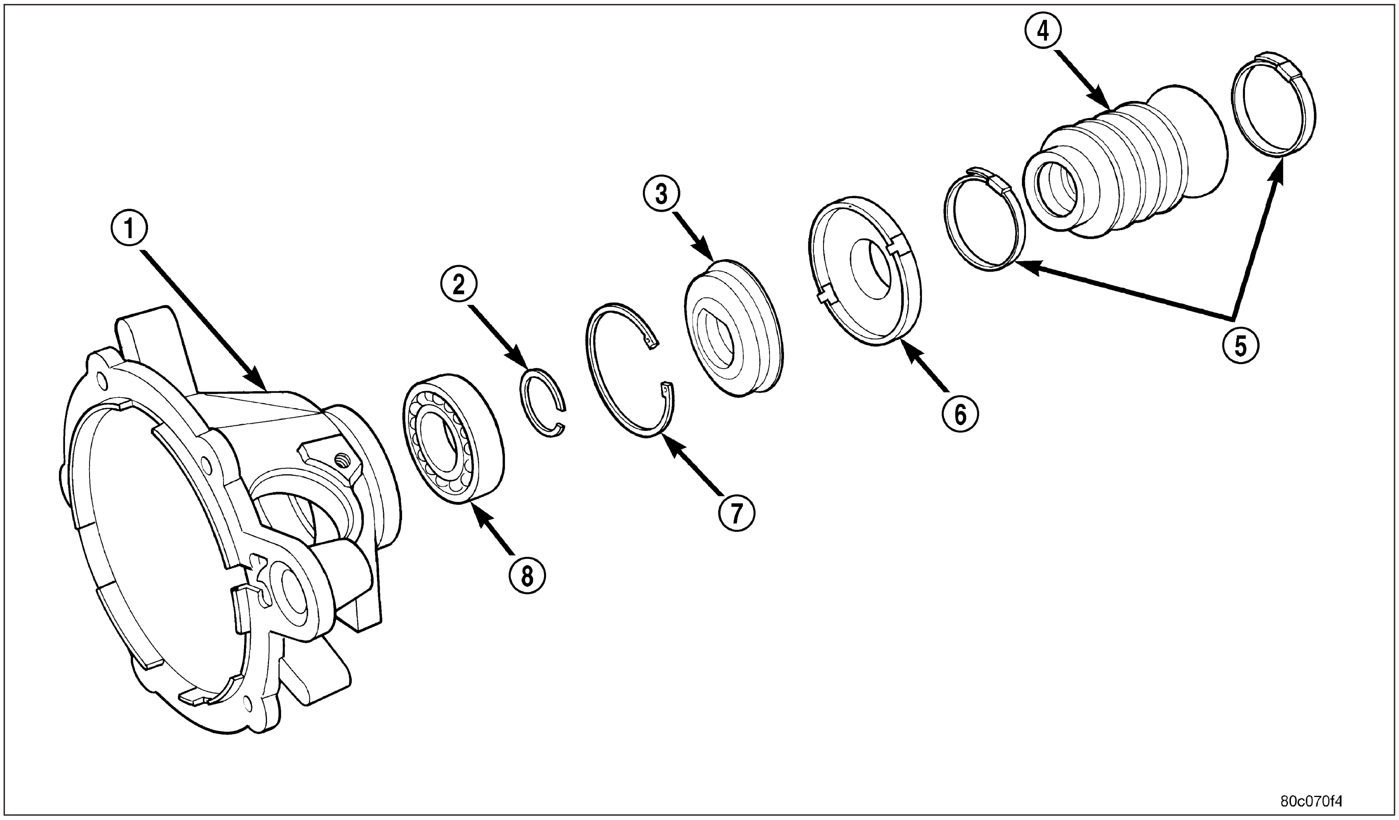
Check condition of the shift forks and mode fork shift rail (1). Minor nicks on the shift rail can be smoothed with 320-400 grit emery cloth.

Inspect the shift fork wear pads. The mode fork pads (4) are serviceable and can be replaced if necessary. The range fork pads (3) are also serviceable.

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.



## REAR RETAINER/BEARING/ SEAL/SLINGER/BOOT



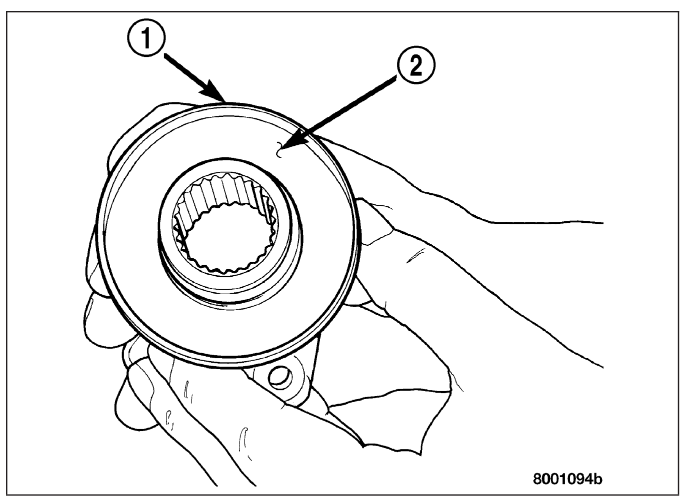

Inspect the retainer components. Replace the bearing (8) if rough or noisy. Check the retainer (1) for cracks or wear in the bearing bore. Clean the retainer sealing surfaces with a scraper and 3M all purpose cleaner. This will ensure proper adhesion of the sealer during reassembly.

Replace the slinger (6) and seal (3) outright; do not reuse either part.

Replace any part if distorted, bent, or broken. Also replace the boot if cut or torn. Replace the boot band clamps, do not reuse them.

## REAR OUTPUT SHAFT/YOKE/DRIVE CHAIN

Check condition of the seal contact surfaces (2) of the yoke slinger (1). This surface must be clean and smooth to ensure proper seal life. Replace the yoke nut and seal washer as neither part should be reused.

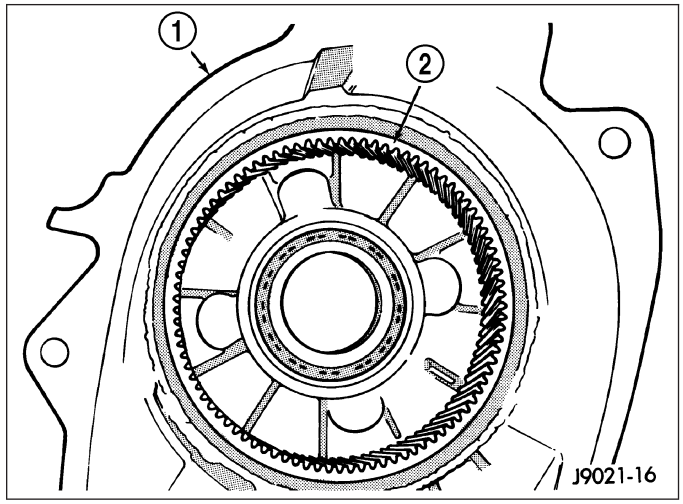



Inspect the shaft threads, sprocket teeth, and bearing surfaces. Minor nicks on the teeth can be smoothed with an oilstone. Use 320-400 grit emery to smooth minor scratches on the shaft bearing surfaces. Rough threads on the shaft can be chased if necessary. Replace the shaft if the threads are damaged, bearing surfaces are scored, or if any sprocket teeth are cracked or broken.

Examine the drive chain and shaft bearings. Replace the chain and both sprockets if the chain is stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.

### LOW RANGE ANNULUS GEAR

Inspect annulus gear condition carefully. The gear is only serviced as part of the front case. If the gear is damaged, it will be necessary to replace the gear and front case as an assembly. Do not attempt to remove the gear (2)




### FRONT-REAR CASES AND FRONT RETAINER

Inspect the cases and retainer for wear and damage. Clean the sealing surfaces with a scraper and 3M all purpose cleaner. This will ensure proper sealer adhesion at assembly. Replace the input retainer seal; do not reuse it.

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

Check the front case mounting studs and vent tube. The tube can be secured with Loctite™ 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil™ stainless steel inserts if required.

### OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any part appears to be worn or damaged. Do not disassemble the pump as individual parts are not available. The pump is only available as a complete assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

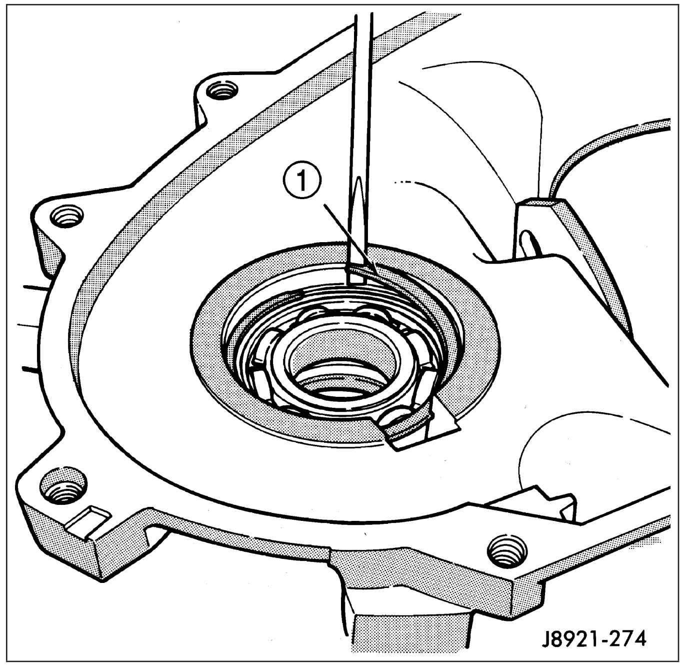
## ASSEMBLY

Lubricate transfer case components with automatic transmission fluid or petroleum jelly (where indicated) during assembly.

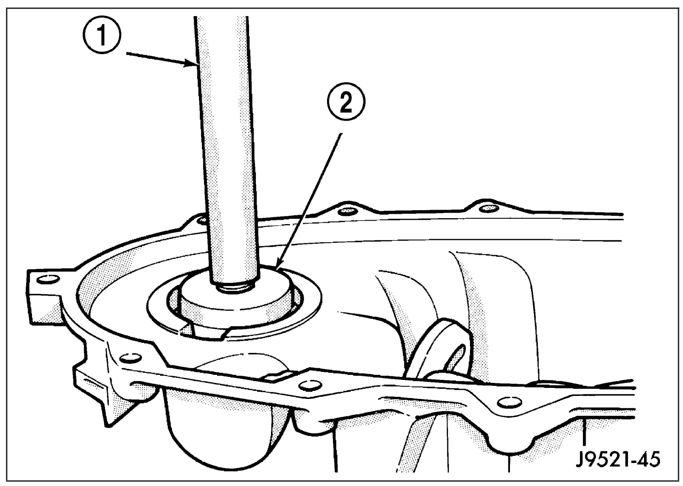
**CAUTION: The bearing bores in various transfer case components contain oil feed holes. Make sure replacement bearings do not block the holes.**

## BEARINGS AND SEALS

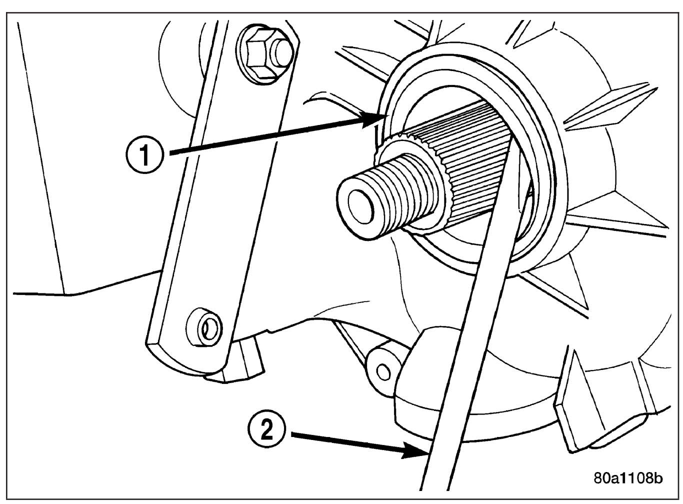
1. Remove snap-ring (1) that retains front output shaft front bearing in case. Then remove bearing. Use hammer handle, or hammer and brass punch to tap bearing out of case.



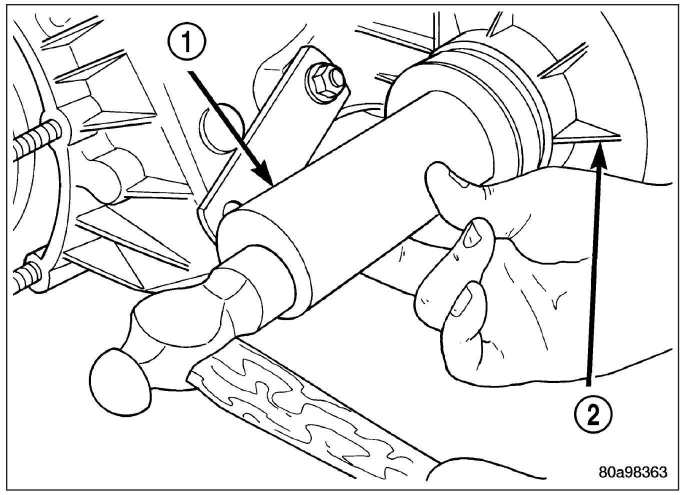

2. Install new front output shaft front bearing with Tool Handle C-4171 (1) and Installer 8033-A (2) with the tapered cone upward.
3. Install front bearing snap-ring.



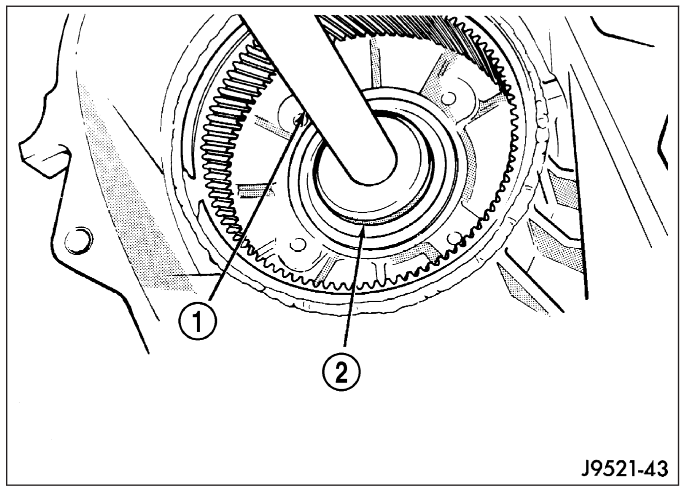

4. Remove front output shaft seal (1) using an appropriate pry tool (2) or slide-hammer mounted screw.



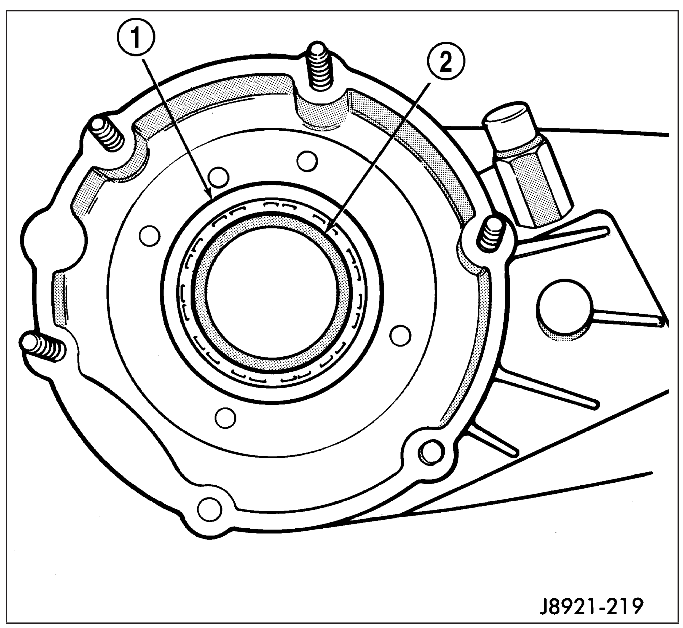
5. Install new front output shaft oil seal with Installer 6952-A (1).



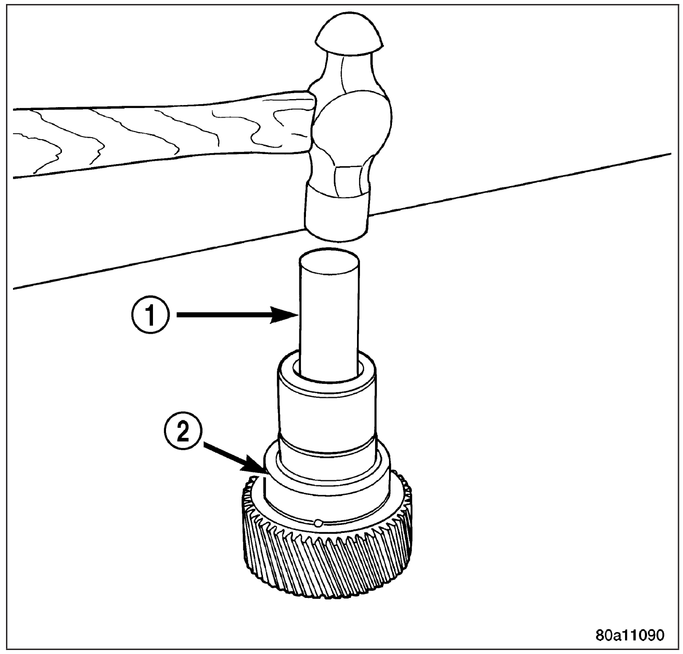

6. Remove input gear bearing with Tool Handle C-4171 (1) and Remover C-4210 (2).



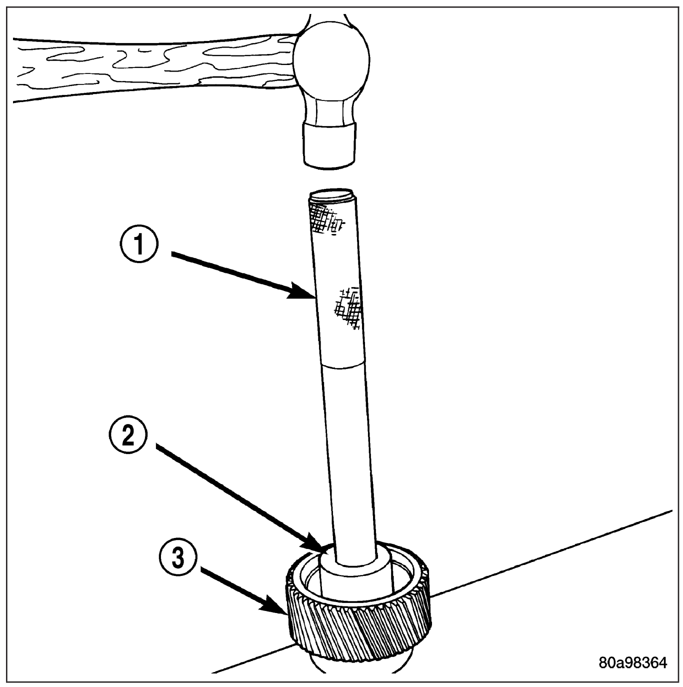

7. Install snap-ring on new input gear bearing.
8. Install new input gear bearing (2) with Tool Handle C-4171 and Remover C-4210. Install bearing far enough to seat snap-ring (1) against case.



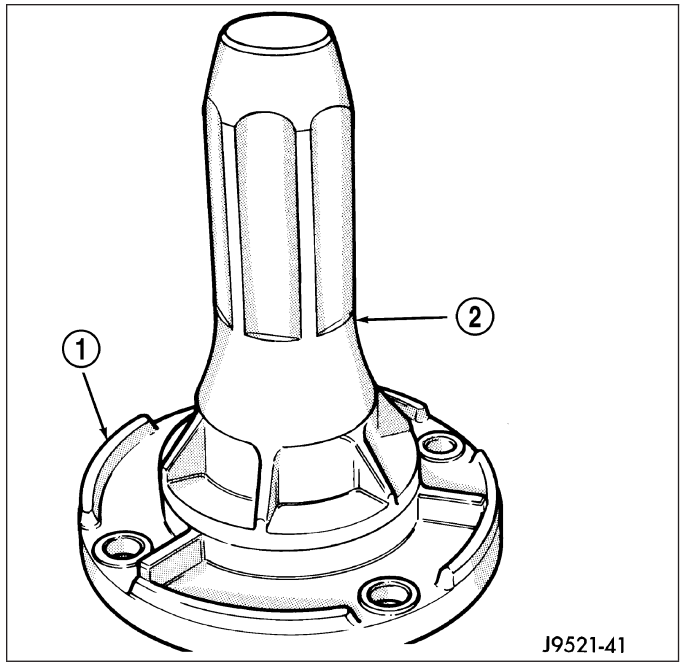
9. Remove the input gear pilot bearing by inserting a suitably sized drift (1) into the splined end of the input gear (2) and driving the bearing out with the drift and a hammer.



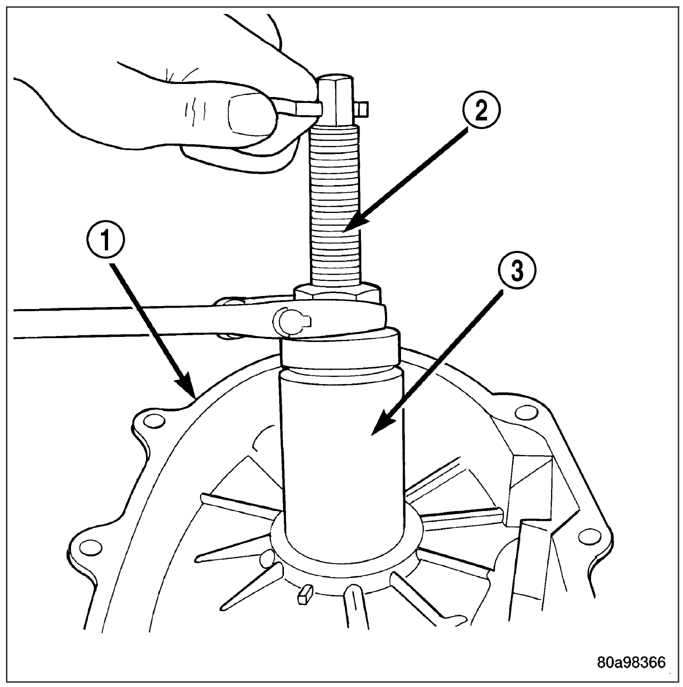

10. Install new pilot bearing with Installer 8128 (2) and Handle C-4171 (1).



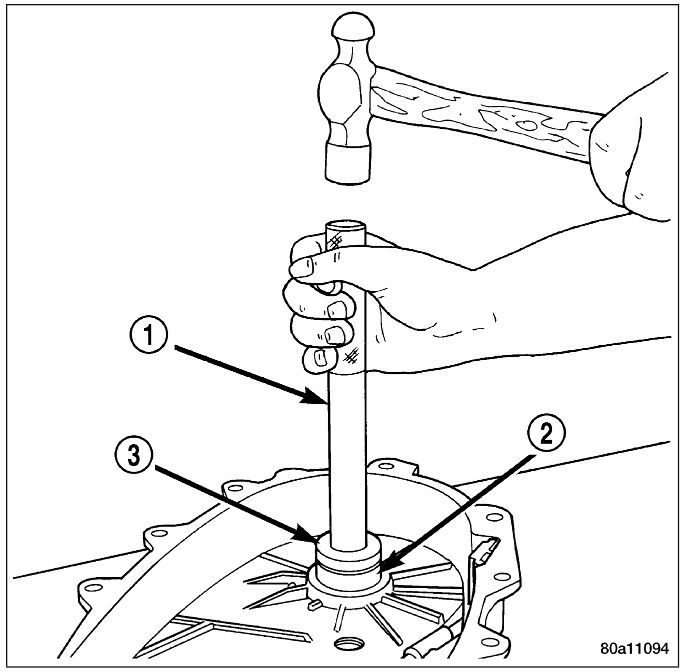
11. Install new seal in front bearing retainer (1) with Installer 7884 (2).



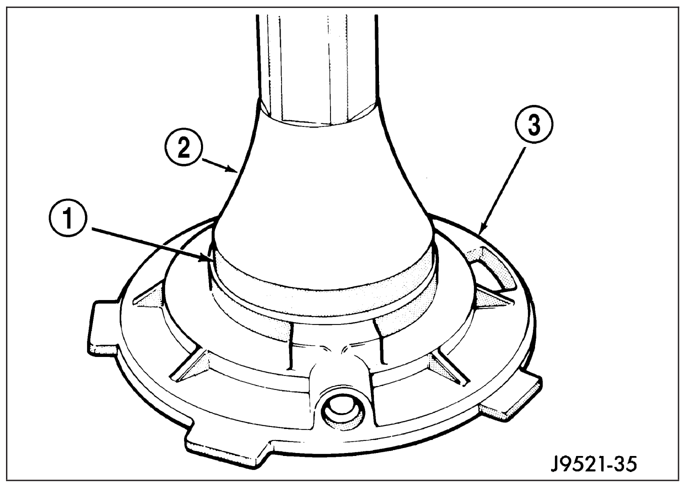

12. Remove output shaft rear bearing with the screw and jaws from Remover L-4454 (2) and Cup 8148 (3).



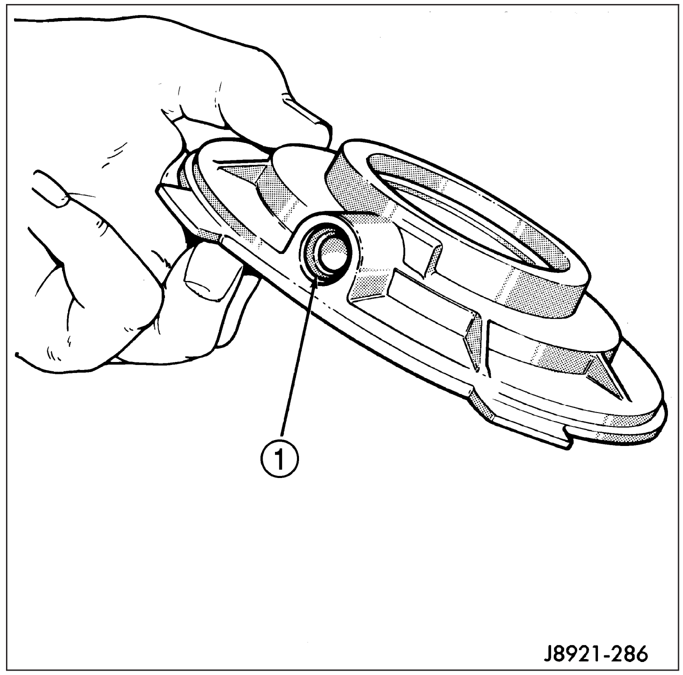
13. Install new bearing with Tool Handle C-4171 (1) and Installer 5066 (3). Lubricate bearing after installation.




14. Install new seal in oil pump feed housing (3) with Special Tool 7888 (2).

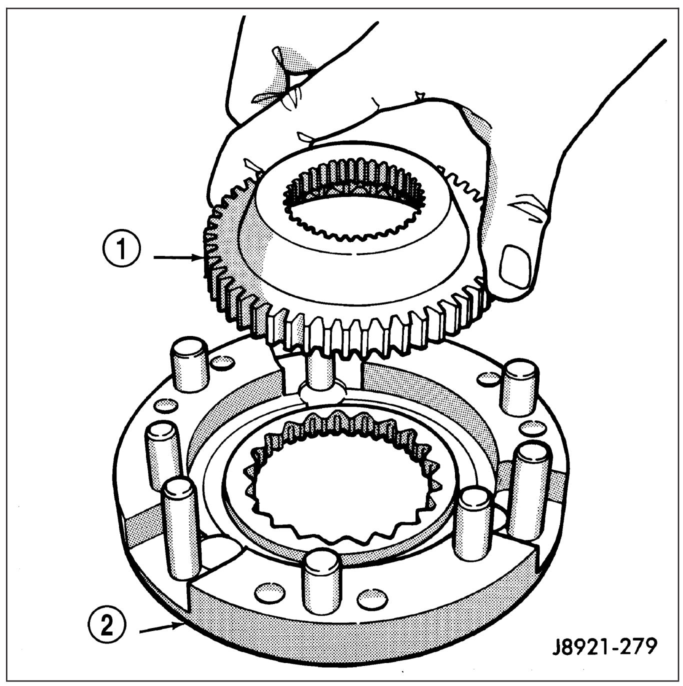


15. Install new pickup tube O-ring (1) in oil pump.

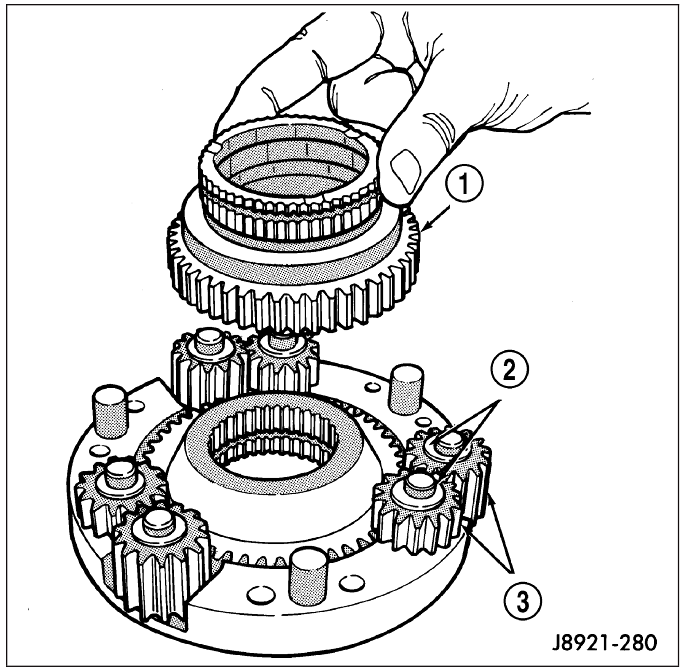



## DIFFERENTIAL

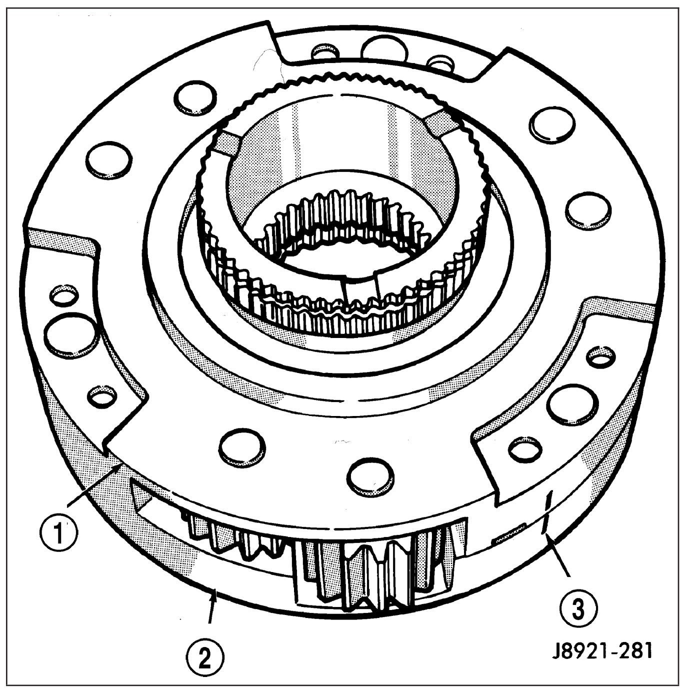
1. Lubricate differential components with automatic transmission fluid.
2. Install sprocket gear (1) in differential bottom case (2).



3. Install differential planet gears (3) and new thrust washers (2). Be sure thrust washers are installed at top and bottom of each planet gear.
4. Install differential mainshaft gear (1).

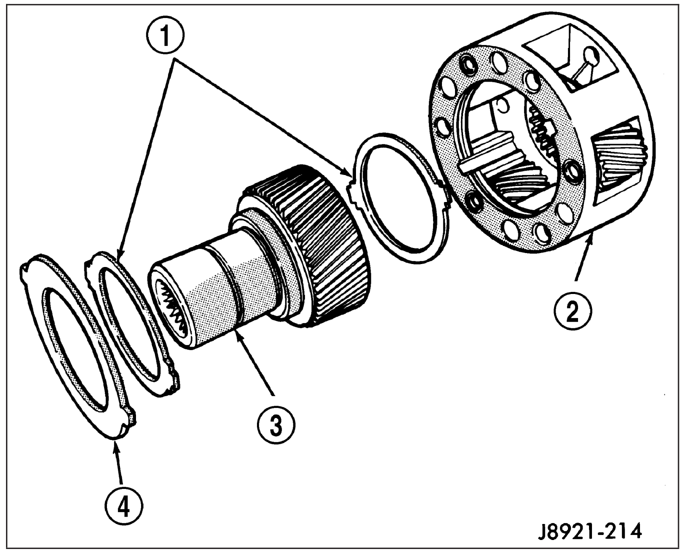



5. Align and position differential top case (1) on bottom case (2). Align using scribe marks (3) made at disassembly.
6. While holding differential case halves together, invert the differential and start the differential case bolts.
7. Tighten differential case bolts to specified torque.

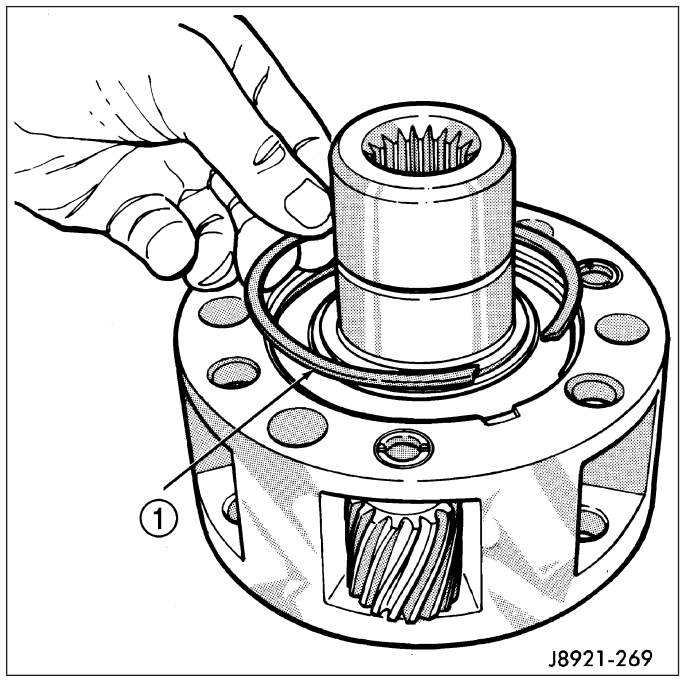


## INPUT GEAR/LOW RANGE ASSEMBLY

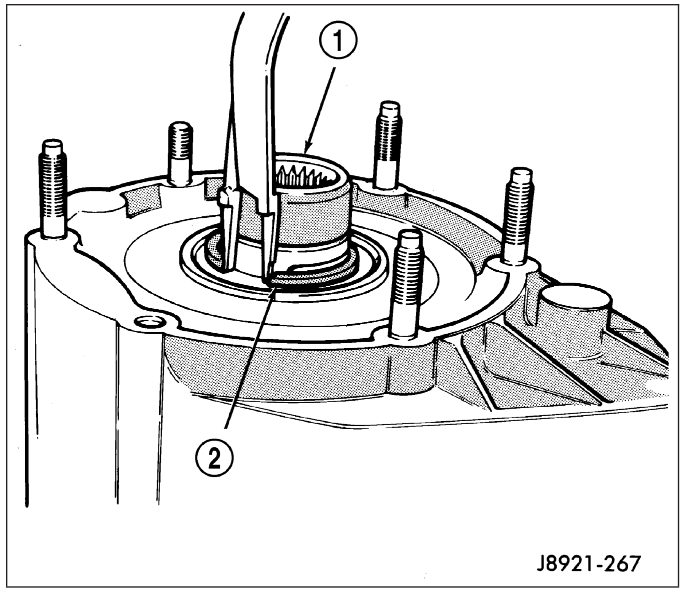
1. Assemble low range gear (2), input gear thrust washers, input gear (3), and input gear retainer (4).



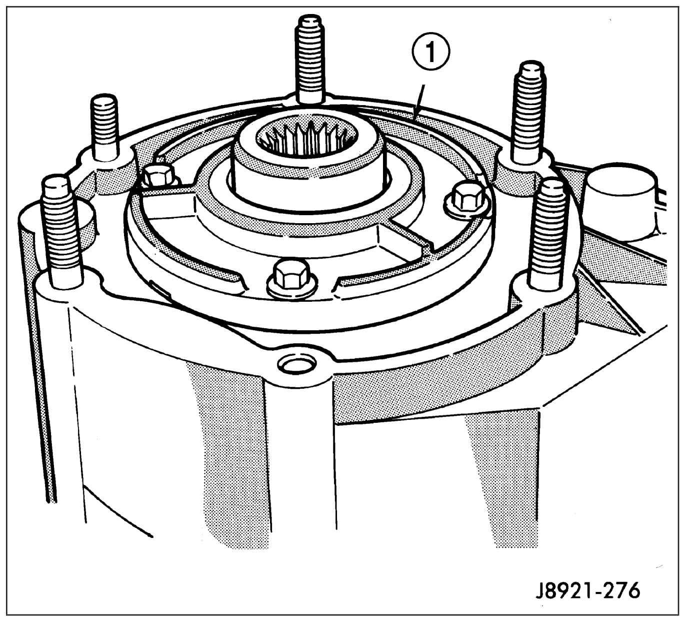

2. Install low range gear snap-ring (1).



3. Lubricate input gear and low range gears with automatic transmission fluid.
4. Start input gear shaft into front case bearing.
5. Press input gear shaft into front bearing.
6. Install new input gear snap ring (2).

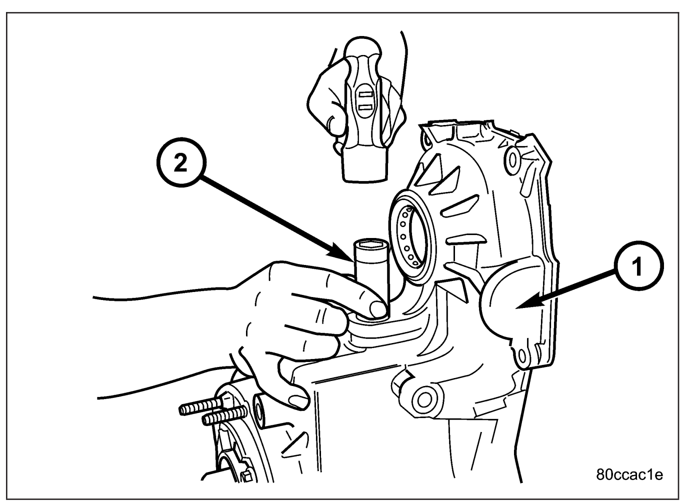



7. Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to seal surface of front bearing retainer.
8. Install front bearing retainer (1). Tighten retainer bolts to 16 ft. lbs. (21 N·m) torque.

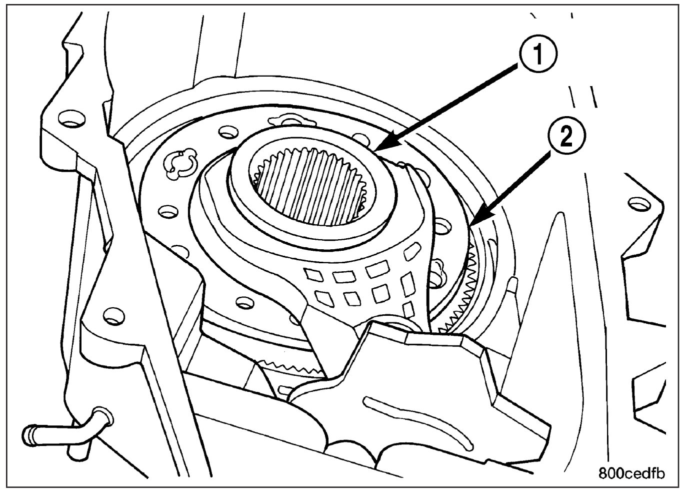



## SHIFT FORKS, SECTOR, AND MAINSHAFT

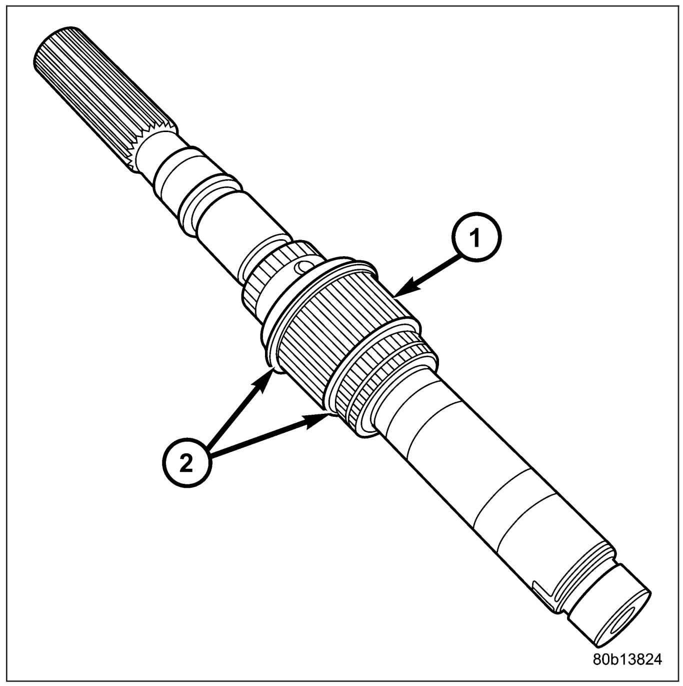
1. Install the shift sector shaft bearing using a suitable socket (2) until the bearing is flush to the bottom, inner edge of the bore.



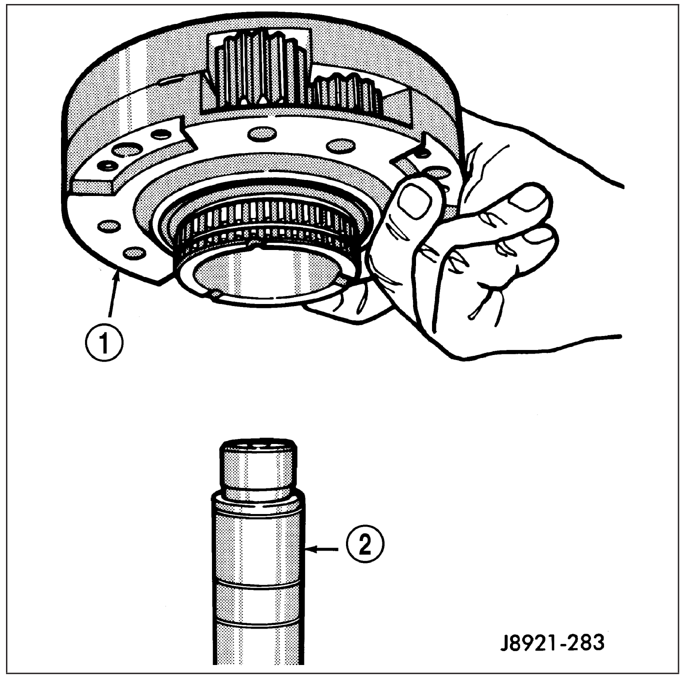
2. Install a new shift sector shaft seal using a suitable socket until the seal is flush to the bottom of the bore lead-in chamfer.
3. Install shift sector.
4. Install new pads on low range fork, if necessary.
5. Assemble low range fork and sleeve.
6. Position low range fork (2) and hub (1) in case. Be sure low range fork pin is engaged in shift sector slot.



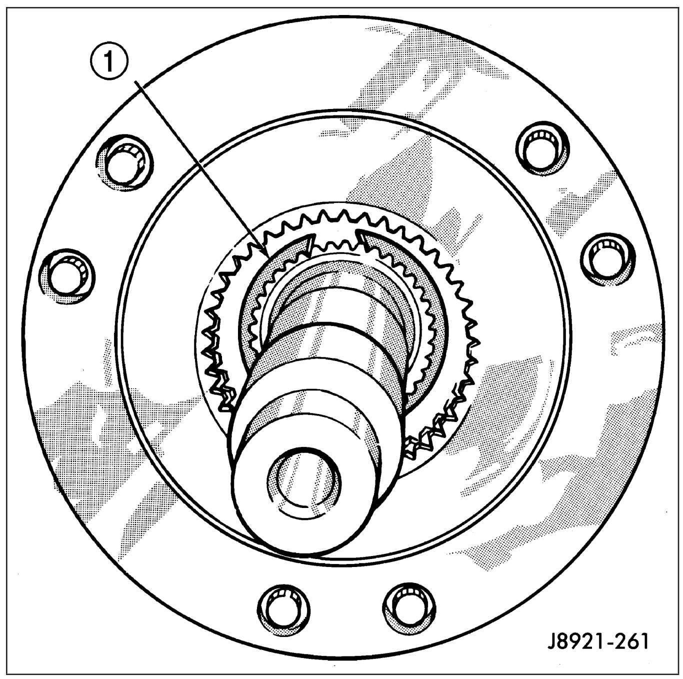

7. Install first mainshaft bearing spacer (2) on mainshaft.
8. Install bearing rollers on mainshaft. Coat bearing rollers with generous quantity of petroleum jelly to hold them in place.
9. Install remaining bearing spacer on mainshaft. Do not displace any bearings while installing spacer.



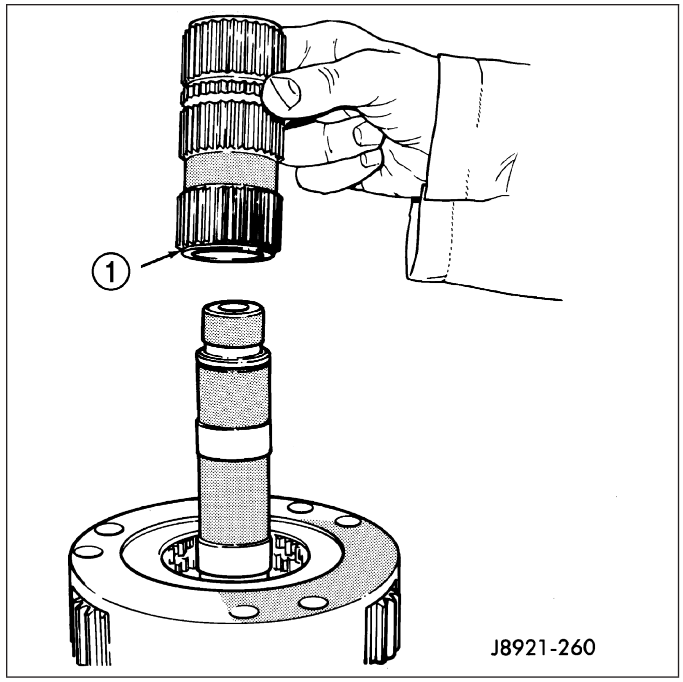
10. Install differential (1). Do not displace mainshaft bearings when installing differential.



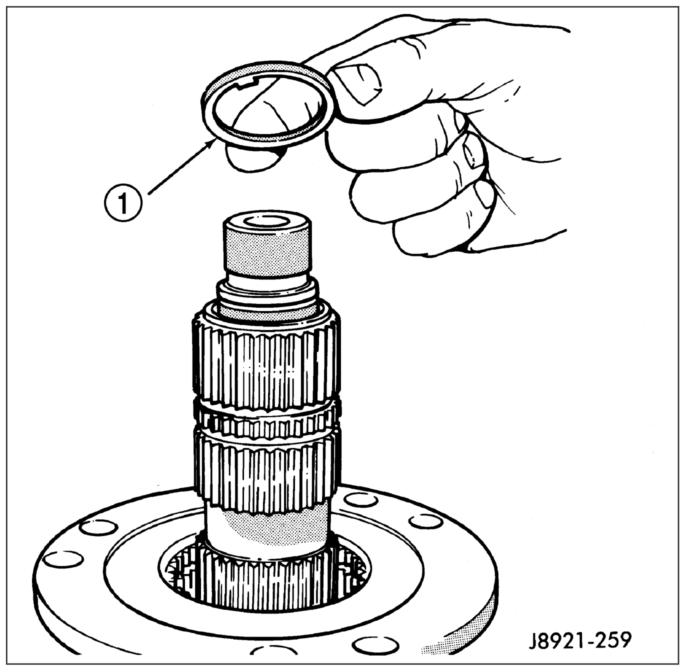

11. Install differential snap-ring (1).



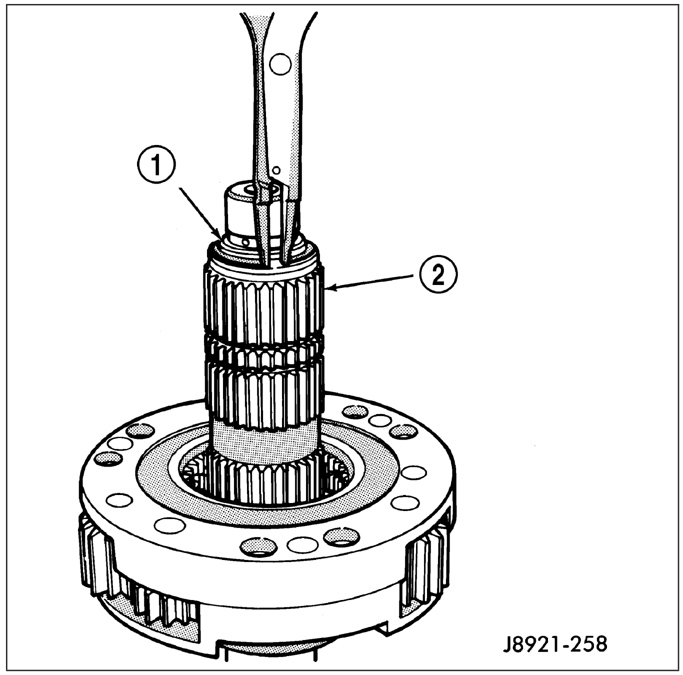
12. Install intermediate clutch shaft (1).



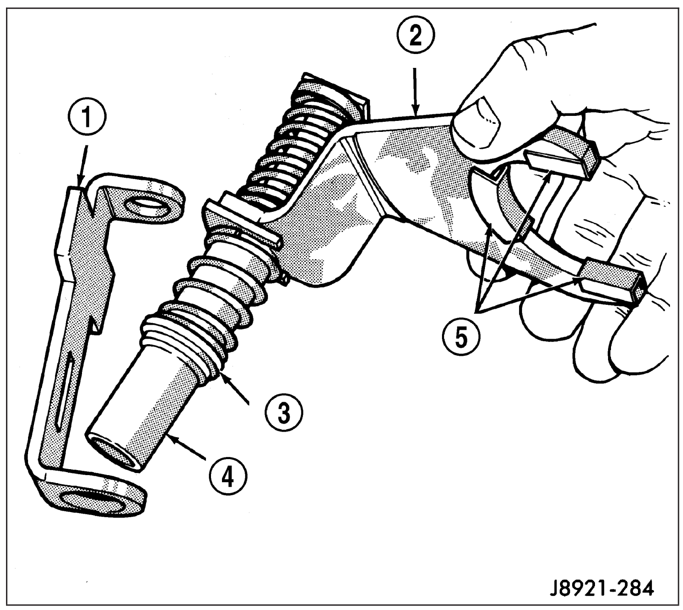

13. Install clutch shaft thrust washer (1).



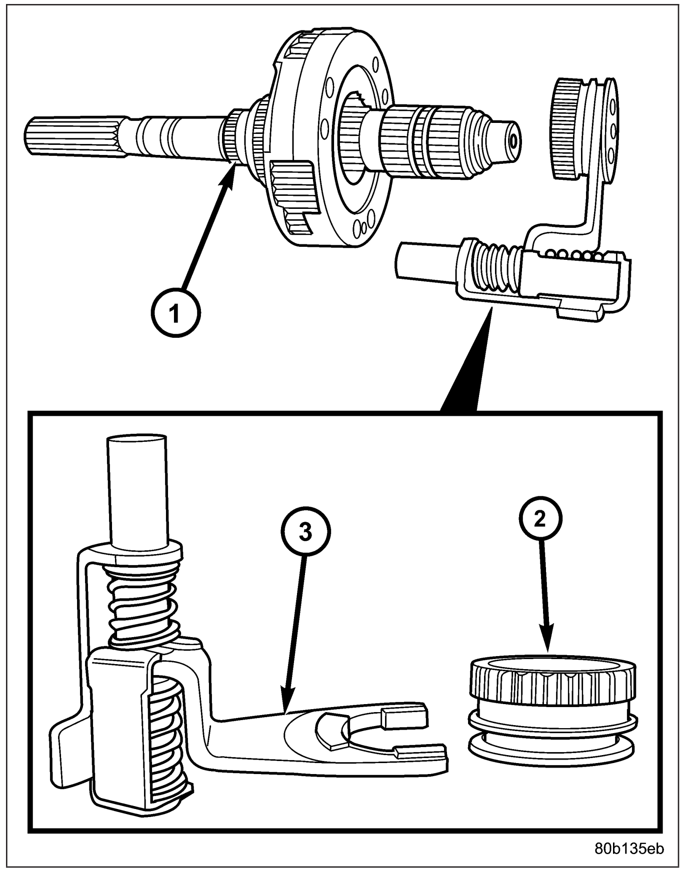
14. Install clutch shaft (2) snap-ring (1).



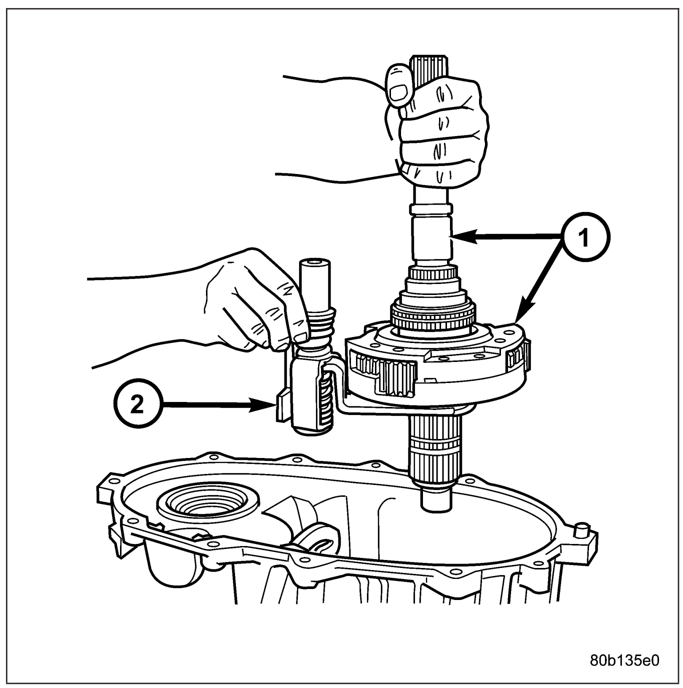

15. Inspect mode fork assembly. Replace pads (5) and bushing (3), if necessary. Replace fork tube (4) if bushings inside tube are worn or damaged. Also check springs (3) and slider bracket. Replace worn, damaged components.



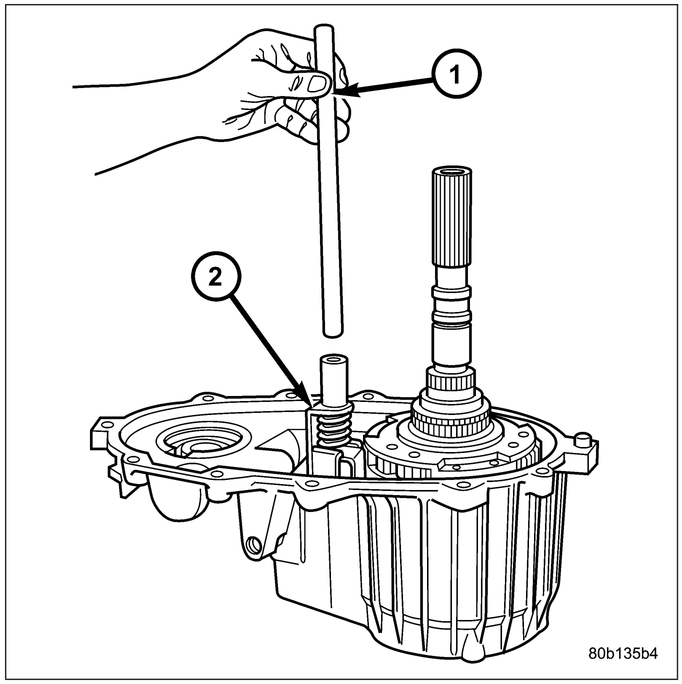
16. Install mode sleeve (2) in mode fork (3). Then install assembled sleeve and fork on mainshaft. Be sure mode sleeve splines are engaged in differential splines.



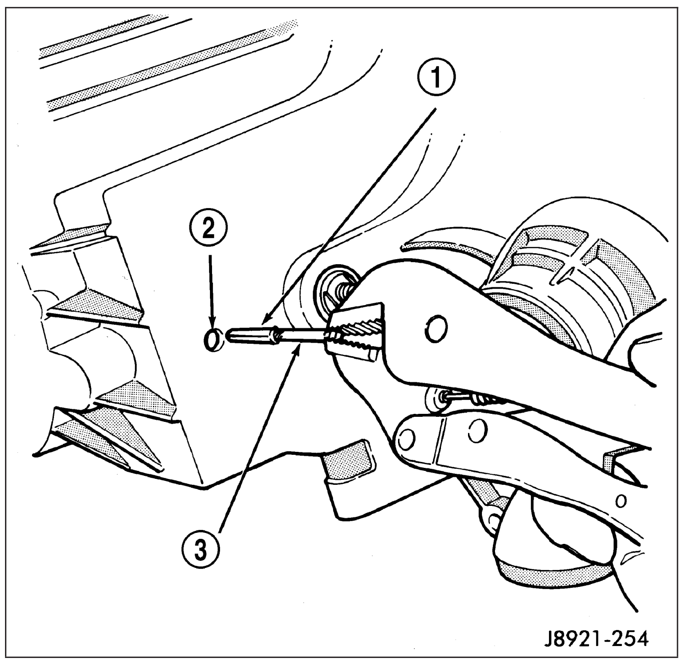

17. Install mode fork (2) and mainshaft assembly (1) in case. Rotate mainshaft slightly to engage shaft with low range gears.
18. Rotate mode fork pin into shift sector slot.



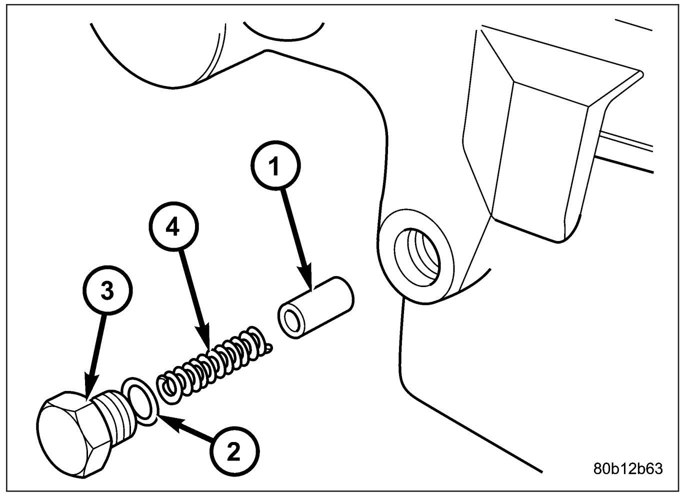
19. Install shift rail (1). Be sure rail is seated in both shift forks.




20. Rotate shift sector to align lockpin hole in low range fork with access hole in case.
21. Insert an easy-out (3) in range fork lockpin (1) to hold it securely for installation. Lockpin is slightly tapered on one end. Insert tapered end into fork and rail.
22. Insert lockpin through access hole and into shift fork. Then remove easy-out and seat the pin with pin punch.
23. Install plug in lockpin access hole.

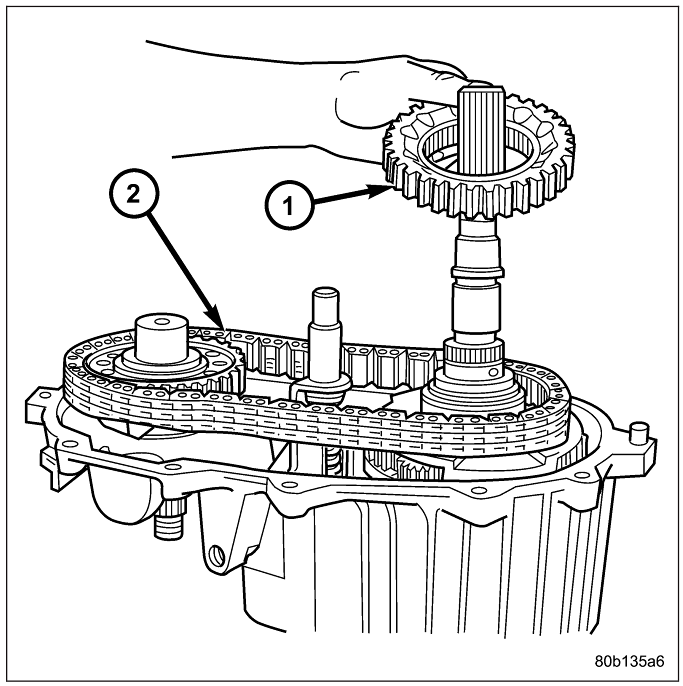


24. Install detent plunger (1), detent spring (4), and detent plug (3) in case.

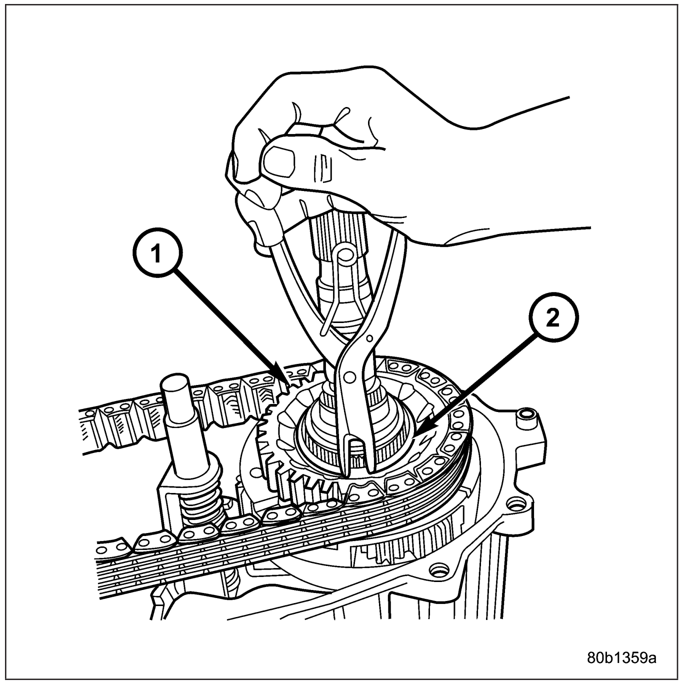



## FRONT OUTPUT SHAFT AND DRIVE CHAIN

1. Install front output shaft.
2. Install drive chain (2). Engage chain with front output shaft sprocket teeth.
3. Install drive sprocket (1). Engage drive sprocket teeth with chain. Then engage sprocket splines with mainshaft splines.

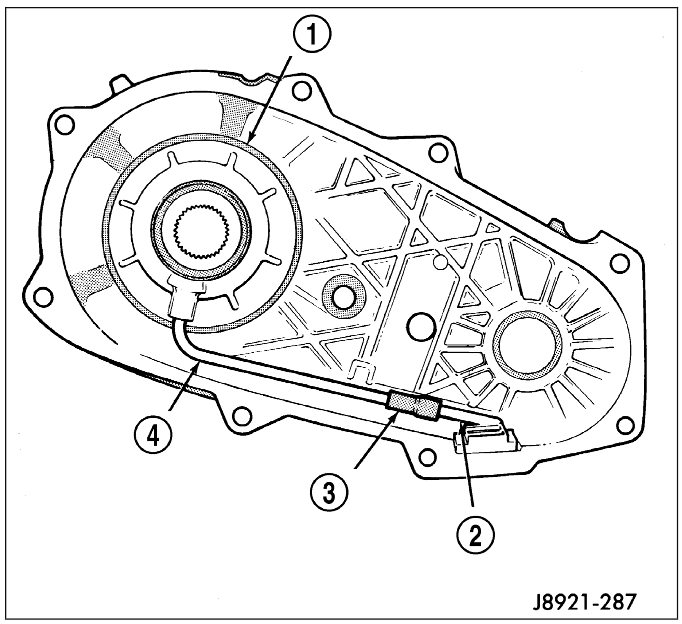


4. Install drive sprocket (1) snap-ring (2).

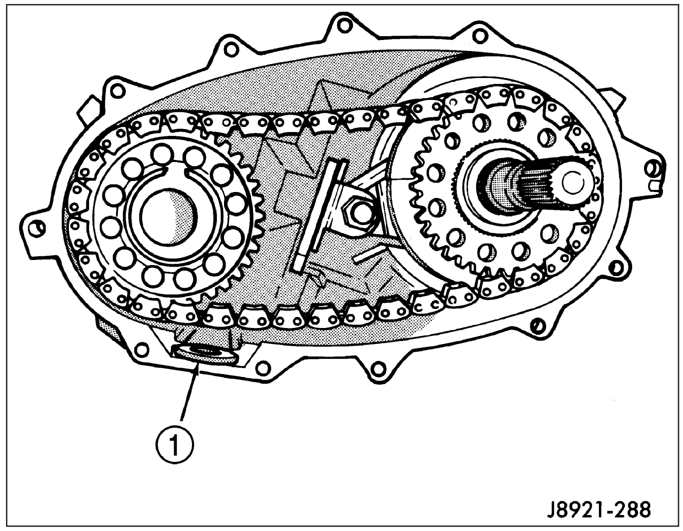



## OIL PUMP AND REAR CASE

1. Insert oil pickup tube (4) in oil pump (1) and attach oil screen (2) and connector hose (3) to pickup tube. Then install assembled pump, tube and screen in rear case. Be sure screen is seated in case slot as shown.

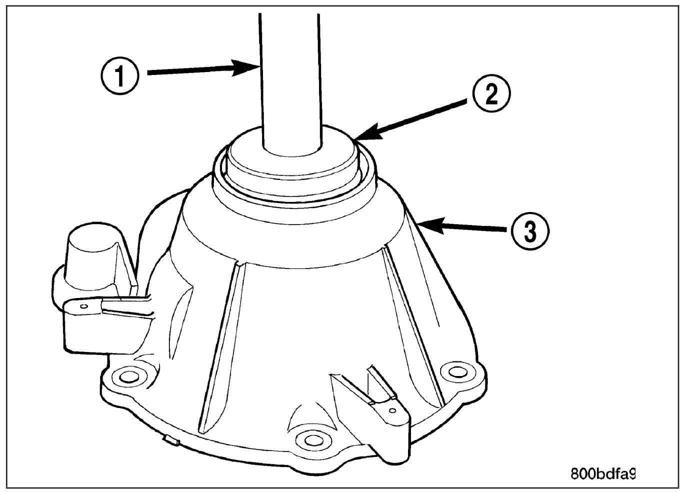


2. Install magnet in front case pocket.
3. Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to seal surface of front case.
4. Align and install rear case on front case. Be sure case locating dowels are in place and that main-shaft splines are engaged in oil pump inner gear.
5. Install and tighten front case-to-rear case bolts to 41 N·m (30 ft. lbs.) torque. Be sure to install a washer under each bolt used at case dowel locations.

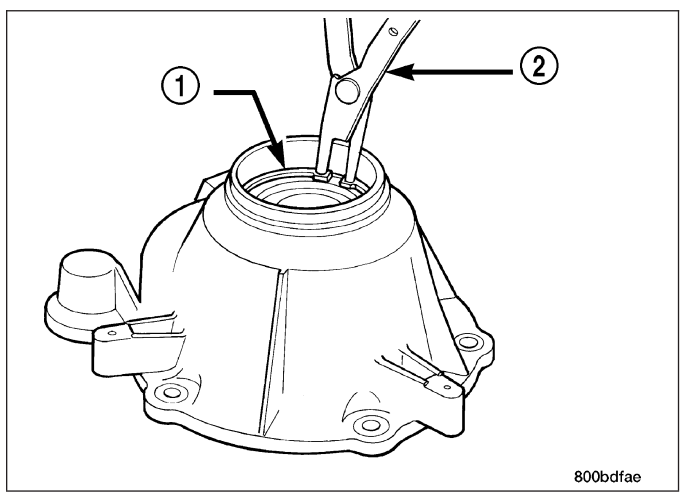



## REAR RETAINER

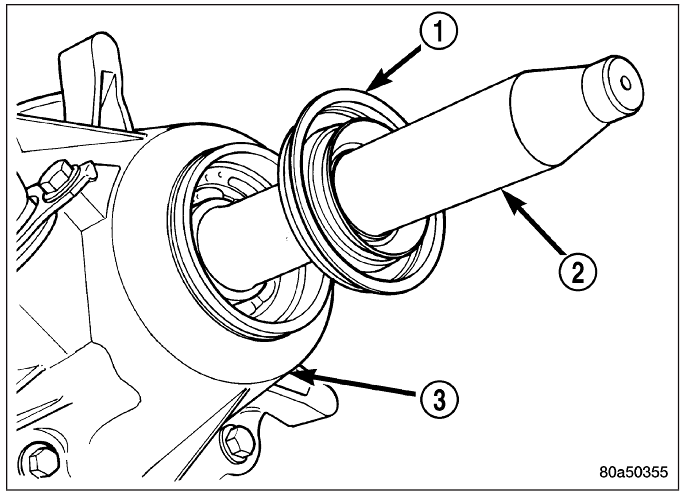
1. Remove rear bearing in retainer using Installer 8128 and Handle C-4171.
2. Install rear bearing in retainer with Tools C-4171 (1) and 5064 (2).



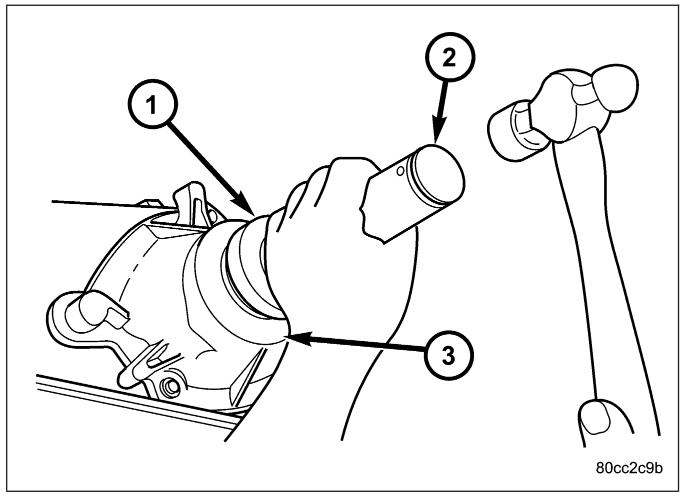

3. Install rear bearing O.D. retaining ring (1) with snap-ring pliers (2). Be sure retaining ring is fully seated in retainer groove.



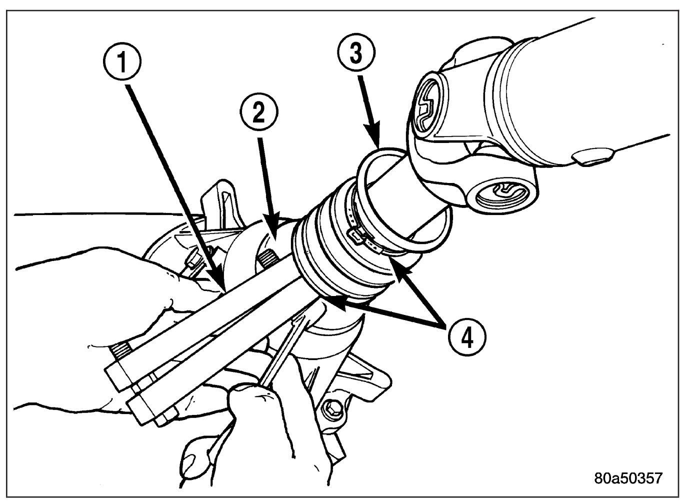
4. Apply bead of Mopar® Sealer P/N 82300234, or Loctite™ Ultra Gray, to mating surface of rear retainer. Sealer bead should be a maximum of 3/16 in.
5. Install rear retainer on rear case. Tighten retainer bolts to 20-27 N·m (15-20 ft. lbs.) torque.
6. Install rear bearing I.D. retaining ring and spacer on output shaft.
7. Apply liberal quantity of petroleum jelly to new rear seal and to output shaft. Petroleum jelly is needed to protect seal lips during installation.
8. Slide seal onto Seal Protector 8824 (2). Slide seal protector and seal (1) onto output shaft.




9. Slide Installer 8691 (1) onto seal protector with the recessed side of the tool toward the seal. Drive seal into rear bearing retainer with Installer 8691.

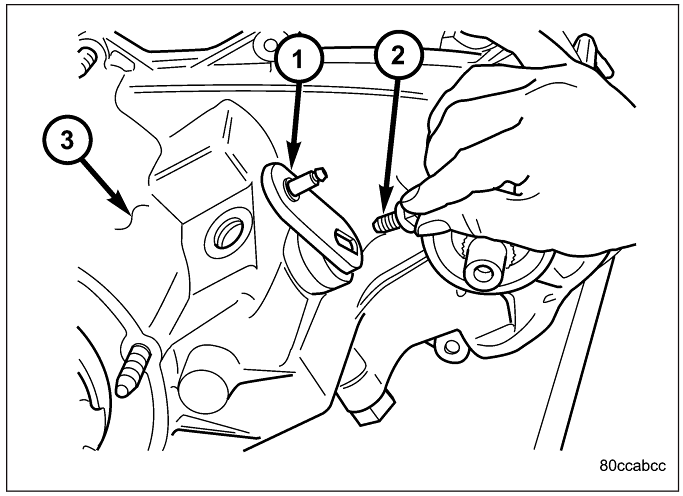



10. Install rear slinger with Installer 9023.
11. Install boot (3) on output shaft slinger (2) and crimp retaining clamp (4) with tool C-4975-A (1).

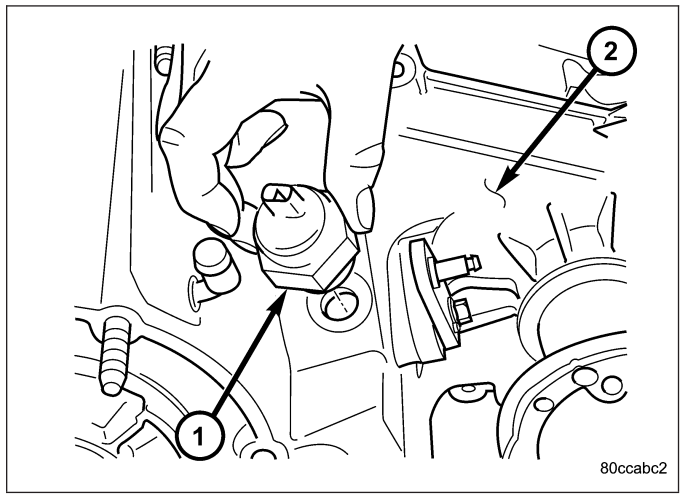


### COMPANION FLANGE AND RANGE LEVER

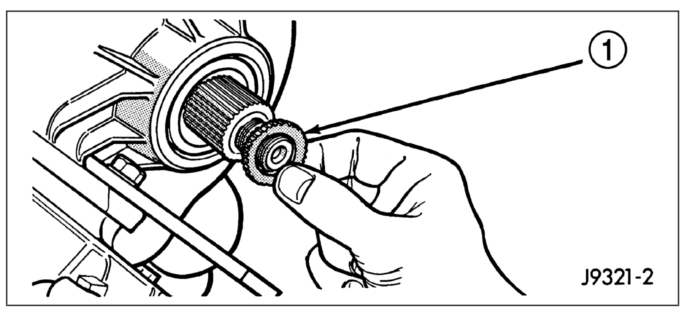
1. Install range lever (1) and bolt (2) on sector shaft. Tighten bolt to 27-34 N·m (20-25 ft. lbs.) torque.




2. Inspect the o-ring on the transfer case position sensor. Replace the o-ring if necessary.
3. Install the transfer case position sensor (1) in the front case (2). Tighten sensor to 20-34 N·m (15-25 ft. lbs.) torque.




4. Install new seal washer (1) on front output shaft.
5. Lubricate companion flange hub with transmission fluid and install flange onto the front ouput shaft.
6. Install new seal washer on front shaft.
7. Install new flange nut onto front output shaft.
8. Tighten flange nut to 122-176 N·m (90-130 ft. lbs.) torque.




## INSTALLATION

1. Mount transfer case on a transmission jack.
2. Secure transfer case to jack with chains.
3. Position transfer case under vehicle.
4. Align transfer case and transmission shafts and install transfer case on transmission.
5. Install and tighten transfer case attaching nuts to 35 N·m (26 ft. lbs.) torque.
6. Connect vent hose.
7. Connect transfer case position sensor connector to sensor.

8. Align and connect propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION).
9. Fill transfer case with correct fluid. Check transmission fluid level. Correct as necessary.
10. Install skid plate. (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION)
11. Remove transmission jack and support stand.
12. Connect shift cable to transfer case range lever.
13. Lower vehicle and verify transfer case shift operation.

# SPECIFICATIONS

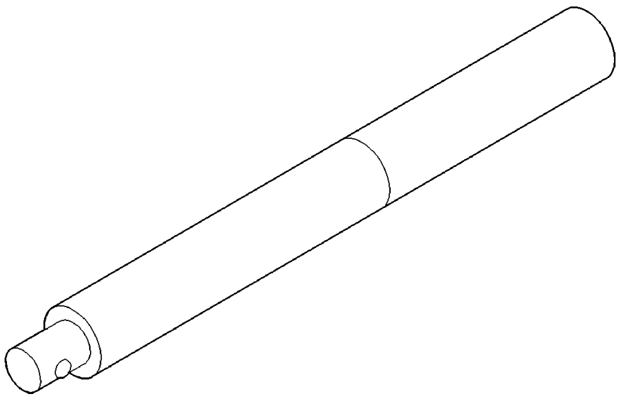
## NV242 TRANSFER CASE

### TORQUE SPECIFICATIONS

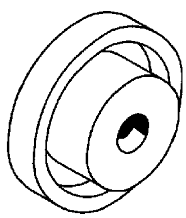
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Plug, Detent | 20 | 15 | - |
| Bolt, Differential Case | 22 | 16 | - |
| Plug, Drain/Fill | 27 | 20 | - |
| Bolt, Front Brg. Retainer | 22 | 16 | - |
| Bolt, Case Half | 41 | 30 | - |
| Nut, Front Companion Flange | 149 | 110 | - |
| Bolt, Range Lever | 31 | 23 | - |
| Bolt, Rear Retainer | 41 | 30 | - |
| Nuts, Mounting | 35 | 26 | - |
| Screw, Oil Pump | 1.5 | - | 13.5 |
| Sensor, Transfer Case Position | 27 | 20 | - |

## SPECIAL TOOLS

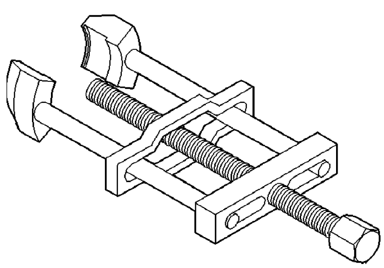
## TRANSFER CASE - NV242



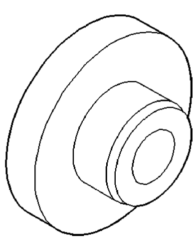
*Handle, Universal - C-4171*



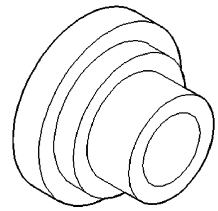
*Remover - C-4210*



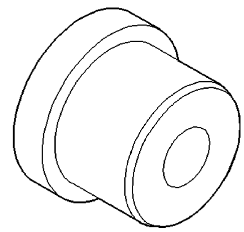
*Puller, Slinger - MD-998056-A*



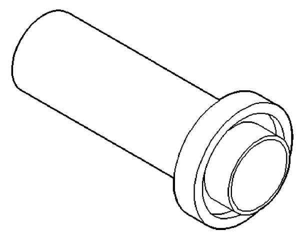
*Installer, Bearing - 5064*



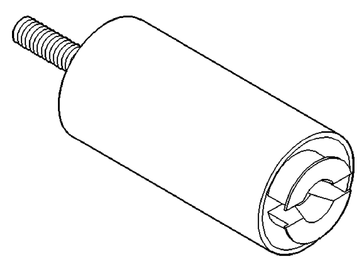
*Installer - 8128*



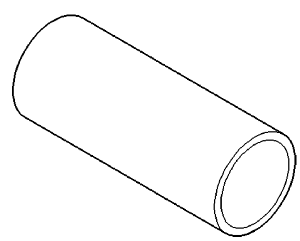
*Installer - 5066*



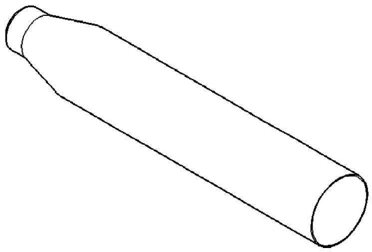
*Installer - 6952-A*



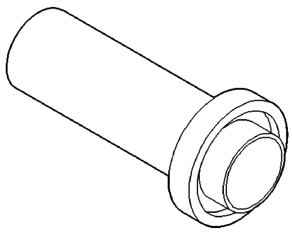
*Remover - L-4454*



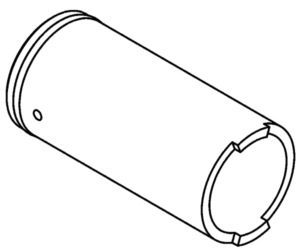
*Cup - 8148*



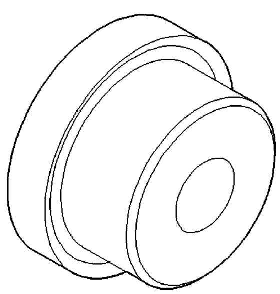
Seal Protector - 8824



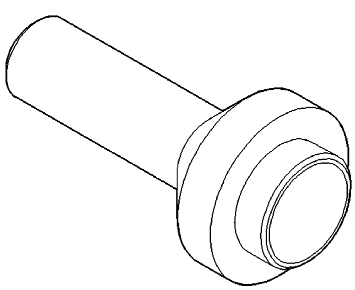
Installer, Seal - 8691



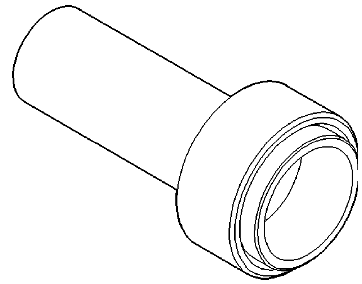
Installer, Output Shaft Slinger - 9023



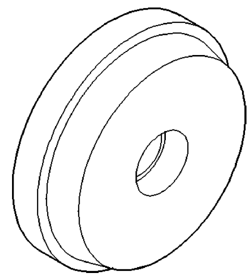
Installer, Input Gear Bearing - 7829-A



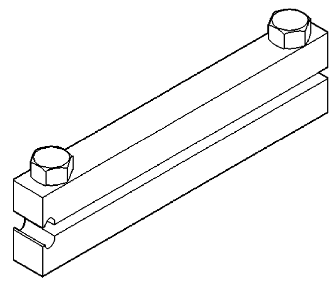
Installer, Seal - 7884



Installer, Pump Housing Seal - 7888



Installer, Bearing - 8033-A

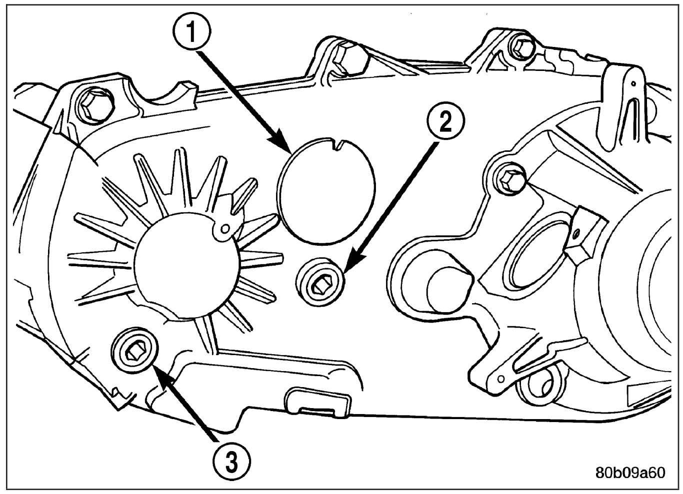


Installer, Boot Clamp - C-4975-A

# FLUID

## STANDARD PROCEDURE - FLUID DRAIN AND FILL

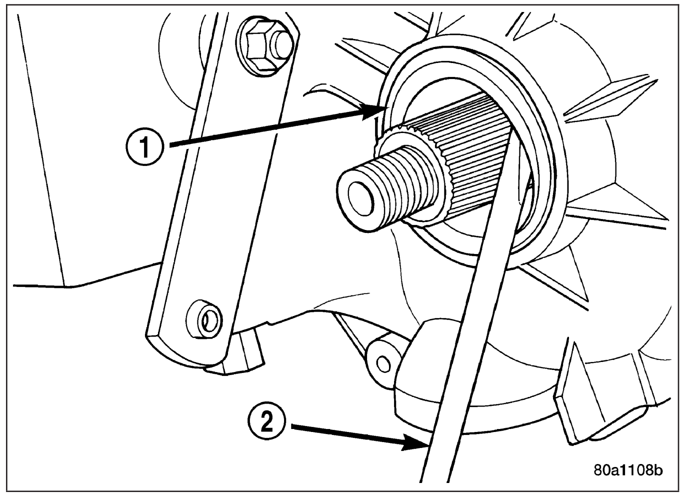
The fill (2) and drain (3) plugs are both in the rear case. Correct fill level is to the bottom edge of the fill plug hole. Be sure the vehicle is level to ensure an accurate fluid level check.



# SEAL-FRONT OUTPUT SHAFT

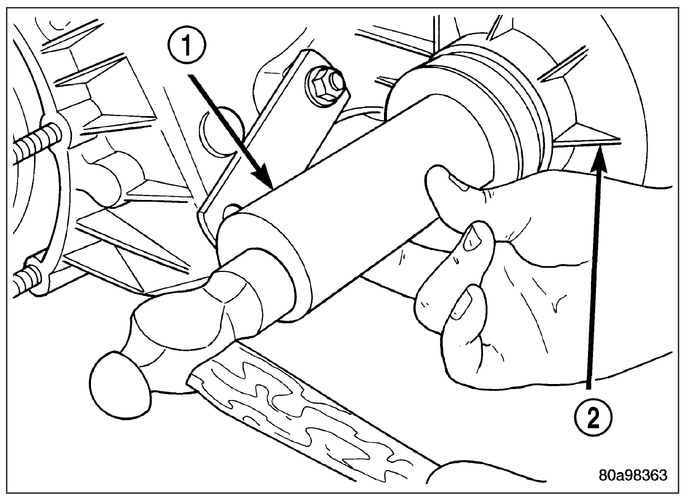
## REMOVAL

1. Raise vehicle.
2. Remove front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
3. Remove front output shaft companion flange.
4. Remove seal (1) from front case with pry tool (2).




## INSTALLATION

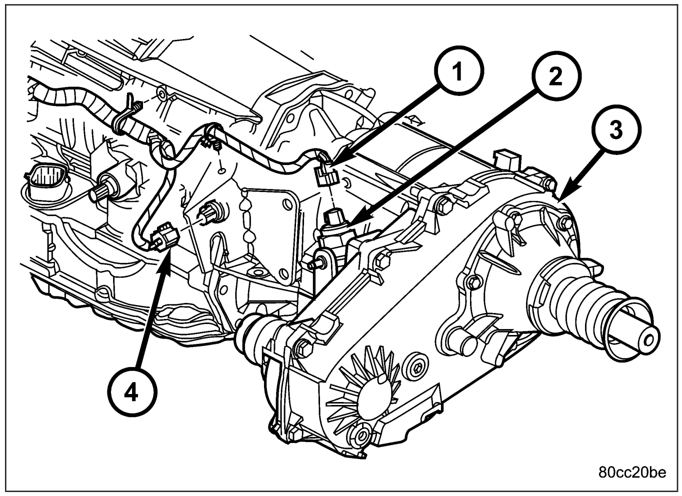
1. Install new front output seal in front case (2) with Installer Tool 6952-A (1) as follows:
   a. Place new seal on tool. Garter spring on seal goes toward interior of case.
   b. Start seal in bore with light taps from hammer. Once seal is started, continue tapping seal into bore until installer tool seats against case.
2. Install the front output shaft companion flange. Tighten the companion flange nut to 149 N·m (110 ft.lbs.).
3. Install the front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)



# SENSOR-POSITION

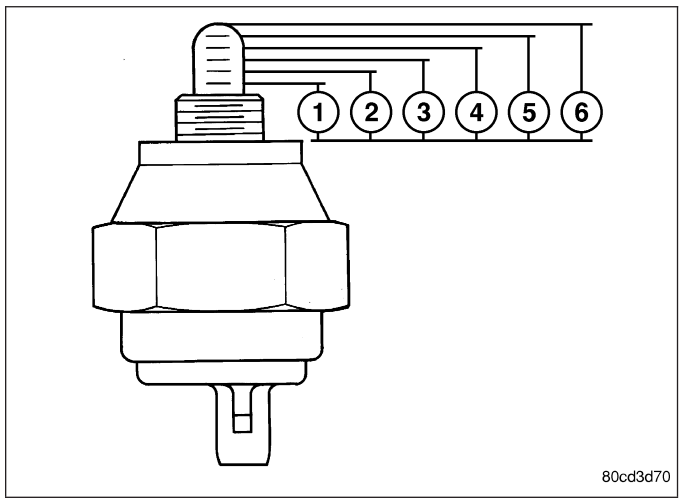
## DESCRIPTION

The transfer case position sensor (2) is an electronic device whose output can be interpreted to indicate the transfer case's current operating mode. The sensor consists of a five position, resistive multiplexed circuit which returns a specific resistance value to the Powertrain Control Module (PCM) for each transfer case operating mode. The sensor is located on the top of the transfer case, just left of the transfer case centerline and rides against the sector plate roostercomb. The PCM supplies 5VDC (+/- 0.5V) to the sensor and monitors the return voltage to determine the sector plate, and therefore the transfer case, position.




## OPERATION

During normal vehicle operation, the Powertrain Control Module (PCM) monitors the transfer case position sensor return voltage to determine the operating mode of the transfer case. Refer to the Operating Mode Versus Resistance table for the correct resistance for each position.




***Position Sensor Linear Movement***

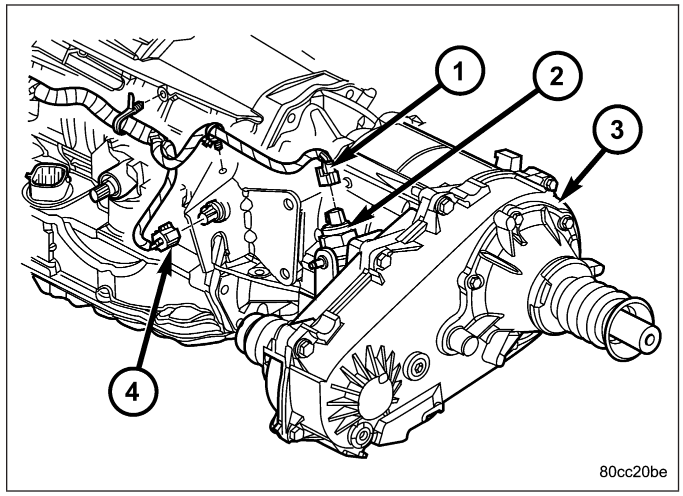
1 - POSITION 1 - 10mm ±0.5mm
2 - POSITION 2 - 12mm ±0.5mm
3 - POSITION 3 - 14mm ±0.5mm
4 - POSITION 4 - 16mm ±0.5mm
5 - POSITION 5 - 18mm ±0.5mm
6 - POSITION 6 - 20mm±0.5mm - FULL EXTENSION

**Operating Mode Versus Resistance**

| SENSOR POSITION | OPERATING MODE | SENSOR RESISTANCE (ohms) |
|---|---|---|
| 1 | 2WD | 1124-1243 |
| 2 | 4WD PART TIME | 650-719 |
| 3 | 4WD FULL TIME | 389-431 |
| 4 | NEUTRAL | 199-221 |
| 5 | 4WD LOW | 57-64 |

## REMOVAL

1. Raise and support the vehicle.
2. Disengage the transfer case position sensor connector from the position sensor (2).
3. Remove the position sensor from the transfer case.



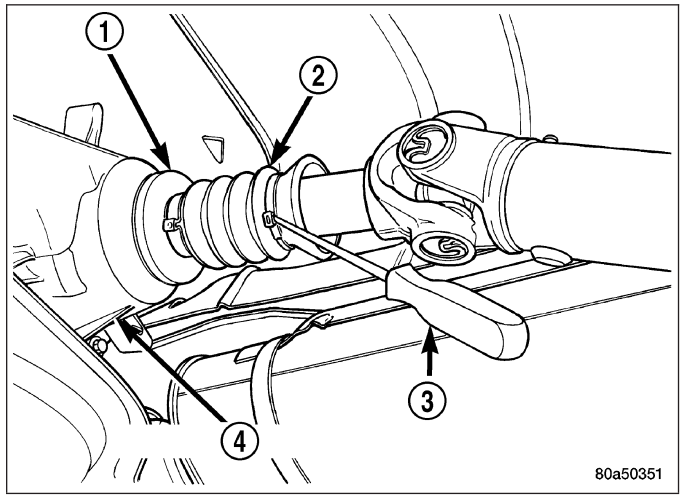

## INSTALLATION

1. Inspect the o-ring seal on the transfer case position sensor. Replace the o-ring if necessary.
2. Install the transfer case position sensor into the transfer case. Torque the sensor to 27 N·m (20 ft.lbs.).
3. Engage the transfer case position sensor connector to the position sensor.
4. Lower vehicle.
5. Verify proper sensor operation.

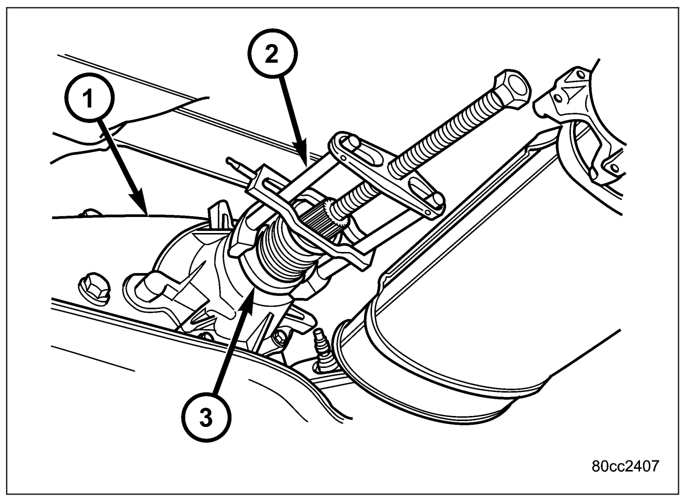
# SEAL-REAR OUTPUT SHAFT

## REMOVAL

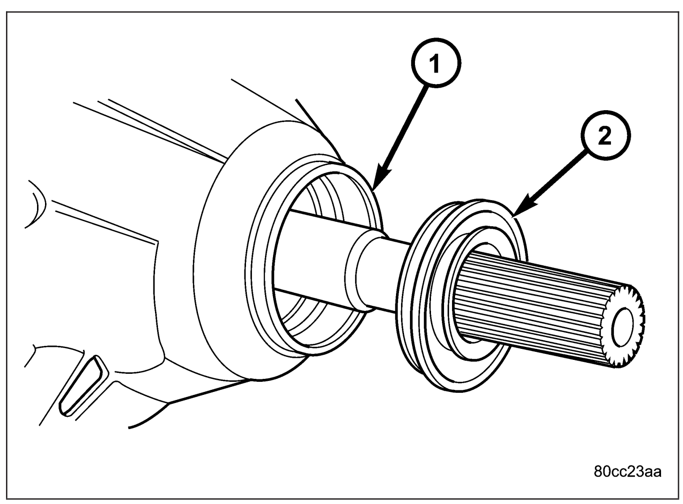
1. Shift the transmission and transfer case into NEUTRAL.
2. Raise and support vehicle.
3. Mark a line across the pinion shaft and at each end of the propeller shaft for installation reference.
4. Remove the U-joint strap bolts at the pinion shaft yoke.
5. Pry open clamp holding the dust boot (2) to propeller shaft yoke.




6. Slide the slip yoke off of the transmission/transfer case output shaft and remove the propeller shaft.
7. Spread band clamp which holds output shaft boot to the output shaft slinger with a suitable awl, or equivalent.
8. Remove output shaft boot from slinger and output shaft.
9. Remove the output shaft rear slinger (3) using Puller MD-998056-A (2).

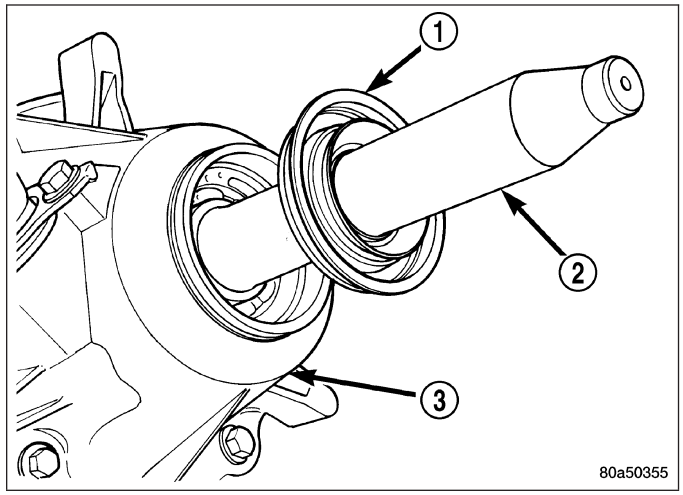



10. Use a suitable pry tool, or a slide hammer mounted screw, to remove the seal (2) from the rear retainer (1).

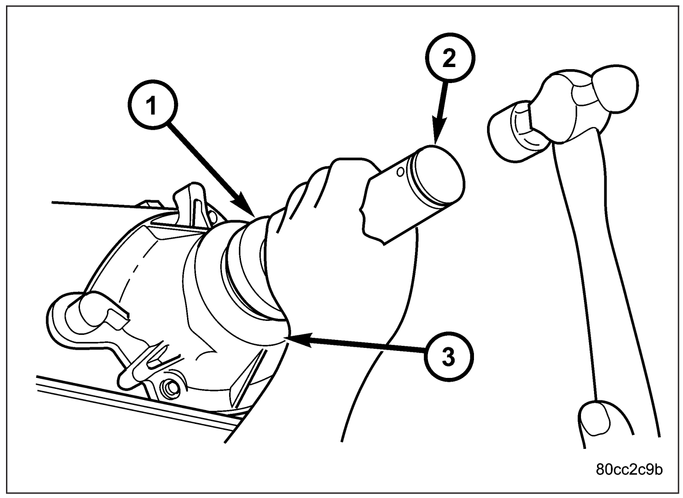


## INSTALLATION

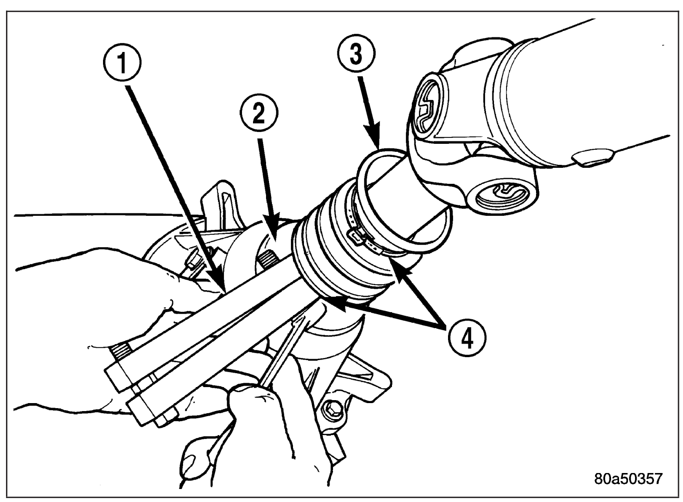
1. Apply liberal quantity of petroleum jelly to new rear seal and to output shaft. Petroleum jelly is needed to protect seal lips during installation.
2. Slide seal onto Seal Protector 8824 (2). Slide seal protector and seal onto output shaft.




3. Slide Installer 8691 (1) onto seal and mainshaft. Drive seal into rear bearing retainer.



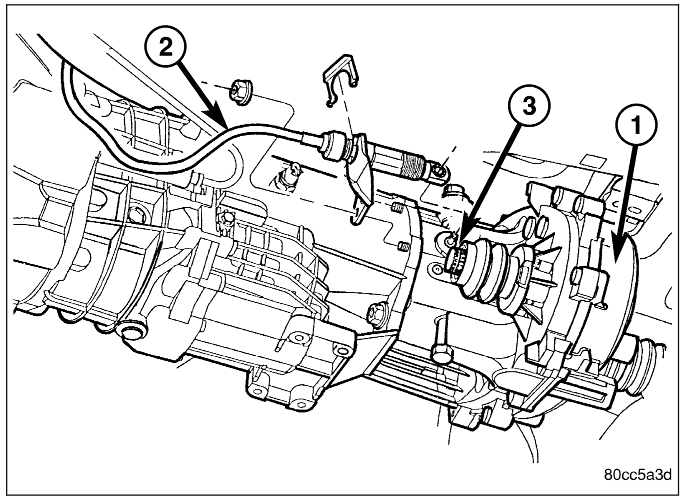

4. Install a new output shaft rear slinger with Installer 9023.
5. Install boot (3) on output shaft slinger and crimp retaining clamp with tool C-4975-A (1).
6. Slide the slip yoke on the transmission/transfer case output shaft. Align installation reference marks at the axle yoke and install the propeller shaft.
7. Tighten the U-joint strap/clamp bolts at the axle yoke to 19 N·m (14 ft. lbs.).
8. Crimp clamp with Clamp Tool C-4975A to hold dust boot to propeller shaft yoke.
9. Remove support and lower the vehicle.



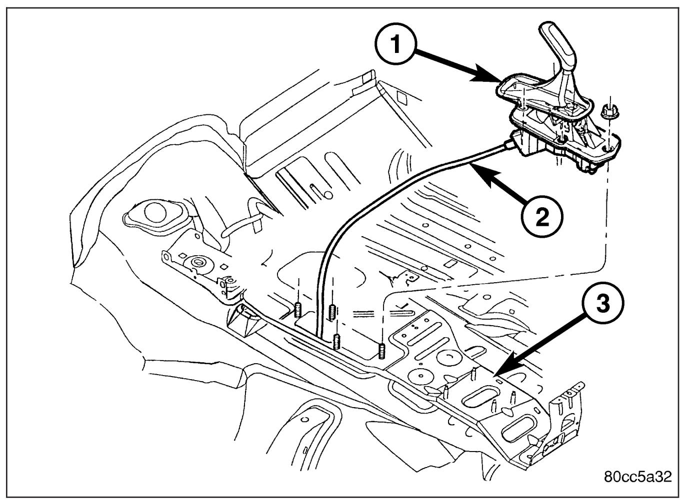
# LEVER-SHIFT

## REMOVAL

1. Shift transfer case into 4L.
2. Raise vehicle.
3. Remove clip securing the transfer case shift cable (2) to the shift cable support bracket.
4. Disengage any additional shift cable routing clips, if necessary.
5. Disengage the shift cable from the transfer case manual lever.




6. Lower vehicle.
7. Remove the floor console as necessary to access the shifter mechanism. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
8. Remove the nuts attaching lever assembly (1) to floorpan and remove assembly and shift cable (2).
9. Remove the shifter mechanism and cable assembly from the vehicle.




## INSTALLATION

1. Route the shift cable through the opening in the floor pan.
2. Position the shift mechanism over the shifter retaining studs on the floor pan.
3. Install the nuts to hold the shifter mechanism to the floor pan. Tighten the nuts to 11.86 N·m (105 in.lbs.).
4. Install any floor console components previously removed. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)
5. Verify that the floor shifter is in the 4L position.
6. Raise vehicle.
7. Route the shift cable through the opening in the shift cable support bracket.
8. Install the cable and a new spring clip into the slot in the support bracket.
9. Install any additional routing clips on the shift cable.
10. Verify that the transfer case is in the 4L position. The 4L position for the transfer case is with the manual lever to the full rearward position.
11. Attach the shift cable to the transfer case manual lever.
12. Lower vehicle and check for proper transfer case shifter operation.

# TIRES/WHEELS

## TABLE OF CONTENTS



## TIRES/WHEELS - ELECTRICAL DIAGNOSIS

### TABLE OF CONTENTS

# TIRE PRESSURE MONITORING SYSTEM - ELECTRICAL DIAGNOSIS

## DIAGNOSIS AND TESTING

## C0077- LOW TIRE PRESSURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  A low pressure condition will exist when the tire pressure falls below or is equal to the low pressure threshold value as specified for the vehicle.

| Possible Causes |
|---|
| INTERMITTENT PERFORMANCE DTC |
| INCORRECT TIRE PRESSURE |
| TIRE PRESSURE SENSOR |
| WCM (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE:**
**If the following conditions are present:**
**– Low Tire Pressure DTC (Stored)**
**– Tire Pressure Sensor Internal DTC (Active)**
**– Spare Tire is not equipped with a Tire Pressure Sensor**
**– Spare Tire is currently on the vehicle**
**Repair the tire and place it back on the vehicle.**
**Test drive the vehicle.**
**If the DTC(s) reset continue with the diagnostic procedure.**

Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 4

### 2. LOW TIRE PRESSURE

**NOTE: The DTC can be caused by many different factors and might not be a sensor/transmitter or a WCM (SKREEM) fault. Interference from other elements will over power the sensor/transmitter RF frequency making erratic operation to the TPM system. Check the vehicle for aftermarket accessories that could compromise the RF frequency signal before diagnosing the TPM system.**

Correct all tire pressure to the recommended specifications and wait 2 minutes.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Test Complete.

## 3. TIRE PRESSURE SENSOR

**NOTE: Before continuing, ensure the tire is free from any leaks or damage that would cause a low tire pressure condition. If a problem is found, repair as necessary and retest.**

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

**No** >> Test Complete.

## 4. INTERMITTENT TIRE PRESSURE SENSOR DTC

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

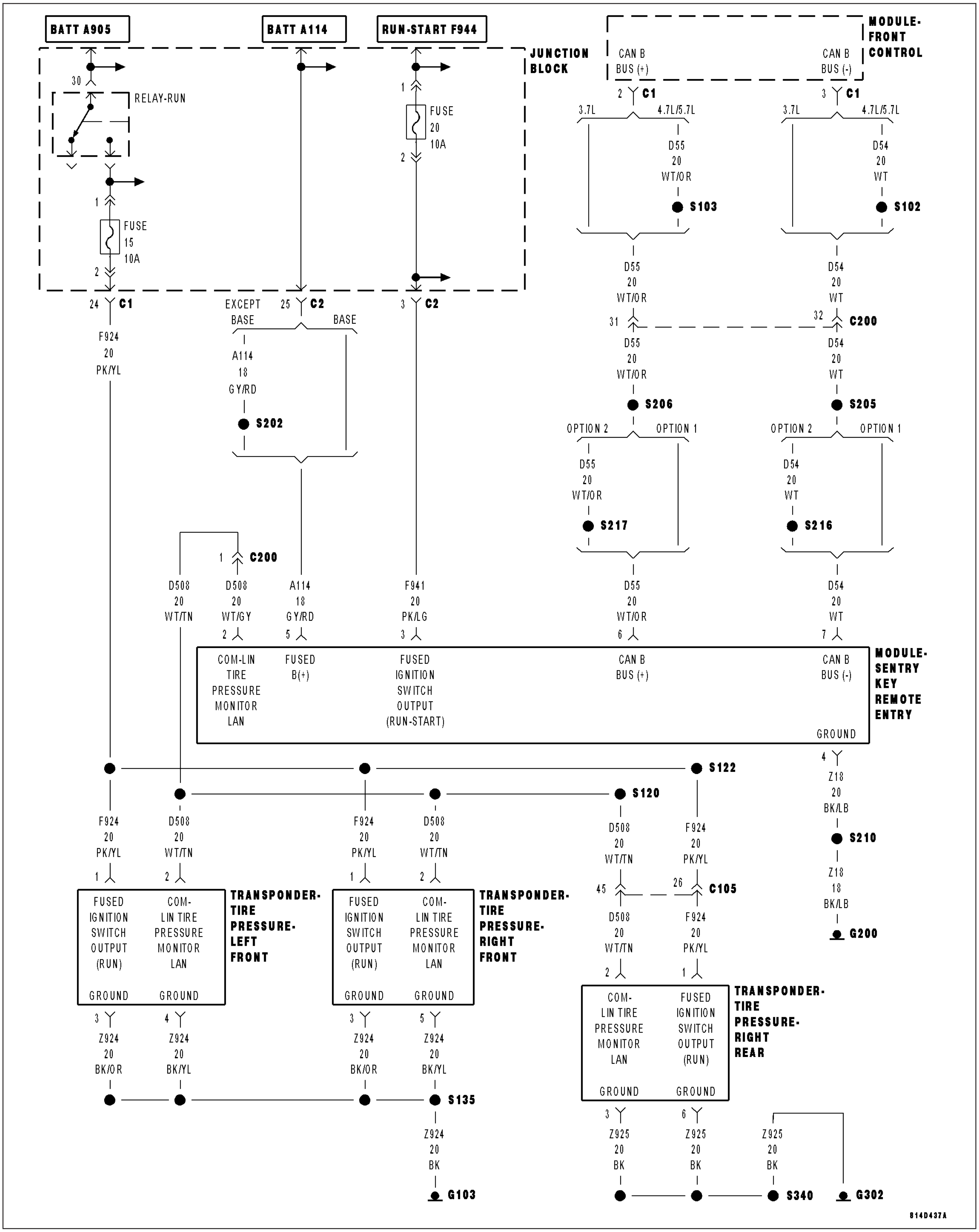
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Repair as necessary.

**No** >> Test complete.

## C1501–TIRE PRESSURE SENSOR 1 INTERNAL




For a complete wiring diagram **Refer to Section 8W**

## Theory of Operation

The tire pressure sensor actively monitors the air pressure and air temperature inside the tire, the sensor internal battery status, and the radial acceleration of the wheel. Each sensor has a unique ID code. The sensor transmits the data at regular intervals via an encoded signal to a receiver circuit located in the Wireless Control Module (SKREEM).

- **When Monitored:**
  With vehicle speed greater than 15 m.p.h. (24 km/h).
- **Set Condition:**
  The WCM (SKREEM) will monitor the signals from the four active road tire sensors. A loss of signal error is detected when eight consecutive blocks of data are not received or cannot be accurately decoded. An internal sensor hardware error condition will be set when an error in the accelerometer, pressure sensor, or temperature sensor is detected.

| Possible Causes |
|---|
| INTERMITTENT TIRE PRESSURE SENSOR INTERNAL DTC |
| TIRE PRESSURE SENSOR |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE:**
**If the following conditions are present:**
**– Low Tire Pressure DTC (Stored)**
**– Tire Pressure Sensor Internal DTC (Active)**
**– Spare Tire is not equipped with a Tire Pressure Sensor**
**– Spare Tire is currently on the vehicle**
**Repair the tire and place it back on the vehicle.**
**Test drive the vehicle.**
**If the DTC(s) reset continue with the diagnostic procedure.**
Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 4

### 2. TIRE PRESSURE SENSOR

**NOTE:**
**When working with vehicles equipped with the base tire pressure monitoring system the correct tire that set the fault must be identified. Following the below procedure will help in identifying the correct tire.**
**1. Set all tire pressures to the recommended specifications and recheck for fault/alert.**
**2. Turn the ignition on.**
**3. Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.**
**4. If the TPM fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**
Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.
With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).
Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Test Complete.

## 3. WIRELESS CONTROL MODULE (SKREEM)

View repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

## 4. INTERMITTENT TIRE PRESSURE SENSOR DTC

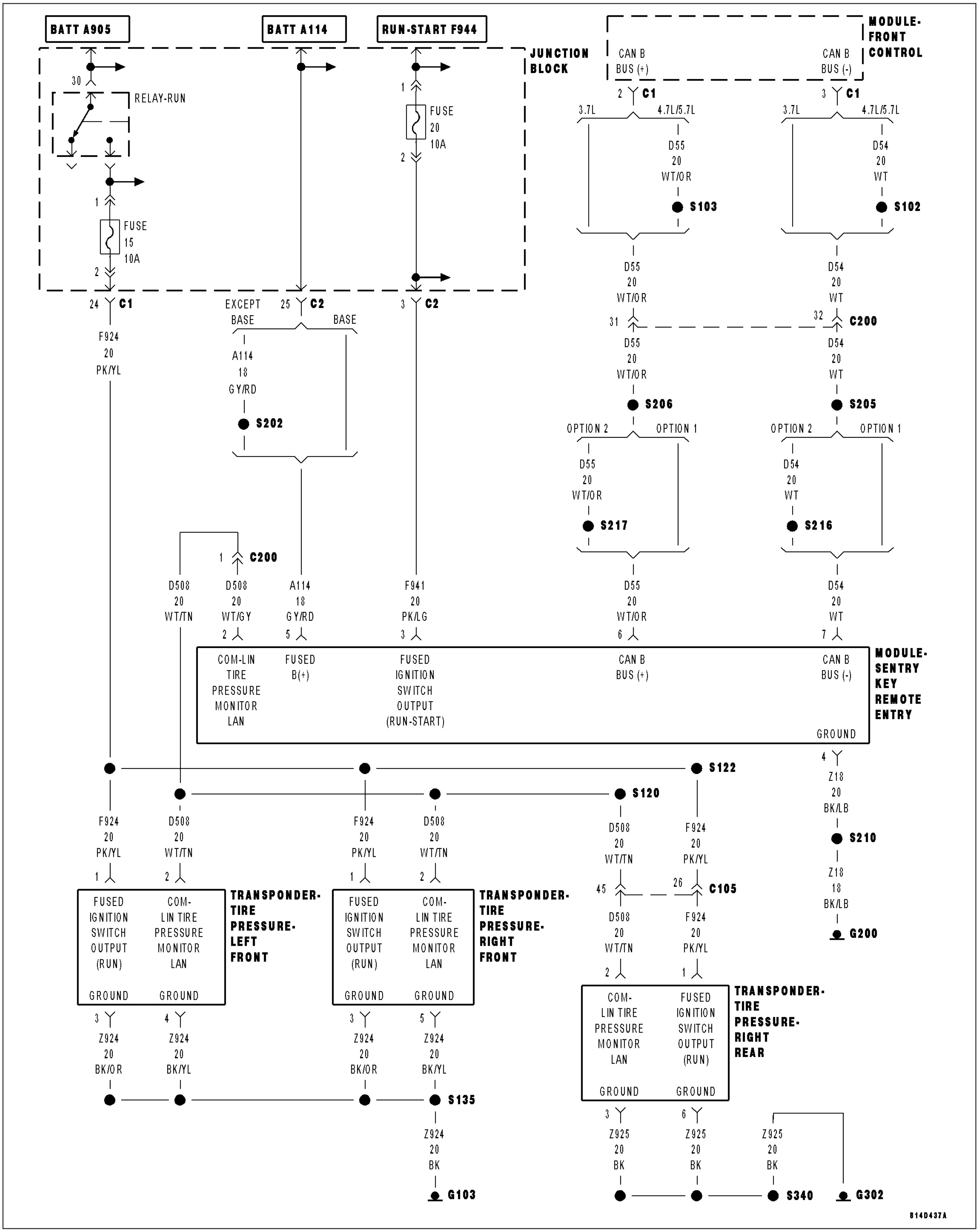
The conditions necessary to set this DTC are not present at this time.
Refer to any Technical Service Bulletins that may apply to this condition.
With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).
Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the beginning of this test and perform the diagnostic procedure as necessary.

**No** >> Test complete.

## C1502–TIRE PRESSURE SENSOR 2 INTERNAL




For a complete wiring diagram **Refer to Section 8W**

## Theory of Operation

The tire pressure sensor actively monitors the air pressure and air temperature inside the tire, the sensor internal battery status, and the radial acceleration of the wheel. Each sensor has a unique ID code. The sensor transmits the data at regular intervals via an encoded signal to a receiver circuit located in the Wireless Control Module (SKREEM).

- **When Monitored:**
  With vehicle speed greater than 15 m.p.h. (24 km/h).
- **Set Condition:**
  The WCM (SKREEM) will monitor the signals from the four active road tire sensors. A loss of signal error is detected when eight consecutive blocks of data are not received or cannot be accurately decoded. An internal sensor hardware error condition will be set when an error in the accelerometer, pressure sensor, or temperature sensor is detected.

| Possible Causes |
|---|
| INTERMITTENT TIRE PRESSURE SENSOR INTERNAL DTC |
| TIRE PRESSURE SENSOR |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE:**
**If the following conditions are present:**
**– Low Tire Pressure DTC (Stored)**
**– Tire Pressure Sensor Internal DTC (Active)**
**– Spare Tire is not equipped with a Tire Pressure Sensor**
**– Spare Tire is currently on the vehicle**
**Repair the tire and place it back on the vehicle.**
**Test drive the vehicle.**
**If the DTC(s) reset continue with the diagnostic procedure.**

Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 4

### 2. TIRE PRESSURE SENSOR

**NOTE:**
**When working with vehicles equipped with the base tire pressure monitoring system the correct tire that set the fault must be identified. Following the below procedure will help in identifying the correct tire.**
**1. Set all tire pressures to the recommended specifications and recheck for fault/alert.**
**2. Turn the ignition on.**
**3. Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.**
**4. If the TPM fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.
With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).
Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Test Complete.

## 3. WIRELESS CONTROL MODULE (SKREEM)

View repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

## 4. INTERMITTENT TIRE PRESSURE SENSOR DTC

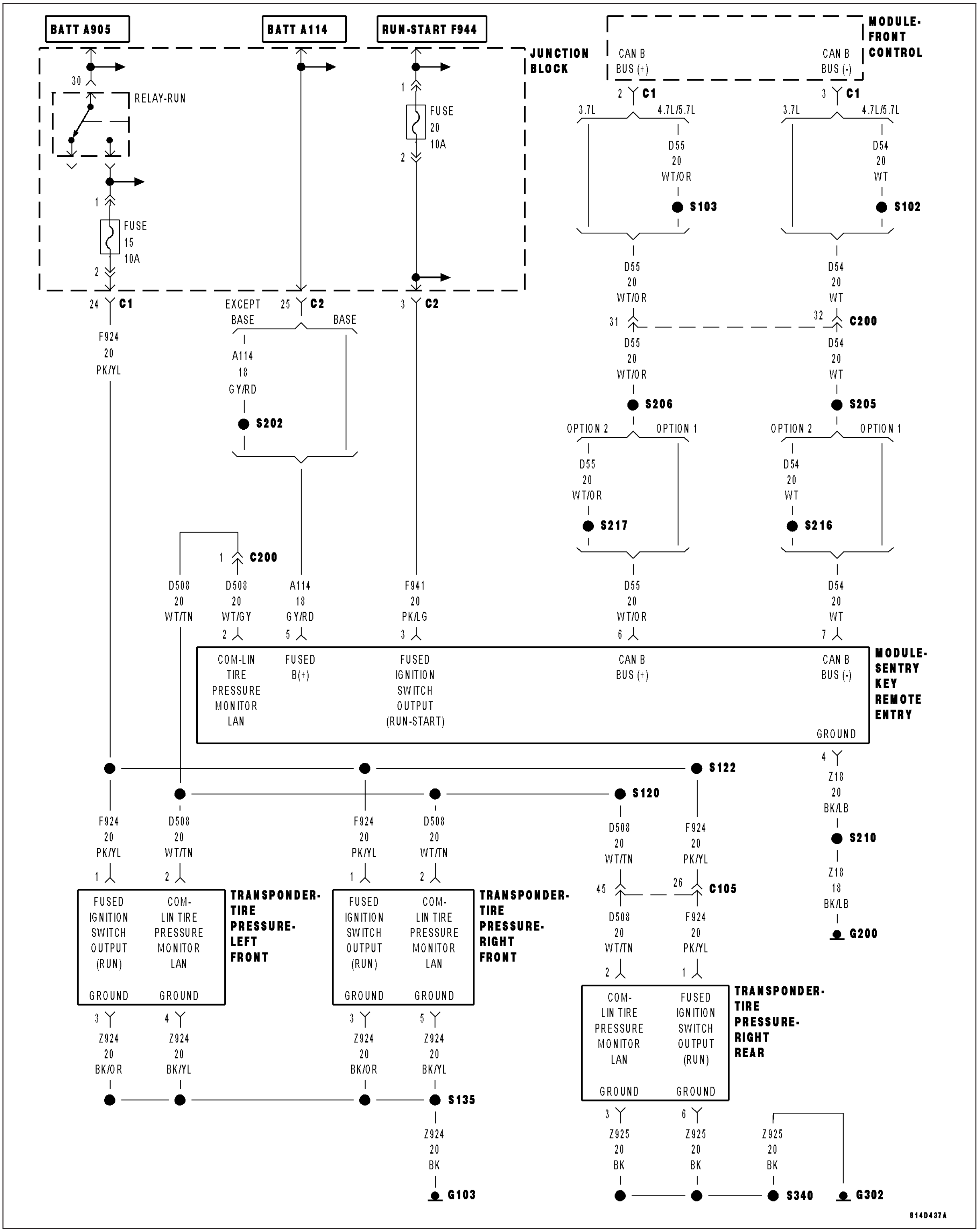
The conditions necessary to set this DTC are not present at this time.
Refer to any Technical Service Bulletins that may apply to this condition.
With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).
Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the beginning of this test and perform the diagnostic procedure as necessary.

**No** >> Test complete.

## C1503–TIRE PRESSURE SENSOR 3 INTERNAL




For a complete wiring diagram **Refer to Section 8W**

## Theory of Operation

The tire pressure sensor actively monitors the air pressure and air temperature inside the tire, the sensor internal battery status, and the radial acceleration of the wheel. Each sensor has a unique ID code. The sensor transmits the data at regular intervals via an encoded signal to a receiver circuit located in the Wireless Control Module (SKREEM).

- **When Monitored:**
  With vehicle speed greater than 15 m.p.h. (24 km/h).
- **Set Condition:**
  The WCM (SKREEM) will monitor the signals from the four active road tire sensors. A loss of signal error is detected when eight consecutive blocks of data are not received or cannot be accurately decoded. An internal sensor hardware error condition will be set when an error in the accelerometer, pressure sensor, or temperature sensor is detected.

| Possible Causes |
|---|
| INTERMITTENT TIRE PRESSURE SENSOR INTERNAL DTC |
| TIRE PRESSURE SENSOR |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE:**
**If the following conditions are present:**
**– Low Tire Pressure DTC (Stored)**
**– Tire Pressure Sensor Internal DTC (Active)**
**– Spare Tire is not equipped with a Tire Pressure Sensor**
**– Spare Tire is currently on the vehicle**
**Repair the tire and place it back on the vehicle.**
**Test drive the vehicle.**
**If the DTC(s) reset continue with the diagnostic procedure.**
Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 4

### 2. TIRE PRESSURE SENSOR

**NOTE:**
**When working with vehicles equipped with the base tire pressure monitoring system the correct tire that set the fault must be identified. Following the below procedure will help in identifying the correct tire.**
**1. Set all tire pressures to the recommended specifications and recheck for fault/alert.**
**2. Turn the ignition on.**
**3. Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.**
**4. If the TPM fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**
Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.
With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).
Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Test Complete.

## 3. WIRELESS CONTROL MODULE (SKREEM)

View repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

## 4. INTERMITTENT TIRE PRESSURE SENSOR DTC

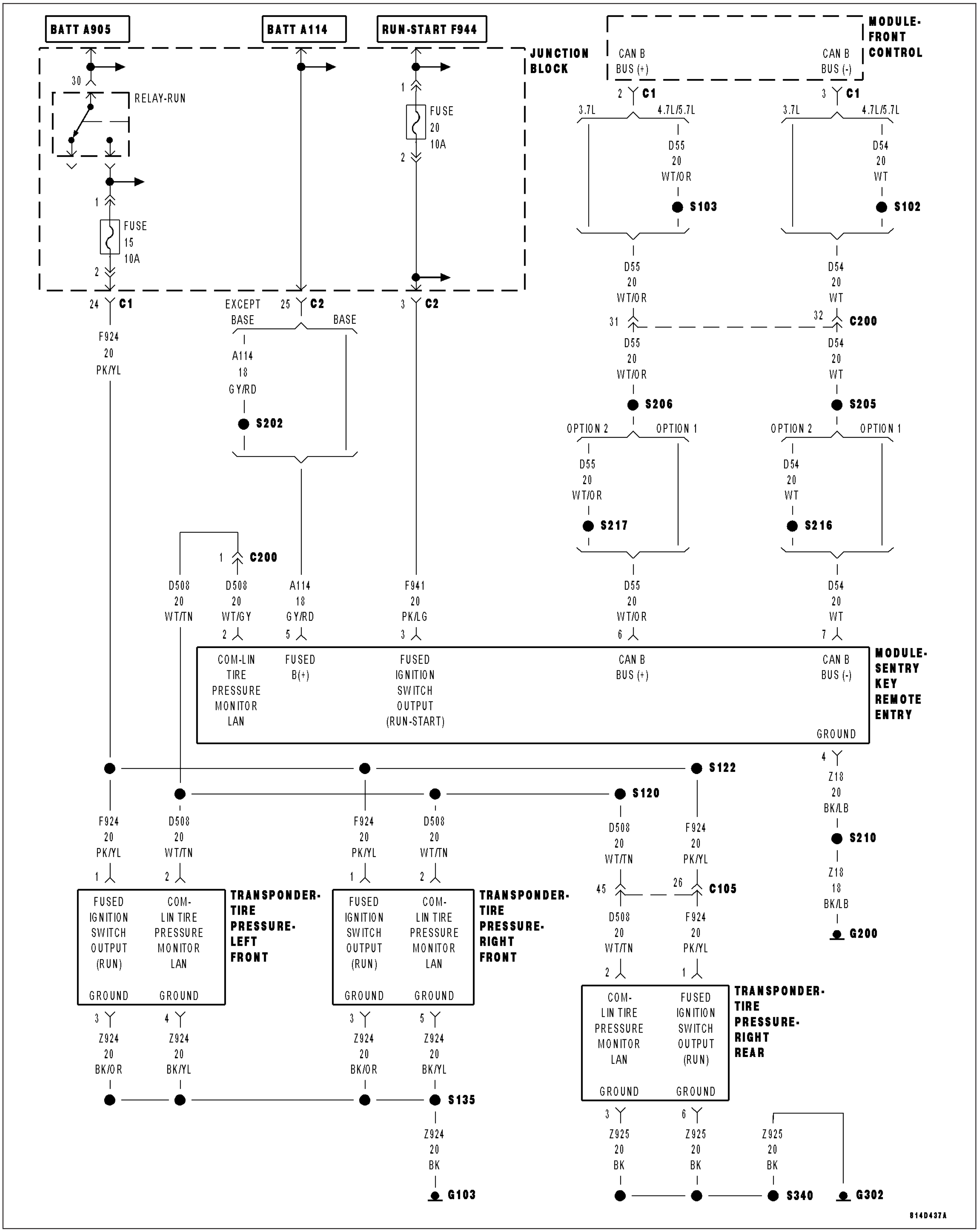
The conditions necessary to set this DTC are not present at this time.
Refer to any Technical Service Bulletins that may apply to this condition.
With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).
Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the beginning of this test and perform the diagnostic procedure as necessary.

**No** >> Test complete.

## C1504–TIRE PRESSURE SENSOR 4 INTERNAL




For a complete wiring diagram **Refer to Section 8W**

## Theory of Operation

The tire pressure sensor actively monitors the air pressure and air temperature inside the tire, the sensor internal battery status, and the radial acceleration of the wheel. Each sensor has a unique ID code. The sensor transmits the data at regular intervals via an encoded signal to a receiver circuit located in the Wireless Control Module (SKREEM).

- **When Monitored:**
  With vehicle speed greater than 15 m.p.h. (24 km/h).
- **Set Condition:**
  The WCM (SKREEM) will monitor the signals from the four active road tire sensors. A loss of signal error is detected when eight consecutive blocks of data are not received or cannot be accurately decoded. An internal sensor hardware error condition will be set when an error in the accelerometer, pressure sensor, or temperature sensor is detected.

| Possible Causes |
|---|
| INTERMITTENT TIRE PRESSURE SENSOR INTERNAL DTC |
| TIRE PRESSURE SENSOR |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE:**
**If the following conditions are present:**
**– Low Tire Pressure DTC (Stored)**
**– Tire Pressure Sensor Internal DTC (Active)**
**– Spare Tire is not equipped with a Tire Pressure Sensor**
**– Spare Tire is currently on the vehicle**
**Repair the tire and place it back on the vehicle.**
**Test drive the vehicle.**
**If the DTC(s) reset continue with the diagnostic procedure.**
Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 4

### 2. TIRE PRESSURE SENSOR

**NOTE:**
**When working with vehicles equipped with the base tire pressure monitoring system the correct tire that set the fault must be identified. Following the below procedure will help in identifying the correct tire.**
**1. Set all tire pressures to the recommended specifications and recheck for fault/alert.**
**2. Turn the ignition on.**
**3. Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.**
**4. If the TPM fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**
Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.
With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).
Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Test Complete.

## 3. WIRELESS CONTROL MODULE (SKREEM)

View repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

## 4. INTERMITTENT TIRE PRESSURE SENSOR DTC

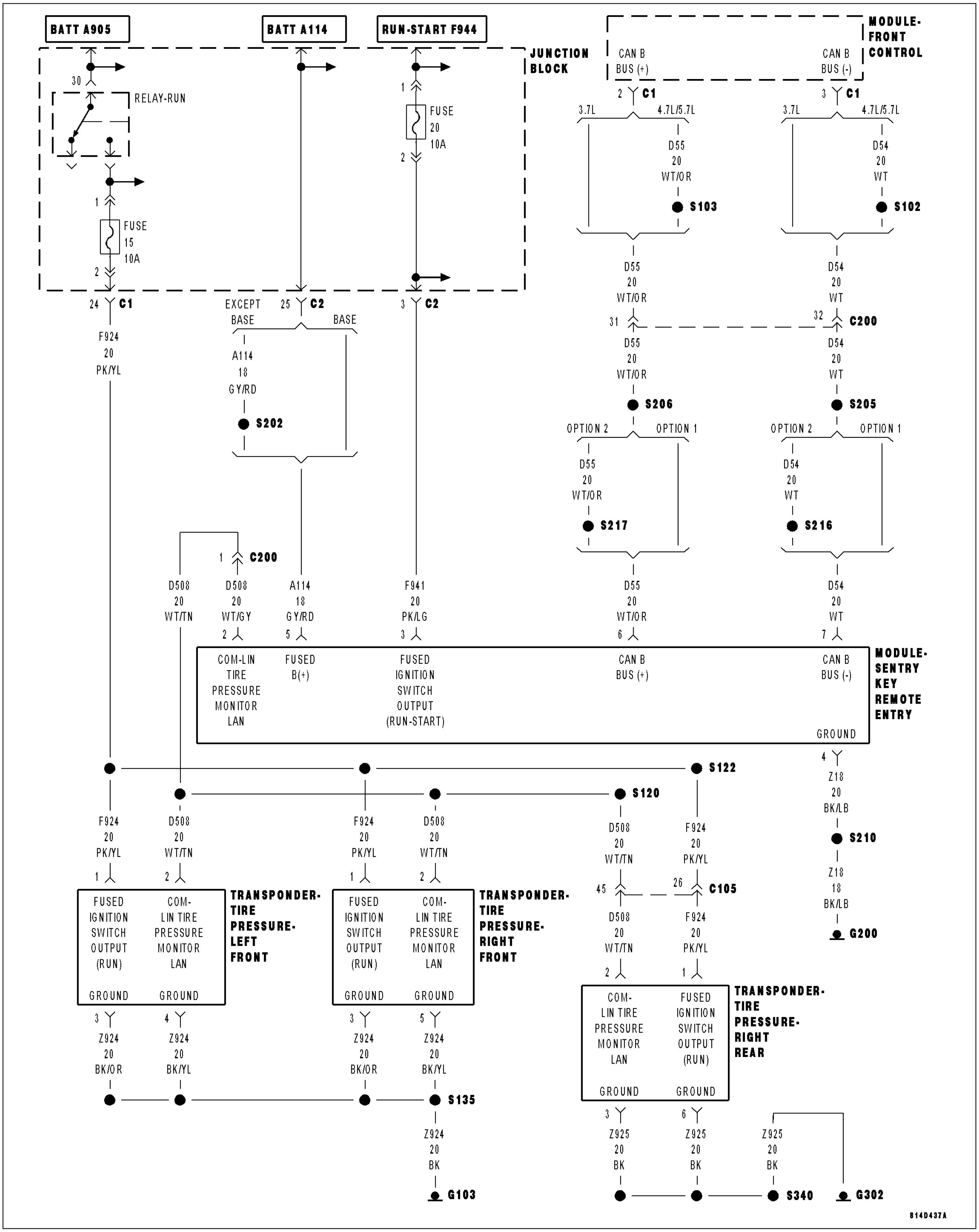
The conditions necessary to set this DTC are not present at this time.
Refer to any Technical Service Bulletins that may apply to this condition.
With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).
Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the beginning of this test and perform the diagnostic procedure as necessary.

**No** >> Test complete.

## C1505–TIRE PRESSURE SENSOR 5 INTERNAL




For a complete wiring diagram **Refer to Section 8W**

## Theory of Operation

The tire pressure sensor actively monitors the air pressure and air temperature inside the tire, the sensor internal battery status, and the radial acceleration of the wheel. Each sensor has a unique ID code. The sensor transmits the data at regular intervals via an encoded signal to a receiver circuit located in the Wireless Control Module (SKREEM).

- **When Monitored:**
  With vehicle speed greater than 15 m.p.h. (24 km/h).
- **Set Condition:**
  The WCM (SKREEM) will monitor the signals from the four active road tire sensors. A loss of signal error is detected when eight consecutive blocks of data are not received or cannot be accurately decoded. An internal sensor hardware error condition will be set when an error in the accelerometer, pressure sensor, or temperature sensor is detected.

| Possible Causes |
|---|
| INTERMITTENT TIRE PRESSURE SENSOR INTERNAL DTC |
| TIRE PRESSURE SENSOR |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE:**
**If the following conditions are present:**
**– Low Tire Pressure DTC (Stored)**
**– Tire Pressure Sensor Internal DTC (Active)**
**– Spare Tire is not equipped with a Tire Pressure Sensor**
**– Spare Tire is currently on the vehicle**
**Repair the tire and place it back on the vehicle.**
**Test drive the vehicle.**
**If the DTC(s) reset continue with the diagnostic procedure.**

Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 4

### 2. TIRE PRESSURE SENSOR

**NOTE:**
**When working with vehicles equipped with the base tire pressure monitoring system the correct tire that set the fault must be identified. Following the below procedure will help in identifying the correct tire.**
**1. Set all tire pressures to the recommended specifications and recheck for fault/alert.**
**2. Turn the ignition on.**
**3. Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.**
**4. If the TPM fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.
With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).
Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Test Complete.

## 3. WIRELESS CONTROL MODULE (SKREEM)

View repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

## 4. INTERMITTENT TIRE PRESSURE SENSOR DTC

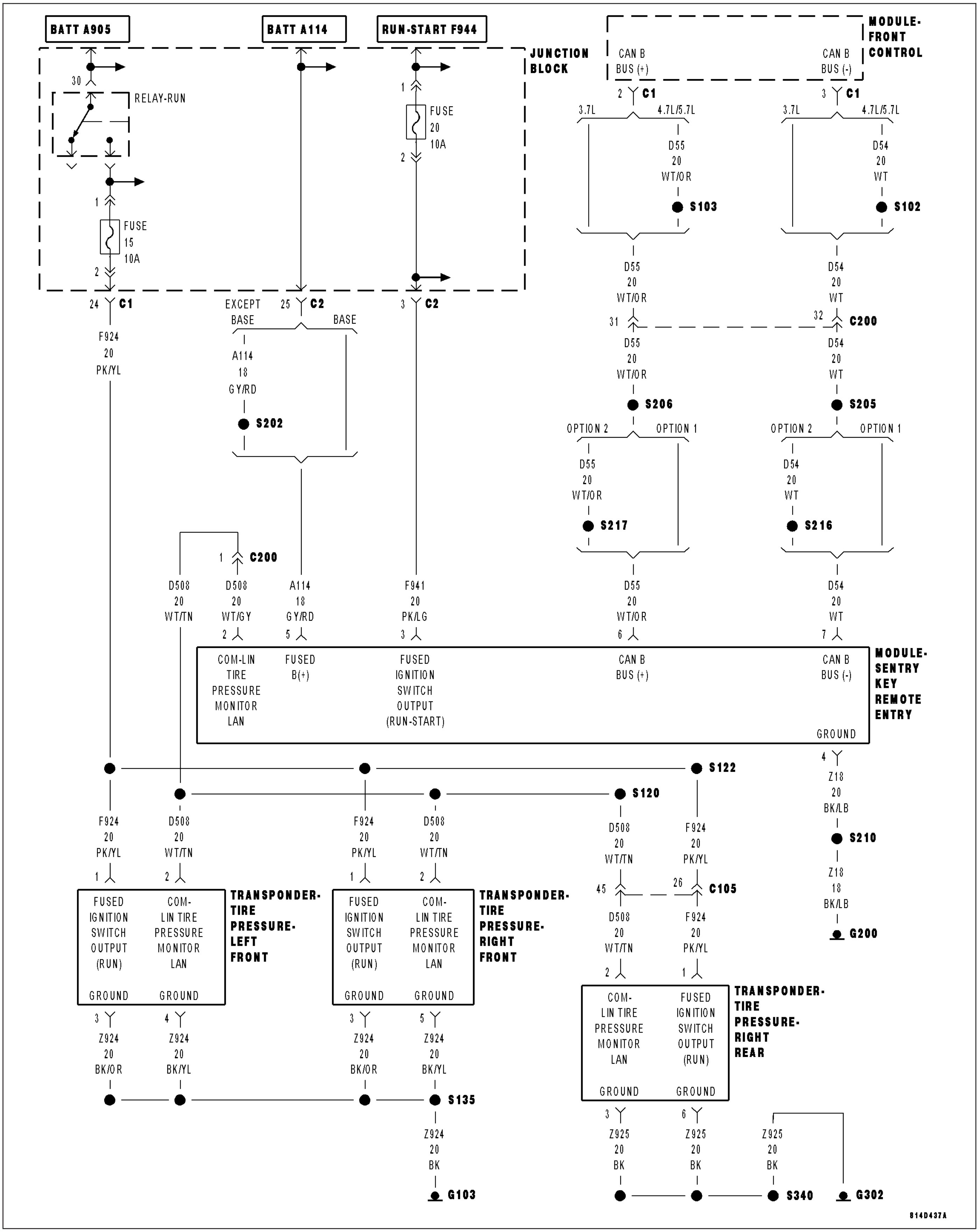
The conditions necessary to set this DTC are not present at this time.
Refer to any Technical Service Bulletins that may apply to this condition.
With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).
Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the beginning of this test and perform the diagnostic procedure as necessary.

**No** >> Test complete.

## C1506–LEFT FRONT TIRE PRESSURE TRIGGER MODULE PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**

## Theory of Operation

The Tire Pressure Trigger Module is used to automatically learn the location of each wheel sensor on the vehicle. The module is controlled and activated in sequence by the Wireless Control Module (SKREEM) over a LIN bus. When activated, the module will generate a 125 KHz signal of sufficient field strength to trigger the tire pressure sensor and force a RF transmission from the sensor.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The WCM (SKREEM) will monitor the messages from each Tire Pressure Trigger Module over the LIN bus. If any of the messages are not received, or are received other than as expected, a DTC will set. When the condition is corrected, or is no longer detected, as acknowledged via a LIN bus message, the WCM will reset the appropriate trigger module fault status.

| Possible Causes |
|---|
| INTERMITTENT TIRE PRESSURE TRIGGER MODULE PERFORMANCE DTC |
| (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT SHORT TO VOLTAGE |
| (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT SHORT TO GROUND |
| (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT OPEN OR HIGH RESISTANCE |
| (F924) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR HIGH RESISTANCE |
| (Z924) GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE |
| TIRE PRESSURE TRIGGER MODULE |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 9

### 2. (F924) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR HIGH RESISTANCE

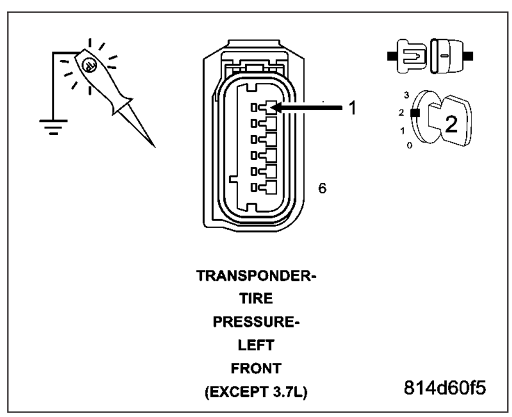
Turn the ignition off.

Disconnect the Tire Pressure Transponder harness connector.

Disconnect the Sentry Key Remote Entry Module harness connector.

Turn the ignition on.

Using a 12–volt test light connect to ground, check the (F924) Fused Ignition Switch Output (Run) circuit.



**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

**Is the test light illuminated and bright?**

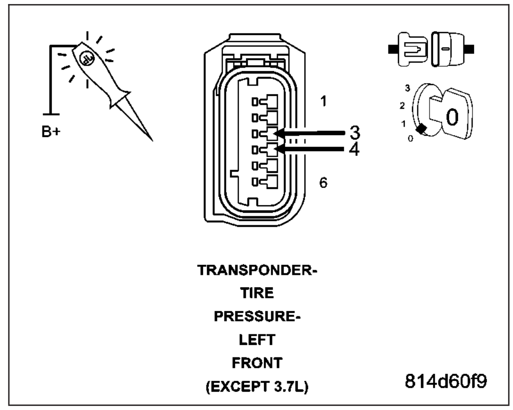
**Yes** >> Go to 3

**No** >> Repair the (F924) Fused Ignition Switch Output (Run) circuit for an open circuit or high resistance.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 3. (Z924) GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE

Using a 12-volt test light connect to battery voltage, probe each of the (Z924) Ground circuit(s).




**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

**Does the test light illuminate brightly?**

**Yes** >> Go to 4

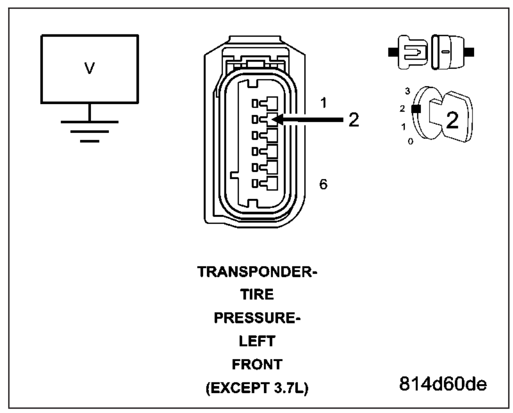
**No** >> Repair the (Z924) Ground circuit(s) for an open circuit or high resistance.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 4. (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT SHORT TO VOLTAGE

Turn the ignition on.

Measure the voltage of the (D508) COM - LIN Tire Pressure Monitor LAN circuit.




**Is there any voltage present?**

**Yes** >> Repair the (D508) COM - LIN Tire Pressure Monitor LAN circuit for a short to voltage.

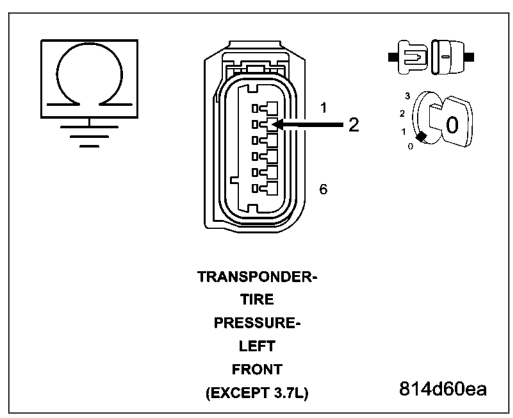
**No** >> Go to 5

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 5. (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT SHORT TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (D508) COM - LIN Tire Pressure Monitor LAN circuit.




**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (D508) COM - LIN Tire Pressure Monitor LAN circuit for a short to ground.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

**No** >> Go to 6

## 6. (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT OPEN OR HIGH RESISTANCE

Use a jumper wire with one end connected to ground and the other to the (D508) COM - LIN Tire Pressure Monitor LAN circuit in the Front Left Pressure Tire Transponder harness connector.

Using a 12-Volt test light connected to battery voltage, probe the (D508) COM - LIN Tire Pressure Monitor LAN circuit in the SKREEM harness connector.

**NOTE: The test light should be illuminated and bright. Compared the brightness to that of a direct connection to the battery.**

**Does the test light illuminate bright?**

**Yes** >> Go to 7

**No** >> Repair the (D508) COM - LIN Tire Pressure Monitor LAN circuit for an open circuit or high resistance.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 7. TIRE PRESSURE TRIGGER MODULE

Turn the ignition off.

Replace the appropriate Tire Pressure Trigger Module in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 8

**No** >> Test Complete.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 8. WIRELESS CONTROL MODULE (SKREEM)

View repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 9. INTERMITTENT TIRE PRESSURE TRIGGER MODULE DTC

The conditions necessary to set this DTC are not present at this time.

Using the wiring schematic as a guide, inspect the wiring and connectors relative to this circuit.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

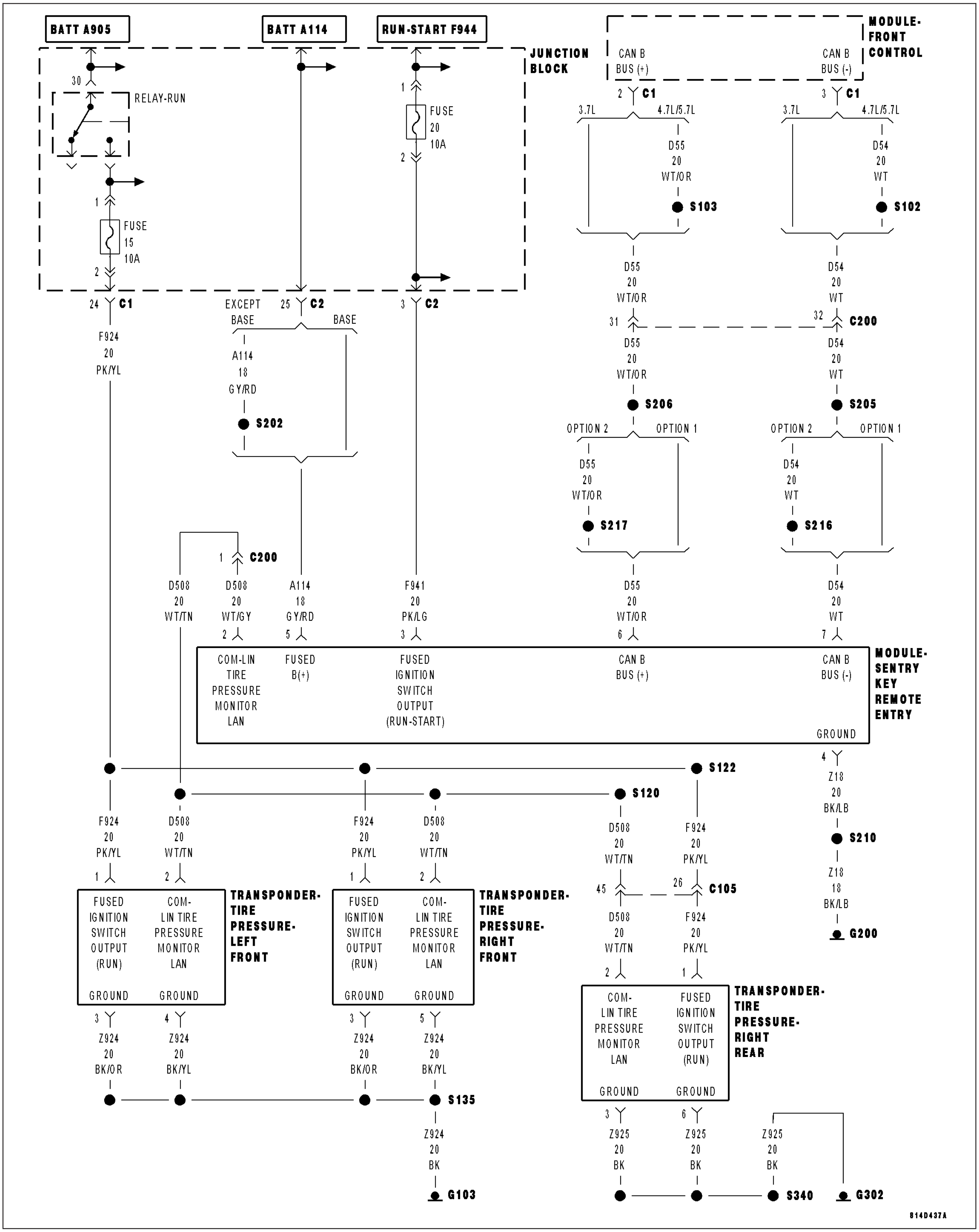
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the first step of this test and perform the diagnostic procedure.

**No** >> Test complete.

## C1507–RIGHT FRONT TIRE PRESSURE TRIGGER MODULE PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**

## Theory of Operation

The Tire Pressure Trigger Module is used to automatically learn the location of each wheel sensor on the vehicle. The module is controlled and activated in sequence by the Wireless Control Module (SKREEM) over a LIN bus. When activated, the module will generate a 125 KHz signal of sufficient field strength to trigger the tire pressure sensor and force a RF transmission from the sensor.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The WCM (SKREEM) will monitor the messages from each Tire Pressure Trigger Module over the LIN bus. If any of the messages are not received, or are received other than as expected, a DTC will set. When the condition is corrected, or is no longer detected, as acknowledged via a LIN bus message, the WCM will reset the appropriate trigger module fault status.

| Possible Causes |
|---|
| INTERMITTENT TIRE PRESSURE TRIGGER MODULE PERFORMANCE DTC |
| (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT SHORT TO VOLTAGE |
| (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT SHORT TO GROUND |
| (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT OPEN OR HIGH RESISTANCE |
| (F924) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR HIGH RESISTANCE |
| (Z924) GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE |
| TIRE PRESSURE TRIGGER MODULE |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 9

### 2. (F924) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition on.

Using a 12–volt test light connect to ground, check the (F924) Fused Ignition Switch Output (Run) circuit.

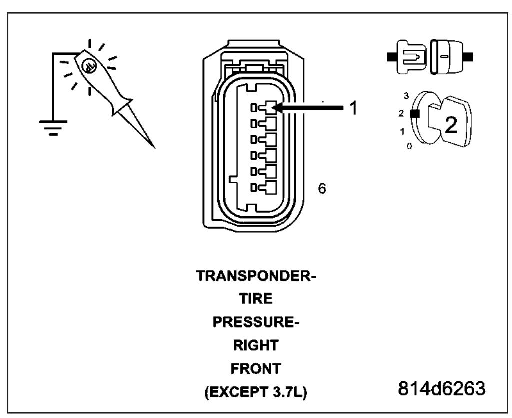
**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

**Is the test light illuminated and bright?**

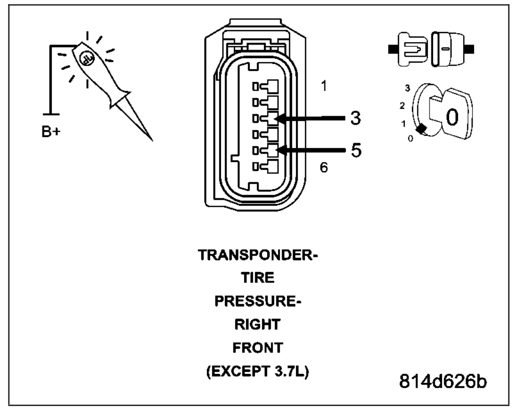
**Yes** >> Go to 3

**No** >> Repair the (F924) Fused Ignition Switch Output (Run) circuit for an open circuit or high resistance.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)



## 3. (Z924) GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE




Using a 12–volt test light connect to 12 volts, check each of the (Z924) Ground circuit(s).

**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

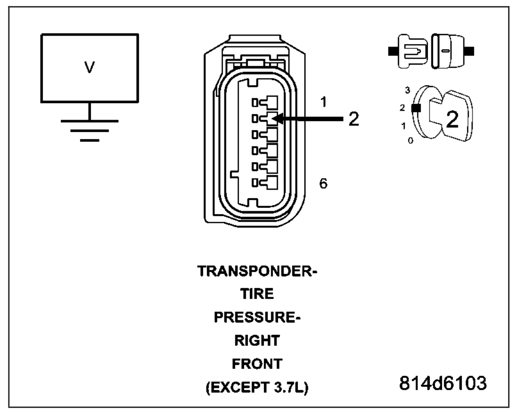
**Is the test light illuminated and bright?**

**Yes** >> Go to 4

**No** >> Repair the (Z924) Ground circuit(s) for an open circuit or high resistance.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 4. (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT SHORT TO VOLTAGE




Turn the ignition off.

Disconnect the Tire Pressure Transponder harness connector.

Disconnect the Sentry Key Remote Entry Module harness connector.

Turn the ignition on.

Measure the voltage of the (D508) COM - LIN Tire Pressure Monitor LAN circuit.

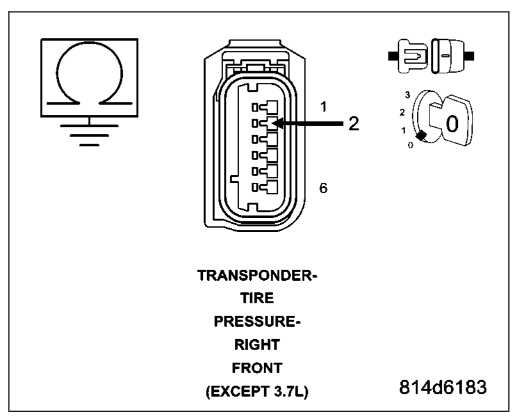
**Is there any voltage present?**

**Yes** >> Repair the (D508) COM - LIN Tire Pressure Monitor LAN circuit for a short to voltage.

**No** >> Go to 5

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 5. (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT SHORT TO GROUND




Turn the ignition off.

Measure the resistance between ground and the (D508) COM - LIN Tire Pressure Monitor LAN circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (D508) COM - LIN Tire Pressure Monitor LAN circuit for a short to ground.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

**No** >> Go to 6

## 6. (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT OPEN OR HIGH RESISTANCE

Use a jumper wire with one end connected to ground and the other to the (D508) COM - LIN Tire Pressure Monitor LAN circuit in the Front Left Pressure Tire Transponder harness connector.

Using a 12-Volt test light connected to battery voltage, probe the (D508) COM - LIN Tire Pressure Monitor LAN circuit in the SKREEM harness connector.

**NOTE: The test light should be illuminated and bright. Compared the brightness to that of a direct connection to the battery.**

**Does the test light illuminate bright?**

**Yes** >> Go to 7

**No** >> Repair the (D508) COM - LIN Tire Pressure Monitor LAN circuit for an open circuit or high resistance.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 7. TIRE PRESSURE TRIGGER MODULE

Turn the ignition off.

Replace the appropriate Tire Pressure Trigger Module in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 8

**No** >> Test Complete.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 8. WIRELESS CONTROL MODULE (SKREEM)

View repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.
Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 9. INTERMITTENT TIRE PRESSURE TRIGGER MODULE DTC

The conditions necessary to set this DTC are not present at this time.

Using the wiring schematic as a guide, inspect the wiring and connectors relative to this circuit.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

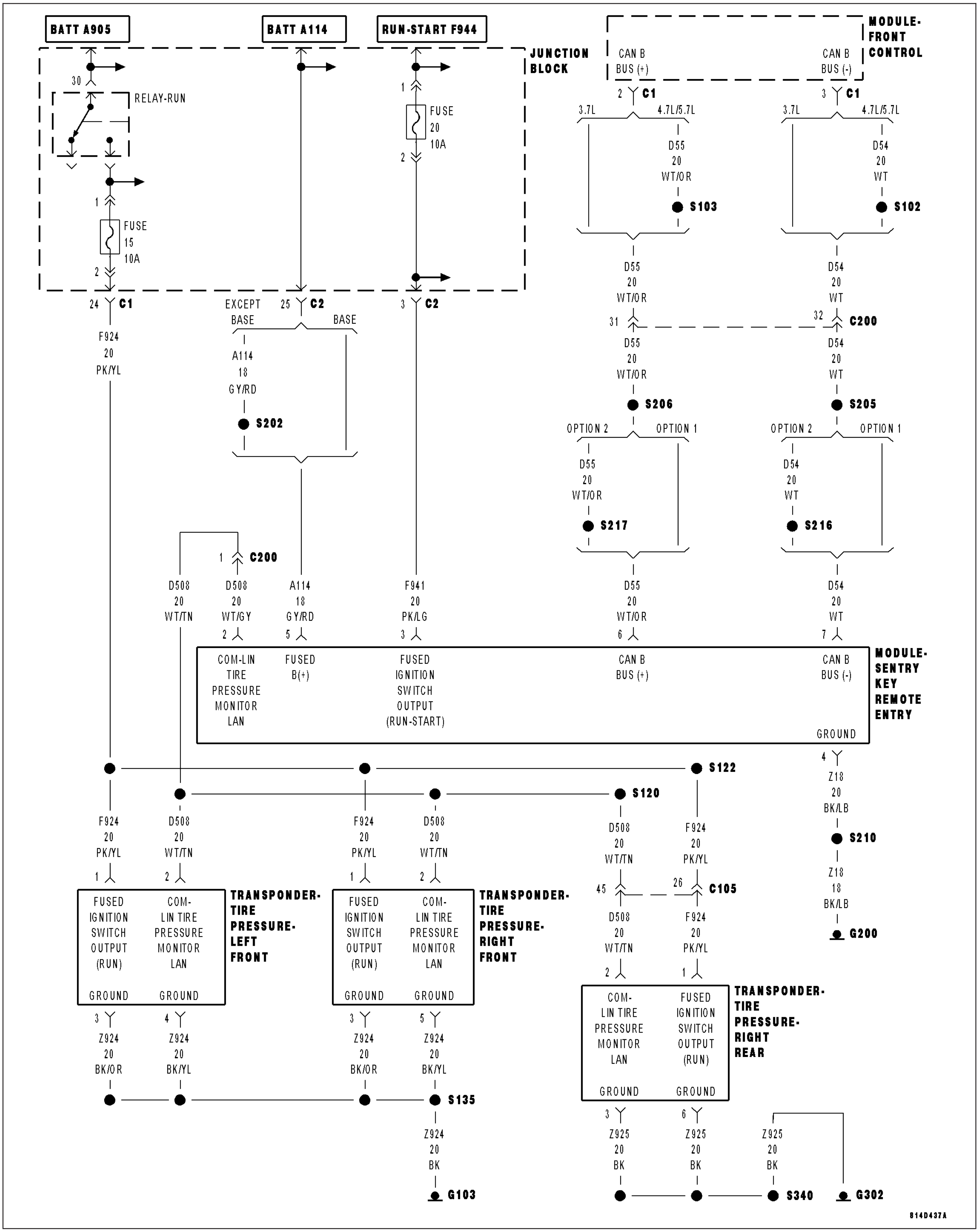
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the first step of this test and perform the diagnostic procedure.

**No** >> Test complete.

## C1509–RIGHT REAR TIRE PRESSURE TRIGGER MODULE PERFORMANCE




For a complete wiring diagram **Refer to Section 8W**

## Theory of Operation

The Tire Pressure Trigger Module is used to automatically learn the location of each wheel sensor on the vehicle. The module is controlled and activated in sequence by the Wireless Control Module (SKREEM) over a LIN bus. When activated, the module will generate a 125 KHz signal of sufficient field strength to trigger the tire pressure sensor and force a RF transmission from the sensor.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The WCM (SKREEM) will monitor the messages from each Tire Pressure Trigger Module over the LIN bus. If any of the messages are not received, or are received other than as expected, a DTC will set. When the condition is corrected, or is no longer detected, as acknowledged via a LIN bus message, the WCM will reset the appropriate trigger module fault status.

| Possible Causes |
|---|
| INTERMITTENT TIRE PRESSURE TRIGGER MODULE PERFORMANCE DTC |
| (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT SHORT TO VOLTAGE |
| (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT SHORT TO GROUND |
| (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT OPEN OR HIGH RESISTANCE |
| (F924) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR HIGH RESISTANCE |
| (Z924) GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE |
| TIRE PRESSURE TRIGGER MODULE |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

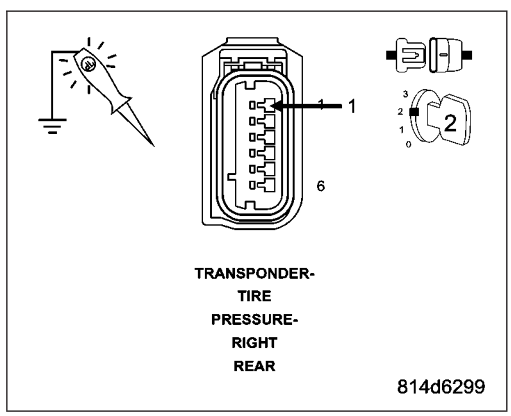
**Yes** >> Go to 2

**No** >> Go to 9

### 2. (F924) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition on.

Using a 12–volt test light connect to ground, check the (F924) Fused Ignition Switch Output (Run) circuit.




**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

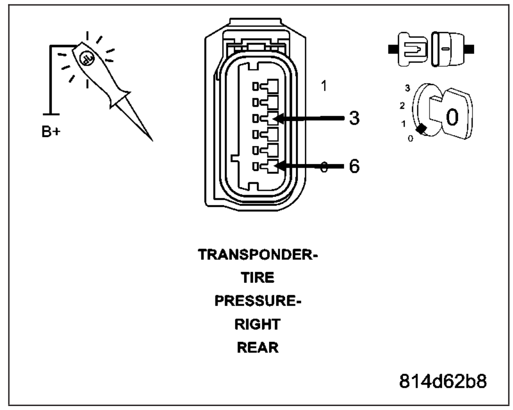
**Is the test light illuminated and bright?**

**Yes** >> Go to 3

**No** >> Repair the (F924) Fused Ignition Switch Output (Run) circuit for an open circuit or high resistance.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 3. (Z924) GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE




Using a 12–volt test light connect to 12 volts, check each of the (Z924) Ground circuit(s).

**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

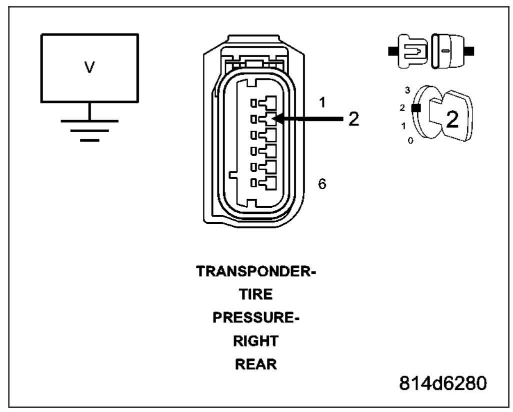
**Is the test light illuminated and bright?**

**Yes** >> Go to 4

**No** >> Repair the (Z924) Ground circuit(s) for an open circuit or high resistance.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 4. (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT SHORT TO VOLTAGE




Turn the ignition off.

Disconnect the Tire Pressure Transponder harness connector.

Disconnect the Sentry Key Remote Entry Module harness connector.

Turn the ignition on.

Measure the voltage of the (D508) COM - LIN Tire Pressure Monitor LAN circuit.

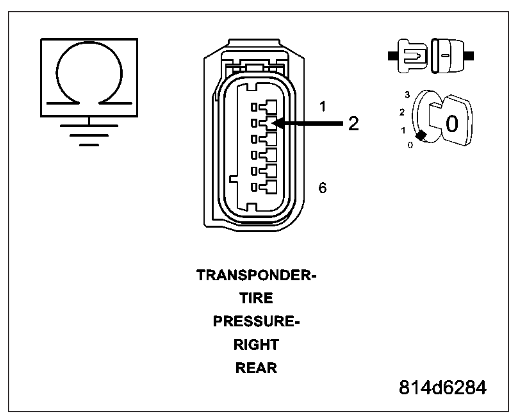
**Is there any voltage present?**

**Yes** >> Repair the (D508) COM - LIN Tire Pressure Monitor LAN circuit for a short to voltage.

**No** >> Go to 5

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 5. (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT SHORT TO GROUND




Turn the ignition off.

Measure the resistance between ground and the (D508) COM - LIN Tire Pressure Monitor LAN circuit.

**Is the resistance below 5.0 ohms?**

**Yes** >> Repair the (D508) COM - LIN Tire Pressure Monitor LAN circuit for a short to ground.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

**No** >> Go to 6

## 6. (D508) COM - LIN TIRE PRESSURE MONITOR LAN CIRCUIT OPEN OR HIGH RESISTANCE

Use a jumper wire with one end connected to ground and the other to the (D508) COM - LIN Tire Pressure Monitor LAN circuit in the Front Left Pressure Tire Transponder harness connector.

Using a 12-Volt test light connected to battery voltage, probe the (D508) COM - LIN Tire Pressure Monitor LAN circuit in the SKREEM harness connector.

**NOTE: The test light should be illuminated and bright. Compared the brightness to that of a direct connection to the battery.**

**Does the test light illuminate bright?**

**Yes** >> Go to 7

**No** >> Repair the (D508) COM - LIN Tire Pressure Monitor LAN circuit for an open circuit or high resistance.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 7. TIRE PRESSURE TRIGGER MODULE

Turn the ignition off.

Replace the appropriate Tire Pressure Trigger Module in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 8

**No** >> Test Complete.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 8. WIRELESS CONTROL MODULE (SKREEM)

View repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

Perform SKREEM VERIFICATION TEST. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

## 9. INTERMITTENT TIRE PRESSURE TRIGGER MODULE DTC

The conditions necessary to set this DTC are not present at this time.

Using the wiring schematic as a guide, inspect the wiring and connectors relative to this circuit.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

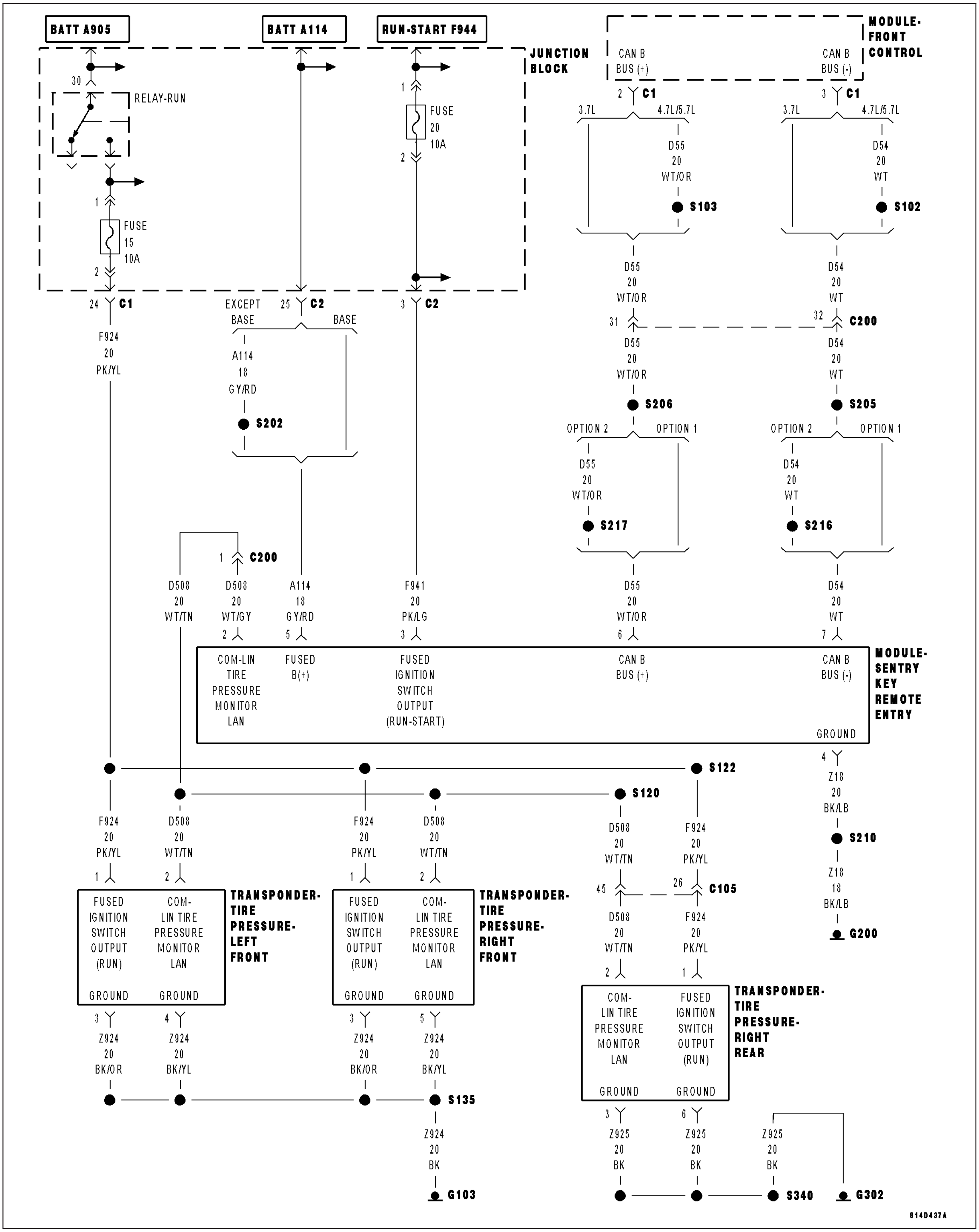
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the first step of this test and perform the diagnostic procedure.

**No** >> Test complete.

## C150A–LEFT FRONT TIRE PRESSURE TRIGGER MODULE VOLTAGE HIGH




For a complete wiring diagram **Refer to Section 8W**

## Theory of Operation

The Tire Pressure Trigger Module is used to automatically learn the location of each wheel sensor on the vehicle. The module is controlled and activated in sequence by the Wireless Control Module (SKREEM) over a LIN bus. When activated, the module will generate a 125 KHz signal of sufficient field strength to trigger the tire pressure sensor and force a RF transmission from the sensor.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The WCM receives a message from the Tire Pressure Trigger Module indicating that an over voltage condition has been detected.

| Possible Causes |
| --- |
| INTERMITTENT TIRE PRESSURE TRIGGER MODULE PERFORMANCE DTC |
| (F924) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR HIGH RESISTANCE |
| (Z924) GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE |
| TIRE PRESSURE TRIGGER MODULE |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

Turn the ignition on.

**NOTE: If a system or battery voltage high DTC is set in the Wireless Control Module (SKREEM) or in the PCM, repair the voltage DTC before continuing with this test.**

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 6

### 2. (F924) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition on.

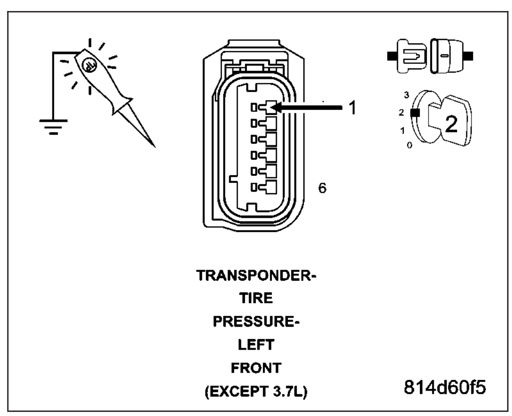
Using a 12–volt test light connect to ground, check the (F924) Fused Ignition Switch Output (Run) circuit.

**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

**Is the test light illuminated and bright?**

**Yes** >> Go to 3

**No** >> Repair the (F924) Fused Ignition Switch Output (Run) circuit for an open circuit or high resistance.



## 3. (Z924) GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE

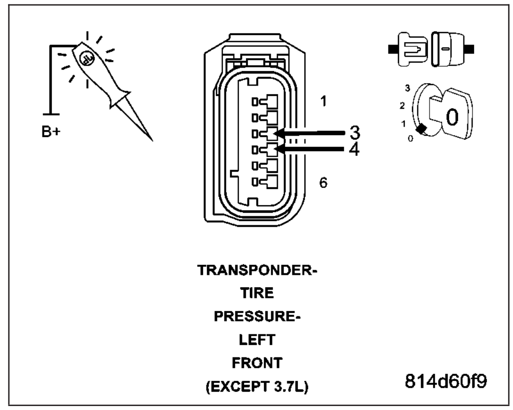
Using a 12–volt test light connect to 12 volts, check each of the (Z924) Ground circuit(s).

**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

**Is the test light illuminated and bright?**

**Yes** >> Go to 4

**No** >> Repair the (Z924) Ground circuit(s) for an open circuit or high resistance.




## 4. TIRE PRESSURE TRIGGER MODULE

Turn the ignition off.

Replace the appropriate Tire Pressure Trigger Module in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 5

**No** >> Test Complete.

## 5. WIRELESS CONTROL MODULE (SKREEM)

View repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

## 6. INTERMITTENT TIRE PRESSURE TRIGGER MODULE DTC

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

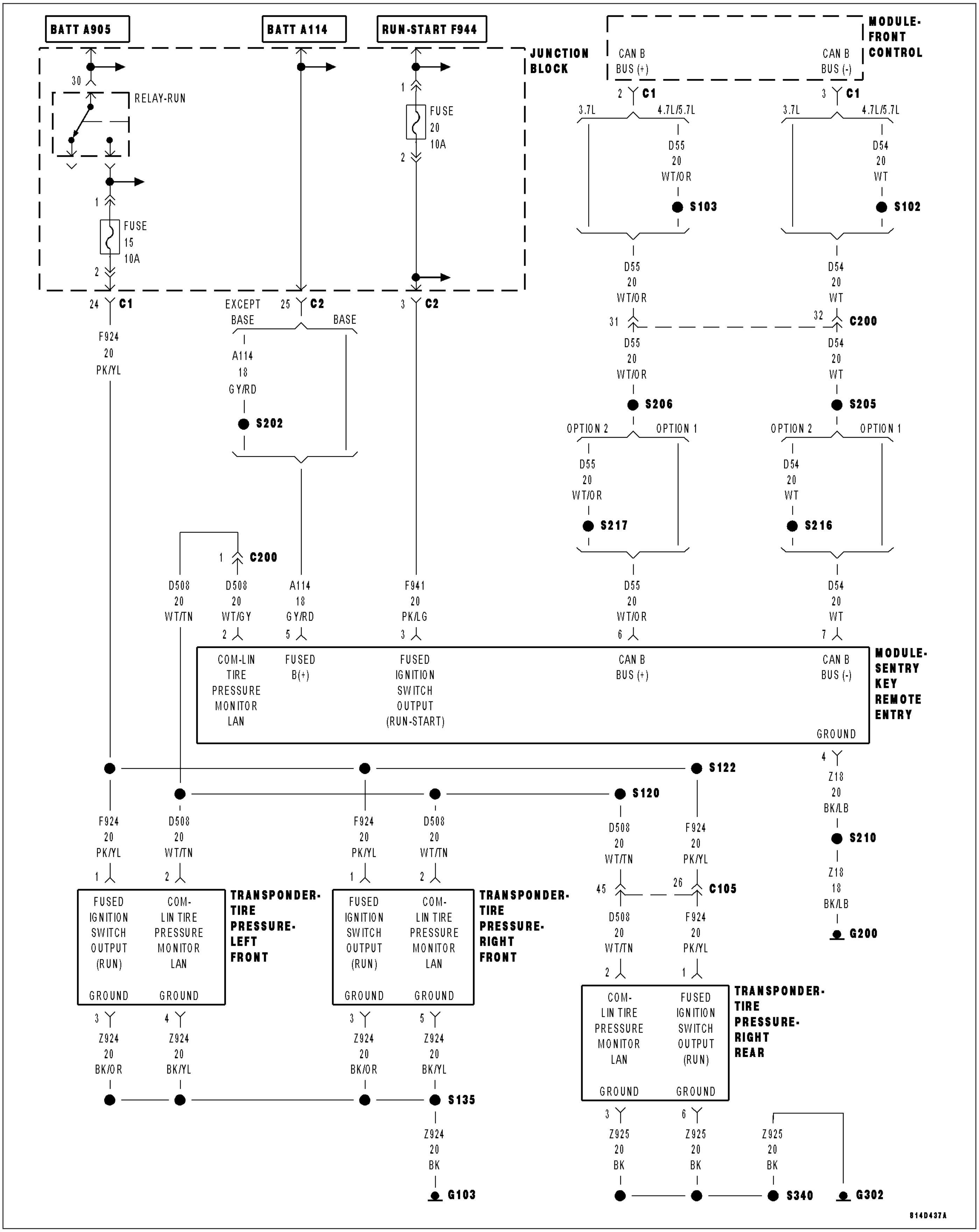
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the first step of this test and perform the diagnostic procedure.

**No** >> Test complete.

# C150B–RIGHT FRONT TIRE PRESSURE TRIGGER MODULE VOLTAGE HIGH




For a complete wiring diagram **Refer to Section 8W**

## Theory of Operation

The Tire Pressure Trigger Module is used to automatically learn the location of each wheel sensor on the vehicle. The module is controlled and activated in sequence by the Wireless Control Module (SKREEM) over a LIN bus. When activated, the module will generate a 125 KHz signal of sufficient field strength to trigger the tire pressure sensor and force a RF transmission from the sensor.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The WCM receives a message from the Tire Pressure Trigger Module indicating that an over voltage condition has been detected.

| Possible Causes |
|---|
| INTERMITTENT TIRE PRESSURE TRIGGER MODULE PERFORMANCE DTC |
| (F924) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR HIGH RESISTANCE |
| (Z924) GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE |
| TIRE PRESSURE TRIGGER MODULE |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

Turn the ignition on.

**NOTE: If a system or battery voltage high DTC is set in the Wireless Control Module (SKREEM) or in the PCM, repair the voltage DTC before continuing with this test.**

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 6

### 2. (F924) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition on.

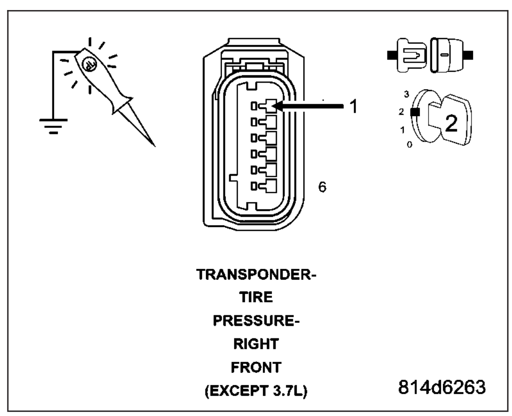
Using a 12–volt test light connect to ground, check the (F924) Fused Ignition Switch Output (Run) circuit.

**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

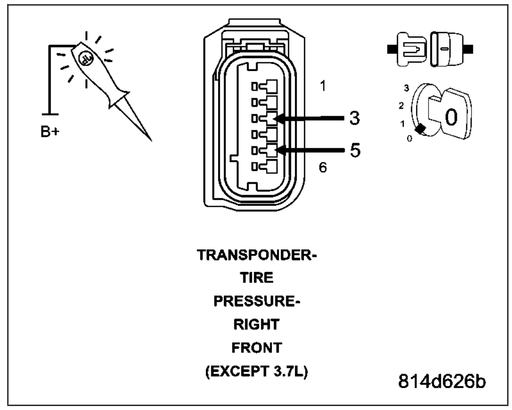
**Is the test light illuminated and bright?**

**Yes** >> Go to 3

**No** >> Repair the (F924) Fused Ignition Switch Output (Run) circuit for an open circuit or high resistance.



## 3. (Z924) GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE




Using a 12–volt test light connect to 12 volts, check each of the (Z924) Ground circuit(s).

**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

**Is the test light illuminated and bright?**

**Yes** >> Go to 4

**No** >> Repair the (Z924) Ground circuit(s) for an open circuit or high resistance.

## 4. TIRE PRESSURE TRIGGER MODULE

Turn the ignition off.

Replace the appropriate Tire Pressure Trigger Module in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 5

**No** >> Test Complete.

## 5. WIRELESS CONTROL MODULE (SKREEM)

View repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

## 6. INTERMITTENT TIRE PRESSURE TRIGGER MODULE DTC

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

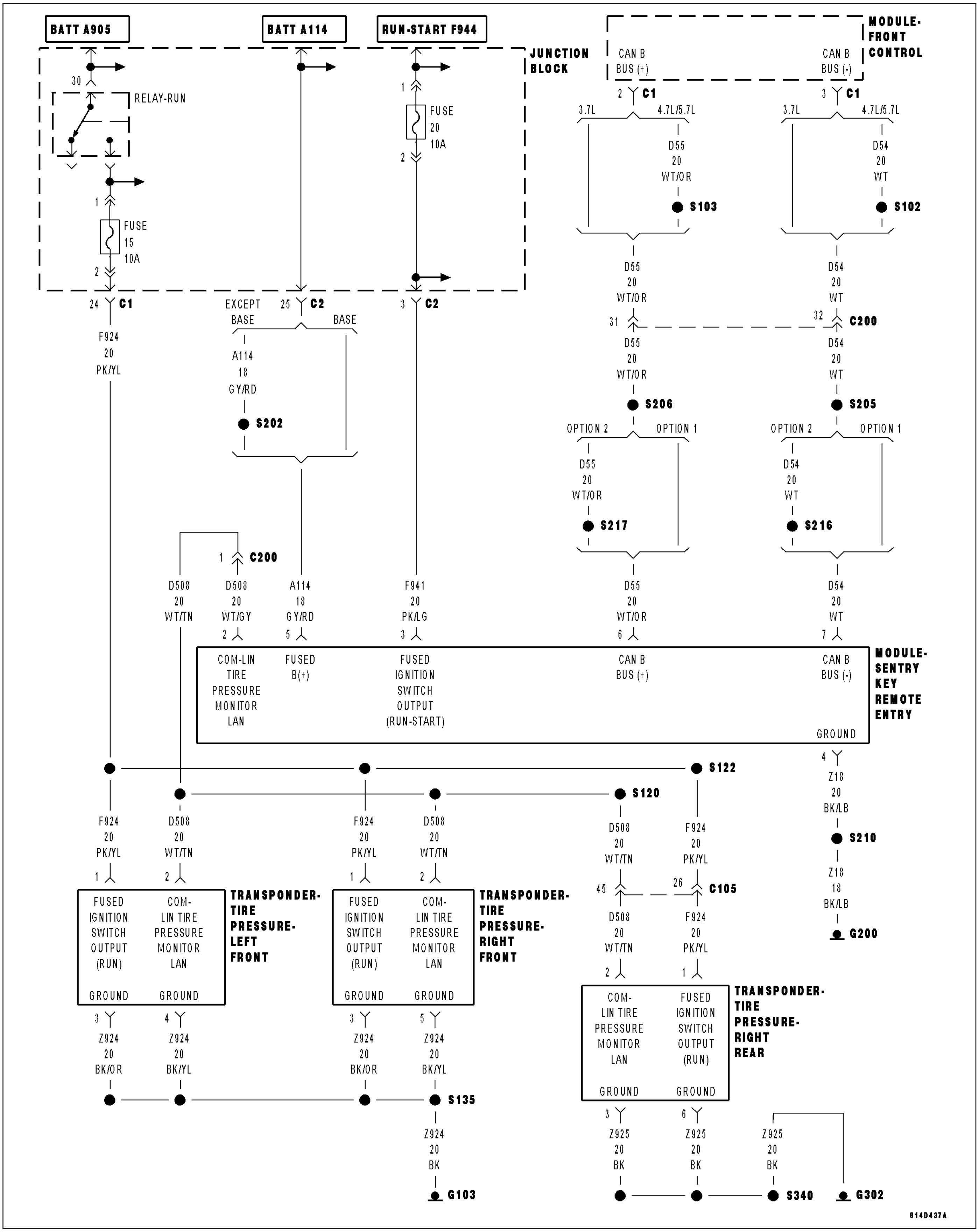
With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the first step of this test and perform the diagnostic procedure.

**No** >> Test complete.

## C150C–RIGHT REAR TIRE PRESSURE TRIGGER MODULE VOLTAGE HIGH




For a complete wiring diagram **Refer to Section 8W**

## Theory of Operation

The Tire Pressure Trigger Module is used to automatically learn the location of each wheel sensor on the vehicle. The module is controlled and activated in sequence by the Wireless Control Module (SKREEM) over a LIN bus. When activated, the module will generate a 125 KHz signal of sufficient field strength to trigger the tire pressure sensor and force a RF transmission from the sensor.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The WCM receives a message from the Tire Pressure Trigger Module indicating that an over voltage condition has been detected.

| Possible Causes |
| --- |
| INTERMITTENT TIRE PRESSURE TRIGGER MODULE PERFORMANCE DTC |
| (F924) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR HIGH RESISTANCE |
| (Z925) GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE |
| TIRE PRESSURE TRIGGER MODULE |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

Turn the ignition on.

**NOTE: If a system or battery voltage high DTC is set in the Wireless Control Module (SKREEM) or in the PCM, repair the voltage DTC before continuing with this test.**

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 6

### 2. (F924) FUSED IGNITION SWITCH OUTPUT (RUN) CIRCUIT OPEN OR HIGH RESISTANCE

Turn the ignition on.

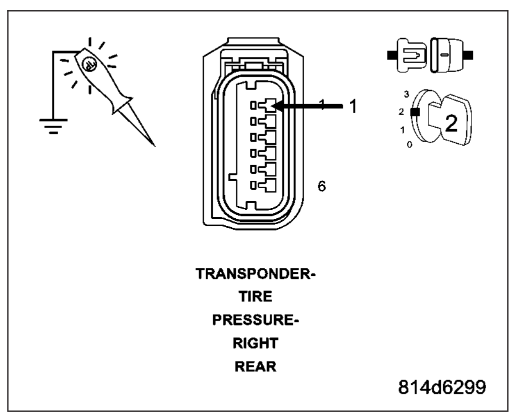
Using a 12–volt test light connect to ground, check the (F924) Fused Ignition Switch Output (Run) circuit.

**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

**Is the test light illuminated and bright?**

**Yes** >> Go to 3

**No** >> Repair the (F924) Fused Ignition Switch Output (Run) circuit for an open circuit or high resistance.



## 3. (Z925) GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE

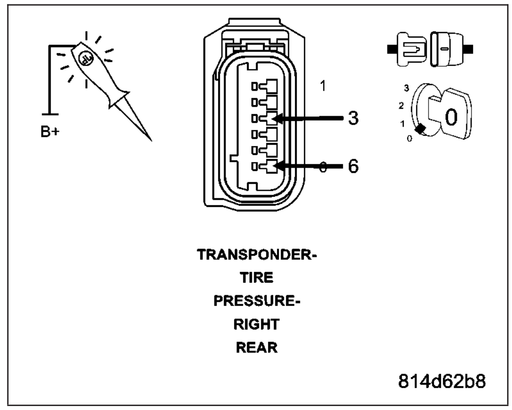
Using a 12–volt test light connect to 12 volts, check each of the (Z925) Ground circuit(s).

**NOTE: The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

**Is the test light illuminated and bright?**

**Yes** >> Go to 4

**No** >> Repair the (Z925) Ground circuit(s) for an open circuit or high resistance.




## 4. TIRE PRESSURE TRIGGER MODULE

Turn the ignition off.

Replace the appropriate Tire Pressure Trigger Module in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 5

**No** >> Test Complete.

## 5. WIRELESS CONTROL MODULE (SKREEM)

View repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

## 6. INTERMITTENT TIRE PRESSURE TRIGGER MODULE DTC

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the first step of this test and perform the diagnostic procedure.

**No** >> Test complete.

## TIRE SENSOR 1 LOW PRESSURE ALERT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The fault is set when there is a low tire pressure condition or sensor pressure measurement failure from the sensor/transmitter.

| Possible Causes |
|---|
| INTERMITTENT PERFORMANCE DTC |
| INCORRECT TIRE PRESSURE |
| TIRE PRESSURE SENSOR |
| WCM (SKREEM) |

### Diagnostic Test

#### 1. TIRE SENSOR LOCATION PROCEDURE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE: If the TPM indicator is illuminated, check for a low tire pressure condition. If the TPM indicator is flashing, check for DTCs.**

**NOTE: The following test is to locate the Tire Pressure Sensor/Transmitter. If the tires have been rotated, the Tire Pressure Sensor/Transmitter are no longer in sequence from the factory. Faults are linked to the sensor/transmitter IDs. You MUST locate the correct Tire Pressure Sensor/Transmitter that set the fault before continuing.**

Set all tire pressures to the recommended specifications and recheck for fault/alert.

Turn the ignition on.

Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.

If the TPMS fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.

**NOTE: Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**

**Once the correct sensor/transmitter has been located continue.**

**Continue**
Go to 2

#### 2. LOW TIRE PRESSURE

**NOTE: The DTC can be caused by many different factors and might not be a sensor/transmitter or a WCM (SKREEM) fault. Interference from other elements will over power the sensor/transmitter RF frequency making erratic operation to the TPM system. Check the vehicle for aftermarket accessories that could compromise the RF frequency signal before diagnosing the TPM system.**

Correct all tire pressure to the recommended specifications and wait 2 minutes.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Go to 4

## 3. TIRE PRESSURE SENSOR

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

**No** >> Test Complete.

## 4. TIRE PRESSURE CORRECTION/INTERMITTENT

**NOTE: If the tire pressure was out of specification and by adjusting the pressure corrected the DTC, the test is complete. If the tire pressure was within specification and were unable to reset the DTC an intermittent condition is present and the below steps may aid in identifying the failure.**

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Repair as necessary.

**No** >> Test complete.

## TIRE SENSOR 1 TRANSMIT FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The fault is set when the WCM (SKREEM) does not receive eight consecutive RF transmissions from the sensor/transmitter

| Possible Causes |
|---|
| INTERMITTENT PERFORMANCE DTC |
| INCORRECT TIRE PRESSURE |
| TIRE PRESSURE SENSOR |
| WCM (SKREEM) |

## Diagnostic Test

### 1. TIRE SENSOR LOCATION PROCEDURE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE: If the TPM indicator is illuminated, check for a low tire pressure condition. If the TPM indicator is flashing, check for DTCs.**

**NOTE: The following test is to locate the Tire Pressure Sensor/Transmitter. If the tires have been rotated, the Tire Pressure Sensor/Transmitter are no longer in sequence from the factory. Faults are linked to the sensor/transmitter IDs. You MUST locate the correct Tire Pressure Sensor/Transmitter that set the fault before continuing.**

Set all tire pressures to the recommended specifications and recheck for fault/alert.

Turn the ignition on.

Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.

If the TPMS fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.

**NOTE: Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**

**Once the correct sensor/transmitter has been located continue.**

**Continue**
Go to 2

### 2. LOW TIRE PRESSURE

**NOTE: The DTC can be caused by many different factors and might not be a sensor/transmitter or a WCM (SKREEM) fault. Interference from other elements will over power the sensor/transmitter RF frequency making erratic operation to the TPM system. Check the vehicle for aftermarket accessories that could compromise the RF frequency signal before diagnosing the TPM system.**

Correct all tire pressure to the recommended specifications and wait 2 minutes.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Go to 4

## 3. TIRE PRESSURE SENSOR

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

**No** >> Test Complete.

## 4. TIRE PRESSURE CORRECTION/INTERMITTENT

**NOTE: If the tire pressure was out of specification and by adjusting the pressure corrected the DTC, the test is complete. If the tire pressure was within specification and were unable to reset the DTC an intermittent condition is present and the below steps may aid in identifying the failure.**

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Repair as necessary.

**No** >> Test complete.

## TIRE SENSOR 2 LOW PRESSURE ALERT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The fault is set when there is a low tire pressure condition or sensor pressure measurement failure from the sensor/transmitter.

| Possible Causes |
|---|
| INTERMITTENT PERFORMANCE DTC |
| INCORRECT TIRE PRESSURE |
| TIRE PRESSURE SENSOR |
| WCM (SKREEM) |

### Diagnostic Test

#### 1. TIRE SENSOR LOCATION PROCEDURE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE: If the TPM indicator is illuminated, check for a low tire pressure condition. If the TPM indicator is flashing, check for DTCs.**

**NOTE: The following test is to locate the Tire Pressure Sensor/Transmitter. If the tires have been rotated, the Tire Pressure Sensor/Transmitter are no longer in sequence from the factory. Faults are linked to the sensor/transmitter IDs. You MUST locate the correct Tire Pressure Sensor/Transmitter that set the fault before continuing.**

Set all tire pressures to the recommended specifications and recheck for fault/alert.

Turn the ignition on.

Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.

If the TPMS fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.

**NOTE: Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**

**Once the correct sensor/transmitter has been located continue.**

**Continue**
Go to 2

#### 2. LOW TIRE PRESSURE

**NOTE: The DTC can be caused by many different factors and might not be a sensor/transmitter or a WCM (SKREEM) fault. Interference from other elements will over power the sensor/transmitter RF frequency making erratic operation to the TPM system. Check the vehicle for aftermarket accessories that could compromise the RF frequency signal before diagnosing the TPM system.**

Correct all tire pressure to the recommended specifications and wait 2 minutes.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Go to 4

## 3. TIRE PRESSURE SENSOR

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

**No** >> Test Complete.

## 4. TIRE PRESSURE CORRECTION/INTERMITTENT

**NOTE: If the tire pressure was out of specification and by adjusting the pressure corrected the DTC, the test is complete. If the tire pressure was within specification and were unable to reset the DTC an intermittent condition is present and the below steps may aid in identifying the failure.**

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Repair as necessary.

**No** >> Test complete.

## TIRE SENSOR 2 TRANSMIT FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The fault is set when the WCM (SKREEM) does not receive eight consecutive RF transmissions from the sensor/transmitter

| Possible Causes |
|---|
| INTERMITTENT PERFORMANCE DTC |
| INCORRECT TIRE PRESSURE |
| TIRE PRESSURE SENSOR |
| WCM (SKREEM) |

### Diagnostic Test

#### 1. TIRE SENSOR LOCATION PROCEDURE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE: If the TPM indicator is illuminated, check for a low tire pressure condition. If the TPM indicator is flashing, check for DTCs.**

**NOTE: The following test is to locate the Tire Pressure Sensor/Transmitter. If the tires have been rotated, the Tire Pressure Sensor/Transmitter are no longer in sequence from the factory. Faults are linked to the sensor/transmitter IDs. You MUST locate the correct Tire Pressure Sensor/Transmitter that set the fault before continuing.**

Set all tire pressures to the recommended specifications and recheck for fault/alert.

Turn the ignition on.

Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.

If the TPMS fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.

**NOTE: Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**

**Once the correct sensor/transmitter has been located continue.**

**Continue**
Go to 2

#### 2. LOW TIRE PRESSURE

**NOTE: The DTC can be caused by many different factors and might not be a sensor/transmitter or a WCM (SKREEM) fault. Interference from other elements will over power the sensor/transmitter RF frequency making erratic operation to the TPM system. Check the vehicle for aftermarket accessories that could compromise the RF frequency signal before diagnosing the TPM system.**

Correct all tire pressure to the recommended specifications and wait 2 minutes.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Go to 4

## 3. TIRE PRESSURE SENSOR

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

**No** >> Test Complete.

## 4. TIRE PRESSURE CORRECTION/INTERMITTENT

**NOTE: If the tire pressure was out of specification and by adjusting the pressure corrected the DTC, the test is complete. If the tire pressure was within specification and were unable to reset the DTC an intermittent condition is present and the below steps may aid in identifying the failure.**

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Repair as necessary.

**No** >> Test complete.

## TIRE SENSOR 3 LOW PRESSURE ALERT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The fault is set when there is a low tire pressure condition or sensor pressure measurement failure from the sensor/transmitter.

| Possible Causes |
|---|
| INTERMITTENT PERFORMANCE DTC |
| INCORRECT TIRE PRESSURE |
| TIRE PRESSURE SENSOR |
| WCM (SKREEM) |

## Diagnostic Test

### 1. TIRE SENSOR LOCATION PROCEDURE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE: If the TPM indicator is illuminated, check for a low tire pressure condition. If the TPM indicator is flashing, check for DTCs.**

**NOTE: The following test is to locate the Tire Pressure Sensor/Transmitter. If the tires have been rotated, the Tire Pressure Sensor/Transmitter are no longer in sequence from the factory. Faults are linked to the sensor/transmitter IDs. You MUST locate the correct Tire Pressure Sensor/Transmitter that set the fault before continuing.**

Set all tire pressures to the recommended specifications and recheck for fault/alert.

Turn the ignition on.

Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.

If the TPMS fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.

**NOTE: Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**

**Once the correct sensor/transmitter has been located continue.**

**Continue**
Go to 2

### 2. LOW TIRE PRESSURE

**NOTE: The DTC can be caused by many different factors and might not be a sensor/transmitter or a WCM (SKREEM) fault. Interference from other elements will over power the sensor/transmitter RF frequency making erratic operation to the TPM system. Check the vehicle for aftermarket accessories that could compromise the RF frequency signal before diagnosing the TPM system.**

Correct all tire pressure to the recommended specifications and wait 2 minutes.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Go to 4

## 3. TIRE PRESSURE SENSOR

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

**No** >> Test Complete.

## 4. TIRE PRESSURE CORRECTION/INTERMITTENT

**NOTE: If the tire pressure was out of specification and by adjusting the pressure corrected the DTC, the test is complete. If the tire pressure was within specification and were unable to reset the DTC an intermittent condition is present and the below steps may aid in identifying the failure.**

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Repair as necessary.

**No** >> Test complete.

## TIRE SENSOR 3 TRANSMIT FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The fault is set when the WCM (SKREEM) does not receive eight consecutive RF transmissions from the sensor/transmitter

| Possible Causes |
|---|
| INTERMITTENT PERFORMANCE DTC |
| INCORRECT TIRE PRESSURE |
| TIRE PRESSURE SENSOR |
| WCM (SKREEM) |

## Diagnostic Test

### 1. TIRE SENSOR LOCATION PROCEDURE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE: If the TPM indicator is illuminated, check for a low tire pressure condition. If the TPM indicator is flashing, check for DTCs.**

**NOTE: The following test is to locate the Tire Pressure Sensor/Transmitter. If the tires have been rotated, the Tire Pressure Sensor/Transmitter are no longer in sequence from the factory. Faults are linked to the sensor/transmitter IDs. You MUST locate the correct Tire Pressure Sensor/Transmitter that set the fault before continuing.**

Set all tire pressures to the recommended specifications and recheck for fault/alert.

Turn the ignition on.

Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.

If the TPMS fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.

**NOTE: Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**

**Once the correct sensor/transmitter has been located continue.**

**Continue**
Go to 2

### 2. LOW TIRE PRESSURE

**NOTE: The DTC can be caused by many different factors and might not be a sensor/transmitter or a WCM (SKREEM) fault. Interference from other elements will over power the sensor/transmitter RF frequency making erratic operation to the TPM system. Check the vehicle for aftermarket accessories that could compromise the RF frequency signal before diagnosing the TPM system.**

Correct all tire pressure to the recommended specifications and wait 2 minutes.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Go to 4

## 3. TIRE PRESSURE SENSOR

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

**No** >> Test Complete.

## 4. TIRE PRESSURE CORRECTION/INTERMITTENT

**NOTE: If the tire pressure was out of specification and by adjusting the pressure corrected the DTC, the test is complete. If the tire pressure was within specification and were unable to reset the DTC an intermittent condition is present and the below steps may aid in identifying the failure.**

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Repair as necessary.

**No** >> Test complete.

## TIRE SENSOR 4 LOW PRESSURE ALERT

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The fault is set when there is a low tire pressure condition or sensor pressure measurement failure from the sensor/transmitter.

| Possible Causes |
|---|
| INTERMITTENT PERFORMANCE DTC |
| INCORRECT TIRE PRESSURE |
| TIRE PRESSURE SENSOR |
| WCM (SKREEM) |

## Diagnostic Test

### 1. TIRE SENSOR LOCATION PROCEDURE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE: If the TPM indicator is illuminated, check for a low tire pressure condition. If the TPM indicator is flashing, check for DTCs.**

**NOTE: The following test is to locate the Tire Pressure Sensor/Transmitter. If the tires have been rotated, the Tire Pressure Sensor/Transmitter are no longer in sequence from the factory. Faults are linked to the sensor/transmitter IDs. You MUST locate the correct Tire Pressure Sensor/Transmitter that set the fault before continuing.**

Set all tire pressures to the recommended specifications and recheck for fault/alert.

Turn the ignition on.

Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.

If the TPMS fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.

**NOTE: Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**

**Once the correct sensor/transmitter has been located continue.**

**Continue**
Go to 2

### 2. LOW TIRE PRESSURE

**NOTE: The DTC can be caused by many different factors and might not be a sensor/transmitter or a WCM (SKREEM) fault. Interference from other elements will over power the sensor/transmitter RF frequency making erratic operation to the TPM system. Check the vehicle for aftermarket accessories that could compromise the RF frequency signal before diagnosing the TPM system.**

Correct all tire pressure to the recommended specifications and wait 2 minutes.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Go to 4

## 3. TIRE PRESSURE SENSOR

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

**No** >> Test Complete.

## 4. TIRE PRESSURE CORRECTION/INTERMITTENT

**NOTE: If the tire pressure was out of specification and by adjusting the pressure corrected the DTC, the test is complete. If the tire pressure was within specification and were unable to reset the DTC an intermittent condition is present and the below steps may aid in identifying the failure.**

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Repair as necessary.

**No** >> Test complete.

## TIRE SENSOR 4 TRANSMIT FAILURE

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously.
- **Set Condition:**
  The fault is set when the WCM (SKREEM) does not receive eight consecutive RF transmissions from the sensor/transmitter

| Possible Causes |
|---|
| INTERMITTENT PERFORMANCE DTC |
| INCORRECT TIRE PRESSURE |
| TIRE PRESSURE SENSOR |
| WCM (SKREEM) |

### Diagnostic Test

#### 1. TIRE SENSOR LOCATION PROCEDURE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

**NOTE: If the TPM indicator is illuminated, check for a low tire pressure condition. If the TPM indicator is flashing, check for DTCs.**

**NOTE: The following test is to locate the Tire Pressure Sensor/Transmitter. If the tires have been rotated, the Tire Pressure Sensor/Transmitter are no longer in sequence from the factory. Faults are linked to the sensor/transmitter IDs. You MUST locate the correct Tire Pressure Sensor/Transmitter that set the fault before continuing.**

Set all tire pressures to the recommended specifications and recheck for fault/alert.

Turn the ignition on.

Starting with the left front wheel, deflate the tire to 20 PSI and wait 2 minutes. The fault will set once the pressure has reached 20 PSI within the 2 minute time frame.

If the TPMS fault was detected and not associated to this Sensor/Transmitter, repeat the process until the faulty Sensor/Transmitter has been identified.

**NOTE: Once a fault/alert has set, it will establish the location of the tire pressure sensors/transmitter. Repeat steps until the applicable Tire Pressure Sensor/Transmitter has been located.**

**Once the correct sensor/transmitter has been located continue.**

**Continue**
Go to 2

#### 2. LOW TIRE PRESSURE

**NOTE: The DTC can be caused by many different factors and might not be a sensor/transmitter or a WCM (SKREEM) fault. Interference from other elements will over power the sensor/transmitter RF frequency making erratic operation to the TPM system. Check the vehicle for aftermarket accessories that could compromise the RF frequency signal before diagnosing the TPM system.**

Correct all tire pressure to the recommended specifications and wait 2 minutes.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Go to 3

**No** >> Go to 4

## 3. TIRE PRESSURE SENSOR

Turn the ignition off.

Replace the Tire Pressure Sensor in accordance with the Service Information.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

**No** >> Test Complete.

## 4. TIRE PRESSURE CORRECTION/INTERMITTENT

**NOTE: If the tire pressure was out of specification and by adjusting the pressure corrected the DTC, the test is complete. If the tire pressure was within specification and were unable to reset the DTC an intermittent condition is present and the below steps may aid in identifying the failure.**

The conditions necessary to set this DTC are not present at this time.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Repair as necessary.

**No** >> Test complete.

## PRNDL MESSAGE MISSING

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  This DTC will set if the PRNDL message is not received for more than 5 seconds.

| Possible Causes |
|---|
| INTERMITTENT PRNDL MESSAGE MISSING DTC |
| PCM DTCS PRESENT |
| CLUSTER DTCS PRESENT |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 5

### 2. DTCS PRESENT IN PCM

Cycle the ignition off and on.

With the scan tool, select View DTCs in the Powertrain Control Module (PCM).

**Are there any DTCs present on the PCM?**

**Yes** >> Refer to the appropriate diagnostic procedure for the PCM DTC.

**No** >> Go to 3

### 3. DTCS PRESENT IN THE CLUSTER

Cycle the ignition off and on.

With the scan tool, select View DTCs in the Instrument Cluster (CCN).

**Are there any DTCs present on the Cluster?**

**Yes** >> Refer to the appropriate diagnostic procedure for the Cluster DTC.

**No** >> Go to 4

## 4. WIRELESS CONTROL MODULE (SKREEM)

Inspect the wiring and connectors relative to this circuit.

Monitor the scan tool data relative to this circuit while performing a wiggle test on the wiring and connectors. Look for the DTC to reset or for the data to change other than as expected.

Refer to any Technical Service Bulletins that may apply to this condition.

If no problems are found view repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

## 5. INTERMITTENT PRNDL MESSAGE MISSING DTC

The conditions necessary to set this DTC are not present at this time.

Inspect the wiring and connectors relative to this circuit.

Monitor the scan tool data relative to this circuit while performing a wiggle test on the wiring and connectors. Look for the DTC to reset or for the data to change other than as expected.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the beginning of this test and perform the diagnostic procedure as necessary.

**No** >> Test complete.

## VEHICLE SPEED MESSAGE MISSING

For a complete wiring diagram **Refer to Section 8W**

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  This DTC will set if the Vehicle Speed message is not received for more than 5 seconds.

| Possible Causes |
|---|
| INTERMITTENT VEHICLE SPEED MESSAGE MISSING DTC |
| PCM DTCS PRESENT |
| CLUSTER DTCS PRESENT |
| WIRELESS CONTROL MODULE (SKREEM) |

## Diagnostic Test

### 1. DTC STATUS IS ACTIVE

**NOTE: If the incorrect Placard Values were programmed into the WCM/SKREEM, a DTC could be set. Before continuing with any TPM diagnostic test, using the scan tool, check that the correct Placard Values have been programmed in to the module.**

Turn the ignition on.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Is the DTC status Active at this time?**

**Yes** >> Go to 2

**No** >> Go to 5

### 2. DTCS PRESENT IN PCM

Cycle the ignition off and on.

With the scan tool, select View DTCs in the Powertrain Control Module (PCM).

**Are there any DTCs present on the PCM?**

**Yes** >> Refer to the appropriate diagnostic procedure for the PCM DTC.

**No** >> Go to 3

### 3. DTCS PRESENT IN THE CLUSTER

Cycle the ignition off and on.

With the scan tool, select View DTCs in the Instrument Cluster (CCN).

**Are there any DTCs present on the Cluster?**

**Yes** >> Refer to the appropriate diagnostic procedure for the Cluster DTC.

**No** >> Go to 4

## 4. WIRELESS CONTROL MODULE (SKREEM)

Inspect the wiring and connectors relative to this circuit.

Monitor the scan tool data relative to this circuit while performing a wiggle test on the wiring and connectors. Look for the DTC to reset or for the data to change other than as expected.

Refer to any Technical Service Bulletins that may apply to this condition.

If no problems are found view repair.

**Repair**

Replace the Wireless Control Module (SKREEM) in accordance with the Service Information.

## 5. INTERMITTENT VEHICLE SPEED MESSAGE MISSING DTC

The conditions necessary to set this DTC are not present at this time.

Inspect the wiring and connectors relative to this circuit.

Monitor the scan tool data relative to this circuit while performing a wiggle test on the wiring and connectors. Look for the DTC to reset or for the data to change other than as expected.

Refer to any Technical Service Bulletins that may apply to this condition.

With the scan tool, clear DTCs in the Wireless Control Module (SKREEM).

Test Drive the vehicle for a minimum of 10 minutes with vehicle speed greater than 15 m.p.h.

With the scan tool, select View DTCs in the Wireless Control Module (SKREEM).

**Does the DTC reset or is the status Active for this DTC?**

**Yes** >> Return to the beginning of this test and perform the diagnostic procedure as necessary.

**No** >> Test complete.

# TIRES/WHEELS - SERVICE INFORMATION

## TABLE OF CONTENTS

# TIRES/WHEELS - SERVICE INFORMATION

## DIAGNOSIS AND TESTING

### TIRE AND WHEEL RUNOUT

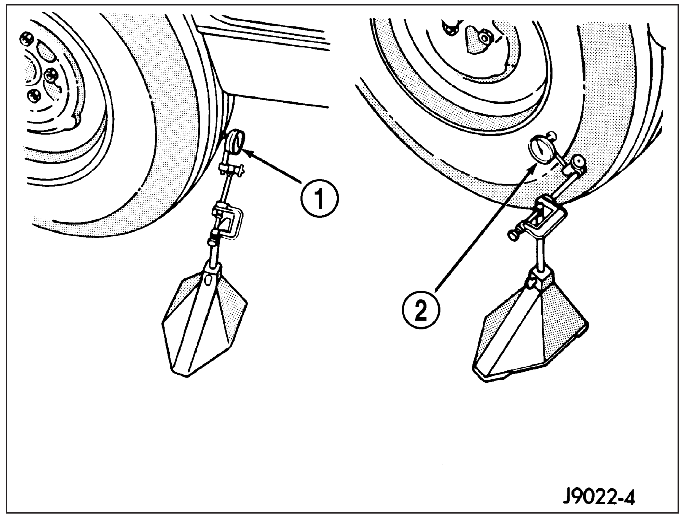
Radial runout is the difference between the high and low points on the tire or wheel.

Lateral runout is the **wobble** of the tire or wheel.

Radial runout of more than 1.5 mm (.060 inch) measured at the center line of the tread may cause the vehicle to shake.

Lateral runout of more than 2.0 mm (.080 inch) measured near the shoulder of the tire may cause the vehicle to shake.

Sometimes radial runout can be reduced. Relocate the wheel and tire assembly on the mounting studs (See Method 1). If this does not reduce runout to an acceptable level, the tire can be rotated on the wheel. (See Method 2).




### METHOD 1 (RELOCATE WHEEL ON HUB)

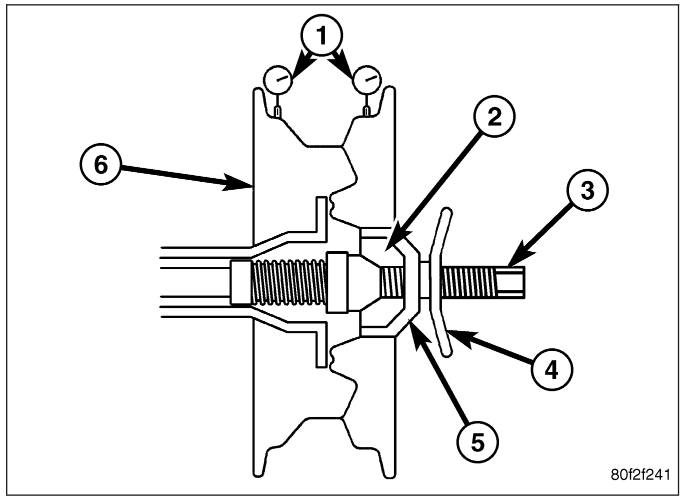
1. Drive vehicle a short distance to eliminate tire flat spotting from a parked position.
2. Check wheel bearings and adjust if adjustable or replace if necessary.
3. Check the wheel mounting surface.
4. Relocate wheel on the mounting, two studs over from the original position.
5. Tighten wheel nuts until all are properly torqued, to eliminate brake distortion.
6. Check radial runout. If still excessive, mark tire sidewall, wheel, and stud at point of maximum runout and proceed to Method 2.

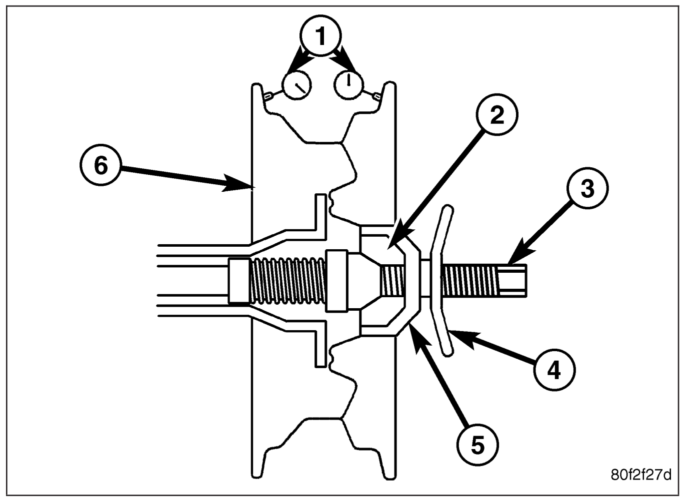
### METHOD 2 (RELOCATE TIRE ON WHEEL)

**NOTE: Rotating the tire on wheel is particularly effective when there is runout in both tire and wheel.**

1. Remove tire from wheel and mount wheel on service dynamic balance machine.
2. Check wheel radial runout and lateral runout.
   - STEEL WHEELS: Radial runout 0.040 in., Lateral runout 0.045 in. (average-maximum)
   - ALUMINUM WHEELS: Radial runout 0.030 in., Lateral runout 0.035 in. (average-maximum)

3. If point of greatest wheel lateral runout is near original chalk mark, remount tire 180 degrees. Recheck runout or match mount, (Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE).



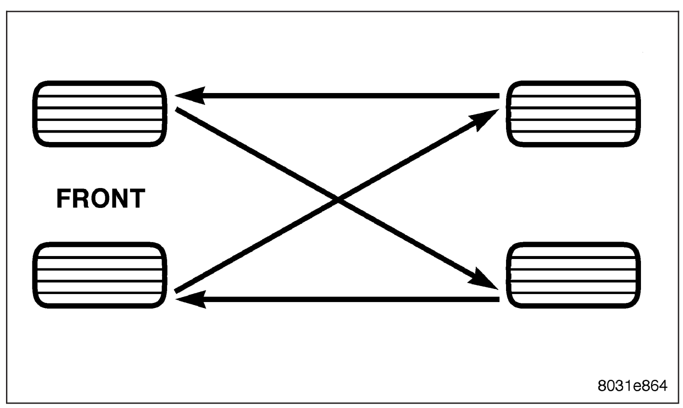

## STANDARD PROCEDURE

## TIRE ROTATION

Tires on the front and rear operate at different loads and perform different steering, driving, and braking functions. For these reasons they wear at unequal rates and tend to develop irregular wear patterns. These effects can be reduced by rotating the tires at regular intervals. The benefits of tire rotation are:

- Increase tread life
- Maintain traction levels
- A smooth, quiet ride

The suggested method of tire rotation is. Other rotation methods can be used, but they will not provide all the tire longevity benefits.



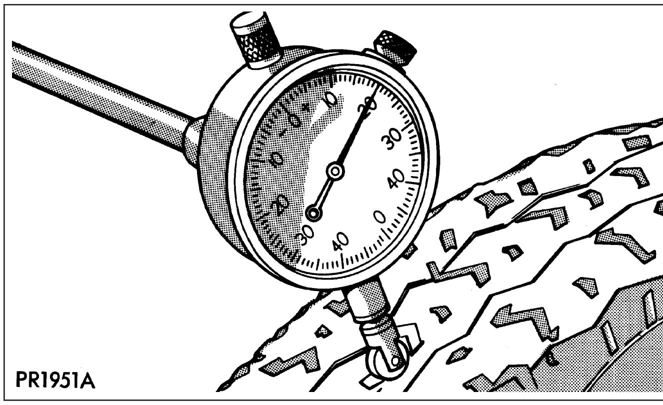

## MATCH MOUNTING

Tires and wheels are currently match mounted at the factory. Match mounting is a technique used to reduce runout in the wheel/tire assembly. This means that the high spot of the tire is aligned with the low spot on the wheel rim. The high spot on the tire is marked with a paint mark or a bright colored adhesive label on the outboard sidewall. The low spot on the rim is identified with a label on the outside of the rim and a dot on the inside of the rim. If the outside label has been removed the tire will have to be removed to locate the dot on the inside of the rim.

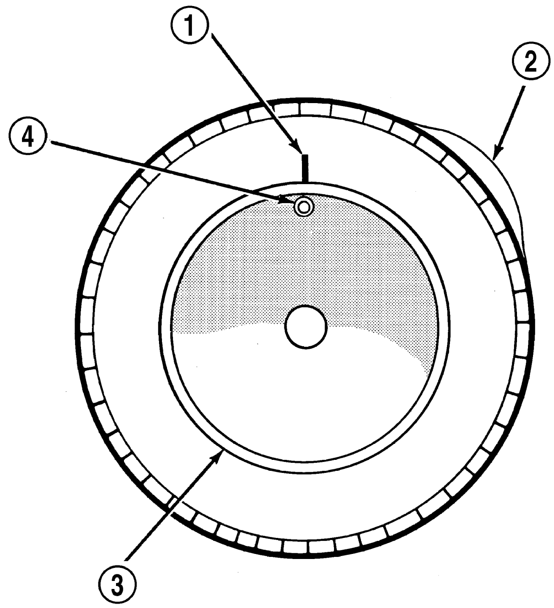
Before dismounting a tire from its wheel, a reference mark should be placed on the tire at the valve stem location. This reference will ensure that it is remounted in the original position on the wheel.

1. Use a dial indicator to locate the high spot of the tire on the center tread rib. Record the indicator reading and mark the high spot on the tire. Place a mark on the tire at the valve stem location.

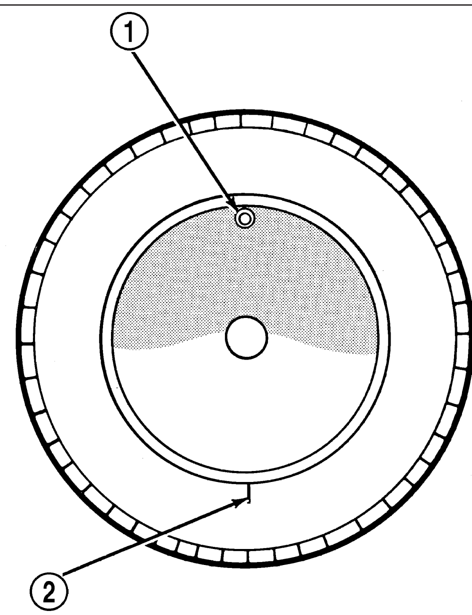
2. Break down the tire and remount it 180 degrees on the rim.
3. Measure the total runout again and mark the tire to indicate the high spot.
4. If runout is still excessive use the following procedures.
   a. If the high spot is within 101.6 mm (4.0 in.) of the first spot and is still excessive, replace the tire.
   b. If the high spot is within 101.6 mm (4.0 in.) of the first spot on the wheel, the wheel may be out of specifications, (Refer to 22 - TIRES/WHEELS - DIAGNOSIS AND TESTING).
   c. If the high spot is NOT within 101.6 mm (4.0 in.) of either high spot, draw an arrow on the tread from second high spot to first. Break down the tire and remount it 90 degrees on rim in that direction. This procedure will normally reduce the runout to an acceptable amount.



PR1951A



J9322-3



J9322-4

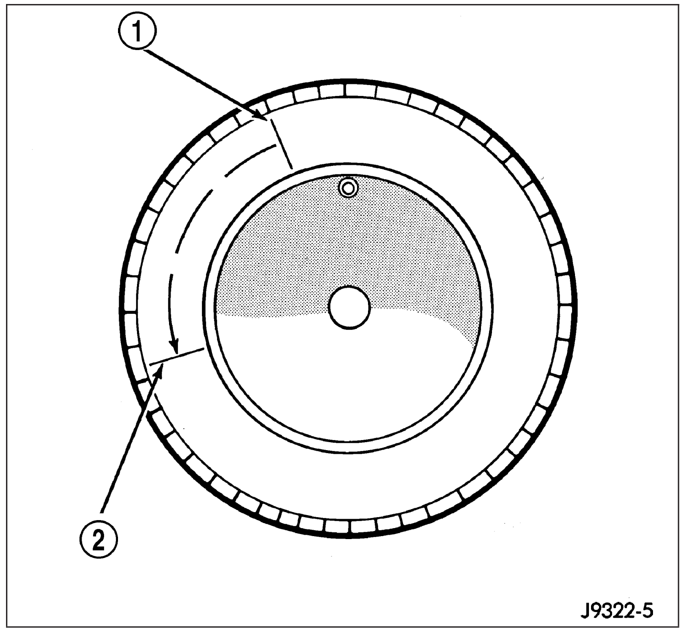
## WHEEL BALANCING

It is recommended that a two plane service dynamic balancer be used when a tire and wheel assembly require balancing. Refer to balancer operation instructions for proper cone mounting procedures. Typically use front cone mounting method for steel wheels. For aluminum wheel use back cone mounting method without cone spring.

**NOTE: Static should be used only when a two plane balancer is not available.**

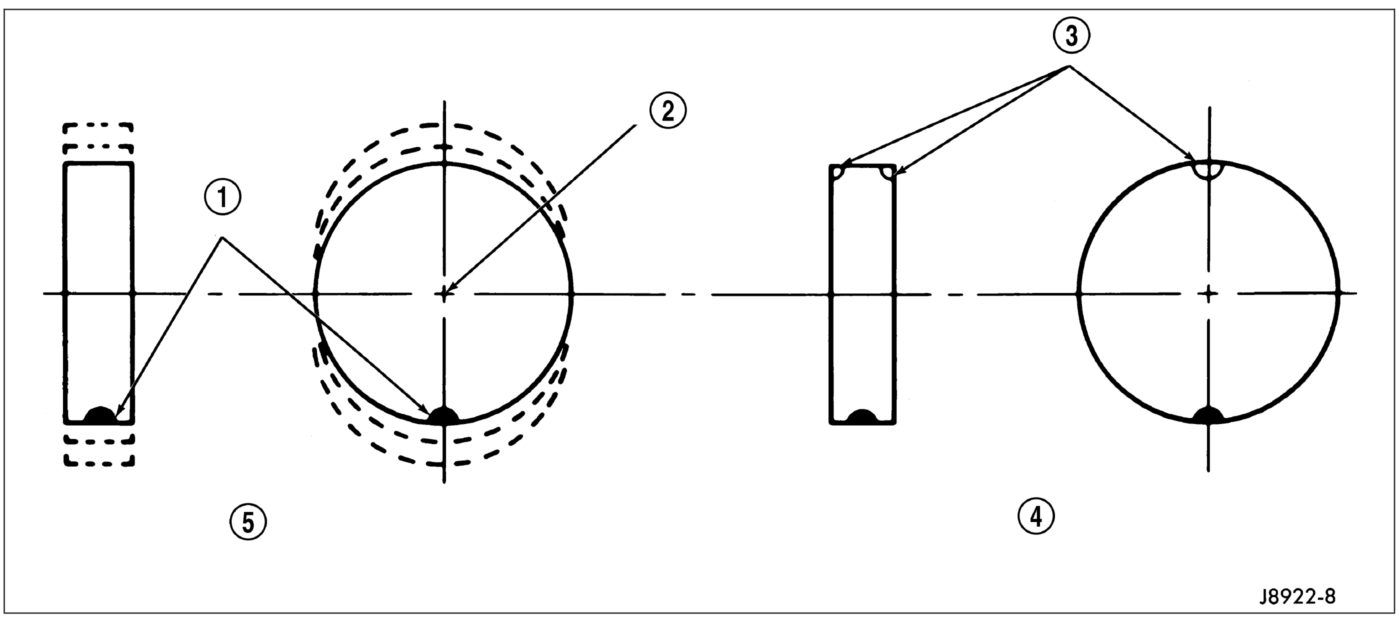
**NOTE: Cast aluminum and forged aluminum wheels require coated balance weights and special alignment equipment.**

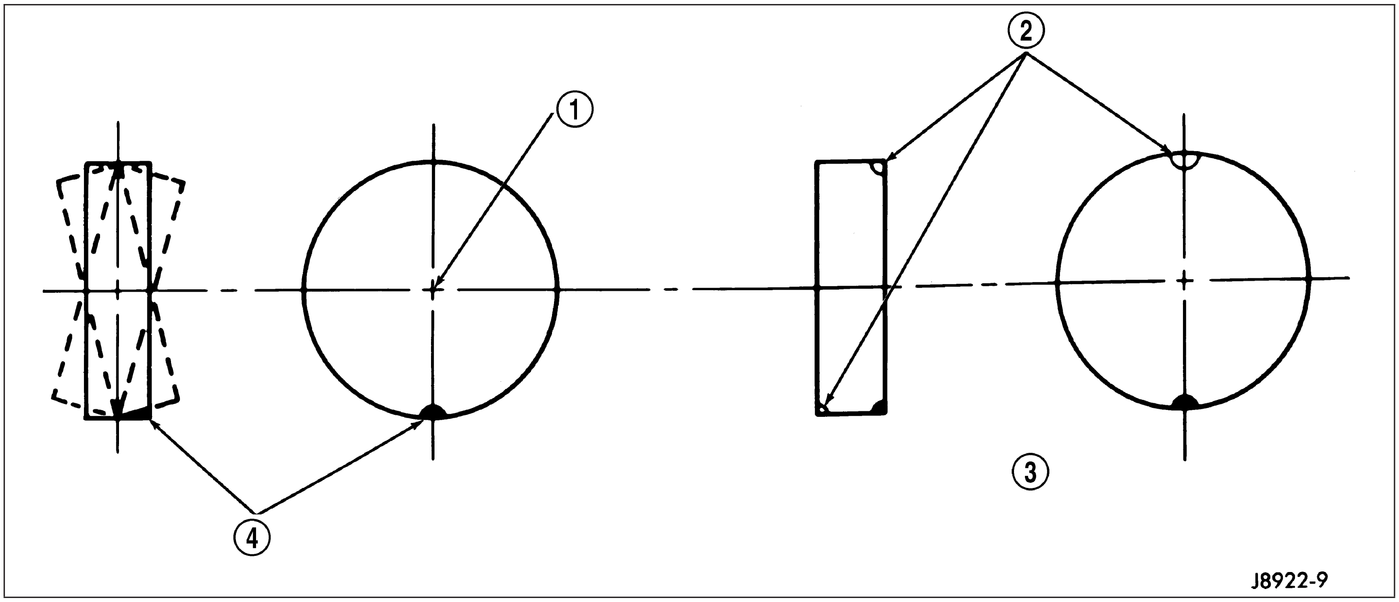
Wheel balancing can be accomplished with either on or off vehicle equipment. When using on-vehicle balancing equipment, remove the opposite wheel/tire. Off-vehicle balancing is recommended.




For static balancing, find location of heavy spot causing the imbalance. Counter balance wheel directly opposite the heavy spot. Determine weight required to counter balance the area of imbalance. Place half of this weight on the **inner** rim flange and the other half on the **outer** rim flange.

For dynamic balancing, the balancing equipment is designed to locate the amount of weight to be applied to both the inner and outer rim flange.






# TIRES

## DESCRIPTION

## TIRES

Tires are designed and engineered for each specific vehicle. They provide the best overall performance for normal operation. The ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability, traction, skid resistance, and tread life.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain in most cases, much greater mileage than severe use or careless drivers. A few of the driving habits which will shorten the life of any tire are:

- Rapid acceleration
- Severe brake applications
- High speed driving
- Excessive speeds on turns
- Striking curbs and other obstacles

Radial-ply tires are more prone to irregular tread wear. It is important to follow the tire rotation interval, (Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE). This will help to achieve a greater tread life.

### TIRE IDENTIFICATION

Tire type, size, aspect ratio and speed rating are encoded in the letters and numbers imprinted on the side wall of the tire. Refer to the chart to decipher the tire identification code.

Performance tires have a speed rating letter after the aspect ratio number.

| LETTER | SPEED RATING |
|---|---|
| S | 180 km/h (112 mph) |
| T | 190 km/h (118 mph) |
| U | 200 km/h (124 mph) |
| H | 210 km/h (130 mph) |
| V | 240 km/h (149 mph) |
| W | 270 km/h (168 mph) |
| Y | 300 km/h (186 mph) |

The speed rating is not always printed on the tire sidewall.

## TIRE CHAINS

Tire snow chains may be used on **certain** models. Refer to the Owner's Manual for more information.

## RADIAL-PLY TIRES

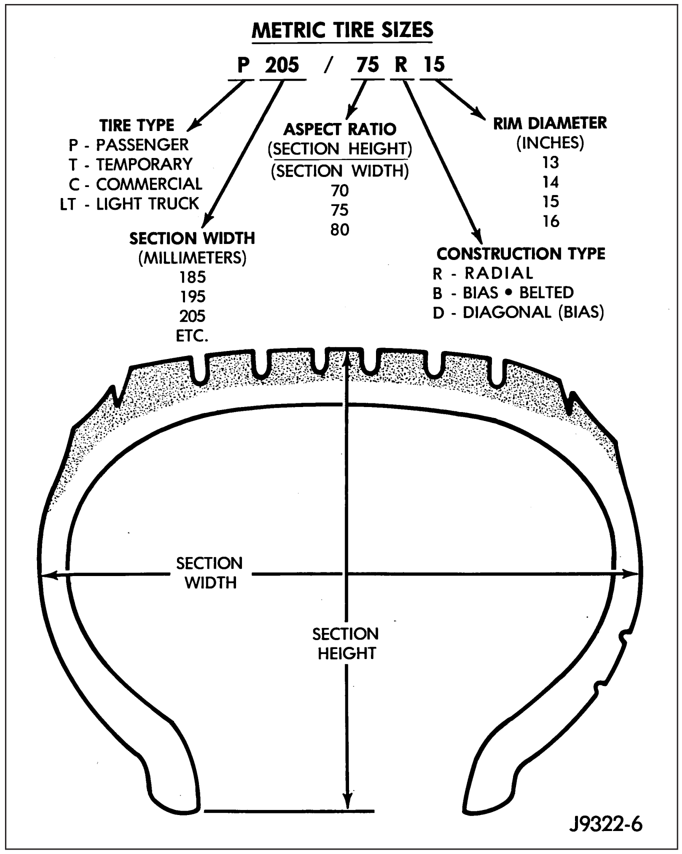
Radial-ply tires improve handling, tread life and ride quality, and decrease rolling resistance.

Radial-ply tires must always be used in sets of four. Under no circumstances should they be used on the front only. They may be mixed with temporary spare tires when necessary. A maximum speed of 80 KPH (50 MPH) is recommended while a temporary spare is in use.

Radial-ply tires have the same load-carrying capacity as other types of tires of the same size. They also use the same recommended inflation pressures.

The use of oversized tires, either in the front or rear of the vehicle, can cause vehicle drive train failure. This could also cause inaccurate wheel speed signals when the vehicle is equipped with Anti-Lock Brakes.

The use of tires from different manufactures on the same vehicle is NOT recommended. The proper tire pressure should be maintained on all four tires.




## TIRE PRESSURE FOR HIGH SPEED

Refer to the Vehicles Owners Manual package.

## SPARE / TEMPORARY TIRE

The temporary spare tire is designed for emergency use only. The original tire should be repaired or replaced at the first opportunity, then reinstalled. Do not exceed speeds of 80 KMH (50 MPH). when using the temporary spare tire. Refer to Owner's Manual for complete details.

## FULL SIZE, SPARE WHEEL WITH MATCHING TIRE

The spare is a full usage wheel with a matching tire. It can be used within the (posted legal) speed limits or distance limitations as of the rest of the vehicles four tires. Refer to Owner's Manual for complete details.

## REPLACEMENT TIRES

The original equipment tires provide a proper balance of many characteristics such as:

- Ride
- Noise
- Handling
- Durability
- Tread life
- Traction
- Rolling resistance
- Speed capability

It is recommended that tires equivalent to the original equipment tires be used when replacement is needed.

Failure to use equivalent replacement tires may adversely affect the safety and handling of the vehicle.

The use of oversize tires may cause interference with vehicle components. Under extremes of suspension and steering travel, interference with vehicle components may cause tire damage.

**WARNING: Failure to equip the vehicle with tires having adequate speed capability can result in sudden tire failure.**

## DIAGNOSIS AND TESTING

## PRESSURE GAUGES

A quality air pressure gauge is recommended to check tire pressure. After checking the air pressure, replace valve cap finger tight.

## TIRE INFLATION

Under inflation will cause rapid shoulder wear, tire flexing, and possible tire failure.

Over inflation will cause rapid center wear and loss of the tire's ability to cushion shocks.

Improper inflation can cause:

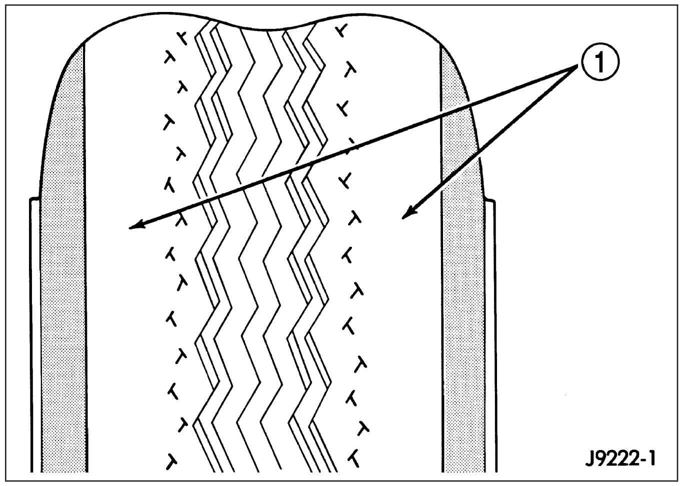
- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy
- Unsatisfactory ride
- Vehicle drift

For proper tire pressure specification refer to the Tire Inflation Pressure Chart provided with the vehicle.

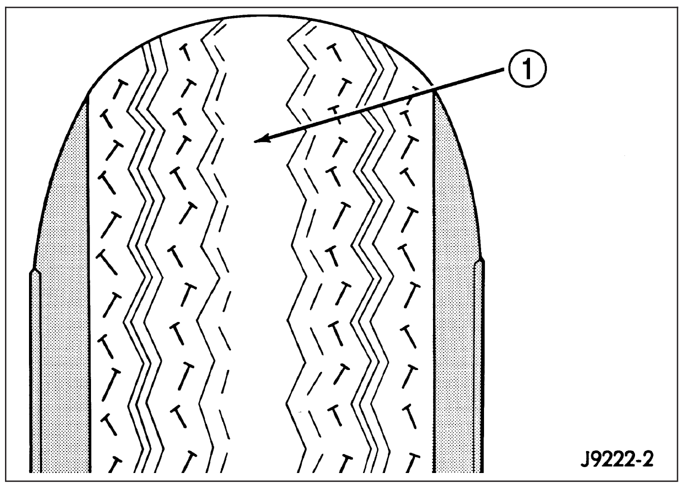
Tire pressures have been chosen to provide safe operation, vehicle stability, and a smooth ride. Tire pressure should be checked cold once a month. The spare tire pressure should be check at least twice annually. Tire pressure decreases as the ambient temperature drops. Check tire pressure frequently when ambient temperature varies widely.

Inflation pressures specified on the placards are cold inflation pressure. The vehicle must sit for at least 3 hours to obtain the correct cold inflation pressure reading. Or driven less than one mile after sitting for 3 hours. Tire inflation pressures may increase from 2 to 6 pounds per square inch (psi) during operation, due to increased tire temperature.

**WARNING: OVER OR UNDER INFLATED TIRES CAN AFFECT VEHICLE HANDLING AND TREAD WEAR. THIS MAY CAUSE THE TIRE TO FAIL SUDDENLY, RESULTING IN LOSS OF VEHICLE CONTROL.**




J9222-1




J9222-2

## TREAD WEAR INDICATORS

Tread wear indicators are molded into the bottom of the tread grooves. When tread depth is 1.6 mm (1/16 in.), the tread wear indicators will appear as a 13 mm (1/2 in.) band.

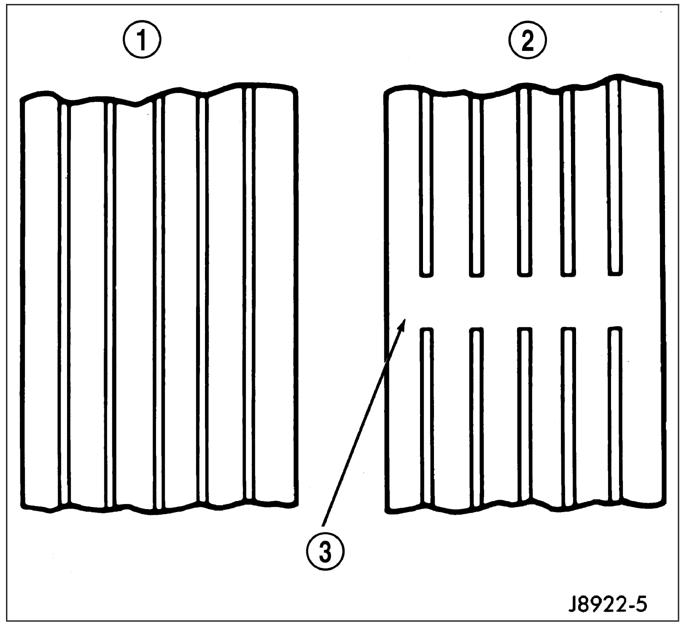
Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs.

## TIRE WEAR PATTERNS

Under inflation will cause wear on the shoulders of tire. Over inflation will cause wear at the center of tire.

Excessive camber causes the tire to run at an angle to the road. One side of tread is then worn more than the other.

Excessive toe-in or toe-out causes wear on the tread edges and a feathered effect across the tread.

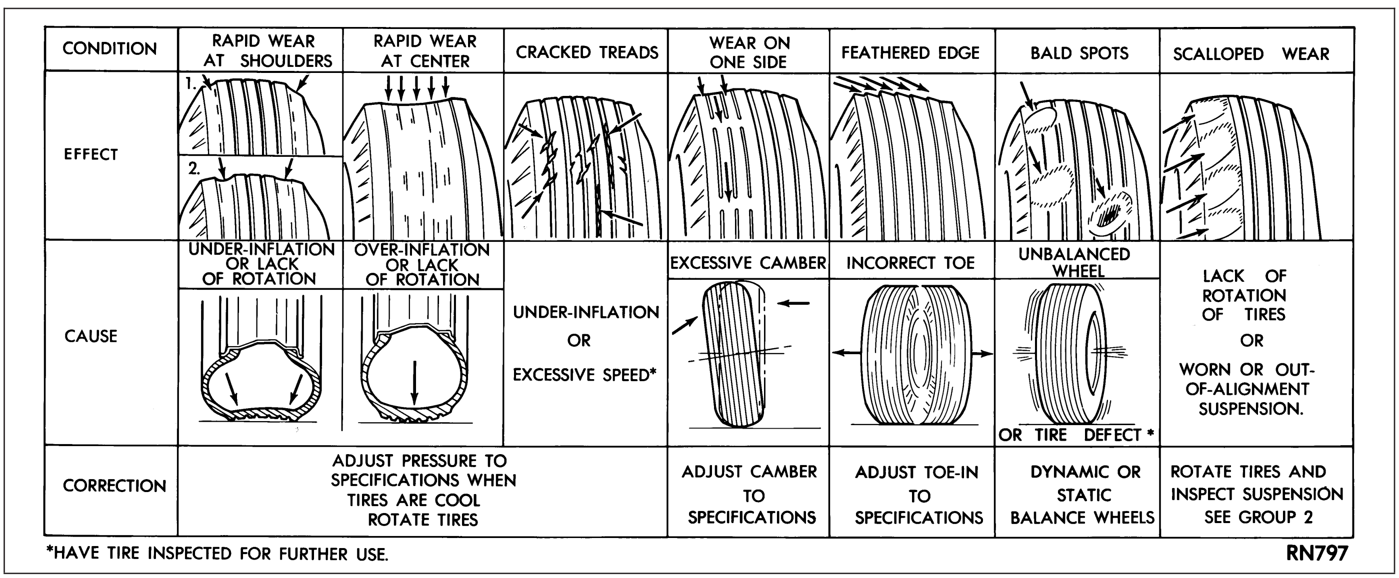


J8922-5

## TIRE NOISE OR VIBRATION

Radial-ply tires are sensitive to force impulses caused by improper mounting, vibration, wheel defects, or possibly tire imbalance.

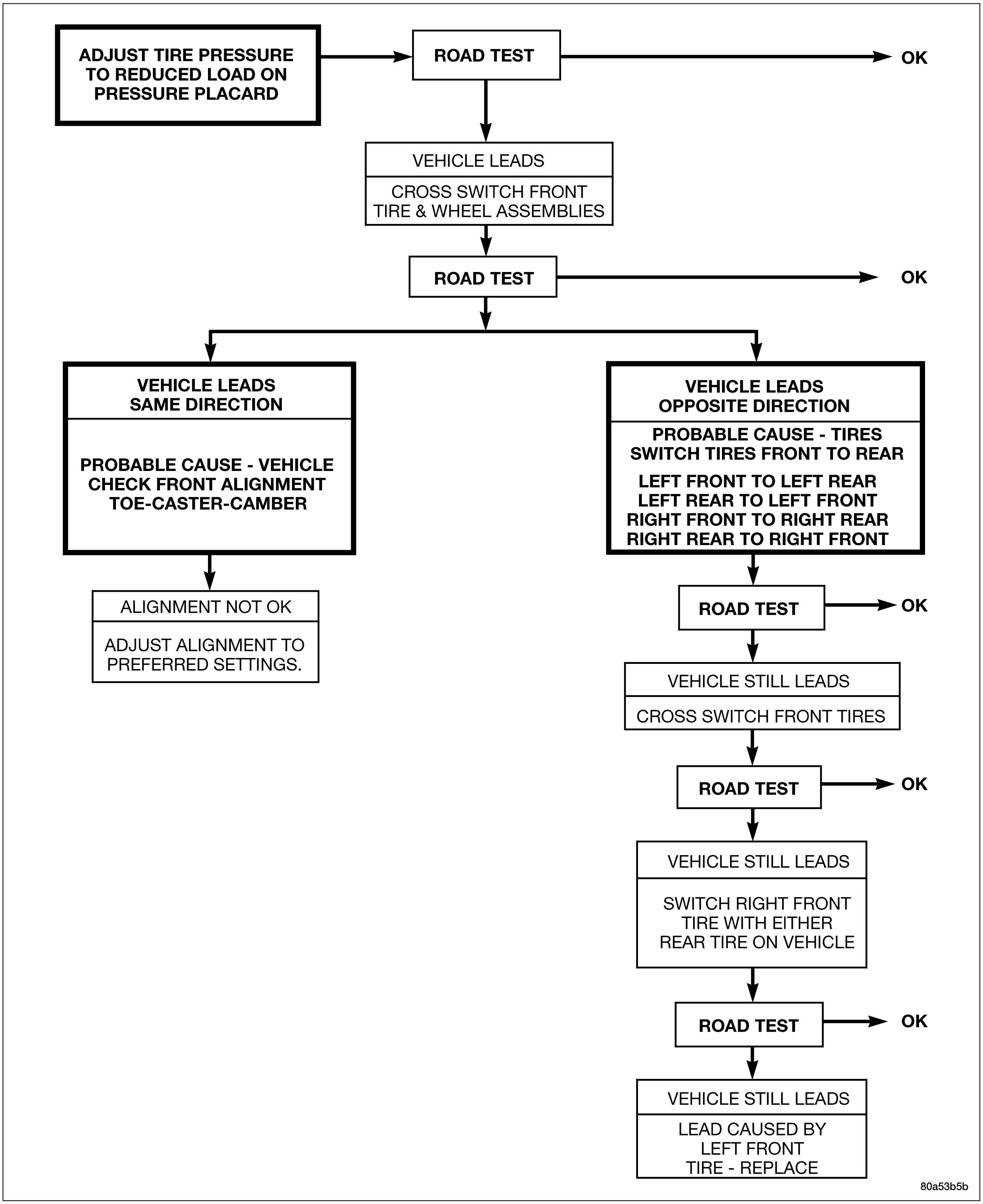
To find out if tires are causing the noise or vibration, drive the vehicle over a smooth road at varying speeds. Note the noise level during acceleration and deceleration. The engine, differential and exhaust noises will change as speed varies, while the tire noise will usually remain constant.



RN797

## TIRE/VEHICLE LEAD

Use the following Vehicle Lead Diagnosis And Correction Chart to diagnose and correct a vehicle lead or drift problem.



## STANDARD PROCEDURE

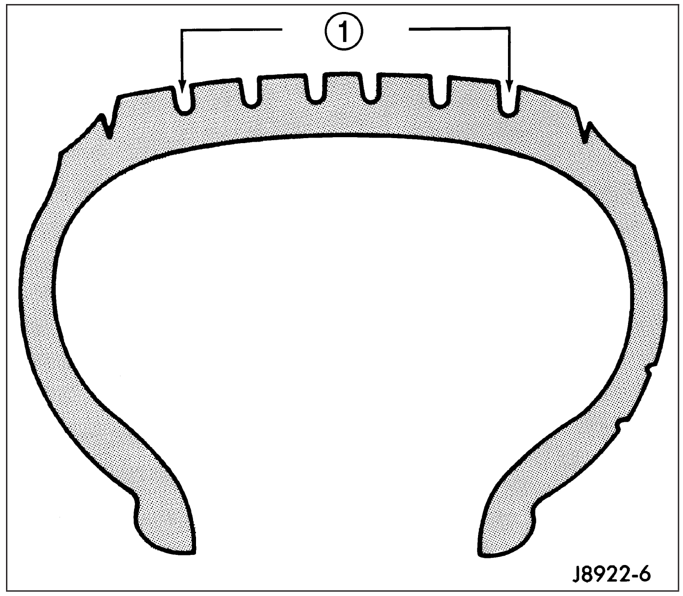
## TIRE REPAIR AREA

For proper repairing, a radial tire must be removed from the wheel. Repairs should only be made if the defect, or puncture, is in the tread area. The tire should be replaced if the puncture is located in the sidewall.

Deflate tire completely before removing the tire from the wheel. Use lubrication such as a mild soap solution when dismounting or mounting tire. Use tools free of burrs or sharp edges which could damage the tire or wheel rim.

Before mounting tire on wheel, make sure all rust is removed from the rim bead and repaint if necessary.

Install wheel on vehicle, and tighten to proper torque specification.




## CLEANING

## TIRES

Remove the protective coating on the tires before delivery of a vehicle. This coating may cause deterioration of the tires.

To remove the protective coating, apply warm water and let it soak for a few minutes. Afterwards, scrub the coating away with a soft bristle brush. Steam cleaning may also be used to remove the coating.

**NOTE: DO NOT use gasoline, mineral oil, oil-based solvent or a wire brush for cleaning.**

## SPECIFICATIONS

## TIRE SIZE CHART

### SPECIFICATIONS

| DESCRIPTION | SPECIFICATION |
|---|---|
| Tire | P215/75R16 |
| Tire | P225/75R16 |
| Tire | P235/70R16 |
| Tire | P235/65R17 |
| Spare Tire<br>BUX & MEXICO | P215/75D16<br>POLYSPARE ONLY ON 16″ |

# SPARE TIRE CARRIER

## REMOVAL

1. Raise the license plate. (Cherokee model)
2. Remove the two bolts securing the wheel cover to the wheel. (Cherokee model)
3. Remove the two lug nuts and the one wheel lock (if equipped) securing the tire/wheel to the spare tire carrier.
4. Remove the spare tire.

## INSTALLATION

1. Install the spare tire onto the studs on the carrier.
2. Install the two lug nuts and one wheel lock (if equipped). Tighten the nuts to 115 N·m (85 ft.lbs.)
3. Close the plastic wheel cover and install the two mounting bolts. Tighten the nuts to 115 N·m (85 ft.lbs.) (Cherokee model)
4. Close the license plate to cover the bolts and latch. (Cherokee model)

# WHEELS

## DESCRIPTION

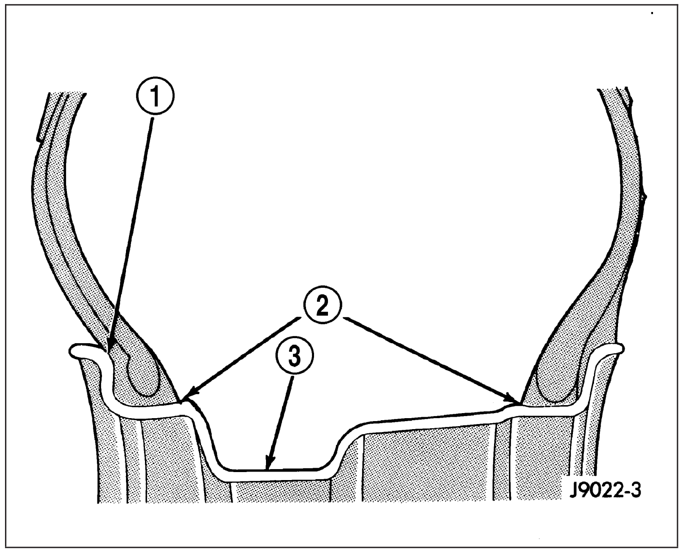
### WHEEL DESIGN

The rim size is on the vehicle safety certification label located on the drivers door shut face. The size of the rim is determined by the drivetrain package. Original equipment wheels/rims are designed for operation up to the specified maximum vehicle capacity.

All models use stamped steel, cast aluminum or forged aluminum wheels. Every wheel has raised sections between the rim flanges and rim drop well called safety humps.

Initial inflation of the tire forces the bead over these raised sections. In case of rapid loss of air pressure, the raised sections help hold the tire on the wheel.

The wheel studs and nuts are designed for specific applications. All aluminum and some steel wheels have wheel stud nuts with an enlarged nose. This enlarged nose is necessary to ensure proper retention of the wheels. Do not use replacement studs or nuts with a different design or lesser quality.




## DIAGNOSIS AND TESTING

### WHEEL INSPECTION

Inspect wheels for:

- Excessive run out
- Dents or cracks
- Damaged wheel lug nut holes
- Air Leaks from any area or surface of the rim

**NOTE: Do not attempt to repair a wheel by hammering, heating or welding.**

If a wheel is damaged an original equipment replacement wheel should be used. When obtaining replacement wheels, they should be equivalent in load carrying capacity. The diameter, width, offset, pilot hole and bolt circle of the wheel should be the same as the original wheel.

**WARNING: FAILURE TO USE EQUIVALENT REPLACEMENT WHEELS MAY ADVERSELY AFFECT THE SAFETY AND HANDLING OF THE VEHICLE. USED WHEELS ARE NOT RECOMMENDED. THE SERVICE HISTORY OF THE WHEEL MAY HAVE INCLUDED SEVERE TREATMENT OR VERY HIGH MILEAGE. THE RIM COULD FAIL WITHOUT WARNING.**

## STANDARD PROCEDURE

## WHEEL INSTALLATION

The wheel studs and nuts are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.

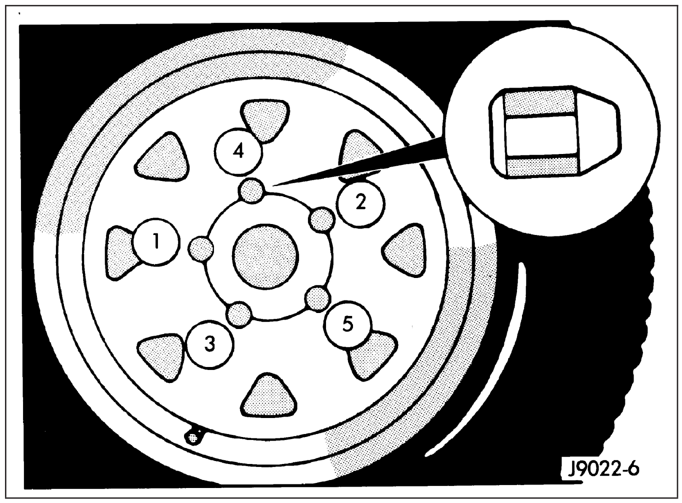
**NOTE: Do not use chrome plated lug nuts with chrome plated wheels.**

Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces. Ensure wheels are installed with good metal-to-metal contact. Improper installation could cause loosening of wheel nuts. This could affect the safety and handling of your vehicle.

To install the wheel, first position it properly on the mounting surface. All wheel nuts should then be tightened just snug. Gradually tighten them in sequence to the proper torque specification. **Never use oil or grease on studs or nuts.**

## WHEEL REPLACEMENT

The wheel studs and nuts are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.




**NOTE: Do not use chrome plated lug nuts with chrome plated wheels.**

Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces. Ensure wheels are installed with good metal-to-metal contact. Improper installation could cause loosening of wheel nuts. This could affect the safety and handling of your vehicle.

To install the wheel, first position it properly on the mounting surface. All wheel nuts should then be tightened just snug. Gradually tighten them in sequence to the proper torque specification. **Never use oil or grease on studs or nuts.**

Wheels must be replaced if they have:

- Excessive runout
- Bent or dented
- Leak air through welds
- Have damaged bolt holes

Wheel repairs employing hammering, heating, or welding are not allowed.

Original equipment wheels are available through your dealer. Replacement wheels from any other source should be equivalent in:

- Load carrying capacity
- Diameter
- Pilot Bore Diameter
- Width
- Offset
- Mounting configuration

Failure to use equivalent replacement wheels may affect the safety and handling of your vehicle. Replacement with **used** wheels is not recommended. Their service history may have included severe treatment.

## SPECIFICATIONS

**CAUTION: DO NOT USE CHROME PLATED LUG NUTS WITH CHROME PLATED WHEELS.**

### TORQUE SPECIFICATIONS

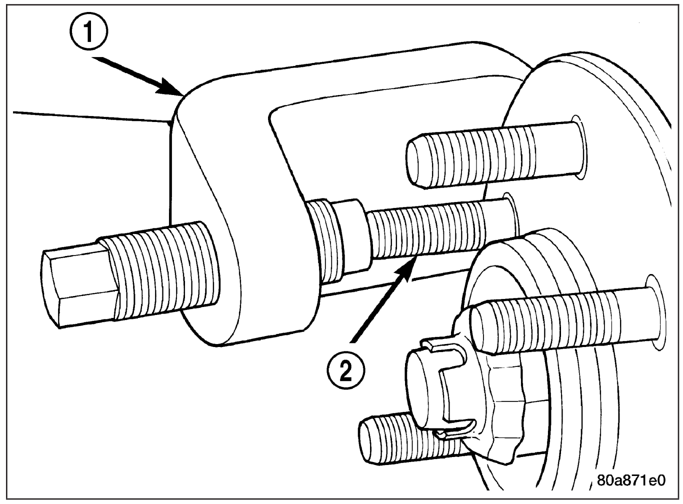
| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Wheel<br>Lug Nut | 115 - 155 | 85 - 115 | — |

# STUDS

## REMOVAL

**CAUTION: Do not use a hammer to remove wheel studs.**

1. Raise and support vehicle.
2. Remove wheel and tire assembly.
3. Remove brake caliper, caliper adapter and rotor, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
4. Remove stud from hub with Remover C-4150A.




## INSTALLATION

**CAUTION: Do not use a hammer to remove wheel studs.**

1. Install new stud into hub flange.
2. Install three washers onto stud, then install lug nut with the flat side of the nut against the washers.
3. Tighten lug nut until the stud is pulled into the hub flange. Verify that the stud is properly seated into the flange.
4. Remove lug nut and washers.
5. Install the brake rotor, caliper adapter, and caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).
6. Install wheel and tire assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE), use new lug nut on stud or studs that were replaced.
7. Remove support and lower vehicle.

# TIRE PRESSURE MONITORING SYSTEM

## DESCRIPTION

### BASE TIRE PRESSURE MONITORING

This system will consist of tire pressure monitoring sensors attached to each wheel through the valve stem mounting hole, a central receiver module (WCM) and a yellow telltale. A sensor shall be installed in the spare wheel if the vehicle is equipped with a matching full size spare wheel and tire assembly.

### PREMIUM TIRE PRESSURE MONITORING

The system will consist of tire pressure monitoring sensors attached to each wheel through the valve stem mounting hole, a wireless control module (WCM), Three Wheel Sensor transponders are mounted in the wheel wells (2 in the front and 1 in the rear wheel wells). a re-configurable dot matrix display module and an amber colored ISO standard Indicator Lamp. A sensor shall be installed in the spare wheel if the vehicle is equipped with a matching full size spare wheel and tire assembly.

### WIRELESS CONTROL MODULE (WCM)

The receiver circuit for the TPM system is integrated into the WCM. The WCM also includes the Remote Keyless Entry (RKE) receiver and the Sentry Key Immobilizer (SKIM) receiver. All three receivers share a number or common components. The WCM decodes the RF signals transmitted by each of the vehicle's tire pressure sensors. The decoded information is used to determine if ″warning″ or ″fault″ conditions exist within the TPM system.

The WCM communicates with the module that controls the ″ISO Indicator Lamp″ and the text display (Premium system), via the vehicle bus system (CAN B).

Upon detection of a warning or fault condition, the WCM will send a request to illuminate the yellow telltale. Also, upon detection of a warning or fault condition, the display module will send a request to sound the ″chime″. A chime will only be requested once per ignition cycle per warning or fault condition detected.

The WCM will store all warning and fault conditions, placard pressure values, low-pressure threshold values and low pressure threshold hysterisis values in memory that can be accessed through diagnostic communication. If new sensors are introduced to the vehicle, the data stored for the sensor being replaced will be deleted.

The WCM will store all wheel sensor ID's and locations and faults in memory that can be accessed through diagnostic communication. All other data values transmitted from each active wheel sensor (not the spare tire) shall be stored in the WCM memory.

## OPERATION

### BASE TIRE PRESSURE MONITORING

The tire pressure monitoring system is designed to operate without loss of function for all types of standard tire constructions. (Function with different types of run flat tire constructions needs to be evaluated for each design). The wheel sensor shall monitor tire pressure, air temperature inside the tire, wheel acceleration and the sensor internal battery status for all four active road tires. The sensor will broadcast this information, along with a unique 32 bit ID, to a central receiver circuit located inside the WCM. The information received by the WCM will be decoded and stored in memory (RAM) in the WCM. If a ″warning or ″fault″ condition exists, the WCM will send a bus message request to illuminate the yellow telltale and to sound the chime.

If the WCM detects a warning or fault condition at ignition key ″on″ it will wait ten seconds +/- 10 % before sending the first request to illuminate the yellow telltale. This will assure that the display module has concluded its bulb check period. The display module will request a chime once per ignition cycle for each ″warning″ or ″fault″ condition detected. A ″warning″ or ″fault″ condition will remain enabled until the problem causing the condition is corrected and removed/reset.

The WCM shall continuously monitor for the receipt of tire pressure RF message transmissions from the wheel sensors during both the ignition key ″on″ and key ″off″ cycles. The wheel sensor ID's and the location of each sensor (e.g. Tire 1, Tire 2 etc.) are stored in the WCM non-volatile memory during the initial Manufacturing Plant Process, or during a service procedure, as required. The recommended ″placard pressure″, ″low-pressure threshold″ and “Hysteresis Pressure Values” for the tires installed on the vehicle, are stored in the WCM non-volatile memory during the initial Manufacturing Plant Process, or during a service procedure, as required. (Note: For vehicles with optional wheel/tire sizes and significantly different tire placard pressures, the placard pressure value and the low-pressure threshold value shall be re-programmable by the dealer to accommodate the customer selected wheel/tire combinations recommended by DaimlerChrysler).

## PREMIUM TIRE PRESSURE MONITORING

The tire pressure monitoring system is designed to operate without loss of function for all types of standard tire constructions. (Function with different types of run flat tire constructions needs to be evaluated for each design). The wheel sensor shall monitor tire pressure, air temperature inside the tire, wheel acceleration and the sensor internal battery status for all four active road tires and the spare tire, if so equipped. The sensor will broadcast this information, along with a unique 32 bit ID, to a central receiver circuit located inside the WCM. The information received by the WCM will be decoded and stored in (RAM) memory in the WCM. The WCM will send bus messages to the re-configurable display module to display the pressures of the four active road tires in vehicle position. The spare tire pressure is monitored but it is not displayed.

If a ″warning″ or ″fault″ condition exists, the WCM will send a bus message request to display the text messages and, when required, illuminate the yellow telltale. ″Warnings″ and ″faults″ are described in more detail below. If the WCM detects a warning or fault condition at ignition key ″on″ it will wait ten seconds +/- 10% before sending the first request to illuminate the yellow telltale and to display the text messages. This will assure that the display module has concluded its bulb check period. The display module will request a chime once per ignition cycle for each ″warning″ or ″fault″ condition detected. A ″warning″ or ″fault″ condition will remain enabled until the problem causing the condition is corrected and removed/reset

The WCM shall continuously monitor for the receipt of tire pressure RF message transmissions from the wheel sensors during both the ignition key ″on″ and key ″off″ cycles. The wheel sensor ID’s and the location of each sensor (e.g. Left Front, Right Front etc.) are stored in the WCM non-volatile memory during the initial Manufacturing Plant Process, or during a service procedure, as required. The recommended ″placard pressure″, ″low-pressure threshold″ and Hysteresis Pressure Values for the tires installed on the vehicle, are stored in the WCM non-volatile memory during the initial Manufacturing Plant Process, as described later in this document or during a service procedure as required. (Note: For vehicles with optional wheel/tire sizes and significantly different tire placard pressures, the placard pressure value and the low-pressure threshold value shall be re-programmable by the dealer to accommodate the customer selected wheel/tire combinations recommended by DaimlerChrysler).

## DIAGNOSIS AND TESTING - TIRE PRESSURE MONITORING SYSTEM

All Tire Pressure Monitoring System Faults are specific to one location. If a ″BATTERY LOW″ or ″SENSOR FAILURE″ fault is detected, the location will be displayed (Premium Systems). The appropriate sensor/transmitter can then be replaced. If a single sensor/transmitter cannot be detected by the WCM, replace that sensor transmitter. If none of the sensors/transmitters can be detected, refer to symptoms in the WCM section. For additional system description and diagnosis, refer to Tire Pressure Monitoring in the Body Diagnostic manual.

## SPECIFICATIONS

## TORQUE CHART

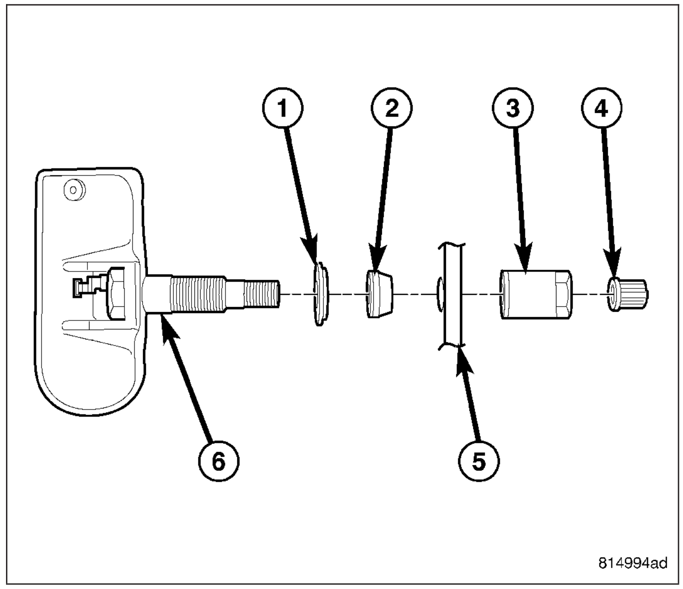
### TORQUE SPECIFICATIONS

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Tire Pressure Sensor/ Transmitter Mounting Nut | 6.5 | — | 58 |

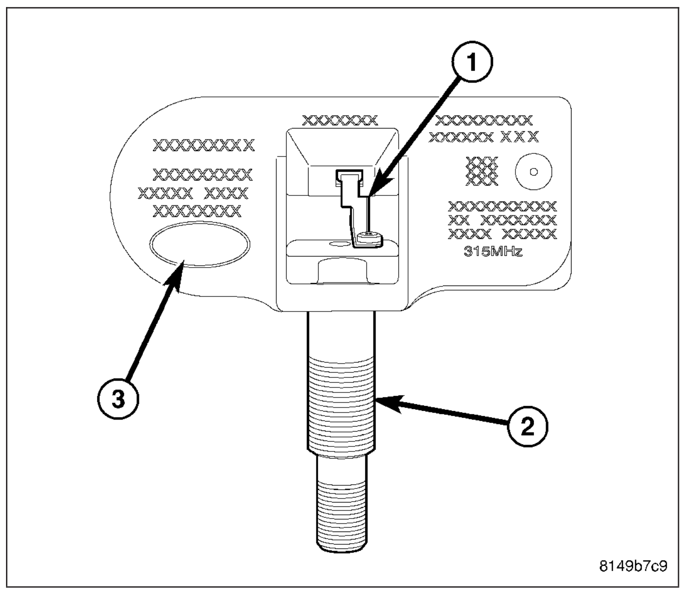
# SENSOR

## DESCRIPTION

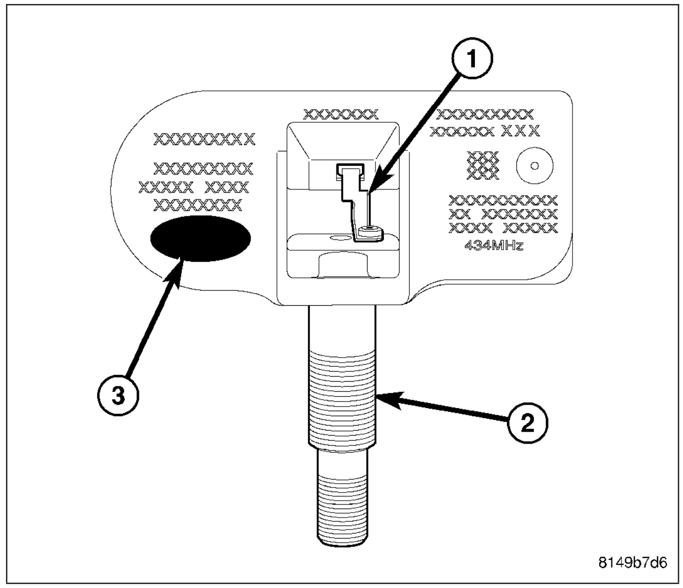
On vehicles equipped with Tire Pressure Monitoring (TPM), one tire pressure sensor (6) is mounted to each wheel (5) in place of the traditional tire valve stem. Each sensor has an internal battery that lasts up to 10 years. The battery is not serviceable. At the time of battery failure, the sensor must be replaced.




The TPM system operates on a 315 MHz radio frequency. The 315 MHz sensors can be easily identified by a white outline oval (black center) insignia (3) on the sensor body.



The Export TPM system operates on a 434 MHz radio frequency. The 434 MHz sensors can be easily identified by a solid white oval insignia (3) on the body.

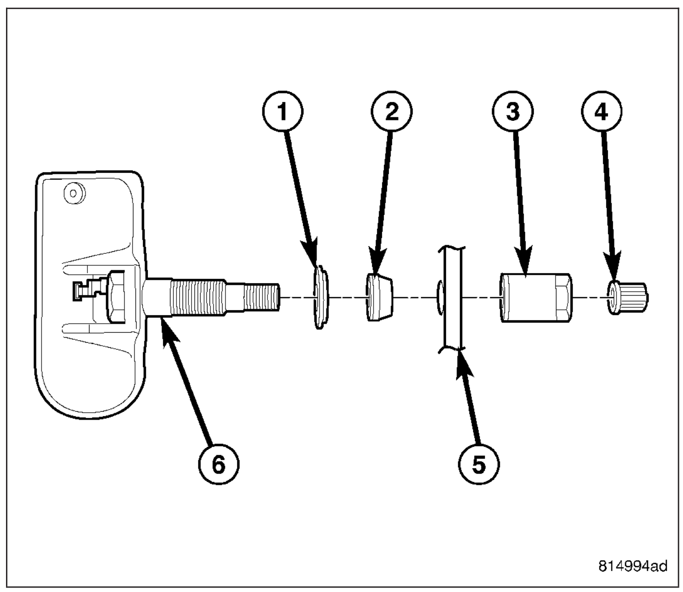



**CAUTION: Although 315 MHz and 434 MHz sensors are identical in size and shape, they are not interchangeable. Always make sure the correct sensor is being used.**

The TPM sensors are designed for original style factory wheels. **Do not attempt to install a tire pressure sensor in an aftermarket wheel.**

The serviceable components of the tire pressure sensor are :

- Sensor-To-Wheel Seal (2) and Metal Washer (1)
- Valve Stem Cap (4)
- Valve Stem Core
- Valve Stem Nut (with pressed-in washer) (3)




The valve stem caps and cores used are specifically designed for the tire pressure monitoring sensors. Although similar to standard valve stem caps and cores, they are different. The valve stem cap has a special seal inside to keep moisture and corrosion out. The valve stem core has a special nickel coating to protect from corrosion.

## OPERATION

The battery operated tire pressure sensors lay dormant (Park Mode), then wake and start transmitting (Drive Mode) when the vehicle first reaches speeds over 20 mph (32 km/h). Once the wheels stop rotating for a period of approximately 20 minutes, the sensors shut down until again awaken. Although not transmitting as when in Drive Mode, while in Park Mode, the sensors still transmit approximately once every 13 hours to let the receiver know air pressure status at that time.

Using an RF signal, each sensor transmits tire pressure data approximately once every minute. Each sensor's (transmitter) broadcast is uniquely coded so that the wireless control module (WCM) can monitor the state of each of the sensors on the four rotating road wheels. The WCM automatically learns and stores the sensor's ID while driving after a sensor has been replaced. **There is no formal retraining procedure necessary.**

For additional information, refer to appropriate diagnostic information.

## CAUTION

**CAUTION: The use of tire sealants is strictly prohibited for vehicles equipped with the Tire Pressure Monitoring system. Tire sealants can clog tire pressure sensors.**

**CAUTION: Tire pressure sensor valve stem caps and cores are specially designed for the sensors. Due to risk of corrosion, do not use a standard valve stem cap or core in a tire pressure sensor in place of the original equipment style sensor cap and core.**

**CAUTION: Do not attempt to install a tire pressure sensor in an aftermarket wheel. Use tire pressure sensors in original style factory wheels only.**

**CAUTION: Any time a sensor is to be installed in a wheel, a new seal and washer must be installed on the stem to ensure air tight sealing.**

**NOTE: TPM thresholds have been established for the original tire size equipped on the vehicle. Use original size tires only to maintain system accuracy.**

## DIAGNOSIS AND TESTING

## TIRE PRESSURE SENSOR

**NOTE: Tire pressure may increase from 2 to 6 psi (14 to 41 kPa) during normal driving conditions. Do NOT reduce this normal pressure build up.**

When diagnosing a tire pressure issue, always check air pressure in the tires first with a known accurate air gauge. Adjust air pressure as necessary to that listed on the Tire Inflation Pressure Label (Placard) provided with the vehicle (usually applied to the driver's side B-pillar). After adjusting air pressure in a tire, allow approximately two minutes for the message or yellow telltale to go out.

Check the tire pressure yellow telltale in the instrument cluster. If the yellow telltale is illuminating continuously, proceed as listed below. If the yellow telltale is flashing on/off for 60 seconds, once every ten minutes, there is a system fault detected. Refer to the appropriate diagnostic information.

If air pressure in any tire is low, inspect **all** the tires for leaks. A water "dunk tank" or other water test may be used to check for a leak around the sensor as long as any water at the valve core is removed once the procedure is completed. The water can be easily expelled from the core area by pushing in on the core for several seconds, allowing escaping air to drive out any moisture. Reinflate the tire as necessary. Always make sure the original valve stem cap is securely installed to keep moisture out of the sensor.

If the gauge-read pressure in the tires does not indicate a tire pressure issue, refer to the appropriate diagnostic information.

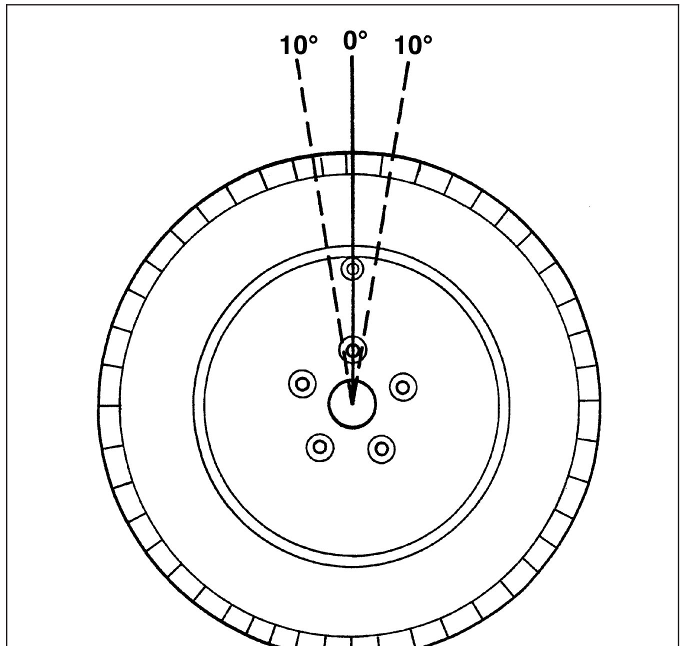
## REMOVAL

1. Raise and support vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)
2. Remove the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS - REMOVAL)

**CAUTION: The cap used on this valve stem contains an O-ring seal to prevent contamination and moisture from entering the valve stem. Retain this valve stem cap for reuse. Do not substitute a regular valve stem cap in its place.**

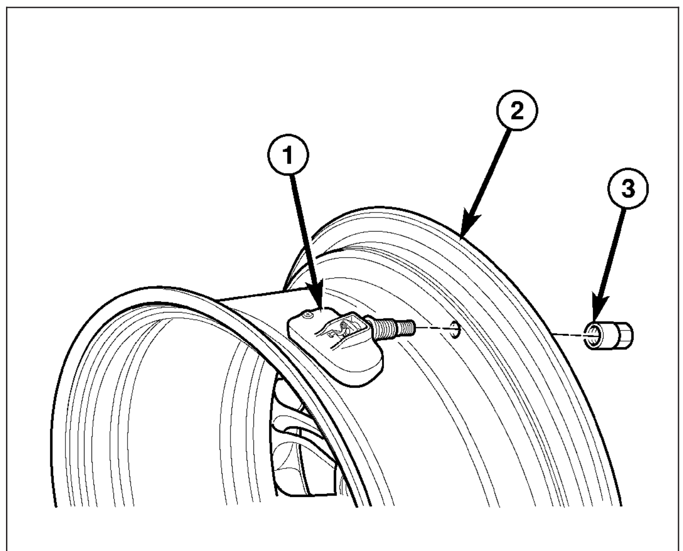
**CAUTION: The valve stem used on this vehicle is made of aluminum and the core is nickel plated brass. The original valve stem core must be reinstalled and not substituted with a valve stem core made of a different material. This is required to prevent corrosion in the valve stem caused by the different metals.**

3. Dismount tire from wheel following tire changer manufacturers instructions while paying special attention to the following to avoid damaging the pressure sensor:
   a. When breaking the tire bead loose from the wheel rim, avoid using the Bead Breaker in the area of the sensor. That includes both front and rear beads of the tire.
   b. When preparing to dismount the tire from the wheel, carefully insert the mounting/dismounting tool at the valve stem ± 10°, then proceed to dismount the tire from the wheel. Use this process on both the upper and lower tire beads.



80dbf339

4. Remove sensor nut (3) retaining sensor to wheel. While removing nut, hold pressure against rear of metal valve stem (See Arrow) to keep valve stem from pushing rearward, damaging antenna strap.
5. Remove sensor (1) from wheel (2) .

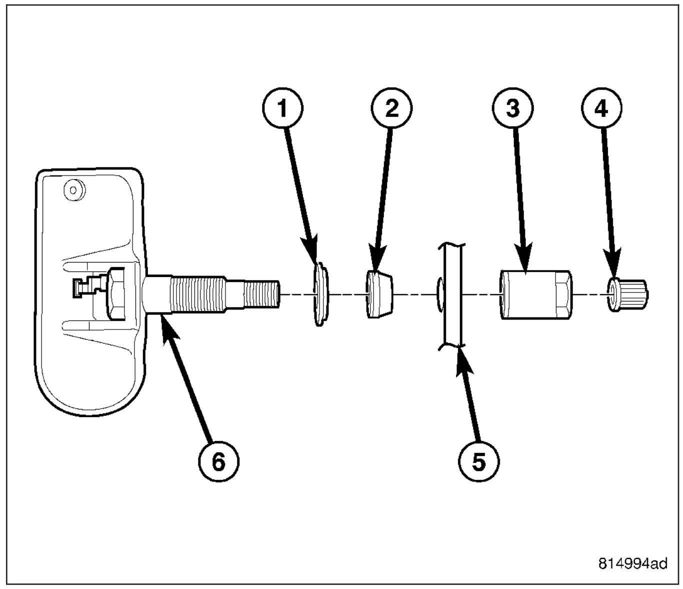


814a12bd

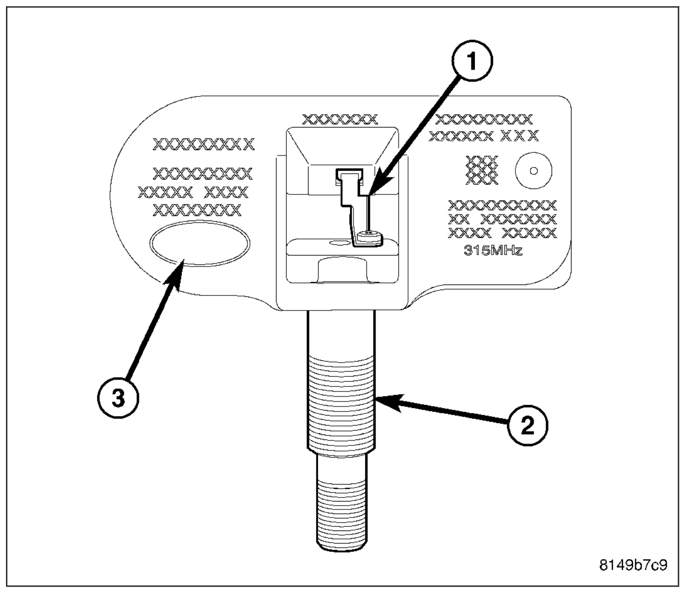
## INSTALLATION

**NOTE: Before reinstalling an existing tire pressure sensor, replace seal (2) and metal washer (1) at base of sensor valve stem (6) to ensure proper sealing.**

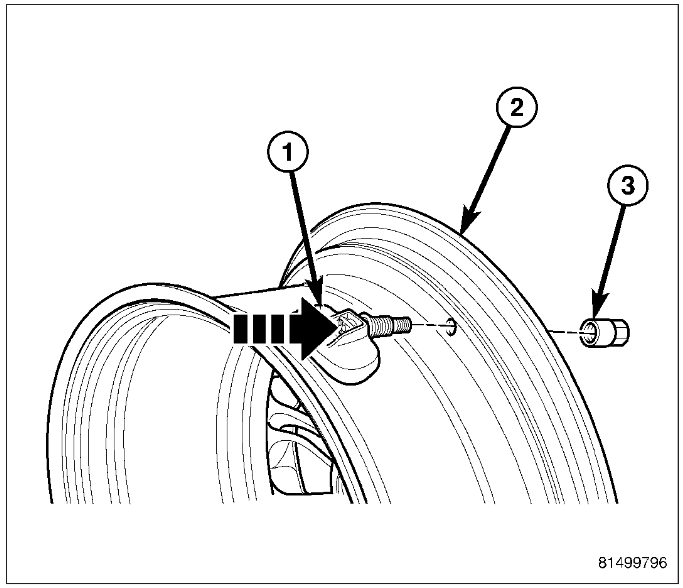
1. Wipe area clean around sensor/valve stem mounting hole in wheel (5). Make sure surface of wheel is not damaged.




**CAUTION: To avoid damaging sensor antenna strap (1), hold pressure against rear of metal valve stem (2) while sensor is inserted through wheel mounting hole and nut is installed.**



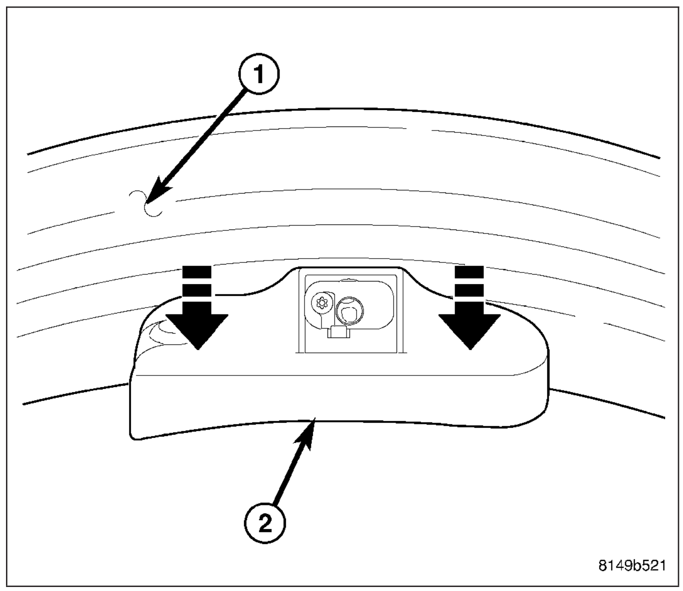
2. Insert sensor (1) through wheel (2) as shown keeping pressure against rear of metal valve stem (See Arrow). Potted side of sensor is to be positioned toward wheel. Do not attempt to mount sensor otherwise, damage may occur.
3. Install sensor nut (with pressed-in washer) (3) by hand.




**NOTE: Before tightening sensor nut, push downward on sensor housing (2) in an attempt to make it flush with interior contour of wheel (1).**

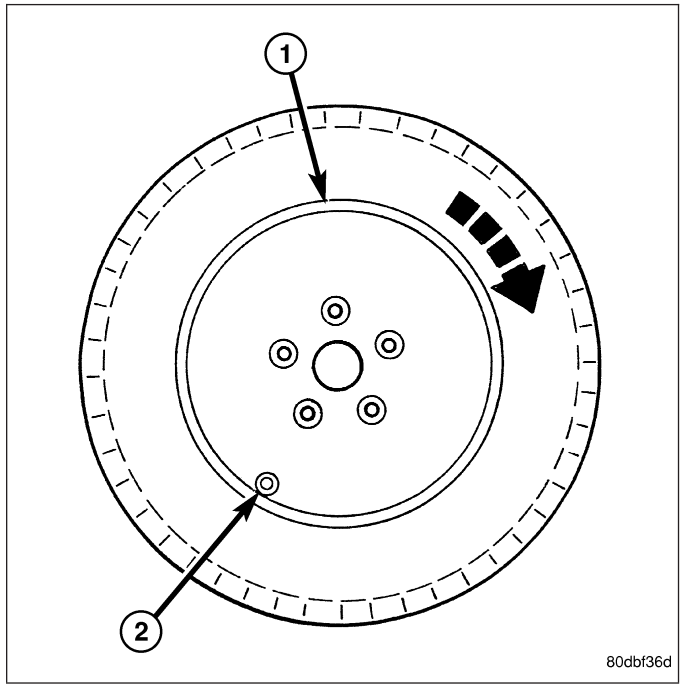
4. While holding sensor in position, tighten sensor nut to 6.5 N·m (58 in. lbs.) torque.

**CAUTION: Over-torquing the sensor nut by as little as 12 N·m (106 in. lbs.) may result in sensor separation from the valve stem. Under this condition, the sensor may still function, however, the condition should be corrected immediately.**

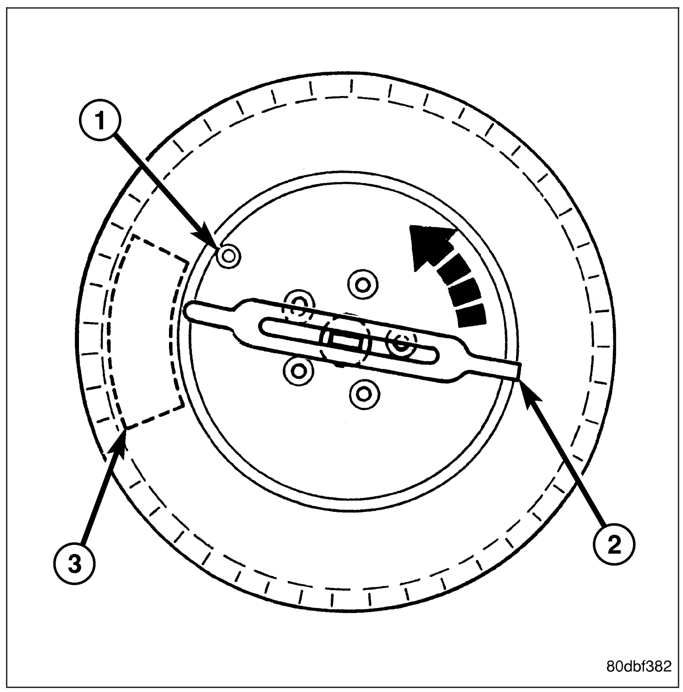



5. Mount tire on wheel following tire changer manufacturers instructions, paying special attention to the following to avoid damaging tire pressure sensor:

a.
Rotating Wheel Tire Changers- Once the wheel is mounted to the changer, position the sensor valve stem (2) approximately 210° from the head of the changer (located at 1) in a clockwise direction before rotating the wheel (also in a clockwise direction) to mount the tire. Use this procedure on both the upper and lower tire beads.




b. Rotating Tool Tire Changers - Position the wheel on the changer so that the sensor valve stem (1) is located approximately 210° clockwise from the installation end of the mounting/dismounting tool (2) once the tool is mounted for tire installation. Make sure the sensor is clear of the lower bead breaker area (3) to avoid damaging the sensor when the breaker rises. Rotate the tool (2) in a counterclockwise direction to mount the tire. Use this procedure on both the upper and lower tire beads.




6. Adjust air pressure to that listed on Tire Inflation Pressure Label (Placard) provided with vehicle (usually applied to driver's side B-pillar). Make sure **original style** valve stem cap is securely installed to keep moisture out of sensor.
7. Install tire and wheel assembly on vehicle (Refer to 22 - TIRES/WHEELS - INSTALLATION).
8. Lower vehicle.
9. Drive vehicle for a minimum of five minutes while maintaining a continuous speed above 20 mph (32 km/h). During this time the system will learn the new sensor ID code and will clear any DTC's automatically.

**NOTE: If a sensor cannot be trained, refer to appropriate diagnostic information.**

# TRANSPONDER

## DESCRIPTION - PREMIUM SYSTEM

A transponder is located in three of the four wheel wells of the vehicle to provide the WCM/SKREEM with the location of the tire pressure sensors on the vehicle. The transponders are located in the left front, right front and right rear wheel wells. A fourth transponder is not necessary in the remaining wheel well due to the process-of-elimination theory. Once the system knows the location of the first three sensors it assumes the location of the fourth tire pressure sensor is in the left rear tire.

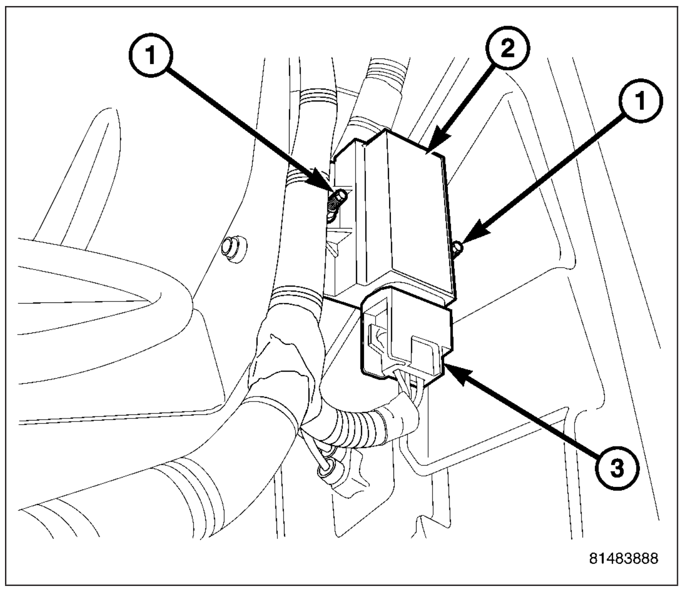
## OPERATION - PREMIUM SYSTEM

Transponders located in three of the four wheel wells of the vehicle to provide the Wireless Control Module (WCM) commonly referred to as the Sentry Key Remote Entry Module (SRKEEM) with the location of the tire pressure sensors on the vehicle. The transponders are located in the left front, right front and right rear wheel wells. A fourth transponder is not necessary in the remaining wheel well due to the process-of-elimination theory. Once the system knows the location of the first three sensors it assumes the location of the fourth tire pressure sensor is in the left rear tire.

## REMOVAL

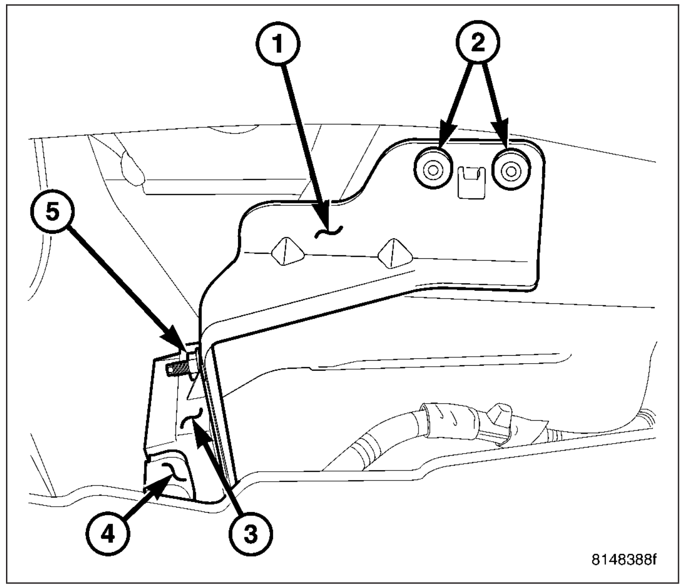
## FRONT

1. Raise and support the vehicle.
2. Remove the front part wheel well housing cover and pull it back toward the tire to gain access to the transponder.
3. Remove the mounting nuts (1) for the transponder (2) from the mounting bracket.
4. Disconnect the electrical connector (3) and remove the transponder (2) from the vehicle.

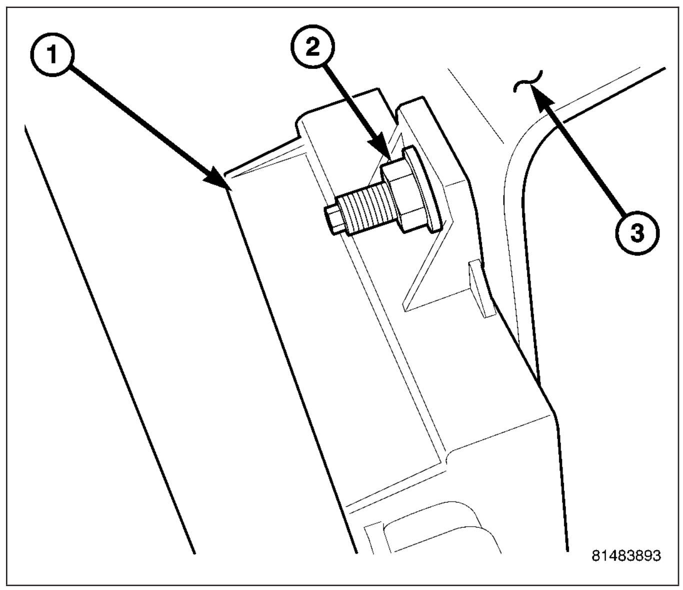


## REAR

1. Raise and support the vehicle.
2. Drill out the rivets (2) for the transponder mounting bracket (1).
3. Disconnect the electrical connector (4).



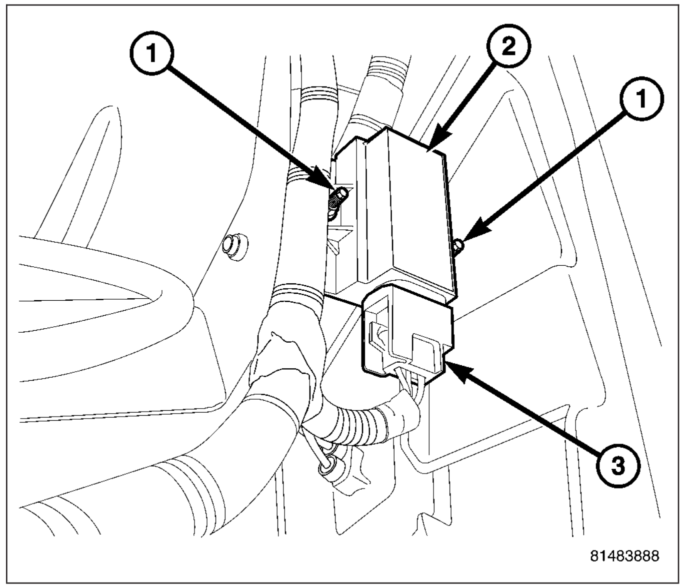

4. Pull the transponder (1) with the bracket down and remove the mounting nuts (2) for the transponder (1).
5. Remove the transponder (1) from the bracket (3).



## INSTALLATION

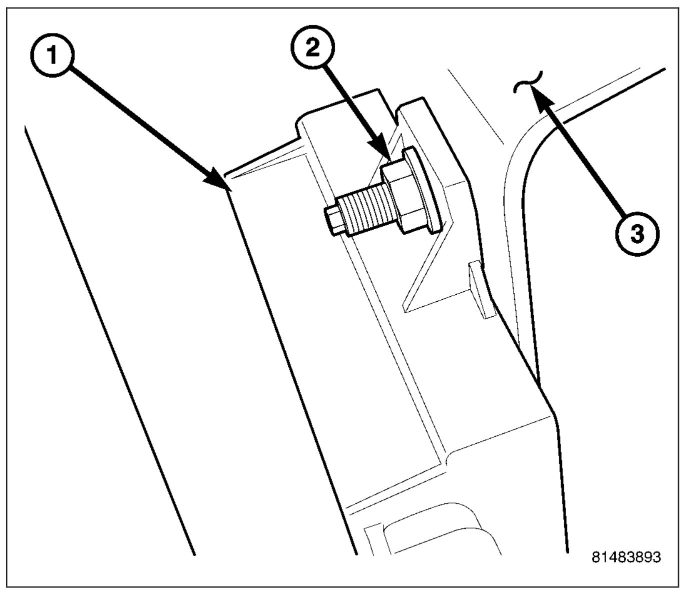
## FRONT

1. Reconnect the electrical connector (3) to the transponder (2).
2. Install the transponder (2) to the mounting bracket and install the mounting nuts (1).
3. Install the front part of the wheel well housing cover.
4. Lower the vehicle.

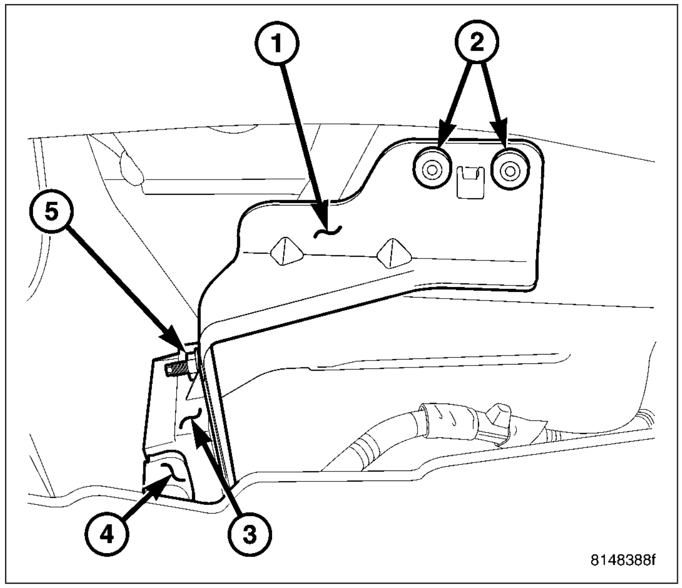



## REAR

1. Install the transponder (1) to the bracket (3) and install the mounting nuts (2).



2. Reconnect the electrical connector (4) to the transponder (3).
3. Install the transponder/bracket assembly (1) to the vehicle and install new rivets (2).
4. Lower the vehicle.



# BODY

## TABLE OF CONTENTS

# BODY

## WARNING

## SAFETY PRECAUTIONS AND WARNINGS

**WARNING: Use an OSHA approved breathing filter when spraying paint or solvents in a confined area. Personal injury can result.**
- **Avoid prolonged skin contact with petroleum or alcohol – based cleaning solvents. Personal injury can result.**
- **Do not stand under a hoisted vehicle that is not properly supported on safety stands. Personal injury can result.**

**CAUTION: When holes must be drilled or punched in an inner body panel, verify depth of space to the outer body panel, electrical wiring, or other components. Damage to vehicle can result.**
- **Do not weld exterior panels unless combustible material on the interior of vehicle is removed from the repair area. Fire or hazardous conditions, can result.**
- **Always have a fire extinguisher ready for use when welding.**
- **Disconnect the negative (-) cable clamp from the battery when servicing electrical components that are live when the ignition is OFF. Damage to electrical system can result.**
- **Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.**
- **Do not use harsh alkaline based cleaning solvents on painted or upholstered surfaces. Damage to finish or color can result.**
- **Do not hammer or pound on plastic trim panel when servicing interior trim. Plastic panels can break.**

## DIAGNOSIS AND TESTING

## WATER LEAKS

Water leaks can be caused by poor sealing, improper body component alignment, body seam porosity, missing plugs, or blocked drain holes. Centrifugal and gravitational force can cause water to drip from a location away from the actual leak point, making leak detection difficult. All body sealing points should be water tight in normal wet-driving conditions. Water flowing downward from the front of the vehicle should not enter the passenger or luggage compartment. Moving sealing surfaces will not always seal water tight under all conditions. At times, side glass or door seals will allow water to enter the passenger compartment during high pressure washing or hard driving rain (severe) conditions. Overcompensating on door or glass adjustments to stop a water leak that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After completing a repair, water test vehicle to verify leak has stopped before returning vehicle to use.

### VISUAL INSPECTION BEFORE WATER LEAK TESTS

Verify that floor and body plugs are in place, body drains are clear, and body components are properly aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

### WATER LEAK TESTS

**WARNING: Do not use electric shop lights or tools in water test area. Personal injury can result.**

When the conditions causing a water leak have been determined, simulate the conditions as closely as possible.
- If a leak occurs with the vehicle parked in a steady light rain, flood the leak area with an open-ended garden hose.
- If a leak occurs while driving at highway speeds in a steady rain, test the leak area with a reasonable velocity stream or fan spray of water. Direct the spray in a direction comparable to actual conditions.
- If a leak occurs when the vehicle is parked on an incline, hoist the end or side of the vehicle to simulate this condition. This method can be used when the leak occurs when the vehicle accelerates, stops or turns. If the leak occurs on acceleration, hoist the front of the vehicle. If the leak occurs when braking, hoist the back of the

vehicle. If the leak occurs on left turns, hoist the left side of the vehicle. If the leak occurs on right turns, hoist the right side of the vehicle. For hoisting recommendations (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE).

## WATER LEAK DETECTION

To detect a water leak point-of-entry, do a water test and watch for water tracks or droplets forming on the inside of the vehicle. If necessary, remove interior trim covers or panels to gain visual access to the leak area. If the hose cannot be positioned without being held, have someone help do the water test.

Some water leaks must be tested for a considerable length of time to become apparent. When a leak appears, find the highest point of the water track or drop. The highest point usually will show the point of entry. After leak point has been found, repair the leak and water test to verify that the leak has stopped.

Locating the entry point of water that is leaking into a cavity between panels can be difficult. The trapped water may splash or run from the cavity, often at a distance from the entry point. Most water leaks of this type become apparent after accelerating, stopping, turning, or when on an incline.

### MIRROR INSPECTION METHOD

When a leak point area is visually obstructed, use a suitable mirror to gain visual access. A mirror can also be used to deflect light to a limited-access area to assist in locating a leak point.

### BRIGHT LIGHT LEAK TEST METHOD

Some water leaks in the luggage compartment can be detected without water testing. Position the vehicle in a brightly lit area. From inside the darkened luggage compartment inspect around seals and body seams. If necessary, have a helper direct a drop light over the suspected leak areas around the luggage compartment. If light is visible through a normally sealed location, water could enter through the opening.

### PRESSURIZED LEAK TEST METHOD

When a water leak into the passenger compartment cannot be detected by water testing, pressurize the passenger compartment and soap test exterior of the vehicle. To pressurize the passenger compartment, close all doors and windows, start engine, and set heater control to high blower in HEAT position. If engine can not be started, connect a charger to the battery to ensure adequate voltage to the blower. With interior pressurized, apply dish detergent solution to suspected leak area on the exterior of the vehicle. Apply detergent solution with spray device or soft bristle brush. If soap bubbles occur at a body seam, joint, seal or gasket, the leak entry point could be at that location.

## WIND NOISE

Wind noise is the result of most air leaks. Air leaks can be caused by poor sealing, improper body component alignment, body seam porosity, or missing plugs in the engine compartment or door hinge pillar areas. All body sealing points should be airtight in normal driving conditions. Moving sealing surfaces will not always seal airtight under all conditions. At times, side glass or door seals will allow wind noise to be noticed in the passenger compartment during high cross winds. Over compensating on door or glass adjustments to stop wind noise that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After a repair procedure has been performed, test vehicle to verify noise has stopped before returning vehicle to use.

## VISUAL INSPECTION BEFORE TESTS

Verify that floor and body plugs are in place and body components are aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

### ROAD TESTING WIND NOISE

1. Drive the vehicle to verify the general location of the wind noise.
2. Apply 50 mm (2 in.) masking tape in 150 mm (6 in.) lengths along weatherstrips, weld seams or moldings. After each length is applied, drive the vehicle. If noise goes away after a piece of tape is applied, remove tape, locate, and repair defect.

**POSSIBLE CAUSE OF WIND NOISE**

- Moldings standing away from body surface can catch wind and whistle.
- Gaps in sealed areas behind overhanging body flanges can cause wind-rushing sounds.
- Misaligned movable components.
- Missing or improperly installed plugs in pillars.
- Weld burn through holes.

## STANDARD PROCEDURE

## STANDARD PROCEDURE - BODY LUBRICATION

All mechanisms and linkages should be lubricated when necessary, except the door check straps and latches. This will maintain ease of operation and provide protection against rust and excessive wear. The weatherstrip seals should be lubricated to prolong their life as well as to improve door sealing.

All applicable exterior and interior vehicle operating mechanisms should be inspected and cleaned. Pivot/sliding contact areas on the mechanisms should then be lubricated.

1. When necessary, lubricate the operating mechanisms with the specified lubricants.
2. Apply silicone lubricant to a cloth and wipe it on door seals to avoid over-spray that can soil passenger's clothing.
3. Before applying lubricant, the component should be wiped clean. After lubrication, any excess lubricant should be removed.
4. The hood latch, latch release mechanism, latch striker, and safety latch should be lubricated periodically.
5. The door lock cylinders should be lubricated twice each year (preferably autumn and spring).
   - Spray a small amount of lock cylinder lubricant directly into the lock cylinder.
   - Apply a small amount to the key and insert it into the lock cylinder.
   - Rotate it to the locked position and then back to the unlocked position several times.
   - Remove the key. Wipe the lubricant from it with a clean cloth to avoid soiling of clothing.
6. Door and swing gate check straps should be wiped clean but not lubricated.

| Component | Fluid, Lubricant, and Genuine Part |
|---|---|
| Hinges: | |
| Door & Hood | Mopar® Engine Oil |
| Swing Gate | Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB |
| Latches: Hood/Safety Catch | Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB |
| Seat Regulator & Track | Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB |
| Lock Cylinders | Mopar® Lock Cylinder Lube |

## HEAT STAKING

1. Remove trim panel.
2. Bend or move the trim panel components at the heat staked joints. Observe the heat staked locations and/or component seams for looseness.
3. Heat stake the components.
   a. If the heat staked or component seam location is loose, hold the two components tightly together and using a soldering gun with a flat tip, melt the material securing the components together. Do not over heat the affected area, damage to the exterior of the trim panel may occur.
   b. If the heat staked material is broken or missing, use a hot glue gun to apply new material to the area to be repaired. The panels that are being heat staked must be held together while the applying the glue. Once the new material is in place, it may be necessary to use a soldering gun to melt the newly applied material. Do not over heat the affected area, damage to the exterior of the trim panel may occur.
4. Allow the repaired area to cool and verify the repair.
5. Install trim panel.

## BUZZ, SQUEAK & RATTLE

Buzz, Squeak & Rattles (BSR) may be caused by any one or more of the following and may be corrected as indicated:

- Loose fasteners should be tightened to specifications.
- Damaged or missing clips should be replaced.
- Damaged trim panels should be replaced.
- Incorrectly installed trim panels should be reinstalled properly.

Many BSR complaints such as loose trim, can be serviced using the Mopar® Parts BSR Noise Reduction Kit. This kit contains various tapes including foam, flock and anti-squeak used to eliminate noises caused by metal, plastic and vinyl components. Long life lubricants and greases can also be used on a variety of components. Refer to the Buzz, Squeak & Rattle Kit table for material contents and usage.

**Buzz, Squeak & Rattle Kit**

| ITEM | FEATURES | APPLICATIONS | SERVICE TEMP |
|---|---|---|---|
| Itch And Squeak Tape | An abrasion resistant material thin enough to conform to most irregular surfaces. Stops most itches and squeaks. | Between metal and metal, metal and plastic, metal and vinyl, vinyl and plastic. Interior. Examples: Trim panels and bezels. | -40° to 225° Fahrenheit (-40° to 107° Celsius) |
| Black Nylon Flock | Nylon Flock with an aggressive acrylic adhesive. Provides for cushioning and compression fit, also isolates components. Water-resistant. | Between metal and metal, metal and plastic, vinyl and plastic. Examples: Pull cups, bezels, clips, ducts, top cover to glass, cowl panel. | -40° to 180° Fahrenheit (-40° to 82° Celsius) |
| High Density Urethane Foam | Tear resistant, highly resilient and durable. | Between metal and metal, metal and plastic. Water-resistant. Examples: I/P, heavy metal rattles, isolating brackets. | -40° to 180° Fahrenheit (-40° to 82° Celsius) |
| Open Cell Foam Tape | Soft foam conforms to irregular surfaces. | Wire harness and connector wrap. Examples: Seals, gasket, wiring, heat ducts. | -40° to 180° Fahrenheit (-40° to 82° Celsius) |
| Closed Cell Low Density Foam Tape | Soft, conformable. Water-resistant. | Wherever bulk is needed. Prevents closing flutters and rattles when applied to door watershield. Examples: Door, I/P. | -40° to 180° Fahrenheit (-40° to 82° Celsius) |
| NYE® Grease 880 | Long life. | Suspensions. Examples: Strut busings, sway bars. | -40° to 390° Fahrenheit (-40° to 200° Celsius) |
| Krytox® Oil | Long life. Will not dry out or harm plastics or rubber. | When access is not possible, oil will migrate to condition. Vinyl, rubber, plastic, metal. Examples: Convertible top bushings, pull cups trim panel inserts. | -30° to 400° Fahrenheit (-34° to 205° Celsius) |
| Krytox® Grease | Long life. Will not dry out or harm plastics or rubber. | Vinyl, rubber, plastic, metal, glass. Examples: Weather-strips, backlite and windshield moldings. | -30° to 400° Fahrenheit (-34° to 205° Celsius) |

## PLASTIC BODY PANEL REPAIR

There are many different types of plastics used in today's automotive environment. We group plastics in three different categories: Rigid, Semi-Rigid, and Flexible. Any of these plastics may require the use of an adhesion promoter for repair. These types of plastic are used extensively on DaimlerChrysler Motors vehicles. Always follow repair material manufacturer's plastic identification and repair procedures.

### Rigid Plastics:

Examples of rigid plastic use: Fascias, Hoods, Doors, and other Body Panels, which include SMC, ABS, and Polycarbonates.

### Semi-Rigid Plastics:

Examples of semi-rigid plastic use: Interior Panels, Under Hood Panels, and other Body Trim Panels.

### Flexible Plastics:

Examples of flexible plastic use: Fascias, Body Moldings, and upper and lower Fascia Covers.

### Repair Procedure:

The repair procedure for all three categories of plastics is basically the same. The one difference is the material used for the repair. The materials must be specific for each substrate, rigid repair material for rigid plastic repair, semi-rigid repair material for semi-rigid plastic repair and flexible repair material for flexible plastic repair.

### Adhesion Promoter/Surface Modifier:

Adhesion Promoters/Surface Modifiers are required for certain plastics. All three categories may have plastics that require the use of adhesion promoter/surface modifiers. Always follow repair material manufacturer's plastic identification and repair procedures.

## SAFETY PRECAUTION AND WARNINGS

**WARNING:**
- **Eye protection should be used when servicing components. Personal injury can result.**
- **Use an OSHA approved breathing mask when mixing epoxy, grinding, and spraying paint or solvents in a confined area. Personal injury can result.**
- **Avoid prolonged skin contact with resin, petroleum, or alcohol based solvents. Personal injury can result.**
- **Do not venture under a hoisted vehicle that is not properly supported on safety stands. Personal injury can result.**

**NOTE:**
- **When holes must be drilled or cut in body panels, verify locations of internal body components and electrical wiring. Damage to vehicle can result.**
- **Do not use abrasive chemicals or compounds on undamaged painted surfaces around repair areas. Damage to finish can result.**

## RIGID, SEMI-RIGID, AND FLEXIBLE PLASTIC PARTS TYPES

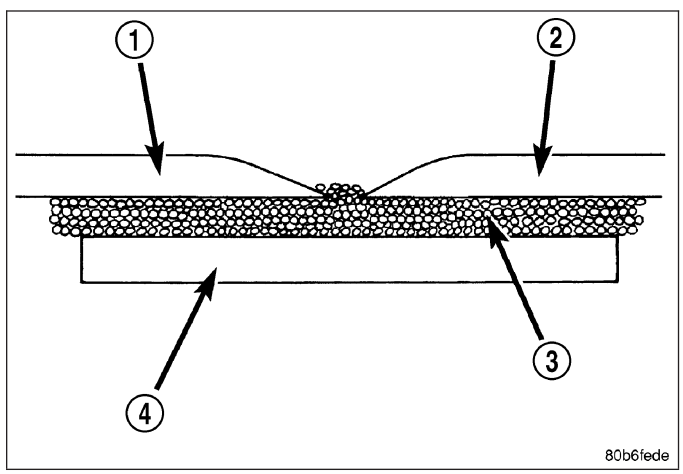
| CODE | FAMILY NAME | COMMON TRADE NAME | TYPICAL APPLICATION |
|---|---|---|---|
| ASA | ACRYLONITRILE STYRENE ACRYLITE | LURAN S | CONSOLES, GRILLES |
| ABS | ACRYLONITRILE BUTADIENE STYRENE | TERLURAN | ″A″ PILLARS, CONSOLES, GRILLES |
| ABS/PC | ABS/PC ALLOY | PULSE, PROLOY, BAYBLEND | DOORS, INSTRUMENT PANELS |
| ABS/PVC | ABS/PV ALLOY | PROLOY, PULSE, LUSTRAN, CYCLOVIN | DOOR PANELS, GRILLES, TRIM |

| CODE | FAMILY NAME | COMMON TRADE NAME | TYPICAL APPLICATION |
|---|---|---|---|
| BMC | BULK MOLDING COMPOUND | BMC | FENDER EXTENSIONS |
| EMA | EHTYLENE METHYL ACRYLATE/IONOMER | SURLYN, EMA, IONOMER | BUMPER GUARDS, PADS |
| METTON | METTON | METTON | GRILLES, KICK PANELS, RUNNING BOARDS |
| MPPO | MODIFIED POLYPHENYLENE OXIDE | MPPO | SPOILER ASSEMBLY |
| PA | POLYAMID | ZYTEL, VYDYNE, PA, MINLON | FENDERS, QUARTER PANELS |
| PET | THERMOPLASTIC POLYESTER | RYNITE | TRIM |
| PBT/PPO | PBT/PPO ALLOY | GERMAX | CLADDINGS |
| PBTP | POLYBUTYLENE THEREPTHALATE | PBT, PBTP, POCAN, VALOX | WHEEL COVERS, FENDERS, GRILLES |
| PBTP/EEBC | POLYBUTYLENE THEREPTHALATE/EEBC ALLOY | BEXLOY, ″M″, PBTP/EEBC | FASCIAS, ROCKER PANEL, MOLDINGS |
| PC | POLYCARBONATE | LEXAN, MERLON, CALIBRE, MAKROLON PC | TAIL LIGHT LENSES, IP TRIM, VALANCE PANELS |
| PC/ABS | PC/ABS ALLOY | GERMAX, BAY BLENDS, PULSE | DOORS, INSTRUMENT PANELS |
| PPO | POLYPHENYLENE OXIDE | AZDEL, HOSTALEN, MARLEX, PRFAX, NORYL, GTX, PPO | INTERIOR TRIM, DOOR PANELS, SPLASH SHIELDS, STEERING COLUMN SHROUD |
| PPO/PA | POLYPHENYLENE/ POLYAMID | PPO/PA, GTX 910 | FENDERS, QUARTER PANELS |
| PR/FV | FIBERGLASS REINFORCED PLASTIC | FIBERGLASS, FV, PR/FV | BODY PANELS |
| PS | POLYSTYRENE | LUSTREX, STYRON, PS | DOOR PANELS, DASH PANELS |
| RTM | RESIN TRANSFER MOLDING COMPOUND | RTM | BODY PANELS |
| SMC | SHEET MOLDED COMPOUND | SMC | BODY PANELS |
| TMC | TRANSFER MOLDING COMPOUND | TMC | GRILLES |
| UP | UNSATURATED POLYESTER (THERMOSETTING) | SMC, BMC, TMC, ZMC, IMC, XSMC, UP | GRILLE OPENING PANEL, LIFTGATES, FLARESIDE FENDERS, FENDER EXTENSIONS |
| EEBC | ETHER/ESTER BLOCKED CO-POLYMER | EEBC | BUMPERS |
| EEBC/PBTP | EEBC/POLYBUTYLENE TEREPTHALATE | EEBC, PBTP, BEXLOY | BUMPER, ROCKER PANELS |
| EMPP | ETHYLENE MODIFIED POLYPROPYLENE | EMPP | BUMPER COVERS |

| CODE | FAMILY NAME | COMMON TRADE NAME | TYPICAL APPLICATION |
|---|---|---|---|
| EPDM | ETHYLENE/ PROPROPYLENE DIENE MONOMER | EPDM, NORDEL, VISTALON | BUMPERS |
| EPM | ETHYLENE/ PROPROPYLENE CO-POLYMER | EPM | FENDERS |
| MPU | FOAM POLYURETHANE | MPU | SPOILERS |
| PE | POLYETHYLENE | ALATHON, DYLAN, LUPOLEN, MARLEX | — |
| PP | POLYPROPYLENE (BLENDS) | NORYL, AZDEL, MARLOX, DYLON, PRAVEX | INNER FENDER, SPOILERS, KICK PANELS |
| PP/EPDM | PP/EPDM ALLOY | PP/EPDM | SPOILERS, GRILLES |
| PUR | POLYURETHANE | COLONELS, PUR, PU | FASCIAS, BUMPERS |
| PUR/PC | PUR/PC ALLOY | TEXIN | BUMPERS |
| PVC | POLYVINYL CHLORIDE | APEX, GEON, VINYLITE | BODY MOLDINGS, WIRE INSULATION, STEERING WHEELS |
| RIM | REACTION INJECTED MOLDED POLYURETHANE | RIM, BAYFLEX | FRONT FASCIAS, MODULAR WINDOWS |
| RRIM | REINFORCED REACTION INJECTED MOLDED | PUR, RRIM | FASCIAS, BODY PANELS, BODY TRIMS |
| TPE | THERMO POLYETHYLENE | TPE, HYTREL, BEXLOY-V | FASCIAS, BUMPERS, CLADDINGS |
| TPO | THERMOPOLYOLEFIN | POLYTROPE, RENFLEX, SANTOPRENE, VISAFLEX, ETA, APEX, TPO, SHIELDS, CLADDINGS | BUMPERS, END CAPS, TELCAR, RUBBER, STRIPS, SIGHT, INTERIOR B POST |
| TPP | THERMO-POLYPROPYLENE | TPP | BUMPERS |
| TPU | THERMOPOLYURETHANE, POLYESTER | TPU, HYTREL, TEXIN, ESTANE | BUMPERS, BODY SIDE, MOLDINGS, FENDERS, FASCIAS |

## PANEL SECTIONING

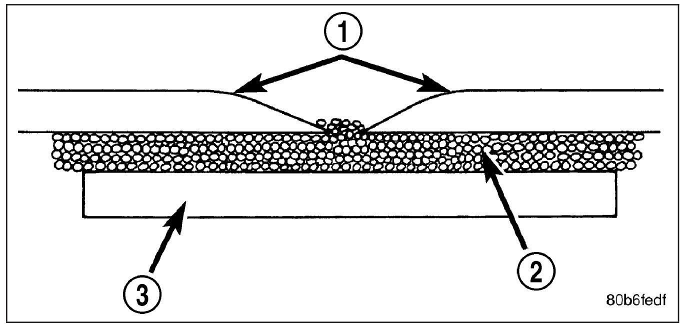
If it is required to section a large panel for a plastic repair, it will be necessary to reinforce the panel. To bond two plastic panels together, a reinforcement must overlap both panels. The panels must be “V’d” at a 20 °angle. The area to be reinforced should be washed, then sanded. Be sure to wipe off any excess soap and water when finished. Lightly sand or abrade the plastic with an abrasive pad or sandpaper. Blow off any dust with compressed air or wipe with a clean dry rag.



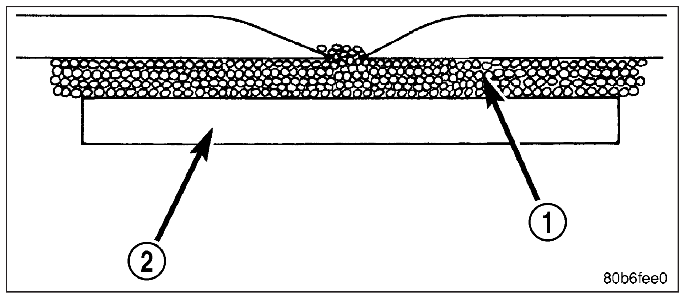

When bonding plastic panels, follow repair material manufacturers recommendations. Be sure that enough adhesive has been applied to allow squeeze out and to fill the full bond line. Once the pieces have been brought together, do not move them until the adhesive is cured. The assembly can be held together with clamps, rivets, etc. A faster cure can be obtained by heating with a heat lamp or heat gun. After the parts have been bonded and have had time to cure, rough sand the seam and apply the final adhesive filler to the area being repaired. Smooth the filler with a spreader, wooden tongue depressor, or squeegee. For fine texturing, a small amount of water can be applied to the filler surface while smoothing. The cured filler can be sanded as necessary and, as a final step, cleanup can be done with soapy water. Wipe the surface clean with a dry cloth allowing time for the panel to dry before moving on with the repair.

## PANEL REINFORCEMENT

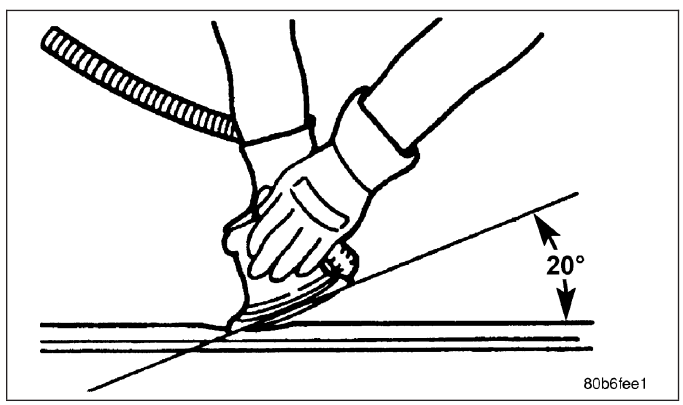
Structural repair procedures for rigid panels with large cracks and holes will require a reinforcement backing. Reinforcements can be made with several applications of glass cloth saturated with structural adhesive. Semi-rigid or flexible repair materials should be used for semi-rigid or flexible backing reinforcement and open meshed fiberglass dry wall tape can be used to form a reinforcement. The dry wall tape allows the resin to penetrate through and make a good bond between the panel and the adhesive. Structurally, the more dry wall tape used, the stronger the repair.



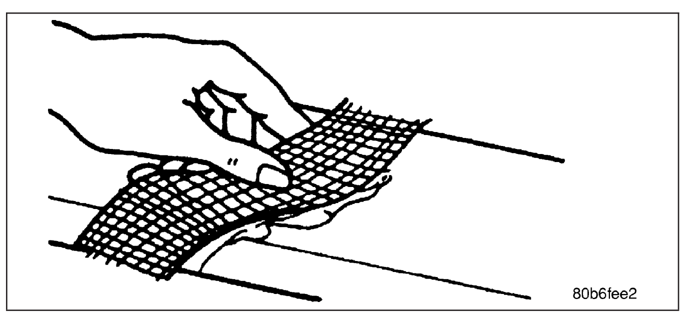

Another kind of repair that can be done to repair large cracks and holes is to use a scrap piece of similar plastic and bond with structural adhesive. The reinforcement should cover the entire break and should have a generous amount of overlap on either side of the cracked or broken area.




When repairing plastic, the damaged area is first “V’d” out, or beveled. Large bonding areas are desirable when repairing plastic because small repairs are less likely to hold permanently. Beveling the area around a crack at a 20 ° angle will increase the bonding surface for a repair. It is recommended that sharp edges be avoided because the joint may show through after the panel is refinished.



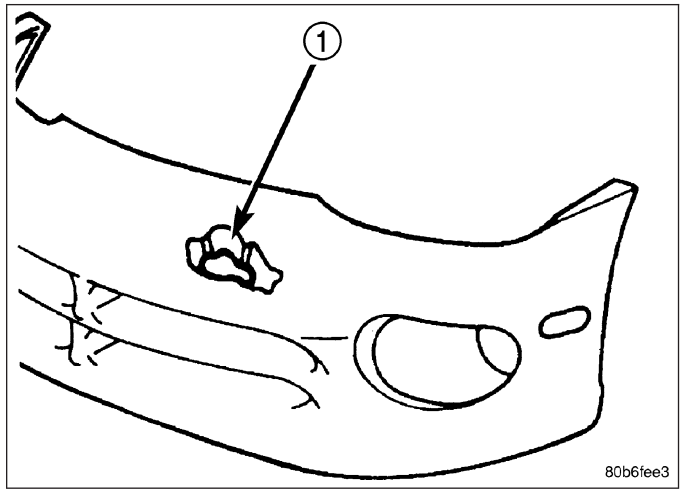

- Panel repair for both flexible and rigid panels are basically the same. The primary difference between flexible panel repair and rigid panel repair is in the adhesive materials used.
- The technician should first decide what needs to be done when working on any type of body panel. One should determine if it is possible to return the damage part to its original strength and appearance without exceeding the value of the replacement part.
- When plastic repairs are required, it is recommended that the part be left on the vehicle when ever possible. That will save time, and the panel will remain stationary during the repair. Misalignment can cause stress in the repair areas and can result in future failure.



## VISUAL INSPECTION

Composite materials can mask the severity of an accident. Adhesive bond lines, interior structure of the doors, and steel structures need to be inspected carefully to get a true damage assessment. Close inspection may require partial removal of interior trim or inner panels.

Identify the type of repair: Puncture or Crack - Damage that has penetrated completely through the panel. Damage is confined to one general area; a panel section is not required. However, a backer panel, open fiberglass tape, or matted material must be bonded from behind.

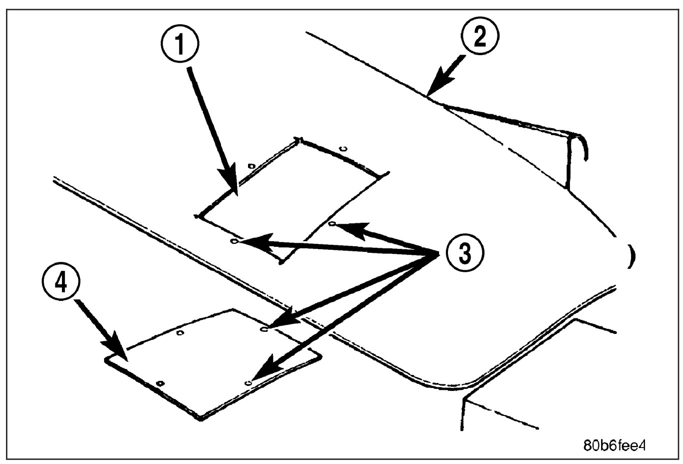



## PANEL SURFACE PREPARATION

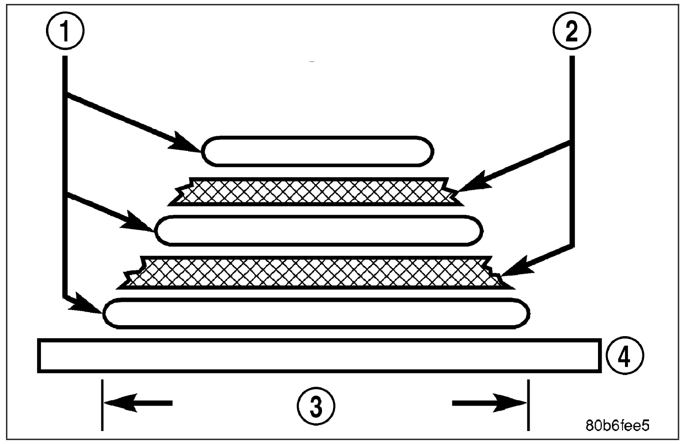
If a body panel has been punctured, cracked, or crushed, the damaged area must be removed from the panel to achieve a successful repair. All spider web cracks leading away from a damaged area must be stopped or removed. To stop a running crack in a panel, drill a 6 mm (0.250 in.) hole at the end of the crack farthest away from the damage. If spider web cracks can not be stopped, the panel would require replacement. The surfaces around the damaged area should be stripped of paint and freed from wax and oil. Scuff surfaces around repair area with 360 grit wet/dry sandpaper, or equivalent, to assure adhesion of repair materials.

## PATCHING PANELS

A panel that has extensive puncture type damage can be repaired by cutting out the damaged material. Use a suitable reciprocating saw or cut off wheel to remove the section of the panel that is damaged. The piece cut out can be used as a template to shape the new patch. It is not necessary to have access to the back of the panel to install a patch. Bevel edges of cutout at 20° to expose a larger bonding area on the outer side. This will allow for an increased reinforcement areas.



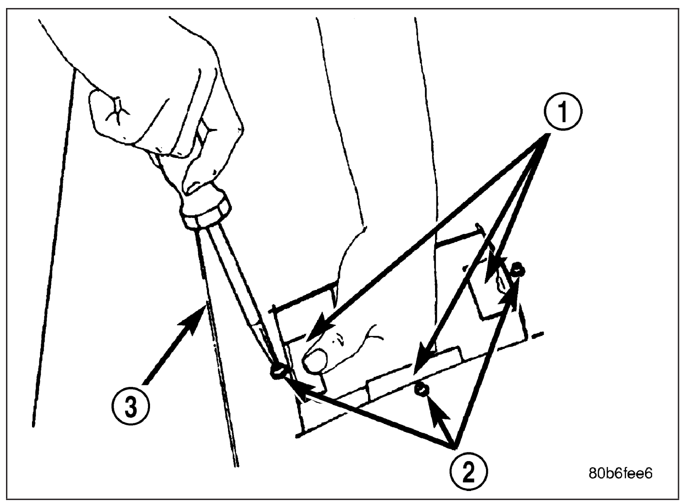
## PANEL PATCH FABRICATIONS




A patch can be fabricated from any rigid fiberglass panel that has comparable contour with the repair area. Lift gates and fenders can be used to supply patch material. If existing material is not available or compatible, a patch can be constructed with adhesive and reinforcement mesh (dry wall tape). Perform the following operation if required:

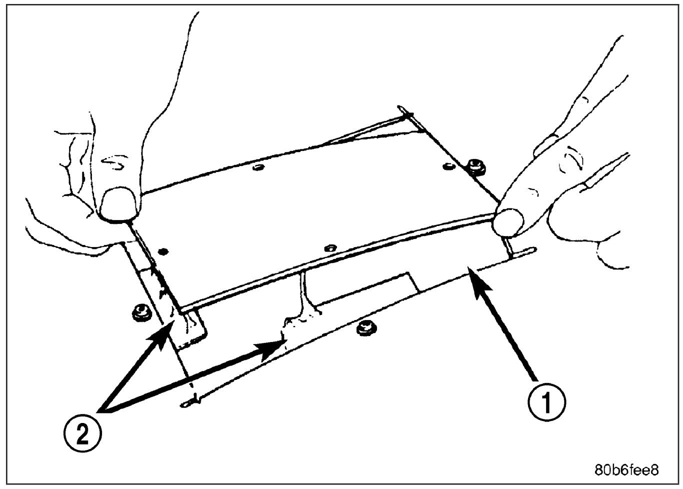
1. Cover waxed paper or plastic with adhesive backed nylon mesh (dry wall tape) larger than the patch required.
2. Tape waxed paper or plastic sheet with mesh to a surface that has a compatible contour to the repair area.
3. Apply a liberal coat of adhesive over the reinforcement mesh. If necessary apply a second or third coat of adhesive and mesh after first coat has cured. The thickness of the patch should be the same as the repair area.
4. After patch has cured, peel waxed paper or plastic from the back of the patch.
5. If desired, a thin film coat of adhesive can be applied to the back of the patch to cover mesh for added strength.

## PANEL PATCH INSTALLATION

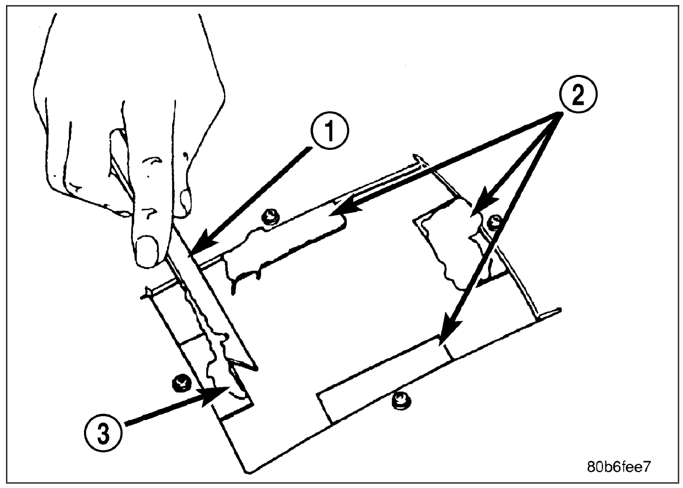



1. Make a paper or cardboard pattern the size and shape of the cutout hole in the panel.
2. Trim 3 mm (0.125 in.) from edges of pattern so patch will have a gap between connecting surfaces.
3. Using the pattern as a guide, cut the patch to size.
4. Cut scrap pieces of patch material into 50 mm (2 in.) squares to use as patch supports to sustain the patch in the cutout.
5. Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) in from edge of cutout hole.
6. Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) away from edge of patch across from holes drilled around cutout.
7. Drill 3 mm (0.125 in.) holes in the support squares 13 mm (0.5 in.) from the edge in the center of one side.
8. Scuff the backside of the body panel around the cutout hole with a scuff pad or sandpaper.
9. Mix enough adhesive to cover one side of all support squares.
10. Apply adhesive to cover one side of all support squares.
11. Using number 8 sheet metal screws, secure support squares to back side of body panel with adhesive sandwiched between the panel and squares.

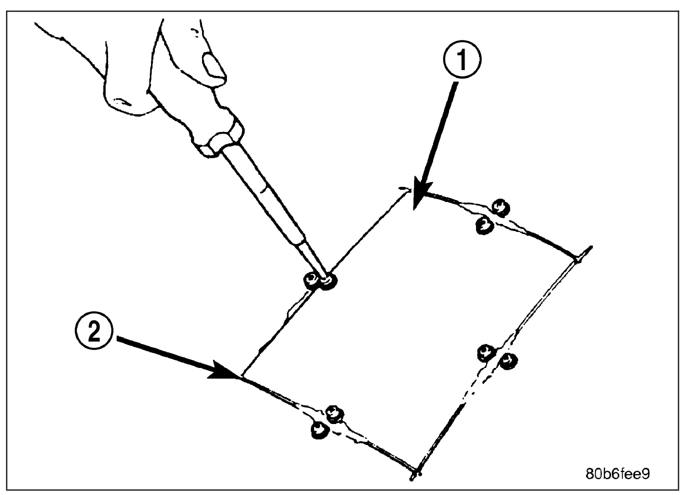
12. Position patch in cutout against support squares and adjust patch until the gap is equal along all sides.
13. Drill 3 mm (0.125 in.) holes in the support squares through the pre-drilled holes in the patch.



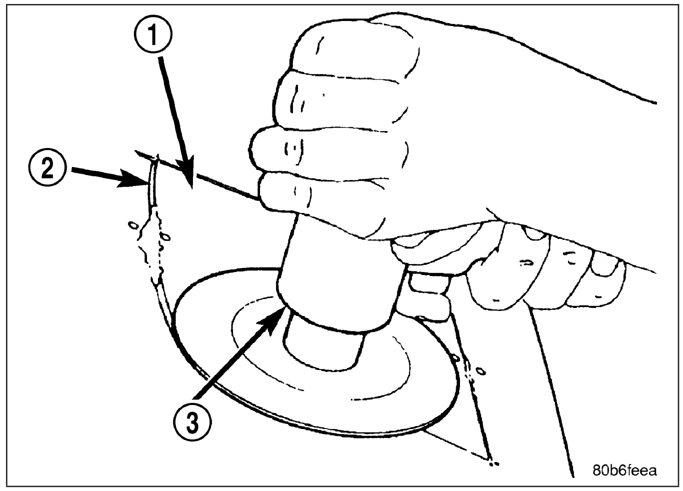

14. Apply a coat of adhesive to the exposed ends of the support squares.



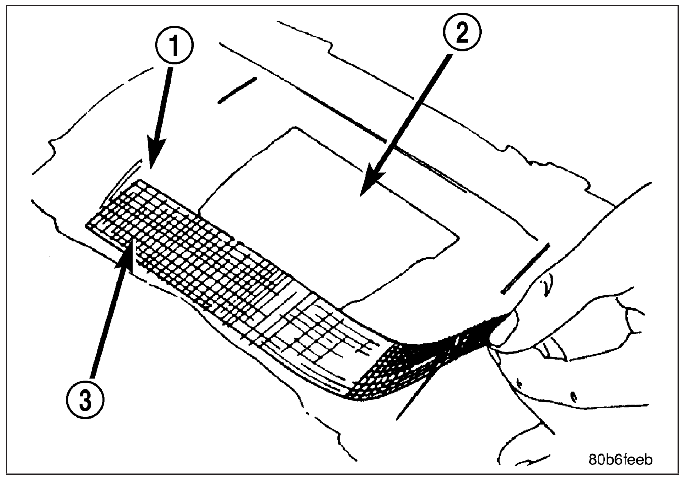

15. Install screws to hold the patch to support squares. Tighten screws until patch surface is flush with panel surface.
16. Allow adhesive to cure, and remove all screws.



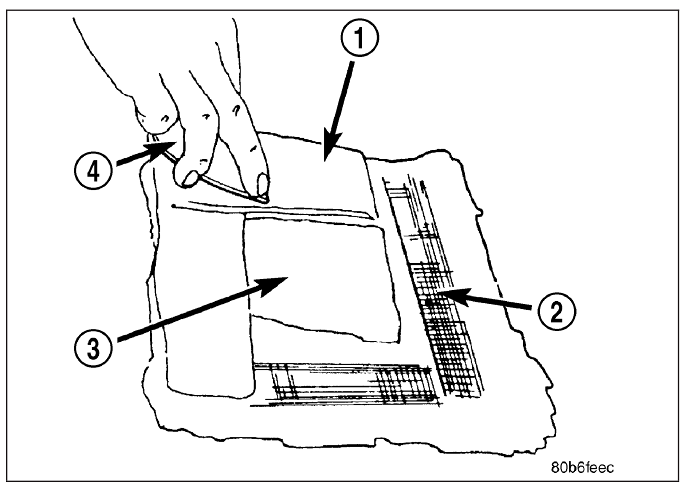
17. Using a 125 mm (5 in.) 24 grit disc grinder, grind a 50 mm (2 in.) to 75 mm (3 in.) wide and 2 mm (0.080 in.) deep path across the gaps around the patch. With compressed air, blow dust from around patch.




18. Apply adhesive backed nylon mesh (dry wall tape) over gaps around patch.
19. Mix enough adhesive to cover the entire patch area.




20. Apply adhesive over the mesh around patch, and smooth epoxy with a wide spreader to reduce finish grinding. Use two to three layers of mesh and adhesive to create a stronger repair.




## PATCHED PANEL SURFACING

After patch panel is installed, the patch area can be finished using the same methods as finishing other types of body panels. If mesh material is exposed in the patched area, grind surface down, and apply a coat of high quality rigid plastic body filler. Prime, block sand, and paint as required.

## SPECIFICATIONS

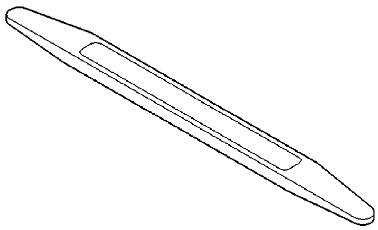
## TORQUE

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Fender bolts | 12 | 9 | — |
| Flip-up glass hinge to body bolts | 7 | — | 60 |
| Flip-up glass hinge to glass bolts | 10 | — | 90 |
| Flip-up glass latch nuts | 12 | 9 | — |
| Front door check strap nuts | 12 | 9 | — |
| Front door check strap to A-pillar bolts | 12 | 9 | — |
| Front door glass run channel bolts | 9 | — | 80 |
| Front door hinge to A-pillar bolts | 28 | 21 | — |
| Front door hinge to door nuts | 23 | 17 | — |
| Front door latch adjustment screw | 3 | — | 30 |
| Front door latch screw | 11 | 8 | 95 |
| Front door latch striker bolts | 28 | 21 | — |
| Front door lock cylinder screw | 6 | — | 55 |
| Front door outside handle nuts | 6 | — | 55 |
| Front door regulator bolts | 9 | — | 80 |
| Front seat back recliner bolts | 28 | 21 | — |
| Front seat bolts/nut | 43 | 32 | — |
| Front seat riser bolts | 28 | 21 | — |
| Front seat track bolts | 28 | 21 | — |
| Grille opening reinforcement | 10 | — | 85 |
| Hood hinge to body bolts | 28 | 21 | — |
| Hood hinge to hood bolts | 12 | 9 | — |
| Hood latch nuts | 14 | 10.5 | — |
| Hood latch support bolts | 10 | — | 85 |
| Instrument panel center support bracket bolts | 23 | 17 | — |
| Instrument panel HVAC nuts/bolts | 6 | — | 55 |
| Instrument panel roll down bolts | 54 | 40 | — |
| Instrument panel top bolts | 28 | 21 | — |
| Outside mirror nuts | 7 | — | 65 |
| Radiator crossmember bolts | 10 | — | 85 |
| Rear door check strap nuts | 12 | 9 | — |
| Rear door check strap to B-pillar bolts | 12 | 9 | — |
| Rear door glass division bar bolt | 9 | — | 80 |
| Rear door glass run channel bolts | 9 | — | 80 |
| Rear door hinge to B-pillar bolts | 28 | 21 | — |
| Rear door hinge to door nuts | 23 | 17 | — |
| Rear door latch adjustment screw | 3 | — | 30 |
| Rear door latch screw | 11 | 8 | 95 |
| Rear door latch striker bolts | 28 | 21 | — |
| Rear door outside handle nuts | 6 | — | 55 |
| Rear door regulator bolts | 9 | — | 80 |

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Rear seat back hinge bolts | 28 | 21 | — |
| Rear seat latch/lock assembly bolts | 28 | 21 | — |
| Rear seat outboard nuts | 43 | 32 | — |
| Rear seat outer seat cushion leg bolts | 35 | 26 | — |
| Rear view mirror setscrew | 1 | — | 15 |
| Rock rail bolts | 23 | 16.5 | 200 |
| Roof rack bolts | 8 | — | 75 |
| Side view mirror nuts | 7 | — | 65 |
| Side step nuts/bolts | 23 | 17 | — |
| Steering column coupler bolt | 49 | 36 | — |
| Steering column lower mounting nuts (See CAUTION below). | 17 | 13 | — |
| Steering column upper mounting nuts (See CAUTION below). | 17 | 13 | — |
| Swing gate check strap to pillar bolts | 11 | 8 | 95 |
| Swing gate check strap nuts | 10 | — | 85 |
| Swing gate exterior handle nuts | 6 | — | 55 |
| Swing gate hinge bolts | 31 | 23 | — |
| Swing gate hinge to D-pillar bolts | 31 | 23 | — |
| Swing gate latch adjustment screw | 3 | — | 30 |
| Swing gate latch screws | 11 | 8 | 95 |
| Swing gate latch striker bolts | 28 | 21 | — |
| Swing gate lock cylinder screw | 6 | — | 50 |
| Swing gate stabilizer cup bolts | 9 | — | 80 |
| Swing gate stabilizer insert bolts | 9 | — | 80 |
| Washer bottle bolt | 10 | — | 85 |
| CAUTION: Lower nuts must be installed and tightened first then the upper nuts in order to prevent damage to the capsules. | | | |

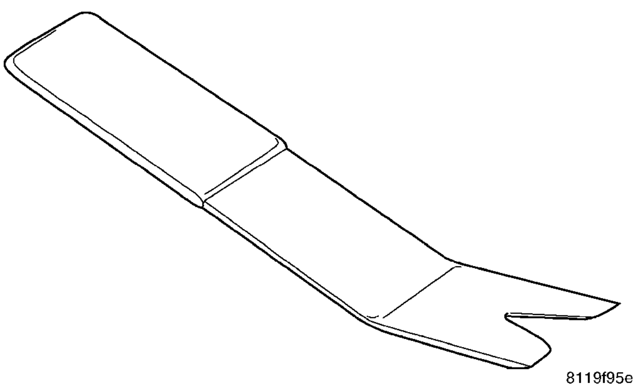
## SPECIAL TOOLS

## BODY

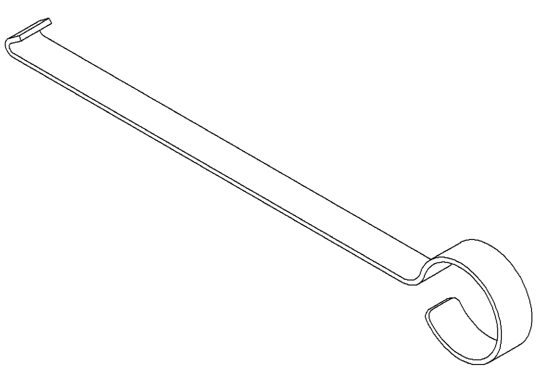


*Trim Stick C-4755*

*TORX BIT SET C-4794-B*




*REMOVER, MOLDINGS C-4829-A*



*Outer Belt Molding Remover - 9093*

# HOOD

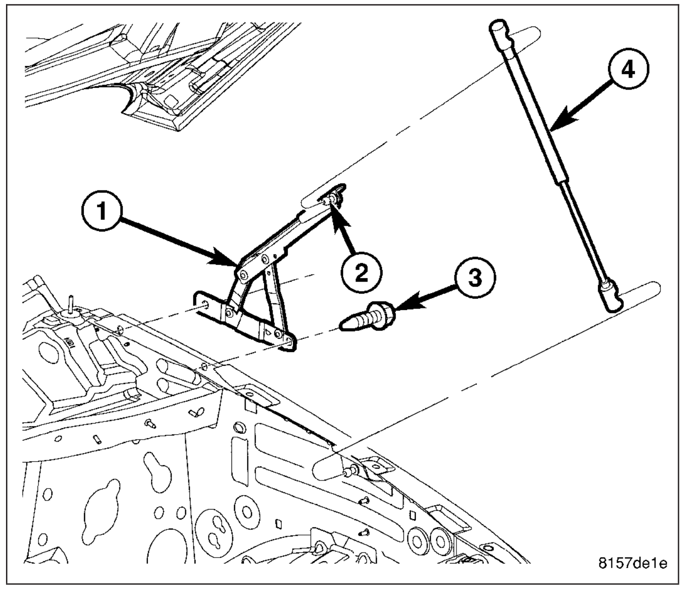
## TABLE OF CONTENTS

# HINGE

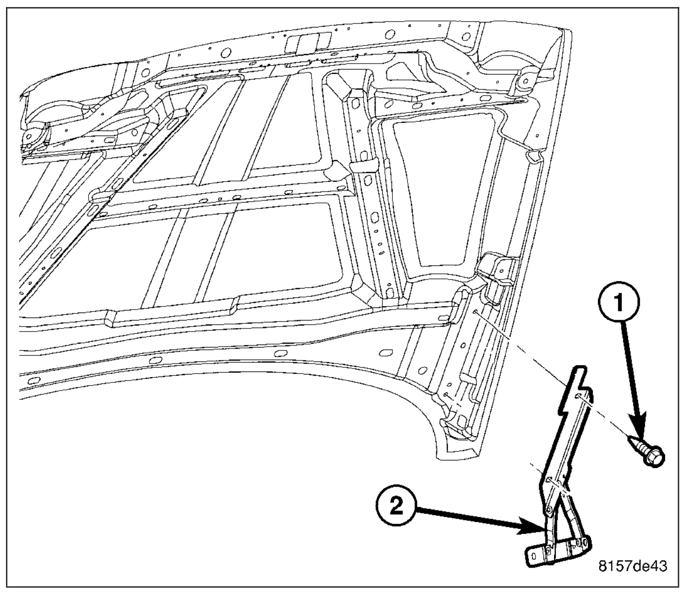
## REMOVAL

**NOTE: It is not necessary to remove the hood to replace one or both hinges. The hinges can be replaced one at a time.**

1. Raise and support hood.
2. Using a grease pencil or equivalent, mark position of hinge (1).
3. Remove hood support cylinder (4). (Refer to 23 - BODY/HOOD/SUPPORT CYLINDER - REMOVAL)
4. Remove bolts (3) attaching hinge (1) to body.

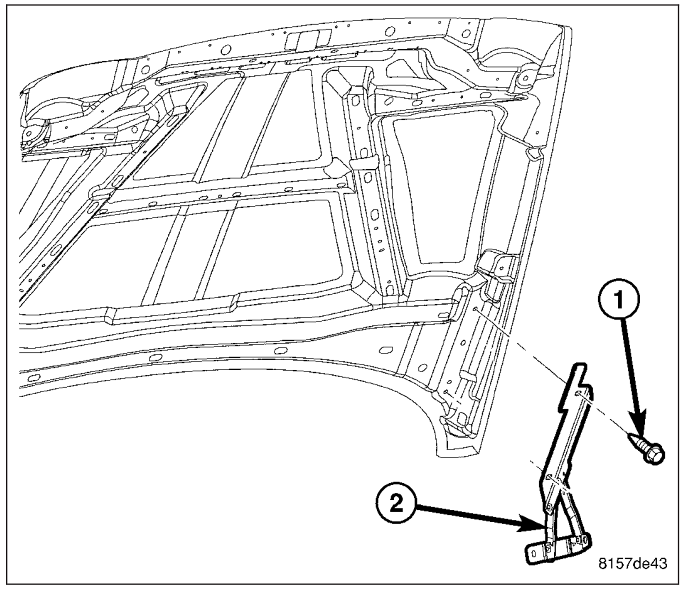



5. Remove bolts (1) attaching hinge (2) to hood.
6. Separate hinge from vehicle.

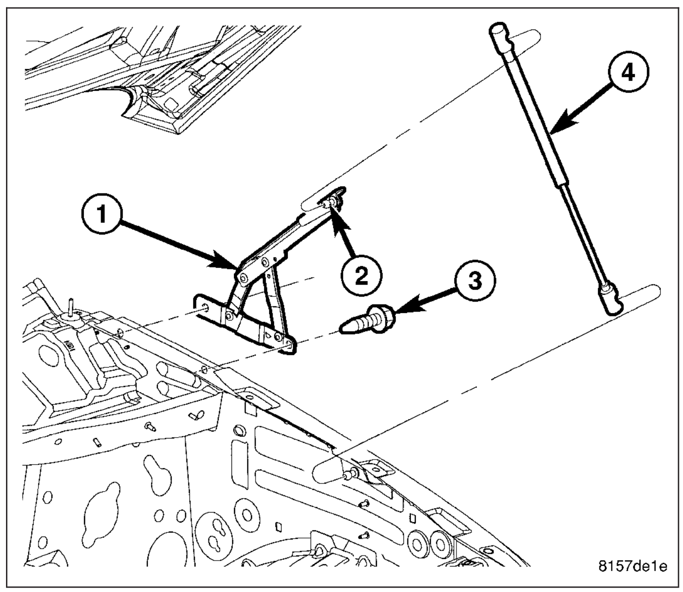


## INSTALLATION

1. Position hinge (2) on vehicle and align reference marks.
2. Install the bolts (1) attaching hinge to hood and tighten to 12 N·m (9 ft. lbs.).



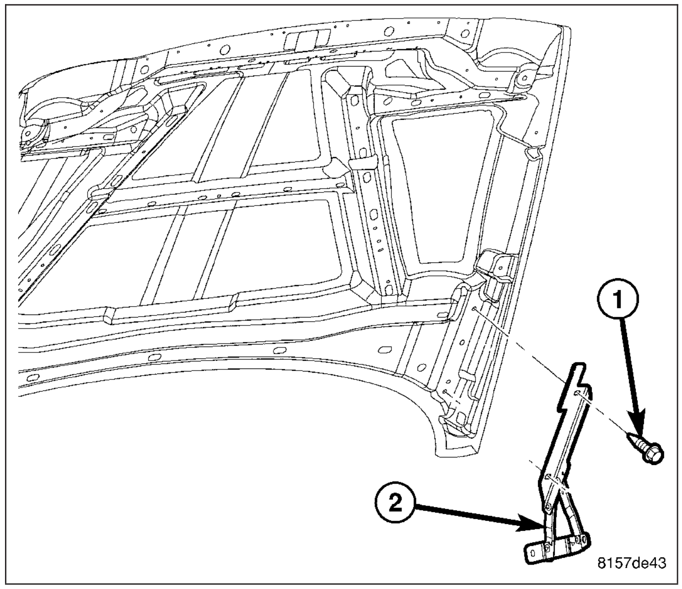

3. Install bolts (3) attaching hinge to body and tighten to 28 N·m (21 ft. lbs.).
4. Install hood hinge support cylinder (4). (Refer to 23 - BODY/HOOD/SUPPORT CYLINDER - INSTALLATION)



# HOOD

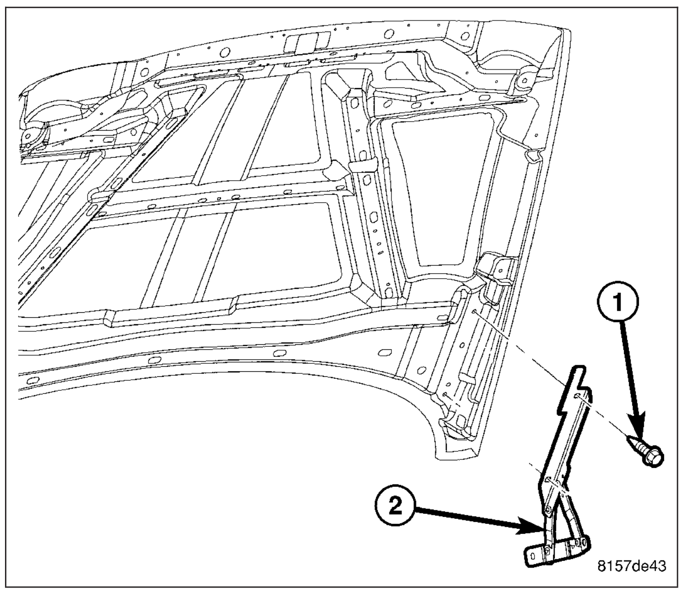
## REMOVAL

1. Raise hood.
2. Using a grease pencil or equivalent, mark location of hood hinges on hood for installation alignment.
3. Remove bolts (1) attaching hinges (2) to hood.
4. With the aid of a helper, remove hood from vehicle.




## INSTALLATION

1. Position hood on hinges.
2. Install bolts (1) finger-tight.
3. Align hinges with installation reference marks made previously and tighten bolts to 12 N·m (9 ft. lbs.).
4. Inspect hood for proper alignment and adjust as necessary. (Refer to 23 - BODY/HOOD/HOOD - ADJUSTMENTS)

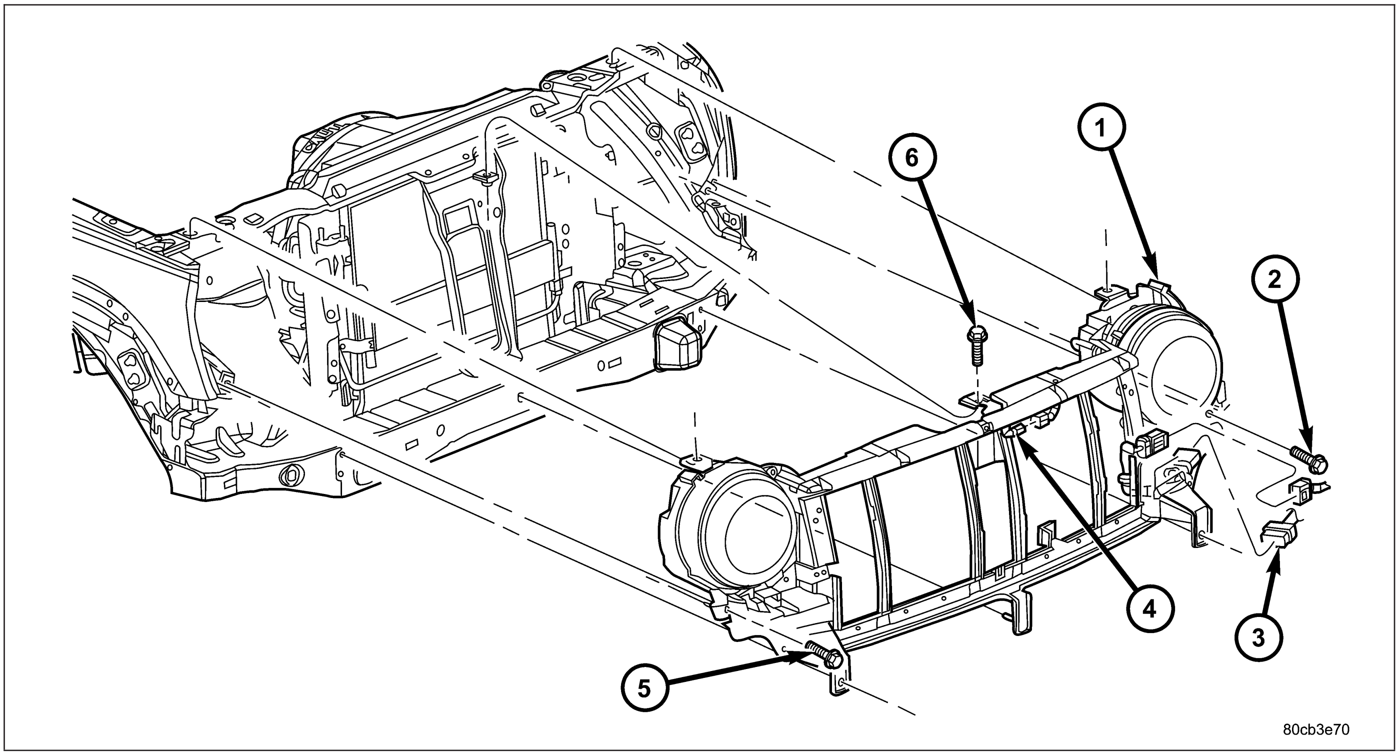



## ADJUSTMENTS

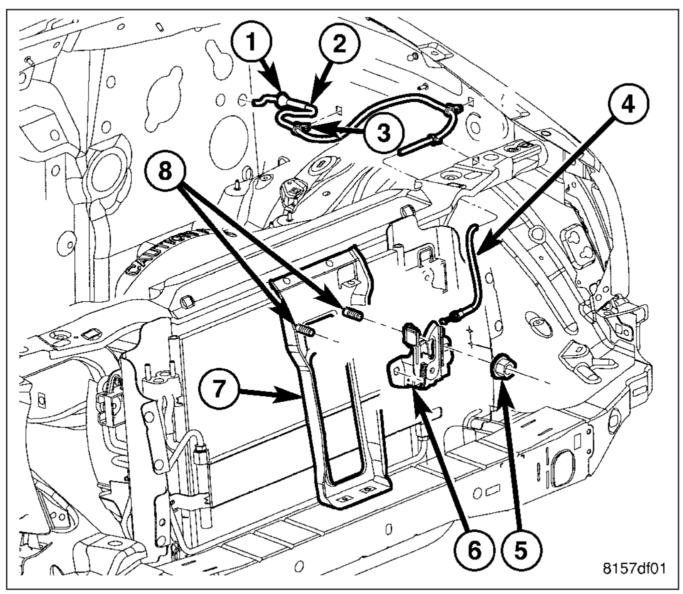
1. If hood is low in relation to cowl panel, insert shims between hinge and hood.
2. Adjust hood bumper in or out to adjust hood-to-fender height alignment.
3. Adjust the hood latch as necessary. Tighten the nuts to 14 N·m (10.5 ft. lbs.).
4. Align the latch striker so that striker enters the latch squarely and without binding.

# LATCH

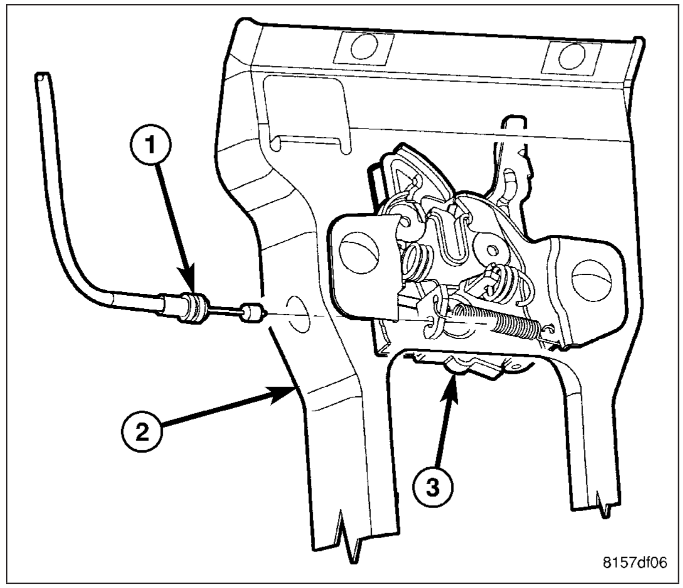
## REMOVAL




1. Remove the three bolts (6) from the top of the grille opening reinforcement (1).
2. Carefully pull the grille opening reinforcement forward and remove the two latch nuts (5) and separate the latch.

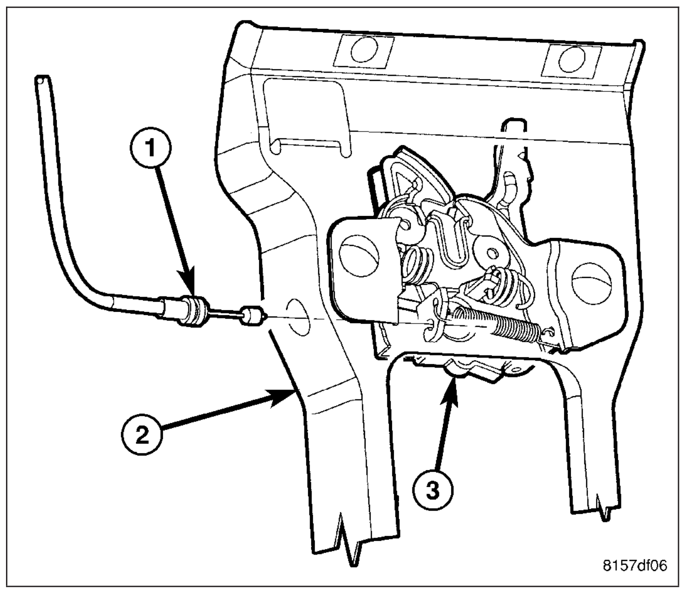


3. Disconnect the release cable (1) and remove the latch (3).

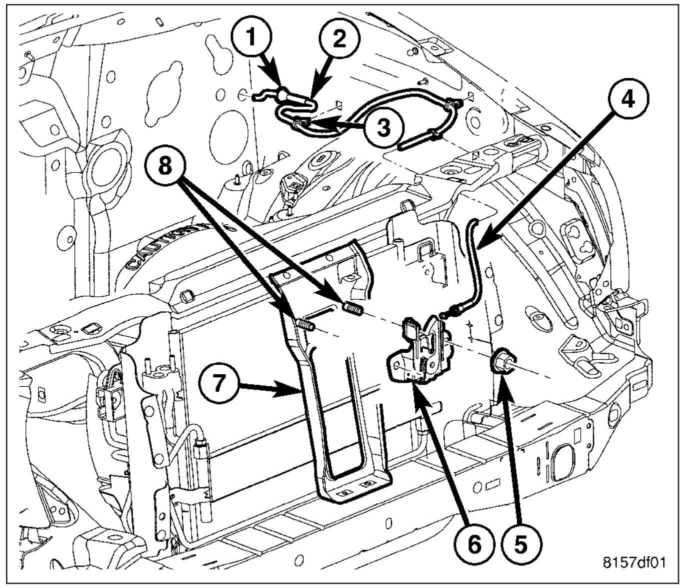


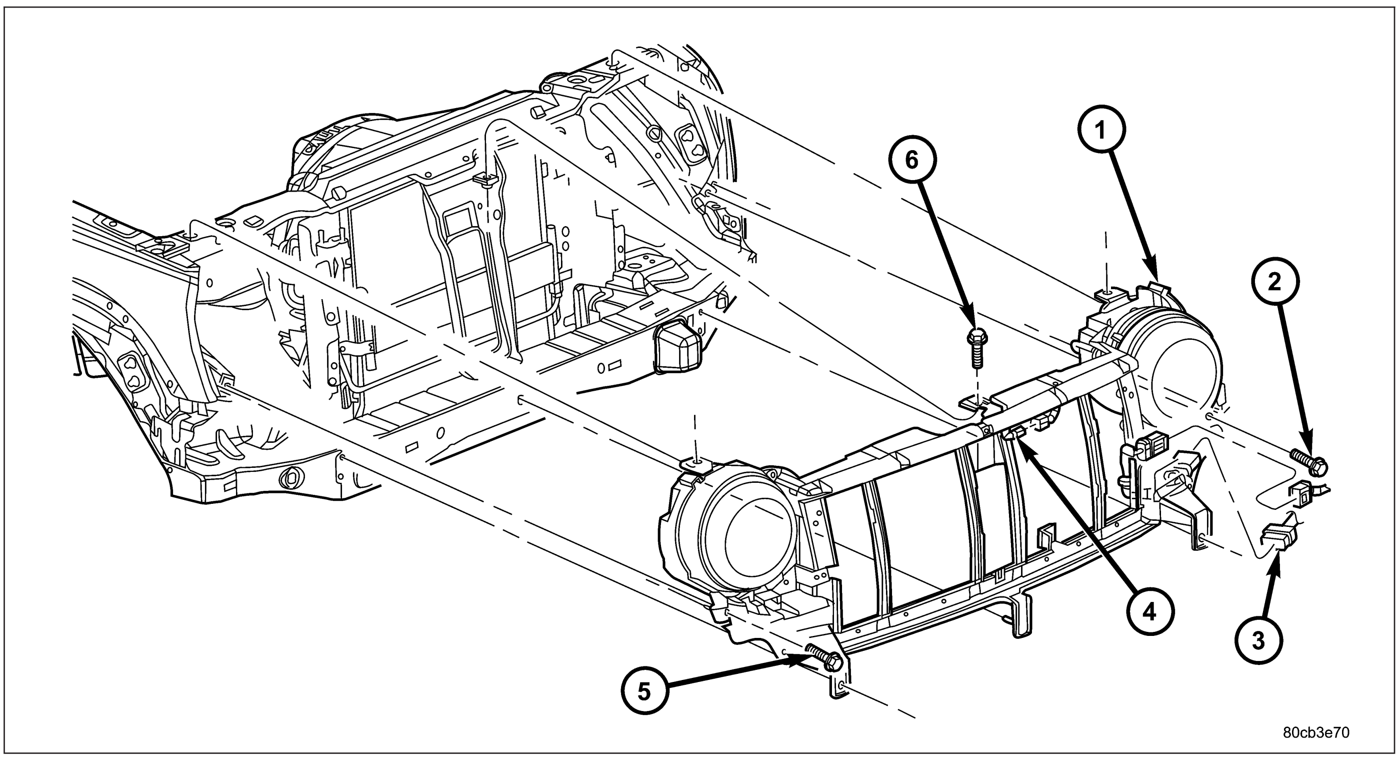

## INSTALLATION

1. Route latch cable (1) through the hole in the support bracket (2).
2. Connect the release cable and install the latch (3) onto the support bracket.



3. Install the two nuts (5) and tighten to 14 N·m (10.5 ft. lbs.).



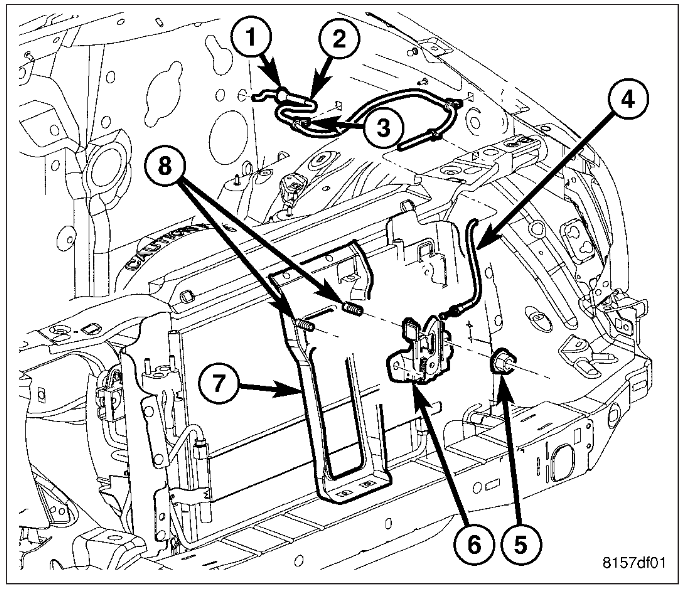




4. Position the grille opening reinforcement (1) back and install the three upper bolts (6).
5. Tighten the bolts to 10 N·m (85 in. lbs.).

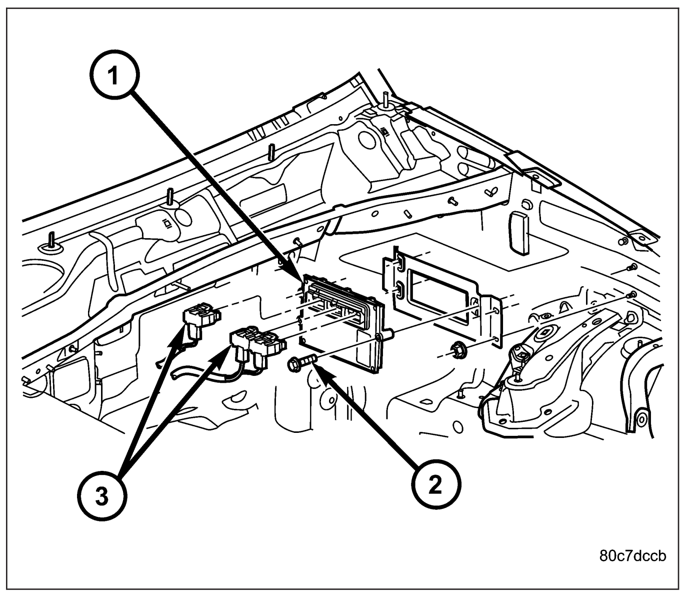
# LATCH RELEASE CABLE

## REMOVAL

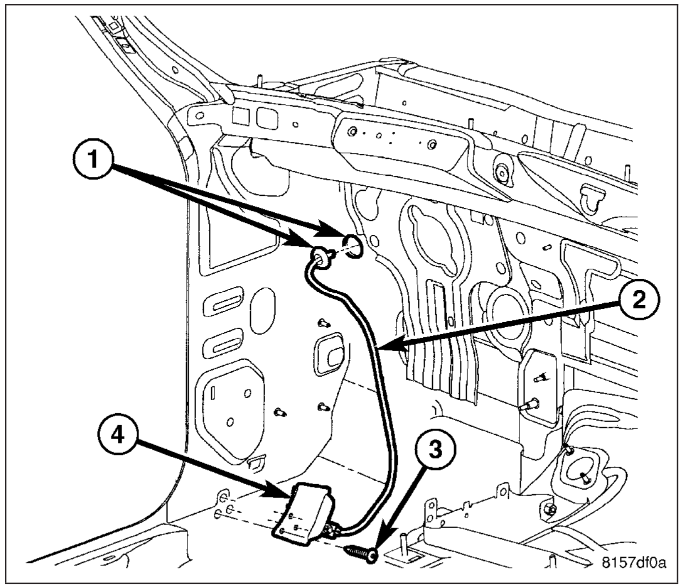
1. Remove the battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL)
2. Remove the hood latch. (Refer to 23 - BODY/HOOD/LATCH - REMOVAL)




3. Remove the powertrain control module. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - REMOVAL)



4. Remove the hood release handle. (Refer to 23 - BODY/HOOD/LATCH RELEASE HANDLE - REMOVAL)




5. Disconnect the attaching clips and remove the cable from the inside.

## INSTALLATION

1. Install the cable from the inside and attach the retaining clips.
2. Install the hood latch release handle. (Refer to 23 - BODY/HOOD/LATCH RELEASE HANDLE - INSTALLATION)
3. Install the powertrain control module. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWER-TRAIN CONTROL MODULE - INSTALLATION)
4. Install the hood latch. (Refer to 23 - BODY/HOOD/LATCH - INSTALLATION)
5. Install the battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION)

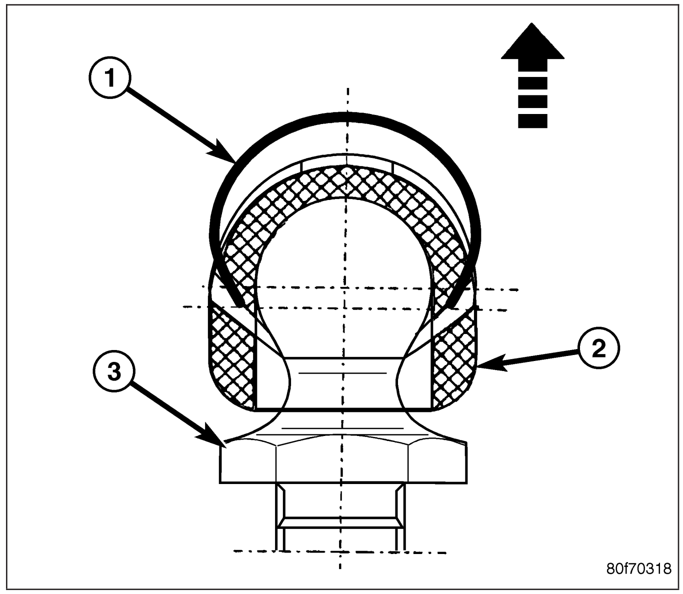
# SUPPORT CYLINDER

## REMOVAL

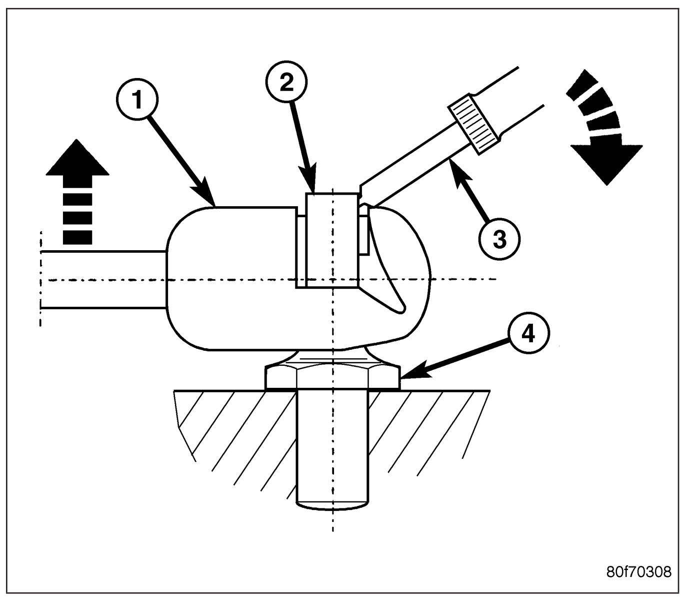
**NOTE: The support cylinders can be replaced one at a time.**

1. Open the hood and support.

**NOTE: Lift the clips only enough to release the ball studs.**

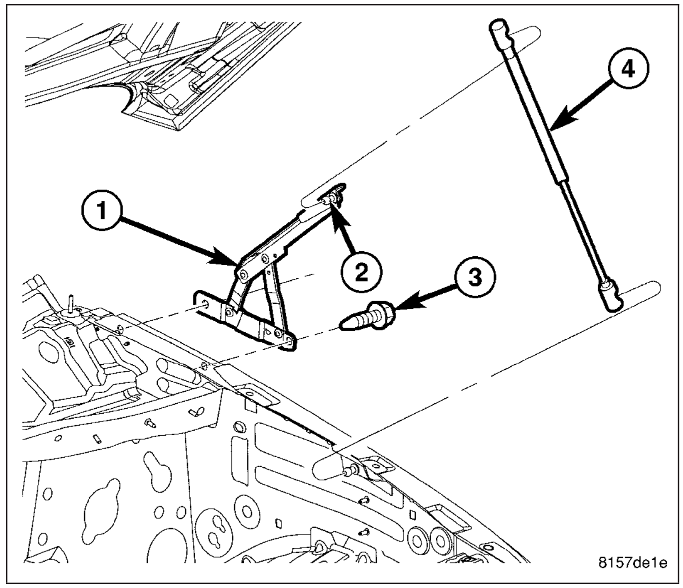



2. Using a small flat bladed tool, or equivalent, release the upper retaining clips while pulling the ball socket away from the ball stud.



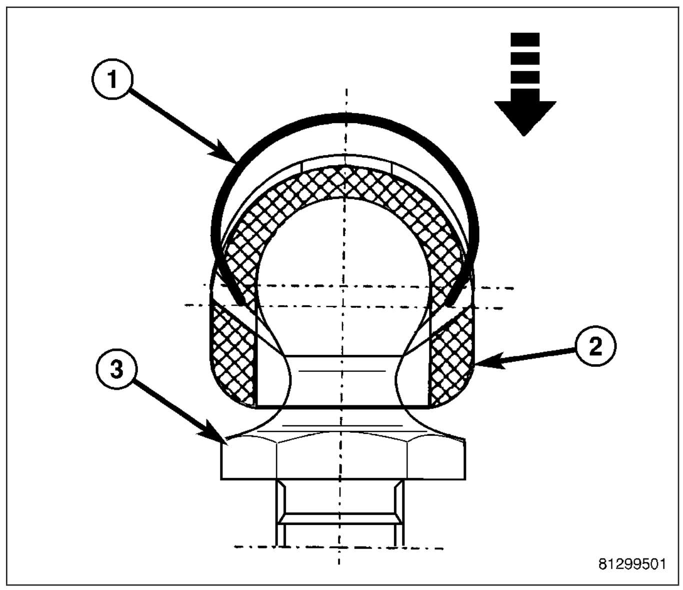
**CAUTION: Do not pull the supports from the middle while removing.**

3. Pulling at the ends only, remove the support cylinder (4).



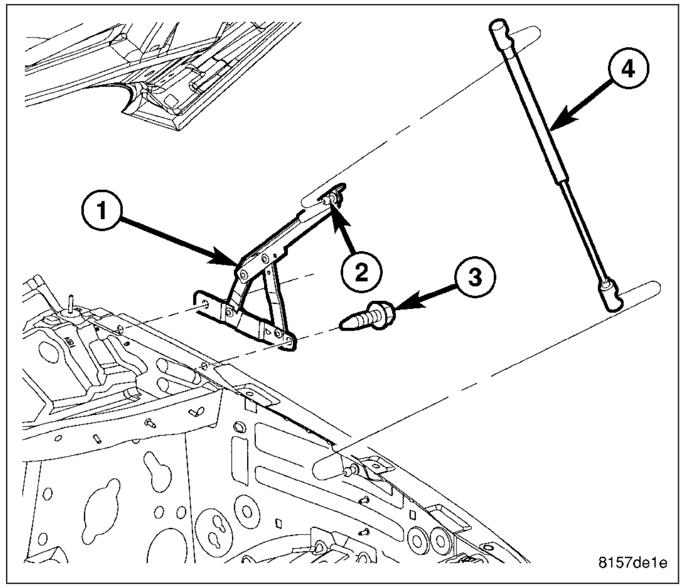

## INSTALLATION

1. Make sure the retaining clips (1) are seated into the ball socket (2) fully.



**CAUTION: Do not install the support cylinders by pressing at the center of the cylinder. Press the ends only.**

2. Install the support cylinder (4) over the ball studs with the thin end connected to the body side of the hinge and the retaining clips snapping into place.



# LATCH RELEASE HANDLE

## REMOVAL

1. Remove the cowl trim panel. (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - REMOVAL)
2. Remove the three screws and remove the handle.
3. Disconnect the hood release cable.

## INSTALLATION

1. Connect the hood release cable to the handle.
2. Install the handle and install the three screws.
3. Install the cowl trim cover. (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - INSTALLATION)

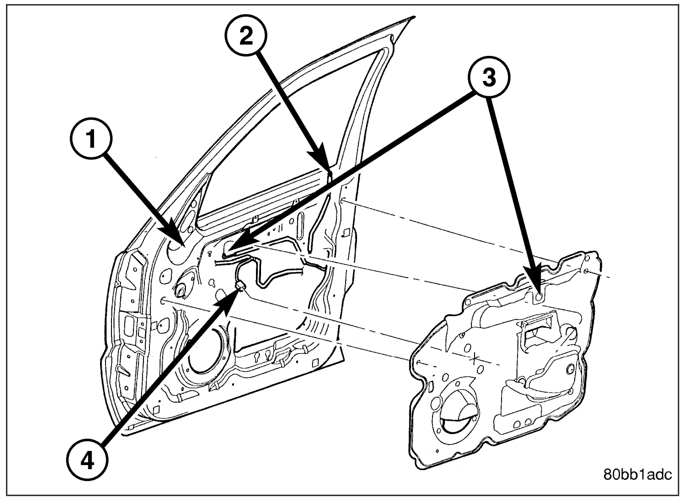
# DOOR - FRONT

## TABLE OF CONTENTS

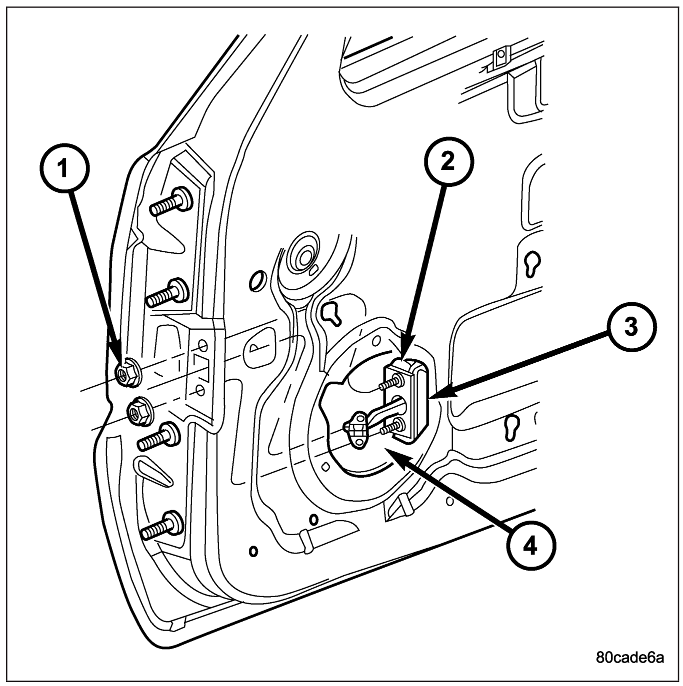
# CHECK STRAP

## REMOVAL

1. Remove the waterdam. (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - REMOVAL)



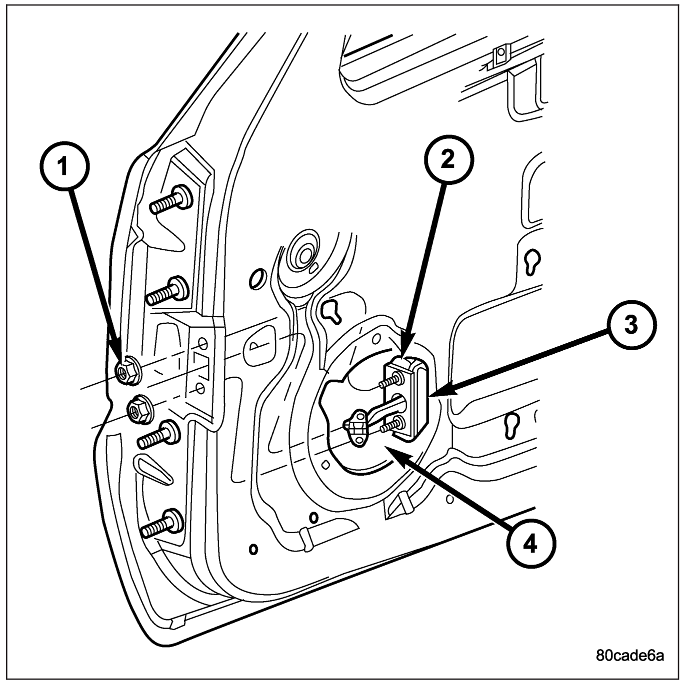

2. Remove screws attaching door check to A-pillar.
3. Remove the two nuts (1) and remove the door check strap (2).



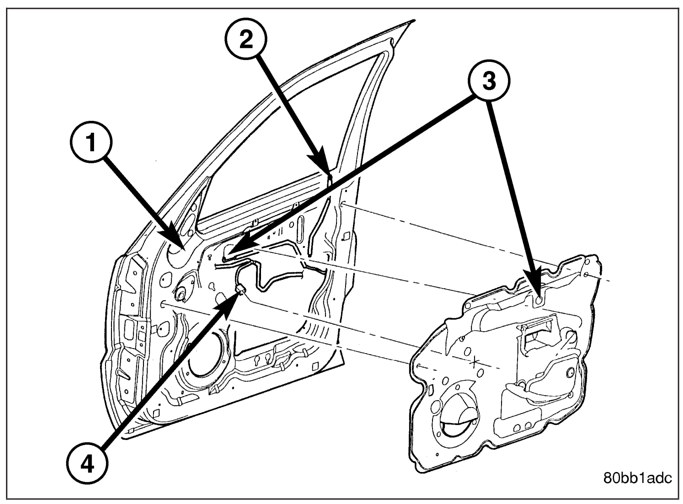
## INSTALLATION

**NOTE: Make sure the proper orientation of the check strap is maintained using the part number (3) printed on the side. The part number should face inboard toward the interior of the vehicle.**

1. Install the check strap (2) through the speaker hole (4).
2. Install the nuts (1) and tighten to 12 N·m (9 ft. lbs.).
3. Connect the strap to the A-pillar and tighten the bolts to 12 N·m (9 ft. lbs.).



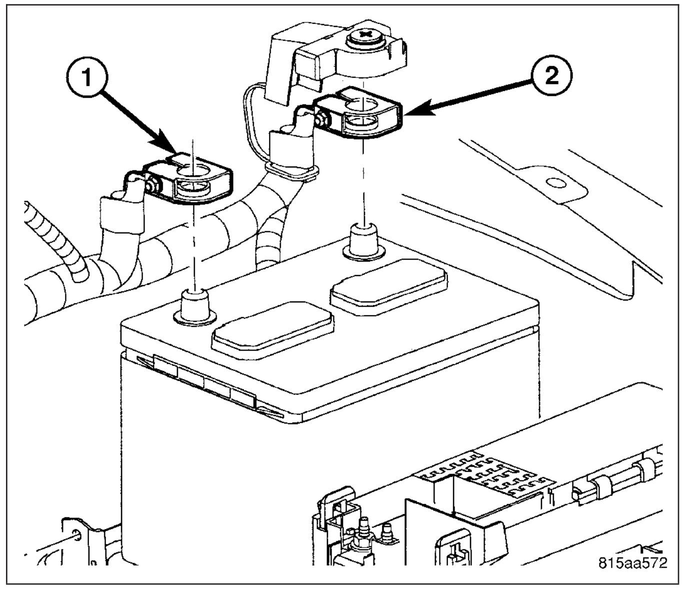

4. Install the waterdam. (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - INSTALLATION)



# DOOR

## REMOVAL

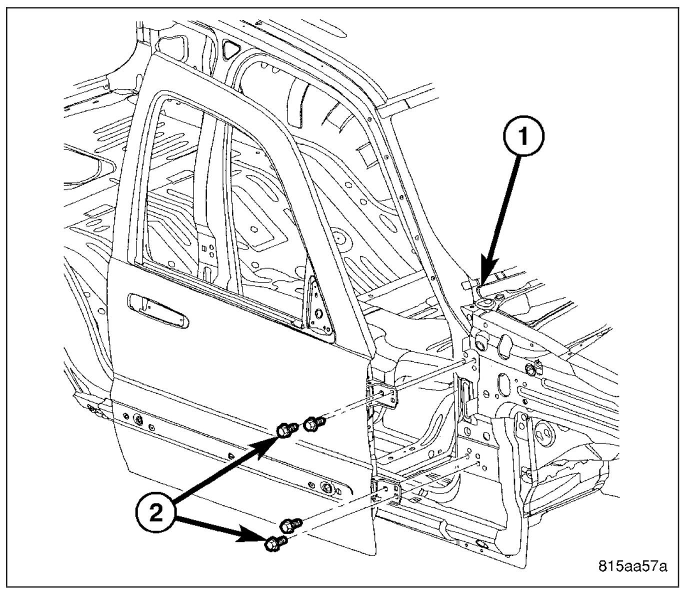
1. Disconnect and isolate the negative battery cable.



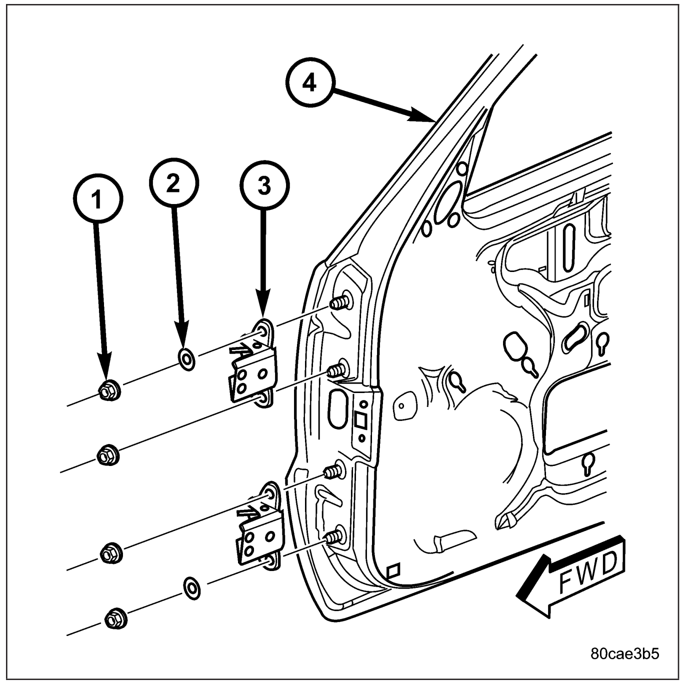

2. Disconnect the door wire harness electrical connector at the A-pillar.
3. Support the door with a suitable lifting device.
4. Remove the bolts attaching the check strap to the A-pillar.

**NOTE: The epoxy washers should not be removed from the hinge. If the washers are removed the door may have to be re-adjusted.**

5. Remove the nuts attaching the door hinges to the door.
6. Carefully remove the door from the body.

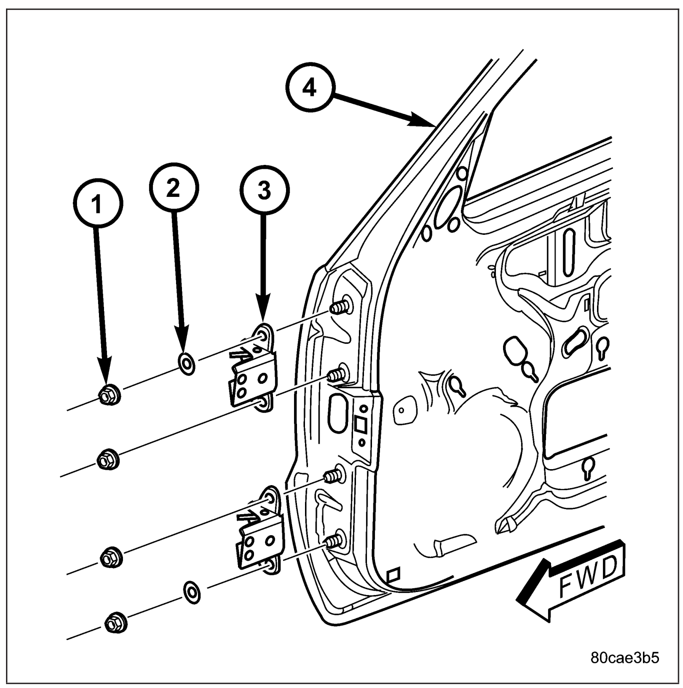


7. If necessary, remove the front door hinges from the door (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL).

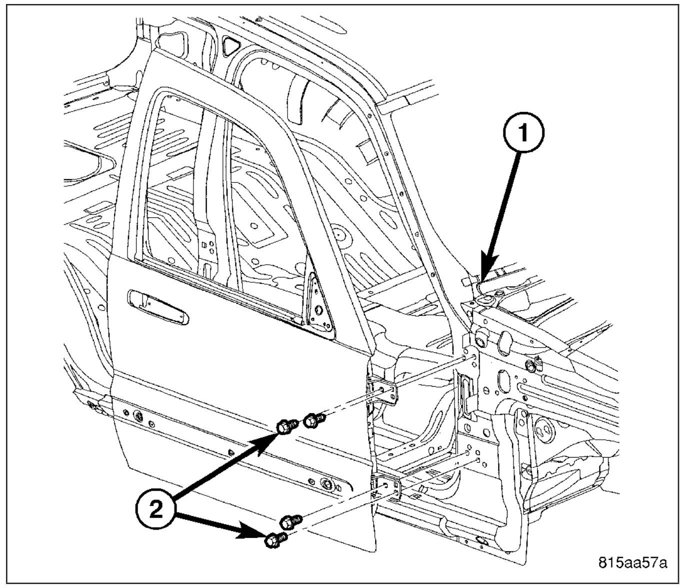



## INSTALLATION

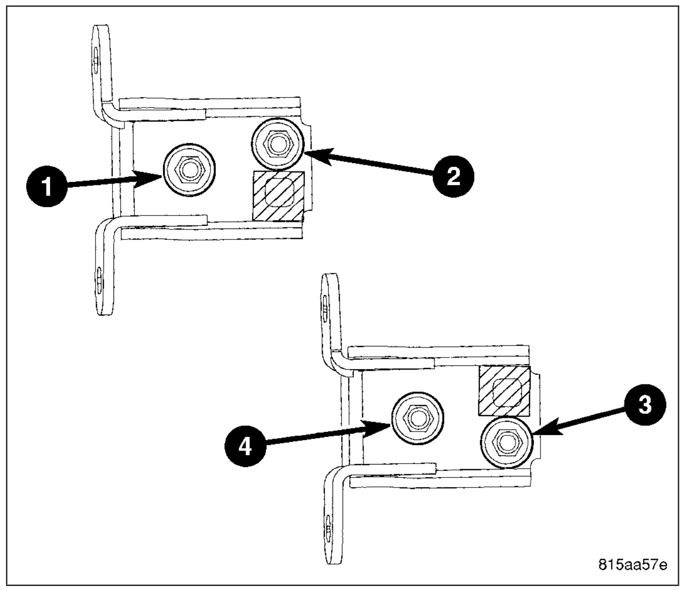
1. If removed, install the front door hinges (3) onto the door (Refer to 23 - BODY/DOOR - FRONT/HINGE - INSTALLATION).



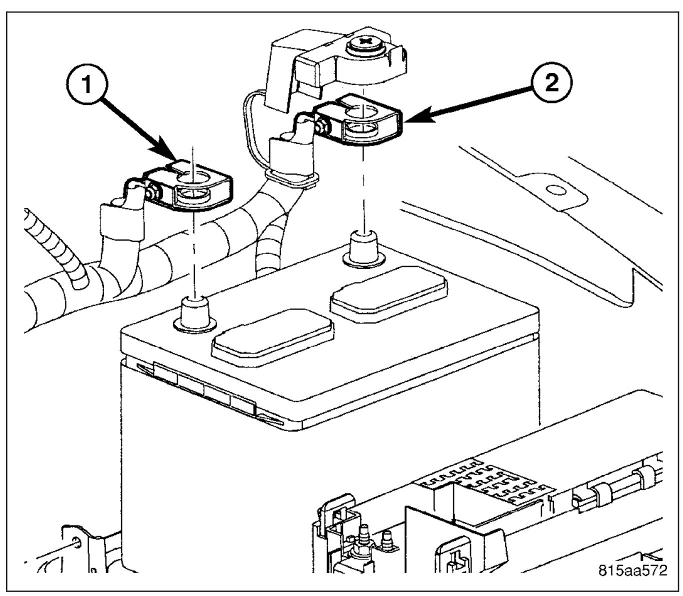
2. Carefully position the door to the body and support the door with a suitable lifting device.
3. Loosely install the four bolts (2) that secure the front door hinges to the A-pillar.
4. Align the door to the body using the reference marks made during the removal procedure.




5. Tighten the hinge to body bolts to 28 N·m (21 ft. lbs.) using the sequence shown.
6. Connect the front door wire harness to the body wire harness.




7. Reconnect the negative battery cable.
8. If necessary, adjust the front door (Refer to 23 - BODY/DOOR-FRONT - ADJUSTMENTS).



## ADJUSTMENTS

## ADJUSTMENT

**NOTE: For vehicles with four doors, it is recommended that you adjust the rear door before adjusting the front door. (Refer to 23 - BODY/DOORS - REAR/DOOR - ADJUSTMENTS)**

- **Door adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.**
- **During adjustment procedures, it is recommended that all the hinge fasteners be loosened except for the upper most fasteners. Adjustments can be made using the upper bolts to hold the door with final torque of the fasteners occurring after correct door positioning is achieved.**
- **A suitable body sealant should be used when removing or moving the hinges.**

### FORE/AFT

**NOTE: Fore/aft (lateral) door adjustment is done by loosening the hinge to the hinge pillar fasteners one hinge at a time and moving the door to the correct position.**

1. Support the door with a suitable lifting device.
2. Loosen the hinge to hinge pillar fasteners. (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL)
3. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
4. Tighten the hinge pillar fasteners to 28 N·m (21 ft. lbs.).

### UP/DOWN

**NOTE: Up/down door adjustment is done by loosening either the hinge to the hinge pillar fasteners or the hinge to door fasteners and moving the door to the correct position.**

**NOTE: When adjustment of the door requires the loosening of the door to hinge fasteners, it will be necessary to separate the epoxy bonded washers with a chisel or other suitable tool.**

**NOTE: When the up/down adjustments are done correctly, the top of the door is positioned over flush to the roof. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)**

1. Support the door with a suitable lifting device.
2. Loosen the latch striker bolts. (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)
3. Loosen the hinge to door fasteners (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL) or loosen the hinge to hinge pillar fasteners (Refer to 23 - BODY/DOOR - FRONT/HINGE - REMOVAL).
4. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Tighten the hinge pillar fasteners or the door to hinges fasteners to 28 N·m (21 ft. lbs.).
6. Tighten the latch striker bolts. (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)

### IN/OUT

**NOTE: In/out door adjustment is done by loosening the hinge to door fasteners one hinge at a time and moving the door to the correct position.**

**NOTE: When adjustment of the door requires the loosening of the door to hinge fasteners, it will be necessary to separate the epoxy bonded washers with a chisel or other suitable tool.**

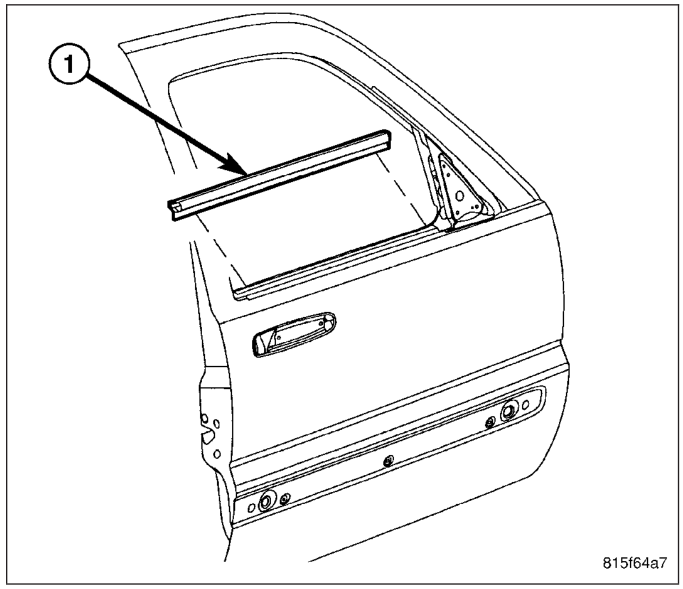
1. Support the door with a suitable lifting device.
2. Loosen the latch striker bolts. (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)
3. Loosen the hinge to door fasteners. (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)

4. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Tighten the door to hinges fasteners to 28 N·m (21 ft. lbs.).
6. Tighten the latch striker bolts. (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)

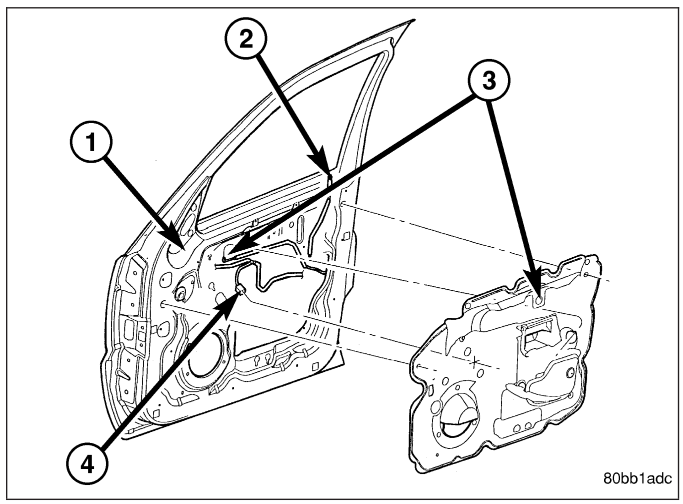
# DOOR GLASS

## REMOVAL

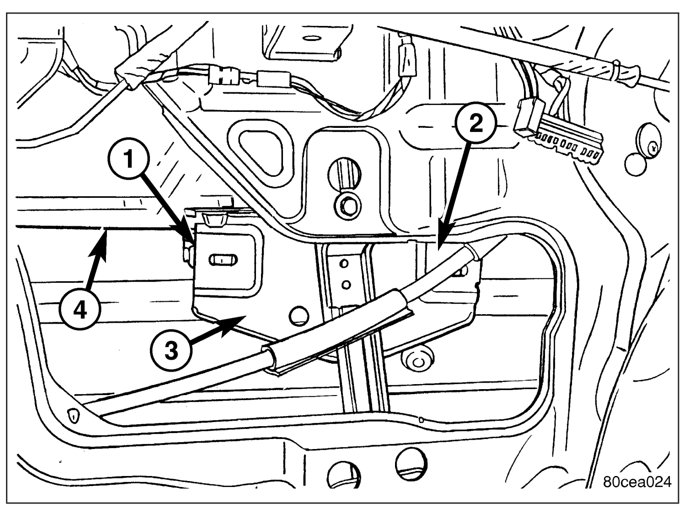
1. Remove the outer belt molding (1). (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FRONT DOOR OUTER BELT MOLDING - REMOVAL)



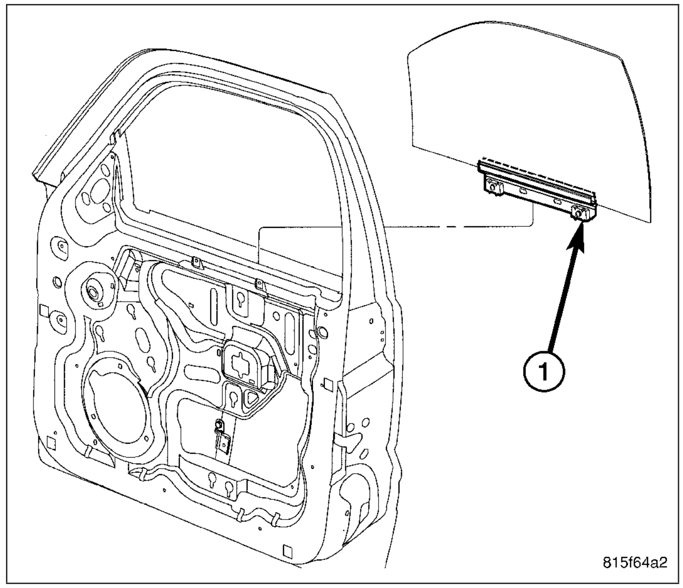

2. Remove the waterdam. (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - REMOVAL)




3. Raise the glass (4) to the position shown and using a long flat blade or hook type tool, disengage clips (1) attaching glass retainer to regulator lift plate (3).
4. Disconnect the glass from the regulator lift plate and re-install the clips.

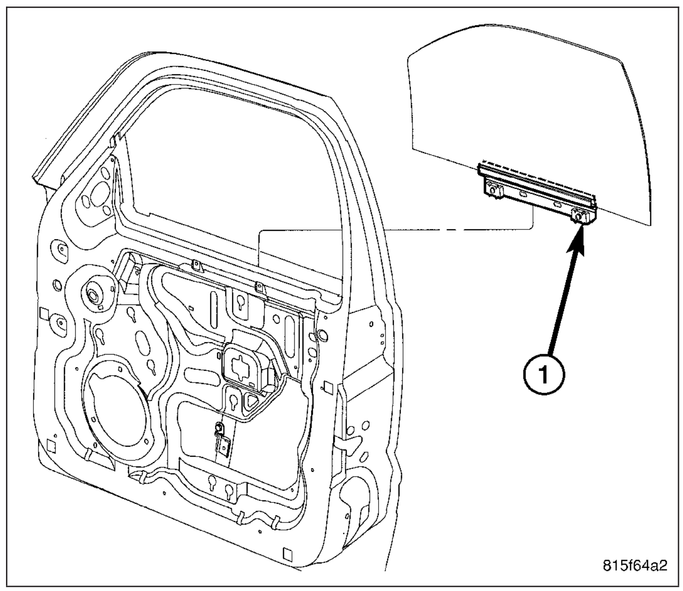


5. Rotate the top of the glass toward the front and remove the glass from the window opening.

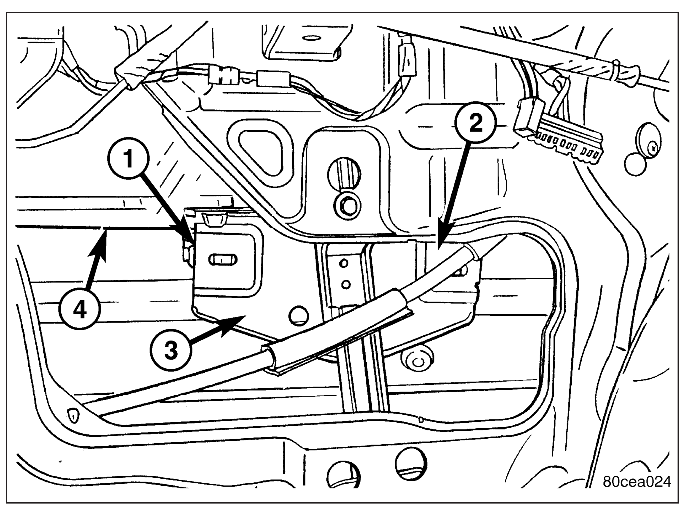



## INSTALLATION

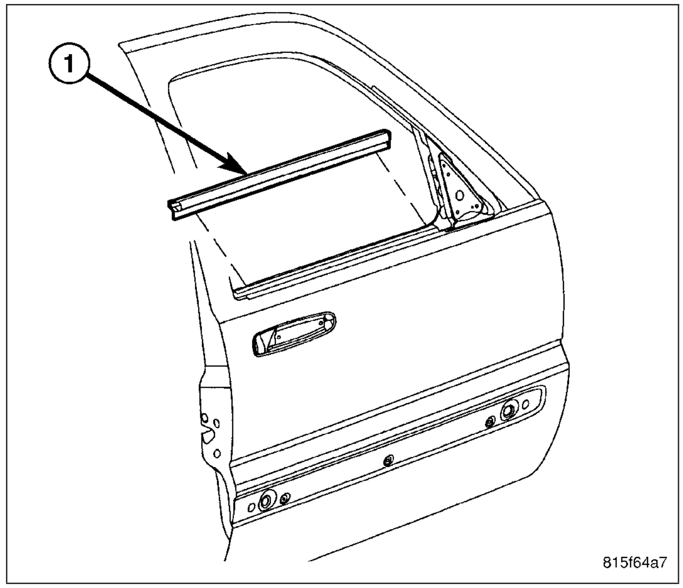
1. Install the glass through the window opening and align the mounting plate to the lift plate.



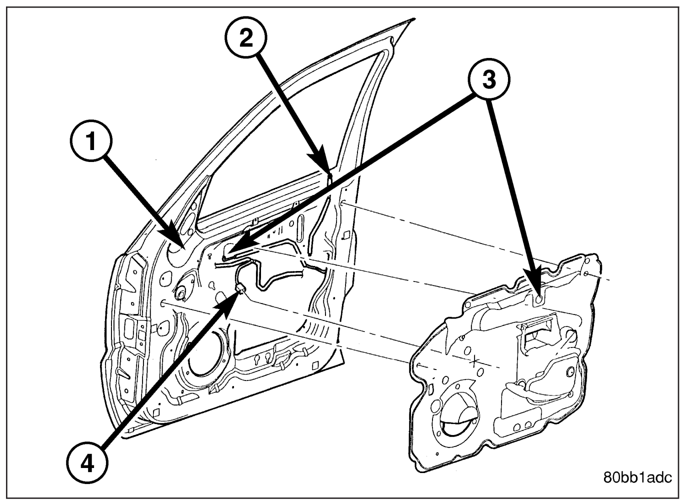

2. Engage the glass (4) to the regulator lift plate (3).



3. Install the outer belt molding (1). (Refer to 23 - BODY/WEATHERSTRIP/SEALS/FRONT DOOR OUTER BELT MOLDING - INSTALLATION)



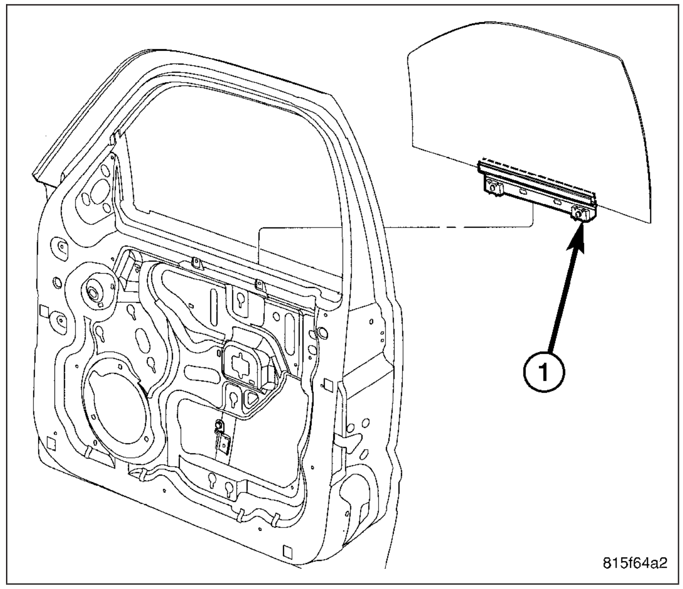

4. Install the waterdam. (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - INSTALLATION)



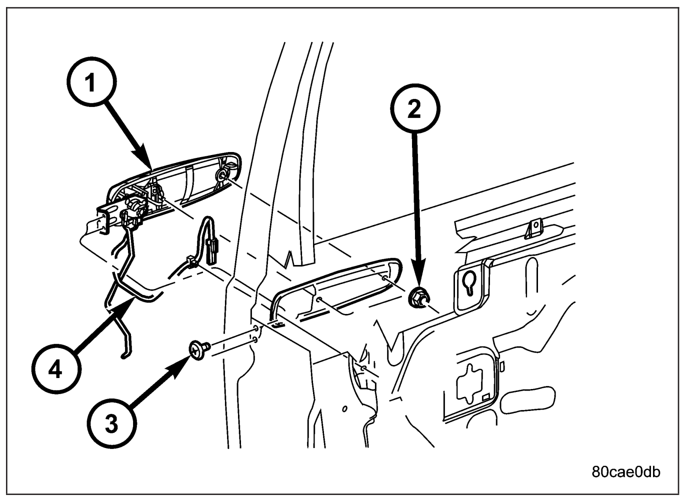
# EXTERIOR HANDLE

## REMOVAL

1. Remove the door glass (1). (Refer to 23 - BODY/ DOOR - FRONT/DOOR GLASS - REMOVAL)

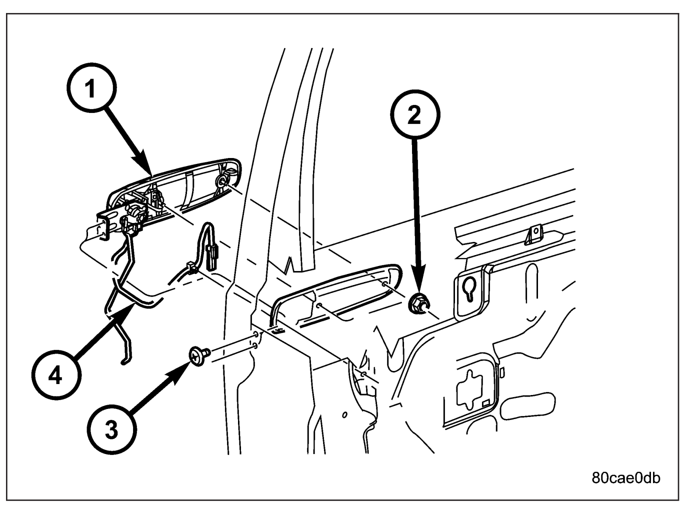



2. Disconnect the lock switch electrical connector (4), if equipped.
3. Disconnect the handle rod at the handle and the key cylinder rod at the latch.
4. Remove the screws (3).
5. Remove the nuts (2) and remove the handle (1).

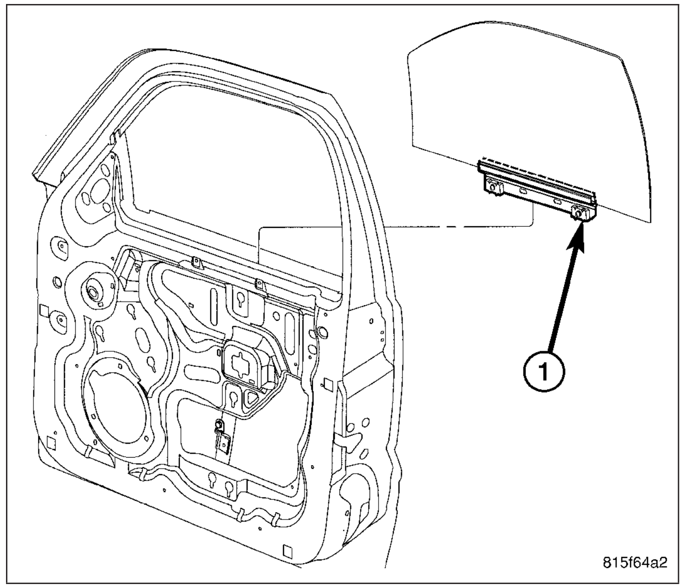



## INSTALLATION

1. Position the handle (1) on the door and slide fully toward the rear of the door.
2. Install the nuts (2) and tighten to 6 N·m (55 in. lbs.).
3. Install the screws (3) and tighten to 6 N·m (55 in. lbs.).
4. Connect the handle rod at the handle and the key cylinder rod at the latch.
5. Connect the lock switch electrical connector (4) , if equipped.



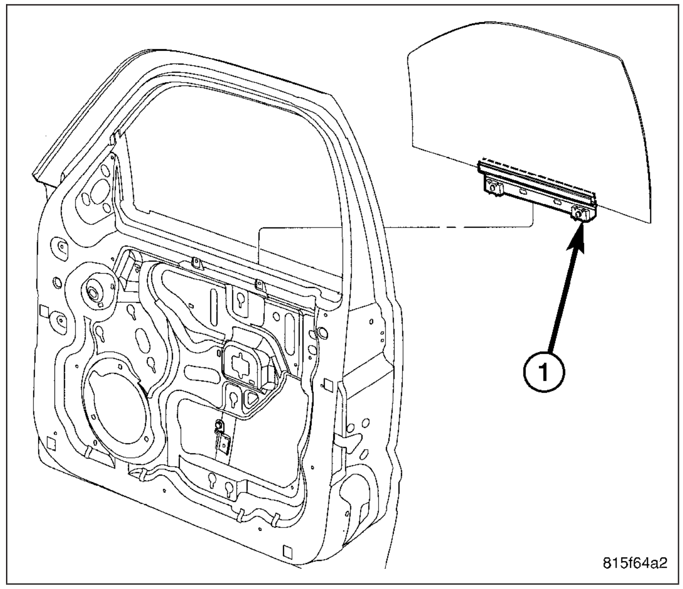
6. Install the door glass. (Refer to 23 - BODY/DOOR - FRONT/DOOR GLASS - INSTALLATION)



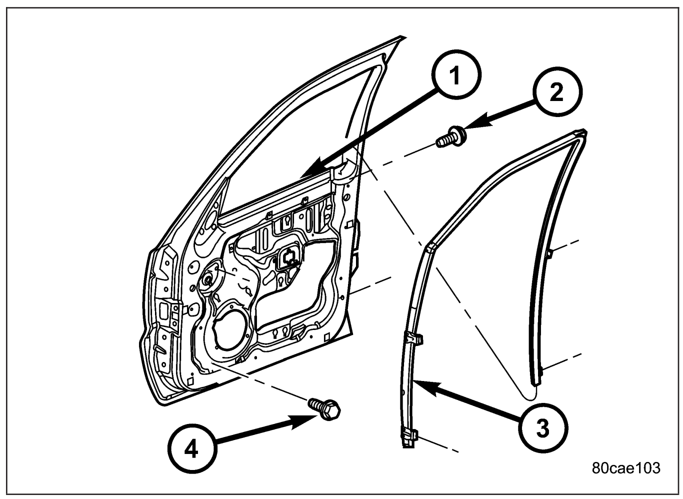
# GLASS RUN CHANNEL

## REMOVAL

1. Remove the door glass. (Refer to 23 - BODY/ DOOR - FRONT/DOOR GLASS - REMOVAL)

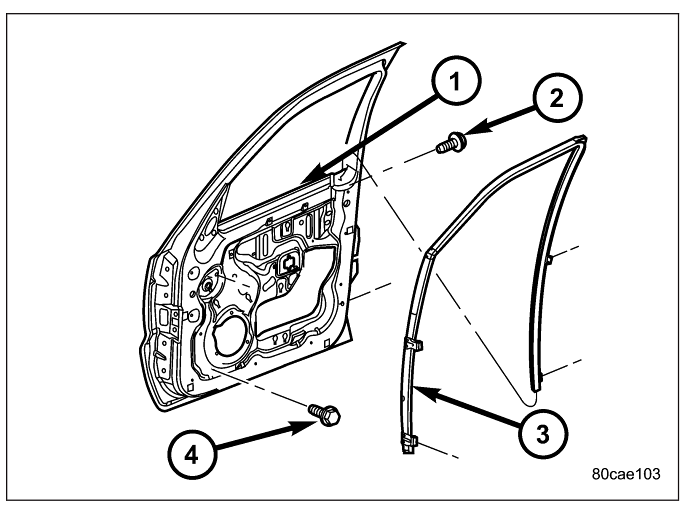



2. Remove the front (4) and rear bolts (2).
3. Peal the weatherstrip out of the door frame and remove the run channel (3) through the window opening (1).

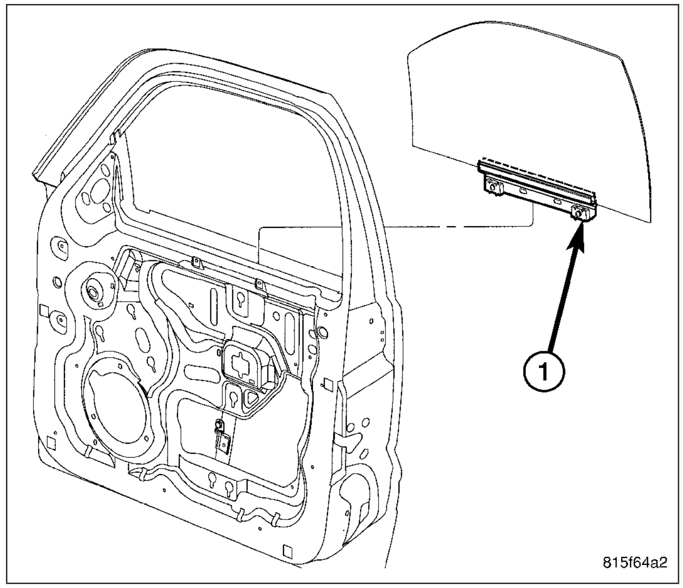



## INSTALLATION

1. Install the run channel (3) through the window opening (1) and into the door frame.
2. Install the front (4), rear bolts (2) and tighten to 9 N·m (80 in. lbs.).



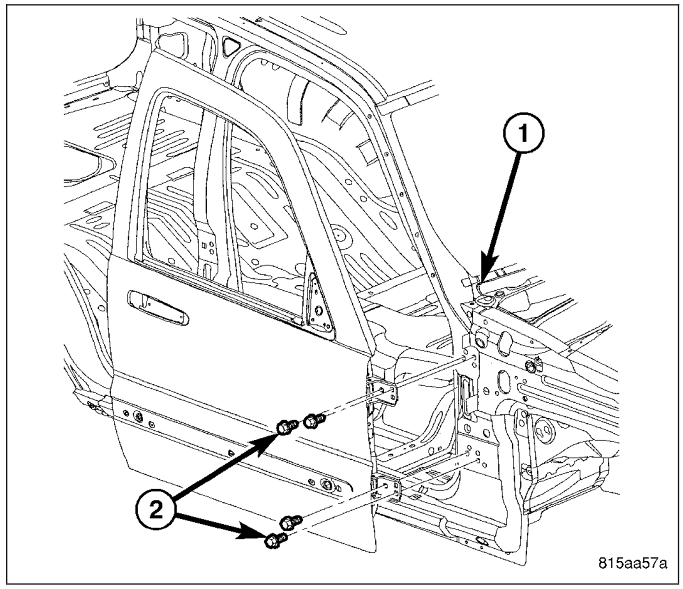
3. Install the door glass. (Refer to 23 - BODY/DOOR - FRONT/DOOR GLASS - INSTALLATION)



# HINGE

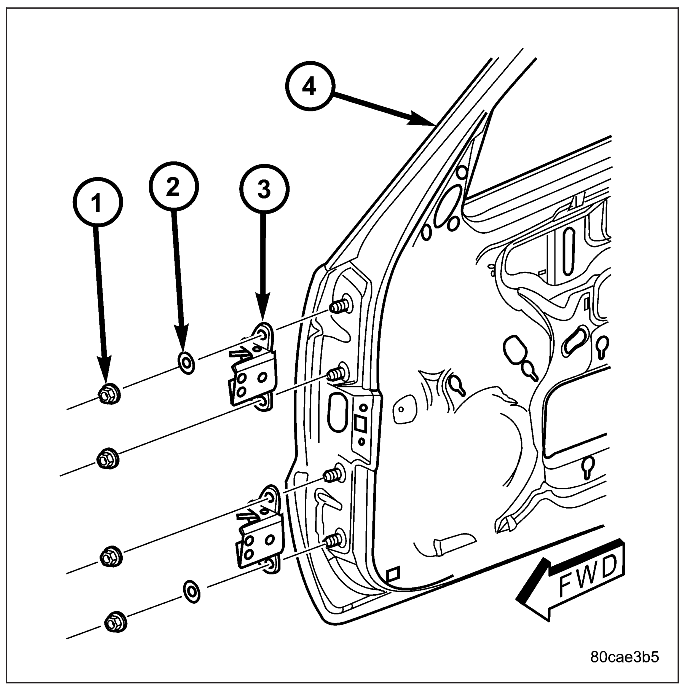
## REMOVAL

1. Remove the door. (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)




2. Using a grease pencil or equivalent, mark the location of the door hinges (3) on the front door.

**NOTE: The epoxy bonded washers (2) do not need to be separated from the door hinges. If the washers are removed, the door may need to be readjusted.**



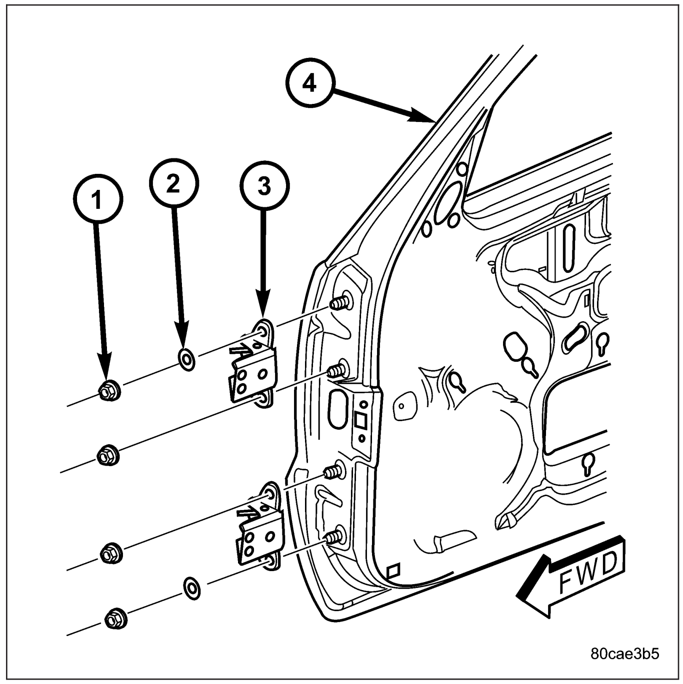

3. Remove the four nuts (1) that secure the front door hinges to the door and remove the hinges.
4. If required, remove the washers (2) from the front door hinges.

## INSTALLATION

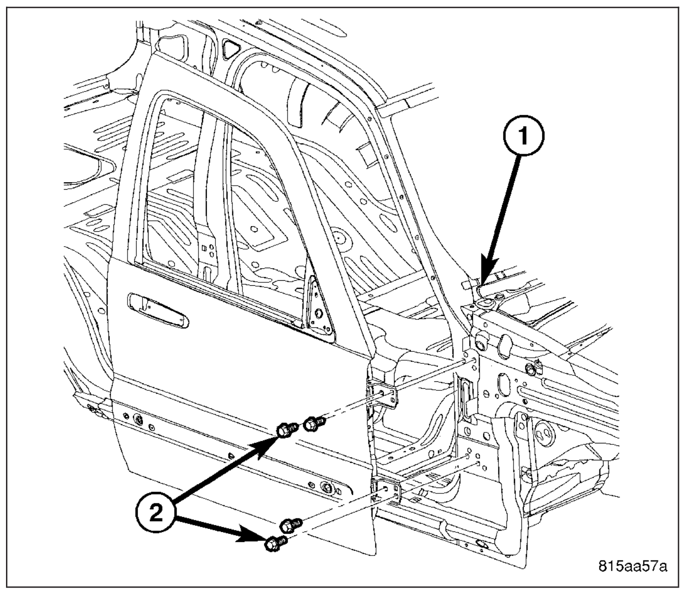
1. Position the front door hinges onto the door.

**NOTE: If the epoxy bonded washers are separated from the door hinges, the door may need to be adjusted.**

2. If removed, install the epoxy bonded washers (2).
3. Loosely install the nuts (1) that secure the hinges to the front door.
4. Align the hinges to the door using the reference marks made during the removal procedure and tighten the nuts to 28 N·m (21 ft. lbs.).



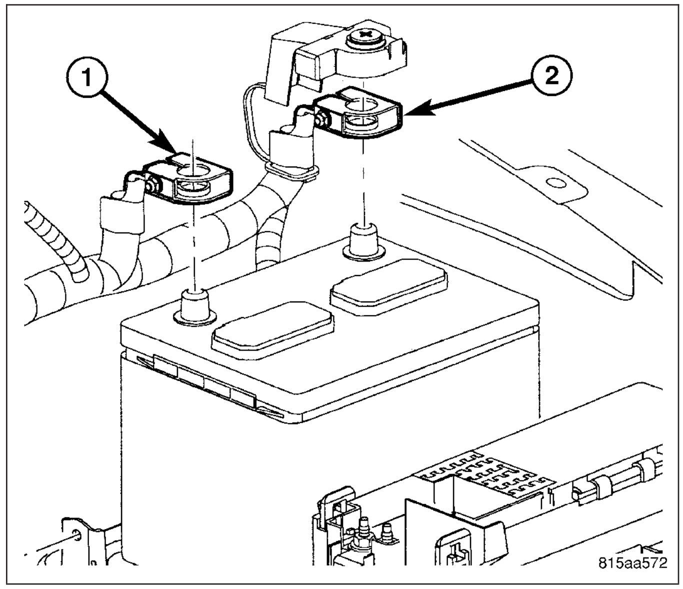

5. Install the door. (Refer to 23 - BODY/DOOR - FRONT/DOOR - INSTALLATION)



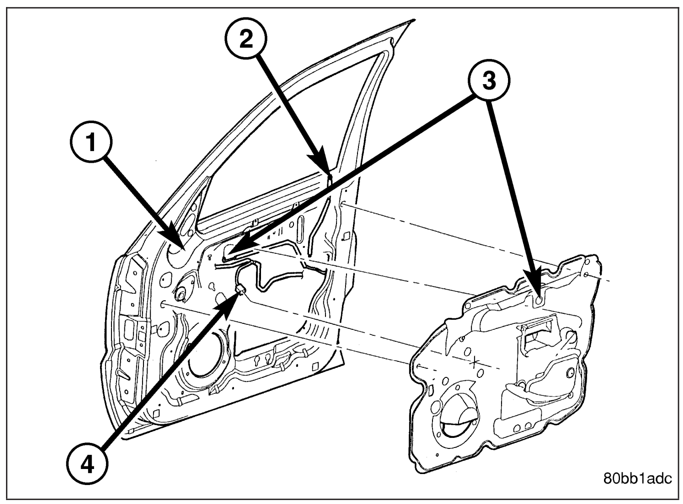
# LATCH

## REMOVAL

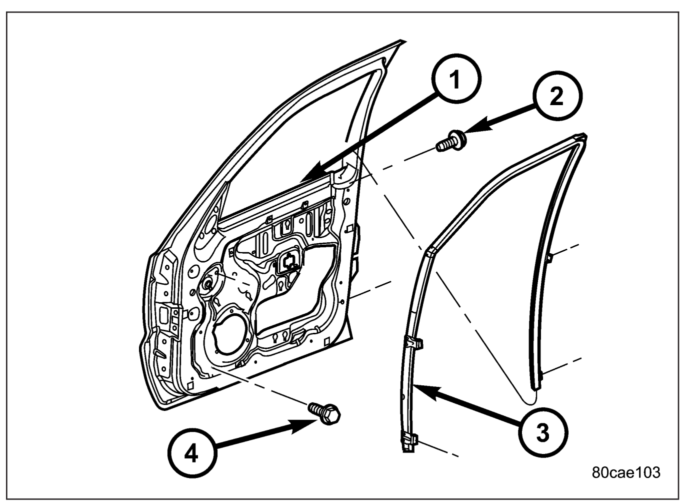
1. Disconnect and isolate the battery negative cable.



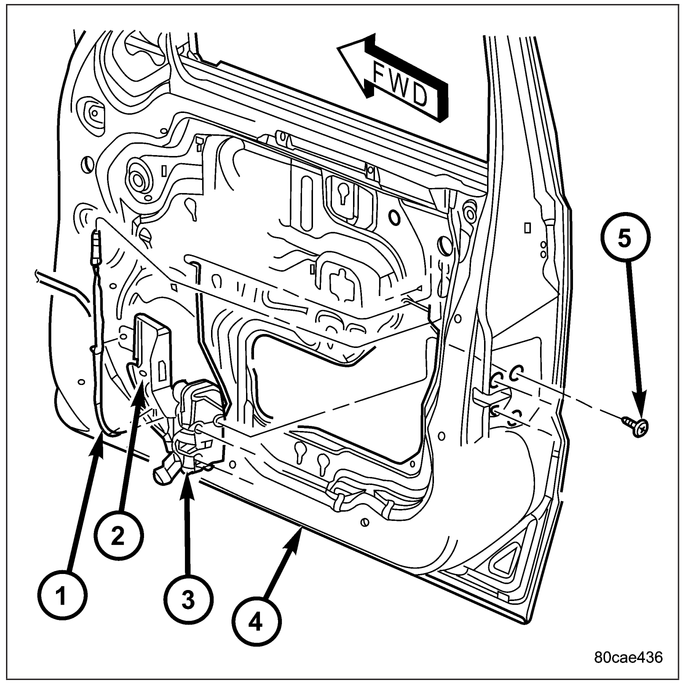

2. Remove the waterdam as necessary to gain access to the latch. (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - REMOVAL)




3. Remove rear glass run channel bolts (2) and position the channel aside.

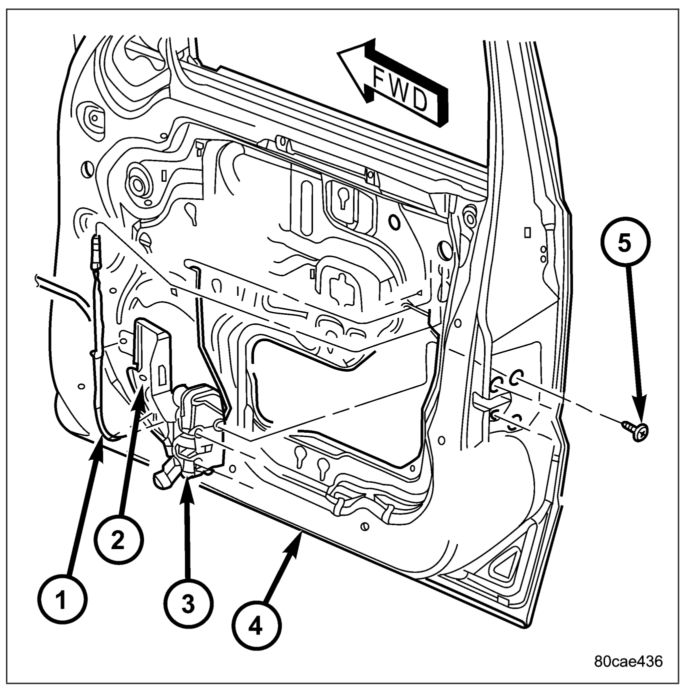


4. Disconnect the exterior handle rod at the handle.
5. Disconnect the lock knob rod (1) and lock cylinder link rod at the latch.
6. Remove the screws (5) and remove the latch assembly (3).
7. Disconnect the electrical connectors.

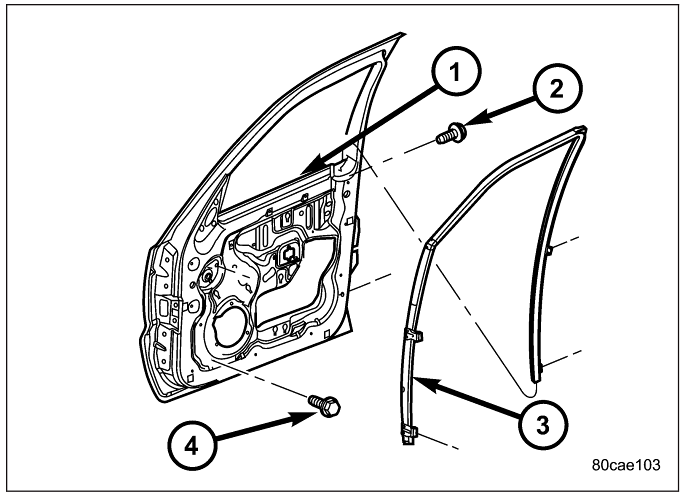



## INSTALLATION

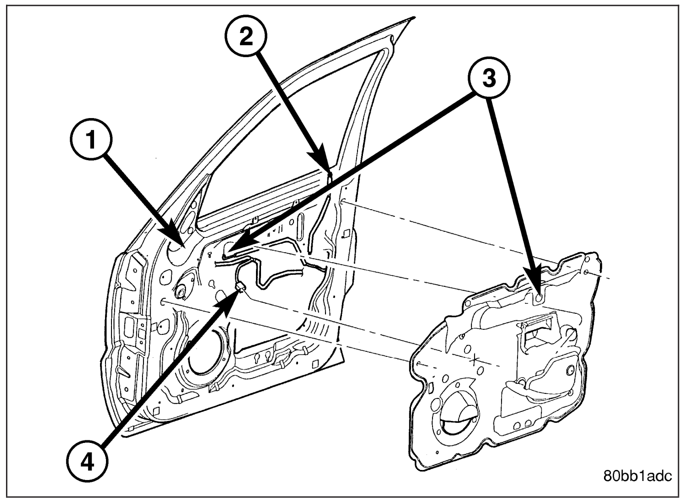
1. Connect the latch electrical connectors.
2. Install the latch assembly (3) into the door (4) and install the screws (5).
3. Tighten the latch screws (5) to 11 N·m (95 in. lbs.).
4. Connect the lock cylinder link rod and lock knob rod at the latch.
5. Connect the exterior handle actuator rod at the handle.



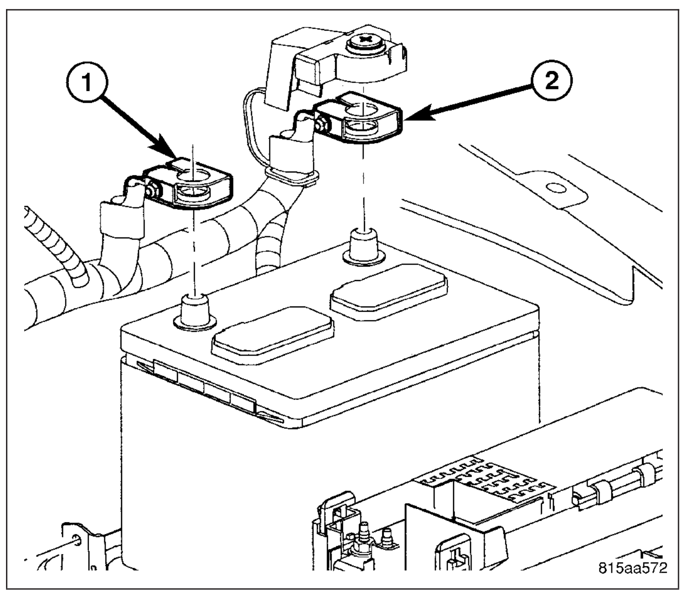
6. Install the rear glass run channel bolts (2) and tighten to 9 N·m (80 in. lbs.).




7. Install the waterdam. (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - INSTALLATION)



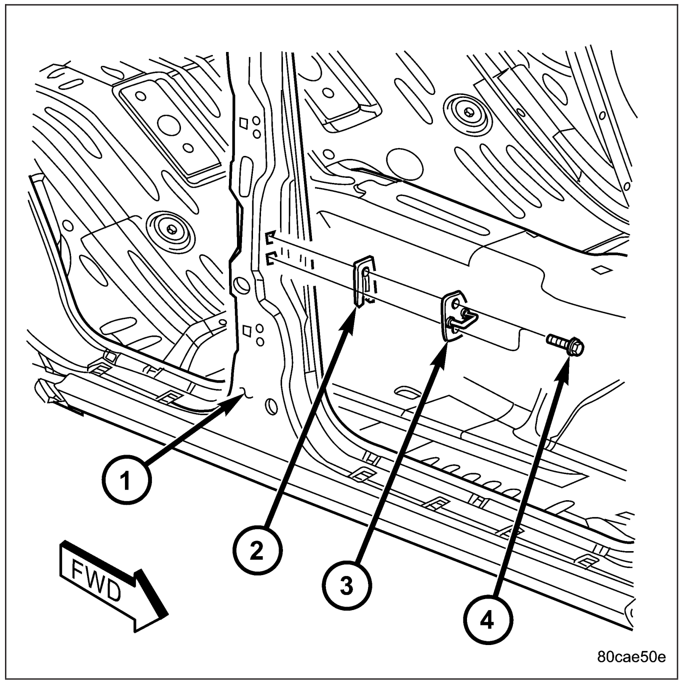

8. Reconnect the battery ground cable (1).



# LATCH STRIKER

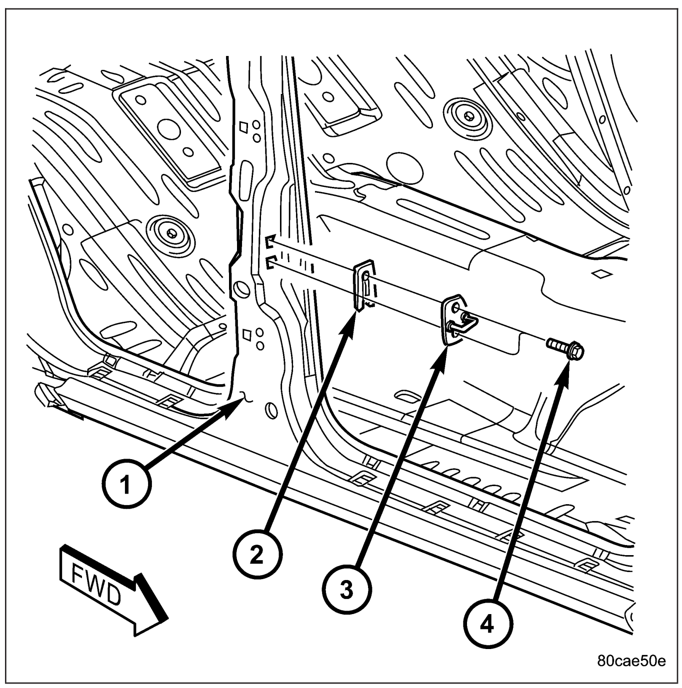
## REMOVAL

1. Remove the bolts (4).
2. Remove the latch striker (3) and the spacer (2), if equipped.




## INSTALLATION

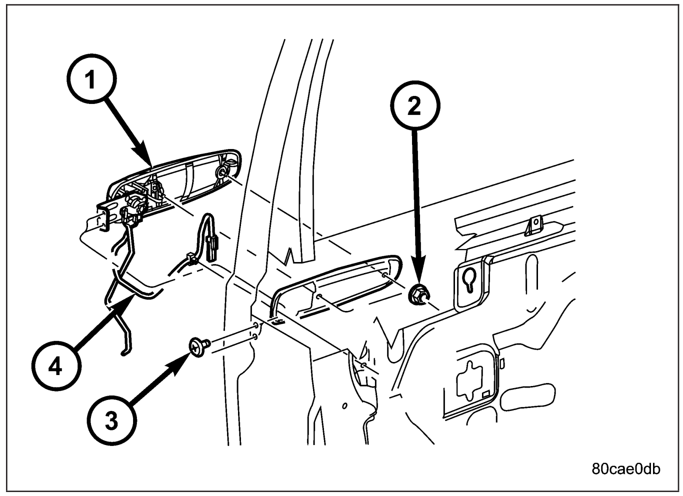
1. Install the striker (3) and spacer (2), if equipped.
2. Install the bolts (4) and tighten to 28 N·m (21 ft. lbs.).
3. Adjust the door as necessary. (Refer to 23 - BODY/ BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)



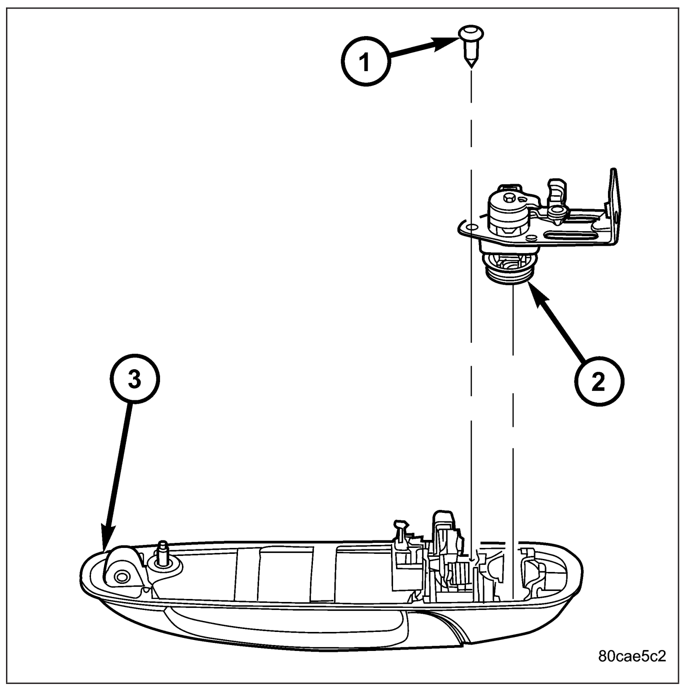
# LOCK CYLINDER

## REMOVAL

1. Remove the exterior handle (1). (Refer to 23 - BODY/DOOR - FRONT/EXTERIOR HANDLE - REMOVAL)

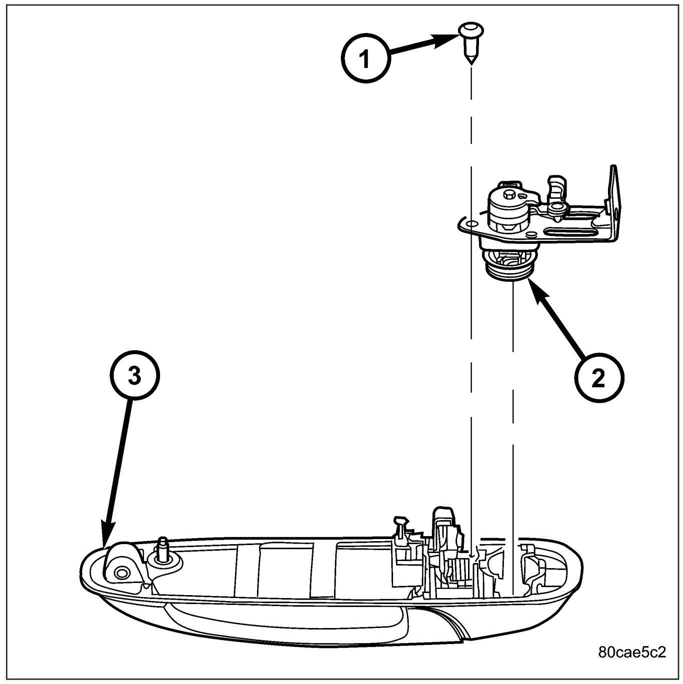



2. Remove the screw (1) and remove the lock cylinder (2).

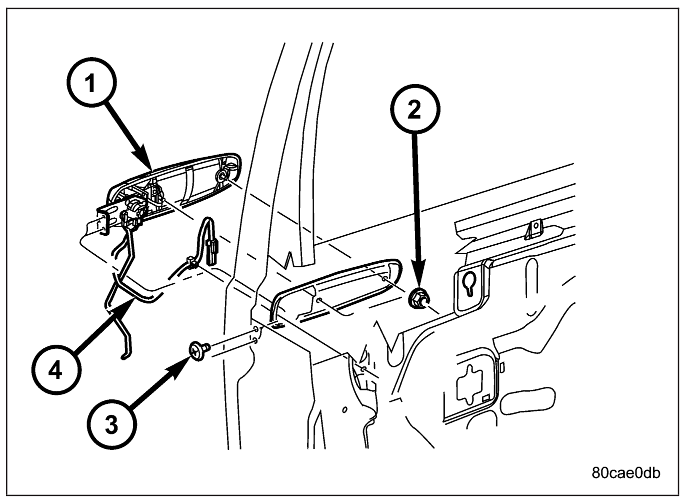


## INSTALLATION

1. Install the lock cylinder (2), the retaining screw (1) and tighten to 6 N·m (55 in. lbs.).



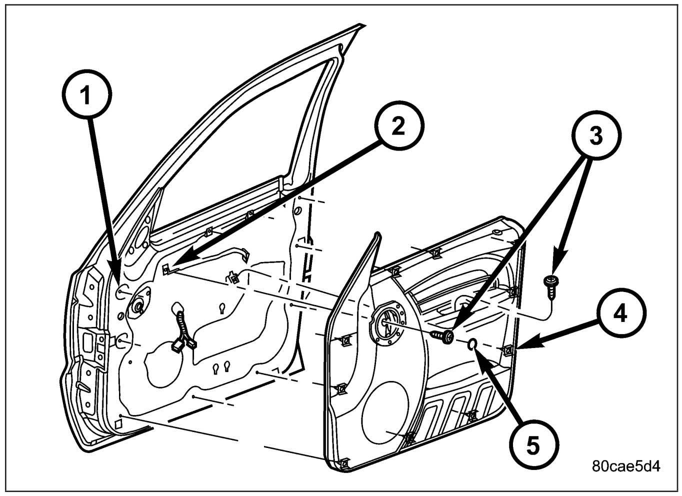

2. Install the exterior handle (1). (Refer to 23 - BODY/DOOR - FRONT/EXTERIOR HANDLE - INSTALLATION)



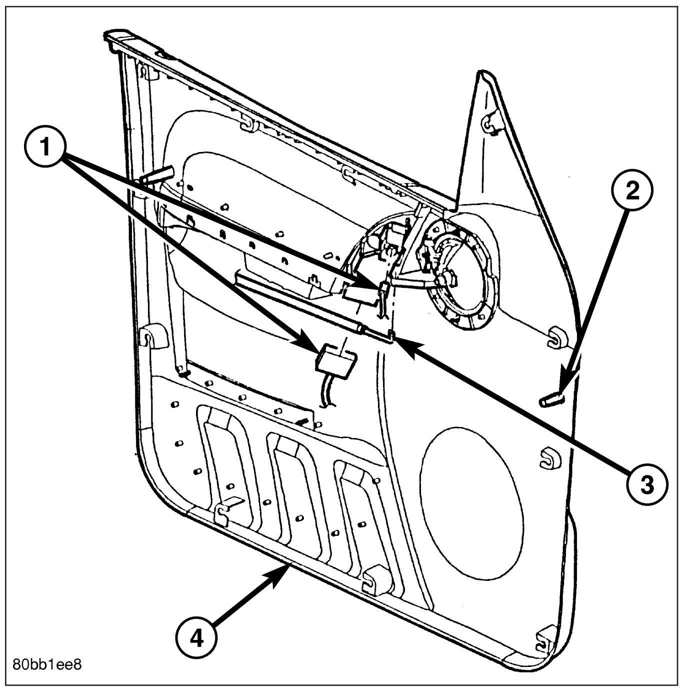
# TRIM PANEL

## REMOVAL

1. Remove the inside handle screw plug (5) and remove the screw (3).
2. Remove the pull handle screw (3).
3. Using a trim stick C-4755 or equivalent, disengage the trim panel clips (4) and remove the trim panel.

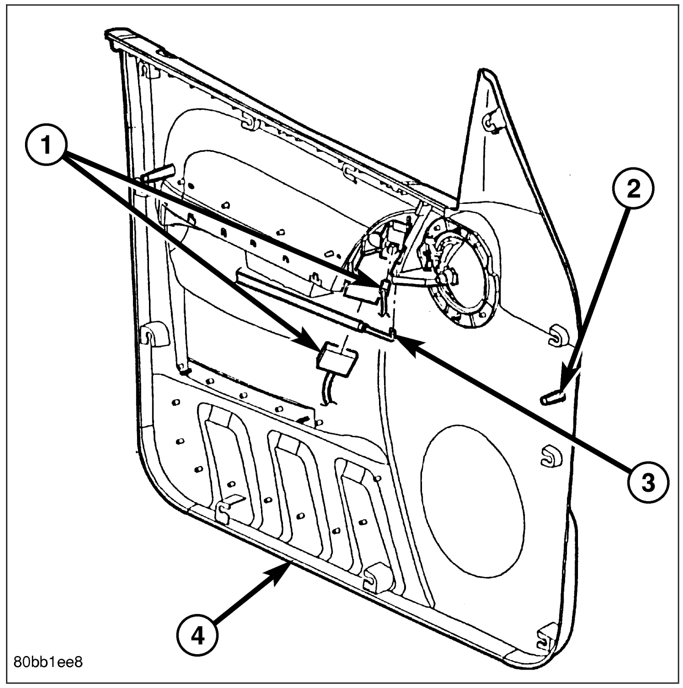



4. Disconnect the electrical connectors (1) and the inside handle actuator rod (3).

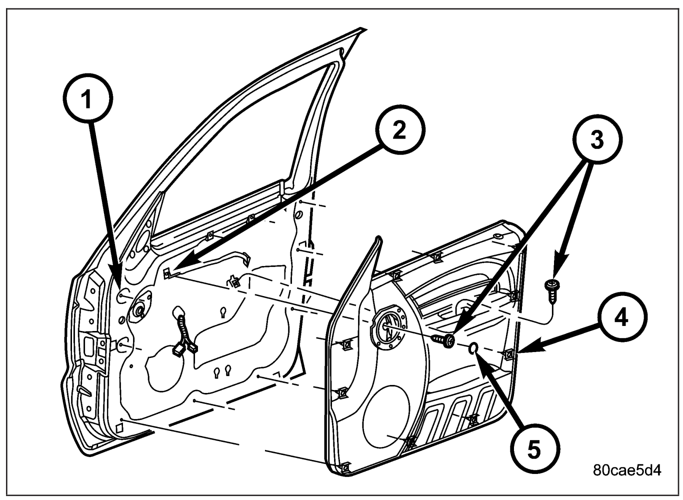


## INSTALLATION

1. Connect the inside handle actuator rod (3) and the electrical connectors (1).



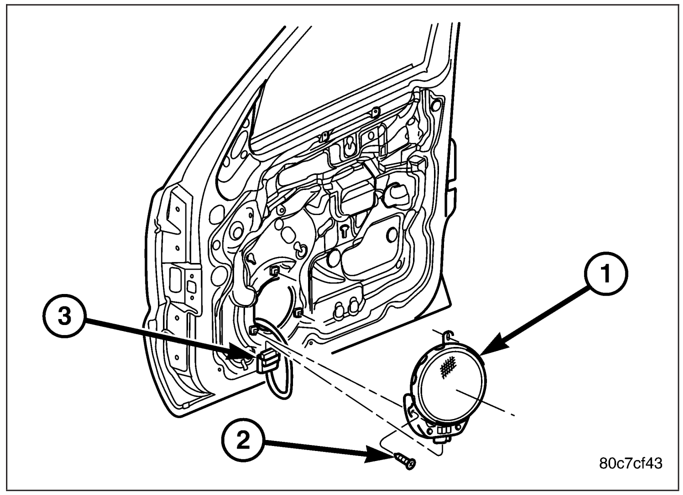

2. Position the trim panel and seat the clips (4) fully.
3. Instal the screws (3) and install the screw plug (5).



# WATERDAM

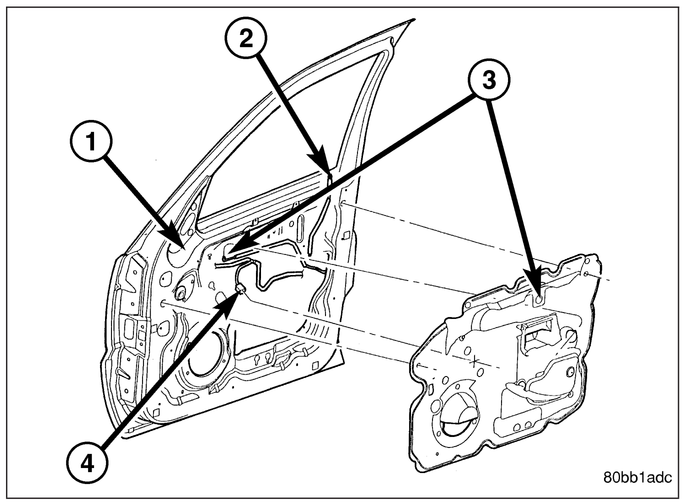
## REMOVAL

1. Remove the door speaker. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - REMOVAL)




**CAUTION: Do not allow the waterdam or adhesive to become contaminated with dirt or other foreign substances.**
**Do not damage the waterdam during removal and installation.**
**If the waterdam becomes contaminated or damaged, replace the waterdam.**

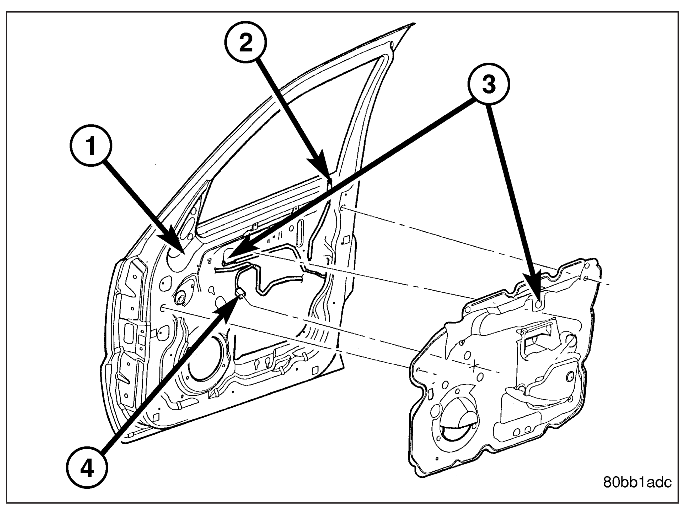
2. Separate the waterdam from the inner door panel and off of the latch linkages.




## INSTALLATION

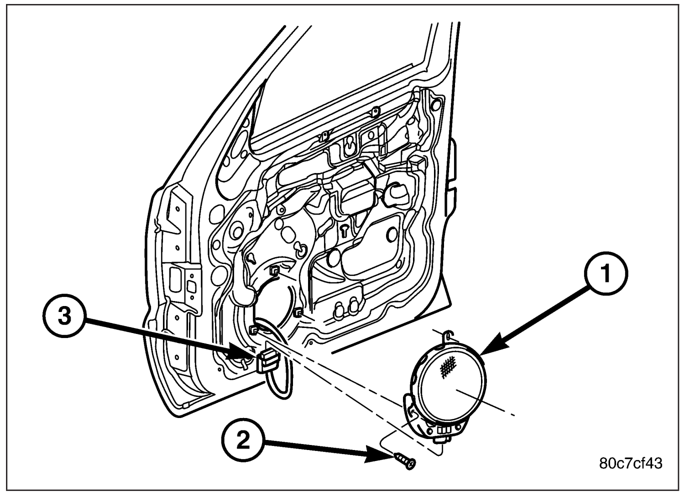
**CAUTION: Do not allow the waterdam or adhesive to become contaminated with dirt or other foreign substances.**
**Do not damage the waterdam during removal and installation.**
**If the waterdam becomes contaminated or damaged, replace the waterdam.**

1. Position the wire harness and actuator rods through the holes in the waterdam.
2. Place waterdam onto the door and pressurize at the butyl bead to seal completely, starting with the top rear locating indent and then moving to the top front locating indent followed by the remaining portion of the waterdam.




3. Run a hard plastic squeegee firmly around the perimeter of the waterdam making sure that the drain holes at the bottom of the inner door panel are fully covered by the waterdam.

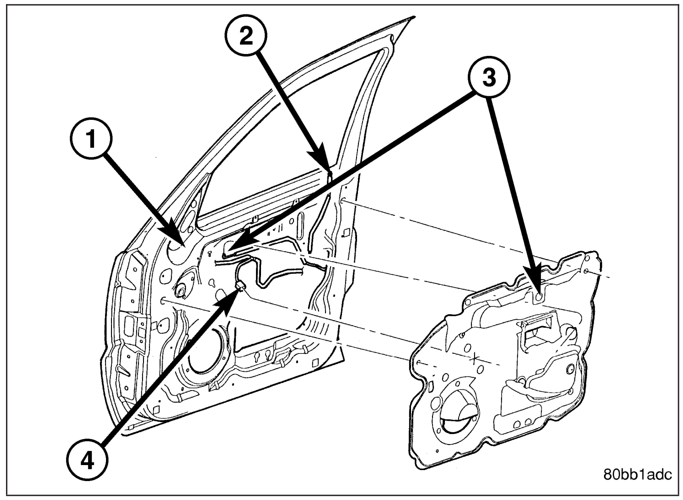
4. Install the speaker. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - INSTALLATION)



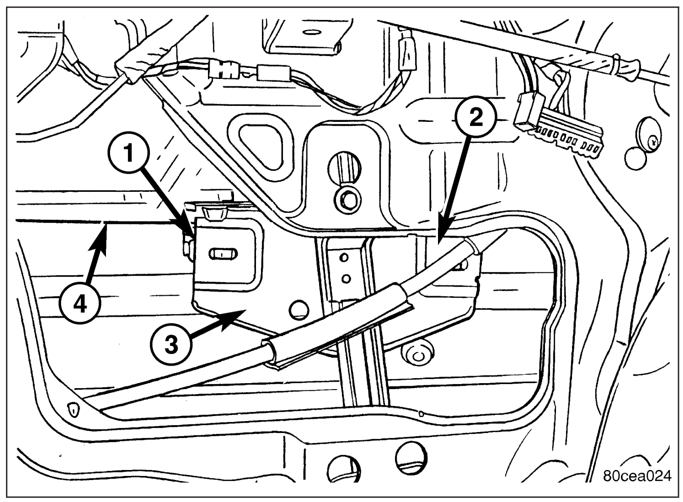
# WINDOW REGULATOR - MANUAL

## REMOVAL

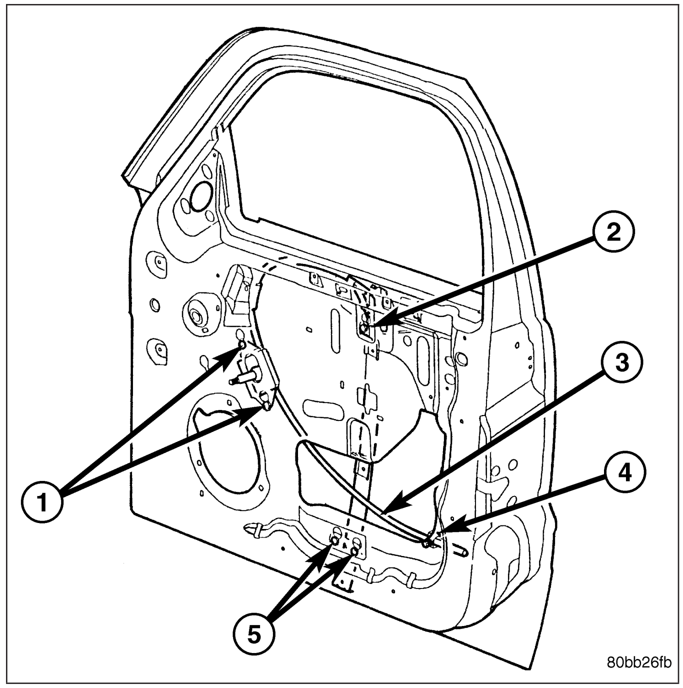
1. Remove the waterdam. (Refer to 23 - BODY/ DOOR - FRONT/WATERDAM - REMOVAL)




2. Raise the glass (4) to the position shown and using a long flat blade or hook type tool, disengage clips (1) attaching glass retainer to regulator lift plate (3).
3. Disconnect the glass from the regulator lift plate (3) and re-install the clips (1).
4. Secure the glass (4) in the up position using a wood wedge, tape or equivalent.

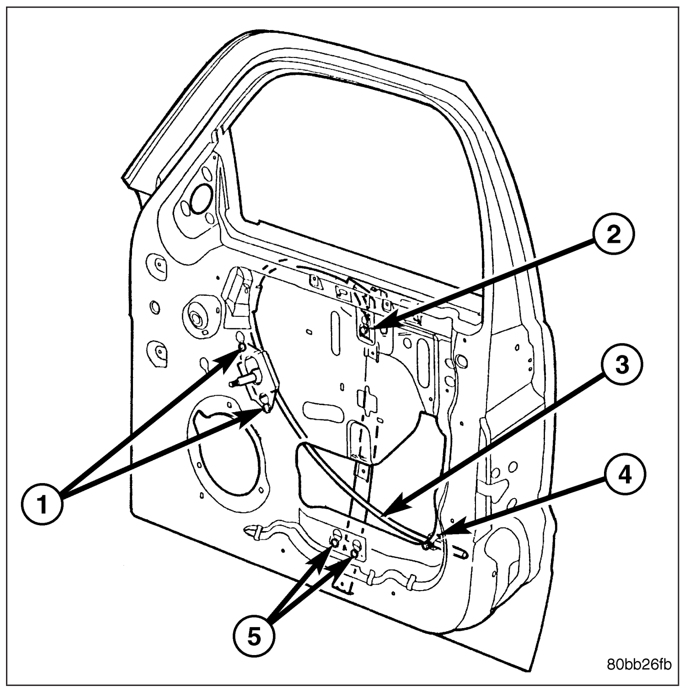


5. Loosen the bolts. (1, 2 and 5)
6. Disconnect the runout tube clip (4) and remove the regulator (3).

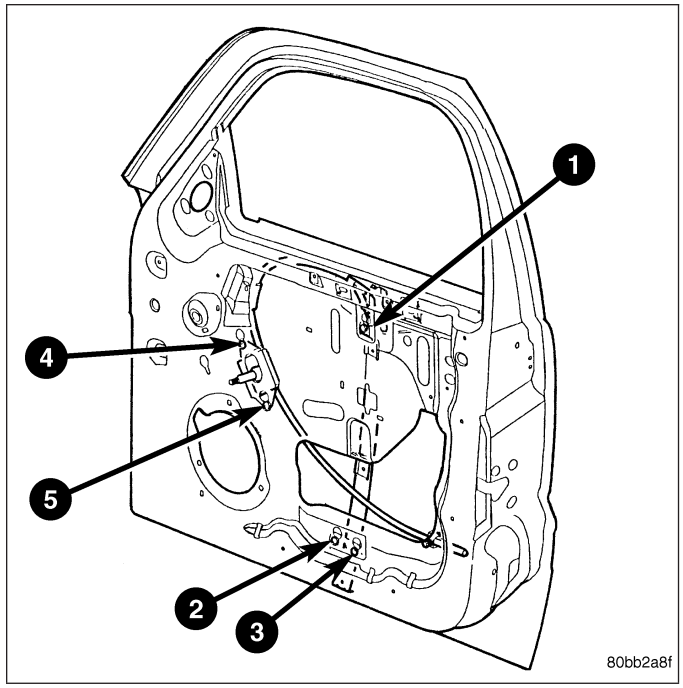



## INSTALLATION

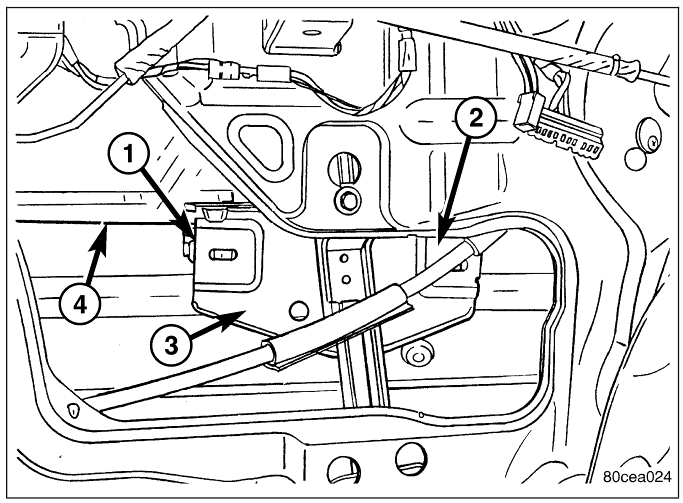
1. Install the regulator assembly (3).



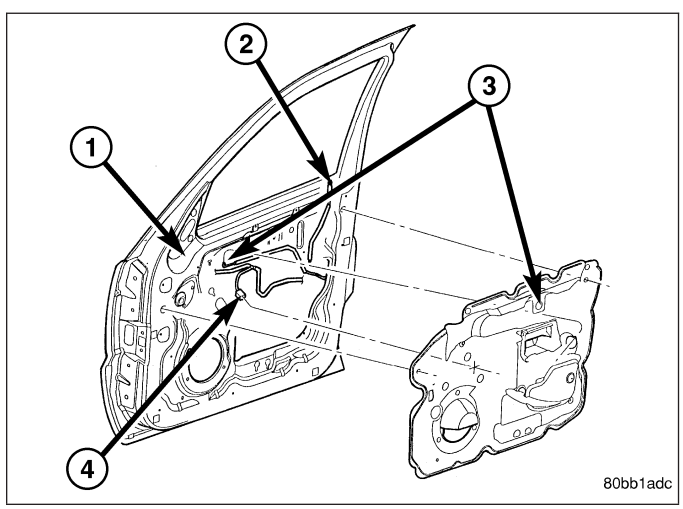
2. Tighten the bolts to 9 N·m (80 in. lbs.) using the sequence shown.




3. Remove the glass support and connect to the regulator lift plate (3).



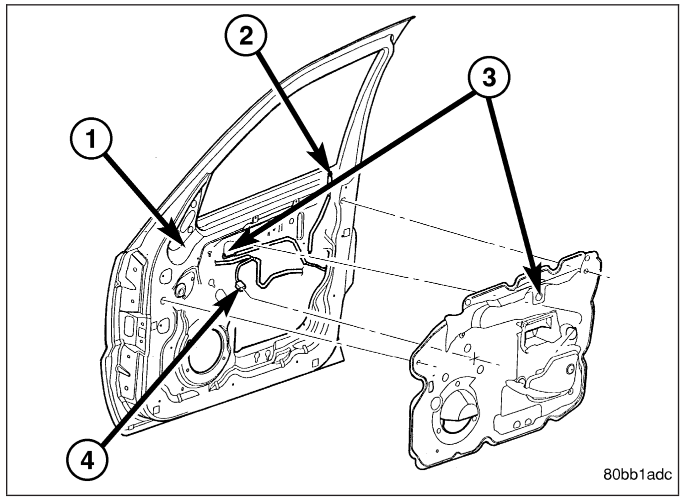

4. Install the waterdam. (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - INSTALLATION)



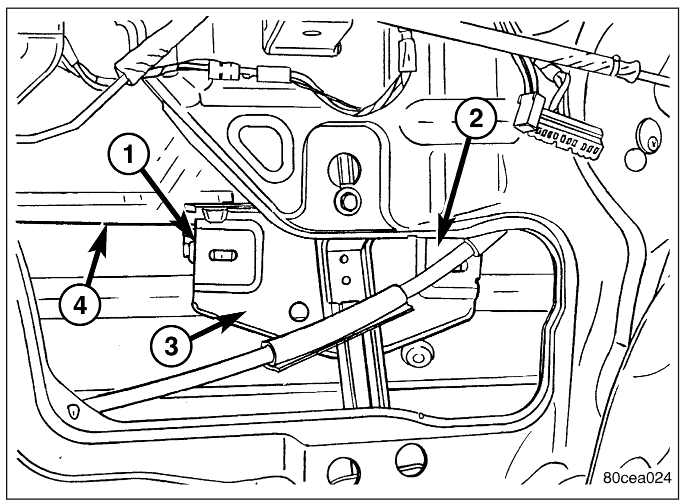
# WINDOW REGULATOR - POWER

## REMOVAL

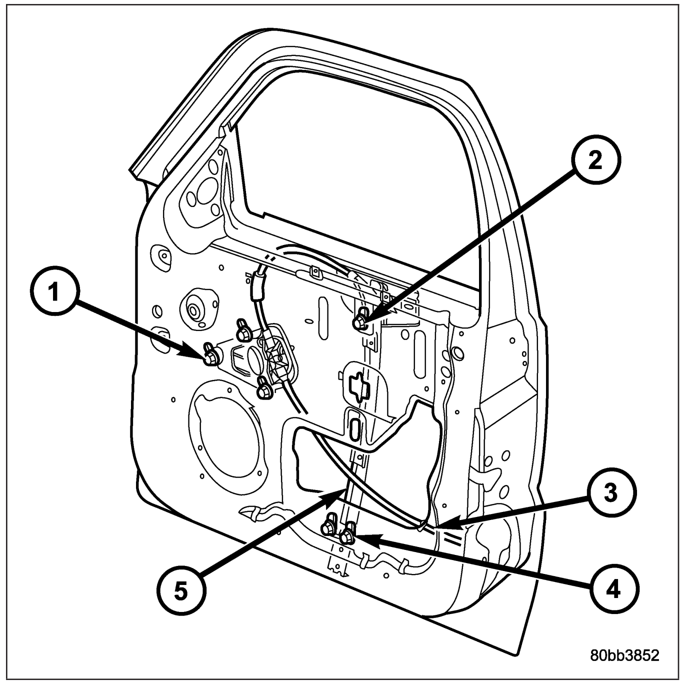
1. Remove the waterdam. (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - REMOVAL)




2. Raise the glass (4) to the position shown and using a long flat blade or hook type tool, disengage clips (1) attaching glass retainer to regulator lift plate (3).
3. Disconnect the glass (4) from the regulator lift plate and re-install the clips (1).
4. Secure the glass in the up position using a wood wedge, tape or equivalent.

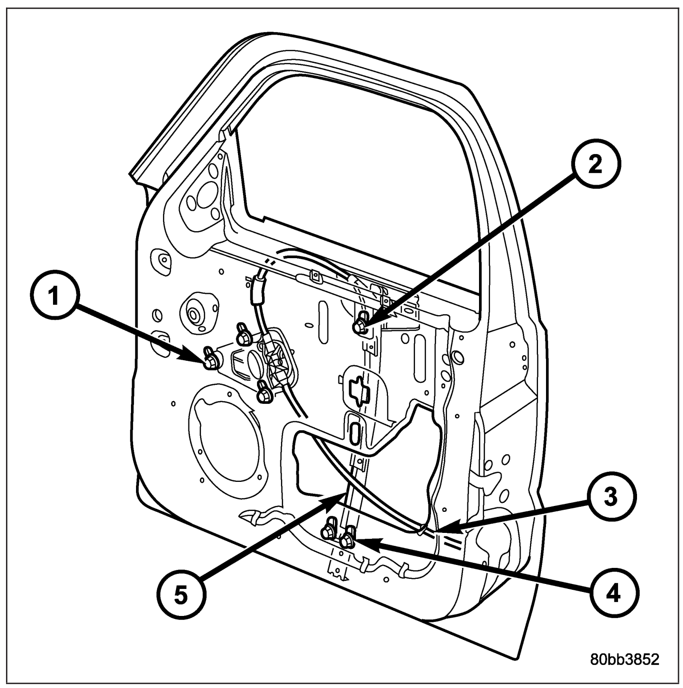


5. Loosen the bolts (1, 2 and 4).
6. Disconnect the runout tube clip (3).
7. Disconnect the electrical connector and remove the regulator (5).

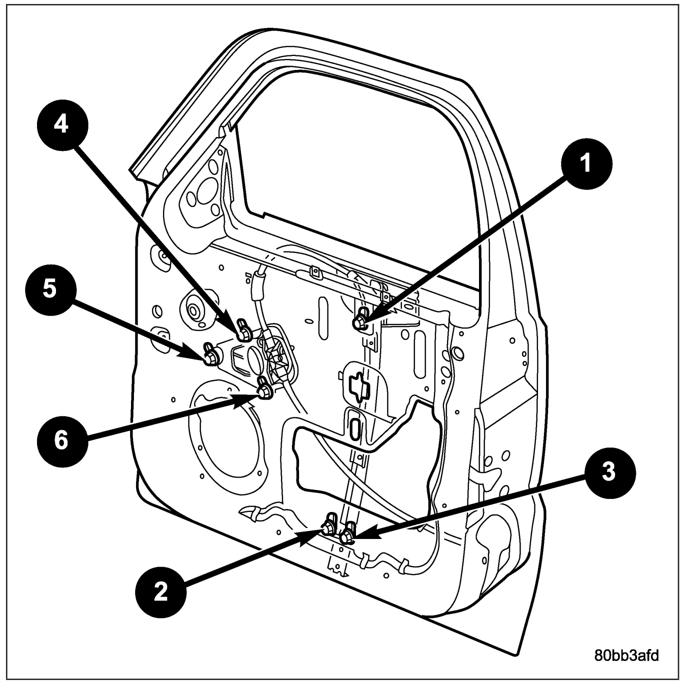



## INSTALLATION

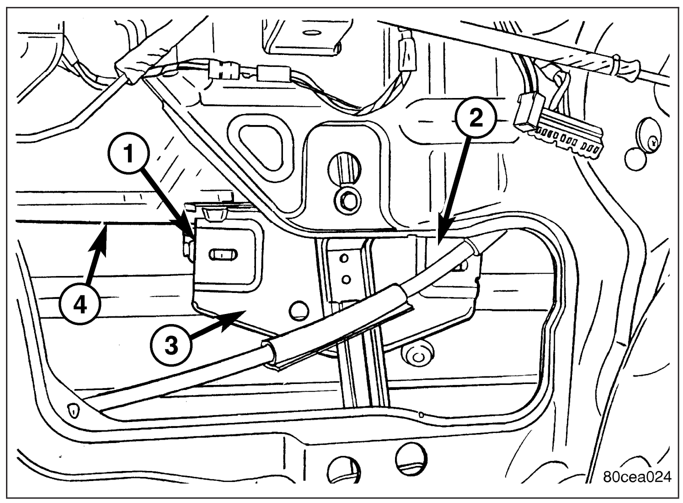
1. Install the regulator assembly (5).
2. Connect the electrical connector.
3. Connect the runout tube clip (3).



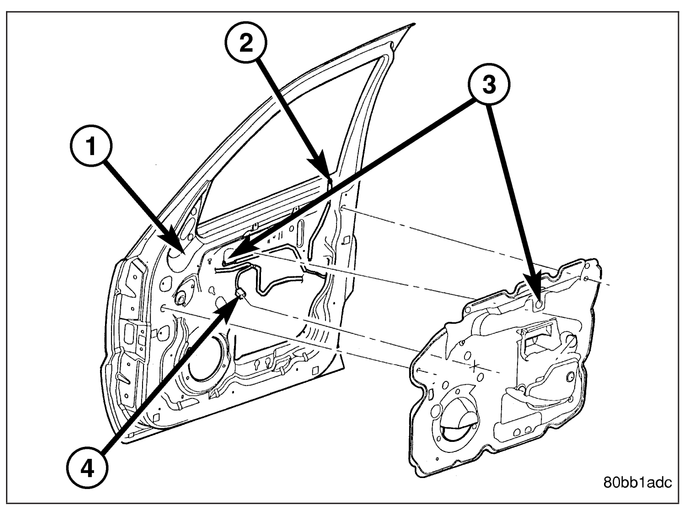
4. Tighten the bolts to 9 N·m (80 in. lbs.) using the sequence shown.




5. Remove the glass support and connect to the regulator lift plate (3).




6. Install the waterdam. (Refer to 23 - BODY/DOOR - FRONT/WATERDAM - INSTALLATION)



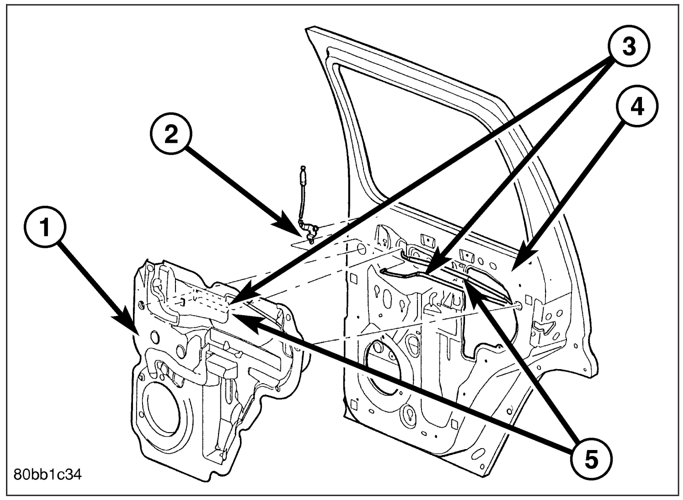
# DOORS - REAR

## TABLE OF CONTENTS

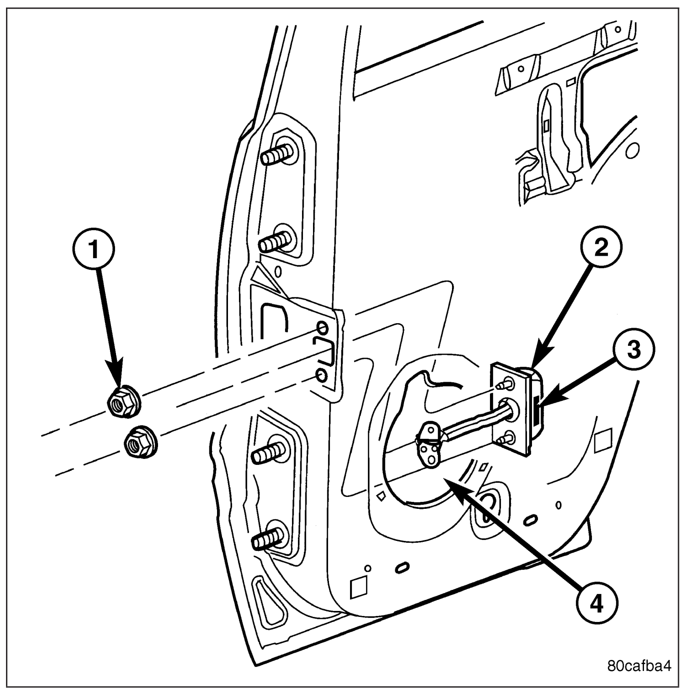
# CHECK STRAP

## REMOVAL

1. Remove the waterdam (1). (Refer to 23 - BODY/ DOORS - REAR/WATERDAM - REMOVAL)

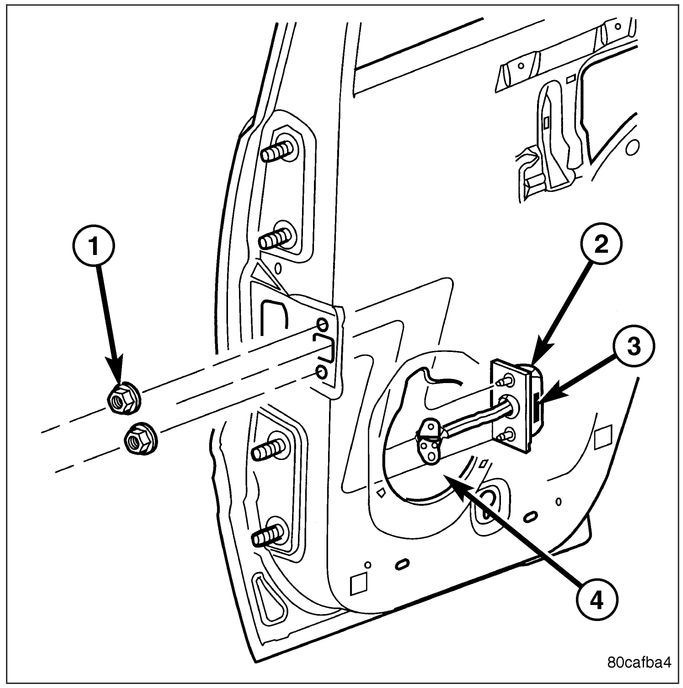



2. Remove screws attaching door check to B-pillar.
3. Remove the two nuts (1) and remove the door check strap (2).

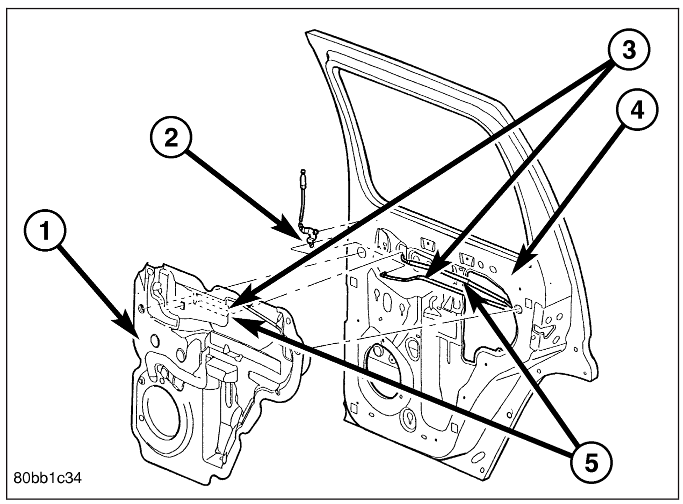


## INSTALLATION

**NOTE: Make sure the proper orientation of the check strap is maintained using the part number printed on the side. The part number should face inboard toward the interior of the vehicle.**




1. Install the check strap (2) through the speaker hole (4).
2. Install the nuts (1) and tighten to 12 N·m (9 ft. lbs.).
3. Connect the strap to the B-pillar and tighten the bolts to 12 N·m (9 ft. lbs.).

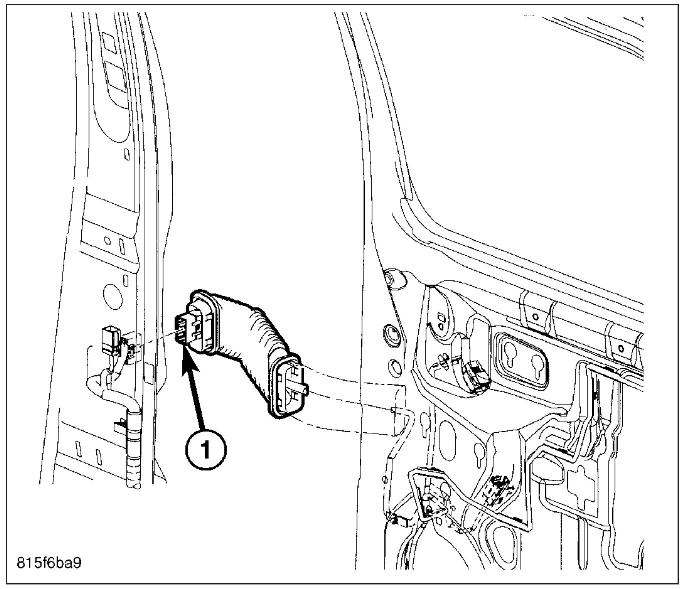



4. Install the waterdam (1). (Refer to 23 - BODY/ DOORS - REAR/WATERDAM - INSTALLATION)

# DOOR

## REMOVAL

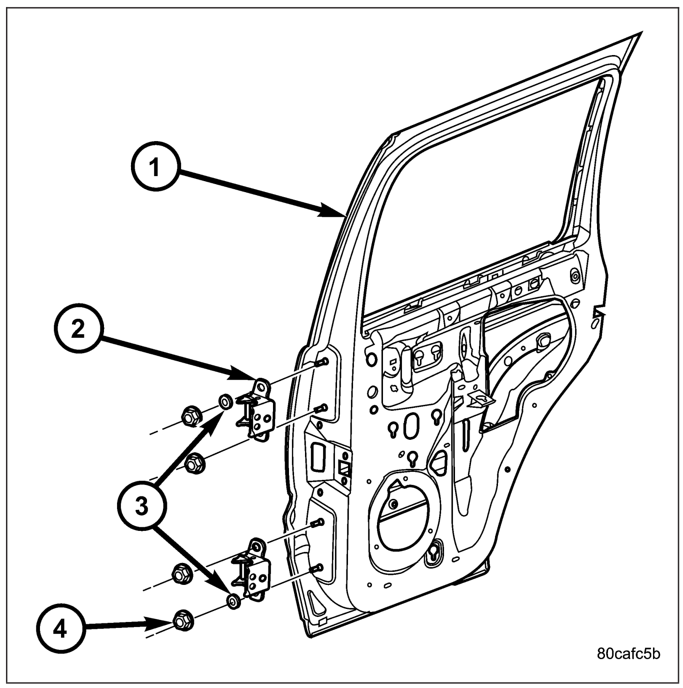
1. Disconnect the door wire harness electrical connector (1) at the B-pillar.
2. Disconnect the check strap from the B-pillar. (Refer to 23 - BODY/DOORS - REAR/CHECK STRAP - REMOVAL)




3. Support the door with a suitable lifting device.

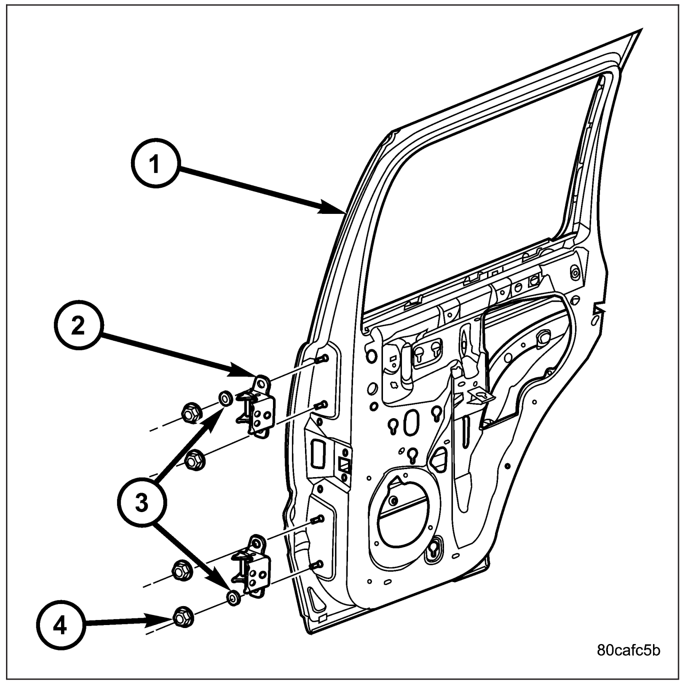
**NOTE: The epoxy washers (3) should not be removed from the hinge. If the washers are removed the door may have to be re-adjusted.**

4. Remove the nuts (4) attaching the door hinges to the door (1).

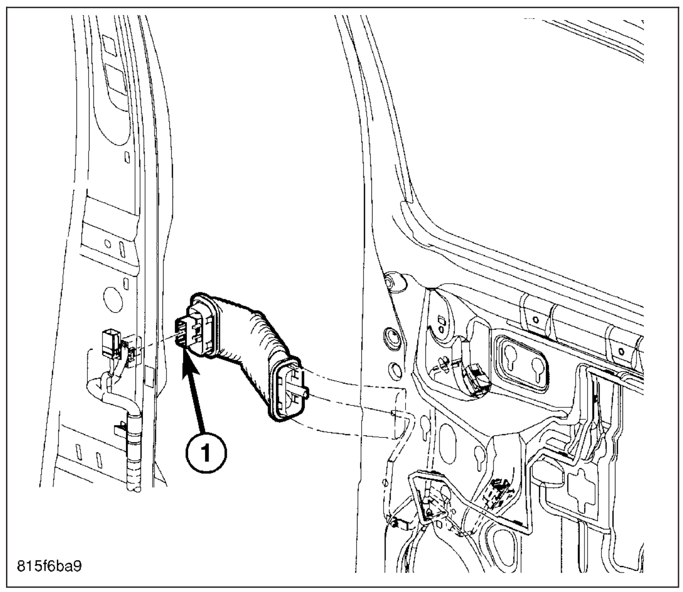


## INSTALLATION

1. Support the door with a suitable lifting device and install the door onto the B-pillar.
2. Install the nuts (4), washers (3) and tighten to 23 N·m (17 ft. lbs.).




3. Connect the door wire harness electrical connector (1).
4. Connect the check strap to the B-pillar. (Refer to 23 - BODY/DOORS - REAR/CHECK STRAP - INSTALLATION)
5. Adjust the door as necessary. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)




## ADJUSTMENTS

**NOTE: For vehicles equipped with four doors, it is recommended that you adjust the rear door before adjusting the front door.**

- **Door adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.**
- **During adjustment procedures, it is recommended that all the hinge fasteners be loosened except for the upper most fasteners. Adjustments can be made using the upper fasteners to hold the door with final torque of the fasteners occurring after correct door positioning is achieved.**

## FORE/AFT

**NOTE: Fore/aft (lateral) door adjustment is done by loosening the hinge to the hinge pillar fasteners one hinge at a time and moving the door to the correct position.**

1. Support the door with a suitable lifting device.
2. Loosen the hinge to hinge pillar fasteners. (Refer to 23 - BODY/DOORS - REAR/HINGE - REMOVAL)
3. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
4. Tighten the hinge pillar fasteners to 28 N·m (21 ft. lbs.). (Refer to 23 - BODY/DOORS - REAR/HINGE - INSTALLATION)

**NOTE: Use a suitable body sealer on the hinge to body mating surfaces.**

## UP/DOWN

**NOTE: Up/down door adjustment is done by loosening either the hinge to the hinge pillar fasteners or the hinge to door fasteners and moving the door to the correct position.**

**NOTE: When adjustment of the door requires the loosening of the door to hinge fasteners, it will be necessary to separate the epoxy bonded washers with a chisel or other suitable tool.**

**NOTE: When the up/down adjustments are done correctly, the top of the door is positioned over flush to the roof. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)**

1. Support the door with a suitable lifting device.
2. Remove the latch striker. (Refer to 23 - BODY/DOORS - REAR/LATCH STRIKER - REMOVAL)
3. Loosen the hinge to hinge pillar fasteners (Refer to 23 - BODY/DOORS - REAR/HINGE - REMOVAL) or loosen the hinge to door fasteners (Refer to 23 - BODY/DOORS - REAR/DOOR - REMOVAL).
4. Adjust the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Tighten the hinge pillar fasteners or the door to hinges fasteners and fasteners to 28 N·m (21 ft. lbs.). (Refer to 23 - BODY/DOORS - REAR/HINGE - INSTALLATION)
6. Install the latch striker. (Refer to 23 - BODY/DOORS - REAR/LATCH STRIKER - INSTALLATION)

## IN/OUT

**NOTE: In/out door adjustment is done by loosening the hinge to door fasteners one hinge at a time and moving the door to the correct position.**

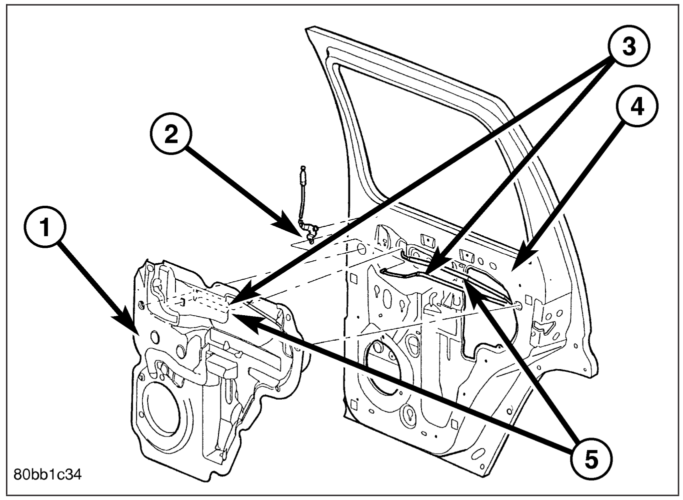
**NOTE: When adjustment of the door requires the loosening of the door to hinge fasteners, it will be necessary to separate the epoxy bonded washers with a chisel or other suitable tool.**

1. Support the door with a suitable lifting device.
2. Remove the latch striker. (Refer to 23 - BODY/DOORS - REAR/LATCH STRIKER - REMOVAL)
3. Loosen the hinge to door fasteners. (Refer to 23 - BODY/DOORS - REAR/DOOR - REMOVAL)
4. Adjust the front of the door to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Tighten the door to hinges fasteners to 28 N·m (21 ft. lbs.).
6. Install the latch striker. (Refer to 23 - BODY/DOORS - REAR/LATCH STRIKER - INSTALLATION)

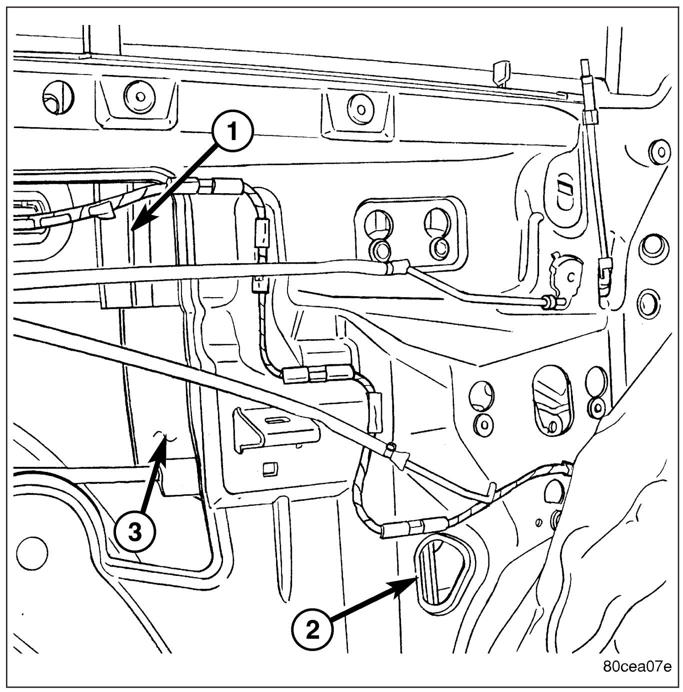
# DOOR GLASS

## REMOVAL

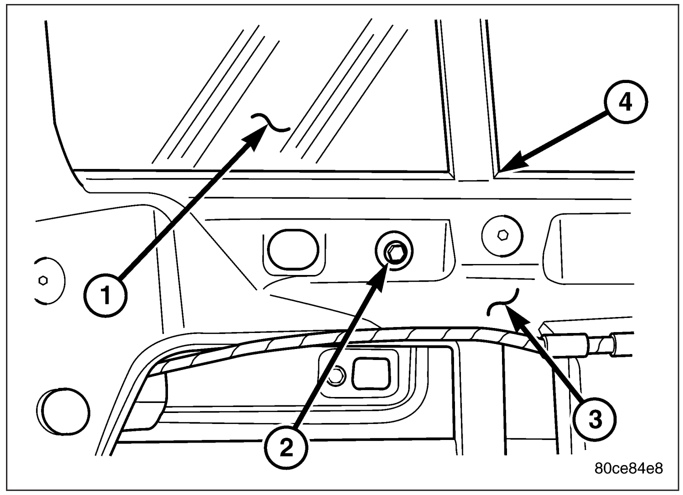
1. Remove the waterdam (1). (Refer to 23 - BODY/ DOORS - REAR/WATERDAM - REMOVAL)



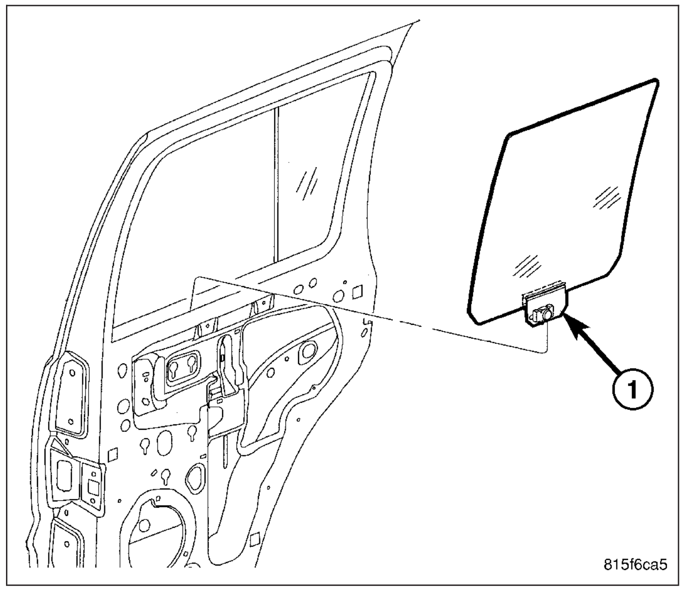

2. Raise the glass (3) and line up the lift plate clip with the hole in the door panel shown (2).
3. Using a long flat blade or hook type tool, disengage the clip attaching glass retainer to regulator lift plate.
4. Disconnect the glass from the regulator lift plate and re-install the clip.
5. Position the glass into the bottom of the door.



6. Remove the glass division bar bolt (2).
7. Twist the division bar towards the inside of the door and disengage the door glass.

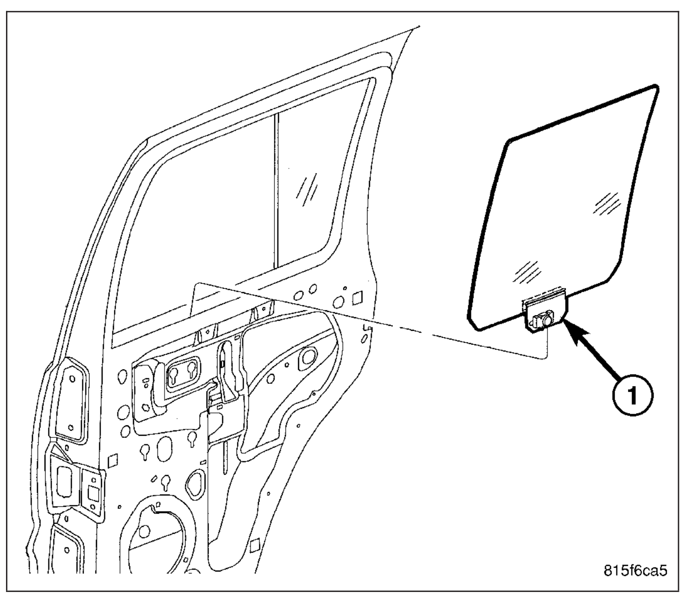



8. Remove the glass from the window opening.

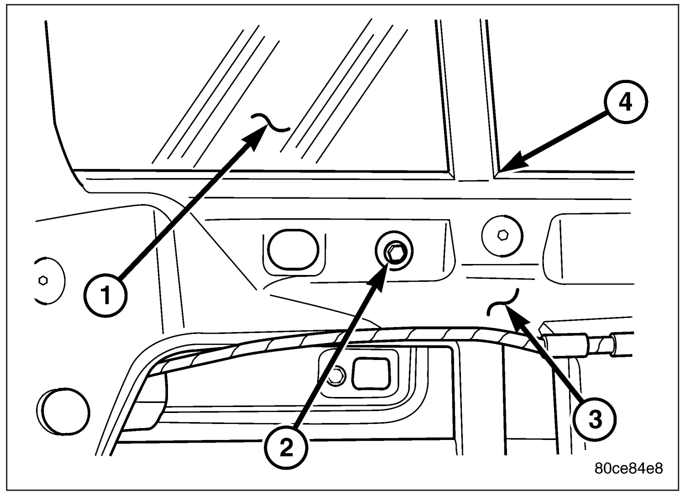



## INSTALLATION

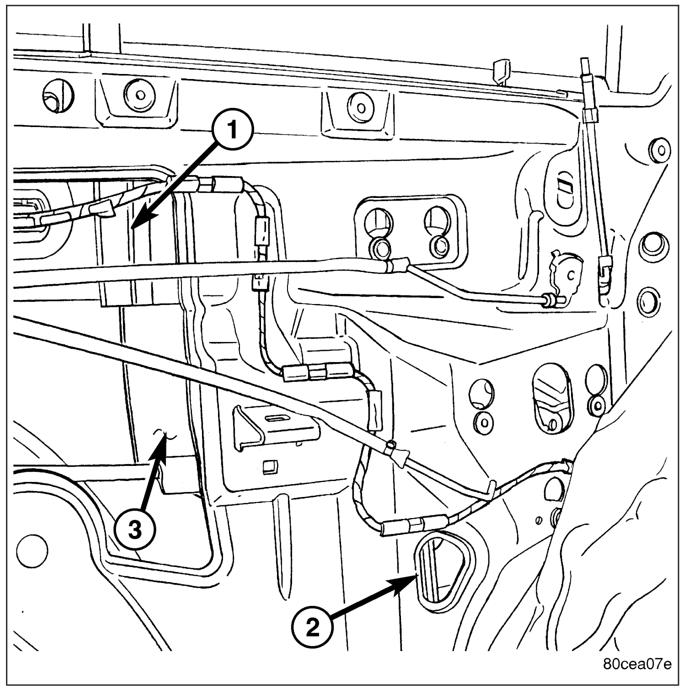
1. Install the glass (1) through the window opening.



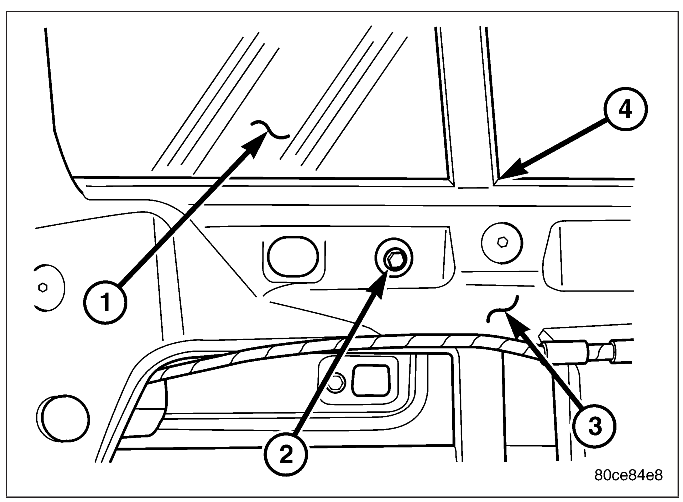
2. Position the front of the glass into the glass run channel and as low as possible in the door.
3. Twist the glass division bar (4) towards the inside of the door and position the door glass into the rear run channel.
4. Seat the division bar firmly up and into the fixed door glass (1), making sure the seal is well engaged into the door frame with no gap inside the car and no folded lip on the C-pillar.



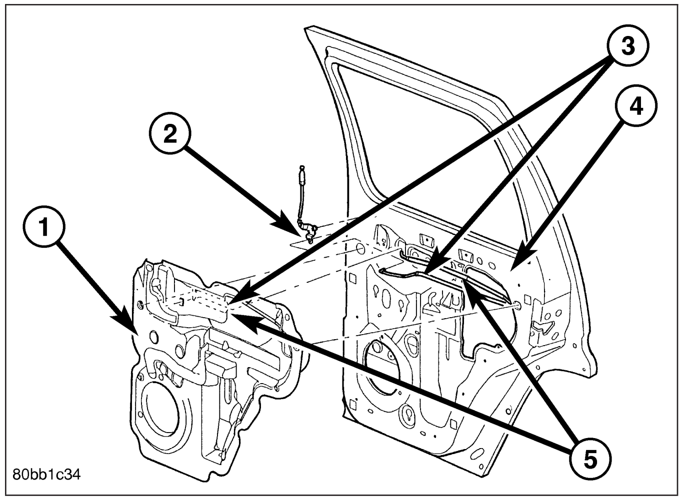

5. Lift glass up in the window and engage the pin into the regulator lift plate (2).




6. Raise the glass into the closed position and install the division bar bolt (2).
7. Tighten the bolt to 9 N·m (80 in. lbs.).



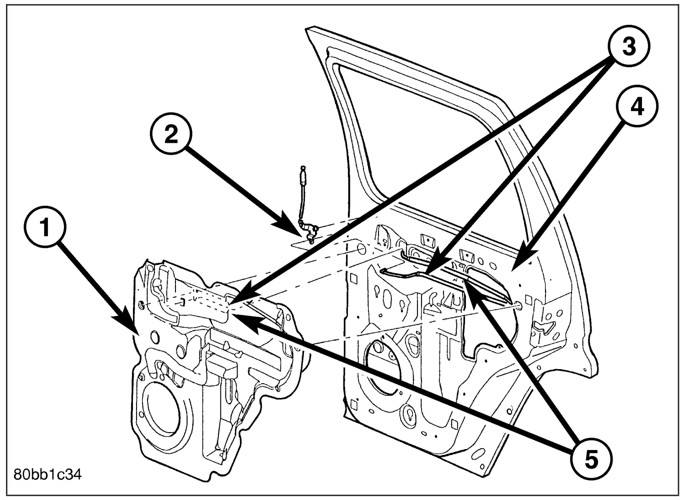
8. Install the waterdam (1). (Refer to 23 - BODY/ DOORS - REAR/WATERDAM - INSTALLATION)



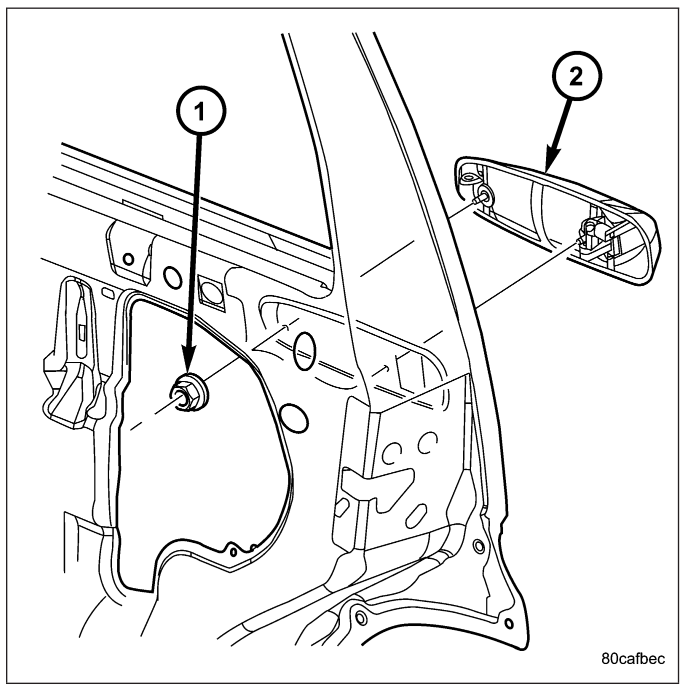
# EXTERIOR HANDLE

## REMOVAL

1. Remove the waterdam as necessary to gain access to the handle. (Refer to 23 - BODY/DOORS - REAR/WATERDAM - REMOVAL)

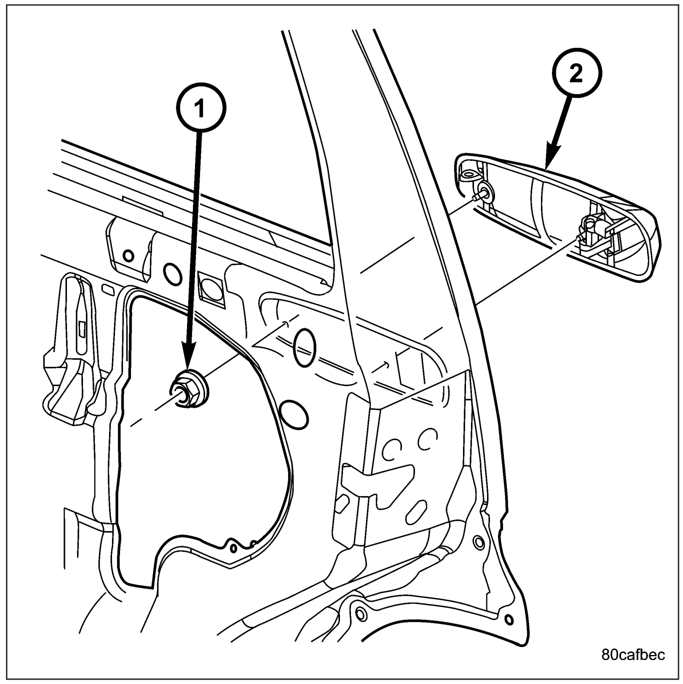



2. Disconnect the handle rod at the handle.
3. Remove the nuts (1) and remove the handle (2).

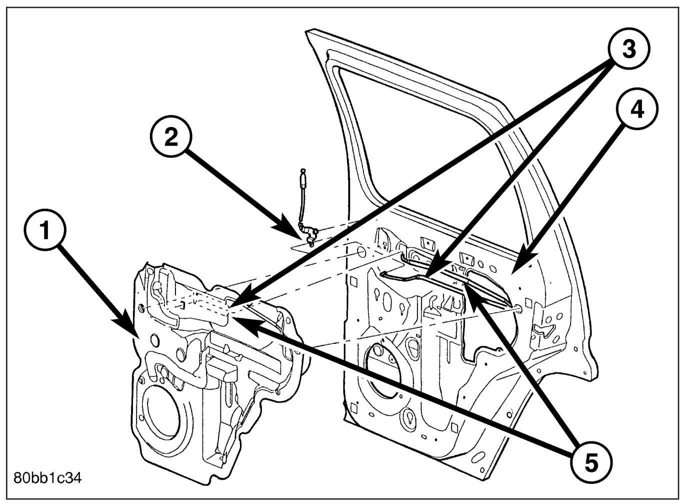


## INSTALLATION

1. Install the handle (2).
2. Install the nuts (1) and tighten to 6 N·m (55 in. lbs.).
3. Connect the handle rod at the handle.



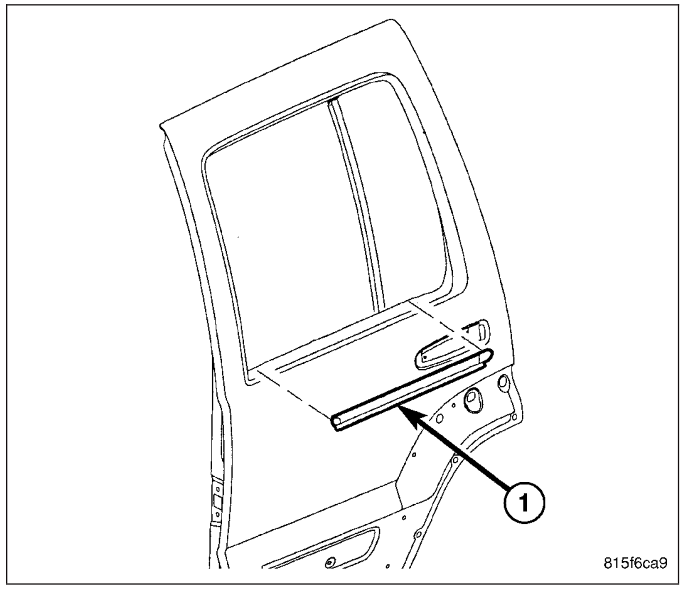

4. Install the waterdam (1). (Refer to 23 - BODY/ DOORS - REAR/WATERDAM - INSTALLATION)



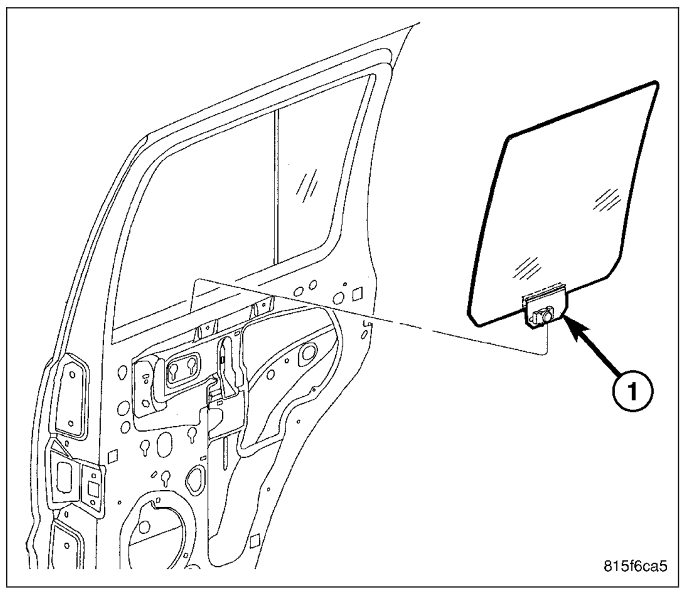
# GLASS RUN CHANNEL

## REMOVAL

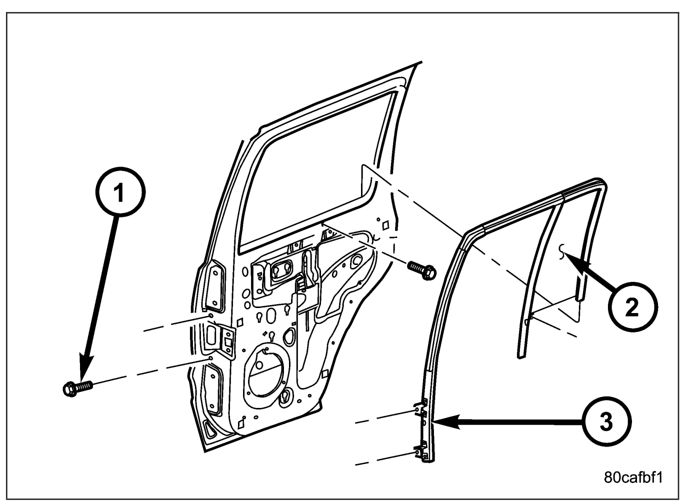
1. Remove the outer belt molding (1). (Refer to 23 - BODY/WEATHERSTRIP/SEALS/REAR DOOR OUTER BELT MOLDING - REMOVAL)




2. Remove the door glass (1). (Refer to 23 - BODY/DOORS - REAR/DOOR GLASS - REMOVAL)

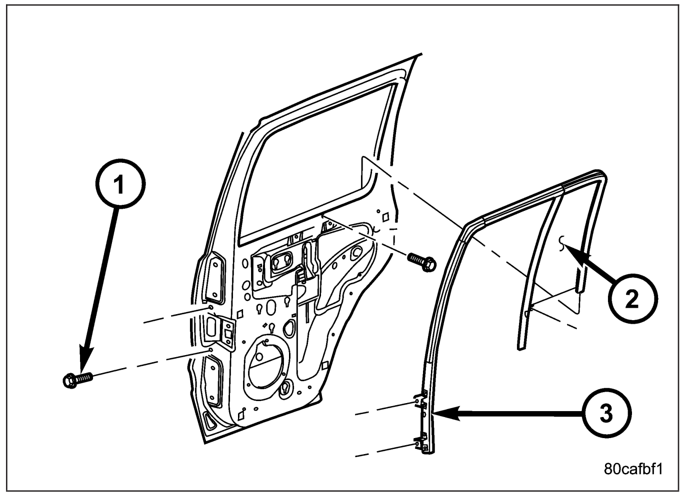



3. Remove the front (1) and rear bolts.
4. Peal the weatherstrip and quarter glass out of the door frame and remove the run channel through the window opening as an assembly.

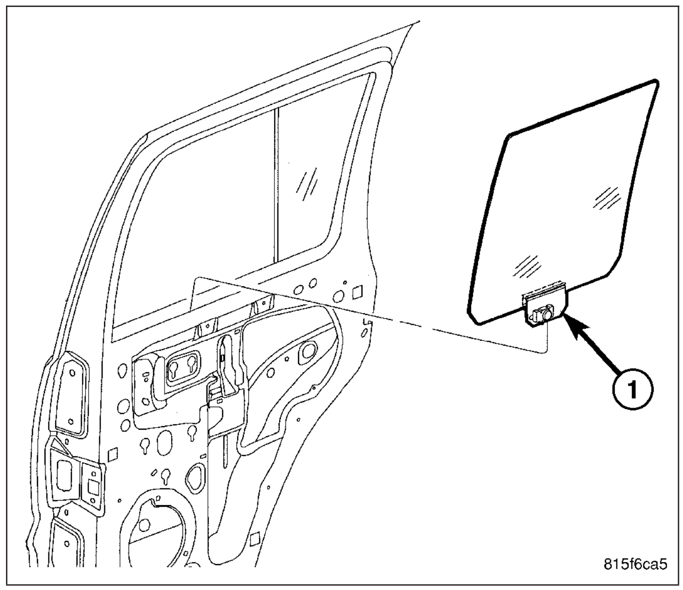


## INSTALLATION

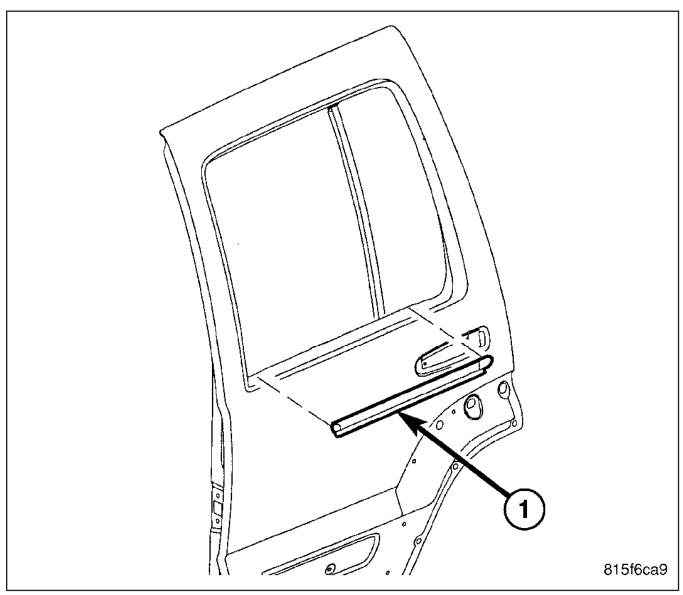
1. Install the run channel and quarter glass assembly through the window opening and into the door frame.
2. Install the front (1), rear bolts and tighten to 9 N·m (80 in. lbs.).




3. Install the door glass (1). (Refer to 23 - BODY/DOORS - REAR/DOOR GLASS - INSTALLATION)



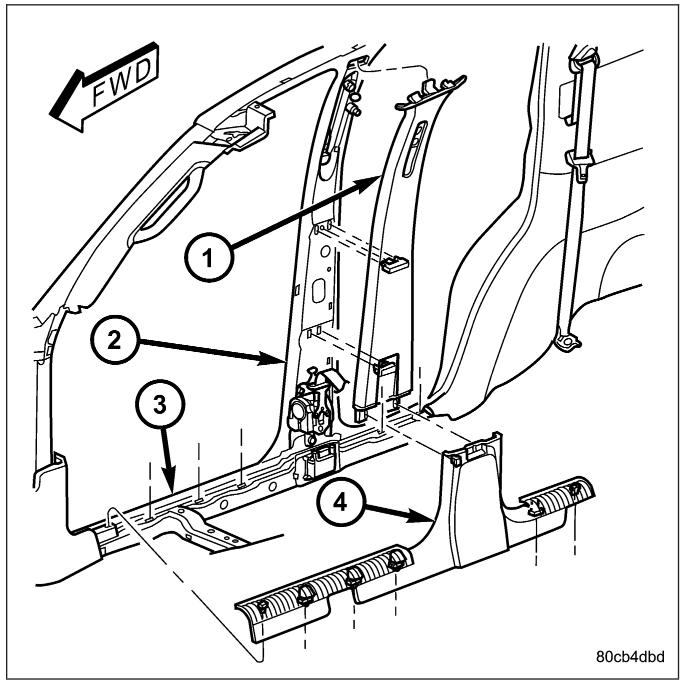

4. Install the outer belt molding (1). (Refer to 23 - BODY/WEATHERSTRIP/SEALS/REAR DOOR OUTER BELT MOLDING - INSTALLATION)



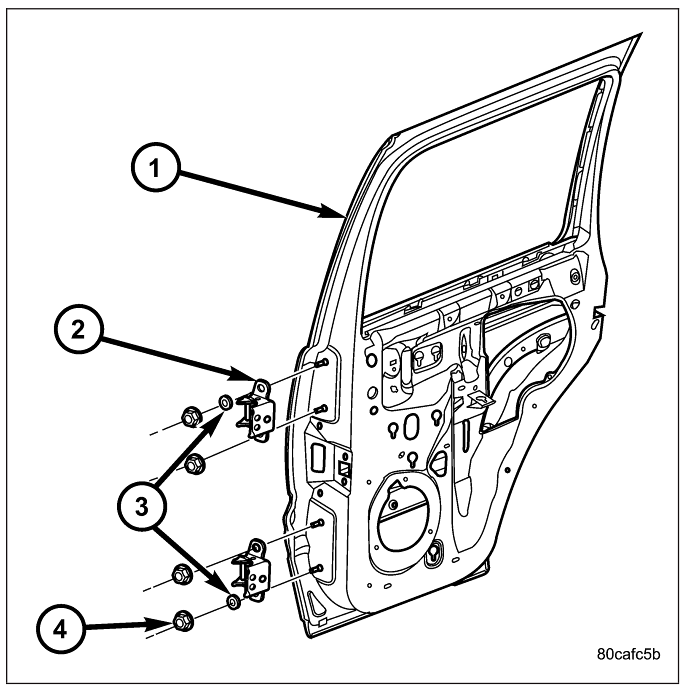
# HINGE

## REMOVAL

1. Remove the upper B-pillar trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - REMOVAL)

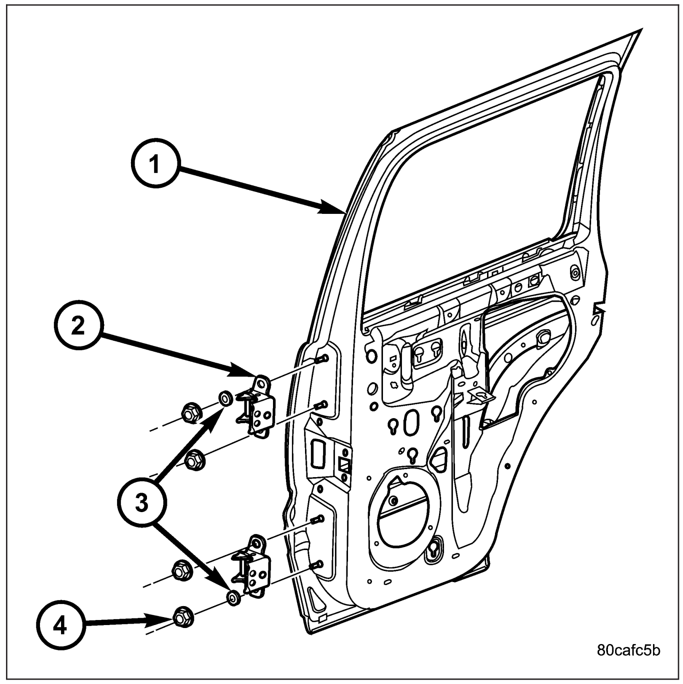



2. Remove the door. (Refer to 23 - BODY/DOORS - REAR/DOOR - REMOVAL)
3. Remove the two door hinge bolts from the inside of the B-pillar.
4. Remove the exterior bolts attaching the door hinges to the B-pillar.

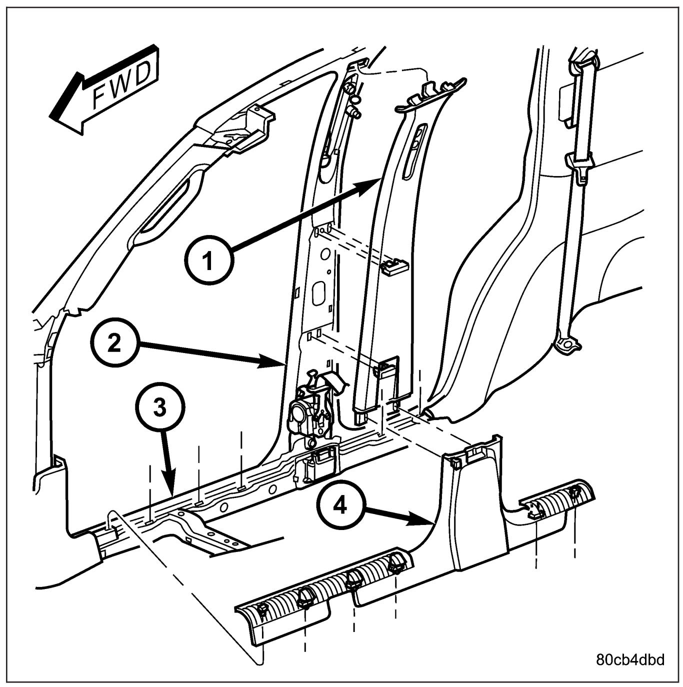


## INSTALLATION

1. Install the hinges.
2. Install the exterior bolts and tighten to 28 N·m (21 ft. lbs.).
3. Install the two inner hinge bolts and tighten to 28 N·m (21 ft. lbs.).
4. Install the door (1). (Refer to 23 - BODY/DOORS - REAR/DOOR - INSTALLATION)



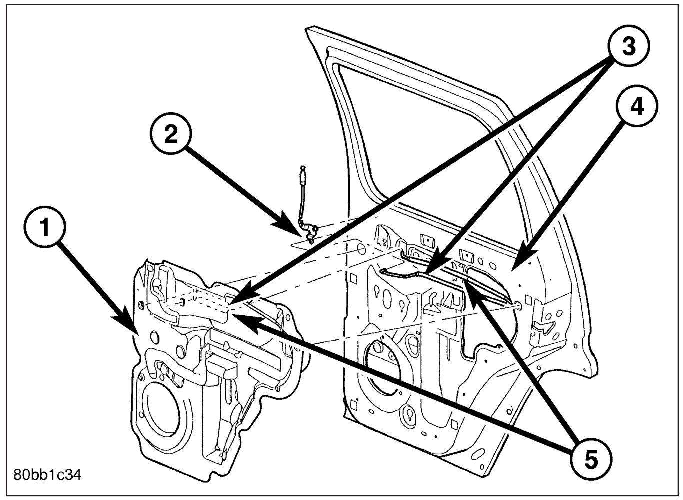

5. Adjust the door as necessary. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
6. Install the upper B-pillar trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - INSTALLATION)



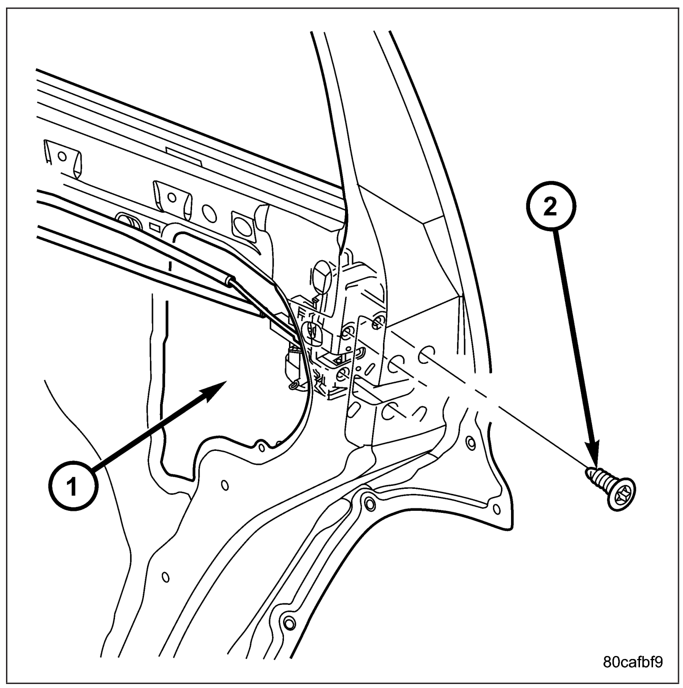
# LATCH

## REMOVAL

1. Remove the waterdam (1) as necessary to gain access to the latch. (Refer to 23 - BODY/DOORS - REAR/WATERDAM - REMOVAL)

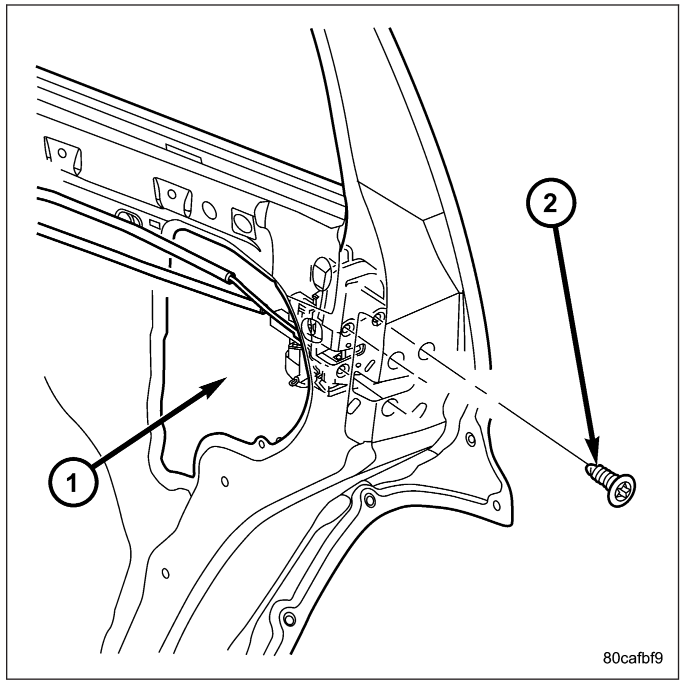



2. Disconnect the lock knob rod at the bell crank and the outside handle rod at the outside door handle.
3. Remove the screws (2) and remove the latch assembly (1).
4. Disconnect the electrical connectors.

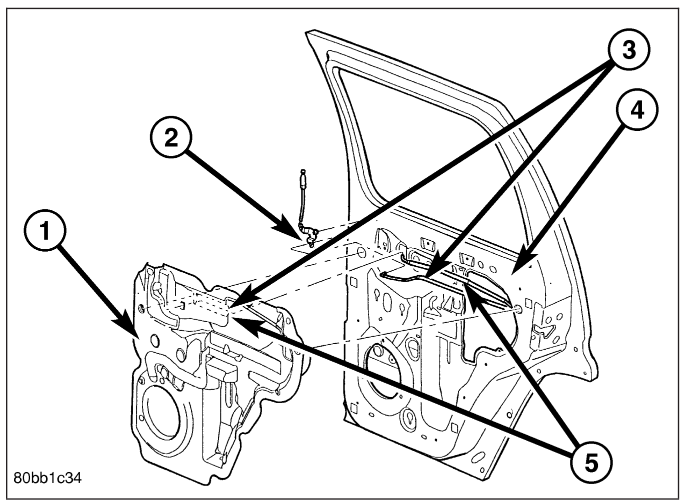


## INSTALLATION

1. Connect the latch electrical connectors.
2. Install the latch assembly (1) into the door and install the screws (2).
3. Tighten the latch screws to 11 N·m (95 in. lbs.).
4. Connect the outside door handle rod at the outside door handle.
5. Connect the lock knob rod at the bell crank and the inside handle rod when installing the trim panel.



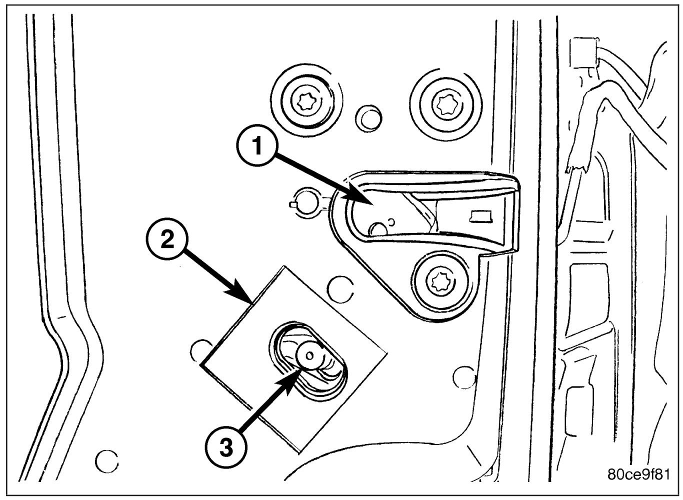

6. Install the waterdam (1). (Refer to 23 - BODY/ DOORS - REAR/WATERDAM - INSTALLATION)
7. Adjust the latch as needed. (Refer to 23 - BODY/ DOORS - REAR/LATCH - ADJUSTMENTS)



## ADJUSTMENTS

## ADJUSTMENT

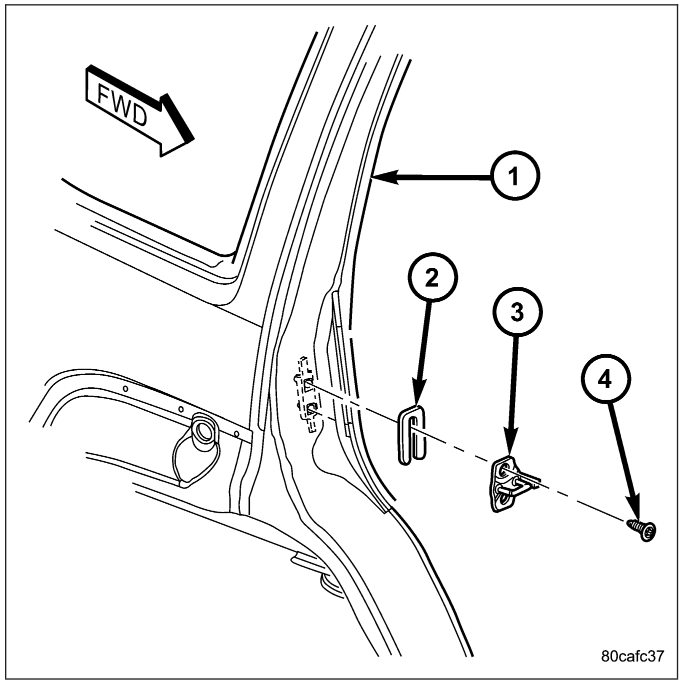
1. Locate access hole and remove the mylar tape (2) covering it.
2. Insert a 5/32” hex-wrench through hole and into adjustment screw (3). Loosen screw.
3. Operate outside handle several times to release any restriction because of mis-alignment.
4. Tighten adjustment screw to 3 N·m (30 in. lbs.).
5. Test handle for proper operation.



# LATCH STRIKER

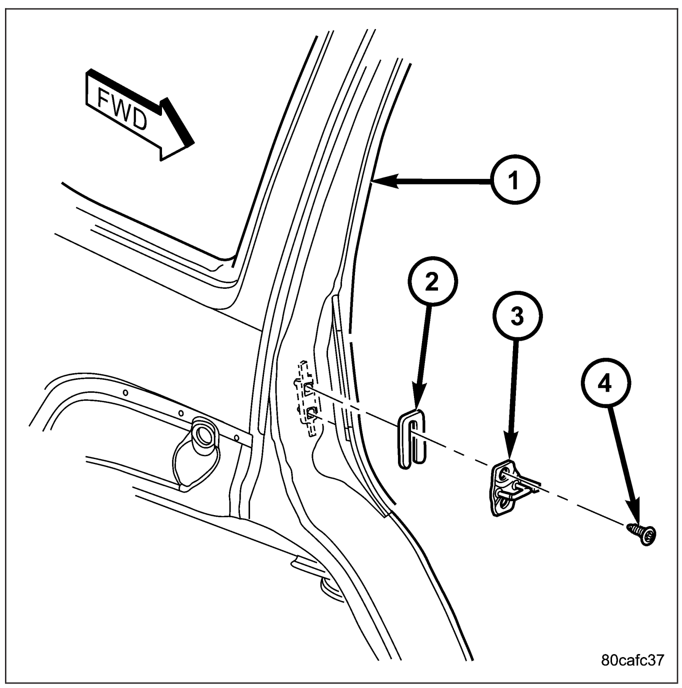
## REMOVAL

1. Remove the bolts (4).
2. Remove the latch striker (3) and the spacer (2), if equipped.




## INSTALLATION

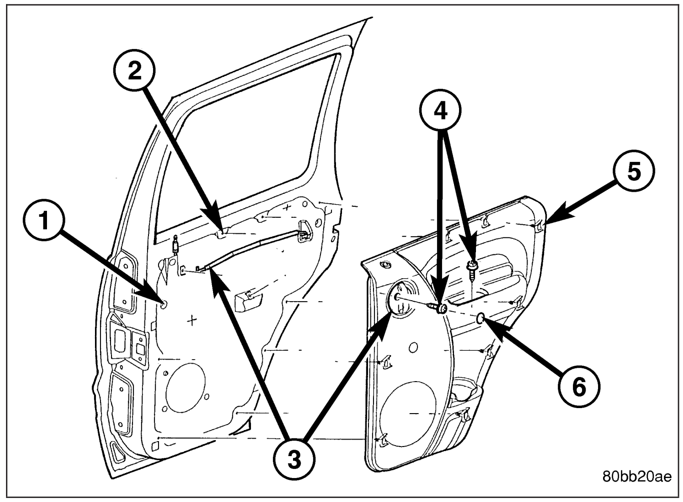
1. Install the striker (3) and spacer (2), if required.
2. Install the bolts (4) and tighten to 28 N·m (21 ft. lbs.).
3. Adjust the door as necessary. (Refer to 23 - BODY/ BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)



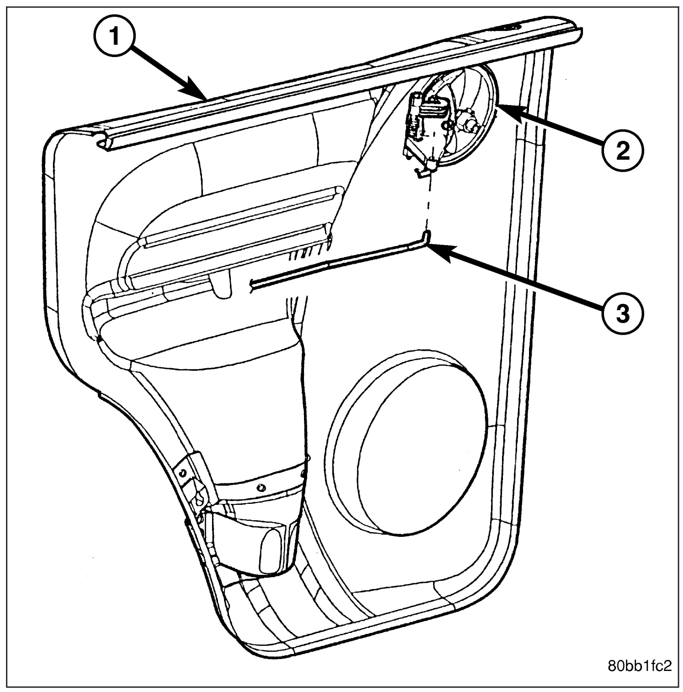
# TRIM PANEL

## REMOVAL

1. Remove the inside handle screw plug and remove the screw (4).
2. Remove the pull handle screw.
3. Using a trim stick C-4755 or equivalent, disengage the trim panel clips (5) and remove the trim panel.

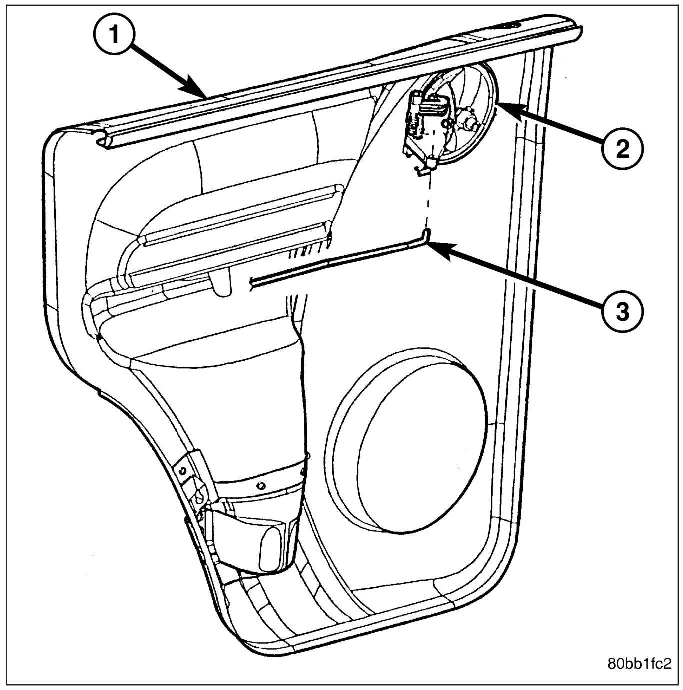



4. Disconnect the electrical connectors and the inside handle actuator rod (3).

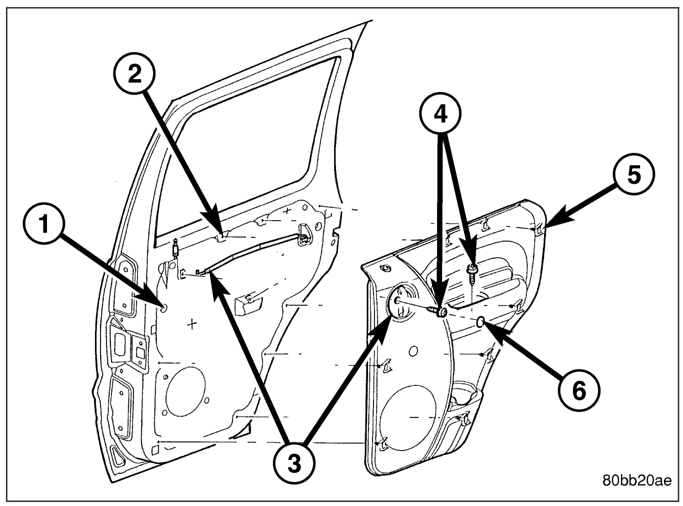


## INSTALLATION

1. Connect the inside handle actuator rod (3) and the electrical connectors.



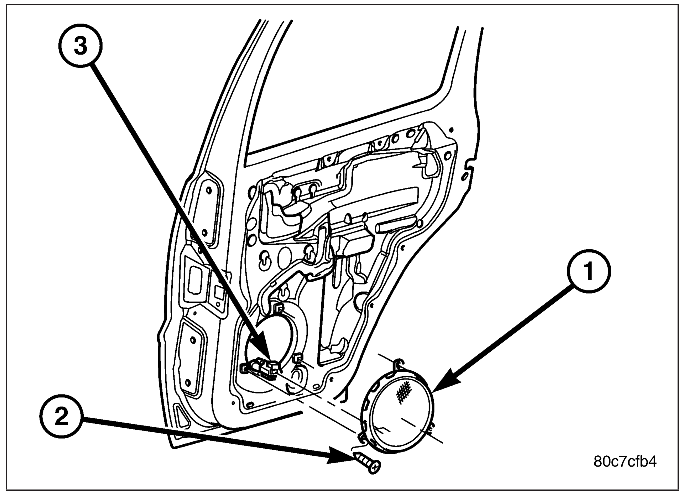

2. Position the trim panel and seat the clips (5) fully.
3. Instal the screws (4) and install the screw plug (6).



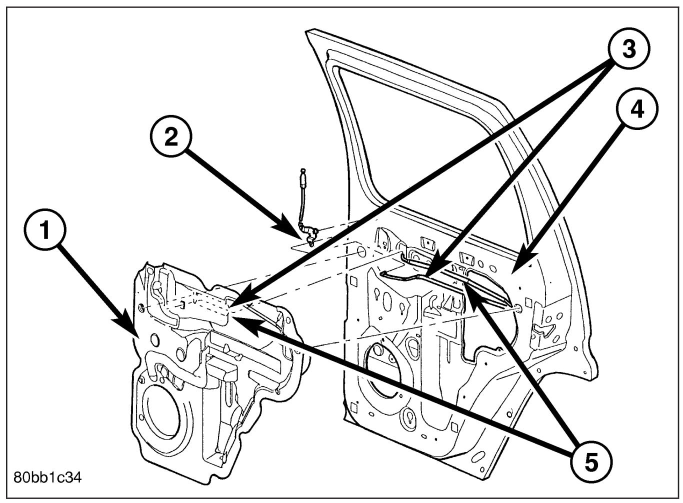
# WATERDAM

## REMOVAL

**CAUTION: Do not allow the waterdam or adhesive to become contaminated with dirt or other foreign substances.**
**Do not damage the waterdam during removal and installation.**
**If the waterdam becomes contaminated or damaged, replace the waterdam.**



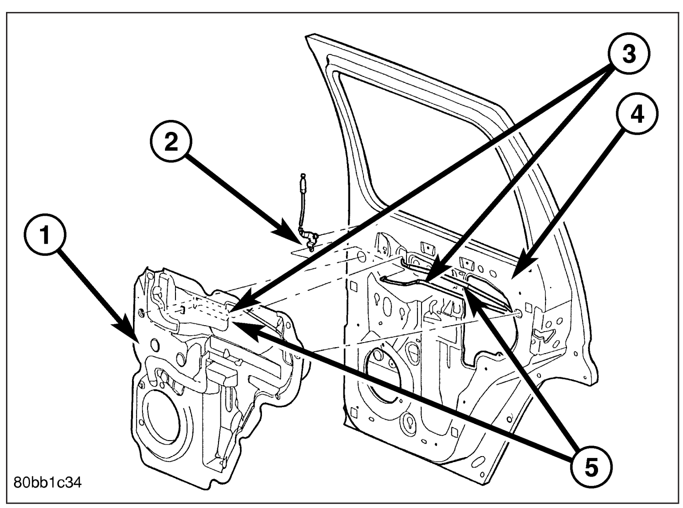

1. Remove the door speaker (1). (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - REMOVAL)




2. Separate the waterdam (1) from the inner door panel and off of the latch linkages (3 and 5).

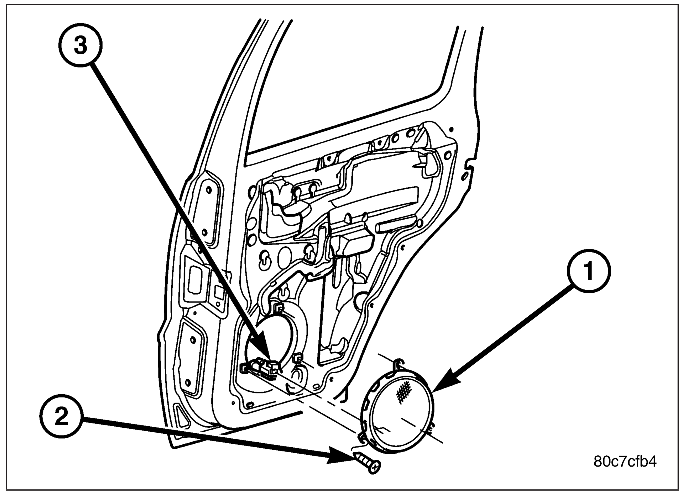
## INSTALLATION

**CAUTION: Do not allow the waterdam or adhesive to become contaminated with dirt or other foreign substances.**
**Do not damage the waterdam during removal and installation.**
**If the waterdam becomes contaminated or damaged, replace the waterdam.**




1. Position the actuator rods through the holes in the waterdam. (3 and 5)
2. Place waterdam (1) onto the door and pressurize at the butyl bead to seal completely, starting with the top rear locating indent and then moving to the top front locating indent followed by the remaining portion of the waterdam.
3. Run a hard plastic squeegee firmly around the perimeter of the waterdam making sure that the drain holes at the bottom of the inner door panel are fully covered by the waterdam.

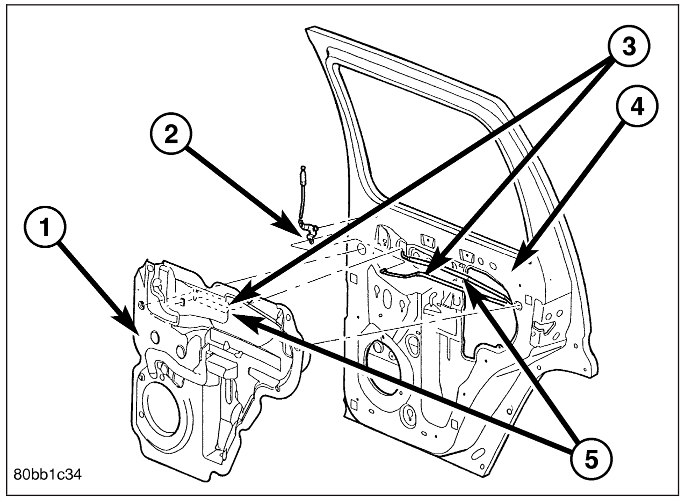
4. Install the door speaker (1). (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - INSTALLATION)



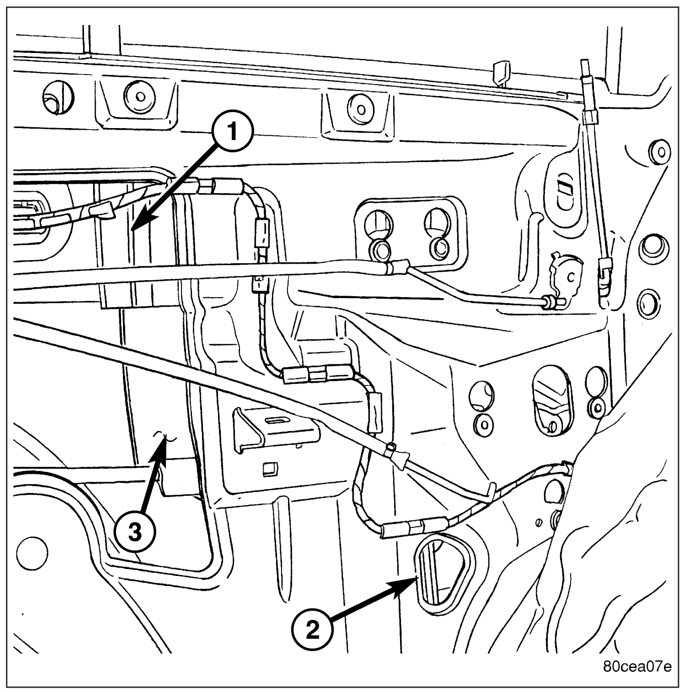
# WINDOW REGULATOR - MANUAL

## REMOVAL

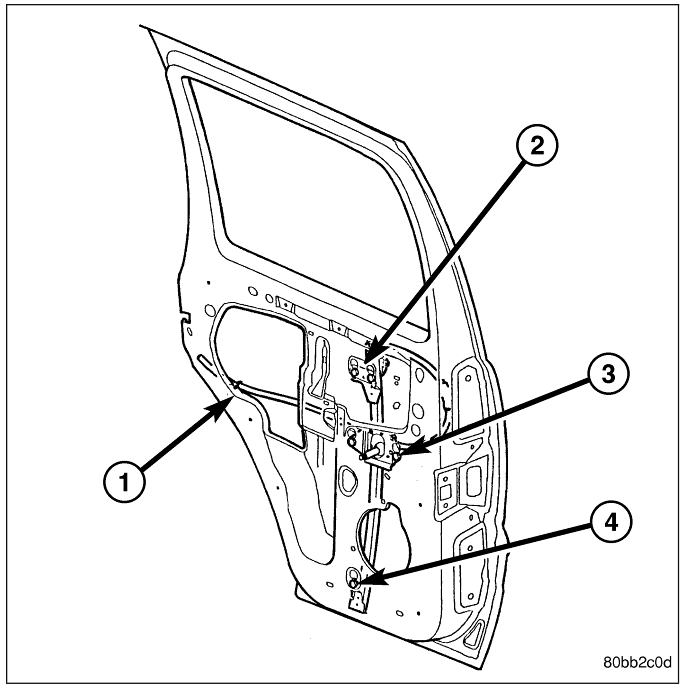
1. Remove the waterdam (1). (Refer to 23 - BODY/ DOORS - REAR/WATERDAM - REMOVAL)




2. Raise the glass (3) and line up the lift plate clip with the hole (2) in the door panel shown.
3. Using a long flat blade or hook type tool, disengage the clip attaching glass retainer to regulator lift plate.
4. Disconnect the glass from the regulator lift plate and re-install the clip.
5. Secure the glass in the up position using a wood wedge, tape or equivalent.

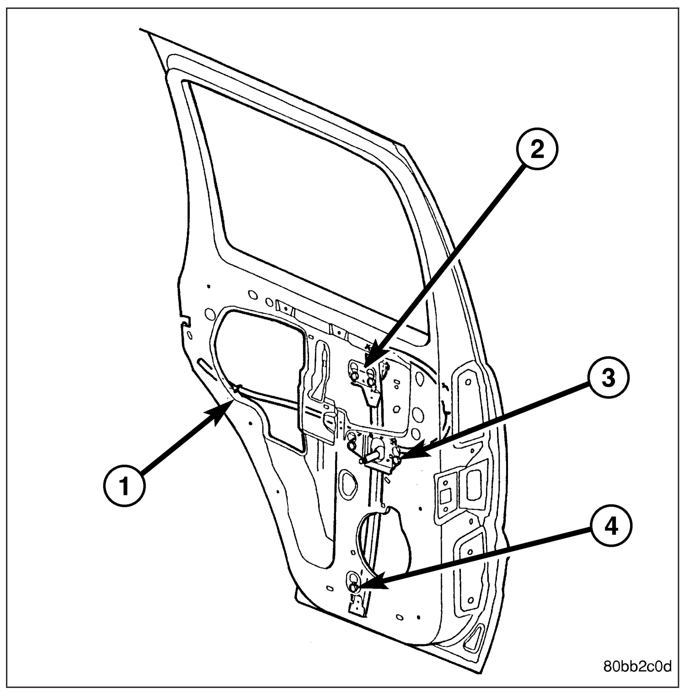


6. Remove the bolts. (2 and 4)
7. Disconnect the runout tube (1) clip and remove the regulator (3).

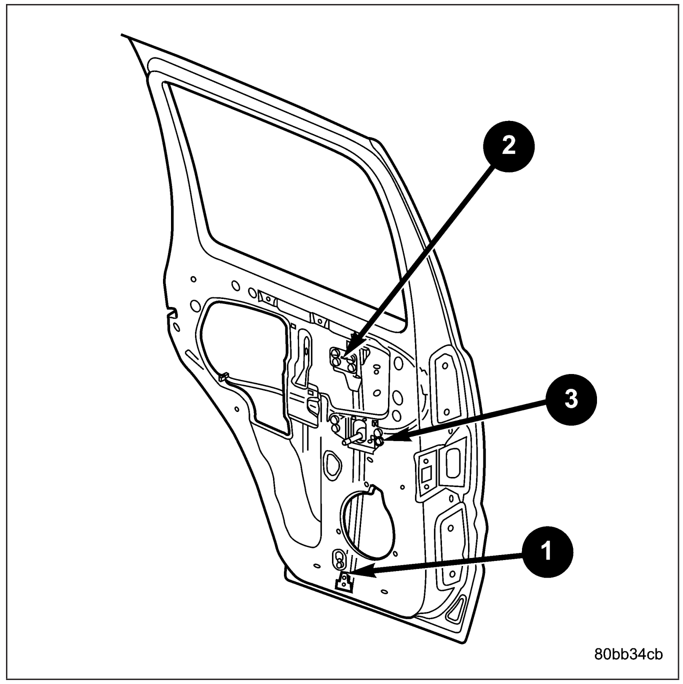



## INSTALLATION

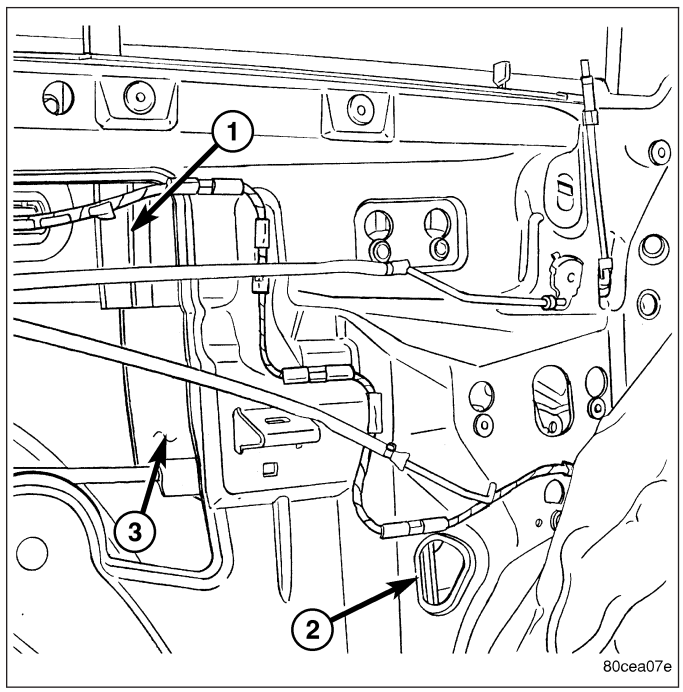
1. Loosely install the bolts onto the regulator assembly (2 and 4).
2. Install the regulator assembly (3).
3. Install the runout tube clip (1).



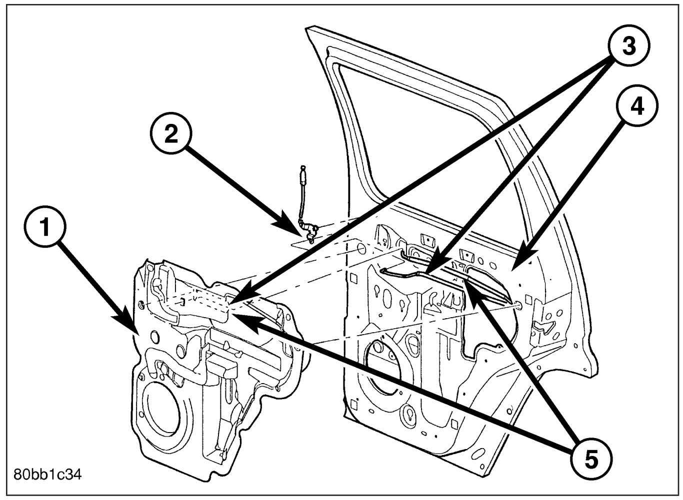
4. Tighten the bolts to 9 N·m (80 in. lbs.) using the sequence shown.




5. Remove the glass support and connect the glass to the regulator lift plate (2).



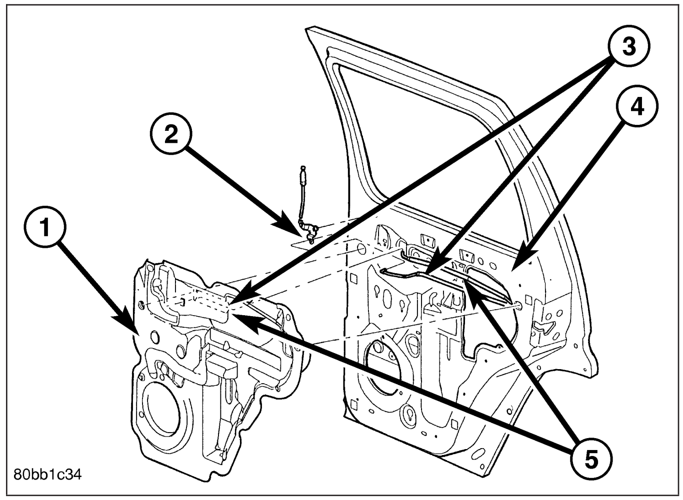
6. Install the waterdam (1). (Refer to 23 - BODY/ DOORS - REAR/WATERDAM - INSTALLATION)



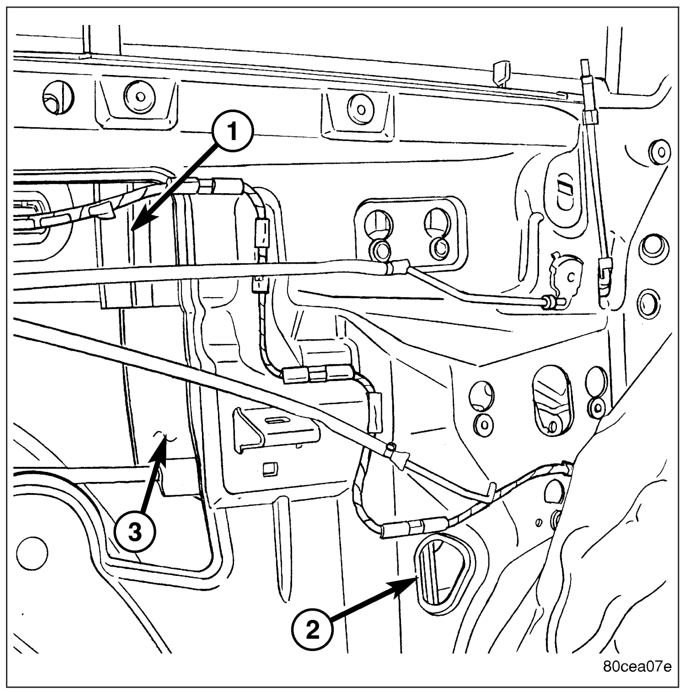
# WINDOW REGULATOR - POWER

## REMOVAL

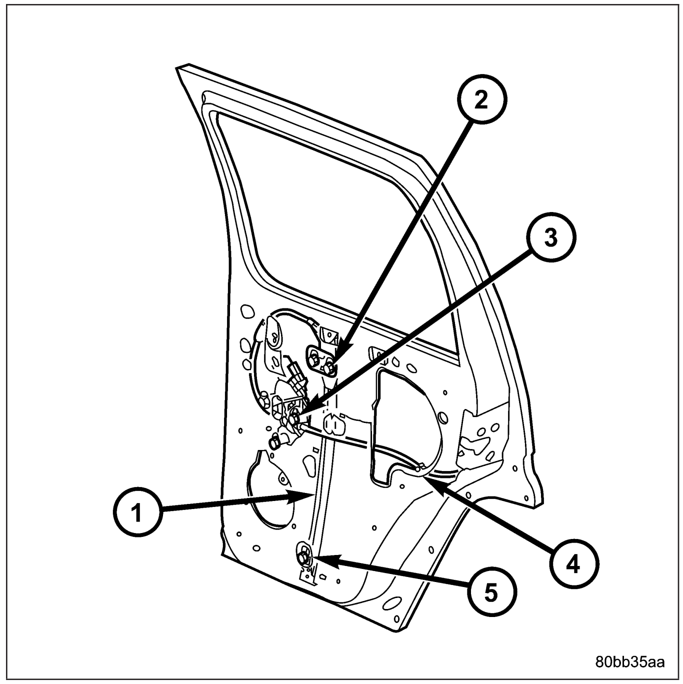
1. Remove the waterdam (1). (Refer to 23 - BODY/ DOORS - REAR/WATERDAM - REMOVAL)




2. Raise the glass and line up the lift plate clip with the hole in the door panel shown.
3. Using a long flat blade or hook type tool, disengage the clip (2) attaching glass retainer to regulator lift plate.
4. Disconnect the glass from the regulator lift plate and re-install the clip.

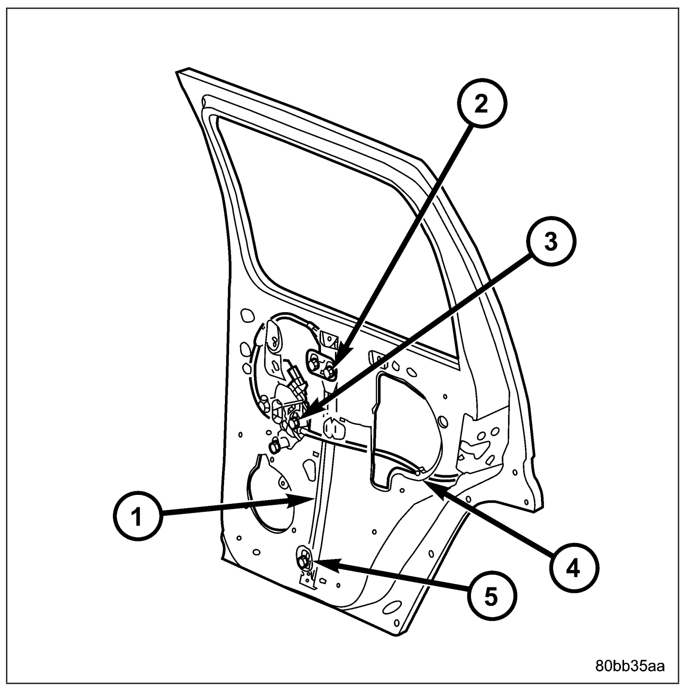


5. Secure the glass in the up position using a wood wedge, tape or equivalent.
6. Remove the bolts. (2, 3 and 5)
7. Disconnect the runout tube clip (4) and remove the regulator.
8. Disconnect the electrical connector.

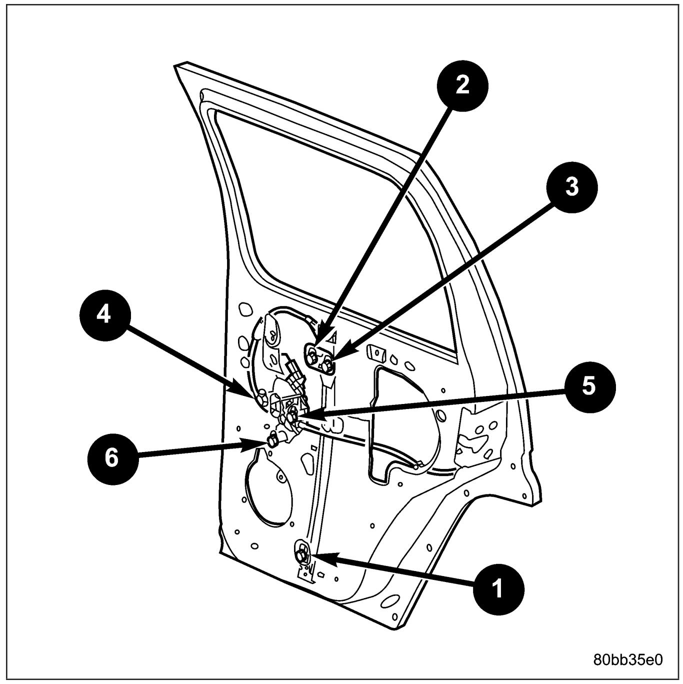



## INSTALLATION

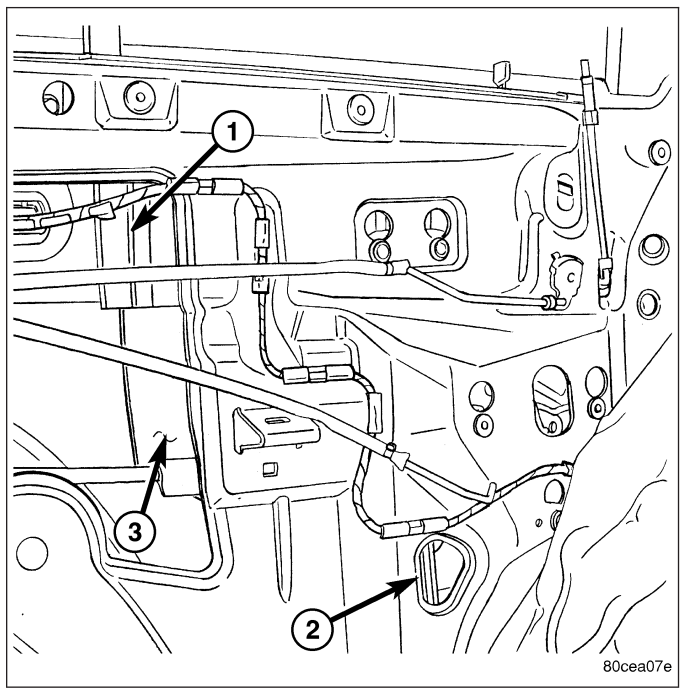
1. Connect the electrical connector.
2. Loosely install the bolts onto the regulator assembly. (2, 3 and 5)
3. Install the regulator assembly (1).



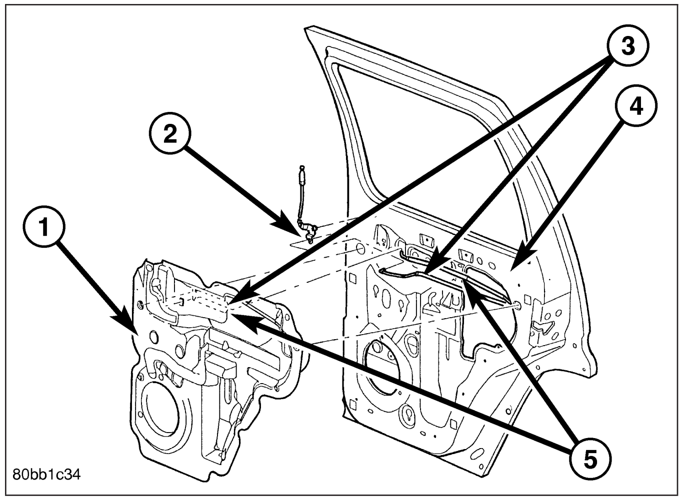
4. Tighten the bolts to 9 N·m (80 in. lbs.) using the sequence shown.




5. Remove the glass support and connect to the regulator lift plate (2).



6. Install the waterdam (1). (Refer to 23 - BODY/ DOORS - REAR/WATERDAM - INSTALLATION)



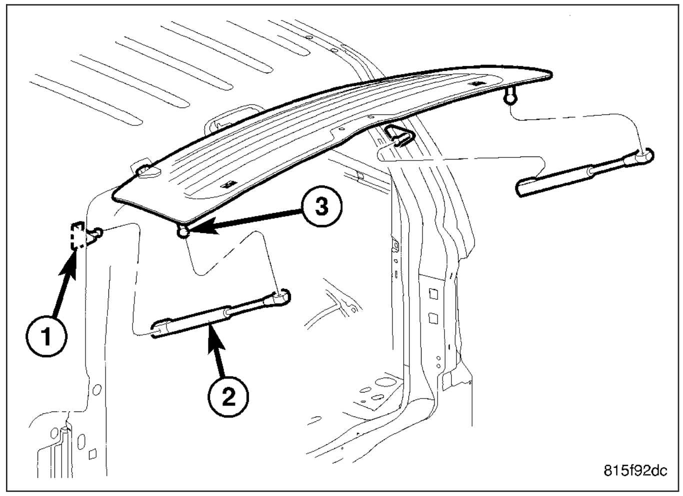
# SWING GATE

## TABLE OF CONTENTS

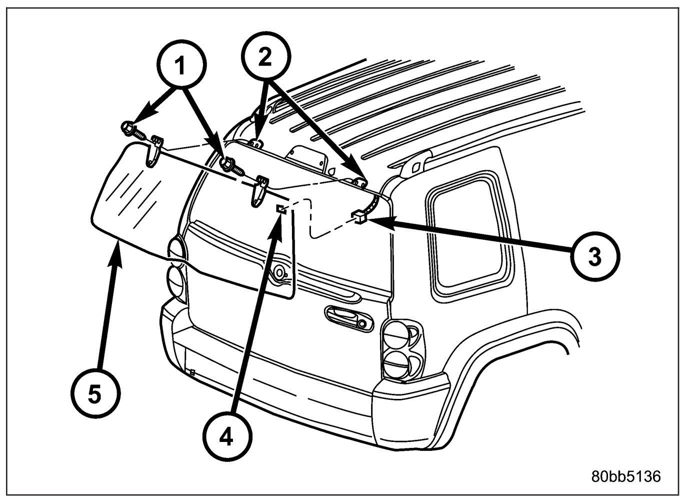
# FLIP-UP GLASS

## REMOVAL

1. Open the flip-up glass.
2. Using a grease pencil or equivalent, mark the position of the hinge on the body to aid installation.
3. Remove the support cylinders (2). (Refer to 23 - BODY/SWING GATE/FLIP-UP GLASS SUPPORT CYLINDER - REMOVAL)

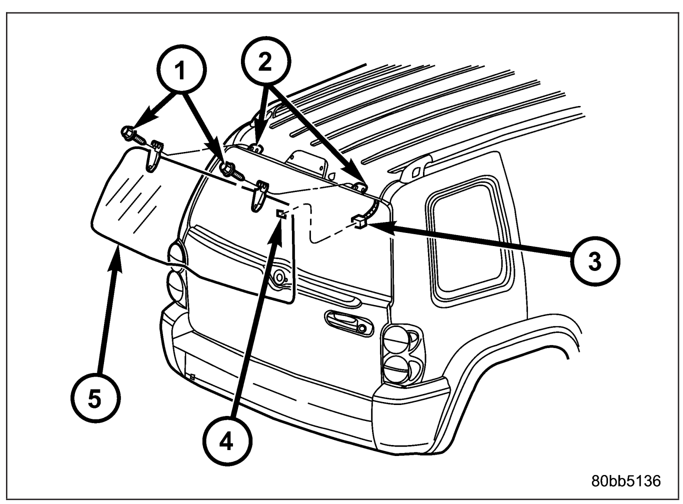



4. Disconnect the electrical connectors (3).
5. Open the glass to the full travel with the support cylinders off.
6. Remove the bolts (1) and remove the glass (5).

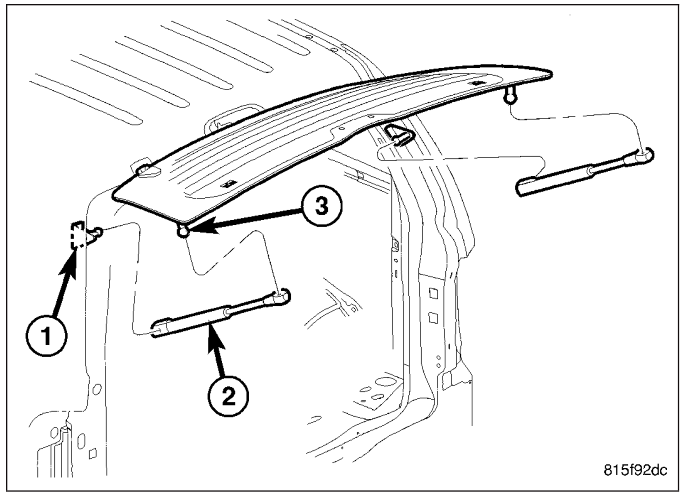



## INSTALLATION

1. Install the flip-up glass, pushing it as far up as it can go and loosely install the hinge bolts (1).
2. Connect the electrical connectors (3).
3. Adjust flip-up glass fit if necessary, making sure there are equal gaps on both sides of the glass while pushing up on the glass and tighten the hinge bolts to 7 N·m (60 in. lbs.). (Refer to 23 - BODY/SWING GATE/FLIP-UP GLASS - ADJUSTMENTS)



4. Install the support cylinders (2). (Refer to 23 - BODY/SWING GATE/FLIP-UP GLASS SUPPORT CYLINDER - INSTALLATION)

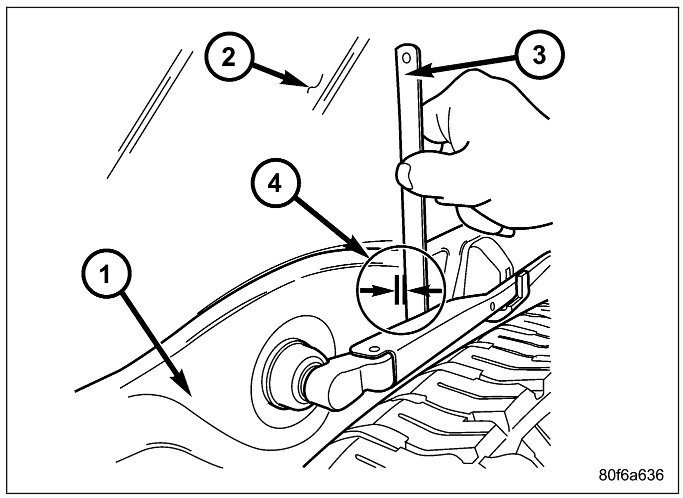



## ADJUSTMENTS

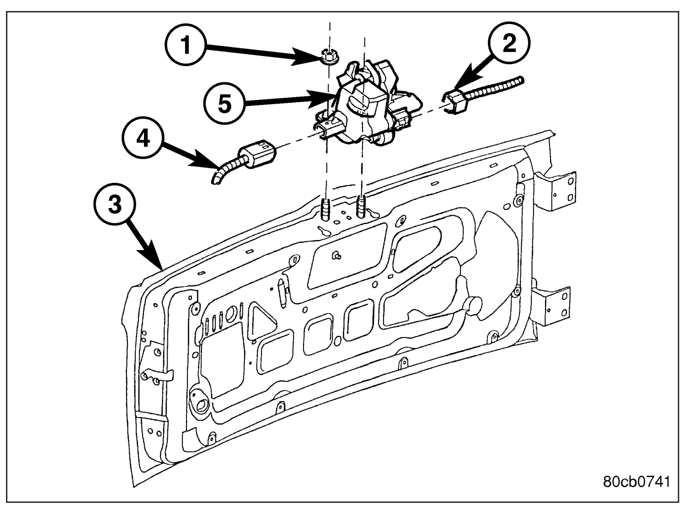
## ADJUSTMENT

1. Verify that the flip-up glass is correctly centered in it’s opening. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
2. Confirm the flip-up glass to swing gate adjustment. Hold a straight edge flush against the glass as indicated, and record the gap/space between the straight edge and the swing gate outer vertical panel.

**NOTE: The flush specification for the flip-up glass to the swing gate outer panel is 0 mm - 2 mm over flush.**



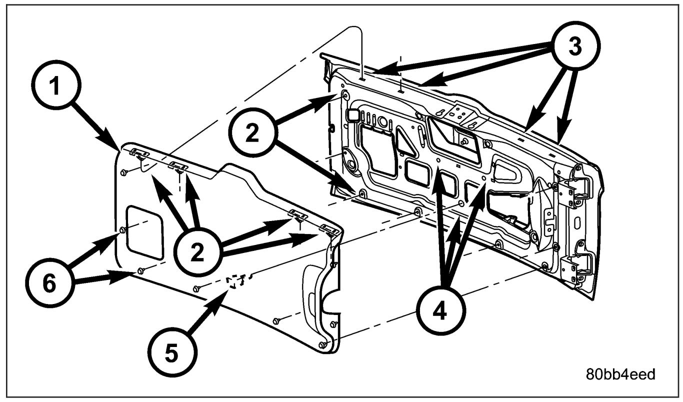

3. If the flip-up glass needs to be adjusted, loosen the two latch attaching fasteners (5) and move the latch for or aft in small increments until desired measurement is achieved.
4. Tighten the flip-up glass latch fasteners to 12 N·m (9 ft. lbs.).
5. Verify correct flip-up glass closing efforts and operation.



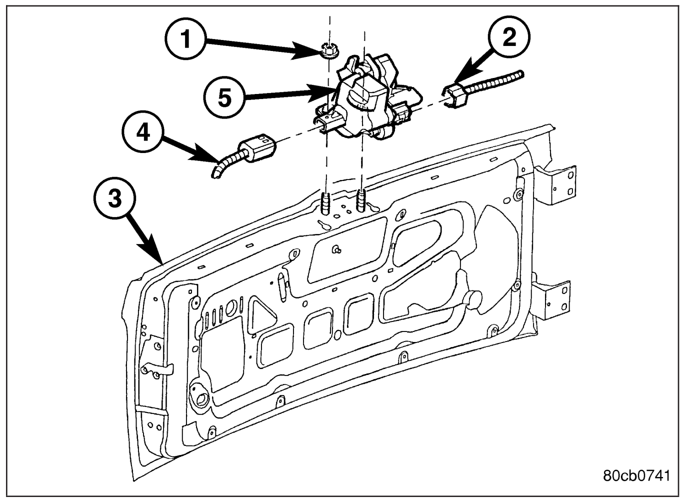
# FLIP-UP GLASS LATCH

## REMOVAL

1. Remove the trim panel (1). (Refer to 23 - BODY/SWING GATE/TRIM PANEL - REMOVAL)

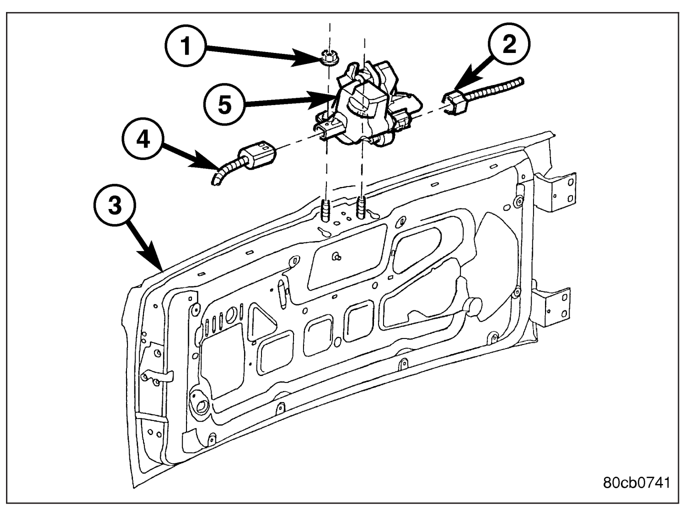



2. Disconnect the electrical connectors (2 and 4).
3. Using a grease pencil or equivalent, mark the location of the latch assembly (5) for installation.
4. Remove the nuts (1) and remove the latch assembly.

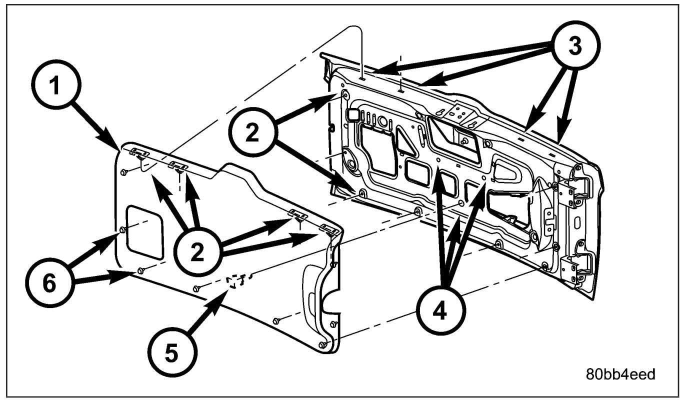



## INSTALLATION

1. Install the latch assembly (5).
2. Install the nuts (1) and tighten to 12 N·m (9 ft. lbs.).
3. Connect the electrical connectors (2 and 4).
4. Adjust the latch to achieve the best glass fit. (Refer to 23 - BODY/SWING GATE/FLIP-UP GLASS - ADJUSTMENTS)



5. Install the trim panel (1). (Refer to 23 - BODY/SWING GATE/TRIM PANEL - INSTALLATION)

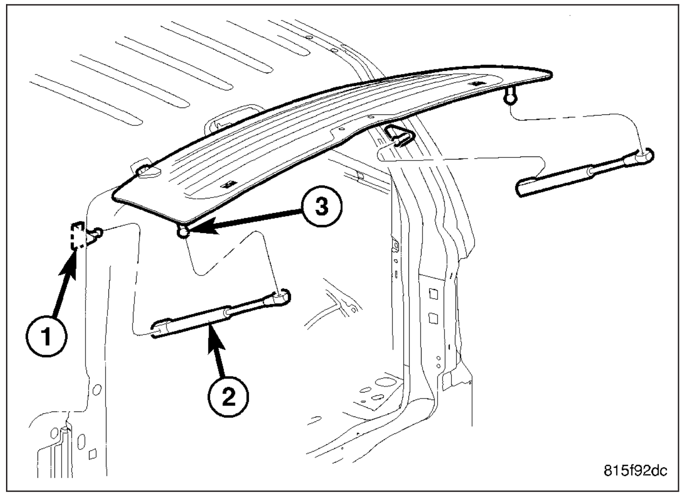


# FLIP-UP GLASS - HINGE

## REMOVAL

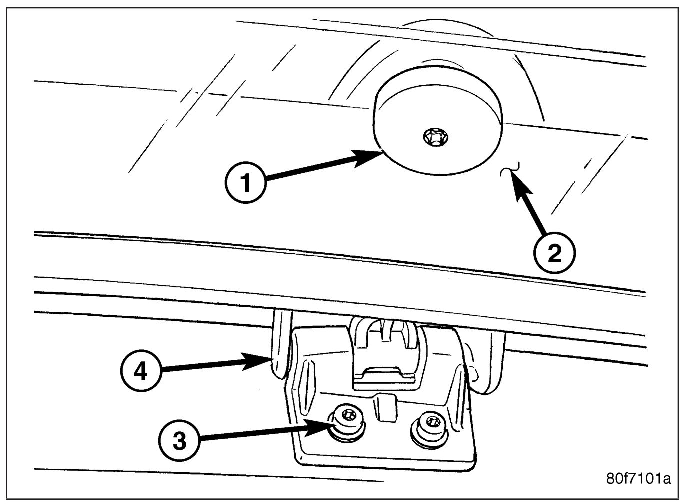
**NOTE: It is not necessary to remove the glass to replace one or both hinges. The hinges can be replaced one at a time.**

1. Open the flip up glass.
2. Using a grease pencil or equivalent, mark the position of the hinge on the body to aid installation.
3. Remove the support cylinders (2) and support glass. (Refer to 23 - BODY/SWING GATE/FLIP-UP GLASS SUPPORT CYLINDER - REMOVAL)

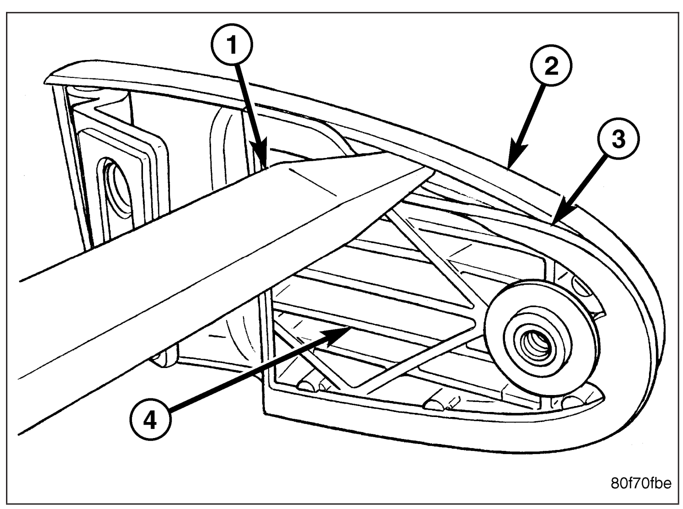



**CAUTION: Do not allow glass to twist on remaining hinge when the other hinge is being serviced. Damage to the hinge that is not being serviced may result.**

4. Remove the bolts (1 and 3) and remove the hinge (4).



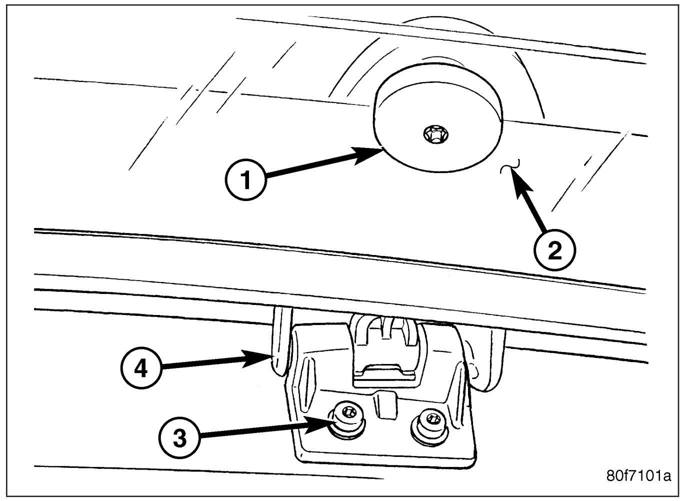

5. Using a trim stick C-4755 (1) or equivalent, release the lower locking tabs (2) and remove the hinge cover.



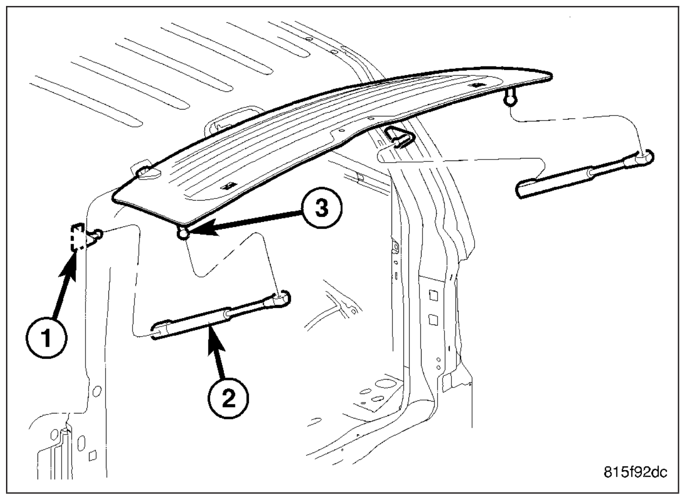
## INSTALLATION

**NOTE: Inspect the hinge cover retention tabs. If they are damaged or cracked, discard the cover and replace with a new one.**

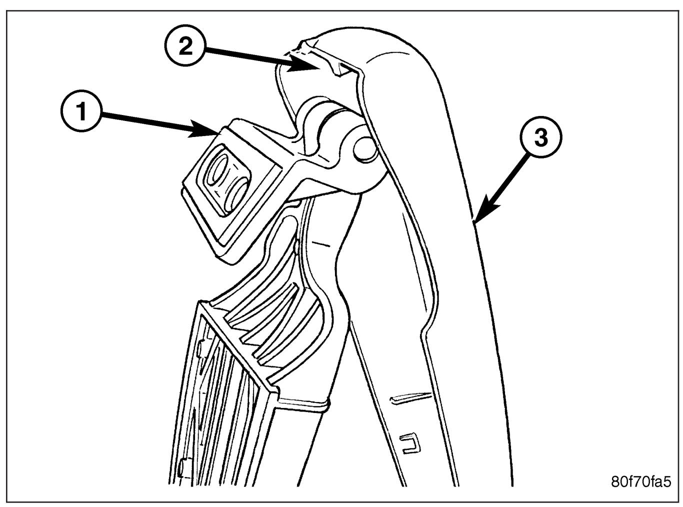
1. Install the hinge onto the vehicle and align with marks made previously.
2. Install the hinge to glass bolt (1) and tighten to 10 N·m (90 in. lbs.).
3. Install the bolts (3) and tighten to 7 N·m (60 in. lbs.).
4. Adjust the flip-up glass as necessary. (Refer to 23 - BODY/SWING GATE/FLIP-UP GLASS - ADJUSTMENTS)




5. Install the support cylinders (2). (Refer to 23 - BODY/SWING GATE/FLIP-UP GLASS SUPPORT CYLINDER - INSTALLATION)



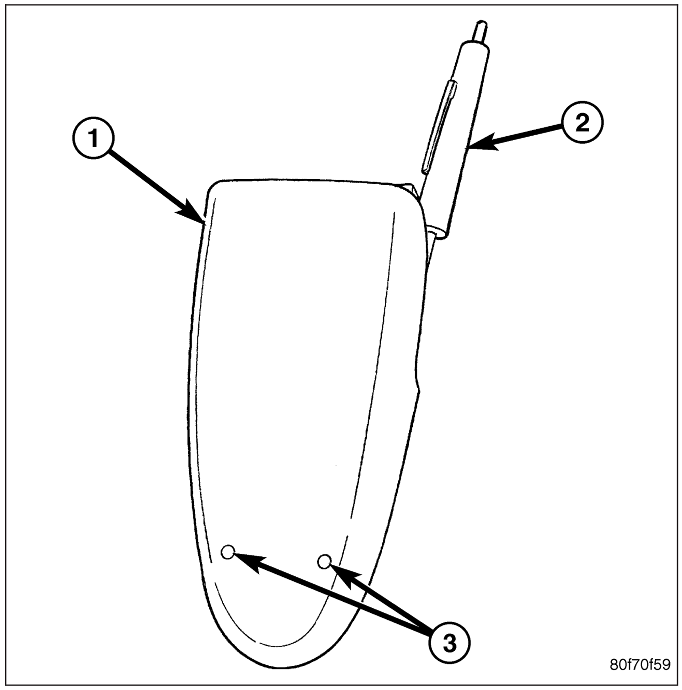

6. Position the top of the hinge cover (3) over the hinge (1) and engage the cover tab (2).
7. Rock the hinge cover down over the hinge and seat fully. Ensure both lower tabs snap into place.



# FLIP-UP GLASS - HINGE COVER

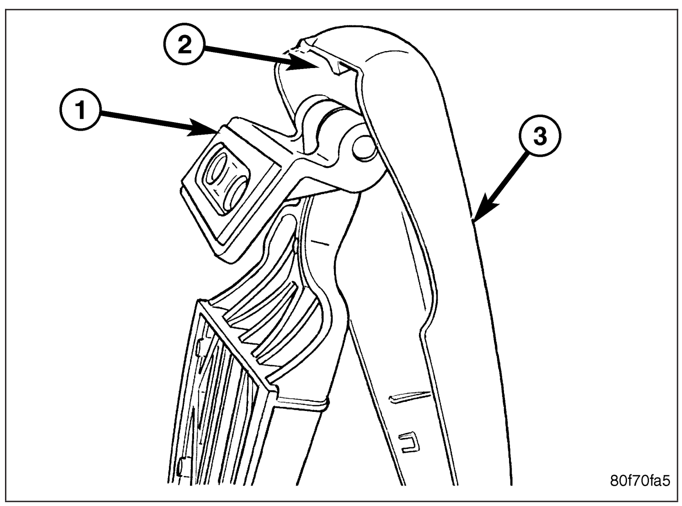
## REMOVAL

1. Using a small flat bladed tool (2) or equivalent, insert the tool under the cover (1) and release the locking tabs (3) as shown.
2. Remove the hinge cover from the hinge.




## INSTALLATION

1. Position the top of the hinge cover (3) over the hinge and engage the cover tab (2).
2. Rock the hinge cover down over the hinge and seat fully. Ensure both lower locking tabs snap into place.

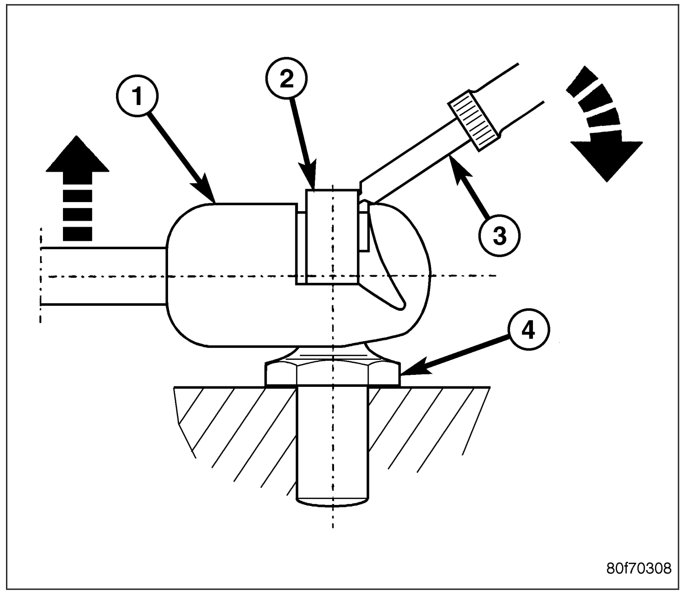


# FLIP-UP GLASS SUPPORT CYLINDER

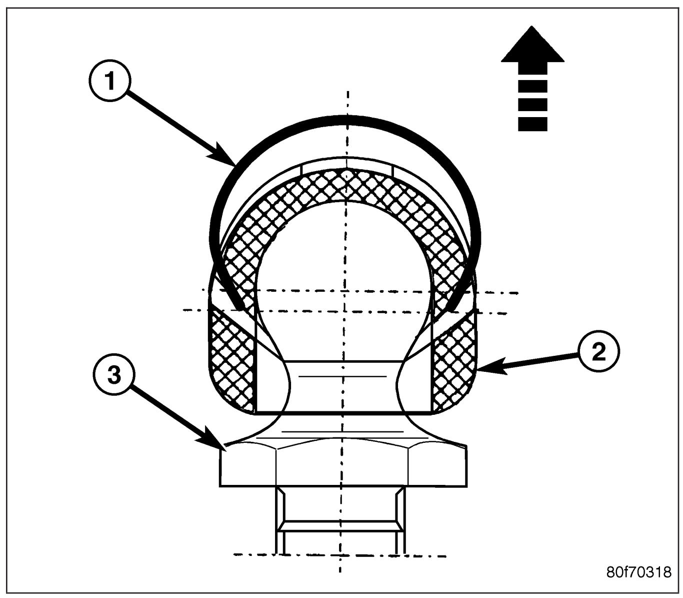
## REMOVAL

**WARNING: Do not remove the flip-up glass support rods with the glass closed. The support rod pistons are operated by high pressure gas and could cause personal injury and/or vehicle damage if they are removed with the pistons compressed (glass closed). Once removed, do not attempt to disassemble or repair the support rods.**

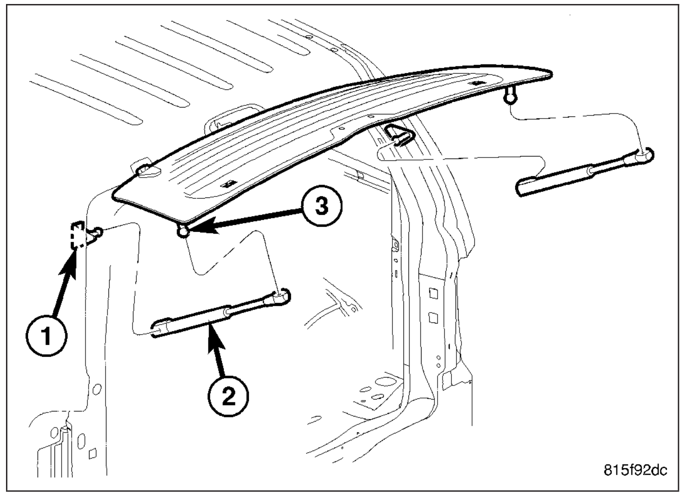
1. Open the flip-up glass and support.
2. Using a small flat bladed tool (3), or equivalent, release the retaining clips (2) while pulling the ball socket (1) away from the ball stud (4).




**NOTE: Lift the clips (1) only enough to release the ball studs (3).**



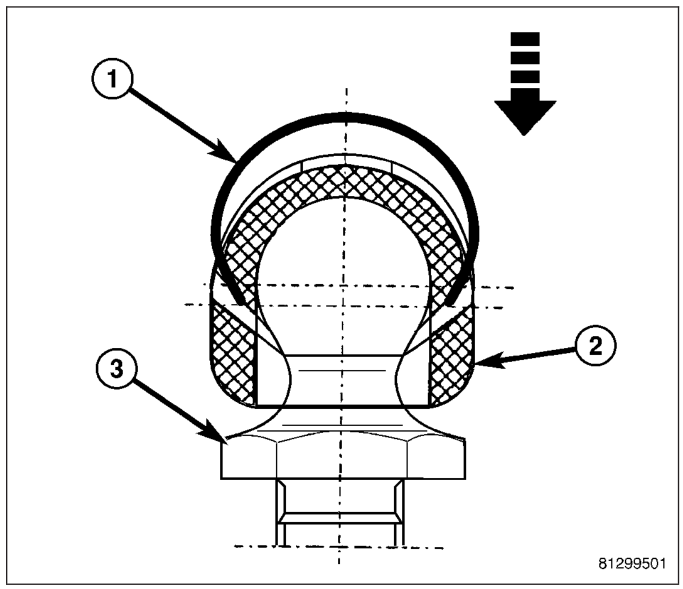
3. Remove the support cylinder (2) from the upper (1) and lower (3) ball studs.



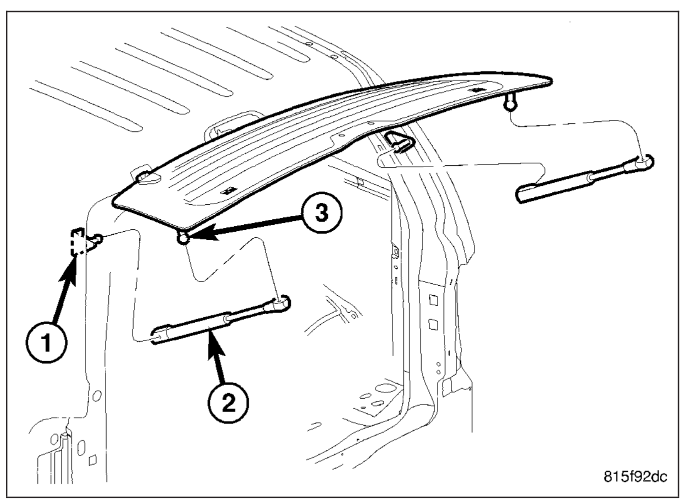

## INSTALLATION

**WARNING: Do not remove the flip-up glass support rods with the glass closed. The support rod pistons are operated by high pressure gas and could cause personal injury and/or vehicle damage if they are removed with the pistons compressed (glass closed). Once removed, do not attempt to disassemble or repair the support rods.**

1. Make sure the retaining clips (1) are seated into the ball socket (2) fully.



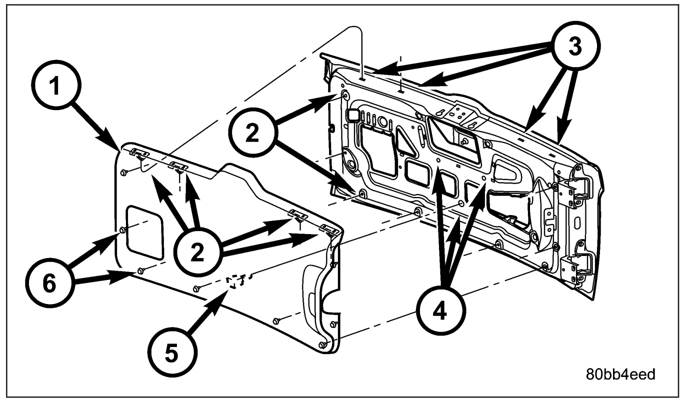

2. Install the support cylinder (2) over the ball studs (1 and 3) with the thin end connected to the glass and the retaining clips snapping into place.



# TRIM PANEL

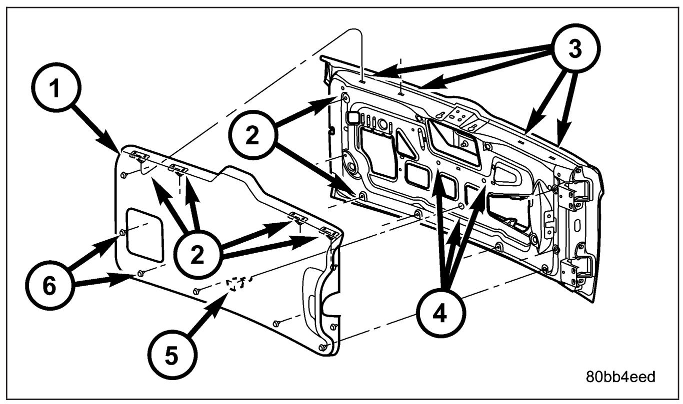
## REMOVAL

1. Using a trim tool C-4829-A or equivalent, release the push pin fasteners.
2. Lift trim panel up off of the upper trim panel clips.




## INSTALLATION

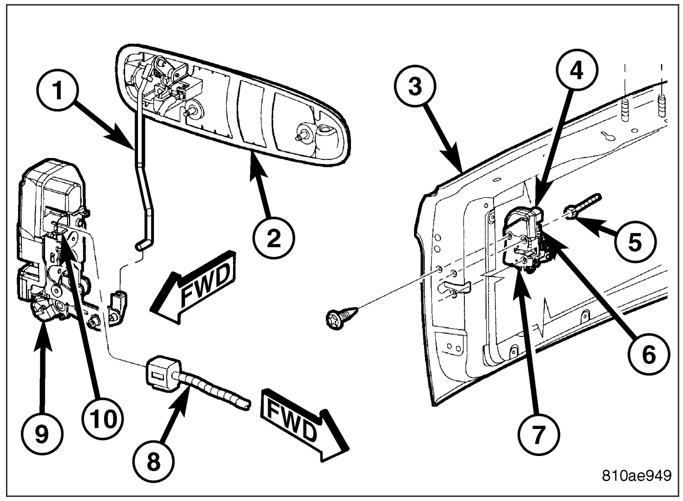
1. Position the trim panel and seat the upper clips.
2. Fully seat the lower trim panel clips.



# LATCH

## REMOVAL

1. Remove the trim panel and waterdam. (Refer to 23 - BODY/SWING GATE/TRIM PANEL - REMOVAL)
2. Disconnect the electrical connector and actuator rod at the clip.
3. Remove the screws and remove the latch.

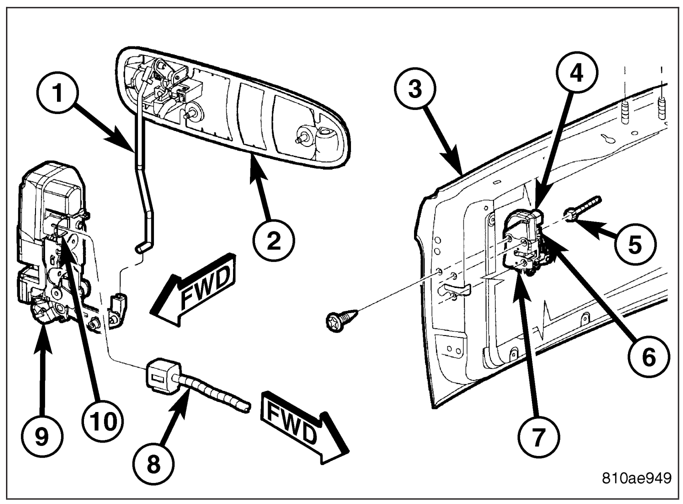



## INSTALLATION

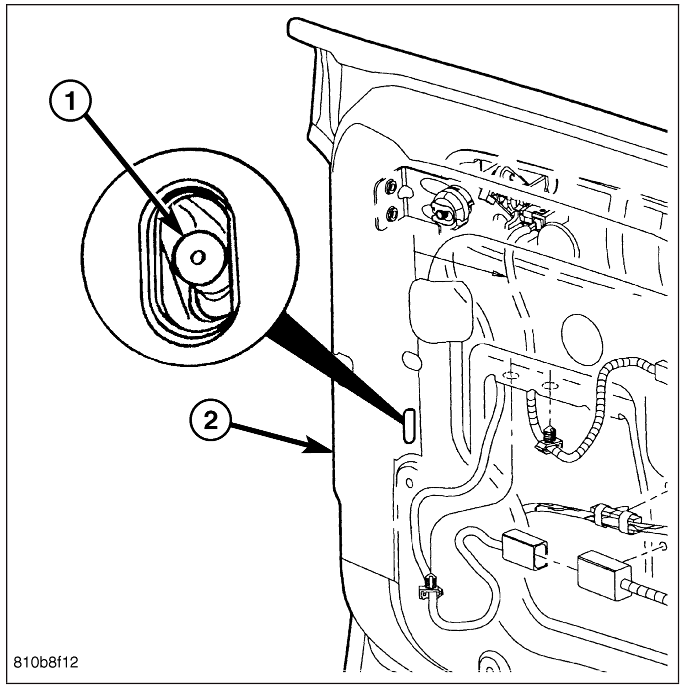
1. Install the latch and tighten the screws to 11 N·m (8 ft. lbs.).
2. Connect the electrical connector.

**CAUTION: Make sure the latch wire harness is installed forward of the actuator rod.**

3. Connect the actuator rod.



4. Insert a 5/32-inch hex-wrench through hole and into adjustment screw. Loosen screw.
5. Operate outside handle several times to release any restriction because of mis-alignment.
6. Tighten adjustment screw to 3 N·m (30 in. lbs.)
7. Test handle for proper operation.
8. Install the trim panel and waterdam. (Refer to 23 - BODY/SWING GATE/TRIM PANEL - INSTALLATION)



# LATCH STRIKER

## REMOVAL

1. Open the gate and using a grease pencil or equivalent, mark the position of the striker to aid installation.
2. Remove the bolts attaching the striker to the D-pillar.

## INSTALLATION

1. Adjust the swing gate as necessary. (Refer to 23 - BODY/SWING GATE/SWING GATE - ADJUSTMENTS)

**NOTE: If the spare tire is removed then add 3 mm on the right side to compensate for sag after the spare tire is installed.**

2. Install the striker and install the bolts.
3. Adjust the striker.

## ADJUSTMENTS

## ADJUSTMENT

**NOTE: Stabilizer insert must be off when adjusting the striker.**

1. Remove the stabilizer insert. (Refer to 23 - BODY/SWING GATE/STABILIZER WEDGE/INSERT - REMOVAL)
2. Loosen the striker bolts.
3. Adjust the striker up/down so that it is centered within the latch opening.
4. Adjust the striker fore/aft so the swing gate is under flush to the body -0.5 mm (+/- 1.0 mm).
5. Adjust the striker cross-car engagement to the latch by adding 2.0 mm shims as necessary.

**NOTE: Make sure the striker is not twisted within the latch opening. Striker should be parallel to the opening.**

6. Tighten the striker bolts to 28 N·m (21 ft. lbs.).
7. Install the stabilizer insert. (Refer to 23 - BODY/SWING GATE/STABILIZER WEDGE/INSERT - INSTALLATION)

# LATCH - ACCESS PANEL

## DESCRIPTION

This panel provides access to the gate latch if gate power fails. The gate can be unlocked by reaching in and pushing the lock lever down.

## REMOVAL

1. Using a trim stick C-4755 or equivalent, remove the access panel.

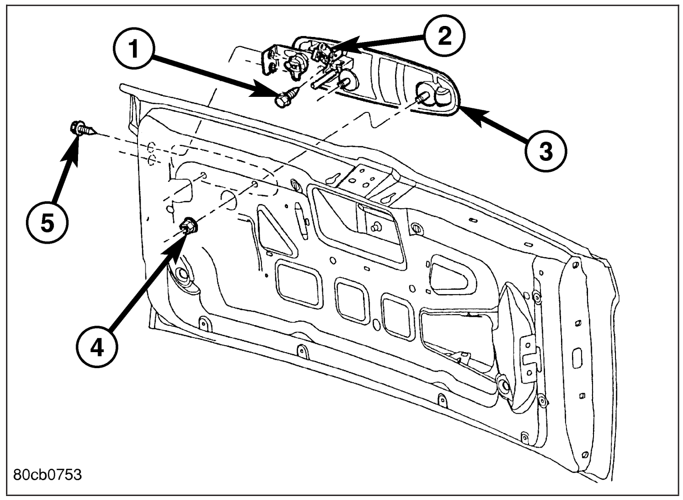
## INSTALLATION

1. Position and install the access panel.

# EXTERIOR HANDLE

## REMOVAL

1. Remove the trim panel and waterdam as necessary to gain access to the handle. (Refer to 23 - BODY/SWING GATE/TRIM PANEL - REMOVAL)
2. Disconnect the lock switch and flip-up glass release electrical connectors.
3. Unclip the threaded clips and disconnect the actuator rods.
4. Remove the screws.
5. Remove the nuts and remove the handle.




## INSTALLATION

1. Install the handle and hold tightly against the gate and support bracket.
2. Install the nuts and tighten to 6 N·m (55 in. lbs.).
3. Install the screws and tighten to 6 N·m (55 in. lbs.).

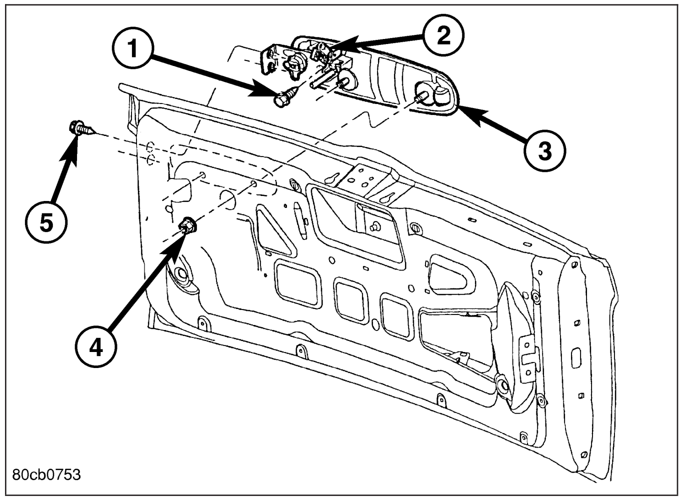
**NOTE: Do not pre-load the latch rod when attaching. The latch and handle must be in a relaxed state when making the connection.**

4. Connect the actuator rod by first pushing the rod into the stationary half of the threaded clip, then close the moving half ensuring the two halves snap together fully.
5. Connect the lock switch and flip-up glass release electrical connectors.
6. Install the trim panel and waterdam. (Refer to 23 - BODY/SWING GATE/TRIM PANEL - INSTALLATION)

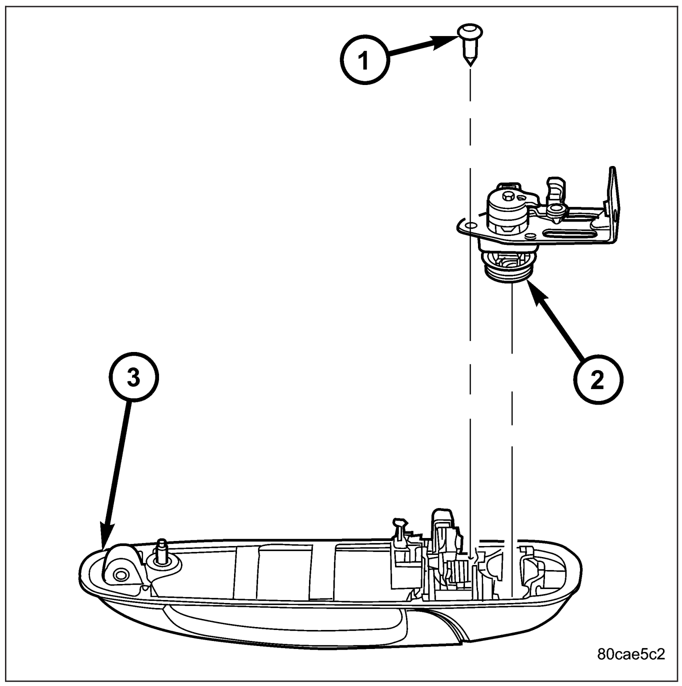
# LOCK CYLINDER

## REMOVAL

1. Remove the exterior handle (1). (Refer to 23 - BODY/SWING GATE/EXTERIOR HANDLE - REMOVAL)

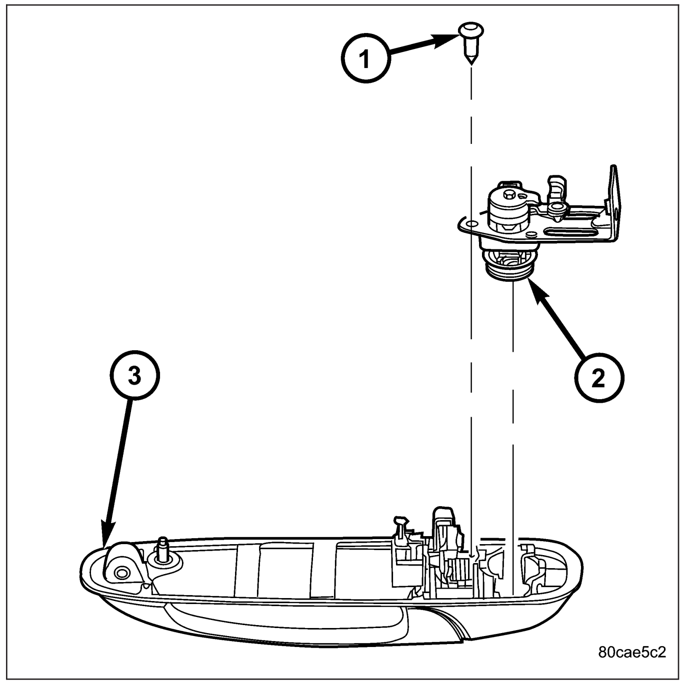



2. Remove the clip and remove the lock cylinder switch.
3. Remove the screw (1) and remove the lock cylinder (2).

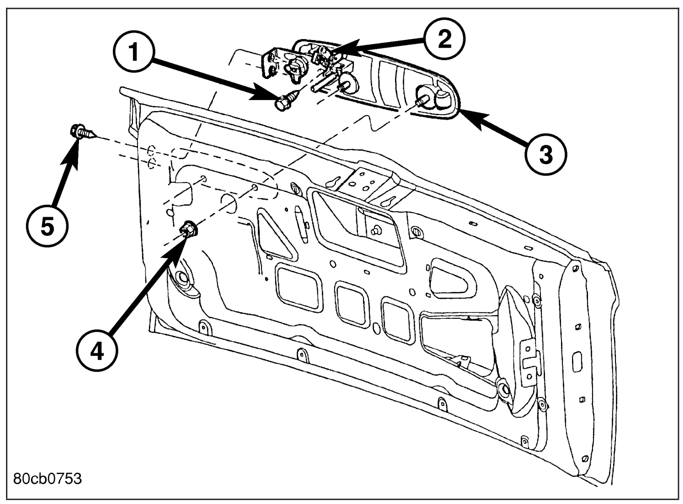


## INSTALLATION

1. Install the lock cylinder.
2. Install the screw (1) and tighten to 6 N·m (50 in. lbs.).
3. Install the lock cylinder switch and retaining clip.



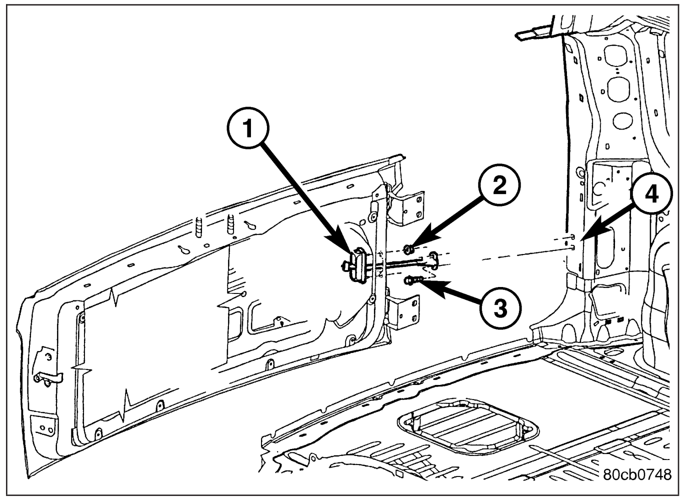

4. Install the exterior handle (3). (Refer to 23 - BODY/SWING GATE/EXTERIOR HANDLE - INSTALLATION)



# CHECK STRAP

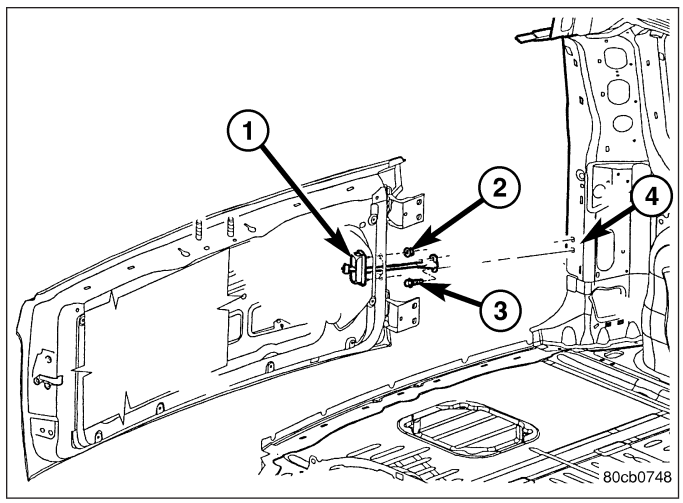
## REMOVAL

1. Remove the swing gate trim panel. (Refer to 23 - BODY/SWING GATE/TRIM PANEL - REMOVAL)
2. Remove the quarter trim panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL)
3. Remove the bolts (3) attaching the check strap (1) to the D-pillar (4).
4. Peel back the waterdam.
5. Remove the nuts and remove the check strap (2) from the swing gate.




## INSTALLATION

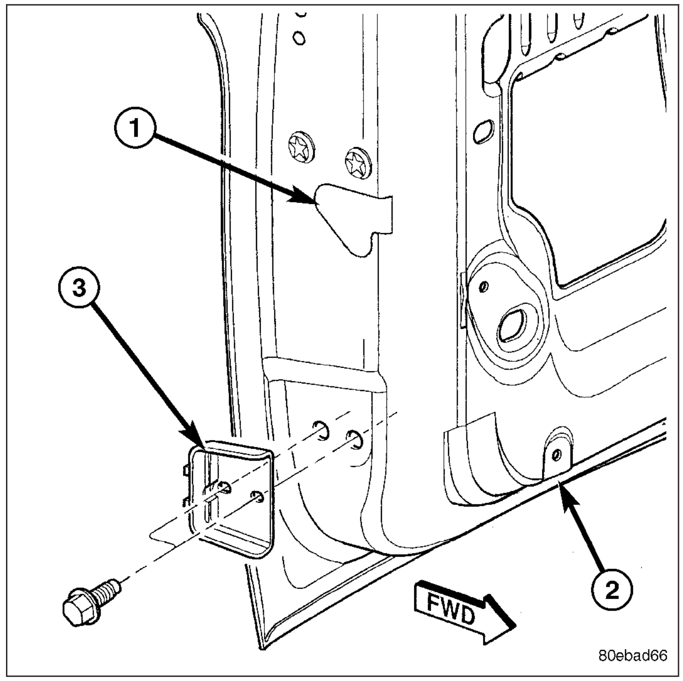
1. Install the check strap.
2. Install the nuts and tighten to 10 N·m (85 in. lbs.).
3. Reposition the waterdam.
4. Install the trim panel. (Refer to 23 - BODY/SWING GATE/TRIM PANEL - INSTALLATION)
5. Install the bolts attaching the check strap to the D-pillar and tighten to 11 N·m (8 ft. lbs.).
6. Install the quarter trim panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - INSTALLATION)



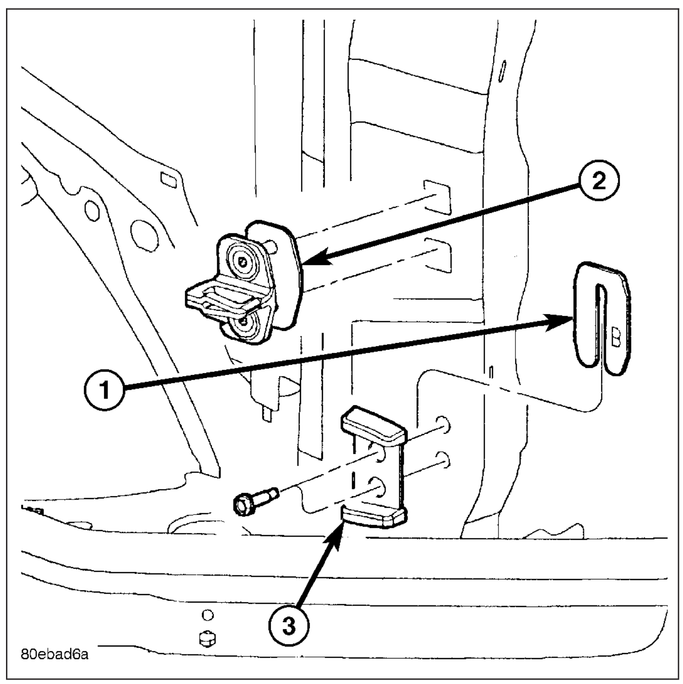
# STABILIZER WEDGE/INSERT

## REMOVAL

1. Open the swing gate.
2. Using a grease pencil or equivalent, mark the location of the stabilizer cup (3) and insert to aid installation.
3. Remove the bolts for the stabilizer cup and remove the cup.

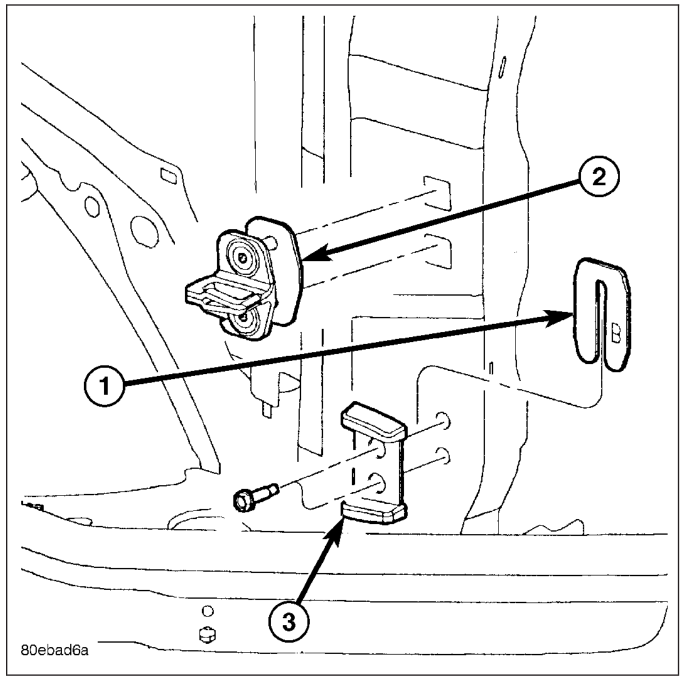



4. Remove the bolts for the insert and remove the insert (3) and shim (1), if equipped.

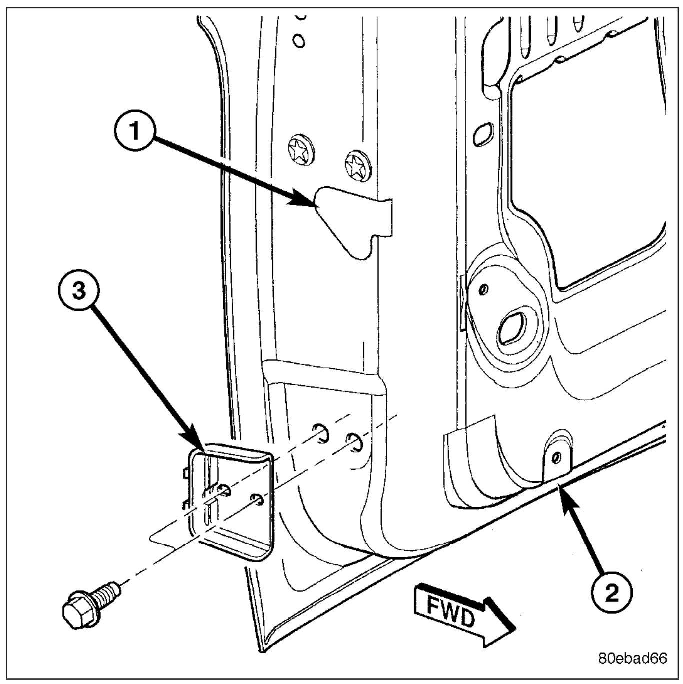


## INSTALLATION

1. Install the stabilizer insert (3) with the narrow end toward the rear of the vehicle and install the bolts.
2. Tighten the bolts to 9 N·m (80 in. lbs.).




3. Install the stabilizer cup (3) and loosely install the bolts.
4. Adjust the stabilizer and tighten the bolts to 9 N·m (80 in. lbs.). (Refer to 23 - BODY/SWING GATE/ STABILIZER WEDGE/INSERT - ADJUSTMENTS)




## ADJUSTMENTS

## ADJUSTMENT

1. Adjust the insert up/down so that it is centered within the stabilizer cup.
2. Adjust the insert for/aft so the swing gate is 1.0 mm over flush to the D-pillar when the insert contacts the rubber bumper in the stabilizer cup.
3. Open the swing gate and tighten the bolts to 9 N·m (80 in. lbs.).

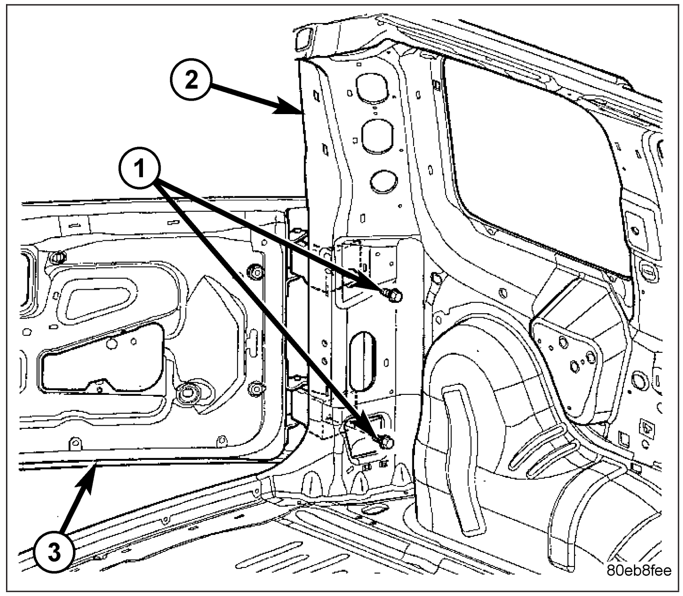
**NOTE: Make sure the stabilizer cup and insert are parallel to each other and not twisted.**

4. Close the swing gate and grab the beltline. Confirm minimal for/aft movement and that closing effort is not excessive. Readjust as required.

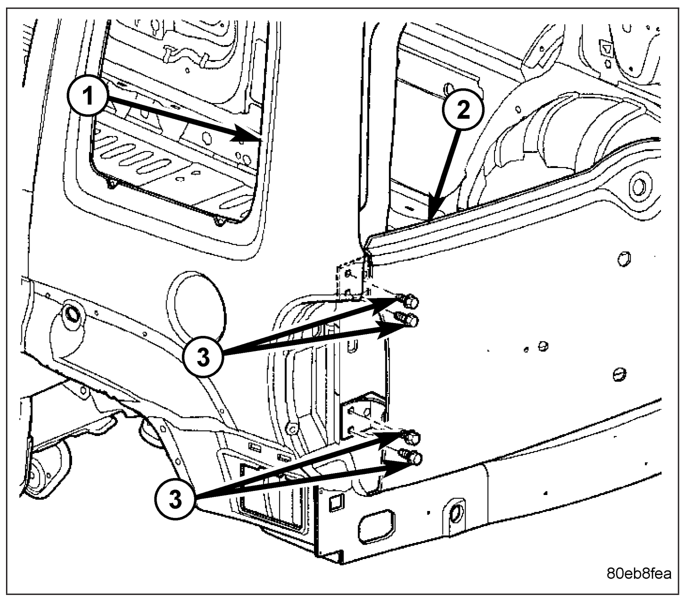
# HINGE

## REMOVAL

1. Remove the swing gate (3). (Refer to 23 - BODY/SWING GATE/SWING GATE - REMOVAL)
2. Using a grease pencil or equivalent, mark the original location of the hinges to aid installation.
3. Remove the bolts (1) from inside the quarter panel.

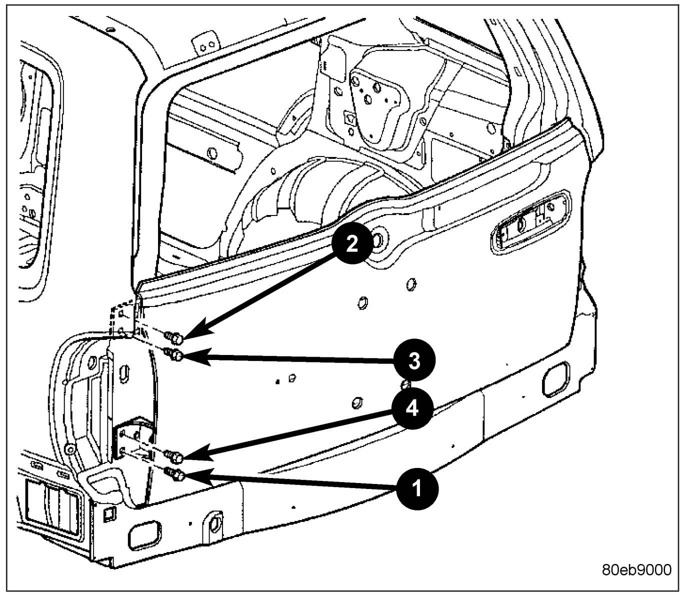



4. Remove the outer hinge bolts (3) and remove the hinges.

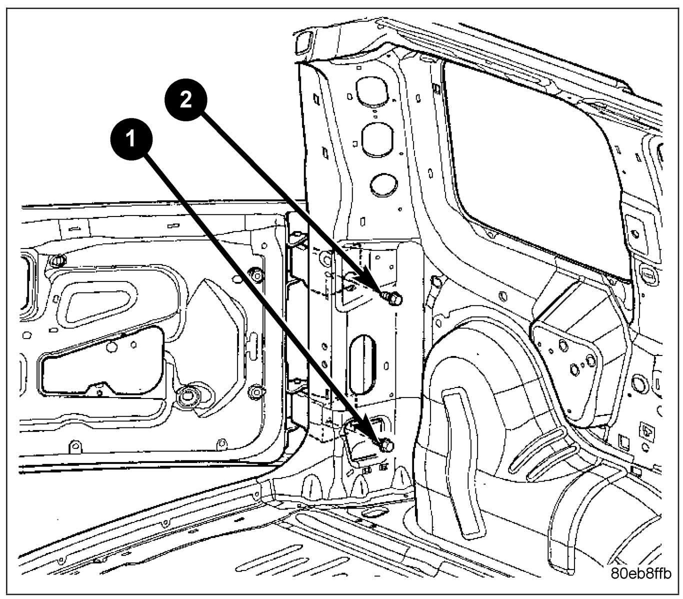


## INSTALLATION

1. Install the hinges and install the inner and outer fasteners.
2. Tighten the outer fasteners to 31 N·m (23 ft. lbs.) using the sequence indicated.



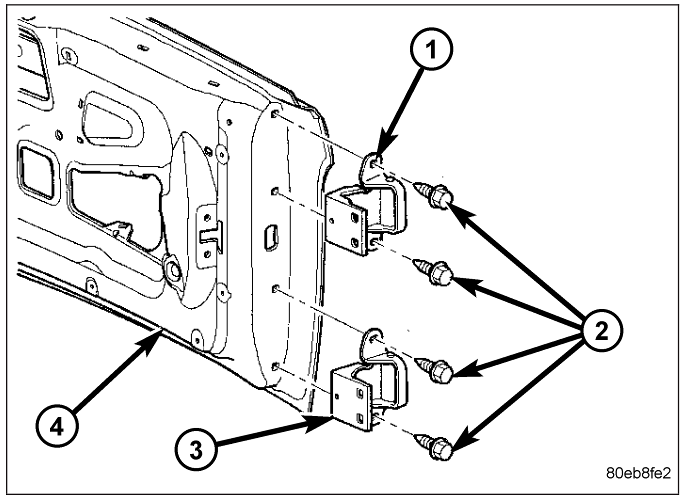

3. Tighten the inner fasteners to 31 N·m (23 ft. lbs.) using the sequence indicated.
4. Install the swing gate. (Refer to 23 - BODY/SWING GATE/ SWING GATE - INSTALLATION)



# SWING GATE

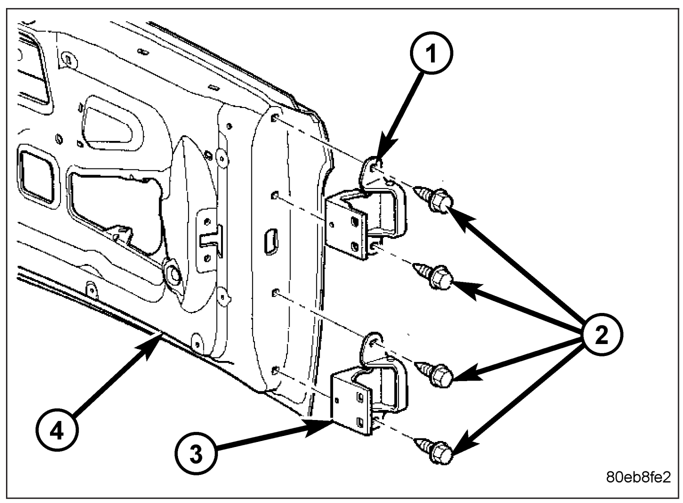
## REMOVAL

1. Remove the spare tire. (Refer to 22 - TIRES/WHEELS/TIRES/SPARE TIRE - REMOVAL)
2. Remove the quarter trim panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL)
3. Support the swing gate with a suitable lifting device.
4. Disconnect the wire harness.
5. Disconnect the check strap from the D-pillar. (Refer to 23 - BODY/SWING GATE/CHECK STRAP - REMOVAL)
6. Remove the bolts (2) and remove the swing gate.




## INSTALLATION

1. Install the swing gate (4) and install the bolts (2).
2. Tighten the bolts to 31 N·m (23 ft. lbs.).
3. Adjust the swing gate as needed adding 3 mm on the right side to compensate for sag after the spare tire is installed. (Refer to 23 - BODY/SWING GATE/SWING GATE - ADJUSTMENTS)
4. Connect the wire harness electrical connector.
5. Connect the check strap. (Refer to 23 - BODY/SWING GATE/CHECK STRAP - INSTALLATION)
6. Install the quarter trim panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - INSTALLATION)
7. Install the spare tire. (Refer to 22 - TIRES/WHEELS/TIRES/SPARE TIRE - INSTALLATION)




## ADJUSTMENTS

## ADJUSTMENT

**NOTE: Swing gate adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.**

- **During adjustment procedures, it is recommended that all the hinge fasteners be loosened except for the upper most fasteners. Adjustments can be made using the upper bolts to hold the door with final torque of the fasteners occurring after correct door positioning is achieved.**
- **A suitable body sealant should be used when removing or moving the hinges.**

1. Remove the spare tire. (Refer to 22 - TIRES/WHEELS/TIRES/SPARE TIRE - REMOVAL)

## IN/OUT

**NOTE: In/out swing gate adjustment is done by loosening the hinge to gate fasteners one hinge at a time and moving the door to the correct position.**

**NOTE: With the spare tire removed add 3 mm on the right side to compensate for sag after the spare tire is installed.**

1. Remove the latch striker. (Refer to 23 - BODY/SWING GATE/LATCH STRIKER - REMOVAL)
2. Remove the stabilizer wedge/striker. (Refer to 23 - BODY/SWING GATE/STABILIZER WEDGE - REMOVAL)
3. For hinge side adjustments, loosen the hinge bolts and leave one upper hinge bolt hand tight. (Refer to 23 - BODY/SWING GATE/HINGE - REMOVAL)
4. Adjust the swing gate to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Tighten the fasteners. (Refer to 23 - BODY/SWING GATE/HINGE - INSTALLATION)
6. Install the latch striker. (Refer to 23 - BODY/SWING GATE/LATCH STRIKER - INSTALLATION)
7. Install the spare tire. (Refer to 22 - TIRES/WHEELS/TIRES/SPARE TIRE - INSTALLATION)

## UP/DOWN

**NOTE: Up/down swing gate adjustment is done by loosening the hinge to gate fasteners or the hinge to body fasteners, one hinge at a time and moving the door to the correct position.**

**NOTE: With the spare tire removed add 3 mm on the right side to compensate for sag after the spare tire is installed.**

1. Remove the latch striker. (Refer to 23 - BODY/SWING GATE/LATCH STRIKER - REMOVAL)
2. Remove the stabilizer wedge/striker. (Refer to 23 - BODY/SWING GATE/STABILIZER WEDGE - REMOVAL)
3. For hinge side adjustments, loosen the hinge bolts and leave one upper hinge bolt hand tight. (Refer to 23 - BODY/SWING GATE/HINGE - REMOVAL)
4. Adjust the swing gate to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Tighten the fasteners. (Refer to 23 - BODY/SWING GATE/HINGE - INSTALLATION)
6. Install the latch striker. (Refer to 23 - BODY/SWING GATE/LATCH STRIKER - INSTALLATION)
7. Install the spare tire. (Refer to 22 - TIRES/WHEELS/TIRES/SPARE TIRE - INSTALLATION)

## LEFT/RIGHT

**NOTE: Left/right swing gate adjustment is done by loosening the hinge to body fasteners one hinge at a time and moving the door to the correct position.**

**NOTE: With the spare tire removed add 3 mm on the right side to compensate for sag after the spare tire is installed.**

1. Remove the latch striker. (Refer to 23 - BODY/SWING GATE/LATCH STRIKER - REMOVAL)
2. Remove the stabilizer wedge/striker. (Refer to 23 - BODY/SWING GATE/STABILIZER WEDGE - REMOVAL)
3. Loosen the hinge to body bolts and leave one upper hinge bolt hand tight. (Refer to 23 - BODY/SWING GATE/HINGE - REMOVAL)
4. Adjust the swing gate to the correct position. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
5. Tighten the fasteners. (Refer to 23 - BODY/SWING GATE/HINGE - INSTALLATION)
6. Install the latch striker. (Refer to 23 - BODY/SWING GATE/LATCH STRIKER - INSTALLATION)
7. Install the spare tire. (Refer to 22 - TIRES/WHEELS/TIRES/SPARE TIRE - INSTALLATION)

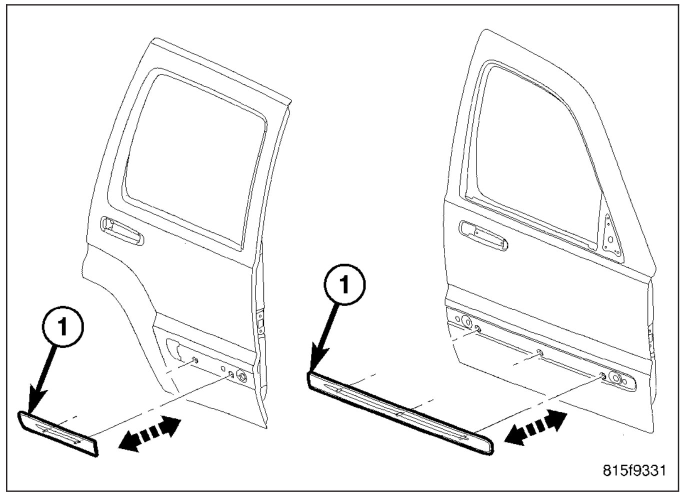
# EXTERIOR

## TABLE OF CONTENTS

# BODY SIDE MOLDINGS

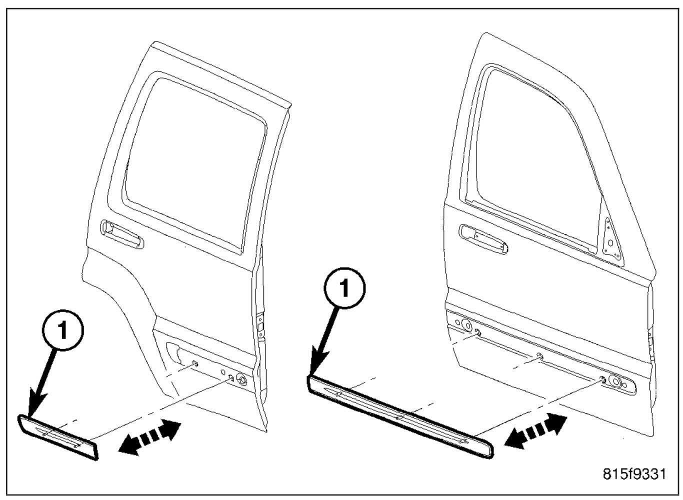
## REMOVAL

1. Using a trim stick C-4755 or equivalent, remove and discard the molding (1) from the outside of the door.




## INSTALLATION

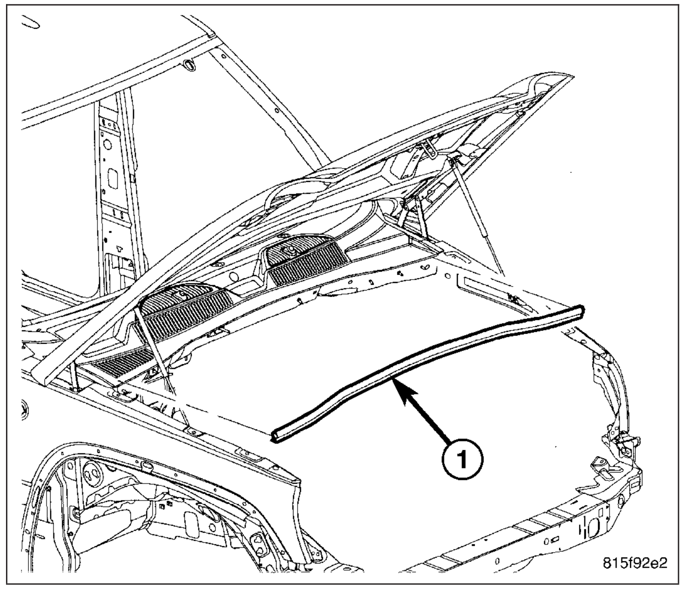
1. Thoroughly clean all residue from the body side molding attachment area of the door.
2. Wipe area clean with a 50% solution of water and alcohol and wipe dry.
3. Apply new body side molding using the locators in the door and apply pressure of approximately 40 p.s.i. over the entire surface of the molding.



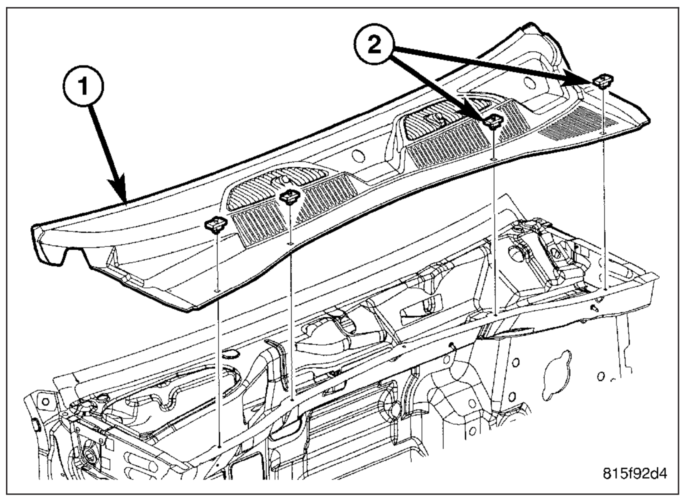
# COWL GRILLE

## REMOVAL

1. Remove the hood seal (1).

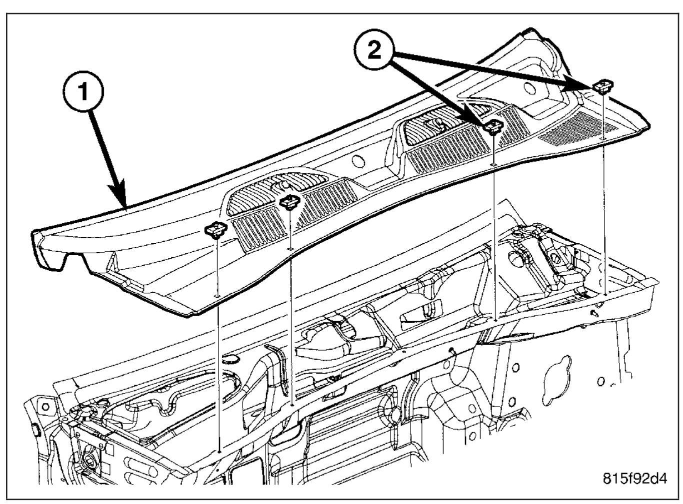



2. Remove the wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - REMOVAL)
3. Remove the four plastic retainers (2) and remove the cowl grille (1).

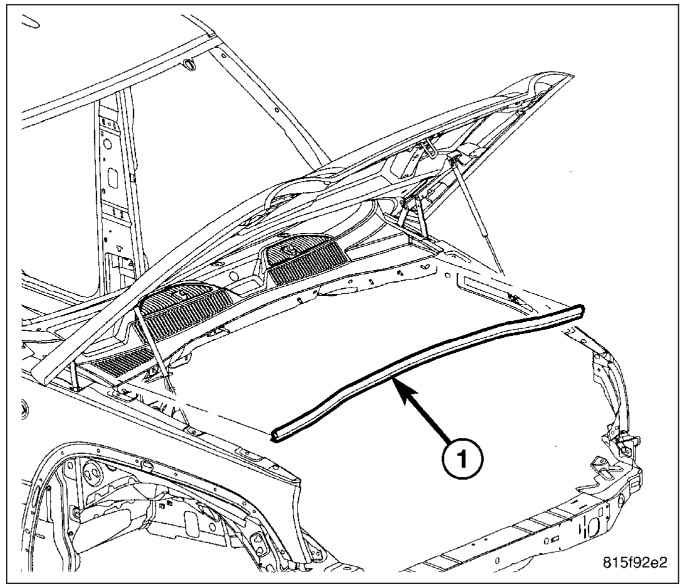



## INSTALLATION

1. Position the cowl grille (1) and engage the nine clips to the bottom of the windshield.
2. Install the four plastic retainers (2).
3. Install the wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - INSTALLATION)



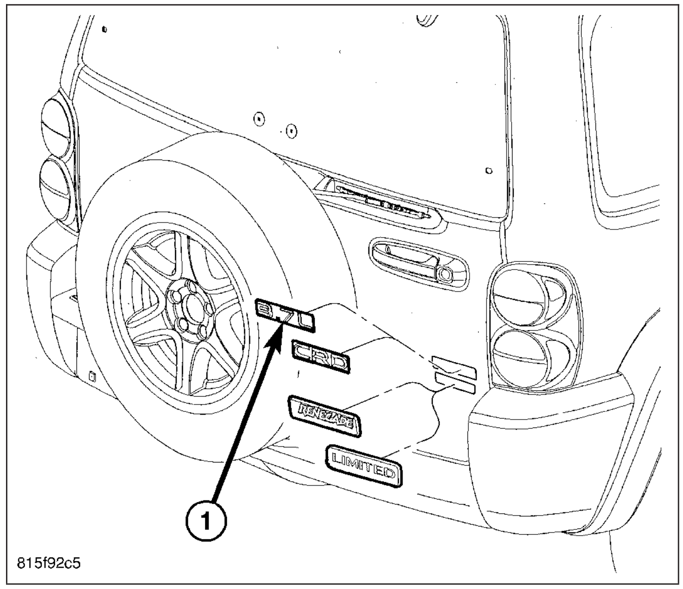
4. Install the hood seal (1).



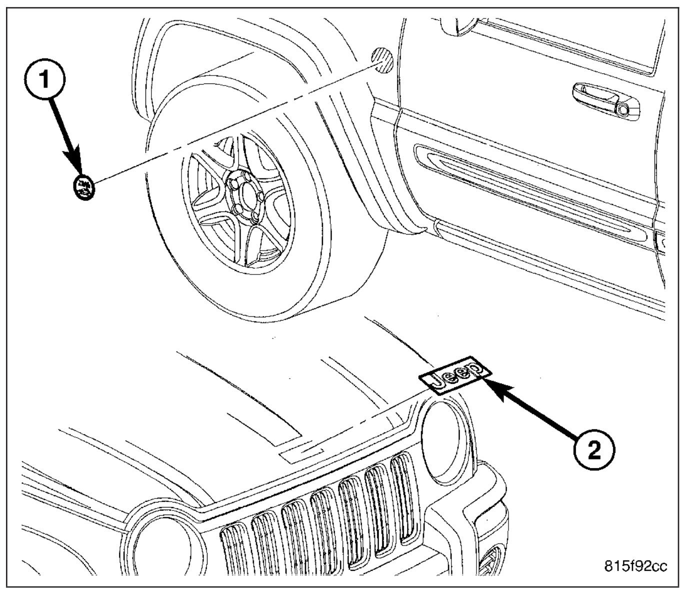
# EXTERIOR NAME PLATES

## REMOVAL

1. Apply a length of masking tape on the body, parallel to the top edge of the nameplate to use as a guide, if necessary.

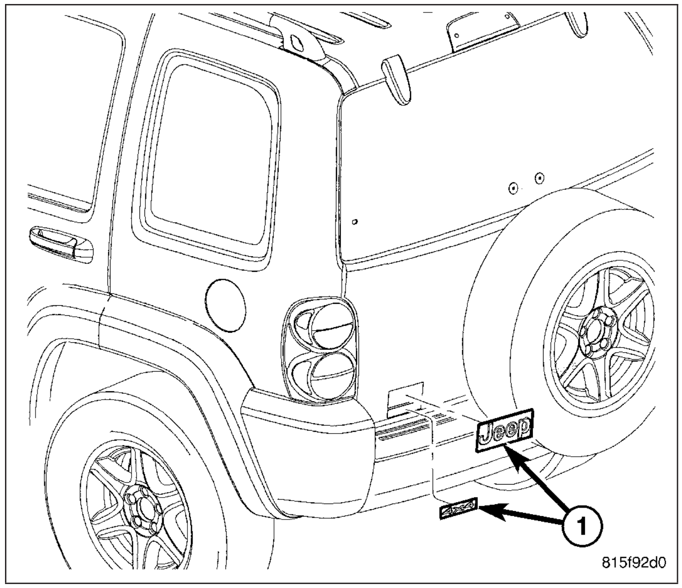



2. Apply a length of masking tape on the body, parallel to the top edge of the nameplate to use as a guide, if necessary.



**NOTE: Exterior nameplates are attached to body panels with adhesive tape.**

3. Apply a length of masking tape on the body, parallel to the top edge of the nameplate to use as a guide, if necessary.

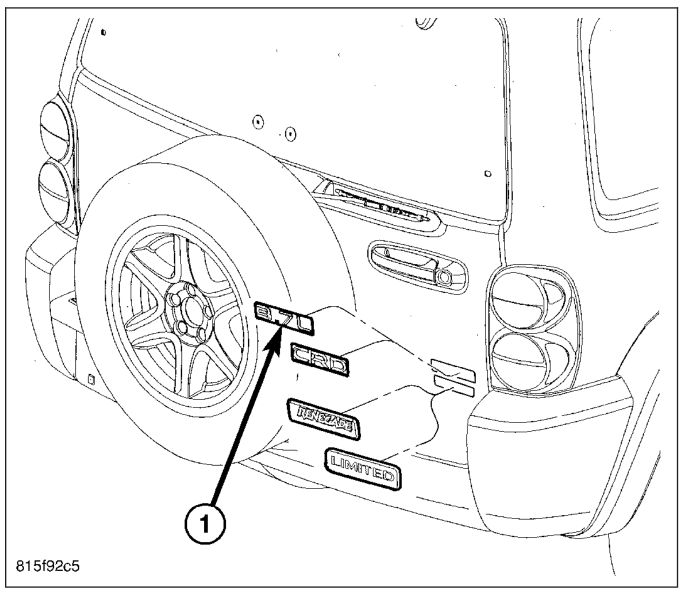


815f92d0

4. If temperature is below 21°C (70°F) warm emblem with a heat lamp or gun. Do not exceed 52°C (120°F) when heating emblem.
5. Using a trim stick C-4755 or equivalent, behind the emblem to separate the adhesive backing from the body.
6. Clean adhesive residue from body with MOPAR® Super Clean solvent or equivalent.

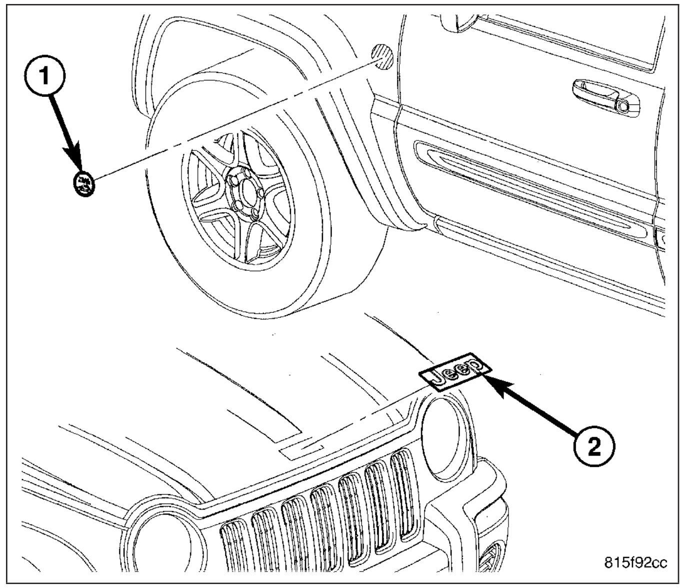
## INSTALLATION

1. Remove protective cover from adhesive tape on back of emblem.
2. Position emblem properly on body.

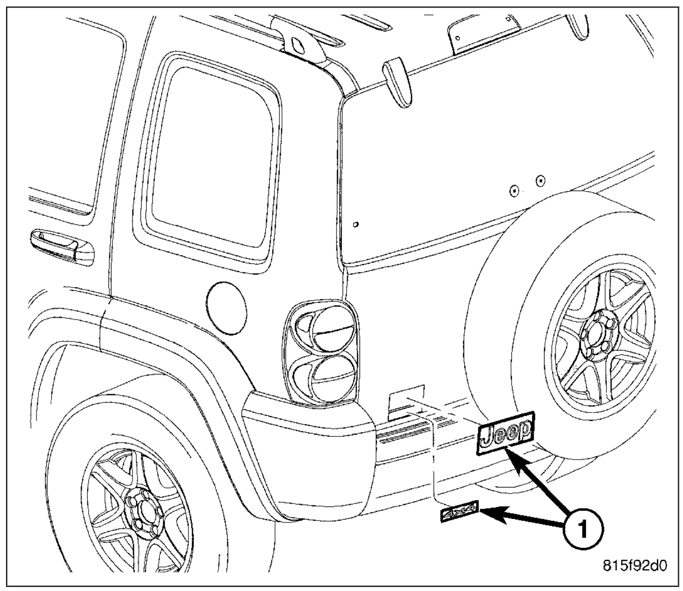


815f92c5

3. Position emblem properly on body.



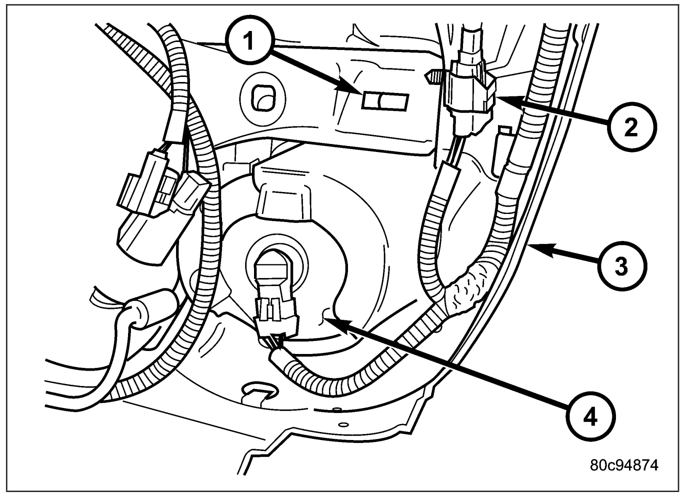

4. Position emblem properly on body.
5. Press emblem firmly to body with palm of hand.
6. If temperature is below 21°C (70°F) warm emblem with a heat lamp or gun to assure adhesion. Do not exceed 52°C (120°F) when heating emblem.



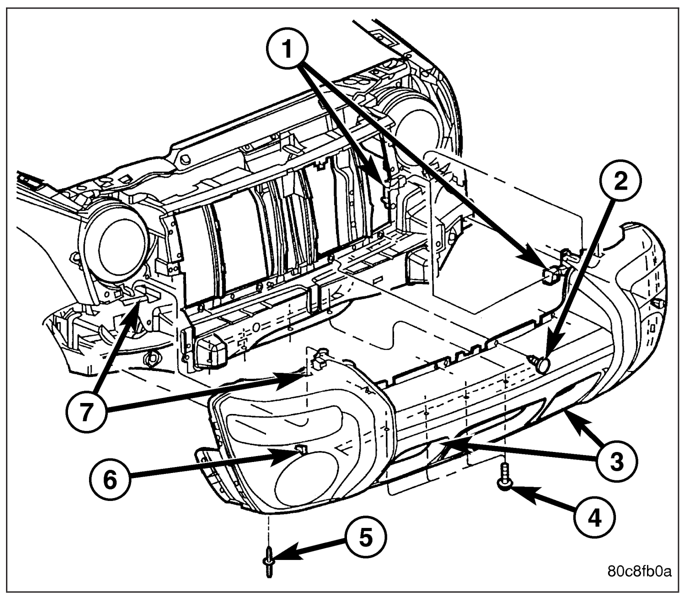
# FRONT FENDER

## REMOVAL

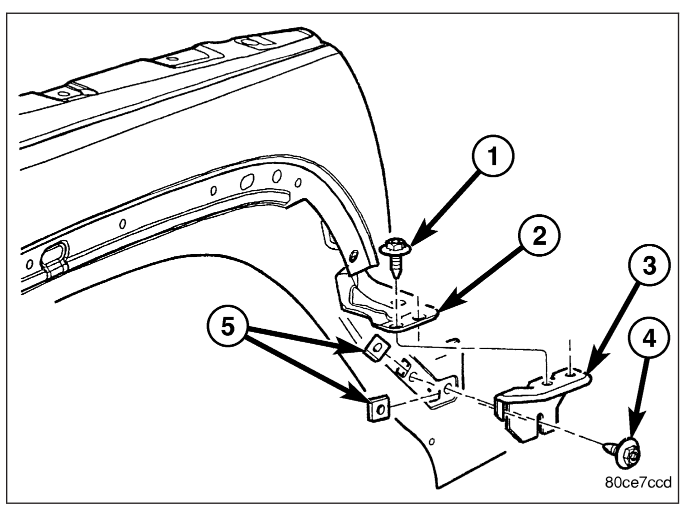
1. Remove the wheel opening splash shield. (Refer to 23 - BODY/EXTERIOR/FRONT WHEELHOUSE SPLASH SHIELD - REMOVAL)
2. Remove the grille. (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL)
3. Raise and support vehicle.
4. Release the inner support clips from within the fascia between the lights.



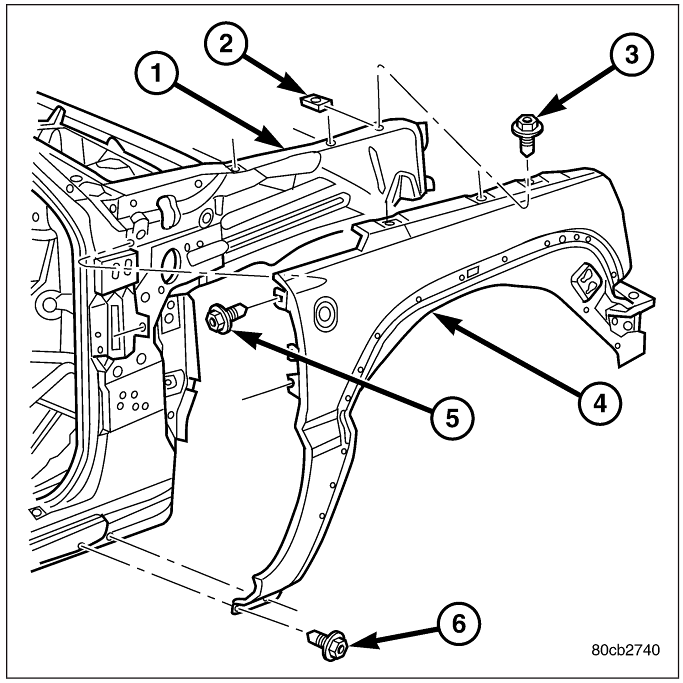

5. Release the support tabs beneath the headlamps and position the fascia assembly aside to access the fender support bracket bolts.



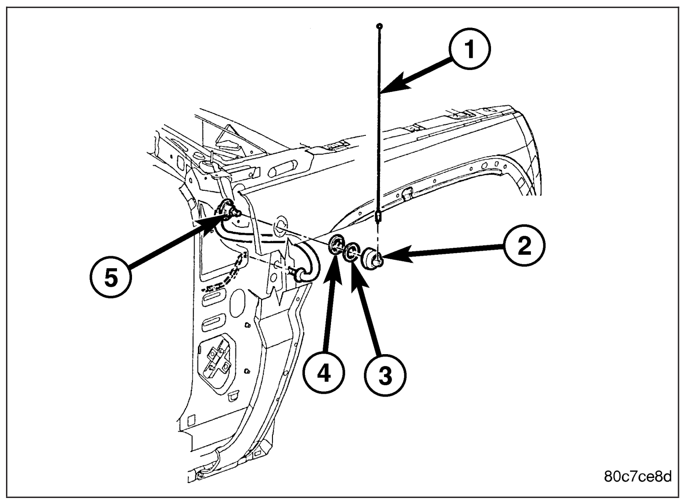

6. Remove the front wheel opening flare moldings. (Refer to 23 - BODY/EXTERIOR/FRONT WHEEL OPENING FLARE MOLDINGS - REMOVAL)
7. Remove the fender support bracket bolts.



8. Remove the bolts and remove the fender.

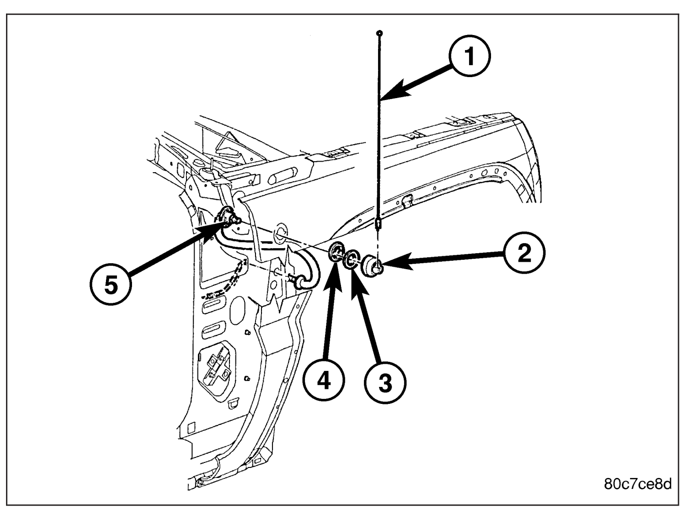



9. Remove the antenna body, if equipped (1). (Refer to 8 - ELECTRICAL/AUDIO/ANTENNA BODY & CABLE - REMOVAL)

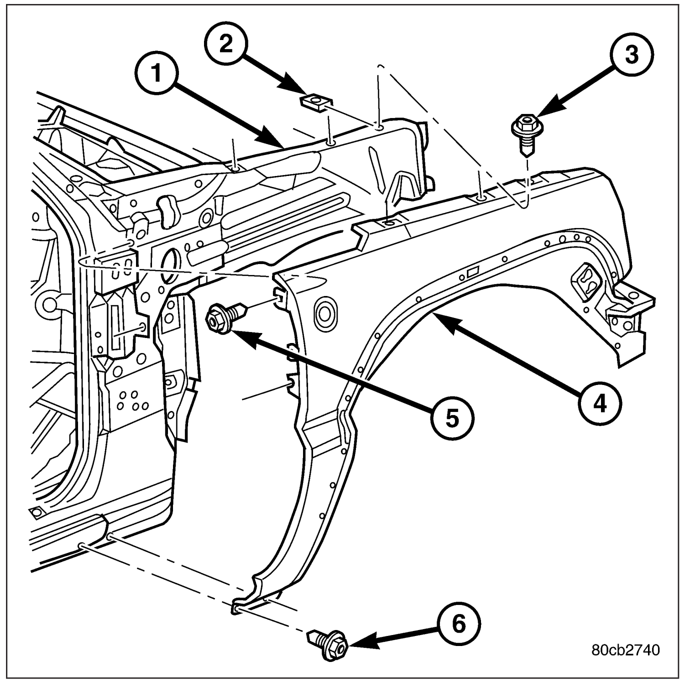



## INSTALLATION

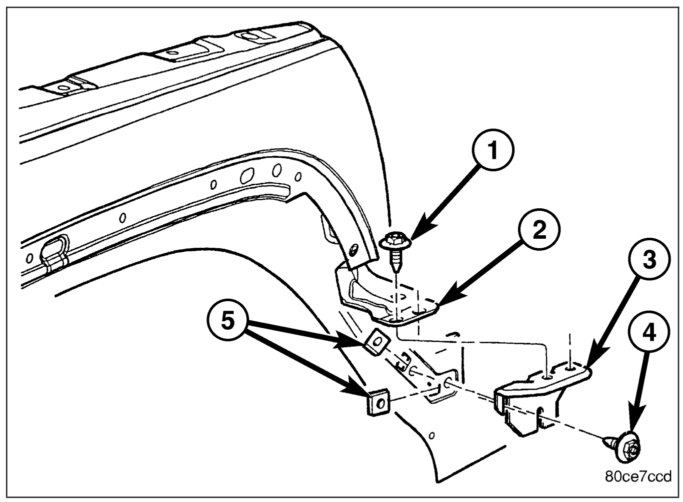
1. Install the antenna body (1), if equipped. (Refer to 8 - ELECTRICAL/AUDIO/ANTENNA BODY & CABLE - INSTALLATION)



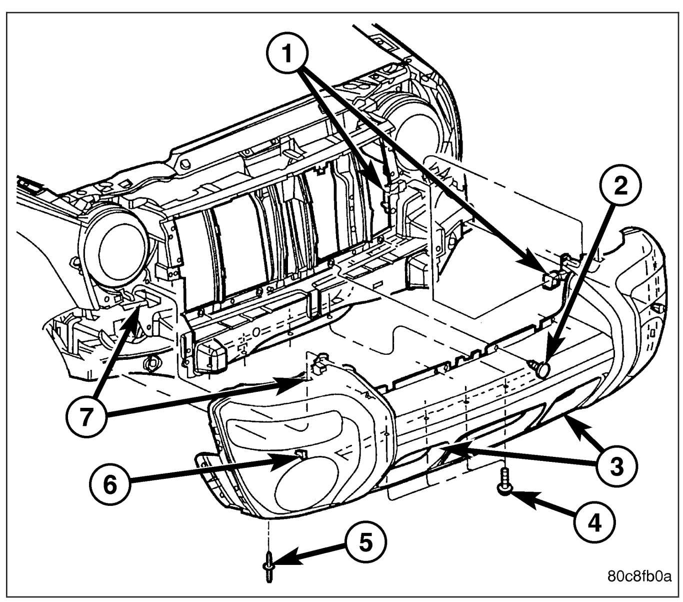
2. Install the fender assembly (4) and install the bolts.




3. Install the fender support bracket (3) and install the bolts.
4. Align the fender with adjacent body parts and tighten the bolts to 12 N·m (9 ft. lbs.). (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)



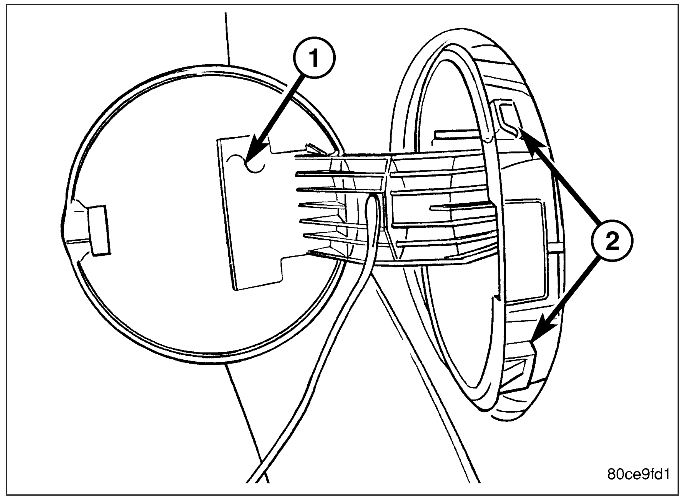

5. Install the fascia assembly. (Refer to 13 - FRAME & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION)
6. Install the wheelhouse splash shield. (Refer to 23 - BODY/EXTERIOR/FRONT WHEELHOUSE SPLASH SHIELD - INSTALLATION)



# FUEL FILL DOOR/HOUSING

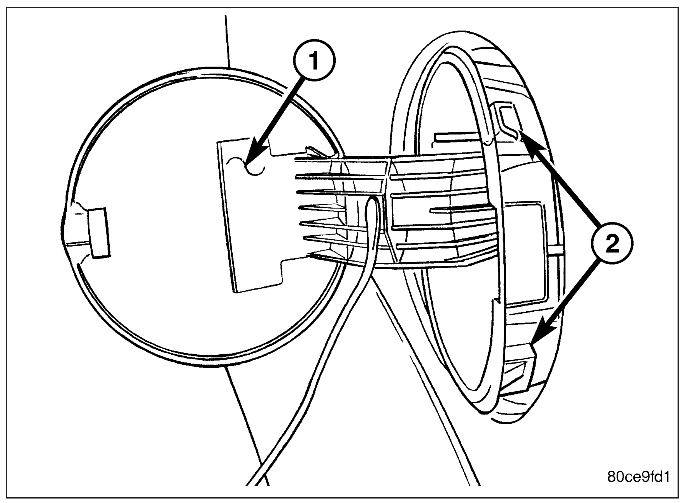
## REMOVAL

1. Remove the fuel cap.
2. Remove the three screws connecting the fuel door/housing to the filler neck.
3. Reach in through the opening and depress the tabs (2) at the upper and bottom right of the door/housing.
4. Remove the fuel door/housing from the vehicle.




## INSTALLATION

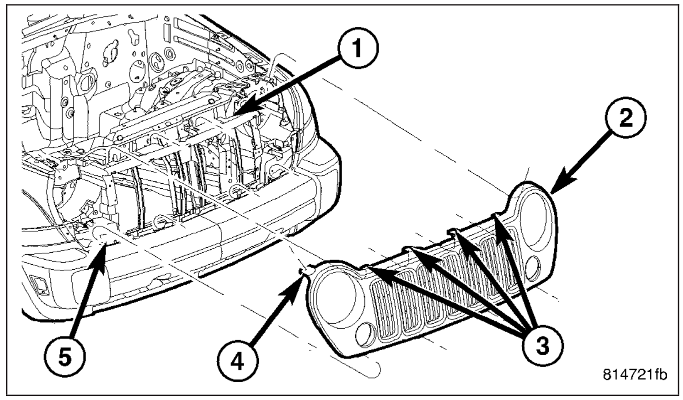
1. Position the fuel filler door/housing into the vehicle and fully seat the tabs (2).
2. Install the three screws.
3. Install the fuel cap.



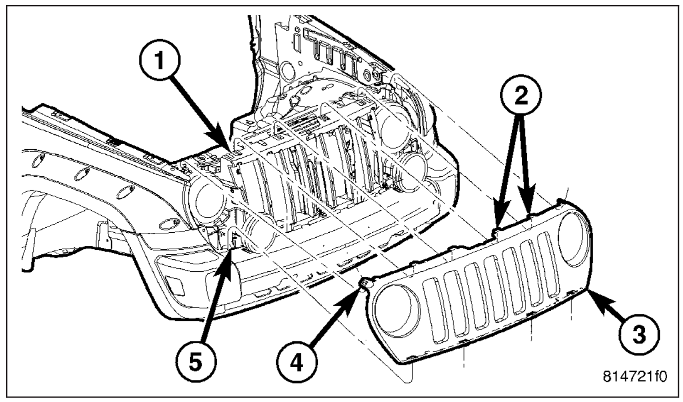
# GRILLE

## REMOVAL

1. Release the upper clips (3 and 4).
2. Roll the grille (2) forward and disengage the two grille hooks (5) under the headlamp units.
3. Lift the grille forward and up off of the location tabs at the bottom and remove.

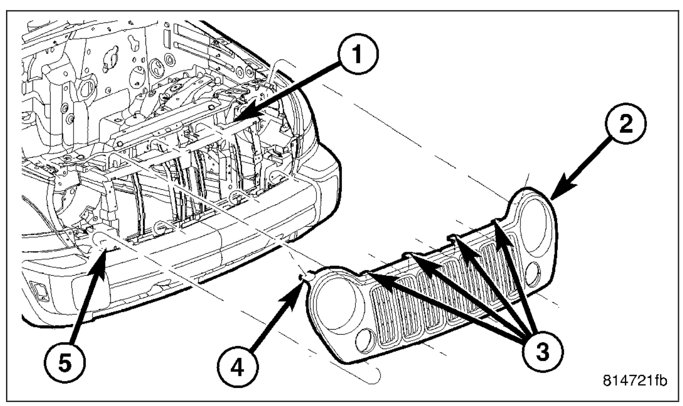



**NOTE: The procedure to remove the Renegade grille (3) is similar to the standard grille shown above.**

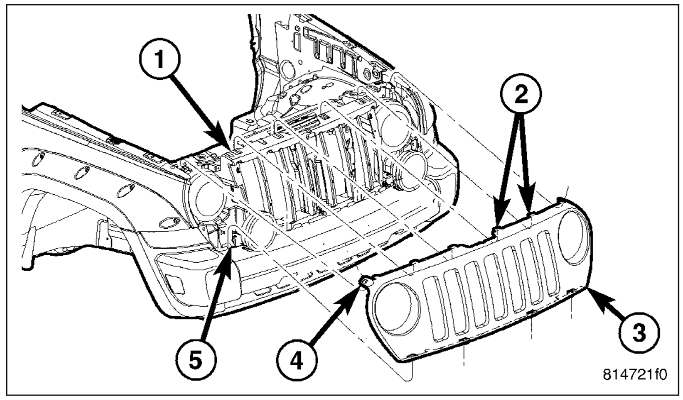



## INSTALLATION

1. Install the grille (2) onto the locating tabs (5) at the bottom.
2. Push the grille back and snap the hooks (3 and 4) onto the grille opening reinforcement (1).

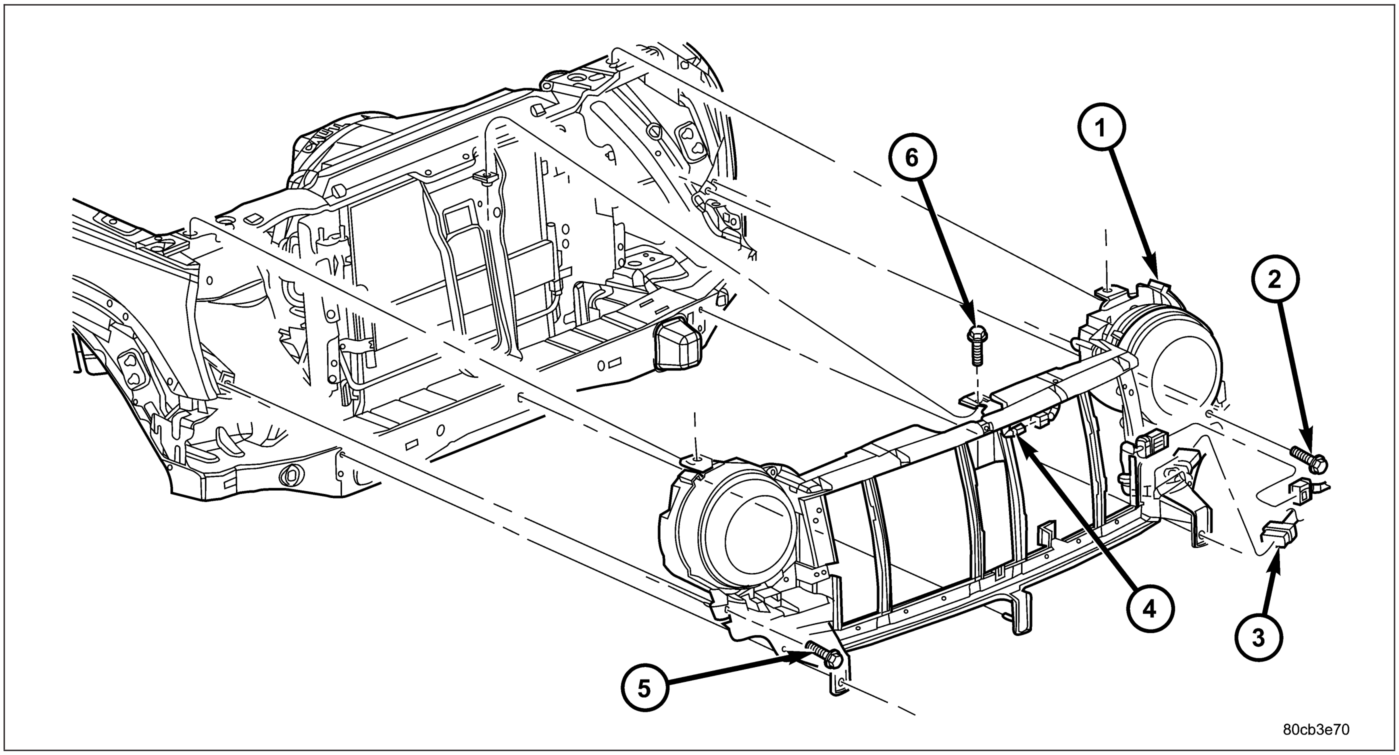


**NOTE: The procedure to install the Renegade grille (3) is similar to the standard grille shown.**



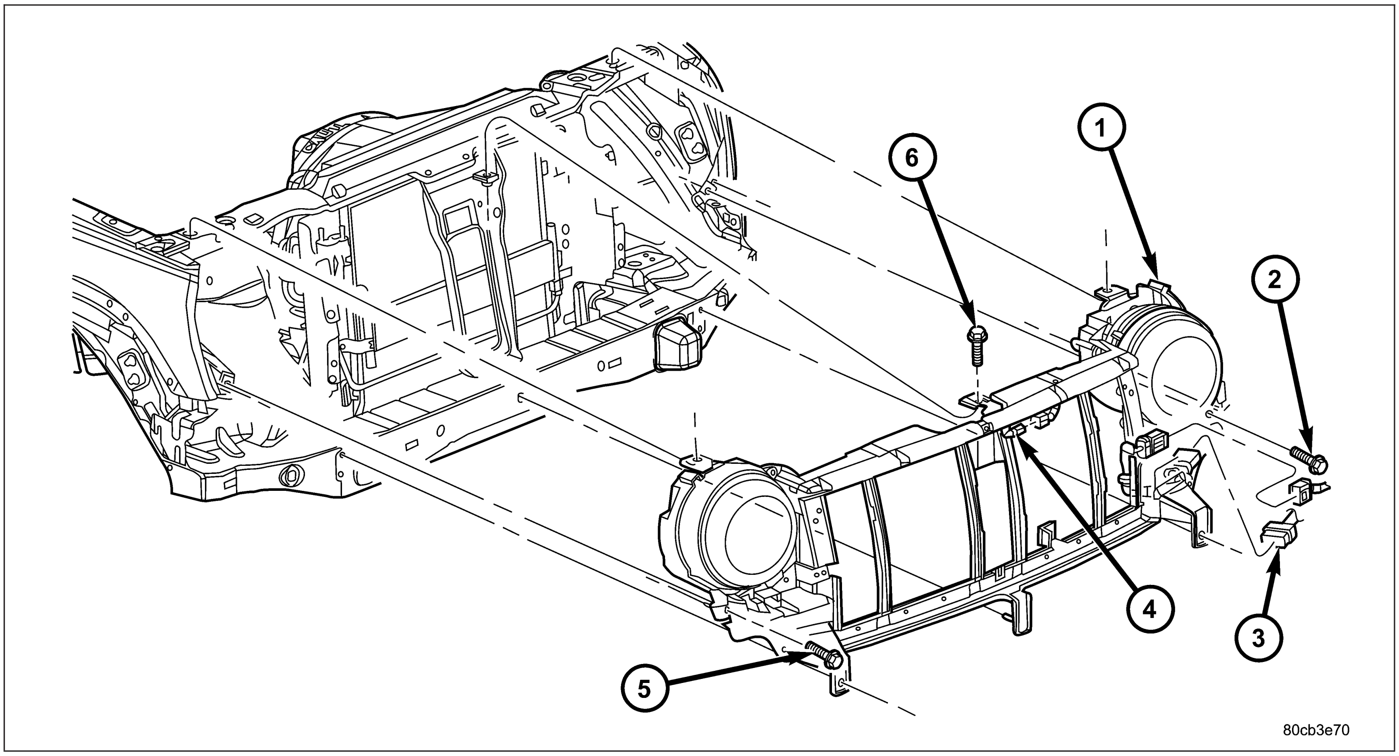
# GRILLE OPENING REINFORCEMENT

## REMOVAL




1. Remove the grille. (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL)
2. Remove the front fascia. (Refer to 13 - FRAME & BUMPERS/BUMPERS/FRONT FASCIA - REMOVAL)
3. Disconnect the electrical connectors (3).
4. Disconnect the rubber side flap push pin connectors.
5. Remove the seven bolts (2, 5 and 6) and remove the grille opening reinforcement (1).
6. Disconnect the headlamp units electrical connectors.
7. Remove the headlamp units. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - REMOVAL)

## INSTALLATION

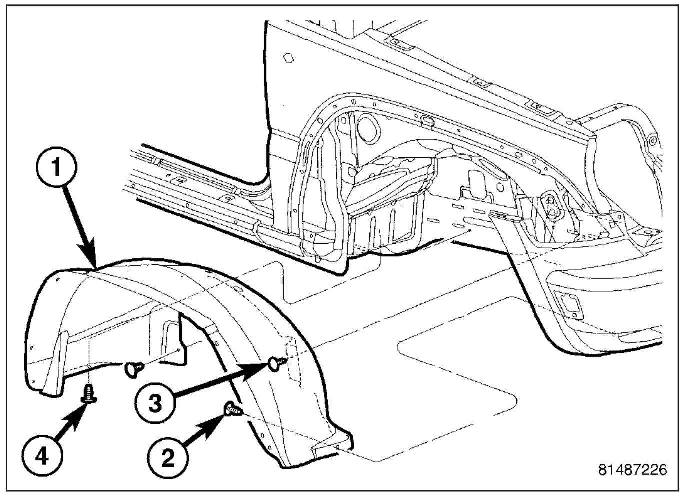



1. Install the headlamp units. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - INSTALLATION)
2. Connect the headlamp unit electrical connectors.
3. Install the grille opening reinforcement (1) and install the seven bolts. (2, 5 and 6)
4. Tighten the bolts to 10 N·m (85 in. lbs.).
5. Connect the rubber side flap and install the push pin connectors.
6. Connect the electrical connectors.
7. Install the front fascia. (Refer to 13 - FRAME & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION)
8. Install the grille. (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION)

# FRONT WHEELHOUSE SPLASH SHIELD

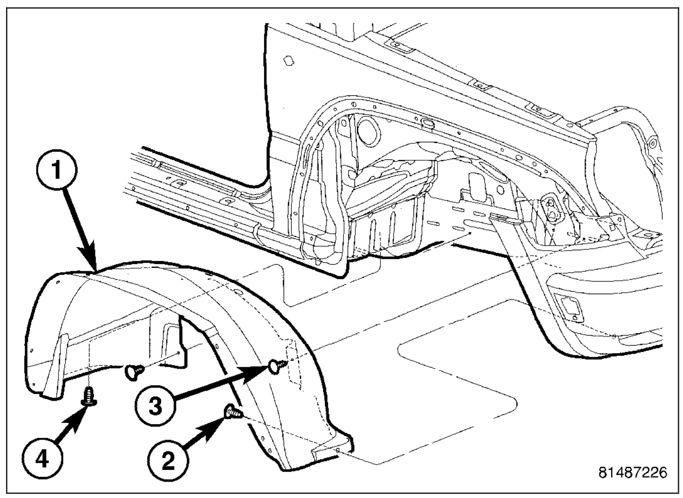
## REMOVAL

1. Raise and support the vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)
2. Turn wheel as necessary to gain access to fasteners.
3. Remove the four rivets connecting the flare to the splash shield
4. Remove the rivet connecting the splash shield to the side sill molding.
5. Remove the three screw/rivets connecting the splash shield to the fascia.
6. Remove the four push pin fasteners and remove the splash shield.




## INSTALLATION

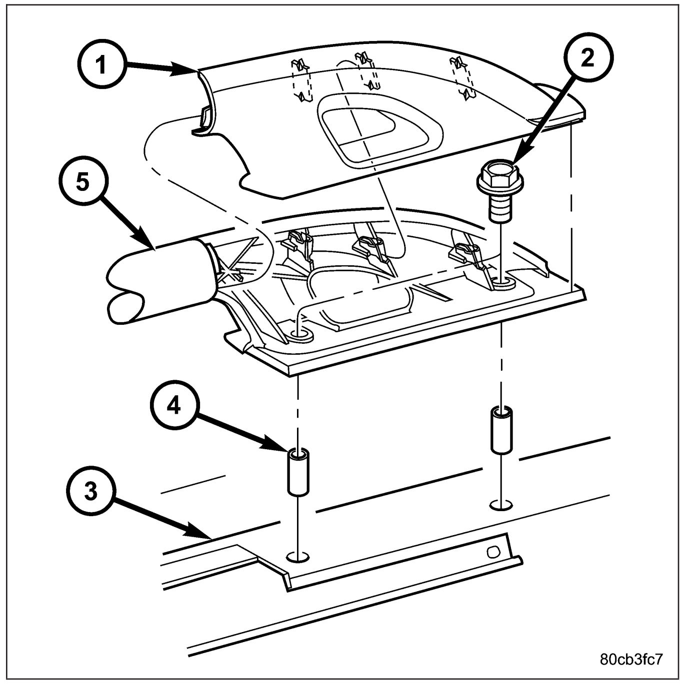
1. Install the splash shield (1) and position above the wheel opening flare molding.
2. Install the four push pin fasteners (2 - 4).
3. Install the three screw/rivets connecting the splash shield to the fascia.
4. Install the four rivets connecting the flare to the splash shield
5. Install the rivet connecting the splash shield to the side sill molding.



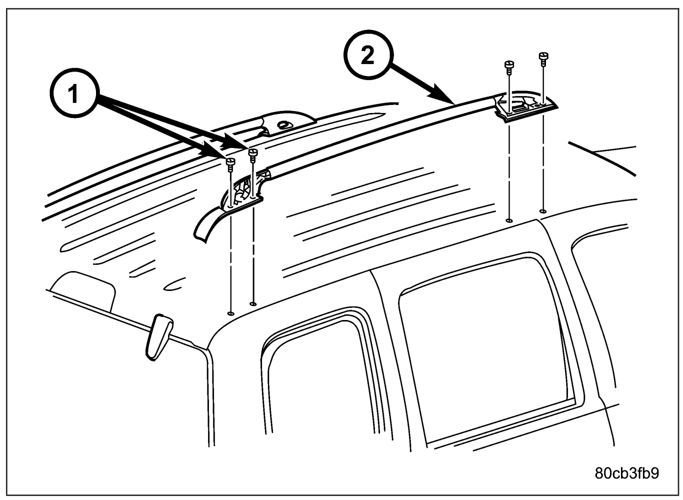
# LUGGAGE RACK

## REMOVAL

1. Using a trim stick C-4755 or equivalent, remove the roof rack covers.

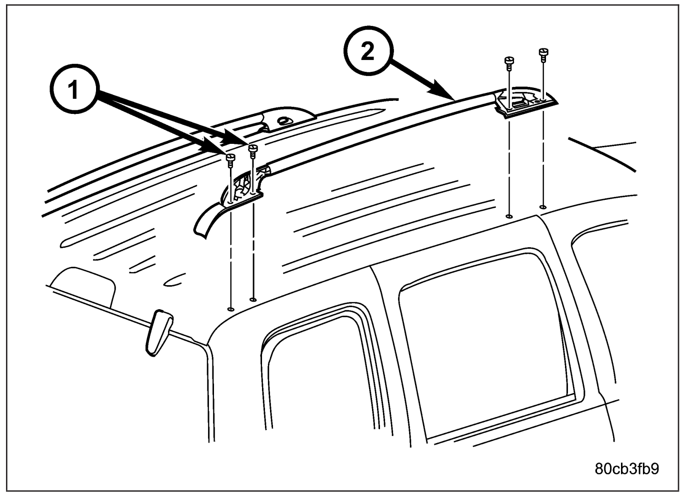



2. Remove the bolts and remove the roof rack.

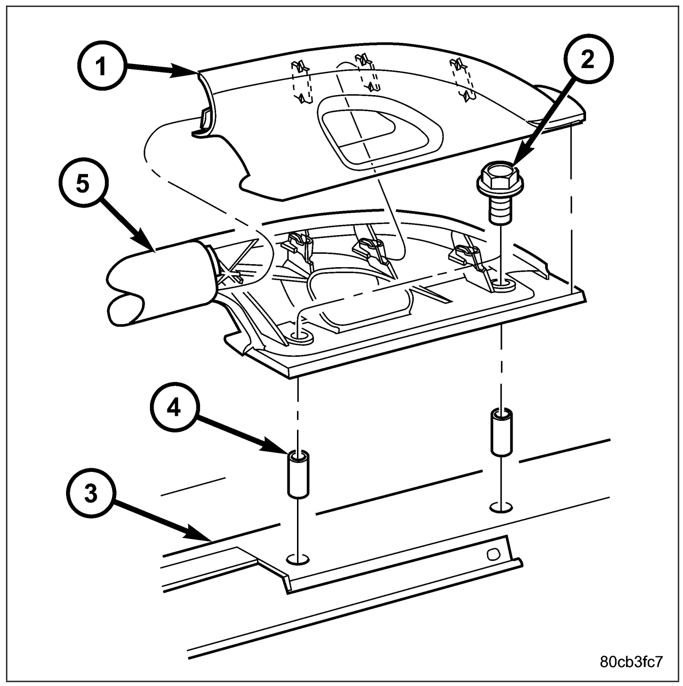


## INSTALLATION

1. Install the roof rack (2) and install the bolts (1).
2. Tighten the bolts to 8 N·m (75 in. lbs.).



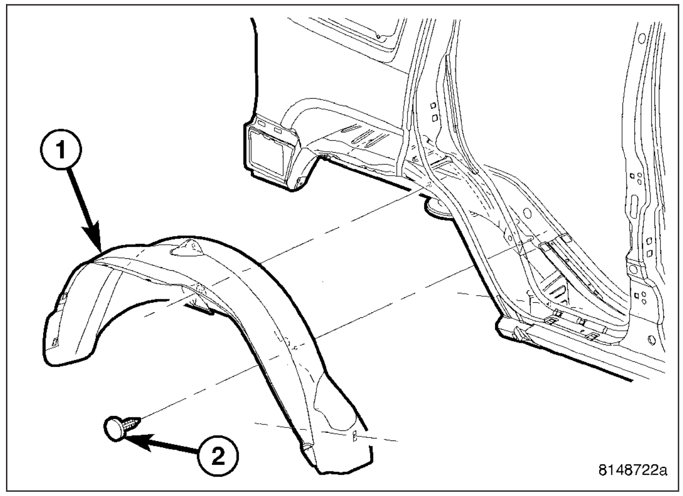

3. Snap on the roof rack covers (1).



# REAR WHEELHOUSE SPLASH SHIELD

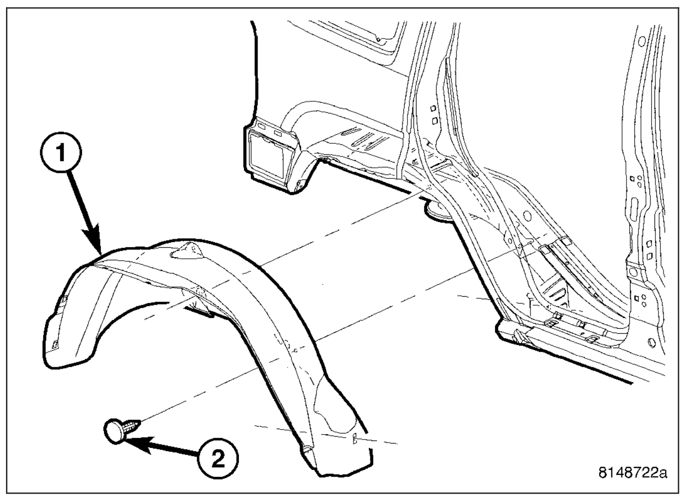
## REMOVAL

1. Raise and support the vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)
2. Remove the wheel.
3. Remove the two rivets connecting the shield to the side sill molding.
4. Remove the four rivets connecting the flare molding to the shield.
5. Remove the two push pin fasteners (2) and remove the shield (1).




## INSTALLATION

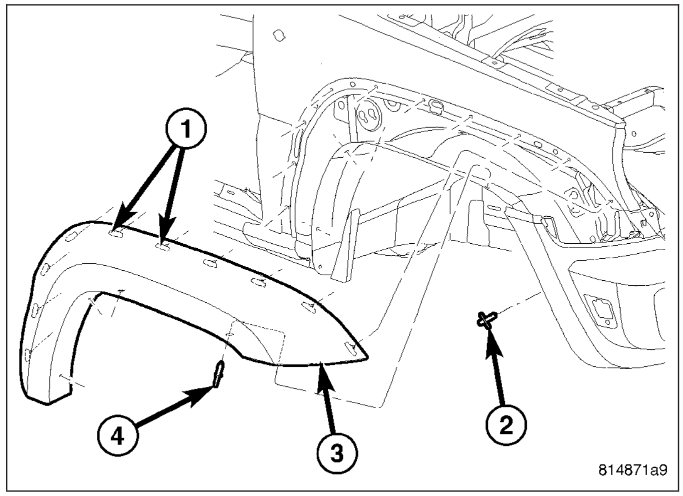
1. Install the splash shield (1) and install the three push pin fasteners (2).
2. Position the rear flare molding and seat the clips attaching it to the body and the rear fascia. (Refer to 23 - BODY/EXTERIOR/WHEEL OPENING FLARE MOLDING - INSTALLATION)
3. Install five new rivets attaching the flare to the splash shield.
4. Install the wheel. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE - WHEEL MOUNTING)



# FRONT WHEEL OPENING FLARE MOLDINGS

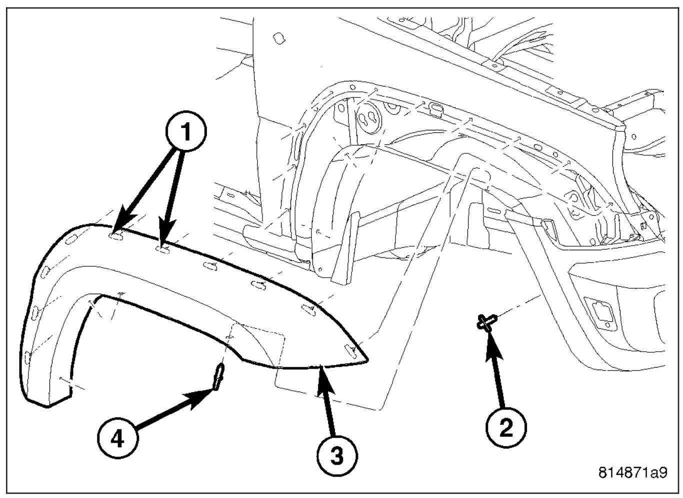
## REMOVAL

1. Remove the four rivets (4) connecting the flare to the splash shield.
2. Using a trim stick C-4755 or equivalent, separate the upper clips (1) attaching the molding (3) to the fender.
3. Remove the flare molding (3).




## INSTALLATION

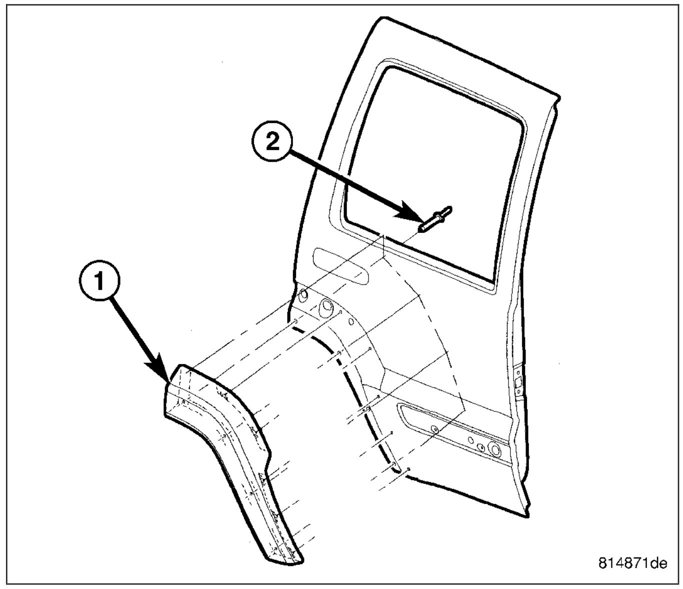
1. Position flare molding and seat clips into the fender.
2. Install four new rivets (4) securing the flare molding to the splash shield.



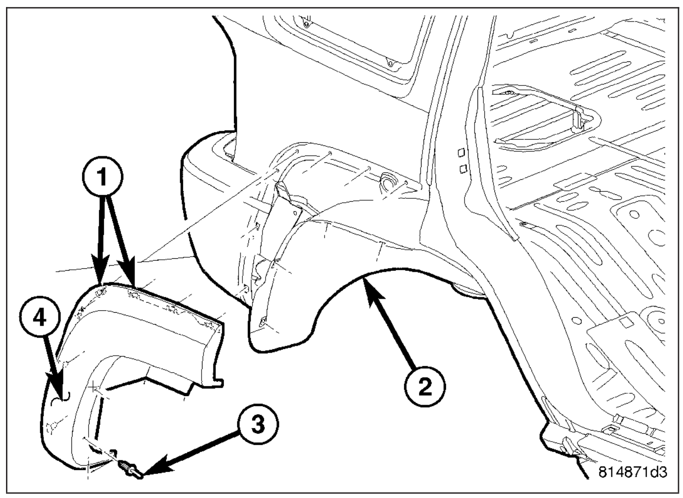
# REAR WHEEL OPENING FLARE MOLDINGS

## REMOVAL

1. Raise and support the vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)
2. Remove the wheel.
3. Open the rear door and remove the five rivets (2) from the inside surface of the door.
4. Using a trim stick C-4755 or equivalent, separate the clips attaching the molding to the door and remove the molding.

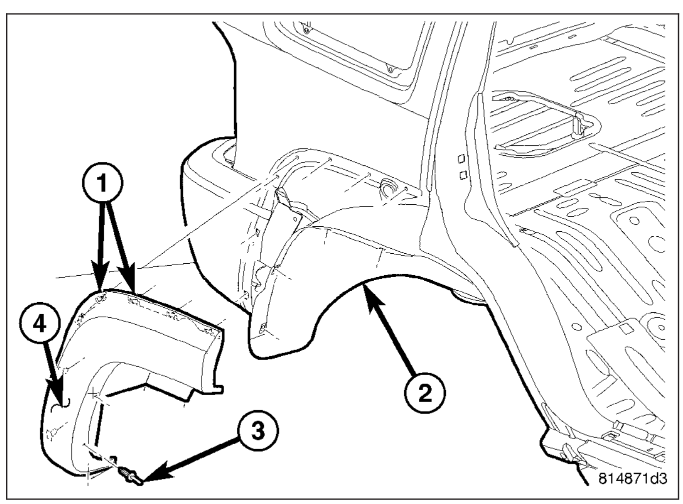



5. Remove the 5 rivets (3) from the rear flare (4) and splash shield (2).
6. Using a trim stick C-4755 or equivalent, separate the clips (1) attaching the molding (4) to the body and the rear fascia and remove the molding.

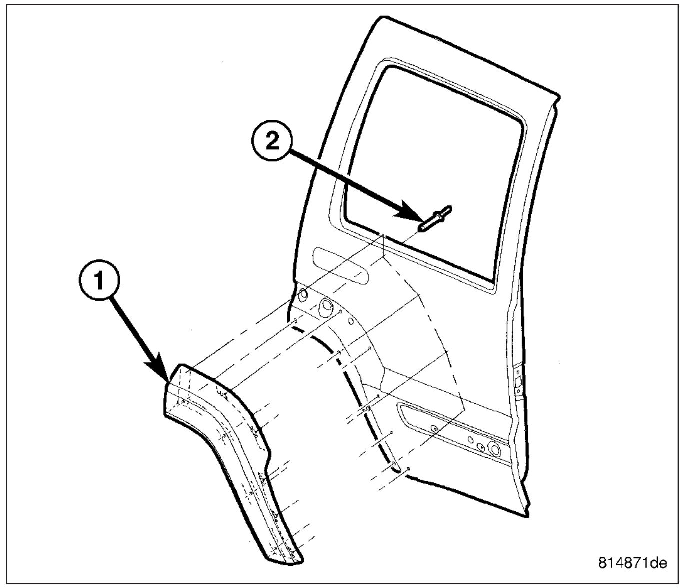



## INSTALLATION

1. Position the rear flare molding and seat the clips (1) attaching it to the body and the rear fascia.
2. Install five new rivets (3) attaching the flare to the splash shield (2).



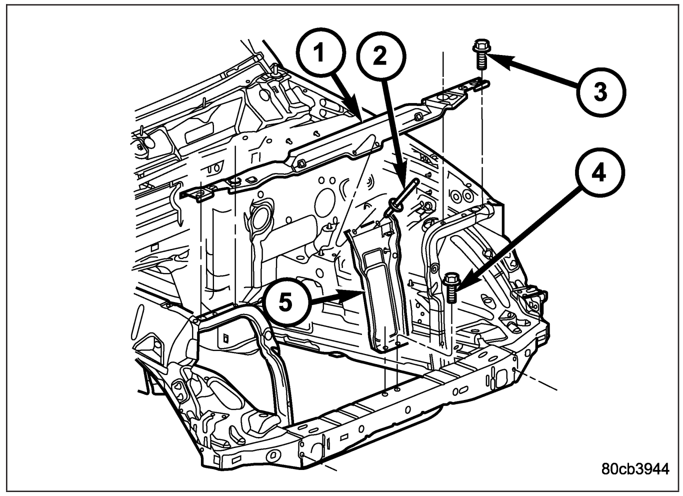
3. Position the door flare (1) and seat the clips.
4. Install five new rivets (2) through the inside surface of the door attaching the flare to the door.
5. Install the wheel. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE - WHEEL MOUNTING)



# RADIATOR CROSSMEMBER

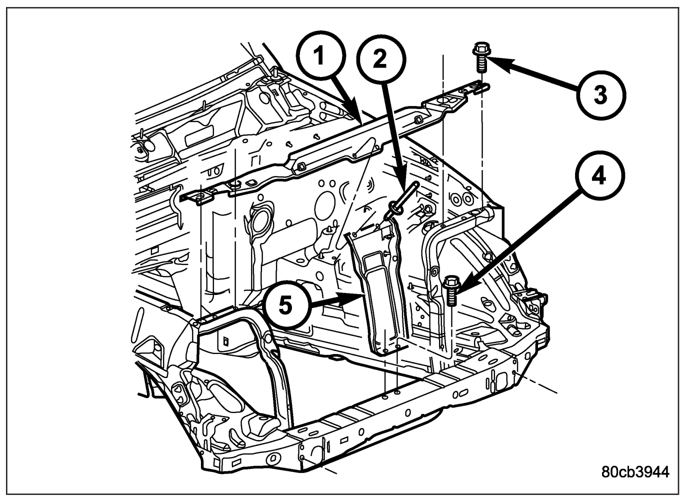
## REMOVAL

1. Remove the grille. (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL)
2. Remove the hood latch. (Refer to 23 - BODY/HOOD/LATCH - REMOVAL)
3. Remove the rivet securing the washer bottle to the crossmember.
4. Remove the rivets attaching the hood latch support to the crossmember.
5. Remove the bolts (4) and remove the hood latch support (5).
6. Remove the bolts (3) and remove the crossmember (1).




## INSTALLATION

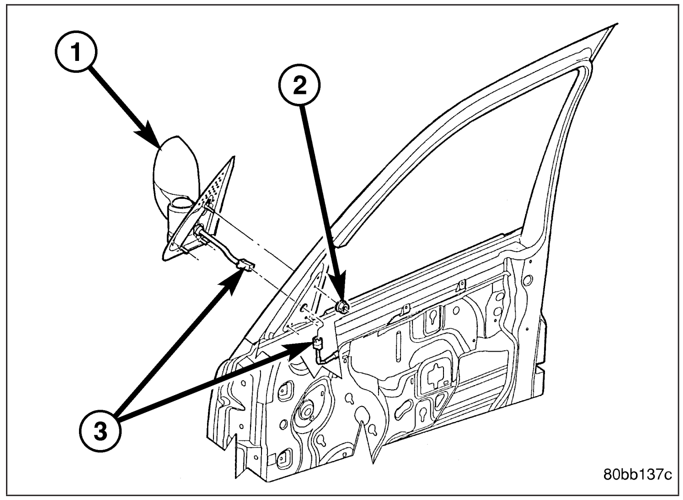
1. Install the crossmember (1) and install the bolts (3).
2. Tighten the bolts to 10 N·m (85 in. lbs.).
3. Install the hood latch support (5) and install the bolts (4).
4. Tighten the bolts to 10 N·m (85 in. lbs.).
5. Install new rivets (2) attaching the hood latch support to the crossmember.
6. Install the hood latch. (Refer to 23 - BODY/HOOD/LATCH - INSTALLATION)
7. Install the grille. (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION)
8. Install a new rivet securing the washer bottle to the crossmember.



# SIDE VIEW MIRROR

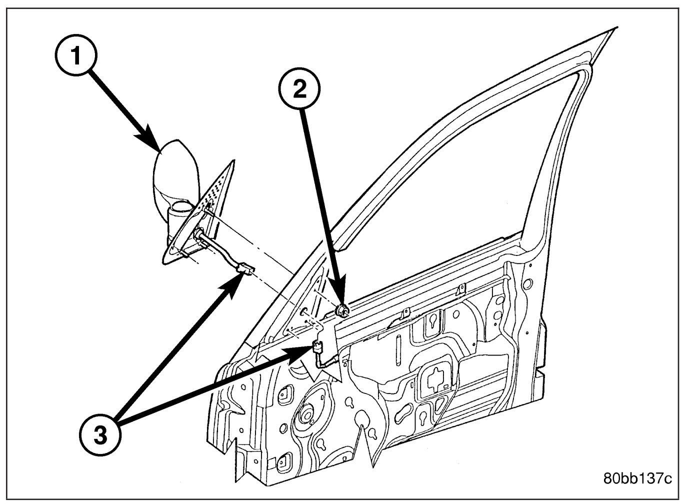
## REMOVAL

1. Remove the trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL)
2. Disconnect the electrical connector (3).
3. Remove the three nuts (2) and remove the mirror assembly (1).




## INSTALLATION

1. Install the mirror assembly (1).
2. Install the three nuts (2) and tighten to 7 N·m (65 in. lbs.).
3. Connect the electrical connector (3).
4. Install the trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION)



# GLASS-OUTSIDE REARVIEW MIRROR

## REMOVAL

**WARNING: Always wear eye and hand protection when servicing the mirror assembly. Failure to observe these warnings may result in personal injury from broken glass.**

1. Carefully pull/pry the broken glass holder from the mirror assembly.
2. Disconnect the heated mirror electrical connectors from the terminals on the mirror glass holder, if equipped.

## INSTALLATION

**CAUTION: It is important to make sure the motor is square to the glass holder (attaching fingers) prior to glass holder attachment, otherwise the glass holder could be installed incorrectly causing poor retention and possible repeat failure.**

1. Position the new mirror glass holder to the mirror assembly.

**NOTE: Position the mirror glass holder so that the moisture drain hole on the mirror glass holder assembly is facing downward.**

2. Align the mirror glass holder's attaching fingers to the mirror motor housing.

**NOTE: Ensure that the protective rubber cover of the mirror motor housing is positioned correctly around the bottom of the fingers area.**

3. Using one hand, firmly press the mirror glass holder assembly into place while at the same time supporting the housing assembly from the backside with the other hand.

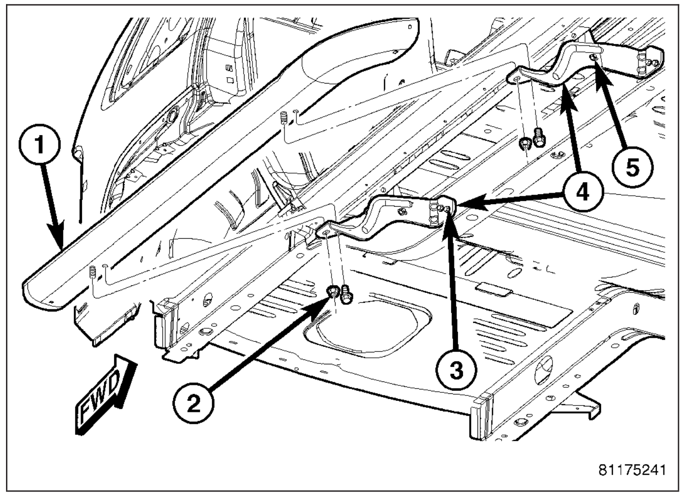
**NOTE: Pressure must be applied equally over the center portion of the mirror to engage the mirror glass holder's attaching fingers to the corresponding fingers on the housing assembly. One or more clicks may be heard when finger engagement takes place.**

4. Verify retention of the mirror glass holder assembly by gently pulling outward on the mirror glass holder.

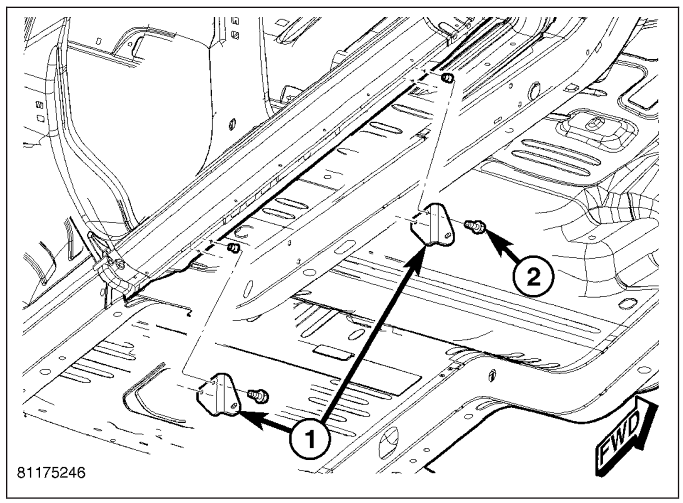
# SIDE STEP

## REMOVAL

1. Raise and support the vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)
2. Remove side step bolts and nuts (2) and remove side step (1).

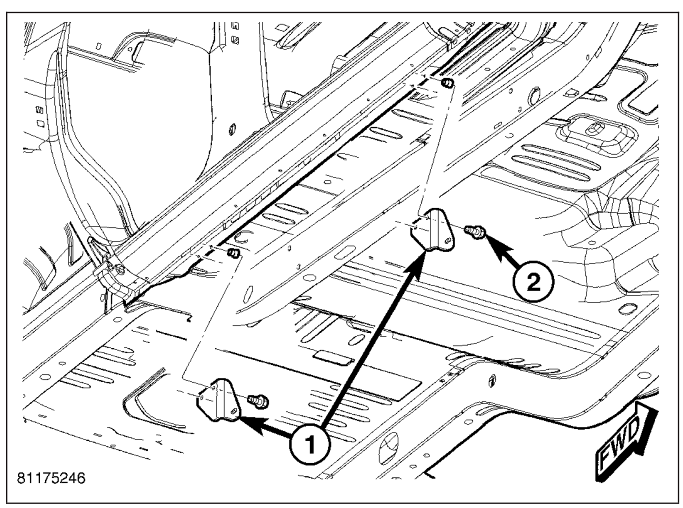



3. Remove sill bracket to frame bracket nuts.
4. Remove frame bracket bolts (2) to frame and remove frame brackets (1).
5. Remove sill bracket bolts and remove sill brackets.

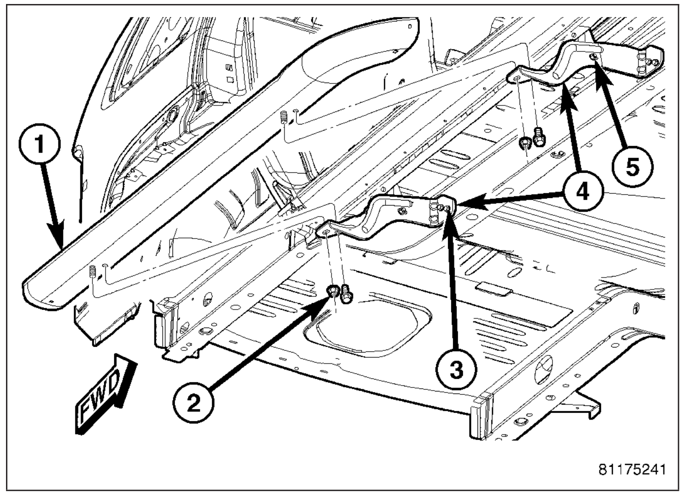



## INSTALLATION

1. Install sill bracket (1) and install bolts (2).
2. Tighten bolts to 23 N·m (17 ft. lbs.).



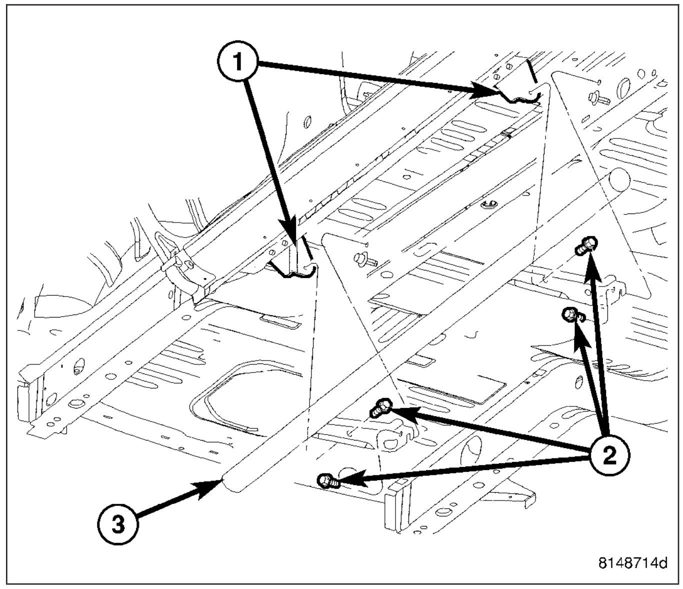
3. Install frame bracket (4) and install bolts.
4. Install sill bracket nut (5).
5. Tighten bolts and nuts to 23 N·m (17 ft. lbs.).
6. Install side step (1) and install bolts/nuts (2).
7. Tighten bolts and nuts to 23 N·m (17 ft. lbs.).



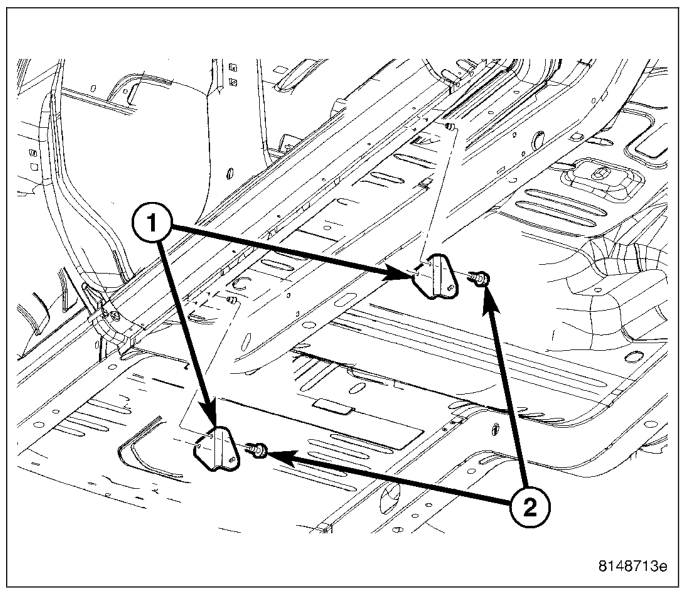
# ROCK RAIL

## REMOVAL

1. Remove the bolts (2) and remove the rock rail.

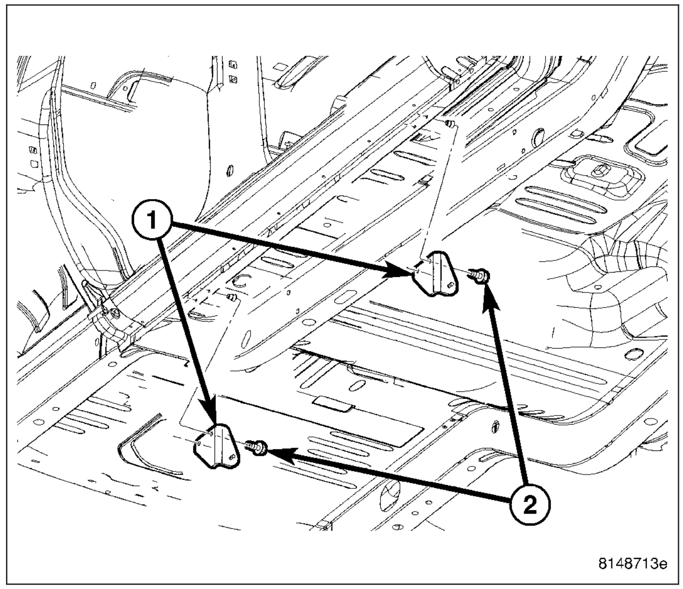



2. Remove the bolts (2) and remove the brackets.

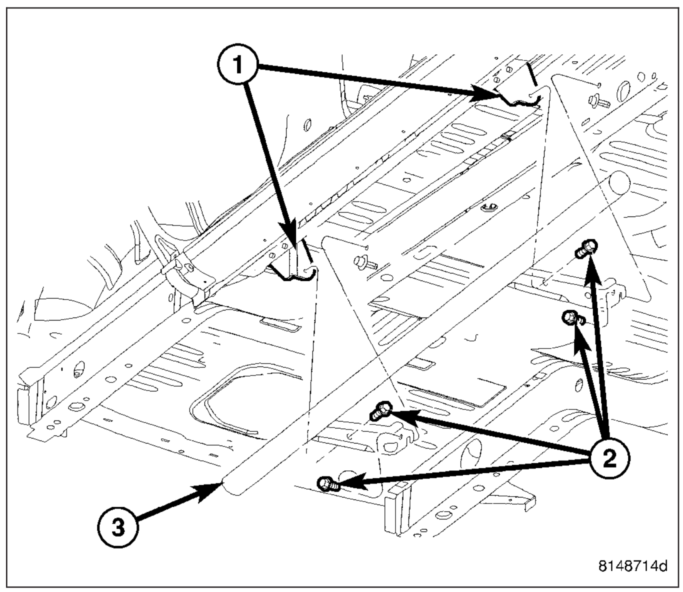


## INSTALLATION

1. Install the brackets (1) and install the bolts (2).
2. Tighten the bolts to 23 N·m (200 in. lbs.).




3. Install the rock rails (3) and install the bolts (2).
4. Tighten the bolts to 23 N·m (200 in. lbs.).

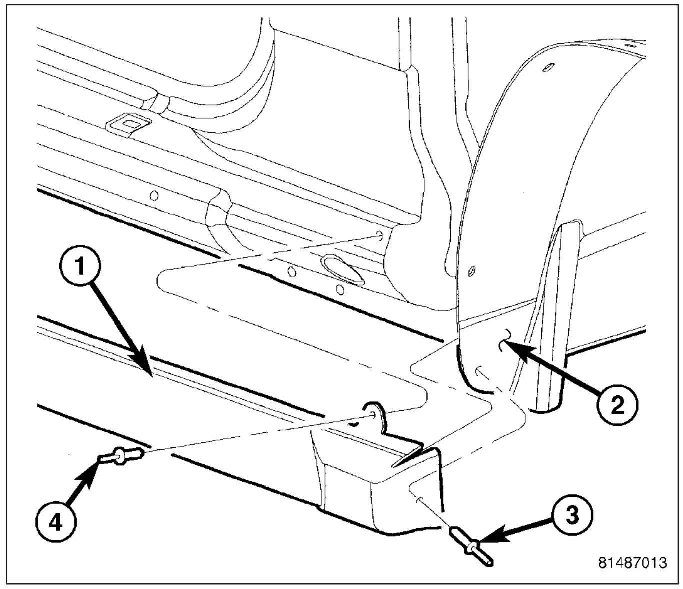


# MOLDING - SILL

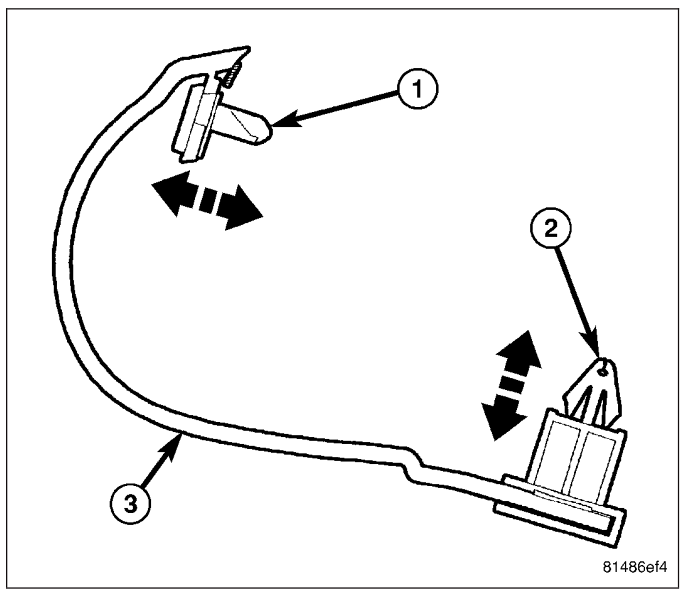
## REMOVAL

### Front Sill Molding

1. Remove the front wheel flare molding as necessary to gain access to the rivets. (Refer to 23 - BODY/EXTERIOR/WHEEL OPENING FLARE MOLDING - REMOVAL)
2. Remove the front rivets (3 and 4).

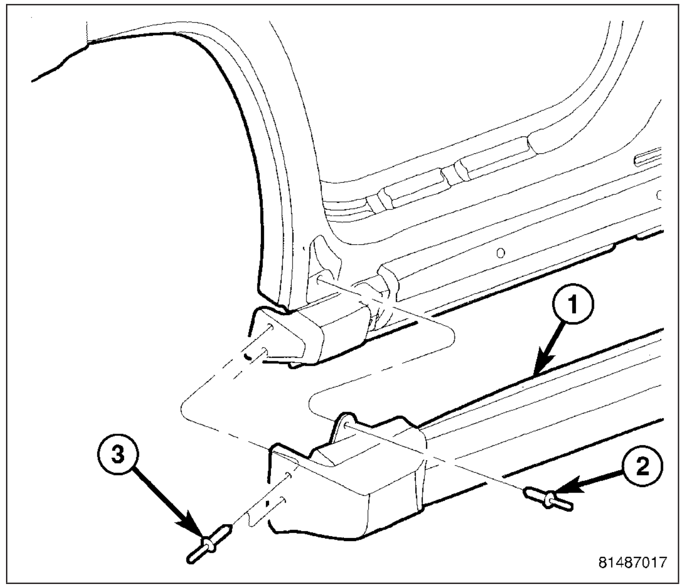



3. Separate the lower clips (2) using a trim tool C-4829-A or equivalent.
4. Using a trim stick C-4755 or equivalent, separate the adhesive tape and upper clips (1) and remove the front sill molding (3).

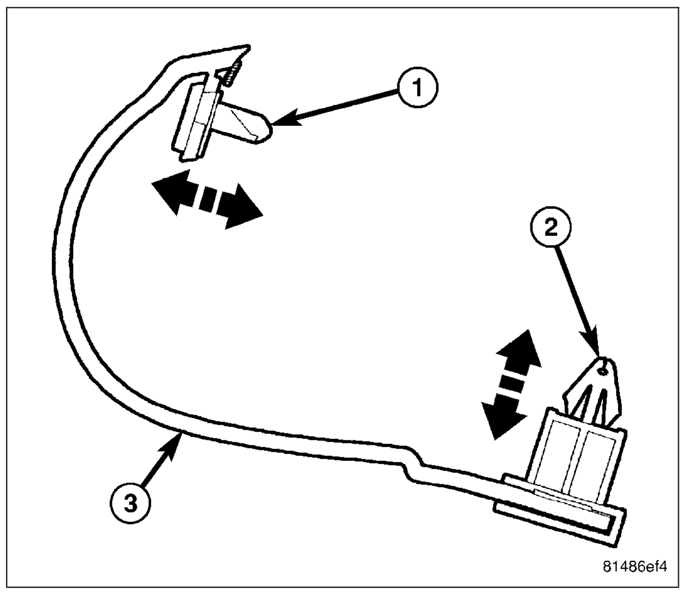


### Rear Sill Molding

1. Open the rear door and remove the rivets (2 and 3).




2. Separate the lower clips (2) using a trim tool C-4829-A or equivalent.
3. Using a trim stick C-4755 or equivalent, separate the adhesive tape and upper clips (1) and remove the rear sill molding (3).

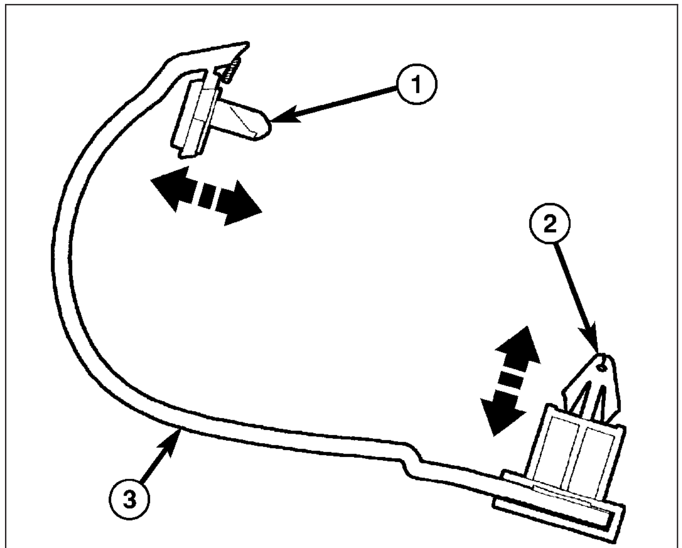



## INSTALLATION

1. Thoroughly clean all residue from the body side sill molding attachment area.
2. Wipe area clean with a 50% solution of water and alcohol and wipe dry.

### Rear Sill Molding

1. Replace the lower push pin fasteners (2) if damaged previously.

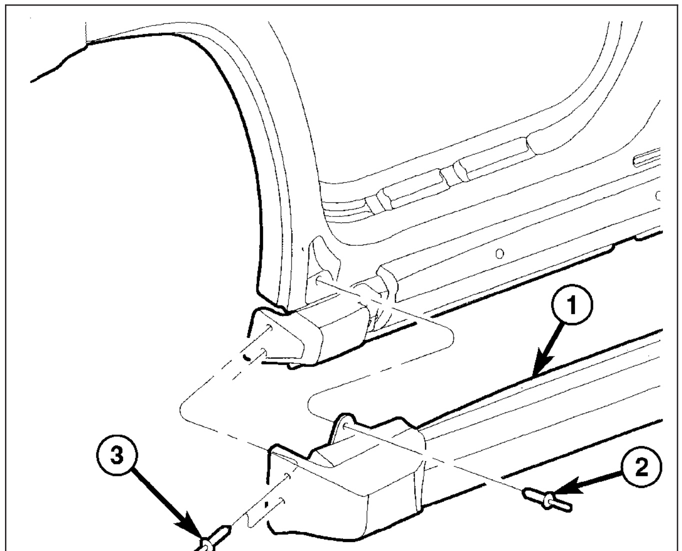


81486ef4

2. Remove the protective backing from the adhesive tape on the upper rear side of the molding.
3. Position the rear sill molding behind the lower rear door and slide forward until fully seated to rear sill with all pins aligned to holes.

**NOTE: Avoid contact with the adhesive strip on rear of sill.**

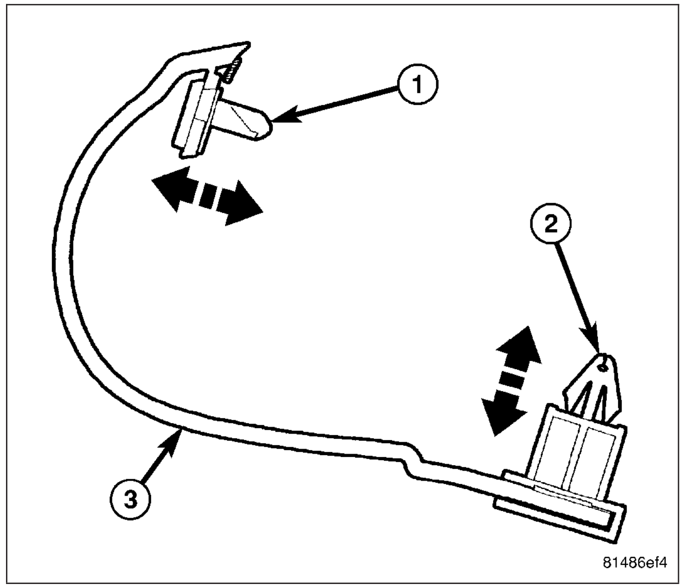
4. Seat the upper push pin fasteners then the lower fasteners fully.



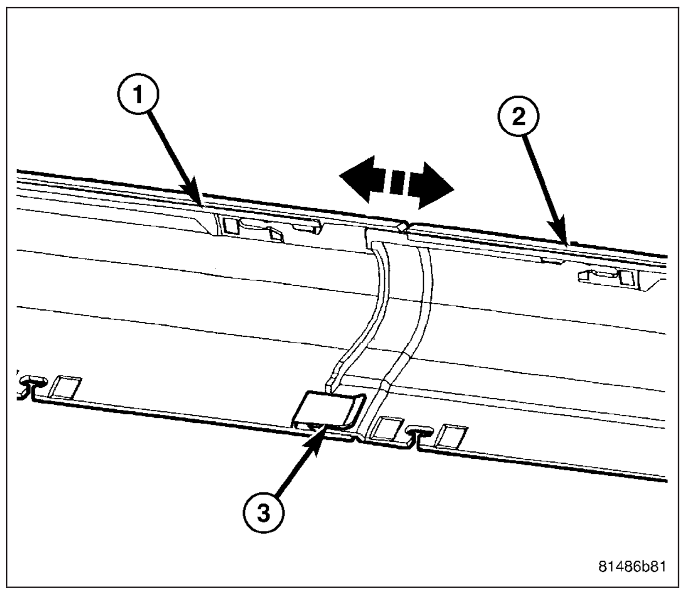
81487017

## Front Sill Molding

1. Replace the lower push pin fasteners (2) if damaged previously.
2. Remove the protective backing from the adhesive tape on the upper rear side of the molding.



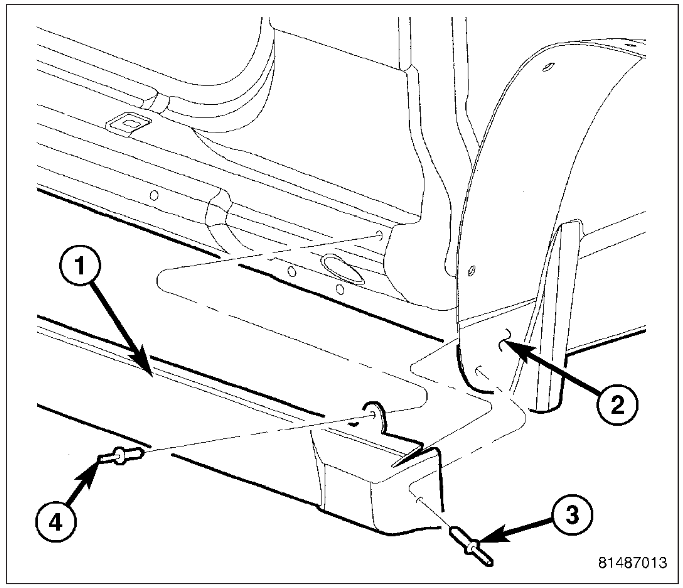

3. Position the front sill molding (1) over the matting flange on the previously installed rear sill molding. Make sure the tab (3) on the front molding (2) is fully engaged onto the rear molding (1) flange and slide rearward.



4. Seat the upper and then the lower push pin fasteners fully.
3. Apply hand pressure along the upper edge (1) of the molding starting at the front of the front molding sliding back to the rear of the rear molding.

**NOTE: This will ensure that the adhesive tape on the back side of the moldings has contacted the sill.**

4. Replace the plastic rivets securing the front and rear moldings at the wheel openings.
5. Install the front wheel opening flare molding as necessary. (Refer to 23 - BODY/EXTERIOR/ WHEEL OPENING FLARE MOLDING - INSTALLATION)



# INSTRUMENT PANEL

## TABLE OF CONTENTS

# INSTRUMENT PANEL

## WARNING

## RESTRAINT SYSTEM

**WARNING: To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the Daimlerchrysler Mopar® parts catalog.**

**WARNING: To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**

**WARNING: To avoid personal injury or death on vehicles equipped with airbags, before performing any welding operations disconnect and isolate the battery negative (ground) cable and disconnect all wire harness connectors from the airbag control module (ACM). Failure to take the proper precautions could result in accidental airbag deployment and other possible damage to the supplemental restraint system circuits and components.**

**WARNING: To avoid personal injury or death, do not attempt to dismantle an airbag unit or tamper with its inflator. Do not puncture, incinerate, or bring into contact with electricity. Do not store at temperatures exceeding 93° C (200° F). An airbag inflator unit may contain sodium azide and potassium nitrate. These materials are poisonous and extremely flammable. Contact with acid, water, or heavy metals may produce harmful and irritating gases (sodium hydroxide is formed in the presence of moisture) or combustible compounds. An airbag inflator unit may also contain a gas canister pressurized to over 2500 psi.**

**WARNING: To avoid personal injury or death, when handling a seat belt tensioner retractor, proper care should be exercised to keep fingers out from under the retractor cover and away from the seat belt webbing where it exits from the retractor cover.**

**WARNING: To avoid personal injury or death, replace all restraint system components only with parts specified in the Daimlerchrysler Mopar® parts catalog. Substitute parts may appear interchangeable, but internal differences may result in inferior occupant protection.**

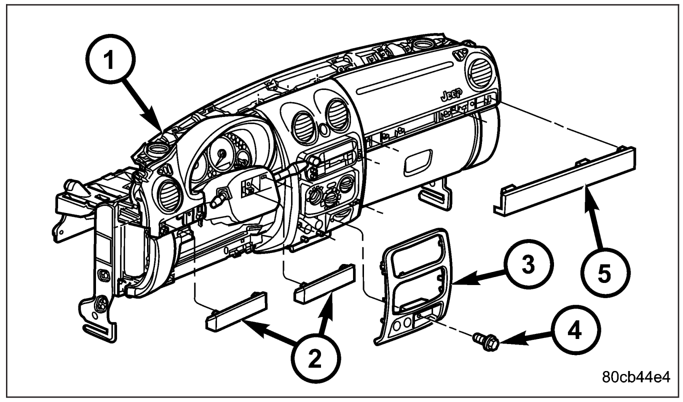
**WARNING: To avoid personal injury or death, the fasteners, screws, and bolts originally used for the restraint system components must never be replaced with any substitutes. These fasteners have special coatings and are specifically designed for the restraint system. Any time a new fastener is needed, replace it with the correct fasteners provided in the service package or specified in the Daimlerchrysler Mopar® parts catalog.**

**WARNING: To avoid personal injury or death, when a steering column has an airbag unit attached, never place the column on the floor or any other surface with the steering wheel or airbag unit face down.**

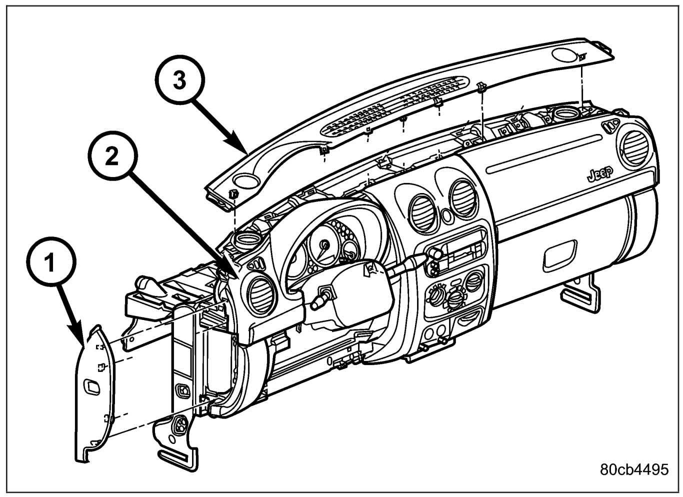
# CLUSTER BEZEL

## REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Remove the driver side trim bezels (2). (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL DRIVER SIDE BEZEL - REMOVAL)

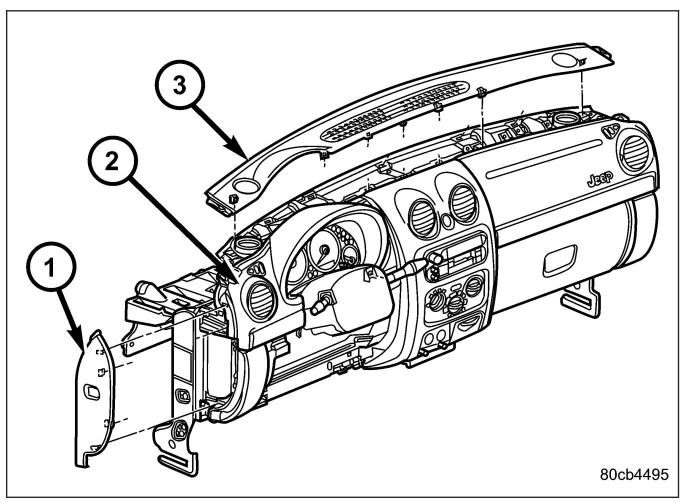



3. Remove the instrument panel top cover (3). (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - REMOVAL)
4. Remove the seven screws and remove the cluster bezel.

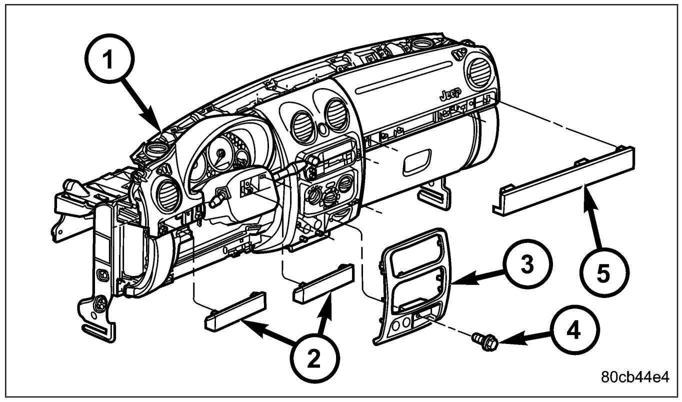



## INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Install the cluster bezel and the seven screws.
3. Install the instrument panel top cover (3). (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - INSTALLATION)



4. Install the driver side trim bezels (2). (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL DRIVER SIDE BEZEL - INSTALLATION)



# GLOVE BOX

## REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Open the glove box.
3. Squeeze the stop tabs located on the sides of the box and allow the box to open fully.
4. With box in the full down position slide the box to the right off of the hinges and remove.

## INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Position the box on and slide the box to the left to engage the hinges.
3. Close the glove box.

# GLOVE BOX LATCH

## REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Remove the glove box. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL)
3. Remove the nine screws and remove the glove box skin.
4. Remove the latch from the locators.

## INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Position the latch onto the locators.
3. Install the glove box skin onto the glove box and install the nine screws.
4. Install the glove box. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION)

# GLOVE BOX LATCH STRIKER

## REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/ INSTRUMENT PANEL - WARNING)
2. Open the glove box.
3. Remove the two striker screws and remove the latch striker.

## INSTALLATION

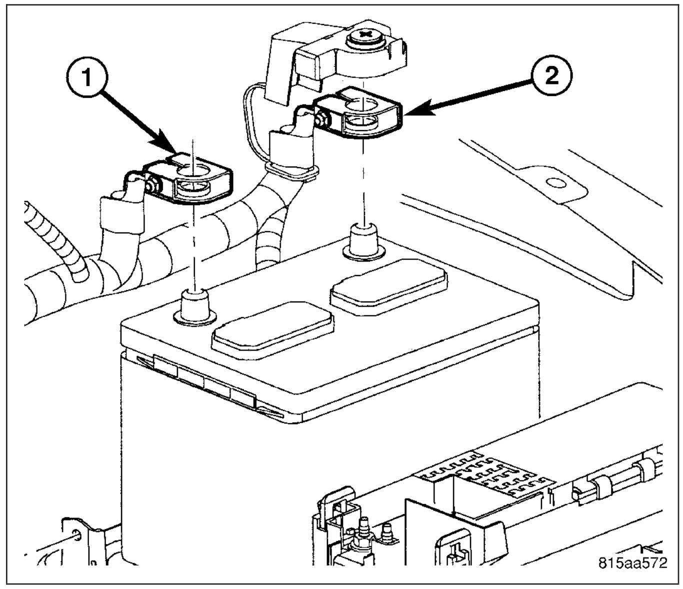
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/ INSTRUMENT PANEL - WARNING)
2. Install the striker and install the two screws.
3. Loosen the screws to adjust if necessary.

# INSTRUMENT PANEL ASSEMBLY

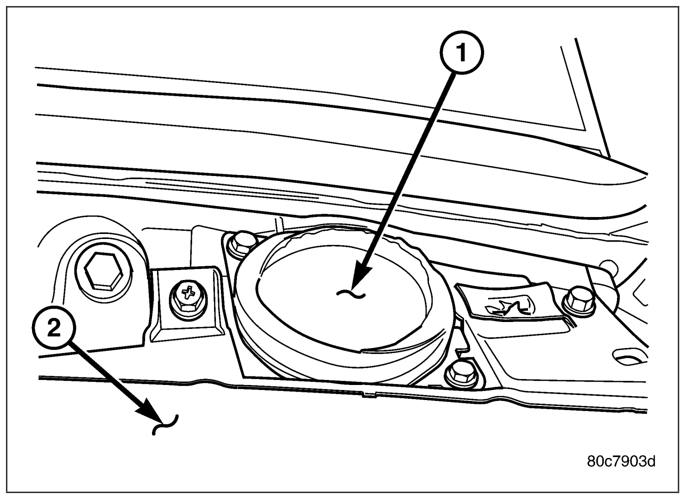
## REMOVAL

**NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.**

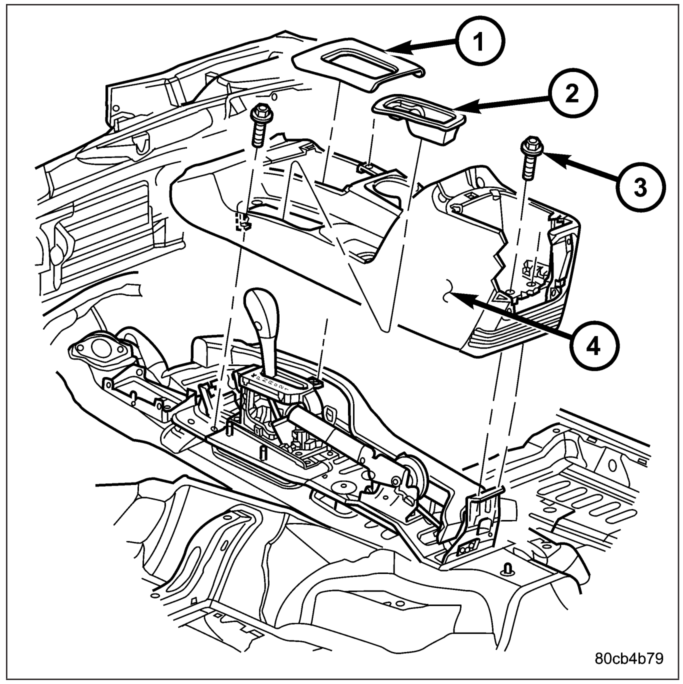
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Disconnect and isolate the battery negative cable.



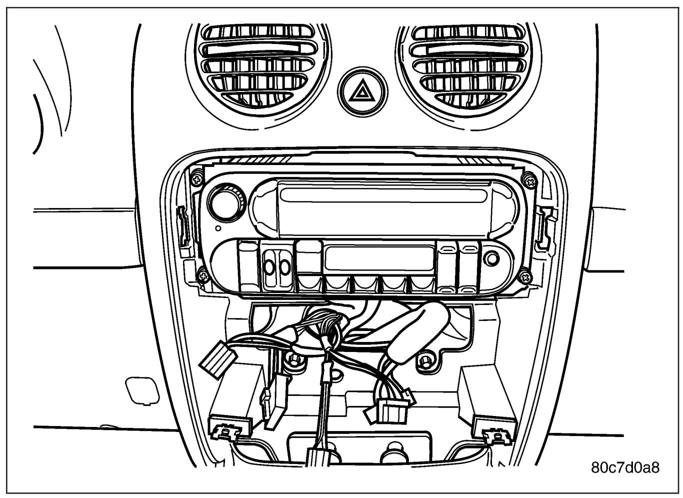

3. Remove the instrument panel speakers. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - REMOVAL)

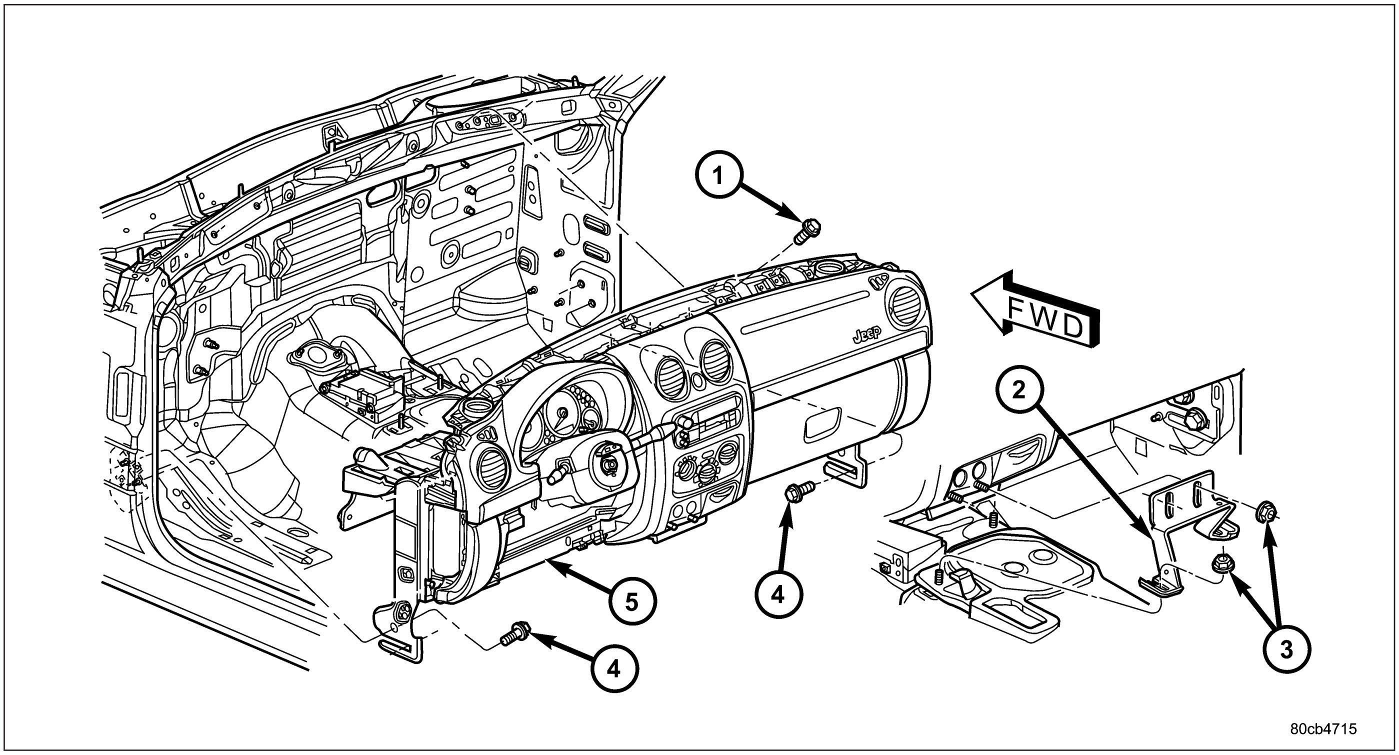


4. Remove the floor console. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)




5. Remove the radio. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - REMOVAL)

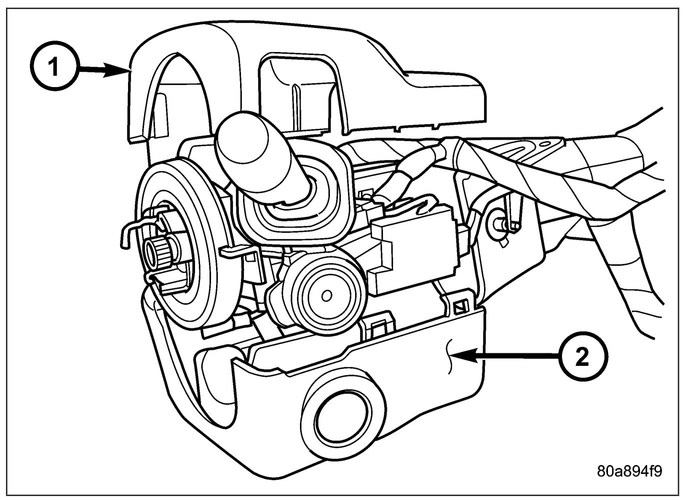


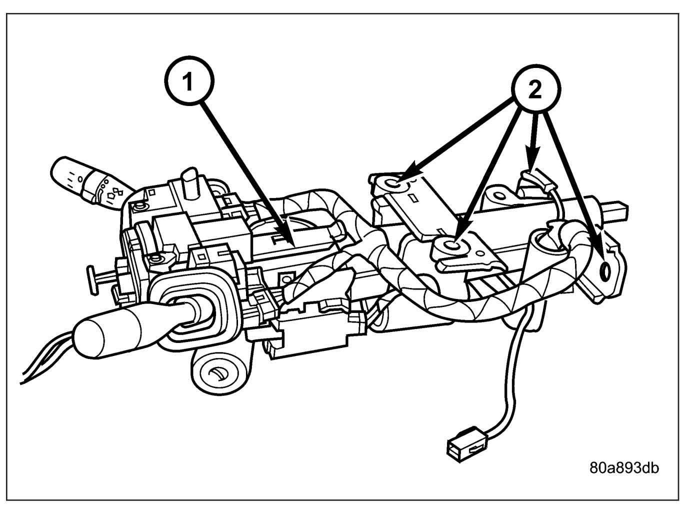



6. Remove the four nuts (3) and remove the center support bracket (2).
7. Remove the ground strap bolt and disconnect the restraint module electrical connector.
8. Position front wheels **straight ahead.**
9. Remove knee blocker cover and knee blocker. (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - REMOVAL)
10. Remove screws from the lower column shroud and remove both the upper (1) and lower (2) shrouds.
11. Turn ignition key to the on position.
12. Disconnect the automatic transmission shifter interlock cable from the column, if equipped.

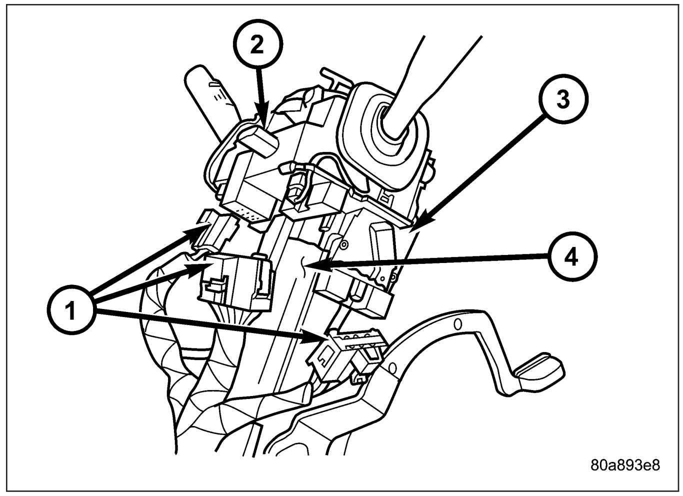
**CAUTION: Do not turn the clockspring more than 90° or damage to the clockspring may occur.**

13. Using a grease pencil or equivalent, mark the position of the steering wheel.
14. Remove the steering coupler bolt and column mounting nuts and bolts then lower column off the mounting studs.



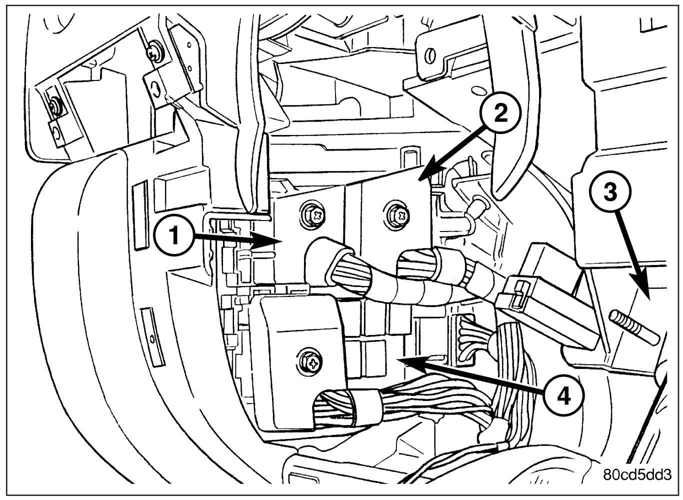



15. Disconnect and remove the wiring harness from the column.
16. Slide the shifter interlock cable from the tie straps.
17. Remove the steering column.

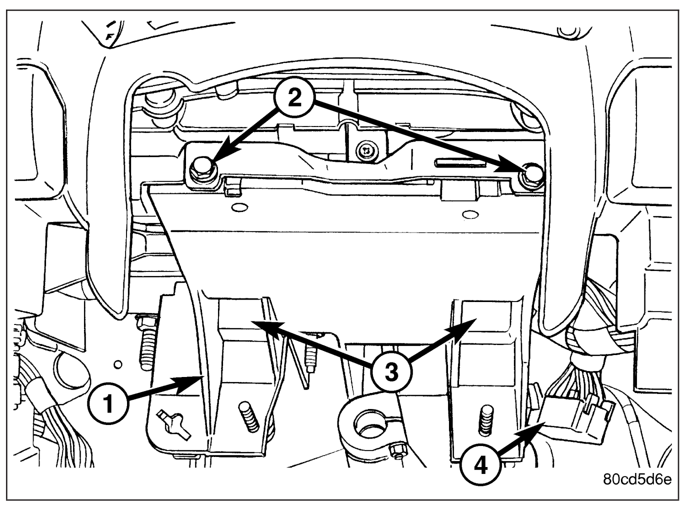


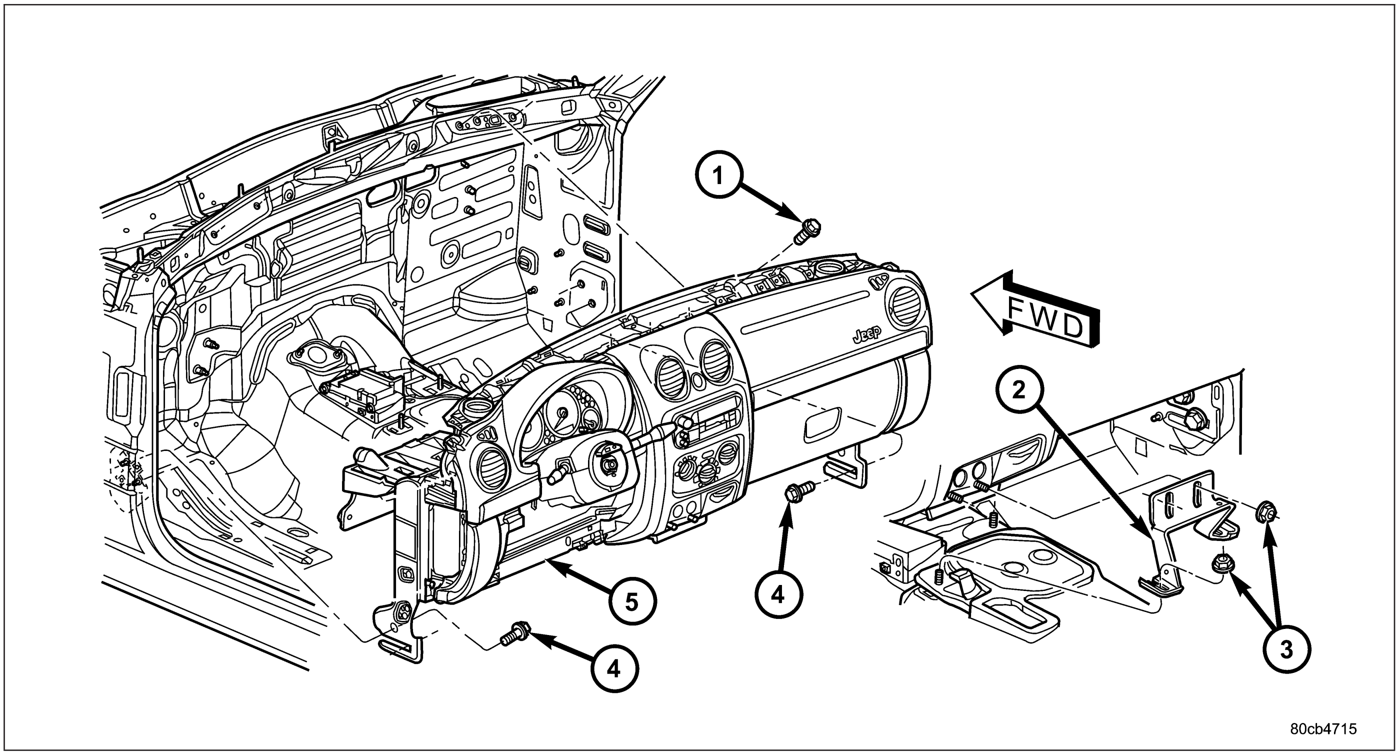

**CAUTION: Do not remove the brake lamp switch. This is a one time component and is not intended for reinstallation. If the brake lamp switch is removed it must be discarded and replaced with a new switch.**

18. Disconnect the brake lamp switch electrical connector.
19. Remove the drivers side cowl trim cover. (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - REMOVAL)
20. Disconnect the wire harness connector behind the drivers side cowl trim cover.
21. Disconnect the green and light blue wire harness bulk connectors at the junction block.

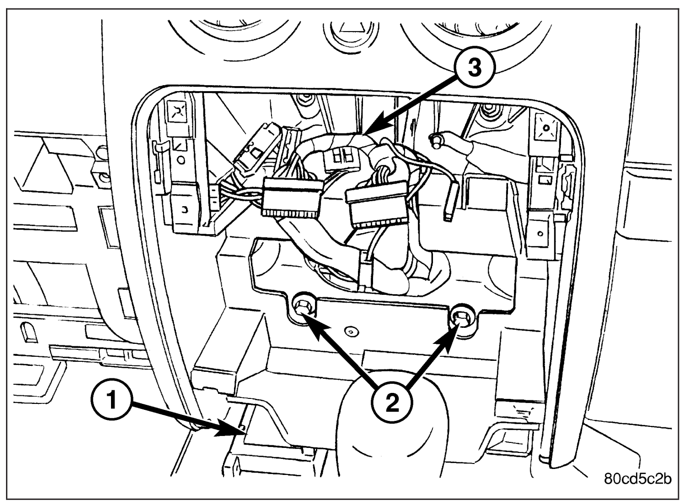



22. Disconnect the electrical connector at the inner side of the pedal support bracket.
23. Remove the two bolts at the front of the pedal support bracket.
24. Remove the two bolts from the bottom side of the pedal support bracket.

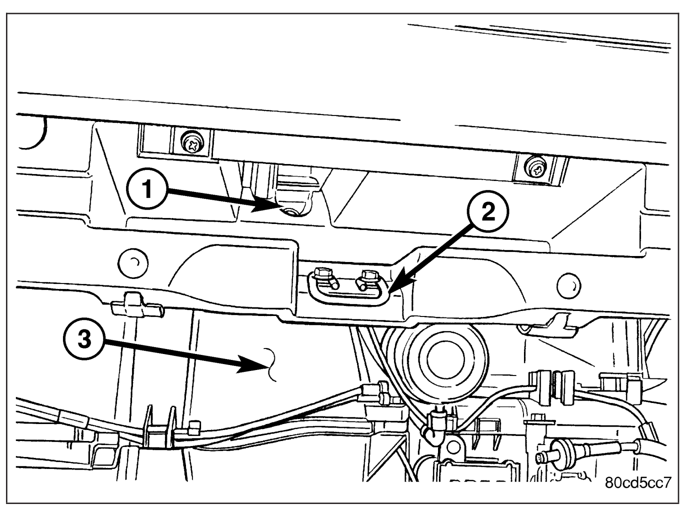




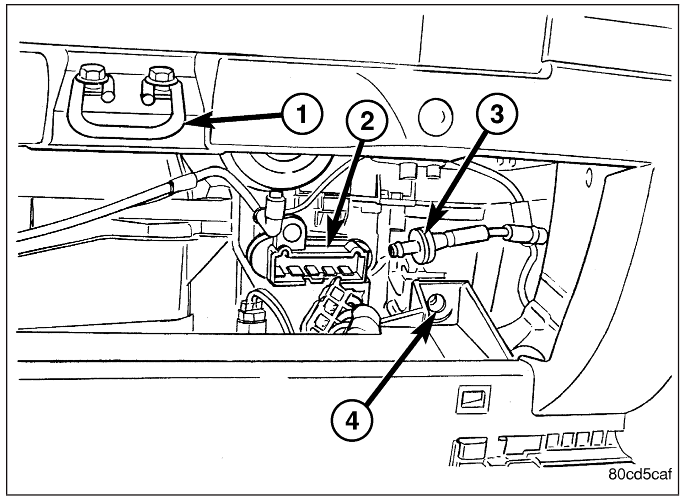

25. Remove the two roll down bracket bolts at the drivers cowl side panel.
26. Remove the glove box. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL)
27. Remove the two HVAC mounting bolts behind the center trim.
28. Remove the passenger side trim bezel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL PASSENGER SIDE BEZEL - REMOVAL)



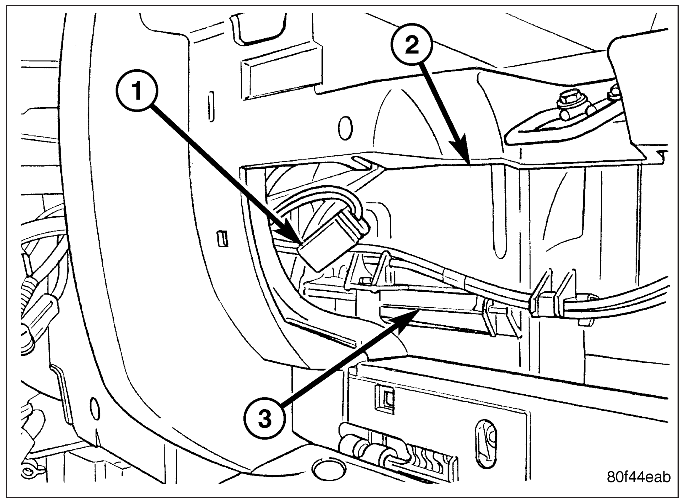

29. Remove the HVAC mounting bolt above the glove box striker.

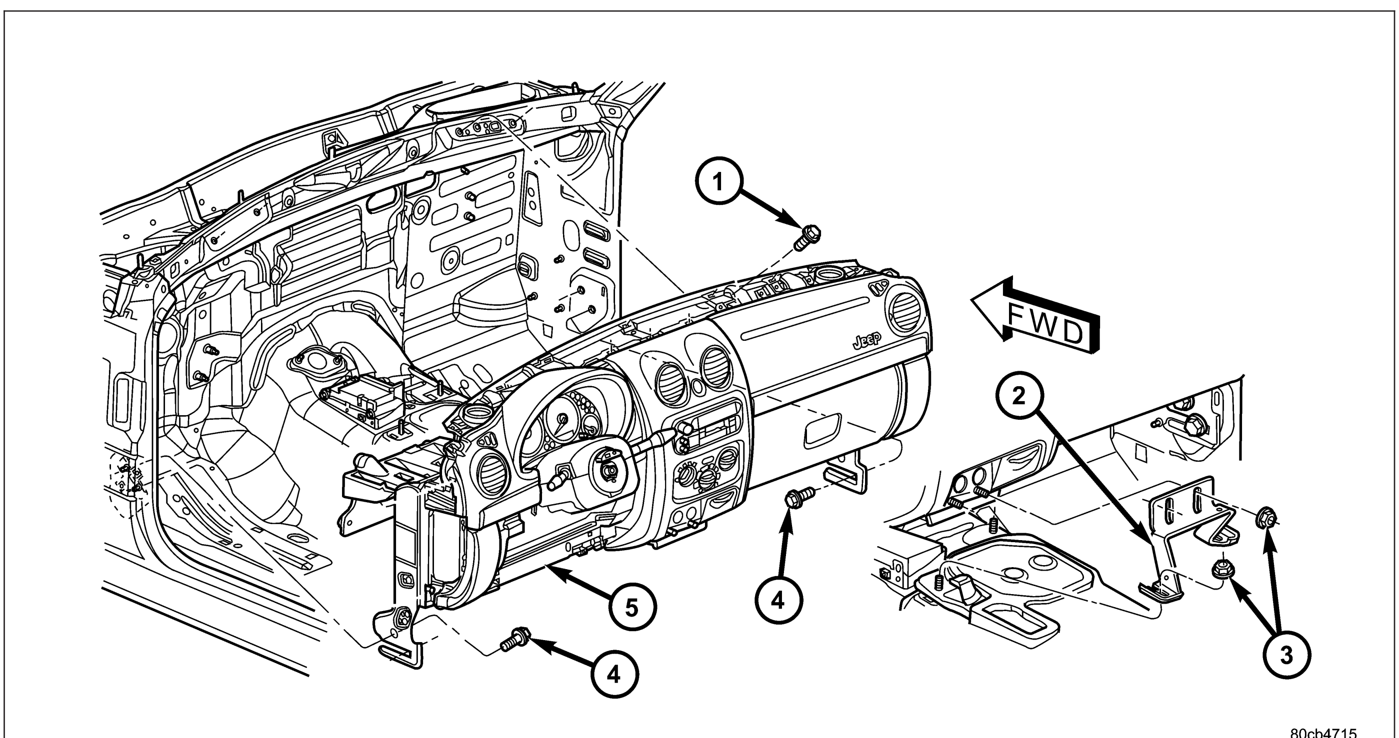


30. Remove the HVAC bolt at the lower outside corner of the glove box opening.
31. Remove the passenger side cowl trim cover. (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - REMOVAL)
32. Disconnect the blower resistor electrical connector.
33. Remove the two roll down bracket bolts at the passenger cowl side panel.
34. Disconnect the vacuum check valve and the vacuum reservoir.




35. Disconnect the blower motor electrical connector.
36. Disconnect the blend door connector.

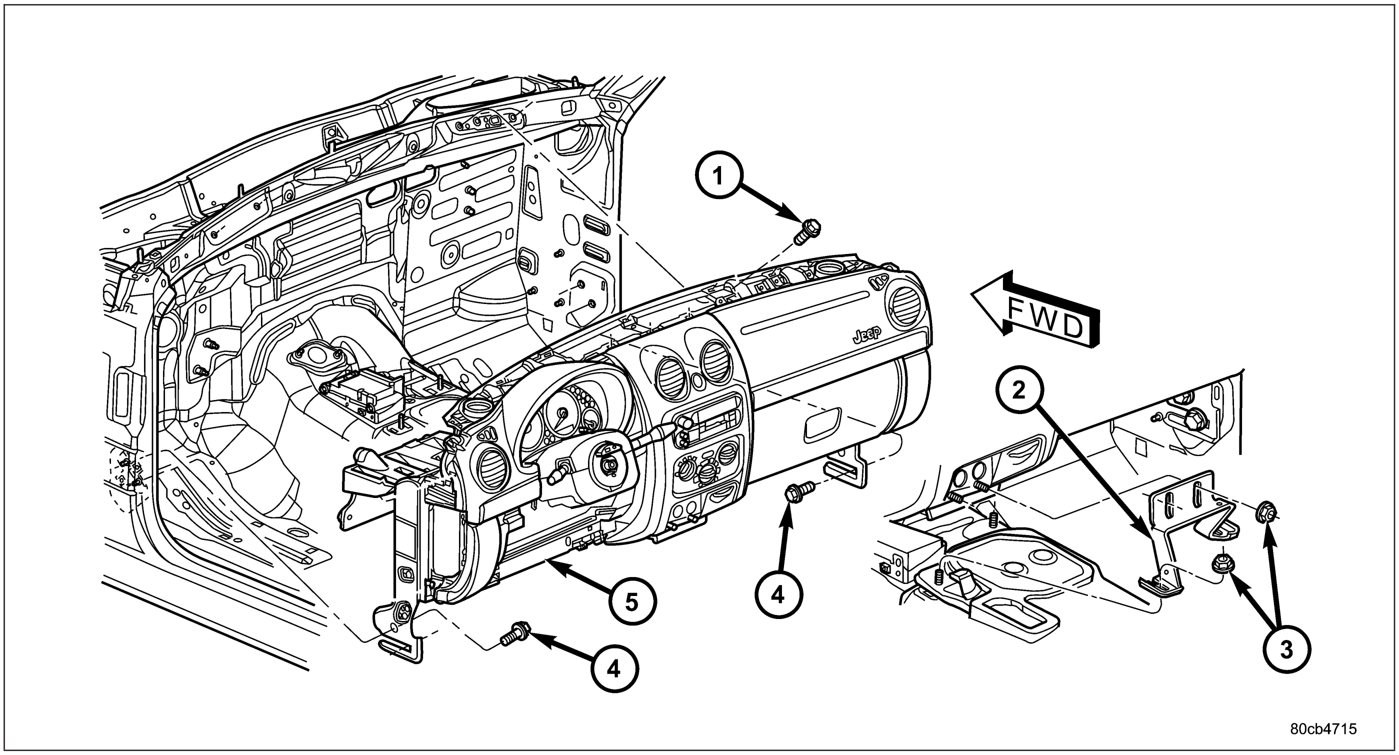



37. Remove the four bolts at the top of the instrument panel connecting to the cowl front panel.

38. Roll the instrument panel rearward and remove the wire harness from routing channel in the rear.
39. Disconnect the push pin fastener and position aside the radio wire harness. Note the location of the harness for installation.
40. Remove the instrument panel.

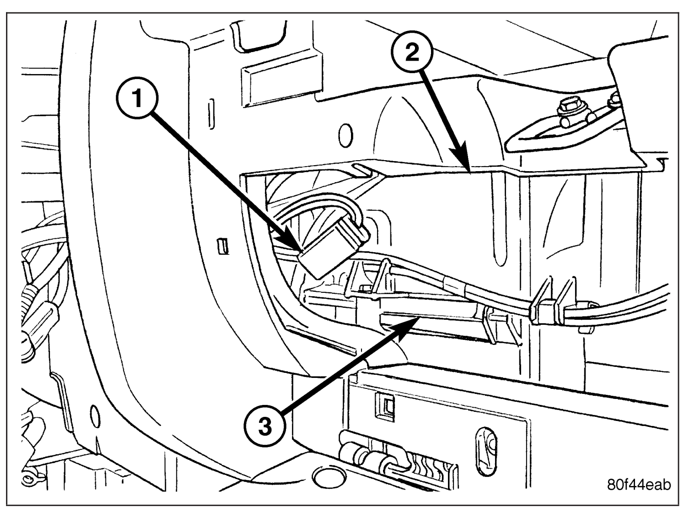
## INSTALLATION



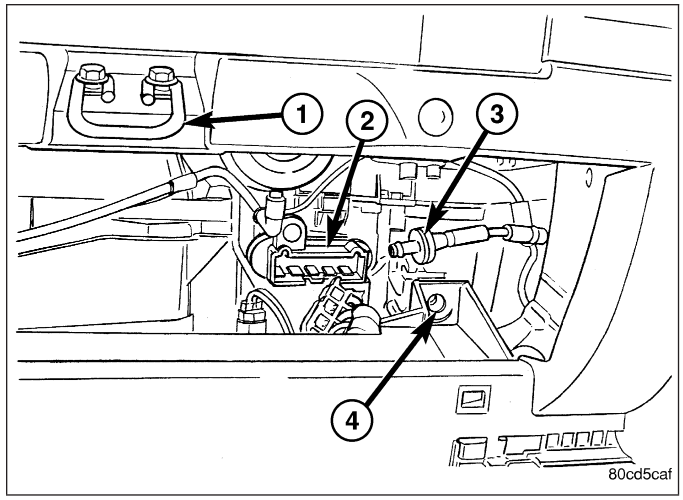

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/ INSTRUMENT PANEL - WARNING)
2. Position the instrument panel into the vehicle.
3. Position the wire harness into the rear routing channel and roll the instrument panel back against the cowl.
4. Position the radio wire harness and seat the push pin fastener.

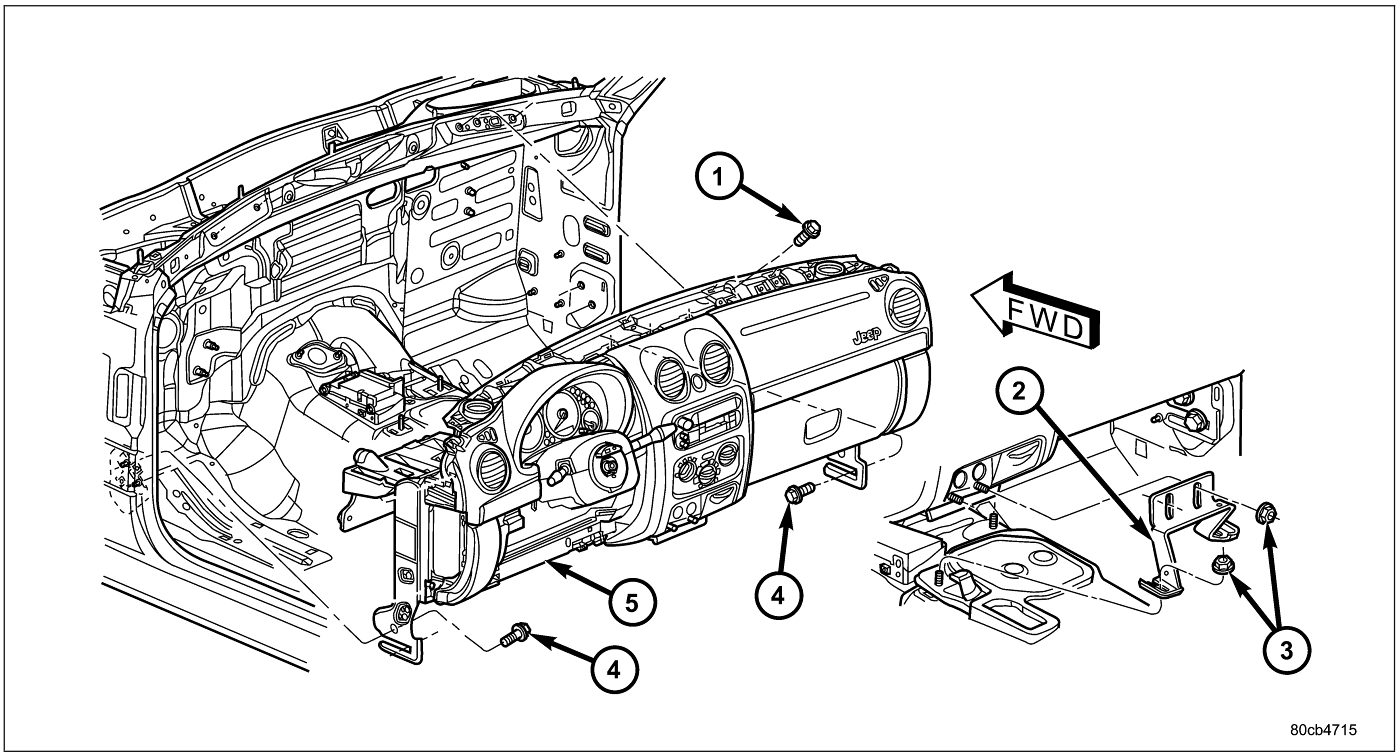
**NOTE: Position the speaker wires through the speaker openings.**

5. Install the four bolts at the top of the instrument panel connecting to the cowl front panel and tighten to 28 N·m (21 ft. lbs.).
6. Connect the blend door electrical connector.
7. Connect the blower motor electrical connector.



8. Connect the vacuum check valve and the vacuum reservoir.
9. Connect the blower resister electrical connector.

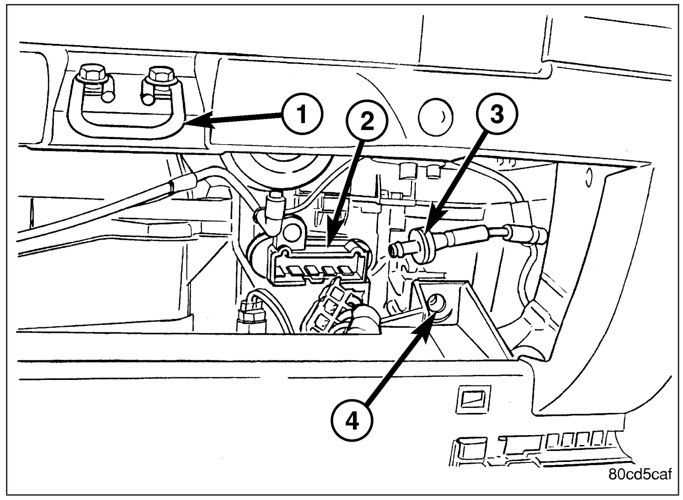


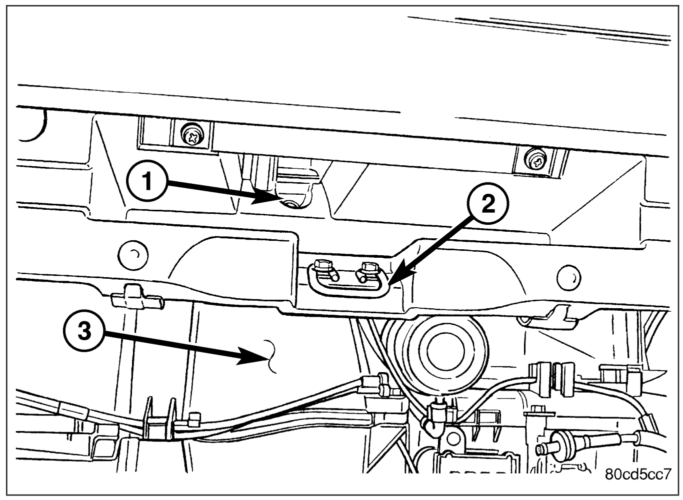

**NOTE: Do not push or pull bracket. Tighten at the rest position.**

10. Install the two roll down bracket bolts at the passenger cowl side panel and tighten to 54 N·m (40 ft. lbs.).

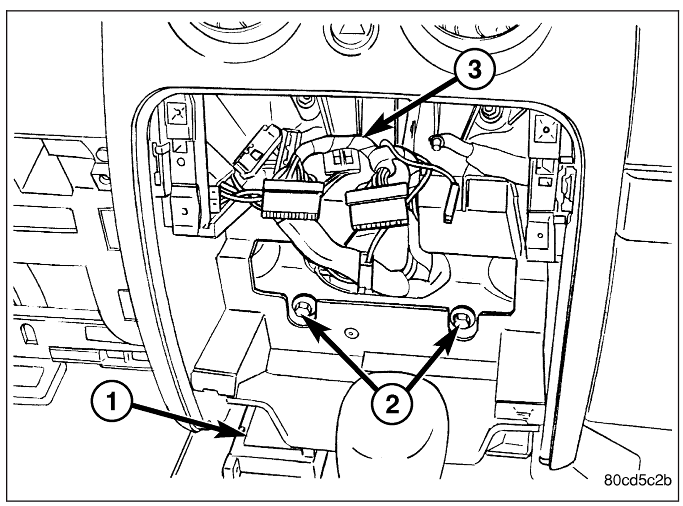
11. Install the HVAC mounting bolt at the lower outside corner of the glove box opening and tighten to 6 N·m (55 in. lbs.).

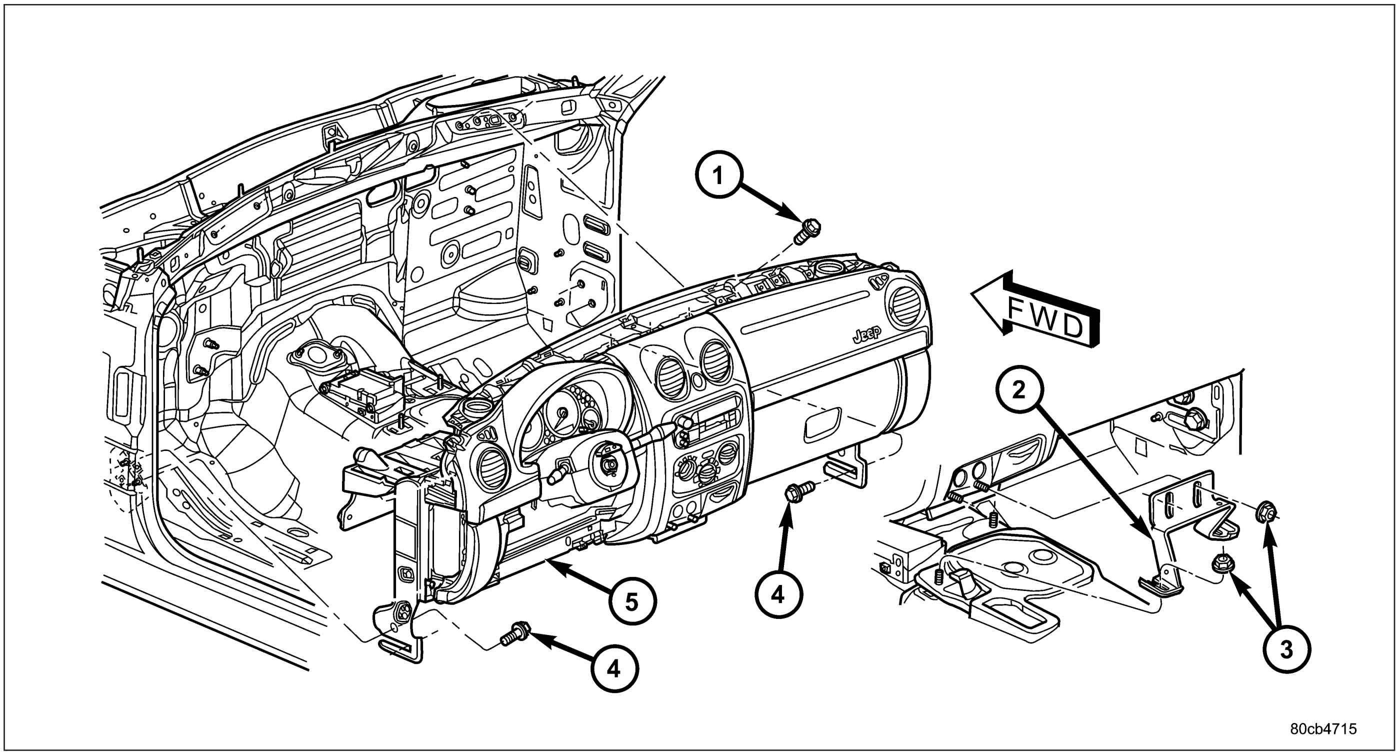



12. Install the HVAC mounting bolt above the glove box striker.



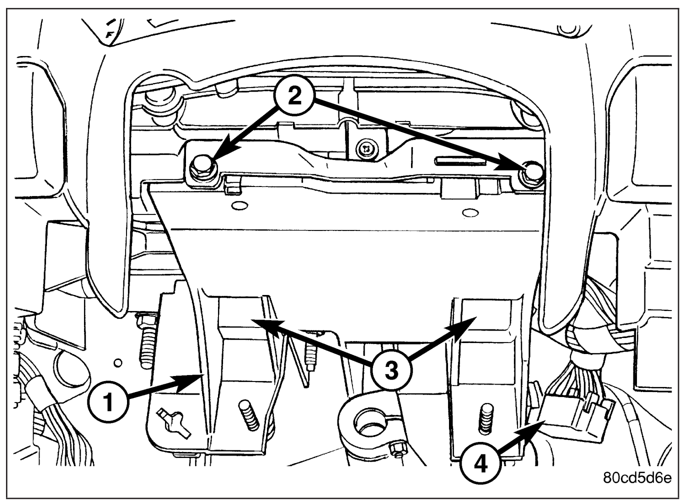

13. Install the passenger side trim bezel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL PASSENGER SIDE BEZEL - INSTALLATION)
14. Install the passenger side cowl trim cover. (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - INSTALLATION)
15. Install the two HVAC mounting bolts behind the center trim.
16. Install the glove box. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION)



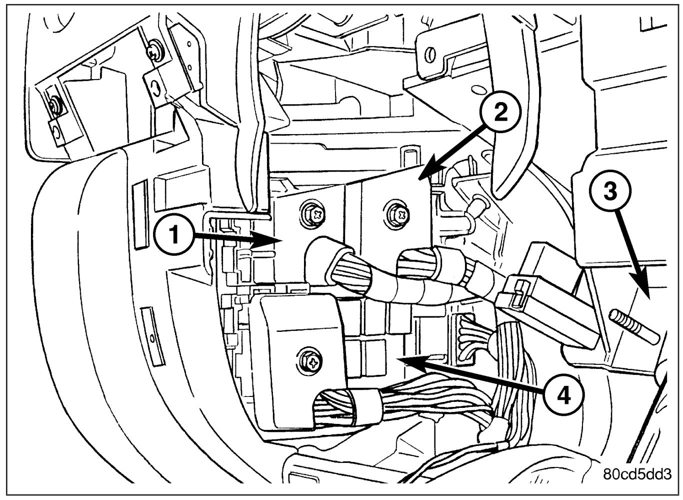



**NOTE: Do not push or pull bracket. Tighten at the rest position.**

17. Install the two roll down bracket bolts at the driver's cowl side panel and tighten to 54 N·m (40 ft. lbs.).
18. Install the two bolts at the bottom side of the pedal support bracket (3).
19. Install the two bolts (2) at the front of the pedal support bracket.
20. Connect the electrical connector at the inner side of the pedal support bracket.

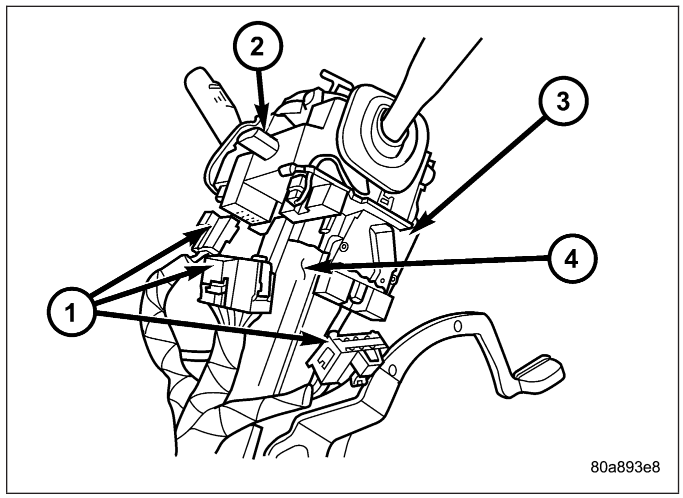


21. Connect the wiring harness electrical connectors at the junction block.
22. Connect the wire harness electrical connector behind the driver's side cowl trim cover.
23. Install the driver's side cowl trim cover. (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - INSTALLATION)




**CAUTION: Do not remove the brake lamp switch. This is a one time component and is not intended for reinstallation. If the brake lamp switch is removed it must be discarded and replaced with a new switch.**

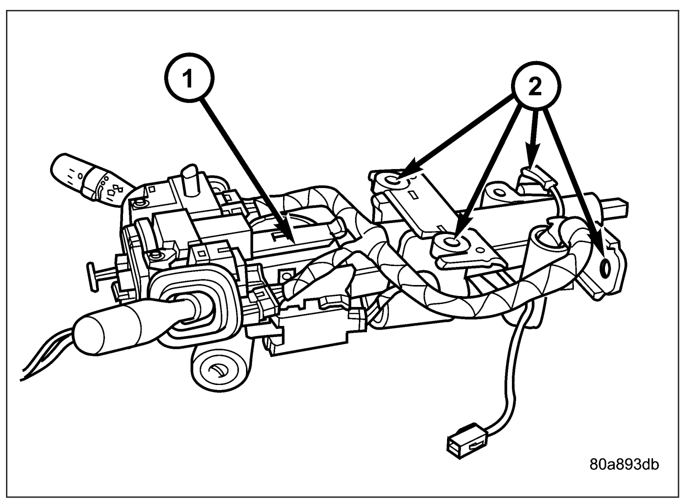
24. Connect the brake lamp switch electrical connector.
25. Install the steering column into the vehicle.
26. Slide the shifter interlock cable into the tie straps.
27. Install and connect the wire harness for the column.

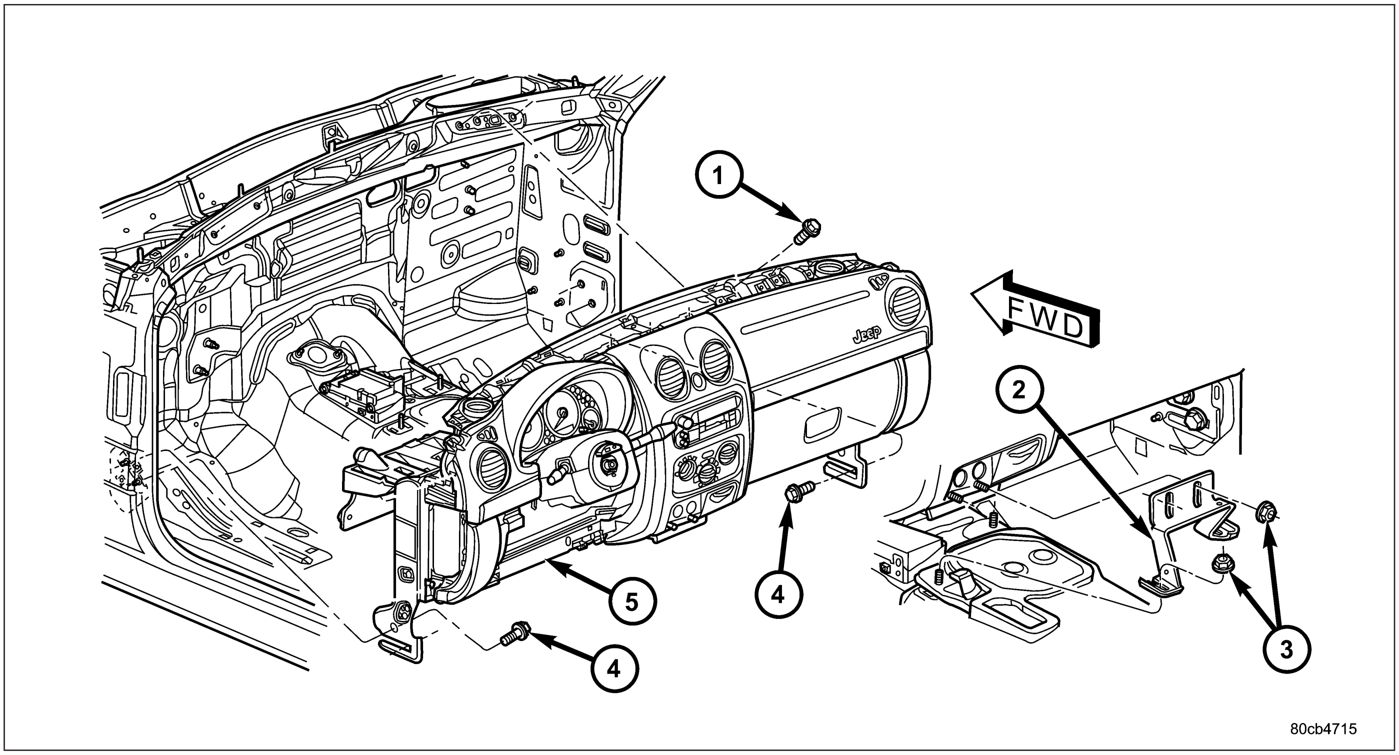



28. Install the two mounting nuts and the two mounting bolts all finger tight.

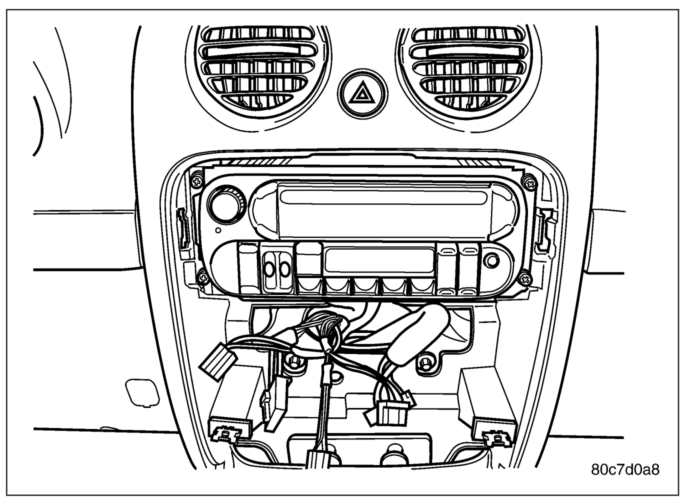
**CAUTION: Lower nuts must be installed and tightened first then the upper nuts in order to prevent damage to the capsules.**

29. Tighten the lower mounting nuts to 17 N·m (13 ft. lbs.).
30. Tighten the upper mounting nuts to 17 N·m (13 ft. lbs.).
31. Install the steering column coupler bolt and tighten to 49 N·m (36 ft. lbs.).
32. Install the upper and lower shrouds and install the screws.
33. Install the knee blocker cover and knee blocker. (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - INSTALLATION)

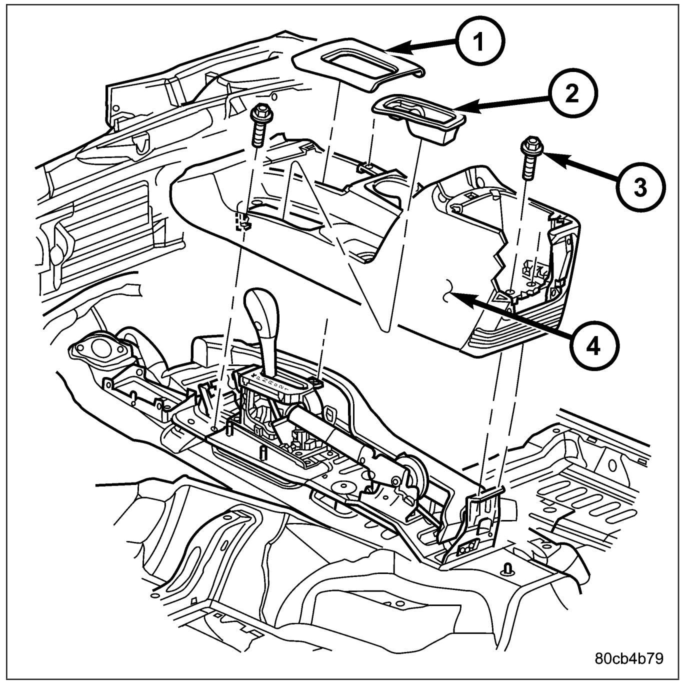




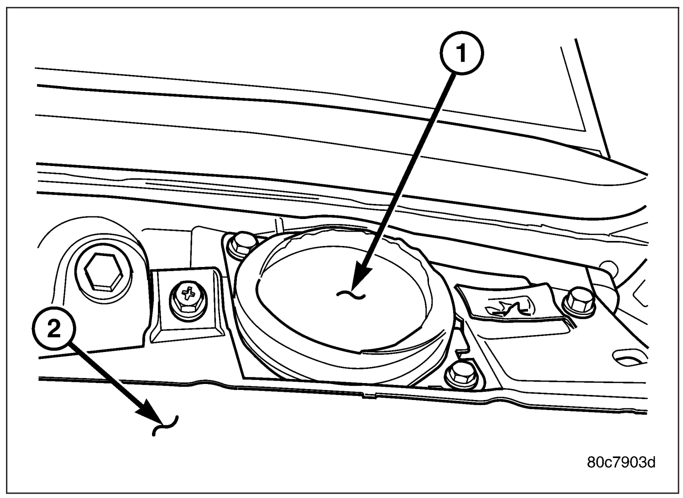

34. Install the ground strap and bolt and connect the restraint module electrical connector.
35. Install the center support bracket (2) and hold it tight against the instrument panel.
36. Tighten the lower nuts to 23 N·m (17 ft. lbs.).
37. Tighten the upper bracket nuts to 23 N·m (17 ft. lbs.).
38. Install the radio. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - INSTALLATION)



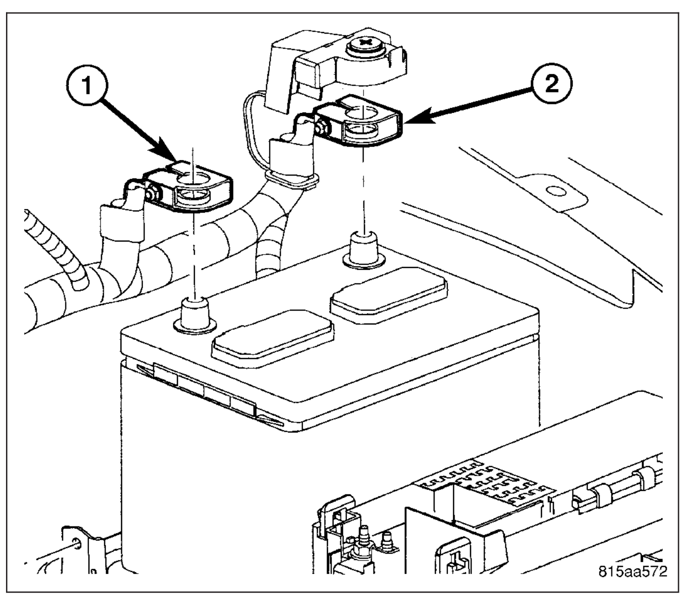
39. Install the floor console. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)




40. Install the speakers. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - INSTALLATION)



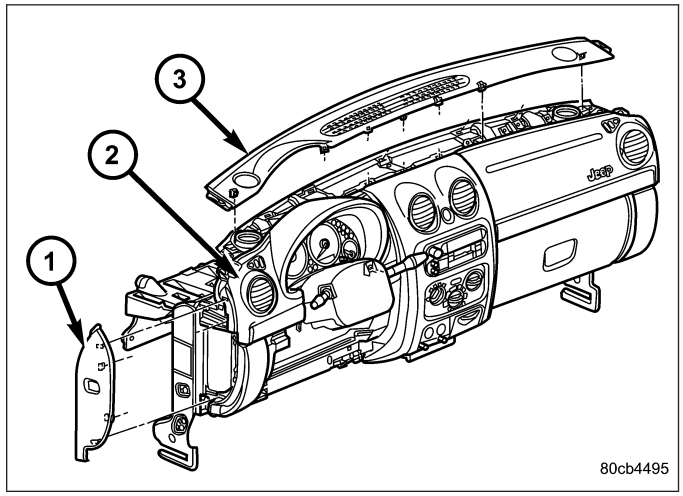

41. Reconnect the battery ground cable.



# INSTRUMENT PANEL TOP COVER

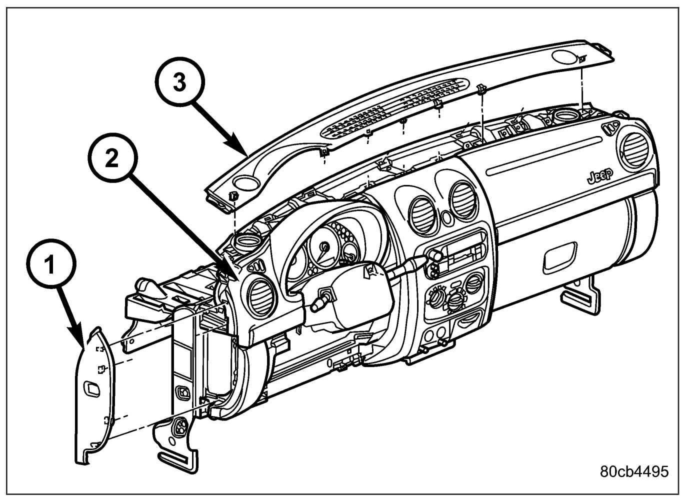
## REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Remove the A-pillar trim. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM AND GRAB HANDLE - REMOVAL)
3. Using a trim stick C-4755 or equivalent, release the attachment clips and remove the top cover (3).




## INSTALLATION

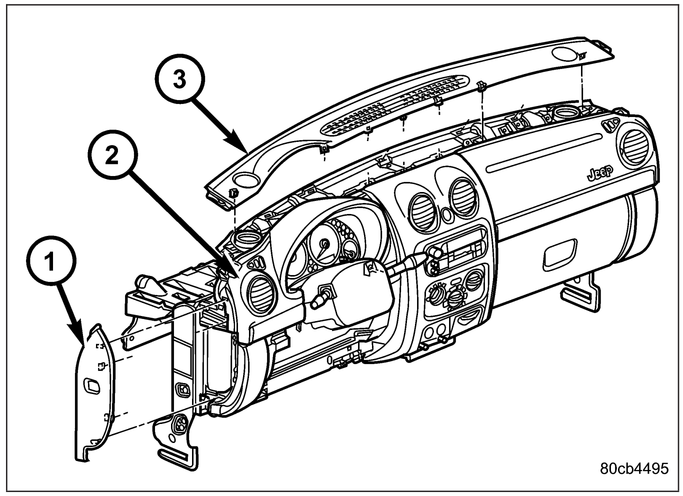
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Position the top cover (3) and seat the clips fully.
3. Install the A-pillar trim panels. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM AND GRAB HANDLE - INSTALLATION)



# INSTRUMENT PANEL END CAP

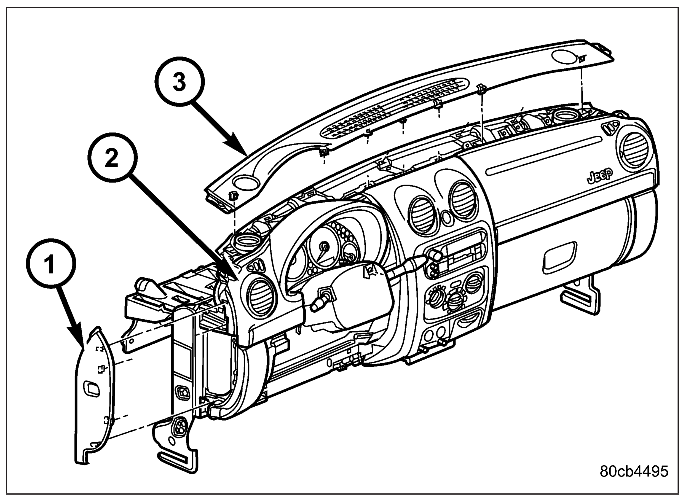
## REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Open the door.
3. Using the finger indent, grasp and remove the side cover (1).




## INSTALLATION

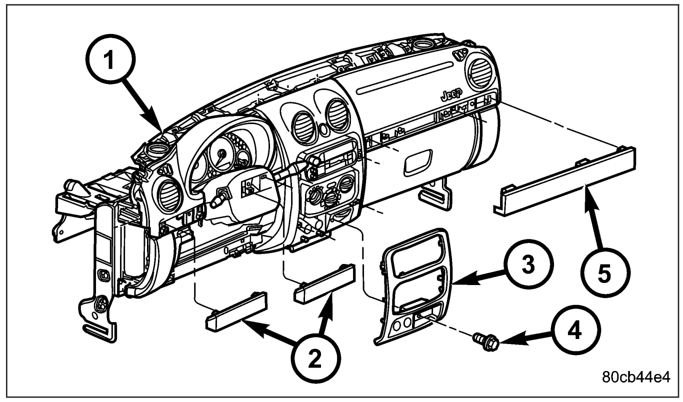
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Position the side panels (1) and seat the clips fully.



# INSTRUMENT PANEL DRIVER SIDE BEZELS

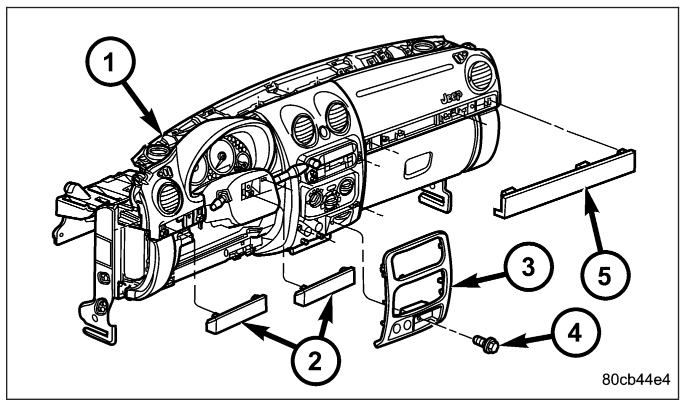
## REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Using a trim stick C-4755 or equivalent, disengage the bezels (2) on either side of the steering column.




## INSTALLATION

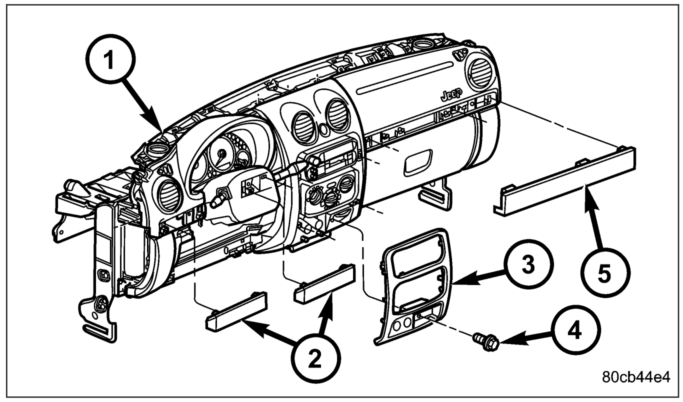
1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Position the appropriate divers side bezels (2) on either side of the steering column and seat the attachment clips.



# INSTRUMENT PANEL CENTER BEZEL

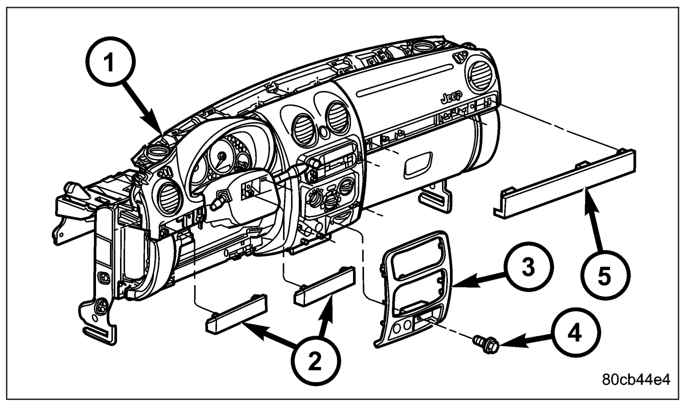
## REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Remove the screw from inside the cubby bin next to the power outlet.
3. Using a trim stick C-4755 or equivalent, remove the center bezel (3) from the instrument panel assembly.
4. Disconnect the electrical and vacuum connectors.




## INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Connect the electrical and vacuum connectors.
3. Position the center bezel (3) and seat the retaining clips starting with the lower clips first.
4. Install the screw in the cubby bin next to the power outlet.



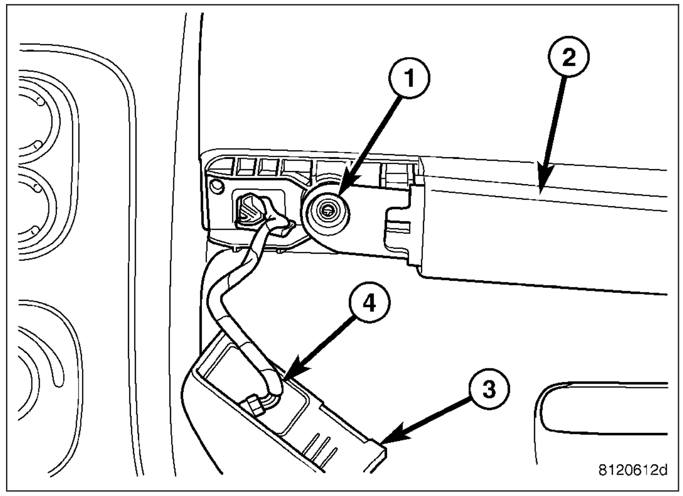
# INSTRUMENT PANEL PASSENGER SIDE BEZEL

## REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/ INSTRUMENT PANEL - WARNING)

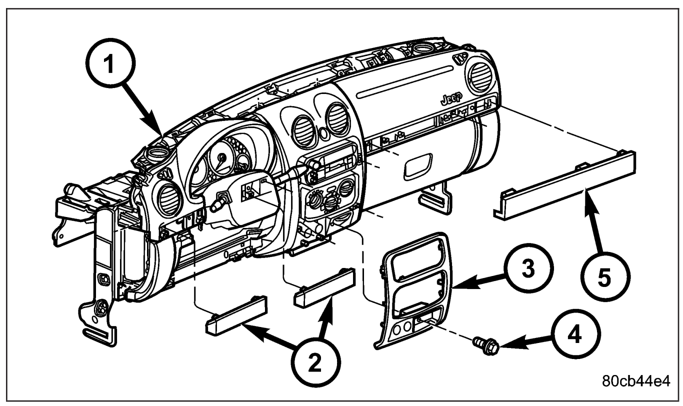
### On vehicles equipped with a grab handle:

1. Using a trim stick C-4755 or equivalent, remove the grab handle end caps.
2. Disconnect the electrical connector, if equipped.
3. Remove the grab handle screws.
4. Remove the grab handle and bezel assembly.




### On vehicles without a grab handle:

1. Using a trim stick C-4755 or equivalent, release the retaining clips and remove the passenger side bezel (5).

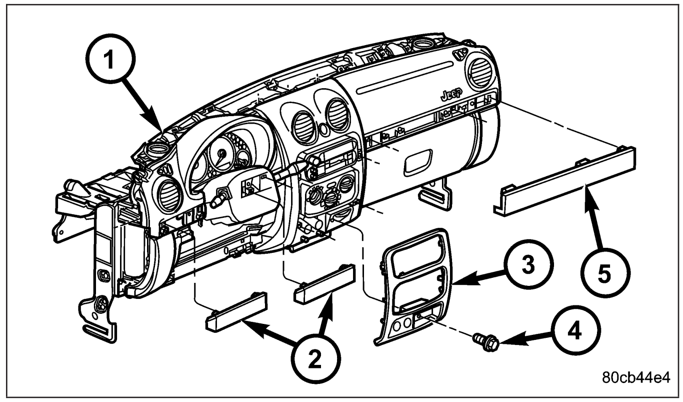



## INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/ INSTRUMENT PANEL - WARNING)

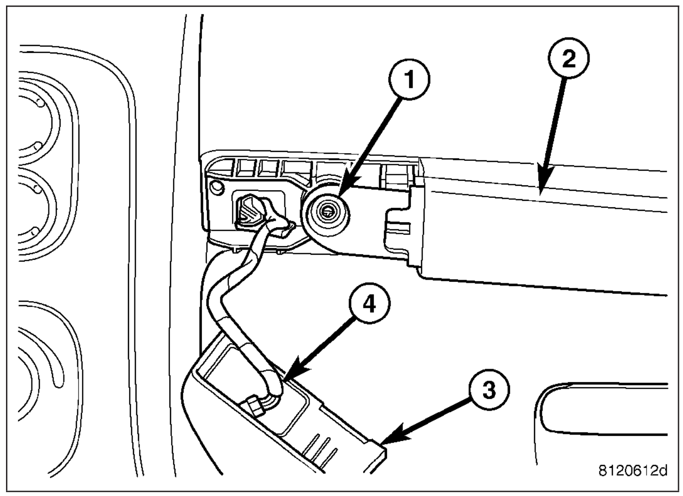
## On vehicles without a grab handle:

1. Position the passenger side bezel (5) and seat the retaining clips.




## On vehicles equipped with a grab handle:

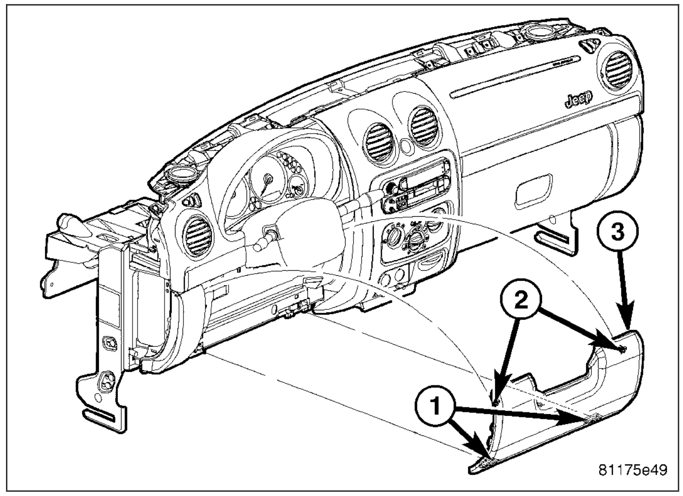
1. Install the grab handle (2) and bezel assembly and install the screws (1).
2. Connect the electrical connector (4), if equipped.
3. Position the end caps (3) in place and seat fully.



# KNEE BLOCKER

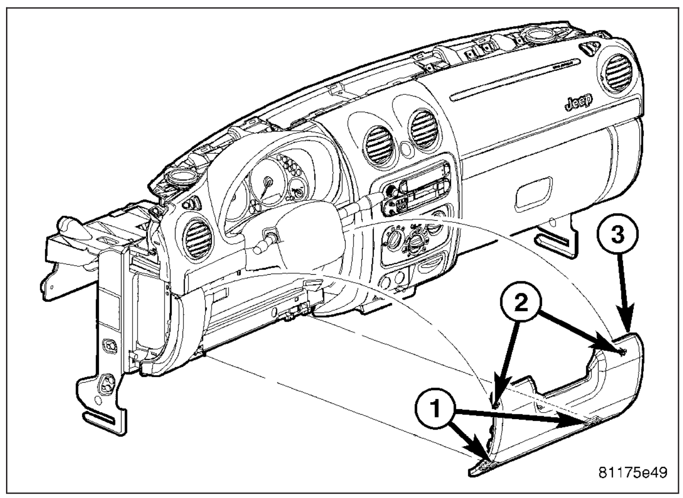
## REMOVAL

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. Reach into the steering column opening at the top of the knee blocker and pull the top rearward to disengage upper knee blocker clips (2).
3. Gently swing the knee blocker open.
4. Slide the knee blocker toward the driver side door and disengage the hinges (1) from the molded in hinge pins in the instrument panel.




## INSTALLATION

1. Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/INSTRUMENT PANEL - WARNING)
2. With the knee blocker close to a horizontal position, align both knee blocker hinges (1) to the tabs at the bottom edge of the instrument panel.
3. engage the hinges by sliding them toward the center of the vehicle as far as they can go.
4. Gently swing the knee blocker upward until the clips (2) touch the corresponding slots in the instrument panel and engage fully.



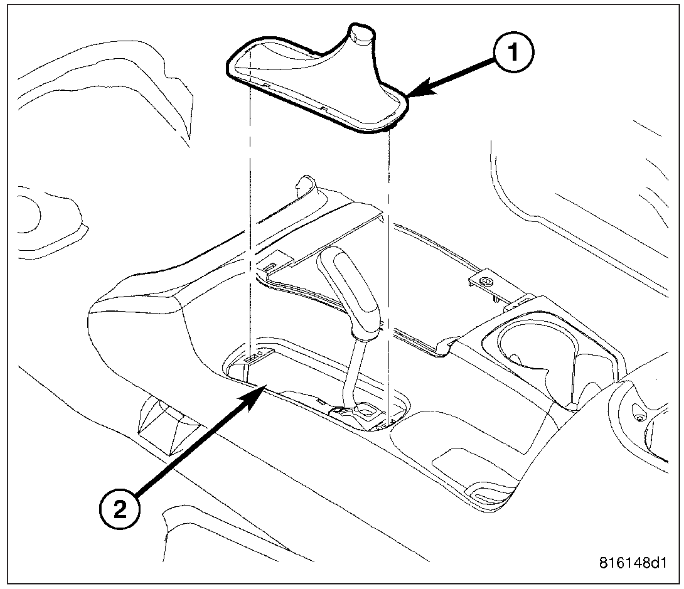
# INTERIOR

## TABLE OF CONTENTS

# 4WD FLOOR SHIFT BOOT

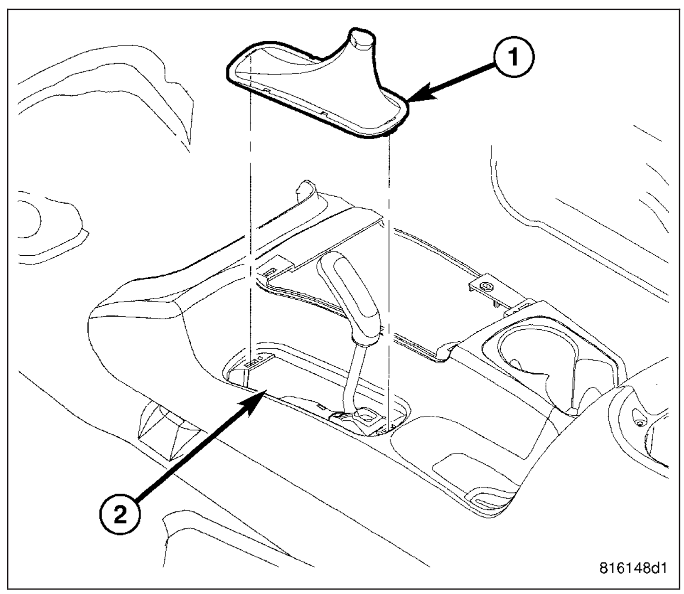
## REMOVAL

1. Separate the boot bezel from the console (2).
2. Release the upper snap and remove the boot (1) from the shifter.




## INSTALLATION

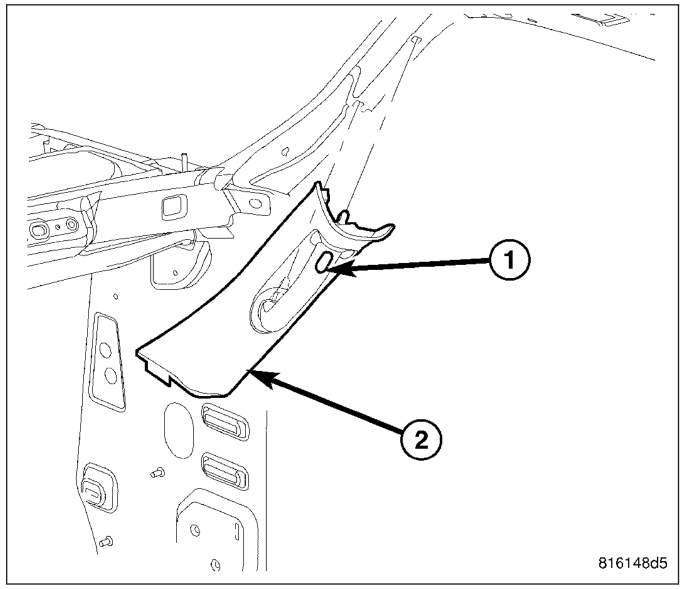
1. Position the boot (1) over the top of the transfer case shifter lever with the snap facing toward the front of the vehicle.
2. Seat the bezel into the console (2) aperture fully.
3. Fasten the snap on the top of the boot above the ring on the bottom of the knob.



# A-PILLAR TRIM AND GRAB HANDLE

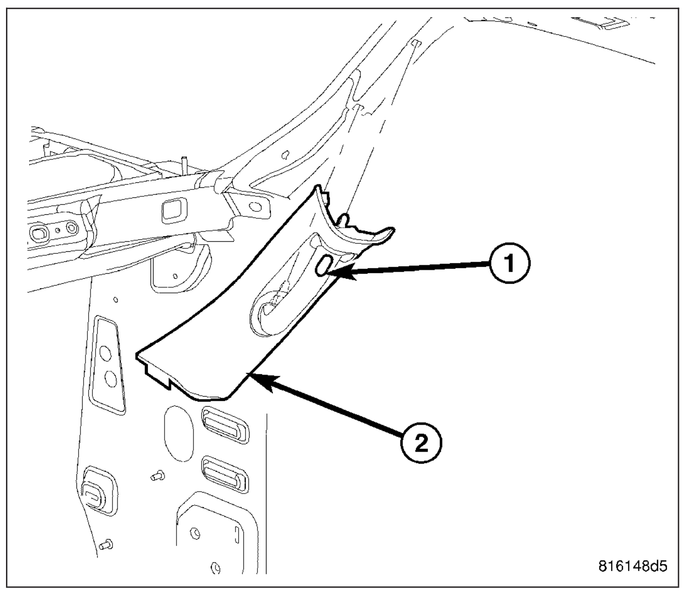
## REMOVAL

1. Using a small pry tool or equivalent, remove the grab handle trim plugs (1).
2. Remove the two grab handle screws.
3. Remove the grab handle and A-pillar trim (2) from the A-pillar.




## INSTALLATION

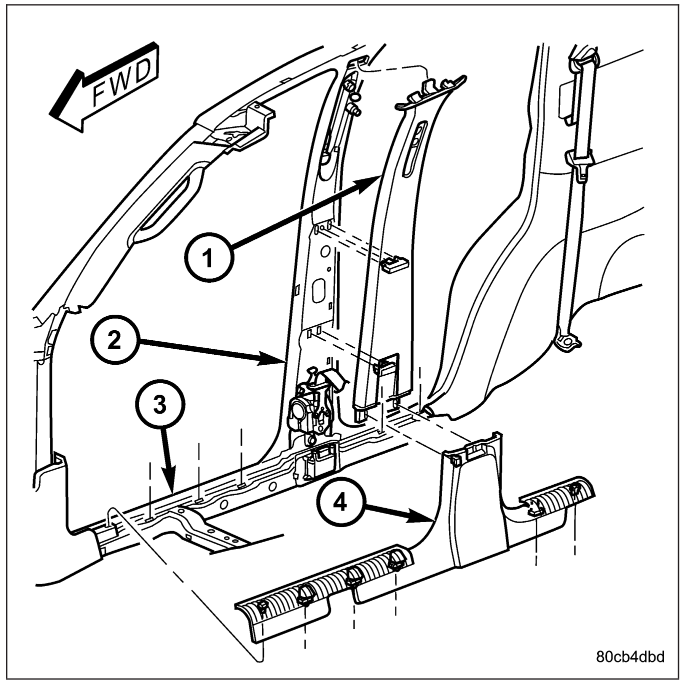
1. Snap A-pillar trim (2) and grab handle into the A-pillar.
2. Install the two screws and install the grab handle trim plugs (1).



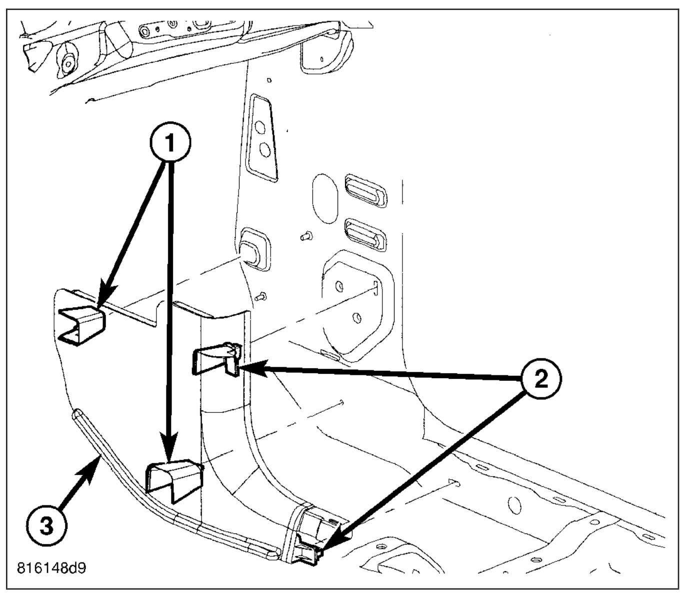
# COWL TRIM COVER

## REMOVAL

1. Using a trim stick C-4755 or equivalent, lift up the front edge of the lower B-pillar trim (4) and position aside. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL)

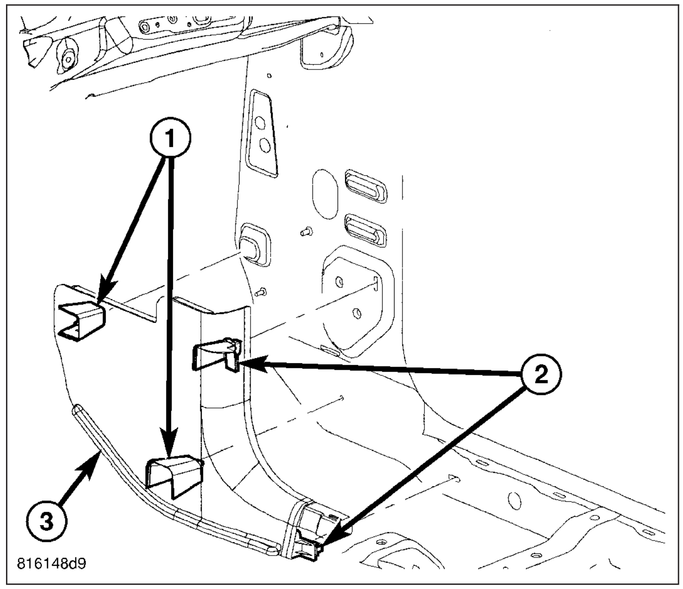



2. Remove the cowl trim cover (3) by pulling it away from the A-pillar and releasing the clips (1 and 2).

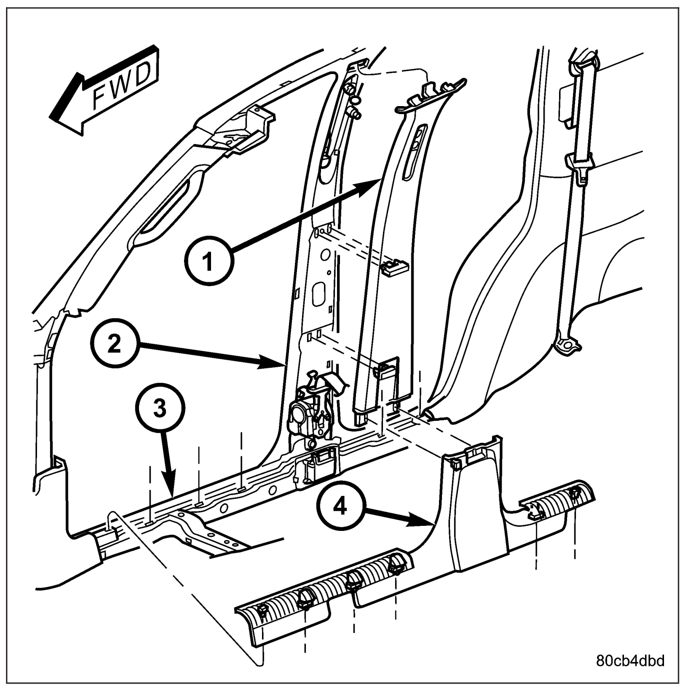


## INSTALLATION

1. Install the cowl trim cover (3) and seat the retaining clips (1 and 2).



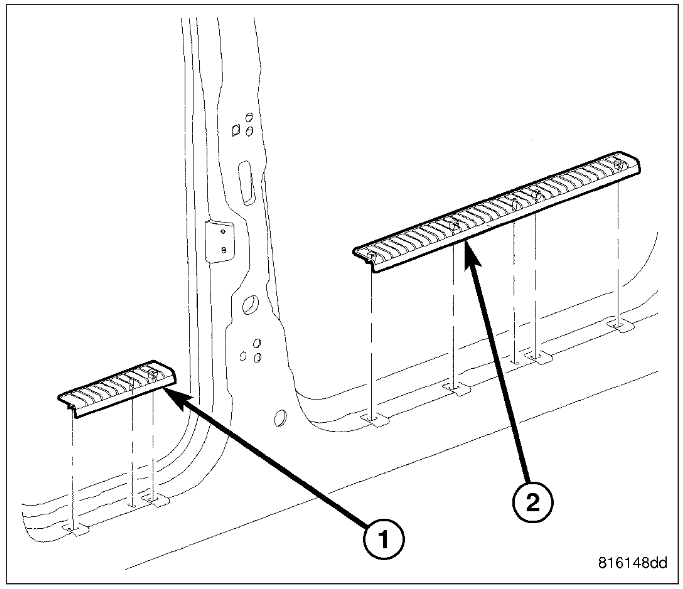

2. Position the B-pillar trim panel (4) and seat the retaining clips.



# DOOR SILL SCUFF PLATE

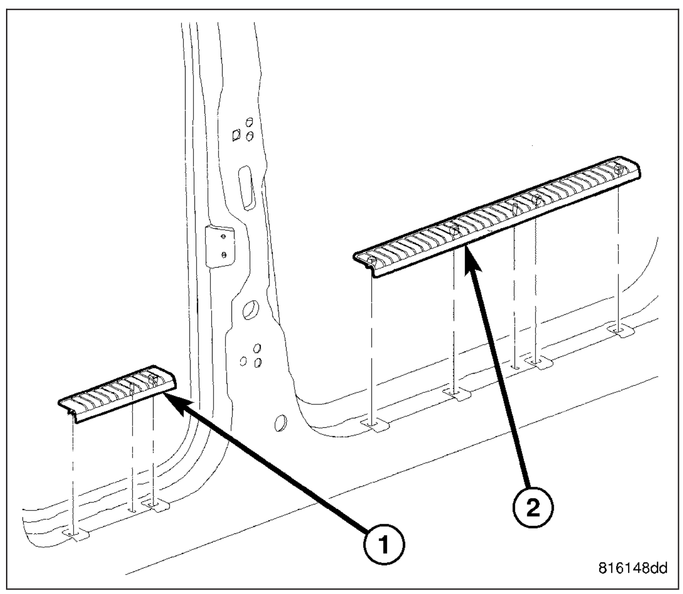
## REMOVAL

1. Using a trim stick C-4755 or equivalent, pry up the scuff plate releasing the retaining clips.




## INSTALLATION

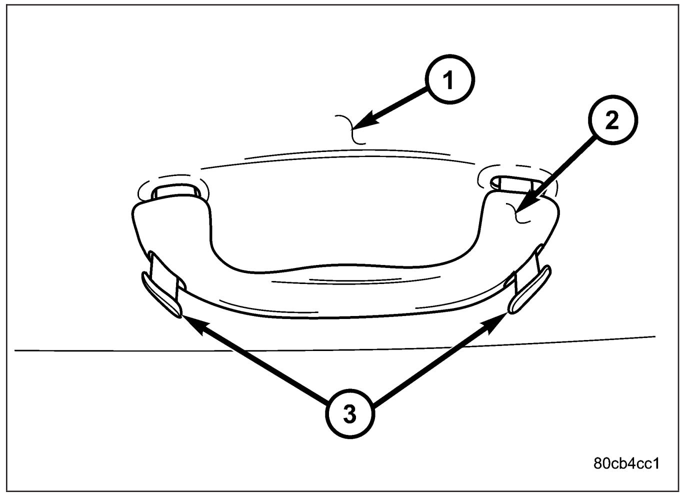
1. Position the scuff plate and seat the retaining clips.



# ASSIST HANDLE

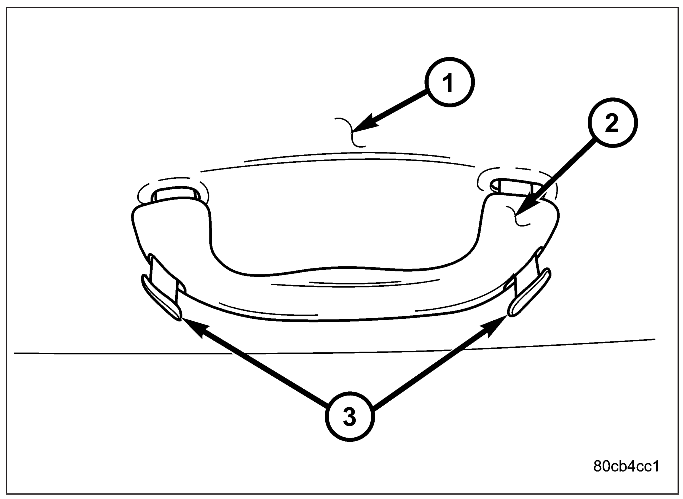
## REMOVAL

1. Using a small pry tool or equivalent, release the assist handle by prying out the clips (3) at either end.




## INSTALLATION

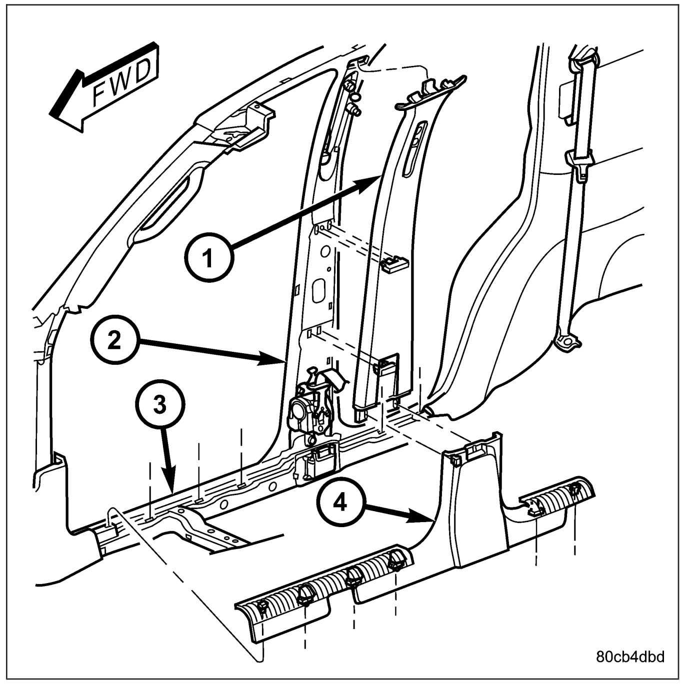
1. Position the assist handle and seat the retaining clips (3).



# B-PILLAR LOWER TRIM

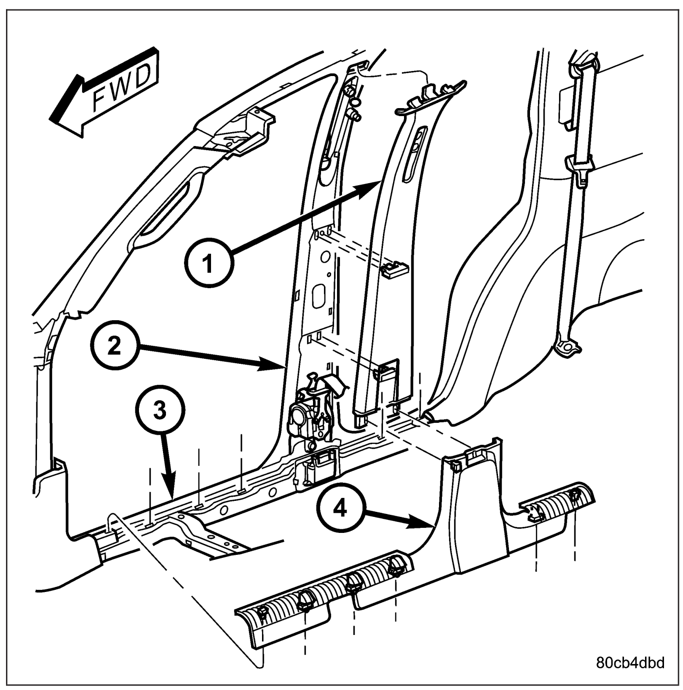
## REMOVAL

1. Using a trim stick C-4755 or equivalent, pry up the trim panel (4), releasing the retaining clips.




## INSTALLATION

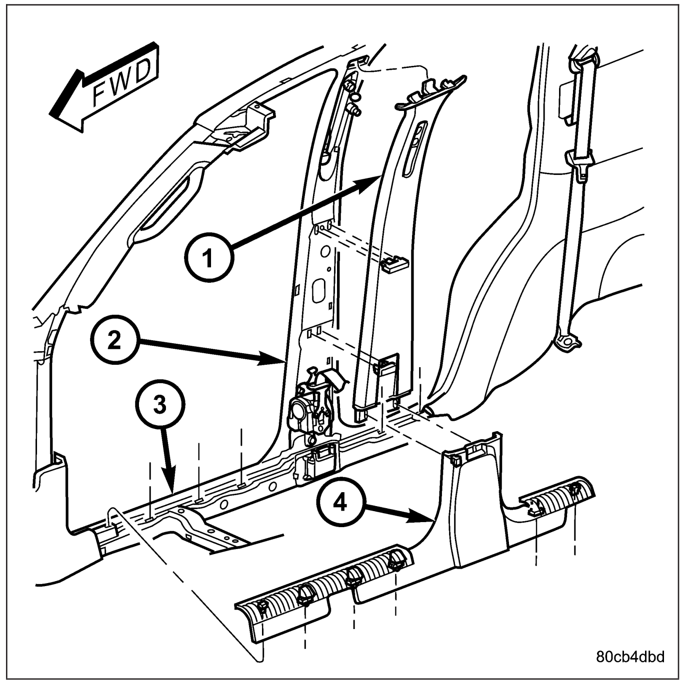
1. Position the trim panel (4) and seat the retaining clips fully.



# B-PILLAR UPPER TRIM

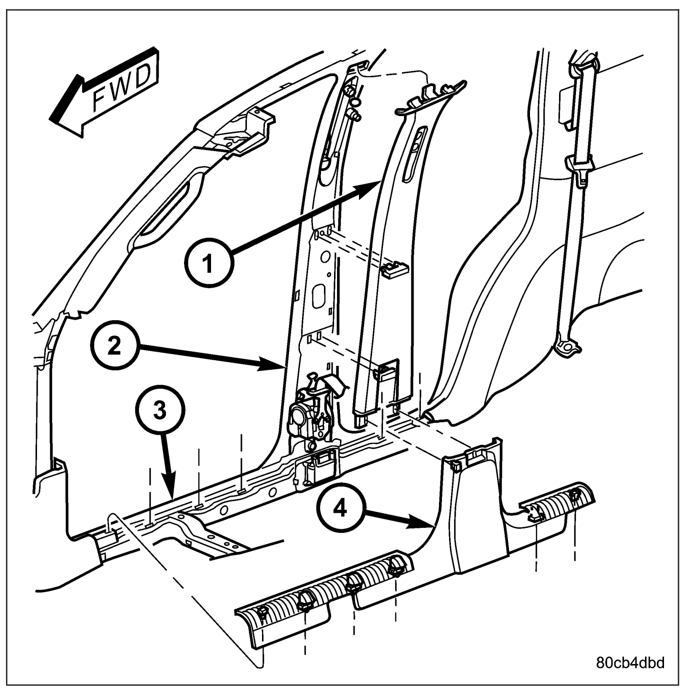
## REMOVAL

1. Remove the lower B-pillar trim panel (4). (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL)
2. Remove the shoulder belt turning loop. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - REMOVAL)
3. Using a trim stick C-4755 or equivalent, release the trim retaining clips and remove the upper trim (1).




## INSTALLATION

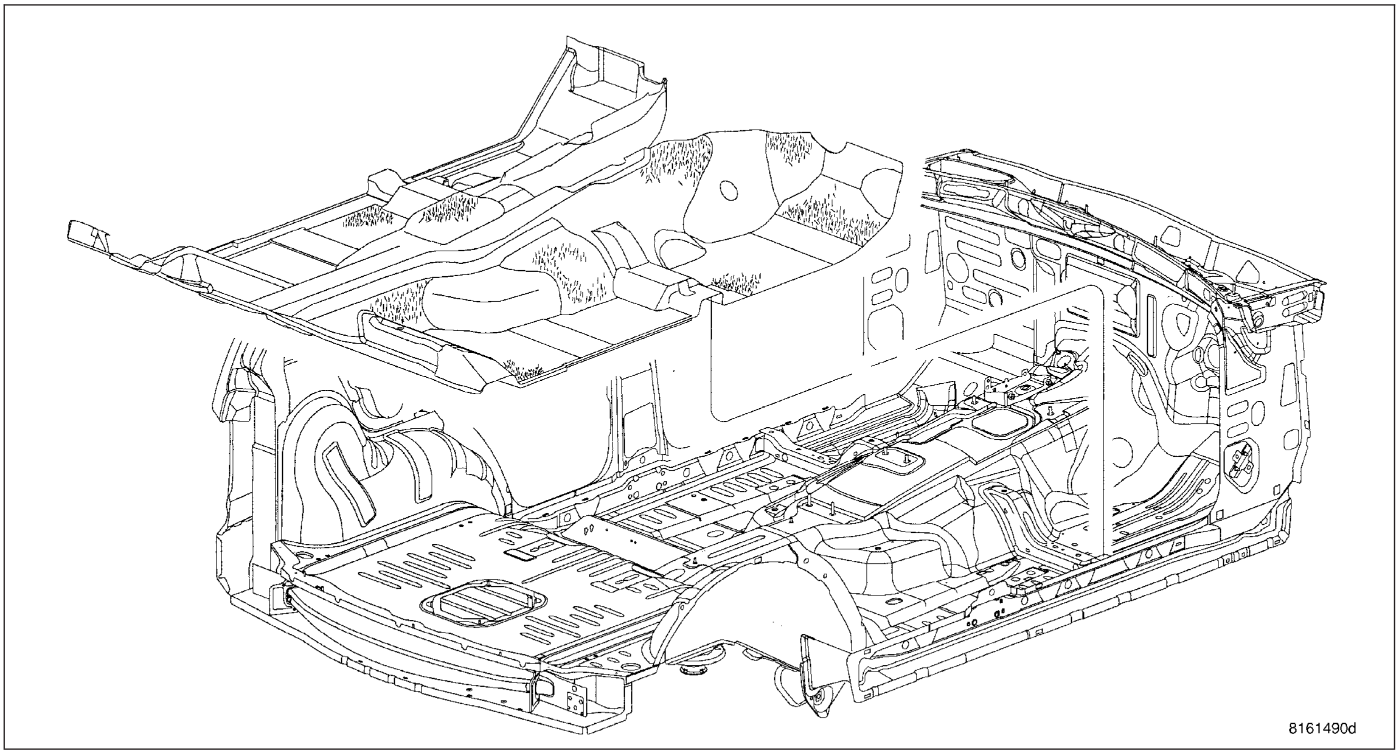
1. Position the upper trim panel (1) and seat the retaining clips.
2. Install the seat belt turning loop. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - INSTALLATION)
3. Install the B-pillar lower trim panel (4). (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION)



# CARPETS AND FLOOR MATS

## REMOVAL

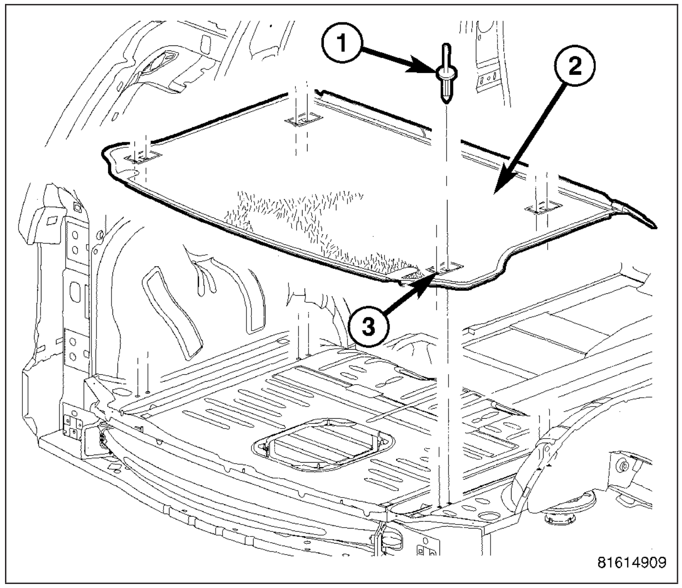
### Front Carpet




1. Remove front seats. (Refer to 23 - BODY/SEATS/SEAT - FRONT - REMOVAL)
2. Remove the floor console. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)
3. Remove the rear seats. (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL)
4. Remove the cowl trim panels. (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - REMOVAL)
5. Remove the B-pillar lower trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL)
6. Remove the jack assembly.
7. Remove the carpet.

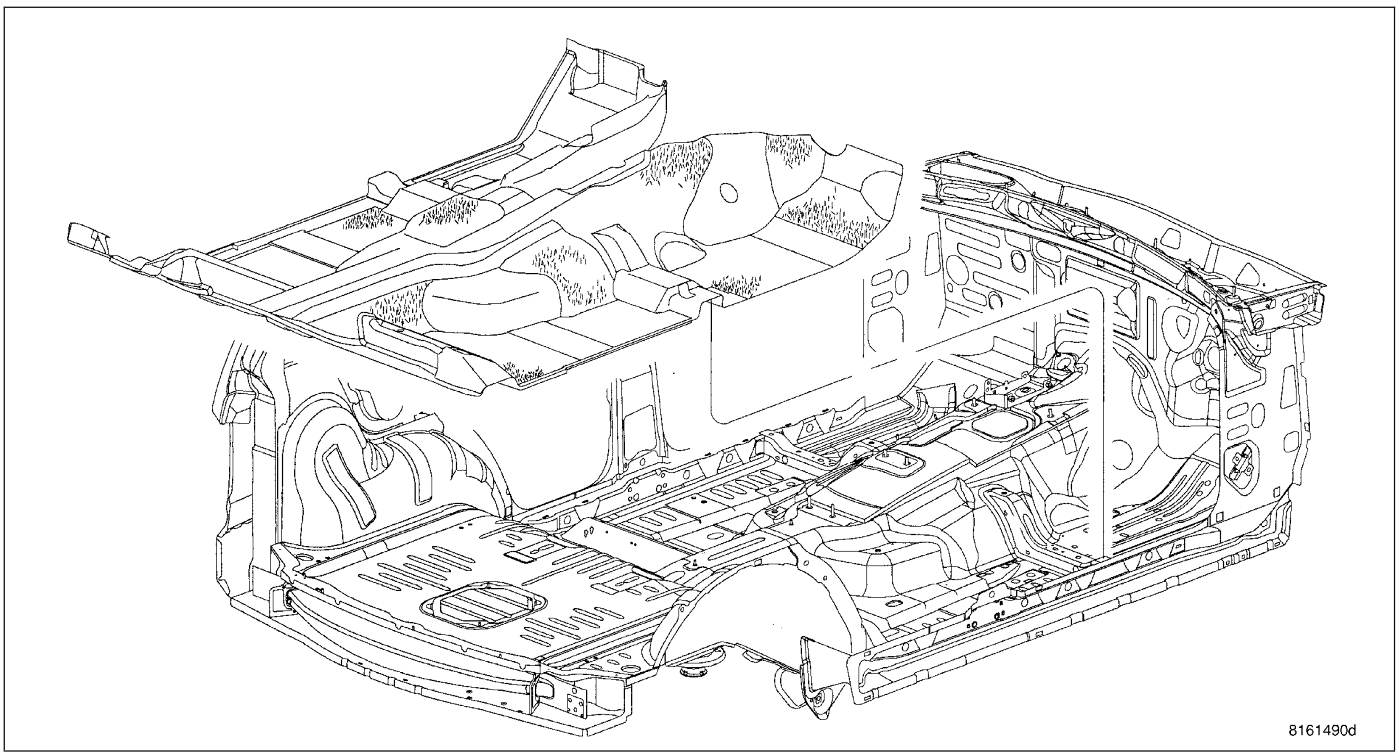
### Rear Cargo Carpet

1. Remove the rivets (1) attaching the cargo hooks (3) to the floor.
2. Remove the carpet (2).




## INSTALLATION

### Front Carpet

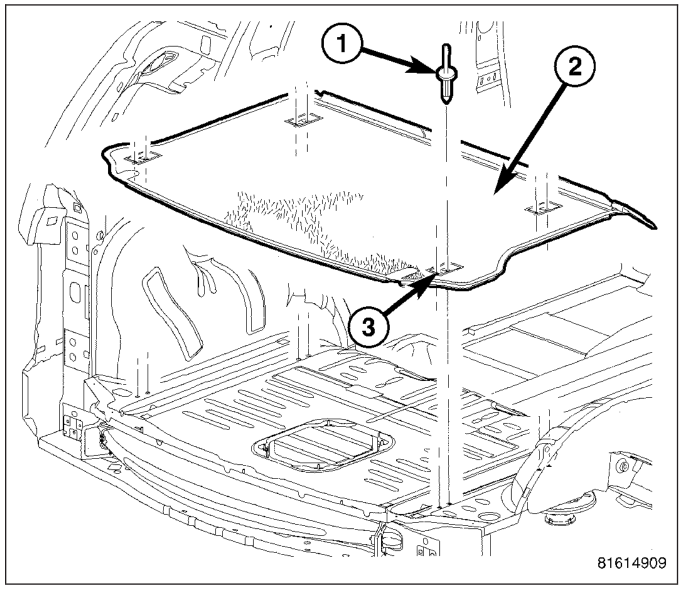



1. Install the carpet.
2. Install the jack assembly.
3. Install the B-pillar lower trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION)
4. Install the cowl trim panels. (Refer to 23 - BODY/INTERIOR/COWL TRIM COVER - INSTALLATION)
5. Install the rear seats. (Refer to 23 - BODY/SEATS/SEAT - REAR - INSTALLATION)
6. Install the floor console. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

7. Install the front seats. (Refer to 23 - BODY/SEATS/SEAT - FRONT - INSTALLATION)

## Rear Cargo Carpet

1. Install the carpet and slide under the trim panels.
2. Install new rivets securing the carpet and cargo hooks to the floor.



# SHIFT BEZEL

## REMOVAL

1. Using a trim stick C-4755 or equivalent, pry shift bezel out of the floor console.

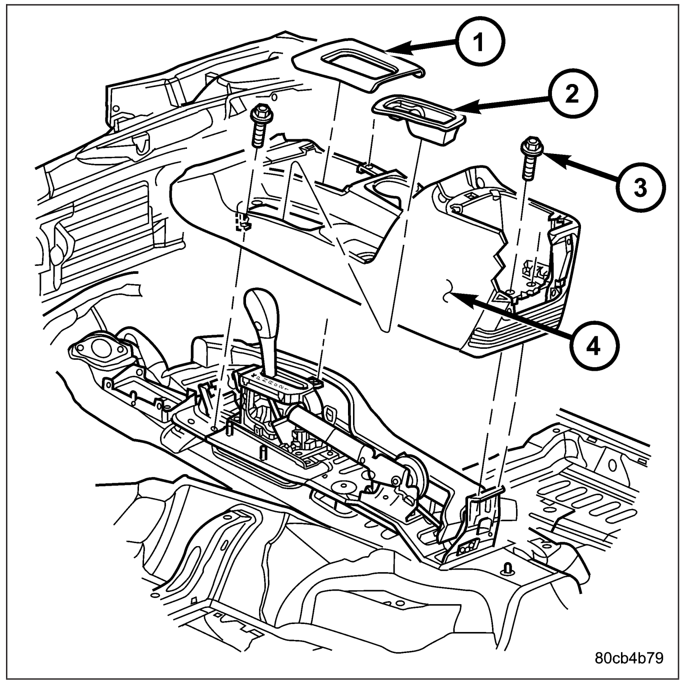
## INSTALLATION

1. Position the shift bezel and seat the retaining clips into the floor console.

# FLOOR CONSOLE

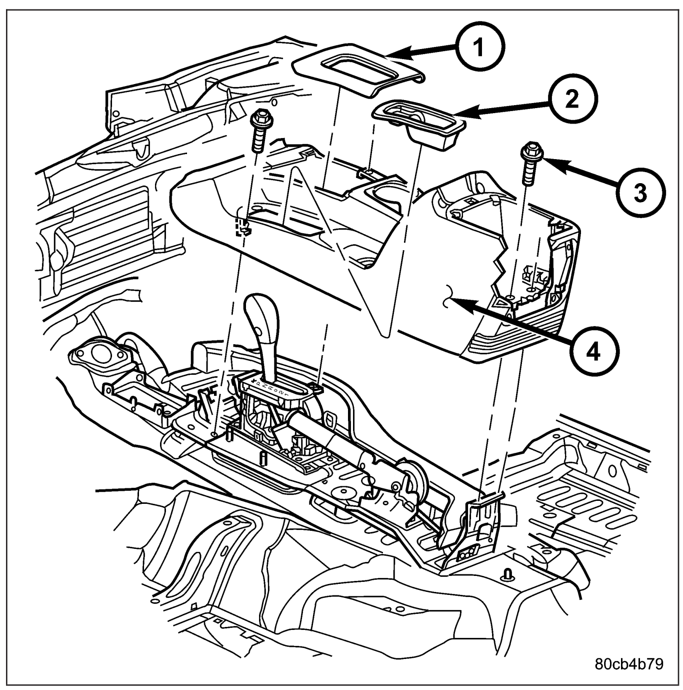
## REMOVAL

1. Remove the shift bezel, if equipped. (Refer to 23 - BODY/INTERIOR/SHIFT BEZEL - REMOVAL)
2. Set park brake lever in the up position.
3. Using a trim stick C-4755 or equivalent, disconnect the manual trans shifter boot, if equipped.
4. Using a trim stick C-4755 or equivalent, disconnect the transfer case shifter boot, if equipped.
5. Remove the four bolts.
6. Lift the console at the back and remove.




## INSTALLATION

1. Position the front of the console and lower the rear over the shifter and brake levers.
2. Install the bolts.
3. Install the shift boots and seat the retainer clips.
4. Install the shift bezel. (Refer to 23 - BODY/INTERIOR/SHIFT BEZEL - INSTALLATION)



# FLOOR CONSOLE LID LATCH

## REMOVAL

1. Remove the screws and remove the lid.
2. Remove the screws attaching the lid cover and remove the latch.

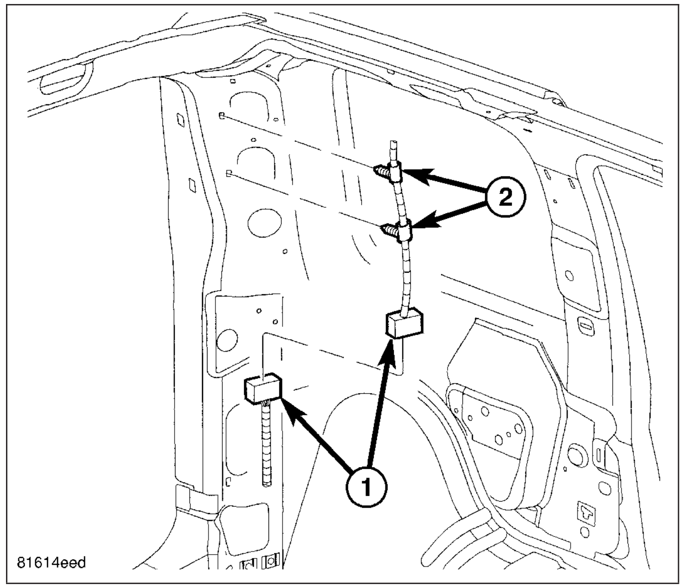
## INSTALLATION

1. Install the latch and the lid cover.
2. Install the screws attaching the lid cover.
3. Install the console lid onto the console and install the screws.

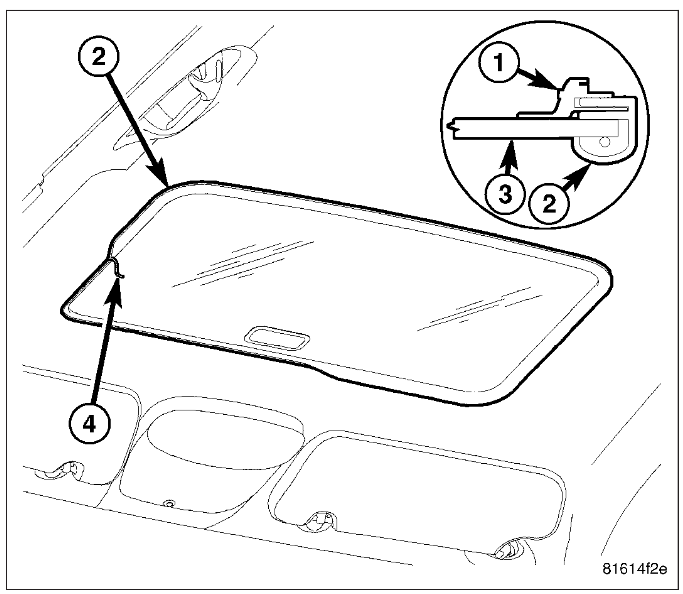
# HEADLINER

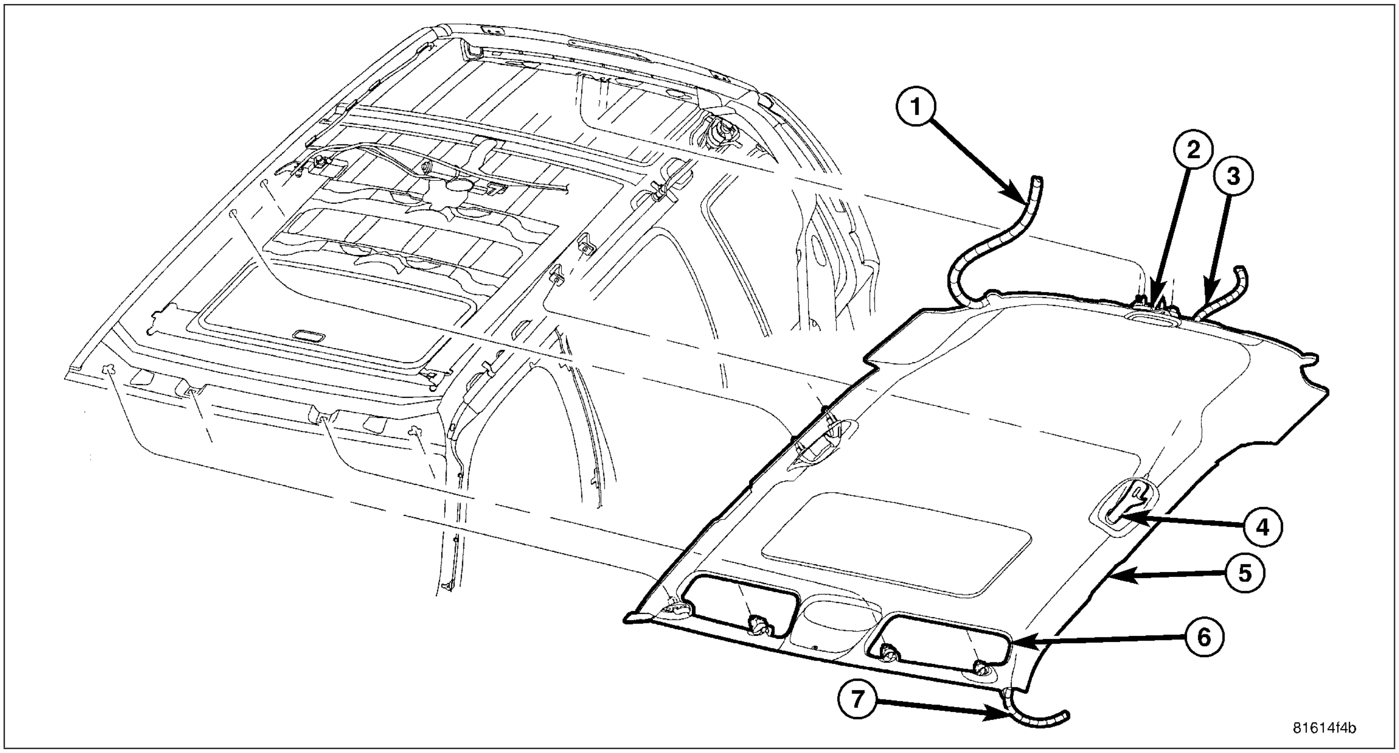
## REMOVAL

1. Remove the A-pillar trim. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM AND GRAB HANDLE - REMOVAL)
2. Remove the visors. (Refer to 23 - BODY/INTERIOR/SUN VISOR - REMOVAL)
3. Remove the sun visor support. (Refer to 23 - BODY/INTERIOR/SUN VISOR SUPPORT - REMOVAL)
4. Remove the overhead console. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL)
5. Cut rear washer hose at the mark about halfway up the A-pillar.
6. Remove the upper B-pillar trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - REMOVAL)
7. Remove the assist handles. (Refer to 23 - BODY/INTERIOR/ASSIST HANDLE - REMOVAL)
8. Remove the quarter trim. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL)
9. Disconnect the electrical connector along the left D-pillar and remove the ground wire.



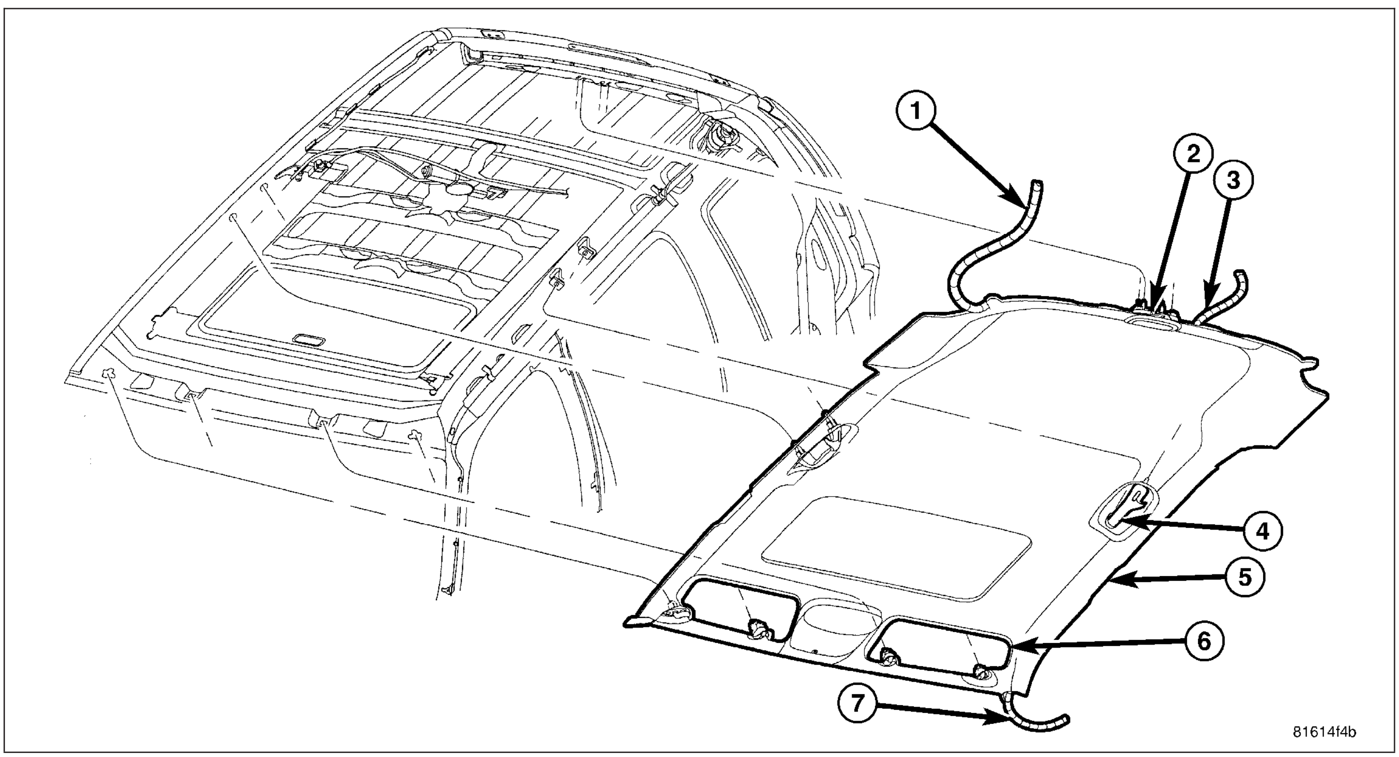

10. Remove the sunroof opening trim lace (2), if equipped. (Refer to 23 - BODY/SUNROOF/OPENING TRIM LACE - REMOVAL)






11. Remove the dome light in the rear.
12. Remove the rear washer nozzle.
13. Remove the headliner.

## INSTALLATION



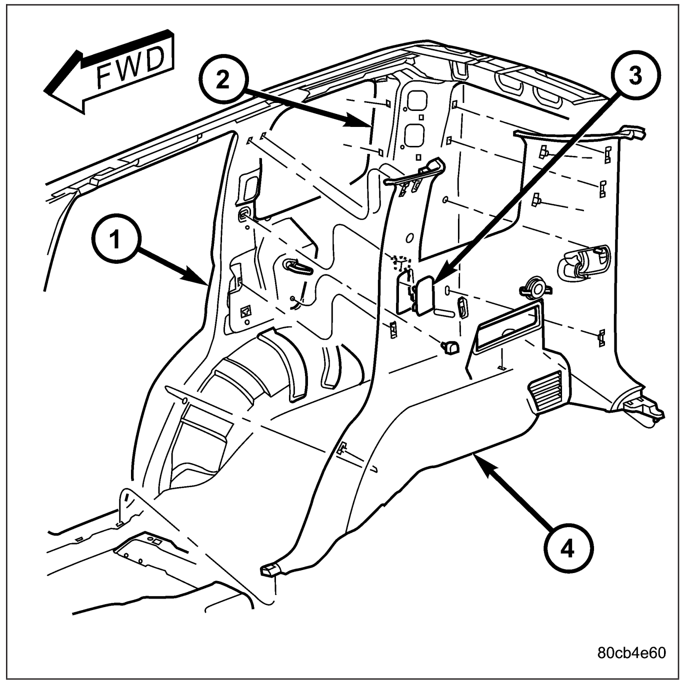

1. Install the headliner.
2. Install the assist handles (4). (Refer to 23 - BODY/INTERIOR/ASSIST HANDLE - INSTALLATION)
3. Install the visors (6). (Refer to 23 - BODY/INTERIOR/SUN VISOR - INSTALLATION)
4. Install the visor supports. (Refer to 23 - BODY/INTERIOR/SUN VISOR SUPPORT - INSTALLATION)

5. Install the overhead console. (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION)
6. Connect the rear washer hose, previously cut, with a hose junction.
7. Install the A-pillar trim and grab handles. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION)
8. Install the upper B-pillar trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR UPPER TRIM - INSTALLATION)
9. Install the rear washer nozzle.
10. Connect the electrical connector and ground wire at the left D-pillar.
11. Install the quarter trim panels. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - INSTALLATION)
12. Install the rear dome light.
13. Install the sunroof opening trim lace, if equipped. (Refer to 23 - BODY/SUNROOF/OPENING TRIM LACE - INSTALLATION)

# QUARTER TRIM PANEL

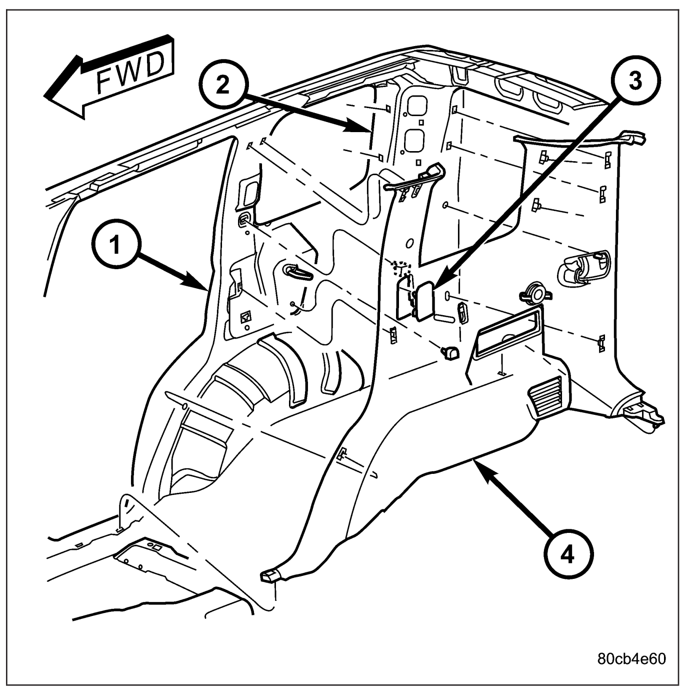
## REMOVAL

1. Using a trim stick C-4755 or equivalent, remove the rear header trim.
2. Using a trim stick C-4755 or equivalent, remove the rear sill plate.
3. Remove the hook pin type connector.
4. Fold down the rear seat.
5. Remove the seat belt anchor and pivot. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - REMOVAL)
6. Remove the belt access panel.
7. Remove the storage cover.
8. Disconnect the 12v power supply electrical connector, if equipped.




## INSTALLATION

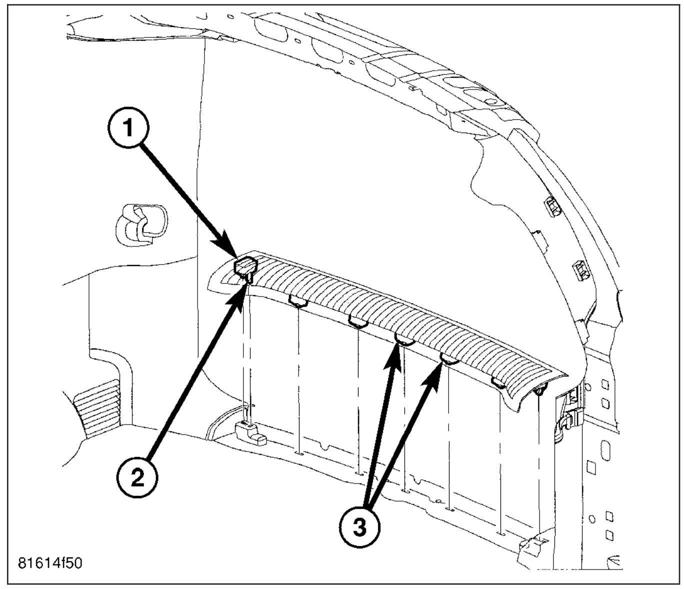
1. Position the 12v power supply electrical connector, if equipped.
2. Install the storage cover.
3. Install the belt access panel.
4. Install the seat belt anchor and pivot. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - INSTALLATION)
5. Install the hook pin type connector.
6. Position the rear sill plate and seat the retaining clips.
7. Position the rear header trim and seat the retaining clips.



# REAR DOOR SCUFF PLATE

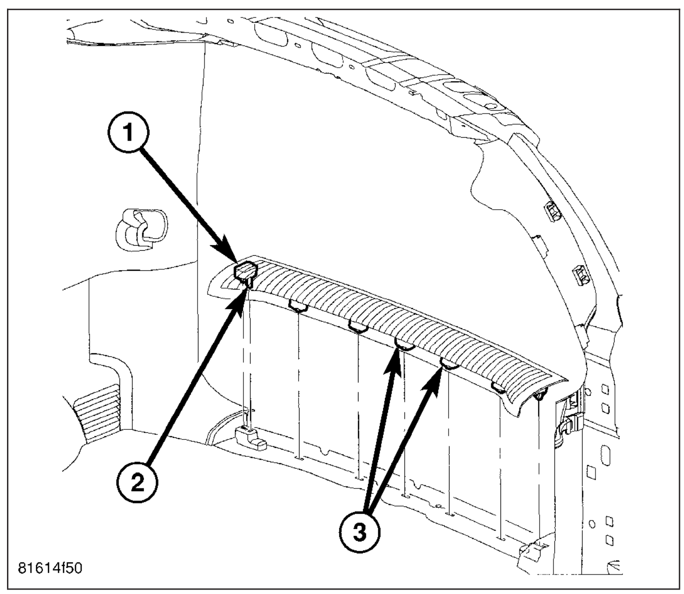
## REMOVAL

1. Using a trim stick C-4755 or equivalent, release the retaining clips and remove the scuff plate.




## INSTALLATION

1. Position the scuff plate and seat the retaining clips.



# SUN VISOR

## REMOVAL

1. Remove the screws at the visor pivot.
2. Disconnect the electrical connector and remove the visor.

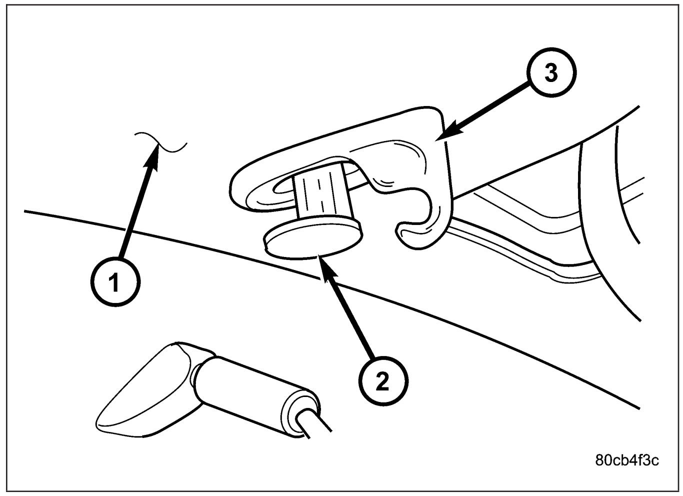
## INSTALLATION

1. Connect the electrical connector and install the visor.
2. Install the screws at the visor pivots.

# SUN VISOR SUPPORT

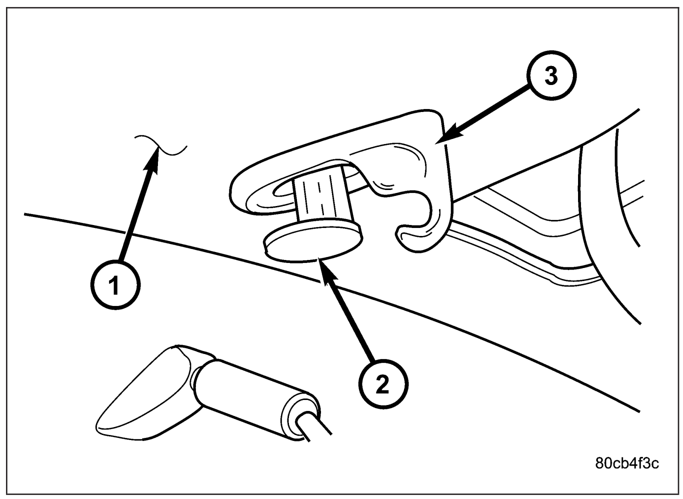
## REMOVAL

1. Using a small pry tool or equivalent, release the support retaining clip by prying out and remove the support.




## INSTALLATION

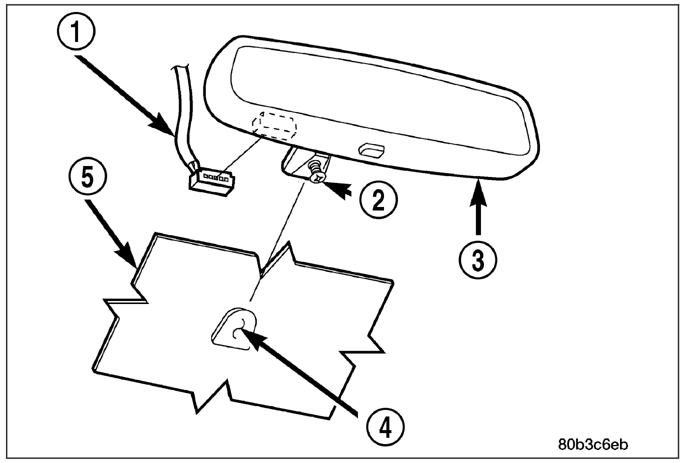
1. Position the visor support and seat the retaining clip.



# REAR VIEW MIRROR

## REMOVAL

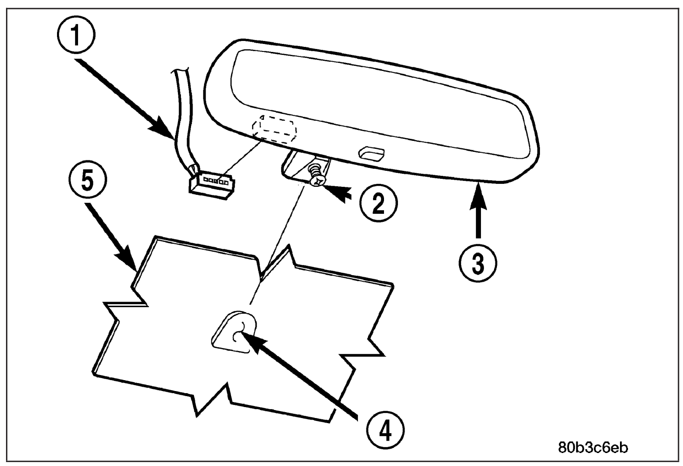
1. If equipped, disconnect mirror harness connector.
2. Loosen the mirror base setscrew.
3. Slide the mirror base upward and off the bracket.




## INSTALLATION

## INSTALLATION

1. Position the mirror base at the bracket and slide it downward onto the support bracket.
2. Tighten the setscrew 1 N·m (15 in. lbs.) torque.
3. If equipped, connect mirror harness connector.




## INSTALLATION - REAR VIEW MIRROR SUPPORT BRACKET

1. Mark the position for the mirror bracket on the outside of the windshield glass with a wax pencil.
2. Clean the bracket contact area on the glass. Use a mild powdered cleanser on a cloth saturated with isopropyl (rubbing) alcohol. Finally, clean the glass with a paper towel dampened with alcohol.
3. Sand the surface on the support bracket with fine grit-sandpaper. Wipe the bracket surface clean with a paper towel.
4. Apply accelerator to the surface on the bracket according to the following instructions:
   a. Crush the vial to saturate the felt applicator.
   b. Remove the paper sleeve.
   c. Apply accelerator to the contact surface on the bracket.
   d. Allow the accelerator to dry for five minutes.
   e. Do not touch the bracket contact surface after the accelerator has been applied.
5. Apply adhesive accelerator to the bracket contact surface on the windshield glass. Allow the accelerator to dry for one minute. Do not touch the glass contact surface after the accelerator has been applied.

6. Install the bracket according to the following instructions:
   a. Apply one drop of adhesive at the center of the bracket contact-surface on the windshield glass.
   b. Apply an even coat of adhesive to the contact surface on the bracket.
   c. Align the bracket with the marked position on the windshield glass.
   d. Press and hold the bracket in place for at least one minute.

**NOTE: Verify that the mirror support bracket is correctly aligned, because the adhesive will cure rapidly.**

7. Allow the adhesive to cure for 8-10 minutes. Remove any excess adhesive with an alcohol-dampened cloth.
8. Allow the adhesive to cure for an additional 8-10 minutes before installing the mirror.

# PAINT

## TABLE OF CONTENTS

# PAINT

## SPECIFICATIONS - PAINT CODES

**NOTE: Because of late model changes to the available paint colors (Refer to VEHICLE DATA/VEHICLE INFORMATION/VEHICLE CERTIFICATION LABEL - DESCRIPTION) or (Refer to VEHICLE DATA/VEHICLE INFORMATION/BODY CODE PLATE - DESCRIPTION) for the correct paint codes for each vehicle. (Refer to 23 - BODY/PAINT/PAINT CODE - DESCRIPTION)**

### EXTERIOR COLORS

| EXTERIOR COLOR | DAIMLERCHRYSLER CODE |
|---|---|
| Flame Read Clearcoat | PR4 |
| Inferno Red Crystal Pearlcoat | ARJ |
| Light Khaki Metallic Clearcoat | AJC |
| Dark Khaki Pearlcoat | BJT |
| Deep Beryl Green Pearlcoat | CGV |
| Atlantic Blue Pearlcoat | ZBJ |
| Midnight Blue Pearlcoat | BB8 |
| Bright Silver Metallic Clearcoat | WS2 |
| Mineral Gray Metallic Clearcoat | CDM |
| Black Clearcoat | DX8 |
| Stone White Clearcoat | SW1 |

### INTERIOR COLORS

| INTERIOR COLOR | DAIMLERCHRYSLER CODE |
|---|---|
| Slate Gray | D5 |
| Khaki | J3 |
| Khaki/Light Graystone | J1 |
| Slate Gray/Light Slate Gray | DB |

### ACCESSORY COLORS

| PART | COLOR | DAIMLERCHRYSLER CODE |
|---|---|---|
| Sport Accent Colors | Dark Medium Gray | BDL |
| Renegade Accent Colors | Medium Khaki | CJM |
| | Dark Slate | CD7 |

# PAINT CODE

## DESCRIPTION

Exterior vehicle body colors are identified on the Vehicle Certification Label (Refer to VEHICLE DATA/VEHICLE INFORMATION/VEHICLE CERTIFICATION LABEL - DESCRIPTION) or the Body Code Plate (Refer to VEHICLE DATA/VEHICLE INFORMATION/BODY CODE PLATE - DESCRIPTION). The first digit of the paint code listed on the vehicle indicates the sequence of application, i.e.: P = primary coat, Q = secondary coat. The color names provided in the Paint and Trim Code Description chart are the color names used on most repair product containers. (Refer to 23 - BODY/PAINT - SPECIFICATIONS)

# BASE COAT/CLEAR COAT FINISH

## DESCRIPTION

The original equipment finish is a multi step process that involves cleaning, applying electro de-position (E-coat), anti-chip primer, basecoat, and clearcoat steps.

On most vehicles a two-part paint application (basecoat/clearcoat) is used. Color paint that is applied to primer is called basecoat. The clear coat protects the basecoat from ultraviolet light and provides a durable high-gloss finish.

**CAUTION: Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result. Do not use harsh alkaline based cleaning solvents on painted surfaces. Damage to finish or color can result.**

# PAINT TOUCH-UP

## DESCRIPTION

When a painted metal surface has been scratched or chipped, it should be touched-up as soon as possible to avoid corrosion. For best results, use Mopar® Scratch Filler/Primer, Touch-Up Paints and Clear Topcoat. Refer to Introduction group of this manual for Body Code Plate information.

**WARNING: Use an OSHA approved respirator and safety glasses when spraying paint or solvents in a confined area. Personal injury can result.**

## OPERATION

1. Scrape loose paint and corrosion from inside scratch or chip.
2. Clean affected area with Mopar® Tar/Road Oil Remover, and allow to dry.
3. Fill the inside of the scratch or chip with a coat of filler/primer. Do not overlap primer onto good surface finish. The applicator brush should be wet enough to puddle-fill the scratch or chip without running. Do not stroke brush applicator on body surface. Allow the filler/primer to dry hard.
4. Cover the filler/primer with color touch-up paint. Do not overlap touch-up color onto the original color coat around the scratch or chip. Butt the new color to the original color, if possible. Do not stroke applicator brush on body surface. Allow touch-up paint to dry hard.
5. On vehicles without clearcoat, the touch-up color can be lightly finesse sanded (1500 grit) and polished with rubbing compound.
6. On vehicles with clearcoat, apply clear top coat to touch-up paint with the same technique as described in Step 4. Allow clear topcoat to dry hard. If desired, Step 5 can be performed on clear topcoat.

**WARNING: Avoid prolonged skin contact with petroleum or alcohol – based cleaning solvents. Personal injury can result.**
**Avoid prolonged skin contact with petroleum or alcohol – based cleaning solvents. Personal injury can result.**

# FINESSE SANDING/BUFFING & POLISHING

## DESCRIPTION

**CAUTION: Do not remove more than .5 mils of clearcoat finish, if equipped. Basecoat paint must retain clearcoat for durability.**
**Use a Paint Thickness Gauge #PR-ETG-2X or equivalent to determine film thickness before and after the repair.**

Minor acid etching, orange peel, or smudging in clearcoat or single-stage finishes can be reduced with light finesse sanding, hand buffing, and polishing. **If the finish has been finesse sanded in the past, it cannot be repeated. Finesse sanding operation should be performed by a trained automotive paint technician.**

# SEATS

## TABLE OF CONTENTS

# SEATS

## WARNING

## WARNINGS - RESTRAINT SYSTEM

**WARNING:**

- **To avoid personal injury or death, during and following any seat belt or child restraint anchor service, carefully inspect all seat belts, buckles, mounting hardware, retractors, tether straps, and anchors for proper installation, operation, or damage. Replace any belt that is cut, frayed, or torn. Straighten any belt that is twisted. Tighten any loose fasteners. Replace any belt that has a damaged or inoperative buckle or retractor. Replace any belt that has a bent or damaged latch plate or anchor plate. Replace any child restraint anchor or the unit to which the anchor is integral that has been bent or damaged. Never attempt to repair a seat belt or child restraint component. Always replace damaged or faulty seat belt and child restraint components with the correct, new and unused replacement parts listed in the DaimlerChrysler Mopar Parts Catalog.**
- **To avoid personal injury or death, on vehicles equipped with airbags, disable the supplemental restraint system before attempting any steering wheel, steering column, airbag, occupant classification system, seat belt tensioner, impact sensor, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the supplemental restraint system. Failure to take the proper precautions could result in accidental airbag deployment.**
- **To avoid personal injury or death on vehicles equipped with airbags, before performing any welding operations disconnect and isolate the battery negative (ground) cable and disconnect all wire harness connectors from the Airbag Control Module (ACM). Failure to take the proper precautions could result in accidental airbag deployment and other possible damage to the supplemental restraint system circuits and components.**
- **To avoid personal injury or death, do not attempt to dismantle an airbag unit or tamper with its inflator. Do not puncture, incinerate, or bring into contact with electricity. Do not store at temperatures exceeding 93° C (200° F). An airbag inflator unit may contain sodium azide and potassium nitrate. These materials are poisonous and extremely flammable. Contact with acid, water, or heavy metals may produce harmful and irritating gases (sodium hydroxide is formed in the presence of moisture) or combustible compounds. An airbag inflator unit may also contain a gas canister pressurized to over 2500 psi.**
- **To avoid personal injury or death, when handling a seat belt tensioner retractor, proper care should be exercised to keep fingers out from under the retractor cover and away from the seat belt webbing where it exits from the retractor cover.**
- **To avoid personal injury or death, replace all restraint system components only with parts specified in the DaimlerChrysler Mopar Parts Catalog. Substitute parts may appear interchangeable, but internal differences may result in inferior occupant protection.**
- **To avoid personal injury or death, the fasteners, screws, and bolts originally used for the restraint system components must never be replaced with any substitutes. These fasteners have special coatings and are specifically designed for the restraint system. Any time a new fastener is needed, replace it with the correct fasteners provided in the service package or specified in the DaimlerChrysler Mopar® Parts Catalog.**
- **To avoid personal injury or death, when a steering column has an airbag unit attached, never place the column on the floor or any other surface with the steering wheel or airbag unit face down.**

**NOTE: A non-calibrated Occupant Classification Module (OCM) is the only component of the Occupant Classification System (OCS) that is available for separate service replacement, as outlined in the procedures that follow. The OCS components of the passenger side front seat cushion including the cushion frame, springs, pad, occupant detection bladder, pressure sensor, seat cushion foam and the OCM are a factory-calibrated and assembled unit. Once this unit is connected to a vehicle electrically, the calibration settings are uploaded from the OCM and stored in the memory of the Airbag Control Module (ACM). If only the OCM is subsequently replaced, the new, non-calibrated OCM learns the proper calibration settings from the ACM after it is connected to the vehicle electrically.**

**If any of the remaining OCS components of the passenger side front seat cushion require replacement, they are serviced only as a factory-calibrated, assembled, and tamper-evident service replacement package. This package includes the assembled frame, springs, pad, bladder, sensor, foam, wiring and a calibrated OCM. When installing this package, always replace all of the existing components with the new components as a unit. Do not attempt to separate or disconnect any of the new OCS components contained in the service replacement package from each other, and do not attempt to reuse any of the replaced components in this or any other vehicle.**

**Once any of the original factory-installed components except the OCM have been replaced with the service replacement package components, the OCM can only be serviced by replacing the entire passenger side front seat cushion unit with another complete service replacement package. (Refer to 23 - BODY/SEATS/SEAT CUSHION - FRONT - REMOVAL).**

# HEADREST

## REMOVAL

1. Depress head restraint release button and lift head restraint to full up position.
2. Using a small flat blade, depress tab on right side head restraint release button and using your hand, simultaneously press tab on left side head restraint release button and pull head restraint up to separate from seat back.

## INSTALLATION

1. Position head restraint in seat back, press tab on left side head restraint release button and push down head restraint to secure.

# HEADREST SLEEVE

## REMOVAL

1. Remove the headrest. (Refer to 23 - BODY/SEATS/HEADREST - REMOVAL)
2. Remove the headrest sleeve cover.
3. Rotate head restraint sleeve 1/4 turn counter-clockwise to release retaining tab.
4. Pull sleeve from seat back frame.

## INSTALLATION

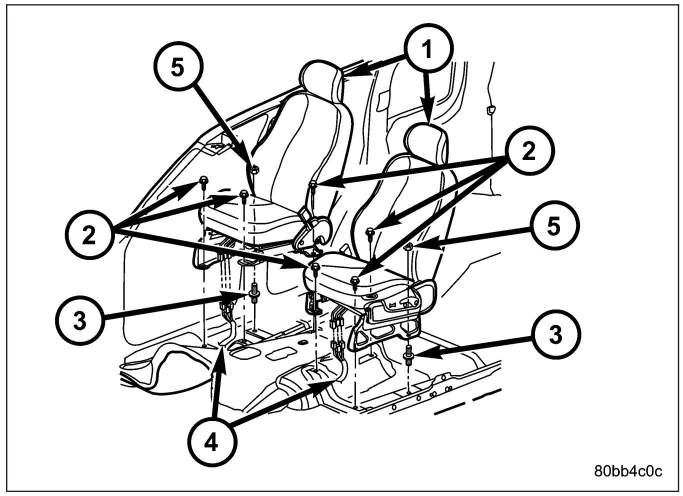
1. Position sleeve in seat back frame.
2. Rotate head restraint sleeve 1/4 turn clockwise to engage retaining tab.
3. Install the headrest sleeve cover.
4. Install the headrest. (Refer to 23 - BODY/SEATS/HEADREST - INSTALLATION)

# SEAT - FRONT

## REMOVAL

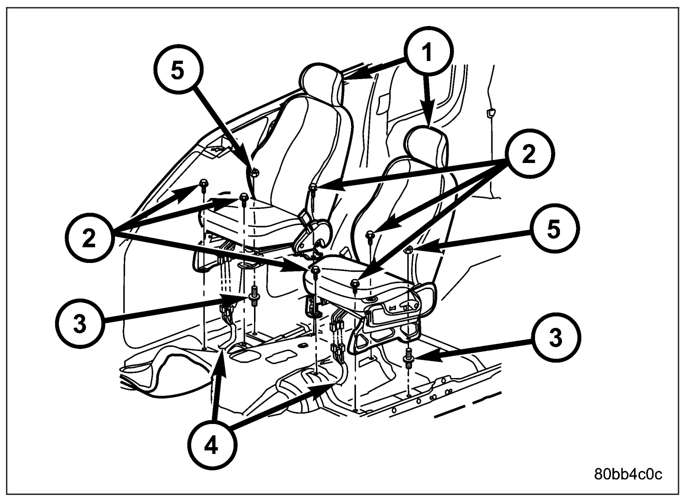
**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

1. Remove the seat belt anchor bolt. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - REMOVAL)
2. Slide seat back and remove the front bolts.
3. Slide seat to forward position and remove the rear bolt/nut.
4. Disconnect the electrical connectors and remove the seat.




## INSTALLATION

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**



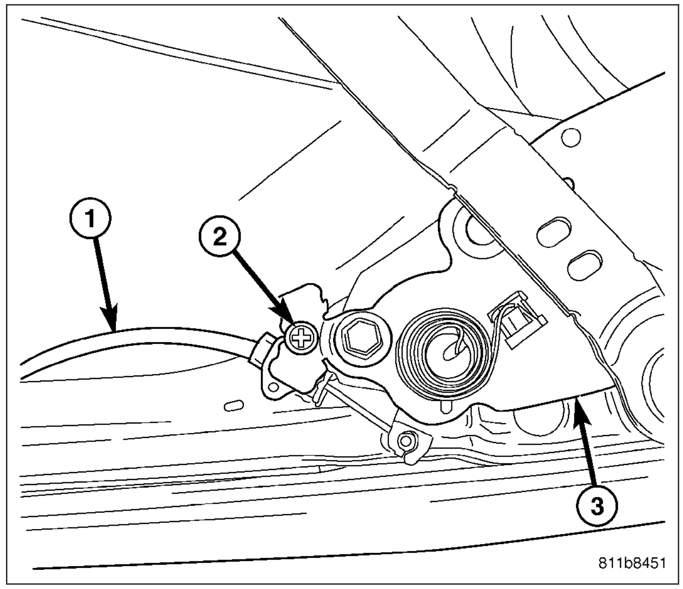

1. Install the seats and connect the electrical connectors.
2. Slide the seat to the rearward position and install the bolts.
3. Tighten the outboard bolt to 43 N·m (32 ft. lbs.) and then tighten the inboard bolt to 43 N·m (32 ft. lbs.).
4. Slide the seat to the forward position and install the rear bolt and nut.
5. Tighten the fasteners to 43 N·m (32 ft. lbs.).
6. Install the seat belt anchor and bolt. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - INSTALLATION)
7. Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).
8. Following successful completion of the supplemental restraint system verification test procedure, perform the Occupant Classification System Verification Test using a DRBIII® scan tool. Refer to the appropriate diagnostic procedures.

# SEAT BACK - FRONT

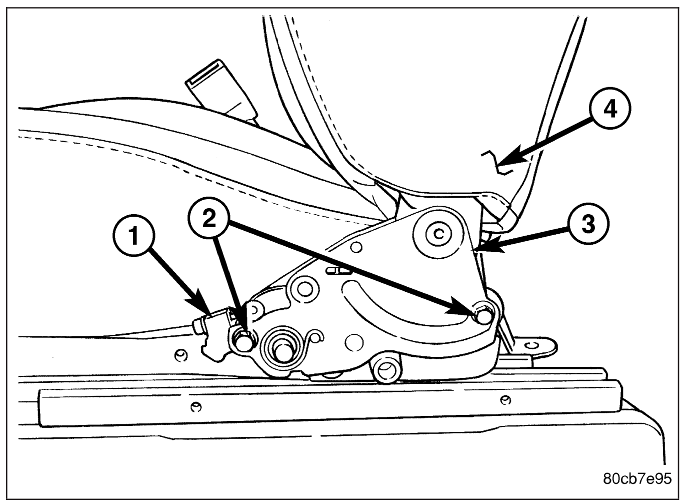
## REMOVAL

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

1. Remove the seat. (Refer to 23 - BODY/SEATS/ SEAT - FRONT - REMOVAL)
2. Remove the seat cushion side shields.
3. Remove the screw and disconnect the lock out cable from both recliners.



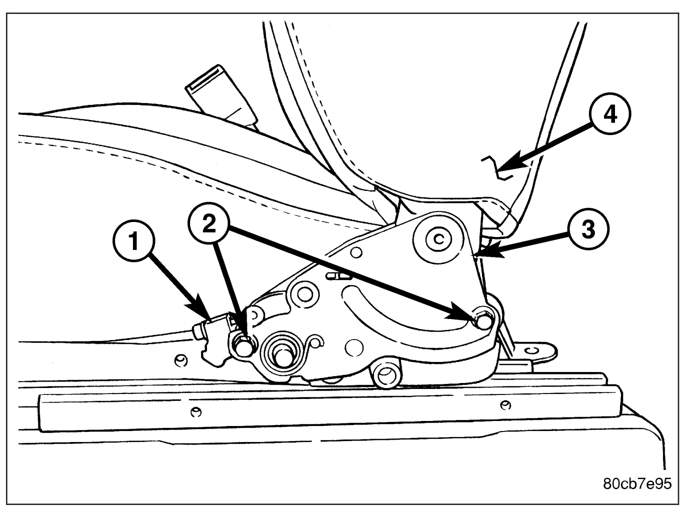

4. Remove the bolts and remove the seat back.



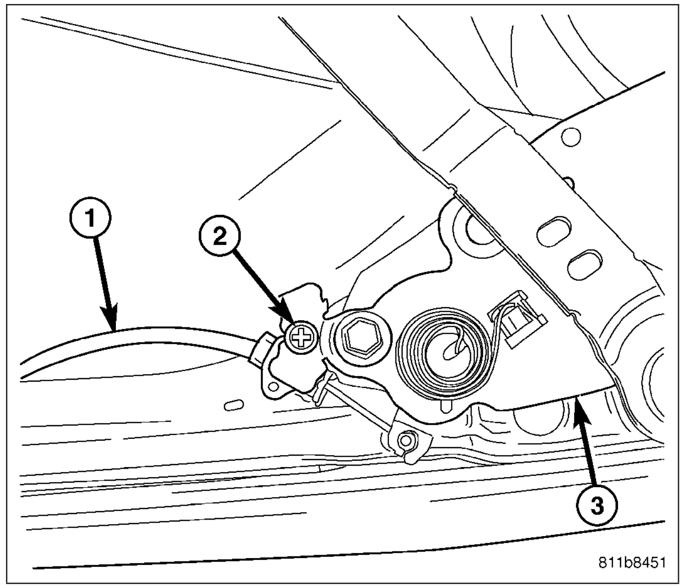

## INSTALLATION

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

1. Install the seat back and install the bolts.
2. Tighten the bolts to 28 N·m (21 ft. lbs.).



3. Connect the lock out cable to both recliners and install the screws.
4. Install the belt buckle. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT BUCKLE - INSTALLATION)
5. Install the side shields.
6. Install the seat. (Refer to 23 - BODY/SEATS/SEAT - FRONT - INSTALLATION)

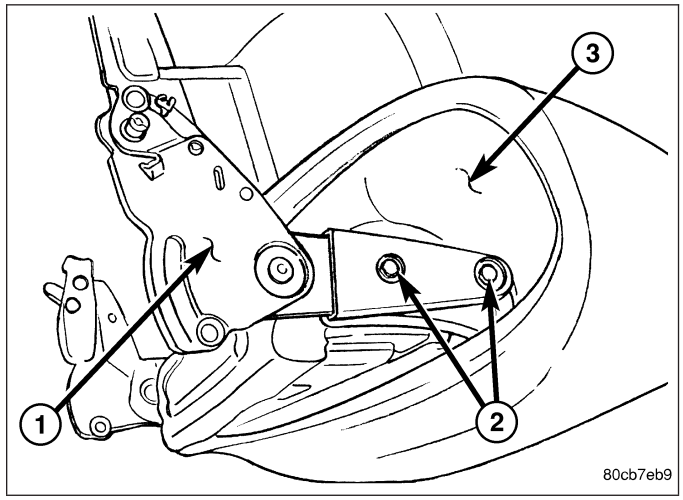


# SEAT BACK RECLINER - FRONT

## REMOVAL

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

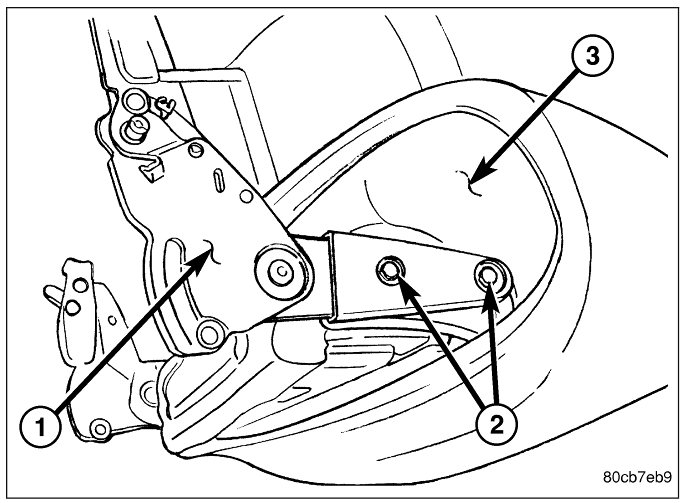
1. Remove the seat back. (Refer to 23 - BODY/SEATS/SEAT BACK - FRONT - REMOVAL)
2. Position the seat back cover out of the way and remove the bolts.
3. Remove the recliners from the seat back frame.




## INSTALLATION

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

1. Install the recliners onto the seat back.
2. Position the seat back cover aside and install the recliner bolts.
3. Tighten the bolts to 28 N·m (21 ft. lbs.).
4. Install the seat back. (Refer to 23 - BODY/SEATS/SEAT BACK - FRONT - INSTALLATION)



# SEAT BACK COVER - FRONT

## REMOVAL

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

1. Remove the seat back. (Refer to 23 - BODY/SEATS/SEAT BACK - FRONT - REMOVAL)
2. Remove the head rest and remove the trim caps. (Refer to 23 - BODY/SEATS/HEADREST - REMOVAL)
3. Disconnect the J-straps.
4. Remove the two lower hog rings.
5. Partially remove the seat back cover and remove the two upper hog rings.
6. Remove the seat back cover.

## INSTALLATION

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

1. Partially install the seat back cover and replace the two top hog rings.
2. Pull cover down and replace the two lower hog rings.
3. Connect the J-straps.
4. Install trim caps and the head rest. (Refer to 23 - BODY/SEATS/HEADREST - INSTALLATION)
5. Install the seat back. (Refer to 23 - BODY/SEATS/SEAT BACK - FRONT - INSTALLATION)

# SEAT BACK CUSHION - FRONT

## REMOVAL

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

1. Remove the seat back cover. (Refer to 23 - BODY/SEATS/SEAT BACK COVER - FRONT - REMOVAL)
2. Separate the cushion from the seat back frame.

## INSTALLATION

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

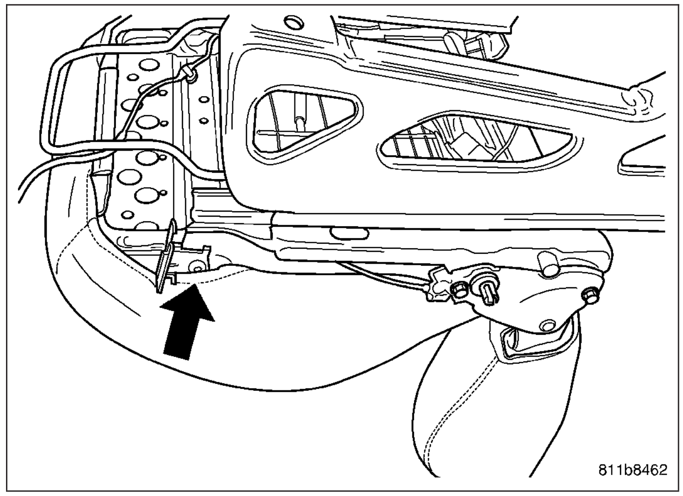
1. Position the cushion onto the seat back frame.
2. Install the seat back cover. (Refer to 23 - BODY/SEATS/SEAT BACK COVER - FRONT - INSTALLATION)

# SEAT CUSHION - FRONT

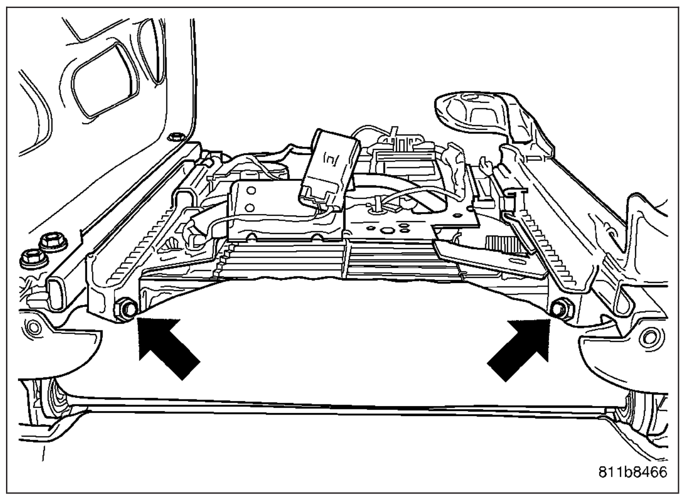
## REMOVAL

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

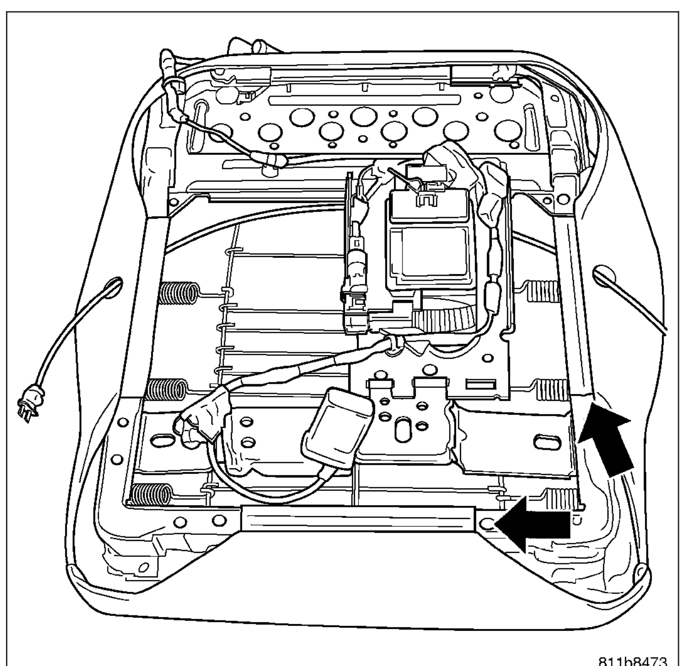
1. Remove the seat. (Refer to 23 - BODY/SEATS/ SEAT - FRONT - REMOVAL)
2. Remove the trim covers from each side.
3. Remove the screws and disconnect the recliner cable to the seat back hinges.
4. Remove the two bolts attaching the front of the cushion frame to the seat frame.



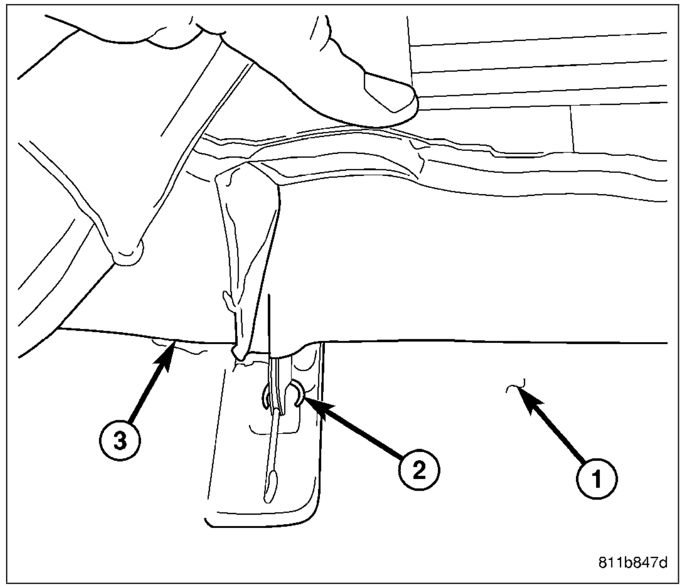

5. Remove the two bolts attaching the rear of the cushion frame to the seat frame.




6. Separate the seat cushion assembly from the seat assembly.
7. Separate the J-straps and remove the seat cushion and cover from the frame.



8. Remove the hog rings and remove the seat cushion cover.




## INSTALLATION

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

**NOTE: After replacing passenger front seat cushion and/or Occupant Classification Module (OCM) there may be a wire connector not used from the seat weight sensor. Secure wire connector to the seat cushion frame with wire ties.**

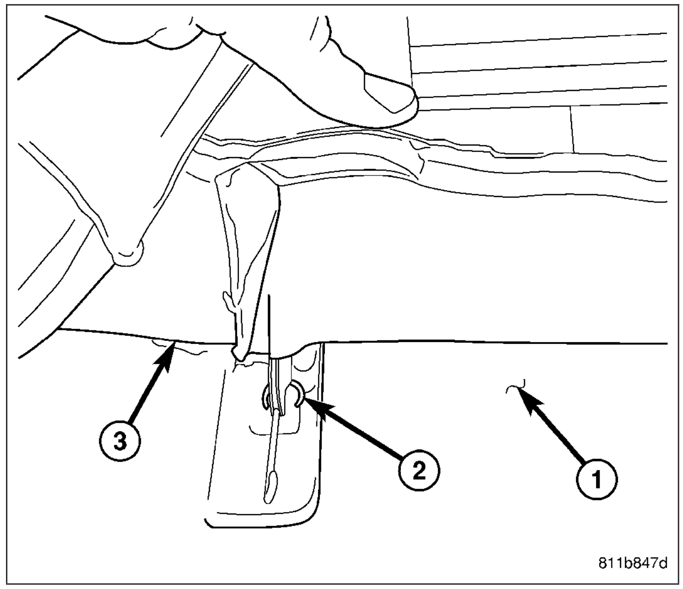
1. Position the seat cushion cover over the seat foam cushion and install new hog rings.
2. Position the seat cushion onto the seat cushion frame and attach the J-straps.
3. Install the seat cushion onto the seat assembly and install the rear two bolts.
4. Install the front two bolts and tighten the bolts to 28 N·m (21 ft. lbs.).
5. Connect the recliner cables to the seat back hinges and install the screws.
6. Install the trim covers.
7. Install the seat. (Refer to 23 - BODY/SEATS/SEAT - INSTALLATION)

# SEAT CUSHION COVER - FRONT

## REMOVAL

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

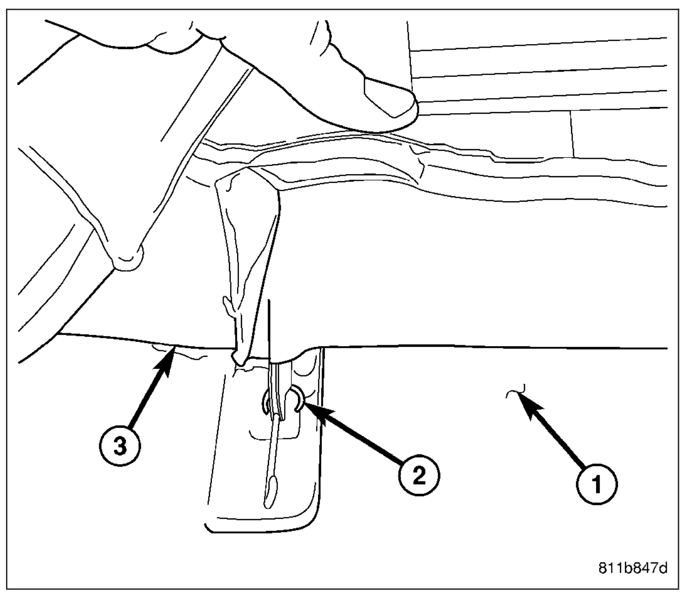
1. Remove the seat cushion. (Refer to 23 - BODY/SEATS/SEAT CUSHION - FRONT - REMOVAL)
2. Disconnect the J-straps.
3. Remove the hog rings and remove the cushion cover.




## INSTALLATION

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

1. Position the seat cushion cover and install new hog rings.
2. Connect the J-straps.
3. Install the seat cushion. (Refer to 23 - BODY/SEATS/SEAT CUSHION - FRONT - INSTALLATION)

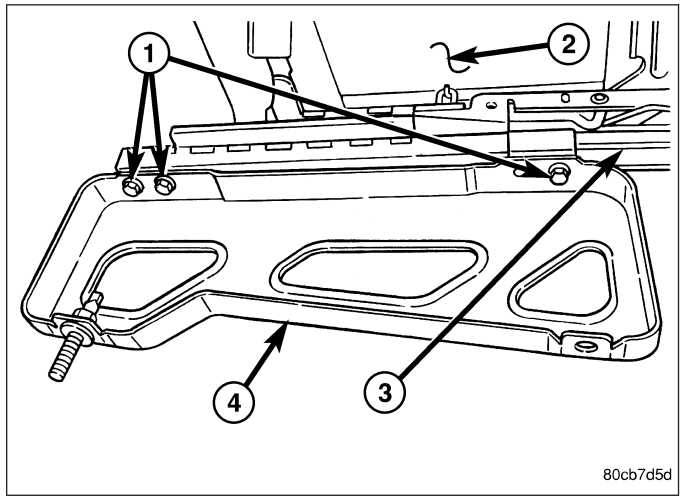


# MANUAL SEAT RISER

## REMOVAL

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

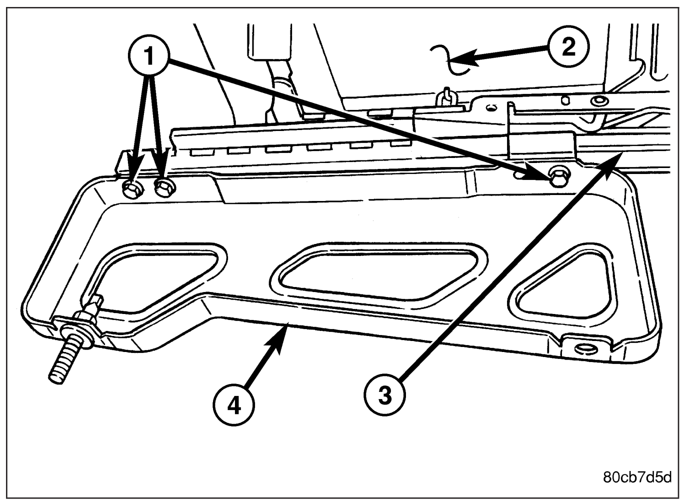
1. Remove the seat. (Refer to 23 - BODY/SEATS/SEAT - FRONT - REMOVAL)
2. Remove the bolts and remove the rivet from the release handle.
3. Remove the riser.




## INSTALLATION

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

1. Install the seat riser and install the bolts.
2. Tighten the bolts to 28 N·m (21 ft. lbs.).
3. Install a new release handle rivet.
4. Install the seat. (Refer to 23 - BODY/SEATS/SEAT - FRONT - INSTALLATION)



# SEAT TRACK

## REMOVAL

**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

1. Remove the seat back. (Refer to 23 - BODY/SEATS/SEAT BACK - FRONT - REMOVAL)
2. Remove the outer riser. (Refer to 23 - BODY/SEATS/SEAT RISER - REMOVAL)
3. Remove the front outer bolts and remove the tracks.

## INSTALLATION

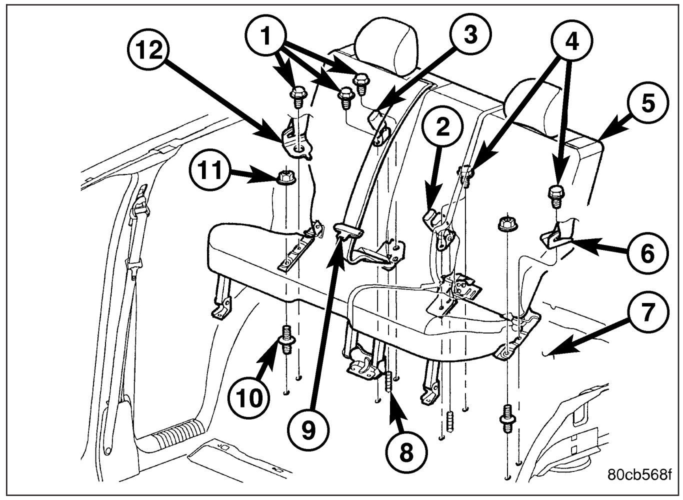
**WARNING: Before proceeding with the following repair procedure, review all warnings and cautions. (Refer to 23 - BODY/SEATS - WARNING)**

1. Install the seat track onto the seat cushion and install the front outer bolts.
2. Tighten the bolts to 28 N·m (21 ft. lbs.).
3. Install the seat riser. (Refer to 23 - BODY/SEATS/SEAT RISER - INSTALLATION)
4. Install the seat back. (Refer to 23 - BODY/SEATS/SEAT BACK - FRONT - INSTALLATION)

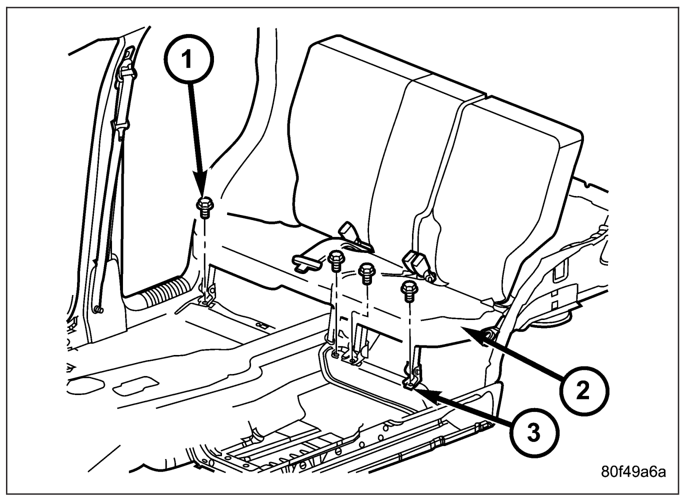
# SEAT - REAR

## REMOVAL

1. Remove the outer seat belt anchors. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - REMOVAL)
2. Remove the inner seat belt buckles. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT BUCKLE - REMOVAL)
3. Remove the center seat belt anchor. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - REMOVAL)
4. Remove the remaining rear seat fasteners.

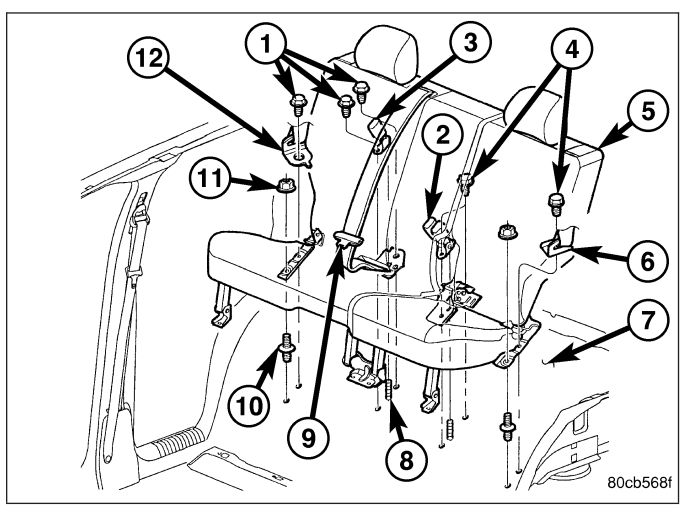



5. Remove the front bolts.
6. Fold down the seat backs and remove the seat assembly through the rear door.

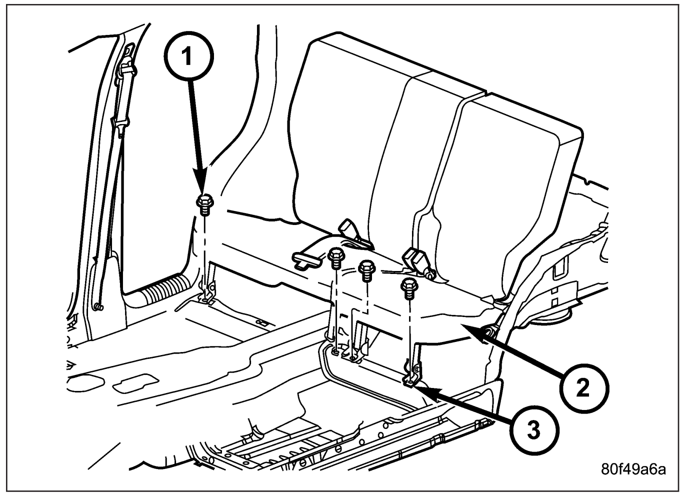



## INSTALLATION

1. Install the seat assembly and position over the studs.
2. Open the seat back and engage the latches onto the latch strikers.
3. Install the rear outboard nuts and tighten to 43 N·m (32 ft. lbs.).
4. Install the outer seat belt anchors. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - INSTALLATION)
5. Install the inner seat belt buckles. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT BUCKLE - INSTALLATION)
6. Install the center seat belt anchor. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - INSTALLATION)



7. Install the front outer seat cushion leg bolts and tighten to 35 N·m (26 ft. lbs.)

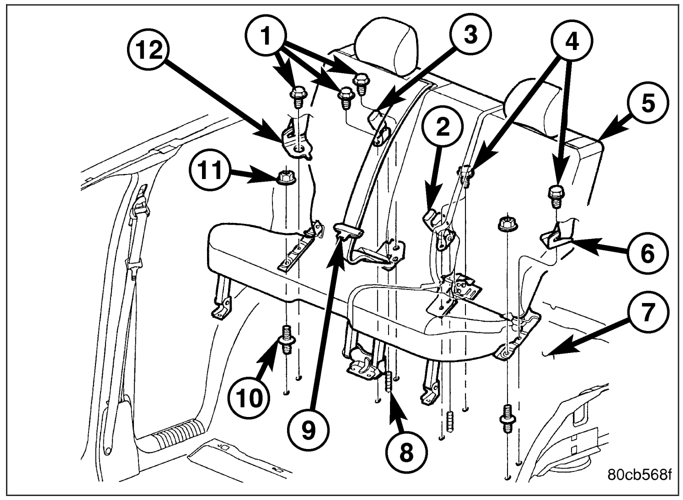


# SEAT BACK - REAR

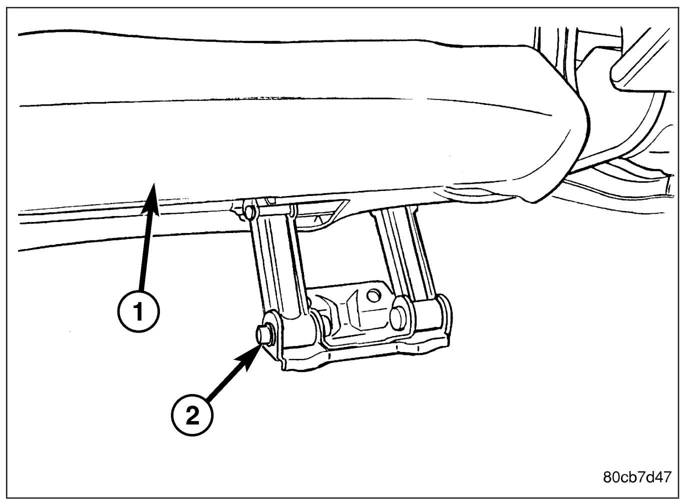
## REMOVAL

### 60/40 Split Seat - Left

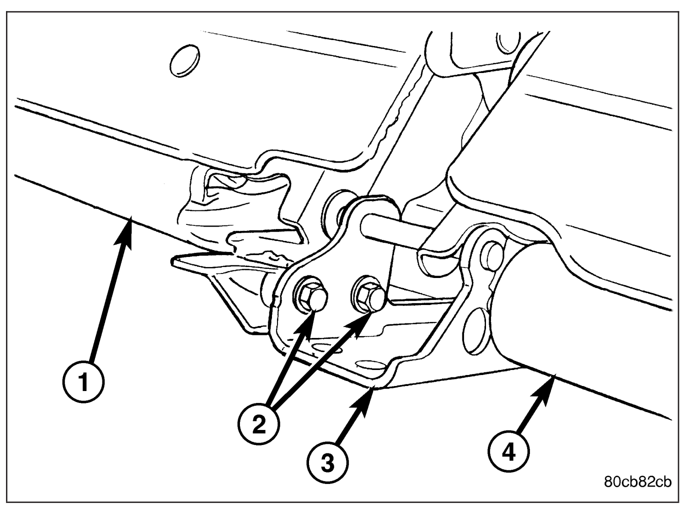
1. Remove the outer seat belt anchors. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - REMOVAL)
2. Remove the outer seat anchor nut.



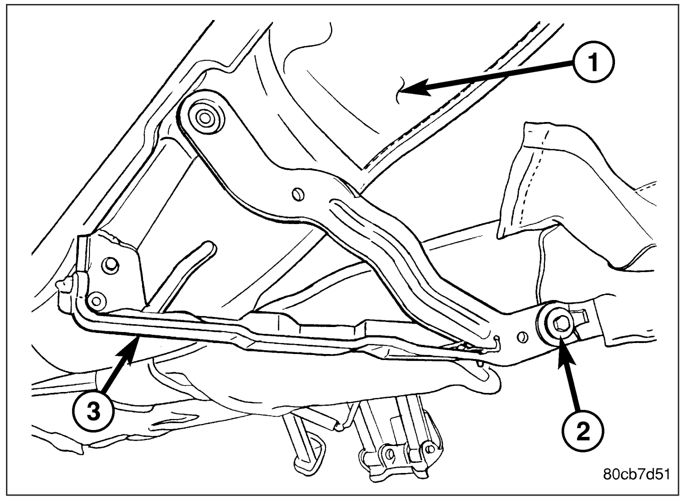

3. Remove the front seat cushion hinge bolt.




4. Remove the center seat back hinge bolts and separate the rear seat assembly.

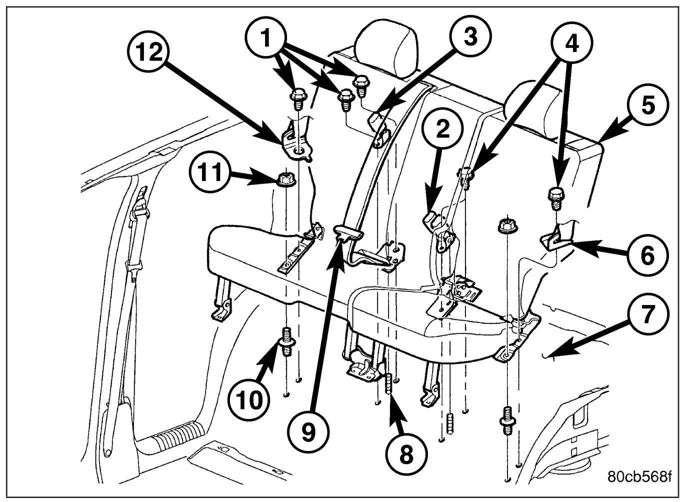


5. Release the clips and remove the seat back hinge covers.
6. Lift the seat cushion cover and remove the hinge bolts.
7. Remove the seat back.

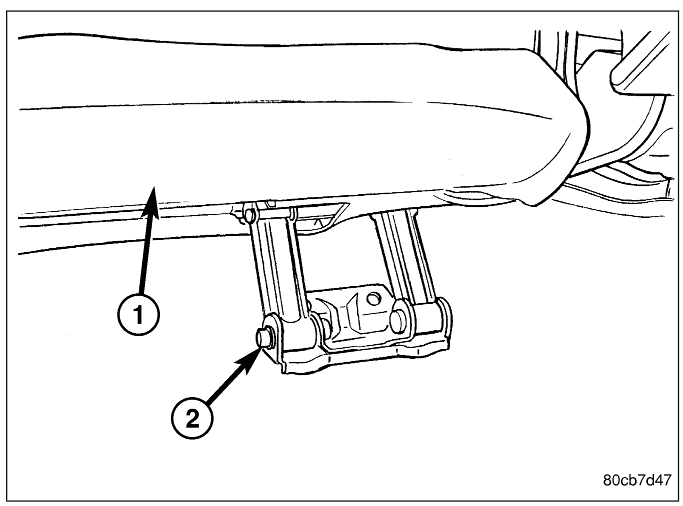



## 60/40 Split Seat - Right

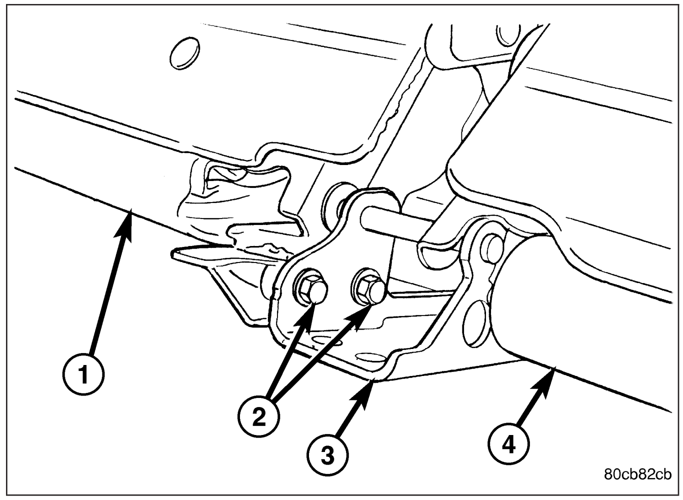
1. Remove the outer seat belt anchors. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - REMOVAL)
2. Remove the outer seat anchor nut.



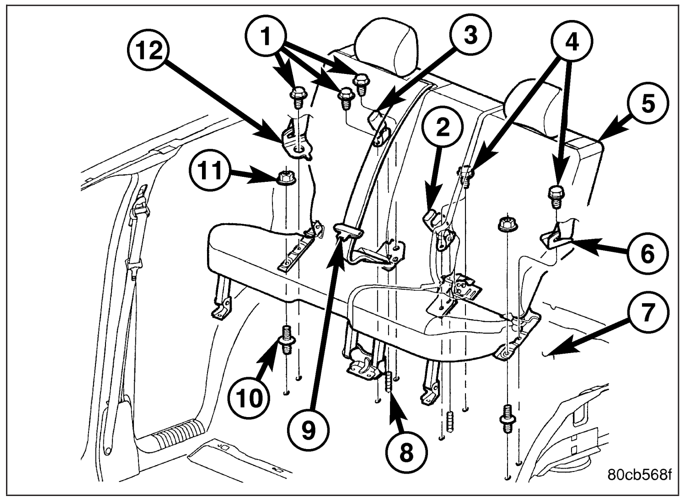

3. Remove the inner seat belt buckles. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT BUCKLE - REMOVAL)
4. Remove the front seat cushion hinge bolt.



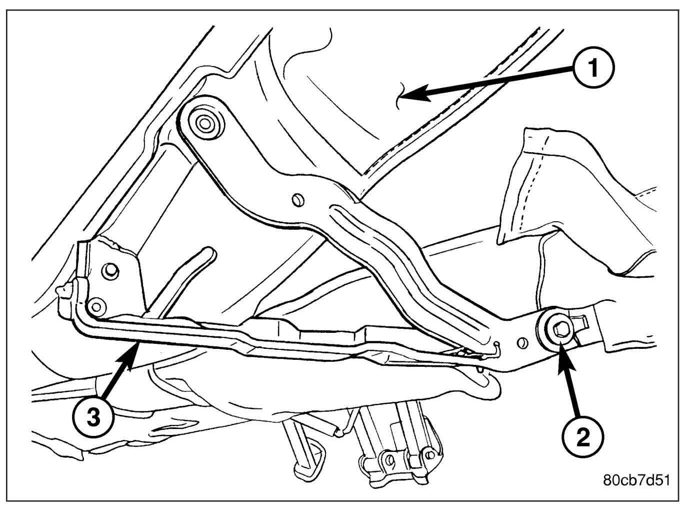
5. Remove the center seat back hinge bolts and separate the rear seat assembly.




6. Remove the center seat belt anchor. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - REMOVAL)
7. Remove the remaining outer and inner seat anchor bolts.



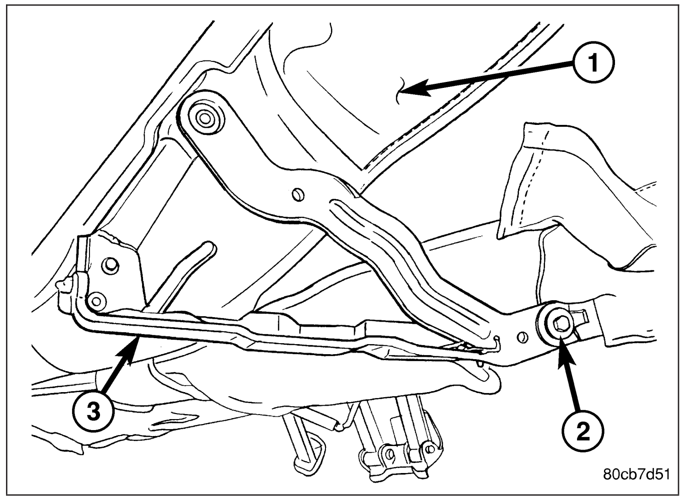

8. Release the clips and remove the seat back hinge covers.
9. Lift the seat cushion cover and remove the hinge bolts.
10. Remove the seat back.



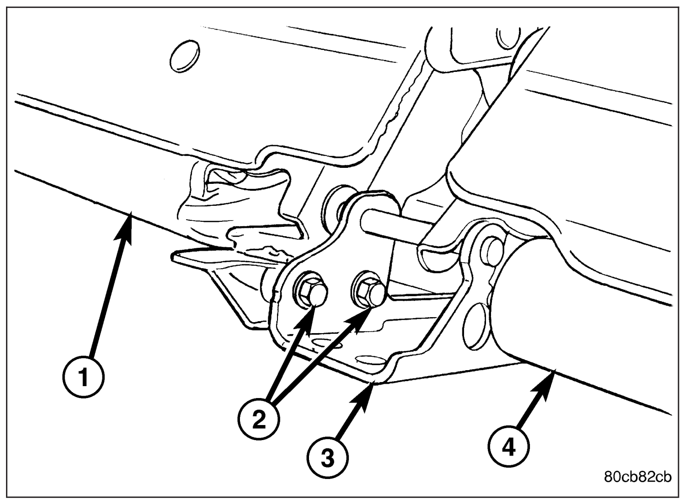
# INSTALLATION

## 60/40 Split Seat - Left

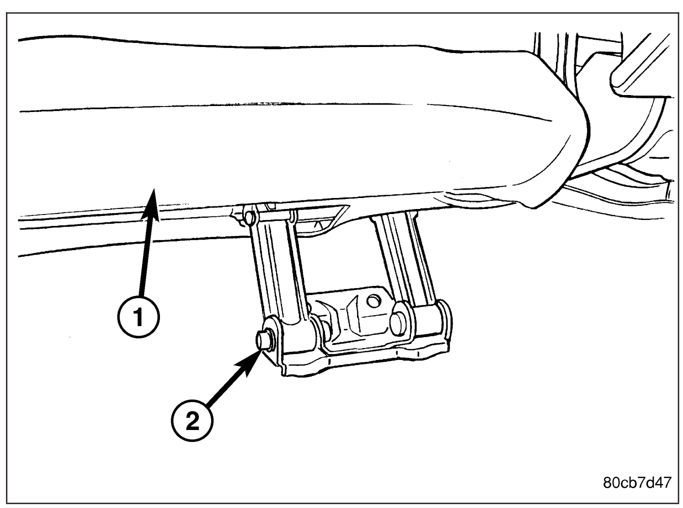
1. Install the seat back.
2. Install the seat back hinge bolt and tighten to 8 N·m (71 in. lbs.).



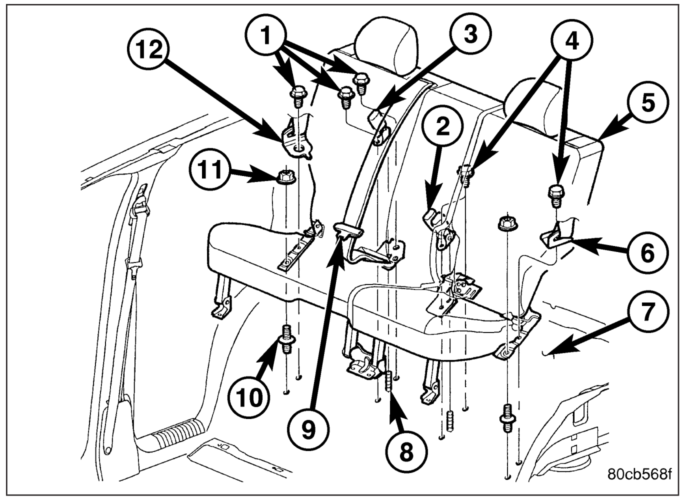

3. Position the seat back hinge covers and fully seat the clips.
4. Connect the seat halves and install the center seat back hinge bolts.
5. Tighten the bolts to 28 N·m (21 ft. lbs.).




6. Install the front seat cushion hinge bolt and tighten to 28 N·m (21 ft. lbs.).

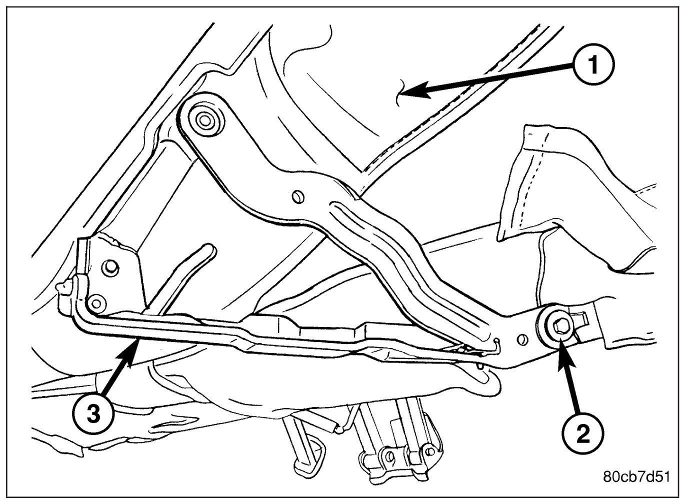


7. Install the outer seat anchor nut and tighten to 35 N·m (26 ft. lbs.).
8. Install the outer seat belt anchors. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - INSTALLATION)

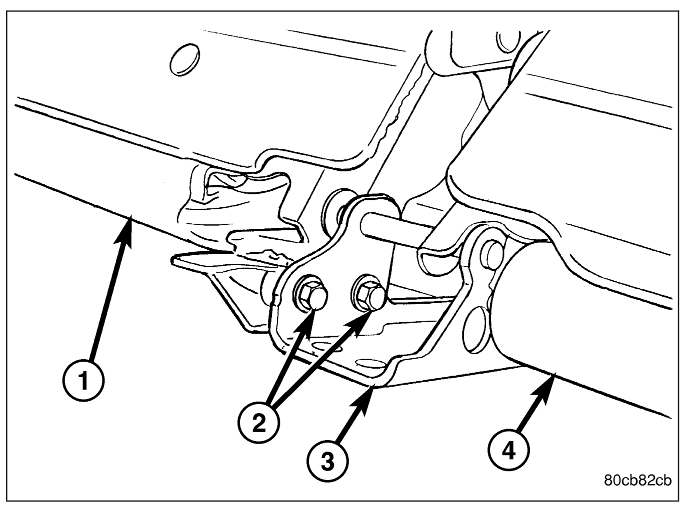



### 60/40 Split Seat - Right

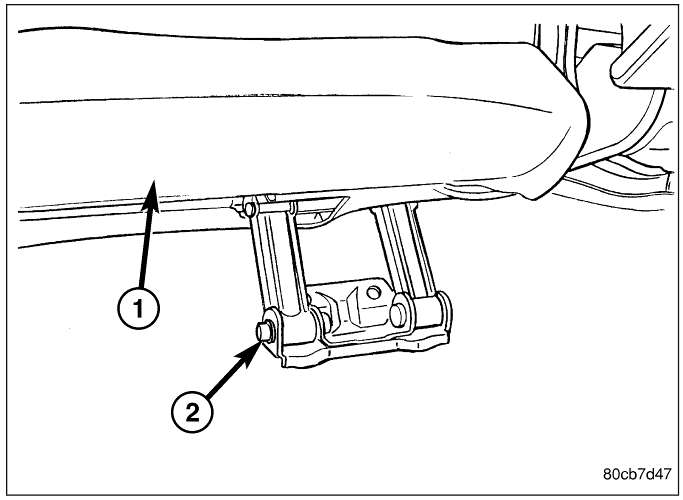
1. Install the seat back.
2. Install the seat back hinge bolt and tighten to 8 N·m (71 in. lbs.).




3. Position the seat back hinge covers and fully seat the clips.
4. Connect the seat halves and install the center seat back hinge bolts.
5. Tighten the bolts to 28 N·m (21 ft. lbs.).

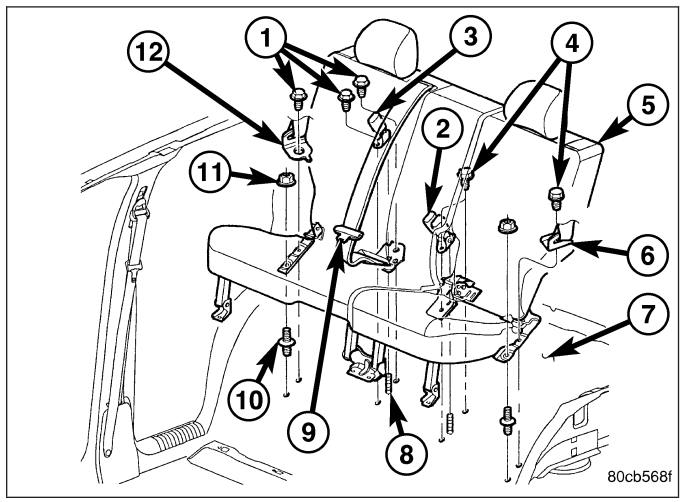


6. Install the front seat cushion hinge bolt and tighten to 28 N·m (21 ft. lbs.).




## Seat Installation

1. Install the outer and inner seat anchor nuts and tighten to 62.5 N·m (46 ft. lbs.).
2. Install the inner seat belt buckles. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT BUCKLE - INSTALLATION)
3. Install the center seat belt anchor. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - INSTALLATION)
4. Install the outer seat belt anchors. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - INSTALLATION)



# SEAT BACK COVER - REAR

## REMOVAL

1. Remove the rear seat back. (Refer to 23 - BODY/SEATS/SEAT BACK - REAR - REMOVAL)
2. Remove the screws and remove the center seat belt guide.
3. Remove the screws and push pin fasteners and remove the latch handle bezel.
4. Remove the head rest and remove the guide covers. (Refer to 23 - BODY/SEATS/HEADREST - REMOVAL)
5. Remove the screws and remove the grocery hooks.
6. Remove the push pin fasteners and remove the seat back panel.
7. Disconnect the J-straps.
8. Remove the seat back cover.

## INSTALLATION

1. Install the seat back cover and connect the J-straps.
2. Install the seat back panel and install the push pin fasteners.
3. Install the grocery hooks and install the screws.
4. Install the head rest guide covers and install the head rest. (Refer to 23 - BODY/SEATS/HEADREST - INSTALLATION)
5. Install the latch handle bezel and install the screws and push pin fasteners.
6. Install the center seat belt guide and screws.
7. Install the rear seat back. (Refer to 23 - BODY/SEATS/SEAT BACK - REAR - INSTALLATION)

# SEAT BACK CUSHION - REAR

## REMOVAL

1. Remove the seat back cover. (Refer to 23 - BODY/SEATS/SEAT BACK COVER - REAR - REMOVAL)
2. Separate the cushion from the seat back frame.

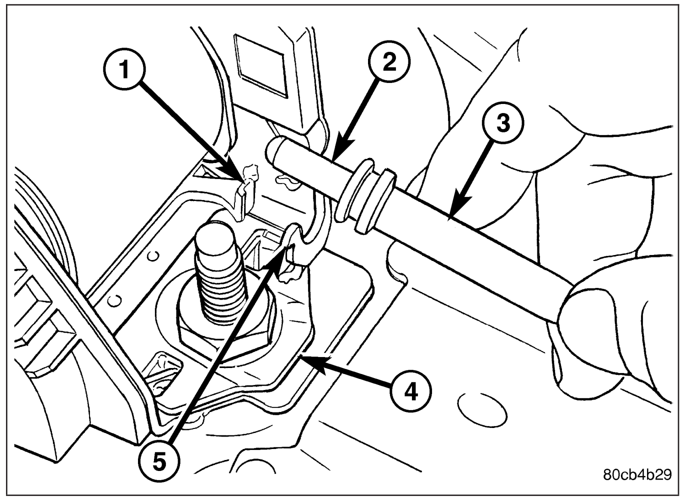
## INSTALLATION

1. Position the seat back cushion onto the seat back frame.
2. Install the seat back cover. (Refer to 23 - BODY/SEATS/SEAT BACK COVER - REAR - INSTALLATION)

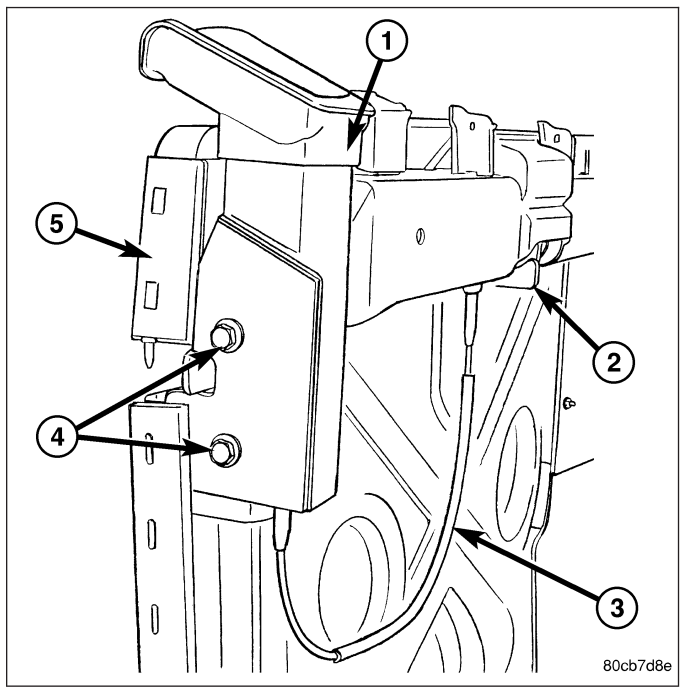
# FOLDING REAR SEAT BACK LATCH / LOCK

## REMOVAL

1. Remove the rear seat back cushion. (Refer to 23 - BODY/SEATS/SEAT BACK CUSHION / COVER - REAR - REMOVAL)
2. Disconnect the shoulder belt release cable.

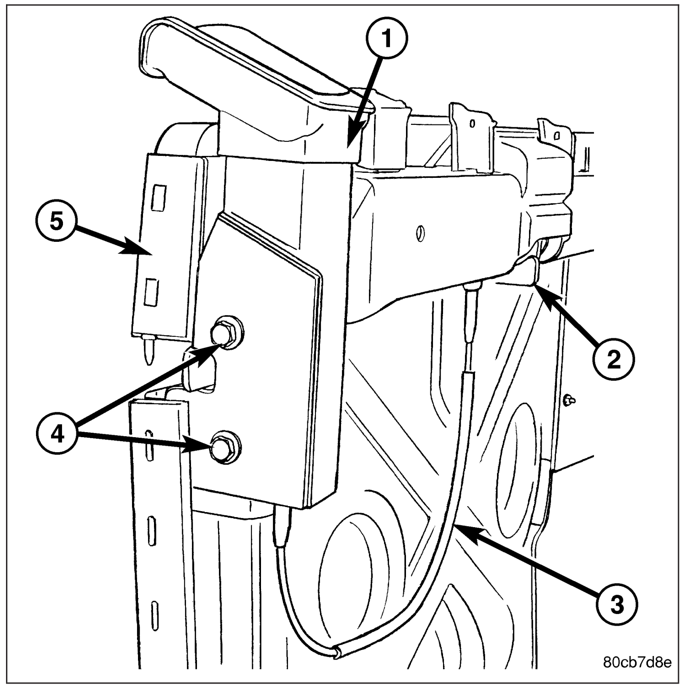



3. Remove the bolts and remove the latch/lock assembly.

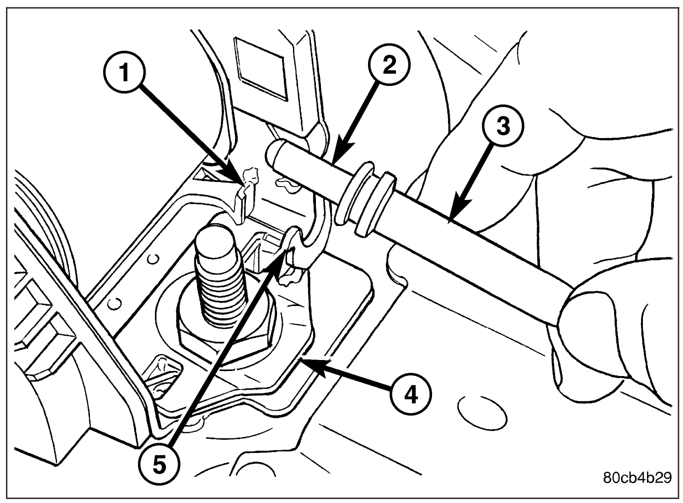


## INSTALLATION

1. Install the latch/lock assembly and install the bolts.
2. Tighten the bolts to 28 N·m (21 ft. lbs.).



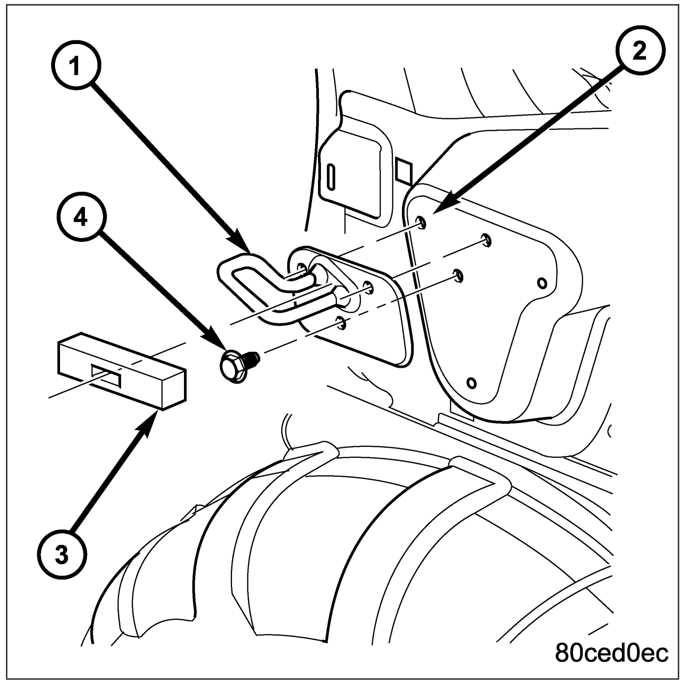

3. Connect the shoulder belt release cable.
4. Install the rear seat back cushion. (Refer to 23 - BODY/SEATS/SEAT BACK CUSHION / COVER - REAR - INSTALLATION)



# REAR SEAT BACK LATCH STRIKER

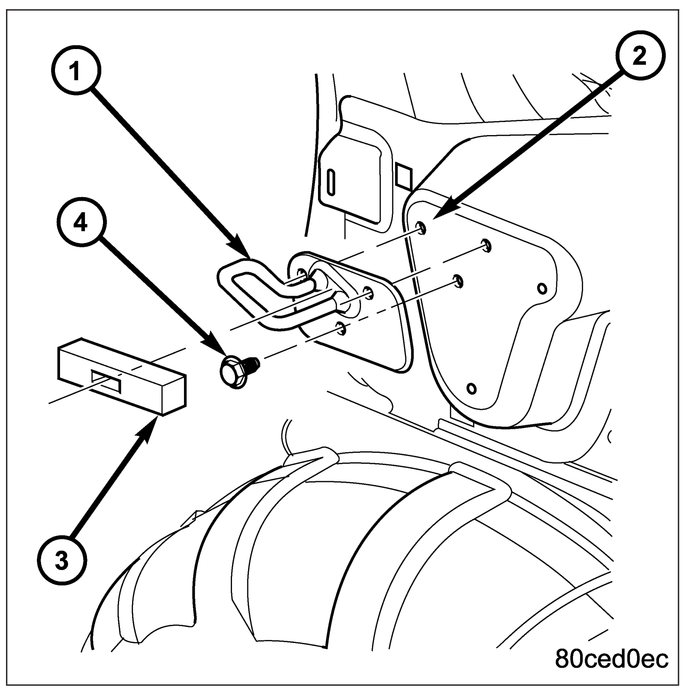
## REMOVAL

1. Remove the quarter trim panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL)
2. Remove the bolts and remove the striker.




## INSTALLATION

1. Position the striker and install the bolts.
2. Tighten the bolts to 35 N·m (26 ft. lbs.).
3. Install the quarter trim panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - INSTALLATION)



# SEAT BACK FRAME - REAR

## REMOVAL

1. Remove the center seat belt retractor, if equipped. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - REMOVAL)
2. Remove the seat back latch/lock assembly. (Refer to 23 - BODY/SEATS/FOLDING REAR SEAT BACK LATCH / LOCK - REMOVAL)

## INSTALLATION

1. Install the seat back latch/lock assembly. (Refer to 23 - BODY/SEATS/FOLDING REAR SEAT BACK LATCH / LOCK - INSTALLATION)
2. Install the center seat belt retractor, if equipped. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT & RETRACTOR - INSTALLATION)

# SEAT CUSHION - REAR

## REMOVAL

1. Remove the seat back. (Refer to 23 - BODY/SEATS/SEAT BACK - REAR - REMOVAL)
2. Disconnect the J-straps and remove the seat cushion and cover.

## INSTALLATION

1. Position the seat cushion and cushion cover onto the seat frame.
2. Connect the J-straps.
3. Install the seat back. (Refer to 23 - BODY/SEATS/SEAT BACK - REAR - INSTALLATION)

# STATIONARY GLASS

## TABLE OF CONTENTS

# DOOR GLASS

## REMOVAL

1. Remove the rear door glass run channel. (Refer to 23 - BODY/DOORS - REAR/GLASS RUN CHANNEL - REMOVAL)

## INSTALLATION

1. Install the rear door glass run channel. (Refer to 23 - BODY/DOORS - REAR/GLASS RUN CHANNEL - INSTALLATION)

# QUARTER WINDOW

## REMOVAL

1. Remove the headliner as necessary to gain access to the glass seal from the inside. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL)
2. Cut urethane bonding from around quarter window glass using a suitable sharp cold knife. A pneumatic cutting device can be used if available.
3. Separate glass from vehicle.

## INSTALLATION

**CAUTION: Open a window before installing glass. This will avoid pressurizing the passenger compartment. If a door or swing gate flip-up glass is slammed before urethane is cured, water leaks can result.**

The window opening fence should be cleaned of old urethane bonding material.

1. Install the headliner as necessary. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION)
2. Clean inside of glass with Mopar® Glass Cleaner and lint-free cloth.
3. Apply PVC (vinyl) primer 25 mm (1 in.) wide around edge of glass. Wipe with clean/dry lint-free cloth.
4. Apply fence primer around edge of fence. Allow at least eighteen minutes drying time.
5. Apply a 10 mm (0.4 in.) bead of urethane around window vinyl border location.
6. Position glass into window opening and lock clips into place.

# WINDSHIELD

## WARNING

## WINDSHIELD SAFETY PRECAUTIONS

**WARNING: Do not operate the vehicle within 24 hours of windshield installation. It takes at least 24 hours for urethane adhesive to cure. If it is not cured, the windshield may not perform properly in an accident.**
- **Urethane adhesives are applied as a system. Use glass cleaner, glass prep solvent, glass primer, pvc (vinyl) primer and pinch weld (fence) primer provided by the adhesive manufacturer. If not, structural integrity could be compromised.**
- **DaimlerChrysler does not recommend glass adhesive by brand. Technicians should review product labels and technical data sheets, and use only adhesives that their manufactures warrant will restore a vehicle to the requirements of FMVSS 212. Technicians should also insure that primers and cleaners are compatible with the particular adhesive used.**
- **Be sure to refer to the urethane manufacturer's directions for curing time specifications, and do not use adhesive after its expiration date.**
- **Vapors that are emitted from the urethane adhesive or primer could cause personal injury. Use them in a well-ventilated area.**
- **Skin contact with urethane adhesive should be avoided. Personal injury may result.**
- **Always wear eye and hand protection when working with glass.**

**CAUTION: Protect all painted and trimmed surfaces from coming in contact with urethane or primers. Be careful not to damage painted surfaces when removing moldings or cutting urethane around windshield.**

## REMOVAL

1. Remove inside rear view mirror. (Refer to 23 - BODY/INTERIOR/REAR VIEW MIRROR - REMOVAL)
2. Remove cowl cover. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - REMOVAL)
3. Remove screws attaching windshield side molding to A-pillar.
4. Cut urethane bonding from around windshield using a suitable sharp cold knife. A pneumatic cutting device can be used if available.
5. Separate windshield from vehicle.

## INSTALLATION

**WARNING: Review all warnings and cautions in this group before preceding with installation.**

**CAUTION: Open a window before installing windshield. This will avoid pressurizing the passenger compartment. If a door or swing gate flip-up glass is slammed before urethane is cured, water leaks can result.**

The windshield fence should be cleaned of old urethane bonding material. Support spacers should be cleaned and properly installed on weld studs or repair screws at bottom of windshield opening.

1. Place replacement windshield into windshield opening. Position glass in the center of the opening against the support spacers. Mark the glass at the support spacers with a grease pencil or masking tape and ink pen to use as a reference for installation. Remove replacement windshield from windshield opening.
2. Position the windshield inside up on a suitable work surface with two padded, wood 10 cm by 10 cm by 50 cm (4 in. by 4 in. by 20 in.) blocks, placed parallel 75 cm (2.5 ft.) apart.
3. Clean inside of windshield with Mopar® Glass Cleaner and lint-free cloth.
4. Apply clear glass primer 25 mm (1 in.) wide around edge of windshield. Wipe with clean/dry lint-free cloth.
5. Apply black-out primer 15 mm (.75 in.) wide on top and sides of windshield and 25 mm (1 in.) on bottom of windshield. Allow at least three minutes drying time.
6. Position windshield spacers on lower fence above support spacers at the edge of the windshield opening.

7. Align the dot on the upper molding to the tick mark in the center of the glass and install upper molding onto windshield.
8. Apply a 10 mm (0.4 in.) bead of urethane around perimeter of windshield along the inside of the moldings. Apply two beads along the bottom edge.
9. Apply fence primer around the perimeter of the windshield opening fence. Allow at least 18 minutes drying time.
10. With aid of a helper, position windshield over windshield opening. Align reference marks at bottom of windshield to support spacers.
11. Slowly lower windshield glass to windshield opening fence. Guide top molding into proper position if necessary. Push windshield inward to fence spacers at bottom and until top molding is flush to roof line.
12. Clean excess urethane from exterior with Mopar® Super Clean or equivalent.
13. Install windshield side moldings. (Refer to 23 - BODY/WEATHERSTRIP/SEALS/WINDSHIELD A-PILLAR WEATHERSTRIP - INSTALLATION)
14. Install cowl grille. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - INSTALLATION)
15. Install inside rear view mirror. (Refer to 23 - BODY/INTERIOR/REAR VIEW MIRROR - INSTALLATION)
16. After urethane has cured, water test windshield to verify repair.

# SUNROOF

## TABLE OF CONTENTS

# SUNROOF

## DESCRIPTION

**WARNING: Keep fingers and other body parts out of sunroof opening at all times.**

The sunroof features a power sliding glass panel and a sunshade which can be manually positioned anywhere along its travel, rearward of glass panel front edge.

The sunroof is electrically operated from two switches located on the windshield header, rearward of the map lamp. To operate the sunroof the ignition switch must be in either the Accessory or On/Run position. One switch (vent) is a push button type and opens the sunroof to the vent position only. The other switch (open/close) is a rocker type for opening and closing the sunroof. Pressing and releasing the open button once the sunroof will express open and the wind deflector will raise. If the button is pressed a second time the sunroof will stop in that position. Pressing and holding the close button will close the sunroof. If the close button is released the sunroof will stop in that position.

### SUNROOF OPERATION INSTRUCTIONS

| SWITCH INPUTS | | | |
|---|---|---|---|
| | OPEN | CLOSE | VENT |
| FULL VENT | Push and hold switch until glass stops in flush closed position glass will then express open | Push and hold switch until glass stops in flush closed position. | No action |
| VENT RANGE | Push and hold switch until glass passes through flush closed position. Glass will then open | Push and hold switch until glass stops in flush closed position. | Push and hold switch until glass stops in full vent position. |
| FLUSH | 1. Press switch for less than 0.65 seconds for express to full open.<br>2. Press switch for more than 0.65 seconds and glass will stop when switch is released | No action | Press and hold switch. Glass will travel through flush closed to full vent. Glass will stop when switch is released or when fully vented. |
| FULL OPEN | No action | Press and hold switch until glass stops in flush closed position or anywhere in between. | Press and hold switch. Glass will travel through flush closed to full vent. Glass will stop when switch is released. |

## DIAGNOSIS AND TESTING

## WATER DRAINAGE AND WIND NOISE DIAGNOSIS

The sliding glass panel is designed to seal water entry with a snug fit between the roof and the seal. The fit can be checked by inserting a piece of paper between the roof and the seal. The piece of paper should have some resistance when pulled out when the glass panel is in the closed position. The sunroof housing will drain off a minimum amount of water. Excessive wind noise could result if the gap clearances are exceeded. The sunroof glass panel may need to be adjusted. Refer to Sunroof Glass Panel Adjustment for proper procedures.

Adequate drainage is provided by a drain trough in the sunroof housing which encircles the sliding glass panel and leads to drain hoses. If a wet headliner or other water leak complaints are encountered, before performing any adjustments, first ensure that the drainage system is not plugged or disconnected. Use a pint container to pour water into the sunroof housing drain trough. If water flow is restricted, use compressed air to blow out any material plugging the drain system. Retest system again.

To further check for a disconnected drain hose:

1. Remove A-pillar trim, sun visors, and map lamps/mini console.
2. Remove sunroof opening trim lace. (Refer to 23 - BODY/SUNROOF/OPENING TRIM LACE - REMOVAL)
3. Lower headliner as necessary to gain access to sunroof housing drain tubes. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL)
4. Repair as necessary.
5. Install headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION)
6. Install sunroof opening trim lace. (Refer to 23 - BODY/SUNROOF/OPENING TRIM LACE - INSTALLATION)

## DIAGNOSTIC PROCEDURES

Before beginning sunroof diagnostics verify that all other power accessories are in proper operating condition. Refer to Sunroof Diagnostic Chart for possible causes. If not, a common electrical problem may exist. Refer to Wiring Diagrams, in this publication for circuit, splice and component descriptions. Check the condition of the circuit protection (20 amp circuit breaker in cavity 19 of the Junction Block). Inspect all wiring connector pins for proper engagement and continuity. Check for battery voltage at the power sunroof drive motor, refer to Wiring Diagrams, for circuit information. If battery voltage of more than 9 volts is detected at the drive motor, proceed with the following tests (the drive motor will not operate at less than 9 volts).

Before beginning diagnosis for wind noise or water leaks, verify that the problem was not caused by releasing the control switch before the sunroof was fully closed. The sunroof module has a water-management system. If however, the sunroof glass is in a partial closed position, high pressure water may be forced beyond the water management system boundaries and onto the headlining.

**SUNROOF DIAGNOSIS CHART**

| SYMPTOM | POSSIBLE CAUSE |
|---|---|
| Sunroof motor inoperative. | Faulty control switch.<br>Faulty circuit ground between sunroof drive motor, control switch, and body harness.<br>Faulty power circuit between sunroof drive motor, control switch, and body harness.<br>Faulty drive motor.<br>Faulty drive motor electrical connector. |
| Audible whine when switch is depressed, sunroof does not operate. | Faulty drive motor.<br>Binding cable. |
| Audible clicking or ratcheting when switch is pressed, sunroof does not operate. | Broken or worn drive cable.<br>Worn drive motor gear.<br>Mechanisms not synchronized. |
| Sunroof vents and opens, but does not close. | Binding cable.<br>Faulty circuit.<br>Faulty control switch.<br>Faulty drive motor. |
| Sunroof vents, but does not open. | Binding cable or mechanism.<br>Faulty circuit.<br>Faulty switch.<br>Faulty drive motor. |

| SYMPTOM | POSSIBLE CAUSE |
|---|---|
| Sunroof does not vent. | Binding cable or mechanism.<br>Faulty circuit.<br>Faulty control switch.<br>Faulty drive motor. |
| Sunroof water leak. | Drain tubes clogged or kinked or disconnected from the sunroof.<br>Glass panel improperly adjusted.<br>Faulty glass panel seal. |
| Gurgling sound from sunroof. | Low spot in drain hose routing, allowing water to stand. |
| Wind noise from sunroof. | Front of glass panel too high or rear too low.<br>Wind deflector not deploying.<br>Glass not centered in opening.<br>Faulty glass panel seal. |
| Rattles from open sunroof while driving. | Loose or broken attaching hardware.<br>Worn or broken mechanism. |
| Sunroof does not stop in the fully closed position. | Drive motor has lost position of glass, teach procedure required to reprogram drive motor. Refer to sunroof drive motor teach procedure. |

# CONTROL SWITCH

## DESCRIPTION

Vehicles equipped with a power sunroof utilize an sunroof control switch. On this model, the sunroof control switch is located in the overhead console, in between the two reading lamps. The switch is mounted in the overhead console with four plastic retaining tabs, molded into the switch housing.

This switch incorporates four selections of operation open, auto open, close and vent. The individual switches in the sunroof control switch unit cannot be repaired. If one switch is damaged or faulty, the entire sunroof control switch unit must be replaced.

## OPERATION

With the operation of the sunroof control switch, voltage is directed to the sunroof motor, through the switch contacts or control module. If the control switch is depressed and held depressed the voltage signal is controlled manually through the switch contacts, so when the switch is released the sunroof stops.

Refer to the Owner's Manual for more information on the operation of the sunroof switch and system.

## DIAGNOSIS AND TESTING - CONTROL SWITCH

The following test will determine if the sunroof control switch is operating properly.

1. Remove the overhead console from the headliner (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
2. Remove the sunroof control switch from the overhead console (Refer to 23 - BODY/SUNROOF/CONTROL SWITCH - REMOVAL).
3. Using an ohmmeter, test the switch terminals for proper continuity using the table below. If any of the terminals do not show proper continuity, replace the sunroof control switch.

| SWITCH POSITION (DEPRESSED) | CONTINUITY BETWEEN TERMINALS |
|---|---|
| VENT (V) | 3, 4 |
| OPEN (AUTO) | 1, 4 |
| CLOSE | 2, 4 |

## REMOVAL

1. Disconnect and isolate the negative battery cable.
2. Remove the overhead console from the headliner (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - REMOVAL).
3. Disconnect the sunroof control switch electrical connector. Depress the connector retaining tab and pull the connector straight out.
4. To remove the switch from the overhead console, push on the back of the switch until it comes free from the overhead console.

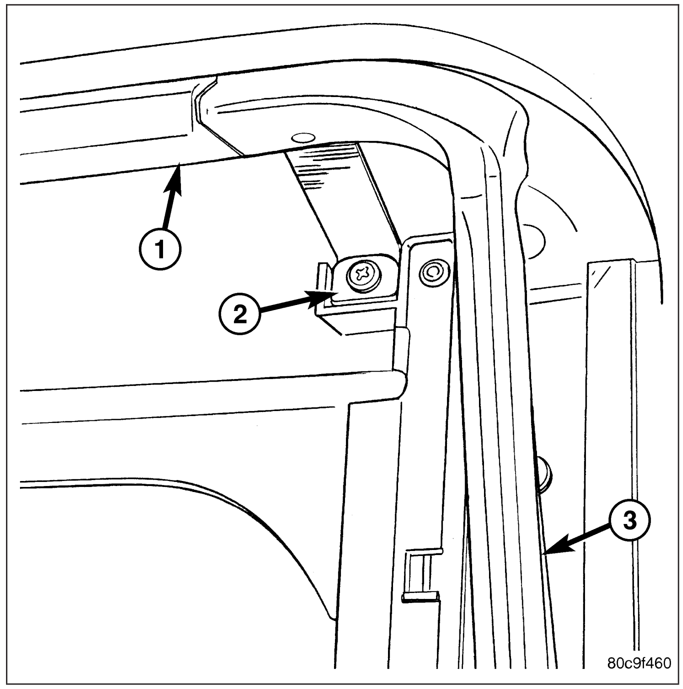
## INSTALLATION

1. Install the switch in the overhead console assembly. Be certain the switch is securely snapped in place.
2. Connect the sunroof control switch electrical connector. Be certain the switch connector is securely snapped in place.
3. Install the overhead console (Refer to 8 - ELECTRICAL/OVERHEAD CONSOLE - INSTALLATION).
4. Connect the negative battery cable.

# DEFLECTOR-WIND

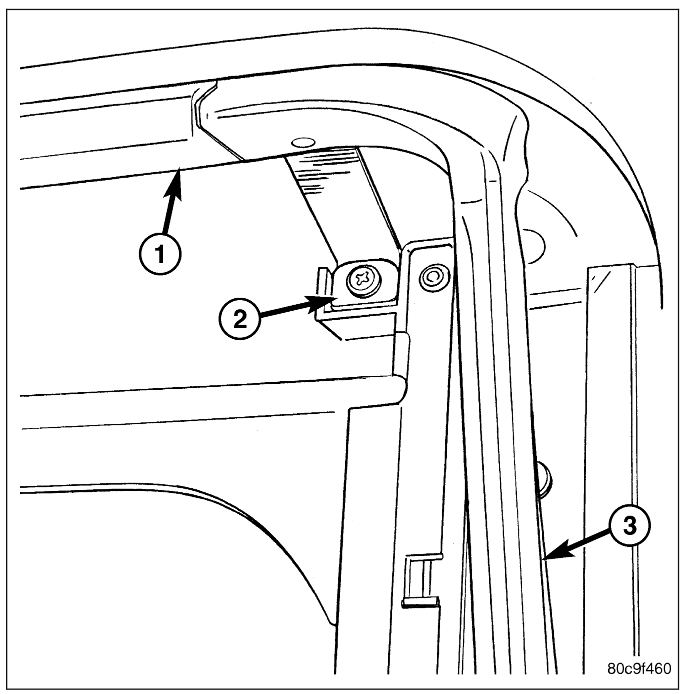
## REMOVAL

1. Open sunroof glass panel to the full open position.
2. Remove screws (2) attaching wind deflector straps to front crossmember.
3. Rotate wind deflector back about 110° and slide backwards to disengage from the spring hook.




## INSTALLATION

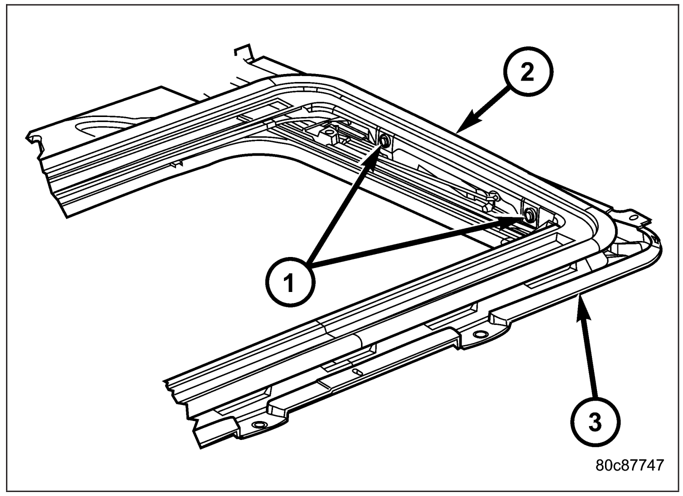
1. Place wind deflector (1) in position 110° to roof.
2. Push arms (3) down and forward to engage spring hooks.
3. Rotate wind deflector forward into correct position. Depress wind deflector down onto front crossmember to check spring function.
4. Install fasteners attaching wind deflector straps (2) to front crossmember.
5. Test sunroof operation.



# GLASS

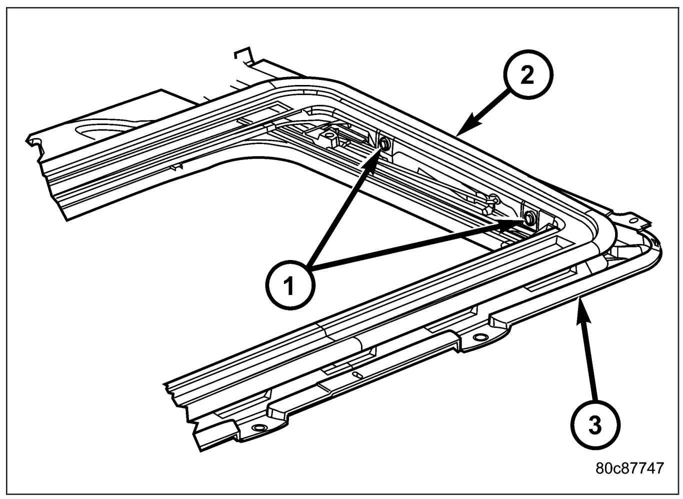
## REMOVAL

1. Slide sunshade rearward to the open position.
2. Move the glass panel (2) to the closed position.
3. Remove the four glass panel screws (1).
4. Lift off glass panel and remove from vehicle.




## INSTALLATION

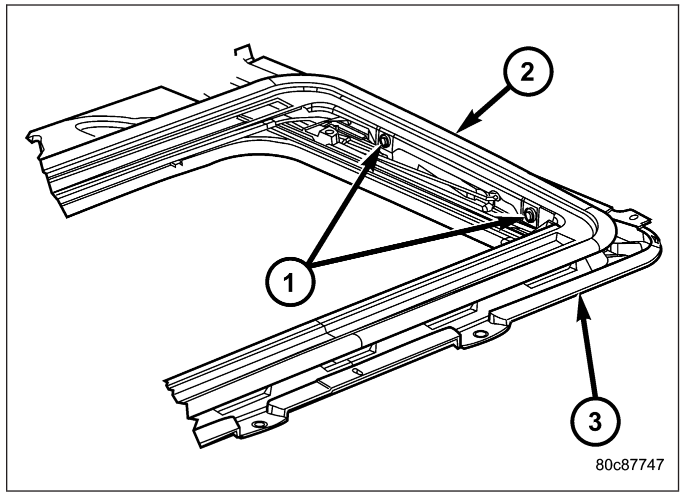
1. Position glass panel (2) on to mechanism lift arm.
2. Start the four attaching screws (1).
3. Center glass in opening by running a business card around the glass.
4. Adjust glass panel. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - ADJUSTMENTS)



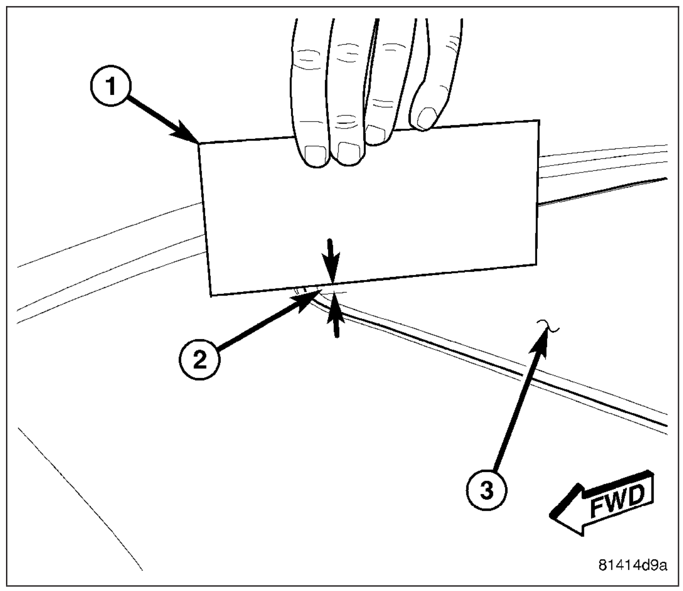
## ADJUSTMENTS

### SUNROOF GLASS PANEL ADJUSTMENT

1. Move the sunshade rearward to the open position.
2. Move the sunroof glass panel to the fully closed position.
3. Adjust the glass one corner at a time.
   a. Loosen four glass screws (1).
   b. Lift glass assembly and align the top of the glass panel to the top of the roof panel.
   c. Tighten screw to 3.5 N·m (31 in. lbs.).
   d. Repeat steps a. and b. for each corner of the glass panel.
   e. When properly adjusted, the front of the glass panel is 1.75 mm (0.07 in.) to 2.75 mm (0.11 in.) lower than the roof surface and the rear edge of the glass panel is 1.75mm (0.07 in.) to .75 mm (0.03 in.) lower than the roof surface.



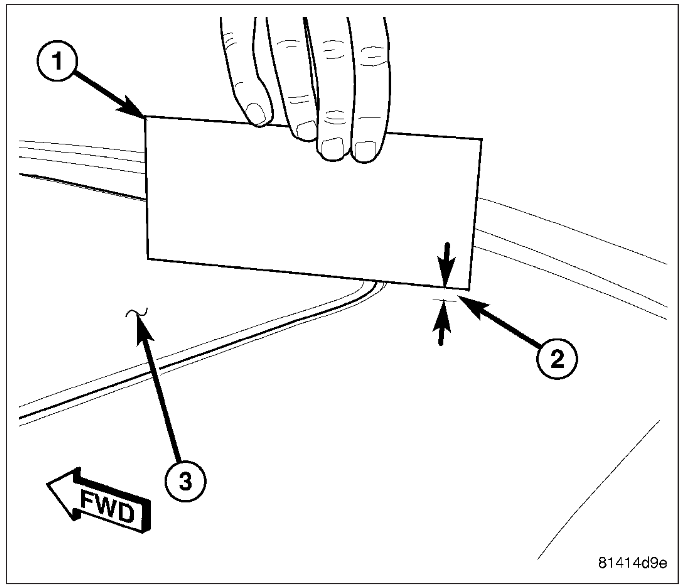

**NOTE: When properly adjusted, the front of the glass panel(3) is 1.75 mm (0.07 in.) to 2.75 mm (0.11 in.) lower than the roof surface (2).**



**NOTE: When properly adjusted, the rear edge of the glass panel (3) is 1.75mm (0.07 in.) to .75 mm (0.03 in.) lower than the roof surface (2).**

**NOTE: Glass assembly seal is 2.5mm (0.1 in) higher than the glass panel. Measure at 300mm (11.8 in) outboard of the centerline of the vehicle.**

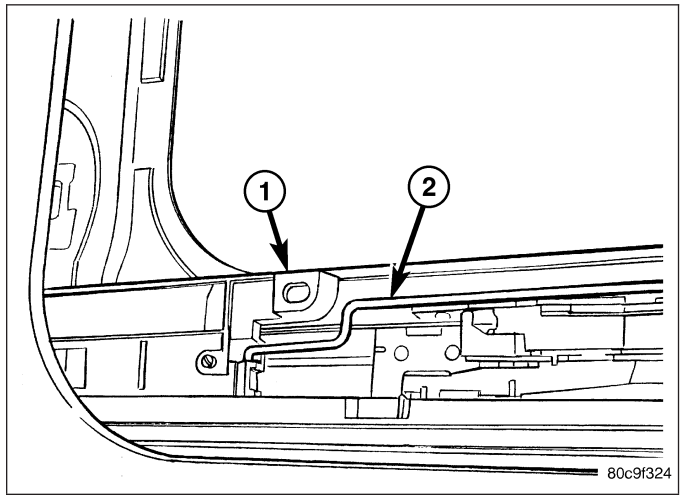
4. Verify sunroof operation and alignment. Check fit and re-adjust as necessary.



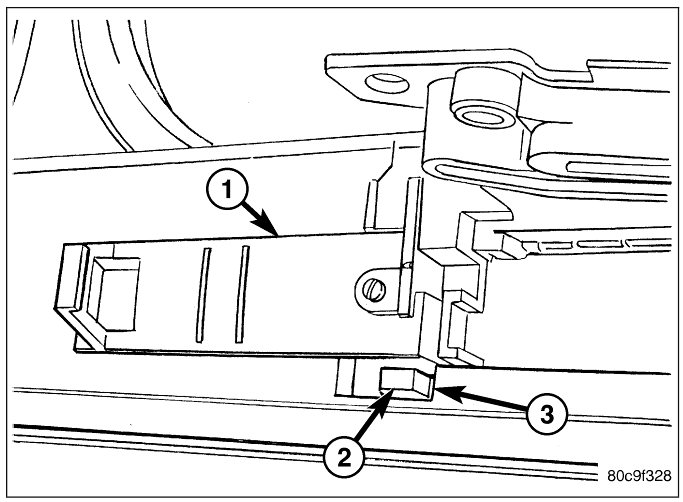
# GUIDE-TROUGH ASSEMBLY

## REMOVAL

1. Remove trough. (Refer to 23 - BODY/SUNROOF/ TROUGH - REMOVAL)
2. Disconnect the guide link (2).

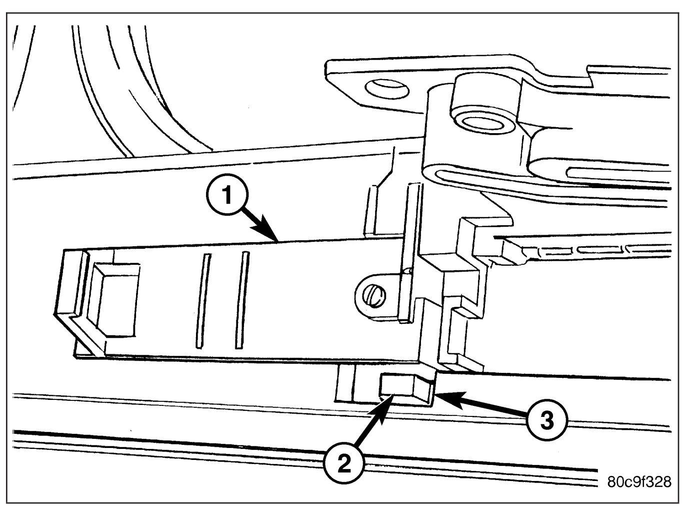



3. Slide trough guide (1) forward and disengage the sliders (2) through the notches (3) in the guide channels.

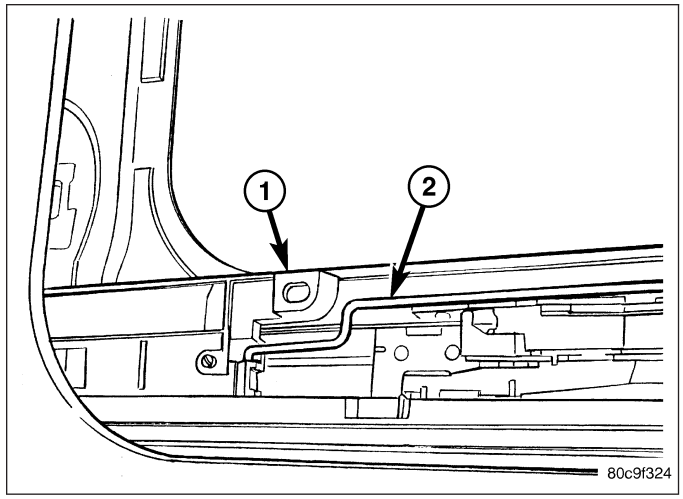



## INSTALLATION

1. Install the trough guide (1) and engage the sliders (2) into the guide channels through the small notch (3) in track.



2. Connect the guide link (2).
3. Install the trough. (Refer to 23 - BODY/SUNROOF/ TROUGH - INSTALLATION)

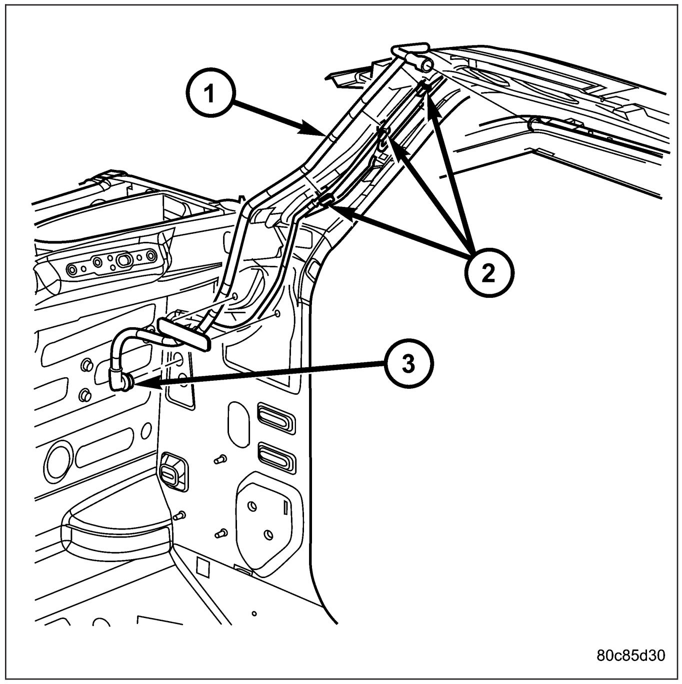


# HOSE-DRAIN

## REMOVAL

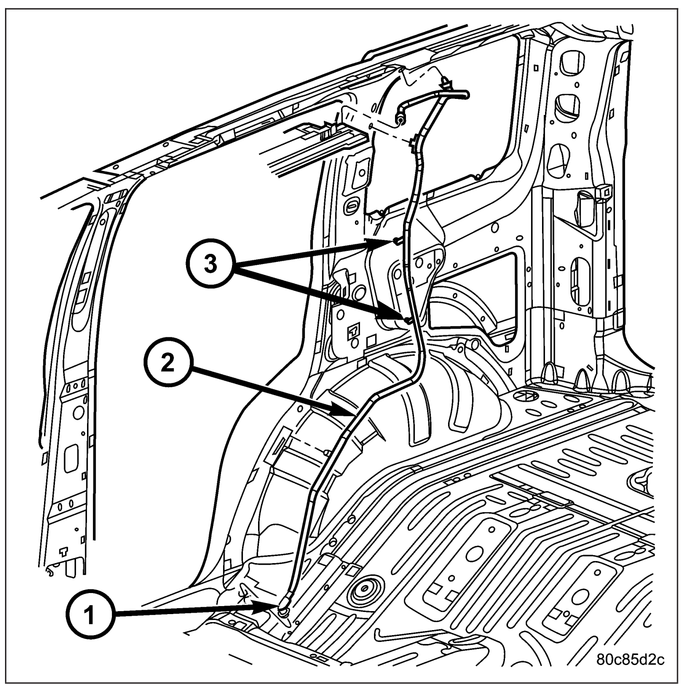
### FRONT DRAIN TUBES

1. Move glass panel to the fully closed position.
2. Remove sunroof opening trim lace.
3. Remove the headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL)
4. Disconnect the drain hose from the sunroof housing.
5. Drain any liquid from hose connection, if necessary.
6. Remove the instrument panel top panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - REMOVAL)
7. Disconnect the grommet, attachment clips and remove the drain tube.




### REAR DRAIN TUBES

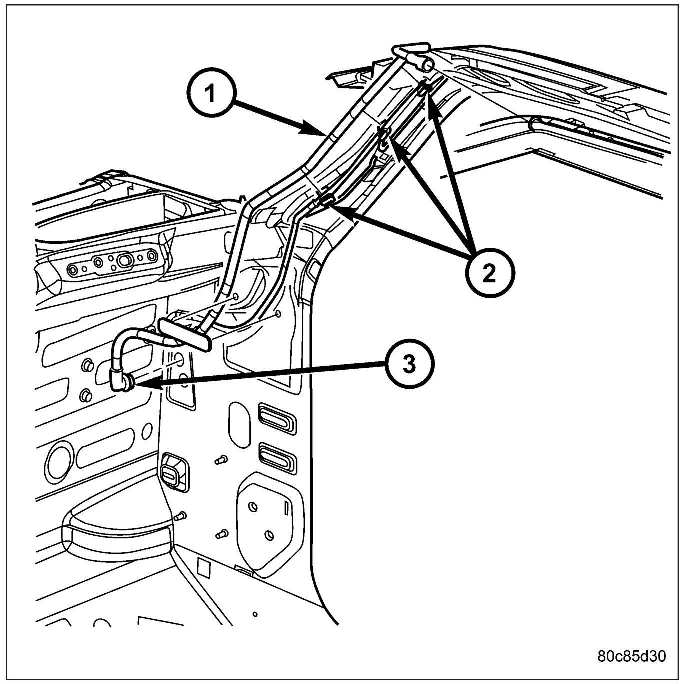
1. Move glass panel to the fully closed position.
2. Remove sunroof opening trim lace.
3. Remove headliner.
4. Disconnect the drain hose from the sunroof housing.
5. Drain any liquid from hose connection, if necessary.
6. Disconnect the grommet, attachment clips and remove the drain tube.



# INSTALLATION

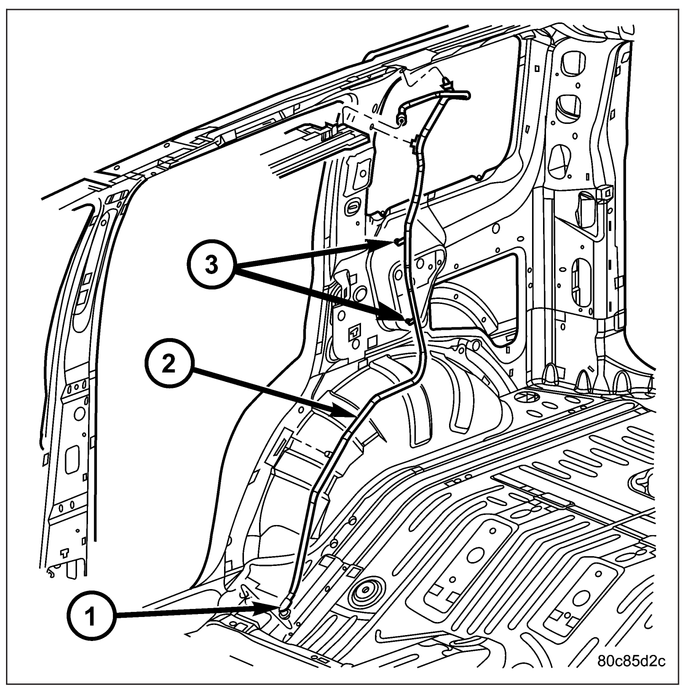
## FRONT DRAIN TUBES

1. Connect the drain hose to the sunroof housing and test drainage.
2. Connect the body grommet and attachment clips.
3. Install the instrument panel top panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - INSTALLATION)
4. Install the headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION)
5. Install sunroof opening trim lace. (Refer to 23 - BODY/SUNROOF/OPENING TRIM LACE - INSTALLATION)




## REAR DRAIN TUBES

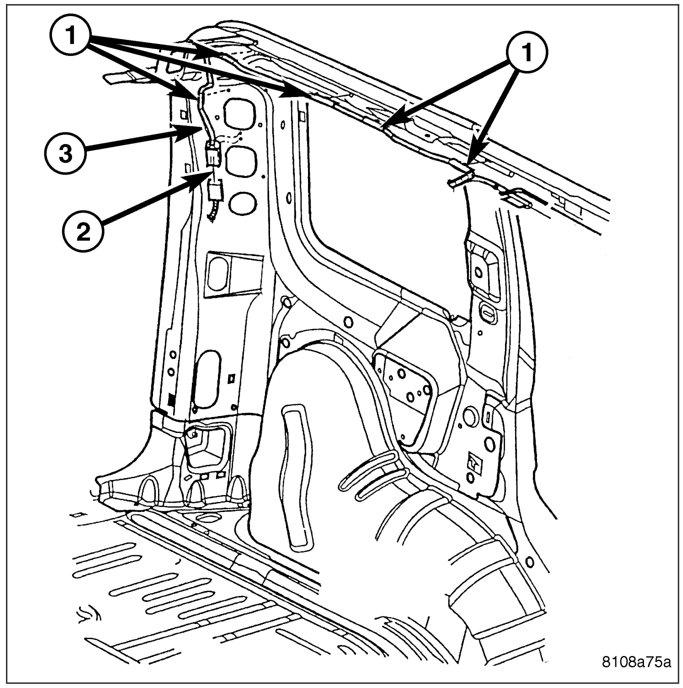
1. Connect the drain hose to the sunroof housing and test drainage.
2. Connect the body grommet and attachment clips.
3. Install the headliner.
4. Install sunroof opening trim lace.



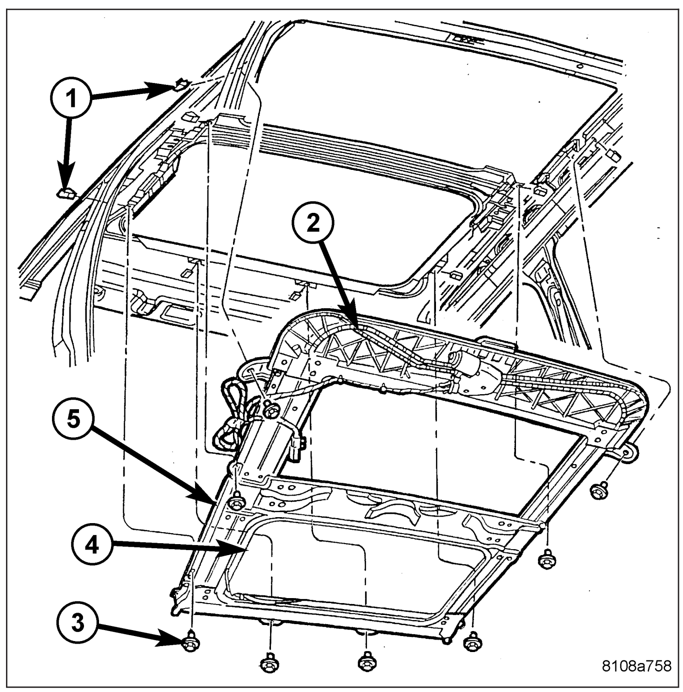
# MODULE/FRAME ASSEMBLY

## REMOVAL

1. Move glass panel to fully closed position.
2. Disconnect and isolate negative battery cable.
3. Remove sunroof opening trim lace. (Refer to 23 - BODY/SUNROOF/OPENING TRIM LACE - REMOVAL)
4. Remove control switch. (Refer to 23 - BODY/SUNROOF/CONTROL SWITCH - REMOVAL)
5. Remove headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL)
6. Disconnect wire harness push in fasteners (1) and electrical connector (2) from vehicle harness (3).
7. Disconnect drain tubes from sunroof housing.
8. Cut foam support pad at rear of module if necessary.

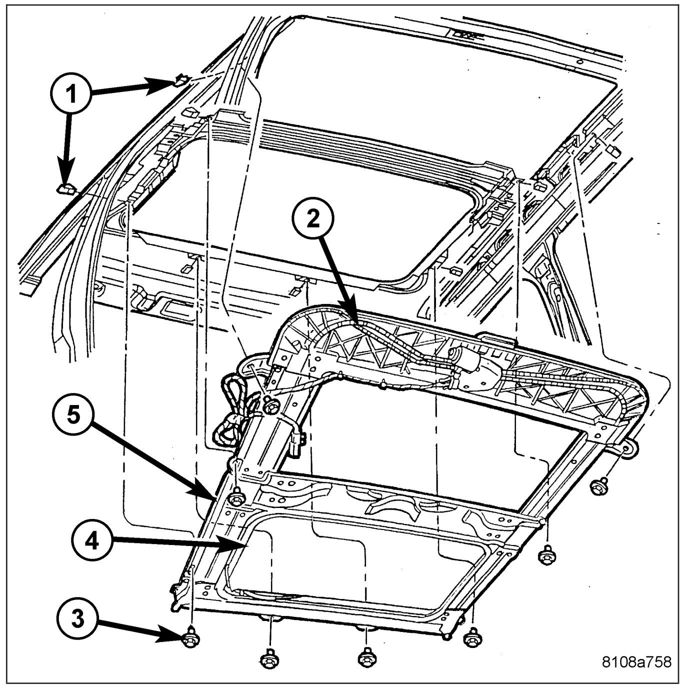



9. Remove two module bracket bolts and loosen the remaining fasteners.
10. With the aid of a helper, remove fasteners attaching sunroof module assembly to roof panel.
11. Remove the sunshade. (Refer to 23 - BODY/SUNROOF/SUNSHADE - REMOVAL)
12. Remove the drive motor. (Refer to 23 - BODY/SUNROOF/DRIVE MOTOR - REMOVAL)
13. Remove the wire harness.
14. Remove the trough guides. (Refer to 23 - BODY/SUNROOF/GUIDE ASSEMBLY - REMOVAL)

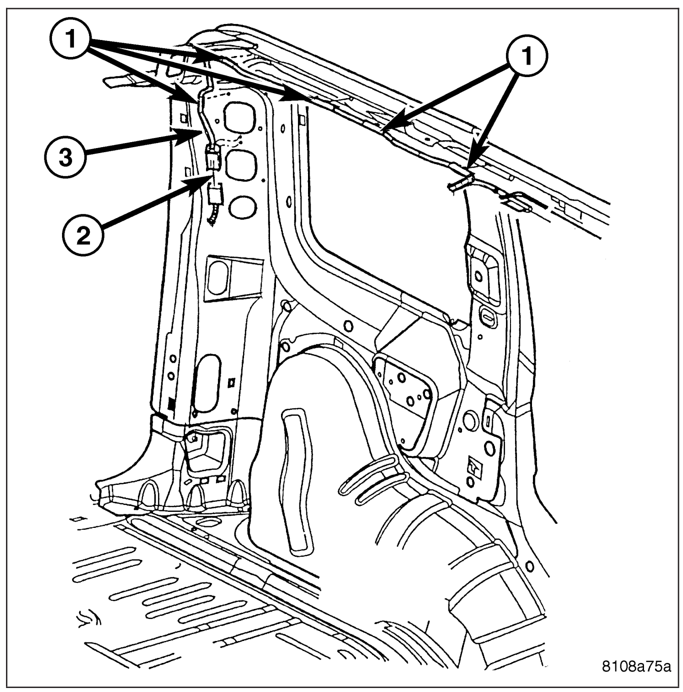


## INSTALLATION

1. Install the trough guides. (Refer to 23 - BODY/SUNROOF/TROUGH GUIDE ASSEMBLY - INSTALLATION)
2. Install the drive motor. (Refer to 23 - BODY/SUNROOF/DRIVE MOTOR - INSTALLATION - VEHICLES BUILT ON 9/10/02 AND LATER)
3. Install the sunshade. (Refer to 23 - BODY/SUNROOF/SUNSHADE - INSTALLATION)
4. Remove the backing tape from the foam support pad, if necessary.
5. Raise rear end of sunroof module assembly and guide into position and start fasteners.
6. Tighten the fasteners to 9 N·m (80 in. lbs.).
7. Connect the drain tubes.




8. Install the wire harness. (Refer to 23 - BODY/SUNROOF/WIRE HARNESS - INSTALLATION)
9. Connect battery negative cable.
10. Temporarily install sunroof switch and perform the sunroof motor teach procedure. (Refer to 23 - BODY/SUNROOF/DRIVE MOTOR - STANDARD PROCEDURE - TEACH PROCEDURE)
11. Test sunroof operation, adjust glass as necessary. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - ADJUSTMENTS)
12. Install the headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION)
13. Install the opening trim lace. (Refer to 23 - BODY/SUNROOF/OPENING TRIM LACE - INSTALLATION)



# MOTOR-SUNROOF - W/CONTROL UNIT

## STANDARD PROCEDURE

## DRIVE MOTOR TEACH PROCEDURE

### REPLACEMENT DRIVE MOTOR

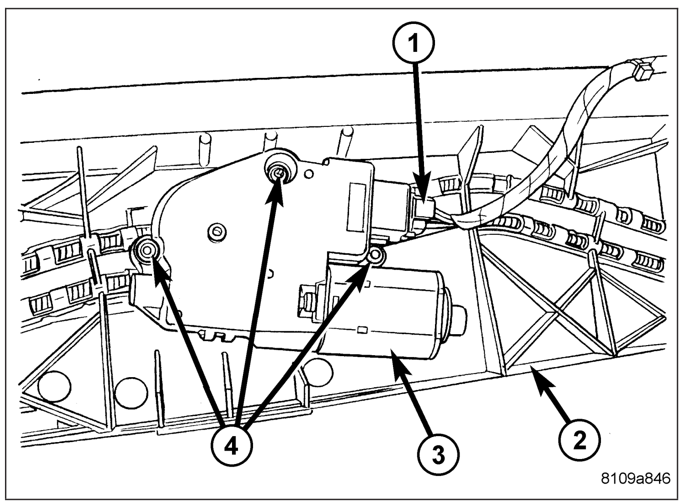
1. Press and hold the sunroof switch open until the sunroof glass fully opens, automatically reverses direction, and stops at a position just forward of the full open position.
2. Release sunroof switch.
3. Within five seconds of releasing sunroof switch, press and hold the sunroof switch open again until the sunroof glass closes, goes into vent position, and then finally stops in the closed position.
4. Release sunroof switch. Sunroof will now operate normally.

### ORIGINAL DRIVE MOTOR

1. Press and hold sunroof switch open until the sunroof glass opens and stops.
2. Release sunroof switch.
3. Press and hold sunroof switch open once again for at least 10 seconds. After 10 seconds of pressing the switch open, the sunroof glass will automatically move and stop at a new location.
4. Release sunroof switch.
5. Within five seconds of releasing the sunroof switch, press and hold the switch open again until the sunroof glass closes, goes into vent position, and then finally stops in the closed position.
6. Release sunroof switch. The sunroof will now operate normally.

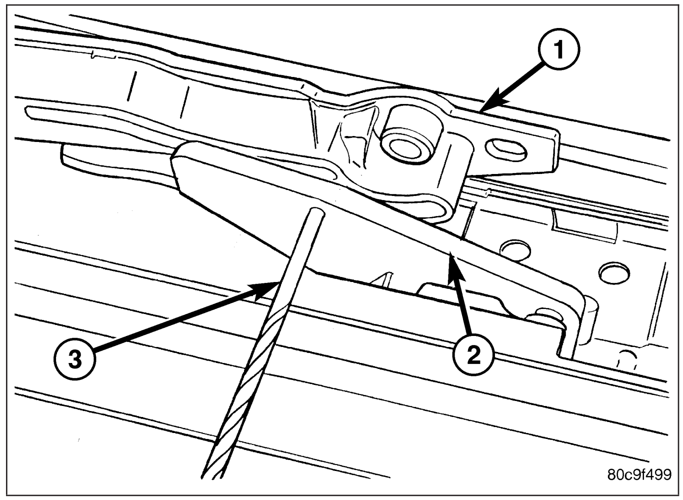
## REMOVAL

1. Remove headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL)
2. Disconnect the electrical connector (1).
3. Remove three motor assembly attaching screws (4) from bottom side of motor assembly (3) and remove motor assembly from the motor bracket.

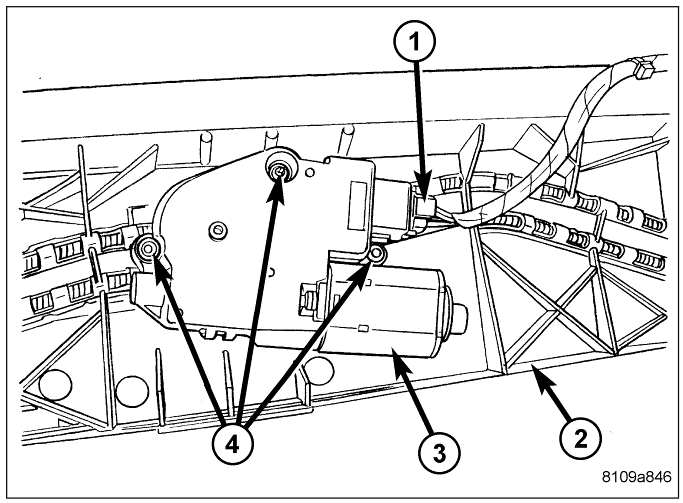


## INSTALLATION

1. If sunroof was open when drive motor was removed, carefully move glass panel into closed position and remove glass panel. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - REMOVAL)
2. Set lifter arm timing by manually sliding the mechanisms (1) in the track until timing holes in the trollies are aligned with the timing holes in the lifter arm cams (2) and insert pins (3) into the mechanisms to hold mechanisms in closed position.




3. Place motor (3) into position and install screws (4) attaching motor to bracket (2).
4. Tighten the screws (4) to 3 N·m (26 in. lbs.).
5. If sunroof glass panel was removed previously, remove the timing pins and install the sunroof glass panel. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - INSTALLATION)
6. Temporarily install sunroof switch and perform the sunroof motor teach procedure. (Refer to 23 - BODY/SUNROOF/DRIVE MOTOR - STANDARD PROCEDURE - TEACH PROCEDURE)
7. Test sunroof operation, adjust glass as necessary. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - ADJUSTMENTS)
8. Install headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION)



# SEAL-SUNROOF GLASS

## REMOVAL

1. Remove sunroof glass panel. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - REMOVAL)
2. Place glass panel on clean work area with the top side up. Support the glass assembly from underside to avoid bending or otherwise damaging the mounting tabs.
3. Grasp the seal and pull seal away from the glass panel. The seal is a one piece seal.

## INSTALLATION

**NOTE: Always position seal seam on center of the passenger side of glass panel.**

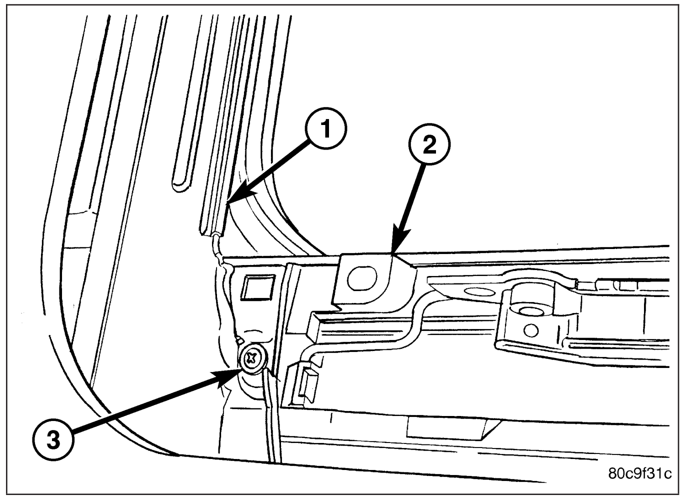
1. Place seal into position.
2. Install seal on glass. Using care working the seal around the glass, being careful not to over stretch the seal while installing.
3. Install the glass panel. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - INSTALLATION)

# SUNSHADE

## REMOVAL

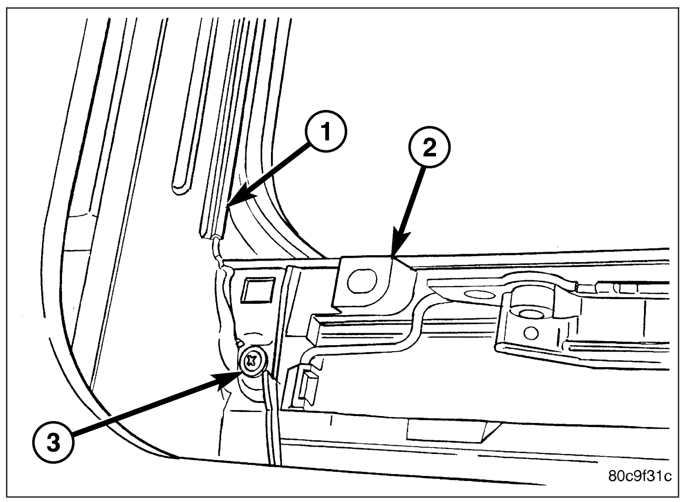
1. Remove glass assembly from the sunroof assembly. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - REMOVAL)
2. Remove two screws (3) from trough assembly (1).
3. Remove trough assembly (1).
4. Slide the sunshade forward to disengage the guide feet from the tracks through the cutouts at the front of the tracks.

**CAUTION: Use care not to crease the sunshade when removing or installing.**




## INSTALLATION

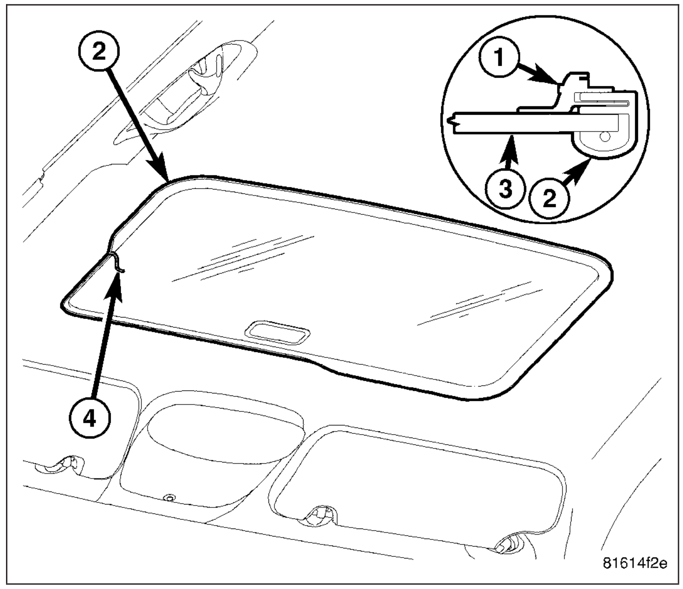
1. Place sunshade into position, through the cutouts at the front of the tracks and slide the sunshade back.
2. Place trough (1) assembly into position on sunroof module and install the screws (3).
3. Install the glass panel. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - INSTALLATION)



# TRIM LACE

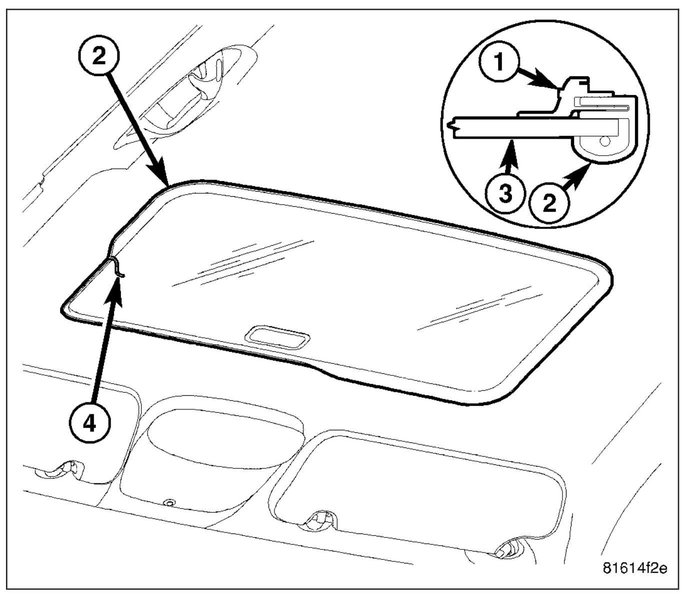
## REMOVAL

1. Remove lace by starting at the joint center of the opening on driver's side.
2. Pull one end of the lace away from the headliner until the entire lace is removed.




## INSTALLATION

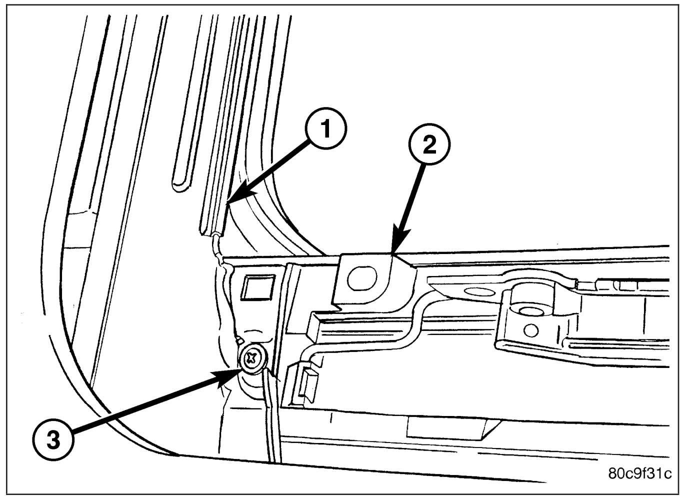
1. Place end of trim lace into position starting at center of the opening on driver's side.
2. Push lace into position.
3. Ensure that the corner radii is fully engage.
4. Once trim lace is attached to sunroof module begin tucking the headline under the lip on the trim lace working all the way around the opening.



# TROUGH

## REMOVAL

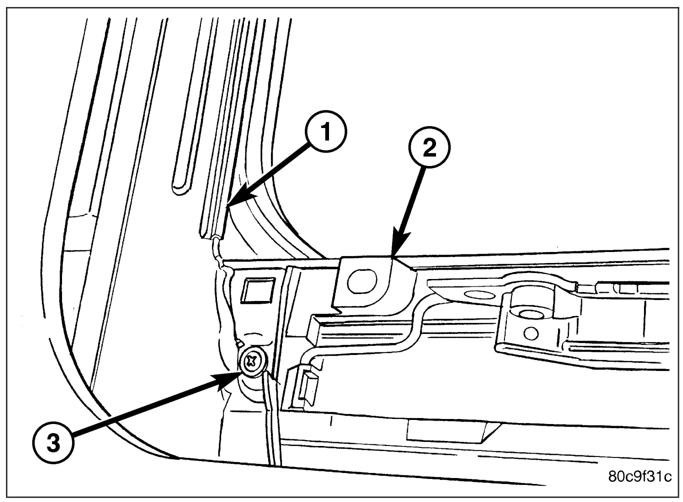
1. Remove the glass panel. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - REMOVAL)
2. Through the top of the roof opening remove two screws (3) from trough assembly (1).
3. Remove trough assembly (1).




## INSTALLATION

**NOTE: When installing the trough be sure the trough crosses over the top of the sunshade.**

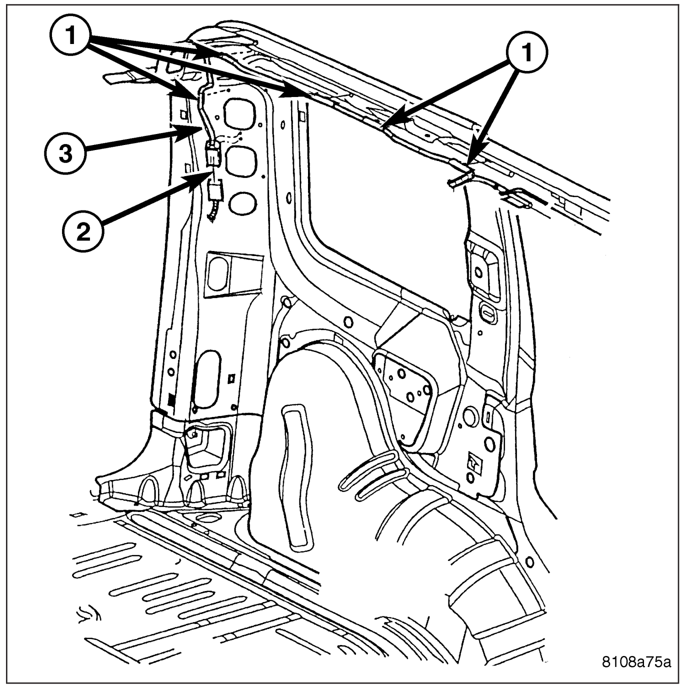
1. Install the trough (1) and install the two screws (3).
2. Install the glass panel. (Refer to 23 - BODY/SUNROOF/GLASS PANEL - INSTALLATION)



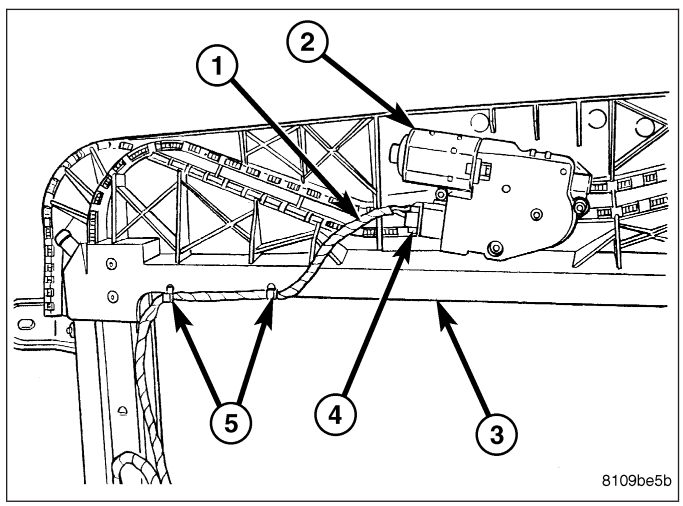
# WIRING

## REMOVAL

1. Remove the headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL)
2. Disconnect wire harness from vehicle harness (2).

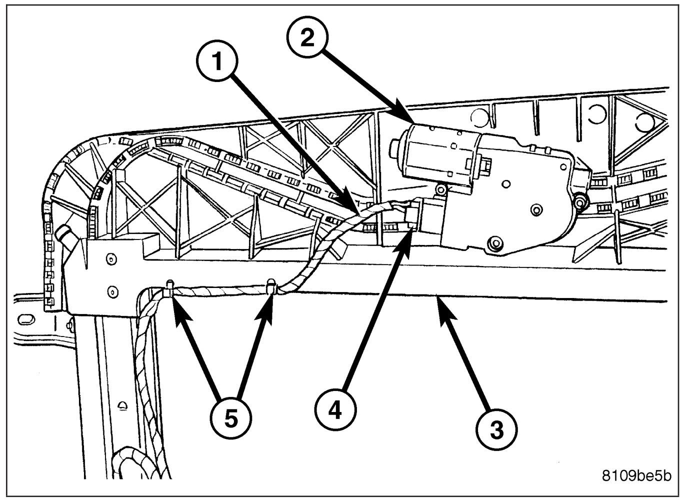



3. Disconnect drive motor electrical connector (4) and cut tie straps (5).
4. Remove harness (1).

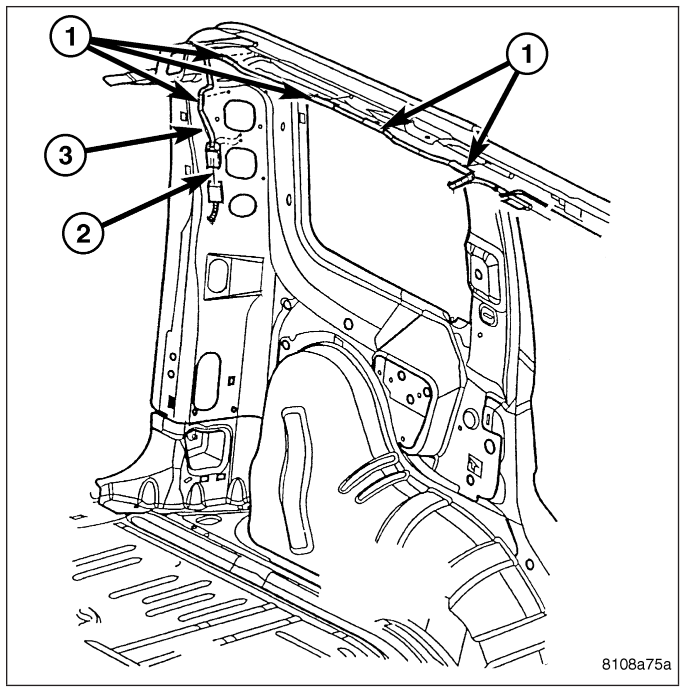


## INSTALLATION

1. Connect drive motor (4) electrical connectors.
2. Replace the two tie straps (5) on the module assembly (3).




3. Connect vehicle harness electrical connectors (2).
4. Install the headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION)



# WEATHERSTRIP/SEALS

## TABLE OF CONTENTS

# A-PILLAR SEAL

## REMOVAL

1. Open the doors and peel the seal away from the A-pillar/windshield and the side rail weather strip flanges.

## INSTALLATION

1. Position the no-notch end of the seal to the rear end of the rail retainer above the C-pillar. Seat the seal fully onto the retainer starting at the rear and working forward along the retainer. Make sure the seal covers the retainer all the way to the C-pillar end and the seal is oriented with the lip down and the bulbs up.

# COWL WEATHERSTRIP

## REMOVAL

1. Open the hood and peel the cowl seal from the cowl panel and cowl flange.

## INSTALLATION

1. Position the weatherstrip over the cowl flange and the cowl grille and seat fully.

# DOOR PRIMARY WEATHERSTRIP

## REMOVAL

1. Remove the lower B-pillar trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - REMOVAL)
2. Peal seal off of the door opening flange.

## INSTALLATION

1. Position the seal to the bottom of the door opening, with bulb facing outboard, starting the installation at the center of the lower flange. Press the seal onto the sill flange and work around the perimeter of the door opening until fully seated. Work ½ the way around and then start at the other end of the seal working back, making sure the splice joint has no gap and smoothing the seal to avoid puckers or wrinkles.
2. Install the lower B-pillar trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR LOWER TRIM - INSTALLATION)
3. When installing a new weatherstrip on the front door opening, remove the tear strip starting at the splice and moving around the front of the door to the back of the opening.
4. When installing a new weatherstrip on the rear door opening, remove the tear strip starting at the splice and moving around the back of the door to the front of the opening.

# DOOR LOWER WEATHERSTRIP

## REMOVAL

1. Carefully disengage the push pin fasteners and remove the seal.

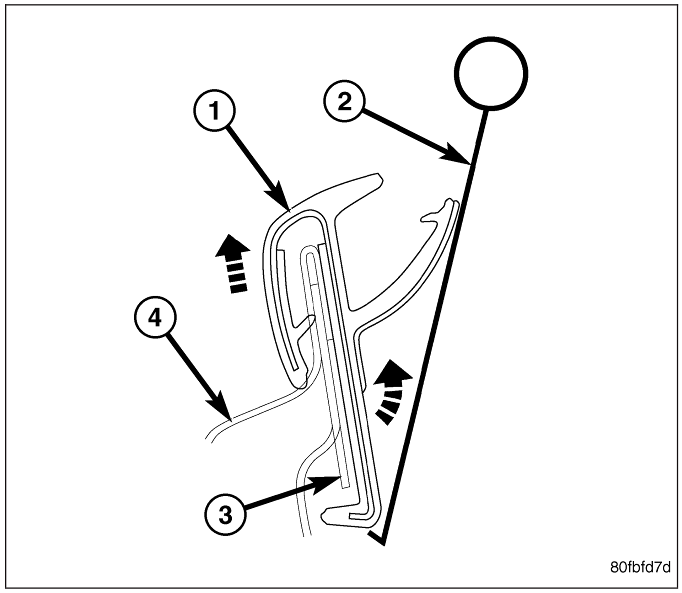
## INSTALLATION

1. Position the seal so that the flat side of the lip faces inboard, and seat the push pin fasteners.

# FRONT DOOR OUTER BELT MOLDING

## REMOVAL

1. Lower window completely.
2. Remove trim panel as necessary. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL)
3. Insert special tool #9093 between belt molding and glass at rear and then slide tool forward approximately 14 cm (5.5 in.).
4. Push down on outer belt molding and rotate upper part of tool outward from vehicle approximately 6 – 8 cm (2.5 - 3 in.) then lift up on molding to disengage from locking tab.
5. Repeat step 3 and 4 at 28 cm (11 in.), 43 cm (17 in.), and 57 cm (22.5 in.) from rear of door.
6. Remove belt molding.




## INSTALLATION

1. Press the belt molding onto the outer door window flange starting at the rear and working forward.
2. Install trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION)

# SWING GATE BELTLINE WEATHERSTRIP

## REMOVAL

1. Remove the swing gate trim panel. (Refer to 23 - BODY/SWING GATE/TRIM PANEL - REMOVAL)
2. Pull seal away from the corner tabs and remove from the swing gate flange.

## INSTALLATION

1. Install the seal over the swing gate flange and seat the corner tabs.
2. Install the swing gate trim panel. (Refer to 23 - BODY/SWING GATE/TRIM PANEL - INSTALLATION)

# SWING GATE OPENING WEATHERSTRIP

## REMOVAL

1. Open the swing gate and using a trim stick C-4755 or equivalent, remove the swing gate lower sill plate.
2. Peel seal off of the gate opening flange.

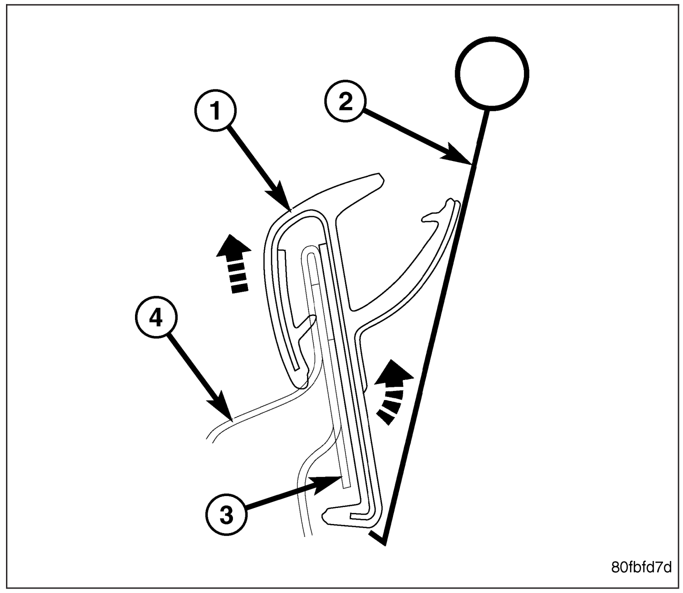
## INSTALLATION

1. Position the seal to the bottom of the gate opening starting the installation 10 to 13 cm (4 to 5 in.) from the hinge side of the flange with the trim lip facing inboard. Press the seal onto the sill flange and work around the perimeter of the door opening until fully seated. Work in one direction, smoothing the seal to avoid puckers or wrinkles. Pull trim lip cord so that the lip covers the trim edge all around.
2. Position the lower sill plate and seat the attachment clips fully.

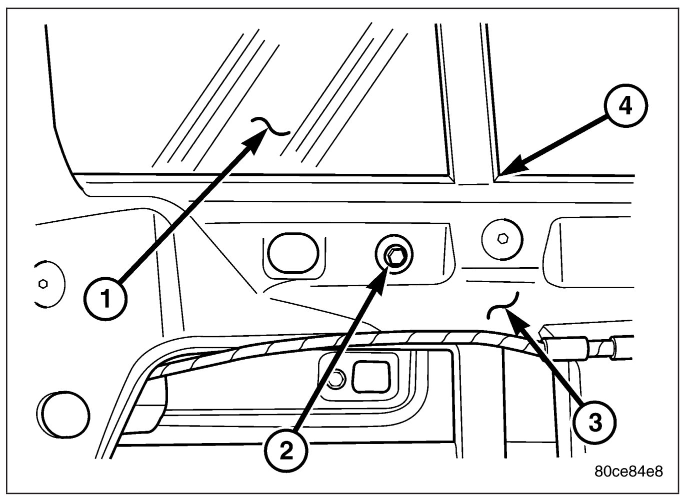
# REAR DOOR OUTER BELT MOLDING

## REMOVAL

1. Lower window completely.
2. Remove trim panel as necessary. (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL)
3. Insert special tool #9093 between belt molding and glass at front and then slide tool back approximately 4.5 cm (1.75 in.).

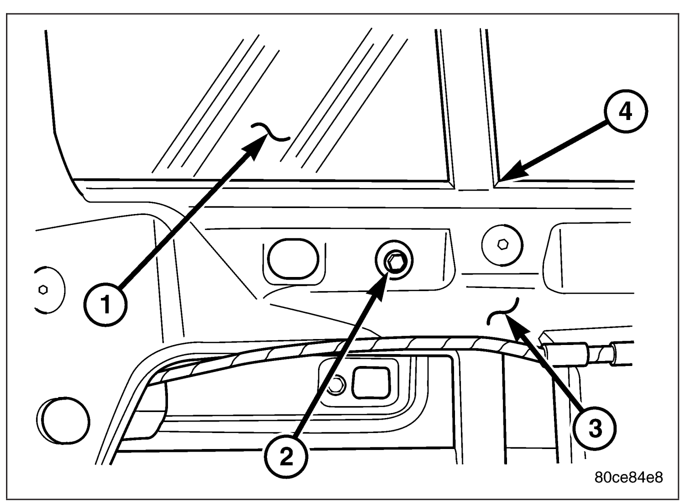



4. Push down on outer belt molding and rotate upper part of tool outward from vehicle approximately 6 – 8 cm (2.5 - 3 in.) then lift up on molding to disengage from locking tab.
5. Repeat step 3 and 4 at 23 cm (9 in.) and 41 cm (16 in.).
6. Loosen division bar bolt and slide tool 57 cm (23 in.) from front of door and disengage the last locking tab.
7. Remove belt molding.




## INSTALLATION

1. Press the belt molding onto the outer door window flange starting at the back and working towards the front.
2. Tighten the division bar bolt to 9 N·m (80 in. lbs.).
3. Install the trim panel. (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION)



# SIDE RAIL WEATHERSTRIP/RETAINER

## REMOVAL

1. Remove the windshield weatherstrip retainer. (Refer to 23 - BODY/WEATHERSTRIP/SEALS/WINDSHIELD A-PILLAR WEATHERSTRIP/RETAINER - REMOVAL)
2. Remove the two screws.
3. Using a trim stick C-4755 or equivalent, release the push in fasteners and remove the weatherstrip.

## INSTALLATION

1. Position the weatherstrip and seat the push in fasteners.
2. Install the two screws.
3. Install the windshield weatherstrip. (Refer to 23 - BODY/WEATHERSTRIP/SEALS/WINDSHIELD A-PILLAR WEATHERSTRIP/RETAINER - INSTALLATION)

# WINDSHIELD A-PILLAR WEATHERSTRIP/RETAINER

## REMOVAL

1. Open the doors and peel the A-pillar seal away from the A-pillar/windshield and the side rail weather strip flanges.
2. Remove the seven screws and remove the weatherstrip.

## INSTALLATION

1. Position the weatherstrip and install the seven screws.
2. Position the A-pillar seal over the windshield/A-pillar and the side rail weatherstrip flanges and seat fully.

# COWL/PLENUM SEAL

## REMOVAL

1. Remove the cowl grille. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - REMOVAL)
2. Remove the seal from the plenum flange above the air inlet duct.

## INSTALLATION

**NOTE: Seal should not be touching the plenum baffle flange seal.**

1. Position the seal on the plenum flange and seat fully.
2. Install the cowl grille. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - INSTALLATION)

# COWL/PLENUM WINDOW BAFFLE SEAL

## REMOVAL

1. Remove the cowl grille. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - REMOVAL)
2. Remove the seal from the window below the cowl/plenum seal.

## INSTALLATION

1. Position the seal against the upper flange of the inner plenum window below the cowl/plenum seal and seat fully.
2. Install the cowl grille. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - INSTALLATION)

# AIR INLET SEAL

## REMOVAL

1. Open the hood and carefully disengage the push pin fasteners and remove the seal.

## INSTALLATION

1. Position the seal and seat the push pin fasteners fully.

# FRONT DOOR INNER BELT WEATHERSTRIP

## REMOVAL

1. Remove the door trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL)
2. Rotate the outer belt molding outboard while pulling up to disengage the retention tabs.

## INSTALLATION

1. Press the belt molding onto the trim panel flange starting at the rear and working forward.
2. Install the door trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION)

# REAR DOOR INNER BELT WEATHERSTRIP

## REMOVAL

1. Remove the door trim panel. (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL)
2. Rotate the outer belt molding outboard while pulling up to disengage the retention tabs.

## INSTALLATION

1. Press the belt molding onto the trim panel flange starting at the rear and working forward.
2. Install the door trim panel. (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION)

# BODY STRUCTURE

## TABLE OF CONTENTS

# ASSEMBLY

## SPECIFICATIONS

## SPECIFICATION

### INDEX

| DESCRIPTION | FIGURE |
|---|---|
| COMPLETE BODY STRUCTURE VIEWS | ( 1 ) |
| BODY STRUCTURE - SECTIONS | ( 2 ) |

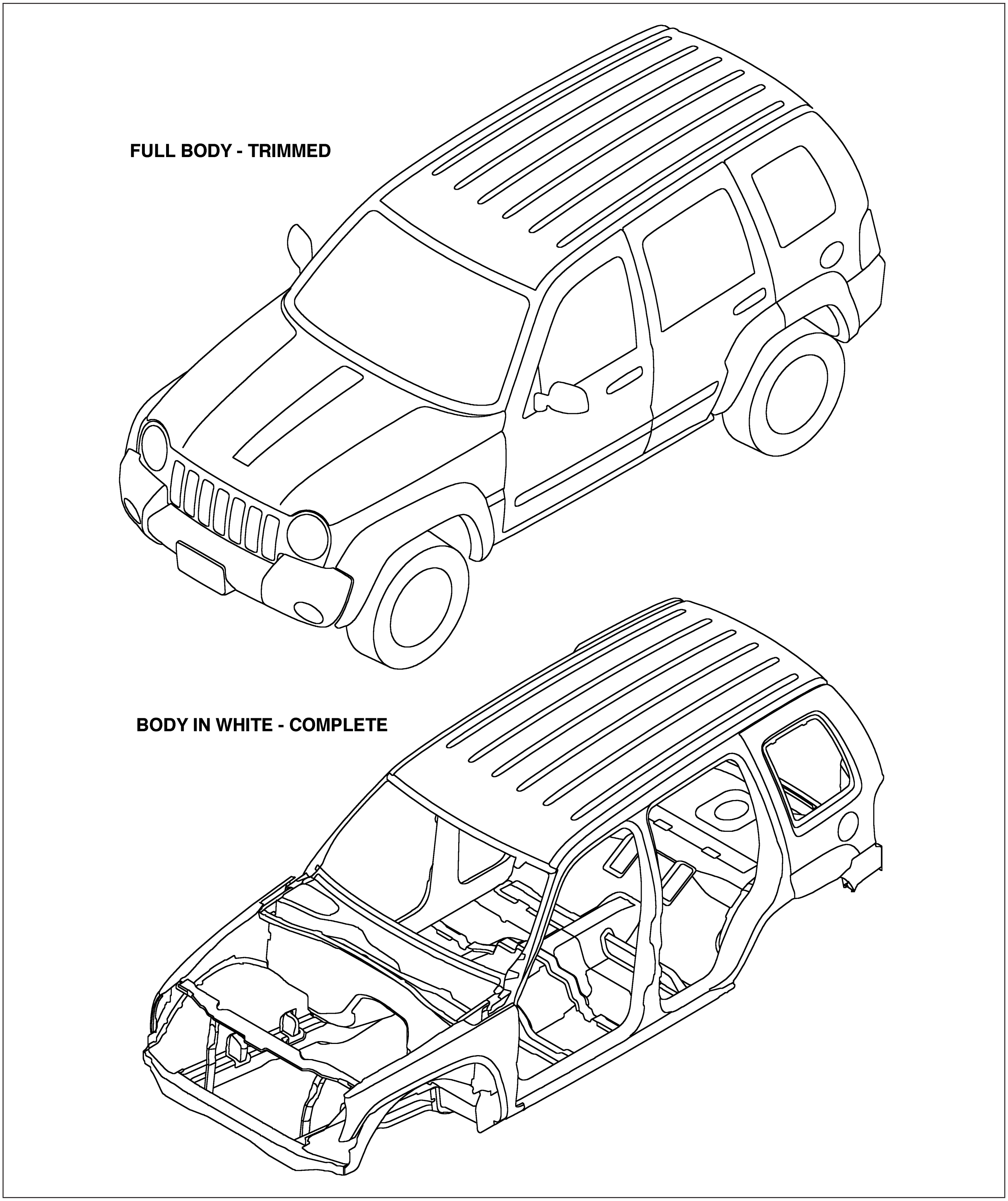



*Fig. 1 COMPLETE BODY STRUCTURE VIEWS*

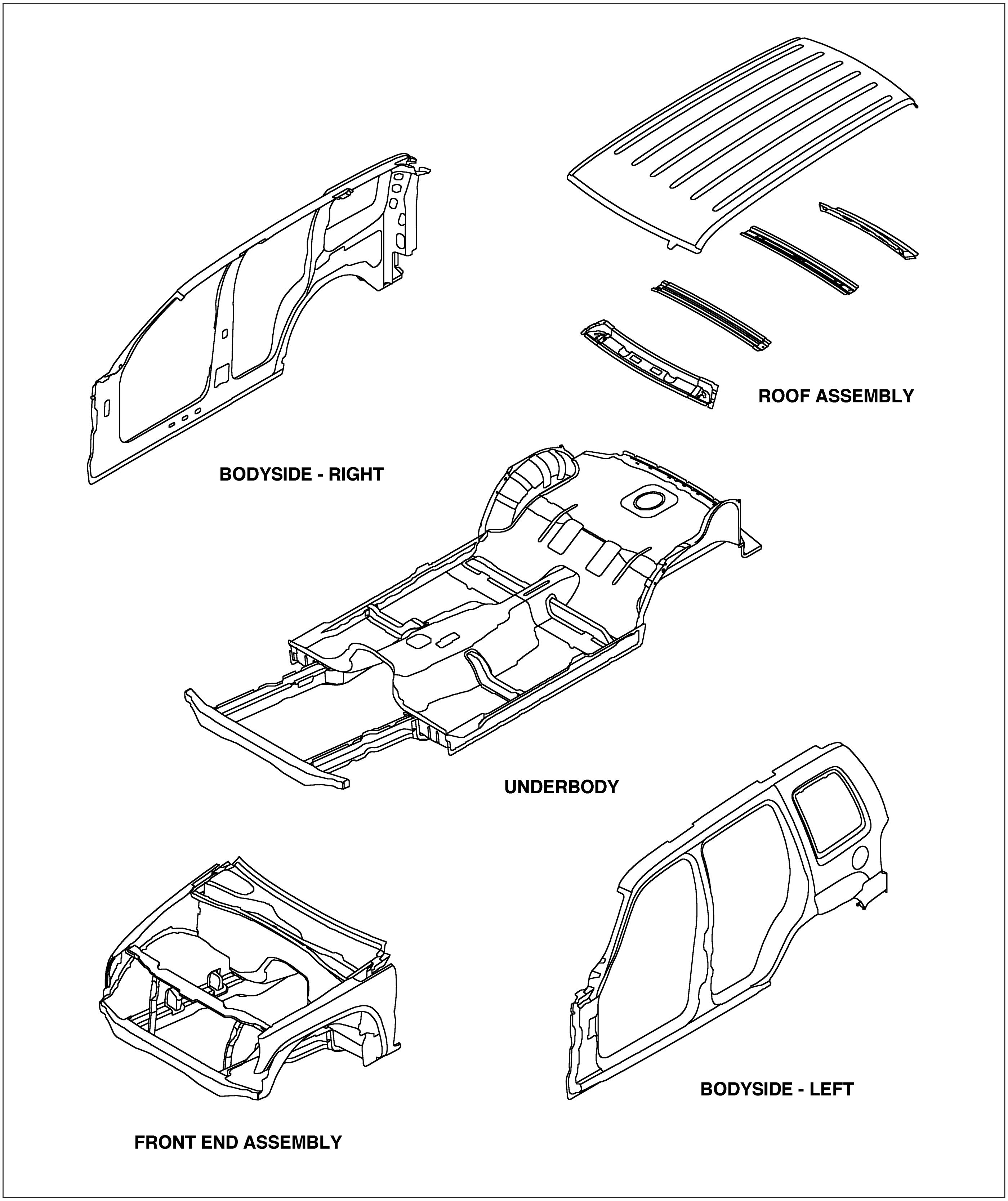



*Fig. 2 BODY STRUCTURE - SECTIONS*

# WELD AND STRUCTURAL ADHESIVE LOCATIONS

## SPECIFICATIONS

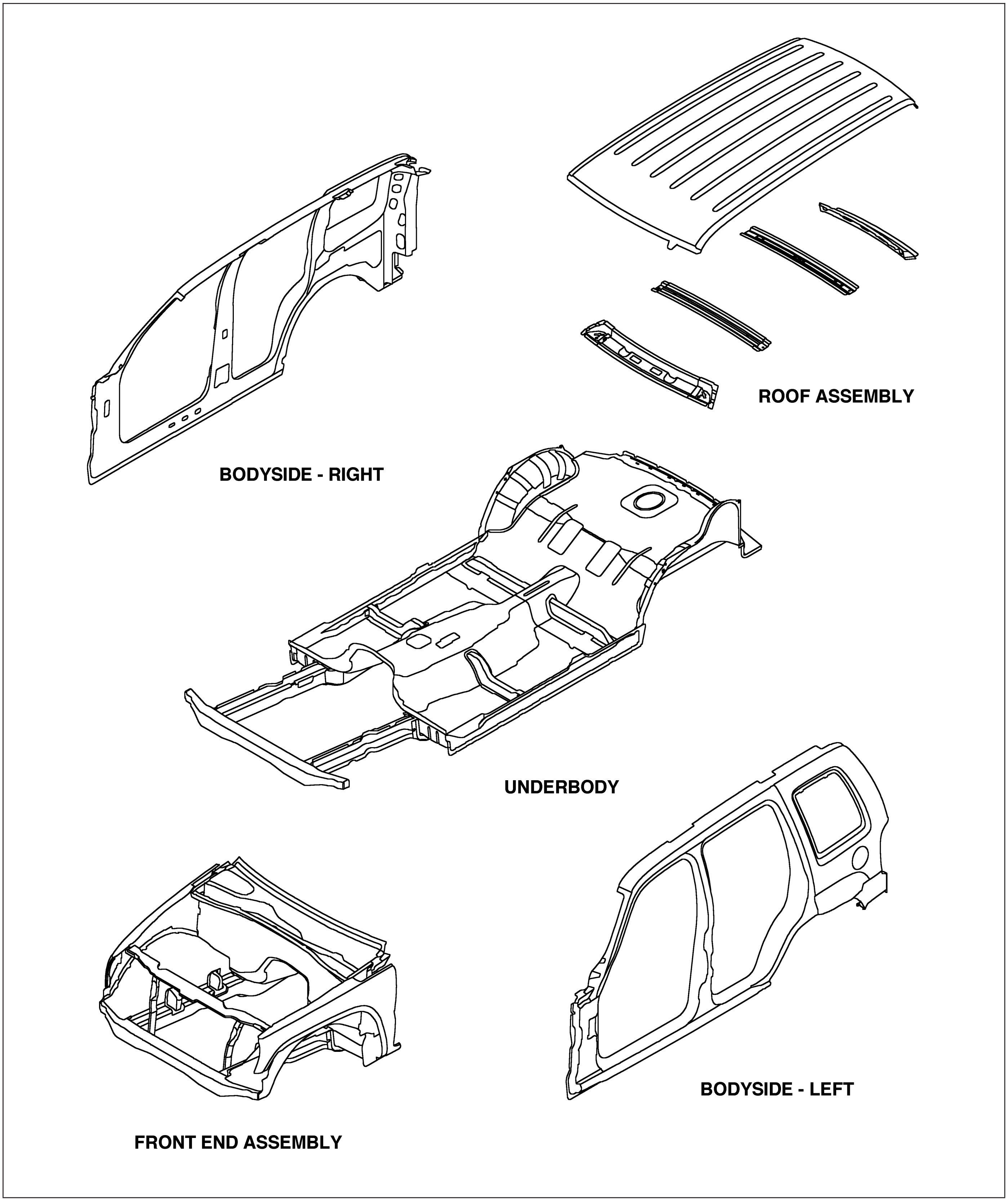



*Fig. 3 BODY IN WHITE - SECTIONS*

**INDEX**

| DESCRIPTION | FIGURE |
|---|---|
| FLOOR PAN AND RAIL ASSEMBLY WELD LOCATIONS | ( 41 ) |
| FLOOR PAN, BODY SIDE SILL, COWL SIDE PANEL AND CROSSMEMBERS | ( 42 ) |
| WHEELHOUSE ADHESIVE LOCATIONS | ( 43 ) |
| WHEELHOUSE WELD LOCATIONS | ( 44 ) |
| **BODY SIDE PANELS AND SUB ASSEMBLIES** | |
| A-PILLAR AND HEADER MOUNTING REINFORCEMENTS | ( 45 ) |
| B-PILLAR REINFORCEMENTS | ( 46 ) |
| C-PILLAR AND SEAT BACK MOUNTING REINFORCEMENTS | ( 47 ) |
| D-PILLAR REINFORCEMENTS | ( 48 ) |
| TAIL LAMP MOUNTING PANEL AND GATE STRIKER REINFORCEMENT | ( 49 ) |
| TAIL LAMP MOUNTING PANEL AND TAIL LAMP EXTENSION | ( 50 ) |
| SWING GATE OPENING PANEL AND ROOF HEADER | ( 51 ) |
| **BODY SIDE PANELS** | |
| BODY SIDE PANEL ASSEMBLY | ( 52 ) |
| BODY SIDE OUTER, INNER FENDER REINFORCEMENT AND FENDER ASSEMBLY | ( 53 ) |
| BODY SIDE OUTER AND INNER PANELS; A-PILLAR | ( 54 ) |
| LOWER INNER BODY SIDE PANELS AND UPPER A-PILLARS | ( 55 ) |
| BODY SIDE PANEL ASSEMBLIES AND B-PILLAR | ( 56 ) |
| BODY SIDE PANEL ASSEMBLIES AND C-PILLAR REINFORCEMENT | ( 57 ) |
| QUARTER WINDOW OPENING; SEAT BACK ATTACH REINFORCEMENT; C-PILLAR REINFORCEMENT | ( 58 ) |
| BODY SIDE PANEL ASSEMBLIES AND OUTER REAR WHEELHOUSES | ( 59 ) |
| OUTER REAR WHEELHOUSE WELDS AND ADHESIVE LOCATIONS | ( 60 ) |
| D-PILLAR AND TAIL LAMP ASSEMBLY WELD AND ADHESIVE LOCATIONS | ( 61 ) |
| SWING GATE STRIKER REINFORCEMENT WELDS AND ADHESIVE LOCATIONS | ( 62 ) |
| REAR WHEELHOUSE WELDS AND TAIL LAMP ADHESIVE LOCATIONS | ( 63 ) |
| **FENDER ASSEMBLIES** | |
| INNER FENDER REINFORCEMENT AND GUSSETS | ( 64 ) |
| INNER FENDER REINFORCEMENT, GUSSETS, PLENUM AND WHEELHOUSES | ( 65 ) |
| INNER FENDER REINFORCEMENT AND WHEELHOUSES | ( 66 ) |
| PLENUM ASSEMBLY AND INNER SIDE PANELS | ( 67 ) |
| **ROOF PANEL ASSEMBLIES** | |
| ROOF PANEL ASSEMBLY | ( 68 ) |
| ROOF PANEL AND BODY SIDE WELD AND ADHESIVE LOCATIONS | ( 69 ) |
| ROOF PANEL AND BODY SIDE WELD AND ADHESIVE LOCATIONS - SUNROOF EQUIPPED | ( 70 ) |
| ROOF AND HEADER PANEL ASSEMBLY | ( 71 ) |
| **BODY SIDE PANELS & FLOOR PAN ASSEMBLIES** | |
| BODY SIDE PANEL AND FLOOR PAN ASSEMBLIES | ( 72 ) |
| BODY SIDE SILLS AND REAR WHEELHOUSES | ( 73 ) |
| ROOF HEADER AND WHEELHOUSE WELDS AND ADHESIVE LOCATIONS | ( 74 ) |
| SWING GATE OPENING PANEL; GATE STRIKER REINFORCEMENT; D-PILLAR REINFORCEMENT ADHESIVE AND WELD LOCATIONS | ( 75 ) |
| SWING GATE OPENING PANEL; D-PILLAR LOWER TO FLOOR GUSSET; GATE OPENING REINFORCEMENT | ( 76 ) |

| DESCRIPTION | FIGURE |
|---|---|
| REAR FLOOR PAN AND CROSSMEMBER; TAIL LAMP MOUNTING; SWING GATE OPENING PANEL | ( 77 ) |

## FRONT END ASSEMBLY

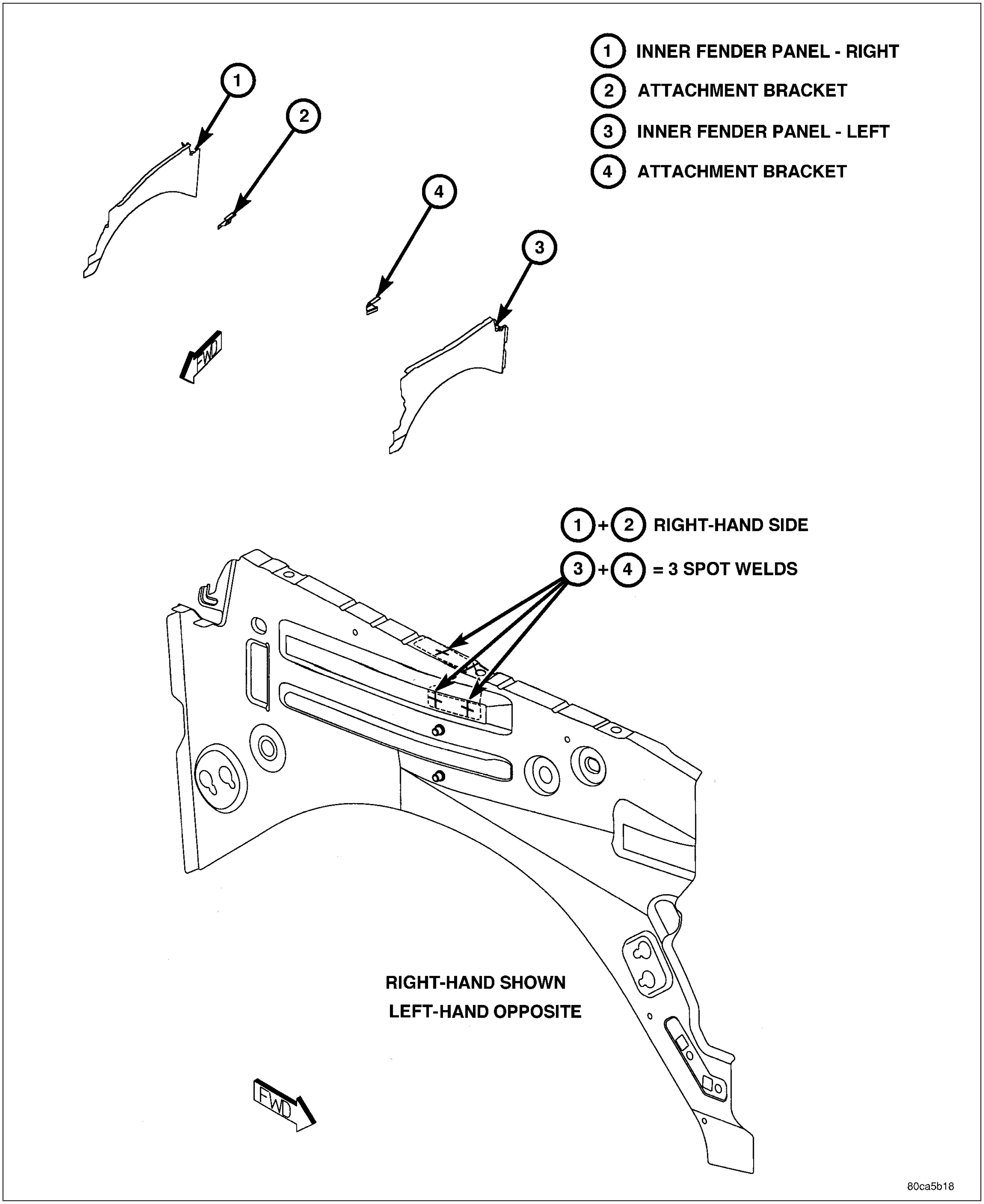



*Fig. 4 INNER FRONT PANELS*

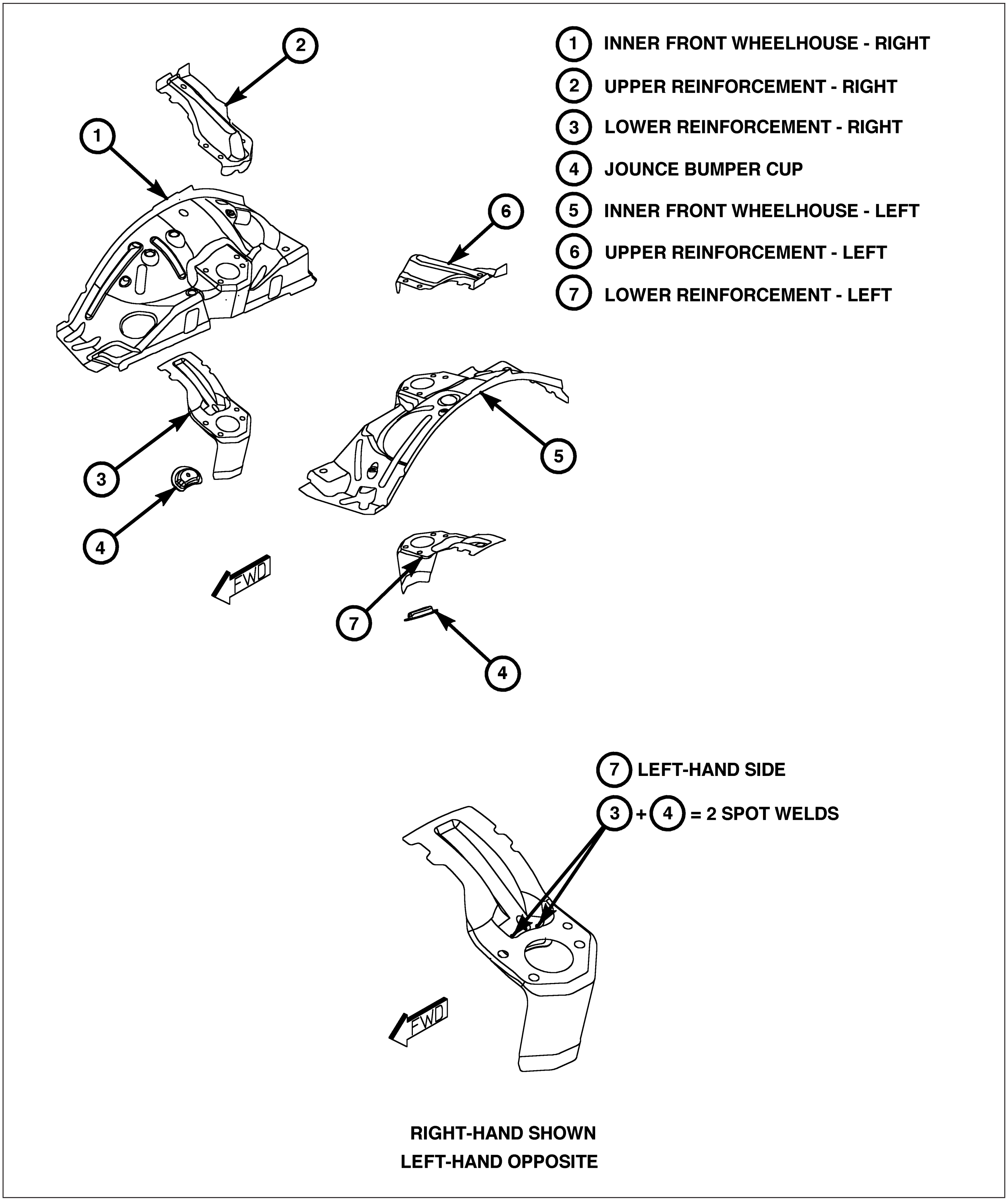



*Fig. 5 INNER WHEELHOUSE ASSEMBLIES*

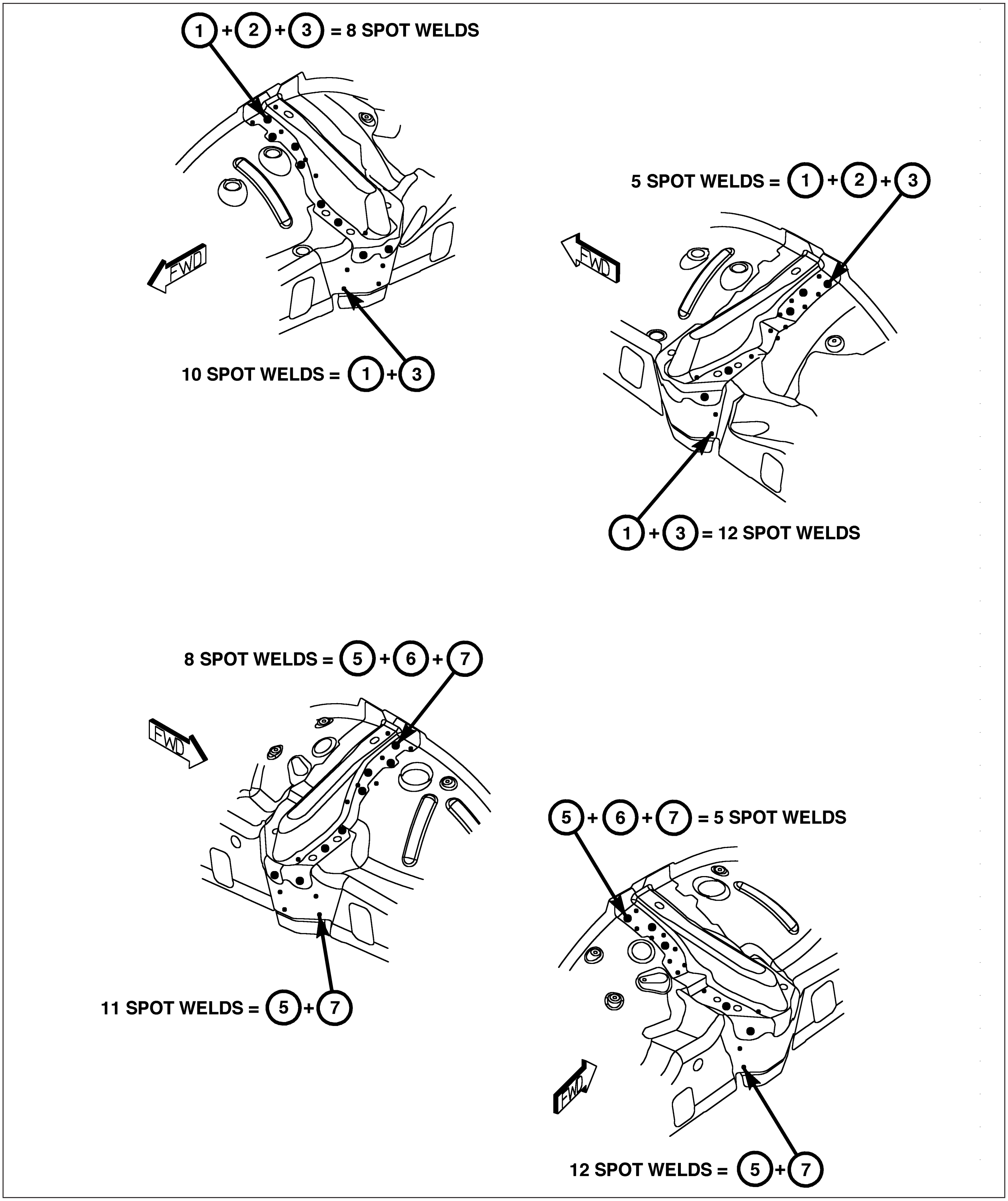



*Fig. 6 INNER WHEELHOUSES & LOWER REINFORCEMENTS*

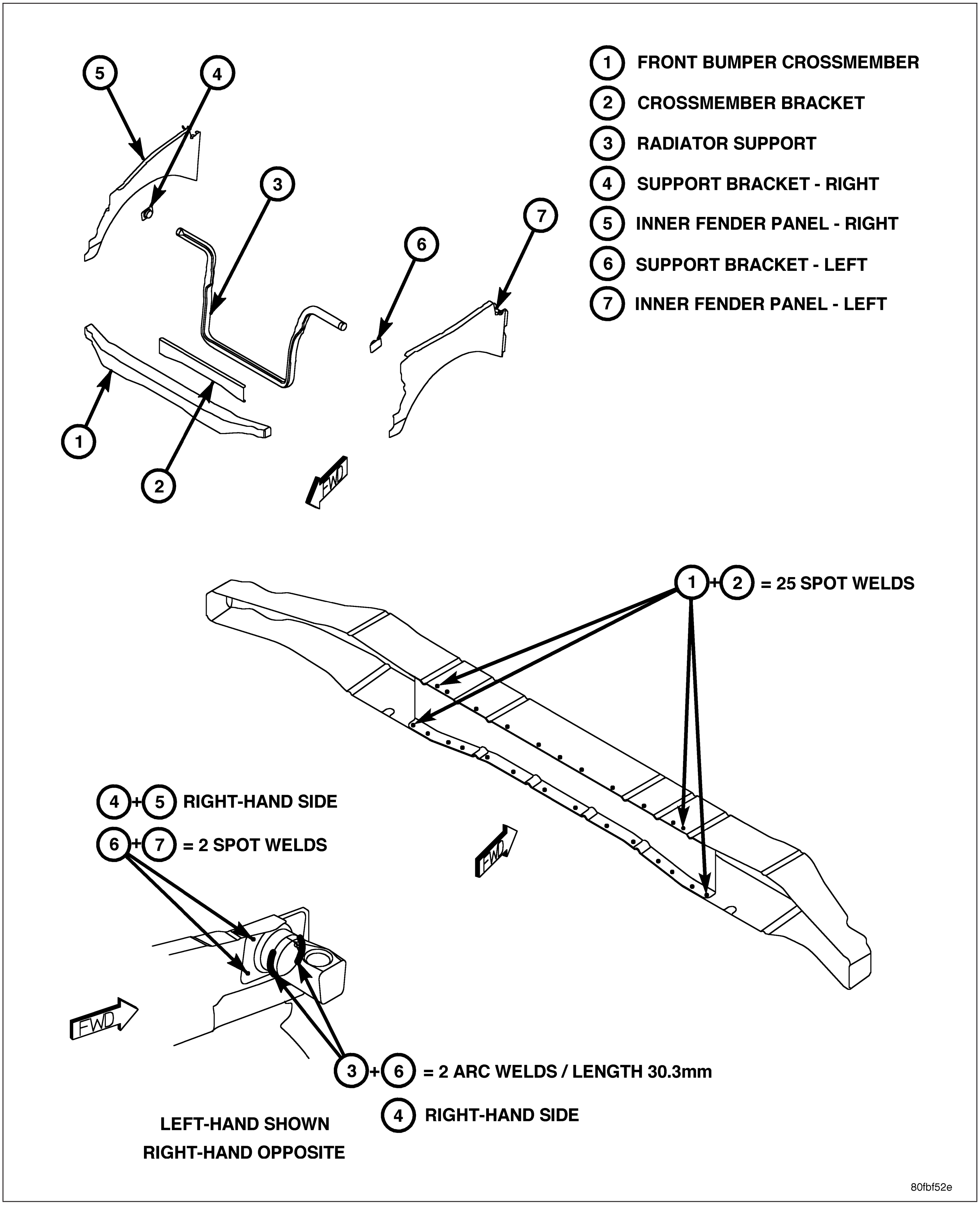



*Fig. 7 FRONT BUMPER CROSSMEMBER*

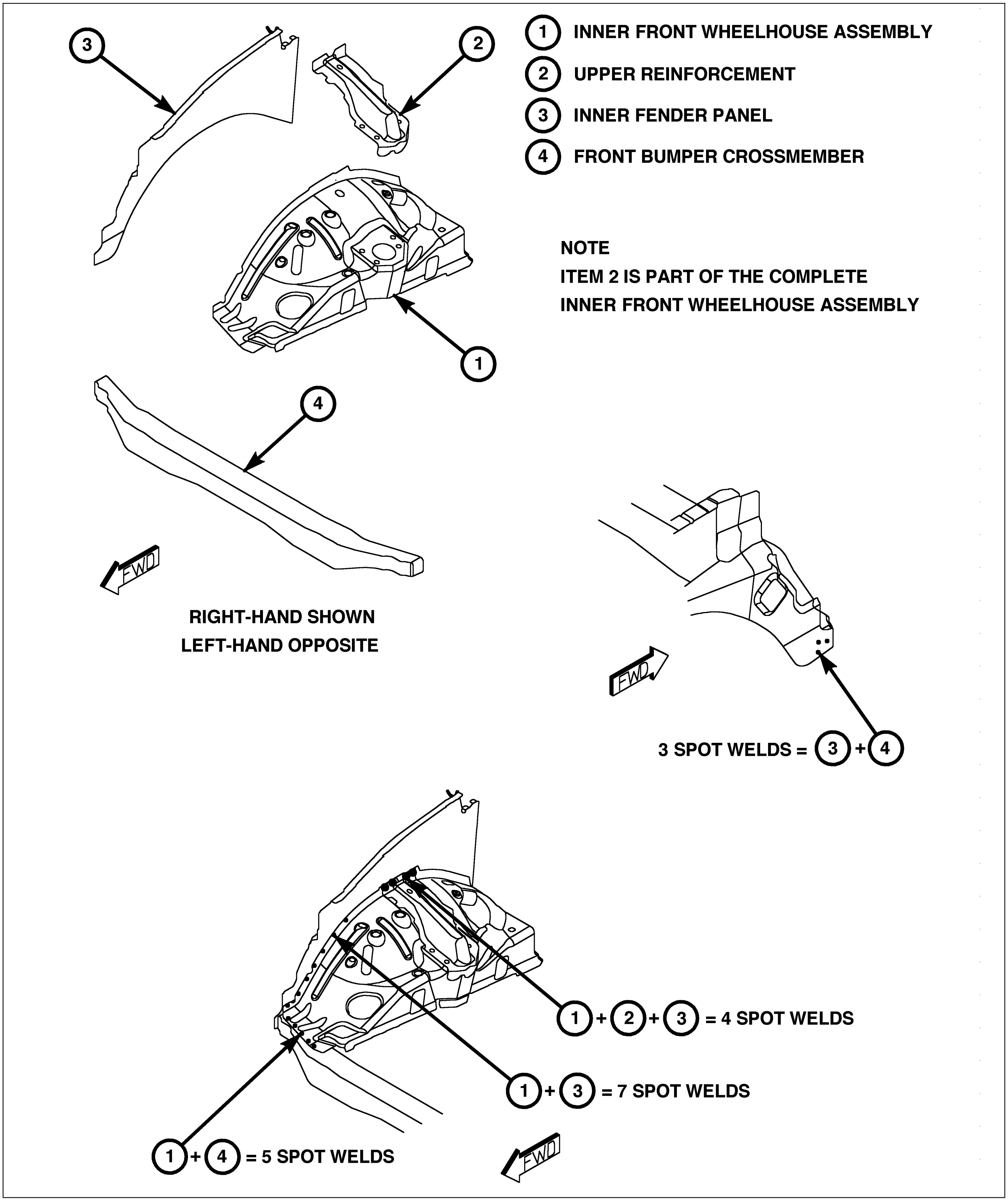
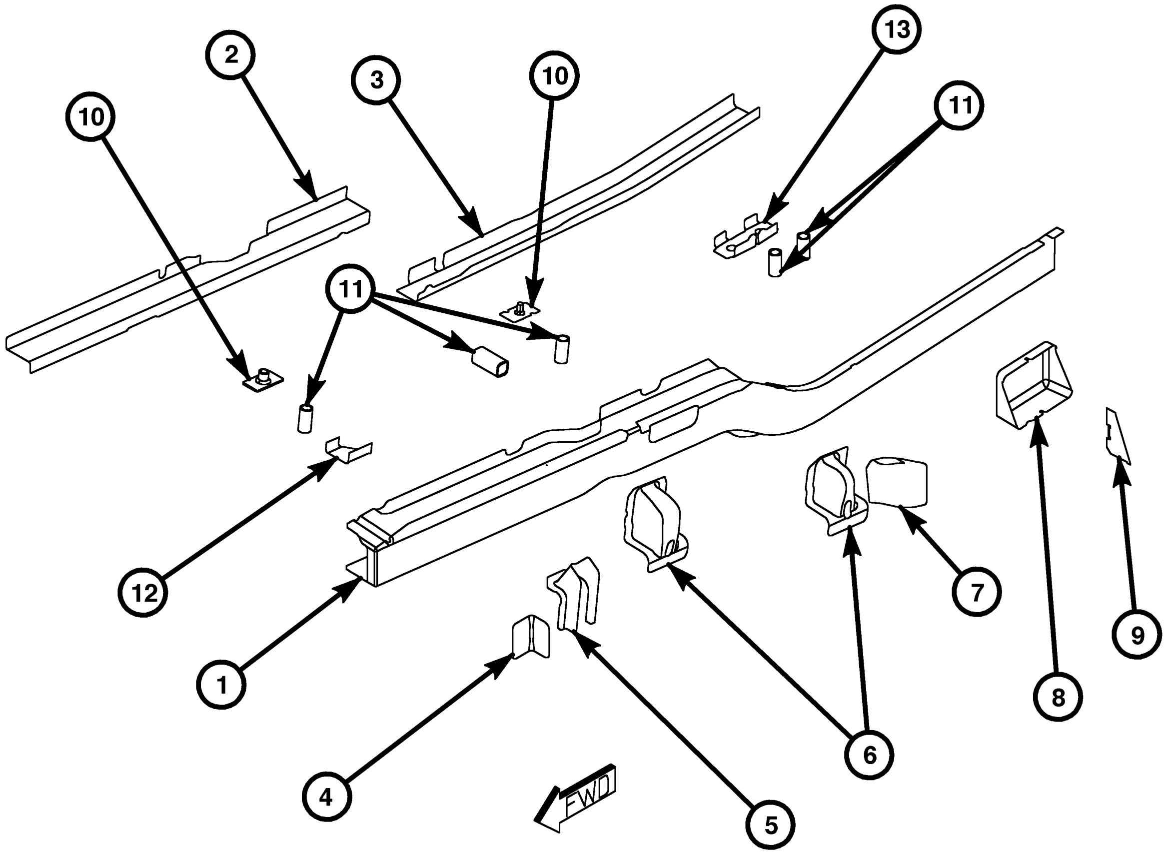



*Fig. 8 INNER FRONT WHEELHOUSE*

1 FRONT INNER RAIL
2 TIP REINFORCEMENT
3 U-CHANNEL REINFORCEMENT
4 FRONT RAIL TO CROSSMEMBER BRACKET
5 RAD SUPPORT AND RAIL BRACKET
6 MOUNTING BRACKET
7 REINFORCEMENT PLATE
8 ATTACHMENT BRACKET
9 ATTACHMENT BRACKET GUSSET
10 TAPPING PLATE
11 CRUSH TUBE SPACER
12 CLOSEOUT SPACER BRACKET
13 REAR SPACER BRACKET




RIGHT-HAND SHOWN
LEFT-HAND OPPOSITE UNLESS SHOWN

*Fig. 9 FRONT INNER RAILS*

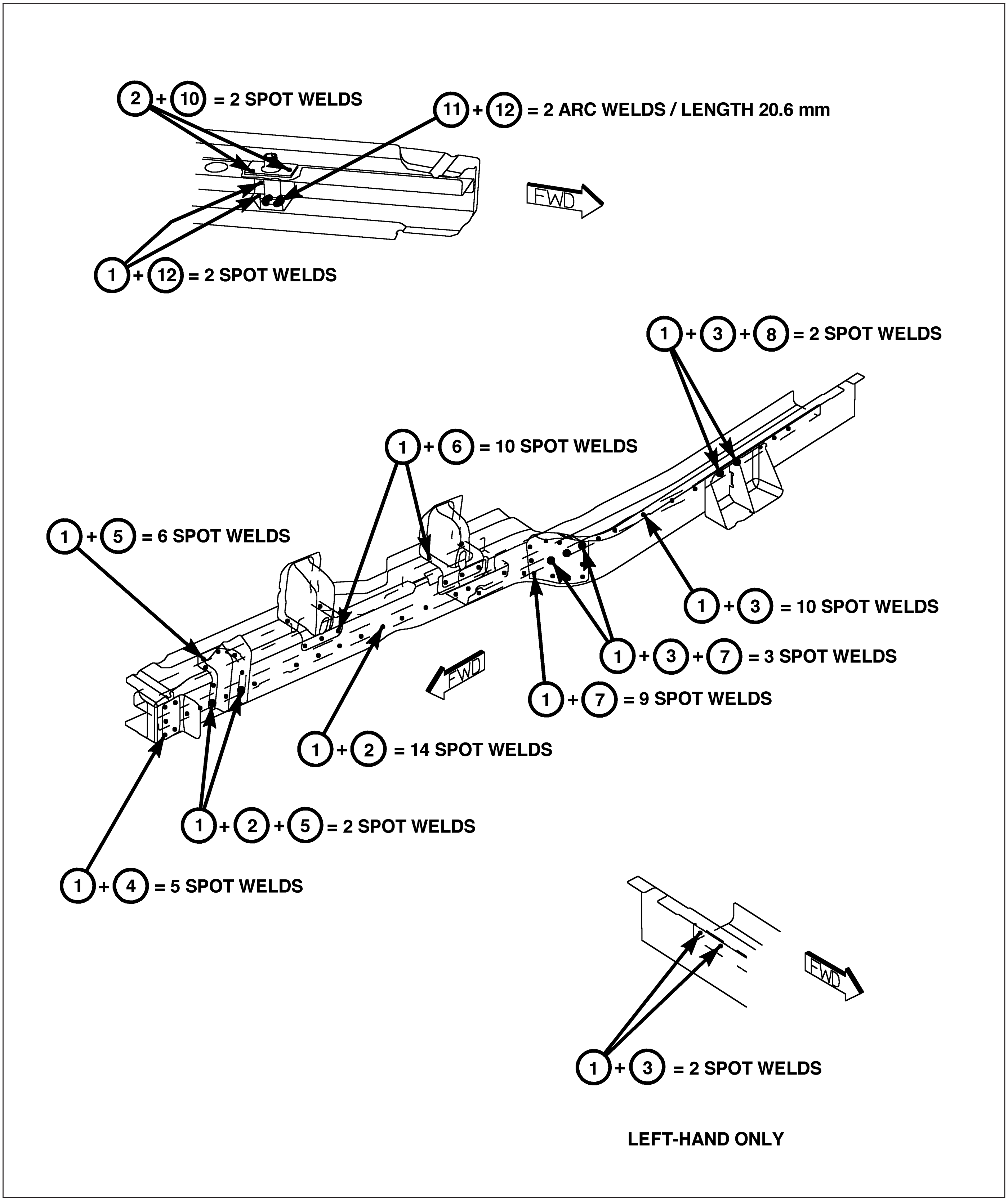



*Fig. 10 FRONT INNER RAILS*

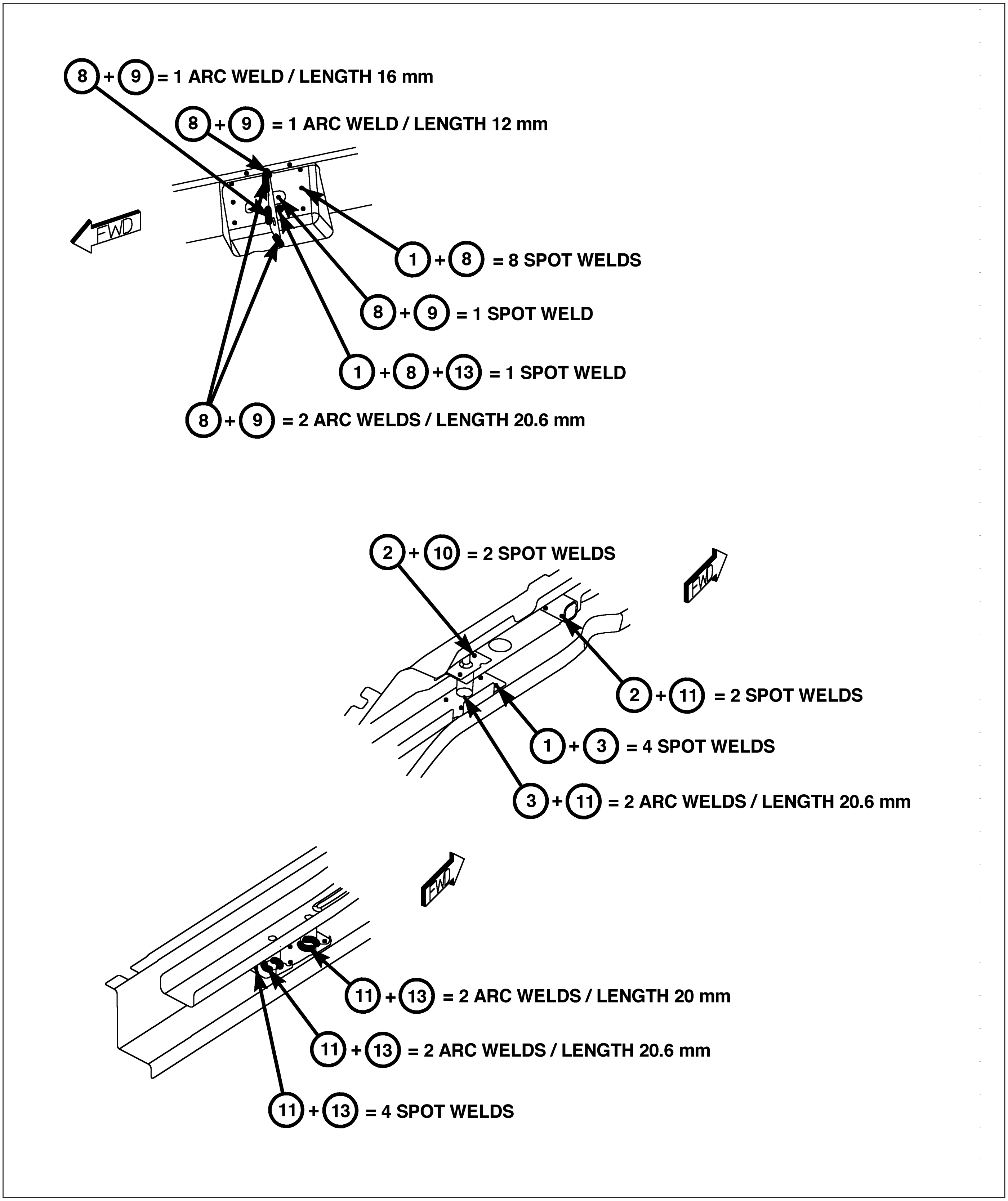



*Fig. 11 FRONT INNER RAILS*

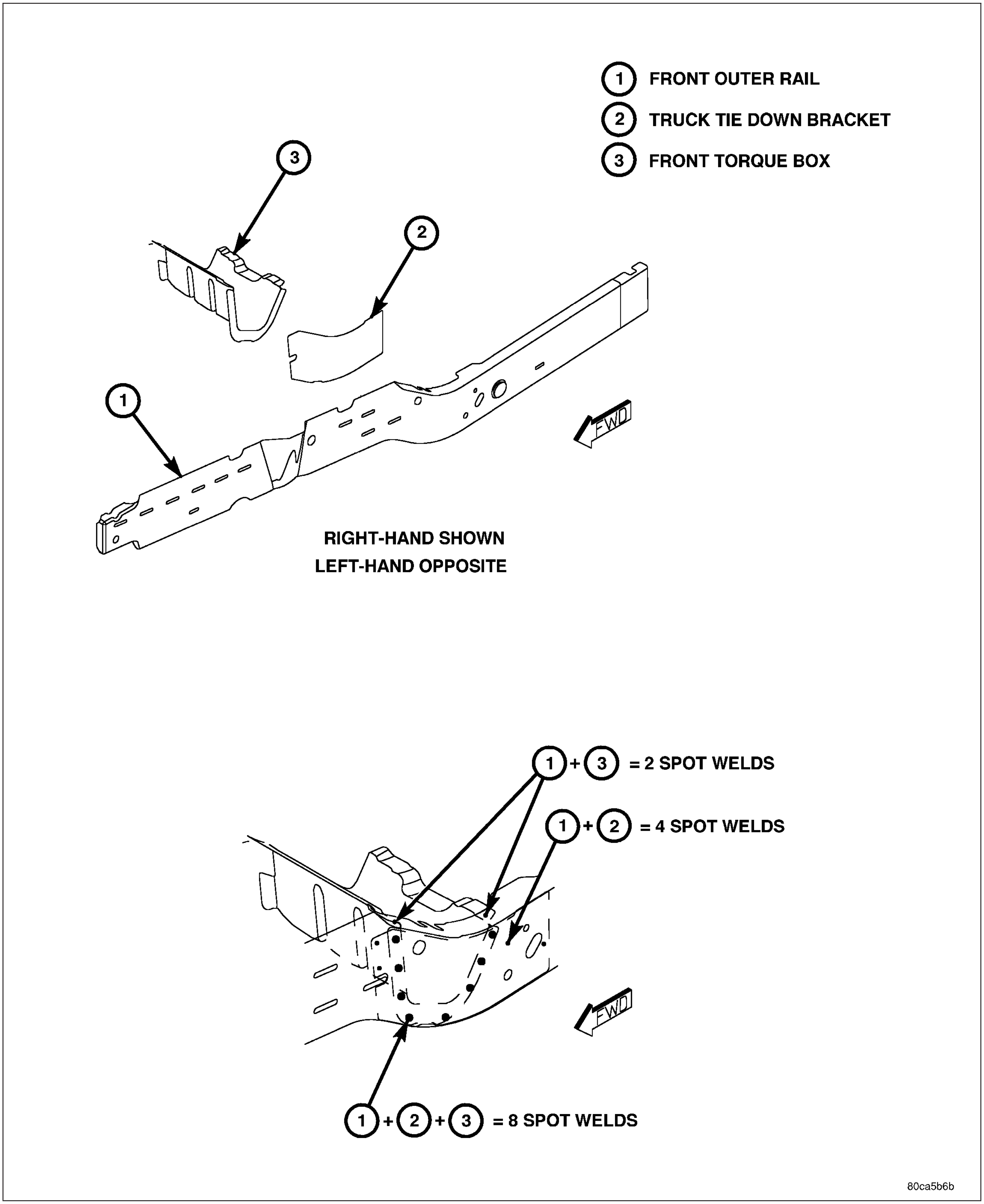
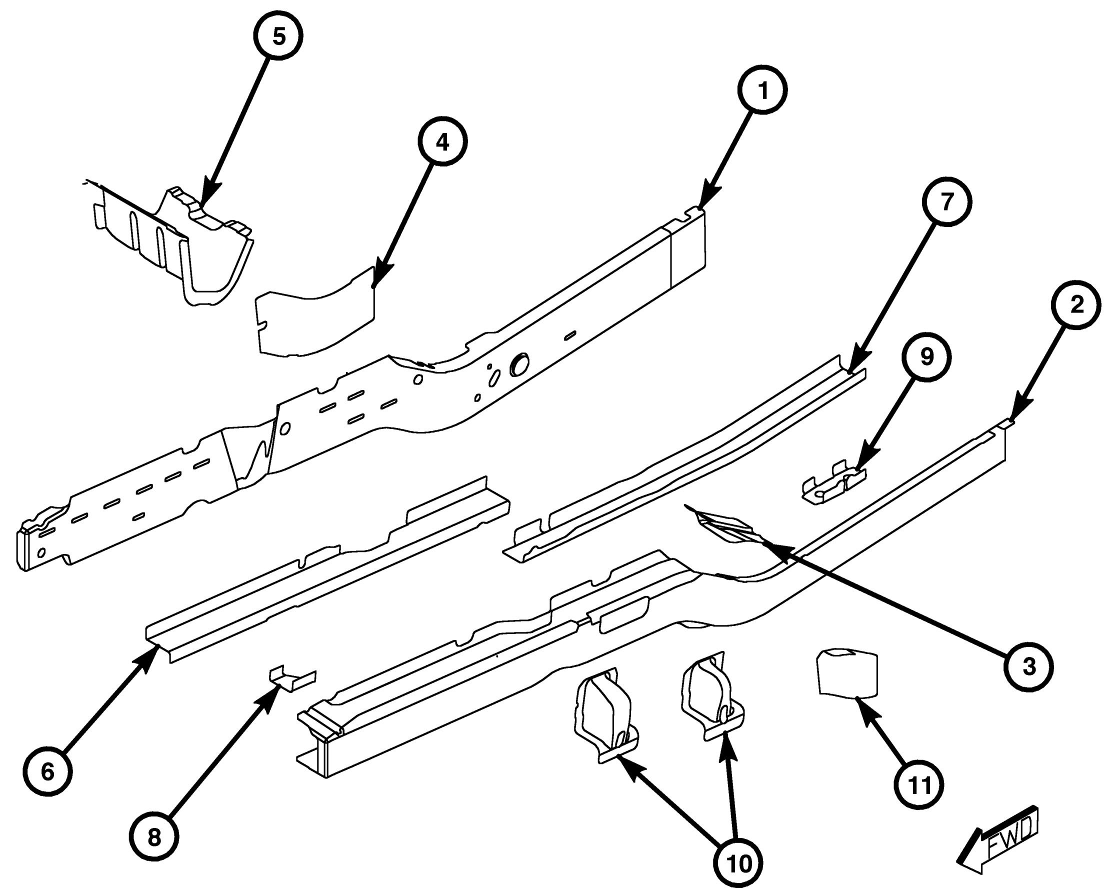



*Fig. 12 FRONT OUTER RAIL*

1. FRONT OUTER RAIL ASSEMBLY
2. FRONT INNER RAIL ASSEMBLY
3. FRONT FLOOR REINFORCEMENT PLATE
4. TRUCK TIE DOWN BRACKET
5. FRONT TORQUE BOX
6. TIP REINFORCEMENT
7. U-CHANNEL REINFORCEMENT
8. CLOSEOUT SPACER BRACKET
9. REAR SPACER BRACKET
10. MOUNTING BRACKET
11. REINFORCEMENT PLATE

NOTE
ITEMS 4,5 ARE PARTS OF THE FRONT OUTER RAIL ASSEMBLY
ITEMS 6,7,8,9,10 AND 11 ARE PARTS OF THE FRONT INNER RAIL ASSEMBLY




RIGHT-HAND SHOWN
LEFT-HAND OPPOSITE UNLESS SHOWN

*Fig. 13 FRONT OUTER RAILS*

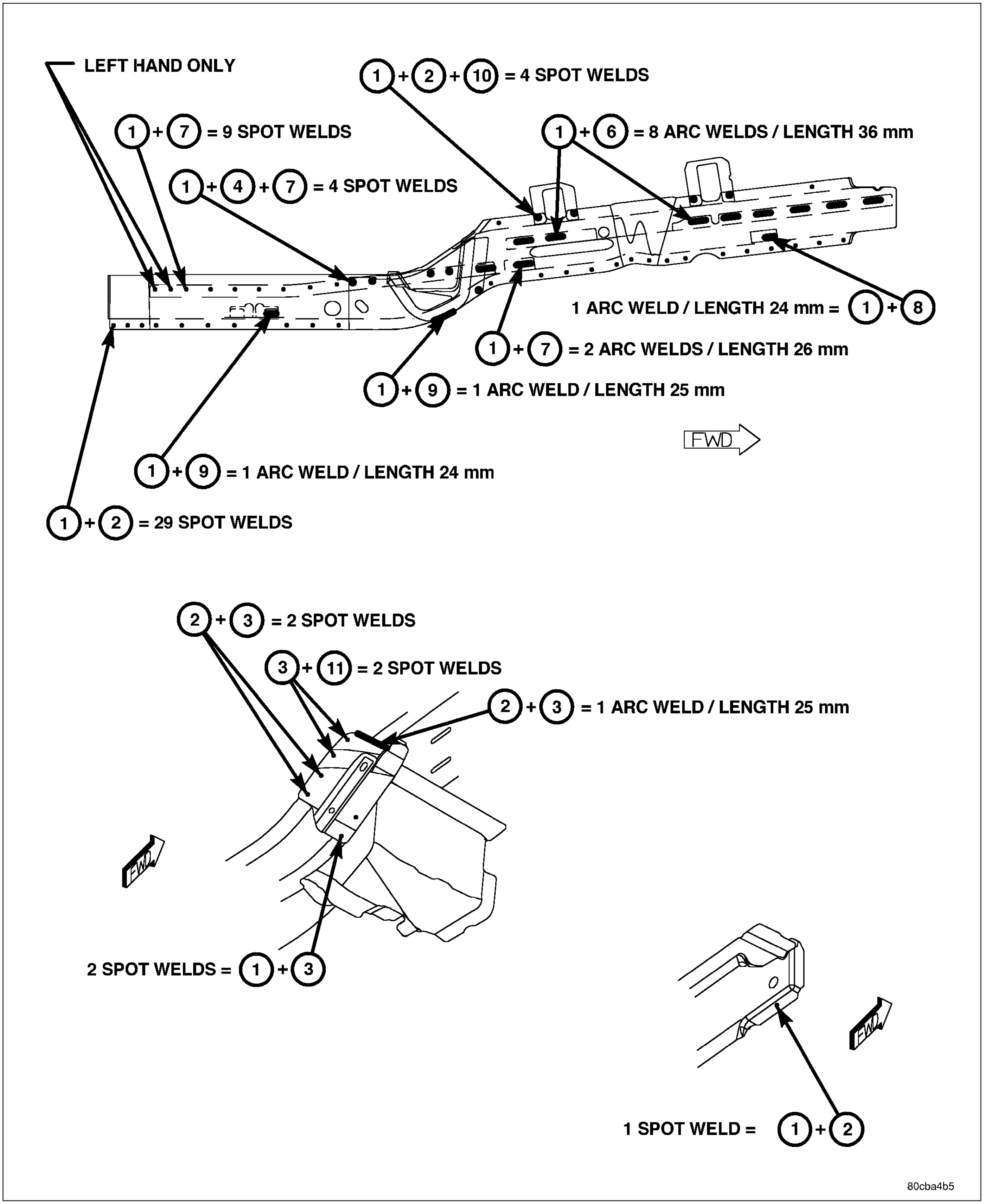
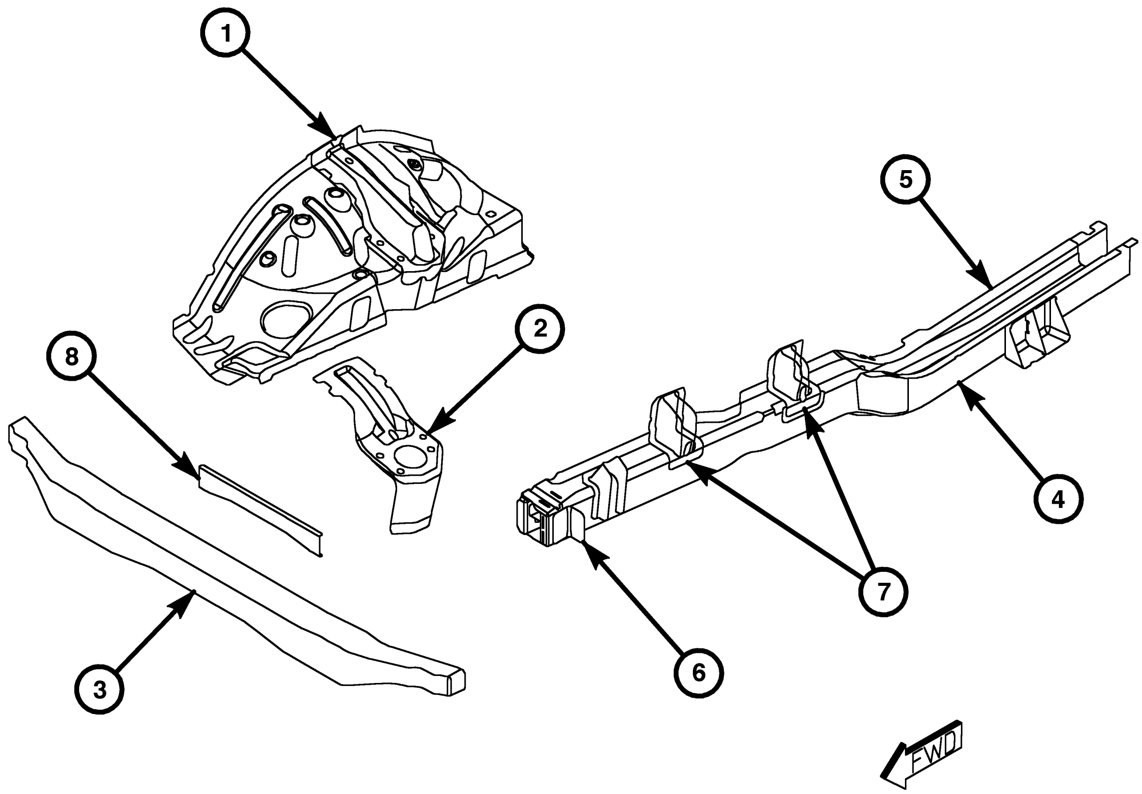



*Fig. 14 FRONT OUTER RAILS*

1 INNER FRONT WHEELHOUSE
2 LOWER REINFORCEMENT
3 FRONT BUMPER CROSSMEMBER
4 FRONT INNER RAIL ASSEMBLY
5 FRONT OUTER RAIL ASSEMBLY
6 FRONT RAIL TO CROSSMEMBER BRACKET
7 MOUNTING BRACKET
8 CROSSMEMBER BRACKET

NOTE
ITEMS 4,5,6 AND 7 ARE PARTS OF THE COMPLETE FRONT RAIL ASSEMBLY
ITEM 2 IS PART OF THE COMPLETE INNER FRONT WHEELHOUSE ASSEMBLY
ITEM 8 IS PART OF THE COMPLETE FRONT BUMPER CROSSMEMBER ASSEMBLY




RIGHT-HAND SHOWN
LEFT-HAND OPPOSITE

*Fig. 15 INNER FRONT WHEELHOUSE/FRONT INNER RAIL*

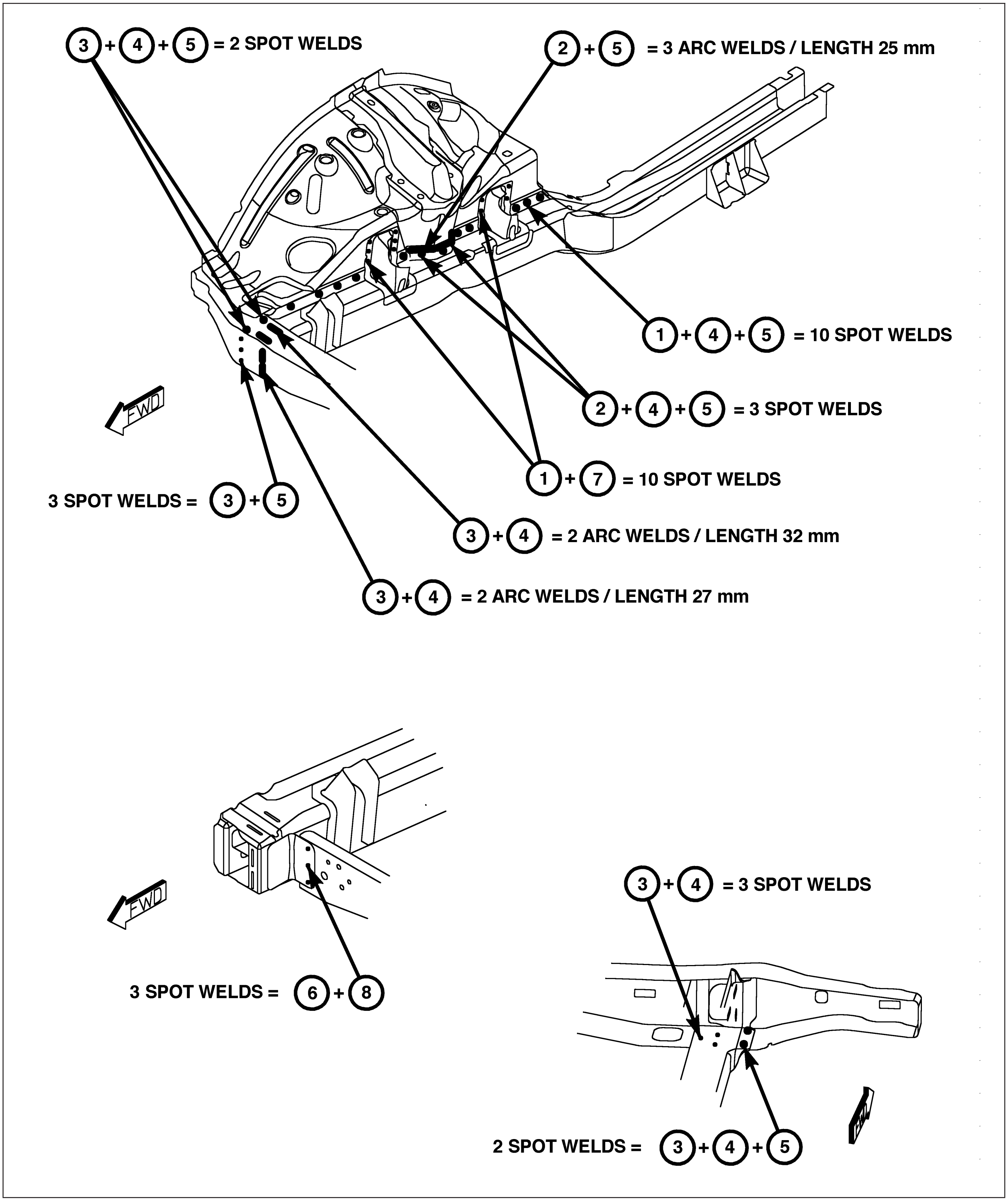



*Fig. 16 INNER FRONT WHEELHOUSE/FRONT INNER RAIL*

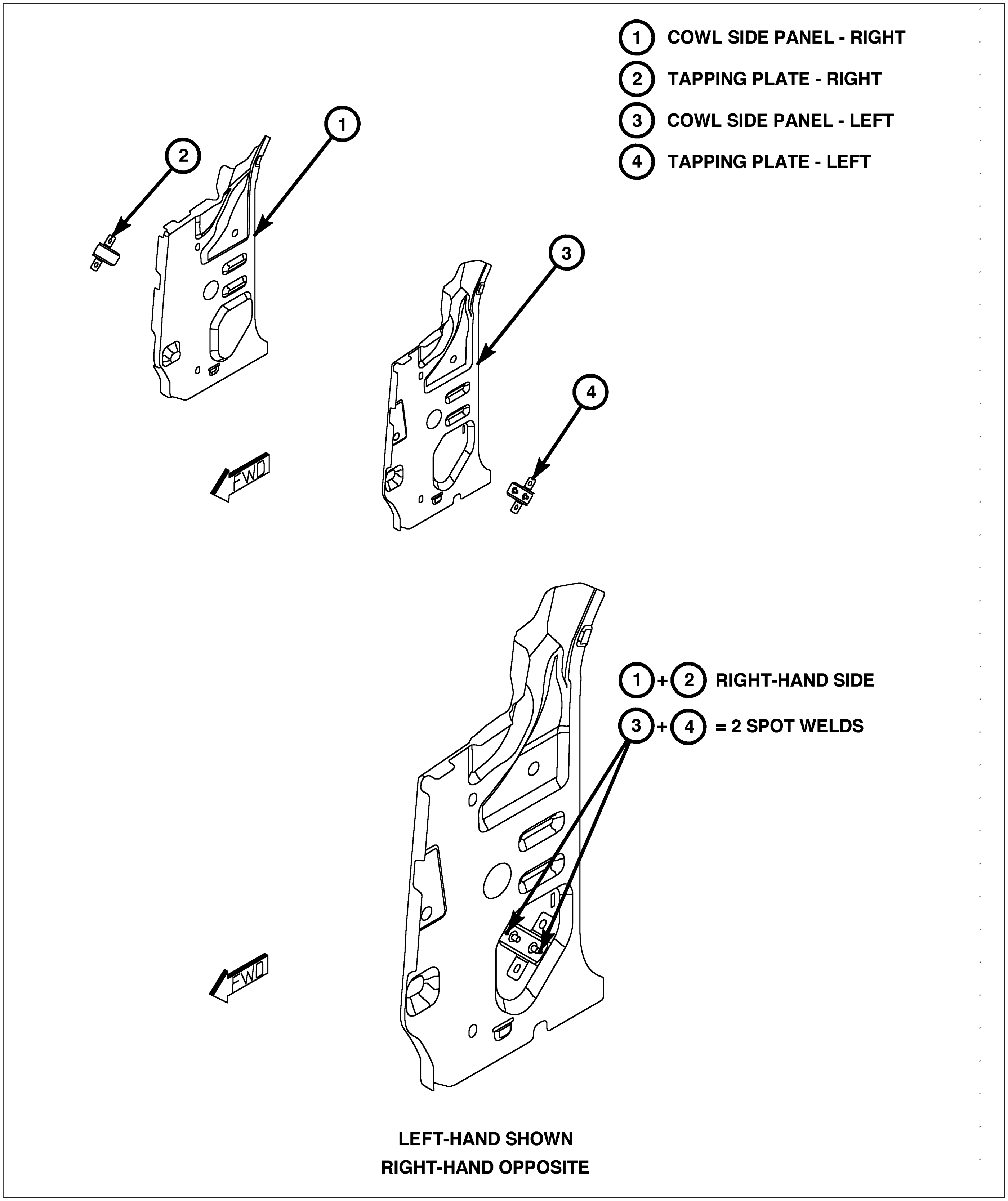



*Fig. 17 COWL SIDE PANEL*

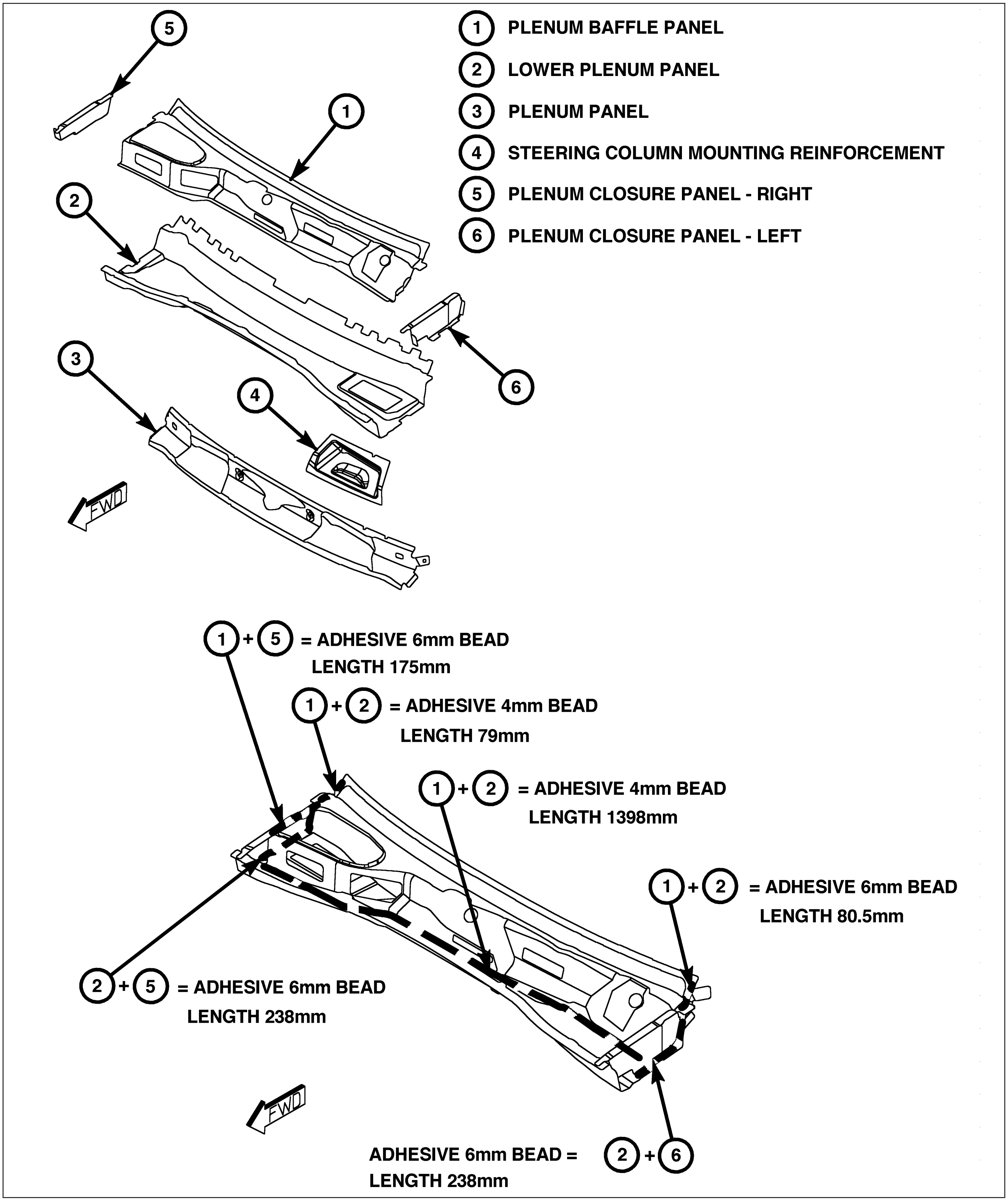



*Fig. 18 PLENUM ASSEMBLY*

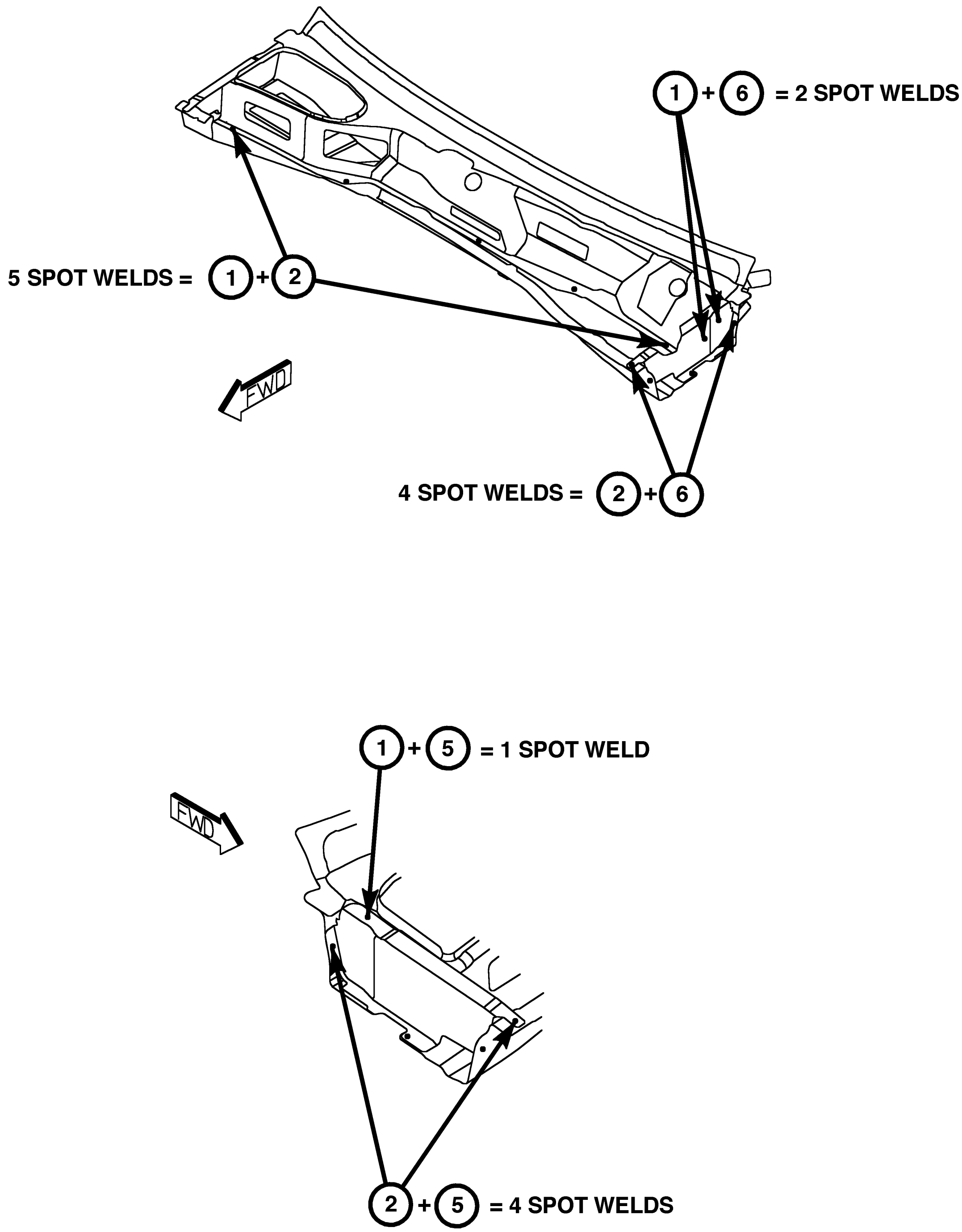



*Fig. 19 PLENUM BAFFLE & PLENUM CLOSURE PANEL*

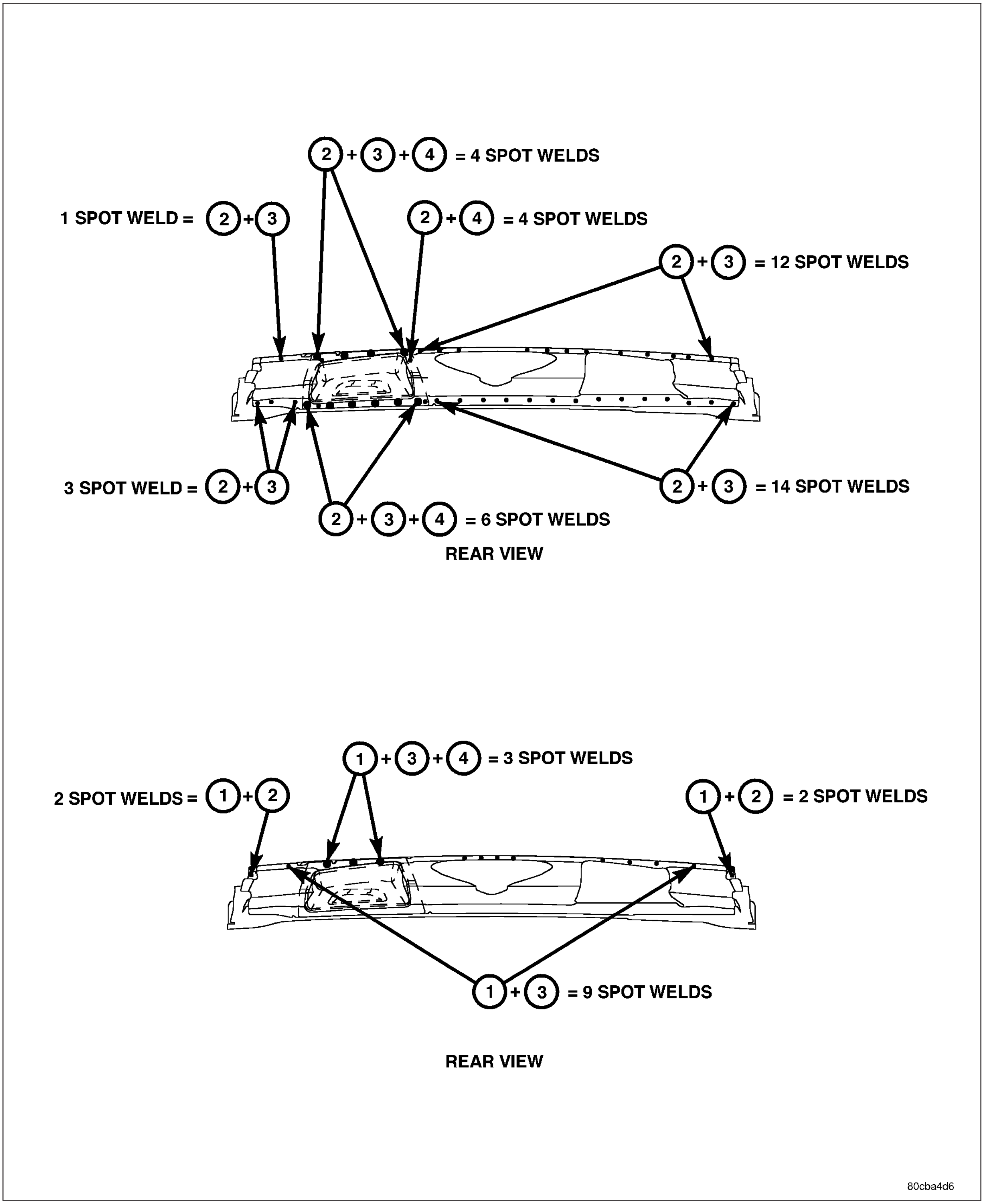



*Fig. 20 PLENUM BAFFLE & STEERING COLUMN REINFORCEMENT*

## FRONT END ASSEMBLY/UNDERBODY

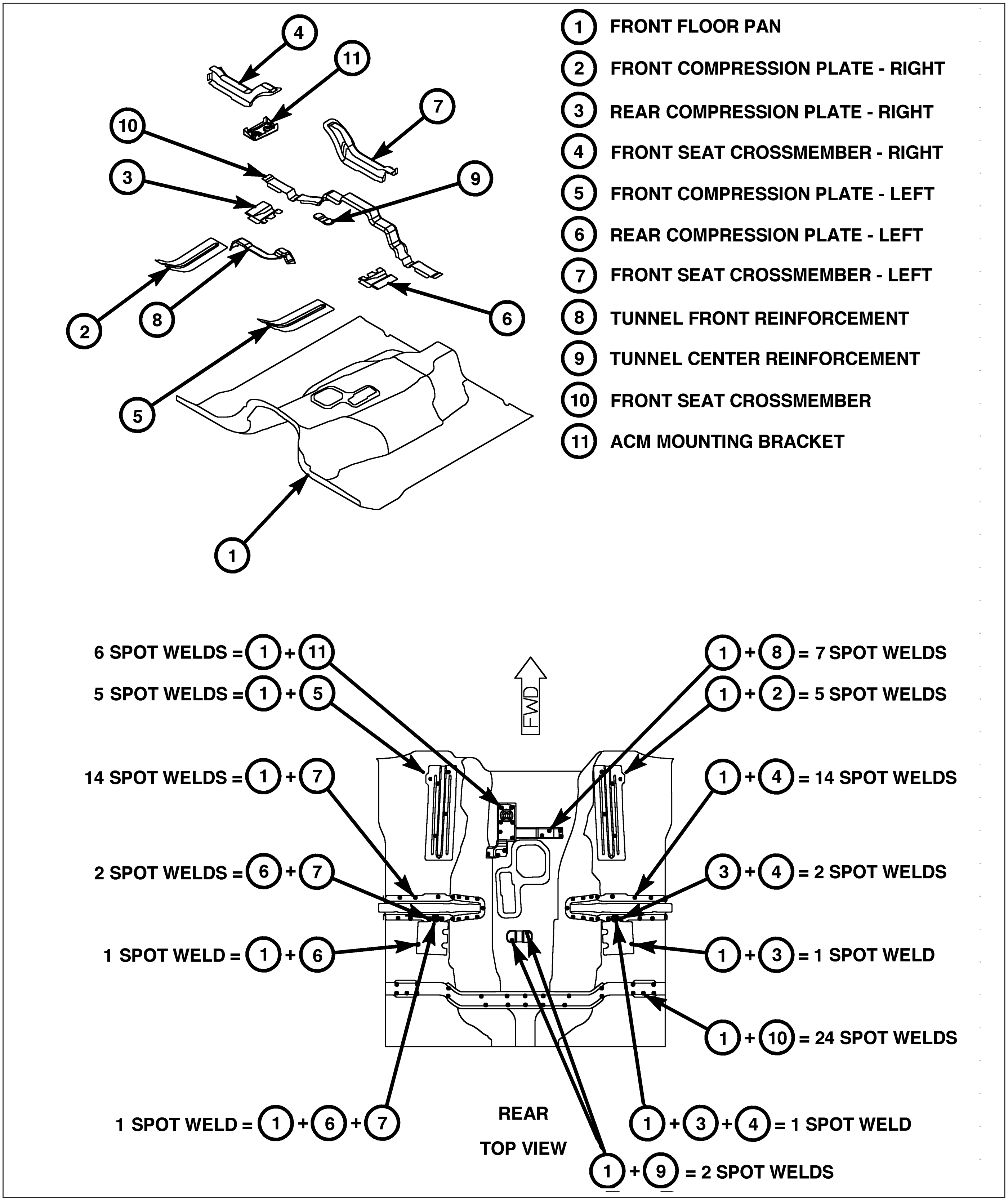



*Fig. 21 FLOOR PAN ASSEMBLY*

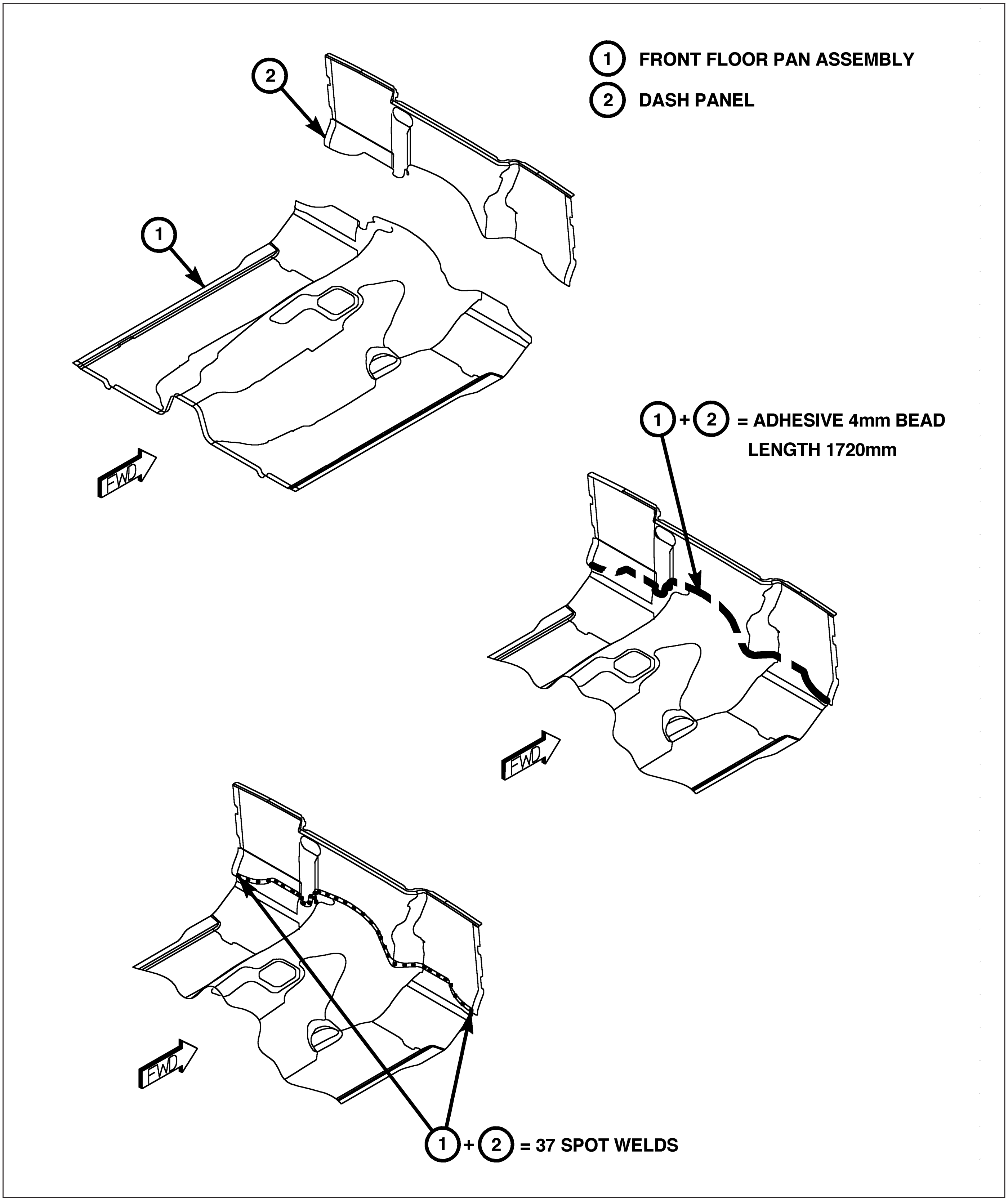



*Fig. 22 FLOOR PAN ASSEMBLY*

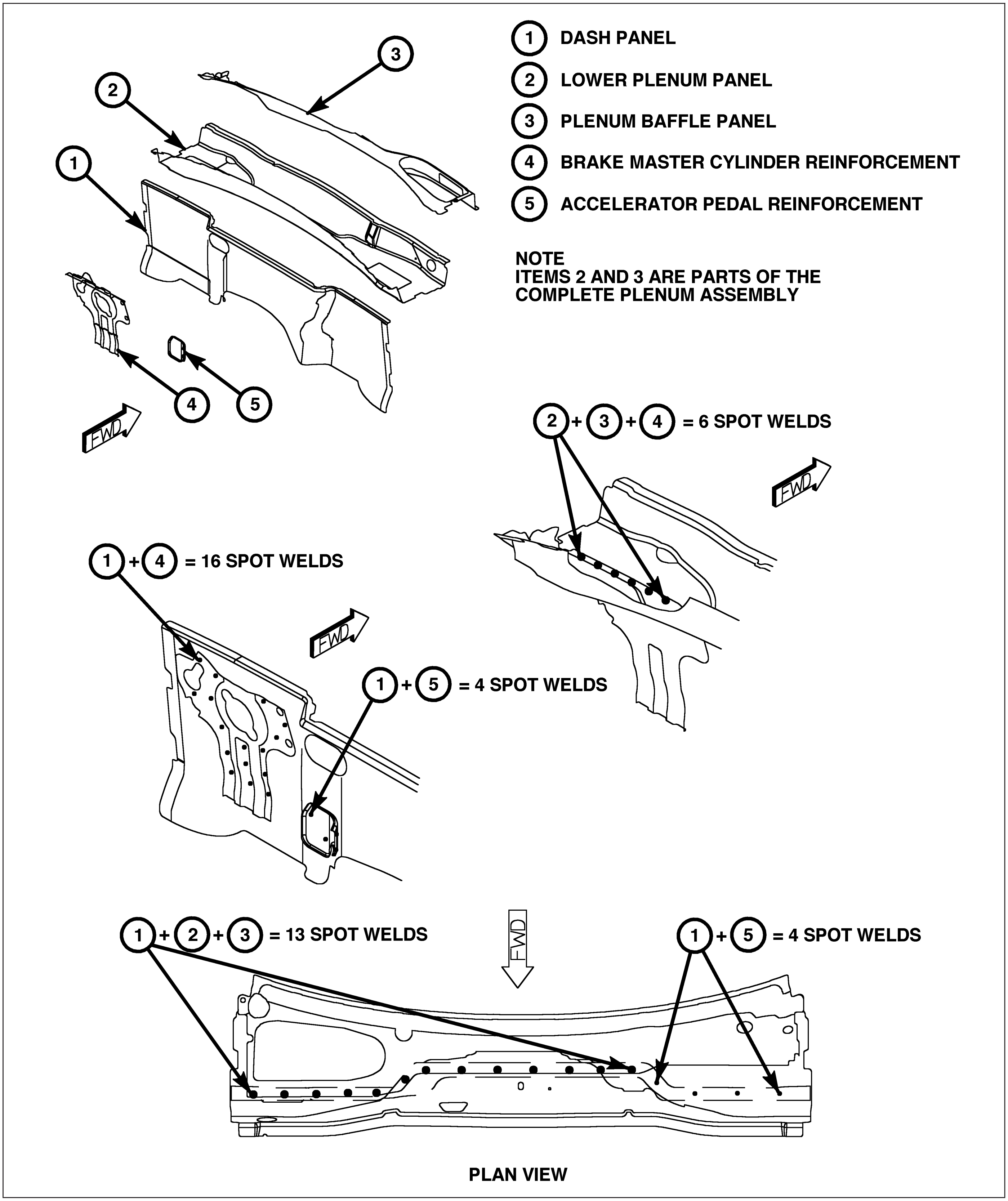



*Fig. 23 DASH PANEL ASSEMBLY*

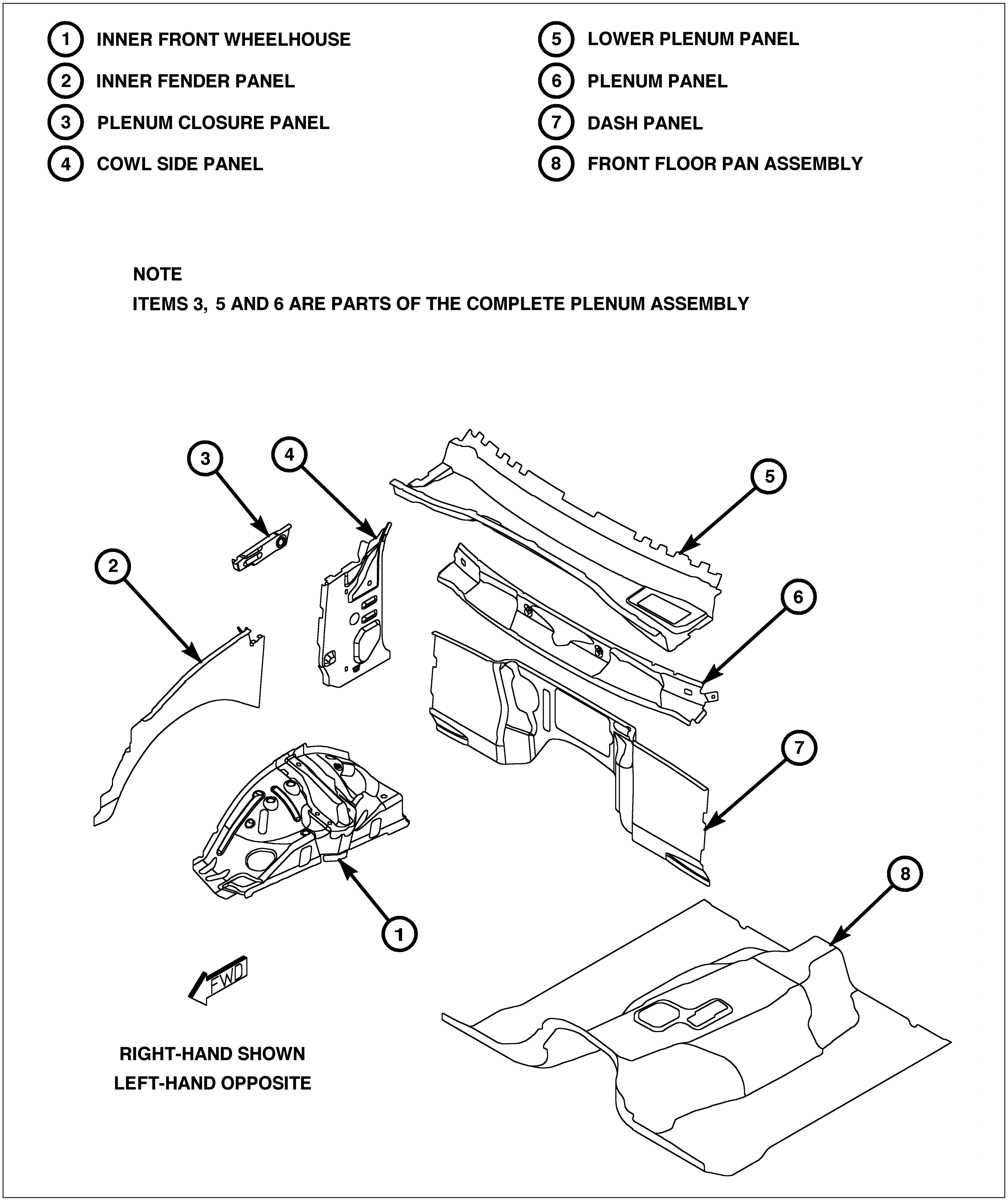



*Fig. 24 DASH PANEL/WHEELHOUSE ASSEMBLY*

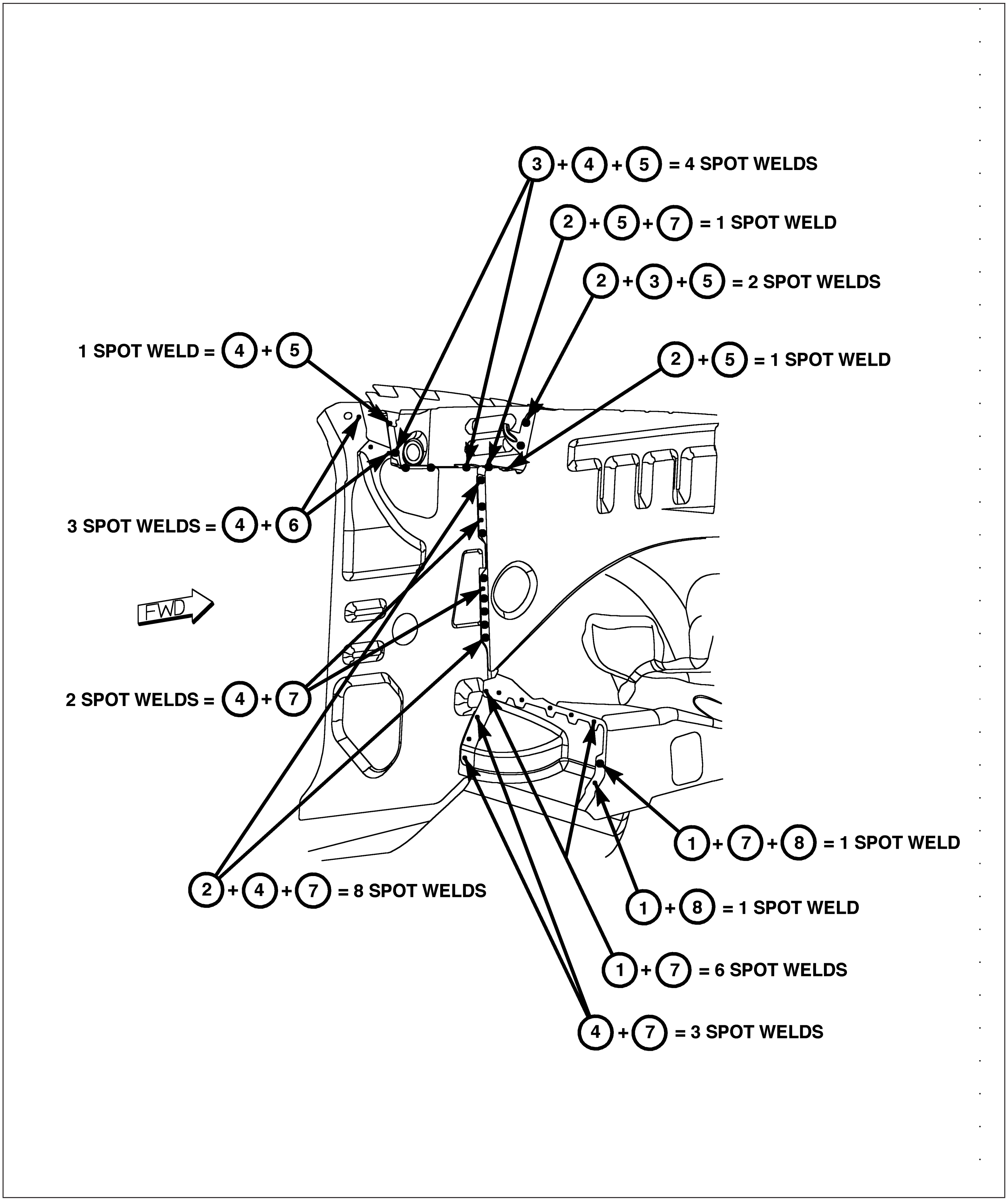



*Fig. 25 COWL SIDE PANEL*

## REAR FRAME RAILS

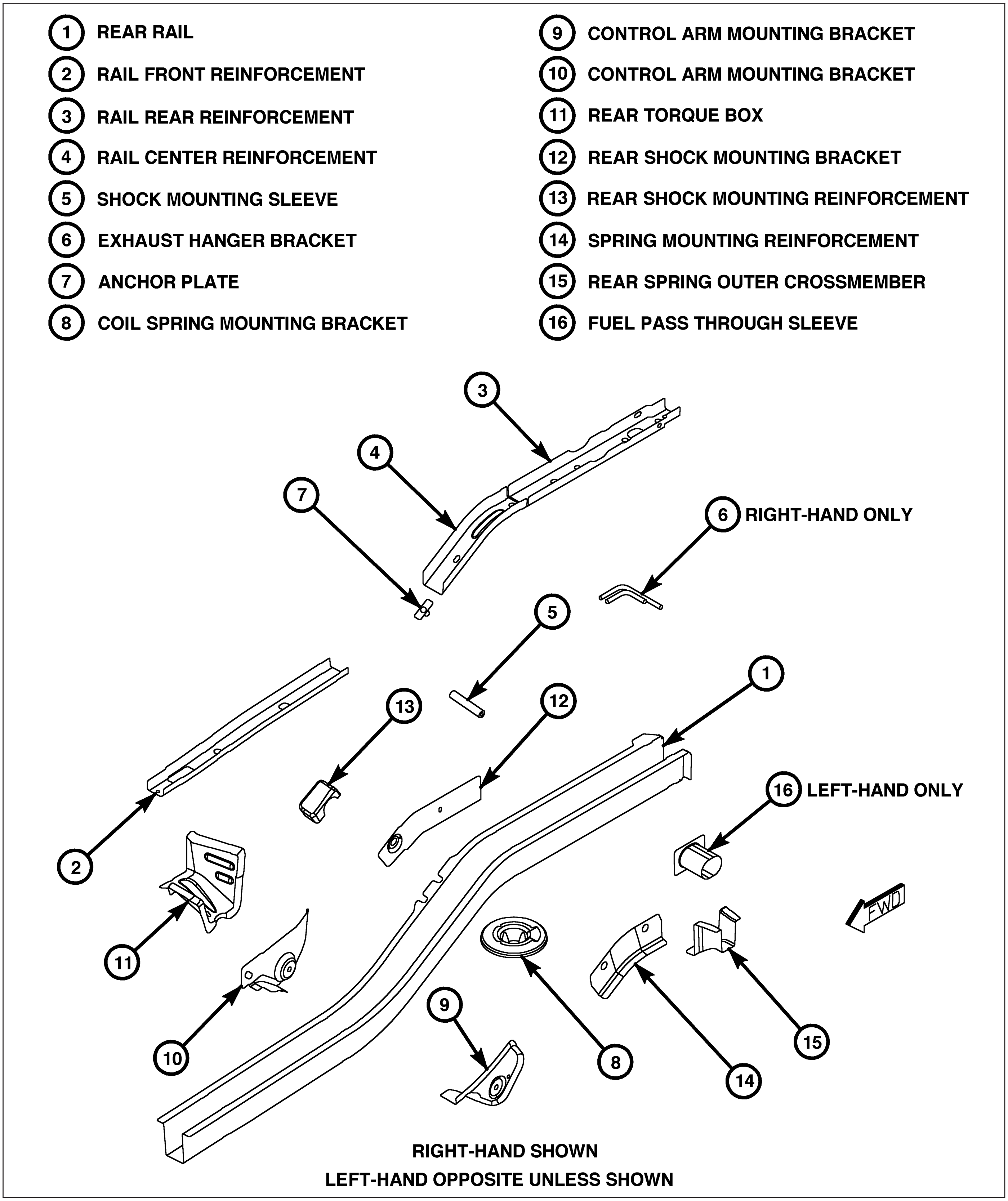



*Fig. 26 REAR FRAME RAILS*

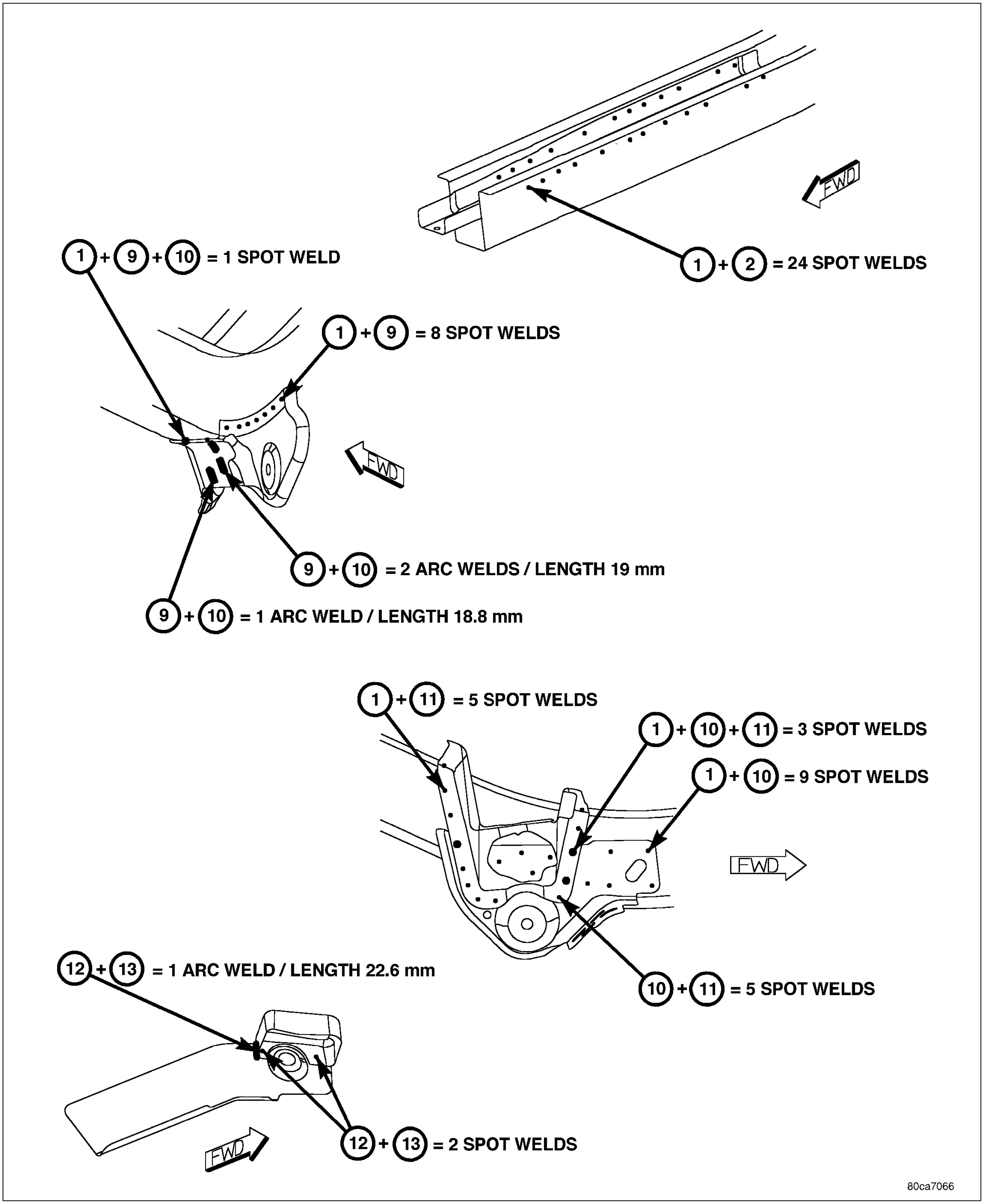



*Fig. 27 REAR CONTROL ARM AND SHOCK MOUNTING BRACKETS*

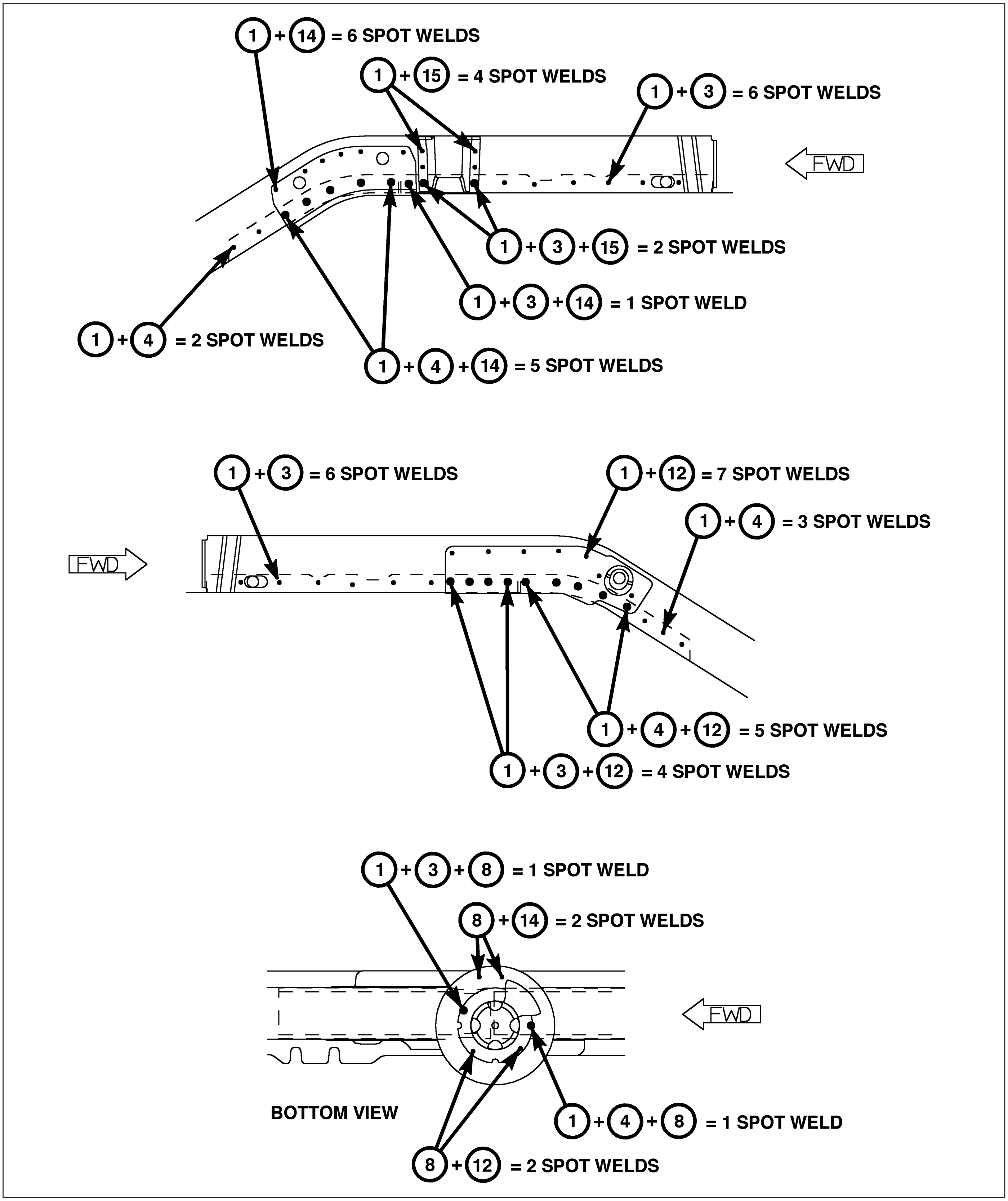



*Fig. 28 REAR SPRING MOUNTINGS*

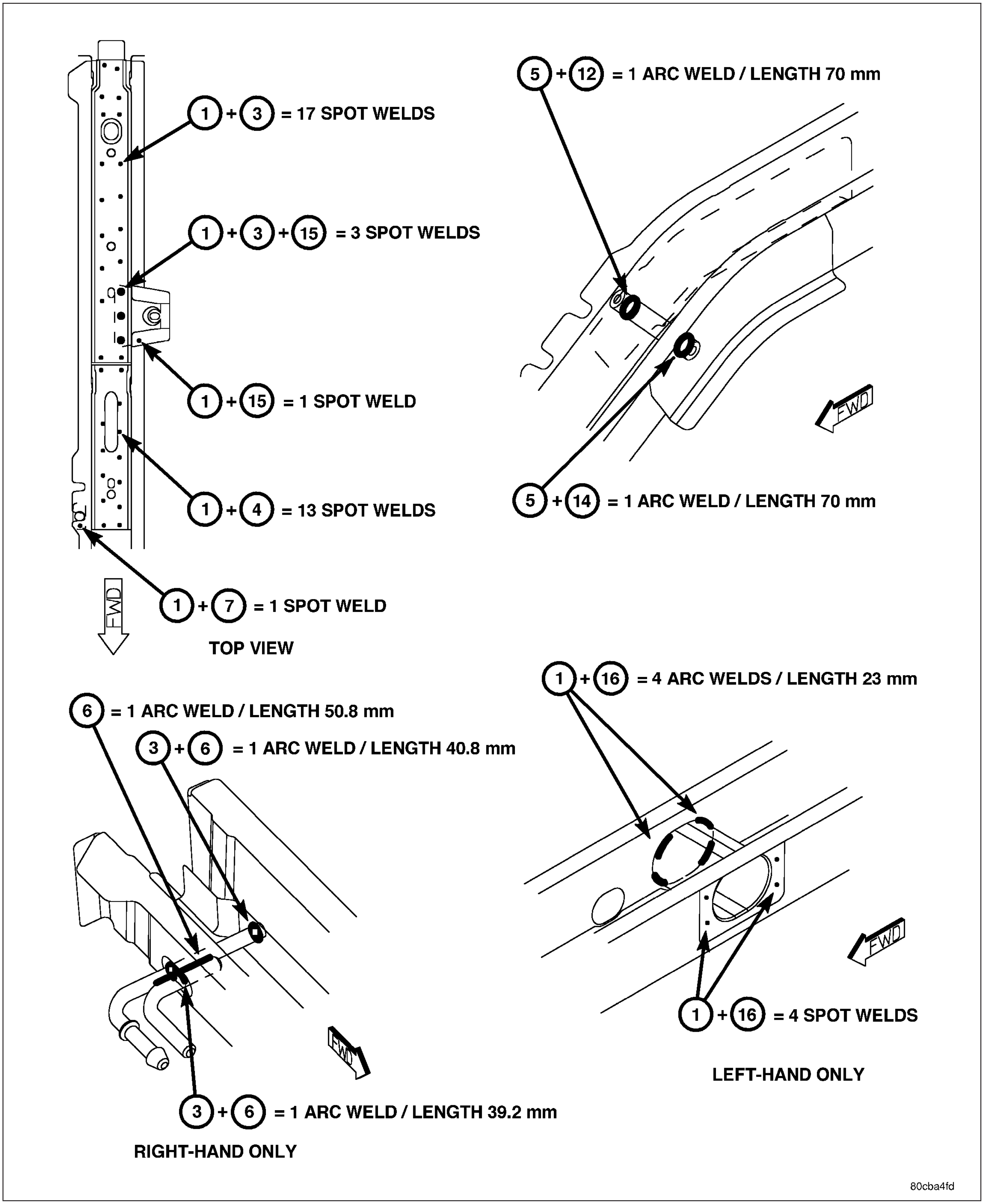



*Fig. 29 REAR SPRING, SHOCK, FUEL PASS AND EXHAUST BRACKETS*

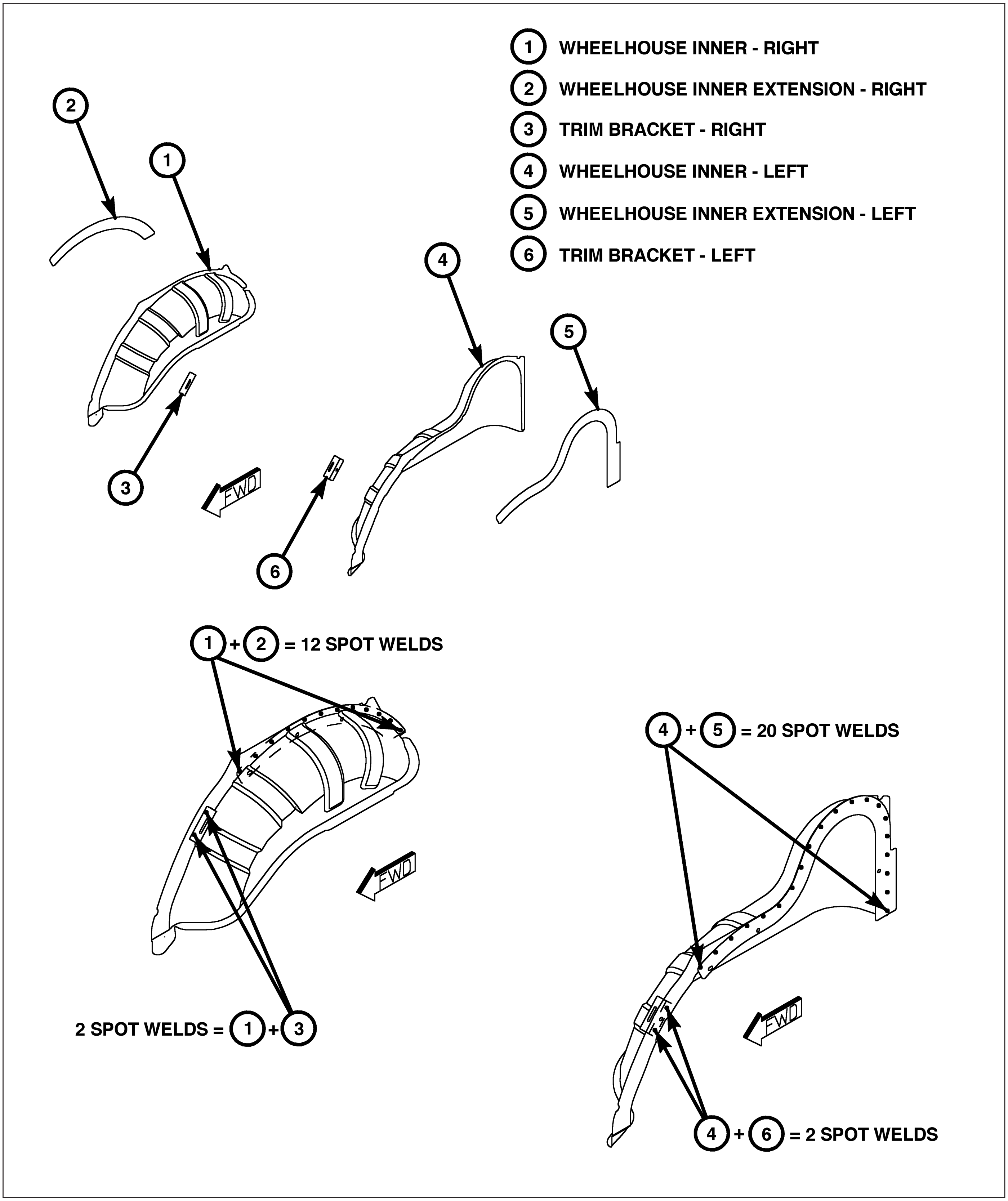



*Fig. 30 REAR WHEELHOUSE ASSEMBLIES*

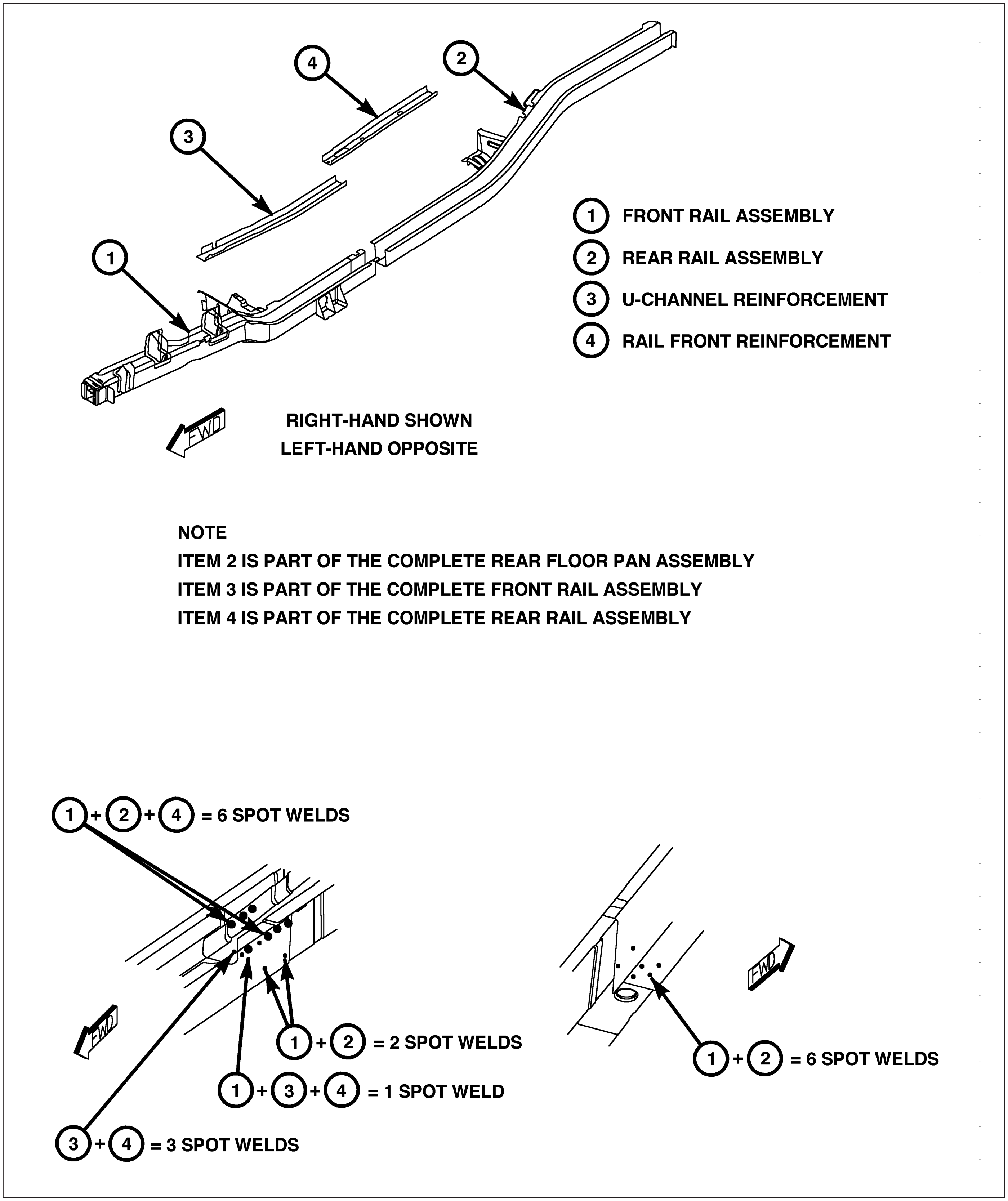



*Fig. 31 RAIL ASSEMBLIES – FRONT/REAR*

## REAR FLOOR PAN ASSEMBLY

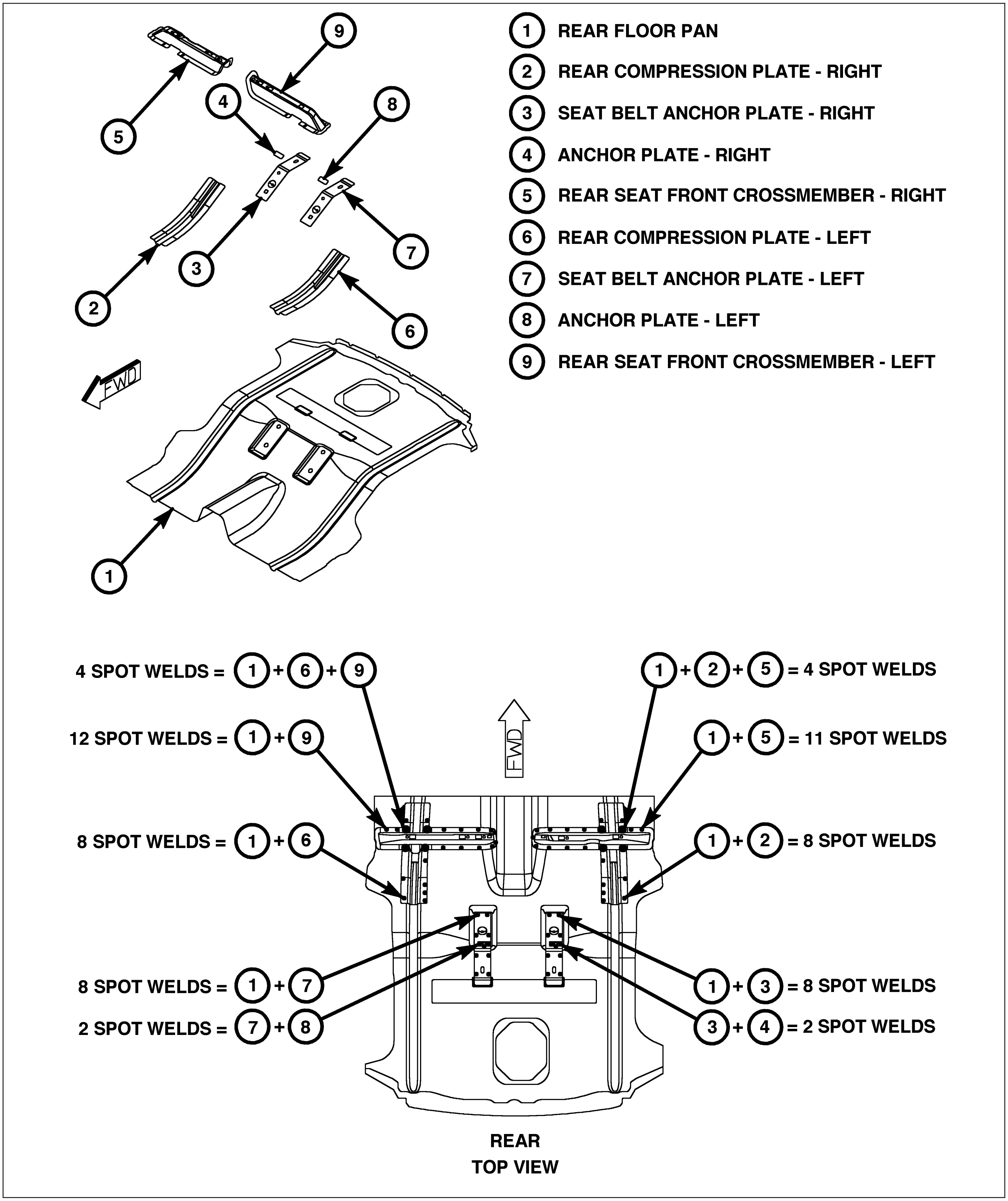



*Fig. 32 REAR FLOOR PAN ASSEMBLY*

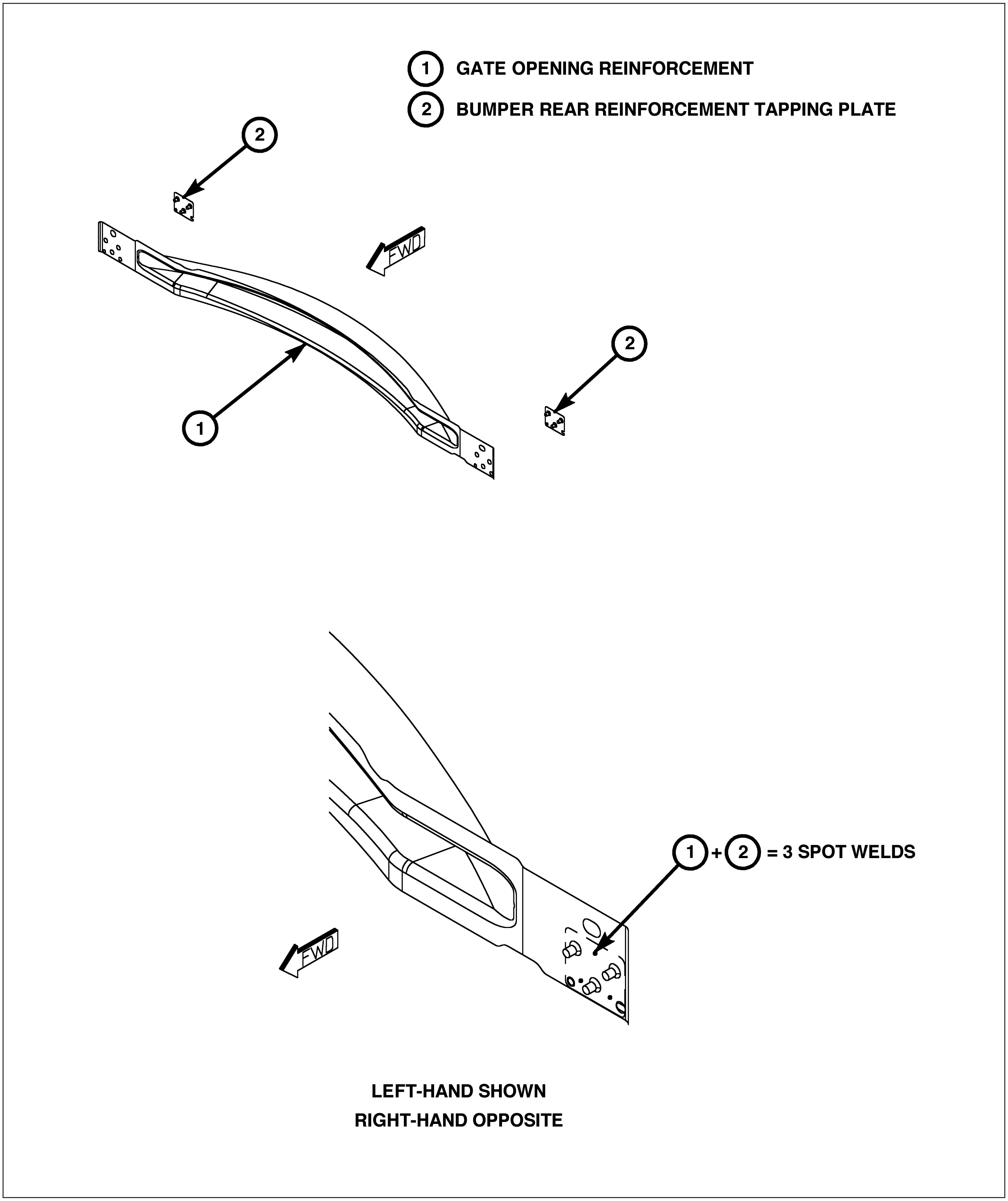



*Fig. 33 BUMPER AND SWING GATE REINFORCEMENT*

1. REAR FLOOR PAN ASSEMBLY
2. SEAT BELT ANCHOR PLATE
3. REAR COMPRESSION PLATE
4. REAR SEAT FRONT CROSSMEMBER
5. REAR RAIL ASSEMBLY - RIGHT
6. REAR RAIL ASSEMBLY - LEFT
7. REAR TORQUE BOX
8. ANCHOR PLATE
9. REAR SHOCK MOUNTING REINFORCEMENT
10. FUEL PASS-THROUGH SLEEVE
11. REAR SEAT CROSSMEMBER - RIGHT
12. A-ARM LOWER BRACKET
13. A-ARM UPPER BRACKET
14. REAR SEAT CROSSMEMBER BULKHEAD
15. REAR SPRING CENTER CROSSMEMBER
16. REAR SPRING OUTER CROSSMEMBER
17. FUEL TANK SUPPORT
18. REAR CROSSMEMBER
19. GATE OPENING REINFORCEMENT
20. REAR SEAT CROSSMEMBER - LEFT
21. FUEL TANK SUPPORT REINFORCEMENT

NOTE
ITEMS 7,8,9 AND 10 ARE PARTS OF THE RIGHT AND LEFT REAR RAIL ASSEMBLIES

ITEMS 2,3 AND 4 ARE PARTS OF THE REAR FLOOR PAN ASSEMBLY

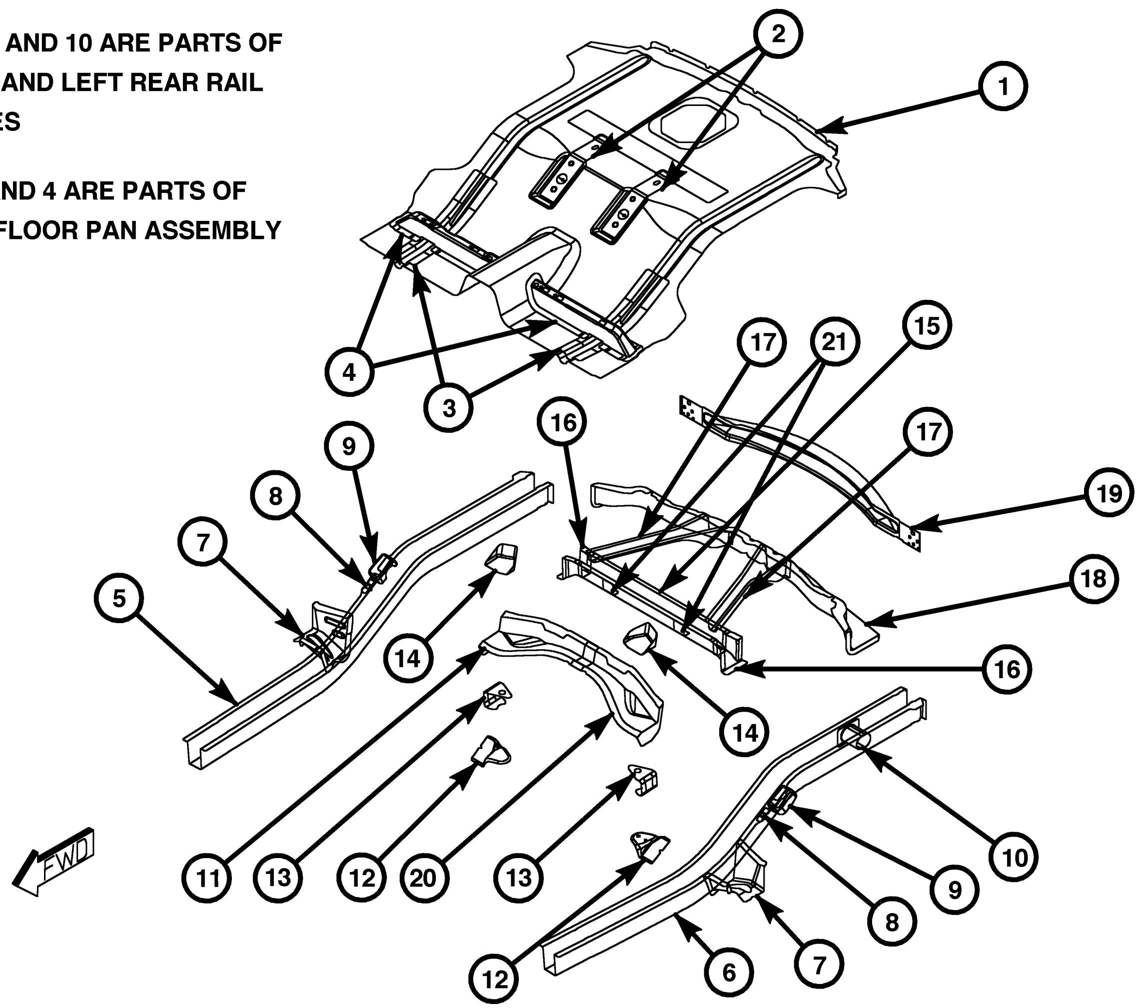



*Fig. 34 REAR FLOOR PAN*

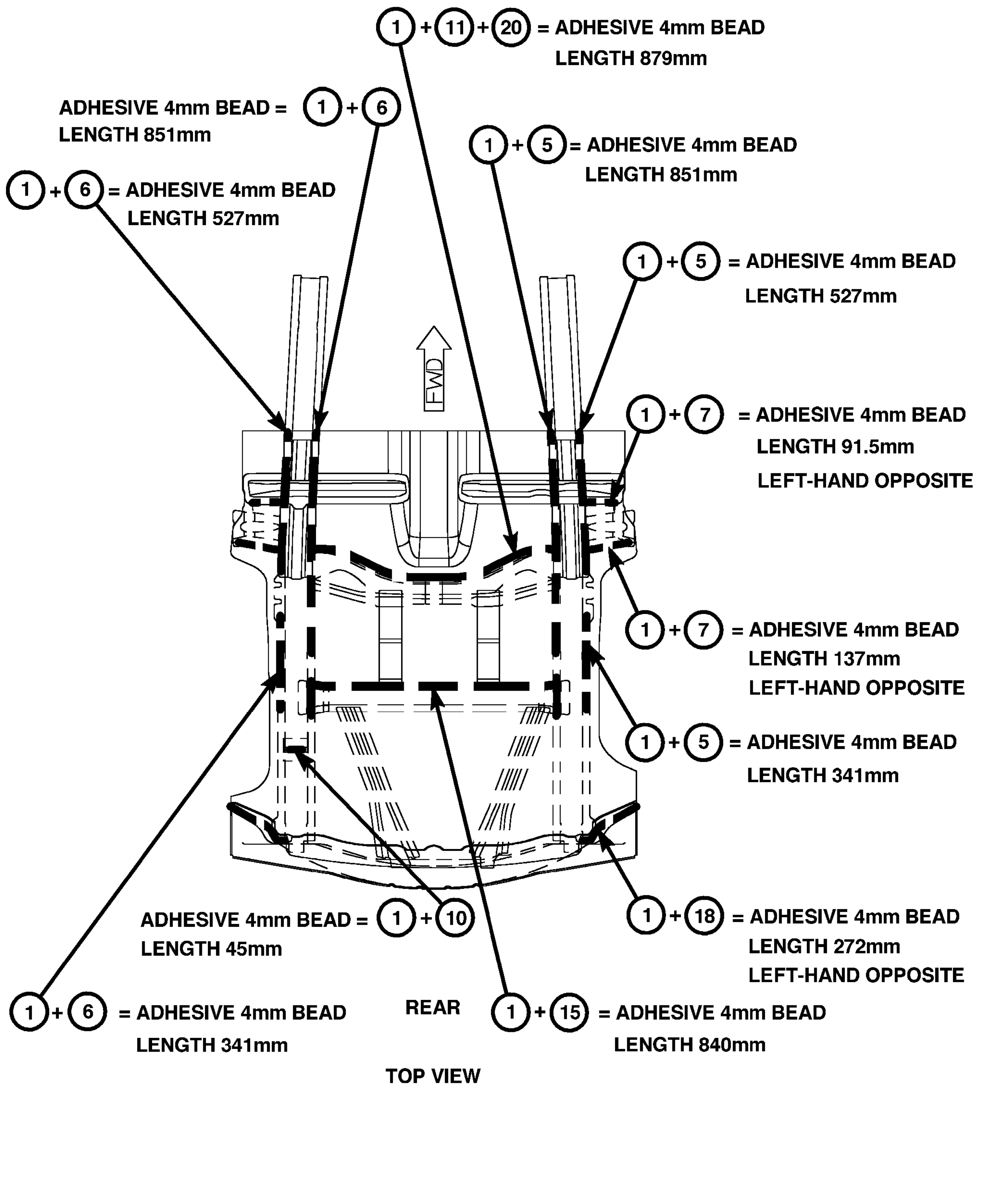



*Fig. 35 FLOOR PAN AND REAR RAIL ADHESIVE LOCATIONS*

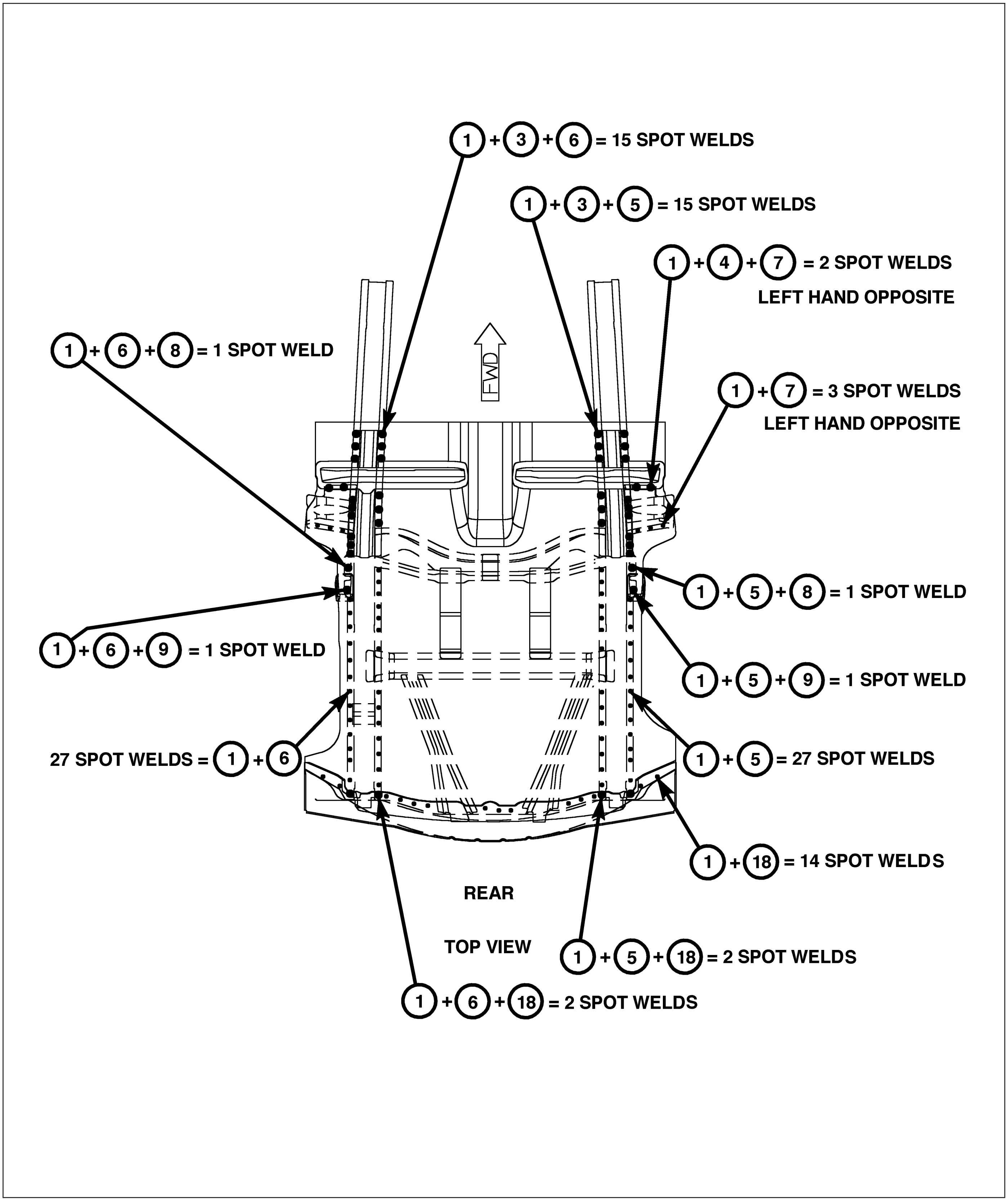



*Fig. 36 REAR FLOOR PAN*

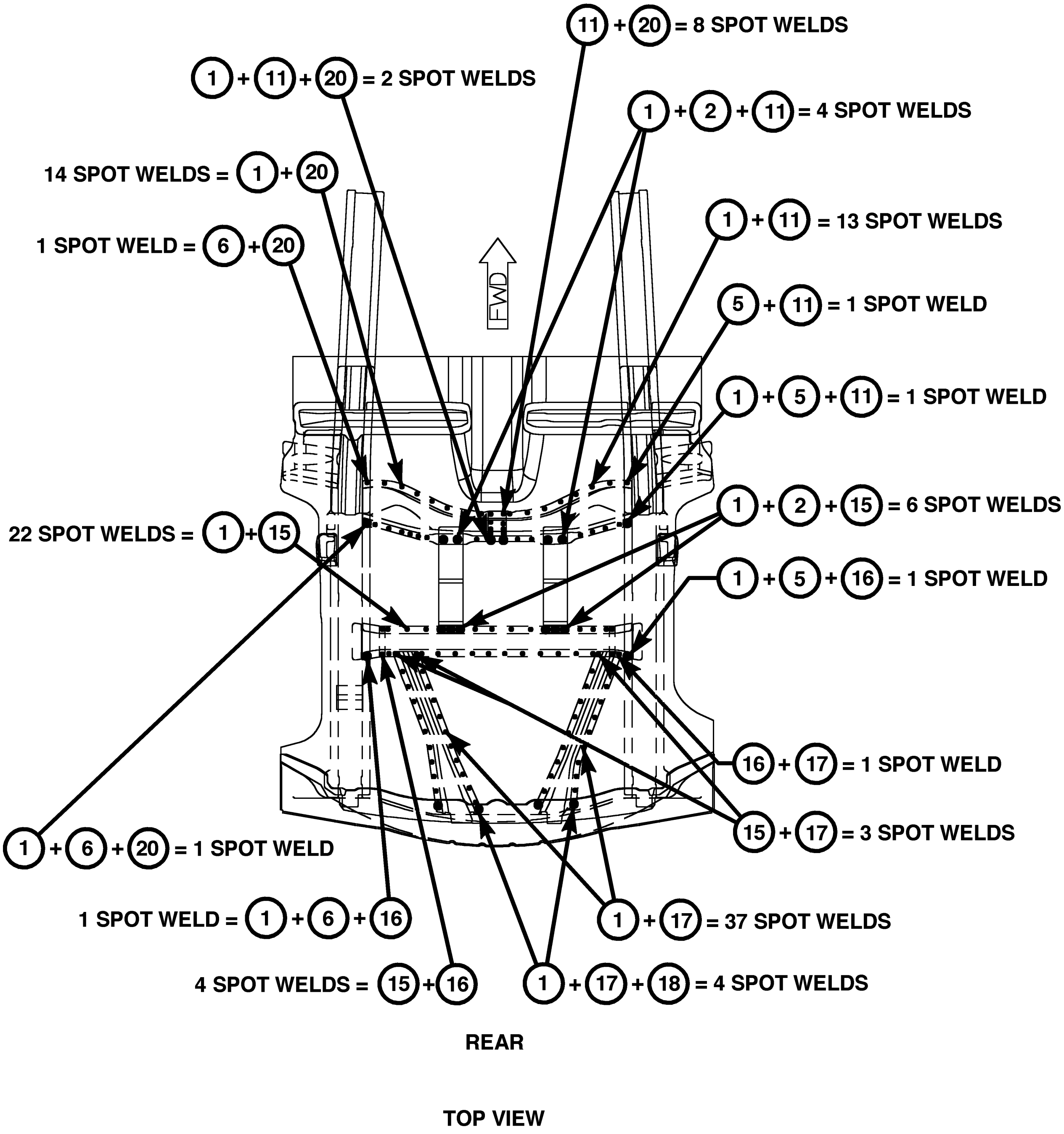



*Fig. 37 REAR FLOOR PAN*

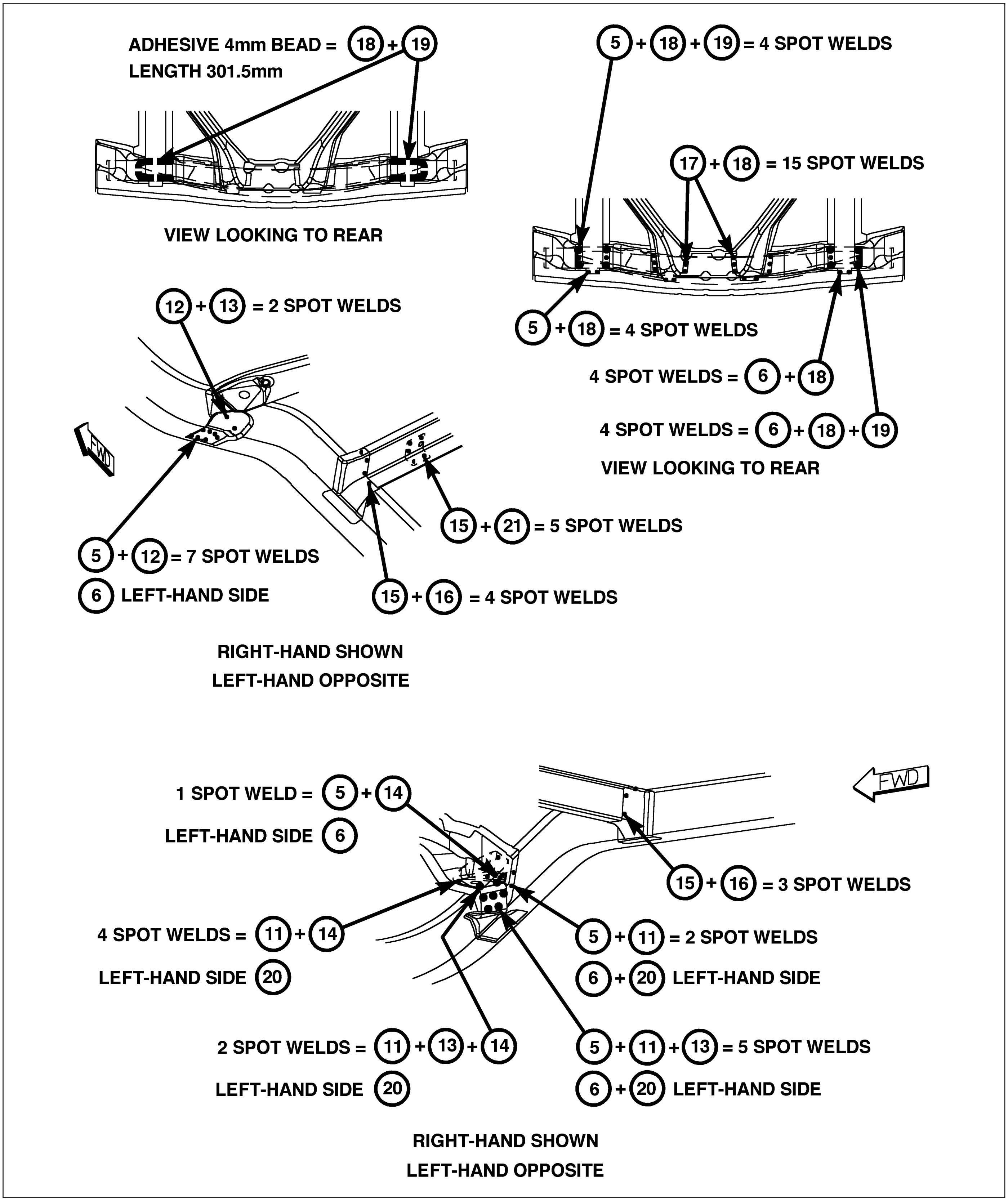



*Fig. 38 REAR CROSSMEMBERS AND REINFORCEMENTS*

## FULL FLOOR PAN ASSEMBLY

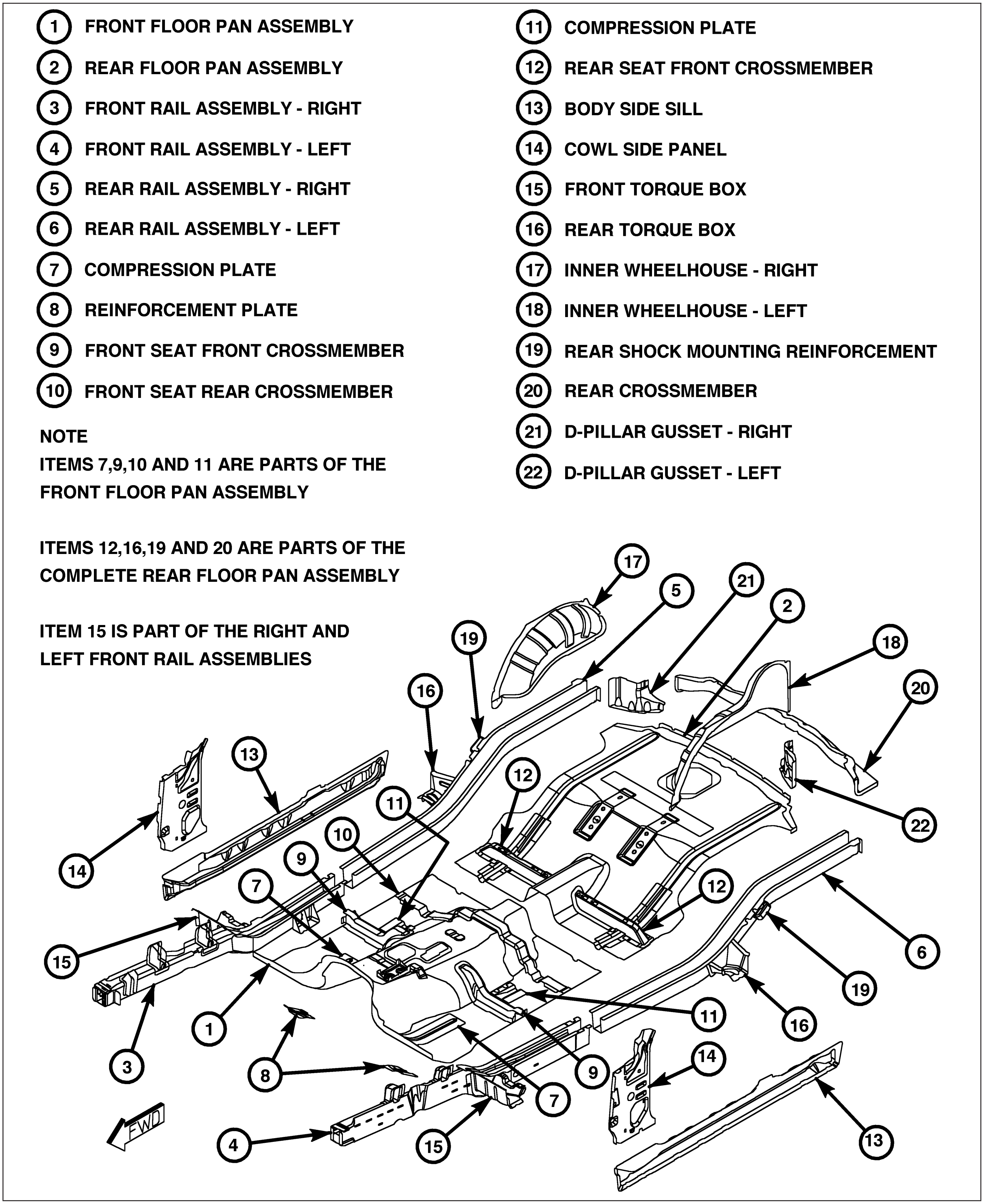



*Fig. 39 FULL FLOOR PAN ASSEMBLIES*

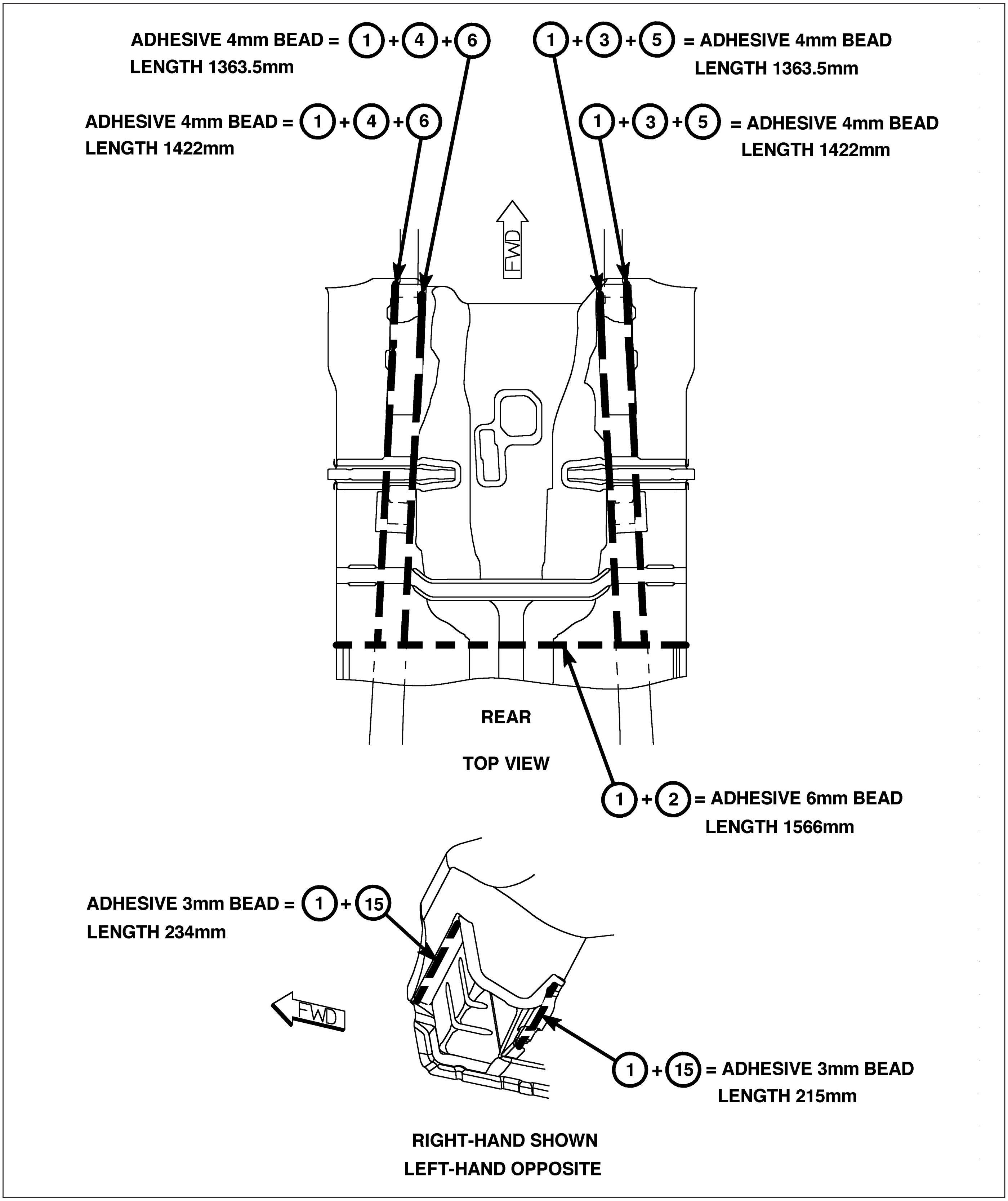



*Fig. 40 FLOOR PAN AND RAIL ASSEMBLY ADHESIVE LOCATIONS*

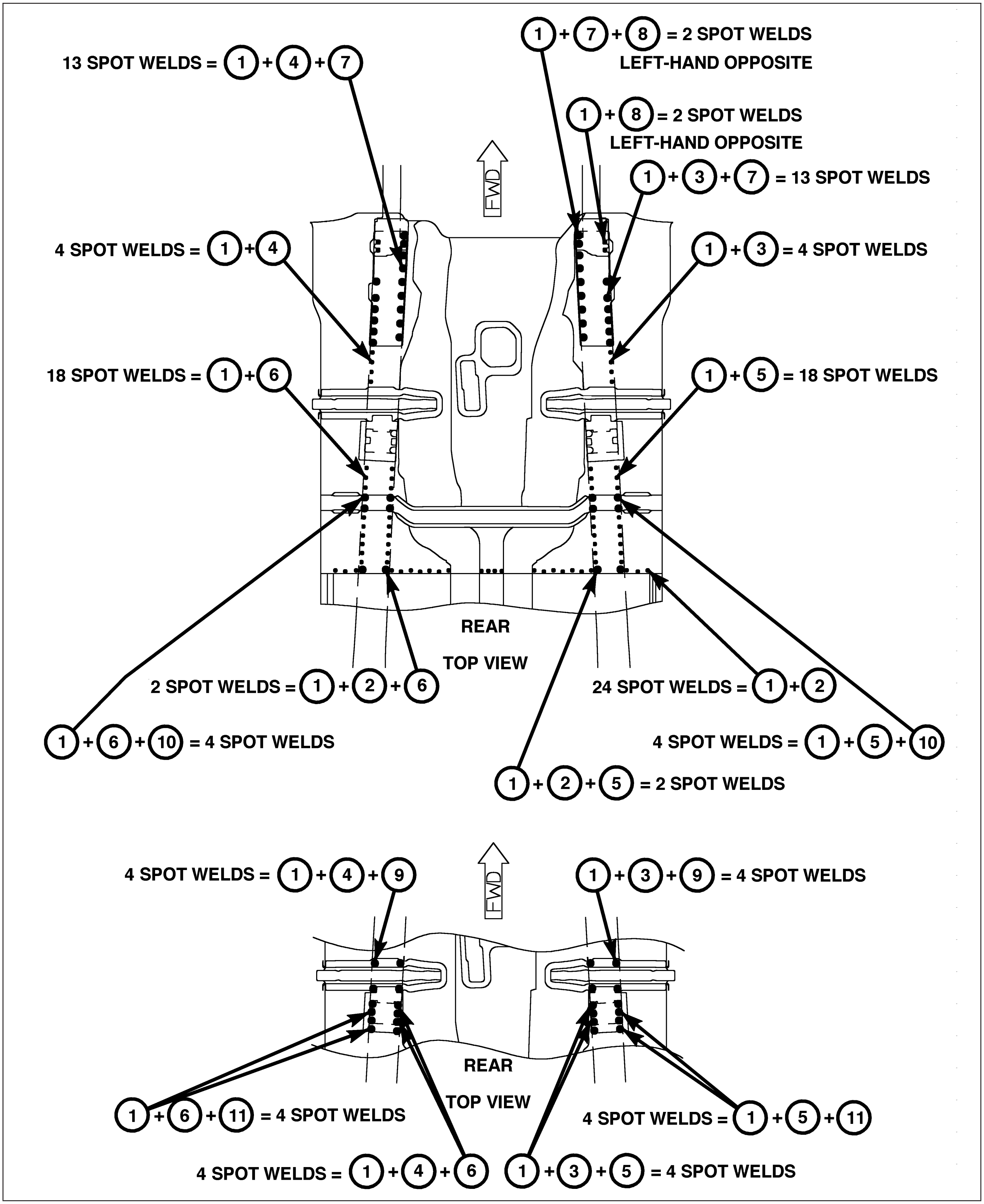



*Fig. 41 FLOOR PAN AND RAIL ASSEMBLY WELD LOCATIONS*

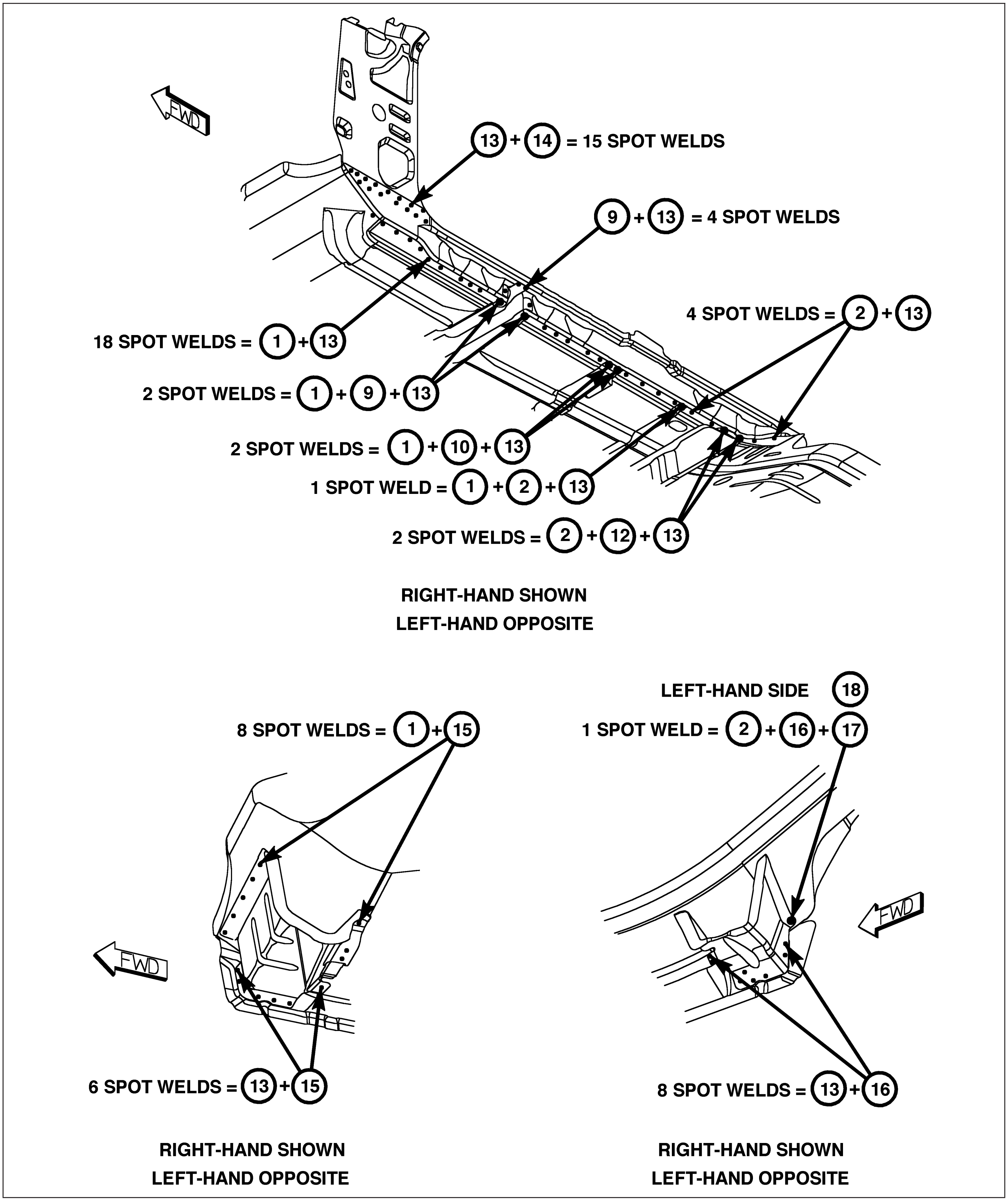



*Fig. 42 FLOOR PAN, BODY SIDE SILL, COWL SIDE PANEL AND CROSSMEMBERS*

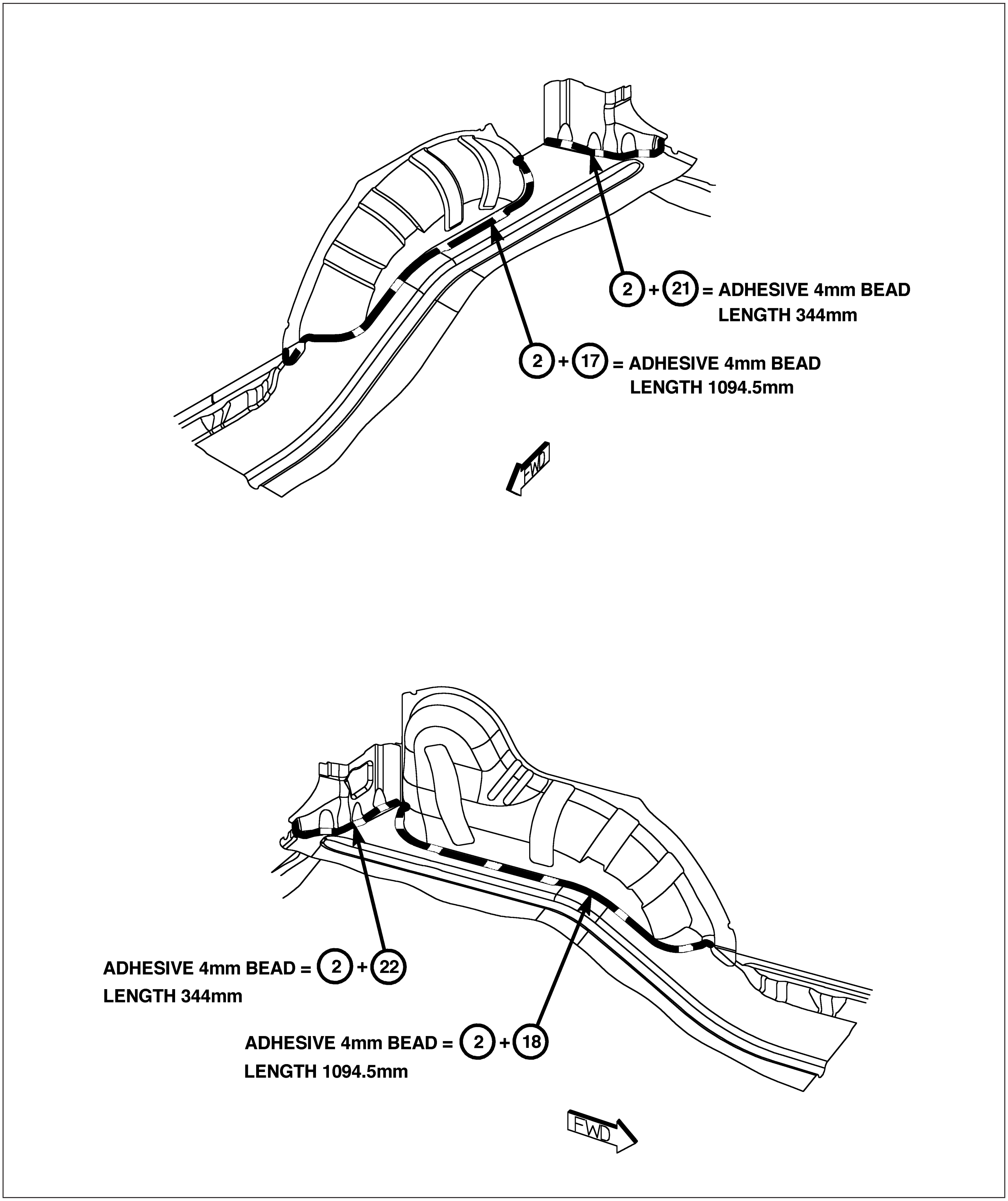



*Fig. 43 WHEELHOUSES – ADHESIVE LOCATIONS*

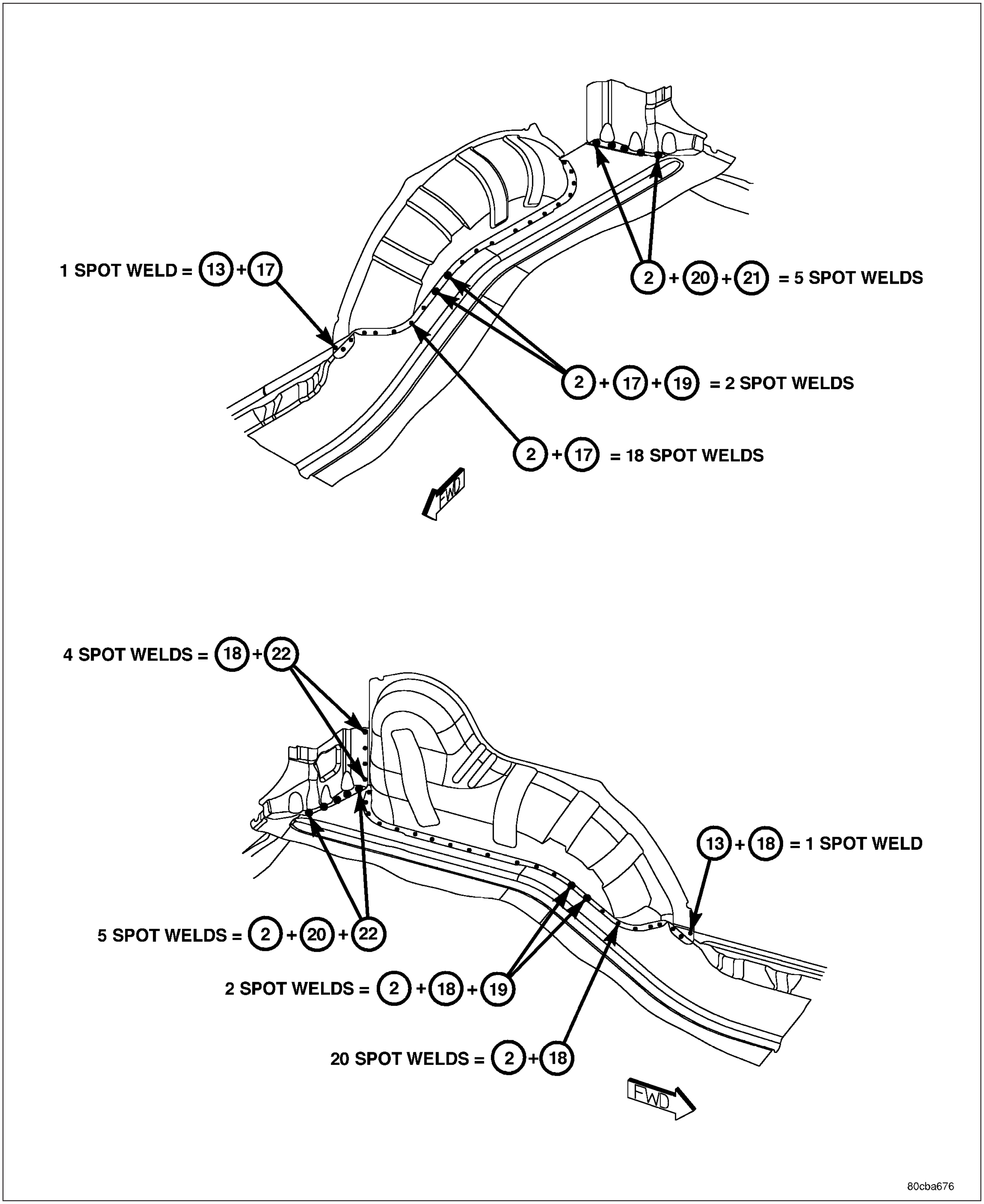



*Fig. 44 WHEELHOUSE WELD LOCATIONS*

## BODY SIDE PANELS AND SUB ASSEMBLIES

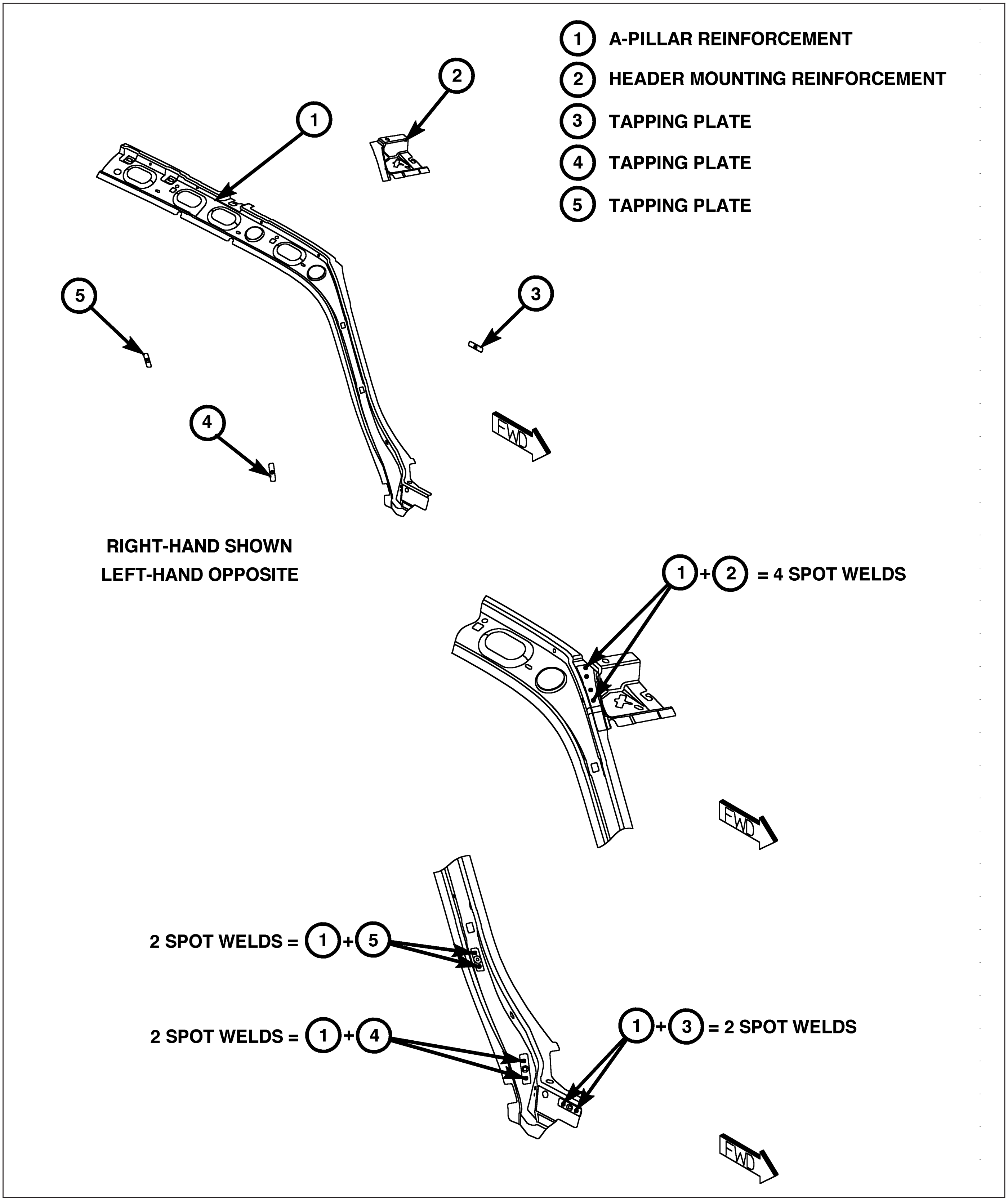



*Fig. 45 A-PILLAR AND HEADER MOUNTING REINFORCEMENTS*

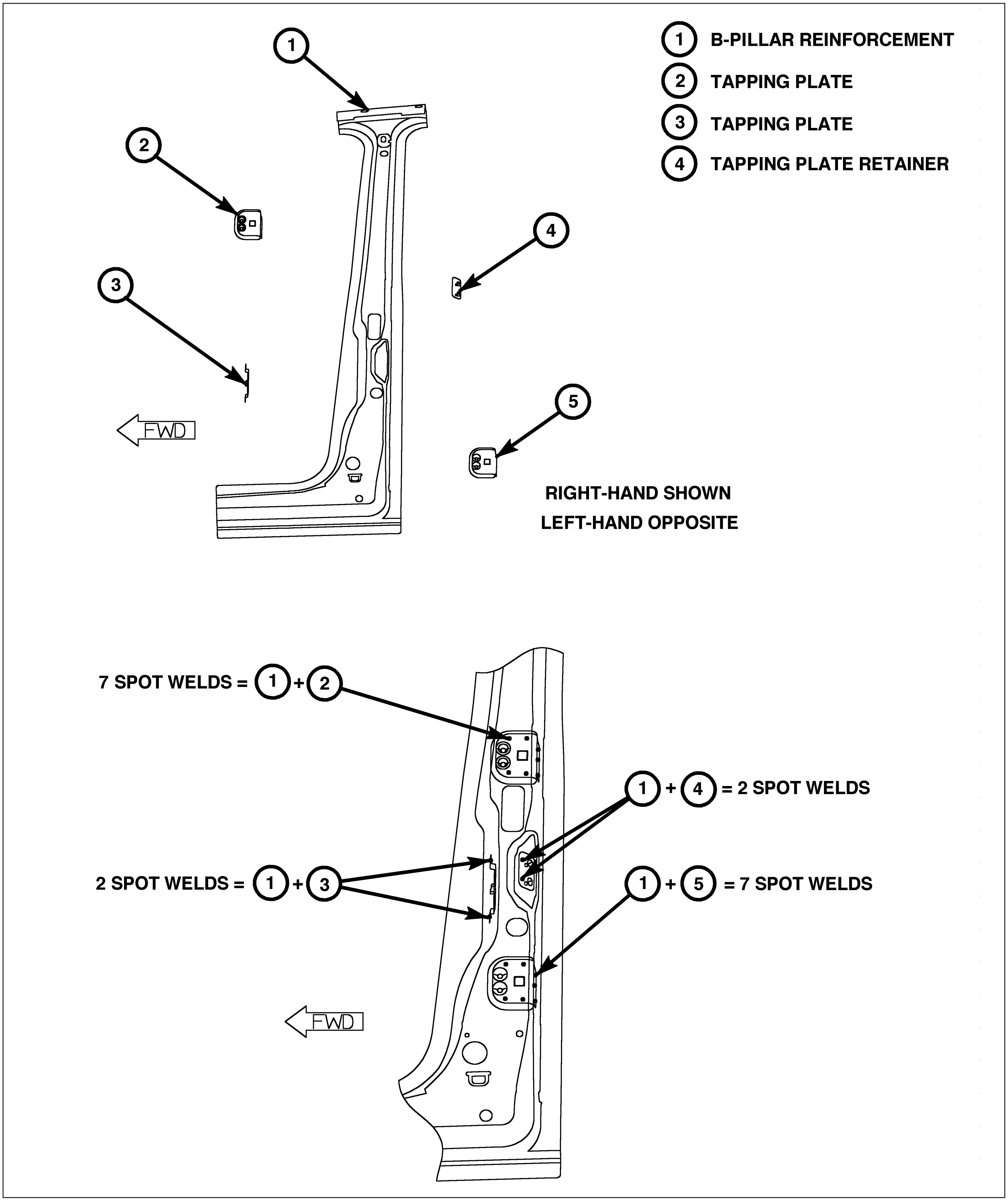



*Fig. 46 B-PILLAR REINFORCEMENTS*

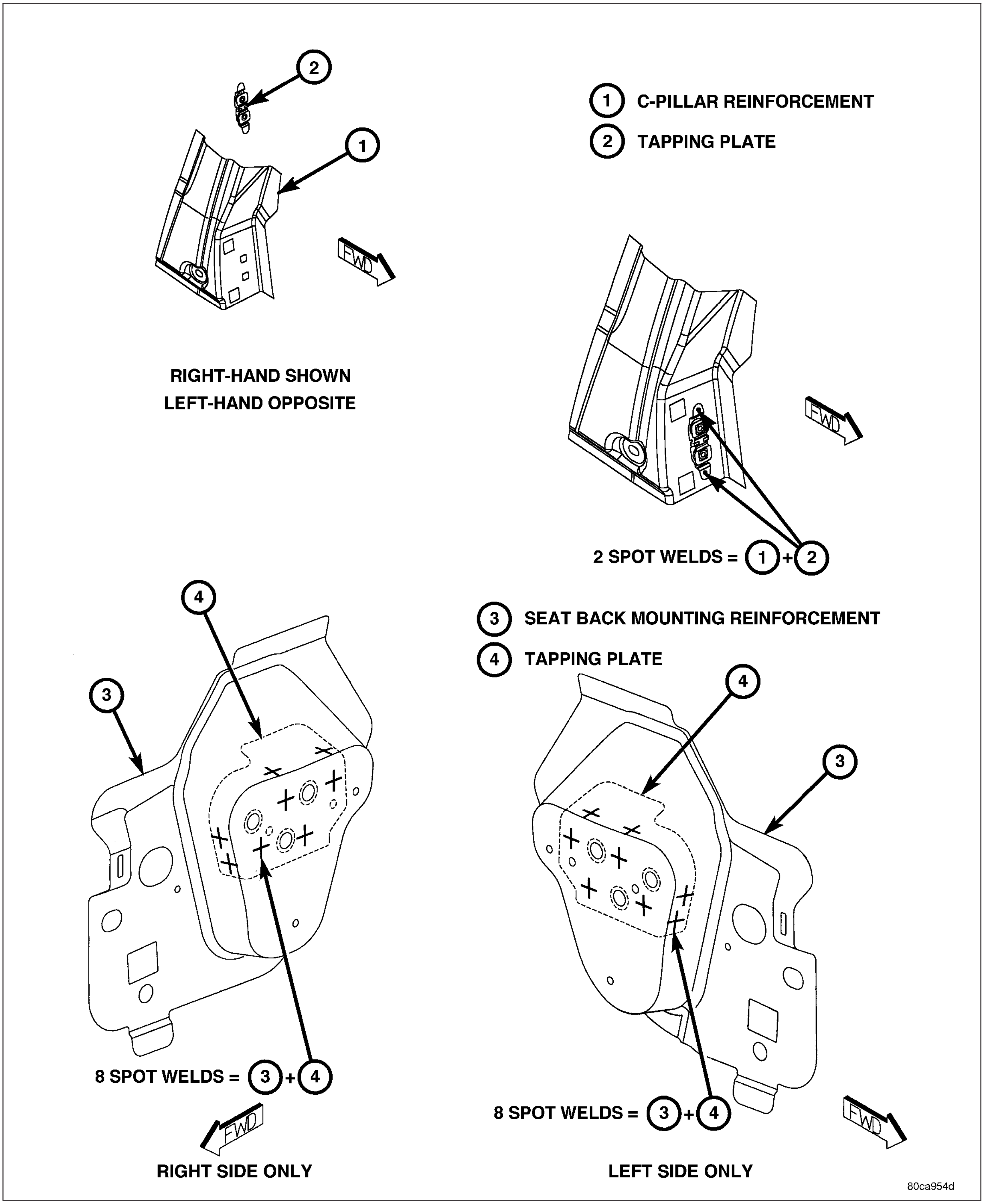



*Fig. 47 C-PILLAR AND SEAT BACK MOUNTING REINFORCEMENTS*

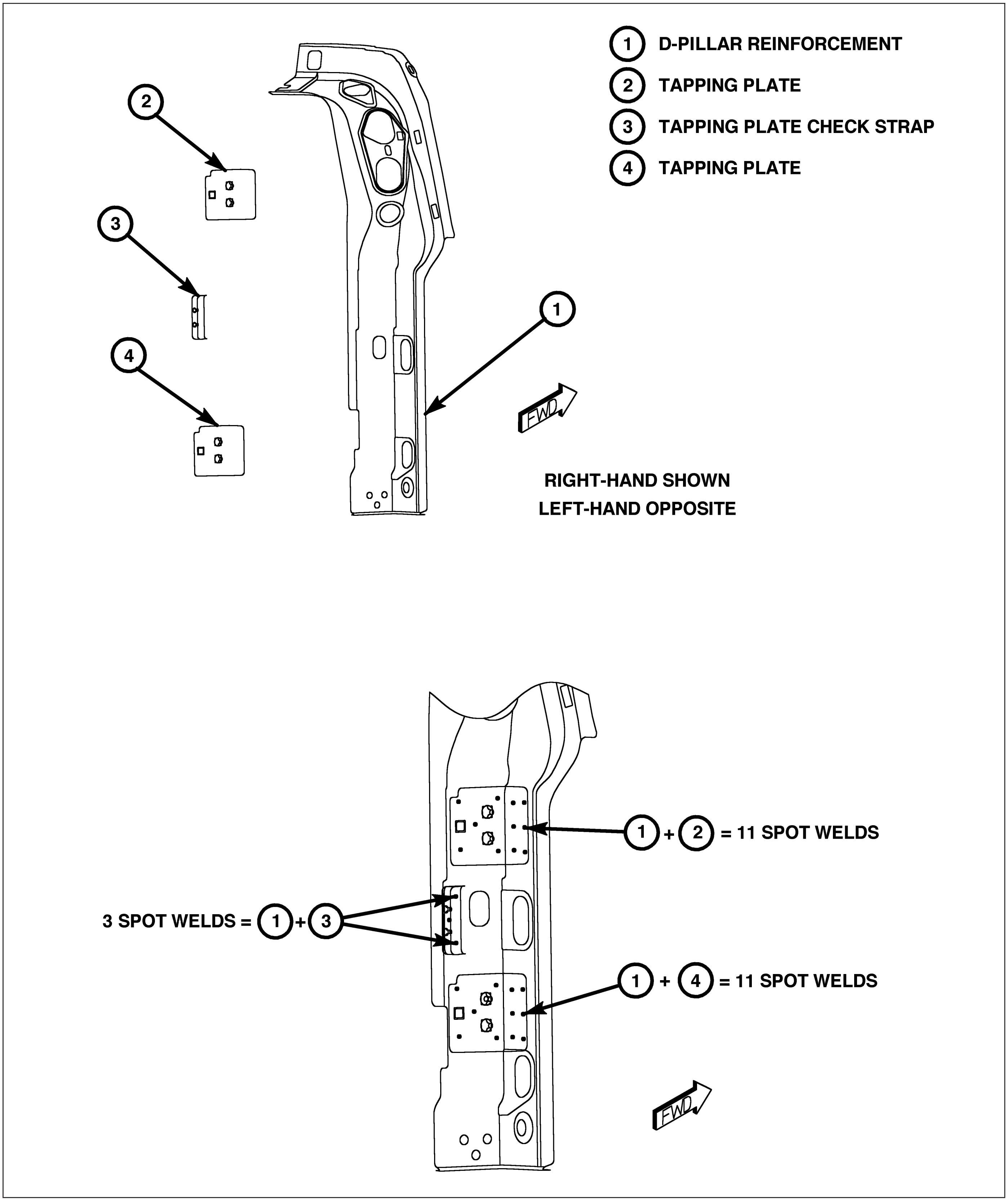



*Fig. 48 D-PILLAR REINFORCEMENTS*

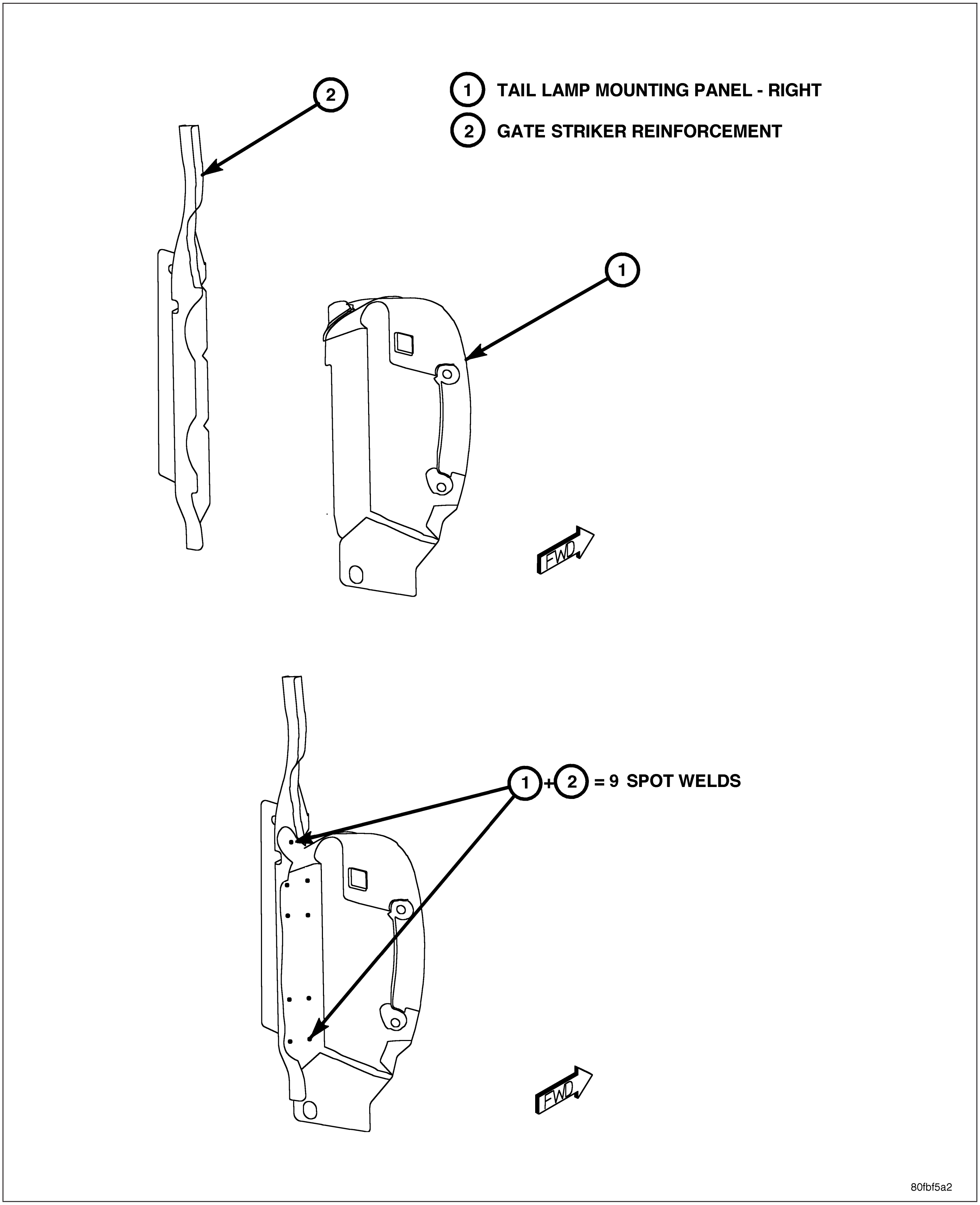



*Fig. 49 TAIL LAMP MOUNTING PANEL*

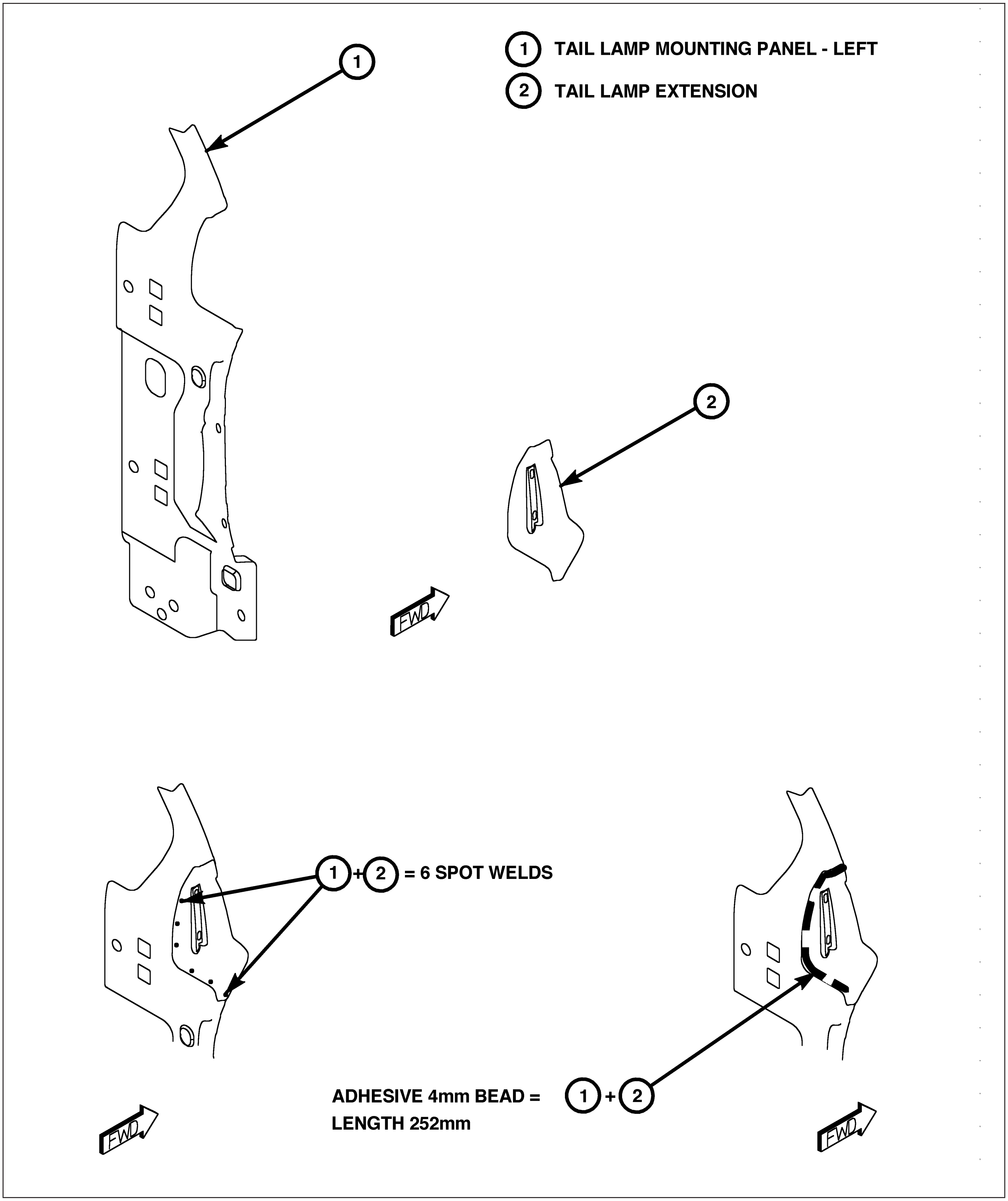



*Fig. 50 TAIL LAMP MOUNTING PANEL*

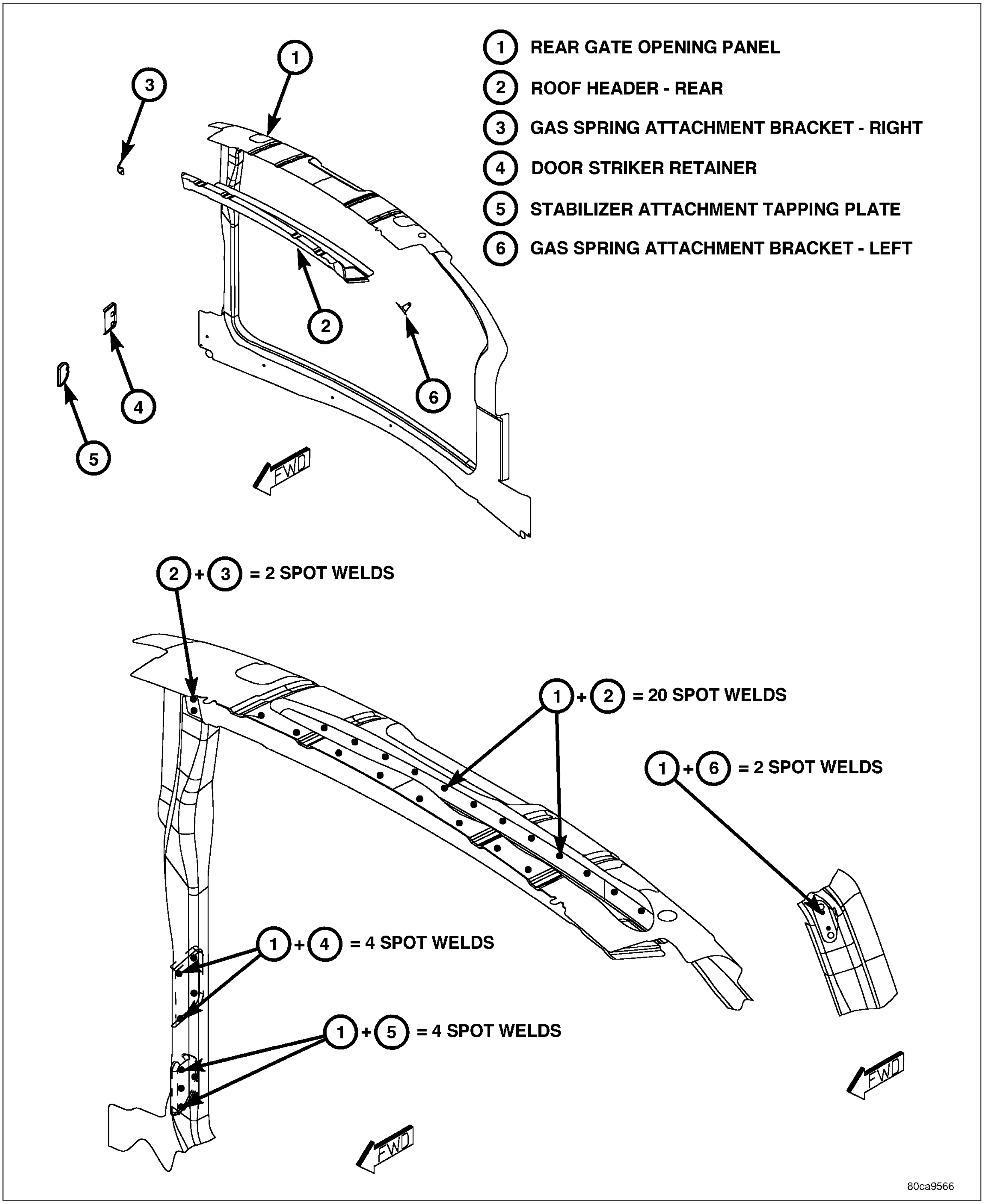
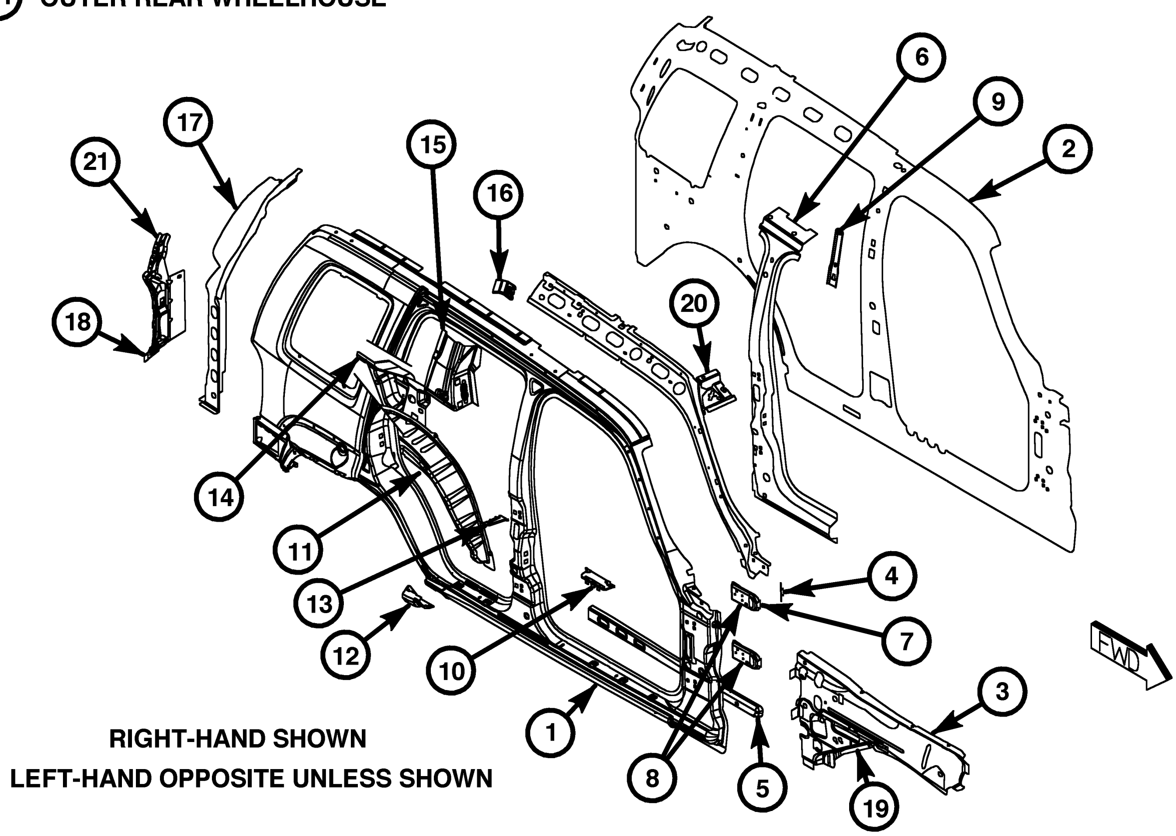



*Fig. 51 SWING GATE OPENING PANEL AND ROOF HEADER*

## BODY SIDE PANELS

1. BODY SIDE OUTER PANEL
2. BODY SIDE INNER PANEL
3. INNER FENDER REINFORCEMENT ASSEMBLY
4. A-PILLAR REINFORCEMENT
5. BODY SIDE INNER LOWER REINFORCEMENT
6. B-PILLAR REINFORCEMENT
7. CHECK STRAP ATTACHMENT TAPING PLATE
8. DOOR HINGE TAPPING PLATE
9. B-PILLAR LOWER BAFFLE
10. SHOULDER BELT REINFORCEMENT
11. OUTER REAR WHEELHOUSE
12. SILL MOLDING ATTACH BRACKET
13. C-PILLAR LOWER BAFFLE
14. SEAT BACK ATTACH REINFORCEMENT
15. C-PILLAR REINFORCEMENT
16. SEAT-SHOULDER BELT REINFORCEMENT
17. D-PILLAR REINFORCEMENT
18. TAIL LAMP PANEL ASSEMBLY
19. INNER FENDER REINFORCEMENT
20. HEADER MOUNTING REINFORCEMENT
21. GATE STRIKER REINFORCEMENT




NOTE
ITEM 19 IS PART OF THE INNER FENDER REINFORCEMENT ASSEMBLY
ITEM 20 IS PART OF THE A-PILLAR REINFORCEMENT ASSEMBLY
ITEM 21 IS PART OF THE TAIL LAMP MOUNTING PANEL ASSEMBLY

*Fig. 52 BODY SIDE PANEL ASSEMBLY*

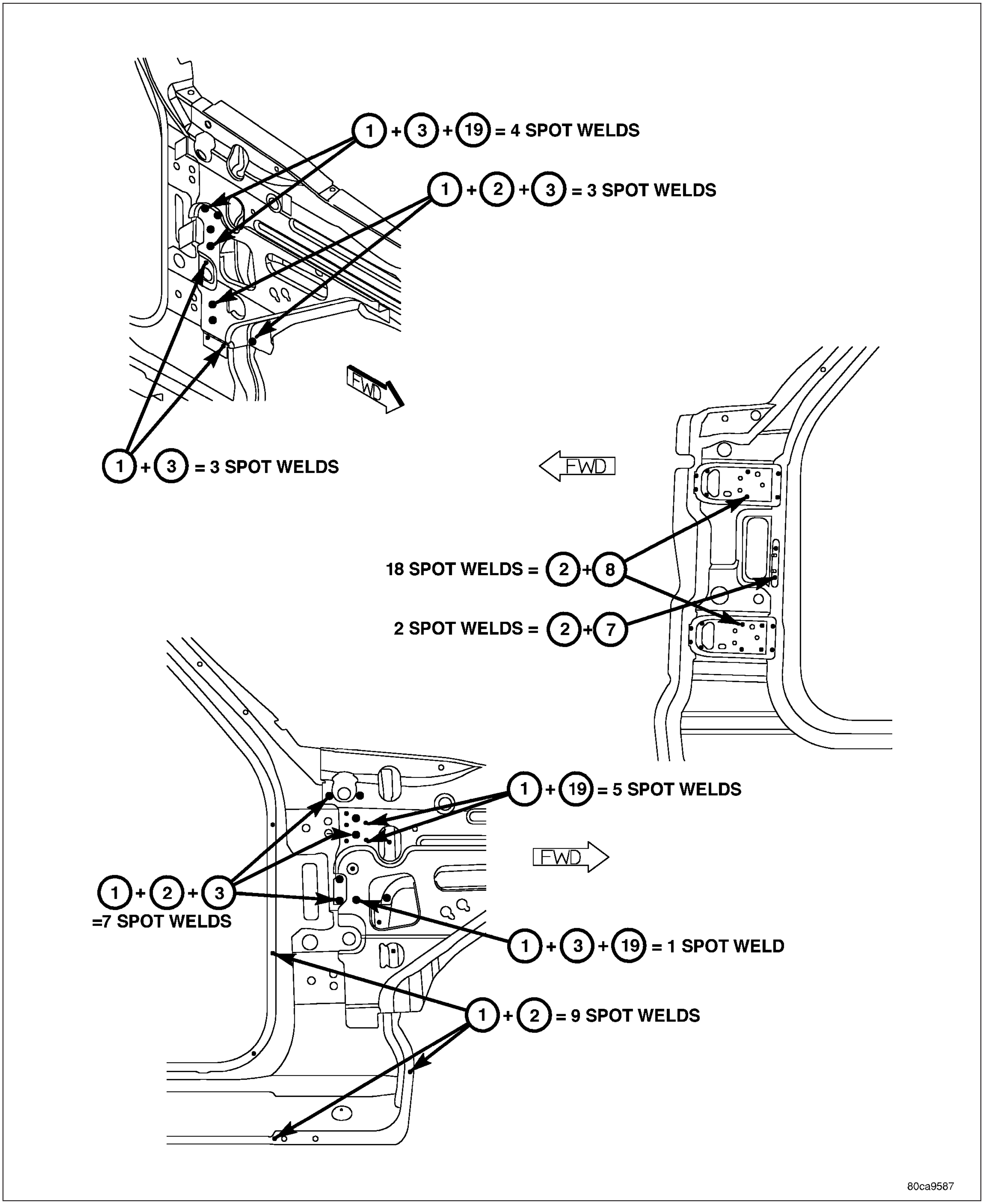



*Fig. 53 BODY SIDE OUTER, INNER FENDER REINFORCEMENT AND FENDER ASSEMBLY*

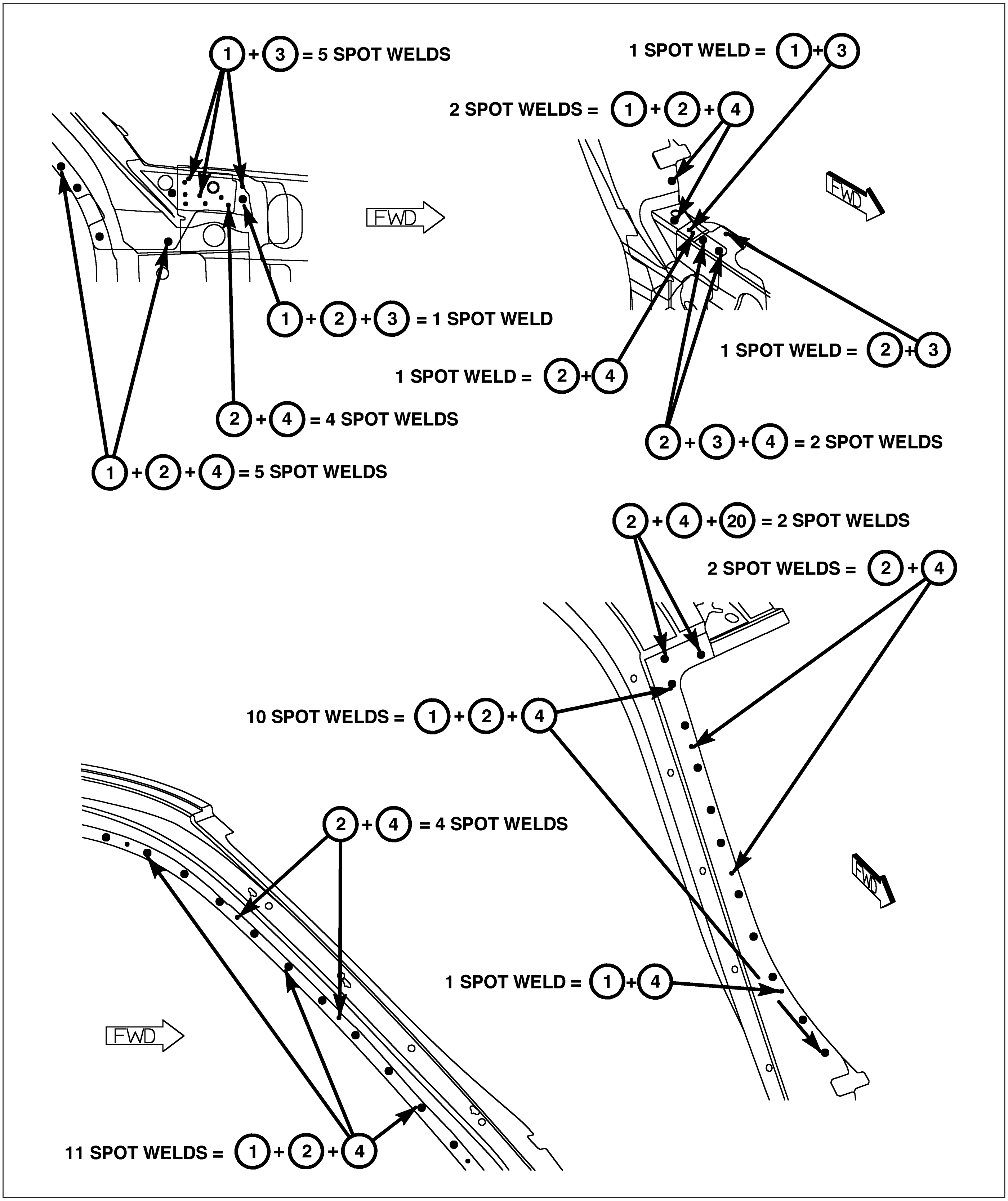



*Fig. 54 A-PILLAR; FENDER REINFORCEMENT*

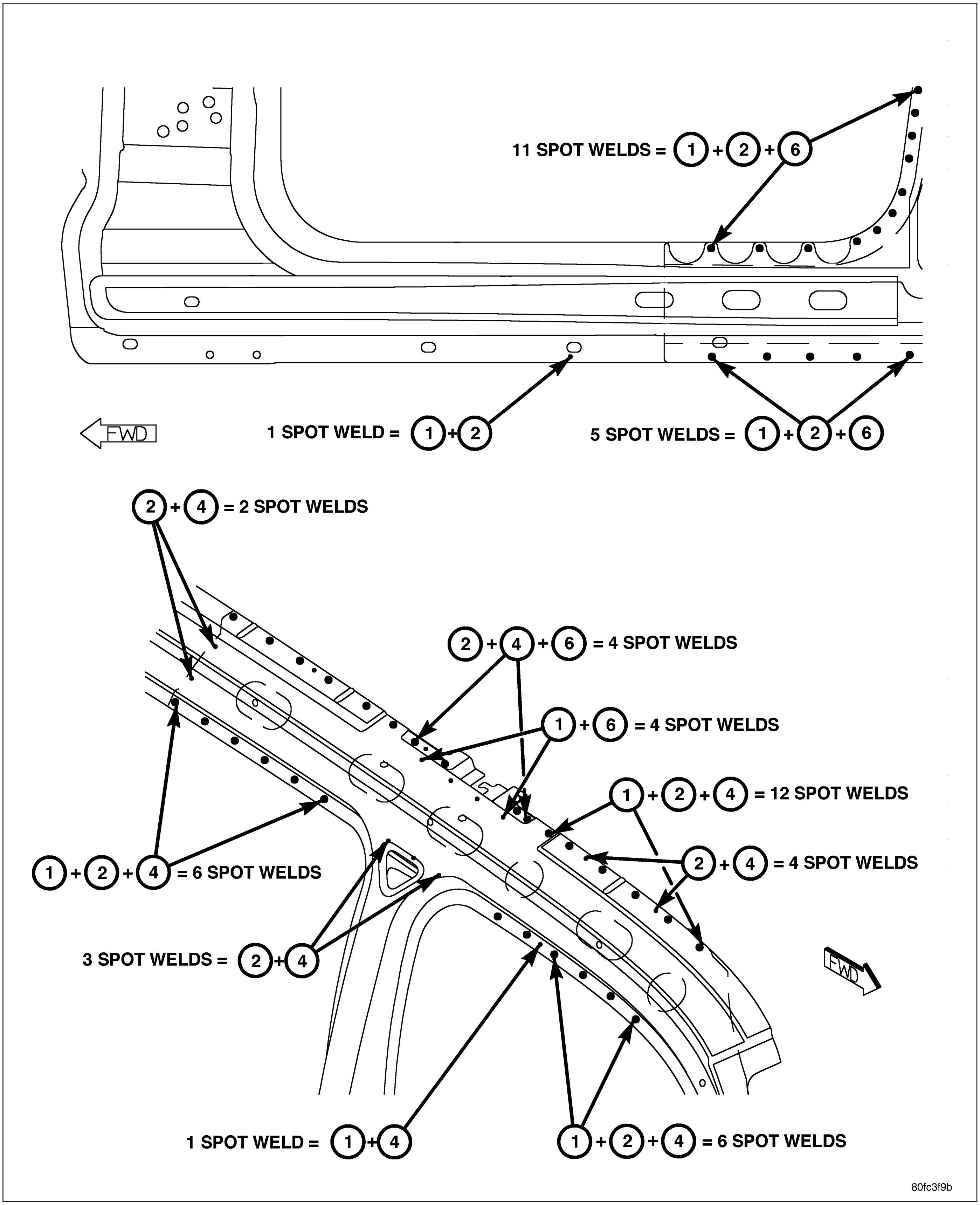



*Fig. 55 LOWER INNER BODY SIDE PANELS AND UPPER A-PILLARS*

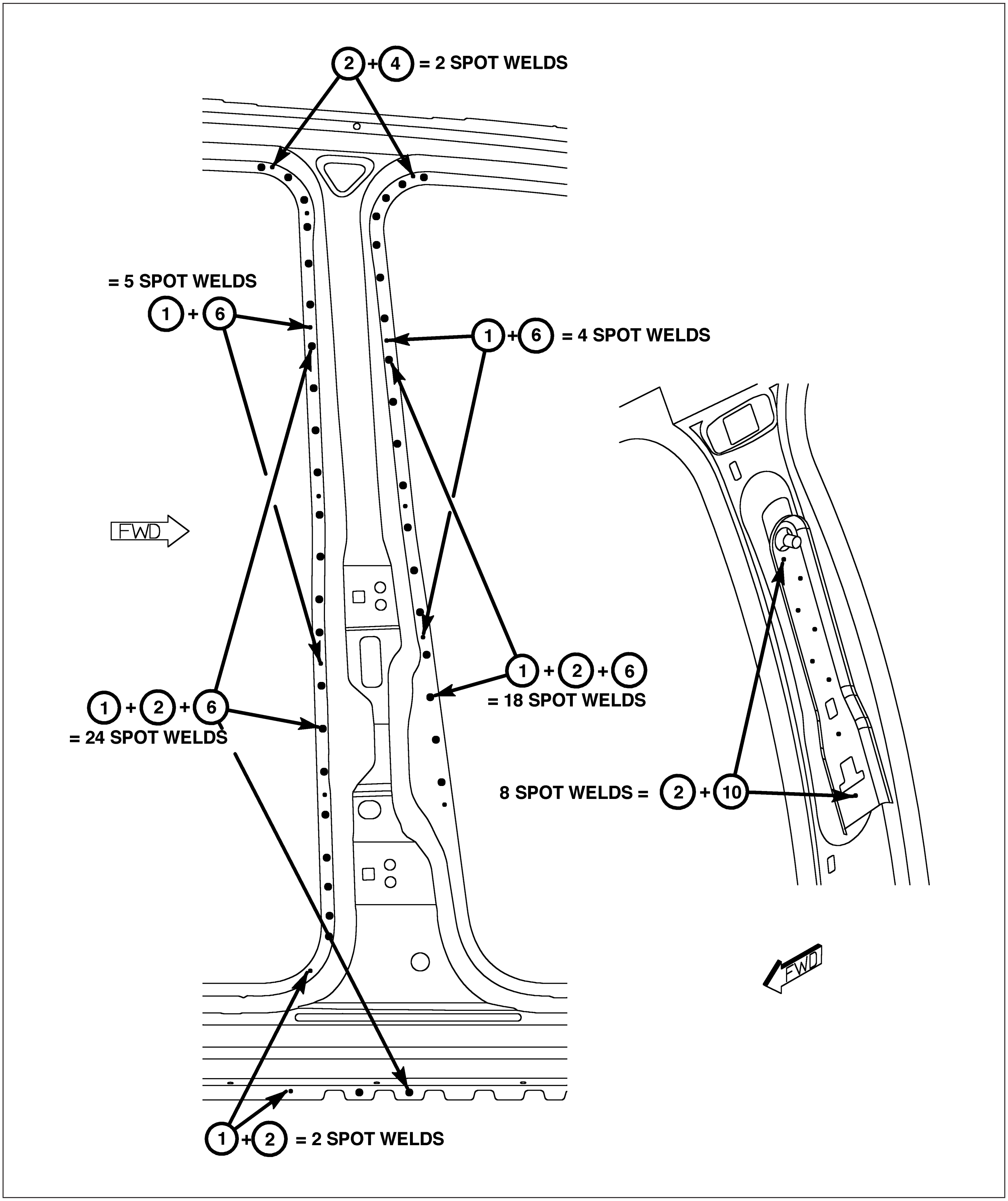



*Fig. 56 BODY SIDE PANEL ASSEMBLIES AND B-PILLAR*

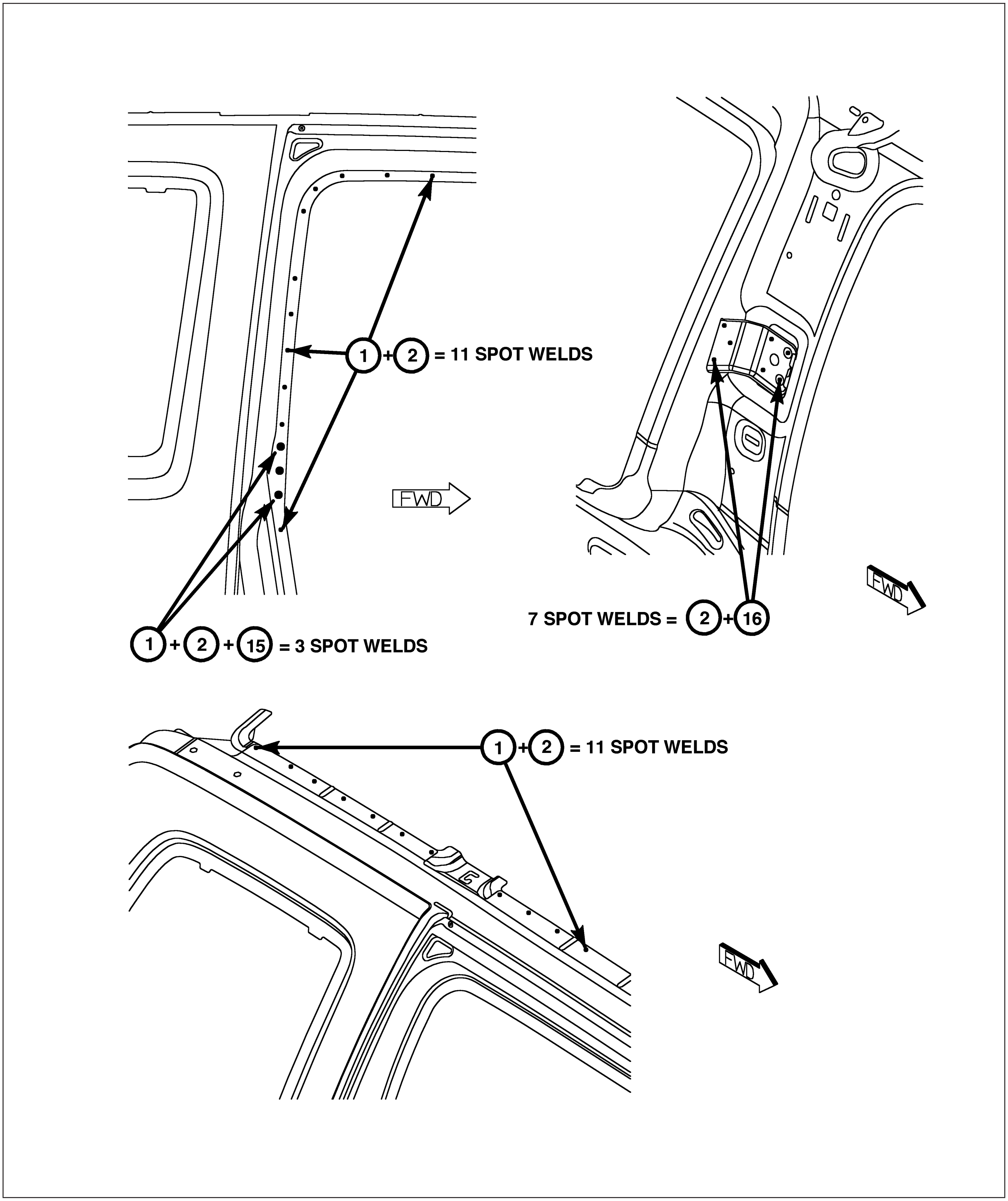



*Fig. 57 BODY SIDE PANEL ASSEMBLIES AND C-PILLAR REINFORCEMENT*

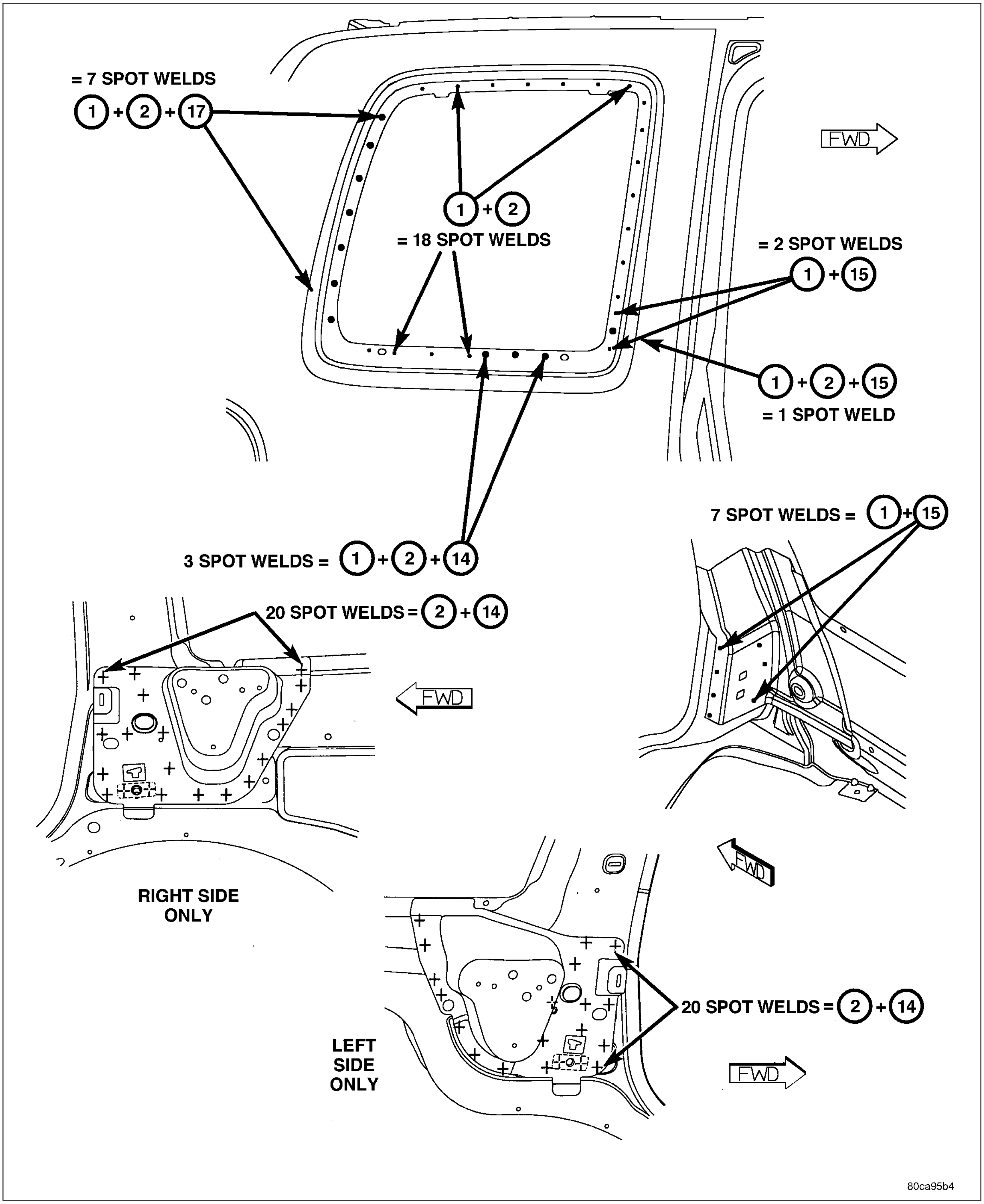



*Fig. 58 QUARTER WINDOW OPENING; SEAT BACK ATTACH REINFORCEMENT; C-PILLAR REINFORCEMENT*

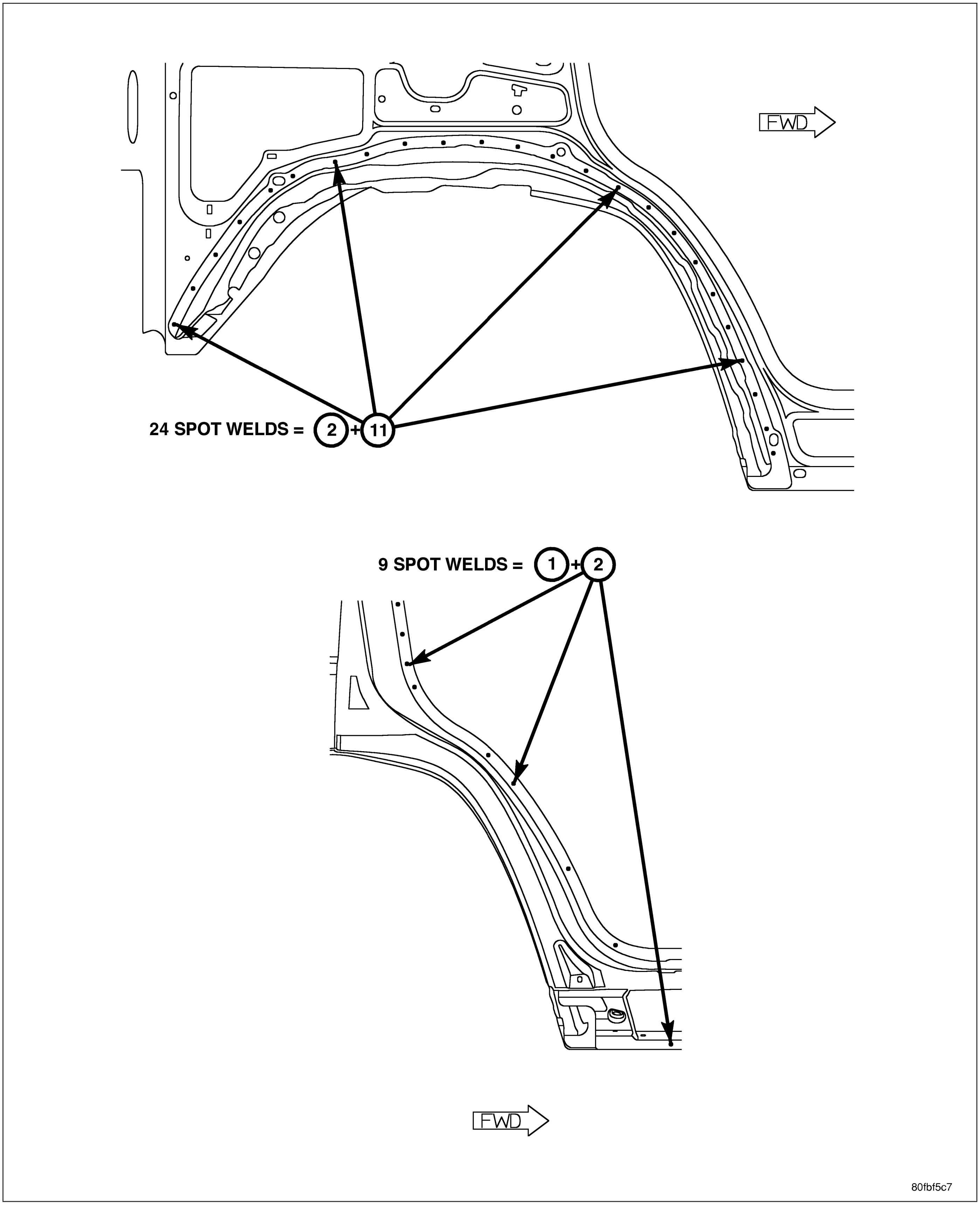



*Fig. 59 BODY SIDE PANEL ASSEMBLIES AND OUTER REAR WHEELHOUSES*

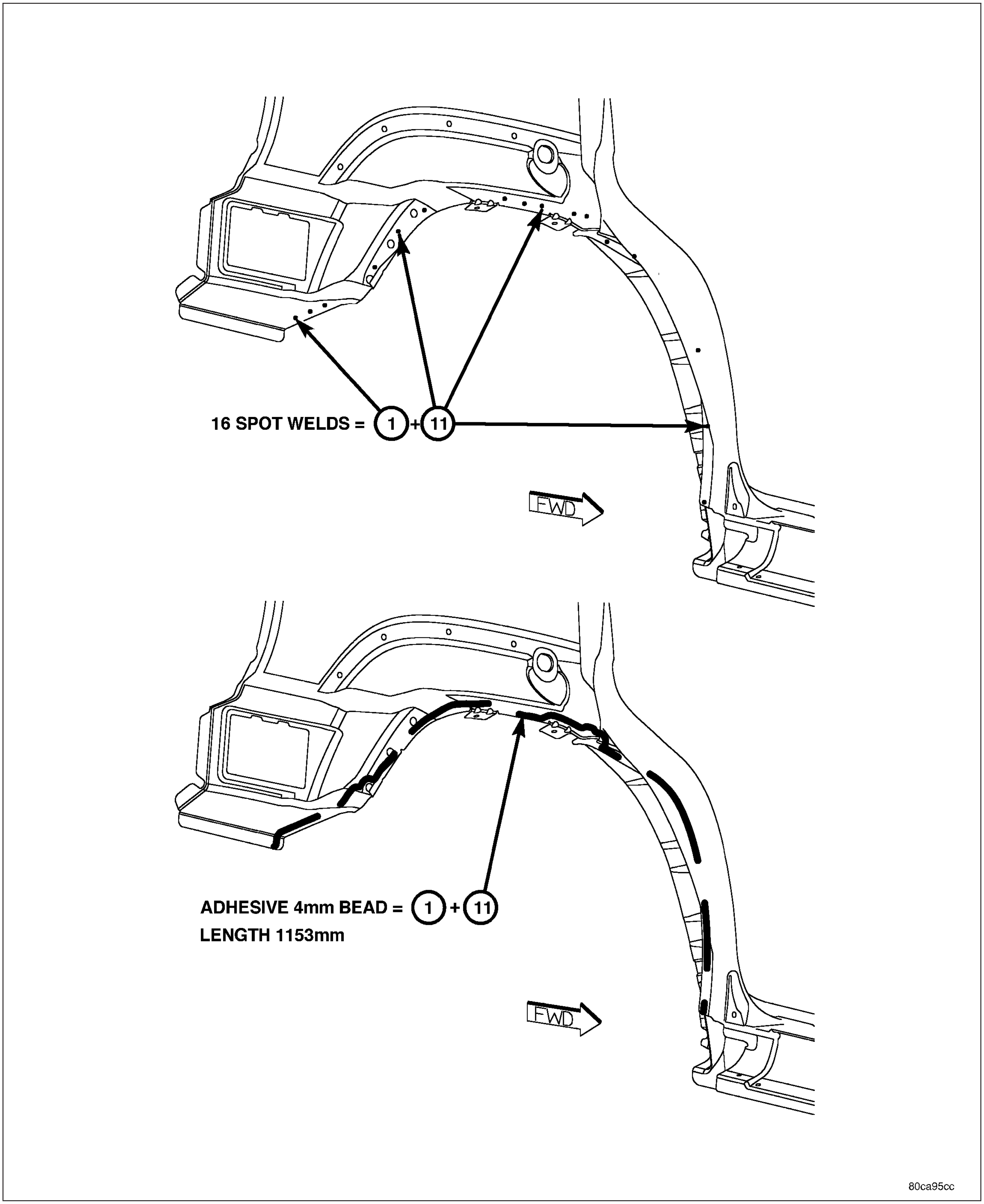



*Fig. 60 OUTER REAR WHEELHOUSE WELDS AND ADHESIVE LOCATIONS*

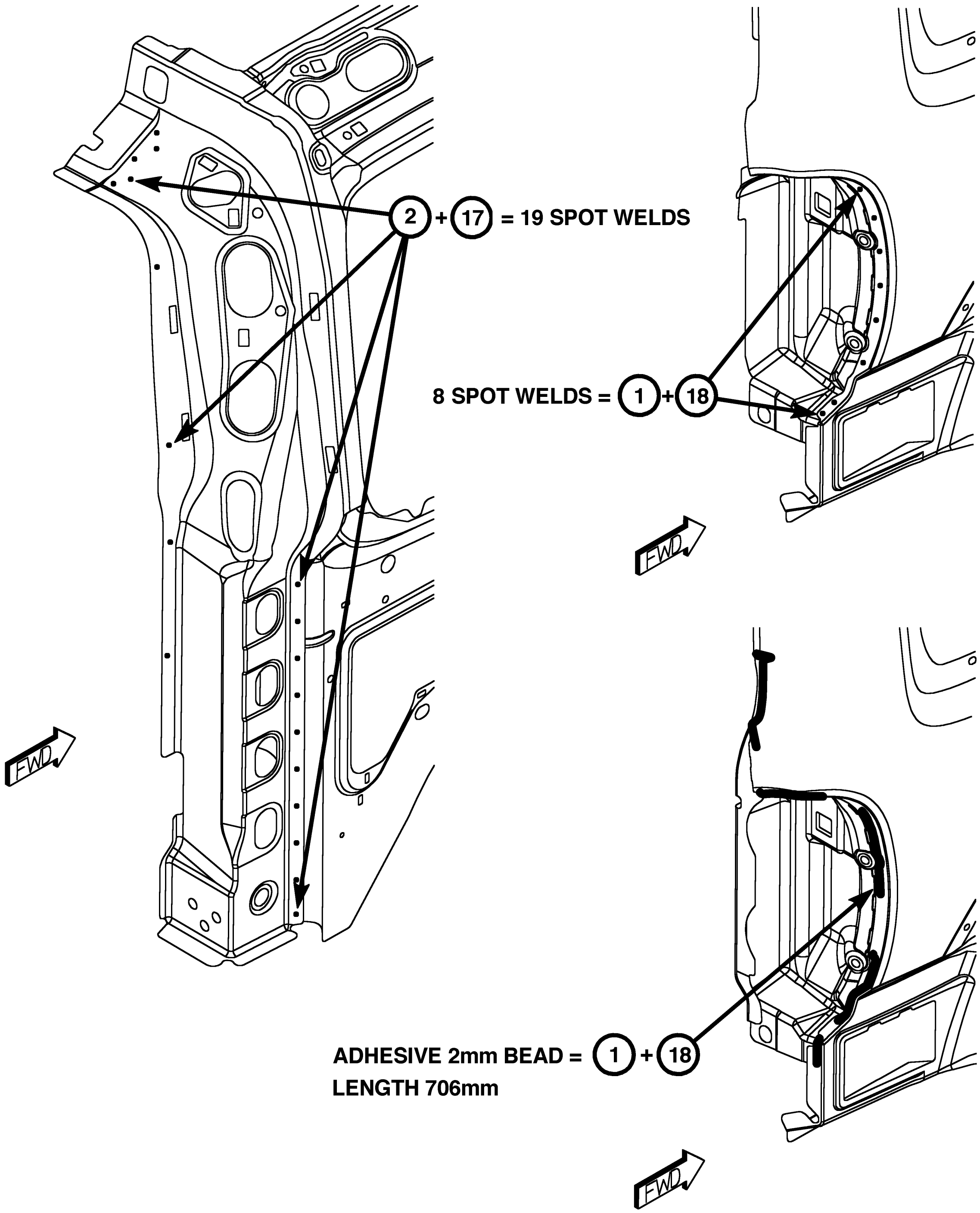



*Fig. 61 D-PILLAR AND TAIL LAMP ASSEMBLY WELD AND ADHESIVE LOCATIONS*

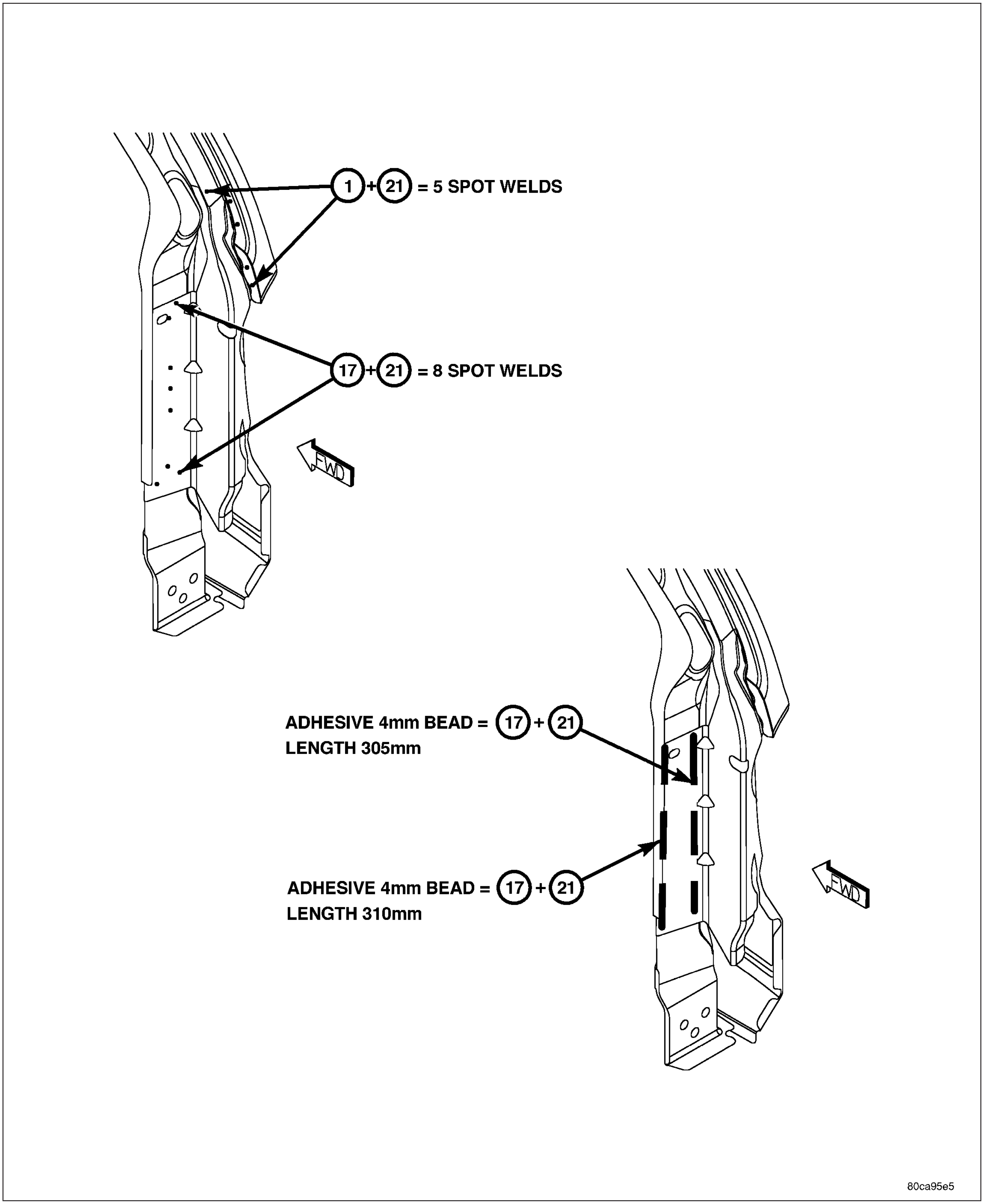



*Fig. 62 SWING GATE STRIKER REINFORCEMENT WELDS AND ADHESIVE LOCATIONS*

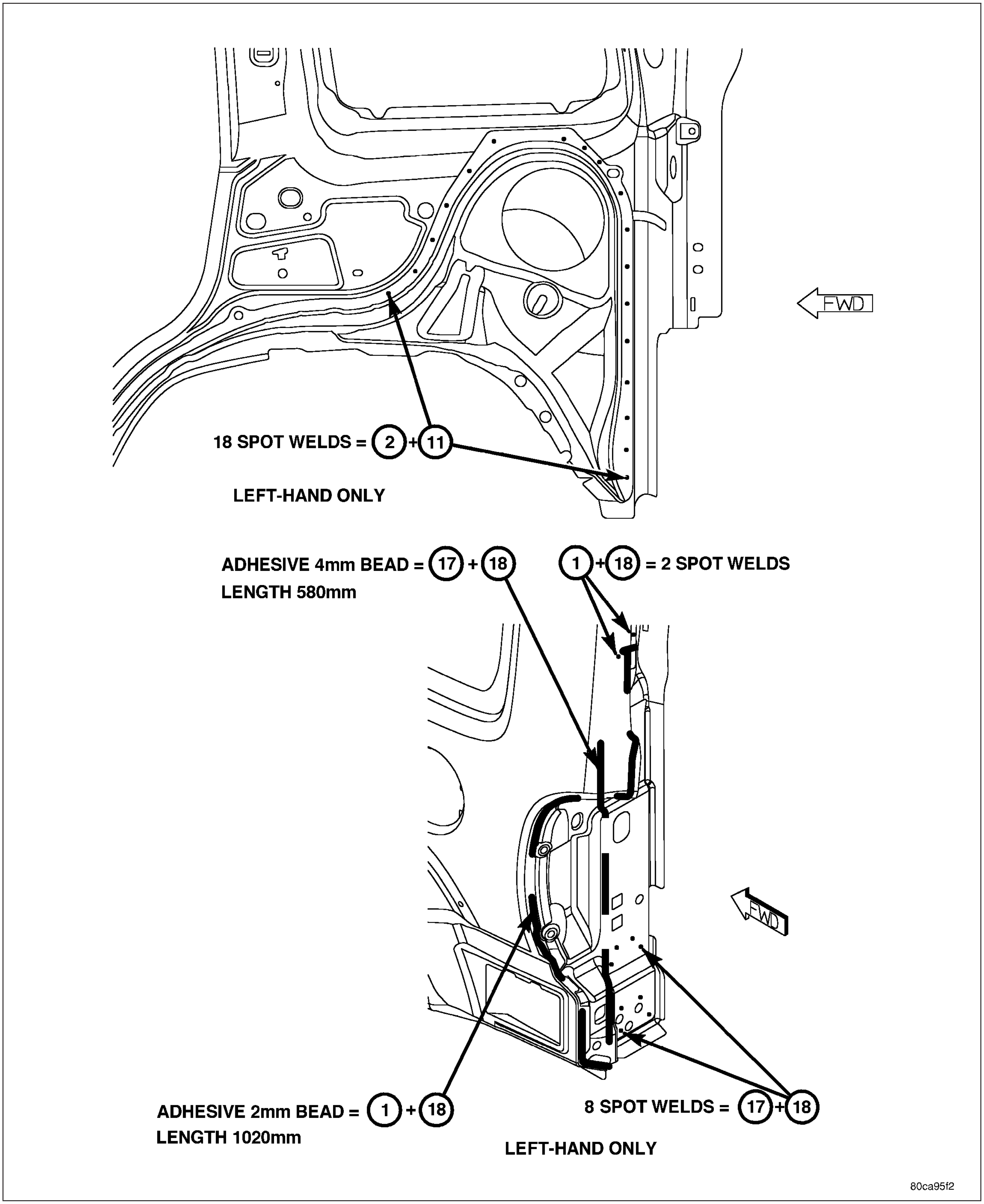



*Fig. 63 REAR WHEELHOUSE WELDS AND TAIL LAMP ADHESIVE LOCATIONS*

## FENDER ASSEMBLIES

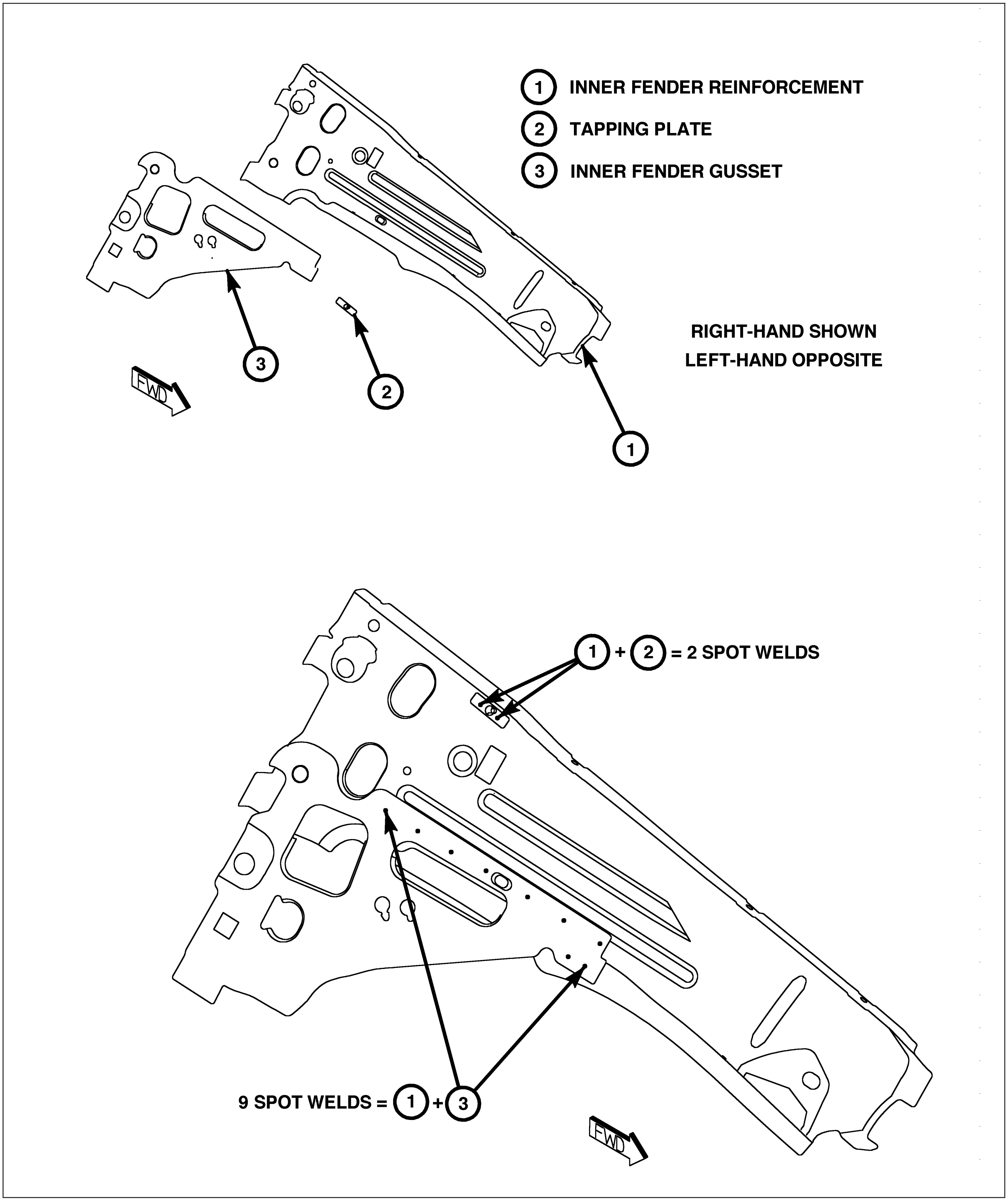



*Fig. 64 INNER FENDER REINFORCEMENT AND GUSSETS*

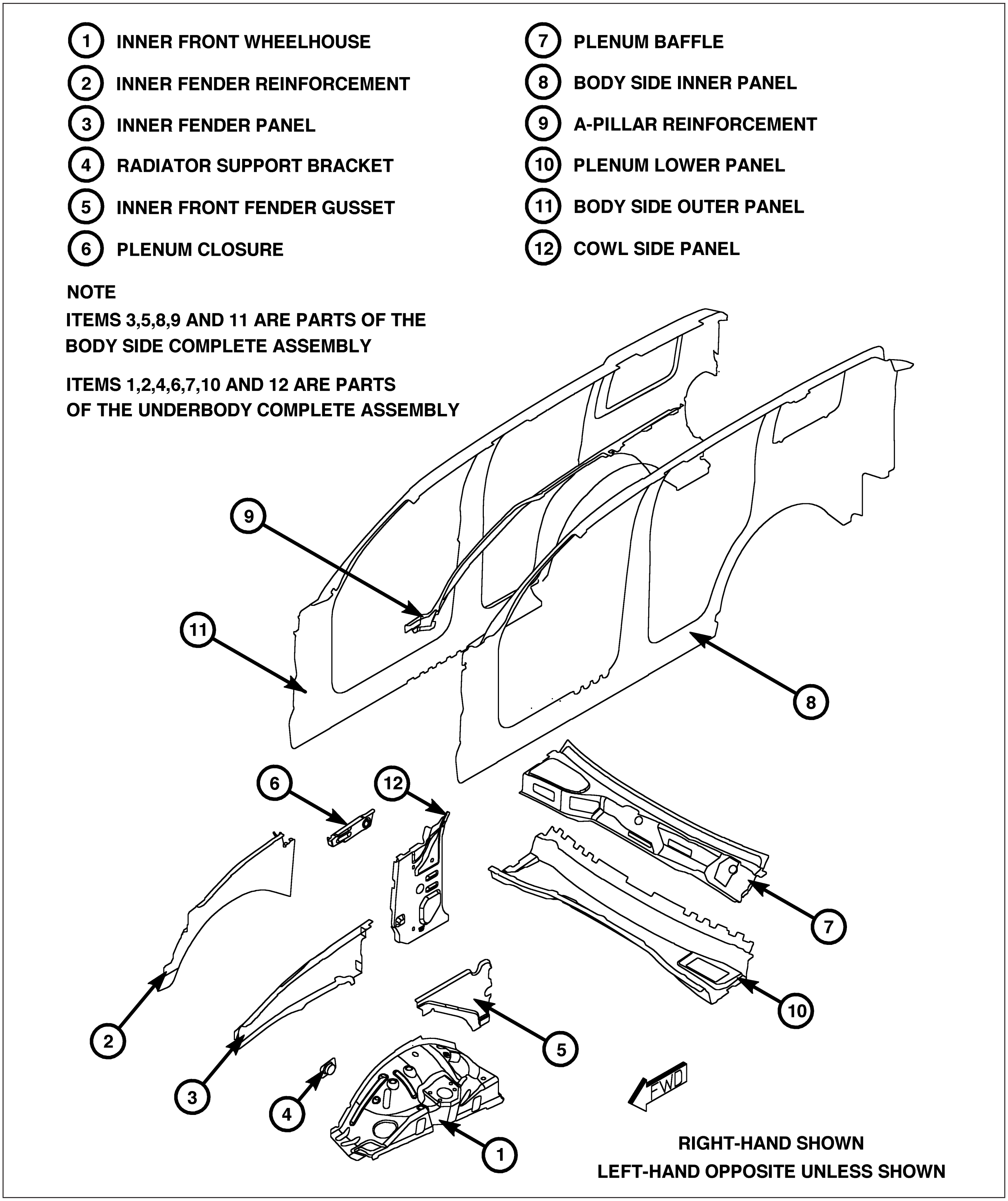



*Fig. 65 INNER FENDER REINFORCEMENT, GUSSETS, PLENUM AND WHEELHOUSES*

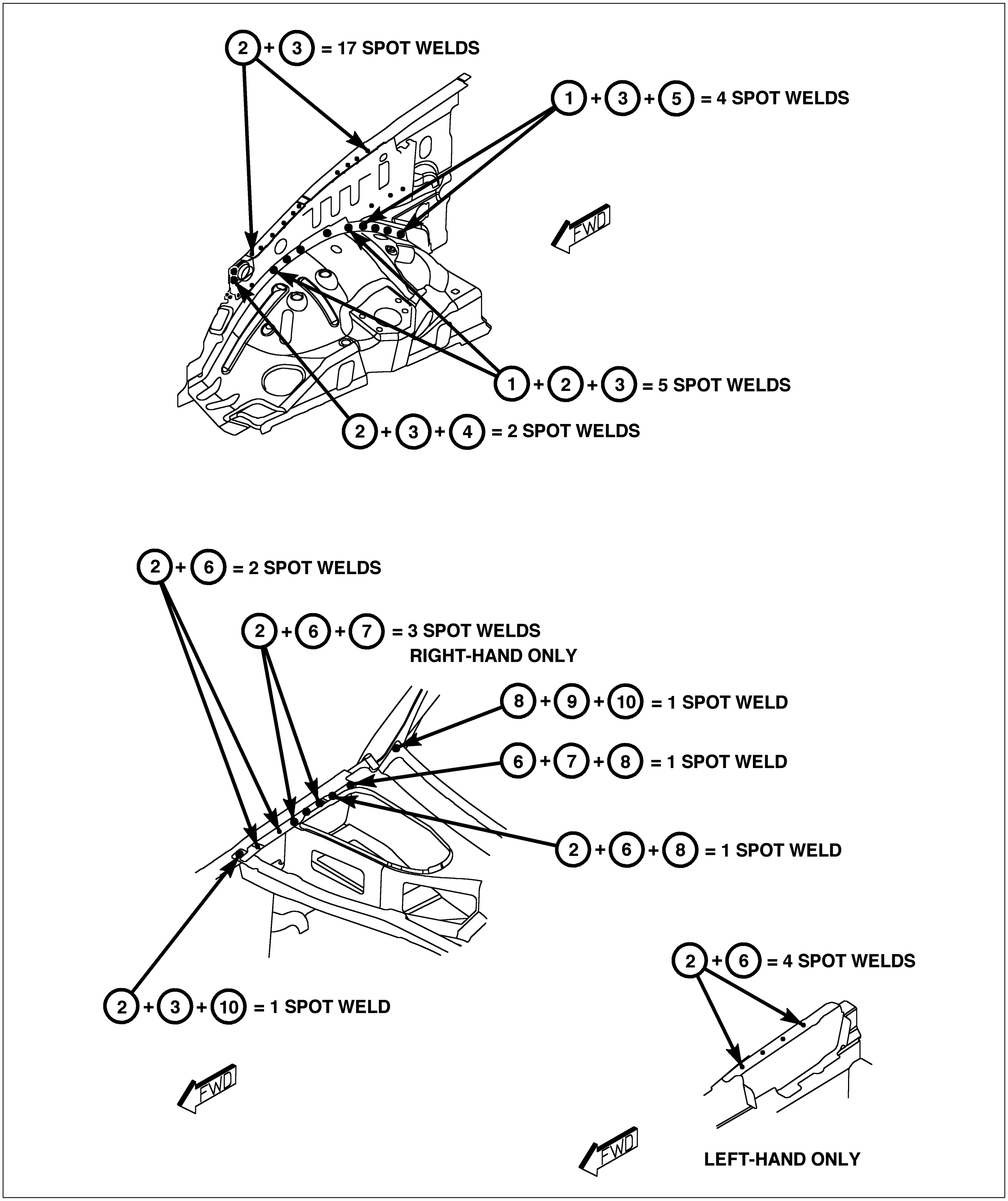



*Fig. 66 INNER FENDER REINFORCEMENT AND WHEELHOUSES*

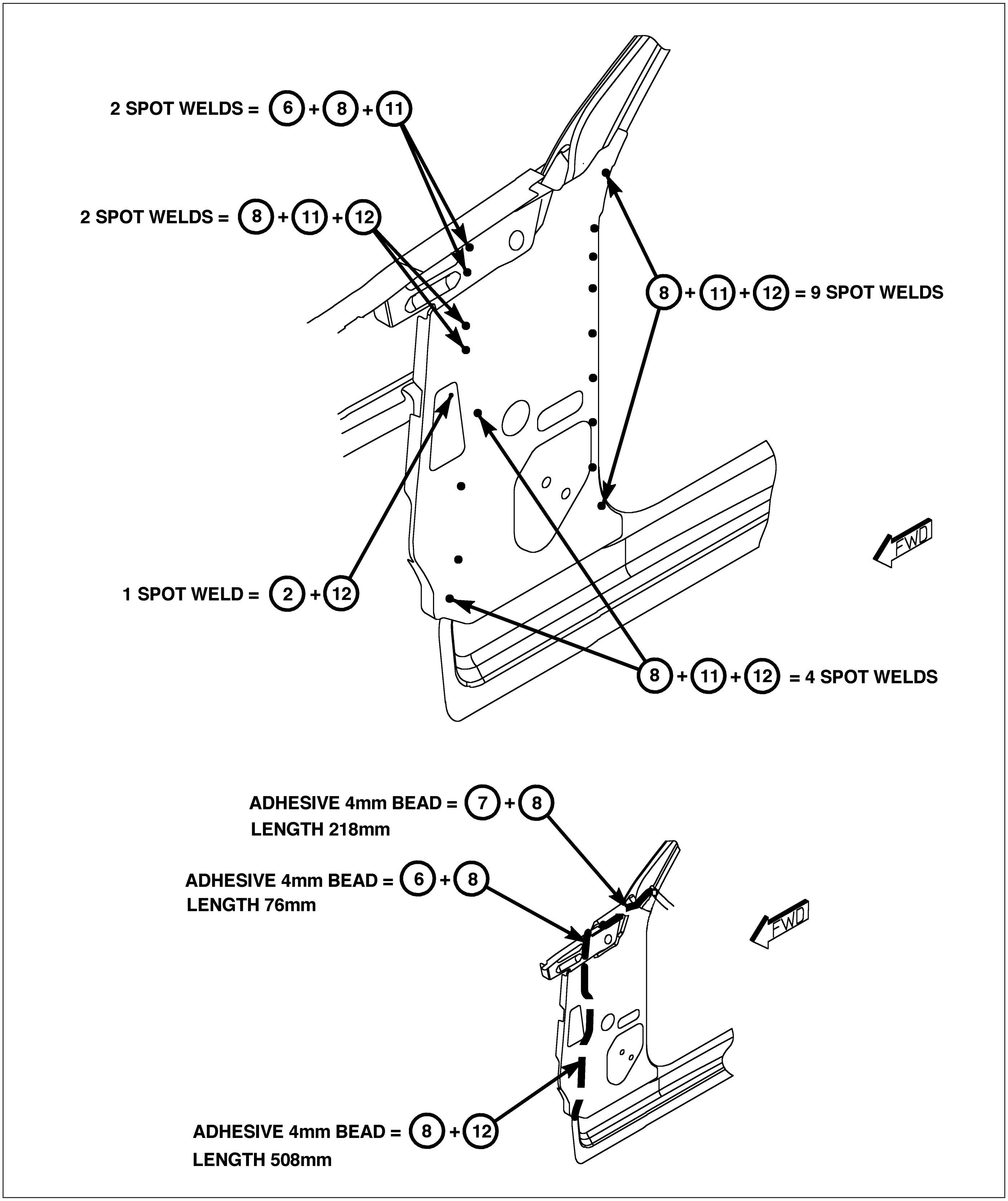



*Fig. 67 PLENUM ASSEMBLY AND INNER SIDE PANELS*

## ROOF PANEL ASSEMBLIES

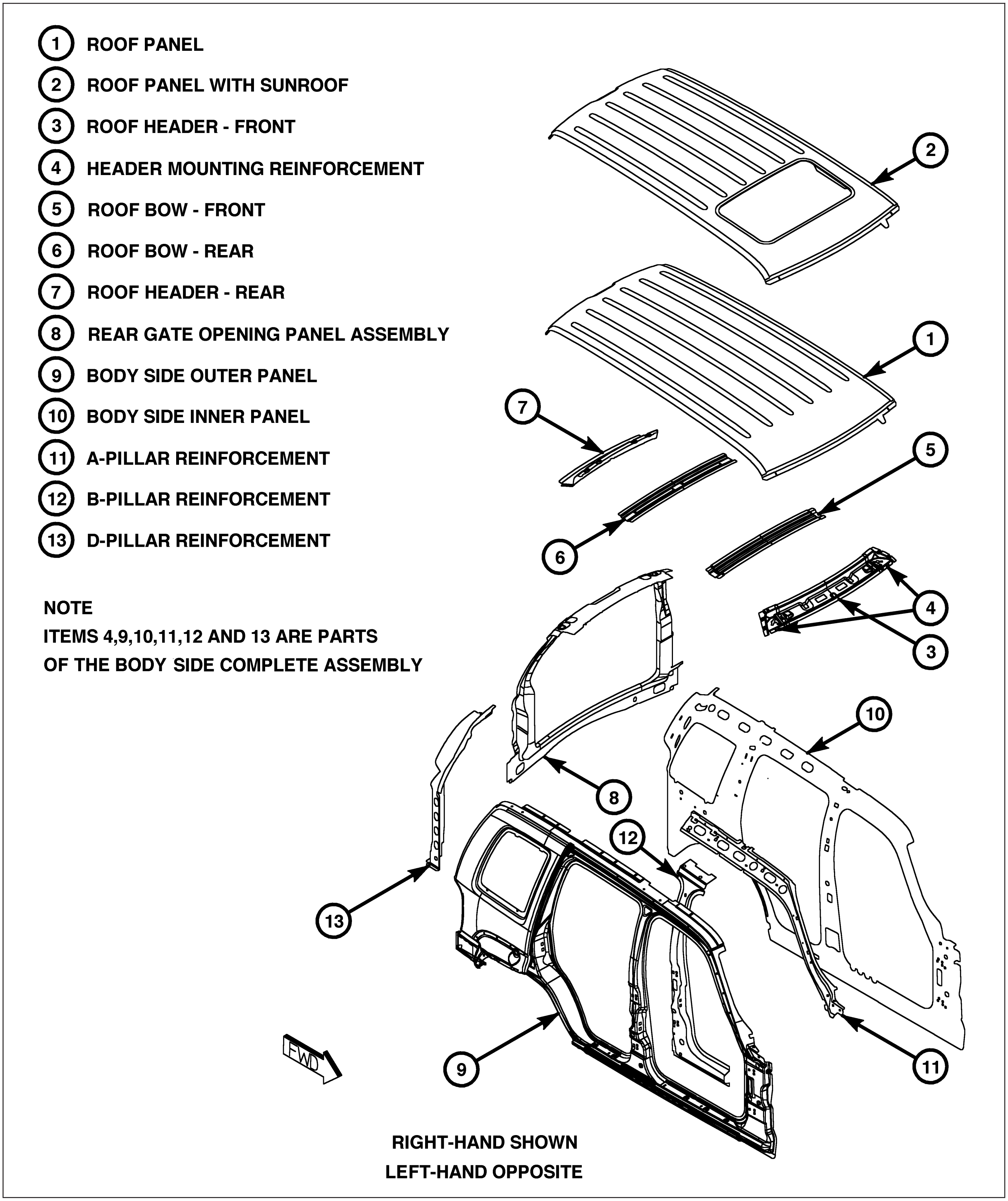



*Fig. 68 ROOF PANEL ASSEMBLY*

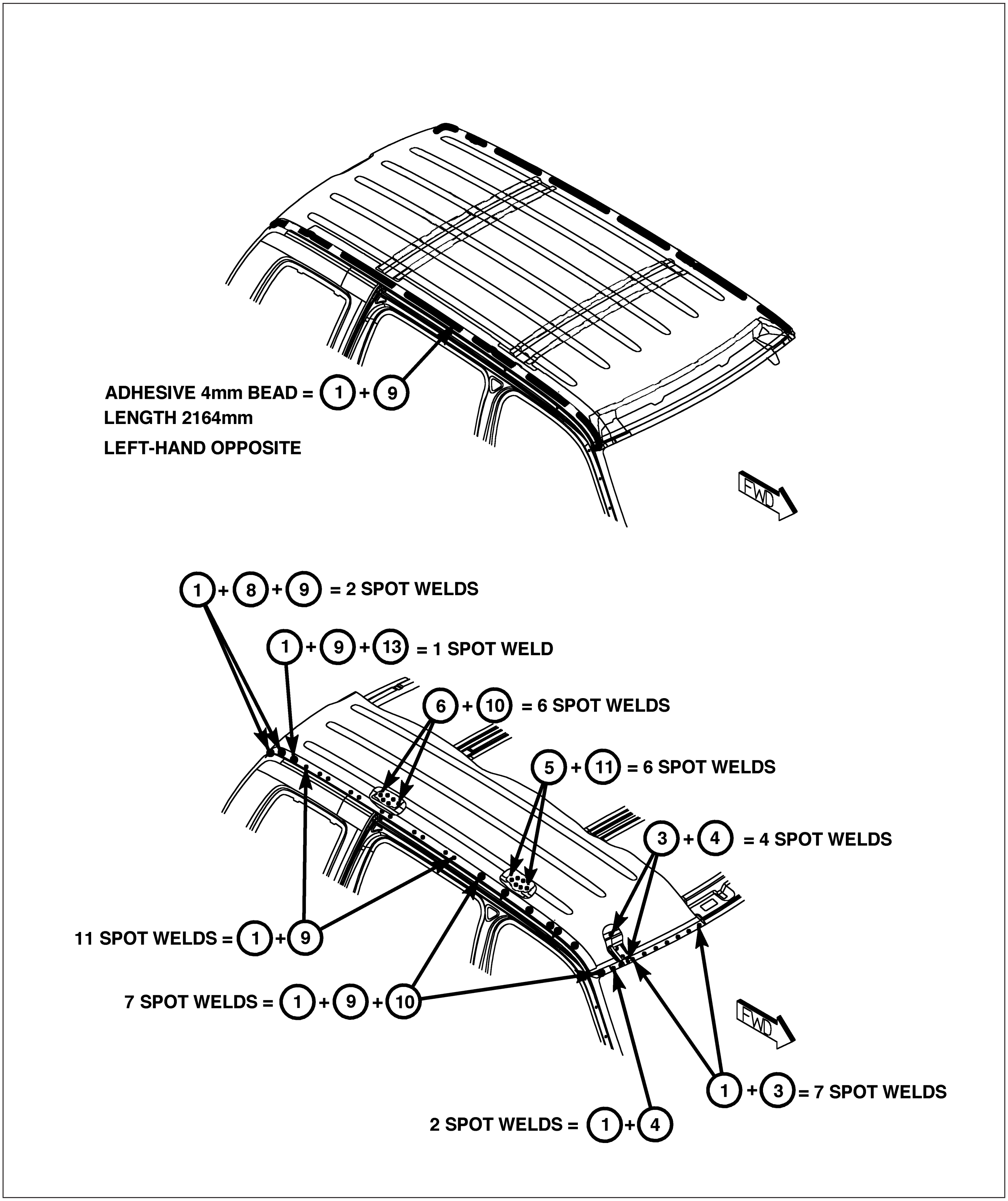



*Fig. 69 ROOF PANEL AND BODY SIDE WELD AND ADHESIVE LOCATIONS*

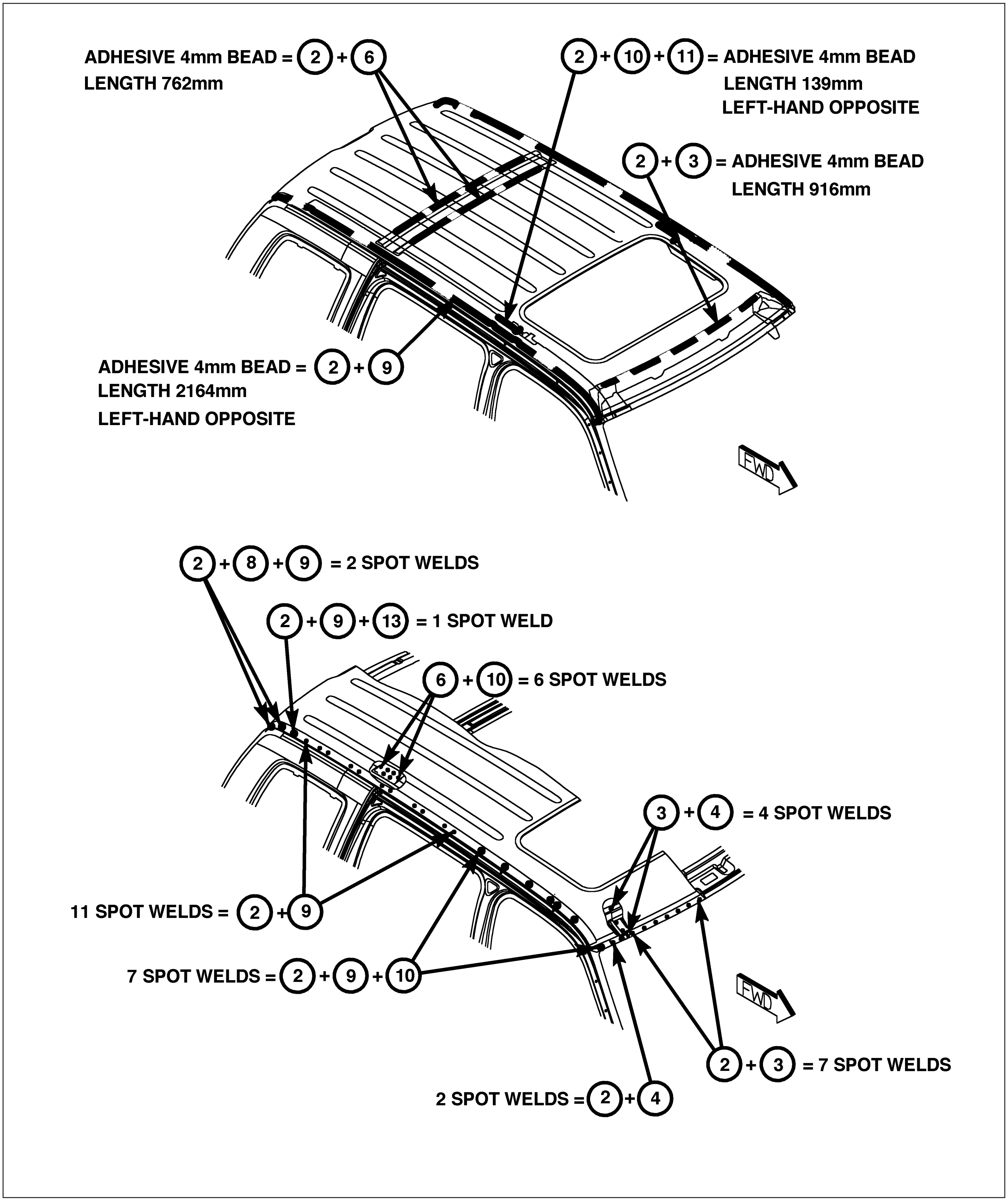
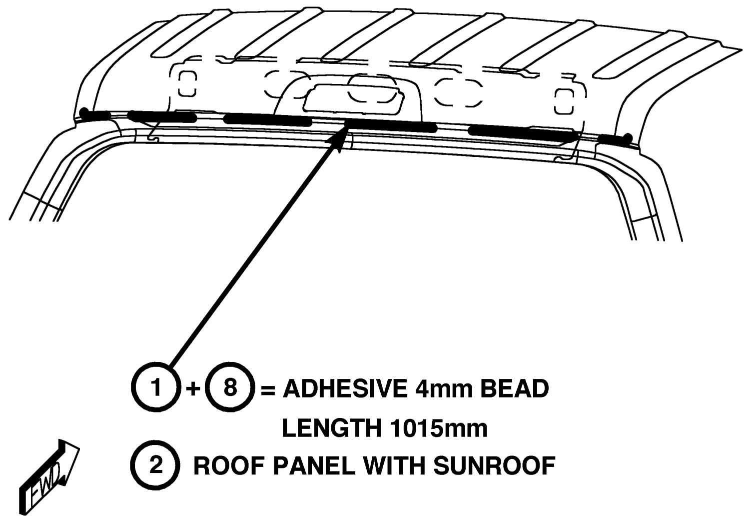



*Fig. 70 ROOF PANEL AND BODY SIDE WELD AND ADHESIVE LOCATIONS - SUNROOF EQUIPPED*



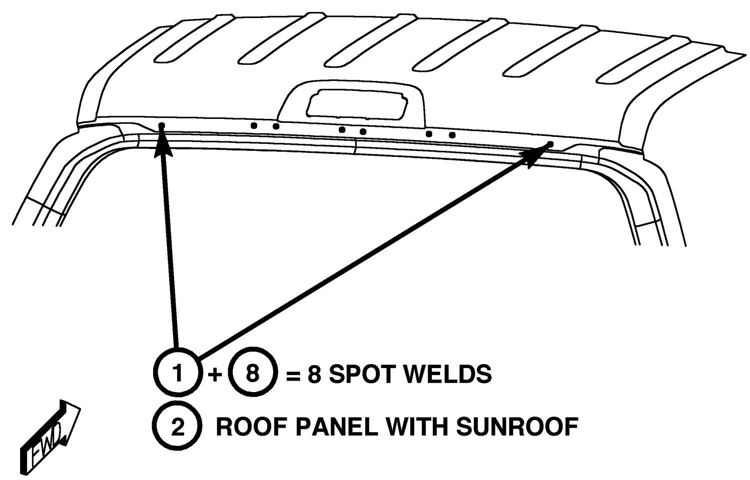



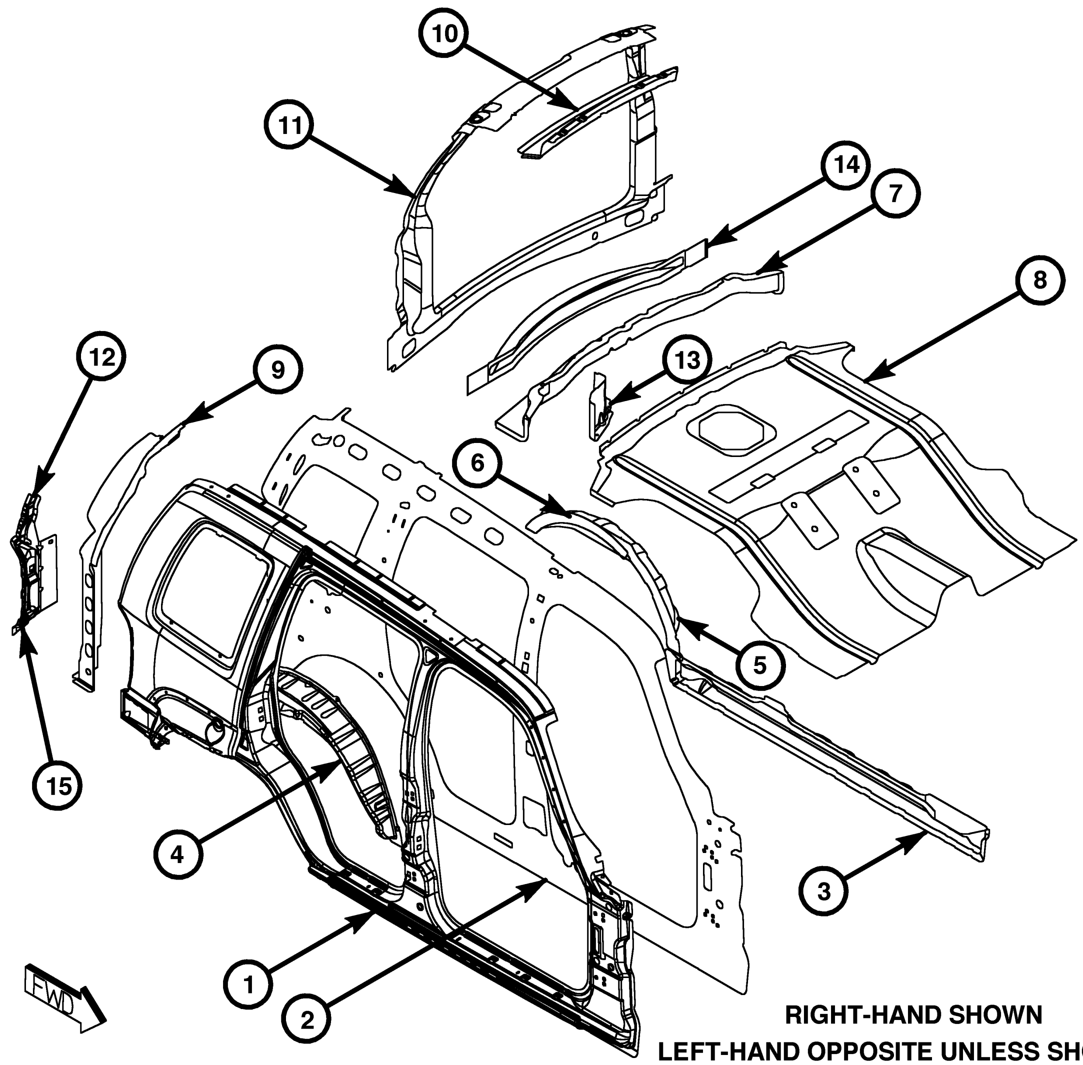

*Fig. 71 ROOF PANEL*

## BODY SIDE PANELS & FLOOR PAN ASSEMBLIES

1. BODY SIDE OUTER PANEL
2. BODY SIDE INNER PANEL
3. BODY SIDE SILL
4. REAR WHEELHOUSE OUTER PANEL
5. REAR WHEELHOUSE INNER PANEL ASSEMBLY
6. REAR WHEELHOUSE INNER EXTENSION
7. REAR CROSSMEMBER
8. REAR FLOOR PAN
9. D-PILLAR REINFORCEMENT
10. ROOF HEADER - REAR
11. REAR GATE OPENING PANEL ASSEMBLY
12. GATE STRIKER REINFORCEMENT
13. D-PILLAR LOWER TO FLOOR GUSSET
14. GATE OPENING REINFORCEMENT
15. TAIL LAMP MOUNTING PANEL

NOTE
ITEMS 1,2,9,12 AND 15 ARE PARTS OF THE BODY SIDE COMPLETE ASSEMBLY

ITEMS 3,4,5,6,7,8,13 AND 14 ARE PARTS OF THE UNDERBODY COMPLETE ASSEMBLY




RIGHT-HAND SHOWN
LEFT-HAND OPPOSITE UNLESS SHOWN

*Fig. 72 BODY SIDE PANEL ASSEMBLY*

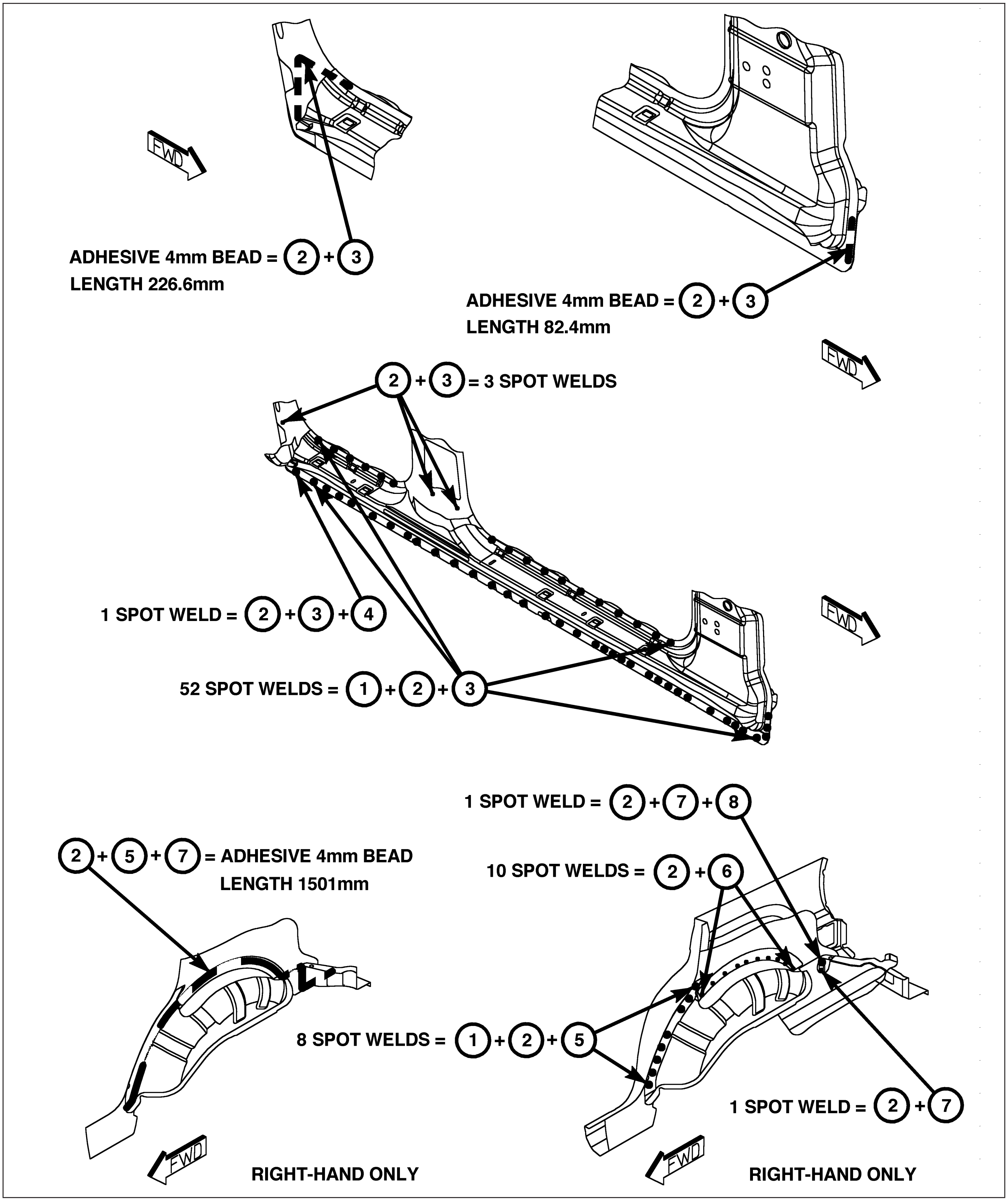



*Fig. 73 BODY SIDE SILLS AND REAR WHEELHOUSES*

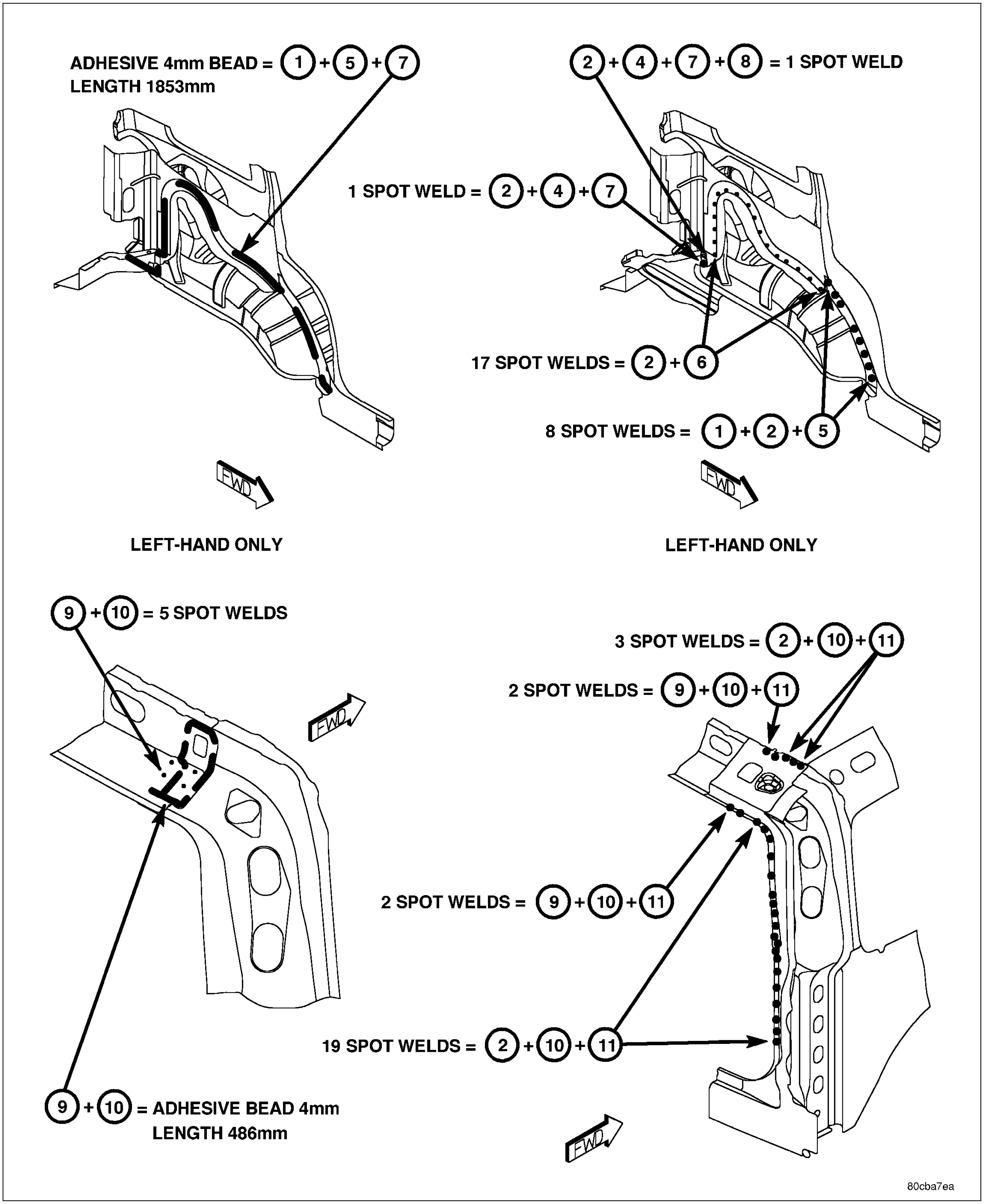



*Fig. 74 ROOF HEADER AND WHEELHOUSE WELDS AND ADHESIVE LOCATIONS*

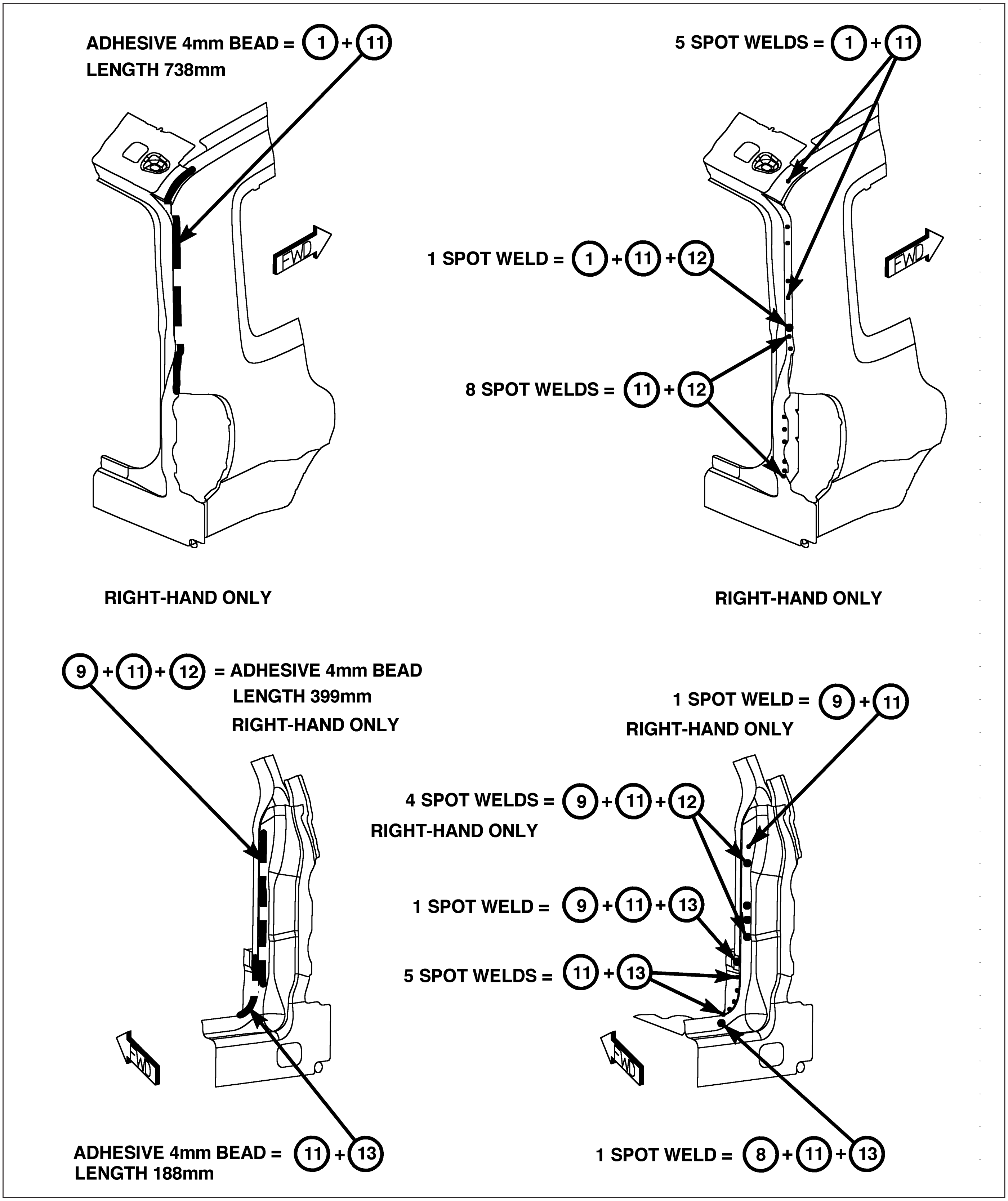



*Fig. 75 SWING GATE OPENING PANEL; GATE STRIKER REINFORCEMENT; D-PILLAR REINFORCEMENT ADHESIVE AND WELD LOCATIONS*

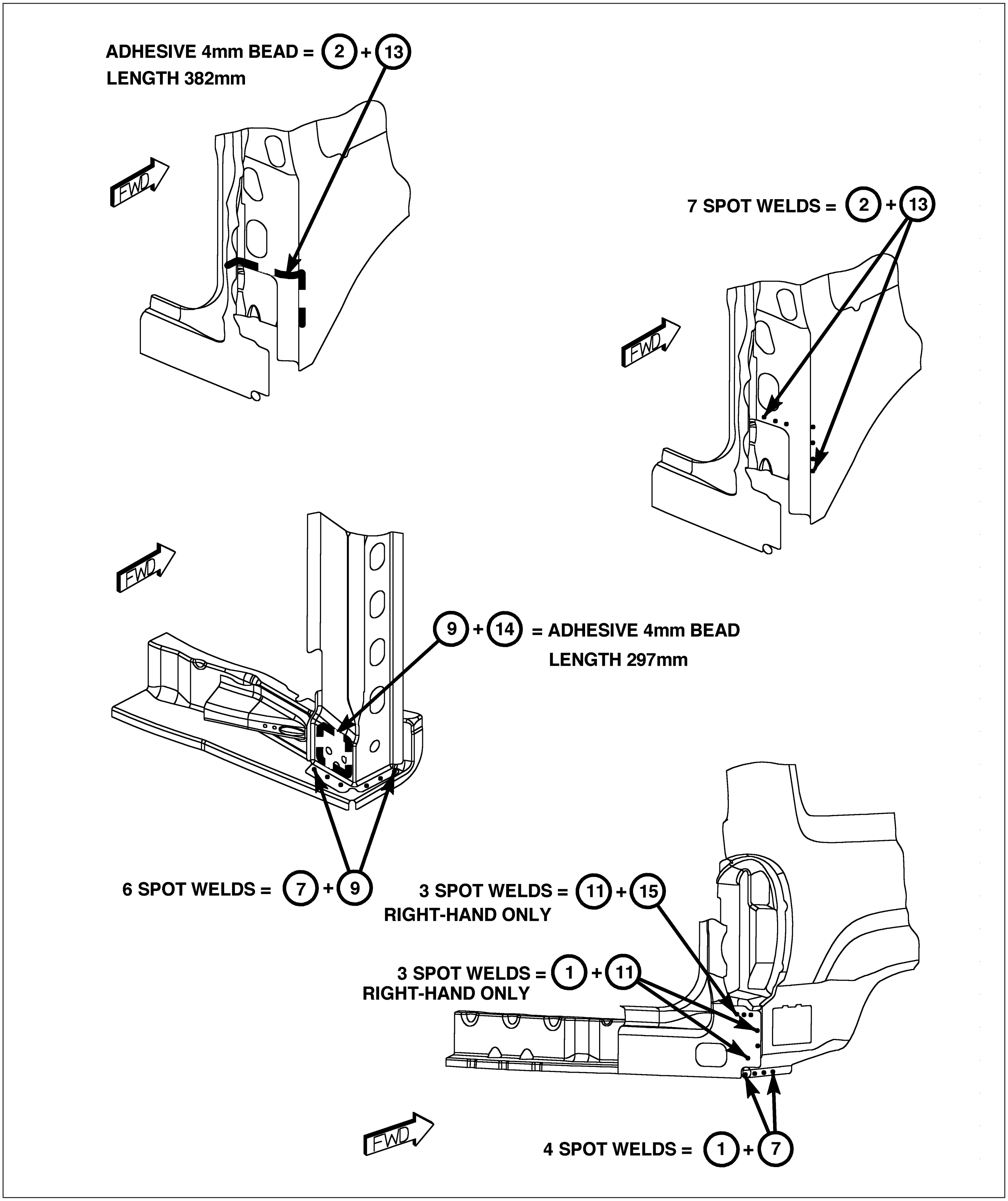



*Fig. 76 SWING GATE OPENING PANEL; D-PILLAR LOWER TO FLOOR GUSSET; GATE OPENING REINFORCEMENT*

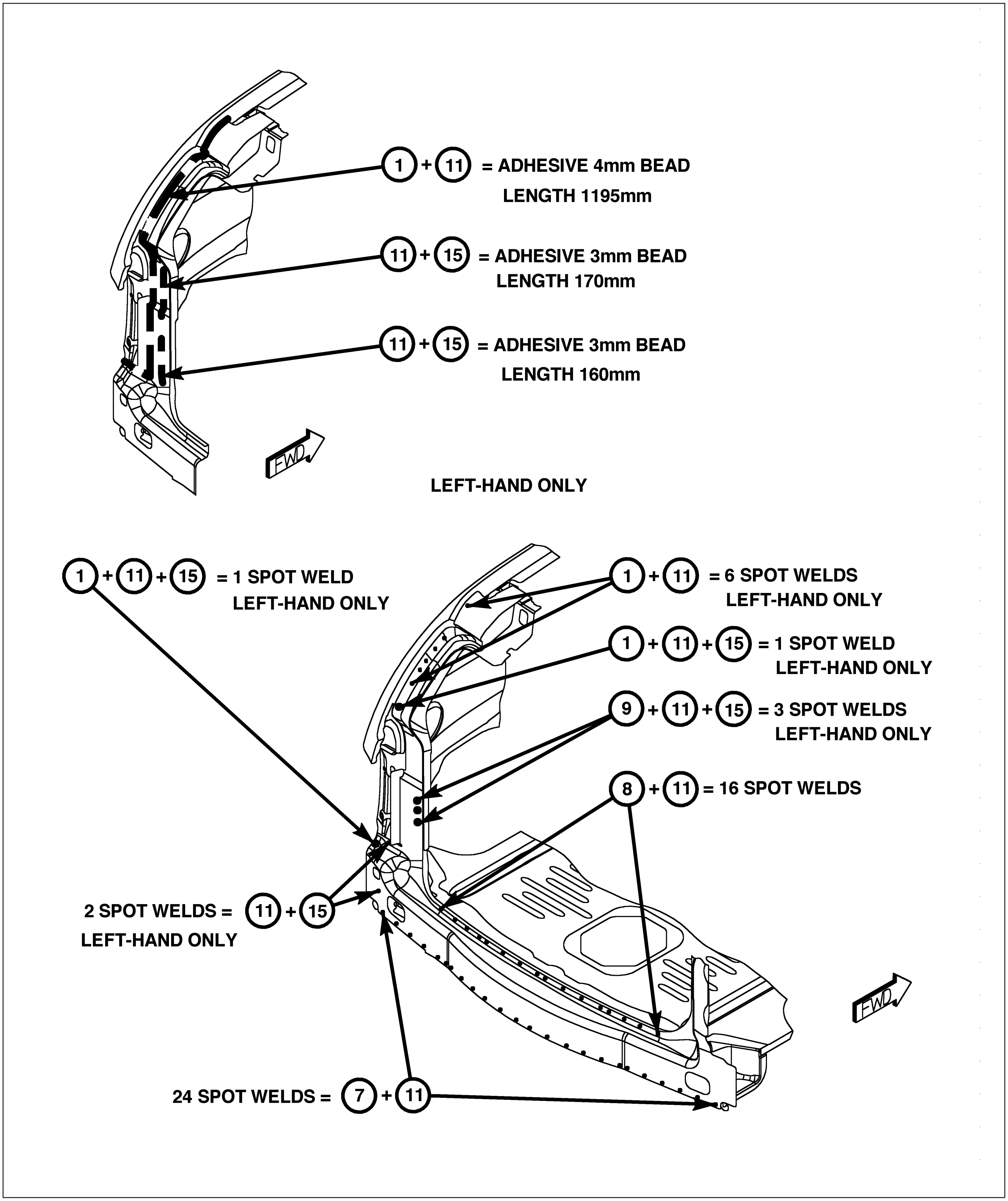



*Fig. 77 REAR FLOOR PAN AND CROSSMEMBER; TAIL LAMP MOUNTING; SWING GATE OPENING PANEL*

# SEALER LOCATIONS

## SPECIFICATIONS

### INDEX

| DESCRIPTION | FIGURE |
|---|---|
| SEALER APPLICATION METHODS | ( 78 ) |
| REAR FLOOR PAN AND FUEL TANK ACCESS DOOR | ( 79 ) |
| FLOOR PANS; BODY SIDE SILLS; DASH PANEL; COWL AND PLENUM ASSEMBLY | ( 80 ) |
| FRONT FLOOR PAN; DASH; BODY SIDE SILL AND COWL PANELS | ( 81 ) |
| FLOOR PANS AND SIDE SILLS | ( 82 ) |
| BODY SIDE, PLENUM AND DASH PANELS ASSEMBLIES | ( 83 ) |
| A-PILLAR AND DASH PANEL | ( 84 ) |
| PLENUM AND DASH PANEL | ( 85 ) |
| BODY SIDE PANEL ASSEMBLIES | ( 86 ) |
| BODY SIDE SILL; WHEELHOUSE; B-PILLAR | ( 87 ) |
| TAIL LAMP MOUNTING AND SWING GATE STRIKER REINFORCEMENT ASSEMBLIES | ( 88 ) |
| ROOF PANEL; SWING GATE OPENING ASSEMBLIES | ( 89 ) |
| ROOF PANEL; SWING GATE OPENING | ( 90 ) |
| ROOF PANEL; SWING GATE OPENING | ( 91 ) |
| BODY SIDE PANEL; SWING GATE OPENING; FLOOR PAN ASSEMBLY | ( 92 ) |
| SWING GATE OPENING | ( 93 ) |
| WHEELHOUSES | ( 94 ) |
| BODY SIDE PANEL; FLOOR PAN; SWING GATE OPENING ASSEMBLIES | ( 95 ) |
| WHEELHOUSES | ( 96 ) |
| WHEELHOUSES | ( 97 ) |
| WHEELHOUSE | ( 98 ) |
| ROOF PANEL ASSEMBLY | ( 99 ) |
| REAR ROOF HEADER AND ROOF PANEL | ( 100 ) |

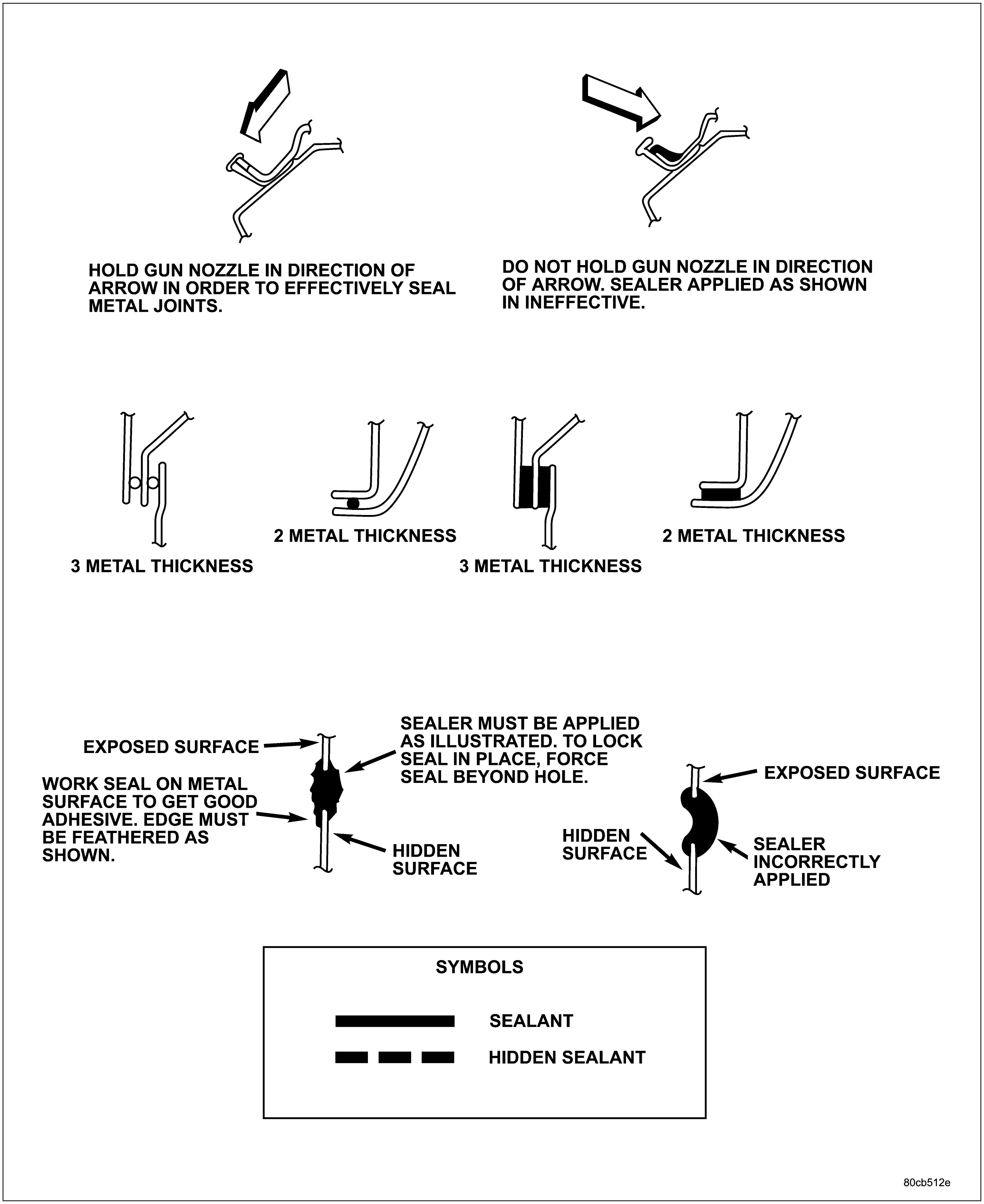



*Fig. 78 APPLICATION METHODS*

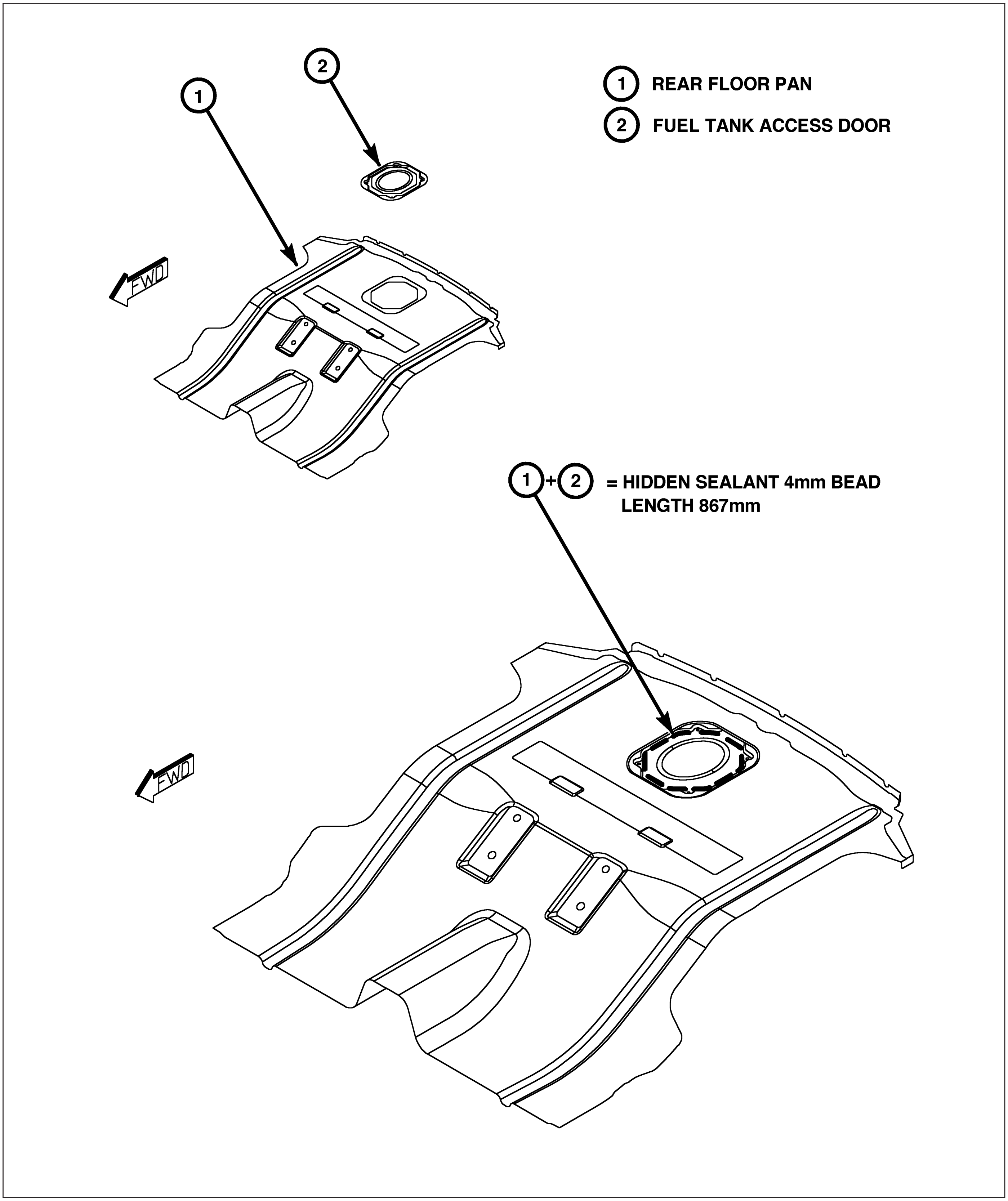



*Fig. 79 REAR FLOOR PAN*

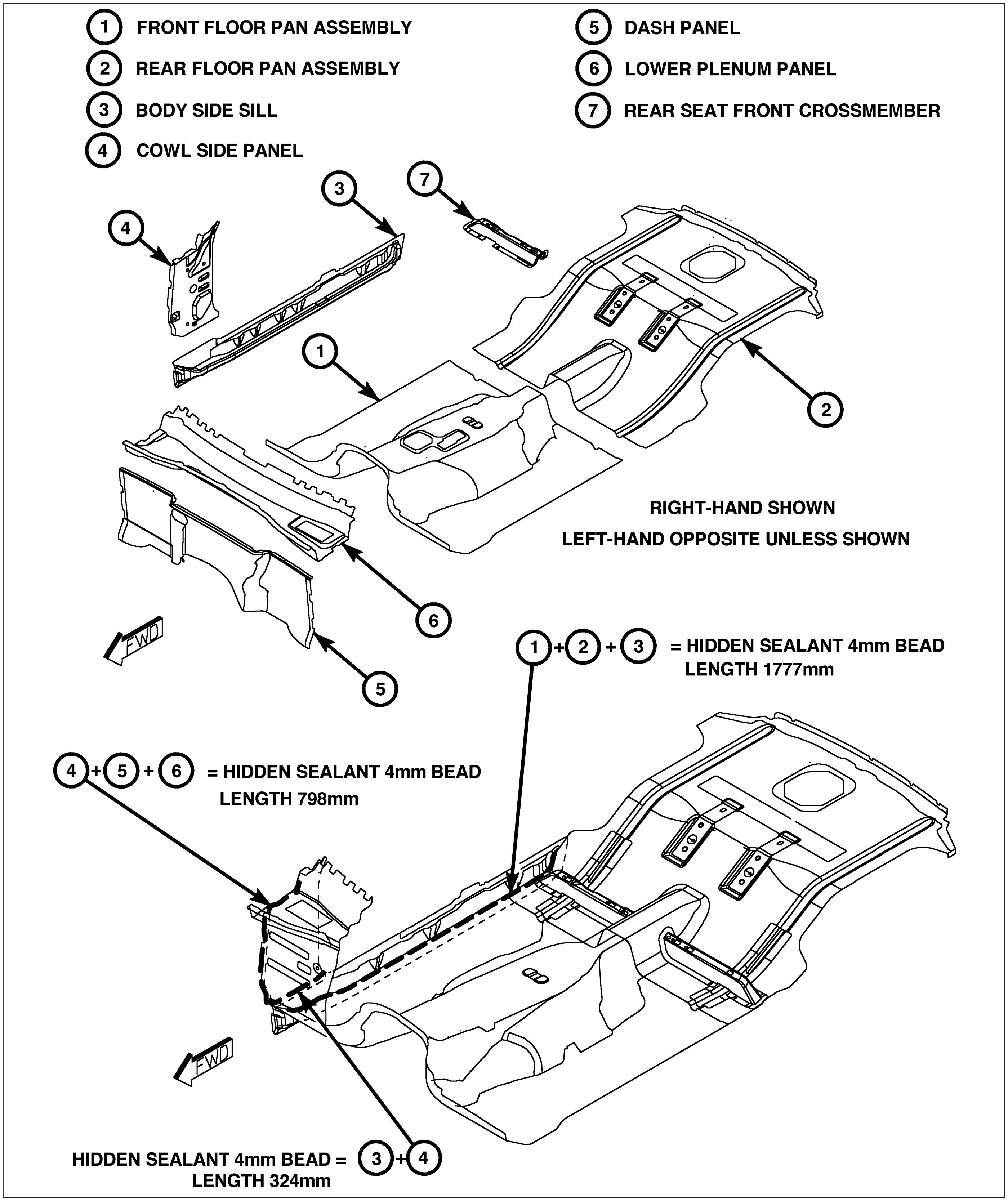



*Fig. 80 FULL FLOOR PAN*

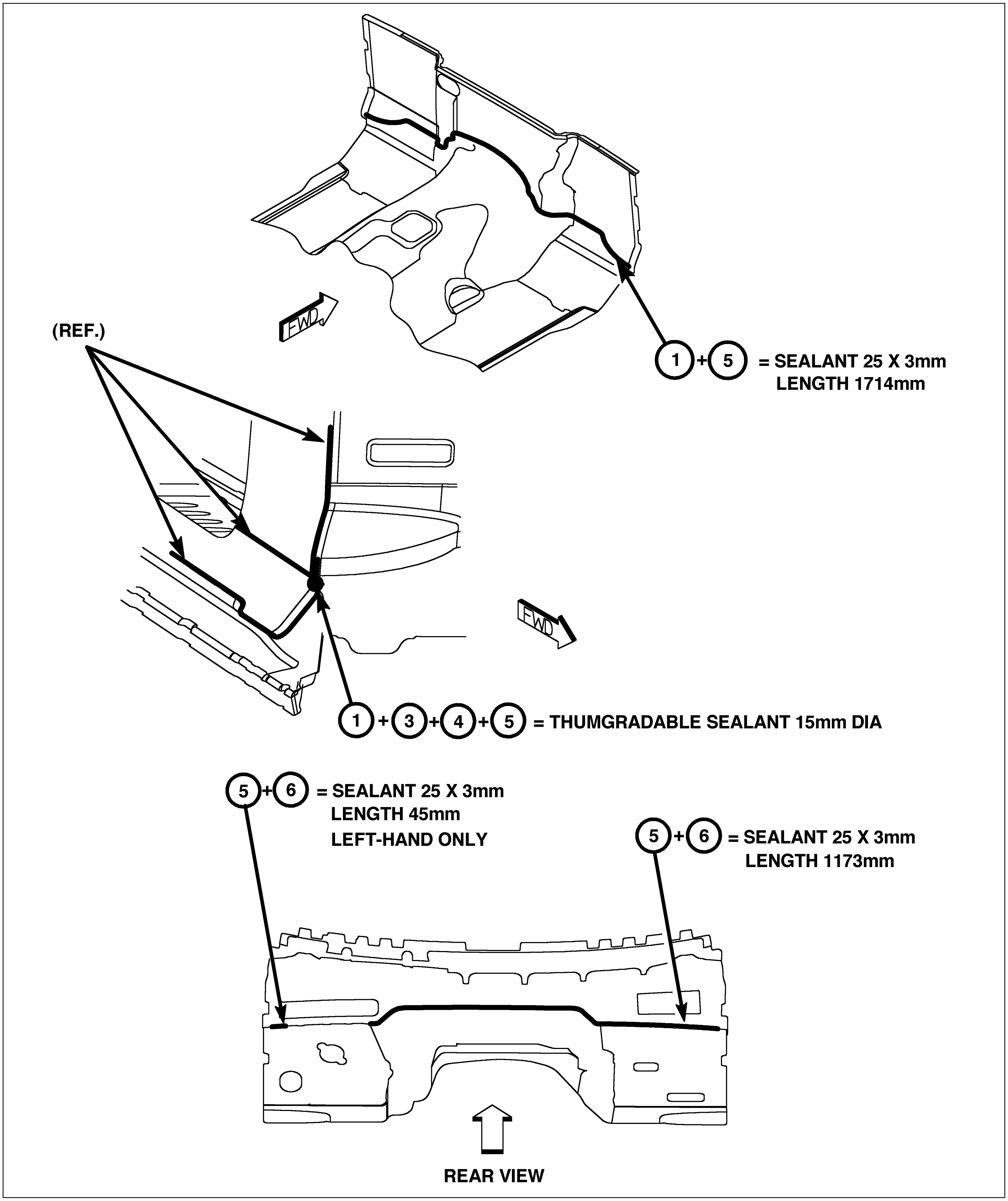



*Fig. 81 FRONT FLOOR PAN & DASH PANEL*

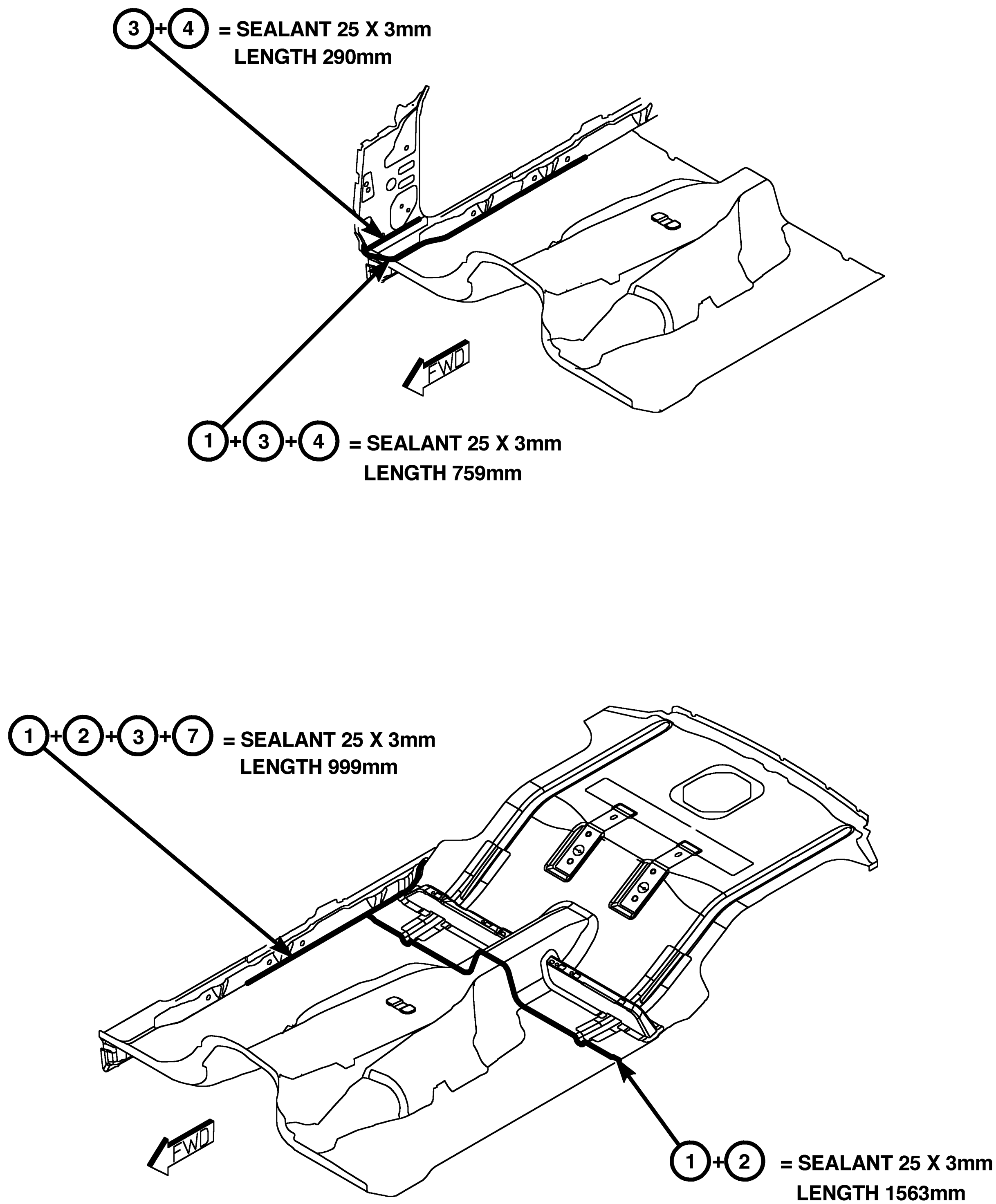



*Fig. 82 FLOOR PAN*

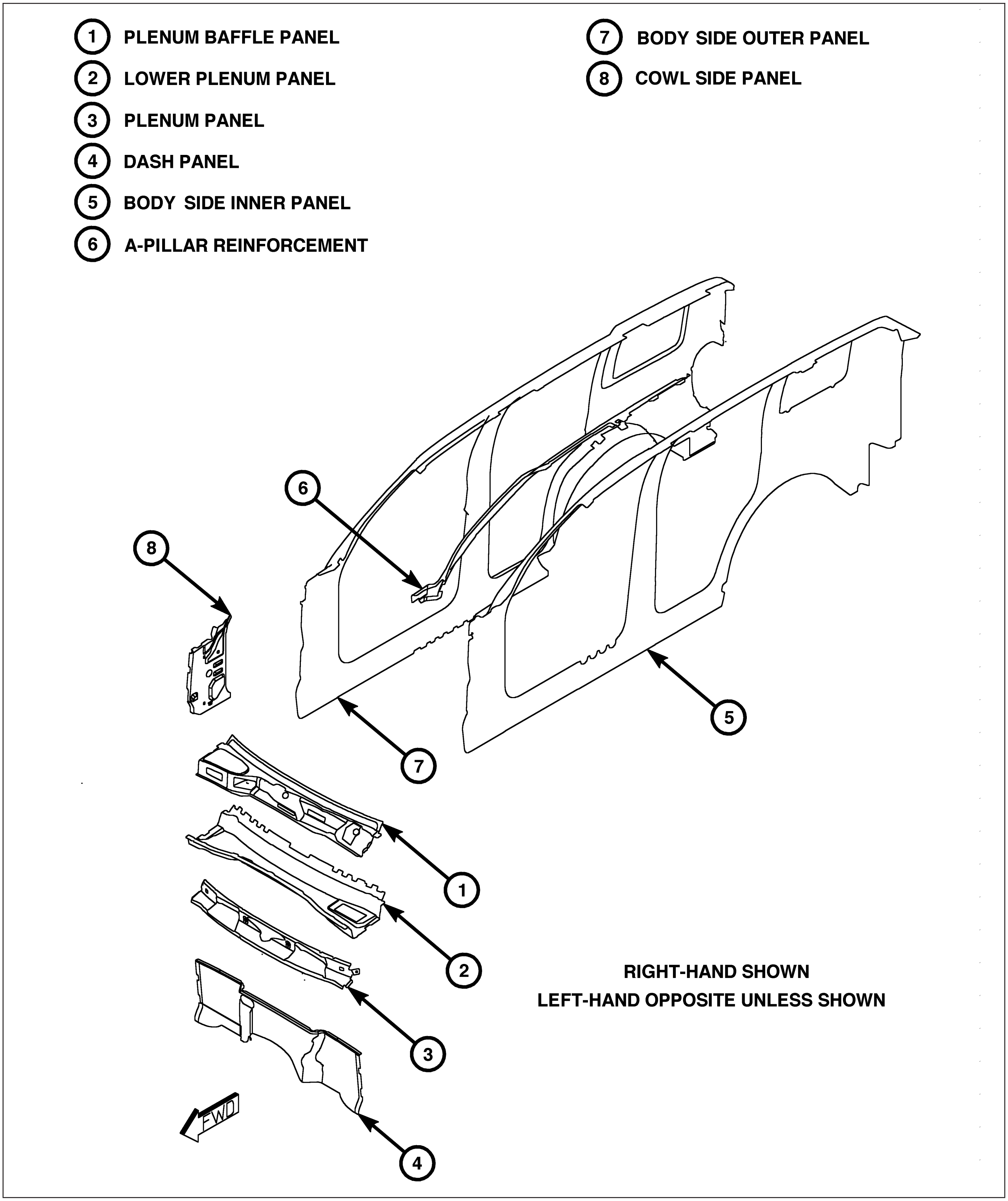



*Fig. 83 BODY SIDE PANEL ASSEMBLY*

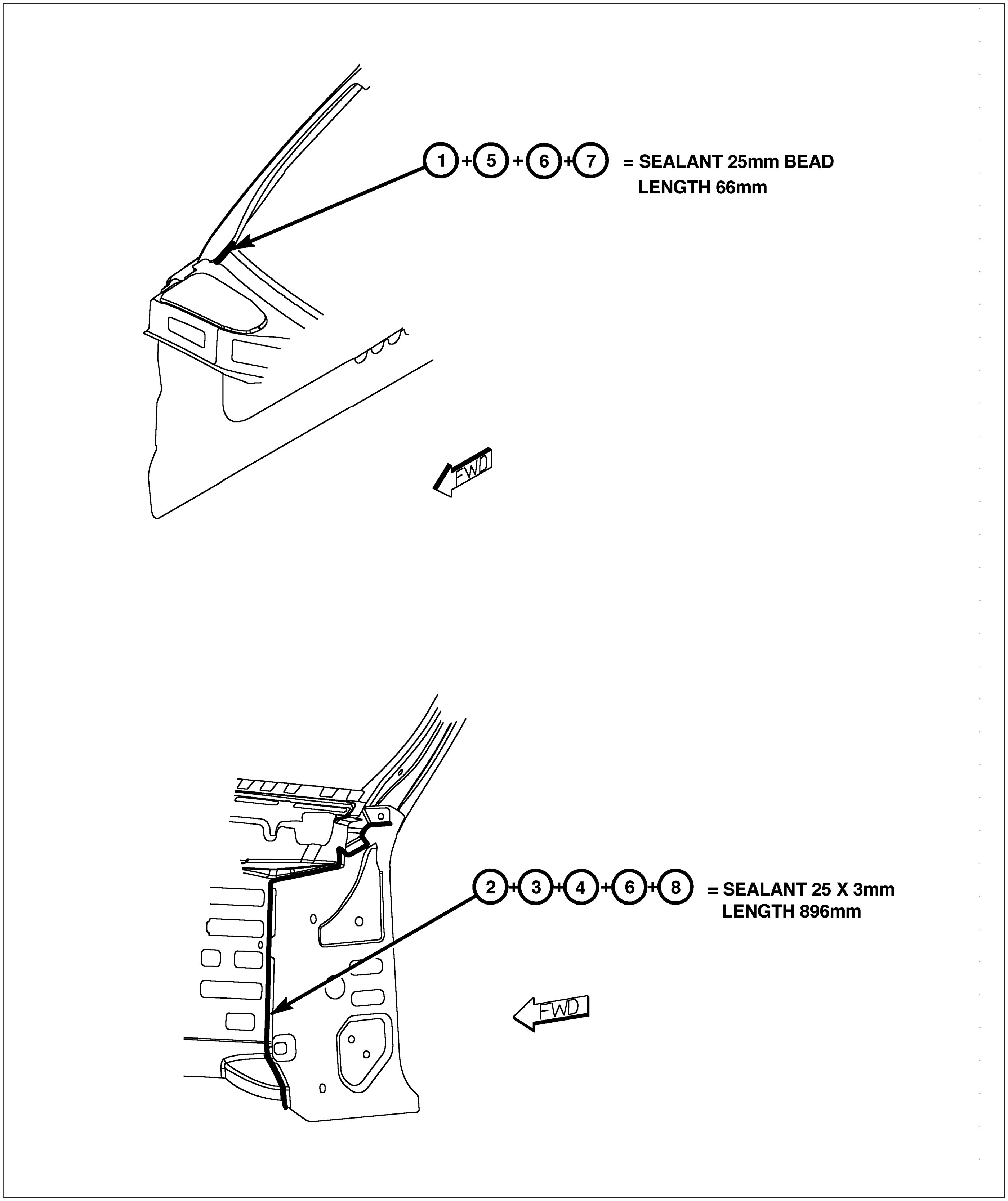



*Fig. 84 A-PILLAR & DASH PANEL*

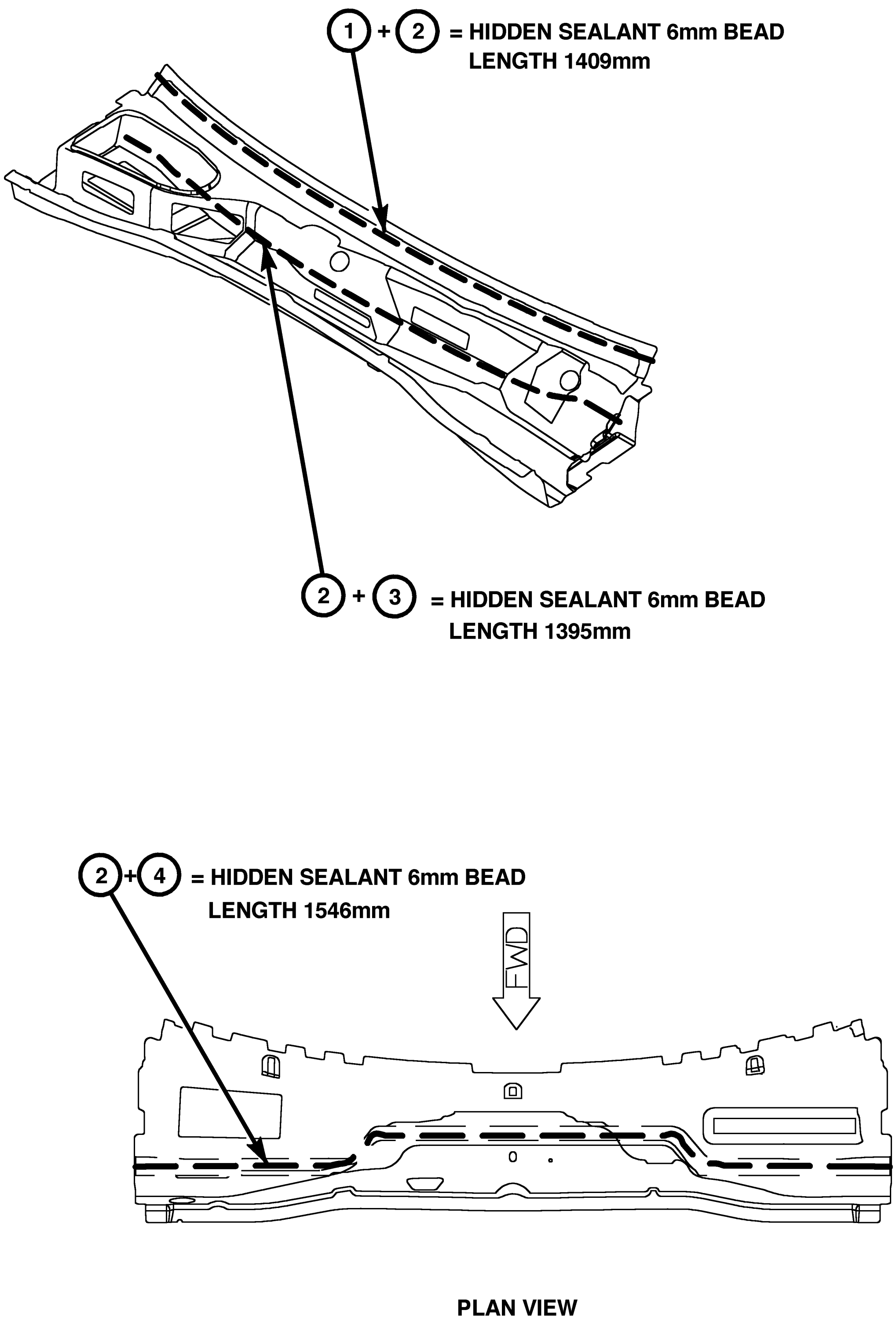



*Fig. 85 PLENUM AND DASH PANEL*

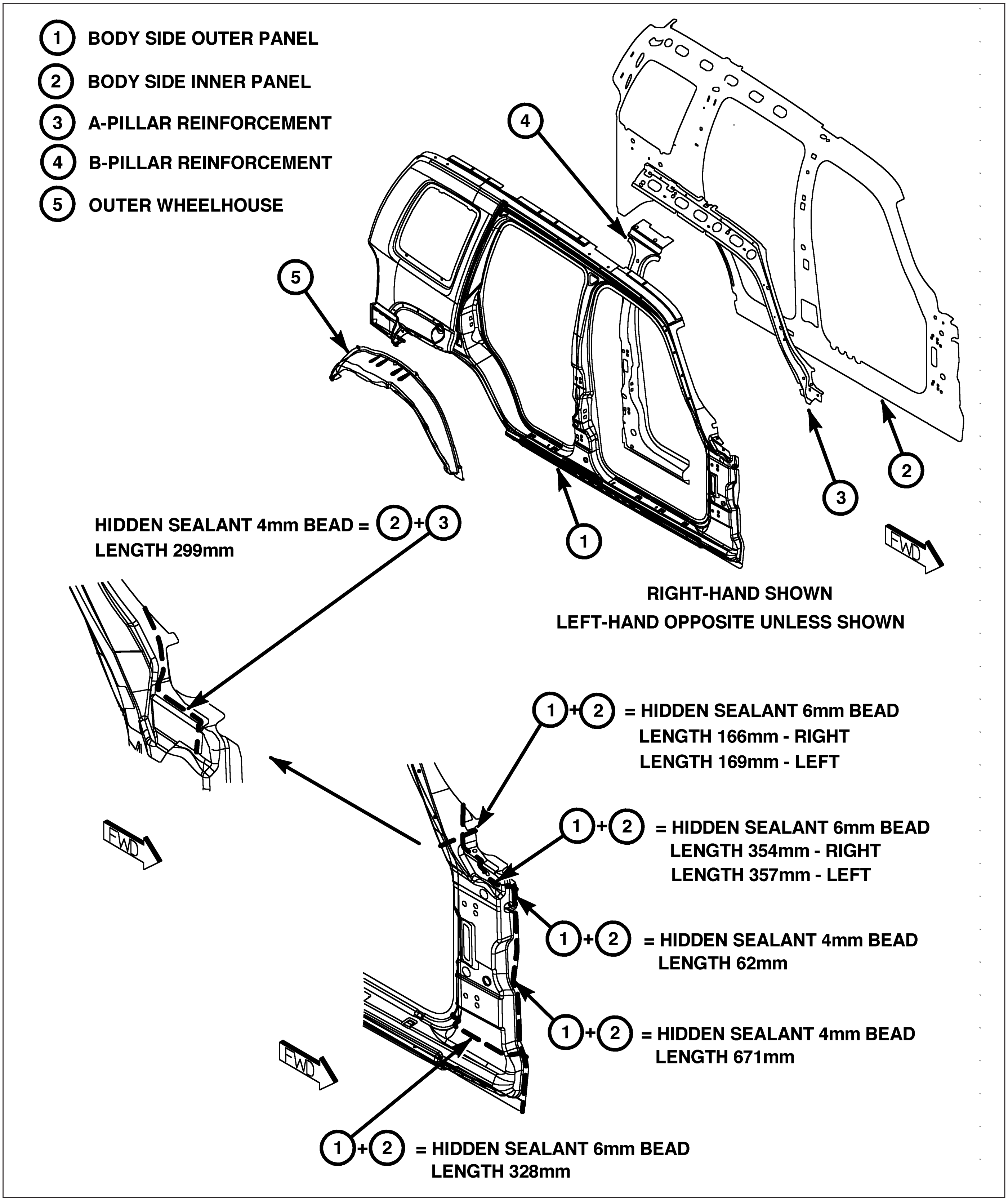



*Fig. 86 BODY SIDE PANEL ASSEMBLIES*

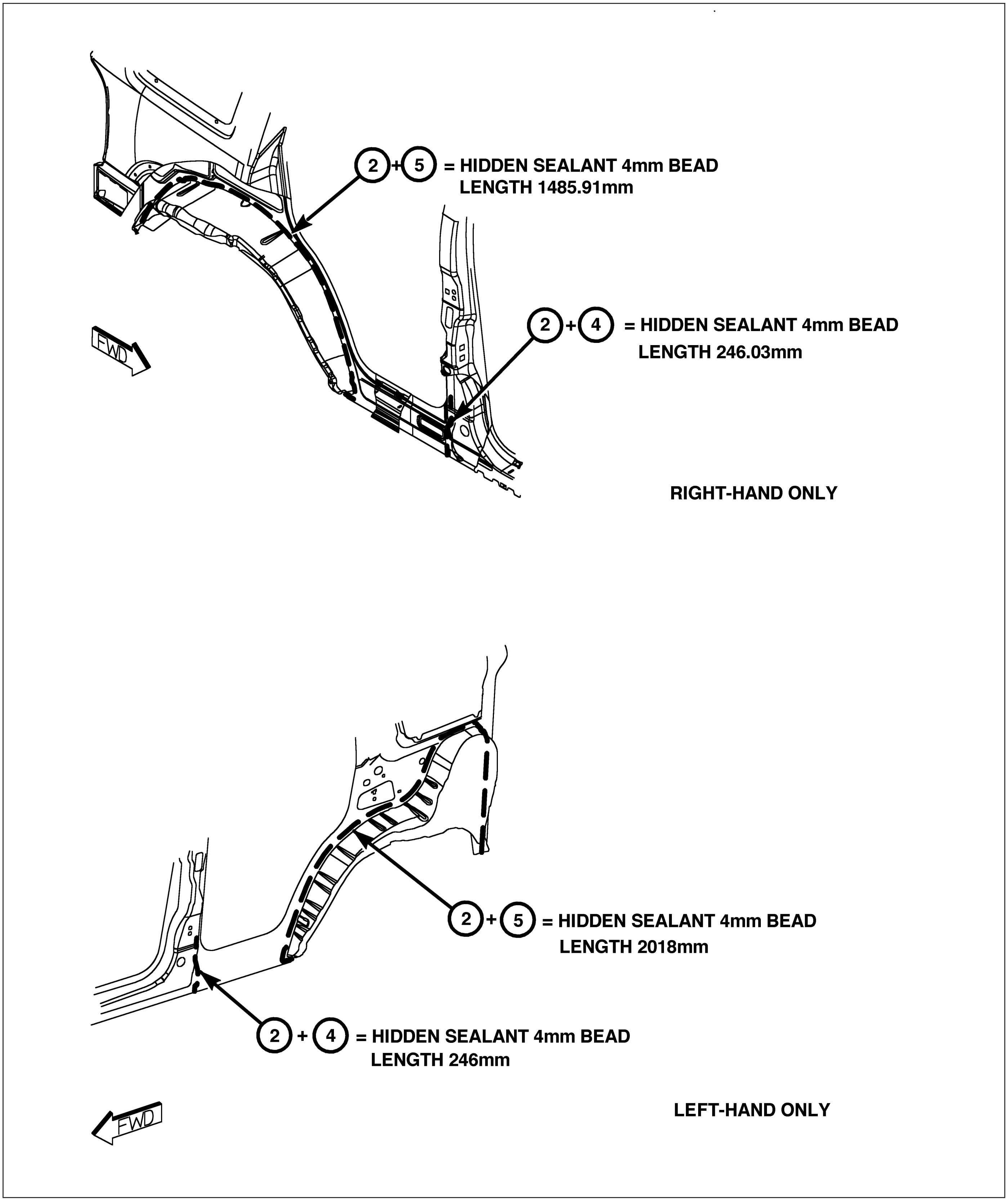



*Fig. 87 WHEELHOUSES*

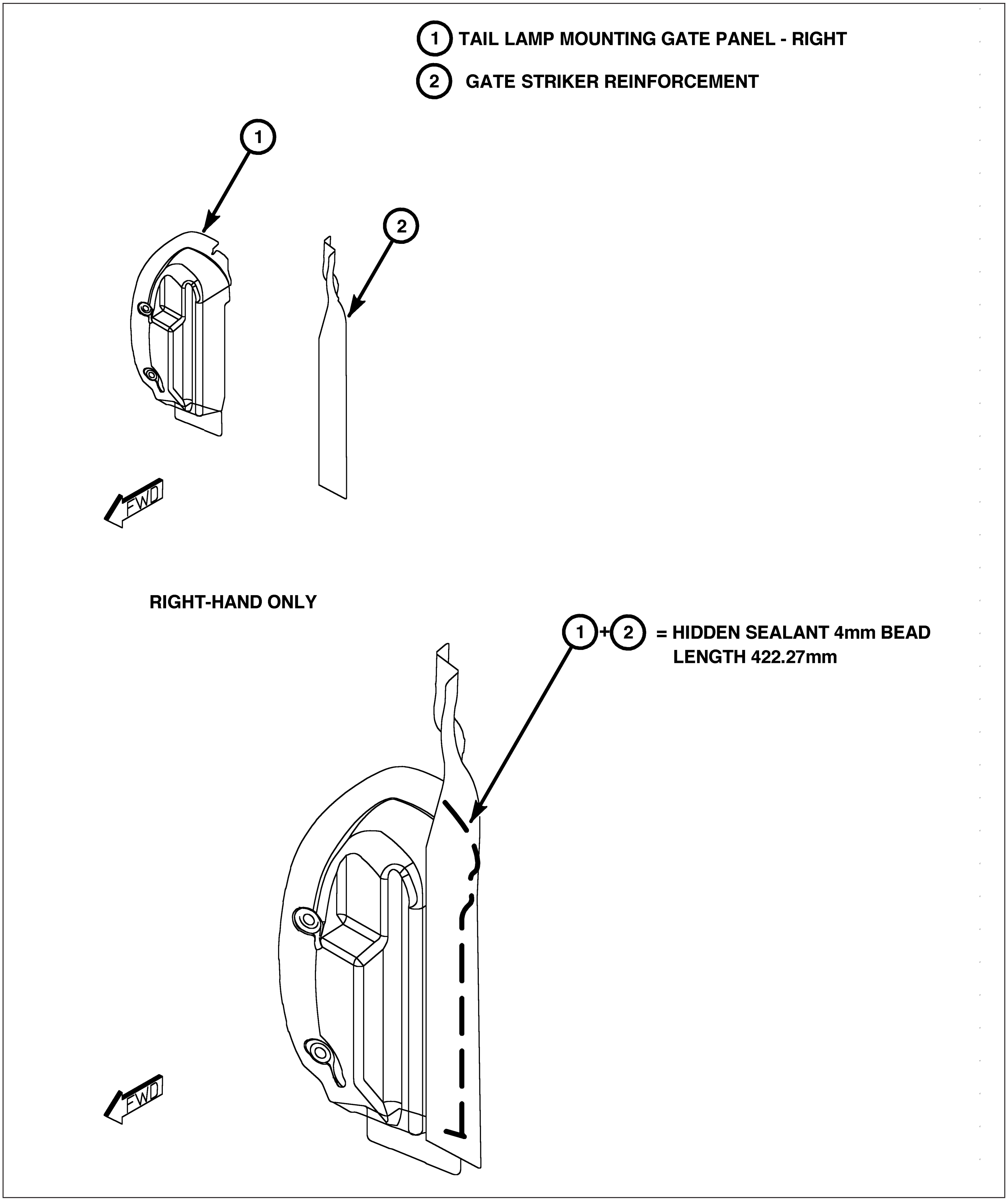



*Fig. 88 TAIL LAMP MOUNTING*

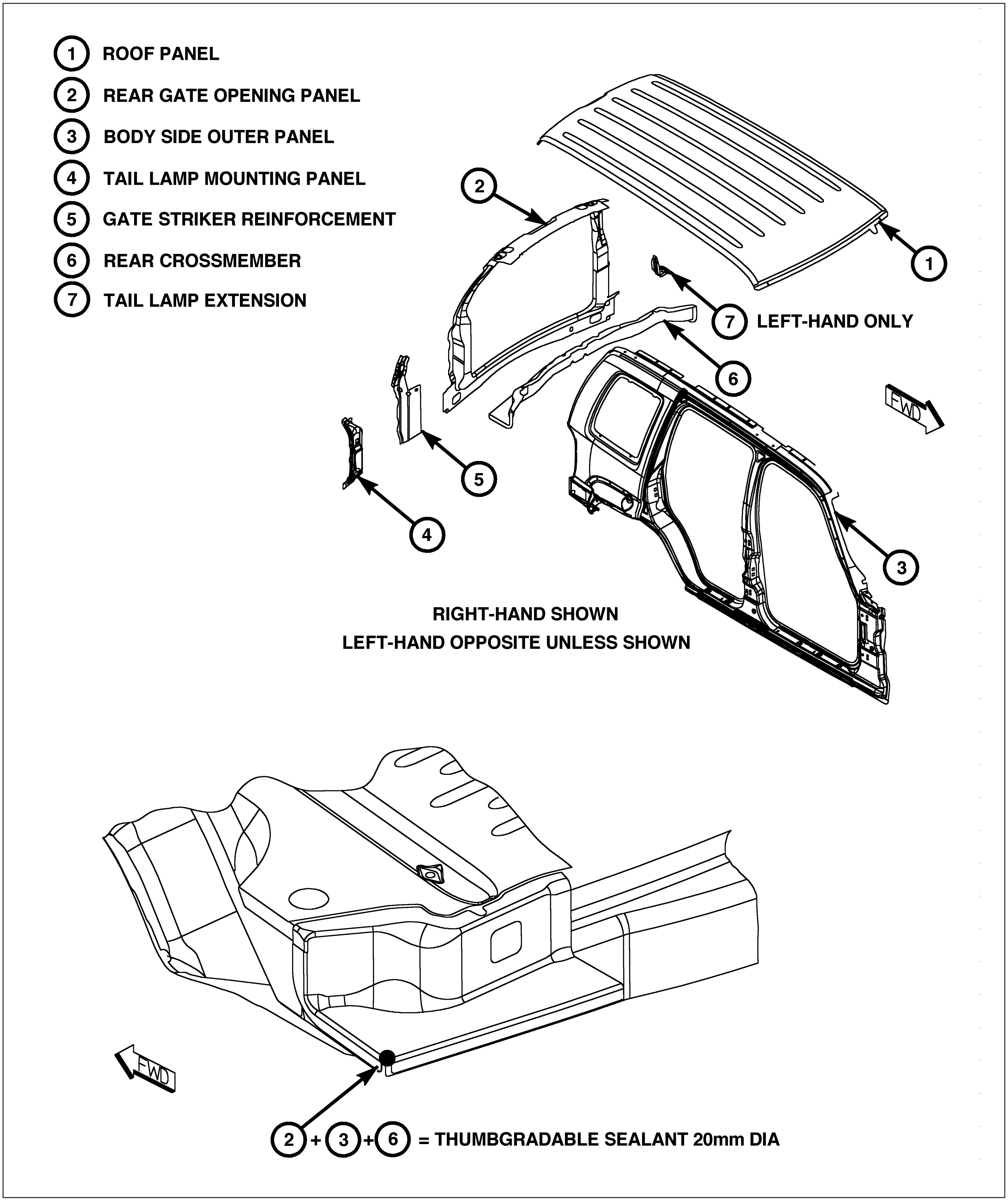



*Fig. 89 ROOF PANEL & BODY SIDE SILL ASSEMBLY*

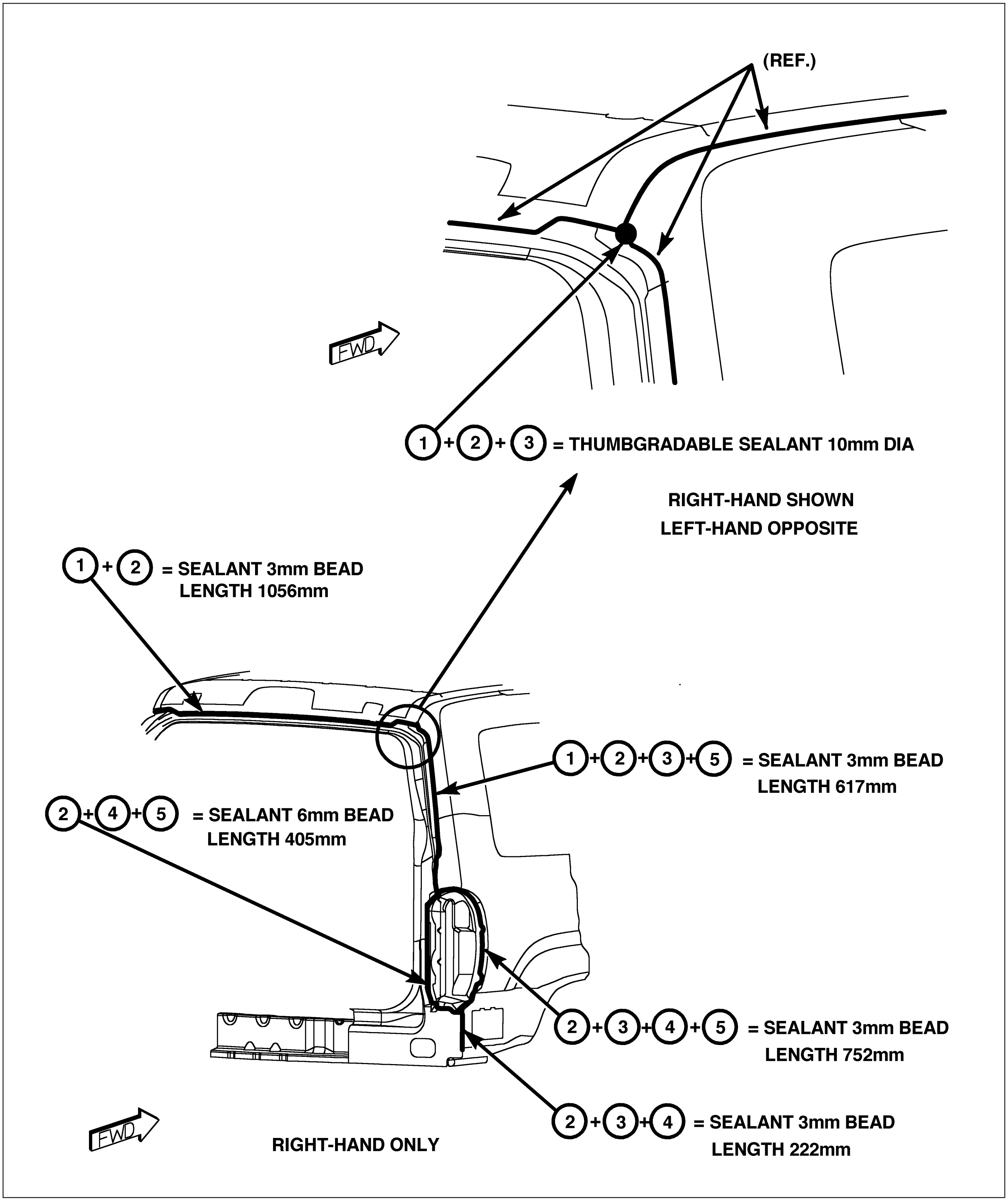



*Fig. 90 SWING GATE OPENING*

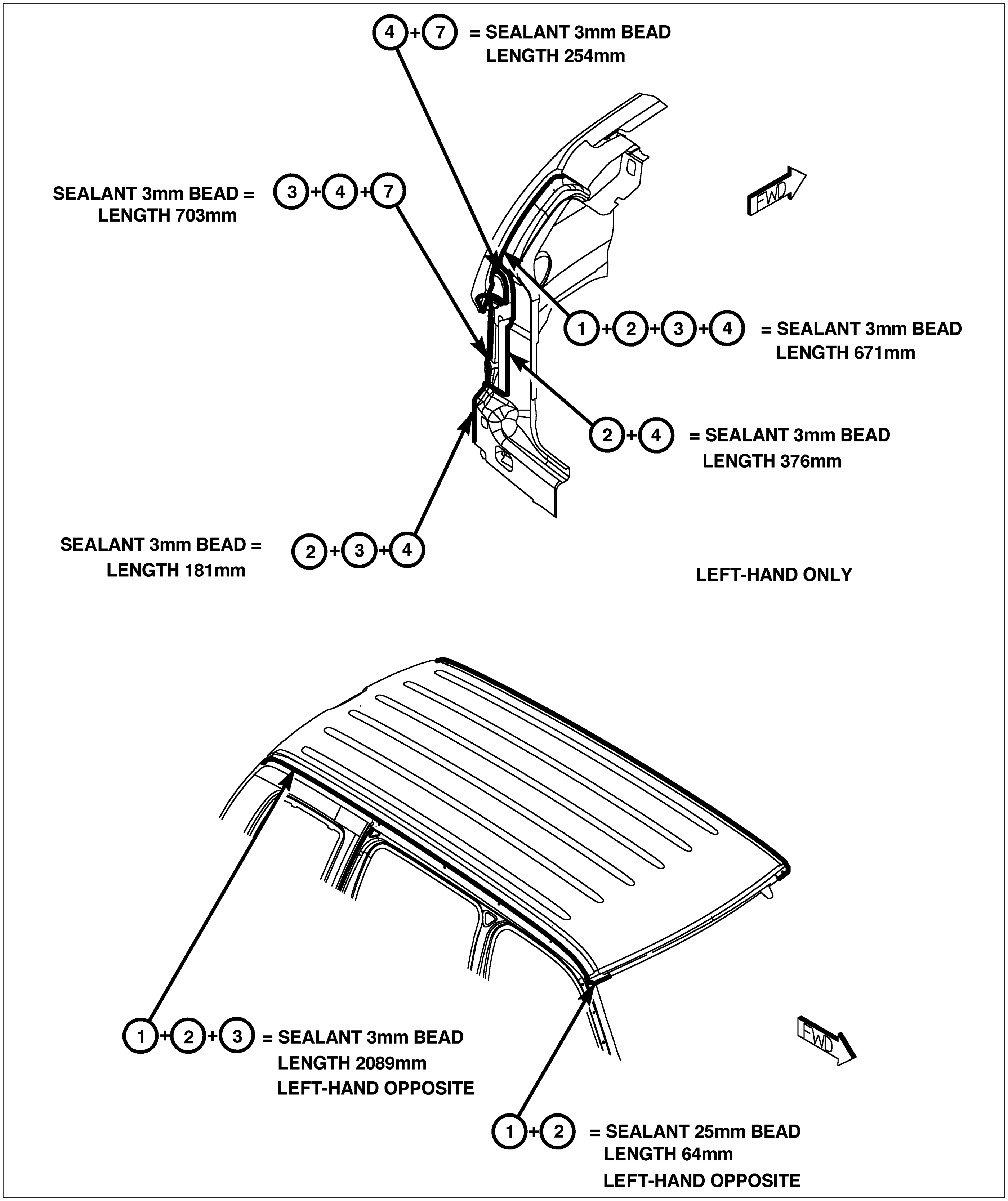



*Fig. 91 ROOF PANEL; SWING GATE OPENING*

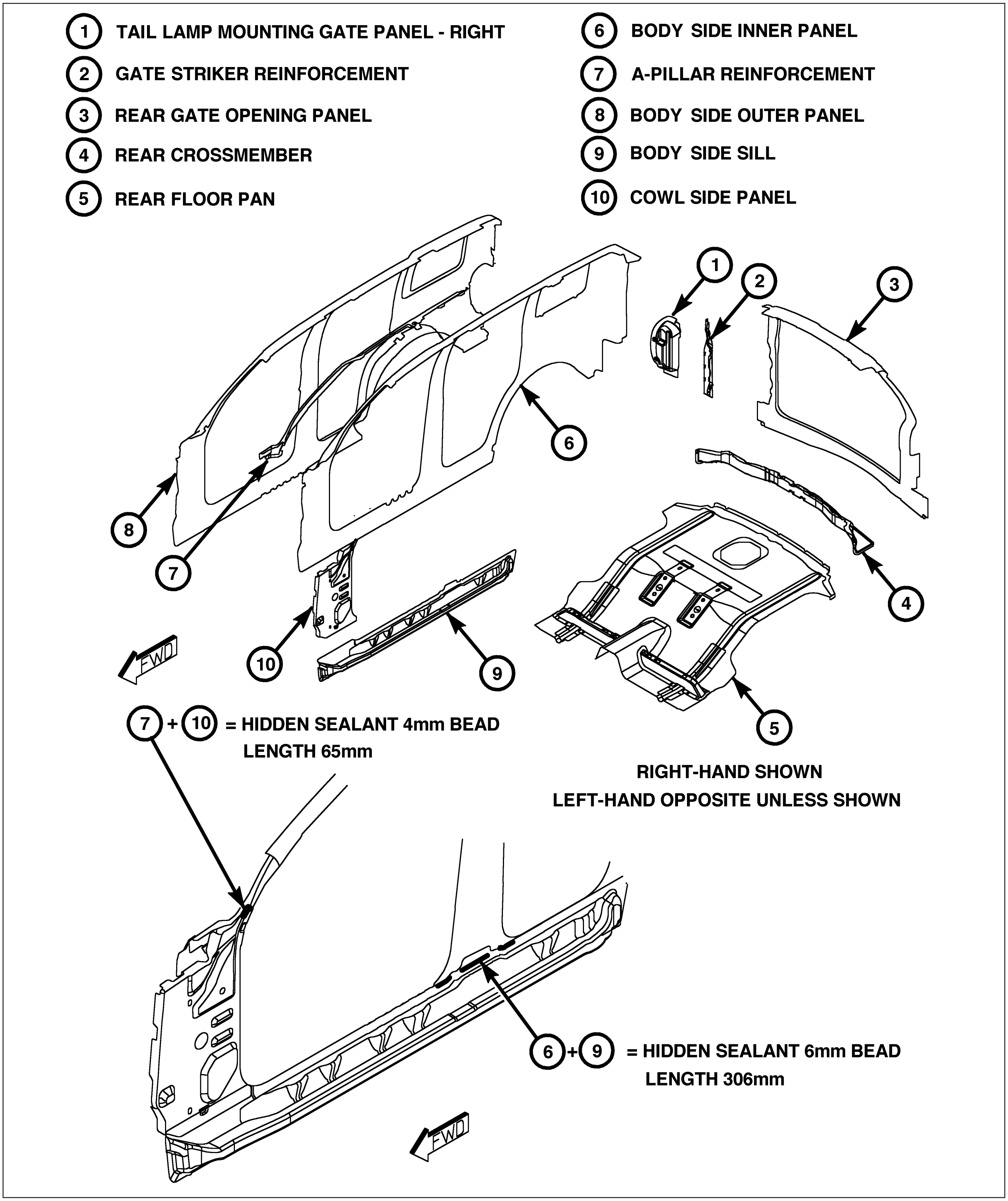



*Fig. 92 BODY SIDE PANEL ASSEMBLY*

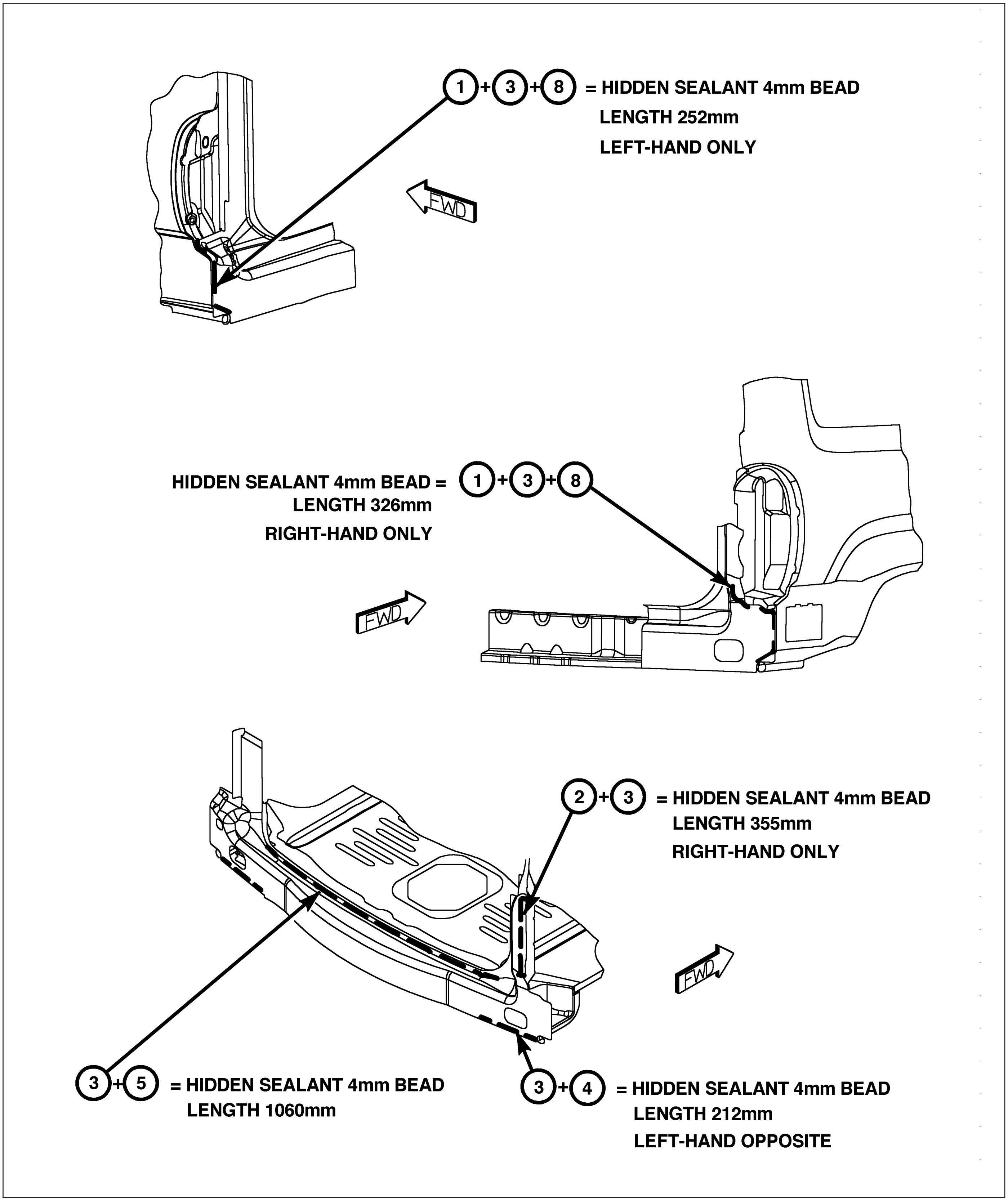



*Fig. 93 SWING GATE OPENING*

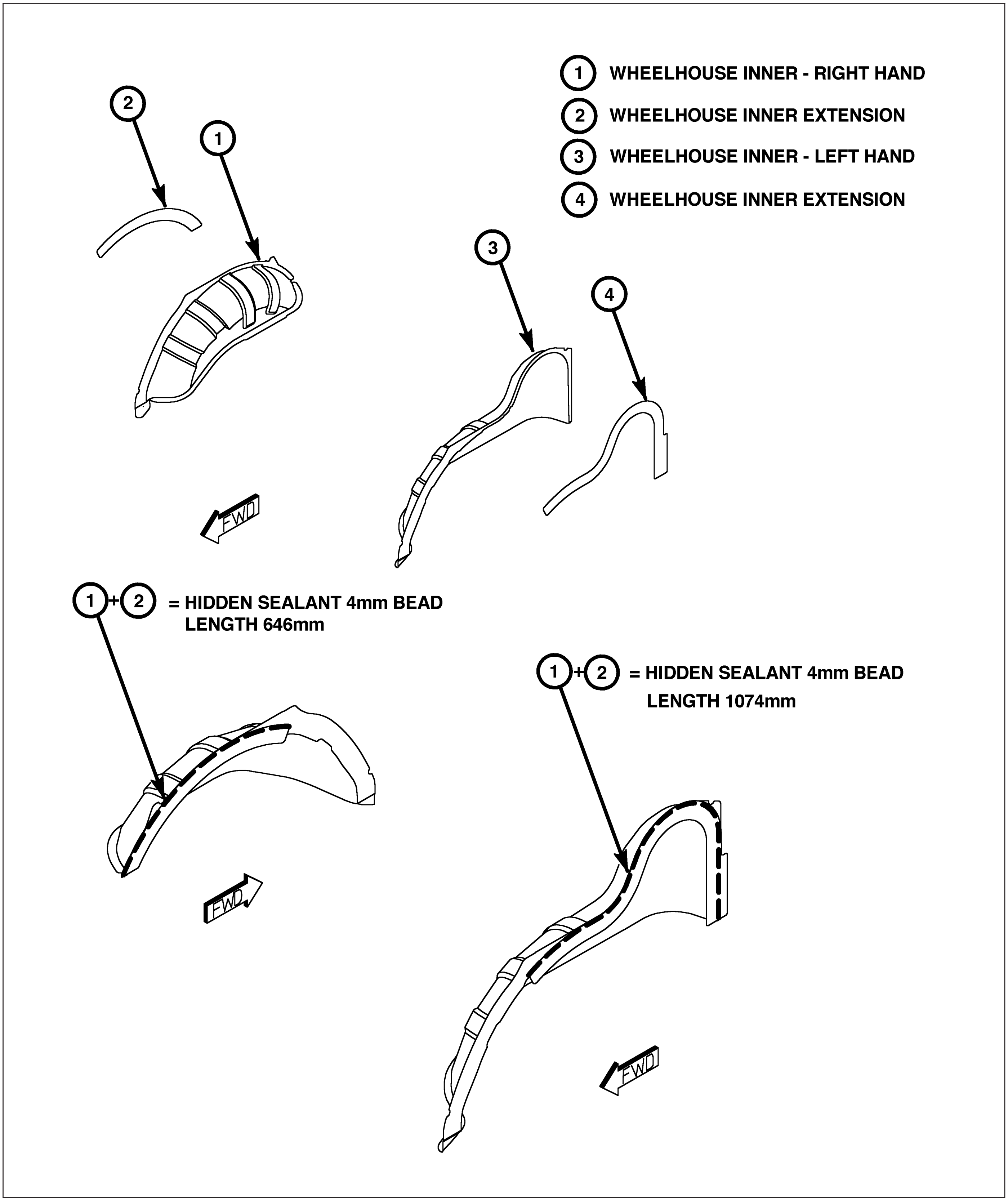



*Fig. 94 WHEELHOUSES*

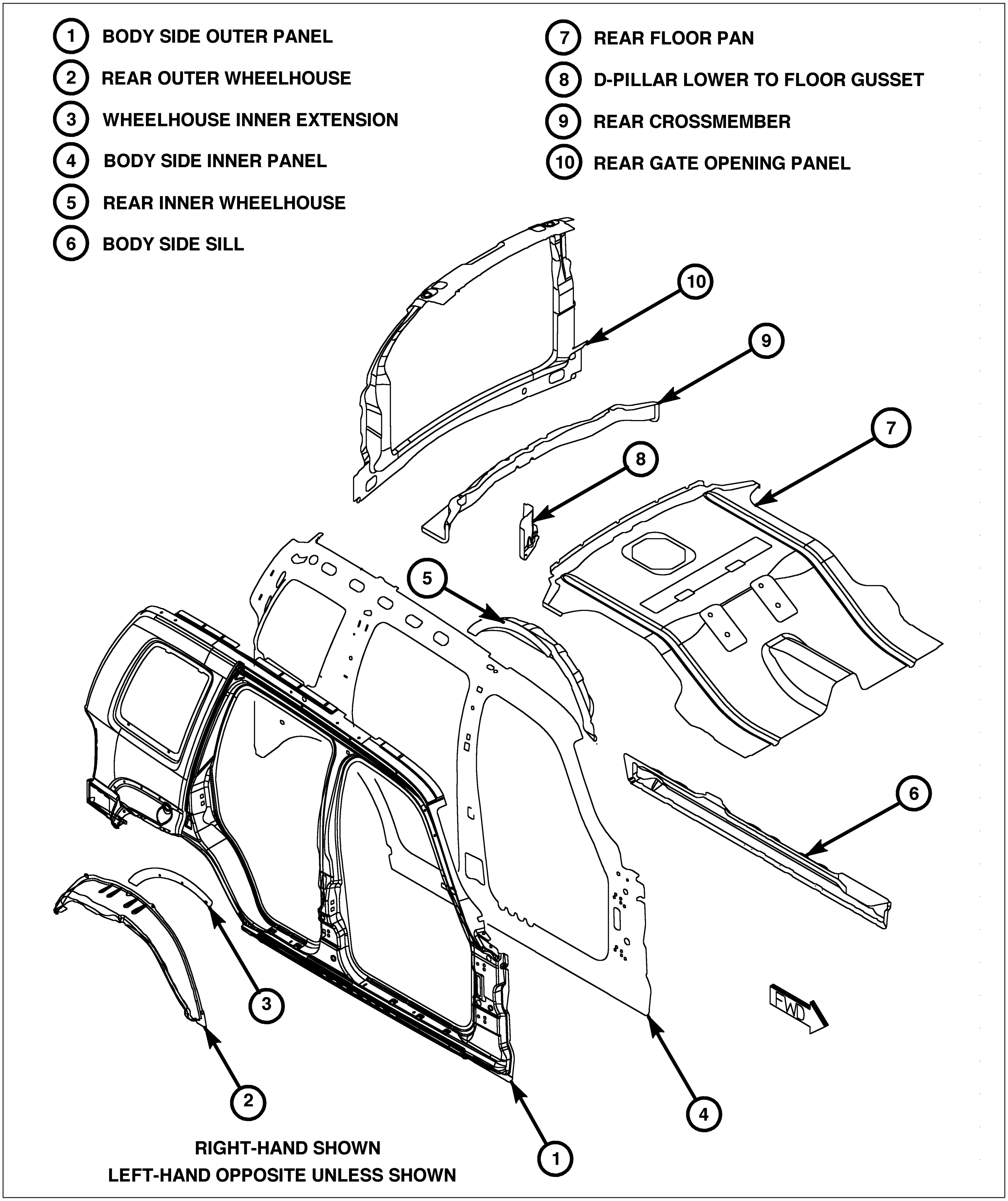



*Fig. 95 BODY SIDE PANEL ASSEMBLY*

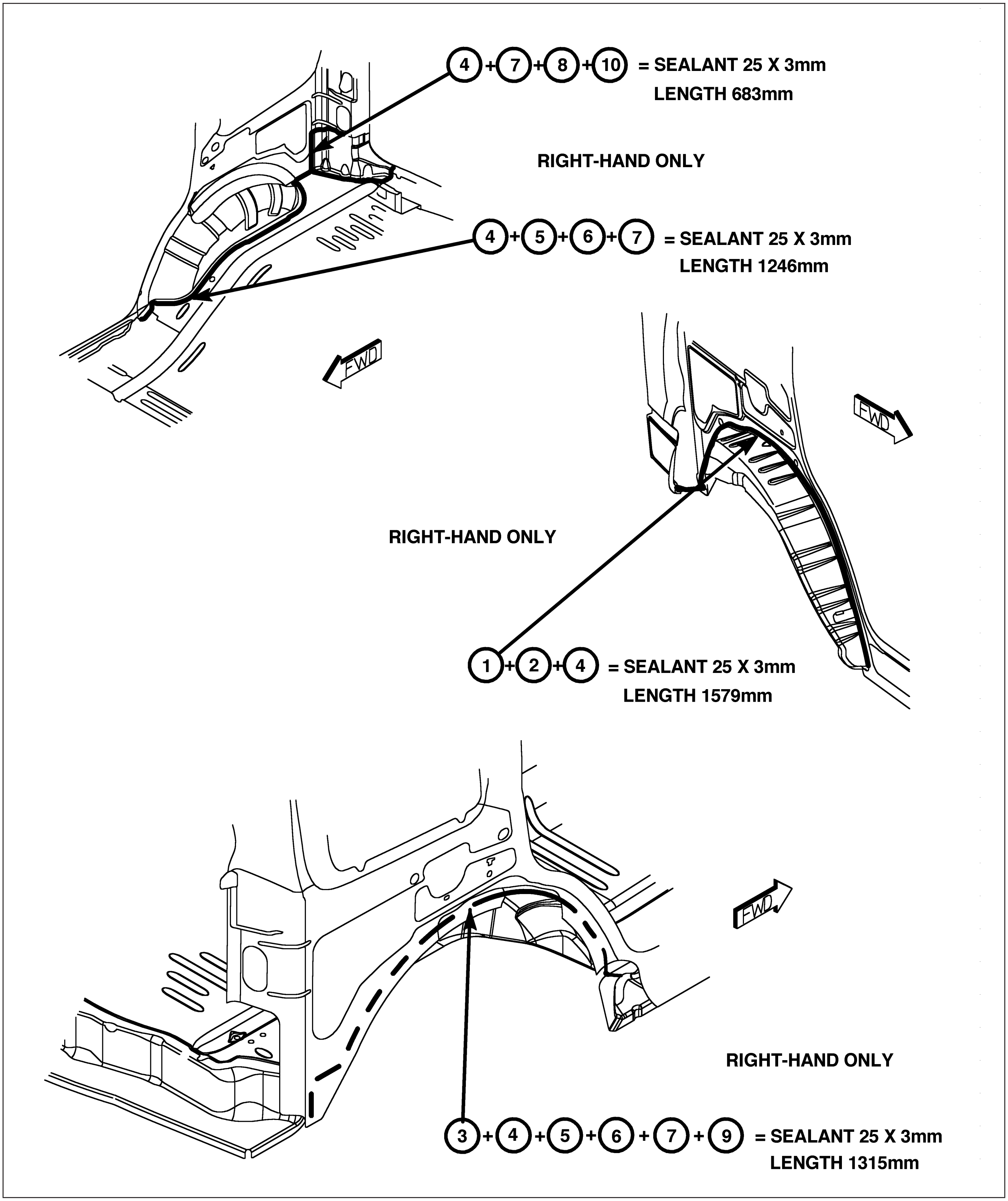



*Fig. 96 WHEELHOUSES*

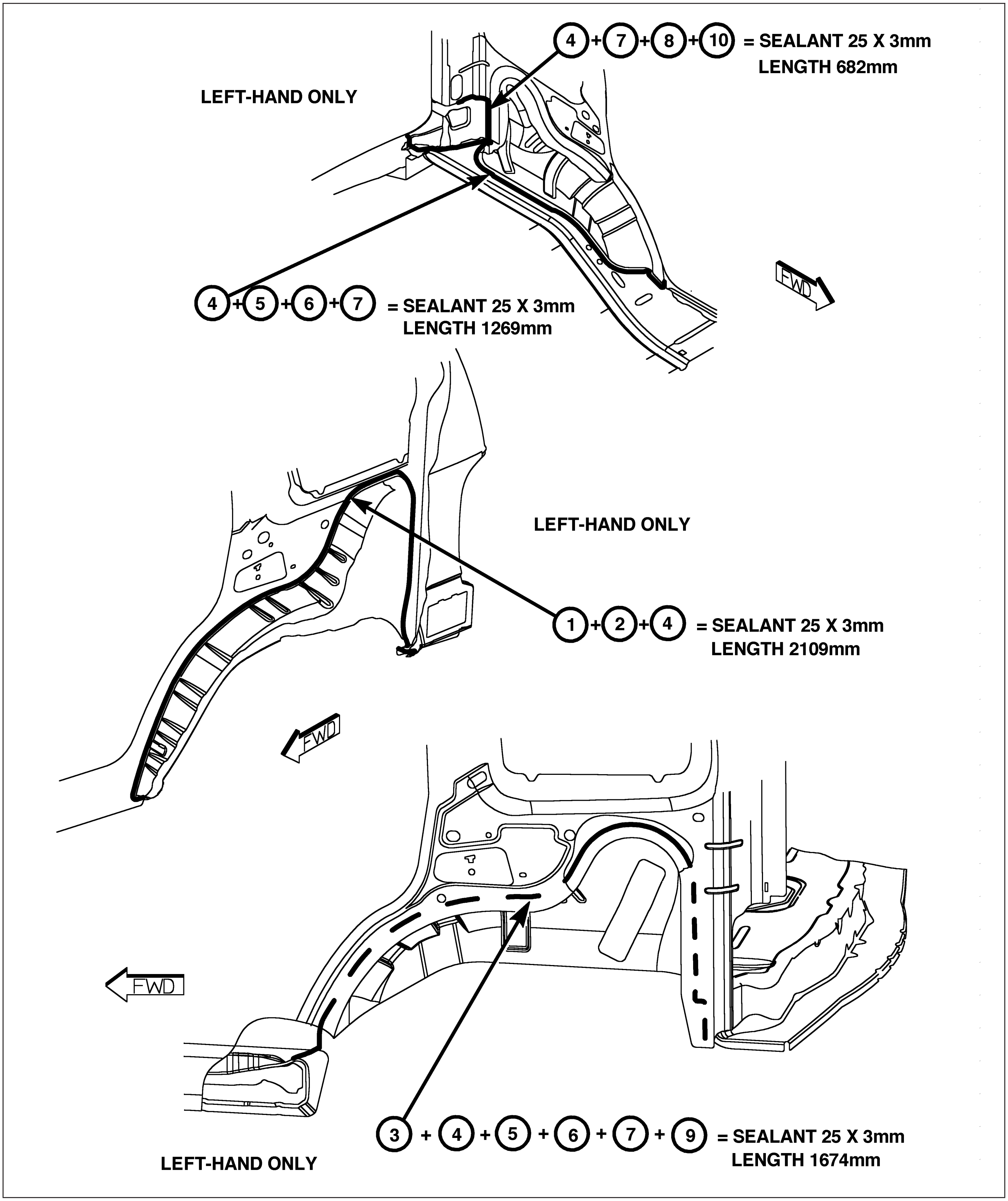



*Fig. 97 WHEELHOUSES*

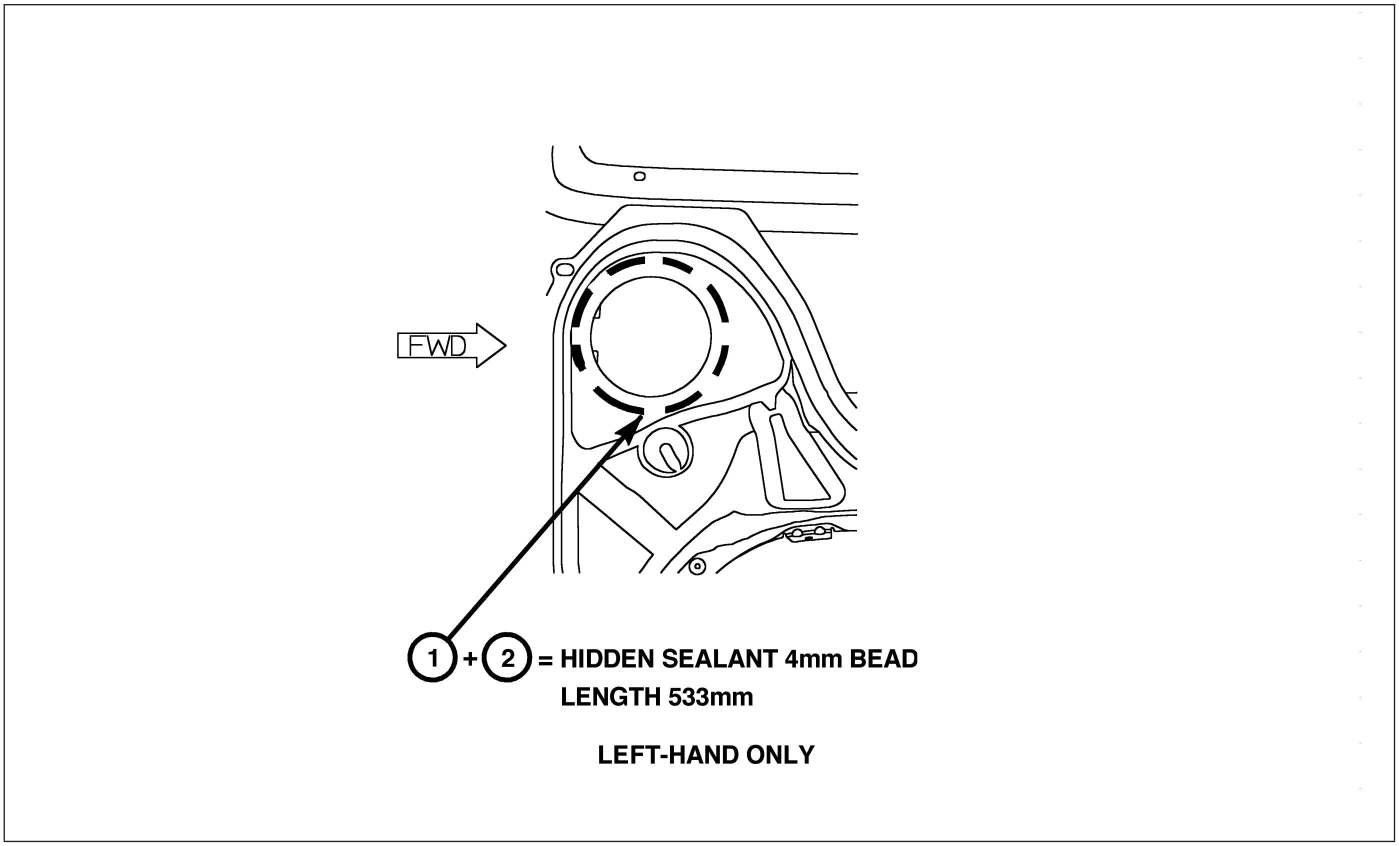



*Fig. 98 WHEELHOUSE*

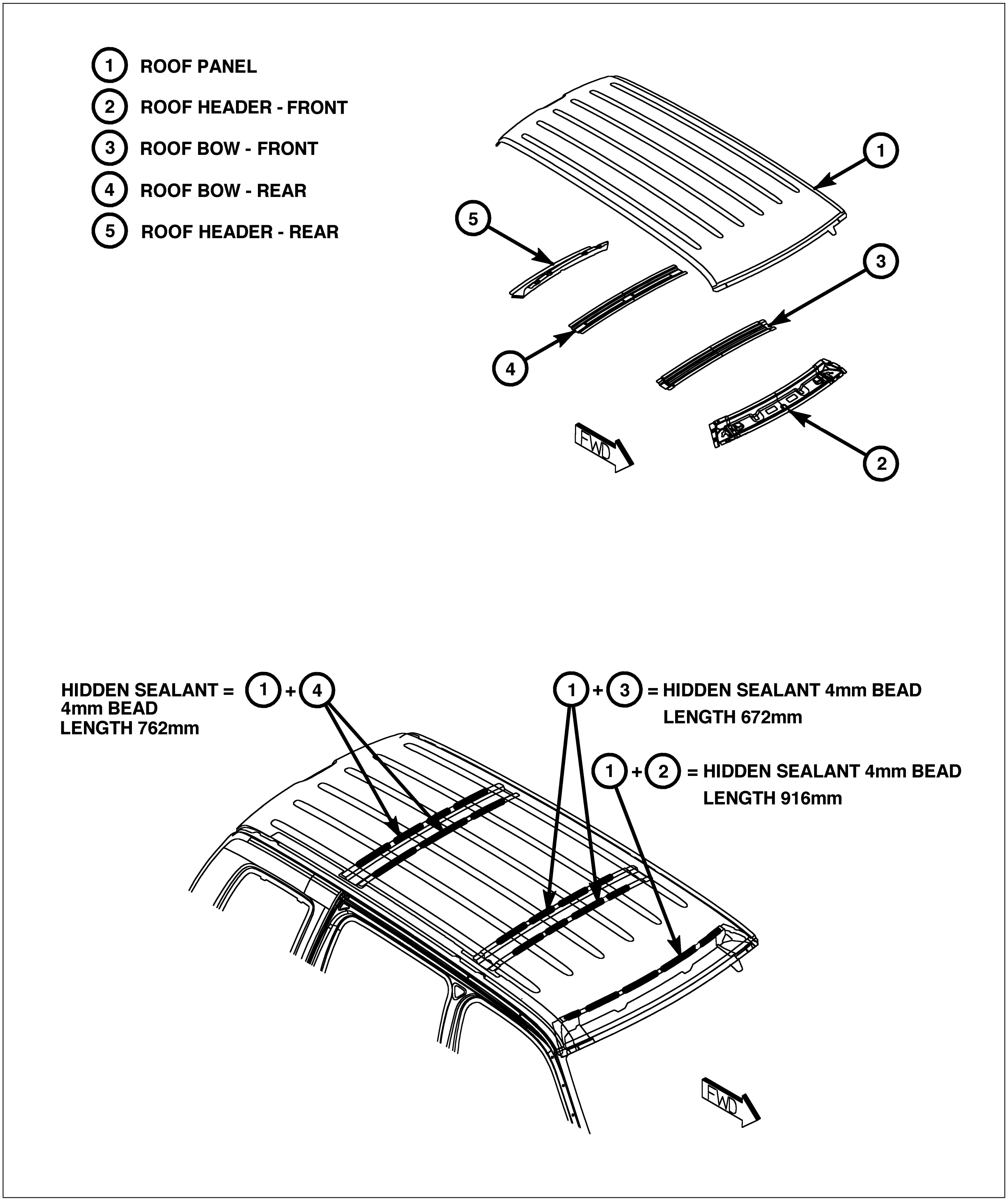



*Fig. 99 ROOF PANEL ASSEMBLY*

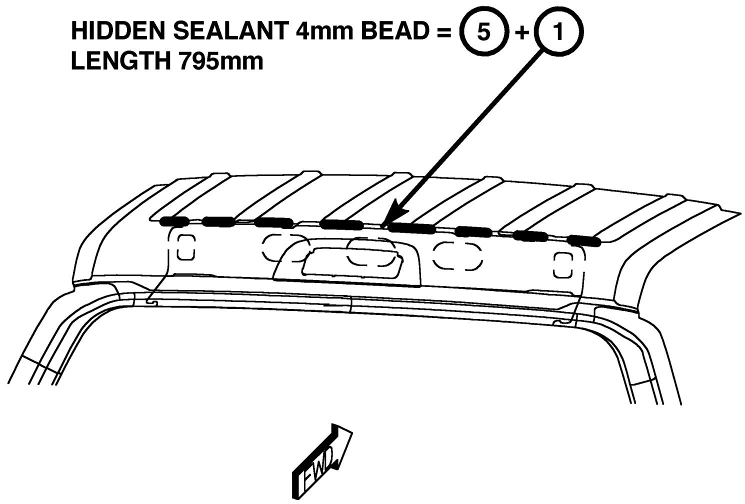



*Fig. 100 ROOF PANEL/REAR ROOF HEADER*

# OPENING DIMENSIONS

## SPECIFICATIONS

### INDEX

| DESCRIPTION | FIGURE |
|---|---|
| ENGINE COMPARTMENT | ( 101 ) |
| WINDSHIELD OPENING | ( 102 ) |
| BODY SIDE OPENINGS | ( 103 ) |
| SWING GATE OPENING | ( 104 ) |

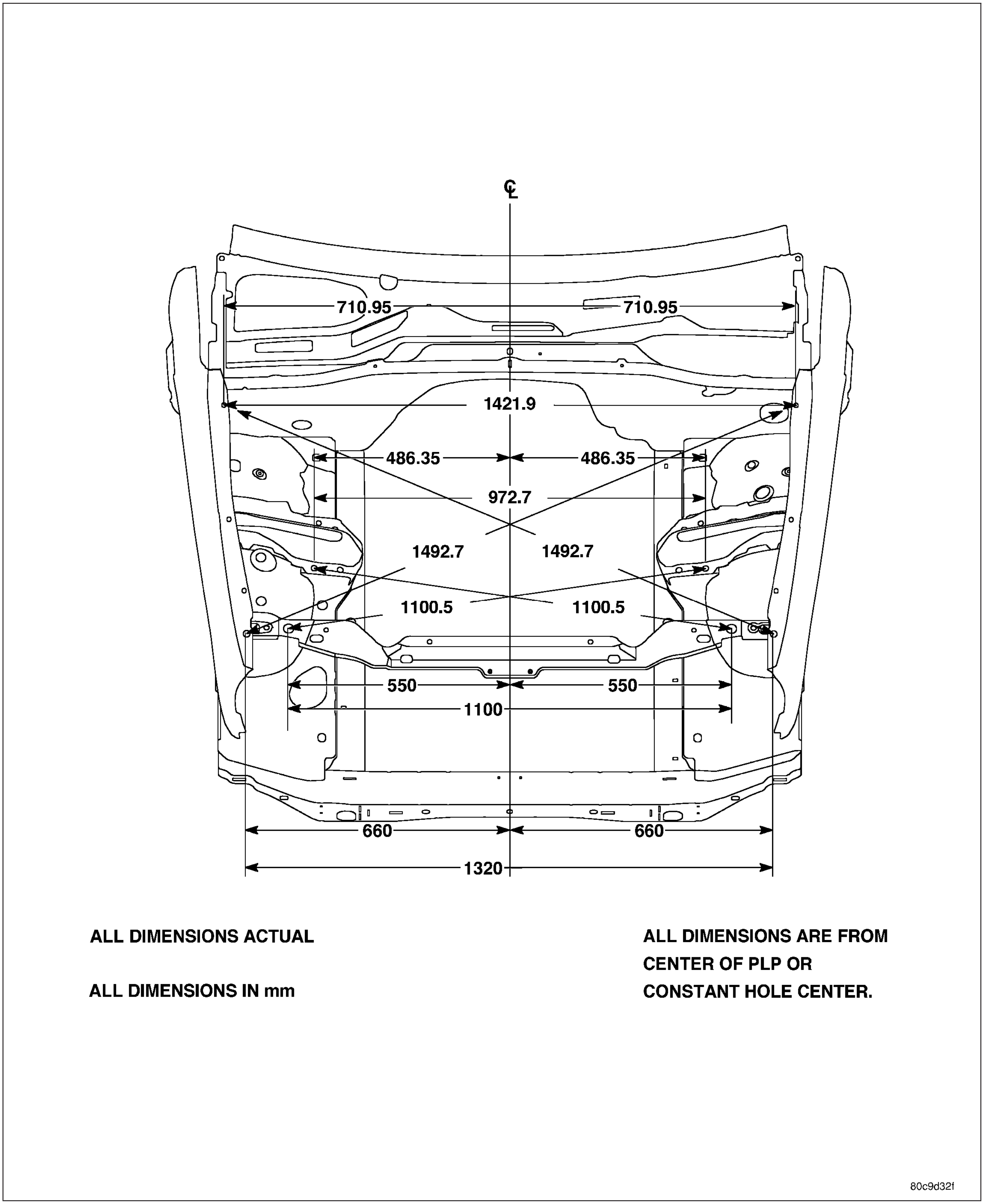



*Fig. 101 ENGINE COMPARTMENT*

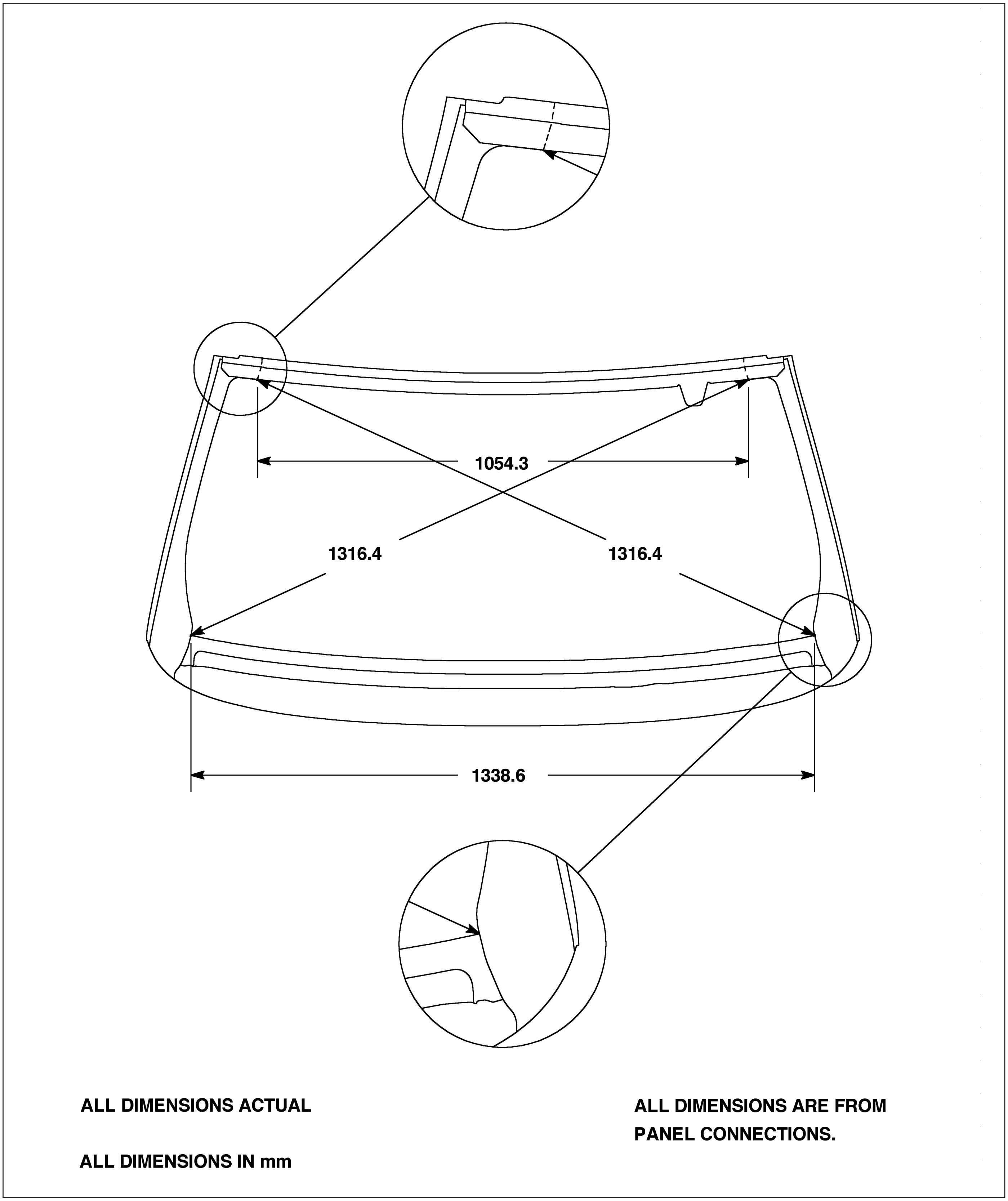



*Fig. 102 WINDSHIELD OPENING*

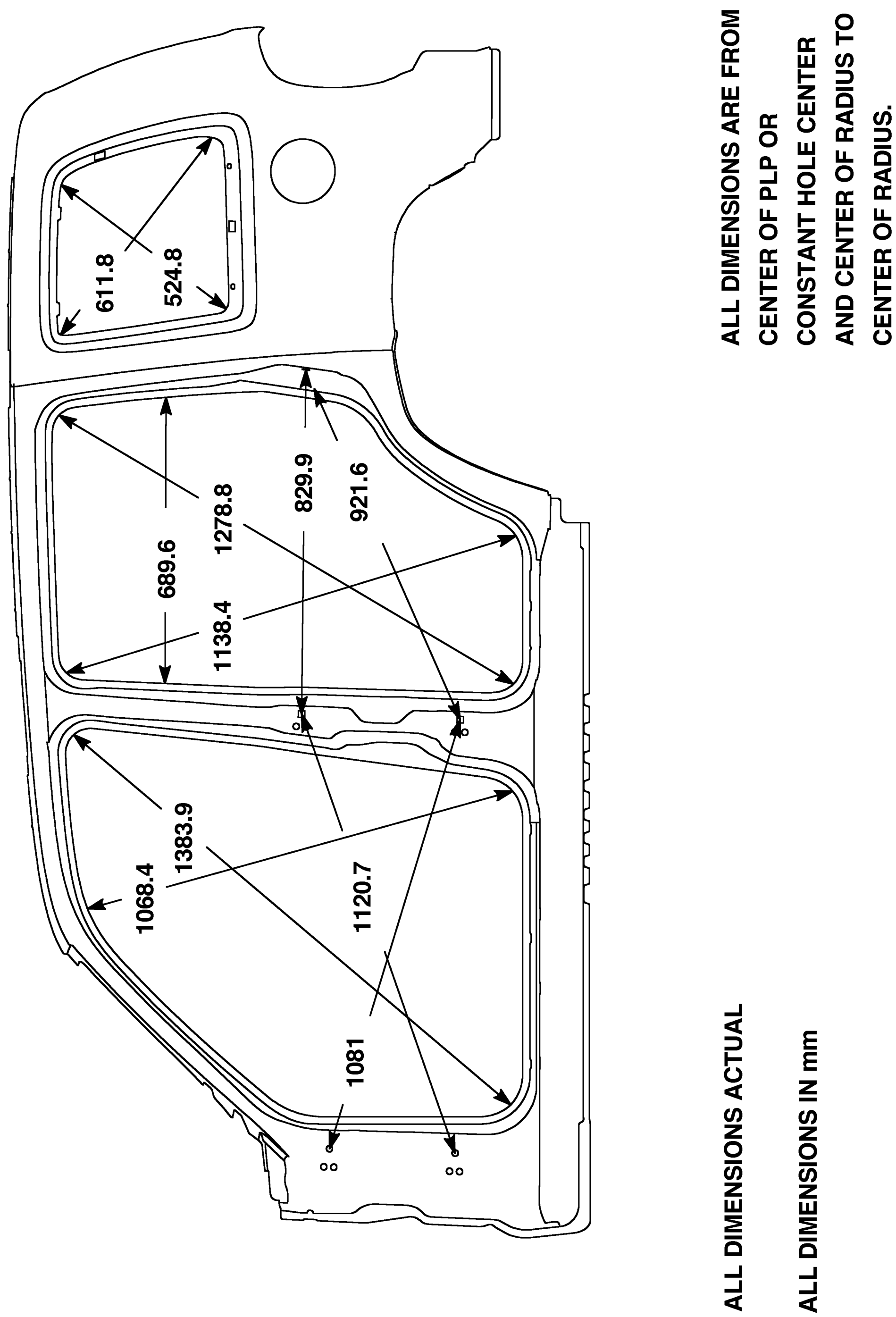



Fig. 103 BODY SIDE OPENINGS

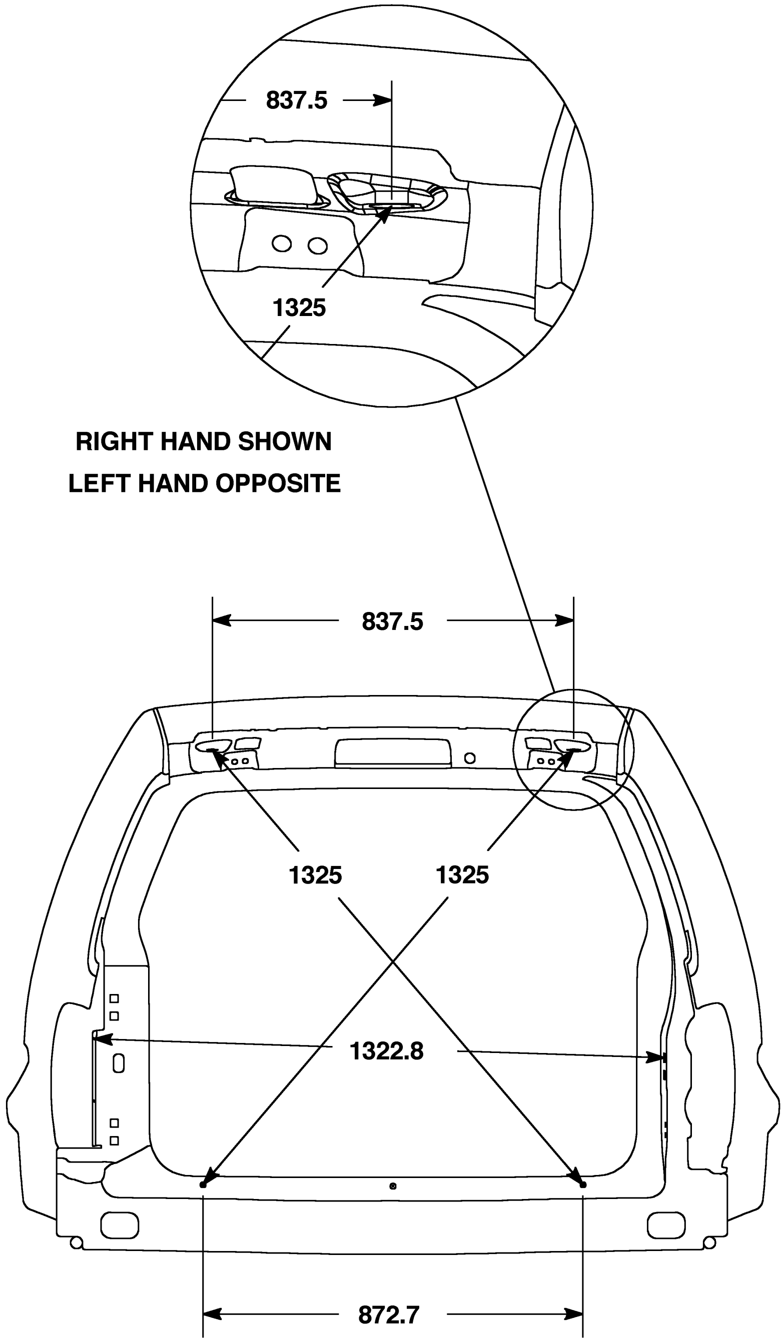



*Fig. 104 SWING GATE OPENING*

# GAP AND FLUSH

## SPECIFICATIONS

### GAP & FLUSH DIMENSIONS INDEX

| DESCRIPTION | FIGURE |
|---|---|
| FRONT QUADRANT | ( 105 ) |
| REAR QUADRANT | ( 106 ) |

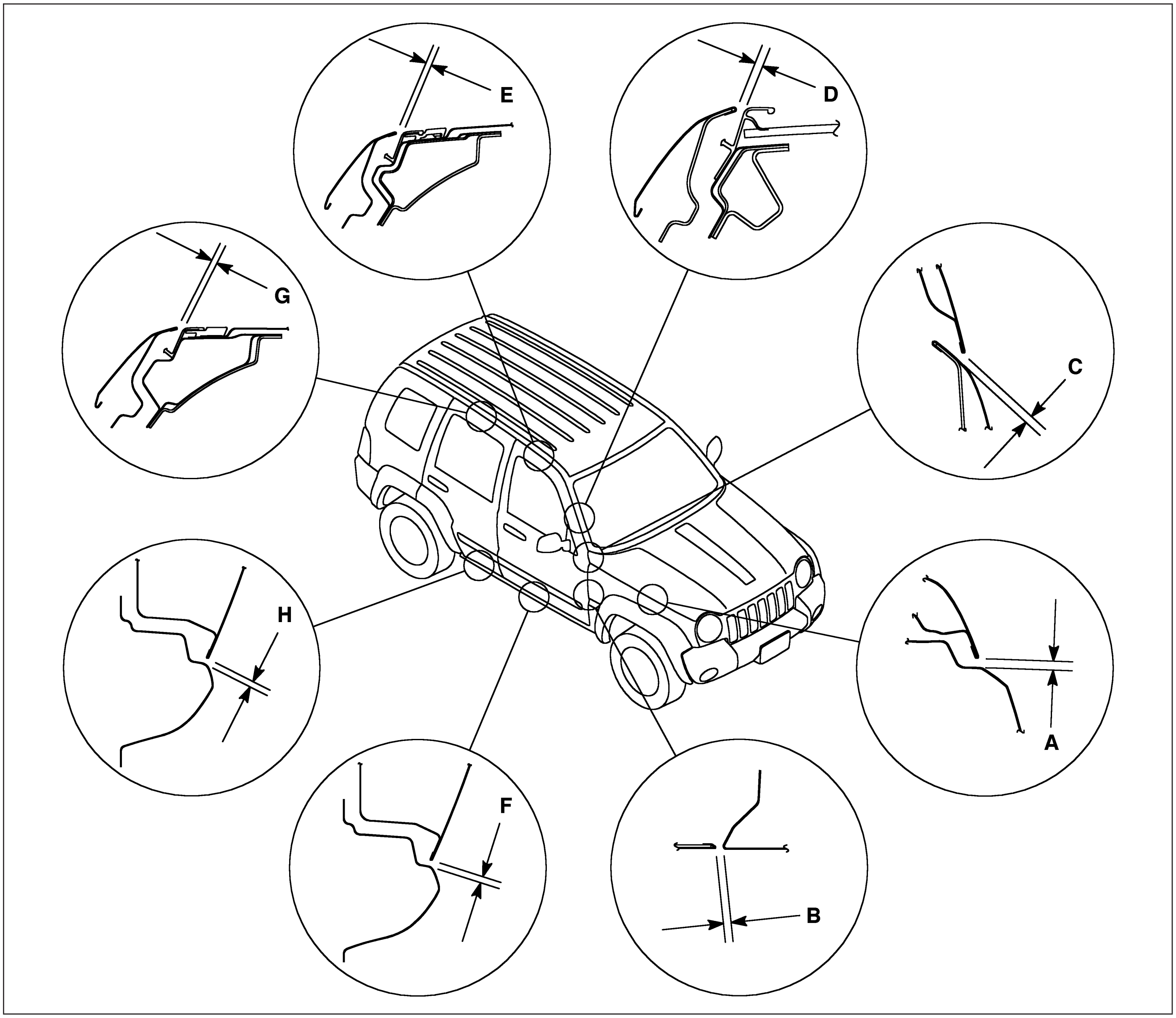



*Fig. 105 GAP & FLUSH/FRONT QUADRANT*

**NOTE: All measurements are in mm.**
- **O/F = Over Flush**
- **U/F = Under Flush**

| DIMENSION | GAP | FLUSH | DIMENSION | GAP | FLUSH |
|---|---|---|---|---|---|
| A | 6.0 +/- 2.0 | O/F 12.0 +/- 2.0 | E | 5.0 +/- 1.5 | O/F 3.0 +/- 1.5 |
| B | 5.0 +/- 1.0 | O/F 0.5 +/- 1.5 | F | 6.0 +/- 2.0 | — |
| C | 6.0 +1.5/- 2.0 | — | G | 5.0 +/- 1.5 | O/F 3.0 +/- 1.5 |
| D | 5.0 +1.0/- 2.0 | O/F 5.0 +/- 1.5 | H | 6.0 +/- 2.0 | — |

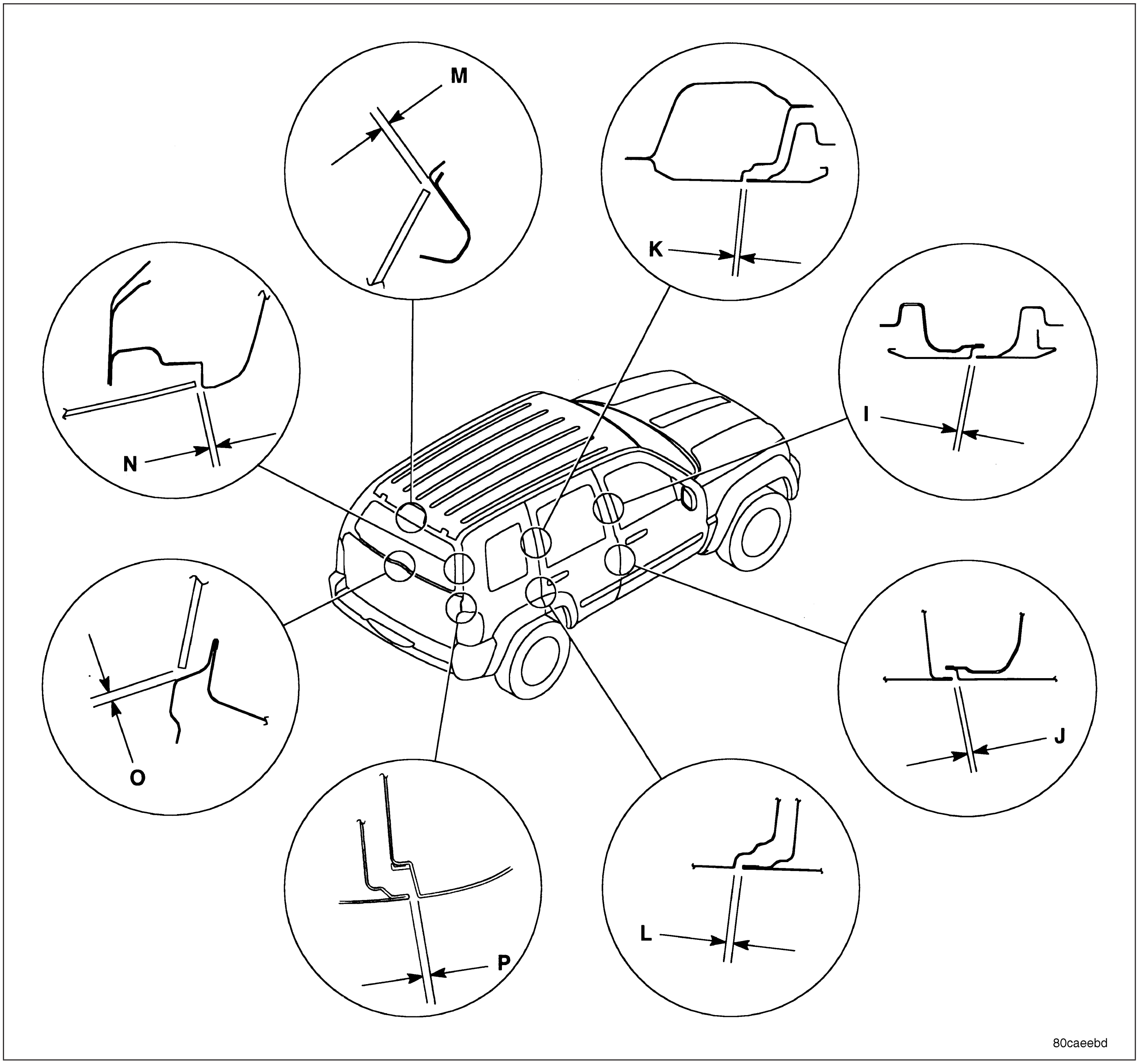



*Fig. 106 GAP & FLUSH/REAR QUADRANT*

**NOTE: All measurements are in mm.**
- **O/F = Over Flush**
- **U/F = Under Flush**

| DIMENSION | GAP | FLUSH | DIMENSION | GAP | FLUSH |
|---|---|---|---|---|---|
| I | 5.0 +/- 1.0 | 0.0 +/- 1.5 | M | 6.0 +/- 1.5 | U/F 4.7 +2.5/-1.0 |
| J | 5.0 +/- 1.0 | 0.0 +/- 1.5 | N | 6.0 +/- 1.5 | U/F 4.0 +2.5/-1.0 |
| K | 5.0 +/- 1.0 | 0.0 +/- 1.5 | O | 6.0 +/- 1.5 | 0.0 - 2.0 O/F |
| L | 5.0 +/- 1.0 | 0.0 +/- 1.5 | P | 5.0 +/- 1.0 | U/F 0.5 +/- 1.0 |

# HEATING & AIR CONDITIONING

## TABLE OF CONTENTS

# HVAC - SERVICE INFORMATION

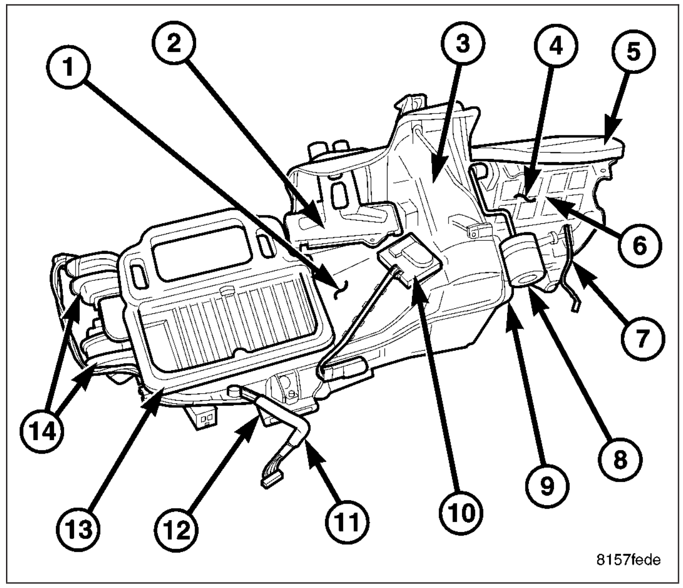
## DESCRIPTION

A manual temperature control (MTC) single zone type heating-A/C system is standard equipment on this vehicle.

To maintain the performance level of the heating, ventilation and air conditioning (HVAC) system, the engine cooling system must be properly maintained. The use of a bug screen is not recommended. Any obstructions in front of the radiator or A/C condenser will reduce the performance of the A/C and engine cooling systems.

The engine cooling system includes the radiator, thermostat, radiator hoses and the engine coolant pump. Refer to 7 - Cooling for more information before opening or attempting any service to the engine cooling system.

All vehicles are equipped with a common heater, ventilation and air conditioning (HVAC) housing (1). The heating-A/C system combines A/C, heating, and ventilating capabilities in a single HVAC housing mounted within the passenger compartment behind the instrument panel. The HVAC housing includes:



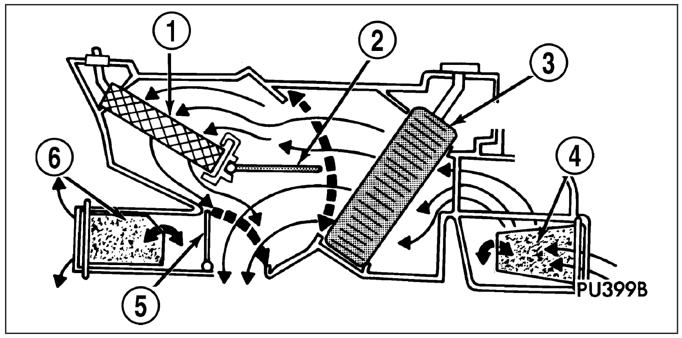

- Heater core (2)
- A/C evaporator (3)
- Air inlet housing (4) and foam seal (5)
- Recirculation-air door (6)
- Blower motor (7)
- Recirculation door actuator (8)
- Blower motor resistor (9)
- Blend-air doors and actuator (10)
- HVAC vacuum harness (11)
- Floor distribution duct (12)
- Mode-air doors (13)
- Mode door actuators (14)

Based upon the mode selected, conditioned air can exit the HVAC housing through one or a combination of the three main housing outlets: defrost, panel or floor. The defrost and panel outlets are located on the top of the housing and the floor outlet is located on the bottom of the housing. Once the conditioned air exits the HVAC housing, it is further directed through molded plastic ducts to the outlets within the vehicle interior. These outlets and their locations are as follows:

- **Defroster Outlet** - Dual defroster outlets are located in the center of the instrument panel top cover, near the base of the windshield.
- **Side Window Demister Outlets** - There are two side window demister outlets, one is located at each outboard end of the instrument panel top cover, near the belt line at the A-pillars.
- **Panel Outlets** - There are four panel outlets in the instrument panel, one located near each outboard end of the instrument panel facing the rear of the vehicle and two located near the top of the instrument panel center bezel.
- **Front Floor Outlets** - There are two front floor outlets, one located above each side of the center of the floor panel near the dash panel.
- **Rear Floor Outlets** - There are four rear floor outlets, two located on each side of the floor console near the rear of each front seat.

## OPERATION

The heating-A/C system used in this vehicle is a single zone, blend-air type system. In this blend-air heating-A/C system, a blend-air door controls the amount of conditioned air that is allowed to flow through, or around, the heater core. The temperature control adjusts discharge air temperature by operating an electric actuator, which operates the blend-air door. This allows an almost immediate control of the output air temperature of the system. The A/C system is designed for the use of non-CFC, R-134a refrigerant and uses an A/C evaporator to cool and dehumidify the incoming air prior to blending it with the heated air.




The heating-A/C system pulls outside (ambient) air through the cowl opening at the base of the windshield, then into the air inlet housing and through the A/C evaporator (3). Air flow can be directed either through or around the heater core (1). This is done by adjusting the position of the blend-air door (2) by an electric actuator using the temperature control on the A/C-heater control. The air flow can then be directed from the panel, floor and defrost outlets in various combinations using the mode control located on the A/C-heater control. Air flow velocity can be adjusted with the blower speed control located on the A/C-heater control.

The outside (fresh) air intake can be shut off by selecting the Recirculation Mode with the mode control. This will operate a vacuum actuated recirculation-air door (4) that closes off the fresh air intake and recirculates the air that is already inside the vehicle.

The A/C compressor is engaged by placing the mode control in any A/C mode and mix to defrost positions. This will remove heat and humidity from the air before it is directed through or around the heater core. The mode control on the A/C-heater control is used to also direct the conditioned air to the selected system outlets. The mode control uses vacuum actuators to control the mode-air doors (5 and 6).

The defroster outlet receives airflow from the HVAC housing through the molded plastic defroster duct, which is connected to the HVAC housing defroster outlet. The airflow from the defroster outlet is directed by fixed vanes in the defroster outlet grille and cannot be adjusted.

The side window demister outlets receive airflow from the HVAC housing through the molded plastic defroster duct and molded plastic demister ducts. The airflow from the side window demister outlets is directed by fixed vanes in the demister outlet grilles and cannot be adjusted. The demisters direct air from the HVAC housing through the outlets located on the top corners of the instrument panel. The demisters operate when the mode control is positioned in the floor-defrost and defrost-only settings. Some air may be noticeable from the demister outlets when the mode control is in the bi-level to floor positions.

The panel outlets receive airflow from the HVAC housing through a molded plastic main panel duct, center panel duct and two end panel ducts. The two end panel ducts direct airflow to the left and right instrument panel outlets, while the center panel duct directs airflow to the two center panel outlets. Each of these outlets can be individually adjusted to direct the flow of air.

The floor outlets receive airflow from the HVAC housing through the floor distribution duct. The front floor outlets are integral to the molded plastic floor distribution duct, which is secured to the bottom of the HVAC housing. The floor outlets cannot be adjusted.

**NOTE: It is important to keep the air intake opening clear of debris. Leaf particles and other debris that is small enough to pass through the cowl opening screen can accumulate within the HVAC housing. The closed, warm, damp and dark environment created within the housing is ideal for the growth of certain molds, mildews and other fungi. Any accumulation of decaying plant matter provides an additional food source for fungal spores, which enter the housing with the fresh intake-air. Excess debris, as well as objectionable odors created by decaying plant matter and growing fungi can be discharged into the passenger compartment during heater-A/C operation if the air intake opening is not kept clear of debris.**

This A/C system uses an A/C fixed orifice tube located in the liquid line to meter the flow of refrigerant to the A/C evaporator. The A/C evaporator cools and dehumidifies the incoming air prior to blending it with the heated air. To maintain minimum evaporator temperature and prevent evaporator freezing, the A/C clutch is cycled on and off by the A/C low pressure switch mounted on the A/C accumulator.

## DIAGNOSIS AND TESTING

## A/C PERFORMANCE

The A/C system is designed to provide the passenger compartment with low temperature and low humidity air. The A/C evaporator, located in the HVAC housing is cooled to temperatures near the freezing point. As warm damp air passes over the fins of the A/C evaporator, the air transfers its heat to the refrigerant in the evaporator coils and the moisture in the air condenses on the evaporator fins. During periods of high heat and humidity, an A/C system will be more effective in the Recirculation mode (max-A/C). With the system in the Recirculation mode, only air from the passenger compartment passes through the A/C evaporator. As the passenger compartment air dehumidifies, the A/C system performance levels rise.

Humidity has an important bearing on the temperature of the air delivered to the interior of the vehicle. It is important to understand the effect that humidity has on the performance of the A/C system. When humidity is high, the A/C evaporator has to perform a double duty. It must lower the air temperature, and it must lower the temperature of the moisture in the air that condenses on the evaporator fins. Condensing the moisture in the air transfers heat energy into the evaporator fins and coils. This reduces the amount of heat the A/C evaporator can absorb from the air. High humidity greatly reduces the ability of the A/C evaporator to lower the temperature of the air.

However, evaporator capacity used to reduce the amount of moisture in the air is not wasted. Wringing some of the moisture out of the air entering the vehicle adds to the comfort of the passengers. Although, an owner may expect too much from their A/C system on humid days. A performance test is the best way to determine whether the system is performing up to design standards. This test also provides valuable clues as to the possible cause of trouble with the A/C system. The ambient air temperature in the location where the vehicle will be tested must be a minimum of 21° C (70° F) for this test.

## A/C PERFORMANCE TEST

**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.**

1. Check for diagnostic trouble codes using a scan tool. If no DTCs are found in the powertrain control module (PCM) or engine control module (ECM), depending on engine application, go to Step 2. If any DTCs are found, repair as required, then proceed to Step 2.
2. Connect a tachometer and a manifold gauge set or an A/C recycling/charging station.
3. Operate the heating-A/C system under the following conditions.
   - Engine at 1,000 rpm at operating temperature
   - Door or windows open
   - Transmission in Park or Neutral with parking brake set (depending on application)
   - A/C-heater controls set to Recirculation mode (max-A/C), full cool, panel mode, high blower and with A/C compressor engaged. If the A/C compressor does not engage, see the A/C System Diagnosis chart.
4. Insert a thermometer in the driver side center panel air outlet and operate the A/C system until the thermometer temperature stabilizes.
5. With the A/C compressor clutch engaged, compare the air temperature at the center panel outlet and the A/C compressor discharge pressure (high side) to the A/C Performance Temperature and Pressure chart. The compressor clutch may cycle, depending upon the ambient temperature and humidity. If the clutch cycles, use the readings obtained before the clutch disengaged.

**A/C PERFORMANCE TEMPERATURE AND PRESSURE**

| **Ambient Air Temperature** | 21° C (70° F) | 27° C (80° F) | 32° C (90° F) | 38° C (100° F) | 43° C (110° F) |
|---|---|---|---|---|---|
| **Air Temperature at Center Panel Outlet** | 7° C (45° F) | 7° C (45° F) | 13° C (55° F) | 13° C (55° F) | 18° C (64° F) |
| **Compressor Inlet Pressure at Service Port (Low Side)** | 138 to 207 kPa (20 to 30 psi) | 172 to 241 kPa (25 to 35 psi) | 207 to 276 kPa (30 to 40 psi) | 241 to 310 kPa (35 to 45 psi) | 276 to 345 kPa (40 to 50 psi) |

| **Ambient Air Temperature** | 21° C (70° F) | 27° C (80° F) | 32° C (90° F) | 38° C (100° F) | 43° C (110° F) |
|---|---|---|---|---|---|
| **Condensor Outlet Pressure at Service Port (High Side)** | 1034 to 1724 kPa (150 to 250 psi) | 1379 to 2068 kPa (200 to 300 psi) | 1724 to 2413 kPa (250 to 350 psi) | 1999 to 2689 kPa (290 to 390 psi) | 2413 to 2965 kPa (350 to 430 psi) |

6. If the air outlet temperature fails to meet the specifications in the A/C Performance Temperature and Pressure chart, or if the A/C compressor discharge pressure is high, refer to the A/C System Diagnosis chart.

**A/C SYSTEM DIAGNOSIS**

| Condition | Possible Causes | Correction |
|---|---|---|
| Rapid A/C clutch cycling (ten or more cycles per minute). | 1. Low refrigerant system charge. | 1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. |
| Equal pressures, but the A/C clutch does not engage. | 1. No refrigerant in the refrigerant system. | 1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. |
| | 2. Faulty fuse. | 2. Check the fuses in the power distribution center and the junction block. Repair the shorted circuit or component and replace the fuses, if required. Refer to Group 8. |
| | 3. Faulty A/C clutch field coil. | 3. See A/C Compressor Clutch in this group. Test the A/C clutch field coil and replace, if required. |
| | 4. Faulty A/C clutch relay. | 4. See A/C Clutch Relay in this group. Test the A/C clutch relay and relay circuits. Repair the circuits or replace the relay, if required. |
| | 5. Improperly installed or faulty A/C low pressure switch. | 5. See A/C Low Pressure Switch in this group. Test the A/C low pressure switch and tighten or replace, if required. |
| | 6. Faulty A/C high pressure switch (diesel engine application). | 6. See A/C High Pressure Switch in this group. Test the A/C high pressure switch and replace, if required. |
| | 7. Faulty A/C pressure transducer (gasoline engine application). | 7. See A/C Pressure Transducer in this group. Test the A/C pressure transducer and replace, if required. |
| | 8. Faulty powertrain control module (PCM) or engine control module (ECM), depending on engine application. | 8. Refer to the proper Diagnostic Procedures manual for testing of the PCM or ECM. Test the PCM or ECM and replace, if required. |
| Normal pressures, but A/C Performance Test air temperatures at center panel outlet are too high. | 1. Excessive refrigerant oil in system. | 1. See Refrigerant Oil Level in this group. Recover the refrigerant from the refrigerant system and inspect the refrigerant oil content. Restore the refrigerant oil to the proper level, if required. |
| | 2. Blend door actuator improperly installed or faulty. | 2. See Blend Door Actuator in this group. Inspect the actuator for proper operation and replace, if required. |
| | 3. Blend-air door inoperative or sealing improperly. | 3. See HVAC Housing in this group. Inspect the blend-air door for proper operation and sealing and correct, if required. |

| Condition | Possible Causes | Correction |
| --- | --- | --- |
| The low side pressure is normal or slightly low, and the high side pressure is too low. | 1. Low refrigerant system charge. | 1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. |
| | 2. Refrigerant flow through the A/C accumulator is restricted. | 2. See A/C Accumulator in this group. Replace the restricted accumulator, if required. |
| | 3. Refrigerant flow through the A/C evaporator is restricted. | 3. See A/C Evaporator in this group. Replace the restricted A/C evaporator, if required. |
| | 4. Faulty A/C compressor. | 4. See A/C Compressor in this group. Replace the A/C compressor, if required. |
| The low side pressure is normal or slightly high, and the high side pressure is too high. | 1. A/C Condenser air flow restricted. | 1. Check the A/C condenser for damaged fins, foreign objects obstructing air flow through the condenser fins, and missing or improperly installed air seals. Clean, repair, or replace components as required. |
| | 2. Inoperative radiator cooling fan. | 2. Test the radiator cooling fan and replace, if required. Refer to Group 7. |
| | 3. Refrigerant system overcharged. | 3. See Refrigerant System Charge Level in this group. Recover the refrigerant from the refrigerant system. Charge the refrigerant system to the proper level, if required. |
| | 4. Air in the refrigerant system. | 4. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. |
| | 5. Engine overheating. | 5. Test the engine cooling system and repair, if required. Refer to Group 7. |
| The low side pressure is too high, and the high side pressure is too low. | 1. Accessory drive belt slipping. | 1. Inspect the accessory drive belt condition and tension. Tighten or replace the accessory drive belt, if required. Refer to Group 7. |
| | 2. Faulty A/C orifice tube. | 2. See A/C Orifice Tube in this group. Replace the liquid line, if required. |
| | 3. Faulty A/C compressor. | 3. See A/C Compressor in this group. Replace the A/C compressor, if required. |
| The low side pressure is too low, and the high side pressure is too high. | 1. Restricted refrigerant flow through the refrigerant lines. | 1. See Liquid Line, Suction Line and A/C Discharge Line in this group. Inspect the refrigerant lines for kinks, tight bends or improper routing. Correct the routing or replace the refrigerant line, if required. |
| | 2. Restricted refrigerant flow through the A/C orifice tube. | 2. See A/C Orifice Tube in this group. Replace the liquid line, if required. |
| | 3. Restricted refrigerant flow through the A/C condenser. | 3. See A/C Condenser in this group. Replace the restricted condenser, if required. |

## HEATER PERFORMANCE

Before performing the following tests, refer to Group 7 - Cooling for the procedures to check the engine coolant level and flow, engine coolant reserve/recovery system operation, accessory drive belt condition and tension, radiator air flow and the fan drive operation.

**WARNING: Do not remove radiator cap when engine is hot, personal injury can result.**

If vehicle has been run recently, wait 15 minutes before removing the radiator cap. Place a rag over the cap and turn it to the first safety stop. Allow pressure to escape through the overflow tube. When the system pressure stabilizes, remove the cap completely.

## MAXIMUM HEATER OUTPUT

Engine coolant is delivered to the heater core through two heater hoses. With the engine idling at normal operating temperature, set the temperature control to the full hot position, the mode control to the floor position, and the blower motor control to the highest speed position. Using a test thermometer, check the temperature of the air being discharged at the front floor outlets. Compare the test thermometer reading to the Heater Temperature Reference chart.

### HEATER TEMPERATURE REFERENCE

| | | | | |
|---|---|---|---|---|
| **Ambient Air Temperature** | 16° C<br>(60° F) | 21° C<br>(70° F) | 26° C<br>(80° F) | 32° C<br>(90° F) |
| **Minimum Air Temperature at Floor Outlet** | 52° C<br>(125° F) | 56° C<br>(133° F) | 59° C<br>(139° F) | 62° C<br>(144° F) |

If the heater outlet air temperature is below the minimum specification, refer to Group 7 - Cooling. Both of the heater hoses should be hot to the touch. The coolant return heater hose should be slightly cooler than the coolant supply heater hose. If the return hose is much cooler than the supply hose, locate and repair the engine coolant flow obstruction in the cooling system. Refer to Group 7 - Cooling for more information.

### OBSTRUCTED COOLANT FLOW

Possible locations or causes of obstructed coolant flow are as follows:

- Faulty water pump.
- Faulty thermostat.
- Pinched or kinked heater hoses.
- Improper heater hose routing.
- Plugged heater hoses or supply and return ports at the cooling system connections.
- Plugged heater core.

If proper coolant flow through the cooling system is verified, and heater outlet air temperature is low, a mechanical problem may exist.

### MECHANICAL PROBLEMS

Possible causes of insufficient heat due to mechanical problems are as follows:

- Obstructed cowl air intake.
- Obstructed heater system outlets.
- Faulty engine thermostat.
- Faulty blower motor system.
- Faulty A/C-heater control.
- Faulty blend door actuator.
- Faulty, obstructed or improperly installed blend-air door.

### TEMPERATURE CONTROL

If the heater outlet air temperature cannot be adjusted with the temperature control on the A/C-heater control, the following could require service:

- Faulty A/C-heater control.
- Faulty blend door actuator.
- Faulty, obstructed or improperly installed blend-air door.
- Faulty related wiring harness or connectors.
- Improper engine coolant temperature.

## SPECIFICATIONS

## A/C SYSTEM

| Item | Description | Notes |
|---|---|---|
| A/C Compressor | Denso 10S17 (2.8L diesel engine) | ND-8 PAG oil |
| | Visteon HS-18 (3.7L engine) | VC-46 PAG oil |
| Freeze–up Control | A/C low pressure switch | Input to PCM, accumulator mounted - cycles clutch off below -1° C (30° F), cycles back on above 7.2° C (45° F) |
| Low psi Control | A/C low pressure switch | Opens below 141 kPa (20.5 psi), resets above 234 - 262 kPa (34 - 38 psi) |
| High psi Control | A/C high pressure switch (diesel engine) | A/C discharge line mounted - opens at discharge pressure above 3100 - 3375 kPa (450 - 490 psi), resets at 1860 - 2275 kPa (270 - 330 psi) |
| | A/C pressure transducer (gasoline engines) | A/C discharge line mounted - opens at discharge pressure above 2971 kPa (431 psi) and below 206 kPa (30 psi) |
| Refrigerant Charge Capacity | Refer to the A/C Underhood Specification Label located in the engine compartment. | R-134a refrigerant |
| A/C Clutch Coil Draw | 2.2 - 2.3 amps @ 12V ± 0.5V @ 21° C (70° F) | 2.8L diesel engine. A/C Clutch Field Coil Resistance when measured across coil lead connector is 3.6 ± 0.2 ohms. |
| | 3.1 - 4 amps @ 12V ± 0.5V @ 21° C (70° F) | 3.7L engine |
| A/C Clutch Air Gap | 0.35 - 0.60 mm (0.014 - 0.024 in.) | 2.8L diesel engine |
| | 0.35 - 0.65 mm (0.014 - 0.025 in.) | 3.7L engine |

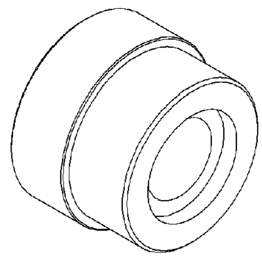
## TORQUE

| Description | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| All Screws NOT Listed Below | 2 | — | 17 |
| A/C Compressor to Engine (2.8L Engine) | 24.5 | 18 | — |
| A/C Compressor to Mounting Bracket Bolts (3.7L Engine–Rear and Inboard Front Bolts) | 55 | 41 | — |
| A/C Compressor to Mounting Bracket Bolt (3.7L Engine–Outboard Front Bolt) | 40 | 30 | — |
| A/C Compressor Clutch Plate Bolt (2.8L) | 20 | 15 | — |

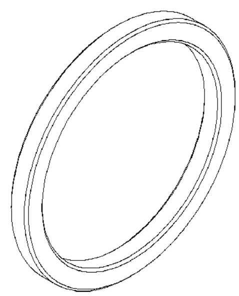
| Description | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| A/C Compressor Clutch Plate Bolt (3.7L) | 15 | — | 133 |
| A/C Condenser to Radiator Bolts | 5 | — | 44 |
| Accumulator Bracket to Dash Nuts | 4.5 | — | 40 |
| Automatic Transmission Cooler to Radiator Bolts | 5 | — | 44 |
| Condenser Upper Bracket to Radiator Bolts | 5 | — | 44 |
| Diesel Engine Coolant Heater to Mounting Bracket Bolts | 33 | 25 | — |
| HVAC Housing to Engine Side of Dash Panel Nuts | 6 | — | 53 |
| HVAC Housing to Passenger Side of Dash Panel Nuts | 6 | — | 53 |
| Liquid Line Bracket to Dash Panel Nut | 5 | — | 44 |
| Liquid Line Front to Rear Section Nut | 22.5 | — | 200 |
| Refrigerant Lines to A/C Evaporator Nuts (RHD Models Only) | 12.5 | — | 110 |
| Refrigerant Lines to A/C Compressor Bolts (2.8L Engine) | 12 | — | 106 |
| Refrigerant Lines to A/C Compressor Nuts (3.7L Engine) | 12 | — | 105 |
| Refrigerant Lines to A/C Condenser Nuts | 22.5 | — | 200 |
| Suction Line to Accumulator Nuts | 12.5 | — | 110 |

## SPECIAL TOOLS

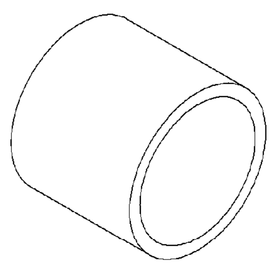
## HEATING-A/C SYSTEM



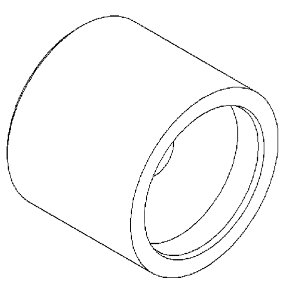
*Compressor Field Coil Installer 9352*



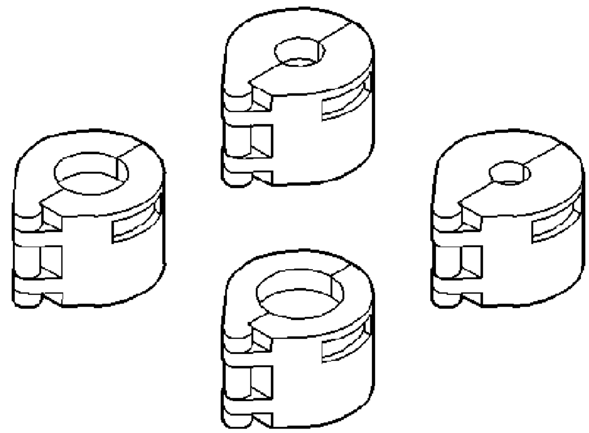
*Compressor Field Coil Installer Spacer 9353*



*Compressor Field Coil Remover 9354*



*Clutch Pulley Installer 9355*



*A/C Line Disconnect Tools 7193*

# CONTROLS

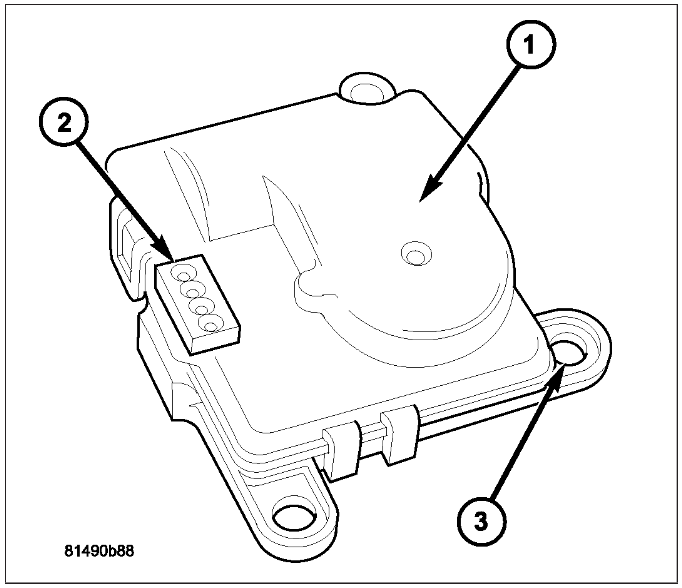
## TABLE OF CONTENTS

# ACTUATOR-BLEND DOOR

## DESCRIPTION

The heating-A/C system uses a reversible, 12-volt direct current (DC) servo motor which mechanically positions the blend-air door. The blend door actuator (1) is located on the top of the HVAC housing.

The blend door actuator is contained within a black molded plastic housing with an integral wire connector receptacle (2) and three integral mounting tabs (3) that allow the actuator to be secured to the HVAC housing. The blend door actuator also has an output shaft with splines that connects it to the linkage that drives the blend-air door. The blend door actuator requires mechanical indexing to the blend door linkage.




## OPERATION

The blend door actuator is connected to the A/C-heater control through the vehicle electrical system by a dedicated three-wire lead and connector of the instrument panel wire harness. The blend door actuator can move the blend-air door in two directions. A potentiometer within the actuator allows the A/C-heater control to know the exact position of the blend-air door at all times.

The blend door actuator can be diagnosed using a scan tool. Refer to 9 - Engine Electrical Diagnostics for more information.

The blend door actuator cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

## REMOVAL

**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.**

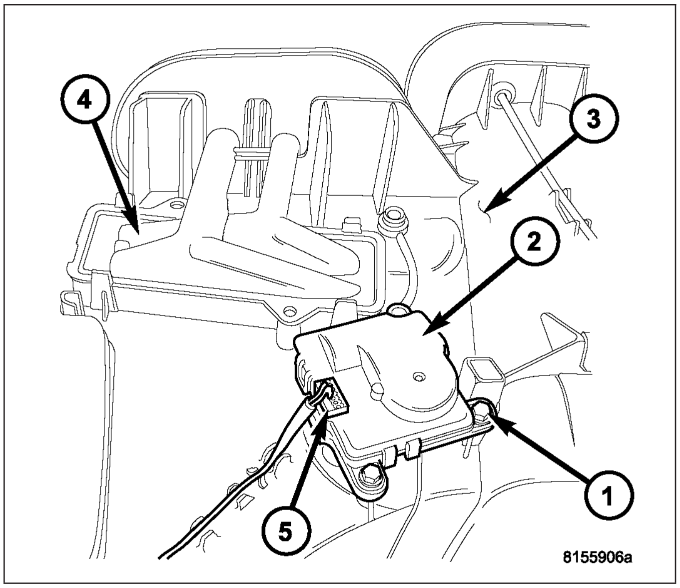
**NOTE: Prior to performing this procedure, turn the ignition key to the On position and set the A/C-heater control in the mid-temperature position and wait 10 seconds.**

**NOTE: LHD model shown in illustration. RHD models similar.**

1. Remove the instrument panel from the vehicle (Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).
2. Remove the three screws (1) that secure the blend door actuator (2) to the top of the HVAC housing (3) near the heater core (4).

**NOTE: Note the actuator shaft position for installation reference.**

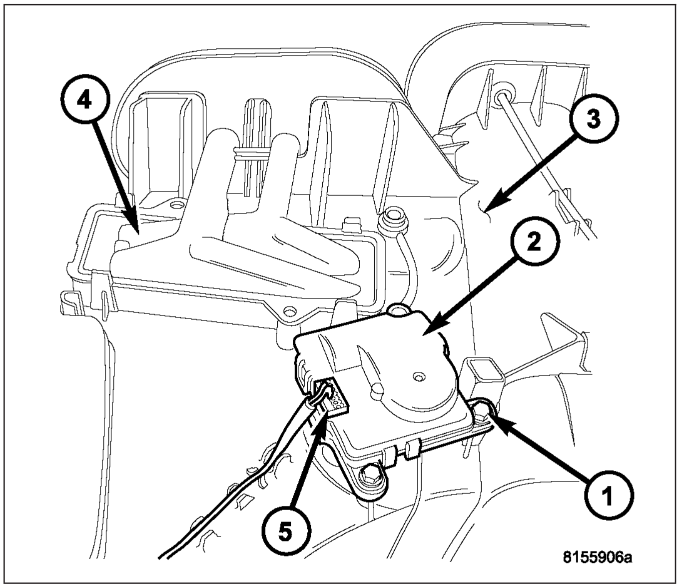
3. Remove the blend door actuator from the HVAC housing and disconnect the wire harness connector (5) from the actuator.
4. Remove the blend door actuator from the vehicle.




## INSTALLATION

**NOTE: LHD model shown in illustration. RHD models similar.**

1. Position the blend door actuator (2) onto the top of the HVAC housing (3) near the heater core (4), making sure the actuator spline is positioned properly with the door spline. If necessary, rotate the actuator slightly to align the splines on the actuator output shaft with those on the blend door pivot.
2. Install the three screws (1) that secure the blend door actuator to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
3. Connect the wire harness connector (5) to the blend door actuator.
4. Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION).



# ACTUATOR-MODE DOOR

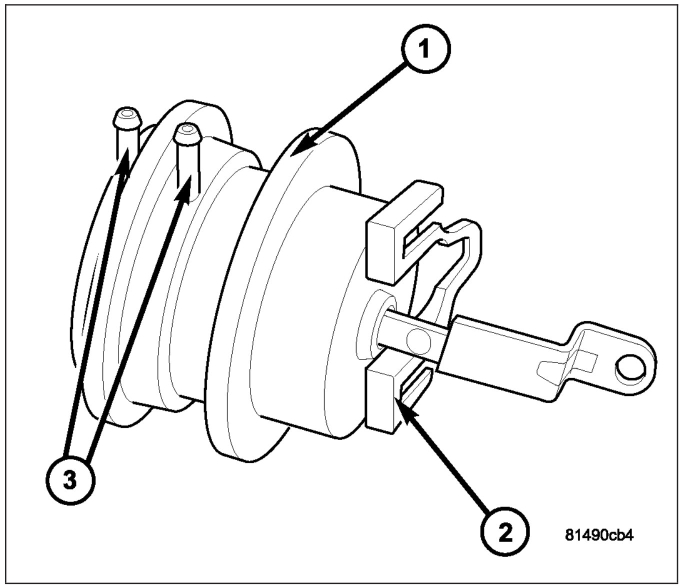
## DESCRIPTION

The heating-A/C system uses two vacuum operated mode door actuators (1) to control the movement of the mode-air doors within the HVAC housing.

When vacuum is supplied by the A/C-heater control to the vacuum connector (3) on one side of the defrost/floor actuator or the panel door actuator, the actuator rod is pulled into the actuator, which moves the mode door lever and mode-air door in one direction. When vacuum is supplied by the A/C-heater control to the other side of the actuator, the rod moves the mode-air door in the other direction.

The mode door actuators are retained to the HVAC housing by an integral mounting provision (2) and can be accessed for service from under the driver side of the instrument panel.

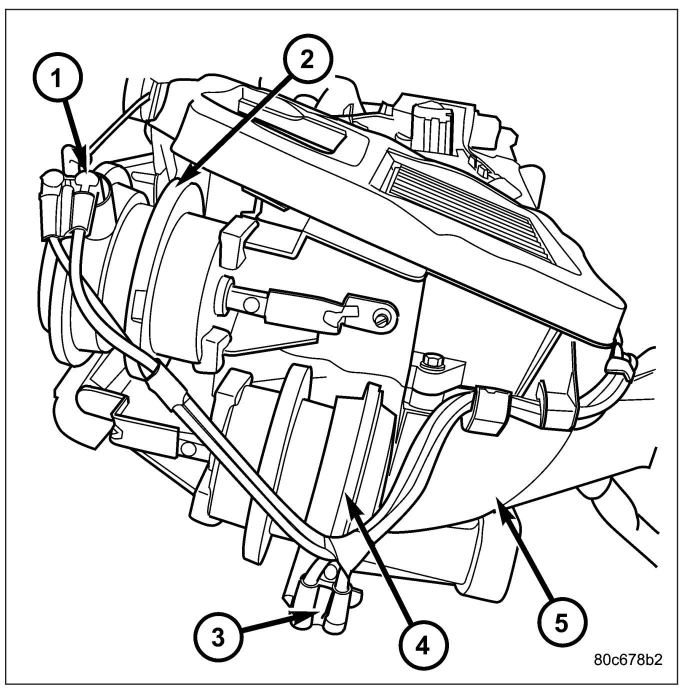
The mode door actuators cannot be adjusted or repaired and, if faulty or damaged, they must be replaced.



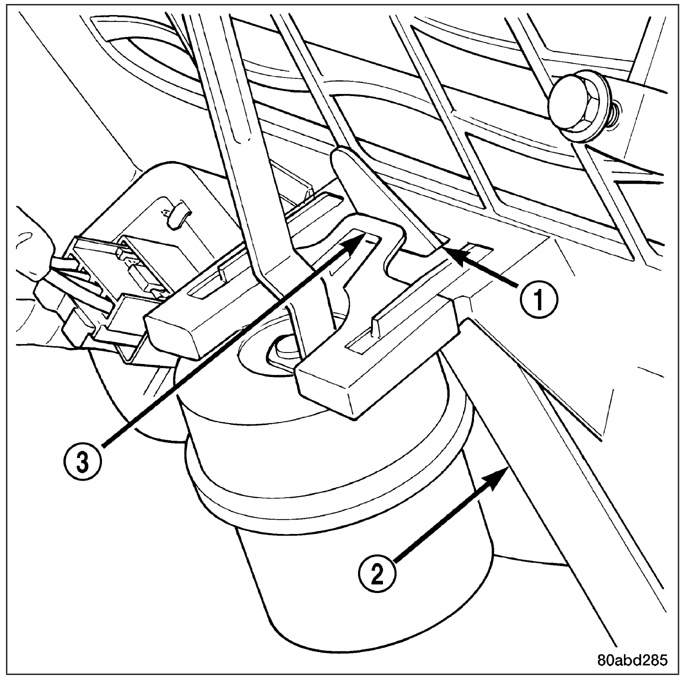

## REMOVAL

**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in an accidental airbag deployment and possible personal injury or death.**

1. Disconnect and isolate the negative battery cable.
2. Remove the knee blocker from the driver side of the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/BLOCKER-KNEE - REMOVAL).
3. Disconnect the vacuum harness connectors (1 and 3) from the panel door actuator (2) or the floor/defrost door actuator (4) located on the driver side of the HVAC housing (5) as required.

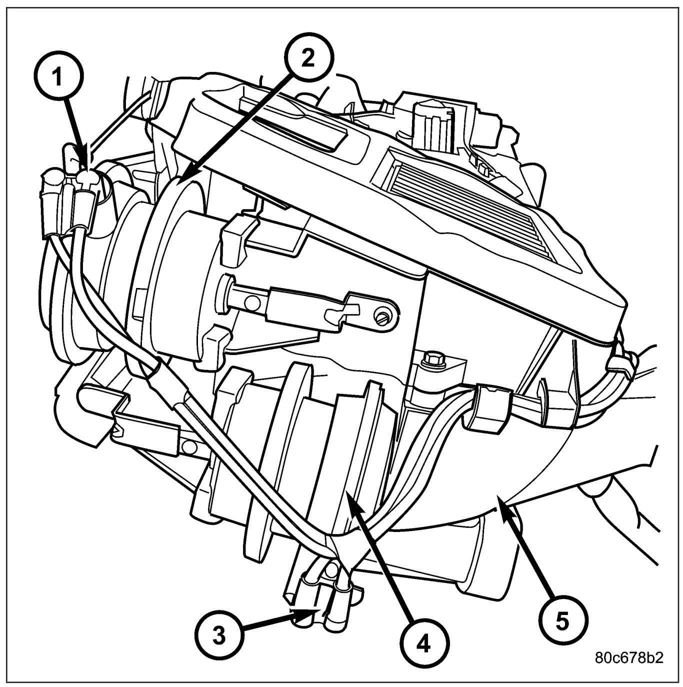


4. Insert a trim stick C-4755 or equivalent (2) into the latch hole of the HVAC housing actuator mount(s) (1). Gently pry the actuator latch (3) away from the HVAC housing mount while pulling firmly outward on the actuator and disconnect the actuator from the HVAC housing.
5. Rotate and tilt the actuator(s) as required to disengage the actuator link from the mode door lever and remove the actuator from the vehicle.




## INSTALLATION

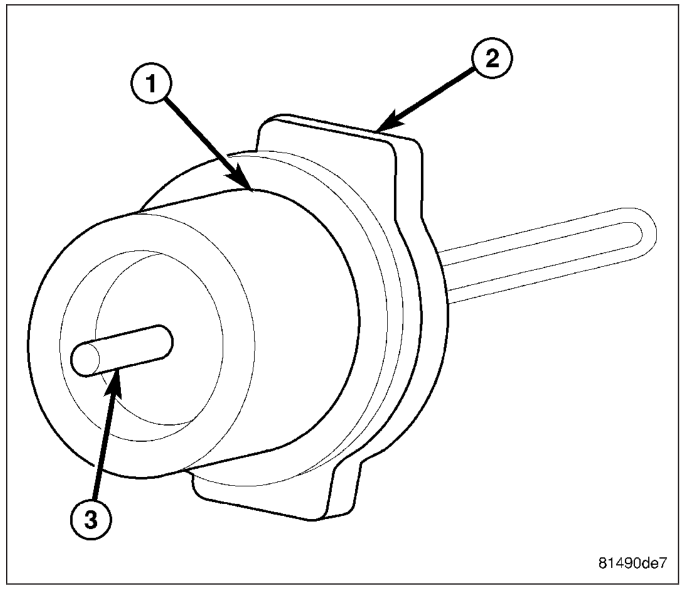
1. Install the panel door actuator (2) or the floor/defrost door actuator (4) as required, by engaging the hole in the end of the actuator link to the hooked pin on the end of the door lever located on the driver side of the HVAC housing (5).
2. Install the actuator(s) onto the actuator mount(s).
3. Connect the vacuum harness connectors (1 and 3) to the actuators as required.
4. Install the knee blocker (Refer to 23 - BODY/INSTRUMENT PANEL/BLOCKER-KNEE - INSTALLATION).
5. Reconnect the negative battery cable.



# ACTUATOR-RECIRCULATION DOOR

## DESCRIPTION

The heating-A/C system uses a vacuum operated recirculation door actuator (1) to control the movement of the recirculation-air door within the HVAC air inlet housing.




When vacuum is supplied by the A/C-heater control to the vacuum connector (3) of the recirculation door actuator, the actuator linkage is pulled into the actuator, which moves the recirculation door lever and recirculation-air door to the Recirculation position. The recirculation door actuator is spring loaded, so when vacuum is released from the actuator, the linkage moves the recirculation-air door back to its static position (fresh air).

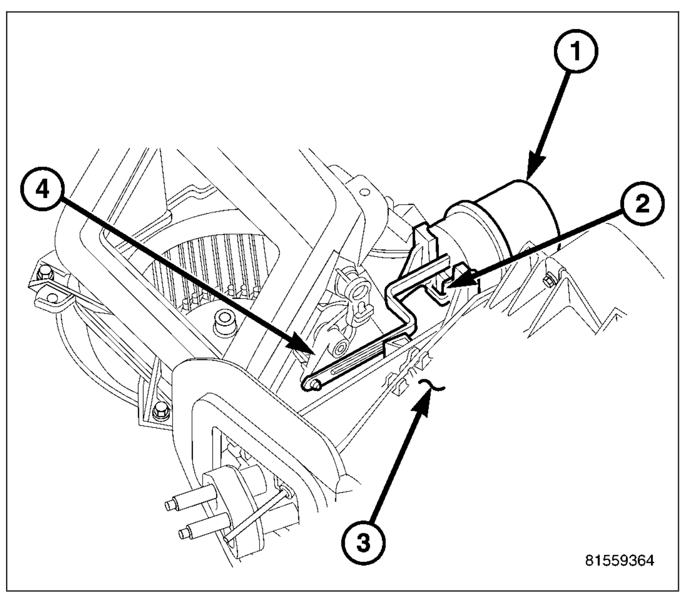
The recirculation door actuator is retained to the HVAC air inlet housing by an integral mounting provision (2) and can be accessed for service by removing the instrument panel.

The recirculation door actuator cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

## REMOVAL

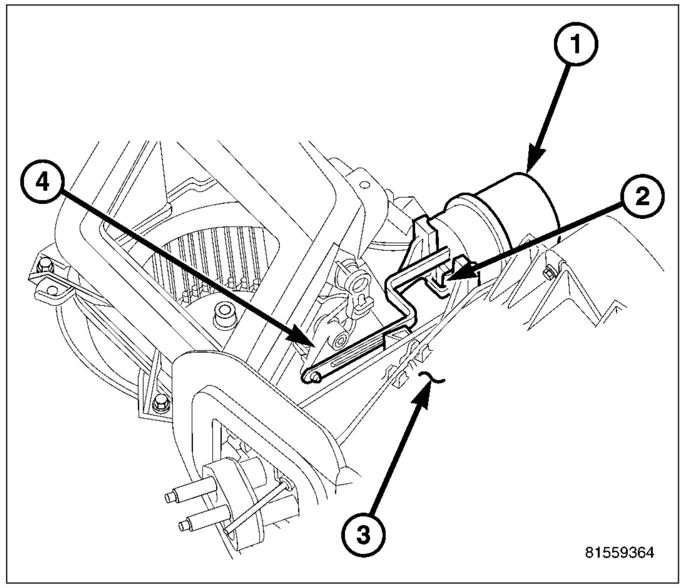
**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in an accidental airbag deployment and possible personal injury or death.**

1. Disconnect and isolate the negative battery cable.
2. Remove the instrument panel from the vehicle (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).
3. Disconnect the vacuum line harness connector from the recirculation door actuator (1).
4. Release the latch that secures the recirculation door actuator mount (2) to the top of the HVAC housing (3) and disengage the actuator from the housing.
5. Disconnect the recirculation door actuator from the recirculation door lever (4) and remove the actuator from the vehicle.



## INSTALLATION

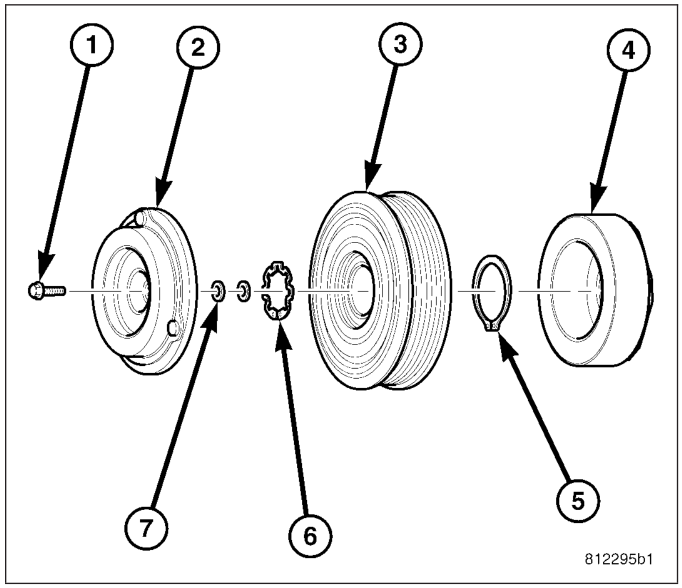
1. Connect the recirculation door actuator (1) to the recirculation door lever (4).
2. Align the recirculation door actuator mount (2) to the stanchion on the HVAC housing (3), and press the actuator onto the stanchion firmly to fully engage the latch.
3. Connect the vacuum harness connector to the recirculation door actuator.
4. Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).
5. Reconnect the battery negative cable.



# CLUTCH-A/C COMPRESSOR

## DESCRIPTION

**NOTE: Denso 10S17 A/C clutch assembly shown. Visteon HS-18 compressor similar.**




The A/C compressor clutch assembly consists of a stationary electromagnetic field coil (4), bearing and pulley assembly (3), shims (7) and a clutch plate (2) that is splined to the compressor shaft and secured by a bolt (1). These components provide the means to engage and disengage the A/C compressor from the engine accessory drive belt.

The A/C clutch bearing and pulley assembly on both A/C compressors are retained to the front of the compressor with a snap ring (6). The A/C clutch field coil on the Denso 10S17 A/C compressor is also retained to the front of the compressor using a snap ring (5). The field coil on the Visteon HS-!8 compressor is pressed onto the front of the compressor.

## OPERATION

The A/C compressor clutch components provide the means to engage and disengage the A/C compressor from the engine accessory drive belt. When the electromagnetic A/C clutch field coil is energized, it magnetically draws the clutch plate into contact with the clutch pulley and drives the compressor shaft. When the coil is not energized, the pulley freewheels on the clutch hub bearing, which is part of the pulley assembly.

A/C clutch engagement is controlled by the following:

- A/C-heater mode control
- A/C clutch relay
- A/C pressure transducer (gasoline engines)
- A/C high pressure switch (diesel engine)
- A/C low pressure switch
- Powertrain control module (PCM) or engine control module (ECM) (depending on application)

The A/C compressor clutch components cannot be repaired and, if faulty or damaged, they must be replaced.

## DIAGNOSIS AND TESTING

## A/C COMPRESSOR CLUTCH COIL

The A/C compressor clutch coil electrical circuit is controlled by the powertrain control module (PCM) or the engine control module (ECM) (depending on engine application) through the A/C clutch relay. Begin testing of a suspected compressor clutch coil problem by performing the preliminary checks.

### PRELIMINARY CHECKS

1. If no diagnostic trouble codes (DTCs) are found in the powertrain control module (PCM) or the engine control module (ECM) (depending on engine application), go to Step 2. If any DTCs are found, repair as required.
2. If the A/C compressor clutch still will not engage, verify the refrigerant charge level (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING - REFRIGERANT SYSTEM LEAKS). If the refrigerant charge level is OK, go to Step 3. If the refrigerant charge level is not OK, adjust the refrigerant charge as required.
3. On models equipped with the 3.7L gasoline engine, if the A/C compressor clutch still will not engage, disconnect the wire harness connector from the A/C pressure transducer and check for battery current at the connector with the engine running and the A/C-heater control set to the A/C mode. If OK, go to TESTS . If not OK, refer to the

Body Diagnostic Procedures to perform further diagnosis. On models equipped with the 2.8L diesel engine, go to TESTS .

**TESTS**

1. Verify the battery state of charge (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - DIAGNOSIS AND TESTING).
2. Connect an ammeter (0 to 10 ampere scale selected) in series with the clutch coil feed terminal. Connect a voltmeter (0 to 20 volt scale selected) to measure voltage across the battery and the clutch coil.
3. With the A/C-heater control in the A/C mode and the blower motor at low speed, start the engine and allow it to run at a normal idle speed.
4. The A/C compressor clutch should engage immediately, and the clutch coil supply voltage should be within two volts of the battery voltage. If the coil supply voltage is OK, go to Step 5. If the coil supply voltage is not within two volts of battery voltage, test the clutch coil feed circuit for excessive voltage drop and repair as necessary. If there is no voltage reading at the clutch coil, use a DRB III ® scan tool and refer to appropriate diagnostic information for testing of the compressor clutch circuit and PCM control. The following components must be checked and repaired as required before you can complete testing of the clutch coil:
   - Fuses in the junction block (JB) and the power distribution center (PDC)
   - A/C heater mode control
   - A/C clutch relay
   - A/C high pressure switch (diesel engine)
   - A/C low pressure switch
   - Powertrain control module (PCM) or the engine control module (ECM) (depending on engine application)
5. Specifications apply for a work area temperature of 21° C (70° F) (Refer to 24 - HEATING & AIR CONDITIONING - SPECIFICATIONS). If voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until voltage reads below 12.5 volts.
   a. If the A/C clutch coil current reading is zero, the coil is open and must be replaced.
   b. If the A/C clutch coil current reading is above specifications, the coil is shorted and must be replaced.

## STANDARD PROCEDURE

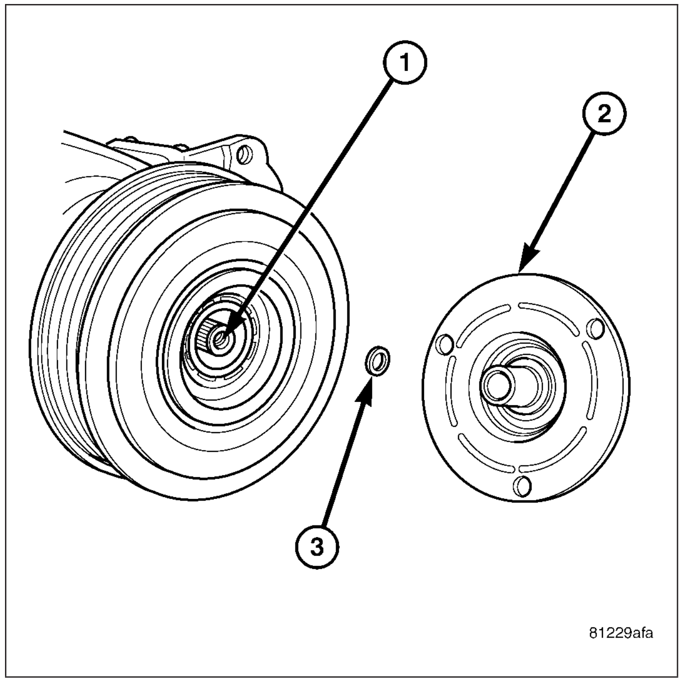
## A/C CLUTCH PLATE INSPECTION

**NOTE: The A/C clutch can be serviced in the vehicle. The refrigerant system can remain fully-charged during compressor clutch, pulley and bearing assembly, or coil replacement.**

Examine the friction surfaces of the pulley and the clutch plate (2) for wear. The pulley and clutch plate should be replaced if there is excessive wear or scoring.

If the friction surfaces are oily, inspect the shaft and nose area of the A/C compressor (1) for refrigerant oil. If refrigerant oil is found, the compressor shaft seal is leaking and the A/C compressor must be replaced.

Check the pulley bearing for roughness or excessive leakage of grease. Replace the pulley and bearing assembly, if required.




## A/C CLUTCH BREAK-IN

After a new A/C compressor clutch has been installed, cycle the compressor clutch approximately 20 times (5 seconds on, then 5 seconds off). During this procedure, set the A/C-heater controls to the A/C Recirculation Mode, the blower motor in the highest speed position, and the engine speed at 1500 to 2000 rpm. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher compressor clutch torque capability.

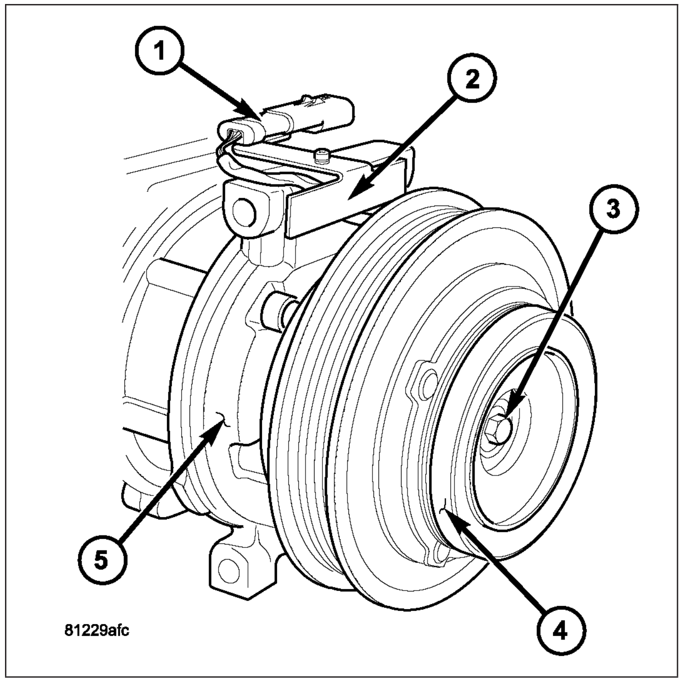
## REMOVAL

## DENSO A/C COMPRESSOR

**NOTE: The compressor clutch assembly can be serviced with the refrigerant system fully-charged and the A/C compressor installed on the engine.**

**NOTE: Typical A/C compressor shown in illustrations.**

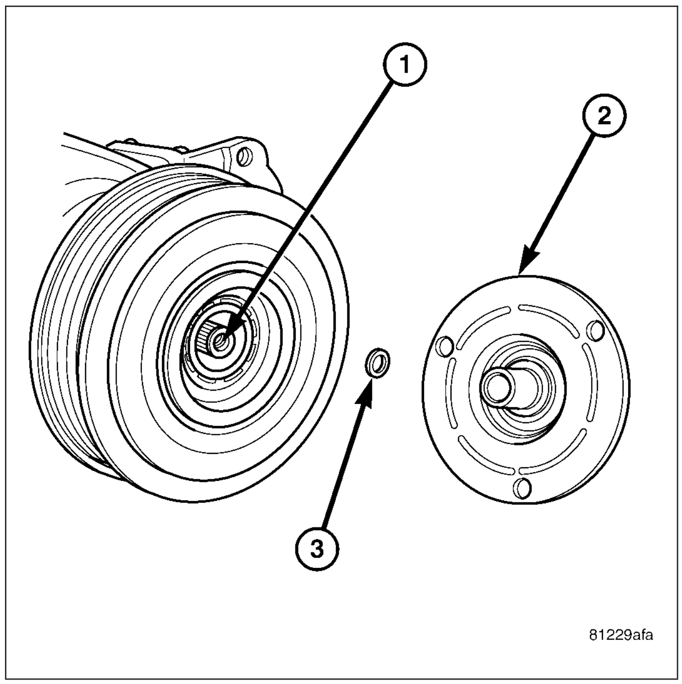
1. Disconnect and isolate the negative battery cable.
2. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Raise and support the vehicle.
4. Remove the front skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - REMOVAL).
5. Disconnect the engine wire harness from the compressor clutch field coil connector (1) located on the top of the A/C compressor (5).
6. Carefully remove the compressor clutch field coil connector and wire lead from the connector bracket (2).
7. Remove the compressor shaft bolt (3). A band-type oil filter wrench or a strap wrench may be used to hold the clutch plate (4) from rotating during bolt removal.



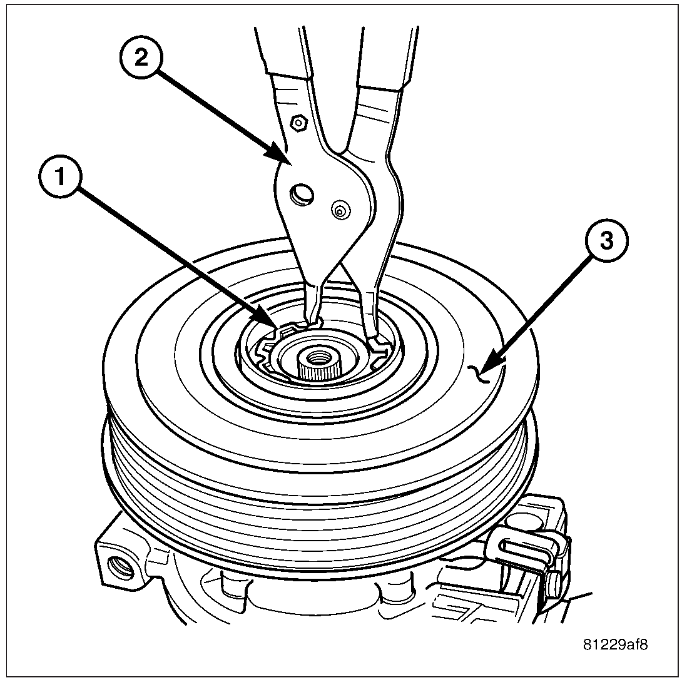

**CAUTION: Do not pry between the clutch plate and the pulley and bearing assembly to remove the clutch plate from the compressor shaft as this may damage the clutch plate.**

**NOTE: Use care not to lose any clutch shim(s) during removal of the clutch plate, as they may be reused during the clutch plate installation process.**

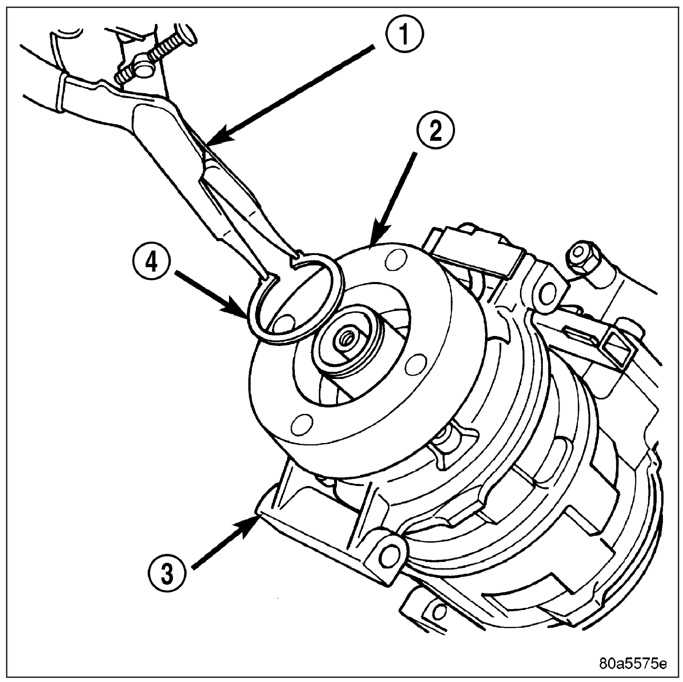
8. Tap the clutch plate (2) lightly with a plastic mallet to release it from the splines on the compressor shaft (1) and remove the clutch plate and shim(s) (3).



9. Using snap ring pliers (2), remove the snap ring (1) that secures the pulley and bearing assembly (3) to the front of the A/C compressor and remove the pulley and bearing assembly.



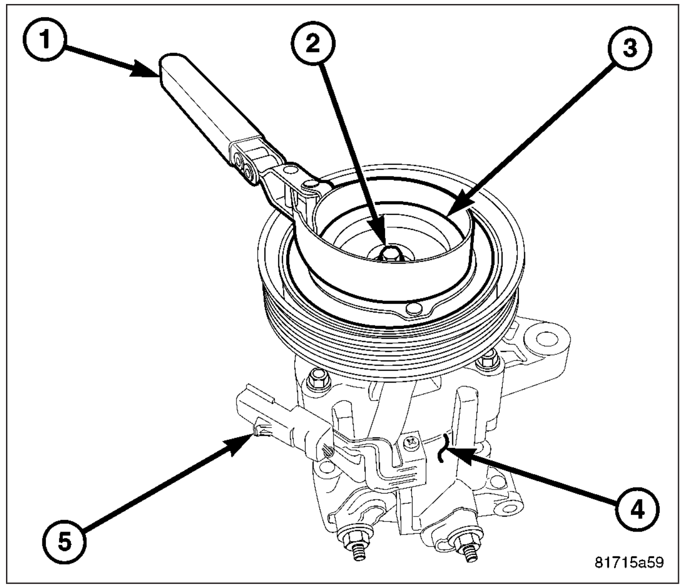

10. Using snap ring pliers (1), remove the snap ring (4) that secures the compressor clutch field coil (2) to the front of the A/C compressor (3) and remove the field coil.




## VISTEON A/C COMPRESSOR

**NOTE: The A/C compressor clutch can be serviced in the vehicle. The refrigerant system can remain fully-charged during compressor clutch, pulley and bearing assembly or field coil replacement.**

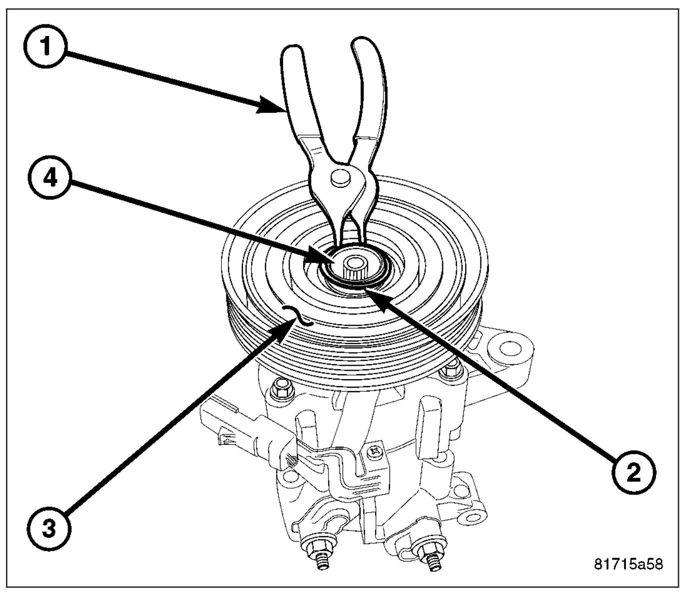
1. Disconnect and isolate negative battery cable.
2. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/BELTS-DRIVE - REMOVAL).
3. Disconnect the engine wire harness from the clutch field coil connector (4).
4. Remove the bolts that secure the A/C compressor (4) to the mounting bracket (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COMPRESSOR-A/C - 3.7L ENGINE - REMOVAL).
5. Remove the A/C compressor from the mounting bracket and support the compressor while servicing the clutch.
6. Using a strap wrench (1), remove the bolt (2) that secures the clutch plate (3) to the compressor shaft.




**NOTE: The clutch plate can be removed from the compressor shaft by hand or, if required, pressed off with an 8 x 1.25 mm bolt.**

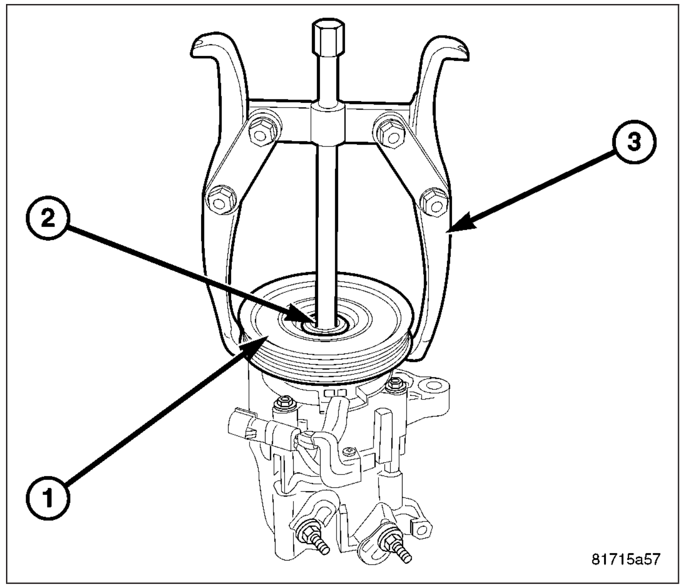
**NOTE: Clutch plate shim(s) may remain inside the hub of the clutch plate. Be sure to remove all of the shims from inside the hub or from the end of the compressor shaft.**

7. Remove the clutch plate and shim(s) from the A/C compressor. If required, install a 8 x 1.25 mm bolt into the center of the clutch plate and turn the bolt clockwise until the clutch plate is completely removed from the A/C compressor.
8. Using snap ring pliers (1), remove the snap ring (2) that secures the pulley and bearing assembly (3) to the front of the A/C compressor (4).

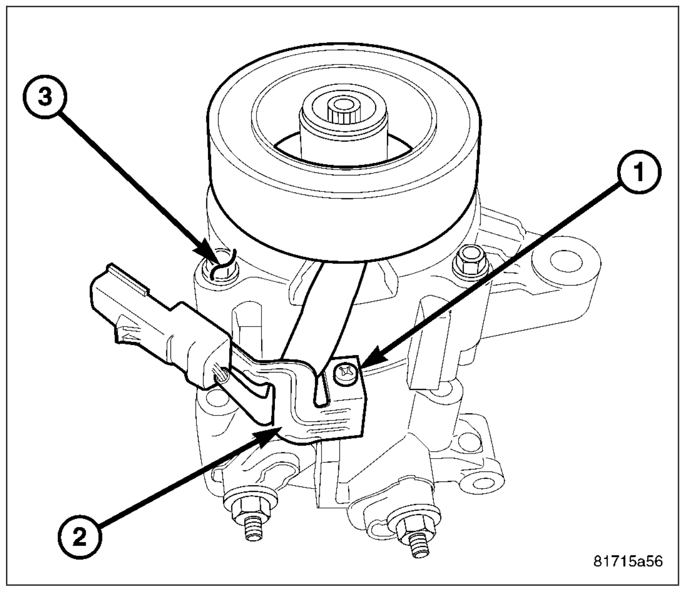


**NOTE: The pulley and bearing assembly can be removed from the compressor by hand or, if required, with a two jaw puller.**

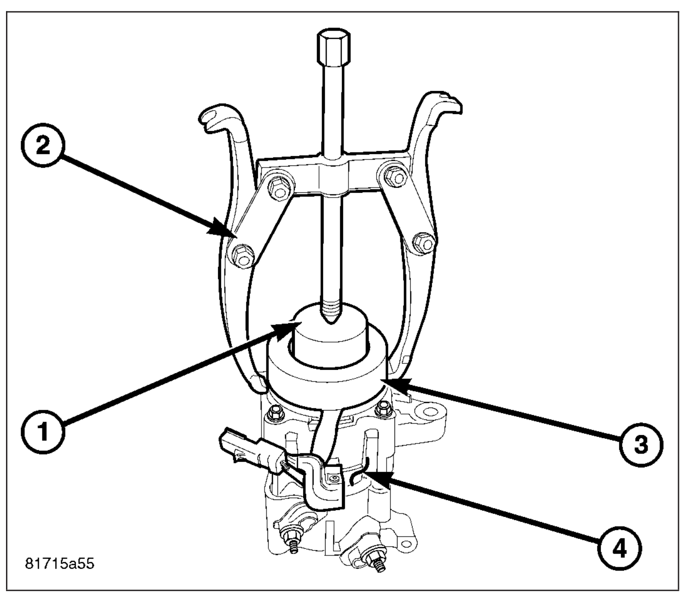
9. Remove the pulley and bearing assembly (1) from the front of the A/C compressor (2). If required, install a two jaw puller (3) and turn the puller center-bolt clockwise until the pulley and bearing assembly is completely removed.




10. Remove the screw (1) that secures the clutch field coil wire lead bracket (2) to the A/C compressor (3).




11. Using compressor field coil remover (Special Tool 9354 in Kit 9349) (1) and a two jaw puller (2), remove the clutch field coil (3) from the front of the A/C compressor (4).

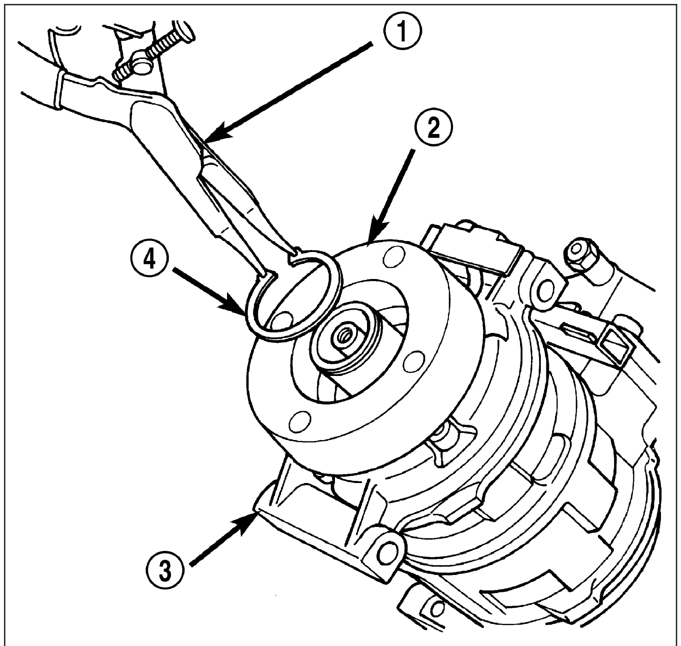


## INSTALLATION

## DENSO A/C COMPRESSOR

**NOTE: Typical A/C compressor shown in illustrations.**

1. Align the dowel pin on the back of the compressor clutch field coil (2) with the hole in the front of the A/C compressor (3) and position the field coil onto the compressor. Be certain that the compressor clutch field coil wire lead is properly routed so that it is not pinched between the A/C compressor and the field coil.



80a5575e

**CAUTION: The snap ring must be fully and properly seated in the groove or it will vibrate out, resulting in a clutch failure and severe damage to the A/C compressor.**

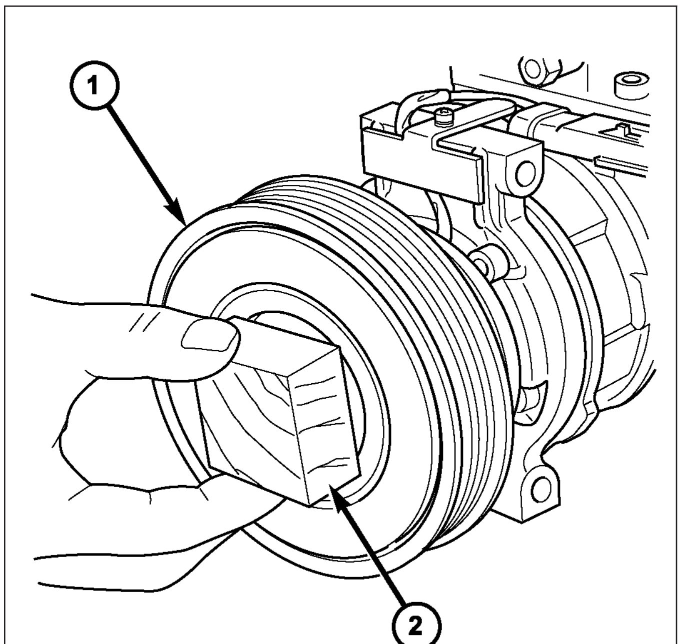
**NOTE: A new snap ring must be used to secure the compressor clutch field coil to the A/C compressor. The bevel side of the snap ring must face outward and both snap ring eyelets must be oriented to the right or to the left of the field coil dowel pin location on the A/C compressor.**

2. Using snap ring pliers (1), install the snap ring (4) that secures the compressor clutch field coil to the front of the A/C compressor. Be certain that the snap ring is fully and properly seated in the groove and oriented correctly.

**CAUTION: Be certain to position the compressor clutch field coil wire lead so that it is not damaged during A/C compressor pulley and bearing installation.**

**CAUTION: When installing the pulley and bearing assembly, DO NOT mar the friction surfaces of the pulley or premature failure of the clutch will result.**

3. Install the pulley and bearing assembly (1) onto the front of the A/C compressor. If necessary, tap the pulley gently with a block of wood (2) placed on the pulley friction surface.

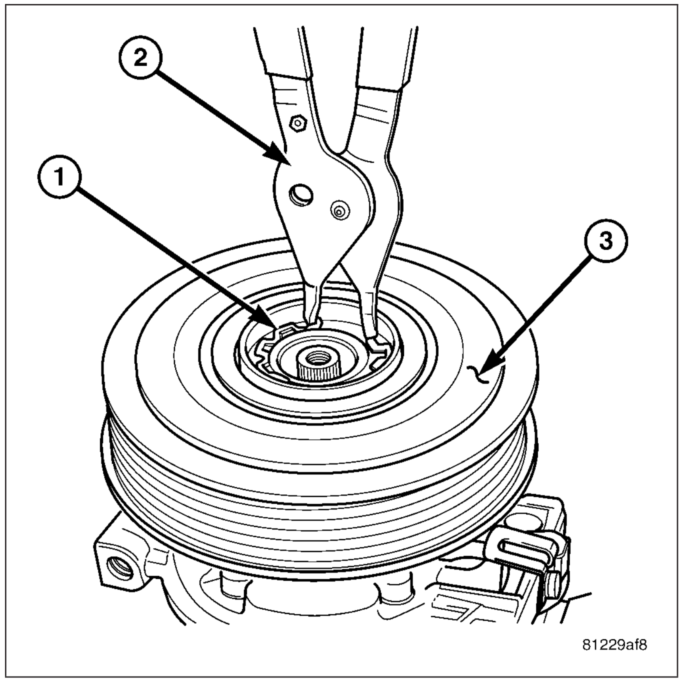


81229b4a

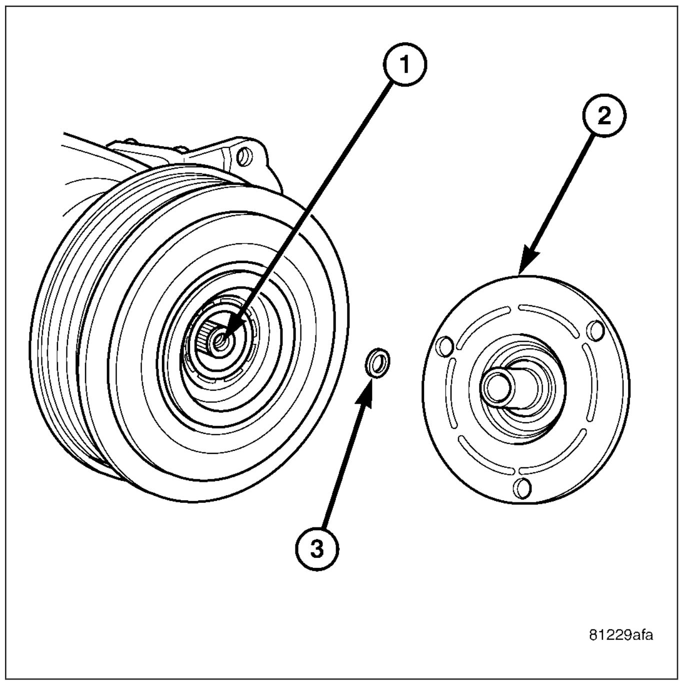
**CAUTION: The snap ring must be fully and properly seated in the groove or it will vibrate out, resulting in a clutch failure and severe damage to the A/C compressor.**

**NOTE: A new snap ring must be used to secure the pulley and bearing assembly to the A/C compressor. The bevel side of the snap ring must face outward.**

4. Using snap ring pliers (2), install the snap ring (1) that secures the pulley and bearing assembly (3) to the front of the A/C compressor. Be certain that the snap ring is fully and properly seated in the groove.




5. If the original clutch plate (2) and pulley and bearing assembly are to be reused, reinstall the original shim(s) (3) onto the compressor shaft (1). If a new clutch plate and pulley and bearing assembly are being used, install a trial stack of shims 2.54 mm (0.010 in.) thick onto the compressor shaft.

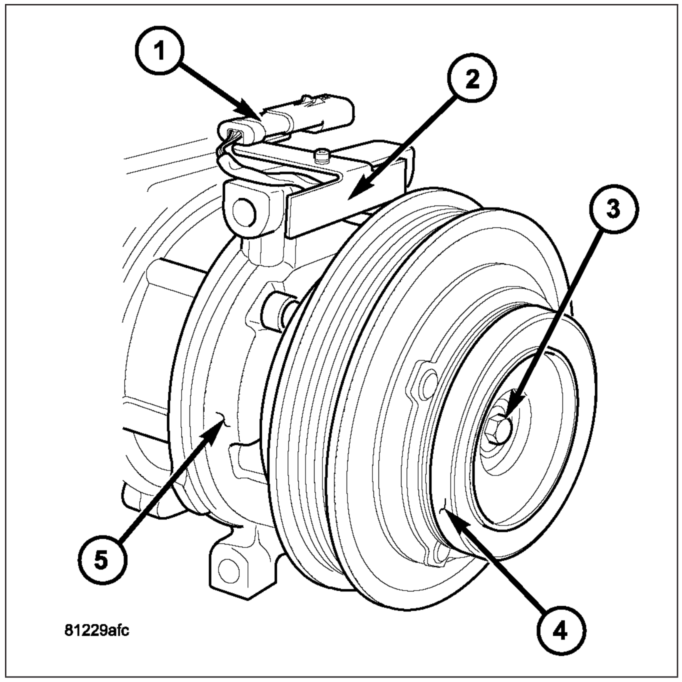


6. Install the clutch plate (4) onto the front of the A/C compressor (5).
7. Install the compressor shaft bolt (3). Tighten the bolt to 19 N·m (168 in. lbs.).

**NOTE: The shims may compress after tightening the shaft bolt. Check the air gap in four or more places to verify the air gap is correct. Spin the pulley before performing a final check of the air gap.**

**NOTE: On models with the clutch plate recessed into the pulley, use a 90° wire gap gauge to measure the clutch air gap. On other models, use a blade type feeler gauge to measure the air gap.**

8. With the clutch plate assembled tight against the shim(s), measure the air gap between the clutch plate and the pulley and bearing assembly. The air gap should be between 0.35 - 0.60 mm (0.014 - 0.024 in.). If the air gap is not between specifications, add or subtract shims as needed until the correct air gap is obtained.




**CAUTION: Be certain that the compressor clutch field coil wire lead is routed so that it is not pinched between the A/C compressor and the field coil connector bracket.**

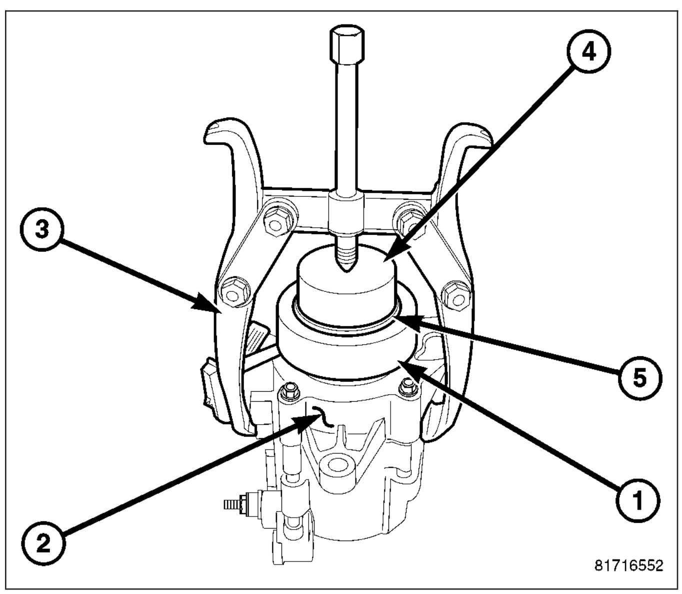
9. Carefully route the compressor clutch field coil wire lead behind the connector bracket (2).
10. Install the compressor clutch field coil connector (1) onto the connector bracket and connect the engine wire harness to the field coil connector.
11. Install the front skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - INSTALLATION).
12. Lower the vehicle.
13. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/BELTS-DRIVE - INSTALLATION).
14. Reconnect the negative battery cable.

## VISTEON A/C COMPRESSOR

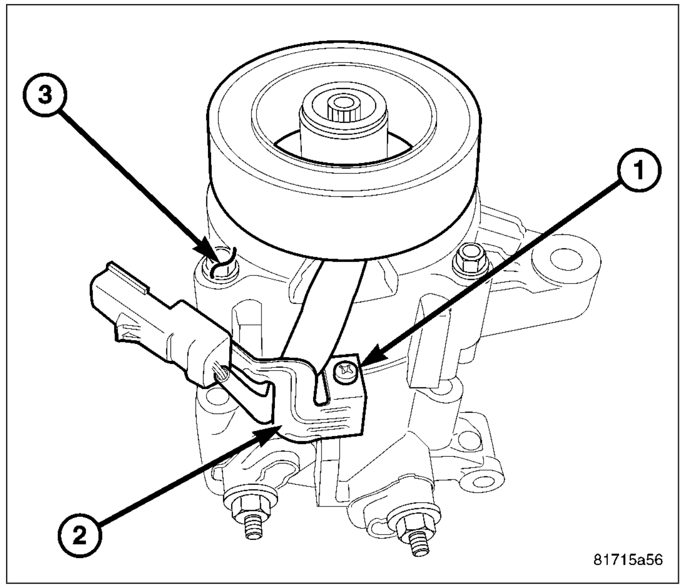
1. Position the A/C clutch field coil (1) squarely onto the front of the A/C compressor (2).

**CAUTION: Position the A/C clutch field coil so that the coil positioning tabs and the wire harness lead are oriented in the correct direction. Failure to correctly position the field coil on the A/C compressor will result in field coil damage.**

2. Align the field coil positioning tabs to the recessed area at the front of the A/C compressor and install the clutch field coil onto the compressor using a two jaw puller (3), compressor field coil installer (Special Tool 9352 in Kit 9349) (4) and the compressor field coil installer spacer (Special Tool 9353 in Kit 9349) (5).



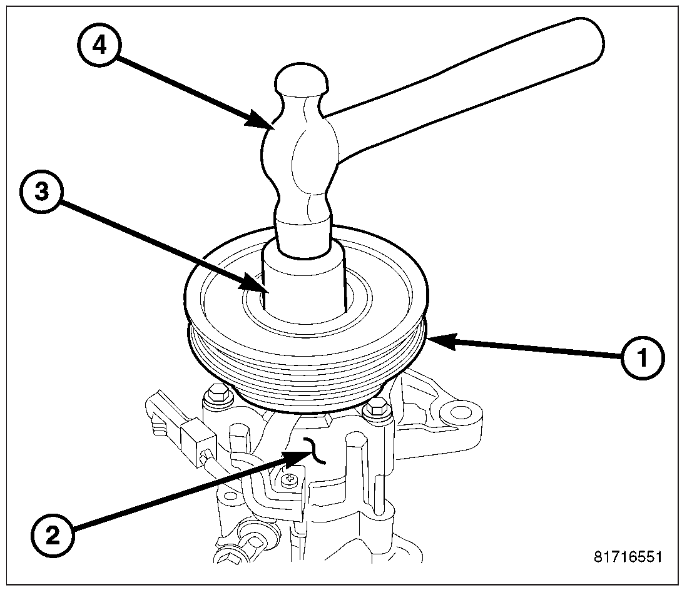
3. Position the clutch field coil wire lead and bracket (2) to the A/C compressor (3) and install the screw (1) that secures the bracket to the compressor. Tighten the screw to 4 N·m (35 in. lbs.).




4. Align the pulley and bearing assembly (1) squarely onto the front of the A/C compressor (2).

**NOTE: A distinct change of sound during the clutch pulley tapping process indicates that the pulley and bearing assembly has bottomed out against the compressor housing.**

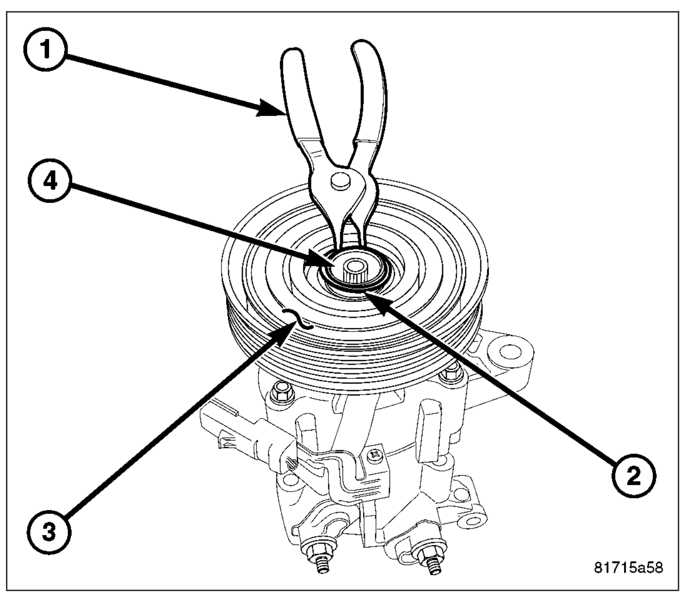
5. Using clutch pulley installer (Special Tool 9355 in Kit 9349) (3) and a hammer (4), install the pulley and bearing assembly onto the front of the A/C compressor. Tap the installer with a hammer until the pulley and bearing assembly has bottomed against the compressor housing.



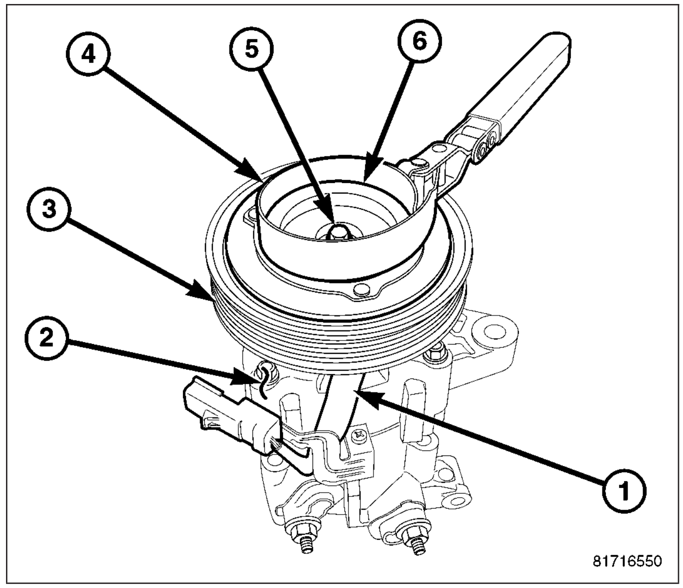

**CAUTION: If the snap ring is not fully seated in the groove it will vibrate out, resulting in clutch failure and severe damage to the A/C compressor.**

**NOTE: Install the snap ring with the beveled side of the snap ring facing outward.**

6. Using snap ring pliers (1), install the snap ring (2) that secures the pulley and bearing assembly (3) to the front of the A/C compressor (4). Make sure the snap ring is properly seated in the groove.

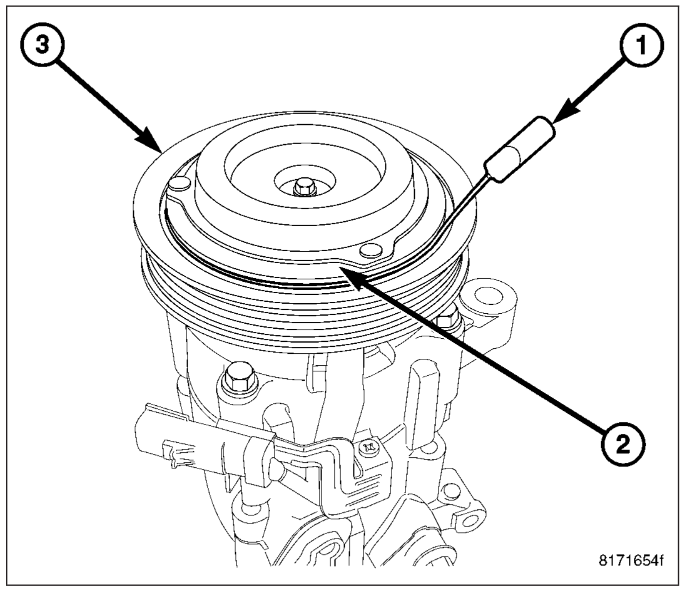


7. Verify that there is adequate clearance for the clutch field coil wire lead (1) between the housing of the A/C compressor (2) and the pulley and bearing assembly (3).




**NOTE: When installing an original or a new clutch assembly, try the original shims first. When installing a clutch onto a compressor that previously did not have a clutch, use the 1.0, 0.50 and 0.13 millimeter (0.040, 0.020 and 0.005 inch) shims from the clutch hardware package which is provided with the new clutch.**

8. Install the clutch shims onto the compressor shaft.
9. Using a strap wrench (4), install the bolt (5) that secures the clutch plate (6) to the A/C compressor. Hold the clutch plate stationary with the strap wrench and tighten the bolt to 15 N·m (133 in. lbs.).
10. Using 90° wire gauges (1), check the air gap between the clutch plate (2) and the pulley and bearing assembly (3). If the air gap is not between 0.35 to 0.65 millimeter (0.014 to 0.025 inch), add or subtract shims as required.



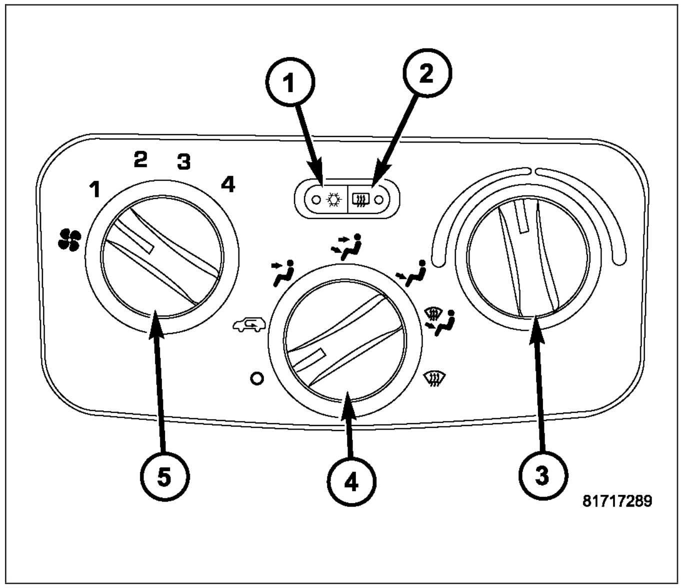

11. Position the A/C compressor onto the mounting bracket.
12. Install the bolts that secure the A/C compressor to the mounting bracket (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COMPRESSOR-A/C - 3.7L ENGINE - INSTALLATION).
13. Connect the engine wire harness to the compressor clutch field coil connector.
14. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
15. Reconnect the negative battery cable.
16. Perform the Clutch Break-in Procedure (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C COMPRESSOR CLUTCH - STANDARD PROCEDURE).

# CONTROL-A/C HEATER

## DESCRIPTION

The A/C-heater control for the manual temperature control (MTC) single zone heating-A/C system allows one temperature setting for the entire vehicle. All controls are identified by ISO graphic symbols.

The heating-A/C system uses a combination of, electrical and vacuum controls. These controls provide the vehicle operator with a number of setting options to help control the climate and comfort within the vehicle.




The A/C-heater control is located in the instrument panel and contains:

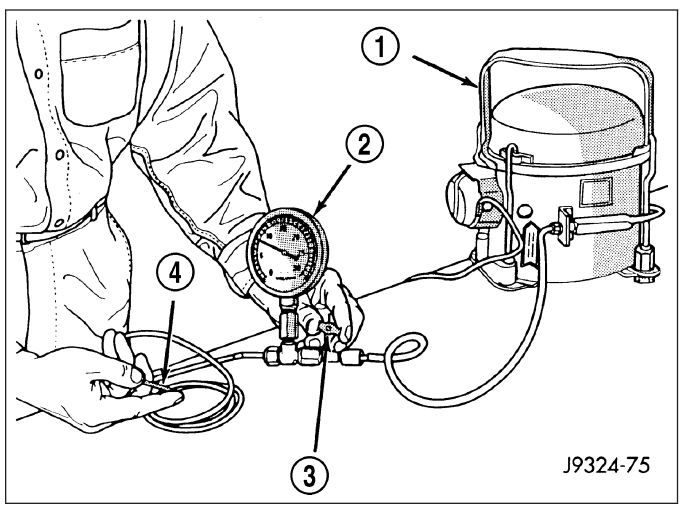
- a push button A/C on/off control (1). The snowflake button contains an LED that illuminates when the A/C system is in operation.
- a push button rear window defogger on/off control (2). The defogger button contains an LED that illuminates when the rear window defogger system is in operation.
- a rotary control for temperature control of the discharged air (3)
- a rotary control for turning the heating-A/C system on and off and for recirculation and mode control of the discharged air (4).
- a rotary control for fan speed selection (5).

The A/C-heater control cannot be repaired and, if faulty or damaged, it must be replaced. The control knobs and illumination lamps are available for service replacement.

## DIAGNOSIS AND TESTING

## VACUUM CONTROL SYSTEM

Use an adjustable Vacuum Test Set (Special Tool C-3707-B or equivalent) (2) and a suitable vacuum pump (1) to test the heater-A/C vacuum control system.




Place a finger over the end of the Vacuum Test Probe (4) and adjust the bleed valve (3) on the Vacuum Test Gauge to obtain a vacuum of exactly -27 kPa (-8 in. Hg.). Release and block the end of the Vacuum Test Probe several times to verify that the vacuum reading returns to the exact -27 kPa (-8 in. Hg.) setting. Otherwise, a false reading will be obtained during testing.

### VACUUM CHECK VALVE

1. Remove the vacuum check valve. The valve is located in the vacuum supply line (black) at the HVAC system vacuum tee.
2. Connect the Vacuum Test Probe from the Vacuum Test Set to the heater side of the vacuum check valve. When connected to this side of the check valve, no vacuum should pass and the Vacuum Test Gauge should return to the -27 kPa (-8 in. Hg.) setting. If OK, go to step Step 3. If not OK, replace the faulty vacuum check valve.

3. Connect the Vacuum Test Probe from the Vacuum Test Set to the engine side of the vacuum check valve. When connected to this side of the check valve, vacuum should flow through the valve without restriction. If not OK, replace the faulty vacuum check valve.

## A/C HEATER CONTROLS

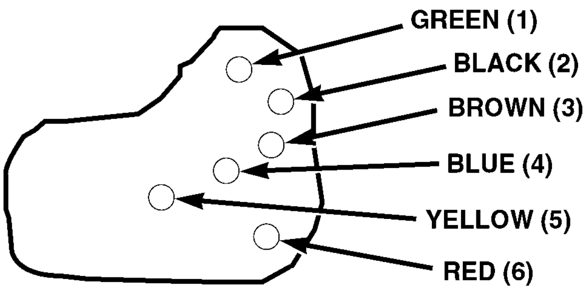
**NOTE: The operation of the recirculation-air door can be viewed by removing the blower motor and looking up into the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/MOTOR-BLOWER - REMOVAL).**

1. Connect the Vacuum Test Probe to the vehicle vacuum supply (black) line. Position the Vacuum Test Gauge so it can be viewed from the passenger compartment.
2. Place the A/C-heater mode control in each mode position, one position at a time, and pause after each selection. The Vacuum Test Gauge should return to the calibrated setting of -27 kPa (-8 in. Hg.) setting shortly after each selection is made. If the Vacuum Test Gauge cannot achieve the calibrated setting, the vacuum circuit or a component has a vacuum leak. See the procedure in Locating Vacuum Leaks.

## LOCATING VACUUM LEAKS

**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in an accidental airbag deployment and possible personal injury or death.**

**CAUTION: Do not use lubricant on the switch ports or in the holes of the connector, as lubricant will ruin the vacuum valve in the switch. A drop of clean water in the connector holes will help the connector slide onto the switch ports.**




| PORT | 1-GREEN | 2-BLACK | 3-BROWN | 4-BLUE | 5-YELLOW | 6-RED |
|---|---|---|---|---|---|---|
| Actuation | Recirc Door | Source | Panel Door-Full | Floor/Def Floor | Floor/Def Mid-Pos | Panel Door-Mid |
| Off | Vacuum | Vacuum | Vent | Vent | Vent | Vent |
| Recirc a/c | Vacuum | Vacuum | Vacuum | Vacuum | Vacuum | Vacuum |
| Panel a/c | Vent | Vacuum | Vacuum | Vacuum | Vacuum | Vacuum |
| Bi-Level a/c | Vent | Vacuum | Vent | Vacuum | Vacuum | Vacuum |
| Bi-Level | Vent | Vacuum | Vent | Vacuum | Vacuum | Vacuum |
| Panel | Vent | Vacuum | Vacuum | Vacuum | Vacuum | Vacuum |
| Floor | Vent | Vacuum | Vent | Vacuum | Vacuum | Vent |
| Floor/Def | Vent | Vacuum | Vent | Vent | Vacuum | Vent |
| Defrost | Vent | Vacuum | Vent | Vent | Vent | Vent |

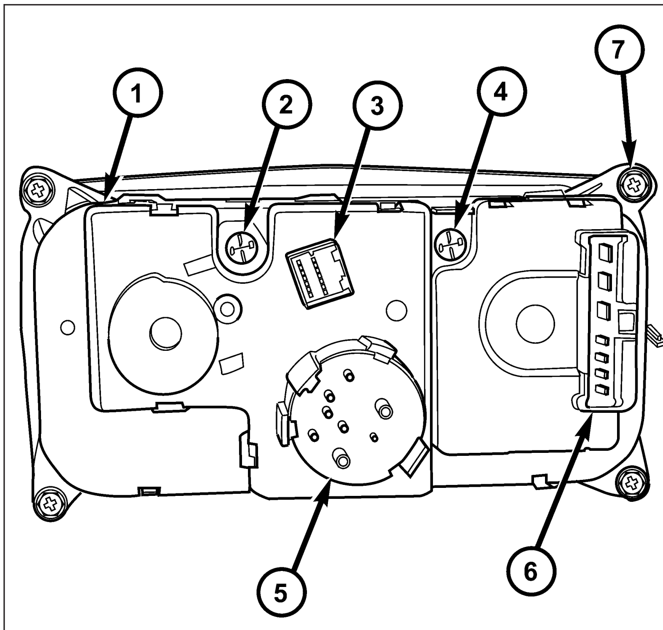
8171400d

1. Disconnect the vacuum harness connector from the back of the A/C-heater control (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CONTROL-A/C HEATER - REMOVAL).
2. Connect the Vacuum Test Probe to each port in the HVAC housing half of the vacuum harness connector, one port at a time, and pause after each connection. The test set gauge should return to the -27 kPa (-8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty A/C-heater control. If not OK, go to Step 3.
3. Determine the vacuum line color of the vacuum circuit that is leaking. To determine the vacuum line colors, refer to the Vacuum Circuits Chart.
4. Disconnect and plug the vacuum line from the component (fitting, actuator, valve, switch, or reservoir) on the other end of the leaking circuit. Instrument panel disassembly or removal may be necessary to gain access to some components. See the appropriate service procedures.
5. Connect the test set hose or probe to the open end of the leaking circuit. The test set gauge should return to the -27 kPa (-8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty disconnected component. If not OK, go to Step 6.
6. To locate a leak in a vacuum line, leave one end of the line plugged and connect the test set hose or probe to the other end of the line. Run your fingers slowly along the line while watching the test set gauge. The vacuum reading will fluctuate when your fingers contact the source of the leak. To repair the vacuum line, cut out the leaking section of the line. Then, insert the loose ends of the line into a suitable length of 3 millimeter (0.125 inch) inside diameter rubber hose.

## REMOVAL

**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.**

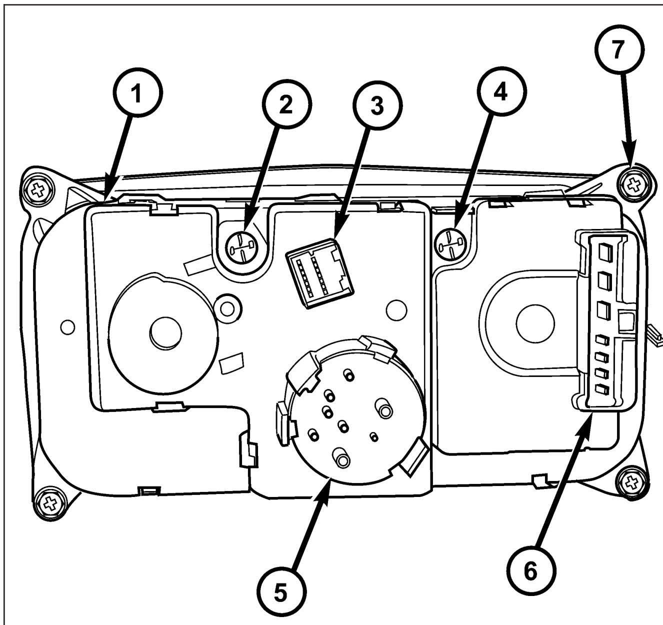
1. Disconnect and isolate the negative battery cable.
2. Remove the center bezel from the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL).
3. Remove the four screws that secure the A/C-heater control (1) to the instrument panel at the mounting screw locations shown (7).
4. Remove the A/C-heater control from the instrument panel to gain access to the wire harness connections (3 and 6) and the vacuum harness connector (5) at the rear of the A/C-heater control.
5. Disconnect the vacuum harness and wire harness connectors from the A/C-heater control and remove the control from the vehicle.
6. If required, remove the illumination lamps (2 and 4) from the A/C-heater control.




80c62f2c

## INSTALLATION

1. If removed, install the illumination lamps (2 and 4) into the rear of the A/C-heater control (1).
2. Connect the wire harness and vacuum connectors to the connections (3, 5 and 6) at the rear of the A/C-heater control.
3. Position the A/C-heater control into the instrument panel and install the four retaining screws at the locations shown (7). Tighten the screws to 2 N·m (17 in. lbs.).
4. Install the instrument panel center bezel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).
5. Reconnect the negative battery cable.



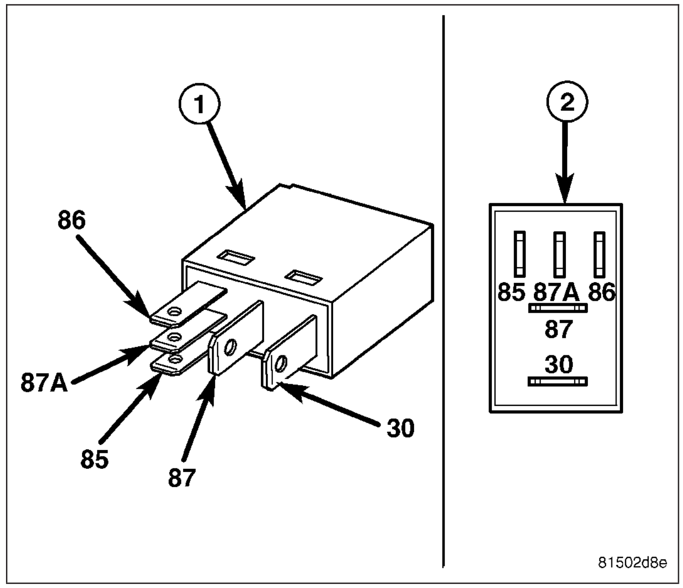

80c62f2c

# RELAY-A/C CLUTCH

## DESCRIPTION

The A/C clutch relay (1) is an International Standards Organization (ISO) micro-relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal functions and patterns (2). The ISO micro-relay terminal functions are the same as a conventional ISO relay. However, the ISO micro-relay terminal pattern (or footprint) is different, the current capacity is lower, and the physical dimensions are smaller than those of the conventional ISO relay.

The A/C clutch relay is located in the power distribution center (PDC) in the engine compartment.




## OPERATION

The A/C clutch relay is an electromechanical switch that uses a low current input controlled by the powertrain control module (PCM) or engine contol module (ECM), depending on engine application, to control the high current output to the A/C clutch field coil. The movable, common feed relay contact is held against the fixed, normally closed relay contact by spring pressure. When the electromagnetic relay coil is energized, it draws the movable common feed relay contact away from the fixed, normally closed relay contact and, holds it against the fixed, normally open relay contact. This action allows high current to flow to the A/C clutch field coil.

When the relay coil is de-energized, spring pressure returns the movable relay contact back against the fixed, normally closed contact point. The resistor or diode is connected in parallel with the relay coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The A/C clutch relay terminals are connected to the vehicle electrical system through a receptacle in the power distribution center (PDC). The inputs and outputs of the A/C clutch relay include:

- The common feed terminal (30) receives battery current through a fuse in the PDC at all times.
- The coil ground terminal (85) receives a ground through the A/C compressor clutch relay control circuit only when the PCM or ECM electronically pulls the circuit to ground.
- On gasoline engine applications, the coil battery terminal (86) receives battery current through a fuse in the junction block only when the ignition switch is in the Run or Start position.
- On diesel engine applications, the coil battery terminal (86) receives battery current through a fuse in the PDC at all times.
- The normally open terminal (87) provides battery current to the A/C clutch coil through the A/C clutch relay only when the A/C clutch relay coil is energized.
- The normally closed terminal (87A) is not connected to any circuit in this application, but provides a battery current output only when the A/C clutch relay coil is de-energized.

The A/C clutch relay cannot be repaired and, if faulty or damaged, it must be replaced. Refer to the appropriate wiring information for diagnosis and testing of the ISO-standard micro-relay and for complete HVAC wiring diagrams.

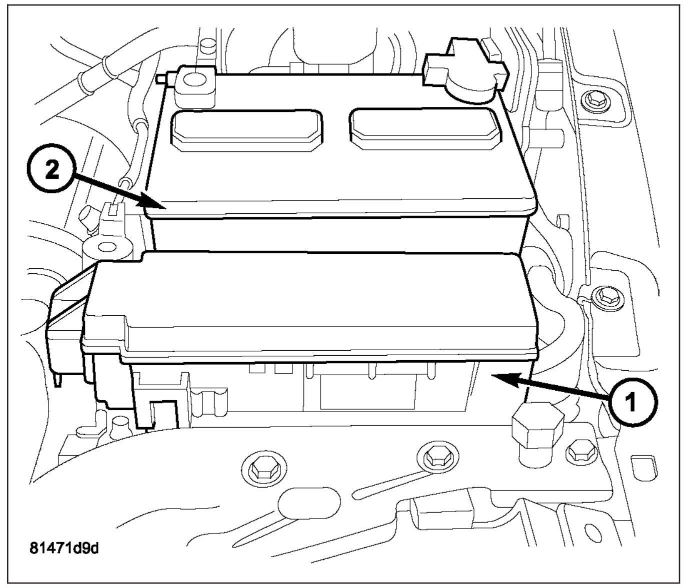
## REMOVAL

**NOTE: LHD model shown in illustration. RHD models similar.**

1. Disconnect and isolate the negative battery cable.
2. Open the cover of the power distribution center (PDC) (1) located near the battery (2) in the engine compartment.

**NOTE: Refer to the fuse and relay layout map on the inside of the PDC cover for A/C clutch relay location.**

3. Remove the A/C clutch relay from the PDC.

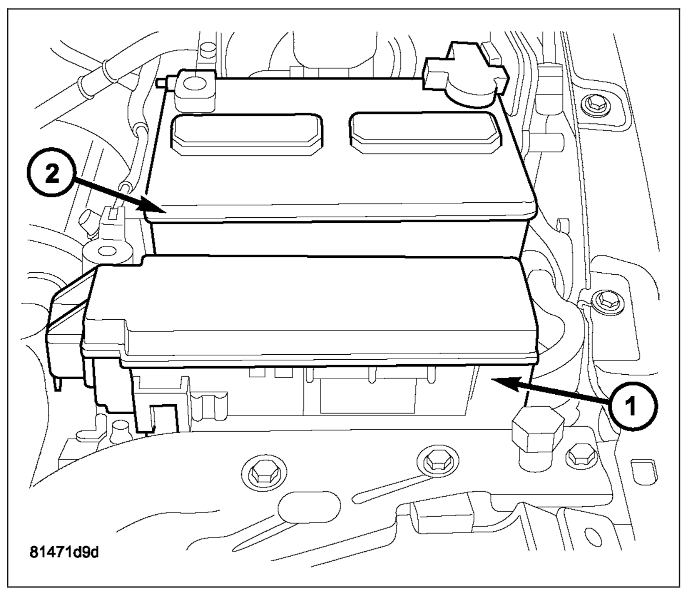



## INSTALLATION

**NOTE: LHD model shown in illustration. RHD models similar.**

**NOTE: Refer to the fuse and relay layout map on the inside of the power distribution center (PDC) cover for A/C clutch relay location.**

1. Position the A/C clutch relay into the proper receptacle of the PDC (1) located near the battery (2) in the engine compartment.
2. Align the A/C clutch relay terminals with the terminal cavities in the PDC receptacle and push down firmly on the relay until the terminals are fully seated.
3. Close the cover of the PDC.
4. Reconnect the negative battery cable.

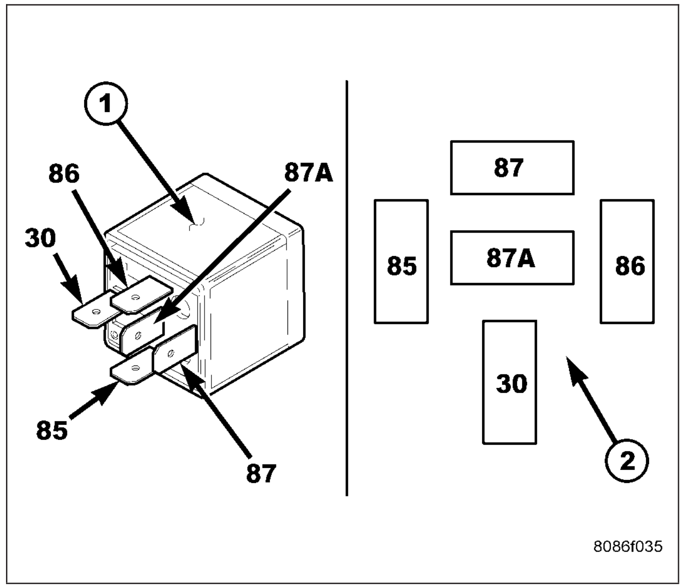


# RELAY-BLOWER MOTOR

## DESCRIPTION

The blower motor relay (1) for the heating-A/C system is an International Standards Organization (ISO)-type relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal functions and patterns (2). The blower motor relay is a electromechanical device that switches battery current from a fuse in the power distribution center (PDC) directly to the blower motor. The blower motor relay is energized when the relay coil is provided a voltage signal by the ignition switch.

The blower motor relay is located in the PDC in the engine compartment.




## OPERATION

The ISO-standard blower motor relay is an electromechanical switch that uses a low current input from the ignition switch to control the high current output to the blower motor. The movable, common feed relay contact is held against the fixed, normally closed relay contact by spring pressure. When the electromagnetic relay coil is energized, it draws the movable common feed relay contact away from the fixed, normally closed relay contact and, holds it against the fixed, normally open relay contact. This action allows high current to flow to the blower motor.

When the relay coil is de-energized, spring pressure returns the movable relay contact back against the fixed, normally closed contact point. The resistor or diode is connected in parallel with the relay coil, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

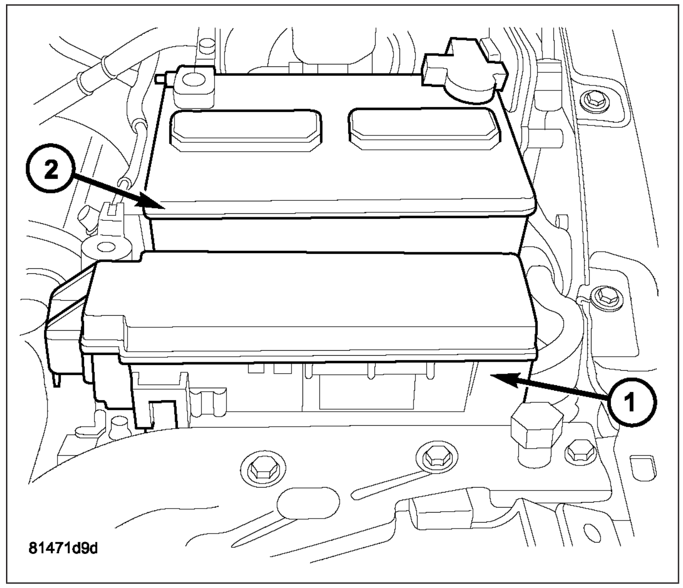
The blower motor relay terminals are connected to the vehicle electrical system through a receptacle in the power distribution center (PDC). The inputs and outputs of the blower motor relay include:

- The common feed terminal (30) receives a battery current input from a fuse in the PDC through a fused B(+) circuit at all times.
- The coil ground terminal (85) is connected to a ground at all times.
- The coil battery terminal (86) receives a battery current input from a fuse in the junction block (JB) through a fused ignition switch output (run) circuit only when the ignition switch is in the On position.
- The normally open terminal (87) provides a battery current output to the blower motor through the blower motor relay output circuit only when the blower motor relay coil is energized.
- The normally closed terminal (87A) is not connected to any circuit in this application, but provides a battery current output only when the blower motor relay coil is de-energized.

The blower motor relay cannot be repaired and, if faulty or damaged, it must be replaced. Refer to the appropriate wiring information for diagnosis and testing of the ISO-standard relay and for complete HVAC wiring diagrams.

## REMOVAL

**NOTE: LHD model shown in illustration. RHD models similar.**



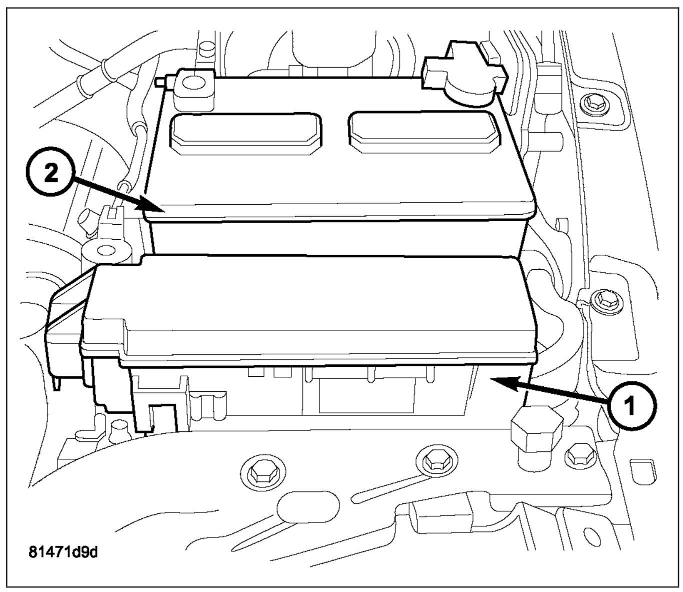

1. Disconnect and isolate the negative battery cable.
2. Open the cover of the power distribution center (PDC) (1) located near the battery (2) in the engine compartment.

**NOTE: Refer to the fuse and relay layout map on the PDC cover for blower motor relay location.**

3. Remove the blower motor relay from the PDC.

## INSTALLATION

**NOTE: LHD model shown in illustration. RHD models similar.**




**NOTE: Refer to the fuse and relay map on the cover of the power distribution center (PDC) for blower motor relay location.**

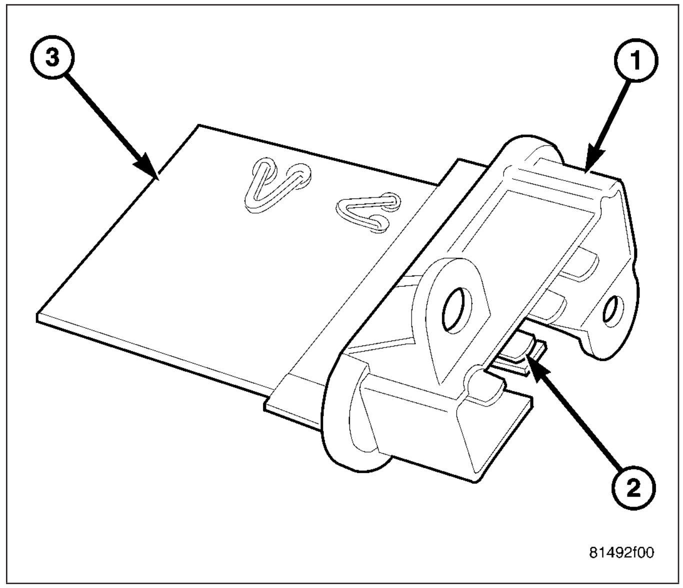
1. Position the blower motor relay into the proper receptacle of the PDC (1) located near the battery (2) in the engine compartment.
2. Align the blower motor relay terminals with the terminal cavities in the PDC receptacle and push down firmly on the relay until the terminals are fully seated.
3. Close the cover of the PDC.
4. Reconnect the negative battery cable.

# RESISTOR-BLOWER MOTOR

## DESCRIPTION

The blower motor resistor is mounted to the rear of the HVAC housing, directly behind the glove box. The blower motor resistor consists of a molded plastic mounting plate (1) with an integral wire connector receptacle (2). Concealed behind the mounting plate is the resistor circuit board (3).

The blower motor resistor is accessed for service by opening the glove box.




## OPERATION

The blower motor resistor is connected to the vehicle electrical system through a dedicated wire lead and connector of the HVAC wire harness. The blower motor resistor has multiple resistor circuits, each of which will reduce the current flow through the blower motor to change the blower motor speed.

The blower motor control in the MTC heating-A/C system directs the ground path for the blower motor through the correct resistor circuit to obtain the selected speed. With the blower motor control in the lowest speed position, the ground path for the blower motor is applied through all of the resistor circuits. Each higher speed selected with the blower motor control applies the blower motor ground path through fewer of the resistor circuits, increasing the blower motor speed. When the blower motor control is in the highest speed position, the blower motor resistor is bypassed and the blower motor receives a direct path to ground.

The blower motor resistor cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

## DIAGNOSIS AND TESTING

## BLOWER MOTOR RESISTOR

**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.**

**NOTE: For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.**

1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness connector from the blower motor resistor (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/RESISTOR-BLOWER MOTOR - REMOVAL).

3. Using an ohmmeter, check for continuity between all of the blower motor resistor terminals. In each case there should be continuity. If OK, repair the wire harness circuits between the blower motor speed control and the blower motor resistor or blower motor as required. If not OK, replace the faulty blower motor resistor.

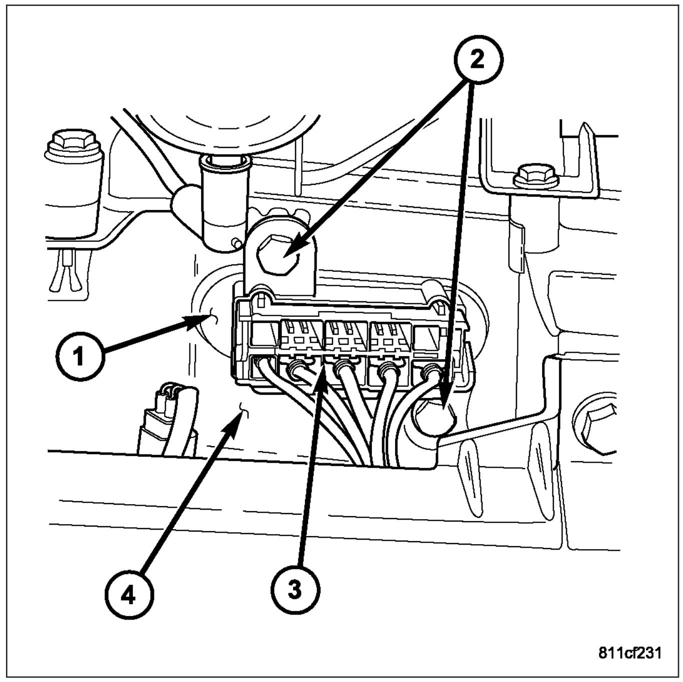
## REMOVAL

**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.**

**WARNING: The blower motor resistor may get very hot during normal operation. If the blower motor was turned on prior to servicing the blower motor resistor, wait five minutes to allow the blower motor resistors to cool before performing diagnosis or service. Failure to take this precaution can result in possible personal injury.**

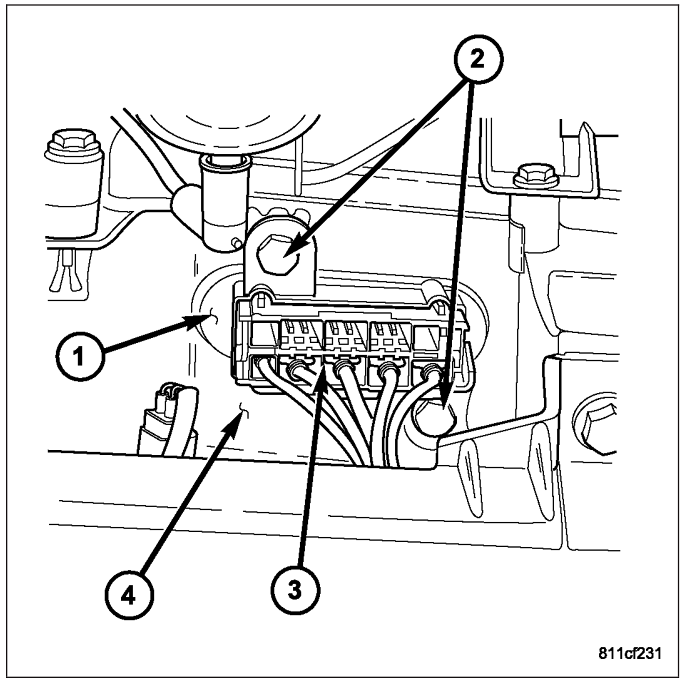
**NOTE: LHD model shown in illustration. RHD models similar.**

1. Disconnect and isolate the negative battery cable.
2. Open the glove box door to gain access to the blower motor resistor (1).
3. Pull out the lock on the blower motor resistor wire harness connector (3) to unlock the connector latch.
4. Depress the latch on the blower motor resistor wire harness connector and disconnect the wire harness from the resistor.
5. Remove the two screws (2) that secure the blower motor resistor to the HVAC housing (4) and remove the resistor.



## INSTALLATION

**NOTE: LHD model shown in illustration. RHD models similar.**



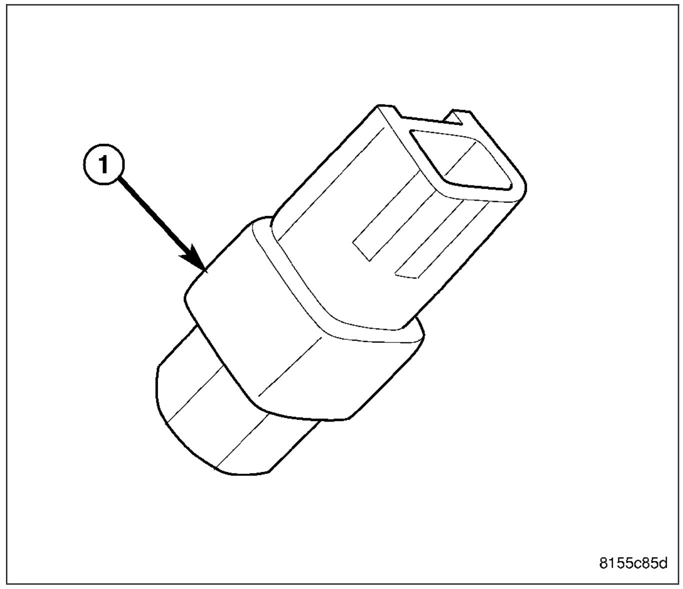

1. Position the blower motor resistor (1) into the HVAC housing (4).
2. Install the two screws (2) that secure the blower motor resistor to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
3. Connect the wire harness connector (3) to the blower motor resistor.
4. Push in the lock on the blower motor resistor wire harness connector.
5. Close the glove box door.
6. Reconnect the negative battery cable.

# SWITCH-A/C HIGH PRESSURE

## DESCRIPTION

The A/C high pressure switch (1) sends a signal to the engine control module (ECM) to control A/C compressor clutch engagement/disengagement and, controls electric cooling fan operation when equipped with the 2.8L diesel engine. The A/C high pressure switch is mounted on a fitting located on the A/C discharge line near the A/C compressor. The ECM will disengage the A/C compressor clutch if the refrigerant system pressure exceeds 3100 - 3375 kPa (450 - 490 psi).

The fitting for the A/C high pressure switch on the A/C discharge line is equipped with an O-ring seal and contains a Schrader-type valve, which allows the switch to be serviced without discharging the refrigerant system.




## OPERATION

The contacts in the A/C high pressure switch open and close causing the engine control module (ECM) to turn the A/C compressor clutch on and off. This prevents A/C compressor operation when the discharge pressure approaches high levels, and also reduces electrical surging from A/C clutch engagement.

The A/C high pressure switch controls the electric cooling fan operation by monitoring refrigerant line pressures. When the A/C discharge line pressure rises above 1900 to 2200 kPa (280 to 320 psi) the fan will turn on. The cooling fan will turn off when the A/C discharge line pressure drops to 1600 kPa (235 psi).

The A/C high pressure switch contacts open when the A/C discharge line pressure rises above 3100 to 3375 kPa (450 to 490 psi). The A/C high pressure switch contacts close when the A/C discharge line pressure drops to 1860 to 2275 kPa (270 to 330 psi).

The A/C high pressure switch is factory-calibrated and cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

## DIAGNOSIS AND TESTING

## A/C HIGH PRESSURE SWITCH

**NOTE: For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.**

Before performing diagnosis of the A/C high pressure switch, verify that the refrigerant system has the correct refrigerant charge (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

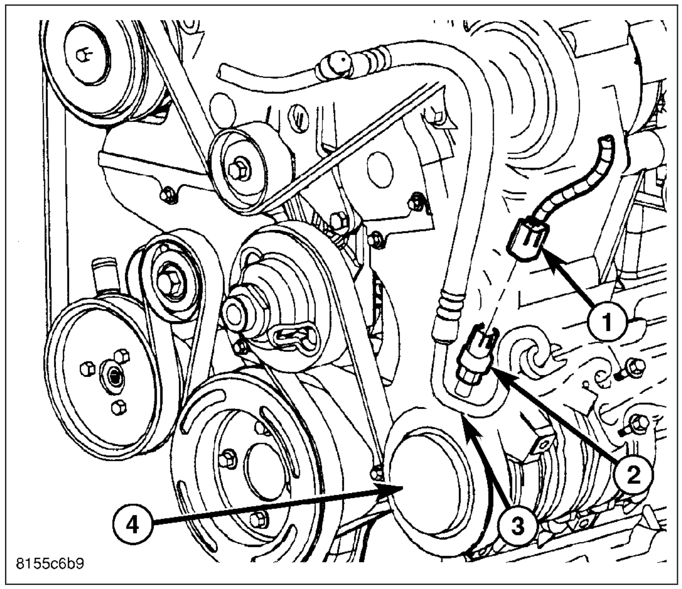
1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness connector from the A/C high pressure switch.
3. Using an ohmmeter, check for continuity between both terminals of the A/C high pressure switch. There should be continuity. If there is not continuity, replace the faulty A/C high pressure switch. If there is continuity, test the A/C high pressure switch sense circuit and repair as required (Refer to 8 - ELECTRICAL/WIRING DIAGRAM INFORMATION - DIAGNOSIS AND TESTING).

## REMOVAL

**NOTE: It is not necessary to discharge the refrigerant system to replace the A/C high pressure switch.**

**NOTE: LHD model shown in illustration. RHD models similar.**

1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness connector (1) from the A/C high pressure switch (2) located on the A/C discharge line (3) near the A/C compressor (4).
3. Remove the A/C high pressure switch from the A/C discharge line and remove and discard the O-ring seal.

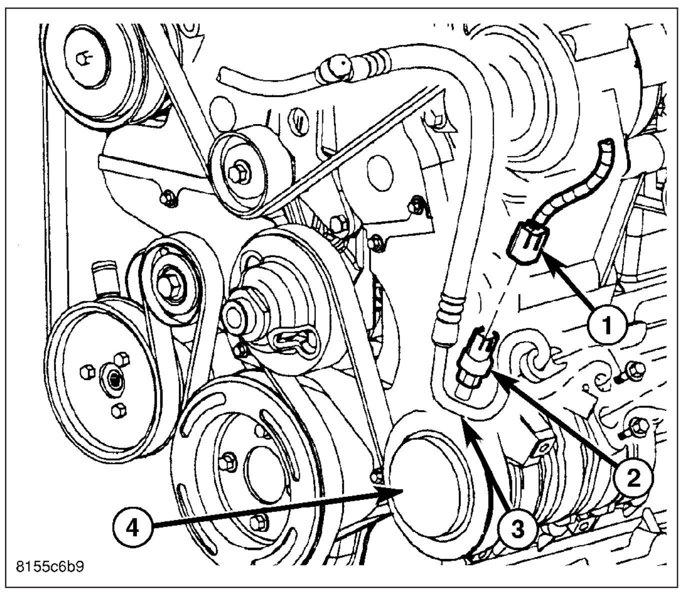



## INSTALLATION

**NOTE: Use only the specified O-ring as it is made of special material for R-134a. Use only refrigerant oil of the type required for the A/C compressor.**

**NOTE: LHD model shown in illustration. RHD models similar.**

1. Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the A/C high pressure switch fitting.
2. Install the A/C high pressure switch (2) onto the A/C discharge line (3) near the A/C compressor (4). Hand-tightened the switch securely.
3. Connect the wire harness connector (1) to the A/C high pressure switch.
4. Reconnect the negative battery cable.

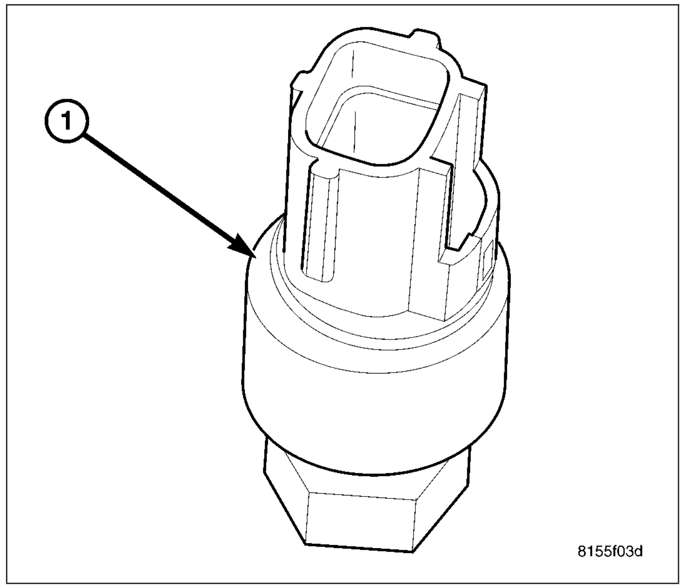


# SWITCH-A/C-LOW PRESSURE

## DESCRIPTION

The A/C low pressure switch (1) sends a signal to the powertrain control module (PCM) or the engine control module (ECM), depending on engine application, to regulate the refrigerant system pressure and control A/C evaporator temperature. The A/C low pressure switch is mounted on a fitting located on the top of the A/C accumulator. The PCM/ECM will disengage the A/C compressor clutch if the refrigerant system suction line pressure falls to approximately 141 kPa (20.5 psi) or lower.

The fitting for the A/C low pressure switch on the A/C accumulator is equipped with an O-ring seal and contains a Schrader-type valve, which allows the switch to be serviced without discharging the refrigerant system.




## OPERATION

The A/C low pressure switch monitors the pressure of the refrigerant leaving the accumulator to the A/C compressor. When equipped with a diesel engine, the A/C low pressure switch is electrically connected in series with the A/C high pressure switch, between ground and the engine control module (ECM).

The contacts in the A/C low pressure switch open or close the path to ground, signaling the powertrain control module (PCM) or the ECM (depending on engine application) to turn the A/C compressor clutch on and off. This regulates the refrigerant system pressure and controls A/C evaporator temperature. Controlling the evaporator temperature prevents condensate water on the evaporator fins from freezing and obstructing A/C system air flow.

The A/C low pressure switch contacts are open when the A/C suction line pressure is approximately 141 kPa (20.5 psi) or lower. The A/C low pressure switch contacts will close when the A/C suction line pressure rises to approximately 234 to 262 kPa (34 to 38 psi) or above. Lower ambient temperatures, below approximately -1° C (30° F), will also cause the A/C low pressure switch contacts to open. This is due to the pressure/temperature relationship of the refrigerant in the system.

The A/C low pressure switch is factory-calibrated and cannot be adjusted or repaired. If the A/C low pressure switch is faulty or damaged, it must be replaced.

## DIAGNOSIS AND TESTING

## A/C LOW PRESSURE SWITCH

**NOTE: Lower ambient temperatures, below about -1° C (30° F), during cold weather will open the A/C low pressure switch contacts and prevent A/C compressor operation due to the pressure/temperature relationship of the refrigerant.**

Before performing diagnosis of the A/C low pressure switch, verify that the refrigerant system has the correct refrigerant charge (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE) and that the A/C low pressure switch is properly installed on the accumulator fitting. If the A/C low pressure switch is not properly installed, it may not open the Schrader-type valve in the accumulator fitting, which will prevent the switch from correctly monitoring the refrigerant system pressure.

For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

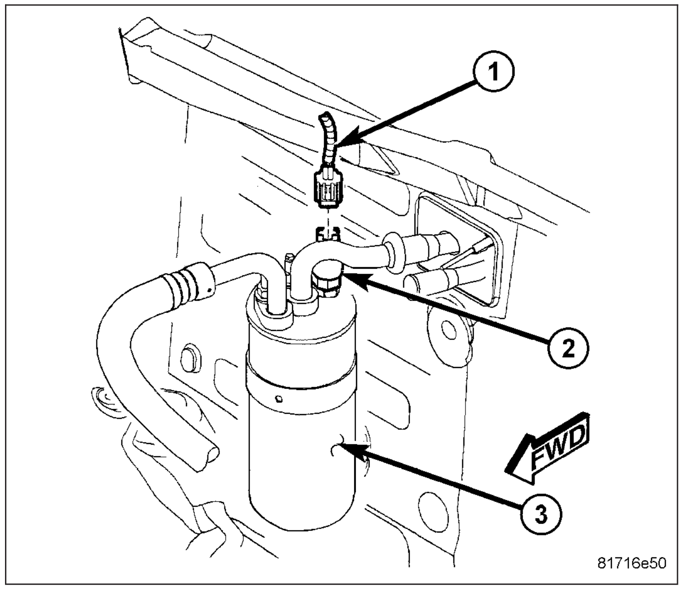
1. With gear selector in Park or Neutral and with park brake set, start the engine and allow it to idle.
2. Place the A/C-heater mode control in any A/C position.
3. Disconnect the wire harness connector from the A/C low pressure switch.
4. Using a suitable jumper wire, install the jumper wire between the two terminals of the wire harness connector for the A/C low pressure switch. The A/C compressor clutch should engage. If the A/C clutch does engage, replace the faulty A/C low pressure switch. If the A/C clutch does not engage, the A/C clutch, A/C clutch relay, A/C-heater control, A/C high pressure switch (diesel engine application), A/C pressure transducer (gasoline engine application), PCM or ECM (depending on engine application), fuses or related wiring circuits may be defective (Refer to 8 - ELECTRICAL/WIRING DIAGRAM INFORMATION - DIAGNOSIS AND TESTING). Repair as required.

## REMOVAL

**NOTE: It is not necessary to discharge the refrigerant system to replace the A/C low pressure switch.**

**NOTE: LHD model shown. RHD model similar.**

1. Disconnect and isolate the battery negative cable.
2. Disconnect the wire harness connector (1) from the A/C low pressure switch (2) located on the top of the A/C accumulator (3).
3. Remove the A/C low pressure switch from the A/C accumulator and remove and discard the O-ring seal.

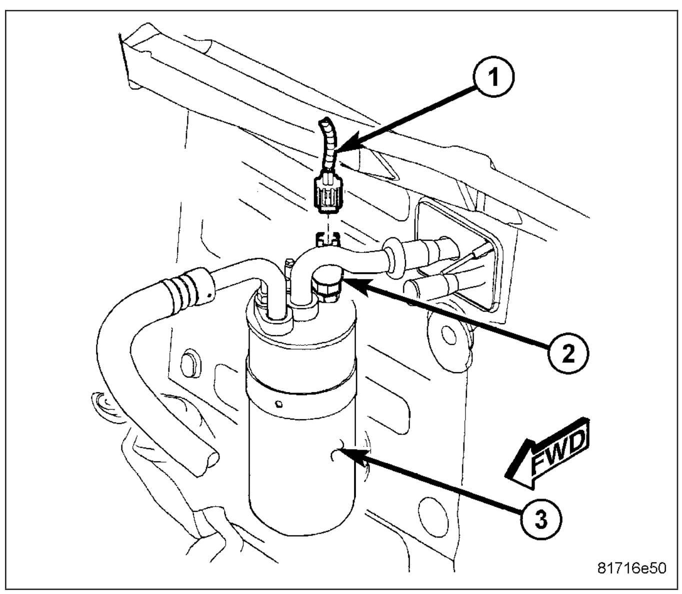



## INSTALLATION

**NOTE: Use only the specified O-ring as it is made of special material for R-134a. Use only refrigerant oil of the type required for the A/C compressor.**

**NOTE: LHD model shown. RHD model similar.**

1. Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the A/C low pressure switch fitting.
2. Install the A/C low pressure switch (2) onto the top of the A/C accumulator (3). Hand-tightened the switch securely.
3. Connect the wire harness connector (1) to the A/C low pressure switch.
4. Reconnect the negative battery cable.

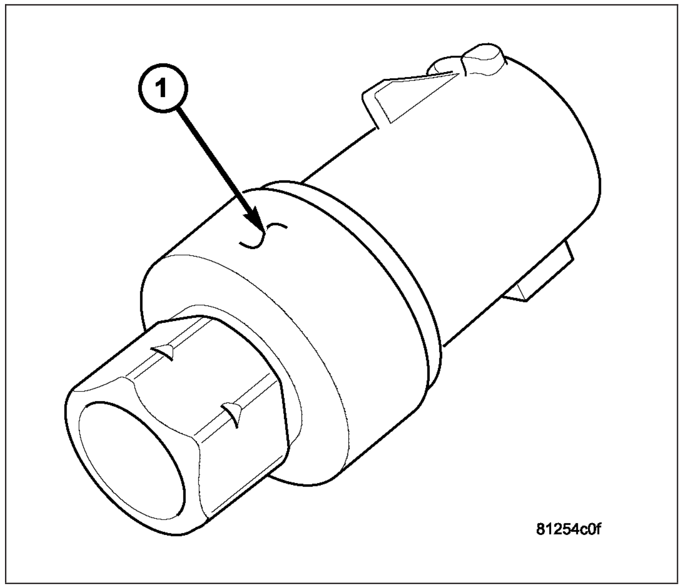


# TRANSDUCER-A/C PRESSURE

## DESCRIPTION

The A/C pressure transducer (1) sends a signal to the powertrain control module (PCM) which controls both A/C compressor clutch engagement/disengagement and electric cooling fan operation when equipped with the 3.7L gasoline engine. The A/C pressure transducer is mounted on a fitting located on the A/C discharge line near the A/C compressor. The PCM will disengage the A/C compressor clutch when high side pressure rises above 2971 kPa (431 psi) or fall below 206 kPa (30 psi).

The fitting for the A/C pressure transducer on the A/C discharge line is equipped with an O-ring seal and contains a Schrader-type valve, which allows the transducer to be serviced without discharging the refrigerant system.




## OPERATION

The A/C pressure transducer monitors the pressures in the high side of the refrigerant system through its connection to a fitting on the A/C discharge line. The A/C pressure transducer will change its internal resistance in response to the pressures it monitors. A Schrader-type valve in the discharge line fitting permits the A/C pressure transducer to be removed or installed without disturbing the refrigerant in the A/C system.

The powertrain control module (PCM) provides a five volt reference signal and a sensor ground to the A/C pressure transducer, then monitors the output voltage of the A/C pressure transducer on a sensor return circuit to determine refrigerant pressure. The PCM is programmed to respond to the A/C pressure transducer and other sensor inputs by controlling the operation of the A/C compressor clutch and the radiator cooling fan to help optimize A/C system performance and to protect the system components from damage PCM will disengage the A/C compressor clutch when high side pressure rises above 2971 kPa (431 psi) or fall below 206 kPa (30 psi). The A/C pressure transducer input to the PCM will also prevent the A/C compressor clutch from engaging when ambient temperatures are below about 1.0° C (50° F) due to the pressure/temperature relationship of the refrigerant.

The A/C pressure transducer is diagnosed using a scan tool. Refer to 9 - Engine Electrical Diagnostics for more information.

The A/C pressure transducer cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

## DIAGNOSIS AND TESTING

## A/C PRESSURE TRANSDUCER

The A/C pressure transducer is tested using a scan tool. Refer to 9 - Engine Electrical Diagnostics for more information. Before testing the A/C pressure transducer, be certain that the transducer wire harness connection is clean of corrosion and properly connected. For the A/C to operate, an A/C pressure transducer voltage reading between 0.451 and 4.519 volts is required. Voltages outside this range indicate a low or high refrigerant system pressure condition to the powertrain control module (PCM). The PCM is programmed to respond to a low or high refrigerant system pressure by suppressing operation of the A/C compressor. Refer to the A/C Pressure Transducer Voltage chart for the possible conditions indicated by the transducer voltage reading.

**A/C PRESSURE TRANSDUCER VOLTAGE**

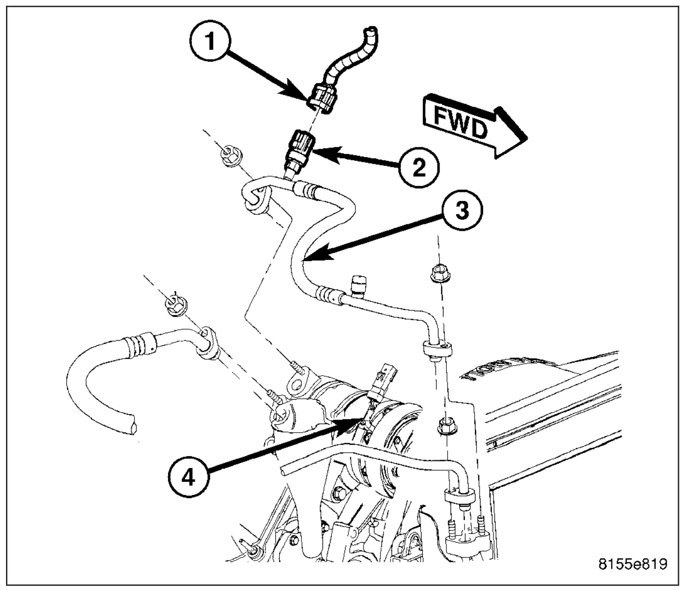
| Voltage | Possible Indication |
|---|---|
| 0.0 | 1. No sensor supply voltage from PCM.<br>2. Shorted sensor circuit.<br>3. Faulty transducer. |
| 0.150 TO 0.450 | 1. Ambient temperature below 10° C (50° F).<br>2. Low refrigerant system pressure. |
| 0.451 TO 4.519 | 1. Normal refrigerant system pressure. |
| 4.520 TO 4.850 | 1. High refrigerant system pressure. |
| 5.0 | 1. Open sensor circuit.<br>2. Faulty transducer. |

## REMOVAL

**NOTE: It is not necessary to discharge the refrigerant system to replace the A/C pressure transducer.**

**NOTE: LHD model shown in illustration. RHD models similar.**

1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness connector (1) from the A/C pressure transducer (2) located on the A/C discharge line (3) near the A/C compressor (4).
3. Remove the A/C pressure transducer from the A/C discharge line and remove and discard the O-ring seal.

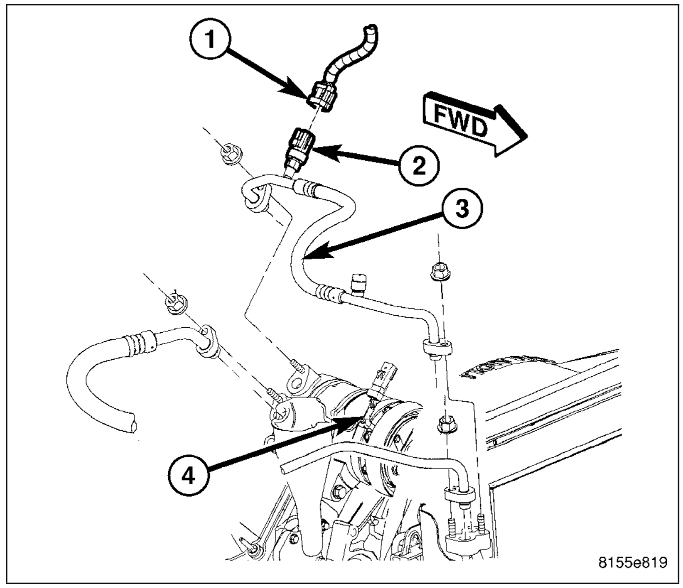



## INSTALLATION

**NOTE: Use only the specified O-ring as it is made of special material for R-134a. Use only refrigerant oil of the type required for the A/C compressor.**

**NOTE: LHD model shown in illustration. RHD models similar.**

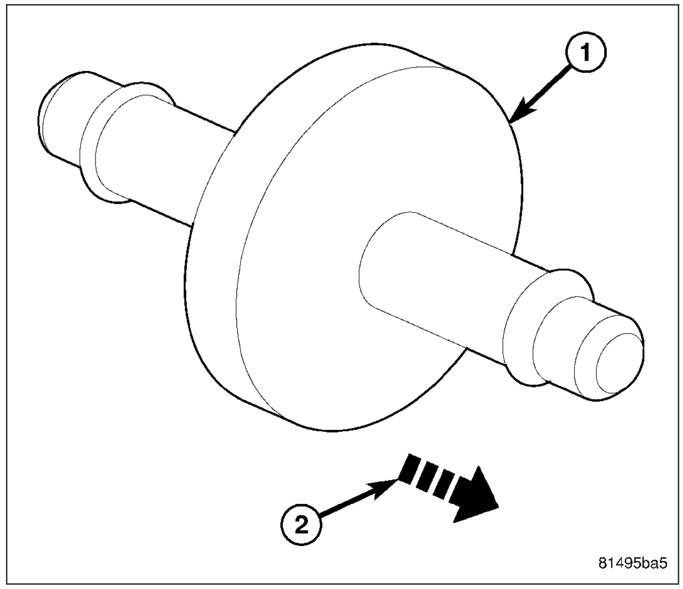
1. Lubricate a new rubber O-ring seal with clean refrigerant oil and install it onto the A/C pressure transducer fitting.
2. Install the A/C pressure transducer (2) onto the A/C discharge line (3) near the A/C compressor (4). Hand-tightened the transducer securely.
3. Connect the wire harness connector (1) to the A/C pressure transducer.
4. Reconnect the negative battery cable.



# VALVE-VACUUM CHECK

## DESCRIPTION

Both the heating-A/C system and the heater-only system use two vacuum check valves. One vacuum check valve (1) is installed in the accessory vacuum supply line located on the dash panel in the engine compartment, near the brake booster and, the other check valve is located on the passenger side of the HVAC housing, behind the glove box. The vacuum check valves are used to stabilize the vacuum within the HVAC vacuum circuits whenever the vehicle is accelerating or when engine vacuum varies due to operating conditions. The vacuum check valves are designed to allow vacuum to flow in only one direction (2) through the vacuum supply circuits.




## OPERATION

The use of two vacuum check valves help to maintain the vacuum required to retain the heating and the A/C systems in the selected operating mode. The vacuum check valves will prevent the engine from bleeding down system vacuum through the intake manifold during extended heavy engine load (low engine vacuum) operation.

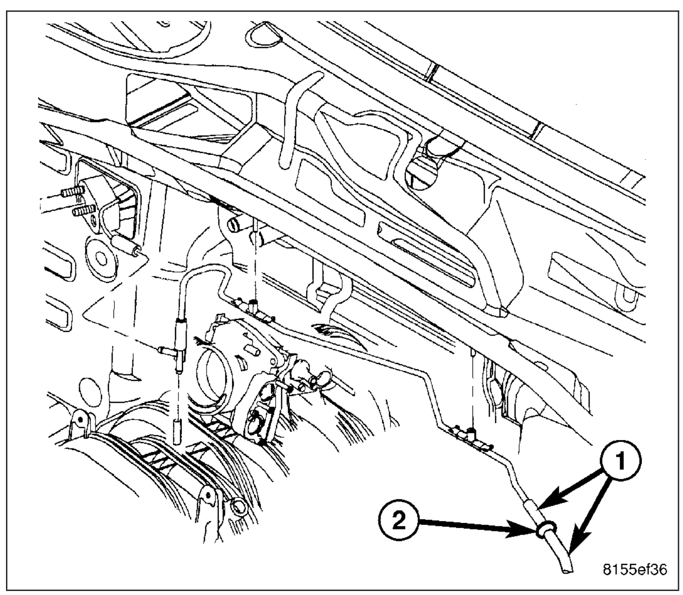
The vacuum check valves cannot be repaired and, if faulty or damaged, they must be replaced.

## REMOVAL

**NOTE: Make note the orientation of the vacuum check valves in the vacuum supply circuit for correct installation position.**

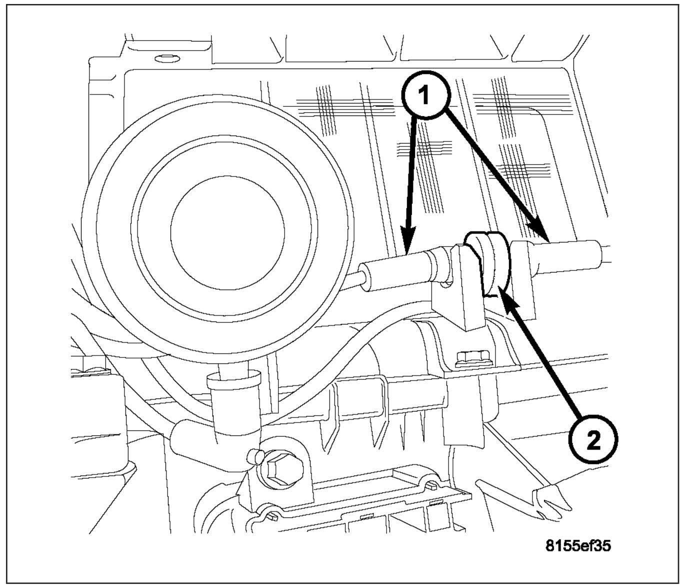
**NOTE: LHD 3.7L engine shown in illustration. Diesel and RHD models similar.**

1. Disconnect the vacuum supply line connectors (1) from the vacuum check valve (2) located in the engine compartment near the dash panel and remove the valve.



**NOTE: LHD heating-A/C system shown in illustration. RHD similar.**

2. Disconnect the vacuum supply line connectors from the vacuum check valve located in the passenger compartment, behind the glove box and remove the valve.

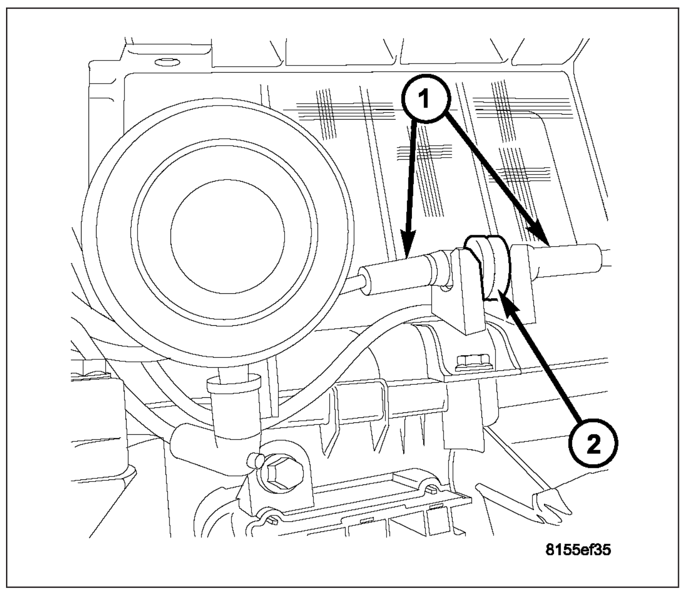



## INSTALLATION

**NOTE: Be sure to install the vacuum check valves into the vacuum supply circuit in the correct orientation as noted during removal.**

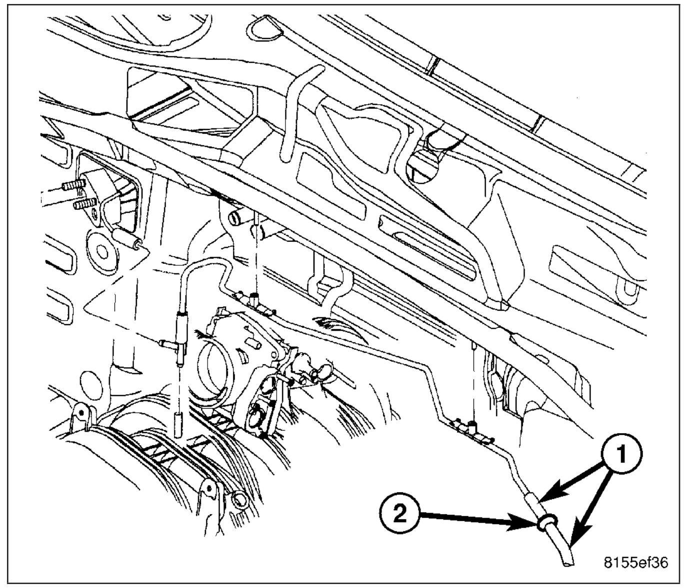
**NOTE: LHD heating-A/C system shown in illustration. RHD similar.**

1. Position the vacuum check valve (2) into the passenger compartment behind the glove box and connect the vacuum supply line connectors (1) to the check valve.



**NOTE: LHD 3.7L engine shown in illustration. Diesel and RHD models similar.**

2. Position the vacuum check valve (2) into the engine compartment near the dash panel and connect the vacuum supply line connectors (1) to the check valve.



# DISTRIBUTION

## TABLE OF CONTENTS

# DUCT-DEFROSTER

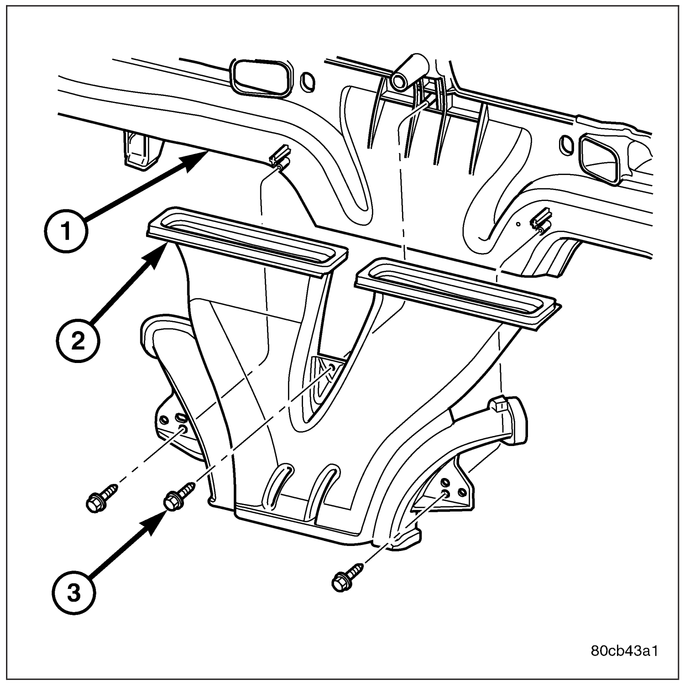
## REMOVAL

**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in an accidental airbag deployment and possible personal injury or death.**

**NOTE: Take the proper precautions to protect the front face of the instrument panel from cosmetic damage during this service procedure.**

**NOTE: LHD model shown in illustration. RHD model similar.**

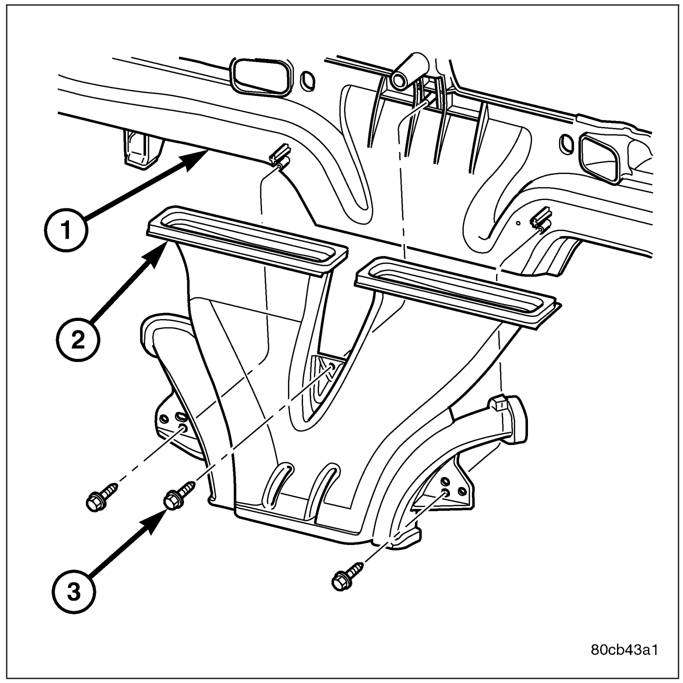
1. Remove the instrument panel and place it on a workbench (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).
2. Remove the three screws (3) that secure the defroster duct (2) to the instrument panel (1) and remove the duct.



## INSTALLATION

**NOTE: LHD model shown in illustration. RHD model similar.**

1. Position the defroster duct (2) into the instrument panel (1).
2. Install the three screws (3) that secure the defroster duct to the instrument panel. Tighten the screws to 2 N·m (17 in. lbs.).
3. Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).



# DUCT-FLOOR DISTRIBUTION

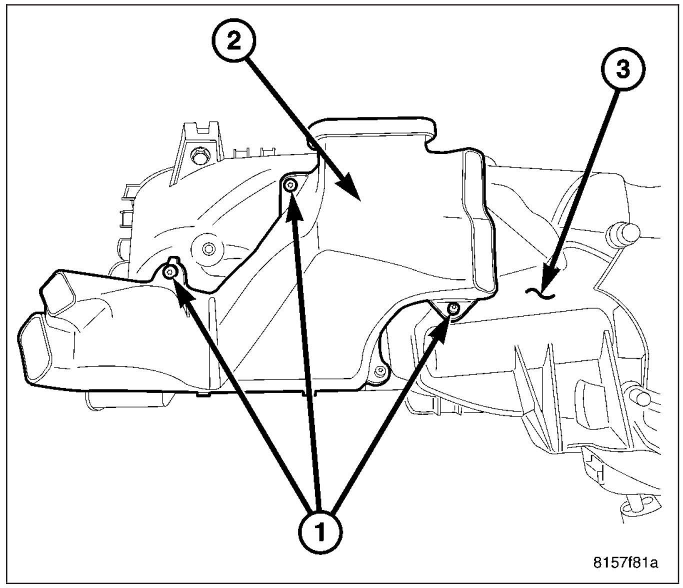
## REMOVAL

**NOTE: LHD model shown in illustration. RHD model similar.**

1. Remove the HVAC Housing and place it on a workbench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - REMOVAL).
2. Remove the three screws (1) that secure the floor distribution duct (2) to the bottom of the HVAC housing (3).

**NOTE: If the foam seal on the floor distribution duct is deformed or damaged, the foam seal must be replaced.**

3. Remove the floor distribution duct from the HVAC housing. If the foam seal on the floor distribution duct is deformed or damaged, the seal must be replaced.

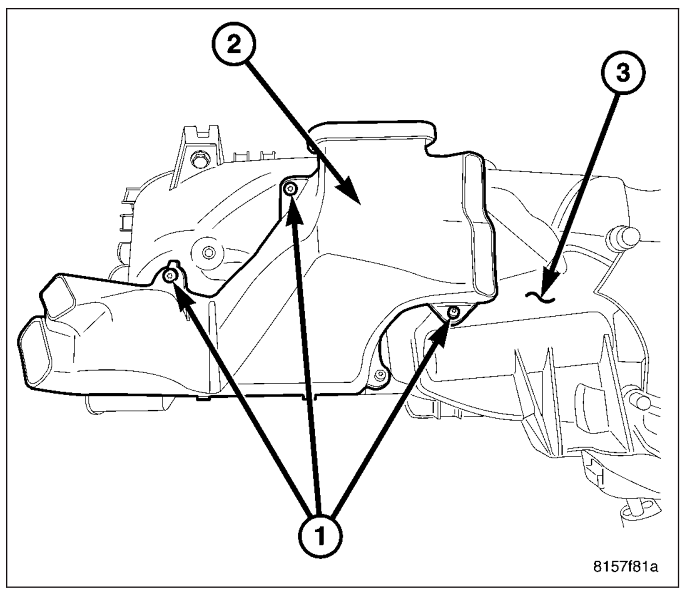



## INSTALLATION

**NOTE: LHD model shown in illustration. RHD model similar.**

**NOTE: If the foam seal on the floor distribution duct is deformed or damaged, the foam seal must be replaced.**

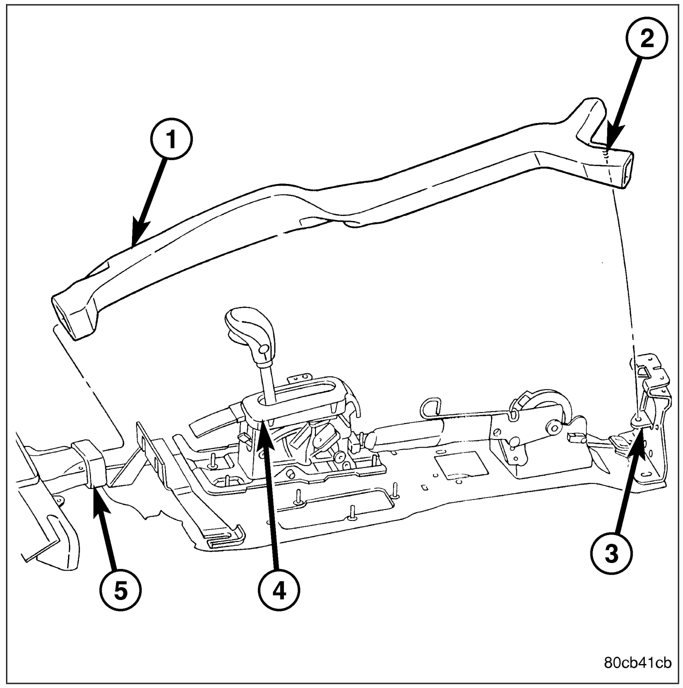
1. Position the floor distribution duct (2) onto the bottom of the HVAC housing (3).
2. Install the three screws (1) that secure the floor distribution duct to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
3. Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - INSTALLATION).



# DUCT-REAR FLOOR HEAT

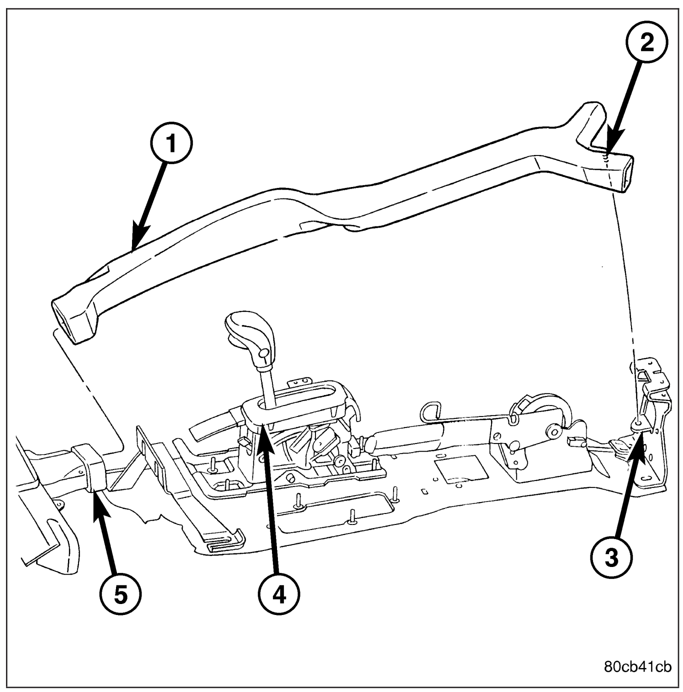
## REMOVAL

1. Remove the floor console (Refer to 23 - BODY/INTERIOR/CONSOLE-FLOOR - REMOVAL).
2. Remove the push-pin retainer (2) that secures the rear floor heat duct (1) to the floor console bracket (3) located behind the gear shift lever assembly (4).
3. Disconnect the rear floor heat duct from the floor distribution duct (5).
4. Remove the rear floor heat duct from the vehicle.




## INSTALLATION

1. Position the rear floor heat duct (1) into the vehicle.
2. Connect the rear floor heat duct to the floor distribution duct (5) located in front of the gear shift lever assembly (4).
3. Install the push-pin retainer (2) that secures the rear floor heat duct to the floor console bracket (3).
4. Install the floor console (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION).

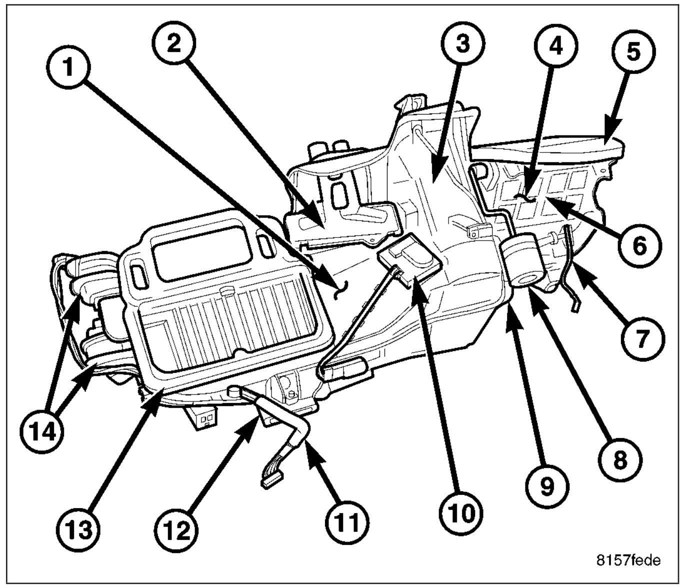


# HOUSING-HVAC

## DESCRIPTION

All models are equipped with a common HVAC housing assembly (1) that combines A/C and heating capabilities into a single unit mounted within the passenger compartment. The HVAC housing consists of the following:

- **HVAC housing** — The HVAC housing consists of an upper housing and a lower housing that are attached together by screws and are mounted to the dash panel behind the instrument panel. The HVAC housing contains the heater core (2), A/C evaporator (3), blower motor (7), blower motor resistor (9), blend-air doors and actuator (10), HVAC vacuum harness (11), floor distribution duct (12), foam seals (13 ) and the mode-air doors and actuators (14).
- **Air inlet housing** — The air inlet housing (4) is mounted to the right end of the HVAC housing and contains the foam seal (5), recirculation-air door (6) and the recirculation door actuator (8).




The heating-A/C system is a blend-air type system. The two blend-air doors control the amount of conditioned air that is allowed to flow through, or around, the heater core. This single zone heating-A/C system uses only one blend door actuator.

The A/C system is designed for the use of a non-CFC, R-134a refrigerant and uses an A/C evaporator to cool and dehumidify the incoming air prior to blending it with the heated air. A temperature control determines the discharge air temperature by operating the blend door actuator, which moves the blend-air doors. This allows an almost immediate control of the output air temperature of the system. The two mode door actuators operate the mode-air doors which direct the flow of the conditioned air out the various air outlets, depending on the mode selected. The recirculation door actuator operates the recirculation-air door which closes off the fresh air intake and recirculates the air already inside the vehicle. The blower motor controls the velocity of air flowing through the HVAC housing assembly by spinning the blower wheel within the HVAC housings at the selected speed by use of the blower motor resistor.

The HVAC housing must be removed from the vehicle for service of the heater core and the air inlet housing, and disassembled for service of the A/C evaporator, blend-air and mode-air doors. The air inlet housing must be removed and disassembled for service of the recirculation-air door.

## REMOVAL

## HVAC HOUSING

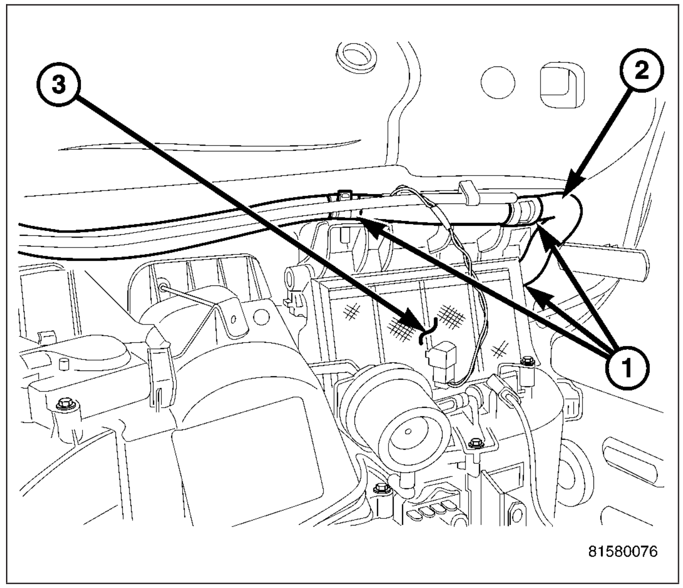
**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in an accidental airbag deployment and possible personal injury or death.**

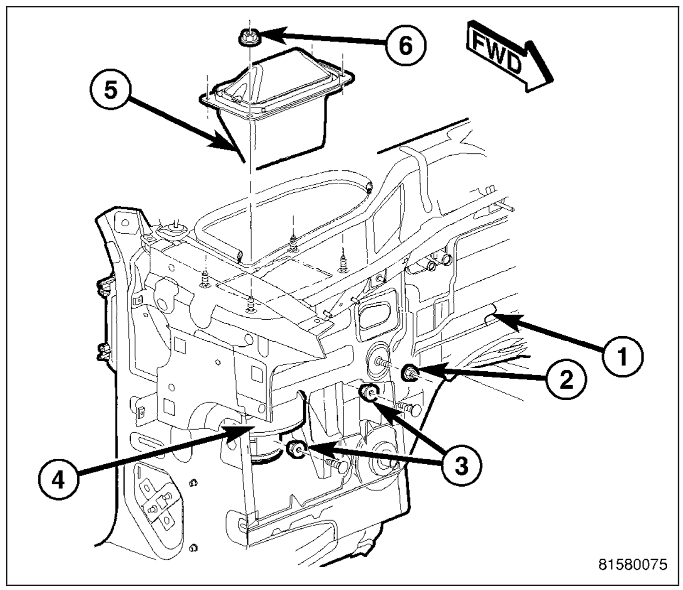
**NOTE: The HVAC housing must be removed from the vehicle and disassembled for service of the A/C evaporator and the mode-air and blend-air doors.**

**NOTE: LHD model shown in illustrations. RHD model similar.**

1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Drain the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM DRAIN).
4. Remove the instrument panel from the passenger compartment (Refer to 23 - BODY/INSTRUMENT PANEL ASSEMBLY - REMOVAL).
5. Disengage the three retaining straps (1) that secure the dash panel wire harness (2) to the top of the HVAC air inlet housing (3) and position the wire harness out of the way.




6. Remove the two nuts that secure the A/C accumulator to the dash panel and disconnect the refrigerant lines from the A/C evaporator (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ACCUMULATOR-A/C - REMOVAL) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LINE-A/C LIQUID - REMOVAL).
7. Install plugs into or caps over the opened refrigerant line fittings and evaporator ports
8. Disconnect the heater hoses from the heater core tubes and install plugs into or caps over the heater core tubes.
9. Disconnect the HVAC system vacuum supply line from the engine vacuum harness at the connector located near the evaporator tapping block.
10. Remove the condensation drain tube (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/TUBE-CONDENSATION DRAIN - REMOVAL).




11. Remove the one nut (2) that secures the HVAC housing (4) to the engine compartment side of the dash panel (1).
12. Remove the two nuts (3) that secure the HVAC housing to the passenger compartment side of the dash panel.
13. Pull the HVAC housing assembly rearward so that the mounting studs and condensate drain clear the dash panel and remove the HVAC housing from the passenger compartment.
14. If required, remove the four retaining nuts (6) and the fresh air inlet screen (5) from the top of the dash panel.

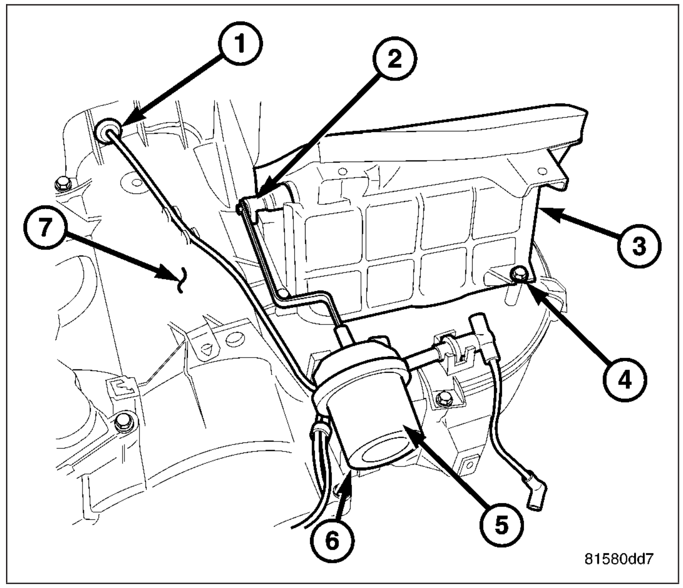
## AIR INLET HOUSING

**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the negative battery (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.**

**NOTE: The air inlet housing must be removed from HVAC housing and disassembled for service of the recirculation-air door.**

1. Disconnect and isolate the negative battery cable.
2. Remove the HVAC housing (7) and place it on a workbench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - REMOVAL).
3. Disconnect the HVAC vacuum harness connector (6) from the recirculation door actuator (5) and if required, position the vacuum harness (1) out of the way.
4. Carefully disconnect the recirculation door actuator from the recirculation door lever (2) and if required, remove the actuator from the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/ACTUATOR-RECIRCULATION DOOR - REMOVAL).
5. Remove the four screws (4) that secure the air inlet housing (3) to the top of the HVAC housing and remove the air inlet housing.




**NOTE: If the foam seal on the air inlet housing is deformed or damaged, it must be replaced.**

6. If required, disassemble the air inlet housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR INLET - DISASSEMBLY).

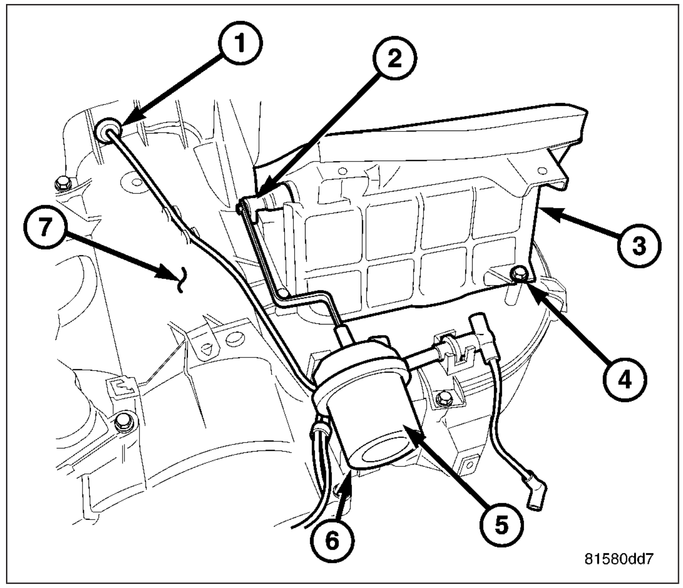
## DISASSEMBLY

## HVAC HOUSING

**NOTE: The HVAC housing must be removed from the vehicle and disassembled for service of the A/C evaporator and the mode-air and blend-air doors.**

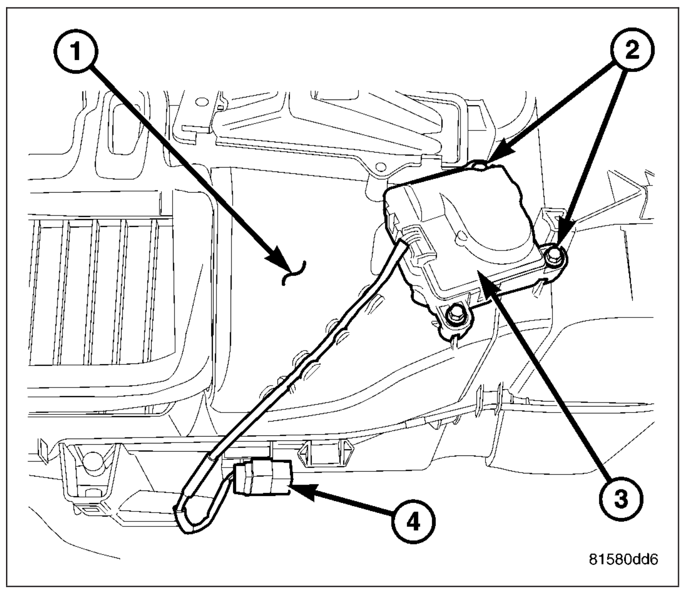
**NOTE: LHD model shown in illustrations. RHD model similar.**

1. Remove the HVAC housing from the vehicle and place it on a workbench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - REMOVAL).
2. Remove the vacuum harness and grommet (1) from the top of the HVAC housing (7).
3. Disconnect the vacuum harness connector (6) from the recirculation door actuator (5).
4. Carefully disconnect the recirculation door actuator from the recirculation door lever (2) and remove the actuator from the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/ACTUATOR-RECIRCULATION DOOR - REMOVAL).
5. Remove the four screws (4) that secure the air inlet housing (3) to the top of the HVAC housing and remove the air inlet housing.

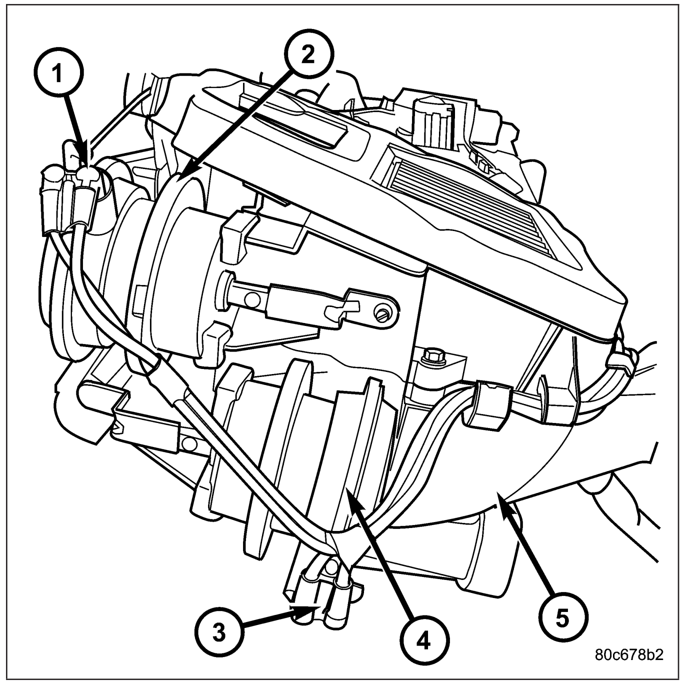



**NOTE: If the foam seal on the air inlet housing is deformed or damaged, the seal must be replaced.**

6. If required, disassemble the air inlet housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR INLET - DISASSEMBLY).
7. Disengage the wire harness lead and connector (4) for the blend door actuator (3) from the retainers located on the top and on the rear of the HVAC housing (1).
8. Remove the three screws (2) that secure the blend door actuator to the top of the HVAC housing and remove the actuator and wire harness lead and connector from the housing.



9. Disconnect the vacuum harness connectors (1 and 3) from the two mode door actuators (2 and 4) located on the driver side end of the HVAC housing (5).
10. Carefully disconnect the mode door actuators from the mode-air door levers and remove the actuators from the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/ ACTUATOR-MODE DOOR - REMOVAL).
11. Disengage the HVAC vacuum harness from the routing clips located on the HVAC housing and remove the vacuum harness from the housing.

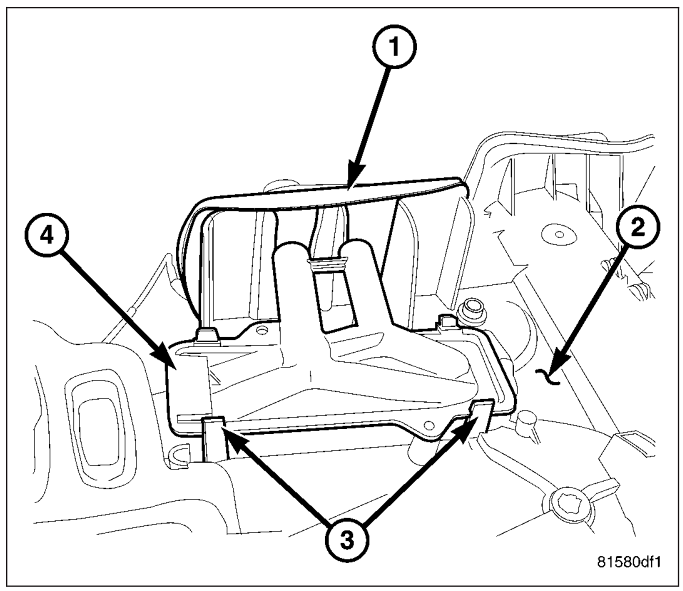



**NOTE: If the foam seal around the heater core tubes is deformed or damaged, the seal must be replaced.**

12. Carefully remove the foam seal (1) from the heater core (4) and the front of the HVAC housing (2). If the seal is deformed or damaged, it must be replaced.

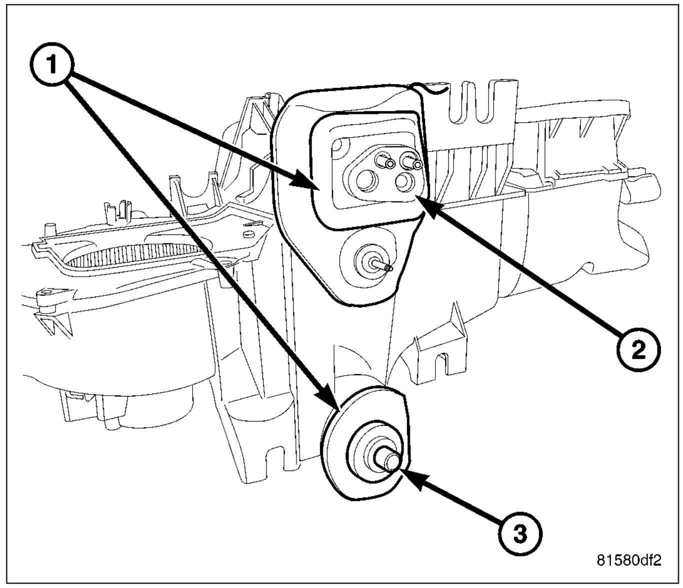
**NOTE: If the foam insulator around the heater core is deformed or damaged, the insulator must be replaced.**

13. Disengage the four retaining tabs (3) that secure the heater core to the top of the HVAC housing and carefully remove the heater core from the housing.

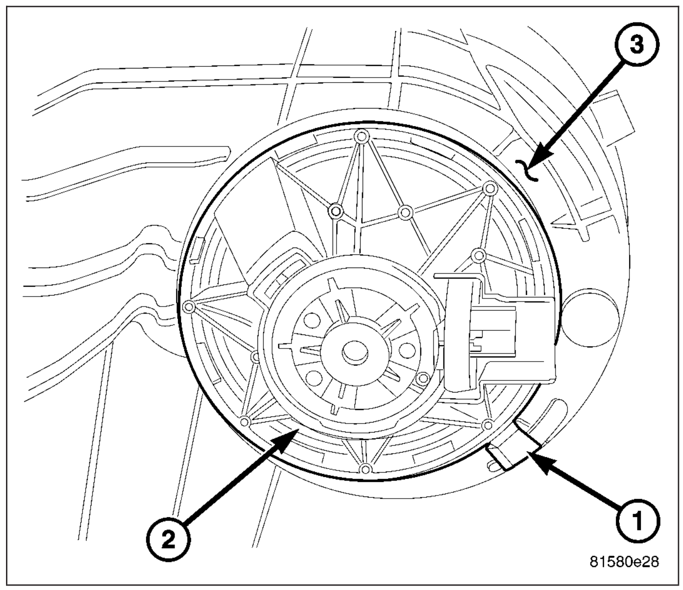


**NOTE: If any foam or rubber seal is deformed or damaged, the seal must be replaced.**

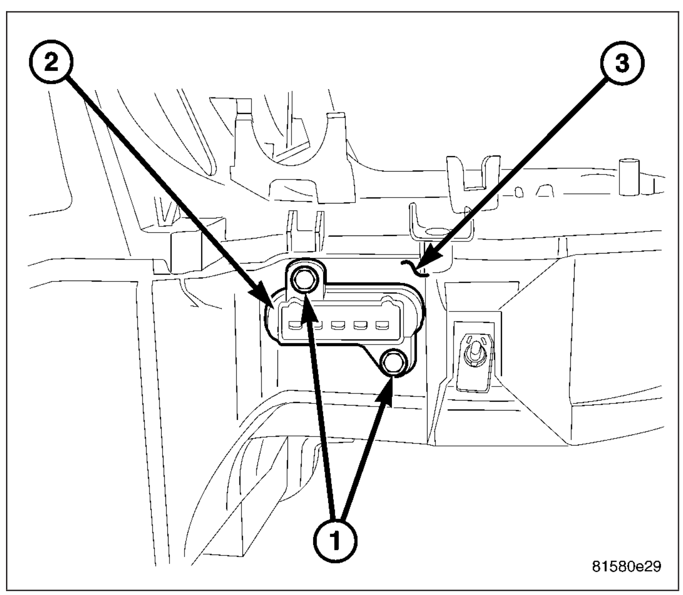
14. Carefully remove the foam and rubber seals (1) from around the evaporator tapping block (2) and the condensate drain (3). If any seal is deformed or damaged, it must be replaced.




15. Release the locking tab (1) that secures the blower motor (2) to the HVAC housing (3) and rotate blower motor counterclockwise.
16. Rotate the blower motor counterclockwise as needed to remove the blower motor and wheel from the HVAC housing.

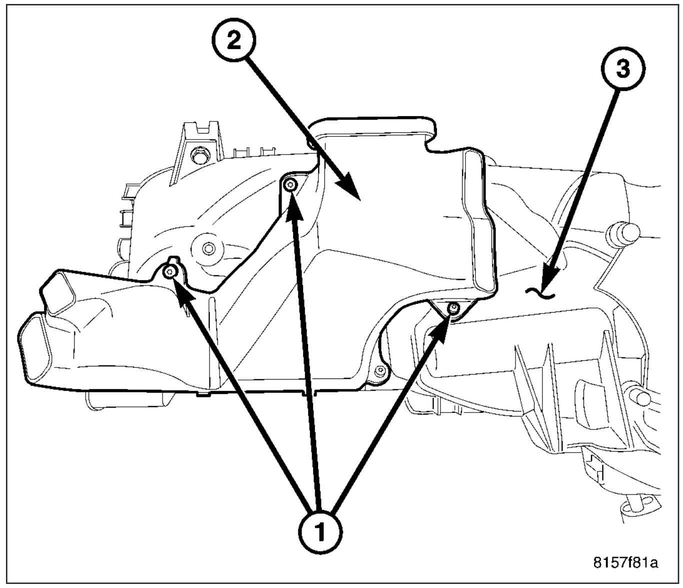



17. Remove the two screws (1) that secure the blower motor resistor (2) to the rear of the HVAC housing (3) and remove the resistor.



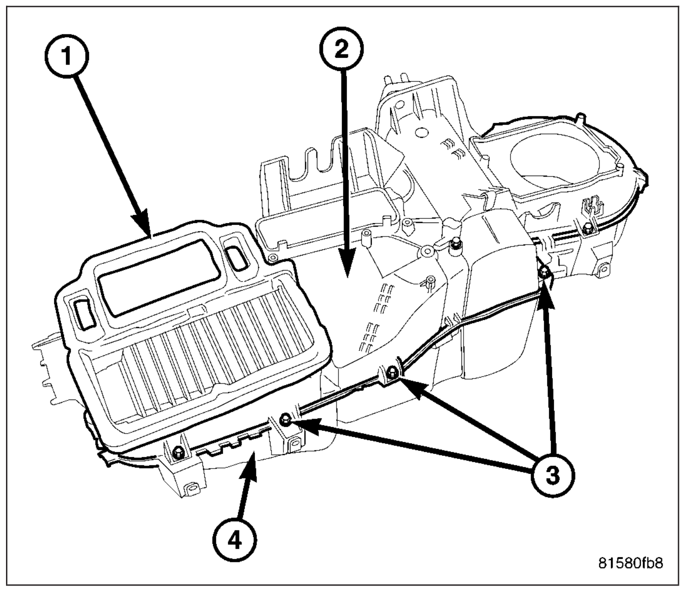
**NOTE: If the foam seal on the floor distribution duct is deformed or damaged, the seal must be replaced.**

18. Remove the three screws (1) that secure the floor distribution duct (2) to the bottom of the HVAC housing (3) and remove the duct.




**NOTE: If the foam seal on the panel/defrost outlet is deformed or damaged, the seal must be replaced.**

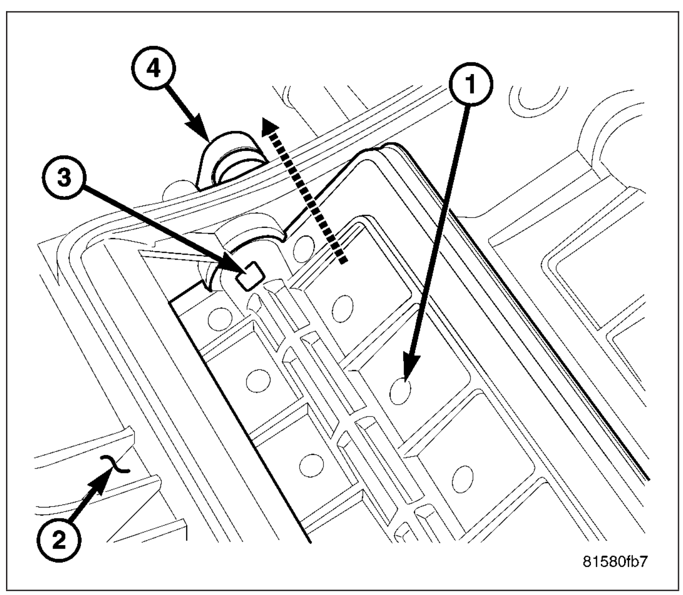
19. If required, remove the foam seal (1) from the panel/defrost outlet located on the upper half of the HVAC housing (2).
20. Remove the screws (3) that secure the upper half of the HVAC housing to the lower half of the HVAC housing (4).
21. Carefully separate the two halves of the HVAC housing.




22. To remove the panel-air door (1) from the inside of the upper half of the HVAC housing (2), first carefully release the retaining tab (3) of the panel door lever (4) from the pivot shaft of the panel-air door, using a small pick-type tool.
23. Pull the panel door lever out of the pivot shaft of the panel-air door.

**NOTE: If the seal on the air door is deformed or damaged, the air door must be replaced.**

24. Remove the panel-air door from the upper half of the HVAC housing.

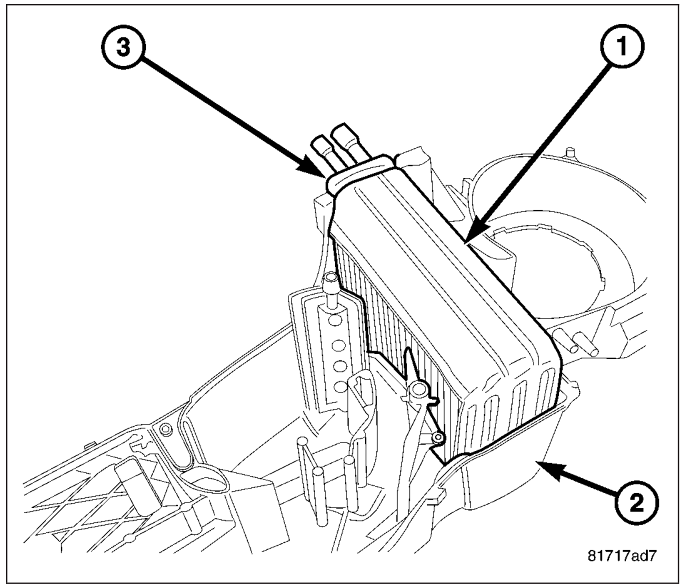


**NOTE: If the foam insulator around the A/C evaporator is deformed or damaged, the insulator must be replaced.**

25. Carefully lift the A/C evaporator (1) and the foam insulator out of the lower half of the HVAC housing (2).

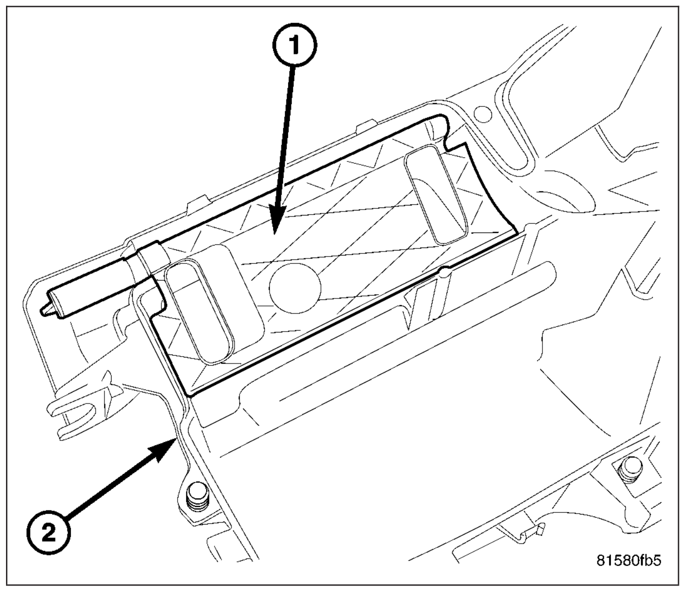
**NOTE: If the rubber seal around the evaporator tubes is deformed or damaged, the seal must be replaced.**

26. If required, remove the rubber seal (3) from around the evaporator tubes.



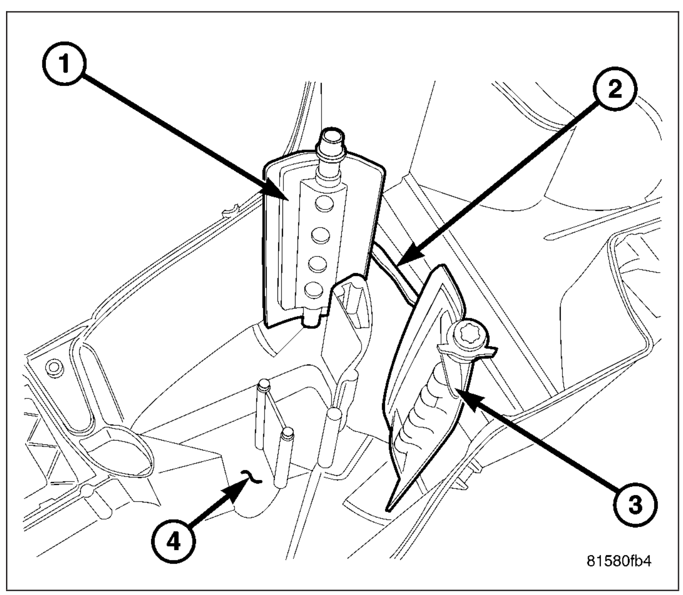

**NOTE: If the seal on the air door is deformed or damaged, the air door must be replaced.**

27. Remove the floor/defrost-air door (1) from the lower half of the HVAC housing (2).




**NOTE: If the seal on any air door is deformed or damaged, the air door must be replaced.**

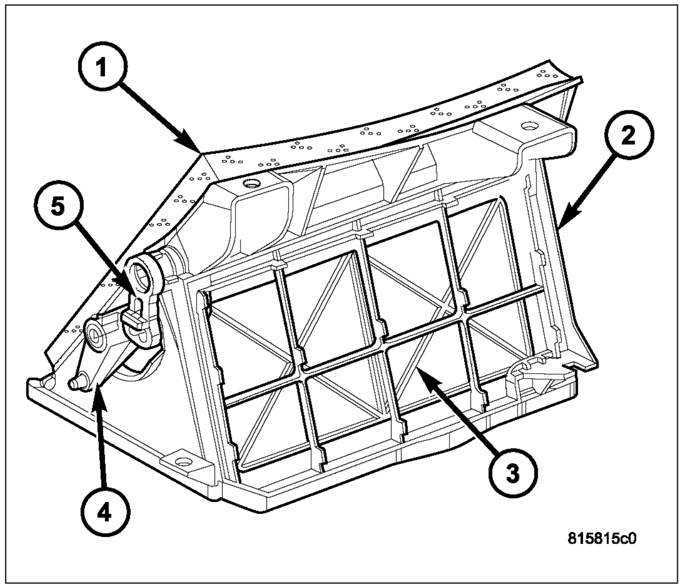
28. Remove both blend-air doors (1 and 3) from the lower half of the HVAC housing (4).
29. If required, disengage the blend door arm (2) from both blend-air doors.



## AIR INLET HOUSING

**NOTE: The air inlet housing must be removed from HVAC housing and disassembled for service of the recirculation-air door.**

1. Remove the air inlet housing from the HVAC housing and place it on a workbench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR INLET - REMOVAL)




**NOTE: If the foam seal on the air inlet housing is deformed or damaged, the seal must be replaced.**

2. If required, remove the foam seal (1) from the top of the air inlet housing (2).
3. To remove the recirculation-air door (3) from the inside of the air inlet housing, first carefully pull the recirculation door lever (5) out from the end of the pivot shaft of the recirculation-air door, using pliers.
4. Remove the pivot lever (4) from the side of the air inlet housing.

**NOTE: If the seal on the air door is deformed or damaged, the air door must be replaced.**

5. Remove the recirculation-air door from the air inlet housing.

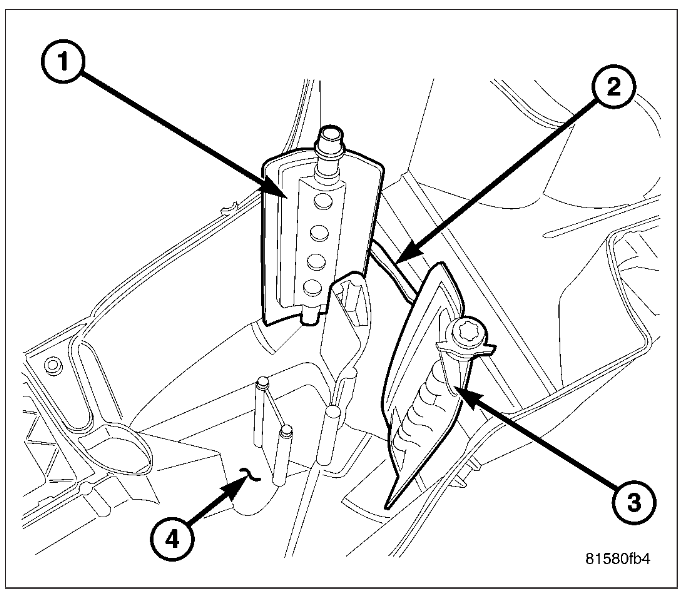
## ASSEMBLY

## HVAC HOUSING

**NOTE: The HVAC housing must be removed from the vehicle and disassembled for service of the A/C evaporator and the mode-air and blend-air doors.**

**NOTE: LHD model shown in illustrations. RHD model similar.**

1. If removed, install the blend door arm (2) onto both blend-air doors (1 and 3).

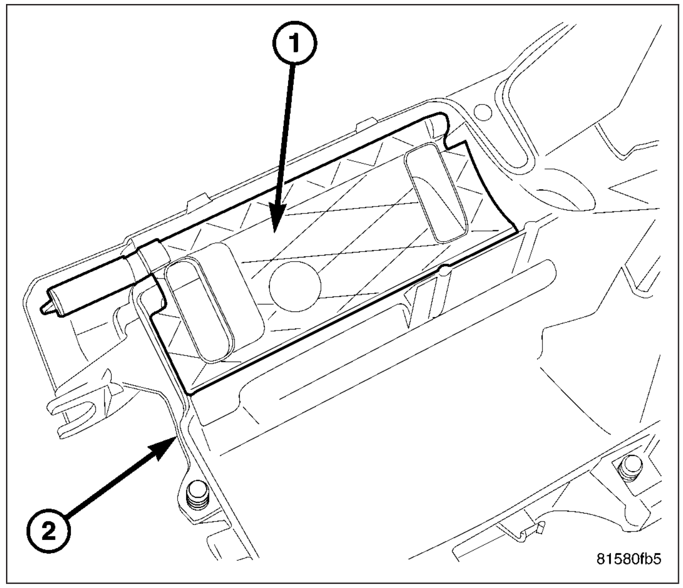



**NOTE: If the seal on any air door is deformed or damaged, the air door must be replaced.**

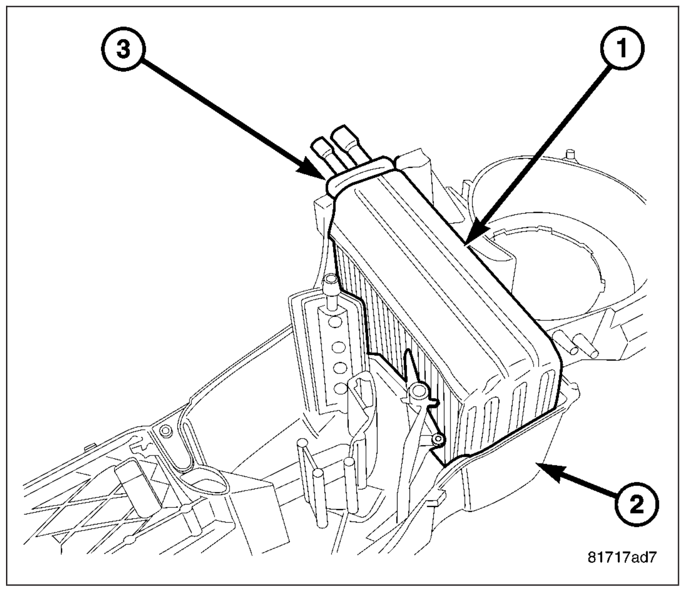
2. Position both blend-air doors into the pivot holes in the lower half of the HVAC housing.

**NOTE: If the seal on any air door is deformed or damaged, the air door must be replaced.**

3. Position the floor/defrost-air door (1) into the pivot grooves in the lower half of the HVAC housing (2).




4. If removed, install the rubber seal (3) around the tubes of the A/C evaporator (1).




**NOTE: Make sure that the evaporator drain is clean and unrestricted and that the rubber seal around the evaporator tubes is properly positioned in the HVAC housing.**

**NOTE: If the A/C evaporator is being replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.**

**NOTE: If the foam insulator around the heater core is deformed or damaged, the insulator must be replaced.**

**NOTE: Make sure that the foam insulator is properly positioned in the HVAC housing.**

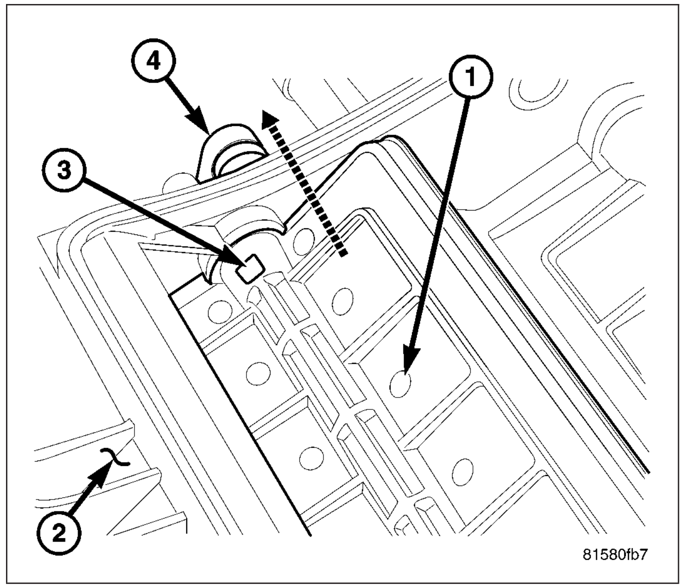
5. Install the A/C evaporator and its foam insulator into the lower half of the HVAC housing (2).

**NOTE: If the seal on the air door is deformed or damaged, the air door must be replaced.**

6. Position the panel-air door (1) into the upper half of the HVAC housing (2).

**CAUTION: Make sure that the panel-air door pivot shaft is properly seated in the pivot holes located in the upper half of the HVAC housing.**

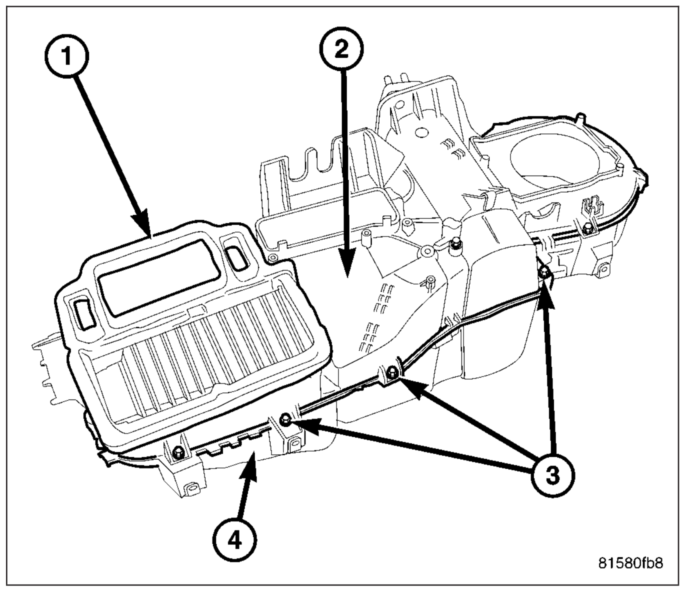
7. Align the panel door lever (4) with the pivot shaft of the panel-air door and install the lever into the pivot shaft. Make sure the retaining tab (3) is fully engaged.




8. Align the blend-air door pivot shafts with the pivot holes in the upper half of the HVAC housing (2) and install it onto the lower half of the HVAC housing (4).
9. Install the screws (3) that secure the two halves of the HVAC housing together. Tighten the screws to 2 N·m (17 in. lbs.).

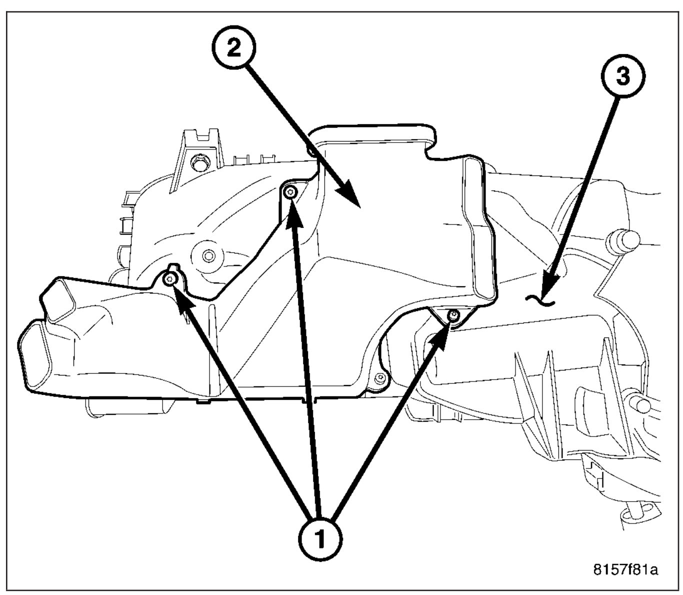
**NOTE: If the foam seal on the panel/defrost outlet is deformed or damaged, the seal must be replaced.**

10. If removed, install a new foam seal (1) onto the panel/defrost outlet located on the upper half of the HVAC housing.

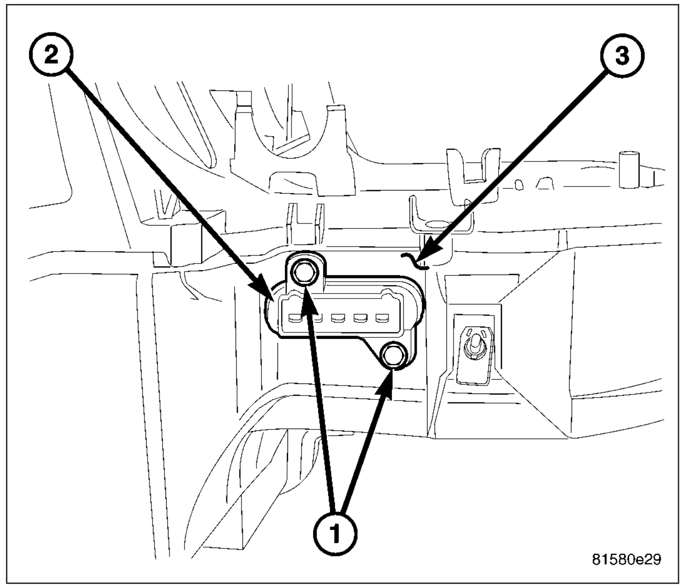



**NOTE: If the foam seal on the floor distribution duct is deformed or damaged, the seal must be replaced.**

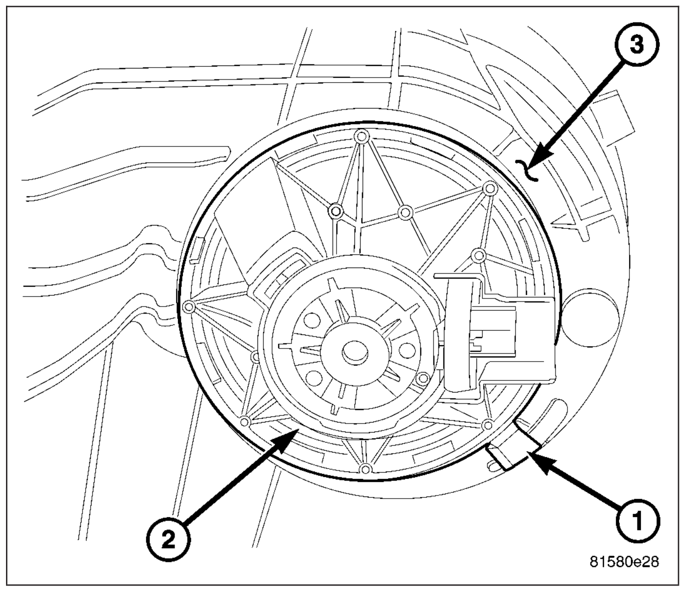
11. Position the floor distribution duct (2) onto the bottom of the HVAC housing (3).
12. Install the three screws (1) that secure the floor distribution duct to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).



13. Position the blower motor resistor (2) into the rear of the HVAC housing (3).
14. Install the two screws (1) that secure the blower motor resistor to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).

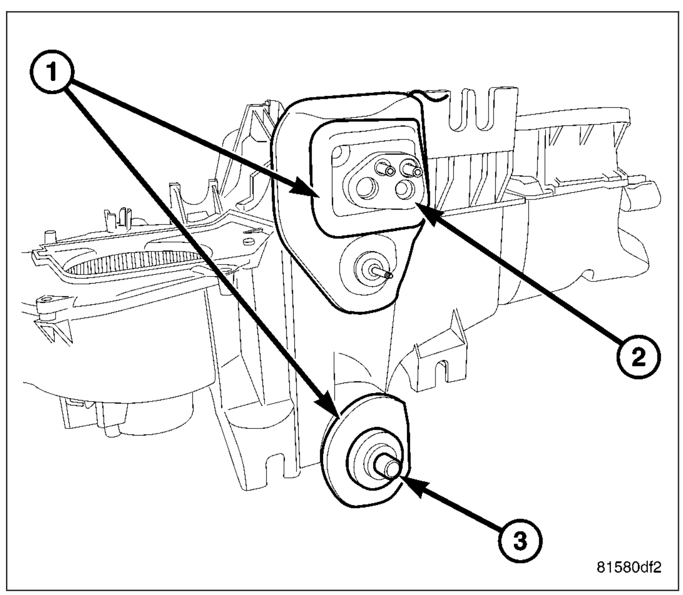



15. Align and install the blower motor (2) into the HVAC housing (3).
16. Rotate the blower motor until the locking tab (1) secures the blower motor to the HVAC housing.




**NOTE: If any foam or rubber seal is deformed or damaged, the seal must be replaced.**

17. Install the foam and rubber seals (1) around the evaporator tapping block (2) and the condensate drain (3).



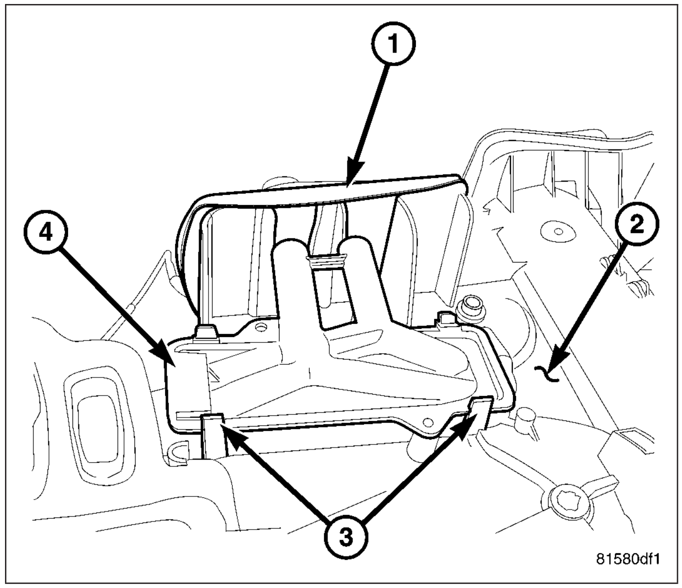
**NOTE: If the foam insulator around the heater core is deformed or damaged, the insulator must be replaced.**

**NOTE: Make sure that the foam insulator is properly positioned in the HVAC housing.**

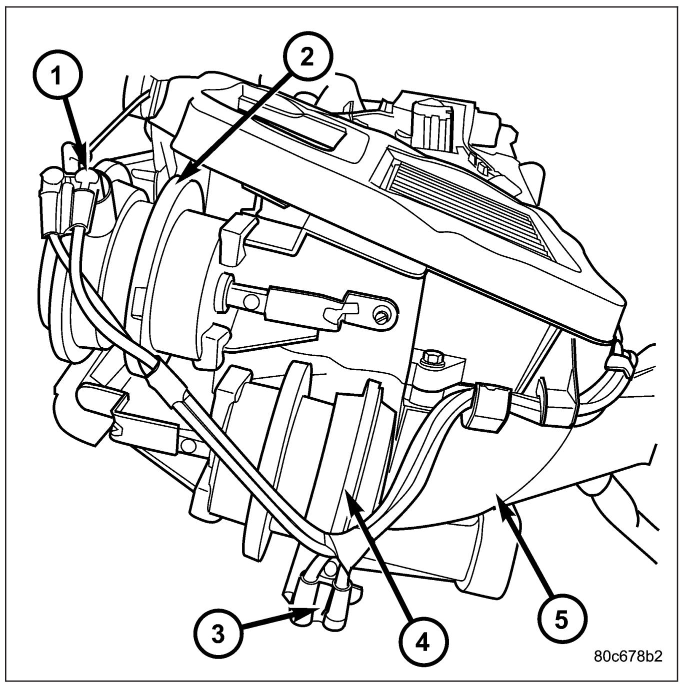
18. Carefully install the heater core (4) into the top of the HVAC housing (2).
19. Engage the four retaining tabs (3) that secure the heater core to the HVAC housing.

**NOTE: If the foam seal around the heater core tubes is deformed or damaged, the seal must be replaced.**

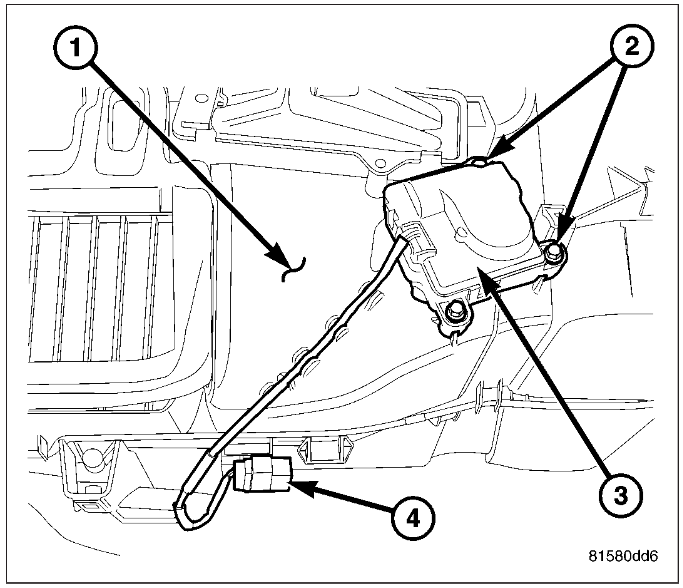
20. Install the foam seal (1) onto the front of the HVAC housing and around the heater core tubes.




21. Position the HVAC vacuum harness and connectors (1 and 3) to the HVAC housing (5) and install the vacuum harness into the routing clips.
22. Install the panel door actuator (2) and the floor/defrost door actuator (4) on to the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/ACTUATOR-MODE DOOR - INSTALLATION).
23. Connect the mode door actuators to the mode-air door levers.
24. Connect the vacuum harness connectors to the mode door actuators.

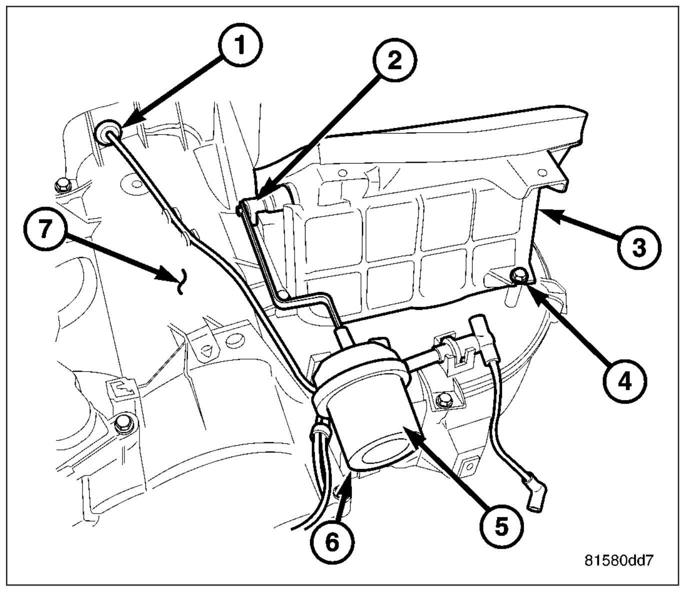


25. Position the blend door actuator (3) onto the top of the HVAC housing (1), making sure the actuator spline is positioned properly with the door spline. If necessary, rotate the actuator slightly to align the splines on the actuator output shaft with those on the blend door pivot.
26. Install the three screws (2) that secure the blend door actuator to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
27. Engage the wire harness lead and connector (4) to the retainers located on the top and on the rear of the HVAC housing.




**NOTE: If the foam seal on the air inlet housing is deformed or damaged, the seal must be replaced.**

28. Position the air inlet housing (3) onto the top of the HVAC housing (7).
29. Install the four screws (4) that secure the air inlet housing to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
30. Install the recirculation door actuator (5) onto the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/ACTUATOR-RECIRCULATION DOOR - INSTALLATION).
31. Connect the recirculation door actuator to the recirculation door lever (2).
32. Connect the HVAC vacuum harness connector (6) to the recirculation door actuator.
33. Install the HVAC vacuum harness and grommet (1) onto the top of HVAC housing.




34. Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - INSTALLATION).

## AIR INLET HOUSING

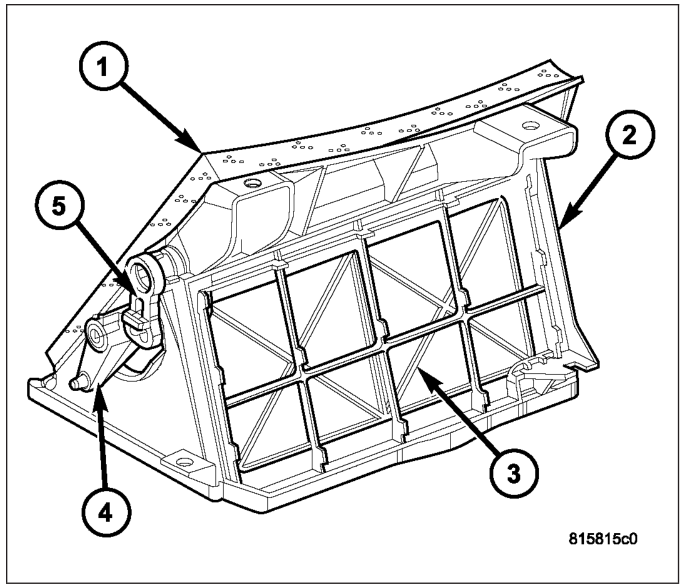
**NOTE: The air inlet housing must be removed from HVAC housing and disassembled for service of the recirculation-air door.**

**NOTE: If the seal on the air door is deformed or damaged, the air door must be replaced.**

1. Position the recirculation-air door (3) into the air inlet housing (2).
2. Install the pivot lever (4) onto the side of the air inlet housing.

**CAUTION: Make sure that the recirculation-air door pivot shaft is properly seated in the pivot holes located in the air inlet housing.**

3. Align the recirculation door lever (5) with the pivot lever and install the recirculation door lever into the end of the pivot shaft of the recirculation-air door. Make sure the recirculation door lever is fully engaged to the pivot shaft and the pivot lever.




**NOTE: If the foam seal on the air inlet housing is deformed or damaged, the seal must be replaced.**

4. If removed, install a new foam seal (1) onto the top of the air inlet housing.
5. Install the air inlet housing onto the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - HOUSING-AIR INLET - INSTALLATION).

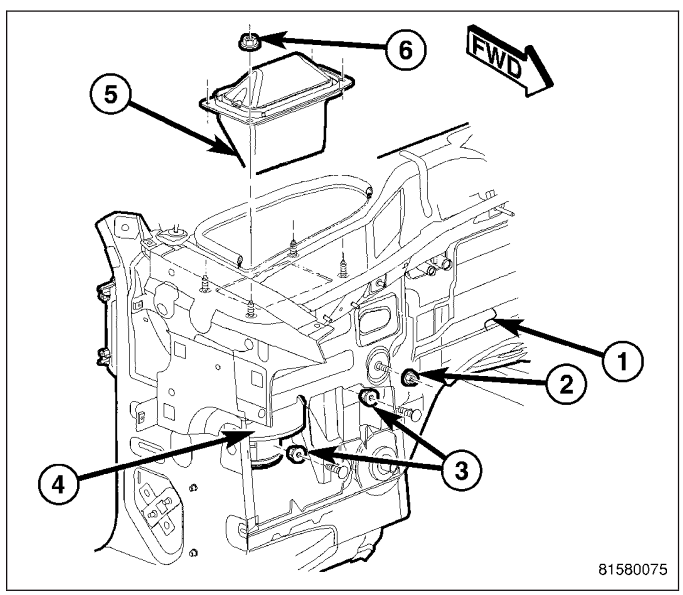
## INSTALLATION

## HVAC HOUSING

**NOTE: The HVAC housing must be removed from the vehicle and disassembled for service of the A/C evaporator and the mode-air and blend-air doors.**

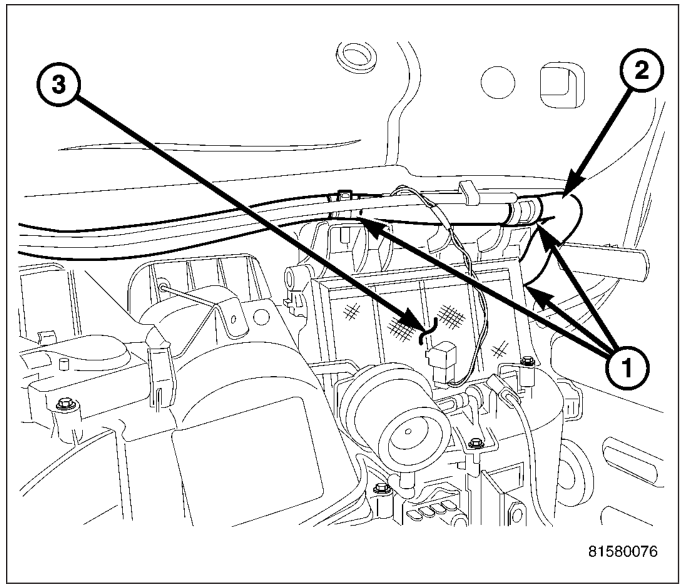
**NOTE: LHD model shown in illustrations. RHD model similar.**

1. If removed, install the fresh air inlet screen (5) and the four retaining nuts (6) onto the top of the dash panel (1).
2. Position the HVAC housing to the dash panel (4). Be certain that the condensate drain and the housing mounting studs are inserted into their correct locations.
3. Loosely install the two nuts (3) that secure the HVAC housing to the passenger compartment side of the dash panel.
4. Install the one nut (2) that secures the HVAC housing to the engine compartment side of the dash panel. Tighten the nut to 6 N·m (53 in. lbs.).
5. Install the condensation drain tube (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/TUBE-CONDENSATION DRAIN - INSTALLATION).
6. Connect the HVAC system vacuum supply line to the engine vacuum harness at the connector located near the evaporator tapping block.




7. Remove the previously installed plugs or caps and connect the heater hoses to the heater core tubes.
8. Remove the previously installed plugs or caps from the opened refrigerant line filltings and evaporator ports.

9. Connect the refrigerant lines to the A/C evaporator using new O-ring seals and install the two nuts that secure the A/C accumulator to the dash panel (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING /LINE-A/C LIQUID - INSTALLATION) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ACCUMULATOR-A/C - INSTALLATION).
10. Tighten the two nuts that secure the HVAC housing to the passenger compartment side of the dash panel to 6 N·m (53 in. lbs.).
11. Position the dash panel wire harness (2) to the top of the HVAC air inlet housing (3) and engage the three retaining straps (1) that secure the wire harness to the housing.
12. Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).
13. Reconnect the negative battery cable.
14. If the heater core is being replaced, flush the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM CLEANING/REVERSE FLUSHING).
15. Refill the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM REFILL).

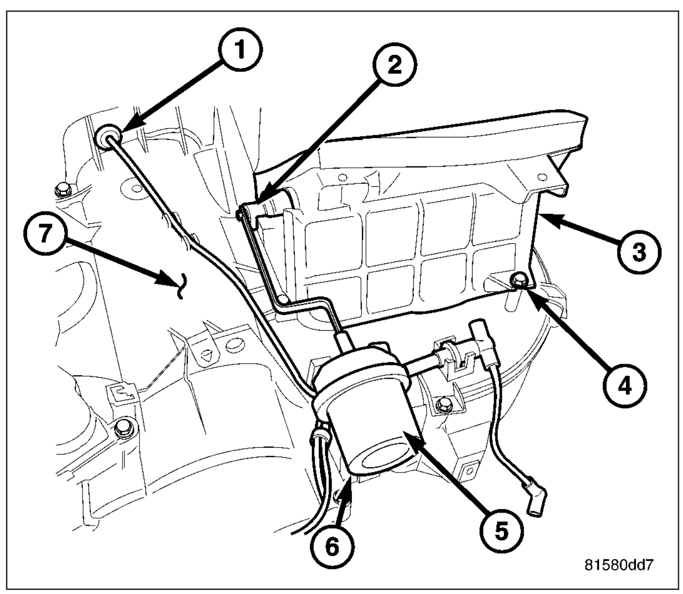



16. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
17. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

## AIR INLET HOUSING

**NOTE: The air inlet housing must be removed from HVAC housing and disassembled for service of the recirculation-air door.**

1. Position the air inlet housing (3) onto the top of the HVAC housing (7).
2. Install the four screws (4) that secure the air inlet housing to the top of the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).
3. If removed, install the recirculation door actuator (5) onto the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/ACTUATOR-RECIRCULATION DOOR - INSTALLATION).
4. Connect the recirculation door actuator to the recirculation door lever (2).
5. If removed, install the HVAC vacuum harness (1) into the routing retainers located on the HVAC housing.
6. Connect the HVAC vacuum harness connector (6) to the recirculation door actuator.




**NOTE: If the foam seal on the air inlet housing is deformed or damaged, the seal must be replaced.**

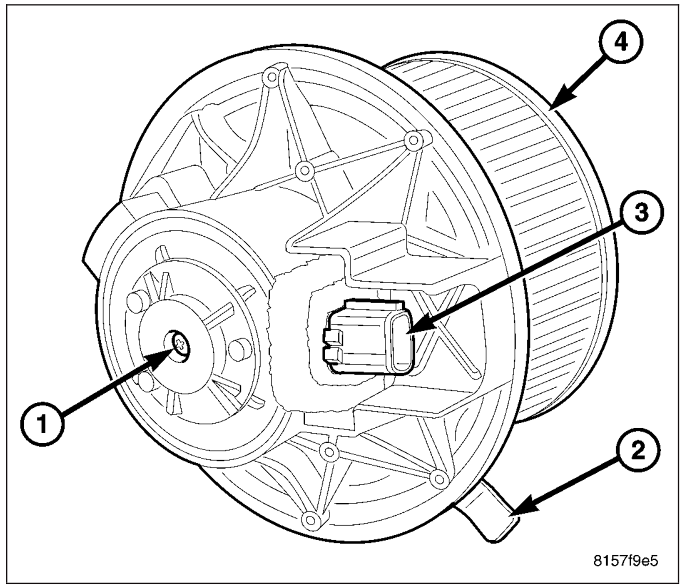
7. Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - INSTALLATION).
8. Reconnect the negative battery cable.

# MOTOR-BLOWER

## DESCRIPTION

The blower motor (1) is a 12-volt, direct current (DC) motor mounted within a plastic housing with an integral retaining tab (2), an integral wire harness connector (3) and a squirrel cage-type blower wheel (4) that is secured to the blower motor shaft. The blower motor wheel is positioned within the HVAC air inlet housing, which is mounted to the passenger side end of the HVAC housing.

The blower motor can be accessed for service from underneath the instrument panel.




## OPERATION

The blower motor is used to control the velocity of air moving through the HVAC housing by spinning the blower wheel within the HVAC air inlet housing at the selected speed.

The blower motor will operate whenever the ignition switch is in the On position and the A/C-heater controls in any position except Off. The blower motor receives fused battery circuit through a fuse and a relay located in the power distribution center (PDC) whenever the ignition switch is in the On position.

Blower motor speed is controlled by regulating the ground path through or around the blower motor resistor and through the blower motor control located within the A/C-heater control.

The blower motor and blower motor wheel are factory balanced and cannot be adjusted or repaired. If faulty or damaged, the blower motor and blower wheel must be replaced as an assembly.

## DIAGNOSIS AND TESTING

## BLOWER MOTOR

**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.**

**NOTE: For circuit descriptions and diagrams, refer to Air Conditioning/Heater in Group 8W - Wiring Diagrams.**

### OPERATION

Possible causes of an inoperative blower motor include:

- Faulty fuse
- Faulty blower motor resistor
- Faulty blower motor switch
- Faulty blower motor relay

- Faulty blower motor
- Faulty mode control switch
- Faulty blower motor circuit wiring or wire harness connectors

**VIBRATION**

Possible causes of a blower motor vibration include:

- Improper blower motor mounting
- Improper blower wheel mounting
- Deformed blower wheel
- Out of balance blower wheel due to foreign material in the wheel
- Faulty blower motor

**NOISE**

To determine if the blower motor is the source of the noise, simply switch the blower motor from Off to On. To verify that the blower motor is the source of the noise, unplug the blower motor wire harness connector and operate the heater-A/C system. If the noise goes away, possible causes include:

- Foreign material in the HVAC housing
- Improper blower motor mounting
- Improper blower wheel mounting
- Faulty blower motor

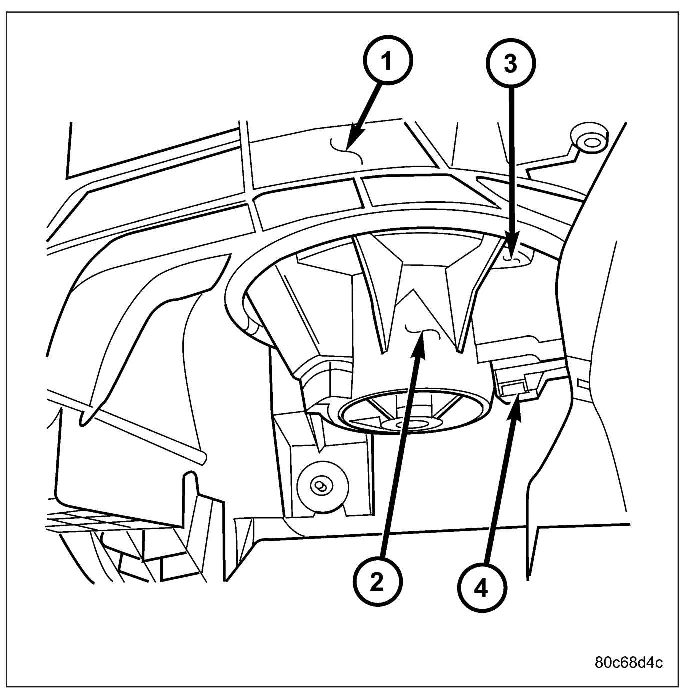
## REMOVAL

**WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. This is the only sure way to disable the airbag system. Failure to take the proper precautions could result in an accidental airbag deployment and possible personal injury or death.**

**NOTE: The blower motor is located on the passenger side of the vehicle under the instrument panel. The blower motor can be removed without having to remove the instrument panel or the HVAC housing.**

**NOTE: LHD model shown in illustration. RHD model similar.**

1. Disconnect and isolate the negative battery cable.
2. Disconnect the wire harness lead from the blower motor connector (4).
3. Release the locking tab (3) that secures the blower motor (2) to the HVAC housing (1) and rotate blower motor counterclockwise.
4. Rotate and tilt the blower motor as needed for clearance to remove the blower motor and wheel from the HVAC housing.

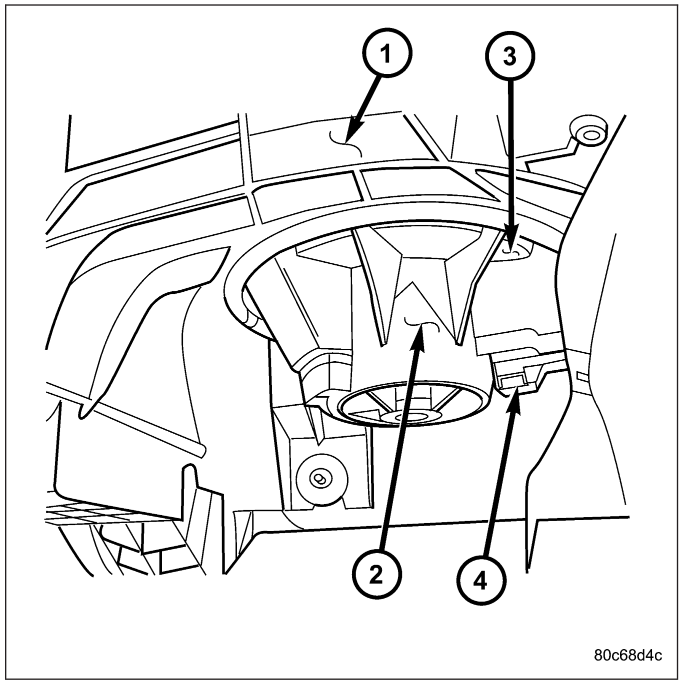


## INSTALLATION

**NOTE: Failure to install the blower motor correctly could result in an air leak or the blower motor becoming completely disengaged from the HVAC housing.**

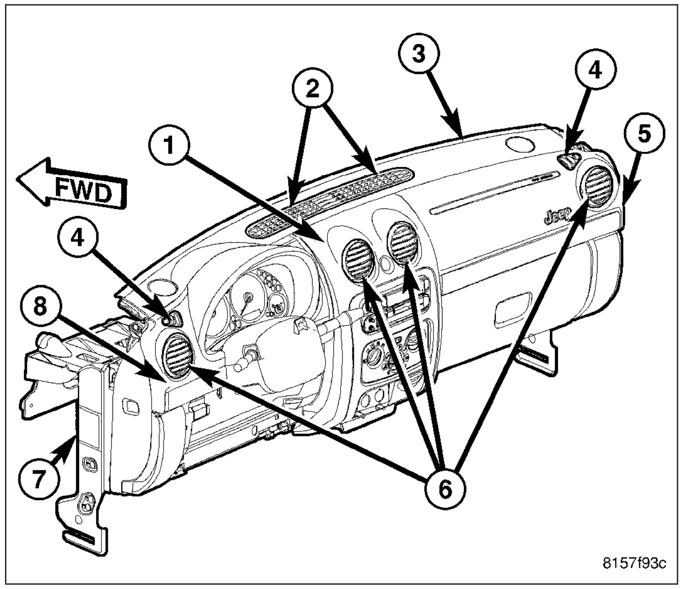
**NOTE: LHD model shown in illustration. LHD model similar.**

1. Align and install the blower motor (2) into the HVAC housing (1).
2. Rotate the blower motor until the locking tab (3) secures the blower motor to the HVAC housing.
3. Connect the wire harness lead to the blower motor connector (4).
4. Reconnect the negative battery cable.
5. Test the blower motor for proper installation by operating the blower motor at its fastest speed while checking around the outer edges of the blower motor and HVAC housing for air leaks. If any are found, remove and reinstall the blower motor.



# OUTLET-AIR

## DESCRIPTION




There are two defroster air outlets (2) in the defroster grille (3) located on the top of the instrument panel (7). The airflow from the defroster outlets is directed by fixed vanes in the defroster grille and cannot be adjusted. The defroster air outlets are not serviceable from the defroster grille (Refer to 23 - BODY/INSTRUMENT PANEL/DEFROSTER GRILLE - REMOVAL).

There are two side window demister air outlets (4). One located at each end of the instrument panel near the A-pillars. The airflow from the side window demister air outlets is directed by fixed vanes in the demister outlet grilles and cannot be adjusted. The side window demister air outlet located at the right end of the instrument panel is integral to the passenger side air bag door (5) and cannot be serviced separately (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL). The other side window demister air outlet is integral to the instrument cluster bezel (8) and cannot be serviced separately (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

There are four instrument panel air outlets. One air outlet is located near each outboard end of the instrument panel facing the rear of the vehicle and the other two outlets are located near the top of the instrument panel center bezel. The air outlet located at the right end of the instrument panel is integral to the passenger side air bag door and cannot be serviced separately (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL). The air outlets located at the center of the instrument panel are integral to the instrument panel and cannot be serviced separately (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL). The other instrument panel air outlet is integral to the instrument cluster bezel (1) and cannot be serviced separately (Refer to 23 - BODY/INSTRUMENT PANEL/IP PASSENGER SIDE BEZEL - REMOVAL).

Each of the instrument panel air outlets contain an air outlet barrel (6) that is used to direct or shut off the flow of the conditioned air leaving the instrument panel.

**CAUTION: The instrument panel air outlet barrels can only be installed in one direction. If the outlet barrel is not properly oriented prior to installation, damage to the outlet barrel will occur.**

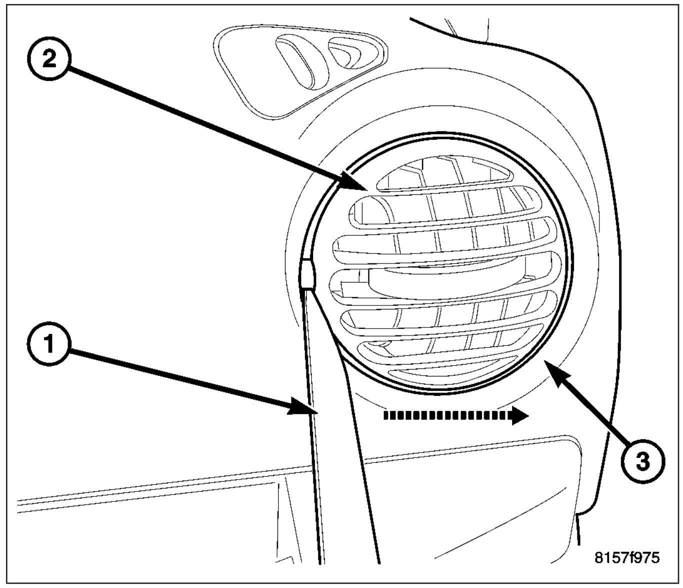
**NOTE: Each air outlet barrel is retained into the air outlet housing by two pivot shafts. One pivot shaft is larger than the other. The air outlet barrel must be first installed onto the larger pivot shaft, then snapped into place over the smaller pivot shaft.**

All of the instrument panel air outlets barrels can be serviced individually.

## REMOVAL

**NOTE: The instrument panel air outlet barrels are retained onto the pivots located in the outlet housing by a light snap fit.**

1. Using a trim stick C-4755 or equivalent (1), gently pry the panel air outlet barrel(s) (2) out of the instrument panel air outlet(s) (3) as required.

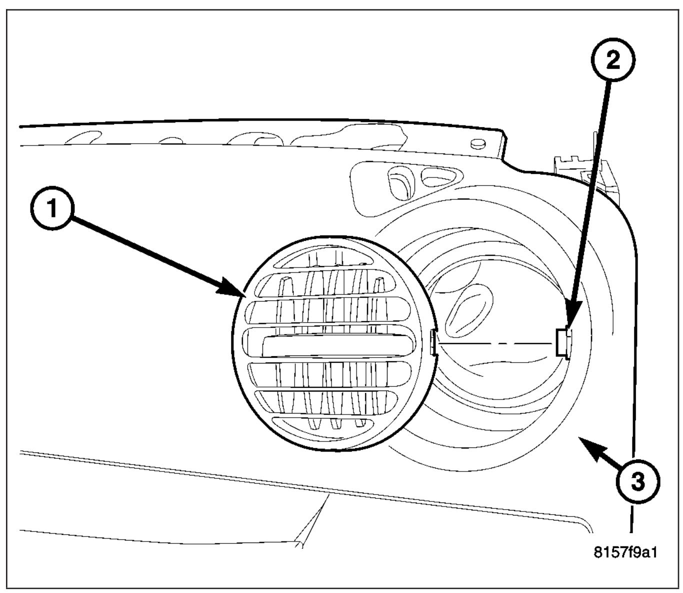



## INSTALLATION

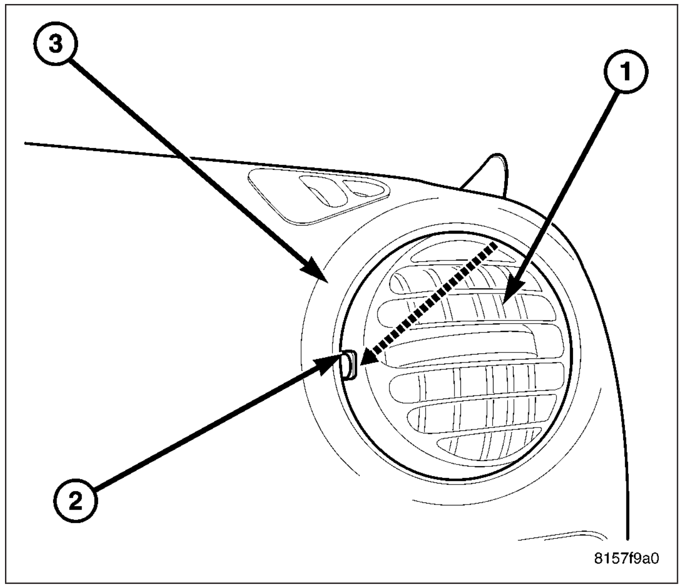
**CAUTION: The instrument panel air outlet barrels can only be installed in one direction. If the air outlet barrel is not properly oriented prior to installation, damage to the air outlet barrel will occur.**

**NOTE: Each air outlet barrel is retained into the air outlet housing by two pivot shafts. One pivot shaft is larger than the other. The air outlet barrel must be first installed onto the larger pivot shaft, then snapped into place over the smaller pivot shaft.**

1. Install the air outlet barrel (1) onto the larger pivot shaft (2) located in the instrument panel air outlet housing (3).



2. Gently push the air outlet barrel (1) onto the smaller pivot shaft (2) of the instrument panel air outlet housing (3) until it snaps into position.



# PLUMBING

## TABLE OF CONTENTS

# PLUMBING

## DESCRIPTION

The A/C refrigerant lines and hoses are used to carry the refrigerant between the various A/C system components. The refrigerant lines and hoses for the R-134a system on this vehicle consist of a barrier-hose design with a nylon tube sandwiched between rubber layers. The nylon tube helps to contain the R-134a refrigerant, which has a smaller molecular structure than R-12 refrigerant. The ends of the refrigerant lines are made from lightweight aluminum or steel, and commonly use braze-less fittings.

Any kinks or sharp bends in the refrigerant lines and hoses will reduce the capacity of the entire A/C system and can reduce the flow of refrigerant in the system. The radius of all bends in the flexible hose refrigerant lines should be at least ten times the diameter of the hose and the refrigerant lines should be routed so they are at least 80 millimeters (3 inches) away from the exhaust manifold(s) and exhaust pipe(s).

## OPERATION

High pressures are produced in the refrigerant system when the A/C compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

Depending on vehicle, model and market application, refrigerant lines are connected to each other or other A/C system components with block-type or quick-connect type fittings. To ensure the integrity of the refrigerant system, flat gaskets and O-rings are used to seal the refrigerant system connections.

The refrigerant lines and hoses cannot be repaired and, if faulty or damaged, they must be replaced.

## WARNING

**WARNING: The A/C system contains refrigerant under high pressure. Repairs should only be performed by qualified service personnel. Severe personal injury or death may result from improper service procedures.**

**WARNING: Avoid breathing the refrigerant and refrigerant oil vapor or mist. Exposure may irritate the eyes, nose, and/or throat. Wear eye protection when servicing the A/C refrigerant system. Serious eye injury can result from direct contact with the refrigerant. If eye contact occurs, seek medical attention immediately.**

**WARNING: Do not expose the refrigerant to open flame. Poisonous gas is created when refrigerant is burned. An electronic leak detector is recommended. Severe personal injury or death may result from improper service procedures.**

**WARNING: If accidental system discharge occurs, ventilate the work area before resuming service. Large amounts of refrigerant released in a closed work area will displace the oxygen and cause suffocation and death.**

**WARNING: The evaporation rate of R-134a refrigerant at average temperature and altitude is extremely high. As a result, anything that comes in contact with the refrigerant will freeze. Always protect the skin or delicate objects from direct contact with the refrigerant.**

**WARNING: The R-134a service equipment or the vehicle refrigerant system should not be pressure tested or leak tested with compressed air. Some mixtures of air and R-134a have been shown to be combustible at elevated pressures. These mixtures are potentially dangerous, and may result in fire or explosion causing property damage, personal injury or death.**

**WARNING: The engine cooling system is designed to develop internal pressures up to 145 kilopascals (21 pounds per square inch). Do not remove or loosen the coolant pressure cap, cylinder block drain plugs, radiator drain, radiator hoses, heater hoses, or hose clamps while the engine cooling system is hot and under pressure. Allow the vehicle to cool for a minimum of 15 minutes before opening the cooling system for service. Failure to observe this warning can result in serious burns from the heated engine coolant.**

## CAUTION

**CAUTION: Never add R-12 to a refrigerant system designed to use R-134a. Do not use R-12 equipment or parts on an R-134a A/C system. These refrigerants are not compatible and damage to the A/C system will result.**

**CAUTION: Never use R-12 refrigerant oil in an A/C system designed to use R-134a refrigerant oil. These refrigerant oils are not compatible and damage to the A/C system will result.**

**CAUTION: The use of A/C system sealers may result in damage to A/C refrigerant recovery/evacuation/recharging equipment and/or A/C system. Many federal, state/provincial and local regulations prohibit the recharge of A/C systems with known leaks. DaimlerChrysler recommends the detection of A/C system leaks through the use of approved leak detectors and fluorescent leak detection dyes. Vehicles found with A/C system sealers should be treated as contaminated and replacement of the entire A/C refrigerant system is recommended. A/C systems found to be contaminated with A/C system sealers, A/C stop-leak products or seal conditioners voids the warranty for the A/C system.**

**CAUTION: Recover the refrigerant before opening any fitting or connection. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.**

**CAUTION: If equipped, do not remove the secondary retention clip from any spring-lock coupler connection while the refrigerant system is under pressure. Recover the refrigerant before removing the secondary retention clip. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.**

**CAUTION: The internal parts of the A/C system will remain stable as long as moisture-free refrigerant and refrigerant oil is used. Abnormal amounts of dirt, moisture or air can upset the chemical stability. This may cause operational troubles or even serious damage if present in more than very small quantities. Before disconnecting a component, clean the outside of the fittings thoroughly to prevent contamination from entering the refrigerant system. Keep service tools and the work area clean. Do not open the refrigerant system or uncap a replacement component until you are ready to service the system. Immediately after disconnecting a component from the refrigerant system, seal the open fittings with a cap or plug. This will prevent contamination from entering the A/C system.**

**CAUTION: Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open a container of refrigerant oil until you are ready to use it. Replace the cap on the oil container immediately after using. Store refrigerant oil only in a clean, airtight, and moisture-free container.**

**CAUTION: Do not overcharge the refrigerant system. Overcharging will cause excessive compressor head pressure and can cause compressor noise and A/C system failure.**

## DIAGNOSIS AND TESTING

## REFRIGERANT SYSTEM LEAKS

**WARNING: R-134a service equipment or vehicle A/C system should not be pressure tested or leak tested with compressed air. Mixture of air and R-134a can be combustible at elevated pressures. These mixtures are potentially dangerous and may result in fire or explosion causing property damage, personal injury or death.**
**Avoid breathing A/C refrigerant and lubricant vapor or mist. Exposure may irritate eyes, nose and throat. Use only approved service equipment meeting SAE requirements to discharge an R-134a system. If accidental system discharge occurs, ventilate work area before resuming service.**

**NOTE: If the A/C refrigerant system charge is empty or low, a leak in the A/C system is likely. Visually inspect all A/C lines, fittings and components for an oily residue. Oil residue can be an indicator of an A/C system leak location.**

**NOTE: The only way to correctly determine if the refrigerant system is fully charged with R-134a is to completely evacuate and recharge the A/C system.**

Connect a suitable manifold gauge set and determine if the static A/C system pressure is above or below 345 kPa (50 psi) (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM SERVICE EQUIPMENT). If less than 345 kPa (50 psi), proceed to SYSTEM EMPTY . If greater than 345 kPa (50 psi), go to SYSTEM LOW .

### SYSTEM EMPTY

1. Evacuate the refrigerant system to the lowest degree of vacuum possible (approximately -88 kPa (- 26 in. Hg) or greater vacuum) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE). Determine if the system holds a vacuum for 15 minutes. If vacuum is held, a leak is probably not present. If system will not maintain vacuum level, proceed to Step 2.
2. Prepare and dispense 0.284 kilograms (10 ounces) of R-134a refrigerant into the evacuated refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE) and proceed to Step 1 of the System Low procedure.

### SYSTEM LOW

1. Position the vehicle in a wind-free work area. This will aid in detecting small leaks.
2. Operate the heating-A/C system with the engine at idle under the following conditions for at least 5 minutes.
   - Doors or windows open
   - Transmission in Park or Neutral with the parking brake set (depending on application)
   - A/C-heater controls set to outside air, full cool, panel mode, high blower and with A/C compressor engaged

**CAUTION: A leak detector only designed for R-12 refrigerant will not detect leaks in an R-134a refrigerant system.**

3. Shut the vehicle Off and wait 2-7 minutes. Then use an electronic leak detector that is designed to detect R-134a refrigerant and search for leaks. Fittings, lines or components that appear to be oily usually indicate a refrigerant leak. To inspect the A/C evaporator for leaks, insert the leak detector probe into the drain tube opening or an air outlet. A dye for R-134a is available to aid in leak detection. Use only DaimlerChrysler approved refrigerant dye.

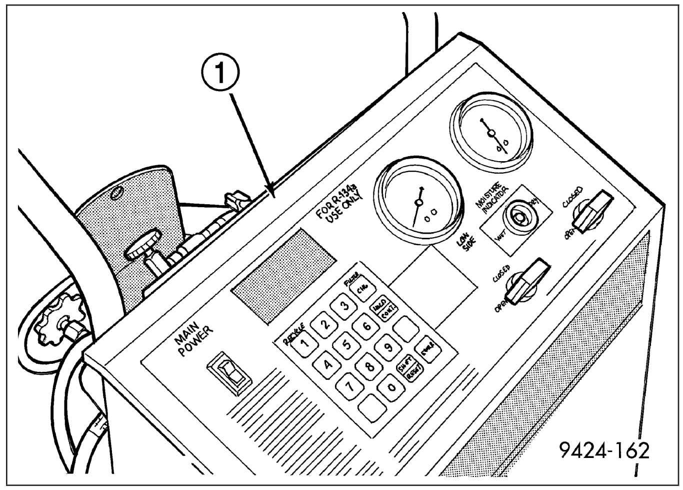
## STANDARD PROCEDURE

## REFRIGERANT SYSTEM SERVICE EQUIPMENT

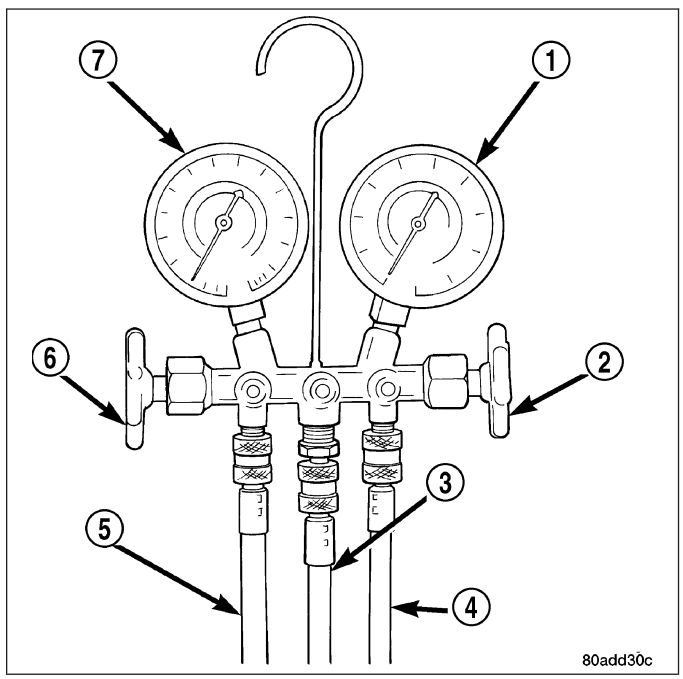
**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**WARNING: Eye protection must be worn when servicing an air conditioning refrigerant system. Turn off (rotate clockwise) all valves on the equipment being used, before connecting to or disconnecting from the refrigerant system. Failure to observe these warnings may result in personal injury or death.**

When servicing the A/C system, a R-134a refrigerant recovery/recycling/charging station that meets SAE standard J2210 must be used (1). Contact an automotive service equipment supplier for refrigerant recovery/recycling/charging equipment. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.




A manifold gauge set (1) may be needed with some recovery/recycling/charging equipment. The manifold gauge set should have manual shut-off valves (2 and 6), or automatic back-flow valves located at the service port connector end of the manifold gauge set hoses (4 and 5). This will prevent refrigerant from being released into the atmosphere.




## MANIFOLD GAUGE SET CONNECTIONS

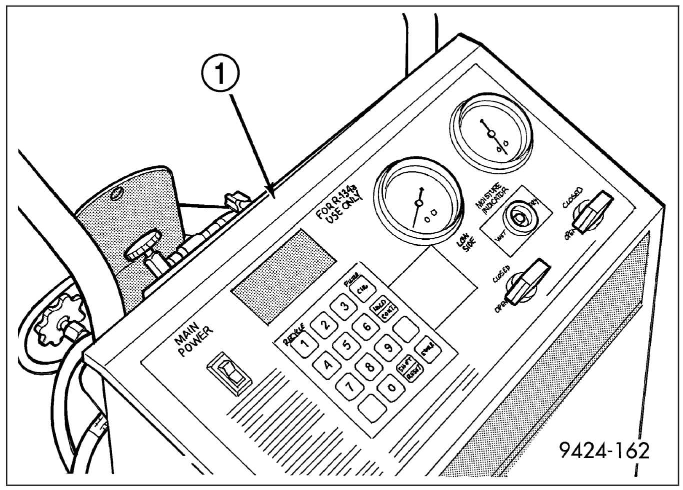
**CAUTION: Do not use an R-12 manifold gauge set on an R-134a system. The refrigerants are not compatible and system damage will result.**

- **LOW PRESSURE GAUGE HOSE** - The low pressure hose (Blue with Black stripe) attaches to the low-side service port. This port is located on the A/C liquid line near the front of the engine compartment.
- **HIGH PRESSURE GAUGE HOSE** - The high pressure hose (Red with Black stripe) attaches to the high-side service port. This port is located on the A/C discharge line near the A/C condenser.
- **RECOVERY, RECYCLING, EVACUATION AND CHARGING HOSE** - The center manifold hose (Yellow, or White, with Black stripe) is used to recover, evacuate, and charge the refrigerant system. When the low or high pressure valves on the manifold gauge set are opened, the refrigerant in the system will escape through this hose.

## REFRIGERANT SYSTEM RECOVERY

**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

An R-134a refrigerant recovery/recycling/charging station (1) that meets SAE standard J2210 must be used to recover the refrigerant from the R-134a refrigerant system. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.




## REFRIGERANT SYSTEM EVACUATE

**NOTE: Special effort must be used to prevent moisture from entering the A/C system oil. Moisture in the oil is very difficult to remove and will cause a reliability problem with the A/C compressor.**

If an A/C compressor designed to use R-134a refrigerant is left open to the atmosphere for an extended period of time. It is recommended that the refrigerant oil be drained and replaced with new oil or a new A/C compressor be used. This will eliminate the possibility of contaminating the refrigerant system.

If the refrigerant system has been open to the atmosphere, it must be evacuated before the system can be filled. Moisture and air mixed with the refrigerant will raise the compressor head pressure above acceptable operating levels. This will reduce the performance of the A/C system and damage the A/C compressor. Moisture will boil at near room temperature when exposed to vacuum. To evacuate the refrigerant system:

**NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.**

1. Recover the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
2. Connect a suitable charging station, refrigerant recovery machine or a manifold gauge set with vacuum pump and refrigerant recovery equipment (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM SERVICE EQUIPMENT).
3. Open the suction and discharge valves and start the vacuum pump. The vacuum pump should run a minimum of 45 minutes prior to charge to eliminate all moisture in system. When the suction gauge reads to the lowest degree of vacuum possible (approximately -88 kPa (- 26 in. Hg) or greater) for 30 minutes, close all valves and turn off vacuum pump. If the system fails to reach specified vacuum, the refrigerant system likely has a leak that

must be corrected. If the refrigerant system maintains specified vacuum for at least 30 minutes, start the vacuum pump, open the suction and discharge valves. Then allow the system to evacuate an additional 10 minutes.

4. Close all valves. Turn off and disconnect the vacuum pump.
5. Charge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

## REFRIGERANT SYSTEM CHARGE

**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**NOTE: Always refer to the Underhood HVAC Specification Label for the refrigerant fill specification of the vehicle being serviced.**

After all refrigerant system leaks have been repaired and the refrigerant system has been evacuated, a refrigerant charge can be injected into the system. For the proper amount of the refrigerant charge, refer to the Underhood HVAC Specification Label.

An R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to charge the refrigerant system with R-134a refrigerant. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.

### CHARGING PROCEDURE

**CAUTION: A small amount of refrigerant oil is removed from the A/C system each time the refrigerant system is recovered and evacuated. Before charging the A/C system, you MUST replenish any oil lost during the recovery process. Refer the equipment manufacturer instructions for more information.**

1. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
2. A manifold gauge set and an R-134a refrigerant recovery/recycling/charging station that meets SAE standard J2210 should be connected to the refrigerant system.
3. Measure the proper amount of refrigerant and heat it to 52° C (125° F) with the charging station. See the operating instructions supplied by the equipment manufacturer for proper use of this equipment.
4. Open both the suction and discharge valves, then open the charge valve to allow the heated refrigerant to flow into the system.
5. When the transfer of refrigerant has stopped, close both the suction and discharge valves.
6. If all of the refrigerant charge did not transfer from the dispensing device, open all of the windows in the vehicle and set the heating-A/C system controls so that the A/C compressor is engaged and the blower motor is operating at its lowest speed setting. Run the engine at a steady high idle (about 1400 rpm). If the A/C compressor does not engage, test the compressor clutch control circuit and repair as required.
7. Open the low-side valve to allow the remaining refrigerant to transfer to the refrigerant system.

**WARNING: Take care not to open the discharge (high pressure) valve at this time. Failure to follow this warning could result in possible personal injury or death.**

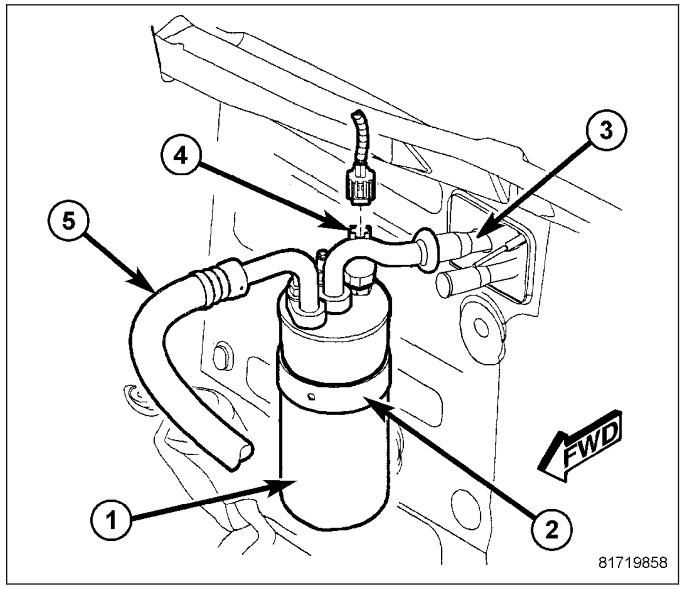
8. Disconnect the charging station and manifold gauge set from the refrigerant system service ports.
9. Reinstall the caps onto the refrigerant system service ports.

# ACCUMULATOR-A/C

## DESCRIPTION

The A/C accumulator (1) is mounted in a bracket (2) in the engine compartment between the A/C evaporator (3) and the A/C suction line (5) and includes a fitting for the A/C low pressure switch (4).

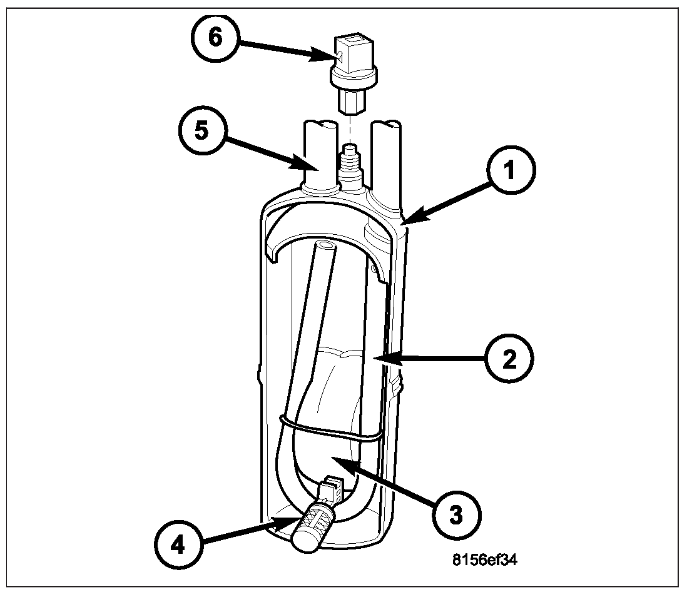
The A/C accumulator has no serviceable parts except for the rubber O-ring seals and the A/C low pressure switch. The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals must be replaced whenever the A/C accumulator is removed and installed.




## OPERATION

Refrigerant enters the A/C accumulator (1) mostly as a low pressure vapor through the inlet tube (2). Any liquid, oil-laden refrigerant falls to the bottom of the canister, which acts as a separator. A desiccant bag (3) is mounted inside the accumulator canister to absorb any moisture which may have entered and become trapped within the refrigerant system. A filter (4) is also mounted inside the canister to trap any foreign material that may have entered the refrigerant system during assembly. The low pressure vapor exits the A/C accumulator through the outlet tube (5). On this model, the A/C low pressure switch (6) is mounted to the top of the A/C accumulator.

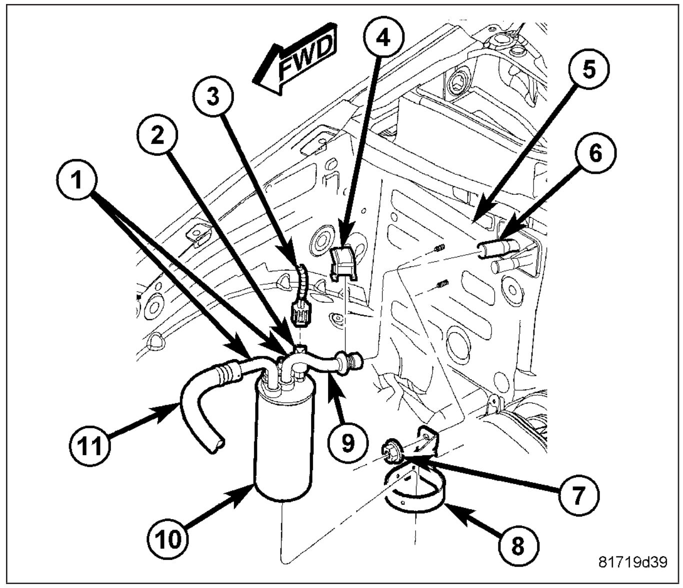
The A/C accumulator cannot be repaired. If the A/C accumulator is faulty or damaged, or if an internal failure of the A/C compressor has occurred, the A/C accumulator must be replaced.




## REMOVAL

**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**NOTE: LHD model shown. RHD model similar.**



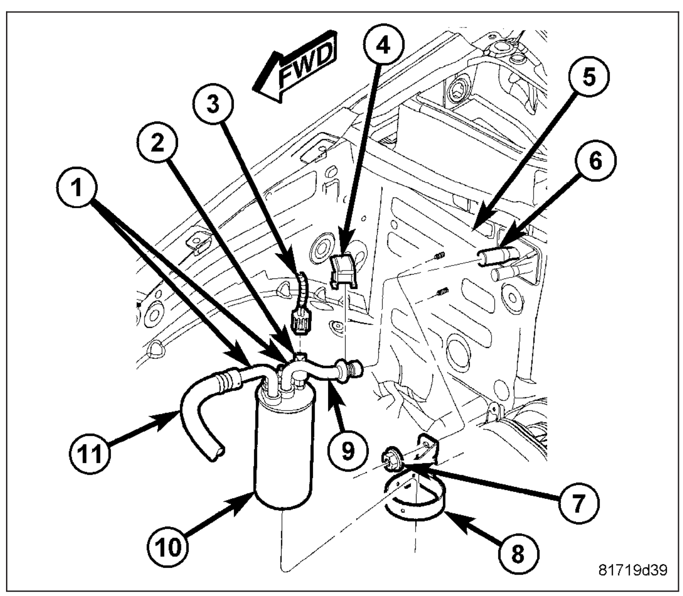

1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Disconnect the wire lead and connector (3) from the A/C low pressure switch (2) and remove the switch from the A/C accumulator (10).
4. Remove the two nuts (7) that secure the accumulator bracket (8) to the dash panel (5).
5. On LHD models, remove the secondary retaining clip (4) from the suction line spring-lock coupler and using the proper A/C line disconnect tool, disconnect the rear section of the A/C suction line (9) from the evaporator outlet tube (6) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ COUPLER-REFRIGERANT LINE - REMOVAL).
6. On RHD models, remove the nut that secures the rear section of the A/C suction line to the A/C evaporator and disconnect the line from the evaporator.
7. Remove the nuts (1) that secure the rear section of the A/C suction line and the front section of the A/C suction line (11) to the A/C accumulator and disconnect the lines from the accumulator.
8. Remove the A/C accumulator and the bracket from the engine compartment as an assembly and, if necessary, remove the bracket from the accumulator.
9. Remove and discard the O-ring seals and install plugs in, or tape over the opened refrigerant line fittings and the accumulator and evaporator ports.

## INSTALLATION

**NOTE: If the A/C accumulator is being replaced, add 120 milliliters (4 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.**

**NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.**

**NOTE: LHD model shown. RHD model similar.**




1. If removed, install the A/C accumulator (10) into the accumulator bracket (8) and position the accumulator and bracket into the engine compartment as an assembly.
2. Remove the tape or plugs from all of the opened refrigerant line fittings and the accumulator and evaporator ports.
3. Lubricate new rubber O-ring seals with clean refrigerant oil and install them onto the refrigerant line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
4. Connect the A/C suction lines (9 and 11) to the A/C accumulator and install the retaining nuts (1). Tighten the nuts to 12.5 N·m (110 in. lbs.).

5. On LHD models, connect the spring-lock coupler that secures the rear section of the A/C suction line to the A/C evaporator (6) and install the secondary retaining clip (4) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COUPLER-REFRIGERANT LINE - INSTALLATION).
6. On RHD models, connect the rear section of the A/C suction line to the A/C evaporator and install the retaining nut. Tighten the nut to 12.5 N·m (110 in. lbs.).
7. Install the two nuts (7) that secure the accumulator bracket to the dash panel (5). Tighten the nuts to 4.5 N·m (40 in. lbs.).
8. If removed, install the A/C low pressure switch (2) onto the A/C accumulator using a new O-ring seal. Hand-tighten the switch securely.
9. Connect the wire lead and connector (3) to the A/C low pressure switch.
10. Reconnect the negative battery cable.
11. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
12. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

# COMPRESSOR-A/C

## DESCRIPTION

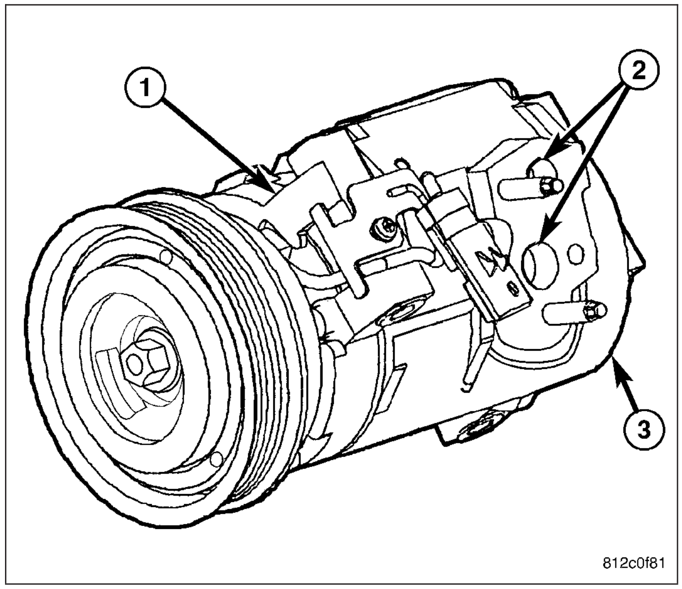
## A/C COMPRESSOR

**NOTE: Denso 10S17 A/C compressor shown. Visteon HS-18 compressor similar.**

The A/C system on vehicles equipped with the 2.8L diesel engine use a Denso 10S17 ten cylinder, double-acting swash plate-type A/C compressor (1). This A/C compressor has a fixed displacement of 170 cubic centimeters (10.374 cubic inches).

The A/C system on models equipped with the 3.7L engine use a Visteon HS-18 A/C compressor. This A/C compressor is a 10 cylinder reciprocating swash plate-type compressor with a fixed displacement of 180 cubic centimeters (10.9 cubic inches).

Both A/C compressors have the suction and discharge ports (2) located on the compressor cylinder head (3) at the rear of the compressor and have a label identifying the use of R-134a refrigerant.




## HIGH PRESSURE RELIEF VALVE

A high pressure relief valve is located on the A/C compressor. This mechanical valve is designed to vent refrigerant from the A/C system to protect against damage to the A/C compressor and other A/C system components, caused by condenser air flow restriction or an overcharge of refrigerant.

## OPERATION

## A/C COMPRESSOR

The A/C compressor is driven by the engine through an electric clutch, drive pulley and belt arrangement. The A/C compressor is lubricated by refrigerant oil that is circulated throughout the refrigerant system with the refrigerant.

The A/C compressor draws in low-pressure refrigerant vapor from the A/C evaporator through its suction port. It then compresses the refrigerant into a high-pressure, high-temperature refrigerant vapor, which is then pumped to the A/C condenser through the compressor discharge port.

The A/C compressor cannot be repaired and, if faulty or damaged, it must be replaced. The compressor clutch, pulley and bearing assembly, and clutch field coil are available for service. If an internal failure of the A/C compressor has occurred, the A/C accumulator must also be replaced.

## HIGH PRESSURE RELIEF VALVE

The high pressure relief valve vents refrigerant from the A/C system when a discharge pressure of 3445 to 4135 kPa (500 to 600 psi) or above is reached. The high pressure relief valve closes with a minimum discharge pressure of 2756 kPa (400 psi) is reached.

The high pressure relief valve vents only enough refrigerant to reduce the A/C system pressure, and then re-seats itself. The majority of the refrigerant is conserved in the A/C system. If the high pressure relief valve vents refrigerant, it does not mean the valve is faulty.

The high pressure relief valve is factory-calibrated and cannot be adjusted or repaired, and must not be removed or otherwise disturbed. The valve is only serviced as a part of the A/C compressor.

## DIAGNOSIS AND TESTING

## A/C COMPRESSOR

When investigating an A/C system related noise, you must first know the conditions under which the noise occurs. These conditions include: weather, vehicle speed, transmission in gear or neutral, engine speed, engine temperature, and any other special conditions. Noises that develop during A/C operation can often be misleading. For example: What sounds like a failed front engine bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets or a loose compressor clutch assembly.

Drive belts are speed sensitive. At different engine speeds and depending upon drive belt tension, drive belts can develop noises that are mistaken for an A/C compressor noise. Improper drive belt tension can cause a misleading noise when the compressor clutch is engaged, which may not occur when the compressor clutch is disengaged. Check the accessory drive belt condition and tension as described in Cooling before beginning this procedure.

1. Select a quiet area for testing. Duplicate the complaint conditions as much as possible. Turn the A/C compressor On and Off several times to clearly identify the compressor noise. Listen to the A/C compressor while the clutch is engaged and disengaged. Probe the A/C compressor with an engine stethoscope or a long screwdriver with the handle held to your ear to better localize the source of the noise.
2. Loosen all of the compressor mounting hardware and retighten. Check the compressor clutch retainer. Be certain that the clutch field coil is mounted securely to the A/C compressor, and that the clutch plate and pulley are properly aligned and have the correct air gap (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/CLUTCH-A/C COMPRESSOR - INSTALLATION).
3. To duplicate high-ambient temperature conditions (high head pressure), restrict the air flow through the A/C condenser. Install a manifold gauge set or a scan tool to be certain that the discharge pressure does not exceed 2760 kPa (400 psi).
4. Check the refrigerant system plumbing for incorrect routing, rubbing or interference, which can cause unusual noises. Also check the refrigerant lines and hoses for kinks or sharp bends that will restrict refrigerant flow, which can cause noises (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DESCRIPTION - REFRIGERANT LINES).
5. If the noise is from opening and closing of the high pressure relief valve, recover, evacuate and recharge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY), (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE). If the high pressure relief valve still does not seat properly, replace the A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COMPRESSOR-A/C - REMOVAL).
6. If the noise is from liquid refrigerant slugging in the A/C suction line, replace the A/C accumulator (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ACCUMULATOR-A/C - REMOVAL) and check the refrigerant oil level and the refrigerant system charge (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE - REFRIGERANT OIL LEVEL) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING- STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).
7. If a slugging condition still exists after replacing the A/C accumulator, then replace the A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COMPRESSOR-A/C - REMOVAL) and repeat Step 1.

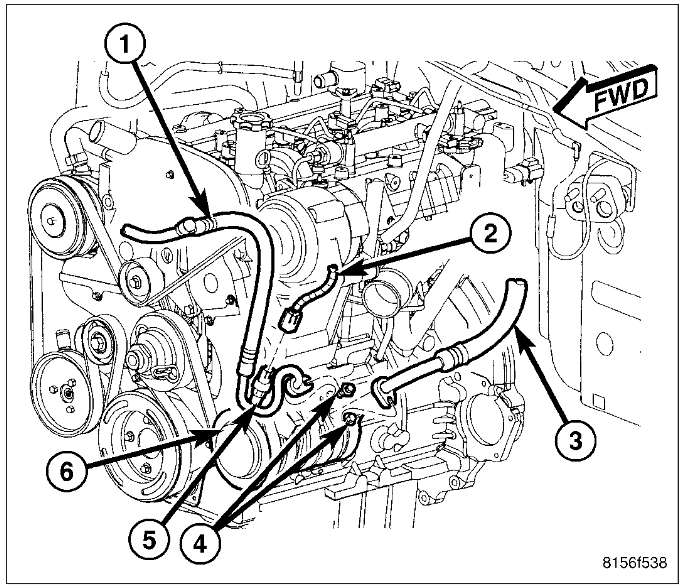
## REMOVAL

## 2.8L DIESEL ENGINE

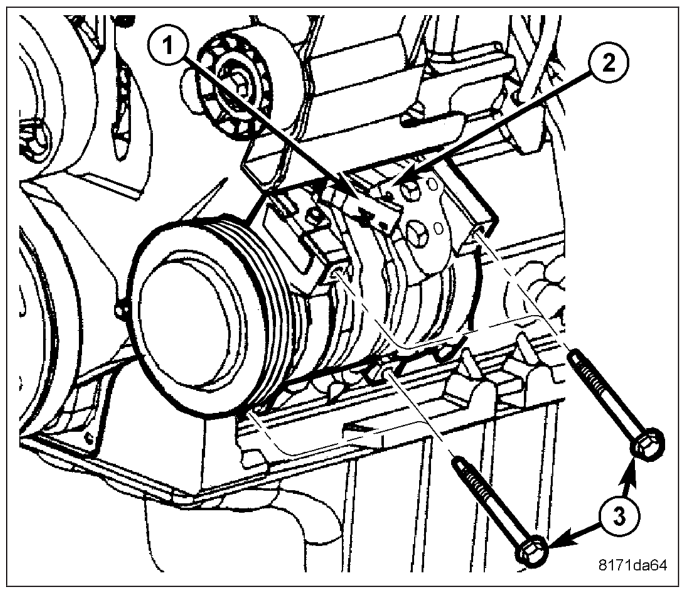
**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**NOTE: The A/C compressor may be removed and repositioned without disconnecting the refrigerant lines or discharging the refrigerant system. Discharging is not necessary if servicing the A/C clutch, clutch field coil or the engine.**

**NOTE: RHD model shown. LHD model similar.**




1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY).
3. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Raise and support the vehicle.
5. Remove the front skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - REMOVAL).
6. If necessary, disconnect the engine wire harness (2) from the A/C high pressure switch (5).
7. Remove the bolts (4) that secure the A/C suction line (3) and the A/C discharge line (1) to the A/C compressor (6) and disconnect the lines from the compressor.
8. Remove and discard the O-ring seals from the refrigerant line fittings and install plugs in, or tape over the opened fittings and the compressor ports.
9. Disconnect the engine wire harness from the A/C clutch field coil connector (1).
10. Support the A/C compressor (2) and remove the four bolts (3) that secure the compressor to the engine.
11. Remove the A/C compressor from the engine compartment.

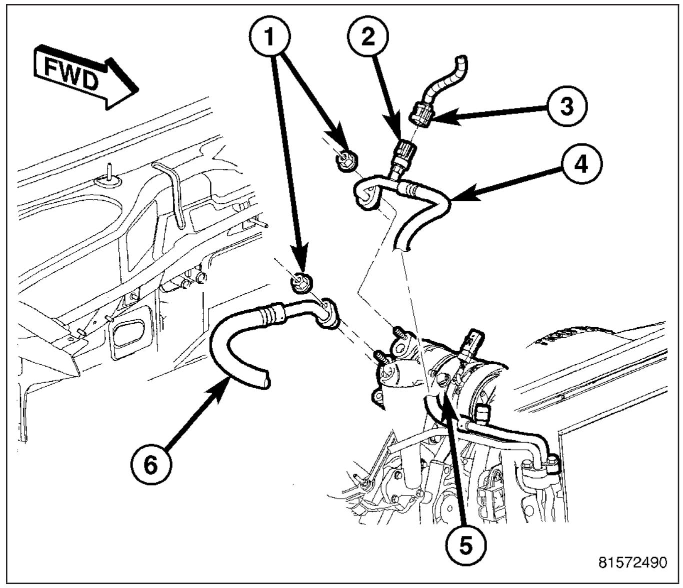


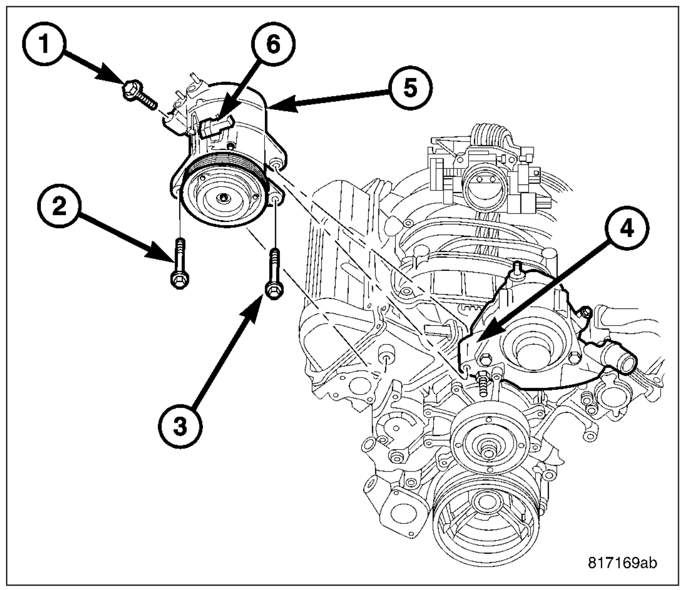

## 3.7L ENGINE

**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**NOTE: The A/C compressor may be removed and repositioned without disconnecting the refrigerant lines or discharging the refrigerant system. Discharging is not necessary if servicing the A/C clutch, clutch field coil or the engine.**

1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY).
3. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/BELTS-DRIVE - REMOVAL).
4. Disconnect the wire harness connector (3) from the A/C pressure transducer (2).
5. Remove the nuts (1) that secure the A/C discharge line (4) and the A/C suction line (6) to the A/C compressor (5).
6. Disconnect the A/C discharge line and the A/C suction line from the A/C compressor and remove and discard the O-ring seals.
7. Install plugs in, or tape over the opened refrigerant line fittings and compressor ports.
8. Disconnect the engine wire harness from the clutch field coil connector (6).
9. Remove the three bolts (1, 2 and 3) that secure the A/C compressor (5) to the engine and mounting bracket (4) and remove the compressor.



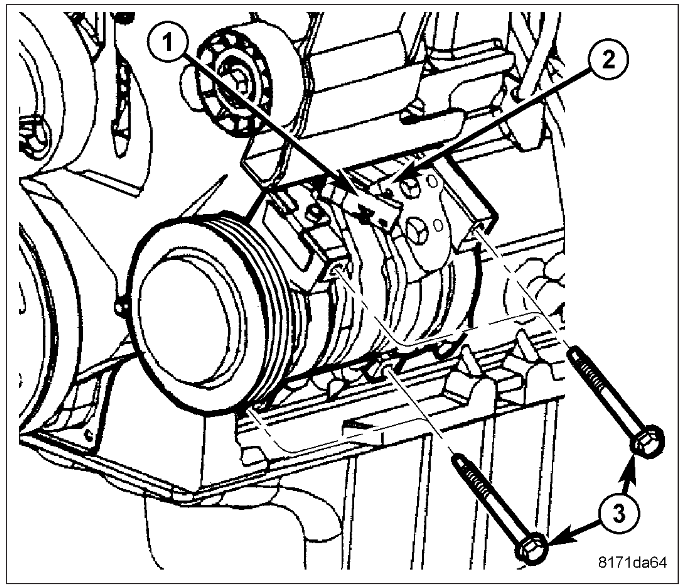

## INSTALLATION

## 2.8L DIESEL ENGINE

**NOTE: If the A/C compressor is being replaced, be certain to check the refrigerant oil level (refer to Refrigerant Oil in this group). Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.**

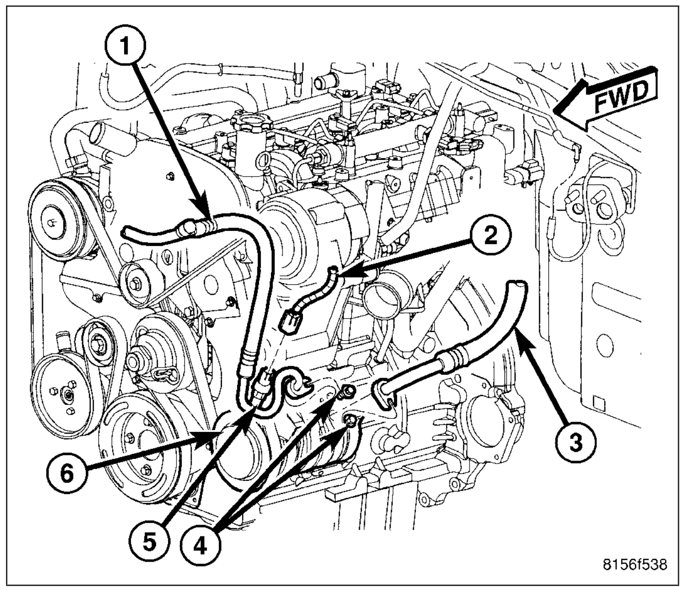
**NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.**

1. Position the A/C compressor (2) onto the engine.
2. Install the four bolts (3) that secure the A/C compressor to the engine. Tighten the bolts to 24.5 N·m (18 ft. lbs.).
3. Connect the engine wire harness to the A/C clutch field coil connector (1).




**NOTE: RHD model shown. LHD model similar.**

4. Remove the tape or plugs from the opened refrigerant line fittings and the compressor ports.
5. Lubricate new rubber O-ring seals with clean refrigerant oil and install them onto the refrigerant line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
6. Connect the A/C discharge line (1) and the A/C suction line (3) to the A/C compressor (6) and install the retaining bolts (4). Tighten the bolts to 12 N·m (106 in. lbs.).
7. If disconnected, connect the engine wire harness (2) to the A/C high pressure switch (5).
8. Install the front skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - INSTALLATION).
9. Lower the vehicle.
10. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/BELTS-DRIVE - INSTALLATION).
11. Reconnect the negative battery cable.
12. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
13. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

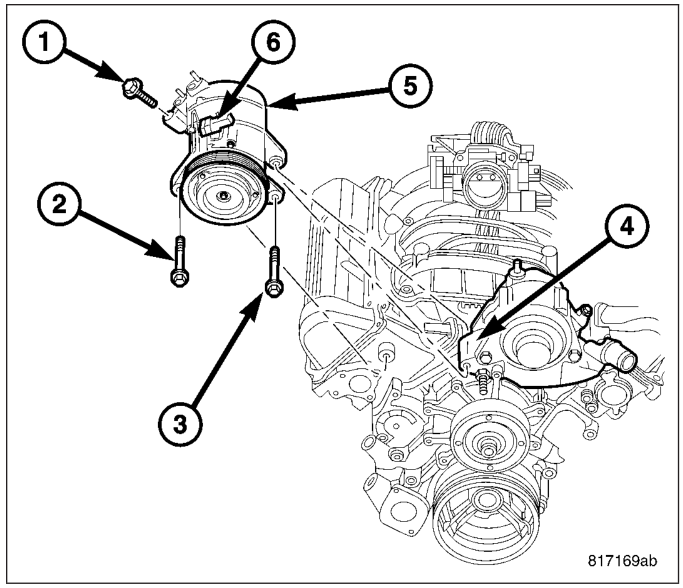



## 3.7L ENGINE

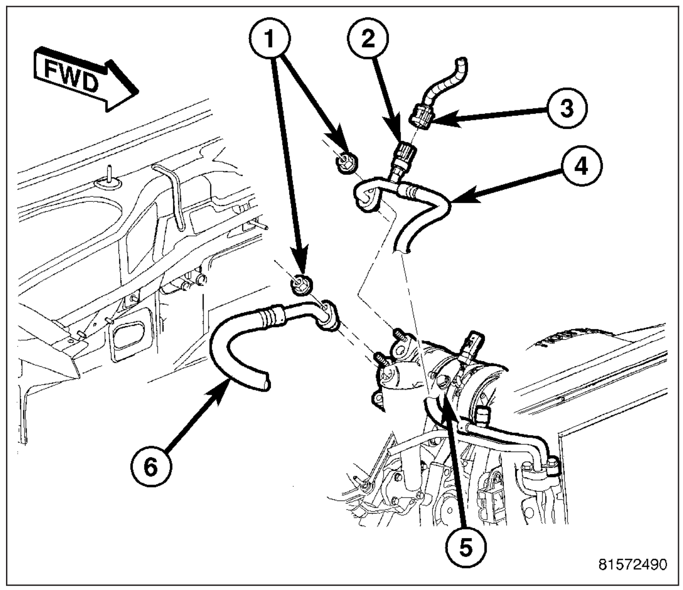
**NOTE: If the A/C compressor is being replaced, be certain to check the refrigerant oil level (refer to Refrigerant Oil in this group). Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.**

**NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.**

1. Position the A/C compressor (5) onto the engine and mounting bracket (4).
2. Install and hand tighten the three bolts that secure the A/C compressor to the engine and mounting bracket.
3. Tighten the mounting bolts in the following sequence:
   - The rear bolt (1) to 55 N·m (41 ft. lbs.).
   - The front inboard bolt (3) to 40 N·m (30 ft. lbs.).
   - The front outboard bolt (2) to 55 N·m (41 ft. lbs.).
4. Connect the wire harness connector to the A/C clutch field coil (6).




5. Remove the tape or plugs from the opened refrigerant line fittings and compressor ports.
6. Lubricate new rubber O-ring seals with clean refrigerant oil and install them onto the refrigerant line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
7. Connect the A/C discharge line (4) and the A/C suction line (6) to the A/C compressor (5).
8. Install the nuts (1) that secure the A/C suction and discharge lines to the A/C compressor. Tighten the nuts to 12 N·m (105 in. lbs.).
9. Connect the wire harness connector (3) to the A/C pressure transducer (2).
10. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).



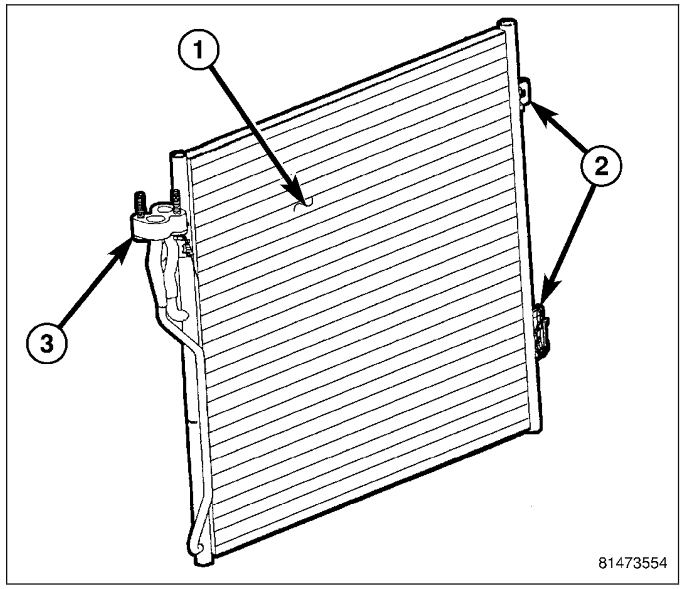

11. Reconnect the negative battery cable.
12. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
13. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

# CONDENSER-A/C

## DESCRIPTION

The A/C condenser (1) is located in the front of the engine compartment behind the grille. The A/C condenser is a heat exchanger that allows the high-pressure refrigerant gas being discharged by the A/C compressor to give up its heat to the air passing over the condenser fins, which causes the refrigerant to cool and change to a liquid state.

The A/C condenser is equipped with mounting provisions (2) and a tapping block (3) for the A/C refrigerant lines.




## OPERATION

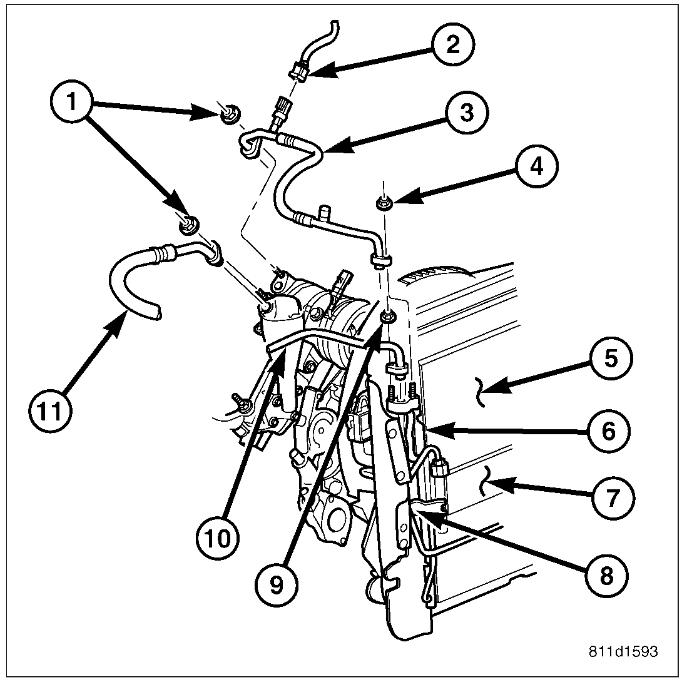
When air passes through the fins of the A/C condenser, the high-pressure refrigerant gas within the A/C condenser gives up its heat. The refrigerant then condenses as it leaves the A/C condenser and becomes a high-pressure liquid. The volume of air flowing over the condenser fins is critical to the proper cooling performance of the A/C system. Therefore, it is important that there are no objects placed in front of the radiator grille openings at the front of the vehicle or foreign material on the condenser fins that might obstruct proper air flow. Also, any factory-installed air seals or shrouds must be properly reinstalled following radiator or A/C condenser service.

The A/C condenser cannot be repaired and, if faulty or damaged, it must be replaced.

## REMOVAL

**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**CAUTION: Before removing the A/C condenser, note the location of each of the radiator/condenser air seals. These air seals are used to direct air through the A/C condenser and radiator. The air seals must be reinstalled in their proper locations in order for the A/C and engine cooling systems to perform as designed.**

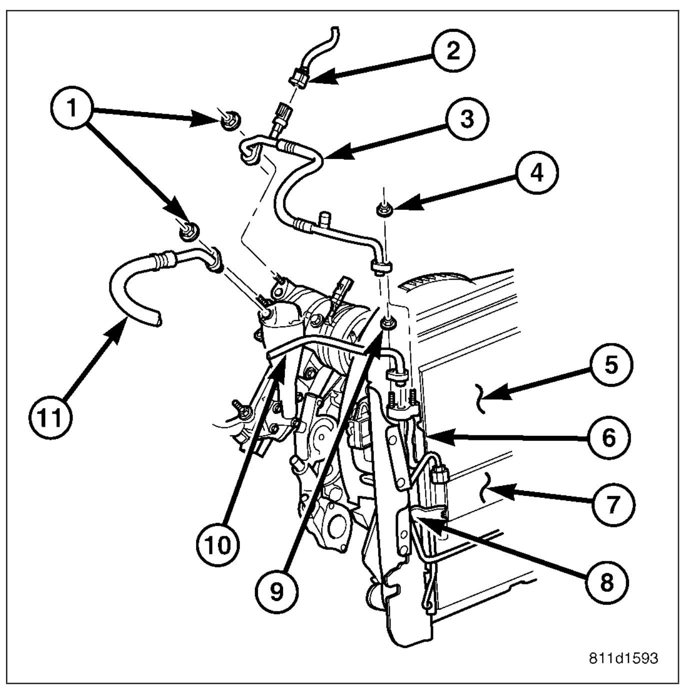



1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Remove the nuts (4 and 9) that secure the A/C discharge line (3) and the A/C liquid line (10) to the A/C condenser (5).
4. Disconnect the A/C discharge line and the A/C liquid line from the A/C condenser and remove and discard the O-ring seals.
5. Install plugs in, or tape over all of the opened refrigerant line fittings and condenser ports.
6. Remove the upper radiator crossmember (Refer to 23 - BODY/EXTERIOR/RADIATOR CROSSMEMBER - REMOVAL).
7. If equipped, remove the two bolts (8) that secure the automatic transmission cooler (7) to the radiator and position the transmission cooler aside.
8. Remove the two bolts (6) that secure the upper A/C condenser brackets to the radiator.
9. Carefully lift the A/C condenser straight up to disconnect the lower brackets from the radiator and remove the A/C condenser from the engine compartment.

## INSTALLATION

**NOTE: If the A/C condenser is being replaced, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.**

**NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.**




1. Carefully position the A/C condenser (5) into the engine compartment and engage the lower condenser brackets to the radiator.
2. Install the two bolts (6) that secure the upper condenser brackets to the radiator. Tighten the bolts to 5 N·m (44 in. lbs.).
3. If equipped, position the automatic transmission cooler (7) to the radiator and install the two retaining bolts (8). Tighten the bolts to 5 N·m (44 in. lbs.).
4. Install the upper radiator crossmember (Refer to 23 - BODY/EXTERIOR/RADIATOR CROSSMEMBER - INSTALLATION).
5. Remove the tape or plugs from the refrigerant line fittings and condenser ports.
6. Lubricate new rubber O-ring seals with clean refrigerant oil and install them onto the refrigerant line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
7. Connect the A/C liquid line (10) and the A/C discharge line (3) to the A/C condenser and install the retaining nuts (4 and 9). Tighten the nuts to 22.5 N·m (200 in. lbs.).

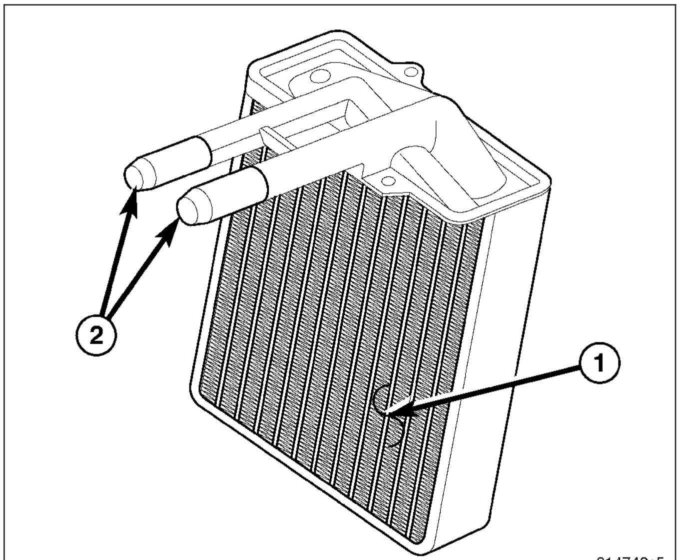
8. Reconnect the negative battery cable.
9. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
10. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

# CORE-HEATER

## DESCRIPTION

The heater core is mounted in the HVAC housing, located behind the instrument panel. The heater core is a heat exchanger made of rows of tubes and fins (1). The heater core inlet and outlet tubes (2) are integral to the heater core and cannot be serviced separately.

The heater core is serviced by removing the HVAC housing from the vehicle.




814742c5

## OPERATION

Engine coolant is circulated through the heater hoses to the heater core at all times. As the coolant flows through the heater core, heat is removed from the engine and is transferred to the heater core tubes and fins. Air directed through the heater core picks up the heat from the heater core fins. The blend-air door(s) allows control of the heater output air temperature by regulating the amount of air flowing through the heater core. The blower motor speed controls the volume of air flowing through the HVAC housing.

The heater core cannot be repaired and, if faulty or damaged, it must be replaced.

## REMOVAL

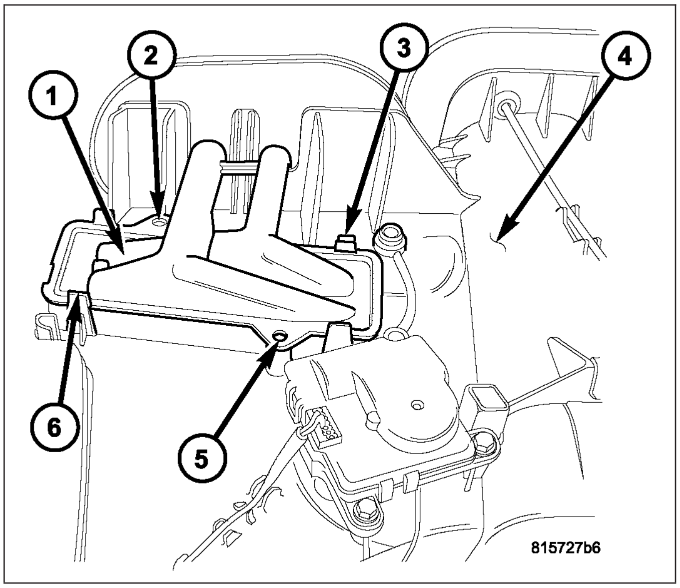
**NOTE: LHD model shown in illustration. RHD models similar.**

1. Remove the HVAC housing and place it on a workbench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - REMOVAL).

**NOTE: If the rubber flange around the heater core tubes is deformed or damaged, the flange must be replaced.**

2. If equipped, remove the two screws (2 and 5) that secure the heater core (1) into the top of the HVAC housing (4).

**NOTE: If the foam insulator around the heater core is deformed or damaged, the insulator must be replaced.**



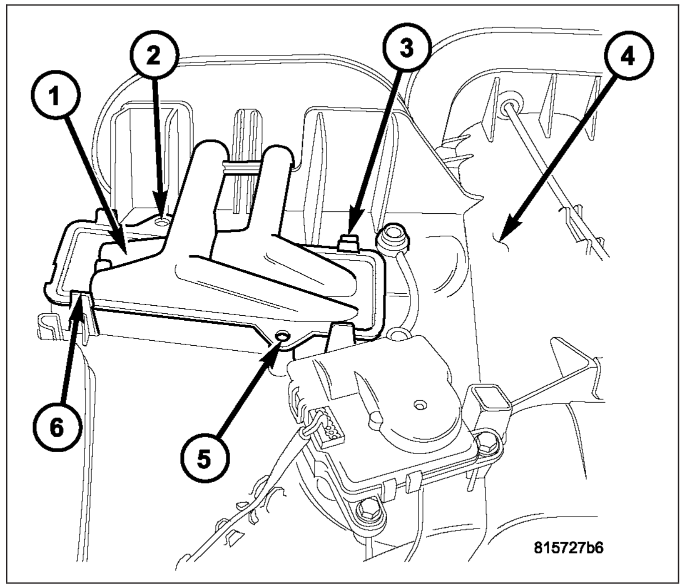

815727b6

3. Disengage the four retaining tabs (3 and 6) that secure the heater core to the HVAC housing and carefully remove the heater core from the housing.

## INSTALLATION

**NOTE: Make sure that the foam insulator is properly positioned in the HVAC housing.**

1. Carefully install the heater core (1) into the top of the HVAC housing (4).
2. Engage the four retaining tabs (3 and 6) that secure the heater core to the HVAC housing.
3. If equipped, install the two screws (2 and 5) that secure the heater core to the HVAC housing. Tighten the screws to 2 N·m (17 in. lbs.).



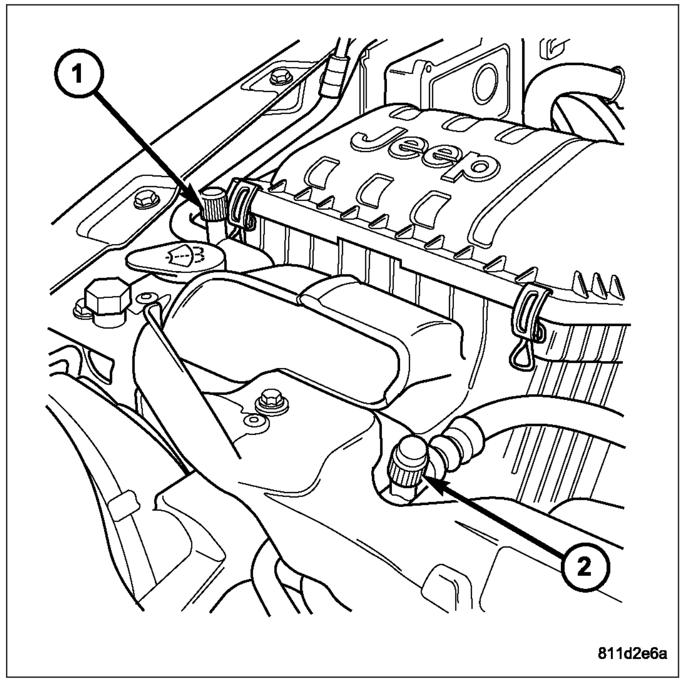

**NOTE: If the heater core is being replaced, flush the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM CLEANING/REVERSE FLUSHING).**

4. Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - INSTALLATION).

# CORE-VALVE-SERVICE PORT

## DESCRIPTION

**NOTE: 3.7L engine shown in illustration. 2.8L engine similar.**




Refrigerant system service ports are used to recover, recycle, evacuate, charge and test the A/C refrigerant system. Unique sizes are used on the two service ports for the R-134a refrigerant system to ensure the system is not accidentally contaminated with R-12 refrigerant or by service equipment used for R-12 refrigerant.

The low-side service port (1) is located on the A/C liquid line near the air filter housing. The high-side service port (2) is located on the A/C discharge line near the A/C condenser. Both the high-side and low-side A/C service port valve cores are serviceable.

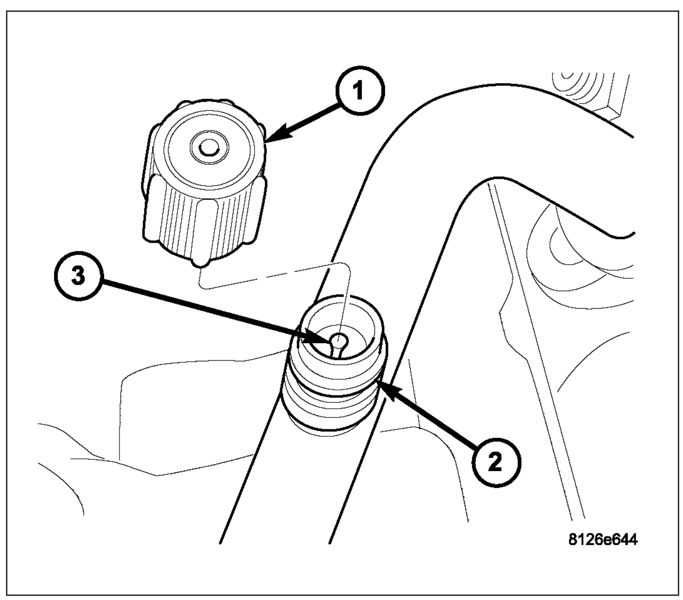
**NOTE: The protective cap aids in service port sealing and helps protects the refrigerant system from contamination. Remember to always reinstall the protective cap onto the service port when refrigerant system service is complete.**

Each of the service ports has a threaded plastic protective cap installed over it from the factory. The service port caps are serviceable items.

## REMOVAL

**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

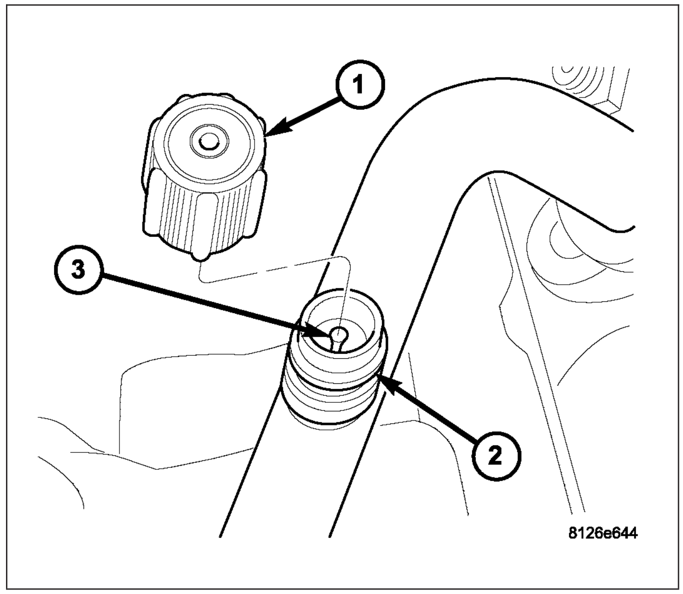
**NOTE: Typical A/C service port shown.**




1. Remove the protective cap (1) from the service port (2).
2. Recover the refrigerant from the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Using a Schrader-type valve core tool, remove the valve core (3) from the service port.
4. Install a plug in or tape over the opened service port(s).

## INSTALLATION

**NOTE: Typical A/C service port shown.**




1. Lubricate the valve core (3) with clean refrigerant oil prior to installation. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
2. Remove the tape or plug from the service port (2).

**CAUTION: A valve core that is not fully seated in the A/C service port can result in damage to the valve during refrigerant system evacuation and charge. Such damage may result in a loss of system refrigerant while uncoupling the charge adapters.**

3. Using a Schrader-type valve core tool, install and tighten the valve core into the service port(s).
4. Evacuate the refrigerant system (r to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
5. Charge the refrigerant system (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

**NOTE: The protective cap helps aid in service port sealing and helps protect the refrigerant system from contamination. Remember to always reinstall the protective cap onto the service port when refrigerant system service is complete.**

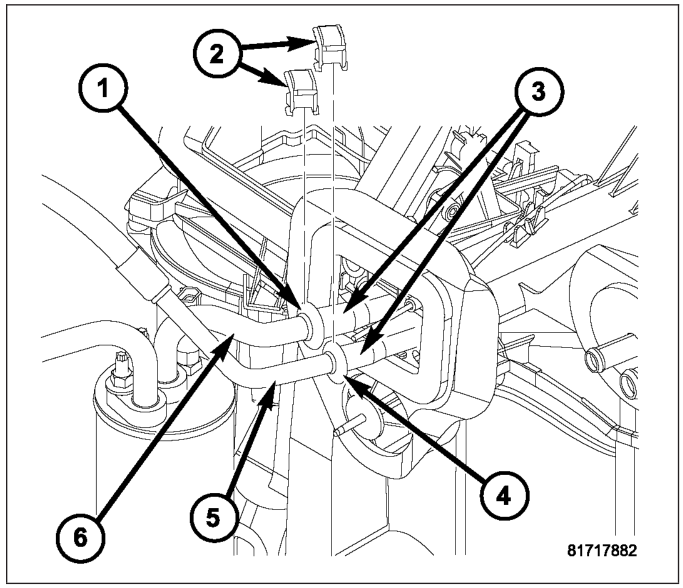
6. Install the protective cap (1) onto the service port.

# COUPLER-REFRIGERANT LINE

## DESCRIPTION

Spring-lock type refrigerant line couplers (1 and 4) are used to connect the A/C liquid and suction lines (5 and 6) to the A/C evaporator tubes (3) on LHD models. Secondary retaining clips (2) are installed over the connected couplers for added protection.

The spring-lock refrigerant line couplers require special disconnect tools for disengaging the two coupler halves.

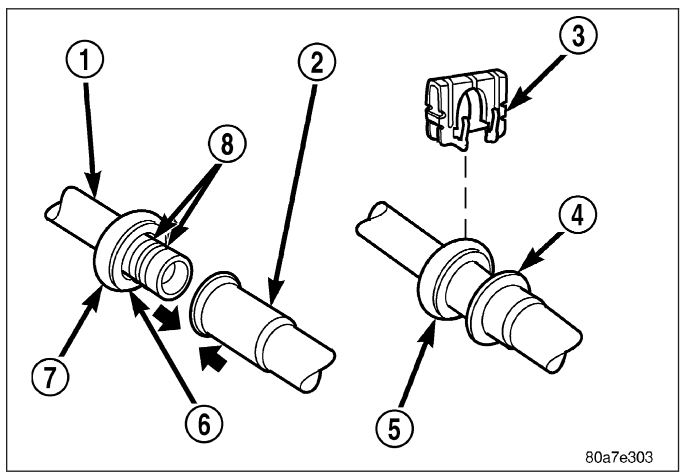



## OPERATION

The spring-lock type refrigerant line coupler is held together by a garter spring (6) inside a circular cage (7) on the male half of the fitting (1). When the two coupler halves are connected, the flared end of the female fitting (2) slips behind the garter spring inside the cage on the male fitting. The garter spring and cage prevent the flared end of the female fitting from pulling out of the cage. Some applications use a connection indicator ring (4) to help indicate when the two coupler halves are fully connected.

Two O-rings (8) are used to seal the coupler connections. These O-rings are compatible with R-134a refrigerant and must be replaced with O-rings made of the same material.

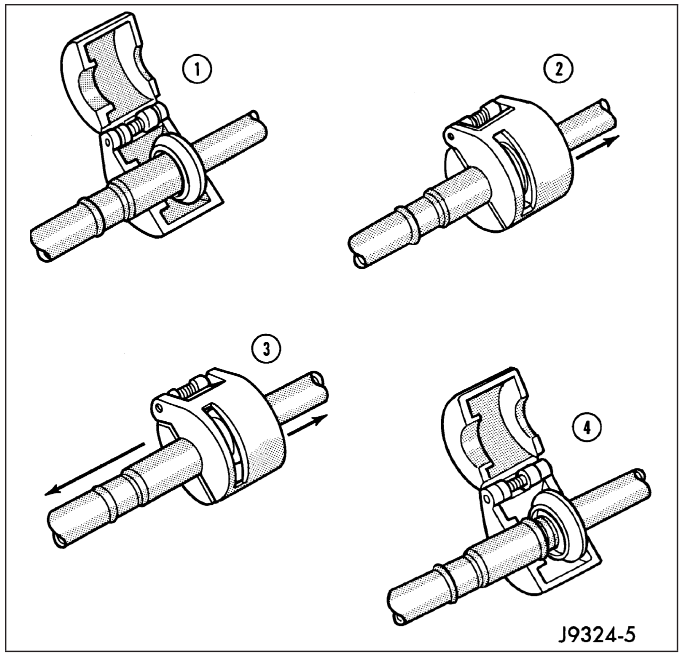
A secondary retaining clip (3) is installed over the connected coupler (5) for added protection.




## REMOVAL

**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

1. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
2. Remove the secondary retaining clip from the spring-lock type refrigerant line coupler.
3. Fit the proper size A/C line disconnect tool (Special Tool Kit 7193 or equivalent) over the coupler cage (1).
4. Close the two halves of the A/C line disconnect tool around the coupler (2).

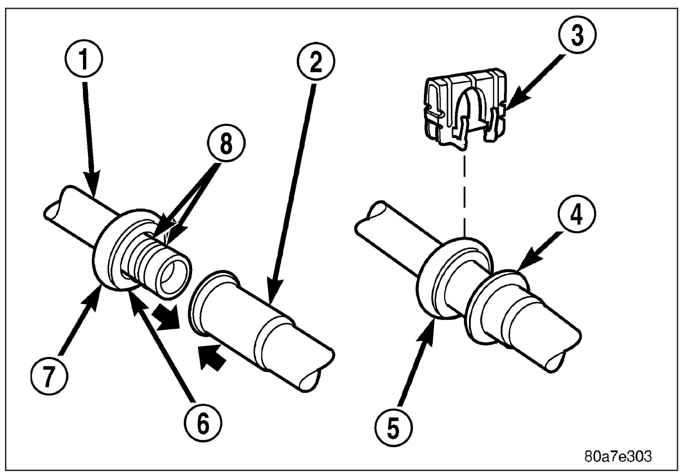



**NOTE: The garter spring may not release if the A/C line disconnect tool is cocked while pushing it into the coupler cage opening.**

5. Push the A/C line disconnect tool into the open side of the coupler cage to expand the garter spring (3). Once the garter spring is expanded, pull on the refrigerant line attached to the female half of the coupler until the flange on the female fitting is separated from the garter spring and cage on the male fitting.
6. Open and remove the A/C line disconnect tool from the refrigerant line coupler (4).

## INSTALLATION

1. Clean any dirt or foreign material from the spring-lock type refrigerant line coupler.
2. Check to make sure that the garter spring (6) is located within the cage (7) of the male half of the refrigerant line coupler (1), and that the garter spring is not damaged.
   a. If the garter spring is missing, install a new spring by pushing it into the coupler cage opening.
   b. If the garter spring is damaged, remove it from the coupler cage with a small hook (DO NOT use a screwdriver) and install a new garter spring.




**CAUTION: Use only the specified O-rings as they are made of a special material for the R-134a system. The use of any other O-rings may allow the connection to leak.**

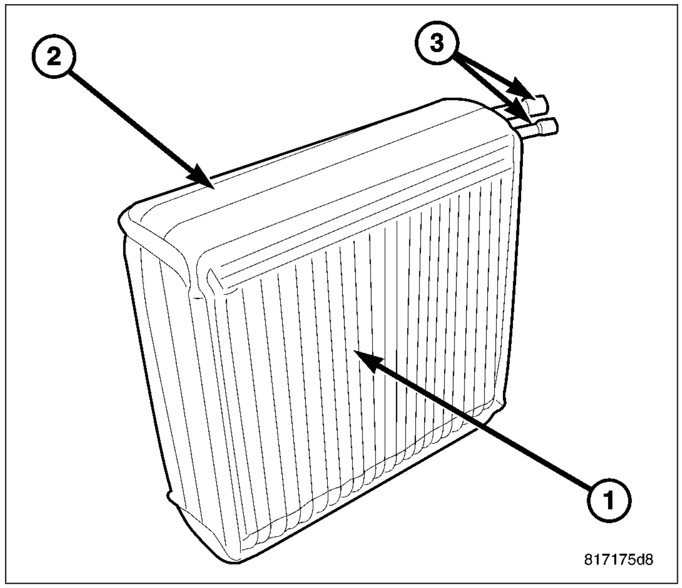
3. Install new O-rings (8) on the male half of the refrigerant line coupler.
4. Lubricate the O-rings, and the inside of the female half of the refrigerant line coupler (2) with clean R-134a refrigerant oil. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
5. Position the female half of the coupler over the male half of the coupler.
6. Push together firmly on the two halves of the refrigerant line coupler until the garter spring in the cage on the male half of the coupler snaps over the flanged end on the female half of the coupler.
7. Make sure that the refrigerant line coupler is fully engaged by firmly pulling the refrigerant lines away from each other on both sides of the coupler.
8. Install the secondary retaining clip (3) over connected coupler cage (5).
9. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

10. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

# EVAPORATOR-A/C

## DESCRIPTION

**NOTE: LHD model shown. RHD model similar.**




The A/C evaporator (1) and its insulator (2) for the heating-A/C system is located within the HVAC housing, behind the instrument panel. The A/C evaporator is positioned in the HVAC housing so that all air entering the housing must pass over the evaporator fins before it is distributed through the heating-A/C system ducts and outlets. However, air passing over the evaporator fins will only be conditioned when the A/C compressor is engaged and circulating refrigerant through the A/C evaporator.

On LHD models, the A/C liquid and suction lines are connected to the evaporator tubes (3) by use of rubber O-rings and quick-connect fittings (refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COUPLER-REFRIGERANT LINE - DESCRIPTION for more information). The refrigerant lines on RHD models are connected to the A/C evaporator by use of rubber O-rings, tapping blocks and retaining nuts.

The A/C evaporator can be serviced by removing and disassembling the HVAC housing assembly.

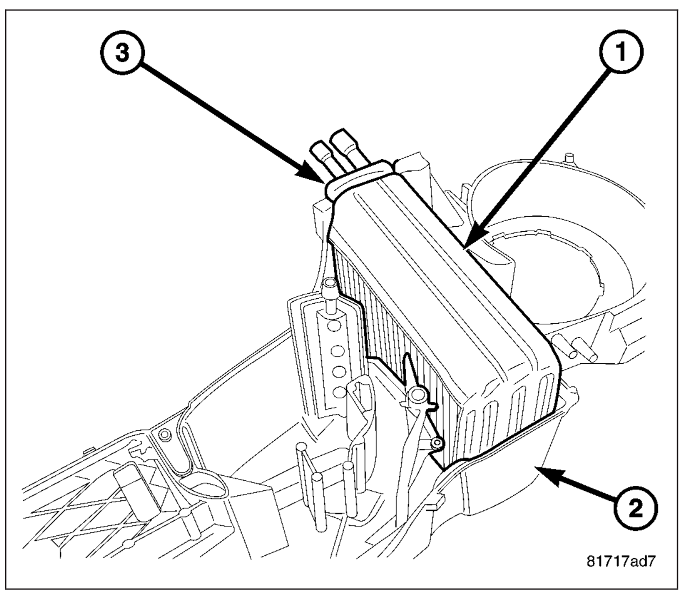
## OPERATION

Refrigerant enters the A/C evaporator through the A/C orifice tube as a low-temperature, low-pressure mixture of liquid and gas. As air flows over the fins of the A/C evaporator, the humidity in the air condenses on the fins, and the heat from the air is absorbed by the refrigerant. Heat absorption causes the refrigerant to boil and vaporize. The refrigerant becomes a low-pressure gas when it leaves the A/C evaporator.

The A/C evaporator cannot be repaired and, if faulty or damaged, it must be replaced.

## REMOVAL

**NOTE: LHD model shown. RHD model similar.**




1. Remove the HVAC housing and place it on a workbench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - REMOVAL).
2. Disassemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - DISASSEMBLY).

**NOTE: If the foam insulator around the A/C evaporator is deformed or damaged, the insulator must be replaced.**

3. Carefully lift the A/C evaporator (1) and the foam insulator out of the lower half of the HVAC housing (2).

**NOTE: If the rubber seal around the evaporator tubes is deformed or damaged, the seal must be replaced.**

4. If required, remove the rubber seal (3) from around the evaporator tubes.

## INSTALLATION

**NOTE: If the A/C evaporator is being replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system.**

**NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.**

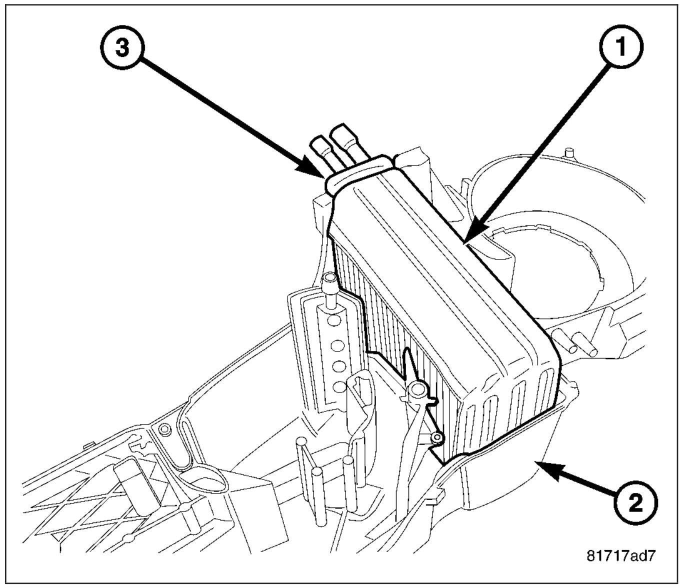
**NOTE: LHD model shown. RHD model similar.**

**NOTE: Make sure that the rubber seal is properly positioned in the HVAC housing.**

1. If removed, install the rubber seal (3) around the tubes of the A/C evaporator (1).

**NOTE: Make sure that the foam insulator is properly positioned in the HVAC housing.**

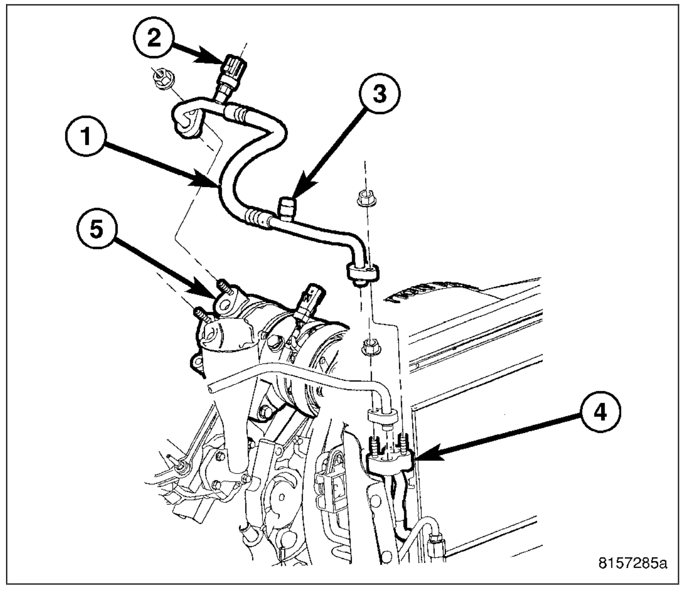
2. Install the A/C evaporator and its foam insulator into the lower half of the HVAC housing (2).
3. Assemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - ASSEMBLY).
4. Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HOUSING-HVAC - INSTALLATION).



# LINE-A/C DISCHARGE

## DESCRIPTION

**NOTE: 3.7L engine shown in illustration. 2.8L engine similar.**




The A/C discharge line (1) is the refrigerant line that carries refrigerant from the A/C compressor (5) to the A/C condenser (4). The A/C discharge line includes the high side service port (3) and a fitting for the A/C pressure transducer (2) (or the A/C high pressure switch, depending on engine application).

**CAUTION: Use only the O-ring seals specified for the vehicle. Failure to use the correct O-ring seals will cause the refrigerant system connections to leak.**

The A/C discharge line has no serviceable parts except for the rubber O-ring seals and the high service port valve core. The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals must be replaced whenever the A/C discharge line is removed and installed.

The A/C discharge line cannot be repaired and, if leaking or damaged, it must be replaced.

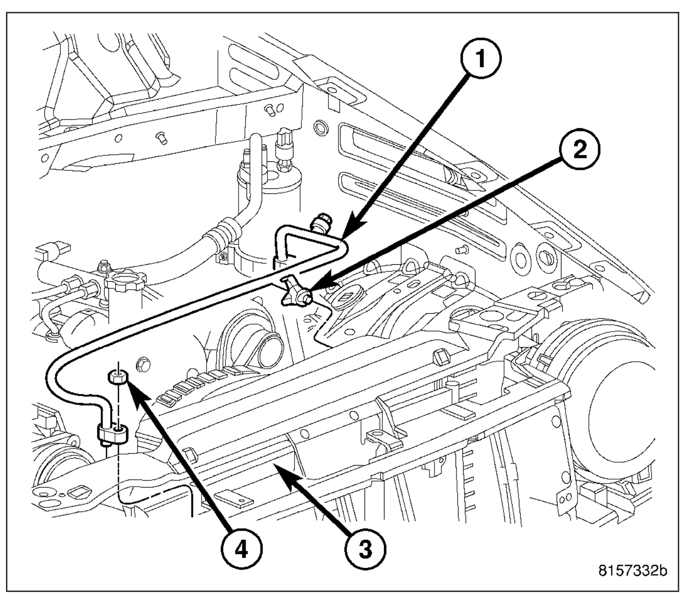
## REMOVAL

## 2.8L DIESEL ENGINE

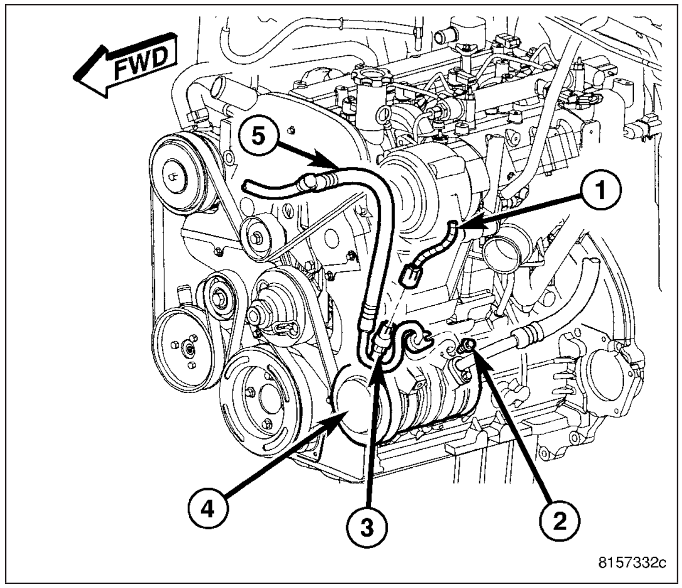
**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**NOTE: RHD model shown in illustrations. LHD model similar.**

1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY).
3. Remove the nut (4) that secures the A/C discharge line (1) to the A/C condenser (3) and disconnect the line from the condenser.
4. Remove and discard the O-ring seal from the refrigerant line fitting and install plugs in, or tape over the opened fitting and condenser port.
5. Disengage the A/C discharge line from the retaining clip (2).



6. Raise and support the vehicle.
7. Remove the front skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - REMOVAL).
8. Disconnect the engine wire harness (1) from the A/C high pressure switch (3) and if required, remove the switch from the A/C discharge line (5).
9. Remove the bolt (2) that secures the A/C discharge line to the A/C compressor (4) and disconnect the line from the compressor.
10. Remove and discard the O-ring seal from the refrigerant line fitting and install plugs in, or tape over the opened fitting and compressor port.
11. Remove the A/C discharge line from the engine compartment.

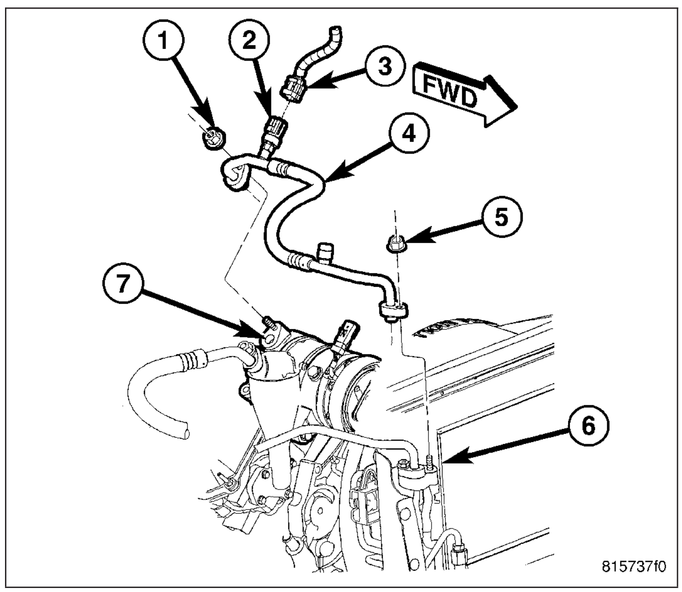



## 3.7L ENGINE

**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**NOTE: LHD model shown. RHD model similar.**

1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Disconnect the wire harness connector (3) from the A/C pressure transducer (2) and, if required, remove the transducer from the A/C discharge line (4).
4. Remove the nuts (1 and 5) that secure the A/C discharge line to the A/C condenser (6) and the A/C compressor (7).
5. Disconnect the A/C discharge line from the A/C condenser and the A/C compressor and remove and discard the O-ring seals.
6. Install plug in, or tape over the opened discharge line fittings and the compressor and condenser ports.



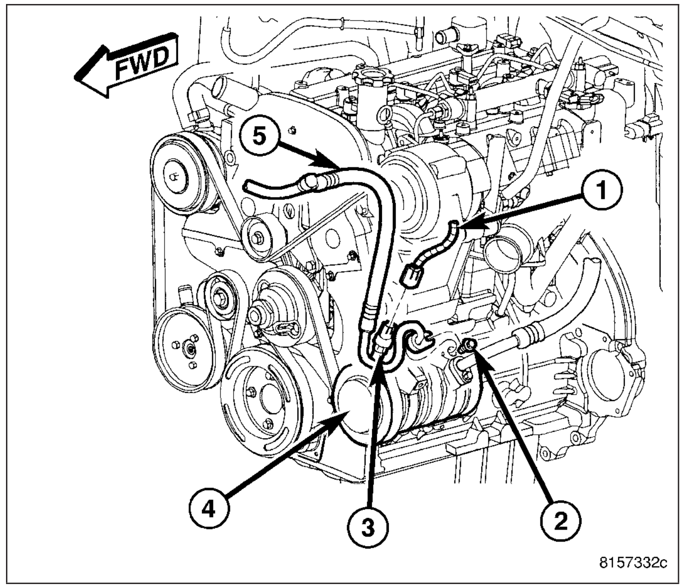

# INSTALLATION

## 2.8L DIESEL ENGINE

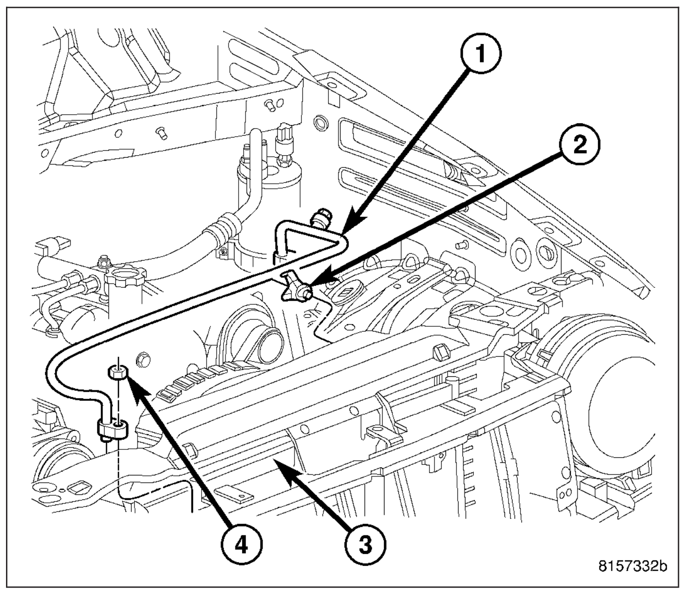
**NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.**

**NOTE: RHD model shown in illustrations. LHD model similar.**

1. Position the A/C discharge line (5) into the engine compartment.
2. Remove the tape or plugs from the discharge line fitting and compressor port.
3. Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the discharge line fitting. Use only the specified O-ring as it is made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
4. Connect the A/C discharge line to the A/C compressor (4) and install the retaining bolt (2). Tighten the bolt to 12 N·m (106 ft. lbs.).
5. If removed, install the A/C high pressure switch (3) onto the A/C discharge line. Hand-tightened the switch securely.
6. Connect the engine wire harness (1) to the A/C high pressure switch.




7. Install the front skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - INSTALLATION).
8. Lower the vehicle.
9. Engage the A/C discharge line (1) into the retaining clip (2).
10. Remove the tape or plugs from the discharge line fitting and condenser port.
11. Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the discharge line fitting. Use only the specified O-ring as it is made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
12. Connect the A/C discharge line to the A/C condenser (3).
13. Install the nut (4) that secures the A/C discharge line to the A/C condenser. Tighten the nut to 22.5 N·m (200 in. lbs.).
14. Reconnect the negative battery cable.
15. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

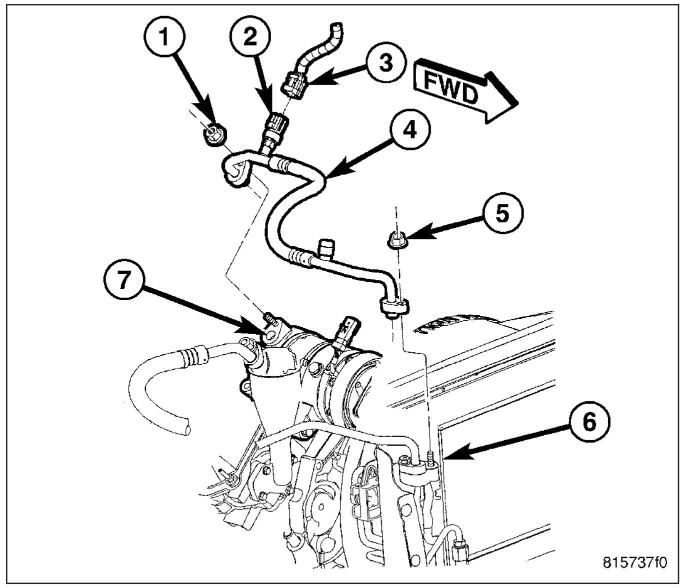



16. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

## 3.7L ENGINE

**NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.**

**NOTE: LHD model shown. RHD model similar.**

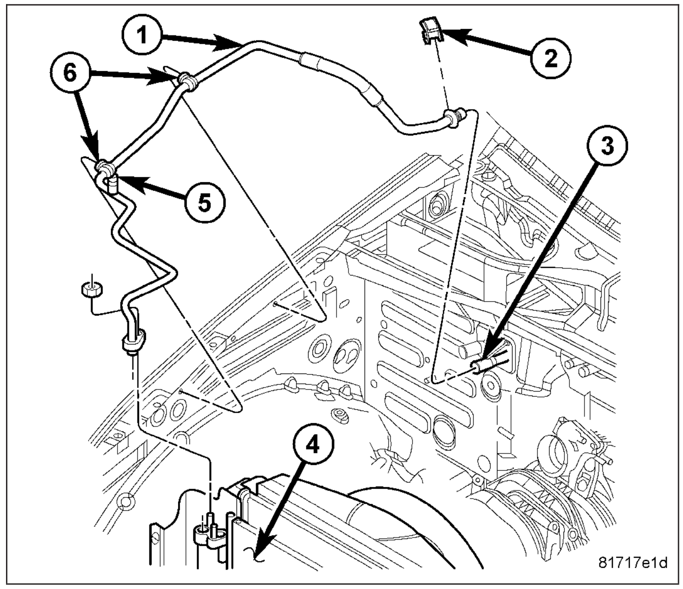



1. Position the A/C discharge line (4) into the engine compartment.
2. Remove the tape or plugs from the discharge line fittings and the compressor and condenser ports.
3. Lubricate a new rubber O-ring seals with clean refrigerant oil and install them on the discharge line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
4. Connect the A/C discharge line to the A/C compressor (7) and install the retaining nut (1). Tighten the nut to 27 N·m (20 ft. lbs.).
5. Connect the A/C discharge line to the A/C condenser (6) and install the retaining nut (5). Tighten the nut to 22.5 N·m (200 in. lbs.).
6. If removed, install the A/C pressure transducer (2) onto the A/C discharge line. Hand-tightened the transducer securely.
7. Connect the wire harness connector (3) to the A/C pressure transducer.
8. Reconnect the negative battery cable.
9. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
10. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

# LINE-A/C LIQUID

## DESCRIPTION

**NOTE: LHD model shown. RHD model similar.**




The A/C liquid line (1) is the refrigerant line that carries refrigerant from the A/C condenser (4) to the A/C evaporator (3). The A/C liquid line contains the fixed A/C orifice tube and the low-side service port (5). On LHD models, the A/C liquid line is serviced only as an assembly and uses a secondary retaining clip (2) installed over the connected spring lock coupler for added protection. On RHD models, the A/C liquid line is serviced in two sections.

**CAUTION: Use only the O-ring seals specified for the vehicle. Failure to use the correct O-ring seals will cause the refrigerant system connections to leak.**

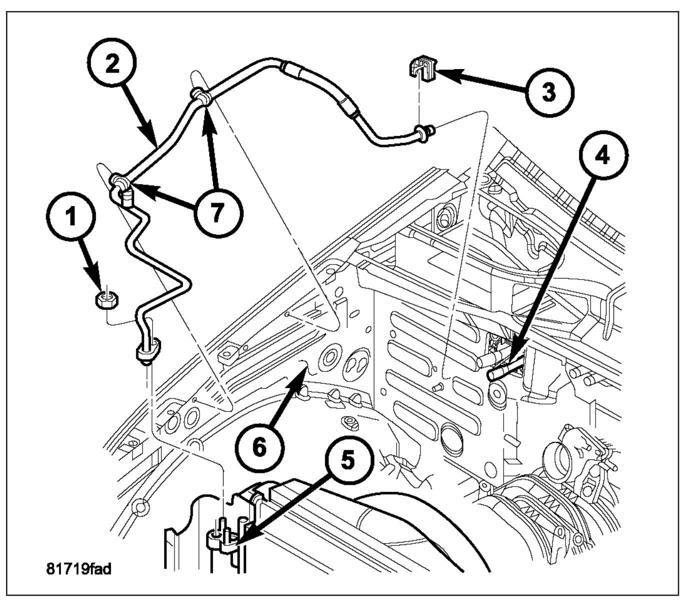
The A/C liquid line has no serviceable parts except for the rubber O-ring seals, plastic retainer clips (6) and the low-side service port valve and its protective cap. The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals must be replaced whenever the A/C liquid line is removed and installed.

If the A/C liquid line is found to be leaking or damaged, it must be replaced.

## REMOVAL

## LHD MODEL

**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

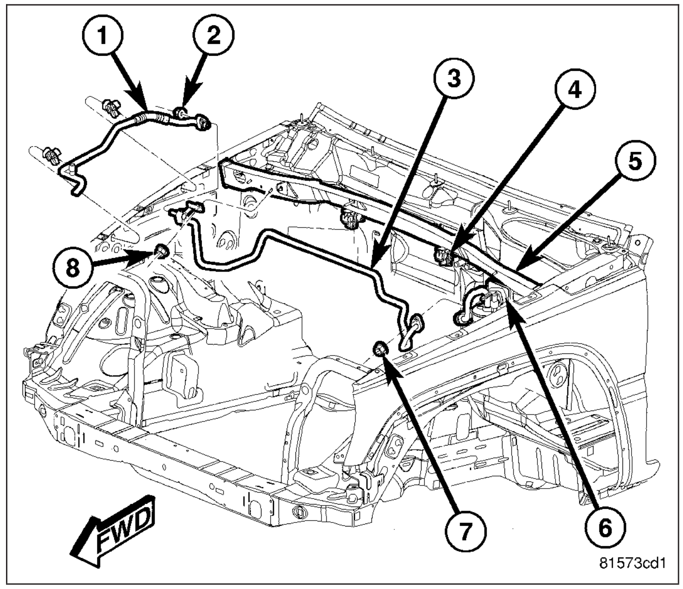



1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Remove the engine air cleaner housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/HOUSING-AIR CLEANER - REMOVAL).
4. Remove the nut (1) that secures the A/C liquid line (2) to the A/C condenser (5) and disconnect the line from the condenser.
5. Disengage the A/C liquid line from the retaining clips (7) located on the inner fender (6).
6. Remove the secondary retaining clip (3) from the liquid line spring-lock coupler and using the proper A/C line disconnect tool, disconnect the A/C liquid line from the evaporator inlet tube (4) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COUPLER-REFRIGERANT LINE - REMOVAL).

7. Remove the A/C liquid line from the engine compartment and remove and discard the O-ring seals and install plugs in, or tape over the opened refrigerant line fittings and the condenser and evaporator ports.

## RHD MODEL

**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

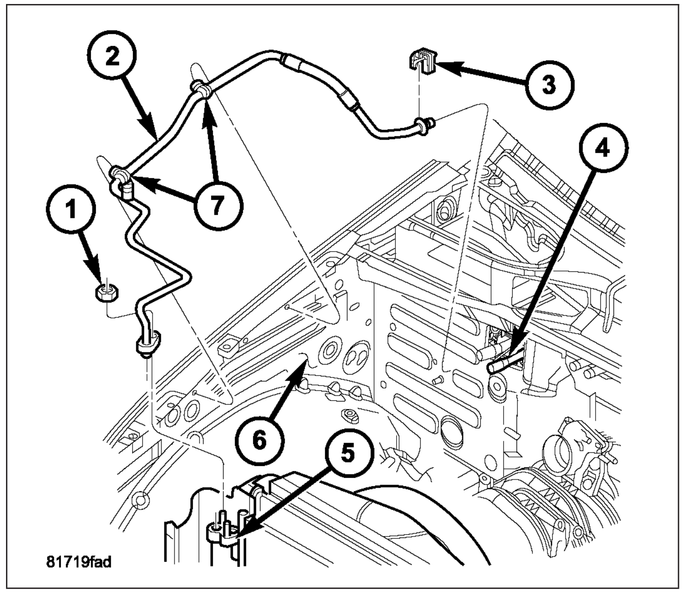



1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. Remove the engine air cleaner housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/HOUSING-AIR CLEANER - REMOVAL).
4. Remove the front section of the A/C liquid line (1) from the A/C condenser and remove and discard the O-ring seal (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/CONDENSER-A/C - REMOVAL).
5. Disengage the A/C liquid line from the retaining clips located on the inner fender.
6. Remove the nut (2) that secures the front section of the A/C liquid line to rear section of the A/C liquid line (3) and disconnect the lines from each other.
7. Remove the nut (8) that secures the rear section of the A/C liquid line to the stud located on the dash panel (5).
8. Disengage the rear section of the A/C liquid line from the retaining clips (4) located on the dash panel.
9. Remove the nut (7) that secures the rear section of the A/C liquid line to the A/C evaporator (6) and disconnect the line from the evaporator.
10. Remove the A/C liquid lines from the engine compartment and remove and discard the O-ring seals and install plugs in, or tape over the opened refrigerant line fittings and the condenser and evaporator ports.

## INSTALLATION

## LHD MODEL

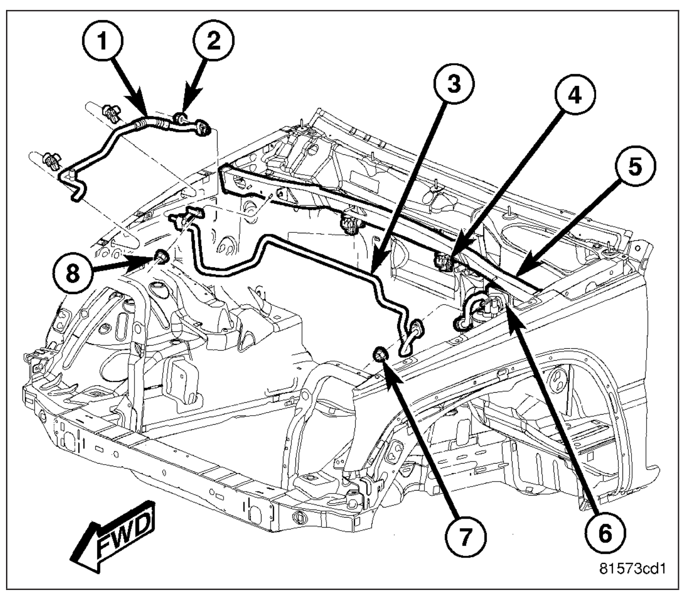
**NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.**




1. Position the A/C liquid line (2) into the engine compartment.
2. Remove the tape or plugs from the liquid line fittings and the condenser and evaporator ports.
3. Lubricate new rubber O-ring seals with clean refrigerant oil and install them on the liquid line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
4. Connect the A/C liquid line to the evaporator inlet tube (4) and install the secondary retaining clip (3) (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING/COUPLER-REFRIGERANT LINE - INSTALLATION).
5. Install the A/C liquid line into the retaining clips (7) located on the inner fender (6).
6. Connect the A/C liquid line to the A/C condenser (5) and install the retaining nut (1). Tighten the nut to 22.5 N·m (200 in. lbs.).
7. Install the engine air cleaner housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/HOUSING-AIR CLEANER - INSTALLATION).
8. Reconnect the negative battery cable.
9. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
10. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

## RHD MODEL

**NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.**




1. Position the two sections of the A/C liquid line (1 and 3) into the engine compartment.
2. Remove the tape or plugs from the liquid line fittings and the condenser and evaporator ports.
3. Lubricate new rubber O-ring seals with clean refrigerant oil and install them on the liquid line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
4. Connect the rear section of the A/C liquid line to the A/C evaporator (6) and install the retaining nut (7). Tighten the nut to 12.5 N·m (110 in. lbs.).
5. Engage the rear section of the A/C liquid line into the retaining clips (4) located on the dash panel (5).
6. Position the rear section of the A/C liquid line onto the stud located on the dash panel and install the retaining nut (8). Tighten the nut to 5 N·m (44 in. lbs.).
7. Connect the front section of the A/C liquid line to the rear section of the A/C liquid line and install the retaining nut (2). Tighten the nut to 22.5 N·m (200 in. lbs.).
8. Engage the front section of the A/C liquid line into the retaining clips located on the inner fender.

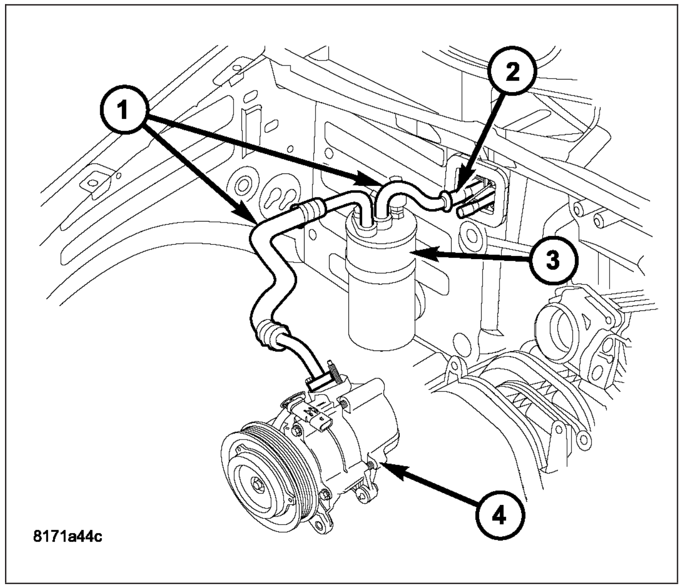
9. Install the front section of the A/C liquid line onto the A/C condenser (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/CONDENSER-A/C - INSTALLATION).
10. Install the engine air cleaner housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/HOUSING-AIR CLEANER - INSTALLATION).
11. Reconnect the negative battery cable.
12. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
13. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

# LINE-A/C SUCTION

## DESCRIPTION

**NOTE: 3.7L LHD shown. 2.8L and RHD similar.**

The A/C suction line (1) is the refrigerant line that carries refrigerant from the A/C evaporator (2) to the A/C accumulator (3), and then, to the A/C compressor (4). The A/C suction line is serviced in two sections.




**CAUTION: Use only the O-ring seals specified for the vehicle. Failure to use the correct O-ring seals will cause the refrigerant system connections to leak.**

The A/C suction lines have no serviceable parts except for the rubber O-ring seals. The O-ring seals used on the connections are made from a special type of rubber not affected by R-134a refrigerant. The O-ring seals must be replaced whenever an A/C suction line is removed and installed.

If an A/C suction line is found to be leaking or is damaged, it must be replaced.

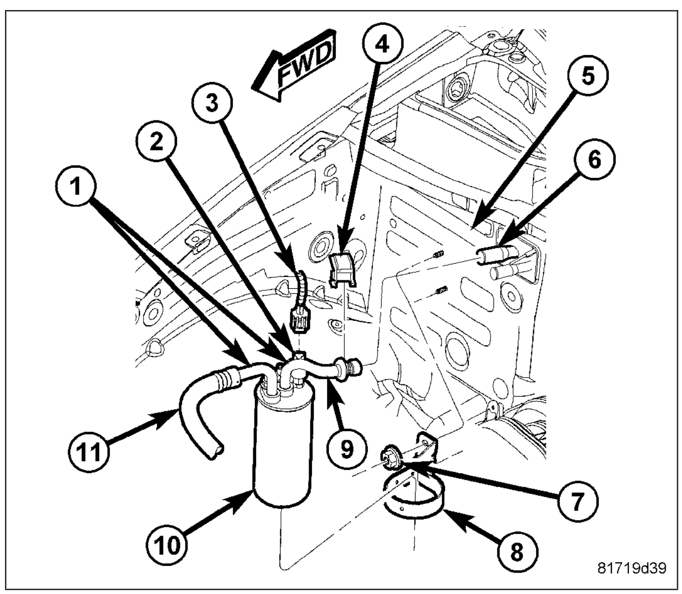
## REMOVAL

## 2.8L DIESEL ENGINE

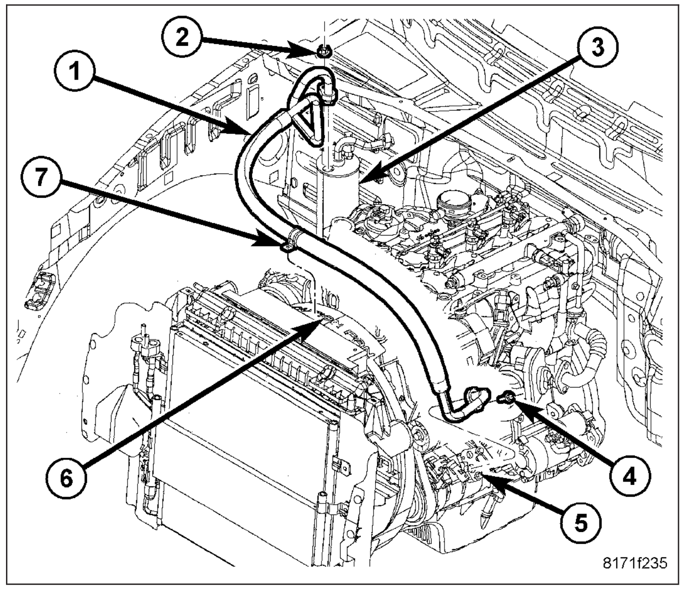
**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**NOTE: LHD model shown in illustrations. RHD model similar.**

1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. If servicing the rear section of the A/C suction line (9), proceed to Step 4. If servicing only the front section of the A/C suction line (11), go to Step 10.
4. Disconnect the wire lead and connector (3) from the A/C low pressure switch (2) and remove the switch from the A/C accumulator (10).
5. Remove the two nuts (7) that secure the accumulator bracket (8) to the dash panel (5).
6. On LHD models, remove the secondary retaining clip (4) from the suction line spring-lock coupler and using the proper A/C line disconnect tool, disconnect the rear section of the A/C suction line (9) from the evaporator outlet tube (6) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COUPLER-REFRIGERANT LINE - REMOVAL).



7. On RHD models, remove the nut that secures the rear section of the A/C suction line to the A/C evaporator and disconnect the line from the evaporator.
8. Remove the nut (1) that secures the rear section of the A/C suction line to the A/C accumulator and disconnect the line from the accumulator.
9. Remove and discard the O-ring seals and install plugs in, or tape over the opened refrigerant line fittings and the accumulator and evaporator ports.
10. Remove the nut (2) that secures the front section of the A/C suction line (1) to the A/C accumulator (3) and disconnect the line from the accumulator.
11. Remove and discard the O-ring seal from the refrigerant line fitting and install plugs in, or tape over the opened refrigerant line fitting and the accumulator port.
12. Disengage the retaining clip (7) that secures the A/C suction line to the top of the fan shroud (6).
13. Raise and support the vehicle.
14. Remove the front skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - REMOVAL).
15. Remove the bolt (4) that secures the A/C suction line to the A/C compressor (5) and disconnect the line from the compressor.
16. Remove and discard the O-ring seal from the refrigerant line fitting and install plugs in, or tape over the opened fitting and compressor port.



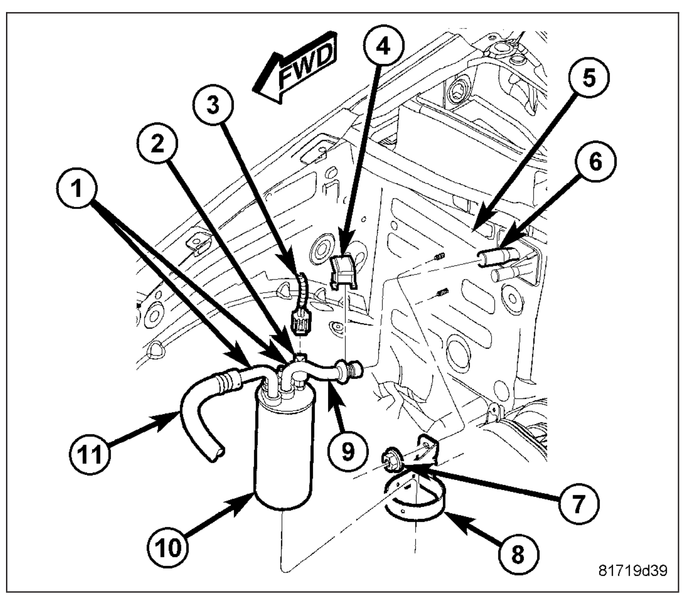

17. Remove the A/C suction line from the engine compartment.

## 3.7L ENGINE

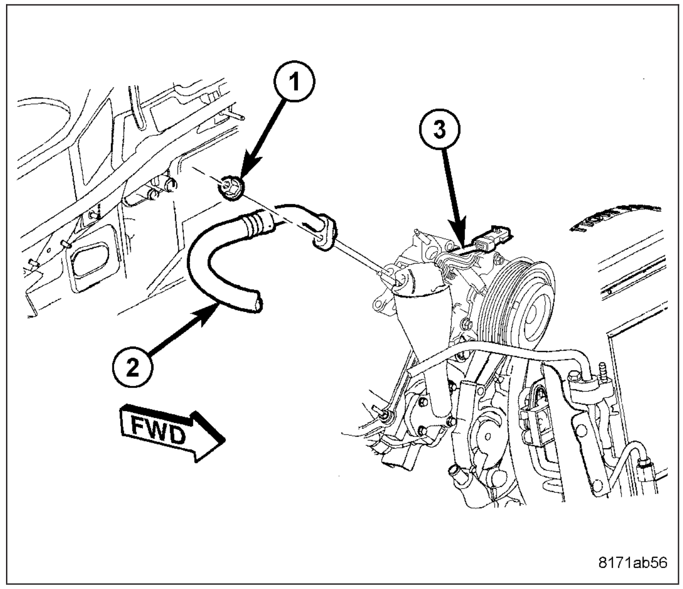
**WARNING: Refer to the applicable warnings and cautions for this system before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNINGS) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTIONS). Failure to follow the warnings and cautions could result in possible personal injury or death.**

**NOTE: LHD model shown in illustrations. RHD model similar.**

1. Disconnect and isolate the negative battery cable.
2. Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).
3. If servicing the rear section of the A/C suction line (9), proceed to Step 4. If servicing only the front section of the A/C suction line (11), go to Step 10.
4. Disconnect the wire lead and connector (3) from the A/C low pressure switch (2) and remove the switch from the A/C accumulator (10).
5. Remove the two nuts (7) that secure the accumulator bracket (8) to the dash panel (5).
6. On LHD models, remove the secondary retaining clip (4) from the suction line spring-lock coupler and using the proper A/C line disconnect tool, disconnect the rear section of the A/C suction line (9) from the evaporator outlet tube (6) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COUPLER-REFRIGERANT LINE - REMOVAL).



7. On RHD models, remove the nut that secures the rear section of the A/C suction line to the A/C evaporator and disconnect the line from the evaporator.
8. Remove the nut (1) that secures the rear section of the A/C suction line to the A/C accumulator and disconnect the line from the accumulator.
9. Remove and discard the O-ring seals and install plugs in, or tape over the opened refrigerant line fittings and the accumulator and evaporator ports.
10. Remove the nut (1) that secures the front section of the A/C suction line (11) to the A/C accumulator (10) and disconnect the line from the accumulator and remove and discard the O-ring seal.
11. Remove the nut (1) that secures the front section of the A/C suction line (2) to the A/C compressor (3) and disconnect the line from the compressor.
12. Remove and discard the O-ring seals and install plugs in, or tape over the opened refrigerant line fittings and the accumulator and compressor ports.



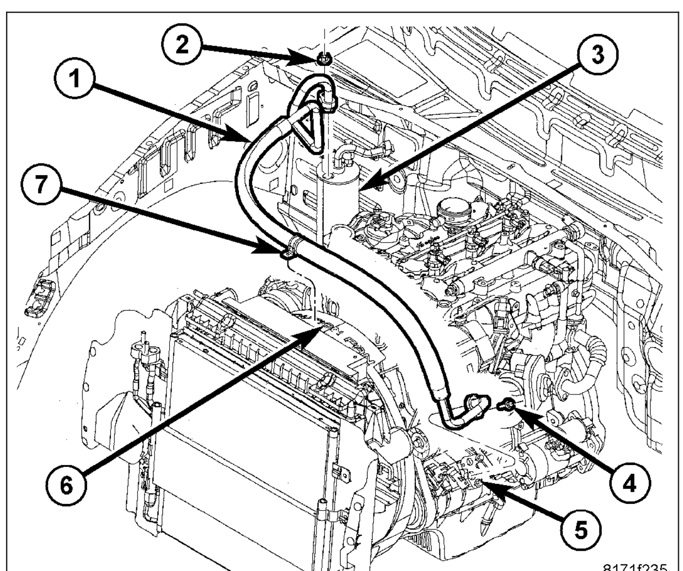

## INSTALLATION

## 2.8L DIESEL ENGINE

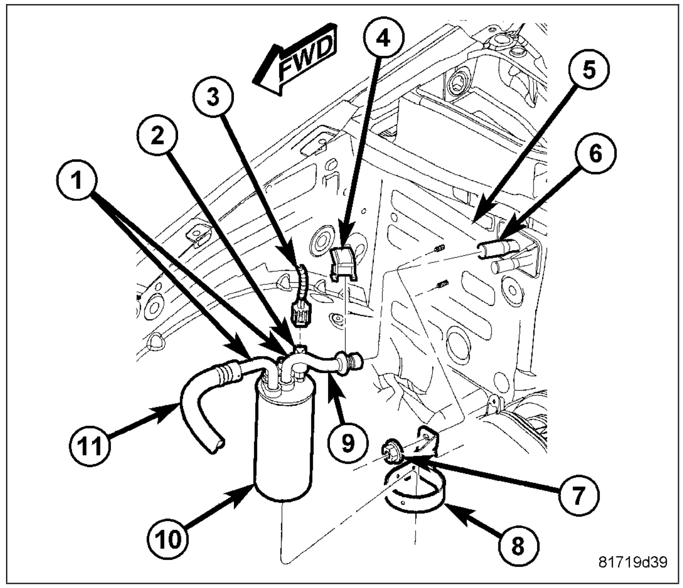
**NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.**

**NOTE: LHD model shown in illustrations. RHD model similar.**

1. If servicing only the rear section of the A/C suction line, go to Step 13.
2. Position the front section of the A/C suction line (3) into the engine compartment.
3. Remove the tape or plugs from the discharge line fitting and compressor port.
4. Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the discharge line fitting. Use only the specified O-ring as it is made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
5. Connect the A/C discharge line to the A/C compressor (4) and install the retaining bolt (2). Tighten the bolt to 12 N·m (106 ft. lbs.).
6. Install the front skid plate (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - INSTALLATION).



7. Lower the vehicle.
8. Engage the retaining clip (7) to the top of the fan shroud (6).
9. Remove the tape or plugs from the discharge line fitting and accumulator port.
10. Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the discharge line fitting. Use only the specified O-ring as it is made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
11. Connect the front section of the A/C suction line to the A/C accumulator (3) and install the retaining nut (2). Tighten the nut to 12.5 N·m (110 in. lbs.).
12. If servicing only the front section of the A/C suction line, go to Step 20.
13. Remove the tape or plugs from the opened refrigerant line fittings and the accumulator and evaporator ports.
14. Lubricate new rubber O-ring seals with clean refrigerant oil and install them on the refrigerant line fittings. Use only the specified O-ring seals as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
15. Connect the rear section of the A/C suction line (9) to the A/C accumulator (10) and install the retaining nut (1). Tighten the nut to 12 N·m (110 in. lbs.).
16. On LHD models, connect the spring-lock coupler that secures the rear section of the A/C suction line to the evaporator outlet tube (6) and install the secondary retaining clip (4) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ COUPLER-REFRIGERANT LINE - INSTALLATION).



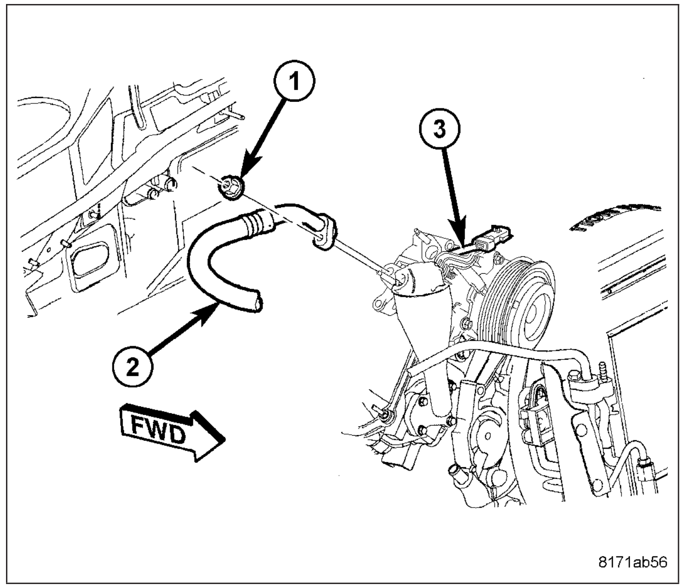

17. On RHD models, connect the rear section of the A/C suction line to the A/C evaporator and install the retaining nut. Tighten the nut to 12 N·m (110 in. lbs.).
18. Install the two nuts (7) that secure the accumulator bracket (8) to the dash panel (5). Tighten the nuts to 4.5 N·m (40 in. lbs.).
19. Connect the wire lead and connector (3) to the A/C low pressure switch (2).
20. Reconnect the negative battery cable.
21. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
22. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

## 3.7L ENGINE

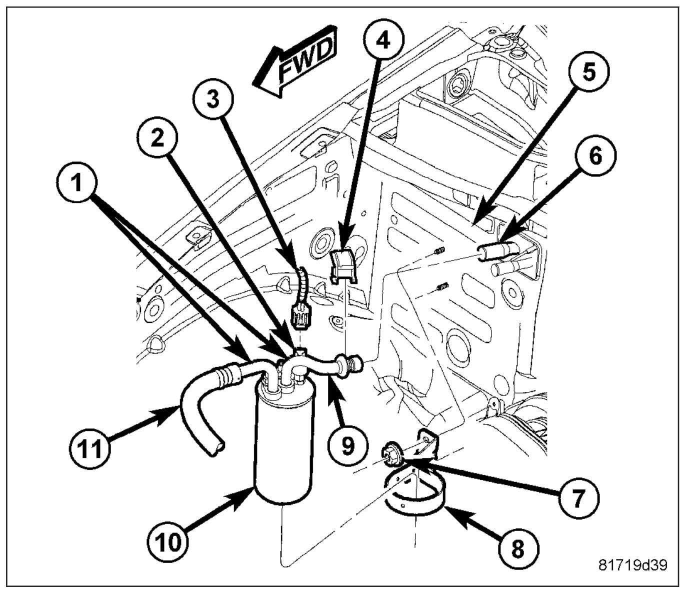
**NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.**

**NOTE: LHD model shown in illustrations. RHD model similar.**

1. Position the front section of the A/C suction line (2) into the engine compartment.
2. Remove the tape or plugs from the opened refrigerant line fittings and the accumulator and compressor ports.
3. Lubricate new rubber O-ring seals with clean refrigerant oil and install them on the refrigerant line fittings. Use only the specified O-ring seals as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
4. Connect the front section of the A/C suction line to the A/C compressor (3) and install the retaining nut (1). Tighten the nut to 12 N·m (105 in. lbs.).




5. Connect the front section of the A/C suction line (11) to the A/C accumulator (10) and install the retaining nut (1). Tighten the nut to 12 N·m (110 in. lbs.).
6. If servicing the front section of the A/C suction line only, go to Step 14.
7. Remove the tape or plugs from all of the opened refrigerant line fittings and the accumulator and evaporator ports.
8. Lubricate new rubber O-ring seals with clean refrigerant oil and install them onto the refrigerant line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.
9. Connect the rear section of the A/C suction line (9) to the A/C accumulator and install the retaining nut. Tighten the nut to 12 N·m (110 in. lbs.).




10. On LHD models, connect the spring-lock coupler that secures the rear section of the A/C suction line to the evaporator outlet tube (6) and install the secondary retaining clip (4) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/COUPLER-REFRIGERANT LINE - INSTALLATION).
11. On RHD models, connect the rear section of the A/C suction line to the A/C evaporator and install the retaining nut. Tighten the nut to 12 N·m (110 in. lbs.).
12. Install the two nuts (7) that secure the accumulator bracket to the dash panel (5). Tighten the nuts to 4.5 N·m (40 in. lbs.).
13. Connect the wire lead and connector (3) to the A/C low pressure switch (2).
14. Reconnect the negative battery cable.
15. Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).
16. Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

# OIL-A/C REFRIGERANT

## DESCRIPTION

The refrigerant oil used in R-134a refrigerant systems is a synthetic-based, PolyAlkylene Glycol (PAG), wax-free lubricant. Mineral-based R-12 refrigerant oils are not compatible with PAG oils, and should never be introduced to an R-134a refrigerant system.

There are different PAG oils available, and each contains a different additive package. Use **only** refrigerant oil of the same type as recommended to service the refrigerant system (**always refer to the specification tag** included with the replacement A/C compressor or the A/C Underhood Specification Label located in the engine compartment).

The Denso 10S17 A/C compressor used in this vehicle when equipped with the 2.8L diesel engine is designed to use ND-8 PAG refrigerant oil. Use only this type of refrigerant oil when servicing this A/C compressor.

The Visteon HS-18 A/C compressor used in this vehicle when equipped with 3.7L engine is designed to use VC-46 PAG refrigerant oil. Use only this type of refrigerant oil when servicing this A/C compressor.

## OPERATION

After performing any refrigerant recovery or recycling operation, always replenish the refrigerant system with the same amount of the recommended refrigerant oil as was removed. Too little refrigerant oil can cause A/C compressor damage, and too much can reduce A/C system performance.

PAG refrigerant oil is more hygroscopic than mineral oil, and will absorb any moisture it comes into contact with, even moisture in the air. The PAG oil container should always be kept tightly capped until it is ready to be used. After use, recap the oil container immediately to prevent moisture contamination.

## STANDARD PROCEDURE

## REFRIGERANT OIL LEVEL

When an A/C system is assembled at the factory, all components except the A/C compressor are refrigerant oil free. After the refrigerant system has been charged and operated, the refrigerant oil in the A/C compressor is dispersed throughout the refrigerant system. The A/C accumulator, A/C evaporator, A/C condenser and the A/C compressor will each retain a significant amount of the needed refrigerant oil.

It is important to have the correct amount of refrigerant oil in the A/C system. This ensures proper lubrication of the A/C compressor. Too little oil will result in damage to the A/C compressor, while too much oil will reduce the cooling capacity of the A/C system and consequently result in higher discharge air temperatures.

**CAUTION: The refrigerant oil in the R-134a A/C system is unique depending on the A/C compressor used. Use only PAG oils that are designed to work with R-134a refrigerant and the A/C compressor in the vehicle. Always refer to the A/C Underhood Specification Label for the correct oil designation. The oil container should be kept tightly capped until it is ready for use and then tightly capped after use to prevent contamination from dirt and moisture. Refrigerant oil will quickly absorb any moisture it comes in contact with, therefore, special effort must be used to keep all R-134a system components moisture-free. Moisture in the refrigerant oil is very difficult to remove and will cause a reliability problem with the A/C compressor.**

**NOTE: Most reclaim/recycling equipment will measure the lubricant being removed during recovery. This amount of lubricant should be added back into the system. Refer to the reclaim/recycling equipment manufacturers instructions.**

It will not be necessary to check the oil level in the A/C compressor or to add oil, unless there has been an oil loss. An oil loss may occur due to component replacement, or a rupture or leak from a refrigerant line, connector fitting, component or component seal. If a leak occurs, add 30 milliliters (1 fluid ounce) of the recommended refrigerant oil to the refrigerant system after the repair has been made. Refrigerant oil loss will be evident at the leak point by the presence of a wet, shiny surface around the leak.

Refrigerant oil must be added when an A/C accumulator, A/C evaporator or A/C condenser is replaced. See the Refrigerant Oil Capacities chart. When an A/C compressor is replaced, the refrigerant oil must be drained from the old compressor and measured. Drain all of the refrigerant oil from the new A/C compressor, then fill the new compressor with the same amount of refrigerant oil that was drained out of the old compressor.

## REFRIGERANT OIL CAPACITIES

| Component | ml | oz |
|---|---|---|
| Total System Fill | 240 | 8 |
| A/C Accumulator | 120 | 4 |
| A/C Condenser | 30 | 1 |
| A/C Evaporator | 60 | 2 |
| A/C Compressor | Drain and measure the oil from the old compressor as noted | |

# REFRIGERANT-A/C

## DESCRIPTION

The refrigerant used in this air conditioning system is a HydroFluoroCarbon (HFC), type R-134a. Unlike R-12, which is a ChloroFluoroCarbon (CFC), R-134a refrigerant does not contain ozone-depleting chlorine. R-134a refrigerant is a non-toxic, non-flammable, clear, and colorless liquefied gas.

Even though R-134a does not contain chlorine, it must be reclaimed and recycled just like CFC-type refrigerants. This is because R-134a is a greenhouse gas and can contribute to global warming.

## OPERATION

R-134a refrigerant is not compatible with R-12 refrigerant in an A/C system. Even a small amount of R-12 refrigerant added to an R-134a refrigerant system will cause A/C compressor failure, refrigerant oil sludge or poor A/C system performance. In addition, the polyalkylene glycol (PAG) synthetic refrigerant oils used in an R-134a refrigerant system are not compatible with the mineral-based refrigerant oils used in an R-12 refrigerant system.

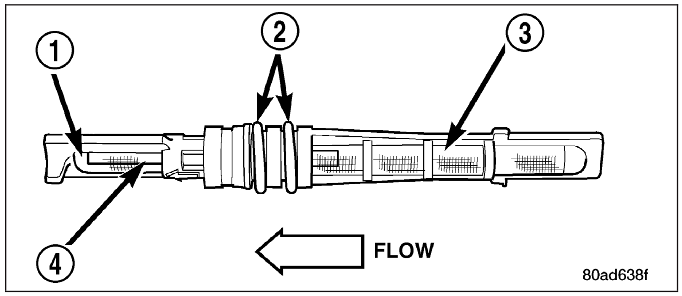
R-134a refrigerant system service ports, service tool couplers and refrigerant dispensing bottles have all been designed with unique fittings to ensure that an R-134a refrigerant system is not accidentally contaminated with the wrong refrigerant (R-12). There are also labels posted in the engine compartment of the vehicle and on the A/C compressor to identify that the A/C system is equipped with R-134a refrigerant.

# TUBE-A/C ORIFICE

## DESCRIPTION

The fixed A/C orifice tube is installed in the A/C liquid line and provides a restriction in the liquid refrigerant line between the A/C condenser and the A/C evaporator. This restriction established the pressure differential between the high and low-pressure sides of the A/C system.

The A/C orifice tube includes a diffuser screen (1), O-ring seals (2) to seal it to the inner wall of the A/C liquid line, an inlet filter screen (3) and the fixed orifice (4).




## OPERATION

The fixed A/C orifice tube is used to meter the flow of liquid refrigerant into the A/C evaporator. The high-pressure liquid refrigerant from the A/C condenser expands into a low-pressure liquid as it passes through the metering orifice and diffuser screen of the A/C orifice tube.

The A/C orifice tube is not serviceable and cannot be repaired and, if faulty or plugged, the A/C liquid line must be replaced (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LINE-A/C LIQUID - DESCRIPTION).

## DIAGNOSIS AND TESTING

## A/C ORIFICE TUBE

**WARNING: The A/C liquid line between the A/C condenser and the A/C orifice tube can become hot enough to burn the skin. Use extreme caution when performing the following test to prevent possible personal injury.**

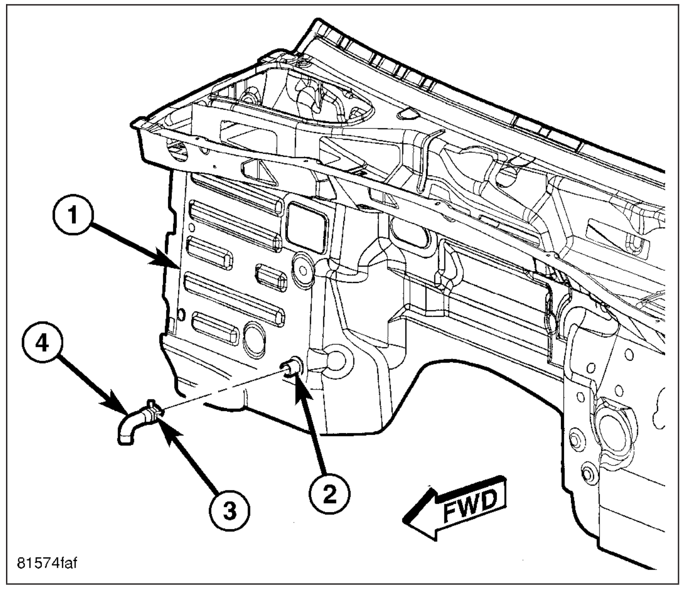
**NOTE: The A/C orifice tube can be checked for proper operation using the following procedure. However, the A/C orifice tube is only serviced as a part of the A/C liquid line. If the results of this test indicate that the A/C orifice tube is obstructed or missing, the A/C liquid line must be replaced.**

1. Confirm that the refrigerant system is properly charged (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING - A/C PERFORMANCE).
2. Start the engine. Turn on the A/C system and confirm that the compressor clutch is engaged.
3. Allow the A/C system to operate for five minutes.
4. Lightly and cautiously touch the A/C liquid line near the condenser outlet at the front of the engine compartment. The A/C liquid line should be hot to the touch.
5. Touch the A/C liquid line near the evaporator inlet at the rear of the engine compartment. The A/C liquid line should be cold to the touch.
6. If there is a distinct temperature differential between the two ends of the A/C liquid line, the A/C orifice tube is in good condition. If there is little or no detectable temperature differential between the two ends of the A/C liquid line, the A/C orifice tube is obstructed or missing and the A/C liquid line must be replaced (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LINE-A/C LIQUID - REMOVAL).

# TUBE-CONDENSATION DRAIN

## DESCRIPTION

**NOTE: LHD model shown in illustration. RHD model similar.**




Condensation that accumulates within the HVAC housing is drained through a port (2) that protrudes through the dash panel (1). A rubber condensation drain tube (4) is installed onto the drain port with a retaining clamp (3) to ensure that any condensation completely drains to the ground.

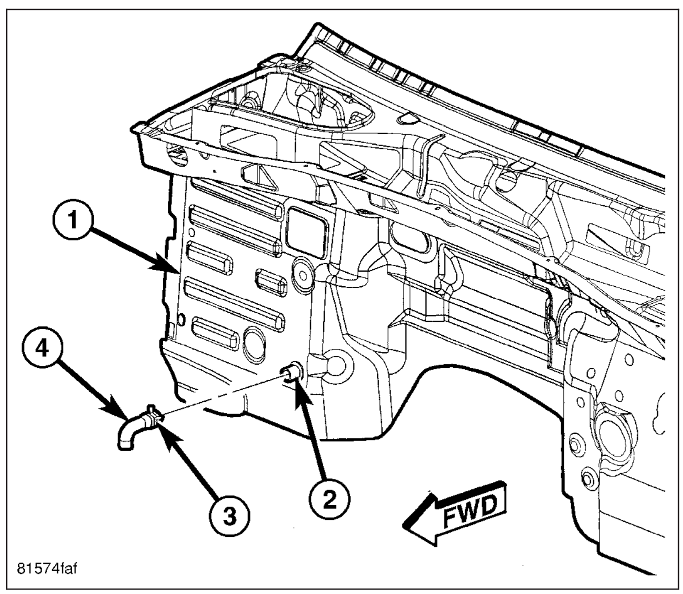
**NOTE: The condensation drain tube must be kept open to prevent condensate water from collecting in the bottom of the HVAC housing.**

The tapered end of the condensation drain tube is designed to keep contaminants from entering the HVAC housing. If the tube is pinched or blocked, condensate cannot drain, causing water to back up and spill into the passenger compartment. It is normal to see condensate drainage below the vehicle in warm weather.

If the condensation drain tube is damaged or missing, it must be replaced.

## REMOVAL

**NOTE: LHD model shown in illustration. RHD model similar.**

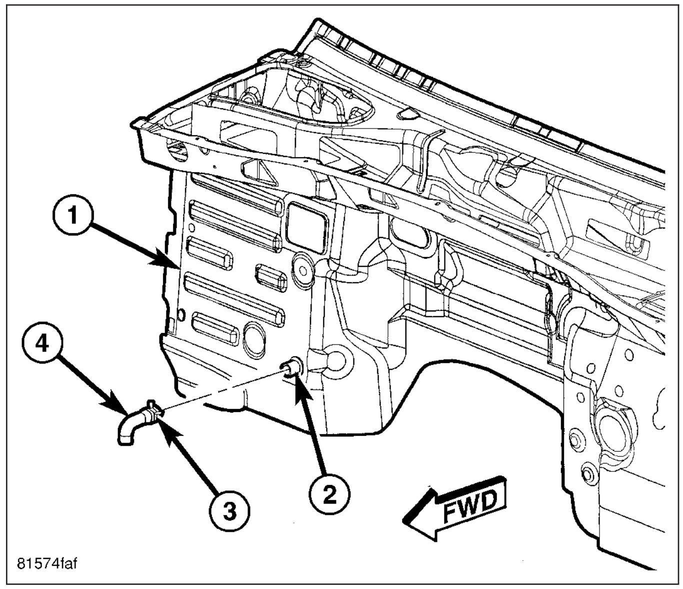



1. Raise and support the vehicle.
2. Disengage the retaining clamp (3) that secures the condensate drain tube (4) to the HVAC housing drain (2) located at the passenger side of the dash panel (1) in the engine compartment.
3. Remove the condensate drain tube.

## INSTALLATION

**NOTE: LHD model shown in illustration. RHD model similar.**

1. Position the condensate drain tube (4) onto the HVAC housing drain (2) located on the passenger side of the dash panel (1) in the engine compartment.
2. Engage the retaining clamp (3) that secures the condensate drain tube onto the HVAC housing drain.
3. Lower the vehicle.



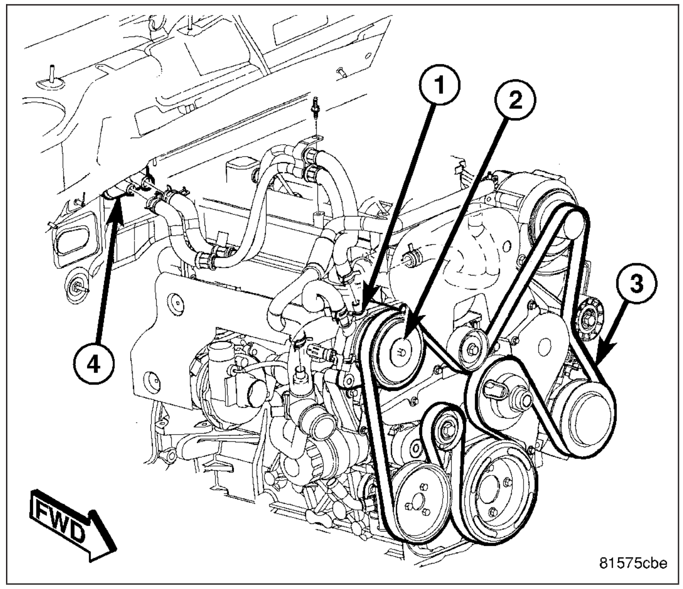
# HEATER-DIESEL ENGINE COOLANT

## TABLE OF CONTENTS

# HEATER-DIESEL ENGINE COOLANT

## DESCRIPTION

The 2.8L diesel engine uses a supplemental engine coolant heater (1) to help heat the engine coolant prior to it entering the heater core (4). This mechanical device is commonly called a viscous heater. The supplemental engine coolant heater is driven by the engine accessory drive belt (3) and has an electro-mechanical clutch (2) which is controlled by the engine control module (ECM).




## OPERATION

The supplemental diesel engine coolant heater (viscous heater) uses an electro-mechanical clutch that receives a signal from the diesel engine control module (ECM) via the A/C-heater control and the viscous heater controller, to energize and engage the clutch. Once engaged, the clutch allows the viscous heater to increase the temperature of the engine coolant flowing to the heater core to provide heat to the passenger compartment quicker than diesel engines without the viscous heater.

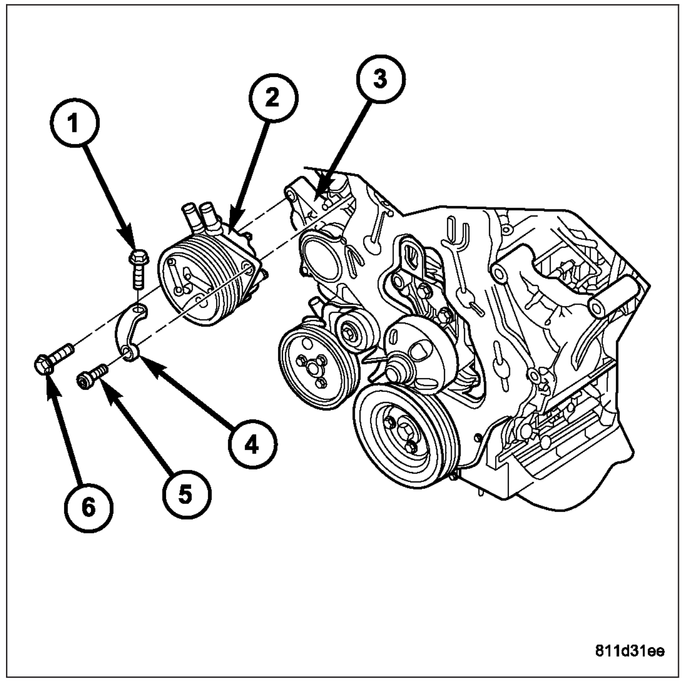
The viscous heater uses friction to heat a special silicon oil within its housing. The generated heat is then transferred to the engine coolant when the coolant passes over the fins within the housing. When demand for passenger compartment heat decreases the viscous heater receives an input from the heater controller to disengage the clutch.

The supplemental diesel engine coolant heater cannot be repaired and, if faulty or damaged, the entire heater assembly must be replaced.

# HEATER UNIT

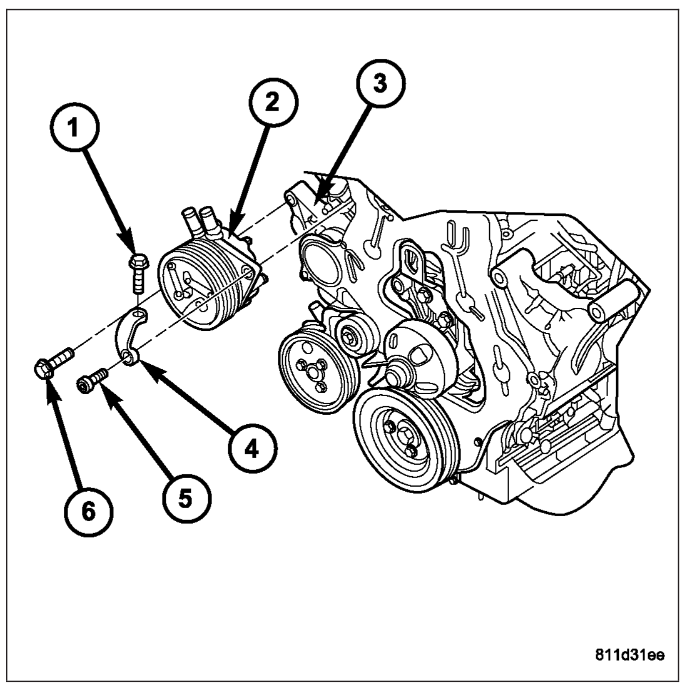
## REMOVAL

1. Disconnect and isolate the negative battery cable.
2. Drain the engine coolant (Refer to 7 - COOLING/ ENGINE - STANDARD PROCEDURE).
3. Remove the engine accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Loosen the hose clamps and disconnect the heater hoses from the supplemental diesel engine coolant heater (2).
5. Disconnect the wire harness connector from the engine coolant heater clutch.
6. Remove the three bolts (1, 5 and 6) and the support bracket (4) that secure the diesel engine coolant heater to the mounting bracket (3).
7. Remove the diesel engine coolant heater from the engine compartment.




## INSTALLATION

1. Position the supplemental diesel engine coolant heater onto the mounting bracket.
2. Install the support bracket (4) and the three bolts (1, 5 and 6) that secure the engine coolant heater to the mounting bracket. Tighten the bolts to 33 N·m (25 ft. lbs.).
3. Connect the wiring harness connector to the engine coolant heater clutch.
4. Install the heater hoses to the engine coolant heater and tighten the hose clamps securely.
5. Install the engine accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
6. Refill the engine cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).
7. Reconnect the negative battery cable.



# EMISSIONS CONTROL

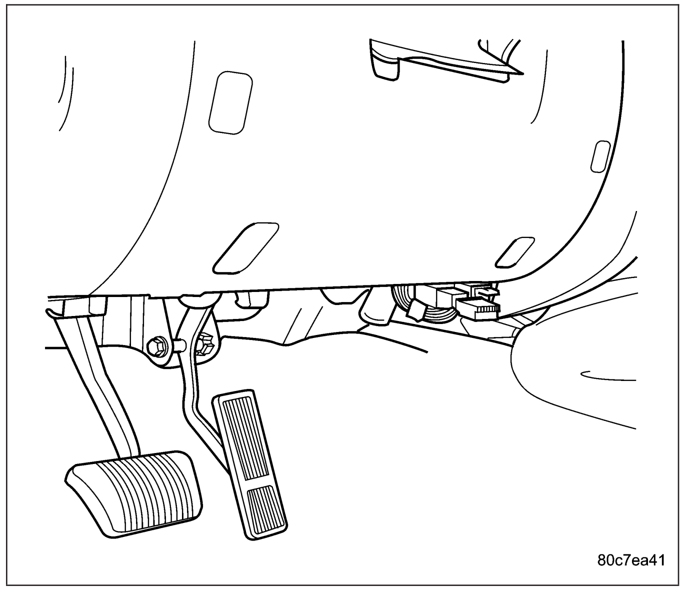
## TABLE OF CONTENTS

# EMISSIONS CONTROL

## DESCRIPTION

## GAS ENGINES

The Powertrain Control Module (PCM) monitors many different circuits in the fuel injection, ignition, emission and engine systems. If the PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a Diagnostic Trouble Code (DTC) in the PCM's memory. If the code applies to a non-emissions related component or system, and the problem is repaired or ceases to exist, the PCM cancels the code after 40 warm-up cycles. Diagnostic trouble codes that affect vehicle emissions illuminate the Malfunction Indicator Lamp (MIL). The MIL is displayed as an engine icon on the instrument panel. Refer to Malfunction Indicator Lamp (MIL) in this section.




Certain criteria must be met before the PCM stores a DTC in memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

The PCM might not store a DTC for a monitored circuit even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. **For example**, assume the diagnostic trouble code criteria requires the PCM to monitor the circuit only when the engine operates between 750 and 2000 RPM. Suppose the sensor's output circuit shorts to ground when engine operates above 2400 RPM (resulting in 0 volt input to the PCM). Because the condition happens at an engine speed above the maximum threshold (2000 rpm), the PCM will not store a DTC.

There are several operating conditions for which the PCM monitors and sets DTC's. Refer to Monitored Systems, Components, and Non-Monitored Circuits in this section.

Technicians must retrieve stored DTC's by connecting the DRB scan tool (or an equivalent scan tool) to the 16–way data link connector.

**NOTE: Various diagnostic procedures may actually cause a diagnostic monitor to set a DTC. For instance, pulling a spark plug wire to perform a spark test may set the misfire code. When a repair is completed and verified, connect the DRB scan tool to the 16–way data link connector to erase all DTC's and extinguish the MIL.**

## STATE DISPLAY TEST MODE

The switch inputs to the Powertrain Control Module (PCM) have two recognized states; HIGH and LOW. For this reason, the PCM cannot recognize the difference between a selected switch position versus an open circuit, a short circuit, or a defective switch. If the State Display screen shows the change from HIGH to LOW or LOW to HIGH, assume the entire switch circuit to the PCM functions properly. Connect the DRB scan tool to the data link connector and access the state display screen. Then access either State Display Inputs and Outputs or State Display Sensors.

## CIRCUIT ACTUATION TEST MODE

The Circuit Actuation Test Mode checks for proper operation of output circuits or devices the Powertrain Control Module (PCM) may not internally recognize. The PCM attempts to activate these outputs and allow an observer to verify proper operation. Most of the tests provide an audible or visual indication of device operation (click of relay contacts, fuel spray, etc.). Except for intermittent conditions, if a device functions properly during testing, assume the device, its associated wiring, and driver circuit work correctly. Connect the DRB scan tool to the data link connector and access the Actuators screen.

## DIAGNOSTIC TROUBLE CODES

A Diagnostic Trouble Code (DTC) indicates the PCM has recognized an abnormal condition in the system.

**Remember that DTC's are the results of a system or circuit failure, but do not directly identify the failed component or components.**

### BULB CHECK

Each time the ignition key is turned to the ON position, the malfunction indicator (check engine) lamp on the instrument panel should illuminate for approximately 2 seconds then go out. This is done for a bulb check.

### OBTAINING DTC'S

1. Obtain the applicable Powertrain Diagnostic Information.
2. Obtain the appropriate scan tool.
3. Connect the appropriate scan tool to the data link (diagnostic) connector. This connector is located in the passenger compartment; at the lower edge of instrument panel; near the steering column.
4. Turn the ignition switch on and access the "Read Fault" screen.
5. Record all the DTC's and "freeze frame" information shown on the appropriate scan tool.
6. To erase DTC's, use the "Erase Trouble Code" data screen on the appropriate scan tool. **Do not erase any DTC's until problems have been investigated and repairs have been performed.**

## TASK MANAGER

The PCM is responsible for efficiently coordinating the operation of all the emissions-related components. The PCM is also responsible for determining if the diagnostic systems are operating properly. The software designed to carry out these responsibilities is referred to as the 'Task Manager'.

## MONITORED SYSTEMS

There are new electronic circuit monitors that check fuel, emission, engine and ignition performance. These monitors use information from various sensor circuits to indicate the overall operation of the fuel, engine, ignition and emission systems and thus the emissions performance of the vehicle.

The fuel, engine, ignition and emission systems monitors do not indicate a specific component problem. They do indicate that there is an implied problem within one of the systems and that a specific problem must be diagnosed.

If any of these monitors detect a problem affecting vehicle emissions, the Malfunction Indicator Lamp (MIL) will be illuminated. These monitors generate Diagnostic Trouble Codes that can be displayed with the MIL or a scan tool.

The following is a list of the system monitors:

- Misfire Monitor
- Fuel System Monitor
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Catalyst Monitor
- Leak Detection Pump Monitor (if equipped)

All these system monitors require two consecutive trips with the malfunction present to set a fault.

**Refer to the appropriate Powertrain Diagnostics Procedures manual for diagnostic procedures.**

The following is an operation and description of each system monitor:

## OXYGEN SENSOR (O2S) MONITOR

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The O2S is also the main sensing element for the Catalyst and Fuel Monitors.

The O2S can fail in any or all of the following manners:

- slow response rate
- reduced output voltage
- dynamic shift
- shorted or open circuits

Response rate is the time required for the sensor to switch from lean to rich once it is exposed to a richer than optimum A/F mixture or vice versa. As the sensor starts malfunctioning, it could take longer to detect the changes in the oxygen content of the exhaust gas.

The output voltage of the O2S ranges from 0 to 1 volt. A good sensor can easily generate any output voltage in this range as it is exposed to different concentrations of oxygen. To detect a shift in the A/F mixture (lean or rich), the output voltage has to change beyond a threshold value. A malfunctioning sensor could have difficulty changing beyond the threshold value.

## OXYGEN SENSOR HEATER MONITOR

If there is an oxygen sensor (O2S) shorted to voltage DTC, as well as a O2S heater DTC, the O2S fault MUST be repaired first. Before checking the O2S fault, verify that the heater circuit is operating correctly.

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572 ° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The voltage readings taken from the O2S sensor are very temperature sensitive. The readings are not accurate below 300°C. Heating of the O2S sensor is done to allow the engine controller to shift to closed loop control as soon as possible. The heating element used to heat the O2S sensor must be tested to ensure that it is heating the sensor properly.

The O2S sensor circuit is monitored for a drop in voltage. The sensor output is used to test the heater by isolating the effect of the heater element on the O2S sensor output voltage from the other effects.

## LEAK DETECTION PUMP MONITOR (IF EQUIPPED)

The leak detection assembly incorporates two primary functions: it must detect a leak in the evaporative system and seal the evaporative system so the leak detection test can be run.

The primary components within the assembly are: A three port solenoid that activates both of the functions listed above; a pump which contains a switch, two check valves and a spring/diaphragm, a canister vent valve (CVV) seal which contains a spring loaded vent seal valve.

Immediately after a cold start, between predetermined temperature thresholds limits, the three port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non test conditions the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling due to the reed switch triggering of the three port solenoid that prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized allowing atmospheric pressure to enter the pump cavity, thus permitting the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

**Pump Mode:** The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test length.

**Test Mode:** The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the Switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5” water. The cycle rate of pump strokes is quite rapid as the system begins to pump up to this pressure. As the pressure increases, the cycle rate starts to drop off. If there is no leak in the system, the pump would eventually stop pumping at the equalized pressure. If there is a leak, it will continue to pump at a rate representative of the flow characteristic of the size of the leak. From this information we can determine if the leak is larger than the required detection limit (currently set at .040” orifice by CARB). If a leak is revealed during the leak test portion of the test, the test is terminated at the end of the test mode and no further system checks will be performed.

After passing the leak detection phase of the test, system pressure is maintained by turning on the LDP’s solenoid until the purge system is activated. Purge activation in effect creates a leak. The cycle rate is again interrogated and when it increases due to the flow through the purge system, the leak check portion of the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

Evaporative system functionality will be verified by using the stricter evap purge flow monitor. At an appropriate warm idle the LDP will be energized to seal the canister vent. The purge flow will be clocked up from some small value in an attempt to see a shift in the 02 control system. If fuel vapor, indicated by a shift in the 02 control, is present the test is passed. If not, it is assumed that the purge system is not functioning in some respect. The LDP is again turned off and the test is ended.

## MISFIRE MONITOR

Excessive engine misfire results in increased catalyst temperature and causes an increase in HC emissions. Severe misfires could cause catalyst damage. To prevent catalytic convertor damage, the PCM monitors engine misfire.

The Powertrain Control Module (PCM) monitors for misfire during most engine operating conditions (positive torque) by looking at changes in the crankshaft speed. If a misfire occurs the speed of the crankshaft will vary more than normal.

## FUEL SYSTEM MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide. The catalyst works best when the Air Fuel (A/F) ratio is at or near the optimum of 14.7 to 1.

The PCM is programmed to maintain the optimum air/fuel ratio of 14.7 to 1. This is done by making short term corrections in the fuel injector pulse width based on the O2S sensor output. The programmed memory acts as a self calibration tool that the engine controller uses to compensate for variations in engine specifications, sensor tolerances and engine fatigue over the life span of the engine. By monitoring the actual fuel-air ratio with the O2S sensor (short term) and multiplying that with the program long-term (adaptive) memory and comparing that to the limit, it can be determined whether it will pass an emissions test. If a malfunction occurs such that the PCM cannot maintain the optimum A/F ratio, then the MIL will be illuminated.

## CATALYST MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide.

Normal vehicle miles or engine misfire can cause a catalyst to decay. This can increase vehicle emissions and deteriorate engine performance, driveability and fuel economy.

The catalyst monitor uses dual oxygen sensors (O2S’s) to monitor the efficiency of the converter. The dual O2S’s sensor strategy is based on the fact that as a catalyst deteriorates, its oxygen storage capacity and its efficiency are both reduced. By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream O2S is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. The PCM calculates the A/F mixture from the output of the O2S. A low voltage indicates high oxygen content (lean mixture). A high voltage indicates a low content of oxygen (rich mixture).

When the upstream O2S detects a lean condition, there is an abundance of oxygen in the exhaust gas. A functioning converter would store this oxygen so it can use it for the oxidation of HC and CO. As the converter absorbs the oxygen, there will be a lack of oxygen downstream of the converter. The output of the downstream O2S will indicate limited activity in this condition.

As the converter loses the ability to store oxygen, the condition can be detected from the behavior of the downstream O2S. When the efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same downstream as upstream. The output voltage of the downstream O2S copies the voltage of the upstream sensor. The only difference is a time lag (seen by the PCM) between the switching of the O2S’s.

To monitor the system, the number of lean-to-rich switches of upstream and downstream O2S’s is counted. The ratio of downstream switches to upstream switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer downstream switches than it has upstream switches i.e., a ratio closer to zero. For a totally ineffective catalyst, this ratio will be one-to-one, indicating that no oxidation occurs in the device.

The system must be monitored so that when catalyst efficiency deteriorates and exhaust emissions increase to over the legal limit, the MIL will be illuminated.

## TRIP DEFINITION

The term "Trip" has different meanings depending on what the circumstances are. If the MIL (Malfunction Indicator Lamp) is OFF, a Trip is defined as when the Oxygen Sensor Monitor and the Catalyst Monitor have been completed in the same drive cycle.

When any Emission DTC is set, the MIL on the dash is turned ON. When the MIL is ON, it takes 3 good trips to turn the MIL OFF. In this case, it depends on what type of DTC is set to know what a "Trip" is.

For the Fuel Monitor or Mis-Fire Monitor (continuous monitor), the vehicle must be operated in the "Similar Condition Window" for a specified amount of time to be considered a Good Trip.

If a Non-Contiuous OBDII Monitor fails twice in a row and turns ON the MIL, re-running that monitor which previously failed, on the next start-up and passing the monitor, is considered to be a Good Trip. These will include the following:

- Oxygen Sensor
- Catalyst Monitor
- Purge Flow Monitor
- Leak Detection Pump Monitor (if equipped)
- EGR Monitor (if equipped)
- Oxygen Sensor Heater Monitor

If any other Emission DTC is set (not an OBDII Monitor), a Good Trip is considered to be when the Oxygen Sensor Monitor and Catalyst Monitor have been completed; or 2 Minutes of engine run time if the Oxygen Sensor Monitor or Catalyst Monitor have been stopped from running.

It can take up to 2 Failures in a row to turn on the MIL. After the MIL is ON, it takes 3 Good Trips to turn the MIL OFF. After the MIL is OFF, the PCM will self-erase the DTC after 40 Warm-up cycles. A Warm-up cycle is counted when the ECT (Engine Coolant Temperature Sensor) has crossed 160°F and has risen by at least 40°F since the engine has been started.

## COMPONENT MONITORS

There are several components that will affect vehicle emissions if they malfunction. If one of these components malfunctions the Malfunction Indicator Lamp (MIL) will illuminate.

Some of the component monitors are checking for proper operation of the part. Electrically operated components now have input (rationality) and output (functionality) checks. Previously, a component like the Throttle Position sensor (TPS) was checked by the PCM for an open or shorted circuit. If one of these conditions occurred, a DTC was set. Now there is a check to ensure that the component is working. This is done by watching for a TPS indication of a greater or lesser throttle opening than MAP and engine rpm indicate. In the case of the TPS, if engine vacuum is high and engine rpm is 1600 or greater and the TPS indicates a large throttle opening, a DTC will be set. The same applies to low vacuum if the TPS indicates a small throttle opening.

All open/short circuit checks or any component that has an associated limp in will set a fault after 1 trip with the malfunction present. Components without an associated limp in will take two trips to illuminate the MIL.

## NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems and conditions that could have malfunctions causing driveability problems. The PCM might not store diagnostic trouble codes for these conditions. However, problems with these systems may cause the PCM to store diagnostic trouble codes for other systems or components. For example, a fuel pressure problem will not register a fault directly, but could cause a rich/lean condition or misfire. This could cause the PCM to store an oxygen sensor or misfire diagnostic trouble code

## FUEL PRESSURE

The fuel pressure regulator controls fuel system pressure. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, or a pinched fuel supply or return line. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor or fuel system diagnostic trouble code.

### SECONDARY IGNITION CIRCUIT

The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

### CYLINDER COMPRESSION

The PCM cannot detect uneven, low, or high engine cylinder compression.

### EXHAUST SYSTEM

The PCM cannot detect a plugged, restricted or leaking exhaust system, although it may set a fuel system fault.

### FUEL INJECTOR MECHANICAL MALFUNCTIONS

The PCM cannot determine if a fuel injector is clogged, the needle is sticking or if the wrong injector is installed. However, these could result in a rich or lean condition causing the PCM to store a diagnostic trouble code for either misfire, an oxygen sensor, or the fuel system.

### EXCESSIVE OIL CONSUMPTION

Although the PCM monitors engine exhaust oxygen content when the system is in closed loop, it cannot determine excessive oil consumption.

### THROTTLE BODY AIRFLOW

The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.

### VACUUM ASSIST

The PCM cannot detect leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices. However, these could cause the PCM to store a MAP sensor diagnostic trouble code and cause a high idle condition.

### PCM SYSTEM GROUND

The PCM cannot determine a poor system ground. However, one or more diagnostic trouble codes may be generated as a result of this condition. The module should be mounted to the body at all times, also during diagnostic.

### PCM CONNECTOR ENGAGEMENT

The PCM may not be able to determine spread or damaged connector pins. However, it might store diagnostic trouble codes as a result of spread connector pins.

## HIGH AND LOW LIMITS

The PCM compares input signal voltages from each input device with established high and low limits for the device. If the input voltage is not within limits and other criteria are met, the PCM stores a diagnostic trouble code in memory. Other diagnostic trouble code criteria might include engine RPM limits or input voltages from other sensors or switches that must be present before verifying a diagnostic trouble code condition.

## LOAD VALUE

| ENGINE | IDLE/NEUTRAL | 2500 RPM/NEUTRAL |
|---|---|---|
| All Engines | 2% to 8% of Maximum Load | 9% to 17% of Maximum Load |

## OPERATION - TASK MANAGER

The Task Manager determines which tests happen when and which functions occur when. Many of the diagnostic steps required by OBD II must be performed under specific operating conditions. The Task Manager software organizes and prioritizes the diagnostic procedures. The job of the Task Manager is to determine if conditions are appropriate for tests to be run, monitor the parameters for a trip for each test, and record the results of the test. Following are the responsibilities of the Task Manager software:

- Test Sequence

- MIL Illumination
- Diagnostic Trouble Codes (DTCs)
- Trip Indicator
- Freeze Frame Data Storage
- Similar Conditions Window

## Test Sequence

In many instances, emissions systems must fail diagnostic tests more than once before the PCM illuminates the MIL. These tests are know as ’two trip monitors.’ Other tests that turn the MIL lamp on after a single failure are known as ’one trip monitors.’ A trip is defined as ’start the vehicle and operate it to meet the criteria necessary to run the given monitor.’

Many of the diagnostic tests must be performed under certain operating conditions. However, there are times when tests cannot be run because another test is in progress (conflict), another test has failed (pending) or the Task Manager has set a fault that may cause a failure of the test (suspend).

- Pending
  Under some situations the Task Manager will not run a monitor if the MIL is illuminated and a fault is stored from another monitor. In these situations, the Task Manager postpones monitors **pending** resolution of the original fault. The Task Manager does not run the test until the problem is remedied.
  For example, when the MIL is illuminated for an Oxygen Sensor fault, the Task Manager does not run the Catalyst Monitor until the Oxygen Sensor fault is remedied. Since the Catalyst Monitor is based on signals from the Oxygen Sensor, running the test would produce inaccurate results.
- Conflict - There are situations when the Task Manager does not run a test if another monitor is in progress. In these situations, the effects of another monitor running could result in an erroneous failure. If this **conflict** is present, the monitor is not run until the conflicting condition passes. Most likely the monitor will run later after the conflicting monitor has passed.
  For example, if the Fuel System Monitor is in progress, the Task Manager does not run the EGR Monitor. Since both tests monitor changes in air/fuel ratio and adaptive fuel compensation, the monitors will conflict with each other.
- Suspend - Occasionally the Task Manager may not allow a two trip fault to mature. The Task Manager will **suspend** the maturing of a fault if a condition exists that may induce an erroneous failure. This prevents illuminating the MIL for the wrong fault and allows more precis diagnosis.
  For example, if the PCM is storing a one trip fault for the Oxygen Sensor and the EGR monitor, the Task Manager may still run the EGR Monitor but will suspend the results until the Oxygen Sensor Monitor either passes or fails. At that point the Task Manager can determine if the EGR system is actually failing or if an Oxygen Sensor is failing.

## MIL Illumination

The PCM Task Manager carries out the illumination of the MIL. The Task Manager triggers MIL illumination upon test failure, depending on monitor failure criteria.

The Task Manager Screen shows both a Requested MIL state and an Actual MIL state. When the MIL is illuminated upon completion of a test for a third trip, the Requested MIL state changes to OFF. However, the MIL remains illuminated until the next key cycle. (On some vehicles, the MIL will actually turn OFF during the third key cycle) During the key cycle for the third good trip, the Requested MIL state is OFF, while the Actual MIL state is ON. After the next key cycle, the MIL is not illuminated and both MIL states read OFF.

## Diagnostic Trouble Codes (DTCs)

With OBD II, different DTC faults have different priorities according to regulations. As a result, the priorities determine MIL illumination and DTC erasure. DTCs are entered according to individual priority. DTCs with a higher priority overwrite lower priority DTCs.

### *Priorities*

- Priority 0 - Non-emissions related trouble codes
- Priority 1 - One trip failure of a two trip fault for non-fuel system and non-misfire.
- Priority 2 - One trip failure of a two trip fault for fuel system (rich/lean) or misfire.

- Priority 3 - Two trip failure for a non-fuel system and non-misfire or matured one trip comprehensive component fault.
- Priority 4 - Two trip failure or matured fault for fuel system (rich/lean) and misfire or one trip catalyst damaging misfire.

Non-emissions related failures have no priority. One trip failures of two trip faults have low priority. Two trip failures or matured faults have higher priority. One and two trip failures of fuel system and misfire monitor take precedence over non-fuel system and non-misfire failures.

## DTC Self Erasure

With one trip components or systems, the MIL is illuminated upon test failure and DTCs are stored.

Two trip monitors are components requiring failure in two consecutive trips for MIL illumination. Upon failure of the first test, the Task Manager enters a maturing code. If the component fails the test for a second time the code matures and a DTC is set.

After three good trips the MIL is extinguished and the Task Manager automatically switches the trip counter to a warm-up cycle counter. DTCs are automatically erased following 40 warm-up cycles if the component does not fail again.

For misfire and fuel system monitors, the component must pass the test under a Similar Conditions Window in order to record a good trip. A Similar Conditions Window is when engine RPM is within ±375 RPM and load is within ±10% of when the fault occurred.

**NOTE: It is important to understand that a component does not have to fail under a similar window of operation to mature. It must pass the test under a Similar Conditions Window when it failed to record a Good Trip for DTC erasure for misfire and fuel system monitors.**

DTCs can be erased anytime with a DRB III. Erasing the DTC with the DRB III erases all OBD II information. The DRB III automatically displays a warning that erasing the DTC will also erase all OBD II monitor data. This includes all counter information for warm-up cycles, trips and Freeze Frame.

## Trip Indicator

The **Trip** is essential for running monitors and extinguishing the MIL. In OBD II terms, a trip is a set of vehicle operating conditions that must be met for a specific monitor to run. All trips begin with a key cycle.

### Good Trip

The Good Trip counters are as follows:

- Specific Good Trip
- Fuel System Good Trip
- Misfire Good Trip
- Alternate Good Trip (appears as a Global Good Trip on DRB III)
  - Comprehensive Components
  - Major Monitor
- Warm-Up Cycles

### Specific Good Trip

The term Good Trip has different meanings depending on the circumstances:

- If the MIL is OFF, a trip is defined as when the Oxygen Sensor Monitor and the Catalyst Monitor have been completed in the same drive cycle.
- If the MIL is ON and a DTC was set by the Fuel Monitor or Misfire Monitor (both continuous monitors), the vehicle must be operated in the Similar Condition Window for a specified amount of time.
- If the MIL is ON and a DTC was set by a Task Manager commanded once-per-trip monitor (such as the Oxygen Sensor Monitor, Catalyst Monitor, Purge Flow Monitor, Leak Detection Pump Monitor, EGR Monitor or Oxygen Sensor Heater Monitor), a good trip is when the monitor is passed on the next start-up.
- If the MIL is ON and any other emissions DTC was set (not an OBD II monitor), a good trip occurs when the Oxygen Sensor Monitor and Catalyst Monitor have been completed, or two minutes of engine run time if the Oxygen Sensor Monitor and Catalyst Monitor have been stopped from running.

### Fuel System Good Trip

To count a good trip (three required) and turn off the MIL, the following conditions must occur:

- Engine in closed loop
- Operating in Similar Conditions Window
- Short Term multiplied by Long Term less than threshold
- Less than threshold for a predetermined time

If all of the previous criteria are met, the PCM will count a good trip (three required) and turn off the MIL.

**Misfire Good Trip**

If the following conditions are met the PCM will count one good trip (three required) in order to turn off the MIL:

- Operating in Similar Condition Window
- 1000 engine revolutions with no misfire

**Warm-Up Cycles**

Once the MIL has been extinguished by the Good Trip Counter, the PCM automatically switches to a Warm-Up Cycle Counter that can be viewed on the DRB III. Warm-Up Cycles are used to erase DTCs and Freeze Frames. Forty Warm-Up cycles must occur in order for the PCM to self-erase a DTC and Freeze Frame. A Warm-Up Cycle is defined as follows:

- Engine coolant temperature must start below and rise above 160° F (71 °C)
- Engine coolant temperature must rise by 40° F (4.5 °C).
- No further faults occur

## Freeze Frame Data Storage

Once a failure occurs, the Task Manager records several engine operating conditions and stores it in a Freeze Frame. The Freeze Frame is considered one frame of information taken by an on-board data recorder. When a fault occurs, the PCM stores the input data from various sensors so that technicians can determine under what vehicle operating conditions the failure occurred.

The data stored in Freeze Frame is usually recorded when a system fails the first time for two trip faults. Freeze Frame data will only be overwritten by a different fault with a higher priority.

**CAUTION: Erasing DTCs, either with the DRB III or by disconnecting the battery, also clears all Freeze Frame data.**

## Similar Conditions Window

The Similar Conditions Window displays information about engine operation during a monitor. Absolute MAP (engine load) and Engine RPM are stored in this window when a failure occurs. There are two different Similar conditions Windows: Fuel System and Misfire.

**FUEL SYSTEM**

- **Fuel System Similar Conditions Window -** An indicator that ’Absolute MAP When Fuel System Fail’ and ’RPM When Fuel System Failed’ are all in the same range when the failure occurred. Indicated by switching from ’NO’ to ’YES’.
- **Absolute MAP When Fuel System Fail -** The stored MAP reading at the time of failure. Informs the user at what engine load the failure occurred.
- **Absolute MAP -** A live reading of engine load to aid the user in accessing the Similar Conditions Window.
- **RPM When Fuel System Fail** - The stored RPM reading at the time of failure. Informs the user at what engine RPM the failure occurred.
- **Engine RPM** - A live reading of engine RPM to aid the user in accessing the Similar Conditions Window.
- **Adaptive Memory Factor** - The PCM utilizes both Short Term Compensation and Long Term Adaptive to calculate the Adaptive Memory Factor for total fuel correction.
- **Upstream O2S Volts** - A live reading of the Oxygen Sensor to indicate its performance. For example, stuck lean, stuck rich, etc.
- **SCW Time in Window (Similar Conditions Window Time in Window)** - A timer used by the PCM that indicates that, after all Similar Conditions have been met, if there has been enough good engine running time in the SCW without failure detected. This timer is used to increment a Good Trip.

- **Fuel System Good Trip Counter -** A Trip Counter used to turn OFF the MIL for Fuel System DTCs. To increment a Fuel System Good Trip, the engine must be in the Similar Conditions Window, Adaptive Memory Factor must be less than calibrated threshold and the Adaptive Memory Factor must stay below that threshold for a calibrated amount of time.
- **Test Done This Trip -** Indicates that the monitor has already been run and completed during the current trip.

**MISFIRE**

- **Same Misfire Warm-Up State -** Indicates if the misfire occurred when the engine was warmed up (above 160° F (71 °C)).
- **In Similar Misfire Window -** An indicator that 'Absolute MAP When Misfire Occurred' and 'RPM When Misfire Occurred' are all in the same range when the failure occurred. Indicated by switching from 'NO' to 'YES'.
- **Absolute MAP When Misfire Occurred -** The stored MAP reading at the time of failure. Informs the user at what engine load the failure occurred.
- **Absolute MAP -** A live reading of engine load to aid the user in accessing the Similar Conditions Window.
- **RPM When Misfire Occurred -** The stored RPM reading at the time of failure. Informs the user at what engine RPM the failure occurred.
- **Engine RPM -** A live reading of engine RPM to aid the user in accessing the Similar Conditions Window.
- **Adaptive Memory Factor -** The PCM utilizes both Short Term Compensation and Long Term Adaptive to calculate the Adaptive Memory Factor for total fuel correction.
- **200 Rev Counter -** Counts 0–100 720° cycles.
- **SCW Cat 200 Rev Counter -** Counts when in similar conditions.
- **SCW FTP 1000 Rev Counter -** Counts 0–4 when in similar conditions.
- **Misfire Good Trip Counter -** Counts up to three to turn OFF the MIL.
- **Misfire Data -** Data collected during test.
- **Test Done This Trip -** Indicates YES when the test is done.

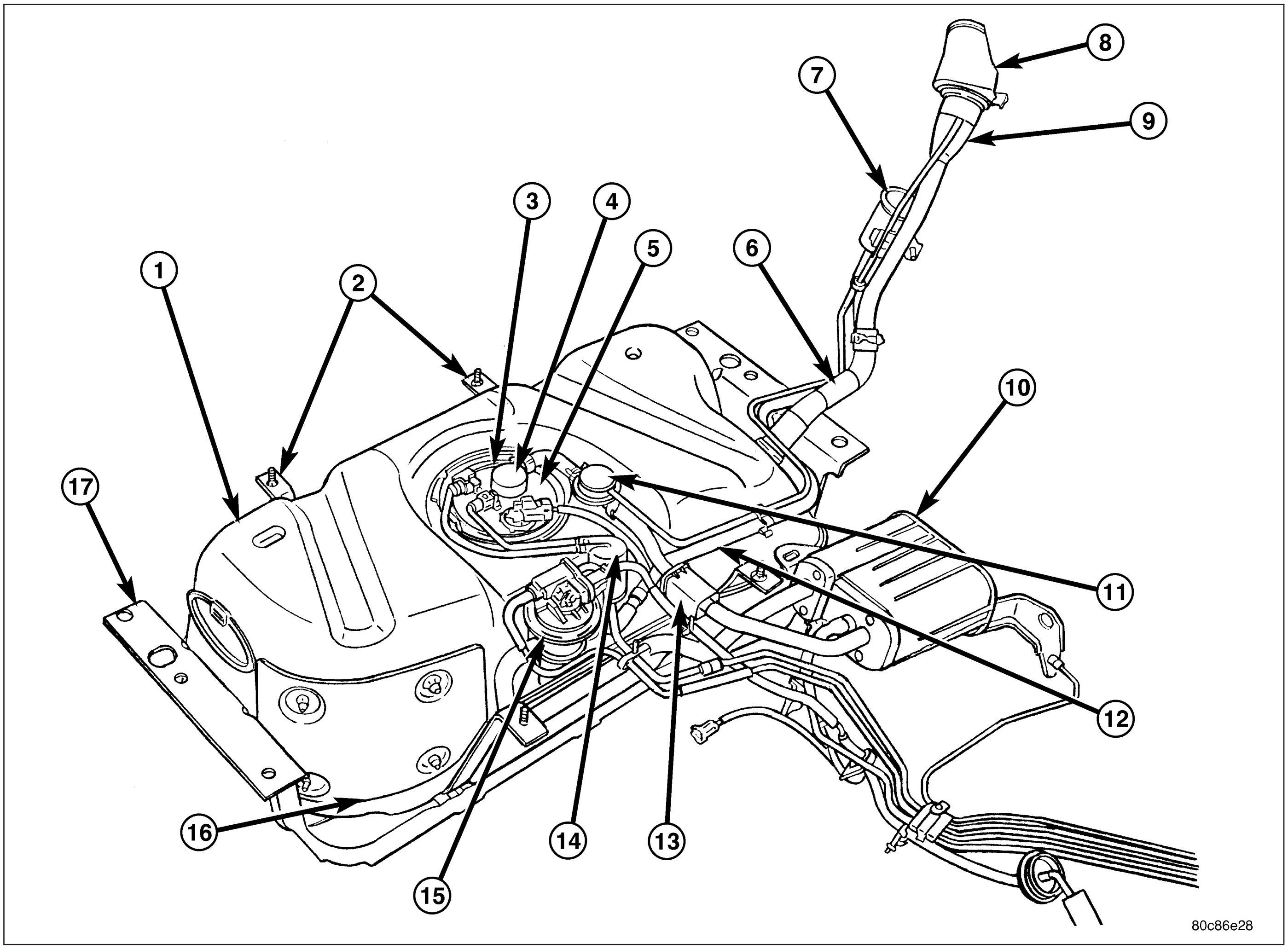
# EVAPORATIVE EMISSIONS

## TABLE OF CONTENTS

# EVAPORATIVE EMISSIONS

## DESCRIPTION

## EVAPORATION CONTROL SYSTEM




**NOTE: The evaporative system uses specially manufactured lines/hoses. If replacement becomes necessary, only use fuel resistant, low permeation hose.**

The evaporation control system prevents the emission of fuel tank vapors into the atmosphere. When fuel evaporates in the fuel tank, the vapors pass through the control valve located in the top section of the fuel pump module, through the fuel management valve, and through vent hoses and tubes to a charcoal filled evaporative canister. The canister temporarily holds the vapors. The Powertrain Control Module (PCM) allows intake manifold vacuum to draw vapors into the combustion chambers during certain operating conditions.

Gas powered engines use a duty cycle purge system. The PCM controls vapor flow by operating the duty cycle EVAP purge solenoid. Refer to Duty Cycle EVAP Canister Purge Solenoid.

When equipped with certain emissions packages, a Leak Detection Pump (LDP) will be used as part of the evaporative system for OBD II requirements. Also refer to Leak Detection Pump.

Vehicles powered with gasoline engines are also equipped with ORVR (On-Board Refueling Vapor Recovery). Refer to ORVR for additional information.

## 2.8L TURBODIESEL

The 2.8L diesel Engine Control Module (ECM) controls many different circuits in the fuel injection pump and engine systems. If the ECM senses a problem with a monitored circuit that indicates an actual problem, a Diagnostic Trouble Code (DTC) will be stored in the ECM's memory, and eventually may illuminate the MIL (Malfunction Indicator Lamp) constantly while the key is on. If the problem is repaired, or is intermittent, the ECM will erase the DTC after 40 warm-up cycles without the fault detected. A warm-up cycle consists of starting the vehicle when the engine is cold, then the engine is warmed up to a certain temperature, and finally, the engine temperature falls to a normal operating temperature, then the key is turned off.

Certain criteria must be met for a DTC to be entered into ECM memory. The criteria may be a specific range of engine rpm, engine or fuel temperature and/or input voltage to the ECM. A DTC indicates that the ECM has identified an abnormal signal in a circuit or the system.

There are several operating conditions that the ECM does not monitor and set a DTC for. Refer to the following Monitored Circuits and Non-Monitored Circuits in this section.

### ECM MONITORED SYSTEMS

The ECM can detect certain problems in the electrical system.

**Open or Shorted Circuit** – The ECM will not distinguish between an open or a short to ground, however the ECM can determine if there is excessive current on a circuit, such as a short to voltage or a decrease in component resistance.

**Output Device Current Flow** – The ECM senses whether the output devices are electrically connected.

If there is a problem with the circuit, the ECM senses whether the circuit is open, shorted to ground (–), or shorted to (+) voltage.

**Fuel Pressure:** High fuel pressure is controlled by the fuel injection pump, fuel pressure solenoid, and fuel rail pressure sensor. The ECM uses inputs from the sensor and solenoid to calculate and determine if a high fuel pressure problem exists.

**Fuel Injector Malfunctions:** The ECM can determine if a fuel injector has an electrical problem. The fuel injectors on the diesel engine are **controlled** by the ECM.

### ECM NON-MONITORED SYSTEMS

The ECM does not monitor the following circuits, systems or conditions that could have malfunctions that result in driveability problems. A DTC will not be displayed for these conditions.

**Cylinder Compression:** The ECM cannot detect uneven, low, or high engine cylinder compression.

**Exhaust System:** The ECM cannot detect a plugged, restricted or leaking exhaust system.

**Vacuum Assist:** Leaks or restrictions in the vacuum circuits of the Exhaust Gas Recirculation System (EGR) are not monitored by the ECM.

**ECM System Ground:** The ECM cannot determine a poor system ground. However, a DTC may be generated as a result of this condition.

**ECM/PCM Connector Engagement:** The ECM cannot determine spread or damaged connector pins. However, a DTC may be generated as a result of this condition.

### HIGH AND LOW LIMITS

The ECM compares input signals from each input device. There are high and low limits that are programmed into the ECM for that device. If the inputs are not within specifications and other DTC criteria are met, a DTC will be stored in memory. Other DTC criteria might include engine rpm limits or input voltages from other sensors or switches. The other inputs might have to be sensed by the ECM when it senses a high or low input voltage from the control system device in question.

## SPECIFICATIONS

### TORQUE

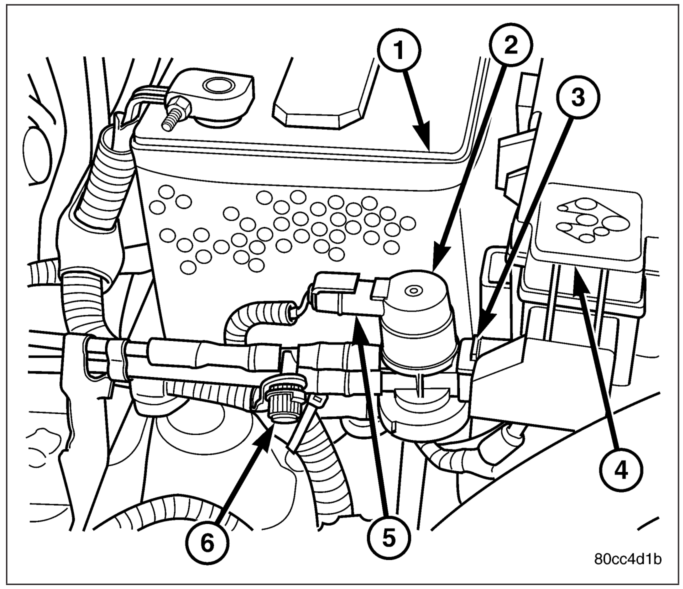
| DESCRIPTION | N-m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Accelerator Pedal Bracket Mounting Nuts | 12 | - | 105 |
| Crankshaft Position Sensor - 2.4L | 28 | 21 | - |
| Crankshaft Position Sensor - 3.7L | 28 | 21 | - |
| Camshaft Position Sensor - 2.4L | 12 | - | 106 |
| Camshaft Position Sensor - 3.7L | 12 | - | 106 |
| Engine Coolant Temperature Sensor | 11 | - | 96 |
| EVAP Canister-to-Body Bolts | 48 | 35 | - |
| EVAP Canister-to-Canis. Bracket Bolt/Nut | 11 | - | 100 |
| Fuel Filler Hose Clamp at Tank | 3 | - | 30 |
| Fuel Filler Housing-to-Body Screws | 2 | - | 17 |
| Fuel Filter Mounting Nut at Tank | 5.5 | - | 49 |
| Fuel Pump Module Access Plate Nuts | 3 | - | 26 |
| Fuel Rail Mounting Bolts - 3.7L | 11 | - | 100 |
| Fuel Rail Mounting Bolts - 2.4L | 28 | - | 250 |
| Fuel Tank Heat Sheild Nuts | 5.5 | - | 49 |
| Fuel Tank Mounting Strap Bolts | 61 | 45 | - |
| Fuel Tank Skid Plate and Trailer Hitch | 88 | 65 | - |
| IAC Motor Mounting Screws | 7 | - | 60 |
| Leak Detection Pump Mounting Bracket-to-Fuel Tank Nuts | 5.5 | - | 49 |
| Leak Detection Pump-to-Bracket Nuts | 1.2 | - | 11 |
| Map Sensor Mounting Screws | 3 | - | 25 |
| PCM-to-Mounting Bracket Mounting Screws | 4 | - | 35 |

| DESCRIPTION | N-m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| Power Steering Pressure Switch | 14-22 | - | 124-195 |
| TPS Mounting Screws | 7 | - | 60 |
| Throttle Body Mounting Bolts | 11 | - | 100 |
| Oxygen Sensors | 30 | 22 | - |

# SOLENOID-EVAP/PURGE

## DESCRIPTION

The duty cycle EVAP canister purge solenoid (DCP) (2) is located in the engine compartment. It is attached to a bracket located between the battery and the Power Distribution Center (PDC). The EVAP system test port is located near the solenoid.




## OPERATION

The duty cycle EVAP canister purge solenoid (DCP) regulates the rate of vapor flow from the EVAP canister to the intake manifold. The Powertrain Control Module (PCM) operates the solenoid.

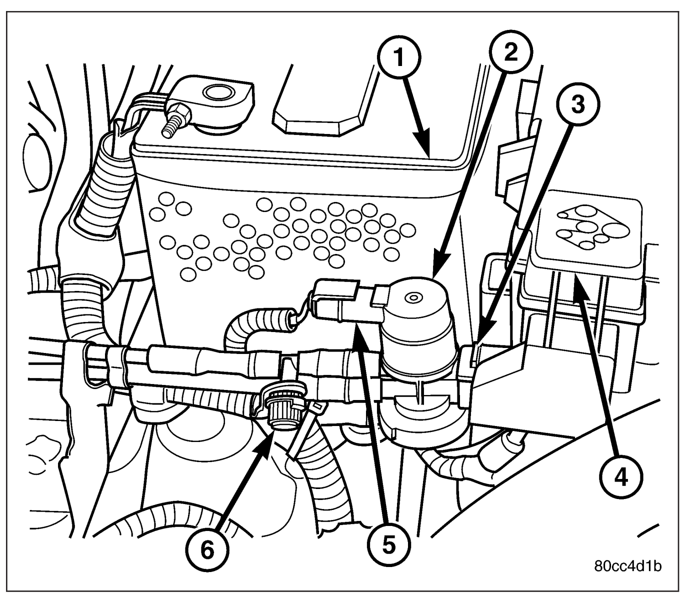
During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged. The PCM de-energizes the solenoid during open loop operation.

The engine enters closed loop operation after it reaches a specified temperature and the time delay ends. During closed loop operation, the PCM cycles (energizes and de-energizes) the solenoid 5 or 10 times per second, depending upon operating conditions. The PCM varies the vapor flow rate by changing solenoid pulse width. Pulse width is the amount of time that the solenoid is energized. The PCM adjusts solenoid pulse width based on engine operating condition.

## REMOVAL

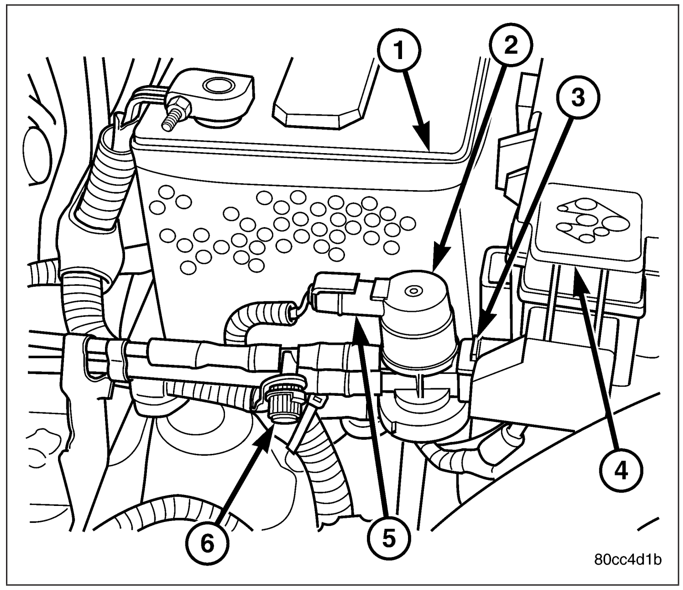
The duty cycle EVAP canister purge solenoid (DCP) (2) is located in the engine compartment. It is attached to a bracket located between the battery and the Power Distribution Center (PDC). The EVAP system test port is located near the solenoid.

1. Disconnect electrical wiring connector (5) at solenoid.
2. Disconnect vacuum harness at solenoid.
3. Remove solenoid and its support bracket (pull straight up).



## INSTALLATION

1. Slip EVAP canister purge solenoid (2) onto its mounting bracket (3).
2. Connect vacuum harness to solenoid.
3. Connect electrical connector (5) to solenoid.



# CAP-FUEL FILLER

## DESCRIPTION

The plastic fuel tank filler tube cap is threaded onto the end of the fuel fill tube. All models are equipped with a 1/4 turn cap.

## OPERATION

The loss of any fuel or vapor out of fuel filler tube is prevented by the use of a pressure-vacuum fuel fill cap. Relief valves inside the cap will release fuel tank pressure at predetermined pressures. Fuel tank vacuum will also be released at predetermined values. This cap must be replaced by a similar unit if replacement is necessary. This is in order for the system to remain effective.

**CAUTION: Remove fill cap before servicing any fuel system component to relieve tank pressure. If equipped with an ORVR system and a Leak Detection Pump (LDP), the cap must be tightened securely. If cap is left loose, a Diagnostic Trouble Code (DTC) may be set.**

# ORVR

## DESCRIPTION

The ORVR (On-Board Refueling Vapor Recovery) system consists of a unique fuel tank, flow management valve, fluid control valve, one-way check valve and vapor canister.

## OPERATION

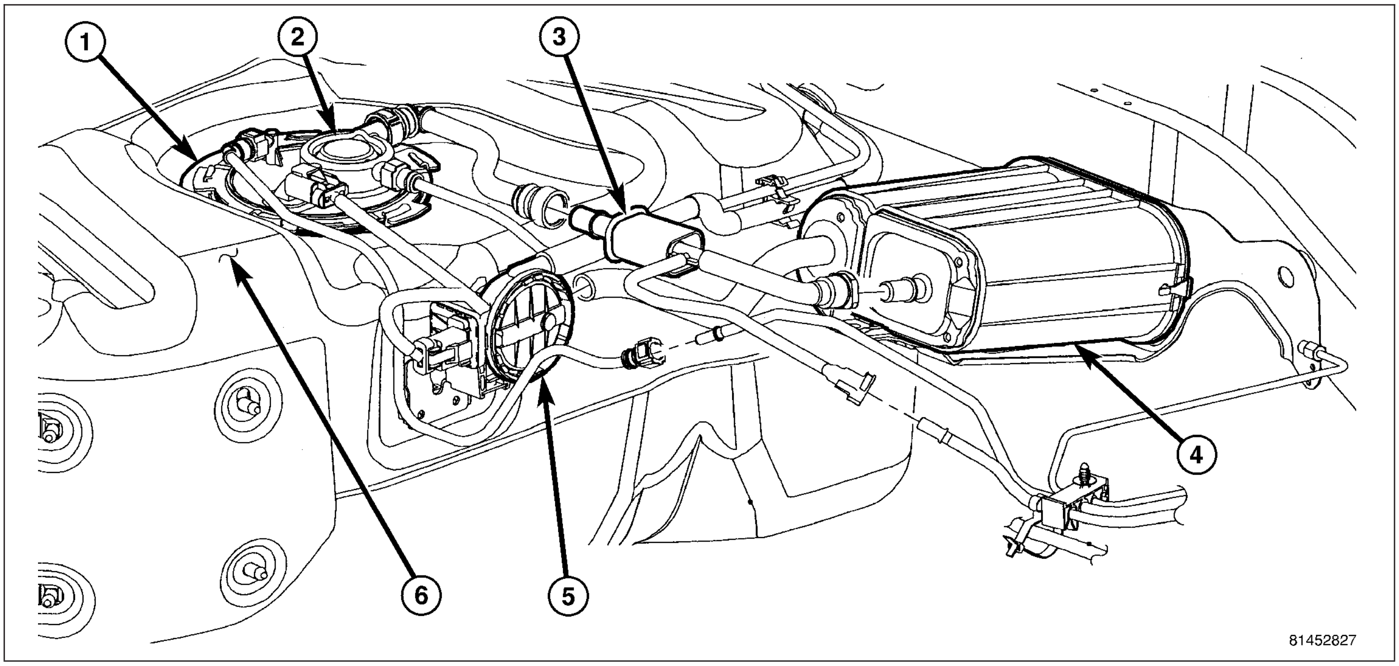
The ORVR (On-Board Refueling Vapor Recovery) system is used to remove excess fuel tank vapors. This is done while the vehicle is being refueled..

Fuel flowing into the fuel filler tube (approx. 1” I.D.) creates an aspiration effect drawing air into the fuel fill tube. During refueling, the fuel tank is vented to the EVAP canister to capture escaping vapors. With air flowing into the filler tube, there are no fuel vapors escaping to the atmosphere. Once the refueling vapors are captured by the EVAP canister, the vehicle’s computer controlled purge system draws vapor out of the canister for the engine to burn. The vapor flow is metered by the purge solenoid so that there is no, or minimal impact on driveability or tailpipe emissions.

As fuel starts to flow through the fuel fill tube, it opens the normally closed check valve and enters the fuel tank. Vapor or air is expelled from the tank through the control valve and on to the vapor canister. Vapor is absorbed in the EVAP canister until vapor flow in the lines stops. This stoppage occurs following fuel shut-off, or by having the fuel level in the tank rise high enough to close the control valve. This control valve contains a float that rises to seal the large diameter vent path to the EVAP canister. At this point in the refueling process, fuel tank pressure increases, the check valve closes (preventing liquid fuel from spiting back at the operator), and fuel then rises up the fuel filler tube to shut off the dispensing nozzle.

# PUMP-NATURAL VAC LEAK DETECTION

## DESCRIPTION




The NVLD pump (5) is located at the front of the fuel tank.

## OPERATION

The Natural Vacuum Leak Detection (NVLD) system is the next generation evaporative leak detection system that will first be used on vehicles equipped with the Next Generation Controller (NGC). This new system replaces the leak detection pump as the method of evaporative system leak detection. This is to detect a leak equivalent to a 0.020″ (0.5 mm) hole. This system has the capability to detect holes of this size very dependably.

The basic leak detection theory employed with NVLD is the ″Gas Law″. This is to say that the pressure in a sealed vessel will change if the temperature of the gas in the vessel changes. The vessel will only see this effect if it is indeed sealed. Even small leaks will allow the pressure in the vessel to come to equilibrium with the ambient pressure. In addition to the detection of very small leaks, this system has the capability of detecting medium as well as large evaporative system leaks.

A vent valve seals the canister vent during engine off conditions. If the vapor system has a leak of less than the failure threshold, the evaporative system will be pulled into a vacuum, either due to the cool down from operating temperature or diurnal ambient temperature cycling. The diurnal effect is considered one of the primary contributors to the leak determination by this diagnostic. When the vacuum in the system exceeds about 1″ H2O (0.25 KPA), a vacuum switch closes. The switch closure sends a signal to the NGC. The NGC, via appropriate logic strategies, utilizes the switch signal, or lack thereof, to make a determination of whether a leak is present.

The NVLD device is designed with a normally open vacuum switch, a normally closed solenoid, and a seal, which is actuated by both the solenoid and a diaphragm. The NVLD is located on the atmospheric vent side of the canister. The NVLD assembly may be mounted on top of the canister outlet, or in-line between the canister and atmospheric vent filter. The normally open vacuum switch will close with about 1″ H2O (0.25 KPA) vacuum in the evaporative system. The diaphragm actuates the switch. This is above the opening point of the fuel inlet check valve in the fill tube so cap off leaks can be detected. Submerged fill systems must have recirculation lines that do not have the in-line normally closed check valve that protects the system from failed nozzle liquid ingestion, in order to detect cap off conditions.

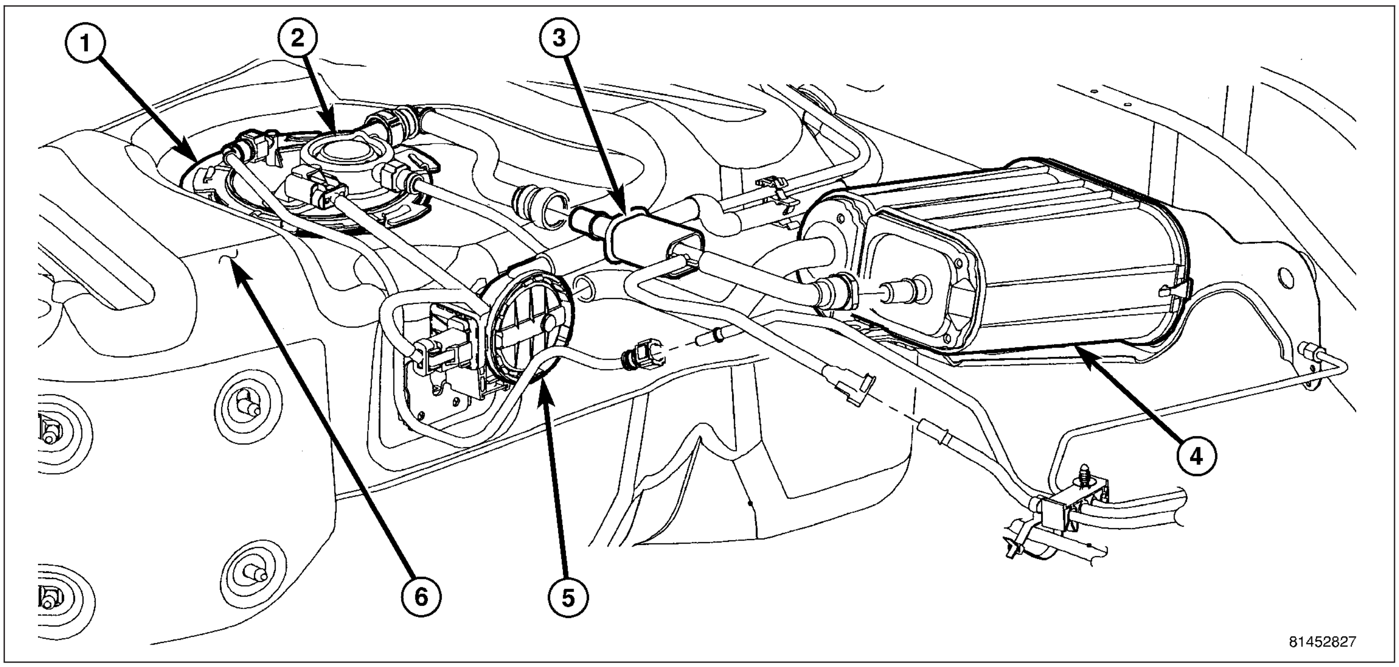
The normally closed valve in the NVLD is intended to maintain the seal on the evaporative system during the engine off condition. If vacuum in the evaporative system exceeds 3″ to 6″ H2O (0.75 to 1.5 KPA), the valve will be pulled off the seat, opening the seal. This will protect the system from excessive vacuum as well as allowing sufficient purge flow in the event that the solenoid was to become inoperative.

The solenoid actuates the valve to unseal the canister vent while the engine is running. It also will be used to close the vent during the medium and large leak tests and during the purge flow check. This solenoid requires an initial 1.5 amps of current to pull the valve open, but after 100 mili-seconds, will be duty cycled down to an average of about 150 mA for the remainder of the drive cycle.

Another feature in the device is a diaphragm that will open the seal in the NVLD with pressure in the evaporative system. The device will ″blow off″ at about 0.5″ $H_2O$ (0.12 KPA) pressure to permit the venting of vapors during refueling. An added benefit to this is that it will also allow the tank to ″breathe″ during increasing temperatures, thus limiting the pressure in the tank to this low level. This is beneficial because the induced vacuum during a subsequent declining temperature will achieve the switch closed (pass threshold) sooner than if the tank had to decay from a built up pressure.

The device itself has 3 wires: Switch sense, solenoid driver and ground. It also includes a resistor to protect the switch from a short to battery or a short to ground. The NGC utilizes a high-side driver to energize and duty-cycle the solenoid.

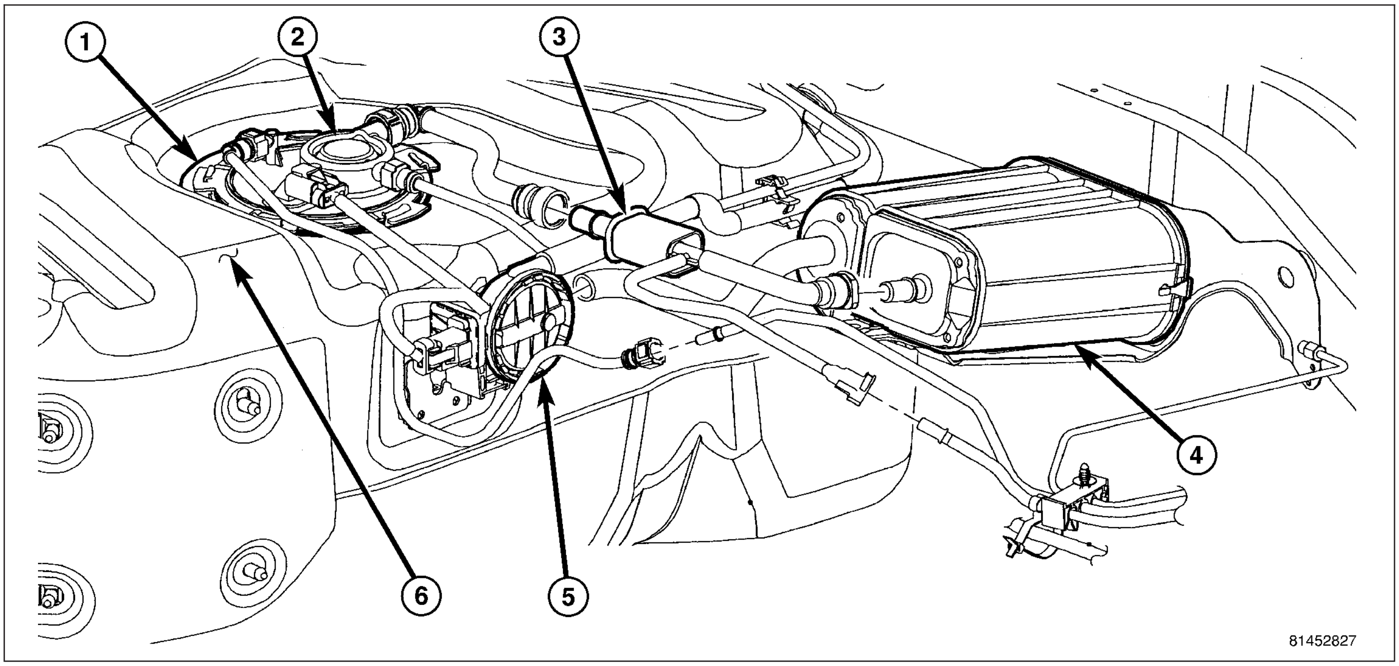
## REMOVAL




The NVLD pump (5) is located at the front of the fuel tank.

1. Raise and support vehicle.
2. If equipped, remove fuel tank skid plate.
3. Disconnect electrical connector at pump.
4. Carefully remove vapor/vacuum hoses at pump.
5. The NVLD pump snaps on to a mounting bracket. Press on release tab while sliding pump from bracket.

## INSTALLATION



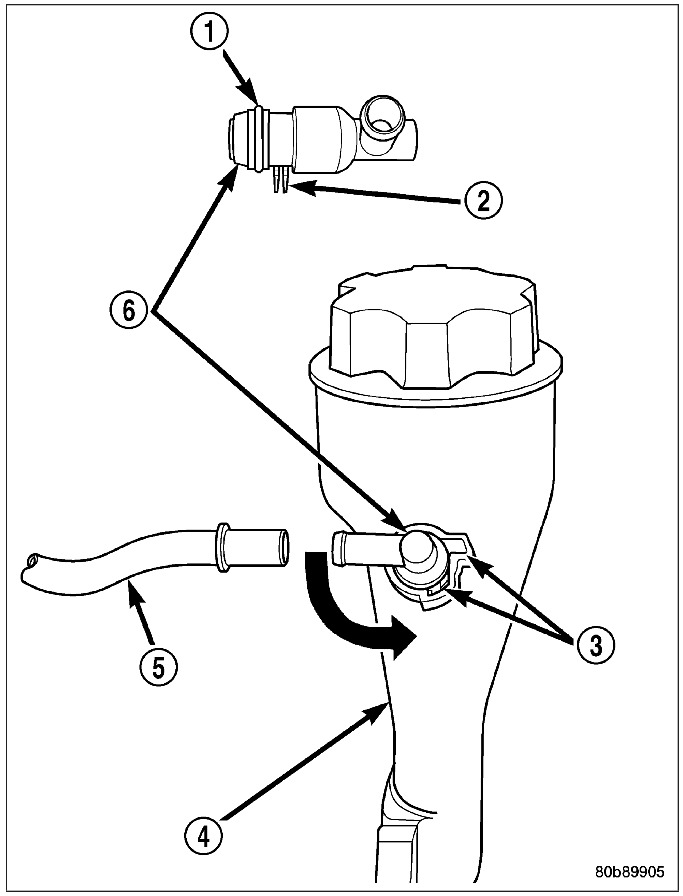

1. Install NVLD pump (5) to mounting bracket (snaps on).
2. Carefully install vapor/vacuum lines to NVLD pump. **The vapor/vacuum lines and hoses must be firmly connected. Check the vapor/vacuum lines at the NVLD pump, filter and EVAP canister purge solenoid for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) may be set.**
3. Connect electrical connector to pump.
4. If equipped, install fuel tank skid plate.

# VALVE-PCV

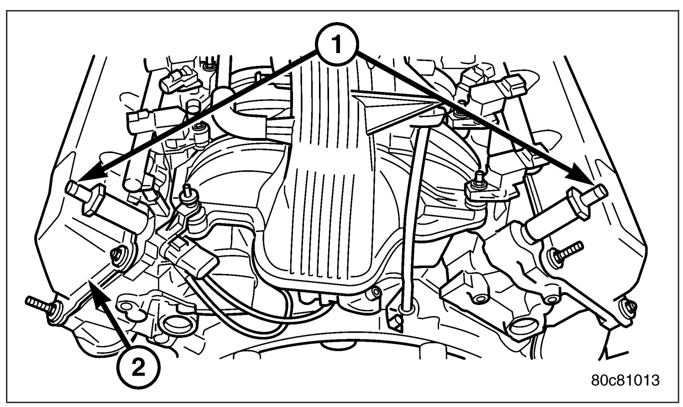
## DESCRIPTION

The 3.7L is equipped with a closed crankcase ventilation system and a Positive Crankcase Ventilation (PCV) valve.

This system consists of the air cleaner housing and the tubes and hoses used to connect the various system components. A PCV valve (6) is mounted to the oil filler housing. The PCV valve (6) is sealed to the oil filler housing with an O-ring (1).

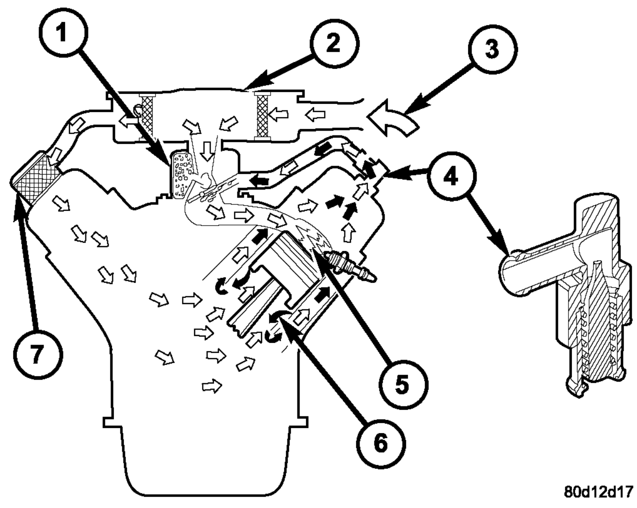



Two interconnected breathers (1) are threaded into the rear of each cylinder head.



## OPERATION

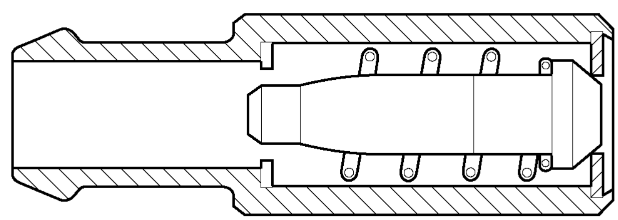
A typical enclosed crankcase ventilation system is shown in the graphic.



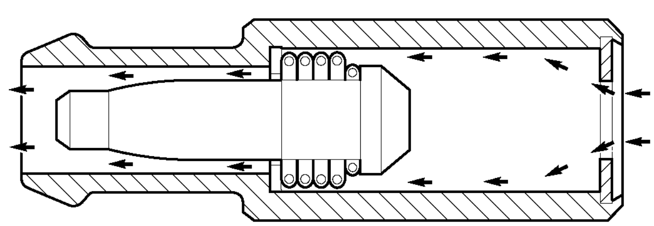

The PCV system operates by engine intake manifold vacuum. Filtered air is routed into the crankcase through the air cleaner hose. The metered air, along with crankcase vapors, are drawn through the PCV valve (4) and into a passage in the intake manifold. The PCV system manages crankcase pressure and meters blow by gases to the intake system, reducing engine sludge formation.

The PCV valve contains a spring loaded plunger. This plunger meters the amount of crankcase vapors routed into the combustion chamber based on intake manifold vacuum.

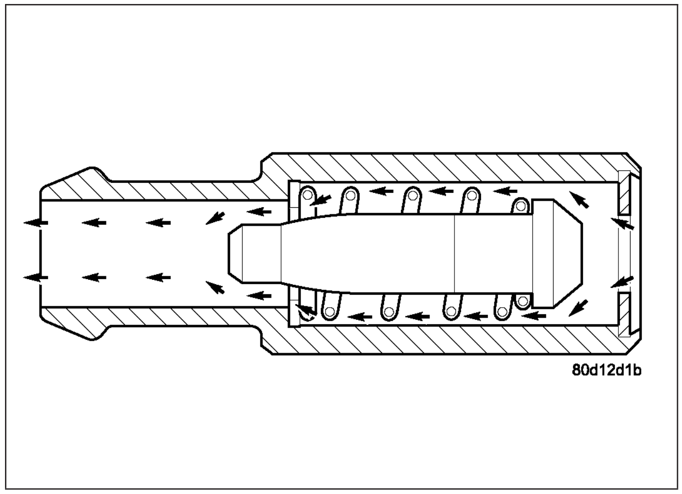
When the engine is not operating or during an engine pop-back, the spring forces the plunger back against the seat. This will prevent vapors from flowing through the valve.




During periods of high manifold vacuum, such as idle or cruising speeds, vacuum is sufficient to completely compress spring. It will then pull the plunger to the top of the valve. In this position there is minimal vapor flow through the valve.



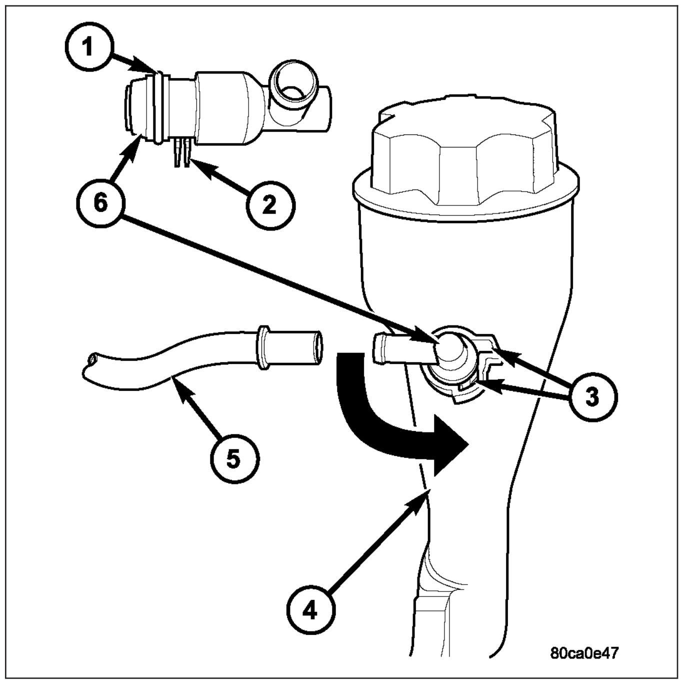
During periods of moderate manifold vacuum, the plunger is only pulled part way back from inlet. This results in maximum vapor flow through the valve.



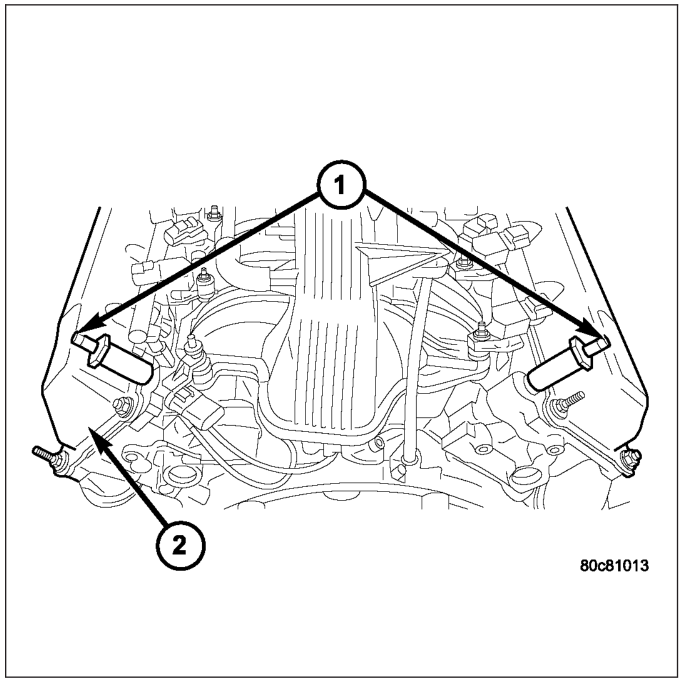

## DIAGNOSIS AND TESTING

### PCV VALVE

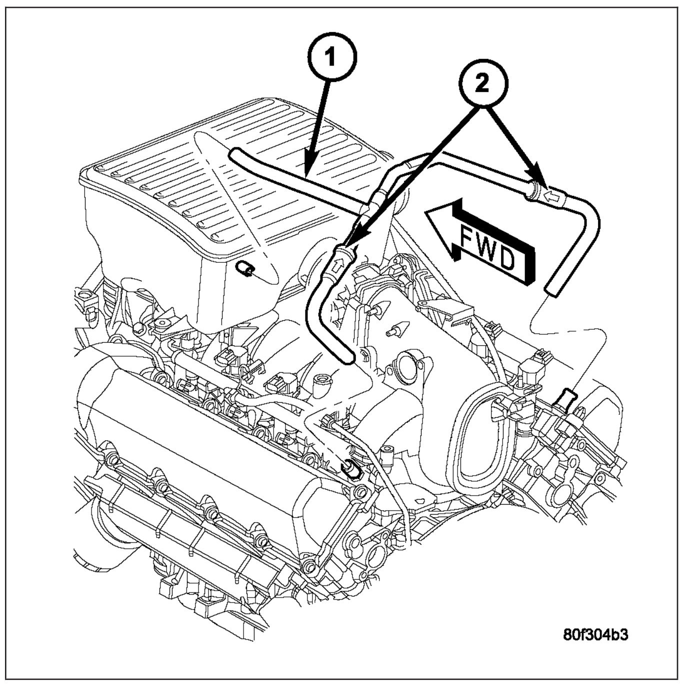
1. Disconnect PCV line/hose (5) by disconnecting rubber connecting hose at PCV valve fitting.
2. Remove PCV valve at oil filler tube by rotating PCV valve downward until locating tabs (2) have been freed at cam lock (3). After tabs have cleared, pull valve straight out from filler tube. **To prevent damage to PCV valve locating tabs, valve must be pointed downward for removal. Do not force valve from oil filler tube.**
3. After valve is removed, check condition of valve O-ring (1). Also, PCV valve should rattle when shaken.
4. Reconnect PCV valve to its connecting line/hose.
5. Start engine and bring to idle speed.
6. If valve is not plugged, a hissing noise will be heard as air passes through valve. Also, a strong vacuum should be felt with a finger placed at valve inlet.
7. If vacuum is not felt at valve inlet, check line/hose for kinks or for obstruction. If necessary, clean out intake manifold fitting at rear of manifold. Do this by turning a 1/4 inch drill (by hand) through the fitting to dislodge any solid particles. Blow out the fitting with shop air. If necessary, use a smaller drill to avoid removing any metal from the fitting.
8. **Do not attempt to clean the old PCV valve.**
9. Return PCV valve back to oil filler tube by placing valve locating tabs (2) into cam lock (3). Press PCV valve in and rotate valve upward. A slight click will be felt when tabs have engaged cam lock. Valve should be pointed towards rear of vehicle.
10. Connect PCV line/hose (5) and connecting rubber hose to PCV valve.
11. Disconnect rubber hose from fresh air fitting at air cleaner resonator box. Start engine and bring to idle speed. Hold a piece of stiff paper (such as a parts tag) loosely over the opening of the disconnected rubber hose.



12. The paper should be drawn against the hose opening with noticeable force. This will be after allowing approximately one minute for crankcase pressure to reduce.
13. If vacuum is not present, disconnect each PCV system hose at top of each crankcase breather (1). Check for obstructions or restrictions.
14. If vacuum is still not present, remove each PCV system crankcase breather (1) from each cylinder head. Check for obstructions or restrictions. If plugged, replace breather. Tighten breather to 12 N·m (106 in. lbs.) torque. Do not attempt to clean breather.



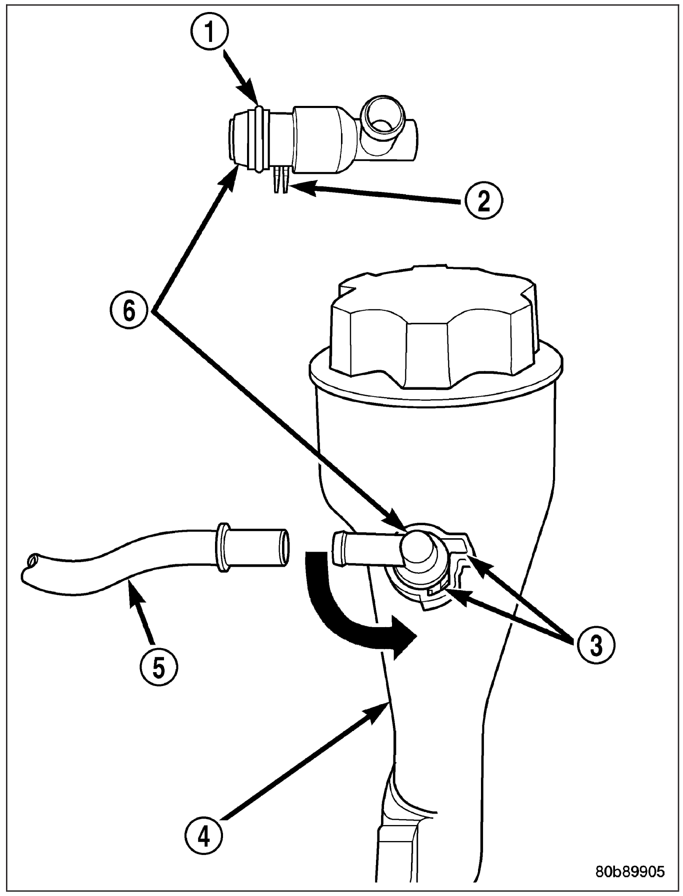

15. If vacuum is still not present, disconnect each PCV system hose (1) at each fitting, and at each check valve (2). Check for obstructions or restrictions.



## REMOVAL

The PCV valve (6) is located on the oil filler tube (4). Two locating tabs (2) are located on the side of the valve. These 2 tabs fit into a cam lock in the oil filler tube. An O-ring seals the valve to the filler tube.

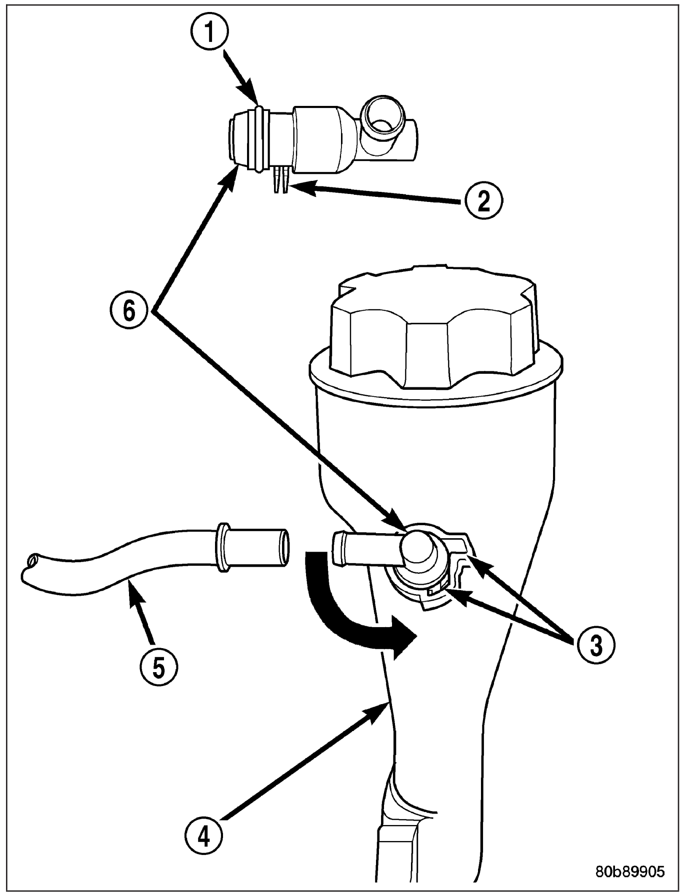
1. Disconnect PCV line/hose (5) by disconnecting rubber hose at PCV valve fitting.
2. Remove PCV valve at oil filler tube by rotating PCV valve downward (counterclockwise) until locating tabs have been freed at cam lock. After tabs have cleared, pull valve straight out from filler tube. **To prevent damage to PCV valve locating tabs, valve must be pointed downward for removal. Do not force valve from oil filler tube.**
3. After valve is removed, check condition of valve O-ring (1).



## INSTALLATION

The PCV valve (6) is located on the oil filler tube (4). Two locating tabs (2) are located on the side of the valve. These 2 tabs fit into a cam lock (3) in the oil filler tube. An O-ring seals the valve to the filler tube.

1. Return PCV valve back to oil filler tube by placing valve locating tabs into cam lock. Press PCV valve in and rotate valve upward. A slight click will be felt when tabs have engaged cam lock. Valve should be pointed towards rear of vehicle.
2. Connect PCV line/hose and rubber hose to PCV valve.



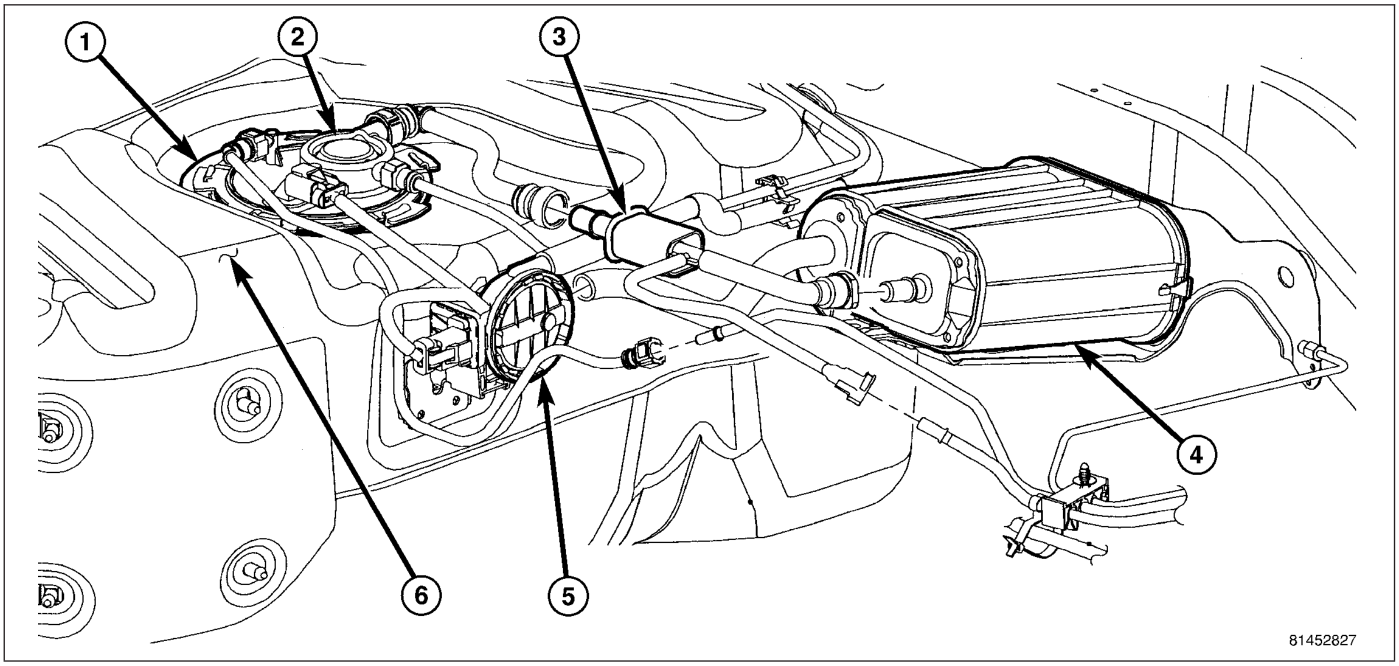
# LINES-VACUUM

## DESCRIPTION

A vacuum schematic for emission related items can be found on the VECI label. Refer to Vehicle Emission Control Information (VECI) Label for label location.

# CANISTER-VAPOR

## DESCRIPTION




A maintenance free, EVAP canister is used on all gasoline powered models. The EVAP canister (4) is located near the left/front corner of the fuel tank.

## OPERATION

The EVAP canister is filled with granules of an activated carbon mixture. Fuel vapors entering the EVAP canister are absorbed by the charcoal granules.

The canister serves two functions: as a temporary fuel vapor storage point while refueling the vehicle for the ORVR system, as a temporary vapor storage point while the engine is running.

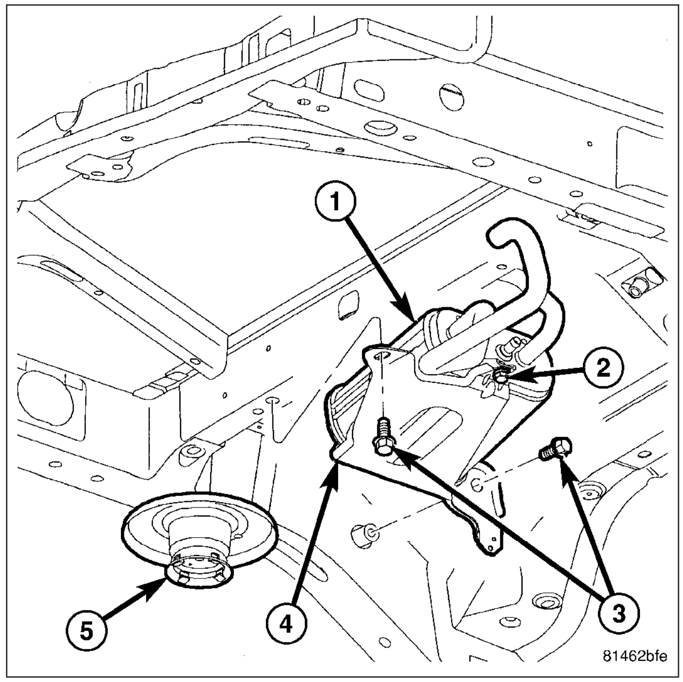
Fuel tank pressure vents into the EVAP canister. Fuel vapors are temporarily held in the canister until they can be drawn into the intake manifold. The duty cycle EVAP canister purge solenoid allows the EVAP canister to be purged at predetermined times and at certain engine operating conditions.

(Refer to 25 - EMISSIONS CONTROL/EVAPORATIVE EMISSIONS/ORVR - OPERATION)

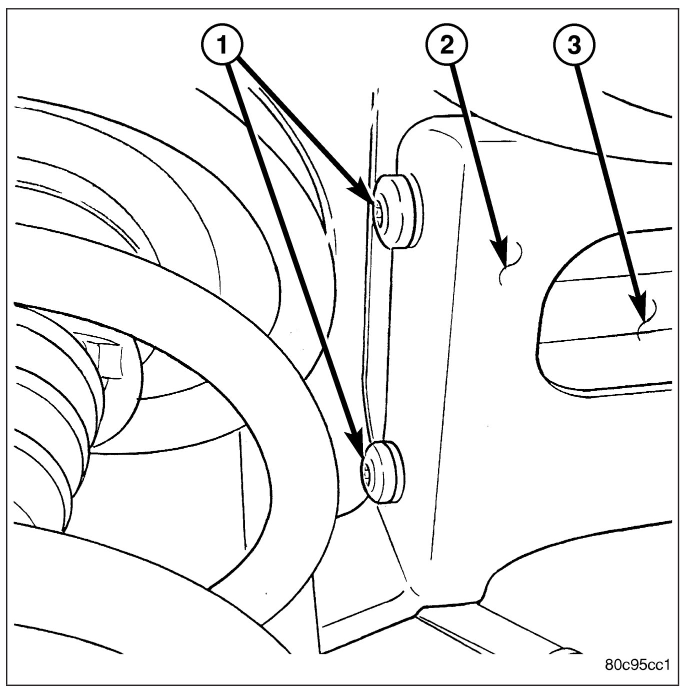
## REMOVAL

The EVAP canister (1) is located near front of fuel tank and next to the left/rear spring perch (5).

1. Raise vehicle.
2. Disconnect vacuum hoses/lines at EVAP canister. Note location of lines before removal.
3. Remove EVAP canister (1) and mounting bracket assembly (4) from body (2 bolts).
4. Remove canister-to-mounting bracket bolt (2).

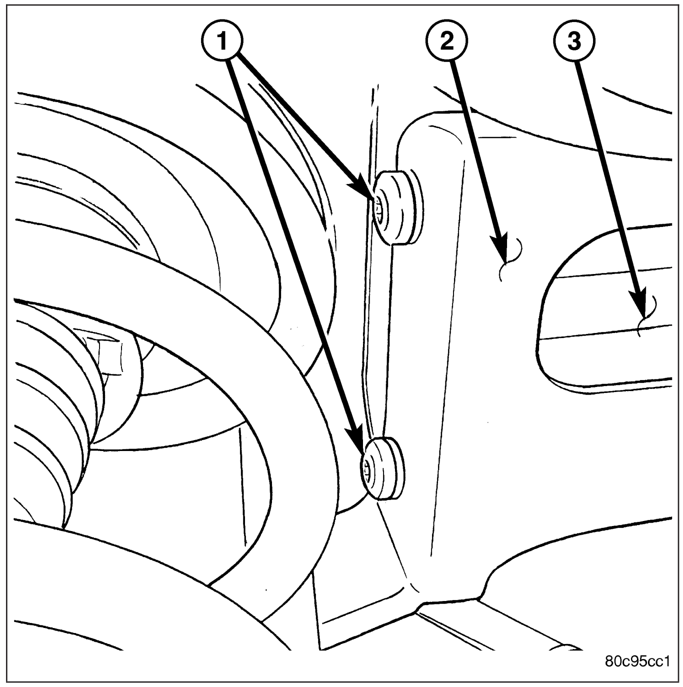



5. Slide two canister mounting pins (1) from mounting bracket (2).

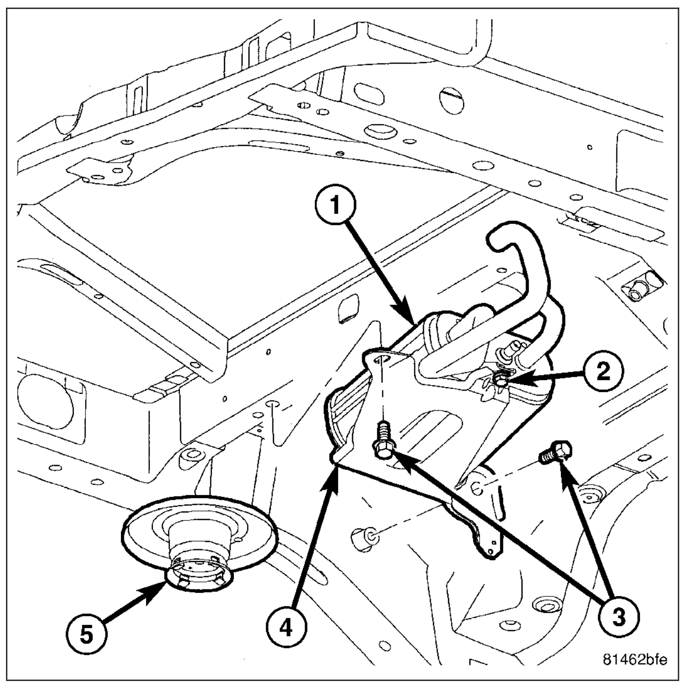


## INSTALLATION

1. Slide two canister mounting pins (1) into mounting bracket (2).




2. Install canister-to-mounting bracket bolt (2).
3. Position canister and bracket assembly to body.
4. Install two mounting bracket bolts (3). Tighten to 48 N·m (35 ft. lbs.) torque.
5. Carefully install vapor/vacuum lines to EVAP canister. **The vapor/vacuum lines and hoses must be firmly connected. Also check the vapor/vacuum lines at the NVLD pump, filter and EVAP canister purge solenoid for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) may be set.**
6. Lower vehicle.



# EXHAUST GAS RECIRCULATION

## TABLE OF CONTENTS

# EXHAUST GAS RECIRCULATION

## DESCRIPTION

The task of the Exhaust Gas Recirculation (EGR) is to regulate the fresh air supply to the engine by means of the exhaust gas recirculation system, in favor of clean combustion. The EGR system reduces oxides of nitrogen (NOx) in the engine exhaust. This is accomplished by allowing a predetermined amount of hot exhaust gas to recirculate and dilute the incoming charge air.

A malfunctioning EGR system can cause engine stumble, sags, or hesitation, rough idle, engine stalling and poor driveability.

## OPERATION

The system consists of:

- A EGR valve assembly. The valve is located on the left side of the engine below the intake manifold.
- A EGR Cooler. The cooler is located on the left side of the engine below the intake manifold.
- A EGR air flow control valve. The EGR air flow control valve is located in the air inlet between the charge air inlet and the intake manifold. The air control valve is used to increase the EGR flow rate at low engine speeds.
- The ECM operates and monitors the EGR valve and air flow control valve. The ECM is located in the left-rear side of the engine compartment.

The ECM will monitor and determine the positioning of the EGR valve and air control valve by internal programming defined during engine development. This will depend on inputs from the engine coolant temperature, engine load, fuel quantity, throttle position and engine speed sensors. The air control valve blends the incoming charge air and the cooled and recirculated EGR gasses, to be used again in the combustion chamber.

Exhaust gas recirculation will begin in this order when:

- The ECM determines that EGR system operation is necessary.
- The inlet seat (poppet valve) at the bottom of the EGR valve opens to dilute and recirculate exhaust gas back into the intake manifold.
- The EGR Cooler further cools the hot exhaust gasses before recirculation

The EGR system will be shut down by the ECM after 60 seconds of continuous engine idling to improve idle quality and the air flow control valve will close completely when the vehicle is shut off to assist with engine shake on shut down.

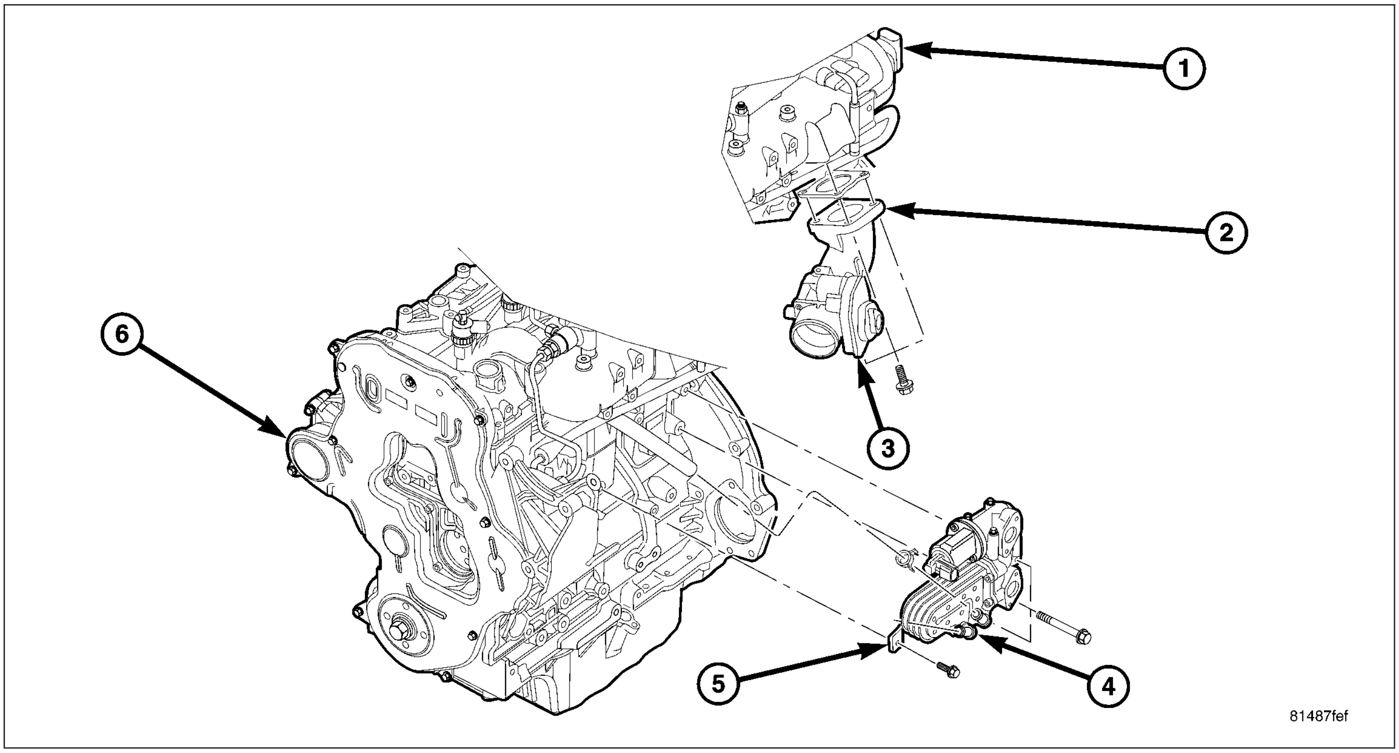
## SPECIFICATIONS

## TORQUE - 2.8L DIESEL

| DESCRIPTION | N·m | Ft. Lbs. | In. Lbs. |
|---|---|---|---|
| EGR tube to EGR Valve Bolts | 32. | 24 | - |
| EGR valve to Cooler Bolts | 11 | - | 95 |
| EGR tube Clamps | 7 | - | 62 |
| EGR Valve to Head Bolts | 24.5 | - | 216 |
| PCV Breather | 12 | - | 106 |

# VALVE

## DESCRIPTION




***EGR AND AIR CONTROL VALVE***

1 - REAR OF INTAKE MANIFOLD
2 - AIR INLET ELBOW
3 - EGR AIR CONTROL VALVE
4 - EGR VALVE COOLER
5 - EGR VALVE
6 - ENGINE

The EGR system consists of:

- EGR valve
- Air Control Valve
- EGR cooler

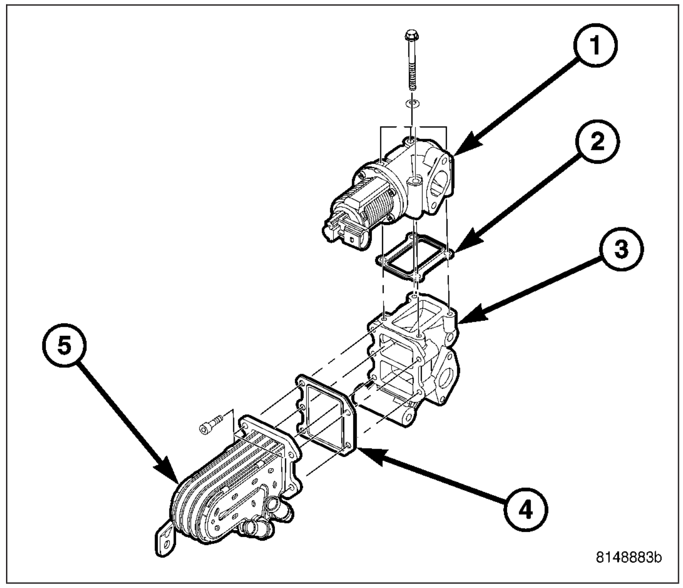
The EGR valve and cooler are located under the intake manifold toward the left rear of the engine. The air control valve is located in the charge air inlet before the intake manifold.

## OPERATION

The EGR system reduces oxides of nitrogen (NOx) in engine exhaust. Formation of NOx increases proportionally with combustion temperature. To reduce the emission of these oxides, the cylinder temperature must be lowered. The system allows a predetermined amount of hot exhaust gas to recirculate and dilute the incoming charge air. The diluted air mixture reduces peak flame temperature during combustion. The EGR cooler further reduces these temperatures.

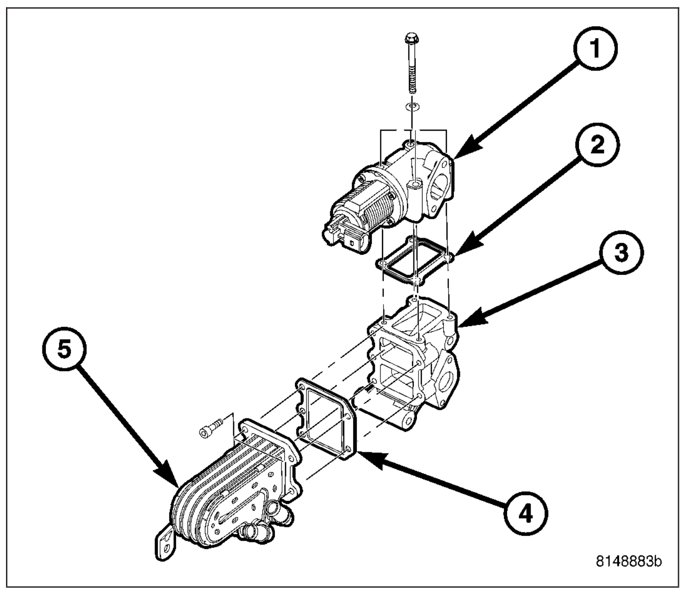
## REMOVAL

1. Disconnect the negative battery cable.
2. Remove engine cover.
3. Drain cooling system.
4. Disconnect the electrical connector at EGR valve.
5. Disconnect coolant hoses at EGR valve (1) and cooler (5).
6. Disconnect tube at the EGR valve housing.
7. Remove EGR valve housing to engine block fastener.
8. Remove EGR valve and cooler assembly from vehicle.
9. Remove EGR valve to cooler retaining bolts and separate EGR valve from cooler.




## INSTALLATION

1. Clean all gasket mating surfaces.
2. Assemble EGR valve (1) and cooler (5) to housing (3). A new gasket should only be required if the cooler has been replaced. Torque bolts to 11 N·m (95 in.lbs.).
3. Install EGR valve/cooler assembly to head and tighten bolts to 24.5 N·m (216 in. lbs.).
4. Install EGR tube to EGR assembly and tighten bolts to 32 N·m (24 ft.lbs).
5. Tighten EGR tube clamps to 7 N·m (62 in. lbs.).
6. Connect the EGR cooler hoses.
7. Refill cooling system.
8. Install engine cover.
9. Connect negative battery cable.



# EGR VALVE COOLER

## DESCRIPTION

Refer to the EGR valve operation for EGR cooler description (Refer to 25 - EMISSIONS CONTROL/EXHAUST GAS RECIRCULATION - OPERATION)

## REMOVAL

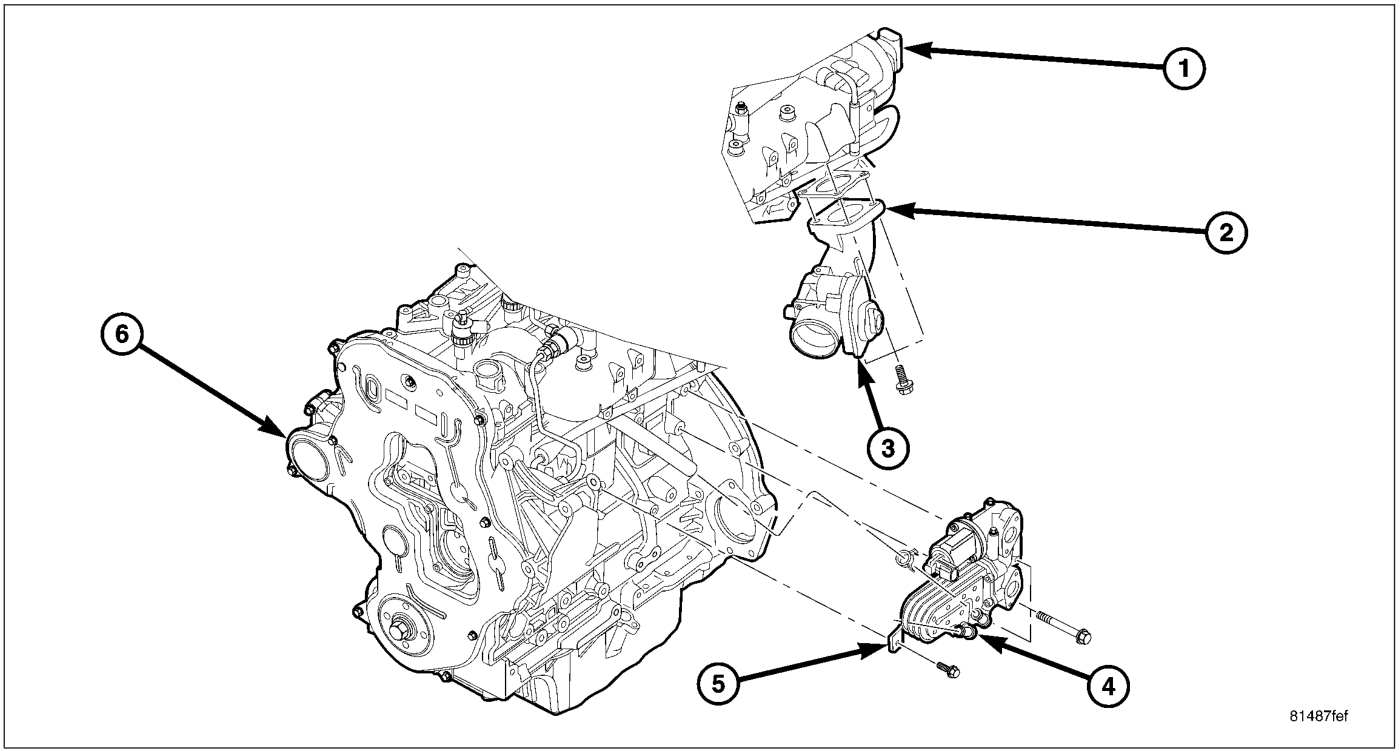
1. (Refer to 25 - EMISSIONS CONTROL/EXHAUST GAS RECIRCULATION/VALVE - REMOVAL)

## INSTALLATION

1. (Refer to 25 - EMISSIONS CONTROL/EXHAUST GAS RECIRCULATION/VALVE - INSTALLATION)

# EGR AIR FLOW CONTROL VALVE

## DESCRIPTION

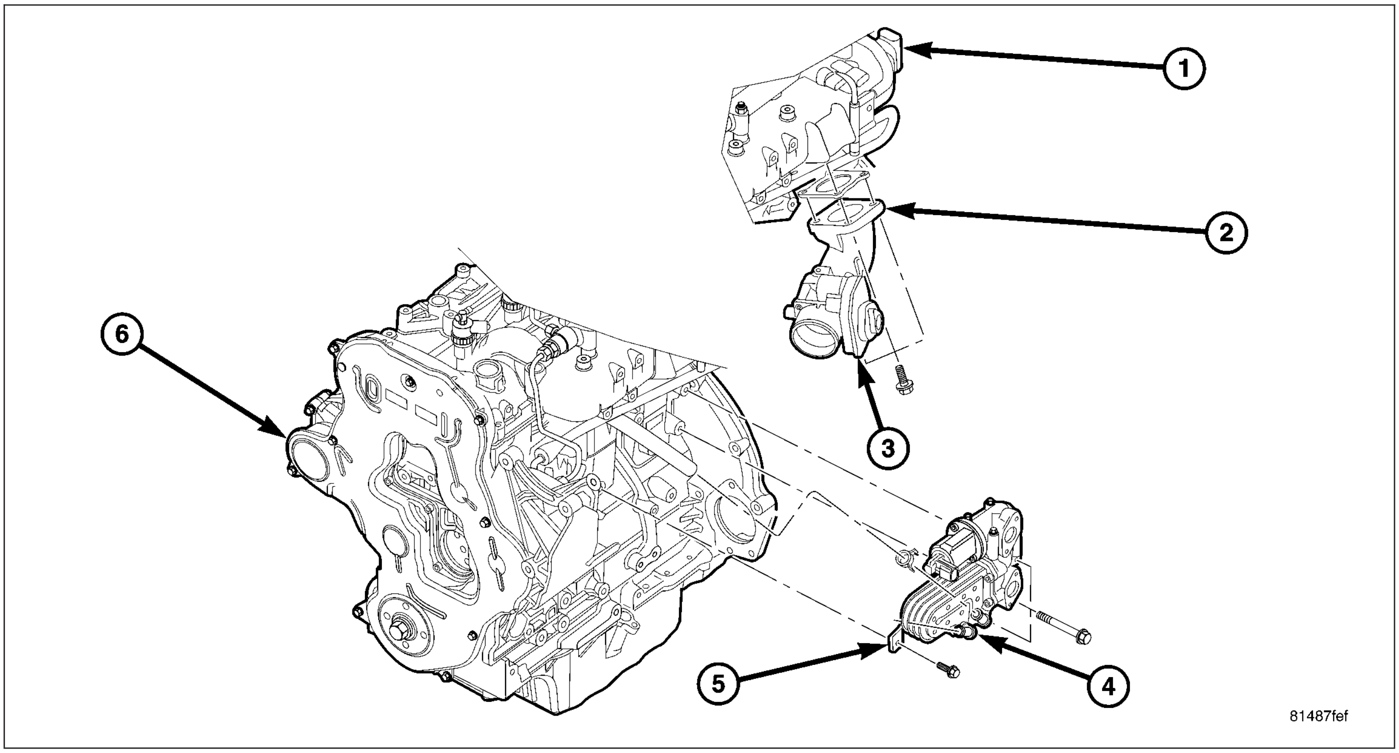



***EGR AND AIR CONTROL VALVE***

1 - REAR OF INTAKE MANIFOLD
2 - AIR INLET ELBOW
3 - EGR AIR CONTROL VALVE
4 - EGR VALVE COOLER
5 - EGR VALVE
6 - ENGINE

The EGR air flow control valve is located between the incoming charge air and the intake manifold. It is used to increase the EGR flow rate at low engine loads. The valve is never totally closed, but the valve position depends on the exhaust gas quantity that needs to be recirculated with in the emission target.

## OPERATION



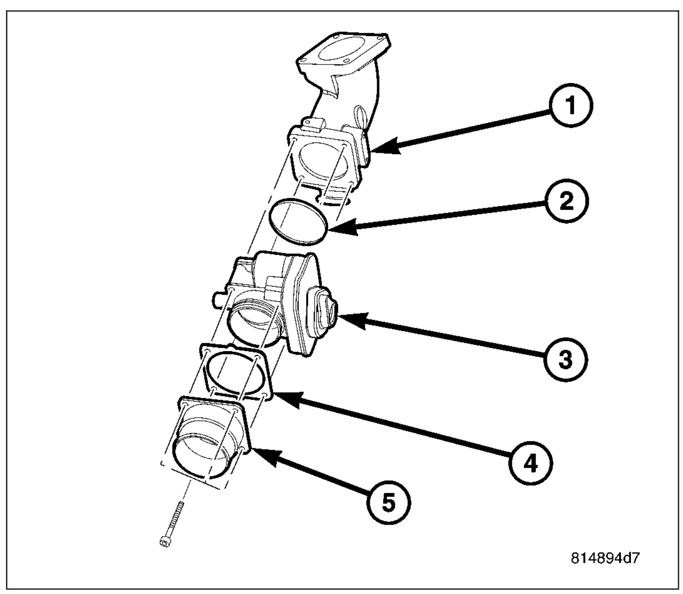

**_EGR AND AIR CONTROL VALVE_**

1 - REAR OF INTAKE MANIFOLD
2 - AIR INLET ELBOW
3 - EGR AIR CONTROL VALVE
4 - EGR VALVE COOLER
5 - EGR VALVE
6 - ENGINE

The EGR air flow control valve is a pluse width modulated control valve that is operated by the ECM in line with the EGR flow quantity required to remain inside the emissions target.

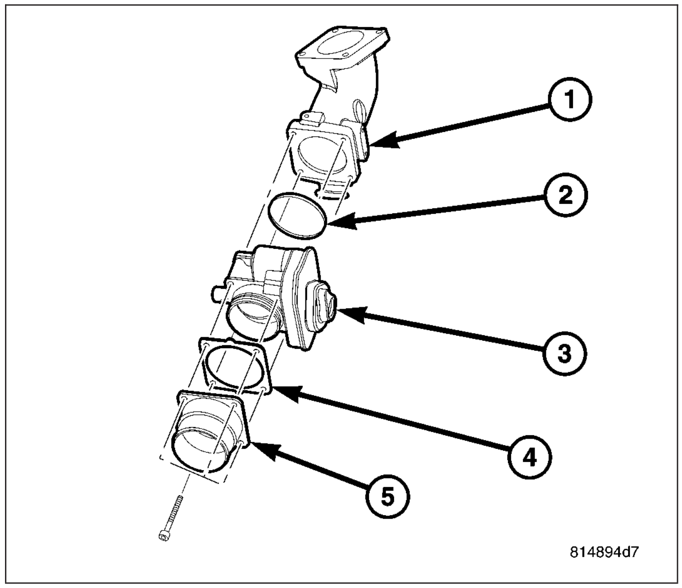
## REMOVAL

1. Disconnect the negative battery cable.
2. Disconnect the EGR air control valve (3) wiring harness connector.
3. Disconnect the charge air inlet hose.
4. Remove the generator to intake manifold support bracket.
5. Separate the oil level indicator tube and the vacuum pipe from the air control valve.
6. Disconnect the EGR tube connected to the back of the air control valve.
7. Remove the air control valve fasteners and the control valve assembly.



## INSTALLATION

1. Clean all gasket mating surfaces.
2. Install the gasket (4), seal (2) and the air control valve (3). Tighten the air control valve fasteners to 10.8 N·m (95 in. lbs.).
3. Install the EGR tube to the back of the air control valve.
4. Connect the vacuum pipe and oil level indicator tube to the air control valve.
5. Install the generator to intake support bracket. Tighten fasteners to 32.4 N·m (24 ft. lbs.).
6. Install the charge air hose. Tighten clamp to 7 N·m (61 in. lbs.).
7. Connect the wiring harness connector.
8. Connect the negative battery cable.



| Description | Group-Page |
|---|---|

## BODY DIAGNOSTICS

## CHASSIS DIAGNOSTICS



## POWERTRAIN DIAGNOSTICS

Description Group-Page

## TRANSMISSION DIAGNOSTICS



Description Group-Page

# SERVICE MANUAL COMMENTS

**What errors(s) have you found?**

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

**In order for us to assist you, please include as much details as possible when reporting an error**

**Comments / Suggestions**

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

☐ **Dealership Technician**
**Dealer Code:** ____________

**Retail Customer** ☐

**Manual Title, Year, Number and Page:** ______________________________

______________________________________________________________________

**Your Name:** ______________________________

**Address:** ______________________________

______________________________

______________________________

(FOLD HERE)

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED
STATES

**BUSINESS REPLY MAIL**

FIRST CLASS MAIL PERMIT NO. 124 CENTER LINE, MI

POSTAGE WILL BE PAID BY ADDRESSEE

DaimlerChrysler Corporation
**Dealer Technical Operations**
**800 Chrysler Drive**
**CIMS 486-02-76**
**Auburn Hills, MI 48326-2757**

(FOLD HERE)